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ACCREDITED TESTING CERT #1255.01
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TEST REPORT #: TR 316396 A
LSR Job #: C-2650

Compliance Testing of:

WCH-186 Wireless Charger

Test Date(s):

1/17/17
1/19/17

Prepared For:

Laird Dabendorf Gmbh
Attn: Heiko Dörschel
Märkische Str. 72
Zossen, Germany 158067

This Test Report is issued under the Authority of:
Michael Hintzke, EMC Engineer III

Signature: Date: 2/28/17

Test Report Reviewed by:	Tested by:
Adam Alger, Quality Systems Engineer	Michael Hintzke, EMC Engineer III
Signature: Date: 2/28/17	Signature: Date: 2/28/17

TABLE OF CONTENTS

EXHIBIT 1: INTRODUCTION

1.1 Scope

References:	FCC Part 15, Subpart C, Section 15.209
Title:	Telecommunication – Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To determine FCC Certification Authorization for Intentional Radiators for Radiated Emission Limits; General Requirements.

Test Procedures:	Radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.10 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.2 Normative References

Publication	Year	Title
47 CFR, Parts 0-15 (FCC)	2017	Code of Federal Regulations - Telecommunications
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
CISPR 16-1-1	2010-01 A1: 2010-06 COR1: 2010	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.

1.3 Laird Technologies, Inc. in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:

TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation

A2LA Certificate Number: 1255.01

Federal Communications Commission (FCC) – USA

Listing of two 3 Meter Semi-Anechoic Chambers based on Title 47 CFR – Part 2.948

FCC Registration Number: 90756

Industrie Canada Industry Canada

Canada

Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-GEN – Issue 4

File Number: IC 3088A-2

On file, 3 Meter Semi-Anechoic Chamber based on RSS-GEN – Issue 4

File Number: IC 3088A-3

1.4 Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at a calibration laboratory accredited to the requirements of ISO 17025, and are traceable to the SI Standard. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz).

EXHIBIT 2: PERFORMANCE ASSESSMENT

2.1 Client Information

Manufacturer Name:	Laird Dabendorf Gmbh
Address:	Märkische Dabendorf Gmbh
Contact Person:	Heiko Dörschel
Contact Phone:	+49 3377 316-0
Contact Email:	heiko.doerschel@lairdtech.com

2.2 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	WCH-186 Wireless Charger
Model Number:	WCH-186
Serial Number:	Engineering Sample

2.4 Product Description

The EUT is a low power Qi compatible inductive wireless power transfer device (wireless charger) with load management and operating at a single frequency at 111kHz.

EXHIBIT 3: EUT OPERATING CONDITIONS & CONFIGURATIONS

3.1 Climate Test Conditions

Temperature:	71° Fahrenheit
Humidity:	30%
Pressure:	741 mmHg

3.2 Applicability & Summary Of EMC Emission Test Results

FCC/IC Paragraph	Test Requirements	Compliance (yes/no)
FCC: 2.1049	Occupied Bandwidth	Yes
FCC: 15.209(a)	Maximum RF Output Power	Yes
FCC: 15.209(c)	Radiated Emissions	Yes

3.3 Modifications Incorporated in The EUT For Compliance Purposes

☒ None ☐ Yes (explain below)

3.4 Deviations & Exclusions from Test Specifications

☒ None ☐ Yes (explain below)

Note: AC powerline emissions was not performed since the EUT is battery operated only.

EXHIBIT 4: CONFORMANCE SUMMARY

When tested on 1/17/17 and 1/19/17, it was determined that the EUT, WCH-186 Wireless Charger, as provided by Laird Dabendorf Gmbh, was compliant with the requirements of:

FCC 15.209

Using the methods of ANSI C63.10-2013

Any modifications made to the EUT after the specified test date(s) will invalidate the data herein.

If some emissions measurements are seen to be within the uncertainty value, as listed in Appendix C there is a possibility that this unit may not meet the required limit specification if subsequently tested.

