



TEST SERVICES

RAYTHEON CABINET SHIELDING EFFECTIVENESS TEST REPORT

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Test Report Number: SR3620.03

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CHOMERICS**Parker** Seals**TEST SERVICES****1.0 INTRODUCTION**

This document is written to report results of shielding effectiveness tests performed on the Raytheon ASDE Cabinet.

The tests were performed as configured below:

1. ASDE Cabinet as delivered front side
2. ASDE Cabinet as delivered back side
3. ASDE Cabinet front side after gasket and vent modifications
4. ASDE Cabinet back side after gasket and vent modifications
5. ASDE Cabinet front side after gasket and vent modifications – handle shielded
6. ASDE Cabinet back side after gasket and vent modifications – handle shielded

The tests were performed May 26 through June 4, 2003 under Raytheon Purchase Order number 53-26T8-BR-0407.

2.0 TEST PURPOSE

The shielding effectiveness tests performed on the Raytheon ASDE cabinet were intended to improve the shielding effectiveness of the cabinet. The shielding effectiveness requirement for the cabinet was 40dB over a frequency range of 8.6GHz to 9.6GHz. The intent was to achieve shielding effectiveness values as high as possible if the 40dB level was not obtained.

3.0 TEST SETUP

The tests were performed at Chomerics of Woburn, Massachusetts.

Support equipment, such as amplifiers and signal generators, were located outside the shielded enclosure. The detection system was located inside the shielded enclosure.

The shielded enclosure was manufactured by Sprague Shielding Corporation. Attenuation tests have demonstrated that the shielded enclosure meets the attenuation requirements of MIL-STD-285 and IEEE-STD-299.

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 10kHz to 10GHz.

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CHOMERICS**Parker** Seals**TEST SERVICES****4.0 SHIELDING EFFECTIVENESS TESTS****4.1 Radiated Plane Wave Tests**

Attenuation tests for radiated plane wave signals were performed in accordance with IEEE-299 test procedures.

The following list includes the equipment used to perform the radiated electric field tests:

| Manufacturer | Model # | Frequency |
|---|---------|---------------|
| Hewlett Packard Signal Generator | 83640A | 10MHz -20GHz |
| Hewlett Packard Spectrum Analyzer | E440A | 3Hz - 26.5GHz |
| EMCO Horn Antenna (Qty 2) | 3115 | 1GHz - 18GHz |
| Logimetrics TWT Amplifier | A300/U | 8GHz - 18GHz |
| We certify that the test equipment used to perform this test was in calibration at the time of the test and is calibrated per MIL-STD-45662 at least once per year. | | |

The test was performed at 100MHz intervals between the following frequencies: 8.6GHz and 9.6GHz.

The test results are listed on the attached data sheets.

A horn antenna was placed inside of the cabinet under test; this antenna was used as the transmitting antenna. The cabinet under test was installed inside the shielded room. A signal generator and RF amplifier located outside the shielded enclosure were connected to the transmitting antenna via an N-Type cable and feed-through connectors and over shielded with aluminum foil terminated with copper tape.

A receiving antenna (matching horn antenna) was placed two feet away from leading surface of the cabinet door. A spectrum analyzer was connected to the receiving antenna.

The open reference numbers were measured with the transmit antenna outside of the cabinet. The closed reference numbers were measured with the antenna inside of the cabinet with the door latched closed. The shielding effectiveness was measured by taking the power level from the open reference and subtracting from it the power level recorded in the closed condition. Sample calculations are shown below.

Open Reference - Closed Reference = Shielding Effectiveness

$$+10\text{dBm} - (-102\text{dBm}) = 112\text{ dB}$$

$$-20\text{dBm} - (-80\text{dBm}) = 60\text{dB}$$

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5.0 OVERALL TEST RESULTS

Although the 40dB limit was not reached over the entire frequency range of 8.6GHz to 9.6GHz, the cabinet shielding effectiveness was greatly improved from the values measured as received.

The test results are listed on the enclosed data sheets.

Table 1

ASDE Cabinet as delivered front side
ASDE Cabinet as delivered back side

Table 2

ASDE Cabinet front side after gasket and vent modifications
ASDE Cabinet back side after gasket and vent modifications

Table 3

ASDE Cabinet front side after gasket and vent modifications – handle shielded
ASDE Cabinet back side after gasket and vent modifications – handle shielded

Modifications made to the cabinet are as follows:

1. Door gaskets were replaced with Chomerics Soft Shield gasket P/N 74011.
2. Both side panels, the back panel, top cover and bottom cover gaskets were replaced with Chomerics Soft Shield gasket P/N 74040. Small access openings in bottom cover were also gasketed with the same Chomerics gasket part number.
4. Vents were coated with Chomerics ECOPLATE material on one side of the honeycomb.
5. Testing was performed with a new top cover including the honeycomb vent only. Other filter openings were not cut in the new top cover.
6. Fingerstock gasket originally installed between the rear panel screw brackets and the cabinet frame remained throughout the tests.
7. Where the fingerstock was removed, the remaining adhesive was taken off the cabinet and in some areas the paint overspray was removed in areas under gasket surfaces.
8. The paint was scrapped around the inside of the handle and covered with copper tape to simulate a gasketed cover.

