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DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR TRANSPONDER TEST SET MODEL AN/UPM-155

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, US 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 provide DA Form 2028 information to AMCOM via e-mail, fax, or the World Wide Web. Our FAX number is: DSN 788-6546 or Commercial 256-842-6546. Our e-mail address is: 2028@redstone.army.mil. Instructions for sending an electronic 2028 may be found at the back of this manual. For the World Wide Web, use: https://amcom2028.redstone.army.mil.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Transponder Test Set, Model AN/UPM-155. The manufacturer's manual was used as the prime data source 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 16 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 in table 1.

Table 1. Calibration Description

Test instrument parameters	Performance specifications	
PRF:		
1030 MHz Xpdr mode:	Range:	5 to 10000 pps
	Accuracy:	± 1 pps
1090 MHz INTR mode:		100 µs (10000 PRF) to 200000 µs (5 PRF) ± 1.0 µs or ± 0.01 percent of setting whichever is greater.

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications		
TRIGGERS:	PRF IN:	Range:	0 to 999,999 pps
		Accuracy:	± 1 pps
		Amplitude:	2 to 30 V
		Pulse Width:	0.3 µs minimum
		Rise Time:	<0.15 µs
		Fall Time:	<0.15 µs
		Pulse spacing:	1 µs minimum
		Impedance:	1M Ω
	EXT SIF IN:	Amplitude:	-2 to -30 V or +2 to +30 V
		Pulse Width:	0.3 to 25 µs
		Rise Time:	<0.5 µs/V
		Rate:	5 to 10,000 pps
		Impedance:	100 kΩ
	SUPPR IN:	Amplitude:	5.0 ± 0.5 V
		Pulse Width:	100 ms minimum
		Impedance:	75 Ω
	SUPPR OUT:	Amplitude:	20 ±5 V
		Pulse Width:	2 to 220 µs (PRF up to 1,000 pps)
		Rise Time:	<0.4 µs
		Fall Time:	<0.4 µs
		Timing:	23 ±1 µs before P3 in SIF 20 ±5 µs before P4 in Mode 4
		Impedance:	75 Ω
	M4 PRE OUT:	Amplitude:	4.5 ±1 V
		Pulse Width:	0.8 ±0.2 µs
		Rise Time:	<0.1 µs
		Fall Time:	<0.2 µs
		Timing:	4 to 38 µs after 0 pulse in 1 µs steps
		Impedance:	90 Ω
	EXT IN:	Amplitude:	-2 to -30 V or +2 to +30 V
		Pulse Width:	0.3 to 25 µs
		Rise Time:	<0.5 µs/V
		Rate:	5 to 10,000 pps
		Impedance:	100 k Ω
	0 OUT:	Amplitude:	+20 ±5 V
		Pulse Width:	1.5 ±0.5 µs
		Rise Time:	<0.1 µs
		Fall Time:	<0.2 µs
		Timing:	5 to 10,000 pps (<0.25 µs delay for external trigger).
		Impedance:	75 Ω

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications		
IFF VIDEO OUT:	FIRST REPLY:	Pulse Width:	0.45 ±0.03 µs
		Range Delay:	For zero range delay, F1 pulse position is 3.0 ±0.5 µs after P3 pulse of challenge. F1 pulse can be delayed from 0 to 4095 µs after this position. Accuracy is ±0.5 µs up to 1023 µs and ±0.8 µs from 1024 to 4995 µs.
		SIF Code Spacing:	F1 (bracket 1) 0 µs C1 1.45 ± 0.02 µs A1 2.90 ± 0.02 µs C2 4.35 ± 0.02 µs A2 5.80 ± 0.02 µs C4 7.25 ± 0.02 µs A4 8.70 ± 0.02 µs B1 11.60 ± 0.02 µs D1 13.05 ± 0.02 µs B2 14.50 ± 0.02 µs D2 15.95 ± 0.02 µs B4 17.40 ± 0.02 µs D4 18.85 ± 0.02 µs F2 (bracket 1) 20.30 ± 0.02 µs
		SIF Reply with X Pulse:	An X pulse spaced 10.15 ± 0.02 µs after the F1 pulse.
		SIF Emergency Replies:	
		Standard:	Each mode code is followed by three sets of empty bracket pulses (F1, F2) with F1 and F2 spaced 20.30 µs apart and each F1 pulse spaced 4.35 ± 1.0 µs after its proceeding F2 pulse.
		Variable:	Selectable to vary spacing between all emergency code empty brackets F1 pulses and their proceeding F2 pulses by 1.00 µs ±0.05 µs.
		SID Identification of Position:	For Mode 1 add second pulse train identical to first spaced 24.65 ± 0.1 µs after F1 pulse of first pulse train. For Modes 2,3/A and C add single F1 pulse (SIF pulse) at this spacing.

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
	Mode 4 Replies: Three Pulse Reply: Spaced 1.75 ±0.05 µs One Pulse Reply: Generates one pulse in the third pulse position ± 0.05 µs of a three pulse reply. Range Delay: For zero range delay, F1 pulse position is 3.0 ± 0.5 µs after P3 pulse of challenge. F1 pulse can be delayed from 0 to 4095 µs after this position. Accuracy is ±0.5 µs up to 1023 µs and ± 0.8 µs from 1024 to 4095 µs. Video Output: Amplitude: 0.0 to 5.0 V 0.1 to 2.2 V ±0.1 V 2.3 to 5V ±0.2 V Pulse Width: 0.45 ± 0.03 µs Rise Time: <0.1 µs Fall Time: <0.15 µs Jitter: < ± 50 µs between ext P3 or zero trigger or ± 0.01% of the delay time, whichever is greater. Impedance: 75 Ω
	SECOND REPLY: Pulse Width: 0.45 ±0.03 µs External Trigger: Amplitude: 2 to 30 V into 75 Ω Pulse Width: 0.3 to 25 µs Rise Time: <0.5 µs/V Impedance: 100 k Ω min. SIF Reply Code: 0000 to 7777 (2 framing pulses and up to 12 information pulses. SIF Code Spacing: F1 (bracket 1) µs 0 C1 1.45 ± 0.02 µs A1 2.90 ± 0.02 µs C2 4.35 ± 0.02 µs A2 5.80 ± 0.02 µs C4 7.25 ± 0.02 µs A4 8.70 ± 0.02 µs B1 11.60 ± 0.02 µs D1 13.05 ± 0.02 µs B2 14.05 ± 0.02 µs D2 15.95 ± 0.02 µs B4 17.40 ± 0.02 µs D4 18.85 ± 0.02 µs F2 (bracket 1) 20.30 ± 0.02 µs

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
	Mode 4: Three Pulse Reply: Spaced 1.75 ± 0.05 µs Range Delay: Variable in 0.05 µs steps from 0 to 50 µs after the SIF1, F1 pulse for SIF replies or the third pulse of the first reply, Mode 4 reply. Video Output: Amplitude: 0.0 to 5.0 V in 0.1 V steps 0.1 to 2.2 V ± 0.1 V 2.3 to 5V ± 0.2 V Pulse Width: 0.45 ± 0.03 µs Rise Time: <0.1 µs Fall Time: <0.15 µs Jitter: <± 50 µs between ext P3 or zero trigger or ±0.01% of the delay time, whichever is greater. Impedance: 75 Ω
	RESETS: Timing: First pulse variable from 30 to 3000 µs Width: First pulse 8.0 ± 0.2 µs Second pulse 2.0 ± 0.25 µs spaced 10.0 ±0.1 µs at 50% point of pulse 1 Third pulse 4.0 ± 0.25 µs spaced 15.0 ± 0.1 µs at 50% point of pulse 1 Amplitude: 4.5 ± 1 V Impedance: 75 Ω
	CHAL/TAG: Mode 1,2,3/A Challenge: Pulses: P1 and P3 Width: 0.8 ± 0.03 µs Spacing: 3.0 ± 0.05 µs Mode 1 5.0 ± 0.05 µs Mode 2 8.0 ± 0.05 µs Mode 3/A P3 Delay: 25 to 430 µs in 1 µs steps Mode C Challenge: Pulses: P1 and P3 Width: 0.8 ± 0.03 µs Spacing: 21.0 ± 0.05 µs Mode 4 Sync Group Challenge: Pulses: S1, S2, S3, and S4 Width: 0.5 ± 0.03 µs Spacing: 2.0 ± 0.05 µs

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications	
		Mode 4 Word A Challenge: Pulses: 28 pulse train Width: 0.5 ± 0.03 µs Spacing: 0, 2, 4, 6, 10, 13, 15, 17, 20, 24, 26, 30, 33, 35, 38, 41, 43, 45, 48, 50, 52, 54, 58, 61, 63,66, 68, and 71 ±0.07 µs from leading edge of first pulse Mode 4 Word B Challenge: Pulses: 28 pulse train Width: 0.5 ± 0.03 µs Spacing: 0, 2, 4, 6, 10, 12, 15, 17, 19, 22, 25, 28, 30, 32, 35, 37, 40, 44, 48, 51, 53, 55, 57, 60, 62, 64, 66, and 70 ± 0.07 µs from leading edge of first pulse. Mode 4 Word C Challenge: Pulses: 36 pulse train Width: 0.5 ± 0.03 µs Spacing: 0, 2, 4, 6, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, and 72 ± 0.07 µs from leading edge of first pulse. Interrogator Side lobe Suppression Pulse: Width: 0.5 ± 0.03 µs Mode 4 0.8 ± 0.03 µs all other modes Spacing: 8.0 ± 0.07 µs after first pulse for Mode 4. 2.0 ± 0.05 µs after P1 pulse for all other modes. Disparity Pulses: Width: 0.3 to 1.0 µs Timing: The pulse occurs 65 µs after the enable trigger. For Mode 4 Word B disparity, the pulse is coincident with the pulse at 19 ± 1.0 µs. For Mode 4 Word A, the pulse occurs 198 ± 2.0 µs after the enable trigger. Impedance: 75 Ω
RADAR SIM:	ACP OUT:	Amplitude: 3.5 ± 1 V Pulse Width: 2 ± 1µs Rise Time: 0.1 µs maximum Fall Time: 0.2 µs maximum Impedance: 75 Ω
	POS READOUT GATE:	Amplitude: 20 ± 5 V Timing: After 0 trig variable from 150 to 1,200 µs in 10 µs steps. Pulse Width: 30 to 300 µs in 10 µs steps Impedance: 75 Ω
	NEG READOUT GATE:	Amplitude: -4.8 ± 0.8 V Timing: After 0 trig variable from 150 to 1,200 µs in 10 µs steps Pulse Width: 30 to 300 µs in 10 µs steps. Impedance: 75 Ω

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications	
	NORTH TRIGGER OUT:	Amplitude: 3.5 ± 1 V Pulse Width: 2 ± 1 µs Timing: One pulse for each 360 degree cycle of antenna rotation. Rise Time: 0.1 µs maximum Fall Time: 0.2 µs maximum
	EXT NORTH IN:	Amplitude: 2 to 30 V Pulse Width: 0.25 to 20 µs Rise Time: 0.02 µs maximum Impedance: 75 Ω
VAR PULSE OUTPUT:	Pulse Width: Rise Time: Fall Time: Timing: Delay: Amplitude: Impedance:	< 0.25 to >10 µs in 0.05 µs steps 0.1 µs maximum 0.5 µs maximum When logically OR'ed with VP1,VP2 can be delayed in 0.1 µs steps from 1 to 100 µs from VP1. < 3 µs to 7500 µs after zero in 0.1 µs steps 5 ±0.5 V 75 Ω
Kit/KIR:	CH VID IN:	Amplitude: +1.5 to +5 V video challenge train containing up to 37 pulses 3 ± 1 µs apart. Pulse Width: 0.4 to 0.6 µs Impedance: 90 Ω
	CH VID OUT:	Amplitude: +4.5 ± 1 V Pulse Width: 0.5 to 3.0 µs Rise Time: ≤ 0.1 µs Fall Time: ≤ 0.15 µs Timing: First Synch pulse occurs 168 ± 0.5 µs after the Mode 4 pre-trigger pulse. Impedance: 90 Ω
	EN TRIG IN:	Amplitude: +1.5 to 5 V ac-coupled Pulse Width: 0.5 to 3.0 µs Rise Time: ≤ 0.1 µs Fall Time: ≤ 1.0 µs Impedance: 90 Ω
	PRE TRIG IN:	Amplitude: +1.5 to +5 V Pulse Width: 0.5 to 10.0 µs Rise Time: ≤ 0.1 µs Fall Time: ≤ 0.5 µs Impedance: 90 Ω

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications	
	DISP OUT:	Amplitude: +4.5 ± 1 V Pulse Width: 0.3 to 1.0 µs Timing: For ISLS disparity, the pulse occurs 65 ± 1 µs after the enable trigger. For Mode 4 Word B disparity, the pulse is coincident with the pulse at 19 ± 1.0 µs. For Mode 4 Word A, the pulse occurs 198 ± 2 µs after the enable trigger. ISLS disparity takes precedents over Word A or B disparity Impedance: 90 Ω
	GTC TRIG OUT:	Amplitude: +4.5 ± 1 V Pulse Width: 0.8 ± 0.2 µs Rise Time: ≤ 0.1 µs Fall Time: ≤ 0.2 µs Timing: 372 ±0.5 µs after Mode 4 pre-trigger Impedance: 90 Ω
	REPLY OUT:	Amplitude: +4.5 ± 1 V Pulse Width: 0.45 ± 0.03 µs Spacing: 3 pulses spaced 1.75 ± 0.025 µs Timing: 199.5 ± 0.75 µs after P4 Impedance: 90 Ω
	ISLS TRIG OUT:	Amplitude: +4 ± 1 V Pulse Width: 0.3 to 1.5 µs Rise Time: ≤ 0.2 µs Fall Time: ≤ 0.2 µs Timing: Trigger occurs 5.9 ± 0.1 µs after first sync pulse of Mode 4 interrogation. Impedance: 90 Ω
	DEMOD OUT:	Amplitude: > 1 V Impedance: 75 Ω
	MARKER STROBE OUT:	Amplitude: +4 ± 1.5 V Impedance: 75 Ω
RF I/O SECTION:	AUX MOD IN:	Amplitude: < 0.5 Vdc for full off condition 1 to 30 Vdc for full on condition Pulse Width: 0.275 µs minimum Impedance: 1 k Ω

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications	
	1030 MHz OUT:	Level: 15 ± 2 dBm Frequency: 1030 MHz ± 0.01%
	60 MHz OUT:	Levels: -30 to -90 dBm Accuracy: ± 1 dB -30 to -79 dBm ± 2 dB -80 to -90 dBm Frequency: swept 40 to 80 MHz
	MAIN MOD IN:	Amplitude: < 0.5 Vdc for full off condition 1 to 30 Vdc for full on condition Pulse Width: 0.275 µs minimum Impedance: 1 k Ω
	MAIN RF I/O 1W TO 10KW:	Input: Frequency: 960 to 1200 MHz Power Level: Pulsed Power:+30 dBm (1.0W)to +70 dBm (10 kW) CW Power: +30 dBm (1.0W) to +48.8 dBm (75 W) Output: Frequency: 1010 to 1110 MHz Swept Freq: 1010 to 1050 MHz or 1070 to 1110 MHz Power Level: 0 to -95 dBm in 1 dBm steps Accuracy: Fixed Frequency ± 1 dB Swept Frequency ± 0.5 dB of fixed frequency at center of sweep, and flatness over swept frequency range ± 1 dB.
	AUX RF I/O 1W TO 10KW:	Input: Frequency: 1010 to 1110 MHz Swept Freq: 1010 to 1050 MHz or 1070 to 1110 MHz Power Level: 0 to -95 dBm in 1 dBm steps Accuracy: Fixed frequency ±1 dB fixed frequency at center of sweep, and flatness over swept frequency range ± 1 dB.
	LOW PWR IN 1W MAX:	Levels: -12 to +30 dBm (1 W) Frequency Range: 12 to 1200 MHz
MIXED VIDEO OUT:	HIGH LEVEL:	Amplitude: +20 ± 5 V Rise Time: ≤ 0.1 µs Fall Time: ≤ 0.15 µs Impedance: 75 Ω

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications		
	VAR LEVEL:	Amplitude:	0.0 to 5 V
		Pulse Width:	.025 to 2.0 µs
		Rise Time:	≤ 0.1 µs
		Fall Time:	≤ 0.15 µs
		Impedance:	75 Ω
	GTC Long modulation:	Width:	0.5 ± 0.1 µs
		Spacing:	15, 30, 60, 120, 240, and 480 µs ± 5% from Mode 4 GTC trigger or from P3 pulse of an SIF challenge.
	GTC Short modulation:	Width:	0.5 ± 0.1 µs
		Spacing:	15, 65, 115 and 165 µs ± 5% from Mode 4 GTC trigger or from P3 pulse of an SIF challenge.
MEASUREMENT:	Pulse Width and pulse spacing:	Accuracy:	± 1 count or ±0.025 µs whichever is greater
	Counter:	Range: Main & Aux RF I/O: 960 to 1200 MHz Low Power in: 12 to 1200 MHz Accuracy: ± 10 kHz or ± 0.02%, whichever is greater	
	Power:	Range: Main & Aux RF I/O: 25 W or less to 75 W CW 25 W or less to 10 kW Pulsed Low Power in: 10 mW to 25W CW or Pulsed Accuracy: ± 0.5 dB	

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 Transfer Calibration Standards Set AN/GSM-286, AN/GSM-287, or AN/GSM-705. 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.

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 accessories are required. Crystal Detector Hewlett Packard Model 423A (POS), DC Power Supply HDL, Elgar, Model DCS40-30EM1-2 (13589313), and Power Amplifier JcAir (15-0777-M0).

