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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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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.

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*This bulletin supersedes TB 9-6625-2369-40, dated 18 June 2008.

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: Option 2 DC operation, Option 4 high stability frequency standard, Option 11 fast pulse and high power, Option 122 avionics.

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^{-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)
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, ±0.6 dB flatness, 100 kHz square wave DC: +5 VDC	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%) Audio Distortion Range: < 0.1 % Audio AC Level Range: 2 VAC Frequency: 10 Hz to 20 kHz Accuracy: ±0.025dB	Measuring receiver system N5530S consisting of: Spectrum Analyzer, Agilent Model E4440A (E4440A), Power meter, Agilent Model E4419B (E4419B), and Sensor module, Agilent Model N5532A, Option 504 (N5532A, Option 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 (3458A)
OSCILLOSCOPE	100 MHz bandwidth Rise/Falltime ≤5 nSec	Agilent, OS-303/G (OS-303/G)
SPECTRUM ANALYZER	Range: 200 kHz to 2801MHz. Level: to -70 dBm	(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

    a. Performance Check

    (1) Connect the time/frequency workstation standard 10 MHz output to frequency counter **REFERENCE IN** (rear panel). Configure the frequency counter for an external time base reference.

    (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 (better than 200 Hz for standard instrument or 20 Hz for instruments with Option 4). Allow time to stabilize. Readjust if necessary.

(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).*

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

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

(9) Repeat (7) and (8) for remaining frequencies in table 3.

Table 3.   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] Min/Max limit based on Standard TCXO aging rate of ± 1 in 10^{-6} per year (at 1 year).

[2] Min/Max limit based on option 4 OCXO aging rate of ± 2.5 in 10^{-7} per year (at 1 year).

(10) Synchronize the TI and frequency counter time bases by disconnecting the time/frequency workstation standard 10 MHz output from the frequency counter **REFERENCE IN** (rear panel) and connecting the TI **FREQ STD IN-OUT** 10 MHz (rear panel) to the 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) Press TI **CARR ON/OFF** (output off).

(13) 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 50 Ohm FREQ A, measurement.

(14) Press TI **CARR ON/OFF** (output on).

(15) Press TI **CARR FREQ, .009, MHz.**

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

(17) Repeat (15) and (16) for remaining carrier frequency values in table 4.

Table 4. Frequency Phase Locked Loop And Divider Accuracy

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
150	149.999999	150.000001
300	299.999999	300.000001

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

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

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

9. **Frequency Modulation Accuracy**

   a. **Performance Check**

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

   (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*.
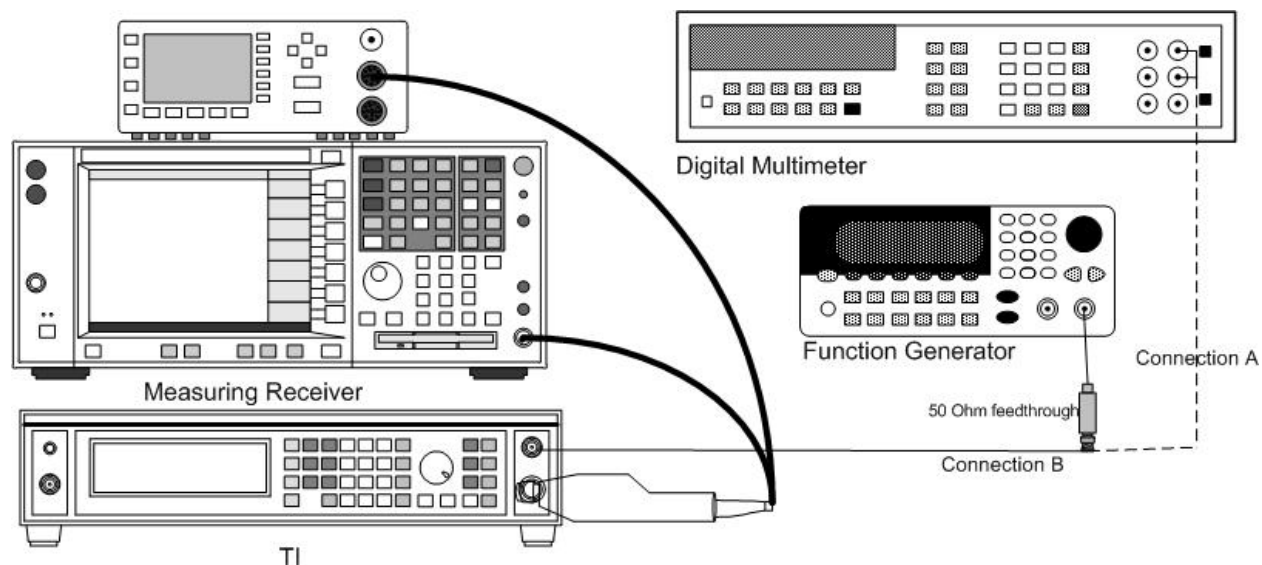
Figure 1. Modulation accuracy hookup.

