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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR SIGNAL GENERATOR AEROFLEX MODEL 2023B AND 2023B WITH OPTIONS 2, 4, 11, AND 122

Headquarters, Department of the Army, Washington, DC
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REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our E-mail address: 2028@redstone.army.mil or by fax 256-842-6546/DSN 788-6546. For the World Wide Web use: https://amcom2028.redstone.army.mil. Instructions for sending an electronic 2028 can be found at the back of this manual.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Signal Generator, Aeroflex Model 2023B and 2023B with options 2, 4, 11 and 122. The manufacturer's manual was used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the TI (test instrument) throughout this bulletin.

a. Model Variations: None.

b. Time and Technique. The time required for this calibration is approximately 8 hours, using the dc and low frequency technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Adjustments to be reported are designated (R) at the end of the sentence in which they appear. When adjustments are in tables, the (R) follows the designated adjustment. Report only those adjustments made and designated with (R).

3. Calibration Description. TI parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Frequency Accuracy	Reference Oscillator Accuracy / stability: (2023B): ±1 in 10^6 per year (nominalized to 1.2 in 10^{-8}) Model 2023B (Option 004): ±2.5 in 10^7 per year (nominalized to 1.2 in 10^{-9}) Display Range: 9 kHz to 2.05 GHz Accuracy: ± 1 count of LSD

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
Frequency Modulation	Deviation range: CW range (MHz) Max. deviation (kHz) 1200 to 2510 12800 600 to 1200 6400 300 to 600 3200 150 to 300 1600 75 to 150 800 37.5 to 75 400 18.75 to 37.5 200 0.009 to 18.75 100 Accuracy ± 4% at 1 kHz modulation rate Bandwidth ± 1 dB DC to 275 kHz (DC coupled) Bandwidth ± 1 dB 10 Hz to 275 kHz (AC coupled) Bandwidth ± 1 dB 20 Hz to 275 kHz (AC coupled with ALC) Distortion: less than 1% at 1 kHz rate for deviations up to 20% of max available deviation
Phase Modulation	Range: 9 kHz to 2.05 GHz 0 to 10 radians Bandwidth (3 dB) 100 Hz to 10 kHz Accuracy: ± 4% at 1 kHz modulation rate Distortion: Less than 3% at 10 radian at 1 kHz modulation rate
RF output	Range: -140 dBm to +13 dBm , 0.1 dB resolution: Accuracy: Frequency >-127 dBm >-100 dBm Temp Coef 9 kHz to 1.2 GHz ± 0.8 ± 0.8 ± 0.02 dB/°C 1.2 GHz to 2.05 GHz ±1.4 ±1.2 ±0.03 dB/°C OPTION 11 Range: -140 dBm to +25 dBm (+19 dBm from 1.2 GHz to 2.05 GHz), 0.1 dB resolution: Accuracy: Same as standard instrument to +7 dBm Above 7 dBm apply specification below ± 1 dBm to 1.2 GHz < 23 dBm ± 1.5 dBm to 1.2 GHz < 25 dBm ± 2.0 dBm to 2.05 GHz (Accuracies reflect temperature range between +17°C to +27°C)
Amplitude Modulation	Carrier frequency range: <500 MHz to 1.5 GHz Range: 0 to 99.9% in 0.1% increments Accuracy: ±5% of set depth at 1 kHz modulation rate Bandwidth ± 1 dB DC to 30 kHz (DC coupled) Bandwidth ± 1 dB 10 Hz to 30 kHz (AC coupled) Bandwidth ± 1 dB 20 Hz to 30 kHz (AC coupled with ALC Distortion: <1.5%, 0 to 30% depth, 1 kHz rate <2.5%, 30 to 80% depth, 1 kHz rate

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
Pulse Modulation	Pulse Range 2023B: 32 MHz to 2.05 GHz, useable to 10 MHz Pulse Range 2023B (Option 11) 100 kHz to 2.05 GHz RF output: -140 dBm to +8 dBm RF output (Option 11): -140 dBm to +19 dBm On/off ratio: Better than -45 dB below 1.2 GHz better than 40 dB above 1.2 GHz On/off ratio (Option 11): Better than -80 dB below 1.2 GHz, Better than -70dB below 2.05 GHz. Rise and fall times: <10 µs (< 20 ns Option 11)
Spectral purity	Non-harmonics: Below –70 dBc for carrier frequencies up to 1 GHz Below –64 dBc for carrier frequencies from 1 GHz to 2.05 GHz Residual FM: Less than 4.5 Hz RMS in a 300 Hz to 3.4KHz unweighted bandwidth at 1 GHz
Internal LF Modulation Oscillator	Frequency range: 0.01 Hz to 20 kHz Frequency Accuracy: Same as frequency (time base accuracy) Distortion: Less than 0.1% THD at 1 kHz Flatness ± 1.0 dB Waveforms: Sine (to 20 kHz), triangle or square wave (to 3 kHz) Output level 2 VRMS (10 Ohm source impedance)
Avionics (VOR, ILS)	ILS MODE SDM (sum of depth of modulation) Range: 0-99.9% Accuracy 40% SDM: ±0.8% depth Accuracy 80% SDM: ±1.6% DDM (difference in depth of modulation) Range: 0-99.9% Accuracy: ± 0.02 of DDM setting ±0.0003 DDM Accuracy ± 0.0003 DDM at 0 DDM Accuracy: ± 0.34 DDM at 0.155 DDM VOR MODE Accuracy of depth at 30 Hz: ≤0.8% Accuracy of depth at 9.96 kHz: ≤0.8% Accuracy of Ident: ≤1.5% Bearing control Range: 0-359.9˚ Accuracy ± 0.05˚

SECTION II
EQUIPMENT REQUIREMENTS

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Reference Calibration Standards Set, NSN 4931-00-621-7878. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio between the standard and TI. Where the four-to-one ratio cannot be met, the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories required for this calibration are common usage accessories, issued as indicated in paragraph **4** above, and are not listed in this calibration procedure. The following peculiar accessory is required: Radio Frequency Detector, Hewlett-Packard, Model HP-423A.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
AUDIO ANALYZER	Frequency measurement: Range: 20 Hz to 100 kHz Accuracy: ±0.5% Distortion capability: ≤.01%	Boonton, Model 1121 (1121)
FREQUENCY COUNTER	Range: 10 Hz to 2050 MHz Accuracy: See TIME/FREQUENCY WORKSTATION	Fluke, Model PM6681/656 (PM6681/656)
FUNCTION GENERATOR	DC to 100 kHz sine, ±0.6dB flatness, 100 kHz square wave DC: +5VDC	Agilent 33250A (33250A)
MEASURING RECEIVER	Attenuation Measurement: 0dBm to -103.1 dBm 2.5 MHz to 1200 MHz. ± 0.2 dB 1200 MHz to 2050 MHz ±0.35 dB Power measurement: (+15 dBm to -6 dBm) 1.0 MHz to 1200 MHz. ± 0.2 dB 1200 MHz to 2050 MHz ±0.35 dB AM accuracy ± 1.25% (2%) at 1 kHz mod frequency FM accuracy: ± 1% at 1 kHz mod frequency Phase Mod ±1%(±3%)	Hewlett-Packard, Model 8902A w/sensor module, Hewlett-Packard, Model 11722A (11722A) and down converter HP 11793A or Measuring receiver system N5531S consisting of: Spectrum Analyzer, Agilent Model E4440A (E4440A), Power meter, Agilent Model E4419B (E4419B), and Sensor module, Agilent Model 504 (504)

Table 2. Minimum Specifications of Equipment Required- Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
MODULATION ANALYZER	ILS Mode: SDM Accuracy @ 40% ± 0.2 (0.5%) SDM accuracy @ 80% ± 0.4 (0.5) DDM Range 1-80%, accuracy ± 0.0075 % depth VOR mode: Bearing accuracy: ± 0.0125˚ (0.03˚) Depth Accuracy: ± 0.875%	Rohde and Schwarz, FMAV
MULTIMETER	Range: 100 mVRMS to 2VRMS Frequency: 30-33 kHz Accuracy: ±2.4%	Hewlett-Packard, Model 3458A
OSCILLOSCOPE	100 MHz bandwidth Rise/Falltime ≤5 nSec	Agilent, OS-303/G (OS-303/G)
SPECTRUM ANALYZER	Range: DC to 7.6 GHz (+13 to -70 dB) 3 Hz Resolution Bandwidth	(AN /USM 677)
TIME/FREQUENCY WORKSTATION	Accuracy: ±3.0 parts in 10^{-10}	Datum, Model ET6000-75 (13589305)

SECTION III
CALIBRATION PROCESS

6. Preliminary Instructions

a. The instructions outlined in paragraphs **6** and **7** are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning the calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

c. Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Adjustments required to calibrate the TI are included in this procedure. Additional maintenance information is contained in the manufacturer's manual for this TI.

d. Unless otherwise specified, all controls and control settings refer to the TI.

7. Equipment Setup

WARNING

HIGH VOLTAGE is used or exposed during the performance of this calibration. DEATH ON CONTACT may result if personnel fail to observe safety precautions. REDUCE OUTPUT(S) to minimum after each step within the performance checks where applicable.

NOTE

Before connecting TI, the protective earth terminal of the instrument must be connected to the protective conductor of the line power cord. The line plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.

NOTE

Before carrying out any adjustments, the date may be set such that when selecting **Save cal data and quit** after the appropriate adjustment has been *successfully* completed, the date of the adjustment will be recorded. Selecting **Quit without saving cal data** (which may be used if a calibration has been unsuccessful), will not set the new date or save any data.

NOTE

Throughout this procedure soft keys are identified by the use of brackets **[ ]** around the key.

a. Set TI **POWER** switch to **ON** and allow at least 30 minutes for TI to stabilize.

b. Unlock the instrument to *Level 2* by pressing: **MENU, 80, [ENTER]**.

c. Press **NEXT** to select *Level 2*, then enter the six-digit password (default 123456) and press **[ENTER]**.

d. Press **MENU, 119 [ENTER]** (Set Calibration Date). Enter the date by keying in numbers: YYYY-MM-DD (dashes are automatically inserted) then press **[ENTER]**.

e. Press **MENU 100 [ENTER],** and then press **SELECT** to *start cal synthesizer*. This calibration will take about 10 seconds.

f. Select *exit* (after cal synthesizer is complete) by pressing **NEXT,** then **SELECT**, then **SELECT** again to choose *Save cal data and quit*.

8. Carrier Frequency Accuracy

NOTE

Ensure that the frequency counter is configured for an external time-base reference throughout this procedure.

a. Performance Check

(1) Connect the time/frequency workstation standard 10 MHz output to frequency counter external 10 MHz input.

(2) Connect TI **OUTPUT RF 50Ω** to frequency counter **INPUT C**.

(3) Press TI keys as listed in (a) thru (f)

(a) **RCL 999 [ENTER]**.
(b) **RF LEVEL, 0 dB**.
(c) **MENU 80 [ENTER]**.
(d) **Level 2: using NEXT**.
(e) six-digit password (default 123456), **[ENTER]**.
(f) **MENU 102 [ENTER]**.

(4) Set frequency counter function to INPUT C with 1 Hz resolution. Frequency counter will indicate approximately 2050.000000 MHz.

(5) Select the *coarse DAC* or the *fine DAC* using **NEXT / PREV** as necessary. Adjust the DAC using the rotary control or the **X10 / 10** key until the frequency displayed on the frequency counter is as close to 2050.000000 MHz as possible. Allow time to stabilize.

(6) Use **NEXT** to select *Exit*, **SELECT** to exit, **PREV** or **NEXT** to choose *Save cal data and quit,* then press **SELECT** to exit adjustment menu to *Calibration Menu (1).* Turn off TI **RF OUTPUT** by pressing **CARR ON/OFF**.

(7) On the TI, press **CARR FREQ, 1200, MHz**.

(8) Press TI **CARR ON/OFF** key.

(9) Frequency counter will indicate between 1199.999880 MHz and 1200.000120 MHz (1199.9999880 MHz and 1200.0000120 MHz for instruments with Option 4).

(10) Synchronize the TI and frequency counter time bases by connecting the TI **FREQ STD IN-OUT** (rear panel) to frequency counter **REFERENCE IN** (rear panel).

(11) Activate TI internal 10 MHz rear panel output by pressing **MENU**, **4 [ENTER]**. Press **4** to select *Internal 10MHz OUT*.

(12) Disconnect TI **OUTPUT RF 50Ω** from frequency counter **INPUT C** and connect the TI **RF OUTPUT 50Ω** to frequency counter **INPUT A. C**onfigure the frequency counter for a FREQ A measurement.

(13) On the TI, press **CARR FREQ, .009, MHz.**

(14)Verify that the frequency counter indication is within limits specified in table 3.

(15) Repeat (13) and (14) for remaining carrier frequency values in table 3.

