W. W. Hansen Experimental Physics Laboratory
STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305 - 4085

Gravity Probe B Relativity Mission

SHIELDING EFFECTIVENESS TEST REPORT
on
PACIFIC DESIGN TECHNOLOGIES 6" VACUUM VALVE
PART NO. 3223 SERIAL NO. 0002
per
Liberty Bel EMC/EMI Services
Test Procedure TP02-010
December 2002

S0743
January 06, 2003

Approved By
Barry Muhlfelder, Payload Technical Manager — Date: 1/7/03

ITAR Assessment Performed — ITAR Control Required? Yes/No — Date: 1/9/03
Tom Langenstein

TR02-010
Addendum

SHIELDING EFFECTIVENESS TEST REPORT ON PACIFIC DESIGN TECHNOLOGIES 6" VACUUM VALVE PART No. 3223 SERIAL No. 0002

PER
Liberty BEL EMC/EMI Services
Test Procedure TP02-010

LIBERTY BEL EMC/EMI SERVICES
EMC ENGINEERING
December, 2002

SHIELDING EFFECTIVENESS
TEST REPORT
ON
PACIFIC DESIGN TECHNOLOGIES
6" VACUUM VALVE
PART No. 3223
SERIAL No. 0002

TEST PERFORMED BY:
LIBERTY BEL
EMI/EMC SERVICES

	SIGNATURE	DATE
TEST INITIATED	_____	_____
TEST COMPLETED	Barry E. Leathers, LBEL	_____
REPORT WRITTEN BY	Barry E. Leathers, LBEL	_____
TEST ENGINEER	Barry E. Leathers, LBEL	_____
FINAL RELEASE	Barry E. Leathers, LBEL	27 DEC 02

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REVISION NUMBER AND DATE	PAGE CHANGED	PAGE SUBSTITUTED	PAGE ADDED

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1.0 SCOPE

The Vacuum Valve, Part Number 3223, Serial Number 0002 was retested with a wire mesh screen, December 8, 2002 in accordance with the tests and requirements of Liberty BEL EMC/EMI Services test procedure TP02-010, which shall be referred to as the subject specifications for the remainder of this report.

The applicable test requirements of the subject specifications are presented here for convenience.

TEST TYPE	PARAGRAPH	FREQUENCY RANGE	TEST POINTS
Shielding Effectiveness	10.3	1MHz - 10GHz	Case

2.0 TEST RESULTS

The test results are tabulated in the test summary and the referenced test data sheet are presented in Appendix A.

The test sample passed the test requirements of the subject specifications.

3.0 GENERAL INFORMATION OF TESTING

3.1 Security Classification

The test sample was unclassified.

3.2 Test Facility

All tests were performed at National Technical Systems, Fullerton California.

3.3 Test Equipment

The test instruments used during testing covered by this report are presented in the equipment list, as Figure B-12 in Appendix B.

3.3.1 Instrument Calibration Policy

The Liberty BEL adheres to a standard calibration cycle. Each category "A" instrument undergoes recalibration every 12 months. While other instruments are recalibrated of a periodic basis. All calibration is traceable to the National Institute of Science and Technology.

3.4 Test setup

The test setups required for the various test conformed to the test provisions stated in the subject specification.

Typical test setup photographs showing the test sample and associated equipment used are included in Appendix B, as Figure B-l through Figure B-10.

3.5 Sample Calculations

Figure B-11, included in Appendix B, provide a example of methods used to calculate system dynamic range and shielding effectiveness levels that are compared with the test specification limits.

4.0 DISPOSITION OF TEST SAMPLE

Upon conclusion of the testing, the test sample was returned to Pacific Design Technologies, 72 Santa Felicia Drive, Goleta, CA 93117.

APPENDIX A

TEST DATA

ENGINEERING T

TYPE TEST Shielding Effectiveness

Project Vacuum Valve | Cust. and No. PDT J02-010

Part No. 3223 | Specification LBEL TP02-010

Serial No. 002 | Test Order 02-010

Conducted by BELBROTHERS | Approved/Witnessed by

Date 8 Dec 02 | Date

Miscellaneous

Shielding Effectiveness (S.E.) of 6 '' Vacuum Valve

Freq. (Hz) Ant. Polarity	Open Door Signal Reading (dBm)	Close Door Signal Reading (dBm)	Dynamic Range (dB)	Spec. Limit S.E. (dB)
1 MHz (Vert)	-14.1	-93	78.9	35
16 MHz (Vert.)	-6.3	-79	72.7	35
100 MHz (Vert.)	-9.8	-64	54.2	35
100 MHz (Hori)	-9.8	-64	54.2	35
500 MHz (Hori)	14.2	-66	51.8	35
1 GHz (Vert.)	-12	-74	62	35
1 GHz (Hori.)	-12	-74	62	35
3 GHz (Vert.)	-9.7	-69	59.3	35
3 GHz (Hori.)	-9.7	-69	59.3	35
10 GHz (Vert.)	-27	-73	46	35
10 GHz (Hori.)	-27	-73	46	35

ENGINEERING T

TYPE TEST Shielding Effectiveness

Project Vacuum Valve **Cust. and No.** PDT J02-010

Part No. 3223 **Specification** LBEL TP02-010

Serial No. 002 **Test Order** 02-010

Conducted by BELEATHERS **Approved/Witnessed by**

Date 8 DEC 02 **Date**

Miscellaneous RETEST W/ WIRE MESH SCREEN

Shielding Effectiveness (S.E.) of 6 '' Vacuum Valve

Freq. (Hz) Ant. Polarity	Open Door Signal Reading (dBm)	Open Flap Signal Reading (dBm)	S.E. (dB)	Spec. Limit S.E. (dB)
1 MHz (Vert)	-14.1	-74	-59.9	35
16 MHz (Vert.)	-6.3	-74	67.7	35
100 MHz (Vert.)	-9.8	-59	49.2	35
100 MHz (Hori)	-9.8	-52	42.2	35
500 MHz (Hori)	14.2	-48	62.2	35
1 GHz (Vert.)	-12	-56	44	35
1 GHz (Hori.)	-12	-59	47	35
3 GHz (Vert.)	-9.7	-71	61.3	35
3 GHz (Hori.)	-9.7	-73	63.3	35
10 GHz (Vert.)	-27	-73	46	35
10 GHz (Hori.)	-27	-67	40	35

APPENDIX B

TEST SETUP PHOTOGRAPHS

SAMPLE CALCULATION

EQUIPMENT LIST

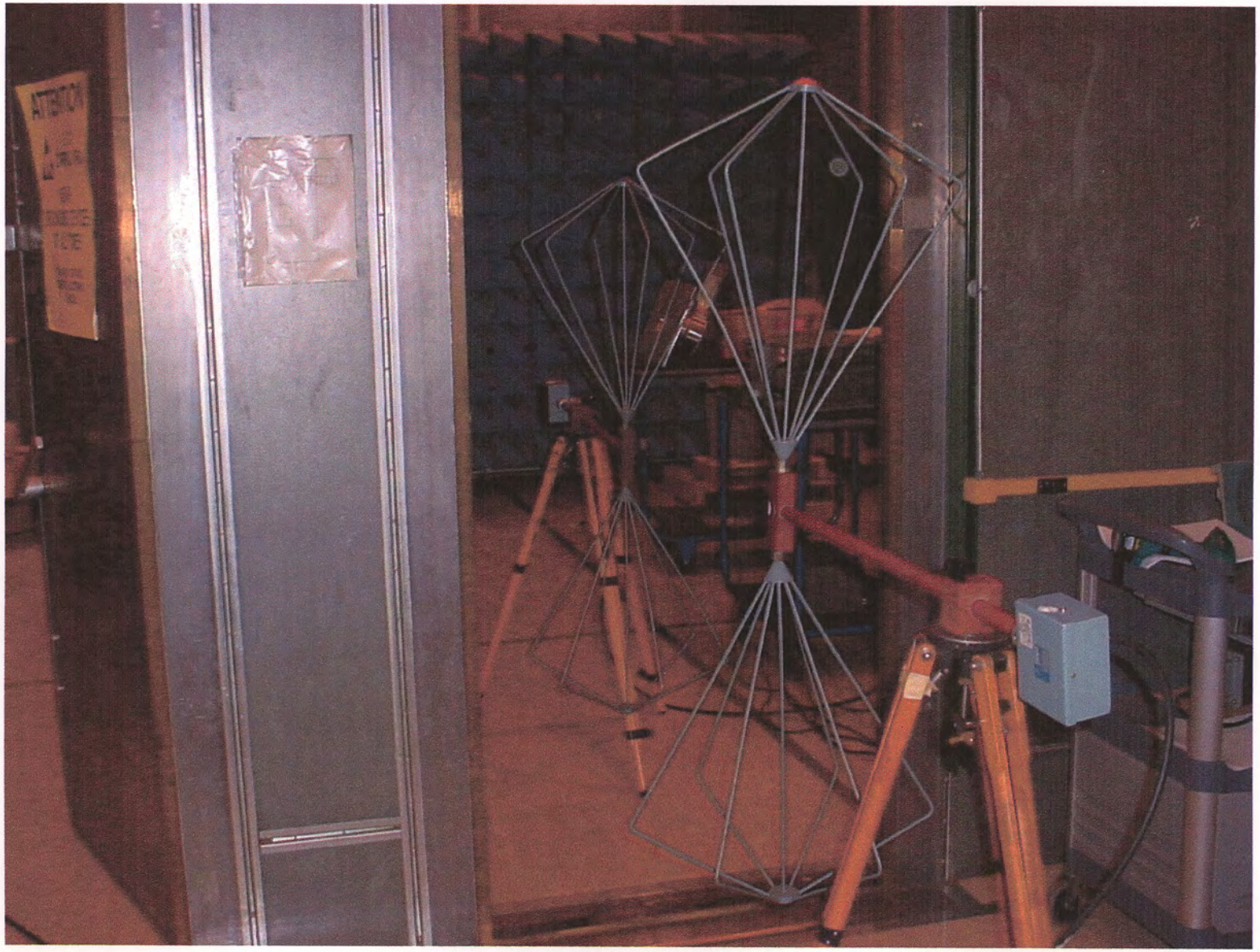

FIGURE B-1 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 100 MHz, Open Door)

