Serial No. GM210052f
FCC ID: IB20ATN01

FCC TEST REPORT
FOR THE
L3 COMMUNICATIONS CORPORATION
AVIATION RECORDERS
AUTOMATIC IDENTIFICATION SYSTEM
AID TO NAVIGATION
PROTEC-D PART NUMBER ATN01-350-00

Prepared for:

L3 Communications Corp.
Aviation Recorders
100 Cattlemen Road
Sarasota, FL 34232
USA

Submitted by:

Green Mountain Electromagnetics, Inc.

(802) 388-3390
Fax: (802) 388-6279
E-mail: gme@gmelectro.com
219 Blake Roy Road • Middlebury, Vermont 05753

Accredited
Cert 898.01 Test Laboratory

L3 Communications Aviation Recorders Corporation
FCC Testing
At
Green Mountain Electromagnetics, Inc.

Unit: Automatic Identification System Aid to Navigation (ATN01-350-00)
Received: 9/13/10
Tested: September 14 - 16, 2010

I. Applicable Standards:

The unit described in this report was measured for certification with the Code of Federal Regulations Chapter 47 – "Telecommunication, Part 2 – Frequency Allocations and Radio Treaty Matters: General Rules and Regulations, Subpart J – Equipment Authorization Procedures (2008)." Measurements required were per paragraphs 2.1053, Field Strength of Spurious Radiation and 2.1091, Radiofrequency Radiation Exposure Evaluation: Mobile Devices.

The AIS was measured for verification of compliance with "47 CFR, Part 15 – Radio Frequency Devices, Subpart C: Intentional Radiators (2008)," paragraph 15.209, Radiated Emissions.

Measurement procedures were in accordance with ANSI C63.4, "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2003)," FCC OET Bulletin 65, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields (Jan. 2001)," and the L3 Test Plan.

L3 engineering determined that the testing previously performed on the electrically identical ATN01-311-03 is satisfactory to demonstrate ATN01-350-00 compliance for all other FCC requirements. See GM28022x/24f for previous results on ATN01-311-03.

II. Unit Tested:

The L3 Communications Corporation, Automatic Identification System (AIS) Aid to Navigation (AtoN) PROTEC-D, Model ATN01-350-00 provides continuous remote signal and data transmission for ship identification. The ATN01-350-00 uses DC power, has a TDMA transmitter and two TDMA/ GPS receivers. It consists of the multi-piece metal enclosure with connector hardware, the transmit/receive circuits, the microprocessor/data-storage electronics, and the antenna interface.

The ATN01-350-00 is identical to ATN01-311-03 except for the new multi-piece, metal enclosure, and that the project application is commercial versus maritime. The table below describes the unit that was subjected to measurements determining compliance with applicable standards:

Model/P/N	Manufacturer	Serial Number
ATN01-350-00	L3 Communications Corp.	000671994

The following table describes the system physical and electrical properties:

Model/P/N	Volts	H/W/D in cm
ATN01-350-00	12 VDC	10/25/18

The following table describes the GME support equipment used during testing:

Product	Manufacturer	Model	Serial
Power Supply	CSI/Speco	PSV-5	n/a
Laptop PC	Apple	iBook	UU101218JQ4
Attenuator 20 dB, 50 W	JFW	50FHC-020-50	n/a
GPS Antenna	Matsushita	n/a	n/a

The following table describes the system cables:

Type	Manufacturer	Description
Power	n/a	DC Unshielded
Signal/GPS	Pasternack	Coaxial RG213/U
Signal	L-Com	RS-232, UL E129298

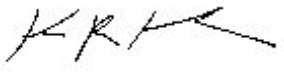
III. Summary of Results:

The L3 Communications Corporation, AIS PROTEC-D, Model ATN01-350-00 complies with the requirements in FCC 47 CFR, Paragraphs 2 and 15. Section X contains the results summarized in the table below.

