TEST REPORT #131 EXTRUSION TECHNOLOGY
SHIELDING EFFECTIVENESS –
ALUMINUM VS STEEL PANELS
MARCH 2010

ALUMINUM VERSUS STEEL ::: SHIELDING EFFECTIVENESS TEST:::

1. **PURPOSE OF TEST**:
   - To study the difference in EMI leakage thro' Aluminum and Steel plates.
   - Shielding effectiveness of Metal Barriers ---Aluminum Versus Steel

2. **TEST DETAILS:**

This document reports results of shielding effectiveness tests. The testing was performed on four sample panels, which are 26 X 26 inches with a sample area of 24 X 24 inches. Each sample was mounted on the bulkhead wall opening.

- 0.062" Thk Aluminum Plate---Yellow Chromate
- 0.062" Thk steel plate----------Zinc Chromate
- 0.062" Thk Aluminum plate--- Electro less Nickel plated
- 0.062" Thk Steel plate --------- Electro less Nickel plated

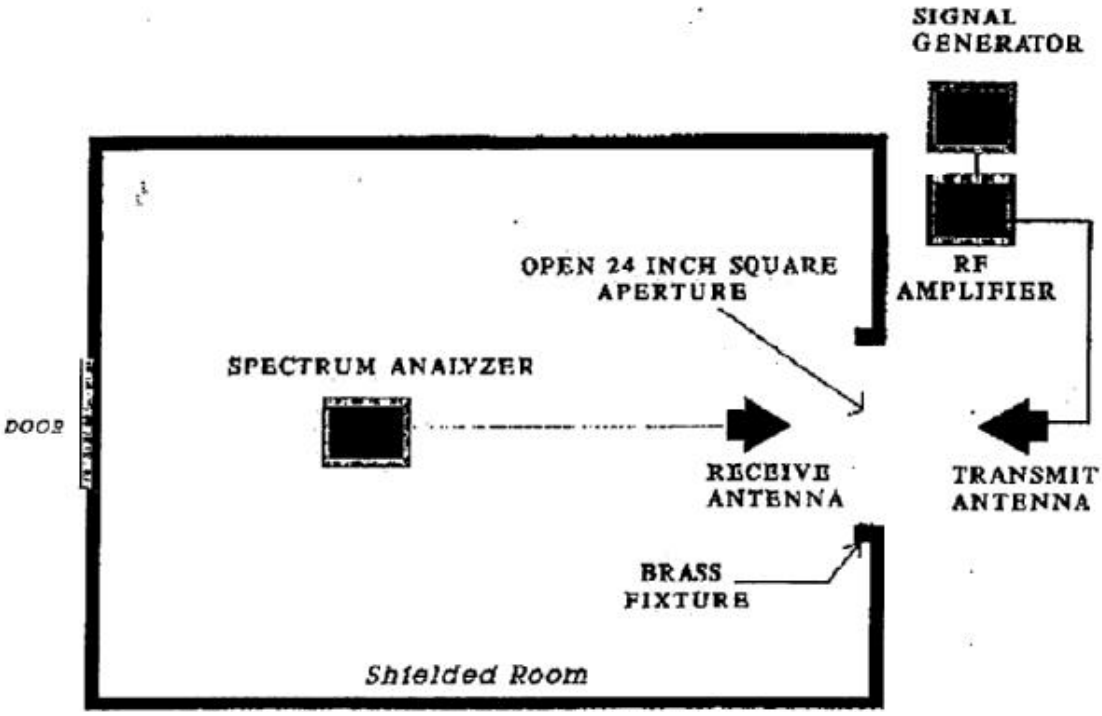
3. **TEST LOCATION:**

Chomerics
Parker Chomerics Division
77, Dragon Court
Woburn, MA 01888-4014
Tel: 781-935-4850
Fax: 781-933-4318

4. **TEST SETUP**

The tests were performed according to a modified MIL-STD 285.
The test was performed at frequencies of 30 MHz, 80 MHz, 100 MHz, 200 MHz, 400 MHz, 600 MHz, 800 MHz, 1 GHz, 4GHz, 6 GHz, 8 GHz, 10 GHz, 14 GHz, and 18 GHz.

