COM-120C Communications Service Monitor

Operation Manual

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OPERATION MANUAL

COMMUNICATIONS SERVICE MONITOR

COM-120C

PUBLISHED BY
IFR

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CABLE STATEMENT

Double shielded and properly terminated external interface cables must be used with this equipment when interfacing with the RS-232 and IEEE-488.

For continued EMC compliance, all external cables must be 3 meters or less in length.

NOMENCLATURE STATEMENT

The COM-120C Communications Service Monitor is the official nomenclature for the EMC and Safety compliant COM-120C Communications Service Monitor. In this manual the COM-120C refers to the COM-120C Communications Service Monitor. The generic terms unit and Test Set also refer to the COM-120C Communications Service Monitor.

BATTERY STATEMENT

For continued EMC compliance with EN61000-3-2:1995/A14:2000, always allow a discharged battery to recharge in Stand-by Mode.

SAFETY FIRST: TO ALL OPERATIONS PERSONNEL

REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL. THIS UNIT CONTAINS NO OPERATOR SERVICEABLE PARTS.

CASE, COVER OR PANEL REMOVAL

Removing protective covers, casings or panels from this unit exposes the operator to electrical hazards that can result in electrical shock or equipment damage. Do not operate this unit with the case, cover or panels removed.

SAFETY IDENTIFICATION IN TECHNICAL MANUAL

This manual uses the following terms to draw attention to possible safety hazards, that may exist when operating or servicing this equipment.

CAUTION: THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN EQUIPMENT OR PROPERTY DAMAGE (E.G., FIRE).

WARNING: THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN PERSONAL INJURY OR DEATH.

SAFETY SYMBOLS IN MANUALS AND ON UNITS

CAUTION: Refer to accompanying documents.

AC OR DC TERMINAL: Terminal that may supply or be supplied with ac or dc voltage.

DC TERMINAL: Terminal that may supply or be supplied with dc voltage.

AC TERMINAL: Terminal that may supply or be supplied with ac or alternating voltage.

SWITCH OFF: AC line power to the device is OFF.

SWITCH ON: AC line power to the device is ON.

DANGEROUS VOLTAGE: Indicates electrical shock hazard due to high voltage levels.

CAT II **INSTALLATION CATEGORY II:** Denotes impulse withstand voltage of 2500 V.

EQUIPMENT GROUNDING PRECAUTION

Improper grounding of equipment can result in electrical shock.

USE OF PROBES

Check the specifications for the maximum voltage, current and power ratings of any connector on the unit before connecting it with a probe from a terminal device. Be sure the terminal device performs within these specifications before using it for measurement, to prevent electrical shock or damage to the equipment.

AC POWER CORD

AC power cord must not be frayed or broken nor expose bare wiring when operating this equipment.

DC POWER CORD

DC power cord is non-terminated. Care should be taken when connecting to external dc source.

USE RECOMMENDED FUSES ONLY

Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

INTERNAL BATTERY

This unit contains a Sealed Lead-Acid Battery, see Battery Instructions for servicing.

CAUTION: SIGNAL GENERATORS CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE (EMI) TO COMMUNICATION RECEIVERS. SOME TRANSMITTED SIGNALS CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICES OUT TO A DISTANCE OF SEVERAL MILES. USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION THAT RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND SHOULD TAKE NECESSARY PRECAUTIONS TO AVOID POTENTIAL COMMUNICATION INTERFERENCE PROBLEMS.

LIST OF EFFECTIVE PAGES

The manual pages listed below that are affected by a current change or revision, are so identified by a revision number.

Date of Issue for original and changed pages are:

Original .... 0 .... Feb 2002

TOTAL NUMBER OF PAGES IN THIS MANUAL IS 326 CONSISTING OF THE FOLLOWING

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SCOPE

This manual contains instructions for operating the COM-120C Communications Service Monitor. The instruction level is relatively basic and presupposes no previous experience on the part of the operator with a communication service monitor of this type. A basic understanding of communication electronics and practical troubleshooting methods is helpful. It is strongly recommended that the operator be thoroughly familiar with this manual before attempting to operate the unit.

ORGANIZATION

The COM-120C Operation Manual is composed of the following sections:

SECTION 1 - INTRODUCTION

Provides an introduction to the unit and a brief overview of unit functions. Specifications are also included in this section.

SECTION 2 - INSTALLATION

Provides a step-by-step procedure for placing the COM-120C into operation.

SECTION 3 - CONTROLS, CONNECTORS AND INDICATORS

Identifies and functionally describes all COM-120C controls, connectors and indicators. All Operation Screens and Menus are identified and available parameters listed and explained.

SECTION 4 - OPERATION

Provides instructions for operating the COM-120C Mode Operating Screens and Menus. In addition, this section contains a selection of basic operating procedures pertaining to all major functions of the Test Set.

SECTION 5 - COMMON PRACTICES

Identifies and presents some examples of common practices the operator can use to help become familiar with the COM-120C operation.

SECTION 6 - OPTIONS

Identifies and provides instructions for operating the options available with the COM-120C.

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1-1   GENERAL

The COM-120C is a microprocessor controlled, digitally synthesized communication service monitor, which combines the operations of many different test instruments into a single, compact unit. The COM-120C is capable of performing these functions:

RF Generator	RF Receiver
Full Duplex Operation	Spectrum Analyzer
Audio/Data/Signaling Generators	Oscilloscope
DVM	Deviation Meter
Distortion Meter	SINAD Meter
Audio Frequency Meter	Frequency Error Meter
RF Power Meter	Modulation Meter
Received Level Meter	

The COM-120C utilizes an alphanumeric keypad, dedicated function keys, multitask "Soft" Function Keys and a high resolution, monochrome flat panel display. Perform tests remotely or manually. Microprocessor controlled memory allows parameter storage and recall. For instance, store and recall Oscilloscope and Spectrum Analyzer traces for signal comparison.

The COM-120C performs a multitude of important functions simultanelusly. The three basic modes of operation are: RF Generate Operation, RF Receive Operation and Duplex Operation. These modes allow generate and receive functions in duplex and simplex mode, while testing other aspects of the Unit Under Test like Modulation Level, Power, Sensitivity and Frequency Error.

Additionally, the COM-120C provides these independent test instruments:

Audio/Data/Signaling Generators
Oscilloscope
Spectrum Analyzer
Meters

SECTION 1
INTRODUCTION

1-2   RF GENERATE OPERATION

Generating

The COM-120C is capable of generating CW or modulated signals from 250 kHz to 1000 MHz.

The output level is variable from -130 to -13 dBm.

Modulation types include AM, FM and PM (Phase Modulation) or apply an external modulation source. Generate DTMF, User Defined Tone Codes or Digital Codes.

Meters

Metering functions include SINAD, Distortion and Audio Frequency Level.

Full Oscilloscope and Spectrum Analyzer operation is available.

Testing

Testing in RF Generate Operation includes Receiver Sensitivity, Receiver Selectivity, and Audio Frequency Level measurements.

noTe   Use the decode capability for defined DCS and POCSAG protocols using the Tone and Digital Coding functions.

1-3   RF RECEIVE OPERATION

Receiving

The COM-120C receives CW and modulated signals ranging from 250 kHz to 1000 MHz.

In addition to single frequency operation, the COM-120C demodulates and detects AM, FM and PM modulated signals and executes defined frequency sweep operations by scanning a range of predetermined Frequency List settings.

The COM-120C receives "off-the-air" signals via the Antenna Connector or connects directly to the Unit Under Test via the T/R Connector.

Meters

Receive Operation Metering functions include RF Power, AM Modulation, FM Deviation, Phase Modulation, Distortion, Frequency Error, AF Frequency, Received Level and SINAD.

Full Oscilloscope and Spectrum Analyzer operation is available.

Testing

Testing in RF Receive Operation includes measuring Carrier Power, Modulation, Distortion, SINAD and RF Frequency Error.

nOTe   Use the independent Audio/Data/Signaling Generators to modulate the Unit Under Test when performing RF Receive Operation.

SECTION 1
INTRODUCTION

1-4   DUPLEX OPERATION

The COM-120C Duplex Operation feature ranges from 250 kHz to 1000 MHz.

The RF Generator and RF Receiver both work in Duplex Operation Mode with the added capacity of using offset frequencies up to ±999.7500 MHz. Testing capabilities mirror those found in RF Generate and RF Receive Operations.

Duplex Operation is composed of three Operation Screens.

⮌ The Duplex Operation Screen contains both Receive and Generate information.

⮌ The Duplex Receive Operation Screen is provided to test the Transmit section of the Unit Under Test.

⮌ The Duplex Generate Operation Screen is provided to test the Receive section of the Unit Under Test.

1-5   AUDIO FUNCTION GENERATORS

Audio/Tone Coding

The COM-120C has two Audio Generators. One generator has a range of 10 Hz through 20 kHz and the second generator has a fixed 1 kHz tone. The waveforms are sine, square, triangle and ramp.

DATA

The DATA Generator generates in DCS, DCS Inverted, POCSAG and POCSAG Inverted formats.

DTMF

The DTMF Generator generates DTMF coding, up to 16 characters long, in Burst, Continuous Mode or configures the DATA ENTRY Keypad as a DTMF Keypad. The DTMF Mark and Space timing and the time between string transmissions are programmable.

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INTRODUCTION

1-6   OSCILLOSCOPE

The COM-120C has a 50 kHz single trace Oscilloscope. The Oscilloscope can operate as a dependent or independent function in each of the Operation Modes. Both functions give the choice of operation modes, live, store, recall, compare and average. The Trigger type choices are Normalized, Auto and One Shot.

Dependent

The dependent Oscilloscope is available with meters and shares space in all Operation Modes with the dependent Spectrum Analyzer. In Generate Operation, sources available for the Oscilloscope are through front panel input connectors, Notch Filter Residual and internal modulation sources. In Receive Operation, sources available for the Oscilloscope are through the front panel input connectors, Audio/Data/Signaling Generators, decode lines, meter lines and the demodulated signal, both filtered and unfiltered. Sweep and scale values differ with each input type.

Independent

The independent Oscilloscope only accepts signals from the SCOPE/DVM Connector. The coupling choices are AC, DC and Ground.

1-7   SPECTRUM ANALYZER

The Spectrum Analyzer monitors internal and external signals ranging from 250 kHz to 1000 MHz. The Scan width range is editable from 1 kHz to 100 MHz per/div. The Sweep rate and Resolution Band Width (RBW) are editable with a menu or manual edit. An UNCAL indication appears on the screen when settings cause an analyzer "uncal" situation.

The log scales are 2 and 10 dB per division. Amplitude scale units of dBm, dBµV, dBmV, dBV, dBµW and dBW are available in the Independent Spectrum Analyzer and with the Receive Operation. The Generate Spectrum Analyzer is a relative measuring device only. Available units are limited to dB.

Memory functions for the Spectrum Analyzer include store and recall of a trace, compare a stored trace to a live trace and peak hold. The Slot number is editable.

External signals can be "off the air" through the Antenna Connector or connected directly to the T/R Connector.

The Independent and Receive Function Spectrum Analyzer have attenuation of 0 and 30 dB through both connectors. The Spectrum Analyzer is available for display alone or with all RF Generate and Receive functions except where the Duplex Transmit and Receive functions are shown simultaneously.

Generate Operation

The Generate Operation Spectrum Analyzer is a relative measuring device only and available units are limited to dB. Scan widths range from 1 kHz to 100 MHz per/div and zero scan. Available log scales are 2 and 10 dB per division. Memory functions for the Spectrum Analyzer include store and recall of a trace, compare a stored trace to a live trace and peak hold.

Receive Operation

The Receive Operation Spectrum Analyzer receives signals ranging from 250 kHz to 1000 MHz. Scan widths range from 1 kHz to 100 MHz per/div and zero scan. Available log scales are 2 and 10 dB per division. Amplitude scale units are dBm, dBμV, dBmV, dBV, dBμW and dBW. Memory functions for the Spectrum Analyzer include store and recall of a trace, compare a stored trace to a live trace and peak hold. Input signals can be "off the air" through the Antenna Connector or connected directly to the T/R Connector. The Spectrum Analyzer has 0 and 30 dB attenuation available through both connectors.

Independent

The Independent Spectrum Analyzer receives signals ranging from 250 kHz to 1000 MHz. Scan widths range from 1 kHz to 100 MHz per/div and zero scan. The log scales are 2 and 10 dB per division. Amplitude scale units are dBm, dBμV, dBmV, dBV, dBμW and dBW are available. Memory functions for the Spectrum Analyzer include store and recall of a trace, compare a stored trace to a live trace and peak hold.

Input signals can be "off the air" through the Antenna Connector or connected directly to the T/R Connector. The Spectrum Analyzer has 0 and 30 dB attenuation available through both connectors. Additional Functions available with the Independent Spectrum Analyzer include a Find function for finding signals above a certain level and split screen displaying two Spectrum Analyzer screens.

1-8   METERS

Dependent

The COM-120C provides metering capability in all three Operation Modes. The meters are in Receive Operation, Generate Operation or both. The meters are available for Simplex and Duplex Operation. The meters are represented directly on the Mode Operation Screen as numeric readout or as a bar meter and numeric readout. Although a meter is available in both Receive and Generate Operation, available inputs may differ. Dependent Meters for each Operation Mode are identified below:

RECEIVE OPERATION	GENERATE OPERATION
SINAD	SINAD
FM Deviation	Distortion
Phase Modulation	Audio Level
Received Level	
Audio Counter	

Independent

The COM-120C provides metering capability independent of the Operation Modes. These meters include:

SINAD	Audio Counter
Distortion	Digital Voltmeter

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1-9   OPTIONS

Option 01 – Internal Battery	Provides self-contained dc power when external ac or dc power is unavailable.
Option 02 – 0.01 OCXO	Replaces the standard TCXO as system time base. Provides 0.01×10^6 accuracy.
Option 03 – 30 kHz IF Filter	This option provides additional band limiting between 15 kHz and 300 kHz offered in a standard set.
Option 04 – Variable Audio Generator 2	Replaces standard fixed 1 kHz Audio Generator with variable frequency Audio Generator.
Option 05 – Generate Amplifier	Internal RF Amplifier providing 26 dB gain for additional RF output.
Option 07 – Data Generator/Bit Error Rate (BER) Meter	This option provides testing for digital characteristics of transceivers.
Option 08 – SSB Receive Filter	This option provides ability to monitor SSB signals.
Option 09 – RCC Signaling	This option provides 10 PS, 20 PS, MTS, IMTS and Tone Remote Control signaling.
Option 11 – Audio/Digital Signaling	This option provides encode/ decode capabilities for the formats: CCIR, CCIRH, CCIRH4, EEA, EIA, NATEL, ZVEI, DZVEI, DDZVEI, EURO, 5/6 Tone and POCSAG.
Option 12 - Tracking Generator	This option provides internal Tracking Generator for use with Spectrum Analyzer.
Option 13 - IEEE 488 (GPIB) Interface	This option provides parallel GPIB interface for remote operation.
Option 14 - CLEARCHANNEL LTR®	Simulates the CLEARCHANNEL LTR® repeater system. CLEARCHANNEL LTR® is a Registered Trademark of E. F. Johnson.
Option 15 - AMPS Mobile Station Test	Auto and manual test to verify operation of AMPS mobiles, transportables and portables.
Option 16 - EDACS	Provides test capability for EDACS repeaters and mobiles

1-10   COM-120C PRODUCT SPECIFICATIONS

A warm-up time of 5 minutes is required for the following performance requirements.

RF measurements are referenced to 50 Ω.

Accuracy and Resolution stated in percent are referenced to measured or selected value unless otherwise stated.

Where resolution exceeds accuracy, resolution takes precedence.

Specifications and features are subject to change without notice.

RF SIGNAL GENERATOR	
Frequency	
Range:	250 kHz to 1 GHz
Resolution:	100 Hz
Accuracy:	*Same as Master Oscillator.*
Output (T/R and AUX RF Connectors)	
Range (T/R):	-130 to -20 dBm (Simplex Mode) -130 to -40 dBm (Duplex Mode)
Range (AUX):	-130 to +13 dBm
Resolution:	0.1 dB
Accuracy:	±2 dB (>-90.1 dBm, <400 MHz) ±2.5 dB otherwise
VSWR:	<1.15:1 (0.25 to ≤100 MHz) <1.23:1 (100 to ≤400 MHz) <1.38:1 (400 MHz to 1 GHz)
Spectral Purity	
Residual FM:	<20 Hz RMS (0.3 to 3 kHz BW)
Residual AM:	<0.5% RMS (0.3 to 3 kHz BW)
Harmonics:	<-26 dBc
Non Harmonics:	<-45 dBc (below 1 GHz) <-40 dBc (above 1 GHz)
Input Protection	
(T/R):	50 W CW continuous 100 W CW (90 sec to 3 min) 150 W CW (30 sec to 3 min) 200 W CW (15 sec to 3 min)

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MODULATION	
Frequency Modulation	
RF Frequency Range:	250 Hz to 1 GHz
Deviation Range:	100 Hz to 100 kHz
Deviation Resolution:	10 Hz (0.01 to 2.55 kHz) 50 Hz (2.60 to 12.75 kHz) 100 Hz (12.8 to 25.5 kHz) 500 Hz (26.0 to 100.0 kHz)
Rate:	10 Hz to 20 kHz (FSK rates up to 40 kbps
Accuracy:	±5% + Residual FM + Resolution (1 kHz rate, GEN1, GEN 2, EXT MOD) ±10% + Residual FM + Resolution (DATA GEN) ±15% + Residual FM + Resolution (DTMF GEN)
Distortion:	<2% (1 kHz sine wave, 10 kHz deviation, 0.3 to 3 kHz BW)
EXT MOD Sensitivity:	2 kHz/Vpk ±15% (FM Narrow)
Amplitude Modulation	
RF Frequency Range:	250 kHz to 1 GHz
AM Depth Range:	30% to 90%
Resolution:	0.5%
Rate:	100 Hz to 10 kHz
Accuracy:	±5% + Residual AM + Resolution (1 kHz rate, RF Level <0 dBm) ±15% + Residual AM + Resolution (RF Level <0 dBm)
Distortion:	<2% (30% to 90% modulation, 1 kHz rate, 0.3 to 3 kHz BW)
EXT MOD Sensitivity:	5% to 15% per Vpk

Phase Modulation	
RF Frequency Range:	250 kHz to 1 GHz
Modulation Range:	0.1 to 10 rad peak
Resolution:	0.01 rad (<2.55 rad)
Rate:	100 Hz to 6 kHz
Accuracy:	±5% + Residual PM + Resolution (1 kHz rate) ±15% + Residual PM + Resolution (DTMF GEN)
EXT MOD Sensitivity:	2 rad/Vpk, ±15%

AUDIO/DATA GENERATORS

AF GENERATOR	
Frequency Range:	5 Hz to 20 kHz (sinewave only) 5 Hz to 10 kHz (other wave shapes)
Frequency Resolution:	0.1 Hz
Frequency Accuracy:	*Same as Master Oscillator, ±0.1 Hz*
Output Range:	
High Level:	0.01 to 2.5 Vpk (into 150 Ω)
Low Level:	1 to 250 mVpk (into 150 Ω)
Output Resolution:	
High Level:	0.01 Vpk
Low Level:	0.1 mV
Output Accuracy:	
High Level:	±3% full range ±5 mVpk (≤10 kHz, ≥0.03 Vpk) ±7% full range ±5 mVpk (>10 kHz, ≥0.03 Vpk)
Low Level:	±4% full range ±0.25 mVpk (≤10 kHz, 0.03 Vpk) < level, ≥1 mVpk) ±7% full range ±0.25 mVpk (>10 kHz, 0.03 Vpk < level, ≥1 mVpk)
THD:	<0.7% (1 kHz sinewave, 2.5 Vpk, 150 Ω Load) <1% sinewave (all other frequencies/ levels)
Wave Shapes:	Sine, Ramp, Square, Triangl

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A.F. GENERATOR #2	
Frequency Range:	1 kHz (sine wave)
Frequency Accuracy:	±0.2 Hz
Output Range (High Lvl):	0.01 to 2.5 Vpk (into 150 Ω)
Output Resolution (High Lvl):	0.01 Vpk
Output Accuracy (High Lvl):	±3% full range ±5 mVpk (≥0.03 Vpk)
Output Range (Low Lvl):	1 to 250 mVpk (into 150 Ω)
Output Resolution (Low Lvl):	1 mV
Output Accuracy (Low Lvl):	±4% full range ±0.25 mVpk (0.03 Vpk <level 1 mVpk)
DTMF GENERATOR	
Output Range:	
High Level:	0.01 to 2.5 Vpk (into 150 Ω)
Low Level:	0.1 to 25 mVpk (into 150 Ω)
Output Resolution:	
High Level:	0.01 Vpk
Low Level:	1 mVpk
Output Accuracy	
High Level:	±10% full range ±5 mVpk (1 to 30 mV)
Low Level:	±10% full range ±0.25 mVpk (≥30 mV)
Modes:	Continuous, Single Shot
Digits:	16 (0-9, *, #, A, B, C, D)
Mark/Space Timing:	25 to 999 ms
Resolution:	1 ms
Accuracy:	±20%

RECEIVER	
Frequency	
Range:	250 kHz to 1 GHz
Resolution:	100 Hz
Tunable Range:	Tunable from 100 Hz to 1.0 GHz (characteristics below 250 kHz are not specified)
Sensitivity:	2 µV (10 dB SINAD, >2 MHz, 1 kHz tone, 3.3 kHz deviation, 15 kHz IF BW, C-Message weighted filter, 10 kHz FM deviation meter range, 15° to 35°C), ≤2.5 µV otherwise
Antenna Input Protection:	10 W CW (5 sec with alarm)
Selectivity:	300 kHz, 15 kHz, 30 kHz
Adjacent Channel Rejection:	IF BW Selectivity (3 dB) >30.0 dB Down 300 kHz ±485 kHz 15 kHz ±15 kHz
Demodulation Output	
FM:	0.20 Vpk/kHz, ±10% (10 kHz range) 0.10 Vpk/kHz, ±10% (20 kHz range) 0.04 Vpk/kHz, ±10% (50 kHz range) 0.02 Vpk/kHz, ±10% (100 kHz range)
AM:	1.13 Vrms (±0.06 Vrms) (80% modulation)
∅M:	0.2 Vpk/Rad, ±10%

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SELECTIVE RF COUNTER	
Frequency Range:	250 kHz to 1 GHz (The received frequency must be within the IF bandpass of the COM-120C.)
Tunable Range:	0 Hz to 1 GHz (characteristics below 250 kHz are not specified)
Resolution:	1 Hz (10 sec gate time) 10 Hz (1 sec gate time)
Accuracy:	*Same as Master Oscillator, ±2 Hz*
RF Level:	
T/R Connector:	0 to +53 dBm
ANT Connector:	-60 to 0 dBm
RF FREQUENCY ERROR METER	
Meter Range:	0 Hz to 100 kHz
Meter Accuracy:	*Same as Master Oscillator, ±2 counts.*
Meter Resolution:	1 Hz (10 sec gate time) 10 Hz (1 sec gate time)
RF Frequency Range:	250 kHz to 1 GHz (The received frequency must be within the IF bandpass of the COM-120C.)
RF Level:	
T/R Connector:	0 to 53 dBm
ANT Connector:	-60 to 0 dBm
AF FREQUENCY COUNTER	
Frequency	
Range:	10 Hz to 20 kHz
Accuracy:	*Same as Master Oscillator, ±1 count.*
Resolution:	0.1 Hz (1 sec gate time, 10 to 500 Hz) 1 Hz (1 sec gate time, 500 Hz to 20 kHz) 0.1 Hz (10 sec gate time)
Input Signal Level	
SCOPE/DVM Input:	90 mVpp (50 mV range, any waveform)
AUDIO/DATA Input:	450 mVpp (any waveform)

FREQUENCY MODULATION METER	
Range:	2, 5, 10, 20, 50, 100 kHz full scale
Resolution:	10 Hz (2, 5 and 10 kHz range) 100 Hz (20, 50 and 100 kHz ranges)
Accuracy:	±5% full scale, ±50 Hz, ±1 digit + source residual FM (300 kHz IF BW, 1 kHz tone, 5 kHz deviation, C-Message weighted filter)
Modulation Rate:	0 to 20 kHz
Carrier Range:	250 kHz to 1 GHz (The received frequency must be within the IF bandpass of the COM-120C.)
Carrier Level:	
T/R Connector:	0 to +53 dBm
ANT Connector:	-60 to 0 dBm
∅M METER	
Range:	1, 2, 5, 10 rad peak full scale
Resolution:	0.01 rad (1 and 2 rad scales) 0.1 rad (5 and 10 rad scales)
Accuracy:	±5% of full scale ±0.1 rad, ±1 count + source residual PM (300 kHz IF BW, 1 kHz tone, 1.0 rad deviation, C-Message weighted filter)
Modulation Rate:	100 Hz to 6 kHz
Carrier Range:	250 kHz to 1 GHz (The received frequency must be within the IF bandpass of the COM-120C.)
Carrier Level:	
T/R Connector:	0 to +53 dBm
ANT Connector:	-60 to 0 dBm

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AM MODULATION METER	
Range:	1% to 100%
Resolution:	0.1%
Accuracy:	±5% of full scale, ±1 count + source residual AM (300 kHz IF BW, 1 kHz tone, 50% AM depth, C-Message weighted filter)
Modulation Rate:	50 Hz to 10 kHz
Carrier Range:	250 kHz to 1 GHz (The received frequency must be within the IF bandpass of the COM-120C.)
Carrier Level:	
T/R Connector:	0 to +53 dBm
ANT Connector:	-60 to 0 dBm
AGC Attack Time:	50 ms maximum
RF POWER METER	
Meter Ranges:	2 mW to 200 W in a 1-2-5 sequence
Resolution:	1% of full scale or 0.1 mW, whichever is greater
Accuracy:	±10%, ±0.1 mW, ±1 digit (>200 mW, 15°C to 36°C) ±15%, ±0.1 mW, ±1 digit (<200 mW below 15°C and above 35°C)
Frequency Range:	1.5 MHz to 1 GHz
RF Level Range:	2 mW to 200 W average power
Usable Level:	0.2 mW to 200 W average power (characteristics below 2 mV not specified)
Operating Conditions:	50 W CW continuous (50°C) 100 W CW (90 sec/3 min, 50°C) 150 W CW (30 sec/3 min, 50°C) 200 W CW (15 sec/3 min, 50°C)
VSWR:	1.15:1 (0.25 to 100 MHz) 1.23:1 (100 to 400 MHz) 1.38:1 (400 MHz to 1 GHz)
Alarms:	Audible and visual (if applied power exceeds 200 W in the 200 W range or the COM-120C's Power Termination Assembly temperature exceeds 105°C)

RECEIVE LEVEL METER	
Range:	-101 to -30 dBm (15 kHz IF BW) -80 to -30 dBm (300 kHz IF BW)
Accuracy:	±3 dB
Frequency Range:	250 kHz to 1 GHz (The received frequency must be within the IF bandpass of the COM-120C.)
DISTORTION METER	
Range:	1% to 20%
Resolution:	0.1%
Accuracy:	±0.5% distortion, ±1 digit (1% to 10%) ±2% distortion, ±1 digit (>10 to 20%)
Signal Frequency:	1 kHz sinewave
Signal Level:	
SCOPE/DVM Input:	0.03 to 200 Vrms
AUDIO/DATA Input:	0.15 to 15 Vrms
SINAD METER	
Range:	3 to 30 dB
Resolution:	0.1 dB
Accuracy:	±1 dB, ±1 count (at 12 dB SINAD)
Signal Frequency:	1 kHz sinewave
Signal Level:	
SCOPE/DVM Input:	0.03 to 200 Vrms
AUDIO/DATA Input:	0.15 to 15 Vrms

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DIGITAL VOLTMETER	
Ranges:	50 mV to 200 V in a 1-2-5 sequence
Range:	
DC:	10 mV to 200 Vdc (SCOPE/DVM input)
AC:	10 mV to 200 Vrms (SCOPE/DVM input) 150 mV to 15 Vrms (AUDIO/ DATA input)
Resolution:	3.5 digit
Accuracy:	±5% full scale, ±5 mV ±1 digit (SCOPE/DVM input) ±7% full scale, ±5 mV ±1 digit (AUDIO/DATA input)
Frequency:	DC, 50 Hz to 20 kHz
Input Impedance:	1 MΩ unbalanced (SCOPE/DVM/SINAD input) 100 kΩ, unbalanced (AUDIO/DATA input)
OSCILLOSCOPE	
Bandwidth (3 dB):	50 kHz
Vertical	
Ranges:	10 mV to 50 V/div in a 1-2-5 sequence
Maximum Input:	200 rms
Accuracy:	5% full scale
Resolution:	1% full scale, 256 data points, 8 major divisions
Coupling:	DC, AC and GND
Horizontal	
Ranges:	100 μs to 200 ms/div in a 1-2-5 sequence
Resolution:	1% full scale, 500 data points, 10 major divisions
Accuracy:	1% full scale
Input Impedance:	1 MΩ, unbalanced (nominal)

SPECTRUM ANALYZER	
Center Frequency:	250 kHz to 1 GHz
Tunable Range:	0 Hz to 1 GHz (characteristics below 250 kHz are not specified)
Resolution:	100 Hz
Frequency Span	
Ranges:	1 kHz to 100 MHz/div in a 1-2-5 sequence and zero span
Accuracy:	±5% of span width
Operational Modes:	Normal, Split Screen
Modes:	<u>Scan Width</u> <u>Resolution BW</u> 100 MHz/div 3 MHz 50 MHz 3 MHz 20 MHz 3 MHz 10 MHz 3 MHz 5 MHz 300 kHz 2 MHz 300 kHz 1 MHz 300 kHz 500 kHz 30 kHz 200 kHz 30 kHz 100 kHz 30 kHz 50 kHz 30 kHz 20 kHz 3 kHz 10 kHz 3 kHz 5 kHz 3 kHz 2 kHz 300 Hz 1 kHz 300 Hz 0 kHz 30 kHz

Level	
Display:	Log, 2 and 10 dB/div
Vertical Resolution:	1 dB
Range (Dynamic):	60 dB
Bandwidth Switching Error:	<3 dB
Log Linearity:	±2 dB (referenced to -40 dBm, 15° to 35°C) ±3 dB (referenced to -40 dBm, 0° to 15°C and 35° to 50°C)
Input Attenuator:	0, 30 dB (ANT Connector)

INPUT/OUTPUT CONNECTORS	
RS-232 Connector	
Operations Mode:	Off, PC (Input/Output)
Baud Rates:	100, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400
Stop Bits:	1, 2
Parity:	Odd, Even, None
Handshake:	None, Xon/Xoff, CTS/RTS

MASTER OSCILLATOR	
TCXO	
Frequency:	10 MHz
Uncertainty:	±0.1 ppm
Temperature Stability:	±0.2 ppm (0° to 50°C)
Aging Rate:	±0.5 ppm/year

POWER REQUIREMENTS	
Line Voltage:	100 to 120 VAC at 60 Hz 220 to 240 VAC at 50 Hz
DC Input:	12 Vdc, 24-30 Vdc
Power Consumption	
AC:	110 VAC, 150 W maximum, 110 W typical 230 VAC, 150 W maximum, 95 W typical
DC:	150 W maximum, 90 W typical

FUSE REQUIREMENTS	
AC Fuses:	
100 to 120 VAC:	3.0 A, 250 V, Type F (5 x 20 mm)
220 to 240 VAC:	3.0 A, 250 V, Type F (5 x 20 mm)
DC Fuse:	10 A, 32 V, Type F (AGC)
Battery Fuse:	10 A, 32 V, Type F (AGC)
SAFETY CONDITIONS	
Use:	Non-condutive pollution only
Altitude:	≤4000 meters (13,124 feet)
Operating Temperatures:	0° to 50°C
Relative Humidity:	≤80% for temperatures up to 31°C decreasing linearly to 50% at 40°C
Mains Supply Voltage Fluctuations:	≤±10% of the nominal voltage
Transient Overvoltages:	According to Installation Category II
Pollution Degree:	2
GENERAL CHARACTERISTICS	
Dimensions:	40.0 cm (15.75") wide, 19.0 cm (7.5") high, 42.9 cm (16.875") deep (without bail handle and front panel cover)
	44.0 cm (17.32") wide, 19.0 cm (7.5") high, 53.7 cm (21.125") deep (with bail handle and front panel cover)
Weight:	17.3 kg (38.5 lbs.) (without options, lid, accessories)

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2-1   GENERAL

This section contains information on preparing the COM-120C for use. Also listed are installation and operating precautions for safe use of the Unit.

2-2   PRECAUTIONS

Before operating this instrument, the operator should be thoroughly familiar with all aspects of this manual.

For operator safety and to prevent damage to this instrument, the following operating precautions should be observed at all times.
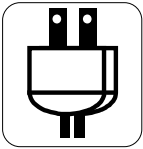
WARNING:
   **DO NOT USE A THREE-PRONG TO TWO-PRONG ADAPTER PLUG.
   DOING SO CREATES A SHOCK HAZARD BETWEEN THE CHASSIS
   AND ELECTRICAL GROUND.**

CAUTION:
   THE T/R CONNECTOR ACCEPTS NO MORE THAN 200 W. MAXIMUM
   OPERATION TIME FOR MEASUREMENT USING THE T/R
   CONNECTOR:

CONTINUOUS ON AT 50 W AND 50°C AMBIENT.
30 SEC ON AND 3 MIN OFF AT 100 W AND 50°C AMBIENT.
15 SEC ON AND 3 MIN OFF AT 200 W AND 50°C AMBIENT.

MAXIMUM CONTINUOUS INPUT INTO THIS CONNECTOR...	...MUST NOT EXCEED THIS MAXIMUM OR DAMAGE TO THE COM-120C MAY RESULT
ANTENNA	0.25 W MAX
DEMOD	20 V MAX
EXT MOD	20 V MAX
SCOPE/DVM	200 V MAX
AUX RF OUT	0.25 W MAX
MIC/ACC	20 V MAX
AUDIO/DATA IN	30 V MAX
This Equipment Contains Parts Sensitive To Damage By Electrostatic Discharge (ESD).	

SECTION 2

INSTALLATION

DC INPUT CONNECTOR   DC FUSE COVER   AC FUSE COVER   BATTERY ACCESS PANEL

AC INPUT CONNECTOR   MAIN POWER SWITCH   00607300

COM-120C Rear Panel

POWER ON INDICATOR

POWER APPLIED INDICATOR

POWER ON KEY

00607028
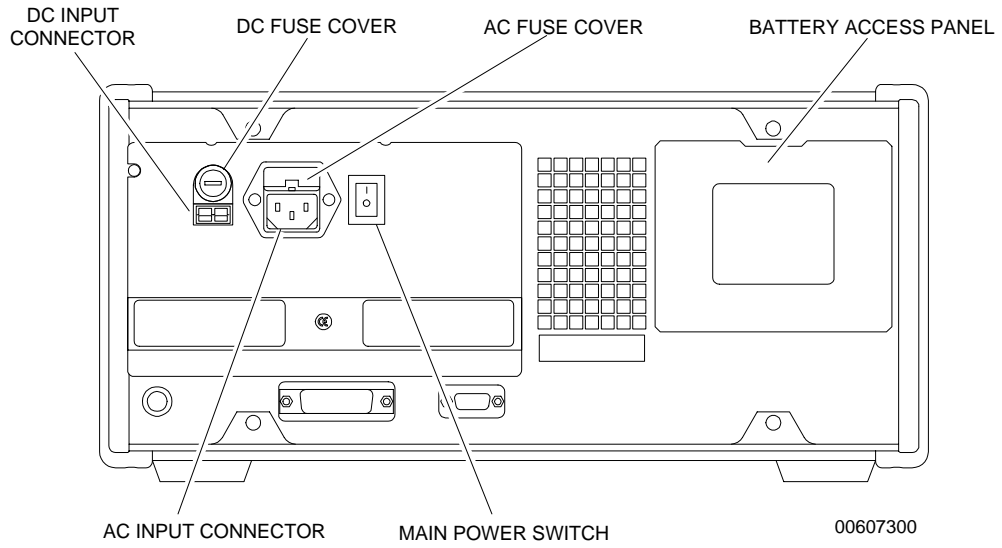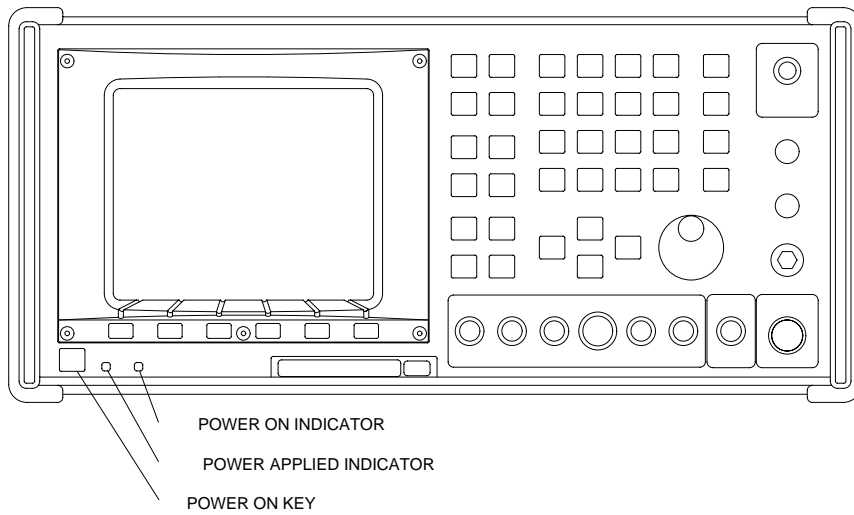
COM-120C Front Panel

2-3   POWER UP PROCEDURES

The Internal Battery, if installed, charges automatically when the COM-120C is connected to a power source and the Main Power Switch is set to ON.

The Power Supply is designed to sense applied ac voltage and compensate automatically with no further action required.

● ●

2-3-1   APPLYING AC POWER

❏   Connect ac power cord to AC Input Connector.

❏   Plug ac power cord into power source. Insure proper grounding.

❏   Set Main Power Switch to ON ("**I**" on switch).

   Power APPLIED Indicator lights when power is available.

❏   Press COM-120C Front Panel Power ON Key to activate Unit. Power ON Indicator lights.

2-3-2   APPLYING EXTERNAL DC POWER

❏   Connect dc power cord to DC Input Connector.

❏   Properly connect non-terminated ends of dc power cord to a 10A current limited dc power source.

   Power APPLIED Indicator lights when power is available.

❏   Press COM-120C Front Panel Power ON Key to activate Unit. Power ON Indicator lights.

note   Before operating unit with 12 V supply, verify voltage level at connector is 12 V or greater.

2-3-3   BATTERY POWER OPERATION (OPTION 01)

❏   Press COM-120C Front Panel Power ON Key.

❏   Power ON Indicator lights.

   Option 01 required for battery operation.

   Power cycles off after approximately 20 to 25 minutes of continuous operation.

   Flashing Power ON Indicator denotes low battery charge.

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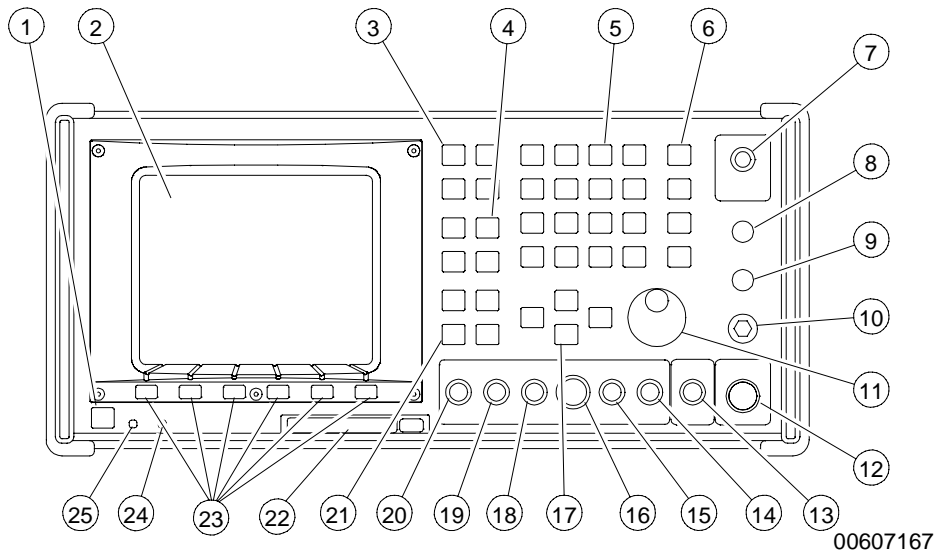
COM-120C Front Panel Controls

3-1   FRONT PANEL CONTROLS

1. Power ON Key

    Selection toggles between Power APPLIED and Power ON states.

2. Display

    Provides video information of current test operation.

3. Test Mode Keys

    | GEN |

    Accesses Generate Mode
    Operation Screen.

    | DPLX |

    Accesses DUPLEX Mode Operation
    Screen.

    | REC |

    Accesses Receive Mode Operation
    Screen.

    | SPCL |

    Accesses Special Optional
    Operation Modes.

4. Instrument Keys

    | SCOPE |

    Accesses Independent Oscilloscope
    Operation Screen.

    | MTRS |

    Accesses Independent Meter
    Functions.

    | ANLYZ |

    Accesses Independent Spectrum
    Analyzer Operation Screen.

    | AUDIO GEN |

    Accesses Independent Audio/Data
    Generators Functions.

SECTION 3
COMPOSITE

5. <u>DATA ENTRY Keys</u>

$\boxed{0}$ thru $\boxed{9}$

Use to enter numeric (0-9) values.

$\boxed{\bullet}$

Use to enter decimal point in numeric values.

$\boxed{*}$

Use for DTMF functions.

$\boxed{\text{SHIFT}}$

Accesses alphabetic function of Front Panel Keys. See Shift Character Table.

$\boxed{\#}$

Use for DTMF functions.

$\boxed{\text{ENTER}}$

Selects a data field for edit or completes an editing procedure.

$\boxed{+/-}$

Use to set sign of entered value.

6. <u>CONTROL Keys</u>

$\boxed{\text{ESC}}$

Use to escape an editing procedure without change to parameters.

$\boxed{\text{TAB}}$

Moves cursor to predetermined areas to simplify editing.

$\boxed{\text{HOLD SCRN}}$

Use to freeze current screen to observe data or print the screen. Press HOLD SCRN Key again to return Test Set to normal operation.

$\boxed{\text{SHIFT}}$ **+** $\boxed{\text{ESC}}$

Deletes the character the cursor is on when editing.

$\boxed{\text{START STOP}}$

Use to start and stop the Reset One Shot in Oscilloscope Operation, Bit Error Rate Meter (Option 07) and LTR® Trunking (Option 14)

FRONT PANEL KEY	SHIFT CHARACTER
GEN	A
REC	B
1	C
2	D
3	E
+/-	F
DPLX	G
SPCL	H
4	I
5	J
6	K
•	L
SCOPE	M
ANLYZ	N
7	O
8	P
9	Q
MTRS	R
AUDIO GEN	S
✳	T
0	U
#	V
STORE	W
RCL	X
SHOW LIST	Y
SETUP	Z
TAB	[space]
SHIFT + ESC	Deletes Character

Shift Character Table

7. ANTENNA Connector

   Input connector to monitor "off-the-air" signals. Also used as a connection for low power (0.25 W maximum) signals.

   CAUTION:
   DO NOT EXCEED 0.25 W MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

8. SQUELCH Control

   Adjusts squelch level of received signal.

9. VOLUME Control

   Controls volume of speaker.

10. PHONES Connector

   Provides access for using Headphones when audio signal is provided to speaker.

11. DATA SCROLL Spinner

   Allows operator to scroll through current test mode operation screen, scroll through lists of parameter selections and actively increase and decrease one digit of numeric parameters. Current test mode operation screen changes with entered data; changed parameter becomes current default unless ENTER Key is pressed. Pressing ESC Soft Function Key returns changed parameter to previous setting.

12. T/R Connector

   50 Ω Connector for high power input or output signals.

   CAUTION:
   DO NOT EXCEED 200 W MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

13. AUX RF OUT Connector

   50 Ω Auxiliary output connector for RF Signals.

   CAUTION:
   DO NOT EXCEED 0.25 W MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

14. AUDIO/DATA GEN Connector

600 Ω connector for output of audio and data generators. Access is selectable from individual generator setup screens.

CAUTION:
DO NOT EXCEED 20 V MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

15. DEMOD Connector

600 Ω connector for output of demodulated signals. Access is selectable from individual generator setup screens.

CAUTION:
DO NOT EXCEED 20 V MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

16. MIC/ACC Connector

Provides access for microphone or accessory equipment both generate and receive lines are available.

CAUTION:
DO NOT EXCEED 20 V MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

17. DATA SCROLL Keys

Allows operator to scroll through current test mode operation screen, scroll through list of parameter selections and actively increase and decrease one digit of numeric parameters.

Increasing and decreasing digits affects higher digits in parameter.

Current test mode operation screen changes with changed data; changed parameter becomes current default unless ENTER Key is pressed.

Pressing ESC (Escape) Soft Function Key returns changed parameter to previous setting.

18. EXT MOD

100 kΩ connector allows input for external modulation source.

CAUTION:
DO NOT EXCEED 20 V MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

19. AUDIO/DATA IN Connector

    100 kΩ connector allows input of external audio and data signals.

    CAUTION:
    DO NOT EXCEED 20 V MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

20. SCOPE/DVM Connector

    1 MΩ input to Oscilloscope and Digital Voltmeter. CAT II.

    CAUTION:
    DO NOT EXCEED 200 V MAXIMUM CONTINUOUS INPUT OR DAMAGE TO THE COM-120C MAY RESULT.

21. MEMORY Keys

STORE	RCL

    Selection allows operator to store current Operation Screen and all current parameters for future access.

    Selection allows operator to recall previously stored Operation Screens.

SHOW LIST	SETUP

    Provides access to menu of all storage lists.

    Provides access to setup menu for system information and system configuration.

22. PCMCIA Card Slot

    Provides access to enhance software capability.

23. Soft Function Keys

    Provide access to defined function.

24. Power ON Indicator

    Denotes system is on when lit.

25. Power APPLIED Indicator

    Denotes power is provided to the system when lit.
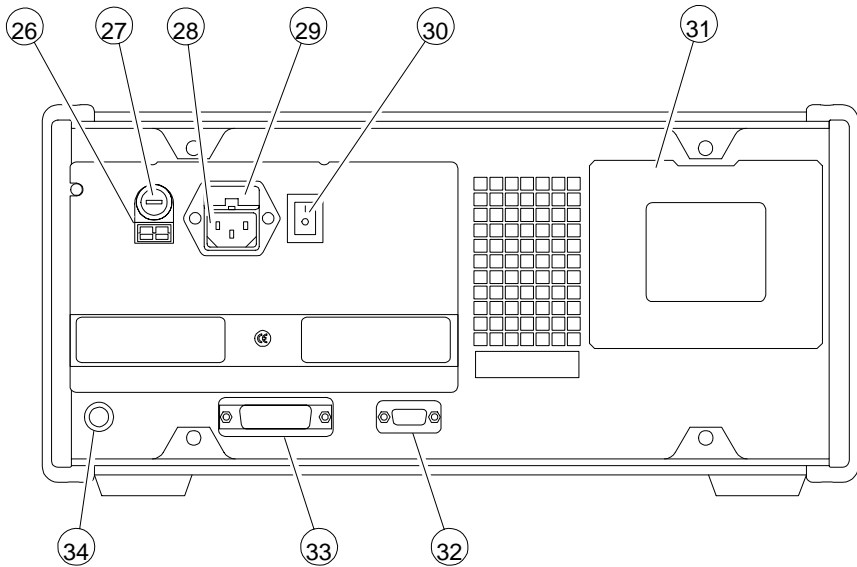
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COM-120C Rear Panel Controls

3-2   REAR PANEL CONTROLS

26. <u>DC Input Connector</u> ⚠

Accepts dc power cord to supply dc power (12, 24 to 30 Vdc) to COM-120C.

CAUTION:
DO NOT EXCEED 30 Vdc OR DAMAGE TO THE COM-120C MAY RESULT.

27. <u>DC Fuse</u> ⚠

10 A, 32 V, Type F, AGC Fuse is provided for dc operation.

CAUTION:
ONLY USE 10 A, 32 V TYPE F FUSE OR DAMAGE TO THE COM-120C MAY RESULT.

28. <u>AC Input Connector</u> ⚠

Accepts ac power cord to supply ac power to COM-120C.

CAUTION:
DO NOT EXCEED 265 VAC OR DAMAGE TO THE COM-120C MAY RESULT.

29. <u>AC Fuse</u> ⚠

   Two 3.0 A, 250 V, Type F, 5 x 20 mm fuses are provided for ac operation.

   ▨ **CAUTION:**
   ONLY USE 3 A FUSE OR DAMAGE TO THE COM-120C MAY RESULT.

30. <u>Main Power Switch</u> ⚠

   Switches power applied ON an OFF.

31. <u>Battery Access Panel</u>

   Provides access to battery.

32. <u>RS-232 Connector</u>

   Provides serial interface for remote operations with COM-120C.

33. <u>GPIB Connector (Option)</u>

   IEEE-488 Connector provides parallel interface for remote operations with COM-120C.

34. <u>Reference Connector</u>

   Provides connection for input of external 10 MHz Reference Signal.

3-3   SCREENS, SOFT FUNCTION KEYS AND MENUS

The following comments apply to all Operation Screens within the COM-120C. Reading and understanding these notes is the responsibility of the operator.

Due to the level of detail required to fully describe all facets of the COM-120C, only surface information is provided to help educate the operator.

3-3-1   SOFT FUNCTION KEYS

Soft Function Keys are alphabetically defined in Appendix D.

3-3-2   CURSOR MOVEMENT

A cursor, in the shape of a box, is used to identify what is currently editable. There are two methods to move the Cursor around the active screen.

Use DATA SCROLL Keys as long as the current Cursor location is not being edited.

Or use TAB Function as follows:

❏   Press TAB Key.

❏   Enter value in desired screen location using DATA ENTRY Key(s).

❏   Press ENTER Key to complete the operation.

3-3-3   EDITING FIELDS USING DATA SCROLL KEYS AND SPINNER

All fields can be edited using DATA SCROLL Keys and/or DATA SCROLL Spinner. Editing Numeric Data Fields is a special case and is covered in para 4-1-3. Edit the remainder of the fields using DATA SCROLL Keys and/or DATA SCROLL Spinner as follows:

❏   Position cursor on field selected for edit using DATA SCROLL Keys or TAB Function.

❏   Press ENTER Key to highlight field.

❏   Press DATA SCROLL Key ($\uparrow$) to move up through search field and DATA SCROLL Key ($\downarrow$) to move down through search field. Alternate method is to use DATA SCROLL Spinner. Turning DATA SCROLL Spinner clockwise performs same operation as pressing DATA SCROLL Key ($\uparrow$).

❏   Press ENTER Key to complete operation.

COM-120C

MEMORY
- RCL
- STORE
- SETUP
  - CALIBRATION
  - CLK/CALENDAR
  - VERSION
  - GPIB
  - RS-232
  - RUN TIME
  - DIAGNOSTICS
  - KEYBOARD
  - DSP SELFTEST
  - PCMCIA SETUP
  - PRINT SCREEN
  - RESTORE
- SHOW LIST
  - STORED FREQ
  - STORED SETUP
  - STORED FILES

00607000

INSTRUMENTS
- ANLYZ
- AUDIO GEN
  - AUDIO GEN-1
  - AUDIO GEN-2
  - DATA GEN
  - DTMF GEN
- SCOPE
- MTRS
  - AF COUNTER
  - SINAD METER
  - DVM
  - DIST METER

MODE
- REC
  - RF
  - AF GEN
  - MODLTN
  - TONE/DATA
  - SINAD/DIST/DEV
  - REC LVL
  - RF ERROR
  - AF FREQ
  - SCOPE/ANLYZ
- SPCL
  - BIT ERROR RATE
  - AMPS CELLULAR
  - LTR TRNKNG
  - EDACS TRNKNG
  - MPT1327 TRNKNG
- GEN
  - RF
  - MODLTN
  - FILTERS
  - SINAD/DIST
  - AF LEVEL
  - SCOPE/ANLYZ
- DPLX
  - GEN
    - RF
    - MODLTN
  - REC
    - RF
    - TONE/DATA
    - MODLTN

COM-120C Composite Hierarchy

3-3-4   EDITING NUMERIC DATA FIELDS

The primary method of editing data in numeric data fields such as frequencies and levels is to use DATA ENTRY Keys. The step-by-step procedure for this method is as follows:

❏ Position cursor on field selected for data entry using DATA SCROLL Keys or TAB Function.

❏ Enter numeric value using DATA ENTRY Keys.

❏ Press ENTER Key to complete operation.

A second method to change current numeric values in small amounts is to use the DATA SCROLL Keys and/or DATA SCROLL Spinner. This method changes one digit of the value directly, but more significant digits are affected indirectly as the edited digit passes zero in either direction. The step-by-step procedure for this method is as follows:

❏ Position cursor on field selected for data entry using DATA SCROLL Keys or TAB Key.

❏ Press ENTER Key to highlight field.

❏ Digit in field to be edited is not highlighted. Pressing DATA SCROLL Key ($\rightarrow$) moves highlight to less significant digit. Pressing DATA SCROLL Key ($\leftarrow$) moves highlight to more significant digit.

❏ Once digit to be edited is selected, press DATA SCROLL Key ($\uparrow$) to increase digit value and DATA SCROLL Key ($\downarrow$) to decrease digit value. Alternate method is to use DATA SCROLL Spinner. Turning DATA SCROLL Spinner clockwise increases value and counterclockwise decreases value.

❏ Press ENTER Key to complete operation.

3-3-5   MAKING SELECTIONS FROM MENUS

Whenever the number of selections for the position being edited exceeds the number of available Soft Function Keys, a MENU Soft Function Key is used. Pressing the MENU Soft Function Key opens a window of selections for the current cursor location. The window cursor is located at the currently active selection. To choose a different selection, move the cursor using the DATA SCROLL Keys or DATA SCROLL Spinner to the selection. Press the ENTER Key to complete the operation.

3-3-6   ESCAPING FROM EDIT WITHOUT CHANGE

An edit procedure can be exited at any time, without change, by pressing the ESC Key.

3-3-7 RF GENERATE SCREEN

The RF Generate Operation Screen defines and activates the COM-120C RF Generator and is accessed by pressing the GEN Test Mode Key.

The RF Generate Operation Screen displays in the configuration last used.

● ●

1. <u>Header Bar</u>

   Displays current operation mode.

2. <u>RF Field</u>

   Displays current RF Generate Frequency from 0.0000 to 1000.0000 MHz.

   Set Reference and Sweep Functions are not active simultaneously.

3. <u>FL (Frequency List) Setting</u>

   Displays selected Frequency List number (FL-00 to FL-99) when active. Blank if inactive. RF Field (2) echoes frequency of selected Frequency List setting. Editing RF Field (2) deactivates Frequency List Function.

RF Generate Screen

4. <u>Frequency List Label</u>

   Displays optional Frequency List Label. Blank if Frequency List Label is not used.

5. <u>Output Level</u>

   Displays Output Level in selected units. If T/R Connector is selected for Output (6), range is -130 to -20 dBm, 0.07 to 22360.6 µV, 0.0000 to 22.3606 mV and 0.000000 to 0.022360 V. If AUX RF Connector is selected for Output (6), range is -130 to -13 dBm, 0.07 to 50059.3 µV, 0.0000 to 50.0593 mV and 0.000000 to 0.050059 V.

6. <u>Output</u>

   Displays connector selected for output. Displays T/R, T/R Gate, AUX or AUX Gate. If Gate Output is selected, output is active only when microphone attached to MIC/ACC Connector is keyed. Default output connector is T/R Connector.
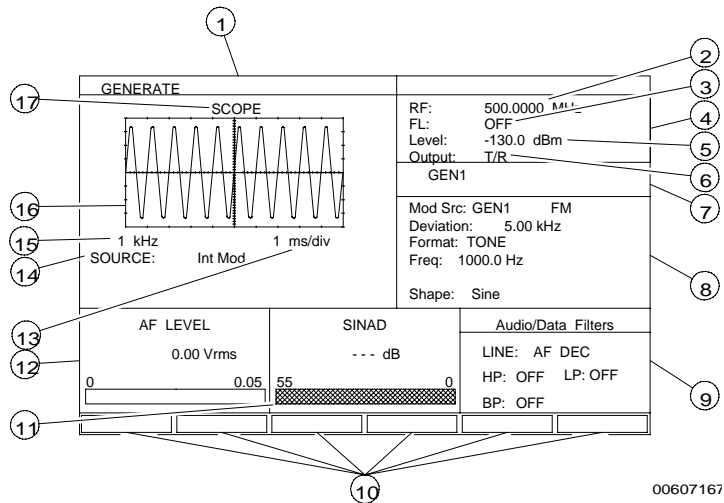
7. Modulation Source Window

   Displays active Modulation Sources. Inactive Modulation Sources are not shown.
   If two (or more) sections of the RF Modulator are set in conflict (e.g. GEN1 set for
   PM and GEN2 set for FM, or GEN1 set for 0.01 kHz deviation and GEN2 set for
   2.60 kHz deviation) the screen displays the invalid source grayed out.

8. Modulation Source Block

   Displays selected Modulation Source and appropriate data. Selections include
   GEN1 (Audio Generator 1), GEN2 (Audio Generator 2), DTMF (DTMF Tone
   Generator), DATA (DATA Generator), EXT (External Modulation) and MIC
   (Microphone Modulation).

9. Audio/Data Filters Block

   Displays current filter information for selected analog signal. Selections include
   AF Decode Line, Data Decode Line and Speaker/Headphones Line.

10. Soft Function Key Definitions

    Functions are redefined with each field of the current operation screen.

11. SINAD/Distortion Meters

    Displays selected Meter Operation. Selections are SINAD or Distortion Meters.

12. AF Level Meter

    Displays AF LEVEL METER Operation.

13. Oscilloscope Sweep

    Displays editable Oscilloscope Sweep.

14. Source

    Displays editable Oscilloscope Source.

15. Oscilloscope Scale

    Displays editable Oscilloscope Vertical Scale. Vertical Scale value and range
    selections is dependent on Source.

16. Scope/Analyzer Screen

    Displays digitized trace of specified signal as Oscilloscope or Spectrum Analyzer.

17. Scope/Analyzer Prompt

    Displays current operation function. Used to toggle between two functions.

SECTION 3
COMPOSITE

3-3-8   RF RECEIVE SCREEN

The RF Receive Operation Screen is used to define and activate the COM-120C RF Receiver and is accessed by pressing the REC Test Mode Key.

The RF Receive Operation Screen displays in the configuration last used.

● ●

1. <u>Header Bar</u>

    Displays current operation mode.

2. <u>RF Field</u>

    Displays current RF Receive Frequency. Range is from 0.0000 to 1000.0000 MHz.

    Scan Function searches a specified Frequency List (3) range, stopping for a selected time period or when squelch is broken.

    Sweep Function sweeps a set range of frequencies, increasing or decreasing frequency at set rate and stopping for a set time or when squelch is broken.

    Δ Function allows change of frequency in selected increment (Δ).

RF Receive Screen

3. <u>FL (Frequency List) Setting</u>

    Displays selected Frequency List number (FL-00 through FL-99) when active and OFF when inactive. RF Field (2) echoes frequency of selected Frequency List setting. Directly editing RF Field (2) inactivates FL Setting. Displays optional Frequency List Label if used.

4. <u>Input Connector</u>

    Displays connector selected for input. Displays either T/R or ANT.

5. <u>Demodulation Type</u>

    Displays selected Demodulation Type. Selections include FM, AM or PM.

6. <u>Attenuation</u>

    Displays selected attenuation of input signal. Displays either 0 or 30.
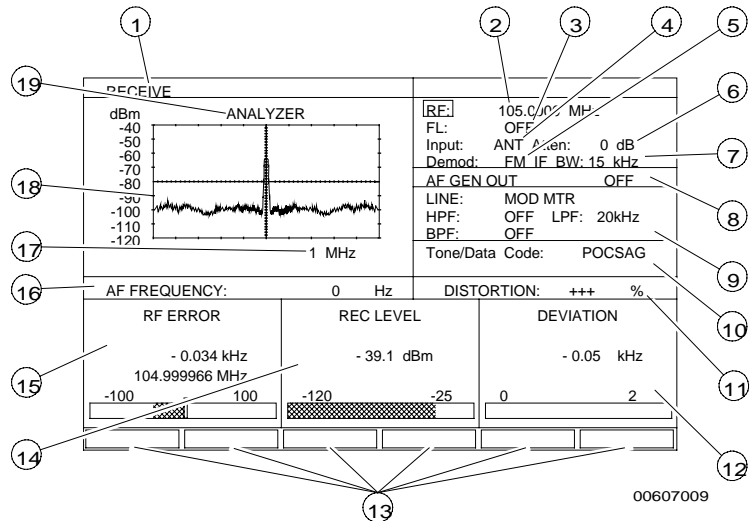
7. <u>IF Bandwidth</u>

   Displays selected IF Bandwidth. Selections include 15 and 300 kHz.

8. <u>AF Gen Out Field</u>

   Pressing ENTER, when cursor is on this field, accesses setup menu for AF Generator sources. Menu displays each source individually. Sources available include GEN1 (Audio Generator 1), GEN2 (Audio Generator 2), DTMF (DTMF Tone Generator) and DATA (DATA Generator).

9. <u>Audio/Data Filters Block</u>

   Displays current filter information for selected analog signal. Selections include Modulation Meters Line, DTMF/SINAD Line, AF Counter Line, Data Decode Line and Speaker/ Headphones Line.

10. <u>Tone/Data Code Field</u>

    Displays selected Tone/Data Type and decoded data.

11. <u>Distortion/SINAD/Modulation Reading</u>

    Displays distortion reading of received signal if Distortion is selected.

    Displays SINAD reading of received signal if SINAD is selected.

