

FM/AM-1000S OPERATOR'S GUIDE

INTRODUCTION:

This publication was developed to aid the communication service technician in measuring certain common transmitter and receiver performance parameters. Tests included were selected because of appropriateness, application to as wide a spectrum of equipment as possible, and minimum amount of auxiliary equipment required to perform the test.

The scope of this publication does not allow the inclusion of specific troubleshooting techniques, nor guarantee that the included test will be suitable for all applications. Consult material from the equipment manufacturer for other tests that are appropriate, or specific test requirements. Consult the IFR FM/AM-1000S Operation and Maintenance Manual for details of 1000S operation and 1000S specifications.

IFR Inc. assumes no liability for damage to equipment or personnel resulting from the misuse of IFR equipment, these test procedures, or equipment serviced by IFR equipment. See "CAUTIONS" on following page.

Perform tests exactly as given. Careful attention must be paid to antenna loading, impedance matching and the use of attenuators (if needed). FM/AM-1000S controls, indicators, and connectors are identified by index numbers. Items on other equipment are designated by generic name. This publication is written for FM/AM-1000S sets S/N 801 and on.

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CAUTIONS

REFER TO LIST OF CONTROLS, INDICATORS, AND CONNECTORS FOR COMPONENT IDENTIFICATION.

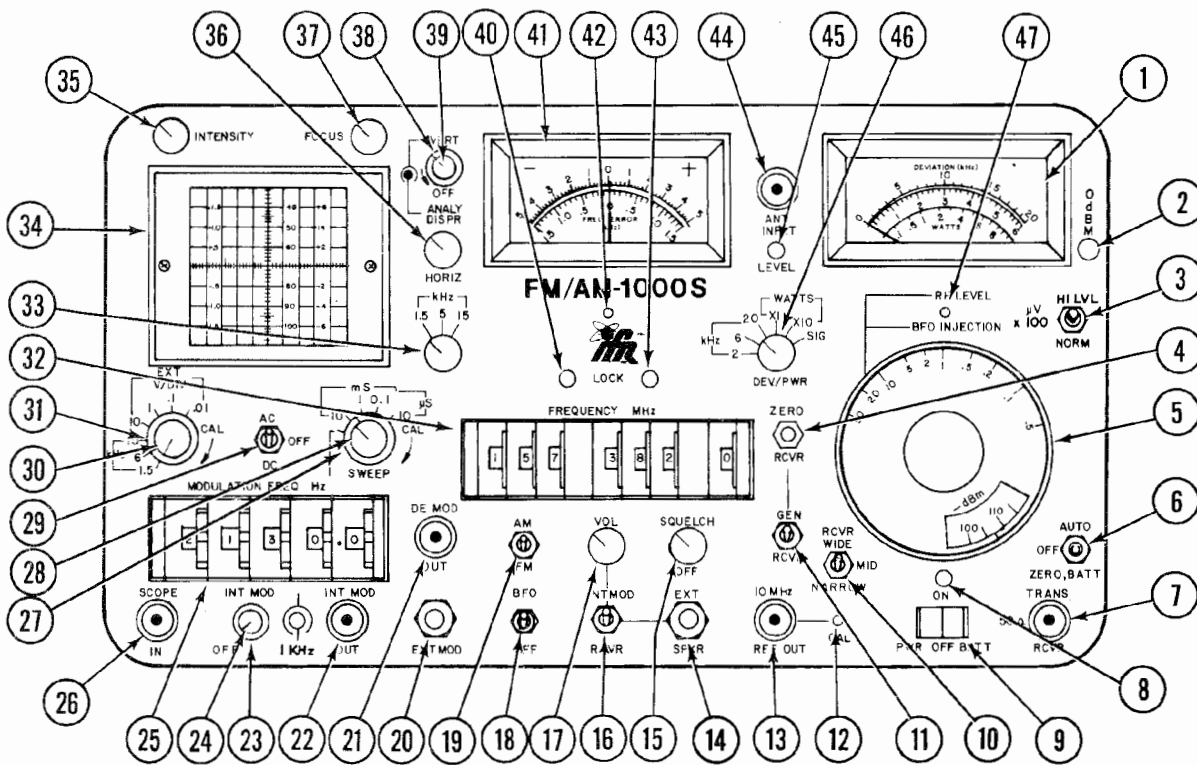
1. Antenna Connector (44) is used for "over the air" testing only. Do **not** connect a transmitter to this input.
2. Maximum ON time for measurement of transmitter output using TRANS/RCVR Connector (7) is:
 - 100 W = 10 sec. max. ON time, 60 sec. minimum OFF time.
 - 50 W = 20 sec. max. ON time, 40 sec. minimum OFF time.
 - 30 W = 2 min. max. ON time, 2 min. minimum OFF time.
 - 15 W Continuous.
3. Do **not** connect transmitter output to any jack other than TRANS/RCVR Connector (7).
4. Do **not** exceed 200 V into "SCOPE IN" Connector (26).
5. If the 1000S is plugged into a vehicle's DC supply, disconnect the 1000S while starting the engine.
6. Remove any possible static charge from an unterminated antenna or cable before connecting to the 1000S.
7. Do **not** force RF/BFO Level Control (5) past the stops.

TABLE OF CONTENTS

LIST OF CONTROLS, INDICATORS, AND CONNECTORS		5
RECEIVER TESTS —	INITIAL RCVR TEST SETUP	7
	12 dB SINAD SENSITIVITY	9
	20 dB QUIETING SENSITIVITY	13
	MODULATION ACCEPTANCE BANDWIDTH	15
	SQUELCH THRESHOLD AND DIFFERENTIAL	19
TRANSMITTER TESTS —	INITIAL XMTR TEST SETUP	21
	CARRIER FREQUENCY	23
	CARRIER POWER	25
	TONE FREQUENCY	27
	AM MODULATION	29
	SPECTRAL PURITY	31
	FM DEVIATION (thru ± 15 kHz)	33
	FM DEVIATION (above ± 15 kHz)	35
	RECEIVED SIGNAL STRENGTH	37
	AUDIO DISTORTION	39
dBm- microvolt correlation chart (soft microvolts)		41

NOTE:

Each 1000S control, indicator, or connector is designated by a reference number in quotes (""). Designators used in a test are referenced to the left-hand page illustration(s) for that test.