- **Figure 1** illustrates the shielding effectiveness test setup.



During the shielding effectiveness test, the sample was mounted on a 24 inch brass test fixture seam welded to the wall of the shielded enclosure. An aluminum frame was placed over the test sample and bolted in place on the brass mount. Support equipment, such as amplifiers and signal generators, were located outside but inside of the shielded transmitter chamber. The detection system was located inside the main shielded enclosure.

Sprague Shielding Corporation manufactured the shielded enclosure.

Attenuation tests have demonstrated that the shielded enclosure meets the attenuation requirement MIL-STD 285.

The available AC power within the shielded enclosure is 110V, 220V AC, single and three phase, 60 cycles. The power line filters are rated for 100dB of attenuation from 10kHz to 10GHz.

5. RADIATED ELECTRIC FIELD SHIELDING TESTS:

Shielding effectiveness tests for radiated electric field signals were performed in accordance with modified MIL-STD 285.
The following equipments were used to perform the tests.

MANUFACTURER	MODEL#	S/N	FREQUENCY	CAL DATE
Hewlett Packard signal generator	83640A	3009A00188	10MHz-40GHz	Aprl'03
Emco Biconical Antenna	3109	2123	20MHz-200MHz	Aprl'03
Emco Biconical Antenna	3109	2054	20MHz-200MHz	Jan'03
Emco Horn Antenna	3115	2743	1GHz-18GHz	Jan'03
Emco Horn Antenna	3115	2345	1GHz-18GHz	Jan'03
Singer Log Spiral Antenna	CLS-105	00316-4780	200MHz-1GHz	Jan'03
Singer Log Spiral Antenna	CLS-105	00315-5007	200MHz-1GHz	Jan'03
Agilent Spectrum Analyser	E4440A	US41421236	9Hz to 26.5GHz	Jan'03
RF Power Labs Amplifier	1kw Pre-Amp	N/A	10KHz to 220MHz	NCR
Logimetrics Amplifier	A300/L	3091	2GHz-4GHz	NCR
Logimetrics Amplifier	A300/C	3093	4GHz-8GHz	NCR
Logimetrics Amplifier	300X/U	3020	8GHz-18GHz	NCR
ENI Amplifier	600L	111	0.8MHz-1GHz	NCR

NCR= No calibration required

6. MANUFACTURER MODEL# S/N FREQUENCY CAL DATE

Hewlett Packard signal generator 83640A 3009A00188 10MHz-40GHz Aprl'03
Emco Biconical Antenna 3109 2123 20MHz-200MHz Aprl'03
Emco Biconical Antenna 3109 2054 20MHz-200MHz Jan'03
Emco Horn Antenna 3115 2743 1GHz-18GHz Jan'03
Emco Horn Antenna 3115 2345 1GHz-18GHz Jan'03
Singer Log Spiral Antenna CLS-105 00316-4780 200MHz-1GHz Jan'03
Singer Log Spiral Antenna CLS-105 00315-5007 200MHz-1GHz Jan'03
Agilent Spectrum Analyser E4440A US41421236 9Hz to 26.5GHz Jan'03
RF Power Labs Amplifier 1kw Pre-Amp N/A 10KHz to 220MHz NCR
Logimetrics Amplifier A300/L 3091 2GHz-4GHz NCR
Logimetrics Amplifier A300/C 3093 4GHz-8GHz NCR
Logimetrics Amplifier 300X/U 3020 8GHz-18GHz NCR
ENI Amplifier 600L 111 0.8MHz-1GHz NCR
NCR= No calibration required

The equipment used for testing was calibrated at the time of testing as per MILSTD-45662.

7. OVERALL TEST RESULTS:

The test results are illustrated on the attached data sheets in the Test Data Appendix.

