# PD-1055 Architectural Shielding Case Study

Objective

To develop and execute a testing plan to replicate a structure to be built in accordance with ICD/ICS-705 and the IC Tech Spec v1.5.1 and to test various shielding materials and installation methods therein. Using this data, the objective is to provide a list of viable materials, installation methods, and their corresponding shielding effectiveness as indicated by the completion of the testing plan.

Shielding Materials
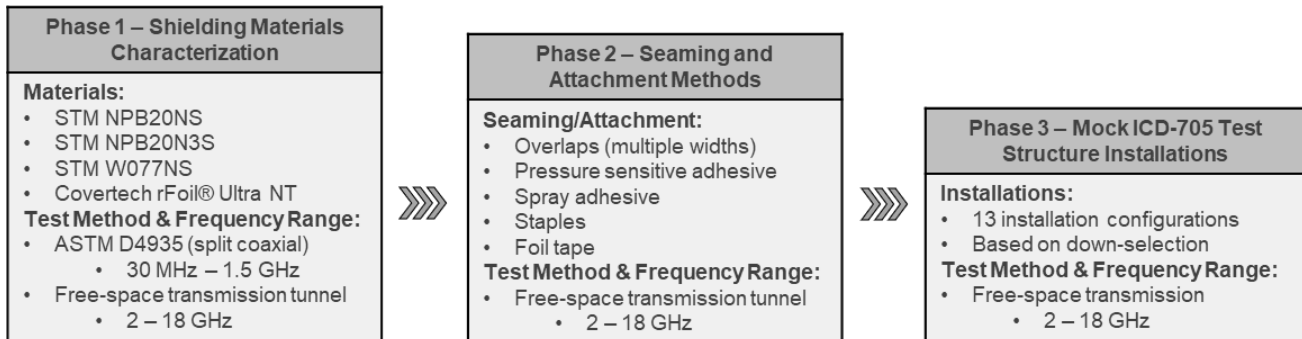
Base materials tested include:

- STM NPB20NS – Electrically Conductive Non-Woven Point Bonded Fabric, Ni Ag Coated, 36" wide
- STM NPB20N3S – Enhanced Electrically Conductive Non-Woven Point Bonded Fabric, Ni Ag Coated, 36" wide
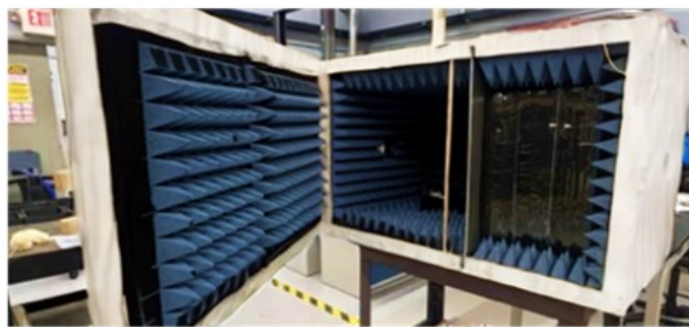- STM W077NS – Electrically Conductive Nylon Rip Stop, Ni Ag Coated, 36" wide
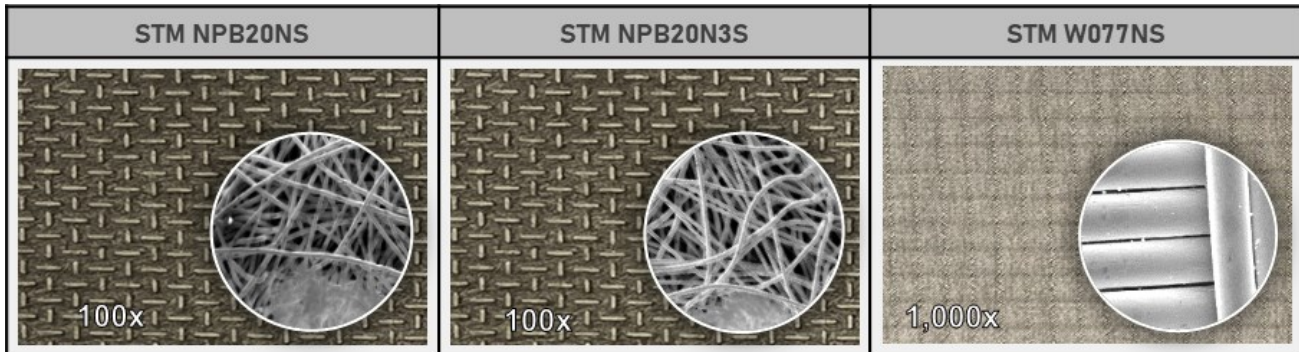
Note: The images above are included to provide an approximate visual representation of the shielding materials used in this project. The 100x magnification of the non-woven materials and 1,000x magnification of the rip stop material are included to demonstrate the complete encapsulation of each fiber that is achieved with STM's proprietary EnCap™ metalization process.

