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Gendarmerie royale du Canada

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<b>Title-Sujet</b> Construction - Bâtiment A		
<b>Solicitation No. – No. de l'invitation</b> 201801002	<b>Amend. – Modif.</b> No. : 3	<b>Date</b> 18 juillet, 2018
<b>Client Reference No. - No. de Référence du Client</b> 201801002		
<b>GETS Reference No. – No de Référence du SEAG</b>		
<b>Solicitation Closes – L'invitation prend fin</b> <b>at – à 14:00 HAE</b> <b>on – 31 juillet, 2018.</b>		
<b>F.O.B. - F.A.B.</b> Destination		
<b>Address Enquiries to: - Adresser toute questions à :</b> Jordan McKenna		
<b>Telephone No. - No de telephone</b> 613-843-5518	<b>Fax:</b> 613-825-0082	
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**Modification n° 3**

Construction – Bâtiment A

**N° DE L'INVITATION** : 201801002

Date : 18 juillet 2018

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La modification n° 3 vise à modifier la demande de propositions

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- 1) Ajouter à ‘Annex Volume 1 Appendices’ (voir ci-dessous) et document Conseils en matière de sécurité des TI**

**VOLUME 1 APPENDICES**

document Conseils en matière de sécurité des TI (ITSG-02)  
Wall Type 9, 9A and 9B Specification RF Shielding Components  
RF Test Procedure 18-3505-tp

# Wall Type 9, 9A and 9B Specification

## Construction Specifications

### Wall Framing (Figure 1)

#### Slab-to-Slab

Walls must be slab-to-slab (from the finished floor to the underside of structural concrete roof or floor) or continue across the ceiling to form a continuous secure enclosure (Secure Ceiling). Where the space above the Secure Ceiling (measured to the underside of the limiting structural component) exceeds 6 inches, the space should be closed and secured or electronically monitored.

Top and Bottom Tracks:

SSMA standard: 1- 5/8" x 6", 18ga (600T162-43); OR

Preferred: 2" x 6", 18ga (600T200-43)

Secure top and bottom steel stud track to both slabs at 300mm oc using any expanding (preferably double expanding) mechanical fastener. Non-expanding (e.g. "Tapcon") screws are not acceptable.

Studs:

SSMA standard: 1- 5/8" x 6", 18ga (600S162-43: 33ksi); OR

Preferred: 2" x 6", 18ga (600S200-43: 33ksi)

Space studs at 300 mm oc and secure to the top and bottom tracks with welds or rivets (not screws).

Install double (jamb) studs at the door frame opening. Install the door frame as per HMMA 840-07, part 3 A, B, C, D and E (except that screws shall be replaced with steel rivets).

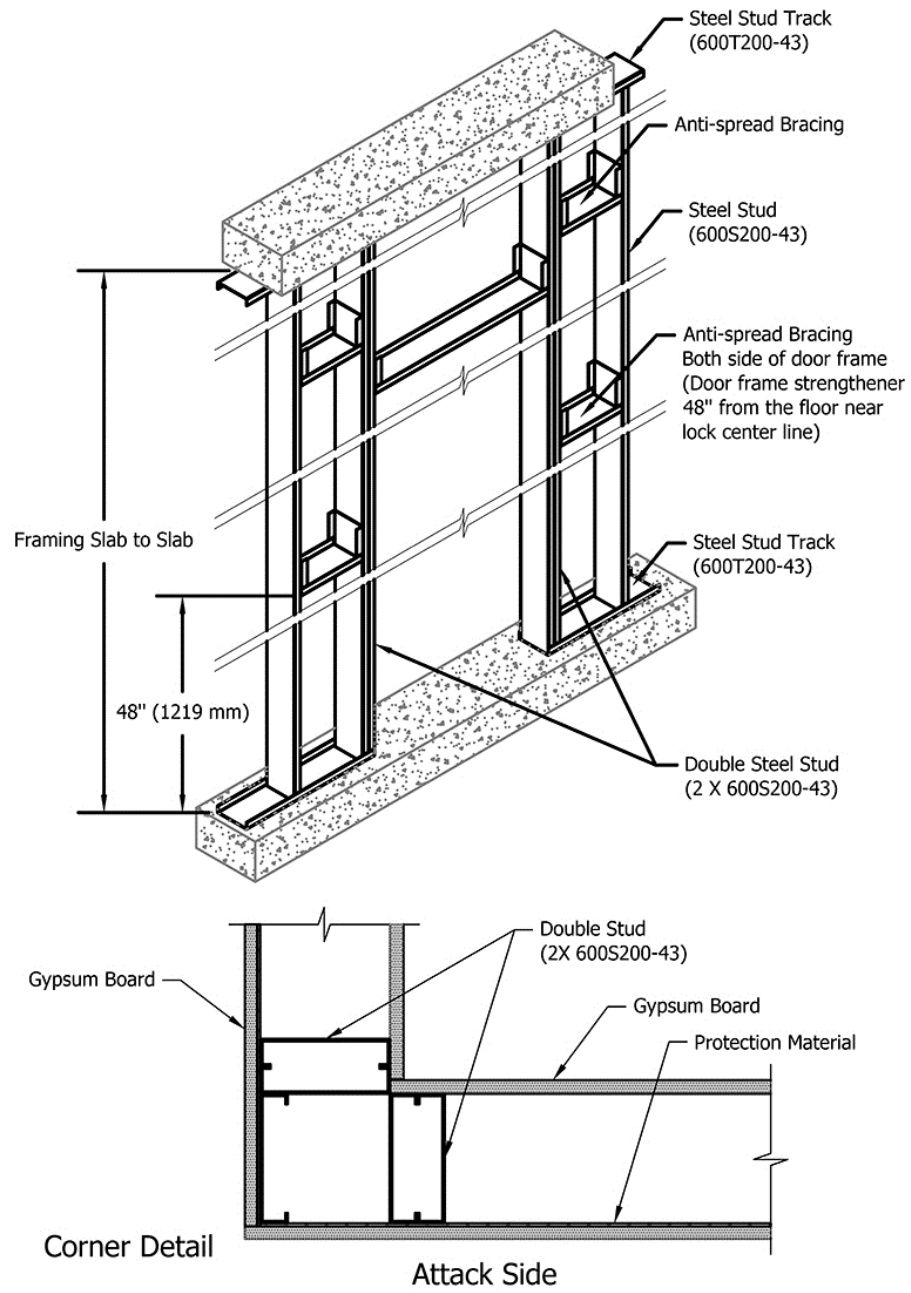
Install anti-spread bracing **approximately** 48" from the bottom of the wall between the door frame double stud and the adjacent stud on both sides of the frame. Bracing to be installed within 6" (vertical) of centreline of locking hardware.

Construct wall corners with double studs.

#### Notes:

1. Leaving a small gap and using drywall sheets to brace frame sections during wall erections is permitted provided steel sheets on the attack side are continuous over all gaps.
2. Drawings of doubled studs are representative. Connect and orient doubled studs as per standard industry practice.

**Figure 1: Wall Framing Detail**



## Wall Protection Material (Figures 2 to 5)

Wall protection material may be one of two options:

**Flattened Metal Mesh:** To EMMA 557-99. Style ¾-9F: nominal strand thickness of 0.120" (0.108" to 0.132"). Diamond opening of 0.563" x 1.688".

