Renovia, Inc.

TEST REPORT

SCOPE OF WORK
EMISSIONS TESTING – leva-02 (915 MHz Case)

REPORT NUMBER
103622007BOX-012c

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DOCUMENT CONTROL NUMBER
Non-Specific Radio Report Shell Rev. December 2017

EMISSIONS TEST REPORT

(FULL COMPLIANCE)

Report Number: 103622007BOX-012c
Project Number: G103622007

Report Issue Date: 07/12/2019

Model(s) Tested: leva-02 (915 MHz Case)
Model(s) Partially Tested: None
Model(s) Not Tested but declared equivalent by the client: None

Standards: CFR47 FCC Part 15.247 Subpart C: 06/2019,
CFR47 FCC Part 15 Subpart B: 06/2019,
RSS-247 Issue 2 February 2017,
ICES-003 Issue 6 Published: January 2016 Updated: April 2017,
RSS-Gen Issue 5 April 2018,
RSS-102 Issue 5 March 2015

Tested by:
Intertek Testing Services NA, Inc.
70 Codman Hill Road
Boxborough, MA 01719
USA

Client:
Renovia, Inc.
263 Summer St
Boston, MA 02210
USA

Report prepared by

Kouma Sinn / EMC Staff Engineer

Report reviewed by

Michael Murphy / Engineering Supervisor

Table of Contents

1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Maximum Peak Output Power and Human RF exposure CFR47 FCC Part 15 Subpart C:06/2019, Section 15.247 (b)(3) RSS-247 Issue 2 February 2017, RSS-102 Issue 5 March 2015	Pass
7	6 dB Bandwidth and Occupied Bandwidth CFR47 FCC Part 15 Subpart C: 06/2019, Section 15.247 (a)(2) RSS-247 Issue 2 February 2017	Pass
8	Maximum Power Spectral Density CFR47 FCC Part 15 Subpart C: 06/2019, Section 15.247 (e) RSS-247 Issue 2 February 2017	Pass
9	Band Edge Compliance CFR47 FCC Part 15 Subpart C: 06/2019, Section 15.247 (d) RSS-247 Issue 2: 02/2017)	Pass
10	Transmitter spurious emissions CFR47 FCC Part 15 Subpart C: 06/2019, Section 15.247 (d) RSS-247 Issue 2 February 2017	Pass
11	Digital Device and Receiver Radiated Spurious Emissions (CFR47 FCC Part 15 Subpart B 15.109: 06/2019, ICES-003 Issue 6 Published: January 2016 Updated: April 2017	Pass
--	AC Mains Conducted Emissions FCC 47CFR Part 15.107: 06/2019 ICES-003 Issue 6 Published: January 2016 Updated: April 2017	N/A
12	Revision History	--

Notes: Not applicable as the EUT powers from internal battery with no connection to AC mains.

3 Client Information

This EUT was tested at the request of:

Client: Renovia Inc.
263 Summer Street
Boston, MA 02210
USA

Contact: Gina Prochilio
Telephone: 617-671-5829
Email: gcawston@renoviainc.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: Renovia Inc.
263 Summer Street
Boston, MA 02210
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
leva-02 (915 MHz Case)	Renovia Inc.	Leva-02	None

Receive Date:	06/17/2019
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)
The leva-02 system includes two physical devices: (1) the *leva-02 device* and (2) the *leva-02 case*. As described in detail in DD-00006, Hardware Design Description, the *leva-02 device* includes a microcontroller with a 915 MHz band ISM radio. The *leva-02 case* includes two microcontrollers: a 915 MHz band ISM radio and a 2.4 GHz band Bluetooth Low Energy (BLE) radio. The overall system also includes a *user interface device*, which can be an iOS or Android mobile telephone with BLE capability. The *leva-02 device* and *leva-02 case* are considered ME EQUIPMENT whereas the *user interface device* is considered a Non-ME EQUIPMENT.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
Internally Battery Powered	N/A	DC	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
2	Pre-programmed to transmit at low, mid, and high channels
3	Pre-programmed to receive at low, mid, and high channels

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	None

Radio/Receiver Characteristics	
Frequency Band(s)	914-918 MHz
Modulation Type(s)	DTS
Maximum Output Power	Low Channel (914 MHz): +5.3 dBm (EIRP) Mid Channel (916 MHz): +5.41 dBm (EIRP) High Channel (918 MHz): +5.41 dBm (EIRP)
Test Channels	Low Channel (914 MHz) Mid Channel (916 MHz) High Channel (918 MHz)
Occupied Bandwidth	Low Channel (914 MHz): 701.403 kHz Mid Channel (916 MHz): 697.395 kHz High Channel (918 MHz): 697.395 kHz
Frequency Hopper: Number of Hopping Channels	N/A
Frequency Hopper: Channel Dwell Time	N/A
Frequency Hopper: Max interval between two instances of use of the same channel	N/A
MIMO Information (# of Transmit and Receive antenna ports)	1
Equipment Type	Standalone
ETSI LBT/Adaptivity	N/A
ETSI Adaptivity Type	N/A
ETSI Temperature Category (I, II, III)	N/A
ETSI Receiver Category (1, 2, 3)	N/A
Antenna Type and Gain	Integral

Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

None

5 System Setup and Method

Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination
--	None	--	--	--	--

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	--	--	--

5.1 Method:

Configuration as required by Configuration as required by FCC Part 15 Subpart C 15.247: 06/2019, FCC Part 15 Subpart B: 06/2019, RSS 247 Issue 2: 02/2017, ICES 003 Issue 6: 01/2016 updated 06/2016, ANSI C 63.10: 2013, and ANSI C 63.4: 2014.

5.2 EUT Block Diagram:

6 Maximum Peak Output Power and Human RF exposure

6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, RSS-102, and ANSI C63.10.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample 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 with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	01/23/2019	01/23/2020
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/28/2019	03/28/2020

Software Utilized:

Name	Manufacturer	Version
None	--	--

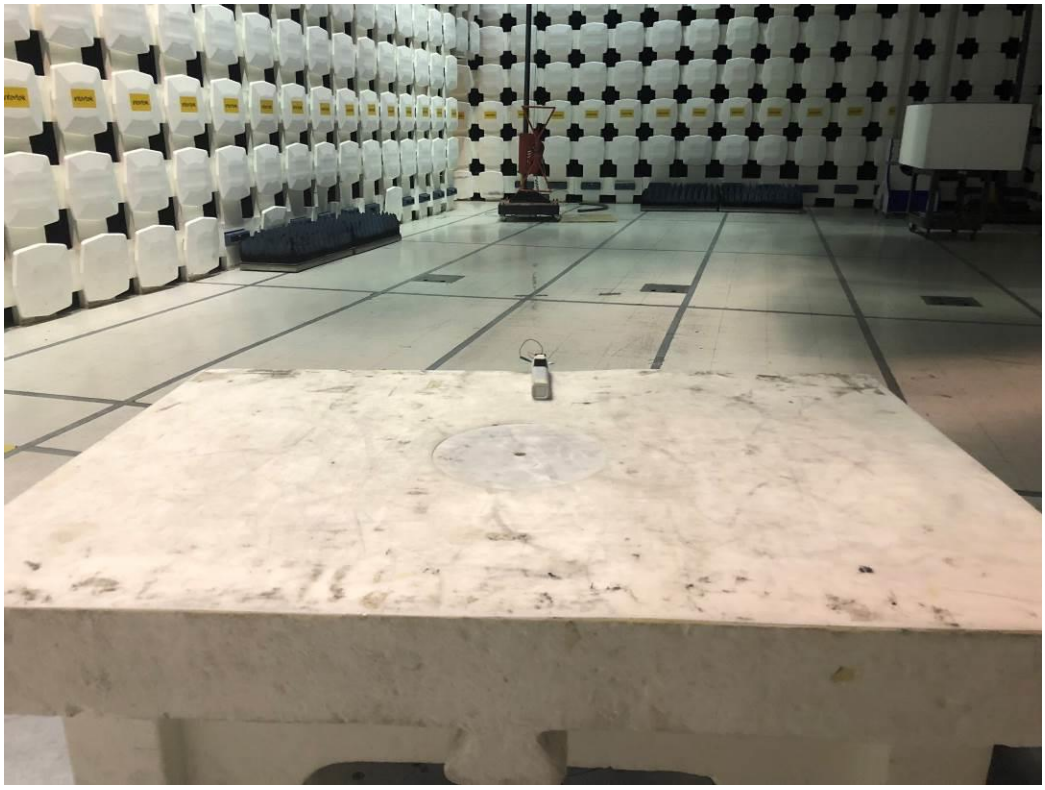
6.3 Results:

The sample tested was found to Comply.

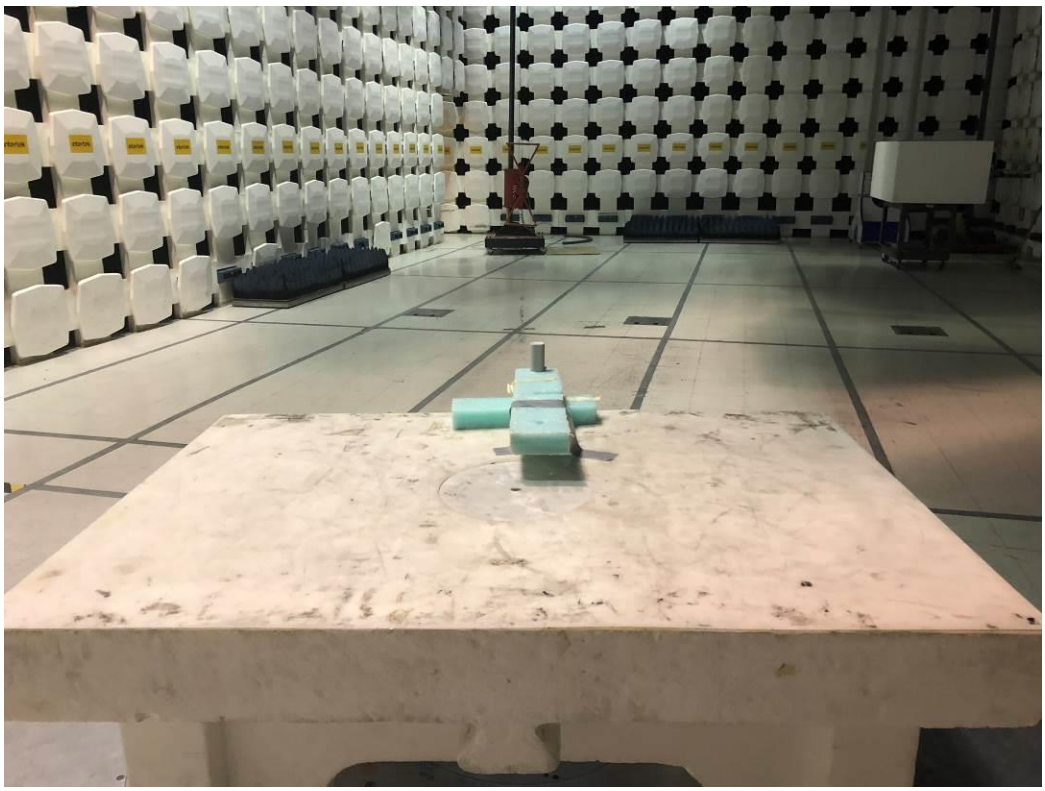
§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt or 30 dBm or 36 dBm (EIRP)

6.4 Setup Photographs

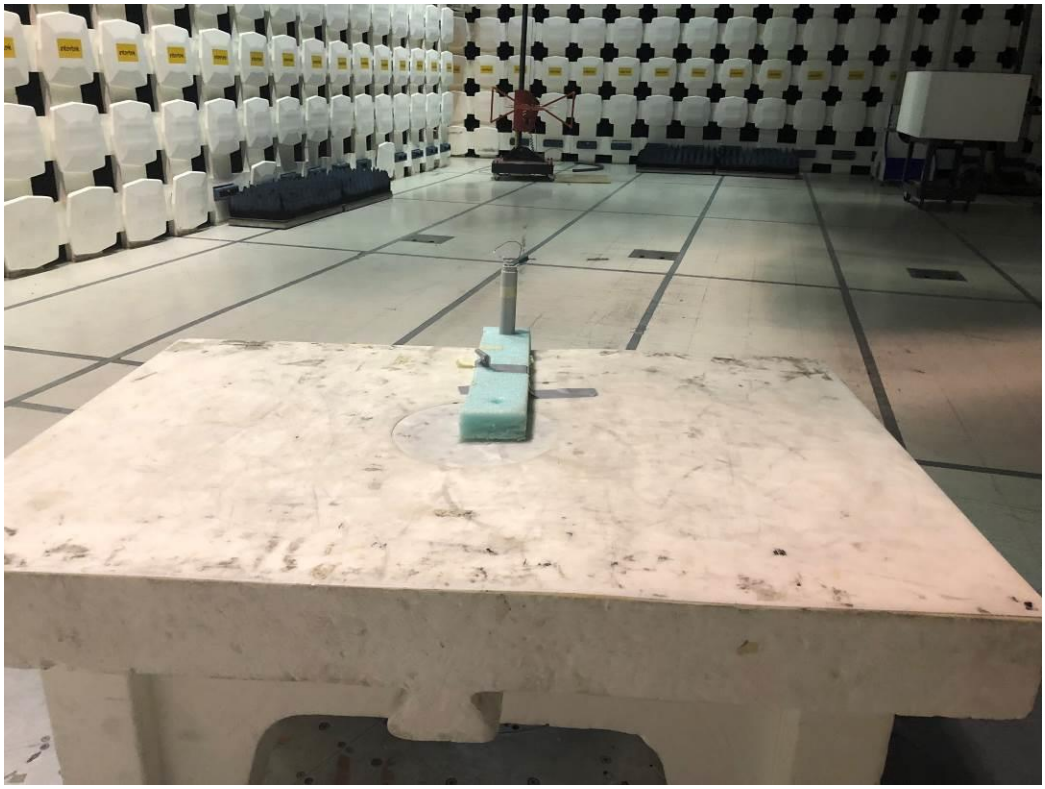
915 MHz Case – X-axis (Battery Side)



