DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR RADAR DATA RECEIVING SET TEST SET AN/GKM-2A (NSN 6625-00-926-4393)

Headquarters, Department of the Army, Washington, D.C.
28 July 1975

SECTION I
INTRODUCTION AND DESCRIPTION

1-1. Purpose and Scope. This bulletin provides information for the periodic calibration of Radar Data Receiving Set Test St AN/GKM-2A (fig. 1). It is to be used by personnel trained and qualified in the use of calibration equipment. Since calibration personnel are trained and qualified in the usage of test and measuring equipment, detailed instructions concerning the operation and use of these equipments are not contained in this bulletin.

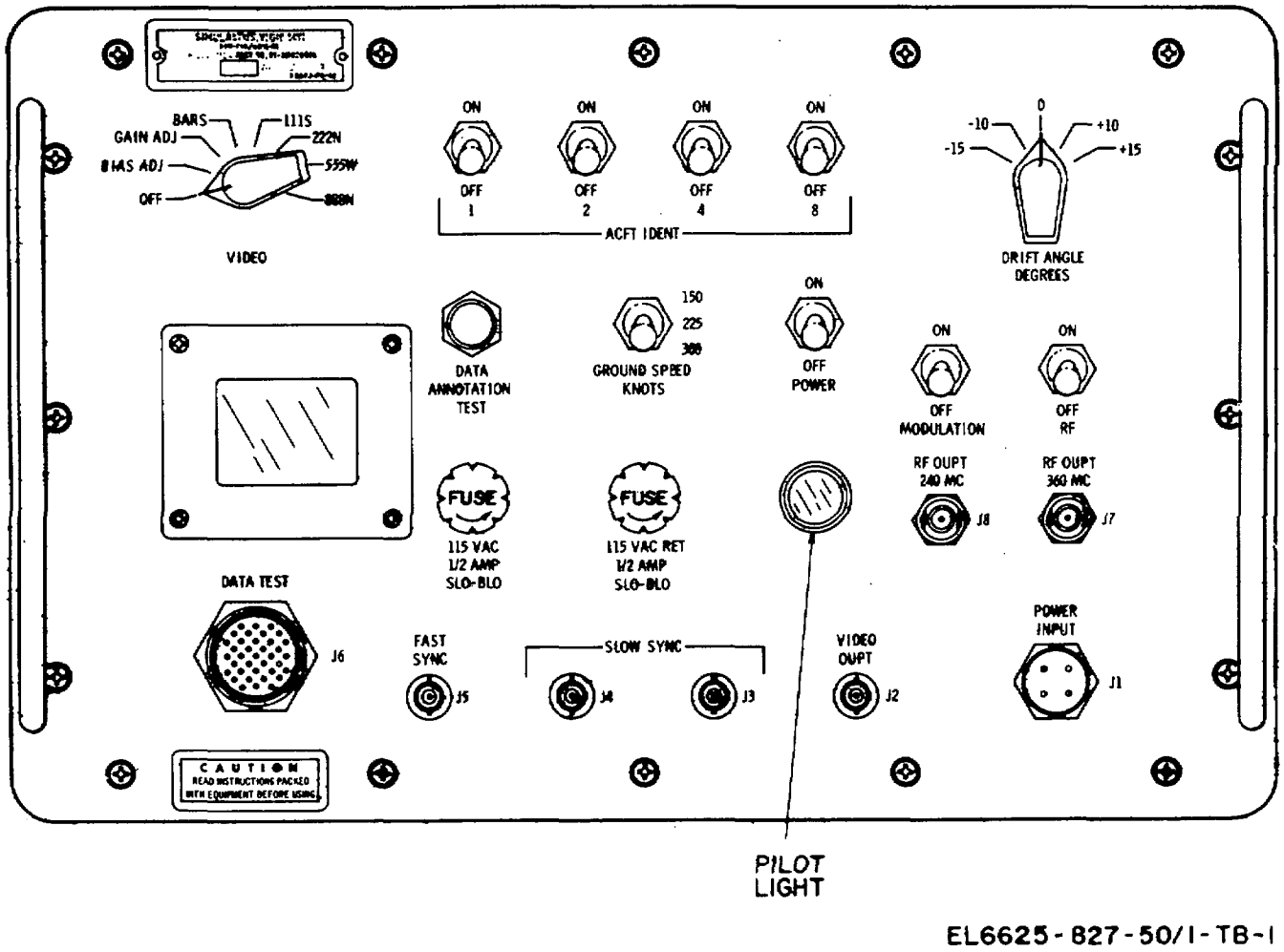


Figure 1. Radar Data Receiving Set Test Set, AN/GKM-2A, front panel view.

