

MIL-W-87105 (USAF)

15 March 1977

MILITARY SPECIFICATION

WAVEGUIDE ASSEMBLIES, GENERAL SPECIFICATION FOR

This specification is approved for use by the Department of the Air Force, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 This specification covers the general requirements and tests for various types of waveguide assemblies.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

QQ-A-225/8	-Aluminum Alloy Bar, Rod, Wire, And Special Shapes, Rolled, Drawn, Or Cold Finished, 6061
QQ-A-250/2	-Aluminum Alloy 3003, Plate And Sheet
QQ-A-250/11	-Aluminum Alloy 6061, Plate And Sheet
QQ-A-367	-Aluminum Alloy Forgings
QQ-A-591	-Aluminum Alloy Die Castings
QQ-A-596	-Aluminum Alloy Permanent And Semi-permanent Mold Castings
QQ-A-601	-Aluminum Alloy Sand Castings
QQ-B-654	-Brazing Alloy, Silver
QQ-C-390	-Copper Alloy Castings (Including Cast Bar)
QQ-C-530	-Copper-beryllium Alloy Bar, Rod, And Wire (Copper Alloy Number 172 And 173)
QQ-C-533	-Copper-beryllium Alloy Strip (Copper Alloy Numbers 170 And 172)

FSC 5985

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASD/ENESS, Wright-Patterson AFB, OH 45433 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-W-87105 (USAF)

QQ-S-365	-Silver Plating, Electrodeposited, General Requirements For
QQ-S-763	-Steel Bars, Shapes, And Forgings - Corrosion Resisting
TT-L-20	-Lacquer Camouflage
TT-P-1757	-Primer Coating, Zinc Chromate, Low Moisture Sensitivity

MILITARY

MIL-R-3065	-Rubber, Fabricated Parts
MIL-E-5400	-Electronic Equipment, Airborne, General Specification For
MIL-C-5410	-Cleaning Compound, Aluminum Surface, Non-Flame-Sustaining
MIL-C-5541	-Chemical Conversion Coating On Aluminum And Aluminum Alloys
MIL-H-5606	-Hydraulic Fluid, Petroleum Base, Aircraft And Ordnance
MIL-J-5624	-Turbine Fuel, Aviation, Grades JP-4 And JP-5
MIL-C-5756	-Cable And Wire, Power, Electric, Portable
MIL-R-81294	-Remover, Paint, Epoxy System.

STANDARDS

MILITARY

MIL-STD-00453	-Inspection, Radiographic
MIL-STD-454	-Standard General Requirements For Electronic Equipment
MIL-STD-471	-Maintainability Demonstration
MIL-STD-781	-Reliability Tests Exponential Distribution
MIL-STD-810	-Environmental Test Methods
MIL-STD-831	-Test Reports, Preparation Of
MIL-STD-891	-Contractors' Parts Control And Standardization Program.

PUBLICATION

DEPARTMENT OF DEFENSE

SD6	-Provisions Governing Qualification (Qualified Products List)
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(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

MIL-W-87105 (USAF)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

B46.1-1962

-Surface Texture

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19102.)

MIL-W-87105 (USAF)

3. REQUIREMENTS

3.1 Detail specification. The individual waveguide assembly requirements shall be as specified herein and in accordance with the applicable detail specification. When the requirements of the detail specification and this general specification conflict, the requirements of the detail specification shall govern.

3.2 Qualification. Waveguide assemblies furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.4 and 6.3).

3.3 Parts, materials, and processes. Unless otherwise specified in the detail specification, parts, materials, and processes for the assembly shall be in accordance with the requirements specified herein. However, final approval of the equipment shall be contingent upon the equipment meeting all specification requirements.

3.3.1 General requirements

3.3.1.1 Approval of nonstandard parts and materials

3.3.1.1.1 Contract category. Contract requirements for nonstandard parts and materials approval shall be category III as defined in MIL-E-5400.

3.3.1.1.2 Approval procedures. Approval of nonstandard parts shall be in accordance with procedures specified in MIL-STD-891.

3.3.1.2 Part selection control. Selection of parts shall be controlled in accordance with the requirements of MIL-STD-891.

3.3.1.3 Castings. Castings shall be in accordance with MIL-STD-454, requirement 21.

3.3.1.4 Corrosion resistance. Materials shall be of corrosion-resistant types or shall be processed to resist corrosion.

3.3.1.5 Ferrous alloys. Ferrous alloys shall be in accordance with MIL-STD-454, requirement 15.

3.3.1.6 Dissimilar metals. Selection and protection of dissimilar metal combinations shall be in accordance with MIL-STD-454, requirement 16.

MIL-W-87105 (USAF)

3.3.1.7 Fungus-inert materials. Fungus-inert materials in accordance with MIL-STD-454, requirement 4, shall be used.

3.3.1.8 Arc-resistant materials. Arc-resistant materials shall be in accordance with MIL-STD-454, requirement 26.

3.3.1.9 Soldering. Soldering shall be in accordance with MIL-STD-454, requirement 5. (Reference 3.3.2.5 herein.)

3.3.1.10 Threaded parts. Threaded parts shall be in accordance with MIL-STD-454, requirement 12. The use of metric threads shall be coordinated with the procuring activity and shall require approval prior to use.

3.3.2 Detailed requirements

3.3.2.1 Rigid assemblies

3.3.2.1.1 Copper alloy. Copper alloy parts shall conform to ASTM-B36, alloy 220, known commercially as 90/10 Bronze.

3.3.2.1.2 Bronze castings. Bronze castings shall conform to QQ-C-390.

3.3.2.1.3 Silver alloy. Silver alloy parts shall be constructed from commercial coin silver having a composition of 90 percent silver and 10 percent copper.

3.3.2.1.4 Aluminum alloy. Aluminum alloy parts shall conform to QQ-A-250/2, or approved equivalent, tempered as necessary to meet performance requirements.

3.3.2.1.5 Aluminum alloy (sand casting). Rigid assemblies fabricated by sand castings shall conform to QQ-A-601, alloy 40E, 356, or Tenzaloy.

3.3.2.1.6 Aluminum alloy (permanent mold castings). When fabricated by permanent mold castings, aluminum alloy shall be Tenzaloy in accordance with QQ-A-596. Where brazing is not a requirement, alloy 356 may be used.

3.3.2.2 Flexible assemblies

3.3.2.2.1 Copper alloy. When used in flexible assemblies, copper alloy shall conform to ASTM-B36, alloy 220, (90/10 Bronze).

3.3.2.2.2 Copper (low phosphorous). Deoxidized, high conductivity, low-phosphorized copper (DLP) may be used and shall be of the following chemical composition:

a. Copper, Minimum-----99.90

MIL-W-87105 (USAF)

b. Phosphorous-----	0.003
c. Tin-----	0.003
d. Tellurium-----	0.001
e. Lead-----	0.001
f. Iron-----	0.001
g. Arsenic-----	0.001
h. Antimony-----	0.001
i. Nickel-----	0.001
j. Bismuth-----	0.0001

3.3.2.2.3 Beryllium copper alloy. Beryllium copper alloy parts shall conform to the requirements of QQ-C-533 or QQ-C-530, as applicable, condition 1/2H.

3.3.2.2.4 Silver alloy. Silver alloy parts shall be constructed from commercial coin silver having a composition of 90 percent silver and 10 percent copper.

3.3.2.2.5 Jacket material. Jacket material shall be molded rubber selected for its ability to enable the assembly to meet all performance and test requirements specified for the assembly.

3.3.2.3 Waveguide flanges

3.3.2.3.1 Aluminum alloy (bar stock). Flanges fabricated from bar stock shall conform to QQ-A-225/8 or QQ-A-250/11, condition T-6.

3.3.2.3.2 Aluminum alloy (sand castings). Flanges fabricated by sand castings shall conform to QQ-A-601, alloy 40E, 356, or Tenzaloy.

3.3.2.3.3 Aluminum alloy (permanent mold castings). When fabricated by permanent mold castings, flanges shall conform to QQ-A-596, alloy 356, or Tenzaloy.

3.3.2.3.4 Aluminum alloy (die castings). When fabricated by die castings, flanges shall conform to QQ-A-591.

MIL-W-87105 (USAF)

3.3.2.3.5 Aluminum alloy (forgings). When fabricated by forging, flanges shall conform to QQ-A-367, conditioned as required to meet performance requirements.

3.3.2.3.6 Beryllium copper. When beryllium copper is specified in flanges, it shall conform to condition 1/2-H of QQ-C-533.

3.3.2.3.7 Bronze castings. When used in castings, bronze shall conform to QQ-C-390.

3.3.2.3.8 Silver castings. If used, silver castings shall be conducted from commercial coin silver having a composition of 90 percent silver and 10 percent copper.

3.3.2.3.9 Dowel pins. When dowel pins are used, they shall be corrosion resistant steel and shall conform to QQ-S-763.

3.3.2.4 Gaskets. The gasket material shall be synthetic rubber and shall conform to MIL-R-3065, grade RS700ABFF.

3.3.2.5 Silver solder. Silver solder shall conform to QQ-B-654, grade 1.

3.3.2.6 Finishes

3.3.2.6.1 Rigid assemblies and flanges

3.3.2.6.1.1 The r-f mating surfaces of rigid assemblies and flanges shall be yellow irridite in accordance with MIL-C-5541.

3.3.2.6.1.2 All other external metal surfaces of the rigid assemblies and flanges shall be primed with zinc chromate primer conforming to TT-P-1757 and finished with flat black lacquer in accordance with TT-L-20.

3.3.2.6.2 Flexible assemblies. Unless otherwise specified in the detail specification, internal metal surfaces of the flexible assemblies shall be silver-plated in accordance with QQ-S-365 to a minimum thickness of 0.00003 inch.

3.3.2.6.3 All other metal parts not specified herein of waveguide assemblies shall be so plated to provide an assembly that is capable of meeting the environmental conditions specified herein.

3.3.2.6.4 Dimensions of metal parts shall include any plating or finish applied to meet electrical, mechanical, or environmental requirements of this specification.

MIL-W-87105 (USAF)

3.3.2.6.5 Surface roughness. Surface roughness shall be in accordance with the requirements of ANSI-B46.1-1962. Unless otherwise specified in the detail specification, surface roughness shall be 16 microinches on all flange mating surfaces and 63 microinches on all other mechanical surfaces.

3.3.2.7 Marking. Marking of the waveguide assemblies shall be in accordance with requirement 67 of MIL-STD-454 and those requirements specified herein.

3.3.2.7.1 Nameplate. A suitable nameplate containing the following information shall be prepared by the contractor and submitted to the procuring activity for review and approval:

- a. Generic name
- b. RG number, if applicable
- c. Federal or National stock number
- d. Serial number
- e. Contract number
- f. Contractor's part number
- g. Manufacturer's identification number.

3.4 Design and construction. The waveguide assembly shall be designed and constructed to meet the performance requirements specified in this specification and the applicable detail specification under any combination of electrical, mechanical, and environmental conditions specified herein.

3.4.1 Functional subassemblies. The waveguide assembly shall consist of all necessary subassemblies and replaceable parts required to develop it into a single end item that will meet all the requirements specified herein and in the applicable detail specification. The required functional subassemblies shall be as specified in the applicable detail specification.

3.4.2 Form factor. The outline dimensions, mounting provisions, attachment provisions, and weight requirements, if applicable, for the waveguide assembly shall be as specified in the applicable detail specification.

MIL-W-87105 (USAF)

3.4.2.1 Attachment provisions for flanges. The location of flange holes shall be as specified in the detail specification. The method for locating the mounting holes shall be as specified herein.

3.4.2.1.1 The holes shall be measured with respect to Datums -A- and -B- which are established by the cavity dimensions on surface -C- as defined on figure 1.

3.4.2.1.2 Tool points shall be located between 0.02 and 0.06 inch below Datum surface -C-. Example TP Tool point No. 1 used to establish Datum -A- or -B-.

1

3.4.2.1.3 Center line Datum -B- shall be defined, for measuring purposes, as a line connecting the midpoints of the actual dimensions between (TPB1 and TPB2) and (TPB3 and TPB4).

3.4.2.1.4 Center line Datum -A- shall be defined, for measuring purposes, as a perpendicular line thru the midpoint of the actual dimensions between TPA1 and TPA2 on -B-.

3.4.2.2 Weight. Unless otherwise specified in the detail specification, the waveguide assembly shall be so designed that weight will be a minimum consistent with good engineering practice.

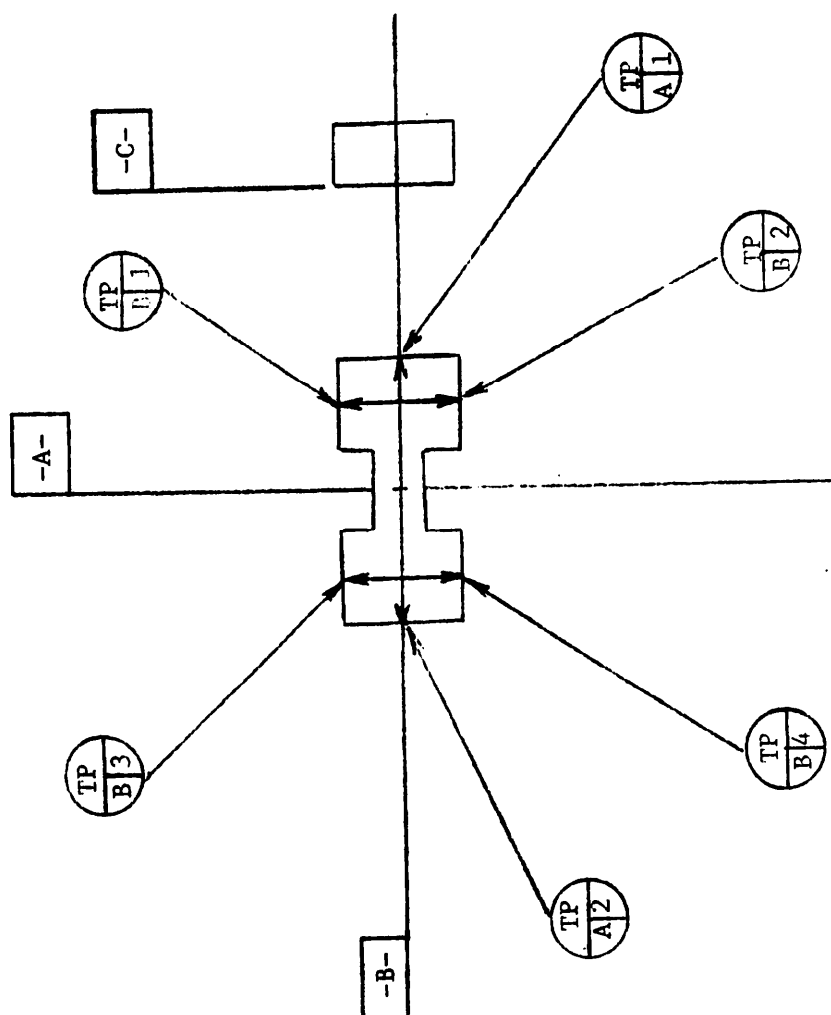
3.4.3 Interface design requirements. Interface design requirements for the waveguide assembly shall be as specified in the detail specification.

3.4.4 Bonding conductivity, discontinuities. The mating surfaces between all metallic parts of the waveguide assembly intentionally designed to be electrically continuous to r-f currents shall be clean metal surfaces free from anodic film, grease, paint, lacquer, or other high-resistance film, to insure negligible r-f impedance between such parts. All portions of the assembly that are required to carry r-f currents or which, during operation, would have high surface current densities, shall have a high surface conductivity.