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
ATTENUATOR	Range: 20 dB Accuracy:[1]	Weinschel, Model 9918-20dB (9918)
DIRECTIONAL COUPLER	Range: 1000 to 1100 MHz Accuracy: 20 dB coupling[1]	Hewlett-Packard, Model 778D, (M15370/11-001)
MEASURING RECEIVER	Frequency: Range: 900 kHz to 1030 MHz Accuracy: ± 0.0025% Power: Range: -95 to +40 dB Accuracy: ±0.25 dB relative	Hewlett-Packard, Model 8902A w/sensor, Hewlett-Packard, Model 11722A (11722A)
OSCILLOSCOPE	Time Base Accuracy: ±0.0025% Amplitude 0-25 V ±1.0%	OS-303/G
PEAK POWER METER	Range: 30 to 1200 MHz +10 dB Accuracy : ±0.125 dB	Wavetek, Model 8502A (8502A) w/power detector, Wavetek, Model 16934 (16934)
POWER SPLITTER	Frequency range: 1.03 GHz Port-to-port tracking accuracy: ±0.15	Weinschel, Model 1870A (7916839)
PULSE GENERATOR	Period: 100 µS to 143 mS Width: 200 nS to 10 µS Amplitude: -15 to 5 V	LeCroy, Model 9210 (9210) w/plug-ins, LeCroy, Models 9211 (9211) and 9215 (9215) (MIS 45839)
SIGNAL GENERATOR	Frequency:[1] Range: 30 MHz – 1200 MHz Power:[1] Range: 0 to +10 dBm	(SG-1207/U)
SPECTRUM ANALYZER	Frequency: Range: 40 MHz to 1110 MHz Accuracy: ±0.01% Amplitude: Range: 0 to 71 dB Accuracy: ±0.25 dB	AN/USM-677

[1]Characterized in the procedure.

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 check where applicable.

a. Connect TI to 115 V power source.

b. Press **POWER** key to **ON** and allow at least 60 minutes for TI to reach operating temperature.

c. Press TI **FUNC** and **ENTR** keys to insure the TI is properly configured for the performance test.

NOTE

TI will indicate that the **SELF TEST FAILED**. Press **ENTR** key **TEST STEPS FAILING 82** and **82A** are acceptable errors due to a IEEE cable being connected. If any other **TEST STEPS** are displayed refer to the Book of BIT for possible problems. Press **FUNC** and **ENTR** keys before continuing after looking at error codes.

8. PRF/PRI and Delays

a. Performance Check

(1) Connect TI **TRIGGERS 0 OUT** to the oscilloscope channel 1 input using a 75 Ω feedthrough termination.

(2) Connect an X1 oscilloscope probe to channel 2 of the oscilloscope.

(3) Connect the probe tip to pin 30 of the **UUT** connector.

(4) Connect pulse generator 9215 **OUTPUT** to TI **TRIGGERS EXT IN** (do not use a 50 Ω feedthrough termination).

NOTE

Wait while pulse generator calibrates. This will take about 80 seconds.

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

(a) Press **FUNC** and **ENTR** keys.

(b) Use the arrow keys to highlight **TRANSPONDER MENUS** and press **ENTR** key.

(c) **5**, **ENTR** (**TIMING-VID**).

(d) Use the arrow keys to highlight **P3 DELAY:**

(e) **25**, **ENTR**.

(f) **FUNC**, ↑, **1**, **4** and **ENTR**.

(g) Use the arrow keys to highlight **PRF:**.

(h) **5**, **ENTR**.

(6) Set the oscilloscope to measure the frequency of channel 1 and verify that the oscilloscope indication is within limits in table 3.

(7) Repeat techniques of (5) (h), and (6) above for the remainder of table 3.

Table 3. PRF/PRI Accuracy

TI			Oscilloscope		
Test description	Function	Setting	Measurement type	Minimum	Maximum
5 INT TRIG PRF	PRF	5	Frequency	4.9995 Hz	5.0005 Hz
10K INT TRIG PRF	PRF	10000	Frequency	9900 Hz	10100 Hz
μS INT TRIG PRI	PRI	200	Period	1.99E-4	2.01E-4

(8) Set the pulse generator as listed in (a) through (l) below:

(a) **Recall Setup**, Standard, and Execute.

(b) **Cal**, **Execute**.

(c) 9215 plugin **Disable** off.

(d) **Ampl**, **2**, **Enter**.

(e) Loadcomp **ON**.

(f) Period **143**, **m**.

(g) Width **300**, **n**.

(h) Ampl, **CHANGE FORMAT**, Median, **1**, **Enter**.

(i) Base, **0.0**, **Enter**.

(j) Delay **0**, **n**.

(k) **TRIGGER**, Mode, Normal.

(l) Slope, Positive.

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

(a) Use the arrow keys to highlight **SOURCE:**.

(b) Press the **INC** key to display **EXT**.

(c) Use the arrow keys to highlight **0 TRIGGER:**.

(d) Press the **INC** key to display **EXTERNAL+**.

(10) Set the oscilloscope channel 1 and channel 2 input impedance to 1 MΩ and to the measurement type required and verify the oscilloscope indicated within the minimum and maximum indications listed in table 4.

(11) Repeat technique of (8) and (10) above for remainder of table 4.

Table 4. PRF/PRI Characteristic

TI		Pulse Generator			Oscilloscope		
Test description	Trigger setting	Amp	Period (s)	Width	Channel 1 measurement type	Minimum	Maximum
143mS EXT TRIG	0 TRIGGER: EXTERN +	2	143 m	300 n	Frequency	6.5 Hz	7.5
10k EXT TRIG	0 TRIGGER: EXTERN -	-15	100 u	10 u	Frequency	9.9995 kHz	10.0005 kHz
0 OUT 20 V level[1]	0 TRIGGER: INT	-------	-------	-------	Max	15 V	25 V
0 OUT 1.5 µs PW	0 TRIGGER: INT	-------	-------	-------	Width	1 µs	2 µs
0 OUT Overshoot	0 TRIGGER: INT	-------	-------	-------	Overshoot	.01 %	5 %
0 OUT Rise Time	0 TRIGGER: INT	-------	-------	-------	Rise Time		200 ns
0 OUT Decay Time	0 TRIGGER: INT	-------	-------	-------	Fall Time		200 ns
TTL 1.5 µs width	0 TRIGGER: INT	-------	-------	-------	Channel 2 Width	1 µs	2 µs
TTL 5V level	0 TRIGGER: INT	-------	-------	-------	Channel 2 Top	4.5 V	5.5 V

[1]Set pulse generator 9215 DISA ON.

(12) Verify that the pulse displayed on channel 2 is approximately coincident with the pulse on channel 1.

(13) Disconnect the equipment setup.

b. Adjustments. No further adjustments can be made.

9. Var Pulses 1 & 2

a. Performance Check

(1) Connect TI **TRIGGERS 0 OUT** to the oscilloscope channel 1 input using a 75 Ω feedthrough termination.

(2) Connect TI **VAR PULSE OUTPUT** to the oscilloscope channel 2 input using a 75 Ω feedthrough termination.

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

(a) Press **FUNC** and **ENTR** keys.

(b) Use the arrow keys to highlight **TRANSPONDER MENUS** and press **ENTR** key.

(c) **6**, **ENTR** (**VAR PULSE**).

(d) Use the arrow keys to highlight **VP1 PW:**.

(e) **.25**, **ENTR**.

(f) Use the arrow keys to highlight **VP1 DLY:**.

(g) **2**, **ENTR**.

(4) Set oscilloscope to measure the functions listed in table 5 with the oscilloscope trigger on channel 1.

Table 5. Variable Pulse 1 Characteristic

TI	Oscilloscope		
Test Description	Measurement Type	Minimum	Maximum
VP1 Rise Time	Channel 2 Rise Time	----------	≤0.1 µs
VP1 Fall Time	Channel 2 Fall Time	---------	≤0.1 µs
VP1 Overshoot	Channel 2 Overshoot	----------	≤5 %
VP1 5V Level	Channel 2 Top	4 V	6 V

(5) Set oscilloscope to measure the pulse width of the signal on oscilloscope channel 2, and verify that indication is within limits listed in table 6.

(6) Repeat technique of (3) (c) (d) and (5) above for remaining values in table 6.

Table 6. Variable Pulse 1 Pulse With Accuracy

TI		Oscilloscope indication	
Test description	VP1 pulse width	Minimum	Maximum
VP1 .25 µs Pulse Width	.25 µs	.2 µs	.3 µs
VP1 10 µs Pulse Width	10 µs	9.95 µs	10.05 µs

(7) Use the arrow keys to highlight **VP1 DLY:** press **3** and **ENTR** keys.

(8) Set the oscilloscope to measure the delay between the **TRIGGER 0 OUT** and **VP1** and verify that indication is within limits listed in table 7.

(9) Repeat technique of (7) and (8) above for remaining values in table 7.

Table 7. Variable Pulse 1 Delay Accuracy

TI		Oscilloscope indication	
Test description	VP1 pulse delay	Minimum	Maximum
VP1 3 µs Delay	3 µs	2.9 µs	3.1 µs
VP1 500 µs Delay	500 µs	499.9 µs	500.1 µs

(10) Disconnect TI **TRIGGER 0 OUT** from oscilloscope channel 1 input.

(11) Connect an X1 oscilloscope probe to channel 1 of the oscilloscope.

(12) Connect the probe tip to pin 29 of the **UUT** connector.

(13) Set oscilloscope to measure the functions listed in table 8 with the oscilloscope trigger on channel 1.

Table 8. Variable Pulse 1 Characteristics

TI	Oscilloscope		
Test description	Measurement type	Minimum	Maximum
TTL 10 µs Pulse Width	Channel 1 Width	9.95 µs	10.05 µs
TTL 10 µs Pulse Width	Channel 1 Top	2.5 V	5.5 V

(14) Verify that the pulse displayed on channel 2 is approximately coincident with the pulse on channel 1.

(15) Connect the probe tip to pin 12 of the **UUT** connector.

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

(a) Use the arrow keys to highlight **VP1**, **ENTR** (OFF).
(b) Use the arrow keys to highlight **VP2**, **ENTR** (ON).
(c) Use the arrow keys to highlight **VP2 DLY:**.
(d) **100**, **ENTR**.
(e) Use the arrow keys to highlight **VP1/VP2:**, **ENTR** (YES).

(17) Verify that the pulse displayed on channel 2 is approximately coincident with the pulse on channel 1.

(18) Verify that the pulse width of the signal on channel 2 is within limits listed in first row of table 9.

(19) Press TI keys as listed in (a) and (b) below:

(a) Use the arrow keys to highlight **VP2 PW:**.
(b) **.25**, **ENTR**.

(20) Verify that the pulse width of the signal on channel 1 is within limits listed in second row of table 9.

(21) Repeat technique of (19) and (20) above for remaining row in table 9.

Table 9. Variable Pulse 2 Characteristic

TI		Oscilloscope		
Test description	VP2 pulse width	Measurement type	Minimum	Maximum
VP1/2 1 µs Pulse Width	----------	Channel 1 Width	.95 µs	1.05 µs
VP1/2 .25 µs Pulse Width	.25 µs	Channel 2 Width	0.2 µs	0.3 µs
VP1/2 10 µs Pulse Width	10 µs	Channel 2 Width	9.95 µs	10.05 µs

(22) Disconnect X1 probe from UUT and oscilloscope channel 1 input. Connect TI **TRIGGERS 0 OUT** to the oscilloscope channel 1 input using a 75 Ω feedthrough termination.

(23) Press TI keys as listed in (a) through (i) below:

(a) Use the arrow keys to highlight **VP1**, **ENTR** (ON).
(b) Use the arrow keys to highlight **VP1 PW:**.
(c) **0.5**, **ENTR**.
(d) Use the arrow keys to highlight **VP1 DLY:**.
(e) **10**, **ENTR**.
(f) Use the arrow keys to highlight **VP2 PW:**.
(g) **0.5**, **ENTR**.
(h) Use the arrow keys to highlight **VP2 DLY:**.
(i) **1**, **ENTR**.

(24) Set the oscilloscope to measure the period between variable pulse 1 and variable pulse 2. Verify that the period is within limits listed in table 10.

(25) Repeat technique of (23) and (24) above for remaining rows in table 10. Verify that the period is within limits listed in table 10.

Table 10. VP1/2 Delay

Test description	VP 1 width	VP1 delay	VP2 width	VP2 delay	Measurement type	Min	Max
VP1/2 1 µs delay	0.5 µs	10 µs	0.5 µs	1 µs	Period	0.9 µs	1.1 µs
VP1/2 100 µs delay	0.5 µs	10 µs	0.5 µs	100 µs	Period	99.9 µs	100.1 µs
VP1/2 20 µs delay	10 µs	10 µs	10 µs	20 µs	Period	19.9 µs	20.1 µs
VP1/2 duty cycle	10 µs	10 µs	10 µs	20 µs	Duty cycle	49 %	51 %
VP1 10 µs delay	10 µs	10 µs	10 µs	20 µs	Delta time [1]	9 µs	11 µs
VP2 30 µs delay	10 µs	10 µs	10 µs	20 µs	Delta time [2]	29 µs	31 µs

[1]Delay from channel 1 to first pulse on channel 2.

[2]Delay from channel 1 to second pulse on channel 2.

(26) Disconnect cable from TI **VAR PULSE** output and connect it to the TI **IFF VIDEO OUT FIRST REPLY** output.

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

(a) Use the arrow keys to highlight **OR CHALLENGE**, **ENTR** (YES).
(b) Use the arrow keys to highlight **1ST REPLY**, **ENTR** (YES).
(c) Press **FUNC** and ↑ keys.
(d) **3**, **ENTR** (**1st REPLY**).

(28) Set the oscilloscope to first measurement function listed in table 11. Verify that the oscilloscope indication is within limits listed in table 11.

(29) Repeat technique of (27) through (28) above for remaining rows in table 11 using settings and connections listed in table 11. Verify that the measurement type is within limits listed in table 11.

NOTE

Oscilloscope channel 2 connections column indicated the connection to be used in repeating technique of (24) above.

Table 11. VP1/2 Delay

Test description	VP1	VP2	VP2 delay	Oscilloscope channel 2 connection	Measurement type	Min	Max
1ST REP 20 µs PER	ON	ON	20 µs	IFF VIDEO OUT FIRST REPLY	Period Channel 2	19.9 µs	20.1 µs
1ST REP Duty cycle	ON	ON	20 µs	IFF VIDEO OUT FIRST REPLY	Duty Channel 2	49 %	51 %
1ST REP 10 µs DLY	ON	OFF	20 µs	IFF VIDEO OUT FIRST REPLY	Delta Time Channel 1 to 2	9 µs	11 µs
1ST REP 30 µs DLY	OFF	ON	20 µs	IFF VIDEO OUT FIRST REPLY	Delta Time Channel 1 to 2	29 µs	31 µs

Table 11. VP1/2 Delay - Continued

Test description	VP1	VP2	VP2 delay	Oscilloscope chan 2 connection	Measurement type	Min	Max
CHAL/TAG 20 µs PER	ON	ON	20 µs	IFF VIDEO CHAL/TAG	Period Channel 2	19.9 µs	20.1 µs
CHAL/TAG Duty Cycle	ON	ON	20 µs	IFF VIDEO CHAL/TAG	Duty Channel 2	49 %	51 %
CHAL/TAG 10 µs DLY	ON	ON	20 µs	IFF VIDEO CHAL/TAG	Delta Time	9 µs	11 µs
CHAL/TAG 30 µs DLY	OFF	ON	20 µs	IFF VIDEO CHAL/TAG	Delta Time	29 µs	31 µs
VP2 3 µs DLY[1]	OFF	ON	3 µs	IFF VIDEO FIRST REPLY	Delta Time	2.9 µs	3.1 µs
VP2 50 µs DLY	OFF	ON	50 µs	IFF VIDEO FIRST REPLY	Delta Time	49.9 µs	50.1 µs
VP2 500 µs DLY	OFF	ON	500 µs	IFF VIDEO FIRST REPLY	Delta Time	499.9 µs	500.1 µs

[1]Use arrow keys to highlight **OR VP1/VP2** and press **ENTR** (NO).

(30) Disconnect the equipment setup.

b. Adjustments. No further adjustments can be made.

10. Challenge & Tag Generator

a. Performance Check

(1) Connect TI **TRIGGERS 0 OUT** to the oscilloscope channel 1 input using a 75 Ω feedthrough termination.

(2) Connect TI **IFF VIDEO OUT CHAL/TAG** to the oscilloscope channel 2 input using a 75 Ω feedthrough termination.

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

(a) Press **FUNC** and **ENTR** keys.
(b) Use the arrow keys to highlight **TRANSPONDER MENUS** and press **ENTR** key.
(c) **2**, **ENTR** (**CHALLENGES**).
(d) Use the arrow keys to highlight **M1:**.
(e) **ENTR** (**ON**).
(f) Use the arrow keys to highlight **M2:**.
(g) **ENTR** (**OFF**).
(h) Use the arrow keys to highlight **P3:**.
(i) **ENTR** (**OFF**).
(j) Press **FUNC** and ↑ keys.
(k) **5, ENTR (TIMING, VIDEO LEVELS)**.
(l) Use the arrow keys to highlight (**CHALLENGE VIDEO:**).
(m) **5**, **ENTR** (**5.0 V**).

(4) Set oscilloscope to measure the functions listed in table 12 with the oscilloscope trigger on channel 2.

