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NAVAIR 17-20AX-737

AX-737

TECHNICAL MANUAL

INSTRUMENT CALIBRATION PROCEDURE

VOR/LOC/COMM AND G/S BENCH TEST SETS

IFR INC.
NAV-750, NAV-750A, AND NAV-750B

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SECTION 1

INTRODUCTION AND DESCRIPTION

1.1 This procedure describes the calibration of IFR Inc. NAV-750, NAV-750A, NAV-750B VOR/LOC/COMM and G/S Bench Test Sets. The instrument being calibrated is referred to herein as the TI (Test Instrument).

1.2 This procedure was derived from draft prepared by NADEP Cherry Point. All comments concerning this procedure should be directed to Navy Measurement Science Directorate, Naval Warfare Assessment Division, P.O. Box 5000, Corona, CA 91718-5000.

1.3 This procedure includes tests of essential performance parameters only. Any malfunction noticed during calibration, whether specifically tested for or not, should be corrected.

Table 1. Calibration Description

TI Characteristics	Performance Specifications	Test Method
Frequency accuracy	Frequency range: 108.000 to 335.000 MHz; (70.000 to 79.000, NAV-750B only) Tolerance: ±1 ppm	Measured with an electronic counter.
Attenuator frequency response	Range: 70.0 MHz to 335.0 MHz Tolerance: ±1.5 dB @ -6 dBm to -50 dBm; ±2.5 dB @ -51 dBm to -120 dBm	Attenuator output monitored by a power meter while the frequency is verified.
Attenuator linearity	Range: -6 to -50 dBm Tolerance: ±1.5 dB Range: -51 to -120 dBm Tolerance: ±2.5 dB	Attenuator output measured with a signal analyzer.
DEMOD tones DC offset	Tone frequencies: 30, 90, 150, 1020, and 9960 Hz DC offset: +40 mV to -40 mV dc Tone Frequencies: 400, 1300, and 3000 Hz DC offset: +80 mV to -80 mV dc	Offset measured using a digital multimeter.
Tone frequency	Tone frequencies: 30, 90, 150, and 9960 Hz Tolerance: ±0.02% Tone frequency: 1020 Hz Tolerance: ±0.5% Tone frequencies: 400, 1300, and 3000 Hz Tolerance: ±0.7%	Measured with an electronic counter.
Tone distortion	Tone frequencies: 90 and 150 Hz Tolerance: ±0.4% Tone frequencies: 30 and 1020 Hz Tolerance: ±0.5% Tone frequencies: 400, 1300, and 3000 Hz Tolerance: ±0.7%	Measured with a signal analyzer.

TI Characteristics	Performance Specifications	Test Method
Tone modulation	VOR 30 Hz: 20% AM Tolerance: ±1.2% VOR 9960 Hz: 30% AM Tolerance: ±1.2% LOC 90 Hz: 20% AM Tolerance: ±0.8% LOC 150 Hz: 20% AM Tolerance: ±0.8% G/S 90 Hz: 40% AM Tolerance: ±1.6% G/S 150 Hz: 40% AM Tolerance: ±1.6% Comm 1020 Hz: 30% AM Tolerance: ±1.2%	Measured with a signal analyzer.
Modulation meter	Range: 0 to 30% AM Tolerance: @ 20%, ±0.8%; @ 30%, ±1.2% Range: 0 to 100% AM Tolerance: @ 40%, ±1.6%; @ 95%, ±3.0%	Modulation meter indication is compared to signal generator calibrator indication.
Meter RF level	Frequency range: 108.000 to 335.000 MHz; (70.000 to 79.000 MHz, NAV-750B only) Tolerance: ±1.5 needle widths	Frequency varied and meter monitored for deflection.
Bearing	Bearing range: 0° to 360° Tolerance: ±0.05%	Compared to a bearing standard.
LOC-G/S	Tone frequencies: 90 and 150 Hz Tolerance: ±2.75 mV	Measured with a digital multimeter.
Harmonics	>30 dBc from 108.000 to 335.000 MHz; (>20 dBc from 70.000 to 79.000 MHz, NAV-750B only)	Measured with a spectrum analyzer.
Harmonic spurious noise	NAV-750 only Frequency: 108.000 MHz Tolerance: ≥68 dB below carrier @ ±12.5 kHz, and ≥71 dB below carrier @ ±25.0 kHz in 300 Hz resolution bandwidth Frequency: 334.700 MHz Tolerance: ≥63 dB below carrier @ ±12.5 kHz, and ≥74 dB below carrier @ ±15.0 kHz in 300 Hz resolution bandwidth	Measured with a spectrum analyzer.

TI Characteristics	Performance Specifications	Test Method
	NAV-750A and NAV-750B Frequency: 108.000 MHz Tolerance: ≥75 dB below carrier @ ±12.5 kHz, and ≥83 dB below carrier @ ±25.0 kHz in 300 Hz resolution bandwidth NAV-750A only Frequency: 334.700 MHz Tolerance: ≥66 dB below carrier @ ±12.5 kHz, and ≥77 dB below carrier @ ±25.0 kHz in 300 Hz resolution bandwidth NAV-750B only Frequency: 334.700 MHz Tolerance: ≥75 dB below carrier @ ±12.5 kHz, and ≥83 dB below carrier @ ±25.0 kHz in 300 Hz resolution bandwidth	
Single-sideband noise	NAV-750 only Frequency: 108.000 MHz Tolerance: ≥74 dB below carrier @ ±20 kHz in 300 Hz resolution bandwidth Frequency: 334.700 MHz Tolerance: ≥68 dB below carrier @ ±20 kHz in 300 Hz resolution bandwidth NAV-750A and NAV-750B Frequency: 108.000 MHz Tolerance: ≥78 dB below carrier @ ±15 kHz in 300 Hz resolution bandwidth Frequency: 334.700 MHz Tolerance: ≥74 dB below carrier @ ±20 kHz in 300 Hz resolution bandwidth NAV-750A only Frequency: 130.000 MHz Tolerance: ≥78 dB below carrier @ ±15 kHz in 300 Hz resolution bandwidth	Measured with a spectrum analyzer.
Broadband noise	NAV-750 and NAV-750B Frequency: 108.000 MHz Tolerance: ≥80 dB below carrier @ ±100 kHz in 1 kHz resolution bandwidth	Measured with a spectrum analyzer.

TI Characteristics	Performance Specifications	Test Method
	NAV-750 and NAV-750B Frequency: 334.000 MHz Tolerance: ≥80 dB below carrier @ ±100 kHz in 1 kHz resolution bandwidth NAV-750A only Frequency: 108.000 MHz Tolerance: ≥82 dB below carrier @ ±100 kHz in 1 kHz resolution bandwidth Frequency: 334.000 MHz Tolerance: ≥82 dB below carrier @ ±100 kHz in 1 kHz resolution bandwidth	
Residual FM	Frequency: 108.000 MHz Residual FM: ≤200 Hz Frequency: 334.700 MHz Residual FM: ≤400 Hz	Measured with a signal generator
RF Type N connector dimensions	Center connector depth range: 0.197 inch Tolerance: ±0.01 inch (MIL-C-71B)	Measured using a connector gage kit

SECTION 2

EQUIPMENT REQUIREMENTS

NOTE

Minimum use specifications are the principal parameters required for performance of the calibration, and are included to assist in the selection of alternate equipment, which may be used at the discretion of the using laboratory. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration.

The instruments utilized in this procedure were selected from those known to be available at Navy calibration facilities, and the listing by make or model number carries no implication of preference, recommendation, or approval for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in this procedure.

Item	Minimum Use Specifications	Calibration Equipment
2.1 Oscilloscope	Bandwidth: 50 MHz Uncertainty: ±3% time base Dual trace and delayed sweep capability	Tektronix 7704AMOD129GOPT03, 7904AOPT03 or 7704AMOD129G with 7A26 and 7B92A plug-ins
2.2 Electronic counter	Frequency range: 25 Hz to 335 MHz Uncertainty: ±0.25 ppm Resolution: 1 Hz	Hewlett-Packard 5335AOPT010, 030, 040, 5345AOPT012, or 5345A
2.3 Digital multimeter (DMM)	DC voltage range: 0 to ±80 mV dc Uncertainty: ±1%	Fluke 8506AAN, 8502AAT, or 8840AAFOPT05
2.4 Power meter/power sensor	Power range: -25 to -35 dBm Uncertainty: ±1.25% Frequency range: 70 to 335 MHz	Hewlett-Packard 436AOPT022, 436A, or 435A with 8484A
2.5 Signal generator calibrator	Frequency range: 108 to 118 MHz Tuned RF level rang: e-6 to -100 dBm Uncertainty: ±0.35 dB AM modulation range: 15% to 100% AM Uncertainty: ±1% AM FM modulation range: <200 Hz to 400 Hz FM Uncertainty: ±2%	Hewlett-Packard 8902AOPTE02 (consists of: H-P 8902AOPT002; and H-P 11722A) or 8902AOPTE04 (consists of: H-P 8902A; H-P 8672AOPT001, 008; H-P 11792AOPT001,H04; and H-P 11793AOPTH04)
2.6 Distortion analyzer	Capable of measuring distortion down to 0.1% with 0.01% resolution	Sound Technology 1700BOPT003, 005; or Hewlett-Packard 8903BOPT050, 907, 910, or 8903BOPT907
2.7 Navigation indicator T/S	No known substitute	Collins 478A-3 ZIFOR III*
2.8 Spectrum analyzer	Range: 50 MHz to 1.2 GHz Resolution: 300 Hz min Dynamic range: >85 dB	Hewlett-Packard 8562AOPTE50, 8569BOPT001, or 8566B
2.9 Connector gage kit	Range: 0 to 0.197 inch Uncertainty: ±0.0025 inch (MIL-C-71B)	Maury Microwave A007B, A007A

*Non-NCE equipment

SECTION 3

PRELIMINARY OPERATIONS

3.1 Ensure that all power switches are set to off, and set all auxiliary equipment controls as necessary to avoid damage to the equipment and so that dangerous voltages will not be present on output terminals when the power switches are turned on.

