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CHANGE 1

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR TRANSPONDER TEST SET AN/APM-421

Headquarters, Department of the Army, Washington, DC
28 October 2008

TB 9-4920-456-24, 17 September 2008, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by a vertical bar in the margin of the page.

Remove Pages	**Insert Pages**
25 and 26	25 and 26

2. File this change sheet in front of the publication for reference purposes.

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Headquarters, Department of the Army, Washington, DC
17 September 2008

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

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

*This bulletin supersedes TB 9-4920-456-35, dated 9 December 1996.

SECTION I
IDENTIFICATION AND DESCRIPTION

1. Test Instrument Identification. This bulletin provides instructions for the calibration of Transponder Test Set AN/APM-421. 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 11 hours, using the dc and low frequency and microwave techniques.

2. Forms, Records, and Reports

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

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

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

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Multimeter function test consisting of:	
Ac voltage	Range: 100 to 126 V ac Accuracy: ±2% of digital voltmeter indication plus ±2 V ac Frequency: 400 Hz
Ac current	Range: 1.0 to 1.26 A Accuracy: TI indication = digital voltmeter indication x ±10 ±2% plus ±0.2A Frequency: 400 Hz
Dc voltage	Range: 18, 28, and 35 V d c Accuracy: ±2% plus ±0.1 V dc
Dc current	Range: 0.194 to 5.2 A Accuracy: ±2% plus ±0.1 A
Keyboard Input/output (I/O test consisting of: Enable/disable codes M-1, M-3/A and M-C	 Enable level: 0.4 V dc (maximum) Disable level: 28 V dc (approximately)

Table 1. Calibration Description - Continued

Test instrument parameters	Performance specifications
Keyboard (continued)	
Invalid codes M-1, M-C, and M-3A	Invalid readout on TI display responds appropriately to invalid codes
Indicator light enable/disable responses	On/off indicator light conditions respond appropriately to enable/disable key entries Eject key indicator: Between 22 and 28 V dc
Panel lights	Range: 5 V ac Accuracy: Between 4.77 and 5.83 V ac Range: 28 V ac Accuracy: Between 25.92 and 31.68 V ac
Kit simulator test, consisting of:	
M-4 word A and B reply pulse simulation	Pulse characteristics: Amplitude range: 4 V p Accuracy: ±1 V p Pulse width: 0.5 ms Accuracy: ±0.2 ms Risetime: 0.1 ms or less Falltime: 0.25 ms or less Pulse spacing: 1.8 ms Accuracy: ±0.1 ms Delay from P1 pulse: 241 ms Accuracy: ±35 ms
A/B disparity pulse simulation	Pulse characteristics: Pulse amplitude: 4 V p Accuracy: ±1 V p Pulse width: 0.65 ms Accuracy: ±0.30 ms Risetime: 0.15 ms or less Falltime: 0.5 ms or less Delay from PI pulse: 196 ms Accuracy: ±10 ms
Counter/decoder test, consisting of:	
Top and bottom counter response	Range: External pulse input of 1000 ±1 Hz Accuracy: TI counters indicate within ±1 count of frequency counter
Top and bottom decoder response	Range: SIF code inputs: 0000, 1111, 2222, 3333, 4444, 5555, 6666, 7777 Accuracy: TI display: 0000, 1111, 2222, 3333, 4444, 5555, 6666, 7777

Table 1. Calibration Description

Test instrument parameters	Performance specifications
Counter/decoder test (continued)	
P2 pulse displacement for top and bottom decoder	Range: 20.350 ms Accuracy: SIF code will disappear from TI display before delay is more than 20.5 ms and less than 20.10 ms
Mode 4 reply pulse displacement	Range: 3.60 ms Accuracy: ±0.35 ms
Top and bottom reply decoder response	Range: 500 Hz Accuracy: ±1 Hz
Programmable attenuator (top or bottom channel)	Range: -20 to -99 dBm Accuracy: -20 to -60 dBm: ±1.25 dB -60 to -70 dBm: ±0.75 dB -70 to -80 dBm: ±0.5 dB -80 to -85 dBm: ±0.75 dB -85 to -99 dBm: ±1.65 dB Frequency: 1.030 GHz
Interrogation path attenuation reference	Attenuation: 65 dB Accuracy: ±0.5 dB Frequency: 1.030 GHz
Reply path insertion loss (top or bottom channel)	UPM 137 path: 19.5 dB Accuracy: ±1.5 dB and within ±0.5 dB of calibration label value APM 305 path: Insertion loss: 6 dB or less, and within 0.5 dB of calibration label value Frequency: 1.090 GHz
Cable insertion loss	Loss value marked on each cable: Accuracy: ±0.1 dB of value listed on cable Frequency: 1.030 and 1.090 GHz
VSWR	Mismatch unit 4049398: Return loss: Between 5.105 and 5.435 dB Frequency: 1.090 GHz Termination 4049397: Return loss: 26.45 dB or greater Frequency: 1.090 GHz

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-287 or AN/GSM-705. Alternate items may be used by the calibrating activity when the equipment listed in table 2 is not available. 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 accessory is also required for this calibration: Calibration test fixture J-4933/APM-421, NSN 6625-01-319-1604.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
FREQUENCY COUNTER	Period range: 186 to 276 ms Period accuracy: 1.3%	Fluke, Model PM6681/656 (PM6681/656)
MEASURING RECEIVER	Power measurement: Frequency range: 1.090 and 1.030 GHz Power range: 0 to -99 dBm Accuracy: ±0.025 dB	Measuring Receiver system N5530S consisting of: Spectrum Analyzer Agilent, Model E4440A (E4440A), Power Meter Agilent, Model E4419B (E4419B), and Sensor Module Agilent, Model N5532-518 (518)
MULTIMETER	Dc voltage range: 0.0 to 35.8 V dc Accuracy: ±0.57% Ac voltage range: 100 mV to 126 V ac Accuracy: ±2.5% Frequency: 400 Hz	Hewlett-Packard, Model 3458A (3458A)

Table 2. Minimum Specifications of Equipment Required - Continued

Common name	Minimum use specifications	Manufacturer and model (part number)
RADAR TEST SET[1]		(AN/UPM-155), Hewlett-Packard, Model 54602A (54602A)
Oscilloscope:	Amplitude range: 4 V per div Amplitude accuracy: ±6.25% Risetime/falltime: <0.025 ms Time accuracy: ±10%	
Radar Test Set	Period range: 20.1 to 20.5 ms Period accuracy: ±0.24% SIF code output: 0000 to 7777 (2 framing pulses and up to 12 information pulses) Mode 4, three pulse reply: Spaced 1.75 ms, PW 0.5 ms Pulse accuracy: ±0.0875 ms PRF: 500 and 1000 Hz PRF accuracy: ±0.25 Hz SIF reply with X pulse: An X pulse spaced 10.15 ms X pulse accuracy: ±0.02 ms after the F1 pulse SIF emergency replies: Each mode code is followed by three sets of empty bracket pulses with F1 and F2 spaced 20.3 ms apart and each new F1 pulse spaced 4.35 ±1.0 ms after its preceding F2 pulse	
SIGNAL GENERATOR	Frequency range: 1.030 and 1.090 GHz Amplitude: 0 dBm	Aeroflex, Model 2023B (2023B) or SG-1207/U
VSWR BRIDGES	Frequency: 1.090 GHz Directivity: ≥39 dB	Wiltron, Model 60NF50 (7910310-3)

[1]Limited deployed.

