



AEROSPACE MATERIAL SPECIFICATION	AMS3913™	REV. B
	Issued 1980-10 Revised 1994-06 Reaffirmed 2022-08	
Superseding AMS3913A		
Radome, Foam Sandwich Hot-Melt, Addition-Type Polyimide		

RATIONALE

AMS3913B has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE:

1.1 Form:

This specification covers the material and process requirements for fabricating sandwich radomes having hot-melt, addition-reaction polyimide-resin-impregnated quartz cloth shells and polyimide-resin syntactic foam cores.

1.2 Application:

This product has been used typically as a radar-transparent structure for use as an electromagnetic window up to 230 °C (446 °F), but usage is not limited to such applications.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

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<https://www.sae.org/standards/content/AMS3913B/>

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 3138	Coating Materials, Fluorocarbon (FKM) Elastomeric
AMS 3619	Resin, Polyimide, Laminating, High Temperature Resistant, 315 °C (600 °F)
AMS 3698	Adhesive Film, Hot-Melt, Addition-Type Polyimide, For Foam Sandwich Structure, -55 to +230 °C (-67 to +450 °F)
AMS 3709	Syntactic Foam Tiles
AMS 3751	Microspheres, Hollow Glass
AMS 3755	Powder, Fumed Silicon Dioxide
AMS 3824	Cloth, Type "E" Glass, Finished for Resin Laminates
AMS 3844	Cloth, Type "E" Glass, Style 7781 Fabric, Hot-Melt, Addition-Type, Polyimide Resin Impregnated
AMS 3849	Cloth, Quartz, Style 581 Fabric, Hot-Melt, Addition-Type, Polyimide Resin Impregnated
AMS 4770	Brazing Filler Metal, Silver, 50Ag - 18Cd - 16.5Zn - 15.5Cu, 1160 to 1175 °F (625 to 635 °C) Solidus-Liquidus Range

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM C 273	Shear Properties in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores
ASTM C 297	Tension Strength of Flat Sandwich Constructions in Flatwise Plane
ASTM D 790	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
ASTM D 790M	Flexural properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials (Metric)
ASTM D 792	Specific Gravity (Relative Density) and Density of Plastics by Displacement
ASTM D 2520	Complex Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials at Microwave Frequencies and Temperatures to 1650 °C
ASTM D 2584	Ignition Loss of Cured Reinforced Resins
ASTM D 2734	Void Content of Reinforced Plastics

2.3 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-2073-1 DOD Materiel, Procedures for Development and Application of Packaging Requirements

3. TECHNICAL REQUIREMENTS:

3.1 Materials:

The materials incorporated into the completed radome shall be as specified herein. The several styles of glass cloth specified shall conform to the applicable requirements of AMS 3824.

3.1.1 Polyimide Syntactic Foam Grout: Shall be as shown in Table 1.

TABLE 1 - Polyimide Syntactic Foam Grout Formulation

Component	Parts by Weight
AHS 3751 Glass Microspheres, Class 15	100
AMS 3619 Polyimide Resin	140
Fine Aluminum Powder	15
1/4-Inch (6.4-mm) Chopped Glass	7.2
Acetone, Technical Grade	40
N-Methylpyrrolidone (NMP)	55

3.1.2 Polyimide Surface Filler: Shall be as shown in Table 2.

TABLE 2 - Polyimide Surface Filler Formulation

Component	Parts by Weight
Fine Inorganic Filler	80
N-Methylpyrrolidone (NMP)	40
AMS 3619 Polyimide Resin	60
AMS 3755 Fumed Silicon Dioxide Powder	1

3.2 Procedure:

- 3.2.1 Mandrel Preparation: The mandrel on which the shell is to be built shall (R) be cleaned with a suitable organic solvent and coated with an appropriate release agent.
- 3.2.2 Bare Mandrel Calibration:
- 3.2.2.1 The mandrel shall be centered in the grinder with a maximum deviation of 0.0007 inch (0.018 mm) total indicator reading (TIR) at the base.
- 3.2.2.2 Using the gaging system on the appropriate grinder, bare mandrel readings relative to the master cam shall be measured to the nearest 0.0010 inch (0.025 mm) at the appropriate stations.
- 3.2.3 General Fabrication Procedures: Fabrication of the radome shell shall be accomplished in the following sequence: (1) layup and cure the inner skin and solid laminate buildups, (2) bond, grout, and grind precured foam core, (3) layup and cure the outer skin, and (4) postcure, final grind, trim, and assemble finished radome (e.g., nose plug, lightning diverters, erosion coating).

