International Compliance Laboratories

FCC Part 15 Subpart C
Transmitter Certification Test Report

ICL Report # 2097A rev. 2
FCC ID: 2AGMQ-ROBERN001

Test Standard: FCC Rule Part 15C: section 15.209,
KDB 680106 D01 v02
FCC Classification: Part 15 Low Power Transmitter Below 1705kHz (DCD)
Operating Frequency: 112 – 205 kHz

Manufacturer: Robern, Inc.
Model Name: Robern ENTICE™ Inductive Charging Dock
Model Number: CB-205-1790
Serial Number: 2097B (defined at ICL)

Test Dates: 10/19, 10/30, 11/6, 11/10, and 11/11/2015

Report Issue Date: 12/11/2015

Test Result: MEETs Requirements

Prepared By:

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ICL Compliance Engineer

Reviewed By:

Ronald W. Zimmerman

Ronald W. Zimmerman
ICL President and NCE

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1.0 Purpose

The purpose of this report is to demonstrate compliance of the Robern ENTICE™ Inductive Charging Dock with FCC: Telecommunication – Code of Federal Regulations, CFR 47, Part 15 (specifically section 15.209). This report will assist with obtaining an FCC Certification Authorization for a Low-Power License-Exempt Transmitter. Accepted methods and procedures from ANSI C63.4 were used to perform the necessary emissions measurements to show conformance.

2.0 Summary of Testing

After reviewing KDB Publication 680106 D01, an FCC Inquiry (#402602) including ICL's proposed course of testing was sent to the FCC (as directed by the KDB). The FCC's response advised that the same KDB be consulted for authorization procedures and highlighted RF exposure testing with an isotropic field probe (see RF Exposure report). ICL continued with its proposed course, testing to FCC Part 15.209. Below is a summary of the test results.

Electromagnetic Radiated Emissions		
FCC 15.203	Antenna Requirement	MEETs Requirements
FCC 15.209	Radiated Emissions – General Requirements	MEETs Requirements

Table 2.0-1, Summary of Testing

3.0 Reference documents

The following standards and references were used:

ANSI C63.4: 2009, American National Standard for Methods of Measurement of Radio-Noise Emissions

US Code of Federal Regulations (CFR): Title 47 - Telecommunication, Chapter I – Federal Communications Commission, Subchapter A – General, Part 15, *Radio Frequency Devices* (Oct. 1, 2014)

KDB 680106 D01 v02 *RF Exposure Considerations for Low Power Consumer Wireless Power Transfer Applications* dated May 31, 2013

"WPTX-A11R-SI13043.pdf" Charger/DOCK antenna datasheet provided by Kohler Company.

Theory of Operation CB-Enticedock.pdf provided by Kohler Company

Entice_OG_BookBody_rev02_101315.pdf provided by Kohler Company

4.0 Product Information (Equipment Under Test – EUT)

Details on the EUT and its general operation can be found in the *Theory of Operation CB-Enticedock.pdf* provided by Kohler Company.

4.1 FCC-ID

The FCC-ID for this product is 2AGMQ-ROBERN001.

4.2 Product Name

Robern ENTICE™ Inductive Charging Dock

4.3 Product Description

Wireless charger and docking station for the Entice™ Magnification Mirror.

4.4 Model Number

CB-205-1790

4.5 Unit Serial Number

2097B (Defined at ICL)

4.6 Printed Circuit Board Information

Serial number: #5, Assembly revision: REV A

4.7 Transmitter Frequency of Operation

112 kHz - 205 kHz

4.8 Other Internal Frequencies

None

4.9 Antenna

Internal type, coil antenna by Sumida, PN WPTX-A11R-SI3043

4.10 Power Source

USB 5Vdc power supplied from Robern Entice™ M Series Cabinet.

4.11 Cables

USB cable provided by Robern with Fair-Rite PN 0431173951 installed near charger/dock station side.

5.0 Auxiliary Equipment Information

The EUT was tested with a Robern Entice™ M Series Cabinet (Model Number: MC2440D4FPLE4) supplied with 120V 60Hz. 2097

An Entice™ Magnification Mirror, Model Number: ENTICE, Serial Number: 2097A (defined at ICL), was also provided with various battery loads for mirror installation: 1) a low battery, 2) a mid-charged battery, and 3) a fully charged battery. The mirror provides the load for the charger. Magnetics in the mirror position its receiving antenna coil over the chargers transmitting coil. See Theory of Operation for more information.

6.0 Manufacturer Information

Robern Inc.
701 North Wilson Avenue
Bristol, PA 19007

Contact: James Stanley
Title: Senior Project Analyst
Phone: (215) 826-9800
FAX: (215) 826-9861
Email: JAMES.STANLEY@KOHLER.COM

7.0 Test Facilities

7.1 Location

The radiated emissions test site is located at the following address:

International Compliance Laboratories, LLC
1057 Tullar Court
Neenah, WI 54904
Phone: (920) 720-5555
Fax: (920) 720-5556

7.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site has been fully described, submitted to, and accepted by the FCC and Industry Canada. In addition, ICL is compliant to ISO 17025 as certified by the American Association for Laboratory Accreditation (A2LA) under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

Accredited Test Firm with Designation Number: US1117
Test Firm Registration Number: 918349
A2LA Certificate Number: 2599.01

Accredited Laboratory

A2LA has accredited

INTERNATIONAL COMPLIANCE LABORATORIES, LLC

Neenah, WI

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 6th day of June 2014.

President & CEO
For the Accreditation Council
Certificate Number 2599.01
Valid to April 30, 2016

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

American Association for Laboratory Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

INTERNATIONAL COMPLIANCE LABORATORIES, LLC
1057 Tullar Court
Neenah WI 54956
Ronald W. Zimmerman Phone: 920 720 5555

ELECTRICAL (EMC)

Valid to: April 30, 2016 Certificate Number: 2599.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following electromagnetic compatibility and product safety tests:

Test Technology:	**Test Method(s):**
Emissions	
RF (Radiated and Conducted)	CFR 47 FCC, Part 15 (using ANSI C63.4:2009) (*up to 18 GHz*); CFR 47 FCC, Part 18 (using MP-5); CISPR 11 (*up to 1 GHz*); EN 55011 (*up to 1 GHz*); CISPR 14-1 (*excluding clause 6*); EN 55014-1 (*excluding clause 6*); CISPR 15 (*clause 8 only*); EN 55015 (*clause 8 only*); CISPR 22; EN 55022; ICES-001; ICES-003
Harmonic Current Emissions	IEC 61000-3-2; EN 61000-3-2
Voltage Fluctuations and Flicker	IEC 61000-3-3; EN 61000-3-3
Immunity	
Electrostatic Discharge (ESD)	IEC 61000-4-2
Radiated Immunity	IEC 61000-4-3 (*up to 2.7 GHz*)
Electrical Fast Transients (EFT)/Burst	IEC 61000-4-4
Electrical Surge	IEC 61000-4-5
Conducted Immunity	IEC 61000-4-6