General Recommendations:

- A. Design and fabricate a box with gasket interfaces to cover the handle on the inside of the door. The same gasket P/N 74040. This will reduce the handle leakage.
- B. Exchange the fingerstock between the rear panel screw brackets and the cabinet frame with the same gasket P/N 74040. Leakage from these seems bypasses the gasket on the door.
- C. Pay close attention to overspray of paint onto gasketed surfaces.

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APPENDIX A

SHIELDING EFFECTIVENESS TEST DATA

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Table 1

| As received Frequency GHz | Front | | | Back | |
|---------------------------------|--------------|----------------|----|----------------|----|
| | Open Ref. | Closed Ref. | SE | Closed Ref. | SE |
| 8.6 | 12 | -9 | 21 | -7 | 19 |
| 8.7 | 12 | -4 | 16 | -7 | 19 |
| 8.8 | 8 | -2 | 10 | -13 | 21 |
| 8.9 | 9 | -5 | 14 | -15 | 24 |
| 9 | 10 | -7 | 17 | -15 | 25 |
| 9.1 | 10 | -10 | 20 | -10 | 20 |
| 9.2 | 11 | -16 | 26 | -20 | 31 |
| 9.3 | 11 | -15 | 25 | -10 | 21 |
| 9.4 | 10 | -22 | 22 | -7 | 17 |
| 9.5 | 10 | -20 | 20 | -16 | 26 |
| 9.6 | 10 | -21 | 21 | -14 | 24 |

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CHOMERICS**Parker** Seals**TEST SERVICES****Table 2**

| After Gasket and Vent Modifications | | | | | |
|-------------------------------------|--------------|----------------|----|----------------|----|
| Frequency GHz | Open Ref. | Front | | Back | |
| | | Closed Ref. | SE | Closed Ref. | SE |
| 8.6 | -1 | -31 | 30 | -34 | 33 |
| 8.7 | -2 | -34 | 32 | -36 | 34 |
| 8.8 | -5 | -36 | 31 | -35 | 30 |
| 8.9 | 0 | -38 | 38 | -38 | 38 |
| 9 | -2 | -35 | 33 | -34 | 32 |
| 9.1 | 1 | -35 | 36 | -32 | 31 |
| 9.2 | -1 | -39 | 38 | -34 | 33 |
| 9.3 | 0 | -33 | 33 | -33 | 33 |
| 9.4 | -3 | -36 | 33 | -36 | 33 |
| 9.5 | -3 | -40 | 37 | -39 | 36 |
| 9.6 | -2 | -41 | 39 | -41 | 39 |

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CHOMERICS**Parker** Seals**TEST SERVICES****Table 2**

| After Gasket and Vent Modifications | | | | | | |
|-------------------------------------|--------------|----------------|----|----------------|----|--|
| Frequency GHz | Open Ref. | Front | | Back | | |
| | | Closed Ref. | SE | Closed Ref. | SE | |
| 8.6 | -1 | -31 | 30 | -34 | 33 | |
| 8.7 | -2 | -34 | 32 | -36 | 34 | |
| 8.8 | -5 | -36 | 31 | -35 | 30 | |
| 8.9 | 0 | -38 | 38 | -38 | 38 | |
| 9 | -2 | -35 | 33 | -34 | 32 | |
| 9.1 | 1 | -35 | 36 | -32 | 31 | |
| 9.2 | -1 | -39 | 38 | -34 | 33 | |
| 9.3 | 0 | -33 | 33 | -33 | 33 | |
| 9.4 | -3 | -36 | 33 | -36 | 33 | |
| 9.5 | -3 | -40 | 37 | -39 | 36 | |
| 9.6 | -2 | -41 | 39 | -41 | 39 | |