915 MHz Case – Y-axis (EUT Straight Down)



915 MHz Case – Z-axis (EUT Straight Up)



6.5 Test Data:

Output Power (EIPR) - Radiated Emissions

Company: Renovia Inc | Antenna & Cables: N | Bands: N, LF, HF, SHF
Model #: 915 MHz CASE | Antenna: 145-145__10M_5-16-2019.txt 145-145__10M_5-16-2019.txt
Serial #: None | Cable(s): 145-410_7-25-2019..txt NONE.
Engineers: Kouma Sinn | Location: 10M | Barometer: BAR1 | Filter: NONE
Project #: G10362207 | Date(s): 03/24/19
Standard: FCC Part 15 Subpart C 15.247 | Temp/Humidity/Pressure: 21C 22% 1006mbar
Receiver: R&S ESI (145-128) 03-22-2019 | Limit Distance (m): 10
PreAmp: NONE. | Test Distance (m): 10
PreAmp Used? (Y or N): N | Voltage/Frequency: 3VDC | Frequency Range: Fundamental

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(m)	Limit dB(m)	Margin dB	Bandwidth
EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in m.											
Low Channel, X-Axis (Battery side up)											
PK	H	914.000	56.42	28.80	4.88	0.00	0.00	5.30	36.00	-30.70	100/300 kHz
Low Channel, Y-Axis (Straight down)											
PK	H	914.000	51.66	28.80	4.88	0.00	0.00	0.54	36.00	-35.46	100/300 kHz
Low Channel, Z-Axis (Straight up)											
PK	V	914.000	50.24	28.80	4.88	0.00	0.00	-0.88	36.00	-36.88	100/300 kHz
Mid Channel, X-Axis (Battery side up)											
PK	H	916.000	56.01	28.80	4.88	0.00	0.00	4.89	36.00	-31.11	100/300 kHz
Mid Channel, Y-Axis (Straight down)											
PK	H	916.000	52.42	28.80	4.88	0.00	0.00	1.30	36.00	-34.70	100/300 kHz
Mid Channel, Z-Axis (Straight up)											
PK	V	916.000	56.53	28.80	4.88	0.00	0.00	5.41	36.00	-30.59	100/300 kHz
High Channel, X-Axis (battery side up)											
PK	V	918.000	56.00	28.80	4.89	0.00	0.00	4.89	36.00	-31.11	100/300 kHz
High Channel, Y-Axis (Straight down)											
PK	H	918.000	52.44	28.80	4.89	0.00	0.00	1.33	36.00	-34.67	100/300 kHz
High Channel, Z-Axis (Straight up)											
PK	V	918.000	49.56	28.80	4.89	0.00	0.00	-1.55	36.00	-37.55	100/300 kHz

SAR Exemption Calculation

Maximum Conducted Output Power of Transmitter (EIRP) = +5.41 dBm = 3.475 mW

Notes: EIRP output power (Worst-Case) was used SAR Tet Exclusion Thresholds calculation

FCC SAR Exemption per KDB 447498

a) For 100 MHz to 6 GHz and *test separation distances* ≤ 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}}$] ≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR,[30] where

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz

SAR Test Exclusion Thresholds = (3.475/5)*(sqrt(0.918))
= 0.666 < 3.0 (below the limit SAR Exempt per FCC)

RSS 102 SAR Exemption

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

The exemption limits in Table 1 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

The conducted output power of the transmitter (EIRP) 3.475 mW @ 918 MHz is less than 7 mW limit specified at 1900 MHz, device meets SAR exclusion.

Test Personnel:	Kouma Sinn KPS	Test Date:	03/24/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See report section 6.3
Input Voltage:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	21 ºC
		Relative Humidity:	22 %
		Atmospheric Pressure:	1006 mbars

Deviations, Additions, or Exclusions: None

7 6 dB Bandwidth and Occupied Bandwidth

7.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, and ANSI C63.10.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample 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 with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	01/23/2019	01/23/2020
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/28/2019	03/28/2020

Software Utilized:

Name	Manufacturer	Version
None	--	--

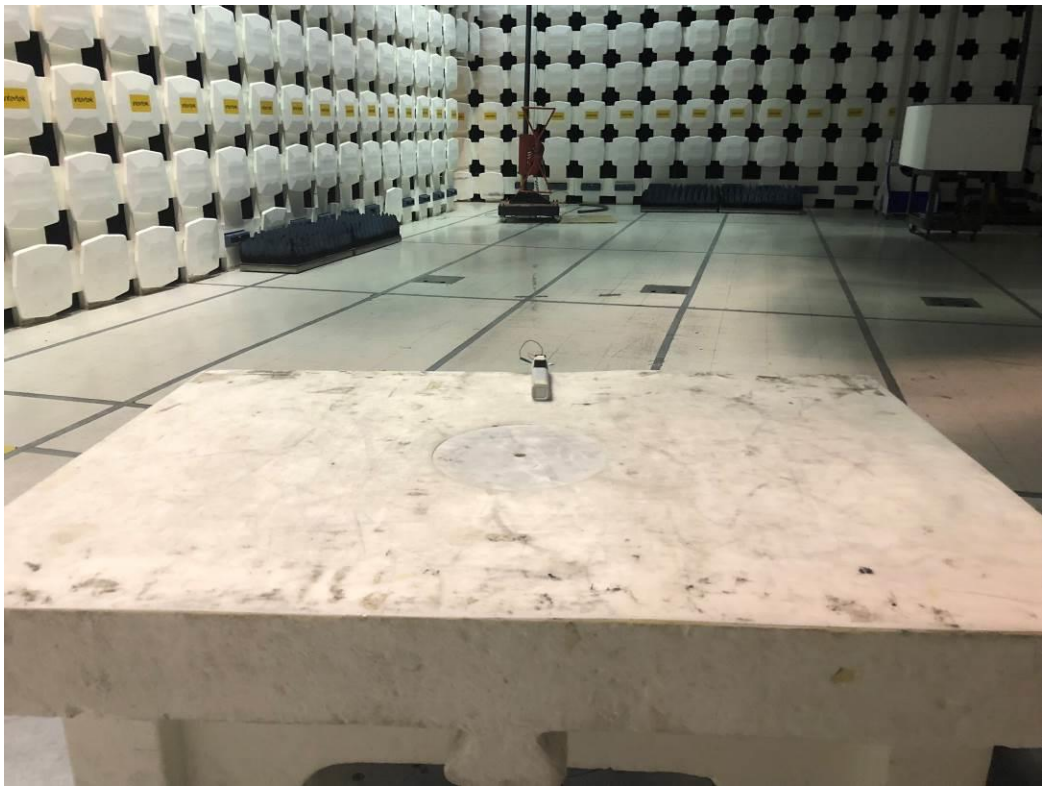
7.3 Results:

The sample tested was found to Comply.

§15.247 (a) (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

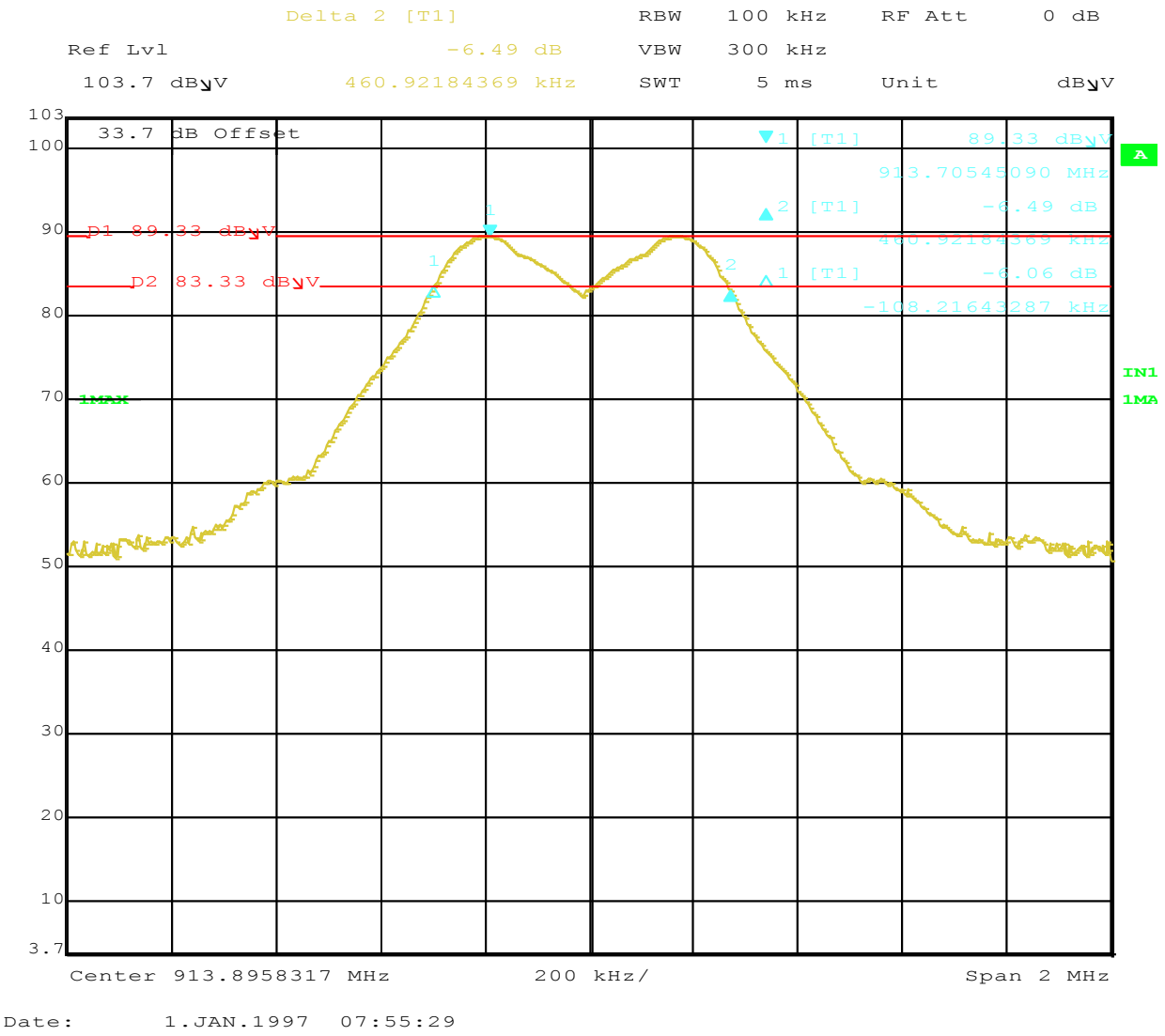
7.4 Setup Photograph:

915 MHz Case – X-axis (Battery Side)



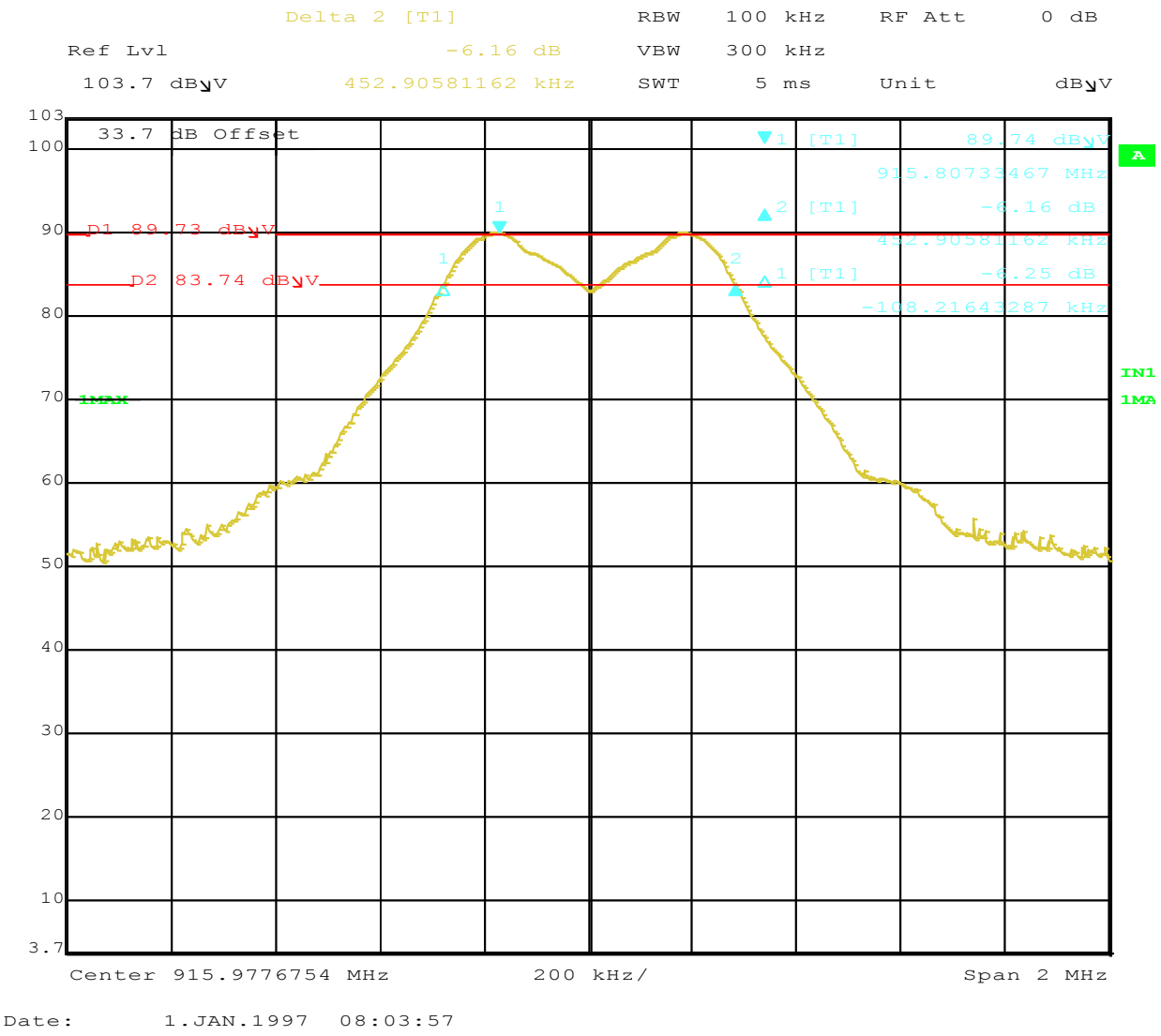
7.5 Plots/Data:

915 MHz Case – Low Channel 6 dB Bandwidth: 569 kHz



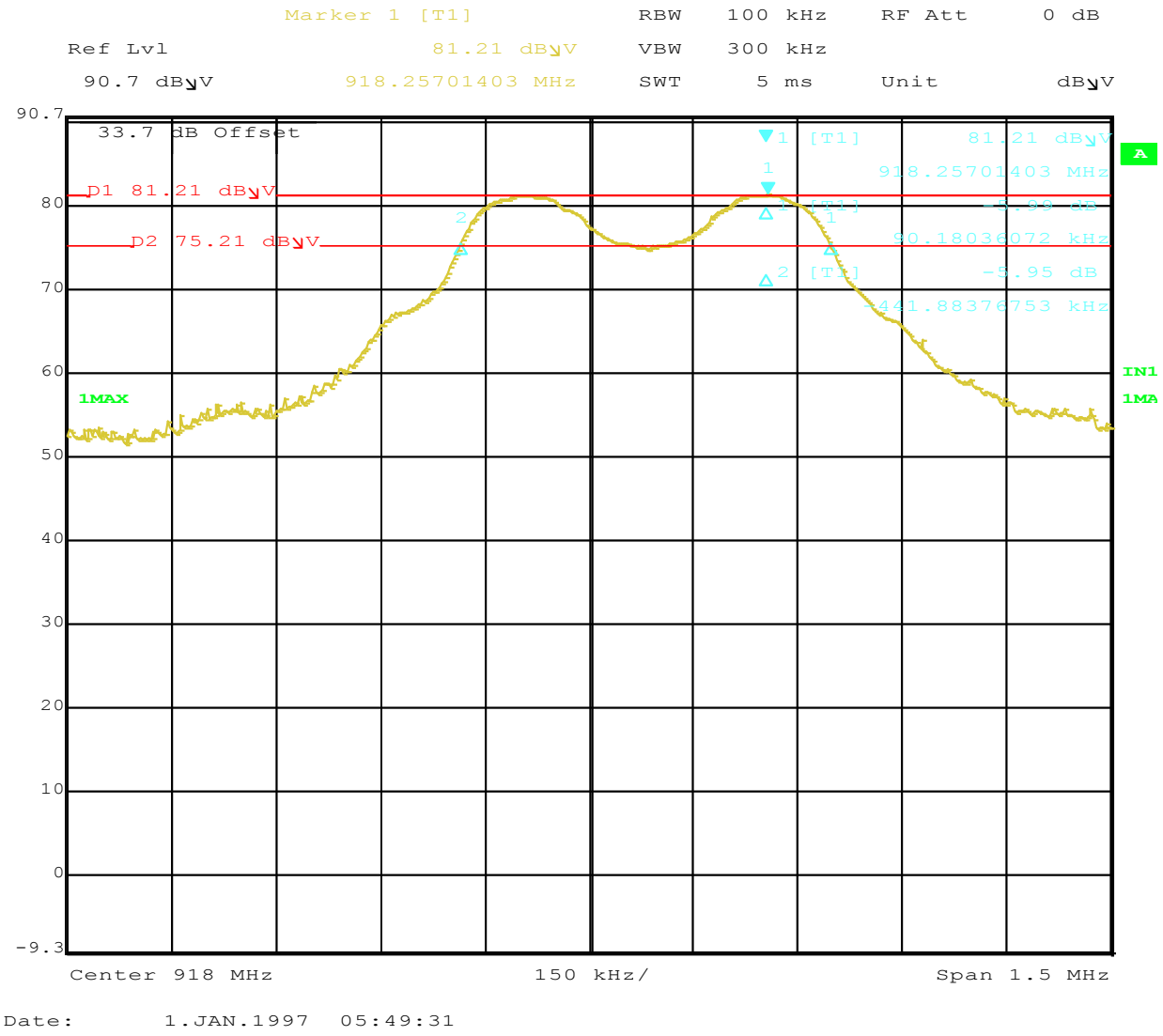
Notes: The date on the plot is default date on the instrument.

915 MHz Case – Mid Channel 6 dB Bandwidth: 561.122 kHz



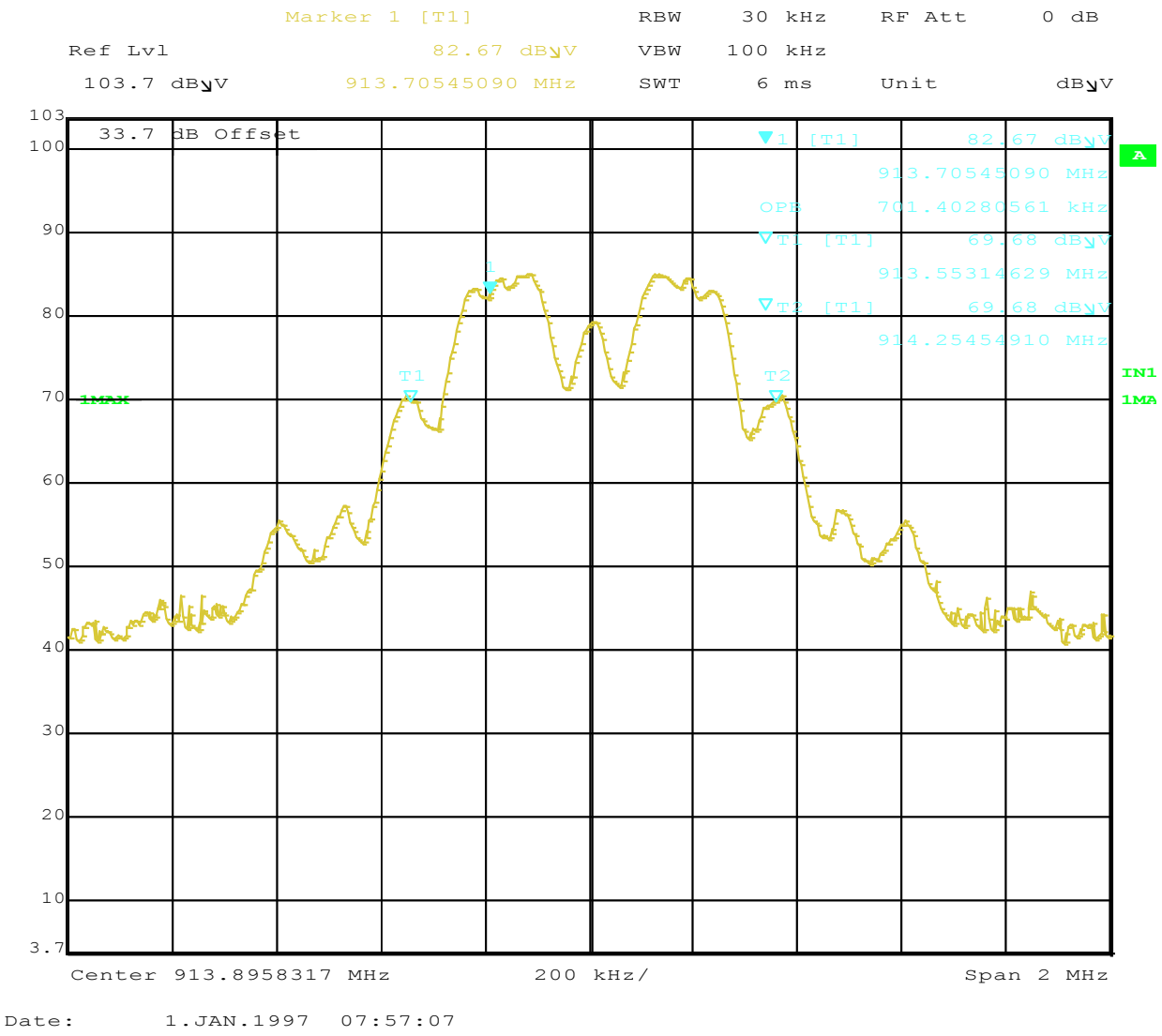
Notes: The date on the plot is default date on the instrument.

915 MHz Case – High Channel 6 dB Bandwidth: 532.064 kHz



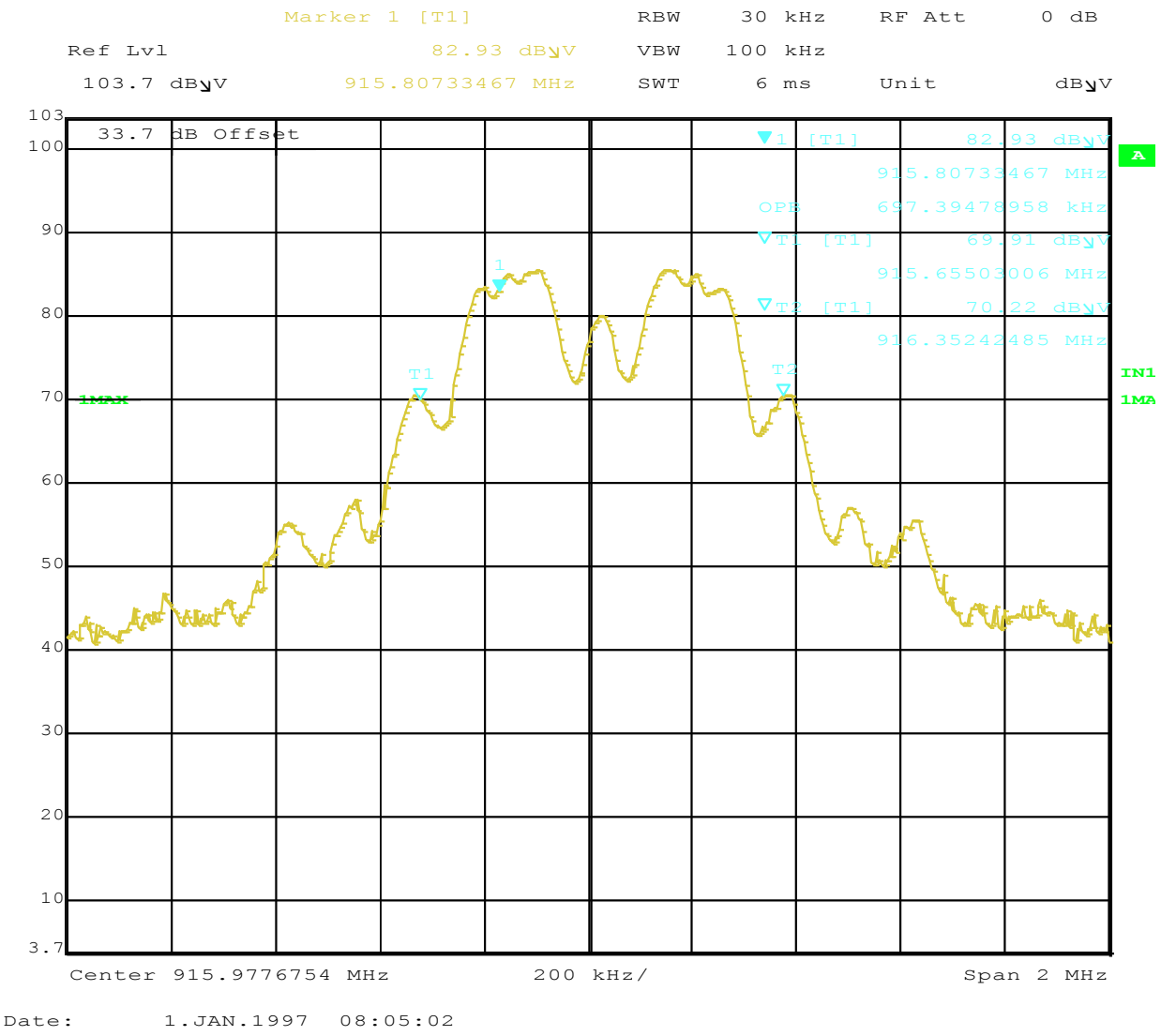
Notes: The date on the plot is default date on the instrument.