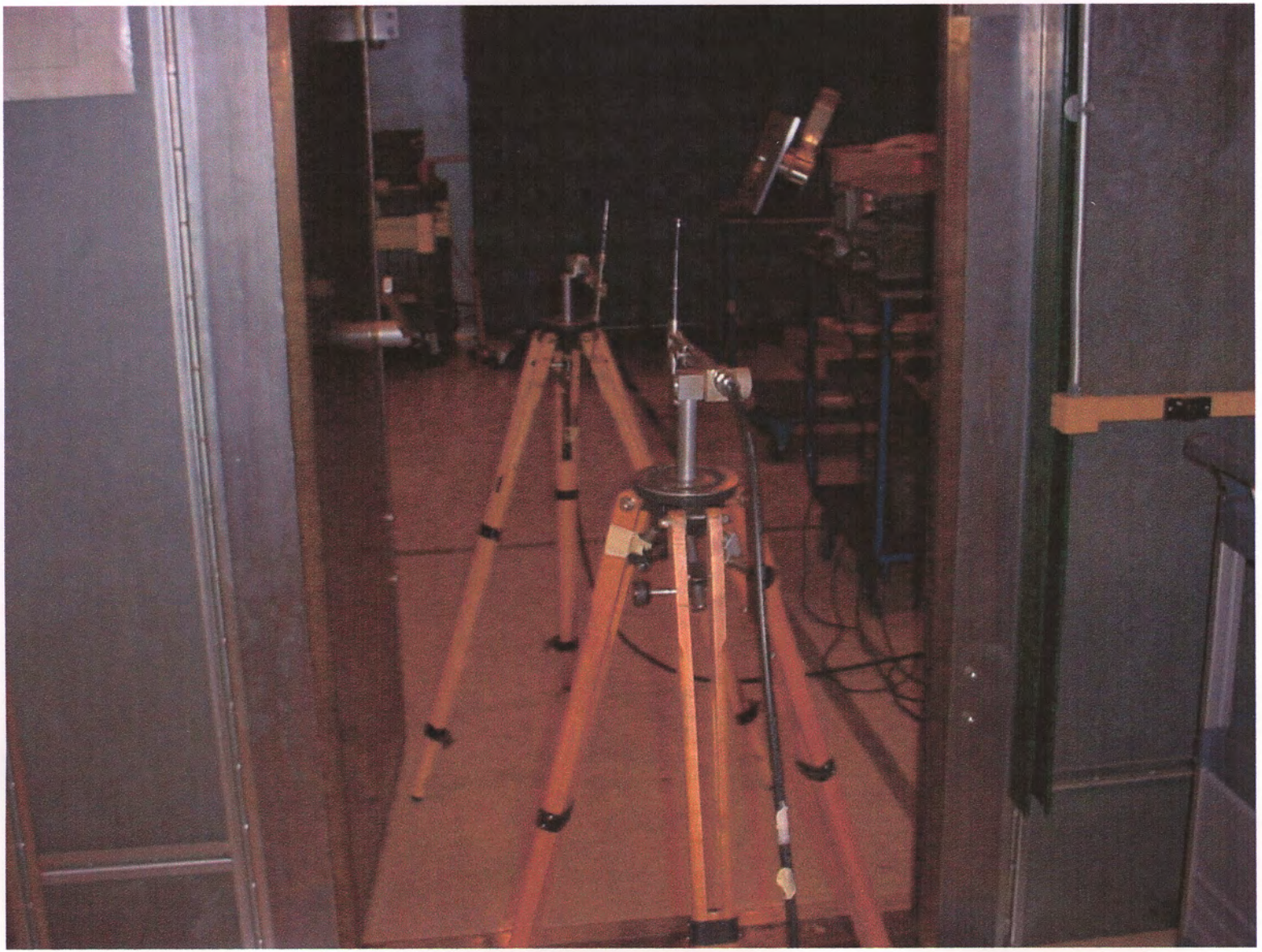

FIGURE B-2 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 500 MHz, Open Door)

FIGURE B-3 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 1, 3, 10 GHz, Open Door)

FIGURE B-4 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 1, 16 MHz, Xmit. Ant.)

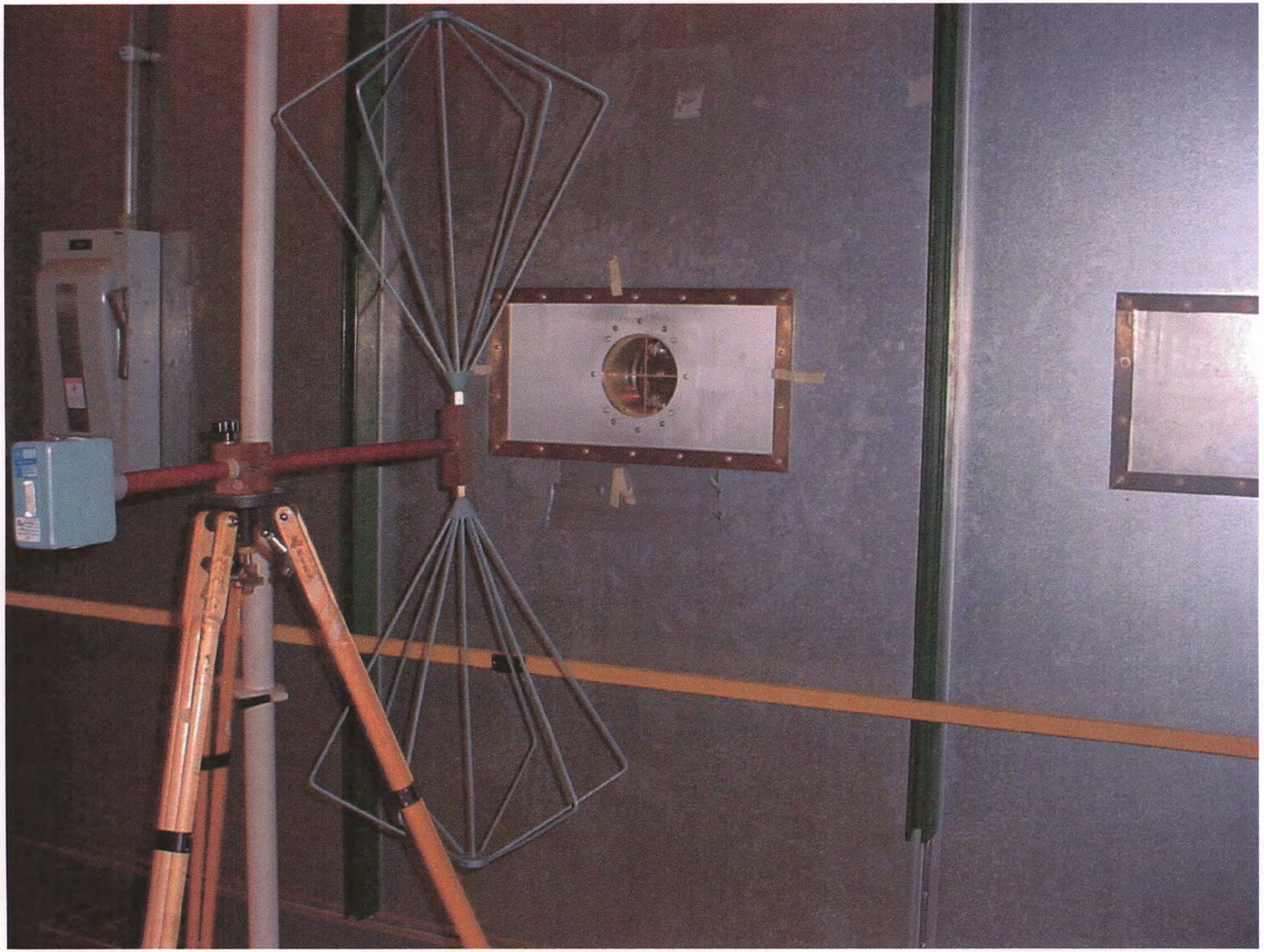

FIGURE B-5 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 100 MHz, Xmit. Ant.)