Table 3. Frequency Phase Locked Loop
And Divider Accuracy 9 kHz To 75 MHz

TI	Frequency counter indication	
Carrier frequency (MHz)	Min (MHz)	Max (MHz)
0.009	0.008999	0.009001
1	0.999999	1.000001
9.999999	9.999998	10.000000
18.75	18.749999	18.750001
37.5	37.499999	37.500001
75	74.999999	75.000001

(16) Press TI **CARR ON/OFF** (RF output off). Disconnect the TI from the frequency counter **INPUT A** and reconnect to **INPUT C**. Configure the frequency counter for a **FREQ C** measurement. Press TI **CARR ON/OFF** key (RF output on).

(17) On the TI, press **150 MHz**.

(18) Verify that the frequency counter indication is within limits specified in table 4.

(19) Repeat technique of (17) and (18) above for remaining values in table 4.

Table 4. Frequency P\Phase Locked Loop And
Dividers Accuracy 150 To 1200 Mhz

TI	Frequency counter	
Frequency (MHz)	Min (MHz)	Max (MHz)
150	149.999999	150.000001
300	299.999999	300.000001
600	599.999999	600.000001
1200	1199.999999	1200.000001

(20) Disable internal 10 MHz rear panel output by selecting TI **MENU 4, [ENTER], 0**.

(21) Disconnect the TI internal 10 MHz frequency standard from the frequency counter. Connect the time/frequency workstation standard 10 MHz output to the frequency counter external reference input.

(22) Press **CARR FREQ, 1200.000001 MHz**.

(23) Verify the frequency counter indication is within limits listed in table 5.

(24) Repeat (22) and (23) for remaining frequencies in table 5.

(25) Set all outputs to minimum and disconnect equipment setup.

Table 5. Carrier Frequency Accuracy Tests Above 1200 Mhz

TI	Frequency counter			
Frequency (MHz)	Standard instrument Min (MHz)[1]	Standard instrument Max (MHz)[1]	Option 4 Min (MHz)[2]	Option 4 Max (MHz)[2]
1200.000001	1199.9988010	1200.0012010	1199.9997010	1200.0003010
1230	1229.9987700	1230.0012300	1229.9996925	1230.0003075
1250	1249.9987500	1250.0012500	1249.9996875	1250.0003125
1260	1259.9987400	1260.0012600	1259.9996850	1260.0003150
1320	1319.9986800	1320.0013200	1319.9996700	1320.0003300
1350	1349.9986500	1350.0013500	1349.9996625	1350.0003375
1500	1499.9985000	1500.0015000	1499.9996250	1500.0003750
1599.999999	1599.9983990	1600.0015990	1599.9995990	1600.0003990
2050	2049.9979500	2050.0020500	2049.9994875	2050.0005125

[1] Limit based on Standard TCXO aging rate of ± 1 in 10^{-6} per year (at 1 year).
[2] Limit based on option 4 OCXO aging rate of ± 2.5 in 10^{-7} per year (at 1 year).

b. Adjustments. No further adjustments can be made.

9. Frequency Modulation Accuracy

a. Performance Check

(1) Connect test equipment as shown in figure 1, Connection A.

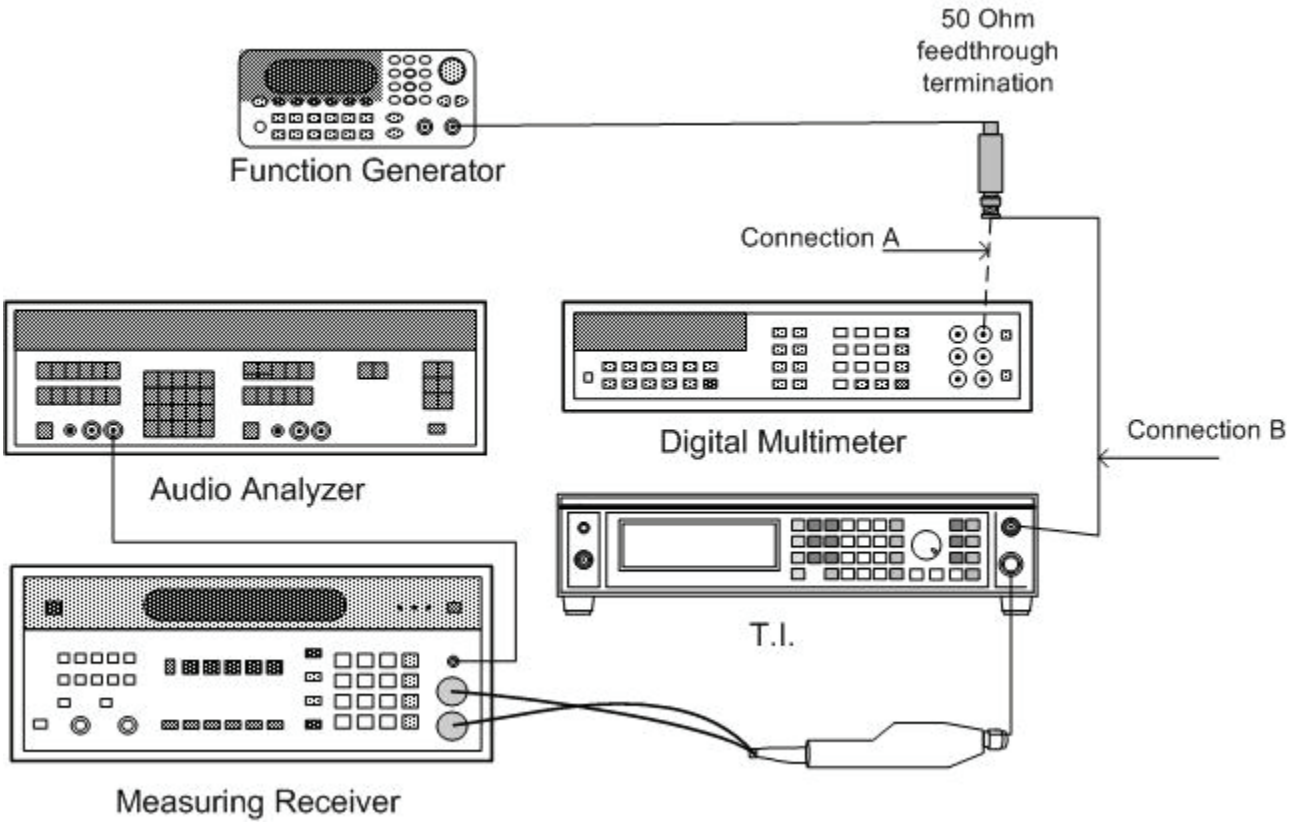

Figure 1. Modulation accuracy hookup.

(2) Use multimeter to set the function generator for 1.00 V RMS, 1 kHz sine wave output.

(3) Connect test equipment as shown in figure 1, Connection B.

(4) Press TI keys as listed in (a) through (j) below:

(a) **RCL, 999 [ENTER]**.
(b) **CARR FREQ, 15, MHz**.
(c) **RF LEVEL, 0, dB**.
(d) **MOD, 50, kHz** (FM1 Devn).
(e) **SOURCE ON/OFF** (to enable modulation source).
(f) **MOD ON/OFF** (to enable modulation).
(g) **MENU, 20, [ENTER]** the TI will enter the Modulation Mode menu**.**
(h) Select *External* using **NEXT** and select *FM ext* by pressing **1**.
(i) **MENU, 30, [ENTER]**. The TI will enter the Modulation Source menu.
(j) Place cursor over *Ext* using **NEXT** then press **2** to select *DC coupling*.

(5) Measure FM deviation using measurement receiver. Measuring receiver will indicate between 47.5 and 52.5 kHz. Set a 0.00 dB reference on the measuring receiver by pressing **RATIO**. Use **LOG/LIN** as necessary to select dB.

(6) Set function generator to remaining frequencies listed in table 6. Measuring receiver will indicate within limits specified in table 6. At frequencies indicated in table 6,

measure the AF distortion with audio analyzer. If indications are not within limits specified in table 6, perform **b** below.

Table 6. External FM Frequency Response (ALC Off, DC Coupled), 50 Khz Deviation, 1VRMS

Function generator	Measuring receiver		
Modulation frequency (kHz)	Response level min (dB)	Response level max (dB)	Distortion (%)
0.03	-1	+1	—
0.1	-1	+1	<3
0.3	-1	+1	—
1	Reference	Reference	<3
3	-1	+1	—
5	-1	+1	<3
10	-1	+1	—
20	-1	+1	<3
50	-1	+1	—
100	-1	+1	—
200	-1	+1	—

(7) Connect test equipment as shown in figure 1, Connection A.

(8) Use multimeter to set the function generator for 0.75 V RMS, 1 kHz sine wave output.

(9) Connect test equipment as shown in figure 1 ,Connection B.

(10) Press the TI keys as listed in (a) through (j) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 15, MHz**.
(c) **RF LEVEL, 0, dB**.
(d) **MOD, 10, kHz** (FM1 Devn.)
(e) **SOURCE ON/OFF** (to enable modulation source).
(f) **MOD ON/OFF** (to enable modulation).
(g) **MENU, 20 [ENTER]** the TI will enter the Modulation Mode menu.
(h) Highlight *Externa*l using **NEXT** and select *FM ext* by pressing **1**.
(i) **MENU 30 [ENTER]**. The TI will enter the Modulation Source menu.
(j) Highlight *Ext* **using NEXT** then press **1** to select ALC.

(11) Measure FM deviation using measuring receiver. Measuring receiver will indicate between 9.5 kHz and 10.5 kHz FM deviation (de-select relative mode from previous measurement if necessary). Set a 0.00 dB reference on measuring receiver by pressing **RATIO**. Use **LOG/LIN** as necessary to select dB.

(12) Set function generator to remaining frequencies listed in table 7. Measuring receiver will indicate within limits specified in table 7. If indications are not within limits specified in table 7, perform **b** below.

(13) Connect test equipment as shown in Figure 1 Connection A.

(14) Use multimeter to set the function generator for 1.25 V RMS, 1 kHz sine wave output and repeat (9), (11) and (12) above using table 8.

Table 7. External FM Frequency Response (ALC On) 10 Khz Deviation, 0.75 VRMS Input

Function generator	Measuring receiver	
Modulation frequency (kHz)	Response level min (dB)	Response level max (dB)
0.02	-1	+1
0.1	-1	+1
0.3	-1	+1
1	Reference	Reference
3	-1	+1
10	-1	+1
30	-1	+1
100	-1	+1
200	-1	+1

Table 8. External FM Frequency Response (ALC On) 10 Khz Deviation, 1.25 VRMS Input

Function generator	Measuring receiver		
Modulation frequency (kHz)	Response level min (dB)	Response level max (dB)	Distortion (%)
0.02	-1	1	—
0.1	-1	1	<3
0.3	-1	1	—
1	Reference	Reference	<3
3	-1	1	—
5	-1	1	—
10	-1	1	—
20	-1	1	<3
30	-1	1	—
100	-1	1	—
200	-1	1	—

(15) Press TI **CARR ON/OFF** key, disable function generator output and remove function generator from equipment setup.

(16) Configure measuring receiver to measure FM with a 50 Hz HP filter and a 15 kHz LP filter.

(17) Press TI keys as listed in (a) through (f) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 10, MHz**.
(c) **RF LEVEL, 0, dB**.
(d) **MOD, 100, kHz** (FM1 Devn).
(e) **SOURCE ON/OFF** (to enable modulation source).
(f) **MOD ON/OFF** (to enable modulation).

(18) Measure FM deviation using measuring receiver. Measurement receiver will indicate FM deviation between 96 kHz and 104 kHz. Measure AF distortion using the audio analyzer. AF distortion will be less than 3.0%. If indications are not within limits specified in table 9 perform **b** below.

(19) Measure FM deviation for remaining carrier frequencies listed in table 9. Measuring receiver will indicate within limits specified in table 9. Measure AF distortion with the audio analyzer. If indications are not within limits specified in table 9, perform **b** below.

Table 9. Internal FM Deviation And Distortion At 100 Khz Deviation

TI	Measurement receiver		Audio analyzer
Carrier frequency (MHz)	FM deviation min (kHz)	FM deviation max (kHz)	Distortion
10	96	104	<3%
10.144	96	104	<3%
10.292	96	104	<3%
10.592	96	104	<3%
10.746	96	104	<3%
10.901	96	104	<3%
11.059	96	104	<3%
11.22	96	104	<3%
11.382	96	104	<3%
11.547	96	104	<3%
11.714	96	104	<3%
11.884	96	104	<3%
12.056	96	104	<3%
12.23	96	104	<3%
12.5	96	104	<3%
12.587	96	104	<3%
12.77	96	104	<3%
12.995	96	104	<3%
13.143	96	104	<3%
13.333	96	104	<3%

(20) Press TI keys as listed in (a) through (f) below:

(a) **RCL, 999 [ENTER]**.
(b) **CARR FREQ, 15, MHz**.
(c) **RF LEVEL, 0, dB**.