Extrusion Technology
358 North Street
Randolph, MA 02368
Tel: 781-963-7200

TEST LOG

CUSTOMER: EXTRUSION TECH **PROGRAM: SHIELDING EFFECTIVENESS**
EQUIPMENT: METAL PANELS **TESTED BY: RON CROOKER**

	Date	Comments
Pre-Test Checklist	4/25/02	Test Plan/Procedure: per Specification Test Specification: modified MIL-STD 285 Chomerics Procedure: CHO TPEC 4.99 EUT Power Requirement Verified: N/A EUT Functional Operational Check: N/A [ ] Pass [ ] Fail 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
	4/25/02	1-4	Shielding Effectiveness	X	X	X	N/A

ost Test hecklist	Date: 4/25/02	EUT Functional Operation Check: N/A	

SHIELDING EFFECTIVENESS TEST DATA:

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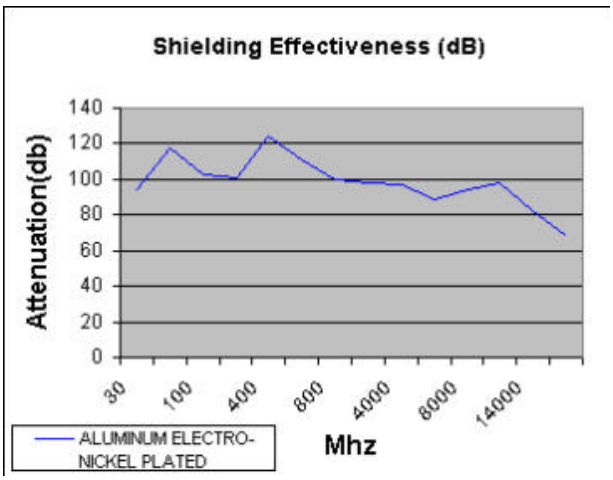
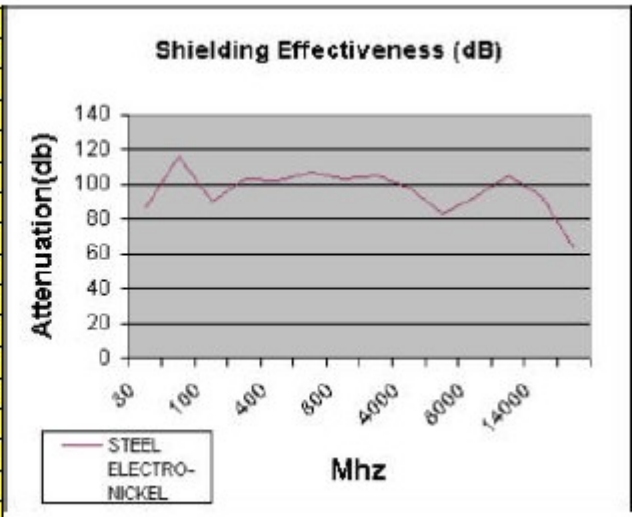
(A) ALUMINUM ELECTRO-NICKEL PLATED

PE OF IELD	FREQUENCY	ANTENNA	OPEN REFERANCE	CLOSED	SHIELDING EFFECTIVENESS (db)
E	30	BICON	-36	<-120	94
E	80	BICON	-2	<-120	118
E	100	BICON	-14	-117	103
E	200	BICON	7	-94	101
E	400	LOG SP	7	-117	124
E	600	LOG SP	5	-106	111
E	800	LOG SP	4	-96	100
E	1000	LOG SP	-2	-100	98
E	4000	HORN	-6	-103	97
E	6000	HORN	-8	-97	89
E	8000	HORN	-9	-103	94
E	10000	HORN	7	-91	98
E	14000	HORN	-10	-92	82
E	18000	HORN	-48	<116	68



(B) STEEL ELECTRO-NICKEL PLATED

YPE OF FIELD	FREQUENCY	ANTENNA	OPEN REFERANCE	CLOSED	SHIELDING EFFECTIVENESS (db)
E	30	BICON	-36	<-123	87
E	80	BICON	-2	<-118	116
E	100	BICON	-14	-104	90
E	200	BICON	7	-96	103
E	400	LOG SP	7	-95	102
E	600	LOG SP	5	-102	107
E	800	LOG SP	4	-99	103
E	1000	LOG SP	-2	-107	105
E	4000	HORN	-6	-104	98
E	6000	HORN	-8	-91	83
E	8000	HORN	-9	-102	93
E	10000	HORN	7	-98	105
E	14000	HORN	-10	-103	93
E	18000	HORN	-48	-111	63