	Test	Mode/Port	CFR 47 Paragraph	Frequency or Range	Specified Values	Measured Values
1	Radiated Emissions	Enclosure	**2.1053** **15.209**	30 – 88 MHz 88 – 216 MHz 216 – 960 MHz 960 – 1630 MHz	40 dBuV/m 43.5 dBuV/m 46 dBuV/m 54 dBuV/m	Within 3 m Limits
2	Exposure Evaluation	Enclosure	**2.1091**	0.3 – 3 MHz 3 – 30 MHz 30 – 300 MHz 300 – 1500 MHz 1500 – 1630 MHz	100 mW/cm^2 $900/f^2$ mW/cm^2 1 mW/cm^2 $f/300$ mW/cm^2 5 mW/cm^2	Within All Limits

Testing was performed by Kyle R. Kowalczyk, president, Green Mountain Electromagnetics and requested by:

L3 Communications Aviation Recorders Corp.
100 Cattlemen Road/PO Box 3041, 34230
Sarasota, FL 34232 USA



Kyle R. Kowalczyk
9/21/10

IV. Measurement Location:

The GME laboratory and Open Area Test Site (OATS) are located at 219 Blake Roy Road, Middlebury, VT. The OATS is a 10-meter site complete with antenna positioner, ground plane and motorized turntable. The OATS is constructed in accordance with ANSI C63.7-2005 and complies with the requirements for radiated emissions testing in ANSI C63.4-2003 and CISPR standards. The electromagnetic laboratory is constructed in accordance with CE immunity standards and ANSI C63.4-2003.

GME is internationally accredited by the American Association for Laboratory Accreditation (A2LA) and meets the quality requirements in ISO/IEC 17025 (2005), "General Requirements for the Competence of Testing and Calibration Laboratories."

V. Equipment, Software and Cable Configuration:

GME witnessed the unit in satisfactory condition for testing, however the manufacturer is responsible for ensuring that the equipment under test (EUT) represents the product line. The manufacturer is also responsible for the EMC test plan and for assuring that this report is consistent with that plan. The EUT configuration was arranged to produce maximum radiated emissions as shown in the block diagram in Section VIII. The equipment was subjected to complete emissions tests. The EUT was operating in a continuous mode utilizing and testing its functions. Hyper-terminal software was used to operate the AtoN under test.

VI. Units of Measurement and Uncertainty:

Measurements of radiated electric fields were made in units of dB referenced to 1 microvolt per meter (dBuV/m). Limits appearing on the spectrum analyzer data were corrected for the appropriate antenna factor, cable loss, amplifier gain (when used) and measurement distances X_{std} and X_{site} in meters.

The following equations were employed:
Corrected Limit (dBuV) = Limit (dBuV/m) + 20 log(X_{std}/X_{site}) + Amplifier Gain (dB) – Antenna Factor (dB/m) – Cable Loss (dB).

Sample calculation at 30 MHz (Vertical Polarization):
31.6 dBuV corrected limit = 40.0 dBuV/m limit + 20 log(3/10) dB distance + 20 dB amp gain – 16.9 dB/m AF – 1 dB cable loss.

Uncertainty

The uncertainty budgets in GME EMC measurements are identified as follows:

1. Field strength between 30 MHz and 26 GHz on a ten-meter OATS using broadband antennas:

Contribution	Probability Distribution	Uncertainty (dB)
antenna factor calibration	normal k=2	0.5
cable loss calibration	normal k=2	0.5
analyzer specification	rectangular	1.5
distance variation	rectangular	0.6
height variation	rectangular	0.5
site imperfection	rectangular	2.0
mismatch	u-shaped	1.5
repeatability	standard deviation	0.5
combined uncertainty u(y)	normal	1.946
expanded uncertainty U	normal k=2	3.892

$$u(y) = \sqrt{(\frac{0.5}{2})^2 + (\frac{0.5}{2})^2 + \frac{1.5^2 + 0.6^2 + .5^2 + 2.0^2}{3} + \frac{1.5^2}{2} + 0.5^2}$$

U = k u(y)

(Note: "U" represents an expanded uncertainty expressed at an approximately 95% confidence level using a coverage factor of k=2.)