(d) **MOD, 100, kHz** (FM1 Devn).
(e) **SOURCE ON/OFF** (to enable modulation source).
(f) **MOD ON/OFF** (to enable modulation).

(21) Ensure that the measuring receiver is configured to measure FM with the 50 Hz HP filter and the 15 kHz LP filter.

(22) Measure the FM deviation using measuring receiver. Measurement receiver will indicate within limits shown in table 10. If measurement receiver does not indicate within limits shown in table 10, perform **b** below.

(23) Repeat (22) for remaining values in table 10.

Table 10. FM Scale Shape Tests At 15 Mhz Carrier

TI	Measurement receiver	
FM deviation (kHz)	FM deviation min (kHz)	FM deviation max (kHz)
100	96	104
71	68.16	73.84
56	53.76	58.24
44	42.24	45.76
34	32.64	35.36
27	25.92	28.08
21	20.16	21.84
16	15.36	16.64
13	12.48	13.52
11	10.56	11.44
10	9.6	10.4
1	0.96	1.04
0.1	0.096	0.104

(24) Press TI keys as listed in (a) through (c) below:

(a) **RCL, 999 [ENTER]**.
(b) **CARR FREQ, 1200, MHz**.
(c) **RF LEVEL, 0, dB**.

(25) Configure measuring receiver for a frequency measurement with 100 Hz resolution. Record measurement receiver frequency display indication.

(26) Press TI keys as listed in (a) through (f) below:

(a) **MOD, 100, kHz** (FM1 Devn).
(b) **SOURCE ON/OFF** (to enable modulation source).
(c) **MOD ON/OFF** (to enable modulation).
(d) **MENU, 20, [ENTER]**.
(e) The TI will enter the modulation mode menu. Select *Externa*l using **NEXT** then press 1 to select *FM ext*. Press **MENU**, **30**, [**ENTER**].
(f) The TI will enter the modulation source menu. Select *Ext* using **NEXT**. Press **2** to select *DC coupling*. Press **MENU**, **23**, **[ENTER]**.

(27) The TI will select the **DCFM Nulling** control. The TI will prompt you to *Apply a ground reference to external modulation input before nulling*. Ground the **MOD I/O**

connector then choose *DCFM Null* by pressing **SELECT**. Record the measuring receiver frequency indication. Subtract this indication from frequency error recorded in (25) above. The difference between the two indications will be less than 1 kHz.

(28) Set all outputs to minimum.

b. Adjustments

(1) Press **RCL, 999, [ENTER]** on TI.

(2) On the TI press: **MENU, 80, [ENTER]**.

(3) Unlock TI by scrolling to *Level 2* using **NEXT**. Enter the six-digit password (default 123456) then press **[ENTER]**.

(4) Connect the TI **LF OUTPUT** (**MOD I/O** for instruments with option 7 or 11) to the digital voltmeter.

(5) Set digital voltmeter to read DC volts.

(6) Press the TI keys: **MENU, 103, [ENTER]**.

(7) Adjust the Ext Mod Ref DAC using either the x10 up/down arrow keys or the rotary knob for a DC voltage indication as close to 1.414 V as possible.

(8) Select *Exit* using the **NEXT** key then press **SELECT**. If you did not adjust DAC level, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* and press **SELECT**. Disconnect digital voltmeter from TI.

(9) Connect the **TIME FREQUENCY WORKSTATION 10 MHz** output to frequency counter external reference input.

(10) Connect the TI **RF OUTPUT 50Ω** to frequency counter **INPUT C**.

(11) On the TI, press: **RCL, 999, [ENTER]**, **MENU, 80, [ENTER]**.

(12) Unlock TI by scrolling to *Level 2* using **NEXT**. Enter the six-digit password (default 123456), then press **[ENTER]**.

(13) Press the TI keys as listed in (a) through (c) below:

(a) **CARR FREQ, 1, GHz**.
(b) **RF LEVEL, 0, dB**.
(c) **MENU, 106, [ENTER]**.

(14) Adjust the FM Factor DAC using either the **X10** up/down arrow keys, or the rotary knob until frequency counter displays 1.00000000 GHz.

(15) Select *Exit* using the **NEXT** key then press **SELECT**. If you did not adjust DAC level, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* and press **SELECT**.

(16) Connect the TI **LF OUTPUT** to TI **EXT MOD INPUT** (this connection is not necessary on instruments with option 7 or as 11 as signal is routed internally).

(17) Press the TI keys: **MENU, 107, [ENTER]**.

(18) Adjust the Mod Amplitude DAC using either the **X10** up/down arrow keys or the rotary knob until the frequency counter displays 1.00000000 GHz.

(19) Select *Exit* using the **NEXT** key then press **SELECT**. If no adjustments to the DAC level were made, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* and press **SELECT**.

(20) Disconnect frequency counter from TI and frequency standard from frequency counter.

(21) (FM Tracking) Press TI keys as listed in (a) through (e) below:

(a) **MENU, 108, [ENTER]**.

(b) **SELECT** (starts the FM Tracking adjustment). The TI will perform a self-calibration which should only take about 10 seconds.

(c) Select *Exit* using the **NEXT** key then press **SELECT**.

(d) Press **PREV** to choose *Save cal data and quit.*

(e) Press **SELECT** to *Save cal data and quit.*

(22) Set all outputs to minimum and disconnect equipment setup.

10. Phase Modulation Accuracy

a. Performance Check

(1) Ensure that the measuring receiver power sensor is connected to the TI **RF OUTPUT 50Ω**.

(2) Ensure that the measuring receiver **MODULATION OUTPUT/AUDIO INPUT** is connected to audio analyzer **INPUT HIGH**.

(3) Press the TI keys as listed in (a) through (h) below:

(a) **RCL, 999, [ENTER]**.

(b) **CARR FREQ, 10.5, MHz**.

(c) **RF LEVEL, 0, dB**.

(d) **MENU, 20, [ENTER]**.

(e) The TI will enter the Modulation Mode menu. Use **NEXT** to highlight *Internal* then press **2** to select *ΦM INT*.

(f) Press TI keys **MOD, 10, rad**.

(g) **SOURCE ON/OFF** (to enable modulation source).

(h) **MOD ON/OFF** (to enable modulation).

(4) Configure the measuring receiver to measure phase modulation with the 50 Hz HP filter and the 15 kHz LP selected. Configure the audio analyzer to measure distortion in percent. Measuring receiver phase modulation indication will be between 9.6 and 10.4 rad. Distortion indication on audio analyzer will be less than 3 percent.

(5) Press the TI keys: **CARR FREQ 15 MHz**.

(6) Configure the measuring receiver to measure FM deviation with the 50 Hz HP and the 15 kHz LP filter.

(7) Use the following formula to calculate Phase Modulation. The result should be approximately 10. Record this first value as the 1 kHz modulation reference for use in step (10).

$$\Phi M = \frac{\text{FM deviation from measuring receiver (Hz)}}{\text{Modulation frequency from TI display (Hz)}}$$

(8) Use the TI **MOD SOURCE** button to set the modulation frequency to the first modulation frequency listed in table 11.

(9) Calculate the phase modulation at each additional frequency using the formula above. The result should be approximately 10 at each frequency. Record these values.

(10) Using the values recorded in (9) above and the reference recorded in (7) above, calculate the change in response at each modulation frequency using the following formula:

$$\text{Change in response} = 20 \text{ LOG } \frac{\text{Value in (9)}}{\text{1 kHz ref value in (7)}}$$

(11) Verify the calculated level is within limits specified in table 11. If calculated response level is not within limits specified in table 11, perform **b** below.

(12) Set all outputs to minimum and disconnect equipment setup.

Table 11 Internal ΦM Flatness

TI modulation freq (kHz)	Calculated response level min (dB)	Calculated response level max (dB)
0.1	-3	3
0.3	-3	3
1	Reference	Reference
3	-3	3
10	-3	3

b. Adjustments

(1) Connect the **TI RF OUTPUT 50Ω** to measuring receiver **RF INPUT**.

(2) Set measuring receiver to measure FM with a 50 Hz high pass filter and a 15 kHz low pass filter.

(3) Press the TI keys as listed in (a) through (f) below:

(a) **RCL, 999, [ENTER]**.
(b) **MENU, 80, [ENTER]**.
(c) Unlock TI by scrolling to Level 2 using **NEXT**. Enter the six-digit password (default 123456) then press **[ENTER]**.
(d) **CARR FREQ, 1, GHz**.
(e) **RF LEVEL, 0, dB**.
(f) **MENU, 110, [ENTER]**.

(4) Adjust the PM Factor DAC using **X10** up or down arrow keys or the rotary knob until a measuring receiver displays deviation as close as possible to 10.00 kHz.

(5) Select *Exit* using the **NEXT** key then press **SELECT**. If no adjustments to the DAC level were made, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* and press **SELECT**.

(6) Set all outputs to minimum and disconnect equipment setup.

11. RF Output (Except Option 3 or 11)

a. Performance Check

(1) Connect TI **RF OUTPUT 50Ω** to multimeter INPUT using 50 Ω feedthrough termination. Configure the multimeter for an AC voltage measurement.

(2) Press the TI keys as listed in (a) through (c) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 30 kHz**.
(c) **RF LEVEL, –4, dB**.

(3) Verify that the multimeter indication is within limits specified in table 12.

(4) Measure remaining RF levels at frequencies listed in table 12. Multimeter will indicate within limits specified in table 12. If multimeter does not indication within limits specified in table, perform **b** below.

NOTE

If performing **b** does not bring instrument into tolerance, refer to manufacturer's manual for additional adjustments.

Table 12. RF Output (Not Option 3 Or 11)

TI	Multimeter					
Carrier. frequency (MHz)	TI RF output at-4 dB		TI RF output at +7 dB		TI RF output at +13 dB	
	Min (mV)	Max (mV)	Min (mV)	Max (mV)	Min (mV)	Max (mV)
0.03	128.67	154.70	456.55	548.89	910.93	1095.2
0.033	128.67	154.70	456.55	548.89	910.93	1095.2

(5) On TI press **CARR ON/OFF**.

NOTE

Zero measuring receiver/sensor; calibrate, and save sensor values as necessary.

(6) Remove digital mulitmeter connection from TI **RF OUTPUT 50Ω**. Connect measuring receiver power sensor to TI **RF OUTPUT 50Ω**.

(7) Configure the measuring receiver for an RF POWER measurement at frequencies listed in table 13. Verify measuring receiver indicates within limits listed in table 13.

(8) Measure remaining RF power at frequencies listed in table 13. Measuring receiver will indicate within limits specified in table 13. If measuring receiver does not indication within limits specified in table, perform **b** below.

Table 13. RF Output Above 33khz (Not Option 3 Or 11)

TI	Measuring receiver					
Carrier frequency (MHz)	TI RF output at -4.0 dB		TI RF output at +7.0 dB		TI RF output at +13 dB	
	Min (dBm)	Max (dBm)	Min dBm)	Max (dBm)	Min (dBm)	Max (dBm)
1	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
9	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
11	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
60	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
180	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
300	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
420	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
540	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
660	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
780	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
900	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
1020	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
1140	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
1200	-4.8	-3.2	+6.2	+7.8	+12.2	+13.8
1201	-5.2	-2.8	+5.8	+8.2	+11.8	+14.2
1260	-5.2	-2.8	+5.8	+8.2	+11.8	+14.2
1380	-5.2	-2.8	+5.8	+8.2	+11.8	+14.2
1500	-5.2	-2.8	+5.8	+8.2	+11.8	+14.2
1620	-5.2	-2.8	+5.8	+8.2	+11.8	+14.2
1740	-5.2	-2.8	+5.8	+8.2	+11.8	+14.2
1860	-5.2	-2.8	+5.8	+8.2	+11.8	+14.2
2050	-5.2	-2.8	+5.8	+8.2	+11.8	+14.2

b. Adjustments

(1) Zero measuring receiver; calibrate, and save sensor values.

(2) Connect the **TI RF OUTPUT 50Ω** to the measuring receiver **RF INPUT**. Set measuring receiver for a tuned RF power measurement at 100 MHz.

(3) Press the TI keys as listed in (a) through (d) below:

(a) **RCL, 999, [ENTER]**.

(b) **MENU, 80, [ENTER]**.

(c) Unlock TI by scrolling to Level 2 using **NEXT**. Enter the six-digit password (default 123456) then press **[ENTER]**.

(d) **MENU, 111, [ENTER]**. (The TI will be set to 100 MHz, *6 dB Atten* will be highlighted).

(4) Press **0** on TI to deselect the 6 dB of attenuation.