(5) Measure FM deviation using measuring receiver. Measuring receiver will indicate between 47.5 and 52.5 kHz. Establish an FM deviation frequency response reference (0.000 dB) by selecting the ratio mode on the measuring receiver.

(6) Set function generator to remaining frequencies listed in table 5. Measuring receiver will indicate within limits specified in table 5. At frequencies indicated in table 5, measure the AF distortion. If indications are not within limits specified in table 5, perform **b** below.

Table 5. 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 *External* 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) Ensure that the measuring receiver is not in the ratio measurement mode. Measure FM deviation using measuring receiver. Measuring receiver will indicate between 9.5 kHz and 10.5 kHz FM deviation. Establish an FM deviation frequency response reference (0.000 dB) by selecting the ratio mode on the measuring receiver.

(12) Set function generator to remaining frequencies listed in table 6. Measuring receiver will indicate within limits specified in table 6. If indications are not within limits specified in table 6, 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 7. At frequencies indicated in table 7, measure the AF distortion. If indications are not within limits specified in table 7, perform **b** below.

Table 6. 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 7. 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	—
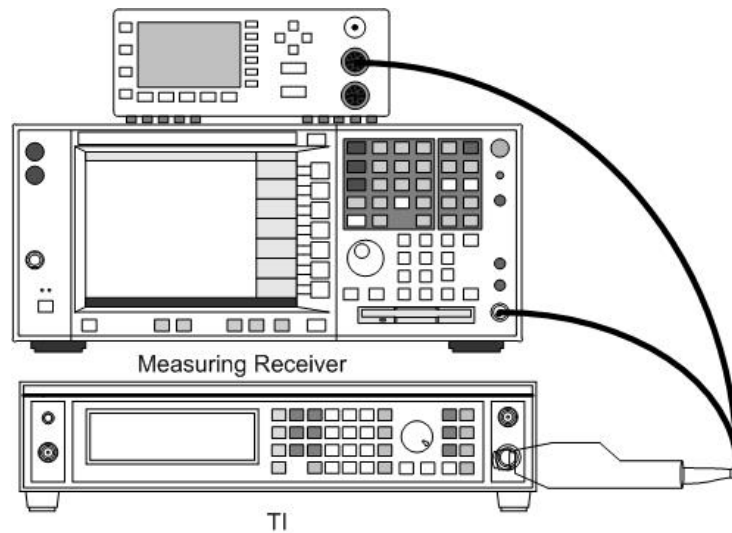
Figure 2. Basic measuring receiver hook-up.

(15) Press TI **CARR ON/OFF** (output off), disable function generator output disconnect set-up and reconnect equipment as shown in figure 2.

(16) 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).

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

(18) Measure FM deviation using measuring receiver. Measuring receiver will indicate FM deviation between 96 kHz and 104 kHz. Measure AF distortion. AF distortion will be less than 3.0%. If indications are not within limits specified in table 8 perform **b** below.

(19) Measure FM deviation and AF distortion for remaining carrier frequencies listed in table 8. Measuring receiver will indicate within limits specified in table 8. If indications are not within limits specified in table 8, perform **b** below.

Table 8. Internal FM Deviation And Distortion At 100 KHz Deviation

TI	Measurement receiver		
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 deviation 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 9. If measurement receiver does not indicate within limits shown in table 9, perform **b** below.