1-2. Reporting of Technical Bulletin Improvements. The reporting of errors, omissions, and recommendations for improving this bulletin is authorized and encouraged. Submit reports on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commander, US Army Electronics Command, ATTN: AMSEL-MA-CQA, Fort Monmouth, NJ 07703.

1-3. Descriptive Data. Radar Data Receiving Set Test Set AN/GKM-2A is an rf and data signal generator used to test Radar Data Receiving Sets AN/TKQ-1 and AN/TKQ-2 (data receiving set). It is also used to monitor the output of the AN/TKQ-2 data annotation converter (Converter-Storer, Signal Data CV-2093/TKQ-2). Additional data is listed in *a*, *b*, and *c* as follows:

a. Identification.

Nomenclature ..... Test Set, Receiving Set, Radar Data AN/GKM-2A
National stock number 6625-00-926-4393
Size ..... 18.7 x 13.56 x 19.62 in.
Weight ..... 62.50 lbs
References ..... TM 11-6625-827-12, TM 11-6625-827-45

b. Specifications.

Input voltage requirements ..... 115 volts alternating current, 50-420 Hz
Power consumption ..... Approximately 40 watts
Output signals:
- Video signal ..... A recurring video signal consisting of different combinations of the following:
  - Groundspeed tone burst (sine wave):
    - Frequency ..... 14.5 kHz
    - Width ..... 5 ms (150 kn), 6.875 ms (225 kn) 11.25 ms (300 kn)
    - Amplitude ..... 13 volts pp
  - Drift angle tone burst (sine wave):
    - Frequency ..... 10.5 kHz
    - Width ..... 2.5 ms (-150°), 4 ms (-10°), 6.875 ms (0°), 9.75 ms (+10°), 11.25 ms. (+15°)
    - Amplitude ..... 13 volts pp
  - Aircraft identification tone burst (sine wave):
    - Frequency ..... 1.125 Hz
    - Width ..... 6.875 ms
    - Amplitude ..... 7 volts pp
  - Data annotation tone burst (sine wave):
    - Frequency ..... 8 kHz
    - Width ..... 1 ms
    - Amplitude ..... 20 volts pp
  - Data annotation data word:
    - Pulses ..... 16-bit digital word
  - Bars signal (square wave):
    - Period ..... 8 ms
    - Width ..... 4 ms
    - Amplitude ..... 1 volt pp (1-volt baseline), 5 volts pp (-10-volt baseline)
  - Video gate (pedestal):
    - Width ..... 52 volts
    - Amplitude ..... 2.5 volts
    - Baseline ..... -10 volts
  - Sweep markers pulses).
    - Amplitude ..... 5 volts

RF signals ..... Frequency modulated (with akHz square wave) or unmodulated frequency; 240 MHz, 360 MHz
RF power output ..... -88.5 dB nominal at 240 and 360 MHz Slow syn (square wave):
- Amplitude ..... 10 volts
- Risetime ..... 27 usec (max.)
- Period ..... 277 ms (nominal)

Fast sync:
- Amplitude ..... 10 volts
- Width ..... 1 ms

c. Calibration.

Time required ..... 5 hours (approximately)
Technique ..... Dc-low frequency
Interval ..... In accordance with TB 43-180

1-4. General Instructions. *a. Calibration Reporting.* During the performance of this procedure, annotate DA Form 2416 (Calibration Data Card)in accordance with TM 38-750.

b. Test Instrument. Radar Data Receiving Set Test Set AN/GKM-2A will be referred to as the Test Instrument.

1-5. Difference among Models. There are slight differences of components and test point locations on the printed circuit boards.

SECTION II
EQUIPMENT REQUIREMENTS
NOTE

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

2-1. Equipment Required. Equipment required for calibration performance tests is listed in table 2-1.

