

AD-A055 798 ARMY TEST AND EVALUATION COMMAND ABERDEEN PROVING GRO--ETC F/G 14/2
R F POWER OUTPUT (AM-FM-SSB) NON-PULSED.(U)
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The methodology and procedures are given for determining non-pulsed, radio frequency, output power. They are adaptable to any power level, can be used in shielded enclosures or in the field and adapted to arctic, desert, temperate or tropic zones. Instrumentation, data collection and analysis are delineated.		

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US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURES

DRSTE-RP-702-105
Test Operations Procedure 6-2-558
AD No.

20 April 1978

RF POWER OUTPUT (AM, FM, SSB)
NON-PULSED

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1. SCOPE.

The objective of this Test Operations Procedure (TOP) is to standardize methods for determining the power output of radio frequency transmitting equipment, non-pulsed, by supplementing Method CE103, MIL-STD-449D, 1/. This TOP can also serve for RF power amplifiers, and signal generators. It is primarily intended for use in a Temperate Zone. (appendix C)

2. FACILITIES AND INSTRUMENTATION.

The Test Item shall be placed in operating condition as outlined in the equipment Technical Manual. A check list is provided in appendix A and is part of the test record.

2.1 Facilities. A shielded enclosure or room which provides at least 100 dB attenuation of all radiated fields, at least 100 dB attenuation of conducted noise on the power lines, and specified line voltage.

CHARACTERISTICS

TOLERANCE

Shielded Enclosure
Power Line Filters
Line Voltage

-5 dB, +∞
-5 dB, +∞
±5% of nominal rms volts.

1/ MIL-STD-449D, Radio Frequency Spectrum Characteristics, Measurement of, 23 Feb 73 with Notice 1.

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2.2 Instrumentation

Must have a current calibration certificate and shall meet the detailed requirements of MIL-STD-449D 1 /, Section 5.

<u>ITEM</u>	<u>TOLERANCE</u>
Wattmeter, Frequency Selective,	$\pm 5\%$ Full Scale Reading
Wattmeter, in line	$\pm 3\%$ Full Scale Reading
Voltmeter - Field Intensity Meter (Frequency Selective VM)	± 1.5 dB output
Audio Oscillators (2) or two-toned oscillator, preferred. At 600 ohms, 1-volt (or to match SSB modulation input requirement).	$\pm 2\%$ of dial reading
RF Signal Generator, with 6db pad,	± 2 dB output level
Frequency Counter	± 1 part per million
Time Domain Reflectometer	
Vertical deflection	$\pm 3\%$
Distance	$\pm 3\%$
RF Resistive Load of adequate power capability	$\pm 0.5\%$ of load impedance (ohms)
Matching Pads	± 0.5 dB

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3. PREPARATION FOR TEST.

3.1 Facilities. Assure facilities conform to minimum requirements.

3.2 Equipment. No specialized equipment required. Testing is conducted in a normal conditioned environment with the usual ancillary equipment. (For field testing see app C)

3.3 Instrumentation. All instrumentation is to be set up in accordance with figure 1. The substitution method is described in Reference 1/, MIL-STD-449D.

3.4 Characteristics Required. Record the following: (see app B)

3.4.1 Test Item: Serial number and nomenclature. Include as applicable, the primary characteristics as stated in MIL-STD-449, Section 4.6.1.

3.4.2 Instrumentation: Name, Types/model, serial number, and calibration due date.

3.4.3 Personnel Data: Technicians' name and MOS/Series.

3.4.4 Power line characteristics.

4. TEST CONTROLS.

4.1 The measuring instrumentation will be set up inside the shielded enclosure, with the test item outside, to minimize the effects of leakage. See Note, figure 1.

4.2 The attenuation in dB of all cables, pads, and filters will be obtained or measured. (see app C)

4.3 The impedance of the test setup will be measured using Time-Domain Reflectometer techniques as shown in figure 1. Record the impedance value at mid-frequency range and upper and lower 3 dB points on response curve.

4.3.1 The characteristic impedance of all cables and the input and output impedance of the test instrumentation will match, within $\pm 6\%$, the output impedance of the test item. In the event that a greater mismatch occurs, matching pads will be used. The impedance shall be determined for each standard test frequency only.

