TEST REPORT

Report Number: 103592127MPK-037
Project Number: G103592127
August 14, 2019

Testing performed on the
Cala Base Station
Model(s) Tested: TWO (Base Station)

FCC ID: 2AT2D-BASE0017

to

FCC Part 15 Subpart C (15.225)
Industry Canada RSS-210 Issue 9

For

Cala Health, Inc

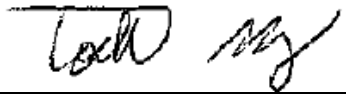
Test Performed by:	Test Authorized by:
Intertek	Cala Health, Inc.
1365 Adams Court	875 Mahler Road Suite 175
Menlo Park, CA 94025 USA	Burlingame, CA 94010 USA

Prepared by: _____ **Date:** August 14, 2019
Todd Moy

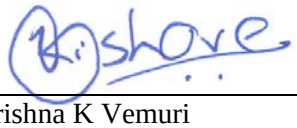
Reviewed by: _____ **Date:** August 14, 2019
Krishna Vemuri

Report No. 103592127MPK-001	
Equipment Under Test:	Cala Base Station
Trade Name:	Cala Health, Inc.
Model(s) Tested:	TWO (Base Station)
Applicant:	Cala Health, Inc.
Contact:	Mark Shughart
Address:	Cala Health, Inc. 875 Mahler Road Suite 175 Burlingame, CA 94010
Country:	USA
Tel. Number:	(415) 890-3961
Email:	mark@calahealth.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2
Date of Test:	August 12-August 13, 2019

We attest to the accuracy of this report:



Todd Moy
Project Engineer



Krishna K Vemuri
Engineering Team Lead

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1.0 Summary of Tests

TEST	REFERENCE FCC 15.225	REFERENCE RSS-210	RESULTS
Field Strength of Fundamental	15.225(a)	B.6	Complies
Radiated Emissions Outside the band	15.225(b), 15.225(c), 15.225(d), 15.209	B.6	Complies
Frequency Tolerance of the Carrier	15.225(e)	B.6	Complies
Line Conducted Emissions	15.207	RSS-GEN	Complies
Occupied Bandwidth	15.215	RSS-GEN	Complies
Antenna requirement	15.203	RSS-GEN	Complies[1]

[1] EUT utilizes an internal Antenna.

2.0 General Description

2.1 Product Description

Cala Health, Inc. supplied the following description of the EUT:

The Cala Base Station provides charging and connectivity to the Cala Trio wrist-worn stimulator.

For more information, refer to the following product specification, declared by the manufacturer.

Overview of the EUT

Models	Cala Health, Inc
FCC Identifier	2AT2D-BASE0017
Operating Frequency	13.56MHz
Number of Channels	1
Type of Modulation	OOK
Operating Temperature	-20°C to +50°C
Antenna Type	Internal Loop Antenna
Applicant name & address	Cala Health, Inc. 875 Mahler Road Suite 175 Burlingame, CA 94010 USA

EUT receive date: August 11, 2019
EUT receive condition: The EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date: August 12, 2019
Test completion date: August 13, 2019

2.2 Related Submittal(s) Grants

None

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4. Radiated tests were performed at an antenna to EUT distance of 10 meters, unless stated otherwise in this test report. All other measurements were made in accordance with the procedures in part 2 of CFR 47 7, ANSI C63.10: 2013, ANSI C63.4-2014 & RSS-GEN Issue 5.

2.4 Test Facility

The radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada (Site # 2042L-1).

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 30MHz	30 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	5.1 dB
AC mains conducted emissions	2.1 dB	-	-

3.0 System Test Configuration

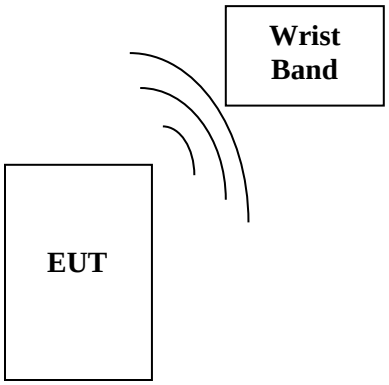
3.1 Support Equipment and description

Support Equipment		
Description	**Manufacturer**	**Model Number**
Wrist Band	Cala Health, Inc.	-

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model**	**Serial Number**
Cala Base Station	Cala Health, Inc.	TWO (BASE STATION)	DEV-009
AC adapter	SINGOF	SINGOF-12U-075160B	1806-0000004

3.2 Block Diagram of Test Setup (Continued)



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table.

3.4 Software Exercise Program

The EUT exercise program used during testing was provided by Cala Health, Inc..

3.5 Mode of Operation during test

The EUT was constantly broadcasting a 13.56 MHz signal while reading an RFID tag embedded into a wrist band.

3.6 Modifications required for Compliance

No Modifications were made e to bring the EUT into compliance.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Field Strength of Fundamental and Radiated Emissions Outside the band

4.1.1 Requirements

FCC Rules 15.225, 15.209

a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBuV) at 30 meters.

b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.209 Radiated emission limits; general requirements.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

4.1.2 Procedure

Radiated Measurements Below 30 MHz

During the test the EUT is rotated and the measuring antenna angles are varied during the search for maximum signal level.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for below 30 MHz were performed at 10 meters. Data results below are corrected for distance at 10m. Limits were normalized to 10 meters.

Radiated Measurements Above 30 MHz

During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for above 30 MHz were made at 10 meters.