    Displays modulation reading in units of selected DEMOD Type (5) if Modulation is selected.

    This field is interactive with Distortion/SINAD/Modulation Meter (12) and displays reading when Distortion/SINAD/Modulation Meter (12) displays meter.

    The same reading cannot be displayed twice. Selection of a specific reading changes source of nonedited field to another source

12. <u>Distortion/SINAD/Modulation Meter</u>

    Displays distortion reading of received signal if Distortion is selected.

    Displays SINAD reading of received signal if SINAD is selected.

    Displays modulation reading in units of selected DEMOD Type (5) if Modulation is selected.

    This field is interactive with Distortion/SINAD/Modulation Reading (11) and field displays complete meter when Distortion/ SINAD/Modulation Reading (11) displays reading only.

    The same reading cannot be displayed twice. Selection of a specific reading changes source of nonedited field to another source. One source must always be Modulation.

13. <u>Soft Function Key Definitions</u>

    Functions are redefined with each field of the current operation screen.

14. <u>Power/Received Level Meter</u>

   Power Meter displays power level of signal received through T/R Connector only in dB and Watts. RECEIVED LEVEL Meter displays referenced Power Level of signal received through ANTENNA Connector only in dBm and µV.

15. <u>RF Error Meter</u>

   Displays difference in RF Field (2) and frequency of received signal.

16. <u>AF Frequency Counter</u>

   Displays Audio Frequency of received signal.

17. <u>Scan Width</u>

   Displays current Scan Width. This field is editable.

18. <u>Scope/Analyzer Screen</u>

   Displays digitized trace of specified signal as Oscilloscope or Spectrum Analyzer.

19. <u>Scope/Analyzer Prompt</u>

   Displays current operation function. Used to toggle between two functions.

3-3-9   DUPLEX SCREEN

The Duplex Operation Screen is used to define and activate the COM-120C RF Generator and RF Receiver simultaneously at the same frequency or offset frequencies and is accessed by pressing the DPLX Test Mode Key.

The Duplex Operation Screen displays in the configuration last used.

● ●

1. Header Bar

   Displays current operation mode.

2. Duplex Generate Prompt

   Accesses Duplex Generate Operation Screen.

3. Duplex Generate RF Field

   Displays current Duplex Generate Frequency. Range is 0.0000 to 1000.0000 MHz.

4. Frequency Offset

   Displays frequency difference between Duplex Generate RF Field (3) and Duplex Receive RF Field (20). Range is from -999.7500 to 999.750 MHz.

Duplex Screen

5. Output Level

   Displays Output Level. If T/R Connector is selected for Output (6), range is -130 to -40 dBm, 0 to .002236 V, 0 to 2.2360 mV or 0.07 to 2236.0 µV. If AUX RF Connector is selected for Output (6), range is -130 to -13 dBm, 0 to 0.050059 V, 0 to 50.0593 mV or 0.07 to 50059.3 µV.

6. Output

   Displays Output Connector. Displays T/R, T/R Gate, AUX or AUX Gate. Gated Output is active only when microphone, attached to MIC/ACC Connector, is keyed.

7. Modulation Source Window

   Displays active Modulation Sources. Inactive Modulation Sources are not shown.

   If two (or more) sections of the RF Modulator are set in conflict (e.g. GEN1 set for PM and GEN2 set for FM, or GEN1 set for 0.01 kHz deviation and GEN2 set for 2.60 kHz deviation) the screen displays the invalid source grayed out.
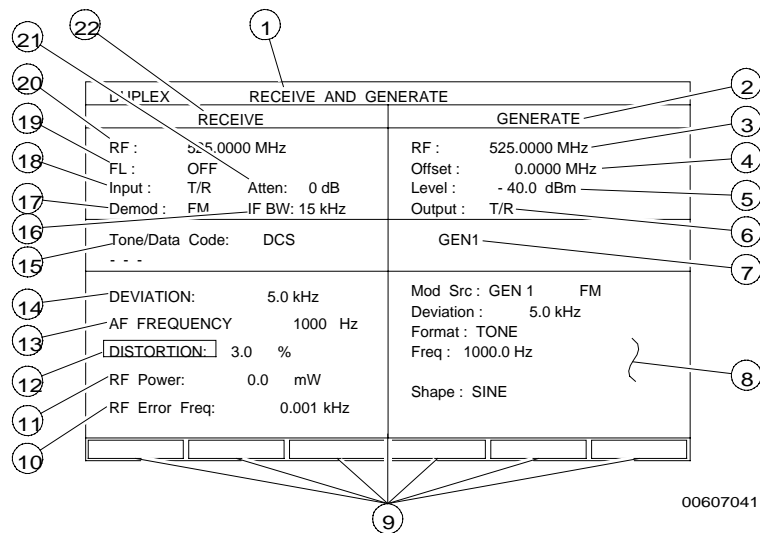
8. Modulation Source Block

   Displays selected Modulation Source. Selections include GEN1 (Audio Generator 1), GEN2 (Audio Generator 2), DTMF (DTMF Tone Generator), DATA (DATA Generator), EXT (External Modulation) and MIC (Microphone Modulation).

9. Soft Function Key Definitions

   Functions are redefined with each field of the current operation screen.

10. RF Error Frequency

    Displays difference in Duplex Receive RF Field (20) and received signal frequency.

11. Power/Received Level Reading

    Power Meter displays power level of signal received through T/R Connector in W. RECEIVED LEVEL Meter displays referenced Power Level of signal received through ANTENNA Connector in dBm.

12. SINAD/Distortion Reading

    Displays selected measurement. Selections include SINAD or Distortion Readings.

13. AF Frequency Reading

    Displays Audio Frequency of demodulated signal.

14. Modulation Reading

    Displays modulation reading in units of selected Demodulation Type (17).

    With FM selected, Field displays DEVIATION and has reading in units of kHz.

    With AM selected, Field displays MODULATION and has reading in units of % Modulation.

    With PM selected, Field displays PHASE and has reading in units of radians.

15. Tone/Data Code Field

    Displays selected Tone/Data Type and decoded data.

16. IF Bandwidth

    Displays selected IF Bandwidth. Selections include 15 and 300 kHz.

17. Demodulation Type

    Displays selected Demodulation Type. Selections include FM, AM or PM.

18. Input Connector

    Displays connector selected for input. Displays either T/R or ANT.

19. FL (Frequency List) Setting

    Displays selected Frequency List number (FL-00 through FL-99) when active and OFF when inactive.

    Duplex Receive RF Field (20) echoes frequency of selected Frequency List setting.

    Directly editing Duplex Receive RF Field (20) inactivates FL Setting.

    Displays optional Frequency List Label if used. Blank if unused.

20. Duplex Receive RF Field

    Displays current Duplex Receive Frequency. Range is 0.0000 to 1000.0000 MHz.

21. Attenuation

    Displays selected attenuation of input signal. Displays either 0 or 30.

22. Duplex Receive Prompt

    Accesses Duplex Receive Operation Screen.

3-3-10   OSCILLOSCOPE SCREEN

The Independent Oscilloscope Operation Screen operates as an independent piece of test equipment and is accessed by pressing the SCOPE Instruments Key. Input for Oscilloscope Operation is through the SCOPE/DVM Connector.   The Oscilloscope Operation Screen

The Oscilloscope Operation Screen displays in the configuration last used.

1. <u>Sweep</u>

   Displays selected Oscilloscope Sweep.

2. <u>Oscilloscope Screen</u>

   Displays digitized trace of specified signal.

3. <u>Marker Position</u>

   Displays current Marker Position if Marker (10) is active or OFF if inactive. Value for Marker Position is in same units as Sweep (1) with Trigger point as reference.
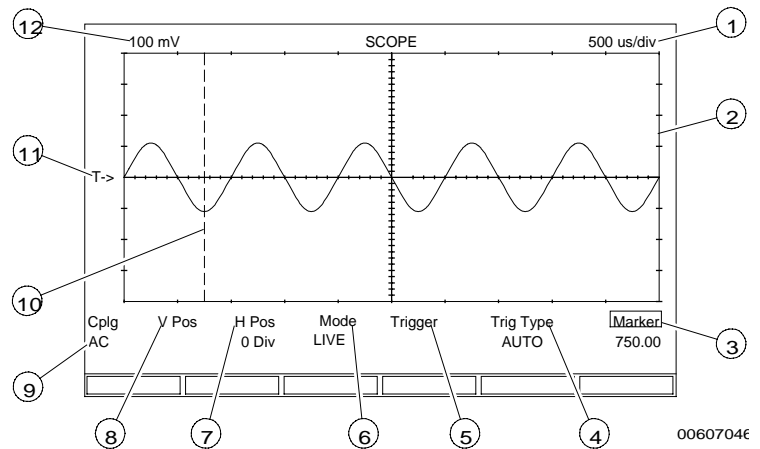
Oscilloscope Screen

4. <u>Trigger Type</u>

   Displays selected Trigger Type.

5. <u>Trigger</u>

   Adjusts trigger level as indicated by Trigger Level Indicator (11) when accessed.

6. <u>Mode</u>

   Displays selected Operation Mode. Selections include Menu, Average, Pk Hold, Min Hold and Store.

   Menu displays a menu window with selections Live, Recall, Compare, Live-Ref and Ref-Live.

   Live displays current signal without modification.

   Recall displays Stored trace only.

   Compare displays Stored trace and live trace simultaneously.

   In Live-Ref, the value of each point of the reference trace is subtracted from the current reading and the result is displayed.

6. Mode (cont)

In Ref-Live, the value of current reading is subtracted from the stored value and the result is displayed.

Both Live-Ref and Ref-Live require a previously stored trace.

Average displays average of last four traces.

Pk Hold displays and holds the trace peak.

Min Hold displays and holds minimum trace.

Store places copy of current trace in memory.

7. H Pos

Displays selected horizontal offset in major divisions. Selections range from -10 to +10 Divisions.

8. V Pos

Accesses vertical position of trace. Trace above or below screen is indicated by straight line trace at top or bottom graticule.

9. Coupling

Displays selected Oscilloscope Coupling. Selections include AC, DC and GND (Ground).

10. Marker

User editable Marker controlled using MARKER Position (3). Movable through extent of visible screen.

11. Trigger Level Indicator

Indicates approximate level of Oscilloscope Trigger Level. Editable using TRIGGER (5).

12. Oscilloscope Scale

Displays selected Oscilloscope Vertical Scale.

3-3-11 SPECTRUM ANALYZER SCREEN

The Independent Spectrum Analyzer Operation Screen operates independent of the Test Modes and is accessed by pressing the ANLYZ Instruments Key.

The Spectrum Analyzer Operation Screen displays in the configuration last used.

● ●

1. Logarithmic Function

   Displays Logarithmic Function for referencing Vertical Scale (1). Selections include dBm, dBµV, dBmV, dBV, dBµW and dBW.

2. Scan Width

   Displays selected Scan Width per division.

3. Zero Scan Sweep

   Displays selected Sweep per division.

4. Marker

   Marker controlled using Marker Position (8). Movable through extent of visible screen.

5. Center Frequency

   Displays Center Frequency. Selections range from 0.0000 to 1000.0000 MHz. For Scan Widths 32 MHz/div, start and stop frequencies must be above 0 MHz and below 1000 MHz.

6. Resolution Bandwidth

   Displays editable Resolution Bandwidth field for selected Scan Width (2).

7. UNCAL

   Displays UNCAL for settings that cause an uncalibrated condition.

8. Marker Position

   Displays Marker Position if Marker (4) is active or OFF if inactive.

9. Marker Level

   Displays current Marker Level if Marker (4) is active. Displays Blank if Marker (4) is OFF.
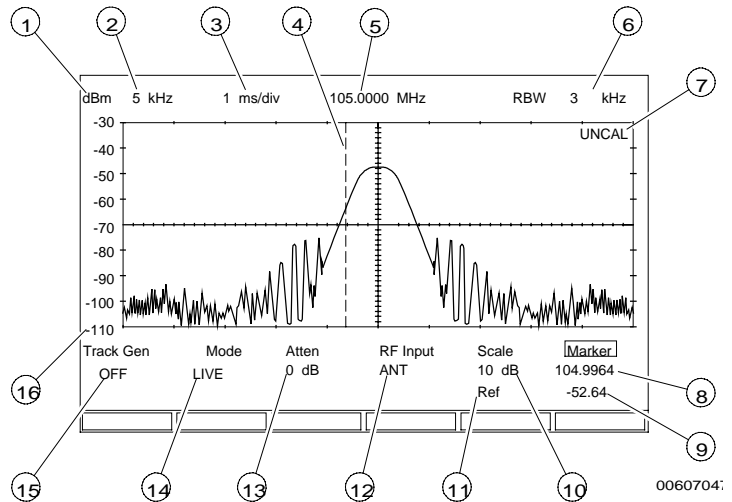
Spectrum Analyzer Screen

10. Scale

Displays Logarithmic Scale for Vertical Scale (10). Selections are 2 and 10 dB.

11. Reference

Adjusts Spectrum Analyzer Vertical Scale (16) ±10 dB when Scale (10) is set to 10 dB. When Scale (10) is set to 2 dB, adjusts Spectrum Analyzer Vertical Scale (10) through full range, displaying 16 dB window and incrementing in 1 dB steps.

12. RF Input

Displays RF Input. Selections are ANT (ANTENNA Connector) and T/R (T/R Connector).

13. Attenuation

Displays selected Attenuation for RF Input (12). Selections include 0 and 30 dB.

14. Mode

Displays selected Operation Mode. Selections include Menu, Average, Peak Hold, Minimum Hold and Store.

Menu displays a menu window with selections Live, Recall, Compare, Live-Ref and Ref-Live.

Live displays current signal without modification.

Recall displays Stored trace only.

Compare displays Stored trace and live trace simultaneously.

In Live-Ref, the value of each point of the reference trace is subtracted from the current reading and the result is displayed.

In Ref-Live, the value of current reading is subtracted from the stored value and the result is displayed.

Both Live-Ref and Ref-Live require a previously stored trace.

Average displays average of last four traces.

Pk Hold displays and holds the trace peak.

Min Hold displays and holds minimum trace.

Store places copy of current trace in memory.

15. Tracking Generator (Option 12)

Displays Tracking Generator Signal level available at AUX RF OUT Connector when active and OFF when inactive. Displayed only with Option 12 installed.

16. Vertical Scale

Provides logarithmic scale for trace. Position is controlled by Reference (11).

3-3-12   AUDIO/DATA/SIGNALING GENERATORS SCREEN

The Audio/Data/Signaling Generators Operation Screen operates as an independent piece of test equipment.

Press the AUDIO GEN Instruments Key to access the Audio/Data/Signaling Generators Operation Screen. The screen displays in the configuration last used.

Four different generator screens, Audio Generator 1, Audio Generator 2, DTMF Generator and DATA Generator, display simultaneously. Any or all of the screens may be active at once.

The AUDIO/DATA GEN Connector is the output.

● ●

1. <u>Audio Generator 1 Section</u>

   Defines and activates Audio Generator 1.

2. <u>Active Source Block</u>

   Displays all active sources. Sources include GEN1 (Audio Generator 1), GEN2 (Audio Generator 2), DTMF (DTMF Tone Generator) and DATA (DATA Generator). Displays 'MAX LEVEL EXCEEDED' excessive level notification.
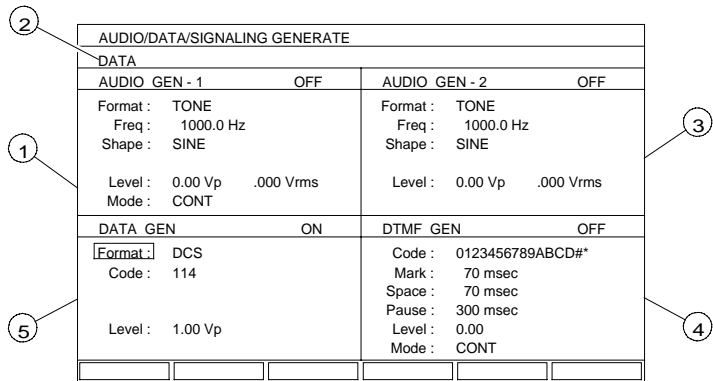
Audio/ Data/ Signaling Generate Screen

3. <u>Audio Generator 2 Section</u>

   Defines and activates Audio Generator 2.

4. <u>DTMF Generator Section</u>

   Defines and activates DTMF Generator.

5. <u>DATA Generator Section</u>

   Defines and activates DATA Generator

3-3-13   METER SCREENS

The COM-120C provides meters that operate independently.

Pressing MTRS Instruments Key accesses a Meters Menu for accessing independent Meters. To access a meter, cursor to desired selection and press ENTER Key or press corresponding Soft Function Key.

● ●

1. Audio Frequency Counter

   The Audio Frequency (AF) Counter counts the audio signal supplied at the indicated source.

2. SINAD Meter

   The SINAD Meter determines SINAD for a 1 kHz tone passed to the COM-120C through the specified Source.

3. Digital Voltmeter

   The Digital Voltmeter (DVM) measures voltage at the indicated Source. The units are dependent on the Source.

4. Distortion Meter

   The Distortion Meter determines Distortion for a 1 kHz tone passed to the COM-120C through the specified Source.
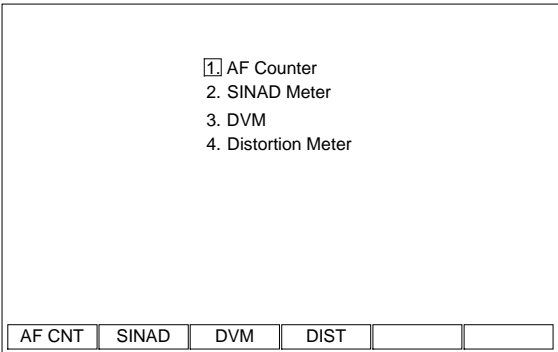
```
┌─────────────────────────────────────┐
│                                      │
│    1. AF Counter                     │
│    2. SINAD Meter                    │
│    3. DVM                            │
│    4. Distortion Meter               │
│                                      │
│                                      │
│                                      │
│                                      │
│                                      │
│ ┌──────┬──────┬──────┬──────┬───┬───┐│
│ │AF CNT│SINAD │ DVM  │ DIST │   │   ││
│ └──────┴──────┴──────┴──────┴───┴───┘│
└─────────────────────────────────────┘
                              8717017
```

Meters Menu Screen
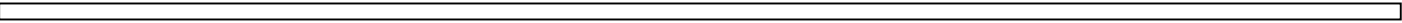
3-3-14   MEMORY LISTS AND STORAGE OF PARAMETERS

The COM-120C offers two ways to use memory to store parameters.

Make a Frequency List specifying a frequency for Generating, a frequency for Receiving and an Offset for Duplex.

Or, store all parameters of RF Generate, RF Receive and Duplex Operation Screens, including supporting meters and operation screens in a Setup List. The Lists are accessible from a List Setup Screen and is accessed by pressing the SHOW LIST Memory Key.

● ●

1. Stored Frequency List

    Accessing the Stored Frequency List displays a screen for editing the Frequency List.

    Move the cursor to any frequency or label field. Up to 100 Frequency List entries (0-99) are used for entering a Generate frequency, a Receive frequency and a Duplex Offset.

    Accessing a Frequency List Parameter from the RF Generate Operation Screen affects only that screen. The same is true for the RF Receive Operation Screen.

```
                    LIST SETUP



            1.    STORED FREQUENCY LIST
            2.    STORED SETUP LIST
            3.    STORED FILES




    FREQ      SETUPS      FILES
                                         0060710
```

List Setup Screen

    Accessing a Frequency List Parameter from any Duplex Operation Screen activates the Generate Frequency, the Receive Frequency and Duplex Offset.

    Whenever used, the Label is also activated for any Operation Screen.

2. Stored Setup List

    Accessing the Stored Setup List displays a screen for editing the Stored Setup List.

    The Stored Setup List displays Stored Setups by List Number Setup Type and an optional Label. Store up to 50 Setups of RF Generate, RF Receive or Duplex Operation Screens.

    The parameters of the screens and all selected meters are stored for future recall.

3. Stored Files

    Accessing Stored Files displays a File List Screen for editing Stored Files. Files are displayed by Name, Type, Size, Date, Time and Attr (Attributes).

    The DRIVE field selections are INTERNAL (COM-120C's Flash) and PCMCIA. The PATH field allows a path entry as a string.
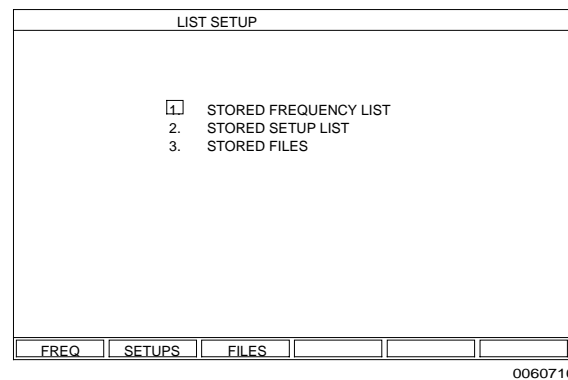
3-3-15   UTILITY FUNCTION SCREENS

The Setup Screen allows access to system configuration and provides information on system status and is accessed by pressing SETUP Memory Key.

Place cursor on desired utility number and press ENTER Key.

Each Setup Screen selection accesses another screen for performing the desired function.

● ●

1. Calibration

    The Calibration selection is under password security and is not covered in this manual.

2. Clock/Calendar

    The Clock/Calendar Screen is used to set the COM-120C internal clock.

3. Version

    This screen reports the current Software Version of the COM-120C programmed devices and displays the installed options.

```
SETUP SCREEN                              MAIN SCREEN

                         1    CALIBRATION
                         2.   CLOCK/CALENDAR
                         3.   VERSION
                         4.   GPIB SETTINGS
                         5.   RS-232 SETTINGS
                         6.   RUN TIME
                         7.   DIAGNOSTICS
                         8.   KEYBOARD
                         9.   DSP SELF TEST
                         10.  PCMCIA SETUP
                         11.  PRINT SCREEN SETUP
                         12.  RESTORE DEFAULTS



                                              0060724
```
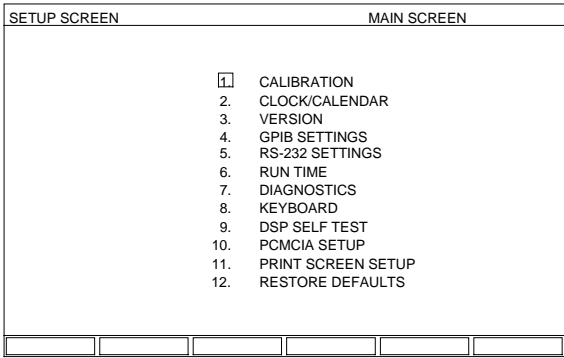
Utility Setup Screen

4. GPIB Settings

    The GPIB Setup Screen is used to configure the COM-120C GPIB Protocol.

5. RS-232 Settings

    The RS-232 Setup Screen is used to configure the COM-120C RS-232 Protocol.

6. Run Time

    The System Run Time Screen displays COM-120C cumulative time spent in operation. Time is displayed in Hours and Minutes.

7. Diagnostics

    The System Diagnostics Screen displays a menu to access specific Diagnostic Screens.

Diagnostic	Description	Diagnostic	Description
Battery and Temperature	Displays Battery Voltage and Power Term Temperature.	Synthesizers Lock Test	Displays current status of synthesizers in the Test Set.
Synthesizer Response Test	Used to test Synthesizer Response.	Self Test	Used for performing Self Test and reading results.

8. Keyboard

   The Keyboard Setup Screen accesses specific operation parameters.

9. DSP Selftest

   The DSP Selftest screen is for performing selftests and reading results. Use the Soft Function Keys to activate the desired test. Each performed test receives a PASS/FAIL indication.

10. PCMCIA Setup

    A variety of screens appear under this setup entry depending on the type of PCMCIA card installed.

    The COM-120C PCMCIA card slot is another Input/Output Source when a PCMCIA card is inserted.

11. Print Screen Setup

    The Print Screen Setup allows the COM-120C to print to a File, RS-232, PCMCIA card or GPIB. Drive, File, Type, Print Mode and Format are all configurable.

12. Restore Defaults

    When selected, the COM-120C immediately restores the Receiver, Generator, Duplex, screens, etc. to the original factory defaults.

4-1   RF GENERATE OPERATION

This section provides information on configuring the COM-120C to perform tests on the receiver.

Press the GEN MODE Key to access the RF Generate Operation Screen. In this mode, the COM-120C acts as a transmitter to test a receiver.

The intention is to provide sufficient information to allow the operator to effectively use the COM-120C to perform specific operator defined tests.

● ●

4-1-1   GENERAL RF GENERATE OPERATION

❏   Enter desired frequency in RF Field.

Frequency range is 0.0000 to 1000.0000 MHz.

Activate additional functions as desired.

To operate with Δ Function active:

> △ =

Activates window to increment RF Field. Range is 0 to 500 MHz.

> △ On/Off

Activate/deactivate Δ Function. Prompt displays by RF Field.

Set Steps:

△ = [0.2000]   MHz

RF: 10.0000   MHz   △

To Operate with Set Reference Function:

> SET REF

R appears beside RF Field. When active, RF Field is set to 0 MHz and changes made to RF Field display offset from Reference Frequency. To deactivate Set Reference Function, press SET REF until *R* is not visible.

RF: 10.0000   MHz   R

To Operate with Sweep Operation:

> SWEEP
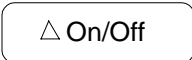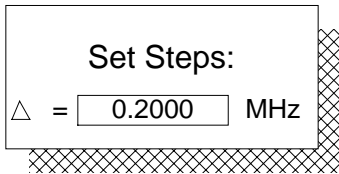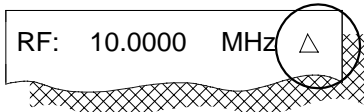
Opens Sweep Configuration Window. Once Sweep Configuration Window is opened, enter start frequency, stop frequency, increment for sweep operation and pause time at each frequency. Press F1 to start continuous sweep, F2 to stop the sweep, F3 for single sweep and F5 to resume a halted sweep. Press F6 to exit.

SWEEP   STOP
Start: 100.0000 MHz
Stop: 200.0000 MHz
Incr: 1.0000 MHz
Pause Time: 1.0 Sec
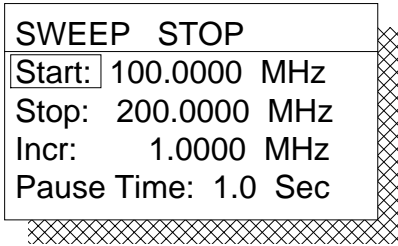
SECTION 4
OPERATION

note Set Reference and Sweep Function work independently, never simultaneously.

| LOCK | UNLOCK |

RF: 10.0000 MHz L

To Operate with RF Generate, RF Receive and Spectrum Analyzer RF Frequencies locked, press F5 until L is displayed beside RF Field. Press F5 again to unlock.

❏ If Frequency List Operation is desired instead of entering frequency in RF Field, select Frequency List Setting as follows:

| On/Off |

Activates Frequency List Setting.

| T-Fwd |

Selects Trunking Forward Channel List.

| T-Rvs |

Selects Trunking Reverse Channel List.

RF: 10.0000 MHz
FL: OFF
Level: -30.0 dBm
Output: T/R

| C-Fwd |

Selects Cellular Forward Channel List.

| C-Rvs |

Select Cellular Reverse Channel List.

| FL |

Select User Defined Frequency List.

If Cellular Channel List or User Defined Frequency List is selected, enter channel/frequency number. Range of cellular channels is 1 to 1023. Range of Frequency List is 0 to 99.

If Trunking Channel List is selected, select channel number. Select Frequency Band. Select desired Frequency Band using DATA SCROLL Keys or DATA SCROLL Spinner. Press ENTER Key.

❏   Set Output Level Units as follows:

dBm

Selects dBm as Output Level Units.

uV

Selects µV as Output Level Units.

mV

Selects mV as Output Level Units.

V

Selects V as Output Level Units.

SINAD=

Accesses SINAD Search Function.

S=On/Off

Activates/deactivates SINAD Search Function.

```
RF:  10.0000  MHz
FL:           OFF
Level:        -30.0 dBm
Output:   T/R
```
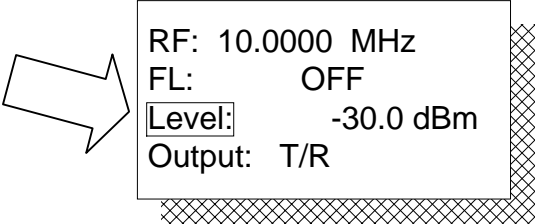
To operate with SINAD Search Function:

SINAD=

Accesses field to set SINAD Search Function value. Range of SINAD= is 6 to 55 dB.

S=On/Off

S= is displayed beside Output Level Field to activate SINAD Search Function. Press F6 again to deactivate.

```
SINAD  =    15.0 dB
```

```
Level:      -20.0 dBm   S=
```
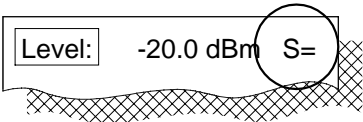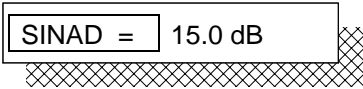
SECTION 4
OPERATION

Select Output as follows:

T/R

Selects T/R Connector as output connector.

AUX

Selects AUX RF Connector as output connector.

T/R Gate

Selects T/R Connector as gated output connector.

AUX Gate

Selects AUX RF Connector as gated output connector.

```
RF:  10.0000  MHz
FL:          OFF
Level:       -30.0 dBm
Output:  T/R
```
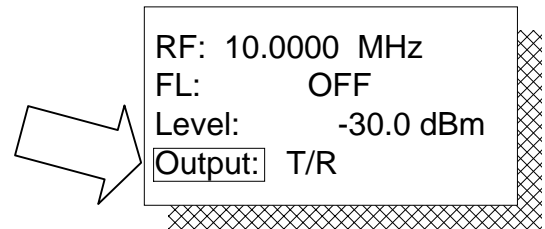
❑ Modulation Source Window displays all active Function Generators. To activate or deactivate Function Generators, each Function Generator must be edited separately.

nOTe

If two (or more) sections of the RF Modulator are set in conflict (e.g. GEN1 set for PM and GEN2 set for FM, or GEN1 set for 0.001 kHz deviation and GEN2 set for 2.60 kHz deviation) the screen displays the invalid source grayed out.

Set Modulation Source Block as follows:

GEN1

If Audio Generator 1 Operation is desired.

GEN2

If Audio Generator 2 Operation is desired.

DATA

If DATA Generator Operation is desired.

DTMF

If DTMF Generator Operation is desired.

MIC

If Microphone Modulation Operation is desired.

EXT

If External Modulation Operation is desired.

```
Mod Src: GEN1       FM
Deviation:    5.0 kHz
Format:  TONE
Freq:  1000.0 Hz

Shape:  SINE
```
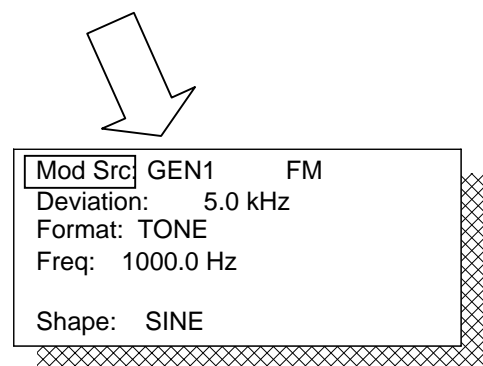
❑   If Audio Generator 1 or 2 Operation is desired, press F1 or F2 to select GEN1 or
     GEN2 for Modulation Source and cursor to OFF.

     Select the desired Modulation Type:

     [OFF]

     Modulation OFF.

     [AM]

     Range is 0.0% to 100.0% for AM Modulation.

     [FM]

     Range is 0.00 to 100 kHz for FM Modulation.

     [PM]

     Range is 0.00 to 10 Radians for PM Modulation.

```
Mod Src: GEN1        FM
Deviation:     5.0 kHz
Format:  TONE
Freq:   1000.0 Hz

Shape:   SINE
```
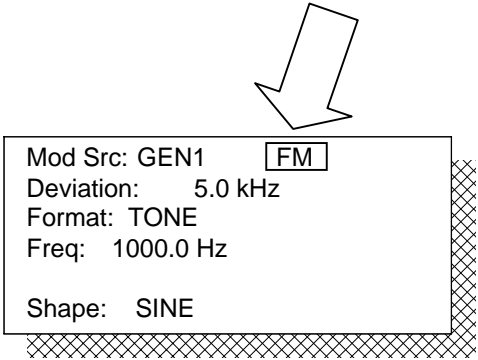
❑   Enter Deviation/Modulation Level.

     Select the desired Format.

     [MENU]

     Accesses a menu with available format selections.

     Select transmission type:

     [CONT]

     Selects continuous transmission of signal.

     [BURST]

     For single transmission of selected signal.

```
Mod Src: GEN1        FM
Deviation:     5.0 kHz
Format:  TONE
Freq:   1000.0 Hz

Shape:   SINE
```

     [TIME]

     Accesses Burst Time Window if TONE is the selected format.

     [CONFIG]

     Accesses Configuration Window if USER is the selected format.

     Used to configure User Selectable Frequency and Duration for codes 0 through 9 and A
     through T.

     Enter desired frequencies and durations for codes. Range of frequencies are 0 to
     9999.9 Hz. Range of durations are 0 to 99.999 seconds.

     Use F1 and F2 to scroll up or down through Configuration Window. Use F3 to fill
     remainder of current column with value of current cursor position.
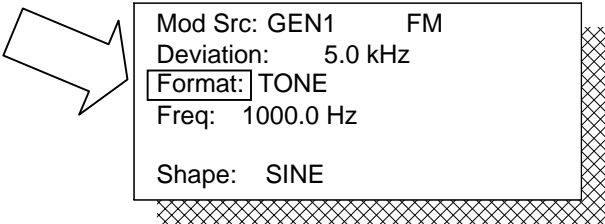
SECTION 4
OPERATION

❏   If TONE is selected as Format, enter Audio Tone Frequency.

❏   If TONE is selected as Format, enter Shape.

Range is 5 to 20000 Hz with Shape set to SINE. Range is 5 to 10000 Hz otherwise.

Select Shape of Wave as follows:

SINE

Selects SINE Wave Shape.
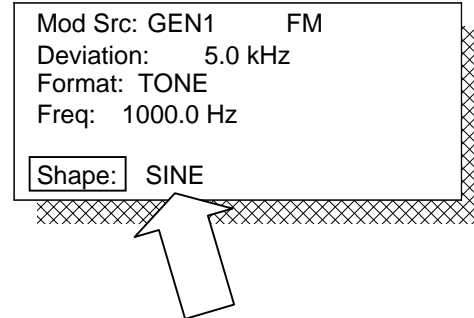
RAMP

Selects RAMP Wave Shape.

TRIANGLE

Selects TRIANGLE Wave Shape.

SQUARE

Selects SQUARE Wave Shape.
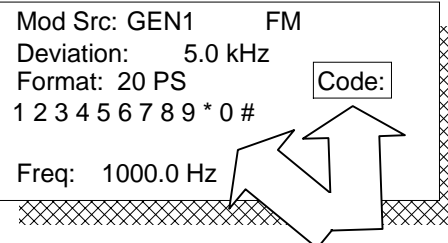
```
Mod Src: GEN1        FM
Deviation:      5.0 kHz
Format:  TONE
Freq:   1000.0 Hz

Shape:   SINE
```

❏   If TONE is not selected Format, enter Code.

CLEAR

Clears current code entry.

```
Mod Src: GEN1        FM
Deviation:      5.0 kHz
Format:  20 PS          Code:
1 2 3 4 5 6 7 8 9 * 0 #

Freq:   1000.0 Hz
```

❏ If DTMF Generator Operation is desired, press F3 to select DTMF for Modulation Source and cursor to OFF.

Select the desired Modulation Type:

> OFF

Modulation OFF.

> AM

Range is 0.0% to 100.0% for AM Modulation.

> FM

Range is 0.00 to 100 kHz for FM Modulation.

> PM

Range is 0.00 to 10 Radians for PM Modulation.
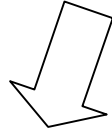
```
Mod Src: DTMF      FM
Deviation:    1.0 kHz
Code:    0123456789#*
Mark:    70 msec
Space:   70 msec
Pause:   300 msec
```

❏ Enter Deviation/Modulation Level.

❏ Enter DTMF Code.

Select the desired Operation:

> CLEAR

Clears code field of current data.

> CONT

Activates DTMF Code in repeating loop.

> BURST

Activates DTMF Code for one tone sequence.

```
Mod Src: DTMF      FM
Deviation:    1.0 kHz
Code:    0123456789#*
Mark:    70 msec
Space:   70 msec
Pause:   300 msec
```

> KEY

Sets DATA ENTRY Keys as DTMF keypad.
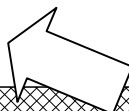
❏ Enter selected Mark Time for DTMF tones. Range is 10 to 999 ms.

❏ Enter selected Space Time for DTMF tones. Range is 1 to 999 ms.

❏ Enter selected Pause Time for DTMF tones Range is 1 to 999 ms.

SECTION 4
OPERATION

❏ If DATA Generator Operation is desired, press F4 to select DTMF for Modulation Source and cursor to OFF.

Select the desired Modulation Type:

```
    OFF
```
Modulation OFF.

```
    AM
```
Range is 0.0% to 100.0% for AM Modulation.

```
    FM
```
Range is 0.00 to 100 kHz for FM Modulation.

```
    PM
```
Range is 0.00 to 10 Radians for PM Modulation.

```
Mod Src:  DATA      FM
Deviation:      5.0 kHz
Format:  DCS
Code:  114
```
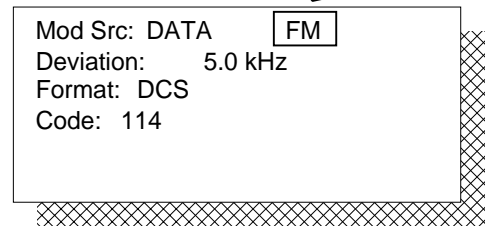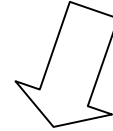
❏ Enter Deviation/Modulation Level.

Select the desired Format.

```
   MENU
```
Accesses a menu with available format selections.
Cursor to DCS, DCS INV, POCSAG or POCSAG INV
Format and press ENTER.

❏ Enter desired Code. Range is 000 (Octal) to 777 (Octal).

❑ If Microphone Modulation Operation is desired, press F5 to set MIC for Modulation Source and cursor to OFF.

Select the desired Modulation Type:

> OFF

Modulation OFF.

```
Mod Src:  MIC     FM
Dev Range: NAR 3
```

> AM

For AM Modulation.

> FM

For FM Modulation.

> PM

For PM Modulation.

If FM Modulation is selected, set Deviation Range as follows:

> NAR 3

For Deviation Range setting for deviation <2 kHz.

```
Mod Src:  MIC        FM
Dev Range: NAR 3
```

> NAR 2

For Deviation Range setting for deviation 2 kHz to 12.75 kHz.

> NAR 1

For Deviation Range setting for deviation 12.75 kHz to 25 kHz.

> WIDE

For Deviation Range setting for deviation >25 kHz.

SECTION 4
OPERATION

❏ If External Modulation Operation is desired, press F6 to select EXT Modulation Source and cursor to OFF.

Select the desired Modulation Type:

```
  OFF
```

Modulation OFF.

```
  AM
```

For AM Modulation.
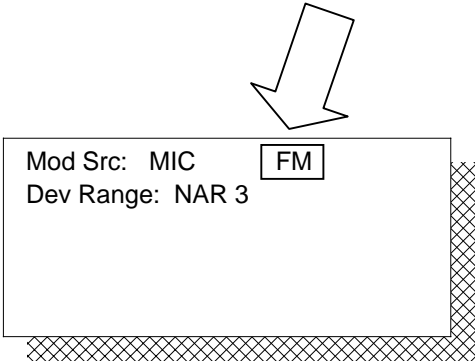
```
  FM
```

For FM Modulation.

```
  PM
```

For PM Modulation.

```
  SET
```

Preserves settings.

```
Mod Src:     EXT      FM
Dev Range:   NAR 3
Deviation:   1.00 kHz
```

If FM Modulation is selected, set Deviation Range as follows:

```
  NAR 3
```

For Deviation Range setting for deviation <2 kHz.

```
  NAR 2
```

For Deviation Range setting for deviation 2 kHz to 12.75 kHz.

```
  NAR 1
```

For Deviation Range setting for deviation 12.75 kHz to 25 kHz.

```
  WIDE
```

For Deviation Range setting for deviation >25 kHz. Deviation Range automatically sets to WIDE if total deviation of FM sources exceeds 20 kHz.
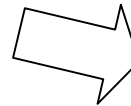
```
Mod Src:     EXT      FM
Dev Range:   NAR 3
Deviation:   1.00 kHz
```

❑ If Audio/Data Filters are required for operation of Meters or Speaker, configure and activate required filters.

note High-Pass Filter/Low-Pass Filter combination and Bandpass Filter never operate simultaneously on same Filter Line.

| CONFIG |

Accesses RF Generator Filters Menu when cursor is on the Filter Line.

```
           Audio/Data  Filters

    LINE:   AF  DEC

    HP:  OFF      LP: OFF

    BP:  OFF
```
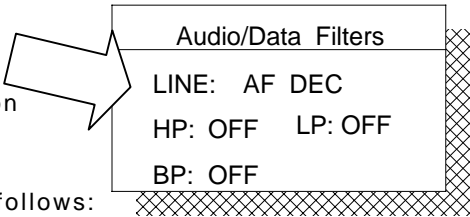
Select DTMF/SINAD Bandpass Filter Field setting as follows:

| OFF |

Sets Filter to OFF.

| C-MSG |

Selects C-Message Weighted Filter.

```
R AUDIO/DATA

    BAND
    PASS
    FILTER

    OFF

EC" TO ACTIV
    INT - MOD
```
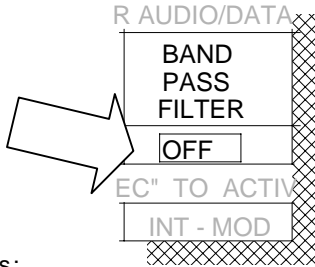
Select DTMF/SINAD High-Pass Filter Field setting as follows:

| OFF |

Sets Filter to OFF.

| 300Hz |

Activates 300 Hz High-Pass Filter.

```
ATA  FILTERS

    HIGH
    PASS
    FILTER

    300Hz

TIVATE  SELEC
```
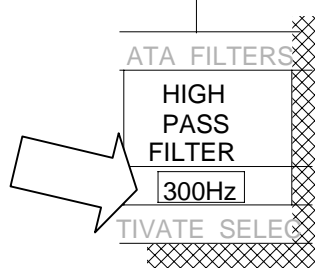
Select DTMF/SINAD Low-Pass Filter Field setting as follows:

| OFF |

Press OFF Soft Function Key F1 to set Filter to OFF.

| 4kHz |

Activates 4 kHz Low-Pass Filter.

| 20kHz |

Activates 20 kHz Low-Pass Filter.

```
S SETUP MEN

    LOW
    PASS
    FILTER

    4kHz

ECTION * * *
```

| EXEC |

Executes all edits made to the screen.

Select Speaker/Headphones Filter Field setting as follows:

OFF
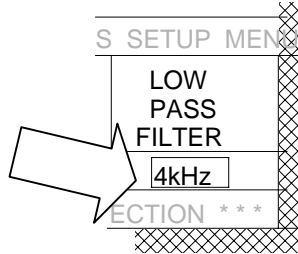
Press OFF Soft Function Key F1 to set Filter to OFF.

C-MSG

Selects C-Message Weighted Filter.

W.B.

Selects no filtering.

INT-MOD

Routes from Internal Modulation Sources to Speaker.

RETURN

Returns to RF Generate Operation Screen.

To display different Filter Line settings:

AF-DEC

Displays DTMF/SINAD Filter Settings.

SPKR

Displays Speaker/ Headphones Filter Settings.

❏ Select desired Meter Operation as follows:

SINAD

Selects SINAD Meter as active meter. Not displayed if meter is currently active.

DIST

Selects Distortion Meter as active meter. Not displayed if meter is currently active.

ENU

WIDE - BAND

ON

* * * PRESS "EXEC" TO ACTIV.

SPEAKER / PHONES   W.B.
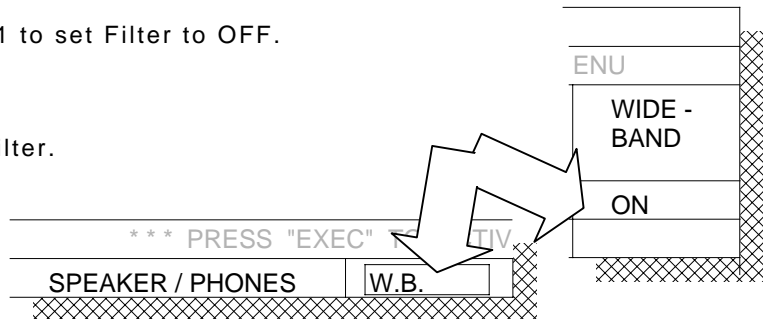
4-1-2   SINAD METER OPERATION

The SINAD Meter for the RF Generate Operation Screen measures SINAD for an audio signal passed through the AUDIO/DATA IN Connector. Filtering for the signal passed to the SINAD Meter is provided by the Audio/Data Filters.

● ●

Configure and operate the SINAD Meter as follows:

    ZOOM

Displays full screen SINAD Meter.

❏   Enter RF Gen Level as required.

| SINAD |
| - - - dB |
| 55 dB   0 dB |
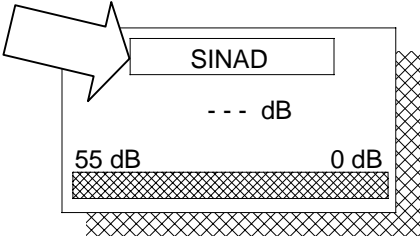
note   Editing RF field affects level on RF Generate Operation Screen.

To operate with SINAD Search Function:

    dBm

Selects dBm as RF Level Units.

    uV

Selects uV as RF Level Units.

    mV

Selects mV as RF Level Units.

    V

Selects V as RF Level Units.

    SINAD=

Accesses field to set SINAD Search Function value. Range of SINAD= is 6 to 55 dB.

    S=On/Off

S= is displayed beside RF Level Field to activate SINAD Search Function. Press F6 again to deactivate.

RF Level:	-30.0 dBm
Range:	AUTO
Peak Hold:	ON
Average:	ON 2
Upper Limit:	ON 28.0
Lower Limit:	ON 12.0
Alarm:	OFF
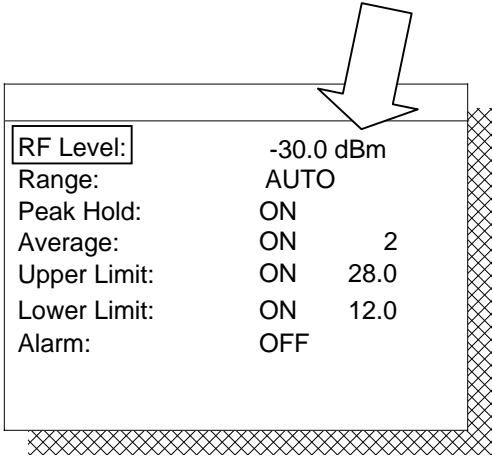
Select Range as follows:

15 dB

Selects 15 dB Range.

55 dB

Selects 55 dB Range.

AUTO

Selects Autorange for Range.
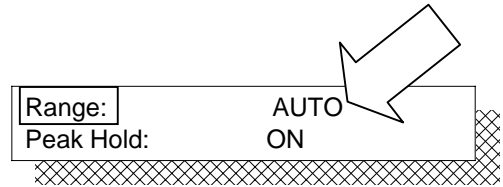
If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

OFF/ON

Toggles Peak Hold Function ON or OFF.

RST PK

Resets Peak Hold Function.
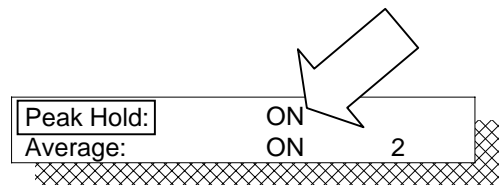
If Average Function is desired, configure as follows:

OFF/ON

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.
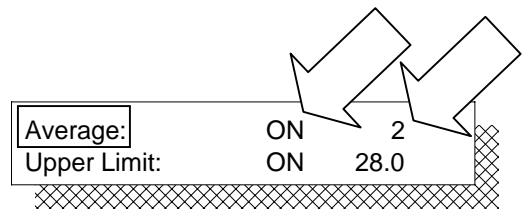
If Upper Limit Function is desired, configure as follows:

OFF/ON

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0 to 55 dB.

If Lower Limit Function is desired, configure as follows:

OFF/ON

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0 to 55 dB.

```
Range:              AUTO
Peak Hold:          ON
```

```
Peak Hold:          ON
Average:            ON       2
```

```
Average:            ON       2
Upper Limit:        ON      28.0
```

```
Upper Limit:        ON      28.0
Lower Limit:        ON      12.0
```

```
Lower Limit:        ON      12.0
Alarm:              OFF
```

If Alarm Function is desired, configure as follows:

> OFF/ON

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

> RETURN

Returns to RF Generate Operation Screen.

Lower Limit:	ON	42.0
Alarm:	OFF	
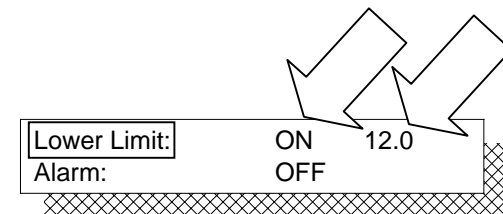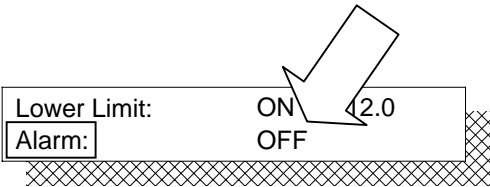
SECTION 4
OPERATION

4-1-3   DISTORTION METER OPERATION

The Distortion Meter for the RF Generate Operation Screen measures Distortion for an audio signal passed through the AUDIO/DATA IN Connector. Filtering for the signal passed to the Distortion Meter is provided by the Audio/Data Filters.

● ●

Configure and operate the Distortion Meter as follows:

> ZOOM

Displays full screen Distortion Meter.

❏   Enter RF Gen Level as required.
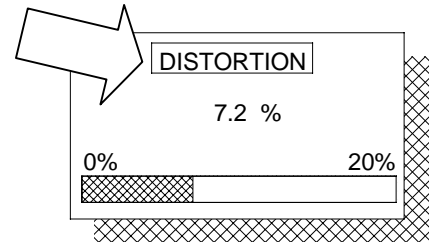
note   Editing RF field affects level on RF Generate Operation Screen.

> dBm

Selects dBm as RF Level Units.

> uV

Selects uV as RF Level Units.

> mV

Selects mV as RF Level Units.

> V

Selects V as RF Level Units.

Select Range as follows:

> 20%

Selects 20% Range.

> 100%

Selects 100% Range.

> AUTO

Selects Autorange for Range.

```
          DISTORTION

             7.2  %

0%                     20%
```

```
          DISTORTION METER

RF Level:          -30.0 dBm
Range:             AUTO
Peak Hold:         ON
Average:           ON        2
Upper Limit:       ON        10.0%
Lower Limit:       ON        5.0%
Alarm:             OFF
```

```
Range:             AUTO
Peak Hold:         ON
```

If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

> OFF/ON

Toggles Peak Hold Function ON or OFF.

> RST PK

Resets Peak Hold Function.

Peak Hold:	ON	
Average:	ON	2

If Average Function is desired, configure as follows:

> OFF/ON

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

Average:	ON	
Upper Limit:	ON	10.0%

If Upper Limit Function is desired, configure as follows:

> OFF/ON

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0.0 to 100.0%.

Upper Limit:	ON	10.0%
Lower Limit:	ON	5.0%

If Lower Limit Function is desired, configure as follows:

> OFF/ON

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0.0 to 100.0%.

Lower Limit:	ON	5.0%
Alarm:	OFF	

If Alarm Function is desired, configure as follows:

> OFF/ON

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

> RETURN

Returns to RF Generate Operation Screen.

Lower Limit:	ON	5.0%
Alarm:	OFF	

SECTION 4
OPERATION

4-1-4   AUDIO FREQUENCY LEVEL METER OPERATION

The Audio Frequency Level Meter for the RF Generate measures the level of an audio signal passed through the AUDIO/DATA IN Connector. Measurements made are in Vrms, dBm (referenced to Impedance [16]) or dB as selected.

● ●

Configure and operate the AF Level Meter as follows:

| ZOOM |

Displays full screen AF Level Meter.

AF LEVEL

0.02 Vrms

0   0.05
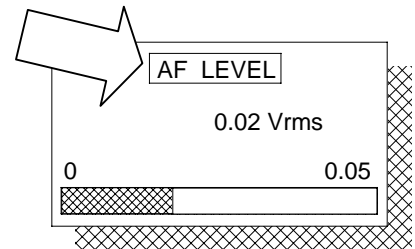
If measuring Vrms, select desired Range:

| MENU |

Displays Range selections including Autorange.

note   Selecting units of dBm or dB sets Range to AUTO (Autorange).

If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

| OFF/ON |

Toggles Peak Hold Function ON or OFF. Displays Peak High and Peak Low digital readout when ON.

Peak Hold: ON
Average: ON   2

Peak High: 1.92V
Peak Low: 0.47V

| RST PK |

Resets Peak Hold Function.

If Average Function is desired, configure as follows:

| OFF/ON |

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

Average: ON   2
Upper Limit: ON   1.50V

If Upper Limit Function is desired, configure as follows:

[OFF/ON]

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0.00 to 50.00 Vrms.

Upper Limit:	ON	1.50V
Lower Limit:	ON	0.50V

If Lower Limit Function is desired, configure as follows:

[OFF/ON]

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0.00 to 50.00 Vrms.

Lower Limit:	ON	0.50V
Alarm:	OFF	

If Alarm Function is desired, configure as follows:

[OFF/ON]

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

[RETURN]

Returns to RF Generate Operation Screen.

Lower Limit:	ON	50V
Alarm:	OFF	
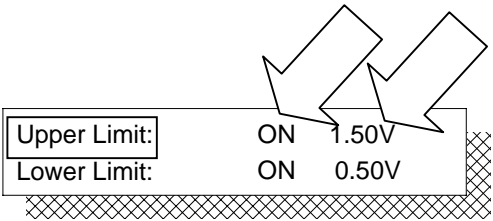
Select desired units for digital readout as follows:

[Vrms]

Select Vrms as units.

[dBm]

Select dBm as units. Range is 0 to 1000 Ω.

0.95 dBm

Z = 600 Ohms

[dB]

Select dB as units. Press F3 as needed to set current reading as Reference.
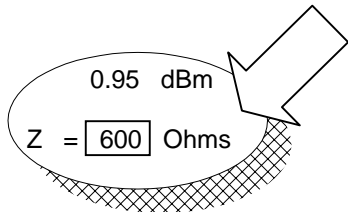
SECTION 4
OPERATION

4-1-5   OSCILLOSCOPE OPERATION SCREEN

The RF Generator Oscilloscope is usable as an abbreviated or full screen Oscilloscope.

The abbreviated Oscilloscope is visible from the RF Generate Operation Screen and the SINAD, Distortion and Audio Frequency Level Meters.

The zoomed, or full screen, Oscilloscope maintains the configuration of the abbreviated Oscilloscope and vice versa.

Oscilloscope parameters set on any of the Operation Screens remain constant on all screens.

● ●

Configuring the abbreviated Oscilloscope is as follows:

MENU

Accesses a list of sweep settings.

ROLL

To view the scope trace in a roll mode. The selected sweep rate must be 100 ms/div or higher.

SLOW

To return to normal mode of operation.
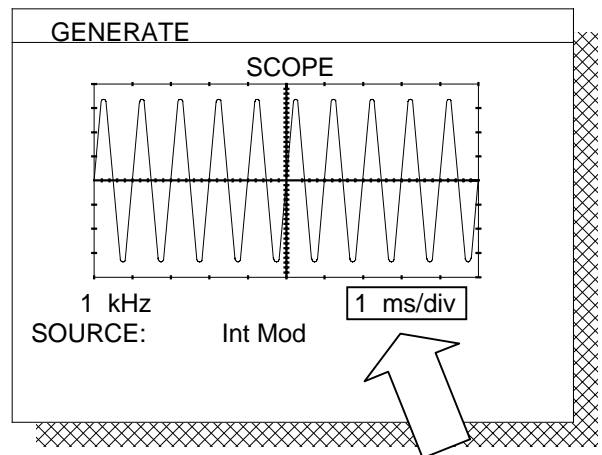
❏   Select Scope Source. Refer to this selection table.

Source	Signal Input	Signal Type
Scope/DVM-GND	SCOPE/ DVM Connector	External GND-Coupled Signal
Scope/DVM-AC	SCOPE/DVM Connector	External AC-Coupled Signal
Scope/DVM-DC	SCOPE/DVM Connector	External DC-Coupled Signal
Ext Mod	EXT MOD IN Connector	External Modulation

Source	Signal Input	Signal Type
Notch Residual	Internal Filtered Signal	Notch Filtered Signal passed to SINAD and Distortion Meters. Reading is relative with no units applied.
Audio/Data In	AUDIO/DATA IN Connector	External Audio or Data Signal
Int Mod	Internal Modulation	Composite Modulation Signal generated by Internal Audio/Data Generators

❏ Select Oscilloscope Scale. Refer to this selection table.

Scope Source	Available Scales	Scope Source	Available Scales
Scope/DVM-GND	10, 20, 50, 100, 200, 500 mV/Div 1, 2, 5, 10, 20, 50 V/Div	Notch Residual	0.20, 0.04, 0.10, 0.20, 0.40, 1.00
Scope/DVM-AC	10, 20, 50, 100, 200, 500 mV/Div 1, 2, 5, 10, 20, 50 V/Div	Audio/Data In	100, 200,500 mV/Div 1, 2, 5 V/Div
Scope/DVM-DC	10, 20, 50, 100, 200, 500 mV 1, 2, 5, 10, 20, 50 V	Int Mod GEN1 FM >25 kHz: GEN1 FM 2.5 to 12.75 kHz: GEN1 FM 12.75 to 25 kHz: GEN1 FM <2.5 kHz: GEN1 PM <2.55 RAD: GEN1 PM >2.55 RAD: GEN1 AM:	 1, 2, 5, 10, 20, 50 kHz/Div 1, 2, 5, 10, 20, 50 kHz/Div 0.2, 0.4, 1, 2, 4, 10 kHz/Div 0.2, 0.4, 1, 2, 4, 10 kHz/Div 0.2, 0.4, 1, 2, 4, 10 RAD 1, 2, 5, 10, 20, 50 RAD All Settings 20%
Ext Mod	100, 200,500 mV/Div 1, 2, 5 V/Div		

Press F1 to access full screen Oscilloscope when cursor is on SCOPE.

n☉Te   Select Scope Source *before* accessing full screen Oscilloscope.

● ●

Configure full screen Oscilloscope as follows:

| MENU |

Accesses a list of sweep settings.

| ROLL |

To view the scope trace in a roll mode. The selected sweep rate must be 100 ms/div or higher.

| SLOW |

To return to normal mode of operation.

500 us/div

Configure full screen Oscilloscope as follows:

| NORM |

Selects Normallized Trigger.

| AUTO |

Selects Auto Trigger.

| 1 SHOT |

Selects and resets One Shot Trigger.
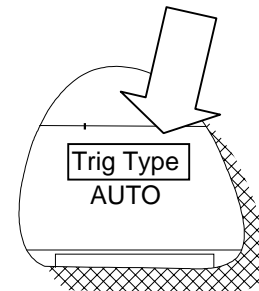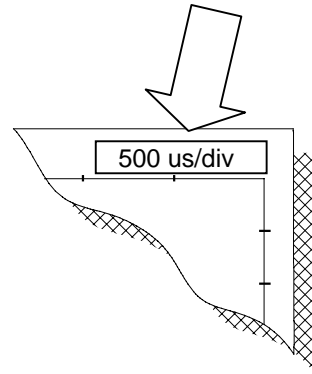
Trig Type
AUTO

Select Operation Mode as follows:

| MENU |

Accesses Operation Mode menu selections.

| LIVE |

Selects Live Operation Mode.

| RECALL |

Selects Recall Operation Mode.

| COMPARE |

Selects Compare Operation Mode.

| LIVE-REF |

Selects Live-Ref Operation Mode.

Mode
LIVE

| REF-LIVE |

Selects Ref-Live Operation Mode.

| RETURN |

Exits to Generate Scope.

| AVG |

Selects Average Operation Mode.

| PK HOLD |

Selects Peak Hold Operation Mode.

| MIN HOLD |

Selects Minimum Hold Operation Mode.

| STORE |

Stores the current trace.
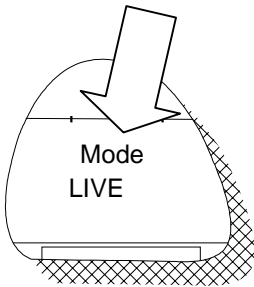
❏ Select H Pos Offset as needed. Range is -10 to 10 Divisions.

❏ Set Vertical Position of trace as needed by accessing V Pos and editing with DATA SCROLL Keys or DATA SCROLL Spinner.

❏ Select Oscilloscope Scale.
Selections available are dependent on Scope Source.