2-2. Accessories Required. Accessories required for calibration performance tests are listed in table 2-2

Table 2-1. Equipment Required

Item No.	Common Name	Minimum use specifications	Calibration[1] equipment
A1	Frequency Counter	Range 0 to 360 MHz Accuracy: 0.004%	S-D, Model 1037M (7910823) with S-D, Model 1948A (7910824) and S-D, Model 1292 (7910648)
A2	Signal Generator	Range: 240 and 360 MHz ±1 kHz (deviation) Accuracy: ±1.5 dB (output), ±3% (deviation)	H-P, Model 608 (8598927-1) or (8598927-3)
A3	Oscilloscope	Range: Dc to 10 MHz Accuracy: ±3%	Tek, Model RM561A (7910655-4) with 3A6 (7911441-2) and 3B (7912040-2)
A4	Spectrum Analyzer	Range: 240 and 360 MHz, -93 to 0 dB (sensitivity) Accuracy: ±0.1 dB	Tek Model 491 (M1S10218)

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

Table 2-2. Accessories Required

Item nr.	Common name	Description
B1	Adapter (MS35173) (2 required)	BNC tee type, 2 jacks, 1 plug
B2	Cable Assembly (2 required) (10519140)	48 in., RG-58A/U BNC plug terminations.
B3	Cable Assembly (2 required)	BNC plug to N type connector. (p/o test instrument)[1]
B4	Cable Assembly (7909410)	BNC plug to 2 alligator clips.

[1]Some Test Instruments are equipped with cables with BNC plugs, both ends. Use Adapter BNC female to N type male (10519457) for those instruments.

SECTION III
PRELIMINARY OPERATIONS
NOTE

It is recommended that personnel familiarize themselves with the entire procedure before performing calibration.

3-1. Preparations. *a.* Remove Test Instrument from protective case.

b. Connect SLOW-SYNC jack to oscilloscope (A3) vertical input, using test cable B2.

3-2. Preliminary Control Settings. *a.* Set VIDEO switch to OFF.

b. Set ACFT IDENT switches to OFF.

c. Set DRIFT ANGLE DEGREES switch to OFF.

d. Set GROUND SPEED KNOTS switch to 150.

e. Set MODULATION switch to OFF.

f. Set RF switch to OFF.

g. Turn on test equipment and allow 15 minutes to warm up.

h. Set POWER switch to ON. Check that plot lamp is lit in either bright or dim position.

SECTION IV
CALIBRATION PROCESS

4-1. Slow and Fast Sync Tests. *a. Performance Check.*

(1) Adjust oscilloscope (A) controls to provide internal positive synchronization.

(2) Check positive going slow sync pulse for an amplitude of 8 to 12 volts peak-to-peak (figure 2, A).

NOTE

Some oscilloscopes may not show the vertical traces or overshoot as depicted in the figures in this bulletin.

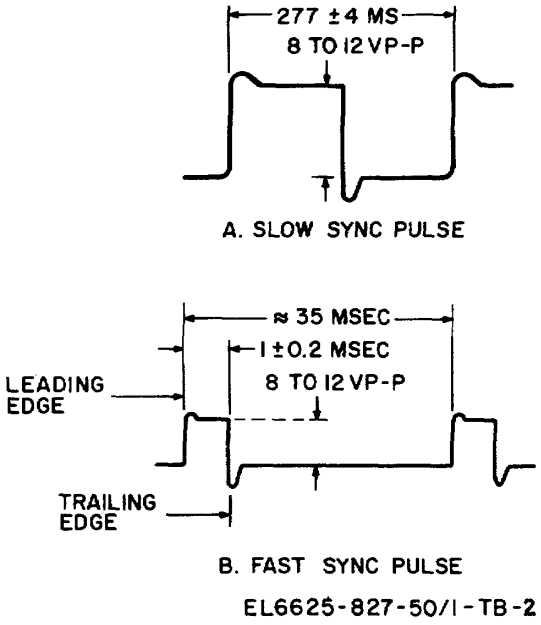


Figure 2. Typical Sync pulse output signals.

(3) Disconnect cable from oscilloscope vertical input and connect to frequency meter (A1) input.

(4) Check the frequency meter for a reading of 280.97 to 273.00 milliseconds.

(5) Disconnect cable from frequency meter input and connect to oscilloscope delayed trigger input.

(6) Connect cable between oscilloscope vertical input and FAST SYNC jack J5.

(7) Adjust the oscilloscope controls to display the fast sync pulse. Use delayed positive trigger.

(8) Check positive-going fast sync pulse (see figure 2, B) for a amplitude of 8 to 12 volts peak-to-peak.

(9) Check the fast sync pulse for a width of 0.8 to 1.2 msec.

b. Adjustments. No adjustments can be made.