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CHOMERICS**Parker** Seals**TEST SERVICES****Table 3**

| After Gasket and Vent Modifications w/handle shielded | | | | | |
|---|--------------|----------------|----|----------------|----|
| Frequency GHz | Front | | | Back | |
| | Open Ref. | Closed Ref. | SE | Closed Ref. | SE |
| 8.6 | -1 | -40 | 39 | -39 | 38 |
| 8.7 | -2 | -38 | 36 | -36 | 34 |
| 8.8 | -5 | -40 | 35 | -35 | 35 |
| 8.9 | 0 | -37 | 37 | -39 | 39 |
| 9 | -2 | -39 | 37 | -39 | 37 |
| 9.1 | 1 | -34 | 35 | -39 | 40 |
| 9.2 | -1 | -36 | 35 | -37 | 36 |
| 9.3 | 0 | -37 | 37 | -40 | 40 |
| 9.4 | -3 | -35 | 33 | -38 | 35 |
| 9.5 | -3 | -38 | 35 | -39 | 36 |
| 9.6 | -2 | -37 | 35 | -37 | 35 |

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CHOMERICS**Parker** Seals**TEST SERVICES****Table 3**

| After Gasket and Vent Modifications w/handle shielded | | | | | |
|---|--------------|----------------|----|----------------|----|
| Frequency GHz | Front | | | Back | |
| | Open Ref. | Closed Ref. | SE | Closed Ref. | SE |
| 8.6 | -1 | -40 | 39 | -39 | 38 |
| 8.7 | -2 | -38 | 36 | -36 | 34 |
| 8.8 | -5 | -40 | 35 | -35 | 35 |
| 8.9 | 0 | -37 | 37 | -39 | 39 |
| 9 | -2 | -39 | 37 | -39 | 37 |
| 9.1 | 1 | -34 | 35 | -39 | 40 |
| 9.2 | -1 | -36 | 35 | -37 | 36 |
| 9.3 | 0 | -37 | 37 | -40 | 40 |
| 9.4 | -3 | -35 | 33 | -38 | 35 |
| 9.5 | -3 | -38 | 35 | -39 | 36 |
| 9.6 | -2 | -37 | 35 | -37 | 35 |

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CHOMERICS**Parker** Seals**TEST SERVICES****Table 3**

| After Gasket and Vent Modifications w/handle shielded | | | | | |
|---|--------------|----------------|----|----------------|----|
| Frequency GHz | Front | | | Back | |
| | Open Ref. | Closed Ref. | SE | Closed Ref. | SE |
| 8.6 | -1 | -40 | 39 | -39 | 38 |
| 8.7 | -2 | -38 | 36 | -36 | 34 |
| 8.8 | -5 | -40 | 35 | -35 | 35 |
| 8.9 | 0 | -37 | 37 | -39 | 39 |
| 9 | -2 | -39 | 37 | -39 | 37 |
| 9.1 | 1 | -34 | 35 | -39 | 40 |
| 9.2 | -1 | -36 | 35 | -37 | 36 |
| 9.3 | 0 | -37 | 37 | -40 | 40 |
| 9.4 | -3 | -35 | 33 | -38 | 35 |
| 9.5 | -3 | -38 | 35 | -39 | 36 |
| 9.6 | -2 | -37 | 35 | -37 | 35 |

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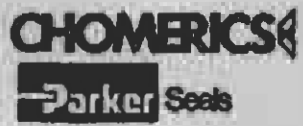
APPENDIX B

