MOTOROLA

Integrated Information Systems Group
8201 E. McDowell Road
Scottsdale, AZ 85252-1417

Report No. 91007-00226-01

Exhibit 6 – Test Report

BiStatix™ BDR-1000

RFID Tag Reader/Programmer

FCC ID: E9U05866001T1

Model No. BDR-1000

Equipment Manufacturer:	**Indala Corporation *(subsidiary of Motorola, Inc.)*** **3041 Orchard Parkway** **San Jose, CA 95134**
Tests Conducted By:	**Motorola IISG** **EMC Test Facility** **8201 E. McDowell Rd.** **Scottsdale, Arizona 85252**
Tests Period:	**April 10th to April 20th, 2001**
Test Summary:	**Complies with FCC Part 15, Subpart C, Unlicensed Low Power Transmitters**

The Motorola SSG EMC/TEMPEST Laboratory is accredited through the

NVLAP®

NVLAP Lab Code 100405-0

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6.0 Introduction

6.0.1 Product Description

The Motorola BiStatix™ BDR-1000 is a Radio Frequency Identification device (RFID). The product is capable of either reading or programming RFID tags. The primary intent is that this product be used as a Development Station for the design of paper BiStatix™ cards and tags. This technology utilizes Electric Fields and Capacitance coupling to complete the RF link between the electronics module and the identification device.

The reader outputs data in Wiegand, ABA Track II, magnetic stripe or RS-232C formats, making it easy to upgrade an existing site to proximity using the wiring already in place.

Product Specifications:

Frequency of Operation

-Excitation	125 kHz Typical
-Data Carrier	62.5 kHz Typical
-Data Rate	7.8125 kbits/second Typical

6.0.2 Facility Description

EMI testing of the BDR-1000 Reader/Programmer was performed at the Motorola Integrated Information Systems Group's (IISG) EMI/TEMPEST Test Laboratory. This test laboratory is located in the southeast wing of the Hayden building at 8201 E. McDowell Road, Scottsdale, AZ.

Motorola IISG Test Facility Address:

Motorola, Inc.
Integrated Information Systems Group
Hayden EMC Facility
8201 E. McDowell Rd. M/D H2550
Scottsdale, AZ 85252

The facility has been found to be in compliance with the requirements of Section 2.948 of the FCC rules, per FCC letter 31040/SIT, 1300F2, dated October 6, 1998. The facility has also been issued a Certificate of Accreditation through the National Voluntary Laboratory Accreditation Program (NVLAP) by NIST. This is under NVLAP Code: 100405-0 and is effective through September 30, 2001.

6.0.3 Quality System

The EMI/TEMPEST Test Laboratory maintains a Quality Manual that describes the quality assurance program of the EMC/TEMPEST Facility to set forth procedures covering all quality assurance functions. This manual has been constructed to reflect a quality program in compliance with the requirements of the following:

- National Institute of Standards & Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP)
- NIST/NVLAP EMC MIL-STD 462 Program Handbook (Apr. 1994)
- NVLAP EMC and Telecommunications FCC Methods Handbook 150-11 (Apr. 1995)
- MIL-Q-9858A, MIL-STD 461, 462, 463, 461D, 462D
- National Security Agency Technical and Security Requirements Document for the Endorsed TEMPEST Test Services Program, NSA TSRD No. 88-8B, 5 Oct. 1993
- System Solution Group of Motorola Quality Six Sigma Program.

6.0.4 Standard References

47 CFR 2	Code of Federal Regulations, Title 47, Part 2, "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
47 CFR 15	Code of Federal Regulations, Title 47, Part 15, "Radio Frequency Devices" Subpart C, "Intentional Radiators"
C63.4-1992	American National Standards Institute (ANSI), "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

6.1 Test Procedures

6.1.1 Requirements

The BDR-1000 reader/programmer is subject to FCC Part 15, Subpart C and Part 2 for FCC Certification for units marketed within the United States. The following tests, as specified in FCC Part 2, with limits as defined in FCC Part 15, and shown in Table 6.1-1 below were performed on the access control reader.

Table 6.1-1 Tests Required for Certification of the 125 kHz BDR-1000 Reader/Programmer

Test Parameter	FCC Part 2 Paragraph Number	FCC Part 15 Paragraph Number	FCC Part 15 Limit
Field Strength of Spurious Emissions	2.1053	15.209	**Freq (MHz) Limit (uV/m) d (m)** .009-0.490 MHz 2400/F(kHz) 300m 0.490-1.705 MHz 24000/F 30 m 1.705-30 MHz 30 30 m 30-88 MHz 100 3 m 88-216 MHz 150 3m 216-960 MHz 200 3m Above 960 MHz 500 3m
Restricted Bands of Operation		15.205	Does not operate in any restricted bands; Spurious requirements same as 15.209
AC Conducted Emissions		15.207	47.95 dBuV

6.1.2 Operational Configuration

The BDR-1000 RFID Tag Reader/Programmer was tested in its typical operational configuration. The BDR-1000 unit was set up and operated in a continuous transmit mode at the frequency of 125 kHz and at its maximum rated output power for all tests. All testing was done in a radiated test setup since the antenna is an integral part of the unit. The RS-485 interface was looped back into itself using the dual RJ45 interfaces on the back of the unit. The RS-232 was terminated into the connector load provided. A general test setup is shown as Figure 6.1-1.

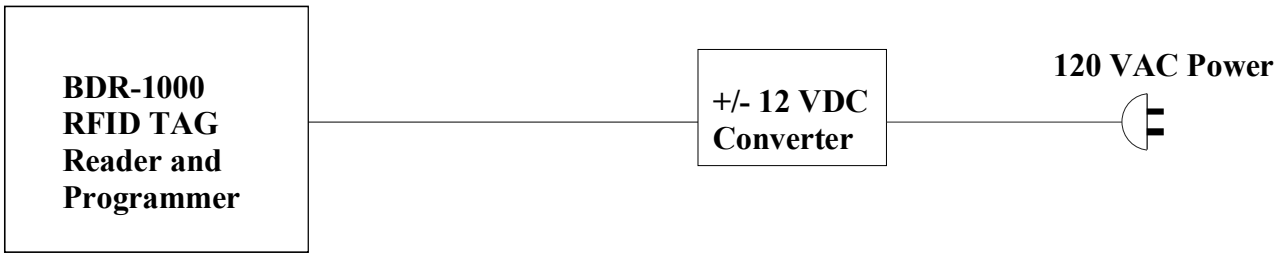


Figure 6.1-1 General Test Setup for Tests

6.1.3 Measurement Equipment

Test Equipment Nomenclature	Motorola Item Number	Manufacturer	Model Number	Cal. Date	Cal. Due
Biconilog Antenna	T47085	EMCO	3142B	10/31/00	10/31/01
Biconilog Antenna	T47086	EMCO	3142B	10/31/00	10/31/01
H-Field Loop Antenna	T36610	Electro Metrics	ALP-70	NCR	NCR
Antenna Mast	0003-2246	EMCO	2070-2	NCR	NCR
Antenna Controller	G72315	EMCO	2090	NCR	NCR
Spectrum Analyzer/ EMI Receiver	G68094	Rhode & Schwarz	ESI40	5/01/00	5/31/01
EMI Receiver	G53133	Rhode & Schwarz	ESMI	10/09/00	10/31/01
Spectrum Analyzer/ EMI Receiver	G71179	Rhode & Schwarz	ESI-7	8/29/00	8/31/01

6.1.4 Radiated Spurious Emissions Procedure

Radiated spurious emissions were measured over the frequency range of 9 kHz to 1 GHz in an anecohic chamber (20ft x 24ft x 16ft) and an open area test site (OATS). Refer to Figure 6.1-2 and 6.1-3 for test setups.

