

S 1312

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SHEET 1 OF 38

TITLE:

TEST PROCEDURE

FOR TMC

HFTA-5KJ

REV:

S 1312

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SHEET 2

OF

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1.2 INTRODUCTION

GENERAL:

The TMC series of HFTA-5KJ transmitters are general purpose High Frequency Radio Transmitters capable of providing CW, SSB, ISB operation. The transmitter will supply 5KW average or PEP power. The HFTA-5KJ operates over the frequency range of 2 to 30 MHz.

OBJECTIVE:

The procedures outlined herein are intended to serve as verification of system operation and to insure the compatibility and performance of the various individual modular assemblies which have been completely tested and inspected on an individual basis prior to system integration.

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1.3

A. Mechanical Inspection

1. Check all knobs and switches for proper operation.
2. Carefully check IPA and FA bandswitches for good mechanical condition, obvious miswiring and loose connections.
3. Check power supply for loose connections and correct value of circuit components.

1.4

A. Preliminary Electrical Inspection

1. With main wall breaker OFF, check all three input phases for possible shorts to ground.
2. Check high voltage power supply for possible shorts to ground.
3. Check complete unit for correct value of fuses.
4. Turn ON main power and check P.A. blower, it must turn in same direction as arrow stamped on housing.
5. Set all overloads at proper values.

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2.1 POWER OUTPUT AND VSWR PROTECTION

A. Performance Criteria

1. Power Output - The linear power amplifier is capable of providing 5KW Average and PEP in continuous keydown service.
2. VSWR Protection - The transmitter has a nominal RF output impedance of 50 ohms and has sufficient tuning range to operate into a load whose impedance can have any phase producing a maximum VSWR of 3 to 1. The transmitter is equipped with an adjustable trip that will automatically disable the transmitter HV when a selected VSWR is exceeded.

B. Test Arrangement

Relevant Figure

- | | |
|--------------------|-----|
| 1. Power Output | 2.1 |
| 2. VSWR Protection | 2.1 |

C. Test Equipment Required Schematic Reference Item No. In Appendix 1 Required For Arrangement

- | | | | |
|--------------------|---|---|-----|
| 1. Wattmeter | A | 1 | 1.2 |
| 2. Dummy Load | B | 2 | 1.2 |
| 3. Audio Generator | C | 3 | 1.2 |
| 4. Oscilloscope | D | 9 | |

D. Test Procedure

1. Power Output
 - a. Connect the equipment as shown in Figure 2.1
 - b. Tune the transmitter to the desired test frequency and load it to rated average power output in CW mode.
 - c. Record the power output as indicated on the transmitter power meter. This reading must be within 7% of the calibrated wattmeter.
 - d. Record the audio input level. This level must be within -20 to +10 dbm.

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e. Repeat parts b to d at frequencies listed on test data form No. 2.1.

E. VSWR Protection

- a. Connect the equipment as shown in Figure 2.1A
- b. Set the variable capacitor on the dummy load for minimum capacitance.
- c. Tune the transmitter for rated average power output at the desired test frequency.
- d. Set the transmitter overload pointer to correspond to a 3:1 VSWR.
- e. Slowly increase the capacitance on the dummy load until the reflected power approaches the overload trip needle.
- f. Verify proper operation of the overload circuit by increasing the capacitance until the overload circuits deactivate the transmitter. Record the trip setting and reflected power at the time of deactivation.
- g. Repeat steps b to g at frequencies listed on test data form No. 2.1.

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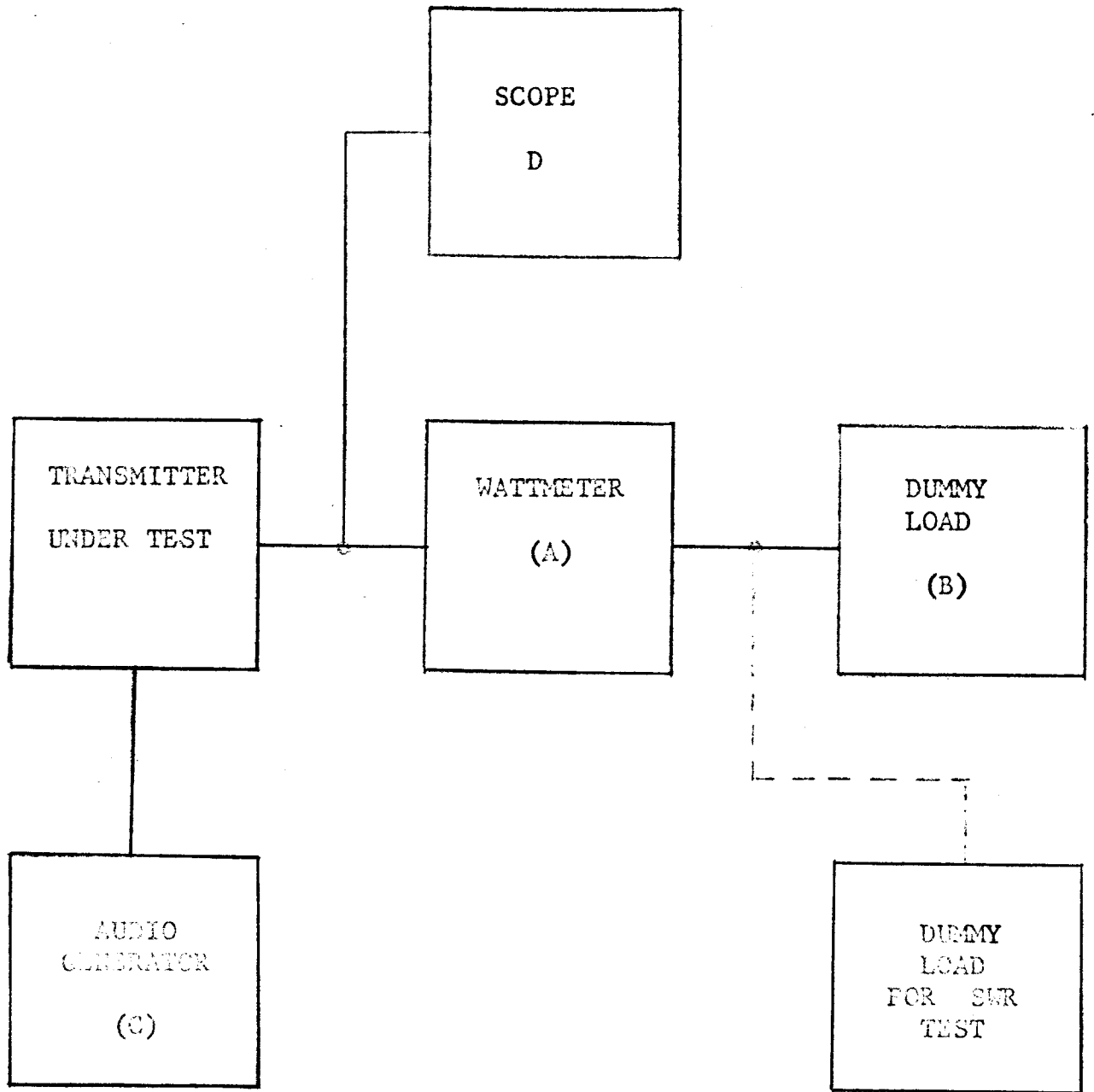