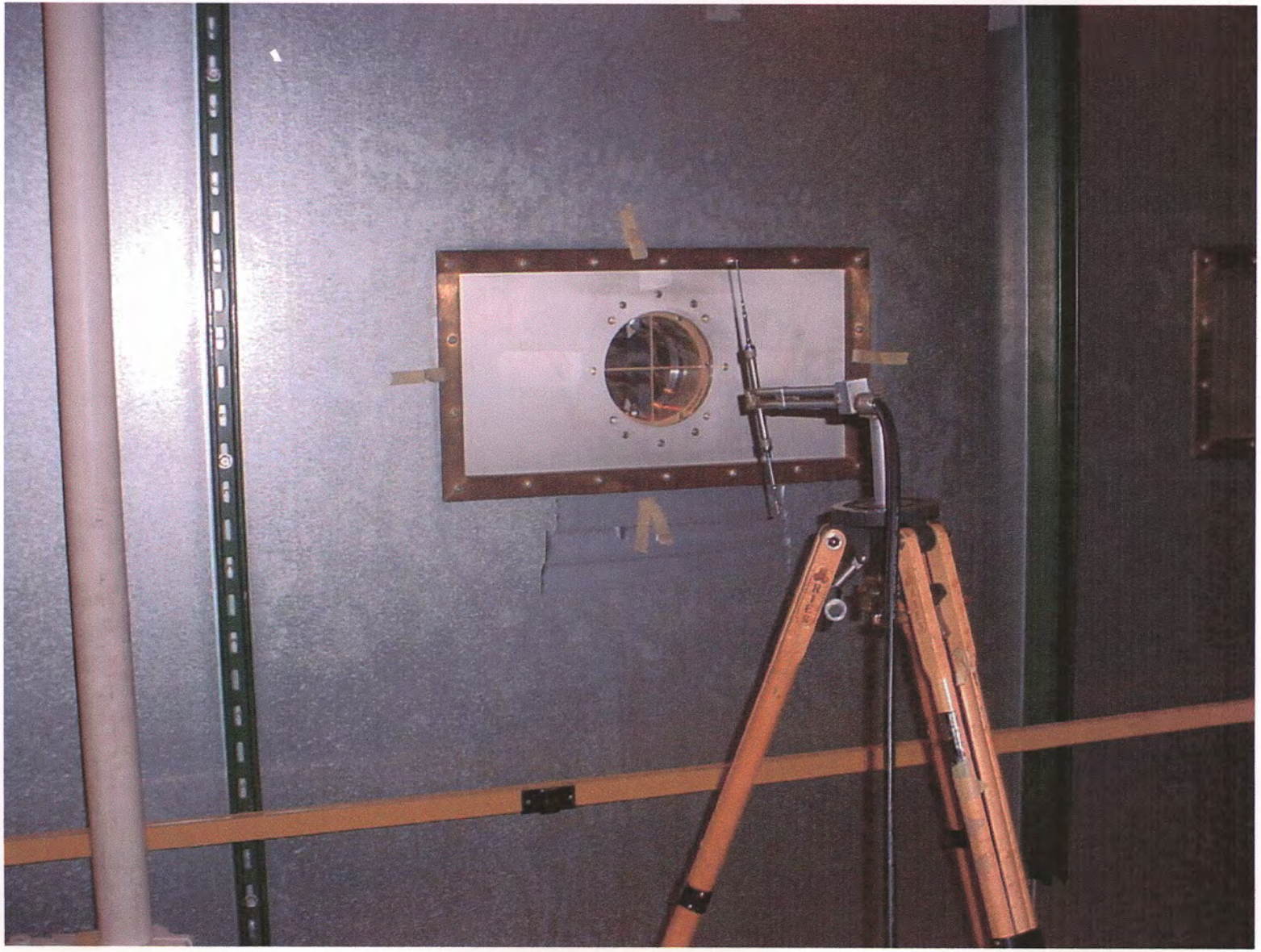

FIGURE B-6 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 500 MHz, Xmit. Ant.)

FIGURE B-7 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 1, 3, 10 GHz, Xmit. Ant.)

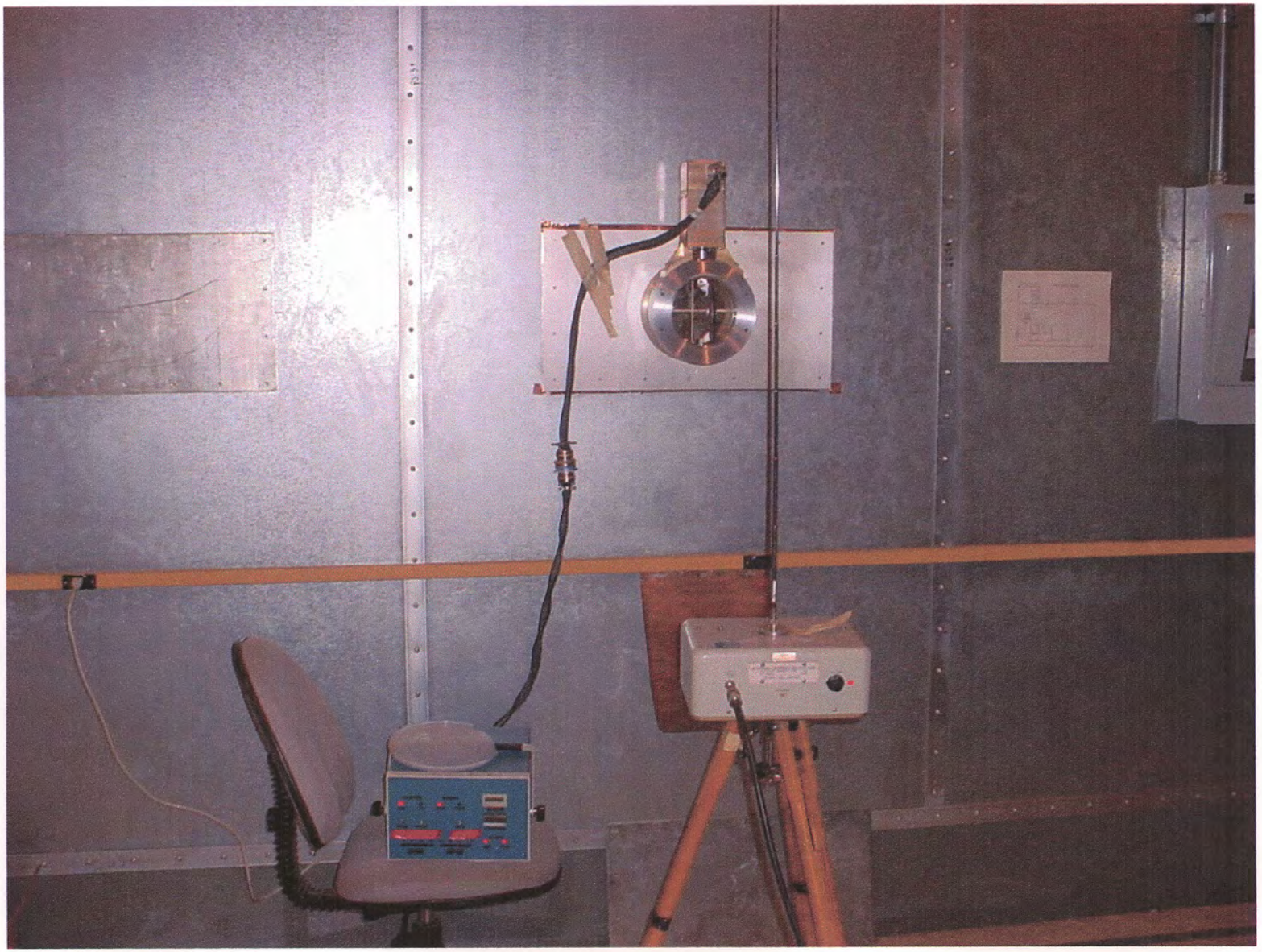

FIGURE B-8 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 1, 16 MHz, Rec. Ant.)

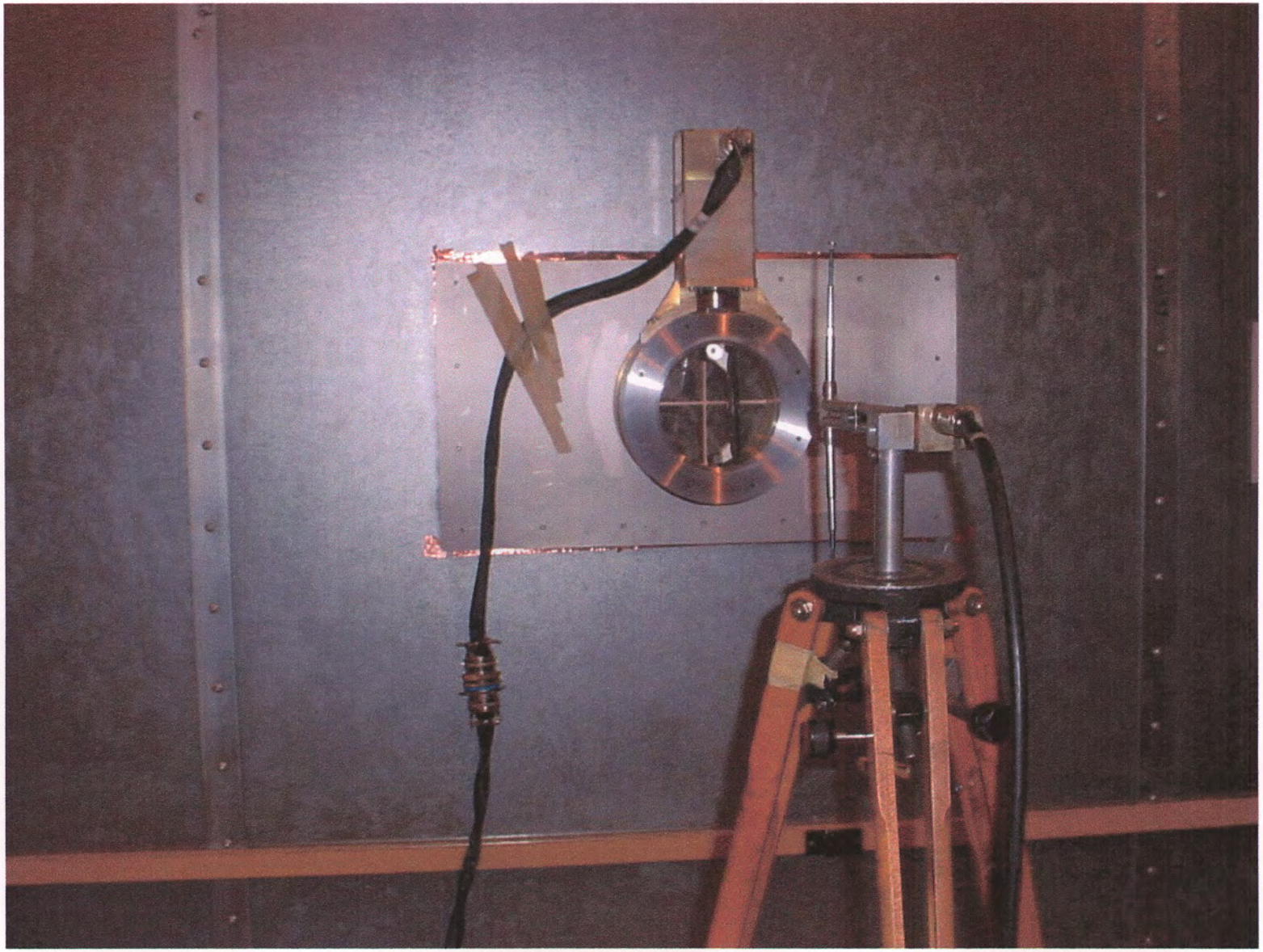

FIGURE B-9 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 500 MHz, Rec. Ant.)