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. Unlatch and remove transit cover from TI and set TI on work surface with front panel vertical.

b. Connect calibration test fixture to transponder test set connector on TI front panel.

c. Set all TI toggle switches (except **POWER** switch) to up position. Ensure **POWER** switch is in **OFF** position.

d. Set all switches on calibration test fixture to **OFF** position.

e. Connect TI to a 115 V ac 400 Hz source A+, D-.

f. Set TI power switch to **ON,** and permit self-test to complete its cycle.

NOTE

When self-test is completed, the displayed messages either indicate that self-test was passed, and TI is now connected for **TESTING**, or display a **SELF TEST FAILED** message (with probable causes of the failure).

g. Allow TI to warm-up for 1 hour before proceeding to next paragraph.

8. Multimeter Function Test

a. Performance Check

(1) Connect multimeter (ac mode) to **VOLTMETER (PWR)** test jacks on calibration test fixture.

(2) Set calibration test fixture **LOAD SELECT S3** switch to **1** and **DC/AC S5** switch to **AC**.

(3) Press **AC V** key on TI **METER SELECT** keyboard.

WARNING

TEST S4 switch on calibration test fixture cannot be in load position longer than 20 seconds for each use. Allow 30 seconds between uses.

(4) Hold **TEST S4** switch on calibration test fixture to **LOAD** position. Multimeter will indicate between 100 and 126 V ac, and TI display will indicate within ±2% plus ±2 V ac of multimeter indication.

(5) Release **TEST S4** switch and set **DC/AC S5** switch on calibration test fixture to **OFF** position.

(6) Connect multimeter to calibration test fixture **SHUNT** test jacks**.**

(7) Press **AC A** key on TI **METER SELECT** keyboard and set **DC/AC S5** switch on calibration test fixture to **AC.**

(8) Hold **TEST S4** switch on calibration text fixture to **LOAD** position. Multimeter will indicate between 0.1 and 0.126 V ac, and TI current display will indicate within ±2% plus ±0.2 A of the equivalent current indicated by the digital voltmeter.

NOTE

TI indication = multimeter indication x 10 ±2% plus ±0.2 A.

(9) Set **DC/AC S5** switch on calibration test fixture to **OFF**.

(10) Connect multimeter (dc mode) to **VOLTMETER (PWR)** test jacks on calibration test fixture.

(11) Set **DC/AC S5** switch on calibration test fixture to **DC**.

(12) Turn TI **DCV ADJ** control fully ccw and press **DC V** key on **METER SELECT** keyboard.

(13) Adjust TI **DCV ADJ** control for an indication of 18.0 V dc on TI display. Multimeter will indicate between 17.54 and 18.46 V dc.

(14) Adjust TI **DCV ADJ** control for an indication of 28.0 V dc on TI display. Multimeter will indicate between 27.34 and 28.66 V dc.

(15) Adjust TI **DCV ADJ** control for an indication of 35.0 V dc on TI display**.** Multimeter will indicate between 34.20 and 35.80 V dc.

(16) Adjust TI **DCV ADJ** control fully ccw.

(17) Set **DC/AC S5** switch on calibration fixture to **OFF**.

(18) Connect multimeter to **SHUNT** test jacks.

(19) Set **DC/AC S5** on calibration test fixture to **DC**.

CAUTION

Calibration test fixture **TEST S4** switch must be in **OFF** position before changing position of **LOAD SELECT S3** switch.

(20) Set calibration test fixture **LOAD SELECT S3** switch to **2**.

(21) Hold **TEST S4** switch to **LOAD** position on calibration test fixture and adjust TI **DCV ADJ** control for a TI display indication of **18.0 V dc**.

(23) Press TI **DC A** key on **METER SELECT** keyboard.

(24) Hold **TEST S4** switch to **LOAD** position on calibration test fixture. Multimeter will indicate within ±2% plus ±0.1 A of TI dc current display.

NOTE

Multimeter (dc mode) indications **MUST** be multiplied by 10 to obtain equivalent current in amperes.

(25) Release **TEST S4** switch on calibration test fixture.

(26) Repeat technique of (20) through (25) above for TI **DCV ADJ** and **LOAD SELECT S3** switch values listed in table 3.

Table 3. Dc Current Measurement

Test instrument display indications (dc voltage) **DCV ADJ** (V dc)	Calibration test fixture **LOAD SELECT S3** switch positions[1]
18.0	3
18.0	4
35.0	5
35.0	6
35.0	7
28.0	8
28.0	9
28.0	10
28.0	11

[1]Calibration test fixture **TEST S4** switch must be in **OFF** position before changing **LOAD SELECT S3** switch position.

(27) Set **LOAD SELECT S3** and **DC/AC S5** switches on calibration test fixture to **OFF**.

9. Keyboard Input/Output (I/O) Test

a. Performance Check

(1) Connect multimeter to **VOLTMETER** (**LGC**) test jacks on calibration test fixture.

NOTE

ENTER key must be pressed on TI **CODE/ATTEN SELECT** keyboard each time a code is selected.

(2) Set **SELECT S1** and **INPUT/OUTPUT S2** switches on calibration test fixture and press TI **CODE/ATTEN SELECT** keys as listed to verify multimeter indication for each entry listed in table 4.

Table 4. Dc Keyboard Test

Calibration test fixture switch position		Test instrument **CODE/ATTEN SELECT** entries[1]		Multimeter indications (levels)[2]
SELECT S1	**INPUT/OUTPUT S2**	Mode key	Numerical code	
A	1	M-1	1000	Low
A	1	M-1	0000	High
A	2	M-1	2000	Low
A	2	M-1	0000	High
A	3	M-1	4000	Low
A	3	M-1	0000	High
A	4	M-1	0100	Low
A	4	M-1	0000	High
A	5	M-1	0200	Low
A	5	M-1	0000	High
A	6	M-3/A	1000	Low
A	6	M-3/A	0000	High
A	7	M-3/A	2000	Low
A	7	M-3/A	0000	High
A	8	M-3/A	4000	Low
A	8	M-3/A	0000	High
A	9	M-3/A	0100	Low
A	9	M-3/A	0000	High
A	10	M-3/A	0200	Low
A	10	M-3/A	0000	High
A	11	M-3/A	0400	Low
A	11	M-3/A	0000	High
A	12	M-3/A	0100	High
A	12	M-3/A	0000	High
A	13	M-3/A	0020	Low
A	13	M-3/A	0000	High
A	14	M-3/A	0040	Low
A	14	M-3/A	0000	High
A	15	M-3/A	0001	Low

See footnotes at end of table.

Table 4. Dc Keyboard Test - Continued

Calibration test fixture switch position		Test instrument **CODE/ATTEN SELECT** entries[1]		Multimeter indications (levels)[2]
SELECT S1	**INPUT/OUTPUT S2**	Mode key	Numerical code	
A	15	M-3/A	0000	High
A	16	M-3/A	0002	Low
A	16	M-3/A	0000	High
A	17	M-3/A	0004	Low
A	17	M-3/A	0000	High
B	1	M-C	1000	Low
B	1	M-C	0000	High
B	2	M-C	2000	Low
B	2	M-C	0000	High
B	3	M-C	4000	Low
B	3	M-C	0000	High
B	4	M-C	0100	Low
B	4	M-C	0000	High
B	5	M-C	0200	Low
B	5	M-C	0000	High
B	6	M-C	0400	Low
B	6	M-C	0000	High
B	7	M-C	0010	Low
B	7	M-C	0000	High
B	8	M-C	0020	Low
B	8	M-C	0000	High
B	9	M-C	0040	Low
B	9	M-C	0000	High
B	10	M-C	0002	Low
B	10	M-C	0000	High
B	11	M-C	0004	Low
B	11	M-C	0000	High

[1]**ENTER** key must be pressed each time a numerical code is selected.
[2]Low level is approximately 0.4 V dc or less. High level is approximately 28 V dc.