Scope Source	Available Scales
Scope/DVM-GND	10, 20, 50, 100, 200, 500 mV/Div 1, 2, 5, 10, 20, 50 V/Div
Scope/DVM-AC	10, 20, 50, 100, 200, 500 mV/Div 1, 2, 5, 10, 20, 50 V/Div
Scope/DVM-DC	10, 20, 50, 100, 200, 500 mV 1, 2, 5, 10, 20, 50 V
Ext Mod	100, 200,500 mV/Div 1, 2, 5 V/Div

Scope Source	Available Scales
Notch Residual	0.20, 0.04, 0.10, 0.20, 0.40, 1.00
Audio/Data In	100, 200,500 mV/Div 1, 2, 5 V/Div
<u>Int Mod</u>	
GEN1 FM >25 kHz:	1, 2, 5, 10, 20, 50 kHz/Div
GEN1 FM 2.5 to 12.75 kHz:	1, 2, 5, 10, 20, 50 kHz/Div
GEN1 FM 12.75 to 25 kHz:	0.2, 0.4, 1, 2, 4, 10 kHz/Div
GEN1 FM <2.5 kHz:	0.2, 0.4, 1, 2, 4, 10 kHz/Div
GEN1 PM <2.55 RAD:	0.2, 0.4, 1, 2, 4, 10 RAD
GEN1 PM >2.55 RAD:	1, 2, 5, 10, 20, 50 RAD
GEN1 AM:	All Settings 20%

❏ Activate Marker as required.

┌─────────────┐
│   On/Off   │
└─────────────┘

Activates Marker. Entered desired Marker position
using DATA ENTRY keys or DATA SCROLL Keys and/or
DATA SCROLL Spinner.

4-1-6   SPECTRUM ANALYZER OPERATION SCREEN

The RF Generator Spectrum Analyzer is usable as an abbreviated or full screen Spectrum Analyzer.

The abbreviated Spectrum Analyzer is visible from the RF Generate Operation Screen and the SINAD Meter, Distortion Meter and Audio Frequency Level Meters.

The zoomed, or full screen, Spectrum Analyzer maintains the configuration of the abbreviated Spectrum Analyzer and vice versa.

Spectrum Analyzer parameters set on any of the Operation Screens remain constant on all screens.

● ●

Configuring the abbreviated Spectrum Analyzer is as follows:

MENU

Accesses a list of Scan Width settings.

CONFIG

Accesses a pop up screen to configure Scan Width, Resolution Bandwidth (RBW) and Sweep rate.
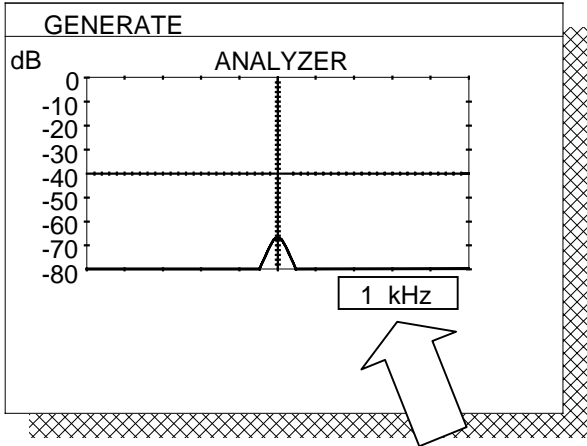
SECTION 4
OPERATION

Press F1 to access full screen Spectrum Analyzer when cursor is on ANALYZER.

Configure full screen Spectrum Analyzer as follows:

<div style="border:1px solid #000">SET REF</div>

Sets current Center Frequency as Reference Frequency.

Select Scan Width as follows:

<div style="border:1px solid #000">MENU</div>

Accesses Scan Width selections including zero scan.

<div style="border:1px solid #000">COUPLE</div>

Sets the sweep and RBW to factory default state for current scan width.

105.0000   MHz

dB   5 kHz   10 ms/div

0
-10
-20
-30
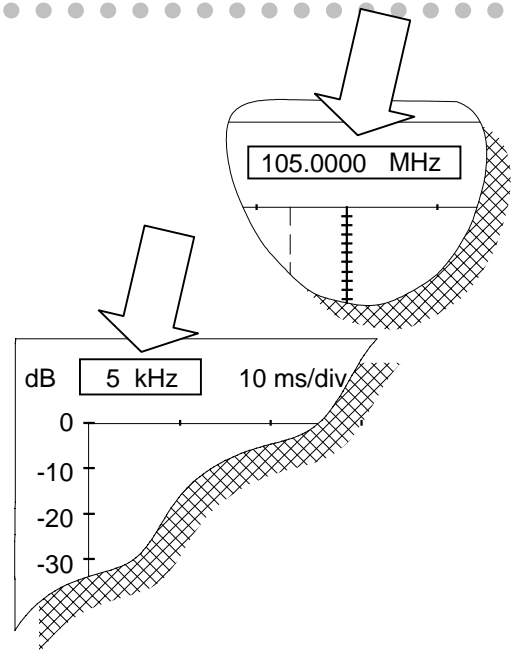
nOTe "UNCAL" appears in the display when combinations of RBW, frequency span and sweep rate for which the analyzer is not calibrated are used.

Set Scale as follows:

<div style="border:1px solid #000">10 dB</div>

Selects 10 dB Vertical Scale.

<div style="border:1px solid #000">2 dB</div>

Selects 2 dB Vertical Scale.

Select Operation Mode as follows:

| MENU |

Accesses Operation Mode menu selections.

| LIVE |

Selects Live Operation Mode.

| RECALL |

Selects Recall Operation Mode.

| COMPARE |

Selects Compare Operation Mode.

| LIVE-REF |

Selects Live-Ref Operation Mode.

| REF-LIVE |

Selects Ref-Live Operation Mode.

| RETURN |

Exits to Generate Scope.

| AVG |

Selects Average Operation Mode.

| PK HOLD |

Selects Peak Hold Operation Mode.

| MIN HOLD |

Selects Minimum Hold Operation Mode.

| STORE |

Stores the current trace.

Mode
LIVE
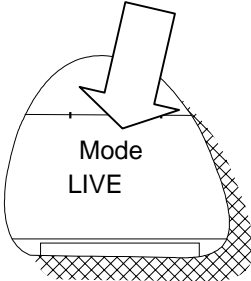
❏ Activate Marker as required.

> On/Off

Activates Marker. Entered desired Marker position
using DATA ENTRY keys or DATA SCROLL Keys and/or
DATA SCROLL Spinner.

❏ Access Ref Field to adjust Vertical Scale as needed.

Scale
10 dB
Ref

If Scan Width is set to zero scan, enter Zero Scan
Sweep selection as follows:

> MENU

Use to set Zero Scan Sweep.

> DEFLT

Sets the current field to factory default.

> COUPLE

Use to set sweep and RBW to factory default state for
the current scan width.
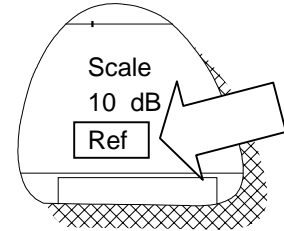
4-1-7   STORE AND RECALL OPERATION

Press STORE Memory Key to store up to 50 RF Generate Operation Screen configurations.

Storage Locations 0 through 49 are used to store an RF Generate Operation configuration, RF Receive Operation configuration or Duplex Operation configuration (Receive and Generate pair).

STORE Operation for RF Generate Operation is as follows:

❏   Press STORE MEMORY Key.

❏   Enter or scroll through Setup # value. Range is 0 to 49. Press ENTER Key.

❏   If Name is desired, press ENTER Key, with Cursor on Name. Enter Name using DATA ENTRY Keys. Name can be alphabetic and/or numeric characters. Press ENTER Key.

Store setup a

Setup #

Name: ------

Type: ------

❏   Type displays the type of data currently saved in the specified setup number. Types saved are: DUPLEX, GENERATOR, RECEIVER, GENERATOR & RECEIVER and EMPTY.

❏   Press F1 to accept selections and save Setup. Press F6 to escape without saving Setup.
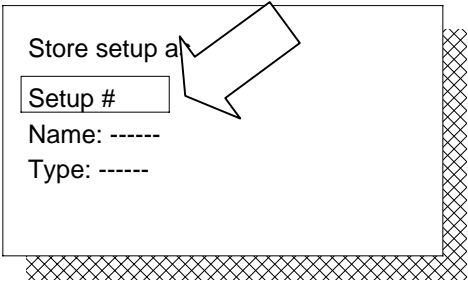
SECTION 4
OPERATION

Press RCL Memory Key to recall up to 50 previously stored setups.

RF Receive, RF Generate or Duplex Operation Screen configurations can all be accessed from the RF Generate Operation Screen.

Recalling a configuration other than an RF Generate Operation Screen configuration, automatically switches the COM-120C to the selected mode of operation.

RECALL Operation for RF Generate Operation is as follows:

● ●

❏ Press RECALL MEMORY Key.

❏ Enter Setup # value. Range is 0 to 49. Press ENTER Key.

❏ Type displays the type of data currently saved in the specified setup number. Types recalled are: DUPLEX, GENERATOR, RECEIVER, GENERATOR & RECEIVER and EMPTY.

❏ Press F1 to accept selections and recall Setup. Press F6 to escape without recalling Setup.

```
Recall setup .
┌─────────┐
│ Setup # │
└─────────┘
Name: ------

Type: ------
```
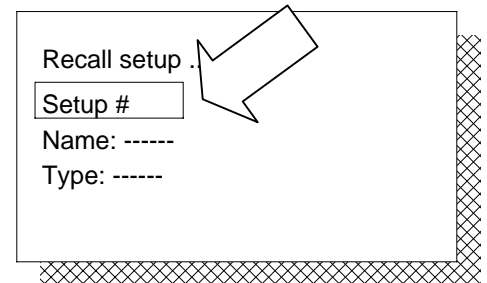
4-2   RF RECEIVE OPERATION

This section provides information on configuring the COM-120C to perform tests on the transmitter.

Press the REC MODE Key to access the RF Receive Operation Screen. In this mode, the COM-120C to acts as a receiver to test a transmitter.

The intention is to provide sufficient information to allow the operator to effectively use the COM-120C to perform specific operator defined tests.

● ●

4-2-1   GENERAL RF RECEIVE OPERATION

❏   Enter desired frequency in RF Field.

Frequency range is 0.0000 to 1000.0000 MHz.

Activate additional functions as desired.

To operate with Δ Function active:

> △ =

Activates window to increment RF Field. Range is 0 to 500 MHz.

> △ On/Off
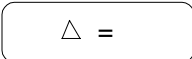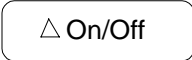
Activate/deactivate Δ Function. Prompt displays by RF Field.

To Operate with Scan Function:
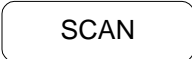
> SCAN

Opens Scan Configuration Window.

Enter start Frequency List number, end Frequency List number and Frequency List number change increment. Enter Pause and Delay Times.

Range is 0 to 9.5 sec with 0.5 sec step. If Pause Time is set to zero, Delay Time is blanked.

Press F1 to start continuous sweep, F2 to stop the sweep, F3 for single sweep and F5 to resume a halted sweep. Press F6 to exit.

Set Steps:

△ = [0.2000]   MHz

RF: 10.0000   MHz   △

SCAN STOP		
FL From:		0
To:		99
Incr:		1
Pause Time:	1.0	Sec
Delay Time:		Sec
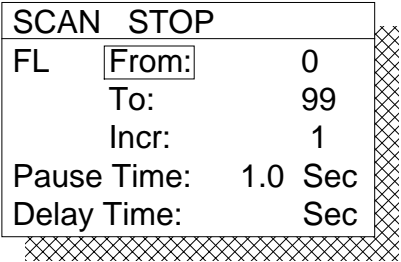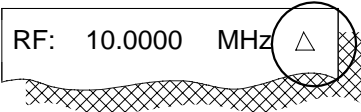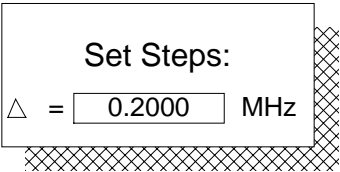
SECTION 4
OPERATION

To Operate with Sweep Operation:

[SWEEP]

Opens Sweep Configuration Window.

Enter start frequency, stop frequency, increment for sweep operation and pause/delay times at each frequency. Enter Pause and Delay Times.

Range is 0 to 9.5 sec with 0.5 sec step. If Pause Time is set to zero, Delay Time is blanked.

Press F1 to start continuous sweep, F2 to stop the sweep, F3 for single sweep and F5 to resume a halted sweep. Press F6 to exit.

```
SWEEP   STOP
Start:  100.0000  MHz
Stop:   200.0000  MHz
Incr:     1.0000  MHz
Pause Time:  1.0 Sec
Delay Time:      Sec
```

[LOCK]   [UNLOCK]

To Operate with RF Generate, RF Receive and Spectrum Analyzer RF Frequencies locked, press F5 until L is displayed beside RF Field. Press F5 again to unlock.

```
RF:   10.0000    MHz   L
```

❑ If Frequency List Operation is desired instead of entering frequency in RF Field, select Frequency List Setting as follows:

[On/Off]

Activates Frequency List Setting.

[T-Fwd]

Selects Trunking Forward Channel List.

[T-Rvs]

Selects Trunking Reverse Channel List.

[C-Fwd]

Selects Cellular Forward Channel List.

[C-Rvs]

Select Cellular Reverse Channel List.

[FL]

Select User Defined Frequency List.

```
RF:  10.0000  MHz
FL:  OFF
Input: ANT    Atten: 30 dB
Demod: FM   IF BW: 15 kHz
```

If Cellular Channel List or User Defined Frequency List is selected, enter channel/frequency number. Range of cellular channels is 1 to 1023. Range of Frequency List is 0 to 99.

If Trunking Channel List is selected, select channel number. Select Frequency Band. Select desired Frequency Band using DATA SCROLL Keys or DATA SCROLL Spinner. Press ENTER Key.

❏ Set Input Level Units as follows:

| T/R |

Selects T/R as input connector.

| ANT |

Selects Antenna as input connector.

```
RF:  10.0000  MHz
FL:   OFF
Input: ANT    Atten: 30 dB
Demod: FM   IF BW: 15 kHz
```

❏ Set Attenuation as follows:

| 30 dB |

Selects 30 dB attenuation for input signal.

| 0 dB |

Selects 0 dB attenuation for input signal.

```
RF:  10.0000  MHz
FL:    OFF
Input: ANT    Atten: 30 dB
Demod: FM   IF BW: 15 kHz
```

❏ Set Demodulation Type as follows:

| AM |

Selects AM Demodulation.

| FM |

Selects FM Demodulation.

| PM |

Selects PM Demodulation.

```
RF:  10.0000  MHz
FL:   OFF
Input: ANT    Atten: 30 dB
Demod: FM   IF BW: 15 kHz
```

SECTION 4
OPERATION

> 300 kHz
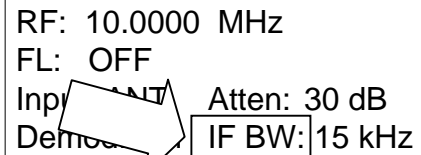
Selects 300 kHz IF Bandwidth Filter.

> 15 kHz

Selects 15 kHz IF Bandwidth Filter.

> 30 kHz

Selects 30 kHz IF Bandwidth Filter.

```
RF:  10.0000  MHz
FL:  OFF
Inp    ANT      Atten: 30 dB
Dem            IF BW: 15 kHz
```

note For following guidelines, ΔF is Frequency Deviation in Hz, Φ is Phase Deviation in Radians, Fm is the Tone Modulation Frequency in Hz and IF is Minimum IF Filter Bandwidth. General Guidelines for IF Filter Selection are as follows:

For FM Modulated Signals:
$$IF = 4(\Delta F + Fm)$$

For PM Modulated Signals:
$$IF = 4Fm(\Phi + 1)$$

For AM Modulated Signals:
$$IF = 15 \text{ kHz, for } Fm \leq 1 \text{ kHz}$$

❏ Edit AF Generator sources as required:

> GEN1

Selects GEN1 as source.

> GEN2

Selects GEN2 as source.

> DATA
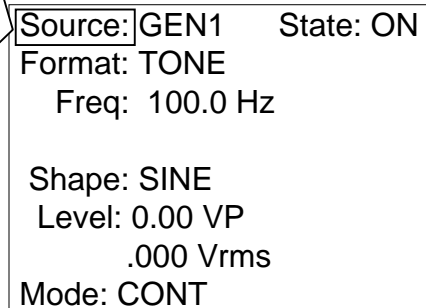
Selects DATA as source.

> DTMF

Selects DTMF as source.

> RETURN

Exits source window.

```
Source: GEN1      State: ON
Format: TONE
   Freq:  100.0 Hz

 Shape: SINE
 Level: 0.00 VP
        .000 Vrms
Mode: CONT
```

MENU

Opens menu with available formats.

RETURN

Exits source window.

Source: GEN1   State: ON
Format: TONE
  Freq: 100.0 Hz

 Shape: SINE
  Level: 0.00 VP
     .000 Vrms
Mode: CONT

❑ Set Frequency, Shape, Level and Mode as desired.

❑ If Audio/Data Filters are required for operation of Meters or Speaker, configure and activate required filters.
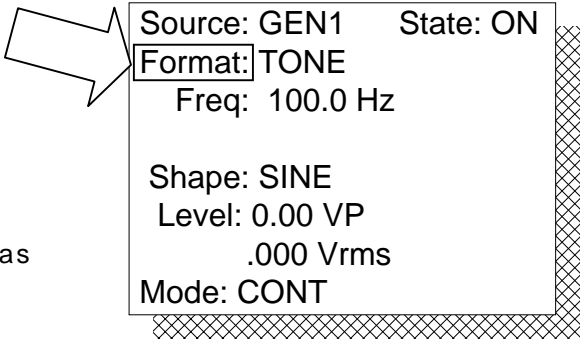
note High-Pass Filter/Low-Pass Filter combination and Bandpass Filter never operate simultaneously on same Filter Line.

CONFIG

Accesses RF Generator Filters Menu when cursor is on the Filter Line.

Select MOD METERS Bandpass Filter Field setting as follows:

OFF

Sets Filter to OFF.

C-MSG

Selects C-Message Weighted Filter.

DIO/DATA FIL
BAND
PASS
FILTER
OFF
OFF
OFF
OFF
EC" TO ACTIV
W.B.
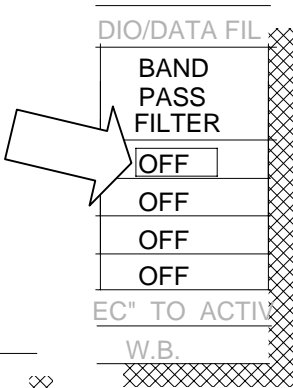
Select MOD METERS High-Pass Filter Field setting as follows:

OFF

Sets Filter to OFF.

300Hz

Activates 300 Hz High-Pass Filter.

4kHz

Activates 4 kHz Low-Pass Filter.

EXEC

Executes all edits made to the screen.

LTERS SETUP
HIGH
PASS
FILTER
300Hz
OFF
OFF
OFF
TIVATE SELEC
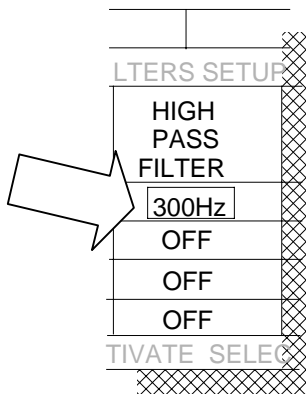
Select MOD METERS Low-Pass Filter Field setting as follows:

| OFF |

Sets Filter to OFF.

| 300Hz |

Activates 300 Hz High-Pass Filter.

| 4kHz |

Activates 4 kHz Low-Pass Filter.

| 20kHz |

Activates 20 kHz Low-Pass Filter.

| EXEC |

Executes all edits made to the screen.

```
              SETUP  MENU
                LOW
                PASS
                FILTER
                4kHz
                OFF
                OFF
                OFF
              ECTION * * *
```

Select Speaker/Headphones Filter Field setting as follows:

| OFF |

Sets Filter to OFF.

| C-MSG |

Selects C-Message Weighted Filter.

| W.B. |

Selects no filtering.

```
                                WIDE -
                                BAND

        * * * PRESS "EXEC" TO     IV
                                         ON
                                         ON
  SPEAKER / PHONES      W.B.               ON
  DEMOD OUT             DET OUT            ON
```
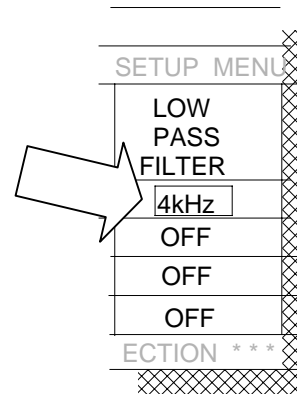
| AUD-GEN |

Routes Audio Signal Internal Modulation sources to Speaker.

| RETURN |
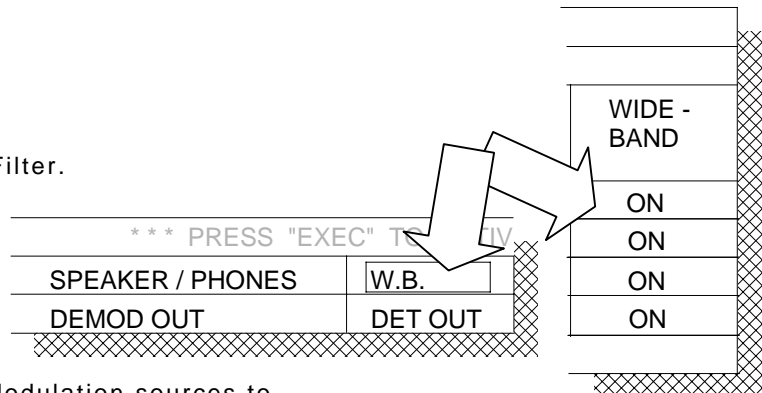
Returns to RF Receive Operation Screen.

Select DEMOD OUT Field setting as follows:

> AF CNT

Accesses AF Counter Signal.

> DET OUT

Accesses Detector Signal.

> C-MSG

Selects Detector Signal through
C-Message Weighted Filter.

> DAT DEC

Accesses Data Decoder Signal.

> AF DECD

Accesses AF Decoder/SINAD Signal.

> MOD MTR

Accesses Modulation Meters Signal.

```
*** PRESS "EXEC" TO
SPEAKER / PHONES      W.B.
DEMOD OUT           DET OUT
```
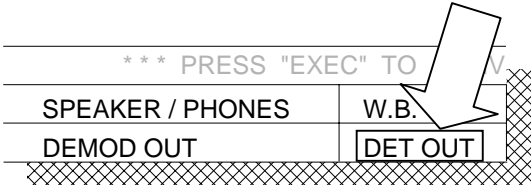
❑   Select MOD METERS, DTMT/SINAD, AF CNTR/DECODE, DATA DECODER,
    SPEAKER/PHONES or DEMOD OUT Filter settings as desired and execute.

SECTION 4
OPERATION

4-2-2   SINAD METER OPERATION

❏   The SINAD Meter for the RF Receiver measures SINAD for a 1 kHz tone demodulated from an RF Signal. Filtering, for the signal passed to the SINAD Meter, is provided by the Audio/Data Filters.

❏   For SINAD Meter Operation, see page 4-13.

4-2-3   DISTORTION METER OPERATION

❏   The Distortion Meter for the RF Receiver measures Distortion for a 1 kHz tone demodulated from an RF Signal. Filtering, for the signal passed to the Distortion Meter, is provided by the Audio/Data Filters.

❏   For Distortion Meter Operation, see page 4-16.

4-2-4   FM DEVIATION METER OPERATION

The FM Deviation Meter for the RF Receiver measures FM Deviation for an RF Signal. Filtering, for the signal passed to the FM Deviation Meter, is provided by the Audio/Data Filters.

● ●

Configure and operate the FM Deviation Meter as follows:

DEVIATION

$\pm$ 0.05   kHz

0 kHz $\pm$ 2 kHz

```
[  ZOOM  ]
```

Displays full screen FM Deviation Meter.
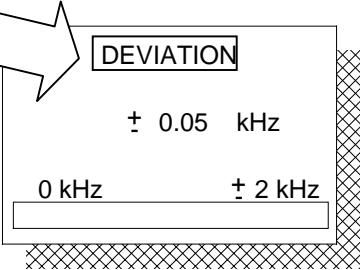
❑   Enter RF as required.

note   Editing RF field affects level on RF Receive Operation Screen.

```
[  AC  ]
```

Selects AC Coupling.

```
[  DC  ]
```

Selects DC Coupling.

```
[  FM-Z  ]
```

Automatically calibrates FM-Zero with no signal applied.

FM DEVIATION METER	
RF:	105.0000 MHz
Scp / Demod Cplg:	AC
Range:	10 kHz
Peak Hold:	ON
Average:	ON 2
Upper Limit:	ON 8.00
Lower Limit:	ON 1.00
Alarm:	OFF
Mode:	BOTH

Select Range as follows:

```
[  MENU  ]
```

Accesses menu of range selections.

```
[  AUTO  ]
```

Selects Autorange for Range.

Range:	AUTO
Peak Hold:	ON

If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

```
[  OFF/ON  ]
```

Toggles Peak Hold Function ON or OFF.

Peak Hold:	ON
Average:	ON 2

```
[  RST PK  ]
```

Resets Peak Hold Function.

If Average Function is desired, configure as follows:

| OFF/ON |

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

```
Average:          ON        2
Upper Limit:      ON        28.0
```

If Upper Limit Function is desired, configure as follows:

| OFF/ON |

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0 to 55 dB.

```
Upper Limit:      ON        28.0
Lower Limit:      ON        12.0
```

If Lower Limit Function is desired, configure as follows:

| OFF/ON |

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0 to 55 dB.

```
Lower Limit:      ON        12.0
Alarm:            OFF
```

If Alarm Function is desired, configure as follows:

| OFF/ON |

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

| RETURN |

Returns to RF Generate Operation Screen.

```
Lower Limit:      ON        12.0
Alarm:            OFF
```

If Mode Function is desired, configure as follows:

| NORM |

Displays normal status bar.

```
Alarm:            ON
Mode:             NORM
```

| BOTH |

Displays negative to positive status bar.

| RETURN |

Returns to RF Receive Operation Screen.

4-2-5   AM MODULATION METER OPERATION

The AM Modulation Meter for the RF Receiver measures AM Modulation for an RF Signal. Filtering, for the signal passed to the AM Modulation Meter, is provided by the Audio/Data Filters.

● ●

Configure and operate the AM Modulation Meter as follows:

```
| MODULATION |

          83.1   %

0 %                100 %

```

ZOOM

Displays full screen AM Modulation Meter.
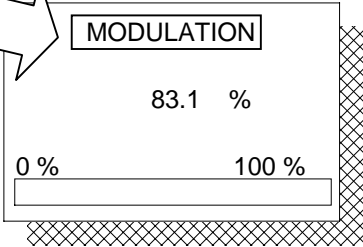
❏   Enter RF as required.

note   Editing RF field affects level on RF Receive Operation Screen.

Select Range as follows:

40%

Selects 40% range.

100%

Selects 100% range.

AUTO

Selects Autorange for Range.

```
         AM MODULATION METER

RF:              105.0000 MHz
Source:          MOD METERS
Range:           100  %
Peak Hold:       ON
Average:         ON      2
Upper Limit:     ON      90.00
Lower Limit:     ON      10.00
Alarm:           OFF
```

If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

OFF/ON

Toggles Peak Hold Function ON or OFF.

```
Peak Hold:        ON
Average:          ON      2
```

RST PK

Resets Peak Hold Function.

If Average Function is desired, configure as follows:

OFF/ON

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

```
Average:          ON      2
Upper Limit:      ON      28.0
```

If Upper Limit Function is desired, configure as follows:

| OFF/ON |

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0 to 99.9%.

| Upper Limit: | ON | 28.0 |
| Lower Limit: | ON | 12.0 |

If Lower Limit Function is desired, configure as follows:

| OFF/ON |

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0 to 99.9%.

| Lower Limit: | ON | 12.0 |
| Alarm: | OFF | |

If Alarm Function is desired, configure as follows:

| OFF/ON |

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

| RETURN |

Returns to RF Receive Operation Screen.

| Lower Limit: | ON | 12.0 |
| Alarm: | OFF | |

If Mode Function is desired, configure as follows:

| NORM |

Displays normal status bar.

| BOTH |

Displays negative to positive status bar.

| RETURN |

Returns to RF Receive Operation Screen.

| Alarm: | ON |
| Mode: | NORM |

4-2-6   PHASE MODULATION METER OPERATION

The Phase Modulation Meter for the RF Receiver measures Phase Deviation for an RF Signal. Filtering, for the signal passed to the Phase Modulation Meter, is provided by the Audio/Data Filters.

Configure and operate the Phase Modulation Meter as follows:

ZOOM

Displays full screen Phase Modulation Meter.
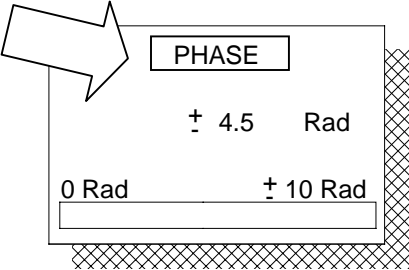
```
         PHASE

            ± 4.5    Rad

0 Rad            ± 10 Rad
```

❑   Enter RF as required.

note   Editing RF field affects level on RF Receive Operation Screen.

Select Range as follows:

1 RAD

Selects 1 Rad range.

2 RAD

Selects 2 Rad range.

5 RAD

Selects 5 Rad range.

10 RAD

Selects 10 Rad range.

AUTO

Selects Autorange for Range.
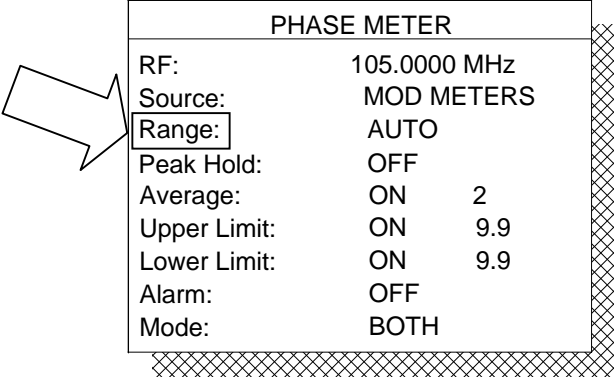
```
              PHASE METER
RF:              105.0000 MHz
Source:          MOD METERS
Range:           AUTO
Peak Hold:       OFF
Average:         ON      2
Upper Limit:     ON      9.9
Lower Limit:     ON      9.9
Alarm:           OFF
Mode:            BOTH
```

If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

OFF/ON

Toggles Peak Hold Function ON or OFF.

```
Peak Hold:        ON
Average:          ON      2
```

RST PK

Resets Peak Hold Function.
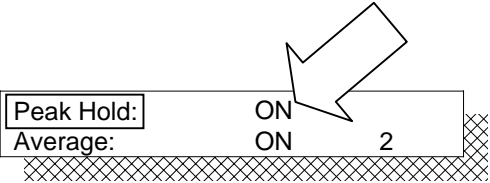
SECTION 4
OPERATION

If Average Function is desired, configure as follows:

> OFF/ON

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

Average:	ON	2
Upper Limit:	ON	28.0

If Upper Limit Function is desired, configure as follows:

> OFF/ON

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0 to 9.99 Radians.

Upper Limit:	ON	28.0
Lower Limit:	ON	12.0

If Lower Limit Function is desired, configure as follows:

> OFF/ON

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0 to 9.99 Radians.

Lower Limit:	ON	12.0
Alarm:	OFF	

If Alarm Function is desired, configure as follows:

> OFF/ON

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

> RETURN

Returns to RF Receive Operation Screen.

Lower Limit:	ON	12.0
Alarm:	OFF	

If Mode Function is desired, configure as follows:

> NORM

Displays normal status bar.

> BOTH

Displays negative to positive status bar.

Alarm:	ON	
Mode:	NORM	

> RETURN

Returns to RF Receive Operation Screen.

4-2-7 RF POWER METER OPERATION

The RF Power Meter for the RF Receiver measures power of an RF Signal.

● ●

Configure and operate the RF Power Meter as follows:
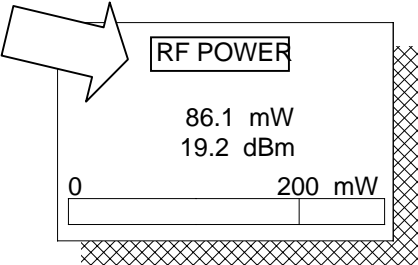
ZOOM

Displays full screen RF Power Meter.

❏ Enter RF as required.

```
RF POWER

        86.1  mW
        19.2  dBm
0                200  mW
```

note Editing RF field affects level on RF Receive Operation Screen.

Select Cable Loss as follows:

RE-ZERO

Re-zeroes Cable Loss.

RST PK

Resets Peak Hold Function.

Select Range as follows:
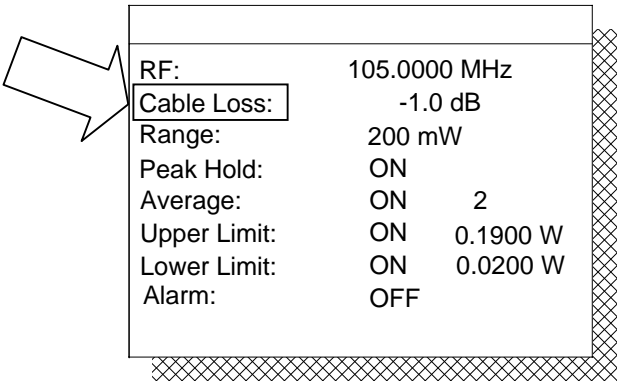
MENU

Accesses menu of range selections.

```
RF:            105.0000 MHz
Cable Loss:       -1.0 dB
Range:          200 mW
Peak Hold:      ON
Average:        ON      2
Upper Limit:    ON    0.1900 W
Lower Limit:    ON    0.0200 W
 Alarm:          OFF
```

If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

OFF/ON

Toggles Peak Hold Function ON or OFF.

RST PK

Resets Peak Hold Function.

```
Peak Hold:        ON
Average:          ON      2
```

If Average Function is desired, configure as follows:

OFF/ON

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

```
Average:          ON      2
Upper Limit:      ON    28.0
```
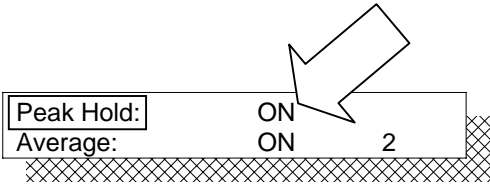
If Upper Limit Function is desired, configure as follows:

OFF/ON

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0 to 200 W.

| Upper Limit: | ON | 28.0 |
| Lower Limit: | ON | 12.0 |

If Lower Limit Function is desired, configure as follows:

OFF/ON

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0 to 200 W.

| Lower Limit: | ON | 12.0 |
| Alarm: | OFF | |

If Alarm Function is desired, configure as follows:

OFF/ON

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

RETURN

Returns to RF Receive Operation Screen.

| Lower Limit: | ON | 12.0 |
| Alarm: | OFF | |

4-2-8   RECEIVED LEVEL METER OPERATION

The Received Level Meter for the RF Receiver measures referenced power of an RF Signal.

• •

Configure and operate the Received Level Meter as follows:
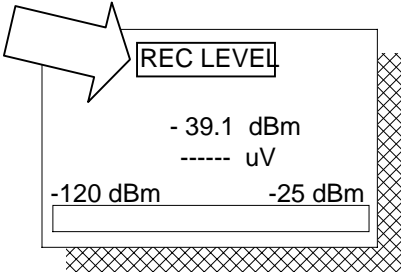
```
REC LEVEL

           - 39.1  dBm
           ------  uV
-120 dBm            -25 dBm
```

ZOOM

Displays full screen RF Power Meter.

❏   Enter RF as required.

note   Editing RF field affects level on RF Receive Operation Screen.

Select Cable Loss as follows:

30 dB

Selects 30 dB attenuation for Input Signal.

0 dB

Selects 0 dB attenuation for Input Signal.

Select Range as follows:

300 kHz

Selects 300 kHz IF Bandwidth Filter.

15 kHz

Selects 15 kHz IF Bandwidth Filter.

30 kHz

Selects 30 kHz IF Bandwidth Filter.

```
          RECEIVE LEVEL METER
RF:              105.0000 MHz
Attn:            30 dB
IF BW:           30 kHz
Peak Hold:       ON
Average:         ON      2
Upper Limit:     ON       -30.0
Lower Limit:     ON       -70.0
 Alarm:          OFF
```

```
Attn:            30 dB
IF BW:           30 kHz
```

If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

OFF/ON

Toggles Peak Hold Function ON or OFF.

```
Peak Hold:       ON
Average:         ON      2
```
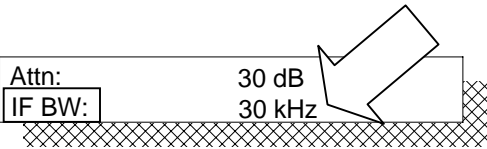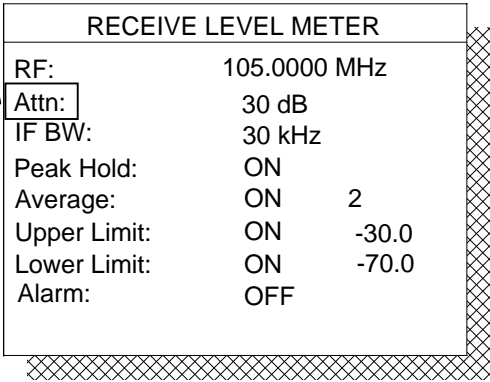
RST PK
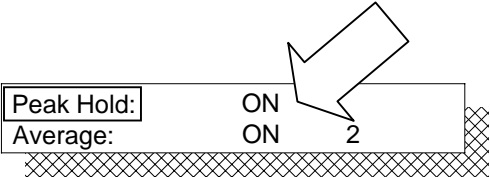
Resets Peak Hold Function.

SET LVL

Once meter is configured, set reference for meter. For greatest accuracy, perform Set Level Function for each new frequency.

EXEC

Used to set reference level.

ESCAPE

Exits without edit.

If Average Function is desired, configure as follows:

OFF/ON

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

If Upper Limit Function is desired, configure as follows:

OFF/ON

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0 to 200 W.

If Lower Limit Function is desired, configure as follows:

OFF/ON

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0 to 200 W.

If Alarm Function is desired, configure as follows:

OFF/ON

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

RETURN

Returns to RF Receive Operation Screen.

Connect a coax cable from T/R connector to ANT connector.

WORKING...
RF level   -30.0 dBm
ADC value   408

Peak Hold: ON
Average: ON   2

Upper Limit: ON   -30.0
Lower Limit: ON   -70.0

Upper Limit: ON   -3
Lower Limit: ON   -70.0

Lower Limit: ON   2.0
Alarm: OFF

4-2-9   RF FREQUENCY ERROR METER OPERATION

The RF Frequency Error Meter for the RF Receiver measures the frequency of the received RF Signal and reports the error.

● ●

Configure and operate the RF Frequency Error Meter as follows:

| ZOOM |

Displays full screen RF Frequency Error Meter.

```
RF ERROR

          - 0.034 kHz
        104.999966 MHz
-100 kHz          100 kHz
```
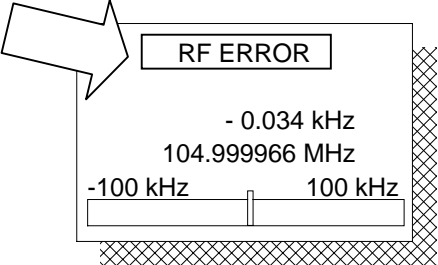
❑   Enter RF as required.

note   Editing RF field affects level on RF Receive Operation Screen.

Select IF Bandwidth as follows:

| 300 kHz |

Selects 300 kHz IF Bandwidth Filter.

| 15 kHz |

Selects 15 kHz IF Bandwidth Filter.

| 30 kHz |

Selects 30 kHz IF Bandwidth Filter.

```
RF FREQUENCY ERROR METER

RF:            105.0000 MHz
IF BW:         30 kHz
Range:         10 kHz
Peak Hold:     ON
Average:       ON      2
Upper Limit:   ON      5000 Hz
Alarm:         OFF
Gate Time:     1.0 S
```
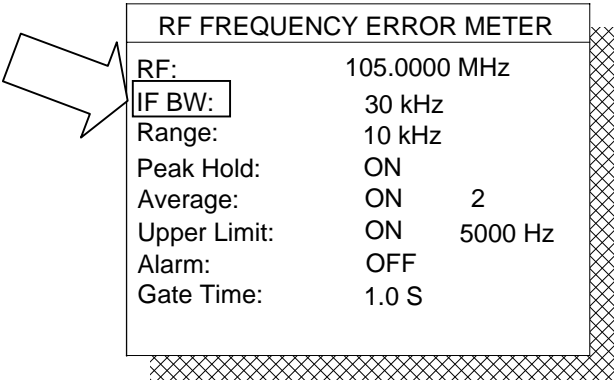
Select Range as follows:

| 100 Hz |

Selects 100 Hz range.

| 1 kHz |

Selects 1 Hz range.

```
Range:         10 kHz
Peak Hold:     ON
```

| 10 kHz |

Selects 10 kHz range.

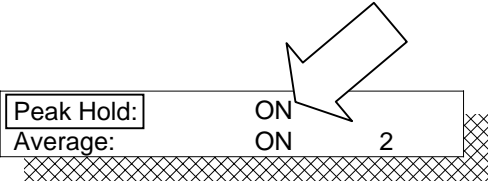| 100 kHz |

Selects 100 kHz range.

| AUTO |

Selects Autorange.
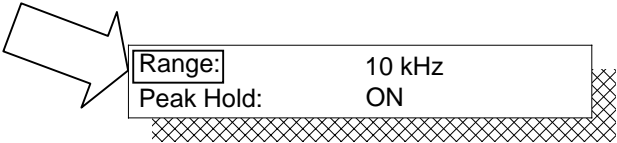
If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

[OFF/ON]

Toggles Peak Hold Function ON or OFF.

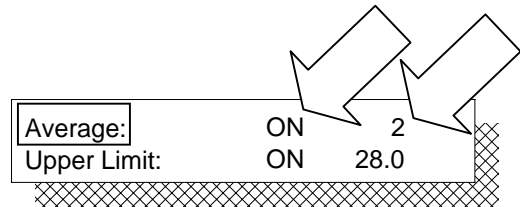| Peak Hold:	ON	
Average:	ON	2

[RST PK]

Resets Peak Hold Function.

If Average Function is desired, configure as follows:

[OFF/ON]

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 75.
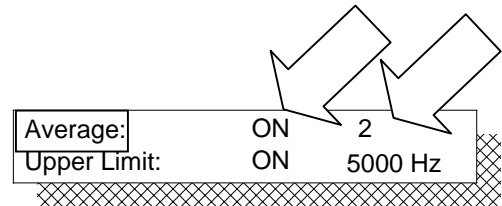
Average:	ON	2
Upper Limit:	ON	5000 Hz

If Upper Limit Function is desired, configure as follows:

[OFF/ON]

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is -110 to −30 dBm.
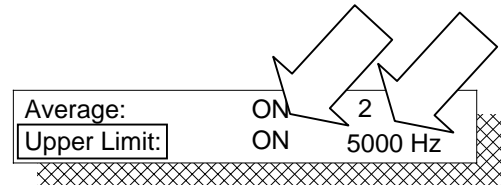
Average:	ON	2
Upper Limit:	ON	5000 Hz

If Alarm Function is desired, configure as follows:

[OFF/ON]

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

Alarm:	OFF
Gate Time:	1.0 S

[RETURN]

Returns to RF Receive Operation Screen.
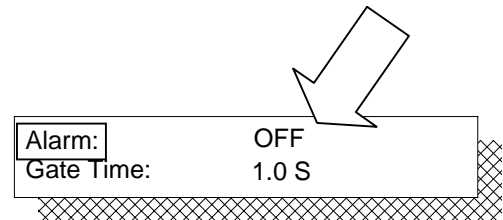
Configure Gate Time as follows:

[0.1 S]

Selects 0.1 Second as Gate Time.

Alarm:	OFF
Gate Time:	1.0 S

[1.0 S]

Selects 1.0 Second as Gate Time.

[RETURN]

Returns to RF Receive Operation Screen.
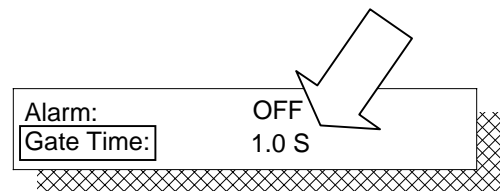
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OPERATION

4-2-10 AUDIO FREQUENCY COUNTER

The Audio Frequency Counter for the RF Receiver counts the audio frequency when the received RF Signal is modulating. Filtering for the signal passed to the Audio Frequency Counter is provided by the Audio/Data Filters.

● ●

Configure and operate the Audio Frequency Counter follows:

> **ZOOM**

Displays full screen Audio Frequency Counter.

Select Range as follows:

> **200 Hz**

Selects 200 Hz range.

> **2000 Hz**

Selects 2000 Hz range.

> **20 kHz**

Selects 20 kHz range.

> **AUTO**

Selects Autorange.

Source:	DEMOD	
Range:	2000 Hz	
Peak Hold:	ON	
Average:	ON	2
Upper Limit:	ON	1900 Hz
Lower Limit:	ON	100 Hz
Alarm:	OFF	
Gate Time:	1 S	

If Peak Hold Function is desired, take meter out of Autorange and configure as follows:

> **OFF/ON**

Toggles Peak Hold Function ON or OFF.

| Peak Hold: | ON | |
| Average: | ON | 2 |

> **RST PK**

Resets Peak Hold Function.

If Average Function is desired, configure as follows:

| OFF/ON |

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

| Average: | ON | 2 |
| Upper Limit: | ON | 1900 Hz |

If Upper Limit Function is desired, configure as follows:

| OFF/ON |

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0 to 20000 Hz.

| Average: | ON | 2 |
| Upper Limit: | ON | 1900 Hz |

If Lower Limit Function is desired, configure as follows:
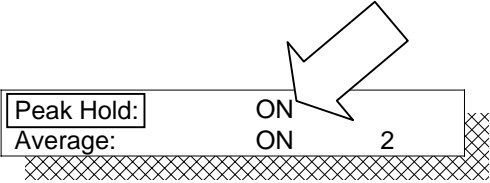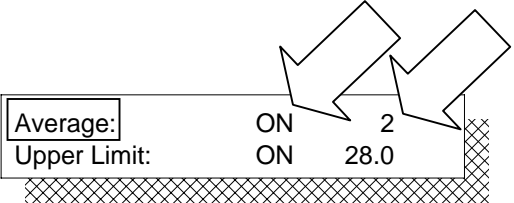
| OFF/ON |

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0 to 20000 Hz.

| Lower Limit: | ON | 100 Hz |
| Alarm: | OFF | |

If Alarm Function is desired, configure as follows:

| OFF/ON |

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

| RETURN |

Returns to RF Receive Operation Screen.

| Alarm: | OFF |
| Gate Time: | 1 S |

Configure Gate Time as follows:

| 1 S |

Selects 1 Second as Gate Time.

| 10 S |

Selects 10 Seconds as Gate Time.

| RETURN |

Returns to RF Receive Operation Screen.

| Alarm: | OFF |
| Gate Time: | 1 S |
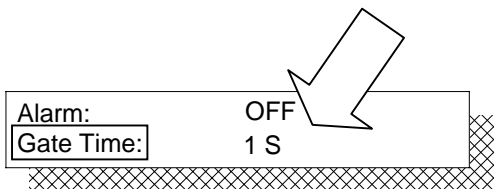
4-2-11 OSCILLOSCOPE OPERATION SCREEN

❑   The RF Receive Oscilloscope is usable as an abbreviated Oscilloscope or as a Full Screen Oscilloscope. The configuration of one is reflected in the other.

❑   Pressing F1 when the cursor is on the abbreviated Oscilloscope SCOPE/ ANALYZER field accesses the Full Screen Oscilloscope. Determine Scope Source before accessing the Full Screen Oscilloscope.

❑   For Oscilloscope Operation Screen, see page 4-22.

4-2-12 DISTORTION METER

❑   The RF Receive Spectrum Analyzer is usable as an abbreviated Spectrum Analyzer or as a Full Screen Spectrum Analyzer. The configuration of one is reflected in the other.

❑   Pressing F1 when the cursor is on the abbreviated Spectrum Analyzer SCOPE/ ANALYZER field accesses the Full Screen Spectrum Analyzer.

❑   For Spectrum Analyzer Operation Screen, see page 4-27.

4-2-13 STORE AND RECALL OPERATION

❑   Pressing STORE Memory Key allows the operator to store up to 100 RF Receive Operation Screen configurations. Storage Locations 0 through 49 can be used to store an RF Generate Operation configuration, an RF Receive Operation configuration or a Duplex Operation configuration (Receive and Generate pair).

❑   For Store and Recall Operation, see page 4-31.

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4-3   DUPLEX OPERATION

Pressing the DPLX MODE Key accesses the Duplex Operation Screen. The Duplex Mode allows the COM-120C to act as a transmitter *and* receiver and test a transceiver that may or may not have a frequency offset.

The Duplex Receive and Duplex Generate Operation Screens are similar in configuration and operation to the RF Receive and RF Generate Screens. Specific tests and configurations discussed in those two sections are applicable within the Duplex System.

The intention is to provide sufficient information to allow the operator to effectively use the COM-120C to perform specific operator defined tests.

● ●

4-3-1   GENERAL DUPLEX GENERATE OPERATION

❏ Enter desired frequency in Duplex Generate RF Field.

Frequency range is 0.0000 to 1000.0000 MHz.

Activate additional functions as desired.

To operate with △ Function active:

| △ = |

Activates window to increment RF Field. Range is 0 to 500 MHz.

| △ On/Off |
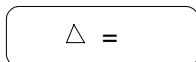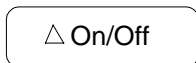
Activate/deactivate △ Function. Prompt displays by RF Field.

To Operate with Set Reference Function:

| SET REF |

R appears beside RF Field. When active, RF Field is set to 0 MHz and changes made to RF Field display offset from Reference Frequency. To deactivate Set Reference Function, press SET REF until *R* is not visible.

ERATE

```
          GENERATE

 RF :        525.0000 MHz
 Offset :      0.0000 MHz
 Level :      - 40.0  dBm
 Output :    T/R
```

```
        Set Steps:

 △  = | 0.2000 |    MHz
```

```
RF:   10.0000    MHz  △
```

```
RF:   10.0000    MHz   R
```
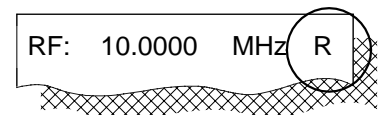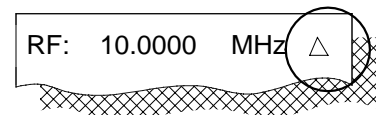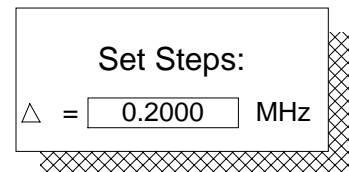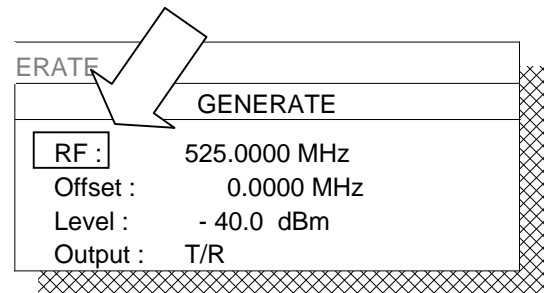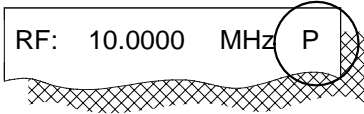
PAIR

Pairs Generate and Receive RF operation.

UNPAIR

Unpairs Generate and Receive RF.operation.

RF: 10.0000   MHz   P

❑ Set Frequency Offset to desired value.

Range is from -999.750 to 999.750 MHz.

note   To activate/ deactivate Pair/ Unpair Function, press F5.

Set Level as follows:

dBm

Selects dBm as Output Level Units.
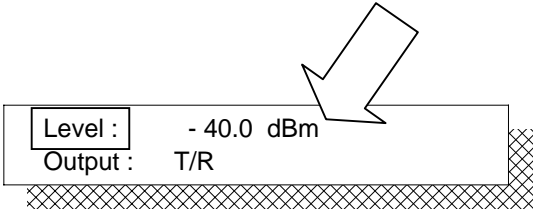
uV

Selects µV as Output Level Units.

Level :   - 40.0 dBm
Output :   T/R

mV

Selects mV as Output Level Units.

V

Selects V as Output Level Units.

Select Output as follows:

T/R

Selects T/R Connector as output connector.

AUX
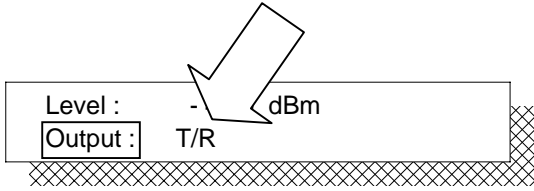
Selects AUX RF Connector as output connector.

Level :   -   dBm
Output :   T/R

T/R Gate

Selects T/R Connector as gated output connector.

AUX Gate

Selects AUX RF Connector as gated output connector.

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Set Modulation Source Block as follows:

[GEN1]

If Audio Generator 1 Operation is desired.

[GEN2]

If Audio Generator 2 Operation is desired.

[DATA]

If DATA Generator Operation is desired.

[DTMF]

If DTMF Generator Operation is desired.

[MIC]

If Microphone Modulation Operation is desired.

[EXT]

If External Modulation Operation is desired.

Select the desired Modulation Type:

[OFF]

Modulation OFF.

[AM]

Range is 0.0% to 100.0% for AM Modulation.

[FM]

Range is 0.00 to 100 kHz for FM Modulation.

[PM]

Range is 0.00 to 10 Radians for PM Modulation.

```
Mod Src: GEN1        FM
Deviation:      5.0 kHz
Format:  TONE
Freq:   1000.0 Hz

Shape:    SINE
```

```
Mod Src: GEN1        FM
Deviation:      5.0 kHz
Format:  TONE
Freq:   1000.0 Hz

Shape:    SINE
```

❏   Enter Deviation/Modulation Level.

Select the desired Format.

MENU

Accesses a menu with available format selections.

Select transmission type:

CONT

Selects continuous transmission of signal.

```
Mod Src: GEN1      FM
Deviation:    5.0 kHz
Format: TONE
Freq:  1000.0 Hz

Shape:   SINE
```

BURST

For single transmission of selected signal.

TIME

Accesses Burst Time Window if TONE is the selected format.

CONFIG

Accesses Configuration Window if USER is the selected format.

Used to configure User Selectable Frequency and Duration for codes 0 through 9 and A through T.

Enter desired frequencies and durations for codes. Range of frequencies are 0 to 9999.9 Hz. Range of durations are 0 to 99.999 seconds.

Use F1 and F2 to scroll up or down through Configuration Window. Use F3 to fill remainder of current column with value of current cursor position.

❑   If TONE is selected as Format, enter Audio Tone Frequency.

❑   If TONE is selected as Format, enter Shape.

Range is 5 to 20000 Hz with Shape set to SINE. Range is 5 to 10000 Hz otherwise.

Select Shape of Wave as follows:

SINE

Selects SINE Wave Shape.

RAMP

Selects RAMP Wave Shape.

TRIANGLE

Selects TRIANGLE Wave Shape.

SQUARE

Selects SQUARE Wave Shape.

Mod Src: GEN1   FM
Deviation: 5.0 kHz
Format: TONE
Freq: 1000.0 Hz

Shape: SINE

4-3-2   GENERAL DUPLEX RECEIVE OPERATION

❑   Enter desired frequency in RF Field.

Frequency range is 0.0000 to 1000.0000 MHz.

Activate additional functions as desired.

To operate with Δ Function active:

| Δ = |

Activates window to increment RF Field.
Range is 0 to 500 MHz.

| Δ On/Off |

Activate/deactivate Δ Function. Prompt
displays by RF Field.

| PAIR |

Pairs Generate and Receive RF operation.

| UNPAIR |

Unpairs Generate and Receive RF.operation.

```
DUPLE           RECEIVE  AND  GEN
            RECEIVE
  RF :        525.0000 MHz
  FL :        OFF
  Input :    T/R      Atten:    0 dB
  Demod :   FM      IF BW: 15 kHz
```

```
        Set Steps:

  Δ  =   0.2000      MHz
```

```
  RF:    10.0000    MHz   Δ
```

```
  RF:    10.0000    MHz   P
```

❑   If Frequency List Operation is desired instead
of entering frequency in RF Field, select Frequency List Setting as follows:

| On/Off |

Activates Frequency List Setting.

| T-Fwd |

Selects Trunking Forward Channel List.

| T-Rvs |

Selects Trunking Reverse Channel List.

| C-Fwd |

Selects Cellular Forward Channel List.

| C-Rvs |

Select Cellular Reverse Channel List.

| FL |

Select User Defined Frequency List.

```
  RF: 10.0000  MHz
  FL:  OFF
  Input: ANT    Atten: 30 dB
  Demod: FM   IF BW: 15 kHz
```

If Cellular Channel List or User Defined Frequency List is selected, enter channel/frequency number. Range of cellular channels is 1 to 1023. Range of Frequency List is 0 to 99.

If Trunking Channel List is selected, select channel number. Select Frequency Band. Select desired Frequency Band using DATA SCROLL Keys or DATA SCROLL Spinner. Press ENTER Key.

❑   Set Input Level Units as follows:

T/R

Selects T/R as input connector.

ANT

Selects Antenna as input connector.

RF: 10.0000 MHz
FL: OFF
Input: ANT   Atten: 30 dB
Demod: FM   IF BW: 15 kHz

❑   Set Attenuation as follows:

30 dB

Selects 30 dB attenuation for input signal.

0 dB

Selects 0 dB attenuation for input signal.

RF: 10.0000 MHz
FL: OFF
Input: ANT   Atten: 30 dB
Demod: FM   IF BW: 15 kHz

❑   Set Demodulation Type as follows:

AM

Selects AM Demodulation.

FM

Selects FM Demodulation.

PM

Selects PM Demodulation.

RF: 10.0000 MHz
FL: OFF
Input: ANT   Atten: 30 dB
Demod: FM   IF BW: 15 kHz

300 kHz

Selects 300 kHz IF Bandwidth Filter.

15 kHz

Selects 15 kHz IF Bandwidth Filter.

30 kHz

Selects 30 kHz IF Bandwidth Filter.

```
RF:  10.0000  MHz
FL:  OFF
Input  ANT     Atten: 30 dB
Demod           IF BW: 15 kHz
```

note For following guidelines, ΔF is Frequency Deviation in Hz, Φ is Phase Deviation in Radians, Fm is the Tone Modulation Frequency in Hz and IF is Minimum IF Filter Bandwidth. General Guidelines for IF Filter Selection are as follows:

For FM Modulated Signals:
$$IF = 4(\Delta F + Fm)$$

For PM Modulated Signals:
$$IF = 4Fm(\Phi + 1)$$

For AM Modulated Signals:
$$IF = 15 \text{ kHz, for Fm} \leq 1 \text{ kHz}$$

❑ Select Tone/Data Type for TONE/DATA CODE Field as required. Press F2 to activate decoding.

❑ Select desired DISTORTION/SINAD Reading.

Press F2 to select SINAD Reading.

Press F3 to select DISTORTION Reading.

SECTION 4
OPERATION

4-4   INDEPENDENT OSCILLOSCOPE OPERATION SCREEN

Press the SCOPE INSTRUMENTS Key to access an independent Oscilloscope Operation Screen.

This Oscilloscope Test Instrument is independent of all other Operation Modes.

For Oscilloscope operation, see page 4-20.

4-5   INDEPENDENT SPECTRUM ANALYZER OPERATION SCREEN

Press the ANLYZ INSTRUMENTS Key to access the Spectrum Analyzer Operation Screen.

This Spectrum Analyzer Test Instrument is independent of all other Operation Modes.

For Spectrum Analyzer operation, see page 4-25.

4-6   INDEPENDENT AUDIO/DATA/SIGNALING GENERATORS

Press the AUDIO GEN INSTRUMENTS Key to access the Audio/Data/Signaling Generators Operation Screen. The Independent Audio/Data/ Signaling Generators provide baseband signal generators that are independent of other Operation Modes.

The Audio/Data/Signaling Generators Operation Screen is composed of four sections. Each section of the screen represents a different generator. The generators are addressed separately in this documentation. Restrictions that apply to the generators are primarily related to the output level.

The sum of the generators output level should not exceed 2.5 volts in X1 mode and 25 mV in /10 (divide by 10) mode. If /10 mode is selected, <u>ALL</u> signal generators are affected.

The intention is to provide sufficient information to allow the operator to effectively use the COM-120C to perform specific operator defined tests.

● ●

4-6-1   AUDIO GENERATOR-1 OPERATION

Configure and operate Audio Generator-1 as follows:

```
  GEN1
```

Toggles Audio Generator-1 ON and OFF.

❏   Cursor to Format and select from the menu.

❏   If TONE is selected as Format:

Enter Audio Tone Frequency. Range is 5.0 to 20000 Hz.

Select Shape of Wave as follows:
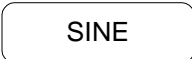
```
  SINE
```
Selects Sine wave.

```
  RAMP
```
Selects Ramp wave.

```
  TRIANGLE
```
Selects Triangle wave.

```
  SQUARE
```
Selects Square wave.

```
AUDIO  GEN - 1              ( ON )

Format :    TONE
  Freq :     1000.0 Hz
Shape :    SINE


 Level :    0.00 Vp      .000 Vrms
Mode :    CONT
```

```
       Freq :      1000.0 Hz
      Shape :     SINE
```
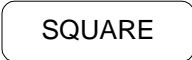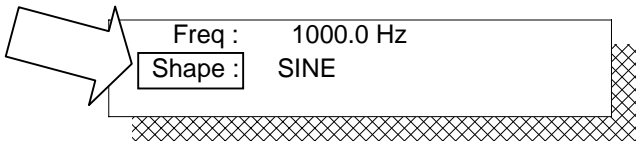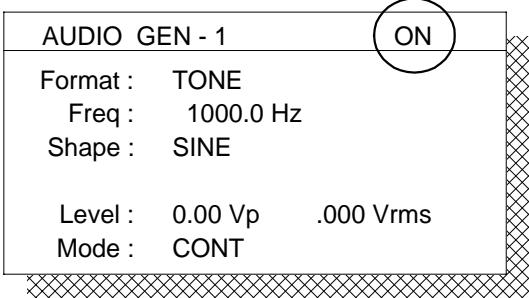
❑ Enter Level as desired.