EXHIBIT 5: RADIATED EMISSIONS TEST

5.1 Test Setup

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, and ANSI C63.10. The WCH-186 charger, henceforth referred to as the EUT, was placed on an 80-cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber.

The EUT operates on a single channel at 111 kHz.

5.2 Test Procedure

Radiated RF measurements were performed at a separation distance of 3 meters on the EUT in a Semi-Anechoic Chamber. The frequency range from 9 kHz to 1000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. A Biconical Antenna was used to measure emissions from 30 MHz to 200 MHz and a Log Periodic Dipole Array Antenna was used to measure emissions from 200 MHz to 1000 MHz. For emissions below 30 MHz, an active loop antenna was used. The loop antenna was set at a height of 1m above the conducting ground plane and it was rotated about its vertical and horizontal axes (while utilizing the turntable to rotate the EUT) in order to measure the maximum radiated RF emissions. The maximum radiated RF emissions above 30 MHz were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities and rotating the EUT using the turntable.

The receiver was operated with the resolution bandwidth set at 200 Hz for measurements between 9 kHz and 150 kHz, 9 kHz for measurements between 150 kHz and 30 MHz and 120 kHz for measurements between 30 MHz and 1000 MHz.

5.3 Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an IEC/ISO 17025 accredited calibration laboratory, traceable to the SI standard. In addition, the Connecting Cables were measured for losses using a calibrated EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with resolution bandwidths as prescribed in ANSI C63.4.

5.4 Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of FCC Part 15.209 for a Low-Power License-Exempt transmitter.

5.5 Calculation of Radiated Emissions Limits

Transmitter Limits

The maximum peak output power of an intentional radiator in the 9-490 kHz band, as specified in FCC Part 15.209, is calculated in a formula as described below.

The following table depicts the general radiated emission limits. These limits were applied to the fundamental emission of the intentional radiator as well as all other significant spurious signals.

Frequency (MHz)	Limit μV/m	Limit (dBμV/m)	Measurement Distance (m)
0.009-0.490	2400/F (kHz)	Note 1	300
0.490-1.705	24000/F (kHz)		30
1.705-30.0	30		30
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
960-24,000	500	54.0	3

Note 1: Sample calculation for the Fundamental Emission of a transmitter:

Example Calculation:

For a transmitter fundamental frequency of 111 kHz, the emission limit is calculated:

2400/F = 2400/111 = 21.6. μV/m at 300 meters.

Expressed in decibels: 20 log(21.6) = 26.69 dBμV/m at 300 m separation.

Note: Although the limits are specified for a measurement distance of 300 meters at 111 kHz, the distance utilized during measurement was 3 meters. The limits have been extrapolated to the required distance using the following equations as detailed in section 6.4 of ANSI C63.10:

$$FS_{\text{limit}} = FS_{\text{max}} - 40\log\left(\frac{d_{\text{near field}}}{d_{\text{measure}}}\right) - 20\log\left(\frac{d_{\text{limit}}}{d_{\text{near field}}}\right)$$

$$FS_{\text{limit}} = FS_{\text{max}} - 40\log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right)$$

$$d_{\text{near field}} = 47.77/f_{\text{MHz}}$$

5.6 Radiated Emissions Test Data Chart

3 Meter Measurements of Electromagnetic Radiated Emissions
Frequency Range Inspected: 9 kHz to 1000 MHz

Manufacturer:	Laird Dabendorf Gmbh						
Date(s) of Test:	1/17/17, 1/19/17						
Project Engineer:	Michael Hintzke						
Test Engineer(s):	Michael Hintzke						
Voltage:	12 VDC						
Operation Mode:	Charging						
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %						
EUT Power:		Single Phase 120VAC		3 Phase ___VAC			
		Battery	√	Other: DC supply			
EUT Placement:	√	80cm non-conductive table		10cm Spacers			
EUT Test Location:		Chamber 5	√	Chamber 3			
Measurements:		Pre-Compliance		Preliminary	√	Final	
Detectors Used:	√	Peak	√	Quasi-Peak	√	Average	

FCC 15.209 Data

The following table represents the extrapolations from the measurement of a single point specified in ANSI C63.10 2013, section 6.4.4.2.