Radiated emission measurements were performed from 9kHz to 1 GHz.
Analyzer resolution is:

200Hz or greater for 9kHz to 150kHz
9 kHz or greater for 150kHz to 30 MHz
120 kHz or greater for 30MHz to 1000 MHz
For those frequencies quasi-peak detector applies

Data includes of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

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 reading. The basic equation is as follows:

FS = RA + AF + CF – AG – DCF

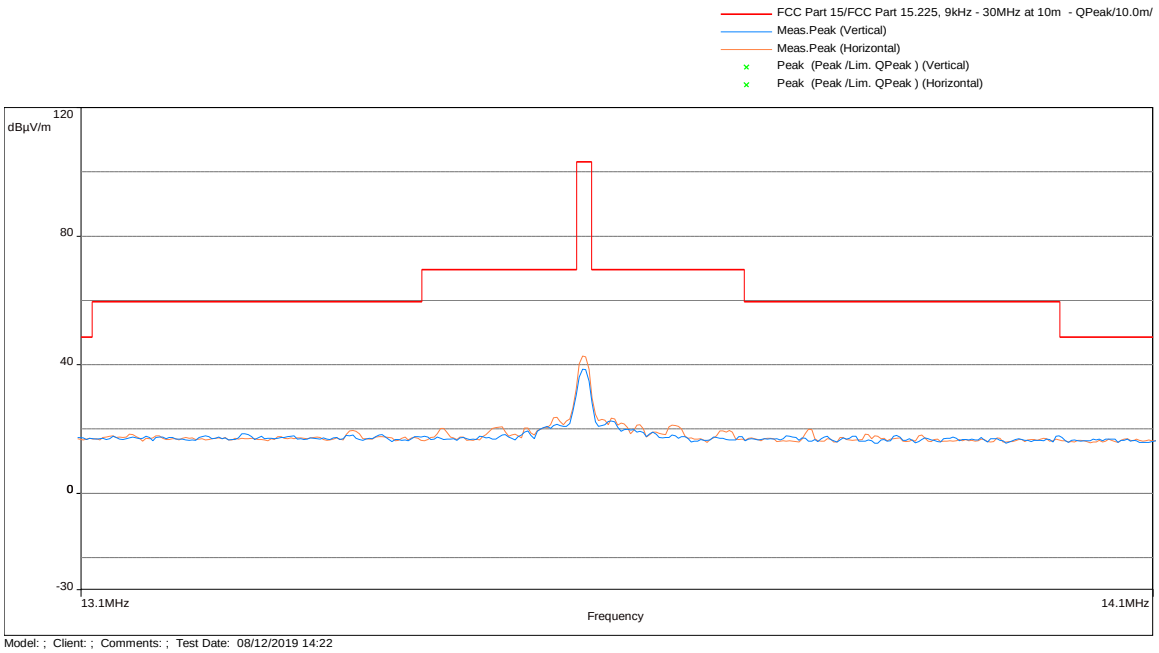
Where FS = Field Strength in dB (μV/m)

RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF = Distance Correction Factor

Note: FS was measured with loop antenna below 30MHz

4.1.3 Test Results

The data below shows the significant emission frequencies, the limit and the margin of compliance.
Note: Measurements were performed at parallel and perpendicular orientation of loop antenna. The worst-case data was presented below.

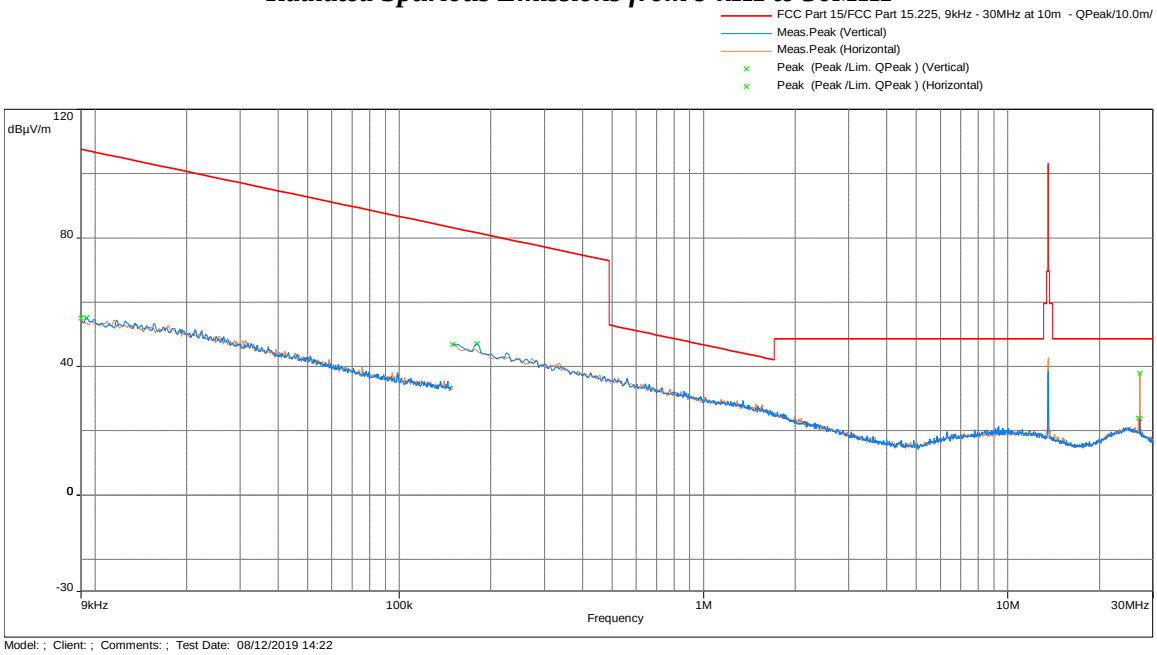


Frequency	Corrected Peak FS @10m	Limit @10m	Margin	RA@10m	Correction
(MHz)	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB
13.56	42.68	103.1	-60.42	39.38	3.3