❑ Enter Mode as desired.

note USER Format is configurable.

Level :	0.00 Vp	.000 Vrms
Mode :	CONT	
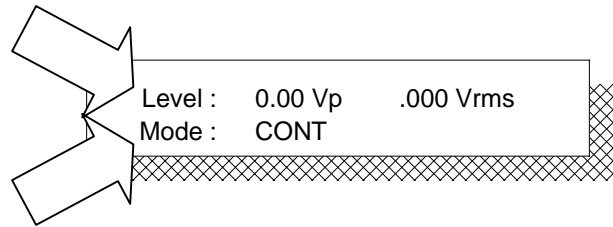
Configure USER Format as follows:

CONFIG

Accesses Configuration Window.

❑ Configure User Selectable Frequency and Duration for codes 0 through 9 and A through T.

Enter desired frequencies and duration for codes.

Range of frequency is 0 to 9999.9 Hz.

Range of duration is 20 to 9999 ms.

USER SIGNALING PROGRAM

CHAR	FREQ (Hz)	DUR (ms)
0	0.0	20
1	0.0	20
2	0.0	20
3	0.0	20
4	0.0	20
5	0.0	20
6	0.0	20
7	0.0	20
8	0.0	20
9	0.0	20

PG UP

Scrolls UP through configuration window.

PG DN

Scrolls DOWN through configuration window.

FILL

Fills remainder of current column with value of current cursor position.

RETURN

Exits configuration window.

❑ Enter code. Press F1 to clear current code entry.

❑ Enter Level.

Selections range from 0 to 2.5 Vp in X1 (times 1) Mode and 0 to 25.0 mVp in /10 (divide by 10) Mode.

Set Level attenuation as follows:

| X1 |

Selects X1 (times 1) level attenuation.

| Level : | 0.00 Vp |
| Mode : | CONT |

| /10 |

Selects /10 (divide by 10) level attenuation.
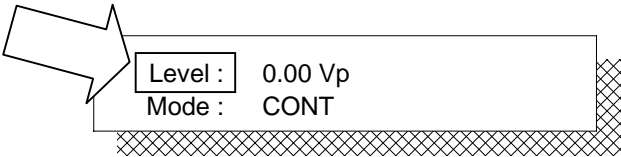
note Level selections range from 0 to 2.5 Vp in X1 (times 1) mode and 0 to 25.0 mVp in /10 (divide by 10) mode.

Select Mode as follows:

| CONT |

Selects continuous transmission of a signal.

| Level : | 0.00 Vp |
| Mode : | CONT |

| BURST |

Executes a single transmission of selected signal.
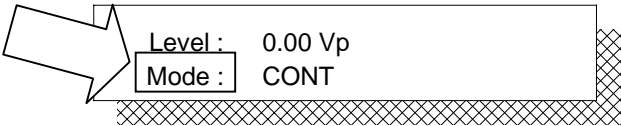
note If TONE is selected as Format, enter duration time for TONE Burst in T= field. Time duration ranges from 0 to 30 seconds.

SECTION 4
OPERATION

4-6-2   AUDIO GENERATOR-2 OPERATION

Configure and operate Audio Generator-2 as follows:

| GEN2 |

Toggles Audio Generator-2 ON and OFF.

❑   Enter Audio Tone Frequency. Range is 5.0 to 20000 Hz.

```
AUDIO  GEN - 2                    ( ON )

Format :    TONE
   Freq :      1000.0 Hz
Shape :    SINE

   Level :    0.00 Vp       .000 Vrms
```

Select Shape of Wave as follows:

| SINE |

Selects Sine wave.

| RAMP |

Selects Ramp wave.

| TRIANGLE |

Selects Triangle wave.

| SQUARE |

Selects Square wave.

```
Freq :      1000.0 Hz
Shape :     SINE
```

Set Level attenuation as follows:

| X1 |

Selects X1 (times 1) level attenuation.

| /10 |

Selects /10 (divide by 10) level attenuation.

```
Level :    0.00 Vp       .000 Vrms
```

note   Level selections range from 0 to 2.5 Vp in X1 (times 1) mode and 0 to 25.0 mVp in /10 (divide by 10) mode.

4-6-3 DATA GENERATOR OPERATION

Configure and operate Data Generator as follows:

> DATA

Toggles Data Generator ON and OFF.

Select Format as follows:

> DCS

Selects DCS format.

> DCS/
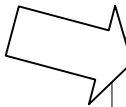
Selects DCS Inverted format.

> POCSAG

Selects POCSAG format.
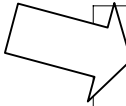
> POCSAG/

Selects POCSAG Inverted format.

❑ Enter desired code.

Range is 000 (Octal) to 777 (Octal).

Set Level attenuation as follows:

> X1

Selects X1 (times 1) level attenuation.

> /10

Selects /10 (divide by 10) level attenuation.

```
DATA  GEN                    ( ON )

Format :    DCS
 Code :     114


Level :    1.00 Vp
```

```
Format :    DCS
 Code :     114
```

```
Format :    DCS
 Code :     114
```

```
Level :    1.00 Vp
```
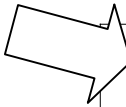
note Level selections range from 0 to 2.5 Vp in X1 (times 1) mode and 0 to 25.0 mVp in /10 (divide by 10) mode.

SECTION 4
OPERATION

4-6-4   DTMF GENERATOR OPERATION

Configure and operate Data Generator as follows:

> DTMF

Toggles DTMF Generator ON and OFF.

```
┌──────────────────────────────────┐
│ DTMF  GEN                  ( ON ) │
├──────────────────────────────────┤
│  Code :   0123456789ABCD#*        │
│  Mark :    70 msec                │
│ Space :    70 msec                │
│ Pause :   300 msec                │
│  Level :   0.00                   │
│  Mode :   CONT                    │
└──────────────────────────────────┘
```
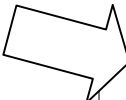
❏ Press F1 to clear code field of current data.

❏ Enter desired Mark Time for DTMF tones.

Range is 25 to 99 msec.

❏ Enter desired Space Time for DTMF tones.

Range is 25 to 99 msec.

❏ Enter desired Pause Time for DTMF tones.

Range is 25 to 99 msec.

Set Level attenuation as follows:

> X1

Selects X1 (times 1) level attenuation.

> /10

Selects /10 (divide by 10) level attenuation.

```
┌──────────────────────────────────┐
│  Level :   0.00                   │
│  Mode :   CONT                    │
└──────────────────────────────────┘
```

note Level selections range from 0 to 2.5 Vp in X1 (times 1) mode and 0 to 25.0 mVp in /10 (divide by 10) mode.

Select Mode as follows:
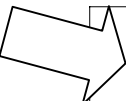
> CONT

Activates DTMF Code in a repeating loop.

> BURST

Activates DTMF Code for one tone sequence.

```
┌──────────────────────────────────┐
│  Level :   0.00 Vp                │
│  Mode :   CONT                    │
└──────────────────────────────────┘
```

> KEY

Sets DATA ENTRY Keys active as DTMF keypad.

4-7   METERS OPERATION

The Independent Meters are independent of all other Operation Modes.

Pressing the MTRS INSTRUMENTS Key accesses the Independent Meters Menu.

From the Meters Menu, cursor to the number of the desired meter and press ENTER.

For Audio Frequency Counter Operation, see page 4-51.

For SINAD Meter Operation, see page 4-13.

For Digital Voltmeter Operation, see page 4-69.

For Distortion Meter Operation, see page 4-16.

The intention is to provide sufficient information to allow the operator to effectively use the COM-120C to perform specific operator defined tests.

● ●

4-7-1   DIGITAL VOLTMETER OPERATION

Select Source as follows:

| MENU |

Accesses a menu of available selections.

Source: SCP/DVM AC
Range: 1 Volt
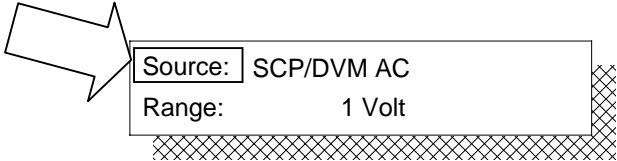
| DC ZERO |

Performs DC Zero when source is SCP/ DVM DC.

Select Range as follows:

| MENU |

Accesses a menu of available selections.

Source: SCP/DVM AC
Range: 1 Volt
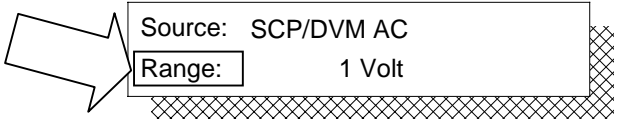
Select Peak Hold Function as follows:

| OFF/ON |

Toggles Peak Hold Function ON or OFF.

| RST PK |

Resets Peak Hold Function.

Peak Hold: ON
Average: ON   2
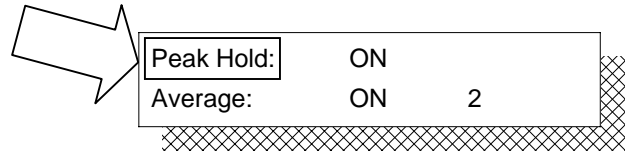
Select Average Function as follows:

| OFF/ON |

Toggles Average Function ON or OFF. Cursor to Sample Number to enter desired value. Range is 2 to 10.

| Peak Hold: | ON |
| Average: | ON | 2 |
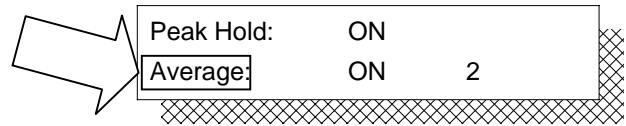
Select Upper Limit Function as follows:

| OFF/ON |

Toggles Upper Limit Function ON or OFF. Enter Limit Value. Range is 0 to 200 V.

| Upper Limit: | ON | 0.900 V |
| Lower Limit: | ON | 0.100 V |
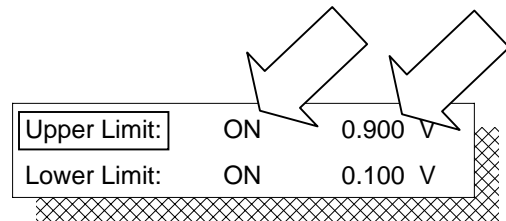
Select Lower Limit Function as follows:

| OFF/ON |

Toggles Lower Limit Function ON or OFF. Enter Limit Value. Range is 0 to 200 V.

| Upper Limit: | ON | 0.90 |
| Lower Limit: | ON | 0.100 V |
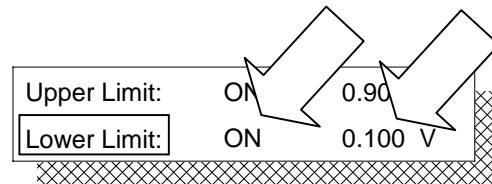
Select Alarm Function as follows:

| OFF/ON |

Toggles Alarm Function ON or OFF. When activated, alarm alerts over range condition.

| RETURN |

Returns to RF Receive Operation Screen.

| Lower Limit: | ON | 0.100 V |
| Alarm: | OFF |
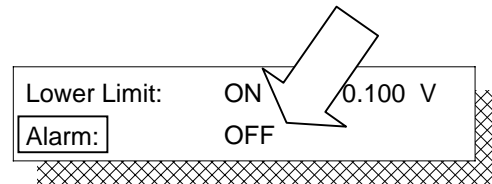
IF Source is SCP/ DVM AC, AUDIO/ DATA IN or EXT MOD IN, configure as follows:

Vrms

Converts reading units to Vrms.

dBm

Converts reading units to dBm. Set Impedance for desired load. Place required load on connector specified by Source.

dB

Converts reading units to dB.

Set Scope Sweep as follows:

MENU

Accesses a menu of available selections.

ROLL

To view the scope trace in a roll mode when selected sweep rate is 100 ms/div or higher.

SLOW

Exits roll and returns to normal mode of operation.
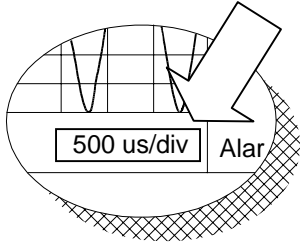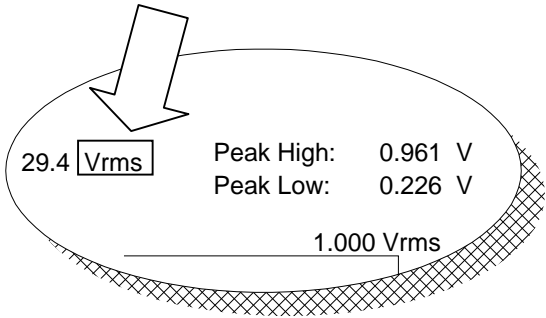
29.4 Vrms   Peak High: 0.961 V
              Peak Low: 0.226 V

                    1.000 Vrms

500 us/div   Alar

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5-1   RF GENERATE

This section offers suggestions for equipment and screen setups for some common RF Generate practices.

SECTION 5
COMMON PRACTICES

5-1-1   GENERATING FM MODULATED RF SIGNAL

This procedure configures the RF Generate Operation Screen to transmit an FM Modulated RF Signal at the T/R Connector.
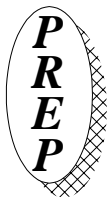
P
R
E
P

The audio portion of the signal is a 1 kHz sine wave from Audio Generator 1.

The deviation is set at 5 kHz.

The Output Level is -50 dBm.

The speaker is configured to play the internal modulated signal.

● ●

o   Set RF Field to **Rcvr Center Frequency**.

o   Set Output Level to **-50 dBm**.

o   Set Output to **T/R**.

o   Select Audio Generator 1 (**GEN1**) for Modulation Source.

o   Set Modulation Type to **FM**.

o   Set Deviation Level to **5.00 kHz**.

o   Set Format to **TONE**.

o   Set Tone Freq to **1000.0 Hz**.

o   Set Shape to **SINE**.

o   Access Filters Setup Menu.

o   Set Speaker/Headphones Field to **INT-MOD**.

o   Return to RF Generate Operation Screen.

o   Set VOLUME Control for desired audio level.

RF GEN AUDIO / DATA FILTERS SETUP MENU	

LINE	BAND PASS FILTER	HIGH PASS FILTER	LOW PASS FILTER	WIDE - BAND
DTMF / SINAD	OFF	OFF	OFF	ON

*** PRESS "EXEC" TO ACTIVATE SELECTION ***

SPEAKER / PHONES	INT - MOD

RF: 100.0000 MHz	
FL: OFF	
Level: -50.0 dBm	
Output: T/R	
GEN1	
Mod Src: GEN1 FM	
Deviation: 5.00 kHz	
Format: TONE	
Freq: 1000.0 Hz	
Shape: Sine	

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Generating FM Modulated RF Signal

SECTION 5
COMMON PRACTICES

5-1-2   GENERATING AM MODULATED RF SIGNAL

This procedure configures the RF Generate Operation Screen to transmit an AM Modulated RF Signal at the T/R Connector.

PREP
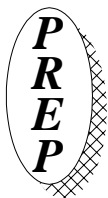
The audio portion of the signal is a 1 kHz sine wave from Audio Generator 1.

The Modulation is set at 50%.

The Output Level is -50 dBm.

The speaker is configured to play the internal modulated signal.

• •

o   Set RF Field to ***Rcvr Center Frequency***.

o   Set Output Level to ***-50 dBm***.

o   Set Output to ***T/R***.

o   Select Audio Generator 1 (***GEN1***) for Modulation Source.

o   Set Modulation Type to ***AM***.

o   Set Modulation Level to ***50.0%***.

o   Set Format to ***TONE***.

o   Set Tone Freq to ***1000.0 Hz***.

o   Set Shape to ***SINE***.

o   Access Filters Setup Menu.

o   Set Speaker/Headphones Field to ***INT-MOD***.

o   Return to RF Generate Operation Screen.

o   Set VOLUME Control for desired audio level.

RF GEN AUDIO / DATA FILTERS SETUP MENU	

LINE	BAND PASS FILTER	HIGH PASS FILTER	LOW PASS FILTER	WIDE - BAND
DTMF / SINAD	OFF	OFF	OFF	ON
*** PRESS "EXEC" TO ACTIVATE SELECTION ***				
SPEAKER / PHONES	INT - MOD			

RF: (Rcvr Center Frequency)
FL: OFF
Level: -50.0 dBm
Output: T/R

GEN1

Mod Src: GEN1   AM
Mdulation: 50.0%
Format: TONE
Freq: 1000.0 Hz

Shape: Sine

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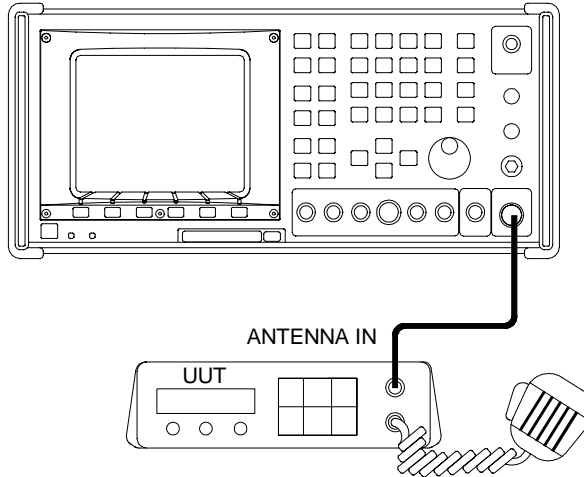
Generating AM Modulated RF Signal

SECTION 5
COMMON PRACTICES

5-1-3   GENERATING PM MODULATED RF SIGNAL

This procedure configures the RF Generate Operation Screen to transmit a PM Modulated RF Signal at the T/R Connector.
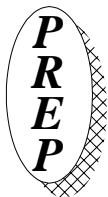
P R E P

The audio portion of the signal is a 1 kHz sine wave from Audio Generator 1.

The deviation is set at 5 Radians.

The Output Level is -50 dBm.

● ●

o   Set RF Field to ***Rcvr Center Frequency***.

o   Set Output Level to ***-50 dBm***.

o   Set Output to T/R.

o   Select Audio Generator 1 (***GEN1***) for Modulation Source.

o   Set Modulation Type to ***PM***.

o   Set Deviation Level to ***5.00 Rad***.

o   Set Format to ***TONE***.

o   Set Tone Freq to ***1000.0 Hz***.

o   Set Shape to ***SINE***.

o   Access Filters Setup Menu.

o   Set Speaker/Headphones Field to ***INT-MOD***.

o   Return to RF Generate Operation Screen.

o   Set VOLUME Control for desired audio level.

RF GEN AUDIO / DATA FILTERS SETUP MENU				
LINE	BAND PASS FILTER	HIGH PASS FILTER	LOW PASS FILTER	WIDE - BAND
DTMF / SINAD	OFF	OFF	OFF	ON
*** PRESS "EXEC" TO ACTIVATE SELECTION ***				
SPEAKER / PHONES	INT - MOD			

```
RF:      (Rcvr Center Frequency)
FL:      OFF
Level:   -50.0 dBm
Output:  T/R

GEN1

Mod Src: GEN1     PM
Mdulation:    5.0  Rad
Format: TONE
Freq:  1000.0 Hz


Shape:   Sine
```

ANTENNA IN

UUT
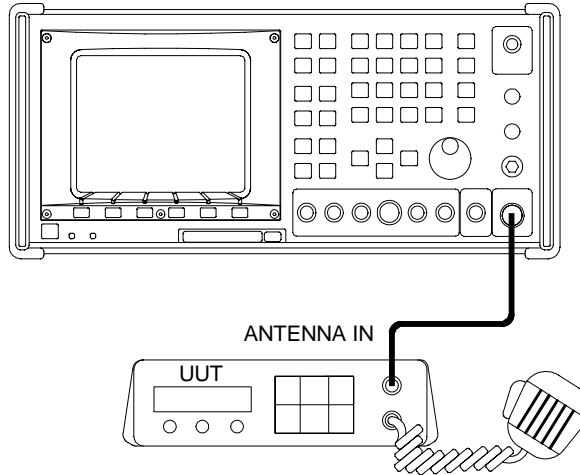
00607221

Generating PM Modulated RF Signal

SECTION 5
COMMON PRACTICES

5-1-4   GENERATING DCS CODED RF SIGNAL

This procedure configures the RF Generate Operation Screen to transmit an RF Signal FM Modulated with a DCS Code at the T/R Connector.
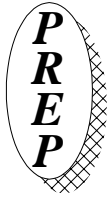
P
R   The deviation is set at 0.50 kHz.
E
P   The Output Level is -50 dBm.

● ●

o   Set RF Field to **Radio Center Frequency**.

o   Set Output Level to **-50 dBm**.

o   Set Output to **T/R**.

o   Select DATA Generator (**DATA**) for Modulation Source.

o   Set Modulation Type to **FM**.

o   Set Deviation Level to **0.50 kHz**.

o   Set Format to **DCS**.

o   Set Code to **114**.

o   Verify radio unsquelches.

o   Turn DATA generator off.

o   Verify radio squelches.

```
RF:      (Radio Center Frequency)
FL:      OFF
Level:   -50.0  dBm
Output:  T/R

DATA

Mod Src: DATA         FM
Deviation:     0.50 kHz
Format:  DCS
Code:  114
```


TRANSMITTER OUT

UUT
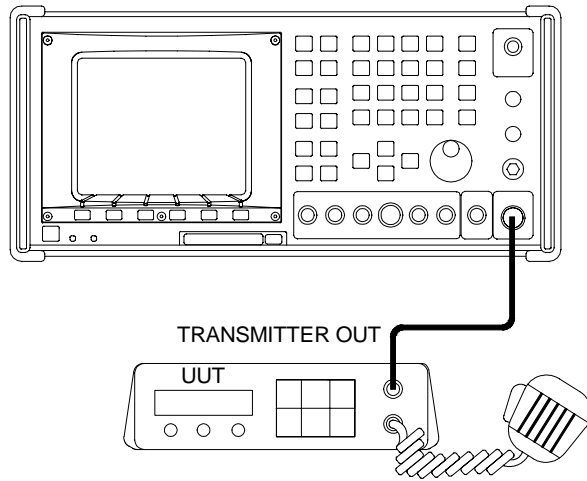
00607222

Generating DCS Coded RF Signal

SECTION 5
COMMON PRACTICES

5-1-5   GENERATING DTMF CODED RF SIGNAL

This procedure configures the RF Generate Operation Screen to transmit an RF Signal FM Modulated with DTMF Code at the T/R Connector.

PREP
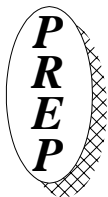
The deviation is set at 5 kHz.

The Output Level is -50 dBm.

The signal is set to run in a continuous loop.

● ●

❏   Set RF Field to **Rcvr Center Frequency**.

❏   Set Output Level to **-50 dBm**.

❏   Set Output to **T/R**.

❏   Select DTMF Generator 1 (**DTMF**) for Modulation Source.

❏   Set Modulation Type to **FM**.

❏   Set Deviation Level to **3.50 kHz**.

❏   Enter desired DTMF Code.

❏   Set Mark Time to **70 msec**.

❏   Set Space Time to **70 msec**.

❏   Set Pause Time to **70 msec**.

❏   Cursor to Code field.

❏   Press F2 **CONT**.

RF:
FL: OFF
Level: -50.0 dBm
Output: T/R

DTMF

Mod Src: DTMF   FM
Deviation: 3.50 kHz
Code: 123456789*0#
Mark: 70 msec
Space: 70 msec
Pause: 70 msec
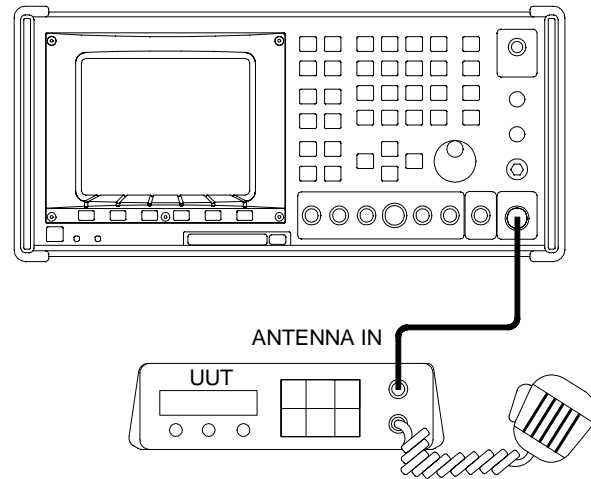
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Generating DTMF Coded RF Signal

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SECTION 5
COMMON PRACTICES

5-1-6   GENERATING RF SIGNAL USING EXTERNAL MODULATION

This procedure configures the RF Generate Operation Screen to transmit an RF Signal FM Modulated with 1 kHz External Modulation Source.

P R E P

The deviation is set at 5 kHz by adjusting the input level of the Modulation Signal.

The Output Level is -50 dBm.

● ●

❏   Set RF Field to *Rcvr Center Frequency*.

❏   Set Output Level to *-50 dBm*.

❏   Set Output to *T/R*.

❏   Select External Modulation (*EXT*) for Modulation Source.

❏   Set Modulation Type to *FM*.

❏   Set Deviation Range to *NAR 3*.

❏   Configure RF Generate Operation Screen for active *SCOPE*.

❏   Set Oscilloscope Sweep for *1 ms/div*.

❏   Set Oscilloscope Source for *Scope/DVM-AC*.

❏   Connect External Modulation Source to SCOPE/DVM IN Connector.

❏   Set External Modulation Source for 2.5 Vp. This setting produces 5 kHz Deviation independent of signal shape.

❏   Connect External Modulation Source to EXT MOD IN Connector.

GENERATE

SCOPE

1 V   1 ms/div
SOURCE: Scope/DVM - AC

RF: (Rcvr Center Frequency)
FL: OFF
Level: -50.0 dBm
Output: T/R

EXT

Mod Src: EXT   FM
Dev Range: NAR 3
Deviation: 5.00 kHz

UUT
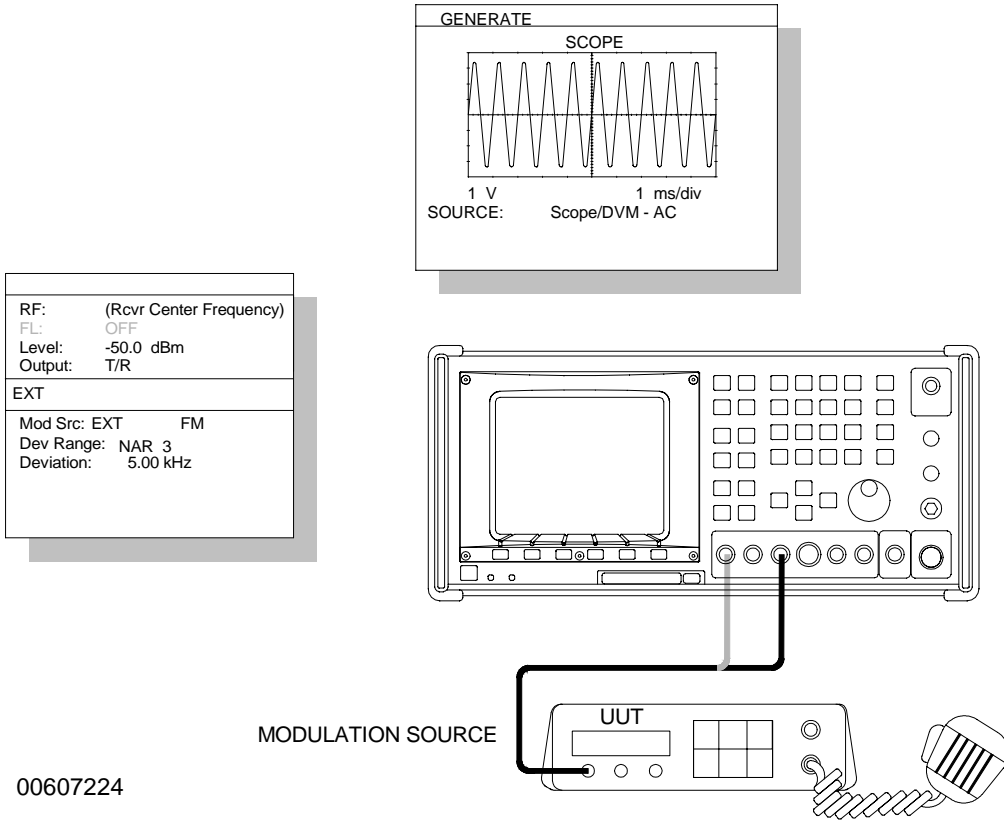
MODULATION SOURCE

00607224

Generating RF Signal Using External Modulation

SECTION 5
COMMON PRACTICES

5-1-7   GENERATING MICROPHONE MODULATED RF SIGNAL

This procedure configures the RF Generate Operation Screen to transmit a Microphone Modulated RF Signal at the T/R Connector.

PREP
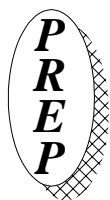
The Microphone is connected to the MIC/ACC Connector.

The Output Level is -50 dBm.

● ●

❑   Set RF Field to *Rcvr Center Frequency*.

❑   Set Output Level to *-50 dBm*.

❑   Set Output to *T/R*.

❑   Select Microphone (*MIC*) for Modulation Source.

❑   Set Modulation Type to *FM*.

❑   Set Deviation Range to *NAR 3*.

```
RF:        (Rcvr Center Frequency)
FL:        OFF
Level:     -50.0  dBm
Output:  T/R

MIC

Mod Src: MIC          FM
Dev Range:    NAR  3
```
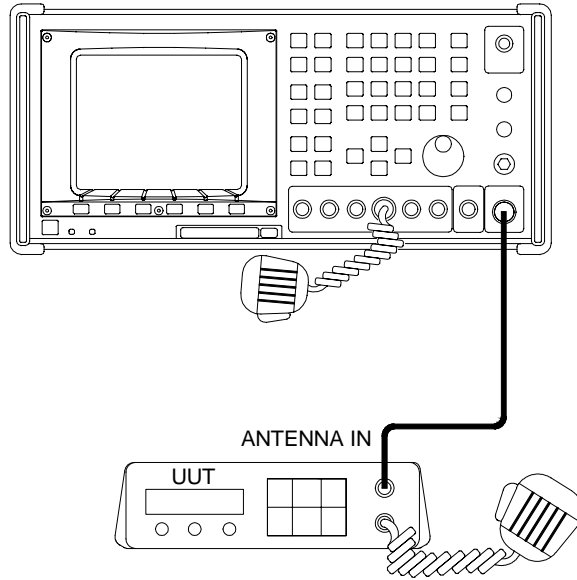
00607225

Generating Microphone Modulated RF Signal

SECTION 5
COMMON PRACTICES

5-1-8   ENCODING 2-TONE SEQUENTIAL FORMAT

This procedure configures the RF Generate Operation Screen to encode using the 2-Tone Sequential format.
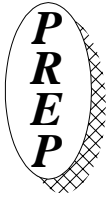
P
R This example assumes an FM pager requires a first tone of 650 Hz for
E 500 ms and a second tone of 850 Hz for 1.5 sec. with a 0.25 sec. gap.
P

● ●

❏   Set RF Field to **Pager Center Frequency**.

❏   Set Output Level to **-30 dBm**.

❏   Set Output to **T/R**.

❏   Select **GEN1** for Modulation Source.

❏   Set Modulation Type to **FM**.

❏   Set Deviation to **5.0 kHz**.

❏   Set Format to **USER**.

❏   Cursor to Format Field and press F4 **CONFIG**.

❏   Edit the USER SIGNALING PROGRAM pop-up window to read:

USER SIGNALING PROGRAM		
CHAR	FREQ (Hz)	DUR (ms)
0	0.0	250
1	650.0	500
2	850.0	1500

❏   Press F6 **RETURN**.

❏   Cursor to Code Field and press F1 **CLEAR**.

❏   Attach an antenna to the T/R Connector.

❏   Enter **102**.

❏   Cursor to Format Field and Press F3 **BURST** or F2 **CONT** to set off the pager.

```
RF:        (Pager Center Frequency)
FL:        OFF
Level:     -30.0  dBm
Output:    T/R
GEN1

Mod Src: GEN1          FM
Deviation:      5.0 kHz
Format:   USER
Code:  102
```
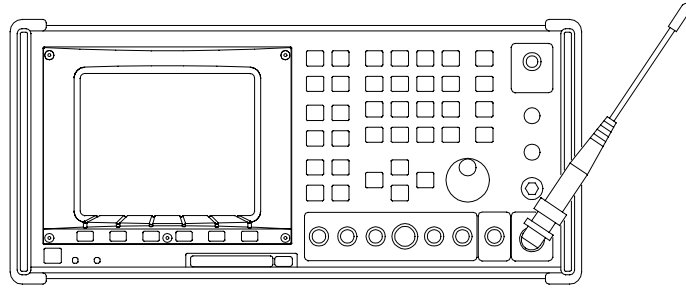
00607247

Encoding 2-Tone Sequential Format

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5-2   RF RECEIVE

This section offers suggestions for equipment and screen setups for some common RF Receive practices.

SECTION 5
COMMON PRACTICES

5-2-1   RECEIVING FM MODULATED RF SIGNAL

This procedure configures the RF Receive Operation Screen to receive a Frequency Modulated RF Signal at the ANTENNA Connector.

P R E P   The transmitted signal Is 5 kHz deviation of a 1 kHz sine wave at -60 dBm level.

The speaker is configured to play the demodulated signal.

● ●

❏   Set *RF Field to Radio Center Frequency*.

❏   Set Input to *ANT*.

❏   Set Attenuation to *0 dB*.

❏   Set Demodulation Type to *FM*.

❏   Set IF Bandwidth to *300 kHz*.

❏   Cursor to Line Field and press F6 *CONFIG.*

❏   Set Mod Meter Filter Line Low-Pass Filter to *20 kHz*.

❏   Set AF Counter Filter Line Low-Pass Filter to *4 kHz*.

❏   Set Speaker/Headphones Filter Line to *W.B.* (Wideband).

❏   Execute and return to RF Receive Operation Screen.

❏   Adjust VOLUME Control for desired audio level.

RECEIVER AUDIO / DATA FILTERS SETUP MENU				
LINE	BAND PASS FILTER	HIGH PASS FILTER	LOW PASS FILTER	WIDE - BAND
MOD METERS	OFF	OFF	20 kHz	OFF
DTMF / SINAD	OFF	OFF	OFF	ON
AF CNTR/DECODE	OFF	OFF	4 kHz	OFF
DATA DECODER	OFF	OFF	OFF	ON
*** PRESS "EXEC" TO ACTIVATE SELECTION ***				
SPEAKER / PHONES	W.B.			
DEMOD OUT	AF CNT			

```
RF:        (Radio Center Frequency)
FL:        OFF
Input:     ANT  Atten:    0  dB
Demod:     FM  IF  BW: 300  kHz
AF GEN OUT              OFF

LINE:      MOD MTR
HPF:       OFF   LPF:  20kHz
BPF:       OFF
```

00607226

TRANSMITTER OUT

UUT

Receiving FM Modulated RF Signal

SECTION 5
COMMON PRACTICES

5-2-2   RECEIVING AM MODULATED RF SIGNAL

This procedure configures the RF Receive Operation Screen to receive an Amplitude Modulated RF Signal at the ANTENNA Connector.

P R E P
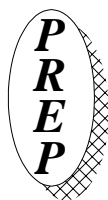
The transmitted signal has 40% Modulation Rate of a 1 kHz sine wave at -60 dBm level.

The speaker is configured to play the demodulated signal.

● ●

❏   Set RF Field to *Radio Center Frequency*.

❏   Set Input to *ANT*.

❏   Set Attenuation to *0 dB*.

❏   Set Demodulation Type to *AM*.

❏   Set IF Bandwidth to *300 kHz*.

❏   Cursor to Line Field and press F6 *CONFIG*.

❏   Set Mod Meter Filter Line Low-Pass Filter to *20 kHz*.

❏   Set AF Counter Filter Line Low-Pass Filter to *4 kHz*.

❏   Set Speaker/Headphones Filter Line to *W.B.* (Wideband).

❏   Execute and return to RF Receive Operation Screen.

❏   Adjust VOLUME Control for desired audio level.

RECEIVER AUDIO / DATA FILTERS SETUP MENU				
LINE	BAND PASS FILTER	HIGH PASS FILTER	LOW PASS FILTER	WIDE - BAND
MOD METERS	OFF	OFF	20 kHz	OFF
DTMF / SINAD	OFF	OFF	OFF	ON
AF CNTR/DECODE	OFF	OFF	4 kHz	OFF
DATA DECODER	OFF	OFF	OFF	ON
*** PRESS "EXEC" TO ACTIVATE SELECTION ***				
SPEAKER / PHONES	W.B.			
DEMOD OUT	AF CNT			

```
RF:        (Radio Center Frequency)
FL:        OFF
Input:     ANT  Atten:    0  dB
Demod:     AM  IF  BW: 300  kHz
AF GEN OUT              OFF
LINE:      MOD MTR
HPF:       OFF  LPF:  20kHz
BPF:       OFF
```

TRANSMITTER OUT

UUT
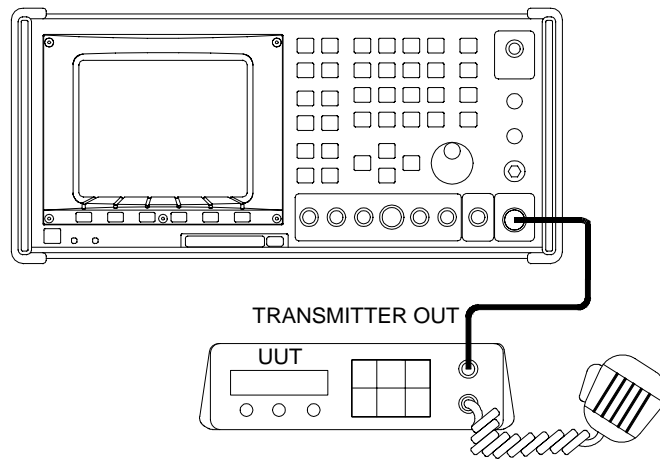
00607227

Receiving AM Modulated RF Signal

SECTION 5
COMMON PRACTICES

5-2-3   RECEIVING PM MODULATED RF SIGNAL

This procedure configures the RF Receive Operation Screen to receive a Phase Modulated RF Signal at the ANTENNA Connector.
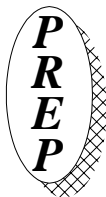
P R E P The transmitted signal has 5 Radians deviation of a 1 kHz sine wave at -60 dBm level.

The speaker is configured to play the demodulated signal.

● ●

❏   Set RF Field to **Radio Center Frequency**.

❏   Set Input to **ANT**.

❏   Set Attenuation to **0 dB**.

❏   Set Demodulation Type to **PM**.

❏   Set IF Bandwidth to **300 kHz**.

❏   Cursor to Line Field and press F6 **CONFIG**.

❏   Set Mod Meter Filter Line Low-Pass Filter to **20 kHz**.

❏   Set AF Counter Filter Line Low-Pass Filter to **4 kHz**.

❏   Set Speaker/Headphones Filter Line to **W.B.** (Wideband).

❏   Execute and return to RF Receive Operation Screen.

❏   Adjust VOLUME Control for desired audio level.

RECEIVER AUDIO / DATA FILTERS SETUP MENU				
LINE	BAND PASS FILTER	HIGH PASS FILTER	LOW PASS FILTER	WIDE - BAND
MOD METERS	OFF	OFF	20 kHz	OFF
DTMF / SINAD	OFF	OFF	OFF	ON
AF CNTR/DECODE	OFF	OFF	4 kHz	OFF
DATA DECODER	OFF	OFF	OFF	ON
* * * PRESS "EXEC" TO ACTIVATE SELECTION * * *				
SPEAKER / PHONES	W.B.			
DEMOD OUT	AF CNT			

```
RF:        (Radio Center Frequency)
FL:        OFF
Input:     ANT  Atten:    0  dB
Demod:     PM  IF  BW: 300  kHz
AF GEN OUT              OFF

LINE:      MOD MTR
HPF:       OFF  LPF:  20kHz
BPF:       OFF
```


TRANSMITTER OUT

UUT
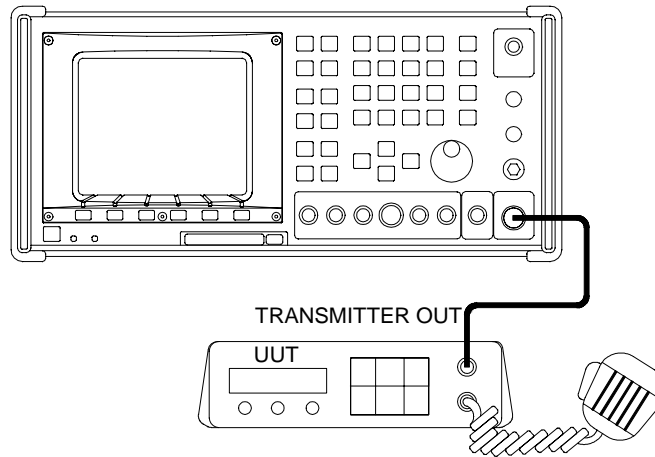
00607228

Receiving ± Modulated RF Signal

SECTION 5
COMMON PRACTICES

5-2-4   DECODING 2-TONE SEQUENTIAL FORMAT

This procedure configures the RF Receive Operation Screen to decode using the 2-Tone Sequential format.

• •

❏   Set RF Field to *Pager Center Frequency*.

❏   Set Input to *T/R*.

❏   Set Attenuation to *30 dB*.

❏   Set Demodulation Type to *FM*.

❏   Cursor to Line Field and press F6 *CONFIG*.

❏   Set AF CNTR/DECODE High-Pass Filter to *OFF*.

❏   Set AF CNTR/DECODE Low-Pass Filter to *4 kHz*.

❏   Press F5 *EXEC*.

❏   Press F6 *RETURN*.

❏   Cursor to Deviation Meter and press F1 *ZOOM*.

❏   Set Scp/Demod Cplg: to *AC*.

❏   Set Range to *AUTO*.

❏   Press F6 *RETURN*.

❏   Set Tone/Data Code to *USER*.

❏   Press F2 *DECODE*.

❏   Observe the frequency and duration of tones received on the RECEIVED TONE DECODING Screen.

RECEIVER AUDIO / DATA FILTERS SETUP MENU				
LINE	BAND PASS FILTER	HIGH PASS FILTER	LOW PASS FILTER	WIDE - BAND
MOD METERS	OFF	OFF	OFF	OFF
DTMF / SINAD	OFF	OFF	OFF	ON
AF CNTR/DECODE	OFF	OFF	4 kHz	OFF
DATA DECODER	OFF	OFF	OFF	ON
*** PRESS "EXEC" TO ACTIVATE SELECTION ***				
SPEAKER / PHONES	W.B.			
DEMOD OUT	AF CNT			

```
            FM DEVIATION METER
RF:          (Pager Center Frequency)
Scp / Demod   Cplg:     AC
Range:                  AUTO
Peak Hold:            ON
Average:             ON      2
Upper Limit:         ON      8.00
Lower Limit:         ON      1.00
Alarm:               OFF
Mode:                NORMAL
```

```
RF:          (Pager Center Frequency)
FL:          OFF
Input:       T/R Atten:    30 dB
Demod:       FM IF BW: 300 kHz
AF GEN OUT              OFF
LINE:        MOD MTR
HPF:         OFF  LPF:  OFF
BPF:         OFF
Tone/Data Code:  USER
```
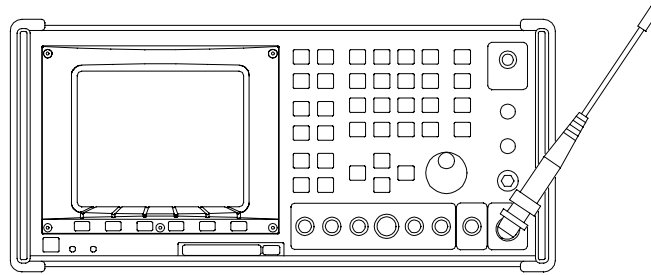
00607248

Decoding 2-Tone Sequential Format

SECTION 5
COMMON PRACTICES

5-3   DUPLEX

This section offers suggestions for equipment and screen setups for a common Duplex practice.

This procedure configures the Duplex Operation Screen to perform a Receive and Generate Sensitivity Check.

❏   Press DPLX Mode Key.

❏   Set Duplex Receive:

RF	*455.0000 MHz*
Input	*ANT*
Atten	*0 dB*
Demod	*FM*
IF BW	*15 kHz*

❏   Set Squelch Control Knob fully Counter Clockwise.

❏   Set Duplex Generate:

❏
RF	*455.0000 MHz*
Offset	*0.0000 MHz*
Output	*AUX*
Level	*-40.0 dBm*
GEN2	*FM*
GEN1, DATA and DTMF	*OFF*
Deviation	*3.30 kHz*
Format	*TONE*
Freq	*1000.0 Hz*

❏   Connect AUX output connector to ANTENNA input connector.

❏   Connect DEMOD OUT connector to SINAD IN connector.

❏   Cursor to RECEIVE field and press F1 *ZOOM*.

❏   Cursor to LINE field and press F6 *CONFIG*.

❏   Set filters:

❏
MOD METERS	HPF, *300 Hz*/LPF, *4 kHz*/WB, *OFF*
DTMF/SINAD	BPF, *C-MSG*
AF CNTR/DECODE	LPF, *20 kHz*
DATA DECODER	LPF, *20 kHz*
SPEAKER/PHONES	*WB*
DEMOD OUT	*DET OUT*

❏ Press F5 *EXEC*.

❏ Press F6 *RETURN*.

❏ Press REC Mode Key.

❏ Repeat steps 8 through 16 for Receive Operation Screen.

❏ Press DPLX Mode Key.

❏ Cursor to RECEIVE field and press F1 *ZOOM*.

❏ Verify these readings:

Analyzer Level	-40 dBm (±4 dB)
AF Frequency	1000 Hz (±1 Hz)
RF Error	0.0 MHz (±30 Hz)
Deviation	3.30 kHz (± .5 kHz)
Distortion	<3%

❏ Press DPLX Mode Key.

❏ Cursor to GENERATE field and press F1 *ZOOM*.

❏ Cursor to LINE field and press F6 *CONFIG*.

❏ Set filters:

DTMF/SINAD	BPF, *C-MSG*
SPEAKER/PHONES	*WB*

❏ Press F5 *EXEC*.

❏ Press F6 *RETURN*.

❏ Cursor to Level field and press F5, SINAD=.

❏ Set SINAD= field to *12.0 dB*.

❏ Press F6 *RETURN*.

❏ Press F6 *S=On/Off*.

❏ Verify RF Level settles to <-101 dBm.

❏ Press F6 *S=On/Off*.

❏ Disconnect everything.

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6-1   INTERNAL BATTERY (OPTION 01)

Provides self-contained dc power when external ac or dc power is unavailable.

6-2   OVEN CRYSTAL OSCILLATOR FREQUENCY STANDARD (OPTION 02)

OCXO replaces the standard TCXO as system time base. Provides 0.01×10^{-6} accuracy.

6-3   30 kHz IF FILTER (OPTION 03)

Provides additional band limiting between 15 kHz and 300 kHz offered in standard set.

6-4   VARIABLE AUDIO GENERATOR-2 (OPTION 04)

NOW A STANDARD OPTION

The Variable Frequency Audio Generator has a frequency range of 5 to 20000 Hz with sine wave shape and 5 to 10000 Hz with ramp, triangle and square wave shapes.

Audio Generator-2 is available for use on the RF Generate, Duplex and Duplex Generate Operation Screens as a modulation source *and* as baseband output from the Audio/Data/Signaling Generators Operation Screen.

6-5   GENERATE AMPLIFIER (OPTION 05)

NOW A STANDARD OPTION

The Generate Amplifier is an internal RF Amplifier providing 26 dB gain for AUX RF OUT Connector. With Option 05 installed, RF AUX OUT Connector output range is -130 to +13 dBm for all Operation Modes.

SECTION 6
OPTIONS

6-6 DATA GENERATOR/BIT ERROR RATE (BER) METER (OPTION 07)

To access the BER Meter, press SPCL TEST MODE Key and select the Bit Error Rate.

The BER Meter is designed for Baseband, RF Generate, RF Receive or Duplex Mode.

The complexity of the BER Meter is best described in four separate sections.

    BER Meter General Operation Screen

    BER Meter Configuration Section

    Receive Data Configuration Section

    Send Data Configuration Section

● ●
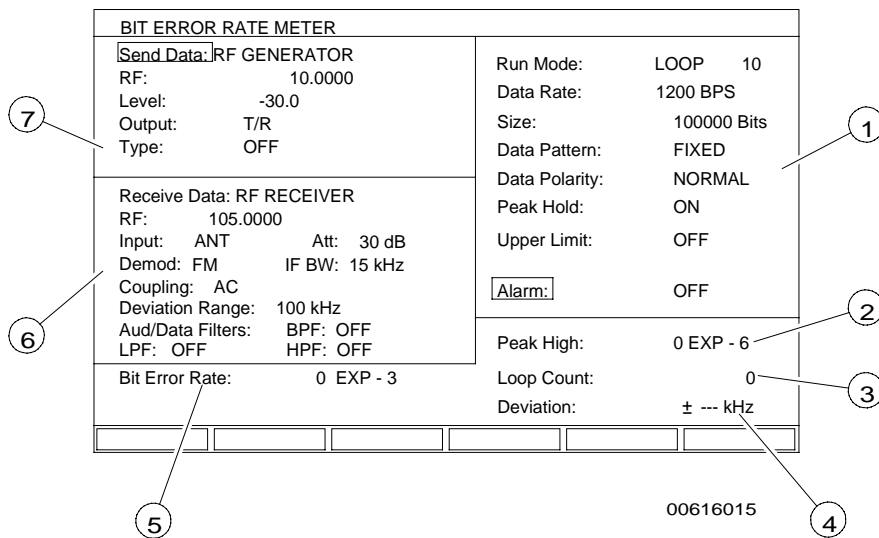
BER Meter Operation Screen

1. <u>BER Meter Configuration Section</u>

   Contains configuration data for signal.

2. <u>Peak Reading</u>

   Displays highest Bit Error Rate for current test.

3. <u>Loop Count</u>

   Displays number of times Data has been sent.

4. Input Level Indicator

   Displays the modulation or voltage level of the Receive Data input source. The level indicator displays an AF Level Meter reading when the field is set for AUDIO/DATA IN.

   When the field is set for RF RECEIVER, the Demod field determines the display (i.e., FM-Deviation Meter in kHz, AM-Modulation Meter in % or PM-Phase Meter in Rad).

5. Bit Error Rate

   Displays Bit Error Rate. Exponent changes depending on Data Pattern Size (11).

6. Receive Data Configuration Section

   Contains configuration data for Receive.

7. Send Data Configuration Section

   Contains configuration data for Generate Section.

SECTION 6
OPTIONS

6-6-1   BER METER CONFIGURATION SECTION

This section contains the parameters for setting the message size, rate and pattern as well as information on configuring the BER Meter.

Functions and parameters for the BER Meter Configuration Section are as follows:

● ●

8. Run Mode

    Displays selected Operation Mode. Selections include Continuous (CONTIN) and LOOP. When LOOP Mode is selected, LOOP Number (9) is displayed.

9. LOOP Number

    Displays selected number of Data Patterns to be Generated. Displayed only with LOOP selected for Run Mode (8). Range is 1 to 100000.

10. Data Rate

    Displays selected Data Rate in Bits Per Second (BPS). Selections include:

75 BPS	150 BPS	300 BPS
600 BPS	1200 BPS	2400 BPS
4800 BPS	9600 BPS	

```
Run Mode:      LOOP     10
Data Rate:     1200 BPS
Size:             100000
Data Pattern:      FIXED
Data Polarity:    NORMAL
Peak Hold:           OFF
Upper Limit:         OFF

Alarm:               OFF
```

⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯

00607094

11. Data Pattern Size

    Displays selected Data Pattern Size. Selections range from 128 to 100000 bits.

12. Data Pattern Type

    Displays selected Data Pattern Type. Selections are RANDOM and FIXED. FIXED is an 8 bit hexadecimal pattern that is repeated. RANDOM is based on a pseudo-random seed.

13. Data Polarity

    Displays selected Data Polarity Type. Displays NORMAL or INVERTED. INVERTED is the opposite code of NORMAL.

    Operation Mode. Selections include Continuous (CONTIN.) and LOOP. When LOOP Mode is selected, LOOP Number (2) is displayed.

14. Peak Hold

    Displays selected Peak Hold Function Status. Status is OFF or ON. When ON, Peak Reading (2) is displayed.
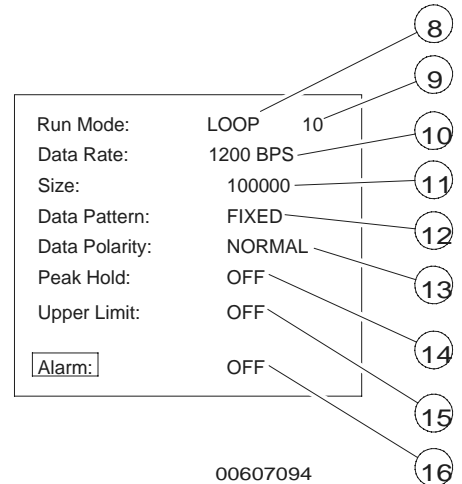
15. <u>Upper Limit</u>

Displays selected Upper Limit. Status is OFF or ON. When ON Upper Limit Value is displayed. Range of Upper Limit Value is 0 x 10^{-6} to 999 x 10^{-3}.

16. <u>Alarm</u>

Displays Alarm status. Status is OFF or ON. Alarm sounds when Upper Limit (15) is exceeded.

SECTION 6
OPTIONS

6-6-2   RECEIVE DATA CONFIGURATION SECTION

This section contains the parameters for setting the Receiver Portion of the BER Meter.

Functions and parameters for the Receiver portion of the BER Meter are as follows:

● ●

17. Receive Data Input

Displays selected Input for BER Meter. Selections include RF RECEIVER and AUDIO DATA IN. Selecting RF RECEIVER means an RF Carrier is demodulated to receive the Data Signal. Selecting AUDIO DATA IN means Data Signal is received directly through the AUDIO/DATA IN Connector.

The following items are displayed only when RF RECEIVER is selected as Receive Data Input (17):

```
Receive Data: RF RECEIVER
RF:          105.0000
Input:    ANT        Att:   30 dB
Demod:  FM        IF BW:  15 kHz
Coupling:   AC
Deviation Range:    100 kHz
Data / Ber - Filter:    BPF:  OFF
LPF:  OFF            HPF:  OFF
```

00607095
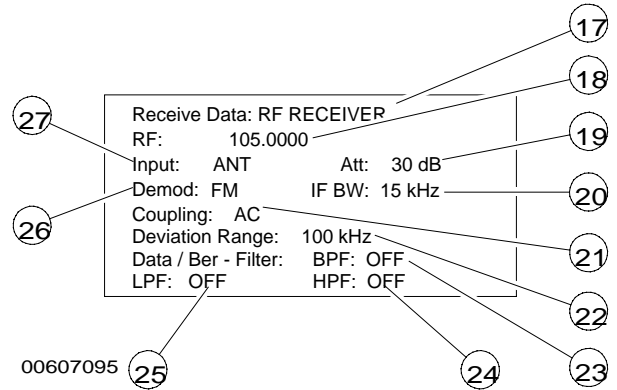
18. RF Field

Displays RF Receive Frequency. Selections range from 0.0000 to 1000.0000 MHz.

19. Attenuation

Displays Input Attenuation. Selections are 0 or 30 dB.

20. IF Bandwidth

Displays IF Filter Bandwidth. Selections are 300 and 15 kHz.

21. Coupling

Displays Coupling Type for RF Receiver. Displayed only with FM selected for Demod Type (26). Selections are AC or DC.

22. Deviation Range

Displays FM Deviation Range. Displayed only with FM selected for Demod Type (26). Selections are 10, 20, 50 and 100 kHz.

23. Bandpass Filter

Displays Bandpass Filter setting for demodulated signal. Selections include OFF and C-MSG (C-Message Weighted Filter).

High-Pass Filter/Low-Pass Filter combination and Bandpass Filter cannot be active simultaneously.

24. High-Pass Filter

Displays current High-Pass Filter setting for demodulated signal. Selections include OFF, 300 Hz and
4 kHz.

High-Pass Filter/Low-Pass Filter combination and Bandpass Filter cannot be active simultaneously.

25. Low-Pass Filter

Displays current Low-Pass Filter setting for demodulated signal. Selections include OFF, 300 Hz, 4 kHz and 20 kHz.

High-Pass Filter/Low-Pass Filter combination and Bandpass Filter cannot be active simultaneously.

26. Demod Type

Displays Demodulation Type. Selections include FM, AM and PM. Selection of FM activates Coupling (21) and Deviation Range (22) Fields.

27. Input

Displays signal Input Connector. Selections include T/R (T/R Connector) and ANT (ANTENNA Connector).

The following items are displayed only when AUDIO DATA IN is selected as Receive Data Input (17):

28. Bandpass Filter

Displays current Bandpass Filter setting for signal passed through AUDIO/DATA IN Connector. Selections include OFF and C-MSG (C-Message Weighted Filter).

High-Pass Filter/Low-Pass Filter combination and Bandpass Filter cannot be active simultaneously.
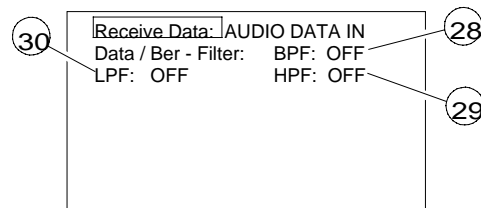
00607096

29. High-Pass Filter

Displays current High-Pass Filter setting for signal passed through AUDIO/DATA IN Connector. Selections include OFF, 300 Hz and
4 kHz.

High-Pass Filter/Low-Pass Filter combination and Bandpass Filter cannot be active simultaneously.

30. Low-Pass Filter

Displays current Low-Pass Filter setting for signal passed through AUDIO/DATA IN Connector. Selections include OFF, 300 Hz, 4 kHz and 20 kHz.

High-Pass Filter/Low-Pass Filter combination and Bandpass Filter cannot be active simultaneously.

SECTION 6
OPTIONS

6-6-3   SEND DATA CONFIGURATION SECTION

This section contains the parameters for setting the Transmitter Portion of the BER Meter.

Functions and parameters for the Transmitter portion of the BER Meter are as follows:

● ●

31. Send Data Output

Displays selected Output for BER Meter. Selections include RF GENERATOR and AUD/DATA GEN OUT. Selecting RF GENERATOR means an RF Carrier is modulated with the Data Signal before transmission. Selecting AUD/DATA GEN OUT means Data Signal is transmitted directly through the AUDIO/DATA GEN Connector.

```
Send Data: RF GENERATOR
RF:              10.0000
Level:           -30.0
Output:          T/R
Type:            FM
Deviation:       5.0kHz
```
00607097
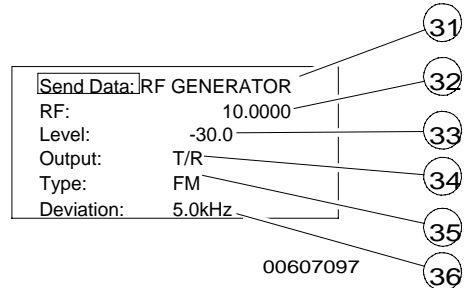
32. RF Field

Displays RF Generator Frequency. Selections range from 0.0000 to 1000.0000 MHz.

33. Level

Displays RF Generator output Level. Selections range from -130 to -30 dBm with T/R Connector selected as Output (34). Selections range from -130 to -13 dBm with AUX RF OUT Connector selected as Output (34).

34. Output

Displays Output Connector.   Selections include AUX (AUX RF OUT Connector) and T/R (T/R Connector).

35. Modulation Type

Displays Modulation Type. Selections include OFF, AM, FM and PM.

36. Modulation/Deviation Level

Displays Modulation Level. Selections range from 0.0% to 100% for AM Modulation Type (35), 0.00 to 100 kHz for FM Modulation Type (35) and 0.00 to 10 Rad for PM Modulation Type.

37. Output Level

Displays Output Level of Data Signal. Selections range from 0.0 to 2.5 Vp in x1 (times 1) Mode or 0 to 25 mVp in /10 (divide by 10) Mode.
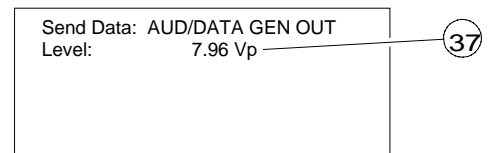
```
Send Data:  AUD/DATA GEN OUT
Level:            7.96 Vp
```
00607098

6-7   SINGLE SIDEBAND RECEIVE FILTER (OPTION 08)

6-7-1   GENERAL

Installation of the Single Sideband Receive IF Filter provides the ability to monitor SSB signals. When Filter is installed, 3 kHz Selection is available for IF Bandwidth Filter.

The Single Sideband and 30 kHz IF Filters are mutually exclusive. Only one additional IF Filter can be installed.

6-7-2   DESCRIPTION OF RECEIVE FUNCTION

RF Receive Operation is changed as follows:

❏   Analyzer Center Frequency is offset from center graticule ±1800 Hz, depending on whether Upper Sideband (UB) or Lower Sideband (LB) is selected as Demodulation Type.

❏   No Modulation Meter is provided for Single Sideband. Either Modulation Reading or Modulation Meter, whichever was last selected, is blanked from the screen.

❏   RF Error Meter is not provided for Single Sideband. RF Error Meter is blanked from the screen.