4-2. Ground Speed and Drift Angle Tone Burst Tests. *a. Performance Check.*

(1) Disconnect cable from FAST SYNC jack J5 and connect to VIDEO OUPT jack J2

(2) Connect oscilloscope (A3) delayed trigger input to SLOW SYNC jack.

(3) Adjust oscilloscope to display a ground speed tone burst. Use delayed positive trigger (see figure 3, A).

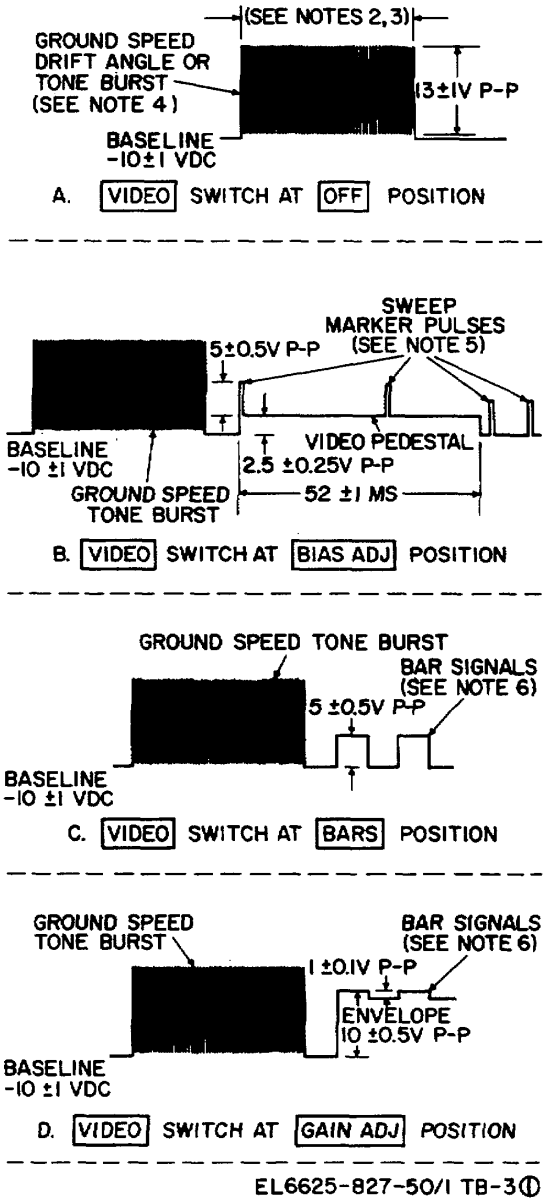
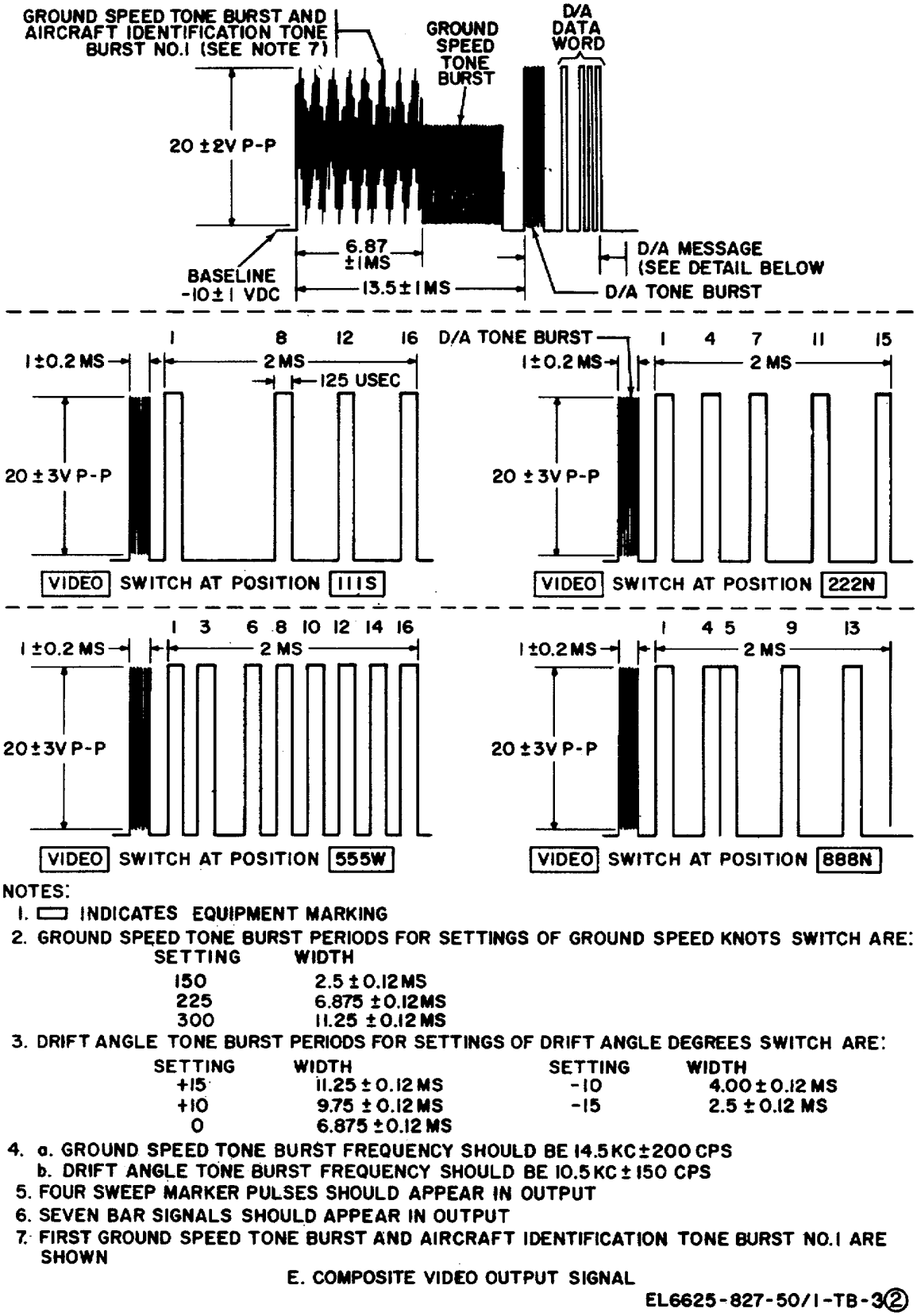


