Global EMC Labs

EMC / EMI Test Report

As per

FCC Part 15.249, Subpart C: 2015

RSS 210:Issue 8: 2010

on the

Unlicensed Intentional Radiators

Head Motion Sensor with Charge Dock

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Testing produced for

Rehabtronics Inc.

See appendix A for full customer & EUT details.

Industry Canada
REGISTRATION #6844A-3

Testing Laboratory
Certificate #2555.01

R-4023, G-506
C-4498, T-1246

REG #377448

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Report Scope

This report addresses the EMC verification testing and test results of the **Head Motion Sensor with Charge Dock**, herein referred to as EUT (Equipment Under Test) performed at Global EMC Labs.

The EUT was tested for compliance against the following standards:

RSS 210 Issue 8:2010
FCC Part 15 Subpart C 15.249:2015

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

The results contained in this report relate only to the item(s) tested.

This report does not imply product endorsement by A2LA or any other accreditation agency, any government, or Global EMC Inc.

Opinions/interpretations expressed in this report, if any, are outside the scope of Global EMC Inc accreditation. Any opinions expressed do not necessarily reflect the opinions of Global EMC Inc, unless otherwise stated.

Client	Rehabtronics Inc.
Product	Head Motion Sensor with Charge Dock
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C:2015

Summary

The results contained in this report relate only to the item(s) tested.

EUT FCC Certification #, FCC ID:	QIQHSHM1
EUT Industry Canada Certification #, IC:	10685AHSHM1
Equipment Under Test	Head Motion Sensor with Charge Dock
EUT Passed all tests performed.	Yes (see test results summary)
Tests conducted by	Sanjiv Vyas

Client	Rehabtronics Inc.
Product	Head Motion Sensor with Charge Dock
Standard(s)	RSS 210 Issue 8:2010 / FCC Part 15 Subpart C:2015

Test Results Summary

Standard/Method	Description	Class/Limit	Result
FCC 15.203 RSS-Gen 7.1.2	Antenna Requirement	Unique	Pass See Justification
FCC 15.205 RSS 210 (Table 1) RSS-Gen Table 3	Restricted Bands for intentional operation	QuasiPeak Average	Pass
FCC 15.207 RSS 210	Power Line Conducted Emissions	QuasiPeak Average	Pass See Justifications
FCC 15.209 RSS-210 (Table 2) RSS-GEN Tables 5 & 6	Spurious Radiated emissions	QuasiPeak Average	Pass
FCC 15.249(a) RSS-210 A2.9(a)	Fundamental/Harmonic limits	Peak Average	Pass
Overall Result			**PASS**

All tests were performed by Project Engineer, Sanjiv Vyas.

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a ‘PASS’ grade. If not ‘FAIL’ grade will be issued.

Justifications, Descriptions, or Deviations

The following justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203 (RSS 210 section 5.5), this device uses a SMD antenna soldered onto the PCB inside the enclosure, and has no provisions for end-user replacement.

For the Restricted Bands of operation requirement specified in FCC15.205 (RSS 210, Table 1), the EUT is designed to only operate between 2.4 to 2.4835 GHz band and does not intentionally transmit in any of the restricted bands.

For FCC 15.207 requirements, when connected to the AC/DC power supply adaptor (Model: PMP15M-10-1, Make: PROTEK POWER), this product charges and does not transmit therefore conducted emission test was performed in this mode of operation.

Radiated emission measurements (spurious, fundamental and harmonics) test was performed with the EUT in transmitting mode as per FCC 15.209.

All radiated emission measurements were performed at a 3 meter distance, with the extrapolation factor applied as per applicable guidance, where applicable.

As this device is handheld, it was scanned in three orthogonal axis for the applicable radiated emissions and worst case results (Y-axis) are presented in this test report.

A later revision of the standard may have been substituted in place of the previous dated referenced revision. The year of the specification used are listed under applicable standards. Using the later revision accomplishes the goal of ensuring compliance to the intent of the previous specification, while allowing the laboratory to incorporate the extensions and clarifications made available by a later revision.

Applicable Standards, Specifications and Methods

ANSI C63.4:2009	- Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10:2009	- American national standard for testing unlicensed wireless devices
CFR 47 FCC 15:2015	- Code of Federal Regulations – Radio Frequency Devices
RSS 210:2010	- Issue 8: Spectrum Management and Telecommunications Radio Standards Specification Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
CISPR 22:2008	- Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
ICES-003:2012	- Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard
ISO/IEC 17025:2005	- General Requirements for the competence of testing and calibration laboratories
FCC KDB 558074	- FCC KDB 558074 Digital Transmission Systems, measurements and procedures (Revision 2)

Sample calculation(s)

Radiated Emission Test

Margin = Limit – (Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain)
Margin = 50.5dBµV/m – (50dBµV + 10dB + 2.5dB – 20dB)
Margin = 8.0 dB (pass)

Power Line Conducted Emission Test

Margin = Limit – (Received Signal + Attenuation Factor + Cable Loss + LISN Factor)
Margin = 73.0dBµV – (50dBµV + 10dB + 2.5dB + 0.5dB)
Margin = 10.0 dB (pass)

Document Revision Status

Revision 1 - July 10, 2015
- First Revision

Definitions and Acronyms

The following definitions and acronyms are applicable in this report.
See also ANSI C63.14.

AE – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

BW – Bandwidth. Unless otherwise stated, this is refers to the 6 dB bandwidth.

AM – Amplitude Modulation

Class A device – A device that is marketed for use in a commercial, industrial or business environment. A 'Class A' device should not be marketed for use by the general public. A 'Class A' device should contain a warning in the accompanying documents, see "Appendix C - Required Identifications, Markings and Document Information".

Class B device – A device that is marketed for use in a residential environment and may also be used in a commercial, business or industrial environments.

EMC – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

EMI – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

Enclosure Port – Physical boundary of equipment through which electromagnetic fields may radiate or impinge.

EUT – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

LISN – Line Impedance Stabilization Network

NCR – No Calibration Required

NSA – Normalized Site Attenuation

RF – Radio Frequency

Testing Facility

Testing for EMC on the EUT was carried out at Global EMC labs near Toronto, Ontario. The testing lab consists of a 3m semi-anechoic chamber calibrated to be able to allow measurements on an EUT with a maximum width or length of up to 2m and height of up to 3m. The chamber is equipped with a turntable that is capable of testing devices up to 3300lb in weight. This facility is capable of testing products that are rated for 120Vac and 240Vac single phase, or 208Vac 3 phase input. DC capability is also available. The chamber is equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the Vertical Ground plane if applicable.

Calibrations and Accreditations

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, 377448), Industry Canada (IC, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-4023, G-506, C-4498, and T-1246). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in 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". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at Global EMC. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at Global EMC. Global EMC Inc is accredited to ISO 17025 by A2LA with Testing Certificate #2555.01. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or bi-annual basis as listed for each respective test.

Testing Environmental Conditions and Dates

Following were the environmental conditions in the facility during time of testing –

Date	Test	Initials	Ambient Temperature (ºC)	Relative Humidity (%)	Pressure (kPa)
Apr 01, 2015	Power Line Conducted Emissions	SV	21-24	42 - 48%	96 - 99
Mar 20, 2015	Radiated Emissions	SV	21-24	42 - 48%	96 - 99
Apr 10, 2015	20 dB Bandwidth Measurement	SV	21 – 24	42 - 48%	96 - 99
Apr 10, 2015	Average measurement using Duty cycle	SV	21 – 24	42 - 48%	96 - 99

Detailed Test Results Section

Power Line Conducted Emissions

Purpose

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT's power line does not exceed the limits listed below as defined in the applicable test standard, as measured from a LISN. This helps protect lower frequency radio services such as AM radio, shortwave radio, amateur radio operators, maritime radio, CB radio, and so on, from unwanted interference.

Limits & Method

The limits are as defined in 47 CFR FCC Part 15 Section 15.207 & 15.107
Method is as defined in ANSI C63.4:2009

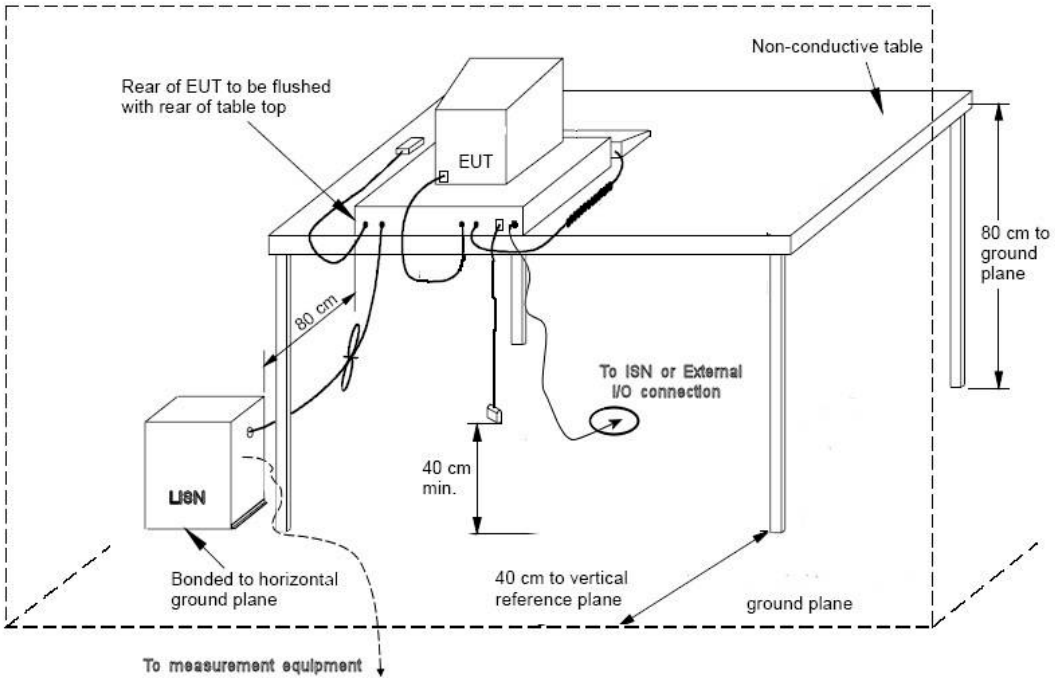
Average Limits		Quasi-Peak Limits	
150 kHz – 500 kHz	56 to 46* dBµV	150 kHz – 500 kHz	66 to 56* dBµV
500 kHz – 5 MHz	46 dBµV	500 kHz – 5 MHz	56 dBµV
5 MHz – 30 MHz	50 dBµV	5 MHz – 30 MHz	60 dBµV

* Decreases linearly with the logarithm of the frequency

Both Quasi-Peak and Average limits are applicable and each is specified as being measured with a resolution bandwidth of 9 kHz. For Quasi-Peak, a video bandwidth at least three times greater than the resolution bandwidth is used.

Based on ANSI C63.4 Section 4.2, if the Peak or Quasi-Peak detector measurements do not exceed the Average limits, then the EUT is deemed to have passed the requirements.

Typical Setup Diagram



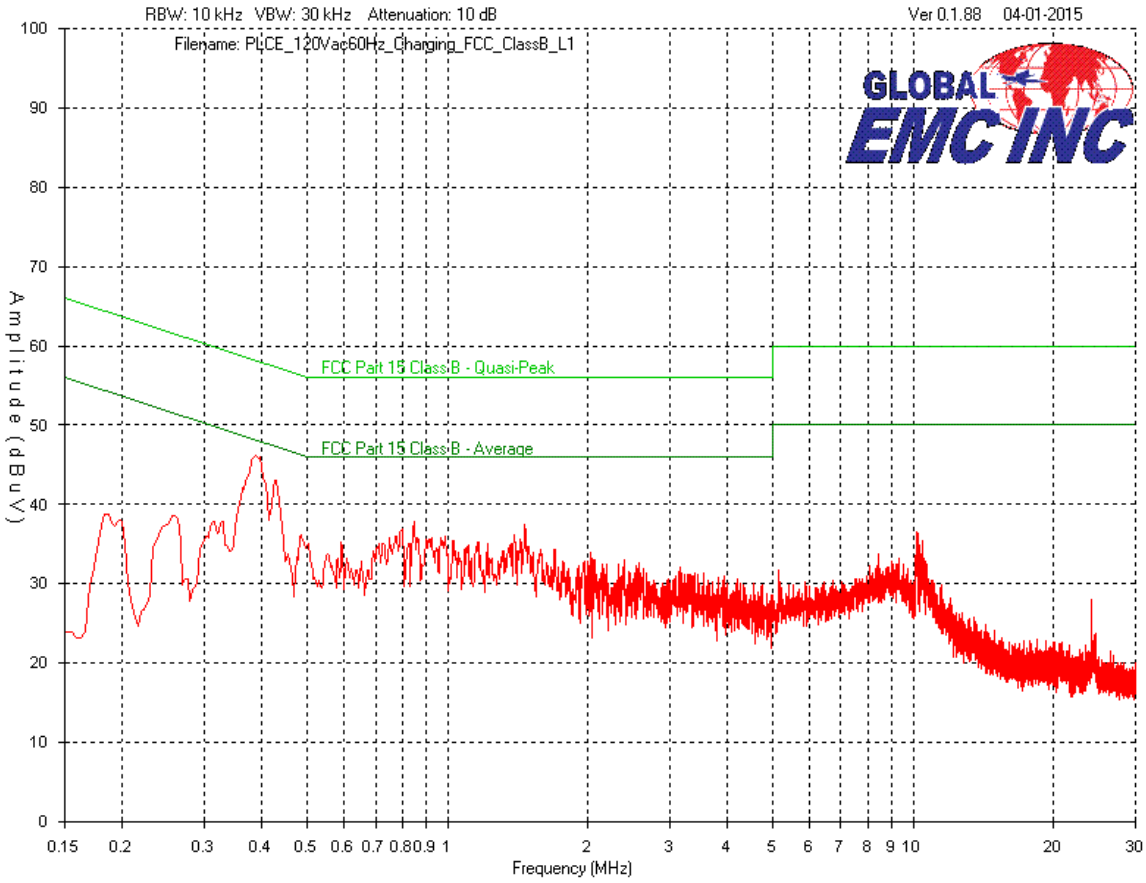
Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±2.91dB with a 'k=2' coverage factor and a 95% confidence level.

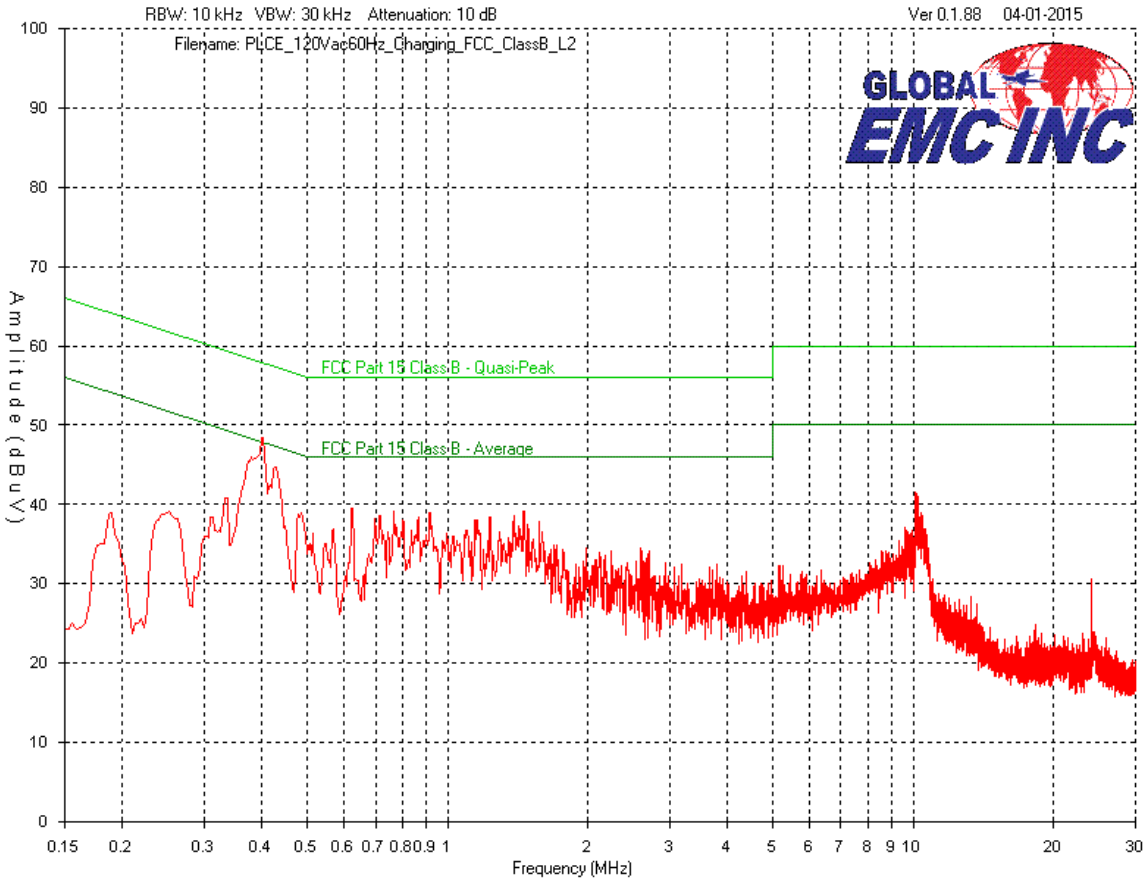
Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

Peak Emissions Graph - L1 (Line) 120 Vac @ 60 Hz (0.15 MHz – 30 MHz)



Peak Emissions Graph - L2 (Neutral) 120 Vac @ 60 Hz (0.15 MHz – 30 MHz)



Final Measurements

Power Line Conducted Emissions Table – Class B
Charging mode: 120V, 60Hz

Test Frequency (MHz)	Detection mode (Peak /Avg/Q-Peak)	Raw signal (dBuV)	Attenuator (dB)	Cable loss (dB)	LISN factor (dB)	Received signal (dBuV)	Quasi-Peak Emission limit (dBuV)	Average Emission limit (dBuV)	Quasi-Peak Emission Margin (dBuV)	Average Emission Margin (dBuV)	Result
Line 1 - Phase											
0.3860	Peak	36.1	10.0	0.1	0.0	46.2	58.1	48.1	11.9	1.9	Pass
0.8479	Peak	27.7	10.0	0.1	0.0	37.8	56.0	46.0	18.2	8.2	Pass
1.4627	Peak	27.3	10.0	0.1	0.0	37.4	56.0	46.0	18.6	8.6	Pass
0.7981	Peak	26.9	10.0	0.1	0.0	37.0	56.0	46.0	19.0	9.0	Pass
1.3896	Peak	26.1	10.0	0.1	0.0	36.2	56.0	46.0	19.8	9.8	Pass
0.4857	Peak	26.0	10.0	0.1	0.0	36.1	56.2	46.2	20.1	10.1	Pass
Line 2- Neutral											
0.3993	Avg	18.2	10.0	0.1	0.0	28.3	-	47.9	-	19.6	Pass
0.6219	Peak	29.4	10.0	0.1	0.0	39.5	56.0	46.0	16.5	6.5	Pass
1.4594	Peak	29.0	10.0	0.1	0.0	39.1	56.0	46.0	16.9	6.9	Pass
0.7681	Peak	28.9	10.0	0.1	0.0	39.0	56.0	46.0	17.0	7.0	Pass
0.9177	Peak	28.8	10.0	0.1	0.0	38.9	56.0	46.0	17.1	7.1	Pass
0.4857	Peak	28.8	10.0	0.1	0.0	38.9	56.2	46.2	17.3	7.3	Pass
0.7183	Peak	28.5	10.0	0.1	0.0	38.6	56.0	46.0	17.4	7.4	Pass
1.2367	Peak	28.3	10.0	0.1	0.0	38.4	56.0	46.0	17.6	7.6	Pass
1.1470	Peak	28.0	10.0	0.1	0.0	38.1	56.0	46.0	17.9	7.9	Pass
1.5757	Peak	27.8	10.0	0.1	0.0	37.9	56.0	46.0	18.1	8.1	Pass

Note: 1)
Peak = Peak measurement
Avg = Average measurement
QP = Quasi-Peak measurement

2) See 'Appendix B – EUT & Test Setup Photographs' for photos showing the test set-up for the highest line conducted emission.

3)Where peak readings are under quasi-peak and/or average limits, the EUT passes the respective requirements. No quasi-peak or average measurements are required.

Test Equipment List

Equipment	Model No.	Manufacturer	Last Calibration Date	Next Calibration Date	Asset #
Spectrum Analyzer	ESL 6	Rohde & Schwarz	Nov. 15, 2013	Nov. 15, 2015	GEMC 160
LISN	FCC-LISN-50/250-16-2-01	FCC	Jan. 15, 2015	Jan. 15, 2017	GEMC 65
RF Cable 7m	LMR-400-7M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50Ω-MN-MN	LexTec	NCR	NCR	GEMC 29
10dB Attenuator	FP-50-10	Trilithic	NCR	NCR	GEMC 42
Emissions Software	0.1.88	Global EMC	NCR	NCR	GEMC 58

This report module is based on GEMC template "FCC – Power Line Conducted Emissions Class B_Rev1"

Radiated Emissions

Purpose

The purpose of these tests is to ensure that the RF energy emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference. RF energy unintentionally emitted from the EUT, and the intentionally emitted fundamental and its harmonics, have limits as shown below.

Limit(s) and Method

The method is as defined in ANSI C63.4:2009 and as per applicable standards.
For the fundamental and harmonics, the limits are as defined in FCC Part 15, Section 15.249 (at 3 m):

Fundamental frequency	Field strength limit of fundamental[2]	Field strength limit of harmonics[2]
2400-2483.5 MHz	50 mV/m (93.97 dBuV/m)	500 uV/m (53.87 dBuV/m)

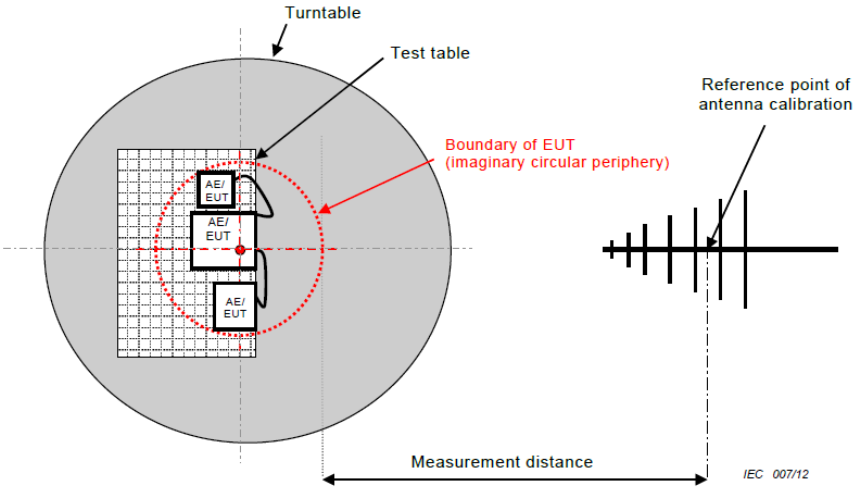
For other spurious emissions, the limits are as defined in FCC Part 15, Section 15.209:
0.009 MHz – 0.490 MHz, 2400/F(kHz) uV/m at 300 m[1]
0.490 MHz – 1.705 MHz, 24000/F(kHz) uV/m at 30 m[1]
1.705 MHz – 30 MHz, 30 uV/m at 30 m[1]
30 MHZ – 88 MHz, 100 uV/m (40.0 dBuV/m[1]) at 3 m
88 MHz – 216 MHz, 150 uV/m (43.5 dBuV/m[1]) at 3 m
216 MHz – 960 MHz, 200 uV/m (46.4 dBuV/m[1]) at 3 m
Above 960 MHz, 500 uV/m (54.0 dBuV/m[1]) at 3 m
Above 1000 MHz[2], 500 uV/m (54 dBuV/m) at 3m

Peak field strengths are limited to be at most 20 dB above the average limits as defined above at the corresponding frequencies.

[1]Limit is with 120 kHz measurement bandwidth and a using a Quasi Peak detector.
[2]Limit is with 1 MHz measurement bandwidth and using an Average detector. Where an average detector is stated, a peak limit of 20 dB higher additionally applies.

Devices scanned below 30 MHz are scanned at a 3 meter test distance, and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 40dB/decade was used. For example for 3 meter measurements, an extrapolation factor 40 dB from 40 Log (30m / 3m) is applied.

Typical Radiated Emissions Setup



Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is ±4.25dB for 30MHz – 1GHz and ±4.93dB for 1GHz – 26GHz with a 'k=2' coverage factor and a 95% confidence level.

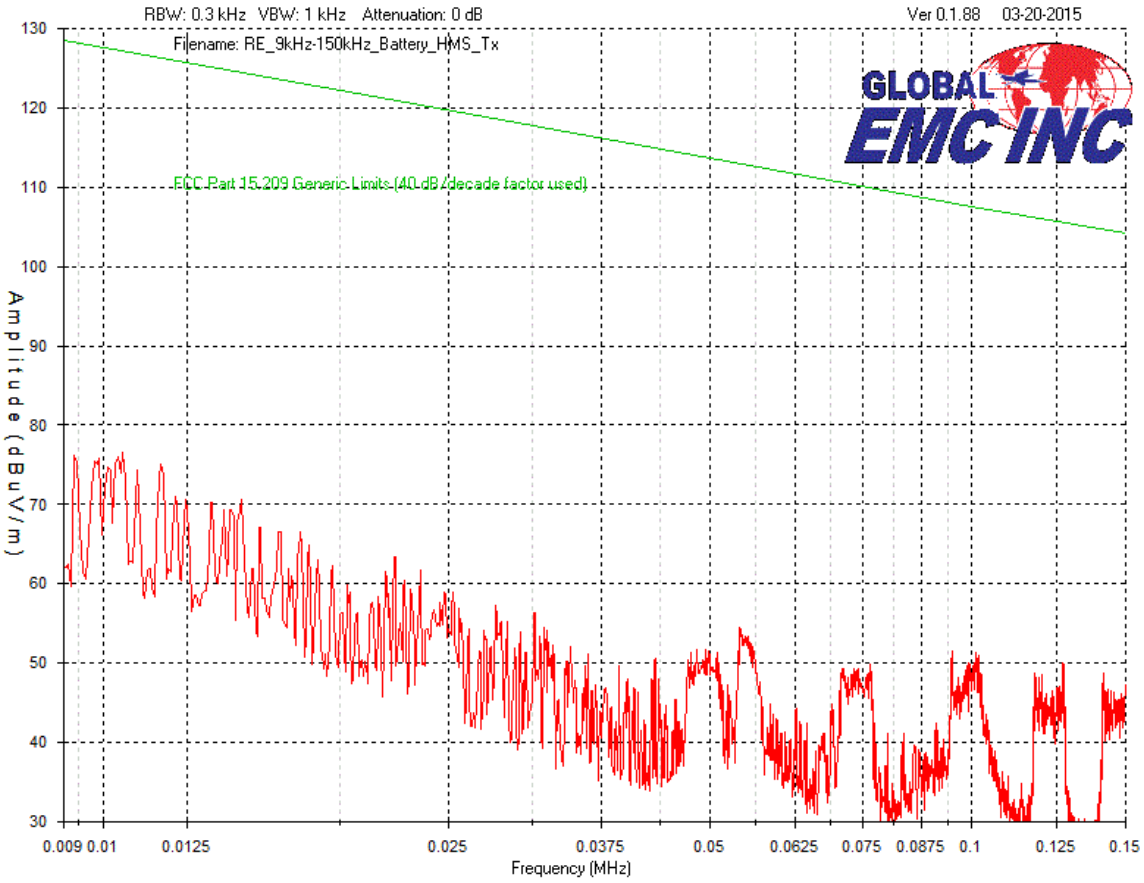
Preliminary Graphs

The graphs shown below are peak scans for graphical illustration only. For final measurements with the appropriate detector, please refer to the final measurement table where applicable. The graph shown below is a maximized peak measurement graph, measured with a resolution bandwidth greater than the final required detector and over a full 0-360° rotation. This peaking process is done as a worst case measurement. This process enables the detection of frequencies of concern for final measurement, and provides considerable time savings.

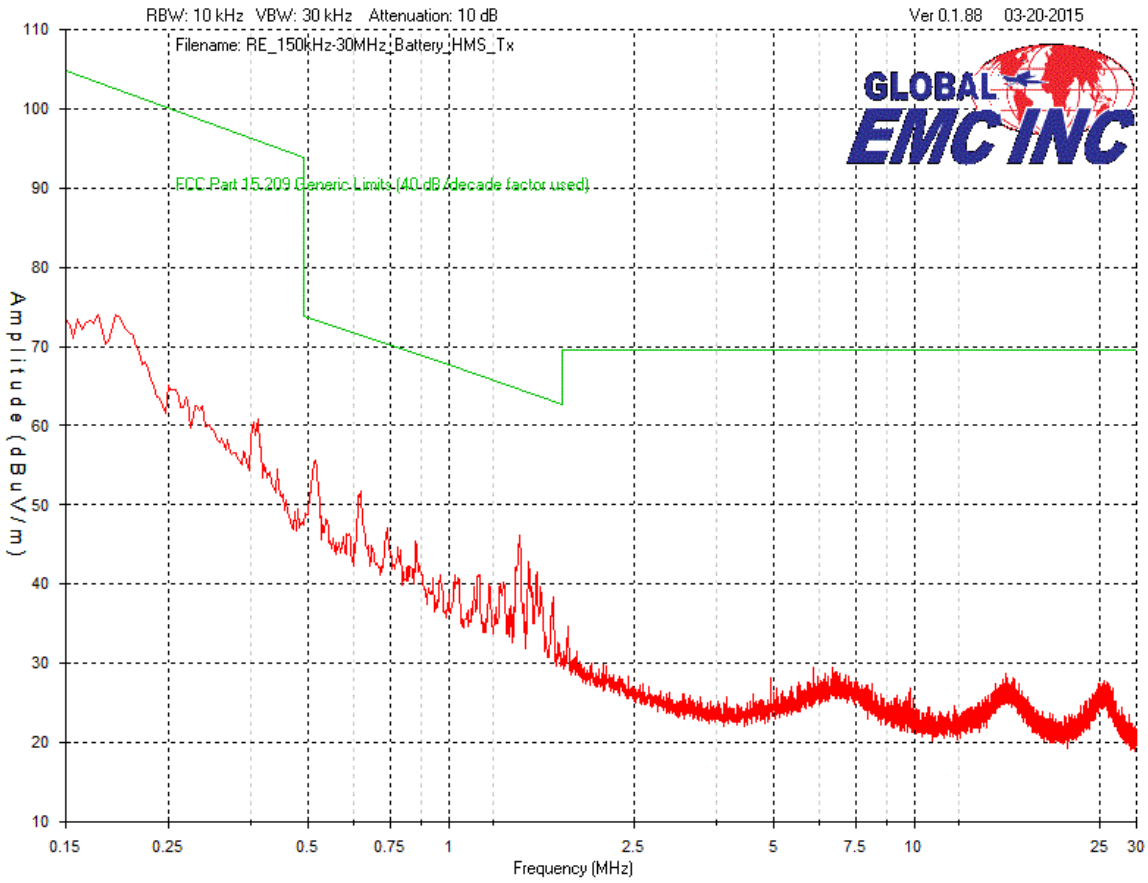
In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10^{th} harmonic (a minimum of 26 GHz). No emissions were detected above 1GHz.

Low, middle, and high channel modes were investigated. The worst case (middle channel) graphs are presented. As this device is handheld, it was scanned in three orthogonal axis for the applicable radiated emissions and worst case results (X-axis) are presented in this test report with the EUT operating in transmitting mode.
Emissions are also verified at the band edges, and shown in the *Final Measurements* table.

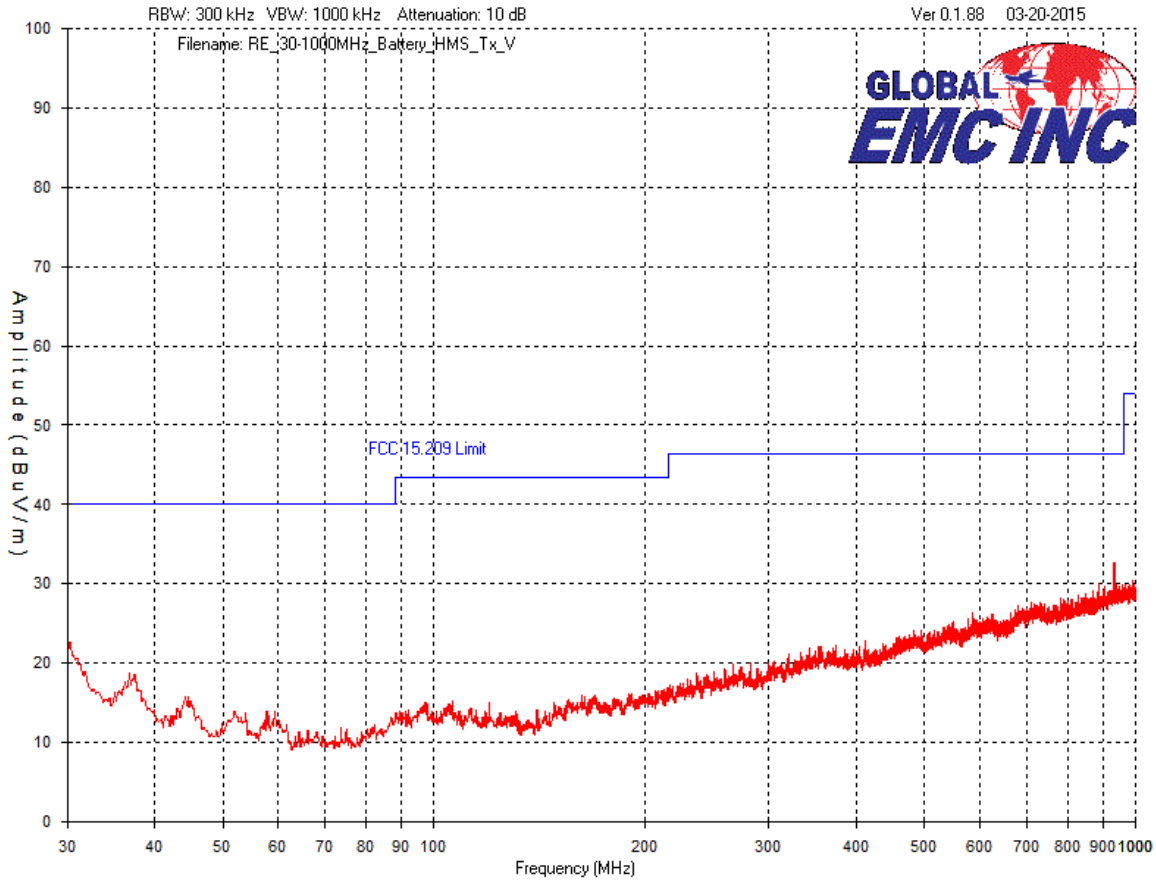
Peak Emissions Graph – Middle Channel, 9 kHz – 150 kHz



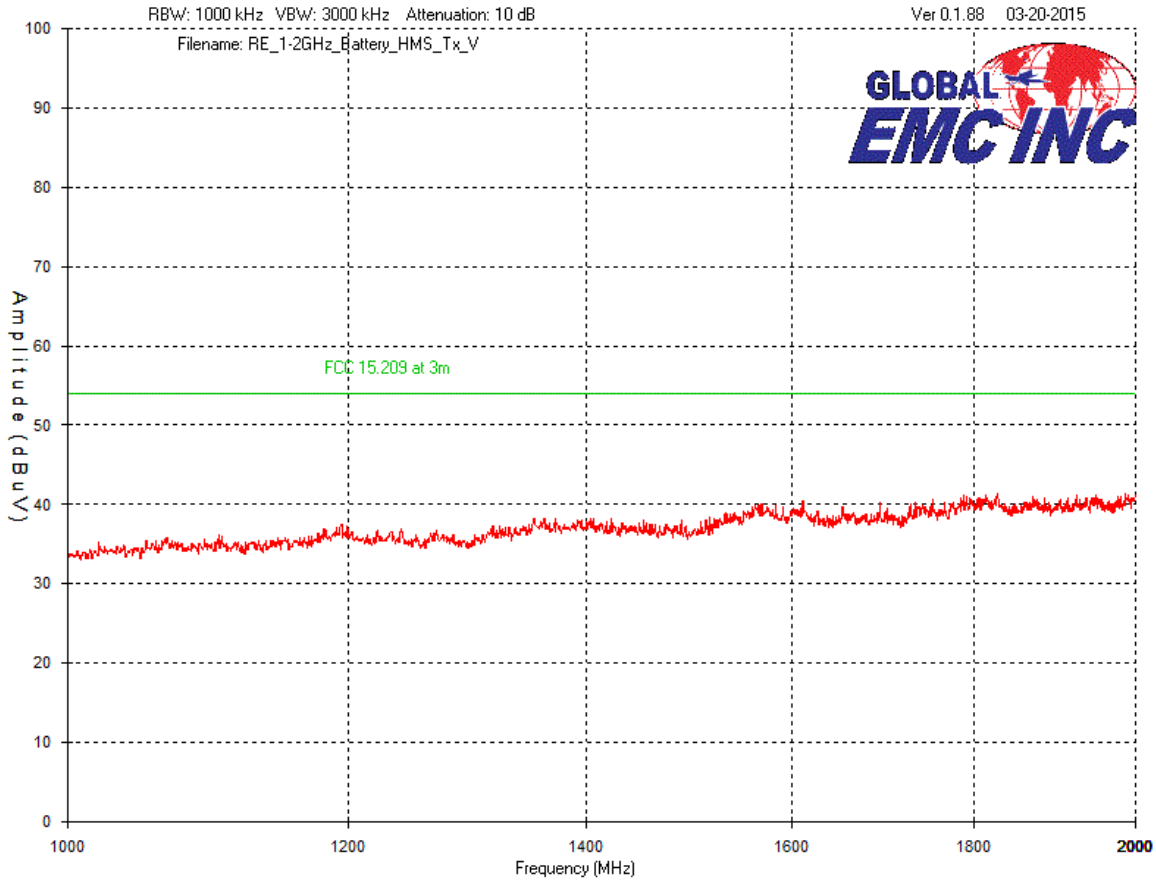
Peak Emissions Graph – Middle Channel, 150 kHz – 30 MHz



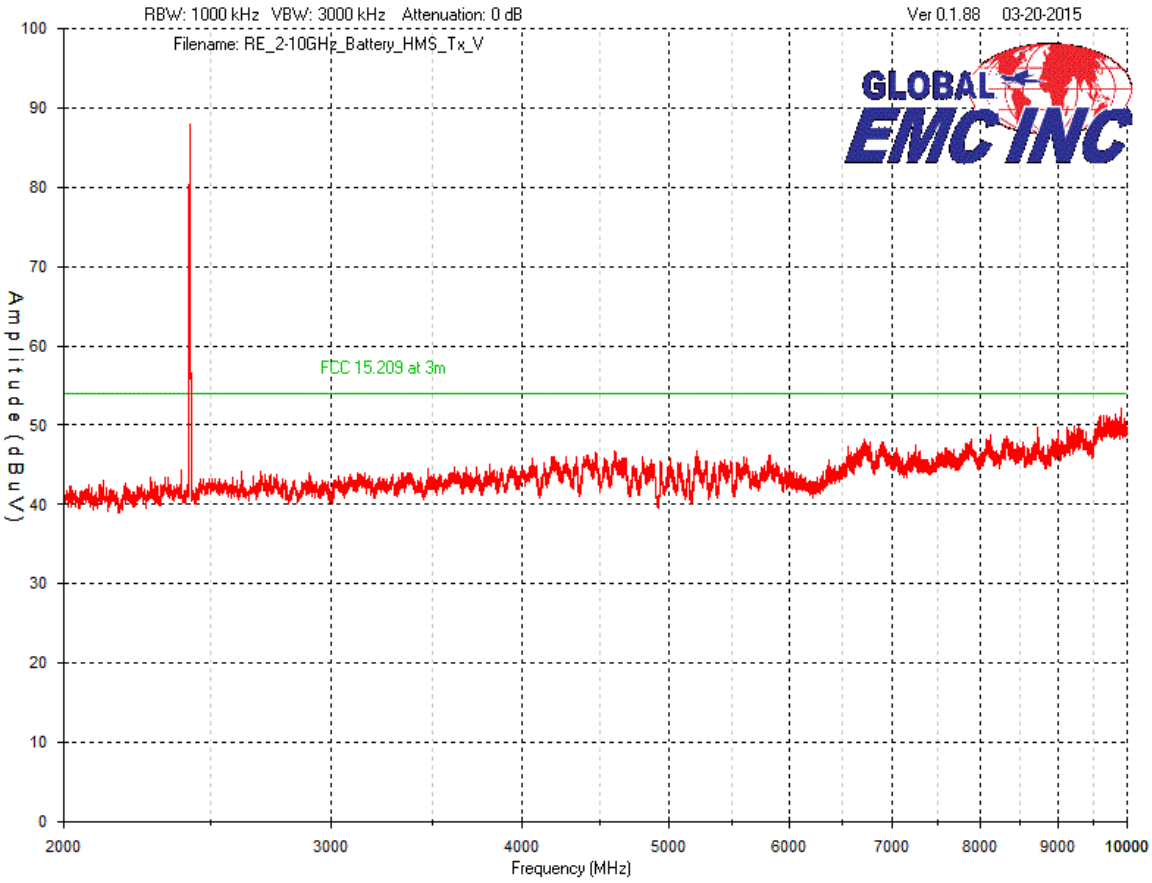
Vertical – Peak Emissions Graph – Middle Channel, 30 MHz – 1 GHz



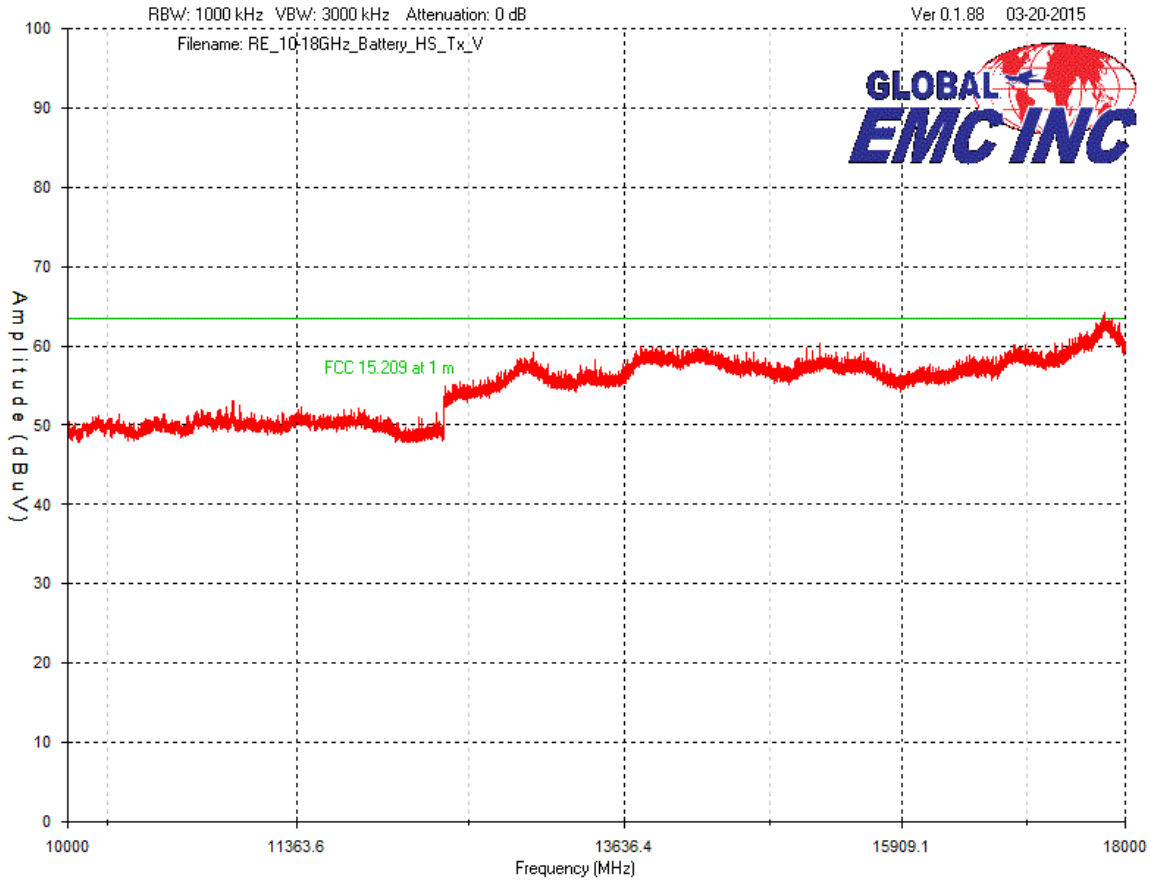
Vertical – Peak Emissions Graph – Middle Channel, 1 GHz – 2 GHz



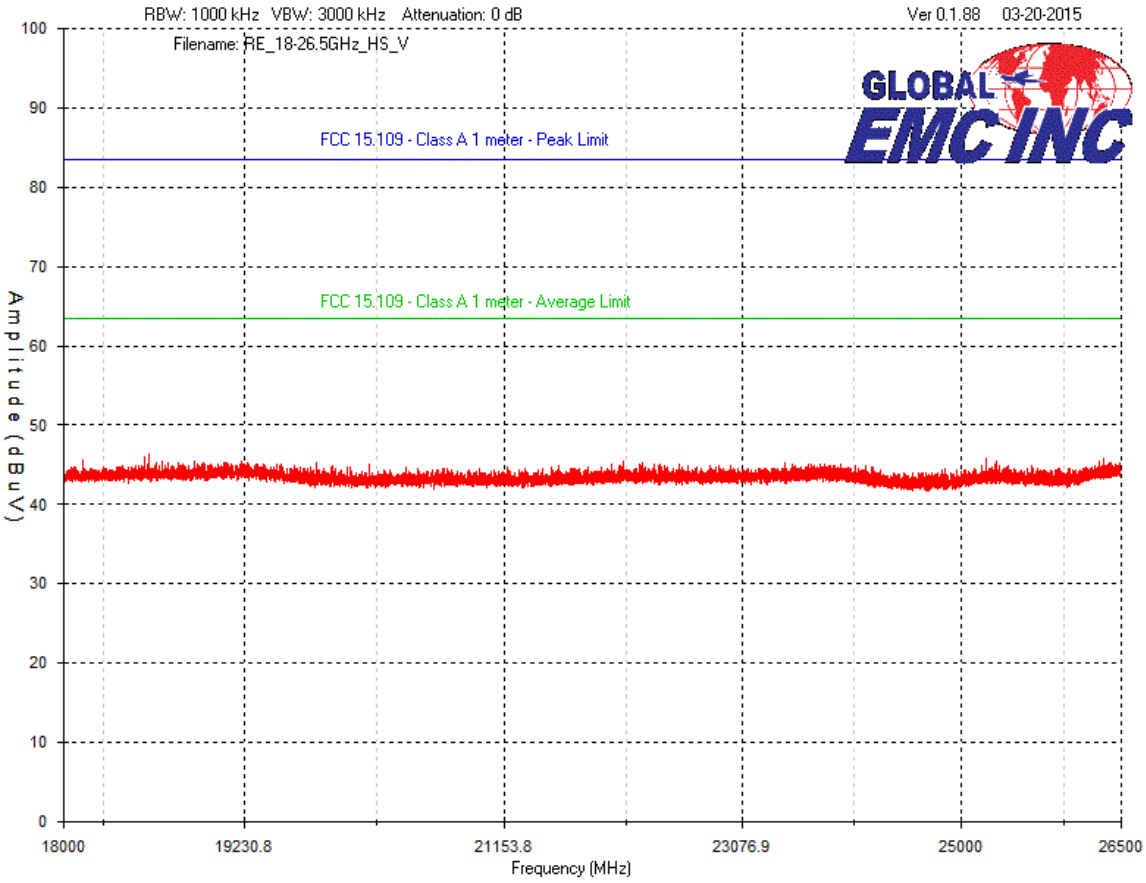
Vertical – Peak Emissions Graph – Middle Channel, 2 GHz – 10 GHz



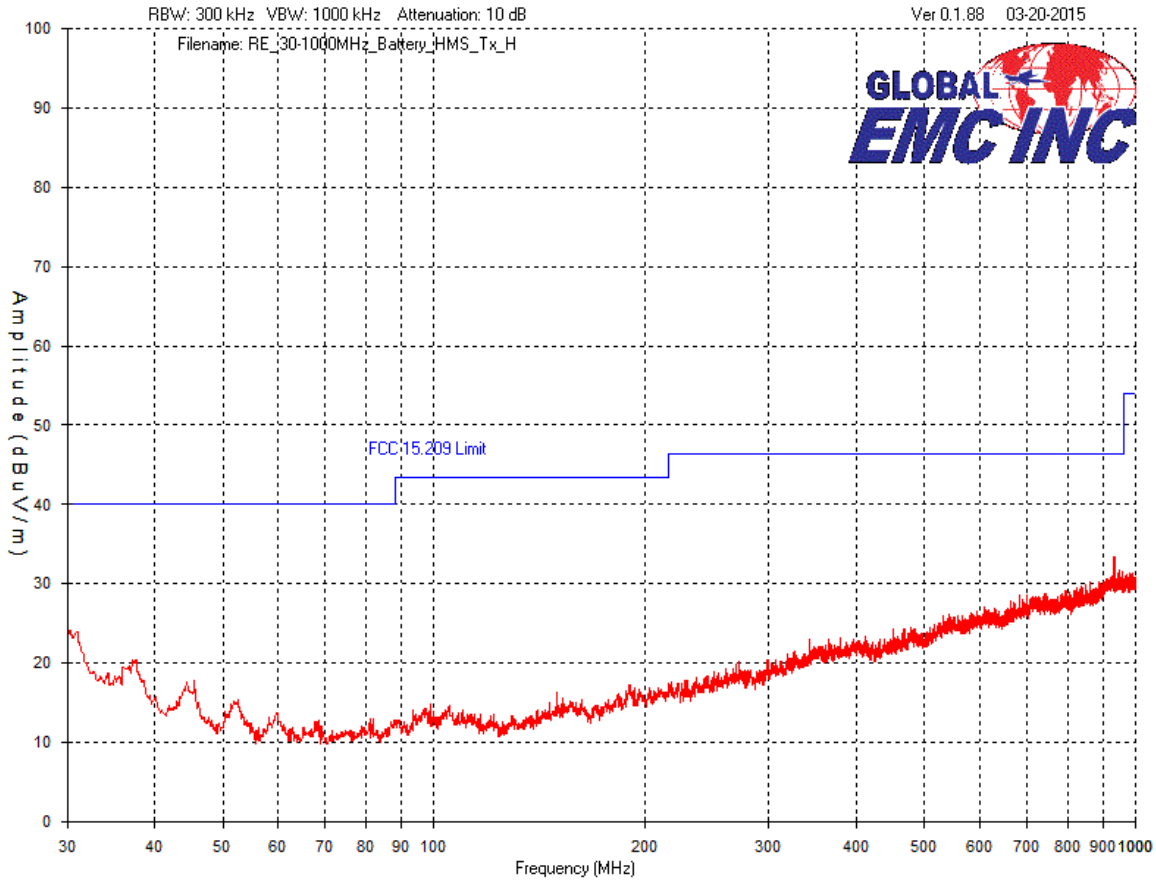
Vertical – Peak Emissions Graph – Middle Channel, 10 GHz – 18 GHz



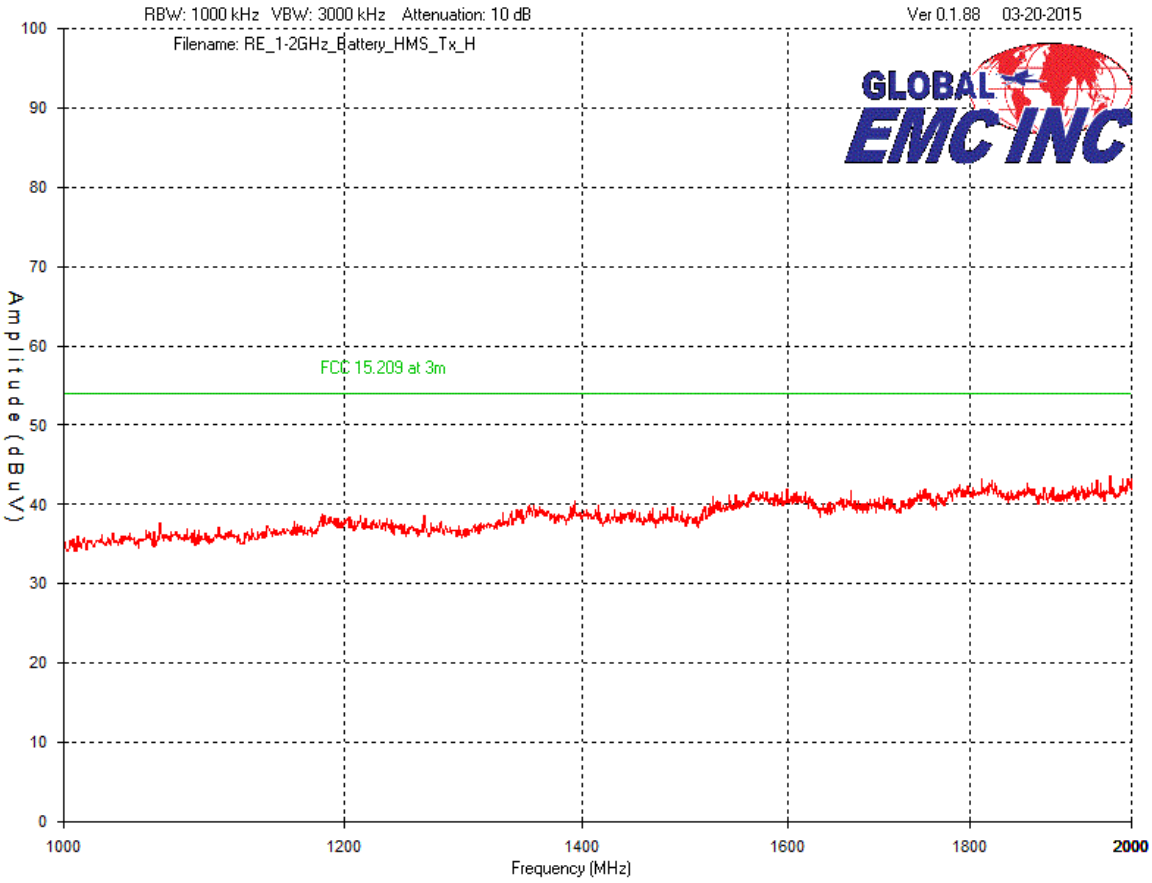
Vertical – Peak Emissions Graph – Middle Channel, 18 GHz – 26.5 GHz



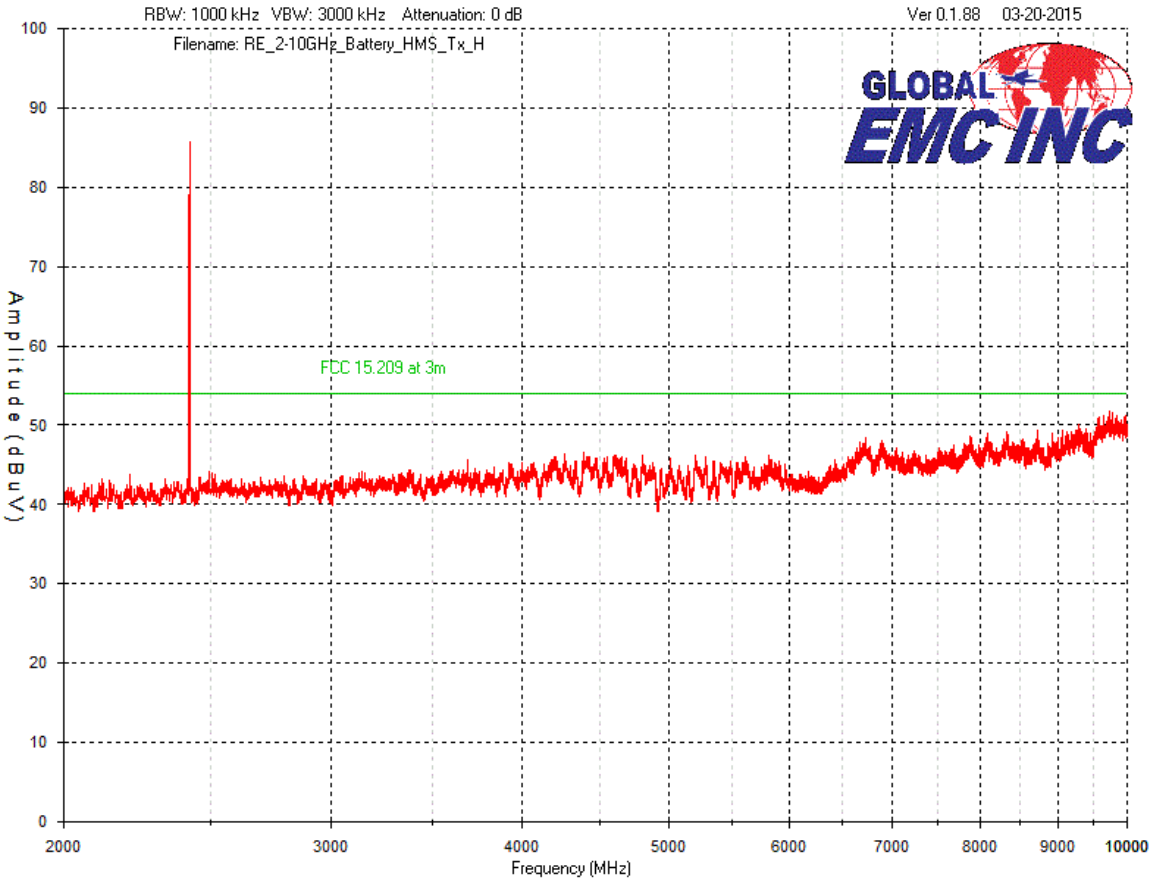
Horizontal – Peak Emissions Graph – Middle Channel, 30 MHz – 1 GHz



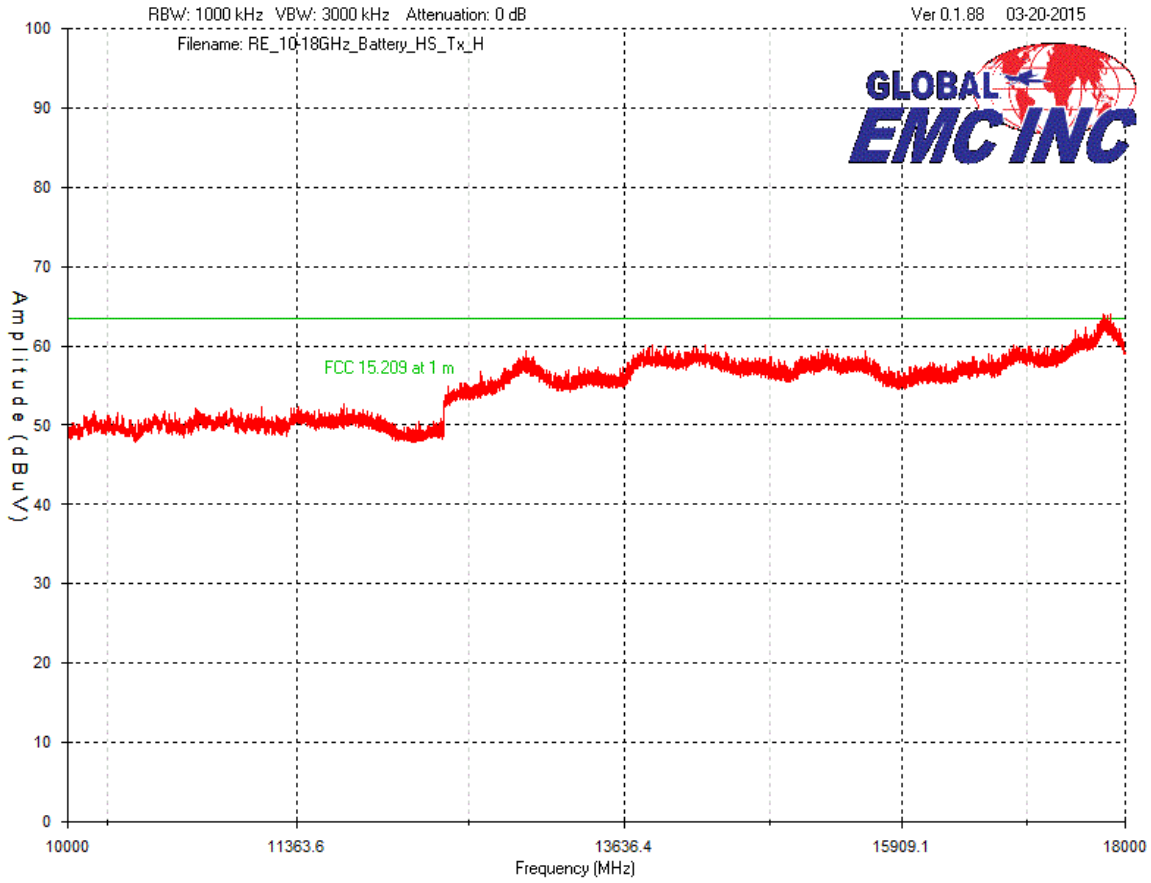
Horizontal – Peak Emissions Graph – Middle Channel, 1 GHz – 2 GHz



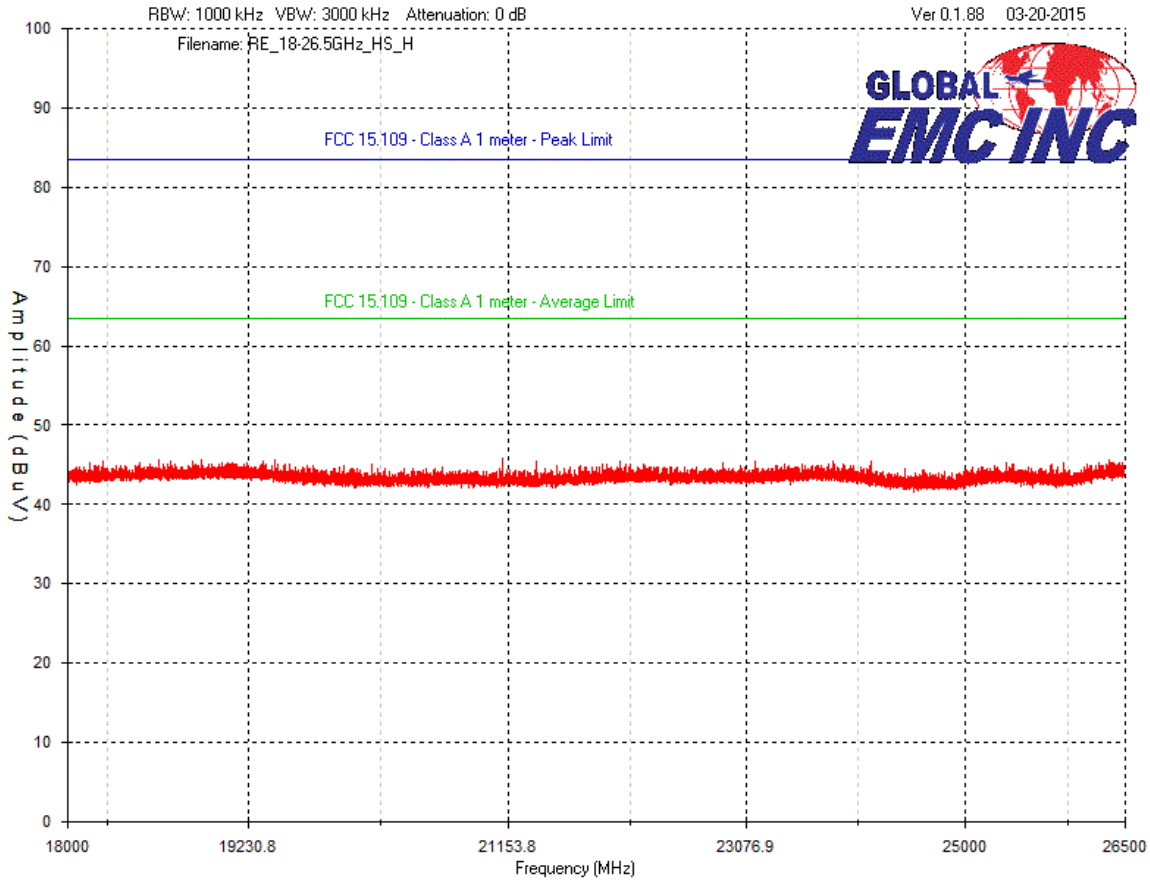
Horizontal – Peak Emissions Graph – Middle Channel, 2 GHz – 10 GHz



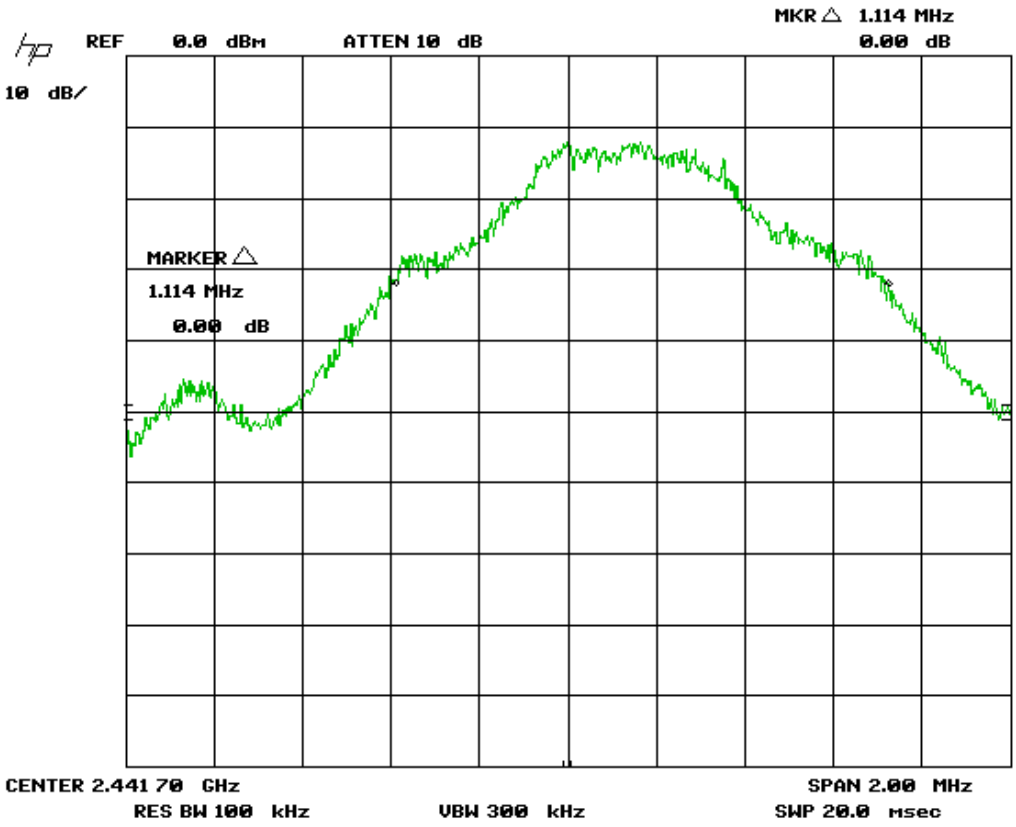
Horizontal – Peak Emissions Graph – Middle Channel, 10 GHz – 18 GHz



Horizontal – Peak Emissions Graph – Middle Channel, 18 GHz – 26.5 GHz



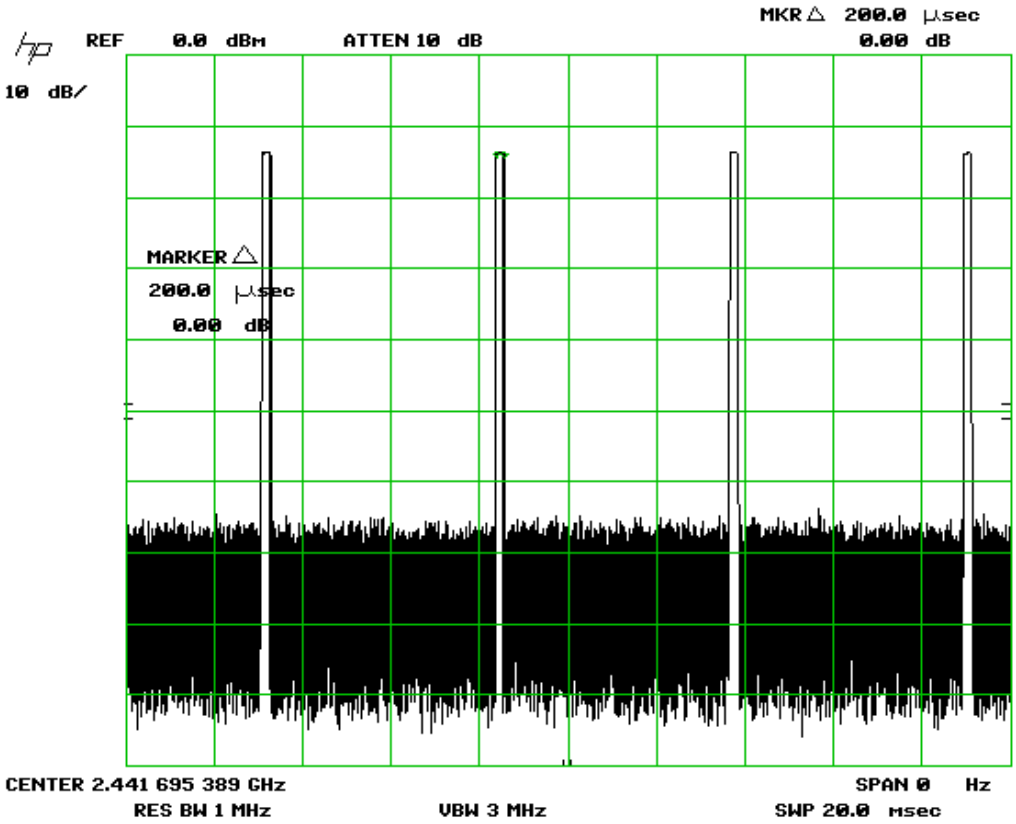
20dB Measurement Bandwidth



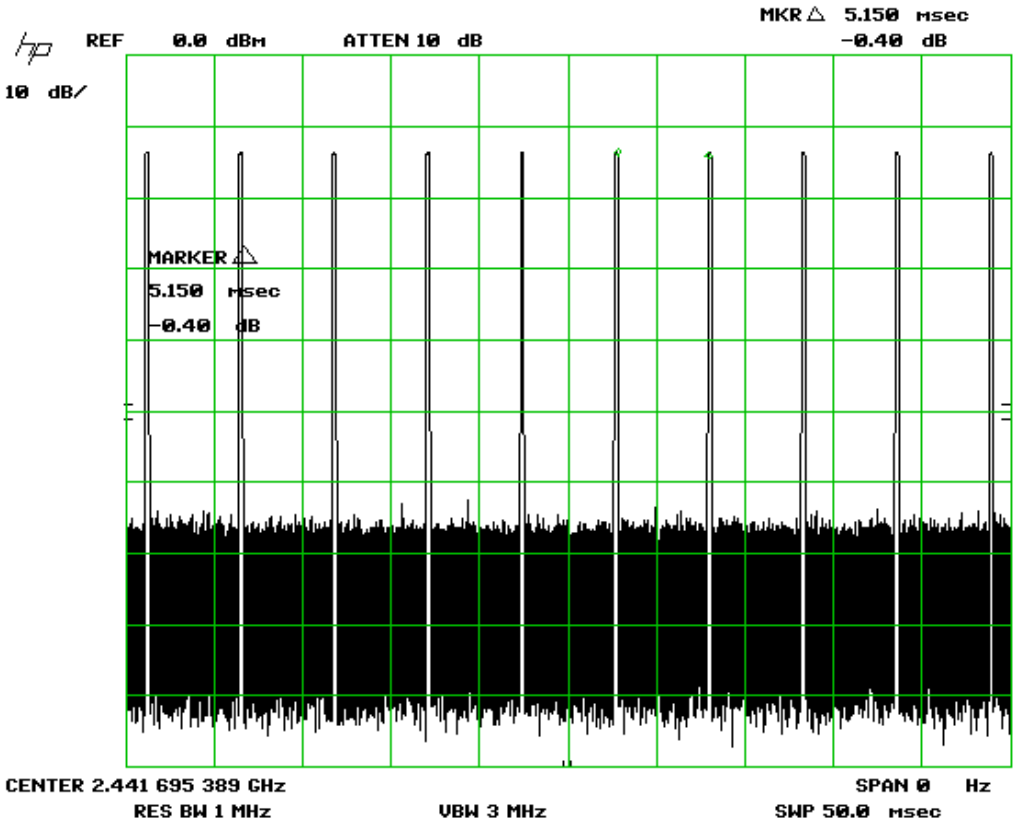
Calculation of Average Value using Duty Cycle

The averaging factor is to be calculated from the On Time per pulse train using 20log(On Time/100ms) as specified in ANSI C63.10. The measured On time for each pulse is 0.20 msec. Each pulse train is 5.15 msec as specified and measured, however a worst case maximum averaging factor of -20dB was applied to the peak considering pulse train length as 10ms and pulse On time as 1 msec.

Pulse On Time = 0.20 mSec



Period of pulse train = 5.15 mSec



Final Measurements

The fundamental was measured to be 98.9 dBuV/m at 3 meters.

The following measurements were made at the harmonics shown in the above graphs, and at the band edges. All emissions above the fourth harmonic are below the noise floor

Maximum of -20dB duty cycle correction factor is applicable to the peak pulse amplitude for calculating the average emissions of this unit, however the EUT pass the test without applying any duty cycle correction factor.

Project Name / Number	**Rehabtronics Inc / HMS with charge dock / 22162**										
Test Frequency (MHz)	**Detection mode (Q-Peak)**	**Antenna polarity (Horz/Vert)**	**Raw signal dB(µV)**	**Antenna factor dB**	**Cable loss dB + Preselecor**	**Attenuator dB**	**Pre-Amp Gain dB**	**Received signal dB(µV/m)**	**Emission limit dB(µV/m)**	**Margin dB(µV)**	**Result**
Low Channel (2403MHz)											
2400	Peak	Horz	62.1	30.6	5.4	0.0	36.2	61.9	74.0	12.1	Pass (Bandedge)
2400	Avg	Horz	32.9	30.6	5.4	0.0	36.2	32.7	54.0	21.3	Pass (Bandedge)
2400	Peak	Vert	66.3	30.6	5.4	0.0	36.2	66.1	74.0	7.9	Pass (Bandedge)
2400	Avg	Vert	33.1	30.6	5.4	0.0	36.2	32.9	54.0	21.1	Pass (Bandedge)
2398	Peak	Horz	52.5	30.6	5.4	0.0	36.2	52.3	74.0	21.7	Pass
2398	Avg	Horz	32.2	30.6	5.4	0.0	36.2	32.0	54.0	22.0	Pass
2398	Peak	Vert	56.2	30.6	5.4	0.0	36.2	56.0	74.0	18.0	Pass
2398	Avg	Vert	32.3	30.6	5.4	0.0	36.2	32.1	54.0	21.9	Pass
2403	Peak	Horz	94.8	30.6	5.4	0.0	36.2	94.6	114.0	19.4	Pass
2403	Avg	Horz	35.3	30.6	5.4	0.0	36.2	35.1	94.0	58.9	Pass
2403	Peak	Vert	98.2	30.6	5.4	0.0	36.2	98.0	114.0	16.0	Pass
2403	Avg	Vert	36.1	30.6	5.4	0.0	36.2	35.9	94.0	58.1	Pass
4806	Peak	Horz	44.3	33.7	7.7	0.0	35.7	50.0	74.0	24.0	Pass
4806	Avg	Horz	31.3	33.7	7.7	0.0	35.7	37.0	54.0	17.0	Pass
4806	Peak	Vert	44.0	33.7	7.7	0.0	35.7	49.7	74.0	24.3	Pass
4806	Avg	Vert	31.4	33.7	7.7	0.0	35.7	37.1	54.0	16.9	Pass
7209	Peak	Horz	49.6	33.7	9.6	0.0	35.7	57.2	74.0	16.8	Pass
7209	Avg	Horz	36.4	33.7	9.6	0.0	35.7	44.0	54.0	10.0	Pass
7209	Peak	Vert	49.5	33.7	9.6	0.0	35.7	57.1	74.0	16.9	Pass
7209	Avg	Vert	36.3	33.7	9.6	0.0	35.7	43.9	54.0	10.1	Pass

Mid channel (2442MHz)											
2442	Peak	Horz	95.0	30.6	5.4	0.0	36.2	94.8	114.0	19.2	Pass
2442	Avg	Horz	33.9	30.6	5.4	0.0	36.2	33.7	94.0	60.3	Pass
2442	Peak	Vert	99.1	30.6	5.4	0.0	36.2	98.9	114.0	15.1	Pass
2442	Avg	Vert	34.1	30.6	5.4	0.0	36.2	33.9	94.0	60.1	Pass
4884	Peak	Horz	44.0	33.4	7.7	0.0	35.7	49.4	74.0	24.6	Pass
4884	Avg	Horz	31.4	33.4	7.7	0.0	35.7	36.8	54.0	17.2	Pass
4884	Peak	Vert	45.0	33.4	7.7	0.0	35.7	50.4	74.0	23.6	Pass
4884	Avg	Vert	31.2	33.4	7.7	0.0	35.7	36.6	54.0	17.4	Pass
7326	Peak	Vert	49.6	37.9	9.6	0.0	35.9	61.2	74.0	12.8	Pass
7326	Avg	Vert	35.7	37.9	9.6	0.0	35.9	47.3	54.0	6.7	Pass
7326	Peak	Horz	49.3	37.9	9.6	0.0	35.9	60.9	74.0	13.1	Pass
7326	Avg	Horz	35.8	37.9	9.6	0.0	35.9	47.4	54.0	6.6	Pass
High channel (2481MHz)											
2485.5	Peak	Horz	52.8	30.6	5.4	0.0	36.2	52.6	74.0	21.4	Pass
2485.5	Avg	Horz	32.5	30.6	5.4	0.0	36.2	32.3	54.0	21.7	Pass
2485.5	Peak	Vert	53.2	30.6	5.4	0.0	36.2	53.0	74.0	21.0	Pass
2485.5	Avg	Vert	32.6	30.6	5.4	0.0	36.2	32.4	54.0	21.6	Pass
2483.5	Peak	Horz	69.4	30.6	5.4	0.0	36.2	69.2	74.0	4.8	Pass (Bandedge)
2483.5	Avg	Horz	33.1	30.6	5.4	0.0	36.2	32.9	54.0	21.1	Pass (Bandedge)
2483.5	Peak	Vert	69.8	30.6	5.4	0.0	36.2	69.6	74.0	4.4	Pass (Bandedge)
2483.5	Avg	Vert	33.2	30.6	5.4	0.0	36.2	33.0	54.0	21.0	Pass (Bandedge)
2481	Peak	Horz	94.8	30.6	5.4	0.0	36.2	94.6	114.0	19.4	Pass
2481	Avg	Horz	34.9	30.6	5.4	0.0	36.2	34.7	94.0	59.3	Pass
2481	Peak	Vert	98.4	30.6	5.4	0.0	36.2	98.2	114.0	15.8	Pass
2481	Avg	Vert	34.2	30.6	5.4	0.0	36.2	34.0	94.0	60.0	Pass
4962	Peak	Horz	44.3	33.7	7.7	0.0	35.7	50.0	74.0	24.0	Pass
4962	Avg	Horz	31.8	33.7	7.7	0.0	35.7	37.5	54.0	16.5	Pass
4962	Peak	Vert	45.1	33.7	7.7	0.0	35.7	50.8	74.0	23.2	Pass
4962	Avg	Vert	30.8	33.7	7.7	0.0	35.7	36.5	54.0	17.5	Pass
7443	Peak	Vert	49.1	37.9	4.3	0.0	35.9	55.4	74.0	18.6	Pass
7443	Avg	Vert	35.6	37.9	4.3	0.0	35.9	41.9	54.0	12.1	Pass
7443	Peak	Horz	48.6	37.9	4.3	0.0	35.9	54.9	74.0	19.1	Pass
7443	Avg	Horz	36.2	37.9	4.3	0.0	35.9	42.5	54.0	11.5	Pass

Notes:
The measurement shown at 2398MHz is the worst case measurement between 2310 and 2400MHz.
The measurement shown at 2483.5MHz is the worst case measurement between 2483.5 and 2500MHz.

Test Equipment List

Equipment	Model No.	Manufacturer	Last calibration date	Next calibration due date	Asset #
Spectrum Analyzer	8566B	HP	May 21, 2014	May 21, 2016	GEMC 141
Quasi-Peak Adapter	85650A	HP	May 22, 2014	May 22, 2016	GEMC 7
BiLog Antenna	3142-C	ETS	Sept. 8, 2014	Sept. 8, 2016	GEMC 8
Loop Antenna 30Hz – 1MHz	EM 6871	Electro-Metrics	Feb 05, 2013	Feb 05, 2015	GEMC 70
Loop Antenna 100kHz – 30MHz	EM 6872	Electro-Metrics	Feb 05, 2013	Feb 05, 2015	GEMC 71
Pre-Amp 9 kHz - 1 GHz	CPA9231A	Chase	Sept 09, 2014	Sept 09, 2016	GEMC 6403
Horn Antenna 1.5 - 18 GHz	6878/24	Q-par	Sept 10, 2014	Sept 10, 2016	GEMC 6365
Horn Antenna 18 GHz - 26.5 GHz	SAS-572	A.H. Systems	Sept 09, 2014	Sept 09, 2016	GEMC 6371
18.0-26.5 GHz Harmonic Mixer	11970K	HP	Jan 28, 2014	Jan 28, 2016	GEMC 158
Pre-Amp 1 - 26.5 GHz	HP 8449B	HP	Sept 09, 2014	Sept 09, 2016	GEMC 6351
RF Cable 7m	LMR-400-7M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 28
RF Cable 1m	LMR-400-1M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 29
RF Cable 0.5M	LMR-400-0.5M-50OHM-MN-MN	LexTec	NCR	NCR	GEMC 31

This report module is based on GEMC template "FCC - 15.209 - Radiated Emissions_Rev1.doc"

Appendix A – Client Provided Details

General EUT Description

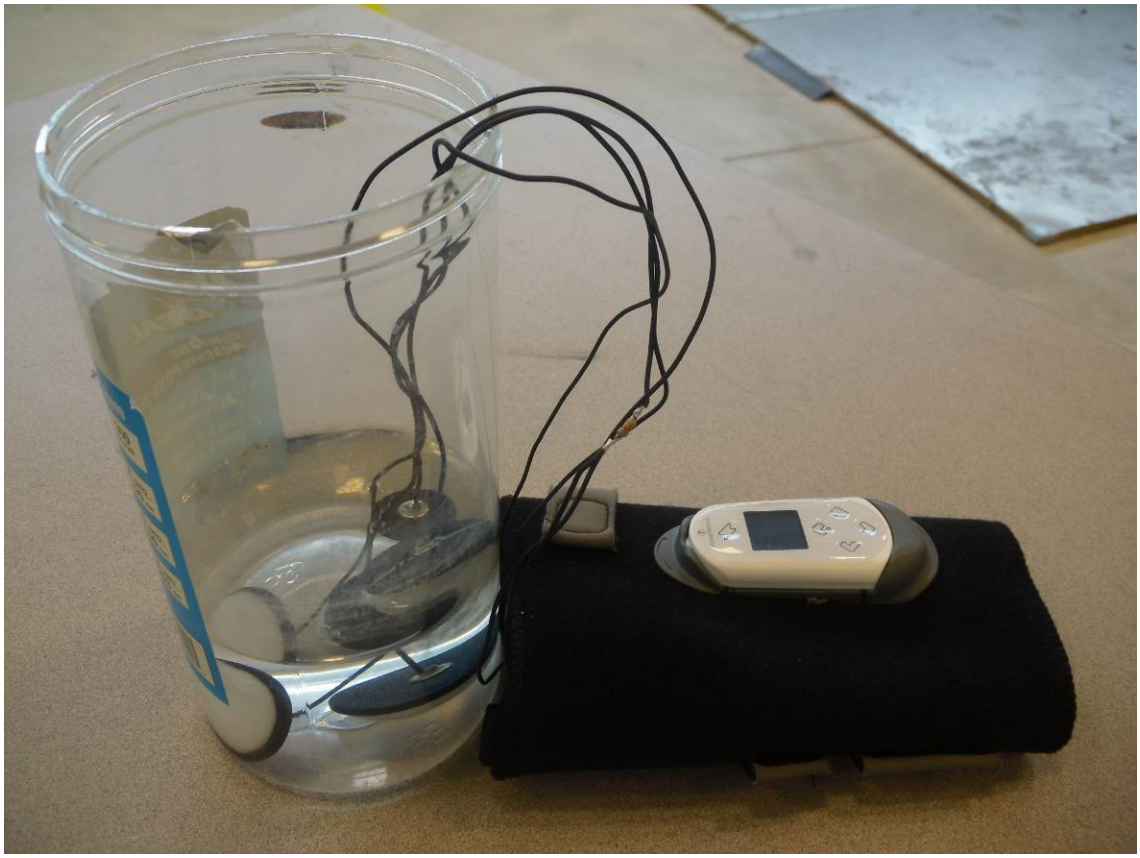
Client Details	
Organization / Address	Rehabtronics Inc. #4352, 10230 Jasper Avenue Edmonton, AB Canada T5J 4P6
EUT (Equipment Under Test) Details	
EUT Name (for report title)	Head Motion Sensor
EUT Model / SN (if known)	HSHM1 (Lot: HSHM-1502 Unit #1 & Unit #2)
EUT revision	V1.04
Software version	V1_02
Equipment category	Body-worn, mobile device for Medical use
EUT is powered using	Internal Lithium-Ion Battery (Normal Operation), AC/DC Power Supply Adaptor (Charging only)
Input voltage range(s) (V)	Input voltage range of the wall adaptor is 100-240V AC. Charge dock accepts voltages in the range of minimum 5.8 V DC
Frequency range(s) (Hz)	DC
Rated input current (A)	Head Motion Sensor draws maximum of 25 mA from the wall adaptor when it is placed into the charge-cradle and it is charging.
Number of power supplies in EUT	1
Transmits RF energy? (describe)	Yes with a operating frequency band of 2403-2482MHz
Basic EUT functionality description	The Head Motion Sensor is worn over the ear and it allows the stimulation to be controlled by the movements of the head
Modes of operation	Charge Mode & Communicating with HS unit
EUT response time (ms)	Turn on time 500ms
Frequency of all clocks present in EUT	Microprocessor: 20 MHz Radio: 32768Hz and 32 MHz I2C: 400kHz SPI Radio 4 MHz SPI Gyro 5 MHz
I/O cable description Specify length and type	None
Available connectors on EUT	Charging mains input connector
Peripherals required to exercise EUT Ex. Signal generator	None
Dimensions of product	(HMS Unit Dimensions) L 52.37mm, W 8.57mm, H 23.62mm

Client Details	
Organization / Address	Rehabtronics Inc. #4352, 10230 Jasper Avenue Edmonton, AB Canada T5J 4P6
EUT (Equipment Under Test) Details	
EUT Name (for report title)	Charge Dock
EUT Model / SN (if known)	HSDK1 (LOT:HSDK-1502: Unit #01 & Unit #02)
EUT revision	V1.05
Software version	N/A
Equipment category	Medical Device
EUT is powered using	AC/DC Power Supply Adaptor
Input voltage range(s) (V)	Input voltage range of the wall adaptor is 100-240V AC. Charge dock accepts voltages in the range of 5.8 V – 16V DC
Frequency range(s) (Hz)	DC
Rated input current (A)	Charge dock draws maximum of 500 mA from the wall adaptor while charging.
Number of power supplies in EUT	1
Transmits RF energy? (describe)	No
Basic EUT functionality description	The charge dock is used to charge the Hand Stimulator and Head Motion Stimulator
Modes of operation	1.Charge dock with wall adaptor attached without HS and HMS unit and charge dock with wall adaptor attached with HS and HMS unit.
EUT response time (ms)	1-5 seconds
Frequency of all clocks present in EUT	None
I/O cable description Specify length and type	None
Available connectors on EUT	DC mains input connector
Peripherals required to exercise EUT Ex. Signal generator	None
Dimensions of product	(Charge dock) L 100mm, W 94.92mm, H 81.87mm

Appendix B – EUT & Test Setup Photos

Head Motion Sensor with AC/DC Power supply adaptor and Charge Dock

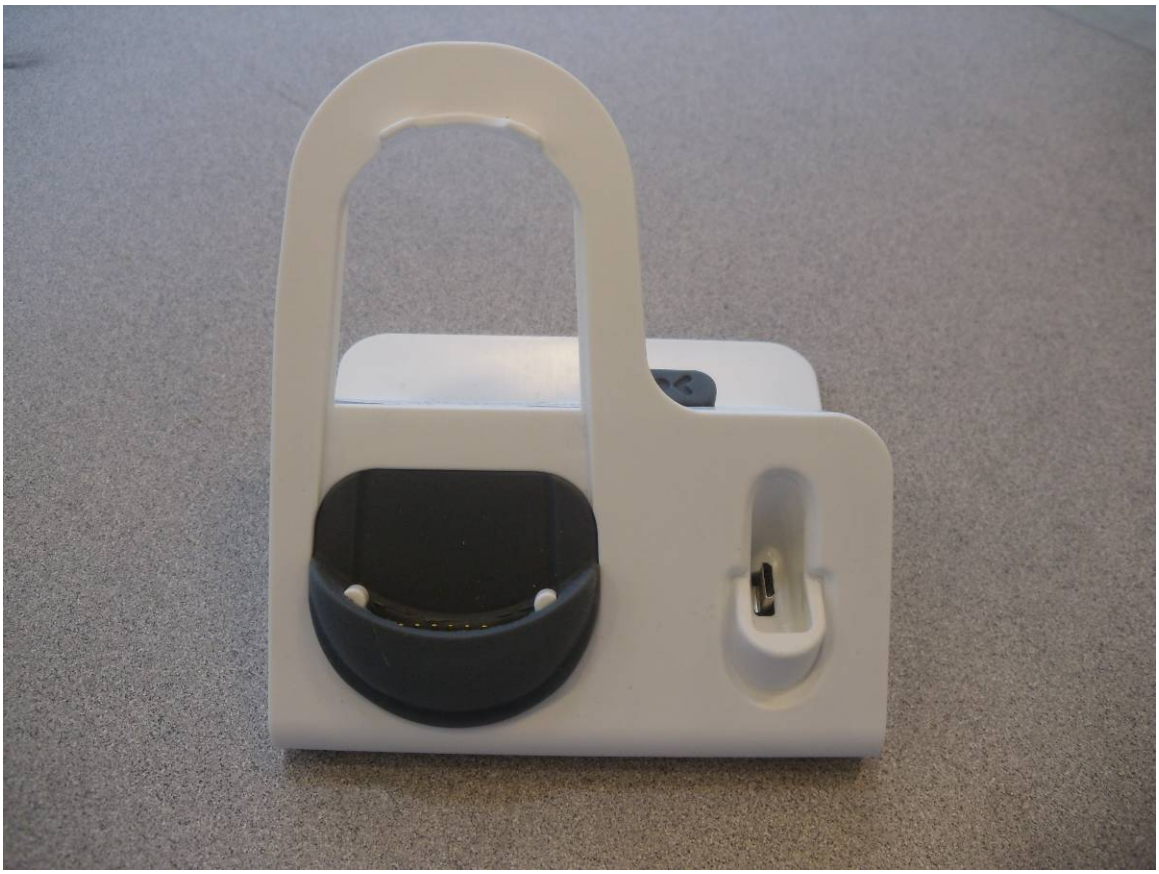
Head Motion Sensor with AC/DC Power supply adaptor, Charge Dock and Hand Stimulator



HS unit with Garment and Electrodes in Saline solution

Head Motion Sensor – Photo 1

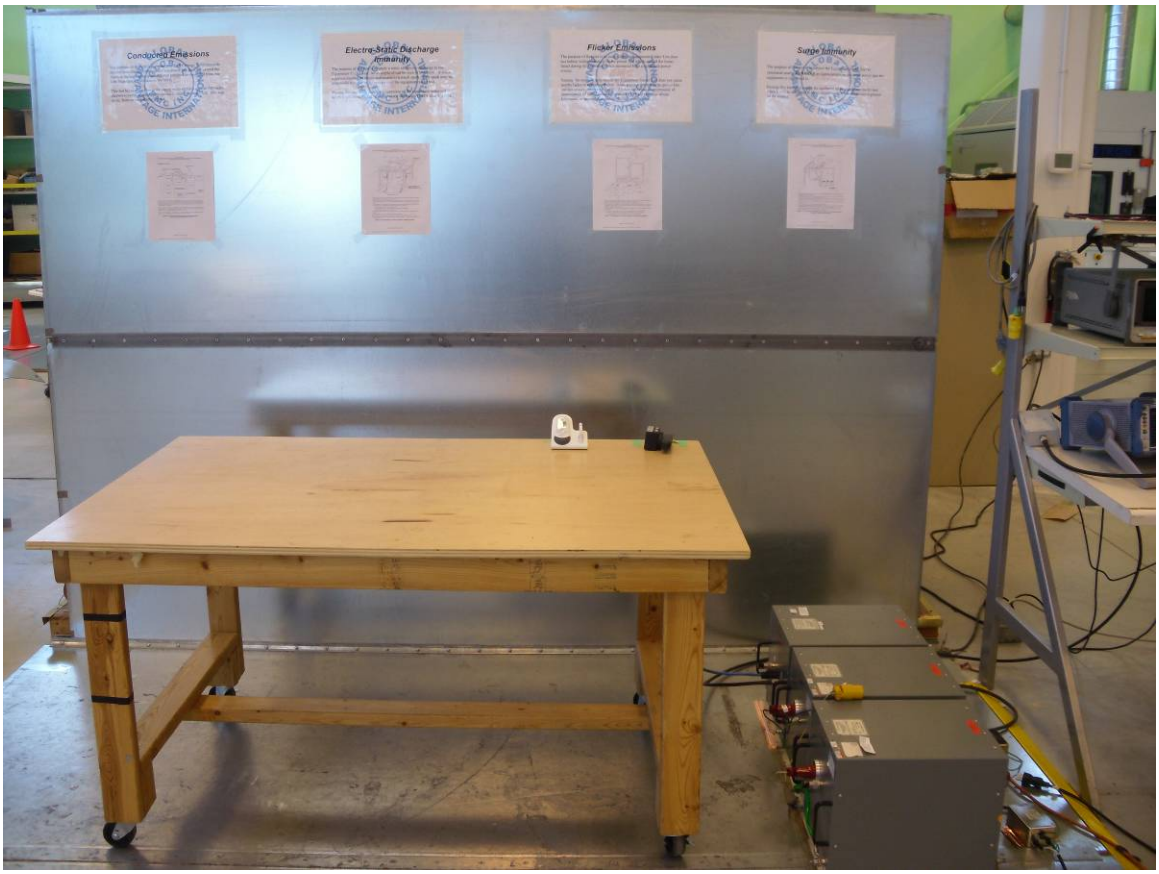
Head Motion Sensor – Photo 2



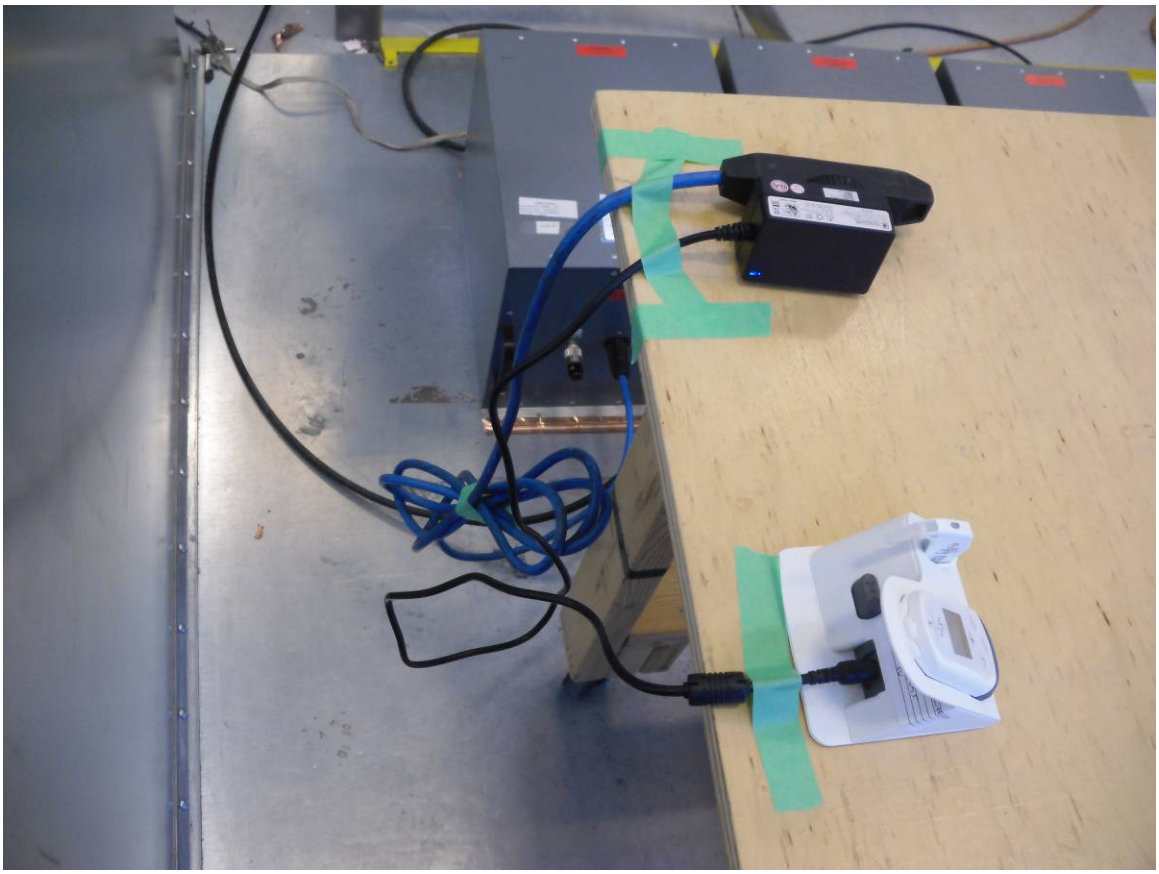
Charge Dock – Photo 1

Charge Dock – Photo 2

AC/DC Power Supply Adaptor



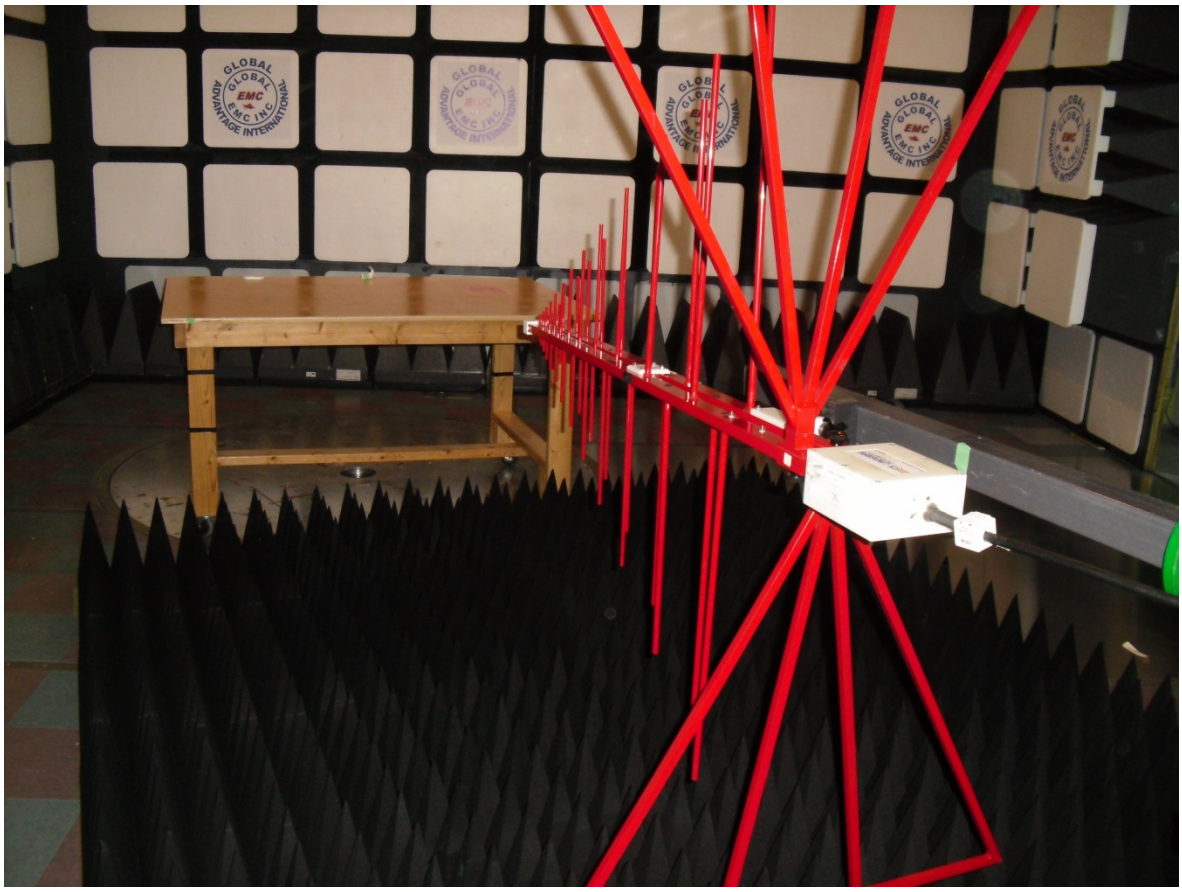
Power Line Conducted Emission Test Set-up_ Photo 1



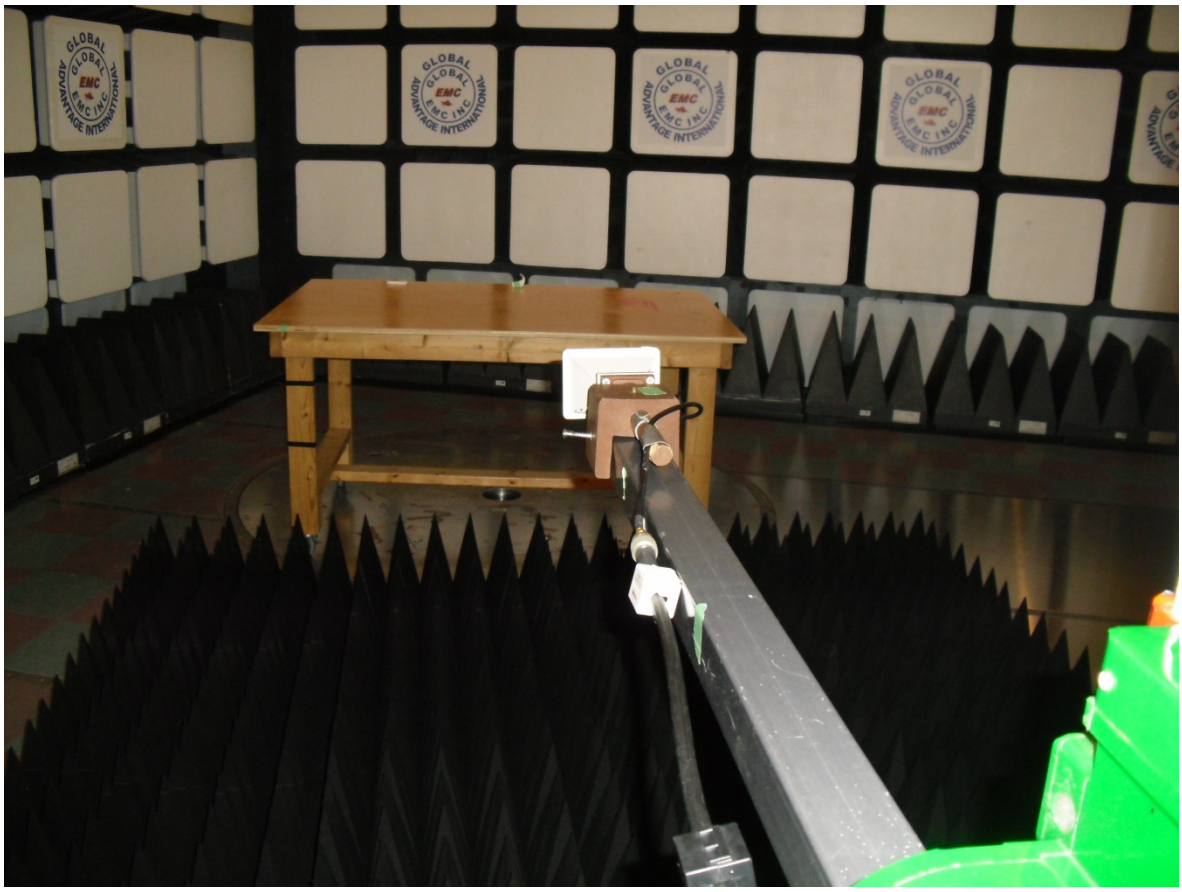
Power Line Conducted Emission Test Set-up_ Photo 2

Radiated Emission Test Set-up _ Photo 1

Radiated Emission Test Set-up _ Photo 2



Radiated Emission Test Set-up _ Photo 3



Radiated Emission Test Set-up _ Photo 4