915 MHz Case – Low Channel Occupied Bandwidth: 701.403 kHz



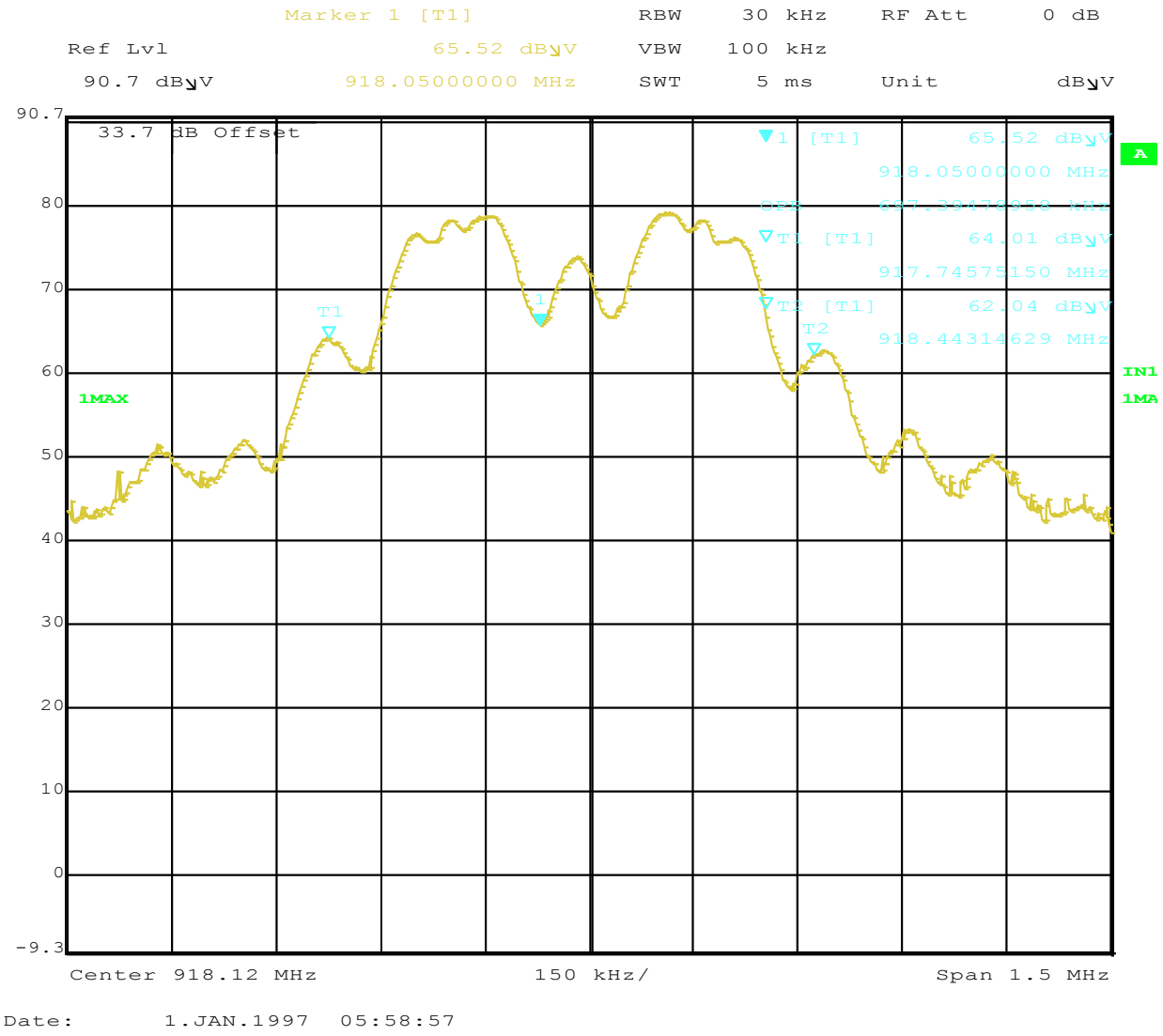
Notes: The date on the plot is default date on the instrument.

915 MHz Case – Mid Channel Occupied Bandwidth: 697.395 kHz



Notes: The date on the plot is default date on the instrument.

915 MHz Case – High Channel Occupied Bandwidth: 697.395 kHz



Notes: The date on the plot is default date on the instrument.

Test Personnel:	Kouma Sinn KPS	Test Date:	03/24/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See report section 7.3
Input Voltage:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	21 ºC
		Relative Humidity:	22 %
		Atmospheric Pressure:	1006 mbars

Deviations, Additions, or Exclusions: None

8 Maximum Power Spectral Density

8.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, and ANSI C63.10.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample 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 with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	01/23/2019	01/23/2020
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/28/2019	03/28/2020

Software Utilized:

Name	Manufacturer	Version
None	--	--

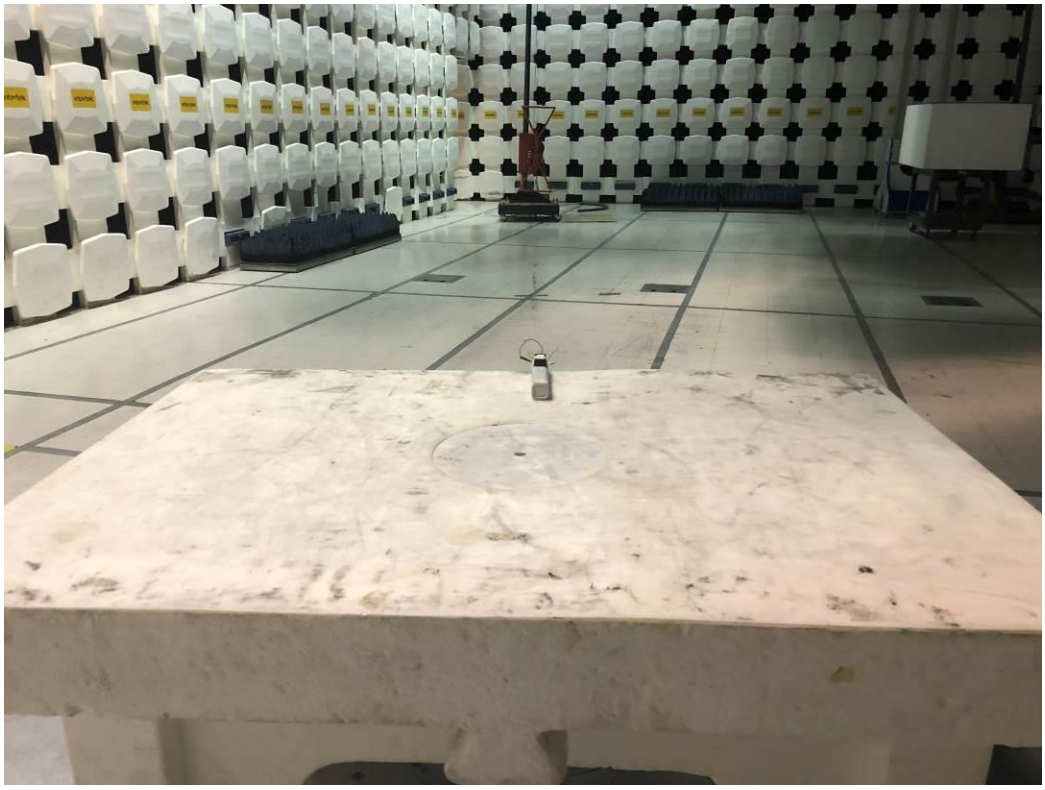
8.3 Results:

The sample tested was found to Comply.

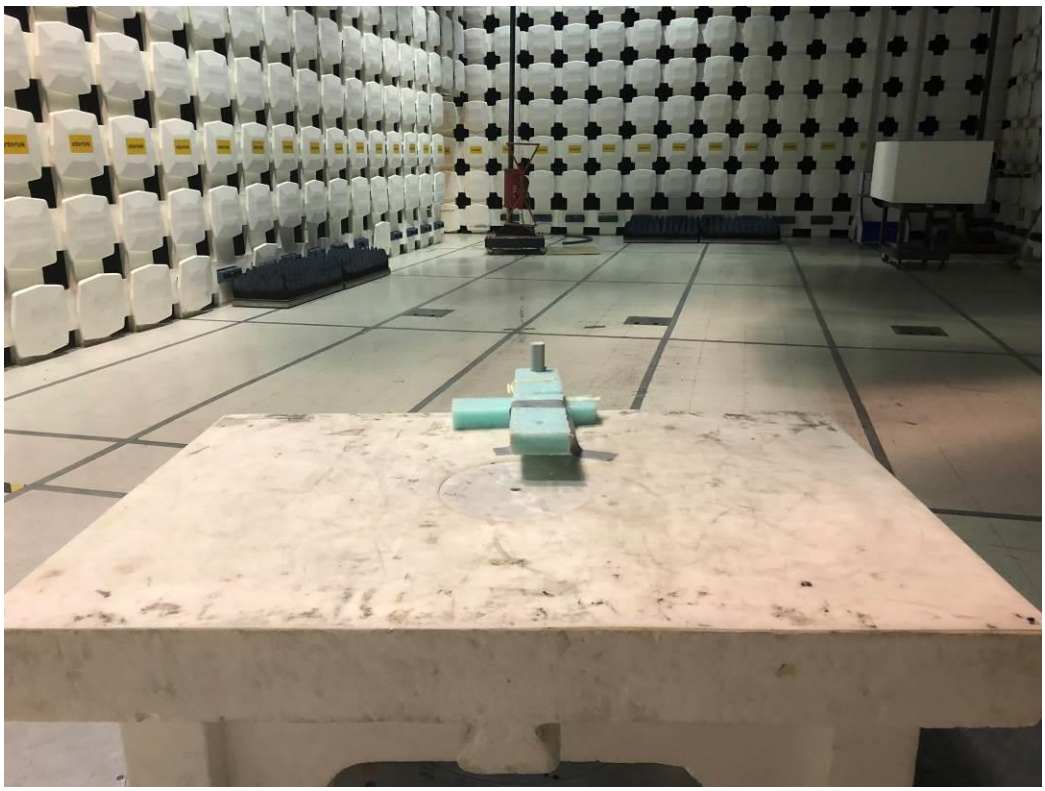
§15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.4 Setup Photograph:

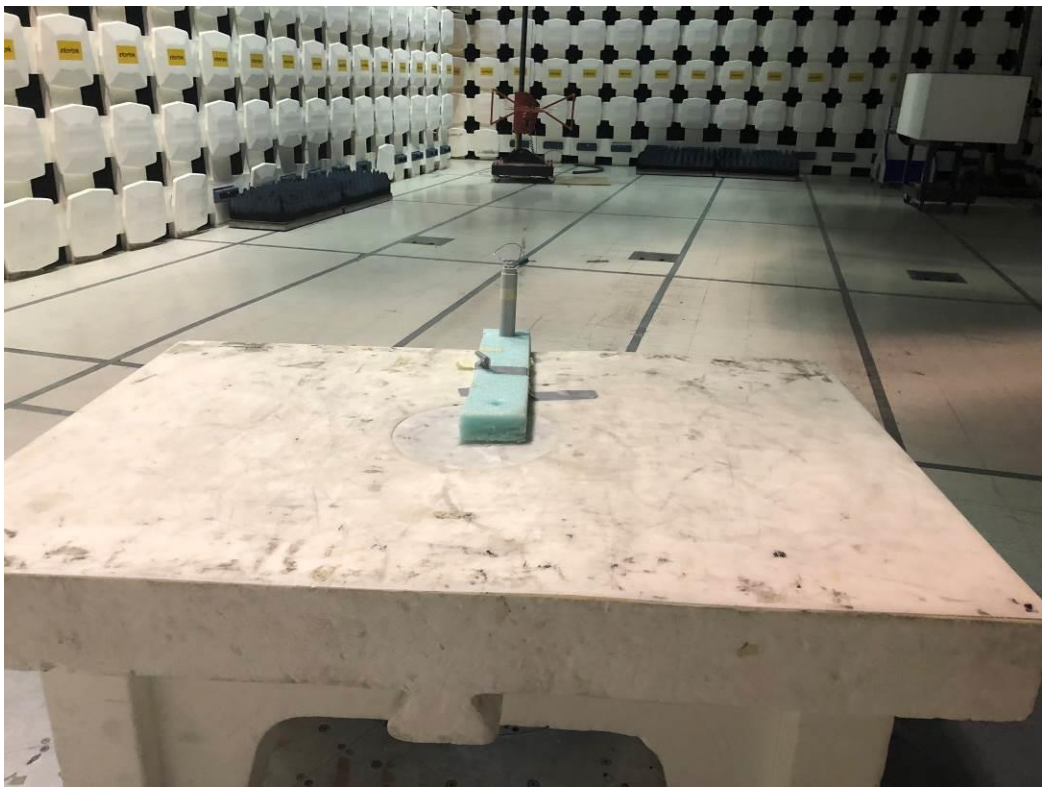
915 MHz Case – X-axis (Battery Side)



915 MHz Case – Y-axis (EUT Straight Down)



915 MHz Case – Z-axis (EUT Straight Up)



8.5 Test Data:

Power Spectral Density (EIPR) - Radiated Emissions

Company: Renovia Inc
Model #: 915 MHz CASE
Serial #: None
Engineers: Kouma Sinn Location: 10M
Project #: G10362207 Date(s): 03/24/19
Standard: FCC Part 15 Subpart C 15.247
Receiver: R&S ESI (145-128) 03-22-2019 Limit Distance (m): 10
PreAmp: NONE. Test Distance (m): 10
PreAmp Used? (Y or N): N Voltage/Frequency: 3VDC Frequency Range: Fundamental

Antenna & Cables: N Bands: N, LF, HF, SHF
Antenna: 145-145__10M_5-16-2019.txt 145-145__10M_5-16-2019.txt
Cable(s): 145-410_7-25-2019..txt NONE.
Barometer: BAR1 Filter: NONE
Temp/Humidity/Pressure: 21C 22% 1006mbar