OR

**Sheet Steel:** 16 Ga, A1008 / A1008M (cold rolled) or A1011/ A1011M (hot rolled) or equivalent.

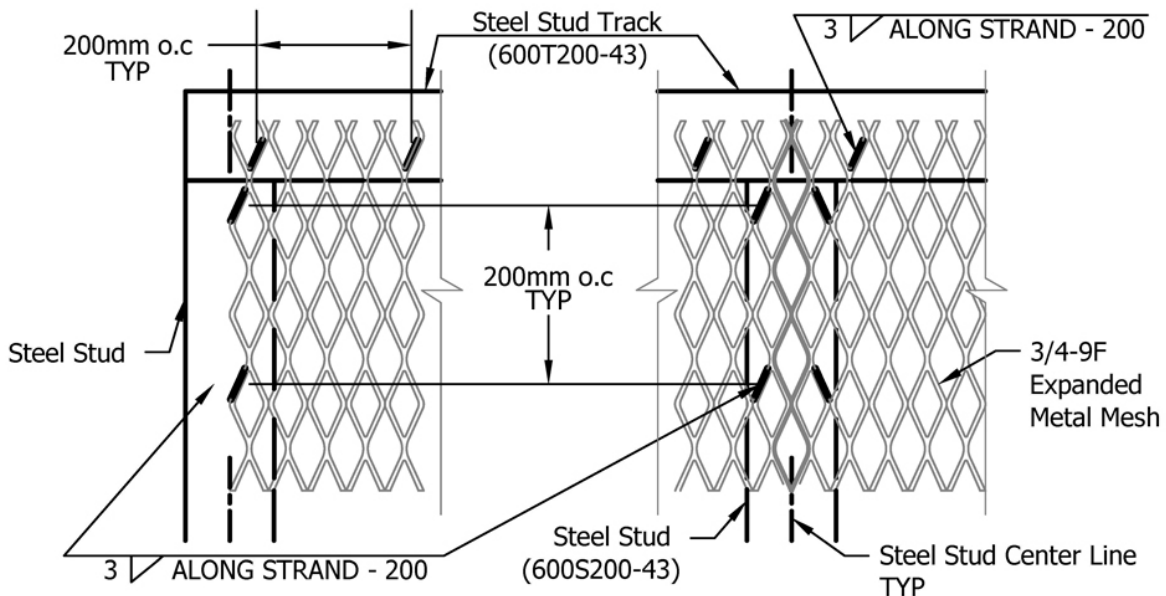
Mount on the outside (attack side) of the room. Support all edges by anti-spread bracing, studs or corners. Align the sheet edges at every vertical and horizontal seam on the centre line of the steel stud or anti-spread bracing and secure all sheets with welds or rivets.

**Note:** Screws (including "security screws") are **NOT** acceptable for permanently attaching the protection material (steel or steel mesh). Screws may be used to "tack" the sheets in place pending riveting or welding. Temporary screws do not need to be removed.

### Welding (Permitted Method)

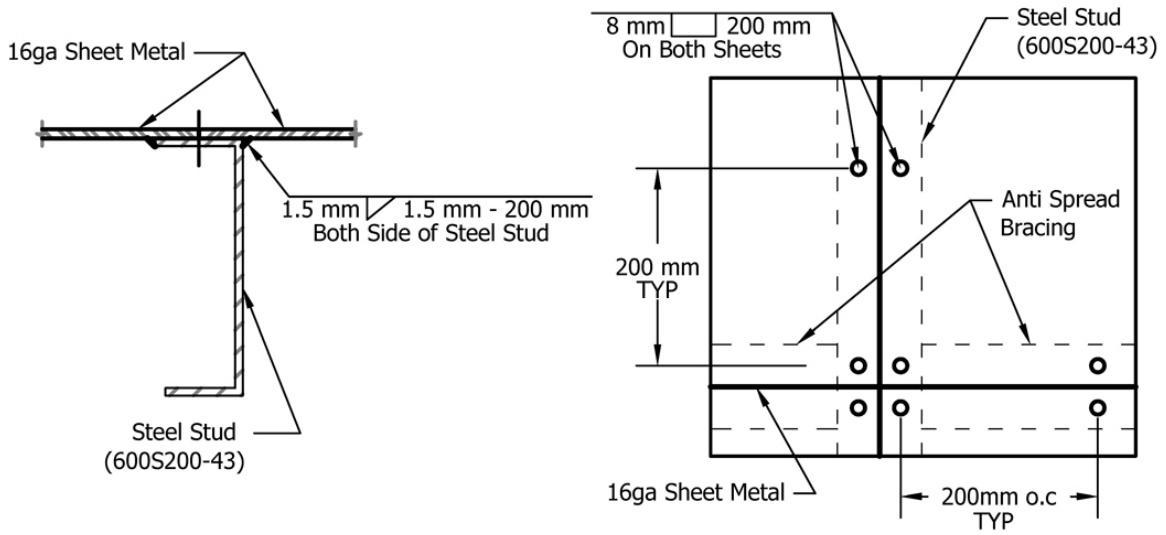
**Steel mesh (Figure 2):** 3mm fillet weld along the strand at 200mm oc

**Figure 2: Welding Steel Mesh**



**Steel Sheet (Figure 3):** 1.5mm fillet weld 15mm long at 200mm oc **OR** 8mm plug weld at 200mm oc

**Figure 3: Welding Sheet Steel**



**Rivets (Preferred Method) (Figure 4):**

**Steel sheet:** 3/16" steel rivets at 200mm o.c.

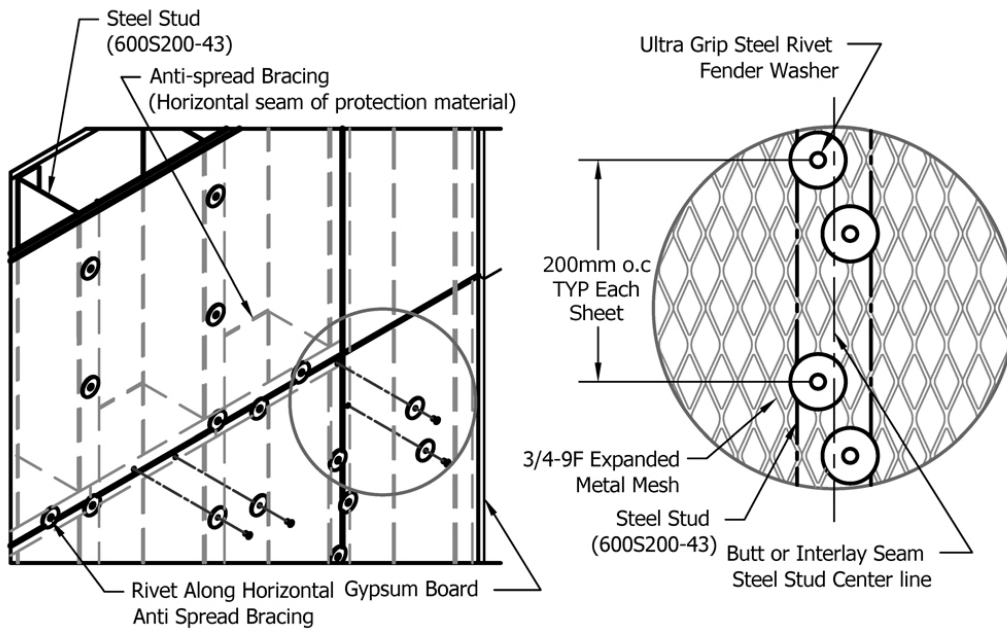
**Steel mesh:** 3/16" steel rivets and "fender" washer (1 1/2 " OD, 3/16" ID) at 200mm o.c.