NOTE

High level (approximately 28 V dc) and low level signals (less than 0.4 V dc) are verified rather than actual values in table 4.

(3) Press TI **CODE/ATTEN SELECT** and numerical keys as listed in table 5 to verify TI response to each code with an invalid message.

Table 5. Invalid Messages

Test instrument **CODE/ATTEN SELECT** mode keys	Numerical keys[1]	Test instrument **CODE/ATTEN SELECT** mode keys	Numerical keys[1]
M-1	7400	M-1	7777
M-1	7500	M-1	8888
M-1	7600	M-1	9999

See footnotes at end of table.

Table 5. Invalid Messages - Continued

Test instrument **CODE/ATTEN SELECT** mode keys	Numerical keys[1]	Test instrument **CODE/ATTEN SELECT** mode keys	Numerical keys[1]
M-1	7700	M-C	7771
M-1	7711	M-C	7773
M-1	7722	M-C	7775
M-1	7733	M-C	7777
M-1	7744	M-3/A	0008
M-1	7755	M-3/A	0900
M-1	7766	M-3/A	0090

[1]**ENTER** key on **CODE/ATTEN SELECT** keyboard must be pressed for each numerical code.

(4) Press TI **STBY** key on **TRANSPONDER CONTROL** keyboard.

(5) Set **SELECT S1** and **INPUT/OUTPUT S2** switches on calibration test fixture and TI **TRANSPONDER CONTROL** key entries to illuminate and/or extinguish indicator lights. Multimeter will indicate high or low level conditions as listed in table 6.

Table 6. Key Indicator Light Test

Calibration test fixture switch positions		Test instrument keyboard section	Key entry and indicator light	Light	Multimeter indications[1]
SELECT S1	**INPUT/OUTPUT S2**				
B	12	(CODE/ATTEN	X PULSE	Lit	Low
B	12	SELECT)	XPULSE	Off	High
B	13	(MODE 4)	ZERO	Lit	Low
B	13		ZERO	Off	High
B	14	(TRANSPONDER CONTROL)	BOT ANT DIV ANT[2]	Lit Off	Low
B	14		DIV ANT	Lit	High
B	15	(TRANSPONDER CONTROL)	TOP ANT DIV ANT[2]	Lit Off	Low
B	15		DIV ANT TOP ANT[2]	Lit Off	High
B	16	(TRANSPONDER CONTROL)	MON	Lit	Low
B	16		MON	Off	High
B	17	(MODE 4)	LIGHT ENBL	Lit	Low
B	17		LIGHT ENBL	Off	High
B	18	(MODE 4)	AUDIO ENBL LIGHT ENBL[2]	Lit Lit	Low
B	18	(MODE 4)	AUDIO ENBL LIGHT ENBL[2]	Off Lit	High
C	1	(TRANSPONDER CONTROL)	M-1 BIT	Lit	Low
C	1		M-1 BIT	Off	High
C	2	(TRANSPONDER CONTROL)	M-2 BIT	Lit	Low
C	2		M-2 BIT	Off	High

See footnotes at end of table.

Table 6. Key Indicator Light Test - Continued

Calibration test fixture switch positions		Test instrument keyboard section	Key entry and indicator light	Light	Multimeter indications[1]
SELECT S1	**INPUT/OUTPUT S2**				
C	3	(TRANSPONDER CONTROL)	M-3/A BIT	Lit	Low
C	3		M-3/A BIT	Off	High
C	4	(TRANSPONDER CONTROL)	M-C BIT	Lit	Low
C	4		M-C BIT	Off	High
C	5	(MODE 4)	BIT	Lit	Low
C	5		BIT	Off	High
C	6	(TRANSPONDER CONTROL)	M-1 ENBL	Lit	Low
C	6		M-1 ENBL	Off	High
C	7	(TRANSPONDER CONTROL)	M-2 ENBL	Off	High
C	7		M-2 ENBL	Lit	Low
C	8	(TRANSPONDER CONTROL)	M-3A ENBL	Off	High
C	8		M-3A ENBL	Lit	Low
C	9	(TRANSPONDER CONTROL)	M-C ENBL	Off	High
C	9		M-C ENBL	Lit	Low
C	10	(TRANSPONDER CONTROL)	M-T ENBL	Lit	Low
C	10		M-T ENBL	Off	High
C	11	(TRANSPONDER CONTROL)	NORM	Lit	Low
C	11		STBY (NORM[2])	Off	High
C	12	(TRANSPONDER CONTROL)	EMER	Lit	Low
C	12		STBY (EMER[2])	Off	High
C	13	(TRANSPONDER CONTROL)	SPARE2[3]	Lit	Low
C	13		SPARE 2	Off	High
C	14	(TRANSPONDER CONTROL)	SPARE 3	Lit	Low
C	14		SPARE 3	Off	High
C	15	(TRANSPONDER CONTROL)	STBY	Lit	Low
C	15		OFF (STBY[2])	Off	High
C	15	NORM		Lit	Low
C	15		OFF (NORM[2])	Off	High
C	15	EMER		Lit	Low
C	15	OFF (EMER[2])		Off	High

[1]Low level is less than 0.4 V dc. High level is approximately 28 V dc.
[2]Indicator light only.
[3]Refer to figure 1 for location.

(6) Press TI **STBY** key on **TRANSPONDER CONTROL KEYBOARD**

(7) Move multimeter high lead from high **VOLTMETER** (**LGC**) and connect lead to **EJECT** test jack.

(8) Press **EJECT** key on TI **TRANSPONDER CONTROL** keyboard; **EJECT** key indicator light will be on and multimeter will indicate between 22 and 28 V dc.

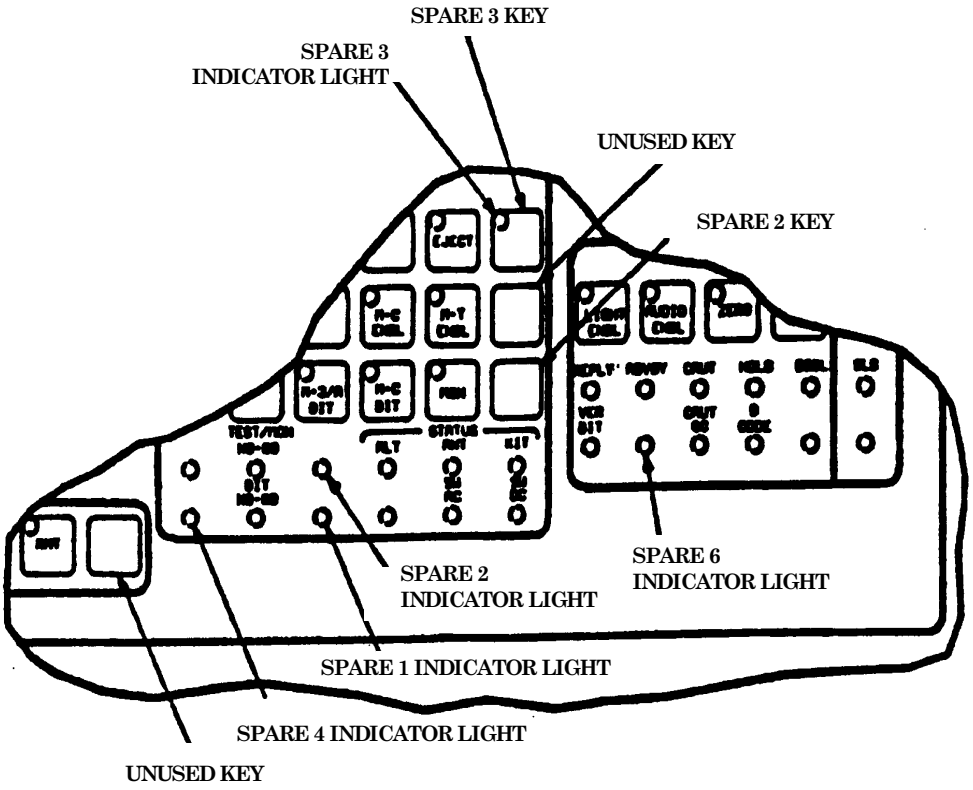

Figure 1. Spare indicator location.