(23) Repeat (22) for remaining values in table 9.

Table 9. 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. 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 *External* 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 recorded in (25) above. The difference between the two indications will be less than 1 kHz.

(28) Set all outputs to minimum.

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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 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 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 equipment is connected as shown in figure 2.

(2) 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).

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

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

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

(6) 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 (9).

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

(7) Use the TI **MOD SOURCE** button to set the modulation frequency to the first modulation frequency listed in table 10.

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

(9) Using the values recorded in (8) above and the reference recorded in (6) above, calculate the change in response at each modulation frequency using the following formula:

$$\text{Change in response} \quad = \quad \frac{20 \quad \text{LOG} \quad \text{Value in (8)}}{1 \text{ kHz ref value in (6)}}$$

(10) Verify the calculated level is within limits specified in table 10. If calculated response level is not within limits specified in table 10, perform **b** below.

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

Table 10. 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 equipment as shown in figure 2.

(2) Configure the measuring receiver for an FM deviation measurement 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 10.00000 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 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 11.

(4) Measure the remaining RF level at the frequency listed in table 11. Multimeter will indicate within limits specified in table 11. If multimeter does not indication within limits specified in table11, perform **b** below.

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

Table 11. RF Output (Except Option 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) Press TI **CARR ON/OFF** (output off).

(6) Remove digital mulitmeter connection from TI **RF OUTPUT 50Ω,** then connect equipment as shown in figure 2.

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

(a) **CARR ON/OFF** (output on)
(b) **CARR FREQ, 1 MHz**.
(c) **RF LEVEL, –4, dB**.

(8) Configure the measuring receiver for an RF POWER measurement. Verify measuring receiver indicates within limits listed in table 12.

(9) Repeat (7) (a) and (7) (b) for remaining RF power levels and frequencies listed in table 12. Measuring receiver will indicate within limits specified in table 12. If measuring receiver does not indication within limits specified in table, perform **b** below.

Table 12. RF Output Above 33 kHz (Except Option 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

Table 12. RF Output Above 33kHz (Except Option 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 +13 dB	
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 and calibrate measuring receiver/sensor as necessary.

(2) Connect equipment as shown in figure 2. Configure the 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 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 13.

(4) Measure remaining RF levels at frequencies listed in table 13. Multimeter will indicate within limits specified in table 13. 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 13. RF Output (Option 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) Press TI **CARR ON/OFF** (output off).

(6) Remove digital mulitmeter connection from TI **RF OUTPUT 50Ω,** then connect equipment as shown in figure 2.

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

(a) **CARR ON/OFF** (output on)
(b) **CARR FREQ, 1 MHz**.
(c) **RF LEVEL, –4, dB**.

(8) Configure the measuring receiver for an RF POWER measurement. Verify measuring receiver indicates within limits listed in table 14.

(9) Repeat (7) (a) and (7) (b) above for remaining RF power levels and frequencies listed in table 14. Measuring receiver will indicate within limits specified in table 14. If measuring receiver does not indication within limits specified in table, perform **b** below.

Table 14. RF Output Above 33kHz (Option 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	-4.8	-3.2	+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
1380	-5.2	-2.8	+5.0	+9.0	+17.0	+21.0
1500	-5.2	-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 and calibrate measuring receiver/sensor as necessary.

(2) Connect equipment as shown in figure 2.

(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.

13. RF Output ALC Linearity

a. Performance Check

(1) Ensure that the equipment is connected as shown in figure 2. 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**.

(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 15.

(4) Measure remaining RF levels listed in table 15. If measuring receiver does not indicate within limits specified in table 15, refer to manufacturer's manual for adjustment procedure.

(5) Press TI keys: **CARR FREQ, 950, MHz, RF LEVEL -4 dB**.

(6) Repeat (2) through (4) above for table 16.