The radiated emissions between 9 kHz and 30 MHz, including the carrier level, were measured in an anechoic chamber using a shielded magnetic loop antenna at a 3-meter distance. The levels were extrapolated to the required test distance defined in 47 CFR Part 15 using the square of an inverse linear distance formula. Rotating the equipment on the turntable maximized these emissions. The magnetic loop antenna, when used, was also rotated along its vertical axis to maximize the signals.

The radiated emissions above 30 MHz were initially measured in a semi-anechoic shield room in order to identify the emissions before proceeding to the open area test site (OATS). This provides the capability of taking accurate measurements in a higher ambient environment such as at the rooftop OATS. The Rohde & Schwarz EMI Receiver System was used for the pre-scans. Typically, signals within approximately 20 dB of the limit are noted for measurements on the OATS.

Final measurements on the OATS were taken with a Rohde & Schwarz EMI Receiver System receiver system at a 3-meter test distance from the receiving antenna. The BDR-1000 was placed on a .8 meter high non-conductive table on a rotating turntable that is flush with the site ground plane. The receiving antenna was scanned over a height range from 1 to 4 meters in both antenna polarities, and the turntable was rotated 360 degrees. The highest emissions were recorded and the final field strength level determined using the following formula:

Field Strength (dBuV/m) = Measured Level (dBuV) + Cable Loss (dB) + Antenna Factor (dB)

6.1.5 AC Powerline Conducted, 450 kHz to 30 MHz

AC power line conducted emissions were performed using the Rhode & Schwarz EMI receiver and a Line Impedance Stabilization Network (LISN). Both AC high and neutral were tested.
The test methods of ANSI 63.4 were used for performing the AC Conducted Emissions tests.

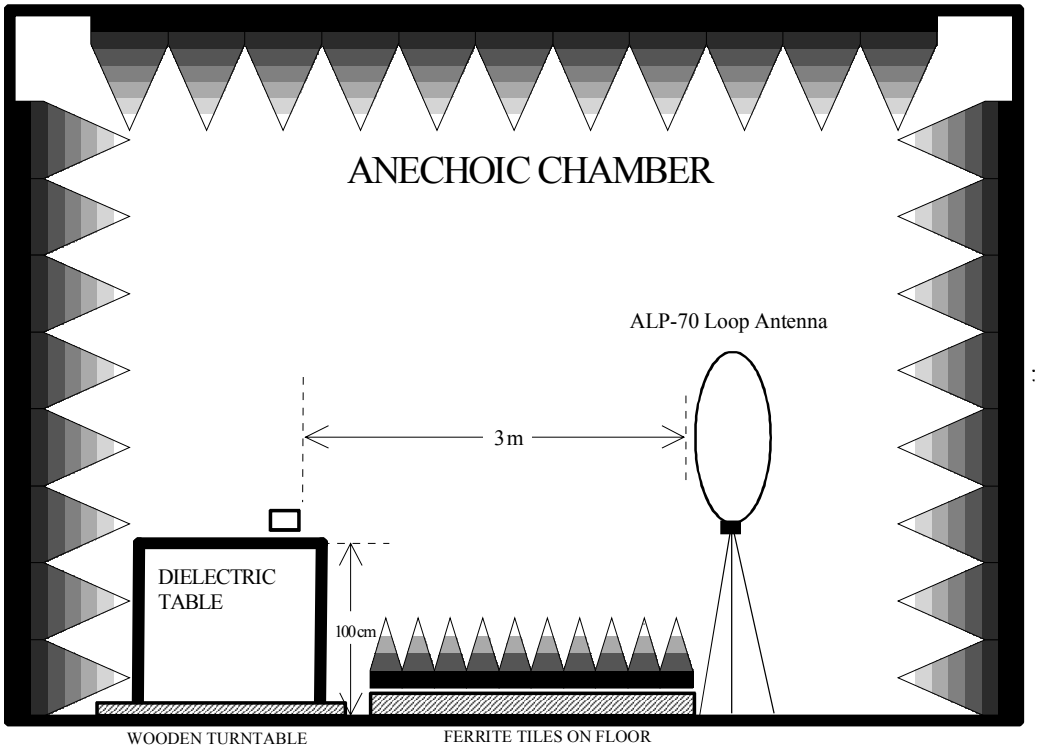


Figure 6.1-2 Radiated Spurious Emissions Test Setup - Chamber

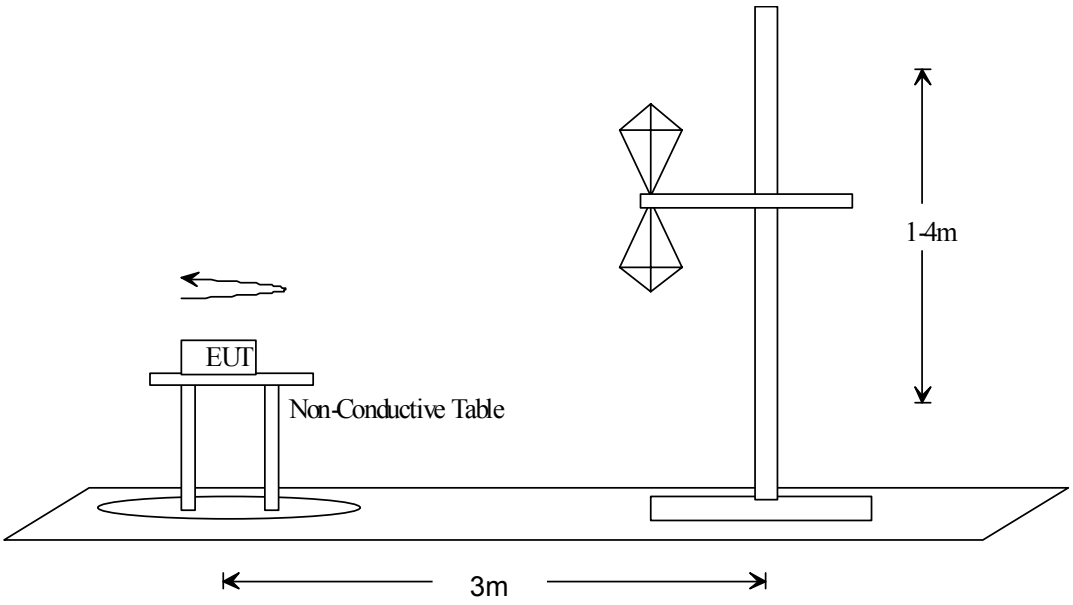


Figure 6.1-3 Radiated Spurious Emissions Test Setup -OATS

6.2 Test Results

6.2.1 Radiated Spurious Emissions Measurement Test Results

All measurements were made with the BDR-1000 transmitting at its maximum rated output power. The antenna is an integral part of the unit and the unit is continuously transmitting at 125 kHz. Most of the pre-scan measurements displayed significant margin, >20 dB, to the limits. For this reason, it was only necessary to re-measure a few of these signals on the OATS and additionally with a Quasi-Peak detector.