**Suggested material:**

Rivets: 3/16" steel pop rivet: Speaneur part #301-440

Washers: 1 1/2 " OD, 3/16" ID "fender" washer: Fastenal part #1133204

**Figure 4: Riveting Sheet or Mesh**



**Steelemesh Interlay Seam (Figure 5):**



**Figure 5: Example of Mesh Interlay Seam, Riveted**

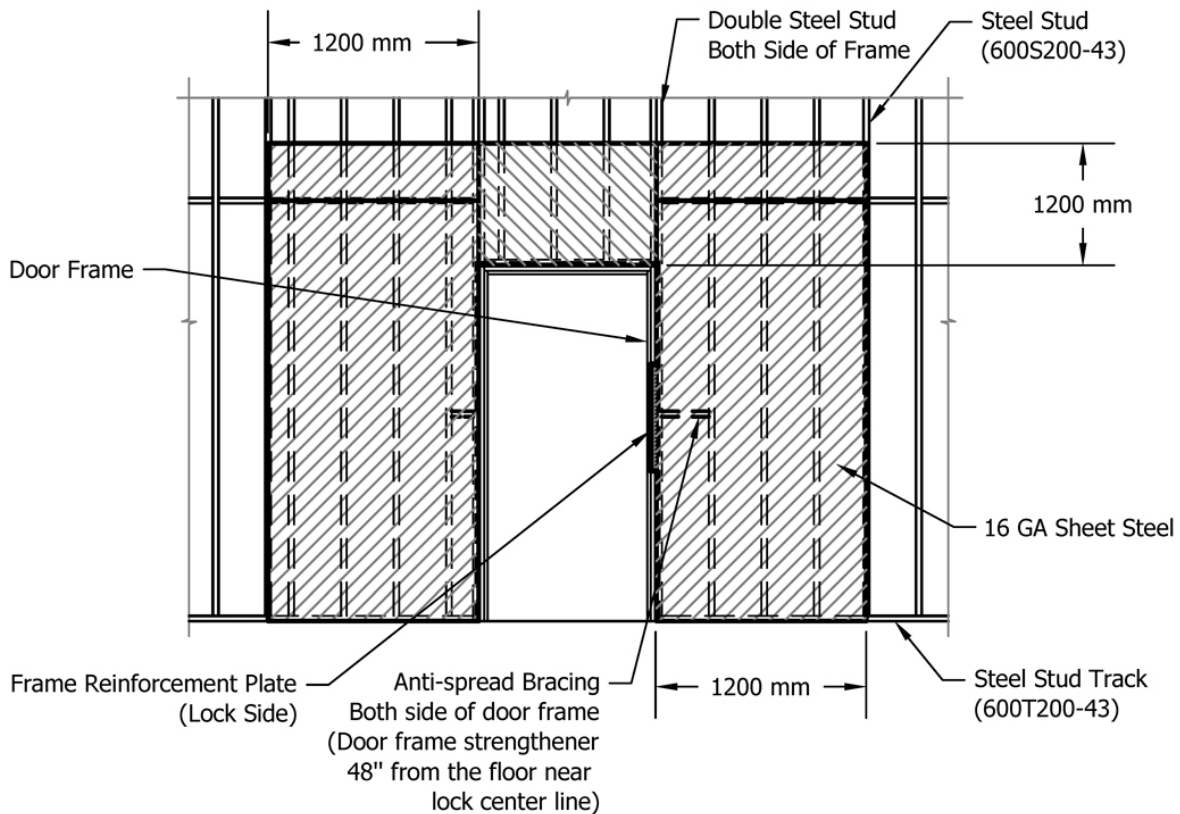


### **Critical Attack Area (Figure 6)**

16 ga. (1.6 mm) steel sheet, HR Commercial quality, ASTM A366, matte finish, shall extend 1200mm around the door frame on the inside of the secure storage room and be attached as per selected rivet or welding requirements for protection material.

**Note:** Perforations for services, conduits or ducts are not permitted in the Critical Attack Area.

**Figure 6: Critical Attack Area Wall Reinforcement**



## Wall Finishing Details

Install 16mm gypsum wall boards on both sides of the wall (interior is optional). Standard drywall screws are acceptable for attaching the drywall.

Apply continuous bead of fire-rated acoustic sealing on both sides of the top and bottom tracks minimum of 7mm, maximum of 16mm. ASTM E814 (UL1479), ASTM E1966 (UL 2079) or CAN/ ULC S115 test standards with a fire/ smoke rating acceptable to the Authority Having Jurisdiction (AHJ).

Paint exterior surface of wall with one coat primer/sealer and one coat of gloss enamel. Primer/sealer must extend above drop ceilings to the bottom of structural ceiling. Paint must be uniform and without blemishes. Joints must not be visible. Custom colors should be considered.

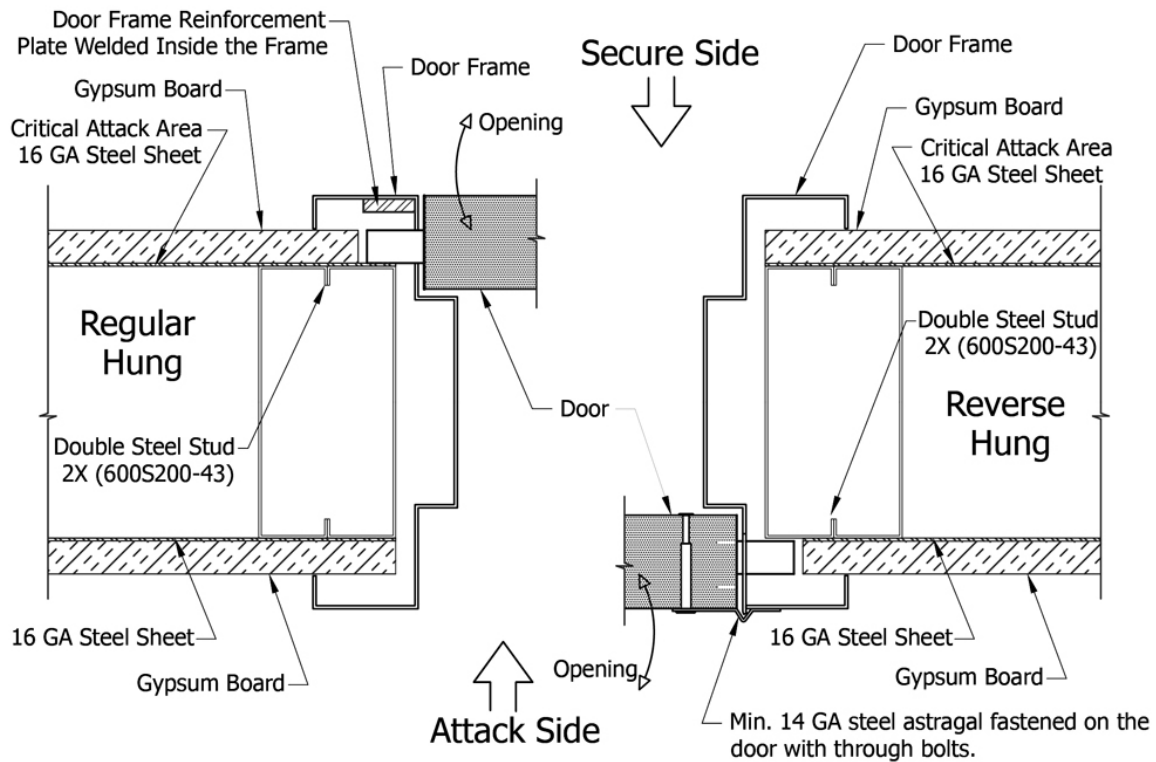
## Frame reinforcement at the lock area (Figure 7):

Secure a 6.4mm x 25mm x 610mm steel plate inside the frame using tack welds on every edge. Align the centre of the plate with the lock bolt.

For reverse hung doors, install a steel astragal covering the entire lock edge of the door AND the unmodified strike plate. The astragal should be at least 14 ga (2 mm) thick, should overlap the door frame by at least 25mm. Attach with minimum 6mm (1/4") diameter steel carriage bolts spaced at 250mm oc and at least 25mm from mortise lock pocket. Carriage bolt heads must be on the attack side.