Figure 3.(1). Video output signals.



NOTES:

1. ▭ INDICATES EQUIPMENT MARKING
2. GROUND SPEED TONE BURST PERIODS FOR SETTINGS OF GROUND SPEED KNOTS SWITCH ARE:

SETTING	WIDTH
150	2.5 ±0.12MS
225	6.875 ±0.12MS
300	11.25 ±0.12 MS

3. DRIFT ANGLE TONE BURST PERIODS FOR SETTINGS OF DRIFT ANGLE DEGREES SWITCH ARE:

SETTING	WIDTH	SETTING	WIDTH
+15	11.25 ±0.12 MS	-10	4.00 ±0.12 MS
+10	9.75 ±0.12 MS	-15	2.5 ±0.12 MS
0	6.875 ±0.12 MS		

4. a. GROUND SPEED TONE BURST FREQUENCY SHOULD BE 14.5KC±200 CPS
   b. DRIFT ANGLE TONE BURST FREQUENCY SHOULD BE 10.5KC ± 150 CPS
5. FOUR SWEEP MARKER PULSES SHOULD APPEAR IN OUTPUT
6. SEVEN BAR SIGNALS SHOULD APPEAR IN OUTPUT
7. FIRST GROUND SPEED TONE BURST AND AIRCRAFT IDENTIFICATION TONE BURST NO.1 ARE SHOWN

E. COMPOSITE VIDEO OUTPUT SIGNAL

EL6625-827-50/1-TB-3②

Figure 3.(2). Video output signals, (continued).

(4) Check for ground speed tone burst width of 2.38 to 2.62 msec.

(5) Check for ground speed tone burst amplitude of 12 to 14 volts, peak-to-peak.

(6) Check the de level of the base line for -11 to -9 Vdc (see figure 3, A).

(7) Set the GROUND SPEED KNOTS switch to 225.

(8) Check for a ground speed tone burst width of 6.755 to 6.995 msec.

(9) Recheck amplitude and base level as in steps (5) and (6).

(10) Set GROUND SPEED KNOTS switch to 300.

(11) Check for ground speed tone burst width of 11.13 to 11.37 msec.

(12) Recheck amplitude and base level as in steps (5) and (6) above.

(13) Set GROUND SPEED KNOTS switch to 150.

(14) Adjust oscilloscope to display a drift angle tone burst. Use delayed negative trigger.

(15) Check for drift angle tone burst width of 6.755 to 6.955 msec.