(5) Set a 0.000 dB reference on the measuring receiver. Press **1** on TI to select 6 dB of attenuation.

(6) Press **NEXT** to place cursor on *RF DAC A*. Adjust RF DAC A using either the x10 up/down arrows or the rotary knob, for precisely -6.000 dB difference from reference set in (5) above on the measuring receiver.

(7) Press **PREV, 0** on TI to deselect the 6 dB attenuation.

(8) Reset the 0.000 dB reference on the measuring receiver if necessary.

(9) Press **NEXT** to select *18 dB Atten*. Press **1** on TI to insert 18 dB of attenuation.

(10) Press **NEXT** to place cursor over *RF DAC B*. Adjust RF DAC B for precisely -18.000 dB difference from reference set in (8) on the measuring receiver.

(11) Select *Exit* using the **NEXT** key then press **SELECT**. If DAC levels were not adjusted, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* and press **SELECT**.

(12) Set all outputs to minimum and disconnect equipment setup.

12. RF Output (Option 3 or 11)

a. Performance Check

(1) Connect TI **RF OUTPUT 50Ω** to multimeter INPUT using 50 Ω feedthrough termination. Configure the multimeter for an AC voltage measurement.

(2) Press the TI keys as listed in (a) through (c) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 30 kHz**.
(c) **RF LEVEL, –4, dB**.

(3) Verify that the multimeter indication is within limits specified in table 14.

(4) Measure remaining RF levels at frequencies listed in table 14. Multimeter will indicate within limits specified in table 14. If multimeter does not indication within limits specified in table, perform **b** below.

NOTE

If performing **b** does not bring instrument into tolerance, refer to manufacturer's manual for additional adjustments.

Table 14. RF Output (Option 3 Or 11)

TI	Multimeter					
Carrier frequency (MHz)	TI RF output at-4 dB		TI RF output at +7 dB		TI RF output at +25 dB	
	Min (mV)	Max (mV)	Min (mV)	Max (mV)	Min (V)	Max (V)
0.03	128.67	154.70	446.15	561.67	3.3457	4.7259
0.033	128.67	154.70	446.15	561.67	3.3457	4.7259

(5) On TI press **CARR ON/OFF**.

NOTE

Zero measuring receiver/sensor; calibrate, and save sensor values as necessary.

(6) Remove digital mulitmeter connection from TI **RF OUTPUT 50Ω**. Connect measuring receiver power sensor to TI **RF OUTPUT 50Ω**.

(7) Configure the measuring receiver for an **RF POWER** measurement at frequencies listed in table 15. Verify measuring receiver indicates within limits listed in table 15.

(8) Measure remaining RF power at frequencies listed in table 15. Measuring receiver will indicate within limits specified in table 15. If measuring receiver does not indication within limits specified in table, perform **b** below.

Table 15. RF Output Above 33khz (Option 3 Or 11)

TI	Measuring receiver					
Carrier frequency. (MHz)	TI RF output at -4.0 dB		TI RF output at +7.0 dB		TI RF output at +25 dB[1]	
	Min (dBm)	Max (dBm)	Min (dBm)	Max (dBm)	Min (dBm)	Max (dBm)
1	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
9	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
11	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
60	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
180	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
300	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
420	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
540	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
660	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
780	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
900	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
1020	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
1140	-4.8	-3.2	+6.0	+8.0	+23.5	+26.5
1200	-5.2	-2.8	+6.0	+8.0	+23.5	+26.5
1201[1]	-5.2	-2.8	+5.0	+9.0	+17.0	+21.0
1260	-5.2	-2.8	+5.0	+9.0	+17.0	+21.0

See footnote at end of table.

Table 15. RF Output Above 33khz (Option 3 Or 11)-Continued

TI	Measuring receiver					
Carrier frequency. (MHz)	TI RF output at -4.0 dB		TI RF output at +7.0 dB		TI RF output at +25 dB[1]	
	Min (dBm)	Max (dBm)	Min (dBm)	Max (dBm)	Min (dBm)	Max (dBm)
1380	-5.2	-2.8	+5.0	+9.0	+17.0	+21.0
1500	-5.0	-2.8	+5.0	+9.0	+17.0	+21.0
1620	-5.2	-2.8	+5.0	+9.0	+17.0	+21.0
1740	-5.2	-2.8	+5.0	+9.0	+17.0	+21.0
1860	-5.2	-2.8	+5.0	+9.0	+17.0	+21.0
2050	-5.2	-2.8	+5.0	+9.0	+17.0	+21.0

[1] At 1201 MHz, decrease RF Output level to +19 dBm.

b. Adjustments

(1) Zero measuring receiver; calibrate, and save sensor values.

(2) Connect the **TI RF OUTPUT 50Ω** to measuring receiver **RF INPUT**.

(3) Press the TI keys as listed in (a) through (d) below:

(a) **RCL, 999, [ENTER]**.
(b) **MENU, 80, [ENTER]**.
(c) Unlock TI by scrolling to *Level 2* using **NEXT**. Enter the six-digit password (default 123456) then press **[ENTER]**.
(d) **MENU**, **116**, [**ENTER**] (the TI will be set to the first Cal Point).

(4) Press **NEXT** to place cursor over Cal Factor. Adjust Cal Factor using either the **X10** up/down arrows or the rotary knob until the reading displayed on the measuring receiver (or multimeter with 50 Ω termination at low frequency) is precisely +19.000 dBm (1.9929 VRMS).

(5) Choose each cal point in turn, by pressing **PREV** to highlight Cal Point then enter the next cal point number and [**ENTER**]. At each cal point, adjust the Cal Factor until the reading displayed is as close as possible to +19.000 dBm.

(6) Repeat (4) and (5) above for remaining cal points.

(7) Select *Exit* using the **NEXT** key then press **SELECT**. If DAC levels were not adjusted, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* and press **SELECT**.

(8) Set all outputs to minimum and disconnect equipment setup.

13. RF Output ALC Linearity

a. Performance Check

(1) Press the TI keys as listed in (a) through (c) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 2.5 MHz**.
(c) **RF LEVEL, –4, dB**.

NOTE

Zero measuring receiver/sensor; calibrate, and save sensor values as necessary.

(2) Set measuring receiver to measure RF power at TI carrier frequency.

(3) Verify that the measuring receiver indication is within limits listed in table 16.

(4) Measure remaining RF levels listed in table 16. If measuring receiver does not indicate within limits specified in table 16, refer to manufacturer's manual for adjustment procedure.

(5) Press TI keys: **CARR FREQ, 950, MHz**

(6) Repeat (2) through (4) above for table 17.

Table 16. ALC Linearity At 2.5 Mhz

TI	Measuring receiver at 2.5 MHz			
RF level (dB)	2023B min (dBm)	2023B max (dBm)	Option 3 & 11 min (dBm)	Option 3 & 11 max (dBm)
-4	-4.8	-3.2	-4.8	-3.2
-3	-3.8	-2.2	-3.8	-2.2
-2	-2.8	-1.2	-2.8	-1.2
-1	-1.8	-0.2	-1.8	-0.2
0	-0.8	0.8	-0.8	0.8
1	+0.2	1.8	+0.2	1.8
2	+1.2	+2.8	+1.2	+2.8
3	+2.2	+3.8	+2.2	+3.8
4	+3.2	+4.8	+3.2	+4.8
5	+4.2	+5.8	+4.2	+5.8
6	+5.2	+6.8	+5.2	+6.8
7	+6.2	+7.8	+6	+8
8	+7.2	+8.8	+7	+9
9	+8.2	+9.8	+8	+10
10	+9.2	+10.8	+9	+11
11	+10.2	+11.8	+10	+12
12	+11.2	+12.8	+11	+13
12.1	+11.3	+12.9	+11.1	+13.1
12.2	+11.4	13	+11.2	+13.2
12.3	+11.5	+13.1	+11.3	+13.3
12.4	+11.6	+13.2	+11.4	+13.4
12.5	+11.7	+13.3	+11.5	+13.5
12.6	+11.8	+13.4	+11.6	+13.6
12.7	+11.9	+13.5	+11.7	+13.7
12.8	+12	+13.6	+11.8	+13.8

Table 16. ALC Linearity At 2.5 Mhz - Continued

TI	Measuring receiver at 2.5 MHz			
RF level (dB)	2023B min (dBm)	2023B max (dBm)	Option 3 & 11 min (dBm)	Option 3 & 11 max (dBm)
12.9	+12.1	+13.7	+11.9	+13.9
13	+12.2	+13.8	+12	+14
14	—	—	+13	+15
15	—	—	+14	+16
16	—	—	+15	+17
17	—	—	+16	+18
18	—	—	+17	+19
19	—	—	+18	+20
20	—	—	+19	+21
21	—	—	+20	+22
22	—	—	+21	+23
23	—	—	+22	+24
24	—	—	+22.5	+25.5
25	—	—	+23.5	+26.5

Table 17. ALC Linearity At 950 Mhz

TI	Measuring receiver at 950 MHz			
RF level (dB)	2023B min. (dBm)	2023B max. (dBm)	Option 3 & 11 min. (dBm)	Option 3 & 11 max.. (dBm)
-4	-4.8	-3.2	-4.8	-3.2
-3	-3.8	-2.2	-3.8	-2.2
-2	-2.8	-1.2	-2.8	-1.2
-1	-1.8	-0.2	-1.8	-0.2
0	-0.8	+0.8	-0.8	0.8
1	+0.2	+1.8	+0.2	1.8
2	+1.2	+2.8	+1.2	+2.8
3	+2.2	+3.8	+2.2	+3.8
4	+3.2	+4.8	+3.2	+4.8
5	+4.2	+5.8	+4.2	+5.8
6	+5.2	+6.8	+5.2	+6.8
7	+6.2	+7.8	+6	+8
8	+7.2	+8.8	+7	+9
9	+8.2	+9.8	+8	+10
10	+9.2	+10.8	+9	+11
11	+10.2	+11.8	+10	+12
12	+11.2	+12.8	+11	+13

Table 17. ALC Linearity At 950 Mhz - Continued

TI	Measuring receiver at 950 MHz			
RF level (dB)	2023B min (dBm)	2023B max (dBm)	Option 3 & 11 min (dBm)	Option 3 & 11 max (dBm)
12.1	+11.3	+12.9—	+11.1	+13.1
12.2	+11.4	13	+11.2	+13.2
12.3	+11.5	+13.1	+11.3	+13.3
12.4	+11.6	+13.2	+11.4	+13.4
12.5	+11.7	+13.3	+11.5	+13.5
12.6	+11.8	+13.4	+11.6	+13.6
12.7	+11.9	+13.5	+11.7	+13.7
12.8	+12	+13.6	+11.8	+13.8
12.9	+12.1	+13.7	+11.9	+13.9
13	+12.2	+13.8	+12	+14
14	—	—	+13	+15
15	—	—	+14	+16
16	—	—	+15	+17
17	—	—	+16	+18
18	—	—	+17	+19
19	—	—	+18	+20
20	—	—	+19	+21
21	—	—	+20	+22
22	—	—	+21	+23
23	—	—	+22	+24
24	—	—	+22.5	+25.5
25	—	—	+23.5	+26.5

(7) Press TI keys: **CARR FREQ, 2050, MHz, RF LEVEL -4 dB**.

(8) Repeat (2) through (4) above using table 18.

Table 18. ALC Linearity At 2050 Mhz

TI	Measuring receiver at 2050 MHz			
RF level (dBm)	2023B min (dB)	2023B max (dB)	Option 3 & 11 min (dB)	Option 3 & 11 max (dB)
-4	-5.2	-2.8	-5.2	-2.8
-3	-4.2	-1.8	-4.2	-1.8
-2	-3.2	-0.8	-3.2	-0.8
-1	-2.2	+0.2	-2.2	+0.2
0	-1.2	+1.2	-1.2	+1.2
1	-0.2	+2.2	-0.2	+2.2
2	+0.8	+3.2	+0.8	+3.2
3	+1.8	+4.2	+1.8	+4.2

Table 18. ALC Linearity At 2050 Mhz - Continued

TI	Measuring receiver at 2050 MHz			
RF level (dBm)	2023B min (dB)	2023B max (dB)	Option 3 & 11 min (dB)	Option 3 & 11 max (dB)
4	+2.8	+5.2	+2.8	+5.2
5	+3.8	+6.2	+3.8	+6.2
6	+4.8	+7.2	+4.8	+7.2
7	+5.8	+8.2	+5	+9
8	+6.8	+9.2	+6	+10
9	+7.8	+10.2	+7	+11
10	+8.8	+11.2	+8	+12
11	+9.8	+12.2	+9	+13
12	+10.8	+13.2	+10	+14
12.1	+10.9	+13.3	+10.1	+14.1
12.2	+11	+13.4	+10.2	+14.2
12.3	+11.1	+13.5	+10.3	+14.3
12.4	+11.2	+13.6	+10.4	+14.4
12.5	+11.3	+13.7	+10.5	+14.5
12.6	+11.4	+13.8	+10.6	+14.6
12.7	+11.5	+13.9	+10.7	+14.7
12.8	+11.6	+14	+10.8	+14.8
12.9	+11.7	+14.1	+10.9	+14.9
13	+11.8	+14.2	+11	+15
14	—	—	+12	+16
15	—	—	+13	+17
16	—	—	+14	+18
17	—	—	+15	+19
18	—	—	+16	+20
19	—	—	+17	+21

b. Adjustments. Refer to manufacturer's manual adjustment procedures for specific options.