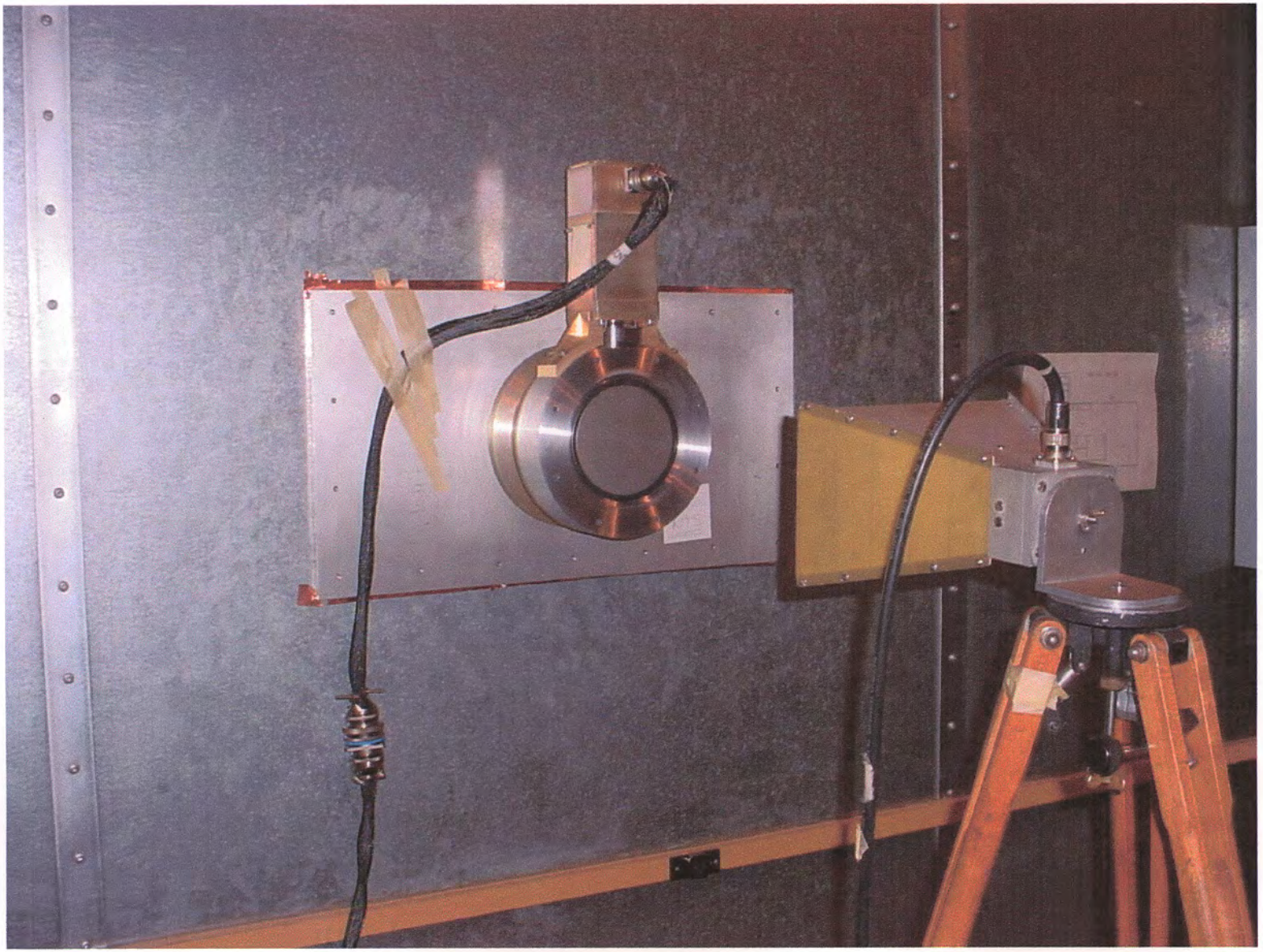

FIGURE B-10 SHIELDING EFFECTIVENESS TEST SETUP (6" Valve, 1, 3, 10 GHz, Rec. Ant.)

Sample Calculations

1. Compute the Dynamic Range (DR).

   where DR (dB) = OD - RN = -7.8 - (-97) = 89.2

   OD: Spectrum Analyzer Open Door Reading (dBm)
   RN: Spectrum Analyzer Internal Noise Floor (dBm)

2. Compute the Shielding Effectiveness (S.E.) of Close Door (CD).

   where S.E. of BP (dB) = OD - Close Door = -7.8 - (-96.2) = 88.4

   OD: Spectrum Analyzer Open Door Reading (dBm)
   CD: Spectrum Analyzer Close Door Reading (dBm)

3. Compute the Shielding Effectiveness (S.E.) of Vacuum Valve (V)

   where S.E. of V (dB) = OD - V = -7.8 - (-96) = 88.2

   OD: Spectrum Analyzer Open Door Reading (dBm)
   V: Spectrum Analyzer Vacuum Valve Reading (dBm)

EQUIPMENT LIST

A. Receivers: The following test instruments with their antennas and accessories, were used during testing covered by this report.

FREQUENCY RANGE	NOMENCLATURE	SERIAL N0.	CAL. DUE DATE
100Hz - 22GHz	Hewlett Packard 8566B	E 4985 F	10-07-03
ACCESSORIES			
10KHz - 32MHz	Eaton 95010-1 (rec.)	E 4875 F	10-03-03
10KHz - 40MHz	Stoddart 90929-2 (xmit)	E 4875 F	N/A
20MHz - 200MHz	Ailtech 94455-1 (rec.)	E 4872 F	12-04-03
20MHz - 200MHz	Eaton 94455-1 (xmit.)	E 4876 F	08-24-03
375MHz - 1.0GHz	Stoddart 91598-2 (dipole)	E 4894 F	N/A
375MHz - 1.0GHz	Stoddart 91598-2 (dipole)	E 4895 F	N/A
1GHz - 18GHz	Eaton 96001 (rec.)	E 4866 F	08-24-03
1GHz - 18GHz	EMCO 3115 (xmit.)	E 4865 F	10-12-03
0.1MHz - 1.0GHz	Hewlett Packard 8648C	E 5472 F	07-30-03
0.05 -36GHz	Hewlett Packard 8673D	E 4638 F	01-22-03
800kHz - 1GHz	Amplifier Research 5W1000	E 5462 F	N/A
2GHz - 4GHz	Hughes TWTA 1277H01	E 4678 F	N/A
8GHz - 12.4GHz	Hughes TWTA 1277H03	E 4680 F	N/A

APPENDIX C

TEST PROCEDURE

TP02-010

SHIELDING EFFECTIVENESS TEST PROCEDURE ON PACIFIC DESIGN TECHNOLOGIES 2.5" AND 6" VACUUM VALVES PART NUMBERS 3179 AND 3223

PREPARE FOR:
PACIFIC DESIGN TECHNOLOGIES
P.O. 40468

PREPARED BY:
LIBERTY BEL EMC/EMI SERVICES
JUNE, 2002

APPROVED BY: Barry E. Leathers

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1.0 SCOPE

This test plan details the test procedures to be applied to the test sample, and the test limits necessary to verify compliance with the general EMI/EMC requirements of MIL-STD-285 and NSA65-6.

2.0 APPLICABLE DOCUMENTS

The following specifications and standards, of the issue in effect on the date of award of contract, shall form a part of this document to the extent specified herein. In the event of conflict between this document and the following specifications and standards, including the specifications and standards referenced herein, this document shall govern.

MIL-STD-285 25 Jun 1957	Attenuation Measurements for Enclosures, Electromagnetic Shielding, For Electronic Test Purposes, Method of
NSA65-6 20 Oct 1964	National Security Agency Specification for R.F. Shielded Enclosures for Communication Equipment: General Specification
MIL-STD-831 28 Aug 1963	Test Report, Preparation of
MIL-STD-45662A 15 Aug 1962	Calibration System Requirements

3.0 INTERFERENCE CONTROL REQUIREMENTS

The test sample shall be subjected to the electromagnetic interference requirements of MIL-STD-285 and NSA65-6.

The laboratory test results shall be compared with the specification limits for compliance therein. The applicable EMI test requirements are listed in Table 1.

Table 1

FREQUENCY (Hz)	SHIELDING EFFECTIVENESS (dB)
1 MHz	35
16 MHz	35
100 MHz	35
500 MHz	35
1 GHz	35
3 GHz	35
10 GHz	35

4.0 TEST SAMPLE

The test samples submitted for test shall be the Part Numbers 3179 and 3223, Vacuum Valves

4.1 Connector Pin Functional Assignment

P1 (J1) Connector Pin (3179 & 3223)	Function
A	M1, PHA, +28 VDC
B	M1, PHA, -28 VDC
C	M1, PHB, +28 VDC
D	M1, PHB, -28 VDC
E	M2, PHA, +28 VDC
F	M2, PHA, -28 VDC
G	M2, PHB, +28 VDC
H	M2, PHB, -28 VDC
J	A - OPEN EXCITE
K	A - OPEN SENSE
L	A - CLOSE EXCITE
M	A - OPEN SENSE
N	A - RETURN
P	B - OPEN EXCITE
R	B - OPEN SENSE
S	B - CLOSE EXCITE
T	B - CLOSE SENSE
U	B - RETURN

5.0 TEST SAMPLES CONFIGURATION

5.1 Primary Power

The primary power applied to the test samples is 28 VDC. The test samples shall not be supplied 28 VDC during the performance of the test required by this document.

5.2 Mounting and Bonding

The test samples shall be mounted and bonding to a shielded enclosure interface plate. The dimension a the interface plate are show in Figure A- 4. The plate shall mounted and bonded to the shielded enclosure at the point indicated as the room peneration panel.

5.3 Support Equipment

Electronic support equipment will not be required during the performance of test required by this document.

6.0 TEST SAMPLE OPERATION

6.1 Open Valve

There shall be one open valve mode of operation which is define as follows:

A. Manual open and secure the valve.

B. Make EMI measurements.

6.2 Close Valve

There shall be one close valve mode of operation which is define as follows:

A. Manual close and secure the valve.

B. Make EMI measurements.

Note: Personnel and equipment to monitor performance of the test sample will be provided by Pacific Design Technologies.

7.0 TEST CONDITION

7.1 Primary Power

The primary power per paragraph 5.1 will not be needed during the performance of test required by this document.

All AC voltages are RMS unless otherwise noted.

7.2 Test Facility

One Shielded enclosure manufactured by Electronics Construction Company shall be used as the test facility for the conduction of the EMI test. The enclosure shall have a shielding effectiveness of at least 10 dB higher than the requirement listed in Table 1.

7.3 Inspection

All electromagnetic interference tests described herein may be witness by the authorized representatives of Pacific Design Technologies.

8.0 INSTRUMENTATION

8.1 Radio Interference and Field Intensity Meter

The following test instruments are available for performing tests covered in this document.