Net = Reading (dBuV/m) + Antenna Factor (dB1/m) + Cable Loss (dB) - Preamp Factor (dB) - Distance Factor (dB)
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; NF = Noise Floor, RB = Restricted Band; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(m)	Limit dB(m)	Margin dB	Bandwidth
EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in m.											
Low Channel, X-Axis (Battery side up)											
PK	H	914.000	47.72	28.80	4.88	0.00	0.00	-3.40	8.00	-11.40	3/10 kHz
Low Channel, Y-Axis (Straight down)											
PK	H	914.000	44.24	28.80	4.88	0.00	0.00	-6.88	8.00	-14.88	3/10 kHz
Low Channel, Z-Axis (Straight up)											
PK	V	914.000	42.30	28.80	4.88	0.00	0.00	-8.82	8.00	-16.82	3/10 kHz
Mid Channel, X-Axis (Battery side up)											
PK	H	916.000	48.44	28.80	4.88	0.00	0.00	-2.68	8.00	-10.68	3/10 kHz
Mid Channel, Y-Axis (Straight down)											
PK	H	916.000	45.84	28.80	4.88	0.00	0.00	-5.28	8.00	-13.28	3/10 kHz
Mid Channel, Z-Axis (Straight up)											
PK	V	916.000	49.13	28.80	4.88	0.00	0.00	-1.99	8.00	-9.99	3/10 kHz
High Channel, X-Axis (battery side up)											
PK	V	918.000	48.33	28.80	4.89	0.00	0.00	-2.78	8.00	-10.78	3/10 kHz
High Channel, Y-Axis (Straight down)											
PK	H	918.000	44.33	28.80	4.89	0.00	0.00	-6.78	8.00	-14.78	3/10 kHz
High Channel, Z-Axis (Straight up)											
PK	V	918.000	41.48	28.80	4.89	0.00	0.00	-9.63	8.00	-17.63	3/10 kHz

Test Personnel: Kouma Sinn KPS
Supervising/Reviewing Engineer: (Where Applicable) N/A
Product Standard: CFR47 FCC Part 15.247 RSS-247, RSS-102
Input Voltage: Internal Battery Powered

Test Date: 03/24/2019
Limit Applied: See report section 8.3

Pretest Verification w/ Ambient Signals or BB Source: N/A

Ambient Temperature: 21 ºC
Relative Humidity: 22 %
Atmospheric Pressure: 1006 mbars

Deviations, Additions, or Exclusions: None

9 Band Edge Compliance

9.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247 RSS 247, and ANSI C 63.10.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample 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 with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

9.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	01/23/2019	01/23/2020
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/28/2019	03/28/2020

Software Utilized:

Name	Manufacturer	Version
None	--	--

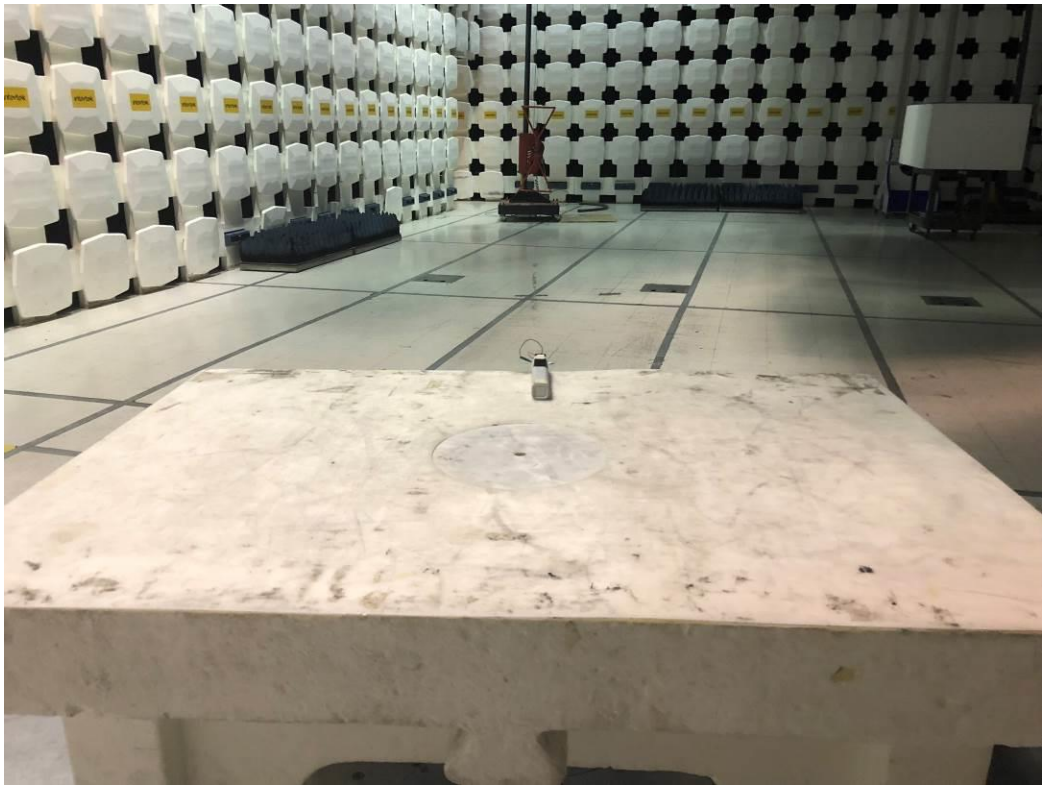
9.3 Results:

The sample tested was found to Comply.

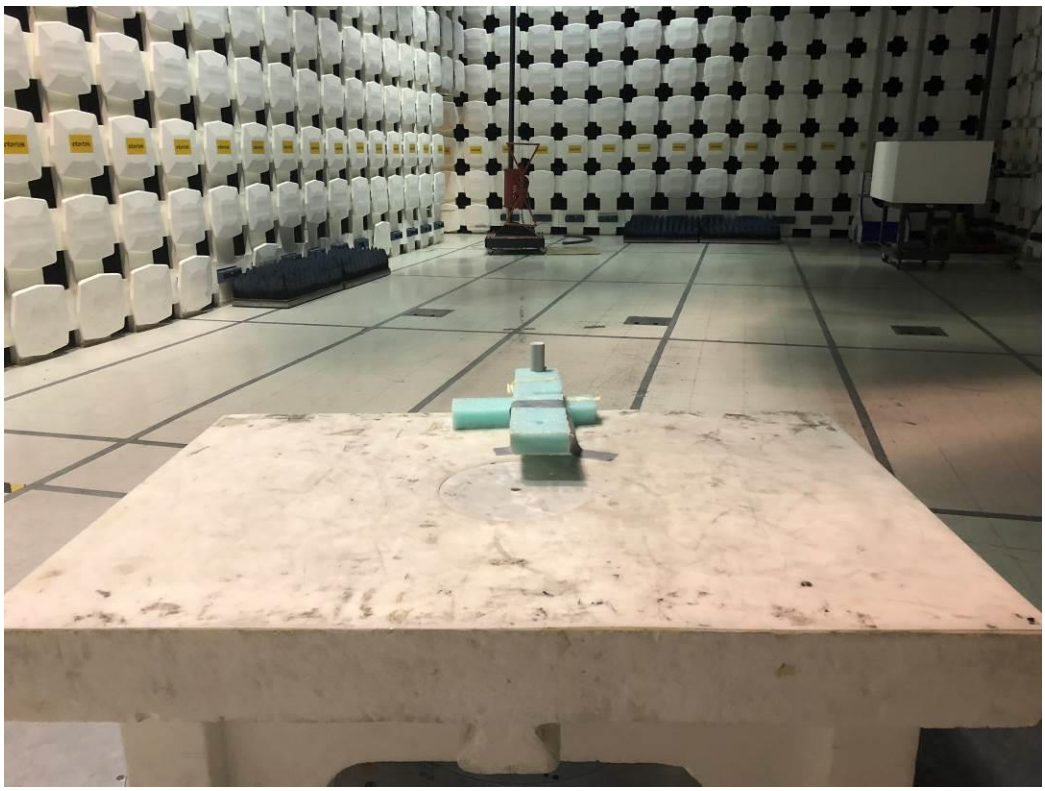
15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

9.4 Setup Photograph:

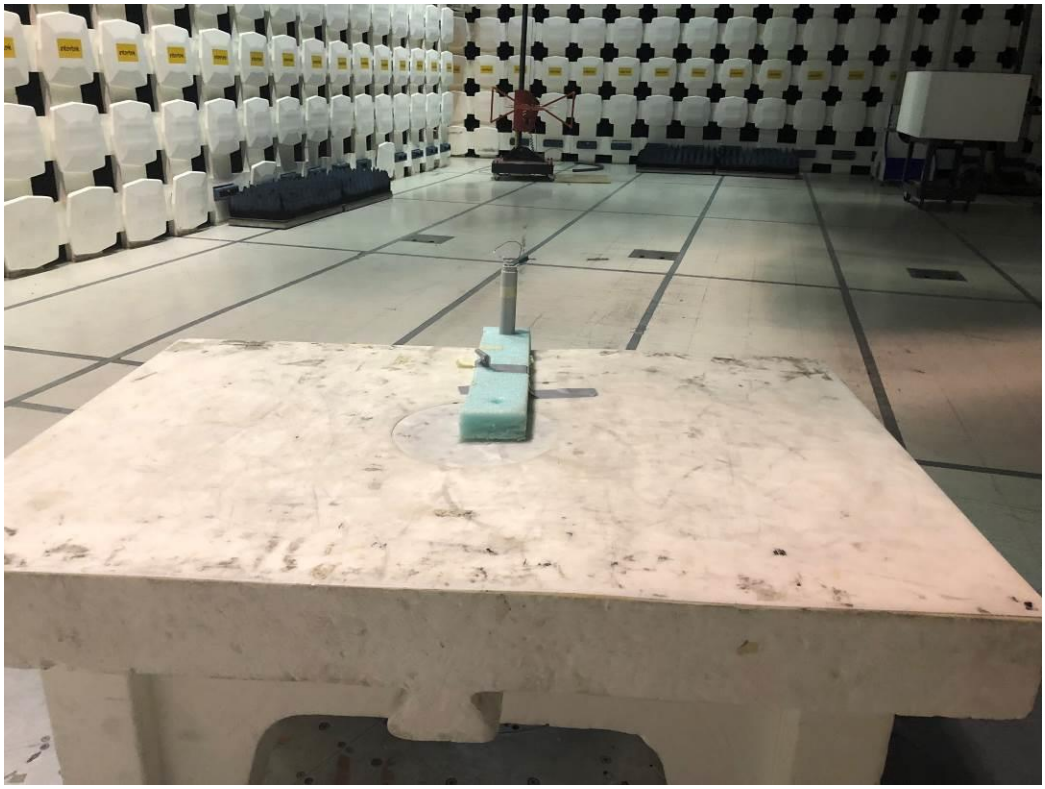
915 MHz Case – X-axis (Battery Side)