FIGURE 2.1

POWER OUTPUT
VSWR PROTECTION

TMC SPECIFICATION

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2.2 NOISE, HUM AND SPURIOUS EMISSIONS

A. Performance Criteria

1. Noise, hum and spurious emission output levels shall be at least 50 db below PEP.

B. Test Arrangement

Relevant Figure

1. Noise, hum and spurious emission levels

2.2

C. Test Equipment Required

Schematic Reference

Item No. In Appendix 1

- | | | |
|----------------------|---|---|
| 1. Spectrum Analyzer | A | 4 |
| 2. Dummy Load | B | 2 |
| 3. Oscilloscope | C | 9 |

D. Test Procedure

- a. Connect the equipment as shown in Figure 2.2
- b. Tune the transmitter to 2 MHz at rated average power output in the CW mode.
- c. Adjust the spectrum analyzer for a full scale presentation of the carrier and establish a 0 db reference level.
- d. Remove 20 db of attenuation from the spectrum analyzer expanding the calibrated display from 0 thru -40db to -20 thru -40 db.
- e. Adjust the spectrum analyzer for a 500 Hz bandwidth and record the noise and hum level.
- f. Increase the spectrum bandwidth to maximum and record the level of any spurious emissions.
- g. Repeat paras b to f at frequency listed on test data form No. 2.2.

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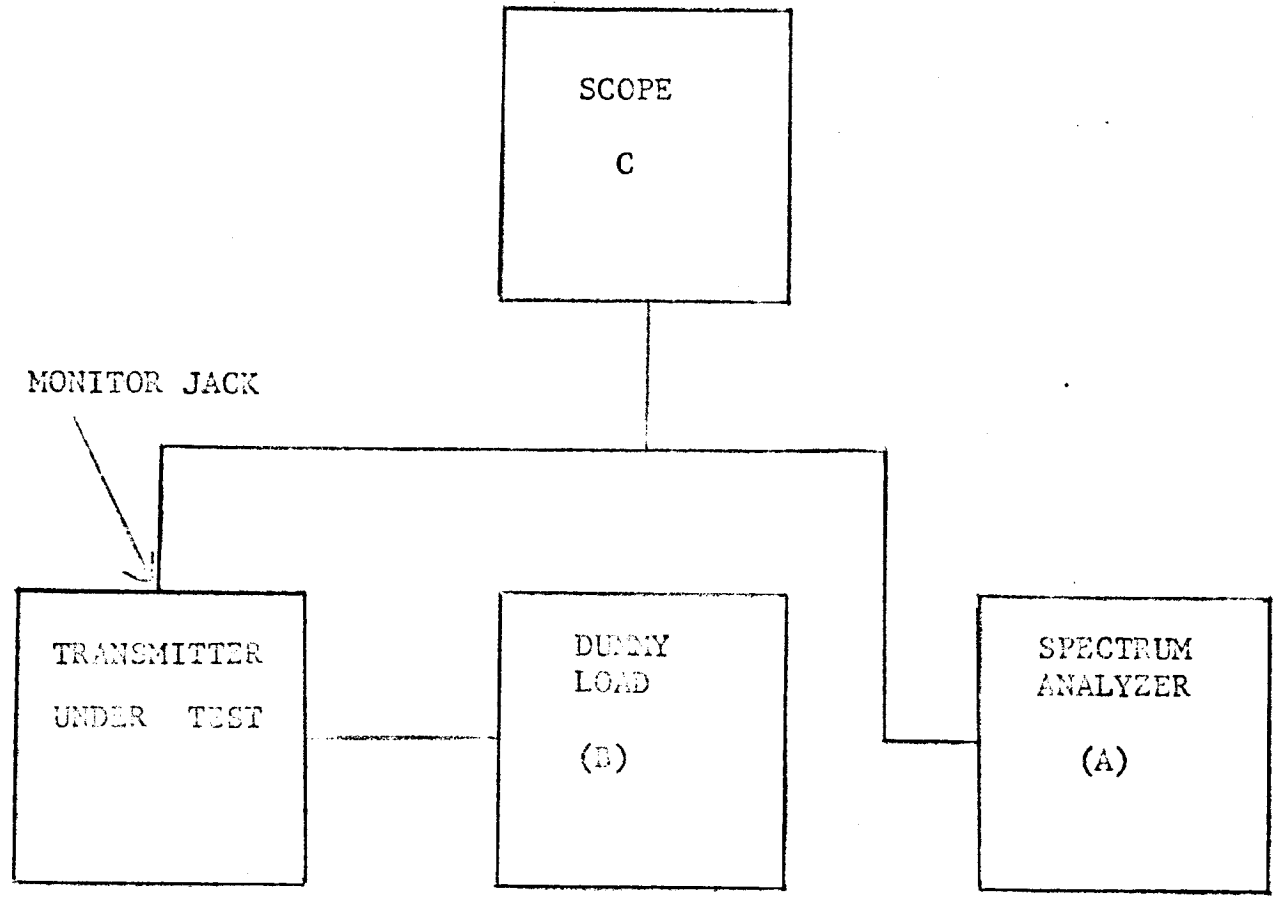


FIGURE 2.2
NOISE LEVEL AND
SPURIOUS EMISSIONS

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2.3 INTERMODULATION

A. Performance Criteria

1. At rated PEP, third and higher order intermodulation distortion products shall be at least 40db below either tone of two tones of equal amplitude.

B. Test Arrangement Relevant Figure

1. Intermodulation Distortion 2.3

C. Test Equipment Required Schematic Reference Item No. In Appendix 1

- | | | |
|-----------------------|---|---|
| 1. Two Tone Generator | A | 5 |
| 2. Spectrum Analyzer | B | 4 |
| 3. Dummy Load | C | 2 |
| 4. Oscilloscope | D | 9 |

D. Test Procedure

1. Intermodulation Distortion:
 - a. Connect the equipment as indicated in Figure 2.3
 - b. Adjust the two tone input for a convenient level in the upper sideband channel. Set the carrier insert control for maximum carrier suppression.
 - c. Tune the transmitter for rated PEP power output at 2 MHz.
 - d. Adjust the spectrum analyzer for a full scale presentation, thus establishing a 0db reference level.
 - e. Remove 20db of attenuation from the spectrum analyzer expanding the calibrated display from 0 thru -40db to -20 thru -60db.
 - f. Record the third order intermodulation product level. Third and higher order intermodulation products must be at least 40db down from either tone.
 - g. Repeat steps b to f at frequency listed on test data form No. 2.3.