Note: Correction = AF+CF–AG

4.1.3 Test Result (Continued)

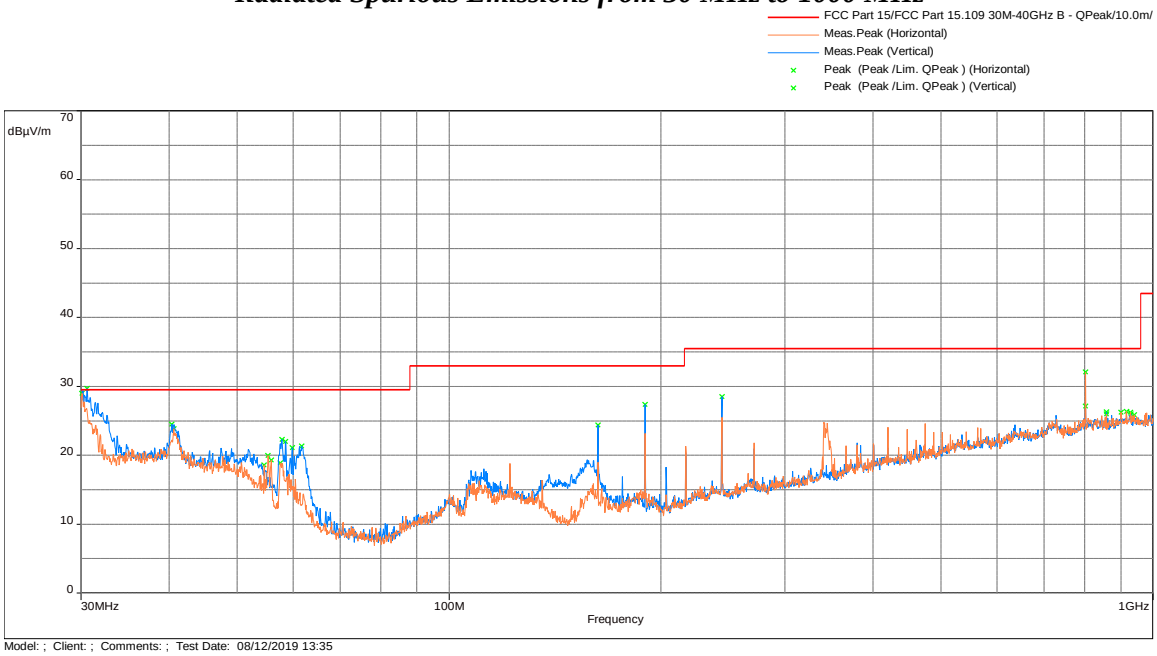
Radiated Spurious Emissions from 9 kHz to 30MHz



Model: ; Client: ; Comments: ; Test Date: 08/12/2019 14:22

4.1.3 Test Result (Continued)

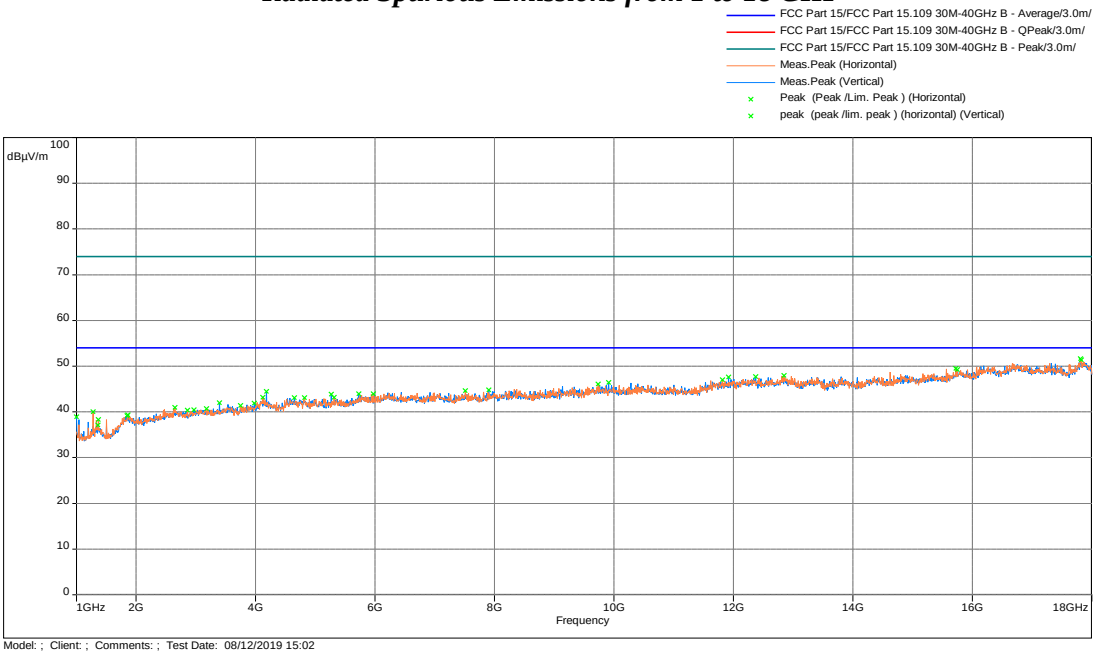
Radiated Spurious Emissions from 30 MHz to 1000 MHz