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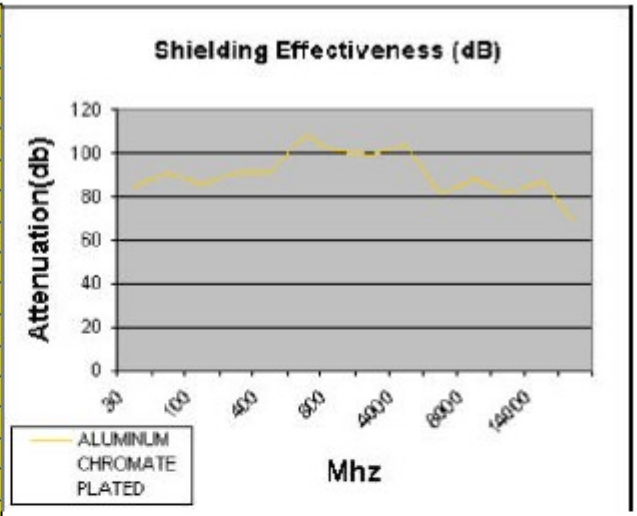
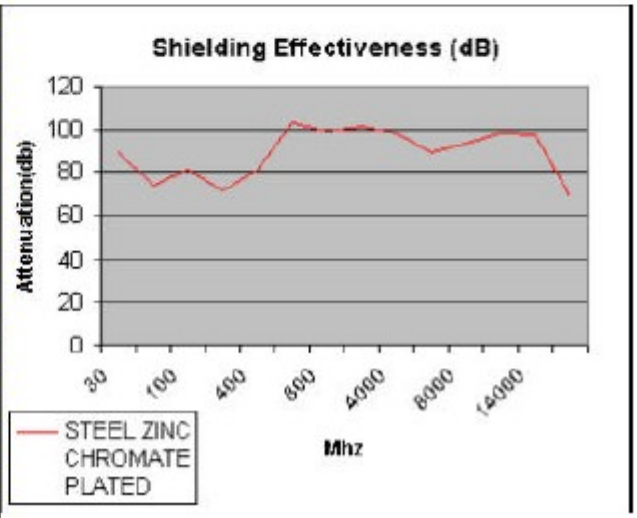
C ALUMINUM CHROMATE PLATED

TYPE OF FIELD	FREQUENCY	ANTENNA	OPEN REFERANCE	CLOSED	SHIELDING EFFECTIVENESS (db)
E	30	BICON	-36	<-121	85
E	80	BICON	-2	-93	91
E	100	BICON	-14	-100	86
E	200	BICON	7	-84	91
E	400	LOG SP	7	-84	91
E	600	LOG SP	5	-103	108
E	800	LOG SP	4	-97	101
E	1000	LOG SP	-2	-101	99
E	4000	HORN	-6	-110	104
E	6000	HORN	-8	-90	82
E	8000	HORN	-9	-97	88
E	10000	HORN	7	-75	82
E	14000	HORN	-10	-97	87
E	18000	HORN	-48	<-116	68



D STEEL ZINC CHROMATE PLATED

TYPE OF FIELD	FREQUENCY	ANTENNA	OPEN REFERANCE	CLOSED	SHIELDING EFFECTIVENESS (db)
E	30	BICON	-36	<-125	89
E	80	BICON	-2	-76	74
E	100	BICON	-14	-95	81
E	200	BICON	7	-64	71
E	400	LOG SP	7	-74	81
E	600	LOG SP	5	-98	103
E	800	LOG SP	4	-95	99
E	1000	LOG SP	-2	-103	101
E	4000	HORN	-6	-104	98
E	6000	HORN	-8	-97	89
E	8000	HORN	-9	-102	93
E	10000	HORN	7	-91	98
E	14000	HORN	-10	-107	97
E	18000	HORN	-48	<-117	69