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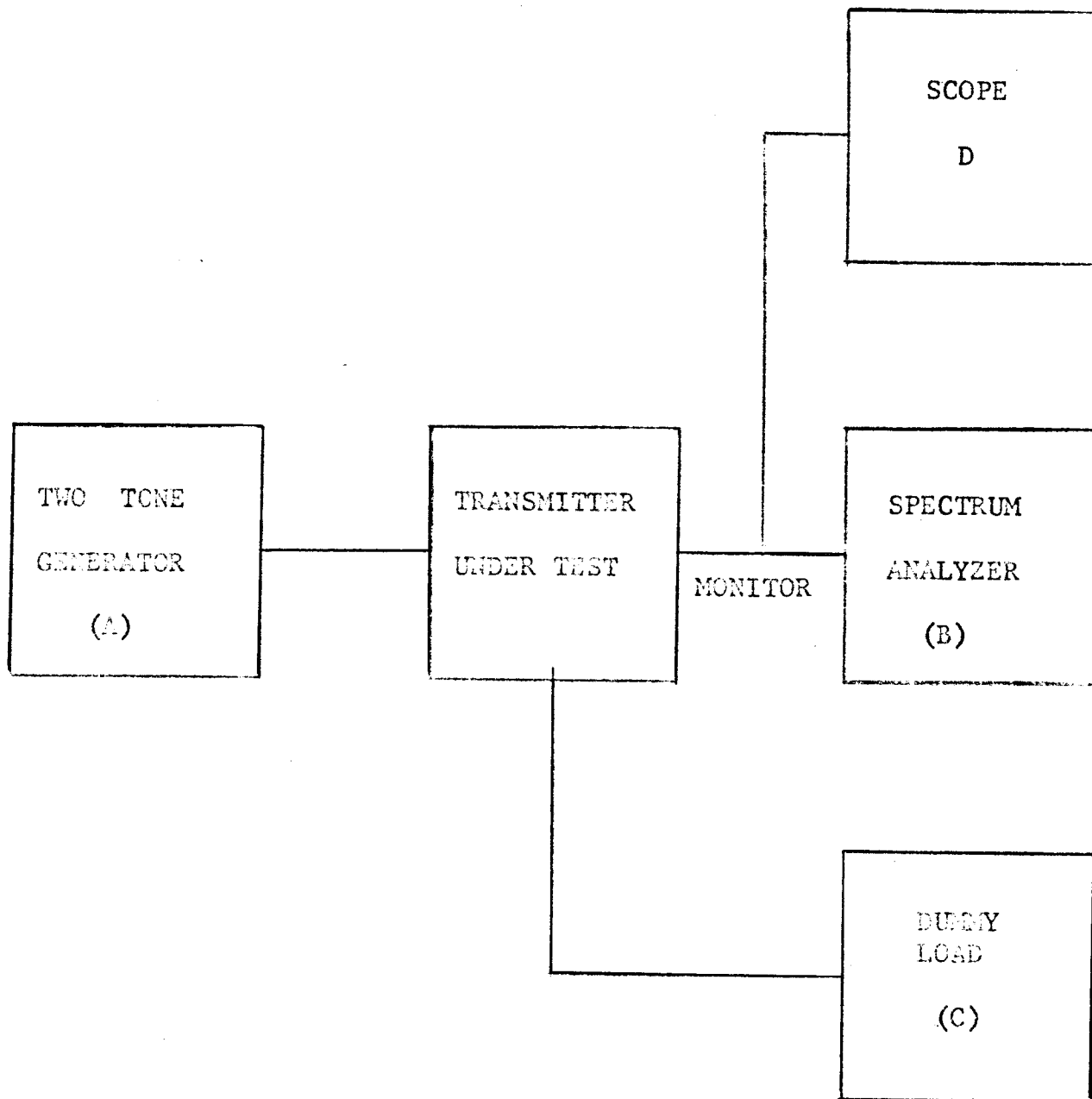


FIGURE 2.3
INTERMODULATION

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2.4 SIDEBAND REJECTION AND CARRIER SUPPRESSION

A. Performance Criteria

1. Sideband Rejection - Unwanted sidebands shall be suppressed at least **60db** below PEP.
2. Carrier Suppression - The carrier level must be continuously adjustable from full output to at least **-60db** below PEP.

B. Test Arrangement

Relevant Figure

1 and 2. Sideband Rejection
and Carrier Suppression

2.4

C. Test Equipment Required

Schematic Reference

Item No. In Appendix 1

Required For Arrangement

1. Dummy Load	A	2	1 & 2
2. Spectrum Analyzer	B	4	1 & 2
3. Audio Generator	C	3	1 & 2
4. Oscilloscope	D	9	

D. Test Procedure

- a. Connect the equipment as shown in Figure 2.4.
- b. Tune the transmitter to 2 MHz at rated average power output, in USB mode, with single tone (500 Hz).
- c. Adjust the spectrum analyzer for full scale presentation of the signal to establish a 0 db reference level. Now remove 20 db of attenuation from spectrum analyzer.
- d. Insert small amount of carrier. Note its relative position on scope then reduce carrier to max suppression.
- e. Record carrier suppression on test data form No. 2.4A. Repeat steps B to D on other frequencies listed on test data form.
- f. Tune transmitter to full rated output at 2 MHz, using a 500 Hz in the USB.
- g. Set up spectrum analyzer as in Step C.
- h. Observe the display and record the level of 500 Hz tone in unwanted sideband, on test data form No. 2.4.
- i. Also repeat steps F to L at frequencies listed on test data form No. 2.4.