3.4.5 Pressurization. The waveguide assembly shall be capable of withstanding and maintaining a minimum internal gas pressure of 30 pounds per square inch gauge for periods up to 24 hours without the use of external pressurizing devices when tested as specified in section 4 herein.

3.4.6 Maintainability. When specified by the procuring activity, the contractor shall establish a maintainability program in accordance with MIL-STD-454, requirement 54.

MIL-W-87105 (USAF)



TOOL POINT LOCATION FOR DETERMINING DATUM LINES A AND B

FIGURE 1. Tool point location for determining Datum Lines A and B

MIL-W-87105 (USAF)

3.4.7 Reliability. When specified by the procuring activity, reliability requirements for the waveguide assembly shall be determined in accordance with MIL-STD-781.

3.4.7.1 Longevity. The waveguide assembly shall be designed to have a minimum operating life of 1000 hours, with a reasonable servicing and replacement of parts, when subjected to continuous periods of operation of up to 8 hours at a time. A total operating life of 2000 hours shall be a design objective.

3.4.7.2 Service life. The waveguide assembly shall be designed to have a life expectancy, both operating and nonoperating, of 10 years.

3.4.8 Safety. Safety requirements shall be in accordance with MIL-STD-454, requirement 1.

3.4.9 Human engineering. Human engineering shall be in accordance with MIL-STD-454, requirement 62.

3.5 Performance. The waveguide assembly shall perform as specified herein and in the detail specification over the specified frequency range when the characteristics are measured as specified in section 4 herein.

3.5.1 Electrical properties

3.5.1.1 Frequency range. The frequency range of the waveguide assembly shall be as specified in the detail specification.

3.5.1.2 Voltage standing wave ratio (VSWR). The VSWR at the input to the waveguide assembly shall not exceed the value specified in the detail specification.

MIL-W-87105 (USAF)

3.5.1.3 Impedance. The impedance of the waveguide assembly shall be measured and plotted as specified in section 4 herein.

3.5.1.4 Insertion loss. The insertion loss of the waveguide assembly shall not exceed the value specified in the detail specification.

3.5.1.5 Power handling capability (PHC). The waveguide assembly shall be capable of handling the power level specified in the detail specification.

3.5.1.6 R-f leakage. The design of the waveguide assembly shall be such to suppress r-f radiation of the fundamental and harmonics. The r-f suppression capability shall be as specified in the detail specification.

3.5.1.7 Electrical length. When the waveguide assembly is tested as specified in section 4, the electrical length shall be as specified in the detail specification.

3.5.2 Mechanical requirements

3.5.2.1 Interface flatness. Both terminations of the waveguide assembly shall be capable of passing the flatness test as specified in section 4.

3.5.2.2 Tensile load. Both terminations of the waveguide assembly shall be capable of passing the tensile load test specified in section 4. The stress force shall be as specified in the applicable detail specification.

3.5.2.3 Torque. Both terminations of the waveguide assembly shall be capable of passing the torque test specified in section 4. The torque value shall be as specified in the applicable detail specification.

3.5.2.4 Flexing endurance. Unless otherwise specified in the detail specification, flexible assemblies shall be capable of withstanding repeated flexures of $\pm 30^\circ$ per foot in the E plane for 10^5 cycles and $\pm 15^\circ$ per foot in the H plane for 10^5 cycles without damage, deterioration, or degradation of performance.

3.5.2.5 Minimum bend radius. The minimum bend radius of flexible waveguides for both planes shall be as specified in the detail specification.

3.5.2.6 Axial twist. The axial twist of the flexible assembly shall be as specified in the detail specification.

3.5.3 Environmental conditions. The waveguide assembly shall be so designed and constructed that no fixed part or assembly will become loose, no moving or movable part will be shifted in position, and no performance degradation, during operation or after storage, will be

MIL-W-87105 (USAF)

caused beyond that specified herein or in the detail specification for the particular waveguide assembly.

3.5.3.1 Temperature. Unless otherwise specified in the detail specification, the waveguide assembly shall perform as specified herein.

3.5.3.1.1 Operating conditions. The assembly shall perform under conditions of uncontrolled humidity, over a temperature range of -54°C to 150°C continuously. The temperature may remain constant for a period of time or vary at a rate as high as 1°C per second.

3.5.3.1.2 Nonoperating conditions. The assembly shall be capable of being stored at temperatures ranging from -62°C to 150°C for long periods of time.

3.5.3.2 Altitude. Unless otherwise specified in the detail specification, the assembly shall operate continuously at barometric pressure ranging from 30 inches Hg down to 1.32 inches Hg (approximately 70,000 feet altitude). The altitude may remain constant for long periods or vary at a rate as high as 0.5 inch of mercury per second.

3.5.3.3 Temperature-altitude. The waveguide assembly shall provide the required performance when subjected to the temperature-altitude tests specified in section 4.

3.5.3.4 Vibration. The assembly shall be designed to withstand the vibration test specified in section 4 without damage, deterioration, or degradation of performance.

3.5.3.5 Shock. The assembly shall be designed to withstand the shock test specified in section 4 without damage, deterioration, or degradation of performance.

3.5.3.6 Dust (fine sand). The assembly shall be designed to withstand the dust (fine sand) test specified in section 4 without damage, deterioration, or degradation of performance.

3.5.3.7 Humidity. The assembly shall be designed to operate both intermittently and continuously at relative humidities up to 100 percent at temperatures up to 50°C , including conditions where condensation takes place in or on the equipment without damage, deterioration, or degradation of performance.

3.5.3.8 Salt-fog. The assembly shall be designed to withstand the salt-fog test specified in section 4 without damage, deterioration, or degradation of performance.

MIL-W-87105 (USAF)

3.5.3.9 Explosion-proof. The assembly shall be made explosion-proof and shall not cause ignition of the explosive mixture when subjected to the explosive atmosphere test as specified in section 4.

3.5.3.10 Flammability. Non-metallic components of the assembly shall not be damaged and shall be self-extinguishing within 6 seconds when tested as specified in section 4.

3.5.3.11 Heat aging and cold bend. There shall be no evidence of cracks, flaws, or loss of flexibility in the principal component parts of the assembly when tested as specified in section 4.

3.5.3.12 Abrasion resistance. Unless otherwise specified in the detail specification, the flexible assemblies shall be capable of withstanding 1000 cycles of the abrasion resistance test specified in section 4 without damage, deterioration or degradation of performance.

3.5.3.13 Chemical resistance. The waveguide assembly shall be resistant to chemicals and shall withstand the test specified in section 4 without degradation to any component of the waveguide.

3.5.3.14 Pressure (immersion)/leakage. The waveguide assembly shall be designed to withstand the tests specified in section 4 without damage, deterioration or degradation of performance.

MIL-W-87105 (USAF)

3.6 Interchangeability. Interchangeability requirements shall be in accordance with MIL-STD-454, requirement 7.

3.7 Workmanship. Workmanship shall be in accordance with MIL-STD-454, requirement 9.

3.8 Definitions. Definitions applicable to this specification shall be as specified under section 6 herein.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Notwithstanding any terms, conditions, tests, etc., delineated elsewhere in this document, the Government in order to assure that the article(s) comply with specification requirements prior to granting approval of the article(s) being procured, unconditionally reserves the right to: repeat any examination or test when a reasonable doubt exists that the performance of the equipment is marginal, and accomplish or have accomplished additional tests or examinations as deemed appropriate by the cognizant engineering activity.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.4)
- b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions

4.3.1 Test conditions

4.3.1.1 Room ambient conditions. Unless otherwise specified, the test shall be conducted under the following conditions:

- a. Temperature: Room ambient (13°C to 38°C)

MIL-W-87105 (USAF)

- b. Altitude: Normal ground
- c. Vibration: None
- d. Relative humidity: 20 to 80 percent.

4.3.1.2 Test condition tolerances. Unless otherwise specified, the maximum tolerances on test conditions shall be as follows:

- a. Temperature: $\pm 2^{\circ}\text{C}$
- b. Altitude: ± 5 percent in feet
- c. Humidity: ± 2 percent relative.

4.3.1.3 Stabilization of test conditions. When specified, temperature and altitude stabilization shall have been achieved prior to the start of the operational portion of the test in accordance with the following definitions:

a. Temperature stabilization. When the temperature of the chamber and the temperature of the test item do not change by more than $\pm 2^{\circ}\text{C}$, nor does the temperature of the chamber and the temperature of the test item differ by more than 3.5°C over a 10-minute period, the temperature shall be considered stabilized.

b. Altitude stabilization. When the altitude remains constant within ± 5 percent of the specified value for 10 minutes, the altitude shall be considered stabilized.

4.3.2 . Temperature sensing devices. When it is required during the test program to measure and record the temperature or associated temperature rise of the equipment, 2 thermocouples shall be used to measure ambient conditions and a minimum of 3 thermocouples shall be used on the test sample. The temperature of the thermocouples shall be recorded at the start and completion of the test period, at 5-minute intervals during the test period, and at more frequent intervals if the temperature rise exceeds 3°C during any 5-minute period.

4.3.3 Air circulating devices. If fans or other devices for circulating air are required in any chamber used in the test program, they shall be positively identified along with their exact position in relation to the test sample as depicted in the sketch of the test configuration. Air shall not be blown directly on the test sample during testing.

MIL-W-87105 (USAF)

4.3.4 Test equipment requirements

4.3.4.1 All of the equipment required to accomplish each different test shall be tabulated and described in a test equipment list contained in each test procedure. All of this equipment shall be traceable to the National Bureau of Standards.

4.3.4.2 The calibration cycle of the equipment used, and the accuracy of the equipment, shall be specified in each test procedure.

4.3.4.3 The frequency measuring device shall have an accuracy of ± 0.2 percent or better.

4.3.4.4 The power measuring or monitoring equipment shall have an accuracy of ± 5 percent.

4.3.4.5 The dimensional measuring instruments shall have an accuracy at least 5 times better than the specified tolerance.

4.3.4.6 The insertion loss measuring equipments shall have an accuracy of ± 0.04 dB, or 2 percent of the specified insertion loss value, whichever is greater.

4.3.4.7 When mating termination is required in a specified test, the mating interfaces shall meet, or exceed, all the requirements specified for the item being tested.

MIL-W-87105 (USAF)

4.4 Qualification inspection

4.4.1 Qualification test samples. The qualification test samples shall be models representative of the production equipment. The samples shall be identified with the manufacturer's part number and such other information as required by the procuring activity. The samples shall be tested under the inspection conditions specified herein and at the location designated by the activity responsible for qualification (see 6.3).

4.4.1.1 Testing instructions. Unless otherwise specified in the detail specification, one each qualification test sample as identified in 4.4.2 shall be subjected to applicable qualification tests in accordance with table I to determine that the design of the waveguide assembly meets the requirements specified herein. Qualification tests shall be conducted in the sequence listed in table I.

4.4.2 Test sample identification. Unless otherwise specified in the detail specification, test sample 1 shall be a rigid waveguide and test sample 2 shall be a flexible waveguide.

4.4.3 Qualification tests. Qualification tests shall consist of the tests specified under table I.

4.4.4 Accept-reject criteria

4.4.4.1 Test failure. If the assemblies fail to pass a test as specified in 4.4.1.1, the contractor shall stop the test program and notify the procuring activity of the test failure within 24 hours. Unless otherwise specified by the procuring activity, the failure of any one test in the test program shall be considered a failure of the test program. When failure occurs, the contractor shall prepare a failure report which shall include description of the failure, an analysis of the cause of the failure, corrective action proposed, and the extent of retest if applicable.

4.4.4.2 Test discrepancy. Any discrepancy that occurs during testing shall be reported to the procuring activity within 24 hours. Testing shall continue unless otherwise advised by the procuring activity. The contractor shall prepare a discrepancy report for procuring activity approval including a description of the discrepancy, an analysis of the cause of discrepancy, corrective action proposed, and the extent of retest if applicable.

MIL-W-87105 (USAF)

TABLE I. QUALIFICATION TEST PROGRAM

TEST	PARAGRAPH	TEST SAMPLES (see 4.4.2)	
		1	2
EXAMINATION OF PRODUCT, ALL PROCEDURES	4.6.1	X	X
INTERFACE FLATNESS	4.6.3.1	X	X
VSWR, PROCEDURE I	4.6.2.1	X	X
IMPEDANCE	4.6.2.2	X	X
INSERTION LOSS, ALL PROCEDURES	4.6.2.3	X	X
POWER HANDLING	4.6.2.4	X	X
R-F LEAKAGE	4.6.2.5	X	X
ELECTRICAL LENGTH	4.6.2.6	X	X
TENSILE LOAD	4.6.3.2	X	X
TORQUE	4.6.3.3	X	X
FLEXING ENDURANCE	4.6.3.4		X
MINIMUM BENDING RADIUS	4.6.3.5		X
AXIAL TWIST	4.6.3.6		X
TEMPERATURE-ALTITUDE	4.6.4.1	X	X
VIBRATION	4.6.4.2	X	X
SHOCK	4.6.4.3	X	X
DUST (FINE SAND)	4.6.4.4	X	X
HUMIDITY	4.6.4.5	X	X
SALT FOG	4.6.4.6	X	X
EXPLOSIVE ATMOSPHERE	4.6.4.7	X	X
FLAMMABILITY	4.6.4.8		X
HEAT AGING & COLD BEND	4.6.4.9		X
ABRASION RESISTANCE	4.6.4.10		X
CHEMICAL RESISTANCE	4.6.4.11	X	X
PRESSURE (IMMERSION)/LEAKAGE PROCEDURE I	4.6.4.12.1	X	X

NOTE: Specific required values for the tests shall be as specified in the detail specification.

MIL-W-87105 (USAF)

4.4.5 Qualification provisions. Qualification provisions shall be in accordance with SD-6. Engineering data and test reports as specified in SD-6 and under 4.10 herein shall be furnished to the procuring activity for review and approval.

4.4.6 Retention of qualification. After approval of his qualification test report, and subsequent listing on a qualified products list (QPL), the contractor shall submit, at two-year intervals, a certification signed by a responsible official of management, attesting that the listed product(s) is still available from the listed plant, can be produced under the same conditions as originally qualified; i.e., same process, materials, construction, design, manufacturer's part number, or designation; and meets the requirements of the current issue of the specification. Failure to provide the certification shall be cause for removal from the QPL.

4.5 Quality conformance inspection. Prior to conducting quality conformance inspection, the qualification test program (4.4) shall be conducted by the contractor, and approved by the procuring activity; and the equipment(s) to be subjected to quality conformance inspection shall be certified by the contractor as being identical to the approved qualification sample(s). Quality conformance inspection shall consist of individual tests (4.5.1) and sampling plans and test (4.5.2).

MIL-W-87105 (USAF)

4.5.1 Individual tests. All production equipment shall be subjected to the tests specified in table II in the sequence as listed.

4.5.2 Sampling plans and tests

4.5.2.1 Sampling test program

4.5.2.1.1 Sampling plan schedule. Production equipment that have passed the individual tests shall be selected at random in accordance with table III.

4.5.2.1.2 Sampling plan tests. Selected equipment shall be subjected to the tests, in the sequence listed, of the applicable sampling plan in accordance with table IV.

4.5.2.2 Accept-reject criteria

4.5.2.2.1 Unless otherwise authorized by the procuring activity in writing, the sampling test program for any one sampling test group shall be completed and the test results shall show that the equipment(s) has successfully passed the required tests prior to delivery of any equipment in that group.

4.5.2.2.2 Test failure. When any selected equipment fails to pass a specified test, the contractor shall stop the test program and notify the procuring activity of the test failure within 24 hours. Unless otherwise stipulated by the procuring activity, the failure of any one test in the test program shall be considered a failure of the test program. When failure occurs, the contractor shall prepare a failure report which shall include a description of the failure, an analysis of the cause of the failure, corrective action proposed, and the extent of retest proposed.