The maximized carrier level at the frequency of operation was 44.5 dBuV/m @ 3 meters (-35.5 dBuV/m @ 300 m) worst case using a shielded magnetic loop antenna. This was well below the 25.7 dBuV/m limit at 300 meters specified in 47 CFR Section 15.209 at the operating frequency of 125 kHz. Measurements were performed in an anechoic chamber at a distance of 3 meters.

The radiated emissions for the frequency range of 9 kHz to 30 MHz were all below the applicable limits of 47 CFR 15.209 including the carrier harmonics. These measurements were also performed in an anechoic chamber at a distance of 3 meters. The limit line shown on the graph of Appendix A-1 is corrected to the 300 meter and 30 meter distances using a 40 dB/decade factor for a $1/r^2$ roll-off. These scans were taken with an automated EMI Receiver system using scan tables setup specifically for the requirement conditions including bandwidth, transducer factors, and distance correction. The worst-case emissions graph is shown as Figure A-1.

Measurements for 30 MHz to 1 GHz were taken first in the semi-anechoic chamber in order to identify the critical frequencies. Signals which were within 10 dB of the limit were recorded and their final measurement was taken on the OATS. The measurements were taken at a test distance of 3 meters per the specification. The worst-case sample of the prescan data is shown as Figure B-1 and the final OATS measurements are provided in Figure B-2. All emissions in this range were below the specification limits of 47 CFR Section 15.209. The emission at 60 MHz was the worst-case emission measuring –9.6 dB below the specification limit.

Additionally, this equipment complies with the requirements of 47 CFR Section 15.205 on Restricted Bands of Operation. The BDR-1000 operating frequency of 125 kHz is outside of any of the restricted bands specified in 15.205. Spurious emissions are permitted in these bands with the condition that they comply with the same requirements of 15.209 as tested.

The test setup photos are shown as Figures D-1 through D-6.

6.2.2 AC Powerline Conducted, 450 kHz to 30 MHz Test Results

The AC powerline conducted emissions were measured on the BDR-1000 and associated AC/DC Converter. The AC/DC converter is a product of APX Technologies Inc., Model No. EPA-203D-1 and P/N: SP25970. The BDR-1000 complies with the AC Conducted Emission requirements. The conducted emissions scans are shown in Appendix C. The test setup photos are shown as Figures D-7 and D-8.