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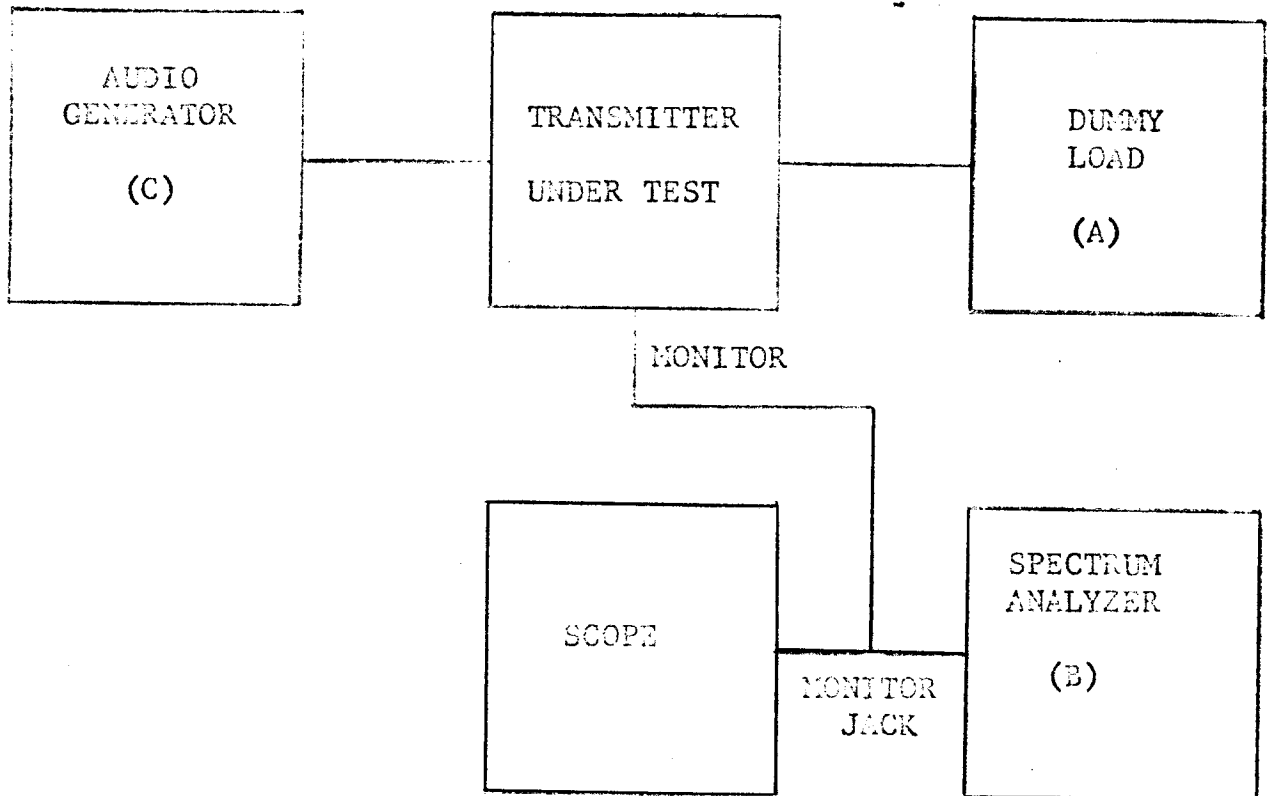


FIGURE 2.4

SIDEBAND REJECTION AND
CARRIER SUPPRESSION

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2.5 A3-H DISTORTION

A. Performance Criteria

1. At rated PEP output, the 2nd and 3rd harmonics of the modulating signal shall be at least **35db** below the carrier level with 90% of modulation.

B. Test Arrangement

Relevant Figure

1. A3-H Distortion

2.5

C. Test Equipment Required

Schematic Reference

Item No. In Appendix 1

1. Two Tone Generator
2. Oscilloscope
3. Spectrum Analyzer
4. Dummy Load

A
C
E
D

5
9
4
2

D. Test Procedure

- a. Connect the equipment as indicated in figure 2.5.
- b. Place MMX meter switch in carrier position and adjust the carrier level for an indication of "FULL" on MMX meter.
- c. Connect the Spectrum Analyzer to MMX external monitor jack.
- d. Increase the audio tone level in MMX until 90% of modulation.
- e. Tune transmitter to full rated power output.
- f. Connect the spectrum analyzer to transmitter monitor jack and adjust the meter for a full scale presentation, thus establishing 0 db level.
- g. Remove 20 db of attenuation from the analyzer and read the 2nd and 3rd harmonics attenuation.

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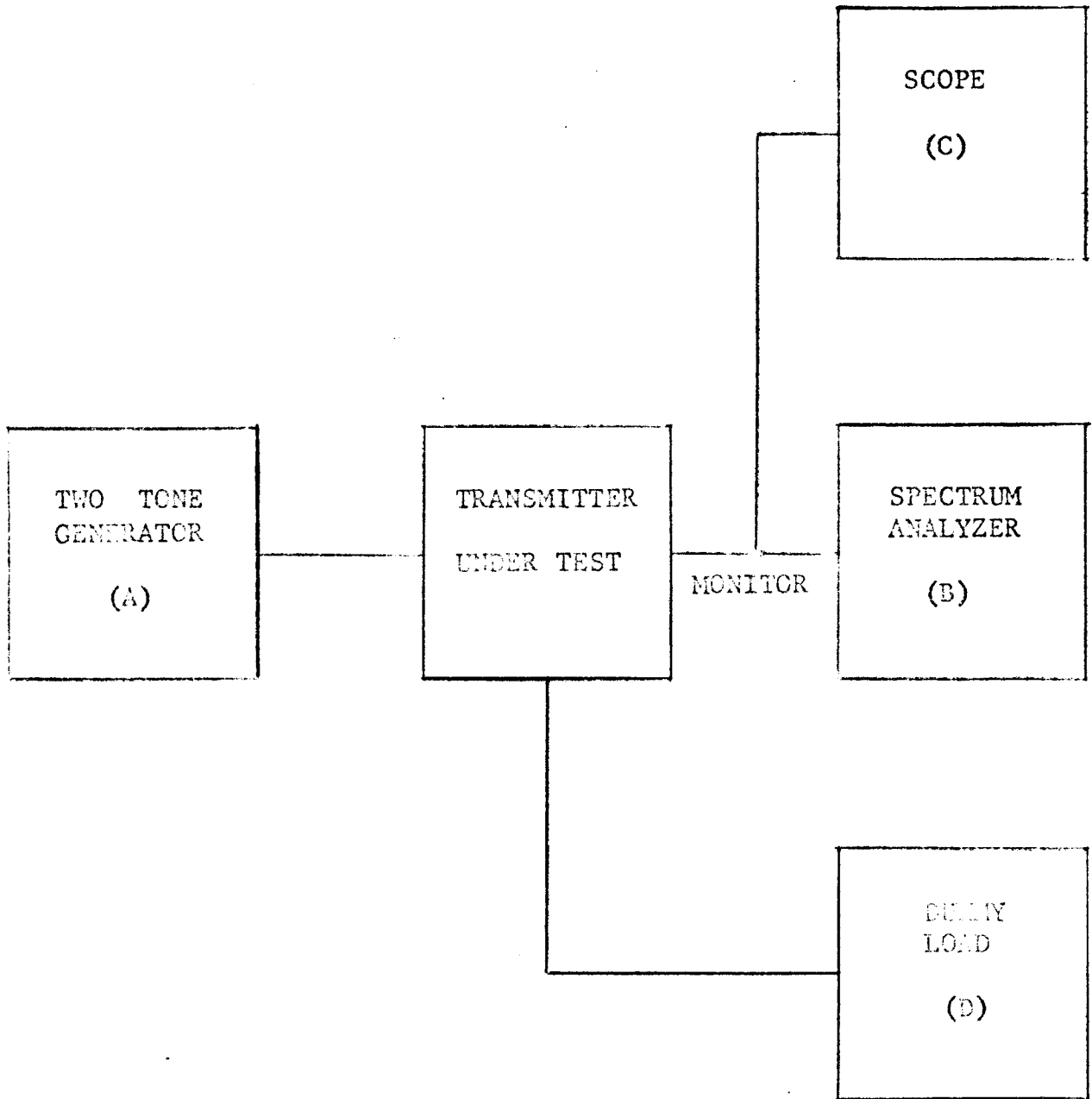