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5202 Presidents Court, Suite 220 | Frederick, MD 21703-8398 | Phone: 301 644 3248 | Fax: 240 454 9449 | www.A2LA.org

Test Technology:	**Test Method(s):**
Immunity (Cont'd)	
Power Frequency and Magnetic Field	IEC 61000-4-8 (*excluding short duration mode*)
Voltage Dip, Interruptions, and Variations	IEC 61000-4-11
Generic and Product Specific EMC Standards	
Generic Immunity Residential	IEC 61000-6-1; EN 61000-6-1
Generic Immunity Industrial	IEC 61000-6-2; EN 61000-6-2
Generic Emissions Residential	IEC 61000-6-3 (*up to 16A*); EN 61000-6-3 (*up to 16A*)
Generic Emissions Industrial	IEC 61000-6-4; EN 61000-6-4
Laboratory Equipment	IEC 61326-1; EN 61326-1
Medical Equipment	IEC 60601-1-2:2001; IEC 60601-1-2
Information Technology Equipment	CISPR 24; EN 55024
Household Appliances and Similar	CISPR 14-2; EN 55014-2
Industry Canada Radio Tests	RSS-GEN; RSS-210 *(up to 18 GHz)*
ETSI Radio Tests	
Immunity	EN 301 489-1 *(up to 16A)*; EN 301 489-17
Automotive Component EMC	
Emissions	CISPR 25; SAE J1113-41
Bulk Current Injection (BCI)	SAE J1113-4; ISO 11452-4
Electrostatic Discharge (ESD)	SAE J1113-13; ISO 10605
Radiated RF Immunity	SAE J1113-21; ISO 11452-2
Electrical Transients	SAE J1113-11; ISO 7637-2

Test Technology:	**Test Method(s):**
Harley Davidson Component EMC	
Engineering Guideline	EG-812-22614
Radiated Emissions	EG-812-22614-401
Conducted Emissions	EG-812-22614-402
Bulk Current Injection (BCI)	EG-812-22614-405
Electrostatic Discharge (ESD)	EG-812-22614-407
United Nations UNECE	
Emissions	E/ECE/324 Addendum 9: Regulation 10, Annexes 7 and 8
Immunity	E/ECE/324 Addendum 9: Regulation 10, Annex 9

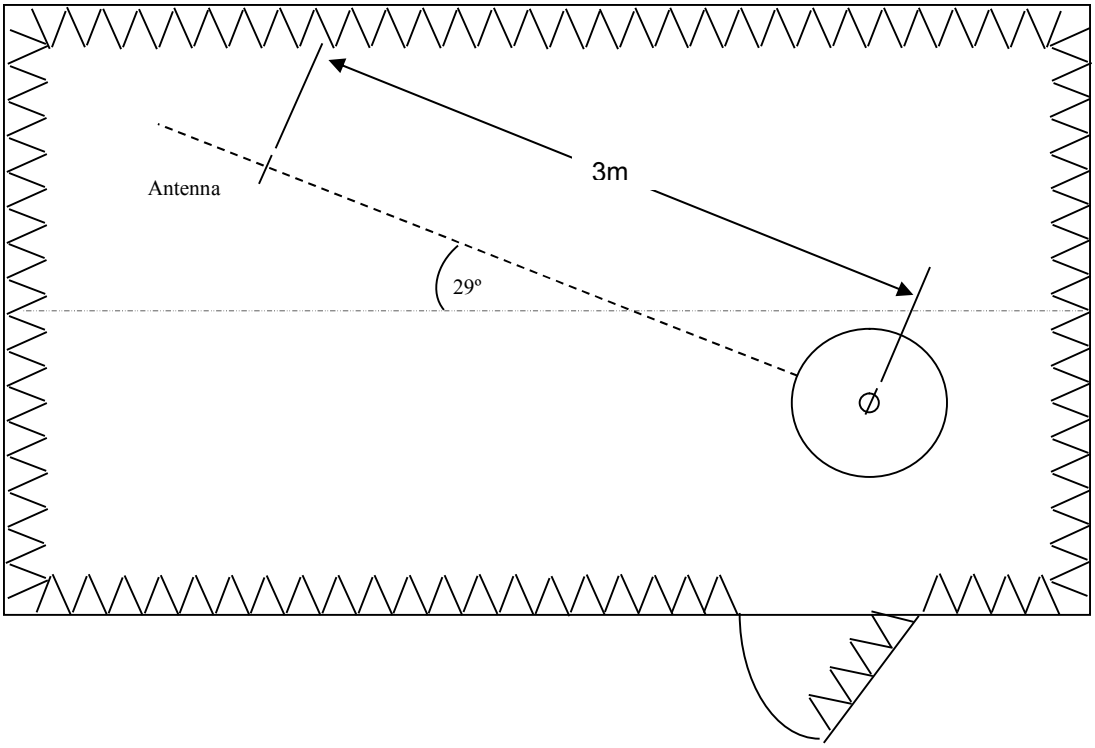
On the following products or types of products:
Light Industrial, Commercial, Residential, Heavy Industrial, Scientific, Medical, Portable Test and Measurement Equipment, Information Technology Equipment, Telecom, Automotive, and other Electrical and Electronic Equipment

8.0 Radiated Emissions Test Site Description

8.1 Semi-Anechoic Chamber Test Site

The semi-anechoic chamber is a Series 81 EMC test chamber manufactured by ETS – Rayproof. This chamber was moved in 2006 to International Compliance Laboratories in Neenah, WI. The interior walls and ceiling are completely covered with 4" x 4" ferrite tiles and 16" absorber cones. The chamber is also equipped with a 1.2 meter flush mounted turntable. The test chamber's dimensions are 30ft. x 20ft. x 20ft. The test volume is 2.0-meter in diameter and 2 meters high and is centered on the turntable.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 1 below:



Power to the room was filtered to prevent ambient noise from coupling to the EUT and measurement equipment. The four filters were model number 07294/GFUL57915-1x100 (100 Amp 277/480Vac 50/60Hz) manufactured by Genisco Electronics Corporation.

The room is of sufficient size to test table top and floor standing equipment in accordance with section 6.3.1 & 6.3.2 of ANSI C63.4.

8.2 Radiated Emissions Measurement Equipment Used

Two measurement set-ups were used for each of the following frequency ranges:

1. 9kHz – 30MHz – COM Power AL-130 Loop Antenna, HP 8564A Receiver and Filter Section
2. 30MHz – 1000MHz – Biconilog Antenna, HP 8564A Receiver and Filter Section.