- 3.2.3.1 Skin Layup: The warp direction of the resin-impregnated fabric shall be parallel to the radome centerline ± 10 degrees. Lap joints shall not be superimposed. Lap joints shall be 0.50 inch \pm 0.25 (12.7 mm \pm 6.4) wide. The layup temperature shall not exceed 70 °C (158 °F) prior to the curing operation.
- 3.2.3.2 Layup Debulk: The uncured layup shall be debulked, after each ply or series of plies is laid up, as required to eliminate wrinkles in the cured skin. Debulking may be accomplished by vacuum bag, wrapping with cord under tension, or by use of shrink tape. Temperatures during debulking operations shall not exceed 70 °C (158 °F).
- 3.2.3.3 Cures: All autoclave cures shall be carried out in a vacuum bag. There shall be at least one thermocouple buried within the layup to be cured, no more than one ply from the mandrel side of the uncured layup, and located in the base overtrim. As the coolest thermocouple during heatup, this shall be the controlling thermocouple. Not less than four thermocouples shall be taped to the outer surface of the vacuum bag, located at the base trim, at the nose, and at two intermediate locations between these. These thermocouples shall be insulated from the air with pads of glass insulation. Where vacuum is specified, the vacuum pressure shall be not less than 24 inches (610 mm) of mercury (Hg). There shall be three vacuum lines, one at the nose and two, 180 degrees apart, at the radome base.
- 3.2.4 Inner Skin Fabrication:
- 3.2.4.1 Layup: Six plies of AMS 3849 resin-impregnated quartz cloth shall be laid up on the mandrel in accordance with 3.2.3.1.
- 3.2.4.2 Preparation for Cure: A peel ply shall be used over the lay-up only (do not connect with bleeder system) and the entire assembly vacuum-bagged using nylon film. A non-perforated film and dry glass fabric "breather" ply between the peel ply and bag shall be used. Bleeder system shall be such that bleeding is through the top surface of the lay-up only and not from the edges.
- 3.2.4.3 Cure: The assembly shall be placed in an autoclave for cure. Vacuum not less than 24 inches (610 mm) Hg shall be applied and maintained throughout the cure cycle. The assembly shall be heated to a temperature within the range 82 to 93 °C (180 to 199 °F) and held at the selected temperature within ± 5 °C (± 9 °F). Autoclave pressure of 90 psi \pm 5 (621 kPa \pm 34) shall be applied and the temperature increased to 180 °C \pm 5 (356 °F \pm 9). Assembly shall be cured for not less than 90 minutes at 180 °C \pm 5 (356 °F \pm 9) and 90 psi \pm 5 (621 kPa \pm 34). During cool-down, autoclave pressure shall be maintained until part has cooled below 120 °C (248 °F) and vacuum shall be maintained on assembly until it has cooled below 90 °C (194 °F).
- 3.2.5 Solid Laminate Layup:
- 3.2.5.1 The unfinished glass fabric, Style 128 or 7628, peel ply, shall be stripped from the part in the buildup areas.

