METAL SPACE FRAME RADOME

REQUIREMENTS

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1.0 SCOPE

This requirement document defines the design, fabrication and performance of a Metal Space Frame Radome. Both electromagnetic and structural-environmental criteria must be considered in providing the optimum radome design. The radome shall be designed to provide an essentially maintenance free service life, while simultaneously complying with all the requirements of this specification.

2.0 APPLICABLE DOCUMENTS

The following documents of the issue in effect on the date of this specification form a part of this specification to the extent specified herein. In the event of a conflict between these documents and the detailed requirements of this specification, the requirements of this specification shall take precedence.

MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-130	Identification Marking
QQ-A-200/8	Aluminum Alloy, Type 6061-T6
MIL-STD-129	Marking for Shipment and Storage
FED-STD-406	Fire Retardancy
MIL-A-8421	Air Transportability Requirements
ISO-9001	Quality Program Requirements
MIL-F-14072	Finishes for Ground Signal Equipment
MIL-STD-81O	Environmental Test Methods for Aerospace and Ground Equipment
MIL-STD-210	Climatic Extremes for Military Equipment
MIL-E-17555	Packaging and Packing of Electronic Equipment, Accessories and Repair parts
MIL-P-116	Methods of Preservation

3.0 REQUIREMENTS

The radome shall be of the Metal Space Frame type composed of triangular panels bolted together to form a truncated spherical structure. The design shall be such that the structural members are quasi-randomly oriented over the radome surface, while simultaneously meeting the electromagnetic and structural-environmental requirements specified herein. All requirements are detailed in the ensuing paragraphs, delineating the design, fabrication and performance aspects of the radome.

3.1 ENVIRONMENTAL

3.1.1 Wind

The radome shall be designed for operation in winds of 210 mph. The wind speed specified shall be considered to apply at the top of the radome.

3.1.2 Ambient Temperature

The radome shall operate in ambient temperature ranges from -65°F to + 165°F (-54°C to + 71°C).

3.1.3 Relative Humidity

The radome shall withstand relative humidity up to 100%.

3.1.4 Barometric Pressure

The radome shall be designed to withstand barometric pressure as found anywhere on the surface of the earth.

3.1.5 Salt Atmosphere

The radome shall withstand salt atmosphere as encountered in coastal regions and during ocean transport and use in accordance with Method 509, Procedure I of MIL-STD-810.

3.1.6 Ozone

The radome shall withstand ozone as encountered in arctic regions and in the vicinity of heavy electrical equipment.

3.1.7 Actinic Radiation

The radome shall withstand actinic radiation as encountered in the tropics.

3.1.8 Self Extinguishing

The radome shall be self extinguishing per FED-STD-406, Method 2021.

3.1.9 Precipitation

The radome shall withstand at least 50 pounds per square foot of loading of any probable combination of ice, snow and/or other precipitation without permanent deformation.

The radome shall withstand rain rates up to 100 millimeters per hour.

3.1.10 Sand and Dust

The radome shall withstand sand and dust as defined in MIL-STD-210.

3.1.11 Solar Radiation

The radome shall provide at least 90% rejection of solar radiation (white exterior).

3.1.12 Fungus

The radome shall not support the growth of fungus in accordance with MIL-STD-454, Requirement 4.

3.2 CONSTRUCTION AND PHYSICAL CHARACTERISTICS

3.2.1 Radome Panels

The radome shall consist of triangular panels bolted together to form a truncated spherical structure. The design shall be such that the structural members are quasi-randomly oriented over the radome surface, while simultaneously meeting the electromagnetic and structural environmental requirements specified herein. The panels shall consist of aluminum extrusions and end fittings welded into triangular form, into which a reinforced plastics laminate membrane is permanently bonded.

3.2.2 Panel Frames

The panel frames shall be constructed of high grade aluminum extrusions welded to high grade aluminum end fittings. Corrosion resistant aluminum alloy 6061-T6, in accordance with specification QQ-A-200/8 shall be used for the panel extrusions and end fittings. Protective treatments, such as irradiating, allodyning, galvanizing, painting, etc. shall not be used in meeting the environmental requirements specified herein.

3.2.3 Panel Membranes

The membrane material shall be a reinforced plastics laminate. The exterior surface of the membrane shall consist of a Dupont™ Tedlar film integrally bonded to the laminate to insure against erosion. To optimize radome performance in rain at higher frequencies above approximately 6 GHz, the membranes may be coated with a factory applied hydrophobic coating.

3.2.3.1 Hydrophobic Coating (Optional)

The hydrophobic surface of the radome shall have a twenty year life without the need for recoating. The coating shall be UV resistant and its hydrophobic performance shall not degrade based on environmental exposure. The coating must have a contact angle of greater than 120°.

3.2.3.2 Membrane Physical Characteristics

The membrane shall be essentially uniform in thickness; shall be crack, tear, and erosion resistant; and shall be permanently bonded to the aluminum panel frames. The entire panel, consisting of the frame and the membrane shall be essentially maintenance free and shall be self extinguishing in accordance with FED-STD-406, Method 2021.