See section 9.0 for additional details on each piece of equipment.

9.0 List of Calibrated Test Equipment

Equipment List					
Manufacturer	**Equipment Type**	**Model**	**Serial**	**Last Calibrated**	**Cal Interval**
Hewlett Packard	EMI Test Receiver	8546A	3746A00414	4/10/2015	1 year
Hewlett Packard	Filter Section	85460A	3704A00360	4/10/2015	1 year
EMCO	Biconilog Antenna	3141	9706-1052	3/18/2015	3 years
EMCO	Horn Antenna	3115	6217	3/31/2014	3 years
ETS-Rayproof	Absorber-Lined Shielded Enclosure	Series 81	n/a	NSA: 4/1/2014	2 years
COM Power	Loop Antenna	AL-130	121016	4/1/2014	3 years

Table 1. List of Calibrated Test Equipment

10.0 Radiated Emissions Test Set-up

The EUT was placed in its normal mounting orientation attached to the accessory rail as described in the owner's manual, "Entice_OG_BookBody_rev02_101315.pdf". The cabinet door was left open.

The EUT was powered by the manufacturer provided USB cord (with ferrite installed near the EUT).

The AC Input Mains of the M-Series Cabinet was supplied with 120V 60Hz.

During radiated emissions different loading conditions were investigated to determine the highest emissions relative to the limit. These were the following:

1) Full battery (minimum load for charger/EUT). Implemented with the Entice Mirror installed with a fully charged battery docked on the charger during measurements.
2) Mid-charged battery (medium load for charger/EUT). Implemented with the Entice Mirror installed with a battery depleted/charged to half its capacity. The mirror was docked on the charger/EUT during measurements.
3) Low battery (maximum load for charger/EUT). Implemented with the Entice Mirror installed with a fully depleted battery. The mirror was docked on the charger/EUT during measurements.
4) Standby (no load for EUT). Implemented with the Entice Mirror not docked during measurements.

The loading condition which generated the highest emissions was #1 Full battery (minimum load for charger/EUT). The measurements below detail these results.

Test set-up photos are not included in this Test Report per customer direction. They are available in a separate exhibit from this document.

11.0 Test Results

11.1 Antenna Requirement – FCC Section 15.203

The EUT employs an integral antenna which satisfies the requirements of CFR 47 Part 15.203. The antenna type is a coil soldered to the printed circuit board. It is manufactured by Sumida and has part number WPTX-A11R-SI13043. See the datasheet for exact specifications.

11.2 Radiated Emissions: General Requirements – FCC Section 15.209

11.2.1 Test Procedure

The maximum field strength was measured following procedures and practices found in ANSI C63.4:2009. The maximum radiated emissions were explored in each loading condition of the EUT. The resolution bandwidth (RBW) and video bandwidth of the spectrum analyzer were set as indicated below. Sample calculations are given below for each frequency range.

9kHz-30MHz Frequency Range:
Corrected Reading = Analyzer Reading + Cable Loss + Antenna Factor (which includes the internal gain from the amplifier) – 3m Distance Correction Factor (applicable for 300m and 30m limits – see limits table)
Margin (dB) = Applicable Limit - Corrected Reading

30MHz-1000MHz Frequency Range:
Corrected Reading = Analyzer Reading + Cable Loss + Antenna Factor
Margin (dB) = Applicable Limit - Corrected Reading

Test Receiver Set-up	9kHz – 150kHz	150kHz – 30MHz	30MHz – 1GHz
Resolution Bandwidth (RBW)	1kHz	9kHz	120kHz
Video Bandwidth (VBW)	3kHz	30kHz	300kHz

Resolution bandwidth and video bandwidth used during testing.

The EUT was investigated for radiated emissions from 9kHz to 1GHz. Antenna polarities investigated were as follows: 1) three orthogonal planes for the loop antenna – 9kHz to 30MHz, and 2) horizontal and vertical polarities for the biconilog antenna - 30MHz to 10GHz.

11.2.2 Radiated Limits

Frequency	Limit (uV/m) @ Distance	Limit (dBuV/m)	Distance Correction
9kHz – 490kHz	2400/F(kHz) @ 300m	48.5 – 13.8 @ 300m	300m to 3m = 80dB
490kHz – 1.705MHz	24000/F(kHz) @ 30m	33.8 – 22.97@ 30m	30m to 3m = 40dB
1.705MHz – 30MHz	30 @ 30m	29.54@ 30m	30m to 3m = 40dB
30MHz – 88MHz	100 @ 3m	40.0 @ 3m	n/a
88MHz – 216MHz	150 @ 3m	43.5 @ 3m	n/a
216MHz – 960MHz	200 @ 3m	46.0 @ 3m	n/a
960MHz – 40GHz	500 @ 3m	54.0 @ 3m	n/a

Table 2. Limits from FCC 15.209 (a)

Maximum spurious emissions including restricted bands using a **peak detector** can be seen in the following graphs. Graphs depict maximum emissions relative to the limit found across all turntable angles, antenna heights, and antenna polarities. Radiated emissions below 30MHz were all 20dB or more below the lowest limit, no quasi-peak or average data was collected.

11.2.3 Radiated Test Results

Radiated Emissions Form

Test Standard: *FCC 47 CFR Part 15 and ANSI C63.4: 2009*

Manufacturer:	Robern Inc.	**Date(s) of Test:**	10/19, 10/30, 11/6, 11/10, and 11/11/2015
Test Engineer:	Dan Berg	**Voltage/Frequency:**	Mini-USB from Cabinet (120V/60Hz)
Model:	CB-205-1790	**Serial Number:**	2097B
Software Version:	n/a	**Mode of Operation:**	Standby, full, medium, and low charged batteries (loads)

Setup Pictures Taken	Verification Completed
☒	☒

Environmental Conditions in Lab		
	Requirement	**Actual**
Temperature	10°C - 40°C	20°C – 22°C
Humidity	10%- 90% R.H.	36% - 55% R.H.
Air Pressure	n/a	101kPa - 102kPa

Overall Test Result
MEETs Requirements
Limit Required
FCC Part 15C section 15.209

Test Equipment Utilized
TILE! V3.4 EMC Control Software
HP 8546A EMI Test Receiver
ETS-Rayproof Series 81 Anechoic Chamber
HP 85460A RF Filter Section
EMCO 3141 Biconilog Antenna
COM-Power AL-130 Active Loop Antenna

Antenna Distance	EUT Configuration:	Antenna Polarities
3 meters	EUT installed in Cabinet on 80cm table-top	Horizontal and Vertical
Frequency Range	**Detector Used**	**Comments**
30MHz - 1000MHz	Peak and Quasi-Peak	See plots and data below.
9kHz – 30MHz	Peak	All peaks >20dB below limits

