

**TEST REPORT**

**CHOMERICS  
PREMIER™ EMI Shielding Thermoplastic  
Face Plate Shielding Effectiveness**

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Test Report Number: TR 1011 EN05/06

Chomerics Approved Signatory:

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**1.0 INTRODUCTION**

This document is written to report test results of shielding effectiveness tests performed in accordance with the IEEE-STD-299 procedure. The face plate Assembly was tested for electric field shielding effectiveness from 600kHz to 10GHz.

The test samples consisted of face plates injection molded from Chomerics PREMIER A220-FR, A230-FRHF, A240-FRHF material, compared to standard aluminum face plates. All parts tested were supplied by Chomerics R&D. The aluminum face plates were fabricated by Chomerics machine shop to duplicate the mechanical configuration of the PREMIER face plates.

Two gasket systems were required. First, the seams between all face plates were sealed (vertically) using Chomerics SOFT-SHIELD 5000 gasket material cross section number 74006. On the top and bottom of the test fixture, a SOFT-SHIELD 5000 gasket material cross section number 74005 was used to seal (horizontally) the fixture and face plates.

The shielding effectiveness tests were performed from February 14 through March 2, 2006.

The tests were performed for Chomerics R&D and New Business Development.

**2.0 TEST REQUIREMENTS**

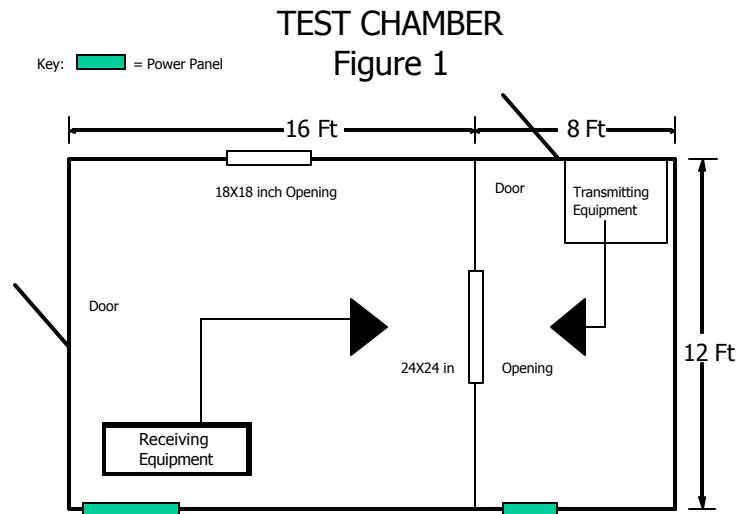
There are no shielding effectiveness requirements for the Rack Face Plate Assembly. The tests were performed for engineering evaluation only in support of Chomerics R&D and New Business Development.

**3.0 TEST SETUP**

The tests were performed at Chomerics Inc., Woburn, Massachusetts. The tests have satisfied the requirements of IEEE-STD-299.

Figure 1 illustrates the shielding effectiveness test setup.

The shielded enclosure was manufactured by Sprague Shielding Corporation. Attenuation tests have demonstrated that the shielded enclosure meets the attenuation requirements of IEEE-STD-299. The shielded enclosures are comprised of two separate rooms separated by a wall where the access panel (test fixture) is located.



The available AC power within the shielded enclosure is 110V AC, 220V AC, single and three phase, 60 cycle. The power line filters are rated for 100dB of attenuation from 800MHz to 6GHz.

Support equipment, such as amplifiers and signal generators, were located in one of the shielded enclosure rooms. The detection system was located in the opposite shielded enclosure room.

The Rack Face Plate System was installed in a test fixture designed and fabricated by Chomerics. The test fixture was designed to hold a series of eleven face plate pieces.

All face plates were mounted to the test fixture using the standard latch and screw assembly.

During the shielding effectiveness test, the test samples were mounted to the center wall of the shielded enclosure which separates the two rooms. The test fixture was attached to the shielded room wall using twenty (20) 1/4" bolts to hold the test fixture on the wall. A flat spring finger gasket was placed between the test fixture and the shielded room wall. The seam was additionally covered with copper tape.