MIL-W-87105 (USAF)

TABLE II. Individual tests for waveguide assemblies.

TEST	APPLICABLE PARAGRAPH
Examination of product, procedure V	4.6.1.5
Interface flatness	4.6.3.1
Pressure (immersion)/leakage, procedure II	4.6.4.12.2
VSWR, procedure III	4.6.2.1.3
Insertion loss, procedure I	4.6.2.3.1

TABLE III. Sampling plan schedule.

Qty of Consecutively Produced Items *	No. Tested Per Increment	Total Tested	Applicable Sampling Plan
1 to 50	1	1	A
51 to 125	1	2	B
126 to 200	1	3	A
201 to 300	1	4	C
Over 300	1 for each additional 100	Variable sequence	Repeat this sequence for each additional 100

* Quantity is taken on a continuous basis regardless of quantity on contract or individual order.

MIL-W-87105 (USAF)

TABLE IV. Sampling plan tests.

TEST	PARAGRAPH	APPLICABLE SAMPLING PLAN			TEST ITEMS	
		A	B	C	RIGID WAVEGUIDE	FLEXIBLE WAVEGUIDE
Examination of product, procedure I	4.6.1.1	A	B	C	X	X
VSWR, procedure I	4.6.2.1.1	A	B	C	X	X
Power handling capability	4.6.2.4		B		X	X
Insertion loss, procedure I	4.6.2.3.2		B	C	X	X
Impedance	4.6.2.2		B		X	X
Salt fog	4.6.4.6			C	X	X
Pressure (immersion)/Leakage, procedure II	4.6.4.12.2			C	X	X

MIL-W-87105 (USAF)

4.5.2.2.3 Test discrepancy. Any discrepancy that occurs during testing shall be reported to the procuring activity within 24 hours. Testing shall continue unless otherwise advised by the procuring activity. The contractor shall prepare a discrepancy report for procuring activity approval including a description of the discrepancy, an analysis of the cause of the discrepancy, corrective action proposed, and the extent of retest if applicable.

4.5.2.3 Individual tests may continue. For production reasons, individual tests may be continued pending the investigation of a sampling test failure. However, final acceptance of equipment on hand or produced later shall not be made until it is determined that all equipments meet all the requirements of this specification.

4.5.3 Defects in equipment already accepted. The investigation of a test failure could indicate that defects may exist in equipments already accepted. If so, the contractor shall fully advise the procuring activity of all defects likely to be found and the methods of correcting them.

MIL-W-87105 (USAF)

4.6 Methods of inspection

4.6.1 Examination of product

4.6.1.1 Procedure I (engineering acceptance inspection). The equipment shall be examined to verify that the physical parameters, finishes, markings, workmanship, and design and construction comply with the applicable detail specification and the requirements specified herein. If the assembly of parts, or the assemblies, prevent accomplishing the examination at the conclusion of the assembly process, the examination may be accomplished at an "in process" inspection point providing that the test procedures so indicates.

4.6.1.1.1 Physical parameters. Using measuring instruments at least five times more accurate than the specified tolerances, all the dimensions specified in the applicable detail specification shall be measured. The measurements shall include concentricity, circularity, surface roughness, angles, corners and edges.

4.6.1.1.2 Finishes. All finishes used on the equipment shall be verified for compliance with the detail specification requirements. The verification shall be a certification if the finish is applied by the prime contractor, or a certificate of compliance if the finish is applied by a subcontractor.

4.6.1.1.3 Markings. The assembly shall be examined to verify that the identification nameplates are properly located and securely attached, and the information contained thereon complies with the requirements of this specification.

4.6.1.1.4 Workmanship. The equipment, including all parts and accessories, shall be examined to insure that the construction of the assembly has been accomplished in a thoroughly workmanlike manner.

4.6.1.1.5 Design and construction. The prime contractor shall verify that the design, materials, processes and construction of the equipment comply with the applicable detail specification.

4.6.1.1.6 Accept-reject criteria (procedure I). If the results of procedure I tests show that the equipment fails to meet the mechanical requirements as established by this document, or if the materials, processes, finishes, design and construction, and workmanship fail to comply with the requirements as established by this document, the equipment shall be considered to have failed the test.

MIL-W-87105 (USAF)

4.6.1.2 Procedure II (damage and deterioration inspection). When required, the waveguide shall be examined for damage, deterioration, corrosion, or change in tolerance limits of any internal or external component. A detailed description of the exact condition of the equipment shall be recorded on the test data sheet.

4.6.1.2.2 Accept-reject criteria (procedure II). If the results of this examination reveal that damage, deterioration, corrosion, or change in tolerance limits of any internal or external components has occurred, the equipment shall be considered to have failed the test.

4.6.1.3 Procedure III (radiographic inspection). When specified, the equipment shall be radiographically inspected for damage and deterioration in accordance with MIL-STD-453.

4.6.1.3.1 Accept-reject criteria (procedure III). If the results of this examination reveal that damage or deterioration has occurred, the equipment shall be considered to have failed the test.

4.6.1.4 Procedure IV (disassembly inspection). The equipment shall be completely disassembled and examined for evidence of moisture, damage, deterioration, or a change beyond specified tolerance limits for any internal or external components.

4.6.1.4.1 Accept-reject criteria (procedure IV). If the results of this examination reveal evidence of moisture, damage, or deterioration, of a change beyond specified tolerance limits for any internal or external components, the equipment shall be considered to have failed the test.

4.6.1.5 Procedure V (identity certification). If the contractor can certify that the design, construction, materials, finishes, and processes of the test sample are identical to the equipment that was subjected to the qualification test program, the test sample shall be subjected to an examination of product that shall include measurement of all design interface dimensions and over-all form factor considerations as specified in the applicable detail specification and inspection of marking and workmanship to determine compliance with specification requirements.

4.6.1.5.1 Accept-reject criteria (procedure V). If the contractor cannot certify that the design, construction, materials, finishes, and processes of the test sample are identical to the equipment that was subjected to the qualification test program, or if the results of this test show that the equipment fails to meet the dimensional, marking, and workmanship requirements as established by this specification, the equipment shall be considered to have failed the test.

4.6.2 Electrical tests

4.6.2.1 Voltage standing wave ratio (VSWR) tests. The VSWR test procedures specified herein shall be accomplished by either the slotted line, reflectometer, or swept slotted line method, requiring the following test apparatus as applicable; a slotted line and related instrumentation, reflectometer setup, or a swept slotted line and related instrumentation, and necessary termination.

4.6.2.1.1 Procedure I (VSWR engineering acceptance test). Procedure I shall determine VSWR engineering acceptance of the equipment.

4.6.2.1.1.1 Test conditions. Test conditions for procedure I shall be those applicable to the method selected (4.6.2.1.1.2, 4.6.2.1.1.3, or 4.6.2.1.1.4). The over-all accuracy of the VSWR measuring device(s) shall be such that the (absolute VSWR) = (measured VSWR) $\pm 0.08^*$ (maximum specified VSWR - 1). (NOTE: $^*0.10$ for frequencies above 12 GHz.)

4.6.2.1.1.2 Test method 1 - Slotted line. When using the slotted line method, measurements shall be made at frequency increments not greater than 0.025 GHz between 0.50 and 5 GHz, 0.05 GHz between 5 and 10 GHz and 0.10 GHz above 10 GHz. The measured data shall be recorded on a tabulation sheet or plotted on 8- by 10-inch graph paper.

4.6.2.1.1.3 Test method 2 - Reflectometer. When using the reflectometer method for recording VSWR, a complete curve shall be recorded by an X-Y recorder using 8- by 10-inch graph paper (10 by 10 to the inch). Calibration curves that represent the maximum VSWR to be measured and the limits of the band of doubt (see 6.4.3) shall be plotted on the graph paper. Curves shall be plotted with a limit of 1 octave per plot.

4.6.2.1.1.3.1 VSWR calibration curves shall be plotted in increments of 0.1 between VSWR limits of 1.1:1 and 1.9:1, and 0.2 above a VSWR of 2:1 and grid markers along the horizontal axis to represent the following frequency increments:

- a. 0.025 GHz increments between 0.50 and 5 GHz
- b. 0.05 GHz increments between 5 and 10 GHz
- c. 0.10 GHz increments above 10 GHz.

MIL-W-87105 (USAF)

4.6.2.1.1.3.2 Using the VSWR curves of 4.6.2.1.1.3.1, the VSWR shall be tabulated at the frequency increments specified under 4.6.2.1.1.3.1.

4.6.2.1.1.3.3 Prior to accomplishing VSWR measurements, the maximum VSWR calibration curve shall be rechecked to insure repeatability of the curve. If values of VSWR are within the band of doubt, the VSWR shall be measured using the slotted line method in sufficiently close increments to define a smooth curve structure, but at increments not greater than those specified in 4.6.2.1.1.2; or the VSWR shall be measured by the reflectometer method using the expanded reflectometer scale to define a curve, but the expanded curve shall cover the entire paper (8 by 10 inches).

4.6.2.1.1.4 Test method 3 - Swept slotted line. When using the swept slotted line, the VSWR measurements shall be recorded by an X-Y recorder using 8- by 10-inch graph paper (10 by 10 to the inch). The traces shall be an X-Y plot of dB/cm versus frequency and shall be plotted with a limit of 1 octave per plot at a minimum sweep rate of 30 seconds per frequency band. If equipment under test exhibits an abrupt change in VSWR, the sweep rate shall be further slowed to assure that the pen of the X-Y recorder can follow these abrupt changes. The traces shall be marked at frequency increments of not greater than 0.025 GHz between 0.50 and 5 GHz, 0.05 GHz between 5 and 10 GHz, and 0.10 GHz above 10 GHz, and labeled at not greater than four times the increments specified. In addition, the plot shall have a nomograph that converts dB/cm to VSWR, and shall identify the test sample, the test date, the serial number, the technician performing the test, the general and detail test procedure, and the maximum allowable VSWR.

4.6.2.1.1.4.1 Using the VSWR traces of 4.6.2.1.1.4, the VSWR shall be tabulated at the frequency increments specified in 4.6.2.1.1.4.

4.6.2.1.1.4.2 Prior to accomplishing the VSWR measurement, adjustments should be made to insure that the frequency and sweep width of the sweep signal generator are set to the desired bandwidth within the limitation of the equipment. (Additional sweep generators shall be used if required to achieve the desired bandwidth.) Precaution shall be taken to insure that the X-sensitivity of the recorder is adjusted to accommodate the entire sweep and that the plot will be approximately in the center of the graph paper for the entire frequency range.

4.6.2.1.1.5 Accept-reject criteria (procedure I). If the VSWR of the equipment under test exceeds the value specified in the applicable detail specification, the equipment shall be considered to have failed the VSWR engineering acceptance test.

4.6.2.1.2 Procedure II (VSWR comparison test). The VSWR comparison test shall check the electrical performance of the equipment before, and after, certain mechanical and environmental tests.

4.6.2.1.2.1 Test conditions. Test conditions for procedure II shall be those applicable to the method selected (4.6.2.1.2.2, 4.6.2.1.2.3, or 4.6.2.1.2.4), and those additionally specified in 4.6.2.1.1.1.

4.6.2.1.2.2 Test method 1 - Slotted line. When using the slotted line method, measurements shall be made at frequency increments not greater than 0.05 GHz between 0.50 and 5 GHz, 0.10 GHz between 5 and 10 GHz, and 0.20 GHz above 10 GHz. If values of VSWR are within the band of doubt, the VSWR shall be measured in sufficiently close increments to define a smooth curve structure, but at increments not greater than those specified in 4.6.2.1.1.2. The measured data shall be recorded on a tabulation sheet or plotted on 8- by 10-inch graph paper.

4.6.2.1.2.3 Test method 2 - Reflectometer. The reflectometer method shall be accomplished as specified in procedure I (4.6.2.1.1.3).

4.6.2.1.2.4 Test method 3 - Swept slotted line. The swept slotted line method shall be accomplished as specified in procedure I (4.6.2.1.1.4).

4.6.2.1.2.5 Accept-reject criteria (procedure II). If the reflection coefficient of the equipment as measured prior to, and after, mechanical or environmental tests, fails to remain within ± 10 percent within the neighborhood or ± 2 percent frequency search, or 0.02, whichever is greater; or if the VSWR exceeds the value specified in the detail specification, the equipment shall be considered to have failed the VSWR comparison test.

4.6.2.1.3 Procedure III (VSWR production test). The VSWR production test shall determine the VSWR of the production equipment.

4.6.2.1.3.1 Test conditions. Test conditions for procedure III shall be those applicable to the method selected (4.6.2.1.3.2, 4.6.2.1.3.3, or 4.6.2.1.3.4) and those additionally specified in 4.6.2.1.1.1.

4.6.2.1.3.2 Test method 1 - Slotted line. When using the slotted line method, measurements shall be made at frequency increments not greater than 0.10 GHz between 0.50 and 5 GHz, 0.20 GHz between 5 and 10 GHz, and 0.40 GHz above 10 GHz. The measured data shall be recorded on a tabulation sheet or plotted on 8- by 10-inch graph paper.

MIL-W-87105 (USAF)

4.6.2.1.3.3 Test method 2 - Reflectometer. The reflectometer method shall be accomplished as specified in procedure I (4.6.2.1.1.3).

4.6.2.1.3.4 Test method 3 - Swept slotted line. The swept slotted line method shall be accomplished as specified in procedure I (4.6.2.1.1.4), except the permanent record may be an X-Y recording or a photographic record taken from an oscilloscope display. (No tabulation required.)

4.6.2.1.3.5 Other test methods. Other test methods may be used when approved by the cognizant engineering activity.

4.6.2.1.3.6 Accept-reject criteria (procedure III). If the VSWR of the equipment under test exceeds the value specified in the applicable detail specification, the equipment shall be considered to have failed the VSWR production test.

MIL-W-87105 (USAF)

4.6.2.2 Impedance test. The impedance test shall determine the impedance of the assembly.

4.6.2.2.1 Test setup

4.6.2.2.1.1 Test equipment. A slotted line and associated equipment, signal generators, terminations, and shorts shall be required.

4.6.2.2.1.2 Test conditions. This test shall be conducted under room ambient conditions (4.3.1.1) and as specified herein.

4.6.2.2.2 Procedure. The impedance of the assembly shall be measured at the frequency increments specified in 4.6.2.1.1.2. All impedance points shall be plotted and clearly labeled on a Smith chart. A circle that represents the specified maximum VSWR of the waveguide assembly under test shall be plotted.

4.6.2.2.3 Accept-reject criteria. If all impedance points fall within the plotted maximum VSWR circle, the assembly shall be considered to have passed the impedance test.

MIL-W-87105 (USAF)

4.6.2.3 R-f insertion loss tests. The test procedures specified herein shall determine the r-f insertion loss characteristics of the assembly.

4.6.2.3.1 Test setup

4.6.2.3.1.1 Test equipment and apparatus. A signal generator, matched loads, detectors, and associated instrumentation shall be required. The test equipment shall be capable of providing a continuous measurement of r-f insertion loss over the required frequency ranges.

4.6.2.3.1.2 Test conditions. Unless otherwise specified in the detail specification, the test shall be conducted under room ambient conditions (4.3.1.1) and as specified herein. The insertion loss versus frequency shall be plotted on rectangular coordinate graph paper 10 by 15 inches (10 divisions per inch) with precaution being taken to insure that the plot is so positioned that both the 0dB reference plot and the insertion loss plot are clearly legible. The permanent record shall be calibrated and capable of differentiating an insertion loss change of 0.05 dB. The measuring system response shall be such that an insertion loss variation of 1.0 dB with a frequency width as narrow as 0.02 GHz will be displayed with degradation limited to less than 20 percent.