14. Amplitude Modulation

a. Performance Check

(1) Connect measuring receiver **MODULATION OUTPUT/AUDIO INPUT** to audio analyzer **INPUT HIGH**. Ensure that the measuring receiver power sensor is connected to TI **RF OUTPUT 50Ω**.

(2) Press the TI keys as listed in (a) through (g) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 1.5, MHz**.
(c) **RF LEVEL, -4, dB**.
(d) **MENU, 20, [ENTER].** The TI will enter the Modulation Mode menu. Place cursor over *Internal* using the **NEXT** key. Select *AM int* by pressing 0.

(e) **MOD**, **30**, % (AM1 depth).
(f) **SOURCE ON/OFF** (to enable modulation source).
(g) **MOD ON/OFF** (to enable modulation).

(3) Configure the measuring receiver for an AM measurement with the 300 Hz HP filter and the 3 kHz LP filters selected.

(4) Verify measurement receiver AM depth indication is within limits specified in table 19. If measuring receiver indications are not within limits specified in table 18, perform **b** below.

(5) Use the audio analyzer to measure distortion. Verify results are within limits specified in table 19.

(6) Repeat (4) and (5) above for remaining TI carrier frequencies listed in table 19.

Table 19. AM Depth And Distortion

	TI		Measuring receiver		Audio analyzer
RF Level (dB)	Carrier frequency (MHz)	AM depth (%)	Min (%)	Max (%)	Distortion (%)
-4	1.5	30	28.5	31.5	< 1.5
-4	1.5	80	76	84	< 2.5
-0	1.5	30	28.5	31.5	< 1.5
-0	1.5	80	76	84	< 2.5
+7	1.5	30	28.5	31.5	< 1.5
+7	1.5	80	76	84	< 2.5
-4	5	30	28.5	31.5	< 1.5
-4	5	80	76	84	< 2.5
-0	5	30	28.5	31.5	< 1.5
-0	5	80	76	84	< 2.5
+7	5	30	28.5	31.5	< 1.5
+7	5	80	76	84	< 2.5
-4	9	30	28.5	31.5	< 1.5
-4	9	80	76	84	< 2.5
0	9	30	28.5	31.5	< 1.5
0	9	80	76	84	< 2.5
+7	9	30	28.5	31.5	< 1.5
+7	9	80	76	84	< 2.5
-4	11	30	28.5	31.5	< 1.5
-4	11	80	76	84	< 2.5
0	11	30	28.5	31.5	< 1.5
0	11	80	76	84	< 2.5
+7	11	30	28.5	31.5	< 1.5
+7	11	80	76	84	< 2.5
-4	20	30	28.5	31.5	< 1.5
-4	20	80	76	84	< 2.5
0	20	30	28.5	31.5	< 1.5
0	20	80	76	84	< 2.5
+7	20	30	28.5	31.5	< 1.5

Table 19. AM Depth And Distortion - Continued

	TI		Measuring receiver		Audio analyzer
RF Level (dB)	Carrier frequency (MHz)	AM depth (%)	Min (%)	Max (%)	Distortion (%)
+7	20	80	76	84	< 2.5
-4	50	30	28.5	31.5	< 1.5
-4	50	80	76	84	< 2.5
0	50	30	28.5	31.5	< 1.5
0	50	80	76	84	< 2.5
+7	50	30	28.5	31.5	< 1.5
+7	50	80	76	84	< 2.5
-4	100	30	28.5	31.5	< 1.5
-4	100	80	76	84	< 2.5
0	100	30	28.5	31.5	< 1.5
0	100	80	76	84	< 2.5
+7	100	30	28.5	31.5	< 1.5
+7	100	80	76	84	< 2.5
-4	200	30	28.5	31.5	< 1.5
-4	200	80	76	84	< 2.5
0	200	30	28.5	31.5	< 1.5
0	200	80	76	84	< 2.5
+7	200	30	28.5	31.5	< 1.5
+7	200	80	76	84	< 2.5
-4	500	30	28.5	31.5	< 1.5
-4	500	80	76	84	< 2.5
0	500	30	28.5	31.5	< 1.5
0	500	80	76	84	< 2.5
+7	500	30	28.5	31.5	< 1.5
+7	500	80	76	84	< 2.5

(7) Press the TI keys **CARR FREQ, 100 MHz**, **RF LEVEL, 0, dB**.

(8) Set TI to first AM depth in table 20.

(9) Verify measuring receiver indication is within limits specified in table 20.

(10) Measure remaining TI AM depths listed in table 20. Verify measuring receiver indication is within limits specified in table 20.

Table 20. AM Shape Carrier Frequency 100 Mhz, 0 Db

AM depth (%)	AM depth min (%)	AM depth max (%)
10	9.5	10.5
20	19	21
30	28.5	31.5
40	38	42
50	47.5	52.5
60	57	63
70	66.5	73.5
80	76	84
85	80.75	89.25

(11) Connect equipment as shown in figure 1 connection A.

(12) Press the TI keys as listed in (a) through (f) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 400, MHz**.
(c) **RF LEVEL, -4, dB**.
(d) **MOD, 80, %**.
(e) **MENU, 20, [ENTER]** (the TI will enter the Modulation Mode menu). Select *External* using **NEXT** and press 0 for *AM ext*.
(f) **MENU, 30, [ENTER]** (the TI will enter the Modulation Source menu). Select Ext using **NEXT** press 2 to select DC coupling, then press **MOD**.

(13) Use the multimeter to set the function generator for 1.00 V RMS, 1 kHz sine wave.

(14) Connect test equipment as shown in figure 1, Connection B.

(15) Configure the measuring receiver to measure AM. Deactivate all filters.

(16) Verify the measuring receiver indicates between 76 and 84 percent modulation. Set a reference on the measuring receiver by selecting **RATIO**, then **LOG/LIN** to select a dB display.

(17) Set the function generator for first frequency listed in table 21. The measuring receiver will indicate within the limits specified in table 21.

(18) Measure remaining frequencies listed in table 21. If measuring receiver indications are not within limits specified in table 21, refer to the manufacturer's manual for additional adjustment procedures.

Table 21. AM Scale Shape

Function generator modulation freq (kHz)	Measuring receiver	
	Response level min (dB)	Response level max (dB)
0.1	-1	+1
0.3	-1	+1
1	reference	reference
10	-1	+1
20	-1	+1
30	-1	+1

(19) On the TI press: **RF LEVEL, +7, dB**, set function generator to 1 kHz and repeat (16) through (18) above.

(20) Set all outputs to minimum and disconnect equipment setup.

b. Adjustments

(1) Connect the TI **RF OUTPUT 50Ω** to measuring receiver **RF INPUT**.

(2) Press the TI keys as listed in (a) through (c) below:

(a) **RCL, 999, [ENTER]**.
(b) **MENU, 80, [ENTER]**.

(c) Unlock TI by scrolling to *Level 2* using **NEXT**. Enter the six-digit password (default 123456) then press **[ENTER]**.

(3) On the measuring receiver select AM; select the 50 Hz high pass filter and the 15 kHz low pass filter.

(4) On the TI press **MENU, 112, [ENTER]**. The TI will be set to 0 dB with 30% AM on a 300 MHz carrier.

(5) Highlight *Adjust DAC* A using **NEXT**. Adjust DAC A using the rotary knob or the x10 up/down arrow keys until the AM reading displayed on the measuring receiver is 30%.

(6) Select *AM Depth* on TI using the **PREV** key and press 1 to select 80% modulation.

(7) Highlight *Enter AM measured* using the **NEXT** key and enter the AM depth measured on the measuring receiver.

(8) Highlight *Adjust DAC B* using **NEXT**. Adjust DAC B for the AM depth for 80% as indicated by the measuring receiver.

(9) Adjustment of DAC B interacts with DAC A, so repeat (5) through (8) as necessary until no further adjustment is necessary.

(10) Select *Exit* using the **NEXT** key then press **SELECT**. If DAC levels were not adjusted, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* and press **SELECT**.

15. Pulse Modulation (Except Option7 And 11)

a. Performance Check

(1) Connect measuring receiver power sensor to TI **RF OUTPUT 50Ω**.

NOTE

Zero, calibrate and save sensor values as necessary.

(2) Connect function generator to **TI PULSE I/P** (rear panel) using a 50 Ω feedthrough termination.

(3) Press the TI keys as listed in (a) through (g) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 32 MHz**.
(c) **RF LEVEL, -7, dB**.
(d) **MENU, 22, [ENTER]** The TI will enter the Pulse Modulation Mode menu.
(e) Press **1** (to Enable *Ext*).
(f) Press **MOD** then **MOD** then **MOD** again (TI will display Pulse ON).
(g) **MOD ON/OFF** (to enable modulation).

(4) Set the function generator to provide +5V DC. (The RF output will now be enabled).

(5) Set the measuring receiver to measure RF power at TI carrier frequency. Select dBm units.

(6) Verify the output level indicated on the measuring receiver is within limits specified in table 22. If measuring receiver does not indicate within limits specified in table 22, perform **b** below

(7) Repeat (3) (b), (3) (c), (5) and (6) above for remaining frequencies and RF levels in table 22. If measuring receiver does not indicate within limits specified in table 22, perform **b** below.

Table 22. Pulse Modulation Frequency Response (Except Option 7 Or 11)

TI		Measuring receiver	
RF Level (dB)	Carr freq (MHz)	RF level min (dBm)	RF level max (dBm)
-7	32	-8.3	-5.7
-7	60	-8.3	-5.7
-7	180	-8.3	-5.7
-7	300	-8.3	-5.7
-7	420	-8.3	-5.7
-7	540	-8.3	-5.7
-7	660	-8.3	-5.7
-7	780	-8.3	-5.7
-7	900	-8.3	-5.7
-7	1020	-8.3	-5.7
-7	1140	-8.3	-5.7
-7	1200	-8.3	-5.7
-7	1201	-8.7	-5.3
-7	1260	-8.7	-5.3
-7	1380	-8.7	-5.3
-7	1500	-8.7	-5.3
-7	1620	-8.7	-5.3
-7	1740	-8.7	-5.3
-7	1860	-8.7	-5.3
-7	2050	-8.7	-5.3
+4	32	+2.7	+5.3
+4	60	+2.7	+5.3
+4	180	+2.7	+5.3
+4	300	+2.7	+5.3
+4	420	+2.7	+5.3
+4	540	+2.7	+5.3
+4	660	+2.7	+5.3
+4	780	+2.7	+5.3
+4	900	+2.7	+5.3
+4	1020	+2.7	+5.3
+4	1140	+2.7	+5.3
+4	1200	+2.7	+5.3
+4	1201	+2.3	+5.7
+4	1260	+2.3	+5.7

Table 22. Pulse Modulation Frequency Response (Except Option 7 Or 11) - Continued

TI		Measuring receiver	
RF Level (dB)	Carr freq (MHz)	RF level min (dBm)	RF level max (dBm)
+4	1380	+2.3	+5.7
+4	1500	+2.3	+5.7
+4	1620	+2.3	+5.7
+4	1740	+2.3	+5.7
+4	1860	+2.3	+5.7
+4	2050	+2.3	+5.7

(8) Press TI **CARR ON/OFF** key. Disconnect the measuring receiver from TI **RF OUTPUT 50Ω**.

(9) Connect TI **RF OUTPUT 50Ω** to spectrum analyzer **RF INPUT**. Press TI **CARR ON/OFF** key.

(10) Press the TI keys as listed in (a) through (f) below:

(a) **CARR FREQ, 32, MHz**.
(b) **RF LEVEL, 0, dB**.
(c) **MENU, 22, [ENTER]** The TI will enter the Pulse Modulation Mode menu.
(d) Select **1** (to enable Pulse Mod.).
(e) **MOD** then **MOD** then **MOD** again (TI will display Pulse ON).
(f) **MOD ON/OFF** (to enable modulation).

(11) Set the function generator to provide +5V DC. (The RF output will now be enabled).

(12) Set the spectrum analyzer to the same frequency as the signal generator.

(13) Press **PEAK SEARCH** on the spectrum analyzer and record the output level.

(14) Switch off the function generator and apply a short to the **PULSE I/P** connector.

(15) Again, record the output level measured by the spectrum analyzer.