Appendix A

Radiated Spurious Emission Measurements

9kHz to 30 MHz

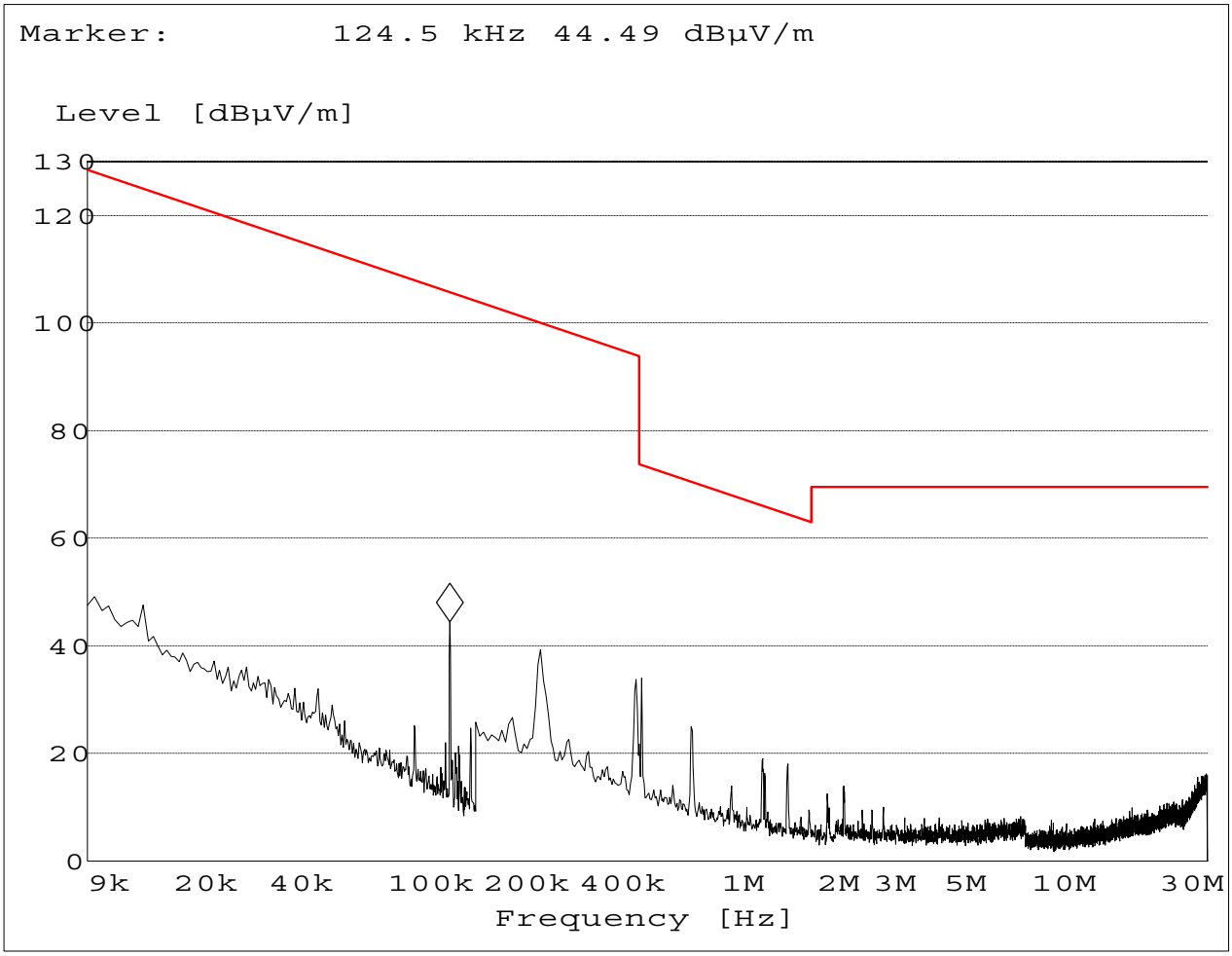


Figure A – 1 Radiated Spurious Emissions, 9 kHz to 30 MHz, Loop Antenna

Appendix B

Radiated Spurious Emission Measurements

30 MHz to 1000 MHz

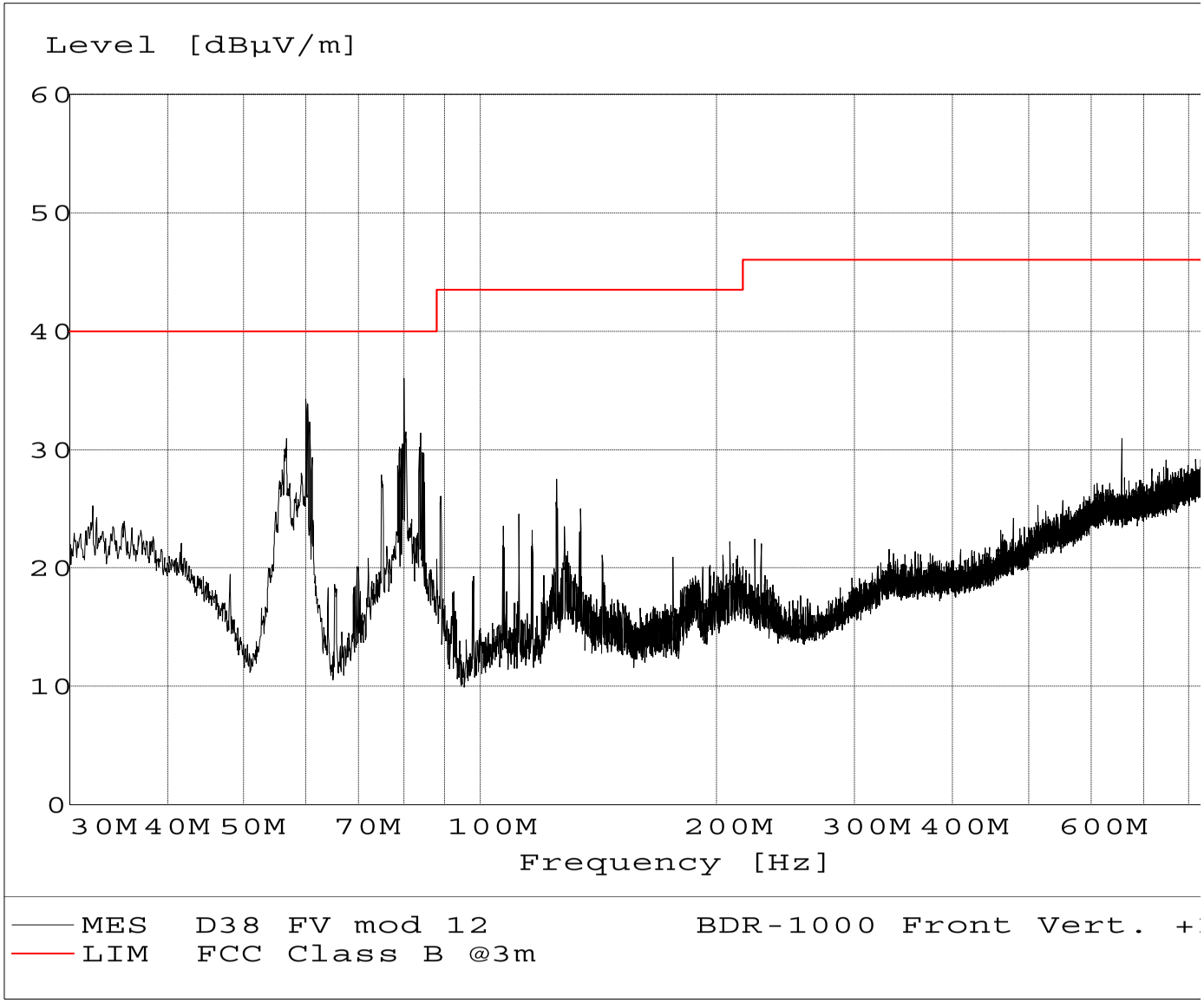


Figure B – 1 Radiated Spurious Emissions Prescan Data, 30 MHz to 1 GHz

FCC Radiated Test Results

Equip.	BDR-1000	Test Date:	4/11/2001
Mode:	Transmit - Typical Modulation	Test Technician:	R. Johnston
Model#:	12VDC Supply	Measurement Distance (m)	3
Serial #:	D38	Equipment Class	B
Bold Reading are Quasi Peak		61° Hum 37.% BP 30.01 F	

Frequency MHz	SA Reading (dBuV)	Az	Ht cm	Pol	Antenna Factor	Cable/Attn. Loss	Pre Amp dB	Emission (dBuV/m)	Spec Limit (dBuV/m)	Deviation from Spec. Limit (dB)
60.000	22.7	B	100	V	8.3	7.3	0.0	38.3	40.0	-1.7
60.000	**14.8**	B	100	V	8.3	7.3	0.0	30.4	40.0	-9.6
80.000	21.7				7.8	8.5	0.0	38.0	40.0	-2.0
80.000	**13.8**				7.8	8.5	0.0	30.1	40.0	-9.9
119.000	18.1	B	100	V	7.0	9.1	0.0	34.2	43.5	-9.3
119.000	**10.2**	B	100	V	7.0	9.1	0.0	26.3	43.5	-17.2