#### 4.0 RADIATED ELECTRIC FIELD SHIELDING TESTS

Tests for radiated field were performed in accordance with IEEE-STD-299. The following list includes the equipment which was used to perform the radiated electric field and plane wave tests:

| Test Equipment |                                      | Asset # | Serial #   | Cal Date |
|----------------|--------------------------------------|---------|------------|----------|
| X              | HP 83640A Signal Generator           | 38      | 3009A00188 | 4/06     |
| X              | AR 30W1000M7 Amplifier               | 480     | 15657      | NCR      |
| X              | Logimetrics A300/S-08 Amplifier      | 133     | 3016       | NCR      |
| X              | Logimetrics A300/C-08 Amplifier      | 132     | 3012       | NCR      |
| X              | Logimetrics A300/IJ Amplifier        | 134     | 3094       | NCR      |
| X              | Agilent 4440A Spectrum Analyzer      | 704     | US41421236 | 1/06     |
| X              | Emco 3109 Biconical Antenna          | 87      | 2123       | 1/06     |
| X              | Emco 3109 Biconical Antenna          | 82      | 2054       | 1/06     |
| X              | Emco 3106 Horn Antenna               | 117     | 2213       | 1/06     |
| X              | Emco 3106 Horn Antenna               | 120     | 2212       | 1/06     |
| X              | EMCO 3115 Double Ridge Guide Antenna | 375     | 2174       | 1/06     |
| X              | EMCO 3115 Double Ridge Guide Antenna | 376     | 2175       | 1/06     |
| X              | EMCO Parallel Element Antenna        | 336     | 3107       | NCR      |
| X              | ENI Amplifier                        | 138     | 510L       | NCR      |
| X              | EMCO Passive Rod Antenna             | 280     | 3303       | 1/06     |

The Electric Field test was performed at frequencies of 600kHz, 800kHz, 1MHz, 10MHz, 20MHz, 30MHz, 40MHz, 60MHz, 80MHz 100MHz, 200MHz, 400MHz, 600MHz and 800MHz. The Plane wave test was performed at frequencies of 1GHz, 2GHz, 4GHz, 6GHz, 8GHz, 10GHz, 12GHz, 14GHz, 16GHz and 18GHz.

Antenna orientation was vertical for all tests in the same orientation as the longest length of the face plates. Preliminary tests done in both horizontal and vertical polarizations determined that the vertical polarization was worst case. The worst case was defined as the polarization that produced the lowest shielding effectiveness values.

The shielded effectiveness test was performed in accordance with the IEEE-STD-299 procedure.

The transmit and receive antennas were placed two feet from each other on opposite sides of the test plate. The open reference was taken by transmitting and receiving the test signal through the open aperture on the test plate where the face plates would be located. The closed reference was taken by transmitting the test signal through the test fixture with the face plates in place.