Suggested product: Zero International #43STST

**Figure 7: Frame Reinforcement at Door**



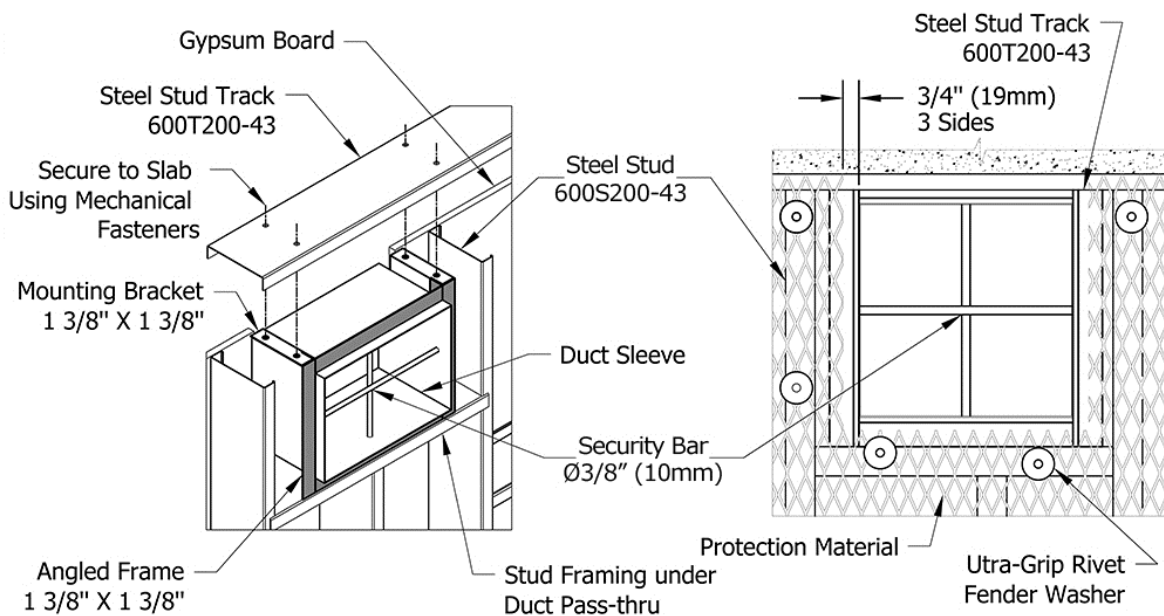
# Ventilation Duct Pass-through

**Note:** Where superior resistance to cutting is required, security bars can be specified as tool-resistant steel (grade 1 or 2) per ASTM A627.

## Ceiling mount: (Figure 8)

1. Duct sleeve to be at least the same thickness as duct passing through.
2. The overall dimension of the sleeve must be slightly greater than the duct.
3. Construct frames of 1- 3/8" x 1- 3/8" x 1/8" angle steel welded around duct sleeve (ceiling mount brackets are recommended).
4. Space 3/8" Ø steel bars at 6" o.c. (max.) and fully weld to the frame.
5. Secure the duct sleeve to the structural ceiling with mechanical fasteners.
6. Cut protection material 3/4" max from the edge of the duct opening (3 sides)
7. Apply fire-rated caulking between duct sleeve and finished wall.

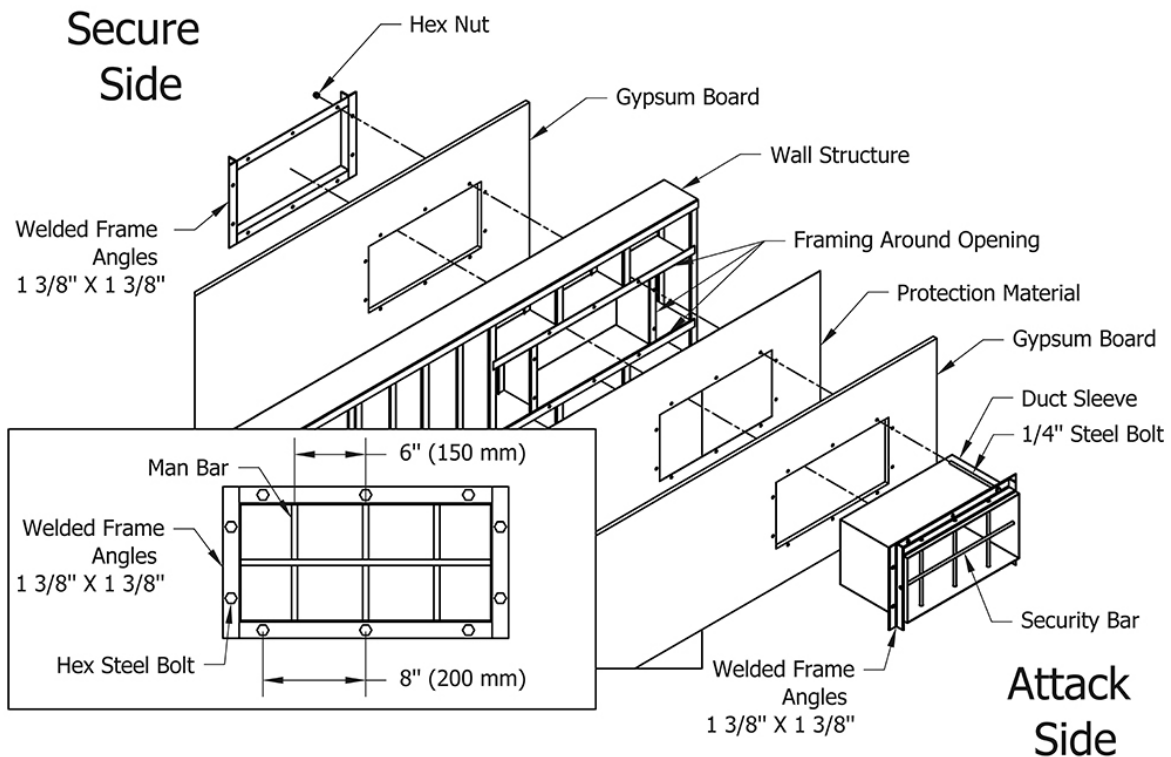
**Figure 8: Ceiling Mount Duct Pass-Through**



## Surface Mount: (Figure 9)

1. Duct sleeve to be at least the same thickness as the duct passing through.
2. The overall dimension of the sleeve must be slightly greater than the duct.
3. Construct frame on each side of the wall of 1- 3/8" x 1- 3/8" x 1/8" angle steel welded around duct sleeve.
4. Space 3/8" dia security bars at 6" o.c. max. and fully weld to the frame.
5. Secure duct sleeve with 1/4" dia bolts and hex nuts (inside the room) at 8" o.c. around the outside duct sleeve. The bolt head shall be on the attack side and be welded in at least three places to the angle frame.
6. Framing around duct sleeve is required.
7. Apply fire-rated caulking between duct sleeve and finished wall.

**Figure 9: Surface Mount Duct Pass-Through**



## Plumbing and Electrical Pass-through Construction

Minimize plumbing and electrical pass-throughs in walls where possible. Do not locate pass-throughs in the Critical Attack Area. Where pass-throughs are required, frame openings within 1 inch (25mm) of the pipe/conduit and secure to the stud framing at minimum two places. Extend the wall protection material to within  $\frac{3}{4}$ " (20 mm) of the edge of the opening. Extend gypsum wall board to within  $\frac{1}{4}$ " of the edge of the pipe or conduit. Seal all gaps with fire rated or acoustic sealant. Recommended product standard: ASTM E 814 (UL 1479) or CAN/ULC S115, or as required by the AHJ.

Where necessary to accommodate pipe or conduit movement or expansion, pipes and conduit may be enclosed in a close-fitting sheet metal sleeve and the sleeve mechanically fastened to the stud framing at two places (minimum). Clearance between the sleeve and pipe or conduit should be kept to a minimum and not exceed  $\frac{1}{4}$ ".