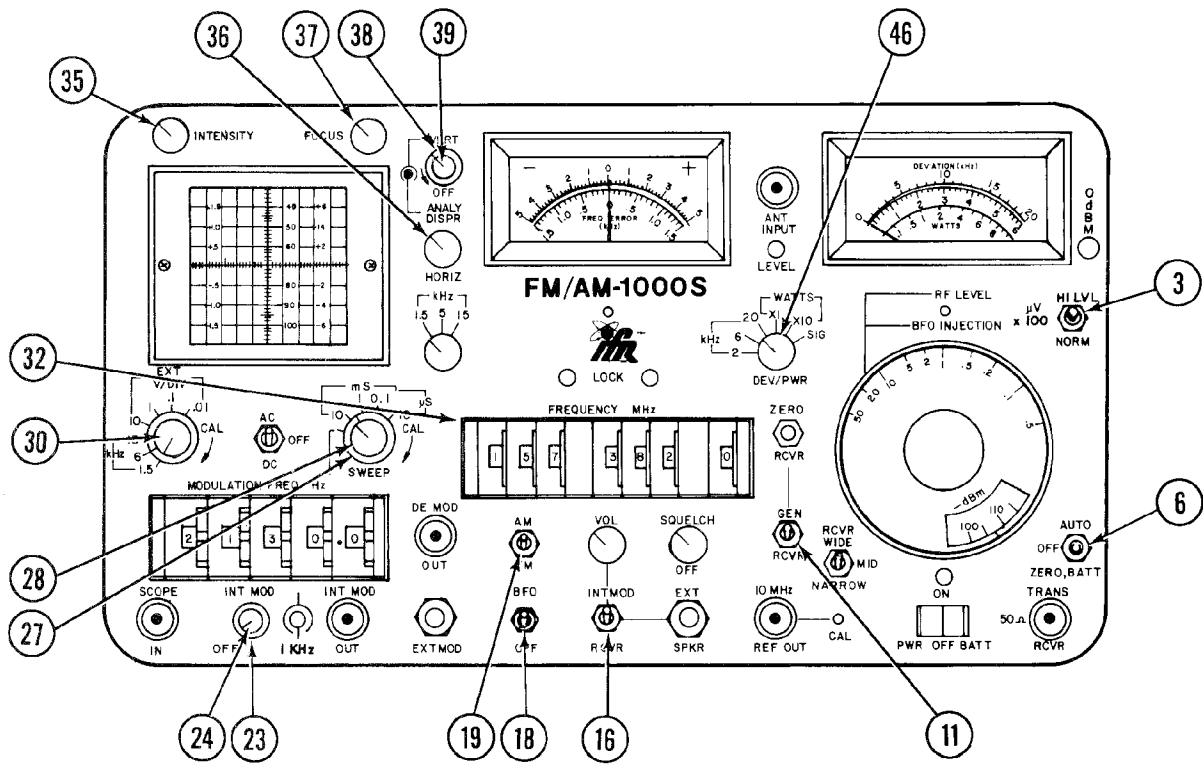


4

CONTROLS, INDICATORS AND CONNECTORS

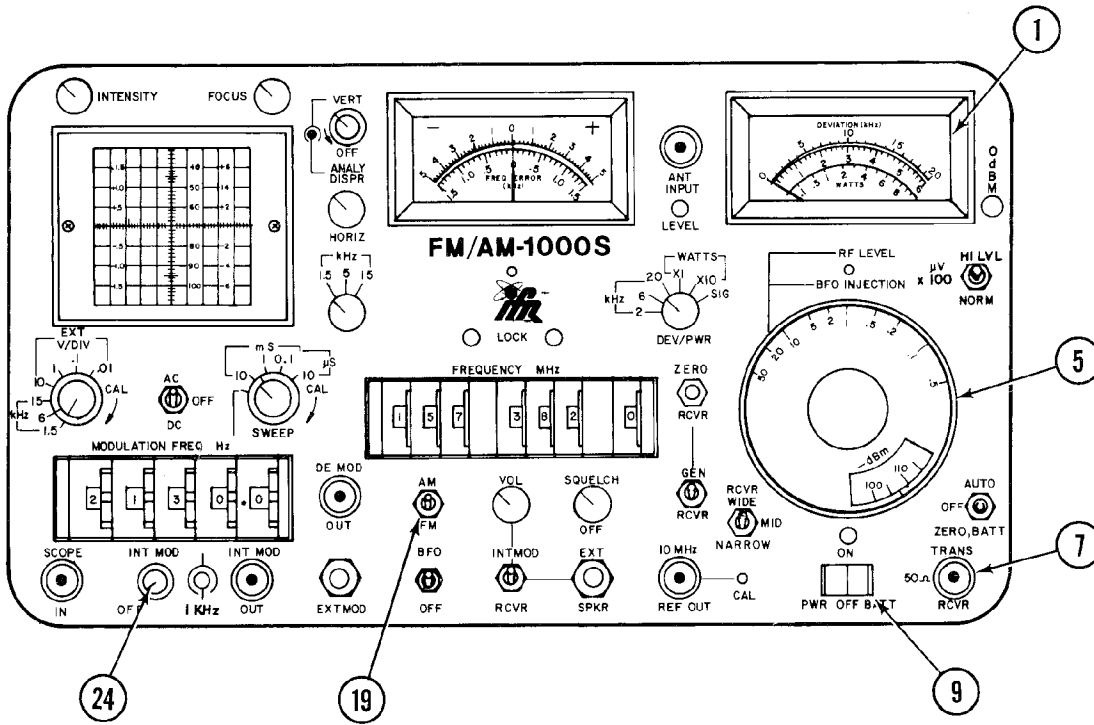
No.		No.	
1	Meter, DEV/PWR	25	Thumbwheels, MODULATION FREQ Hz
2	Indicator, 0 dBm	26	Connector, SCOPE IN
3	Switch, RF/BFO Level Range	27	Control, SWEEP
4	Control, ZERO RCVR	28	Control, SWEEP Vernier
5	Control, RF/BFO Level	29	Switch, Scope Coupling Mode
6	Switch, AUTO ZERO/BATT	30	Control, Vertical Sensitivity Vernier
7	Connector, TRANS/RCVR	31	Switch, Oscilloscope Vertical Sensitivity
8	Indicator, Power On	32	Thumbwheels, FREQUENCY MHz
9	Switch, Power	33	Switch, Frequency Error Range
10	Switch, Receiver Bandwidth Selector	34	Display, CRT
11	Switch, GEN/RCVR Mode	35	Control, INTENSITY
12	Adjustment, 10 MHz CAL Screwdriver	36	Control, HORIZ
13	Connector, 10 MHz REF OUT	37	Control, FOCUS
14	Connector, EXT SPKR	38	Control, VERT/ANALY ON-OFF
15	Control, SQUELCH	39	Control, ANALY DISPR
16	Switch, INT MOD/RCVR	40	Lamp, High Frequency Phase LOCK
17	Control, Speaker Volume	41	Meter, Frequency Error
18	Switch, BFO ON/OFF	42	Adjustment, Frequency Error Meter Zero
19	Switch, AM/FM	43	Lamp, Low Frequency Phase LOCK
20	Connector, EXT MOD	44	Connector, ANT
21	Connector, DEMOD OUT	45	Lamp, INPUT LEVEL
22	Connector, INT MOD OUT	46	Switch, DEV/PWR Meter Function
23	Control, VAR INT MOD	47	Adjustment, DEV/PWR Meter Zero
24	Control, 1 kHz INT MOD		

5



INITIAL RCVR TEST SETUP

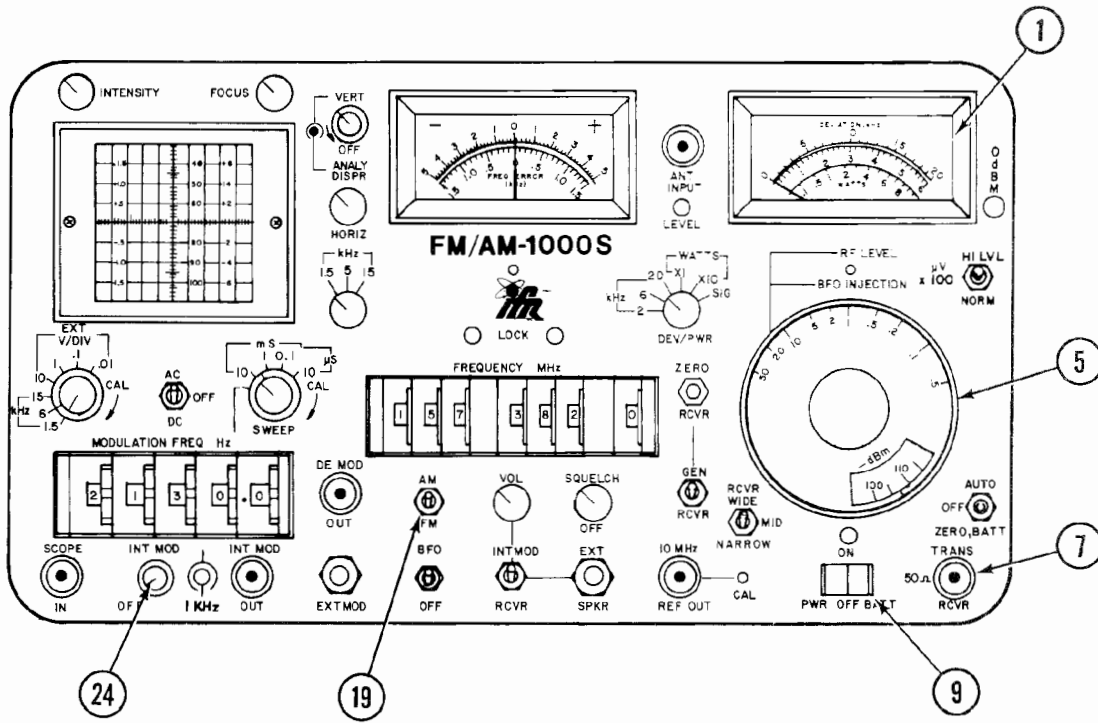
STEP	CONTROL	SETTING
1	3	NORM
	6	AUTO
	11	GEN
	16	RCVR
	18	OFF
	19	as req'd
	23	OFF
	24	OFF
	27	as req'd
	28	full cw, detent
	30	full cw, detent
	32	desired freq.
	35	as req'd
	36	as req'd
	37	as req'd
	38	as req'd
39	OFF	
46	6 kHz.	