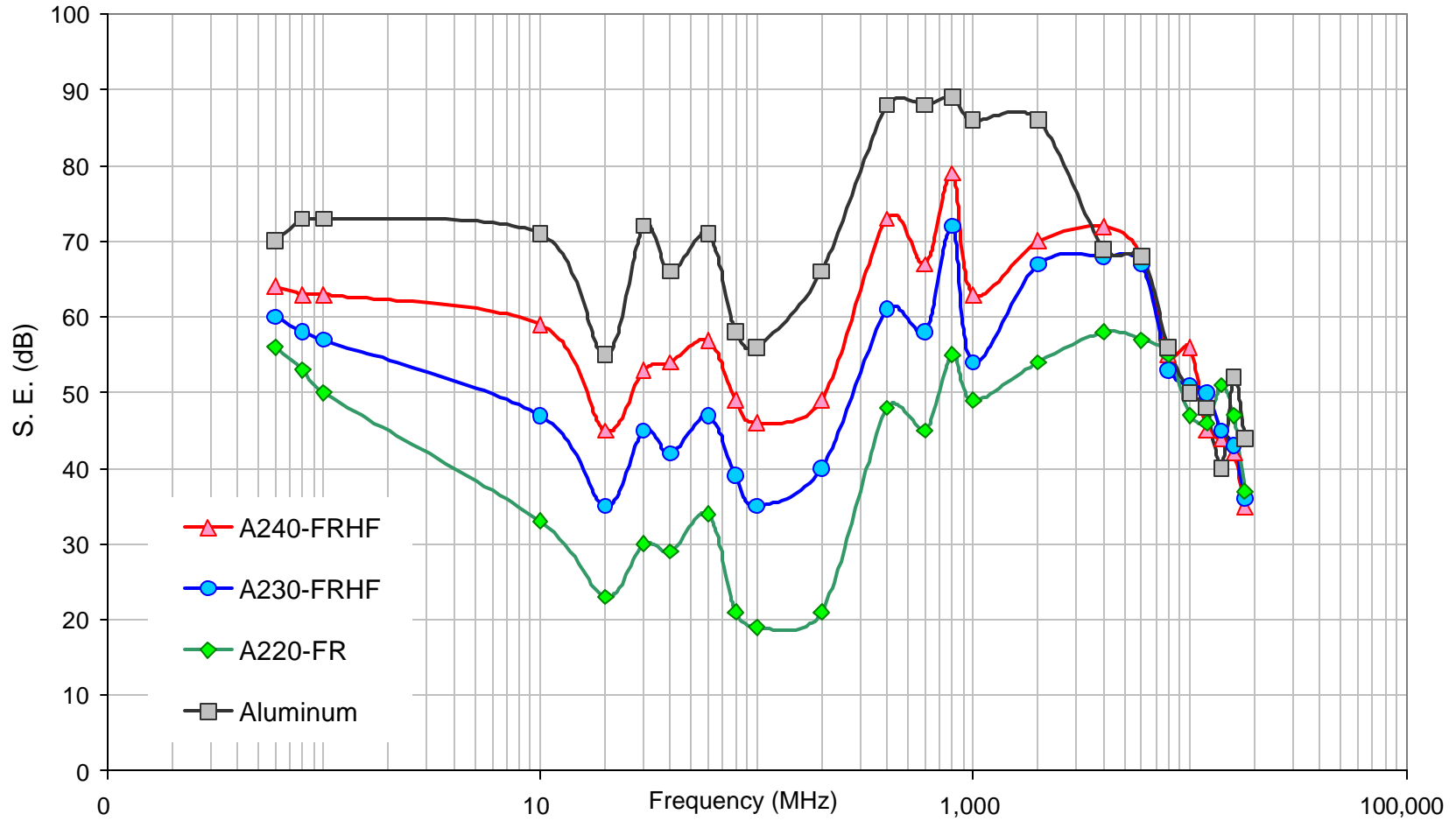
The difference between the closed reference and the open reference is the shielding effectiveness. Below is a sample calculation.

$$\begin{array}{rclcl} \text{Open Reference} & - & \text{Closed Reference} & = & \text{Shielded Effectiveness} \\ +14\text{dBm} & - & -100\text{dBm} & = & 114\text{dB} \end{array}$$

## 5.0 OVERALL TEST RESULTS

The test results are illustrated on the attached graph.

### Appendix A Face Plate Shielding Effectiveness Study Premier Grades vs Aluminum



APPENDIX B SET UP PHOTOGRAPHS

CUSTOMER: N/A

DATE: 02/14/06

EQUIPMENT: RACK FACE PLATE SYSTEM

TEST NUMBER: ONE (1)

TESTED BY: B. COUTURE

COUPLING DEVICE: PASSIVE ROD ANTENNA

OPERATING MODE: N/A

TEST SPEC: IEEE-STD-299



Photograph Description: Test set-up using the Passive Rod antenna 500kHz to 20MHz.  
FORM CTS-PHOTO

CUSTOMER: N/A

DATE: 02/14/06

EQUIPMENT: RACK FACE PLATE SYSTEM

TEST NUMBER: ONE (1)

TESTED BY: B. COUTURE

COUPLING DEVICE: BICONICAL ANTENNA

OPERATING MODE: N/A

TEST SPEC: IEEE-STD-299



Photograph Description: Open reference test setup with Biconical antenna 20MHz to 1GHz.  
FORM CTS-PHOTO