Frequency (kHz)	Frequency (MHz)	$d_{near\ field}$	Limit Distance	Limit Distance greater than $d_{near\ field}$ (use equation 2 if yes)	Limit Distance closer to EUT than $d_{near\ field}$ (use equation 4 if yes)	Conversion
110.9	0.1109	430.7	300	no	yes	-80.0
334.5	0.3345	142.8	300	yes	no	-73.6
91.6	0.0916	521.5	300	no	yes	-80.0
556.8	0.5568	85.8	30	no	yes	-40.0
110.9	0.1109	430.7	300	no	yes	-80.0
332.2	0.3322	143.8	300	yes	no	-73.6
91.8	0.0918	520.4	300	no	yes	-80.0

Frequency (kHz)	Limit Distance* (m)	Measurement Detector(s)**
110.9	300	Peak, Average
334.5	300	Peak, Average
91.6	300	Quasi-Peak
556.8	30	Quasi-Peak
110.9	300	Peak, Average
332.2	300	Peak, Average
91.8	300	Quasi-Peak

* Limit distance as specified in FCC 15.209

** Measurement detector(s) as specified in FCC 15.35 & FCC 15.209

Frequency (kHz)	Antenna Height (m)	Azimuth (degree)	Peak Field Strength at Limit Distance (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Average Field Strength at Limit Distnace (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Quasi-Peak Field Strength at Limit Distance (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Quasi-Peak Margin	Antenna Polarity	Notes
110.9	1.00	241	16.6	46.7	30.1	13.5	26.7	13.2	-	-	-	H	1
334.5	1.00	242	-15.7	37.1	52.8	-21.8	17.1	38.9	-	-	-	H	1
91.6	1.00	0	-34.0	-	-	-	-	-	-	28.4	62.3	H	1,2,3
556.8	1.00	243	-	-	-	-	-	-	7.1	32.7	25.6	H	1
110.9	1.00	242	6.6	46.7	40.1	3.5	26.7	23.2	-	-	-	V	1
332.2	1.00	243	-17.2	37.2	54.4	-21.6	17.2	38.8	-	-	-	V	1
91.8	1.00	0	-32.5	-	-	-	-	-	-	28.3	60.8	V	1,2,3

*measurements were performed at a 3 m separation with the EUT in the flat orientation

** each measurement is converted to the specified 15.209 limit distance

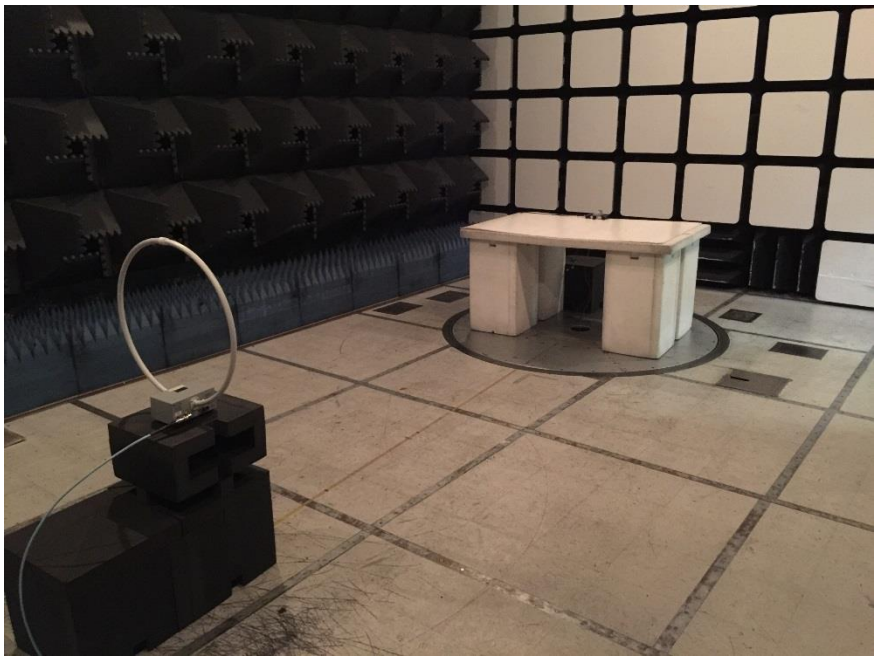
Note 1: EUT load was positioned over the bottom loop position