Notes:

Set-up:

- The EUT was set-up and tested in accordance with ANSI C63.4 as directed by FCC Part 15.
- The EUT was set-up in its normal installation condition as directed by the user's manual. The charger locked onto a rail inside the M-Series Cabinet.
- A USB cable provided by Kohler/Robern powered the EUT. It was attached between the M-Series Cabinet and EUT. Fair-Rite PN 0431173951 was installed on this cable.
- The M-Series Cabinet (Model: MC2440D4FPLE4) was plugged into the chamber's filtered power supplied with 120V 60Hz. The cabinet also obtained its ground through this connection.
- All cabinet functions were present during testing (none were disabled). Functions included heated mirrors, LED lighting, motion sensing, and power conversion.
- When evaluating each of the charger loading states, the batteries were installed into the ENTICE Mirror and then the mirror was docked onto the charger (EUT). A flashing green LED on the mirror indicated that charging was in process. For full battery the same LED remained solid indicating a full state had been achieved.
- Exploratory measurements were made to find the mode of operation with the highest emissions relative to the limit. Modes investigated were the following: full battery (lightest load), medium battery charge (medium load), low battery charge (high load), and standby. Full battery charge was found to have the highest emissions relative to the limit.
- See below for test data. A test set-up photo exists external to this document.

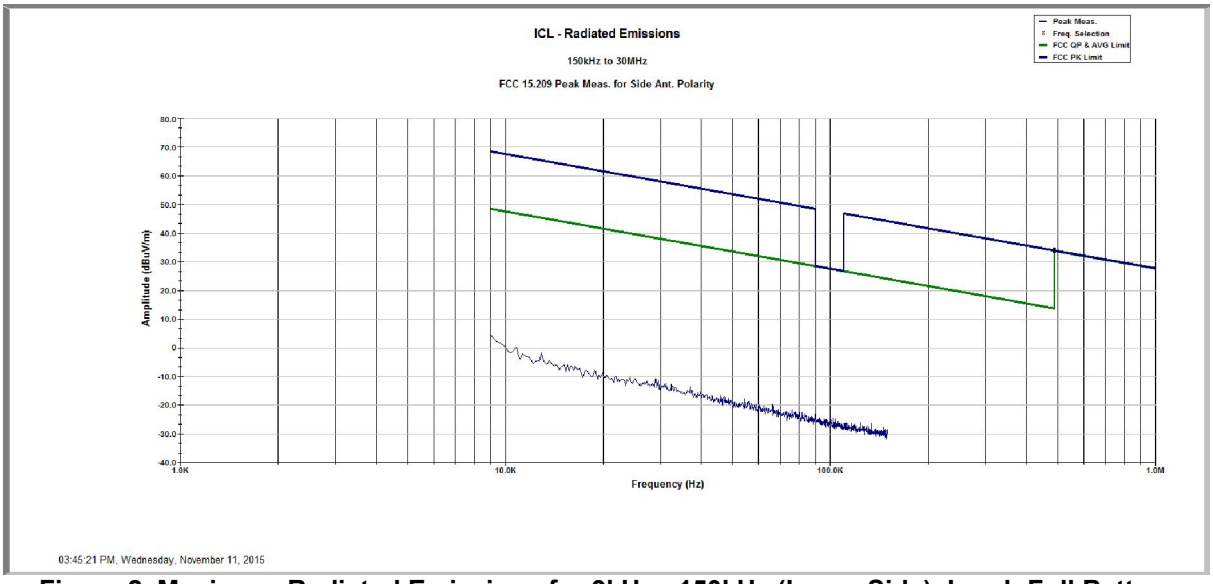


Figure 2. Maximum Radiated Emissions for 9kHz - 150kHz (Loop: Side). Load: Full Battery

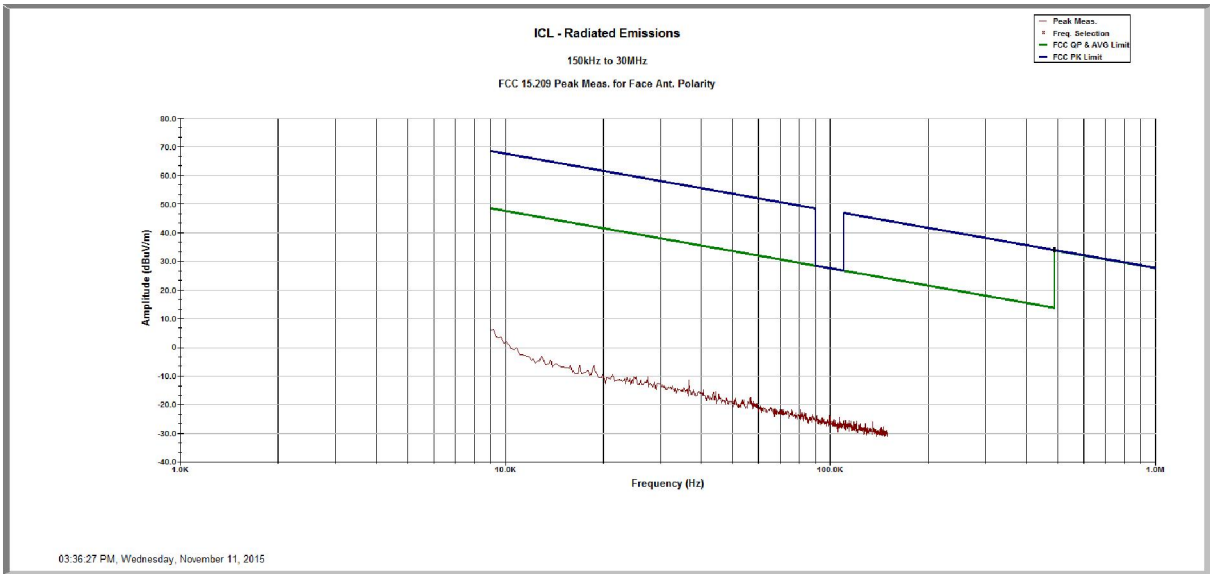


Figure 3. Maximum Radiated Emissions for 9kHz - 150kHz (Loop: Face). Load: Full Battery