Test Methodology

Multiple test procedures are utilized to characterize, test and validate various shielding materials and installation methods. Note: Complete test methodology (procedures and instrumentation) available by request.

Phase 1 – Shielding Materials Characterization

Materials:
- STM NPB20NS
- STM NPB20N3S
- STM W077NS
- Covertech rFoil® Ultra NT

Test Method & Frequency Range:
- ASTM D4935 (split coaxial)
  - 30 MHz – 1.5 GHz
- Free-space transmission tunnel
  - 2 – 18 GHz

Phase 2 – Seaming and Attachment Methods

Seaming/Attachment:
- Overlaps (multiple widths)
- Pressure sensitive adhesive
- Spray adhesive
- Staples
- Foil tape

Test Method & Frequency Range:
- Free-space transmission tunnel
  - 2 – 18 GHz

Phase 3 – Mock ICD-705 Test Structure Installations

Installations:
- 13 installation configurations
- Based on down-selection

Test Method & Frequency Range:
- Free-space transmission
  - 2 – 18 GHz

STM split coaxial testing fixture

STM free-space transmission loss testing fixture

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STM Mock ICD-705 Test Structure

Many of the thirteen shielding material configurations are measured at multiple stages of the installation. Depicted above are multiple stages along the installation process: pre-installation, mid-installation, and post-installation. For example, a first test cycle is performed on the base material installation. A second test cycle is performed after seams are taped using foil tape (center). A final test cycle is performed after adding a second layer of drywall over the shielding material configuration (right). STM NPB20N3S – Enhanced Electrically

An antenna coordinate system is used to catalogue the free-space transmission loss measurements at nine (9) distinct locations in the test structure in both the V and H polarizations, for a total of 18 measurements per test cycle.
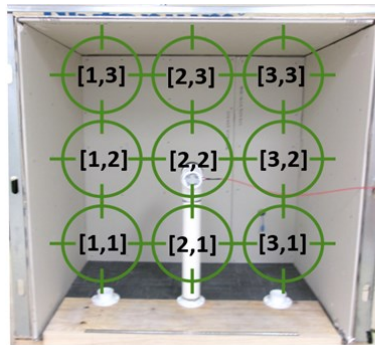
Antenna Coordinate System Illustration
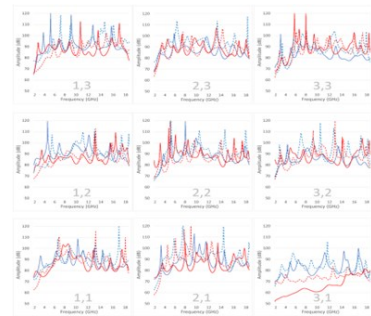
Sample Data Set Illustration

Phase 3 Test Data on Mock ICD-705 Configurations

Sample	Configuration	Avg Attenuation (dB)	Min Attenuation (dB)
W077NS	PSA+FT+DW	64	55
W077NS	Staples+FT+ W077NS Backed DW	80	68
NPB20NS	Backed DW w/wings	76	63
NPB20N3S	Flash+FT+DW	76	69

PSA = Pressure Sensitive Adhesive
FT = Foil Tape
DW = Drywall

The data sets across all 9 locations, and two polarizations, are averaged to provide an average attenuation. Signal attenuation has been made positive for ease of viewing, but is measured as a negative value indicating signal loss / attenuation.

A full copy of the report and / or relevant summarized sections can be made available upon request.