- 3.2.5.2 Sufficient plies of AMS 3844 Style 7781, E-glass, hot-melt, addition-type, polyimide-resin-impregnated fabric shall be laid up over the aft section of the inner skin to obtain the cured thickness specified on the drawing, plus not less than two excess plies. Patterns may be bias-cut relative to the radome axis. The nose area buildup shall be cut and laid up as shown on the drawing, using AMS 3849 resin-impregnated cloth.
- 3.2.5.3 The solid buildup layups shall be debulked in accordance with 3.2.3.2, vacuum bagged in accordance with 3.2.3.3, and autoclave cured in accordance with 3.2.4.3.
- 3.2.6 Preparation of Foam Core Tiles: The foam tiles shall be fabricated in accordance with AMS 3709 to the requirements of the applicable drawing.
- 3.2.7 Bonding of Tiles to Inner Skin:
- 3.2.7.1 The remaining 128 or 7628 glass peel ply shall be removed from the inner skin. A ply of AMS 3698 polyimide adhesive film shall be applied to the peeled area.
- 3.2.7.2 The prepared tiles from 3.2.6 shall be positioned on the inner skin in accordance with the applicable drawing so that there is a gap of 0.150 inch \pm 0.030 (3.81 mm \pm 0.76) around each tile.
- 3.2.7.3 One layer of glass bleeder fabric shall be laid over the entire radome/tiles surface, the part shall be vacuum bagged, and a vacuum of not less than 24 inches (610 mm) Hg shall be applied.
- 3.2.7.4 The part shall be placed in an autoclave and cured as follows: simultaneously raise the autoclave air temperature to 185 °C \pm 2 (365 °F \pm 4) at a rate of 1.5 to 2.0 °C (2.5 to 3.5 F) degrees per minute and raise the pressure to not less than 50 psi (345 kPa). When the coolest-part thermocouple reaches 170 °C (338 °F), the part shall be maintained at 180 °C \pm 5 (356 °F \pm 9) for not less than 90 minutes. The part shall be cooled to 100 °C (212 °F) or below under vacuum and at least 50 psi (345 kPa) pressure before debagging.
- 3.2.8 Core Joint Grouting:
- 3.2.8.1 Open all joints to 0.19 inch \pm 0.06 (4.8 mm \pm 1.5) at the base and taper the sides to an angle approximately 10 degrees from normal to the radome surface.
- 3.2.8.2 Apply a thin coat of AMS 3619 polyimide resin to all joint surfaces.
- 3.2.8.3 Prepare grout mix in accordance with 3.1.1.
- 3.2.8.4 Pack grout mix into all foam tile joints.
- 3.2.8.5 Raise radome temperature to 65 °C \pm 2 (149 °F \pm 4) and hold at heat for 60 minutes \pm 5. Cool to room temperature.

- 3.2.8.6 One ply of glass release/bleeder fabric shall be placed over all filled joints. Vacuum bag the part and apply a vacuum of not less than 24 inches (610 mm) mercury.
- 3.2.8.7 Heat the radome to $115\text{ }^{\circ}\text{C} \pm 5$ ($239\text{ }^{\circ}\text{F} \pm 9$) and hold at temperature for not less than 45 minutes; raise radome temperature to $175\text{ }^{\circ}\text{C} \pm 5$ ($347\text{ }^{\circ}\text{F} \pm 9$), and hold for not less than 90 minutes. Cool the radome under full vacuum to below $65\text{ }^{\circ}\text{C}$ ($149\text{ }^{\circ}\text{F}$) before debagging.
- 3.2.9 Pregrind: The part shall be centered in the grinder with a maximum deviation of 0.0007 inch (0.018 mm) total indicator reading (TIR) at the nose and a maximum of 0.0010 inch (0.025 mm) TIR at the base. The foam core window areas shall be ground to the total wall thickness shown on the drawing, -0.082 inch (-2.08 mm), $+0$. The solid laminate base area shall be ground to the total thickness shown on the applicable drawing, -0.072 inch (-1.83 mm), $+0$. After grinding, the radome surface shall be vacuum cleaned.
- 3.2.10 Outer Skin Layup:
- 3.2.10.1 At least two plies more than the six required for the final outer skin shall be laid over the entire surface of the radome using AMS 3849 resin-impregnated cloth.
- 3.2.10.2 The outer skin layup shall be fitted with not less than four autoclave cured in accordance with 3.2.4.3.
- 3.2.11 Postcure: The radome shall be fitted with not less than four thermocouples taped to the outer surface and located at the base, at the nose, and at two intermediate locations between. The thermocouples shall be insulated from the surrounding medium to reflect the radome temperature. The radome shall be postcured in accordance with 3.2.11.1 as recorded on the coolest thermocouple.
- 3.2.11.1 Temperature shall be uniformly increased in stages to $190\text{ }^{\circ}\text{C} \pm 5$ ($374\text{ }^{\circ}\text{F} \pm 9$) over a 2-hour ± 0.1 period and maintained at temperature for not less than 12 hours.
- 3.2.12 Final Grind: The radome window area shall be ground to the electrical design configuration as determined with a one-horn interferometer. Base attach area and nose area shall be ground to the dimensional requirements of the applicable drawing.
- 3.2.13 Coating and Assembly of Radome:
- 3.2.13.1 The radome shell shall be removed from the mandrel using an appropriate removal tool.
- 3.2.13.2 All tooling and drain holes shall be drilled as specified on the applicable drawing.
- 3.2.13.3 The radome shell shall be trimmed and routed, as specified on the applicable drawing, using the proper trim fixture.