## Sound Reduction Type 9A and 9B

The following assembly will provide an STC rating of approximately 54-55:

- Two layers of 16 mm fire-rated gypsum board
- One layer of sheet or expanded mesh steel
- Steel studs spaced 300 mm oc
- 150 mm thick mineral wool batts between studs
- Resilient metal channels spaced 400 mm apart
- One layer of 16 mm fire-rated gypsum board

This rating is for the wall assembly without pass-throughs or gaps. Acoustic caulking must be applied between the gypsum board and all adjacent surfaces to prevent sound leakage through spaces and gaps.

Electrical boxes shall not be installed back to back.

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## 1. PROJECT DESCRIPTION

### 1.1 BACKGROUND

To provide a RF environment in Building A, some components are required to be integrated into the structure of the building. These components are RF vestibules and interconnect system.

### 1.2 SCOPE

Design, manufacture, and test components to be integrated into concrete RF shielded building. The proposed work is described in detail in the upcoming sections.

### 1.3 ASSUMPTIONS

- The enclosure will be sized to suite the parent building.
- The parent building will be closed in and heated prior to commencing work.
- The parent floor slab will be flat and level 1/8" in 10' and be designed to bare the weight of the entire shielded enclosure.
- The contractor will be responsible for all aspects of the design, supply, installation, and testing of the shielded vestibules and interconnect system.
- The contractor will provide all tools, rigging and scaffolding, test equipment, etc. required to construct and test the shielded vestibules.
- The contractor will supply and install all materials and fixtures necessary to construct the vestibules and the interconnect system.
- Review by Structural and Seismic Engineer not required.
- Enclosure ceiling can be hung and supported by the parent structure.

### 1.4 PERFORMANCE

#### 1.4.1 Shielding Effectiveness

The contractor will conduct shielding effectiveness measurements as per an ITSG-02 test procedure. The RF vestibule and interconnect system are required to meet or exceed the following shielding effectiveness levels

• Frequency	• Field Component	• Minimum Attenuation
• 900 MHz	• Plane-wave	• 80 dB

After the successful completion of the RF shielding effectiveness testing, the contractor will submit a complete test report signed by a Canadian Professional Engineer.

### 1.5 DESIGN

Engineering design is the single most important process in the supply of the shielded vestibules and interconnects system. The function of vestibules construction and the interconnect system is to permit an interference-free environment within the RF building. This is done through shielding of the outer enclosure, prohibiting RFI signals from passing through the shield.

All designs in Solid Works 3D modelling software, ensuring that the design, bill of materials, manufacturing and assembly process work seamlessly.

The shielded enclosure shall be constructed ungrounded with a minimum resistance to ground of 100,000 ohms. To ensure proper operation of all filters, a single point system ground shall be maintained.

## 1.6 SHOP DRAWINGS

Submit drawings stamped and signed by professional engineer registered or licensed in Province Ontario, Canada.

Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

Shop drawings will include technical detailed design views of the shielded enclosure, complete with elevations, ceiling and floor plan views.

## 1.7 APPROACH AND METHODOLOGY

To fulfill delivery and requirements, the contractor plans to follow the subsequent project plan.

### 1.7.1 Engineering and Submittals

#### 1.7.1.1 Quality Assurance Plan Submittal

A Quality Assurance Plan will be submitted detailing how the schedule and performance characteristics will be achieved.

#### 1.7.1.2 Design

Drawings as well as applicable component details and product information will be submitted for Departmental Representative review.

#### 1.7.1.3 Test Procedure Submittal

A test procedure will clearly define the method in which the applicable testing will be performed.

#### 1.7.1.4 Design Review

The Departmental Representative will review the drawings prior to commencing the manufacturing process. The contractor will be responsible for satisfying all contractual requirements.

#### 1.7.1.5 Test Procedure Review

The Departmental Representative will review the applicable test procedures prior to testing being completed on site. The contractor will be responsible for satisfying all contractual requirements.

### 1.7.2 Manufacturing

The manufacturing process commences for all RF shielding components.

### 1.7.3 Shipping

All components shipped to site.

### 1.7.4 Installation

The contractor's designated installation crew commences the installation of the RF shielding vestibules and interconnect system as per the approved designs. The site supervisor will inspect the site prior to commencing construction.

#### 1.7.5 Testing

The contractor will complete shielding effectiveness tests to demonstrate compliance with the contract

#### 1.7.6 Documentation

##### 1.7.6.1 Testing Report

A test report will be provided demonstrating compliance with the contractual requirements.

##### 1.7.6.2 Operation and Maintenance Manuals

These manuals will outline operational and maintenance requirements for the chamber.

##### 1.7.6.3 As-built Drawings

As-built drawings, including applicable electrical and mechanical schematics, will be submitted to the Departmental Representative.

#### 1.7.7 Project Signoff

The Departmental Representative will review all work, deliverables and reports to provide a formal signoff on the completed project.

## 2. VESTIBULES AND INTERCONNECT SYSTEM DESCRIPTION

### 2.1 RF SHIELDING COMPONENTS INTEGRATION TO CONCRETE BUILDING

All RF vestibules and interconnect system attached to the Concrete building shall be connected to the single point ground stud with an insulated #6 ground wire.

### 2.2 RF VESTIBULES

#### 2.2.1 RF Vestibule with Modular Shielding

The vestibule enclosures will be provided with 6 mil plastic sheeting vapour barrier followed by an underlay of 3mm (1/8") hard board both with anti-oxidizing and moisture resistance characteristics. The RF modular shielding surfaces will be constructed using a system of solid shielding panels. All floor, wall and ceiling panels and framing members will include the necessary supports and fasteners. The panels will be either in an edge-to-edge configuration, or in a right-angle arrangement. The steel framing will use screw-type fasteners and will be capable of achieving the pressure necessary between the framing and the panels to achieve the required attenuation.

##### 2.2.1.1 Airlock 2

Airlock 2 shall be constructed with one 3230mm x 3100mm high wall, two 2105mm x 3100 high walls and one 3230mm x 2105mm ceiling. This airlock shall include two fully automatic 915mm (36") x 2440mm (96") RF shielded high traffic sliding doors as listed in the section below.

### 2.2.1.2 Airlock 4

Airlock 4 shall be constructed with one 2850mm x 3100 mm high wall, two 2000mm x 3100mm high walls and one 2850mm x 2000mm ceiling. This airlock shall include one manual RF shielded door as listed in the section below. The RF shielded modular system, and door, shall be upgraded to include an STC 51 treatment.

### 2.2.1.3 Airlock 5

Airlock 5 shall be constructed with one 3400mm x 3100mm high wall, one 2110mm x 3100mm high wall and one 3400mm x 2110mm ceiling. This airlock shall include one manual RF shielded door as listed in the section below. The RF shielded modular system, and door, shall be upgraded to include an STC 51 treatment.

## 2.2.2 RF Shielded Doors

### 2.2.2.1 Manual Doors

The project will include the supply of two manual 1067mm (42") x 2185mm (86") reversible RF shielded doors. The RF shielded doors will be fitted for use as emergency exits. Operation will require the user to push the handle down to open and will not have an operating handle on its exterior. The RF shielded door is designed incorporating a brass knife edge contacting two concentric rows of beryllium-copper fingerstock and are by far the most reliable and proven ways of achieving high levels of RF shielding. The RF shielded door, fitted with forward mounted fingerstock, provide long life cycle and excellent service. As with all mechanical products, some maintenance will be necessary to maintain their performance. Maintenance information will be provided in the Operation and Maintenance Manual. The in-swinging doors are field configurable as right hand or left hand.

The manual RF shielded door shall be supplied with an STC 51 upgrade.

### 2.2.2.2 High Traffic Sliding RF Shielded Doors

The project will include the supply of two fully automatic 915mm (36") x 2440mm (96") RF shielded high traffic sliding doors. The extremely low maintenance requirements of the door make it the perfect radio frequency shielded door solution for high-traffic EMI/RFI systems where physical location does not allow for the swing of a hinged door. The compression-type seal offers high shielding effectiveness while eliminating the constant wear and oxidation seen with conventional RCM shielded doors.