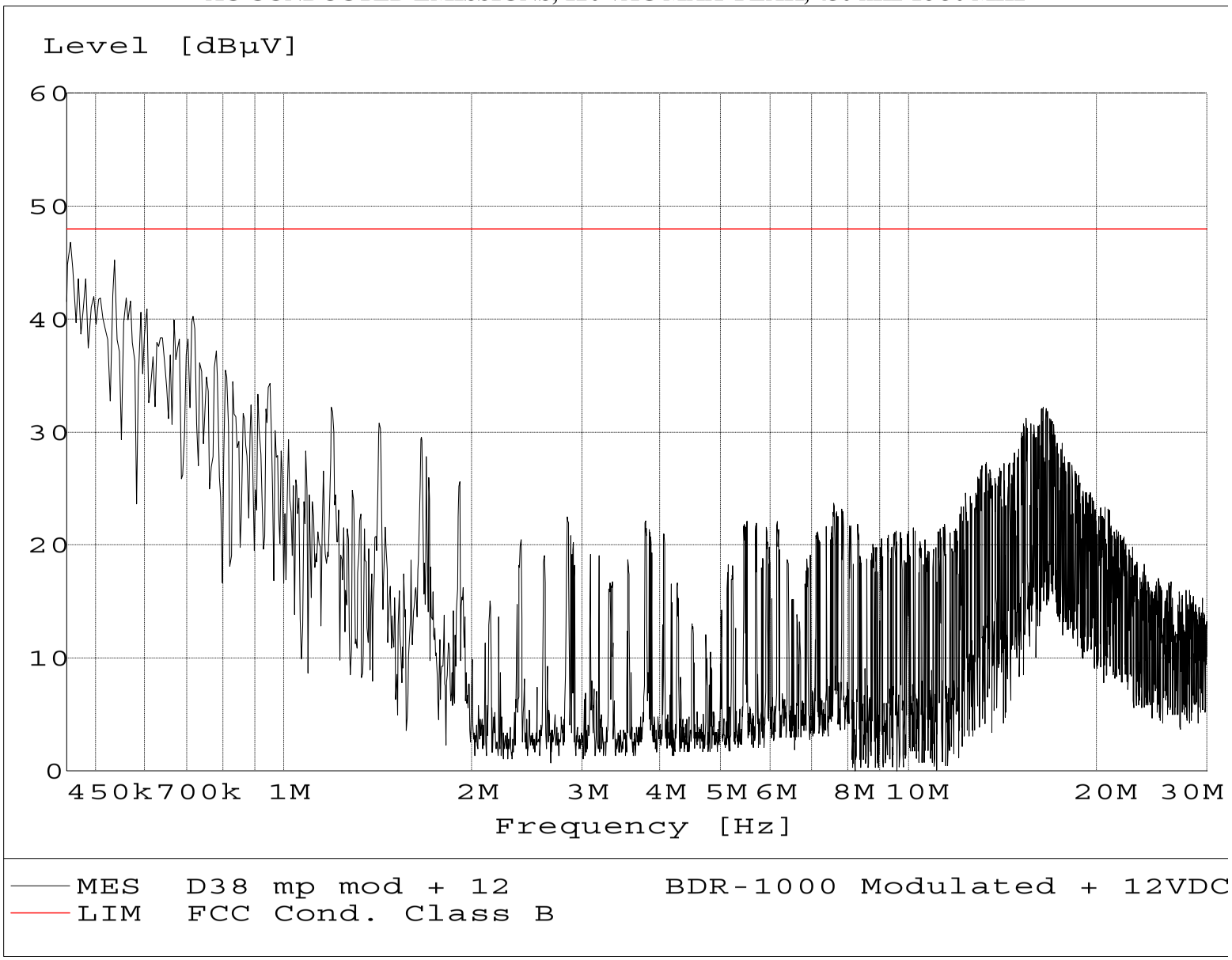
Figure B – 2 Radiated Spurious Emissions, OATS Data, 30 MHz to 1 GHz