(9) Press **EJECT** key on **TRANSPONDER CONTROL** keyboard. **EJECT** key indicator light will be off and multimeter will indicate less than 0.4 Vdc.

(10) Disconnect multimeter from calibration test fixture jacks.

(11) Set **SELECT S1** switch on calibration test fixture to **D**.

(12) Set **INPUT/OUTPUT S2** switch on calibration test fixture to positions listed in table 7 to light corresponding indicator.

Table 7. Indicator Light Test

Calibration test fixture switch position **INPUT/OUTPUT S2**	Test instrument keyboard section	Test instrument indicator (highlighted)
1	(MODE 4)	DSBL
2	(MODE 4)	HOLD
3	(MODE 4)	VER BIT
4	(TRANSPONDER CONTROL)	TEST/MON NO-GO
5	(TRANSPONDER CONTROL)	STATUS-ANT
6	(TRANSPONDER CONTROL)	STATUS-KIT
7[1]	(TRANSPONDER CONTROL)	STATUS-ALT
8	(MODE 4)	B CODE
9	(MODE 4)	ADVSY
10[2]	(TRANSPONDER CONTROL)	SPARE[1]

[1]Set TI M-C interlock toggle switch to out.
[2]Refer to figure 1 for location.

NOTE

SELECTOR Sl switch will remain in position **D** for remainder of keyboard input/output tests.

(13) Set **INPUT/OUTPUT S2** switch on calibration test fixture to **11**.

(14) Press **RESET** key on TI **TEST SET** keyboard. TI display will indicate **TESTING APX-72/APX-64**.

(15) Set **INPUT/OUTPUT S2** switch on calibration test fixture to **12**.

(16) Press **RESET** key on TI **TEST SET** keyboard. TI display will indicate **TESTING APX-100/APX-101**.

(17) Set **INPUT/OUTPUT S2** switch on calibration test fixture to **13**.

(18) Press **RESET** key on TI **TEST SET** keyboard. TI display will indicate **TESTING APX-100**.

(19) Set **INPUT/OUTPUT S2** switch on calibration test fixture to **14**.

(20) Press **RESET** on TI **TEST SET** keyboard, then press **STBY** key on TI **TRANSPONDER CONTROL** keyboard. TI **TEST GO** indicator on **TRANSPONDER CONTROL** keyboard will light.

(21) Set switches on calibration test fixture to positions listed in table 8. Indicators and indicator conditions are listed for each position.

Table 8. Mode 4 Indicator Test

Calibration test fixture		Test instrument		
Switch	Switch position	Keyboard section	Indicator	Indicator condition
S2	15	TRANSPONDER CONTROL	TEST GO	Off
S6	ON	MODE 4	ZERO	Lit
S6	OFF	MODE 4	ZERO	Off
S7	ON	MODE 4`	CAUT OC	Lit
S4[1]	15 V	- - -	- - -	- - -
S14	ON	MODE 4`	REPLY	Lit
S14	OFF	MODE 4	REPLY	Off
S11	ON	MODE 4	CAUT	Lit
S11	OFF	MODE 4	CAUT	OFF
S12	ON	TRANSPONDER CONTROL	TEST GO	Lit
S2	16		TEST GO	OFF
S8	ON	TRANSPONDER CONTROL	BIT NO-GO	Lit
S8	OFF		BIT NO-GO	Off
S15	ON	TRANSPONDER CONTROL	SW AC	Lit
S15	OFF		SW AC	Off
S13	ON	TRANSPONDER CONTROL	SW DC	Lit
S13	OFF		SW DC	Off

[1]S4 must be in 15 V position to complete table 9.

(22) Connect multimeter (ac mode) to **LAMP VOLTAGE 5 VAC** test jacks on calibration on calibration test fixture.

(23) Set TI **PANEL LIGHTS** switch to **5 VOLTS**. Multimeter will indicate between 4.77 and 5.83 V ac.

(24) Move multimeter hi lead from **LAMP VOLTAGE 5 VAC** jack and connect to **LAMP VOLTAGE 28 VAC** test jack on calibration test fixture. Set TI **PANEL LIGHTS** switch to **28 VOLT**. Multimeter will indicate between 25.92 and 31.68 V ac.

(25) Set **S9** switch on calibration test fixture to **ON**. TI SPARE 6 INDICATOR LIGHT (fig. 1) on **MODE 4** keyboard will light.

(26) Set **S9** switch on calibration test fixture to **OFF**. TI SPARE 6 INDICATOR LIGHT (fig. 1) on **MODE 4** keyboard will be off.

(27) Set **S10** switch on calibration test fixture to **ON**. TI SPARE 4 INDICATOR LIGHT (fig. 1) on **TRANSPONDER CONTROL** keyboard will light.

(28) Set **Sl0** switch on calibration test fixture to **OFF**. TI SPARE 4 INDICATOR LIGHT (fig. 1) on **TRANSPONDER CONTROL** keyboard will be off.

(29) Return all switches on calibration test fixture to **OFF** position.

b. Adjustments. No adjustments can be made.

10. Kit Simulator Test

a. Performance Check

(1) Press **STBY** key on TI **TRANSPONDER CONTROL** keyboard and press **CODE SEL** key on **MODE 4** keyboard to light **A** indicator (B indicator must be off).

NOTE

Ensure all switches on calibration test fixture are in **OFF** position.

(2) Connect equipment as shown in figure 2.

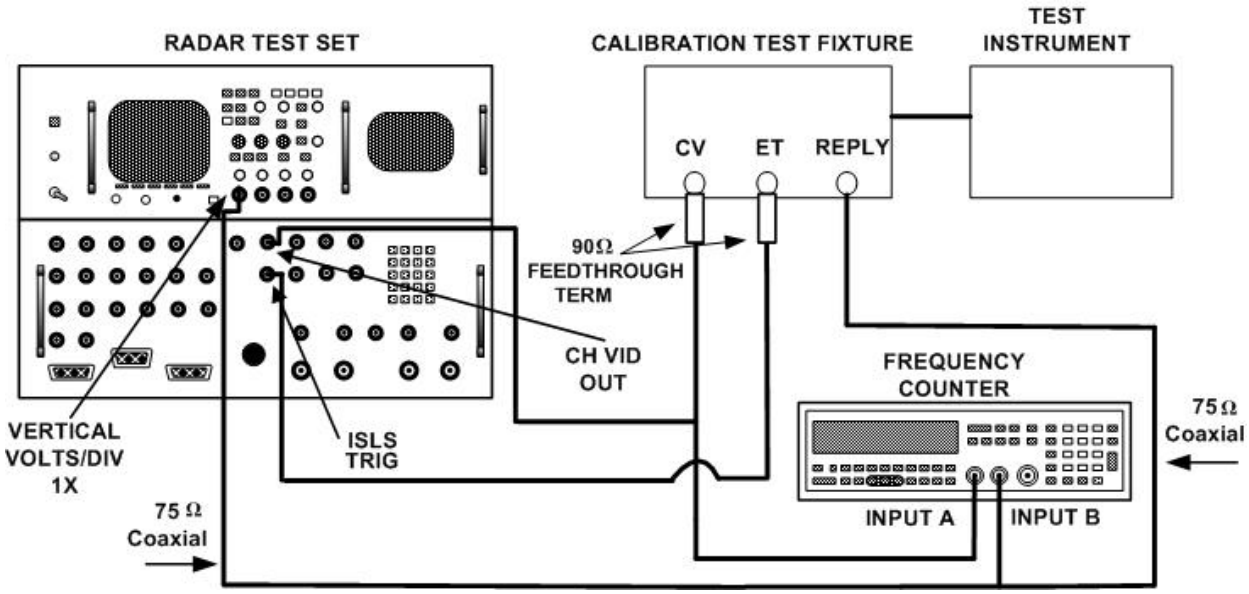

Figure 2. KIT/KIR - equipment setup.