TEST SETUP PHOTOGRAPHS

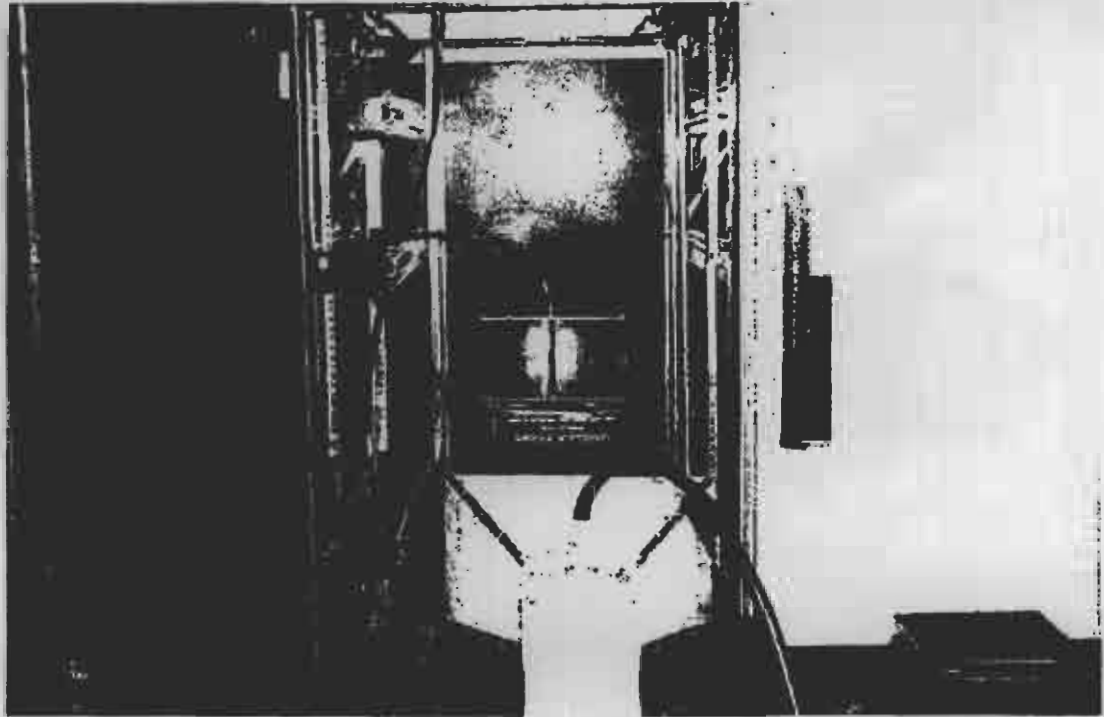
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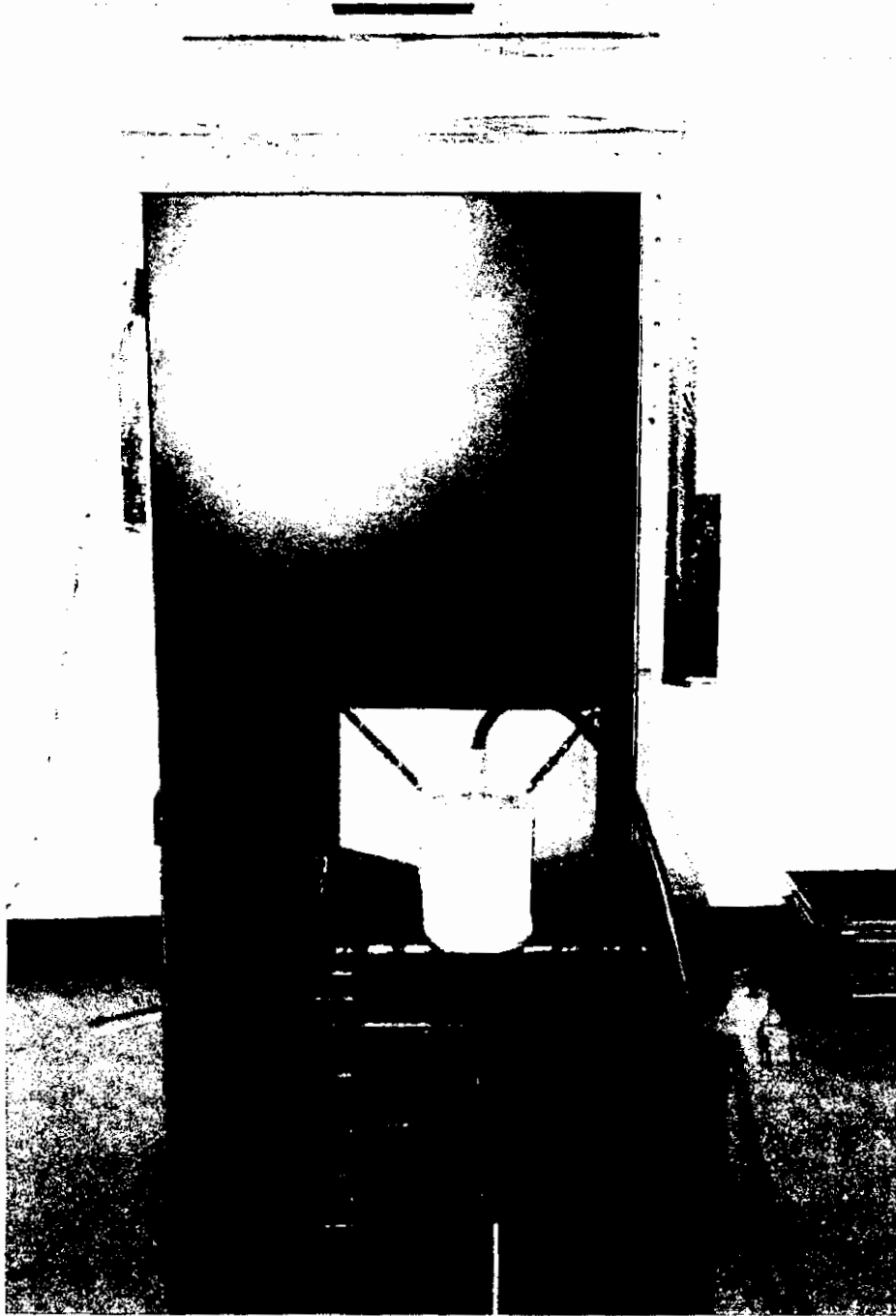


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