FIGURE 2.5
AM DISTORTION

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2.6 ALDC TEST

A. Performance Criteria

1. With ALDC engaged, transmitter must maintain rated output within +20%.

B. Test Arrangement

Relevant Figure

ALDC

2.6

C. Test Equipment Required

<u>Schematic Reference</u>	<u>Item No. In Appendix 1</u>
----------------------------	-------------------------------

1. Dummy Load

A

2

D. Test Procedure

- a. Connect the equipment as shown in Figure
- b. Tune the transmitter to 2 MHz at 6 KW in CW mode.
- c. Slowly engage ALDC until output drops to about 5 KW.
- d. When increasing transmitter drive to maximum, output must remain within +20%.
- e. Record output.
- f. Repeat steps b to e at frequencies listed on test data form No. 2.6.
- g. Also check rated power on all modes.

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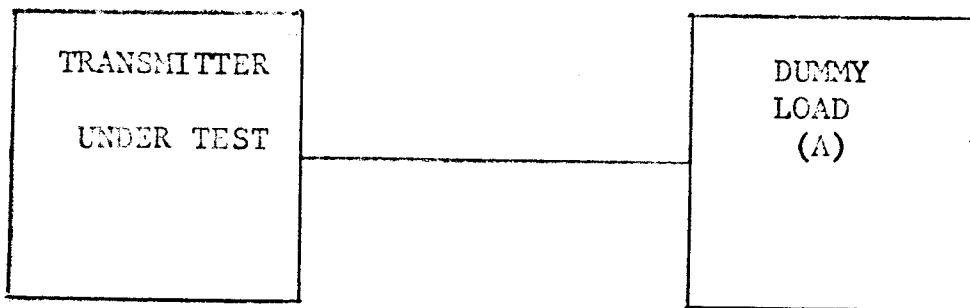


FIGURE 2.6

ALDC

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2.7 CW KEYING

A. Performance Criteria

1. Transmitter must be capable of transmitting a CW signal with no more than 5% keying distortion.

B. Test Arrangement Relevant Figure

CW Keying 2.7

C. Test Equipment Required Schematic Reference Item No. In Appendix

1. Dummy Load	B	2
2. Oscilloscope	C	9
3. Keyer	A	10

D. Test Procedure

- a. Connect equipment as shown in Figure 2.7.
- b. Tune transmitter to rated output at 2 MHz in CW mode, with test key switch in up position.
- c. Set keyer frequency at 12½ cycles. This is equivalent to 25 Bauds.
- d. Using oscilloscope with TIME/CM Switch in 10 millisecc position, record mark - space - pulse duration in millisecc.
- e. Mark - space deviation must not exceed 4 millisecc.
- f. Repeat steps B to E using keying frequencies listed on test data form No. 2.7.

Note: 25 cycles = 50 Bauds.
50 cycles = 100 Bauds.

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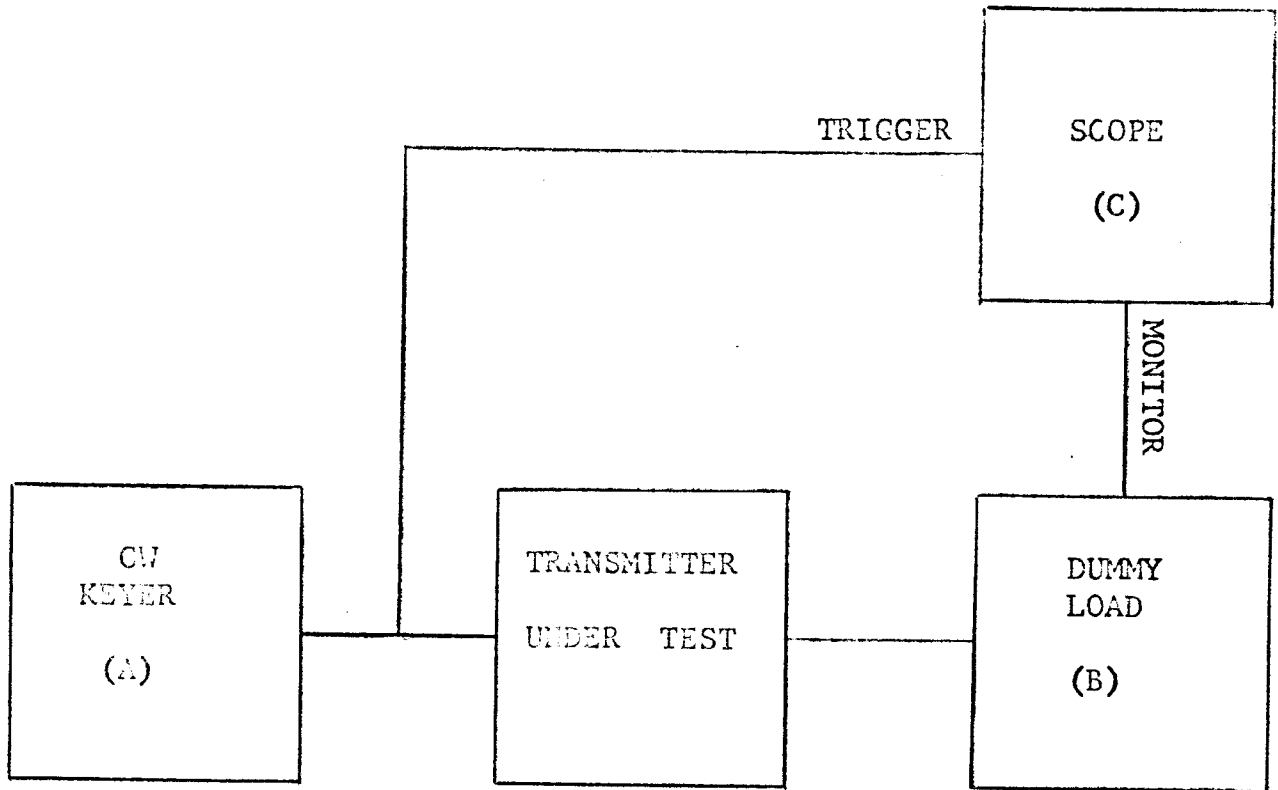