(3) Position frequency counter controls as listed in (a) through (g) below:

(a) Press **MENU**, press **<FUNCTION>** to select **TIME A – B**. Press **MENU**.

(b) Press **TIME**, press **<FUNCTION>** for a gate time of **10mS**. Press **ENTER**.

(c) **INPUT A** and **B**.

(d) **50Ω / 1 MΩ** το **1M, TRIGGER LEVEL AUTO** deselected**, 1X / 10X** to **10X**.

(e) ⎍/⎍ (slope) to ⎍ .

(f) **AC/DC** to **DC**.

(g) **INPUT B COM A** deselected.

(4) On radar test set, position oscilloscope as listed in (a) through (d) below:

(a) **VERTICAL VOLTS/DIV** (channel 1) set to **2.00 V**.

(b) **HORIZONTAL TIME/DIV** set to **2 ms**.

(c) **TRIGGER SOURCE** set to **1**.

(d) **TRIGGER SLOPE** set to positive.

(5) On radar test set, press pushbuttons as listed in (a) through (c) below:

(a) On radar test set, press pushbutton **FUNC, ENTR**. Wait a second and press **ENTR** pushbutton and then press **ENTR** pushbutton again**.** Select menu **CHALLENGES** (highlighted) and press pushbuttons as listed in 1 through 6 below:

1 **M4: WORD A**.

2 **S1: ON**.

3 **S2: ON**.

4 **S3: ON**.

5 **S4: ON**.

6 **S5: ON**.

(b) Select menu **PRF/PRI** (highlighted) and press pushbuttons as listed in 1 through 3 below:

1 **PRF: 3700 ENTR (PPS)**.

2 **0 TRIGGER: INTERNAL**.

3 **KIR TRIGGER: INT**.

(c) Select **MENU SELECTIONS** (highlighted).

(6) Adjust frequency counter for a stable reading. Frequency counter will indicate between 206 and 276 μs.

NOTE

If frequency counter does not indicate any count or a stable reading, adjust **INPUT A** and **INPUT B TRIGGER LEVEL** for stable indication.

(7) Adjust oscilloscope controls to view three TI reply pulses on oscilloscope display.

(8) Adjust the oscilloscope controls as required to verify that the three reply pulses have the following characteristics:

(a) Pulse amplitude between 3 and 5 V p.

(b) Pulse width between 0.3 and 0.7 μs.

(c) Risetime of 0.1 μs or less.

(d) Falltime of 0.25 μs or less.

(e) Pulse spacing between 1.7 and 1.9 μs.

(9) On radar test set, select menu **CHALLENGES** (highlighted) and press pushbutton to **M4: WORD B** (highlighted). Press TI pushbutton **CODE SEL** key on **MODE 4** keyboard to select word **B** (**B** light on, **A** light off).

(10) Adjust oscilloscope controls to verify three reply pulses on oscilloscope display.

(11) On calibration test fixture, move test cable from **REPLY** jack and connect cable to **DISPARITY** jack.

(12) On radar test set, select menu **CHALLENGES** (highlighted) and press pushbutton to **M4: NORM** to **DISP** (highlighted).

(13) On oscilloscope display, disparity pulse will appear and frequency counter will indicate between 186 and 206 μs.

NOTE

If frequency counter does not indicate any count or a stable reading, adjust **INPUT A** and **INPUT B TRIGGER LEVEL** for stable indication.

(14) Adjust oscilloscope controls as required to measure the disparity pulse for the following characteristics below:

(a) Pulse amplitude between 3 and 5 V p.

(b) Pulse width between 0.35 and 0.95 ms.

(c) Risetime of 0.15 ms or less.

(d) Falltime of 0.5 ms or less.

(15) Observe **SLS** (highlighted) indicator on TI **MODE 4** keyboard. On radar test set, press pushbutton **S5: OFF** (highlighted). **SLS** indicator light will go off.

(16) On radar test set, press pushbutton **S5: ON** (highlighted). **SLS** indicator light will go on.

(17) On radar test set, press pushbutton **M4: DISP** to **NORM** (highlighted) and **M4: OFF** (highlighted).

(18) Press TI **CODE SEL** key on **MODE 4** keyboard to select word **A** (**B** light off, **A** light on).

(19) Set TI switches on **MODE 4** panel to **OUT** position as listed in (a) through (d) below:

(a) **VIDEO** (located above **VIDEO** jack on **MODE 4** panel).

(b) **TRIG** (located above **TRIG** jack on **MODE 4** panel).

(c) **REPLY** (located above **REPLY** jack on **MODE 4** panel).

(d) **DISPARITY** (located above **DISPARITY** jack on **MODE 4** panel).

b. Adjustments. No adjustments can be made.

11. Counter/Decoder Test

a. Performance Check

(1) On radar test set, press pushbutton **FUNC, ENTR**. Wait a second and press **ENTR** pushbutton and then **ENTR** pushbutton again.

(2) Connect equipment as shown in figure 3.