RCVR 12 dB SINAD SENSITIVITY (1 of 2)

Equipment Req'd: Distortion Analyzer, cables with appropriate connectors.

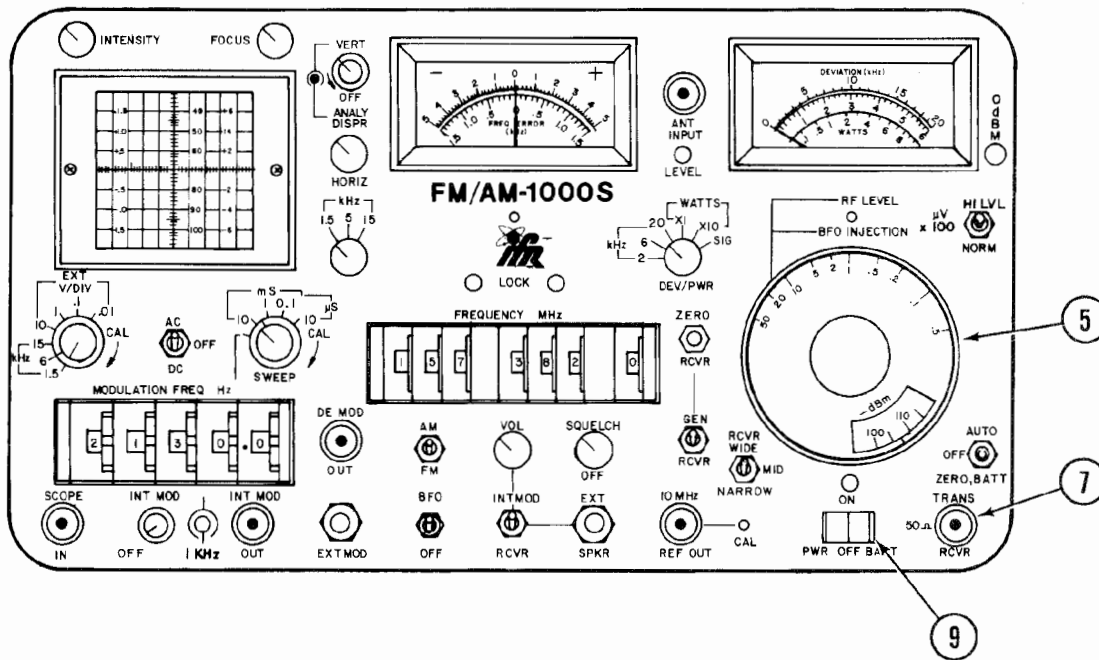
STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform RCVR TEST SETUP procedure.
2	5	full ccw	Connect coax from "7" to RCVR ANT terminals.
	19	FM	Connect coax from RCVR speaker terminals to Distortion Analyzer input.
3	9	ON	Set "24" for 2/3 of desired system deviation, as displayed on "1".
	24	as req'd	
4	RCVR 5	ON as req'd	Set "5" for full quieting of received signal.
5	AF Gain		Set AF Gain and Distortion Analyzer controls for null on Analyzer Meter.
6			Set Distortion Analyzer Function switch to AC Volts position. Set RCVR AF Gain for reference level on Analyzer Meter.



10

RCVR 12 dB SINAD SENSITIVITY (2 of 2)

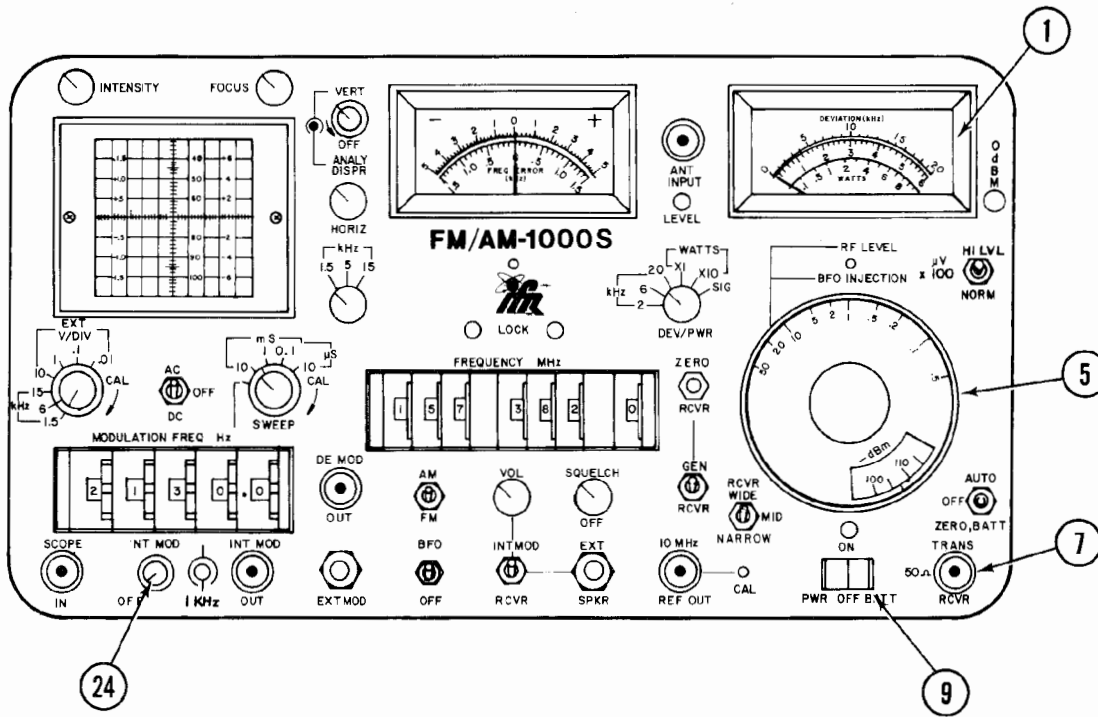
STEP	CONTROL	SETTING	ACTION/RESULT
7			Select between AC Voltmeter and Distortion positions on Analyzer Function switch and note difference in meter readings.
8			Vary "5" and repeat step 7 until difference in meter readings is 12 dB. Setting of "5" is 12 dB SINAD sensitivity. Record. NOTE: 12 dB is 1/4 of reference level set in Step 6.



RCVR 20 dB QUIETING SENSITIVITY

Equipment Req'd: AC Voltmeter, cables with appropriate connectors.

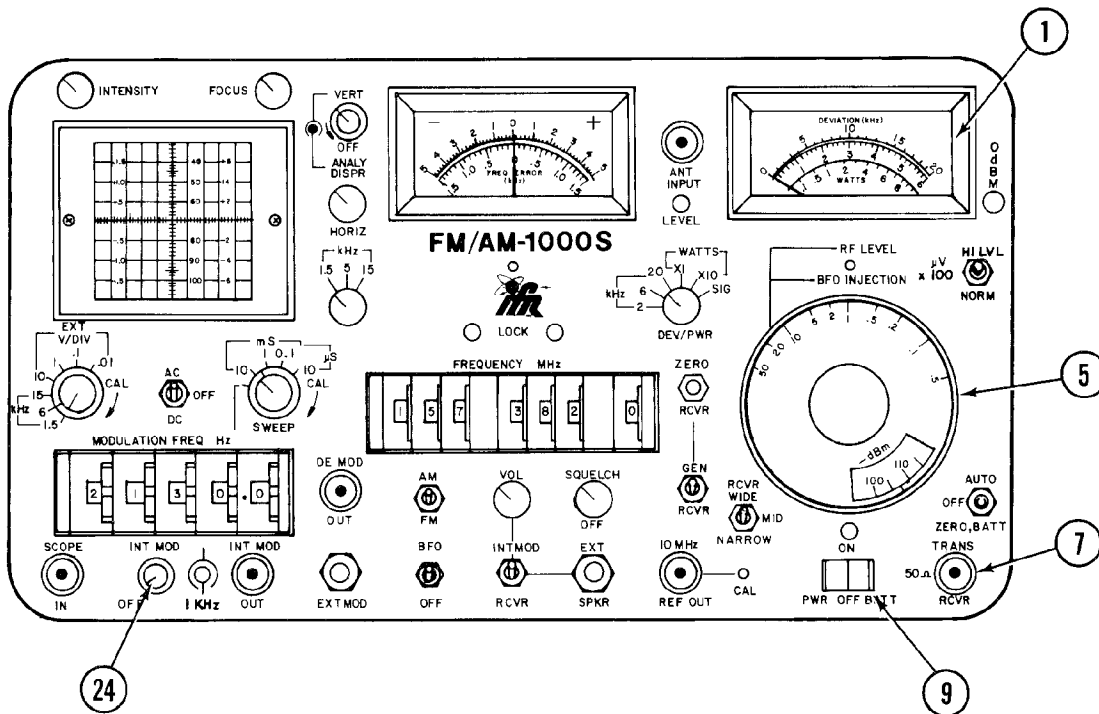
STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform RCVR TEST SETUP procedure.
2			Connect coax from RCVR speaker terminals to AC Voltmeter input. Connect coax from "7" to RCVR ANT terminals.
3	RCVR Squelch Voltmeter	ON OFF ON	Set RCVR AF Gain for reference level on AC Voltmeter. Record.
4	5 9	full ccw ON	Rotate "5" cw until AC Voltmeter reading is 1/10 of level recorded in step 3. Record. Setting of "5" is RCVR sensitivity for 20 dB quieting.