Additions and Redefinitions of parameters on the RF Receiver Operation Screen are as follows:

1.   <u>Demodulation Type</u>

Includes two additional settings: UB (Upper Sideband) and LB (Lower Sideband).

2.   <u>IF Bandwidth</u>

Includes additional 3 kHz setting.

3.   <u>BFO Frequency</u>

Tone/Data Code Field is renamed when UB or LB is selected as Demodulation Type (1). Displays selected adjustment for BFO Frequency. Adjustment range is ±4.0 kHz. No Soft Function Keys are defined when BFO Frequency is displayed.

4.   <u>AGC Setting</u>

Displays current AGC Setting, AUTO or MANUAL. AUTO provides automatic gain control while MANUAL sets feedback level for automatic gain control to defined level. Selection of MANUAL accesses Feedback Level Data Field. Range is 0 to 1023.

SECTION 6
OPTIONS

6-8 RCC SIGNALING FORMATS (OPTION 09)

Activates encode capabilities for 10 PS, 20 PS, MTS, IMTS and Tone Remote Control Signaling Formats. These formats appear as selections for GEN1 RF Generate Modulation Source, GEN1 Duplex Generate Modulation Source and Audio Function Generator-1. While these selections appear whether or not Option 9 is installed, they are not active. Accessing these selections is discussed in Section 3-3, Screens, Softkeys and Menus.

6-9 AUDIO/DIGITAL SIGNALING FORMATS (OPTION 11)

Provides encode/decode capabilities for both analog and digital signaling formats. Analog formats supported by Option 11 include:

CCIR	CCIRH	CCIRH4
EEA	EIA	NATEL
ZVEI	DZVEI	DDZVEI
EURO	5/6 Tone	

Listed below are the Frequencies and duration for each of the Audio Signaling Formats:

Tone Number	Code Digit	CCIR	CCIRH	CCIRH4	EEA	EIA	NATEL	ZVEI	DZVEI	DDZVEI	EURO	5/6 Tone
Tone 0	0	1981	1981	1981	1981	600	1633	2400	2200	2400	979.8	600
Tone 1	1	1124	1124	1124	1124	741	631	1060	970	1060	903.1	741
Tone 2	2	1197	1197	1197	1197	882	697	1160	1060	1160	832.5	882
Tone 3	3	1275	1275	1275	1275	1023	770	1270	1160	1270	767.4	1023
Tone 4	4	1358	1358	1358	1358	1164	852	1400	1270	1400	707.4	1164
Tone 5	5	1446	1446	1446	1446	1305	941	1530	1400	1530	652.0	1305
Tone 6	6	1540	1540	1540	1540	1446	1040	1670	1530	1670	601.0	1446
Tone 7	7	1640	1640	1640	1640	1587	1209	1830	1670	1830	554.0	1587
Tone 8	8	1747	1747	1747	1747	1728	1336	2000	1830	2000	510.7	1728
Tone 9	9	1860	1860	1860	1860	1869	1477	2200	2000	2200	470.8	1869
Repeat Tone	R	2110	2110	2110	2110	459	1805	2600	2400	970	1062.9	459
Group Tone	G	2400	2400	2400	1055	2010	1995	2800	885	885		2010
Alarm Tone	A				2400							
Tone Width (ms)		100	20	40	40	33	70	70	70	70	100	33/52

Digital formats supported by Option 11 include:

POCSAG
POCSAG/ (POCSAG INVERTED)

SECTION 6
OPTIONS

Encoding of the analog formats is available in RF Generate, Duplex Generate and Audio/Data/Signaling Generators Operation Screens. In the RF Generate and Duplex Generate Operation Screens, these formats are accessed by selecting GEN1 (Audio Generator-1) as a modulation source.

In the Audio/Data/Signaling Generators Operation Screen, these formats are accessed through Audio Generator-1. Refer to Section 3-3, Screens, Softkeys and Menus for information on selecting these formats.

Decoding of the analog formats is available in RF Receive and Duplex Receive Operation Screens. Select the desired signaling format for decoding at the Tone/Data Code Field. Refer to Section 3-3, Screens, Softkeys and Menus for information on selecting these formats.

For information on Digital Signaling Formats refer to the following:

6-9-1   Modulating RF Signals With Digital Signaling Formats

6-9-2   Encoding Digital Signaling Formats for Audio Signal

6-9-3   Decoding Digital Signaling Formats

6-9-4   Testing A Receiver using Digital Signaling Formats

6-9-5   Testing A Transmitter using Digital Signaling Formats

6-9-1   MODULATING RF SIGNALS WITH DIGITAL SIGNALING FORMATS

Digital Signaling Formats can be used as a modulation source in both RF Generate and Duplex Generate Operation. With Option 11 installed, optional Digital Signaling Formats are accessed by selecting the DATA Generator as the Modulation Source.

Additional Formats available with this option include POCSAG and POCSAG Inverted (POCSAG/).

DATA Modulation Source Block is defined as follows:

●●●

1. <u>Modulation Source</u>

   Displays selected Modulation Source. Selections include GEN1 (Audio Generator-1), GEN2 (Audio Generator-2), DTMF (DTMF Tone Generator), DATA (DATA Generator), EXT (External Modulation) and MIC (Microphone Modulation).

2. <u>Modulation Type</u>

   Displays selected Modulation Type. Selections include OFF, AM, FM and PM.

```
         ①        ②
                              ③
   Mod Src: DATA      FM
   Deviation:    5.0 kHz
   Format: DCS                ④
   Code:  114

   8717127                    ⑤
```
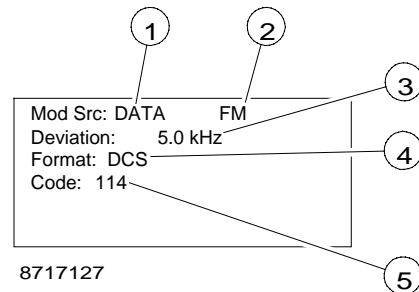
3. <u>Deviation/Modulation Level</u>

   Displays selected Deviation in kHz if current Modulation Type (2) is FM with range from 0.0 to 100 kHz. Displays selected Percent Modulation if current Modulation Type (2) is AM with range from 0% to 100%. Displays selected Deviation in radians if current Modulation Type (2) is PM with range from 0 to 10 Radians. Field is not displayed if Modulation Type (2) is OFF.

4. <u>Format</u>

   Displays Format type for Modulation Source (1). Selections available with DATA include DCS, DCS INV (DCS Inverted), POCSAG and POCSAG INV (POCSAG Inverted).

   Access CONFIG for selecting POCSAG Function, Capcode Range and Data Rate.

   Capcode Range values are 1 to 9999999. Start and Stop Capcode are selected. Activated, the system generates Start Capcode message. Capcode increases by one and message is sent until Stop Capcode message is generated.

Data Rates 512, 1200 and 2400 bps are only displayed with cursor at Data Rate field. POCSAG Functions include:

Function	Description
1 BEEP	Causes pager to beep one time.
2 BEEP	Causes pager to beep two times.
3 BEEP	Causes pager to beep three times.
4 BEEP	Causes pager to beep four times.
ALPHA_NUM	Transmits 0123456789
ALPHA_NUM UC	Transmits ABCDEFGHIJKLIMOPQU RSTUVWXYZ.
ALPHA_NUM LC	Transmits abcdefghijklmnopqurstuv wxyz.
ALPHA_NUM SPEC	Transmits !"#$%'()*+,- ./:;<=>?
NUMERIC	Transmits 0123456789-][
NUMERIC SEQ	Transmits following messages in sequence: 00000, 11111, 22222, 33333, 44444, 55555, 66666, and 77777.
NUMERIC CUSTOM	Transmits numbers.
ALPHA-NUM CUSTOM	Transmits data.

5. <u>Code</u>

Displays selected code for DATA Modulation Source. Not displayed with POCSAG or POCSAG/ selected as Format (4).

6-9-2   ENCODING DIGITAL SIGNALING FORMATS FOR AUDIO SIGNAL

With Option 11 installed, the DATA Generator in the Audio/Data/Signaling Generators Operation Screen has POCSAG and POCSAG Inverted (POCSAG/) Formats in addition to the DCS and DCS Inverted (DCS/) Formats contained in the standard set. Output for the DATA Generator is through the AUDIO/DATA GEN Connector. Editing the DATA Generator can be performed from the Audio/Data/Signaling Operation Screen, from the RF Receive Operation Screen, or from the Duplex Receive Operation Screen.

Functions and parameters for the DATA Generator with Option 11 installed are as follows:

● ●

1. DATA Generator Prompt

    Activates selected Generator Source. Selections include GEN1 (Audio Generator-1), GEN2 (Audio Generator-2), DTMF (DTMF Tone Generator) and DATA (DATA Generator).

2. Format

    Displays Format type for DATA Generator. Selections include DCS, DCS/ (DCS Inverted), POCSAG and POCSAG/ (POCSAG Inverted).

    See Format under 6-9-1.

3. Code

    Displays selected code for DATA Generator. Not displayed with POCSAG or POCSAG/ selected as Format (2).

4. Level

    Displays selected Level of DATA Generator. Selections range from 0 to 2.5 Vp in X1 (times 1) Mode and 0 to 25.0 mVp in /100 (divide by 100) Mode.

6-9-3   DECODING DIGITAL SIGNALING FORMATS

With Option 11 installed, the RF Receive Operation Screen and the Duplex Receive Operation Screen are configurable to decode POCSAG and Inverted POCSAG signals.

A specific decode screen is provided for each Digital Signaling format type

• •

```
         ┌1┐                                              ┌2┐
              ┌──────────────────────────────────────────────┐
         POCSAG DECODE          │FUNC BITS:│ AUTO        RATE   512      ┌3┐

          CAPCODE:        5130         TYPE:       ALPHANUMERIC
          MESSAGE:    abcdefghijklmnopqrstuvwxyz

          CAPCODE:        5130         TYPE:       ALPHANUMERIC
          MESSAGE:    ABCDEFGHIJKLMNOPQRSTUVWXYZ

          CAPCODE:        5130         TYPE:       ALPHANUMERIC           ┌4┐
          MESSAGE:    0123456789

          CAPCODE:        5130         TYPE:       ALPHANUMERIC
          MESSAGE:    !"#$%'()*+,-./:;<=>?'

          CAPCODE:        5130         TYPE:       TONE 4 BEEPS
          MESSAGE:
```
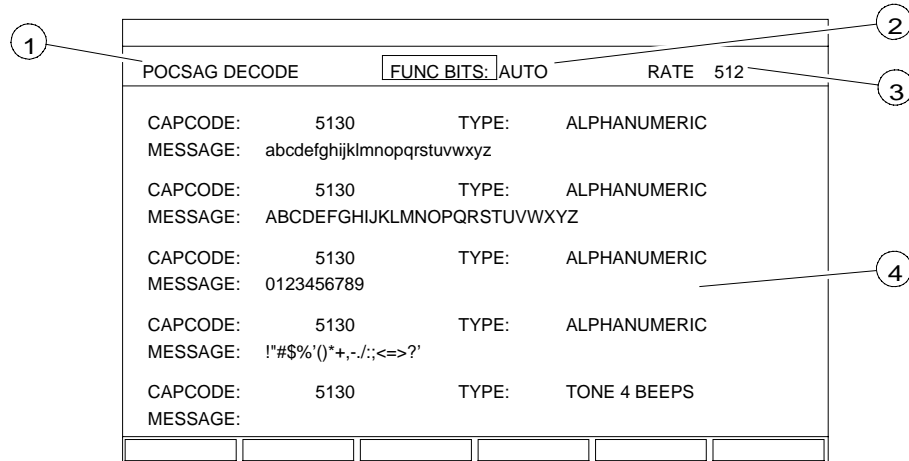
8717038

1. Decode Screen Label

    Identifies whether Decode Screen format is POCSAG or POCSAG INV (Inverted POCSAG).

2. Function

    Allows user to set Message Type to ALPHANO (ALPHANUMERIC), NUMERIC or AUTO. ALPHANO and NUMERIC settings force Decode Function to decode message as specified type. AUTO setting allows Decode Function to determine Message Type from received data.

3. Data Rate

    Displays selected Data Rate for decoding messages.   Selections include 512 and 1200 bps.

4. Data Screen

    Displays up to five decoded messages. Information displayed includes Capcode, Message Type and Message for each received transmission.

6-9-4   TESTING A RECEIVER USING DIGITAL SIGNALING FORMATS

This procedure is an example for testing a Receiver using Digital Signaling Formats. In this procedure, an RF signal is modulated with a POCSAG message.

● ●

❏   Press GEN Test Mode Key to access RF Generate Operation Screen.

❏   Enter Receiver frequency in RF Field.

❏   Select desired Output Connector for output of signal. If Receiver is tested with direct connection, connect Receiver Input Connector to selected Output Connector. Otherwise, connect antennas to selected Output Connector and Receiver Input Connector.

❏   Set Output Level to desired level.

❏   Select DATA Generator for Modulation Source.

❏   Set Modulation Type to FM.

❏   Set Deviation Level for 4.0 kHz or as required.

❏   Set DATA Generator Format for POCSAG or POCSAG/.

❏   Press F4 Config.

❏   Set Data Rate to required setting for Receiver.

❏   Set Capcode Range to Receiver Capcode.

❏   Set POCSAG Function for desired test function.

❏   Press F6 RETURN.

❏   Press F5 BURST.

❏   Verify Receiver receives signal and decodes POCSAG Message correctly.

SECTION 6
OPTIONS

6-9-5   TESTING A TRANSMITTER USING DIGITAL SIGNALING
        FORMATS

This procedure is an example for testing a Transmitter using Digital Signaling Formats.
In this procedure, an RF signal is received and demodulated for the POCSAG message.

● ●

❏   Press REC Test Mode Key to access RF Receive Operation Screen.

❏   Enter Transmitter frequency in RF Field.

❏   Select desired Input Connector for input of signal. If Transmitter is tested with
    direct connection, connect Transmitter Output Connector to T/R Connector.
    Otherwise, connect antennas to ANTENNA Connector and Transmitter Output
    Connector.

❏   Set Demodulation Type to FM.

❏   Set IF Bandwidth to 15 kHz.

❏   Select DATA DEC as Audio Filter. Set Filter for 20 kHz Low-Pass.

❏   Select POCSAG or POCSAG/ for Tone/Data Type.

❏   With cursor on Tone/Data Code Field, press F2 DECODE to access Decode Screen.

❏   Set Decode Function to ALPHANO for Alphanumeric decode only, NUMERIC for
    Numeric decode only or AUTO for automatic selection based on POCSAG Message.

❏   Set Data Rate to required setting for Transmitter.

❏   If use of Scroll Function is required, press F5 SCROLL until highlighted.

❏   Press DECODE Soft Function Key F1 to start Decode Function.

❏   Verify transmitted message is decoded properly on Decode Screen. Press F2 STOP
    any time to stop decoding.

6-10 SPECTRUM ANALYZER TRACKING GENERATOR (OPTION 12)

Option 12 provides internal Tracking Generator for use with Spectrum Analyzer. A new field is displayed for turning on the Tracking Generator. Field displays OFF or Tracking Generator Level. When active, an RF signal is available at the AUX RF OUT Connector at the specified level.

The Tracking Generator function is independent of the analyzer center frequency and is programmable to sweep at a frequency different from the analyzer center frequency.

● ●
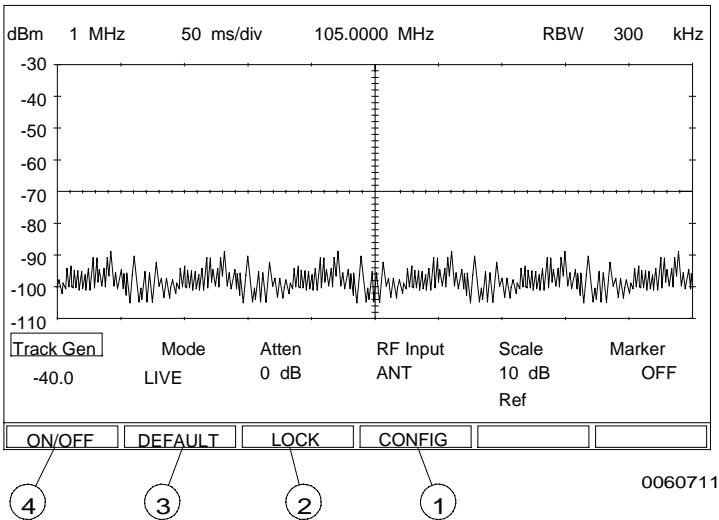
1. <u>CONFIG Soft Function Key F4</u>

   Opens the Tracking Generator Configuration window. The two Tracking Generator fields are Center Frequency and Offset. Changing one field changes the other field appropriately.

   There are separate Tracking Generator Configuration windows for Left Hand and Right Hand Analyzer when the analyzer is in split screen mode.

2. <u>LOCK Soft Function Key F3</u>

   Locks the Tracking Generator center frequency at a constant offset from the analyzer center frequency. Changing the analyzer center frequency changes the tracking generator center frequency by a like amount.

3. <u>DEFAULT Soft Function Key F2</u>

   Normal operation mode.

4. <u>ON/OFF Soft Function Key F1</u>

   Activates the Tracking Generator ON or OFF. Range is -130.0 to 13.0 dB.
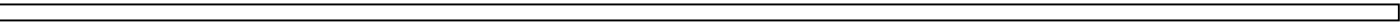
SECTION 6
OPTIONS

6-11 IEEE 488 (GPIB) INTERFACE (OPTION 13)

6-11-1 GENERAL

Provides parallel GPIB interface for remote operation. Refer to COM-120C TMAC
Manual for additional information on COM-120C Remote Operation and Commands.

6-11-2 CONFIGURING FOR REMOTE OPERATIONS USING GPIB

To access GPIB Setup Screen, Press SETUP MEMORY Key (21) and access "4. GPIB
SETTINGS." Configure for GPIB Operation as follows:

❏ Select Operations Mode (1). Available selections include TALK/LISTEN, TALK
 ONLY and LISTEN ONLY.

❏ Select GPIB Address (2). Selections range from 1 to 30.

❏ Set RCI Control to *ON*.

8717030
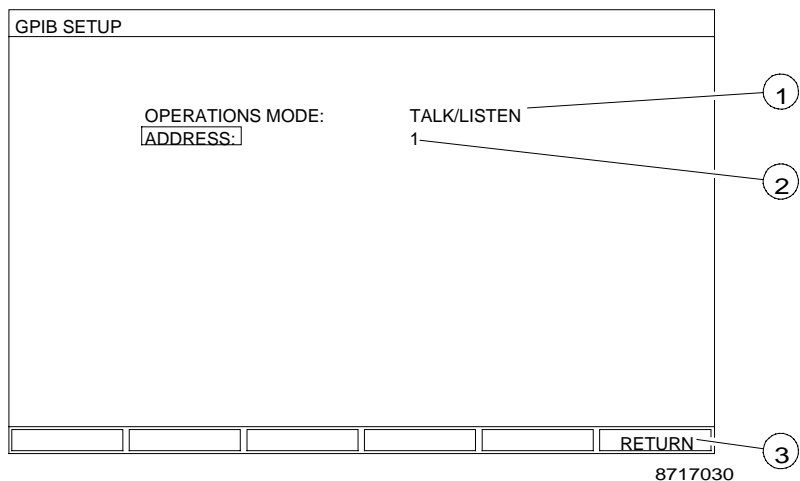
6-12 CLEARCHANNEL LTR® (OPTION 14)

6-12-1 GENERAL

The CLEARCHANNEL LTR® Option allows the testing of Trunked Repeaters and Radios. The COM-120C tests encode/decode, Repeater access and Handoff functions of Trunked Radio mobile units. The COM-120C tests Handshake and Handoff functions of Repeaters.

SECTION 6
OPTIONS

6-12-2 ACCESSING THE CLEARCHANNEL LTR® TRUNKING TEST SYSTEM

CLEARCHANNEL LTR® testing is accessed by pressing the SPCL Test Mode Key and accessing "3. LTR Trunking." When accessed, the LTR Trunking Menu is displayed.

The LTR Trunking Functions are as follows:

● ●

```
                              LTR Trunking

          Choose test:
               1.  Repeater Simulation
               2.  Radio Simulation
               3.  Auxiliary Setup




          
          
          
          
          
          | REPEAT |  RADIO  |  SETUP  |        |        | RETURN |
```
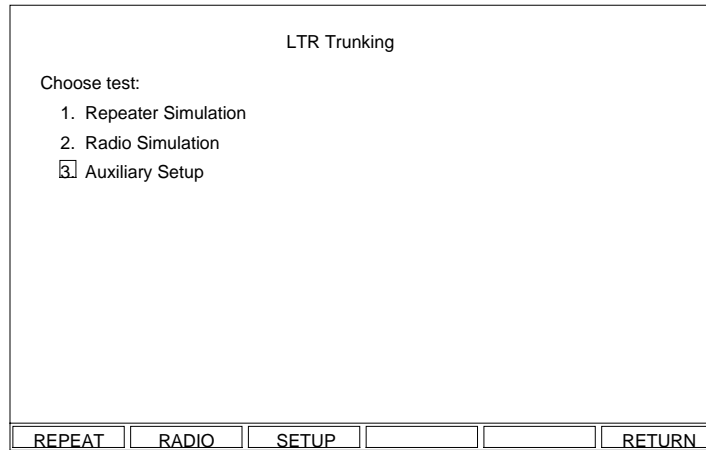
0060707

1. <u>Repeater Simulation</u>

   Configures COM-120C to simulate Repeater to test Mobile Radios. Refer to paragraph 6-12-3 for description and paragraph 6-12-6 for operation.

2. <u>Radio Simulation</u>

   Configures COM-120C to simulate a Mobile Radio to test Repeaters. Refer to paragraph 6-12-4 for description and paragraph 6-12-7 for operation.

3. <u>Auxiliary Setup</u>

   Provides additional configuration for testing.   Refer to paragraph 6-12-5 for description.

6-12-3 LTR TRUNKING REPEATER SIMULATION

The LTR Repeater Simulator is designed to test mobile phones. Once the LTR System is properly configured, continuous paging of the mobile phone is possible.

Go to the Duplex Operation Screen and set DATA Generator to LTR. Features of the LTR Trunking Repeater Simulator Operation Screen are as follows:

● ●

```
                    LTR TRUNKING REPEATER SIMULATOR
Ch #:   258    Band:    800 MHz                        Extended Meas:
          RECEIVE                              GENERATE

RF:  812.4375      MHz             RF:  857.4375     MHz
Atten:   0  dB                     Level:  -120.0  dBm
Input:   T/R                       Output:  T/R
Area            In Use             Area    0         Goto      5
Home            Group              Home    5         Group     151
Free                               Free    5         Status    CONT
RF Power:        0.0  mW           GEN-1   DATA

RF Error Freq:      2.752 kHz      Mod Source:    GEN1    FM
Deviation:      7.57  kHz  (V)     Deviation:     3.3 kHz:
AF Frequency:       1894 Hz        Frequency:     1000.0 Hz
Distortion:    + + + %
                                   Sinad:
```

00607236
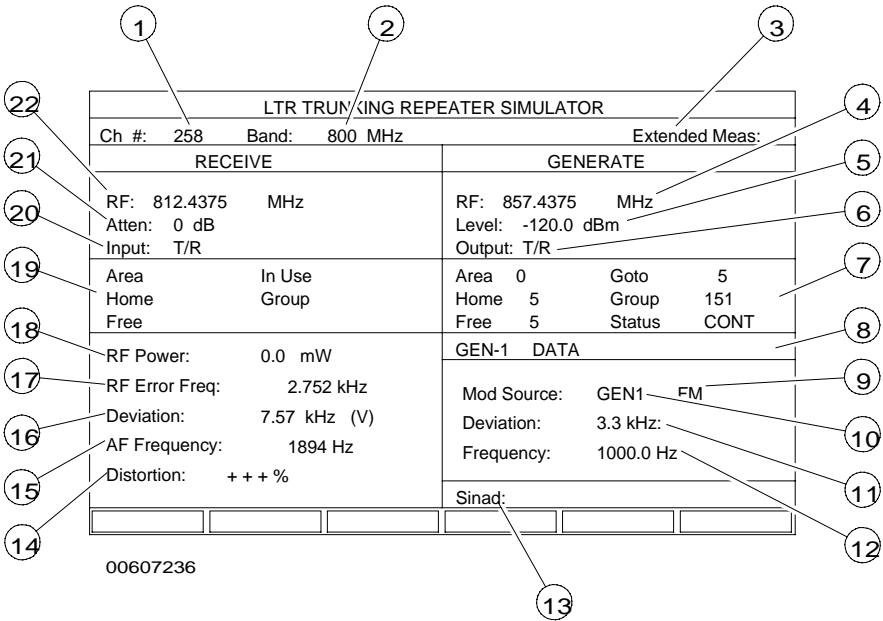
1. <u>Channel Number</u>

    Displays Channel Number. Selections are 1 to 760. Selection of Channel Number and Band Selection (2) set Generate RF Field (4) and Receive RF Field (22).

2. <u>Band Selection</u>

    Displays Trunking Band selection, 800 or 900 MHz.

3. <u>Extended Meas:</u>

    Allows for Extended Measurements.

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4. Generate RF Field

    Displays RF Generate Frequency of COM-120C. Value is dependent on Channel Number (1) and Band Selection (2). Field is for display only. Formula for figuring value is as follows where Channel # is Channel Number (1):

    800 MHz Band Selection (2)

    Frequency (MHz) = 806.0125 + [0.025 x (Channel # - 1)]

    900 MHz Band Selection (2)

    Frequency (MHz) = 896.0125 + [0.0125 x Channel # - 1)]

    note   Radios operating in 800 MHz Band within range of Canada or Mexico must use a 12.5 kHz offset.

5. Level

    Displays Output Level.   Range is dependent on Output (6). Range for Output (6) set to T/R is -130 to -20 dBm. Range for Output (6) set to AUX is -130 to -13 dBm.

6. Output

    Displays Output Connector. Selections are T/R (T/R Connector) and AUX (AUX RF OUT Connector).

7. Transmit Trunking Data Block

    Displays current data being passed to mobile radio. Refer to 6-12-3 for additional information.

8. Modulation Source Window

    Displays active Modulation Sources (10). Inactive Modulation Sources (10) are not shown. If two (or more) sections of the RF Modulator are set in conflict (e.g. GEN1 set for PM and GEN2 set for FM, or GEN1 set for 0.01 kHz deviation and GEN2 set for 2.60 kHz deviation) then the screen shows the invalid source grayed out.

9. Modulation Source

    Displays selected Modulation Source. Selections include GEN1 (Audio Generator-1), GEN2 (Audio Generator-2), DTMF (DTMF Tone Generator) and DATA (DATA Generator).

10. Modulation Type

    Displays selected Modulation Type. Selections include OFF, AM, FM and PM.

11. Deviation/Modulation Level

Displays selected Deviation in kHz if current Modulation Type (9) is FM with range from 0.00 to 100 kHz. Displays selected Percent Modulation if current Modulation Type (9) is AM with range from 0.0% to 100%. Displays selected Deviation in Radians if current Modulation Type (9) is PM with range from 0.00 to 10 Radians. Field is not displayed if Modulation Type (9) is OFF.

12. Frequency/Code Field

If Modulation Source (8) is set for GEN1 or GEN2, displays Tone Frequency. GEN2 Frequency is not an editable field unless Option Generator 2 is installed. Range for GEN1 is 0.0 to 20000 Hz. If Modulation Source (8) is set for DTMF, displays DTMF Code. Any DTMF code can be entered up to 16 characters and other softkeys become available. If Modulation Source (8) is set for DATA, field is blank.

13. AUDIO/DATA IN Meters

Displays selected meter for measuring audio input to AUDIO/DATA IN Connector. Selections include Distortion, SINAD and AF LEVEL Meters. If one of these meters is active, Deviation Meter (16), AF Frequency Meter (15), Distortion/DTMF Meter (14) and LTR decoding are deactivated.

14. Distortion/DTMF Meters

Displays Distortion or DTMF. If Distortion is displayed as meter, distortion of demodulated signal is measured. If DTMF is displayed as meter, displays decoded DTMF Code from demodulated signal.

15. AF Frequency Counter

Displays AF Frequency of demodulated signal. Field is for display only.

16. Deviation Meter

Displays Deviation for data or audio (voice) as selected by operator. If Voice is Deviation Measurement is selected, (V) appears beside meter reading. If Data is selected, (D) appears beside meter reading.

17. RF Error Meter

Displays frequency error of LTR Transmitter referenced to Receive RF Field (22). Field is for display only.

18. RF Power Meter/RF Level Meter

Displays RF Power, in Watts, applied to T/R Connector. If ANT is selected for Input (20), RF Level Meter appears. Field is for display only.

19. Receive Trunking Data Block

Displays data being passed from mobile radio. Refer to 6-12-3(C) for additional information.

20. Input

    Displays selected Input Connector. Selections are ANT (ANTENNA Connector) or T/R (T/R Connector).

21. Attenuation

    Displays selected Input Attenuation. Selections are 0 or 30 dB.

    Trunking Data Block is used to set the Repeater parameters that are passed to the Mobile Radios.   This information, as well as the Channel Number (1) and

22. Receive RF Field

    Displays RF Receive Frequency of COM-120C. Value is dependent on Channel Number (1) and Band Selection (2). Field is for display only. Formula for figuring value is as follows where Channel # is Channel Number (1):

    note Radios operating in 800 MHz Band within range of Canada or Mexico must use a -12.5 kHz offset.

    800 MHz Band Selection (2)

    Frequency (MHz) = 851.0125 + [.025 x (Channel # - 1)]

    900 MHz Band Selection (2)

    Frequency (MHz) = 935.0125 + [.0125 x Channel # - 1)]

    note Band Selection is required to test a Mobile Radio.

6-12-4 TRANSMIT TRUNKING DATA BLOCK

● ●

23. Goto

Displays Repeater Number to use for
Status (25) set to Continuous. Must
match Home (27) for Mobile Radio to
unsquelch. Range is 1 to 31.

24. Group

Displays ID Code for Mobile Radio to
Test. Range is 1 to 255. Information is
passed when Repeater transmits to
access selected Mobile Radio.


```
Area    0        Goto     9
Home    5        Group    151
Free    9        Status   CONT

                          00607237
```
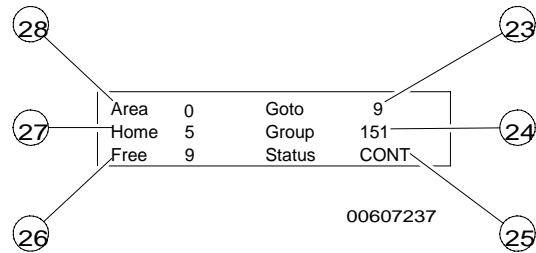
25. Status

Displays Status for Repeater for testing Mobile Radio. Set to FREE (Free Home
Repeater), BUSY (Busy Home Repeater), CONT (Continuous transmit by Home
Repeater) and DISCN (Disconnect Repeater-Mobile link). If CONT is desired,
Goto (23) must match Home (27).

26. Free

Displays Repeater Number used for Mobile transmission with Status (25) set to
BUSY. Free Repeater Channel on LTR Trunking Auxiliary Setup Screen
(paragraph 6-12-4) must also be set for proper operation. Range is 1 to 31.

27. Home

Displays Home Repeater Number used for testing Mobile Radios. Range is 1 to
31.

28. Area

Displays Proximity Switch setting. Range is 1 or 0.

SECTION 6
OPTIONS

6-12-5 RECEIVE TRUNKING DATA BLOCK

The Receive Trunking Data Block is used to display the Mobile Radio parameters that are passed to the Repeater.

This information is for display only and cannot be edited.

● ●

29. In Use

Displays Repeater Number used by Mobile Radio. Displays 31 at message end to signify end of transmission.

30. Group

Displays ID Code for Mobile Radio.

34			29
	Area	0	In Use	9	
33	Home	5	Group	151	30
	Free	31	CONNECT-DSP		

00607238

| 32 | | 31 |

31. Radio Status

Displays Mobile Radio Status. If CONNECT-DSP is displayed, Radio is currently linked to COM-120C in Dispatch Mode.

If CONNECT-RIC is displayed, Radio is currently linked to COM-120C in Radio Interconnect Mode.

If RELEASE is displayed, indicates COM-120C has received disconnect code from Mobile Radio.

If DISCONNECT is displayed, indicates Mobile Radio and Repeater are no longer connected due to manual disconnect or COM-120C disconnect due to elapsed time.

32. Free

Displays Free Field Data received from data. Displays 31 during normal operation.

33. Home

Displays Home Repeater Number for Mobile Radio. Range is 1 to 31.

34. Area

Displays Proximity Switch setting. Displays 1 or 0.
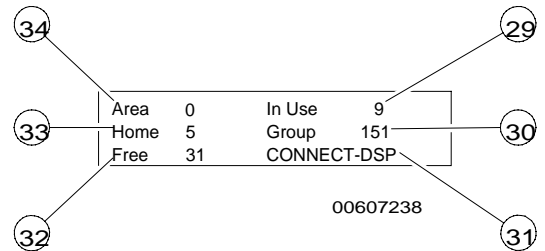
6-12-6 LTR TRUNKING RADIO SIMULATION

```
                LTR TRUNKING RADIO SIMULATOR
Ch #:     1     Band:    800 MHz              Extended Meas:
          RECEIVE                         GENERATE

RF:   851.0125      MHz           RF:   806.0125      MHz
Atten:   0 dB                     Level:   -40.0  dBm
Input:   T/R                      Output:  T/R

Area            Goto              Area   0        In Use      1
Home            Group             Home   1        Group       1
Free                              Free   2        PTT       OFF

RF Power:          0.0  mW        GEN-1    DATA

RF Error Freq:        2.774 kHz   Mod Source:   GEN1   FM
Deviation:        7.74  kHz  (v)  Deviation:    0.0 kHz:
AF Frequency:        1919 Hz      Frequency:    1000.0 Hz
Distortion:     + + + %
                                  Shad:
```

00607239

1. <u>Channel Number</u>

   Displays Trunking Channel Number. Selections range from 1 to 760. Selection of Channel Number and Band Selection (2) is used to set Generate RF Field (4) and Receive RF Field (22).

2. <u>Band Selection</u>

   Displays Trunking Band Selection. Displays 800 or 900 MHz.

3. <u>Extended Meas:</u>

   Allows for Extended Measurements.

4. <u>Generate RF Field</u>

   Displays RF Generate Frequency of COM-120C. Value is dependent on Channel Number (1) and Band Selection (2). Band automatically changes to USER if this field is edited. Formula for figuring value is as follows where Ch # is Channel Number (1):

   800 MHz Band Selection (2)

   Frequency (MHz) = 806.0125 + [.025 x (Channel # - 1)]

   900 MHz Band Selection (2)

   Frequency (MHz) = 896.0125 + [.0125 x (Channel #-1)]

SECTION 6
OPTIONS

nOTe Radios operating in 800 MHz Band within range of Canada or Mexico must use a 12.5 kHz offset.

5. Level

    Displays Output Level. Range is dependent on Output (6). Output set to T/R is -130 to -20 dBm. Output set to AUX is -130 to -13 dBm.

6. Output

    Displays Output Connector. Selections are T/R (T/R Connector) and AUX (AUX RF OUT Connector).

7. Transmit Trunking Data Block

    Displays current data being passed to Repeater. Refer to paragraph 6-12-4(B) for additional information.

8. Modulation Source Window

    Displays active Modulation Sources (10). Inactive Modulation Sources are not shown. Two (or more) sections of the RF Modulator set in conflict shows the invalid source grayed out (e.g. GEN1 set for PM and GEN2 set for FM, or GEN1 set for 0.01 kHz deviation and GEN2 set for 2.60 kHz deviation).

9. Modulation Source

    Displays selected Modulation Source. Selections include GEN1 (Audio Generator-1), GEN2 (Audio Generator-2), DTMF (DTMF Tone Generator) and DATA (DATA Generator).

10. Modulation Type

    Displays selected Modulation Type. Selections include OFF, AM, FM and PM.

11. Deviation/Modulation Level

    Displays selected Deviation in kHz if current Modulation Type (9) is FM with range from 0.00 to 100 kHz. Displays selected Percent Modulation if current Modulation Type (9) is AM with range from 0.0% to 100%. Displays selected Deviation in Radians if current Modulation Type (9) is PM with range from 0.0 to 10 Radians. Field is not displayed if Modulation Type (9) is OFF.

12. Frequency/Code Field

    If Modulation Source (8) is set for GEN1 or GEN2, displays Tone Frequency. GEN2 Frequency is not an editable field unless Option Generator 2 is installed. Range for GEN1 is 0.0 to 20000 Hz. If Modulation Source (8) is set for DTMF, displays DTMF Code. Any DTMF code can be entered up to 16 characters and other softkeys become available. If Modulation Source (8) is set for DATA, field is blank.

13. AUDIO/DATA IN Meters

    Displays selected meter for measuring audio input to AUDIO/DATA IN Connector. Selections include Distortion, SINAD and AF LEVEL Meters. If one of these meters is active, Deviation Meter (16), AF Frequency Meter (15), Distortion/DTMF Meter (14) and LTR Trunking are deactivated.

14. Distortion Meter

    Displays distortion of demodulated signal.

15. AF Frequency Counter

    Displays AF Frequency of demodulated signal. Field is for display only.

16. Deviation Meter

    Displays Deviation for data or audio (voice) as selected by operator. If Voice is Deviation Measurement is selected, (V) appears beside meter reading. If Data is selected, (D) appears beside meter reading.

17. RF Error Meter

    Displays frequency error of Repeater referenced to Receive RF Field (21). Field is for display only.

18. RF Power Meter/RF Level Meter

    Displays RF Power, in Watts, applied to T/R Connector. If ANT is selected for Input (20), RF Level Meter appears. Field is for display only.

19. Receive Trunking Data Block

    Displays data being passed from Repeater. Refer to paragraph 6-12-4(C) for additional information.

20. Input

    Displays selected Input Connector. Selections are ANT (ANTENNA Connector) or T/R (T/R Connector).

21. Attenuation

    Displays selected Input Attenuation. Selections are 0 or 30 dB.

22. Receive RF Field

Displays RF Receive Frequency of COM-120C. Value is dependent on Channel Number (1) and Band Selection (2). Band automatically changes to USER if this field is edited. Formula for figuring value is as follows where Ch # is Channel Number (1):

800 MHz Band Selection (2)

Frequency (MHz) = 851.0125 + [.025 x (Channel # - 1)]

900 MHz Band Selection (2)

Frequency (MHz) = 935.0125 + [.0125 x (Channel # -1)]

note Radios operating in 800 MHz Band within range of Canada or Mexico must use a 12.5 kHz offset.

6-12-7 TRANSMIT TRUNKING DATA BLOCK

The Transmit Trunking Data Block is used to set the Mobile Radio paramaters that are passed to the Repeater.

This information, as well as the Channel Number (1) and Band Selection are required to test a Repeater.

● ●

23. <u>In Use</u>

Displays Repeater Number used by Mobile Radio. Displays 31 at message end to signify end of transmission. Range is 1 to 31.

Area	0	In Use	9
Home	5	Group	151
Free	31	PTT	ON

00607240

24. <u>Group</u>

Displays ID Code for Mobile Radio serviced by Repeater. Range is 1 to 255.

25. <u>PTT</u>

Displays Push-To-Talk Status passed to Repeater. Displays ON or OFF. Push-To-Talk Status is toggled by pressing START/STOP CONTROL Key or use the MIC Accessory PTT.

26. <u>Free</u>

Not used by Mobile Radios. Field is editable, but should contain 31 for normal operation. Range is 1 to 31.

27. <u>Home</u>

Displays Home Repeater Number for Mobile Radio. Range is 1 to 31.

28. <u>Area</u>

Displays Proximity Switch setting. Range is 1 or 0.
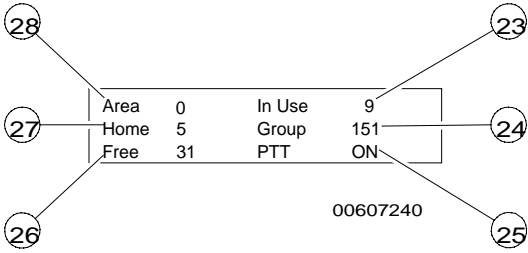
SECTION 6
OPTIONS

6-12-8 RECEIVE TRUNKING DATA BLOCK

The Receive Trunking Data Block is used to display the Repeater parameters that are passed to the Mobile Radio.

This information is for display only and cannot be edited.

● ●

29. <u>Goto</u>

Displays number of Repeater being tested.
Display of 31 indicates end of transmission
for Repeater.

30. <u>Group</u>

Displays ID Code specified by Group (24).

31. <u>Repeater Status</u>

Displays Repeater-Mobile Radio Connection
Status. CONNECT is displayed if Repeater is receiving COM-120C signal. Blank
if no signal.

32. <u>Free</u>

Displays Free Repeater data sent to COM-120C.

33. <u>Home</u>

Displays Home Repeater data sent by Repeater to COM-120C. Range is 1 to 31.

34. <u>Area</u>

Displays Proximity Switch setting. Displays 1 or 0.

```
       34                                    29

              Are   0        Got     9
       33     Hom   5        Grou   151            30
              Fre   9        CONNEC

                             00607241
       32                                    31
```
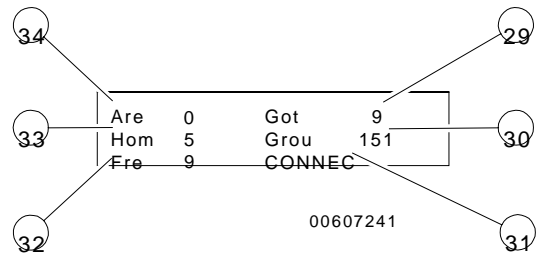
6-12-9 LTR TRUNKING AUXILIARY SETUP SCREEN

The LTR Trunking Auxiliary Setup Screen is provided to setup additional system parameters. This screen must be configured before operating the LTR Trunking Repeater

Simulator or the LTR Trunking Radio Simulator. Configure the LTR Trunking Auxiliary Setup Screen as follows:

● ●

1. Radio Ric ID

    Displays Mobile Radio Interconnect Channel Number. Range is 1 to 250.

2. Free Rep Chan

    Displays Free Repeater Channel Number for Free Repeater specified on LTR Trunking Repeater Simulator Operation Screen. Range is 1 to 760. If desired, the Repeater Receive and Transmit frequencies are editable to 1 GHz.

```
                    LTR Trunking
                    Auxiliary Setup
  RADIO RIC ID           2
  FREE REP CHAN          2
  BORDER OFFSET          DISABLED
  SYSTEM SYNC            158
  DECODE DATA            NORMAL
  ENCODE DATA            NORMAL

  PORCH ENABLE           OFF
  KEY UP DELAY            40 mSec
  UNKEY DELAY           150 mSec
  MAX RETRIES             3
  RETRY TIMEOUT         500 mSec
  RECV IF BW            15 kHz

                              RETURN
                              00607246
```

1 2 3 4 5 6 7 8 9 10 11 12
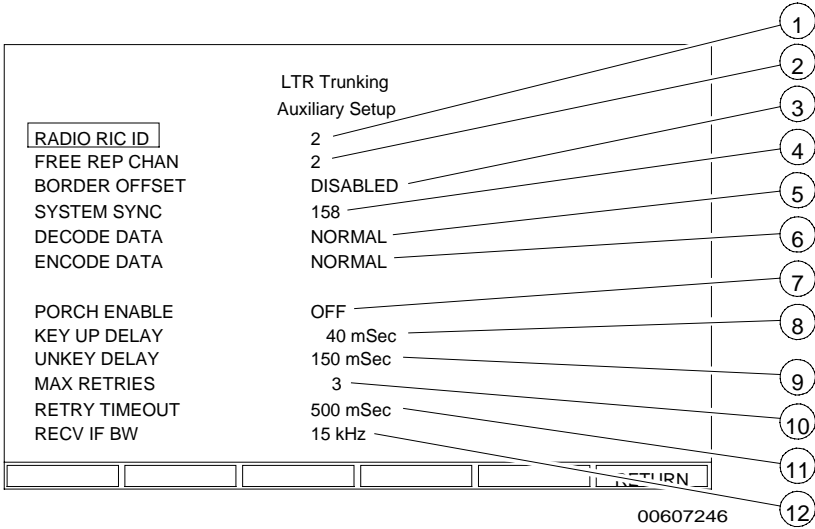
3. Border Offset

    Displays status of Border Offset to RF due to proximity to Canadian or Mexican Border. Displays ENABLED or DISABLED.

4. System Sync

    Displays hexadecimal code used for System Sync Code in Data Word. Default value is 158 (Hexadecimal). Range of value is 0 to 1FF (Hexadecimal).

5. Decode Data

    Displays the polarity of Decoded Data. This feature enables the LTR option to work in any frequency band up to 1 GHz regardless of polarity.

6. Encode Data

    Displays the polarity of Encoded Data. This feature enables the LTR option to work in any frequency band up to 1 GHz regardless of polarity.

7. Porch Enable

    Toggles the Data Back Porch ON/OFF in the Radio Simulator. The LTR
    specification requires the radio to generate the back porch, but, some repeaters
    fail to function with this field enabled. Therefore, the factory default is OFF.

8. Key Up Delay

    Sets the time data is sent after the COM-120C begins transmitting. Factory
    default is 40 ms. Shorter values connect more quickly. Use longer values if the
    repeater is having trouble locking onto the signal. (Example, a repeater that is
    seriously off frequency may exhibit this problem.)

9. Unkey Delay

    Sets the time the RF carrier is turned off after the COM-120C stops sending data.
    Factory default is 150 mSec. The noise burst after the COM-120C unkeys and
    before the repeater squelch closes may confuse the repeater. Increase the time
    to help the repeater.

10. Max Retries

    Sets the number of times the COM-120C tries to connect to the repeater.
    Factory default is 3.

11. Retry Timeout

    Tells the COM-120C how long to wait for the repeater response. Factory default
    is 500 ms.

12. Recv IF BW

    Set the COM-120C IF Bandwidth filter to use during operation. Factory default is
    15 kHz.

6-12-10   AUXILIARY SETUP SCREEN CONFIGURATION

❏   From LTR Trunking Menu, select "3. Auxiliary Setup."

❏   If Mobile Radio RIC Test is required, set RADIO RIC ID (1) to Radio Interconnect Channel (RIC). IF RIC Operation is not required, set to value with no Dispatch Operation interference.

❏   If Mobile Radio Busy Home Repeater Test is desired, enter Free Repeater Channel for FREE REP CHAN (2).

❏   If testing devices set for Border Offset, set BORDER OFFSET (3) to ENABLED. If Border Offset is not required, set BORDER OFFSET (3) to DISABLED.

❏   Set SYSTEM SYNC (4) to 158 unless nonstandard system is tested.

❏   Set DECODE DATA (5) to NORMAL or INVERT. Invert enables the LTR option to work in any frequency band up to 1 GHz regardless of polarity.

❏   Set ENCODE DATA (6) to NORMAL or INVERT.   Invert enables the LTR option to work in any frequency band up to 1 GHz regardless of polarity.

❏   Press RETURN Soft Function Key F6 to return to LTR Trunking Menu.

SECTION 6
OPTIONS

6-12-11   REPEATER SIMULATOR OPERATION

The Repeater Simulator is used to test LTR Mobile Radios. To test LTR Mobile Radios, knowledge of the Radio Configuration Data, for the Radio under test, is required.

This section is divided into paragraphs. The first paragraph is General Configuration and the remaining paragraphs are different tests. Perform the General Configuration before each test.

● ●


```
                        LTR TRUNKING REPEATER SIMULATOR
Ch #:    258    Band:    800  MHz                        Extended Meas:
         RECEIVE                              GENERATE

RF:  812.4375     MHz           RF:  857.4375      MHz
Atten:   0  dB                  Level:   -120.0  dBm
Input:   T/R                    Output:  T/R
Area            In Use          Area    0          Goto       5
Home            Group           Home    5          Group      151
Free                            Free    5          Status     CONT
RF Power:        0.0  mW        GEN-1    DATA
RF Error Freq:       2.752 kHz  Mod Source:   GEN1    FM
Deviation:           7.57  kHz  (V)   Deviation:     3.3 kHz:
AF Frequency:        1894 Hz    Frequency:     1000.0 Hz
Distortion:     + + + %
                                Sinad:
```

00607236
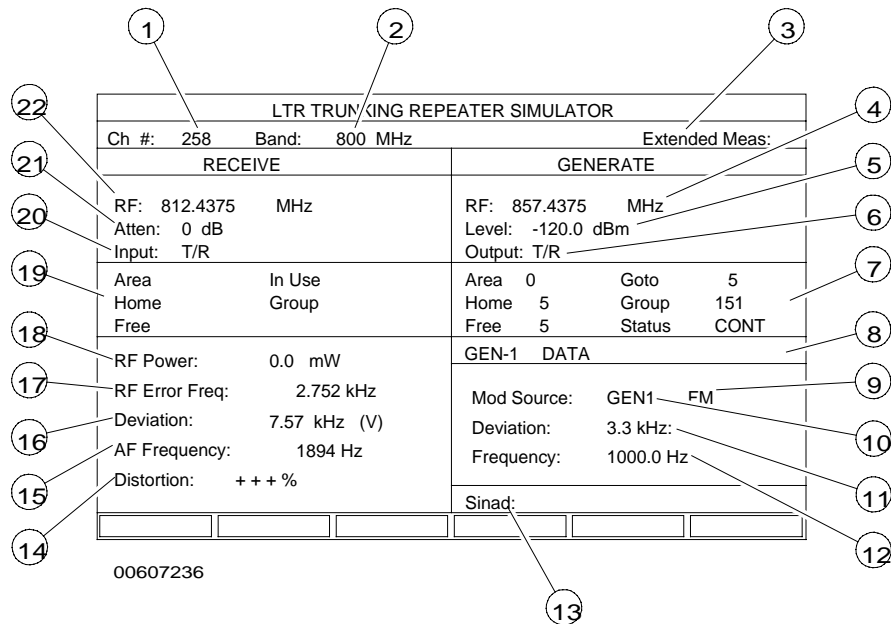
❏   Configure Auxiliary Setup Screen.

❏   From LTR Trunking Menu, select "1. Repeater Simulation."

❏   Enter Channel Number (1) of Mobile Radio. Range is 1 to 760.

❏   Choose Band Selection (2). Selections are 800 MHz, 900 MHz or USER.

❏   Select Output (6) for COM-120C Generator. Selections are T/R (T/R Connector) or AUX (AUX RF OUT Connector).

❏   Set Level (5) to desired Output Level. Range for Output (6) set to T/R is -130 to -40 dBm. Range for Output (6) set to AUX is -130 to -13 dBm.

❏   Activate Modulation Source (10) as required. If two (or more) sections of the RF Modulator are set in conflict (e.g. GEN1 set for PM and GEN2 set for FM, or GEN1 set for 0.01 kHz deviation and GEN2 set for 2.60 kHz deviation) then the screen shows the invalid source grayed out.

❏   If AUDIO/DATA IN Meter Operation is required, select desired Meter.

If AUDIO/DATA IN Meter Operation is selected, Deviation Meter (16), AF Frequency Meter (15), and Distortion/ DTMF Meter are deactivated.

❑ If Distortion/DTMF Meter Operation is required, select desired Meter.

❑ Configure Deviation Meter (16).

❑ Select Input (20) for desired Input Connector. Selections include T/R (T/R Connector) and ANT (ANTENNA Connector).

If Mobile Radio output is >0 dBm, select T/R. If ANT Input (20) is selected and Mobile Radio Output is >30 dBm, set Attenuation (21) for 30 dB.

❑ Set Attenuation (21). Selections include 0 dB and 30 dB. If ANT Input (20) is selected and Mobile Radio Output is >30 dBm, set Attenuation (21) for 30 dB.

SECTION 6
OPTIONS

6-12-12   LTR RADIO HANDSHAKE TEST

This test verifies the COM-120C is able to link with the Mobile Radio and a proper encode/decode sequence is performed. Perform these additional tests simultaneously:

RF Power, RF Error, Voice FM Deviation, Data FM Deviation, Distortion and AF Frequency Measurements.

● ●

❏ Set Deviation Meter (16) to measure Voice or Data FM Deviation as needed.

❏ Set Group (24) for ID Code of Mobile Radio.

❏ Set Status (25) to **FREE**.

❏ Set Home (27) to Mobile Radio Home Repeater Number.

❏ Set Area (28) for Mobile Radio Area switch setting.

❏ Connect Mobile Radio RF Output to connector specified by Input (20).

❏ Connect Mobile Radio RF Input to connector specified by Output (6).

❏ Key Mobile Radio. Verify **CONNECT-DSP** or **CONNECT-RIC** is displayed for Radio Status (31).

❏ Verify Group (30) matches Group (24).

❏ Verify Home (33) and In Use (29) match Home (27).

❏ Verify Area (34) matches Area (28).

❏ Verify Free (32) displays **31**.

❏ Unkey Mobile Radio. Verify Release is displayed for Radio Status (31). Verify In Use (29) displays **31**.

Area	0	Goto	9
Home	5	Group	151
Free	9	Status	CONT

00607237

Area	0	In Use	9
Home	5	Group	151
Free	31		CONNECT-DSP

00607238
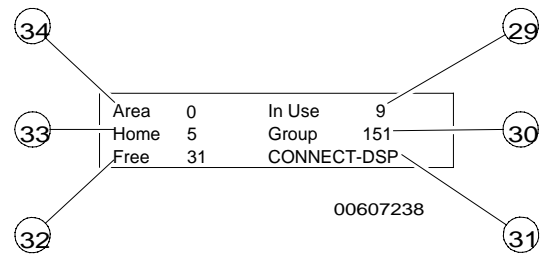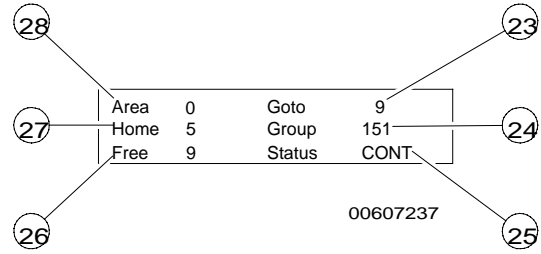
6-12-13   LTR RADIO HANDOFF TEST

This test verifies that the COM-120C is able to link with the Mobile Radio and a proper Handoff to a free repeater is performed. Perform these additional tests simultaneously:

RF Power, RF Error, Voice FM Deviation, Data FM Deviation, Distortion and AF Frequency Measurements.

● ●

❏   Set Deviation Meter (16) to measure Voice or Data FM Deviation as needed.

❏   Set Group (24) for ID Code of Mobile Radio.

❏   Set Status (25) to *BUSY*.

❏   Set Free (26) for Mobile Radio Free Repeater Number.

❏   Set Home (27) to Mobile Radio Home Repeater Number.

❏   Set Area (28) for Mobile Radio Area switch setting.

❏   Connect Mobile Radio RF Output to connector specified by Input (20).

❏   Connect Mobile Radio RF Input to connector specified by Output (6).

28		23
27	Area 0 Goto 9 Home 5 Group 151 Free 9 Status CONT	24
26	00607237	25
34		29
33	Area 0 In Use 9 Home 5 Group 151 Free 31 CONNECT-DSP	30
32	00607238	31

❏   Key Mobile Radio. Verify *CONNECT-DSP* or *CONNECT-RIC* is displayed for Radio Status (30).

❏   Verify Group (30) matches Group (24).

❏   Verify Home (33) matches Home (27).

❏   Verify In Use (29) matches Free (26).

❏   Verify Area (34) matches Area (28).

❏   Verify Free (32) displays *31*.

❏   Unkey Mobile Radio. Verify Release is displayed for Radio Status (31). Verify In Use (29) displays *31*.
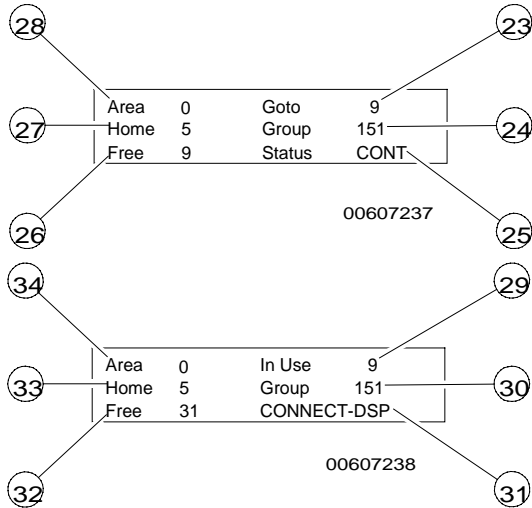
6-12-14   LTR RADIO RECEIVE TEST

This test verifies that the COM-120C is able to link with the Mobile Radio and an audio modulated RF Signal transmitted by the COM-120C is received by the Mobile Radio.

Perform these additional tests simultaneously: AUDIO/DATA IN Meters to measure Distortion, SINAD and AF Level of the signal demodulated by the Mobile Radio.

● ●

❏ If AUDIO/DATA IN Meters (13) are required, set following parameters:

   Modulation Source for **GEN1**.

   Modulation Type (10) to **FM**.

   Deviation/Modulation Level for **3.30 kHz**.

   Frequency/Code Field for **1000.0 Hz**.

❏ Set Goto (23) to Home Repeater Number for Mobile Radio.

❏ Set Group (24) for ID Code of Mobile Radio.

❏ Set Status (25) to **CONT**.

❏ Set Home (27) to Mobile Radio Home Repeater Number.

❏ Set Area (28) for Mobile Radio Area switch setting.

❏ Connect Mobile Radio RF Output to connector specified by Input (20).

❏ Connect Mobile Radio RF Input to connector specified by Output (6).

❏ Connect Mobile Radio Audio Output to AUDIO/DATA IN Connector.

❏ Verify 1000 kHz audio tone is audible.

❏ Verify AUDIO/DATA IN Meter Measurement, if required.

Area	0	Goto	9
Home	5	Group	151
Free	9	Status	CONT

00607237

Area	0	In Use	9
Home	5	Group	151
Free	31	CONNECT-DSP	

00607238
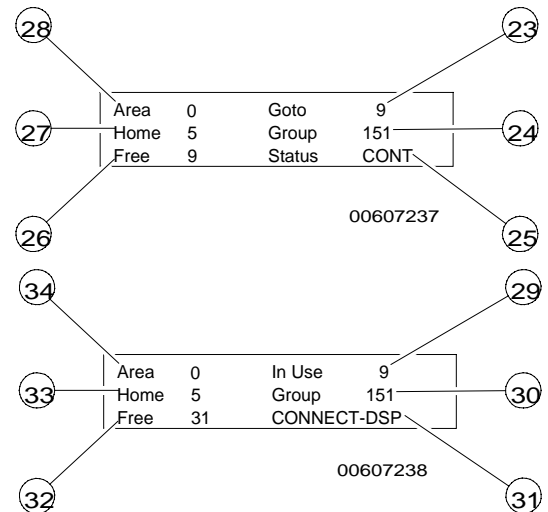
6-12-15   RADIO SIMULATOR OPERATION

The Radio Simulator is used to test LTR Repeaters. To test LTR Repeaters, knowledge of the Radio Configuration Data is required for the Mobile Radios that are serviced by the Repeater being tested.

This section is divided into paragraphs with the first paragraph being General Configuration and the remaining paragraphs being different tests. Perform the General Configuration before each test.

● ●


```
                    LTR TRUNKING RADIO SIMULATOR
Ch #:     1      Band:    800  MHz              Extended Meas:
          RECEIVE                          GENERATE

RF:  851.0125      MHz            RF:   806.0125     MHz
Atten:   0  dB                    Level:   -40.0  dBm
Input:   T/R                      Output:  T/R

Area            Goto             Area   0        In Use      1
Home            Group            Home   1        Group       1
Free                             Free   2        PTT      OFF

RF Power:        0.0  mW         GEN-1   DATA

RF Error Freq:       2.774 kHz   Mod Source:   GEN1   FM
Deviation:       7.74  kHz  (v)  Deviation:    0.0 kHz:
                                 Frequency:    1000.0 Hz
AF Frequency:        1919 Hz

Distortion:     + + + %
                                 Shad:
```

00607239
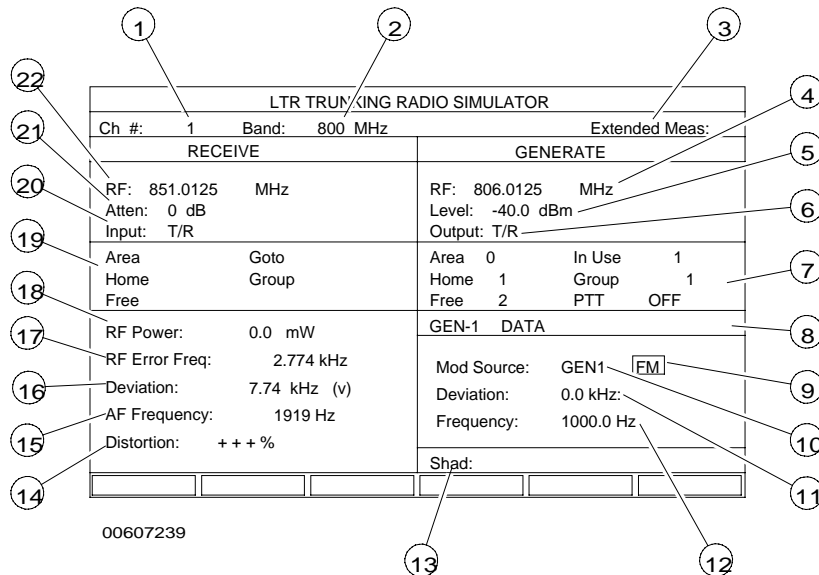
❏   Configure Auxiliary Setup Screen

❏   From LTR Trunking Menu, select "1. Radio Simulation."

❏   Enter Channel Number (1). Range is 1 to 760.

❏   Choose Band Selection (2). Selections are 800 MHz, 900 MHz or USER.

❏   Select Output (6) for COM-120C Generator. Selections are T/R (T/R Connector) or AUX (AUX RF OUT Connector).