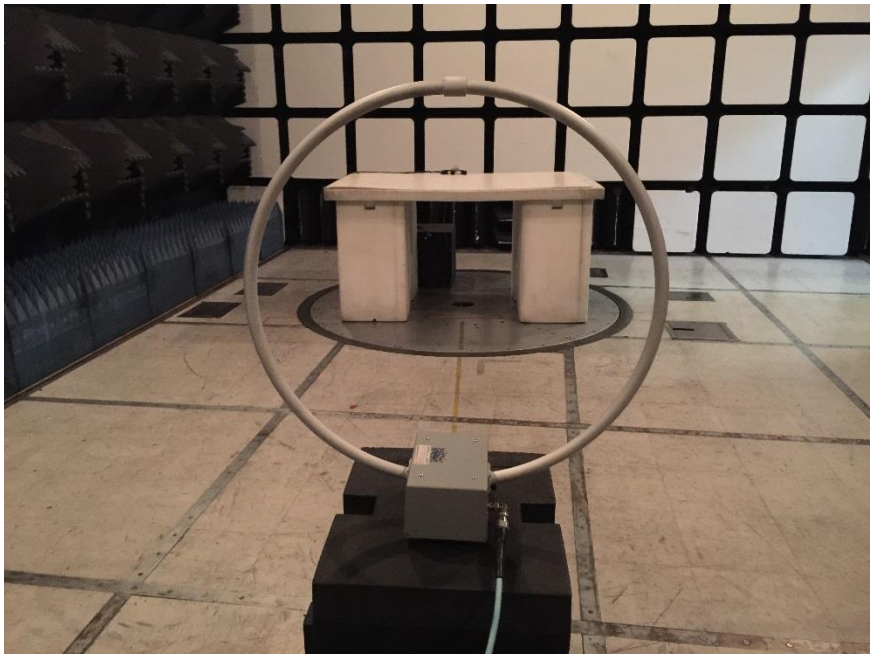
Note 2: System noisefloor measurement

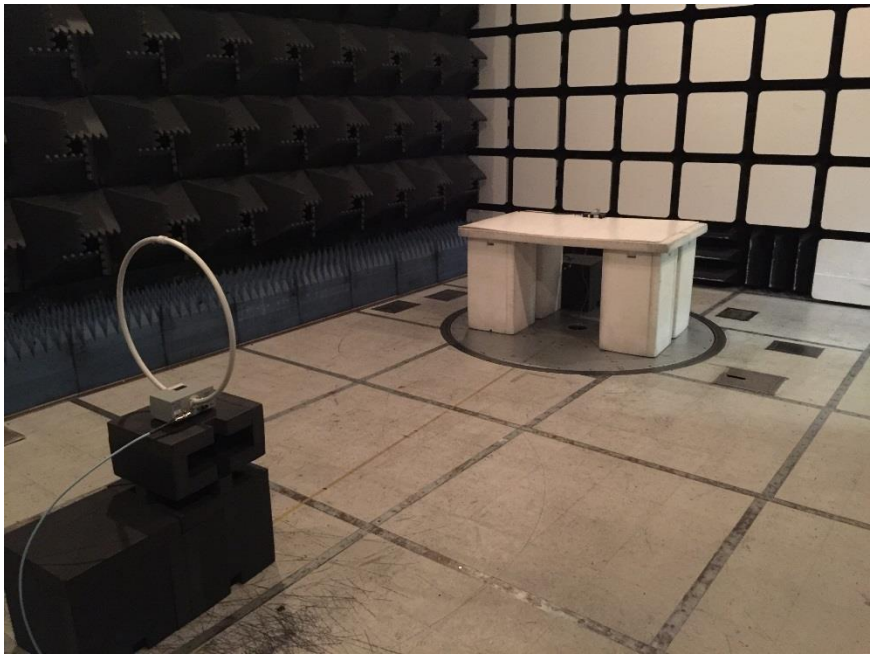
Note 3: Peak value compared to Quasi-Peak limit