Table 15. ALC Linearity At 2.5 MHz

TI	Measuring receiver			
RF level (dB)	2023B min (dBm)	2023B max (dBm)	Option 11 min (dBm)	Option 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

Table 15. ALC Linearity At 2.5 MHz - Continued

TI	Measuring receiver			
RF level (dB)	2023B min (dBm)	2023B max (dBm)	Option 11 min (dBm)	Option 11 max (dBm)
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
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 16. ALC Linearity At 950 MHz

TI	Measuring receiver			
RF level (dB)	2023B min (dBm)	2023B max (dBm)	Option 11 min (dBm)	Option 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

Table 16. ALC Linearity At 950 MHz - Continued

TI	Measuring receiver			
RF level (dB)	2023B min (dBm)	2023B max (dBm)	Option 11 min (dBm)	Option 11 max (dBm)
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
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 17.

Table 17. ALC Linearity At 2050 MHz

TI	Measuring receiver			
RF level (dBm)	2023B min (dB)	2023B max (dB)	Option 11 min (dB)	Option 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
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) Ensure that the equipment is connected as shown in figure 2.

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

(5) Verify measuring receiver AF distortion indication is within limits specified in table 18.

(6) Repeat (2) (b), (2) (c), (2) (e), (4) and (5) above for remaining TI carrier frequencies, RF levels and AM depths listed in table 18.

Table 18. AM Depth And Distortion

TI			Measuring receiver		
RF Level (dB)	Carrier frequency (MHz)	AM depth (%)	AM depth Min (%)	AM depth 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

Table 18. AM Depth And Distortion - Continued

TI			Measuring receiver		
RF Level (dB)	Carrier frequency (MHz)	AM depth (%)	AM depth Min (%)	AM depth Max (%)	Distortion (%)
-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
+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 19.

(9) Verify measuring receiver indication is within limits specified in table 19.

(10) Measure remaining TI AM depths listed in table 19. Verify measuring receiver indication is within limits specified in table 19.

Table 19. AM Shape Carrier Frequency 100 MHz, 0 dBm

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

Table 19. AM Shape Carrier Frequency 100 MHz, 0 dBm - Continued

AM depth (%)	AM depth min (%)	AM depth max (%)
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 (h) below:

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

(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. Establish an AM frequency response reference (0.000 dB) by selecting the ratio mode on the measuring receiver

(17) Set the function generator for first frequency listed in table 20. The measuring receiver will indicate within the limits specified in table 20.

(18) Measure frequency response at function generator frequencies listed in table 20. If measuring receiver indications are not within limits specified in table 20, refer to the manufacturer's manual for additional adjustment procedures.

Table 20. 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.

b. Adjustments

(1) Ensure that the equipment is connected as shown in figure 2.

(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 Option 11)

a. Performance Check

(1) Ensure that the equipment is connected as shown in figure 2.

(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 TI RF output will now be enabled).

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

(6) Verify the output level indicated on the measuring receiver is within limits specified in table 21. If measuring receiver does not indicate within limits specified in table 21, perform **b** below

(7) Repeat (3) (b), (3) (c), (5) and (6) above for remaining frequencies and RF levels in table 21. If measuring receiver does not indicate within limits specified in table 21, perform **b** below.

Table 21. Pulse Modulation Frequency Response (Except Option 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

Table 21. Pulse Modulation Frequency Response (Except Option 11) - Continued

TI		Measuring receiver	
RF Level (dB)	Carr freq (MHz)	RF level min (dBm)	RF level max (dBm)
+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
+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) **CARR ON/OFF** (output off).

(9) Disconnect measuring receiver and connect spectrum analyzer to TI **OUTPUT RF 50Ω**.

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

    (a) **CARR FREQ, 32, MHz**.
    (b) **RF LEVEL, 0, dB**.
    (c) **CARR ON/OFF** (output on).

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

(12) Set spectrum analyzer center frequency to TI carrier frequency and record the output level.

(13) Disable the function generator output and apply a short to the **PULSE INPUT** connector.

(14) Again, record the output level of the TI carrier frequency as measured by the spectrum analyzer.

(15) Subtract indication recorded in (12) from indication recorded in (14). The difference between the levels recorded in (12) and (14) is the pulse mod on/off ratio. Verify the ratio is within limits specified in table 22.

(16) Repeat (12) through (15) above for remaining TI carrier frequencies listed in table 22. TI will indicate with the limits of table 22.