4.6.2.3.2 Procedure I (r-f insertion loss). An appropriate test setup shall be assembled to measure the power delivered to a load by a generator before and after insertion loss of the test sample. Precaution shall be taken to insure that the reflected energy does not affect the output of the generator. The insertion loss shall be measured at the frequencies specified in the applicable detail specification. (Reference 6.4.4.)

4.6.2.3.2.1 Accept-reject criteria (procedure I). If the measured insertion loss is equal to, or less than, the value specified in the detail specification, the assembly shall be considered to have passed the r-f insertion loss test.

4.6.2.3.3 Procedure II (insertion loss uniformity). The r-f insertion loss uniformity shall be determined by measuring the fine structure variation (reference 6.4.5) of the r-f insertion loss. The permanent record obtained in procedure I (4.6.2.3.2) shall be measured to determine the maximum value of fine structure variation within the specified bandwidth.

4.6.2.3.3.1 Accept-reject criteria (procedure II). The assembly shall be considered to have failed the insertion loss uniformity test if the assembly fails to meet the criteria specified in the detail specification.

MIL-W-87105 (USAF)

4.6.2.4 Power handling capability test. The power handling capability of the test sample shall be determined by subjecting the assembly to rated power at the altitudes and temperatures specified herein.

4.6.2.4.1 Test setup

4.6.2.4.1.1 Test equipment. A temperature-altitude chamber, high power terminations, a power source, and associated instrumentation shall be required.

4.6.2.4.1.2 Test conditions

a. Temperature sensing devices (see 4.3.2) shall be used to measure chamber and test sample conditions, and chamber and test sample conditions shall be stabilized (see 4.3.1.3) prior to each step in the test program.

b. The upper frequency used shall be within 10 percent of the upper frequency limit of the sample under test. The lower frequency shall be within 0.10 GHz of the low end of the band, and the third frequency shall be the approximate center of the frequency range.

c. If a peak power rating is specified in the detail specification, the assembly shall be subjected to the peak power rating for 1 hour at a frequency within 10 percent of the high end of the band.

d. Test shall be conducted while the test sample is being subjected to the high temperature and high altitude conditions specified in 3.5.3.1 and 3.5.3.2.

e. The VSWR of the load shall be a minimum of 1.75:1.

4.6.2.4.2 Procedure

4.6.2.4.2.1 The assembly shall be placed in the test chamber and the power handling capability of the test sample shall be determined by energizing the test sample at full rated power as specified in the detail specification.

4.6.2.4.2.2 The time period for the low and middle frequencies tested shall not be less than 20 minutes. The time period for the high frequency tested shall not be less than 1 hour.

4.6.2.4.2.3 The chamber and equipment temperature shall be returned to, and stabilized at, room temperature (4.3.1.1) between each application of high power.

MIL-W-87105 (USAF)

4.6.2.4.2.4 The assembly shall be subjected to the peak power specified in the applicable detail specification for a period of 1 hour within 10 percent of the specified high frequency.

4.6.2.4.2.5 At the conclusion of the power handling test the assembly shall be removed from the chamber and shall be subjected to examination of product, procedure II (4.6.1.2).

4.6.2.4.3 Accept-reject criteria. If the assembly completes the power test without breakdown and passes the accept-reject criteria of 4.6.1.2.2, the equipment shall be considered to have passed the test.

4.6.2.5 R-f leakage test. The r-f leakage test shall determine that the r-f energy leaked from an assembly is within specified limits.

4.6.2.5.1 Test setup

4.6.2.5.1.1 Test equipment. Test equipment used to perform the r-f leakage test shall meet the requirements of 4.3.4. The test equipment listed on sheet 1, figure 2, shall be required to perform this test and it shall be capable of performing satisfactorily throughout the design frequency range of the assembly. The apparatus described on sheets 2 through 4 of figure 2 shall also be required, as applicable.

4.6.2.5.1.2 Test conditions. Test shall be conducted under room ambient conditions (4.3.1.1) and as specified herein.

4.6.2.5.2 Procedure

4.6.2.5.2.1 Test frequencies shall be selected to insure complete scanning of the design frequency range of the assembly.

4.6.2.5.2.2 R-f leakage measurements shall be made at each interface.

4.6.2.5.2.3 The test routine for a single test frequency at a particular point shall be as follows:

a. RECORDER CALIBRATION:

Step 1: Connect the test equipment as shown on figure 2, sheet 2.

MIL-W-87105 (USAF)

<u>EQUIPMENT ITEM</u>	<u>EQUIPMENT NOMENCLATURE</u>	<u>REQUIRED PERFORMANCE PARAMETERS</u>
1	Microwave Sweep Oscillator	Levelled output variable 0 to 100 mw minimum
2	Directional Coupler	20 dB
3	Variable Attenuator	Variable 0 to 50 dB
4	Isolator	20 dB isolation minimum
5	Direction Coupler	10 dB
6	Harmonic Frequency Converter	
7	Network Analyzer with Gain Indicator Plug-In	
8	X-Y Recorder	
9	Fixed Attenuator	20 dB
10	Test Cavity	
11	D-C Oscilloscope	
12	Frequency Meter	
13	Detector Mount	
14	Short Circuit Assy	

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FIGURE 2. R-f leakage test equipment and setup
(Sheet 1 of 4).

MIL-W-87105 (USAF)

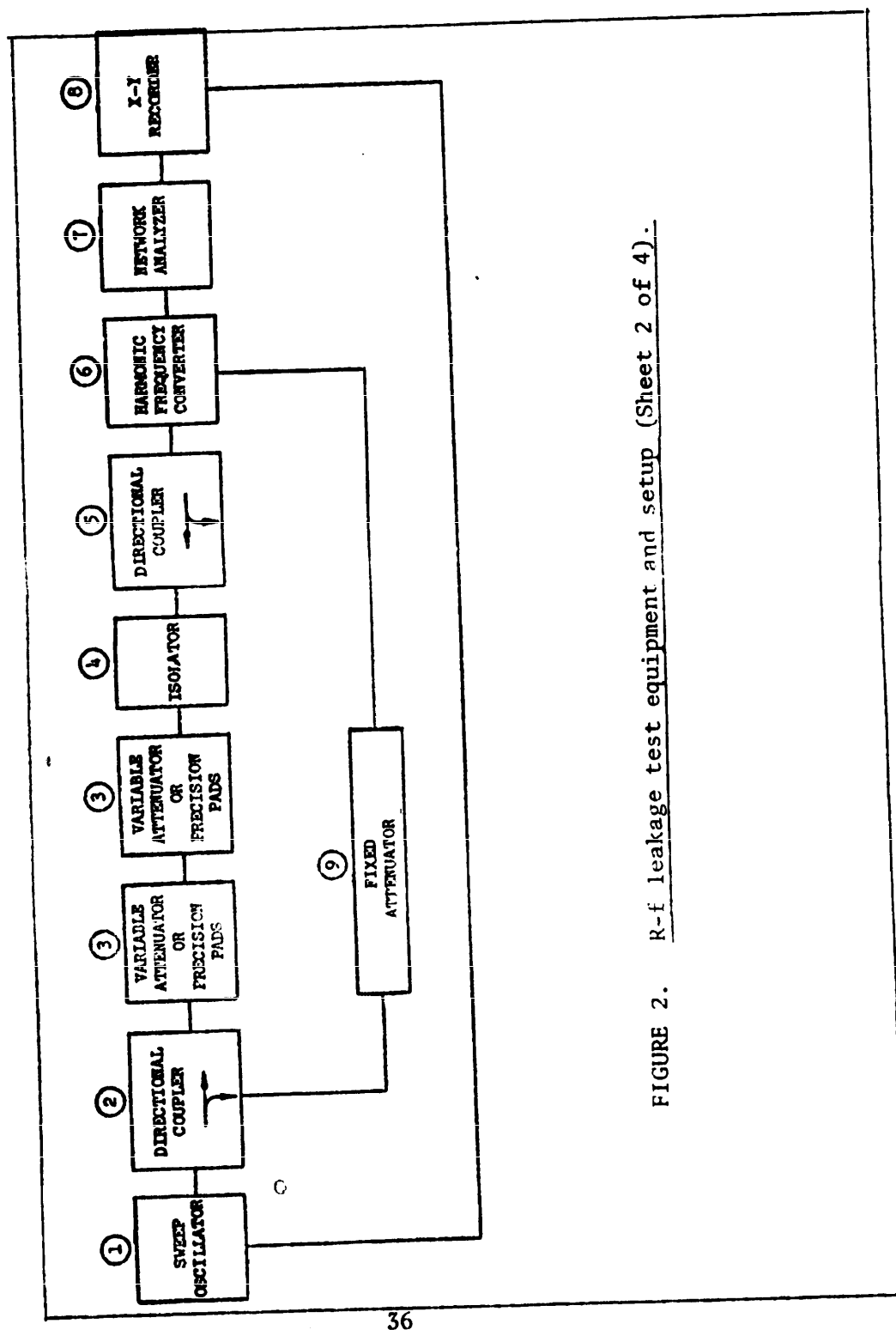


FIGURE 2. R-f leakage test equipment and setup (Sheet 2 of 4).

Step 2: With equipment warmed up and operating, set the sweep oscillator to sweep over a minimum 5 percent bandwidth containing the intended test frequency.

Step 3: With the sweep oscillator operating at a convenient output level and using the variable attenuators for test channel level set, record calibration traces on the X-Y recorder corresponding to 40-, 50-, 60-, 70-, 80-, 90- and 100- dB ratios of reference channel to test channel signal level versus frequency. If more than one leakage measurement is intended, remove the calibration record sheet from the recorder and retain for future use as a calibration overlay.

b. CAVITY ADJUSTMENT AND "Q" MEASUREMENT:

Step 4: Install test unit or mated interface pair in the test cavity using appropriately sized short circuits.

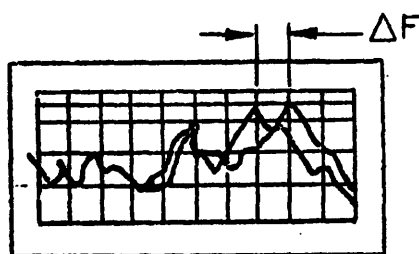
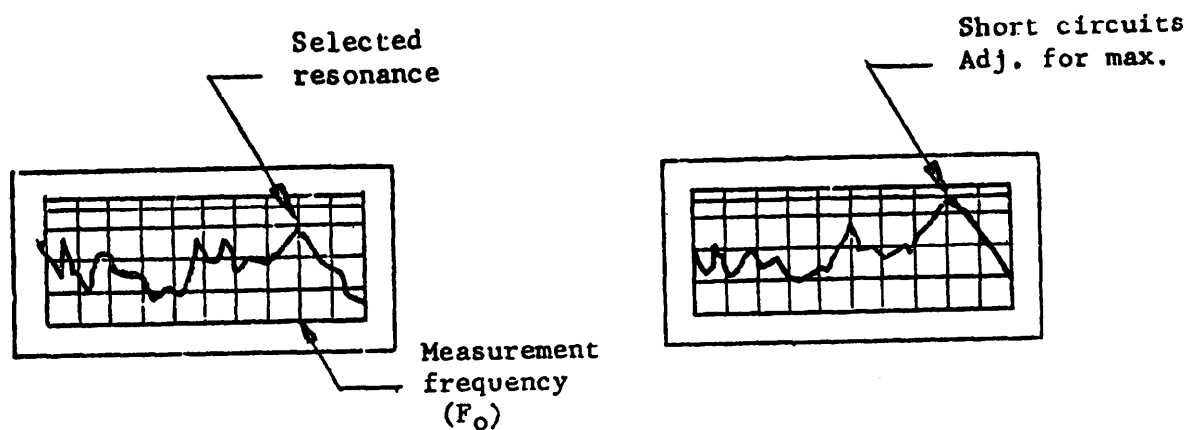
Step 5: Connect the equipment as shown in figure 2, sheet 3. Set the variable attenuators to "0" dB.

Step 6: With the test equipment warmed up and operating, set the sweep oscillator to sweep over the same frequency range used for recorder calibration (see 4.6.2.5.2.3a). Adjust oscillator output level and oscilloscope gain controls for usable scope presentation.

Step 7: Adjust spacing between cavity short circuits until TEM resonance, as indicated by oscilloscope presentation, is centered on test frequency. Keeping the spacing between the short circuits approximately constant, slide the combination with respect to the cavity coupling probe to obtain maximum amplitude of the selected resonance. Verify that the selected mode is TEM by holding one short circuit fixed and sliding the other while observing the oscilloscope. The electrical dimensions of the cavity are such that several TEM modes as well as TE and TM modes can exist within the frequency range being observed. TEM modes can be identified by (1) for a given change in cavity length they undergo a greater frequency shift than TE or TM modes and (2) they maintain a nearly constant amplitude for small changes in cavity length.

0 MIL-W-87105 (USAF)

Step 7: Oscilloscope presentation:



Change of resonant frequency (ΔF) resulting from small increase in cavity length.

MIL-W-87105 (USAF)

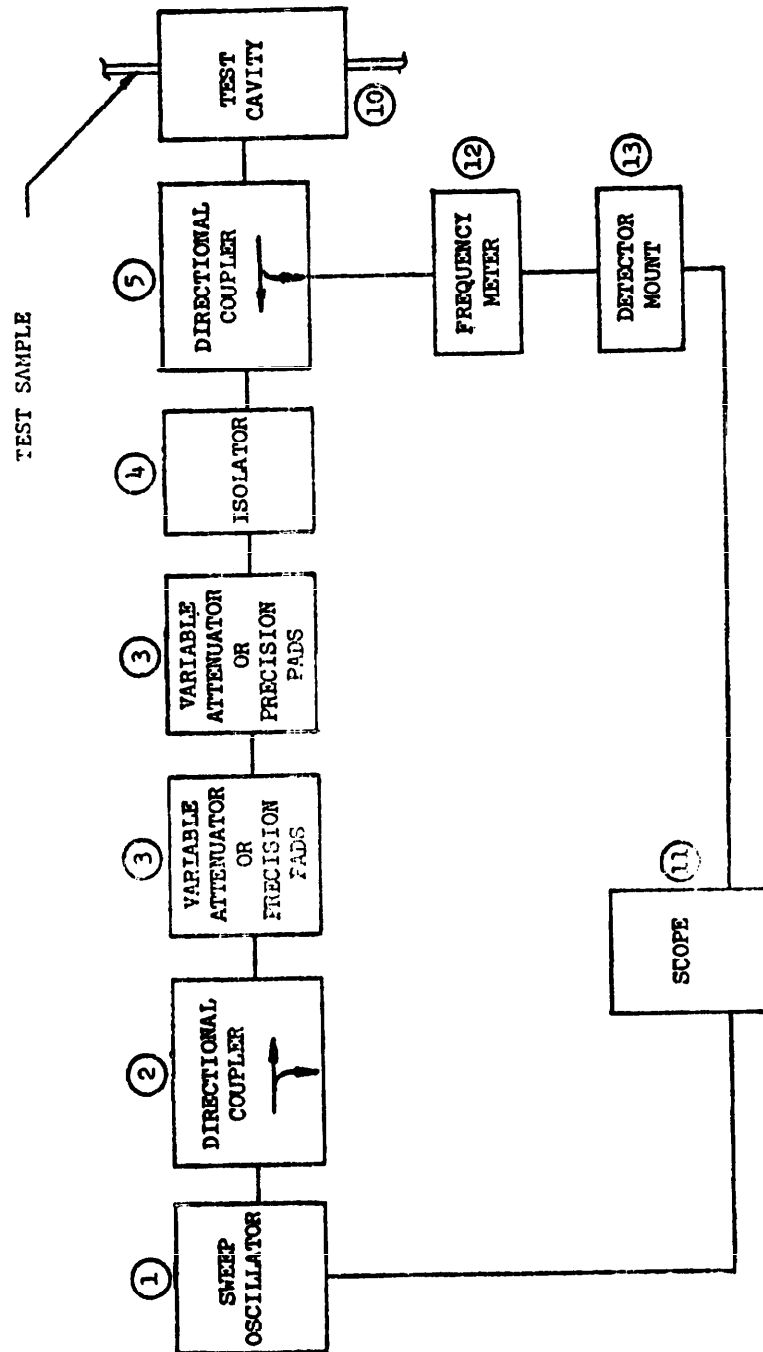
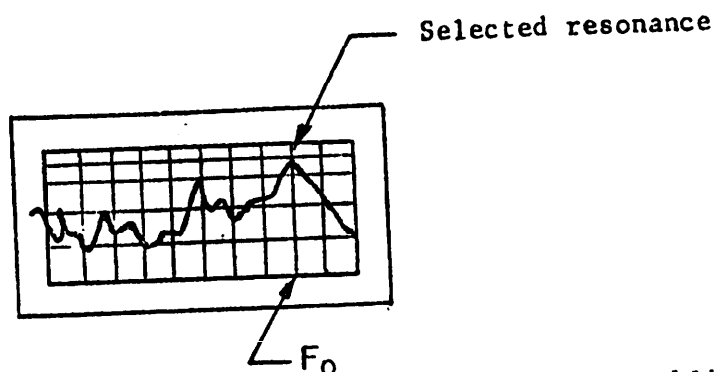


FIGURE 2. R-f leakage test equipment and setup (Sheet 3 of 4).