3.2.13.4 Surface Sealing:

3.2.13.4.1 The polyimide filler of 3.1.2 shall be applied to the exterior shell surfaces and to all cut or drilled laminate edges. The radome shall be heated to $175\text{ }^{\circ}\text{C} \pm 5$ ($347\text{ }^{\circ}\text{F} \pm 9$) at a rate of 2 to 3 C (4 to 5 F) degrees per minute, cured for 60 minutes ± 5 at $175\text{ }^{\circ}\text{C} \pm 5$ ($347\text{ }^{\circ}\text{F} \pm 9$), and cooled to room temperature.

3.2.13.4.2 (R) All radome surfaces shall be lightly sanded with No. 100 to 180 (150 to 80 μm) grit sandpaper to remove the gloss. The dust shall be removed by using clean cheesecloth dampened with a suitable cleaning solvent. Silicone resin shall be diluted for spraying with a 3 to 1 by weight mixture of xylene. All interior radome surfaces shall be sprayed to a dry film thickness of 0.001 to 0.002 inch (0.025 to 0.051 mm). The radome shall be heated to $175\text{ }^{\circ}\text{C} \pm 5$ ($347\text{ }^{\circ}\text{F} \pm 9$) at a rate of 2 to 3 C (4 to 5 F) degrees per minute, cured for 60 minutes ± 5 at $175\text{ }^{\circ}\text{C} \pm 5$ ($347\text{ }^{\circ}\text{F} \pm 9$), and cooled to room temperature.

3.2.13.5 Bonding of Lightning-Diverter Strips:

3.2.13.5.1 (R) The lightning-diverter strips shall be located on the radome surface in accordance with the applicable drawing. The bonding surfaces of the radome and the lightning-diverter strips shall be lightly sanded with No. 100 to 180 (150 to 80 μm) grit sandpaper. The sanded radome and strip surfaces shall be wiped dust-free with clean cheesecloth dampened with a suitable cleaning solvent.

3.2.13.5.2 AMS 3698 polyimide film adhesive shall be applied to the bonding surface of the radome.

3.2.13.5.3 The lightning-diverter strip buttons shall be masked for protection from resin-bleedout.

3.2.13.5.4 The lightning-diverter strips shall be positioned on the radome and covered with one ply of glass release fabric and the part shall be vacuum bagged.

3.2.13.5.5 A vacuum of not less than 24 inches (610 mm) Hg shall be applied and the bondline temperature raised to $175\text{ }^{\circ}\text{C} \pm 5$ ($347\text{ }^{\circ}\text{F} \pm 9$) at a rate of 2 to 3 C (4 to 5 F) degrees per minute. The part shall be cured for 60 minutes ± 5 at $175\text{ }^{\circ}\text{C} \pm 5$ ($347\text{ }^{\circ}\text{F} \pm 9$). The part shall be cooled to below $70\text{ }^{\circ}\text{C}$ ($158\text{ }^{\circ}\text{F}$) under full vacuum before debuggng.