5.7 Test Setup Photo(s) – Radiated Emissions Test

FCC 15.209 Setup





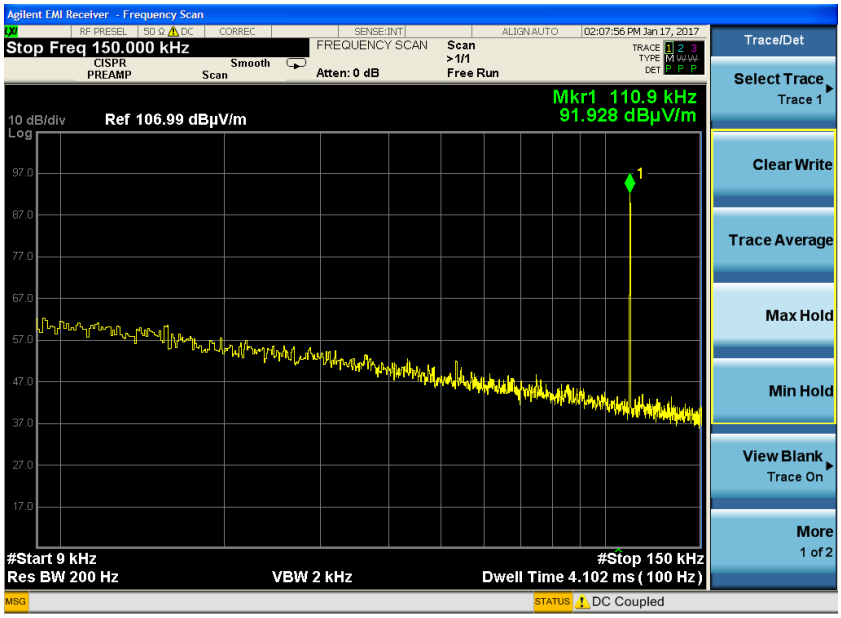


5.8 Screen Captures - Radiated Emissions Test

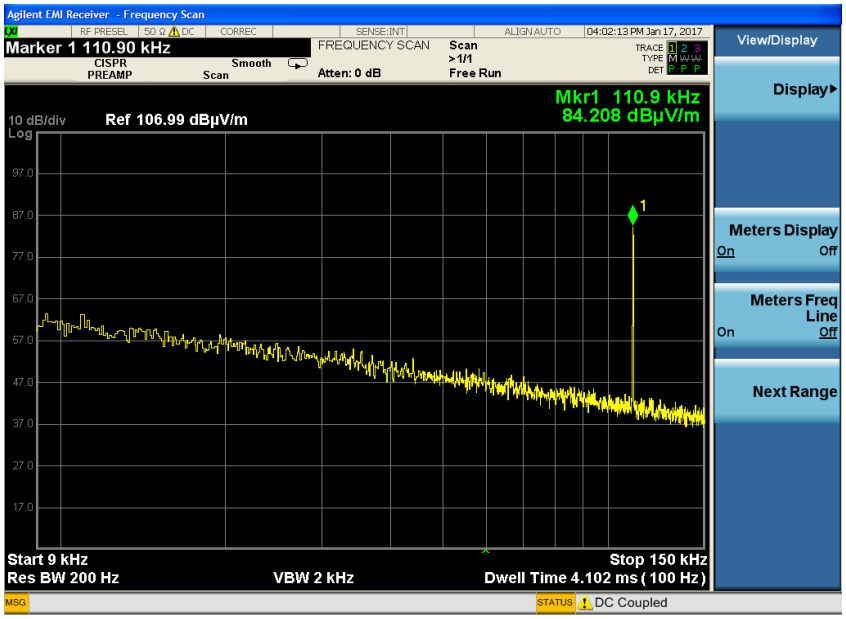
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak or Average detector function is utilized when measuring frequencies below 1 GHz.