(17) Press **TI CARR ON/OFF** key (output off). Set all other outputs to minimum.

Table 22. 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

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

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

(a) **CARR FREQ, 50, MHz**.
(b) **RF LEVEL, +7, dB**.
(c) **CARR ON/OFF** (output on).

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

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

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

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

b. Adjustments (Except Option 11)

(1) Ensure that the equipment is connected as shown in figure 2.

(2) Connect the function generator to the **PULSE I/P** connector on the TI using a 50 Ω feedthrough termination. Set the function generator for +5 V DC.

(3) Configure the measuring receiver for an RF Power measurement.

(4) 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.

(5) 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.

(6) 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.

(7) Repeat (6) above for remaining Cal Factors.

(8) 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**.

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

16. Pulse Modulation (Option 11)

a. Performance Check

(1) Ensure that the equipment is connected as shown in figure 2.

(2) Connect function generator to **TI PULSE INPUT** (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 Mod EXT 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) Configure the measuring receiver to measure RF power of the TI carrier frequency.

(6) Verify the output level indicated on the measuring receiver is within limits specified in table 23. If measuring receiver does not indicate within limits specified in table 23, perform **b** below

(7) Repeat (3) (b), (3) (c), (5) and (6) above for remaining frequencies and RF levels in table 23. If measuring receiver does not indicate within limits specified in table 23, perform **b** below.

Table 23. Pulse Modulation Frequency Response (Option 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 23. Pulse Modulation Frequency Response (Option 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 23. Pulse Modulation Frequency Response (Option 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) **CARR ON/OFF** (output off).

(9) Disconnect measuring receiver and connect spectrum analyzer to TI **OUTPUT RF 50Ω**.

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

   (a) **CARR FREQ, 0.2, MHz**.
   (b) **RF LEVEL, 0, dB**.
   (c) **CARR ON/OFF** (output on).

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

(12) Set spectrum analyzer center frequency to TI carrier frequency and record the output level.

(13) Disable the function generator output and apply a short to the **PULSE INPUT** connector.

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

(15) Subtract indication recorded in (12) from indication recorded in (14). The difference between the levels recorded in (12) and (14) above is the pulse mod on/off ratio. Verify the ratio is within limits specified in table 24.

(16) Repeat (12) through (15) above for remaining TI carrier frequencies listed in table 24. TI will indicate with the limits of table 24.

(17) Press TI **CARR ON/OFF** (output off) set all other outputs to minimum.

Table 24. 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

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

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

(a) **CARR FREQ, 1 GHz**.
(b) **RF LEVEL, +7, dB**.
(c) **CARR ON/OFF** (output on)**.**

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

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

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

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

b. Adjustments (Option 11)

(1) Ensure that the equipment is connected as shown in figure 2.

(2) Connect the function generator to the **PULSE INPUT** connector on the TI using a 50 Ω feedthrough termination. Set the function generator for +5 V DC.

(3) Configure measuring receiver to measure RF power.

(4) 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.

(5) 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.

(6) Select 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.

(7) Repeat (6) above for remaining Cal Factors.

(8) 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**.

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

17. Attenuation

a. Performance Check

(1) Ensure that the equipment is connected as shown in figure 2. Configure the measuring receiver to measure RF power.

(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 25. Use ÷10 arrow key as appropriate. Verify the results indicated on the measurement receiver are within limits listed in table 25.

Table 25. 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	-4.9	-3.3
-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	-4.9	-3.3
-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

Table 25. Attenuator Accuracy - Continued

TI		Measuring receiver	
RF level (dBm)	Carrier frequency (MHz)	RF level min (dBm)	RF level max (dBm)
-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	-4.9	-3.3
-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
-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) Ensure that the equipment is connected as shown in figure 2.

(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.

18. Spectral Purity

a. Performance Check

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

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 26. Spectrum analyzer will indicate within limits in table 26.

(5) Repeat (2) (b), (3) and (4) for remaining TI frequencies and levels in table 26. Spectrum analyzer will indicate within limits in table 26.

Table 26. 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
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
9.9	100	-70
9.9	109.9	-70

(6) Connect the equipment as shown in figure 2.