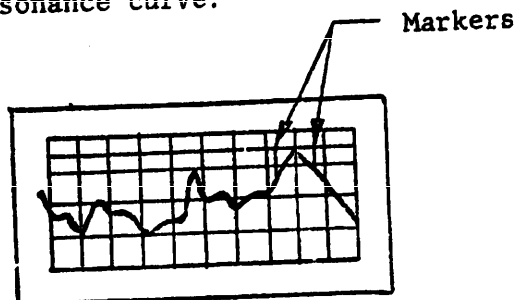
MIL-W-87105 (USAF)

Step 8: After verifying that the selected mode is TEM, readjust the short circuit to the mode at the test frequency.

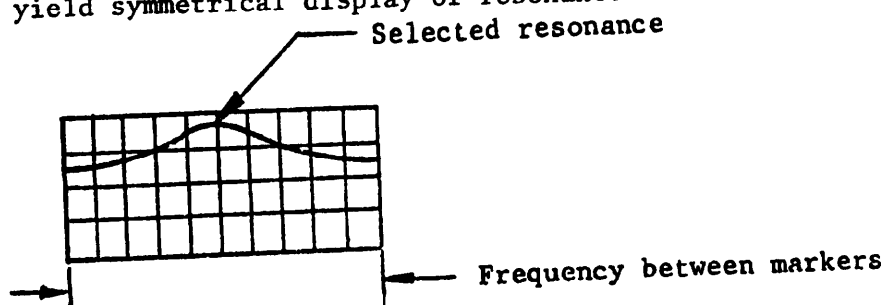


Step 9: Adjust oscilloscope controls to establish maximum deflection at a convenient level.

Step 10: Set sweep oscillator markers to coincide with "base" of selected resonance curve.

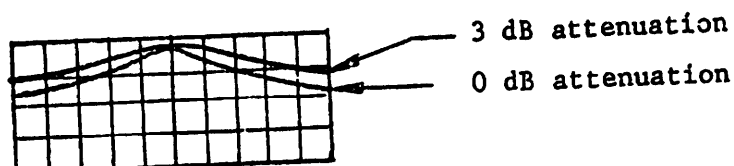


Step 11: Set sweep oscillator to "marker sweep" mode and adjust markers to yield symmetrical display of resonance curve on scope.

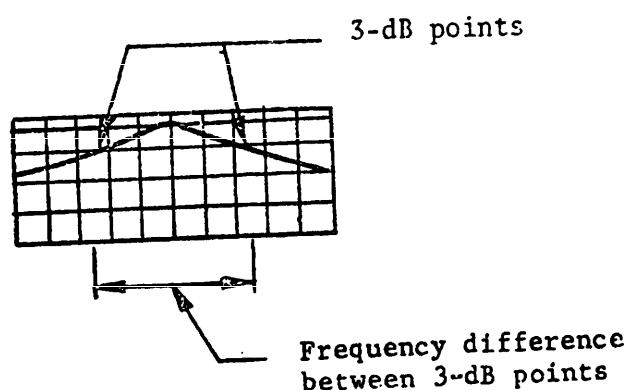


MIL-W-87105 (USAF)

Step 12: Adjust variable attenuator to insert 3 dB attenuation and note level on oscilloscope corresponding to this condition. Remove 3 dB attenuation.



Step 13: Use frequency meter to determine the frequency spacing between the 3-dB points on the resonance curve.



Step 14: Calculate the Q of the cavity for this condition by dividing the resonant frequency by the difference in frequency between the 3-dB points. Record this value for future calculation of test sample leakage.

MIL-W-87105 (USAF)

CAUTION: Use extreme care not to disturb the cavity adjustment until leakage measurements are completed.

c. LEAKAGE MEASUREMENT:

Step 15: Being careful not to disturb the test sample and cavity adjustment obtained in step 8, connect the test equipment as shown on figure 2, sheet 4. Set the sweep oscillator to sweep the frequency range of step 2 and record a trace of leakage energy over this frequency range.

Step 16: Identify the recorded leakage level at the cavity resonant frequency.

Step 17: Determine and record the physical spacing between the faces of the short circuits. This determination may be made by measuring the distance between accessible locations on the adjustment handles and correcting the distance from these locations to the face of the short circuits.

Step 18: Determine the dB value which corresponds to a power ratio equivalent to the cavity Q measured in step 14 by ($\text{dB} = 10 \log Q$).

Step 19: Increase the numerical value measured in step 16 by the dB value determined in step 18. The resultant dB value represents the ratio of power flowing in the test sample to the energy "leaked" from the test sample over the length determined in step 17.

Step 20: Calculate the r-f leakage power ratio for a 12-inch length of cable component by decreasing the numeric value determined in step 19 by the factor of:

$$10 \log \frac{12}{\text{length (inches) of spacing determined in step 17.}}$$

Step 21: Mated interface pairs shall be measured by the same procedure described above for cable with the measured value being corrected for the leakage attributable to the length of cable contained between the short circuits.

MIL-W-87105 (USAF)

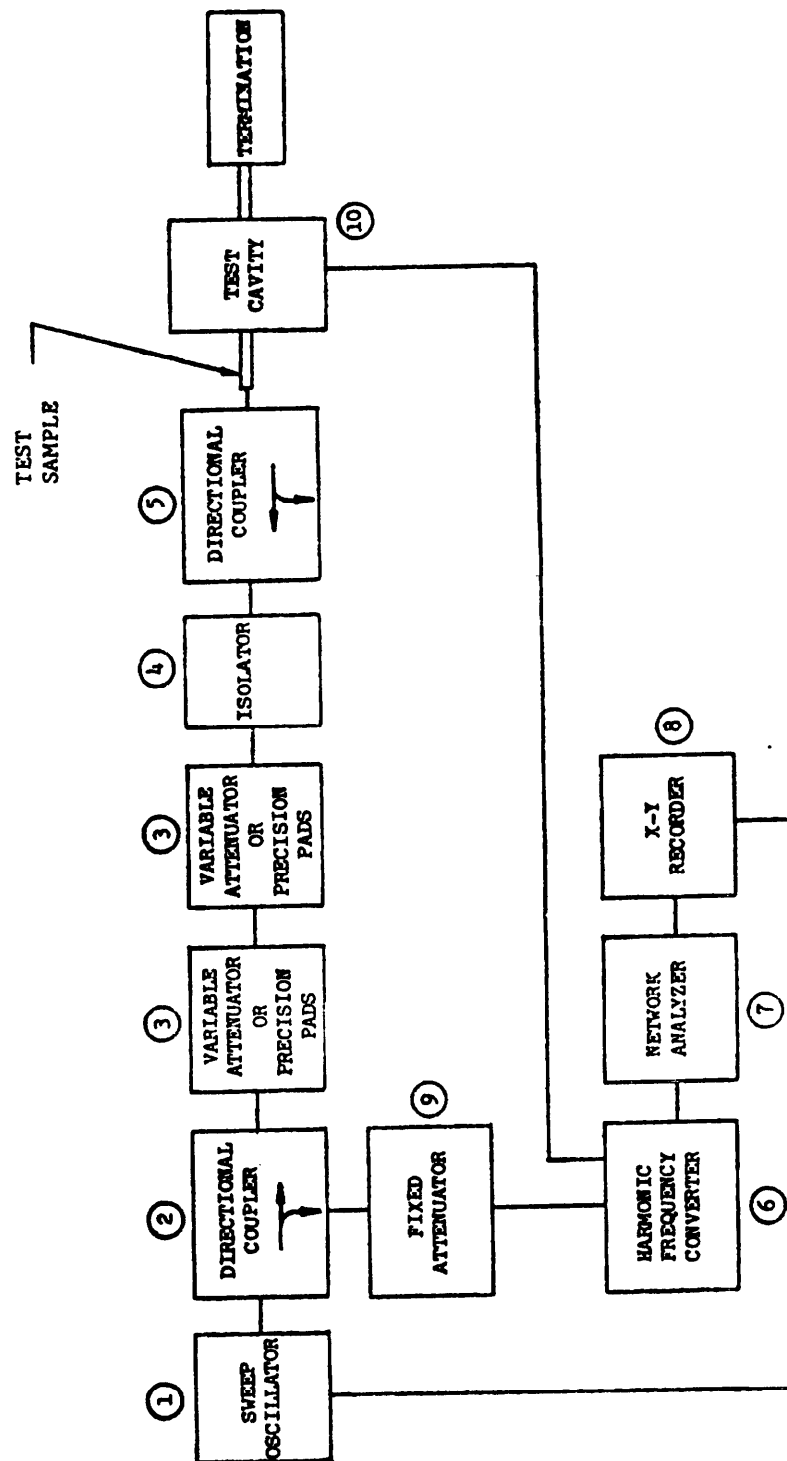


FIGURE 2. R-f leakage test equipment and setup (Sheet 4 of 4).

MIL-W-87105 (USAF)

4.6.2.5.2.4 Measurements at each required test frequency shall be made in accordance with the requirements of 4.6.2.5.2.2 and 4.6.2.5.2.3.

4.6.2.5.2.5 The r-f leakage power ratio values determined in 4.6.2.5.2.3, steps 20 and 21, for each test frequency and each particular point on the assembly shall be recorded.

4.6.2.5.3 Accept-reject criteria. If the r-f leakage of the test sample is greater than the value specified in the applicable detail specification, the sample shall be considered to have failed this test.

MIL-W-87105 (USAF)

4.6.2.6 Electrical length test. The electrical length test shall measure the ~~electrical length and phase delay~~ of the waveguide assembly.

4.6.2.6.1 Test setup

4.6.2.6.1.1 Test equipment. Network analyzer, or approved equivalent, and associated adapters shall be required.

4.6.2.6.1.2 Test conditions. This test shall be performed under room ambient conditions (4.3.1.1) and as specified herein.

4.6.2.6.2 Procedure. The electrical length shall be measured at the frequencies specified for insertion loss measurements (see 4.6.2.3.2) and the phase delay shall be calculated from the resulting data.

4.6.2.6.3 Accept-reject criteria. If the electrical length of the assembly deviates from the value specified in the detailed specification, the assembly shall be considered to have failed the electrical length test.

MIL-W-87105 (USAF)

4.6.3 Mechanical test. The equipment shall be subjected to the mechanical tests specified herein to determine compliance with mechanical requirements of this document. When the tests are performed in sequence, it shall not be required to duplicate VSWR and examination of product tests at the beginning of a mechanical test if the identical VSWR and examination of product was conducted at the end of the preceding test and less than 24 hours have elapsed.

4.6.3.1 Interface flatness test. The interface flatness test shall determine the acceptance of waveguide flanges in compliance with applicable detail specification.

4.6.3.1.1 Test setup

4.6.3.1.1.1 Apparatus. The required apparatus shall include a surface plate, gauge block, dial indicator and related instrumentation, or light interference method instrumentation.

4.6.3.1.1.2 Test conditions. Unless otherwise specified in the applicable detail specification, the test shall be conducted at room ambient temperature (4.3.1.1).

4.6.3.1.2 Procedural steps. The flatness test shall be conducted in accordance with the following steps:

- a. Mount the test item on a gauge block positioned on the surface plate of the test setup.
- b. Scan the entire waveguide flange face in a 1/4-inch grid pattern plotted in both the X and Y axes.
- c. Record maximum indicator reading on the test data sheet neglecting permissible roll-off areas; that is, any area within 1/16 inch of any hole or groove or outer edge of the waveguide flange.
- d. Repeat steps a through c for applicable surfaces.

4.6.3.1.3 Accept-reject criteria. The test sample shall be considered to have passed the flatness test if the flange surface is flat within the specification requirements of the applicable detail specification.

4.6.3.2 Tensile load test. The tensile load test shall determine the mechanical strength and electrical stability of the junction between the guide and flange components of the waveguide assembly. This test simulates the longitudinal forces that may be applied during in-service and maintenance.

4.6.3.2.1 Test setup. The test apparatus shall include the following:

a. Linear actuator. The linear actuator shall provide a means of applying and maintaining the required in-line force.

b. Force measurement. Spring scales or other appropriate means of measuring in-line force without introducing harmonic motion into the system shall be required. Accuracy of the test equipment shall be ± 5 pounds, or better.

c. Movable support. Movable support shall provide a surface which will allow free horizontal motion (less than 0.1 pound drag) when vertical loads up to ten pounds are applied.

d. Connector clamp. The connector clamp shall provide for uniform distribution of the applied force about the circumference of the flange component and shall not interfere with electrical test equipment connection.

e. Fixed support. Fixed support shall be capable of sustaining the test system without flexing during the application of the in-line force.

4.6.3.2.1.2 Test conditions. Test shall be conducted under room ambient conditions (4.3.1.1) and as specified herein.

4.6.3.2.2 Procedure

4.6.3.2.2.1 The assembly shall be subjected to examination of product, procedure II (4.6.1.2); VSWR, procedure II (4.6.2.1.2); and r-f insertion loss, procedure I and II (4.6.2.3.2 and 4.6.2.3.3).

4.6.3.2.2.2 The assembly shall be mounted in the tensile load test fixture and the required electrical test equipment shall be connected.

4.6.3.2.2.3 The test sample shall be subjected to 5 straight in-line pulls. The duration of maximum stress shall be for 5 seconds for the first four in-line pulls. The fifth in-line pull shall be maintained while the tests specified in 4.6.2.1.2, and 4.6.2.3.2 and 4.6.2.3.3 are performed on the test unit.

4.6.3.2.2.4 The assembly shall be removed from the test fixture and the tests specified in 4.6.1.2, 4.6.2.1.2, and 4.6.2.3.2 and 4.6.2.3.3 shall be performed.

MIL-W-87105 (USAF)

4.6.3.2.3 Accept-reject criteria. If the assembly fails at any time to meet the accept-reject criteria established in 4.6.1.2.2, 4.6.2.1.2.5, and 4.6.2.3.2.1 and 4.6.2.3.3.1, the test sample shall be considered to have failed the tensile load test.

4.6.3.3 Torque test. The torque test shall determine the electrical and mechanical integrity of the waveguide assembly when they are subjected to the simulated rotational shearing stresses that may be encountered during in-service and maintenance periods.