(16) Subtract indication recorded in (13) from indication recorded in (15). The difference between the levels recorded in (13) and (15) is the pulse mod on/off ratio. Verify the ratio is within limits specified in table 23.

(17) Repeat (12) through (16) above for remaining TI carrier frequencies listed in table 23.

(18) Press **TI CARR ON/OFF** key. Disconnect the spectrum analyzer from the TI **RF OUTPUT 50Ω**.

Table 23. Pulse Modulation On/Off Ratio

TI carrier freq (MHz)	Pulse mod on/off ratio (dB)
32	>45
100	>45
320	>45
1000	>45
1200	>45
1500	>40
1800	>40

(19) Connect the **TI RF OUTPUT 50Ω** to oscilloscope **CH 1 INPUT** using the crystal detector.

(20) Press the TI keys as listed in (a) through (g) below:

(a) **CARR FREQ, 50, MHz**.
(b) **RF LEVEL, +7, dB**.
(c) **MENU, 22, [ENTER]** The TI will enter the Pulse Modulation Mode menu.
(d) Select **1** (to enable Pulse Mod.).
(e) **MOD** then **MOD** then **MOD** again (TI will display Pulse ON).
(f) **MOD ON/OFF** (to enable modulation).
(g) The **RF OUTPUT** will now be enabled **MOD ON/OFF** (to enable modulation).

(21) Set the function generator to provide 10 kHz, square wave (0V to +5V).

(22) Adjust the oscilloscope controls to measure the rise time of the modulation envelope. Rise time will be less than 10 μs.

(23) Adjust the oscilloscope controls to measure the fall time of the modulation envelope. Fall time will be less than 10 μs.

(24) Set all outputs to minimum and disconnect equipment setup.

b. Adjustments (Except Options 7 And 11)

(1) Connect measuring receiver power sensor module to the **RF POWER OUT**. Configure measuring receiver to measure **RF POWER** in **LOG** mode with 0.01 dB resolution.

NOTE

Zero, calibrate and save sensor values as necessary.

(2) Connect measuring receiver power sensor to TI **RF OUTPUT 50Ω**.

(3) Press the TI keys as listed in (a) through (c) below:

(a) **MENU, 80, [ENTER]**.
(b) Unlock TI by scrolling to *Level 2* using **NEXT**. Enter the six-digit password (default 123456) then press **[ENTER]**.
(c) **MENU, 115, [ENTER]**. The TI will be set to Cal Point 0.

(4) Highlight *Cal Factor:* using **NEXT** and adjust Cal Factor using either the x10 arrow keys or the rotary knob until the reading displayed on the measuring receiver is as close as possible to nominal.

(5) Enter the next Cal Point--1, and adjust the Cal factor at each step until the reading displayed on the measuring receiver is as close as possible to nominal.

(6) Repeat (5) above for remaining Cal Factors (0-44).

(7) Select *Exit* using the **NEXT** key then press **SELECT**. If DAC levels were not adjusted, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* and press **SELECT**.

(8) Set all outputs to minimum and disconnect equipment setup.

16. Pulse Modulation (Options 7 and 11)

a. Performance Check

(1) Connect measuring receiver power sensor to TI **RF OUTPUT 50Ω**.

NOTE

Zero, calibrate and save sensor values as necessary.

(2) Connect function generator to **TI PULSE I/P** (front panel) using a 50 Ω feedthrough termination.

(3) Press the TI keys as listed in (a) through (g) below:

(a) **RCL, 999, [ENTER]**.
(b) **CARR FREQ, 200 kHz**.
(c) **RF LEVEL, -7, dB**.
(d) **MENU, 22, [ENTER]** The TI will enter the Pulse Modulation Mode menu.
(e) Press **1** (to Enable *Ext*).
(f) Press **MOD** then **MOD** then **MOD** again (TI will display Pulse ON).
(g) **MOD ON/OFF** (to enable modulation).

(4) Set the function generator to provide +5V DC. (The RF output will now be enabled).

(5) Set the measuring receiver to measure RF power at TI carrier frequency. Select dBm units.

(6) Verify the output level indicated on the measuring receiver is within limits specified in table 24. If measuring receiver does not indicate within limits specified in table 24, perform **b** below

(7) Repeat (3) (b), (3) (c), (5) and (6) above for remaining frequencies and RF levels in table 24. If measuring receiver does not indicate within limits specified in table 24, perform **b** below.

Table 24. Pulse Modulation Frequency Response (Option 7 Or 11)

TI		Measuring receiver	
RF Level (dB)	Carr freq (MHz)	RF level min (dBm)	RF level max (dBm)
-7	0.2	-7.8	-6.2
-7	1	-7.8	-5.7
-7	3	-7.8	-5.7
-7	9	-7.8	-5.7
-7	30	-7.8	-5.7
-7	90	-7.8	-5.7
-7	210	-7.8	-5.7
-7	330	-7.8	-5.7
-7	450	-7.8	-5.7
-7	570	-7.8	-5.7
-7	690	-7.8	-5.7
-7	810	-7.8	-5.7

Table 24. Pulse Modulation Frequency Response (Option 7 Or 11) - Continued

TI		Measuring receiver	
RF Level (dB)	Carr freq (MHz)	RF level min (dBm)	RF level max (dBm)
-7	930	-7.8	-5.3
-7	1050	-7.8	-5.3
-7	1200	-7.8	-5.3
-7	1201	-8.2	-5.3
-7	1290	-8.2	-5.3
-7	1410	-8.2	-5.3
-7	1530	-8.2	-5.3
-7	1650	-8.2	-5.3
-7	1770	-8.2	+5.3
-7	1890	-8.2	+5.3
-7	2050	-8.2	+5.3
0	0.2	-0.8	+0.8
0	1	-0.8	+0.8
0	3	-0.8	+0.8
0	9	-0.8	+0.8
0	30	-0.8	+0.8
0	90	-0.8	+0.8
0	210	-0.8	+0.8
0	330	-0.8	+0.8
0	450	-0.8	+0.8
0	570	-0.8	+0.8
0	690	-0.8	+0.8
0	810	-0.8	+0.8
0	930	-0.8	+0.8
0	1050	-0.8	+0.8
0	1200	-0.8	+0.8
0	1201	-1.2	+1.2
0	1290	-1.2	+1.2
0	1410	-1.2	+1.2
0	1530	-1.2	+1.2
0	1650	-1.2	+1.2
0	1770	-1.2	+1.2
0	1890	-1.2	+1.2
0	2050	-1.2	+1.2
+16	0.2	+15	+17
+16	1	+15	+17
+16	3	+15	+17
+16	9	+15	+17
+16	30	+15	+17
+16	90	+15	+17
+16	210	+15	+17

Table 24. Pulse Modulation Frequency Response (Option 7 Or 11) - Continued

TI		Measuring receiver	
RF Level (dB)	Carr freq (MHz)	RF level min (dBm)	RF level max (dBm)
+16	330	+15	+17
+16	450	+15	+17
+16	570	+15	+17
+16	690	+15	+17
+16	810	+15	+17
+16	930	+15	+17
+16	1050	+15	+17
+16	1200	+15	+17
+16	1201	+14	+18
+16	1290	+14	+18
+16	1410	+14	+18
+16	1530	+14	+18
+16	1650	+14	+18
+16	1770	+14	+18
+16	1890	+14	+18
+16	2050	+14	+18

(8) Press TI **CARR ON/OFF** key. Disconnect the measuring receiver from TI **RF OUTPUT 50Ω**.

(9) Connect TI **RF OUTPUT 50Ω** to spectrum analyzer **RF INPUT**. Press TI **CARR ON/OFF** key.

(10) Press the TI keys as listed in (a) through (f) below:

(a) **CARR FREQ, 32, MHz**.
(b) **RF LEVEL, 0, dB**.
(c) **MENU, 22, [ENTER]** The TI will enter the Pulse Modulation Mode menu.
(d) Select **1** (to enable Pulse Mod).
(e) **MOD** then **MOD** then **MOD** again (TI will display Pulse ON).
(f) **MOD ON/OFF** (to enable modulation).

(11) Set the function generator to provide +5V DC. (The RF output will now be enabled).

(12) Set the spectrum analyzer to the same frequency as the signal generator.

(13) Press **PEAK SEARCH** on the spectrum analyzer and record the output level.

(14) Switch off the function generator and apply a short to the **PULSE I/P** connector.

(15) Again, record the output level measured by the spectrum analyzer.

(16) Subtract indication recorded in (13) from indication recorded in (15). The difference between the levels recorded in (13) and (15) above is the pulse mod on/off ratio. Verify the ratio is within limits specified in table 25.

(17) Repeat (12) through (16) above for remaining TI carrier frequencies listed in table 25.

(18) Press **TI CARR ON/OFF** key. Disconnect the spectrum analyzer from the TI **RF OUTPUT 50Ω**.

Table 25. Pulse Modulation On/Off Ratio

TI Carrier freq. (MHz)	Pulse mod. On/off ratio (dB)
0.2	>80
32	>80
100	>80
1000	>80
1200	>80
1500	>70
1800	>70
2050	>70

(19) Connect the **TI RF OUTPUT 50Ω** to oscilloscope **CH 1 INPUT** using the crystal detector.

(20) Press the TI keys as listed in (a) through (g) below:

(a) **CARR FREQ, 1 GHz**.
(b) **RF LEVEL, +7, dB**.
(c) **MENU, 22, [ENTER]** The TI will enter the Pulse Modulation Mode menu.
(d) Select **1** (to enable Pulse Mod).
(e) **MOD** then **MOD** then **MOD** again (TI will display Pulse ON).
(f) **MOD ON/OFF** (to enable modulation).
(g) The **RF OUTPUT** will now be enabled **MOD ON/OFF** (to enable modulation).

(21) Set the function generator to provide 100 kHz, square wave (0V to +5V).

(22) Adjust the oscilloscope controls to measure the rise time of the modulation envelope. Rise time will be less than 20 ns.

(23) Adjust the oscilloscope controls to measure the fall time of the modulation envelope. Fall time will be less than 20 ns.

(24) Set all outputs to minimum and disconnect equipment setup.

b. Adjustments (Options 7 and 11)

(1) Connect the function generator to the **PULSE INPUT** connector on the TI. Set the function generator for +5 V DC.

(2) Connect measuring receiver power sensor module to the **CALIBRATE OUTPUT**. Set up measuring receiver to measure RF power in LOG mode with 0.01 dB resolution.

NOTE

Zero, calibrate and save sensor values as necessary.

(3) Press the TI keys: **MENU, 115, [ENTER]**. The TI will be set to +7 dBm at Cal Point 0 (100 kHz).

(4) Highlight *Cal Factor* using the **NEXT** key. Adjust *Cal Factor* using the x10 up/down arrow keys or the rotary knob until the reading displayed on the digital voltmeter is as close as possible to +7.00 dBm.

(5) Select next Cal Point (0-44) and adjust the Cal factor at each step until the reading displayed on the digital voltmeter is as close as possible to nominal.

(6) Select *Exit* using the **NEXT** key then press **SELECT**. If no adjustments were made to any Cal Factor, choose *Quit without saving cal data* otherwise choose *Save cal data and quit* then press **SELECT**.

(7) Set all outputs to minimum and disconnect equipment setup.

17. Attenuation (Not Required For Option 1)

a. Performance Check

NOTE

Zero, calibrate and save measuring receiver sensor values as necessary.

(1) Connect measuring receiver power sensor to TI **RF OUTPUT 50Ω.** Configure the measuring receiver to measure RF power. Select dBm units).

(2) Press TI keys as listed in (a) through (f) below:

(a) **RCL, 999, [ENTER**].
(b) **CARR FREQ, 2.6, MHz**.
(c) **RF LEVEL, 0, dB**.
(d) **SET** Δ.
(e) **RF LEVEL** (to select *Levl Stp*) **11, dB**.
(f) **RF LEVEL**.

(3) Set measuring receiver for tuned RF power measurement at the carrier frequency and verify that the measuring receiver indicates between -0.8 dBm and +0.8 dBm.

(4) Repeat (2) (b), (2) (c) and 3 for remaining RF frequencies and levels in table 26. Verify the results indicated on the measurement receiver are within limits listed in table 26.

NOTE

RECAL measurement receiver as necessary.