Frequency (MHz)	Peak dB(µV/m) @10m	Lim. QPeak dB(µV/m) @10m	Margin (dB)	Height (m)	Angle (°)	Polarity	Correction (dB)
29.908	25.4	29.5	-4.1	3.97	151.75	Vertical	-6.7
29.700	24.9	29.5	-4.7	1.04	185	Horizontal	-6.7
162.723	22.0	33	-11.0	1.86	201	Vertical	-16.0
189.841	25.5	33	-7.5	1.14	230.25	Vertical	-14.6
244.084	25.6	35.5	-9.9	1.13	188	Vertical	-11.5
801.816	30.6	35.5	-4.9	1.32	268.25	Horizontal	-1.6
Results: **Complies** by 4.1 dB							

4.1.3 Test Result (Continued)

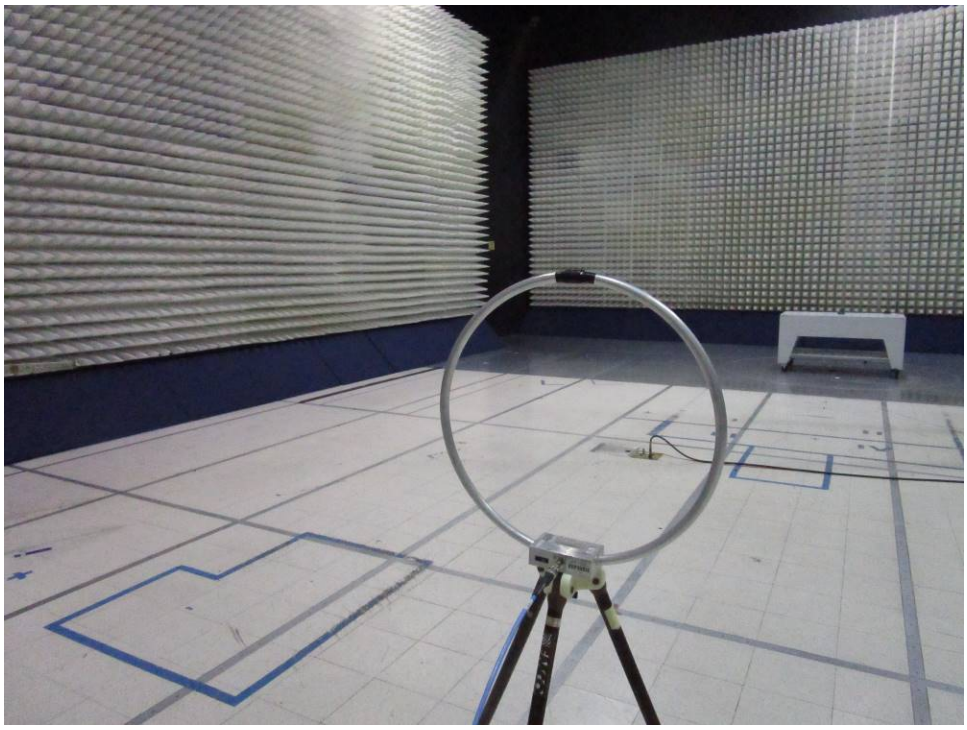
Radiated Spurious Emissions from 1 to 18 GHz



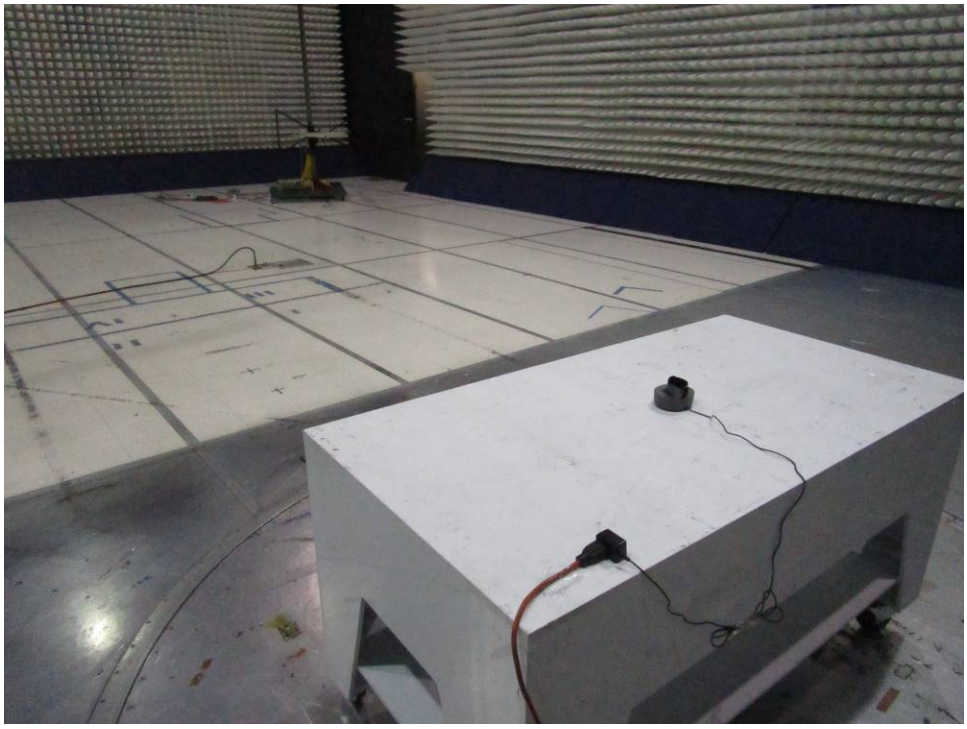
Model: ; Client: ; Comments: ; Test Date: 08/12/2019 15:02