4.6.3.3.1 Test setup

4.6.3.3.1.1 Apparatus. The test apparatus shall include the following:

a. Flange clamp. The flange clamp shall provide for uniform distribution of the applied force about the circumference of the connector component and shall not interfere with electrical test equipment connection.

b. Guide grip fixture. The guide grip fixture shall uniformly grip and hold the guide component for a minimum of 8 inches and shall not deform or indent the test sample. A means, such as wrench flats, shall be provided to allow torque to be applied by a standard torque wrench, or other acceptable means.

c. Fixed supports and guides. The fixed supports shall be rigid and shall not flex during the application of force. The guides shall support the test sample, but not restrict rotation of the test sample.

4.6.3.3.1.2 Test conditions. Tests shall be conducted under room ambient conditions (4.3.1.1) and as specified herein.

4.6.3.3.2 Procedure I (for flexible assemblies)

4.6.3.3.2.1 The assembly shall be subjected to examination of product, procedure II (4.6.1.2); VSWR, procedure II (4.6.2.1.2); and r-f insertion loss, procedures I and II (4.6.2.3.2 and 4.6.2.3.3). The input interface shall be noted.

4.6.3.3.2.2 The assembly shall be so mounted in the torque fixture that the input interface will be subjected to the torque force. The electrical test equipment required to perform the measurements specified in 4.6.3.3.2.1 shall be connected.

MIL-W-87105 (USAF)

4.6.3.3.2.3 The torque specified in the applicable detail specification shall be applied in a clockwise direction and maintained for 10 seconds. The force shall be released and the torque shall be applied in a counter-clockwise direction and maintained for 10 seconds. Torque applied in both the clockwise and counterclockwise directions shall constitute one test cycle.

4.6.3.3.2.4 The torque test shall consist of five test cycles as described in 4.6.3.3.2.3. However, during the fifth cycle, the force shall be maintained in each direction until the tests specified in 4.6.2.1.2 and 4.6.2.3.2 and 4.6.2.3.3 have been accomplished

4.6.3.3.2.5 The force shall be released and the procedures specified in 4.6.3.3.2.2 through 4.6.3.3.2.4 shall be repeated for the other interface.

4.6.3.3.3 Procedure II (for rigid assemblies)

4.6.3.3.3.1 One end of the assembly shall be held in a fixed position while the torque (specified in the detail specification) is applied in line to the other end of the assembly five consecutive times in both a clockwise and counterclockwise direction.

4.6.3.3.3.2 The duration of maximum stress shall be for five seconds for each application of torque.

4.6.3.3.3.2.1 At the completion of the torque test, the assembly shall be subjected to the tests specified in 4.6.1.2, 4.6.2.1.2, and 4.6.2.3.2 and 4.6.2.3.3. The input interface shall be noted.

4.6.3.3.4 Accept-reject criteria (procedures I and II). If the assembly fails at any time to meet the accept-reject criteria established in 4.6.1.2.2, 4.6.2.1.2.5 and 4.6.2.3.2.1 and 4.6.2.3.3.1, the unit shall be considered to have failed the torque test.

4.6.3.4 Flexing endurance test. The waveguide assembly shall be subjected to the flexing endurance test to determine their ability to withstand repeated flexing.

4.6.3.4.1 Test setup

4.6.3.4.1.1 Test equipment. A flexing endurance test fixture shall be required that is capable of flexing a 30-inch section of the flexible waveguide through $+75^{\circ}$ (over-all travel of 150°) at a continuous rate of approximately 40 cycles per minute.

MIL-W-87105 (USAF)

4.6.3.4.1.2 Test conditions. Tests shall be conducted under room ambient conditions (4.3.1.1) and as specified herein.

4.6.3.4.2 Procedure

4.6.3.4.2.1 The assembly shall be subjected to the examination of product, procedure II (4.6.1.2), and the VSWR test, procedure II (4.6.2.1.2).

4.6.3.4.2.2 The assembly shall be subjected to repeated flexures of +30 degrees per foot for 400 cycles at 15 cycles per minute and +10 degrees per foot for 100,000 cycles at 40 cycles per minute in each plane.

4.6.3.4.2.3 The assembly shall be subjected to examination of product, procedure II and the VSWR test, procedure II.

4.6.3.4.3 Accept-reject criteria. If the assembly passes the accept-reject criteria established by 4.6.1.2.2 and 4.6.2.1.2.5, the assembly shall be considered to have passed the test.

4.6.3.5 Minimum bending radius test. The minimum bending radius test shall determine the ability of the test sample to meet all performance requirements after being bent to its minimum bending radius.

4.6.3.5.1 Test setup

4.6.3.5.1.1 Test equipment. Test equipment shall include the following: guides or mandrels having a set radius equal to the minimum bend radius of the test sample in each plane; a suitable mechanism which will so impart an even and smooth oscillating motion to one end of the test sample that the fixed end will bend around the mandrel for at least two-thirds of its length, or 90°, whichever is less; a stationary platform; and necessary attachment hardware.

4.6.3.5.1.2 Test conditions. This test shall be conducted under room ambient conditions (4.3.1.1) and as specified herein.

4.6.3.5.2 Procedure

4.6.3.5.2.1 Prior to the start of this test, the test sample shall be subjected to examination or product, procedure II (4.6.1.2) and VSWR, procedure II (4.6.2.1.2).

4.6.3.5.2.2 The test sample shall be fixed firmly at one end to a stationary platform; the guide or mandrel shall be attached on the same end. The sample shall be so mounted as to be under neither tension nor compression when in the straight position. The free end shall be connected to the oscillatory mechanism by means of a suitable connection and subjected to 5 complete cycles of bend over two-thirds of its length, or 90°, whichever is less, for both E and H planes.

4.6.3.5.2.3 At the conclusion of this test, while the sample is under neither compression nor tension, it shall be subjected to examination of product, procedure II, VSWR, procedure II; r-f insertion loss, procedures I and II (4.6.2.3.2 and 4.6.2.3.3); and leakage test, procedure II (4.6.4.12.2).

4.6.3.5.3 Accept-reject criteria. If the test sample passes the accept-reject criteria established in 4.6.1.2.2, 4.6.2.1.2.5, 4.6.2.3.2.1 and 4.6.2.3.3.1, it shall be considered to have passed the minimum bending radius test.

MIL-W-87105 (USAF)

4.6.3.6 Axial twist test. The axial twist test shall determine the ability of the flexible waveguide assembly to withstand repeated axial twisting.

4.6.3.6.1 Test setup

4.6.3.6.1.1 Test equipment. The test equipment shall include a stationary platform with a shaft attached to it which will extend through the geometrical center of the test sample. Provisions shall be made for attaching one end of the test sample rigidly to the platform and for permitting the other end to rotate freely about the shaft. A mechanism capable of applying the required uniform twisting motion alternating clockwise and counterclockwise at a rate of approximately 40 cycles per minute shall also be required.

4.6.3.6.1.2 Test conditions. This test shall be conducted under room ambient conditions (4.3.1.1) and as specified herein.

4.6.3.6.2 Procedure

4.6.3.6.2.1 Prior to the start of this test, the test sample shall be subjected to examination of product, procedure II (4.6.1.2); VSWR, procedure II (4.6.2.1.2); r-f insertion loss, procedure I and II, (4.6.2.3.2 and 4.6.2.3.3); and leakage, procedure II (4.6.4.12.2).

4.6.3.6.2.2 With one end of the sample mounted rigidly to the platform, the sample shall be subjected to the amount of twisting specified in the detail specification at a rate of approximately 40 cycles per minute.

4.6.3.6.2.3 At the conclusion of this test, the test sample shall be subjected to examination of product, procedure II; VSWR, procedure II; the tests specified in paragraphs 4.6.1.2, 4.6.2.1.2, r-f insertion loss, procedures I and II; and leakage, procedure II.

4.6.3.6.3 Accept-reject criteria. If the test sample passes the accept-reject criteria established in 4.6.1.2.2, 4.6.2.1.2.5, 4.6.2.3.2.1 and 4.6.2.3.3.1, and 4.6.4.12.2.3, it shall be considered to have passed the axial twist test.

MIL-W-87105 (USAF)

4.6.4 Environmental tests. The equipment shall be subjected to the environmental tests specified herein to determine compliance with the environmental requirements of this document. When tests are performed in a sequence, it shall not be required to duplicate VSWR and examination of product tests at the beginning of an environmental test if the identical VSWR and examination of product was conducted at the end of the preceding test and less than 24 hours have elapsed.

4.6.4.1 Temperature-altitude test. The temperature-altitude test shall determine satisfactory operation of the equipment under the temperature-altitude conditions specified herein.

4.6.4.1.1 Test setup

4.6.4.1.1.1 Test equipment. A temperature-altitude chamber, r-f power source, high power terminations, and associated instrumentation shall be required.

4.6.4.1.1.2 Test conditions

a. The test sample shall be placed in the test chamber in a manner simulating installed conditions, making such connections and instrumentation as necessary. The sample being tested shall not occupy more than 50 percent of the chamber volume.

b. Temperature sensing devices (see 4.3.2) shall be used to measure chamber and test sample conditions, and chamber and test sample conditions shall be stabilized (see 4.3.1.3) prior to each step in the test program.

c. Unless otherwise specified, the test shall be conducted in accordance with test condition A for a specified altitude of 70,000 feet, test condition B for a specified altitude of 60,000 feet, or test condition C for a specified altitude of 50,000 feet (reference table V).

d. When changing chamber conditions from those of one step to those required for any other step in the sequence given in table V, the rate of temperature and pressure changes shall not exceed 1°C per second and 0.5 inch of mercury per second. The minimum VSWR of the load shall be 1.75:1.

e. The assembly shall be energized at full rated power (see 3.5.1.5) at three frequencies: the lower frequency shall be within 0.10 GHz of the low end of the frequency band; the second frequency shall be within 10 percent of the center of the band; and the third frequency shall be within 10 percent of the high end of the frequency band. Full rated power shall be applied to the assembly for a minimum of 10 minutes for each frequency tested.

MIL-W-87105 (USAF)

TABLE V. Temperature-altitude test conditions and testing schedule.

Test Condition A			Test Condition B		Test Condition C	
Step	Altitude (Thousands of feet)	Temp. °C	Altitude (Thousands of feet)	Temp. °C	Altitude (Thousands of feet)	Temp. °C
1	40	-54°	40	-54°	40	-54°
2	55	-54°	60	-54°	50	-54°
3	70	-54°	60	-10°	50	-10°
4	70	-10°	40	-10°	40	-10°
5	55	-10°	20	-10°	20	-10°
6	40	-10°	Atmosphere	-10°	Atmosphere	-10°
7	20	-10°	Atmosphere	20°	Atmosphere	20°
8	Atmosphere	-10°	20	20°	20	20°
9	Atmosphere	20°	40	20°	40	20°
10	20	20°	60	20°	50	20°
11	40	20°	60	55°	50	55°
12	55	20°	40	55°	40	55°
13	70	20°	20	55°	20	55°
14	70	55°	Atmosphere	55°	Atmosphere	55°
15	55	55°	Atmosphere	150°	Atmosphere	150°
16	40	55°	20	150°	20	150°
17	20	55°	40	150°	40	150°
18	Atmosphere	55°	60	150°	50	150°
19	Atmosphere	150°				
20	20	150°				
21	40	150°				
22	55	150°				
23	70	150°				

MIL-W-87105 (USAF)

4.6.4.1.2 Procedure

4.6.4.1.2.1 The equipment shall be subjected to the examination of product, procedure II (4.6.1.2), and the VSWR test, procedure II (4.6.2.1.2).

4.6.4.1.2.2 The test shall be conducted in accordance with the testing schedule of table V, and for each step, the following procedure shall be followed:

a. With the test sample non-energized, adjust the test chamber conditions to those specified in the applicable step. Unless otherwise specified in the applicable detail specification, subject the test sample to the test as specified in 4.6.4.1.1.2e.

b. After step 6 for condition B and C tests, or step 8 for condition A tests, and with the test sample non-energized, adjust the test chamber conditions to those specified in the applicable step; and unless otherwise specified by the procuring activity, subject the test sample to the test as specified in 4.6.4.1.1.2e. Open the test chamber door so that frost will form on the equipment. If frost does not form, an artificial means shall be used to provide the relative humidity necessary to form frost. The door shall remain open long enough for the frost to melt but not long enough to allow the moisture to evaporate. Close the chamber door and continue the test.

4.6.4.1.2.3 The equipment shall be subjected to the examination of product, procedure II and the VSWR test, procedure II.

4.6.4.1.3 Accept-reject criteria. If the equipment satisfies the accept-reject criteria as specified in 4.6.1.2.2 and 4.6.2.1.2.5, and the equipment completes the power test without breakdown, the equipment shall be considered to have passed the temperature-altitude test.

MIL-W-87105 (USAF)

4.6.4.2 Vibration test. The vibration test shall determine the assembly's ability to withstand various frequencies of vibration without degradation of the electrical performance.

4.6.4.2.1 Test setup

4.6.4.2.1.1 Test configuration. The assembly shall be installed on the vibration table to simulate the same physical configuration as could be encountered if the item were attached to an antenna assembly. For flexible assemblies, one end of the assembly shall be mated to a flange receptacle that is mounted on the vibration table, and the other end of the assembly shall be mated to a flange receptacle that is mounted to a rigid structure off the vibration table. Clamps or supports shall not be used within 18 inches of the termination that is located on the vibration table.

4.6.4.2.1.2 Test conditions

a. The specified vibratory accelerations or displacement levels shall be maintained at the termination that is mounted on the vibration table. Displacement levels shall be monitored at various locations on the test sample.

b. All frequency measurements shall be accurate within ± 5 percent.

c. All displacement or acceleration measurements shall be accurate within ± 10 percent.

d. The motion of the vibrator table shall be simple harmonic motion with not more than 20 percent distortion.

4.6.4.2.2 Procedure. The vibration test shall be performed with the motion applied in the direction of each of three mutually orthogonal axes, at three temperatures: room ambient (4.3.1.1), -53.8°C , and 71.1°C ; and in two modes: frequency range scans and resonant endurance runs.

4.6.4.2.2.1 The test sample shall be subjected to examination of product, procedure II (4.6.1.2); VSWR, procedure II (4.6.2.1.2); and r-f insertion loss, procedures I and II (4.6.2.3.2 and 4.6.2.3.3) at room ambient temperature.

4.6.4.2.2.2 Frequency range scans. The frequency range scans shall be conducted under the conditions specified herein.

4.6.4.2.2.2.1 Amplitude. Unless otherwise specified in the detail specification, the test sample shall be subjected to a simple harmonic motion having an amplitude of either 0.2 inch double amplitude (maximum total excursion), or $\pm 1g$, whichever is less, between the approximate limits of 5 and 18 Hz; and 0.06 inch double amplitude (maximum total excursion), or $\pm 15g$, whichever is less, between the approximate limits of 18 and 2000 Hz.

4.6.4.2.2.2.2 Frequency range. The vibration frequency shall be varied logarithmically between the approximate limits of 5 and 2000 Hz.

4.6.4.2.2.2.3 Sweep and duration. The entire frequency range of 5 to 2000 Hz and return to 5 Hz shall be traversed in 20 minutes. This cycle shall be performed 12 times in each of three mutually perpendicular directions (total of 36 times), so that the motion will be applied for a total period of approximately 12 hours. Interruptions will be permitted, provided the requirements for the rate of change and test duration are met. Completion of cycling within any separate band is permissible before going to the next band.

4.6.4.2.2.2.4 The assembly shall be subject to the tests specified in 4.6.2.1.2 and 4.6.2.3.2 and 4.6.2.3.3 while performing the vibration test procedures.