FM RCVR MODULATION ACCEPTANCE BANDWIDTH (1 of 2)

Equipment Req'd: Distortion Analyzer, cables with appropriate connectors.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform 12 dB SINAD SENSITIVITY TEST procedure.
2			Perform RCVR TEST SETUP procedure.
3			Connect coax from "7" to RCVR ANT terminals. Connect coax from RCVR speaker terminals to Distortion Analyzer input.
4	24 Squelch AF Gain RCVR Analyzer 9 5	ON OFF as req'd ON ON ON as req'd	Set AF Gain to max. rated output. Set "5" for 6 dB above level recorded in 12 dB SINAD SENSITIVITY TEST.
5	24	as req'd	Set "24" for audible tone output from RCVR.
6			Set Distortion Analyzer controls for null on Analyzer Meter.

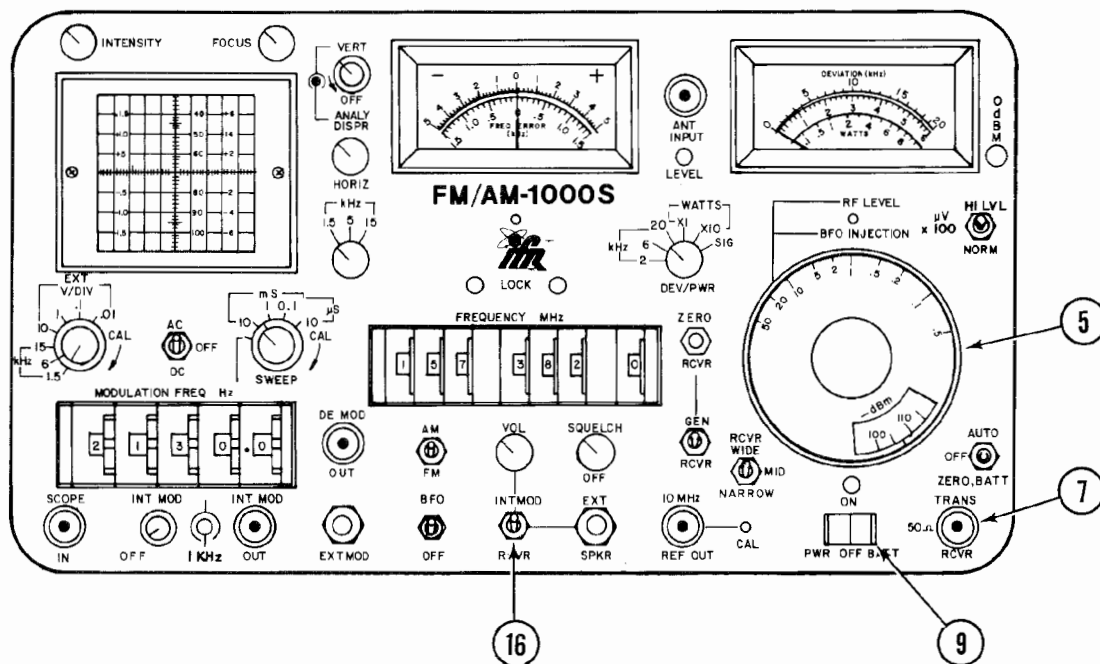


16

RCVR MODULATION ACCEPTANCE BANDWIDTH (2 of 2)

STEP	CONTROL	SETTING	ACTION/RESULT
7	24	as req'd	Set "24" to level used in 12 dB SINAD SENSITIVITY TEST. Select between AC Voltmeter and Distortion positions on Analyzer Function switch, and note difference in meter readings.
8			Vary "24" above level used in step 7 and repeat step 7 until 12 dB difference in meter readings is noted. Record deviation on "1".
9			Multiply result of step 8 by 2. Record. Result is RCVR modulation acceptance bandwidth.

17



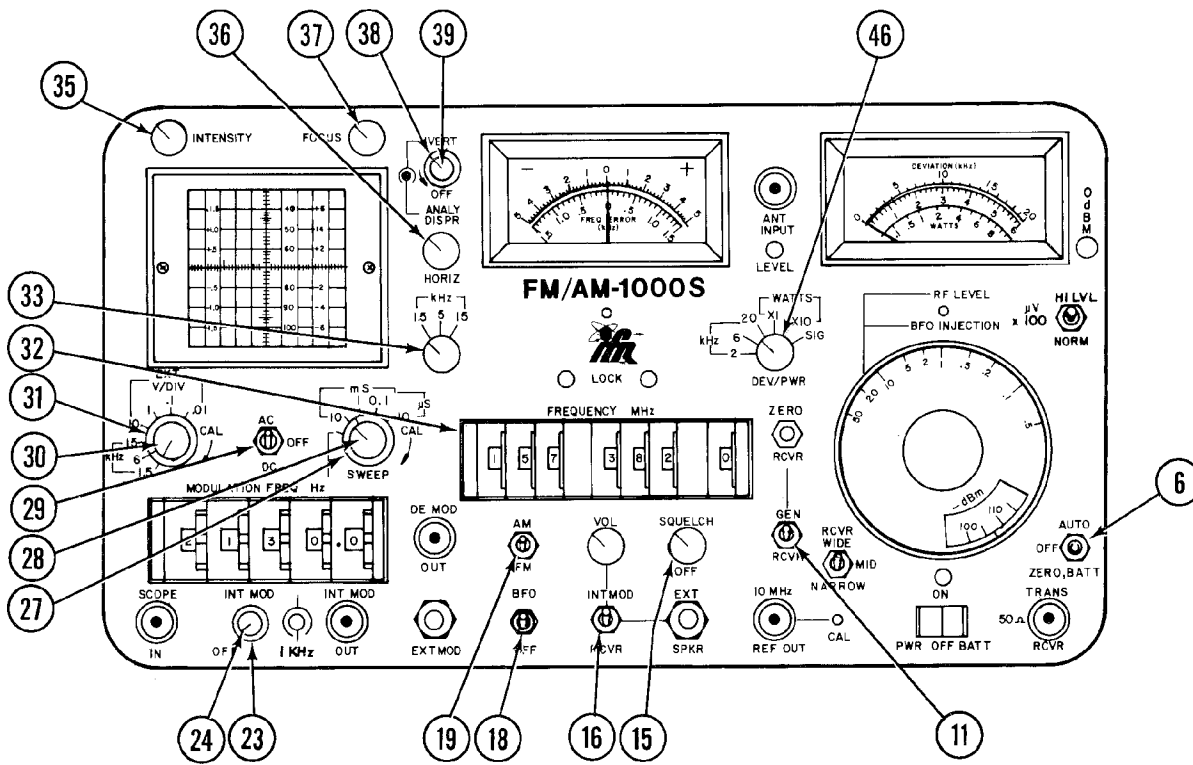
18

RCVR SQUELCH THRESHOLD AND DIFFERENTIAL

Equipment Req'd: Cable with appropriate connectors.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform RCVR TEST SETUP procedure.
2			Connect coax from "7" to RCVR ANT terminals.
3	5 16 Squelch RCVR AF Gain	full ccw RCVR OFF ON as req'd	Increase AF Gain until noise is heard from speaker.
4	Squelch	as req'd	Adjust Squelch control until RCVR is just quieted.
5	9	ON	Rotate "5" cw until squelch is just deactivated. This is the RCVR squelch threshold. Record setting of "5".
6			Rotate "5" ccw until squelch just operates. Record setting of "5".
7			Calculate squelch differential by subtracting step 6 result from step 5 result.