FREQUENCY RANGE	NOMENCLATURE	SERIAL NO.
l0KHz - 1.0GHz	Hewlett Packard 8590A	2839A03856
10KHz - 32MHz	Ailtech NM 17/27	113 / 128
30MHz - 1GHz	Ailtech NM 37/57	190 / 826
lGHz - l0GHz	CarNel Labs NM 67	67-B
10KHZ - 320GHz	Tektronix 492P	1383
ACCESSORIES		
Tektronix Digital Plotter	4662	B057076
Tektronix Display Terminal	4l07A	B023281
Tektronix Controller	4041	B020576

8.2 Antennas

The following antennas are available for performing tests covered in this document..

FREQUENCY RANGE	NOMENCLATURE	SERIAL N0.
10kHz - 32MHz	41" Rod Ant, Ailtech 945942-1	TBD
20MHz - 200MHz	Biconical, Ailtech 94455-1	TBD
370MHz - l GHz	Dipole, Stoddart 91598-2	TBD
1GHz - 18 Ghz	Double Ridge Guide, EMCO 3115	TBD

8.3 Signal Generator

The following laboratory type signal generators are available for performing the tests covered by this test plan.

FREQUENCY RANGE	MANUFACTURER	MODEL NO.	SERIAL NO.
Signal Generator	Ailtech	460	515
Signal Generator	Alfred	650	Main Frame
1 - 2GHz Plug-in	Alfred	650	1854-7
2 - 4GHz Plug-in	Alfred	650	1880
8 - 12.4GHz Plug-in	Alfred	650	1625

8.4 Auxiliary Instrumentation

The following items of test equipment are available for interference and/or susceptibility testing.

NOMENCLATURE	MANUFACTURER	MODEL NO.	SERIAL NO.
RF Amplifier	IFI	5520	011171LB01
RF Amplifier	Eaton	3552A	2189-90310
RF Amplifier	ENI	350L	26192
RF Amplifier	ENI	240L	525
TWTA	Hughes	1177H01F000	152
TWTA	Hughes	8020H03F00	271

8.5 Accessory Equipment.

Accessory equipment used in conjunction with measurement receiver shall not degrade measurement integrity.

8.6 Equipment Substitution

If necessary, the test engineer may substitute similar instruments for those listed above, with equivalent tolerance, performance characteristics, and or sensitivity.

8.7 Excess Personnel and Equipment.

The area shall be kept free of unnecessary personnel, equipment, cable racks, and desks. Only the equipment essential to the test being performed shall be in the test area or enclosure. Only personnel actively involved in the test shall be permitted in the enclosure.

8.8 Calibration Requirements

Test equipment and accessories required for measurement in accordance with this document shall be calibrated under an approved program in accordance with MIL-STD-45662. In particular, measurement antennas, current probes, filed sensors, and other devices used in the measurement loop shall be calibrated at least every two years.

8.8.1 Measurement System Test

At the start of each emission test, the complete system (including measurement receivers, cables, attenuators, couplers, and so forth) shall be verified by injecting a known signal, as stated in the individual test method, while monitoring system output for the proper indication. The EMI test engineer shall verify that all instruments are in calibration during their use. The date of last calibration for each instruments used shall be recorded at the time of use and reported in the EMI test report.

8.8.2 Antenna Factors.

Factors for electric field test antennas shall be determined in accordance with SAE ARP-958.

8.9 Instrument Operation

Interference measuring instrument operation and calibration shall be in accordance with the test specification and the manufacturers recommendations. In the event of conflict, the test procedure shall take precedence except as otherwise noted. Meters shall be operated in the peak mode of operation for all measurements. The instruments are direct meter reading.

8.10 Measurement Instrument Grounding

The interference measuring instruments shall be physically grounded with only one connection at all times and the antenna shall be remote from the meter if possible.

8.11 Accuracy of Measurement

The expected accuracy of measurement shall be:

Frequency Accuracy: $\pm$ 2%

Amplitude Accuracy: $\pm$ 2 dB.

Distance: $\pm$ 5%

Time (waveforms): $\pm$ 5%

Amplitude, measurement system (includes measurement receivers, transducers, cables and so forth): $\pm$ 3dB

9.0 TEST PROGRAM DEVIATION

Unless otherwise directed by the responsible engineer, electromagnetic interference test described herein may be performed in any sequence indicated in Table 1 of this document.

In the event that the test plan deviations are required during the normal qualification test program, they shall be made only upon approval of the cognizant representative and his approval shall be noted in the test log with complete description and justification for such deviations.

10.0 TEST PROCEDURE

10.1 Prequalification Acceptance Tests

Prior to the start of EMI testing, a functional test of the test sample shall be performed to insure proper operation of the test system.

10.2 Ambient Tests

Ambient condition measurements shall be made across the frequency range for all frequency domain emissions testing. Ambient measurements shall be made with all equipment on except for the system under test.

10.3 Shielding Effectiveness

10.3.1 Shielding Effectiveness, SE01, 1MHz - 10GHz

In the performance of this test, the Dynamic Range (dB) which is the difference between the receiver noise floor and the amplitude of the received signal, and the enclosure's Shielding Effectiveness (dB) without the test samples installed must first be determined to insure that test conditions are adequate before evaluating the test samples. Refer to Figure A-1 for test data sheet.

10.3.2 The following procedures shall be followed.

A. Setup the test equipment and shielded enclosure as shown in Figures SE01-1 and SE01-2, the electric field measurement. Note: At the room peneration panel, the soild blank interface plate is installed. Open the door which signal isolates the two antennas.

B. With the transmitter's signal turned off, tune the EMI meter for a 1 MHz signal. Measure and record this level as the Receiver Noise (RN) at the frequency of 1MHz.

C. Repeat Step B for the frequency of 16 MHz.

D. Turn the transmitter on and allow sufficient time to stabilize.

E. Tune the transmitter for a 1 MHz signal to be received and monitored by the EMI meter.

F. Re-tune the EMI meter so as to receiver the 1MHz transmitted signal. Measure the received signal amplitude, incease the amplitude at the signal generator, if the difference between received signal amplitude and the receiver noise floor RN is not greater than or equal to the required shielding effectiveness level (dB) plus 10. Once the signal amplitude above receiver noise floor requirement is met record as the Open Door (OD) Reading at the frequency of 1 MHz. Record generator (Gs) setting. Compute and record the Dynamic Range (DR), where DR (dB) = OD - RN.

G. Repeat Steps E and F for the frequency of 16 MHz.

H. Turn transmitter off. With the solid blank plate in place at the peneration panel, move both the transmit and receive antennas so that they are separated by the common wall; the distance separating the antennas shall be maintained. The antennas shall be laterally centered on the blank plate. Close and secure the door.

I. Repeat Steps D through G using the predetermined generator (Gs) settings of Step F. Record as the Blank Plate Reading (BP) for the appropriate frequency.

J. Compute the Shielding Effectiveness (S.E. of BP) of the blank plate as: S.E. of BP(dB) = OD - BP, for the appropriate frequency. Note: S.E. of BP(dB) must be greater than or equal to the requirements of Table 1 before continuing.

K. Turn transmitter off. Replace the blank plate with an interface plate having any one of the two test samples mounted on it. The test sample shall be centered both vertically and laterally on the plate. The antennas shall be laterally centered on the plate; the distance separating the antennas shall be maintained. Close and secure the door.

L. With the valve in the open position per paragraph 6.1, repeat Step I through J. Record as the Open Valve Reading (OV) for the appropriate frequency. Compute S.E. of OV(dB) = OD - OV, for the appropriate frequency.

M. With the valve in the close position the paragraph 6.2, repeat Step I through J. Record as the Close Valve Reading (CV) for the appropriate frequency. Compute S.E. of CV(dB) = OD - CV, for the appropriate frequency.

N. Repeat Steps A through M for the setup shown in Figure SE01-3, the plane wave measurements of 100MHz and 500MHz.

O. Repeat Steps A through M for the setup shown in Figure SE01-4, the plane wave measurements of 1GHz, 3GHz and 10GHz.

P. Repeat Steps A through O for the second test sample.

10.3.3 Data Presentation

Data presentation shall be as a follows:

A. Provide indications of compliance with this document requirements.

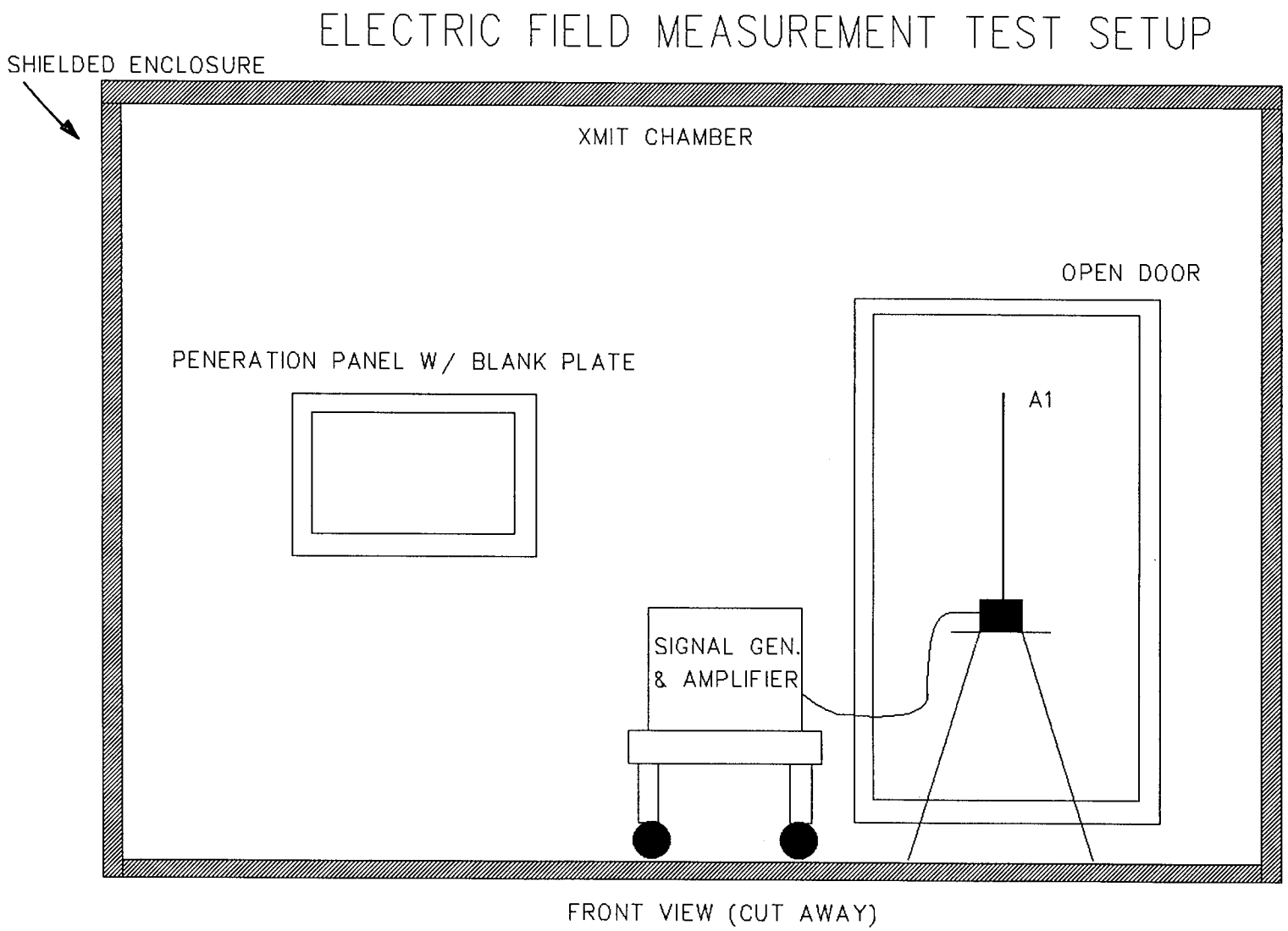


FIGURE SE01-1 SHIELDING EFFECTIVENESS (1MHz & 16MHz)

A1 & A2: Rod Antenna w/ Counterpoise

D: 26 INCHES

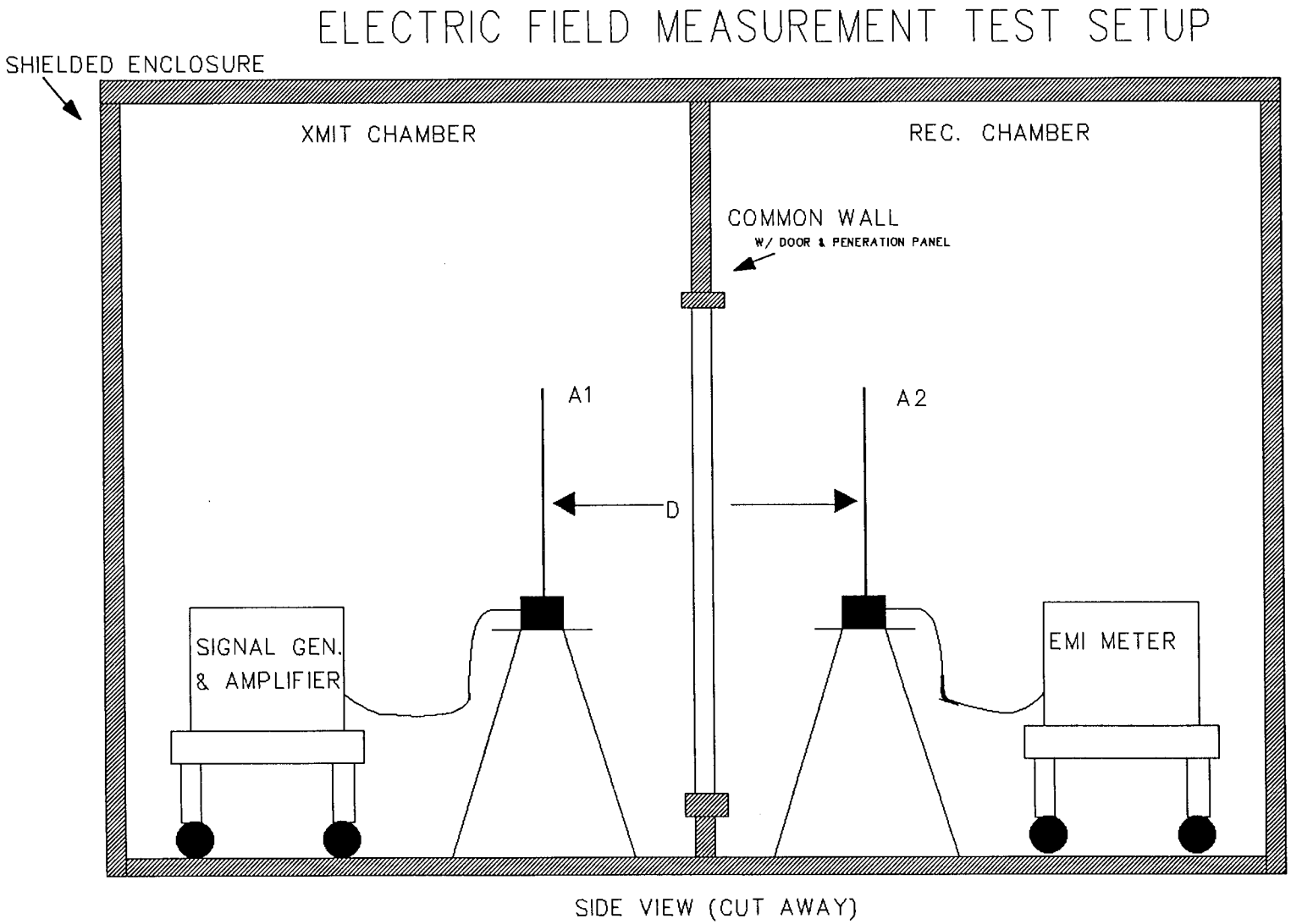


FIGURE SE01-2 SHIELDING EFFECTIVENESS (1MHz & 16MHz)

A1 & A2: Rod Antenna w/ Counterpoise

D: 26 INCHES

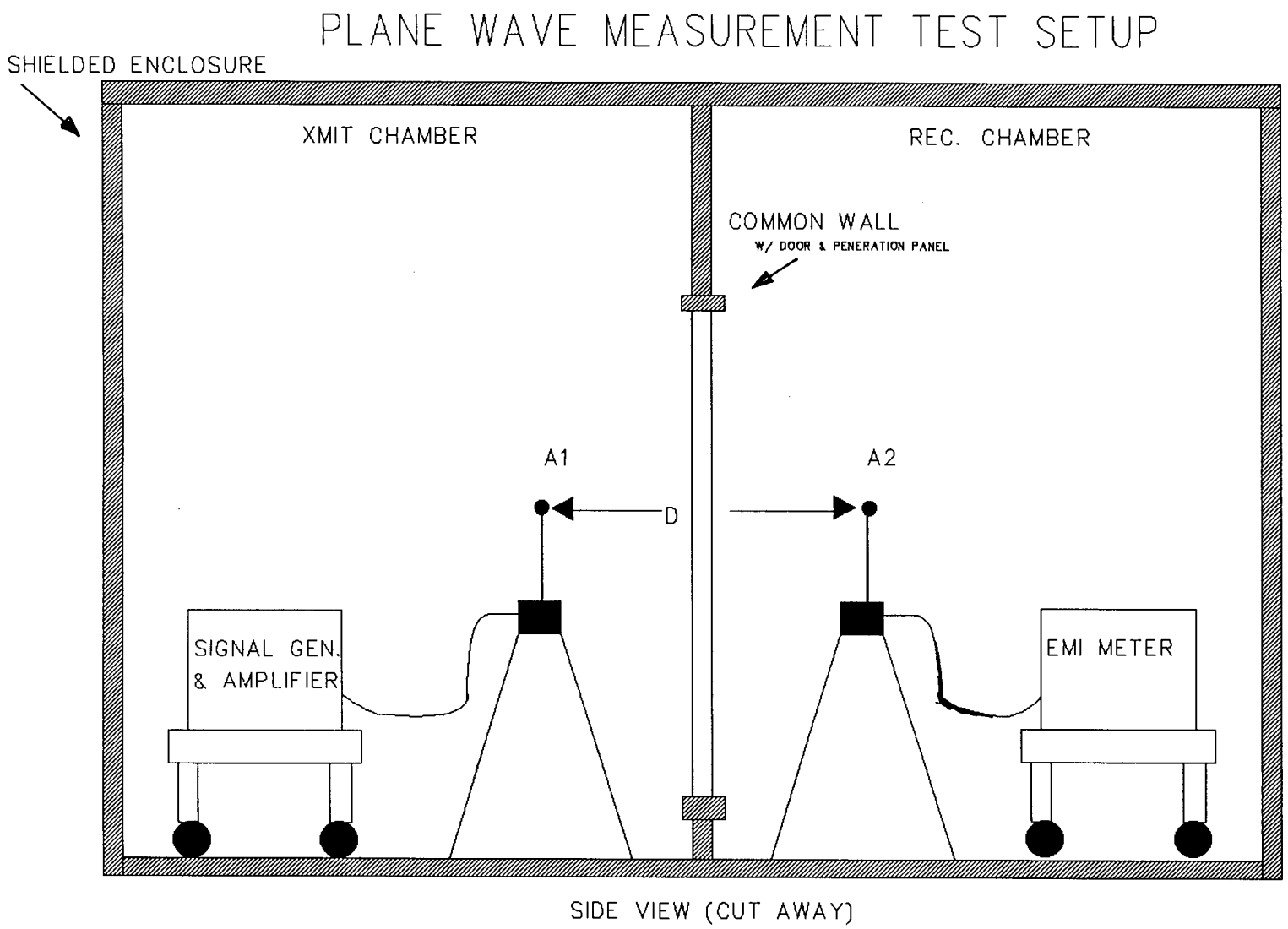


FIGURE SE01-3 SHIELDING EFFECTIVENESS (100MHz & 500MHz)

A1 & A2: Dipole Antennas

D: >= lampda*2 where lampda = 300/frequency (MHz)