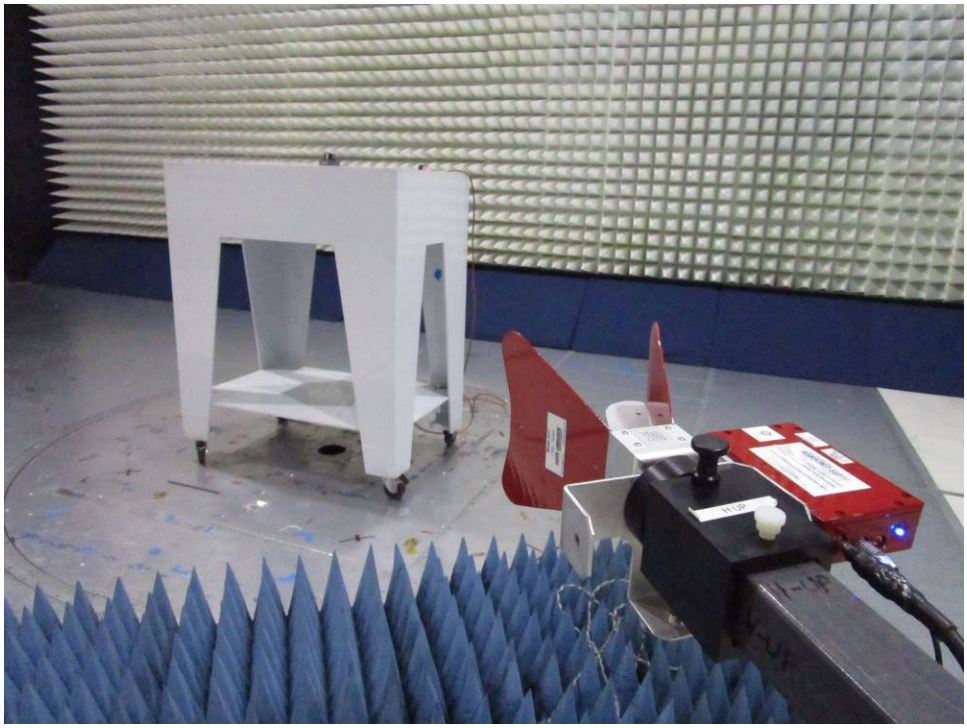
4.1.4 Test Configuration Photographs

The following photographs show the testing configurations used.



4.1.4 Test Configuration Photographs (continued)





4.2 Frequency Tolerance

4.2.1 Requirement

FCC 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.2.2 Procedure

The RFID radio was placed in the temperature chamber. The frequency counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded.

4.2.3 Test Results

Voltage (AC)	Temperature (C)	Measured Frequency (Hz)	Deviation from Reference (Hz)	Deviation (%)
120	50	13559920	-80	0.00059
120	40	13559599	-401	0.00296
120	30	13559760	-240	0.00177
120	20	13559696	-304	0.00225
120	10	13559840	-160	0.00118
120	0	13559768	-232	0.00171
120	-10	13559688	-313	0.00231
120	-20	13559728	-272	0.00201
Voltage (AC)	**Temperature (C)**	**Measured Frequency (Hz)**	**Deviation from Reference (Hz)**	**Deviation (%)**
102	20	13559776	-224	0.00166
138	20	13559776	-224	0.00165

Nominal Frequency @ 20C, 120VAC: 13559696 Hz

4.3 Occupied Bandwidth
FCC 15.215

4.3.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

4.3.2 Procedure

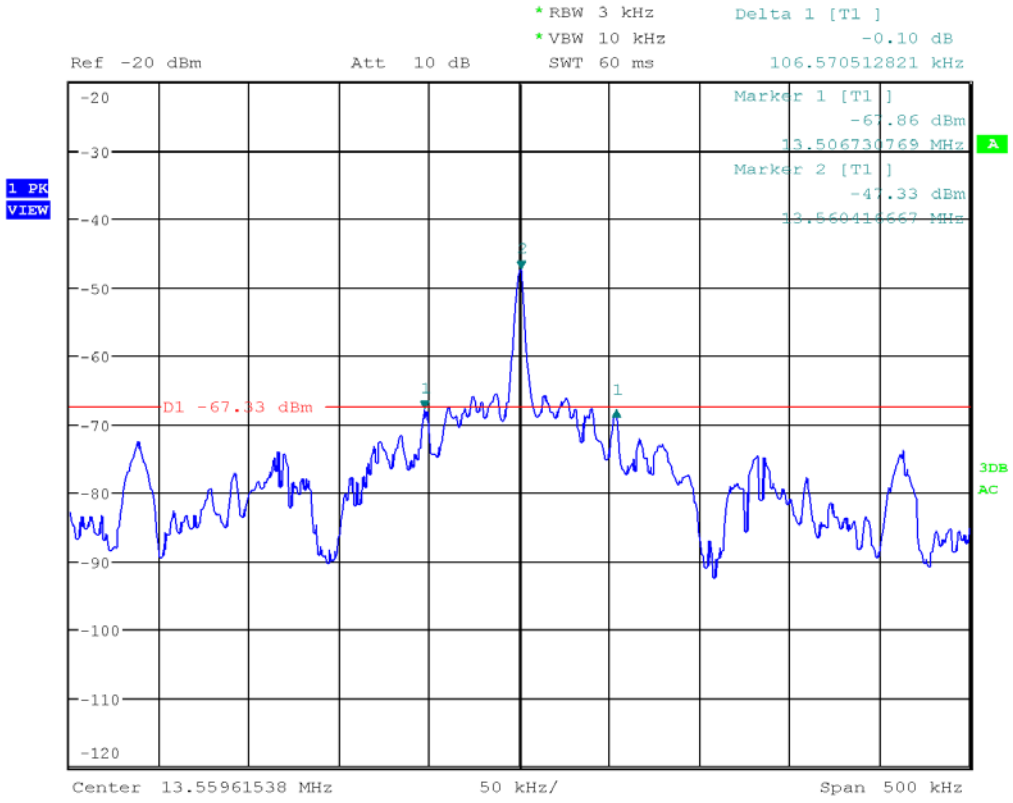
The EUT was setup to transmit in normal operating condition.