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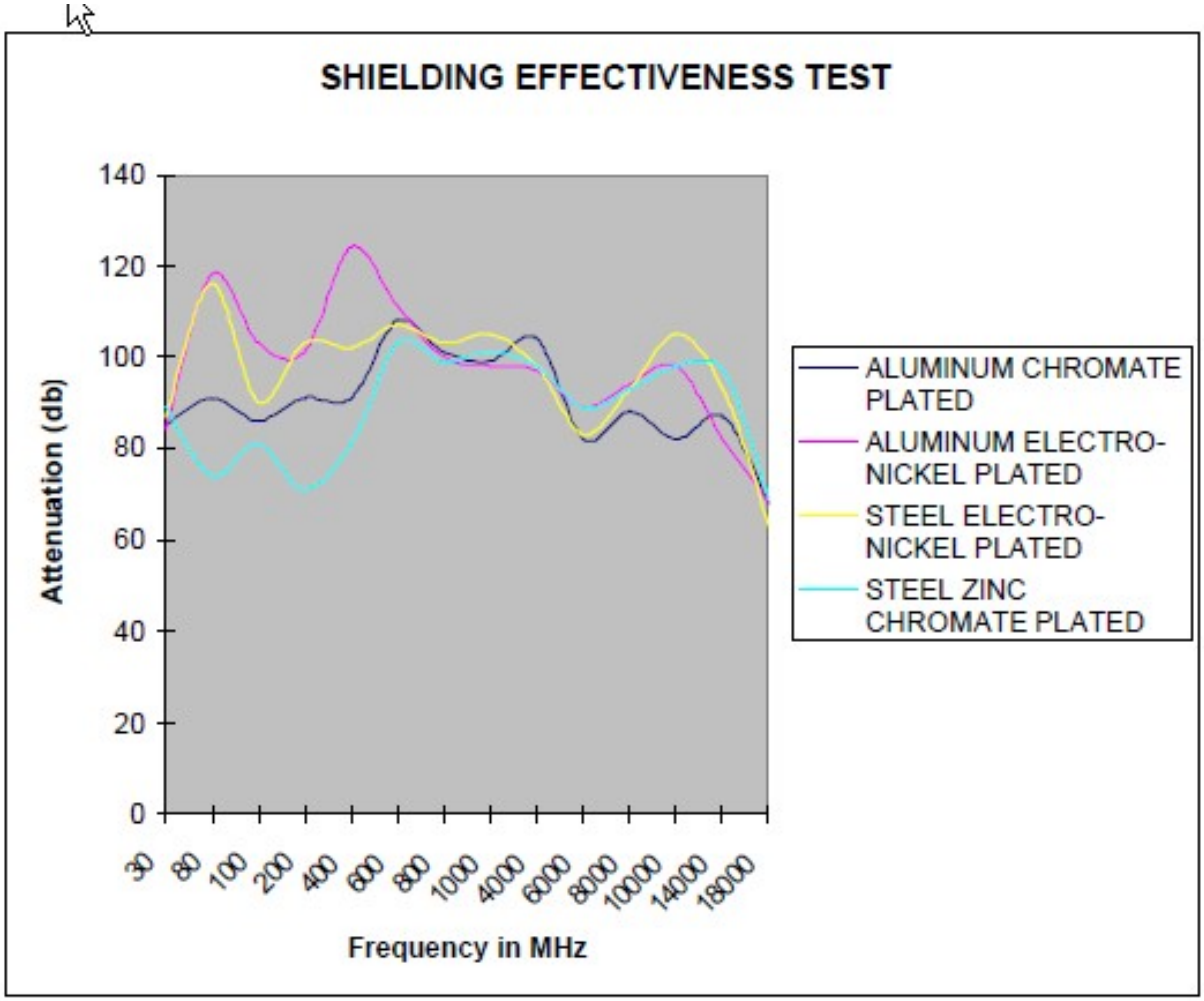
8: SUMMARY

Comparison of the test data:



- The leakage through the base metal is more or less negligible (less than 124 db) for frequency up to 18GHz.
- Actual leakage through the base metal material is not measurable.
- Differences in shielding effectiveness below 1GHz are due to differences in metal surface conductivity. (i.e. plated vs. conversion coat).
- Nickel-plated panel resulted in higher shielding effectiveness below 1GHz due to higher surface conductivity.

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- All test plates and surface treatment combinations had equivalent shielding effectiveness results at frequencies above 1GHz.

For additional details on the testing – or determining whether Aluminum or Steel best meets your application's requirements – contact the Extrusion Technology applications engineering team at:

sales@extrutech.com

www.extrutech.com

or call us at 1-888-444-1644

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