4.6.4.2.2.2.5 Temperature conditions. The frequency range scans shall be conducted at room ambient temperature (see 4.3.1.1), -53.8°C , and 71.1°C , with two-thirds of the frequency range scans being conducted at room ambient temperature, one-sixth of the scans at -53.8°C and one-sixth of the scans at 71.1°C .

4.6.4.2.2.2.6 During the entire frequency range scans the test sample shall be monitored by accelerometers for resonant frequencies.

4.6.4.2.2.2.7 The frequency and amplitude of all critical resonant frequencies and resonant frequencies below 13 cycles shall be recorded on a data sheet.

4.6.4.2.2.3 Resonance endurance tests

4.6.4.2.2.3.1 Critical resonance. If a critical resonance is detected during the frequency range scans, the test sample shall be vibrated at the critical resonant frequency (see 6.4.6) in accordance with the following conditions:

- a. If all three temperature counterparts of a critical resonance are determined, two-thirds of each resonance endurance test shall be conducted at room ambient temperature, one-sixth of each test shall be

MIL-W-87105 (USAF)

conducted at -53.8°C , and one-sixth of each test shall be conducted at 71.1°C . The total dwell time shall be 30 minutes at each critical resonance.

b. If all three temperature counterparts of a critical resonance are not determined and the amplitude of the resonance is less than 4:1, the amount of dwell time shall be: 20 minutes if the critical resonance point was recorded at room ambient temperature; 5 minutes if the critical resonance point was recorded at -53.8°C ; and 5 minutes if the critical resonance point was recorded at 71.1°C .

c. . If all three temperature counterparts of a critical resonance are not determined and the amplitude of the resonance is greater than 4:1, the dwell time of the missing temperature(s) shall be distributed on the remaining resonance in the normal ratio of temperature-time distribution, with the total dwell time being 30 minutes.

4.6.4.2.2.3.2 Resonant frequencies. Resonant frequencies (see 6.4.7) shall be determined by the use of accelerometers capable of detecting 10 percent difference in relative amplitude between the points and the sample under tests. The location of the accelerometers shall be specified in the detailed test procedure.

4.6.4.2.2.3.3 The frequency, duration, amplitude, axis and temperature of each resonant endurance run shall be recorded on a data sheet.

4.6.4.2.2.4 At the termination of the vibration test, the test sample shall be subjected to examination of product, procedures II and III (4.6.1.2 and 4.6.1.3); leakage, procedure II (4.6.4.12.2); VSWR, procedures II (4.6.2.1.2); and r-f insertion loss, procedures I and II (4.6.2.3.2 and 4.6.2.3.3) in the sequence listed.

4.6.4.2.3 Accept-reject criteria. The test sample shall be considered to have failed to pass the vibration test if: resonance occurs below 13 cycles; the test sample fails to satisfy the accept-reject criteria specified in 4.6.1.2.2, 4.6.1.3.1, 4.6.2.1.2.5, and 4.6.2.3.2.1 and 4.6.2.3.3.1; or there was evidence of bubbles coming from within the equipment while being subjected to the leakage test (see 4.6.4.12.2.3)

MIL-W-87105 (USAF)

4.6.4.3 Shock test. The shock test shall determine the structural integrity of the equipment and determine if the equipment can perform satisfactorily after being subjected to mechanical shocks that might be encountered in in-service and maintenance periods.

4.6.4.3.1 Test setup

4.6.4.3.1.1 Test equipment. The test equipment shall consist of a shock machine as specified in MIL-STD-810, method 516.2.

4.6.4.3.1.2 Test conditions. The test conditions shall be as specified in MIL-STD-810, method 516.2, procedure I, and herein.

4.6.4.3.2 Procedural steps. The shock test shall be conducted in accordance with the following steps:

a. Step 1: Subject the test sample to examination of product, procedure II (4.6.1.2).

b. Step 2: Subject the test sample VSWR, procedure II (4.6.2.1.2).

c. Step 3: Subject the equipment to the r-f insertion loss test, procedure I and II (4.6.2.3.2 and 4.6.2.3.3).

d. Step 4: Subject the equipment to the shock test as specified in MIL-STD-810, method 516.2, procedure I, figure 516.2-1. Remove the assembly from the test fixture.

4.6.4.3.3 Accept-reject criteria. If the waveguide assembly meets the accept-reject criteria of 4.6.1.2.2, 4.6.2.1.2.5, and 4.6.2.3.2.1 and 4.6.2.3.3.1, the assembly shall be considered to have passed the shock test.

MIL-W-87105 (USAF)

4.6.4.4 Dust (fine sand) test. The dust test shall ascertain the ability of the equipment to resist the effects of dust (fine sand) as would be encountered in a dry dust laden atmosphere.

4.6.4.4.1 Test setup

4.6.4.4.1.1 Test equipment. The apparatus as specified in MIL-STD-810, method 510.1, shall be required.

4.6.4.4.1.2 Test conditions. The test conditions shall be as specified in MIL-STD-810, method 510.1, procedure I, and herein.

4.6.4.4.2 Procedural steps. The dust test shall be conducted in accordance with the following steps:

- a. Step 1: Subject the test sample to examination of product, procedure II (4.6.1.2).
- b. Step 2: Subject the test sample to VSWR, procedure II (4.6.2.1.2).
- c. Step 3: Subject the test sample to the dust (fine sand) test as specified in MIL-STD-810, method 510.1, procedure I, except exposure to the conditions of procedure I shall be for a period of 2 hours.
- d. Step 4: Subject the test sample to examination of product, procedure II.
- e. Step 5: Subject the test sample to VSWR, procedure II.

4.6.4.4.3 Accept-reject criteria. If the equipment passes the accept-reject criteria specified in 4.6.1.2.2 and 4.6.2.1.2.5, it shall be considered to have passed the dust test.

4.6.4.5 Humidity test. The humidity test shall determine the resistance of the equipment to the effects of exposure to a warm, highly humid atmosphere.

4.6.4.5.1 Test setup

4.6.4.5.1.1 Test equipment. The apparatus as specified in MIL-STD-810, method 507.1, shall be required.

4.6.4.5.1.2 Test conditions. The test conditions shall be as specified in MIL-STD-810, method 507.1, procedure I, and herein. Unless otherwise specified in the detail specification, the assembly shall be placed horizontally and open-ended in the chamber.

MIL-W-87105 (USAF)

4.6.4.5.2 Procedural steps. The humidity test shall be conducted in accordance with the following steps:

- a. Step 1: Subject the test sample to examination of product, procedure II (4.6.1.2).
- b. Step 2: Subject the test sample to VSWR, procedure II (4.6.2.1.2).
- c. Step 3: Subject the test sample to the humidity test as specified in MIL-STD-810, method 507.1, procedure I, except exposure to the conditions of procedure I shall be for a period not less than 180 hours.
- d. Step 4: At the conclusion of the exposure to the humid atmosphere, remove the test sample from the chamber.
- e. Step 5: Subject the test sample to examination of product, procedure II.
- f. Step 6: Subject the test sample to VSWR, procedure II.

4.6.4.5.3 Accept-reject criteria. If the assembly passes the accept-reject criteria specified in 4.6.1.2.2 and 4.6.2.1.2.5, the equipment shall be considered to have passed the humidity test.

4.6.4.6 Salt fog test. The salt fog test shall determine the resistance of the equipment to the effects of a salt atmosphere.

4.6.4.6.1 Test setup

4.6.4.6.1.1 Test equipment. The apparatus as specified in MIL-STD-810, method 509.1, shall be required.

4.6.4.6.1.2 Test conditions. The test conditions shall be as specified in MIL-STD-810, method 509.1, procedure I, and herein. The test sample shall be open-ended.

4.6.4.6.2 Procedural steps. The salt fog test shall be conducted in accordance with the following steps:

- a. Step 1: Subject the test sample to examination of product, procedure II (4.6.1.2).
- b. Step 2: Subject the test sample to VSWR, procedure II (4.6.2.1.2).

MIL-W-87105 (USAF)

c. Step 3: Subject the test sample to the salt fog test as specified in MIL-STD-810, method 509.1, procedure I, except exposure to the conditions of procedure I shall be for a period not less than 130 hours.

d. Step 4: At the conclusion of the exposure to the salt atmosphere, remove the test sample from the chamber.

e. Step 5: Subject the test sample to the rated power (see 3.5.1.5) for 20 minutes at a frequency within 10 percent of the high end of the frequency band for the assembly and at an altitude of 70,000 feet.

f. Step 6: At the conclusion of the power test, subject the test sample to examination of product, procedure II.

g. Step 7: Subject the test sample to VSWR, procedure II.

4.6.4.6.3 Accept-reject criteria. If the assembly passes the accept-reject criteria specified in 4.6.1.2.2, 4.6.2.1.2.5, and 4.6.3.1.3, and successfully handles the specified power without damage or deterioration, the equipment shall be considered to have passed the salt fog test.

4.6.4.7 Explosive atmosphere test. The explosive atmosphere test shall determine the ability of the equipment to operate in the presence of an explosive atmosphere.

4.6.4.7.1 Test setup

4.6.4.7.1.1 Test equipment. The apparatus as specified in MIL-STD-810, method 511.1, an r-f power source, and related instrumentation shall be required.

4.6.4.7.1.2 Test conditions. The test conditions shall be as specified in MIL-STD-810, method 511.1, procedure I, and herein.

4.6.4.7.2 Procedural steps. The explosive atmosphere test shall be conducted in accordance with the following steps:

a. Step 1: Subject the test sample to the explosive atmosphere test as specified in MIL-STD-810, method 511.1, procedure I.

b. Step 2: Subject the test sample to rated power (see 3.5.1.5) for 1 minute at a frequency within 10 percent of the high end of the frequency range for the assembly while the assembly is being subjected to the explosive mixture at each different altitude.

4.6.4.7.3 Accept-reject criteria. If the equipment causes an explosion while being energized at any of the test altitudes, it shall be considered to have failed the explosive atmosphere test.

4.6.4.8 Flammability test. The flammability test shall determine the flammability of the non-metalic components of the assembly.

4.6.4.8.1 Test setup

4.6.4.8.1.1 Test equipment. A flammability test chamber, a bunsen burner and related equipment, and measuring apparatus, as applicable, shall be required.

4.6.4.8.1.2 Test conditions. The test shall be conducted under the conditions specified herein.

4.6.4.8.2 Procedure

4.6.4.8.2.1 The test sample shall be held taut at an angle of 45 degrees within a chamber approximately 2 feet by 1 foot by 1 foot, open at top and on one vertical side that allows sufficient flow of air for complete combustion, but is free from drafts.

4.6.4.8.2.2 The test sample shall be marked at a distance of 9 and 15 inches from one end of the sample to designate a central test length.

4.6.4.8.2.3 A flame from a bunsen burner shall be applied for 30 seconds to the lower test mark.

4.6.4.8.2.4 The bunsen burner shall have a 1/4-inch-inlet, a normal bore of 3/8 inch and a length of approximately 4 inches from top to the primary inlets.

4.6.4.8.2.5 The burner shall be so adjusted that the hottest portion of the flame is applied to the test sample.

4.6.4.8.3 Accept-reject criteria. If the non-metal components of the assembly are damaged or are not extinguished within 6 seconds after removal of the flame, the assembly shall be considered as having failed the flammability test.

MIL-W-87105 (USAF)

4.6.4.9 Heat aging and cold bend test. The heat aging and cold bend test shall determine the ability of the assembly to withstand heat aging and cold bending that may be applied during in-service and maintenance periods.

4.6.4.9.1 Test setup

4.6.4.9.1.1 Test equipment. Temperature chambers, a mandrel, and related instruments, as applicable, shall be required.

4.6.4.9.1.2 Test conditions. Test conditions shall be conducted under room ambient conditions (4.3.1.1), except that the temperature shall be as specified under 4.6.4.9.2.

4.6.4.9.2 Procedure

4.6.4.9.2.1 Prior to the start of this test, the test sample shall be subjected to examination of product, procedure II (4.6.1.2) and VSWR, procedure II (4.6.2.1.2).

4.6.4.9.2.2 The test sample shall be placed in an air oven maintained at a temperature of $100^{\circ}\text{C} + 2^{\circ}\text{C}$ for a period of 7 days. After the heat aging period, the sample shall be removed from the oven and conditioned at room ambient temperature (see 4.3.1.1) for approximately one hour.

4.6.4.9.2.3 The sample shall then be conditioned for 20 hours at $-54^{\circ}\text{C} + 2^{\circ}\text{C}$.

4.6.4.9.2.4 At the end of this conditioning period, but while still in the cold chamber, the sample shall be subjected to the minimum bending radius test (4.6.3.5).

4.6.4.9.2.5 At the conclusion of the minimum bending radius test, the sample shall be subjected to examination of product, procedure II; VSWR, procedure II; and leakage, procedure II (4.6.4.12.2).

4.6.4.9.3 Accept-reject criteria. If the test sample passes the accept-reject criteria of 4.6.2.1.2.5, 4.6.3.5.3, and 4.6.4.12.2.3, the sample shall be considered to have passed the heat aging and cold bend test.

MIL-W-87105 (USAF)

4.6.4.10 Abrasion resistance test. The abrasion resistance test shall determine the abrasion resistance of the assembly.

4.6.4.10.1 Test setup

4.6.4.10.1.1 Test equipment. A squirrel cage abrasion tester and related apparatus shall be required as specified in figure 2 of MIL-C-5756. The abrasion test apparatus shall be checked for its finish and unbroken and unrounded edges prior to each test. The finish shall be recorded. The radius of any portion of the abrasion bars shall not exceed 0.002 inch.

4.6.4.10.1.2 Test conditions. Tests shall be conducted under room ambient conditions (4.3.1.1) and as specified herein.

4.6.4.10.2 Procedure. The test sample shall be mounted securely at one end and a three-pound weight freely suspended to the other end with the assembly placed over the squirrel cage abrasion tester. A suitable tripping circuit shall be arranged to denote failure by stopping the machine when any bar of the squirrel cage comes in contact with the bare conductor of the assembly. The test sample shall be subjected to 20 \pm 2 oscillations per minute (an oscillation shall consist of 5 bars travel forward and backward from a given point).

4.6.4.10.3 Accept-reject criteria. If any bar of the squirrel cage abrasion tester comes in contact with any conductor of the sample prior to the completion of 1000 oscillations, the sample shall be considered as having failed the abrasion resistance test.

MIL-W-87105 (USAF)

4.6.4.11 Chemical resistance test. The chemical resistance test shall determine the assembly's resistance to corrosive materials. The test simulates the exposures experienced during normal service life.

4.6.4.11.1 Test apparatus. The apparatus used to perform this test shall consist of the following:

a. Exposure chamber with adequate ventilation and suitable containers for the required chemical materials.

b. Controlled container - heating means capable of maintaining the temperature $\pm 2^{\circ}\text{C}$ throughout the range of 32.2°C to 65.6°C .

c. Racks for air-drying test units.

4.6.4.11.1 Chemical materials. The chemical solutions and fluids used in this test and their specified test temperatures shall be as follows:

	<u>Solution or fluid</u>	<u>Reference document</u>	<u>Test temperature</u>
a.	JP-4 or JP-5 fuel	MIL-J-5624	$37.8^{\circ}\text{C} \pm 5^{\circ}\text{C}$
b.	Hydraulic fluid	MIL-H-5606	$37.8^{\circ}\text{C} \pm 5^{\circ}\text{C}$
c.	Cleaner/brightener	MIL-C-5410	$60^{\circ}\text{C} \pm 5^{\circ}\text{C}$
d.	Epoxy stripper	MIL-R-81294	$60^{\circ}\text{C} \pm 5^{\circ}\text{C}$

WARNING: Toxic materials are used in this procedure that may be harmful to health if suitable safety precautions are not taken.