Table 12. Challenge/Tag Generator

Test description	TI setting	Channel 2 measurement type	Min	Max
M1 Rise Time	----------	Rise Time	----------	≤0.1µs
M1 Fall Time	----------	Fall Time	----------	≤0.15µs
Challenge Video 5 V Level	----------	V Top	4.9 V	5.1 V
M1 Overshoot	----------	Overshoot	----------	≤5 %
M1 .8 µs PW	----------	Width	0.77 µs	0.83 µs
Challenge Video 1 V Level	CHALLENGE VIDEO ,1V	Top	0.9 V	1.1 V
M1 to P3 Delay	Press **FUNC** and ↑ keys. **2, ENTR** P3: ON	Period	2.95 µs	3.05 µs
M2 to P3 Delay	Press **FUNC** and ↑ keys. **5**, **ENTR** Use the arrow keys to **CHALLENGE VIDEO**, **5 V** Press **FUNC** and ↑ keys. **2**, **ENTR** (**CHALLENGES**) Use the arrow keys to highlight **M1:** **ENTR** (**OFF**) Use the arrow keys to highlight **M2:** **ENTR** (**ON**)	Period	4.95 µs	5.05 µs
M3/A To P3 Delay	Use the arrow keys to highlight **M2:** **ENTR** (**OFF**) Use the arrow keys to highlight M**3/A:** **ENTR** (**ON**)	Period	7.95 µs	8.05 µs
MC To P3 Delay	Use the arrow keys to highlight **M3/A:** **ENTR** (**OFF**) Use the arrow keys to highlight M**C:** **ENTR** (**ON**)	Period	20.95 µs	21.05 µs
MC To P1 Delay	Use the arrow keys to highlight **P2:** **ENTR** (**ON**)	Period 1st to 2d pulse	1.95 µs	2.05 µs
Pulse Count P1,P2,P3 ON	----------	Pulses on oscilloscope	----------	3
Pulse Count P1 OFF	Use the arrow keys to highlight **P1 :** **ENTR** (**OFF**)	Pulses on oscilloscope	----------	2
Pulse Count P2 OFF	Use the arrow keys to highlight **P2 :** **ENTR** (**OFF**)	Pulses on oscilloscope	----------	1
Pulse Count P3 OFF	Use the arrow keys to highlight **P3 :** **ENTR** (**OFF**)	Pulses on oscilloscope	----------	0
P3 25 µs Delay	Use the arrow keys to highlight **P3 :** **ENTR** (**ON**) Press **FUNC** and ↑ keys. **5**, **ENTR** (**TIMING, VIDEO LEVELS**) Use the arrow keys to highlight **P3** **DELAY :** **25**, **ENTR**	Delay	24 µs	26 µs
P3 430 µs Delay	Use the arrow keys to highlight **P3** **DELAY:** **430**, **ENTR**	Delay	429 µs	431 µs

Table 12. Challenge/Tag Generator - Continued

Test description	TI setting	Channel 2 measurement type	Min	Max
MODE4 Rise Time	**FUNC,** ↑ **2**, **ENTR** (**CHALLENGES**) Use the arrow keys to highlight **M4:** **ENTR** until (**SYNC**), is displayed Use the arrow keys to highlight **M2:** **ENTR (OFF**) Use the arrow keys to highlight **MC:** **ENTR (OFF**) Use the arrow keys to highlight **S2:** **ENTR** (**OFF**) Use the arrow keys to highlight **S3:** **ENTR** (**OFF**) Use the arrow keys to highlight **S4:** **ENTR** (**OFF**)	Rise Time	----------	≤0.1 µs
MODE4 Fall Time	----------	Fall Time	----------	≤0.1 µs
MODE4 5 V Lvl	----------	Top	4.9 V	5.1 V
MODE4 Overshoot	----------	Overshoot	.1 %	5 %
MODE4 .5 µs PW	----------	Width	470 ns	530 ns
S1 TO S2 DLY	Use the arrow keys to highlight (**S1: ON**) Use the arrow keys to highlight (**S2: ON**) Use the arrow keys to highlight (**S3: ON**) Use the arrow keys to highlight (**S4: ON**)	Period	1.95 µs	2.05 µs
S1 TO S3 DLY	Use the arrow keys to highlight (**S2: OFF**)	Period	3.95 µs	4.05 µs
S1 TO S4 DLY	Use the arrow keys to highlight (**S3: OFF**)	Period	5.95 µs	6.05 µs
S1 TO S5 DLY	Use the arrow keys to highlight (**S4: OFF**) Use the arrow keys to highlight (**S5: ON**)	Period	7.93 µs	8.07 µs

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

(a) Use the arrow keys to highlight (**S5: OFF**).
(b) Use the arrow keys to highlight (**M4:**).
(c) **ENTR**.
(d) Use the arrow keys to highlight (**WORD A**).
(e) Use the arrow keys to highlight (**S1: ON**).
(f) Use the arrow keys to highlight (**S2: ON)**.
(g) Use the arrow keys to highlight (**S3: ON)**.
(h) Use the arrow keys to highlight (**S4: ON**).

(6) Use the oscilloscope delta time markers to measure the first and second pulses of WORD A.

(7) Verify that the oscilloscope delta time markers indicate within the limits listed in first row of table 13.

(8) Repeat technique of (6) and (7) for remaining rows in table 13.

Table 13. Word A Generator

Test description	TI		Oscilloscope Δ time indication	
	From pulse	To pulse	Minimum (μs)	Maximum (μs)
WORD A 1 TO 2	1	2	1.93	2.07
WORD A 1 TO 3	1	3	3.93	4.07
WORD A 1 TO 4	1	4	5.93	6.07
WORD A 1 TO 5	1	5	9.93	10.07
WORD A 1 TO 6	1	6	12.93	13.07
WORD A 1 TO 7	1	7	14.93	15.07
WORD A 1 TO 8	1	8	16.93	17.07
WORD A 1 TO 9	1	9	19.93	20.07
WORD A 1 TO 10	1	10	23.93	24.07
WORD A 1 TO 11	1	11	25.93	26.07
WORD A 1 TO 12	1	12	29.93	30.07
WORD A 1 TO 13	1	13	32.93	33.07
WORD A 1 TO 14	1	14	34.93	35.07
WORD A 1 TO 15	1	15	37.93	38.07
WORD A 1 TO 16	1	16	40.93	41.07
WORD A 1 TO 17	1	17	42.93	43.07
WORD A 1 TO 18	1	18	44.93	45.07
WORD A 1 TO 19	1	19	47.93	48.07
WORD A 1 TO 20	1	20	49.93	50.07
WORD A 1 TO 21	1	21	51.93	52.07
WORD A 1 TO 22	1	22	53.93	54.07
WORD A 1 TO 23	1	23	57.93	58.07
WORD A 1 TO 24	1	24	60.93	61.07
WORD A 1 TO 25	1	25	62.93	63.07
WORD A 1 TO 26	1	26	65.93	66.07
WORD A 1 TO 27	1	27	67.93	68.07
WORD A 1 TO 28	1	28	70.93	71.07

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

(a) Use the arrow keys to highlight (**M4:**).
(b) **ENTR**.
(c) Use the arrow keys to highlight (**WORD B**).

(10) Repeat technique of (6) and (7) above for each row in table 14.

Table 14. Word B Generator

Test description	TI		Oscilloscope Δ time indication	
	From pulse	To pulse		From pulse
WORD B 1 TO 2	1	2	1.93	2.07
WORD B 1 TO 3	1	3	3.93	4.07
WORD B 1 TO 4	1	4	5.93	6.07
WORD B 1 TO 5	1	5	9.93	10.07
WORD B 1 TO 6	1	6	11.93	12.07
WORD B 1 TO 7	1	7	14.93	15.07
WORD B 1 TO 8	1	8	16.93	17.07
WORD B 1 TO 9	1	9	18.93	19.07
WORD B 1 TO 10	1	10	21.93	22.07
WORD B 1 TO 11	1	11	24.93	25.07
WORD B 1 TO 12	1	12	27.93	28.07
WORD B 1 TO 13	1	13	29.93	30.07
WORD B 1 TO 14	1	14	31.93	32.07
WORD B 1 TO 15	1	15	34.93	35.07
WORD B 1 TO 16	1	16	36.93	37.07
WORD B 1 TO 17	1	17	39.93	40.07
WORD B 1 TO 18	1	18	43.93	44.07
WORD B 1 TO 19	1	19	47.93	48.07
WORD B 1 TO 20	1	20	50.93	51.07
WORD B 1 TO 21	1	21	52.93	53.07
WORD B 1 TO 22	1	22	54.93	55.07
WORD B 1 TO 23	1	23	56.93	57.07
WORD B 1 TO 24	1	24	59.93	60.07
WORD B 1 TO 25	1	25	61.93	62.07
WORD B 1 TO 26	1	26	63.93	64.07
WORD B 1 TO 27	1	27	65.93	66.07
WORD B 1 TO 28	1	28	69.93	70.07

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

(a) Use the arrow keys to highlight (**M4:**).
(b) **ENTR.**
(c) Use the arrow keys to highlight (**WORD C**).

(12) Repeat technique of (6) and (7) above for each row in table 15.

Table 15. Word C Generator

Test description	TI		Oscilloscope Δ time indication	
	From pulse	To pulse		From pulse
WORD C 1 TO 2	1	2	1.93	2.07
WORD C 1 TO 3	1	3	3.93	4.07
WORD C 1 TO 4	1	4	5.93	6.07
WORD C 1 TO 5	1	5	9.93	10.07
WORD C 1 TO 6	1	6	11.93	12.07
WORD C 1 TO 7	1	7	13.93	14.07
WORD C 1 TO 8	1	8	15.93	16.07

Table 15. Word C Generator - Continued

Test description	TI		Oscilloscope Δ time indication	
	From pulse	To pulse		From pulse
WORD C 1 TO 9	1	9	17.93	18.07
WORD C 1 TO 10	1	10	19.93	20.07
WORD C 1 TO 11	1	11	21.93	22.07
WORD C 1 TO 12	1	12	23.93	24.07
WORD C 1 TO 13	1	13	25.93	26.07
WORD C 1 TO 14	1	14	27.93	28.07
WORD C 1 TO 15	1	15	29.93	30.07
WORD C 1 TO 16	1	16	31.93	32.07
WORD C 1 TO 17	1	17	33.93	34.07
WORD C 1 TO 18	1	18	35.93	36.07
WORD C 1 TO 19	1	19	37.93	38.07
WORD C 1 TO 20	1	20	39.93	40.07
WORD C 1 TO 21	1	21	41.93	42.07
WORD C 1 TO 22	1	22	43.93	44.07
WORD C 1 TO 23	1	23	45.93	46.07
WORD C 1 TO 24	1	24	47.93	48.07
WORD C 1 TO 25	1	25	49.93	50.07
WORD C 1 TO 26	1	26	51.93	52.07
WORD C 1 TO 27	1	27	53.93	54.07
WORD C 1 TO 28	1	28	55.93	56.07
WORD C 1 TO 29	1	29	57.93	58.07
WORD C 1 TO 30	1	30	59.93	60.07
WORD C 1 TO 31	1	31	61.93	62.07
WORD C 1 TO 32	1	32	63.93	64.07
WORD C 1 TO 33	1	33	65.93	66.07
WORD C 1 TO 34	1	34	67.93	68.07
WORD C 1 TO 35	1	35	69.93	70.07
WORD C 1 TO 36	1	36	71.93	72.07

(13) Reduce all outputs to minimum and disconnect equipment setup.

b. Adjustments. No adjustments can be made.

11. Mode Repeat

a. Performance Check

(1) Connect the pulse generator 9215 **OUTPUT** to TI **TRIGGERS EXT IN** (DO NOT USE A 50 Ω FEEDTHROUGH TERMINATION).

(2) Connect TI **IFF VIDEO OUT CHAL/TAG** to the oscilloscope channel 1 input using a 75 Ω feedthrough termination.

(3) Connect TI **TRIGGERS M4 GTC OUT** to the oscilloscope channel 2 input using a 75 Ω feedthrough termination.

NOTE

Wait while pulse generator calibrates. This will take about 80 seconds.

(4) Reset and calibrate the pulse generator.

(5) Press TI keys as listed in (a) through (w) below:

(a) Press **FUNC** and **ENTR** keys.
(b) Use the arrow keys to highlight **TRANSPONDER MENUS** and press **ENTR** key.
(c) **2**, **ENTR** (**CHALLENGES**).
(d) Use the arrow keys to highlight **M1 : ENTR** (**ON**).
(e) Use the arrow keys to highlight **M2: ENTR** (**ON**).
(f) Use the arrow keys to highlight **M3/A: ENTR** (**ON**).
(g) Use the arrow keys to highlight **MC: ENTR** (**ON**).
(h) Use the arrow keys to highlight **P1: ENTR** (**ON)**.
(i) Use the arrow keys to highlight **P2: ENTR (ON)**.
(j) Use the arrow keys to highlight **P3: ENTR (OFF)**.
(j) Use the arrow keys to highlight **M4: SYNC**.
(k) Use the arrow keys to highlight **(S1: ON)**.
(l) Use the arrow keys to highlight **(S2: ON)**.
(m) Use the arrow keys to highlight **(S3: ON)**.
(n) Use the arrow keys to highlight **(S4: ON)**.
(o) Use the arrow keys to highlight **MODE REPEAT:**.
(p) **8, ENTR**.
(q) Press **FUNC** and ↑ keys.
(r) **5, ENTR (TIMING)**.
(s) Use the arrow keys to highlight **CHALLENGE VIDEO:**.
(t) **5** and press **ENTR** key.
(u) Press **FUNC** and ↑ keys.
(v) **14, ENTR** (**PRF/PRI**).
(w) Use the arrow keys to highlight **0 TRIGGER: EXTERNAL +**.

(6) Set the pulse generator to produce a 5 μs wide, 5 V pulse with a period of 100 ms in single step mode, (one pulse will be output each time the pulse generator is triggered).

(7) Set oscilloscope to trigger on channel 1, measurement type to Delta time, and to measure the delay between channel 1 and channel 2.

(8) Trigger the pulse generator one time.

(9) Adjust the oscilloscope cursors to measure the delta time between the first pulse on channel 1 and the channel 2 pulse. Oscilloscope will indicate within limits listed in first row of table 16.

(10) Count pulses displayed on channel 1. The count will be within limits listed in table 16 row 2.

(11) Repeat technique of (8) and (10) above for remaining rows in table 16.

Table 16. Mode Repeat

Test description	Pulse generator action	Oscilloscope		
		Measurement type	Minimum (μs)	Maximum (μs)
M1 REPEAT 1	----------	Delta time	2.5	3.5
M1 PULSE COUNT	----------	Count	2	2

Table 16. Mode Repeat - Continued

Test description	Pulse generator action	Oscilloscope		
		Measurement type	Minimum (μs)	Maximum (μs)
M1 REPEAT 8	Trigger 7 pulses	Delta time	2.5	3.5
M2 REPEAT 1	Trigger 1 pulse	Delta time	4.5	5.5
M2 PULSE COUNT	----------	Count	2	2
M2 REPEAT 8	Trigger 7 pulses	Delta time	4.5	5.5
M3A REPEAT 1	Trigger 1 pulse	Delta time	7.5	8.5
M3A PULSE COUNT	----------	Count	2	2
M3A REPEAT 8	Trigger 7 pulses	Delta time	7.5	8.5
MC REPEAT 1	Trigger 1 pulse	Delta time	20.5	21.5
MC PULSE COUNT	----------	Count	2	2
MC REPEAT 8	Trigger 7 pulses	Delta time	20.5	21.5
M4 PULSE COUNT 1	Trigger 1 pulse	Count	4	4
M4 PULSE COUNT 8	Trigger 7 pulses	Count	4	4

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

b. Adjustments. No adjustments can be made.

12. 1st SIF Reply Video

a. Performance Check

(1) Connect TI **IFF VIDEO OUT FIRST REPLY** to oscilloscope channel 1 using a 75 Ω feedthrough termination.

(2) Connect TI **TRIGGERS M4 PRE OUT** to the oscilloscope channel 2 input using a 93 Ω feedthrough termination.

(3) Connect pulse generator 9215 to TI **TRIGGERS EXT IN** using a 50 Ω feedthrough termination disable the output.

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

(a) Press **FUNC** and **ENTR** keys.
(b) Use the arrow keys to highlight **TRANSPONDER MENUS** and press **ENTR** key.
(c) **3**, **ENTR** (**1ST REPLY**).
(d) Use the arrow keys to highlight **REPLY SIGNAL:**.
(e) **ENTR (SIF)**.
(f) Use the arrow keys to highlight **M2: 0000 (ON)**.
(g) Use the arrow keys to highlight **F2: (OFF)**.
(h) Use the arrow keys to highlight **SIF 2: (OFF)**.

(5) Set oscilloscope to trigger on channel 1 and channel 1 measurement type to Rise Time.

(6) Oscilloscope will indicate within limits listed in first row of table 17.

(7) Repeat technique of (4) through (6) above using remaining setting and limits listed in table 17.

Table 17. 1st Reply Video Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
1st REP M2 Rise Time	----------	Rise	----------	100 ns
1st REP M2 Fall Time	----------	Fall	----------	150 ns
1st REP M2 Overshoot	----------	Overshoot	----------	5 %
1st REP M2 .45 µs Pulse Width	----------	Width	420 ns	480 ns
1st REP M2 2.2 V Level	----------	Top	2.1 V	2.3 V
1st REP M2 5 V Level	Press **FUNC** and ↑, keys **5**, **ENTR** (**TIMING VIDEO LEVELS**) Use the arrow keys to highlight **1ST REPLY VIDEO: 5, ENTR**	Top	4.8 V	5.2 V
1st REP M2 0.1 V Level	**.1**, **ENTR**	Top	0.0 V	0.2 V
1st REP SIF+X Period	**2.2**, **ENTR** Press **FUNC** and ↑, keys **3**, **ENTR** (**1ST REPLY**) Use the arrow keys to highlight **REPLY SIGNAL: ENTR (SIF + X)**	Period	10.13 µs	10.17 µs

(8) Press TI keys as listed in (a) through (p) below:

(a) Press **FUNC, ENTR** keys.

(b) Use the arrow keys to highlight **TRANSPONDER MENUS** and press **ENTR** key.

(c) **2, ENTR (CHALLENGES)**.

(d) Use the arrow keys to highlight **M1:** (**ON**).