3.2.13.6 The metal nose plug shall be bonded into the nose. Both bonding surfaces shall be prepared by lightly sanding with No. 100 to 180 (150 to 80 μm) grit sandpaper and coating with AMS 3619 polyimide resin. The resin shall be dried for not less than 45 minutes at $105\text{ }^{\circ}\text{C} \pm 5$ ($221\text{ }^{\circ}\text{F} \pm 9$). A second coat of polyimide resin shall be applied and the nose plug assembled into the radome in accordance with the applicable drawing.

- 3.2.13.7 The assembled radome shell shall be placed in an oven and the temperature raised to $245\text{ }^{\circ}\text{C} \pm 5$ ($473\text{ }^{\circ}\text{F} \pm 9$) at a rate of 2 to 3 C (4 to 5 F) degrees per minute, held at $245\text{ }^{\circ}\text{C} \pm 5$ ($473\text{ }^{\circ}\text{F} \pm 9$) for $4\text{ hours} \pm 0.5$, and cooled to ambient temperature in not less than 2 hours.
- 3.2.14 Application of Erosion-Resistant Coating: The entire outer shell surface, except for the lightning-diverter strip buttons, shall be spray coated with AHS 3138 fluoroelastomer erosion-resistant coating, or equivalent.
- 3.2.14.1 (R) All surfaces to be coated shall be lightly sanded with No. 100 to 180 (150 to 80 mm) grit sandpaper and wiped clean with a suitable solvent dampened cheesecloth. The lightning-diverter strip buttons shall be masked off during the spraying operation.
- 3.2.14.2 (R) The fluoroelastomer erosion-resistant coating material shall be catalyzed in accordance with manufacturer's instructions. The coating material shall be thinned with an appropriate solvent as necessary for spray application.
- 3.2.14.3 The fluoroelastomer coating shall be applied and cured in accordance with manufacturer's instructions to produce a dry film thickness of 0.009 to 0.013 inch (0.23 to 0.33 mm).
- 3.2.14.4 After a three-day ambient cure, the buttons shall be unmasked and the coated radome assembly cured for at least 1 hour each at $9\text{ }^{\circ}\text{C} \pm 2$ ($203\text{ }^{\circ}\text{F} \pm 4$), $120\text{ }^{\circ}\text{C} \pm 2$ ($248\text{ }^{\circ}\text{F} \pm 4$), and $150\text{ }^{\circ}\text{C} \pm 2$ ($302\text{ }^{\circ}\text{F} \pm 4$).
- 3.2.15 Hardware Assembly:
- 3.2.15.1 The radome aft-end attaching hardware shall be assembled to the radome shell in accordance with the applicable drawing.
- 3.2.15.2 A 0.028-inch (0.71-mm) diameter hole shall be drilled through a button in the diverter strip and the solid laminate base area of the radome in accordance with the drawing.
- 3.2.15.3 The resistor wire shall be fed through the hole and brazed to the diverter-strip buttons in accordance with the applicable drawing using AMS 4770 filler metal. The resistor wire shall be securely attached to the inside of the attaching hardware as specified on the drawing. This procedure shall be repeated for each diverter strip used. The holes shall be potted with AMS 3619 polyimide resin and the assembly cured for $60\text{ minutes} \pm 5$ at $175\text{ }^{\circ}\text{C} \pm 5$ ($347\text{ }^{\circ}\text{F} \pm 9$).

3.3 Properties:

The radome shall conform to requirements shown in Table 3. Tests shall be performed on the test panels of 4.3 and in accordance with specified ASTM methods, insofar as practicable.