Appendix C

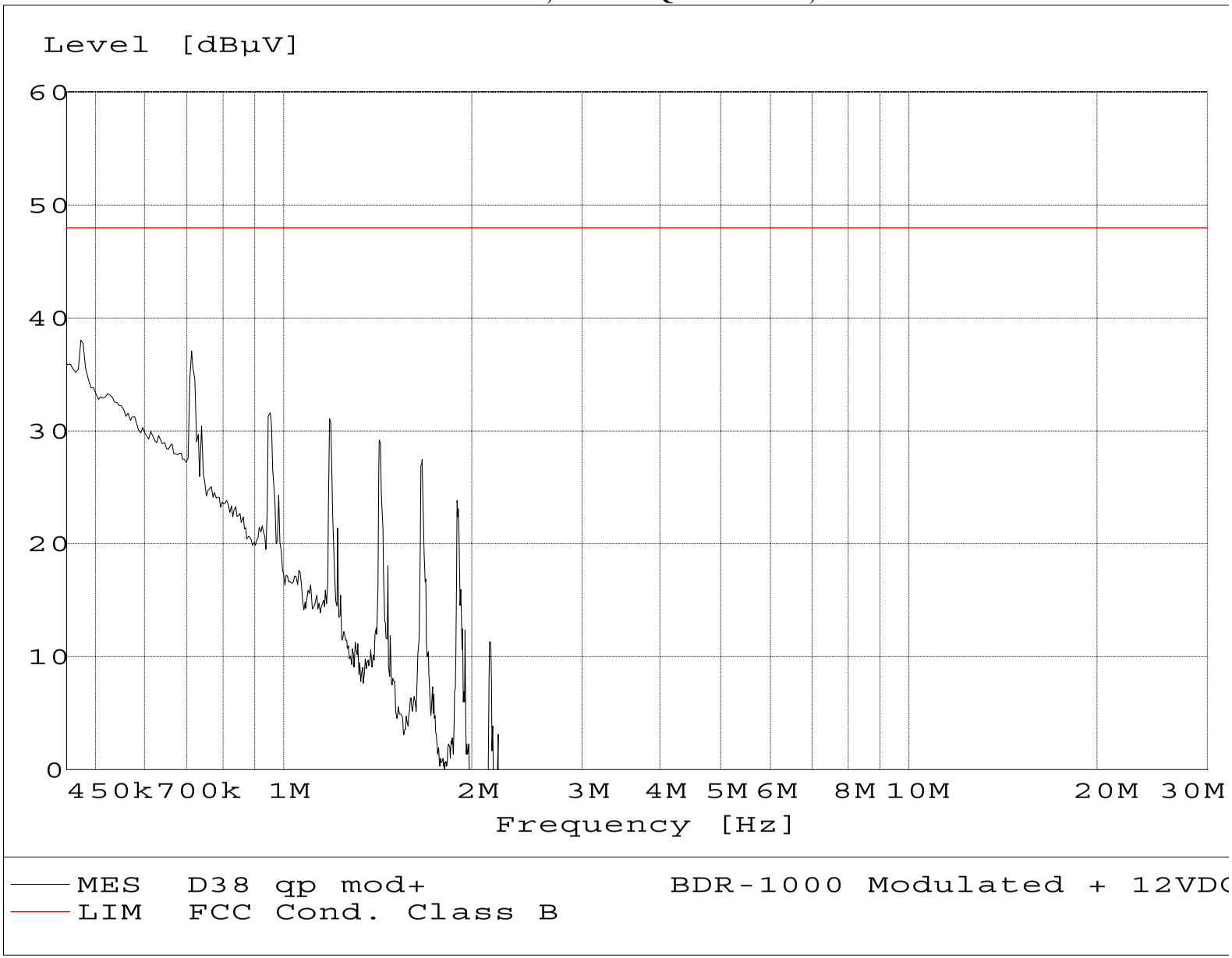
AC Conducted Emission Measurements

450 kHz to 30 MHz

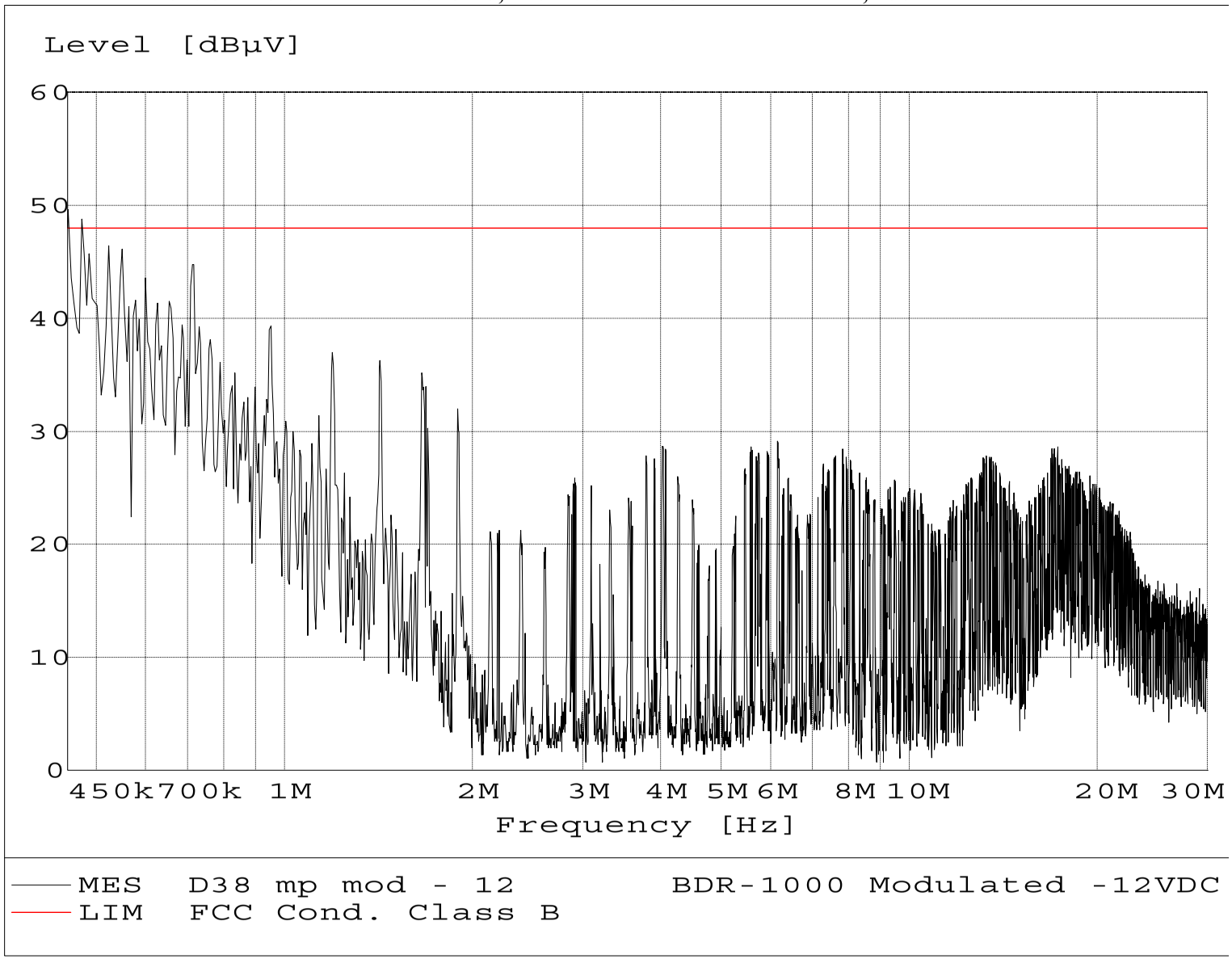
AC CONDUCTED EMISSIONS, 120 VAC MAX PEAK, 450 kHz To 30 MHz



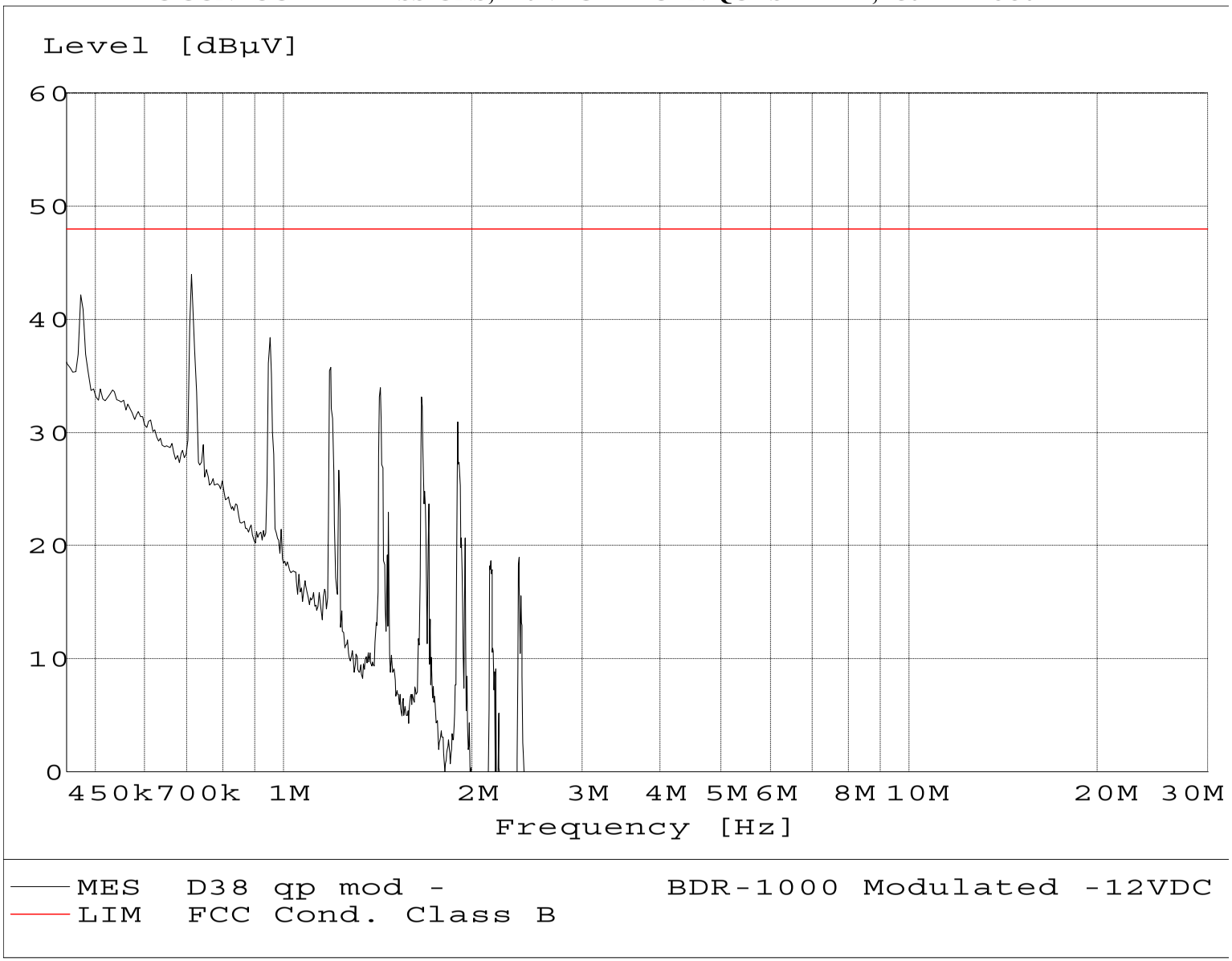
AC CONDUCTED EMISSIONS, 120 VAC QUASI-PEAK, 450 kHz To 30 MHz