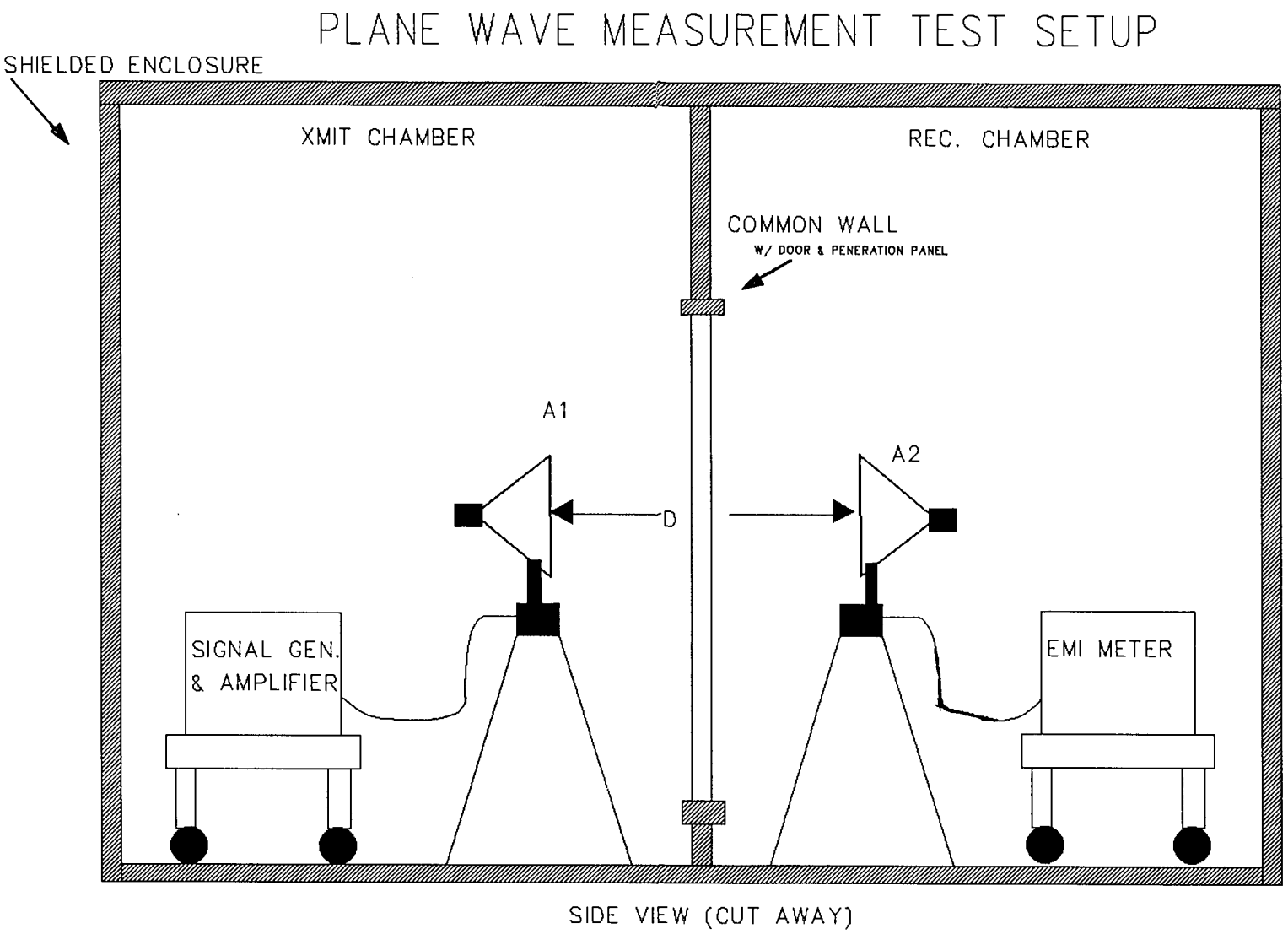


FIGURE SE01-4 SHIELDING EFFECTIVENESS (1GHz, 3GHz & 10GHz)

A1 & A2: Horn Antennas

D: >= lampda*2 where lampda = 300/frequency (MHz)

11.0 TEST REPORT

Upon completion of this program a separate report, conforming to MIL-STD-831, shall be issued. The approved test plan shall be included as an Appendix to the report. The report shall include a description of any EMI fixes or modifications determined necessary to enable test sample compliance with EMI requirements.

APPENDIX A

Liberty BEL

EMC/EMI

Services

ENGINEERING TEST DATA

TYPE TEST SHIELDING EFFECTIVENESS PAGE

Project VACUUM VALVE Cust. and No. PACIFIC DESIGN TECH.

Part No. Specification LBEL TP02-010

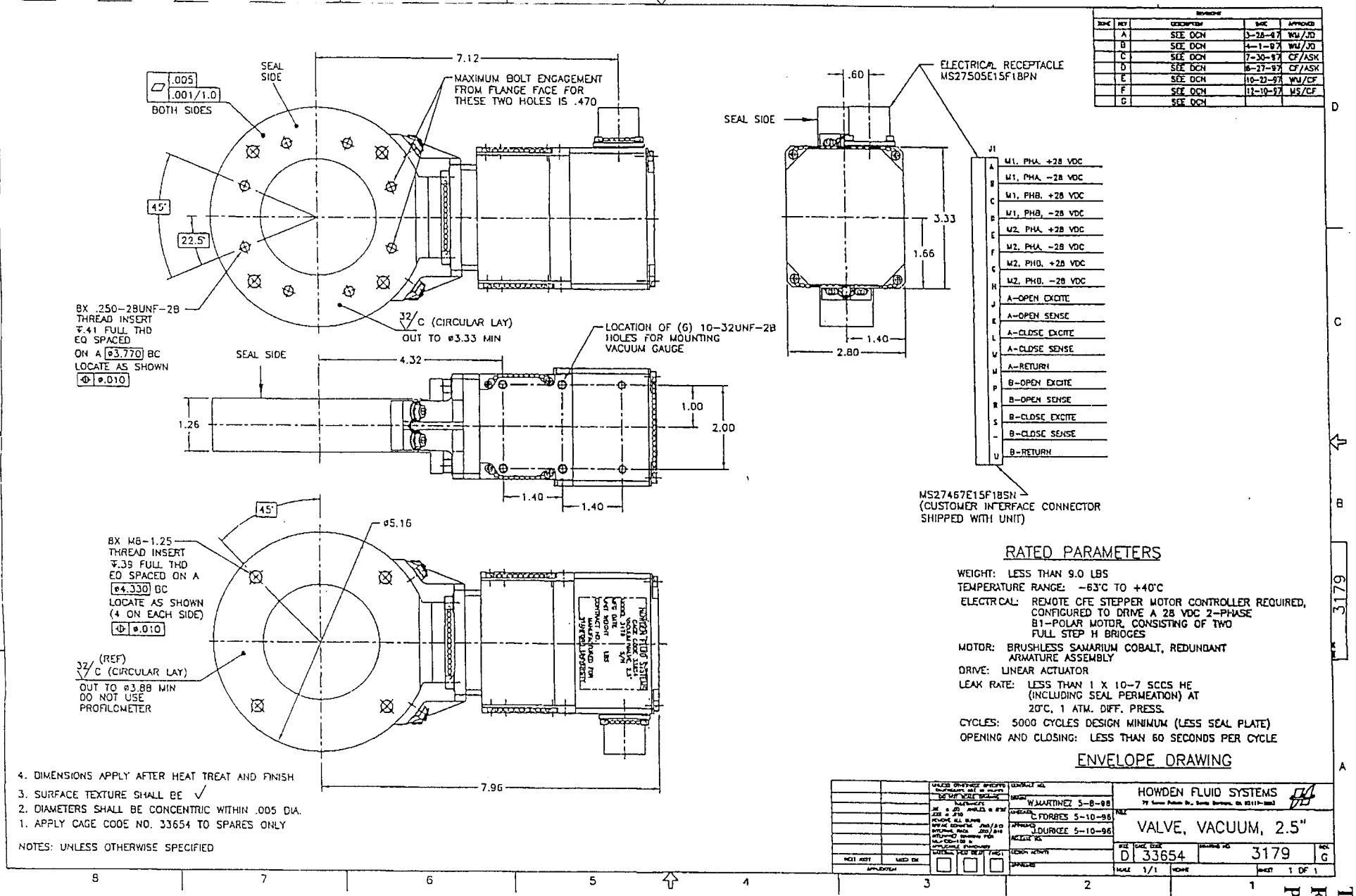
Serial No. Test Order

Conducted by Approved/Witnessed by

Date Date

Miscellaneous

FREQUENCY (Hz)						
1 MHz						
16 MHz						
100 MHz						
500 MHz						
1 GHz						
3 GHz						
10 GHz						



ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	SEE DCN	3-28-97	WU/JD
	B	SEE DCN	4-1-97	WU/JD
	C	SEE DCN	7-30-97	CF/ASK
	D	SEE DCN	8-27-97	CF/ASK
	E	SEE DCN	10-23-97	WU/CF
	F	SEE DCN	12-10-97	MS/CF
	G	SEE DCN		

RATED PARAMETERS

WEIGHT: LESS THAN 9.0 LBS
TEMPERATURE RANGE: -63°C TO +40°C
ELECTRICAL: REMOTE CFE STEPPER MOTOR CONTROLLER REQUIRED, CONFIGURED TO DRIVE A 28 VDC 2-PHASE BI-POLAR MOTOR, CONSISTING OF TWO FULL STEP H BRIDGES
MOTOR: BRUSHLESS SAMARIUM COBALT, REDUNDANT ARMATURE ASSEMBLY
DRIVE: LINEAR ACTUATOR
LEAK RATE: LESS THAN 1 X 10-7 SCCS HE (INCLUDING SEAL PERMEATION) AT 20°C, 1 ATM. DIFF. PRESS.
CYCLES: 5000 CYCLES DESIGN MINIMUM (LESS SEAL PLATE)
OPENING AND CLOSING: LESS THAN 60 SECONDS PER CYCLE