FCC 15.209

9 kHz to 150 kHz, at 3m

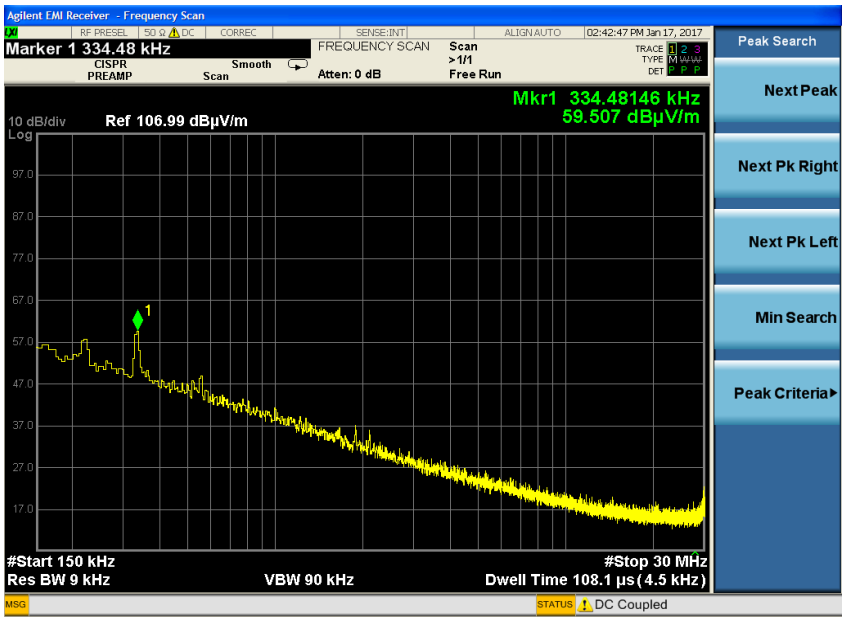


Horizontal Polarity

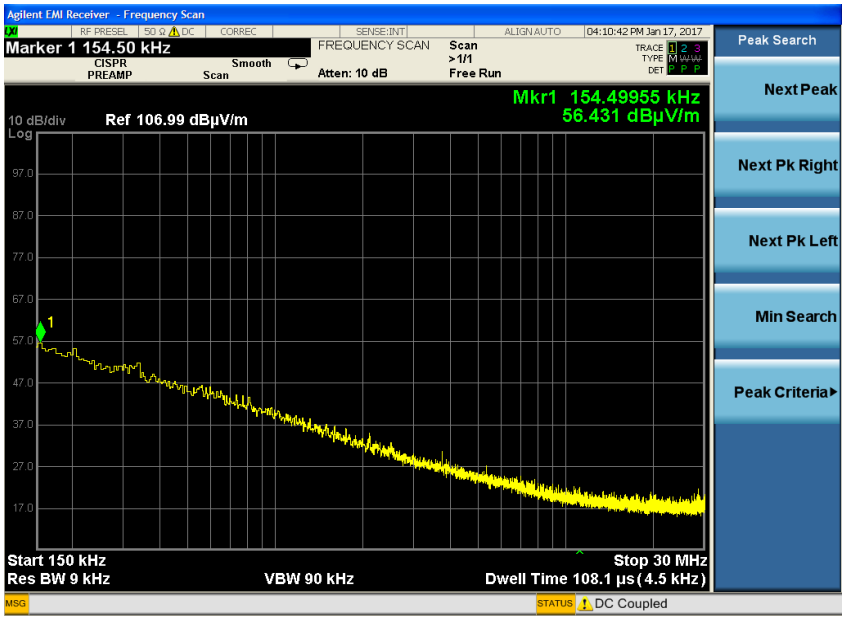


Vertical Polarity

150 kHz to 30 MHz, at 3m



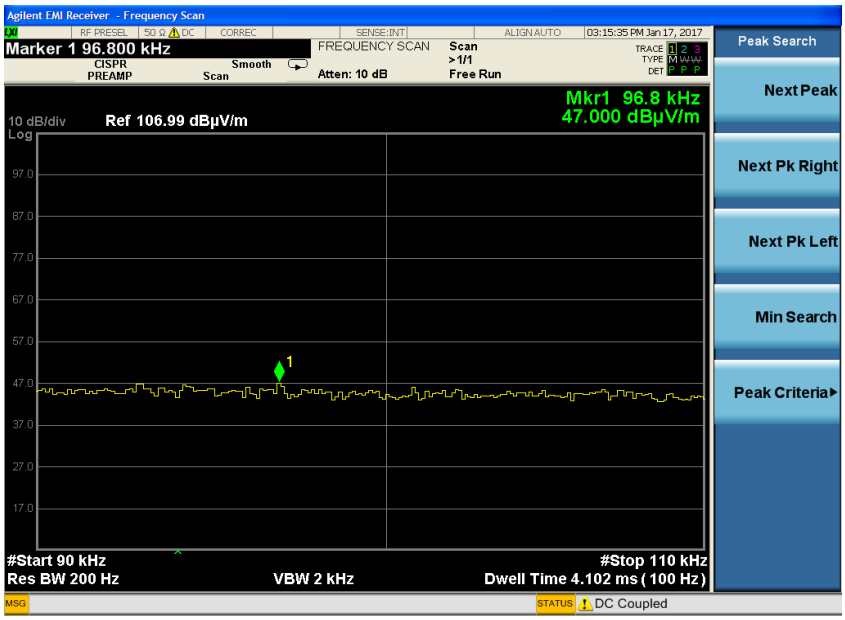
Horizontal Polarity