AC CONDUCTED EMISSIONS, 120 VAC RETURN MAX PEAK, 450 kHz To 30 MHz



AC CONDUCTED EMISSIONS, 120 VAC RETURN QUASI-PEAK, 450 kHz To 30 MHz



Appendix D

Test Setup Photos

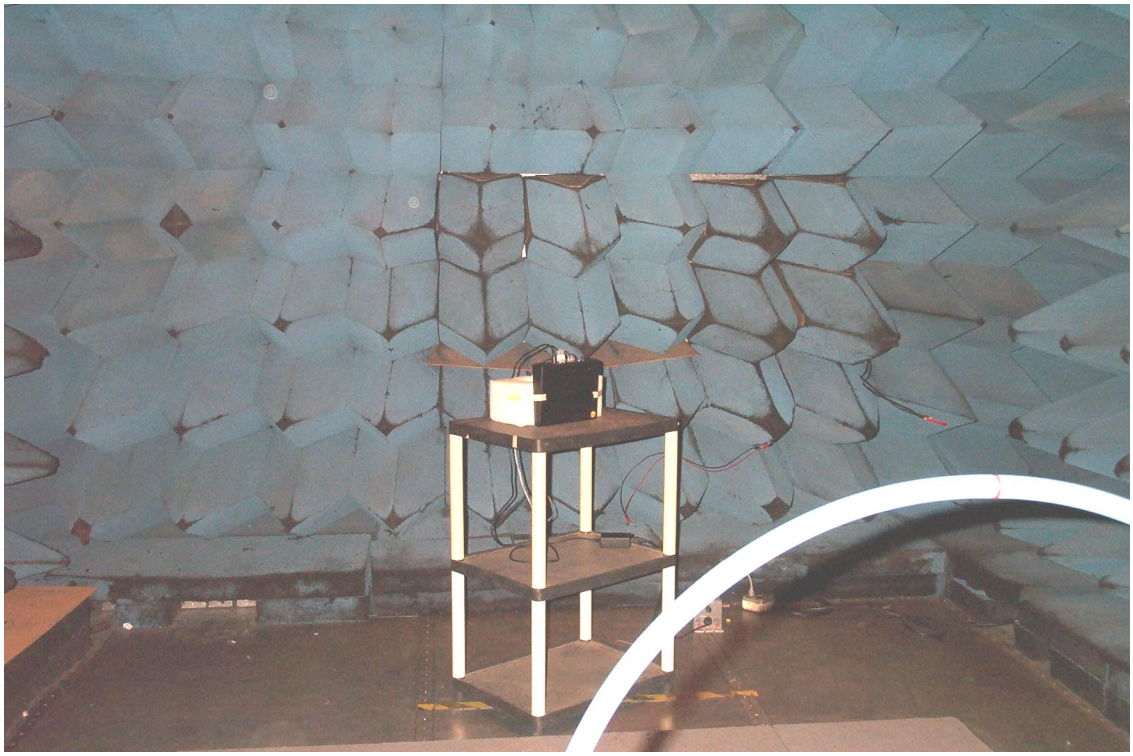


Figure D – 1 Radiated Spurious Emissions – Magnetic Loop

Figure D – 2 Radiated Spurious Emissions – Magnetic Loop

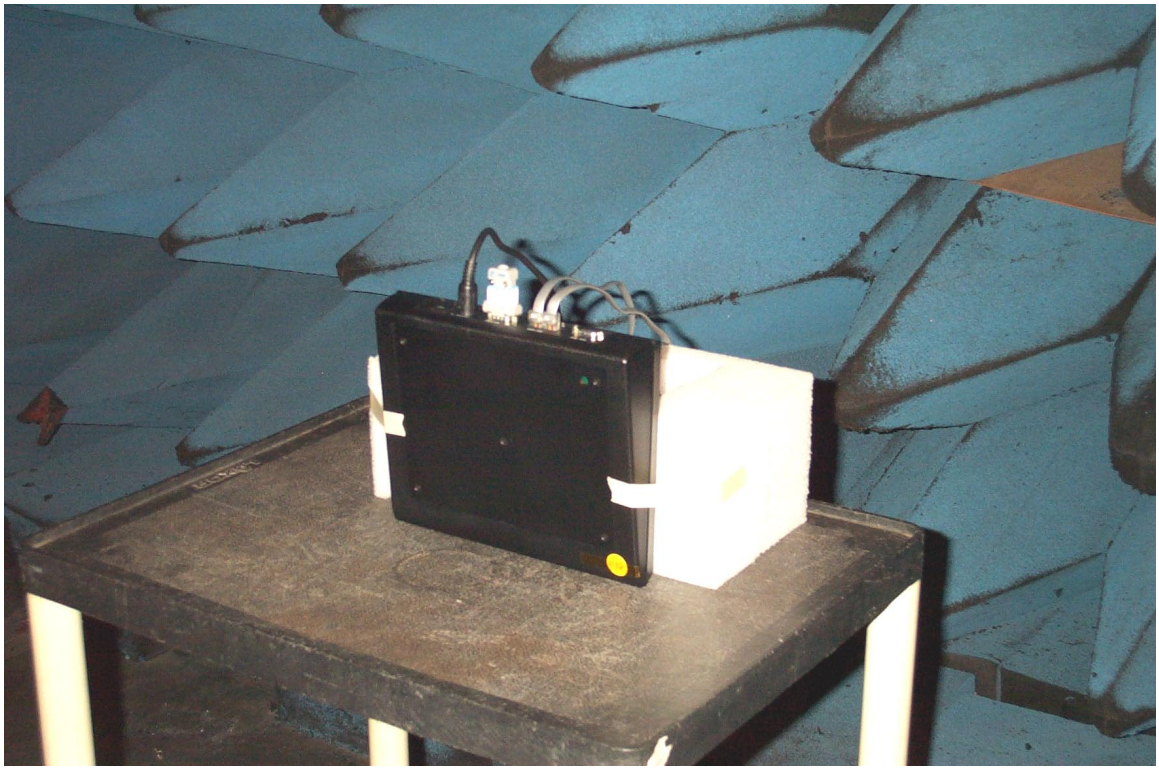


Figure D – 3 Radiated Spurious Emissions Prescan Test Setup, Chamber