ENVELOPE DRAWING

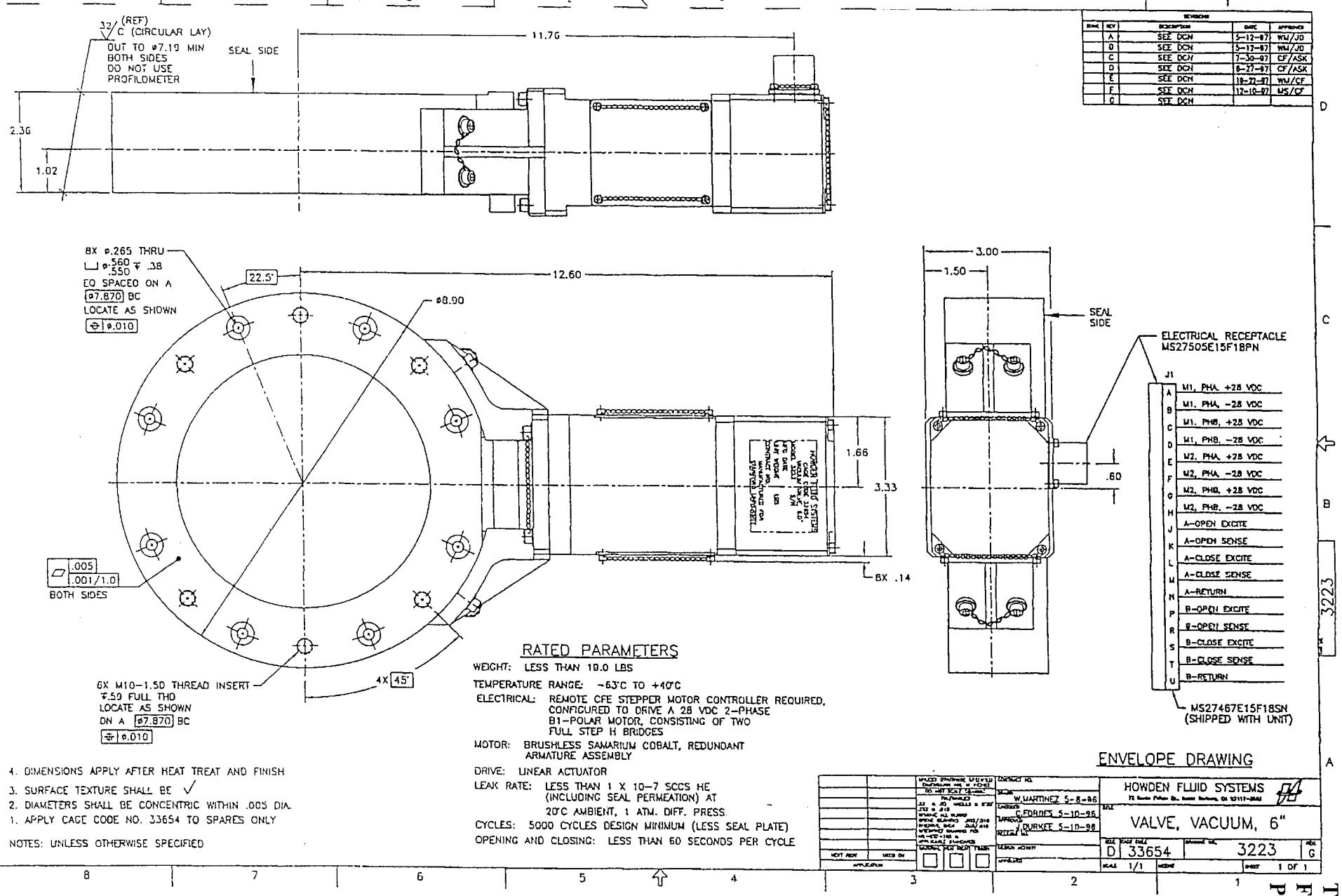
4. DIMENSIONS APPLY AFTER HEAT TREAT AND FINISH
3. SURFACE TEXTURE SHALL BE √
2. DIAMETERS SHALL BE CONCENTRIC WITHIN .005 DIA.
1. APPLY CAGE CODE NO. 33654 TO SPARES ONLY

NOTES: UNLESS OTHERWISE SPECIFIED

DRAWN	W.MARTINEZ 5-8-96	HOWDEN FLUID SYSTEMS
CHECKED	C.FORBES 5-10-96	VALVE, VACUUM, 2.5"
APPROVED	J.DURKEE 5-10-96	
SIZE D	CAGE CODE 33654	DRAWING NO. 3179 REV G
SCALE 1/1	WEIGHT	SHEET 1 OF 1

3179

TP02-010
FIGURE A-2
Page 21



RATED PARAMETERS

WEIGHT: LESS THAN 19.0 LBS

TEMPERATURE RANGE: -63°C TO +40°C

ELECTRICAL: REMOTE CFE STEPPER MOTOR CONTROLLER REQUIRED, CONFIGURED TO DRIVE A 28 VDC 2-PHASE BI-POLAR MOTOR, CONSISTING OF TWO FULL STEP H BRIDGES

MOTOR: BRUSHLESS SAMARIUM COBALT, REDUNDANT ARMATURE ASSEMBLY

DRIVE: LINEAR ACTUATOR

LEAK RATE: LESS THAN 1 X 10-7 SCCS HE (INCLUDING SEAL PERMEATION) AT 20°C AMBIENT, 1 ATM. DIFF. PRESS.

CYCLES: 5000 CYCLES DESIGN MINIMUM (LESS SEAL PLATE)

OPENING AND CLOSING: LESS THAN 60 SECONDS PER CYCLE

4. DIMENSIONS APPLY AFTER HEAT TREAT AND FINISH
3. SURFACE TEXTURE SHALL BE √
2. DIAMETERS SHALL BE CONCENTRIC WITHIN .005 DIA.
1. APPLY CAGE CODE NO. 33654 TO SPARES ONLY

NOTES: UNLESS OTHERWISE SPECIFIED

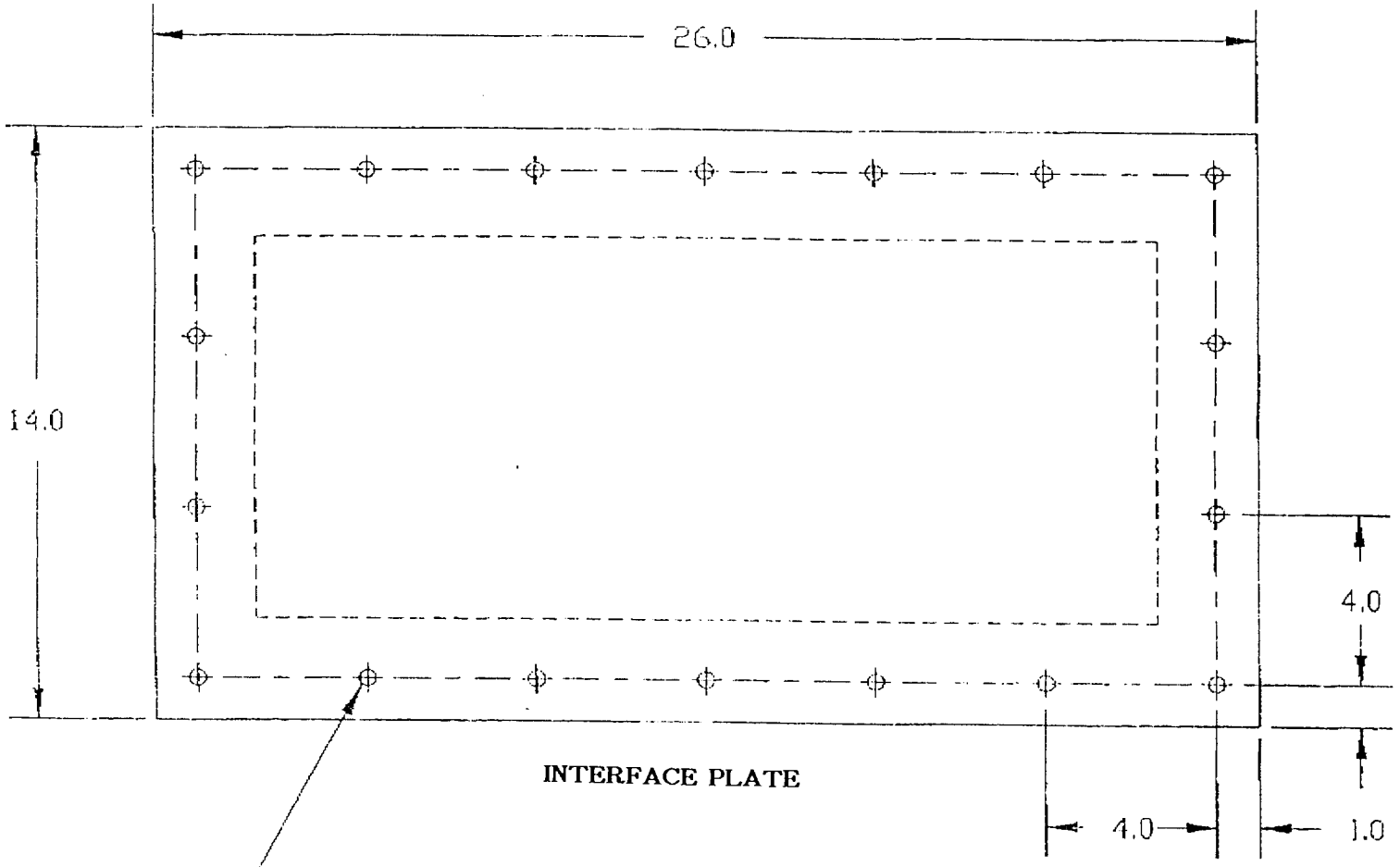
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	SEE DCN	5-12-97	WM/JD
	B	SEE DCN	5-17-97	WM/JD
	C	SEE DCN	7-30-97	CF/ASK
	D	SEE DCN	8-27-97	CF/ASK
	E	SEE DCN	10-22-97	WM/CF
	F	SEE DCN	12-10-97	MS/CF
	G	SEE DCN		

ENVELOPE DRAWING

DRAWN	W.MARTINEZ 5-8-96	HOWDEN FLUID SYSTEMS	
ENGINEER	C.FORNES 5-10-96	TITLE: VALVE, VACUUM, 6"	
APPROVED	J.DURKEE 5-10-98	SIZE D	CAGE CODE 33654
		DRAWING NO. 3223	REV G
		SCALE 1/1	WEIGHT
		SHEET 1 OF 1	

NOTES:

1. DWG NOT TO SCALE.
2. ALL DIMENSIONS IN INCHES.
3. MAT'L: 3/8" THK. ALUMINUM
4. QTY: 1 EA.



INTERFACE PLATE

CUSTOMER	
JOB NO.	
DATE/REV.	12-8-95, REV. A
PAGE	1 OF 1
DRAWING	FTP-1A.DWG, 126