(16) Recheck amplitude and base level as in steps (5) and (6) above.

(17) Set DRIFT ANGLE DEGREES switch to position listed in table 4-1, and check for the corresponding drift angle tone burst width.

NOTE

After each check made in step (17), repeat step (5) and (6).

b. Adjustments. No adjustments can be made.

Table 4-1. Drift Angle Tone Burst Tests

Test Instrument DRIFT ANGLE DEGREES switch setting	Oscilloscope Tone burst width (msec) Minimum	Maximum
-10	3.88	4.12
-15	2.38	2.62
+10	9.63	9.87
+15	11.63	11.87

4-3. Ground Speed and Drift Angle Frequency Tests.

a. Performance Check.

(1) Connect frequency meter (A1) to Test Instrument test point TP4 (identified as E4 TP on some models) located on video generator module A5 (see figure 4).

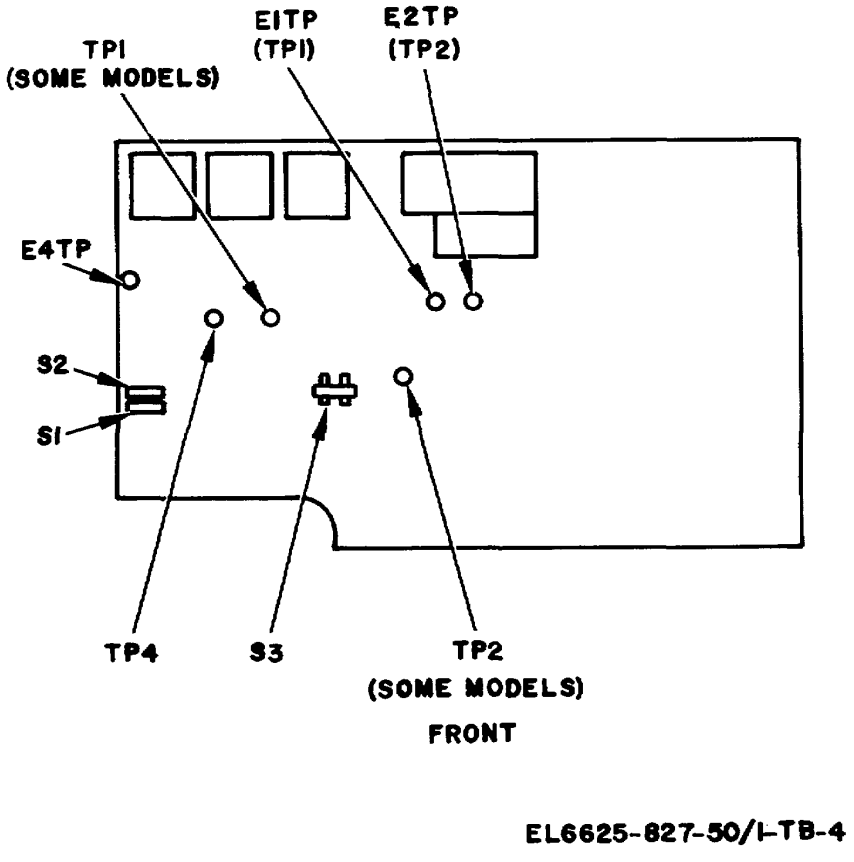


Figure 4. Test Instrument top view, Video generator module A5.

(2) Depress switch S1, located on video generator module A5. Frequency meter should read between 14.38 and 14.62 kHz.

(3) Connect frequency meter to test point TP1 (identified as E1 TP on some models), located on video generator module A5.

(4) Depress switch S2, located on video generator module A5 Frequency meter should read between 10.38 and 10.62 kHz.

b. Adjustments. No adjustments can be made.

4-4. Aircraft Identification Tone Burst Tests. *a. Performance Check.*

(1) Disconnect cable from frequency meter (A1) and A5TPL.

(2) Set GROUND SPEED KNOTS switch to 150.

(3) Set DRIFT ANGLE DEGREES switch to 0.

(4) Set ACFT IDENT switch 1 to ON.

(5) Adjust the oscilloscope (A3) controls to display the multiplexed ground speed and aircraft identification tone bursts. Use positive delayed trigger.

(6) Check for an aircraft identification tone burst width of 5.87 to 7.87 ms.

NOTE

Aircraft identification tone burst is the low frequency component.

(7) Check the aircraft identification tone burst for an amplitude of 18 to 22 volts peak-to-peak (figure 3(2)).