Table 26. Attenuator Accuracy

TI		Measuring receiver	
RF level (dBm)	Carrier frequency (MHz)	RF level min (dBm)	RF level max (dBm)
0	2.6	-0.8	+0.8
-4.1	2.6	-.3.3	+4.9
-15.1	2.6	-15.9	-14.3
-26.1	2.6	-26.9	-25.3
-37.1	2.6	-37.9	-36.3
-48.1	2.6	-48.9	-47.3
-59.1	2.6	-59.9	-58.3
-70.1	2.6	-70.9	-69.3
-81.1	2.6	-81.9	-80.3
-92.1	2.6	-92.9	-91.3
-103.1	2.6	-103.9	-102.3
0	880.1	-0.8	+0.8
-4.1	880.1	-.3.3	+4.9
-15.1	880.1	-15.9	-14.3
-26.1	880.1	-26.9	-25.3
-37.1	880.1	-37.9	-36.3
-48.1	880.1	-48.9	-47.3
-59.1	880.1	-59.9	-58.3
-70.1	880.1	-70.9	-69.3
-81.1	880.1	-81.9	-80.3
-92.1	880.1	-92.9	-91.3
-103.1	880.1	-103.9	-102.3
0	1199	-0.8	+0.8
-4.1	1199	-.3.3	+4.9
-15.1	1199	-15.9	-14.3
-26.1	1199	-26.9	-25.3
-37.1	1199	-37.9	-36.3
-48.1	1199	-48.9	-47.3
-59.1	1199	-59.9	-58.3
-70.1	1199	-70.9	-69.3
-81.1	1199	-81.9	-80.3
-92.1	1199	-92.9	-91.3
-103.1	1199	-103.9	-102.3
0	1875	-1.2	+1.2
-4.1	1875	-5.3	-2.9
-15.1	1875	-16.3	-13.9
-26.1	1875	-27.3	-24.9
-37.1	1875	-38.3	-35.9
-48.1	1875	-49.3	-46.9

Table 26. Attenuator Accuracy - Continued

TI		Measuring receiver	
RF level (dBm)	Carrier frequency (MHz)	RF level min (dBm)	RF level max (dBm)
-59.1	1875	-60.3	-57.9
-70.1	1875	-71.3	-68.9
-81.1	1875	-82.3	-79.9
-92.1	1875	-93.3	-90.9
-103.1	1875	-104.5	-101.7
0	2050	-1.2	+1.2
-4.1	2050	-5.3	-2.9
-15.1	2050	-16.3	-13.9
-26.1	2050	-27.3	-24.9
-37.1	2050	-38.3	-35.9
-48.1	2050	-49.3	-46.9
-59.1	2050	-60.3	-57.9
-70.1	2050	-71.3	-68.9
-81.1	2050	-82.3	-79.9
-92.1	2050	-93.3	-90.9
-103.1	2050	-104.5	-101.7

(5) Set all outputs to minimum and disconnect equipment setup.

b. Adjustments

NOTE

Frequency response adjustment must be performed prior to adjusting attenuator pads. Attenuator pad values are: 0=33 db, 1=11 db, 3=22 db and 4=33 db.

(1) Zero and calibrate the measuring receiver power sensor.

(2) Connect the measuring receiver power sensor to the TI **RF OUTPUT**.

(3) Press the TI keys as listed in (a) through (c) below:

(a) **MENU 80 [ENTER]**.

(b) Unlock TI by scrolling to *Level 2* using **NEXT**. Enter the six-digit password (default 123456) then press **[ENTER]**.

(c) **MENU 118 [ENTER]**. The TI will be set to Cal Point 0.

(4) Set a reference on measuring receiver.

(5) On TI use **NEXT** to highlight *In/Out Pad* and press 1 to insert pad 0.

(6) Select *Measured Atten* using **NEXT** and enter the reading on the measuring receiver to two decimal places.

(7) Repeat (4) through (6) above selecting pads 1 through 4.

(8) Select Cal Points 1 to 20 in turn repeating steps (4) to (6) above.

(9) Select *Exit* using the **NEXT** key then press **SELECT**. If no adjustments to Cal Factors were made, choose *Quit without saving cal data* otherwise choose *Save cal data and quit,* then press **SELECT**.

(10) Set all outputs to minimum and disconnect equipment setup.

18. Spectral Purity

a. Performance Check

(1) Connect TI **RF OUTPUT 50Ω** to spectrum analyzer **INPUT**.

NOTE

Some spurious signals may be generated by the spectrum analyzer. If a spurious signal is present, change TI frequency. If it disappears, it most likely is from the TI. If the spurious signal moves with the TI frequency it most likely is in the spectrum analyzer.

(2) Press TI keys as listed in (a) through (c) below:

(a) **RCL 999 [ENTER]**.
(b) **CARR FREQ, 1201, MHz**.
(c) **RF LEVEL, -0, dB**.

(3) Measure the level of the TI carrier frequency and set a reference.

(4) Measure the level of the TI non-harmonic frequencies on the spectrum analyzer with respect to the reference set in (3) at each of the carrier frequencies shown in table 28. Spectrum analyzer will indicate within limits in table 28.

(5) Repeat (2) (b), (2) (c), (3) and (4) for remaining TI frequencies and levels in table 27. Spectrum analyzer will indicate within limits in table 27.

Table 27. Non-Harmonics (Spurious Signals)

TI	Spectrum analyzer	
Carrier frequency (MHz)	Non-harmonic frequency (MHz)	Non-harmonic level (dBc)
1201	400.3333	-64
1201	800.6667	-64
1201	1601.333	-64
1201	2001.667	-64
1599	533	-64
1599	1066	-64
1599	2132	-64
1599	2665	-64
1601	800.5	-64
1601	1200.75	-64
1601	2001.25	-64
1601	2401.5	-64

Table 27. Non-Harmonics (Spurious Signals) - Continued

TI	Spectrum analyzer	
Carrier frequency (MHz)	Non-harmonic frequency (MHz)	Non-harmonic level (dBc)
1999	999.5	-64
1999	1499.25	-64
1999	2498.75	-64
1999	2998.5	-64
2001	1200.6	-60
2001	1600.8	-60
2001	2401.2	-60
2001	2801.4	-60
2400	1440	-60
2400	1920	-60
2400	2880	-60
2400	3360	-60
9.9	100	-70
9.9	109.9	-70

NOTE

Zero, calibrate and save measuring receiver sensor values as necessary.

(6) Press TI keys as listed in (a) through (c) below:

(a) **RCL 999 [ENTER]**.
(b) **CARR FREQ, 1000, MHz**.
(c) **RF LEVEL, 0, dB**.

(7) Set the measuring receiver as listed in (a) through (d) below:

(a) Measurement: FM.
(b) Filter: 300 Hz HP.
(c) Filter: 3 kHz LP.
(d) Detector: AVG.

(8) Measure the residual FM. The measuring receiver will indicate <4.5 Hz average.

(9) Set all outputs to minimum and disconnect equipment setup.

b. Adjustments. No adjustments can be made.

19. Modulation Oscillator

a. Performance check

(1) Connect the time/frequency workstation standard 10 MHz output to frequency counter external 10 MHz input.

NOTE

Ensure that the frequency counter is configured for an external time-base reference throughout this procedure.

(2) Connect the TI **MOD I/O** connector to the frequency counter input A.

(3) Press TI keys as listed in (a) through (e) below:

(a) **RCL 999 [ENTER]**
(b) **SOURCE ON/OFF (**to enable modulation source).
(c) **MOD ON/OFF** (to enable modulation).
(d) **MOD SOURCE 10 Hz**
(e) Press **MOD SOURCE** button repeatedly to change *MODF* waveform to square wave.

NOTE

Adjust frequency counter filter, gate time and trigger as necessary for a stable display.

(4) Measure LF modulation oscillator frequency with the frequency counter. Verify that the frequency counter indicates within the limits of table 28. Repeat for remaining frequencies listed in table 28.

Table 28. Modulation Oscillator Frequency

TI	Frequency counter			
Frequency (Hz)	Standard instrument min (Hz)	Standard instrument max (Hz)	Option 4 min (Hz)	Option 4 max (Hz)
10	9.999990	10.000010	9.99999750	10.00000250
100	99.99990	100.00010	99.9999750	100.0000250
1000	9,999.990	1000.0010	999.999750	1000.000250
20000	19,999.980	20,000.020	19,999.9950	20,000.005

(5) Disconnect TI **MOD I/O** from frequency counter and connect to audio analyzer **INPUT HIGH**.

(6) Press the TI keys: **MOD SOURCE, 1 kHz**.

(7) Press TI **MOD SOURCE** button repeatedly to select *MODF sine wave* waveform.

(8) Measure the distortion (1 kHz only) on the audio analyzer. The indication will be less than 0.1%.

(9) Configure the audio analyzer to measure input level in dBm. Set a 0.0 db (1 kHz) reference.

(10) Set the TI mod source at each of the frequencies shown in table 29, verifying that the output level is within the limits listed in table 29.

(11) Set all outputs to minimum and disconnect equipment setup.

Table 29. Modulation Oscillator

	Audio Analyzer	
TI Mod source (Hz)	Response level min (dBm)	Response level max (dBm)
1000	Reference	Reference
20	-1	+1
50	-1	+1
100	-1	+1
200	-1	+1
500	-1	+1
2000	-1	+1
5000	-1	+1
10000	-1	+1
20000	-1	+1

b. Adjustments. No adjustments can be made**.**

20. ILS (Option 122 only)

a. Performance Check

(1) Connect the TI **RF OUTPUT 50Ω** to modulation analyzer **RF 50Ω** input.

(2) Press TI keys as listed in (a) through (f) below:

(a) **RCL 999 [ENTER]**.
(b) **RF LEVEL, -4 dB**.
(c) **MENU 20 [ENTER]** (to enter modulation menu).
(d) Use **NEXT** key to highlight *Avionics* menu.
(e) **0** to select *Mod Mode: Avionics (ILS)*.
(f) **MOD ON/OFF** (to enable modulation). The TI will be set to a carrier frequency of 108.1 MHz; SDM 40%; DDM 0%.

(3) Configure the modulation analyzer as listed in (a) through (g) below:

(a) **PRESET**.
(b) **DEMOD**.
(c) Softkey AMAvion (to select modulation type).
(d) Softkey AMAvion (to enter Avionics sub menu).
(e) Softkey ILS (to select ILS menu).
(e) Softkey ILS (to enter ILS sub menu).
(f) Softkey m90 Hz.
(g) Softkey SDM.

(4) Verify that the value of the SDM measurement as indicated on the modulation analyzer's **AUDIO** display (far right) is within the limits of table 30 for SDM.

(5) On TI, press **MOD** key repeatedly to select *DDM Dpth*.

(6) Configure the modulation analyzer for a DDM measurement by pressing softkey DDM.

(7) On the TI, Enter **1.0 %**. The TI will indicate *FLY RIGHT,* if not, toggle the TI **T90/150** pushbutton.

(8) Verify that the value of the DDM measurement as indicated on the modulation analyzer's MODULATION display (center) is within the limits of table 30 for DDM.

(9) Repeat (7) and (8) above for remaining FLY RIGHT DDM measurements listed in table 30.

(10) On the TI press **T90/150 Couple**. The TI will now indicate *FLY LEFT*.

(11) Repeat (7) and (8) above for remaining *FLY LEFT* DDM measurements listed in table 30.

(12) Repeat (2) through (11) above, with the TI **RF LEVEL** to **+7 dB** in step (2) (b).

Table 30. Localizer SDM And DDM At -4 Dbm And +7 Dbm

TI		Modulation analyzer		
Measurement type	Modulation setting (%)	Display function	Minimum modulation (%)	Maximum modulation (%)
SDM	40	SDM	39.2	40.8
Fly Right DDM	1	DDM	0.0095	0.0105
Fly Right DDM	4.6	DDM	0.0448	0.0472
Fly Right DDM	9.3	DDM	0.0908	0.0952
Fly Right DDM	12	DDM	0.1173	0.1227
Fly Right DDM	15.5	DDM	0.1516	0.1584
Fly Right DDM	20	DDM	0.1957	0.2043
Fly Right DDM	32	DDM	0.313	0.3267
Fly Right DDM	40	DDM	0.3917	0.4083
Fly Left DDM	1	DDM	-0.0095	-0.0105
Fly Left DDM	4.6	DDM	-0.0448	-0.0472
Fly Left DDM	9.3	DDM	-0.0908	-0.0952
Fly Left DDM	12	DDM	-0.1173	-0.1227
Fly Left DDM	15.5	DDM	-0.1516	-0.1584
Fly Left DDM	20	DDM	-0.1957	-0.2043
Fly Left DDM	32	DDM	-0.313	-0.3267
Fly Left DDM	40	DDM	-0.3917	-0.4083

(13) On the TI press **LOC/GS, RF LEVEL -4 dB**. Verify that the TI display of 334.7 MHz, SDM 80%.

(14) On TI, press **MOD** key repeatedly to select *DDM Dpth*. Press 0%.

(15) Configure the modulation analyzer as listed in (a) through (g) below:

(a) **PRESET**.
(b) **DEMOD**.
(c) Softkey AMAvion (to select modulation type).
(d) Softkey AMAvion (to enter Avionics sub menu).
(e) Softkey ILS (to select ILS menu).
(e) Softkey ILS (to enter ILS sub menu).
(f) Softkey m90 Hz.
(g) Softkey SDM.