Measurements were made with the loop antenna in close proximity of the EUT. Following the procedures of ANSI 63.10, the 20dB bandwidth measurements were taken. The following plots show Occupied Bandwidth.

4.3.3 Test Results

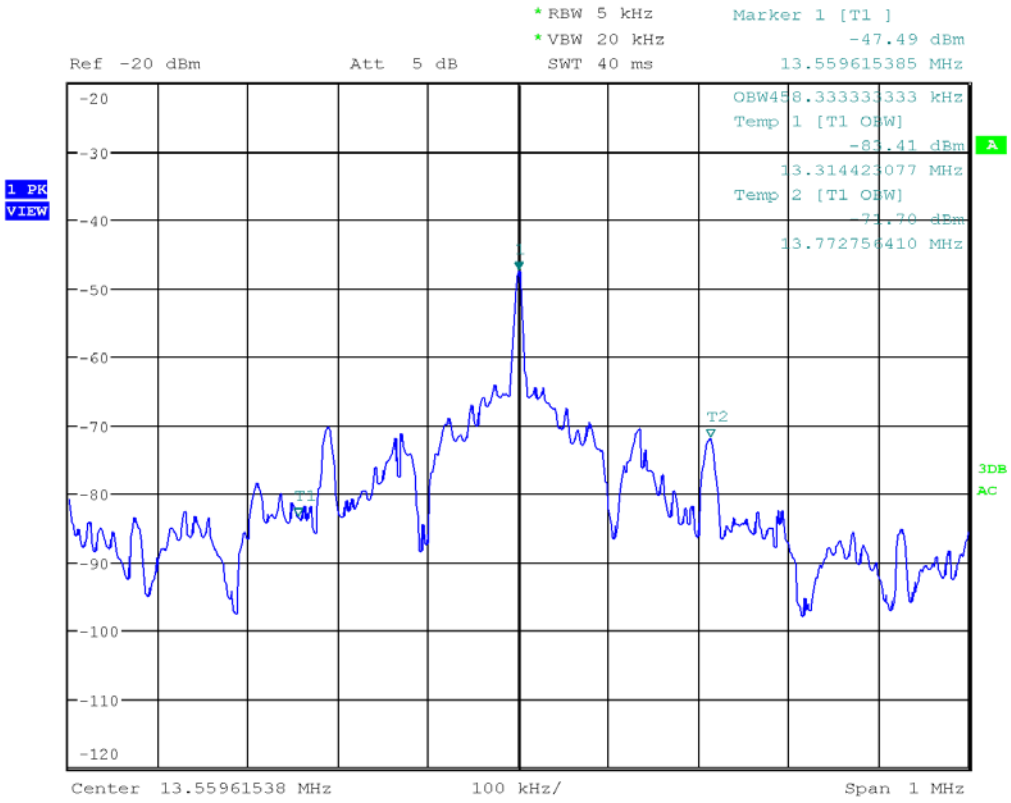
Frequency (MHz)	20-dB Channel Bandwidth (kHz)	99% Channel Bandwidth (kHz)
13.56	106.6	458.3

20-dB Channel Bandwidth



4.3.3 Test Results (Continued)

99% Channel Bandwidth



Date: 13.AUG.2019 08:55:31

4.4 AC Line Conducted Emission
FCC Rule 15.207

4.4.1 Requirement

Frequency Band MHz	15.207 Limit dB(μV)	
	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *
0.50-5.00	56	46
5.00-30.00	60	50

*Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.*

4.4.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per 15.207 to ensure the device complies with 15.207 outside the transmitter fundamental emissions band. After, the EUT antenna is removed from the EUT and only the fundamental emission band was measured to show that the fundamental emission band is in compliance with the 15.207 limits.

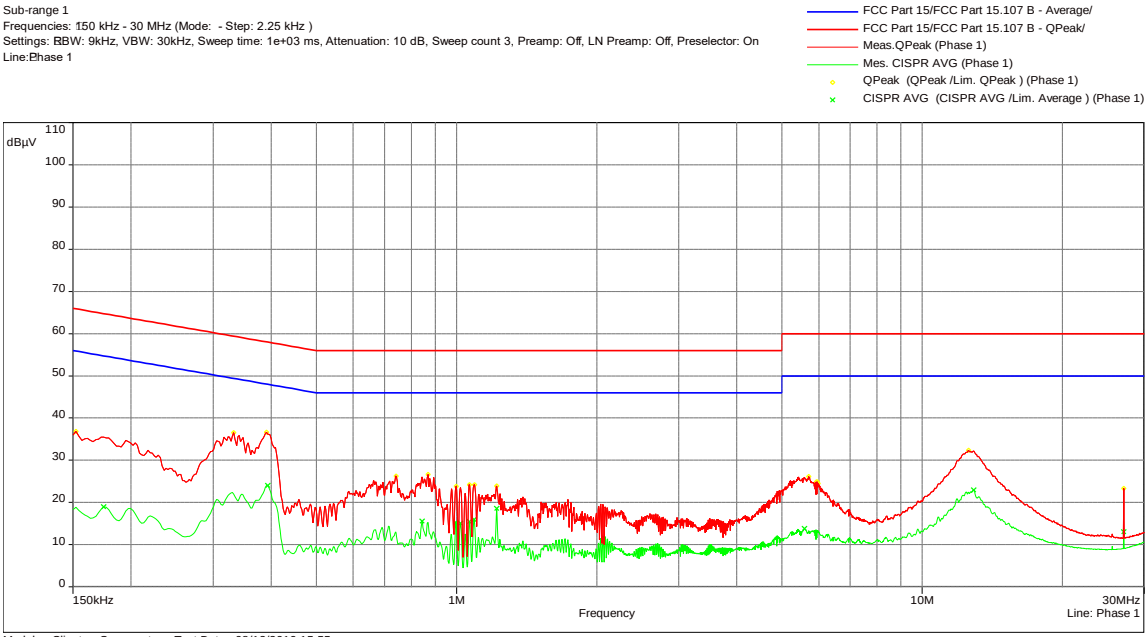
Equipment setup for conducted disturbance tests followed.