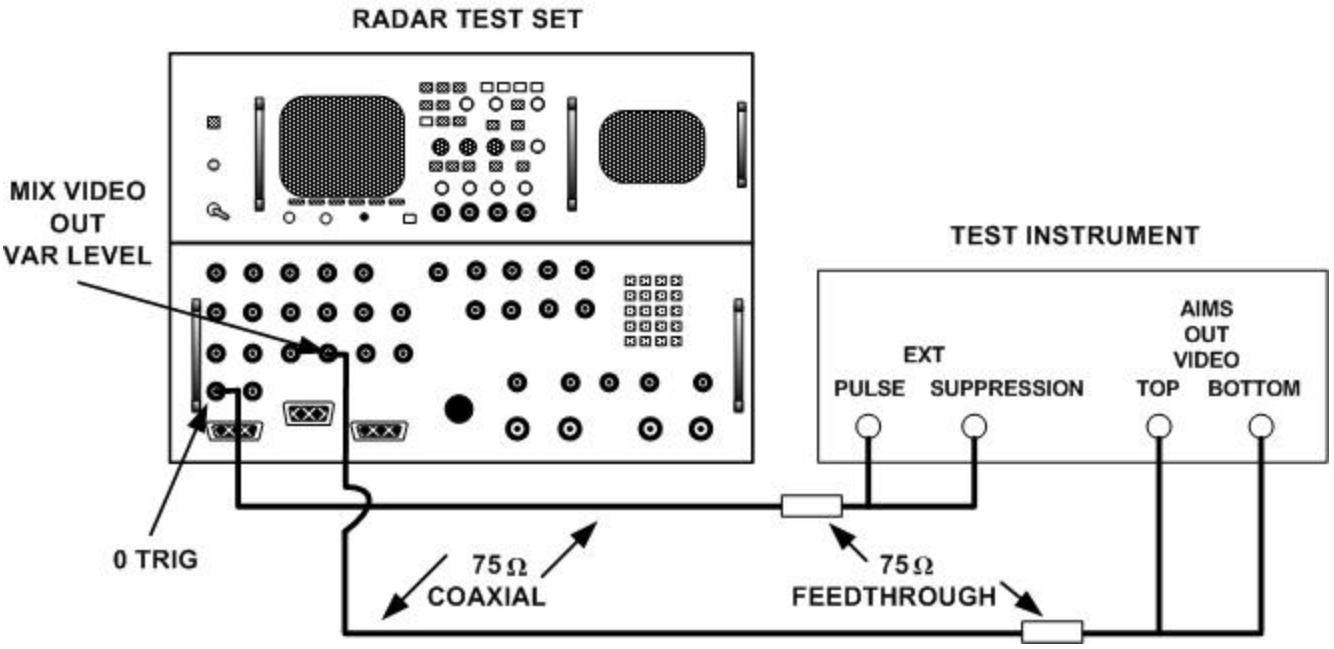

Figure 3. Counter/decoder - equipment setup.

(3) On radar test set, press pushbuttons as indicated in (a) through (e) below:

(a) Starting from **MENU SELECTIONS** (highlighted), select menu **CHALLENGES** (highlighted) and press pushbuttons as listed in 1 through 3 below:

1 **M1: ON**.

2 **P1: ON**.

3 **P3: ON**.

(b) Select menu **1ST REPLY** (highlighted) and press pushbuttons as listed in 1 through 7 below:

1 **M1: 1111 ON**.

2 **M2: OFF**.

3 **M3/A: OFF**.

4 **MC: OFF**.

5 **RANGE DELAY: 0 mS**.

6 **CHAL SOURCE: INTERN**.

7 **SIF2: OFF**.

(c) Select menu **TIMING, VIDEO LEVELS** (highlighted) and press pushbutton as required to indicate **MIXED VIDEO: 3V**.

(d) Select menu **MIXED VIDEO** (highlighted) and press pushbuttons as listed in 1 and 2 below:

1 **2ND REPLY: OFF**.

2 **DEMOD: OFF**.

(e) Select menu **PRF/PRI** (highlighted) and press pushbuttons as listed in 1 through 3 below:

1 **PRF: 1000 PPS**.

2 **0 TRIGGER: INTERNAL**.

3 **KIR TRIGGER: INT**.

(4) Press **TOP-EXT PULSE** and **BOT-EXT PULSE** keys on TI **DISPLAY** keyboard. Top and bottom **EXT PULSE** display will indicate 1000 Hz ±1 count indication.

(5) Press **TOP-SIF DCD** and **BOT-SIF DCD** keys on TI **DISPLAY** keyboard. TI top and bottom **SIF CODE** display will indicate **1111**.

(6) On radar test set, select menu **1ST REPLY** and press pushbutton **M1:**, as listed in table 9, to verify TI response to each **SIF CODE**.

Table 9. SIF Code Test

Radar test set **M1:** pushbutton settings	Test instrument top and bottom **SIF CODE** displays
2222	2222
3333	3333
4444	4444
5555	5555
6666	6666
7777	7777
0000	0000

(7) On radar test set, press pushbuttons **F2: OFF** and **SIF2: OR**.

(8) On radar test set, select menu **2ND REPLY** (highlighted) and press pushbutton **SIF CODE: 0000**, **DELAY: 20.35 μS**, and **F2: OFF**.

(9) Verify TI top and bottom displays indicate **SIF CODE 0000**.

(10) On radar test set, select **DELAY: 20.35 μS** (highlighted).

(11) On radar test set, press and release **INC** pushbutton as required until TI **SIF CODE 0000** disappears. Radar test set **DELAY:** will not indicate greater than 20.5 μS.

(12) On radar test set, set **DELAY: 20.35 μS** (highlighted).

(13) On radar test set, press and release **DEC** pushbutton as required until TI **SIF CODE 0000** disappears. Radar test set **DELAY:** will not indicate less than 20.1 μS.

(14) On radar test set, press pushbuttons as indicated in (a) through (b) below:

(a) Select menu **CHALLENGES** (highlighted)**,** press pushbuttons **M1: OFF** and **M3/A: ON**.

(b) Select menu **1ST REPLY** (highlighted) and press pushbuttons as listed 1 through 6 below:

1 **REPLY SIGNAL: VAR EMERG**.

2 **M1: OFF**.

3 **M3/A: 0000**.

4 **M3/A: ON**.

5 **F2: ON**.

6 **SIF2: OFF**.

(15) Press TI **EMER** on **TRANSPONDER CONTROL** keyboard. Top and bottom displays will indicate **SIF CODE 0000 E**.

(16) Press TI **NORM** key on **TRANSPONDER CONTROL** keyboard. **E** will disappear from top and bottom displays and **TRANSPONDER CONTROL I/P** indicator will light.

(17) On radar test set, press pushbutton **REPLY SIGNAL: SIF + X.** TI top and bottom displays will indicate **SIF CODE 0000X** and **TRANSPONDER CONTROL I/P** indicator light will go out.

(18) On radar test set, press pushbuttons as indicated in (a) through (f) below:

(a) Select menu **CHALLENGES** (highlighted) and press pushbuttons as listed in 1 through 3 below:

1 **M2: ON**.

2 **M3/A: OFF**.

3 **P3: OFF**.

(b) Select menu **1ST REPLY** (highlighted) and set pushbutton as listed in 1 through 3 below:

1 **REPLY SIGNAL: OFF**.

2 **M3/A: OFF**.

3 **F2: OFF**.

(c) Select menu **TIMING, VIDEO LEVELS** (highlighted), and press pushbutton **P3 DELAY: 38 μS**.

(d) Select menu **VARIABLE PULSES** (highlighted) and press pushbuttons as listed in 1 through 7 below:

1 Under **VP1: ON**.

2 **PW: 0.50 μS**.

3 **DL: 34.6 μS**.

4 **OR CHALLENGE: YES**.

5 **VP2: ON**.

6 **PW: 0.50 μS**.

7 **DLY: 36.4 μS**.

(e) Select menu **MIXED VIDEO** (highlighted) and press pushbuttons as listed in 1 through 3 below:

1 **OUTPUT PW: VARIABLE**.

2 **CHAL & TAG: ON**.

3 **1ST REPLY: OFF**.

(f) On radar test set, select menu **PRF/PRI** (highlighted) and press pushbutton to **PRF: 500 PPS**.

(19) Press TI **TOP-M-4 REPLY** and **BOT-M-4 REPLY** keys on **DISPLAY** keyboard.

(20) Verify TI top and bottom displays indicate **M4 RPLY 0500 Hz** ±1 count indication.

(21) On radar test set, select menu **VARIABLE PULSES** (highlighted), then select **VP2:** and press pushbutton to **DLY: 36.4 µS** (highlighted).

(22) On radar test set, press and release **INC** pushbutton as required until TI top and bottom display **M4 RPLY 0500 Hz** drifts or changes to **0000 Hz**. Record **VP2:, DLY:** display indication on radar test set.

(23) On radar test set, select menu **VARIABLE PULSES** (highlighted), then select **VP2:** and set pushbutton to **DLY: 36.4 µS** (highlighted).

(24) Press and release **DEC** pushbutton as required on radar test set until TI top and bottom display **M4 RPLY 0500 Hz** drifts or changes to **0000 Hz**. Record **VP2:, DLY:** display indication on radar test set.