(16) Verify that the value of the SDM measurement as indicated on the modulation analyzer's **AUDIO** display (far right) is within the limits of table 31 for SDM.

(17) Configure the modulation analyzer for a DDM measurement by pressing softkey DDM from the Avionics ILS sub menu.

(18) On TI, press **MOD** key repeatedly to select *DDM Dpth*.

(19) Enter **1.0 %**. The TI will indicate *FLY UP,* if not, toggle the TI **T90/150 Couple** pushbutton.

(20) Verify that the value of the DDM measurement as indicated on the modulation analyzer's MODULATION display (center) is within the limits of table 31 for DDM.

(21) Repeat (19) and (20) above for remaining *FLY UP* measurements listed in table 31.

(22) On the TI press **T90/150 Couple**. The TI will now indicate *FLY DOWN*.

(23) Repeat (19) and (20) above for remaining *FLY DOWN* DDM measurements listed in table 31.

(24) Repeat (13) through (23) above, with the TI **RF LEVEL** set to **+7 dB** in step (13).

(25) Set all outputs to minimum.

Table 31. Glideslope At 334.7 Mhz SDM And DDM -4 Dbm And +7 Dbm

TI		Modulation Analyzer		
Measurement type	Modulation setting (%)	Display function	Minimum modulation (%)	Maximum modulation (%)
SDM	80	SDM	78.4	81.6
Fly Up DDM	1	DDM	.0095	.0105
Fly Up DDM	4.6	DDM	.0448	.0472
Fly Up DDM	9.3	DDM	.0908	.0952
Fly Up DDM	12	DDM	.1173	.1227
Fly Up DDM	15.5	DDM	.1516	.1584
Fly Up DDM	20	DDM	.1957	.2043
Fly Up DDM	32	DDM	.313	.3267
Fly Up DDM	40	DDM	.3917	.4083
Fly Down DDM	1	DDM	-.0095	-.0105
Fly Down DDM	4.6	DDM	-.0448	-.0472
Fly Down DDM	9.3	DDM	-.0908	-.0952
Fly Down DDM	12	DDM	-.1173	-.1227
Fly Down DDM	15.5	DDM	-.1516	-.1584
Fly Down DDM	20	DDM	-.1957	-.2043
Fly Down DDM	32	DDM	-.313	-.3267
Fly Down DDM	40	DDM	-.3917	-.4083

b. Adjustments. No adjustments can be made.

21. VOR (Option 122 only)

a. Performance Check

(1) Ensure that the TI **RF OUTPUT 50Ω** is connected to modulation analyzer **RF 50Ω** Input.

(2) Press TI keys as listed in (a) through (f) below:

(a) **RCL 999 [ENTER]**.
(b) **MENU 20 [ENTER]** (to enter modulation menu).

(c) Use **NEXT** key to highlight *Avionics* menu.
(d) Press **1** to select *Mod Mode: Avionics (VOR).*
(e) Press **RF LEVEL -4 dB**.
(f) Press **MOD ON/OFF** (to enable modulation).

(3) The TI will be in VOR mode with a *BEAR* indication of 0.00˚. *REF* and *SUB Dpth* will be set to 30.0%.

(4) Configure the modulation analyzer as listed in (a) through (f) below:

(a) **PRESET**.
(b) **DEMOD**.
(c) Softkey AMAvion (to select modulation type).
(d) Softkey AMAvion (to enter Avionics sub menu).
(e) Softkey VOR (to enter VOR sub menu)
(f) Softkey m9.96 kHz (to measure the TI 9.96 kHz SUBcarrier).

(5) Use the modulation analyzer (center display) to measure the 30% SUB Dpth. Record this value.

(6) In the modulation analyzer's VOR sub menu select m30 Hz. Use the modulation analyzer to measure the 30% REF. Record this value.

(7) Add the values obtained in (5) and (6) above. The result will be within the limits listed in table 32 below.

(8) Repeat (4)(f) through (7) above for SUB depth % and REF depth % values listed in table 32. Use **NEXT** key and Toggle **MOD** key as necessary to select *REF dpth*, *Idnt Dpth* or *SUB Dpth*. Results will be within the limits specified.

(9) On the TI, repeatedly press **MOD** key and set *REF Dpth* to 0%, *SUB Dpth* to 0%, and *Idnt Dpth* to 30%. Use TI **SOURCE ON / OFF** to activate the 1.0200 kHz Ident signal.

(10) On the modulation analyzer press softkey m ID to measure the *Idnt Dpth*. The result will be within the limits listed in table 32 for IDENT %.

(11) On the TI, repeatedly press **MOD** key until *REF Dpth* is highlighted, then press the **MOD SOURCE** to highlight *BEAR To*. Press **25.5 [ENTER]**.

(12) Repeat (2) through (10) at 25.5 ˚ for values listed in table 32.

(13) On the TI, repeatedly press **MOD** key until *REF Dpth* is highlighted, then press the **MOD SOURCE** to highlight *BEAR To*. Press **270 [ENTER]**.

(14) Repeat (2) through (10) at 270˚ for values listed in table 32.

(15) Press TI keys as listed in (a) through (d) below:

(a) Indt Dpth 0%.
(b) **MOD** (to select SUB dpth) **30 %.**
(c) **MOD** (to select REF dpth) **30 %.**
(d) **MOD SOURCE** (to select *BEAR To*) **0 [ENTER]**.

(16) Measure the bearing accuracy using the avionics modulation analyzer. The result will be within the limits listed in table 32.

(17) Measure remaining *BEAR T*o values listed in table 32. The result will be within the limits listed in table 32.

(18) Repeat (2) through (17) above for values listed in table 33 at TI **RF LEVEL +7 dB**.

(19) Repeat (2) through (17) above for values listed in table 34 at TI **RF LEVEL -4 dB** and **CARR FREQ** of **136 MHz**.

(20) Repeat (2) through (17) above for values listed in table 35 at TI **RF LEVEL +7 dB** and **CARR FREQ** of **136 MHz**.

Table 32. VOR Modulation At 108 Mhz -4db

TI								Modulation analyzer	
Bearing (°)	Frequency (MHz)	Level (dB)	IDENT %	Ref %	Sub %	Ref % Indication	Sub % Indication	Minimum	Maximum
0.00°	108	-4	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
25.50	108	-4	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	---------	----------			28.6	31.4
270.00	108	-4	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
0	----------	----------	----------	----------	----------			-0.05	0.05
25.5	----------	----------	----------	----------	----------			25.45	25.55
40	----------	----------	----------	----------	----------			39.95	40.05
85.7	----------	----------	----------	----------	----------			85.65	85.75
90	----------	----------	----------	----------	----------			89.95	90.05
120	----------	----------	----------	----------	----------			119.95	120.05
150	----------	----------	----------	----------	----------			149.95	150.05
180	----------	----------	----------	----------	----------			179.95	180.05
225	----------	----------	----------	----------	----------			224.95	225.05
270	----------	----------	----------	----------	----------			269.95	270.05
285.2	----------	----------	----------	----------	----------			285.15	285.25
315	----------	----------	----------	----------	----------			314.95	315.05
345	----------	----------	----------	----------	----------			344.95	345.05

Table 33. VOR Modulation At 108 Mhz +7 Db

TI								Modulation analyzer	
Bearing (°)	Frequency (MHz)	Level (dB)	IDENT %	Ref %	Sub %	Ref % Indication	Sub % Indication	Minimum	Maximum
0.00°	108	+7	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4

Table 33. VOR Modulation At 108 Mhz +7 Db - Continued

TI								Modulation analyzer	
Bearing (°)	Frequency (MHz)	Level (dB)	IDENT %	Ref %	Sub %	Ref % Indication	Sub % Indication	Minimum	Maximum
----------	----------	----------	30	----------	----------			28.6	31.4
25.50	108	+7	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
270.00	108	+7	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
0	----------	----------	----------	----------	----------			-0.05	0.05
25.5	----------	----------	----------	----------	----------			25.45	25.55
40	----------	----------	----------	----------	----------			39.95	40.05
85.7	----------	----------	----------	----------	----------			85.65	85.75
90	----------	----------	----------	----------	----------			89.95	90.05
120	----------	----------	----------	----------	----------			119.95	120.05
150	----------	----------	----------	----------	----------			149.95	150.05
180	----------	----------	----------	----------	----------			179.95	180.05
225	----------	----------	----------	----------	----------			224.95	225.05
270	----------	----------	----------	----------	----------			269.95	270.05
285.2	----------	----------	----------	----------	----------			285.15	285.25
315	----------	----------	----------	----------	----------			314.95	315.05
345	----------	----------	----------	----------	----------			344.95	345.05

Table 34. VOR Modulation At 136 Mhz -4 Db

TI								Modulation analyzer	
Bearing (°)	Frequency (MHz)	Level (dB)	IDENT %	Ref %	Sub %	Ref % Indication	Sub % Indication	Minimum	Maximum
0.00°	136	-4	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
25.50	136	-4	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
270.00	136	-4	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
0	----------	----------	----------	----------	----------			-0.05	0.05
25.5	----------	----------	----------	----------	----------			25.45	25.55
40	----------	----------	----------	----------	----------			39.95	40.05
85.7	----------	----------	----------	----------	----------			85.65	85.75
90	----------	----------	----------	----------	----------			89.95	90.05

Table 34. VOR Modulation At 136 Mhz -4 Db - Continued

TI								Modulation analyzer	
Bearing (°)	Frequency (MHz)	Level (dB)	IDENT %	Ref %	Sub %	Ref % Indication	Sub % Indication	Minimum	Maximum
120	----------	----------	----------	----------	----------			119.95	120.05
150	----------	----------	----------	----------	----------			149.95	150.05
180	----------	----------	----------	----------	----------			179.95	180.05
225	----------	----------	----------	----------	----------			224.95	225.05
270	----------	----------	----------	----------	----------			269.95	270.05
285.2	----------	----------	----------	----------	----------			285.15	285.25
315	----------	----------	----------	----------	----------			314.95	315.05
345	----------	----------	----------	----------	----------			344.95	345.05

Table 35. VOR Modulation At 136 Mhz +7 Db

TI								Modulation Analyzer	
Bearing (°)	Frequency (MHz)	Level (dB)	IDENT %	Ref %	Sub %	Ref % Indication	Sub % Indication	Minimum	Maximum
0.00°	136	+7	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
25.50	136	+7	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
270.00	136	+7	----------	30	30			57.7	62.3
----------	----------	----------	----------	30	0			28.6	31.4
----------	----------	----------	----------	0	30			28.6	31.4
----------	----------	----------	30	----------	----------			28.6	31.4
0	----------	----------	----------	----------	----------			-0.05	0.05
25.5	----------	----------	----------	----------	----------			25.45	25.55
40	----------	----------	----------	----------	----------			39.95	40.05
85.7	----------	----------	----------	----------	----------			85.65	85.75
90	----------	----------	----------	----------	----------			89.95	90.05
120	----------	----------	----------	----------	----------			119.95	120.05
150	----------	----------	----------	----------	----------			149.95	150.05
180	----------	----------	----------	----------	----------			179.95	180.05
225	----------	----------	----------	----------	----------			224.95	225.05
270	----------	----------	----------	----------	----------			269.95	270.05
285.2	----------	----------	----------	----------	----------			285.15	285.25
315	----------	----------	----------	----------	----------			314.95	315.05
345	----------	----------	----------	----------	----------			344.95	345.05

(21) Set all outputs to minimum and disconnect equipment setup.

b. Adjustments. No adjustments can be made.

22. Final Procedure

a. Deenergize and disconnect all equipment.

b. Annotate and affix DA label/form in accordance with TB 750-25.

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

0811203

Distribution:

To be distributed in accordance with STD IDS No. RLC-1500, 2 January 2003, requirements for calibration procedure TB 9-6625-2369-40.

Instructions for Submitting an Electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" whomever@redstone.army.mil
To: <2028@redstone.army.mil

Subject: DA Form 2028

1. **From**: Joe Smith
2. Unit: home
3. **Address**: 4300 Park
4. **City**: Hometown
5. **St**: MO
6. **Zip**: 77777
7. **Date Sent**: 19-OCT –93
8. **Pub no:** 55-2840-229-23
9. **Pub Title**: TM
10. **Publication Date**: 04-JUL-85
11. Change Number: 7
12. Submitter Rank: MSG
13. **Submitter FName**: Joe
14. Submitter MName: T
15. **Submitter LName**: Smith
16. **Submitter Phone**: 123-123-1234
17. **Problem**: 1
18. Page: 2
19. Paragraph: 3
20. Line: 4
21. NSN: 5
22. Reference: 6
23. Figure: 7
24. Table: 8
25. Item: 9
26. Total: 123
27. **Text**

This is the text for the problem below line 27.