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

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

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

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

(9) Measure the residual FM. The measuring receiver will indicate <4.5 Hz RMS.

(10) 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 **REFERENCE IN** (rear panel). Configure the frequency counter for an external time base reference.

(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 TI modulation oscillator frequency with the frequency counter. Verify that the frequency counter indicates within the limits of table 27. Repeat for remaining frequencies listed in table 27.

Table 27. 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	999.9990	1000.0010	999.999750	1000.000250
20000[1]	19,999.980	20,000.020	19,999.9950	20,000.005

[1] Press **MOD SOURCE** button repeatedly to change *MODF* waveform to sine wave.

(5) Disconnect TI **MOD I/O** from frequency counter and connect to measuring receiver **AUDIO INPUT**.

(6) Press the TI keys: **MOD SOURCE, 1 kHz,** and **MOD SOURCE** button repeatedly to select *MODF sine wave* waveform.

(7) Configure the measuring receiver for and audio distortion measurement.

(8) Measure the distortion, at 1 kHz only, on the measuring receiver. The indication will be less than 0.1%.

(9) Configure the measuring receiver for an audio AC level measurement. After reading has settled, use the ratio function to set a 0.00 dB (1 kHz) reference.

(10) Set the TI mod source to each of the frequencies listed in table 28, verifying that the output level is within the limits listed in table 28.

Table 28. Modulation Oscillator

TI	Measuring receiver	
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

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

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

(3) Configure the modulation analyzer for an avionics ILS measurement by pressing the keys 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 DDM.
(g) Softkey SDM.

(4) Verify that the value of the SDM measurement as indicated on the modulation analyzer's **AUDIO** display (right) is within the limits of table 29 for SDM.

(5) Press TI **MOD** key repeatedly, as necessary, to select *DDM Dpth*.

(6) Press TI **1 %** to select a DDM depth of 1.00 %. Toggle the TI **T90/150/COUPLE** pushbutton as necessary for a TI display of *FLY RIGHT*.

(7) Verify that the value of the DDM measurement as indicated on the modulation analyzer **MODULATION** display (center) is within the limits of table 29 for DDM.

(8) Repeat technique of (6) and (7) above for remaining *FLY RIGHT* DDM values listed in table 29.

(9) Toggle the TI **T90/150/COUPLE** pushbutton as necessary for a TI display of *FLY LEFT*.

(10) Repeat technique of (6) and (7) above for *FLY LEFT* DDM measurements listed in table 29.

(11) On the TI, press **0 %** to select a DDM depth of 0.00 %.

(12) Press TI **RF LEVEL**, **+7 dB** and repeat technique of (4) through (10) above.

Table 29. 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	39.20	40.80
Fly Right DDM	1	DDM	.0095	.0105
Fly Right DDM	4.6	DDM	.0448	.0472
Fly Right DDM	9.3	DDM	.0908	.0952
Fly Right DDM	12	DDM	.1173	.1227
Fly Right DDM	15.5	DDM	.1516	.1584
Fly Right DDM	20	DDM	.1957	.2043
Fly Right DDM	32	DDM	.3130	.3267
Fly Right DDM	40	DDM	.3917	.4083
Fly Left DDM	1	DDM	-.0105	-.0095
Fly Left DDM	4.6	DDM	-.0472	-.0448
Fly Left DDM	9.3	DDM	-.0952	-.0908
Fly Left DDM	12	DDM	-.1227	-.1173
Fly Left DDM	15.5	DDM	-.1584	-.1516
Fly Left DDM	20	DDM	-.2043	-.1957
Fly Left DDM	32	DDM	-.3267	-.3130
Fly Left DDM	40	DDM	-.4083	-.3917

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

(a) **LOC/GS/TO/FROM** (To select glideslope).
(b) **RF LEVEL -4 dB**.
(c) **MOD** repeatedly as necessary to select *DDM Dpth*.
(d) **0** % (to set *DDM Dpth* to 0%).
(e) **MOD ON/OFF** as necessary to enable modulation. (The TI should now be set to a carrier frequency of 334.7 MHz; SDM 80%; DDM 0%).

(14) Modulation analyzer should be configured as in (3) (a) through (g) above.

