TEXAS DEPARTMENT OF TRANSPORTATION

TRAFFIC OPERATION DIVISION

RADIO FREQUENCY DOUBLE SHIELDED ENCLOSURE

PUBLICATION

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PART I

GENERAL CLAUSES AND CONDITIONS

1. The equipment furnished under this specification shall be the latest improved model in current production, as offered to commercial trade, and shall be of quality workmanship and material. The respondent represents that all equipment offered under this specification shall be new. USED, SHOPWORN, DEMONSTRATOR, PROTOTYPE, REMANUFACTURED, RECONDITIONED OR DISCONTINUED MODELS ARE NOT ACCEPTABLE.
2. Respondent should submit with the solicitation or have on file with TxDOT, Austin, Texas, the latest printed literature and detailed specifications on equipment the respondent proposes to furnish. This literature is for informational purposes only.
3. All parts not specifically mentioned which are necessary for the unit to be complete and ready for operation or which are normally furnished as standard equipment shall be furnished by the vendor. All parts shall conform in strength, quality and workmanship to the accepted standard of the industry.
4. The unit provided shall meet or exceed all federal and state of Texas safety, health, lighting and noise regulations and standards in effect and applicable to equipment furnished at the time of manufacture.
5. It is the intent of TxDOT to purchase goods, equipment and services having the least adverse environmental impact, within the constraints of statutory purchasing requirements, TxDOT need, availability, and sound economical considerations. Suggested changes and environmental enhancements for possible inclusion in future revisions of this specification are encouraged.
6. TxDOT encourages all manufacturers to comply voluntarily with the Society of Automotive Engineers (SAE) Recommended Practice for marking of plastic parts per current SAE J1344 standard. All plastic components furnished to this specification should have an imprinted SAE symbol identifying the resin composition of the component so that the item can be recycled after its useful life. Manufacturers are encouraged to use recycled plastics and materials in the manufacture of their products in order to conserve natural resources, energy and landfill space. Respondents should note that future specification revisions may require mandatory compliance with the SAE plastic coding system.
7. TxDOT is committed to procuring quality goods and equipment. TxDOT encourages manufacturers to adopt the International Organization for Standardization (ISO) 9001-9003 standards, technically equivalent to the current American National Standards Institute/American Society for Quality Control (ANSI/ASQC Q91-93), and obtain certification. Adopting and implementing these standards is considered beneficial to the manufacturer, TxDOT, and the environment. It is TxDOT's position that the total quality management concepts contained within these standards can result in reduced production costs, higher quality products, and more efficient use of energy and natural resources.

PART II

SPECIFICATIONS

1. SCOPE: The successful vendor shall provide all labor, materials, equipment, tools, scaffolding, and all other incidental items to provide, fabricate, deliver, and test the radio frequency enclosure with the maximum (in all directions) exterior dimensions of 12' 6" X 10' 6" X 8' 6" (length x width x height) in the Radio Lab room at the TxDOT Cedar Park, Bldg. 51 facility. Vendor shall provide a minimum of 90dB attenuation in electric field over the frequency range of 15 KHz to 10 GHz complete with electric circuits, lighting, flooring, power line, phone line, fire alarm, and communication line filters.

   Applicable Standards: The following codes and standards where referred to shall be applicable to the extent as indicated.

IEEE 299	IEEE Standard Method for Measuring the Effectiveness of Electromagnetic Shielding Enclosures
MIL-STD-285	Method of Attenuation Measurements for Electromagnetic Shielding Enclosure for Electronic Test Purposes
MIL-STD-220A	Method of Insertion Loss measurement for Radio Frequency Filters
UL 1283	Standard for Safety – Electromagnetic Interference Filters
ASTM E90-83	Recommended Practice for Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions
ASTM E413-73	Standard Classification for Determination of Sound Transmission Class
SS-A-118-B	Federal Specification Flame Resistance Test
ASTM E84-81A	Test for Surface Burning Characteristics of Building Materials

   EXAMPLES:

   Panashield Panabolt ™ Shielded Enclosure
   Universal Shielding Corporation Model USC26-101210
   Or TxDOT approved equal

   NOTICE TO RESPONDENT: Any example shown is listed to show type and class of equipment desired. Respondent is cautioned to read the specification carefully, as there may be special requirements not commonly offered by the manufacturer. DO NOT ASSUME STANDARD EQUIPMENT MEETS ALL OF THE DETAILED SPECIFICATION REQUIREMENTS MERELY BECAUSE IT IS LISTED AS AN EXAMPLE. Respondent is cautioned that any unit delivered to the FOB point which does not meet specification in every aspect will not be accepted.

2. FUNCTIONAL AND DESIGN REQUIREMENTS: The function of radio frequency interference resistant construction is to permit an interference-free environment with a single ground point when tested in accordance with MIL-STD-285 or IEEE-299.

   2.1 Enclosure shall meet the following functional requirements:

      2.1.1 Attenuation of magnetic field 20db at 1 KHz to 100 dB at 200 KHz

      2.1.2 Attenuation of electric fields 70 dB at 1 KHz to 100 dB at 10 KHz and a performance level of 100 dB between 10 KHz and 100 MHz

      2.1.3 Attenuation of plane waves 100 dB from 50KHz to 1GHz

      2.1.4 Attenuation of microwaves 100 dB from 1GHz to 10GHz

2.1.5 The environment will be constructed ungrounded and tested for a minimum resistance to ground of 1,000 ohms

2.2 Panels and doors shall have Sound Transmission Class (STC) 30, when tested per specification ASTM E90-083 (not including sound transmission loss of surrounding building construction).

2.3 Flame Resistance of shielded construction shall have a flame spread classification (FSC) of 0, and corresponding NFPA, interior finish classification to be Class A, UBC Class One, when tested in accordance with ASTM method E84-81A.

2.4 Engineering/design shop drawings shall be submitted by the vendor for approval prior to fabrication. Drawings shall show typical plan elevations, and section details, locations of miscellaneous penetrations and any other conditions which affect the enclosure.

2.5 Bill of materials and installation drawings shall be submitted by the vendor for approval prior to installation.

2.6 Vendor will be responsible for modifications and preparations to existing departmental building structures with approval methods and designs as approved by TxDOT representatives.

2.7. The external dimensions shall be a maximum of 12' 6" length X 10' 6" wide X 8' 6" high not including externally mounted filters. The internal dimensions shall be a minimum of 10' length X 12' wide X 8' high with a minimum of 120 square feet of floor space.

2.8 Enclosure shall be of a modular arrangement of double shielded radio frequency structural non-welded panels, including the framing system. Enclosure shall be designed for future disassembly and removal.

2.9 Floor, walls and ceiling panels/shielding shall be of plywood or particle board type core with 24 gauge galvanized steel bonded to the core joined together with a hat and flat framing system. Steel surfaces of the panels shall be treated to resist corrosion without degrading the electrical continuity of the radio frequency attenuation. The exterior shield shall be of 24 to 28 gauge galvanized sheet steel.

2.9.1 The chamber shall be installed with an underlayment consisting of polyvinyl vapor barrier and masonite.

2.9.2 The floor will be installed such that the area between the floor framing members is either filled in with ¼ to 3/16 inch thick hardboard screwed to the floor or 12" x 12" peel and stick 1/8" vinyl floor tiles. Then install 18" x 18" minimum, charcoal grey, non-static, carpet tiles on top of the vinyl.

2.10 The panel inter-locking system shall consist of approximately 1/8" thick steel, zinc coated to resist corrosion without degrading the electrical continuity of the joint. Framing elements shall consist of shapes which provide a clamping action of panel edges with uniform and consistent pressure contact against the shielded elements.

2.11 The corners shall be framed and sealed with cast bronze corner casing cap assemblies consisting of inner and outer parts.

2.12 The enclosure shall be self-supported. The deflection of the walls under static load of 75 pounds applied normal to the wall surface will cause a deflection not to exceed 1/250 of the unsupported span. Deflection of the ceiling panels shall not exceed 1/270 of the unsupported span.