3.2.3.3 Membrane Electrical Characteristics

The average dielectric constant and average loss tangent of the radome membrane, over the frequency range specified, shall average 3.0 and 0.009 respectively.

3.2.4 Dimensions

The radome shall have a diameter of 96' and be fixed to a ringwall with an outside diameter of 67'-1".

3.2.5 Assembly and Assembly Hardware

The assembly and disassembly of the radome and the removal and replacement of individual panels shall be accomplished by the use of simple hardware - bolts, nuts, lock washers or locknuts. External sealing caps shall be included. An instruction manual of commercial grade shall be furnished with the radome, and shall provide instructions adequate for assembly and disassembly of the radome at the site location.

3.2.6 Radome Sealing

All panel joints and hub plates shall be suitably caulked or sealed after assembly. Sealing shall be accomplished utilizing silicone sealants to prevent the free ingress of moisture and to provide for an essentially watertight structure.

3.2.7 Panel to Panel Bond

Adjacent structural members shall be in physical contact so as to eliminate electrical arcing, provide an electrostatic shield for lighting protection of the antenna and improve the overall electromagnetic performance. Thus, the panel to panel electrical connection bond shall exhibit an electrical resistance of less than 10 milliohms DC between adjacent structural panel members, independent of the position along the structural members.

3.2.8 Lightning Protection

The radome shall provide an electrostatic shield for protection of the enclosed antenna, in accordance with the requirements of paragraph 3.2.7.

3.2.9 Weight

The radome weight shall be approximately 96,600 lbs.

3.2.10 Lifting Capacity

The radome shall be designed so as to be capable of being lifted after assembly as a complete unit on or off the antenna assembly in order to reduce installation down-time sphere required or to facilitate system tests with and without the radome in place.

3.3 ELECTROMAGNETIC PERFORMANCE

The electromagnetic performance of the radome shall not exceed the following values.

3.3.1 Transmission

The radome shall be designed such that the transmission loss from 0.25 - 8 GHz shall be less than 1.5 dB under dry conditions.

3.3.2 Noise Temperature

The noise temperature contribution of the radome shall be less than 15°K at elevation angles higher than 10°.

3.3.3 Boresight Shift

The radome shall be of the quasi-random geometry configuration to minimize sidelobe perturbations and boresight shift. The radome shall be designed such that the boresight shift attributable to the radome shall not exceed 0.020 milliradians from 0.25 - 8 GHz.

4.0 ACCESSORY EQUIPMENT

The radome shall be supplied with the following accessories: aircraft warning lights with lightning protection, interior light kit, base access hatch, zenith hatch with electric vent, anchor bolt template, base mounting hardware, radome sling lift, internal rope ladder and climbing harness kit, installation tool kit, membrane repair kit, blower system, and spare panel kit..

5.0 PREPARATION FOR DELIVERY

5.1 Preservation, Packing and Marking

The radome shall be of rugged design, capable of being transported by truck, van, rail, aircraft or ship. The radome shall be packaged for transport in accordance with the radome supplier's commercial practice in a manner that will ensure safe delivery. Marking shall be in conformance with MIL-STD-129. Preservation and packing shall be in accordance with MIL-E17555, Level C/C, and MIL-P-116, Method III.

6.0 QUALITY ASSURANCE PROVISIONS

6.1 Maintenance Free Service Life

The radome described in this specification is intended to be essentially maintenance free over its service life. The high quality materials specified shall not be deviated from

and equally high standards of workmanship shall be employed to insure compliance with this specification.

6.2 Quality Assurance Program

A quality assurance program, conforming to ISO-9001 shall be applied during the manufacture and installation of the radome supplied and installed in accordance with this specification.

6.2.1 Inspection and Test Conditions

All required inspections and tests shall be the responsibility of the radome supplier and shall be performed at prevailing ambient conditions.

6.2.2 Access to Records

During the manufacture of the radome, the buyer shall be allowed access to all applicable quality assurance records pertaining to the production of the radome specified herein.

6.3 Documentation

6.3.1 Technical Manual

A technical manual which includes installation, maintenance and repair instructions, as well as a complete parts list, shall be supplied.

6.3.2 Panel Static Load Test

Test data for each panel demonstrating the strength of the panel under simulated wind load shall be supplied with the radome. The panel test shall be compatible with the design wind speed.

6.3.3 Radome Foundation Design Criteria

Radome foundation loads and design criteria shall be given by the radome supplier. The design loads and interface requirements shall be compatible with the values given in Paragraphs 3.1.1, 3.2.4 and 3.2.9.

6.3.4 Radome and Accessory Equipment Acceptance

All the documentation as specified in Paragraph 6.3 along with visual inspection in accordance with the quality assurance provisions of this specification, Paragraph 6.2, shall constitute acceptance of the installation and services supplied.

7.0 PROPOSAL REQUIREMENTS

The following information shall be included in the vendor's proposal as evidence of their ability to meet the specifications set forth in this document.

1. General description of the proposed design.
2. Foundation load and interface information.
3. Electromagnetic analysis of radome performance.
4. Description of the method used for structural analysis and derivation of foundation loads.
5. Description of manufacturing facilities and methods with an explanation of in-process quality measurement points.
6. Listing of previous applicable experience.