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

(16) Press TI **MOD** key repeatedly, as necessary, to select *DDM Dpth*.

(17) On the TI, press **1 %** to select a DDM depth of 1.00 %. Toggle the TI **T90/150/COUPLE** pushbutton as necessary for a TI display of *FLY UP*.

(18) 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.

(19) Repeat technique of (17) and (18) above for remaining *FLY UP* DDM values listed in table 30.

(20) Toggle the TI **T90/150/COUPLE** pushbutton as necessary for a TI display of *FLY DOWN*.

(21) Repeat technique of (17) and (18) above for *FLY DOWN* DDM measurements listed in table 30.

(22) On the TI, press **0 %** to select a DDM depth of 0.00 %.

(23) Press TI **RF LEVEL**, **+7 dB** and repeat technique of (15) through (21) above.

Table 30. 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	78.40	81.60
Fly Up DDM	1	DDM	-.0105	-.0095
Fly Up DDM	4.6	DDM	.-0472	-.0448
Fly Up DDM	9.3	DDM	-.0952	-.0908
Fly Up DDM	12	DDM	-.1227	-.1173
Fly Up DDM	15.5	DDM	-.1584	-.1516
Fly Up DDM	20	DDM	-.2043	-.1957
Fly Up DDM	32	DDM	-.3267	-.3130
Fly Up DDM	40	DDM	-.4083	-.3917
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	.3130	.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) **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** as necessary to enable modulation. (The TI should now be set to a carrier frequency of 108 MHz, *BEAR* 0.00˚, 30 % *REF* and *SUB Dpth*).

(3) Configure the modulation analyzer for an avionics VOR measurement by pressing the keys 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 select VOR menu).

(f) Softkey VOR (to enter VOR sub menu).

(4) Ensure that the TI is set to 30 % *SUB Dpth, 30 % REF Dpth* and 0 % *Ident Dpth*.

(5) Select m 9.96kHz from the modulation analyzer VOR sub menu to measure the *30 % SUB Dpth*. Record this value.

(6) Select m 30 Hz from the modulation analyzer VOR sub menu to measure the *30 % REF Dpth*. Record this value.

(7) Add the values obtained in (5) and (6) above. The result will be within the limits listed in table 31 below.

(8) Toggle TI **MOD** key as necessary to select *REF dpth*, and *SUB Dpth*. Using TI numeric keypad followed by **%,** enter values listed in table 32 for *REF dpth*, and *SUB Dpth*.

(9) Measure the *REF Dpth* values using the modulation analyzer m 30 Hz softkey and the *SUB dpth* values using the modulation analyzer m 9.96 kHz softkey. The result will be within the limits listed in table 31 below.

(10) Toggle TI **MOD** key as necessary to select and set *REF Dpth* to 0%, *SUB Dpth* to 0%, and *Idnt Dpth* to 30%. Toggle TI **SOURCE ON/OFF** as necessary to enable the 1.0200 kHz Ident signal.

(11) Select m ID from the modulation analyzer VOR sub menu to measure the 30 % *Idnt Dpth*. The result will be within the limits listed in table 31 below.

(12) Toggle TI **MOD** key as necessary until *REF Dpth* is highlighted, then press the **MOD SOURCE** to highlight *BEAR From*. Press **25.5 [ENTER]**. (If necessary, press TI **LOC/GS/TO/FROM** to toggle between *BEAR To* and *BEAR From)*.

(13) Repeat technique of (4) through (12) at *BEAR From* 25.5 ˚ for values listed in table 31.

(14) Using technique of (12), set TI *BEAR From* 270.00˚.

(15) Repeat technique of (4) through (12) for *BEAR From* 270 ˚ for values listed in table 31.

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

(a) **MOD** (to select Indt dpth) **0%**.

(b) **MOD** (to select SUB dpth) **30 %.**

(c) **MOD** (to select REF dpth) **30 %.**

(d) **LOC/GS TO/FROM** (as necessary to select *BEAR FROM).*

(e) **MOD SOURCE** (to select *BEAR From*) **0 [ENTER]**.