4.4.3 Test Result

Measured with RFID Antenna Terminated

Line 1

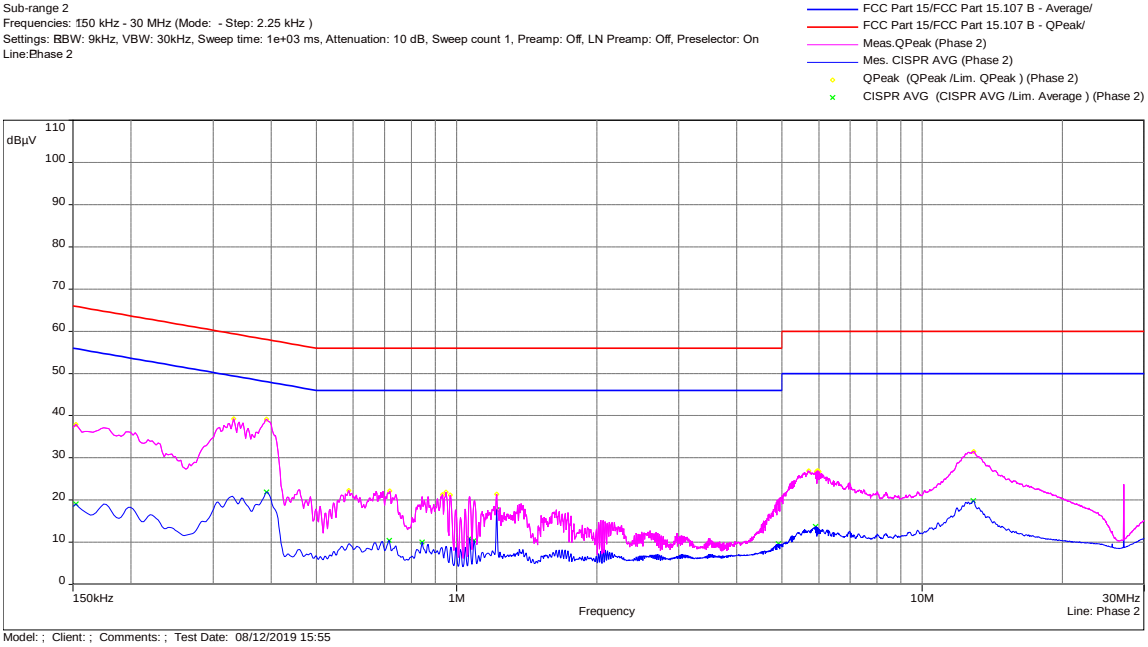
Sub-range 1
Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
Settings: RBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 3, Preamp: Off, LN Preamp: Off, Preselector: On
Line:Phase 1



Model: ; Client: ; Comments: ; Test Date: 08/12/2019 15:55

Line 2

Sub-range 2
Frequencies: 150 kHz - 30 MHz (Mode: - Step: 2.25 kHz)
Settings: RBW: 9kHz, VBW: 30kHz, Sweep time: 1e+03 ms, Attenuation: 10 dB, Sweep count 1, Preamp: Off, LN Preamp: Off, Preselector: On
Line:Phase 2