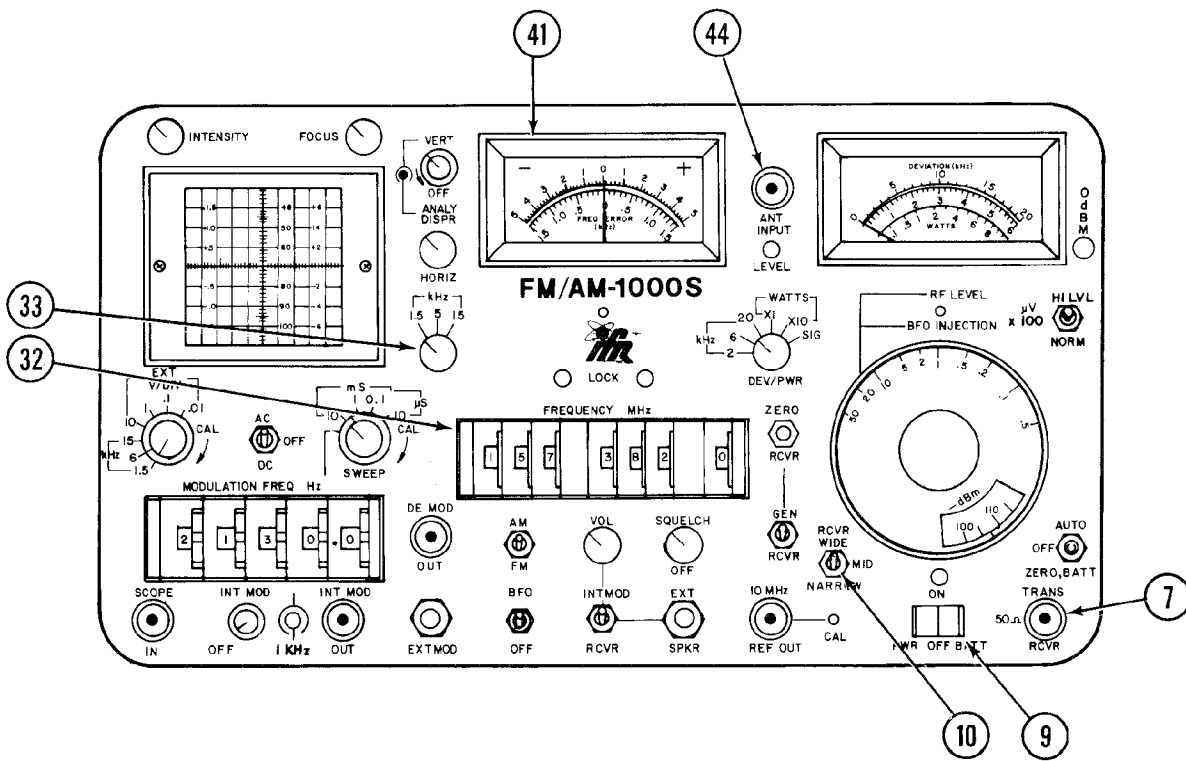
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20

INITIAL XMTR TEST SETUP

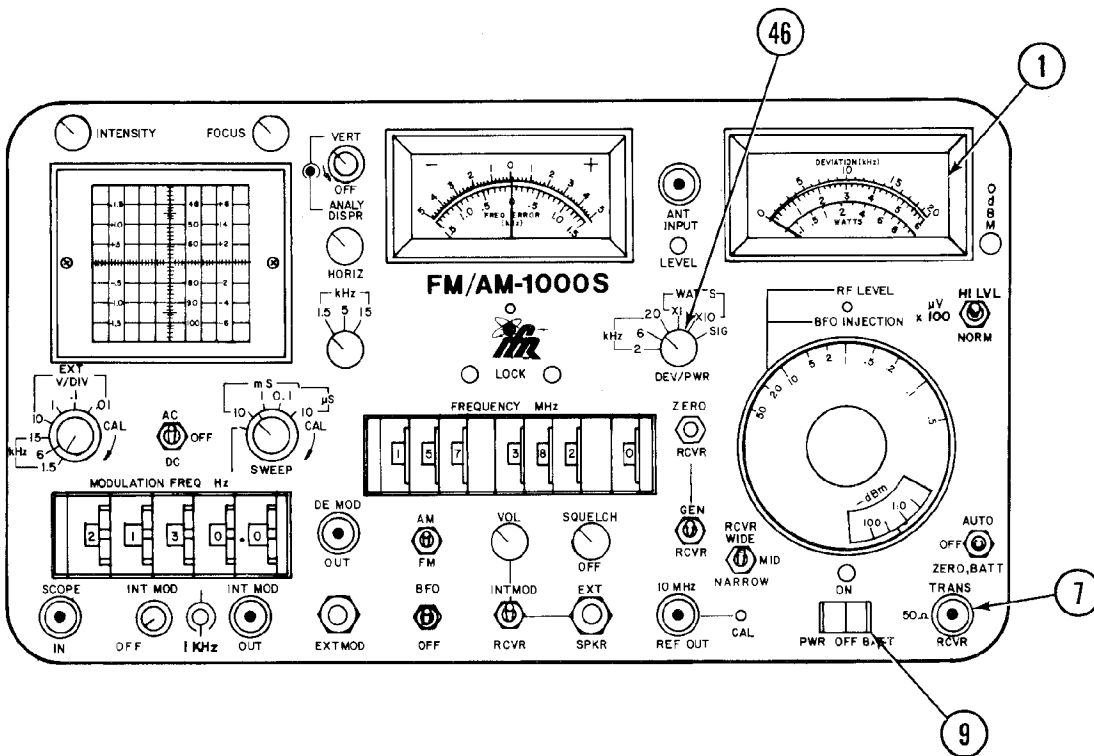
STEP	CONTROL	SETTING
1	6	AUTO
	11	RCVR
	15	ON
	16	RCVR
	18	OFF
	19	as req'd
	23	OFF
	24	OFF
	27	as req'd
	28	full cw, det.
	29	DC
	30	full cw, det.
	31	as req'd
	32	as req'd
	33	15 kHz
	35	as req'd
	36	as req'd
	37	as req'd
	38	as req'd
	39	full ccw, det.
	46	SIG



XMTR CARRIER FREQUENCY

Equipment Req'd: 1000S antenna, or cable with appropriate connectors.

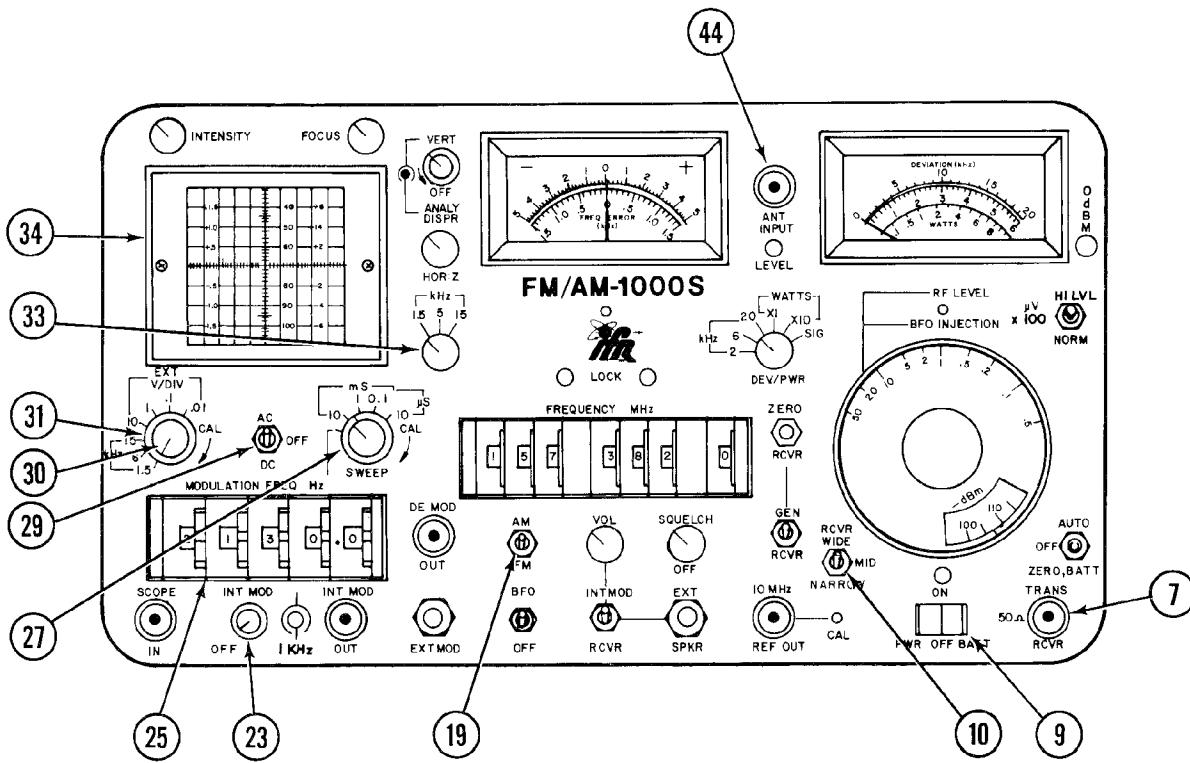
STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform XMTR TEST SETUP procedure.
2			Connect antenna to "44", or connect coax from XMTR output to "7". CAUTION: DO NOT CONNECT XMTR OUTPUT TO ANY JACK OTHER THAN "7".
3	10 33 9 XMTR 32	NARROW 5 kHz ON ON XMTR Freq	Key XMTR. CAUTION: DO NOT EXCEED PWR INPUT LIMITS. Select "32" so that needle of "41" is as close to 0 frequency error as possible.
4	33 32	15 or 1.5 kHz (as needed) as req'd	Select "32" so that needle of "41" is as close to 0 frequency error as possible. Frequency error shown on "41" + setting of "32" is XMTR carrier frequency.



XMTR CARRIER POWER

Equipment Req'd: Cable with appropriate connectors.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform XMTR TEST SETUP procedure.
2			Connect coax from XMTR output to "7". CAUTION: DO NOT CONNECT XMTR OUTPUT TO ANY JACK OTHER THAN "7".
3	46 9 XMTR	X1 or X10 ON ON	Key XMTR, and read XMTR output power on "1". CAUTION: DO NOT EXCEED PWR INPUT LIMITS.

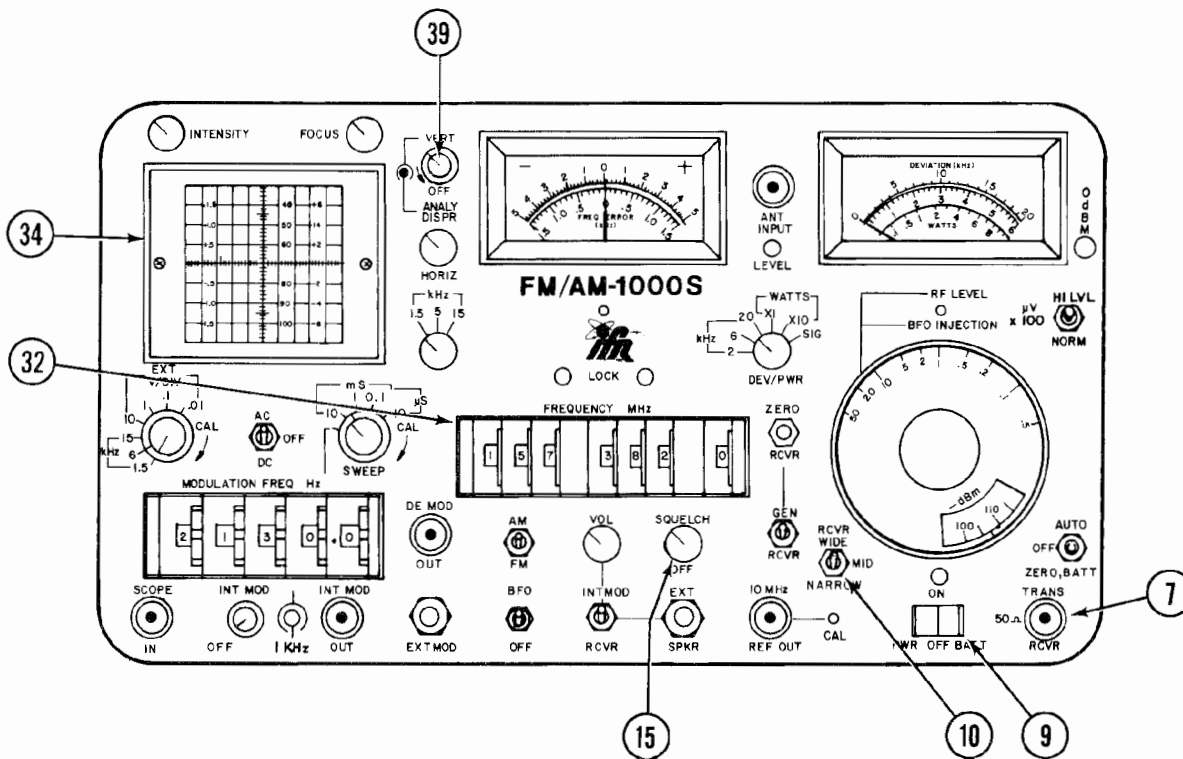


26

XMTR TONE FREQUENCY

Equipment Req'd: 1000S antenna, or cable with appropriate connectors.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform XMTR TEST SETUP procedure.
2			Connect antenna to "44", or connect coax from XMTR output to "7". CAUTION: DO NOT CONNECT XMTR OUTPUT TO ANY JACK OTHER THAN "7".
3	10 27 31 33 29 19 9	MID MOD FREQ Hz 1.5, 6 or 15 1.5 kHz AC FM ON	Set "23" & "30" for approx. equal vertical and horizontal displacement of trace on "34".
4	XMTR 25	ON as req'd	Key XMTR. CAUTION: DO NOT EXCEED PWR INPUT LIMITS. Select frequency on "25" for stationary, or slowest revolving 1st order Lissajou figure. Setting of "25" is tone frequency.



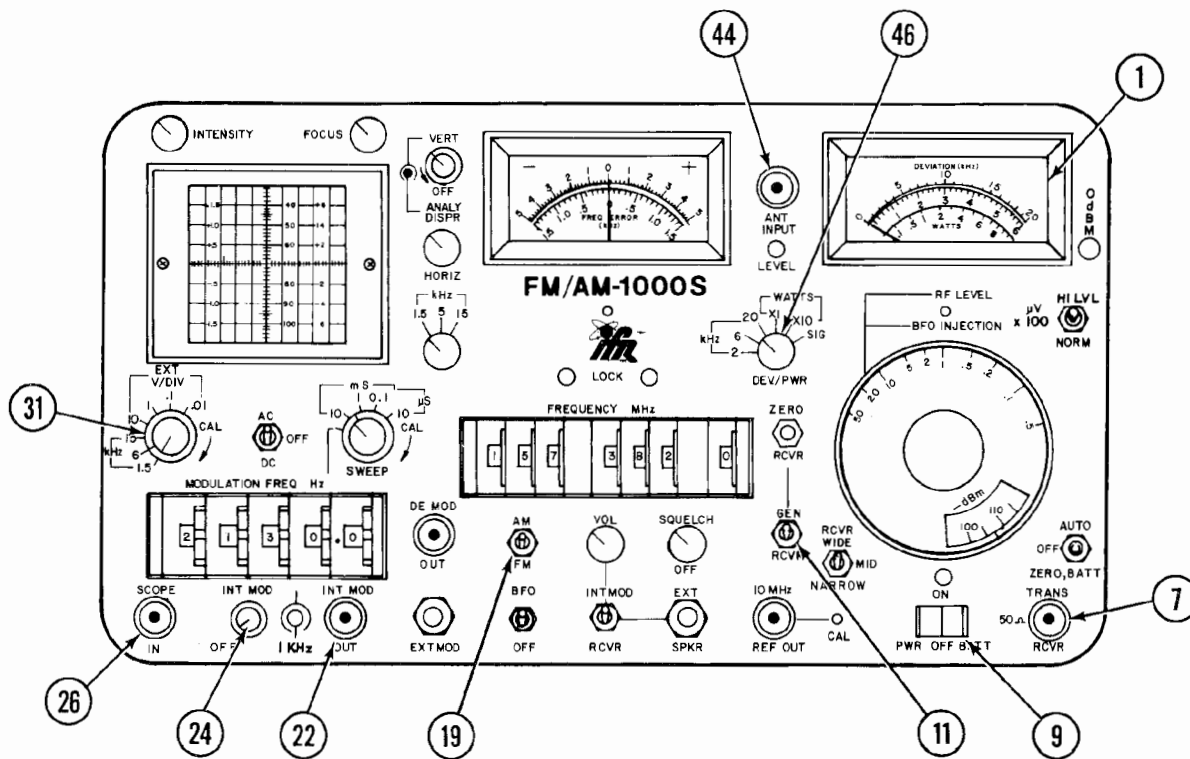
30

XMTR SPECTRAL PURITY

Equipment Req'd: Cable with appropriate connectors.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform XMTR TEST SETUP procedure.
2	10 15 39	WIDE OFF full cw	Connect coax from XMTR output to "7". CAUTION: DO NOT CONNECT XMTR OUTPUT TO ANY JACK OTHER THAN "7".
3	9 XMTR 32	ON ON as req'd	Key XMTR. Select "32" in desired increments above and below carrier frequency while observing "34" for unwanted signals.* CAUTION: DO NOT EXCEED PWR INPUT LIMITS. NOTE: With Analyzer set for wide dispersion; a low-level spurious signal, 2 MHz below carrier frequency, is possible.
4	32	as req'd	Adjust "39" full ccw, not detent. Observe "34" for unwanted signals.*

*NOTE: Verify spurious signals are XMTR generated by rocking 1 or 0.1 MHz digit of "32". If spurious signals do not change relationship to main signal, they are XMTR generated.



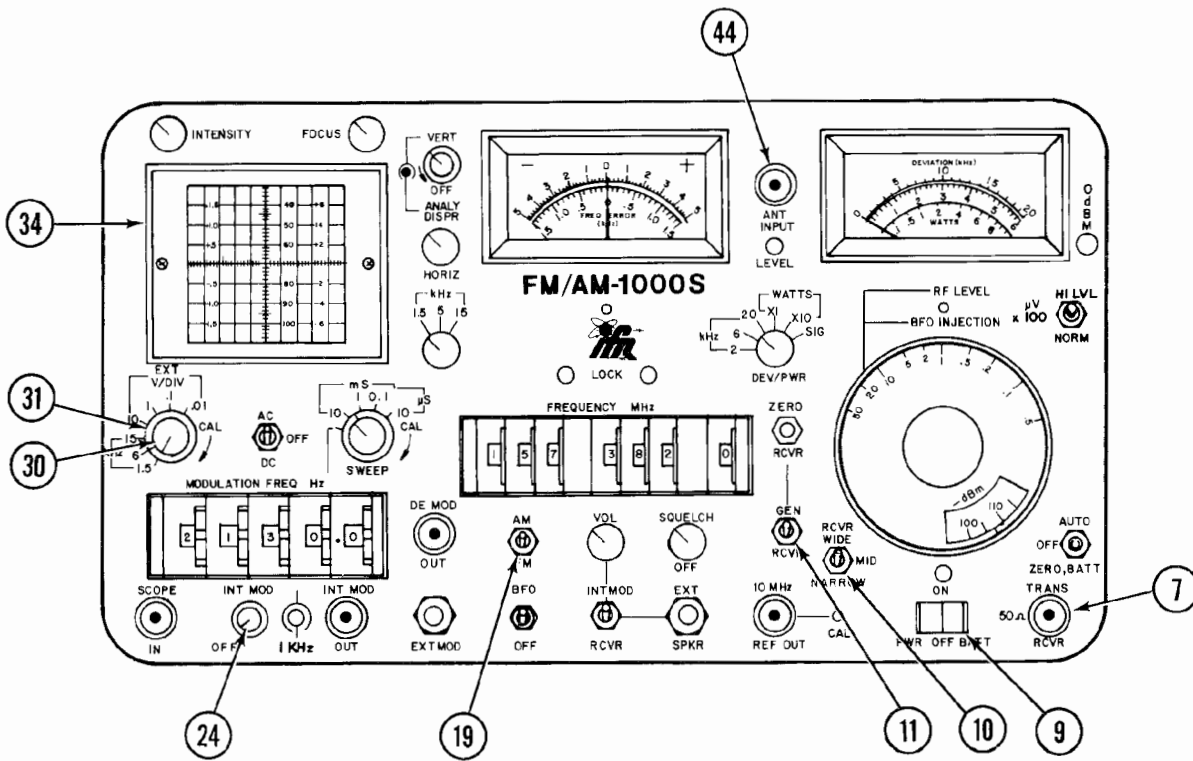
32

XMTR FM DEVIATION (thru ± 15 kHz)

Equipment Req'd: 1000S antenna, cables with appropriate connectors.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform XMTR TEST SETUP procedure.
2	11 19 24 31 46 9	RCVR FM ON 1 μ V/div. 6 kHz ON	
3			Connect coax from "22" to "26". Set "24" for desired output voltage, as specified by manufacturer. Remove coax from "26".
4	11	RCVR	Connect antenna to "44", or connect coax from XMTR output to "7". CAUTION: DO NOT CONNECT XMTR OUTPUT TO ANY JACK OTHER THAN "7". Connect coax from "22" to XMTR MIC input.
5	XMTR	ON	Key XMTR. Read deviation on "1". CAUTION: DO NOT EXCEED PWR INPUT LIMITS.

33



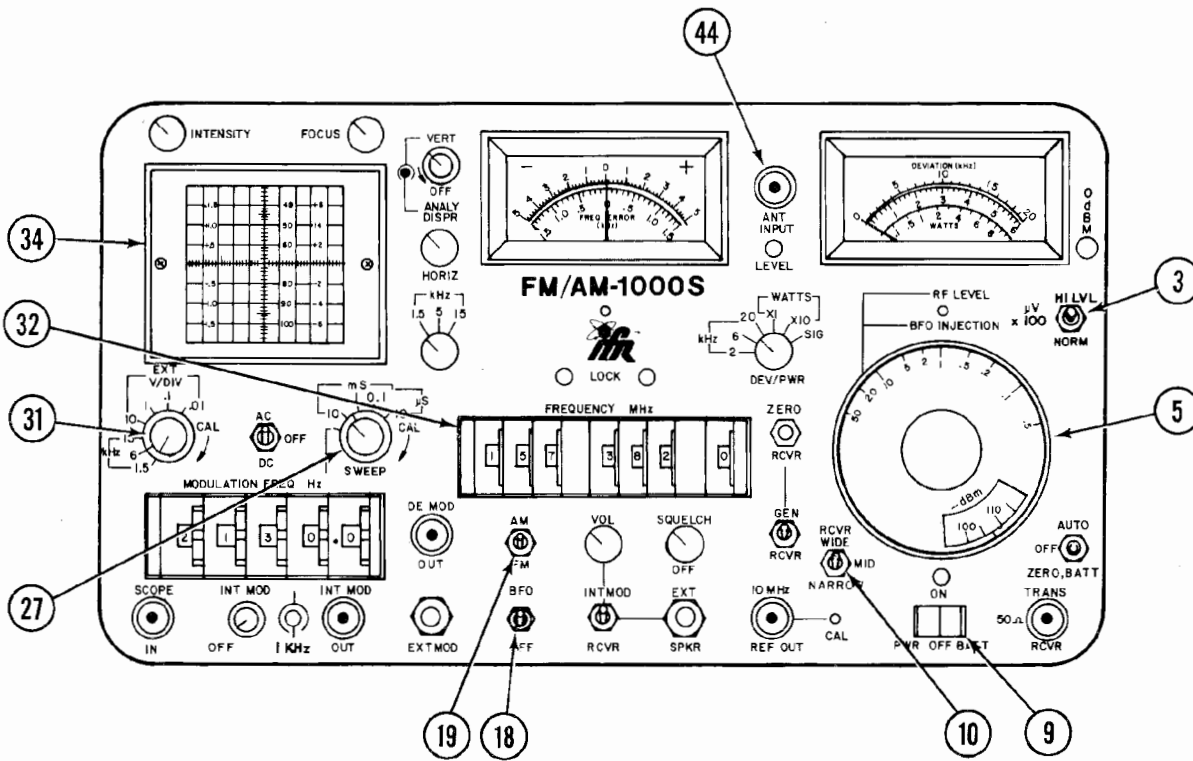
34

XMTR FM DEVIATION (above ± 15 kHz)

Equipment Req'd: 1000S antenna, or cable with appropriate connectors.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform XMTR TEST SETUP procedure.
2	10 11 19 24 31 9	WIDE GEN FM ON 15 kHz/div. ON	
3	24	as req'd	Adjust "24" for ± 10 kHz dev. as displayed on "34" (4 div P-P).
4	30	as req'd	Rotate "30" ccw, out of detent, until trace on "34" is 1 div. P-P.
5	11	RCVR	Connect antenna to "44" or connect coax from XMTR output to "7". CAUTION: DO NOT CONNECT XMTR OUTPUT TO ANY JACK OTHER THAN "7".
6	XMTR	ON	Key XMTR. CAUTION: DO NOT EXCEED PWR INPUT LIMITS. Measure FM dev. as displayed on "34". NOTE: 1 div. on "34" = 20 kHz dev. instead of 5 kHz dev.

35



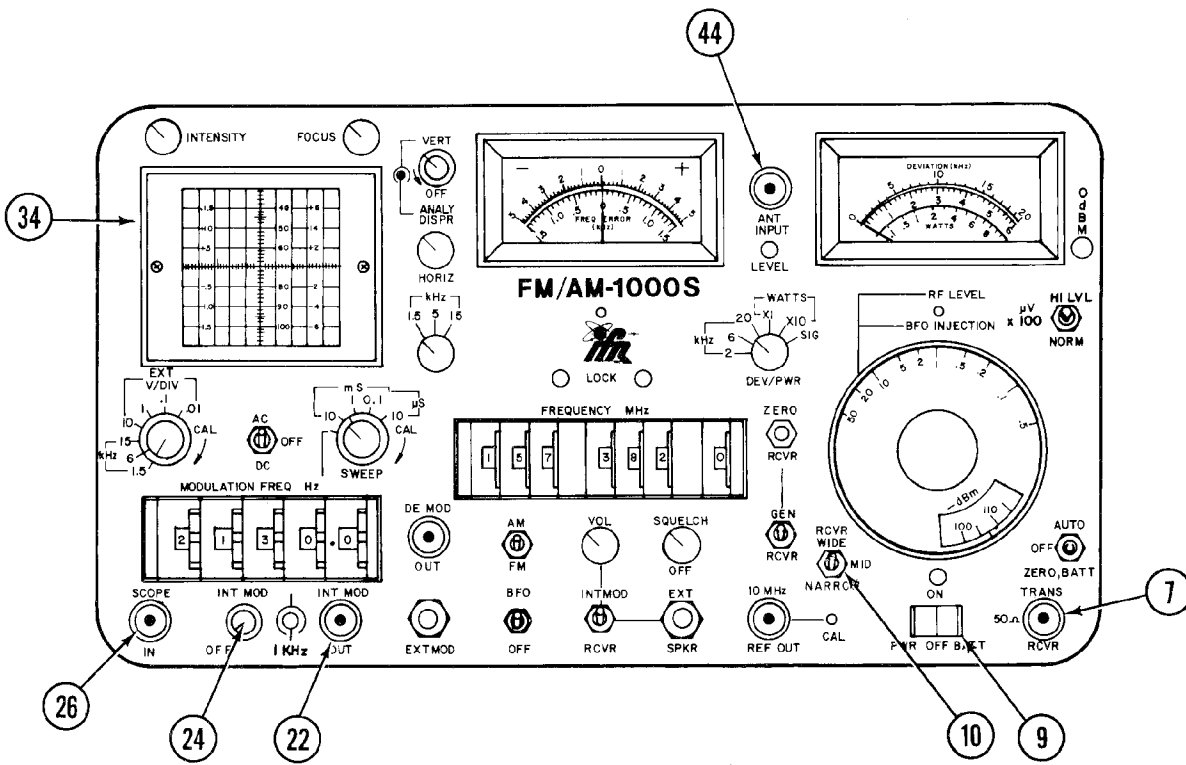
36

RECEIVED SIGNAL STRENGTH

Equipment Req'd: Antenna.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Connect antenna to "44".
2	3 5 10 18 19 27 31 9 XMTR 32	NORM full ccw NARROW BFO AM 10 ms/div. 1.5, 6 or 15 kHz ON ON 1 kHz offset from XMTR Freq.	Key XMTR. Adjust "5" until beat note is observed on "34".
3	5	as req'd.	Adjust "5" until peak of beat just goes to zero on "34". Setting of "5" (μ V scale) is received signal strength at "44".

37



38

XMTR AUDIO DISTORTION

Equipment Req'd: 1000S Antenna, cables with appropriate connectors.

STEP	CONTROL	SETTING	ACTION/RESULT
1			Perform XMTR TEST SETUP procedure.
2	10 9 24	NARROW ON as req'd	Connect coax from "22" to "26". Set "24" for desired audio input voltage, as displayed on "34".
3			Disconnect coax from "26". Connect coax from "22" to XMTR MIC input. Connect antenna to "44", or coax from XMTR output to "7". CAUTION: DO NOT CONNECT XMTR OUTPUT TO ANY JACK OTHER THAN "7".
4	XMTR	ON	Key XMTR. CAUTION: DO NOT EXCEED PWR INPUT LIMITS. Observe "34" for excessive audio distortion, percent modulation, clipping, etc.

39

dBm - microvolt correlation chart (soft microvolts)											
dBm	uv	dBm	uv	dBm	uv	dBm	uv	dBm	uv	dBm	uv
0	224.000	-20	22.400	-40	2.240	60	224	-80	22.4	-100	2.24
-1	200.000	-21	20.000	-41	2.000	-61	200	-81	20.0	-101	2.00
-2	178.000	-22	17.800	-42	1.780	62	178	-82	17.8	-102	1.78
-3	159.000	-23	15.900	-43	1.590	-63	159	-83	15.9	-103	1.59
-4	141.000	-24	14.100	-44	1.410	64	141	-84	14.1	-104	1.41
5	126.000	-25	12.600	45	1.260	65	126	-85	12.6	-105	1.26
-6	112.000	-26	11.200	-46	1.120	-66	112	-86	11.2	-106	1.12
-7	100.000	-27	10.000	-47	1.000	67	100	-87	10.0	-107	1.00
-8	89.100	-28	8.900	-48	891	-68	89.1	-88	8.91	-108	0.891
-9	79.500	-29	7.950	-49	795	69	79.5	-89	7.95	-109	0.795
-10	70.900	-30	7.090	50	709	-70	709	-90	7.09	-110	0.709
-11	63.300	-31	6.330	-51	633	71	63.3	-91	6.33	-111	0.633
-12	56.300	-32	5.630	-52	563	-72	563	-92	5.63	-112	0.563
-13	50.100	-33	5.010	-53	501	73	50.1	-93	5.01	-113	0.501
-14	44.700	-34	4.470	-54	447	-74	44.7	-94	4.47	-114	0.447
-15	39.900	-35	3.990	55	399	-75	39.9	-95	3.99	-115	0.399
-16	35.500	-36	3.550	-56	355	76	35.5	-96	3.55	-116	0.355
-17	31.700	-37	3.170	-57	317	-77	31.7	-97	3.17	-117	0.317
-18	28.200	-38	2.820	-58	282	78	28.2	-98	2.82	-118	0.282
-19	25.200	-39	2.520	-59	252	-79	25.2	-99	2.52	-119	0.252
										-140	0.0224