VII. Measuring Equipment:

The table below describes the instrumentation used by Green Mountain Electromagnetics to perform this testing:

Unit	Manufacturer	Model	Serial #	Last Cal.	Next Cal.
Spectrum Analyzer	Hewlett-Packard	8592 L	3624A00631	10/20/09	10/20/10
Pre-Amplifier	MiniCircuits	ZFL-2500VHB+	424400919	10/27/09	10/27/10
Broadband E-field Antenna	Antenna Research Associates	LPB-2513/A	1125 (GM3)	10/09/09	10/09/10

Weather Station	Davis Instruments	Perception II	PC30923A07	11/16/09	11/16/10
Plotter	Hewlett-Packard	7550A	2444A05912	n/a	n/a

VIII. Measurement Procedures:

1. Radiated Emissions.

Frequency range: 30 MHz to 88 MHz
Limit: 40 dBuV/m @ 3 meters
Frequency range: 88 kHz to 216 MHz
Limit: 43.5 dBuV/m @ 3 meters
Frequency range: 216 MHz to 960 MHz
Limit: 46 dBuV/m @ 3 meters
Frequency range: 960 MHz to 1630 MHz
Limit: 54 dBuV/m @ 3 meters

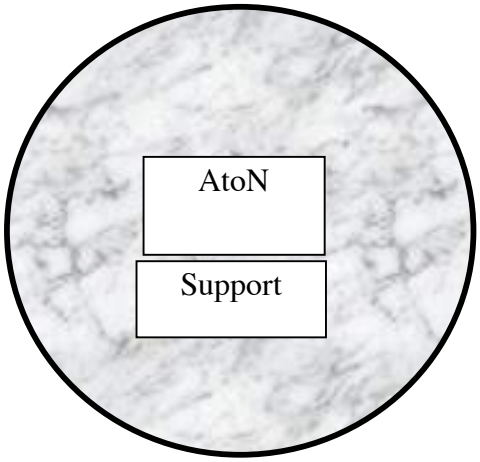
a. Set up instrumentation at open area test site.
   i. Mount EUT on ground plane and broadband antenna on antenna positioner.
   ii. Observe temperature, humidity and atmospheric pressure.
   iii. Measurement distance is 10 meters and antenna scan height is 1 to 4 meters.
b. Verify spectrum analyzer and antenna operation.
   i. Spectrum analyzer is connected to antenna.
   ii. Preamplifier is inserted between antenna and analyzer to ensure analyzer noise threshold is at least 6 dB below specification limit.
c. Set up, power and operate EUT as in block diagram below.
d. Perform preliminary evaluation of equipment in the near field.
   i. Vary antenna height, antenna polarization, and antenna orientation to EUT.
   ii. Repeat step d.i. while evaluating radiation in the 30-MHz to 1.63-GHz spectrum.
e. Determine frequencies and equipment orientations that produce maximum radiation.
   i. Identify processor, clock and beat frequencies, and harmonics.
f. Perform final evaluation of unit by recording spectrum analyzer data on the plotter.
   i. Ensure the EUT is producing the maximum radiation found in step e.
   ii. Collect data over the entire frequency range.

2. Exposure Evaluation.

Frequency range: 0.3 MHz - 3 MHz
Limit: 100 mW/cm^2
Frequency range: 3 MHz - 30 MHz

Limit: $900/f^2$ mW/cm^2
Frequency range: 30 MHz - 300 MHz
Limit: 1 mW/cm^2
Frequency range: 300 MHz - 1500 MHz
Limit: f/300 mW/cm^2
Frequency range: 1500 MHz - 1630 MHz
Limit: 5 mW/cm^2

a. Set up instrumentation at open area test site.
   i. Mount EUT on table and isotropic probe or loop on antenna positioner.
   ii. Observe temperature, humidity and atmospheric pressure.
   iii. Measurement distance is 1 meter and antenna scan height is varied over human body dimensions (0.1 to 2 meters).
b. Verify spectrum analyzer and antenna operation.
   i. Spectrum analyzer is connected to antenna.
c. Set up, power and operate EUT as in block diagram below.
d. Perform preliminary evaluation of equipment in the near field.
   i. Vary antenna height, antenna polarization, and antenna orientation to EUT.
   ii. Repeat step d.i. while evaluating electromagnetic radiation in the 0.3-MHz to 1630-MHz spectrum. H- and E-field are both measured below 300 MHz.
   iii. Near field measurements of unit emissions are made at ambient frequencies.
e. Determine frequencies and equipment orientations that produce maximum radiation.
   i. Set peak hold on analyzer for 6 minutes while slowly varying antenna height.
f. Record spectrum analyzer data on the plotter if health-hazard fields are identified.