These doors are designed for high traffic applications of greater than 200,000 cycles per year. Their heavy-duty construction includes a fingerless, low maintenance dual RF seal design. An LM guide keeps the door motion smooth and precise. An operations and maintenance manual will be provided supplied with the doors.

The door requires a 120VAC 15A circuit and be connected to a compressor, see mechanical documents for compressor specifications.

## 2.3 INTERCONNECT SYSTEM

### 2.3.1 Mechanical Room RF Modular Interface Panel

One 15' x 10' high mechanical room interface panel shall be supplied to accommodate all connections between the mechanical room and RF shielded enclosure.

### 2.3.2 Penetrations

One 150mm (6") hybrid pipe penetration shall be supplied for use in gaseous applications. The 5mm (3/16") cell honeycomb insert will be soldered inside the pipe penetration.

Three 13mm (1/2") NPT bronze waveguide pipe penetrations shall be supplied for use with the fire alarm fiber-optic application. The 13mm (1/2") diameter penetration shall be 100mm (4") in length.

Two 13mm (1/2") copper tube insulated bronze pipe penetrations shall be supplied.

Three RS232/485 fiber-optic filter for use with the fire alarm fiber-optic application.

Three 12 port waveguide fiber-optic filter shall be supplied.

### 2.3.3 Honeycomb Waveguide Air Vents

The project shall include the supply of various honeycomb waveguide air vents. Vents shall consist of welded brass frames surrounding 25mm (1") thick and 5mm (3/16") cell steel honeycomb. Installation is performed by clamping two brass frames to the shielded panel using torx type fasteners and on 100mm (4") maximum centres. The vents shall include security bars be installed into a RF mounting panel with a mitred and welded hat & flat mounting. Each mounting panel includes a 10mm (3/8") ground stud. The vents shall be supplied as follows:

Quantity	Honeycomb Waveguide Air Vent Clear Opening	RF Mounting Panel
4	600mm x 500mm	780mm x 680mm
1	550mm x 450mm	730mm x 630mm
1	500mm x 400mm	680mm x 580mm

### 2.3.4 Power Line Filters

Facility filters shall be supplied to bring four banks of three phase 120/208V AC 100 Amp power into the shielded enclosure. All power filters will be UL labelled. All electrical conductors (for power and lighting, controls and signals, telephone, communications, fire suppression, etc.), must be fitted with filters and transient suppressers (metal oxide varistors) that preserve the RF shielding performance of the enclosure. All filters will be mounted directly on the shielded panels. Attaching filter cabinets, closets, etc. to the shielded enclosure by ferrous conduit shall not be permitted. The power filters will meet the following requirements:

- Voltage drop shall be a maximum of 2% at full rated load
- Insertion loss shall be 100 dB from 10 kHz to 10 GHz

- Rated to UL 1283
- Rated at 140% maximum current for 15 minutes

#### 2.3.5 Signal Filters

Four dual conductor 120V 1 Amp signal filters shall be supplied for use with analog controls.

### 3. INSTALLATION

#### 3.1 GENERAL INSTALLATION

An on-site Supervisor shall be on site at all times during the installation and testing of the RF vestibules and the interconnect system. While on site, this individual shall be responsible to liaise with all owner representatives involved with the project as well as be responsible for all technical, contractual and scheduling issues.

The contractor will utilize only factory-trained employees for the installation of the RF vestibules and interconnect system components. Workmanship will be consistent with the highest industry standards and/or commercial practices.

The installation team will be responsible for cleaning up their tools and all debris in the construction area at the end of each day and prior to leaving the site.

All modular shielded panels and RF framing members including all necessary supports and fasteners will be supplied and installed for this project.

#### 3.2 CONCRETE TO COMPONENT TRANSITION

Plate metal will be used to produce a frame which will create a Radio Frequency (RF) seal for the transition between the special concrete and the RF penetrations i.e. doors, electrical panels, air vents etc. As per drawings, the plate metal will be embedded into the concrete and will protrude from the concrete to which the RF components will be attached. For each penetration the plate metal will be fabricated to create a continuous piece of metal so that there are no gaps or holes in the metal frame either in the embedded portion or exposed portion.

- If welding is needed to create the continuous metal RF frame it should be done as follows.
  1. Only metal inert gas (MIG) or shielded metal arc welding processes are to be used.
  2. Surfaces are prepared by removing rust, scale, oil, and other foreign materials.
  3. It is essential to produce a continuous full penetration weld free of slag, inclusions, gas pockets, worm holes, cracks, or incomplete fusion.
  4. Stresses in the welds should be relieved by skip welding to minimize buckling

All embedded interface steel plates, angles or frames required to attach the RF modular shielding walls of the vestibules, (or RF Shielding components for power, signal, or HVAC penetrations), to the poured concrete shielding shall be coordinated with the concrete trade to ensure the RF shielding performance requirement is achieved.

## **4. SERVICE & WARRANTY**

### **4.1 WARRANTY**

The shielded vestibules and interconnect system will be guaranteed against defective materials, workmanship and to retain the specified RF shielding and for a period of five years from the date of acceptance.

All warranty issues should be directed directly to the contractor's service department for proper processing. The service team will respond to inquiries by phone and/or email within 24 hours and onsite representation, if required, within 48 hours.

### **4.2 SERVICE PROVISIONS**

It is recommended that the shielded vestibules and interconnect systems have preventative maintenance performed on a continual basis as described in the Operations and Maintenance manual provided with the door maintenance kit.

A contact number shall be provided for any service issues. All service request are to be actioned by next business day.

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## **1. INTRODUCTION**

- 1.1. This document outlines the procedures that shall be utilized in the determination of the shielding effectiveness of the RCMP's Shielded Enclosure known as Building A. Diagrams and descriptions of test equipment setups for reference level establishment and shielding effectiveness measurements are included.
- 1.2. Testing will be performed upon the completion of work at three milestones. The frequencies and performance values of this test are listed in Section 5, Table 1.
- 1.3. The receiver will be placed outside the enclosure and the transmitter will be placed within.
- 1.4. All testing will be conducted by personnel of the testing firm. The Engineer or an appointed delegate will witness all testing.
- 1.5. Test instrumentation will be provided by the testing firm.
- 1.6. Upon completion of the preceding tests, the testing firm will provide a test report including copies of test data and analysis of shielding performance. The test report shall be signed and stamped by a P. Eng. registered in the province of Ontario.

## **2. APPLICABLE SPECIFICATIONS AND DOCUMENTS**

- 2.1. The shielding effectiveness tests will be performed in general compliance with the following specifications and documents:
  - 2.1.1. This Test Procedure, 18-3503-TP
  - 2.1.2. Technical Proposal, 181-SET-631
  - 2.1.3. Amended ITSG-02 "Criteria for the design, fabrication, supply, installation, and acceptance testing of walk-in radio frequency shielded enclosures. December 1999

## **3. AMENDMENTS TO SPECIFICATIONS**

- 3.1. ITSG-02
  - 3.1.1. As seen in Section 5, Table 1, the only frequency to be tested will be the client-specified frequency.

- 3.1.2. The antenna used for testing will be the most appropriate frequency-matching antenna as outlined in Section 5, Table 1.
- 3.1.3. A single-point ground is not possible given the construction of the shielded enclosure. There will be multiple points of grounding.
- 3.1.4. Test points have been assigned for every 20 square meters, as opposed to the standard 10 square meters.

#### 4. ELECTRICAL ISOLATION

- 4.1. The specified shield grounding procedure as outlined in ITSG-02 is not applicable to this Shielded enclosure due to physical characteristics.

#### 5. RF PERFORMANCE REQUIREMENTS

- 5.1. RF shielding effectiveness is the performance criteria of the subject radio frequency shielded doors and filters. Shielding effectiveness is defined as the reduction of electromagnetic energy, measured in decibels (dB), resulting from the introduction of the shield.