FIGURE 2.7

CW KEYING

TMC SPECIFICATION

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2.9 AUDIO RESPONSE

A. Performance Criteria

1. Transmitter audio response must be ± 1.5 db from 250 to 3040 cycles.

B. Test Arrangement

Relevant Figure

Audio Response

2.9

C. Test Equipment Required

Schematic Reference

Item No. In Appendix 1

- | | | |
|---------------------------|---|----|
| 1. Dummy Load | B | 2 |
| 2. Audio Generator | A | 12 |
| 3. High Frequency Counter | C | 11 |

D. Test Procedure

- a. Connect Equipment as shown in Figure 2.8.
- b. Tune transmitter for output of 1kW, at 2MHz, in CW mode.
- c. Adjust audio generator for an output of 0db, at a frequency of 1 kHz.
- d. Reduce transmitter drive to min., and place MIX in USB mode.
- e. Increase drive until transmitter output indicates 1kW.
- f. Slowly reduce frequency and record output as indicated on test data form.
- g. Return generator frequency to 1kHz, now slowly increase frequency and record output as indicated on test data form.
- h. Output should not deviate more than 3 db thru the range of 250-3040 cycles.
- i. Repeat steps d to h on LSB.

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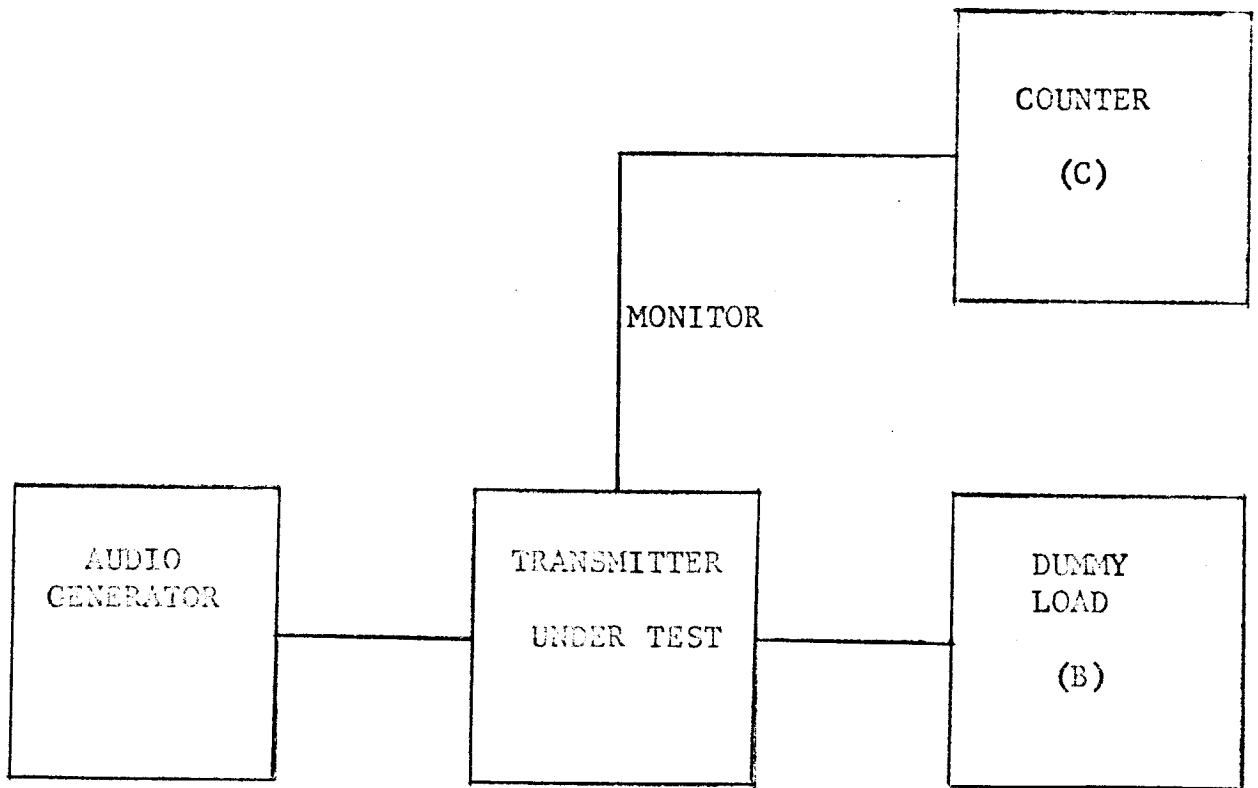


FIGURE 2.9
AUDIO RESPONSE

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3.0 HARMONIC SUPPRESSION

A. Performance Criteria

1. The transmitter is capable of producing full rated average power output with the second harmonic suppressed at least 50db below PEP, the third and higher harmonics suppressed at least 55db below PEP.

B. Test Arrangement

Relevant Figure

- | | |
|-------------------------|-----|
| 1. Harmonic Suppression | 3.0 |
|-------------------------|-----|

C. Test Equipment Required

Schematic Reference

Item No. In Appendix 1

- | | | |
|-------------------------------|---|---|
| 1. Dummy Load | A | 2 |
| 2. Spectrum Analyzer | B | 4 |
| 3. Coaxial RF Voltage Divider | C | 8 |
| 4. Step Attenuator | D | 6 |
| 5. RF Signal Generator | E | 7 |

D. Test Procedure

- a. Connect the equipment as shown in Figure 2.5A.
- b. Tune the transmitter to the center frequency of one of the RF bands and load it to full rated average power output in the CW mode.
- c. Tune the spectrum analyzer to the fundamental frequency and establish a 0db reference level. Disconnect the step attenuator from the coaxial divider and correct the signal generator. Tune the signal generator to the test frequency and note the level required to produce a full scale deflection on the analyzer.
- d. Tune the spectrum analyzer and signal generator to the frequency of the second harmonic. Set the signal generator input level to the level noted in part c and adjust the spectrum analyzer for full scale deflection. Disconnect the signal generator from the step attenuator and connect the step attenuator to the coaxial divider.