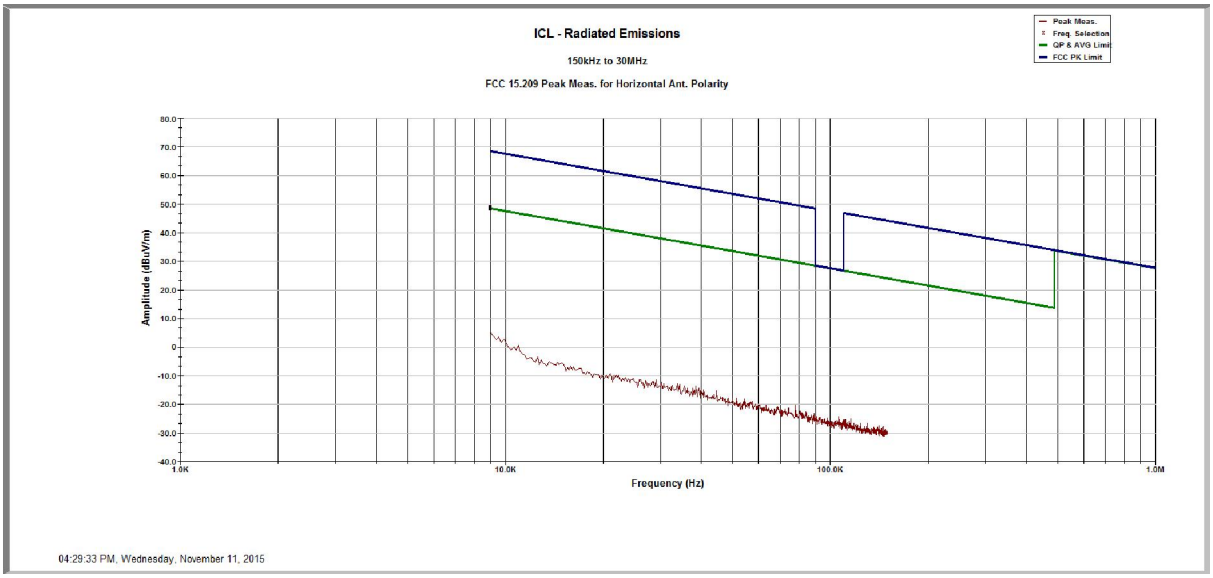


Figure 4. Maximum Radiated Emissions for 9kHz – 150kHz (Loop: Horizontal) Load: Full Battery

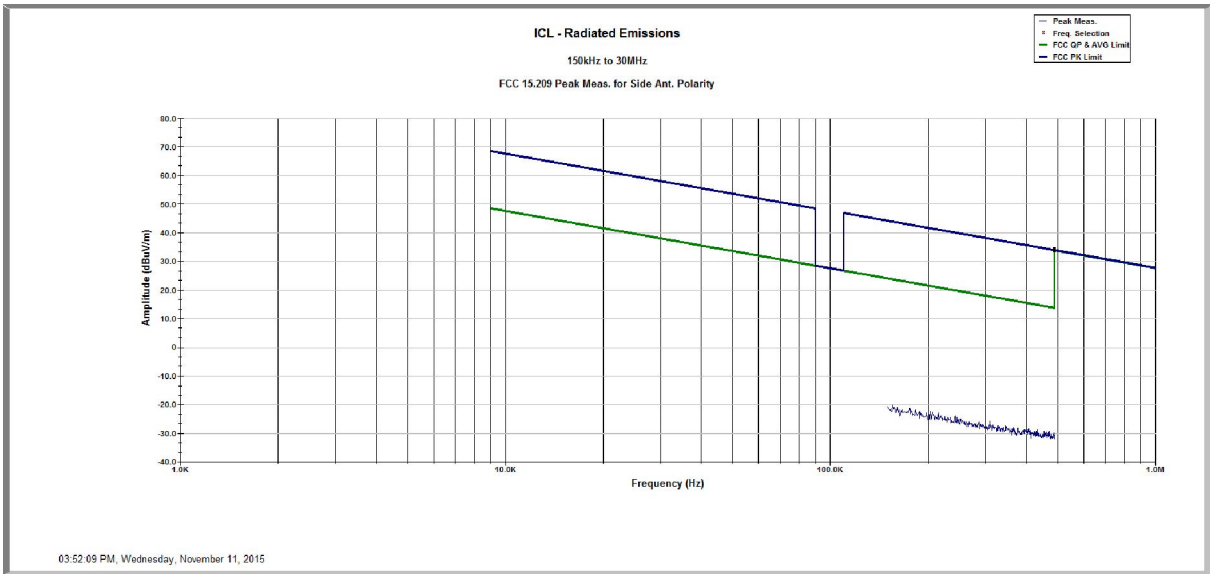


Figure 5. Maximum Radiated Emissions for 150kHz – 490kHz (Loop: Side) Load: Full Battery

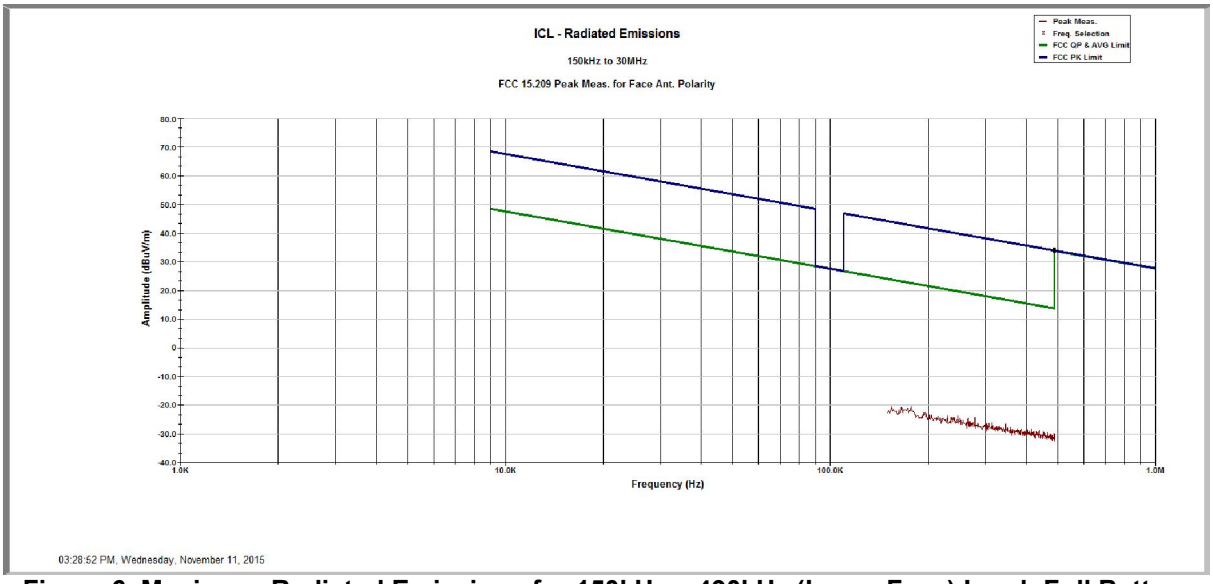


Figure 6. Maximum Radiated Emissions for 150kHz – 490kHz (Loop: Face) Load: Full Battery