TABLE 3 - Properties

Paragraph	Property	Requirement	Test Method
3.3.1	Sandwich Properties		
3.3.1.1	Core Shear Strength:		ASTM C 273, determined on three specimens per test
	Test Temperature	Min Individual	Min Average
	At 25 °C ± 2 (77 °F ± 4)	280 psi (1.93 MPa)	300 psi (2.07 MPa)
	At 230 °C ± 2 (446 °F ± 4)	230 psi (1.59 MPa)	250 psi (1.72 MPa)
3.3.1.2	Flatwise Tensile Strength:		ASTM C 297, determined on three specimens per test
	Test Temperature	Min Individual	Min Average
	At 25 °C ± 2 (77 °F ± 4)	325 psi (2.24 MPa)	360 psi (2.48 MPa)
	At 230 °C ± 2 (446 °F ± 4)	200 psi (1.38 MPa)	225 psi (1.55 MPa)
3.3.2	Laminate Properties:		
3.3.2.1	Specific Gravity	1.60 to 1.80	ASTM D 792
3.3.2.2	Resin Content:	30 to 40%	ASTM D 2584, Furnace Temperature: 620 °C ± 25 (1148 °F ± 45)
3.3.2.3	Void Content:		4.5.1
	Inner Skin	5%, max	
	Outer Skin	10%, max	

TABLE 3 - Properties (Continued)

Paragraph	Property	Requirement	Test Method
3.3.2.4	Flexural Strength:		ASTM D 790 or ASTM D 790M, determined on three specimens per test
	Test Temperature	Min Individual	Min Average
	At 25 °C ± 2 (77 °C ± 4)	54.0 psi (372 kPa)	60.0 psi (414 kPa)
	At 230 °C ± 2 (446 °C ± 4)	40.0 psi (276 kPa)	45.0 psi (310 kPa)
3.3.3	Composite Dielectric Properties:		ASTM D 2520, Method A
	At 9.375 GHz at room temperature	2.90 to 3.40	

3.4 Quality:

Radomes, as received by purchaser, shall be uniform in quality and condition, sound, and free from foreign materials and from imperfections detrimental to usage of the radomes.

- 3.4.1 After applying the sealer coating but before attaching the diverter strips and erosion-resistant coating, radome shells shall be inspected by photochromic or other suitable nondestructive test method on both inner and outer surfaces for internal imperfections such as disbonds or crushed core. All suspected imperfections shall be subjected to review for disposition of the part.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

(R)

The manufacturer of radomes shall supply all samples for required tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the radomes conform to the requirements of this specification.

4.2 Classification of Tests:

Tests for all technical requirements are acceptance tests and preproduction tests and shall be performed prior to or on the initial shipment of radomes to a purchaser, on test panels representing each lot, when a change in ingredients and/or processing requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

- 4.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, a test radome shall be submitted to the cognizant agency as directed by the procuring activity, contracting officer, or request for procurement.

4.3 Sampling and Testing:

(R)

Shall be as follows; a lot shall be all radomes produced in a single production run from the same batches of raw materials under the same fixed conditions, and presented for manufacturer's inspection at one time.

- 4.3.1 The sandwich test panel representing the radome shall be not less than 12 x 12 x T inches (305 x 305 x T mm), where "T" is the thickness of the radome wall, and shall be prepared and cured alongside the radome shell.

- 4.3.2 Samples for laminate property tests shall be cut from the tag end overtrim on the solid laminate buildup of the radome.

- 4.3.3 Inspection Unit: Shall be each radome.

- 4.3.4 When a statistical sampling plan has been agreed upon by purchaser and manufacturer, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and 4.3.2 and the report of 4.6 shall state that such plan was used.

4.4 Approval:

- 4.4.1 A sample radome shall be approved by purchaser before radomes for production use are supplied, unless such approval be waived by purchaser. Results of tests on production radomes shall be essentially equivalent to those on the approved sample.

- 4.4.2 Manufacturer shall establish parameters for the process control factors which will produce radomes meeting the technical requirements. These shall constitute the approved procedures and shall be used for manufacturing production radomes. If necessary to make any change in parameters for process control factors, manufacturer shall submit for reapproval a statement of the revised procedures and, when requested, sample test panels. Production radomes incorporating the revised procedures shall not be shipped prior to receipt of reapproval.