3.2 Connect the auxiliary equipment, and the TI, to the appropriate power source.

3.3 Verify that the TI panel meter indicates zero. If the TI meter does not indicate zero, adjust the TI meter mechanical screw adjustment for a zero scale indication. (Perform adjustment only after TI has been off for at least 30 minutes.)

3.4 Set the TI controls as follows:

TO-FROM bearing switch to	FROM
Meter function switch to	0-100 or OFF
MASTER MOD control to	CAL (UNCAL lamp off)
1020 Hz indent tone MOD control to	CAL (UNCAL lamp off)
9960 Hz FM tone MOD control to	CAL (UNCAL lamp off)
30 Hz tone MOD control to	CAL (UNCAL lamp off)
.01-.05 degree bearing switch to	.01
LOC DDM switch to	0
LOC variable DDM control to	0
LOC-G/S frequency switch to	LOC
G/S DDM switch to	0
G/S variable DDM control to	0
FREQUENCY MHz switches to	108.000
Channeling frequency increment switch to	25 kHz
AUTO-MANUAL switch to	MANUAL
CHANNELING rate control to	fully ccw
ΔF control to	fully ccw
BEARING-FREQ display select switch to	FREQ
Attenuator control to	-30 dBm

3.5 Turn all power switches on, and allow a sufficient warm-up time for the equipment (the TI requires a 1 hour warm-up time).

3.6 Using connector gage kit (item 2.9), ensure the TI RF connector complies with specifications of MIL-C-71B.

SECTION 4

CALIBRATION PROCESS

NOTE

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met,before proceeding.

4.1 FREQUENCY ACCURACY TESTS

4.1.1 Set the TI controls as follows:

FREQUENCY MHz switches to	108.000
MASTER MOD control to	UNCAL [fully ccw (0)]
Output attenuator control to	-20 dBm

4.1.2 Ensure that the TI Ø LOCK indicator is on.

4.1.3 Connect the electronic counter to the TI RF output connector, and set the electronic counter for frequency measurements, as necessary.

4.1.4 Adjust the TI output attenuator control, if necessary, to obtain a stable electronic counter indication. (Repeat this step, if necessary, for the following tests of the TI frequency accuracy.)

4.1.5 Verify that the electronic counter indicates between 107.999892 and 108.000108 MHz.

4.1.6 Set the TI FREQUENCY MHz switches to 130.000, and verify that the electronic counter indicates between 129.999870 and 130.000130 MHz.

4.1.7 Set the TI FREQUENCY MHz switches to 157.000, and verify that the electronic counter indicates between 156.999843 and 157.000157 MHz.

4.1.8 Set the TI FREQUENCY MHz switches to 328.000, and verify that the electronic counter indicates between 327.999672 and 328.000328 MHz.

4.1.9 Set the TI FREQUENCY MHz switches to 335.000, and verify that the electronic counter indicates between 334.999665 and 335.000335 MHz.

4.1.10 If the TI is a NAV-750B, proceed with step 4.1.11. Otherwise, if the TI is not a NAV-750B, skip to step 4.1.13.

4.1.11 Set the TI FREQUENCY MHz switches to 070.000, and verify that the electronic counter indicates between 69.999930 and 70.000070 MHz.

4.1.12 Set the TI FREQUENCY MHz switches to 079.000, and verify that the electronic counter indicates between 78.999921 and 79.000079 MHz.

4.1.13 Disconnect the electronic counter from the TI.

4.2 ATTENUATOR FREQUENCY RESPONSE TESTS

4.2.1 Connect the power sensor to the power meter. Zero and reference calibrate the power sensor and power meter.

4.2.2 Set the TI attenuator to -30 dBm, and the TI frequency switches to 108 MHz. Connect the power sensor input to the TI RF output connector.

4.2.3 Set the power meter controls for auto ranging or -25 dBm range, as applicable.

NOTE

For that following tests, set the power meter calibration factor switch to the appropriate setting corresponding to the power sensor cal chart at the test frequency (TI FREQUENCY MHz switches setting).

4.2.4 Verify that the power meter indicates between -28.5 and-31.5 dBm.

4.2.5 Set the TI FREQUENCY MHz switches to the following settings. At each setting, verify that the power meter indicates within the tolerance limits listed.

TI FREQUENCY MHz Switch Setting	Power Meter Tolerance Limits (dBm)
115.000	-28.5 to -31.5
125.000	"
135.000	"
145.000	"
157.000	"

4.2.6 Set the TI FREQUENCY MHz switches to 328.000.

4.2.7 Verify that the TI G/S Mode indicator is on, and that the power meter indicates between -28.5 and -31.5 dBm.

4.2.8 Set the TI FREQUENCY MHz switches to the following settings. At each setting, verify that the power meter indicates within the tolerance limits listed.

TI FREQUENCY MHz Switch Setting	Power Meter Tolerance Limits (dBm)
330.000	-28.5 to -31.5
332.000	"
335.000	"

4.2.9 If the TI is a NAV-750B continue with step 4.2.10. Otherwise, if the TI is not a NAV-750B, proceed to step 4.2.13.

4.2.10 Set the TI FREQUENCY MHz switches to 70.000.

4.2.11 Verify that the power meter indicates between -28.5 to -31.5 dBm.

4.2.12 Set the TI FREQUENCY MHz switches to the following settings. At each setting, verify that the power meter indicates within the tolerance limits listed.

TI FREQUENCY MHz Switch Setting	Power Meter Tolerance Limits (dBm)
072.000	-28.5 to -31.5
074.000	"
076.000	"
079.000	"

4.2.13 Disconnect the power sensor from the TI.

4.3 ATTENUATOR LINEARITY TESTS

4.3.1 Set the TI controls as follows:

FREQUENCY MHz switches to	108.000 MHz
MASTER MOD control to	UNCAL [fully ccw (0)]
Output attenuator control to	-6 dBm

4.3.2 Connect the signal generator calibrator sensor module input to the TI RF output connector.

4.3.3 Press the signal generator calibrator INSTR PRESET key (Blue key, AUTOMATIC OPERATION key), and ensure that the signal generator calibrator is in the FREQ measurement mode and tunes to the TI FREQUENCY MHz switches setting. Set the signal generator calibrator for TUNED RF LEVEL measurements with log (dBm) display, enter 39.9 SPCL, and then press the CALIBRATE key.

4.3.4 Set the TI output attenuator control to each of the following settings. At each setting, verify that the signal generator calibrator indicates within the tolerance limits listed.

TI Output Attenuator Control Setting	Signal Generator Calibrator Tolerance Limits (dBm)
-6	-4.5 to -7.5
-10	-8.5 to -11.5
-20	-18.5 to -21.5
-30	-28.5 to -31.5
-40	-38.5 to -41.5
-50	-48.5 to -51.5
-60	-57.5 to -62.5
-70	-67.5 to -72.5
-80	-77.5 to -82.5
-90	-87.5 to -92.5
-100	-97.5 to -102.5

4.3.5 Disconnect the signal generator calibrator sensor module from the TI.

4.4 DEMOD TONES AND DC OFFSET TESTS

4.4.1 Set the TI controls as follows:

BEARING-FREQ switch to	FREQ
MASTER MOD control to	CAL (UNCAL lamp off)
1020 Hz indent tone MOD control to	CAL (UNCAL lamp off)
9960 Hz FM tone MOD control to	CAL (UNCAL lamp off)
30 Hz tone MOD control to	CAL (UNCAL lamp off)
LOC DDM switch to	0
G/S DDM switch to	0

4.4.2 Connect the oscilloscope vertical amplifier input to the TI rear panel DEMOD jack. Connect the DMM voltage input to the TI rear panel TONES jack.

4.4.3 Set the TI oscilloscope and DMM controls as necessary to measure the TI signals in the following steps:

4.4.3.1 Set the TI FREQUENCY MHz switches to 108.100 MHz. Ensure that the TI frequency display indicates 108.100, and the LOC mode indicator is on.