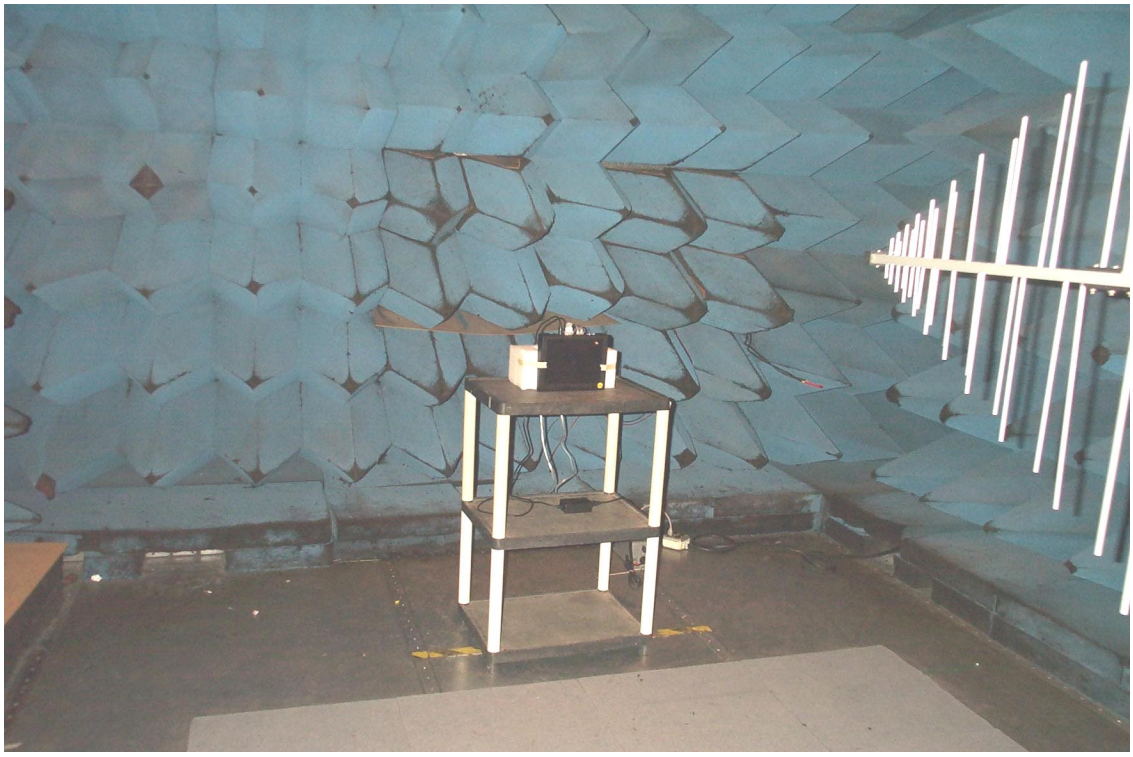


Figure D – 4 Radiated Spurious Emissions Prescan Test Setup, Chamber

Figure D – 5 Radiated Spurious Emissions Test Setup, OATS

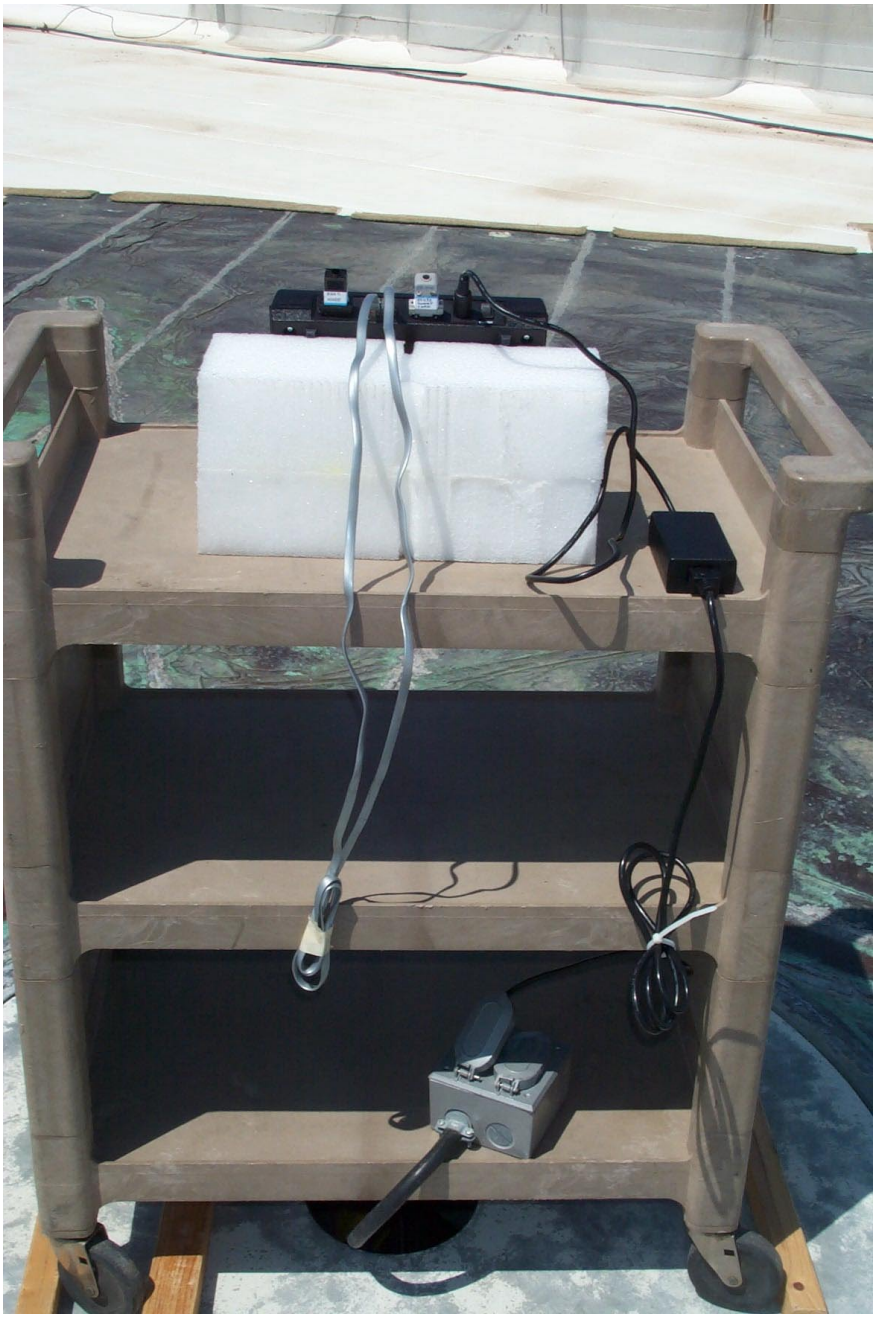


Figure D – 6 Radiated Spurious Emissions Test Setup, OATS

Figure D – 7 AC Conducted Emissions - +/-12 Vdc Supply (EPA-203D-1)

Figure D – 8 AC Conducted Emissions - +/-12 Vdc Supply (EPA-203D-1)