(25) Difference between recorded values in steps (22) and (24) above will not be greater than 0.7 µS.

(26) On radar test set, press pushbutton **FUNC, ENTR**. Wait a second and press **ENTR** pushbutton and then press **ENTR** again, and disconnect all cables.

b. Adjustments. No adjustments can be made.

12. Programmable Attenuator Accuracy Test

a. Performance Check

(1) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN BOT** key.

(2) Enter **990** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **99.0 dBM***.

(3) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN TOP** key.

(4) Enter **200** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **20.0 dBM***.

(5) Setup measuring receiver to measure power, Zero and Calibrate the sensor module.

(6) Connect TI attached 50 W load to **BOT ANT** connector.

(7) Setup signal generator for frequency of 1030 MHz at 0 dBm with **RF OUTPUT** off.

(8) Connect signal generator external reference output (rear panel) to measuring receiver external reference input (rear panel).

(9) Connect signal generator **RF OUTPUT** with 50 W cable to measuring receiver sensor module.

(10) On signal generator turn **RF OUTPUT** on.

(11) Setup measuring receiver for **Tuned RF Level**. Set signal generator to 0.0 dBm.

(12) On signal generator turn **RF OUTPUT** off.

(13) Disconnect measuring receiver sensor module from signal generator and connect sensor module to TI **TOP ANT**.

(14) Connect signal generator **RF OUTPUT** to TI **RF,** using 50 W coaxial cable.

(15) On signal generator turn **RF OUTPUT** on.

(16) On measuring receiver select **RATIO** function.

(17) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN TOP** key.

(18) Enter **300** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **30.0 dBm***.

(19) Measuring receiver will indicate between -8.75 and -11.25 dBm.

(20) Press in **ATTEN TOP** settings on TI **CODE/ATTEN SELECT** keyboard to values listed in table 10. Measuring receiver will indicate within limits listed.

Table 10. Programmable Attenuator

Test instrument		Measuring receiver indications (dB)	
ATTEN TOP (BOT) key settings	Display indications (dBm)	Min	Max
400	40.0*	-21.25	-18.75
500	50.0*	-31.25	-28.75
550	55.0*	-36.25	-33.75
650	65.0*	-45.75	-44.25
710	71.0*	-51.5	-50.5
720	72.0*	-52.5	-51.5
730	73.0*	-53.5	-52.5
740	74.0*	-54.5	-53.5
750	75.0*	-55.5	-54.5
760	76.0*	-56.5	-55.5
770	77.0*	-57.5	-56.5
780	78.0*	-58.5	-57.5
790	79.0*	-59.5	-58.5
830	83.0*	-63.75	-62.25
880	88.0*	-69.65	-66.35

(21) On signal generator turn **RF OUTPUT** off.

(22) On measuring receiver deselect **RATIO** function.

(23) Disconnect measuring receiver sensor module from TI **TOP ANT** connector.

(24) Move TI attached 50 Ω load from **BOT ANT** to **TOP ANT** connector.

(25) Connect measuring receiver sensor module to TI **BOT ANT** connector.

(26) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN TOP** key.

(27) Enter **990** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **99.0 dBM***.

(28) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN BOT** key.

(29) Enter **200** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **20.0 dBM***.

(30) On signal generator turn **RF OUTPUT** on.

(31) On measuring receiver select **RATIO** function.

(32) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN BOT** key.

(33) Enter **300** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI **ATT BOT** display will indicate **30.0 dBm***.

(34) Measuring receiver will indicate between -8.75 and -11.25 dBm.

(35) Press **ATTEN BOT** key on TI **CODE/ATTEN SELECT** keyboard to values listed in table (10). Measuring receiver will indicate within limits listed.

(36) On signal generator turn **RF OUTPUT** off.

b. Adjustments. No adjustments can be made.

13. Interrogation Path Attenuator Reference Test

a. Performance Check

(1) Disconnect measuring receiver sensor module from TI **BOT ANT** connection.

(2) Move TI attached 50 W load from **TOP ANT** to **BOT ANT** connector**.**

(3) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN BOT** key.

(4) Enter **990** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **99.0 dBM***.

(5) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN TOP** key.

(6) Enter **750** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **75.0 dBM***.

(7) Disconnect 50 W coaxial cable at TI **RF** and connect measuring receiver sensor module to end of the cable.

(8) On measuring receiver deselect **RATIO** function.

(9) On signal generator turn **RF OUTPUT** on.

(10) Set up measuring receiver for **Tuned RF Level**.

(11) On measuring receiver select **RATIO** function.

(12) On signal generator turn **RF OUTPUT** off.

(13) Disconnect 50 W coaxial cable at measuring receiver sensor module and connect end of the coaxial cable to TI **RF**.

(14) Connect measuring receiver sensor module to TI **TOP ANT** connection.

(15) On signal generator turn **RF OUTPUT** on.

(16) If measuring receiver does not indicate between -64.5 and -65.5 dBm, perform **b** (1) below.

(17) On signal generator turn **RF OUTPUT** off.

(18) Disconnect measuring receiver sensor module from TI **TOP ANT** connection.

(19) Move TI attached 50 W load from **BOT ANT** to **TOP ANT** connector.

(20) Connect measuring receiver sensor module to TI **BOT ANT** connection.

(21) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN BOT** key.

(22) Enter **750** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **75.0 dBM***.

(23) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN TOP** key.

(24) Enter **990** with **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **99.0 dBM***.

(25) On signal generator turn **RF OUTPUT** on.

(26) If measuring receiver does not indicate between -64.5 and -65.5 dBm, perform **b** (2) below.

(27) On measuring receiver deselect **RATIO** function.

(28) On signal generator turn **RF OUTPUT** off.

(29) Disconnect measuring receiver sensor module from TI **BOT ANT** connection.

b. Adjustments

(1) Remove adapter-signal divider from TI case and adjust R8 (located on right side of chassis) for an indication between -64.5 and -65.5 dBm (R) on measuring receiver.

(2) Remove adapter signal divider from TI case and adjust dip switches (located at top of right side of adapter-signal divider) for an indication between -64.5 and -65.5 dBm (R) on measuring receiver.

NOTE

After each TI **DIP** switch setting, it will be necessary to reset the TI by pressing **ATTEN BOT, 7, 5, 0,** and **ENTER** keys, in that sequence, before the measuring receiver will display a new dBm indication.

14. Reply Path Insertion Loss Test

a. Performance Check

(1) Disconnect 50 W coaxial cable at TI **RF** and connect measuring receiver sensor module to end of the cable.

(2) On TI **CODE/ATTEN SELECT** keyboard, press **ATTEN BOT** key.

(3) Enter **990** using the **CODE/ATTEN SELECT** numeric keys and press **ENTER** key. TI display will indicate **99.0 dBM***.

(4) Set TI **NORMAL, REPLY PWR/FREQ** switch to down position.

(5) Set up signal generator frequency for 1090 MHz.

(6) On signal generator turn **RF OUTPUT** on.

(7) Set up measuring receiver for **Tuned RF Level**.

(8) On measuring receiver select **RATIO** function.

(9) On signal generator turn **RF OUTPUT** off.

(10) Disconnect 50W coaxial cable at measuring receiver sensor module and connect end of cable to TI **BOT ANT**.

(11) Connect measuring receiver sensor module to TI **RF**.

(12) On signal generator turn **RF OUTPUT** on.

(13) If measuring receiver does not indicate between -18.0 and -21.0 dB, and within ±0.5 dB of value (BOT 137) recorded on calibration label (located near **REPLY ATTEN** switch), perform **b** (1) through (7) below.