4.3.2 The standard test frequencies will be as specified in MIL-STD-449D,1/. Additional frequencies shall be tested as required.

4.4 Turn the test item and all instrumentation on and allow time for thermal equilibrium to be attained, as specified in the manuals.

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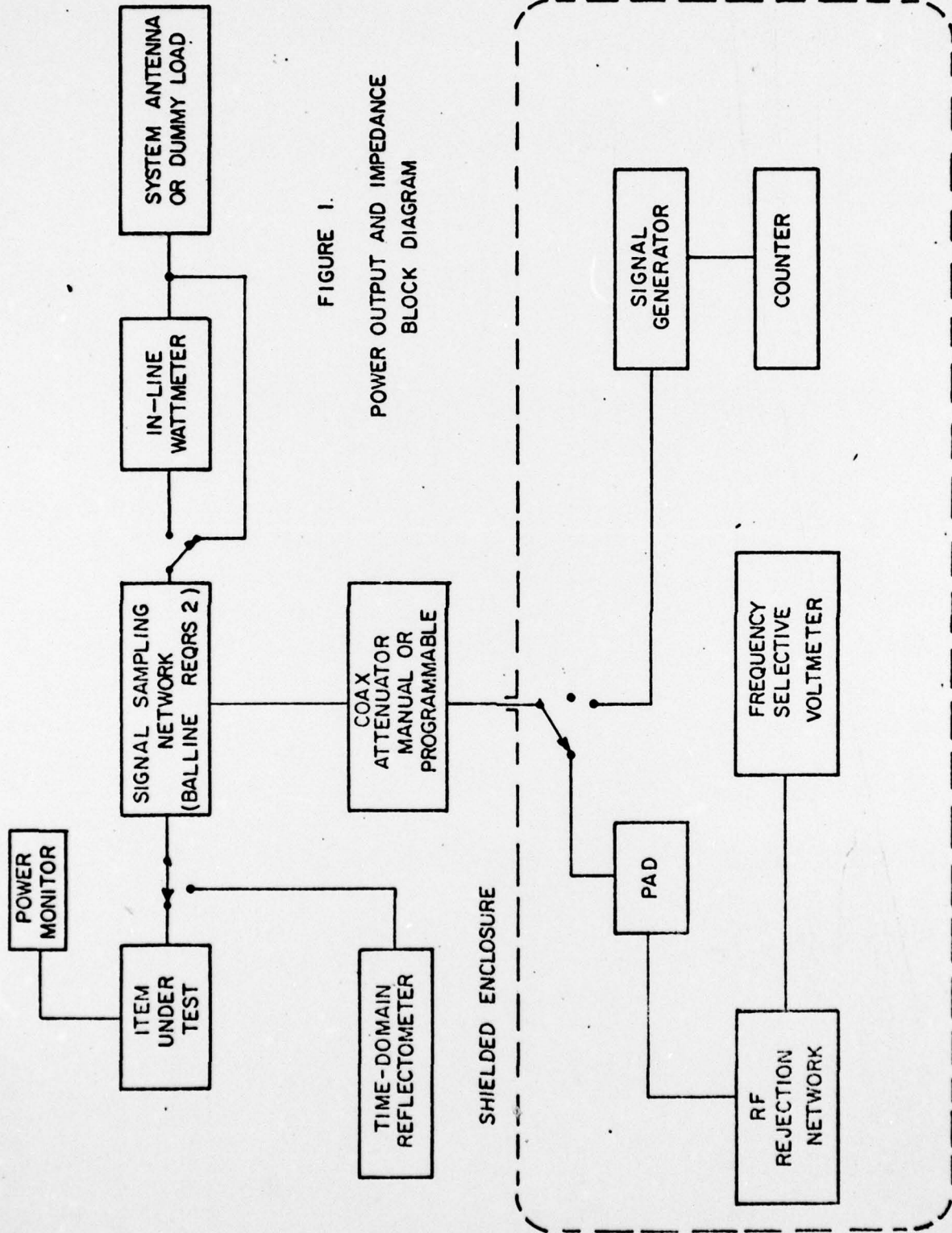