(e) Use the arrow keys to highlight **M2:** (**OFF**).

(f) Use the arrow keys to highlight **MC:** (**OFF**).

(g) Use the arrow keys to highlight **M3/A:** (**OFF**).

(h) Use the arrow keys to highlight **M4: (OFF)**.

(i) Press **FUNC**, ↑.

(j) **3**, **ENTR** (**1ST REPLY**).

(k) Use the arrow keys to highlight **REPLY SIGNAL: ENTR, (SIF)**.

(l) Use the arrow keys to highlight **M1: 1030 (ON)**.

(m) Use the arrow keys to highlight **M2: 6040 (ON)**.

(n) Use the arrow keys to highlight **M3/A: 0301 (ON)**.

(o) Use the arrow keys to highlight **MC: 0406 (ON)**.

(p) Use the arrow keys to highlight **F2: (ON)**.

(9) Set oscilloscope to trigger on channel 1 and measurement type to the delta time between the 1st and 2d pulses on channel 1.

(10) Verify that the oscilloscope indicates within limits of table 18.

(11) Repeat technique of (8) through (10) above using remaining setting and limits listed in table 18.

Table 18. Reply Codes

TI		Oscilloscope		
Test description	Settings	Pulses to be measured	Minimum (µs)	Maximum (µs)
M1 1030 P1 to P2	----------	1 to 2	1.43	1.47
M1 1030 P1 to P3	----------	1 to 3	2.88	2.92
M1 1030 P1 to P4	----------	1 to 4	4.33	4.37
M2 6040 P1 to P2	Press **FUNC, ↑** **2**, **ENTR** (**CHALLENGES**). Use the arrow keys to highlight **M1:** (**OFF**) Use the arrow keys to highlight **M2:** (**ON**)	1 to 2	5.78	5.82
M2 6040 P1 to P3	----------	1 to 3	7.23	7.27
M2 6040 P1 to P4	----------	1 to 4	8.68	8.72
M3 0301 P1 to P2	Use the arrow keys to highlight **M2:** (**OFF**) Use the arrow keys to highlight **M3/A:** (**ON**)	1 to 2	11.58	11.62
M3 0301 P1 to P3	----------	1 to 3	13.03	13.07
M3 0301 P1 to P4	----------	1 to 4	14.48	14.52
MC 0406 P1 to P2	Use the arrow keys to highlight **M3A:** (**OFF**) Use the arrow keys to highlight **MC:** (**ON**)	1 to 2	15.93	15.97
MC 0406 P1 to P3	----------	1 to 3	17.38	17.42
MC 0406 P1 to P4	----------	1 to 4	18.83	18.87

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

(a) Press **FUNC, ↑**.
(b) **3**, **ENTR (1ST REPLY)**.
(c) Use the arrow keys to highlight **M1: 7777** (**ON**).
(d) Use the arrow keys to highlight **M2: 7777** (**ON**).
(e) Use the arrow keys to highlight **M3/A: 7777** (**ON**).
(f) Use the arrow keys to highlight **MC: 7777** (**ON**).
(g) Press **FUNC, ↑**.
(h) **2, ENTR (CHALLENGES)**.
(i) Use the arrow keys to highlight **M2:** (**ON**).
(j) Use the arrow keys to highlight **MC:** (**OFF**).

(13) Verify oscilloscope display indicates as listed in table 19 first row.

(14) Repeat technique of (12) and (13) above for remaining rows in table 19. Oscilloscope display will indicate as listed in table 19.

Table 19. 7777 Reply Code

TI		Oscilloscope display
Test description	Settings	Number of pulses
M2 7777 REPLY	----------	14
M3A 7777 REPLY	Use the arrow keys to highlight **M2: (OFF)** Use the arrow keys to highlight **M3/A: (ON)**	14
MC 7777 REPLY	Use the arrow keys to highlight **M3/A: (OFF)** Use the arrow keys to highlight **MC: (ON)**	14
M1 7777 REPLY	Use the arrow keys to highlight **MC: (OFF)** Use the arrow keys to highlight **M1: (ON)**	14

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

(a) Press **FUNC, ENTR** keys.

(b) Use the arrow keys to highlight **TRANSPONDER MENUS** and press **ENTR** key.

(c) **2, ENTR (CHALLENGES)**.

(d) Use the arrow keys to highlight **M1: (ON)**.

(e) Use the arrow keys to highlight **M2: (OFF)**.

(f) Use the arrow keys to highlight **MODE REPEAT:**.

(g) **8**, **ENTR**.

(h) Press **FUNC**, ↑.

(i) **3**, **ENTR** (**1ST REPLY**).

(j) Use the arrow keys to highlight **REPLY SIGNAL: ENTR**, (**VAR EMERG**).

(k) Use the arrow keys to highlight **M1: 0000 (ON)**.

(l) Use the arrow keys to highlight **M2: 0000 (OFF)**.

(m) Use the arrow keys to highlight **M3/A: 0000 (OFF)**.

(n) Use the arrow keys to highlight **MC: 0000 (OFF)**.

(16) Set oscilloscope to trigger on channel 1 and measurement type to the delta time between the 1st and 3d pulses on channel 1.

(17) Verify that the oscilloscope indicates within limit of table 20.

(18) Repeat technique of (15) through (17) above using remaining setting and limits listed in table 20.

Table 20. VAR EMERG Codes

TI		Oscilloscope		
Test description	Settings	Pulses to be measured	Minimum (μs)	Maximum (μs)
VAR EMERG 1 - 3	----------	1 to 3	24.55	27.55
VAR EMERG 1 - 4	----------	1 to 4	44.85	45.05

Table 20. VAR EMERG Codes - Continued

TI		Oscilloscope		
Test description	Settings	Pulses to be measured	Minimum (µs)	Maximum (µs)
VAR EMERG 1 - 5	----------	1 to 5	49.20	49.40
VAR EMERG 1 - 6	----------	1 to 6	69.50	69.70
VAR EMERG 1 - 7	----------	1 to 7	73.85	74.05
VAR EMERG 1 - 8	----------	1 to 8	94.15	94.35
+1 VAR EMERG 1 - 3	Use the arrow keys to highlight **VAR EMG:** Press **ENTR** to select **+1**	1 to 3	25.50	25.80
+1 VAR EMERG 1 - 4	----------	1 to 4	45.80	46.10
+1 VAR EMERG 1 - 5	----------	1 to 5	51.15	51.45
+1 VAR EMERG 1 - 6	----------	1 to 6	71.45	71.75
+1 VAR EMERG 1 - 7	----------	1 to 7	76.80	77.10
+1 VAR EMERG 1 - 8	----------	1 to 8	97.10	97.40
-1 VAR EMERG 1 - 3	Use the arrow keys to highlight **VAR EMG:** Press **ENTR** to select **-1**	1 to 3	23.50	23.80
-1 VAR EMERG 1 - 4	----------	1 to 4	43.80	44.10
-1 VAR EMERG 1 - 5	----------	1 to 5	47.15	47.45
-1 VAR EMERG 1 - 6	----------	1 to 6	67.45	67.75
-1 VAR EMERG 1 - 7	----------	1 to 7	70.80	71.10
-1 VAR EMERG 1 - 8	----------	1 to 8	91.20	91.40

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

(a) Use the arrow keys to highlight **REPLY SIGNAL: ENTR**, (**ID OF POS**).
(b) Use the arrow keys to highlight **M1: 7777(ON)**.
(c) Use the arrow keys to highlight **M2: 7777(OFF)**.
(d) Use the arrow keys to highlight **F2: (OFF)**.

(20) Verify the pulse count and delta time between pulse repeats on channel 1 of oscilloscope are within limits indicated in row 1 of table 21.

(21) Repeat technique of (19) and (20) above for remaining rows of table 21.

Table 21. ID, SIF1,SIF2, Etc.

TI		Oscilloscope		
Test description	Settings	Number of pulses	Delta time indication	
			Minimum (µs)	Maximum (µs)
1ST REP ID OF POS	----------	26	24.55	24.75
1ST REP ID OF POS M2	Press **FUNC, ↑** **2**, **ENTR** (**CHALLENGES**) Use the arrow keys to highlight **M1:** (**OFF**) Use the arrow keys to highlight **M2:** (**ON**) Press **FUNC, ↑** **3**, **ENTR (1st REPLY)** Use the arrow keys to highlight **M1:7777** (**OFF**) Use the arrow keys to highlight **M2:7777** (**ON**)	14[1]	24.55	24.75

[1]Measure delta time between first and fourteenth pulse.

(22) Press TI keys as listed in (a) through (t) below:

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **3, ENTR (1ST REPLY).**
(d) Use the arrow keys to highlight **REPLY SIGNAL: ENTR**, (**SIF**).
(e) Use the arrow keys to highlight **SIF2:** (**ALT**).
(f) Use the arrow keys to highlight **M2: 0000** (**ON**).
(g) Use the arrow keys to highlight **RANGE DELAY:**.
(h) **0**, **ENTR** (**0μS**).
(i) Press **FUNC**, ↑.
(j) **4**, **ENTR** (**2ND REPLY**).
(k) Use the arrow keys to highlight **DELAY:**.
(l) **0**, **ENTR** (**0μS**).
(m) Press **FUNC**, ↑.
(n) **5**, **ENTR** (**TIMING, VIDEO LEVELS**).
(o) Use the arrow keys to highlight **P3 DELAY:**.
(p) **25**, **ENTR** (**25μS**.).
(q) Press **FUNC**, ↑.
(r) **14**, **ENTR** (**PRF/PRI**).
(s) Use the arrow keys to highlight **0 TRIGGER:**.
(t) **ENTR** (**EXTERNAL+**).

(23) Set the pulse generator to produce a 5 μs wide, 5 V pulse with a period of 100 ms in single step mode, (one pulse will be output each time the pulse generator is triggered).

(24) Manually trigger the pulse generator, and verify that the oscilloscope channel 1 displays changes from 14 pulses to 2 pulses with each trigger.

(25) Measure the delay from pulse on channel 2 to first pulse on channel 1 at each trigger. The difference in delays will be within +/- 0.05 μs.

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

(a) Press **FUNC**, ↑.
(b) **6**, **ENTR** (**VARIABLE PULSES**).
(c) Use the arrow keys to highlight **VP1 DLY:**.
(d) **50**, **ENTR** (**50μS**).
(e) Use the arrow keys to highlight **VP2:**.
(f) **ENTR** (**ON**).
(g) Use the arrow keys to highlight **VP2 PW:**.
(h) **5**, **ENTR** (**5μS**).
(i) Use the arrow keys to highlight **VP2 DLY:**.
(j) **60**, **ENTR** (**60μS**).
(k) Use the arrow keys to highlight **OR 1ST REPLY:.**
(l) **ENTR** (**YES**).

(27) Disconnect **M4 PRE OUT** from oscilloscope channel 2 and connect **0 OUT** to oscilloscope channel 2 input using a 75 Ω feedthrough termination.

(28) Manually trigger the pulse generator.

(29) Verify that oscilloscope display indicates as listed in row 1 of table 22.

Table 22. 1st Variable/M4 Pulse Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
7777 PULSE COUNT	----------	Pulse count channel 1	15	15
7777 VP 2 60 µs DELAY	----------	Delta time channel 2 pulse 1 to channel 1 pulse 15	59 µs	61 µs
7777 VP 2 Pulse Width	----------	Pulse Width channel 1 pulse 15	4.9 µs	5.1 µs
0000 PULSE COUNT	Manually trigger pulse generator 1 time	Pulse count channel 1	3	3
0000 VP 2 50 µs DELAY	----------	Delta time Channel 2 pulse 1 to channel 1 pulse 3	49 µs	51 µs
0000 VP 2 Pulse Width	----------	Pulse Width channel 1 pulse 3	0.9 µs	1.1 µs
M4-3 PULSE 1 TO 2	Press **FUNC, ENTR** keys. Use the arrow keys to highlight **GENERAL MENUS** press **ENTR** **2 and ENTR** Use the arrow keys to highlight **M2:** **ENTR** (**OFF**) Use the arrow keys to highlight **M4:** **ENTR** (**SYNC**) Press **FUNC**, ↑ **3**, **ENTR** (**1ST REPLY**) Use the arrow keys to highlight **REPLY SIGNAL:** **ENTR** (**MODE 4-3**) Use the arrow keys to highlight **SIF2:** **ENTR (OFF)**	Delta time from 1st to 2d pulse	1.7 µs	1.8 µs
M4-3 PULSE 2 TO 3	----------	Delta time from 2d to 3d pulse	1.7 µs	1.8 µs
M4-3 1ST PW	----------	Pulse Width channel 1	420 ns	480 ns
M4-1 PULSE COUNT	Use the arrow keys to highlight **REPLY SIGNAL:** **ENTR** (**MODE 4-1**)	Pulse count on channel 1	1	1

(30) Press TI keys as listed in (a) through (p) below:

(a) Press **FUNC**, ↑.

(b) **2**, **ENTR** (**CHALLENGES**).

(c) Use the arrow keys to highlight **M1:**.

(d) **ENTR**, (**ON**).
(e) Use the arrow keys to highlight **M4:**.
(f) **ENTR**, (**OFF**).
(g) Press **FUNC**, ↑.
(h) **3**, **ENTR** (**1ST REPLY**).
(i) Use the arrow keys to highlight **REPLY SIGNAL:**.
(j) **ENTR**, (**SIF**).
(k) Press **FUNC**, ↑.
(l) **5**, **ENTR** (**TIMING, VIDEO LEVELS**).
(m) Use the arrow keys to highlight **CHALLENGE VIDEO:**.
(n) **5**, **ENTR** (**5V**).
(o) Use the arrow keys to highlight **1ST REPLY VIDEO:**.
(p) **5**, **ENTR** (**5V**).

(31) Disconnect TI from oscilloscope.

(32) Connect the **IFF VIDEO CHAL/TAG** output to channel 1 of the oscilloscope using a 75 Ω feedthrough termination.

(33) Connect the **IFF VIDEO FIRST REPLY** output to channel 2 of the oscilloscope using a 75 Ω feedthrough termination.

(34) Press TI keys as listed in (a) through (p) below:

(a) Press **FUNC**, ↑.
(b) **14**, **ENTR** (**PRF/PRI**).
(c) Use the arrow keys to highlight **PRI:**.
(d) **6000**, **ENTR**, (**6000μs**).
(e) Press **FUNC**, ↑.
(f) **3**, **ENTR** (**1ST REPLY**).
(g) Use the arrow keys to highlight **M1:**.
(h) **ENTR**, (**ON**).
(i) Use the arrow keys to highlight **M2:**.
(j) **ENTR**, (**ON**).
(k) Use the arrow keys to highlight **M3/A:**.
(l) **ENTR**, (**ON**).
(m) Use the arrow keys to highlight **MC:**.
(n) **ENTR**, (**ON**).
(o) Use the arrow keys to highlight **RANGE DELAY:**.
(p) **0**, **ENTR**, (**0μs**).

(35) Measure the delay from the leading edge of the last pulse on oscilloscope channel 1 to the leading edge of the first pulse on oscilloscope channel 2.

(36) Oscilloscope indication will be within limits shown in row 1 of table 23.

(37) Repeat technique of (34) through (36) above for remaining rows in table 23. Oscilloscope indication will be within limits shown in table 23.

Table 23. Range Delay

TI		Oscilloscope	
Test description	Settings	Minimum	Maximum
RANGE DLY 3 µs	----------	2.5 µs	3.5 µs
RNG DLY 4096 µs	Use the arrow keys to highlight **RANGE DELAY: 4096**, **ENTR**, (**4096µs**)	4.0982 ms	4.0998 ms
RANGE DLY M4[1]	Press **FUNC**, ↑ **2**, **ENTR** (**CHALLENGES**) Use the arrow keys to highlight **M1:** **ENTR** (**OFF**) Use the arrow keys to highlight **M4:** **ENTR** (**WORD A**) Press **FUNC**, ↑ **3**, **ENTR** (**1ST REPLY**) Use the arrow keys to highlight **REPLY SIGNAL:** **ENTR** (**MODE 4-3**) Use the arrow keys to highlight **RANGE DELAY: 0**, **ENTR**, (**0µs**)	371.5 µs	372.5 µs

[1]Disconnect **IFF VIDEO CHAL/TAG** from oscilloscope. Connect the **TRIGGER M4 PRE OUT** output to channel 1 of the oscilloscope using a 93 Ω feedthrough termination.

(38) Reduce all outputs to minimum and disconnect equipment setup.

b. Adjustments. No adjustments can be made.

13. Second Reply

a. Performance Check

(1) Connect the **IFF VIDEO SECOND REPLY** to channel 1 of the oscilloscope using a 75 Ω feedthrough termination.

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

(a) Press **FUNC**, **ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **4**, **ENTR** (**2ND REPLY**).
(d) Use the arrow keys to highlight **SIF CODE:**.
(e) **0000**, **ENTR**.
(f) Use the arrow keys to highlight **F2:**.
(g) **ENTR**, (**OFF**).
(h) Press **FUNC**, ↑.
(i) **3**, **ENTR** (**1ST REPLY**).
(j) Use the arrow keys to highlight **REPLY SIGNAL:**.
(k) **ENTR** (**SIF**).
(l) Use the arrow keys to highlight **M2:2222**.
(m) **ENTR** (**ON**).

(3) Set oscilloscope to trigger on channel 1 and channel 1 measurement type to Rise Time.

(4) Oscilloscope will indicate within limits listed in first row of table 24.

(5) Repeat technique of (2) through (4) above using remaining setting and limits listed in table 24.