❏   Set Level (5) to desired Output Level. Range for Output (6) set to T/R is -130 to -40 dBm. Range for Output (6) set to AUX is -130 to -13 dBm.

❏   Activate Modulation Source (10) as required. If two (or more) sections of the RF Modulator are set in conflict (e.g. GEN1 set for PM and GEN2 set for FM, or GEN1 set for 0.01 kHz deviation and GEN2 set for 2.60 kHz deviation) then the screen shows the invalid source grayed out.

❏   If AUDIO/DATA IN Meter Operation is required, select desired meter.

❏   If AUDIO/DATA IN Meter Operation is selected, Deviation Meter (16), AF Frequency Meter (15) and Distortion/ DTMF Meter are deactivated.

❏   If Distortion Meter Operation is required, select desired meter.

SECTION 6
OPTIONS

❏   Configure Deviation Meter (16).

❏   Select Input (20) for desired Input Connector. Selections include T/R (T/R Connector) and ANT (ANTENNA Connector). If Repeater output is >0 dBm, select T/R. If ANT Input (20) is selected and Repeater Output is >30 dBm, set Attenuation (21) for 30 dB.

❏   Set Attenuation (21). Selections include 0 dB and 30 dB. If ANT Input (20) is selected and Repeater Output is >30 dBm, set Attenuation (21) for 30 dB.

6-12-16   LTR REPEATER HANDSHAKE TEST

This test verifies that the COM-120C is able to link with the Repeater and a proper encode/decode sequence is performed. Perform these additional tests simultaneously:

RF Power, RF Error, Voice FM Deviation, Data FM Deviation, Distortion and AF Frequency Measurement.

● ●

❏   Perform paragraph 6-12-6. AUDIO/DATA IN Meters (13) are not used with this test. Set Deviation Meter (16) to measure Voice or Data FM Deviation as needed.

❏   Set Group (24) for ID Code of Mobile Radio being simulated.

❏   Set In Use (23) and Home (27) to Repeater Number.

❏   Set Area (28) for simulated Mobile Radio Area switch setting.

❏   Connect Repeater RF Output to connector specified by Input (20).

❏   Connect Mobile Radio RF Input to connector specified by Output (6).

❏   Press START/STOP CONTROL Key. Verify CONNECT is displayed for Repeater Status (31).

Area	0	In Use	9
Home	5	Group	151
Free	31	PTT	ON

00607240

Area	0	Goto	9
Home	5	Group	151
Free	9	CONNECT	

00607241
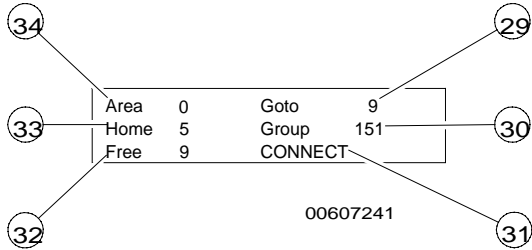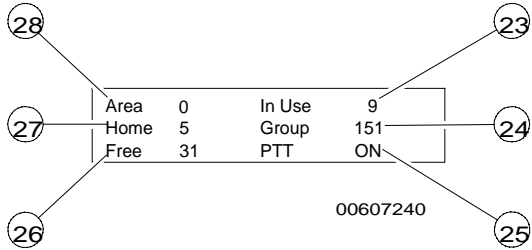
6-13 AMPS CELLULAR TESTING (OPTION 15)

The AMPS Cell Site Simulator is Option 15 of the COM-120C and is used to test AMPS Mobile Telephone Equipment. This option is accessed by pressing SPCL Test Mode Key and selecting "2. Cellular."

6-13-1 AMPS CELL SITE SIMULATOR SETUP

The COM-120C is set up for AMPS Mobile Phone testing by the following procedure:

● ●

❏ Press SPCL Mode Key. Select "2. Cellular" from the Options Menu.

❏ Rotate SQUELCH Control ccw until squelch is set to minimum.

❏ Rotate VOLUME Control fully ccw and then cw, until static becomes audible.

❏ Rotate SQUELCH Control cw, slowly, until static is no longer audible.

note *If "data parity error" message is displayed during test operation, squelch setting may be too low.*

❏ Squelch levels higher than necessary can prevent AMPS testing from functioning.

❏ Turn Mobile Phone power on.

❏ To perform Audio Test, connect demodulated audio output connector of Mobile Phone to AUDIO/DATA IN Connector.

6-13-2 AMPS CELL SITE SIMULATOR MAIN AND SETUP MENUS

Press the SPCL Mode Key. Choose "2. Cellular" to access the AMPS Cellular Menu.

The Automatic and Manual Tests and Setup Screens are selected from this Menu.

● ●

```
                              AMPS Cellular

        Choose test:
           1  Automatic Test
           2.  Manual Test
           3.  Setup
```
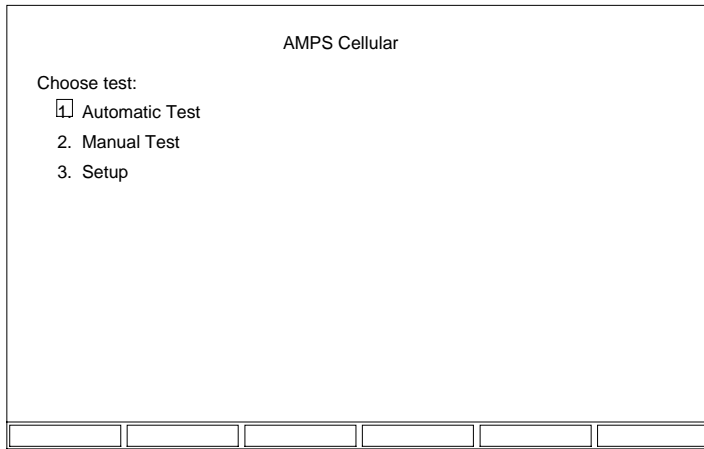
871709

The parameters used for the Automatic and Manual Tests are selected through the AMPS Setup Screen. The AMPS Setup Menu is divided into 2 screens: Pages 1 and 2.

Access "3. Setup" from the AMPS Cellular Menu to display Page 1 of the AMPS Setup Screen. Following is a listing of the AMPS Setup parameters, uses and ranges.

SECTION 6
OPTIONS


```
                    AMPS Cellular
                   Setup Parameters
    Control Channel        327                          (1)
    Voice Channel          300                          (2)
    Home/Roam Select       HOME                         (3)
    Mobile I.D.            3166486263                   (4)
    Mobile Serial No.      26314782194                  (5)
    SAT Frequency          5970 Hz                      (6)
    Home/Area I.D.         00163                        (7)
    Digital Color Code     2
    Power Level Ref        3                            (8)
    SINAD Test Ref         12  dB    C-MSG              (9)
    Customer Information

                                          8717092
              (12)        (11)       (10)
```
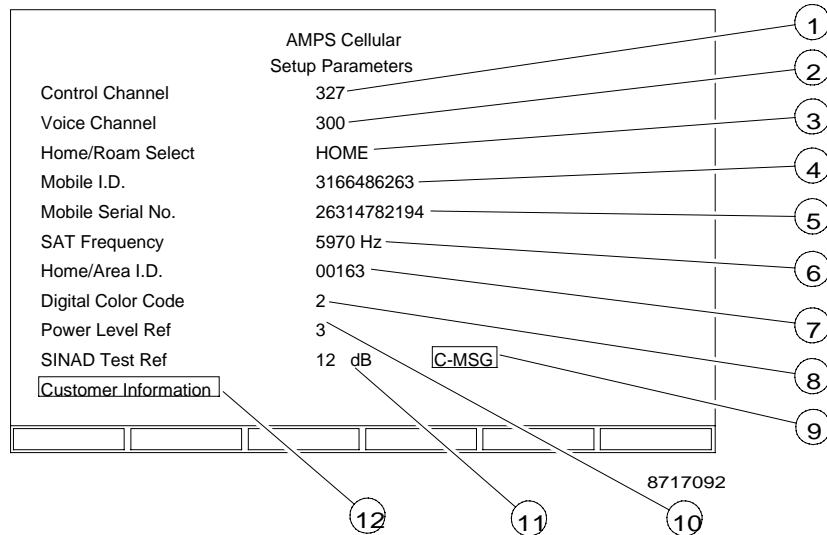
1. <u>Control Channel</u>

   Selects simulated Control Channel. Range is 1 to 1023. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

2. <u>Voice Channel</u>

   Selects simulated Voice Channel. Range is 1 to 1023. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

3. <u>Home/Roam Select</u>

   Selects simulated Home or Roaming Registration. Selections are Home or Roam.

4. <u>Mobile I.D.</u>

   Selects the Mobile Identification Number (MIN) used to identify Mobile Phone. Maximum length is 10 characters using A to D, 0 to 9, and # character. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

   Performing Registration Test automatically enters MIN of Mobile Phone.

5. <u>Mobile Serial No.</u>

   Selects Electronic Serial Number (ESN) used to identify Mobile Phone. Length is 11 digits. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

6. <u>SAT Frequency</u>

   Selects SAT Frequency simulated. Selections include 5970, 6000 or 6030 Hz.

7. <u>Home/Area I.D.</u>

    Selects System Identification Number (SID) used to test Home System Identification of Mobile Phone. Length is 5 digits. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

8. <u>Digital Color Code</u>

    Selects Digital Color Code (DCC) simulated. Range is 0 to 3. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

9. <u>Audio Test Filter</u>

    Displays Audio Filter setting for SINAD Test. Selections include C-MSG (C-Message Weighted Bandpass Filter) and 20 kHz Low-Pass Filter.

10. <u>Power Level Ref</u>

    Mobile Phone Power Level used when Mobile Phone power readings are taken. Range is 0 to 7. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

11. <u>SINAD Test Ref</u>

    Selects Pass/Fail SINAD Test Reference. Range is 3 to 40 dB. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

12. <u>Customer Information</u>

    Displays Customer Information Menu. Edit Customer Information using DATA ENTRY Keys. Press ENTER Key to complete edit. Customer Information is printed out on Automatic Test Printout. Submenu Fields are as follows:

Customer Name	Customer I.D.
Manufacturer	Model
Serial Number	Type Approval
Certificate	

    Pressing F1 "Page 2" displays Page 2 of the AMPS Setup Menu.

```
                        AMPS Cellular                              ①
                      Setup Parameters
     Pass/Fail Indicator        ENABLED                           ②
     Print-Out                  DISABLED
     Handoff Start                 1                               ③
     Handoff end                  300                              ④
     Handoff Increment             50
     Power Lev Tolerance        15 %                               ⑤
     RF Freq Err Tolerance     1.00 kHz                            ⑥
     SAT Freq Tolerance          1 Hz
     ST Freq Tolerance           1 Hz                              ⑦
     SAT Dev Tolerance          10 %                               ⑧
     ST Dev Tolerance           13 %
     Flash Dur Tolerance        50 %                               ⑨

                                                  8717093          ⑩

                              ⑫        ⑪
```
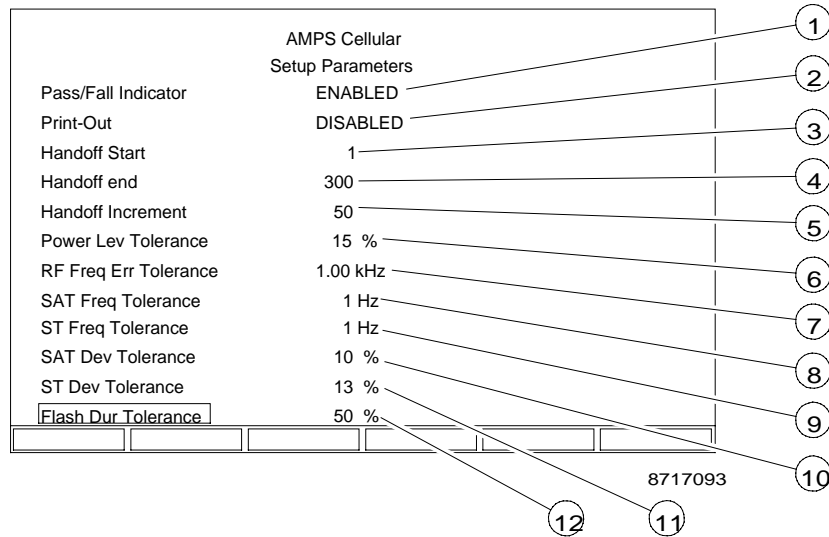
1. <u>Pass/Fail Indicator</u>

   Displays status of Pass/Fail Indicator on Automatic Test Printout. Displays ENABLED or DISABLED.

2. <u>Print-Out</u>

   Enables or disables print-out of Automatic Test Output. Requires printer connection to RS-232 Connector.   Refer to Section 5 for configuring RS-232 Connector.

3. <u>Handoff Start</u>

   First channel of Handoff Test sequence. Handoff Test starts with Handoff Start channel, increases by Handoff Increment (5), performing Handoff Test at each channel and ends with Handoff End (4) channel. Range is 1 to 1023.   Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

4. <u>Handoff End</u>

   Last channel of Handoff Test sequence. Handoff Test starts with Handoff Start (3) channel, increments by the Handoff Increment (5) performing Handoff Test at each channel and ends with Handoff End channel. Range is 1 to 1023. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

5. <u>Handoff Increment</u>

   Increment Number for Handoff Test. Handoff Test starts with Handoff Start (3) channel, increments by Handoff Increment, performing Handoff Test at each channel and ends with the Handoff End (4) channel. Range is 1 to 1023. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

6. Power Lev Tolerance

    Selects tolerance used for Power Level Test. Consists of two editable fields:
    Positive Tolerance and Negative Tolerance. Range for both fields is from 0% to
    99% or 0 to 99 dB. For each field, select using DATA ENTRY Keys. Press
    ENTER Key to complete edit.

7. RF Freq Err Tolerance

    Selects tolerance for RF Frequency Error measurements. Range is 0.00 to
    9.99 kHz. Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

8. SAT Freq Tolerance

    Selects tolerance for SAT Frequency measurements. Range is 0 to 99 Hz. Select
    using DATA ENTRY Keys. Press ENTER Key to complete edit.

9. ST Freq Tolerance

    Selects tolerance for Signal Tone (ST) Frequency Test. Range is 0 to 999 Hz.
    Select using DATA ENTRY Keys. Press ENTER Key to complete edit.

10. SAT Dev Tolerance

    Selects tolerance for SAT Deviation measurements. Range is 0% to 99%.   Select
    using DATA ENTRY Keys. Press ENTER Key to complete edit.

11. ST Dev Tolerance

    Selects the tolerance used to determine if the Signal Tone (ST) Deviation Test
    passes or fails. Range is from 0% to 99%. To set, move cursor to "11. ST Dev
    Tolerance" and press ENTER Key. Use DATA ENTRY Keypad (29) to enter a
    tolerance and press ENTER Key.

12. Flash Dur Tolerance

    Selects the tolerance used to determine if the Flash Hook Duration Test passes or
    fails. Range is from 0% to 99%. To set, move cursor to "12. Flash Dur
    Tolerance" and press ENTER Key. Use DATA ENTRY Keypad (29) to enter a
    tolerance and press ENTER Key.

SECTION 6
OPTIONS

6-13-3 AMPS CELL SITE SIMULATOR AUTOMATIC TESTS

The AMPS Automatic Test Screen is accessed by selecting "1. Automatic Test" from the AMPS Cellular Menu.

Tests listed on the AMPS Automatic Test Screen are performed individually or in any combination *except* Mobile Init and Cell Init Tests must be performed if Handoff Test or Audio Test is desired.

Tests listed as ENABLED are performed. Tests listed as DISABLED are not performed. Each of the AMPS Automatic Test Screens are listed in the following paragraphs. The descriptions of the tests and results assume the mobile test was performed with all tests ENABLED.

● ●

AMPS Automatic Test Screen pretest softkeys are:

1. Disabled

   Sets test at current cursor location to DISABLED.

2. Enabled

   Sets test at current cursor location to ENABLED.

3. Start

   Starts tests that are ENABLED.

```
                         AMPS Cellular
                         Automatic Test

        Registration          ENABLED
        Mobile Init           ENABLED
       [Cell Init ]           ENABLED
        Handoff Test          ENABLED
        Audio Test            ENABLED




    ┌────┬────┬────┬────┬────┬──────┐
    │    │    │    │    │    │RETURN│
    └────┴────┴────┴────┴────┴──────┘
```

871712

4. Return/Abort

   RETURN returns operation to AMPS Cellular Menu. ABORT stops current test and reports test as FAILED.
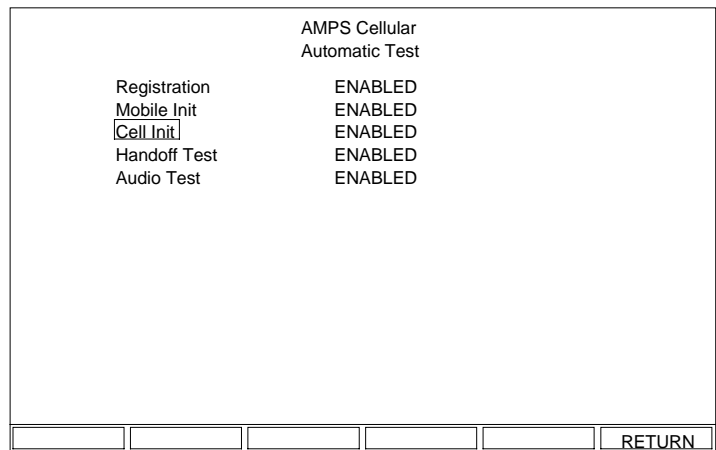
AMPS Automatic Test Screen post test softkeys are:

1. Reset

   Resets AMPS Automatic Test to initial conditions.

2. Results

   Pages through AMPS Automatic Test results.

3. Start

   Starts tests that are ENABLED.

4. Return

   Returns operation to AMPS Cellular Menu.

6-13-4 REGISTRATION TEST

The Registration Test sends a Registration order to the Mobile Phone. The registration parameters of the Mobile Phone tested and displayed.

To perform the Registration Test, verify the Registration Field is ENABLED. Registration Test results appear following test completion.

● ●

1. SCM

   Displays 4 least significant Station Class Mark bits.

2. Power Class

   Displays Power Class of Mobile Phone under test.

```
                        AMPS Cellular
                        Manual Test

            Registration
            Mobile Init
            Cell Init
                                                              (1)

       MIN:   316/522-4981              SCM:  0100
       ESN:   HEX  8208A4C4             POWER CLASS 1           (2)
              Dec  13000566468          DISCONTINUOUS
              Oct  20202122304          BANDWIDTH: 20  MHz      (3)
       DCC:   2                                                 (4)

     REG      MOBILE     CELL                         RETURN
```
8717126

3. Transmission State

   Displays Transmission State, Continuous or Discontinuous, of Mobile Phone under test.

4. Bandwidth

   Displays bandwidth of Mobile Phone under test. 20 MHz allows channels 1 to 666. 25 MHz allows channels 1 to 1023.

5. DCC

   Displays Digital Color Code last received by Mobile Phone under test.

6. ESN

   Displays Electronic Serial Number of Mobile Phone under test in Hexadecimal, Decimal and Octal.

7. MIN

   Displays Mobile Identification Number of Mobile Phone under test.

8. V Chan

   Displays Voice Channel designated to Mobile Phone by Test Set.
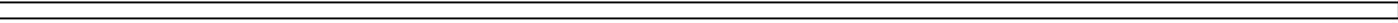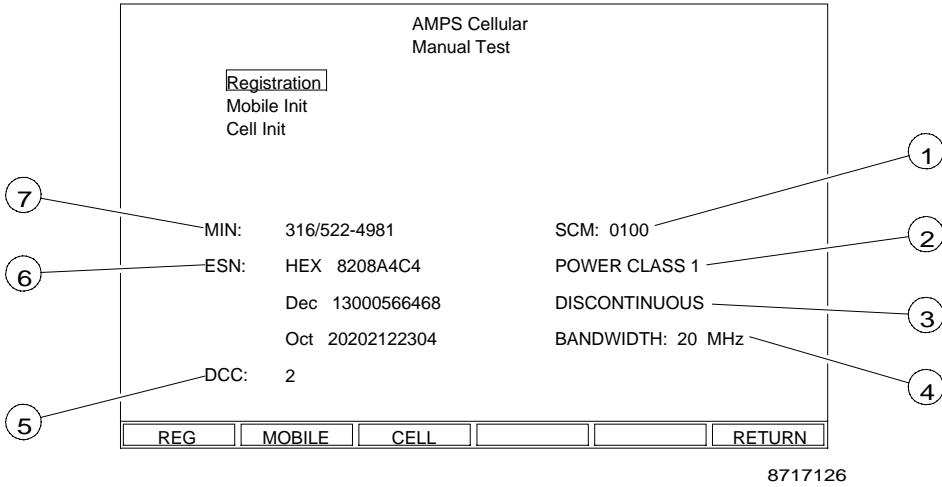
9. <u>DTMF</u>

Displays DTMF digits transmitted after "ENTER DIGITS" prompt.

10. <u>Flash Dur</u>

Displays Flash Hook signal time duration transmitted by Mobile Phone under test.

11. <u>ST Freq</u>

Displays Signal Tone frequency transmitted by Mobile Phone under test.

12. <u>Hangup Dev</u>

Displays deviation of hang up signal of Mobile Phone under test.

13. <u>TX Pwr</u>

Displays Mobile Phone Output Power. Mobile Phone is set to Power Level Reference in AMPS Setup Menu.

14. <u>SAT Dev</u>

Displays deviation of SAT transmitted by Mobile Phone under test.

15. <u>Freq Err</u>

Displays error of Reverse Voice Channel Frequency received from Mobile Phone.

16. <u>SAT Freq</u>

Displays SAT frequency transmitted by Mobile Phone under test.

17. <u>Called Adr</u>

Displays phone number transmitted by Mobile Phone under test.

The Power Level Test sends the VMAC values 0 to 7 to the Mobile Phone and the output power is measured.

18. <u>Level</u>

Displays power levels of Mobile Phone.

19. <u>Reading</u>

Displays power readings of Mobile Phone for each power level.

```
                          AMPS Cellular
                          Automatic Test

         Registration              FINISHED
         Mobile Init               FINISHED
         Cell Init                 FINISHED
         Handoff Test              FINISHED
         Audio Test                FINISHED

         Called Adr:    6823819         V Chan:      300
         SAT Freq:      5970 Hz         DTMF         123456789"0"
         Freq Err:      0.06 kHz
         SAT Dev:       2.37 kHz        Flash Dur:   390 msec
         TX Pwr:        22.0 dBm
         Hangup Dev:    9.57 kHz        ST Freq:     10.000 kHz

         [      ][      ][      ][      ][     RETURN ]
```

8717122

```
                          AMPS Cellular
                          Automatic Test

         Registration              FINISHED
         Mobile Init               FINISHED
         Cell Init                 FINISHED
         Handoff Test              FINISHED
         Audio Test                FINISHED

         Level   Reading       Level   Reading
           0     34.0 dBm        0     17.5 dBm
           1     29.7 dBm        1     13.8 dBm
           2     26.1 dBm        2      9.2 dBm
           3     22.0 dBm        3      6.0 dBm

         [      ][      ][      ][      ][     RETURN ]
```

8717118

20. SAT Dev

     Displays SAT Deviation received from Mobile Phone.

21. ST Freq

     Displays Signal Tone (Hang Up) Frequency received from Mobile Phone.

22. Hangup Dev

     Displays Signal Tone (Hang Up) Deviation received from Mobile Phone.

23. TX Pwr

     Displays Mobile Phone Output Power. Mobile Phone is set to Power Level
     selected as Power Level Reference in AMPS Setup Menu.

24. SAT Freq

     Displays SAT Frequency received from Mobile Phone.

25. RF Freq Err

   Displays error of Reverse Voice Channel Frequency received from Mobile Phone.

26. Ring Dev

   Displays Signal Tone Deviation received from Mobile Phone in response to Page order.

27. Voice Chan

   Displays Voice Channel designated to Mobile Phone by Test Set.

```
                              AMPS Cellular
                              Automatic Test

                  Registration           FINISHED
                  Mobile Init            FINISHED
                  Cell Init              FINISHED
           (27)   Handoff Test           FINISHED
                  Audio Test             FINISHED

           (26)   Voice Chan:    300
           (25)   Ring Dev:      9.56 KHz
                  RF Freq Err:   0.05 KHz                              (20)
           (24)   SAT Freq:      5970 Hz      SAT Dev:    2.24 KHz
           (23)   TX Pwr:        22.0 dBm
                  Hangup Dev:  9.57 KHz       ST Freq:    10.000 KHz   (21)
           (22)
                  ┌──────┬──────┬──────┬──────┬──────┬─RETURN─┐
                  └──────┴──────┴──────┴──────┴──────┴────────┘
```

8717121
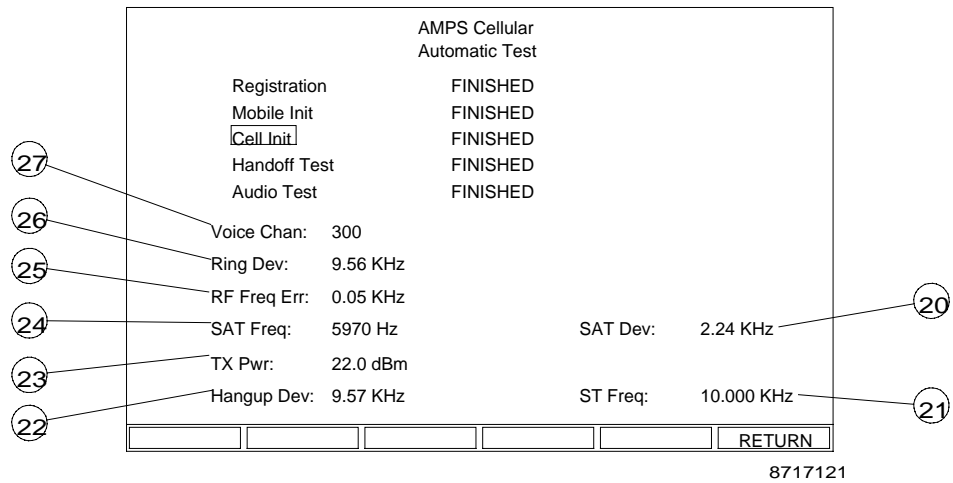
6-13-5 HANDOFF TEST

The Handoff Test performs a series of handoffs to different Channels. The first handoff is to the Handoff Start Channel. All other handoffs go to the next channel by adding the Handoff Increment to the current Channel until the Handoff End Channel receives a handoff.

To perform this test, press F2 ENABLED with cursor on Handoff Test.

Press F3 to start test. The Handoff Test cannot be selected unless the Mobile Init Test or the Cell Init Test is selected.

● ●

28. <u>Chan</u>

   Displays Voice Channel which the handoff was made.

29. <u>Pwr</u>

   Displays Mobile Phone Output Power. Mobile Phone is set to Power Level selected as Power Level Reference in AMPS Setup Menu.

AMPS Cellular
Automatic Test

Registration	FINISHED
Mobile Init	FINISHED
Cell Init	FINISHED
Handoff Test	FINISHED
Audio Test	FINISHED

Chan	Pwr	SAT	SAT Dev	Err
1	22.1 dBm	5970 Hz	2.27 KHz	0.05 KHz
51	22.1 dBm	5970 Hz	2.30 KHZ	0.05 KHz
101	21.9 dBm	5970 Hz	2.28 KHz	0.05 KHz
151	22.0 dBm	5970 Hz	2.49 KHz	0.05 KHz
201	22.1 dBm	5970 Hz	2.28 KHz	0.05 KHz

RETURN

8717119

30. <u>SAT</u>

   Displays SAT Frequency received from Mobile Phone.

31. <u>SAT Dev</u>

   Displays SAT Deviation received from Mobile Phone.

32. <u>Err</u>

   Displays RF Frequency Error of Reverse Voice Channel.

SECTION 6
OPTIONS

6-13-6 AUDIO TEST

The Audio Test measures Audio Distortion, Audio Power and RF Input Power required to maintain a SINAD Level. Connect the Phone Audio Out to the COM-120C AUDIO/DATA IN Connector. The SINAD Test Reference is set from the AMPS Setup Menu.

To test, press F2 ENABLED while cursor is on Audio Test. Press F3 START. Press FX SKIP to skip a test when prompted by Test Set. The Audio Test works when the Mobile Init Test or the Cell Init Test is also performed.

● ●

33. <u>RF Level</u>

Displays RF Input Level, in dBm and volts, which produces SINAD reading equal to SINAD Test Reference.

34. <u>Audio Pwr</u>

Displays Mobile Phone Audio Power.

35. <u>Audio Dist</u>

Displays Mobile Phone Audio Distortion.

36. <u>REF LOAD</u>

Displays Load Reference for Audio Test.

```
                        AMPS Cellular
                        Automatic Test

        Registration              FINISHED
        Mobile Init               FINISHED
        Cell Init                 FINISHED
        Handoff Test              FINISHED                      (33)
        Audio Test                FINISHED

        RF Level:      -121 dBm            0.199 uV             (34)

        Audio Pwr:     -8.7 dBm                                 (35)

        Audio Dist:    1.3%

        REF LOAD:      600 Ohms                                 (36)

     ┌──────┬──────┬──────┬──────┬──────┬──────┐
     │      │      │      │      │      │RETURN│
     └──────┴──────┴──────┴──────┴──────┴──────┘
```
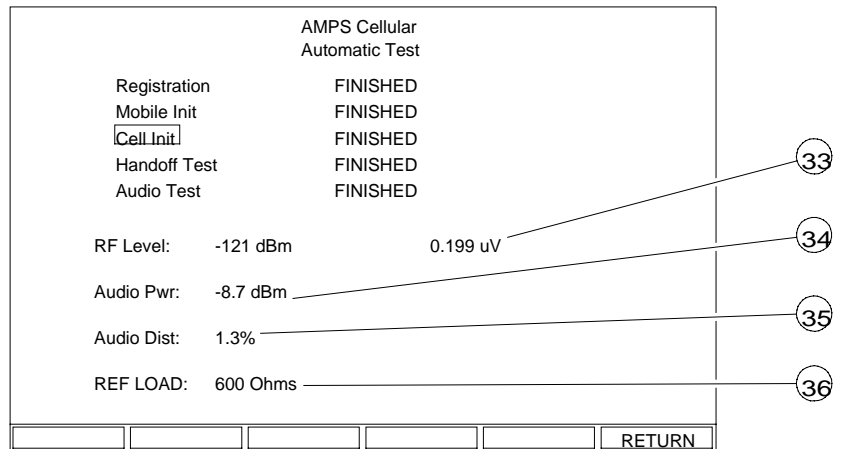
8717120

6-13-7 MOBILE INIT TEST

The Mobile Init (Initiated) Test requires a call to be initiated from the Mobile Phone. The following procedure performs the Mobile Init (Initiated) Test:

❏ With cursor on Mobile Init, press F2 ENABLED=. Press F3 START to start test.

❏ "Place Call" prompt appears. Place call using Mobile Phone under test.

❏ "Enter Digits" prompt appears. Enter up to 16 digits using Mobile Phone to test DTMF transmission. Pressing F1 Cont continues Mobile Init Test with or without digits entered.

❏ "Press Flash Hook" prompt appears. Send Flash Hook signal using Mobile Phone. Pressing F1 Cont continues Mobile Init Test without testing Flash Hook message.

❏ "Measuring Frequency" message appears indicating Maintenance Order is sent to the Mobile Phone for measuring Signal Tone frequency.

❏ "Press Flash Hook" prompt appears. Send Flash Hook signal using Mobile Phone.

"Hangup Phone" prompt appears. Hang up Mobile Phone or press F5 Release for release order to be sent to Mobile Phone. When "Hangup Phone" prompt disappears, Mobile Init Test is finished.

❏ Power Level Test is performed with the Mobile Init Test. After testing is finished, press F2 Results to page through results. Mobile Init Test results resemble the example.

SECTION 6
OPTIONS

6-13-8 CELL INIT TEST

The Cell Init (Cell Site Initiated) Test simulates a call from the Cell Site. The following procedure performs the Cell Init Test:

• •

❑   With cursor on Cell Init, press F2 ENABLED. Press F3 START to start test.

❑   "Paging Mobile", "Page Answered" and "Ringing Mobile" messages appear as Test Set performs test.

❑   "Answer Phone" prompt appears. Answer call placed to Mobile Phone.

❑   "Measuring Frequency" message appears indicating Maintenance Order is sent to the Mobile Phone for measuring Signal Tone frequency.

❑   If Maintenance Order does not fail, "Press Flash Hook" prompt appears. Press Flash Hook on Mobile Phone. "Hangup Phone" prompt appears. Hanging up Mobile Phone completes Cell Init Test.

A Power Level Test is also performed with the Cell Init Test. Refer to paragraph 6-13-3B for Power Level Test information. After the Cell Init Test is finished, press F2. Results to page through the Cell Init Test results.

6-13-9 AUTOMATIC TEST PRINTOUT

If "2. Print-Out" is enabled on Page 2 of the AMPS Setup Menu, the performed test results are printed on a device connected to the RS-232 Connector.

A Printout for all Automatic Tests is shown here. Test readings are followed by P (Pass) or F (Fail) to indicate the test passed or failed.

```
*******************************************************************************************
*************************IFR COM-120C AMPS CELLULAR MOBILE AUTO TEST*****************
DATE: FEB-24-1997
CUST:                              CUST ID: 5438
MANUFACTURER: IFR ENGINEERING
MODEL: TYPE 2                        SERIAL #: 1234567890
        TYPE APPROVAL: 0987654321             CERTIFICATE: 123ABC456DEF
 ****************************************************************************************
MOBILE ID NUMBER (MIN): 316/522-4981
ELECTRONIC SERIAL NUMBER (ESN): HEX: 820A4CA
                                DEC: 13000566468
                                OCT: 20202122304
MOBILE STATION CLASS: 0100
                        POWER: POWER CLASS I
                  TRANSMISSION:  DISCONTINUOUS
                  BANDWIDTH:  20 MHZ
DIGITAL COLOR CODE: 3
HOME ID (SID): 00163      HOME
                        SAT: 5970 HZ
*****************************MOBILE INITIATED CALL**********************************
CALLED ADDRESS: 6955895452
VOICE CHANNEL: 300          FREQ FWD/FREQ RVS: 879.0000/834.0000
FREQ ERROR: 0.026 KHZ     P
SAT FREQ: 5970 HZ  P          SAT DEV: 2.26 KHZ  F
MOBILE TX POWER: 5.9 DBM  P
DTMF RESPONSE: 123456789*0#
    FLASH HOOK DURATION: 100 MS  F
 *******************************POWER LEVEL TEST************************************
        LEVEL          READING
        0              33.8 DBM  P
        1              29.4 DBM  P
        2              25.8 DBM  P
        3              21.8 DBM  P
        4              17.2 DBM  P
        5              13.5 DBM  P
        6               9.1 DBM  P
        7               5.9 DBM  P
 *********************************HAND-OFF TEST************************************
        VOICE          RF            SAT          SAT            RF FREQ
        CHANNEL        PWR           FREQ         DEVIATION      ERROR
        51             6.0 DBM       5970 HZ      *2.24 KHZ      0.020 KHZ  F
        101            5.5 DBM       5970 HZ      *2.22 KHZ      0.020 KHZ  F
        151            5.7 DBM       5970 HZ      *2.24 KHZ      0.020 KHZ  F
        201            6.0 DBM       5970 HZ      *2.23 KHZ      0.019 KHZ  F
        251            6.0 DBM       5970 HZ      *2.24 KHZ      0.016 KHZ  F
*****************************SINAD TEST AT REF 12 DB********************************
RF LEVEL: -119 DBM            0.250 UV
AUDIO POWER: -54.0 DBM        REF LOAD: 600 OHMS
    AUDIO DISTORTION: 1.0 %
 ****************************CELL INITIATED CALL**********************************
VOICE CHANNEL: 300
RING PLUS SAT DEVIATION: 9.48 KHZ  P
RF FREQ ERROR: 0.006 KHZ  P
SAT FREQ: 5970 HZ  P
SAT DEV: 2.24 KHZ  F
TX POWER: 5.7 dBm  P
HANGUP (ST) PLUS SAT DEVIATION: 9.56 kHz  P
ST FREQUENCY: 10.000 kHz  P
```

SECTION 6
OPTIONS

6-13-10   AMPS CELL SITE SIMULATOR MANUAL TESTS

The AMPS Manual Test Screen is accessed by selecting "2. Manual Test" from the AMPS Cellular Menu.

● ●

1. <u>Reg</u>

   Initiates Manual Registration Test.

2. <u>Mobile</u>

   Initiates Manual Mobile Initiated Call Test.

3. <u>Cell</u>

   Initiates Manual Cell Site Initiated Call Test.

4. <u>Return</u>

   Returns Operation to AMPS Cellular Menu.

```
                  AMPS Cellular
                   Manual Test

     Registration
     Mobile Init
    [Cell Init]
```
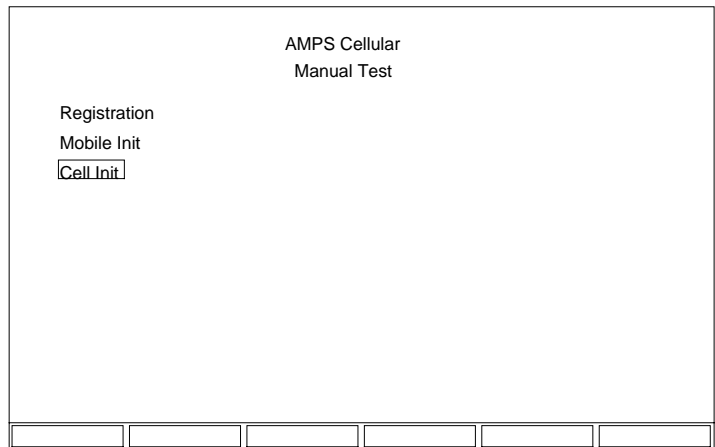
871709

6-13-11   REGISTRATION TEST

The Registration Test simulates a Registration order from the Cell Site and tests the Mobile Phone's response.

To perform the Registration Test, press F1 REG. After the Registration Tests are completed, results are displayed.

● ●

1. <u>SCM</u>

    Displays 4 least significant Station Class Mark bits.

2. <u>Power Class</u>

    Displays Power Class of Mobile Phone under test.

```
                        AMPS Cellular
                        Manual Test

            Registration
            Mobile Init
            Cell Init

                                                          1
    MIN:    316/522-4981        SCM: 0100                 2
    ESN:    HEX  8208A4C4       POWER CLASS 1
            Dec  13000566468    DISCONTINUOUS             3
            Oct  20202122304    BANDWIDTH: 20  MHz
    DCC:    2                                             4

    REG    MOBILE    CELL                      RETURN
                                                   8717126
```

7, 6, 5 (callouts)

3. <u>Transmission State</u>

    Displays Transmission State, Continuous or Discontinuous, of Mobile Phone under test.

4. <u>Bandwidth</u>

    Displays bandwidth of Mobile Phone under test. 20 MHz allows channels 1 to 666. 25 MHz allows channels 1 to 1023.

5. <u>DCC</u>

    Displays Digital Color Code last received by Mobile Phone under test.

6. <u>ESN</u>

    Displays Electronic Serial Number of Mobile Phone under test in Hexadecimal, Decimal and Octal.

7. <u>MIN</u>

    Displays Mobile Identification Number of Mobile Phone under test.
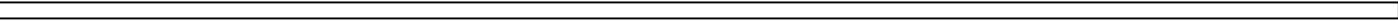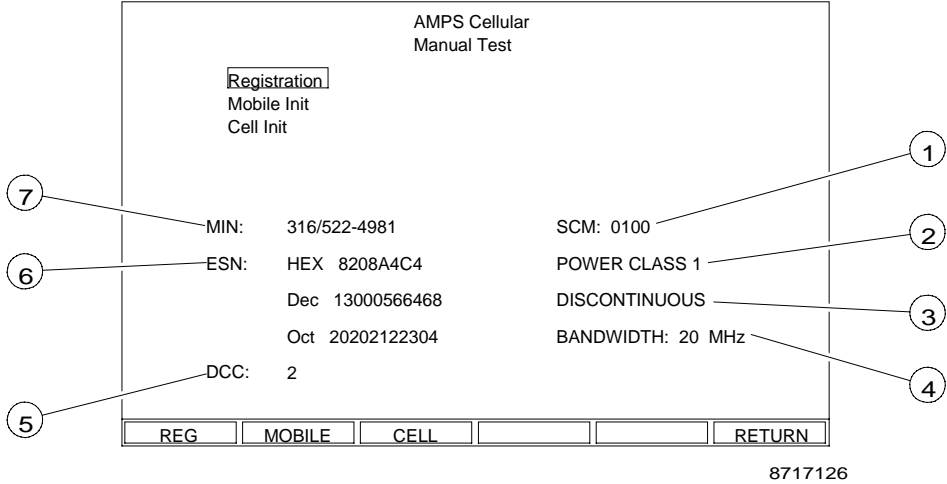
6-13-12   MOBILE INIT TEST

The Mobile Init (Initiated) Test requires a call to be initiated from the Mobile Phone. To perform the Mobile Init Test, press F2 MOBILE from AMPS Manual Test Menu. "Place Call" prompt appears.

Place call using Mobile Phone under test.

Once a connection is made, the Mobile Init Screen appears containing data.

● ●

8. Freq Err

Displays Reverse Voice Channel Frequency and Frequency Error received from Mobile Phone.

9. PWR

Displays output power received from Mobile Phone.

```
                          AMPS Cellular
                          Manual Test

              Registration
              Mobile Init
              Cell Init
       Called Adr:    6823819                    FREQ ERR
       Handoff Test            300                  0.336 kHz
       Pwr Level Test           3              834.000336 kHz
       SAT Test              5970 Hz              PWR
       Signal Tone Test                         21.9 dBm
       Call Processing           MAINTENANCE
                                  AF              Dev
                                5.970 kHz        2.36 kHz

       SCOPE     ANALY     DVM      SINAD     START     QUIT
                                                       8717124
```
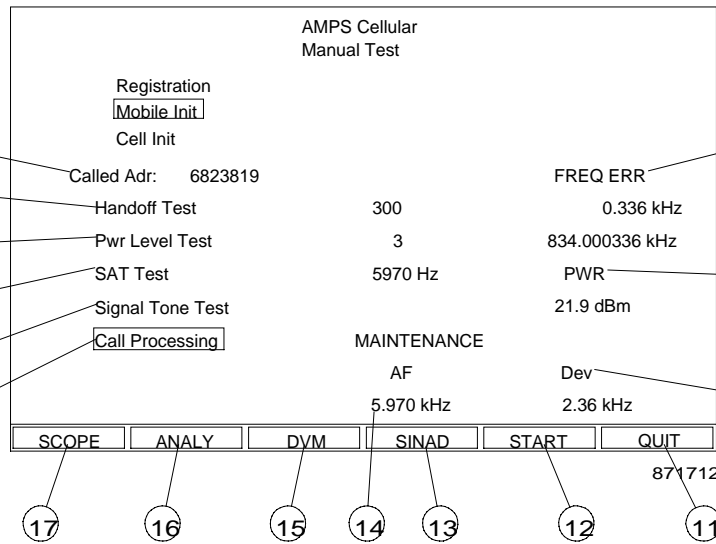
10. Dev

Displays the SAT Deviation or Audio Deviation received from the Mobile Phone.

11. Quit

Press F6 QUIT to exit Manual Mobile Init Screen.

12. Start

Initiates test at cursor location.

13. SINAD

Accesses SINAD Meter for use with Cellular Testing.

14. AF

Displays SAT Frequency received from the Mobile Phone.

15. DVM

Accesses SINAD Meter for use with Cellular Testing.

16. Analy

    Accesses Spectrum Analyzer for use with Cellular Testing. Additional Field with Cellular Spectrum Analyzer is Return Cellular Field for returning to Manual Mobile Init Test Screen.

17. Scope

    Accesses Oscilloscope for use with Cellular Testing. Additions for Cellular Oscilloscope include allowing Demod Audio for input Source and Return Cellular Field for returning to Manual Mobile Init Test Screen.

18. Call Processing

    Prompt for accessing Call Processing Tests. Call Processing Tests include ALERT, SEND CALLED ADDRESS, DTMF TEST, AUDIT and MAINTENANCE. Selected test is started by pressing F5 START.

    ALERT Test is provided to observe AF (14) and Dev (10). Press F5 START to initiate test. "Press Send to Clear" message is displayed. Observe AF (14) and Dev (10).   Press Mobile Phone Send Key to terminate test.

    SEND CALLED ADDRESS Test requires Mobile Phone to have placed phone call. Place call on Mobile Phone. Press F5 START.

    DTMF TEST allows testing of Mobile Phone DTMF Transmission. Press F5 START to initiate test. Window is displayed to enter DTMF Digits. Press keys on Mobile Phone and verify echo appears in Window. Press F5 CLR WND to terminate test.

    AUDIT Test exercises Audit Function of Mobile Phone. Press F5 START to initiate test. Once Audit Test is complete, "Confirmation: Audit" Window is displayed.

    MAINTENANCE Test is provided to observe AF (14) and Dev (10). Press F5 START to initiate test. "Press Send to Clear" message is displayed. Observe AF (14) and Dev (10). Press Mobile Phone Send Key to terminate test.

19. Signal Tone Test

    Signal Tone Test measures Signal Tone Frequency. Press F5 START to initiate test. "Measuring Frequency" message appears indicating Maintenance Order is sent to the Mobile Phone for measuring Signal Tone frequency. Once test is complete, "Press Flash Hook" message is displayed. Press Flash Hook on Mobile Phone. "Flash Hook Detected" message is displayed. Press F5 CLR WND to terminate test.

20. SAT Test

    SAT Test allows change of SAT Frequency. To change SAT Frequency, press ENTER Key with cursor on SAT Test. Use DATA SCROLL Keys to select new SAT Frequency. Press ENTER Key. Verify AF (14) displays selected SAT Frequency.

21. <u>Power Level Test</u>

Each time a power level is entered, a VMAC message is sent to change the power level of the Mobile Phone to the level entered. To enter a power level, use DATA ENTRY Keys to enter a power level and press ENTER Key.

22. <u>Handoff Test</u>

Handoff Test hands off Mobile Phone to another Cellular Channel. With cursor on Handoff Test, use DATA ENTRY Keys to select new Channel. Press ENTER Key. Verify FREQ ERR (8) changes to match new Channel.

23. <u>Called Adr</u>

Displays the address called by the Mobile Phone.

6-13-13 CELL INIT TEST

The Cell Init (Initiated) Test places a call to the Mobile Phone. To perform the Cell Init Test, press F3 CELL from AMPS Manual Test Menu. "Paging Mobile", "Page Answered" and "Answer Phone" messages appear in order.

Once "Answer Phone" message appears, answer Mobile Phone. Once a connection is made, the Cell Init Screen appears containing data:
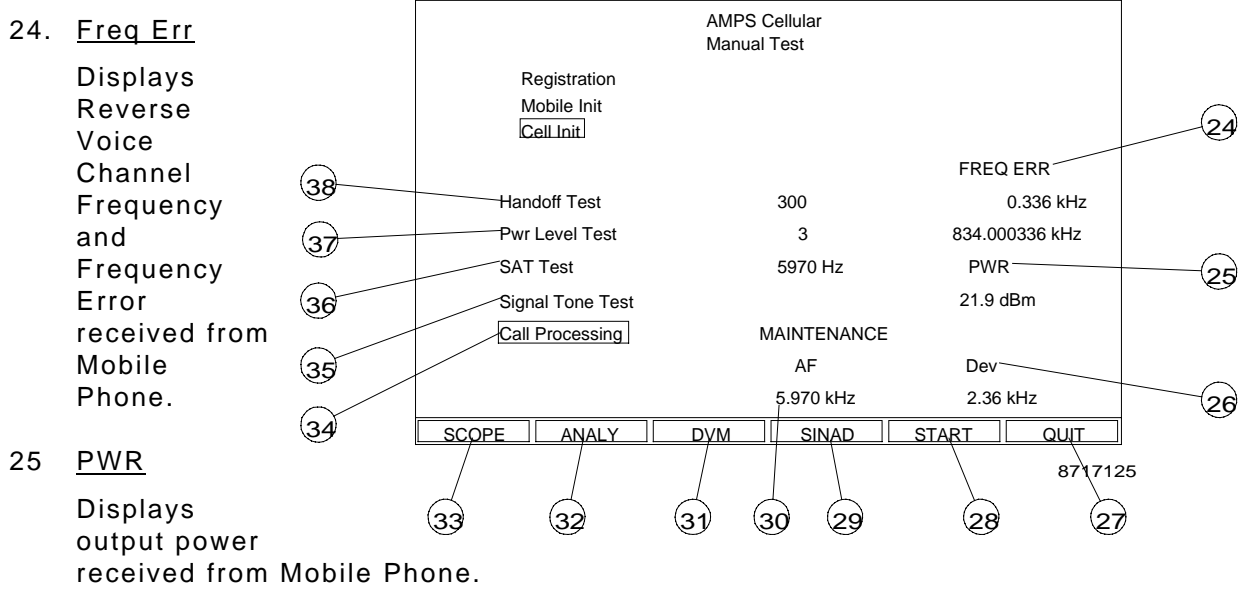
● ●

24. Freq Err

    Displays Reverse Voice Channel Frequency and Frequency Error received from Mobile Phone.

```
                              AMPS Cellular
                              Manual Test

                    Registration
                    Mobile Init
                    Cell Init                              ⎛24⎞

                                                   FREQ ERR
          ⎛38⎞
                    Handoff Test          300           0.336 kHz
          ⎛37⎞      Pwr Level Test          3       834.000336 kHz
                    SAT Test            5970 Hz          PWR          ⎛25⎞
          ⎛36⎞      Signal Tone Test                   21.9 dBm
                    Call Processing      MAINTENANCE
          ⎛35⎞                              AF            Dev
                                         5.970 kHz      2.36 kHz      ⎛26⎞
          ⎛34⎞
                    SCOPE   ANALY   DVM   SINAD   START   QUIT

                                                        8717125
          ⎛33⎞    ⎛32⎞    ⎛31⎞  ⎛30⎞  ⎛29⎞     ⎛28⎞    ⎛27⎞
```

25 PWR

    Displays output power received from Mobile Phone.

26. Dev

    Displays the SAT Deviation or Audio Deviation received from the Mobile Phone.

27. Quit

    Press F6 QUIT to exit Manual Cell Init Screen.

28. Start

    Initiates test at cursor location.

29. SINAD

    Accesses SINAD Meter for use with Cellular Testing.

30. AF

    Displays the SAT Frequency received from the Mobile Phone.

31. DVM

    Accesses SINAD Meter for use with Cellular Testing.

32. <u>Analy</u>

    Accesses Spectrum Analyzer for use with Cellular Testing. Additional Field with Cellular Spectrum Analyzer is Return Cellular Field for returning to Manual Mobile Init Test Screen.

33. <u>Scope</u>

    Accesses Oscilloscope for use with Cellular Testing. Additions for Cellular Oscilloscope is allowing Demod Audio for input Source and Return Cellular Field for returning to Manual Mobile Init Test Screen.

34. <u>Call Processing</u>

    Prompt for accessing Call Processing Tests. Call Processing Tests include ALERT, SEND CALLED ADDRESS, DTMF TEST, AUDIT and MAINTENANCE. Selected test is started by pressing F5 START.

    ALERT Test is provided to observe AF (14) and Dev (10). Press F5 START to initiate test. "Press Send to Clear" message is displayed. Observe AF (14) and Dev (10). Press Mobile Phone Send Key to terminate test.

    SEND CALLED ADDRESS Test requires Mobile Phone to have placed phone call. Place call on Mobile Phone. Press F5 START.

    DTMF TEST allows testing of Mobile Phone DTMF Transmission. Press F5 START to initiate test. Window is displayed to enter DTMF Digits. Press keys on Mobile Phone and verify echo appears in Window. Press F5 CLR WND to terminate test.

    AUDIT Test exercises Audit Function of Mobile Phone. Press F5 START to initiate test. Once Audit Test is complete, "Confirmation: Audit" Window is displayed.

    MAINTENANCE Test is provided to observe AF (14) and Dev (10). Press F5 START to initiate test. "Press Send to Clear" message is displayed. Observe AF (14) and Dev (10). Press Mobile Phone Send Key to terminate test.

35. <u>Signal Tone Test</u>

    Signal Tone Test measures Signal Tone Frequency. Press F5 START to initiate test. "Measuring Frequency" message appears indicating Maintenance Order is sent to the Mobile Phone for measuring Signal Tone frequency. Once test is complete, "Press Flash Hook" message is displayed. Press Flash Hook on Mobile Phone. "Flash Hook Detected" message is displayed. Press F5 CLR WND to terminate test.

36. <u>SAT Test</u>

    SAT Test allows change of SAT Frequency. To change SAT Frequency, press ENTER Key with cursor on SAT Test. Use DATA SCROLL Keys to select new SAT Frequency. Press ENTER Key. Verify AF (14) displays selected SAT Frequency.

37. Power Level Test

   Each time a power level is entered, a VMAC message is sent to change the power level of the Mobile Phone to the level entered. To enter a power level, use DATA ENTRY Keys to enter a power level and press ENTER Key.

38. Handoff Test

   Handoff Test hands off Mobile Phone to another Cellular Channel. With cursor on Handoff Test, use DATA ENTRY Keys to select new Channel. Press ENTER Key. Verify FREQ ERR (8) changes to match new Channel.

SECTION 6
OPTIONS

6-14 EDACS TRUNKING (OPTION 16)

The EDACS Trunking Option is used to test radios and repeaters of the EDACS trunked-radio signaling type. EDACS Trunked Radio System is a product of GE/Ericsson. The COM-120C EDACS Option runs in manual and automatic modes for radio and repeater testing.

To execute EDACS Trunking Option, the selection is made from the Special Test screen. Press the SPCL Mode Key on the front panel for this selection screen:

Press F4 EDACS or cursor to selection "4. EDACS Trunking" and press the ENTER Hard Key to access the EDACS Trunking screen.

● ●

1. <u>Auto</u>

   Accesses the Automatic Test screen.

2. <u>Manual</u>

   Accesses the Manual Test screen.

3. <u>Setup</u>

   Accesses the Setup Screen.

4. <u>Return</u>

   Returns to Specials Screen.


```
                    1. Bit Error Rate
                    2. AMPS Cellular
                    3. LTR Trunking
                    4. EDACS Trunking


  BER      CELL       LTR       EDACS
```
0061601
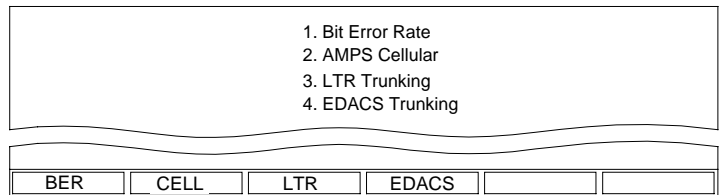
6-14-1 EDACS TRUNKING SETUP SCREEN

EDACS Trunking Setup Screen.

● ●

1. Control Chan

    This field is used to select a logical channel for use as a control channel.   The actual RF Frequencies display to the right of the channel number, in relationship to a mobile radio. The logical channels (1-20) are programmed under the CHANNEL ASSIGNMENTS Menu selection. The control channel set here is used as the control channel for establishing connections (call processing) with the radio in the Automatic Test (Radio) and the Manual Test (Repeater Simulator).

```
                        EDACS Trunking
                       Setup Parameters
                                      Mobile Rx    Mobile Tx
    CONTROL CHAN              1        856.2125     811.2125
    WORKING CHAN             2        857.2125     812.2125
    SITE ID                  1
    SYSTEM BAND        NARROW (900 MHz)
    CHANNEL ASSIGNMENTS

    ┌──────┬────────┬──────┬──────┬──────┬────────┐
    │ WIDE │ NARROW │      │      │      │ RETURN │
    └──────┴────────┴──────┴──────┴──────┴────────┘
                                              0061601
```

2. Working Chan

    This field is used to select a logical channel for use as a working channel.   The actual RF Frequencies display to the right of the channel number, in relationship to a mobile radio. The logical channels (1-20) are programmed under the CHANNEL ASSIGNMENTS Menu selection. The working channel set here is used as the working channel for the Automatic Test (Radio) and as the Gen/Rec Frequencies for the Automatic Test (Repeater).

3. Site ID

    This field is used to select the Site ID to use in the overhead messages in the Automatic Test and the Manual Test (Repeater Simulator). The value range is 0 to 31.

4. System Band

    This field is used to set the EDACS Trunking System Band to Wide (800 MHz) or Narrow (900 MHz).

5. Channel Assignments
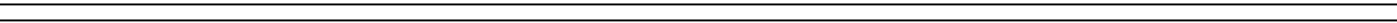
    This field is used to program the 20 logical channels for the EDACS Trunking tests. These programmed frequencies are used for all channels referenced in the Automatic and Manual Tests.

6-14-2 EDACS TRUNKING CHANNEL ASSIGNMENTS

This field is used to program the 20 logical channels for the EDACS Trunking tests. These programmed frequencies are used for all channels referenced in the Automatic and Manual Tests.

There are a total of 20 logical channels available for programming. Two pages of 10 per page. Each logical channel is capable of being an (FCC) 800 MHz or 900 MHz Standard Channel No. or a user defined RF Frequency pair ranging from 0 to 1000.0000 MHz.

There is no correlation between the logical channel number and an FCC number. The logical channel numbers are programmed to work with the system under test's channel numbers. The ability to assign an FCC Standard Channel No. to a logical channel is only for ease of programming.

Setting a channel format to 800 or 900 MHz *does not* set the system band to wide or narrow. Set wide or narrow with the 'SYSTEM BAND' field in the EDACS Trunking Setup Parameters screen.

● ●

1. Format

   Designates the format used.

   800 MHz Selects FCC 800 MHz format. If 800 MHz is the current format when an edit is started, (ENTER pressed), the value under the No. column is edited to set the Rx/Tx Frequencies to an FCC standard channel (1-760).

   900 MHz Selects FCC 900 MHz format. If 900 MHz is the current format when an edit is started, (ENTER pressed), the value under the No. column is edited to set the Rx/Tx Frequencies to an FCC standard channel (1-760).

2. Mobile Rx

   Manually enter the Mobile Receiver frequency. If the Format field is not set to USER, it is forced to user and the No. Field is set to null.

3. Mobile Tx

   Manually enter the Mobile Transmitter frequency. If the Format field is not set to USER, it is forced to user and the No. Field is set to null.

EDACS Trunking
Setup Parameters

EDACS CHANNEL ASSIGNMENTS

Chan	Format	No.	Mobile Rx	Mobile Tx
1	800 MHz	100	853.4875	808.4875
2	800 MHz	33	851.8125	806.8125
3	900 MHz	201	937.5125	898.5125
4	User		465.8125	425.8125
5	800 MHz	5	851.1125	806.1125
6	800 MHz	6	851.1375	806.1375
7	800 MHz	7	851.1625	806.1625
8	User		432.8125	412.8125
9	800 MHz	9	851.2125	806.2125
10	800 MHz	10	851.2375	806.2375

Mobile Tx
811.2125
812.2125

| 800 MHz | 900 MHz | USER | PG UP | PG DN | RETURN |

0060724.

EDACS Trunking
Automatic Test

Registration   DISABLED
Radio Test   ENABLED
Repeater Test   DISABLED
Audio Test   ENABLED

| DISABLED | ENABLED | START | FMZ | | RETURN |

0061601

6-14-3 EDACS TRUNKING AUTOMATIC TEST

EDACS Trunking Automatic Test Screen consists of 4 main parts. Registration, Radio Test, Repeater Test and Audio Test. Each Test is either ENABLED or DISABLED. This state of the Automatic Test is referred to as the 'Idle' state. All Automatic Tests are run with the UUT connected to the T/R port for both transmit and receive operations.

1. Registration

   If ENABLED, Registration is the first test executed for the Automatic Test which simply captures a login message from the radio and displays the Radio's Group and Logical ID's along with the Control/Working channel frequencies.

2. Radio Test

   If ENABLED, Radio Test executes and completes a Group Call sequence with a radio and measures the Radio's Transmitter Frequency Error, Transmitter RF Power, High-Speed Data Deviation, Subaudible Data Deviation and Voice Peak Deviation.

3. Repeater Test

   If ENABLED, the Repeater Test measures the Repeater's Transmitter Frequency Error and Transmitter RF Power.

6-14-4 EDACS TRUNKING AUTOMATIC TEST EXECUTION

Press F3 START to execute the Automatic Test. At least one of these tests must be ENABLED: Registration, Radio Test or Repeater Test. If one or more of these tests is not ENABLED, the screen displays, "INVALID SELECTS" and the test does not execute. The Audio Test only applies to the Radio Simulator and Repeater Simulator.

● ●

A. REGISTRATION

When ENABLED, Registration executes first. The field status changes from ENABLED to RUNNING. The Control Channel programmed from the Setup screen is used for the RF Frequencies and the COM-120C begins generating Site ID messages (overhead). The screen prompts to, "Turn on Power to Radio."

The COM-120C then looks for the login message (data) from the Radio. The Radio must be programmed to do automatic login. When the login message is found, the COM-120C acknowledges the login back to the Radio and captures the Radio's Group and Logical ID which displays along with the Control/Working channel frequencies used. The field status changes to COMPLETE when the test is finished and proceeds to the next ENABLED part of the Automatic Test.

B. RADIO TEST

If ENABLED, Radio Test executes next. The field status changes from ENABLED to RUNNING. The Control Channel programmed from the Setup screen is used for the RF Frequencies and the COM-120C begins generating Site ID messages (overhead). The Radio locks onto the COM-120C. If the Push-to-Talk cable is properly connected, the Radio performs a hands-free PTT (Group Call). If not, the screen prompts to manually press the PTT button, "Press PTT now (Group Call)".

The Radio should connect with the COM-120C at this point. If a successful Group Call was achieved, the Control/Working channels and the Radio's Group/Logical ID's are displayed and the test measurements begin with the message: "Taking Measurements..."