(17) Configure the modulation analyzer to measure bearing accuracy by pressing softkey VOR PHASE. Verify that the value of the bearing measurement as indicated on the modulation analyzer's **AUDIO** display (right) is within the limits of table 31.

(18) Measure remaining *BEAR FROM* values listed in table 31. The result will be within the limits listed in table 31.

(19) Repeat technique of (4) through (18) above for values listed in table 32 at TI **RF LEVEL +7 dB**.

(20) Repeat technique of (4) through (18) above for values listed in table 33 at TI **RF LEVEL -4 dB** and **CARR FREQ** of **136 MHz**.

(21) Repeat technique of (4) through (18) above for values listed in table 34 at TI **RF LEVEL +7 dB** and **CARR FREQ** of **136 MHz**.

Table 31. VOR Modulation At 108 MHz -4 dBm

		TI				Modulation analyzer	
Bearing (°)	IDENT %	Ref %	Sub %	Ref % indication	Sub % indication	Minimum	Maximum
0.00°	0	30	30			57.7	62.3
----------	0	30	0			28.6	31.4
----------	0	0	30			28.6	31.4
----------	30	0	0			28.6	31.4
25.50	0	30	30			57.7	62.3
----------	0	30	0			28.6	31.4
----------	0	0	30			28.6	31.4
----------	30	0	0			28.6	31.4
270.00	0	30	30			57.7	62.3
----------	0	30	0			28.6	31.4
----------	0	0	30			28.6	31.4
----------	30	0	0			28.6	31.4
0	0	30	30			-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 32. VOR Modulation At 108 MHz +7 dBm

	TI					Modulation analyzer	
Bearing (°)	IDENT %	Ref %	Sub %	Ref % indication	Sub % indication	Minimum	Maximum
0.00°	0	30	30			57.7	62.3
----------	0	30	0			28.6	31.4
---------	0	0	30			28.6	31.4
---------	30	0	0			28.6	31.4
25.50	0	30	30			57.7	62.3
---------	0	30	0			28.6	31.4
---------	0	0	30			28.6	31.4
---------	30	0	0			28.6	31.4
270.00	0	30	30			57.7	62.3
---------	0	30	0			28.6	31.4
---------	0	0	30			28.6	31.4
---------	30	0	0			28.6	31.4
0	0	30	30			-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 136 MHz -4 dBm

	TI					Modulation Analyzer	
Bearing (°)	IDENT %	Ref %	Sub %	Ref % Indication	Sub % Indication	Minimum	Maximum
0.00°	0	30	30			57.7	62.3
---------	0	30	0			28.6	31.4
---------	0	0	30			28.6	31.4
---------	30	0	0			28.6	31.4
25.50	0	30	30			57.7	62.3
---------	0	30	0			28.6	31.4
---------	0	0	30			28.6	31.4
---------	30	0	0			28.6	31.4
270.00	0	30	30			57.7	62.3
---------	0	30	0			28.6	31.4
---------	0	0	30			28.6	31.4
---------	30	0	0			28.6	31.4
0	0	30	30			-0.05	0.05
25.5	----------	----------	----------			25.45	25.55
40	----------	----------	----------			39.95	40.05
85.7	----------	----------	----------			85.65	85.75

Table 33. VOR Modulation At 136 MHz -4 dBm - Continued

Bearing (°)	IDENT %	Ref %	Sub %	Ref % Indication	Sub % Indication	Minimum	Maximum
			TI			Modulation Analyzer	
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 +7 dBm

Bearing (°)	IDENT %	Ref %	Sub %	Ref % indication	Sub % indication	Minimum	Maximum
			TI			Modulation analyzer	
0.00°	0	30	30			57.7	62.3
----------	0	30	0			28.6	31.4
----------	0	0	30			28.6	31.4
----------	30	0	0			28.6	31.4
25.50	0	30	30			57.7	62.3
----------	0	30	0			28.6	31.4
----------	0	0	30			28.6	31.4
----------	30	0	0			28.6	31.4
270.00	0	30	30			57.7	62.3
----------	0	30	0			28.6	31.4
----------	0	0	30			28.6	31.4
----------	30	0	0			28.6	31.4
0	0	30	30			-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

(22) 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

0830103

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.