(8) Adjust oscilloscope controls to display four tone bursts.

(9) Check that the aircraft identification tone bursts multiplex with the proper ground speed or drift angle tone burst by setting the ACFT IDENT switches ON and OFF as follows:

(a) ACFT INDENT 1 multiplexes with First ground speed tone burst.

(b) ACFT INDENT 2 multiplexes with Second ground speed tone burst.

(c) ACFT INDENT 4 multiplexes with First drift angle tone burst.

(d) ACFT INDENT 8 multiplexes with Second drift angle tone burst.

(10) Connect frequency meter to test point TP2 (identified as E2TP on some models) located on video generator module A5 (see figure 4).

(11) Depress switch S3, located on video generator module A5 (see figure 4). Frequency meter should read between 1122 and 1128 Hz.

b. Adjustments. No adjustments can be made.

4-5. Data Annotation Tone Burst Test. *a. Performance Check.*

(1) Disconnect cable between frequency meter (A1) and A5TPU.

(2) Adjust oscilloscope (A) controls to display the data annotation tone burst, while repeatedly depressing (to synchronize) DATA ANNOTATION TEST button.

(3) Check the width of the data annotation tone burst for 0.8 to 1.2 ms.

(4) Check the tone burst amplitude for 17 to 23 volts peak-to-peak (figure 3(2), E).

(5) Check the time period from the leading edge of the ground speed tone burst to the leading edge of the data annotation tone burst for 12.5 to 14.5 ms.

b. Adjustments. No adjustments can be made.

4-6. Bias Adjust Test. *a. Performance Check.*

(1) Set the VIDEO switch to BIAS ADJ.

(2) Adjust the oscilloscope (A3) controls to display the video pedestal (figure 4(1), B). Use positive delayed trigger.

(3) Check the video pedestal time period for 51 to 53 ms.

(4) Check the video pedestal for an amplitude of 2.25 to 2.75 volts peak-to-peak.

(5) Using the oscilloscope, check the dc level of the baseline for -11 to -9 Vdc.

(6) Check display for proper number and polarity of sweep markers (figure 4(2), B).

(7) Check the sweep marker amplitude for 4.5 to 5.5 volts peak-to-peak. Do not include the video pedestal in this measurement

b. Adjustments. No adjustments can be made.

4-7. Gain Adjust Test. *a. Performance Check.*

(1) St the VIDEO switch to GAIN ADJ.

(2) Adjust the oscilloscope (A) controls to display the gain adjust signal (figure 4(1), D)

(3) Check the square wave signal amplitude for 0.9 to 1.1 volt, peak-to-peak.

(4) Check the gain adjust envelope amplitude for 9.5 to 10.5 volts peak-to-peak.

(5) Using the oscilloscope, check the dc level of the baseline for -11 to -9 Vdc.

b. Adjustments. No adjustments can be made.

4-8. Bars, 111S, 222N, 555W, and 888N Test. *a. Performance Check.*

(1) Set the VIDEO switch to BARS.

(2) Disconnect cable from oscilloscope (A) delayed trigger input and connect it to oscilloscope trigger input. Use positive trigger slope.

(3) Check bars signal amplitude for 4.5 to 5.5 volts, peak-to-peak (see figure 4(1), C).

(4) Check for 7 positive going bar signals.

(5) Check de level of the baseline for -11 to -9 Vdc, using oscilloscope.

(6) Continue checking the VIDEO at switch positions 111S, 222N, 555W, and 888N for values as specified in figure 3(2).

b. Adjustment. No adjustments can be made.

4-9. Rf Output Level Test. *a. Performance Check.*

(1) Disconnect test setup and replace Test Instrument in its case.

(2) Connect equipment as shown in figure 5.