The PTT button must remain depressed during the measurements (if doing manual PTT). If not, the Radio Test terminates and the field status changes to DROPPED. The message, "CALL DROP" is briefly displayed.

When the Voice Peak Deviation Test begins, the screen prompts to whistle (or blow) into microphone and updates the deviation accordingly. The PTT button must remain depressed during Voice Peak Deviation measurement.

If Audio Tests are planned, skip this test. The Radio's microphone is disabled if Audio Connectors are in place.

If the CONT or SKIP softkey is pressed, the Radio test finishes and the field status changes to COMPLETE.

Results of the test are shown and the screen prompts to release the PTT button.

If the Radio has the Push-to-Talk cable connected, the PTT is automatically released.

If the Audio Test is ENABLED, it is performed next on the Radio. The field status changes to RUNNING and the screen prompts to, "Install Audio Connectors. Press CONT when ready". It is extremely important that audio connections to the Radio are installed correctly. Press F4 CONT to continue the test.

The COM-120C establishes a Group Call identical to the Group Call used in the Radio Test.

If the PTT cable is properly connected, the Radio is instructed to automatically engage the PTT button. Otherwise, manually depress the PTT button.

Once the Radio is connected via Group Call, the screen displays the message: "Taking Measurements...". The PTT button must remain depressed (if manually doing PTT) during measurements or the Audio Test terminates. The field status indicates DROPPED. The message, "CALL DROP" is briefly displayed.

After the Transmitter Audio Tests are complete, the COM-120C prompts to release PTT (if manual PTT) and calls the Radio to do Receiver Audio Tests. When the call to the Radio is complete, the screen prompts to, "Set Radio Volume to Maximum. Press CONT when ready". Check the Radio for a busy ('BSY') light indicator and/or a Group Call (GR) light indicator with the caller's Logical ID which indicates a successful call to the Radio. If the call is not successful, ABORT the test.

If the F4 CONT is pressed, the screen displays the message: "Taking Measurements". The field status changes to COMPLETE when the test is finished and goes to the next ENABLED part in the Automatic Test.

C. REPEATER TEST

If ENABLED, Repeater Test executes next. The field status changes from ENABLED to RUNNING. The Working Channel programmed from the Setup screen is used for the RF Frequencies. The Repeater Test is a conventional-mode test.

Manually control the Repeater Transmitter/Receiver as instructed by the COM-120C. When the test begins, the screen prompts, "Turn on Repeater transmitter now". The screen displays the message: "Taking Measurements.." when the transmitter is on,.

The Repeater Transmitter must remain on during measurements. If not, the test terminates and the field status indicates DROPPED. The message, "REPEATER DROP" is briefly displayed.

If the Audio Test is ENABLED, it is performed next on the Repeater. The field status changes to RUNNING and the screen prompts to, "Install Audio Connectors. Press CONT when ready".

It is extremely important that audio connections to the Repeater are installed correctly.

Press F4 CONT to continue the test.   If the Repeater's Transmitter is not on, the screen prompts for it to be turned on. Once the Repeater is transmitting, the screen displays the message: "Taking Measurements...".

The Repeater Transmitter must remain on during measurements. If not, the test terminates and the field status indicates DROPPED. The message, "REPEATER DROP" is briefly displayed. The field status changes to COMPLETE after the test.

SECTION 6
OPTIONS

6-14-5 EDACS TRUNKING AUTOMATIC TEST RESULTS

After Automatic Testing is complete, use the softkeys to display or print the results.

Press F2 to show the first page of results. Results appear in the lower half of the EDACS Trunking Automatic Test screen.

The following text describes the test results and their significance in order of appearance on the screen.

If only Registration was ENABLED, only the first three rows of results are shown.

● ●

Results: Radio Test

CONTROL CHANNEL
  Shows the Mobile Radio's Receive/ Generate RF Frequencies used for the test as the EDACS Control Channel.

	[Radio]	
	Mobile Rx	Mobile Tx
CONTROL CHANNEL	856.2125	811.2125
WORKING CHANNEL	857.2125	812.2125
LOGICAL/GROUP ID	1002/100	
TX FREQ ERROR:	-0.199 kHz	
TX RF POWER:	827.4 mW	
TX DATA DEV:	3.20 kHz	
SUB-AUDIBLE DEV:	0.68 kHz	
VOICE AUDIO DEV:	4.14 kHz	

00616008

WORKING CHANNEL
  Shows the Mobile Radio's Receive/ Generate RF Frequencies used for the test as the EDACS Working Channel.

LOGICAL/GROUP ID
  Shows the Mobile Radio's Logical ID and Group ID which was acquired from the Group Call (or Login message if Registration only) performed during the Radio Test.

TX FREQ ERROR
  Shows the RF Frequency Error of the radio transmitter kHz.

TX RF POWER
  Shows the RF Power of the radio transmitter in mW (if less than 1 Watt) or Watts.

TX DATA DEV
  Shows the Deviation of the Radio's high-speed data in kHz.

SUB-AUDIBLE DEV
  Shows the Deviation of the Radio sub-audible data during transmission of a Group Call in kHz.

VOICE AUDIO DEV
  Shows the Peak Deviation of transmitted microphone audio from the Radio in kHz.

These are all the test results available for the Audio Test-Radio except for the Tx Audio Response results. Some of these results are based on the Rated Output of the radio. This is acquired by injecting a 1 kHz sine wave via the Data Gen output jack and raising the level until 3 kHz (1.5 kHz for narrow band) of deviation is transmitted by the radio.

● ●

Results: Audio Test (Radio)

TX DEVIATION @ 15 mVrms
   This result is the deviation reading (in kHz) of the Radio transmitter modulating a 1 kHz sine wave injected into the Radio's audio-in path from the COM-120C Data Gen output baseband jack at 15 mVrms level.

```
                              [Radio]
TX DEVIATION @ 15 m Vrms:        3.73 kHz
TX MOD LIMITING @ 300 Hz:        4.15 kHz        110m Vp
TX MOD LIMITING @ 3 kHz:         2.89 kHz        110m Vp
TX MOD LIMITING (Burst):         3.68 kHz        110m Vp
TX AUDIO DISTORTION:              2.8%
RX AUDIO SESITIVITY:             878.4m Vp_p     0.30 Vrms
RX SINAD @ 12dB:                 -121.8 dBm
```
0061600

   Does not include any deviation from the Radio's sub-audible data.

TX MODULATION LIMITING @ 300 Hz
   This result is the deviation reading (in kHz) of the Radio transmitter modulation with a 300 Hz sine wave injected into the Radio's audio-in path from the COM-120C Data Gen output baseband jack at a level which is 20 dB higher than 60% of the Radio's Rated Output. The result in the right column is the actual level in mVp which was used to make the deviation measurement.

TX MODULATION LIMITING @ 3 kHz
   This result is the deviation reading (in kHz) of the Radio transmitter modulation with a 3 kHz sine wave injected into the Radio's audio-in path from the COM-120C Data Gen output baseband jack at a level which is 20 dB higher than 60% of the Radio's Rated Output. The result in the right column is the actual level in mVp which was used to make the deviation measurement.

TX MODULATION LIMITING (Burst)
   This result is the peak deviation reading (in kHz) of the Radio transmitter modulation with a burst of 1 kHz sine wave injected into the Radio's audio-in path from the COM-120C Data Gen output baseband jack at a level which is 20 dB higher than 60% of the Radio's Rated Output. The result in the right column is the actual level in mVp which was used to make the deviation measurement.

TX AUDIO DISTORTION
   This result is the Distortion measurement in % of the Radio's transmitter with a 1 kHz sine wave injected into the Radio's audio-in path from the COM-120C Data Gen output baseband jack at the level of the Radio's Rated Output. The Radio's sub-audible data is not included in this measurement.

SECTION 6
OPTIONS

RX AUDIO SENSITIVITY

This result is the AF Level read back from the Radio's audio output path with a 1 kHz sine wave FM-generated at 3 kHz (1.5 kHz for narrow band) deviation, -50.0 dBm level, from the COM-120C to the Radio's antenna input (Radio must have receiver unsquelched). The AF Level voltage is then measured using wideband (no) filtering from the Audio/Data/SINAD Input baseband jack. The radio must be set at full volume to make this measurement. The result is the AF Level voltage shown in Vrms and mV peak to peak.

RX SINAD @ 12 dB

This result is the SINAD reading from the Radio's audio output path with a 1 kHz sine wave FM-generated at 3 kHz (1.5 kHz for narrow band) deviation from the COM-120C to the Radio's antenna input (Radio must have receiver unsquelched). The COM-120C Generator RF Level starts at -105.0 dBm and lowered until a SINAD reading of 12 dB is acquired. Then the RF Level is recorded as the result of the test in dBm.

If the Radio squelches because of sub-audible drop out before the 12 dB SINAD is reached, the last good reading taken before the Radio squelched is recorded and shown along with the RF Level at that reading.

Results: Audio Test (Radio Tx Audio Response)

TX AUDIO RESPONSE

This shows the results of the measured deviation from the Radio's transmitter with a series of tone frequencies (sine wave) injected into the Radio's audio input path from the COM-120C Data Gen output

baseband jack at 20% of the Radio's **Rated Output**. Measurements do not include the Radio's sub-audible data deviation.
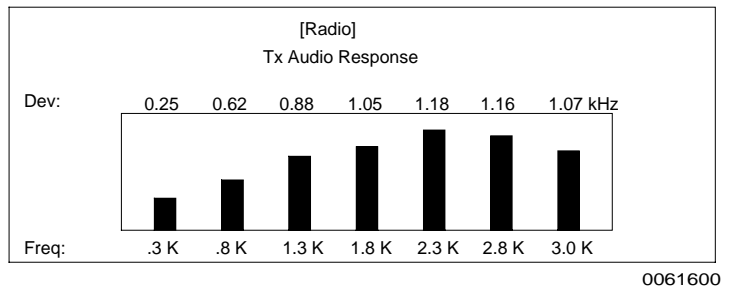
The series of tone frequencies used are: 300 Hz, 800 Hz, 1300 Hz, 1800 Hz, 2300 Hz, 2800 Hz and 3000 Hz.

The following text describes the test results and their significance in order of appearance on the screen.

If only Registration was ENABLED, only the first three rows of results are shown.

Results: Repeater Test

WORKING CHANNEL

Shows the Repeater's
Receive/Generate RF
Frequencies used for the test.

```
                                    [Reptr]
                          Repeater Rx         Repeater Tx
WORKING CHANNEL           857.2125            812.2125
TX FREQ ERROR:            -0.199 kHz
TX RF POWER:              827.4 mW
```
0061600

TX FREQ ERROR

Shows the RF Frequency Error of the Repeater transmitter in kHz.

TX RF POWER

Shows the RF Power of the Repeater transmitter in mW (if less than 1 Watt) or
Watts.

Results: Audio Test (Repeater)

These are all the test results
available for the Audio Test-
Repeater except for the Tx Audio
Response results. Some of these
results are based on the Rated
Output of the Repeater. This is
acquired by injecting a 1 kHz sine
wave via the Data Gen output jack

```
                                    [Reptr]
TX DEVIATION @ 15 m Vrms:       0.73 kHz
TX MOD LIMITING @ 300 Hz:       4.15 kHz        110m Vp
TX MOD LIMITING @ 3 kHz:        2.89 kHz        110m Vp
TX MOD LIMITING (Burst):        3.68 kHz        110m Vp
TX AUDIO DISTORTION:            1.8%
RX AUDIO SESITIVITY:            878.4m Vp_p     0.30 Vrms
RX SINAD @ 12dB:                -121.8 dBm
```
0061600

and raising the level until 3 kHz (1.5 kHz for narrow band) of deviation is transmitted by
the Repeater.

TX DEVIATION @ 15 mVrms

This result is the deviation reading (in kHz) of the Repeater transmitter modulating a
1 kHz sine wave injected into the Repeater's audio-in path from the COM-120C Data
Gen output baseband jack at 15 mVrms level.

TX MODULATION LIMITING @ 300 Hz

This result is the deviation reading (in kHz) of the Repeater transmitter modulation
with a 300 Hz sine wave injected into the Repeater's audio-in path from the COM-
120C Data Gen output baseband jack at a level which is 20 dB higher than 60% of
the Repeater's Rated Output. The result in the right column is the actual level in
mVp which was used to make the deviation measurement.

TX MODULATION LIMITING @ 3 kHz

This result is the deviation reading (in kHz) of the Repeater transmitter modulation
with a 3 kHz sine wave injected into the Repeater's audio-in path from the COM-
120C Data Gen output baseband jack at a level which is 20 dB higher than 60% of
the Repeater's Rated Output. The result in the right column is the actual level in
mVp which was used to make the deviation measurement.

SECTION 6
OPTIONS

TX MODULATION LIMITING (Burst)
This result is the peak deviation reading (in kHz) of the Repeater transmitter modulation with a burst of 1 kHz sine wave injected into the Repeater's audio-in path from the COM-120C Data Gen output baseband jack at a level which is 20 dB higher than 60% of the Repeater's Rated Output. The result in the right column is the actual level in mVp which was used to make the deviation measurement.

TX AUDIO DISTORTION
This result is the Distortion measurement in % of the Repeater's transmitter with a 1 kHz sine wave injected into the Repeater's audio-in path from the COM-120C Data Gen output baseband jack at the level of the Repeater's Rated Output.

RX AUDIO SENSITIVITY
This result is the AF Level read back from the Repeater's audio output path with a 1 kHz sine wave FM-generated at 3 kHz (1.5 kHz for narrow band) deviation, -50.0 dBm level, from the COM-120C to the Repeater's RF input (Repeater must have receiver unsquelched). The AF Level voltage is then measured using wideband (no) filtering from the Audio/Data/SINAD Input baseband jack. The result is the AF Level voltage shown in Vrms and mV peak to peak.

RX SINAD @ 12 dB
This result is the SINAD reading from the Repeater's audio output path with a 1 kHz sine wave FM-generated at 3 kHz (1.5 kHz for narrow band) deviation from the COM-120C to the Repeater RF input (Repeater must have receiver unsquelched). The COM-120C Generator RF Level starts at -105.0 dBm and lowered until a SINAD reading of 12 dB is acquired. Then the RF Level is recorded as the result of the test in dBm.

Results: Audio Test (Repeater Tx Audio Response)

TX AUDIO RESPONSE
This shows the results of the measured deviation from the Repeater's transmitter with a series of tone frequencies (sine wave) injected into the Repeater's audio input path from the COM-120C Data Gen output baseband jack at 20% of the Repeater's **Rated Output**.

	[Reptr]						
			Tx Audio Response				
Dev:	0.25	0.62	0.88	1.05	1.18	1.16	1.07 kHz
Freq:	.3 K	.8 K	1.3 K	1.8 K	2.3 K	2.8 K	3.0 K
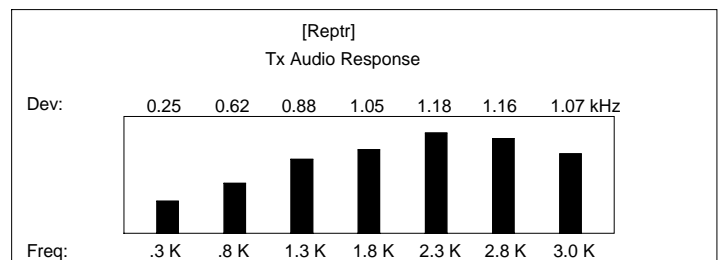
00616003

The measurements do not include the Radio's sub-audible data deviation. The series of tone frequencies used are: 300 Hz, 800 Hz, 1300 Hz, 1800 Hz, 2300 Hz, 2800 Hz and 3000 Hz.

Automatic Test Results (Printout)

Printouts of the Automatic Tests are acquired by pressing F4 PRINT after an automatic test has completed. Results are printed out the serial (RS-232) port on the COM-120C rear panel. The RS-232 line settings are set in the COM-120C Setup Screen, selection 5. Here is an example of a printout.

```
*************************IFR COM-120C EDACS AUTOMATIC TEST RESULTS******************
DATE: Apr-6-1997                                                        TIME: 16:07:34


******************************************RADIO TEST*****************************************


                              MOBILE RX              MOBILE TX
CONTROL CHANNEL:              856.2125               811.2125
WORKING CHANNEL:              857.2125               812.2125
RADIO LOGICAL ID:            1002
RADIO GROUP ID:              100
TX FREQ ERROR:               -0.199 kHz
TX RF POWER:                 827.4 mW
TX DATA DEV:                 3.24 kHz
SUB-AUDIBLE DEV:             0.68 kHz
VOICE AUDIO DEV:             4.14 kHz


                                    [AUDIO TEST]


TX DEVIATION @ 15 mVrms:               4.02 kHz
TX MOD LIMITING @ 300 Hz:              4.15 kHz          110 mVp input
TX MOD LIMITING @ 3 kHz:               4.45 kHz          110 mVp input
TX MOD LIMITING @ (BURST):             4.22 kHz          110 mVp input
TX AUDIO DISTORTION:                   2.2%
TX AUDIO RESPONSE @ 300 Hz:            0.25 kHz
TX AUDIO RESPONSE @ 800 Hz:            0.85 kHz
TX AUDIO RESPONSE @ 1300 Hz:           1.25 kHz
TX AUDIO RESPONSE @ 1800 Hz:           1.35 kHz
TX AUDIO RESPONSE @ 2300 Hz:           1.55 kHz
TX AUDIO RESPONSE @ 2800 Hz:           1.55 kHz
TX AUDIO RESPONSE @ 3000 Hz:           1.35 kHz
RX AUDIO SENSITIVITY:                  1003. mVp-p       0.30 Vrms
RX SINAD @ 12 dB:                      -118.8 dBm        15.5 dB


*****************************************REPEATER TEST****************************************


                              REPTR RX               REPTR TX
WORKING CHANNEL:              857.2125               812.2125
TX FREQ ERROR:               -0.199 kHz
TX RF POWER:                 827.4 mW


                                    [AUDIO TEST]


TX DEVIATION @ 15 mVrms:               4.02 kHz
TX MOD LIMITING @ 300 Hz:              4.15 kHz          110 mVp input
TX MOD LIMITING @ 3 kHz:               4.45 kHz          110 mVp input
TX MOD LIMITING @ (BURST):             4.22 kHz          110 mVp input
TX AUDIO DISTORTION:                   2.2%
TX AUDIO RESPONSE @ 300 Hz:            0.25 kHz
TX AUDIO RESPONSE @ 800 Hz:            0.85 kHz
TX AUDIO RESPONSE @ 1300 Hz:           1.25 kHz
TX AUDIO RESPONSE @ 1800 Hz:           1.35 kHz
TX AUDIO RESPONSE @ 2300 Hz:           1.55 kHz
TX AUDIO RESPONSE @ 2800 Hz:           1.55 kHz
TX AUDIO RESPONSE @ 3000 Hz:           1.35 kHz
RX AUDIO SENSITIVITY:                  1003. mVp-p       0.30 Vrms
RX SINAD @ 12 dB:                      -118.8 dBm        15.5 dB
```

6-14-6 EDACS TRUNKING MANUAL TEST

The EDACS Trunking Manual Test consists of 2 main parts.

A Repeater Simulator for testing EDACS Radios and a Radio Simulator for testing EDACS Repeaters.

● ●

1. <u>Rept Sim</u>

    Accesses the EDACS
    Repeater Simulator Screen.

2. <u>Radio Sim</u>

    Accesses the EDACS Radio
    Simulator Screen.

3. <u>Return</u>

    Returns to the EDACS Trunking Test screen.

```
┌─────────────────────────────────────────────────┐
│                    EDACS Trunking                │
│                    Manual Test                   │
│                                                  │
│  Repeater Simulator                              │
│  Radio Simulator                                 │
│                                                  │
└─────────────────────────────────────────────────┘
┌─────────────────────────────────────────────────┐
│                                                  │
└─────────────────────────────────────────────────┘
│ Rept Sim │ Radio Sim │     │     │     │ RETURN │
```
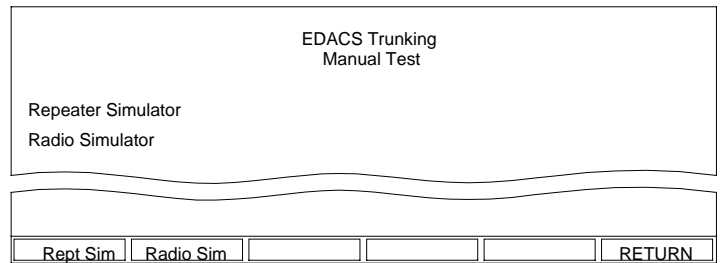
0061602

6-14-7 EDACS TRUNKING MANUAL TEST-REPEATER SIMULATOR

Entering the Repeater Simulator causes the COM-120C to perform an FM-Zero operation to adjust the Receiver's DC offset to zero. The screen displays the message: "Doing FMZ...please wait".

While in the Repeater Simulator and the Radio is not transmitting, or the repeater is not calling the Radio, the Site ID message is continuously transmitting. In this idle mode, the Repeater Simulator is looking for a Call (or Login) request from the Radio. When the request is found, the Repeater Simulator allows the Radio to transmit (until the Radio releases). The Group/Logical ID's are captured (and displayed) when the Group Call is made (and used to call a Radio). A Radio's Login is also decoded by the simulator and the ID's captured. There is also a mode of operation (activated by softkey) where the repeater simulates a Radio calling the Radio Under Test. In this mode, there are softkeys to disconnect and return back to the idle state.

● ●

1. <u>CH#:</u>

    This field is used to change the EDACS Repeater Simulator Working Channel, as specified by the Channel Number pre-programmed in the Setup Screen. Value range: 1 to 20. The corresponding RF Frequencies are shown in the RF fields as the CH# field is edited. This only sets the Working Channel. The Control Channel is taken from the Setup Screen and must be changed there if necessary.

EDACS REPEATER SIMULATOR		
CH #: 2 Band: USER		Extended Meas:
RECEIVE		GENERATE
RF: 812.2125 MHz Atten: 0 dB Input: T/R		RF: 857.2125 MHz Level: -40.0 dBm Output: T/R
Group ID 273 Logical ID 1 Call Type: SYSTEM ALL		Status: IDLE Message:
RF Power: 837.8 mW RF Error Freq: 0.210 kHz Deviation: 0.78 kHz (D) AF Frequency: 300 Hz Distortion: 2.3 %		DATA Mod Source: DATA FM Deviation: 3.2 kHz: Subaud dev: 0.70 kHz Sinad:
CALL	DISC	PRGM			RETURN

0061601

    If the Band field is set to 'Manual' there is no channel number to edit. The PRGM Soft Function Key F3 may then be used to return to the channel Band mode.

2. <u>Band:</u>

    This field shows the channel format for the Repeater Simulator Working Channel. Valid values are: 800 MHz, 900 MHz, USER or Manual. Display-only field. If 'Manual' is displayed, the RF Frequencies have been set manually in the Repeater Simulator. All other values are taken from the pre-programmed logical channels from the Setup Screen, according to the channel number set in the CH# field.

3. <u>RF: (Receive)</u>

This field shows the current RF Frequency of the EDACS Working Channel for the Receiver side of the Repeater Simulator. This field is editable (which puts the Working Channel in 'Manual' mode). Value range: 0 to 1000.0000 MHz.

4. <u>Atten:</u>

This field is used to set the Receiver Attenuation. Value range: 0 or 30 dB.

5. <u>Input:</u>

This field is used to select the Receiver's RF Input for the Repeater Simulator to the T/R or Antenna connector. Valid values are T/R or ANT.

6. <u>Group ID:</u>

This field shows the Radio's Group ID acquired from a Group Call or Login operation (if performed). This field is also used for the Group ID when making a call to the Radio Under Test. This field is editable. Value range: 0 to 2047.

7. <u>Call Type:</u>

This field handles outgoing call processing selections Group, Individual or System-All calls, for Radio and Repeater-initiated calls.

8. <u>Logical ID:</u>

This field shows the Radio's Logical ID acquired from a Group Call or Login operation (if performed). This field is also used for the Logical ID when making a call to the Radio Under Test. This field is editable. Value range: 0 to 16383.

9. <u>RF Power:</u>

This field shows the Radio's Transmitter RF Power in Watts (or mW). It is a display-only field (meter) with no cursor position. Value range: 0.0 mW to 10.00 W.

10. <u>RF Error Freq:</u>

This field shows the Radio's Transmitter RF Frequency Error in kHz. It is a display-only field (meter) with no cursor position. Value range: ±0.000 to 5.000 kHz.

11. <u>Deviation: (Receive)</u>

This field shows the Radio's Transmit Deviation for Voice or Data in kHz. Voice Deviation is designated with a 'V' symbol, and Data Deviation (low-frequency data) is designated with a 'D' symbol. Value range: 0.00 to 10.00 kHz.

12. <u>AF Frequency:</u>

This field shows the Radio's Transmitter Audio Frequency in Hz. It is a display-only field (meter) with no cursor position. Measuring range: 300 to 4500 Hz.

13. Distortion: (Receive)

This field shows the Radio's Transmitter Distortion in %. Value range: 0.0 to 20.0%. Also used to show decoded DTMF digits by pressing the DTMF softkey.

14. Extended Meas:

This field allows access to one of three external screens: Scope, Analyzer or Digital Voltmeter (DVM). Radio-initiated Group Calls are still performed while in any of the three screens. If a call was made to the Radio and is still in progress, it is possible to access any of the three screens without interrupting the call.

However, there is no way to call the Radio Under Test or disconnect a made call while in the extended screens. The call must be made before entering an extended screen.

The *only* way to enter the extended screens is to use the softkeys. The 'Return' field in the extended screen allows a return to the Repeater Simulator.

15. RF: (Generate)

This field shows the current RF Frequency of the EDACS Working Channel for the Generator side of the Repeater Simulator. This field is editable (which puts the Working Channel in 'Manual' mode). Value range: 0 to 1000.0000 MHz.

Soft Function Keys available with this function include:

16. Level:

This field is used to set the Generator's RF Output Level in dBm. Value range: -40 to -130.0 dBm (T/R), 13.0 to -130.0 dBm (AUX) with AUX option.

17. Output:

This field is used to set the Generator's RF Output source to the T/R port or the Auxiliary (AUX) RF port. Valid values: T/R or AUX.

18. Status:

This field shows the current status of the Repeater Simulator. It is a display-only field. Valid status values:

IDLE
> Repeater is in the idle state, generating overhead (Site ID) messages. In this state, the Radio may initiate a Group Call, do a Login or the simulator may initiate another call to another radio.

RADIO SETUP
> Repeater is in the process of processing a Call from the Radio. *This message is usually very brief and may not be noticeable.*

RADIO INIT
> Repeater successfully completes a Call from the Radio and call is in progress.

REP INIT
> Repeater made a Group Call to the Radio.

19. Message:

Briefly shows the last EDACS message received from the Radio. Display-only field.

GROUP CALL
>   A Group Call message is received from the Radio.

UN-KEYED
>   An un-keyed message is received from the Radio.

EMER GROUP
>   An Emergency Group Call message is received from the Radio.

LOGIN
>   A Login message is received from the Radio.

STATUS
>   A Status message is received from the Radio.

INDV CALL *(Log ID)*
>   An Individual Call is received from the radio. The Logical ID of the radio being called is shown in parenthesis.

SYSTEM ALL
>   A System-All Call is received from the radio.

20. Mod Source:

This field is used to select a Generator source for modulation. GEN1, GEN2 and DTMF are only modulated when a call is made to the Radio. The DATA modulation field is used to modulate the EDACS signaling data. All enabled modulation sources display above the Mod Source field.

In the field to the right of Mod Source, select the modulation type for the selected source.

21. Deviation: (Generate)

This field is active when the selected source is FM or PM modulation type. This controls the deviation of the modulated source. Value range: 0.00 to 100.0 kHz for FM and 0.00 to 10.0 Rad for PM. *For deviation of DATA, 3.2 kHz (1.5 kHz for narrow band) is the recommended default value.*

22. Modulation:

This field is active when the selected source is AM modulation type. This controls the modulation of the selected source. Value range: 0.0% to 100.0%.

23. Frequency:

This field is active when the selected source, GEN1 or GEN2, is modulated. This selects the Audio Frequency of the selected Function Generator source (sine wave). Value range: 0.0 Hz to 20000.0 Hz.

24. <u>Subaud dev:</u>

This field is active when the selected source, DATA, is modulated. This controls the deviation of the sub-audible data used during established call processing with the EDACS Radio. Value range: 0.00 to 100.0 kHz. *Should be ≤ Deviation (20). The recommended default value is 0.70 kHz (0.35 kHz for narrow band).*

25. <u>Code:</u>

This field is active when the selected source, DTMF, is modulated. This allows the entry of desired DTMF digits to use for DTMF source generation.

26. <u>Sinad:</u>

This field is used to select a meter to read signals from the Audio/Data/SINAD input baseband jack. The measurements appear to the right of this field. Valid selections:

nOTe

When baseband measurements are made, all receiver measurements including the DSP data decoding are disabled due to hardware limitations. Therefore, an EDACS Radio-initiated call cannot be made with any baseband measurements enabled. The Radio-initiated call must be made first, then the baseband measurements may be enabled during the call. Calling the Radio may be done at any time.

6-14-8 EDACS TRUNKING MANUAL TEST-RADIO SIMULATOR

Entering the Repeater Simulator causes the COM-120C to perform an FM-Zero operation to adjust the Receiver's DC offset to zero. The screen displays the message: "Doing FMZ…please wait."

While in the Radio Simulator the Control Channel is continually monitored looking for SITE-ID from the controller. If not found, the NC status is shown. When a SITE-ID message is found, the status goes to IDLE.

This allows Group Calls to be made (Push-to-Talk) or calls to be made to the COM-120C from another Radio as dictated by the Repeater. There are 3 main call-processing sequences supported in the Radio Simulator. Perform a Group Call, receive a call in response to a Channel Assignment message from a Repeater and receive a call in response to a Channel Update message from a Repeater (if coming on-line during a call).

Several error conditions can occur during the Radio Simulation. Error messages display briefly under these conditions.

● ●

LOST CHANNEL
> The Radio has lost contact with the Repeater during a Group Call.

CHAN OUT OF RANGE
> A channel assignment from the Repeater was out of pre-programmed Channel range.

INVALID ID
> An ID other than what was set in the Logical/Group ID fields was used to call the Radio Simulator.

EDACS RADIO SIMULATOR		
CH #: 2 Band: USER		Extended Meas:
RECEIVE		GENERATE
RF: 812.2125 MHz Atten: 0 dB Input: T/R		RF: 857.2125 MHz Level: -40.0 dBm Output: T/R
Group ID 273 Logical ID 1		Status: NC Message:
RF Power: 837.8 mW RF Error Freq: 0.210 kHz Deviation: 0.78 kHz (D) AF Frequency: 300 Hz Distortion: 2.3 %		DATA Mod Source: DATA FM Deviation: 3.2 kHz: Subaud dev: 0.70 kHz
		Sinad:
CALL	DISC	PRGM			RETURN

0061601

NO UN-MUTE FOUND
> The Repeater has transmitted the channel assignment to the Radio Simulator for calling the simulator, but did not send the Un-mute message on the Working Channel.

NO CHAN ASSGN FOUND
> The Channel Assignment message was not received from the Repeater when a Group Call (PTT) was executed from the Radio Simulator.

1. <u>CH#:</u>

   This field is used to change the EDACS Control Channel Number (pre-programmed in the Setup Screen). Value range: 1 to 20. The corresponding RF Frequencies are shown in the RF fields as the CH# field is edited.

   If the Band field is set to 'Manual', there is no channel number to edit. The PRGM Soft Function Key F3 may then be used to return to the channel Band mode.

2. <u>Band:</u>

   This field shows the channel format for the Radio Simulator Control Channel. Valid values are: 800 MHz, 900 MHz, USER or Manual. Display-only field. If 'Manual' is displayed, the RF Frequencies have been set manually in the Radio Simulator. All other values are taken from the pre-programmed logical channels from the Setup Screen, according to the channel number set in the CH# field.

3. <u>RF: (Receive)</u>

   This field shows the current RF Frequency of the EDACS Control Channel for the Receiver side of the Radio Simulator. This field is editable (which puts the Control Channel in 'Manual' mode). Value range: 0 to 1000.0000 MHz.

4. <u>Atten:</u>

   This field is used to set the Receiver Attenuation. Value range: 0 or 30 dB.

5. <u>Input:</u>

   This field is used to select the Receiver's RF Input for the Radio Simulator to the T/R or the Antenna port. Valid values are T/R or ANT.

6. <u>Group ID:</u>

   This field is used to select Radio Simulator's Group ID that is used when simulating a Group Call (PTT) to another Radio. This field is editable. Value range: 0 to 2047.

7. <u>Logical ID:</u>

   This field is used to select Radio Simulator's Logical ID that is used when simulating a Group Call (PTT) to another Radio. This field is editable. Value range: 0 to 16383.

8. <u>RF Power:</u>

   This field shows the Repeater's Transmitter RF Power in Watts (or mW). A display-only field (meter). Value range: 0.0 mW to 10.00 W.

9. <u>RF Error Freq:</u>

   This field shows the Repeater's Transmitter RF Frequency Error in kHz. A display-only field (meter). Value range: ±0.000 to 5.000 kHz.

10. <u>Deviation: (Receive)</u>

    This field shows the Repeater's Transmit Deviation for Voice or Data in kHz. A 'V' symbol means Voice Deviation. A 'D' symbol means Data Deviation (low-frequency data). Value range: 0.00 to 100.0 kHz.

11. <u>AF Frequency:</u>

    This field shows the Repeater's Transmitter Audio Frequency in Hz. It is a display-only field (meter) with no cursor position. Measuring range: 300 to 4500 Hz.

12. <u>Distortion: (Receive)</u>

    This field shows the Repeater's Transmitter Distortion in %. Value range: 0.0 to 20.0%. Also used to show decoded DTMF digits by pressing the DTMF softkey.

13. <u>Extended Meas:</u>

    This field allows access to one of three external screens: Scope, Analyzer or Digital Voltmeter (DVM). If a Group Call (PTT) was made to another Radio and is still in progress, it is possible to access any of the three screens without interrupting the call. The *only* way to enter the extended screens is to use the softkeys. The 'Return' field in the extended screen allows a return to the Repeater Simulator.

14. <u>RF: (Generate)</u>

    This field shows the current RF Frequency of the EDACS Control Channel for the Generator side of the Radio Simulator. This field is editable (which puts the Control Channel in 'Manual' mode). Value range: 0 to 1000.0000 MHz.

15. <u>Level:</u>

    This field is used to set the Generator's RF Output Level in dBm. Value range: -40 to -130.0 dBm (T/R), 13.0 to -130.0 dBm (AUX) with AUX option.

16. <u>Output:</u>

    This field is used to set the Generator's RF Output source to the T/R port or the Auxiliary (AUX) RF port. Valid values: T/R or AUX.

17. Status

    This field shows the current status of the Radio Simulator. Display-only field.
    Valid status values:

    NC

        No Control Channel overhead found from the Repeater. No calls accepted
        in this state.

    IDLE

        Radio is locked into a Repeater Site and is waiting to make a Group Call or
        accept a Group Call.

    BEGIN CALL

        A Group Call is initiated and call processing with the Repeater is in
        progress. This message is usually brief.

    GROUP CALL

        Radio Simulator successfully executed a Group Call and is transmitting/
        receiving on the Working Channel assigned by the Repeater Under Test.
        The Working Channel is displayed in parenthesis.

    CALLED

        A call is made to the Radio Simulator and is transmitting/receiving on the
        Working Channel assigned by the Repeater Under Test. The words "EMG"
        is displayed if an Emergency Group Call was made.

18. Message:

    Briefly shows the last EDACS message received from the Repeater. Display-only
    field.

    GRP CHAN ASSGN

        A Group Call Channel Assignment message is received from the Repeater.

    CH UPDATE

        A Channel Update message is received from the Repeater.

    CALL DROP

        A Call Drop message is received from the Repeater.

19. Mod Source:

    This field is used to select a Generator source for modulation. Sources are only
    modulated when a call (PTT) is initiated from the Radio Simulator. The DATA
    modulation field is to modulate the EDACS signaling data. All enabled modulation
    sources display above the Mod Source field.

    To the right of Mod Source, select the modulation type for the selected source.

20. Deviation: (Generate)

    This field is active when the selected source is FM or PM modulation type. This
    controls the deviation of the modulated source. Value range: 0.00 to 100.0 kHz
    for FM and 0.00 to 10.0 Rad for PM. *For deviation of DATA, 3.2 kHz (1.5 kHz for
    narrow band) is the recommended default value.*

21. <u>Modulation:</u>

    This field is active when the selected source is AM modulation type. This controls the modulation of the selected source. Value range: 0.0% to 100.0%.

22. <u>Frequency:</u>

    This field is active when the selected source, GEN1 or GEN2, is modulated. This selects the Audio Frequency of the selected Function Generator source (sine wave). Value range: 0.0 Hz to 20000.0 Hz.

23. <u>Subaud dev:</u>

    This field is active when the selected source, DATA, is modulated. This controls the deviation of the sub-audible data used during an established call initiated from the Radio Simulator. Value range: 0.00 to 100.0 kHz. *Should be $\leq$ Deviation (20). The recommended default value is 0.70 kHz (0.35 kHz for narrow band).*

24. <u>Code:</u>

    This field is active when the selected source, DTMF, is modulated. This allows the entry of desired DTMF digits to use for DTMF source generation.

25. <u>Sinad:</u>

    This field is used to select a meter to read signals from the Audio/Data/SINAD input baseband jack. The measurements appear to the right of this field. Valid selections:

    nOTe

    When baseband measurements are made, all receiver measurements including the DSP data decoding are disabled due to hardware limitations. Therefore an EDACS Call Processing cannot be made with any baseband measurements enabled. The Call Processing must be made first, then the baseband measurements may be enabled during the call.

6-14-9 EDACS HIGH-SPEED DATA CAPTURE (SCOPE)

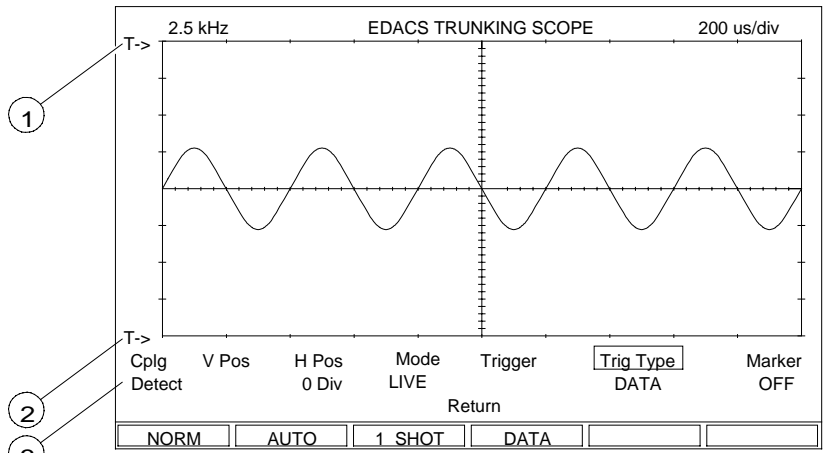Access the EDACS Repeater or Radio Simulator Extended Measure Scope.

Set H Pos negative to view the dotting or barker code before the data. Cursor to Trig Type field. "DATA" acts like 1-SHOT mode

and triggers when High-Speed EDACS data is decoded. Press DATA to re-arm trigger.

Set the EDACS Trunking Scope trigger level high or low enough to avoid causing a trigger before the EDACS Data Burst occurs.

● ●

1. <u>Trigger</u>

   Displays trigger level set high.

2. <u>Trigger</u>

   Displays trigger level set low.

3. <u>Cplg (Coupling)</u>

   Selects type of coupling preferred.

| 2.5 kHz | EDACS TRUNKING SCOPE | 200 us/div |

Cplg	V Pos	H Pos	Mode	Trigger	Trig Type	Marker
Detect		0 Div	LIVE		DATA	OFF

Return

| NORM | AUTO | 1 SHOT | DATA | | |

0060712

SECTION 6
OPTIONS

6-14-10 EDACS STORE AND RECALL

The COM-120C provides the ability to store and recall EDACS system configurations. Data is stored to one of 50 standard stored test setups under the *Type* EDACS. Press the STORE Hard Key in any EDACS Option screen for this menu window:

● ●

1. <u>Setup #</u>

    Displays selected Memory Location for storage of current configuration.

2. <u>Name</u>

    Displays optional alphanumeric label for selected Memory Location.

00607091

3. <u>Type</u>

    Displays the type of data currently saved in the specified setup number. Available types to save and recall are: DUPLEX, GENERATOR, RECEIVER, GENERATOR & RECEIVER and EDACS.

Press the RECALL Hard Key in any EDACS option screen for this menu window:

1. <u>Setup #</u>

    Displays selected Memory Location for storage of current configuration.

2. <u>Name</u>

    Displays optional alphanumeric label for selected Memory Location.

00607092

3. <u>Type</u>

    Displays the type of data currently saved in the specified setup number. Available types to save and recall are: DUPLEX, GENERATOR, RECEIVER, GENERATOR & RECEIVER and EDACS.

6-14-11 EDACS TRUNKING OPERATIONAL NOTES

This section provides some notes and hints on operating the EDACS Trunking Option of the COM-120C.

Squelch Setting

The squelch knob setting on the COM-120C unit is very important for all testing.

While in the EDACS Trunking Main Screen with no RF being transmitted into the COM-120C unit, turn the squelch knob full counterclockwise. The green squelch light is ON. Slowly turn the knob clockwise until the green light just goes off (make sure there is no flickering). This setting is valid for all EDACS testing.

Control/Working Channels

If a radio is having trouble locking onto the Repeater Simulator, completing calls or the Radio Simulator is showing NC, check the programming of the Control and/or Working Channels in the Setup menu. These channels must be valid for the particular system under test.

If the radio is having trouble locking onto the Repeater simulator, check the CH #: field. This must be set to a valid working channel number, it is NOT the Control Channel number.

Data Generation

If the radio won't lock onto the Repeater Simulator, won't stay up when being called or the Radio Simulator is having trouble completing calls, check the DATA Mod Source. The DATA Mod Source must be set for FM Modulation. The recommended deviation is 3.2 kHz (1.5 kHz for narrow band) with a sub-audible deviation of 0.70 kHz (0.35 kHz for narrow band).

Logical/Group ID

If a radio can not be called in the Repeater Simulator or can not make a call in the Radio Simulator, check the Group/Logical ID. The Group ID must valid for the system under test.

FM-Zero

If a radio is having trouble completing a Group Call (maybe works 50% of the time), an FM-Zero (FMZ) operation may be necessary. Do this in the Automatic Test using F4 FMZ while in the idle state, or FMZ in any manual mode simulator by cursoring to the Deviation field in the left column and pressing F3 FMZ.

SECTION 6
OPTIONS

6-15 MPT 1327 TRUNKING (OPTION 17)

The MPT 1327 Trunking Option allows protocol and parametric testing of radio units and trunking system controllers (repeaters) designed for operation on MPT 1327 trunked private land mobile radio systems.

MPT 1327 is an open signaling standard, originally specified by the United Kingdom Ministry of Post and Telecommunications (now under the auspices of the Department of Trade and Industry Radiocommunications Agency), and adopted for use world-wide.

The MPT 1327 Trunking Option 17 provides facilities for both automatic and manual testing of radio units, repeater testing, off-air monitoring and network data configuration/storage.

To access the MPT 1327 Trunking Option, press SPCL Test Mode Key and select the option from the Special Menu. If the MPT 1327 Trunking Main screen is not displayed, press SETUP Hard Key. Select Version information to verify the option is installed.

● ●

AUTOMATIC TEST MODE

An Automatic Test facility is provided where a Radio Unit (RU) is subjected to a series of predefined tests with minimum intervention.

REPEATER SIMULATOR

The COM-120C is configured to simulate a trunked single site repeater to manual test radio units.

RADIO UNIT SIMULATOR

The COM-120C is configured to simulate a trunked Radio Unit to enable testing of the trunked infrastructure.

OFF-AIR MONITOR

```
                MPT 1327 Trunking

Select Option:
  1. Automatic Test Mode
  2. Repeater Simulator
  3. Radio Unit Simulator
  4. Off-Air Monitor
  5. Setup




 ┌──────┬─────────┬─────────┬─────────┬───────┬────────┐
 │ AUTO │ REP SIM │ RAD SIM │ MONITOR │ SETUP │ RETURN │
 └──────┴─────────┴─────────┴─────────┴───────┴────────┘
```

The COM-120C is configured to become an "off-air" monitor and displays the protocol messages on screen from either a repeater or radio unit.

SETUP

The SETUP screen allows the network configuration parameters to be entered. These parameters are required by the other test facilities.

6-15-1 SETUP NETWORK DEFINITION

The SETUP screen allows the customization of network definitions.

● ●

NAME

This field allows a network definition to be assigned a descriptive label of up to 19 characters. This parameter is optional and has no effect on the system operation.

SYSTEM ID

The SYSCODE is used in the generation of control channel signaling (Repeater Simulator).

See notes on following pages for a description of how to calculate the SYSCODE.

The TSCI (Trunked System Controller Ident) is used as the COM-120C ident in message transactions with a radio unit.

```
                    MPT 1327 Network Definition
 Name:                      IFR SYSTEMS
 System ID               SYSCODE:  2809    TSCI:      8190
 Codewords               SYNC:    C4D7     SYNT:      3B28
 Channel Range           Lowest:     1     Highest:    512
 Control Channel         Initial:  100     Second:     200
 First Traffic Channel:            200
 Base Rec Freq:  157.3500 MHz  Chan Spacing:  12.5 kHz
 Base Gen Freq:  149.3500 MHz  FFSK Mod:    1.50 kHz
 Channel-Frequency Allocation
 ┌─Chan:──────────┐ ┌─Rx:───────────┐ ┌─Tx:───────────┐
 │    *           │ │        *MHz    │ │        *MHz    │
 └────────────────┘ └───────────────┘ └───────────────┘
 │ LOAD │ SAVE │ DEFAULT │ REP SIM │ RAD SIM │ RETURN │
```

With some Radio Unit's, SDM's from TSCI have a system-dependent meaning, sometimes making it necessary to change this value.

CODEWORDS

These parameters are the syncronization codewords for control and traffic channels, used in the generation of control channel signaling and encode of transmitted messages.

The default values for SYNC and SYNT (UK standard) are C4D7 and 3B28 respectively. Do not change these settings for standard MPT 1327/1343 networks.

CHANNEL RANGE

The maximum permissible channel range is 1 to 1023. This range may be controlled using the lowest and highest channel fields.

These values are also used in the automatic test mode for the low and high channel handoff tests.

SECTION 6
OPTIONS

DEFAULT CHANNELS

The first control channel is the channel the COM-120C uses on entry to all the test screens. The second control channel is used by the automatic test mode for the MOVE test.

The Radio Unit only goes into service on a channel that is contained within the programmed hunt sequence. See notes on following pages for discussion of UK Band III DTI numbering scheme.

BASE FREQUENCIES

These are the base Rx and Tx frequencies from which the channel spacing is used as an offset to calculate the frequencies for each channel.

The base frequencies are effectively those of logical channel 0.

CHANNEL SPACING

The normal values for this parameter are either 12.5 kHz (default) or 25 kHz. If it is set to zero, editing of the channel-frequency allocation plan fields is enabled, otherwise editing is disabled. Other values of channel spacing can be entered as required.

FFSK MODULATION

The FFSK modulation level is used to determine the deviation applied to the data generator for FFSK modulation.

Usual values are 1.5 kHz for 12.5 kHz channel spacing, 2.5 kHz for 25 kHz channel spacing.

CHANNEL PLAN

Some networks do not use a fixed channel spacing frequency plan. In order to create such a network definition, set the channel spacing field to zero. Now it is possible to individually edit the Rx and Tx frequencies for each channel.

OPTIONS

6-15-2 SYSCODE CALCULATION

The system codeword is used when generating control channel signalling as a system identifier. When testing Radio Units, the correct SYSCODE allows the RU under test to go into service.

The SYSCODE is actually constructed from a number of different fields. The codeword is 15 bits long with the most significant bit (B15) = 0.

• •

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	OPID							NDD				LAB		
0	1	OPID		NDD										LAB		

B14 specifies whether the network is termed a National Network (1) or a Regional Network (0). Depending on the setting of the Network type, the length of the OPID field is either 7 bits or 2 bits and the NDD field 4 or 9 bits. The LAB field is normally set to 001 to allow any category radio unit to access the system.

The NDD field generally contains a site identifier number for a multiple site network.

The easiest way to construct the SYSCODE is to convert each field into binary with all leading zeroes to complete the field width, then create a 16 bit hexadecimal number converting each four bits into a hexadecimal character 0-9, A-F.

Example: A Radio Unit is programmed for a regional network, OPID=50, and has access authorization for site area 1.

    OPID   = 94 decimal = 1011110 binary

    NDD   = 1 decimal = 0001

    LAB   = 001 SYSCODE = 2F09

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
0	0	OPID							NDD				LAB		
0	0	1	0	1	1	1	1	0	0	0	0	1	0	0	1
2				F				0				9			

In many instances where the Radio Unit has unlimited access, authorization NDD may be set to any value.

6-15-3   CHANNEL NUMBERING

It is important the first control channel number used here is a channel defined in the Normal Hunt table of the Radio Unit. Although an RU is instructed to MOVE to another control channel, a channel is not acquired unless the channel is in the Normal Hunt table. Otherwise, the RU enters a Comprehensive Hunt. This may take many minutes before acquiring a channel and going into service.

Radio Units operating in the UK Band III sub-bands 1 and 2 use a slightly different channel designation.

● ●

Sub-band 1

Channel No.	CHAN field binary representation	Radio Unit tx freq
1		184.5000MHz
58	1000000001	185.2125MHz
560	1111110111	191.4875MHz

Sub-band 2

Channel No.	CHAN field binary representation	Radio Unit tx freq
1		192.5000MHz
58	0000000001	193.2125MHz
560	0111110111	199.4875MHz

nOTe   The COM-120C uses the binary channel number (as programmed into the radio).

6-15-4 BASE FREQUENCIES

Every network has a channel plan, identifying a channel number with a specific transmit and receive frequency. Generally this plan is referenced back to an initial BASE frequency which is either logical channel 0 or occasionally logical channel 1. Each channel is then related to the channel number and base frequency by the formula BASE FREQUENCY + (channel number x channel spacing).

For example if it is known that the frequency of a control channel is 188.8750 MHz and it is channel number 298, the base frequency must be 188.8750 − (298 x 0.0125) = 185.025 MHz assuming the channel spacing is 12.5kHz.

For situations with a non incremental channel plan, usually used when there are different channel spacings (Rx/Tx split) on different channels, it is possible to define each channel number manually by setting the channel spacing to zero.

SECTION 6
OPTIONS

6-15-5 TRUNKING SIMULATOR SCREENS

In the manual test modes, the COM-120C simulates either a trunked single site repeater (to test radio units) or a trunked radio unit (to test repeaters).

In automatic test mode, the COM-120C simulates a trunked single site repeater controlled by a configurable automated test procedure.

● ●

1. <u>CCH#</u>

   Displays control channel status. The cursor is highlighted when the COM-120C is in control channel mode.

2. <u>TCH#</u>

   Displays traffic channel status. The cursor is highlighted when the COM-120C is in traffic channel mode.

3. <u>Extended Meas</u>

   Provides access to extended measurement screens.

```
            MPT 1327 REPEATER SIMULATOR
CCH#:  100  TCH#:   200              Extended Meas:
         RECEIVE                       GENERATE
RF: 159.8500 MHz             RF: 151.8500 MHz
Input: T/R   Atten: 0 dB     Level:  -40.0 dBm
IF: 15  kHz  Speaker: WIDE   Output: T/R
Prefix:        1             Repeater:   IDLE
Ident:        1001           Call type:  SPEECH
ESN:       003/10/054087     RU PTT ON
RF Power:    21.6 WATTS      GEN-1  DATA
                             Mod Source: GEN1  FM
RF Error Freq:  -0.208 kHz   Deviation:      1.50 kHz
Deviation:   ± 0.02 kHz  (V) Frequency:   1000.0 Hz
                             Baseband level:  0.54
AF Frequency:        0 Hz
Distortion:  79.6 %          Sinad:
 SPEECH  REGISTN  STATUS    SDM    CONFIG   RETURN
```

4. <u>RF (Receive)</u>

   Receiver frequency, value dependent on current channel.

5. <u>Input</u>

   Receiver RF source selection. Selections are T/R or ANT.

6. <u>Atten</u>

   Receiver input attenuation. Selections are 0 or 30 dB.

7. <u>IF</u>

   Receiver IF selections are 300 kHz, 15 kHz or 30 kHz.

8. <u>Speaker</u>

   Speaker routing and filters.

9. <u>RF (Generate)</u>

   Generator frequency, value dependent on current channel.

10. Level

    Generator output level. Range is dependent on output; for T/R output selection range is -130 to -40 dBm, for AUX ouput selection range is -130 to –13 dBm.

11. Output

    Generator RF output selection. Selections are T/R or AUX.

12. RF Power/ RF Level

    Displays UUT transmitter RF power in W or mW (T/R input connection) or level in dBm (ANT input connection).

13. RF Error Freq

    Displays unit under test's transmitter RF frequency error in kHz.

14. Deviation

    Displays selected (voice or data) deviation in kHz. Voice is indicated by a 'V', data by a 'D'.

15. AF Frequency

    Displays Unit Under Test transmitter Audio Frequency in Hz.

16. Distortion/ DTMF

    This field displays either Distortion or DTMF.

17. Mod Source

    Displays selected modulation source. Selections include GEN1 (Audio Generator-1), GEN2 (Audio Generator-2, where fitted), and DTMF (DTMF Tone Generator).

18. Deviation

    Displays modulation source Deviation.

19. Frequency

    Displays modulation source Frequency.

20. Baseband Level

    Displays modulation source baseband level in Vpk and Vrms or mVpk and mVrms.

21. Distortion/ SINAD/ AF Level

    This field can be selected to display one of receiver distortion, SINAD or AF level. These functions require direct connection to the unit under test.

6-15-6 REPEATER SIMULATOR

In the manual Repeater Simulator mode, all editable fields are available.

● ●

1. <u>Prefix</u>

    MPT 1327 prefix of the RU under test. Valid range is 0 to 127.

2. <u>Ident</u>

    MPT 1327 identity of the RU under test. Valid range is 0 to 8191.

3. <u>ESN</u>

    Electronic Serial Number of the RU under test, displayed following a successful registration test.

4. <u>Repeater</u>

    See, Appendix D for softkey definition.

5. <u>Call Type</u>

    This field allows selection of the call types for COM-120C initiated calls to the RU selected by PFIX/IDENT.

6. <u>Status Info</u>

    Displays information messages pertaining to the current status, eg "IN TRAFFIC," "STATUS 27 SENT."

6-15-7 TESTING RADIO UNITS

When testing a Radio Unit, the most commonly used mode is the manual REPEATER SIMULATOR. In this mode the COM-120C acts as a single channel MPT 1327 trunked repeater using control/traffic reversion when calls are initiated. The COM-120C allows a radio unit to be sent a GTC and switch into a call mode, making basic functionality and parametric measurements possible.

● ●

The quickest route to checking a Radio Unit is to:

❏   Select the correct Network file from stored files or create a new one

❏   Enter Repeater Simulator mode

❏   Ensure correct Antenna connections are selected and RF levels are correct

❏   Wait until Radio Unit goes into service

❏   Initiate a Speech Call request from the Radio Unit

If the Radio Unit does not enter service, but appears to be attempting to register on the COM-120C channel, check that the squelch is adjusted correctly and the baseband metering is switched OFF.

SECTION 6
OPTIONS

6-15-8 MPT 1327/MPT 1343 NUMBERING SCHEMES

All signalling over air uses MPT 1327 numbering for the RU identity (7 bit prefix, 13 bit identity). However, most RU's use MPT 1343 numbering schemes to reduce the digits dialed to two or three digits for calls within fleet. The conversion between 1343 numbers and 1327 identities is performed within the RU. It is impossible for the COM-120C to determine the MPT 1343 number; however, the conversion between the two is relatively easy.

● ●

To convert MPT 1343 to MPT 1327:

MPT 1327 PFIX = MPT 1343 PFIX − 200

MPT 1327 IDENT = (FLEET ID −2000)
x 2 + (FLEET NUMBER-20 *or* 200)

Example:

MPT 1343 ID = 201 2500 27

MPT 1327 PFIX = 201-200 = 001

MPT 1327 IDENT = (2500-2000) x 2 +
(27-20) = 1007

6-15-9 RADIO SIMULATOR

In this mode the COM-120C simulates a MPT 1327 Trunked Radio Unit.

The features of the Radio Unit Simulator screen are described in this section.

● ●

1. Prefix

    This field is the MPT
    1327 Prefix of the
    simulated Radio Unit.
    Valid range is 0 to
    127.

2. Ident

    This field is the MPT
    1327 Identity of the
    simulated Radio Unit.
    Valid range is 0 to
    8191.

3. ESN

    Electronic Serial
    Number of the
    simulated RU under
    test, derived from
    the unit serial number
    of the COM-120C.

```
                MPT 1327 RADIO SIMULATOR
CCH#:   200  TCH#:   300               Extended Meas:
        RECEIVE              │        GENERATE
RF: 151.8500 MHz            │ RF: 159.8500 MHz
Input: T/R   Atten: 0 dB    │ Level: -13.0 dBm
IF: 15  kHz  Speaker: WIDE  │ Output: AUX
Prefix:          1           │ Called ID:    1000
Ident:        1001           │
ESN:        252/01/008187    │
RF Power:      0.0 mW        │ GEN-1   DATA
                             │ Mod Source: GEN1  FM
RF Error Freq:     ---kHz    │ Deviation:      0.00 kHz
Deviation:   ±  ---kHz  (V)  │ Frequency:  1000.0 Hz
                             │ Baseband level:  2.00
AF Frequency:      ---Hz     │
Distortion:   ---%           │ Sinad:
  CALL  ║  PTT  ║     ║      ║      ║        ║ RETURN
```

4. Called ID

    This field allows selection of the called RU ident. Setting this the same as the
    IDENT field allows testing without an additional RU.

5. Status Info

    Displays information messages pertaining to the current status, e.g. "IN
    SERVICE."

SECTION 6
OPTIONS

6-15-10   AUTOMATIC TEST MODE, TEST SELECTION

An automatic test facility that subjects a Radio Unit to a series of predefined tests.

The test selection screen allows the user to decide which protocol tests are required.

● ●

1. Network

    Name of the network
    currently in use
    (configured in the
    SETUP screen).

2. RU Type

    Name of the Radio Unit
    type (configured in the
    parametrics LIMITS
    screen).

3. RU Prefix

    MPT 1327 prefix of the
    Radio Unit under test.
    Valid range is 0 to 127.

4. RU Ident

```
┌─────────────────────────────────────────────────┐
│        MPT 1327 Auto Test Selection/Results       │
├─────────────────────────────────────────────────┤
│  Network:                     IFR SYSTEMS          │
│  RU Type:                     PRM8060              │
│  RU Prefix:    1                                   │
│  RU Ident:  1001              RU ESN:  003/10/054087│
│                                                    │
│  Registration              ENABLE          PASS    │
│  Moving CCH                ENABLE          PASS    │
│  RU Speech Call            ENABLE          PASS    │
│  Speech Call to RU         ENABLE          PASS    │
│  [Handoff]                 ENABLE          PASS    │
│  Overall result:                           PASS    │
├────────┬─────────┬─────────┬────────┬──────┬──────┤
│ ENABLE │ DISABLE │ MEAS-LO │MEAS-HI │START │RETURN│
└────────┴─────────┴─────────┴────────┴──────┴──────┘
```

    MPT 1327 identity of the Radio Unit under test. Valid range is 0 to 8191.

5. ESN

    Electronic Serial Number of the RU under test, displayed following a successful
    registration test.

6. Registration

    This test demands the RU to register and interrogates the ESN.

7. Moving CCH

    This test sends the Radio Unit to another control channel (defined in the network
    definition). An availability check is performed to ensure the RU successfully
    moved to the new channel. The RU is then moved back to the original control
    channel.

8. RU Speech Call

    This test attempts to set up a speech call from the Radio Unit (only possible with
    direct connection to the RU under test). If unsuccessful, the COM-120C prompts
    to press the RU call button to set up the call. The COM-120C prompts to clear the
    call.

9. Speech Call to RU

   This test attempts to set up a speech call to the Radio Unit. Transmit and receive parametric measurements are then taken, subject to the correct audio connections between the RU and COM-120C.

   If direct audio connection is not available, choose to SKIP the receiver parametrics test when at the prompt.

   The call is cleared from the COM-120C.

10. Handoff

    This test sets up a speech call to the Radio Unit. Once in traffic, the RU is handed off to the lowest channel specified in the network definition. Parametric measurements are performed as per SPEECH CALL TO RU. The call is cleared by the COM-120C, which then calls the RU again and hands it off to the highest channel. The parametric measurements are repeated on this channel. Finally, the COM-120C clears the call and ensures the RU returns to the control channel.

SECTION 6
OPTIONS

6-15-11   PARAMETRIC LIMITS

The Parametric Limits Screen for the Automated Test Mode allows pass/fail limits settings.

●●●

1. <u>RU Type</u>

    This field allows a set of limits to be given a descriptive label of up to 19 characters. This parameter is optional and has no effect on the system operation.

2. <u>Tx Freq Error</u>

    Maximum permissable frequency error, in kHz.

3. <u>Tx Power</u>

    Minimum and maximum permissable transmitter power, in W.

```
          MPT 1327 Auto Test: Limits
 ┌────────┐
 │RU Type:│                    PRM8060
 └────────┘

  Tx Freq Error:                      kHz      ----
  Tx Power:                  20.00     W       MIN
  Tx Deviation:              1.40      kHz     MIN
  Tx Limiter:                2.00      kHz     MIN
  Tx Distortion:                       %       ----
  Rx Sensitivity:                      dBm     ----
  Rx SINAD:                  120.0     dB      MIN
  Rx Distortion:                       %       ----
  Rx AF Level:               0.05      Vrms    MIN

 ┌──────┬──────┬──────┬──────┬──────┬────────┐
 │ LOAD │ SAVE │ MIN  │ MAX  │      │ RETURN │
 └──────┴──────┴──────┴──────┴──────┴────────┘
```

4. <u>Tx Deviation</u>

    Minimum and maximum permissable transmitter deviation, in kHz. Since the COM-120C GEN1 is used to generate the test signal, direct audio connections are required to perform this measurement.