Block Diagram of Radiated Emissions Test & Exposure Evaluation

IX. Test Setup Photograph:

Radiated Emissions & Exposure Evaluation

X. Measurement Results:

1. Radiated Emissions.

Vertical Polarization.

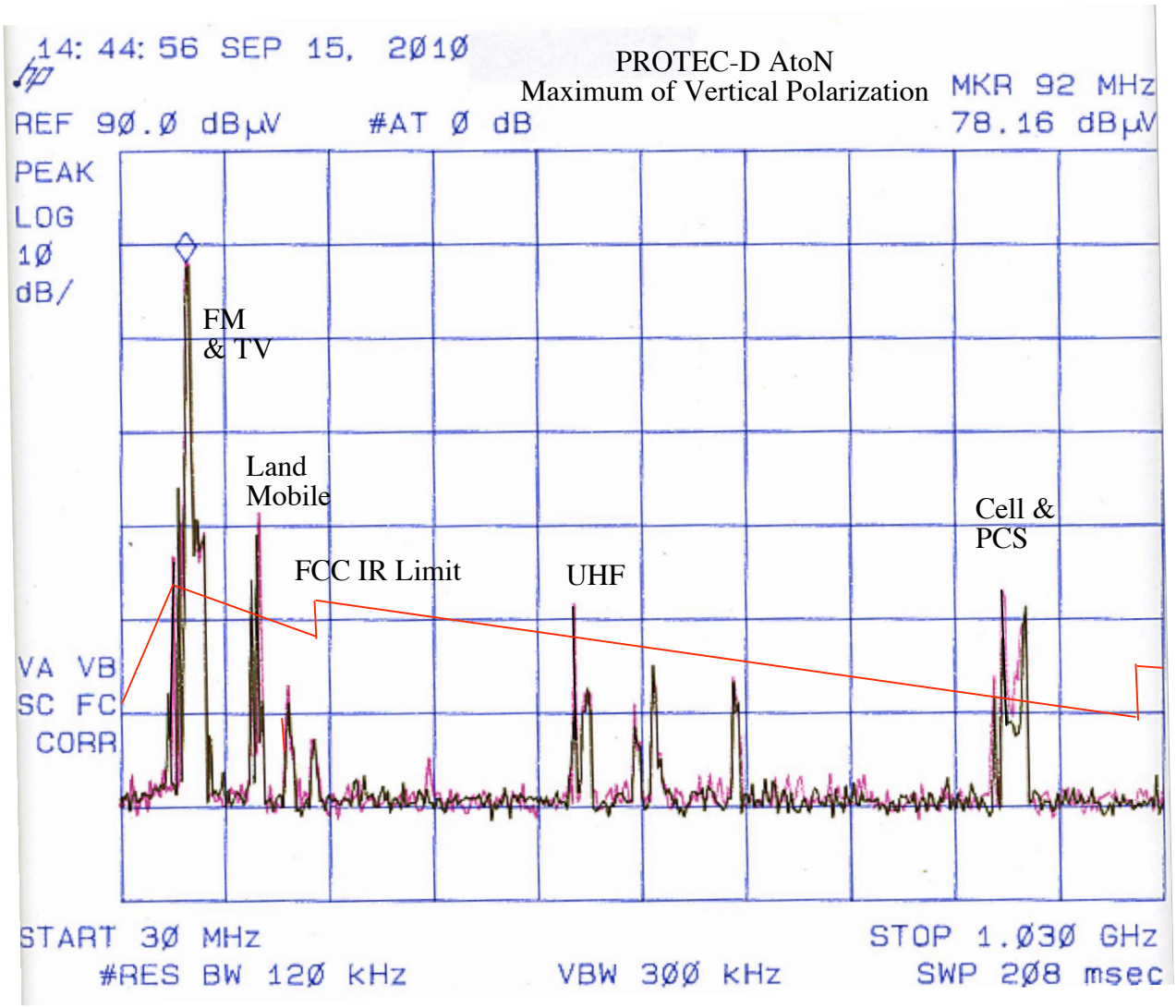
The table below describes the correction factors necessary to apply the limit to the spectrum analyzer output. The following pages contain the spectrum analyzer output with the corrected specification limits superimposed. The black pen is the ambient condition, and the other color identifies EUT emissions. Maximum amplitudes of vertical polarization are shown in the results below.