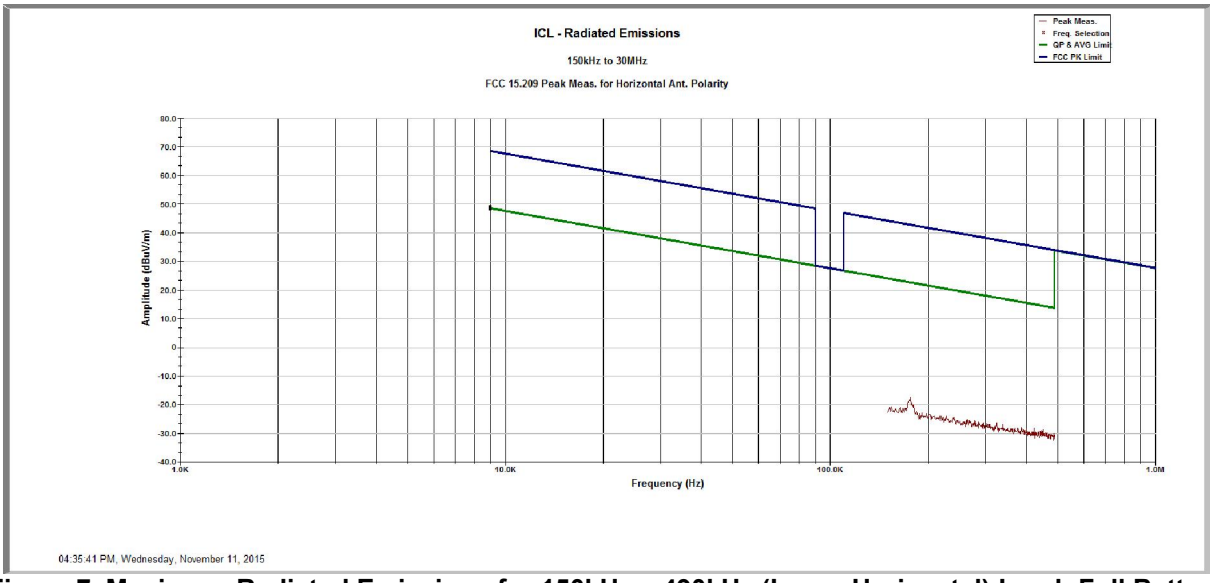


Figure 7. Maximum Radiated Emissions for 150kHz – 490kHz (Loop: Horizontal) Load: Full Battery

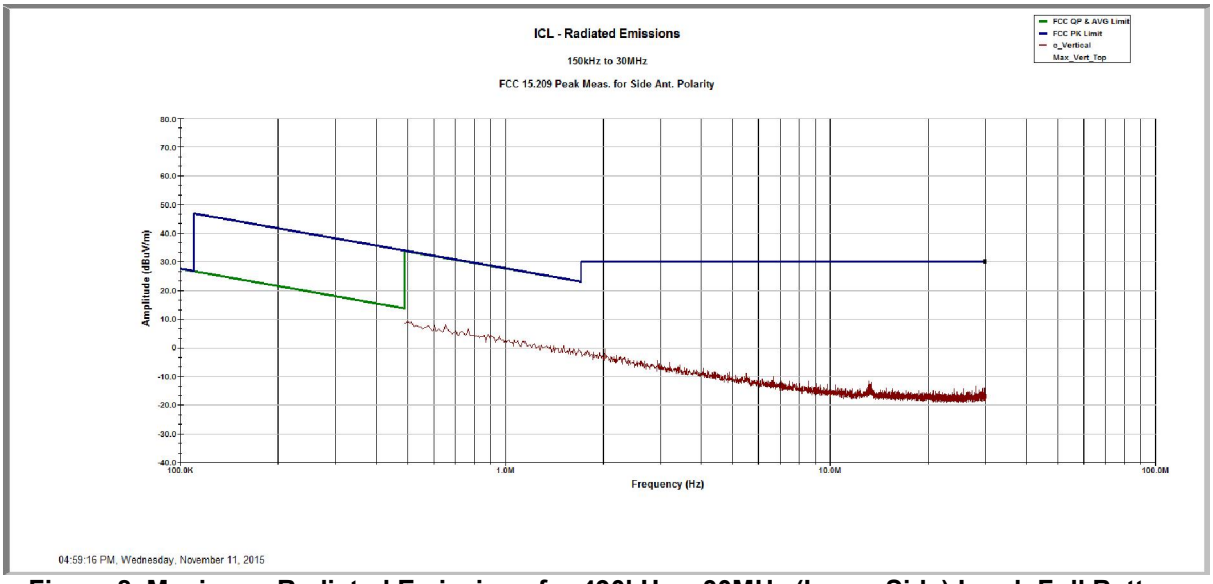


Figure 8. Maximum Radiated Emissions for 490kHz – 30MHz (Loop: Side) Load: Full Battery

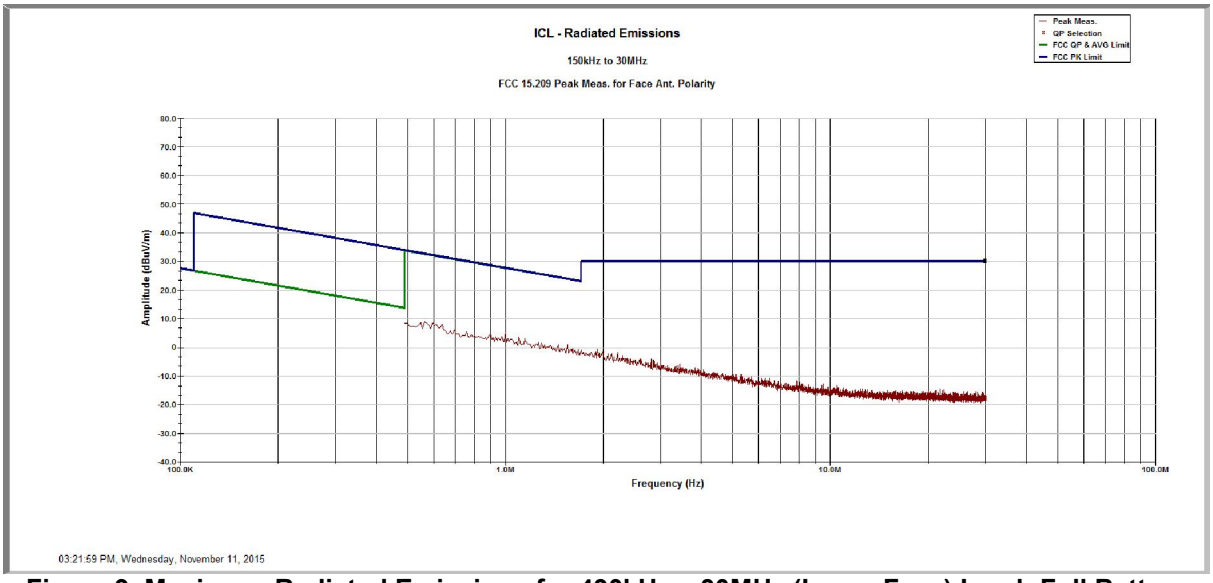


Figure 9. Maximum Radiated Emissions for 490kHz – 30MHz (Loop: Face) Load: Full Battery