The calculated attenuation can be represented as:

$$\text{Attenuation (dB)} = 20 \text{ Log } \frac{E1}{E2}$$

Where:

E1 = Field intensity generated on one side of the shield.

E2 = Field intensity received on the other side of the shield.

The required frequency, field and attenuation level are listed below:

FREQUENCY	FIELD	ANTENNA TYPE	ANTENNA SEPARATION	REQUIRED SHIELDING EFFECTIVENESS
900 MHz	PW	Dipole	75"	80 dB

H = Magnetic Field

PW = Plane Wave

**Table 1.** Frequency and Separation Distance

## 6. RF TEST PROCEDURE

This procedure describes the method of testing which will be utilized to evaluate the shielding effectiveness of the subject enclosure.

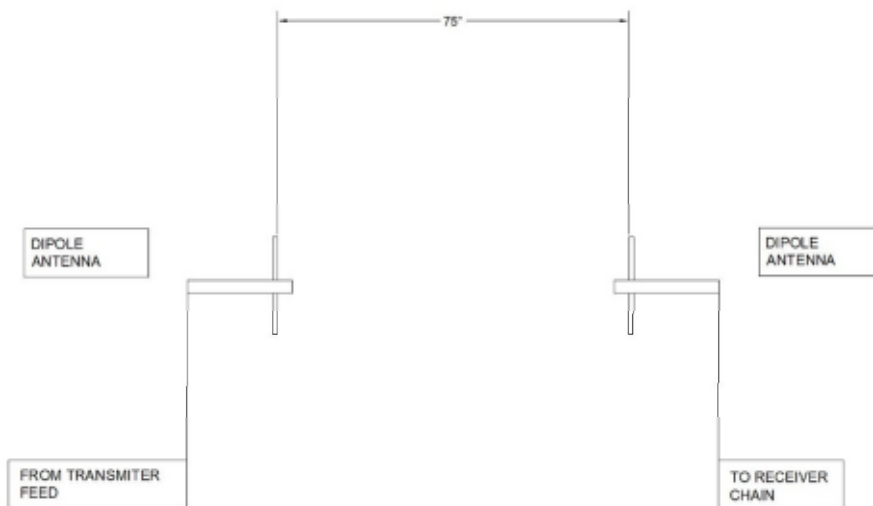
### 6.1. Setup

For all measurements, the transmitting and receiving antenna will be correctly positioned and orientated and will remain fixed at each test point for the duration of the measurement. All measurements will be recorded in real time on the Test Data Sheets.

During the testing, if the prescribed antenna separation cannot be achieved due to physical limitations, an attempt will be made to increase or decrease the antenna spacing and reference standardization. A notation will be made on the test data sheet if the standard was changed.

The dynamic range of the test equipment will be capable of measuring 6 dB greater than the required attenuation listed in Section 5, Table 1.

Neither the transmitter nor the receiver will be adjusted after the reference measurement has been established. Operating adjustments can be made for different reference measurements. Any changes will be noted on the test data sheet. Refer to Figure 1 for Reference test equipment setup.



**Figure 1.** Dipole Antenna Reference Setup

### 6.2. Reference Level

6.2.1. Firstly, the ambient background level will be established. The receiver will be brought into the enclosure, the transmitter turned off, the attenuation will be

removed and the ambient interference signals will be read on the Spectrum Analyzer. If ambient signals are present, the frequency span of the analyzer will be reduced to eliminate the interfering signals.

6.2.2. Next, a dynamic range will be established for the shielding effectiveness measurements. The transmitting and receiving antennas will be brought to the appropriate separation distances (see Section 5, Figure 1) and a measurement will be taken. Adjustment of the attenuator in the receiver (Spectrum Analyzer) chain will be made such that the signal is clearly visible within the receiver screen. The difference between the signal amplitude and the noise floor combined with the attenuator value shall add to 6 dB above the required shielding effectiveness.

6.2.3. Example:

Signal Amplitude = -30 dB

Noise Floor = -110 dB

Attenuator Value = 60 dB

Required Shielding  
Effectiveness = 100 dB

Required Dynamic Range = 100 dB + 6 dB  
= 106 dB

Dynamic Range = Signal Amplitude - Noise Floor + Attenuator  
Value

Dynamic Range = -30 dB - (-110 dB) + 60 dB  
= 140 dB

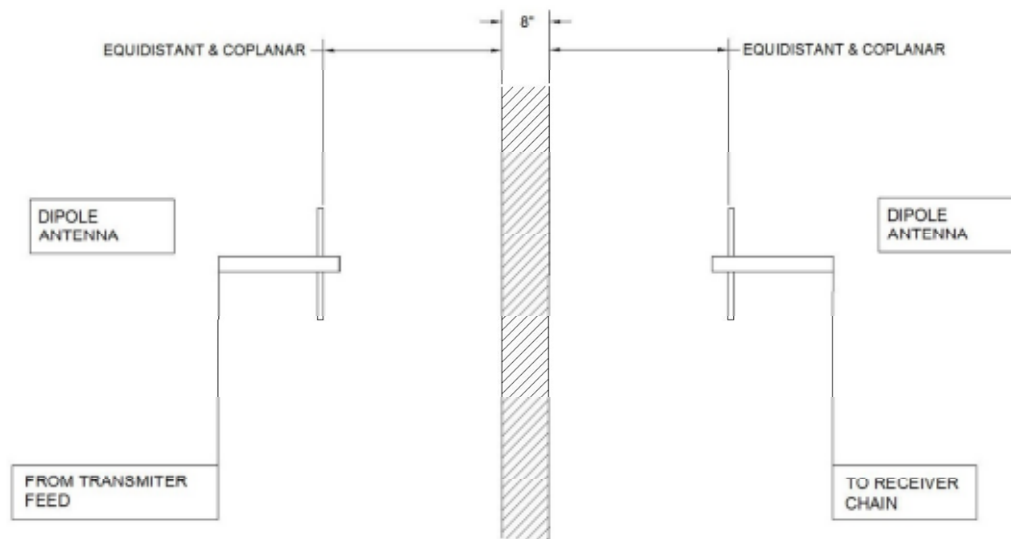
Therefore, the dynamic range is sufficient since it is larger than 106 dB.

6.2.4. Record the addition of the signal amplitude and the attenuator value as the "Reference Level".

6.2.5. To establish a reference signal with sufficient dynamic range, it may become necessary to add the use of a pre-amplifier or modify the antenna separation distances. Any changes made to the separation distances will be noted on the test data sheet.

### 6.3. Measurement

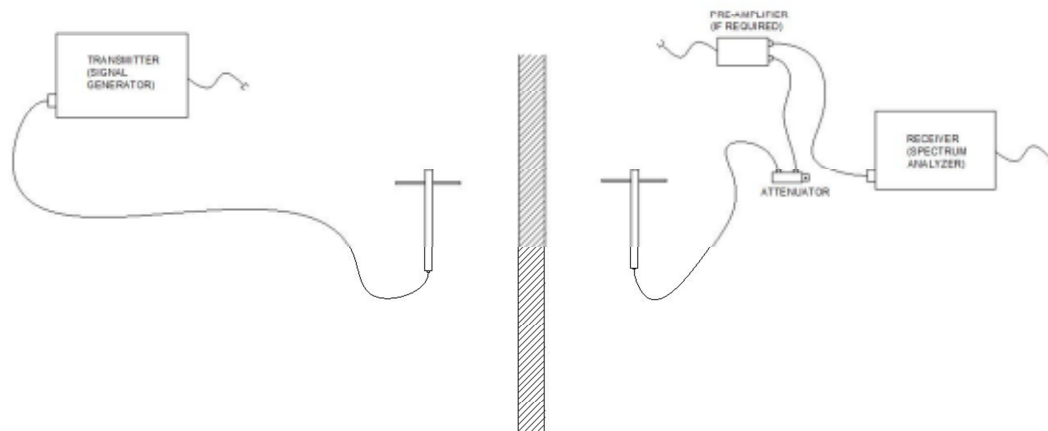
6.3.1. For the shield attenuation measurement, position the antennas on opposite sides of the shield and at an overall separation distance and polarization used for the Reference Level. See Figure 2 for test equipment set-up.