Frequency MHz	IR limit @ 3m dBuV	Correction dB	Amp Gain dB	Antenna Factor dB	Cable Loss dB	Corrected Limit dBuV
30	40	-10.5	20	16.9	1	31.6
50	40	-10.5	20	12.4	1	36.1
88	40	-10.5	20	8	1	40.5
89	43.5	-10.5	20	8	1	44.0
100	43.5	-10.5	20	9.7	2	41.3
125	43.5	-10.5	20	9.3	2	41.7
216	43.5	-10.5	20	11.3	3	38.7
217	46	-10.5	20	11.3	3	41.2
300	46	-10.5	20	13.2	3	39.3
500	46	-10.5	20	17.7	4	33.8
960	46	-10.5	20	21.8	4	29.7
961	54	-10.5	20	21.8	4	37.7
1630	54	-10.5	20	26	5	32.5

Table 1 – Corrected Limit - Vertical Polarization

X. Measurement Results Cont'd:

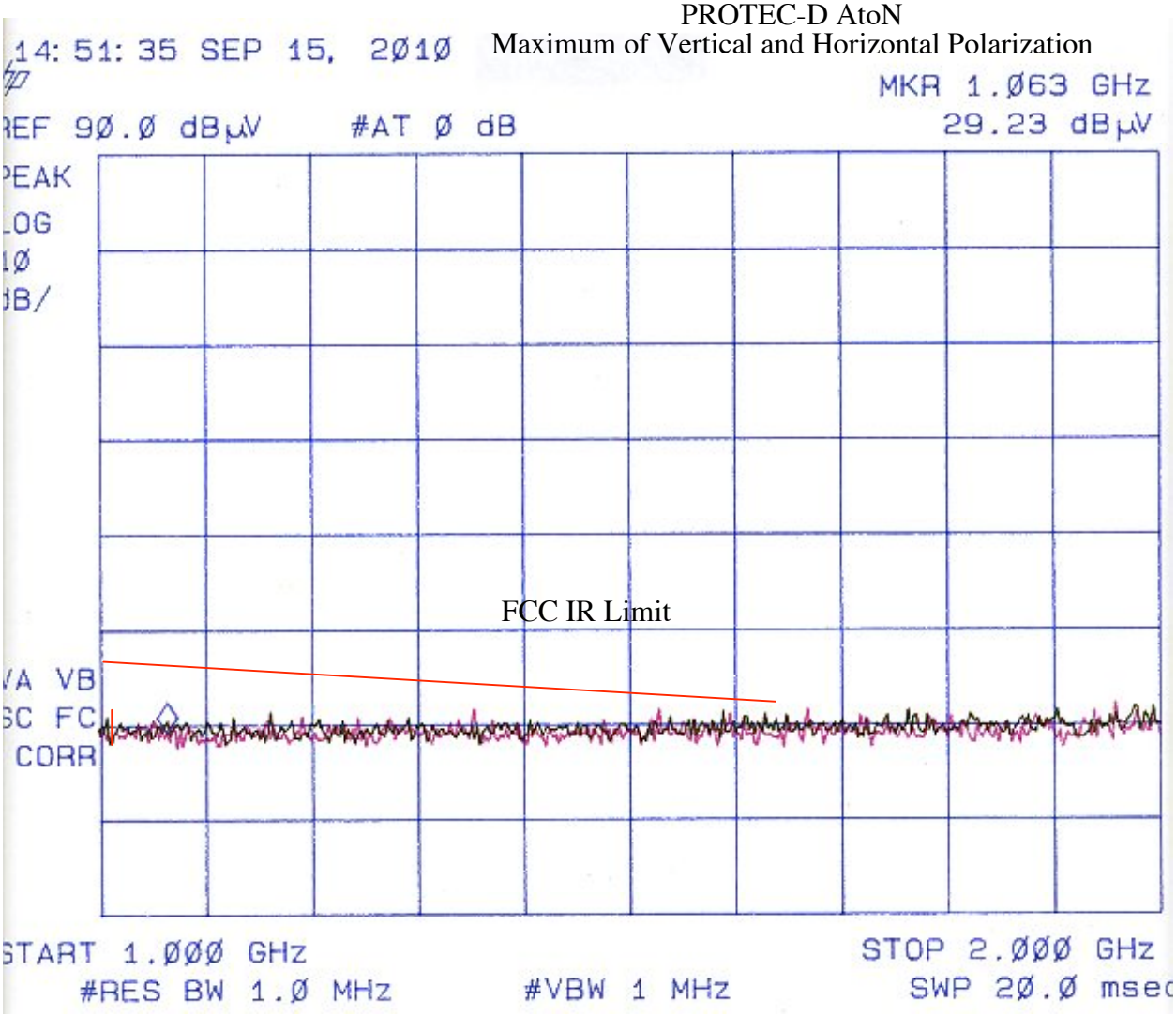
1. Radiated Emissions.