NOTE

If measuring receiver indications are within specified limits and if calibration label (located near **REPLY ATTEN** switch) does NOT have any values, record actual receiver indications on calibration label.

(14) Set **REPLY ATTEN** switch to down position. If measuring receiver does not indicate -6 dB or less and within ±0.5 dB of value (BOT 305) recorded on calibration label (located near **REPLY ATTEN** switch), record measuring receiver indication and perform **b** (8) below.

(15) On signal generator turn **RF OUTPUT** off.

(16) Disconnect TI attached 50 Ω load from **TOP ANT**.

(17) Disconnect signal generator 50 Ω coaxial cable from TI **BOT ANT** and connect cable to **TOP ANT**.

(18) Connect TI attached 50 Ω load to **BOT ANT** connector**.**

(19) On signal generator turn **RF OUTPUT** on.

(20) If measuring receiver does not indicate -6 dB or less and within ±0.5 dB of value (TOP 305) recorded on calibration label (located near **REPLY ATTEN** switch), record measuring receiver indication and perform **b** (8) below.

(21) Set **REPLY ATTEN** switch to up position. If measuring receiver does not indicate between -18.0 and -21.0 dB and within ±0.5 dB of value (TOP 137) recorded on calibration label (located near **REPLY ATTEN** switch), perform **b** (l) through (7) below.

(22) On signal generator turn **RF OUTPUT** off.

b. Adjustments

NOTE

Ensure signal generator with 50 Ω coaxial cable is connected to TI **BOT ANT** and measuring receiver sensor module is connected to TI **RF**.

(1) Set TI power switch off and remove adapter-signal-divider from TI case.

(2) Set TI power switch on and allow sufficient time to warm-up.

(3) Set **NORMAL, REPLY PWR/FREQ** switch to down position and **REPLY ATTEN** switch to up position.

(4) Adjust R10 (located on right side of chassis) for a measuring receiver indication between -18.0 and -21.0 dB.

(5) Disconnect signal generator 50 Ω coaxial cable from TI **BOT ANT** and reconnect cable to **TOP ANT**. Adjust R10 (located on right side of chassis) for a measuring receiver indication between -18.0 and -21.0 dB.

(6) Disconnect signal generator 50 Ω coaxial cable from TI **TOP ANT** and reconnect cable to TI **BOT ANT** and repeat (3) through (5) above for best compromise.

(7) If **b** (1) through (5) indications are within tolerance, post new values for BOT 137 and TOP 137 on TI calibration label (located near **REPLY ATTEN** switch).

(8) Record new values of BOT 305 and TOP 305 recorded in **a** (14) and (20) above on TI calibration label (located near **REPLY ATTEN** switch).

15. Cable Insertion Loss Test

a. Performance Check

(1) In TI transit cover, remove two W4 cables and one W5 cable from storage compartment.

(2) On measuring receiver deselect **RATIO** function.

(3) Disconnect measuring receiver sensor module from TI **RF** and connect sensor module to signal generator **RF OUTPUT,** using N and BNC connector adapters.

(4) On signal generator turn **RF OUTPUT** on.

(5) Setup measuring receiver for **Tuned RF Level**.

(6) On measuring receiver select **RATIO** function.

(7) On signal generator turn **RF OUTPUT** off.

(8) Connect one end of W4 cable to signal generator **RF OUTPUT** and connect the other end of W4 cable to measuring receiver sensor module, using (TNC to BNC) connector adapter.

NOTE

TNC to BNC adapter is supplied with AN/UPM 155 connector box.

(9) On signal generator turn **RF OUTPUT** on.

(10) If measuring receiver does not indicate within ±0.l dB of calibration value posted on cable, record measuring receiver indication and perform **b** below.

(11) On signal generator turn **RF OUTPUT** off.

(12) Disconnect cable from setup.

(13) Repeat (8) through (12) above for the second W4 and W5 cables.

(14) Ensure that signal generator **RF OUTPUT** is off.

(15) On measuring receiver deselect **RATIO** function.

(16) Connect measuring receiver sensor module directly to signal generator **RF OUTPUT**.

(17) Set up signal generator frequency for 1030 MHz.

(18) On signal generator turn **RF OUTPUT** on.

(19) Set up measuring receiver for **Tuned RF Level**.

(20) On measuring receiver select **RATIO** function.

(21) On signal generator turn **RF OUTPUT** off.

(22) Connect one end of W4 cable to signal generator **RF OUTPUT** and connect the other end of W4 cable to measuring receiver sensor module, using (TNC to BNC) connector adapter.

(23) On signal generator turn **RF OUTPUT** on.

(24) If measuring receiver does not indicate within ±0.l dB of calibration value posted on cable, record measuring receiver indication and perform **b** below.

(25) On signal generator turn **RF OUTPUT** off.

(26) Disconnect cable from setup.

(27) Repeat (22) through (26) above for the second W4 and W5 cables.

(28) On signal generator turn **RF OUTPUT** off.

b. Adjustments. On TI cable, change the calibration label to read the measuring receiver recorded values in (a) above to indicate frequency and insertion loss.

16. VSWR

a. Performance Check

(1) On measuring receiver deselect **RATIO** function.

NOTE
Ensure signal generator **RF OUTPUT** is off.

(2) Connect measuring receiver sensor module to signal generator **RF OUTPUT**.

(3) Set signal generator output for 1090 MHz.

(4) On signal generator turn **RF OUTPUT** on.

(5) Setup measuring receiver for **TUNED LEVEL POWER**. Set signal generator to 0.0 dBm.

(6) On signal generator turn **RF OUTPUT** off.

(7) Disconnect measuring receiver sensor module from signal generator **RF OUTPUT**.

(8) Connect VSWR bridge **RF INPUT** to signal generator **RF OUTPUT**.

(9) Connect short to VSWR bridge device under test.

(10) Connect measuring receiver sensor module to SWR bridge **REFLECTED RF OUTPUT**.

(11) On signal generator turn **RF OUTPUT** on.

(12) On measuring receiver select **RATIO** function.

(13) Disconnect short from VSWR bridge and record indication on measuring receiver to include the positive or negative sign.

(14) Connect mismatch unit (4049398) to VSWR bridge and record indication on measuring receiver.

(15) If value recorded in (13) above is a negative number, see example in paragraph (a) below. If value recorded in (13) above is a positive number, see example in paragraph (b) below.

(a) EXAMPLE A. If value of (13) above is (-.42 divided by 2) = -.21 (subtract from value recorded in (14) above).

If value of (14) above is: -5.31
- -.21
Return loss is: -5.1 dB

(b) EXAMPLE B. If value of (13) above is (+.42 divided by 2) = .21 (invert sign and add to value recorded in (14) above).

If value of (14) above is: -5.31
+ -.21
Return loss is -5.52 dB

(16) Repeat technique of (1) through (15) above three times and average value. Return loss value for mismatch unit (4049398) will be between -5.105 and -5.435 dB.

(17) On measuring receiver deselect **RATIO** function.

(18) Repeat technique of (1) through (15) for termination (4049397). Return loss will be -26.45 dB or greater (more negative).

(19) On signal generator turn **RF OUTPUT** off.

b. Adjustments. No adjustments can be made.

17. Final Procedure

a. De-energize and disconnect all equipment.

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

By Order of the Secretary of the Army:

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

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0719047

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 343470, requirements for calibration procedure TB 9-4920-456-24.

INSTRUCTIONS FOR SUBMITTING AN ELECTRONIC 2028

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

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

Subject: DA Form 2028

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

This is the text for the problem below line 27.

PIN: 085032-000