Table 24. 2d Reply Video Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
2d REP M2 Rise Time	----------	Rise	----------	100 ns
2d REP M2 Fall Time	----------	Fall	----------	150 ns
2d REP M2 Overshoot	----------	Overshoot	----------	5 %
2d REP M2 .45µs Pulse Width	----------	Width	420 ns	480 ns
2d REP M2 2.2 V Level	----------	Top	2.1 V	2.3 V
2d REP M2 5 V Level	Press **FUNC** and ↑, keys **5**, **ENTR** (**TIMING VIDEO LEVELS**) Use the arrow keys to highlight **2ND REPLY VIDEO: 5, ENTR** (**5.0V**)	Top	4.8 V	5.2 V
2d REP M2 0.1 V Level	**.1**, **ENTR** (**0.1V**)	Top	0.0 V	0.2 V

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

(a) **5**, **ENTR** (**5.0V**).
(b) Press **FUNC**, ↑.
(c) **4**, **ENTR** (**2ND REPLY**).
(d) Use the arrow keys to highlight **F2:** (**ON**).

(7) Verify oscilloscope display indicates as listed in table 25 first row.

(8) Repeat technique of (6) and (7) above for remaining rows in table 25. Oscilloscope display will indicate as listed in table 25.

Table 25. M2 Reply Code

TI		Oscilloscope display
Test description	Settings	Number of pulses
M2 0000 REPLY	----------	2
M2 7777 REPLY	Use the arrow keys to highlight **SIF CODE: 7777**, **ENTR**	14

(9) Press TI keys as listed in (a) through (l) below:

(a) Use the arrow keys to highlight **REPLY SIGNAL:**.
(b) **ENTR**, (**MODE 4-3**).
(c) Press **FUNC** and ↑ keys.
(d) **3**, **ENTR** (**1ST REPLY**).
(e) Use the arrow keys to highlight **REPLY SIGNAL:**.
(f) **ENTR**, (**MODE 4-1**).
(g) Press **FUNC** and ↑ keys.
(h) **2**, **ENTR** (**CHALLENGES**).
(i) Use the arrow keys to highlight **M2:**.

(j) **ENTR**, (**OFF**).
(k) Use the arrow keys to highlight **M4:**.
(l) **ENTR**, (**WORD A**).

(10) Verify that the oscilloscope channel 1 displays three pulses that are nominally spaced 1.75 ±0.05 μs apart.

(11) Connect **IFF VIDEO OUT FIRST REPLY** to oscilloscope channel 1 using a 75 Ω feedthrough termination.

(12) Connect **IFF VIDEO OUT SECOND REPLY** to oscilloscope channel 2 using a 75 Ω feedthrough termination.

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **2**, **ENTR** (**CHALLANGES**).
(d) Use the arrow keys to highlight **M1:**.
(e) **ENTR** (**ON**).
(f) Use the arrow keys to highlight **M2:**.
(g) **ENTR**, (**OFF**).
(h) Press **FUNC**, ↑.
(i) **3**, **ENTR** (**1ST REPLY**).
(j) Use the arrow keys to highlight **REPLY SIGNAL:**.
(k) **ENTR** (**SIF**).
(l) Use the arrow keys to highlight **M1:**.
(m) **0000**, **ENTR**.
(n) ↓, **ENTR** (**ON**).
(o) Use the arrow keys to highlight **F2:** (**OFF**).
(p) Use the arrow keys to highlight **SIF2:** (**OFF**).
(q) Use the arrow keys to highlight **RANGE DELAY:**.
(r) **0**, **ENTR**.
(s) Press **FUNC**, ↑.
(t) **4**, **ENTR** (**2ND REPLY**).
(u) Use the arrow keys to highlight **SIF CODE:**.
(v) **0000**, **ENTR**.
(w) Use the arrow keys to highlight **F2:** (**OFF**).
(x) Use the arrow keys to highlight **DELAY:**.
(y) **0**, **ENTR** (**0.00 μs**.

(14) Verify the difference between leading edges of the pulse on channel 1 and channel 2 is within limits indicated in table 26 row 1.

(15) Repeat technique of (13) and (14) above for remaining rows in table 26. Oscilloscope display will indicate as listed in table 26.

Table 26. Delay

TI		Oscilloscope	
Test description	Settings	Minimum (µs)	Maximum (µs)
M1 SIF 0 µs DLY DIF	----------	-0.05	0.05
M1 SIF 50 µs DLY	Press **FUNC**, ↑ **5**, **ENTR** (**TIMING, VIDEO LEVELS**) Use the arrow keys to highlight **1ST REPLY VIDEO:** **5**, **ENTR** (**5.0V**) Use the arrow keys to highlight **2ND REPLY VIDEO:** **5**, **ENTR** (**5.0V**) Press **FUNC**, ↑ **4**, **ENTR** (**TIMING, VIDEO LEVELS**) Use the arrow keys to highlight **DELAY:** **50**, **ENTR** (**50.00 µs**)	49.95	50.05
M4-1 0 µs DLY DIF	Use the arrow keys to highlight **DELAY:** **0**, **ENTR** (**0.00 µs**) Use the arrow keys to highlight **REPLY SIGNAL:** **ENTR** (**MODE 4-1**) Press **FUNC**, ↑ **3**, **ENTR** (**1ST REPLY**) Use the arrow keys to highlight **REPLY SIGNAL:** **ENTR** (**MODE 4-1**) Press **FUNC**, ↑ **2**, **ENTR** (**CHALLENGES**) Use the arrow keys to highlight **M1:** **ENTR** (**OFF**) Use the arrow keys to highlight **M4:** **ENTR** (**SYNC**)	-0.05	0.05
M4-1 50 µs DLY DIF	Press **FUNC**, ↑ **4**, **ENTR** (**TIMING, VIDEO LEVELS**) Use the arrow keys to highlight **DELAY:** **50**, **ENTR** (**50.00 µs**)	49.95	50.05

(16) Reduce all outputs to minimum and disconnect equipment setup.

b. Adjustments. No adjustments can be made.

14. Suppression-Gate

a. Performance Check

(1) Connect the **SUPPR OUT** to channel 1 of the oscilloscope using a 75 Ω feedthrough termination.

(2) Connect the **IFF VIDEO CHAL/TAG** to channel 2 of the oscilloscope using a 75 Ω feedthrough termination.

(3) Press TI **FUNC**, **ENTR** keys and wait for TI to complete reset.

(4) Set oscilloscope to trigger on channel 1 and channel 1 measurement type to Rise Time.

(5) Oscilloscope will indicate within limits listed in first row of table 27.

(6) Repeat technique of (4) and (5) above using remaining setting and limits listed in table 27.

Table 27. Suppression-Gate Output Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
SUPPR OUT RT	----------	Rise	----------	400 ns
SUPPR OUT FT	----------	Fall	----------	400 ns
SUPPR OUT 25 µs PW	----------	Width	24 µs	25 µs
SUPPR OUT 20 V Lvl	----------	Top	15 V	25 V
SUPPR OUT TIMING	----------	Delta time Channel 1 1st pulse to channel 2 2d pulse	22 µs	23 µs
SUPPR OUT 2 µs PW	Use arrows to highlight **GENERAL MENUS** and press **ENTR** **15**, **ENTR** (**SUPPRESSION**) Use the arrow keys to highlight **SUPPRESSION WIDTH:** **2, ENTR**	Width	0.1 µs	3 µs
SUPPR OUT 220 µs PW	Use the arrow keys to highlight **SUPPRESSION WIDTH:** **220, ENTR**	Width	219 µs	221 µs
M4 SYNC DELAY	Press **FUNC** and ↑ keys **14**, **ENTR** (**PRF/PRI**) Use the arrow keys to highlight **PRF:** **1000, ENTR** (**1000 PPS**) Press **FUNC** and ↑ keys **2**, **ENTR** (**CHALLENGES**) Use the arrow keys to highlight **M2:** **ENTR** (**OFF**) Use the arrow keys to highlight **M4:** **ENTR** (**SYNC**)	Delta time Channel 1 1st pulse to channel 2 4th pulse	1 5µs	25 µs

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

b. Adjustments. No adjustments can be made.

15. Mode 4 Pretrig Out

a. Performance Check

(1) Connect TI **TRIGGER 0 OUT** to oscilloscope channel 1 using a 75 Ω feedthrough termination.

(2) Connect TI **TRIGGERS M4 PRE OUT** to the oscilloscope channel 2 input using a 93 Ω feedthrough termination.

(3) Press TI **FUNC, ENTR** keys and wait for TI to complete reset.

(4) Set oscilloscope to trigger on channel 1 and channel 2 measurement type to Rise Time.

(5) Oscilloscope will indicate within limits listed in first row of table 28.

(6) Repeat technique of (3) through (5) above using remaining settings and limits listed in table 28.

Table 28. Mode 4 Pretrigger Output Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
M4 PRETRIG RT	----------	Rise	----------	100 ns
M4 PRETRIG FT	----------	Fall	----------	200 ns
PRETRIG Overshoot	----------	Overshoot	----------	5 %
PRETRIG 0.8 µs PW	----------	Width	0.6 µs	1.0 µs
PRETRIG 4.5V Lvl	----------	Top	3.5 V	5.5 V
PRETRIG DELAY	----------	Delta time Channel 1 pulse to channel 2 pulse	3.0 µs	5.0 µs
M4 PRETRIG DELAY	Use the arrow keys to highlight **GENERAL MENUS** **ENTR** key **5**, **ENTR** (**TIMING VIDEO LEVELS**) Use the arrow keys to highlight **M4 PRETRIGGER:** **38, ENTR**	Delta time Channel 1 pulse to channel 2 pulse	37.0 µs	39.0 µs

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

b. Adjustments. No adjustments can be made.

16. Mode 4 GTC Trig Out

a. Performance Check

(1) Connect TI **TRIGGER M4 PRE OUT** to oscilloscope channel 1 using a 93 Ω feedthrough termination.

(2) Connect TI **TRIGGERS M4 GTC OUT** to the oscilloscope channel 2 input using a 75 Ω feedthrough termination.

(3) Press TI **FUNC, ENTR** keys and wait for TI to complete reset.

(4) Set oscilloscope to trigger on channel 2 and channel 2 measurement type to Rise Time.

(5) Oscilloscope will indicate within limits listed in first row of table 29.

(6) Repeat technique of (3) through (5) above using remaining setting and limits listed in table 29.

Table 29. Mode 4 GTC Trigger Output Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
M4 GTC RT	----------	Rise	----------	100 ns
M4 GTC FT	----------	Fall	----------	200 ns
M4 GTC Overshoot	----------	Overshoot	----------	5 %
M4 GTC 0.8 µs PW	----------	Width	0.6 µs	1.0 µs
M4 GTC 4.5 V Lvl	----------	Top	3.5 V	5.5 V
M4 GTC DELAY	----------	Delta time[1] Channel 1 pulse to channel 2 pulse	371.5 µs	372.5 µs

[1] Set oscilloscope to trigger on channel 1.

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

b. Adjustments. No adjustments can be made.

17. Video Reset Output

a. Performance Check

(1) Connect TI **IFF VIDEO OUT RESETS** to the oscilloscope channel 2 input using a 75 Ω feedthrough termination.

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

(a) Press **FUNC**, **ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **14**, **ENTR** (**PRF/PRI**).
(d) Use the arrow keys to highlight **PRI:**.
(e) **4000**, **ENTR** (**4000 µs**).
(f) Press **FUNC**, ↑.
(g) 1**3**, **ENTR** (**RESET SIGINAL**).
(h) Use the arrow keys to highlight **RESET PULSE 2:**.
(i) **ENTR** (**OFF**).
(j) Use the arrow keys to highlight **RESET PULSE 3:**.
(k) **ENTR** (**OFF**).

(3) Set oscilloscope to trigger on channel 2 and channel 2 measurement type to overshoot.

(4) Oscilloscope will indicate within limits listed in first row of table 30.

(5) Repeat technique of (3) through (5) above using remaining setting and limits listed in table 30.

Table 30. Video Reset Output Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
RESETS Overshoot	----------	Overshoot	----------	5

Table 30. Video Reset Output Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
RESETS 1 8 µs PW	----------	Width	7.8 µs	8.2 µs
RESETS 4.5 V Lvl	----------	Top	3.5 V	5.5 V
RESETS 2, 2 µs PW	Use the arrow keys to highlight **RESET PULSE 1: ENTR (OFF)** Use the arrow keys to highlight **RESET PULSE 2: ENTR (ON)**	Width	1.75 µs	2.25 µs
RESETS 4, 2 µs PW	Use the arrow keys to highlight **RESET PULSE 2: ENTR (OFF)** Use the arrow keys to highlight **RESET PULSE 3: ENTR (ON)**	Width	3.75 µs	4.25 µs
1 TO 3 DELAY	Use the arrow keys to highlight **RESET PULSE 1: ENTR (ON)**	Delta time	14.9 µs	15.1 µs
1 TO 2 DELAY	Use the arrow keys to highlight **RESET PULSE 3: ENTR (OFF)** Use the arrow keys to highlight **RESET PULSE 2: ENTR (ON)**	Delta time	9.9 µs	10.1 µs
PULSE 1 DELAY[1] 25 µs	Use the arrow keys to highlight **PUSLE 1 DELAY: 25, ENTR (25 µs)**	Delta time Channel 1 to channel 2 pulse 1	24.0 µs	26.0 µs
PULSE 1 DELAY 3500 µs	Use the arrow keys to highlight **PUSLE 1 DELAY: 3500, ENTR (3500 µs)**	Delta time Channel 1 to channel 2 pulse 1	3499.0 µs	3501.0 µs

[1]Connect **TRIGGERS 0 OUT** to oscilloscope channel 1 using 75 Ω feedthrough termination.

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

b. Adjustments. No adjustments can be made.

18. Reply Signal Gating

a. Performance Check

(1) Connect TI **RADAR SIM NORTH TRIGGER OUT** to oscilloscope channel 1 using a 75 Ω feedthrough termination.

(2) Connect TI **RADAR SIM POS READOUT GATE** to the oscilloscope channel 2 input using a 75 Ω feedthrough termination.

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **14**, **ENTR** (**PRF/PRI**).
(d) Use the arrow keys to highlight **PRF:**.
(e) **300**, **ENTR** (**300PPS**).

(f) Press **FUNC**, ↑.
(g) **9**, **ENTR** (**ACTIVE GATING**).
(h) Use the arrow keys to highlight **AZIMUTH SOURCE:**.
(i) **ENTR** (**SYN INT**).
(j) Use the arrow keys to highlight **ANT. RATE:**.
(k) **4000000**, **ENTR** (**4000000 μs**).
(l) Use the arrow keys to highlight **READOUT WIDTH:**.
(m) **300**, **ENTR** (**300 μs**).
(n) Use the arrow keys to highlight **READOUT DELAY:**.
(o) **300**, **ENTR** (**300 μs**).
(p) Use the arrow keys to highlight **AZ GATE START:**.
(q) **45**, **ENTR** (**45 °**).
(r) Use the arrow keys to highlight **AZ GATE WIDTH:**.
(s) **10**, **ENTR** (**10.0 °**).

(4) Set oscilloscope to trigger on channel 2 and channel 2 measurement type to delta time.

(5) Oscilloscope will indicate within limits listed in first row of table 31.

(6) Repeat technique of (3) through (5) above using remaining setting and limits listed in table 31.

Table 31. Azimuth Gate Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
AZIMUTH GATE 500 ms	----------	Delta time Channel 1 to channel 2 first pulses	450 ms	550 ms
AZIMUTH WIDTH 111 ms	----------	Width of pulse train on channel 2	99.9 ms	122.1 ms
AZIMUTH GATE 125 ms	Use the arrow keys to highlight **Ant. Rate:** **1000000**, **ENTR** (**1,000,000 μs**)	Delta time Channel 1 to channel 2 first pulses	112.5 ms	137.5 ms
AZIMUTH WIDTH 28 ms	----------	Width of pulse train on channel 2	25.2 ms	30.8 ms
AZIMUTH	Press **FUNC**, ↑ **14**, **ENTR** (**PRF/PRI**) Use the arrow keys to highlight **PRF:** **1000**, **ENTR** (**1000PPS**) Press **FUNC**, ↑ **9**, **ENTR** (**ACTIVE GATING**) Use the arrow keys to highlight **Ant. Rate:** **10000000**, **ENTR** (**10,000,000 μs**)	Delta time Channel 1 to channel 2 first pulses	1125 ms	1375 ms

Table 31. Azimuth Gate Characteristics - Continued

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
AZIMUTH	----------	Width of pulse train on channel 2	250.2 ms	305.8 ms
AZIMUTH GATE 1500 ms	Press **FUNC**, ↑ **14**, **ENTR** (**PRF/PRI**) Use the arrow keys to highlight **PRF:** **300**, **ENTR** (**300 PPS**) Press **FUNC**, ↑ **9**, **ENTR** (**ACTIVE GATING**) Use the arrow keys to highlight **Ant. Rate:** **4000000**, **ENTR** (**4,000,000 µs**) Use the arrow keys to highlight **AZ GATE START:** **135**, **ENTR** (**135°**) Use the arrow keys to highlight **AZ GATE WIDTH:** **3**, **ENTR** (**3.0°**)	Delta time Channel 1 to channel 2 first pulses	1.350 s	1.650 s
AZIMUTH WIDTH 33 ms	----------	Width of pulse train on channel 2	29.7 ms	36.3 ms

(7) Move connection from **RADAR SIM POS READOUT GATE** to **TRIGGERS 0 OUT**.

(8) Move connection from **RADAR SIM NORTH TRIGGER OUT** to **RADAR SIM POS READOUT GATE**.

(9) Adjust the oscilloscope to trigger on channel 1 with channel 2 pulse displayed to the left of the pulse on channel 1. Set oscilloscope to measurement type to delta time.

(10) Oscilloscope will indicate within limits listed in first row of table 32.

(11) Repeat technique of (3) through (5) above using remaining setting and limits listed in table 32.