2.13 One (1) 3’ wide x 7’ high shielded personnel door equipped with a minimum of a 2-point latching mechanism for a tight, RFI-EMI-secure closing. Bearing surfaces, rollers and door cams made of case-hardened tool steel, designed for trouble-free operation with no loss of attenuation capability due to friction and wear. Doors should be easy to operate; requiring less than 20 pounds of force on the handle. Doors equipped with a minimum of two rows of beryllium copper “finger” round the periphery of the door. In the closed position, the fingers contact the door frame to insure an RFI/EMI leak-proof seal. Single knife edge (MIL-STD-285/IEEE-299) 100 dB. concealed finger stock – with a minimum of two adjustable hinges on a standard door clear opening 36” x 84”. The door shall open “right-hand out” (outward and hinged on the left when viewed from the perspective of being outside the room.)

2.14 A removable or internal ramp shall be provided for easy access into the enclosure with a loaded equipment cart.

2.15 Radio frequency filters assembly shall be used for all penetrations.

2.16 Single power line filters shall be supplied for circuits (one per circuit) entering the chamber. Filters shall be rated for 30 ampere 0 to 60Hz, 120VAC with an insertion loss of 100dB for a minimum range 15 KHz – 10 GHz and installed with appropriate hardware designed for penetrating the RFI tight compartment.

2.17 All incoming electrical lines shall be provided with UL listed radio frequency filters. Filters shall be provided for each electrical conductor. The filtered conductors shall penetrate the enclosure through radio frequency filter penetrations which shall be an integral part of the filter. Power filters shall attenuate radio frequency energy on the incoming power by minus 100 dB from 14KHz to 10GHz (when tested per MIL-STD-220A).

2.17.1 A minimum of two – 2 plug, 120V AC electrical service outlets per wall shall be provided.

2.17.2 Extruded metal tubing for wiring for electrical outlets and light circuits.

2.17.3 Each electrical service and outlet shall be designed for and equipped with separate 30 amp circuit breakers.

2.18 One (1) telephone line filter shall be provided. The filter location will be determined at a later date by TxDOT.

2.19 Eight (8) coaxial signal input ports shall be provided with “N” style radio frequency connectors. The panel location will be determined at a later date by the department.

2.20 Radio frequency filtered air vents shall be provided. The temperature of the interior of the enclosure shall be kept at 74 degrees Fahrenheit (plus or minus 2 degrees) in any external ambient temperature from 10 degrees Fahrenheit to 100 degrees Fahrenheit. According to departmental calculations, the supplied duct opening will need to be a minimum of 360 square inches. Vent locations will be determined at a later date. Connection into the HVAC system of the building will be done in consultation with TxDOT building maintenance.

2.21 Provide and install eight (8) each incandescent light fixtures with two – sixty (60) watt bulbs in each fixture. Fixtures shall be located so department personnel standing and/or sitting at the work surfaces are not working in their own shadows. Fluorescent fixtures are not acceptable.

2.22 The vendor shall tie the chamber ground conductor consisting of a 1/0 tinned, copper, stranded and insulated cable to a ground bus bar provided by TxDOT. The vendor will be required to verify that the ground bus will provide adequate grounding for the unit to function as required. Connection to the ground bus will be made with an approved grounding lug adequate for the grounding conductor. Should additional grounding be needed, the vendor shall submit an alternative grounding plan with the bid submittal.

2.23 Vendor shall be responsible for any and all storage of components prior to installation. Any storage needs shall be coordinated prior to bid submittal.

2.24 Vendor shall be responsible for all delivery, off loading and final disposal of all packing materials from the delivery truck, as well as moving the material to and around the installation vicinity or staging area, and any required preparation of the radio room floor prior to installation and during assembly of the room on site. Vendor shall also be responsible for installation of all electrical circuits, grounding, filters, penetration panels, waveguide or environmental control air vents, modifications and preparation to existing departmental structures with approval of methods and designs by TxDOT.

2.25 At the completion of the installation, an RF attenuation test shall be provided by the vendor. The test shall be performed in accordance with MIL-STD-285 (or equivalent IEEE standard 299) and at six (6) frequencies of TXDOT's choice up to 10 GHz.

3. SAFETY PLAQUES OR DECALS

3.1. Product safety plaques or decals shall be furnished and affixed at the operator's station and at any hazardous area. The safety plaques or decals shall describe the nature of the hazard, level of hazard seriousness, how to avoid the hazard, and the consequence of human interaction with the hazard. Permanent plaques are preferred to decals. Type, size and location of product safety plaques or decals shall be in accordance with current ANSI Z535.4 standard.

3.2. A permanent lubrication plaque shall be furnished and visible from the outside of the unit. The plaque shall note all lubrication points and recommended periodic oil changes and lubrication intervals.

4. CABLING AND ATTACHMENTS: All cabling and attachment devices needed for the installation of the Radio Frequency Shield Room shall be included.

5. INSTALLATION: – Vendor shall be responsible for a complete "turnkey" installation of the equipment, excluding physical modifications to the installation site. All leveling of floors, telephone cables, electrical wiring, HVAC ducting and accessories necessary for a complete and safe installation shall be provided. It is stressed this is a total turn key project and installation.

5.1. Vendor shall install unit(s) at the FOB point(s) and include attachment to the power source, telecommunications, diagnostic testing, and be fully operational.

5.2. Vendor shall notify TxDOT point of contact a minimum of 60 working days prior to proposed installation date.

6. SITE SURVEYS: Prior to response submission, respondent shall conduct a site survey(s) of the premises where the Radio Frequency Shield room shall be installed. Site survey(s) shall be arranged by contacting the TxDOT designated representative listed in the solicitation. Failure to conduct site survey shall result in disqualification of response.

7. MANUAL(S): Equipment shall be delivered with current original manual(s) and 3 copies containing illustrated parts list, operating, calibration, and service instructions in English. The manual(s) shall be as detailed as possible outlining all necessary service and operating instructions for the equipment delivered. Manual(s) shall include necessary warnings and safety precautions. It is requested, but not required, that the manual be printed on recycled paper. Copies shall be reproduced from the current original manual and be clean and legible.

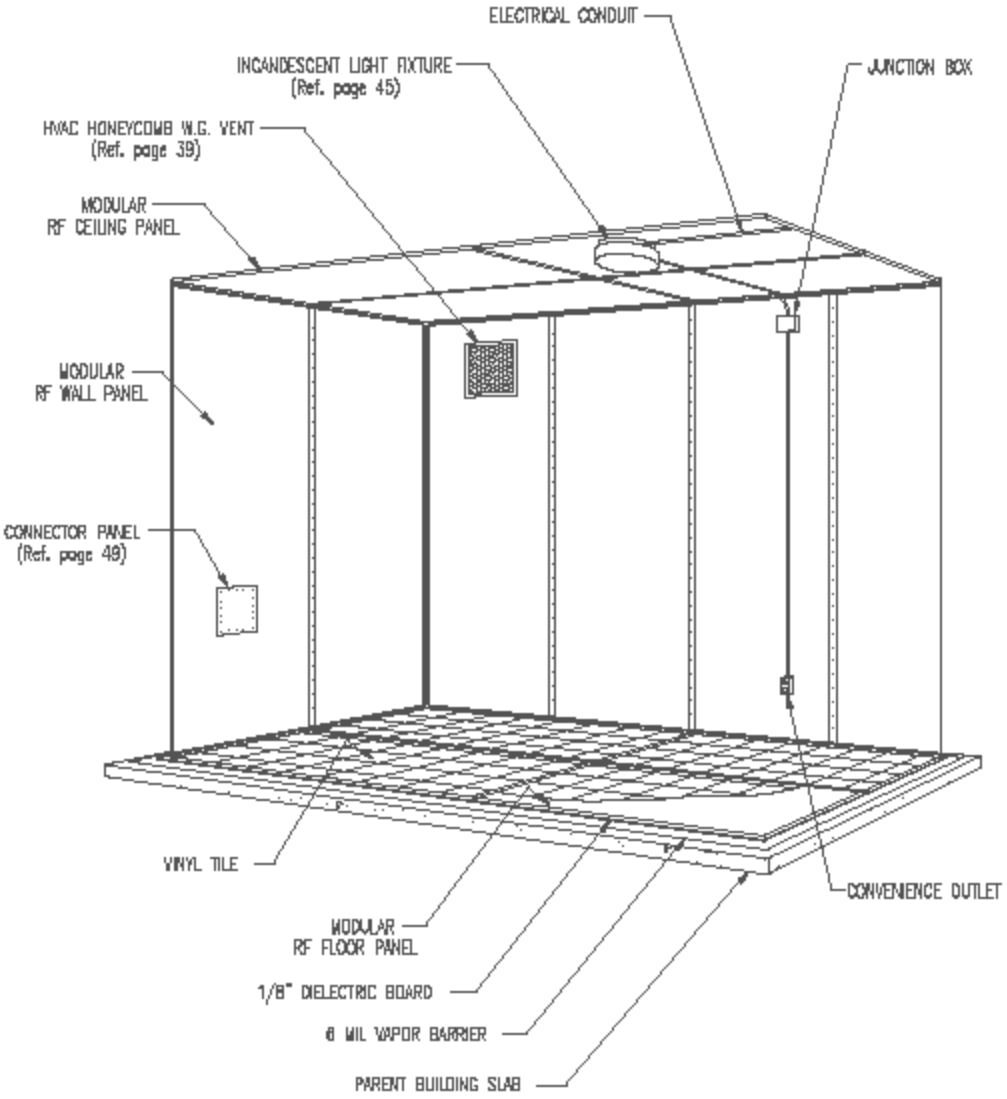
8. WARRANTY: The equipment offered shall be warranted against defective materials, workmanship, and failures for 60 months from the date of acceptance. If the manufacturer's standard warranty period is in excess of 60 months, the standard warranty period shall apply. If the manufacturer's standard warranty is less than 60 months for a any components, that is to be noted in their proposal and extended to 60 months as requested in this specification.

At time of delivery, the vendor shall furnish a list of names and addresses of servicing dealers who shall perform warranty work.

The vendor shall furnish a warranty card with the equipment indicating the terms and conditions of the warranty.

Provisions shall be made by the successful respondent to provide a delayed warranty start date for each unit furnished to this specification. Warranty start date shall be effective the day the unit is placed into service. Instructions shall be included with each unit delivered, advising TxDOT of the procedures to be followed for obtaining the delayed warranty start date.

9. TRAINING: The vendor shall provide the services of a competent factory-trained technician thoroughly trained in the use and operation of the unit to TxDOT for a minimum of 4 hour(s) instruction on safety, operation and preventive maintenance of the unit. Services shall be provided after the unit has been delivered and is ready for operation but prior to payment. The training shall take place on TxDOT's premises at a time and date mutually agreed upon by the vendor and TxDOT.
10. SUPPORT: Vendor shall provide TxDOT with a point of contact and telephone number. The point of contact shall respond to all inquiries relating to the purchase order. Inquiries may include, but not be limited to, technical support, service, and training coordination.
11. ACCEPTANCE: System acceptance will occur upon successful completion of RF testing as required in Part 2, Paragraph 2.25 and ten (10) consecutive failure free calendar days of operation following installation. If the system fails the acceptance tests, TxDOT will notify the vendor in writing within 10 days and the purchase order may be canceled.



TYPICAL RF ENCLOSURE/CONTROL ROOM

MODULAR SHIELDING DETAIL N° 399.M228-1

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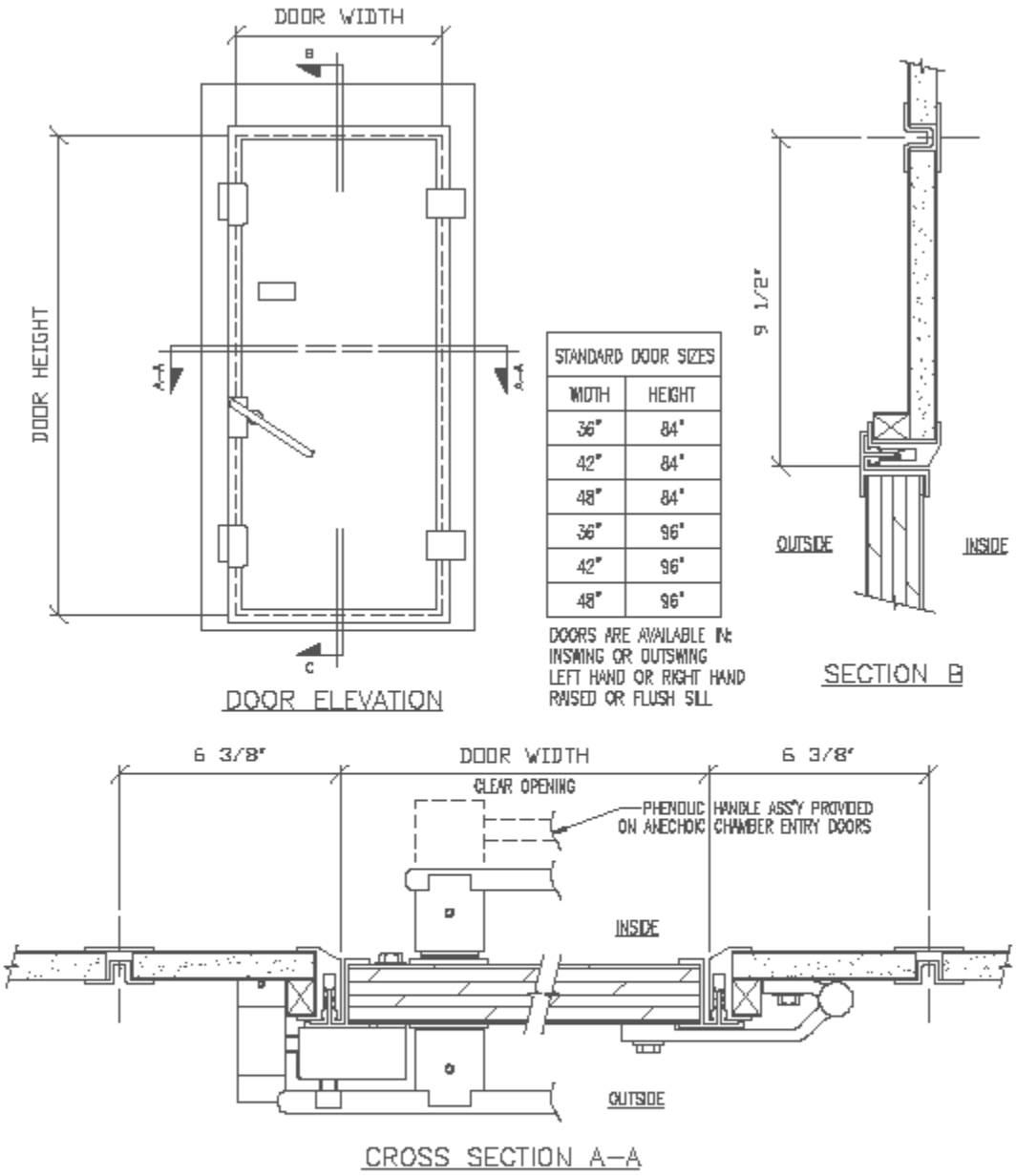
Provided as an example. Panabolt ™ has approved the use of their drawing.

TO Specification No. 155-86 Radio Frequency Double Shielded Enclosure, Dated: May 29, 2007



RCM SINGLE DOOR DETAIL

MODULAR SHIELDING DETAIL N° 399.M228–12

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Provided as an example. Panabolt ™ has approved the use of their drawing.