5. <u>Tx Limiter</u>

    Minimum and maximum permissable transmitter limiting deviation, in kHz. Since the COM-120C GEN1 is used to generate the test signal, direct audio connections are required to perform this measurement.

6. <u>Tx Distortion</u>

    Maximum permissable transmitter distortion, as a percentage. Since the COM-120C GEN1 is used to generate the test signal, direct audio connections are required to perform this measurement.

7. <u>Rx Sensitivity</u>

    Maximum permissable receiver sensitivity, in dBm or µV. Since the COM-120C GEN1 is used to generate the test signal, direct audio connections are required to perform this measurement.

8. Rx SINAD

    Minimum permissable receiver SINAD, in dB. Since the COM-120C GEN1 is used
    to generate the test signal, direct audio connections are required to perform this
    measurement.

9. Rx Distortion

    Maximum permissable receiver distortion, as a percentage. Since the COM-120C
    GEN1 is used to generate the test signal, direct audio connections are required to
    perform this measurement.

10. Rx AF Level

    Minimum and maximum permissable receiver audio level, in Vrms. Since the
    COM-120C GEN1 is used to generate the test signal, direct audio connections are
    required to perform this measurement.

6-15-12   TEST EXECUTION

During test execution, the Repeater Simulator screen is displayed. Editing of fields is not permitted in this mode. Autotest status and user prompts are displayed in the title bar at the top of the screen, or in pop-up windows.

Note that before the selected tests are executed, a control channel acquisition test is always performed. Pressing any hard-key aborts the autotest.

Once the sequence of tests has been completed, the auto test selection/results screen is re-displayed. This screen indicates the overall result and result for each test: "PASS", "FAIL" or "----" (not tested). These results are based on both protocol and parametric checks.

6-15-13 PARAMETRIC RESULTS

The Parametric Measurements Screen for the Automated Test Mode displays the measured values, together with pass/fail results for each measurement based on the limits table. The result for each test is indicated as: "PASS", "FAIL" or "----" (not tested).

● ●

1. <u>Tx Freq Error</u>

   Measured value of transmitter frequency error, in kHz.

2. <u>Tx Power</u>

   Measured value of transmitter power, in W.

3. <u>Tx Deviation</u>

   Measured value of transmitter deviation, in kHz.

4. <u>Tx Limiter</u>

   Measured value of transmitter limiting deviation, in kHz.

5. <u>Tx Distortion</u>

   Measured value of transmitter distortion, as a percentage.

6. <u>Rx Sensitivity</u>

   Measured value of Receiver Sensitivity, in dBm or µV.

7. <u>Rx SINAD</u>

   Measured value of receiver SINAD, in dB.

8. <u>Rx Distortion</u>

   Measured value of receiver distortion, as a percentage.

9. <u>Rx AF Level</u>

   Measured value of receiver audio level, in Vrms.

SECTION 6
OPTIONS

6-15-14   OFF-AIR MONITOR

In this mode the COM-120C becomes an off-air monitor and displays the MPT 1327 messages on screen from either a Radio Unit or Trunked Repeater Unit.

● ●

1. CCH# / TCH#

    Displays control and traffic channel status. The relevant cursor is highlighted when the COM-120C is in control or traffic channel mode. Softkey functions available are dependent upon mode.

2. PFIX/ IDENT

    Identity of Radio Unit, for use in FOLLOW mode.

3. GTC/ ACKQ

    Displays statistics summary. The cursor is highlighted when the COM-120C is in traffic channel mode.

4. Repeater Monitor Softkeys

    See Appendix D.

```
              MPT 1327 OFF-AIR MONITOR
 CCH#:  834   TCH#:  894      GTCs:    0   ACKQs:    0

 Sysdef:02 Sys:2811  BCAST Per:1 Ival:0 Pon:0 Id:0 Tsclim:255
 Pfix:000 Id1:0000    ALH    Chan4:02 Wt:1 Rsvd:0 M:00 N:02
 Sysdef:03 Sys:2811  BCAST NA:1 Reg:0
 Pfix:000 Id1:0000    ALH    Chan4:02 Wt:1 Rsvd:0 M:00 N:02
 Sysdef:02 Sys:2811  BCAST Per:1 Ival:0 Pon:0 Id:0 Tsclim:255
 Pfix:000 Id1:0000    ALH    Chan4:02 Wt:1 Rsvd:0 M:00 N:02
 Sysdef:03 Sys:2811  BCAST NA:1 Reg:0
 Pfix:000 Id1:0000    ALH    Chan4:02 Wt:1 Rsvd:0 M:00 N:02
 Sysdef:02 Sys:2811  BCAST Per:1 Ival:0 Pon:0 Id:0 Tsclim:255


 DECODE   FOLLOW     RAD    FILTERS  SUMMARY  RETURN
```

1. <u>Monitor Filter Softkeys</u>

   See Appendix D.

2. <u>Radio Monitor Softkeys</u>

   See Appendix D.

```
                MPT 1327 OFF-AIR MONITOR
 CCH#:   834  TCH#:   894     Pfix:      1   Ident:   1001

 12:08:08 Sysdef:03 Sys:2811   BCAST 8D408C701004   2555

 12:08:08 Sysdef:02 Sys:2811   BCAST 89408C7200FF   8AC6

 12:08:08 Pfix:000 Id1:0000    ACK   800004201456   9AAA

 12:08:08 Sysdef:02 Sys:2811   BCAST 89408C7200FF   8AC6

 12:08:09 Pfix:000 Id1:0000    ALH   800004008802   9156

 12:08:09 Sysdef:03 Sys:2811   BCAST 8D408C701000   D7C6

 12:08:09 Pfix:000 Id1:0000    ALH   800004008802   9156

 12:08:09 Sysdef:02 Sys:2811   BCAST 89408C7200FF   8AC6

 12:08:09 Pfix:000 Id1:0000    ALH   800004008802   9156


 │NO ALH│NO ACKS│  GTC  │EXT MSG│HEX MSG│RETURN│
```

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APPENDIX A - USER I/O CONNECTORS AND PIN-OUT TABLE

A-1   TABLE OF I/O CONNECTORS

CONNECTOR NAME	CONNECTOR TYPE	SIGNAL IN/OUT	SIGNAL TYPE
T/R	"N" TYPE	IN/OUT	RF, 200 W MAX
SCOPE/DVM	BNC	IN	Analog, 200 Vdc MAX CAT II
DEMOD	BNC	OUT	Audio
AUDIO/DATA GEN	BNC	OUT	Audio
AUDIO/DATA IN	BNC	IN	Analog, Digital 20 Vdc MAX
EXT MOD	BNC	IN	Analog, 20 Vdc MAX
MIC/ACC	8 Pin DIN	IN/OUT	See Pin-Out Table
AUX RF OUT	BNC	OUT	RF
ANTENNA	TNC	IN	RF, 0.25 W CW MAX
AC LINE IN	AC Power	IN	120/240 VAC
DC IN		OUT	12 Vdc, 24-30 Vdc
GPIB (IEEE-488)	24 Pin Champ	IN/OUT	See Pin-Out Table
RS-232	9 Pin, D	IN/OUT	See Pin-Out Table
EXTERNAL REFERENCE	BNC	IN	10 MHz >0 dB

Table of I/O Connectors

A-2 PIN-OUT TABLE FOR MIC/ACC CONNECTOR

PIN NUMBER	SIGNAL NAME	SIGNAL TYPE	I/O
1	PTT-Out	TTL	Programmable Out
2	Mic Audio	Audio	In
3	Demod Audio	Audio	Out
4	NC	NC	
5	+15 Vdc	10-15 Vdc, 1 mA	Out
6	NC	NC	
7	Mic Switch	TTL	Programmable In
8	GND		

Pin-Out for MIC/ACC Connector Table
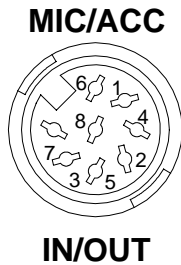
MIC/ACC

IN/OUT

861801

MIC/ACC Connector Pin Identification

A-3 PIN-OUT TABLE FOR GPIB CONNECTOR

PIN NUMBER	ASSIGNMENT	PIN NUMBER	ASSIGNMENT
1	DIO 1	10	SRO
2	DIO 2	11	ATN
3	DIO 3	12	Digital GND
4	DIO 4	13	DIO 5
5	EOI	14	DIO 6
6	DAV	15	DIO 7
7	NFRD	16	DIO 8
8	NDAC	17	REN
9	IFC	18-24	Digital GND

Pin-Out for GPIB Connector Table
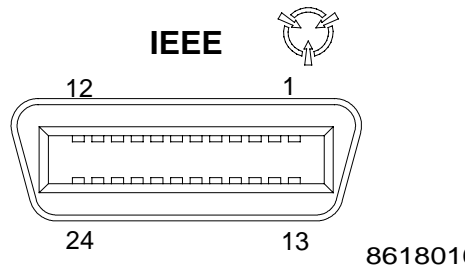
GPIB Pin Identification

Use of the GPIB Connector is in compliance with ANSI/IEEE Standard 488.2-1987.

A-4   PIN-OUT TABLE FOR RS-232 CONNECTOR

PIN NUMBER	ASSIGNMENT
1	4.7 kΩ + 15 Vdc
2	TX DATA
3	RX DATA
4	N/C
5	Digital GND
6	4.7 kΩ + 15 Vdc
7	CTS
8	RTS
9	N/C

Pin-Out for RS-232 Connector Table
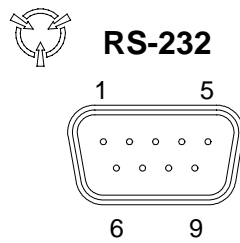
RS-232

8618017

RS-232 Connector Pin Identification

APPENDIX B - ABBREVIATIONS

A

A	Ampere
ac	Alternating Current
AF	Audio Frequency
A Freq	Audio Frequency
AGC	Automatic Gain Control
AM	Amplitude Modulation
amp	Ampere
ANLZ	Analyzer
ANSI	American National Standards Institute
ANT	Antenna
AR	Autorange
ASCII	American National Standard Code for Information Interchange
Atten	Attenuation
Auto	Automatic
AUX	Auxiliary

B

BFO	Beat Frequency Oscillator
BER	Bit Error Rate
bps	Bits per second

C

Cbl Flt	Cable Fault
CCH	Control Channel
ccw	Counterclockwise
Cont	Continued
CW	Continuous Wave
C Wt	C-Weight

D

DAC	Digital to Analog Converter
DCS	Digital Coded Squelch
dB	Decibels
dBm	Decibels relative to 1 milli-watt
dc	Direct Current
DCS	Digital Coded Squelch Codes
Demod Audio	Demodulated Audio
Dev	Deviation
Disp	Display
Dist	Distortion
div	Division(s)
DMM	Digital Multimeter
DPL	Duplex
DPLX	Duplex
DTMF	Dual Tone Multi-Frequency
Dup	Duplex

E

ERR	Error
ESC	Escape
ESD	Electrostatic discharge
E-TACS	Enhanced Total Access Communications System
EXT MOD	External

F

Fig	Figure
FM	Frequency Modulation
Folw	Follow
freq	Frequency
Func	Function
Func Gen	Function Generator

G

G-Scan	RF Generator Scan
Gen	Generator
GND	Ground
GPIB	General Purpose Interface Bus

H

Hz	Hertz
Hex	Hexadecimal
Horiz	Horizontal

I

Id	Identification
IF	Intermediate Frequency
IEEE	Institute of Electrical and Electronic Engineers
I/O	Input/Output

K

kbps	Kilobits per second
kHz	Kilohertz (1000 Hertz)

L

L-lim	Lower Limit
Lmt	Limit
LSB	Single Sideband Lower
lvl	Level

M

M-Freq	Audio Frequency
MHz	Megahertz (1000000 Hertz)
MIC	Microphone Source
Mkr	Marker
mod	Modulation
modul	Modulation
ms	Millisecond
MTRS	Meters
mV	Millivolt
mW	Milliwatt

N

Neg	Negative
NADC	North American Digital Cellular

O

OFST	Offset Frequency

P

PH	Peak Hold
PM	Phase Modulation
Pos	Positive
PROG	Program
PWR	Power (switch)

R

RCL	Recall
Rcvr	Receiver
Recap	Recapture
Ref	Reference
Res	Resolution
Ret	Return
RF	Radio Frequency
RF Pwr Lvl	RF Power Level
R freq	Receiver Frequency
RMS	Root Mean Square
Rx	Duplex Receiver (Transmitting) Frequency

S

SCRN	Screen
SCSI	Small Computer System Interface
sec	Second
SGL	Single
SIG	Signal Strength
SQLCH	Squelch
SSB	Single Side Band

T

TERM	Terminal
T Freq	Duplex Transmitter Frequency
Tone Rem	Tone Remote
Trig	Trigger
Trk	Tracking
Tx	Duplex Transmitter (Receiving) Frequency

U

U-lim	Upper Limit
us	Microsecond
USB	Single Sideband Upper
UUT	Unit Under Test

V

V	Volt
VAC	Alternating current voltage
VChan	Voice Channel
Vdc	Direct current voltage
Vert	Vertical
VOL	Volume
VRMS	Voltage Root Mean Square

W

W	Watt

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APPENDIX C - REPACKING FOR SHIPPING

C-1   SHIPPING INFORMATION

IFR Test Sets returned to factory for calibration, service or repair must be repackaged and shipped subject to the following conditions:

C-1-1   AUTHORIZATION

Do not return any products to factory without authorization from IFR Customer Service Department.

```
CONTACT:      IFR
              Customer Service Dept.
              10200 West York Street
              Wichita, Kansas  67215

Telephone:    (800) 835-2350)
FAX:          (316) 524-2623
```

C-1-2   TAGGING TEST SETS

All test sets must be tagged with:

- Owner's identification and address.

- Nature of service or repair required.

- Model No. and Serial No.

C-1-3   SHIPPING CONTAINERS

Test Sets must be repackaged in original shipping containers using IFR packing materials. If original shipping containers and materials are not available, contact IFR Customer Service Department for shipping instructions.

C-1-4   FREIGHT COSTS

All freight costs on non-warranty shipments are assumed by the customer. (See "Warranty Packet" for freight charge policy on warranty claims.)

C-2   REPACKING PROCEDURE

- Make sure bottom packing mold is seated on floor of shipping container.

- Adjust handle to lay unlocked against Test Set as shown.

- Place Elastic Retainer around Test Set to secure handle.

- Carefully wrap Test Set with polyethylene sheeting.

- Place Test Set into shipping container, making sure Test Set is securely seated in bottom packing mold.

- Place top packing mold over top of Test Set and press down until mold rests solidly on bottom packing mold.

• Close shipping container lids and seal with shipping tape or an industrial stapler. Tie all sides of container with break resistant rope, twine or equivalent.

TOP PACKING
MOLD

TEST INSTRUMENT
WRAPPED WITH
POLYETHYLENE
SHEETING

ELASTIC
RETAINER

BOTTOM PACKING
MOLD

HOLD DOWN
STRAP

IFR SHIPPING CONTAINER
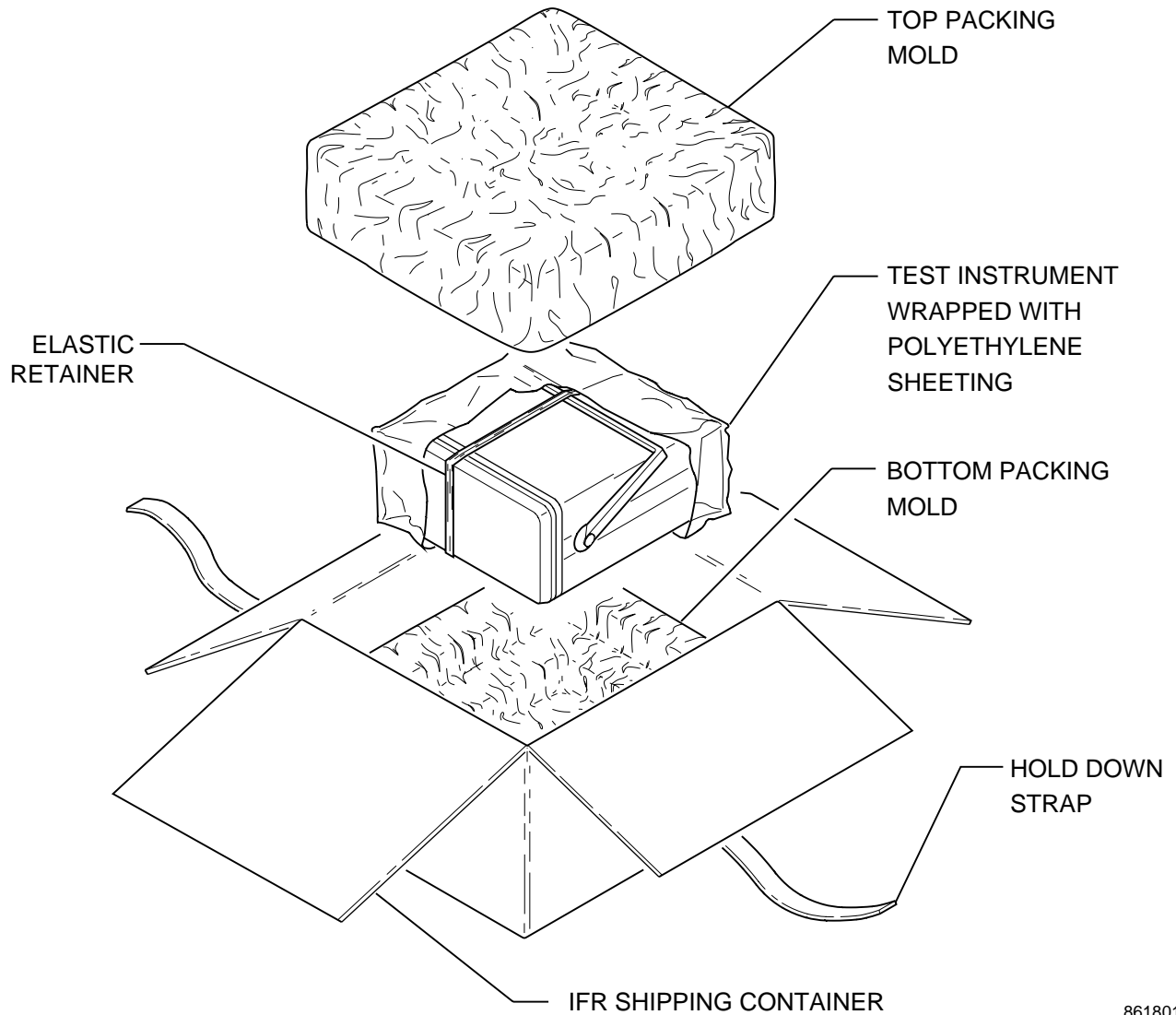
8618018

Repacking for Shipment

C-2

APPENDIX D – SOFT FUNCTION KEYS

ALPHABETICAL LISTING OF COM-120C SOFT FUNCTION KEYS

FUNCTION	DESCRIPTION		
%	Toggles between dB and % settings. Inactive units displayed on softkey.		
Δ ON/OFF	Toggles Δ Function ON and OFF. Δ displays adjacent to Frequency Readout when active.		
••	Moves up one directory (to the directory's parent.)		
Δ=	Accesses window to set RF Field change increment (Δ Freq).		
/10	Activates /10 Mode for Level.	Alters the scaling factor for the baseband level.	
/100	Activates /100 Mode for Level.		
\	Adds a backslash to the directory.		
0 dB	Selects 0 dB Attenuation.		
0.1 S	Selects 0.1 Second Gate Time.		
1 kHz	Selects 1 kHz Range.		
1 RAD	Selects 1 Radian as active upper range for Phase Modulation Meter.		
1 S	Selects 1 Second Gate Time.		
1 SHOT	Selects and enables One Shot as Trigger type.		
1.0 S	Selects 1.0 Second Gate Time.		
10 dB	Selects 10 dB Logarithmic Scale for Spectrum Analyzer Vertical Scale.		
10 kHz	Selects 10 kHz Range.		
10 RAD	Selects 10 Radians as active upper range for Phase Modulation Meter.		
10 S	Selects 10 Second Gate Time.		
100 Hz	Selects 100 Hz Range.		
100 kHz	Selects 100 kHz Range.		
100 kHz	Selects 100 kHz Range.		
100%	Sets Distortion Meter Upper Range to 100%.	Selects 100% as active upper range for AM Modulation meter.	
1200	Selects 1200 bps Data Rate. Displayed only with cursor at Data Rate Field.		
15 dB	Selects 15 dB as active upper range for SINAD Meter.		
15 kHz	Selects 15 kHz bandpass filter as active filter.	Selects 15 kHz IF Filter in optional BER Meter operation.	
2 dB	Selects 2 dB Logarithmic Scale for Spectrum Analyzer Vertical Scale.		
2 RAD	Selects 2 Radians as active upper range for Phase Modulation Meter.		
20 kHz	Selects 20 kHz Range.	Routes DTMF/SINAD Signal through 20 kHz Low-Pass Filter.	Activates 20 kHz Low-Pass Filter in optional BER Meter operation.

FUNCTION	DESCRIPTION	
20%	Sets Distortion Meter Upper Range to 20%.	
200 Hz	Selects 200 Hz Range.	
2000 Hz	Selects 2 kHz Range.	
24 PIN	Configures printer output for an Epson 24 Pin Printer.	
2400	Selects 2400 bps Data Rate. Displayed only with cursor at Data Rate Field.	
30 dB	Selects 30 dB Attenuation.	
30 kHz	Selects 30 kHz bandpass filter as active filter.	Selects 3 kHz Optional IF Bandwidth Filter in optional BER Meter operation.
300 Hz	Routes DTMF/SINAD Signal through 300 Hz High-Pass Filter.	Activates 300 Hz High/Low-Pass Filter in optional BER Meter operation.
300 kHz	Selects 300 kHz bandpass filter as active filter.	Selects 300 kHz IF Filter in optional BER Meter operation.
4 kHz	Routes DTMF/SINAD Signal through 4 kHz Low-Pass Filter.	Activates 4 kHz High/Low-Pass Filter in optional BER Meter operation.
40%	Selects 40% as active upper range for AM Modulation meter.	
5 RAD	Selects 5 Radians as active upper range for Phase Modulation Meter.	
50 kHz	Selects 50 kHz Range.	
512	Selects 512 bps Data Rate. Displayed only with cursor at Data Rate Field.	
55 dB	Selects 55 dB as active upper range for SINAD Meter.	
5970 Hz	Selects 5970 SAT Frequency in optional AMPS Cellular operation.	
6000 Hz	Selects 6000 SAT Frequency in optional AMPS Cellular operation.	
6030 Hz	Selects 6030 SAT Frequency in optional AMPS Cellular operation.	
800 MHz	Selects 800 MHz Trunking Band.	
9 PIN	Configures printer output for an Epson 9 Pin Printer.	
900 MHz	Selects 900 MHz Trunking Band.	
ABORT	Escapes Storage Operation without performing edit.	Aborts the directory creation or format action and returns to the File List Screen.
AC	Selects AC Coupling for Oscilloscope, DEMOD Connector and optional BER Meter operation..	
AF DEC	Selects AF Decode as current Filter Line.	
AF DECD	Routes AF Decoder/SINAD signal to DEMOD Connector.	
AF LVL	Selects AF Level as active meter.	
AF-CNT	Routes AF Counter signal to DEMOD Connector.	
ALPHANO	Forces Decode Function to decode message as specified type.	
AM	Selects Amplitude Modulation as Modulation type.	Selects Amplitude Modulation as Demodulation type.

FUNCTION	DESCRIPTION				
ANALY	Displays abbreviated Analyzer.				
ANT	Selects ANTENNA Connector as RF input connector.				
APP	Displays when there are stored macro files. A loaded macro application appears as Item Number 4 on the List Setup Screen.				
ARCHIVE	Sets or clears Archive attribute to a file to indicate the file has been changed.				
AUD/DAT	Selects AUDIO/DATA IN Connector as input source for meter.				
Aud-Gen	Routes Audio signal from internal Audio/Data/Signaling Generators, as composite signal, to Speaker and PHONES Connector.				
AUTO	Selects Autorange as active upper range for SINAD and Modulation Meters. Automatically adjusts to a higher or lower range if signal increases or decreases to a specified level of the current setting.	Selects Auto as Trigger type for Oscilloscope.	Allows Decode Function to determine Message Type from received data.	Automatically decodes 1200 or 2400 baud rate incoming POCSAG data.	Accesses Automatic Test screen.
AUX	Selects AUX RF OUT as output connector. Indicator lights up.				
AUX Gate	Selects AUX RF OUT as output connector. Indicator lights up. Only active when microphone is keyed.				
AVG	Activates/deactivates Average Oscilloscope Operation Mode.				
BER	Accesses Bit Error Rate Option.				
BER +	Inserts Bit Errors in the control channel signaling. This function increases the number of bit errors in an erred frame.				
BER INT	Inserts Bit Errors in the control channel signaling. This function decreases the interval at which erred frames are inserted in the control channel.				
BIDIR	Sets Bidirectional Print Mode.				
BMP	Makes the file type a Bitmap format. There is a COLORS field with this selection. (see, NORMAL and INVERT)				
BOTH	Selects + and – peak deviation. The upper limit applies to the largest peak Positive reading and the lower limit applies to the largest Negative reading. For Peak hold readings, Peak Hi applies to the largest Positive peak reading found and Peak Lo applies to the largest Negative reading found.				
BURST	Activates single transmission of selected signal.				
BUSY	Sets Status to BUSY (Busy Home Repeater).				

FUNCTION	DESCRIPTION				
CALL	Makes a Group Call to the Radio, simulating a call from another radio. The ID's used to make the call are taken from the Group/Logical ID fields.	Attempts to set up a Speech Call with RU selected by CALLED ID. Status info display indicates "GO TO CHANNEL" if the call is successful, and the CALL softkey remains highlighted. Press the softkey again, or the start/stop key to clear the call.			
CELL	Accesses AMPS Cellular Option.	Initiates Manual Cell Site Initiated Call Test.			
C-Fwd	Accesses Cellular-Forward Channel List.				
CLEAR	Clears Code Field of current data.	Clears the path to the root path "\."	Clears current entry.		
C-MSG	Routes Detector signal through C-Message Weighted Filter to DEMOD Connector.				
C-MSG	Routes DTMF/SINAD Signal through C-Message Weighted Bandpass Filter.	Activates C-Message Weighted Bandpass Filter.			
COMPARE	Displays stored trace and live trace simultaneously.				
CONFIG	Accesses Configuration Window for configuring User Selectable Frequency and Duration for codes 0 through 9 and A through T.	Accesses RF Generator Filters Setup Menu.	Accesses an Analyzer pop up window to configure Scan Width, RBW and Sweep Rate.	Accesses Tracking Generator Configuration pop up window.	Accesses Configure screen for selecting POCSAG Function, Capcode Range and Data Rate.	Displays a window allowing editing of the default status (SDM1) code and (SDM2) text message.
Config	Accesses pop up window for setting Sweep Width for Find Function. Range of Sweep Width is 0.2000 to 500.0000 MHz.	Accesses pop up window for setting Scan Width, RBW and Sweep Rate.			
CONT	Activates continuous transmission of selected signal.	Continues on with an Automatic Test.			
CONTIN	Selects Continuous Run Mode in optional BER Meter operation..				
COPY	Copies a file without destroying the original. Enter a drive, directory and name of copy destination. Copy the file within the same drive or from one drive to another.				
COUPLE	Sets the Sweep and RBW to factory default state for the current Scan Width.				
CREATE	Creates the directory in the path string.				
C-Rvs	Accesses Cellular-Reverse Channel List.				
DAT DEC	Routes Data Decoder signal to DEMOD Connector.				
DATA	Accesses DATA Generator parameters.	Selects DATA Deviation measurement.			
DATA GEN	Selects Data Signal output through AUDIO/DATA GEN Connector in optional BER Meter operation.				
DATA IN	Selects AUDIO DATA IN as BER Meter input.				

FUNCTION	DESCRIPTION			
dB	Selects dB for Reading Units.		Toggles between dB and % settings. Inactive units displayed on softkey.	
dBm	Sets Output Level Units to dBm.	Selects dBm as Logarithmic Function.	Selects dBm for Reading Units. Activates Impedance field.	Toggles value setting.
dBmV	Selects dBmV as Logarithmic Function.			
dBuV	Selects dBµV as Logarithmic Function.			
dBuW	Selects dBµW as Logarithmic Function.			
dBV	Selects dBV as Logarithmic Function.			
dBW	Selects dBW as Logarithmic Function.			
DC	Selects DC Coupling for Oscilloscope, DEMOD Connector and optional BER Meter operation.			
DC ZERO	Zeroes reading to indicate 0 Vdc reading when selected Source is SCP/DVM DC.			
DCS	Selects DCS as Format type.			
DCS/	Selects Inverted DCS as Format type.			
DEC CLR	Clears the decoded are manually. Fresh data is now displayed and recognized.			
DECODE	Activates DECODE Function for specified Audio/Data type. Accesses Tone Decode Screen for USER Defined signaling format and initiates decoding function for DCS and DCS Inverted Functions.		Toggles message decoding ON and OFF. Pressing the softkey highlights the "DECODE" softkey. Messages continue to scroll through the screen until DECODE is pressed again.	
DEFAULT	Sets only the current field to factory default state for the current scan width.			
DEFLT	Sets the current Analyzer field to factory default.			
DELETE	Permanently deletes a file from the file system. There is no operation to recover a deleted file.			
Demod	Output to Demod Out Conncector.			
Detect	Raw data detected.			
DET-OUT	Routes Detector signal to DEMOD Connector.			
DEV	Selects FM Deviation Meter as active meter.			
DISABLE	Disables Border Offset.		Disables the selected test.	
DISABLED	Disables automatic test condition.			
DISC	Disconnects a call to the Radio which was made previously using the CALL softkey.			
DISCN	Sets Status to DISCN (Disconnect Repeater-Mobile Link).			
DIST	Selects Distortion Meter as active meter.			
DTMF	Accesses DTMF Generator parameters.			
DVM	Accesses LTR Trunking Digital Voltmeter.			
EDACS	Accesses EDACS Trunking Option.			

FUNCTION	DESCRIPTION	
ENABLE	Enables Border Offset.	Enables the selected test.
ENABLED	Enables automatic test condition.	
ESCAPE	Returns to RF Receive Operation Screen without saving edits when Filter field(s) are edited and not executed.	
EXEC	Executes and validates all edits before returning to operation mode.	
EXT	Accesses External Modulation parameters.	
EXT MOD	Selects EXT MOD Connector as input source for meter.	
EXT MSG	When selected, messages are displayed in fully decoded MPT 1327/1343 field format. Messages with bad CRCs are not decoded.	
EXTERNAL	Saves data externally to a PCMCIA memory card.	
FCC	Displays FREE REP CHAN field. Frequencies are entered in terms of the FCC defined channel numbers.	
FILE	Prints to a file.	
FILES	Displays the Stored File List.	
FILL	Fills remainder of selected column with value of current cursor position.	
FILTERS	Displays the selected Filters softkey bar.	
Find	Activates Find Function which searches for first signal with level exceeding reference set by Find Lvl Function. Search band is twice Sweep Widgh, set by Config Function, centered around Center Frequency.	
Find Lvl	Activates horizontal marker for setting reference level of Find Function. Marker level is controlled by DATA SCROLL Keys or DATA SCROLL Spinner. Press Find Lvl again to exit mode.	
FIX	Repairs damage to the system (CHKDSK operation).	
FIXED	Selects Fixed Data Pattern type in optional BER Meter operation.	
FL	Accesses User Defined Frequency List.	
FM	Selects Frequency Modulation as Modulation type.	Selects Frequency Modulation as Demodulation type.
FM CAL	Offsets FM Detector to compensate for Transmitter Frequency Error in LTR Radio. Offsetting FM Detector "tunes" data decoder that decodes data from LTR Radio.	
FMZ	Calibrates FM Detector when dc coupled.	
FM-Z	Automatically calibrates FM Zero.	
FOLLOW	When selected, the COM-120C follows the RU specified by the PFIX/IDENT fields after receiving go to traffic messages and automatically returns to the control channel on a CLEAR, and follow control channel MOVE. Has no effect during monitoring of an RU.	
FORCE	Forces the COM-120C to convert to the repeater even if the repeater does not sent the convert message. Toggles ON and OFF.	
FORMAT	Only available with PCMCIA selected. Formats the file system for use.	
FREE	Sets Status to FREE (Free Home Repeater).	

FUNCTION	DESCRIPTION	
FREQ	Displays the Stored RF Frequency List.	
GEN1	Accesses Audio Generator 1 parameters.	
GEN2	Accesses Audio Generator 2 parameters.	
Gnd	Ground coupled.	
GROUP	Group Call is selected and starts when softkey is pressed.	
GTC	When selected, all messages are filtered except GTCs. Useful for control loading.	
HEX MSG	When selected, messages are displayed with timestamp, basic MPT 1327 fields including message mnemonic, hex content and CRC, Messages with bad CRCs are decoded and may contain erred field values.	
HI CHAN	Displays parametric results for Highest Handoff Channel (HANDOFF test only).	
HOME	Selects simulated Home Registration.	
HP LJ	Configures printer output for an HP LASERJET Printer.	
HP TJ	Configures printer output for an HP THINKJET Printer.	
IDLE	Normal repeater operation for incoming speech/status calls.	
IDLE	Repeater is in the idle state, generating overhead (Site ID) messages. In this state, the Radio may initiate a Group Call, do a Login or the simulator may initiate a call to another radio.	
INDV	Individual Call is s4elected and starts when softkey is pressed.	
INFO	Accesses Customer Information Menu.	
INTERNAL	Selects internal file system.	Saves data internally in the COM-120C for later retrieval.
INT-MOD	Routes Audio signal from Internal Modulation sources as composite signal to Speaker and PHONES Connector.	
INVERT	The printed screen orientation is white background with black text. (see, BMP and PCX)	Inverts Decode/Encode Data.
INVERTED	Selects Inverted Data Polarity in optional BER Meter operation.	
KEY	Configures DATA ENTRY Keys as DTMF keypad. Code Field displays press key and DTMF Generator produces specified DTMF Code.	
LB	Selects Lower Sideband Demodulation.	
LIMITS	Accesses Parametric Limits screen.	
LIVE	Displays current signal without modification.	
LIVE-REF	The value of each point of the reference trace is subtracted from the current reading and the result is displayed. Requires a previously stored trace.	
LO CHAN	Displays parametric results for Lowest Handoff Channel (HANDOFF test only).	
LOAD	Accesses filing system Load screen.	

FUNCTION	DESCRIPTION		
LOCK	Sets frequency used for Generate, Receive and Spectrum Analyzer operation to same frequency as current RF Field. Change displays in all three operation screens when engaged.	Locks the Tracking Generator center frequency at a constant offset from the analyzer center frequency. Changing the analyzer center frequency changes the Tracking Generator center frequency by a like amount.	
LOOP	Selects Loop Run Mode in optional BER Meter operation.		
LTR	Accesses LTR Trunking Option.		
MANUAL	Accesses Manual Test screen.		
MAX	Displays Maximum Limit values only.		
MEAS-HI	Accesses the Parametric Measurements screen for the High Channel Handoff.		
MEAS-LO	Accesses the Parametric Measurements screen for the Low Channel Handoff.		
MENU	Displays pop up menu with multiple selections.		
MIC	Accesses MIC Modulation parameters.		
MIN	Displays Minimum Limit values only.		
MIN HOLD	Activates/deactivates Minimum Hold Oscilloscope Operation Mode.		
MOBILE	Initiates Manual Mobile Initiated Call Test.		
MOD MTR	Routes Modulation Meter signal to DEMOD Connector.		
MONITOR	Accesses Off-Air Monitor screen.		
MOVE	Moves a file from one directory to another. Enter a drive, directory and name to relocate the file. Move the file within the same drive or from one drive to another.	Moves the control channel to that displayed in the CCH# field and sets the RF frequencies accordingly.	
MPT1327	Accesses MPT1327 Trunking Option.		
mV	Sets Output level Units to mV.		
NAR 1	Selects Deviation Range, 12.75 to 25 kHz.		
NAR 2	Selects Deviation Range, 2 to 12.75 kHz.		
NAR 3	Selects Deviation Range, <2 kHz.		
NARROW	Sets System Band to Narrow (900 MHz).		
NETWORK	Accesses SETUP Network Definition screen.		
NO ACKS	When selected, all acknowledgement messages are filtered. Use in conjunction with NO ALH if required. (see, NO ALH)		
NO ALH	When selected, filter out ALHOA and BCAST messages.		
NORM	Selects Normalized Trigger type.	Selects Normal for +/- peak div by 2.	
NORMAL	The printed screen orientation is black background with white text. (see, BMP and PCX)	Selects Normal Data Polarity in optional BER Meter operation.	Sets Decode/Encode Data to normal.

FUNCTION	DESCRIPTION	
Normal	Sets Spectrum Analyzer to Normal single Center Frequency Operation. (see, Split)	
NUMERIC	Forces Decode Function to decode message as specified type.	
OFF	Deactivates High-Pass Filtering on DTMF/SINAD Line.	Turns Modulation Source OFF.
OFF/ON	Toggles features OFF and ON.	
ON/OFF	Toggles active function ON and OFF.	
OPEN	Opens the file Only files of type SYSTEM, MACRO, SETUP or TRACE may be OPEN'ed.	
PACK	Performs any needed packing on the file system.	
PAIR	Activates Pair Function which ties Duplex Generate and Receive RF Fields together as a pair with specified Frequency Offset. Editing Duplex Generate RF Field changs Duplex Receive Field. Editing Frequency Offset or Duplex Receive RF Field changes Duplex Generate RF Field.	
PCMCIA	Selects external file system.	Prints to a PCMCIA Modem or RS-232 card.
PG DN	Used to scroll down through a window list.	
PG DOWN	Pages down 12 files in the list.	
PG UP	Used to scroll up through a window list.	Pages up 12 files in the list.
PK HOLD	Activates/deactivates Peak Hold Oscilloscope Operation Mode.	
PM	Selects Phase Modulation as Modulation type.	Selects Phase Modulation as Demodulation type.
POCSAG	Selects POCSAG as Format type.	
POCSAG/	Selects Inverted POCSAG as Format type.	
PRGM	Puts the 'Band ' mode back to one of the channel modes: 800 MHz, 900 MHz or USER. The logical channels from the Setup Screen are then active. The simulator is taken out of the pre-programmed channel mode when the RF Frequencies are manually edited.	
PRINT	Saves the screen to a file or prints the screen according to the Print setup configuration.	
PRINTER	Allows printer configuration.	
PTT	Keys the COM-120C during a call. PTT remains highlighted until PTT is released by pressing the softkey again or the call is cleared.	
PTT OUT	Asserts the PTT Out line of the MIC Connector. This is useful for forcing a directly connected RU to key up.	
QUEUED	Simulates call Queuing for incoming speech/status calls.	
RAD	Switch to decoding messages from the RU. The receiver frequency is adjusted automatically.	
RAD SIM	Accesses EDACS or MPT 1327 Radio Unit Simulator screen.	
RADIO	Accesses LTR Trunking Option Radio Simulation.	

FUNCTION	DESCRIPTION	
RAMP	Selects Ramp as active Wave Shape.	
RANDOM	Selects Random Data Pattern type in optional BER Meter operation.	
RD ONLY	Sets or clears Read Only attribute to a file to prevent the file from being deleted or changed.	
RECALL	Displays stored trace only.	
REF-LIVE	The value of current reading is subtracted from the stored value and the result is displayed. Requires a previously stored trace.	
REG	Initiates Manual Registration Test.	
REGISTN	Forces RU selected by PFIX/IDENT to Register and interrogates the ESN.	
REP	Switch to decoding messages from the repeater. The receiver frequency is automatically adjusted.	
REP SIM	Accesses EDACS or MPT 1327 Repeater Simulator screen.	
REPEAT	Accesses LTR Trunking Option Repeater Simulation.	
RESET	Resets the current field to zero.	
RESTORE	Finalizes Recall Operation.	
RESULTS	Pages through automatic test results.	
RESUME	Restarts Sweep Function.	Returns the COM-120C to normal operation.
RETURN	Exits an application or window and returns to normal operation.	
RE-ZERO	Sets RF Power Meter to 0 mW referenced to current input at T/R Connector.	
RF GEN	Selects RF Generator as BER Meter source.	
RF POW	Selects RF Power Meter input line s input source for meter.	
RF REC	Selects RF Receiver (either T/R or ANT) as BER Meter input.	
ROAM	Selects simulated Roam Registration.	
ROLL	Views the scope trace in a roll mode when selected sweep rate is 100 ms/div or higher.	
RS-232	Prints via RS-232 Connector on the COM-120C rear panel.	
RST PK	Resets Peak Readings displayed to 0.	
S=On/Off	Toggles SINAD Function ON and OFF.	
SAVE	Finalizes Storage Operation.	
SCAN	Accesses Scan pop up window for setting Scan Function parameters. Scans specified frequencies on Frequency List.	
SCOPE	Displays abbreviated Scope.	
SCP/DVM	Selects SCOPE/DVM Connector as input source for meter.	
SCROLL	Toggles Scroll Function ON and OFF. Highlighted when SCROLL is active.	
SDM	Sends a textual (SDM2) message to the RU selected by PFIX/IDENT.	

FUNCTION	DESCRIPTION		
SEARCH	Performs SINAD search operation.		
SET LVL	Accesses procedure for setting reference for measuring input level at current frequency.		
Set Ref	Adjusts Spectrum Analyzer to internal reference level at current frequency. Initiate function at each new frequency to achieve maximum accuracy.		
SET REF	Changes frequency in current RF Field to reference frequency. "R" displays when active.		
SETUP	Accesses LTR Trunking Option Auxiliary Setup.	Accesses Setup screen.	Accesses Network Definition Configuration screen.
SETUPS	Displays the Stored Test Setups.		
SINAD	Selects SINAD Meter as active meter.		
SINAD=	Access field to set SINAD Search Function Value.		
SINE	Selects Sine as active Wave Shape.		
SINGLE	Activates Sweep Function for one pass through frequency range.		
SKIP	Skips the current test.		
SLOW	Returns to normal mode of operation following a ROLL execution. (see ROLL)		
SPEECH	Attempts to set up a Speech Call with RU selected by PFIX/IDENT,		
SPKR	Selects Speaker/Headphones as current Filter Line.		
Split	Accesses Split Screen Function. Split Screen Spectrum Analyzer allows two Center Frequencies.		
SQUARE	Selects Square as active Wave Shape.		
START	Activates a function.		Starts an Automatic Test.
STATUS	Sends a Status (SDM1) message to the RU selected by PFIX/IDENT.		
STOP	Stops an activated function.		
STORE	Stores the current trace.		
SUMMARY	Toggles between PFIX/IDENT display and GTC/ACKQ summary statistics.		
Swap	Interchanges Analyzer displays. (see, Split)		
SWEEP	Accesses menu to configure RF Generator to sweep specified frequency range. Sweep Prompt displays when active.		
SYS ALL	System-All Call is selected and starts when softkey is pressed.		
T/R	Selects T/R as RF output/input Connector. Indicator lights up.		
T/R Gate	Selects T/R as output connector. Indicator lights up. Only active when microphone is keyed.		
T-Fwd	Accesses Trunking-Forward Channel List.		
TIME	Accesses window for setting BURST Function duration. Duration ranges from 0 to 30 seconds.		
TRIANGLE	Selects Triangle as active Wave Shape.		

FUNCTION	DESCRIPTION	
T-Rvs	Accesses Trunking-Reverse Channel List.	
UB	Selects Upper Sideband Demodulation.	
UNIDIR	Sets Unidirectional Print Mode.	
UNLOCK	Disengages LOCK Function. (see LOCK)	
UNPAIR	Deactivates Pair Function. (see, PAIR)	
USER	Allows User Defined frequency.	Displays FREE REP RCV: and GEN: fields. Position the cursor on RCV: or GEN: to edit the frequency. Directly enter frequencies from 0 to 1 GHz.
uV	Sets Output Level Units to μV.	Toggles value setting.
V	Sets Output Level Units to V.	
VOICE	Selects Voice Deviation measurement.	
Vrms	Selects Vrms for Reading Units.	
W.B.	Routes Audio signal from AUDIO/DATA IN Connector to Speaker and PHONES Connector without filtering.	
WIDE	Sets System Band to Wide (800 MHz).	
WIDE	Selects Deviation Range, >25 kHz.	
x1	Alters the scaling factor for the baseband level.	
X1	Activates X1 Mode for Level.	
ZOOM	Expands current meter to full size.	

INDEX

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USER REPLACEABLE BATTERY AND FUSES

BATTERY/VOLTAGE/FUSE INSTRUCTIONS

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WARNING:

<u>HIGH VOLTAGE EQUIPMENT</u>

THIS EQUIPMENT CONTAINS CERTAIN CIRCUITS AND/OR COMPONENTS OF EXTREMELY HIGH VOLTAGE POTENTIALS, CAPABLE OF CAUSING SERIOUS BODILY INJURY OR DEATH. WHEN PERFORMING ANY OF THE PROCEDURES CONTAINED IN THIS MANUAL, HEED ALL APPLICABLE SAFETY PRECAUTIONS.

SAFETY FIRST: TO ALL SERVICE PERSONNEL

REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL.

WARNING: USING THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE ACCOMPANYING DOCUMENTATION MAY IMPAIR THE SAFETY PROTECTION PROVIDED BY THE EQUIPMENT.

CASE, COVER OR PANEL REMOVAL

Removing the Chassis Assembly from the Case Assembly exposes the technician to electrical hazards that can result in electrical shock or equipment damage.

SAFETY IDENTIFICATION IN TECHNICAL MANUAL

This manual uses the following terms to draw attention to possible safety hazards, that may exist when operating or servicing this equipment.

CAUTION: THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN EQUIPMENT OR PROPERTY DAMAGE (E.G., FIRE).

WARNING: THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN PERSONAL INJURY OR DEATH.

SAFETY SYMBOLS IN MANUALS AND ON UNITS

CAUTION: Refer to accompanying documents.

AC OR DC TERMINAL: Terminal that may supply or be supplied with ac or dc voltage.

DC TERMINAL: Terminal that may supply or be supplied with dc voltage.

AC TERMINAL: Terminal that may supply or be supplied with ac or alternating voltage.

SWITCH OFF: AC line power to the device is OFF.

SWITCH ON: AC line power to the device is ON.

DANGEROUS VOLTAGE: Indicates electrical shock hazard due to high voltage levels.

EQUIPMENT GROUNDING PRECAUTION

Improper grounding of equipment can result in electrical shock.

USE OF PROBES

Check specifications for the maximum voltage, current and power ratings of any connector on the Test Set before connecting it with a probe from a terminal device. Be sure the terminal device performs within these specifications before using it for measurement, to prevent electrical shock or damage to the equipment.

POWER CORDS

Power cords must not be frayed, broken nor expose bare wiring when operating this equipment.

USE RECOMMENDED FUSES ONLY

Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

WARNING: THE COM-120C USES A SEALED LEAD-ACID-BATTERY PACK. THE FOLLOWING WARNINGS CONCERNING LEAD-ACID BATTERIES MUST BE HEEDED:

- **DO NOT RECHARGE OUTSIDE THE COM-120C.**

- **DO NOT CRUSH, INCINERATE OR DISPOSE OF IN NORMAL WASTE.**

- **DO NOT SHORT CIRCUIT OR FORCE DISCHARGE AS THIS MIGHT CAUSE THE BATTERY TO VENT, OVERHEAT OR EXPLODE.**

CAUTION: INTEGRATED CIRCUITS AND SOLID STATE DEVICES SUCH AS MOS FETS, ESPECIALLY CMOS TYPES, ARE SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGES RECEIVED FROM IMPROPER HANDLING, THE USE OF UNGROUNDED TOOLS AND IMPROPER STORAGE AND PACKAGING. ANY MAINTENANCE TO THIS UNIT MUST BE PERFORMED WITH THE FOLLOWING PRECAUTIONS:

- BEFORE USE IN A CIRCUIT, KEEP ALL LEADS SHORTED TOGETHER EITHER BY THE USE OF VENDOR-SUPPLIED SHORTING SPRINGS OR BY INSERTING LEADS INTO A CONDUCTIVE MATERIAL.

- WHEN REMOVING DEVICES FROM THEIR CONTAINERS, GROUND THE HAND BEING USED WITH A CONDUCTIVE WRISTBAND.

- TIPS OF SOLDERING IRONS AND/OR ANY TOOLS USED MUST BE GROUNDED.

- DEVICES MUST NEVER BE INSERTED INTO NOR REMOVED FROM CIRCUITS WITH POWER ON.

- PC BOARDS, WHEN TAKEN OUT OF THE SET, MUST BE LAID ON A GROUNDED CONDUCTIVE MAT OR STORED IN A CONDUCTIVE STORAGE BAG. REMOVE ANY BUILT-IN POWER SOURCE, SUCH AS A BATTERY, BEFORE LAYING PC BOARDS ON A CONDUCTIVE MAT OR STORING IN A CONDUCTIVE BAG.

- PC BOARDS, IF BEING SHIPPED TO THE FACTORY FOR REPAIR, MUST BE PACKAGED IN A CONDUCTIVE BAG AND PLACED IN A WELL-CUSHIONED SHIPPING CONTAINER.
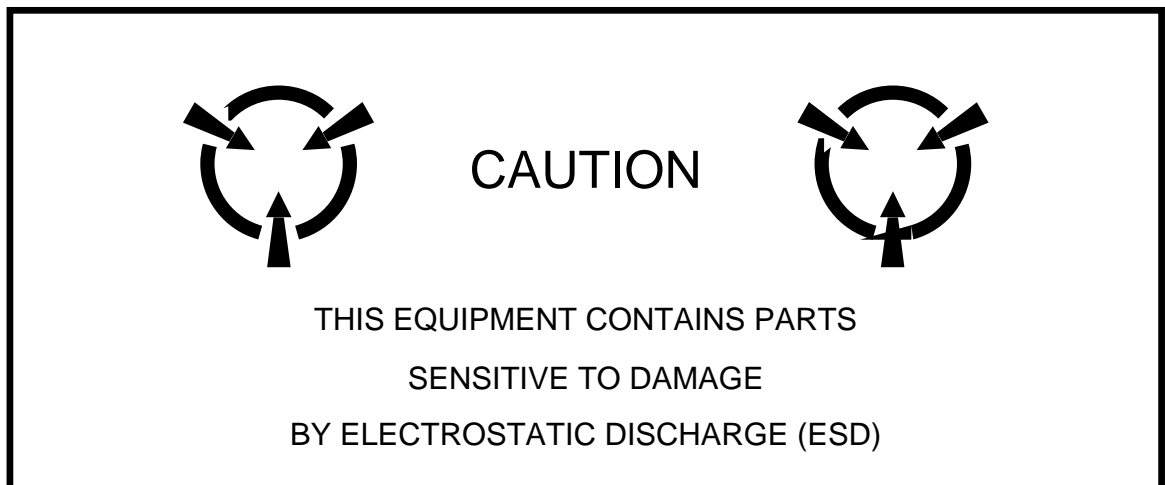
CAUTION

THIS EQUIPMENT CONTAINS PARTS

SENSITIVE TO DAMAGE

BY ELECTROSTATIC DISCHARGE (ESD)

CAUTION: SIGNAL GENERATORS CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE (EMI) TO COMMUNICATION RECEIVERS. SOME TRANSMITTED SIGNALS CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICES OUT TO A DISTANCE OF SEVERAL MILES. USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION THAT RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND ENSURE COMPLIANCE WITH INSTRUCTIONS IN FAA CIRCULAR AC 170-6C, DATED FEBRUARY 19, 1981.

POWER SOURCE REQUIREMENT

The Internal Battery, if installed, charges automatically whenever the COM-120C is connected to a power source and the Main Power Switch is set to ON.

The Power Supply is designed to sense applied voltage and automatically compensate with no further actions required.

*NOTE:* Fans may operate when unit is OFF but plugged in or Internal Battery installed.

AC FUSE REPLACEMENT

o   Disconnect ac power from COM-120C.

o   Depress clip on underside of AC FUSE Holder and pull straight out.

o   Remove AC FUSE Holder and remove fuse.

Insure proper fuse is installed in AC FUSE Holder.

Fuses provided include two 3.0 A, 250 V, Type F, 5 X 20 mm fuses for ac operation.

o   Replace fuse and reinstall AC FUSE Holder.
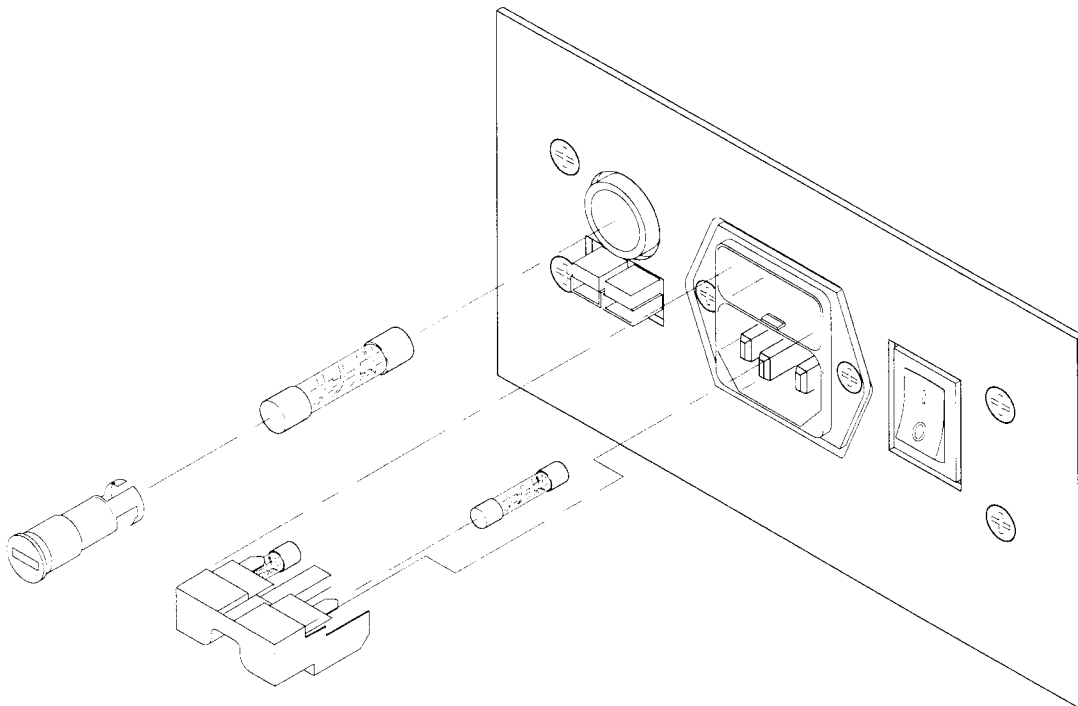
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COM-120C AC & DC Fuse Location

DC FUSE REPLACEMENT

o   Disconnect all external power connections.

o   Use a slotted tool to depress DC FUSE Holder (1) and turn counter clockwise.

o   Remove DC FUSE Holder and remove fuse.

   Insure proper fuse is installed in DC FUSE Holder.

   Fuse provided:
   10 A, 32 V, Type F, AGC fuse for dc operation.

o   Replace fuse and reinstall DC FUSE Holder.

BATTERY REPLACEMENT

The following procedure should be followed when replacing the battery.
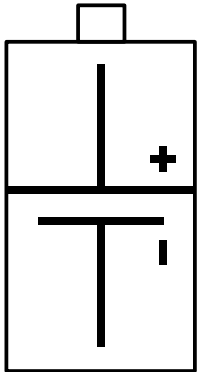
WARNING:
   THE BATTERY USED IS A SEALED LEAD-ACID BATTERY PACK.   THE FOLLOWING WARNINGS CONCERNING LEAD-ACID BATTERIES MUST BE HEEDED.

   DO NOT CRUSH, INCINERATE OR DISPOSE OF IN NORMAL WASTE.   PROPER DISPOSAL FOR DISCARD OF BATTERY IS REQUIRED. REFER TO APPROPRIATE STATE AND LOCAL REGULATIONS FOR INSTRUCTIONS AS TO PROPER DISPOSITION OF DISCARDED BATTERIES.

   DO NOT RECHARGE OUTSIDE THE COM-120C.

   DO NOT SHORT CIRCUIT OR FORCE DISCHARGE AS THIS MIGHT CAUSE THE BATTERY TO VENT, OVERHEAT OR EXPLODE.

⚠

CAUTION:
 REPLACE BATTERY WITH IFR PART NUMBER 4000-0000-011 BATTERY ONLY.

⚠

CAUTION:
 DO NOT USE OR CONNECT A NON-RECHARGEABLE BATTERY TO THE
 TERMINALS. DANGER OF OVERHEAT OR FIRE.

NOTE: Option 01 required for battery operation.

Internal Battery, if installed, charges automatically whenever unit is connected to a power source and Main Power Switch is set to ON.
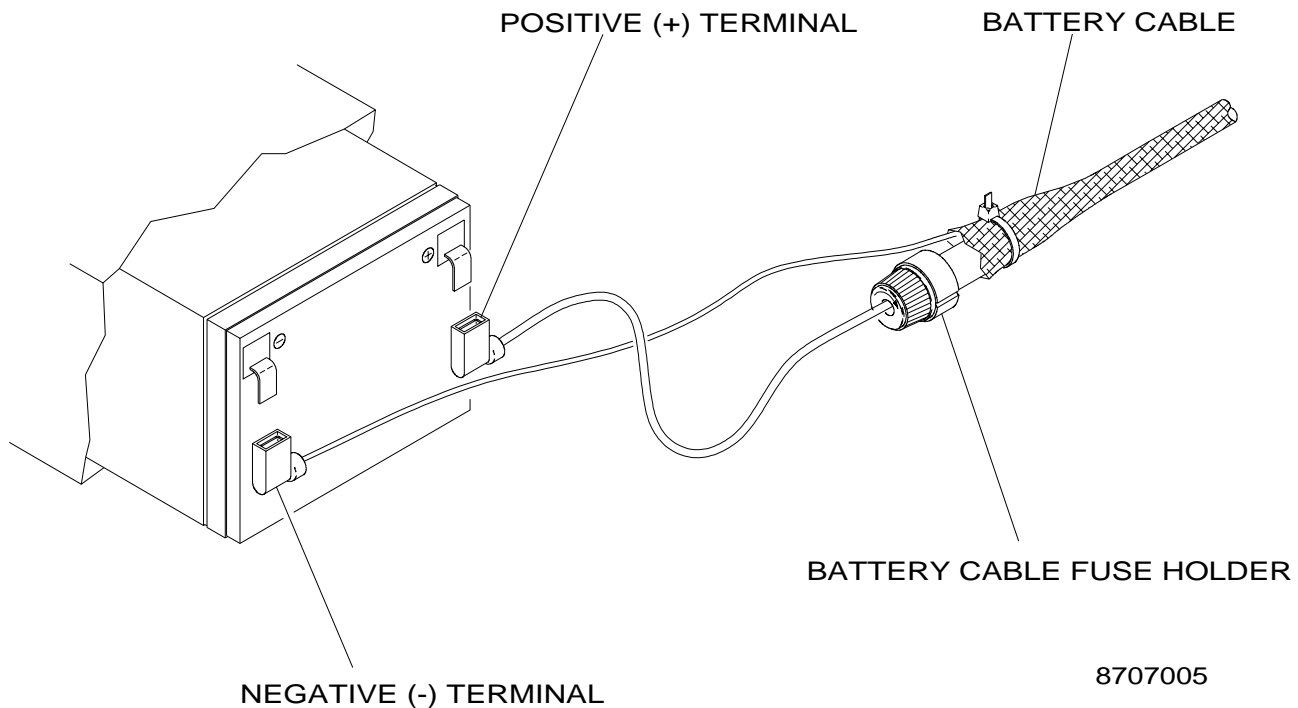
o   Set COM-120C Main Power Switch to OFF ("0" on switch).

o   Remove all power sources and disconnect all measuring terminals from COM-120C.

o   Loosen 4 Screws on Battery Access Panel. Remove Battery Access Panel.

o   Disconnect Positive (+) and Negative (-) Terminals from battery.

o   Remove Battery from cavity.

o   Install replacement battery in cavity.

o   Connect Positive (+) and Negative (-) Terminals to replacement battery. Install Battery Access Panel.

NOTE: For continued EMC compliance with EN61000-3-2:1995/A14:2000,always allow a discharged battery to recharge in Stand-by Mode.

BATTERY FUSE REPLACEMENT

The following procedure should be followed when replacing the battery fuse.

o   Set COM-120C Main Power Switch to OFF.

o   Remove all power sources from COM-120C.

o   Loosen 4 screws on Battery Access Panel.

o   Remove Battery Access Panel.

o   Disconnect Positive (+) and Negative (-) Terminals from battery.

o   Remove Battery from cavity.

o   Pull Battery cable out of COM-120C until Battery Fuseholder is exposed.

o   Unscrew Battery Cable Fuseholder cap and remove fuse.

o   Replace fuse with 10 A, 32 V, Type F, AGC fuse.

o   Feed Battery Cable into Chassis.

o   Install Battery in cavity.

o   Connect Positive (+) and Negative (-) Terminals to Battery. Install Battery Access Panel.

POSITIVE (+) TERMINAL   BATTERY CABLE

BATTERY CABLE FUSE HOLDER

8707005

NEGATIVE (-) TERMINAL

COM-120C Battery and Battery Cable

Web www.ifrsys.com   Email info@ifrsys.com