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- e. Remove 20db of attenuation from the spectrum analyzer and note the level of the second harmonic. Add the attenuation correction factor for the coaxial divider and obtain the level of the second harmonic. Record this level.
- f. Repeat parts d and e for the third and higher harmonics.
- g. Repeat parts b to f at frequencies listed on test data form No. 3.0.

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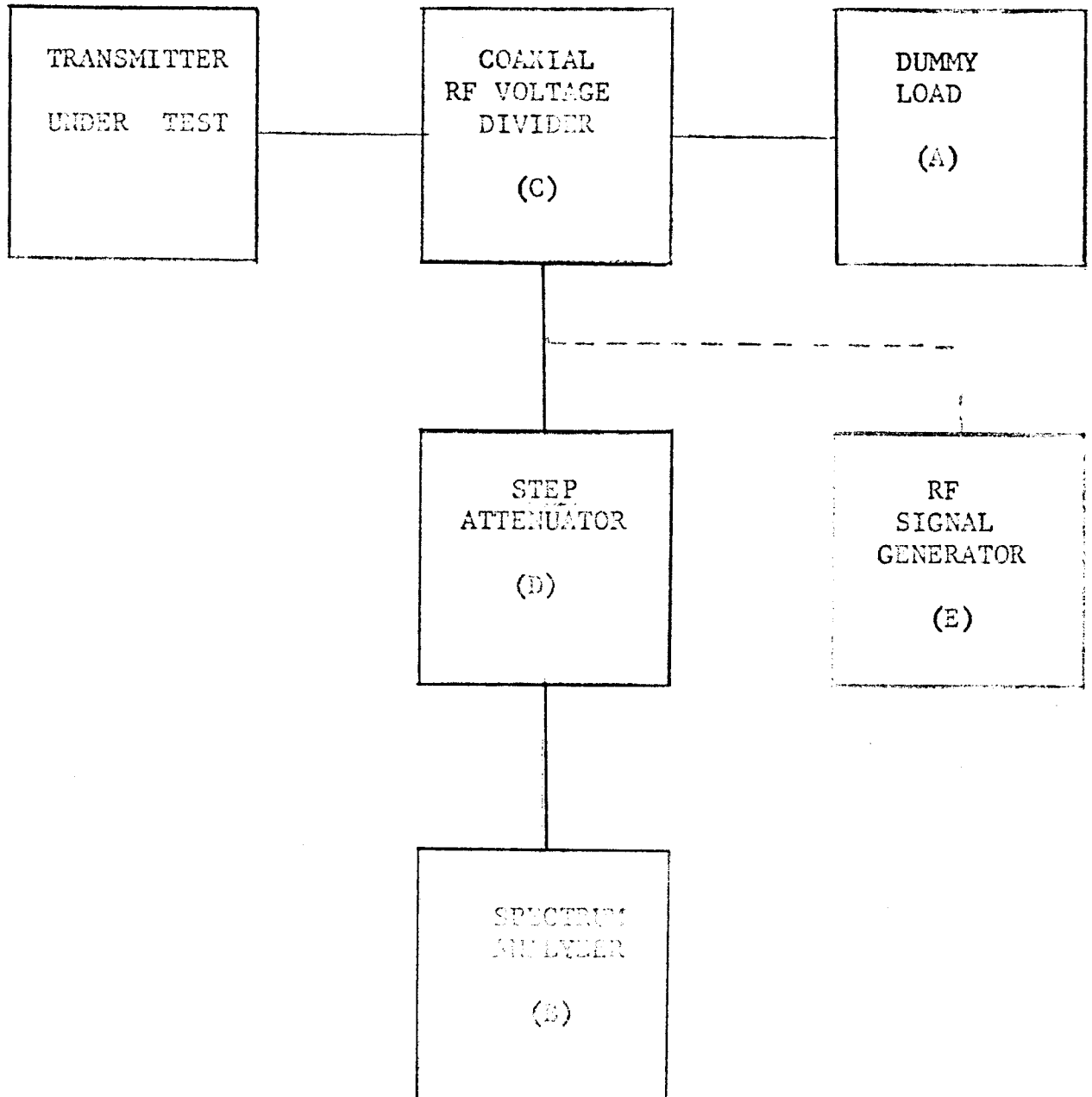
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DOTTED LINE INDICATES ALTERNATE CONNECTION.

FIGURE 3.0

HARMONIC SUPPRESSION

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3.1 FREQUENCY ALLOCATION

<p>A. <u>Test Arrangement</u></p> <p style="padding-left: 40px;">Frequency Allocation</p>	<p><u>Relevant Figure</u></p> <p>3.1</p>				
<p>B. <u>Test Equipment Required</u></p> <p style="padding-left: 40px;">1. Frequency Counter</p>	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"><u>Schematic Reference</u></td> <td style="width: 50%;"><u>Item No. In Appendix 1</u></td> </tr> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">11</td> </tr> </table>	<u>Schematic Reference</u>	<u>Item No. In Appendix 1</u>	A	11
<u>Schematic Reference</u>	<u>Item No. In Appendix 1</u>				
A	11				

C. Test Procedure

- a. Connect the equipment as shown in Figure 3.1.
- b. Allow MK Exciter at least a one hour warm up before starting test.
- c. Using test data form No. 3.0 record exciter output frequency as listed on form, No. 3.1.
- d. Measured frequency must be within \pm one cycle.

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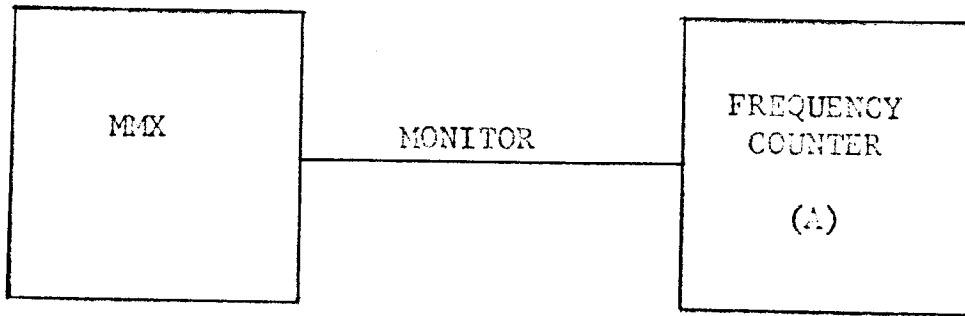


FIGURE 3.1

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APPENDIX 1 TEST EQUIPMENT LIST