CUSTOMER: N/A  
EQUIPMENT: RACK FACE PLATE SYSTEM  
TESTED BY: B. COUTURE  
OPERATING MODE: N/A

DATE: 02/14/06  
TEST NUMBER: ONE (1)  
COUPLING DEVICE: HORN ANTENNA  
TEST SPEC: IEEE-STD-299



Photograph Description: Open reference test setup with Horn antenna 200MHz to 1GHz.  
FORM CTS-PHOTO

CUSTOMER: N/A  
EQUIPMENT: RACK FACE PLATE SYSTEM  
TESTED BY: B. COUTURE  
OPERATING MODE: N/A

DATE: 02/14/06  
TEST NUMBER: ONE (1)  
COUPLING DEVICE: HORN ANTENNA  
TEST SPEC: IEEE-STD-299



Photograph Description: Open reference test setup with Horn antenna 1GHz to 18GHz.  
FORM CTS-PHOTO

CUSTOMER: N/A  
EQUIPMENT: RACK FACE PLATE SYSTEM  
TESTED BY: B. COUTURE  
OPERATING MODE: N/A

DATE: 02/14/06  
TEST NUMBER: ONE (1)  
COUPLING DEVICE: N/A  
TEST SPEC: IEEE-STD-299



Photograph Description: Test set-up with Face Plates installed in test fixture.  
FORM CTS-PHOTO

CUSTOMER: N/A  
EQUIPMENT: RACK FACE PLATE SYSTEM  
TESTED BY: B. COUTURE  
OPERATING MODE: N/A

DATE: 02/14/06  
TEST NUMBER: ONE (1)  
COUPLING DEVICE: HORN ANTENNA  
TEST SPEC: IEEE-STD-299



Photograph Description: Test set-up of transmit side of test fixture using Horn antenna.  
FORM CTS-PHOTO



### TEST LOG

CUSTOMER: N/A  
EQUIPMENT: FACE PLATE

PROGRAM: FACE PLATE ASSEMBLY  
TESTED BY: B. COUTURE

|                           |                 |  |           |   |   |                                    |               |
|---------------------------|-----------------|--|-----------|---|---|------------------------------------|---------------|
| Pre-Test Checklist        | Date            | Comments   |           |   |   |                                    |               |
|                           | 2/14/06         | Test Plan/Procedure: IEEE STD 299<br>Test Specification: IEEE STD 299<br>Chomerics Procedure: CHO TP08<br>EUT Power Requirement Verified: N/A<br>Voltage   Frequency   Phase<br>Voltage   Frequency   Phase<br>EUT Functional Operational Check: [ ] Pass [ ] Fail<br>Environmental: Bonding/Grounding: N/A Safety Issues: N/A |           |   |   |                                    |               |
| In-Process Test Checklist | Date            | Test #   | Test Type | Test Equipment Calibrated   | Test Performed Properly – Data Accepted | EUT Set-up Check/Operational Check | EUT Pass/Fail |
|                           | 2/14/06         | 1  | SE        | Yes   | Yes                                     | N/A                                | N/A           |
|                           | 2/23/06         | 2  | SE        | Yes   | Yes                                     | N/A                                | N/A           |
|                           | 3/2/06          | 3  | SE        | Yes   | Yes                                     | N/A                                | N/A           |
|                           |                 |  |           |   |   |                                    |               |
|                           |                 |  |           |   |   |                                    |               |
|                           |                 |  |           |   |   |                                    |               |
|                           |                 |  |           |   |   |                                    |               |
|                           |                 |  |           |   |   |                                    |               |
|                           |                 |  |           |   |   |                                    |               |
| Post Test Checklist       | Date:<br>3/2/06 | EUT Functional Operation Check:<br>[ X ] Pass [ ] Fail   |           | <div style="display: flex; justify-content: space-around;"> <span>_____</span> <span>_____</span> </div> Test Engineer/Tech      Approved Signatory |   |                                    |               |

FORM CTS-010