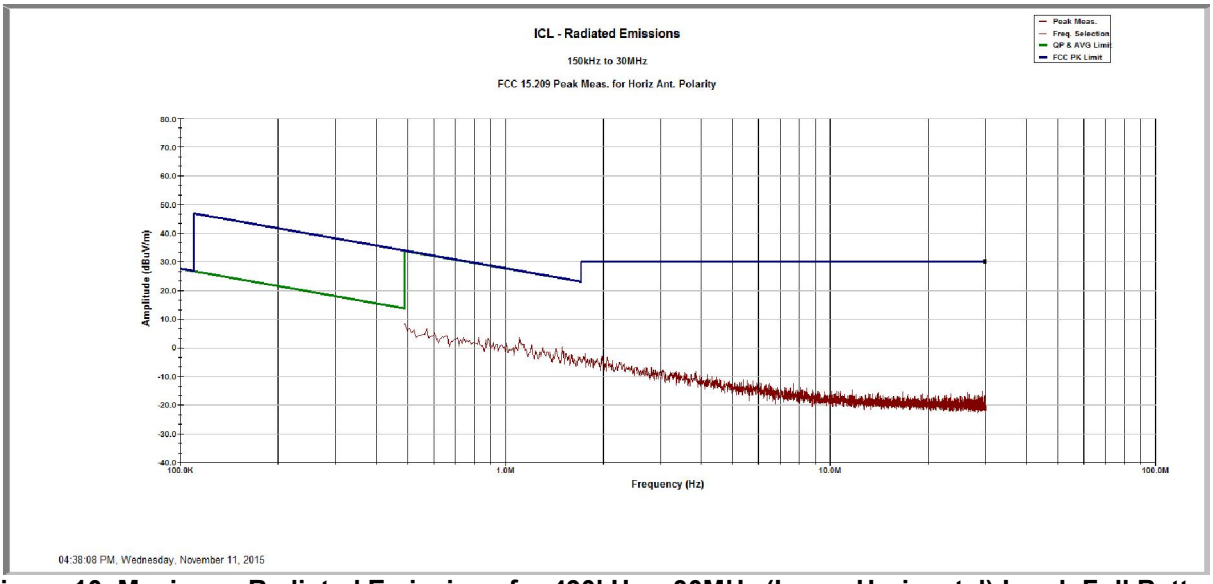


Figure 10. Maximum Radiated Emissions for 490kHz – 30MHz (Loop: Horizontal) Load: Full Battery

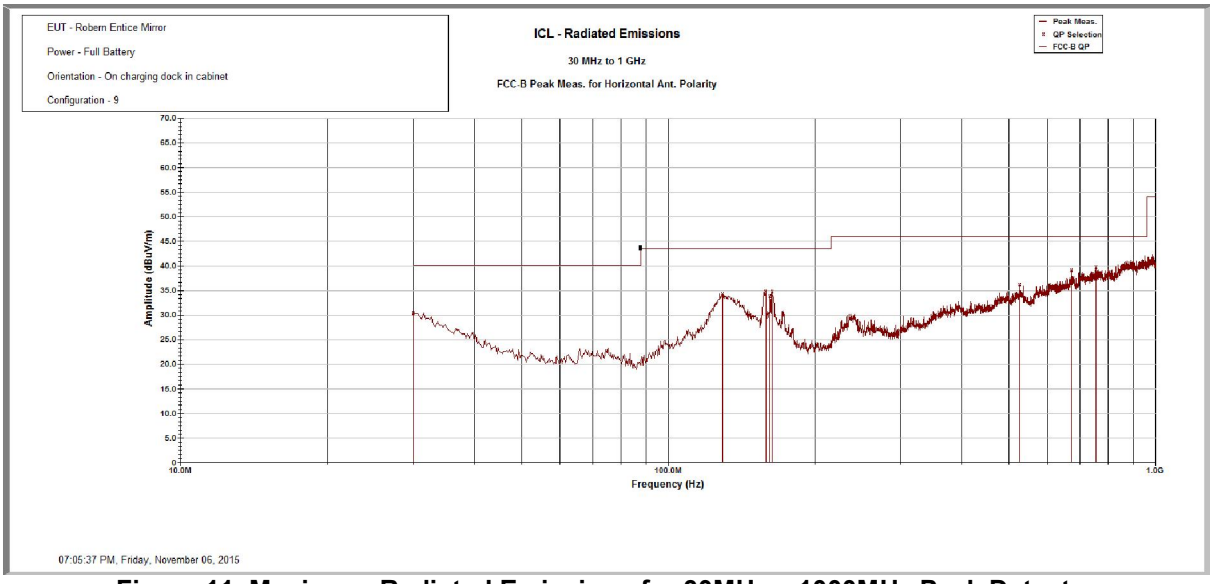


Figure 11. Maximum Radiated Emissions for 30MHz – 1000MHz Peak Detector Horizontal Antenna Polarity, Load: Full Battery

ICL - Radiated Emissions					
Frequency	**QP Meas.**	**FCC-B Limit**	**FCC Margin**	**Turn Table**	**Ant. Height**
	(dBuV/m)	**(dBuV/m)**	**(dB)**	**(deg)**	**(cm)**
129.3 MHz	28.29	43.52	15.24	349.3	117.3
157.64 MHz	27.59	43.52	15.93	26.8	224.8
160.73 MHz	28.56	43.52	14.96	24.7	187.1
162.7 MHz	28.75	43.52	14.77	50.4	151.4
527.44 MHz	27.59	46.02	18.43	249.0	181.9
672.46 MHz	30.79	46.02	15.23	85.0	249.8
744.68 MHz	31.48	46.02	14.55	154.4	123.7
Negative margin indicates measurements ABOVE the limit. Positive margin indicates measurements BELOW the limit.					