X. Measurement Results Cont'd:

1. Radiated Emissions.

PROTEC-D AtoN
Maximum of Vertical and Horizontal Polarization



X. Measurement Results Cont'd:

1. Radiated Emissions.

Horizontal Polarization

The table below describes the correction factors necessary to apply the limit to the spectrum analyzer output. The following page contains the spectrum analyzer output with the corrected specification limits superimposed. The black pen is the ambient condition, and the other color identifies EUT emissions. Maximum amplitudes of horizontal polarization are shown in the results below.

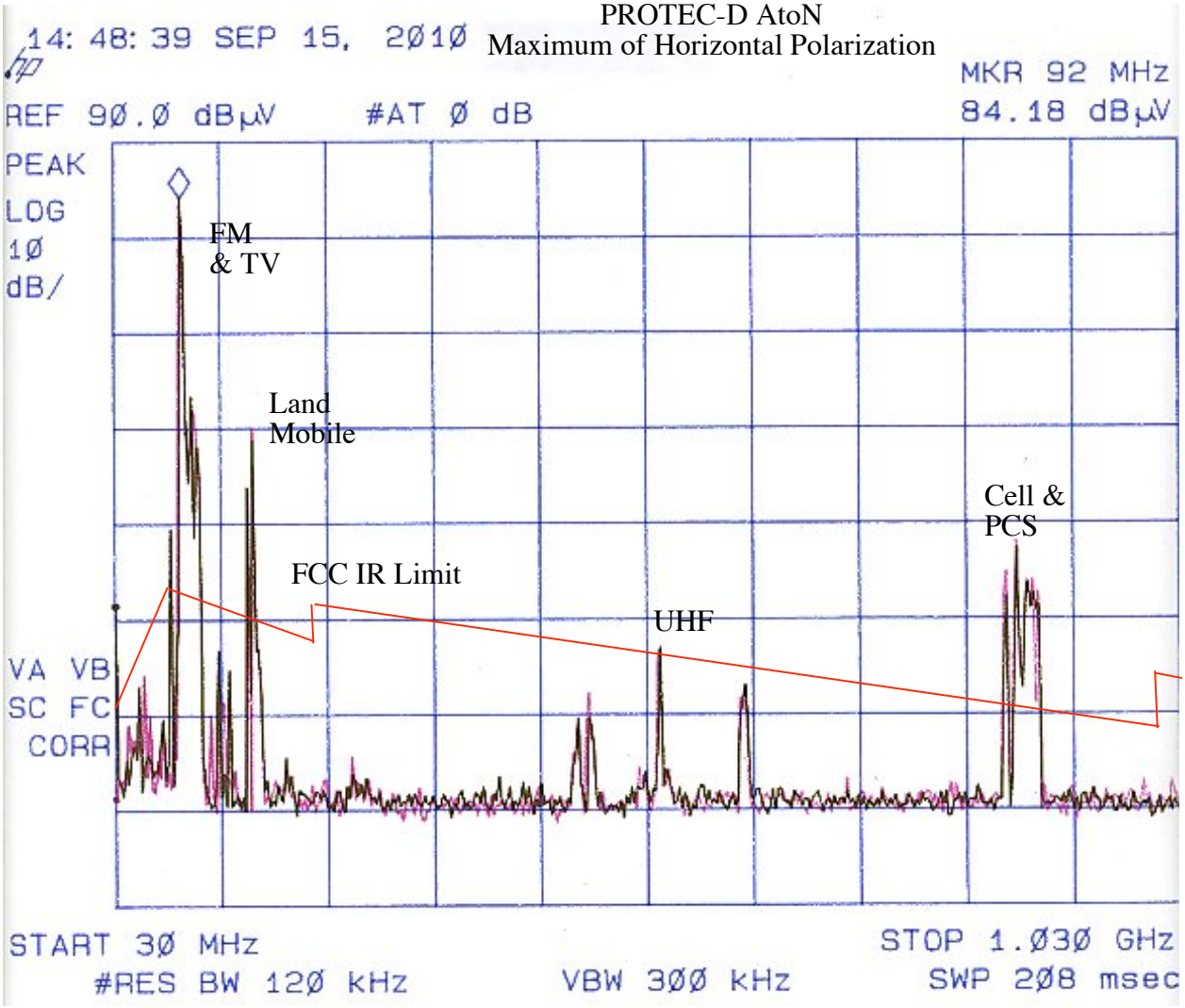
Frequency MHz	IR limit @ 3m dBuV	Correction dB	Amp Gain dB	Antenna Factor dB	Cable Loss dB	Corrected Limit dBuV
30	40	-10.5	20	17.3	1	31.2
50	40	-10.5	20	14.1	1	34.4
88	40	-10.5	20	6.7	1	41.8
89	43.5	-10.5	20	6.7	1	45.3
100	43.5	-10.5	20	9.8	2	41.2
125	43.5	-10.5	20	10.6	2	40.4
150	43.5	-10.5	20	8.7	3	41.3
216	43.5	-10.5	20	11.8	3	38.2
217	46	-10.5	20	11.8	3	40.7
300	46	-10.5	20	17.1	3	35.4
500	46	-10.5	20	21	4	30.5
960	46	-10.5	20	24.2	4	27.3
961	54	-10.5	20	24.2	4	35.3
1630	54	-10.5	20	25.5	5	33.0

Table 2 – Corrected Limit - Horizontal Polarization

X. Measurement Results Cont'd:

1. Radiated Emissions.

PROTEC-D AtoN
Maximum of Horizontal Polarization



X. Measurement Results Cont'd:

2. Exposure Evaluation.

The table below compares the measured fields to the occupational exposure limit. The unit produces no significant electric or magnetic fields that would create an exposure hazard. Above 300 MHz the power density in mW/cm^2 is related to the electric field in V/m by: $S = E^2/3770$.

Freq MHz	H-field A/m	Limit A/m	Dev A/m	E-Field V/m	Limit V/m	Dev V/m	Power (S) mW/cm^2	Limit mW/cm^2	Dev mW/cm^2
0.3	< 0.1	1.63	-1.53	< 0.1	614	-613.9			
0.5	0.1	1.63	-1.53	0.1	614	-613.9			
1	0.1	1.63	-1.53	0.1	614	-613.9			
3	0.1	1.63	-1.53	0.1	614	-613.9			
5	0.1	0.98	-0.88	0.1	368	-367.9			
10	0.1	0.49	-0.39	0.1	184	-183.9			
30	< 0.01	0.163	-0.153	0.1	61.4	-61.3			
50	0.01	0.163	-0.153	0.1	61.4	-61.3			
100	0.01	0.163	-0.153	0.1	61.4	-61.3			
156	0.01	0.163	-0.153	< 1	61.4	-60.4			
163	0.01	0.163	-0.153	< 1	61.4	-60.4			
300	0.01	0.163	-0.153	0.1	61.4	-61.3			
500							< 0.1	1.7	-1.6
600							0.1	2.0	-1.9
800							0.1	2.7	-2.6
1000							0.1	3.3	-3.2
1200							0.1	4.0	-3.9
1500							0.1	5.0	-4.9
1630							0.1	5.4	-5.3

Table 3 - Exposure Evaluation Results