Table 32. Azimuth Gate Characteristics

TI		Oscilloscope		
Test description	Connections	Measurement type	Minimum	Maximum
AZIMUTH GATE 300 ms	----------	Delta time Channel 2 to channel 1 pulse	270 µs	330 µs
POS READOUT PW	----------	Width of pulse on channel 1	270 µs	330 µs
POS READOUT AMP	----------	V Top	15 V	25 V
AZIMUTH GATE	Move the connection from the **RADAR SIM POS READOUT GATE** to the **RADAR SIM NEG READOUT GATE**.	Delta time Channel 2 to channel 1 pulse	270 µs	330 µs

Table 32. Azimuth Gate Characteristics - Continued

TI		Oscilloscope		
Test description	Connections	Measurement type	Minimum	Maximum
NEG READOUT PW	----------	Width of pulse on channel 1	270 µs	330 µs
NEG READOUT AMP	----------	V amptd	4.0 V	5.6 V
ACP OUT RT	Move the connection from the **RADAR SIM NEG READOUT GATE** and move it to the **RADAR SIM ACP OUT**.	Rise Time	----------	0.1 µs
ACP OUT FT	----------	Fall Time	----------	0.2 µs
ACP OUT PW	----------	Width	1 µs	3 µs
ACP OUT 3.5 V Lvl	----------	V Top	2.5 V	4.5 V
NORTH TRIGGER OUT RT	Move the connection from the **RADAR SIM ACP OUT** to the **RADAR SIM NORTH TRIGGER OUT**.	Rise Time	----------	0.1 µs
NORTH TRIGGER OUT FT	----------	Fall Time	----------	0.2 µs
NORTH TRIGGER OUT PW	----------	Width	1 µs	3 µs
NORTH TRIGGER OUT 3.5 V Lvl	----------	V Top	2.5 V	4.5 V

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

b. Adjustments. No adjustments can be made.

19. Mixed Video

a. Performance Check

(1) Connect the TI **MIXED VIDEO OUT VAR LEVEL** output to oscilloscope channel 1 using a 75 Ω feedthrough termination.

(2) Connect the TI **MIXED VIDEO OUT HI LEVEL** output to oscilloscope channel 2 using a 75 Ω feedthrough termination.

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **3**, **ENTR** (**1ST REPLY**).
(d) Use the arrow keys to highlight **REPLY SIGNAL:**.
(e) **ENTR (SIF)**.
(f) Use the arrow keys to highlight **M2:**.
(g) **0000**, **ENTR**.
(h) ↓, **ENTR** (ON).
(i) Use the arrow keys to highlight **RANGE DELAY:**.
(j) **0**, **ENTR** (0 µs).
(k) Use the arrow keys to highlight **F2:**.
(l) **ENTR** (OFF).

(m) Use the arrow keys to highlight **SIF2:**.
(n) **ENTR** (OFF).
(o) Press **FUNC**, ↑
(p) **7**, **ENTR** (**MIXED VIDEO**)
(q) Use the arrow keys to highlight **ISLS**:
(r) **ENTR** (OFF)
(s) Use the arrow keys to highlight **DEMOD**:
(t) **ENTR** (OFF)

(4) Oscilloscope will indicate within limits listed in first row of table 33.

(5) Repeat technique of (3) and (4) above using remaining settings and limits listed in table 33.

Table 33. Mixed Video Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
MIXED VIDEO MODE 2 CHALLENGE	----------	Pulse count channel 1	2	2
----------	----------	Pulse count channel 2	2	2
MIXED VIDEO 1ST REPLY	Use the arrow keys to highlight **CHAL&TAG:** **ENTR** (OFF) Use the arrow keys to highlight **1ST REPLY:** **ENTR** (ON)	Pulse count channel 1	1	1
----------	----------	Pulse count channel 2	1	1
MIXED VIDEO 2D REPLY	Use the arrow keys to highlight **1ST REPLY:** **ENTR** (OFF) Use the arrow keys to highlight **2ND REPLY:** **ENTR** (ON)	Pulse count channel 1	14	14
----------	----------	Pulse count channel 2	14	14
MIX VIDEO ISLS PW	Use the arrow keys to highlight **2ND REPLY:** **ENTR** (OFF) Use the arrow keys to highlight **ISLS:** **ENTR** (ON)	Width channel 1	750 ns	850 ns
----------	----------	Width channel 2	750 ns	850 ns
MIXED VIDEO RESET	Use the arrow keys to highlight **ISLS:** **ENTR** (OFF) Use the arrow keys to highlight **RESET:** **ENTR** (ON)	Pulse count channel 1	3	3
----------	----------	Pulse count channel 2	3	3

Table 33. Mixed Video Characteristics - Continued

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
VAR LEV 2.2 LVL	Use the arrow keys to highlight **RESET:** **ENTR** (OFF) Use the arrow keys to highlight **ISLS:** **ENTR** (ON)	V Top channel 1	2.1 V	2.3 V
VAR LEV RISE TIME	----------	Rise Time channel 1	----------	0.1 µs
VAR LEV FALL TIME	----------	Fall Time channel 1	----------	0.15 µs
VAR LEV OVERSHOOT	----------	Overshoot channel 1	.1 %	5 %
VAR LEV VAR PW	----------	Width Channel 1	750 ns	850 ns
VAR LEV 5 V LVL	Press **FUNC**, ↑ **5**, **ENTR** (**TIMING**) Use the arrow keys to highlight **MIXED VIDEO:** **5**, **ENTR** (**5 .0 V**)	V Top channel 1	4.9 V	5.1 V
VAR LEV .1V LVL	**0.1**, **ENTR** (**0.1 V**)	V Top channel 1	0.1 V	0.2 V
VAR LEV .25 µS PW	**5**, **ENTR** (**5.0 V**) Press **FUNC**, ↑ **7**, **ENTR** (**MIXED VIDEO**) Use the arrow keys to highlight **OUTPUT PW:** **ENTR** (**VARIABLE**) Use the arrow keys to highlight **VAR PW:** **0.25, ENTR (0.25 µs**)	Width Channel 1	200 ns	300 ns
VAR LEV 2 µS PW	**2, ENTR (2.00 µs**)	Width Channel 1	1.95 µs	2.05 µs
HI LEV 20 LVL	----------	V Top channel 2	15 V	25 V
HI LEV RISE TIME	----------	Rise Time channel 2	----------	0.1 µs
HI LEV FALL TIME	----------	Fall Time channel 2	----------	0.15 µs
HI LEV OVERSHOOT	----------	Overshoot channel 2	.1 %	5 %
HI LEV .8 µS PW	----------	Width Channel 2	750 ns	850 ns

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

b. Adjustments. No adjustments can be made.

20. M4 KIR Simulator

a. Performance Check

(1) Connect equipment as shown in figure 1.

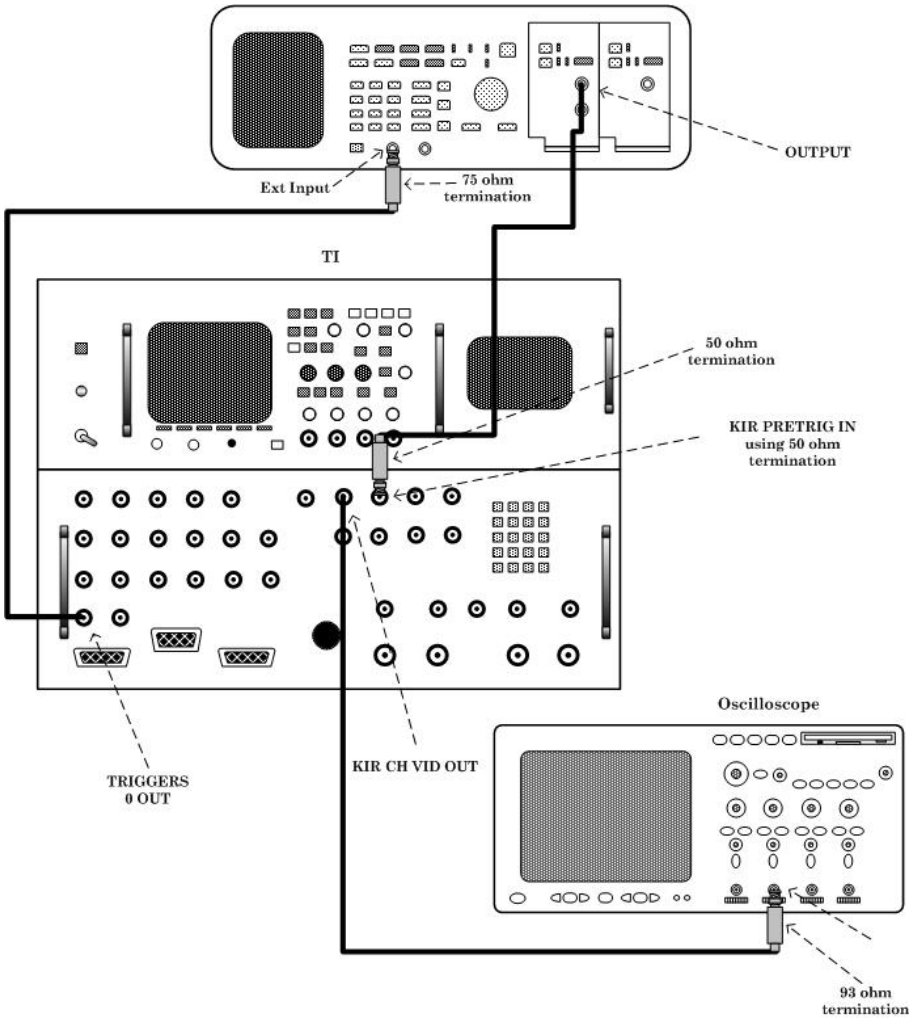

Figure 1. Kir hookup.

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **2**, **ENTR** (**CHALLENGES**).
(d) Use the arrow keys to highlight **M2:**.
(e) **ENTR** (**OFF**).
(f) Use the arrow keys to highlight **M4:**.
(g) **ENTR**, (**WORD A**).
(h) Press **FUNC**, ↑.
(i) **14**, **ENTR** (**PRF/PRI**).
(j) Use the arrow keys to highlight **KIT/KIR SELECT:**.
(k) **ENTR** (**KIR**).

(3) Set the pulse generator to produce a 10 µs wide, 5 V pulse with 0 µs delay, trigger mode to external, and slope to negative.

(4) Oscilloscope will indicate within limits listed in first row of table 34.

(5) Repeat technique of (2) through (4) above using remaining setting and limits listed in table 34.

Table 34. KIR Characteristics

TI		Oscilloscope		
Test description	Settings/connection	Measurement type	Minimum	Maximum
KIR EXT TRIG	----------	Pulse count channel 2	28	28
----------	Set pulse generator for: 0.5 µs width 1.5 V	Pulse count channel 2	28	28
CHVID 4.5V LVL	Use the arrow keys to highlight **KIR TRIGGER:** **ENTR** (**INT**) Press **FUNC**, ↑ **2**, **ENTR** (**CHALLENGES**) Use the arrow keys to highlight **M4:** **ENTR** (**SYNC**) Use the arrow keys to highlight **S2:** **ENTR** (**OFF**) Use the arrow keys to highlight **S3:** **ENTR** (**OFF**) Use the arrow keys to highlight **S4:** **ENTR** (**OFF**)	V Top Channel 2	3.5 V	5.5 V
CHVID RISE TIME	----------	Rise Time channel 2	----------	100 ns
CHVID FALL TIME	----------	Fall Time channel 2	----------	150 ns
CHVID OVERSHOOT	----------	Overshoot channel 2	----------	5 %
CHVID .5 µS PW	----------	Width channel 2	470 ns	530 ns
CHVID 168 µS DLY	Disconnect Pulse Generator from setup. Connect TI **TRIGGERS M4 PRE OUT** to oscilloscope channel 1 input using a 93 Ω feedthrough termination.	Delta time channel 1 to channel 2	167.5 µs	168.5 µs
GTC TRIG 4.5 V LVL	Move connection from TI **KIR CH VID OUT** to TI **KIR GTC TRIG OUT**.	V Top Channel 2	3.5 V	5.5 V
GTC TRIG RT	----------	Rise Time Channel 2	----------	100 ns
GTC TRIG FT	----------	Fall Time Channel 2	----------	200 ns

Table 34. KIR Characteristics - Continued

TI		Oscilloscope		
Test description	Settings/connection	Measurement type	Minimum	Maximum
GTC TRIG OVERSHOOT	----------	Overshoot Channel 2	----------	5
GTC TRIG .8 µS PW	----------	Width Channel 2	600 ns	1.0 µs
GTC TRIG DLY	----------	Delta time channel 1 to channel 2	371.5 µs	372.5 µs
ISLS TRIG 4.5V LVL	Move connection from TI **KIR GTC TRIG OUT** to TI **KIR ISLS TRIG OUT**.	V Top Channel 2	3.5 V	5.5 V
ISLS TRIG RT	----------	Rise Time Channel 2	----------	200 ns
ISLS TRIG FT	----------	Fall Time Channel 2	----------	200 ns
ISLS TRIG OVERSHOOT	----------	Overshoot Channel 2	----------	5 %
ISLS TRIG PW	----------	Width Channel 2	100 ns	1.5 µs
CHVID - ISLS DLY	Move the connection from the TI **TRIGGERS M4 PRE OUT** to the **KIR CH VID OUT**.	Delta time channel 1 to channel 2	5.8 µs	6.0 µs

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

b. Adjustments. No adjustments can be made.

21. M4 KIT Simulator

a. Performance Check

(1) Connect as follows:

(a) Connect TI **VAR PULSE OUTPUT** to pulse generator Ext Input using a 75 Ω feedthrough termination.

(b) Connect pulse generator (9211) **OUTPUT** to TI **KIT EN TRIG IN** using a 50 Ω feedthrough termination.

(c) Connect TI **IFF VIDEO CHAL/TAG** output to **KIT CH VID IN** using a 75 Ω feedthrough termination.

(d) Connect **KIT REPLY OUT** to oscilloscope channel 1 input using a 93 Ω feedthrough termination.

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

(a) Press **FUNC**, **ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **2**, **ENTR** (**CHALLENGES**).
(d) Use the arrow keys to highlight **M2:**.
(e) **ENTR** (**OFF**).
(f) Use the arrow keys to highlight **M4:**.
(g) **ENTR**, (**WORD A**).

(3) Set the pulse generator to produce a 1.5 µs wide, 1.5 V pulse with 10 µs period, trigger mode to external, and slope to negative.

(4) Oscilloscope will indicate within limits listed in first row of table 35.

(5) Repeat technique of (2) through (4) above using remaining setting and limits listed in table 35.

Table 35. KIT Characteristics

TI		Oscilloscope		
Test description	Settings/connection	Measurement type	Minimum	Maximum
KIT REPLY OUT External	----------	Pulse count channel 1	3	3
KIT P1-P2 External	----------	Delta time pulse 1 to pulse 2 leading edges	1.725 µs	1.775 µs
KIT P2-P3 External	----------	Delta time pulse 2 to pulse 3 leading edges	1.725 µs	1.775 µs
KIT REPLY 4.5 V LVL External	----------	V top	3.5 V	5.5 V
KIT REPLY OVERSHOOT External	----------	Overshoot	--------	5 %
KIT REPLY PW External	----------	Width	420 ns	480 ns
KIT REPLY OUT Internal	Turn pulse generator output off and remove cable from 9211 output to TI **KIT EN TRIG IN**. Disconnect cable from pulse generator Ext input and connect to TI **KIT EN TRIG IN** using a 75 Ω feedthrough termination. Press **FUNC**, ↑ **6**, **ENTR** (**VAR PULSES**) Use the arrow keys to highlight **VP1:PW: 0.5**, **ENTR** (**0.5 µs**) Use the arrow keys to highlight **VP1:DLY: 177.4**, **ENTR** (**177.4 µs**) Press **FUNC**, ↑ **5**, **ENTR** (**TIMING, VIDEO LEVELS**) Use the arrow keys to highlight **CHALLENGE VIDEO: 5**, **ENTR** (**5.0 V**)	Pulse count channel 1	3	3
KIT P1-P2 Internal	----------	Delta time pulse 1 to pulse 2 leading edges	1.725 µs	1.775 µs
KIT P2-P3 Internal	----------	Delta time pulse 2 to pulse 3 leading edges	1.725 µs	1.775 µs

Table 35. KIT Characteristics - Continued

TI		Oscilloscope		
Test description	Settings/connection	Measurement type	Minimum	Maximum
KIT DISP 4.5V LVL	Move connection from TI **KIT REPLY OUT** to **KIT DISP OUT**. Press **FUNC**, ↑ **2**, **ENTR** (**CHALLENGES**) Use the arrow keys to highlight **M4 NORMAL:** **ENTR** (**DISP**)	V top	3.5 V	5.5 V
KIT DISP OVERSHOOT	----------	Overshoot	--------	5 %
KIT DISP PW	----------	Width	300 ns	1.0 µs
DISP DELAY WORD A	Using a tee connector and an additional cable connect the TI **VAR PULSE OUT** to oscilloscope channel 2 and **KIT EN TRIG IN**.	Delta time from channel 2 to channel 1	197 µs	200 µs
DISP DELAY WORD B	Disconnect TI **VAR PULSE** from the oscilloscope channel 2 input leaving connected to **KIT EN TRIG IN**. Using a tee connector and an additional cable connect the TI **IFF VIDEO OUT CHAL/TAG** to oscilloscope channel 2 and **KIT CH VID IN**. Use the arrow keys to highlight **M4:** **ENTR** (**WORD B**)	Delta time from channel 2 to channel 1	18 µs	20 µs

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

b. Adjustments. No adjustments can be made.

22. Measurement

a. Performance Check

(1) Connect equipment as shown in figure 2.

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

(a) Press **FUNC**, **ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **2**, **ENTR** (**CHALLENGES**).
(d) Use the arrow keys to highlight **M2:**.
(e) **ENTR** (**OFF**).
(f) Use the arrow keys to highlight **M4:**.
(g) **ENTR**, (**WORD C**).
(h) Press **FUNC**, ↑.