4.4.3.2 Set the TI G/S DDM switch to 90 Hz, and ensure that the 150 Hz tone off indicator is on.

4.4.3.3 Verify that the oscilloscope displays a 90 Hz tone, and that the DMM indicates between -40.0 and +40.0 mV dc.

4.4.3.4 Set the TI LOC-G/S frequency switch to G/S.

4.4.3.5 Ensure that the TI frequency display indicates 334.700, and the G/S mode indicator is on.

4.4.3.6 Verify that the oscilloscope displays a 90 Hz tone, and that the DMM indicates between -40.0 and +40.0 mV dc.

4.4.3.7 Set the TI G/S DDM switch to 150 Hz, and then ensure that the 90 Hz tone off indicator is on.

4.4.3.8 Verify that the oscilloscope displays a 150 Hz tone, and that the DMM indicates between -40 to +40 mV dc.

4.4.3.9 Set the TI LOC-G/S frequency switch to LOC.

4.4.3.10 Ensure that the TI frequency display indicates 108.100, the 90 Hz tone off indicator is on, and the LOC mode indicator is on.

4.4.3.11 Verify that the oscilloscope displays a 150 Hz tone, and that the DMM indicates between -40 to +40 mV dc.

4.4.3.12 Set the TI G/S DDM switch to 0, and the FREQUENCY MHz switches to 108.000.

4.4.3.13 Ensure that the TI VOR mode indicator is on.

4.4.3.14 Verify that the oscilloscope displays a 9960 Hz tone, and that the tone is both frequency and amplitude modulated with a 30 Hz tone.

4.4.3.15 Verify that the DMM indicates between -40.0 and +40.0 mV dc.

4.4.3.16 Adjust the TI 9960 FM tone modulation control toUNCAL [fully ccw (0)].

4.4.3.17 Verify that the oscilloscope displays a 30 Hz tone, and that the DMM indicates between -40.0 and +40.0 mV dc.

4.4.3.18 Set the TI 9960 Hz tone modulation control to the CAL (UNCAL lamp off) position, and set the FREQUENCY MHz switches to 118.000.

4.4.3.19 Verify that the oscilloscope displays a 1020 Hz tone, and that the DMM indicates -40.0 to +40.0 mV dc.

4.4.3.20 If the TI is a NAV-750B continue with step 4.4.3.21. Otherwise, if the TI is not a NAV-750B, proceed to step 4.4.3.27.

4.4.3.21 Set the TI meter function and tone selector switch to 400 Hz.

4.4.3.22 Verify that the oscilloscope displays a 400 Hz tone, and that the DMM indicates between -80.0 to +80.0 mV dc.

4.4.3.23 Set the TI meter function and tone selector switch to 1300 Hz.

4.4.3.24 Verify that the oscilloscope displays a 1300 Hz tone, and that the DMM indicates between -80.0 and +80.0 mV dc.

4.4.3.25 Set the TI meter function and tone selector switch to 3000 Hz.

4.4.3.26 Verify that the oscilloscope displays a 3000 Hz tone, and that the DMM indicates between -80.0 to +80.0 mV dc.

4.4.3.27 Disconnect the oscilloscope and the digital multimeter from the TI.

4.5 TONE FREQUENCY TESTS

4.5.1 Set the TI controls as follows:

FREQUENCY MHz switches to	108.000
LOC-G/S frequency switch to	LOC
BEARING-FREQ switch to	FREQ
MASTER MOD control to	CAL (UNCAL lamp off)
1020 Hz indent tone MOD control to	CAL (UNCAL lamp off)
9960 Hz FM tone MOD control to	CAL (UNCAL lamp off)
30 Hz tone MOD control to	CAL (UNCAL lamp off)
LOC DDM switch to	0
G/S DDM switch to	0

4.5.2 Connect the electronic counter, set for a 30 Hz measurement and AC coupled, input to the TI rear panel 30 Hz REF jack.

4.5.3 Verify that the electronic counter indicates between 29.994 and 30.006 Hz.

4.5.4 Set the TI FREQUENCY MHz switches to 108.100, and the G/S DDM switch to 90 Hz.

4.5.5 Disconnect the electronic counter from the TI 30 Hz REF jack, and connect it to the TI rear panel DEMOD jack.

4.5.6 Verify that the electronic counter indicates between 89.982 and 90.018 Hz.

4.5.7 Set the TI LOC-G/S frequency switch to G/S. Ensure that the TI frequency display indicates 334.700.

4.5.8 Verify that the electronic counter indicates between 89.982 and 90.018 Hz.

4.5.9 Set the TI G/S DDM switch to 150 Hz.

4.5.10 Verify that the electronic counter indicates between 149.97 and 150.03 Hz.

4.5.11 Set the TI LOC-G/S frequency switch to LOC.

4.5.12 Verify that the electronic counter indicates between 149.97 and 150.03 Hz.

4.5.13 Set the TI FREQUENCY MHz switches to 108.000.

4.5.14 Adjust the TI 30 Hz tone modulation control to UNCAL [fully ccw (0)].

4.5.15 Connect the oscilloscope vertical amplifier input to the TI rear panel TONES jack.

4.5.16 Set the oscilloscope controls for 500 mV vertical sensitivity, 100 μs/div sweep time, and the trigger slope to positive (+).

4.5.17 Adjust the oscilloscope trigger and position controls to vertically center the TI 9960 Hz signal on the oscilloscope CRT display, and position the sweep trigger point at the left edge of the horizontal center line. (See Figure 1.)

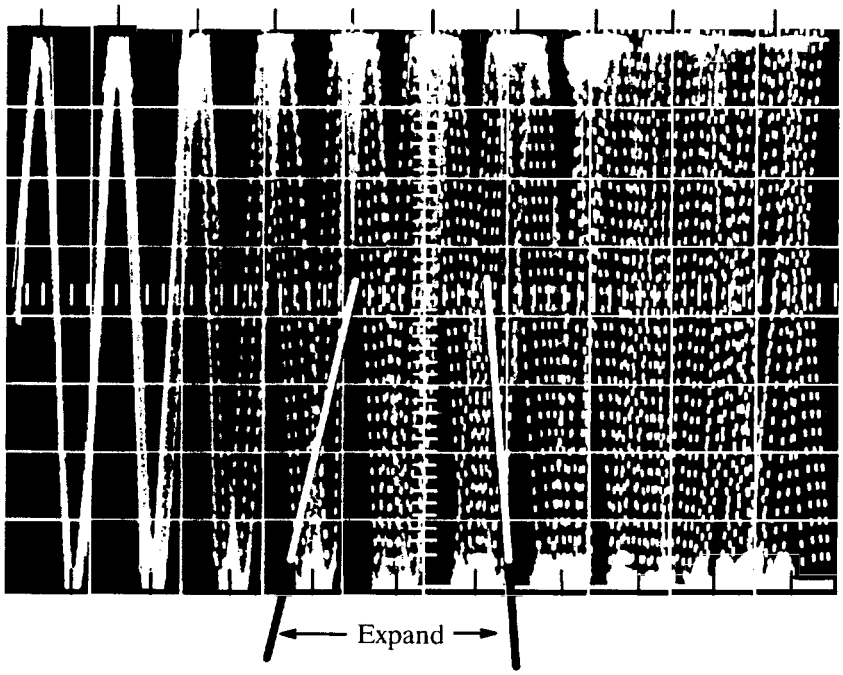

Figure 1. FM Deviation Display

4.5.18 Use the oscilloscope delayed sweep function to expand the portion of the TI signal indicated in Figure 1, with the oscilloscope delayed time base set for 10 μs/div, such that the display is similar to Figure 2. Verify that the deviation of the expanded display corresponds to delta time (Δt) = 48.5 μs ±2.4 μs.

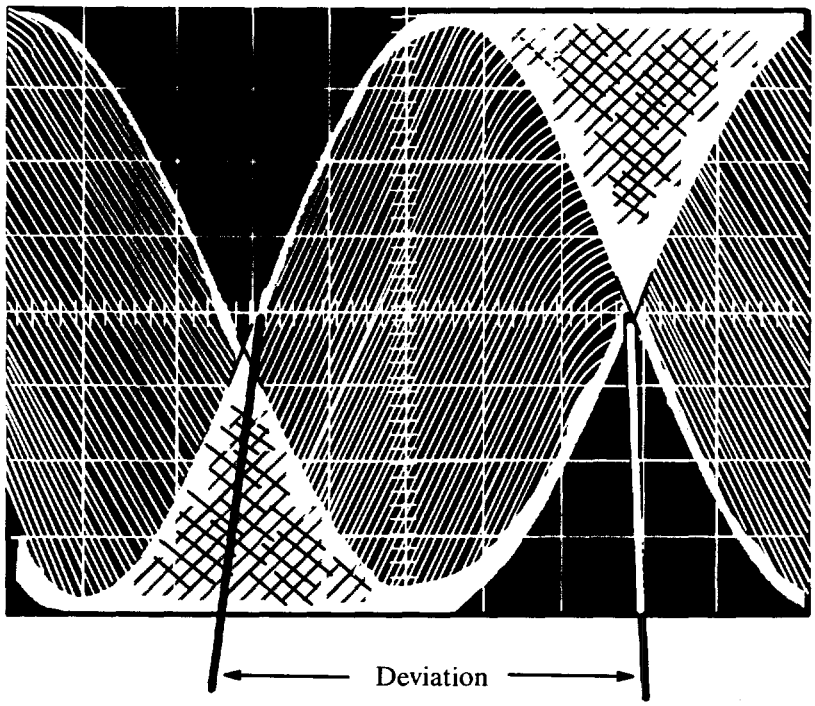

Figure 2. 9960 Hz Deviation (Expanded)

4.5.19 Verify that the electronic counter indicates between 9958.008 and 9961.992 Hz.

4.5.20 Adjust the TI 9960 FM tone modulation control to UNCAL [fully ccw (0)].

4.5.21 Set the TI 30 Hz tone modulation control to the CAL (UNCAL lamp off) position.

4.5.22 Verify that the electronic counter indicates between 29.994 and 30.006 Hz.

4.5.23 Set the TI 9960 FM tone modulation control to the CAL (UNCAL lamp off) position, the FREQUENCY MHz switches to 118.000, and the Meter function switch to OFF.

4.5.24 Verify that the electronic counter indicates between 1014.9 and 1025.1 Hz.

4.5.25 If the TI is a NAV-750B, proceed with step 4.5.26. Otherwise, if the TI is not a NAV-750B, skip to step 4.5.32.

4.5.26 Set the TI FREQUENCY MHz switches to 075.000, and the Meter function and Tone Selector switch to 400 Hz.

4.5.27 Verify that the electronic counter indicates between 397.2 and 402.8 Hz.

4.5.28 Set the TI meter function and tone selector switch to 1300 Hz.

4.5.29 Verify that the electronic counter indicates between 1290.9 and 1309.1 Hz.

4.5.30 Set the meter function and tone switches 3000 Hz.

4.5.31 Verify that the electronic counter indicates between 2979.0 and 3021.0 Hz.

4.5.32 Disconnect the electronic counter and the oscilloscope from the TI.

4.6 TONE DISTORTION TESTS

4.6.1 Set the TI controls to the following positions:

FREQUENCY MHz switches to	108.000
LOC-G/S frequency switch to	LOC
BEARING-FREQ switch to	FREQ
MASTER MOD control to	CAL (UNCAL lamp off)
9960 Hz FM tone MOD control to	CAL (UNCAL lamp off)
1020 Hz indent tone MOD control to	CAL (UNCAL lamp off)
30 Hz tone MOD control to	CAL (UNCAL lamp off)
LOC DDM switch to	0
G/S DDM switch to	0
Meter function switch to	0-100 or OFF

4.6.2 Connect the distortion analyzer input to the TI rear panel 30 Hz REF jack. Set the distortion analyzer controls for distortion measurement of a 30 Hz fundamental, as applicable.

4.6.3 Verify that the distortion analyzer indicates $\leq$0.5% total harmonic distortion.

4.6.4 Set the TI FREQUENCY MHz switches to 108.100, and set the G/S DDM switch to 90 Hz.

4.6.5 Disconnect the distortion analyzer from the 30 Hz REF jack, and connect it to the TI rear panel TONES jack.

4.6.6 Set the distortion analyzer controls for distortion measurement of a 90 Hz fundamental, as applicable.

4.6.7 Verify that the distortion analyzer indicates $\leq$0.4% total harmonic distortion.

4.6.8 Set the TI LOC-G/S frequency switch to G/S.

4.6.9 Verify that the distortion analyzer indicates $\leq$0.4% total harmonic distortion.

4.6.10 Set the TI G/S DDM switch to 150 Hz.

4.6.11 Set the distortion analyzer controls for distortion measurement of a 150 Hz fundamental, as applicable.

4.6.12 Verify that the distortion analyzer indicates $\leq$0.4% total harmonic distortion.

4.6.13 Set the TI LOC-G/S frequency switch to LOC.

4.6.14 Verify that the distortion analyzer indicates $\leq$0.4% total harmonic distortion.

4.6.15 Set the TI FREQUENCY MHz switches to 108.000.

4.6.16 Adjust the TI 9960 FM tone modulation control to the UNCAL [fully ccw (0)] position. Set the distortion analyzer controls for distortion measurement of a 30 Hz fundamental, as applicable.

4.6.17 Verify that the distortion analyzer indicates ≤0.5% total harmonic distortion.

4.6.18 Set the TI 9960 FM tone modulation control to the CAL (UNCAL lamp off) position.

4.6.19 Set the TI frequency switch to 118.000 MHz. Set the distortion analyzer controls for distortion measurement of a 1020 Hz fundamental, as applicable.

4.6.20 Verify that the distortion analyzer indicates ≤0.5% total harmonic distortion.

4.6.21 If the TI is a NAV-750B, proceed with step 4.6.22. Otherwise, if the TI is not a NAV-750B, skip to step 4.6.28.

4.6.22 Set the TI FREQUENCY MHz switches to 075.000, and the Meter function and Tone Selector switch to 400 Hz.

4.6.23 Set the distortion analyzer controls for distortion measurement of a 400 Hz fundamental, as applicable, and verify that the distortion analyzer indicates ≤0.7% total harmonic distortion.

4.6.24 Set the TI meter function and tone selector switch to1300 Hz.

4.6.25 Set the distortion analyzer controls for distortion measurement of a 1300 Hz fundamental, as applicable, and verify that the distortion analyzer indicates ≤0.7% total harmonic distortion.

4.6.26 Set the TI meter Function and the Tone Selector switch to 3000 Hz.

4.6.27 Set the distortion analyzer controls for distortion measurement of a 3000 Hz fundamental, as applicable, and verify that the distortion analyzer indicates ≤0.7% total harmonic distortion.

4.6.28 Disconnect the distortion analyzer from the TI.

4.7 PERCENT AMPLITUDE MODULATION OF TONES AND MODULATION METER TESTS

4.7.1 Set the TI controls as follows:

FREQUENCY MHz switches to	108.000
Meter function switch to	0-30
9960 Hz FM tone MOD control to	UNCAL [fully ccw (0)]
30 Hz tone MOD control to	CAL (UNCAL lamp off)
1020 Hz indent tone MOD control to	CAL (UNCAL lamp off)
MASTER MOD control to	CAL (UNCAL lamp off)
Output attenuator control to	-20 dBm
LOC-G/S frequency switch to	LOC
LOC DDM switch to	0
G/S DDM switch to	0

4.7.2 Connect the signal generator calibrator sensor module input to the TI RF output connector.

4.7.3 Press the signal generator calibrator INSTR PRESET key (Blue key, AUTOMATIC OPERATION key), and ensure that the signal generator calibrator is in the FREQ measurement mode and tunes to the TI FREQUENCY MHz switches setting. Set the signal generator calibrator for AM modulation measurements with the DETECTOR set to PEAK $\pm/2$. Activate the signal generator calibrator 3 kHz LP FILTER.

4.7.4 Verify that the signal generator calibrator indicates between 28.8% and 31.2% AM modulation, and record the reading.

4.7.5 Verify that the TI meter indicates within $\pm$1.2% (AM depth) of the recorded value in step 4.7.4.

4.7.6 Set the TI meter function switch to 0-100, and then set the TI 30 Hz tone modulation control to the fully cw position.

4.7.7 Verify that the signal generator calibrator indicates >60% AM modulation.

4.7.8 Set the TI 30 Hz modulation control to the UNCAL [fully ccw (0)] position.

4.7.9 Set the TI 1020 Hz tone modulation control to the fully cw position.

4.7.10 Activate the signal generator calibrator 50 Hz HP FILTER, and the 3 kHz LP FILTER. Verify that the signal generator calibrator indicates >60% AM modulation.

4.7.11 Set the TI 1020 Hz tone modulation control to the CAL (UNCAL lamp off) position, and the 9960 Hz tone modulation control to the CAL (UNCAL lamp off) position.

4.7.12 Activate the signal generator calibrator 300 Hz HP FILTER, and the >20 kHz LP FILTER.

4.7.13 Verify that the signal generator calibrator indicates between 28.8% and 31.2% AM modulation.

4.7.14 Set the TI 9960 Hz tone modulation control to the fully cw position.

4.7.15 Verify that the signal generator calibrator indicates >60% AM modulation.

4.7.16 Set the TI 30 Hz tone modulation control to the CAL (UNCAL lamp off) position, and the 9960 Hz tone modulation control to the CAL (UNCAL lamp off) position.

4.7.17 Set the TI FREQUENCY MHz switches to 108.100. Set the TI G/S DDM switch to 90 Hz.

4.7.18 Deactivate the signal generator calibrator 300 Hz HP FILTER, and activate the 3 kHz LP FILTER.

4.7.19 Verify that the signal generator calibrator indicates between 19.2% and 20.8% AM modulation.

4.7.20 Set the TI G/S DDM switch to 150 Hz, and the TI meter function switch to 0-30.

4.7.21 Verify that the signal generator calibrator indicates between 19.2% and 20.8% AM modulation, and record the reading.

4.7.22 Verify that the TI meter indicates within $\pm$0.8% of the recorded value in step 4.7.21.

4.7.23 Set the TI meter Function switch to 0-100, the G/S DDM switch to 0, the LOC-G/S switch to G/S, and the LOC DDM switch to 90 Hz.

4.7.24 Verify that the signal generator calibrator indicates between 38.4% and 41.6% AM modulation.

4.7.25 Set the TI LOC DDM switch to 150 Hz.

4.7.26 Verify that the signal generator calibrator indicates between 38.4% and 41.6% AM modulation, and record the reading.

4.7.27 Verify that the TI meter indicates within ±1.6% of the recorded value in step 4.7.26.

4.7.28 Set the TI LOC DDM switch to 0, and the FREQUENCY MHz switches to 118.000.

4.7.29 Activate the signal generator calibrator 50 Hz HP FILTER, and the 15 kHz LP FILTER.

4.7.30 Verify that the signal generator calibrator indicates between 28.8% and 31.2% AM modulation.

4.7.31 If the TI is a NAV-750B, proceed with step 4.7.32. Otherwise, if the TI is not a NAV-750B, skip to step 4.7.41.

4.7.32 Set the TI controls as follows:

FREQUENCY MHz switches to	075.000
MASTER MOD control to	CAL (UNCAL lamp off)
Meter function and tone Selector switch to	400 Hz
1020 Hz indent tone MOD control to	CAL (UNCAL lamp off)
Output attenuator control to	-20 dBm

4.7.33 Press the signal generator calibrator INSTR PRESET key (Blue key, AUTOMATIC OPERATION key), and ensure that the signal generator calibrator is in the FREQ measurement mode and tunes to the TI FREQUENCY MHz switches setting. Set the signal generator calibrator for AM modulation measurements with the DETECTOR set to PEAK ±/2. Activate the signal generator calibrator 50 Hz HP FILTER, and the 15 kHz LP FILTER.

4.7.34 Verify that the signal generator calibrator indicates between 92.15% and 97.85% AM modulation, and record the reading.

4.7.35 Verify that the TI meter indicates within ±3% of the recorded value in step 4.7.34.

4.7.36 Set the TI meter function and tone selector switch to 1300 Hz.

4.7.37 Verify that the signal generator calibrator indicates between 92.15% and 97.85% AM modulation.

4.7.38 Set the TI meter function and tone selector switch to 3000 Hz.

4.7.39 Activate the signal generator calibrator 300 Hz HP FILTER, and the >20 kHz LP FILTER.

4.7.40 Verify that the signal generator calibrator indicates between 92.15% and 97.85% AM modulation.

4.7.41 Disconnect the signal generator calibrator sensor module from the TI.

4.8 RF LEVEL METER TESTS

4.8.1 Set the TI controls as follows:

FREQUENCY MHz switches to	108.000
Meter function switch to	RF

4.8.2 Verify that the TI meter needle is aligned over the RF level vertical mark within ±1.5 needle widths.

4.8.3 Set the TI FREQUENCY MHz switches to 110.000.

NOTE

NAV-750B is tested from 110.000 to 150.000 MHz, and from 330.000 to 335.000 MHz, only.

4.8.4 Advance the TI FREQUENCY MHz switches in 20 MHz steps to 335 MHz (after 330 MHz setting, set to 335 MHz), and at each setting, verify that the TI meter needle remains aligned over the RF Level mark within ±1.5 needle widths.

4.8.5 If the TI is a NAV-750B, proceed with step 4.8.6. Otherwise, if the TI is not a NAV-750B, skip to subsection 4.9.

4.8.6 Set the TI FREQUENCY MHz switches to 072.000.

4.8.7 Verify that the TI meter needle is aligned over the RF Level vertical mark within ±1.5 needle widths.

4.8.8 Advance the TI FREQUENCY MHz switches in 2.0 MHz steps to 78.000 MHz, and at each setting, verify that the TI meter needle remains aligned over the RF level mark within ±1.5 needle widths.

4.9 VOR BEARING TESTS

4.9.1 Set the TI controls as follows:

FREQUENCY MHz switches to	108.000 MHz
30 Hz tone MOD control to	CAL (UNCAL lamp off)
1020 Hz indent tone MOD control to	CAL (UNCAL lampoff)
9960 Hz FM tone MOD control to	CAL (UNCAL lampoff)
BEARING-FREQ switch to	BEARING
TO-FROM switch to	TO

4.9.2 Connect the navigation indicator T/S input connector to the TI rear panel DEMOD (J23) connector.

4.9.3 Press the TI 0° VOR bearing select pushbutton, and ensure that the TI bearing display indicates 0.0°.

4.9.4 Verify that the navigation indicator T/S indicates 000.00° ±0.05°.

4.9.5 Set the TI TO–FROM switch to the FROM position.

4.9.6 Verify that the navigation indicator T/S indicates 180.00° ±0.05°.

4.9.7 Set the TI TO–FROM switch to the TO position, and press the 180° VOR bearing select pushbutton. Ensure that the TI bearing display indicates 180°.

4.9.8 Verify that the navigation indicator T/S indicates 180.00° ±0.05°.

4.9.9 Set the TI TO/FROM switch to the FROM position.

4.9.10 Verify that the navigation indicator T/S indicates 000.00° ±0.05°.

4.9.11 Press the TI 90° bearing select pushbutton, and set the TO/FROM switch to the TO position. Ensure that the TI bearing display indicates 90°.

4.9.12 Verify that the navigation indicator T/S indicates 90.00° ±0.05°.

4.9.13 Set the TI TO/FROM switch to the FROM position.

4.9.14 Verify that the navigation indicator T/S indicates 270.00° ±0.05°.

4.9.15 Set the TI TO/FROM switch to the TO position, and press the 270° VOR bearing select pushbutton. Ensure that the TI bearing display indicates 270°.

4.9.16 Verify that the navigation indicator T/S indicates 270.00° ±0.05°.

4.9.17 Set the TO/FROM switch to the FROM position.

4.9.18 Verify that the navigation indicator T/S indicates 90.00° ±0.05°.

4.9.19 Disconnect the navigation indicator T/S from the TI.

4.10 LOC CENTERING TEST

4.10.1 Connect the DMM voltage input to the TI DEMOD connector. Set the DMM for autoranging ac rms voltage measurements, as applicable.

4.10.2 Set the TI controls as follows:

FREQUENCY MHz switches to	108.100
LOC–G/S switch to	LOC
LOC DDM switch to	0
G/S DDM switch to	150 Hz
MASTER MOD control to	CAL (UNCAL lamp off)
1020 Hz indent tone MOD control to	CAL (UNCAL lamp off)

4.10.3 Record the 150 Hz DEMOD voltage as indicated on the DMM.

4.10.4 Set the TI G/S DDM switch to 90 Hz.

4.10.5 Record the 90 Hz DEMOD voltage as indicated on the DMM.

4.10.6 Verify that the difference between the 150 Hz DEMOD voltage recorded in step 4.10.3, and the 90 Hz DEMOD voltage recorded in step 4.10.5, is ≤2.75 mV rms.

4.11 G/S CENTERING TEST

4.11.1 Set the TI controls as follows:

LOC-G/S switch to	G/S
LOC DDM switch to	150 Hz
G/S DDM switch to	0

4.11.2 Record the 150 Hz DEMOD voltage as indicated on the DMM.

4.11.3 Set the TI LOC DDM switch to 90 Hz.

4.11.4 Record the 90 Hz DEMOD voltage as indicated on the DMM.

4.11.5 Verify that the difference between the 150 Hz DEMOD voltage recorded in step 4.11.2, and the 90 Hz DEMOD voltage recorded in step 4.11.4 is, ≤2.75 mV rms.

4.11.6 Disconnect the DMM from the TI.

NOTE

Perform the appropriate Spectral Purity Tests subsection corresponding to the TI being calibrated (4.12 for NAV-750, 4.13 for NAV-750A, and 4.14 for NAV-750B).

4.12 SPECTRAL PURITY TESTS (NAV-750 ONLY)

4.12.1 Set the TI controls as follows:

FREQUENCY MHz switches to	108.000
MASTER MOD control to	UNCAL [fully ccw (0)]
Output attenuator control to	-10 dBm

4.12.2 Connect the spectrum analyzer input to the TI RF output connector.

4.12.3 Set the spectrum analyzer for a center frequency of 108.0 MHz, and a frequency span of 100 MHz/div with a 3 MHz resolution bandwidth.

NOTE

For the following tests, set the spectrum analyzer frequency span and center frequency controls as necessary to check the level ofthe harmonics of the TI signals.

4.12.4 Set the TI FREQUENCY MHz switches to each of the following settings. At each setting, verify that the harmonics (using the spectrum analyzer tuned to the TI frequencies and its harmonics) of all the selected TI frequencies are ≥30 dB below the carrier level.

TI FREQUENCY MHz Switches Setting
108.000
115.000
130.000
145.000
157.000

4.12.5 Set the TI FREQUENCY MHz switches to 329.000.

4.12.6 Set the TI FREQUENCY MHz switches to each of the following settings. At each setting, verify that the harmonics (using the spectrum analyzer tuned to the TI frequencies and its harmonics) of all the selected TI frequencies are ≥30 dB below the carrier level.

TI FREQUENCY MHz Switches Setting
329.000
332.000
335.000

4.12.7 Set the TI FREQUENCY MHz switches 334.700 MHz.

4.12.8 Set the spectrum analyzer for a frequency span of 5 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 10 Hz, and the reference level and position controls as necessary for a single-sideband noise measurement at ±20 kHz from the TI 334.700 MHz carrier frequency.

4.12.9 Verify that the single-sideband noise level is ≥68 dB below the carrier level.

4.12.10 Set the TI FREQUENCY MHz switches to 108.000.

4.12.11 Set the spectrum analyzer for a frequency span of 5 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 10 Hz, and the reference level and position controls as necessary for a single-sideband noise measurement at ±20 kHz from the TI 108.000 MHz carrier frequency.

4.12.12 Verify that the single-sideband noise level is ≥74 dB below the carrier level.

NOTE

Set the spectrum analyzer frequency span and center frequency controls as necessary to perform the tests of the TI harmonic spurious noise.

4.12.13 Verify that the harmonic spurious noise is ≥68 dB below the carrier level at ±12.5 kHz from the TI 108.000 MHz carrier frequency.

4.12.14 Verify that the harmonic spurious noise is ≥71 dB below the carrier level at ±25.0 kHz from the TI 108.000 MHz carrier frequency.

4.12.15 Set the TI frequency switches to 334.700 MHz.

4.12.16 Verify that the harmonic spurious noise is ≥63 dB below the carrier level at ±12.5 kHz from the TI 334.700 MHz carrier frequency.

4.12.17 Verify that the harmonic spurious noise is ≥74 dB below the carrier level at ±25.0 kHz from the TI 334.700 MHz carrier frequency.

4.12.18 Set the spectrum analyzer for a frequency span of 10 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 300 Hz, and the attenuator and position controls as necessary for a single-sideband noise measurement at ±100 kHz from the TI 334.700 MHz carrier frequency as stated in a 1 kHz resolution bandwidth.

NOTE

When converting 300 Hz bandwidth data to 1 kHz bandwidth data, subtract 5.23 dB from the 300 Hz bandwidth data.

4.12.19 Verify that the broad band noise is ≥80 dB below the TI 334.700 MHz carrier level. (See the note prior to this step.)

4.12.20 Set the TI frequency switches to 108.000 MHz.

4.12.21 Set the spectrum analyzer for a frequency span of 10 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 300 Hz, and the attenuator and position controls as necessary for a single-sideband noise measurement at ±100 kHz from the TI 108.000 MHz carrier frequency as stated in a 1 kHz resolution bandwidth.

4.12.22 Verify that the broadband noise is ≥80 dB below the TI 108.000 MHz carrier level. (See the note prior to step 4.12.19.)

4.12.23 Disconnect the spectrum analyzer from the TI.

4.13 SPECTRAL PURITY TESTS (NAV-750A ONLY)

4.13.1 Set the TI controls as follows:

FREQUENCY MHz switches to	108.000
MASTER MOD control to	UNCAL [fully ccw (0)]
Output attenuator control to	-10 dBm

4.13.2 Connect the spectrum analyzer input to the TI RF output connector.

4.13.3 Set the spectrum analyzer for a frequency span of 100 MHz/div with a 3 MHz resolution bandwidth.

NOTE

For the following tests, set the spectrum analyzer frequency span and center frequency controls as necessary to check the level ofthe harmonics of the TI signals.

4.13.4 Set the TI FREQUENCY MHz switches to each of the following settings. At each setting, verify that the harmonics (using the spectrum analyzer tuned to the TI frequencies and its harmonics) of all the selected TI frequencies are ≥30 dB below the carrier level.

TI FREQUENCY MHz Switches Setting
108.000
115.000
130.000
145.000
157.000

4.13.5 Set the TI FREQUENCY MHz switches to 329.000.

4.13.6 Set the TI FREQUENCY MHz switches to each of the following settings. At each setting, verify that the harmonics (using the spectrum analyzer tuned to the TI frequencies and its harmonics) of all the selected TI frequencies are ≥30 dB below the carrier level.

TI FREQUENCY MHz Switches Setting
329.000
332.000
335.000

4.13.7 Set the TI FREQUENCY MHz switches 334.700 MHz.

4.13.8 Set the spectrum analyzer for a frequency span of 5 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 10 Hz, and the reference level and position controls as necessary for a single-sideband noise measurement at ±20 kHz from the TI 334.700 MHz carrier frequency.

4.13.9 Verify that the single-sideband noise level is ≥74 dB below the carrier level.

4.13.10 Set the TI frequency switches to 130.000 MHz.

4.13.11 Set the spectrum analyzer for a frequency span of 5 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 10 Hz, and the reference level and position controls as necessary for a single-sideband noise measurement at ±15 kHz from the TI 130.000 MHz carrier frequency.

4.13.12 Verify that the single-sideband noise level is ≥78 dB below the carrier level.

4.13.13 Set the TI FREQUENCY MHz switches to 108.000.

4.13.14 Set the spectrum analyzer for a frequency span of 5 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 10 Hz, and the reference level and position controls as necessary for a single-sideband noise measurement at ±15 kHz from the TI 108.000 MHz carrier frequency.

4.13.15 Verify that the single-sideband noise level is ≥78 dB below the carrier level.

NOTE

Set the spectrum analyzer frequency span and center frequency controls as necessary to perform the tests of the TI harmonic spurious noise.

4.13.16 Verify that the harmonic spurious noise is ≥75 dB below the carrier level at ±12.5 kHz from the TI 108.000 MHz carrier frequency.

4.13.17 Verify that the harmonic spurious noise is ≥83 dB below the carrier level at ±25.0 kHz from the TI 108.000 MHz carrier frequency.

4.13.18 Set the TI frequency switches to 334.700 MHz.

4.13.19 Verify that the harmonic spurious noise is ≥66 dB below the carrier level at ±12.5 kHz from the TI 334.700 MHz carrier frequency.

4.13.20 Verify that the harmonic spurious noise is ≥77 dB below the carrier level at ±25.0 kHz from the TI 334.700 MHz carrier frequency.

4.13.21 Set the spectrum analyzer for a frequency span of 10 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 300 Hz, and the attenuator and position controls as necessary for a single-sideband noise measurement at ±100 kHz from the TI 334.700 MHz carrier frequency as stated in a 1 kHz resolution bandwidth.

NOTE

When converting 300 Hz bandwidth data to 1 kHz bandwidth data, subtract 5.23 dB from the 300 Hz bandwidth data.

4.13.22 Verify that the broadband noise is ≥82 dB below the TI 334.700 MHz carrier level. (See the note prior to this step.)

4.13.23 Set the TI frequency switches to 108.000 MHz.

4.13.24 Set the spectrum analyzer for a frequency span of 10 kHz/div, the resolution bandwidth to 300 Hz, video bandwidth to 300 Hz, and the attenuator and position controls as necessary for a single-sideband noise measurement at ±100 kHz from the TI 108.000 MHz carrier frequency as stated in a 1 kHz resolution bandwidth.

4.13.25 Verify that the broadband noise is ≥82 dB below the TI 108.000 MHz carrier level. (See the note prior to step 4.13.22.)

4.13.26 Disconnect the spectrum analyzer from the TI.

4.14 SPECTRAL PURITY TESTS (NAV-750B ONLY)

4.14.1 Set the TI controls as follows:

FREQUENCY MHz switches to	070.000
MASTER MOD control to	UNCAL [fully ccw (0)]
Output attenuator control to	-10 dBm

4.14.2 Connect the spectrum analyzer input to the TI RF output connector.

4.14.3 Set the spectrum analyzer for a frequency span of 100 MHz/div with a 3 MHz resolution bandwidth.

NOTE

For the following tests, set the spectrum analyzer frequency span and center frequency controls as necessary to check the level of the harmonics of the TI signals.

4.14.4 Set the TI FREQUENCY MHz switches to the following settings. At each setting, verify that the harmonics (using the spectrum analyzer tuned to the TI frequencies and its harmonics) of all the selected TI frequencies are ≥30 dB below the carrier level.

TI FREQUENCY MHz Switches Setting
108.000
115.000
130.000
145.000
157.000

4.14.5 Set the TI FREQUENCY MHz switches to 329.000.

4.14.6 Set the TI FREQUENCY MHz switches to the following settings. At each setting, verify that the harmonics, (using the spectrum analyzer tuned to the TI frequencies and its harmonics) of all the selected TI frequencies are ≥30 dB below the carrier level.

TI FREQUENCY MHz Switches Setting
329.000
332.000
335.000

4.14.7 Set the TI FREQUENCY MHz switches to 070.000.

4.14.8 Set the TI FREQUENCY MHz switches to the following settings. At each setting, verify that the harmonics (using the spectrum analyzer tuned to the TI frequencies and its harmonics) of all the selected TI frequencies are ≥20 dB below the carrier level.

TI FREQUENCY MHz Switches Setting
070.000
075.000
079.000

4.14.9 Set the TI FREQUENCY MHz switches 334.700 MHz.

4.14.10 Set the spectrum analyzer for a frequency span of 5 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 10 Hz, and the reference level and position controls as necessary for a single-sideband noise measurement at ±20 kHz from the TI 334.700 MHz carrier frequency.

4.14.11 Verify that the single-sideband noise level is ≥74 dB below the carrier level.

4.14.12 Set the TI FREQUENCY MHz switches to 108.000.

4.14.13 Set the spectrum analyzer for a frequency span of 5 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 10 Hz, and the reference level and position controls as necessary for a single-sideband noise measurement at ±20 kHz from the TI 108.000 MHz carrier frequency.

4.14.14 Verify that the single-sideband noise level is ≥78 dB below the carrier level.

NOTE

Set the spectrum analyzer frequency span and center frequency controls as necessary to perform the tests of the TI harmonic spurious noise.

4.14.15 Verify that the harmonic spurious noise is ≥75 dB below the carrier level at ±12.5 kHz from the TI 108.000 MHz carrier frequency.

4.14.16 Verify that the harmonic spurious noise is ≥83 dB below the carrier level at ±25.0 kHz from the TI 108.000 MHz carrier frequency.

4.14.17 Set the TI frequency switches to 334.700 MHz.

4.14.18 Verify that the harmonic spurious noise is ≥75 dB below the carrier level at ±12.5 kHz from the TI 334.700 MHz carrier frequency.

4.14.19 Verify that the harmonic spurious noise is ≥83 dB below the carrier level at ±25.0 kHz from the TI 334.700 MHz carrier frequency.

4.14.20 Set the spectrum analyzer for a frequency span of 10 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 300 Hz, and the attenuator and position controls as necessary for a single-sideband noise measurement at ±100 kHz from the TI 334.700 MHz carrier frequency as stated in a 1 kHz resolution bandwidth.

NOTE

When converting 300 Hz bandwidth data to 1 kHz bandwidth data, subtract 5.23 dB from the 300 Hz bandwidth data.

4.14.21 Verify that the broadband noise is ≥80 dB below the TI 334.700 MHz carrier level. (See the note prior to this step.)

4.14.22 Set the TI frequency switches to 108.000 MHz.

4.14.23 Set the spectrum analyzer for a frequency span of 10 kHz/div, the resolution bandwidth to 300 Hz, the video bandwidth to 300 Hz, and the attenuator and position controls as necessary for a single-sideband noise measurement at ±100 kHz from the TI 108.000 MHz carrier frequency as stated in a 1 kHz resolution bandwidth.

4.14.24 Verify that the broadband noise is ≥80 dB below the TI 108.000 MHz carrier level. (See the note prior to step 4.14.21.)

4.14.25 Disconnect the spectrum analyzer from the TI.

4.15 RESIDUAL FM TESTS

4.15.1 Set the TI controls as follows:

FREQUENCY MHz switches to	118.000
Output attenuator control to	-120 dBm
MASTER MOD control to	UNCAL [fully ccw (0)]
1020 Hz indent tone MOD control to	UNCAL [fully ccw (0)]
9960 Hz FM tone MOD control to	UNCAL [fully ccw (0)]
30 Hz tone MOD control to	UNCAL [fully ccw (0)]

4.15.2 Connect the signal generator calibrator sensor module input to the TI RF power output connector.

4.15.3 Set the TI Output Attenuator control to -10 dBm.

4.15.4 Press the signal generator calibrator INSTR PRESET key (Blue key, AUTOMATIC OPERATION key), and ensure that the signal generator calibrator is in the FREQ measurement mode and tunes to the TI FREQUENCY MHz switches setting. Set the signal generator calibrator for FM modulation measurements with the DETECTOR set to PEAK $\pm$/2. Activate the signal generator calibrator >20 kHz LP FILTER.

4.15.5 Verify that the signal generator calibrator indicates <200 Hz FM deviation.

4.15.6 Set the TI FREQUENCY MHz switches to 332.000 MHz.

4.15.7 Verify that the signal generator calibrator indicates <400 Hz FM deviation.

4.15.8 If no other measurements are to be performed, turn all equipment to OFF or STANDBY and disconnect the equipment from the TI.

CALIBRATION CHECKLIST

TEST INST (S) IFR Inc. NAV-750, NAV-750A, and NAV-750B VOR/LOC/COMM and G/S Bench Test Sets

PROC. NO. NA 17-20AX-737		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
3.3	Meter Zero	--	ck ( )		NA	Adjust, if necessary
		(in)	(in)			(in)
3.6	RF Type N connector	0.197				±0.01
4.1	Frequency Accuracy Tests					
	(MHz)	(MHz)				(MHz)
4.1.5	108.000	108.0				107.999892 to 108.000108
4.1.6	130.000	130.0				129.999870 to 130.000130
4.1.7	157.000	157.0				156.999843 to 157.000157
4.1.8	328.000	328.0				327.999672 to 328.000328
4.1.9	335.000	335.0				334.999665 to 335.000335
4.1.11*	070.000	70.0				69.999930 to 70.000070
4.1.12*	079.000	79.0				78.999921 to 79.000079
4.2	Attenuator Frequency Response Tests					
	(dBm) (MHz)	(dBm)				(dBm)
4.2.4	-30 108.000	-30.0				-28.5 to -31.5
4.2.5	" 115.000	"				"
"	" 125.000	"				"
"	" 135.000	"				"
"	" 145.000	"				"
"	" 157.000	"				"
4.2.7	" 328.000	"				"
4.2.8	" 330.000	"				"
"	" 332.000	"				"
"	" 335.000	"				"
4.2.11*	" 070.000	"				"
4.2.12*	" 072.000	"				"
"*	" 074.000	"				"
"*	" 076.000	"				"
"*	" 079.000	"				"

*Applicable only if TI is a NAV-750B.

TEST INST (S) IFR Inc. NAV-750, NAV-750A, and NAV-750B VOR/LOC/COMM and G/S Bench Test Sets

PROC. NO. NA 17-20AX-737		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.3	Attenuator Linearity Tests					
	(dBm)	(dBm)				(dBm)
4.3.4	-6	-6.0				-4.5 to -7.5
"	-10	-10.0				-8.5 to -11.5
"	-20	-20.0				-18.5 to -21.5
"	-30	-30.0				-28.5 to -31.5
"	-40	-40.0				-38.5 to -41.5
"	-50	-50.0				-48.5 to -51.5
"	-60	-60.0				-57.5 to -62.5
"	-70	-70.0				-67.5 to -72.5
"	-80	-80.0				-77.5 to -82.5
"	-90	-90.0				-87.5 to -92.5
"	-100	-100.0				-97.5 to -102.5
4.4	DEMOD Tones and DC OFFSET Tests					
4.4.3.3	90 Hz tone	--	ck ( )		NA	Displayed
"		(V dc)				(mV dc)
"	DC offset	0.0				-40.0 to +40.0
4.4.3.6	90 Hz tone	--	ck ( )		NA	Displayed
"		(V dc)				(mV dc)
"	DC offset	0.0				-40.0 to +40.0
4.4.3.8	150 Hz tone	--	ck ( )		NA	Displayed
"		(V dc)				(mV dc)
"	DC offset	0.0				-40.0 to +40.0
4.4.3.11	150 Hz tone	--	ck ( )		NA	Displayed
"		(V dc)				(mV dc)
"		0.0				-40.0 to +40.0
4.4.3.14	9960 Hz tone	--	ck ( )		NA	Displayed
"	30 Hz mod tone	--	ck ( )		NA	Displayed
4.4.3.15	DC offset	0.0				-40.0 to +40.0
4.4.3.17	30 Hz tone	--	ck ( )		NA	Displayed

CALIBRATION CHECKLIST

TEST INST (S) IFR Inc. NAV-750, NAV-750A, and NAV-750B VOR/LOC/COMM and G/S Bench Test Sets

PROC. NO. NA 17-20AX-737		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
		(V dc)				(mV dc)
4.4.3.17	DC offset	0.0				-40.0 to +40.0
4.4.3.19	1020 Hz tone	--	ck ( )		NA	Displayed
"		(V dc)				(mV dc)
"		0.0				-40.0 to +40.0
4.4.3.22*	400 Hz tone	--	ck ( )		NA	Displayed
"		(V dc)				(mV dc)
"	DC offset	0.0				-80.0 to +80.0
4.4.3.24*	1300 Hz tone	--	ck ( )		NA	Displayed
"		(V dc)				(mV dc)
"	DC offset	0.0				-80.0 to +80.0
4.4.3.26*	3000 Hz tone	--	ck ( )		NA	Displayed
"		(V dc)				(mV dc)
"	DC offset	0.0				-80.0 to +80.0
4.5	Tone Frequency Tests					
	(Hz)	(Hz)				(Hz)
4.5.3	30 REF	30.0				29.994 to 30.006
4.5.6	90	90.0				89.982 to 90.018
4.5.8	90	90.0				"
	(Hz)	(Hz)				(Hz)
4.5.10	150	150.0				149.97 to 150.03
4.5.12	150	150.0				"
		(μs)				(μs)
4.5.18	9960 Hz deviation	48.5				46.1 to 50.9
	(Hz)	(Hz)				(Hz)
4.5.19	9960	9960.0				9958.008 to 9961.992
4.5.22	30 Variable	30.0				29.994 to 30.006
4.5.24	1020	1020.0				1014.9 to 1025.1

*Applicable only if TI is a NAV-750B.