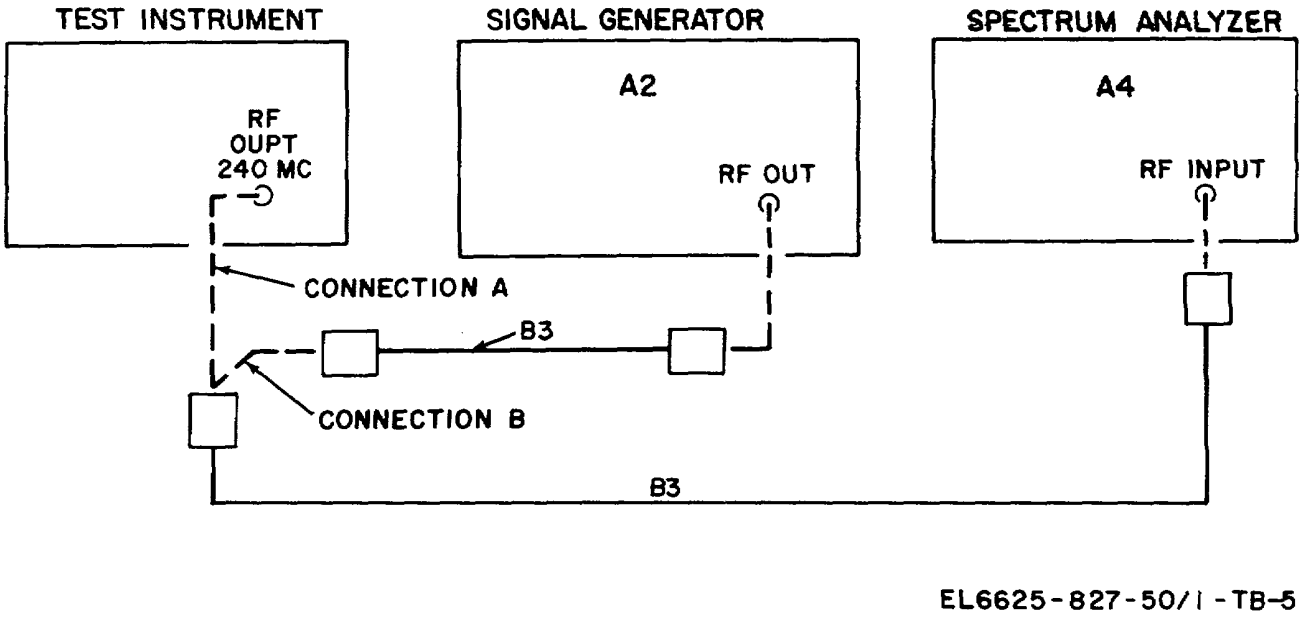


Figure 5. Rf output level test setup.

(3) Set POWER switch to ON.

(4) Set ACFT IDENT switches to OFF.

(5) Set DRIFT ANGLE DEGREES switch to 0.

(6) Set GROUND SPEED KNOTS switch to 150

(7) Set VIDEO switch to OFF.

(8) Set MODULATION switch to OFF.

(9) Set RF switch to ON.

(10) Adjust spectrum analyzer (A4) until Test Instrument 240 MHz signal is displayed and its peak is aligned with top horizontal graticule line.

(11) Disconnect cable from RF OUPT 240 MC jack J8 and connect to signal generator (A2) output.

(12) Adjust Signal generator for a 240 MHz output signal and a full scale indication on the spectrum analyzer. Signal generator output level should be between -84 and -93 dB (5 to 15 uvolts).

(13) Disconnect cable from signal generator output and connect to RF OUPT 360 MC jack J7.

(14) Repeat steps (10) through (13) for 360 MHz. The gain for 360 MHz will be much lower than it was for 240 MHz.

b. Adjustments. No adjustments can be made.

4-10. Rf Frequency Test. *a. Performance Check.*

(1) Connect both frequency counter (A1) and spectrum analyzer (A4) to signal generator (A2) output using adapter (B1).

(2) Adjust signal generator (A2) for minimum output.

(3) Adjust spectrum analyzer (A4) controls to display Test Instrument 240 MHz signal.

(4) Adjust signal generator controls until signal output displayed on spectrum analyzer is equal to Test Instrument signal level.

(5) Adjust signal generator frequency until zero beat is obtained with Test Instrument output signal.

NOTE

Zero beat is evidenced by apparent instability of spectrum analyzer display.

(6) Disconnect Test Instrument. Frequency counter (A1) should indicate between 239.985 and 240.015 kHz.

b. Adjustments. No adjustments can be made.

4-11. Final Procedure. *a.* Deenergize and disconnect all equipment.

b. Replace the Test Instrument protective case.

c. In accordance with TM 38-750, annotate and affix DA Label 80 (US Army Calibration System). When the Test Instrument cannot be adjusted within tolerance, annotate and affix red tag, DA Form 2417 (Unserviceable or Limited Use Tag).

By Order of the Secretary of the Army:

FRED C. WEYAND
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Major General, United States Army
The Adjutant Genera

Distribution:
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