(i) **5**, **ENTR** (**TIMING, VIDEO LEVELS**).
(j) Use the arrow keys to highlight **CHALLENGE VIDEO:**.
(k) **5**, **ENTR** (**5.0 V**).
(l) Press **FUNC**, ↑.
(m) **16**, **ENTR** (**GENERAL MEASUREMENTS**).
(n) Use the arrow keys to highlight **SOURCE: ENTR** (**LOW PWR**).
(o) Use the arrow keys to highlight **PULSE#:**.
(p) **10**, **ENTR**.
(q) Use the arrow keys to highlight **TO PULSE#:**.
(r) **36**, **ENTR**.

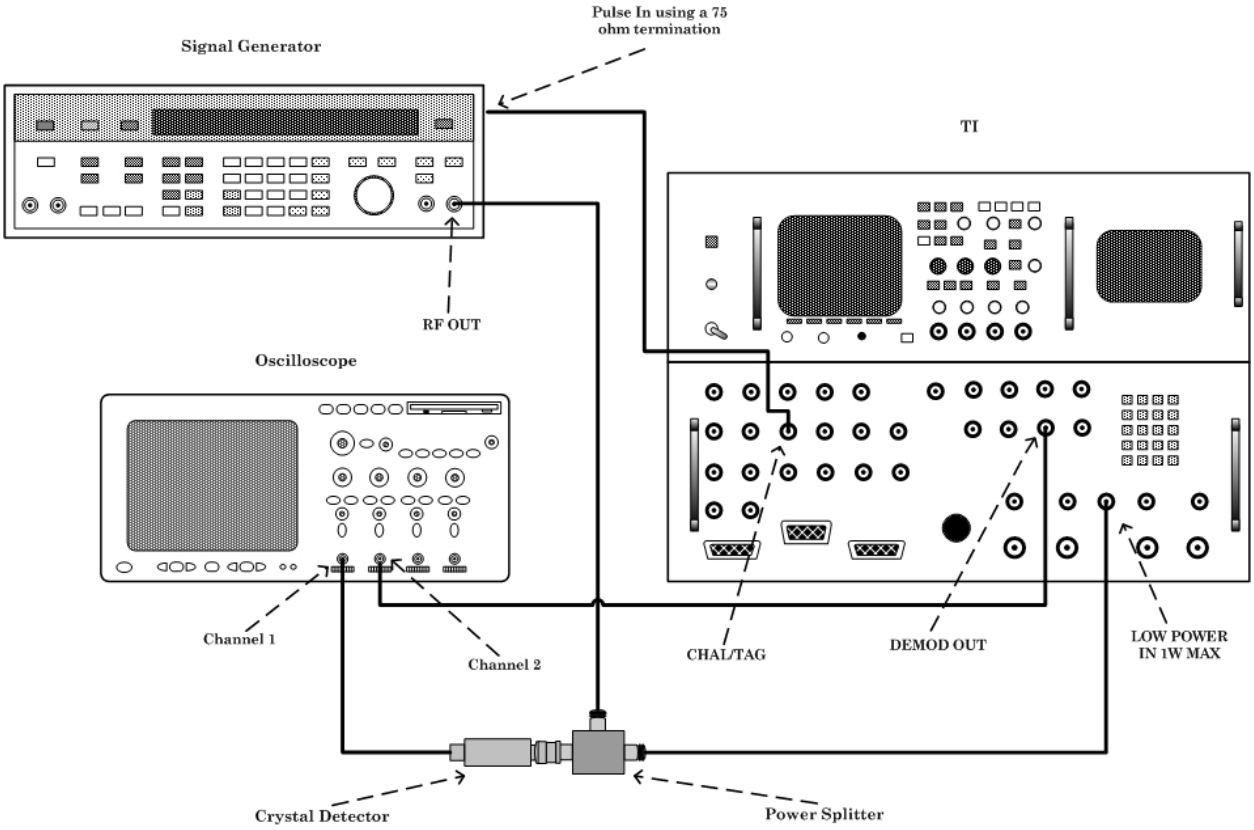

Figure 2. Spacing setup.

(3) Set signal generator for an output of 1030 MHz at +10 dBm with external pulse modulation.

(4) Use the arrow keys to highlight **SPACING:** and press the **ENTR** key.

(5) Adjust the oscilloscope channel 1 Volts/Div and vertical position controls for 2 to 4 divisions of vertical deflection with the signal baseline on the center graticule line.

(6) Adjust the oscilloscope horizontal Sec/Div and position control to display 36 pulses.

(7) Measure and record the delay time from the 10^{th} pulse to the 36^{th} pulse on channel 2 of the oscilloscope.

(8) Verify that the TI **SPACING** indication agrees with the value recorded in (7) above ±25 ns.

(9) Use the arrow keys to highlight **PULSE WIDTH:** and press the key.

(10) Measure and record the pulse with of the 1st pulse on channel 2 of the oscilloscope.

(11) Verify that the TI **PULSE WIDTH** indication agrees with the value recorded in (10) above ±25 ns.

(12) Verify that the oscilloscope channel 2 display signal is ≥ 1.0 V.

(13) Disconnect equipment setup.

(14) Pulse generator channel **A OUTPUT** to measuring receiver power sensor and TI **PRF INPUT** using 50 Ω feedthrough termination. The termination should be on the **PRF INPUT**.

(15) Set the pulse generator to produce a 3 V output with a pulse width of 0.3 μs and a frequency of 900 kHz.

(16) Set the Measuring receiver to measure frequency and measure and record the frequency.

(17) Verify that the TI PRF display indicates within 0.01% of the value recorded in (16) above.

(18) Disconnect the equipment setup.

(19) Connect 30 MHz to 18.5 GHz probe to channel A on the peak power meter and calibrator 1 GHz output. Calibrate the detector.

(20) Connect signal generator **RF OUTPUT** to peak power meter channel A detector using cable 57057ASSY8190001616-1 and N type feedthrough.

(21) Set the signal generator to produce a 30 MHZ +10 dB cw output and turn the RF OUTPUT off.

(22) Zero the peak power meter.

(23) Set the signal generator **RF OUTPUT** to on and using the peak power meter measure the cw signal and record the indication.

(24) Set the signal generator **RF OUTPUT** to off and disconnect signal generator from power meter.

(25) Connect signal generator **RF OUTPUT** to TI **LOW PWR 1W MAX** through cable 57057ASSY8190001616-1 and turn **RF OUTPUT** to on.

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

(a) Press **FUNC**, **ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **16**, **ENTR** (**GENERAL MEASUREMENTS**).
(d) Use the arrow keys to highlight **SOURCE:**.
(e) **ENTR** (**LOW PWR**).
(f) Use the arrow keys to highlight **TYPE:**.
(g) **ENTR** (**CW**).

(h) Use the arrow keys to highlight **POWER:**.
(i) **ENTR**.

(27) Verify that the TI **POWER** indication is within .5 db of the value recorded in (23) above.

(28) Use the arrow keys to highlight **FREQUENCY:** and press the **ENTR** key.

(29) Verify that the TI **FREQUENCY** indication is between 29.99 and 30.01 MHz.

(30) Set the signal generator to produce a 1200 MHZ +10 dB cw output and turn the RF OUTPUT off.

(31) Repeat technique of (20) through (28) above for 1200 MHz, and verify that the TI **FREQUENCY** indication is between 1199.76 and 1200.24 MHz.

(32) Turn signal generator **RF OUTPUT** to off.

(33) Press TI keys as listed in (a) through (z) below:

(a) Press **FUNC**, ↑.
(b) **2**, **ENTR** (**CHALLENGES**).
(c) Use the arrow keys to highlight **M2:**.
(d) **ENTR** (**OFF**).
(e) Use the arrow keys to highlight **M4:**.
(f) **ENTR** (**WORD C**).
(g) Press **FUNC**, ↑.
(h) **15**, **ENTR** (**SUPPRESSION**).
(i) Use the arrow keys to highlight **SUPPRESSION GATE:**.
(j) **ENTR**, (**OFF**).
(k) Press **FUNC**, ↑.
(l) **14**, **ENTR** (**PRF/PRI**).
(m) Use the arrow keys to highlight **PRF:**.
(n) **4000**, **ENTR** (**4000 PPS**).
(o) Press **FUNC**, ↑.
(p) **5**, **ENTR** (**TIMING, VIDEO LEVELS**).
(q) Use the arrow keys to highlight **MIXED VIDEO:**.
(r) **5**, **ENTR** (**5.0V**).
(s) Press **FUNC**, ↑.
(t) **7**, **ENTR** (**MIXED VIDEO**).
(u) Use the arrow keys to highlight **OUTPUT PW:**.
(v) **ENTR**, (**VARIABLE**).
(w) Use the arrow keys to highlight **VAR PW:**.
(x) **1**, **ENTR** (**1.00μS**).
(y) Use the arrow keys to highlight **DEMOD:**.
(z) **ENTR**, (**OFF**).

(34) Disconnect TI from signal generator.

(35) Connect signal generator **OUTPUT** to peak power meter channel A through cable 57057ASSY8190001616-1 and N type feedthrough.

(36) Connect TI **MIXED VIDEO OUT VAR LEVEL** output to signal generator rear panel **PULSE** in using a 75 Ω feedthrough termination.

(37) Set signal generator for an output of 30 MHz at +10 dBm with external pulse modulation and turn the **RF OUTPUT** off.

(38) Zero the peak power meter.

(39) Set the signal generator **RF OUTPUT** to on and using the peak power meter measure the pulse modulated signal and record the indication.

(40) Set signal generator **RF OUTPUT** to off and disconnect signal generator from power meter.

(41) Connect signal generator **OUTPUT** to TI **LOW PWR 1W MAX** through cable 57057ASSY8190001616-1.

(42) Set signal generator **RF OUTPUT** on.

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

(a) Press **FUNC**, ↑.
(b) **16**, **ENTR** (**GENERAL MEASUREMENTS**).
(c) Use the arrow keys to highlight **TYPE:**.
(d) **ENTR** (**PULSE**).
(e) Use the arrow keys to highlight **POWER:**.
(f) **ENTR**.

(44) Verify that the TI **POWER** indication is within .5 db of the value recorded in (39) above.

(45) Use the arrow keys to highlight **FREQUENCY:** and press the **ENTR** key.

(46) Verify that the TI **FREQUENCY** indication is between 29.99 and 30.01 MHz.

(47) Repeat technique of (33) through (44) above for 1030 MHz, and verify that the TI **FREQUENCY** indication is between 1029.79 and 1030.206 MHz.

(48) Disconnect equipment setup.

b. Adjustments. No adjustments can be made.

23. RF Section

a. Performance Check

NOTE

Some of these tests take a considerable amount of time. Insure all measurements are complete before continuing.

(1) Connect the **MAIN RF I/O 1W to 10 KW** output connector to the spectrum analyzer **INPUT 50 Ω.**

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **10**, **ENTR** (**RF & BANDWIDTH**).

(d) Use the arrow keys to highlight **MAIN FREQ:**.
(e) **1010**, **ENTR** (**1010 MHZ**).
(f) Press **FUNC**, ↑.
(g) **11**, **ENTR** (**MAIN MODULATION**).
(h) Use the arrow keys to highlight **CW:**.
(i) **ENTR** (**ON**).
(j) Use the arrow keys to highlight **RF:**.
(k) **0**, **ENTR** (**-0**).
(l) Press **FUNC**, ↑.
(m) **10**, **ENTR** (**RF & BANDWIDTH**).

(3) Set spectrum analyzer as listed in (a) through (e) below.

(a) Center frequency to 1010 MHz.
(b) Span 20 MHz.
(c) Resolution bandwidth to 300 kHz.
(d) Video bandwidth to 300 kHz.
(e) Peak Search.

(4) Verify that the spectrum analyzer indication is within limits listed in table 36.

(5) Repeat technique of (2) (e), (3) and (4) for remaining rows and settings in table 36. The spectrum analyzer will indicate within limits listed in table 36.

Table 36. Output Characteristics

TI		Spectrum analyzer		
Test description	Settings	Measurement type	Minimum	Maximum
1010 MHZ MAIN OUT	----------	Marker frequency	1.0095 G	1.0105 G
1030 MHZ MAIN OUT	Use the arrow keys to highlight **MAIN FREQ:** **1030**, **ENTR** (**1030 MHZ**)	Marker frequency	1.0295 G	1.0305 G
1090 MHZ MAIN OUT	**1090**, **ENTR** (**1090 MHZ**)	Marker frequency	1.0895 G	1.0905 G
1110 MHZ MAIN OUT	**1100**, **ENTR** (**1100 MHZ**)	Marker frequency	1.0995 G	1.1105 G

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

(a) **1030**, **ENTR** (**1030 MHZ**).
(b) Press **FUNC**, ↑.
(c) **14**, **ENTR** (**PRF/PRI**).
(d) Use the arrow keys to highlight **PRF:**.
(e) **300**, **ENTR** (**300 PPS**).
(f) Press **FUNC**, ↑.
(g) **2**, **ENTR** (**CHALLENGES**).
(h) Use the arrow keys to highlight **M2:**.
(i) **ENTR**, (**OFF**).
(j) Press **FUNC**, ↑.
(k) **10**, **ENTR** (**RF & BANDWIDTH**).

(l) Use the arrow keys to highlight **AUX:**.
(m) **10**, **ENTR** (**-10**).

(7) Set spectrum analyzer as listed in (a) through (f) below:
(a) Center frequency to 1030 MHz.
(b) Start frequency to 1010 MHz.
(c) Stop frequency to 1050 MHz.
(d) Scale/Div 1 dB.
(e) Sweep Time 500 ms.
(f) Points to 101.

(8) Use the arrow keys to highlight **STROBE FREQ:** and **ENTR.**

(9) Verify that the spectrum analyzer display stays within limits listed in table 37.

(10) Repeat technique of (6) through (9) above for remaining rows in table 37.

Table 37. Swept Output Characteristics

TI		Spectrum analyzer			
Test description	Settings	Settings	Measurement type	Minimum	Maximum
1030 MHz Flatness check	----------	----------	Marker amplitude min peak	-1 dB	1 dB
1090 MHz Flatness check	Use the arrow keys to highlight **MAIN FREQ:** **1090**, **ENTR** (**1090 MHZ**)	Center Freq 1090 MHz Start Freq 1070 MHz Stop Freq 1110 MHz	Marker amplitude min peak	-1 dB	1 dB
60 MHZ OUT[1] Frequency (-30 dB)	Press **FUNC, ENTR** keys. Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key. **12**, **ENTR** (**AUX MODULATION**) Use the arrow keys to highlight **CW:** **ENTR**, (**ON**) Press **FUNC**, ↑ **11**, **ENTR** (**MAIN MODULATION**) Use the arrow keys to highlight **MODULATION:** **ENTR**, (**OFF**) Press **FUNC**, ↑ **10**, **ENTR** (**RF & BANDWIDTH**) Use the arrow keys to highlight **60 MHZ:** **ENTR**, (**ON**) Press **FUNC**, ↑ **14**, **ENTR** (**PRF/PRI**) Use the arrow keys to highlight **PRF:** **300**, **ENTR** (**300 PPS**)	Center Freq 60 MHz Span 200 kHz Res. BW 300 kHz Video BW 300 kHz Atten to 0 dB Ref Lvl –25 dBm	Peak search marker frequency	59.4 MHz	60.6 MHz

Table 37. Swept Output Characteristics – Continued

TI		Spectrum analyzer			
Test description	Settings	Settings	Measurement type	Minimum	Maximum
60 MHZ OUT -30 dB Level	----------	----------	Marker amplitude	-31 dB	-29 dB
30 DB Flatness check	Press **FUNC**, ↑ **10**, **ENTR** (**RF & BANDWIDTH:**) Use the arrow keys to highlight **STROBE FREQ:** **ENTR**	Start Freq 40 MHz Stop Freq 80 MHz Sweep time 1 S Points 300 Single sweep	Marker Amplitude Min Peak	-31 dB	-29 dB
60 MHZ OUT Frequency (-70 dB)	Use the arrow keys to highlight **POWER:** **70**, **ENTR** (**-70 DBM**)	Continuous sweep Ref Lvl -69 dBm	Peak Search Marker Frequency	59.4 MHz	60.6 MHz
60 MHZ OUT -70 dB Level	----------	----------	Marker amplitude	-71 dB	-69 dB
	Use the arrow keys to highlight **STROBE FREQ:** **ENTR**	Single sweep	Marker Amplitude Min Peak	-71 dB	-69 dB

[1]Disconnect cable from T**I MAIN RF I/O 1W TO 10KW OUTPUT** and connect cable to **60MHZ OUTPUT**.

(11) Disconnect TI **60 MHZ OUT** from spectrum analyzer.

(12) Zero, calibrate, and save values for the measuring receiver power sensor.

(13) Connect measuring receiver sensor module to TI **1030 MHZ OUT**.

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **10**, **ENTR** (**RF & BANDWIDTH**).
(d) Use the arrow keys to highlight **1030 MHZ CW:**.
(e) **ENTR** (**ON**).

(15) Set the measuring receiver to measurement function listed in first row of table 38.

(16) Verify that the measuring receiver indication is within limits listed in table 38.

(17) Repeat technique of (13) through (16) above for remaining rows in table 38.