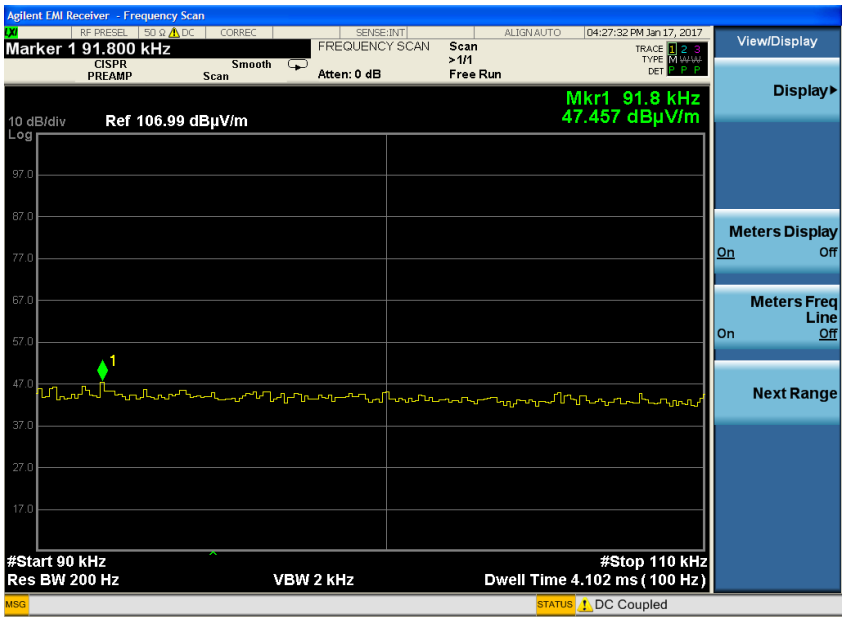
Vertical Polarity

FCC 15.205 Restricted Band

0.090 – 0.110 kHz



Horizontal Polarity



Vertical Polarity

EXHIBIT 6: Occupied Bandwidth

6.1 Limits

There is no limit. Measurement of the 99% bandwidth is required by FCC Part 2.1049.