**Figure 2.** Dipole Antenna Measurement Setup

- 6.3.2. With the shield doors closed and all penetrations complete, the value of the attenuator shall be dialed to zero.
- 6.3.3. Record the value of the signal amplitude as the “Measured Level”.
- 6.3.4. Subtract the Measured level from the Reference Level (in dB) to calculate the shield attenuation at the current location, frequency and antenna polarization. Refer to sample calculations in Section 6.3.5.
- 6.3.5. Sample Calculation
- |                    |                                    |
|--------------------|------------------------------------|
| Reference Level    | = -15 dB                           |
| Measured Level     | = -128 dB                          |
| Shield Attenuation | = Reference Level - Measured Level |
|                    | = -15 dB – (-128 dB)               |
|                    | = 113 dB                           |

#### 6.4. Transmitter and Receiver Test Set-Up



**Figure 3.** Transmitter and Receiver Test Setup

## 6.5. ACCURACY, TOLERANCE AND CALIBRATION

- 6.5.1. Variations of up to 10% of the nominal value of the frequencies required in Table 1 are acceptable.
- 6.5.2. Standardization of the measurement system to determine the analyzer reference signal level will be re-conducted every two hours of continuous testing.
- 6.5.3. If the re-standardization, without any adjustment of the measurement system, indicates a decrease from the last standardization, then all the shielding results from the previous hour will be reduced by the same decrease. Alternatively, all the measurements made in the previous two hours, will be repeated.

## 7. TEST POINTS

- 7.1. Test point locations have been selected based on ITSG-02.

## 8. TEST MILESTONES

- 8.1. Factory testing of each shielding component should be completed prior to install.

- 8.2. Milestone 1 Testing shall occur after the concrete structure has been completely poured and cured. All penetrations will be closed with simple shielding material except for one door and one power filter.
- 8.3. Milestone 2 Testing shall occur after all shielded penetrations have been installed. This includes doors, pipe penetrations, vents, filters, etc.
- 8.4. Milestone 3 Testing shall occur after all facility finishes have been installed, including air ventilation systems, electrical power, communications, etc.

## **9. TEST PERSONNEL**

- 9.1. All testing will be conducted by personal of the testing firm.
- 9.2. All testing will be witnessed by Engineer or an appointed delegate.

## **10. TEST EQUIPMENT**

- 10.1. Equipment to be utilized in performing the required shielding effectiveness test will be selected based on contract requirements. The Spectrum Analyzer and the step attenuators will all be in valid calibration to national standards.

**APPENDIX A. SAMPLE DATA SHEET**

**SAMPLE DATA SHEET  
SHIELDING EFFECTIVENESS TEST RESULTS**

DATE: \_\_\_\_\_ Project: \_\_\_\_\_ Job # \_\_\_\_\_  
 TEST TYPE:  ITSG-02  Mil Std 285  IEEE-299  NSA 65-6  Other:  
 Location: \_\_\_\_\_ Enclosure Type: \_\_\_\_\_  
 Qualification  Acceptance  Other

Frequency	Field	Test Point	Reference Level	Measured Level (db)	Shielding Effectiveness (db)	Required Effectiveness (db)	Comments

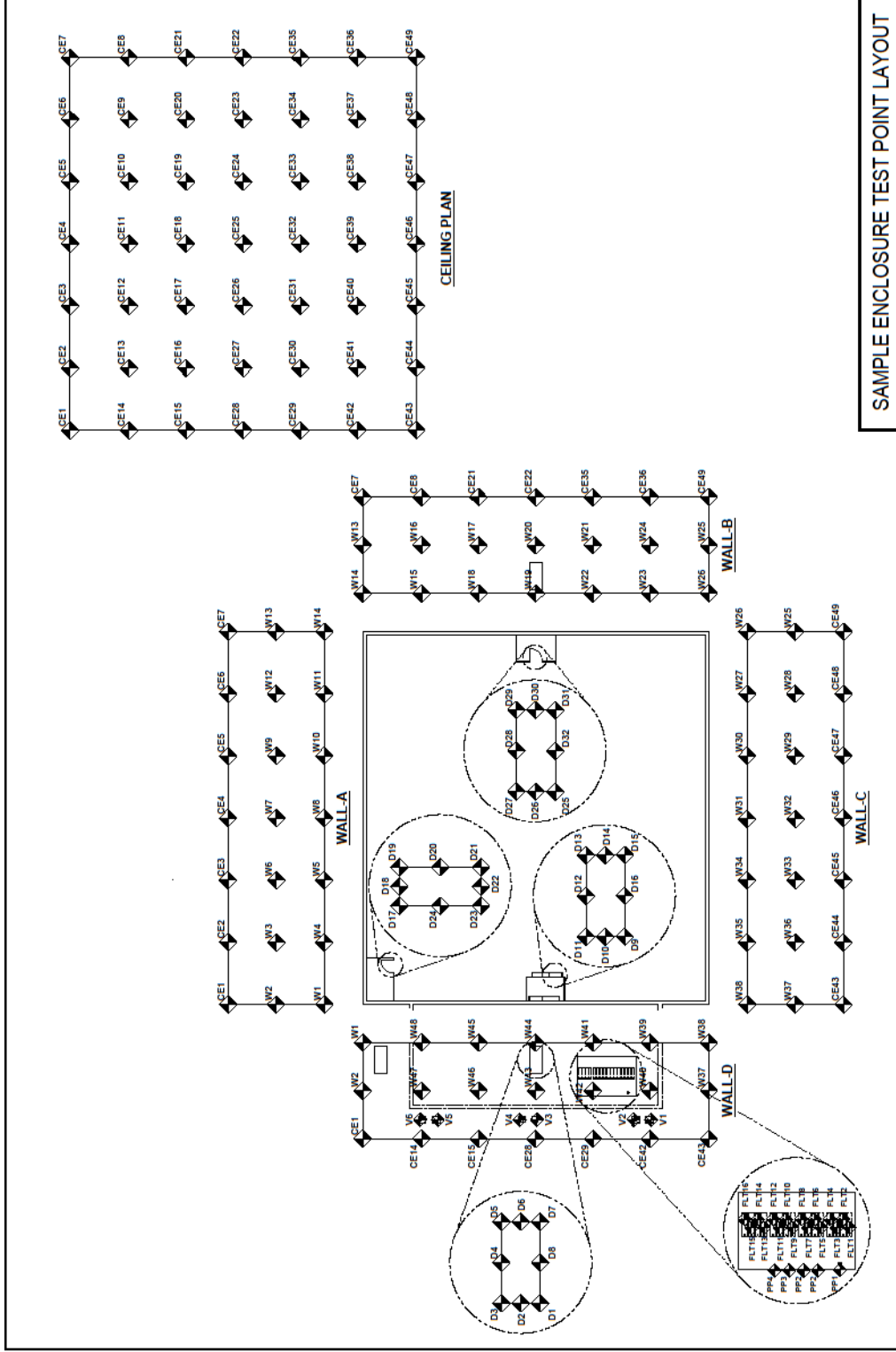
E - Electric Field H - Magnetic Field P - Planewave MW - Microwave MMW - Millimeterwave Other	Transmitter Location: <input type="checkbox"/> Inside <input type="checkbox"/> Outside
--	--

This Data accurately demonstrates the Shielding Effectiveness of the Shielded Enclosure to this date.

X			
Signature of Shielding Test Technician	Date	Witness	Date



**APPENDIX B. TEST POINT DRAWING**



**TOUS LES AUTRES MODALITÉS DE MEURENT INCHANGÉES.**

**FIN**