Table 38. Output Characteristics

TI		Measuring receiver		
Test description	Settings	Settings	Minimum	Maximum
1030 MHZ OUT	----------	FREQ	1029.897 MHz	1030.103 MHz

Table 38. Output Characteristics - Continued

TI		Measuring receiver		
Test description	Settings	Settings	Minimum	Maximum
1030 MHZ OUT 15 DB	----------	RF POWER LOG	13 dBm	17 dBm
MAIN 0 DB[1]	Use the arrow keys to highlight **1030 MHZ CW: ENTR (OFF)** Press **FUNC**, ↑ **12**, **ENTR** (**AUX MODULATION:**) Use the arrow keys to highlight **CW: ENTR**, (**ON**) Press **FUNC**, ↑ **11**, **ENTR** (**MAIN MODULATION:**) Use the arrow keys to highlight **MODULATION: ENTR**, (**OFF**) Use the arrow keys to highlight **RF:** **0**, **ENTR** (**-0**) Use the arrow keys to highlight **AUX:** **0**, **ENTR** (**-0 R**)	TUNED[2] RF LEVEL CAL RATIO	-1 dBm	1 dBm
MAIN -20 DB	Use the arrow keys to highlight **RF:** **20**, **ENTR** (**-20**)	----------	-21 dB	-19 dB
AUX -20 DB	Use the arrow keys to highlight **RF:** **0**, **ENTR** (**-0**) Use the arrow keys to highlight **AUX:** **20**, **ENTR** (**-20 R**)	----------	-21 dB	-19 dB
MAIN -25 AUX -0	Press **FUNC**, ↑ **12**, **ENTR** (**AUX MODULATION:**) Use the arrow keys to highlight **MODULATION: ENTR**, (**OFF**) Press **FUNC**, ↑ **11**, **ENTR** (**MAIN MODULATION:**) Use the arrow keys to highlight **MODULATION: ENTR**, (**ON**) Use the arrow keys to highlight **CW: ENTR**, (**ON**) Use the arrow keys to highlight **RF:** **25**, **ENTR** (**-25**)	----------	-26 dB	-24 dB

See footnotes at end of table.

Table 38. Output Characteristics - Continued

Test description	Settings	Settings	Minimum	Maximum
MAIN -25 AUX -50	Use the arrow keys to highlight **AUX: 50**, **ENTR** (**-50**)	----------	-26 dB	-24 dB
AUX -25 MAIN –0[3]	Press **FUNC, ENTR** keys. Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key. **11**, **ENTR** (**MAIN MODULATION:**) Use the arrow keys to highlight **MODULATION: ENTR**, (**OFF**) Press **FUNC**, ↑ **12**, **ENTR** (**AUX MODULATION:**) Use the arrow keys to highlight **CW: ENTR**, (**ON**) Use the arrow keys to highlight **RF: 0**, **ENTR** (**-0**) Use the arrow keys to highlight **AUX: 25**, **ENTR** (**-25**)	Reestablish a reference at 0 dB first if necessary.	-26 dB	-24 dB
AUX -25 MAIN -50	Use the arrow keys to highlight **RF: 50**, **ENTR** (**-50**)	----------	-26 dB	-24 dB

[1]Disconnect measuring receiver sensor module from **TI 1030 MHZ OUTPUT** and connect sensor module to **TI MAIN RF I/O 1W TO 10KW OUTPUT**.

[2]Perform after measurement is made.

[3]Move power sensor from **MAIN RFI/O 1 TO 10 KW** to the **AUX RF I/O** connector.

(18) Disconnect equipment setup.

b. Adjustments. No adjustments can be made.

24. Modulation

a. Performance Check

(1) Connect the TI **MAIN RF I/O 1W to 10 KW** output connector to the crystal detector then connect crystal detector to oscilloscope channel 2 input.

(2) Connect TI **IFF VIDEO OUT CHAL/TAG** to oscilloscope channel 1 input using a 75 Ω feedthrough termination.

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **3**, **ENTR** (**1ST REPLY**).

(d) Use the arrow keys to highlight **M2:**.
(e) **ENTR** (**ON**).
(f) Use the arrow keys to highlight **REPLY SIGNAL:**.
(g) **ENTR** (**SIF**).
(h) Use the arrow keys to highlight **RF:**.
(i) **0**, **ENTR** (**-0**).
(j) Use the arrow keys to highlight **AUX:**.
(k) **95**, **ENTR** (**-95**).
(l) Press **FUNC**, ↑.
(m) **11**, **ENTR** (**MAIN MODULATION**).
(n) Use the arrow keys to highlight **GTC SHORT:**.
(o) **ENTR** (**ON**).

(4) Adjust the oscilloscope channel 1 and channel volts/div and vertical position controls for 2 to 4 divisions of vertical deflection with the signal baseline on the center graticule line (trigger oscilloscope on channel 1).

NOTE

The number of pulses displayed in the set on channel 2 will vary depending on the TI settings.

(5) Adjust the oscilloscope horizontal Sec/Div and position control to display 2 pulses on channel 1 and 1 set of pulses on channel 2.

(6) Verify that the oscilloscope channel 2 indication is within limits listed in table 39.

(7) Repeat technique of 3 through (6) above for remaining settings and values listed in table 39.

Table 39. Modulation Characteristics

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
GTC SHORT P1 SPACE	----------	Delta time from 2d to 3d pulse	14.25 µs	15.75 µs
GTC SHORT P2 SPACE	----------	Delta time from 2d to 4th pulse	61.75 µs	68.25 µs
GTC SHORT P3 SPACE	----------	Delta time from 2d to 5th pulse	109.25 µs	120.75 µs
GTC SHORT P4 SPACE	----------	Delta time from 2d to 6th pulse	156.75 µs	173.25 µs
GTC SHORT P1 PW	----------	Width pulse 3	400.0 ns	600.0 ns
GTC SHORT P2 PW	----------	Width pulse 4	400.0 ns	600.0 ns
GTC SHORT P3 PW	----------	Width pulse 5	400.0 ns	600.0 ns
GTC SHORT P PW	----------	Width pulse 6	400.0 ns	600.0 ns

Table 39. Modulation Characteristics - Continued

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
GTC LONG P1 SPACE	Use the arrow keys to highlight **GTC SHORT:** **ENTR** (**OFF**) Use the arrow keys to highlight **GTC LONG:** **ENTR** (**ON**)	Delta time from 2d to 3d pulse	14.25 µs	15.75 µs
GTC LONG P2 SPACE	----------	Delta time from 2d to 4th pulse	28.5 µs	31.5 µs
GTC LONG P3 SPACE	----------	Delta time from 2d to 5th pulse	57.0 µs	63.0 µs
GTC LONG P4 SPACE	----------	Delta time from 2d to 6th pulse	114.0 µs	126.0 µs
GTC LONG P5 SPACE	----------	Delta time from 2d to 7th pulse	228.0 µs	252.0 µs
GTC LONG P6 SPACE	----------	Delta time from 2d to 8th pulse	456.0 µs	504.0 µs
GTC LONG P1 PW	----------	Width pulse 3	400.0 ns	600.0 ns
GTC LONG P2 PW	----------	Width pulse 4	400.0 ns	600.0 ns
GTC LONG P3 PW	----------	Width pulse 5	400.0 ns	600.0 ns
GTC LONG P4 PW	----------	Width pulse 6	400.0 ns	600.0 ns
GTC LONG P5 PW	----------	Width pulse 7	400.0 ns	600.0 ns
GTC LONG P6 PW	----------	Width pulse 8	400.0 ns	600.0 ns
GTC SHORT P1 SPACE[1]	Press **FUNC**, ↑ **12**, **ENTR** (**AUX MODULATION**) Use the arrow keys to highlight **CHALLENGE:** **ENTR** (**ON**) Use the arrow keys to highlight **ISLS:** **ENTR** (**OFF**) Use the arrow keys to highlight **RF:** **95**, **ENTR** (**-95**) Use the arrow keys to highlight **AUX:** **0**, **ENTR** (**-0**) Use the arrow keys to highlight **GTC SHORT:** **ENTR** (**ON**) Use the arrow keys to highlight **GTC LONG:** **ENTR** (**OFF**)	Delta time from 2d to 3d pulse	14.25 µs	15.75 µs

See footnote at end of table.

Table 39. Modulation Characteristics - Continued

TI		Oscilloscope		
Test description	Settings	Measurement type	Minimum	Maximum
GTC SHORT P2 SPACE	----------	Delta time from 2d to 4th pulse	61.75 µs	68.25 µs
GTC SHORT P3 SPACE	----------	Delta time from 2d to 5th pulse	109.25µs	120.75 µs
GTC SHORT P4 SPACE	----------	Delta time from 2d to 6th pulse	156.75 µs	173.25 µs
GTC SHORT P1 PW	----------	Width pulse 3	400.0 ns	600.0 ns
GTC SHORT P2 PW	----------	Width pulse 4	400.0 ns	600.0 ns
GTC SHORT P3 PW	----------	Width pulse 5	400.0 ns	600.0 ns
GTC SHORT P PW	----------	Width pulse 6	400.0 ns	600.0 ns
GTC LONG P1 SPACE	Use the arrow keys to highlight **GTC SHORT:** **ENTR** (**OFF**) Use the arrow keys to highlight **GTC LONG:** **ENTR** (**ON**)	Delta time from 2d to 3d pulse	14.25 µs	15.75 µs
GTC LONG P2 SPACE	----------	Delta time from 2d to 4th pulse	28.5 µs	31.5 µs
GTC LONG P3 SPACE	----------	Delta time from 2d to 5th pulse	57.0 µs	63.0 µs
GTC LONG P4 SPACE	----------	Delta time from 2d to 6th pulse	114.0 µs	126.0 µs
GTC LONG P5 SPACE	----------	Delta time from 2d to 7th pulse	228.0 µs	252.0 µs
GTC LONG P6 SPACE	----------	Delta time from 2d to 8th pulse	456.0 µs	504.0 µs
GTC LONG P1 PW	----------	Width pulse 3	400.0 ns	600.0 ns
GTC LONG P2 PW	----------	Width pulse 4	400.0 ns	600.0 ns
GTC LONG P3 PW	----------	Width pulse 5	400.0 ns	600.0 ns
GTC LONG P4 PW	----------	Width pulse 6	400.0 ns	600.0 ns
GTC LONG P5 PW	----------	Width pulse 7	400.0 ns	600.0 ns
GTC LONG P6 PW	----------	Width pulse 8	400.0 ns	600.0 ns

[1]Move connection from **MAIN RF I/O 1W TO 10KW** connector to **AUX RF I/O 1W TO 10KW** connector.

(8) Disconnect equipment setup.

b. Adjustments. No adjustments can be made.

25. Out Main/Aux

a. Performance Check

(1) Zero, Calibrate, and save values for the measuring receiver power sensor.

(2) Connect the measuring receiver sensor module to TI **MAIN RF I/O 1W TO 10 KW** connector.

(3) Set measuring receiver to measure frequency.

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **11**, **ENTR** (**MAIN MODULATION**).
(d) Use the arrow keys to highlight **CW:**.
(e) **ENTR** (**ON**).
(f) Use the arrow keys to highlight **AUX:**.
(g) **95**, **ENTR** (**-95**).
(h) Use the arrow keys to highlight **RF:**.
(i) **0**, **ENTR** (**-0**).

(5) Verify that the measuring receiver indication is approximately 1030 MHz.

(6) Set measuring receiver to measure tuned RF level in log mode and average detection (4.4 SPCL).

(7) Verify that the measuring receiver indication is within limits listed in table 40.

(8) Repeat technique of (4) and (7) above for remaining settings and limits listed in table 40.

NOTE

CAL and RECAL measuring receiver as necessary.

Table 40. Output Power Level

TI		Measuring receiver indication	
Test description	Settings	Minimum (dB)	Maximum (dB)
MAIN 0 dB @ 1030 MHz	----------	-1.0	1.0
MAIN -10 dB @ 1030 MHz	**10**, **ENTR** (**-10**)	-11.0	-9.0
MAIN -20 dB @ 1030 MHz	**20**, **ENTR** (**-20**)	-21.0	-19.0
MAIN -30 dB @ 1030 MHz	**30**, **ENTR** (**-30**)	-31.0	-29.0
MAIN -40 dB @ 1030 MHz	**40**, **ENTR** (**-40**)	-41.0	-39.0
MAIN -50 dB @ 1030 MHz	**50**, **ENTR** (**-50**)	-51.0	-49.0
MAIN -60 dB @ 1030 MHz	**60**, **ENTR** (**-60**)	-61.0	-59.0
MAIN -70 dB @ 1030 MHz	**70**, **ENTR** (**-70**)	-71.0	-69.0
MAIN -80 dB @ 1030 MHz	**80**, **ENTR** (**-80**)	-81.0	-79.0
MAIN -90 dB @ 1030 MHz	**90**, **ENTR** (**-90**)	-91.0	-89.0
MAIN -95 dB @ 1030 MHz	**95**, **ENTR** (**-95**)	-96.0	-94.0

See footnote at end of table.

Table 40. Output Power Level – Continued

TI		Measuring receiver indication	
Test description	Settings	Minimum (dB)	Maximum (dB)
AUX 0 dB @ 1030 MHz[1]	Use the arrow keys to highlight **CW:** **ENTR** (**OFF**) Press **FUNC**, ↑ **12**, **ENTR** (**AUX MODULATION**) Use the arrow keys to highlight **CW:** **ENTR** (**ON**) Use the arrow keys to highlight **AUX:** **0**, **ENTR** (**-0**)	-1.0	1.0
AUX -10 dB @ 1030 MHz	**10**, **ENTR** (**-10**)	-11.0	-9.0
AUX -20 dB @ 1030 MHz	**20**, **ENTR** (**-20**)	-21.0	-19.0
AUX -30 dB @ 1030 MHz	**30**, **ENTR** (**-30**)	-31.0	-29.0
AUX -40 dB @ 1030 MHz	**40**, **ENTR** (**-40**)	-41.0	-39.0
AUX -50 dB @ 1030 MHz	**50**, **ENTR** (**-50**)	-51.0	-49.0
AUX -60 dB @ 1030 MHz	**60**, **ENTR** (**-60**)	-61.0	-59.0
AUX -70 dB @ 1030 MHz	**70**, **ENTR** (**-70**)	-71.0	-69.0
AUX -80 dB @ 1030 MHz	**80**, **ENTR** (**-80**)	-81.0	-79.0
AUX -90 dB @ 1030 MHz	**90**, **ENTR** (**-90**)	-91.0	-89.0
AUX -95 dB @ 1030 MHz	**95**, **ENTR** (**-95**)	-96.0	-94.0

[1]Move connection from **MAIN RF I/O 1W TO 10KW** connector to **AUX RF I/O 1W TO 10KW** connector.

(9) Disconnect equipment setup.

b. Adjustments. No adjustments can be made.

26. High Power In

a. Performance Check

(1) Determine actual coupling value of directional coupler at 1090 and 1030 MHz for use in paragraph (8) below by measuring the nominal loss between the primary input port and the auxiliary side arm port, with the output port terminated as shown in (a) through (h) below.

(a) Connect measuring receiver to signal generator output.
(b) Set signal generator output for 1090 MHz at 0 dBm.
(c) Set measuring receiver to measure frequency then measure tuned level.
(d) Set reference level on measuring receiver.
(e) Connect directional coupler input port to the signal generator output and auxiliary output to measuring receiver. Ensure that the output and the reflected arm of the directional coupler are terminated.
(f) Record the measuring receiver indication in table 41 for use in (8) below.
(g) Repeat technique in paragraphs (a) through (f) above at 1030 MHz at 0 dB.
(h) Repeat technique in paragraphs (a) through (f) above substituting the directional coupler with the 20 dB attenuator at 1030 MHz and 1090 MHz for use in (8) below.

Table 41. Standards Values

Standard	Frequency	Reading
Directional coupler	1030 MHz	
Directional coupler	1090 MHz	
20 dB attenuator	1090 MHz	
20 dB attenuator	1030 MHz	

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

(a) Press **FUNC, ENTR** keys.
(b) Use the arrow keys to highlight **GENERAL MENUS** and press **ENTR** key.
(c) **16**, **ENTR** (**GENERAL MEASUREMENTS**).
(d) Use the arrow keys to highlight **TYPE:**.
(e) **ENTR** (**CW**).

(3) Connect the power amplifier to +13 V output of dc power supply, monitored with multimeter.

(4) Connect the signal generator to the power amplifier input.

(5) Connect power amplifier output to directional coupler.

(6) Connect the main output of the directional coupler to the TI **MAIN RF I/O 1W TO 10 KW** input connector.

(7) Connect the –20 dB sample output of the directional coupler and a –20 dB attenuator to the measuring receiver.

(8) Compute the measuring receiver indication by algebraically adding the attenuator value and directional coupler coupling value recorded in table 41 above, then subtracting the total from +40 dBm.

EXAMPLE: Directional Coupler value recorded in table 41 above = 19.90 dB

Attenuation value recorded in table 41 above = 19.81 dB

39.71 dB

Measuring receiver indication: 40 dB – 39.71 dB = 0.29 dB

(9) Set the signal generator frequency to 1090 MHz and power level for a measuring receiver indication equal to the value calculated in (8) above.

(10) Use the arrow keys to highlight **POWER** and press **ENTR** key.

(11) Verify the TI measured value displayed on the monitor is +40.0 dBm ±0.5 dB.

(12) Repeat technique of (4) through (11) above for remaining settings and limits listed in table 42.

Table 42. High Power Input

TI		TI CW indication	
Test description	Settings	Minimum (dB)	Maximum (dB)
1090 MHz 10W (40 dBm) MAIN I/O	----------	39.5	40.5

Table 42. High Power Input - Continued

TI		TI CW indication	
Test description	Settings	Minimum (dB)	Maximum (dB)
1090 MHz 10W (40 dBm) AUX I/O[1]	Use the arrow keys to highlight **SOURCE: ENTER (AUX)**	39.5	40.5
1030 MHz 10W (40 dBm) AUX I/O	----------	39.5	40.5
1030 MHz 10W (40 dBm) MAIN I/O[2]	Use the arrow keys to highlight **SOURCE: ENTER (MAIN)**	39.5	40.5

[1]Move connection from **TI 10W (40 dBm) MAIN I/O** to the **10W (40 dBm) AUX I/O**.

[2]Move connection from **TI 10W (40 dBm) AUX I/O** to the **10W (40 dBm) MAIN I/O**.

b. Adjustments. No adjustments can be made.

27. 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:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0607503

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 344758, requirements for calibration procedure TB 9-6625-2337-35.

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