4.6.4.11.2 Procedure

4.6.4.11.2.1 The assembly shall be subjected to the examination of product, procedure II (4.6.1.2), VSWR, procedure II (4.6.2.1.2), and r-f insertion loss, procedures I and II (4.6.2.3.2 and 4.6.2.3.3).

MIL-W-87105 (USAF)

4.6.4.11.2.2 The assembly shall be exposed to the listed fluids and solutions in the sequence shown for the specified exposure period. Exposure to all solutions and drying period shall constitute one test cycle:

	<u>Solution or fluid</u>	<u>Exposure period</u>
a.	JP-4 or JP-5 fuel	4 hours
b.	Water rinse	5 minutes
c.	Hydraulic fluid	4 hours
d.	Water rinse	5 minutes
e.	Cleaner/brightener	15 minutes
f.	Water rinse	5 minutes
g.	Epoxy stripper	15 minutes
h.	Water rinse	5 minutes
i.	Air dry storage	16 to 24 hours

The assembly shall be immersed in each solution with no protective caps or coverings on the termination.

4.6.4.11.2.3 The test sample shall be subjected to ten test cycles of the chemical resistance test.

4.6.4.11.2.4 After completion of the ten test cycles, the assembly shall be subjected to the tests as specified in 4.6.1.2, 4.6.2.1.2, and 4.6.2.3.2 and 4.6.2.3.3.

4.6.4.11.3 Accept-reject criteria. If the assembly fails to meet the accept-reject criteria specified in 4.6.1.2.2, 4.6.2.1.2.5, and 4.6.2.3.2.1 and 4.6.2.3.3.1, the unit shall be considered to have failed the chemical resistance test.

MIL-W-87105 (USAF) .

4.6.4.12 Pressure (immersion)/leakage tests

4.6.4.12.1 Procedure I (pressure (immersion)). Equipment utilizing waveguide input feed systems shall be subjected to the pressure (immersion) test to establish ability for withstanding and maintaining a minimum internal gas pressure.

4.6.4.12.1.1 Test setup

4.6.4.12.1.1.1 Test equipment. Temperature chamber, pressure container, pressure pump, and necessary instrumentation shall be required.

4.6.4.12.1.1.2 Test conditions. The test conditions shall be as specified herein.

4.6.4.12.1.2 Procedure

4.6.4.12.1.2.1 Prior to the start of the test, the equipment shall be subjected to examination of product, procedure II (4.6.1.2) and VSWR, procedure II (4.6.2.1.2).

4.6.4.12.1.2.2 The equipment shall be subjected to 50 cycles at room temperature (4.3.1.1), 50 cycles at -53.8°C , and 50 cycles at 71.1°C . Each cycle shall consist of the pressure being varied between 0 and 30 psig in 5 seconds, maintained at 30 psig for 10 seconds, and returning from 30 to 0 psig in 5 seconds.

4.6.4.12.1.2.3 The equipment shall then be subjected to 30 psig and completely submerged in a suitable liquid such as water for a period of not less than 5 minutes. While the equipment is submerged, it shall be observed for any evidence of bubbles.

4.6.4.12.1.2.4 After the equipment is removed from the liquid, it shall be attached to a container with a minimum capacity of 30-inch cubed and subjected to 30 psig for 24 uninterrupted hours at room temperature (see 4.3.1.1).

4.6.4.12.1.2.5 After completion of the tests specified above, the equipment shall be subjected to examination of product, procedure IV (4.6.1.4) and VSWR, procedure II (4.6.2.1.2).

MIL-W-87105 (USAF)

4.6.4.12.1.3 Accept-reject criteria (procedure I). The equipment shall be considered to have failed the pressure (immersion) test for any of the following reasons:

a. If the equipment does not satisfy the accept-reject criteria of 4.6.1.4.1 and 4.6.2.1.2.5.

b. If any bubbles occur while the equipment is submerged or if the test sample fails to maintain the pressure specified for 24 hours without the use of an external pressurizing device.

4.6.4.12.2 Procedure II (leakage). When required during the test program, the leakage test shall be conducted to verify that leakage does not occur as a result of the associated test.

4.6.4.12.2.1 Test setup

4.6.4.12.2.1.1 Test equipment. An altitude chamber, or equivalent, and a tank of water shall be required.

4.6.4.12.2.1.2 Test conditions. The test conditions shall be as specified herein. Unless otherwise specified in the detail specification, the assembly shall be immersed in tap water with a cover over its flange.

4.6.4.12.2.2 Procedure. The assembly shall be completely immersed in water and placed in the test chamber. The absolute pressure of the air above the liquid shall then be reduced to approximately one inch of mercury and maintained for one minute, or until air bubbles substantially cease to be given off by the liquid, whichever is the longer. The absolute pressure shall then be increased to 2.5 inches of mercury and maintained for 5 minutes. After the chamber has been allowed to return to ambient pressure, the assembly shall be removed from the chamber and dried with a clean lint-free cloth.

4.6.4.12.2.3 Accept-reject criteria (procedure II). If there was no evidence of bubbles coming from within the equipment while submerged, the test sample shall be considered as having passed the leakage test.

MIL-W-87105 (USAF)

4.7 Reliability tests. When required by the procuring activity, reliability tests shall be conducted in accordance with MIL-STD-781.

4.8 Maintainability demonstration. When required by the procuring activity, maintainability demonstration shall be conducted in accordance with MIL-STD-471.

4.9 Inspection of the packaging. Inspection of the packaging shall be in accordance with the requirements of section 5.

4.10 Test data preparation

4.10.1 Test procedures. Unless otherwise specified by the procuring activity, the contractor shall prepare detailed test procedures, subject to the approval of the procuring activity prior to the start of the qualification or the quality conformance test program. The procuring activity shall reserve the right to modify the tests or require any additional tests deemed necessary to determine compliance with the requirements of this document. Unless otherwise specified, the approved test procedures shall be considered a part of this specification and a separate test procedure shall be required for each different test.

4.10.2 Test reports. Unless otherwise specified by the procuring activity, the contractor shall prepare a test report in accordance with the requirements of MIL-STD-831, with the additions and exceptions specified herein, for each test procedure.

4.10.2.1 Procedure I. The test report for procedure I shall include data to show compliance with each and every characteristics of the equipment examined. This shall include measured data to show compliance with all physical requirements. Certificates of compliance may be substituted for data providing they contain positive identification, or a totally defining description, of the materials, processes, finishes, or design characteristics being certified.

4.10.2.1.2 Procedures II and IV. A detailed description of the exact condition of the equipment shall be recorded on the test data sheet for procedures II and IV.

4.10.2.1.3 Procedure III. A copy of all X-ray photographs taken along with the laboratory test report shall be submitted with the test report for procedure III.

MIL-W-87105 (USAF)

4.10.2.1.4 Procedure V. The test report for procedure V shall include signed certifications that the design, construction, material, finishes, and processes are identical to the equipment that was subjected to the qualification test program.

4.10.2.2 Each test report shall contain the following certification, which shall be signed by a responsible officer of the contractor's organization.

The data contained in this report has been obtained in accordance with the requirements specified in (specific test procedure, applicable revision and date) and has been reviewed, verified and certified to be as stated. The unit under test is certified to have (passed/failed) this test.

4.10.2.3 Each test report shall contain the following certification, which shall be signed by the cognizant Government representative.

This test was performed under my cognizance and, to the best of my knowledge, the test and all data contained in the test report was accomplished in accordance with applicable test procedure.

4.10.2.4 In addition, each quality conformance test report shall contain the following certification which shall be signed by a responsible officer of the contractor's organization.

The design, construction, materials, finishing and processes are identical to the model that was subjected to the qualification test program (4.4).

4.10.2.5 The results of quality conformance testing on the waveguide assembly shall be submitted with the sampling plan test report for the assembly.

MIL-W-87105 (USAF)

5. PACKAGING

5.1 All preservation, packaging, packing, marking, and testing thereof, shall conform to the requirements specified in the contract.

6. NOTES

6.1 Intended use. The waveguide assemblies covered by this general specification are intended for use with airborne electronic systems.

6.2 Ordering data. Procurement documents should specify the requirements specified herein.

6.2.1 Procurement requirements

a. Title, number, and date of this specification or the detail specification.

b. Qualification test program.

(1) Number of qualification samples

(2) Point of inspection.

c. Quality conformance test program

(1) Sample plan(s) required (see 4.5.2)

(2) Point of inspection.

d. Test level and test plan for reliability testing, if required (see 4.7).

e. Test method for maintainability demonstration, if required (see 4.8).

f. Selection of applicable levels of preservation and packaging, and packing.

6.2.2 Contract data requirements. Data specified under 4.10 will be listed directly on a DD Form 1423 incorporated into the contract.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products

MIL-W-87105 (USAF)

List whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is ASD/ENADD, Wright-Patterson AFB, OH 45433 and information pertaining to qualification of products may be obtained from that activity.

6.4 Definitions

6.4.1 Test discrepancy: Test discrepancy shall be construed to be a condition whereby the equipment fails the accept-reject criteria for a given test due to accidental damage, documentation error, installation error, instrumentation malfunction, or failure of the test equipment or facility.

6.4.2 Damage, deterioration, and degradation of performance

6.4.2.1 Damage: Damage shall be construed to include such items as: cracks or fractures of external or internal structure, irreversible strain or deformation of the structure, fatigue embrittlement of any component, damaged threads, hairline cracks, cracks or flaws in epoxied or soldered joints, or change in tolerance limits of any internal or external components beyond specified tolerance limits. If the equipment cannot be completely examined both internally and externally, it will be necessary to accomplish the examination by radiographic means.

6.4.2.2 Deterioration: Deterioration shall be construed to include such items as: discoloration as would result from inadequate finish, corrosion, fraying, plating or paint blisters, pitting or peeling, warped or bent parts, excessive wear, fungus growth, and evidence of moisture inside the equipment.

6.4.2.3 Degradation of performance: Degradation of performance shall be construed to include any condition that results in the loss of performance beyond specification limits.

6.4.3 Band of doubt: A VSWR value shall be considered to be in the band of doubt if the measured VSWR = the maximum allowable VSWR ± 0.08 (the maximum VSWR - 1). If the VSWR values fall within the band of doubt, a frequency band of ± 10 percent shall be investigated about the point. (*0.1 for frequencies above 12.0 GHz.)

MIL-W-87105 (USAF)

6.4.4 Insertion loss: The insertion loss shall be defined as the ratio of the power (P_1) absorbed by a given load from a generator and the power (P_2) absorbed by a given load from a generator after insertion of the sample between the generator and the load, shall be primarily made up of two factors; (1) the mismatch losses and (2) dissipative losses. The insertion loss shall be expressed in dB and shall be equal to:

$$10 \log_{10} \frac{(P_1)}{(P_2)}$$

6.4.5 Fine structure variation: A periodic or abrupt change that appears in the plotted measurement of insertion loss versus frequency (reference figure 3).

6.4.6 Critical resonant frequency: A critical resonant frequency is that frequency at which any point on the test sample is observed to have a maximum amplitude more than twice that of the support points.

6.4.7 Resonant frequency: A resonant frequency is that frequency which has an amplitude that is greater than 1.5 times the amplitude of the support points.

6.4.8 Interface component: The part of a waveguide assembly which provides a mechanical and electrical mate between the flange and other equipment. The interface component terminates the waveguide and is permanently attached to the waveguide.

6.4.9 Interface: The final electrical and mechanical transition between a waveguide assembly and external equipment.

6.4.10 Outline dimensions: Outline dimensions, for the purpose of this document, are defined as those that describe the physical size and shape of a waveguide assembly and, if applicable, locate required markings.

6.4.11 Responsible officer: For the purpose of this document, a responsible officer shall refer to any person who can legally bind the company in contractual matters.

Custodian:
Air Force - 11

Preparing activity:
Air Force - 11

Project No. 5985-F469

MIL-W-87105 (USAF)

TYPICAL INSERTION LOSS CURVE

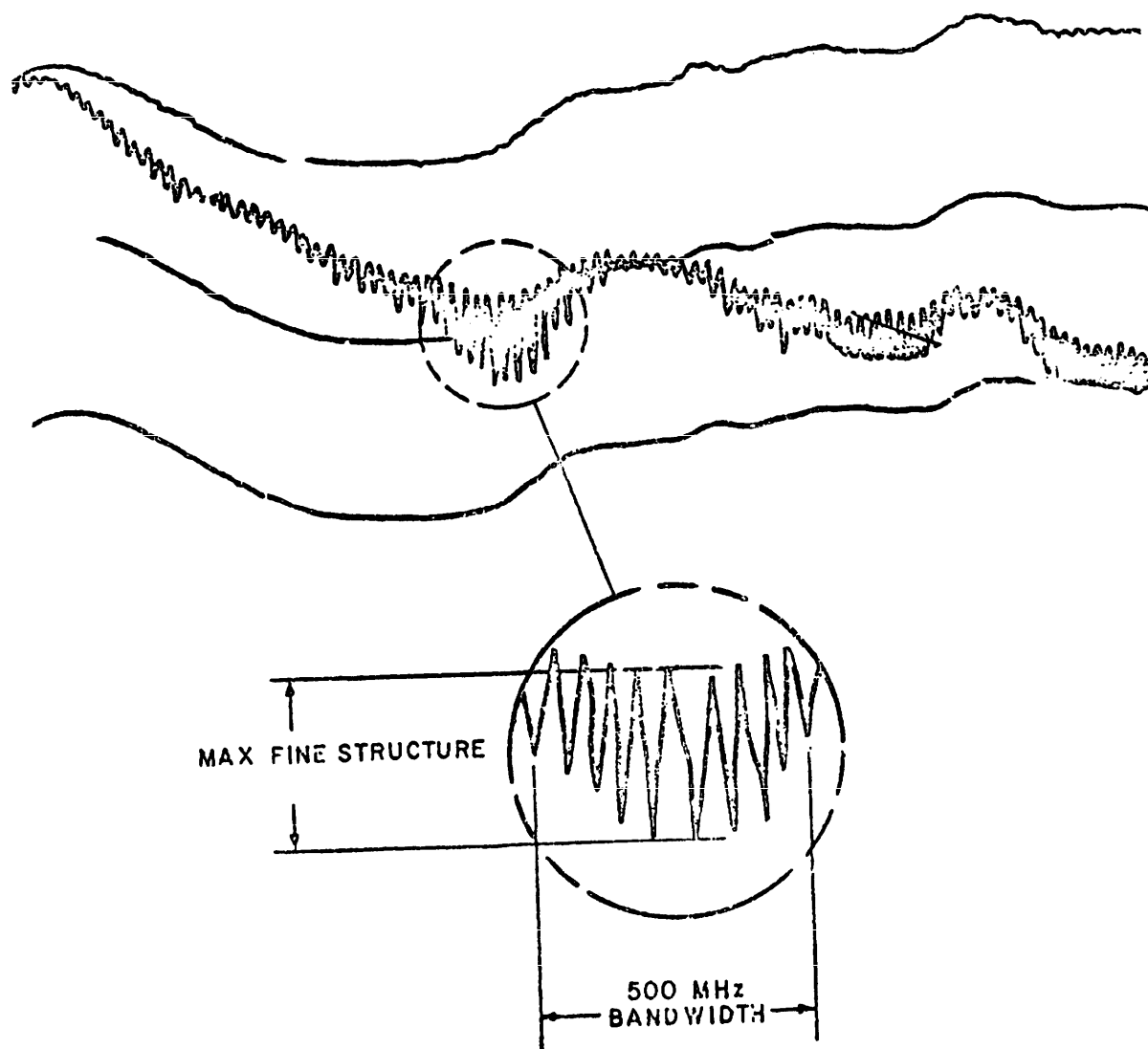


FIGURE 3. Typical fine structure variation.

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