Model: ; Client: ; Comments: ; Test Date: 08/12/2019 15:55

4.4.3 Test Result (Continued)

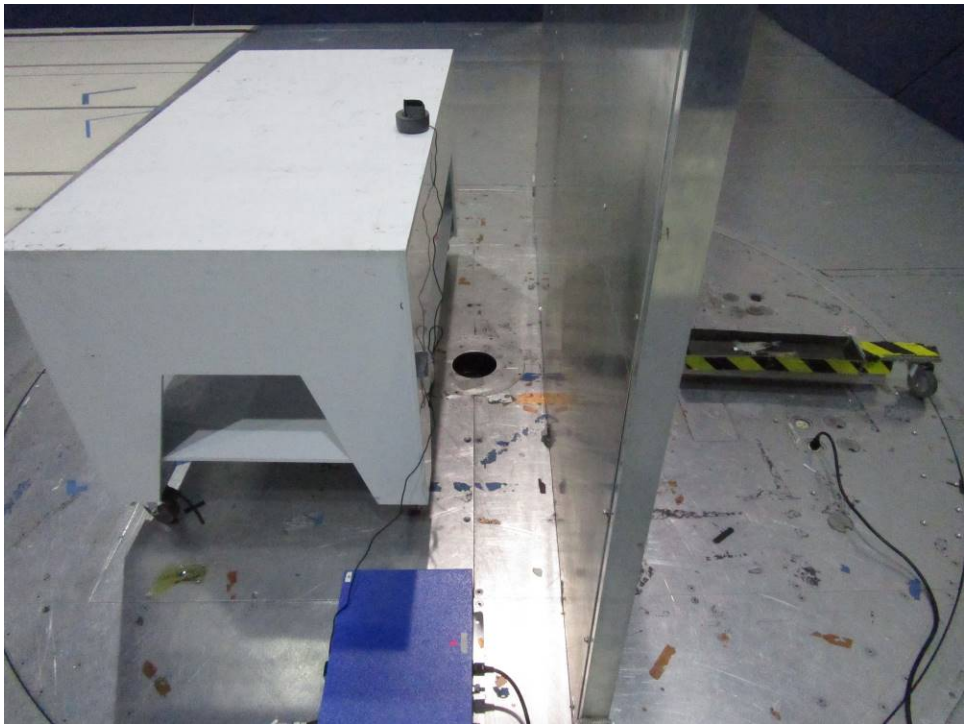
Quasi-Peak Table					
Frequency (MHz)	Q.Peak (dBµV)	Limit (dBµV)	Margin (dB)	Comment	Correction (dB)
0.152	36.9	65.88	-29.0	Phase 1	12.5
0.152	37.9	65.88	-28.0	Phase 2	12.5
0.332	36.5	59.39	-22.9	Phase 1	11.3
0.332	39.3	59.39	-20.2	Phase 2	11.3
0.391	36.6	58.05	-21.4	Phase 1	11.2
0.391	39.2	58.05	-18.9	Phase 2	11.2
0.587	22.2	56	-33.8	Phase 2	11.1
0.719	22.1	56	-33.9	Phase 2	11.1
0.742	26.3	56	-29.7	Phase 1	11.1
0.868	26.7	56	-29.3	Phase 1	11.0
0.933	21.3	56	-34.7	Phase 2	11.1
0.949	21.9	56	-34.1	Phase 2	11.1
0.969	21.2	56	-34.8	Phase 2	11.0
0.998	23.8	56	-32.2	Phase 1	11.0
1.066	24.2	56	-31.8	Phase 1	11.0
1.093	24.2	56	-31.8	Phase 1	11.0
1.219	21.4	56	-34.7	Phase 2	11.0
1.219	23.9	56	-32.1	Phase 1	11.0
5.710	26.2	60	-33.8	Phase 1	11.3
5.714	26.9	60	-33.1	Phase 2	11.3
5.928	24.9	60	-35.1	Phase 1	11.3
5.933	26.8	60	-33.2	Phase 2	11.3
5.953	24.9	60	-35.1	Phase 1	11.3
5.955	26.9	60	-33.1	Phase 2	11.3
5.978	24.5	60	-35.5	Phase 1	11.3
5.980	27.0	60	-33.0	Phase 2	11.3
6.005	26.8	60	-33.3	Phase 2	11.2
12.575	32.4	60	-27.6	Phase 1	11.4
12.903	31.5	60	-28.5	Phase 2	11.4
27.121	23.4	60	-36.7	Phase 1	11.7

4.4.3 Test Result (Continued)

Average Table					
Frequency (MHz)	**Average (dBµV)**	**Limit (dBµV)**	**Margin (dB)**	**Comment**	**Correction (dB)**
0.152	19.1	55.88	-36.8	Phase 2	12.5
0.175	19.0	54.73	-35.8	Phase 1	12.1
0.391	21.9	48.05	-26.2	Phase 2	11.2
0.393	24.0	48	-24.0	Phase 1	11.2
0.717	10.4	46	-35.6	Phase 2	11.1
0.843	15.6	46	-30.4	Phase 1	11.0
0.843	10.0	46	-36.0	Phase 2	11.0
0.996	15.3	46	-30.7	Phase 1	11.0
1.021	15.1	46	-30.9	Phase 1	11.0
1.066	15.4	46	-30.6	Phase 1	11.0
1.066	10.9	46	-35.2	Phase 2	11.0
1.091	15.9	46	-30.1	Phase 1	11.0
1.091	10.4	46	-35.6	Phase 2	11.0
1.219	18.6	46	-27.4	Phase 1	11.0
1.221	17.7	46	-28.3	Phase 2	11.0
4.911	9.6	46	-36.4	Phase 2	11.2
5.584	13.8	50	-36.2	Phase 1	11.3
5.908	13.7	50	-36.3	Phase 2	11.3
12.883	19.9	50	-30.1	Phase 2	11.4
12.899	23.0	50	-27.0	Phase 1	11.4
27.121	13.0	50	-37.0	Phase 1	11.7
Results: **Complies** by 18.9 dB					

4.4.4 Test Configuration Photographs

The following photographs show the testing configurations used.



5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Asset No.	Calibration Interval	Cal Due
Bi-Log Antenna	Antenna Research	LPB-2513/A	ITS 00355	12	04/24/20
Pre-Amplifier	Sonoma Instrument	310N	ITS 00415	12	04/19/20
Horn Antenna	ETS Lindgren	3117-PA	ITS 01636	12	01/17/20
EMI Receiver	Rohde and Schwarz	ESR7	ITS 01607	12	10/23/19
RF Cable	TRU Corporation	TRU CORE 300	ITS 01330	12	05/09/20
RF Cable	TRU Corporation	TRU CORE 300	ITS 00465	12	08/16/19
RF Cable	TRU Corporation	TRU CORE 300	ITS 01470	12	08/16/19
Loop Sensor	Solar Electronics	7334-1	ITS 01608	12	10/09/19
Environmental Test Chamber	ESPEC	BTX-475	ITS 01436	12	09/21/19
Ant-Passive Loop	EMCO	6512	ITS 01598	12	10/09/19
LISN	COM-POWER	LIN-115A	ITS 01290	12	06/26/20

Verified before use

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.17.0.10	Cala Health August 12, 2019.bpp

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
1.0 / G103592127	TM	KV	August 14, 2019	Original document

END OF REPORT