Table 3. Final Quasi-Peak Measurements (Horizontal Antenna Polarity) Load: Full Battery

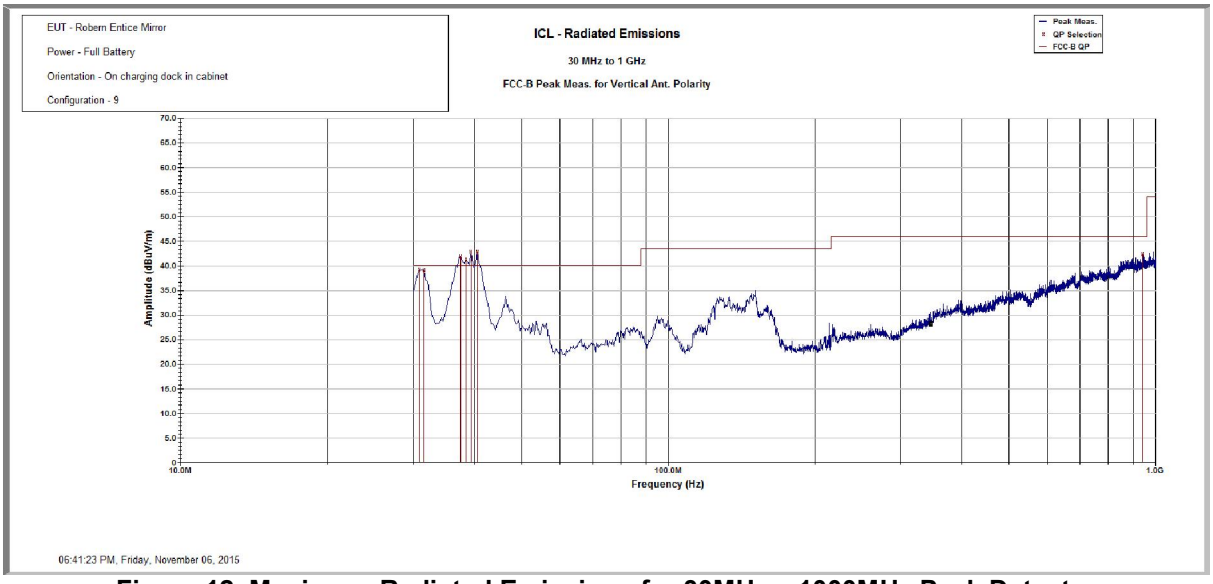


Figure 12. Maximum Radiated Emissions for 30MHz – 1000MHz Peak Detector Vertical Antenna Polarity, Load: Full Battery

ICL - Radiated Emissions					
Frequency	**QP Meas.**	**FCC-B Limit**	**FCC Margin**	**Turn Table**	**Ant. Height**
	(dBuV/m)	**(dBuV/m)**	**(dB)**	**(deg)**	**(cm)**
31.023 MHz	28.90	40.00	11.10	343.7	137.1
31.097 MHz	28.18	40.00	11.82	345.5	174.3
37.414 MHz	33.41	40.00	6.59	352.0	117.9
38.502 MHz	30.95	40.00	9.05	230.5	207.2
39.257 MHz	32.45	40.00	7.55	262.6	107.6
40.629 MHz	32.94	40.00	7.06	255.0	149.0
941.92 MHz	34.43	46.02	11.59	124.5	198.4
Negative margin indicates measurements ABOVE the limit. Positive margin indicates measurements BELOW the limit.					

Table 4. Final Quasi-Peak Measurements (Vertical Antenna Polarity) Load: Full Battery

11.2.4 Highest Fundamental Radiated Emission

Although the Full Battery mode of operation yielded radiated emissions that were higher relative to the limit across the frequency spectrum, Standby mode, yielded the highest fundamental emissions relative to the limit when measured using a peak detector. A plot of this emission and its measurement are presented below:

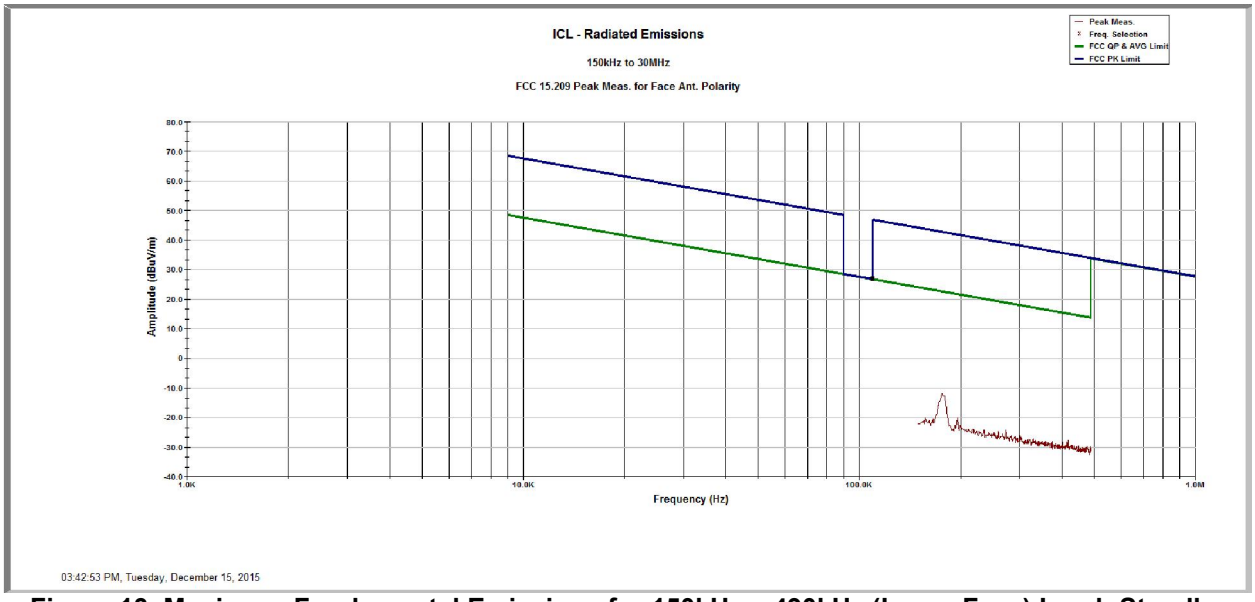


Figure 13. Maximum Fundamental Emissions for 150kHz – 490kHz (Loop: Face) Load: Standby

The fundamental measurement at 176.35 kHz is -11.97 dBuV/m.
The Peak Limit is 42.68 dBuV/m.
The Quasi-Peak/Average Limit is 22.68 dBuV/m.
The calculated Peak margin is 54.65 dB.
Additionally, this peak is 34.65 dB below the QP Limit of 22.68 dBuV/m (which is greater than 20dB).
No Average or Quasi-Peak measurement was recorded.

12.0 CONCLUSION

It was found that the Robern Inc. ENTICE™ Inductive Charging Dock **MEETs** the emission requirements of the CFR47, Part 15, Subpart C, Section 15.209 for a low power transmitter operating below 1705kHz.