TEST INST (S) IFR Inc. NAV-750, NAV-750A, and NAV-750B VOR/LOC/COMM and G/S Bench Test Sets

PROC. NO. NA 17-20AX-737		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
	(Hz)	(Hz)				(Hz)
4.5.27*	400	400.0				397.2 to 402.8
4.5.29*	1300	1300.0				1290.9 to 1309.1
4.5.31*	3000	3000.0				2979.0 to 3021. 0
4.6	Tone Distortion Tests					
	(Hz)					
4.6.3	30 REF	--	ck ( )			≤0.5% thd
4.6.7	90	--	ck ( )			≤0.4% thd
4.6.9	90	--	ck ( )			≤0.4% thd
4.6.12	150	--	ck ( )			≤0.4% thd
4.6.14	150	--	ck ( )			≤0.4% thd
4.6.17	30 Variable	--	ck ( )			≤0.5% thd
4.6.20	1020	--	ck ( )			≤0.5% thd
4.6.23	400	--	ck ( )			≤0.7% thd
4.6.25	1300	--	ck ( )			≤0.7% thd
4.6.27	3000	--	ck ( )			≤0.7% thd
4.7	Percent Amplitude Modulation of Tones and Modulation Meter Tests					
4.7.4	30% AM - 30 Hz	30.0%				28.8% to 31.2%
4.7.5	0-30 Meter Scale	--	ck ( )			±1.2% (AM) of step 4.7.4
4.7.7	30 Hz variable	--	ck ( )			>60%
4.7.10	1020 Hz variable	--	ck ( )			>60%
4.7.13	30% AM - 9960 Hz	30.0%				28.8% to 31.2%
4.7.15	9960 Hz variable	--	ck ( )			>60%
4.7.19	20% AM - 90 Hz	20.0%				19.2% to 20.8%
4.7.21	20% AM - 150 Hz	20.0%				19.2% to 20.8%
4.7.22	0-30 Meter Scale	--	ck ( )			±0.8% (AM) of step 4.7.21
4.7.24	40% AM - 90 Hz	40.0%				38.4% to 41.6%
4.7.26	40% AM - 150 Hz	40.0%				"
4.7.27	0-100 Meter Scale	--	ck ( )			±1.6% (AM) of step 4.7.26

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CALIBRATION CHECKLIST

TEST INST (S) IFR Inc. NAV-750, NAV-750A, and NAV-750B VOR/LOC/COMM and G/S Bench Test Sets

PROC. NO. NA 17-20AX-737		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.7.30	30% AM - 1020 Hz	30.0%				28.8% to 31.2%
4.7.34	95% AM - 400 Hz	95.0%				92.15% to 97.85%
4.7.35	0-100 Meter Scale	--	ck ( )			±3.0% (AM) of step 4.7.34
4.7.37	95% AM - 1300 Hz	95.0%				92.15% to 97.85%
4.7.40	95% AM - 3000 Hz	95.0%				92.15% to 97.85%
4.8	RF Level Meter Tests					
	(MHz)					(needle widths)
4.8.2	108.000	--	ck ( )			within ±1.5
4.8.4	110.000	--	ck ( )			"
"	130.000	--	ck ( )			"
"	150.000	--	ck ( )			"
"	170.000	--	ck ( )			"
"	190.000	--	ck ( )			"
"	210.000	--	ck ( )			"
"	230.000	--	ck ( )			"
"	250.000	--	ck ( )			"
"	270.000	--	ck ( )			"
"	290.000	--	ck ( )			"
"	310.000	--	ck ( )			"
"	330.000	--	ck ( )			"
"	335.000	--	ck ( )			"
4.8.7*	72.000	--	ck ( )			"
4.8.8*	74.000	--	ck ( )			"
4.8.8*	76.000	--	ck ( )			"
"	78.000	--	ck ( )			"

*Applicable only if TI is a NAV-750B.

TEST INST (S) IFR Inc. NAV-750, NAV-750A, and NAV-750B VOR/LOC/COMM and G/S Bench Test Sets

PROC. NO. NA 17-20AX-737		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.9	VOR Bearing Tests					
4.9.4	TO 0°	0.0°				000.00° ±0.05°
4.9.6	FROM 0°	180.0°				180.00° ±0.05°
4.9.8	TO 180°	180.0°				"
4.9.10	FROM 180°	0.0°				000.00° ±0.05°
4.9.12	TO 90°	90.0°				90.00° ±0.05°
4.9.14	FROM 90°	270.0°				270.00° ±0.05°
4.9.16	TO 270°	"				"
4.9.18	FROM 270°	90.0°				90.00° ±0.05°
4.10	LOC Centering Test					
4.10.3	150 Hz DEMOD voltage				NA	Record
4.10.5	90 Hz DEMOD voltage				NA	Record
4.10.6	Difference					Diff ≤2.75 mV rms
4.11	G/S Centering Test					
4.11.2	150 Hz DEMOD voltage					NA Record
4.11.4	90 Hz DEMOD voltage					NA Record
4.11.5	Difference					Diff ≤2.75 mV rms
4.12	Spectral Purity Tests (NAV-750 only)					
	(MHz)					(Harmonics)
4.12.4	108.000	--	ck ( )			≥30 dBc
"	115.000	--	ck ( )			"
"	130.000	--	ck ( )			"
"	145.000	--	ck ( )			"
"	157.000	--	ck ( )			"
4.12.6	329.000	--	ck ( )			"
"	332.000	--	ck ( )			"
"	335.000	--	ck ( )			"

CALIBRATION CHECKLIST

TEST INST (S) IFR Inc. NAV-750, NAV-750A, and NAV-750B VOR/LOC/COMM and G/S Bench Test Sets

PROC. NO. NA 17-20AX-737		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.12.9	334.700 @ ±20 kHz	--	ck ( )			SSB noise ≥68 dBc
4.12.12	108.000 @ ±20 kHz	--	ck ( )			" ≥74 "
4.12.13	108.000 @ ±12.5 kHz	--	ck ( )			Har. " ≥68 "
4.12.14	108.000 @ ±25 kHz	--	ck ( )			" ≥71 "
4.12.16	334.700 @ ±12.5 kHz	--	ck ( )			" ≥63 "
4.12.17	334.700 @ ±25 kHz	--	ck ( )			" ≥74 "
4.12.19	334.700 @ ±100 kHz	--	ck ( )			Brd. " ≥80 "
4.12.22	108.000 @ ±100 kHz	--	ck ( )			" ≥80 "
4.13	Spectral Purity Tests (NAV-750A only)					
	(MHz)					(Harmonics)
4.13.4	108.000	--	ck ( )			≥30 dBc
"	115.000	--	ck ( )			"
"	130.000	--	ck ( )			"
"	145.000	--	ck ( )			"
"	157.000	--	ck ( )			"
4.13.6	329.000	--	ck ( )			"
"	332.000	--	ck ( )			"
"	335.000	--	ck ( )			"
4.13.9	334.700 @ ±20 kHz	--	ck ( )			SSB noise ≥74 dBc
4.13.12	130.000 @ ±15 kHz	--	ck ( )			" ≥78 "
4.13.15	108.000 @ ±15 kHz	--	ck ( )			" ≥78 "
4.13.16	108.000 @ ±12.5 kHz	--	ck ( )			Har. " ≥75 "
4.13.17	108.000 @ ±25 kHz	--	ck ( )			" ≥83 "
4.13.19	334.700 @ ±12.5 kHz	--	ck ( )			" ≥66 "
4.13.20	334.700 @ ±25 kHz	--	ck ( )			" ≥77 "
4.13.22	334.700 @ ±100 kHz	--	ck ( )			Brd. " ≥82 "
4.13.25	108.000 @ ±100 kHz	--	ck ( )			" ≥82 "

TEST INST (S) IFR Inc. NAV-750, NAV-750A, and NAV-750B VOR/LOC/COMM and G/S Bench Test Sets

PROC. NO. NA 17-20AX-737		MFG.	MODEL			SER. NO.
PROCEDURE STEP NO. (1)	FUNCTION TESTED (2)	NOMINAL (3)	MEASURED VALUES FIRST RUN (4)	MEASURED VALUES SECOND RUN (5)	OUT OF TOL (6)	CALIBRATION TOLERANCES (7)
4.14	Spectral Purity Tests (NAV-750B only)					
	(MHz)					(Harmonics)
4.14.4	108.000	--	ck ( )			≥30 dBc
"	115.000	--	ck ( )			"
"	130.000	--	ck ( )			"
"	145.000	--	ck ( )			"
"	157.000	--	ck ( )			"
4.14.6	329.000	--	ck ( )			"
"	332.000	--	ck ( )			"
"	335.000	--	ck ( )			"
4.14.8	070.000	--	ck ( )			≥20 dBc
"	075.000	--	ck ( )			"
"	079.000	--	ck ( )			"
4.14.11	334.700 @ ±20 kHz	--	ck ( )			SSB noise ≥74 dBc
4.14.14	108.000 @ ±20 kHz	--	ck ( )			" ≥78 "
4.14.15	108.000 @ ±12.5 kHz	--	ck ( )			Har. " ≥75 "
4.14.16	108.000 @ ±25 kHz	--	ck ( )			" ≥83 "
4.14.18	334.700 @ ±12.5 kHz	--	ck ( )			" ≥75 "
4.14.19	334.700 @ ±25 kHz	--	ck ( )			" ≥83 "
4.14.21	334.700 @ ±100 kHz	--	ck ( )			Brd. " ≥80 "
4.14.24	108.000 @ ±100 kHz	--	ck ( )			" ≥80 "
4.15	Residual FM Tests					
4.15.5	118.000 MHz	--	ck ( )			<200 Hz
4.15.7	332.000 MHz	--	ck ( )			<400 Hz