ITEM NUMBER	DESCRIPTION	MANUFACTURER & MODEL USED	TMC SERIAL #	CALIBRATION DATE
1	Wattmeter	Bird Electronics Model 3127 or equiv.	2701	
2	Dummy Load	TMC 1SK/50 (Modified) or equivalent.	5056	
3	Audio Generator	General Radio Model 1304-B or equiv.	1855	
4	Spectrum Analyzer	Lavoie Labs Model LA-40A or equiv.	5074	
5	Two Tone Generator	TMC Model TFG-1 or equivalent.	60320	
6	Step Attenuator	Belonic TG950 or equivalent.	5087	
7	RF Signal Generator	Hewlett-Packard 606A or equivalent.	1854	
8	Coaxial RF Voltage Divider.	1/8 TMC 1SK/50 (modified) or equivalent.	5056	
9	Oscilloscope	Tektronix	2226	
10	OT Keyer	TMC Model AK-100	6005	
11	Frequency Counter	Hewlett Packard	1543	
12	Audio Generator	Hewlett Packard	1881	
13	Telegraph Character Generator	Dispatch Inc.	1884	

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FACTORY TEST - TEST DATA SHEET FOR VSWR

TRANSMITTER SERIAL NO. _____

TEST DATA FORM #2.1

EXCITER SERIAL NO. _____

DATE _____

Signature _____

BAND	FREQUENCY MHz	DIRECT POWER kW	REFLECTED POWER	VSWR	PA Ip	IPa Ip
2 - 2.3	2					
2.3 - 2.6	2.4					
2.6 - 3	2.7					
3 - 4	3.5					
4 - 5	4					
5 - 8	6					
8 - 12	9					
12 - 16	12					
16 - 24	18					
24 - 30	25					
34 - 39	29.9999					

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TITLE: TEST DATA FOR NOISE AND HUM. LEVEL & SPURIOUS EMISSIONS

WITH ALDC

TEST DATA FORM #2.2

TRANSMITTER SERIAL NO. _____

EXCITER SERIAL NO. _____

DATE _____

Signature

BAND	TEST FREQUENCY MHz	HUM LEVEL	NOISE LEVEL db below reference level	SPURIOUS EMISSION
2 - 2.3	2			
2.3 - 2.6	2.4			
3 - 4	3			
3 - 4	3.5			
4 - 5	4.9999			
5 - 8	6			
8 - 12	9			
12 - 16	12			
12 - 16	15			
16 - 24	18			
16 - 24	20			
24 - 30	24			
24 - 30	26			
24 - 30	29.9999			

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TITLE: INTERMODULATION TEST CON F1=935 F2=2805

DATE -

TRANSMITTER SERIAL NO.

EXCITER SERIAL NO.

TEST DATA FORM #2.3

SIGNATURE

BAND	TEST FREQ. MHZ	IPA TUNE	P.A. SCREEN	P.A. PLATE	SIDE- BAND	INTER MOD db	AUDIO INPUT db
2-2.3	2				USB		
2.3-2.6	2.5				USB		
2.6-3	2.7				USB		
3-4	3.5				USB		
4-5	4				USB		
4-5	4.5				USB		
5-8	5				USB		
5-8	6				USB		
5-8	7				USB		
8-12	8				USB		
8-12	10				LSB		
12-16	12				LSB		
12-16	14				LSB		
12-16	15.9999				LSB		
16-24	18				LSB		
16-24	20				LSB		
16-24	22				LSB		
16-24	23.9999				LSB		
24-30	26				LSB		
24-30	28				LSB		
24-30	29.9999				LSB		

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OF

TITLE: **FACTORY TEST - SIDEBAND REJECTION**

CON F1=935 F2=2805

TEST DATA FORM #2.4

TRANSMITTER SERIAL NO. _____

DATE _____

EXCITER SERIAL NO. _____

SIGNATURE

FREQ. mhz	POWER OUTPUT kw	SIDE- BAND USED	SIDEBAND REJECTION db	NOTES
2		LSB		
2.4		USB		
3		USB		
3.5		LSB		
5		LSB		
6		USB		
9		USB		
12		LSB		
15		LSB		
18		USB		
20		USB		
24		LSB		
25		LSB		
26		USB		
29.9999		USB		

TMC SPECIFICATION

NO. S S 1312

REV: 2

COMPILE J:

CHECKED:

APPD:

SHEET 32

OF

TITLE: FACTORY TEST - CARRIER SUPPRESSION

TEST FORM #2.4A

TRANSMITTER SERIAL NO. _____

DATE _____

EXCITER SERIAL NO. _____

Signature

FREQUENCY	CARR. SUPPRESS.	MODE	NOTES
2		USB	
5		USB	
9		USB	
15		LSB	
20		LSB	
25		LSB	

TMC SPECIFICATION

NO. S S 1312

REV: 0

COMPILED:

CHECKED:

APPD:

SHEET 34

OF

TITLE:

ALDC TEST

TEST DATA FORM # 2.6

OUTPUT

TRANSMITTER SERIAL NO. _____

EXCITER SERIAL NO. _____

SIGNATURE _____

BAND	FREQ MHZ	CW	USB	LSB	Ip	Iss
2-2.3	2					
2.3-2.6	2.5					
2.6-3	2.8					
3-4	3.5					
4-5	4.5					
5-8	6.0					
8 -12	10.0					
12-16	14.0					
16-24	20.0					
24-30	26.0					
24-30	29.9999					

TMC SPECIFICATION

NO. S S 1312

REV:

COMPILED:

CHECKED:

APPD:

SHEET 35 OF

TITLE:

FACTORY TEST - CW SPEED - TEST

TEST DATA FORM #2.7

DATE _____

TRANSMITTER SERIAL NUMBER _____

EXCITER SERIAL NUMBER _____

Signature

FREQUENCY 2 mHz (Test with ALDC)

	MARK	SPACE	
50 BAUDS			
100 BAUDS			
220 BAUDS			

FREQUENCY 29.9999 mHz (Test with ALDC)

	MARK	SPACE	
50 BAUDS			
100 BAUDS			
220 BAUDS			

TMC SPECIFICATION

NO. 5 S 1312

REV:

COMPILED:

CHECKED:

APPD:

SHEET 36

OF

TITLE:

FACTORY TEST AUDIO RESPONSE TEST

TEST DATA FORM #2.9

DATE _____

TRANSMITTER SERIAL NO. _____

EXCITER SERIAL NO. _____

Signature

AUDIO FREQ. Hz	USB BAND		LSB-BAND		NOTES: 1KHz TONE db
	OUTPUT LIN.	OUTPUT db	OUTPUT LIN	OUTPUT db	
200					
250					
300					
350					
400					
500					
600					
700					
800					
900					
1000					
2000					
3000					
3100					
3200					
3300					
3500					
3700					
3800					