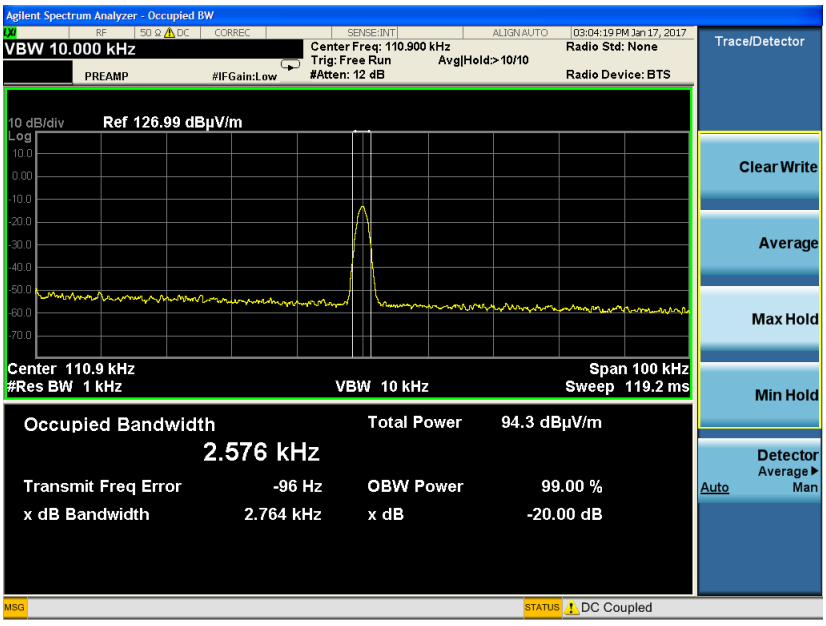
6.2 Method of Measurements

The transmitter output was placed in normal operation mode. The bandwidth of the fundamental frequency was measured via radiated measurement using the Spectrum Analyzer bandwidth measurement function.

6.3 Test Data

Center Frequency (MHz)	Measured 99%. BW (Hz)
0.111	2576

6.4 Screen Capture - 99% BANDWIDTH



Appendix A: Instrument List

Laird
Smart Technology. Delivered.

Date : 17-Jan-2017 Test : RSS - Radiated Emissions Job # : C-2650

PE: Michael Hintzke Customer : Laird Novero Quote #: 316396

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	N9038A MXE 26.5GHz Receiver	Agilent	N9038A	MY51210148	5/12/2016	5/12/2017	Active Calibration
2	AA 960006	Active Loop Antenna	EMCO	6502	9205-2753	8/14/2015	8/13/2017	Active Calibration
3	AA 960128	Biconical Antenna	ETS Lindgren	3110B	00062899	3/21/2016	3/21/2017	Active Calibration
4	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	3/31/2016	3/31/2017	Active Calibration

Tested By: Quality Assurance:

Laird
Smart Technology. Delivered.

Date : 17-Jan-2017 Test : FCC - Radiated Emissions Job # : C-2650

PE: Mike Customer : Laird Novero Quote #: 316396

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960088	8GHz MXE Spectrum Analyzer	Agilent	N9038A	MY51210138	2/24/2016	2/23/2017	Active Calibration
2	AA 960006	Active Loop Antenna	EMCO	6502	9205-2753	8/14/2015	8/13/2017	Active Calibration

Tested By: Quality Assurance:

Appendix B: Test Standards - Current Publication Dates

Standard	Edition	Date	AMD 1	AMD 2
FCC 15.109		2017		
ANSI C63.10		2013		

Appendix C: Uncertainty Statements

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Configuration	Uncertainty Values
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	AMN	3.4 dB
Telecom Conducted Emissions	AAN	4.9 dB
Disturbance Power (Emissions)	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/Meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst / Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C.+/-	U.C.+/-
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (PM)	1.5 dB	1.2 dB
RF conducted emissions (SA)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %