Intertek ETL SEMKO

TEST REPORT

Report Number: 3089882MIN-001
Project Number: 3089882
February 24, 2006

Testing performed on the
R4500 Scanning Receiver

to
47 CFR: 2005, §15.107 and §15.109, Class B, §15.121
FCC ID: TZF-4500A

For
Advanced Telemetry Systems, Inc.

Test Performed by:	Test Authorized by:
Intertek	Advanced Telemetry Systems, Inc.
7250 Hudson Blvd. Suite 100	470 First Avenue North
Oakdale, MN 55128	Isanti, MN 55040-0398

Prepared by: _____ Date: February 24, 2006
Uri Spector

Reviewed by: _____ Date: February 24, 2006
Norman Shpilsher

CONTENTS

1.0 JOB DESCRIPTION

Equipment:	R4500 Scanning Receiver
Frequency Range:	Any specified 4MHz range from 140 to 220MHz
EUT Serial No:	R2252
Receiving Frequency:	164MHz-168MHz
Voltage/Phase:	100-240VAC, 50-60Hz
Customer:	Mr. Peter Kuechle Advanced Telemetry Systems, Inc. 470 First Avenue North Isanti, MN 55040-0398 Ph: (763) 444-9267; Fax: (763) 444-9384
Test Standard:	**47 CFR:2005**, §15.107 and §15.109 Class B, §15.121
Date Sample Submitted:	January 27, 2006
Test Work Started:	January 27, 2006
Test Work Completed:	January 31, 2006
Test Sample Conditions:	Good

2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST STANDARD	TEST	COMMENTS
Subpart B – 15.107	Conducted Emissions	Pass
Subpart B – 15.109	Radiated Emissions	Pass
Subpart B – 15.121	Signal Rejection from Cellular Radiotelephone frequency	Pass

Where comments other than "pass" are entered in the "comments" column, further details may be found in the TEST RESULTS section.

Note 1: The measured result in this report is within the specification limits by more than the measurement uncertainty; the measured result indicates that the product tested complies with the specification limit.

Note 2: All test measurements were performed with:

1. Pre-installed ferrite by Steward p/n: 25B-0870-100 on the DC cable with 5 turns was placed inside the unit.
2. The paint from the top edge of the enclosure and the bottom part of the cover was removed to provide continuous enclosure.

2.1 Limits for Conducted and Radiated Disturbances for FCC parts 15.107 and 15.109

Conducted Emissions Limits

Frequency range (MHz)	Class A		Class B	
	QP Limits (dBμV)	AVG Limits (dBμV)	QP Limits (dBμV)	AVG Limits (dBμV)
0.15 to 0.50	79	66	66 to 56	56 to 46
0.50 to 5	73	60	56	46
5 to 30	73	60	60	50

NOTES 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

Radiated Emissions Limits

Frequency of Emissions (MHz)	CLASS A at 10 m		CLASS B at 3 m	
	μV/m	dBμV/m	μV/m	dBμV/m
30 to 88	90	39	100	40
88 to 216	150	44	150	44
216-960	210	46	200	46
Above 960	300	50	500	54

NOTE: In the emission tables above, the tighter limit applies at the band edges.

2.2 Emissions Test Results (see Appendix I)

The Radiated Emissions test was performed in Anechoic Chamber at 3m-measurement distance in frequency range from 30MHz to 8GHz (see Tables 1, 2, 3, 4 and Graphs 1, 2, 3, 4). Radiated Emissions measurements were performed at two edges of the EUT operating frequency: 164.5MHz and 167.5MHz

The Conducted Emissions test was performed in frequency range from 150kHz to 30MHz (see Tables 5, 6 and Graphs 5,6). Line Conducted Emissions test was performed with CINCON Electronic Co., LTD model: TR36A-13 AC adapter in normal operation. Also Line Conducted Emissions test was performed in charging mode with Ault Inc. model BCM7510 battery charger.

Signals from Cellular Radiotelephone Service frequency bands were rejected by the EUT at the level of the internal noise level.

3.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers and Test Software

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Rohde & Schwarz FSP 40 Spectrum Analyzer	100024	08/05	08/06	X
Agilent E7402A Spectrum Analyzer	MY44212200	09/05	09/06	X
TILE! Instrument Control System	Ver. 3.4 K.2	N/A	N/A	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Schaffner-Chase Bicono-Log Antenna	2468	01/14/06	01/14/07	X
EMCO Horn Antenna 3115	6579	12/05	12/06	X

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
FCC LISN-2	316	04/05	04/06	X

4.0 TEST CONFIGURATION (see Appendix II)

4.1 Support Equipment/Services

VHF Receiving antenna
GPS Receiving antenna
ATS Pulse modulator
Rohde & Schwarz SMT 03, Signal Generator with connected Rode Antenna as transmitter

4.2 Sample Set-Up

The EUT was setup as a tabletop unit and was powered 120VAC, 60Hz via CINCON Electronic Co., LTD model: TR36A-13 AC adapter. I/O ports were connected to appropriate cables. The Rode antenna was placed in close proximity of the EUT in order to cohere and activate the receiver.

Cables

Antenna port cable, coax BNC, less then 3m long, BNC connectors
GPS port cable, not shielded, less then 3m long, SMA connector
AUX port cable, not shielded, less then 3m long, 15 pin connector
PC/Clone port cable, shielded, less then 3m long, DB 9 connector

4.3 Mode of Operation

The EUT was exercised continuously in receiving pulse modulated signal. The EUT operates using Advanced Telemetry Systems Software ver. 1.027.

5.0 TEST PROCEDURES

5.1 Emissions Testing: General Setup & Application Information

Radiated emission measurements are performed according to the procedures in ANSI C63.4 (2001) and CISPR. Measurements are performed in Open Area Test Sites (Distances: 3 meters, 10 meters, 30 meters) or the 3m full-size Anechoic Chamber. For each scan, the procedure for maximizing emissions in Appendices D and E were followed.

All test sites include a metal ground plane constructed of 22-gauge sheet metal. Each site contains a 2.5 meters diameter turntable for floor standing equipment, and a wooden table measuring 1.5 x 1.5 x 0.8 meters for tabletop equipment to facilitate testing, also it has heat and air conditioning systems to control environmental test conditions.

Measurements from 30 MHz to 1000 MHz are taken with bicono-log antennas. A horn antenna is used above 1000 MHz. The mast to support the antennas is capable of a 1 to 4 meter height range, which meets CISPR requirements. The antenna mast is non-conductive and remotely controllable.

Since radiated emissions, and to a lesser extent, conducted emissions, are a function of cable placement, the cable placement is varied to encompass all configurations that an end user would encounter to determine the configuration resulting in maximum emissions. At least one cable for each I/O port type is attached to the EUT. If peripherals or modules are available, at least one of each available type is installed and noted in the report. Generally, only one of each type is used unless good engineering judgment dictates that the use of more will affect emission levels. Excess cable lengths are arranged into a 30 x 40-cm bundle. Cables requiring non-standard lead dress are recorded in the report.

For conducted emissions testing, the equipment is moved to an insulating platform over the ground plane, and the EUT is powered from a LISN. Both sides of the AC line are measured and the results are compared to the applicable limits. Measurements are taken using CISPR quasi-peak and average detectors when the peak readings approach or exceed the average limit. Only quasi-peak readings are taken when the emissions from the EUT meet the average limit as measured with the quasi-peak detector.

5.2 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude in dB(μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(μV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(μV/m).

RA = 48.1 dB(μV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(μV/m)

In the Tables of the Appendix I Total Correction Factor includes the Cable Attenuation Factor and the Antenna Factor.

5.3 Measurement Uncertainty

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:
±4 dB at 10m ±5.4 dB at 3m

The expanded uncertainty (k = 2) for conducted emissions from 150 kHz to 30 MHz has been determined to be: ±2.6 dB

APPENDIX I - EMISSIONS TEST DATA

TILE Instrument Control System EMI Measurement Software

Radiated Emissions from 30MHz to 1GHz **Date:** 01-27-2006

Company: Advanced Telemetry Systems, Inc.
Model: R4500
Test Engineer: Norman Shpilsher
Special Info: Operating Frequency 164.5MHz
Standard: FCC Part 15.109, Class B
Test Site: 3m Anechoic Chamber, 3m measurement distance
Note: The table shows the worst case radiated emissions
All measurements were taken using a Peak detector

Table # 1

Frequency	Ant. Polarity	Reading dBμV	Ant.Factor dB1/m	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
30.26 MHz	V	4.9	18.8	23.7	40.0	-16.3
75.639 MHz	V	16.5	7.6	24.0	40.0	-16.0
119.66 MHz	V	20.5	13.3	33.8	43.5	-9.7
153.72 MHz	V	24.2	11.8	35.9	43.5	-7.6
175.02 MHz	V	12.4	10.9	23.3	43.5	-20.3
224.04 MHz	V	11.2	12.0	23.2	46.0	-22.8
401.3 MHz	V	10.2	18.7	28.9	46.0	-17.2
769.23 MHz	V	11.2	23.5	34.7	46.0	-11.3
923.08 MHz	V	9.5	25.1	34.5	46.0	-11.5
30.519 MHz	H	6.3	18.6	24.8	40.0	-15.2
61.256 MHz	H	15.5	6.8	22.3	40.0	-17.7
90.375 MHz	H	13.2	9.8	23.0	43.5	-20.5
121.34 MHz	H	15.7	13.3	29.0	43.5	-14.5
153.72 MHz	H	25.3	11.8	37.1	43.5	-6.5
164.57 MHz	H	25.6	11.3	36.9	43.5	-6.6
769.23 MHz	H	14.6	23.5	38.0	46.0	-8.0
923.08 MHz	H	11.7	25.1	36.8	46.0	-9.2
932.8 MHz	H	9.0	25.1	34.1	46.0	-11.9

TILE Instrument Control System EMI Measurement Software

Radiated Emissions from 1 to 8GHz **Date:** 01-27-2006

Company: Advanced Telemetry Systems, Inc.
Model: R4500
Test Engineer: Norman Shpilsher
Special Info: Operating Frequency 164.5MHz
Standard: FCC Part 15.109, Class B
Test Site: 3m Anechoic Chamber, 3m measurement distance
Note: The table shows the worst case radiated emissions
All measurements were taken using a Peak detector or Average Value (marked *)

Table # 3

Frequency	Ant. Polarity	Reading dBμV	Ant.Factor dB1/m	Amp.Gain dB	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
1.0756 GHz	V	40.5	26.5	30.9	36.2	54.0	-17.8
1.2296 GHz	V	53.9	27.0	30.6	50.3	54.0	-3.7
1.3836 GHz	V	43.5	27.5	30.3	40.7	54.0	-13.3
1.5376 GHz	V	48.5	28.0	30.1	46.4	54.0	-7.6
1.6944 GHz	V	44.1	28.8	30.1	42.8	54.0	-11.2
*4.1164 GHz	V	38.7	36.7	26.3	49.1	54.0	-4.9
7.9636 GHz	V	32.5	42.5	22.5	52.4	54.0	-1.6
1.2296 GHz	H	47.9	27.0	30.6	44.3	54.0	-9.7
1.3836 GHz	H	41.2	27.5	30.3	38.4	54.0	-15.6
1.5376 GHz	H	43.7	28.0	30.1	41.6	54.0	-12.4
1.6944 GHz	H	45.3	28.8	30.1	44.0	54.0	-10.0
4.1164 GHz	H	39.6	36.7	26.3	50.1	54.0	-3.9
7.9916 GHz	H	32.6	42.5	22.4	52.7	54.0	-1.3

TILE Instrument Control System EMI Measurement Software

Radiated Emissions from 1 to 8GHz **Date:** 01-27-2006

Company: Advanced Telemetry Systems, Inc.
Model: R4500
Test Engineer: Norman Shpilsher
Special Info: Operating Frequency 167.5MHz
Standard: FCC Part 15.109, Class B
Test Site: 3m Anechoic Chamber, 3m measurement distance
Note: The table shows the worst case radiated emissions
All measurements were taken using a Peak detector or Average Value (marked *)

Table # 4

Frequency	Ant. Polarity	Reading dBμV	Ant.Factor dB1/m	Amp.Gain dB	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
1.098 GHz	V	48.3	26.6	30.8	44.1	54.0	-9.9
1.4116 GHz	V	44.9	27.6	30.3	42.2	54.0	-11.8
1.5684 GHz	V	44.1	28.2	30.1	42.2	54.0	-11.8
1.7252 GHz	V	38.9	29.0	30.1	37.7	54.0	-16.3
*4.1136 GHz	V	39.2	36.7	26.3	49.6	54.0	-4.4
7.944 GHz	V	32.9	42.5	22.7	52.6	54.0	-1.4
1.098 GHz	H	44.8	26.6	30.8	40.6	54.0	-13.4
1.4116 GHz	H	43.0	27.6	30.3	40.4	54.0	-13.6
1.5684 GHz	H	40.9	28.2	30.1	39.0	54.0	-15.1
4.1136 GHz	H	40.2	36.7	26.3	50.6	54.0	-3.4
7.9832 GHz	H	32.5	42.5	22.4	52.6	54.0	-1.4

TILE Instrument Control System EMI Measurement Software

Conducted Emissions from 150kHz to 30MHz for AC port **Date:** 01-30-2006

Company: Advanced Telemetry Systems, Inc.
Model: R4500
Test Engineer: Uri Spector
Standard: FCC Part 15, Class B
Note: The table shows the worst case conducted emissions
All measurements were taken using a CISPR Quasi-peak detector

Table # 5

Line 1

Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
172.54 KHz	53.0	47.1	64.9	54.9	-11.9	-7.8
172.75 KHz	52.9	47.2	64.8	54.8	-11.9	-7.6
173.29 KHz	52.9	47.2	64.8	54.8	-11.9	-7.6
173.51 KHz	52.8	47.0	64.8	54.8	-12.0	-7.8
173.94 KHz	52.6	46.9	64.8	54.8	-12.2	-7.9
174.49 KHz	52.3	46.6	64.7	54.7	-12.5	-8.2
174.78 KHz	51.9	45.8	64.7	54.7	-12.8	-8.9
174.84 KHz	51.9	46.3	64.7	54.7	-12.8	-8.4
174.98 KHz	51.8	46.2	64.7	54.7	-12.9	-8.6
180.48 KHz	45.7	35.8	64.5	54.5	-18.8	-18.7
181.79 KHz	45.2	33.2	64.4	54.4	-19.2	-21.3
233.14 KHz	47.0	42.8	62.3	52.3	-15.3	-9.5

Line 2

Frequency	QP dBmV	AVG dBmV	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
172.49 KHz	53.8	48.1	64.9	54.9	-11.1	-6.8
172.53 KHz	54.1	48.1	64.9	54.9	-10.8	-6.8
172.84 KHz	54.1	48.4	64.8	54.8	-10.7	-6.4
173.11 KHz	54.2	48.5	64.8	54.8	-10.6	-6.3
173.35 KHz	54.3	48.6	64.8	54.8	-10.5	-6.2
173.66 KHz	54.3	48.6	64.8	54.8	-10.5	-6.2
173.66 KHz	54.3	48.6	64.8	54.8	-10.5	-6.2
173.77 KHz	54.3	48.6	64.8	54.8	-10.5	-6.2
174.07 KHz	54.3	48.5	64.8	54.8	-10.5	-6.3
174.9 KHz	54.1	48.1	64.7	54.7	-10.6	-6.6
175.13 KHz	53.6	47.8	64.7	54.7	-11.2	-7.0
232.31 KHz	49.2	44.9	62.4	52.4	-13.2	-7.5

TILE Instrument Control System EMI Measurement Software

Conducted Emissions from 150kHz to 30MHz **Date:** 01-30-2006
Charging Mode with BCM 7510 charger by Ault, Inc.

Company: Advanced Telemetry Systems, Inc.
Model: R4500
Test Engineer: Uri Spector
Standard: FCC Part 15, Class B
Note: The table shows the worst case conducted emissions
All measurements were taken using a CISPR Quasi-peak detector

Table # 6

Line 1

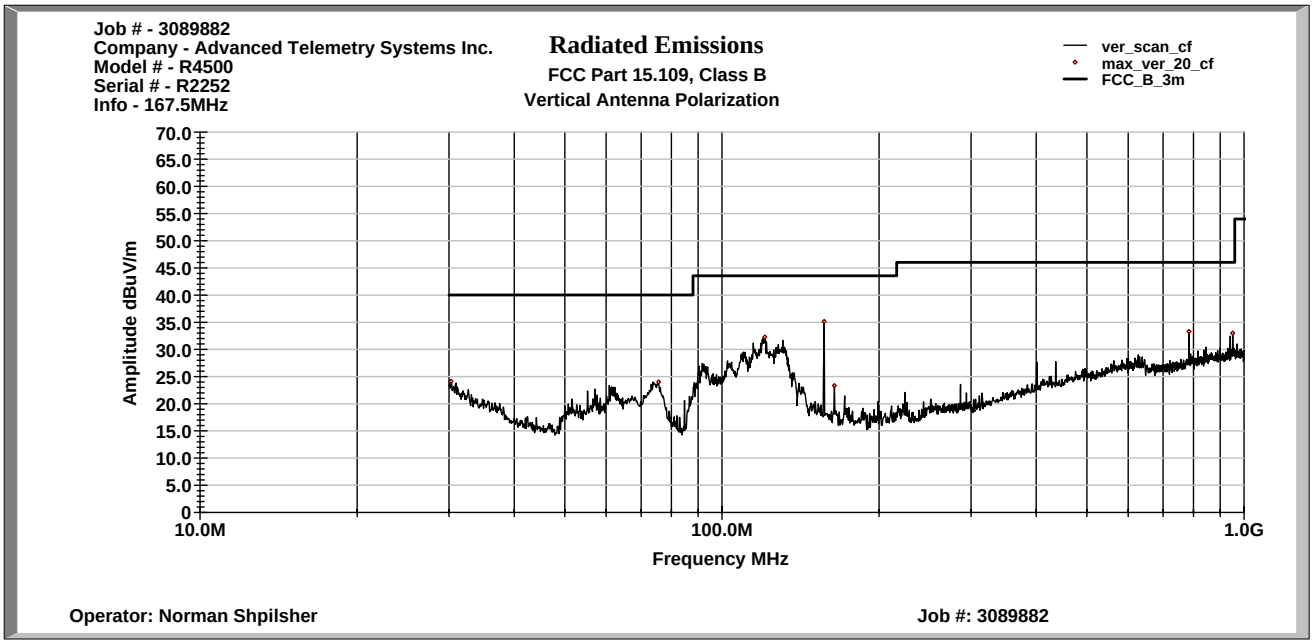
Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
181.03 KHz	45.4	24.5	64.4	54.4	-19.0	-29.9
181.32 KHz	45.3	24.6	64.4	54.4	-19.1	-29.8
183.26 KHz	45.6	24.7	64.3	54.3	-18.8	-29.6
183.54 KHz	45.5	24.7	64.3	54.3	-18.8	-29.6
183.95 KHz	36.0	24.8	64.3	54.3	-28.3	-29.5
184.01 KHz	45.6	24.6	64.3	54.3	-18.7	-29.7
184.01 KHz	45.3	24.5	64.3	54.3	-19.0	-29.8
184.02 KHz	45.4	24.7	64.3	54.3	-18.9	-29.6
184.35 KHz	45.4	24.8	64.3	54.3	-18.9	-29.6
184.46 KHz	45.3	24.7	64.3	54.3	-19.0	-29.6
184.47 KHz	45.4	24.7	64.3	54.3	-18.9	-29.6
184.71 KHz	45.5	24.5	64.3	54.3	-18.8	-29.8

Line 2

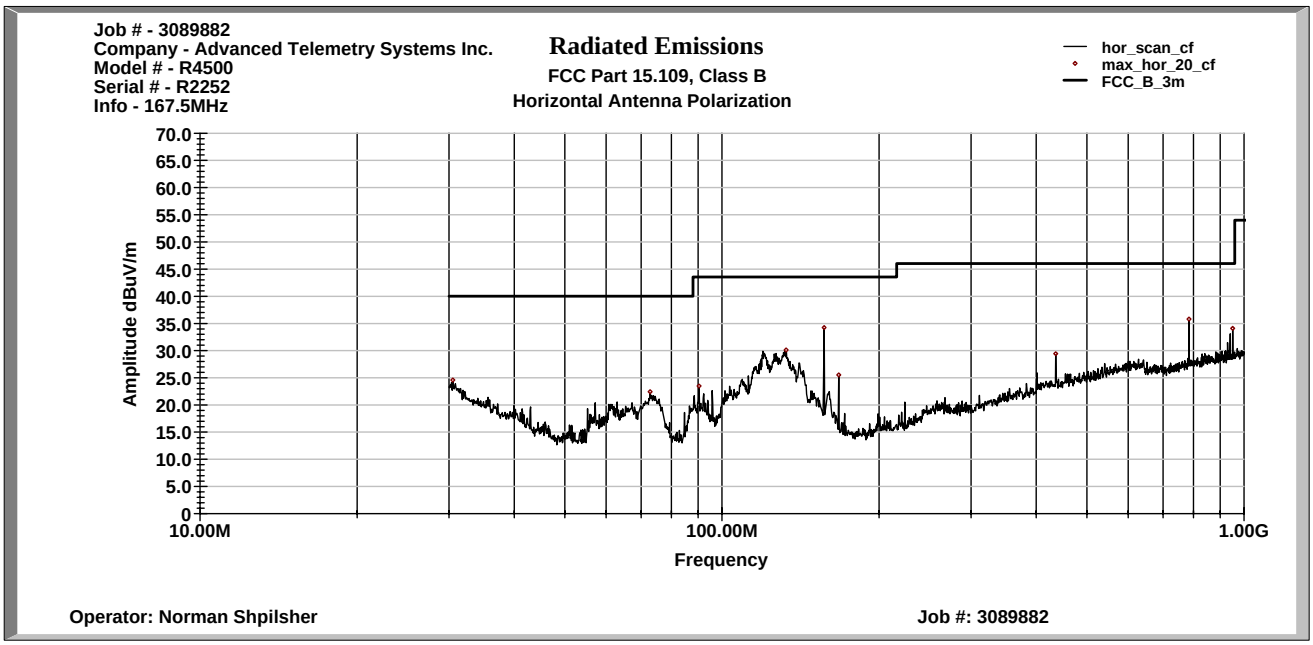
Frequency	QP dBmV	AVG dBmV	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
179.04 KHz	45.3	24.6	64.5	54.5	-19.2	-29.9
181.16 KHz	38.1	24.4	64.4	54.4	-26.4	-30.0
182.08 KHz	36.0	24.7	64.4	54.4	-28.4	-29.7
182.76 KHz	45.3	24.6	64.4	54.4	-19.1	-29.8
183.06 KHz	35.0	24.6	64.3	54.3	-29.3	-29.7
183.11 KHz	45.3	24.8	64.3	54.3	-19.0	-29.5
183.79 KHz	45.5	24.7	64.3	54.3	-18.8	-29.6
184.15 KHz	45.5	24.5	64.3	54.3	-18.8	-29.8
184.4 KHz	45.3	24.5	64.3	54.3	-19.0	-29.8
185.69 KHz	45.3	24.3	64.2	64.2	-18.9	-39.9
211.43 KHz	43.7	39.0	63.2	53.2	-19.5	-14.2
270.9 KHz	37.7	29.6	61.1	51.1	-23.4	-21.5

Graph # 1
Radiated Emissions from 30MHz to 1GHz @ 167.5MHz

Vertical Antenna Polarization

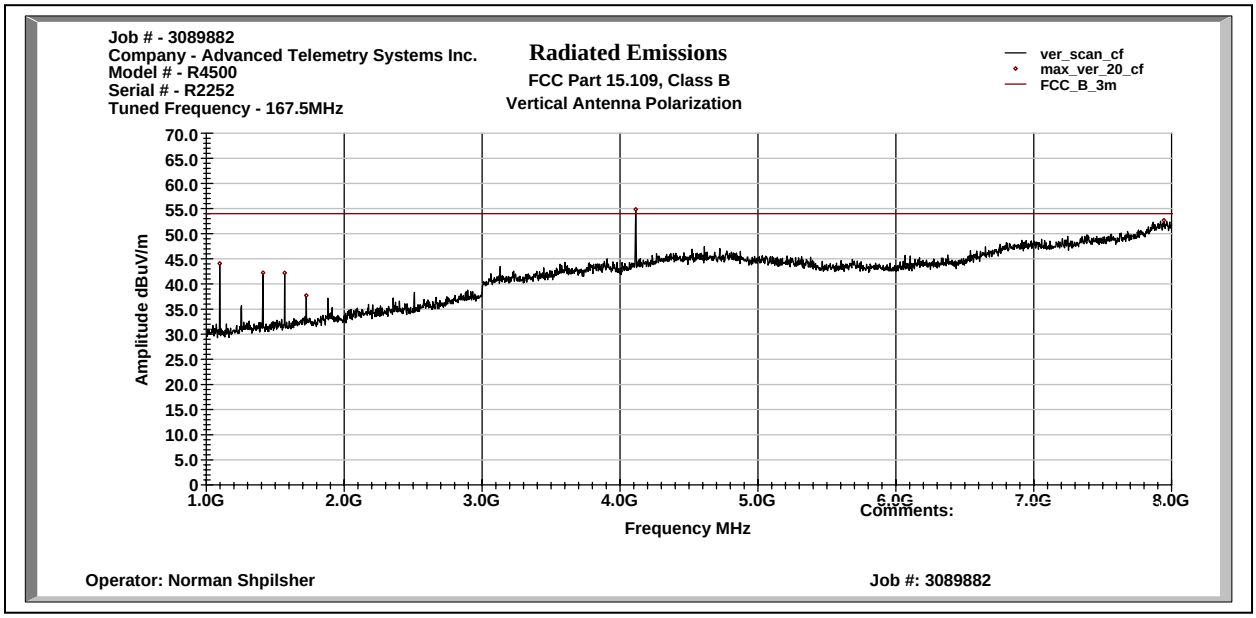


Horizontal Antenna Polarization

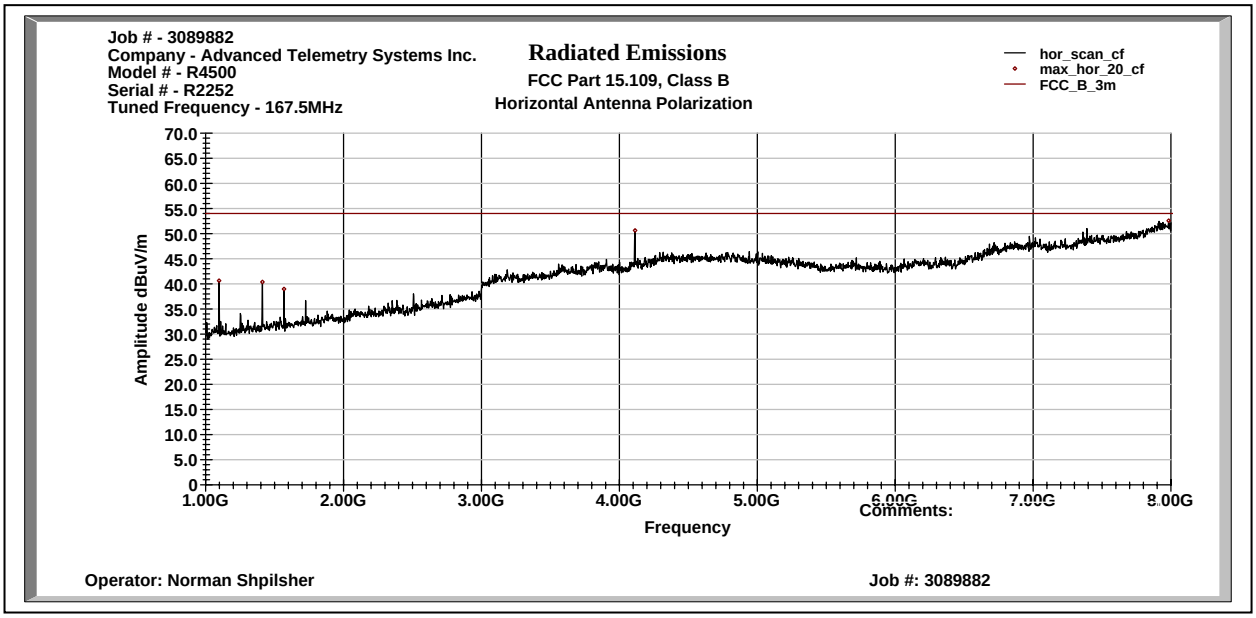


Graph # 2
Radiated Emissions from 1MHz to 8GHz @ 167.5MHz

Vertical Antenna Polarization

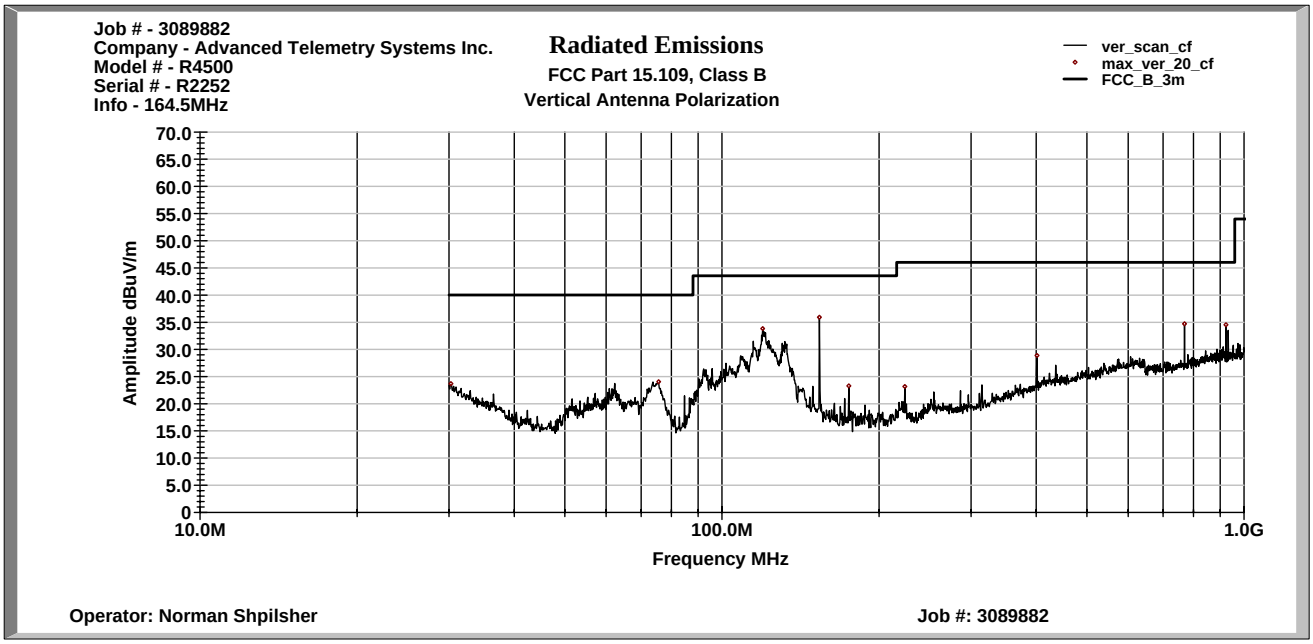


Horizontal Antenna Polarization

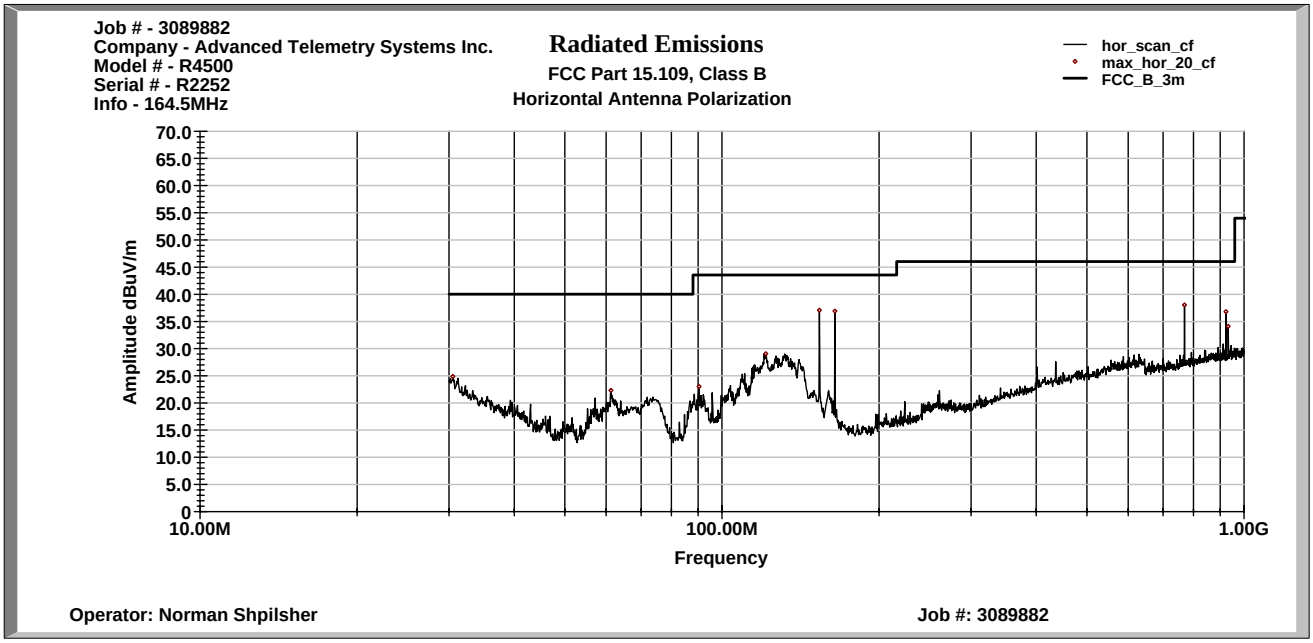


Graph # 3
Radiated Emissions from 30MHz to 1GHz @ 164.5MHz

Vertical Antenna Polarization

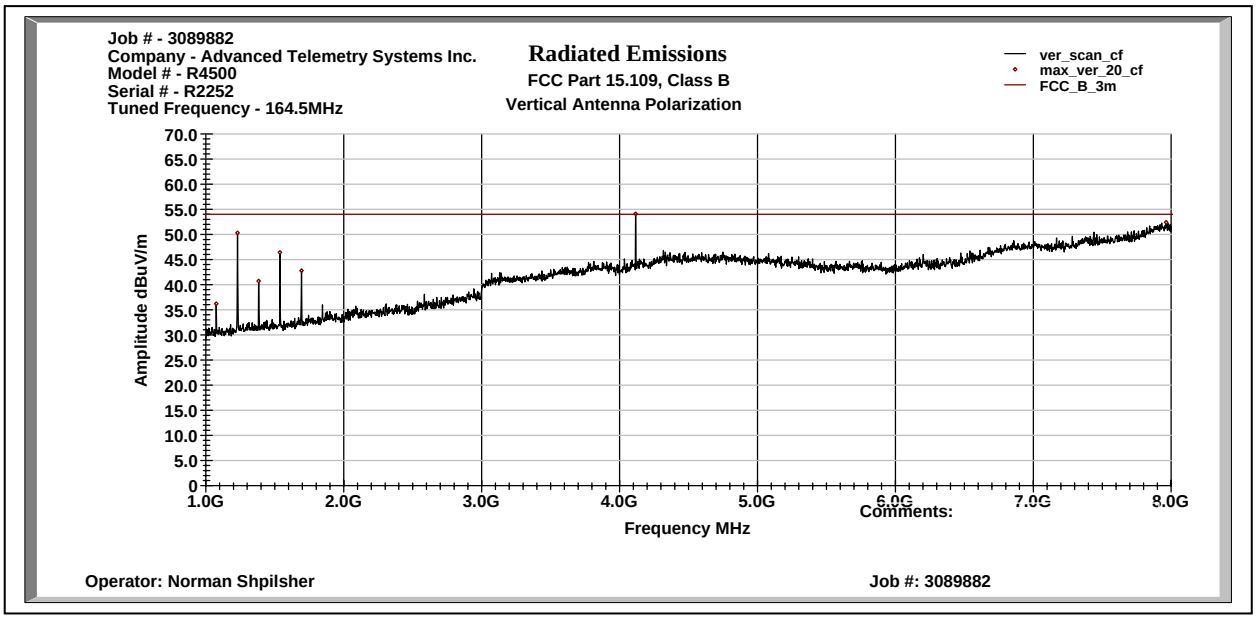


Horizontal Antenna Polarization

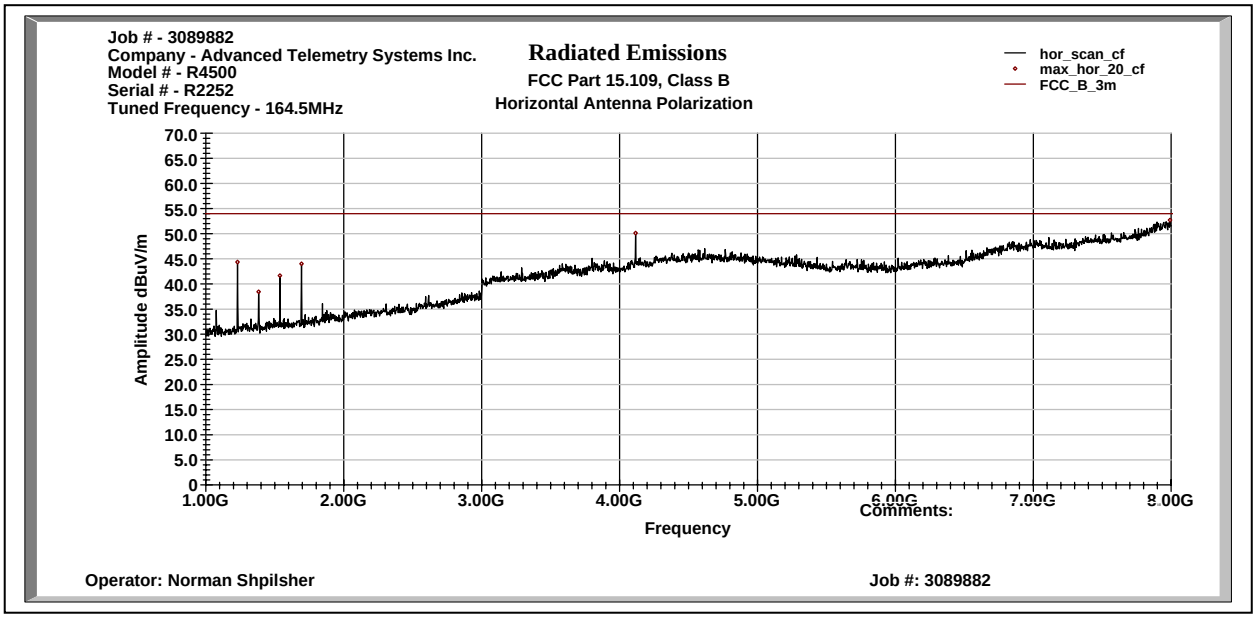


Graph # 4
Radiated Emissions from 1GHz to 8GHz @ 164.5MHz

Vertical Antenna Polarization

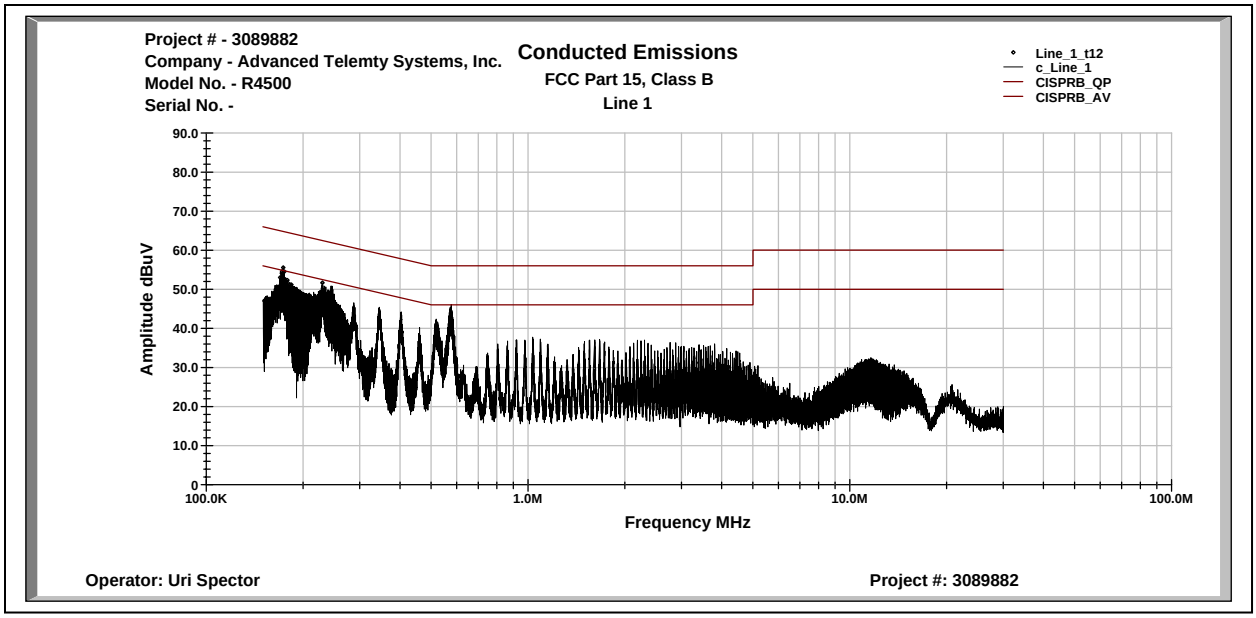


Horizontal Antenna Polarization

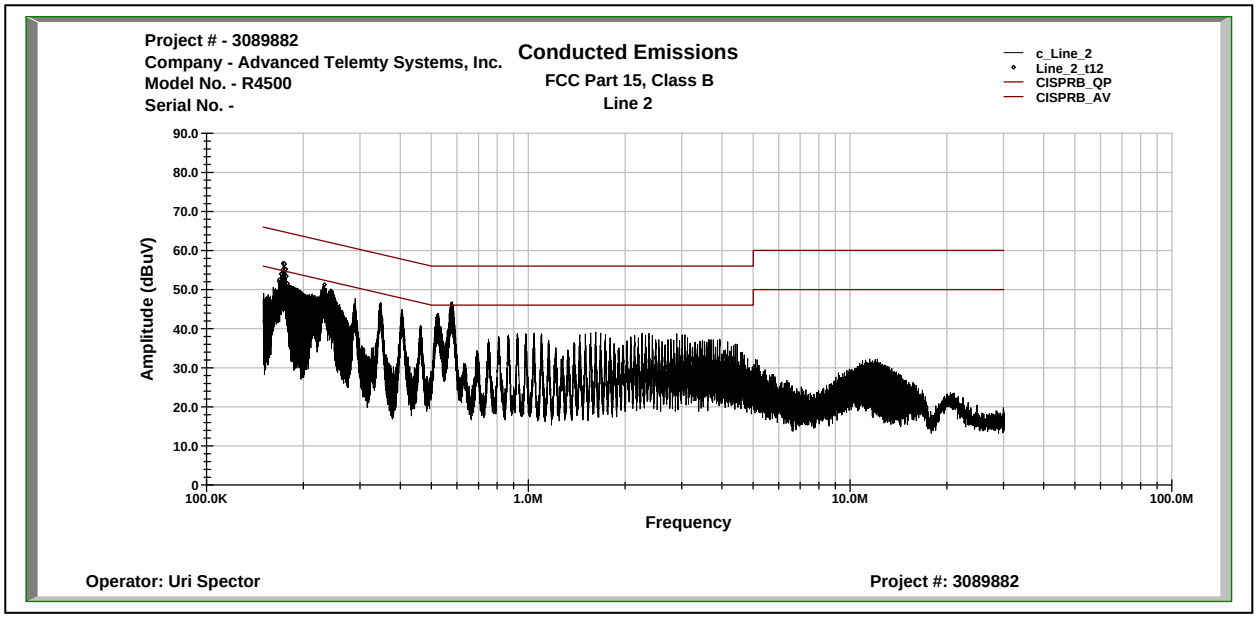


Graph # 5
Conducted Emissions from 150kHz to 30MHz with AC adapter

Line 1



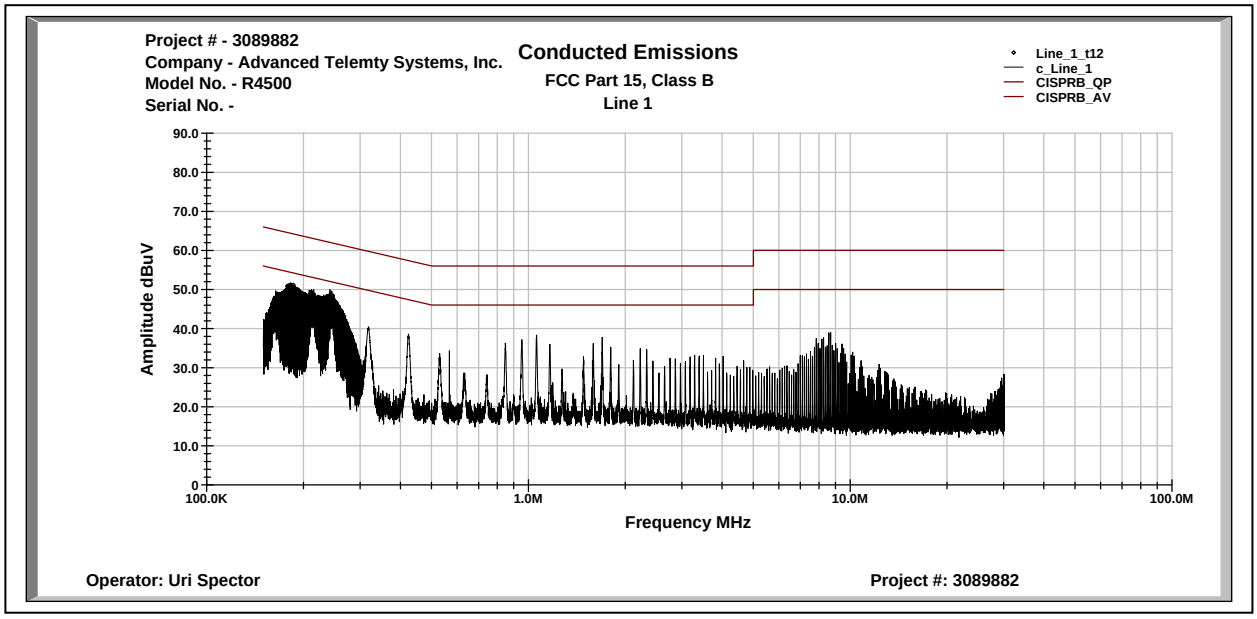
Line 2



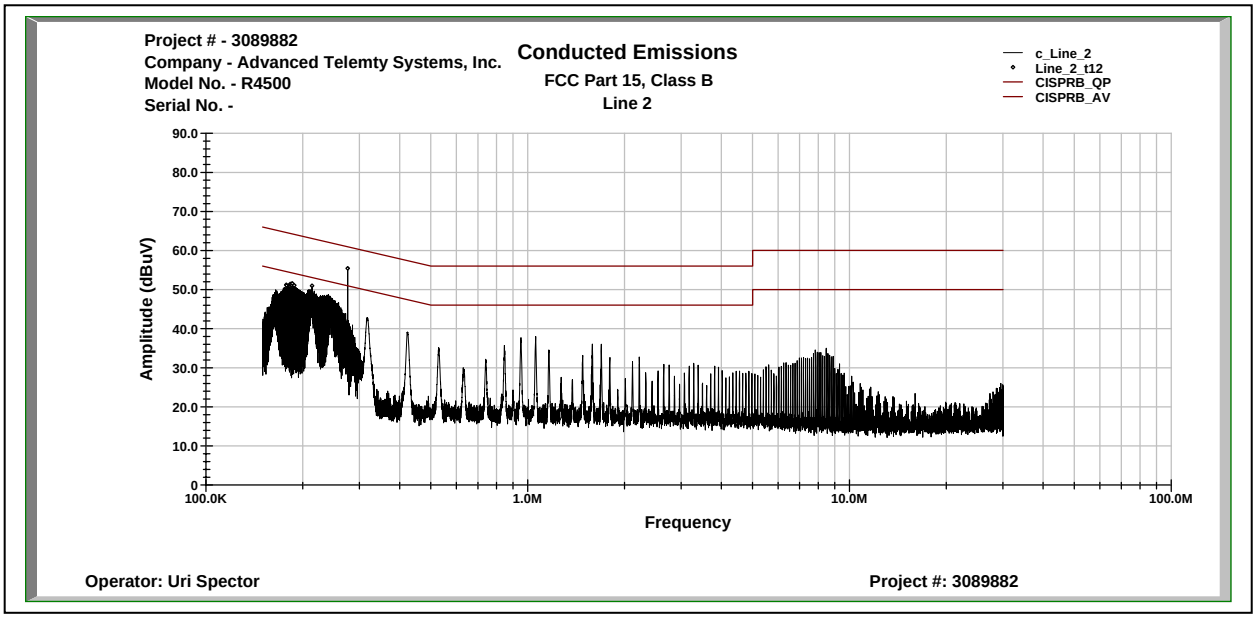
Graph # 6

Conducted Emissions from 150kHz to 30MHz with battery charger in charging mode

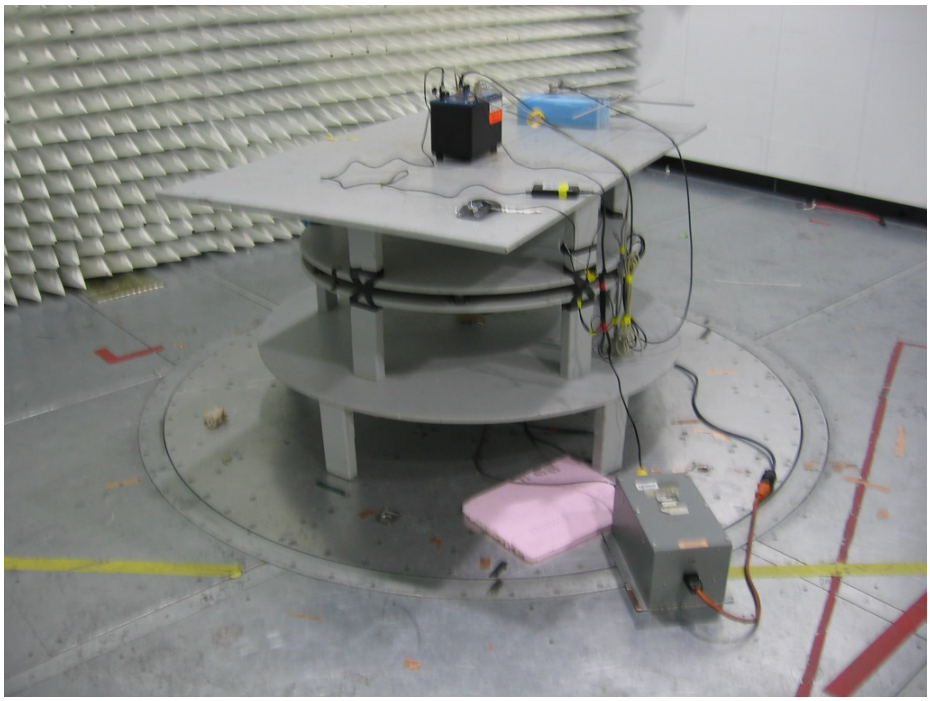
Line 1



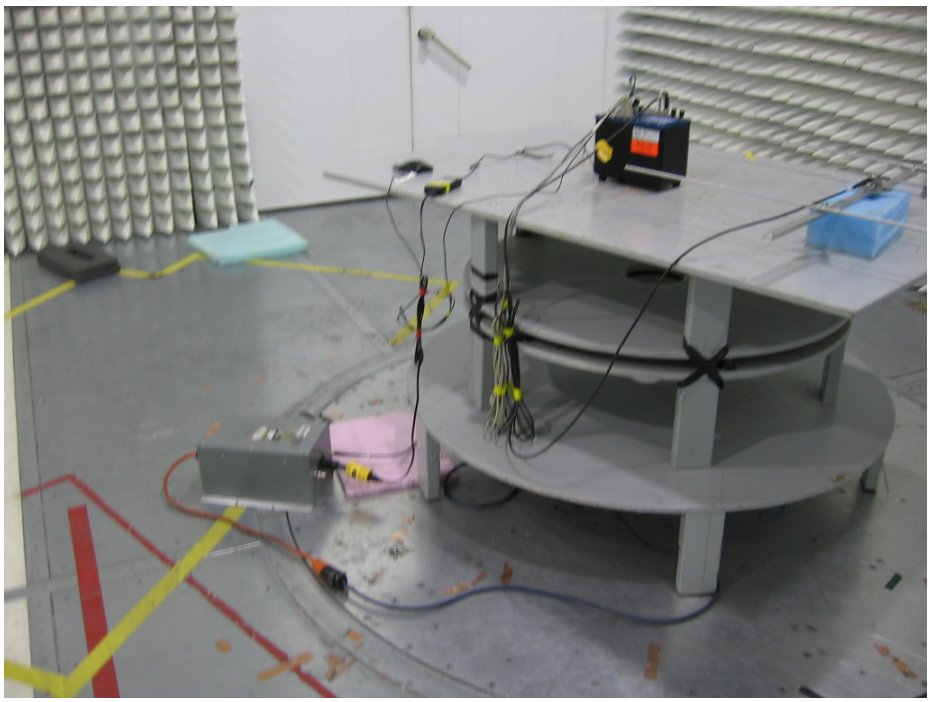
Line 2



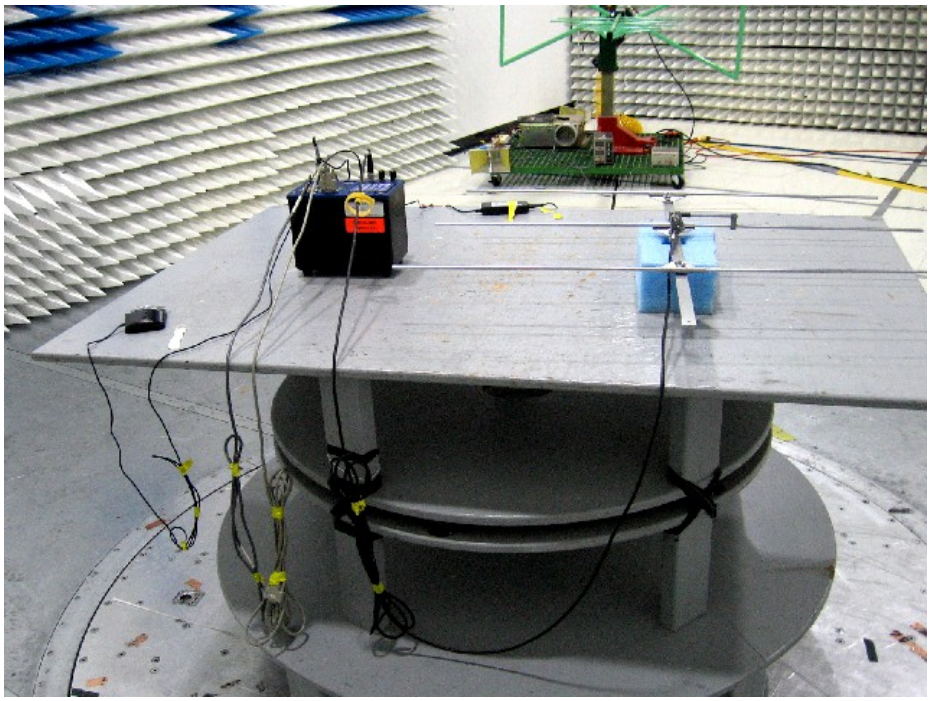
APPENDIX II - CONFIGURATION PHOTOGRAPHS



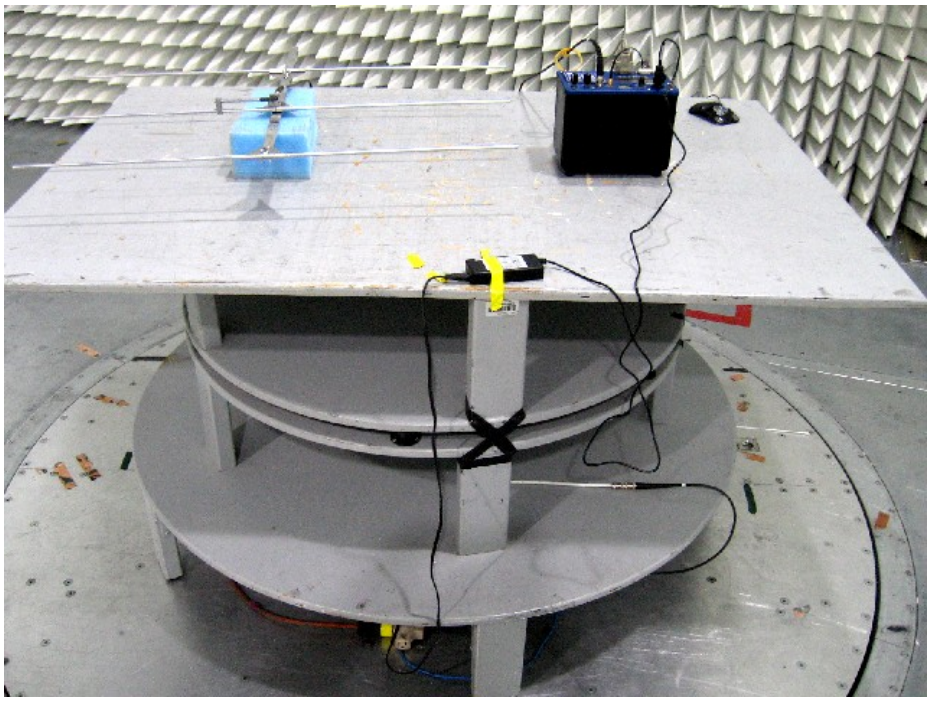
Conducted Emissions Test Configuration



Conducted Emissions Test Configuration



Radiated Emissions Test Configuration



Radiated Emissions Test Configuration