FIGURE 1.
POWER OUTPUT AND IMPEDANCE
BLOCK DIAGRAM

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5. PERFORMANCE TESTS

5.1 Data Required. Record the following: (app B)

- Frequency, all frequencies measured.
- Output voltage or power of test item
- Audio input voltage (SSB only)
- Attenuation and insertion losses

5.2 Method. The procedure of MIL-STD-449D, Method CE103, will be used for average output power. A modulation characteristic curve must be plotted, per MIL-STD-449-D, 1/, Method CE102 in determining SSB power. (app C)

6. DATA REDUCTION AND PRESENTATION.

6.1 Data Reduction

6.1.1 Computations to determine the output power.

6.1.1.1 AM or FM Transmitters. When the signal generator is substituted, the attenuation, plus cable, pad and filter insertion losses in the measuring circuit dB, converted to dBm, will be added to the signal generator power-out.

6.1.1.2 SSB Transmitters. The peak envelope power (PEP) will be computed using

$$PEP = 2 \times P_{AV}$$

where P_{AV} is the average power of the two tone modulated carrier signal.

6.1.2 The average power measured by the meter will be converted to dBm and added to the attenuation, in dB, of the interconnecting cables to determine the output power of the test item in direct power measurement.

6.2 Data Presentation. Table of power output and frequency, appendix B.

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Figure 2.

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APPENDIX A. RF POWER OUTPUT CHECKLIST

Facility conforms to minimum requirements.	_____
Instrumentation in calibration.	_____
Instrumentation data recorded.	_____
Name and MOS of person taking data recorded.	_____
Test item data recorded.	_____
Cable attenuation known.	_____
Impedance of test setup measured.	_____
Matching pads required.	_____
Thermal equilibrium obtained.	_____
Output voltage/power measured.	_____
Data reduced.	_____
Temperature Record (Daily) in log: (for field testing)	_____
Initial	_____
Final	_____
Deviations	_____

Date _____

APPENDIX B
SAMPLE FORM TEST AND POWER OUTPUT DATA

Test Item _____ Serial No. _____

Other Characteristics _____

<u>Instrumentation (Name)</u>	<u>Type/Model No.</u>	<u>Serial No.</u>	<u>Calibration Due Date</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Line Voltage, Required: VAC _____ Freq. _____ Hz Tolerance ±5%
 Measured: VAC _____ Freq. _____ Hz Tolerance _____ %

Shielded Enclosure: Check for visible damage _____ then _____
 Check for RF leakage if necessary. _____
 (100 dB attenuation required)

Date _____

APPENDIX B (Cont)

Tuned Frequency MHz (by Counter)	Mod Input (rms mV)	Mod. Freq. Hz Counted (SSB only)	Avg. Pwr. Wattmeter	Sig. Gen. Output (dBm)	Losses (dB)(1)	Pwr Output (dBm)(2)

Impedance:

f_{low} _____ f_{mid} _____ f_{hi} _____ Average _____

Data Taken By _____ MOS/Series _____ Date _____

NOTES:

- (1) Indicate for each test frequency
- (2) Indicate average, peak or PEP power

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APPENDIX C. SUPPLEMENTARY INFORMATION

GENERAL:

The section numbers below refer to corresponding sections in the test.

2.2 The MIL-STD-449D, Section 5 contains specific details on the test instrumentation.

3.1 The shielded enclosure should be carefully inspected visually and, if necessary, a RFI sweep made through the frequency band of the test item.

3.2 Those Army transmitters required to be tested under field conditions in Arctic, Desert or Tropic zones can utilize this TOP in any ambient temperature consistent with the specifications of the Test Item. The test equipment should normally be kept in a controlled environment and in a shielded enclosure. This would necessitate an outfitted van and longer cable runs, with a mobile power generator. There is provision in appendix B for recording daily temperatures, and deviations.

4.2 The attenuation/losses of all cables must be obtained or measured and of all pads or filters in the measuring circuit. Expressed in dB and totaled, the loss-correction will be added to the signal generator power output in dBm.

5.2 In plotting modulation frequency versus voltage or power, the frequency should be plotted along the semi-log (3 cycle) axis. The results of Modulation versus Power Output (PEP) is plotted on rectangular coordinate paper.