915 MHz Case – Y-axis (EUT Straight Down)

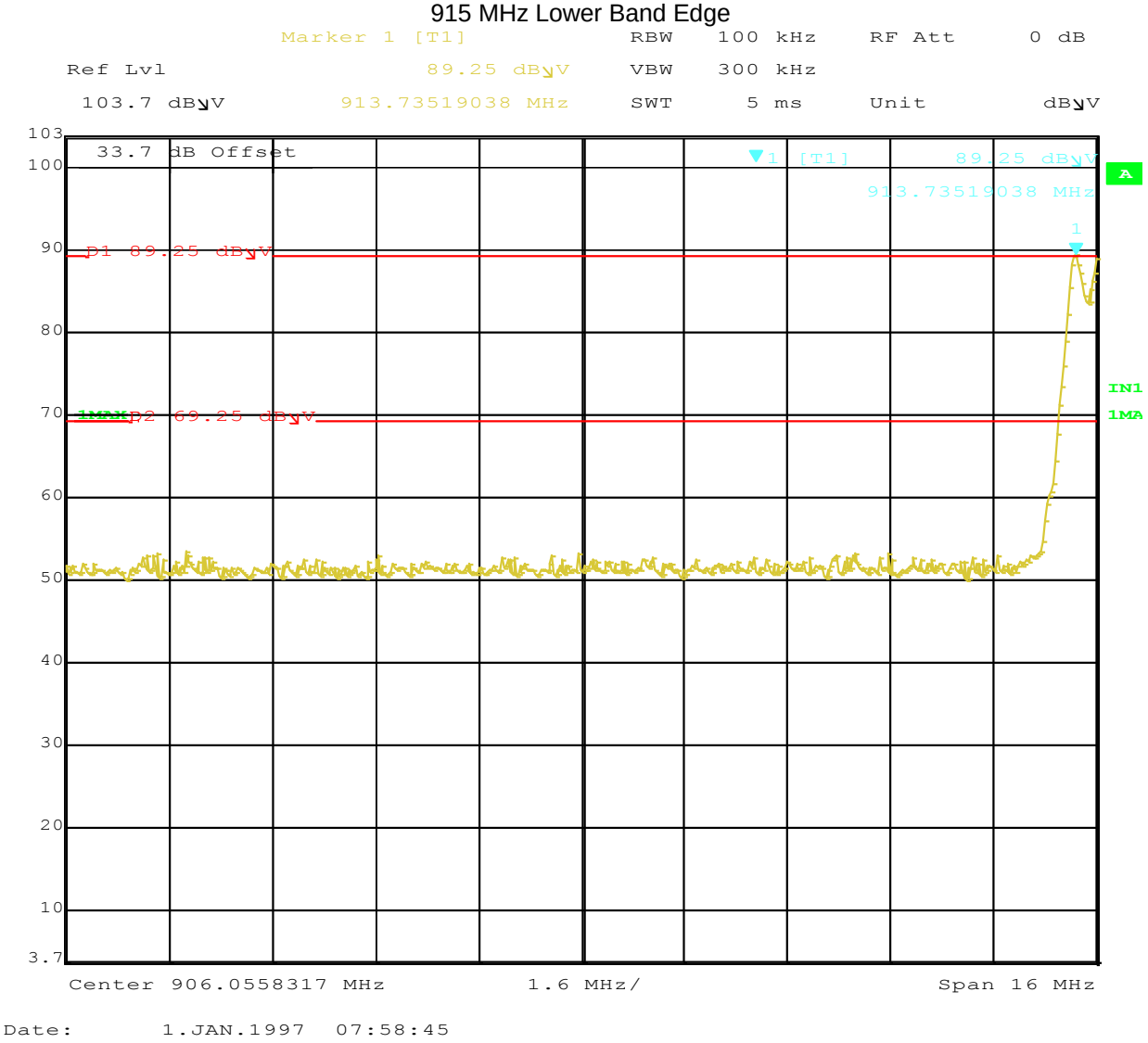


915 MHz Case – Z-axis (EUT Straight Up)



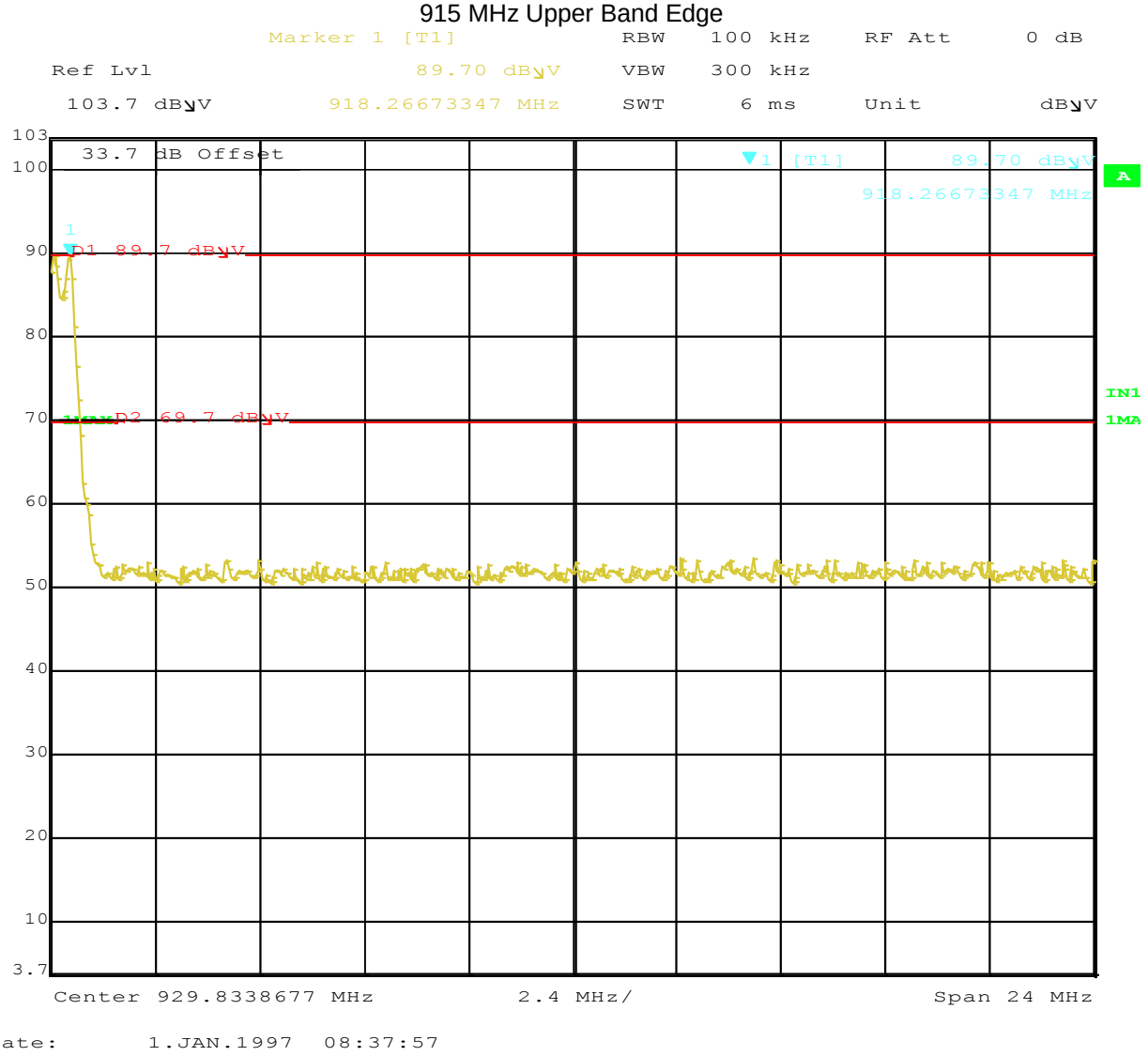
9.5 Plots/Data:

915 MHz Lower Band Edge



Notes: The date on the plot is default date on the instrument.

915 MHz Upper Band Edge



Notes: The date on the plot is default date on the instrument.

Test Personnel:	Kouma Sinn KPS	Test Date:	03/24/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247, RSS-102	Limit Applied:	See report section 9.3
Input Voltage:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Ambient Temperature:	21 ºC
		Relative Humidity:	22 %
		Atmospheric Pressure:	1006 mbars

Deviations, Additions, or Exclusions: None

10 Transmitter spurious emissions

10.1 Method

Tests are performed in accordance with FCC Part 15 Subpart C 15.247, FCC Part 15 Subpart B, RSS 247 ICES 003, ANSI C 63.10, and ANSI C 63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample 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 with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

10.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019
ETS005'	1-18GHz horn antenna	ETS-Lindgren	3117	00218279	05/14/2018	05/14/2019
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	06/14/2018	06/14/2019
REA008'	band reject filter 2.4GHz	Reactel, Inc	12RX7-2441.75-x140 S	17-01	07/13/2018	07/13/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.17.0.3

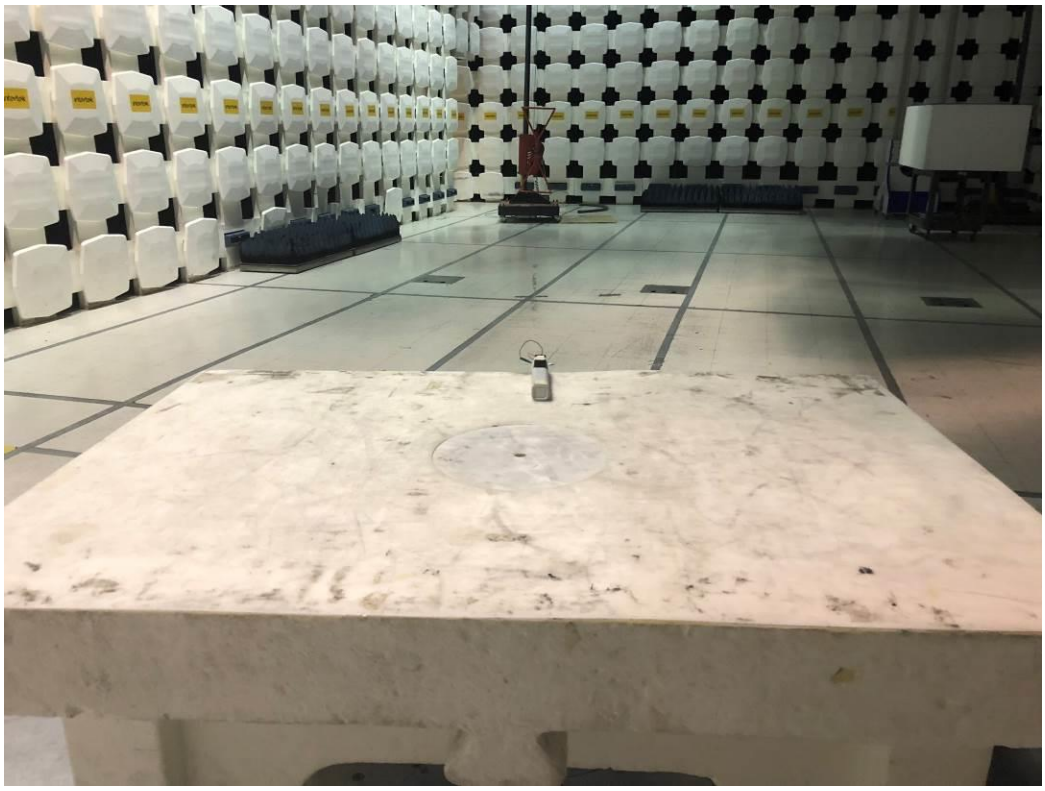
10.3 Results:

The sample tested was found to Comply.

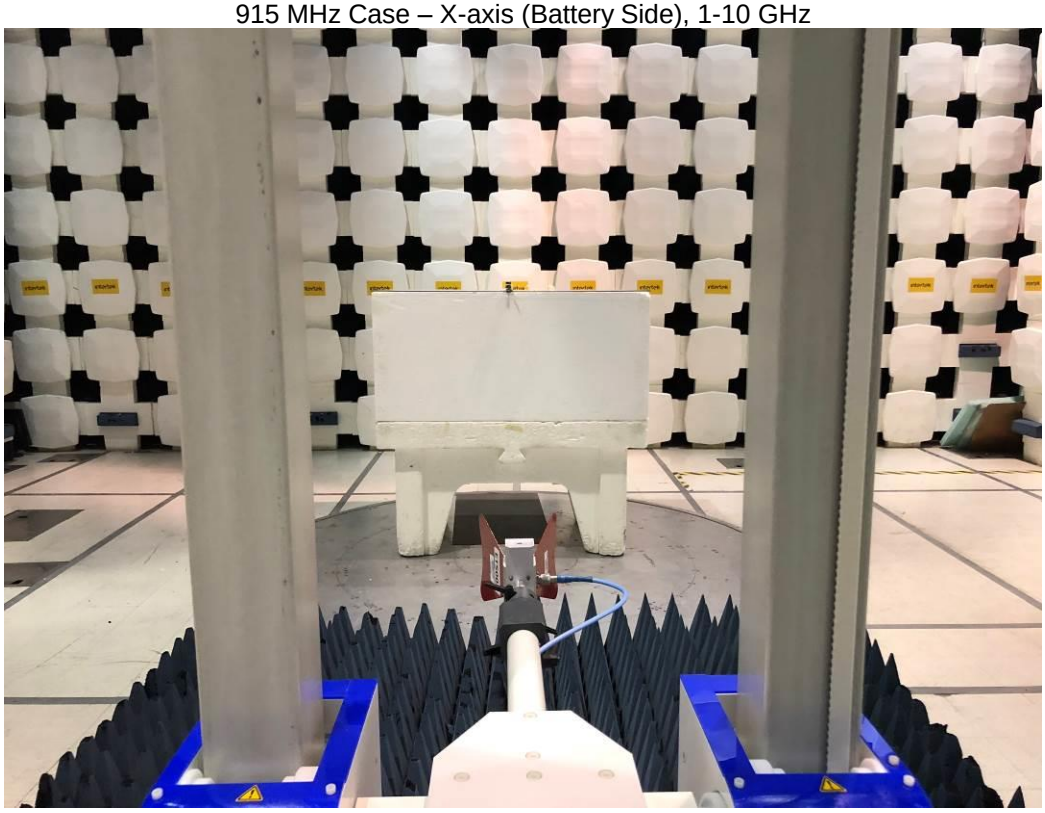
15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c))

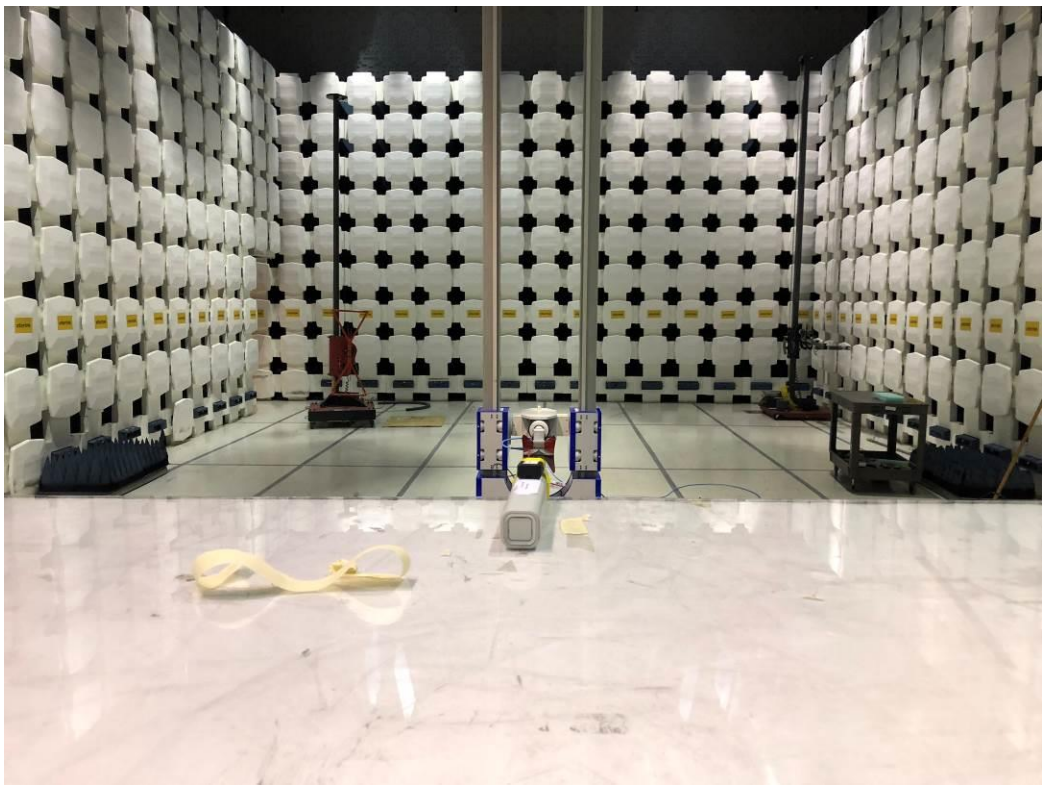
10.4 Setup Photographs:

915 MHz Case – X-axis (Battery Side), 30-1000 MHz

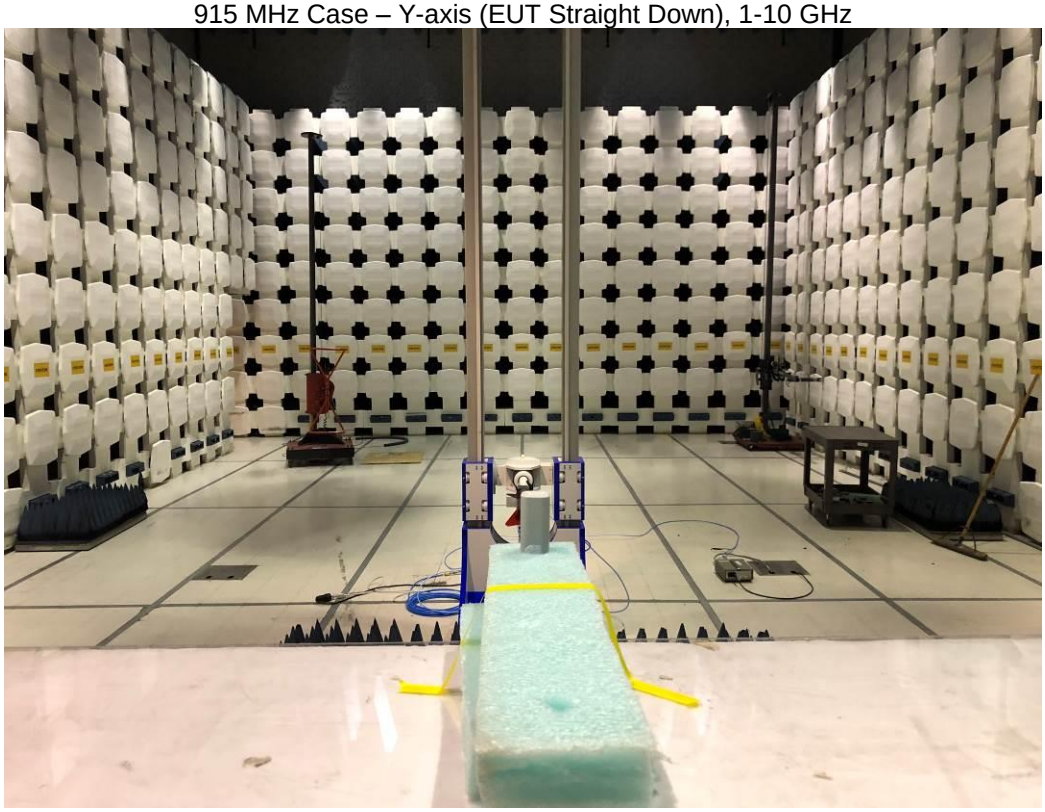


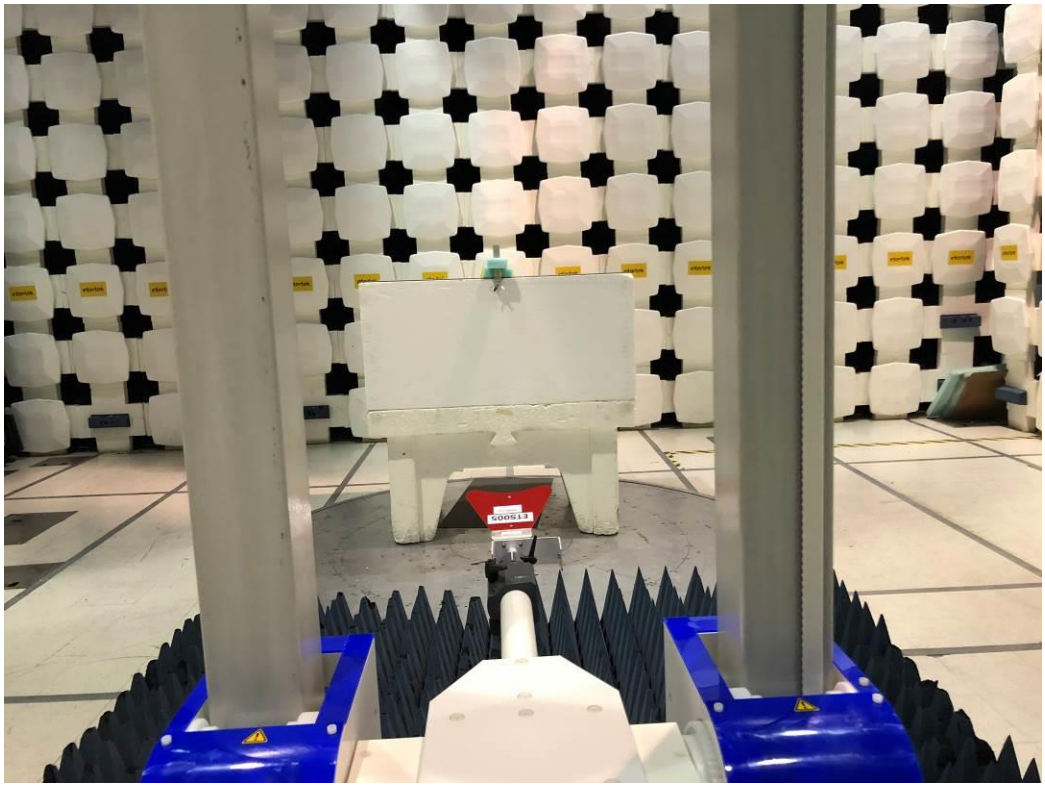
915 MHz Case – X-axis (Battery Side), 1-10 GHz



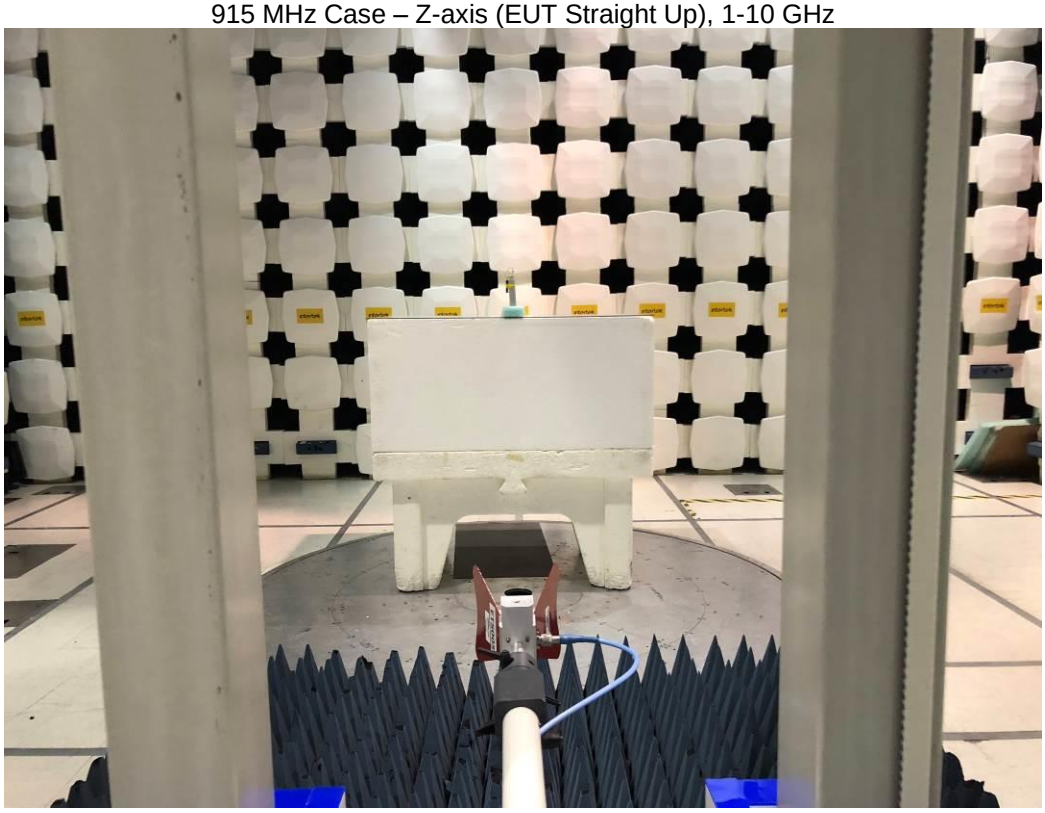


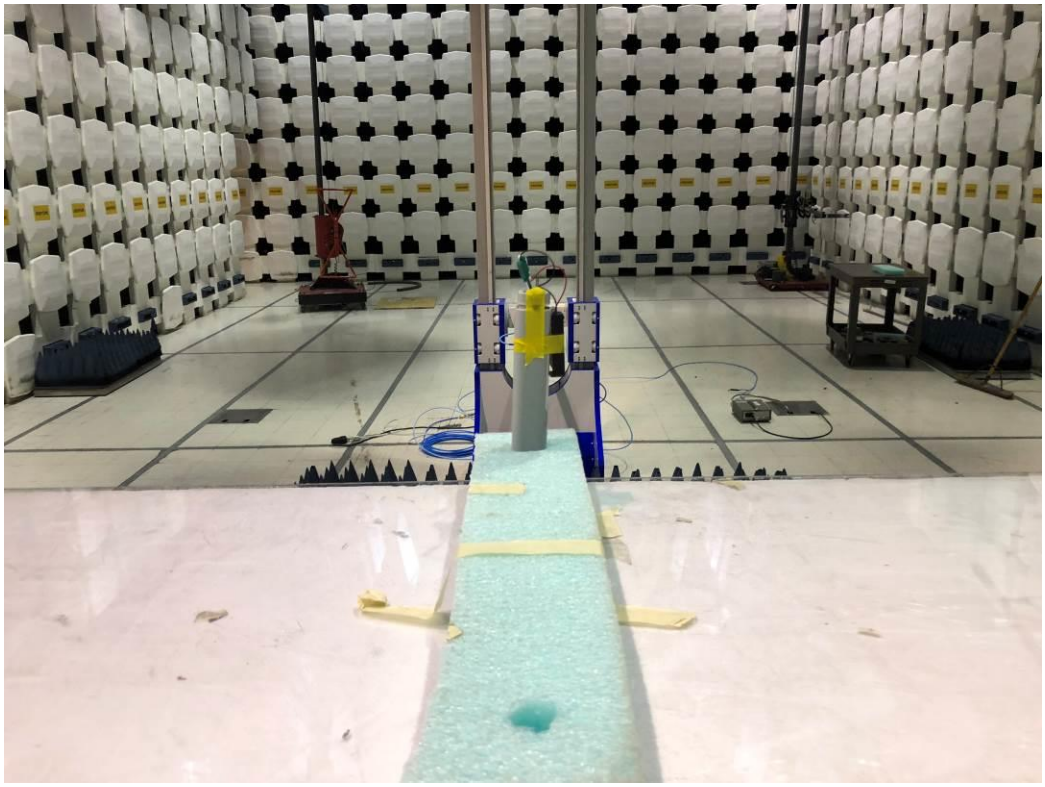
915 MHz Case – Y-axis (EUT Straight Down), 1-10 GHz





915 MHz Case – Z-axis (EUT Straight Up), 1-10 GHz





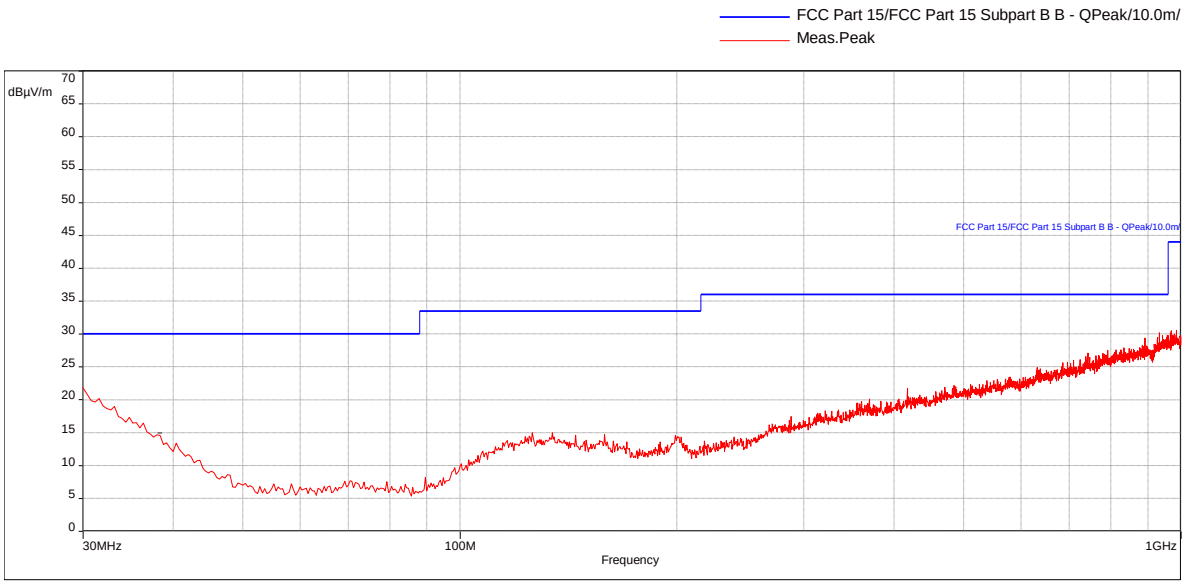
10.5 Plots/Data:

915 MHz Case – Transmit Low Channel (X-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 12:04:09 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, Low Channel X-axis (Battery side up) 30-1000 MHzQuick Prescan (Antenna at 1m high)

Graph:



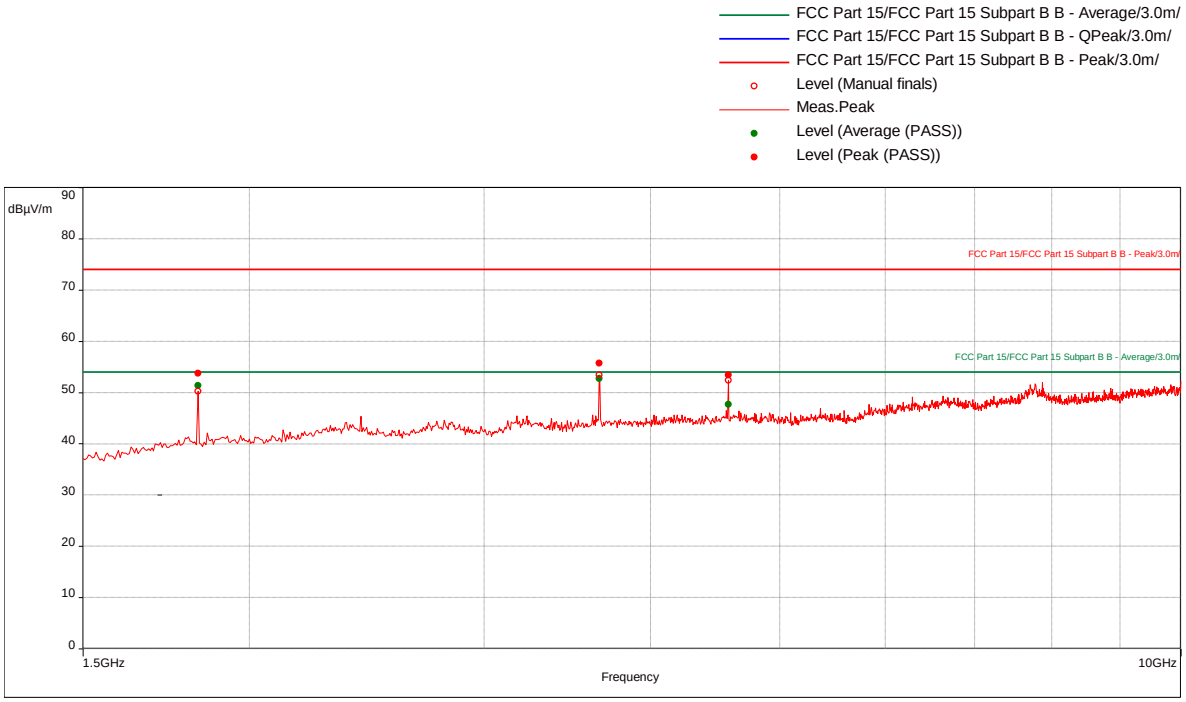
Notes: Since no emissions were detected. Only pre-scan was performed on this axis.

915 MHz Case – Transmit Low Channel (X-axis), 1-10 GHz

Test Information:

Date and Time	2/24/2019 9:20:54 AM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	1004mbar
Comments	915 MHz Case, Low Channel, X-axis (Battery sied up), 1.5-10 GHz

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1830	53.70	74.00	-20.30	224.00	1.70	Horizontal	1000000.00	-1.88
3660	55.68	74.00	-18.32	222.00	1.90	Horizontal	1000000.00	4.05
4574.736842	53.43	74.00	-20.57	53.00	1.15	Horizontal	1000000.00	6.24

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1830	51.34	54.00	-2.66	224.00	1.70	Horizontal	1000000.00	-1.88
3660	52.69	54.00	-1.31	222.00	1.90	Horizontal	1000000.00	4.05
4574.736842	47.62	54.00	-6.38	53.00	1.15	Horizontal	1000000.00	6.24

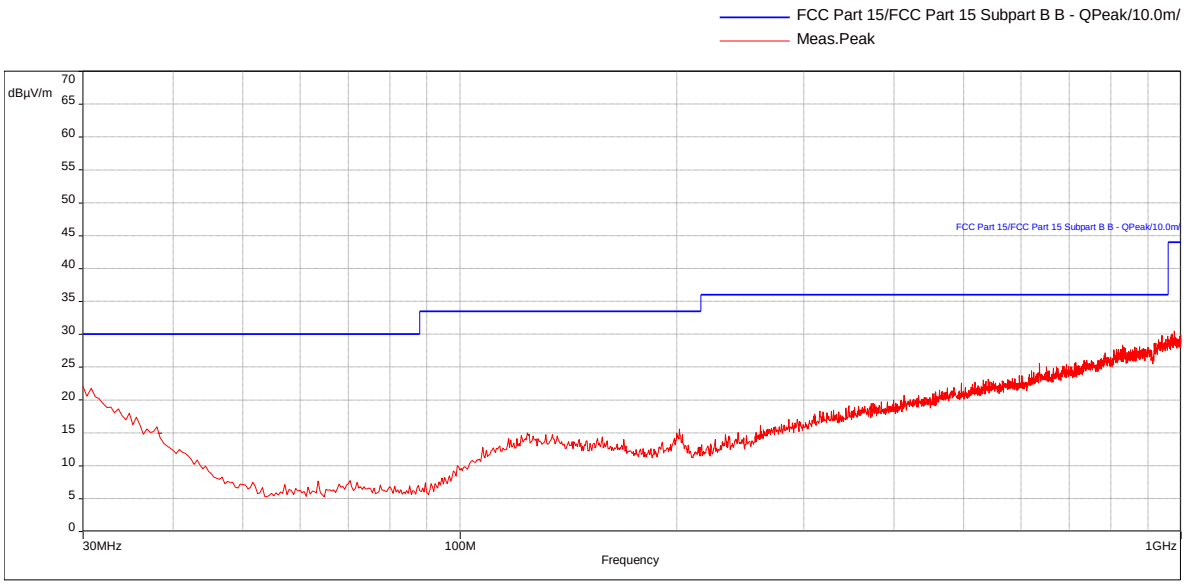
Notes: 1-1.5 GHz was performed manually with no emissions were detected

915 MHz Case – Transmit Low Channel (Y-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 12:21:27 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, Low Channel Y-axis (Pointing Down) 30-1000 MHz, Quick Prescan (Antenna at 1m high)

Graph:



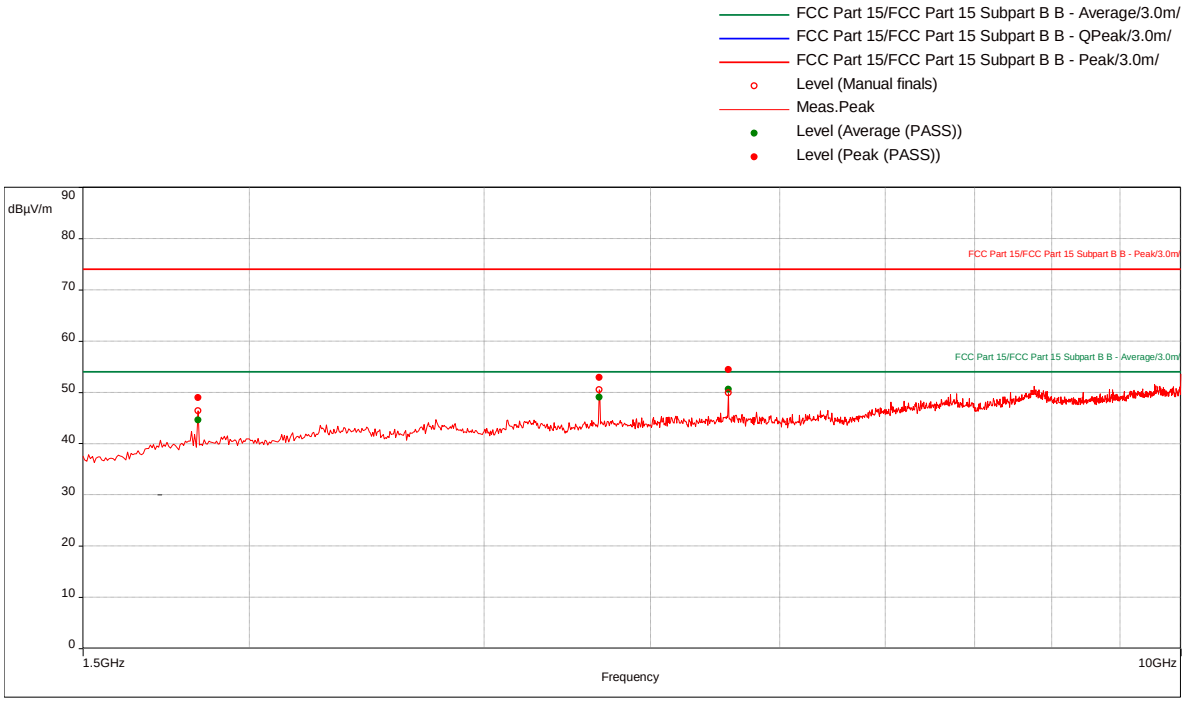
Notes: Since no emissions were detected. Only pre-scan was performed on this axis.

915 MHz Case – Transmit Low Channel (Y-axis), 1-10 GHz

Test Information:

Date and Time	2/24/2019 9:50:45 AM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	1004mbar
Comments	915 MHz Case, Low Channel, Y-axis (Pointing down), 1.5-10 GHz

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1830	48.94	74.00	-25.06	32.00	2.15	Vertical	1000000.00	-1.88
3660	52.91	74.00	-21.09	39.00	3.25	Horizontal	1000000.00	4.05
4575	54.46	74.00	-19.54	255.00	1.45	Vertical	1000000.00	6.24

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1830	44.58	54.00	-9.42	32.00	2.15	Vertical	1000000.00	-1.88
3660	49.01	54.00	-4.99	39.00	3.25	Horizontal	1000000.00	4.05
4575	50.53	54.00	-3.47	255.00	1.45	Vertical	1000000.00	6.24

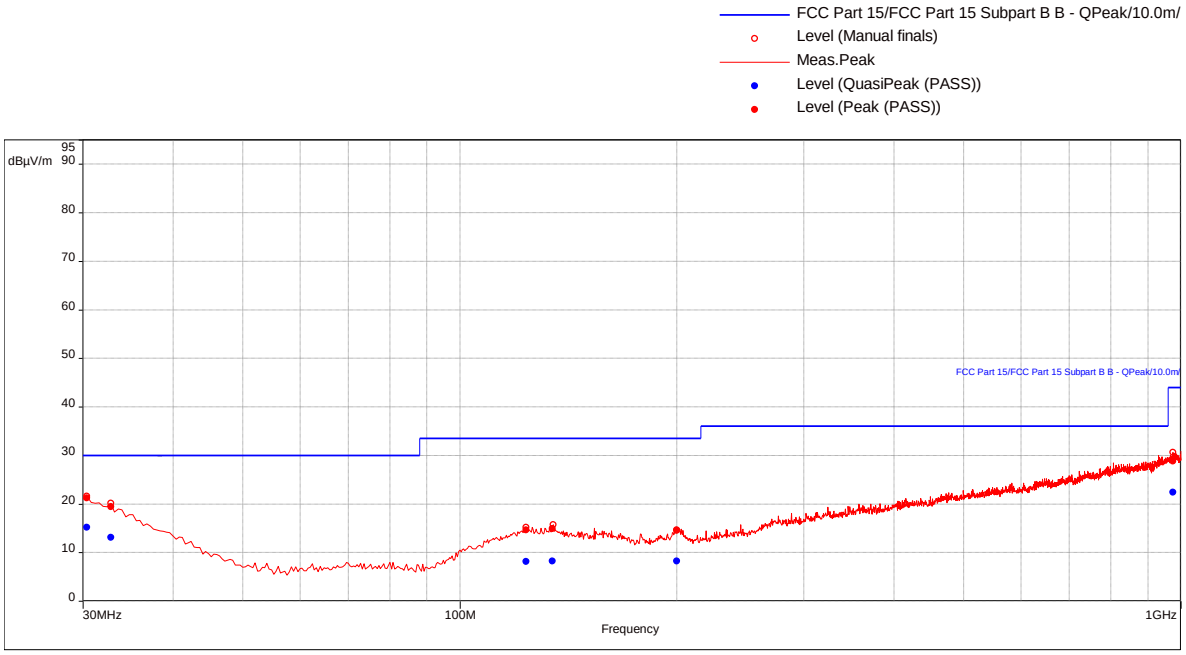
Notes: 1-1.5 GHz was performed manually with no emissions were detected.

915 MHz Case – Transmit Low Channel (Z-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 10:35:19 AM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, Low Channel, Z-Axis (EUT sits straight up), 30-1000 MHz

Graph:



Results:

QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
30.28421053	15.13	30.00	-14.87	313.00	1.12	Vertical	120000.00	-11.17
32.64210526	13.13	30.00	-16.87	357.00	1.29	Horizontal	120000.00	-12.96
123.6315789	8.14	33.50	-25.36	300.00	2.26	Horizontal	120000.00	-18.58
134.5157895	8.20	33.50	-25.30	122.00	2.84	Horizontal	120000.00	-18.64
199.8421053	8.20	33.50	-25.30	357.00	1.75	Horizontal	120000.00	-18.71
974.7368421	22.38	44.00	-21.62	151.00	2.94	Horizontal	120000.00	-3.92

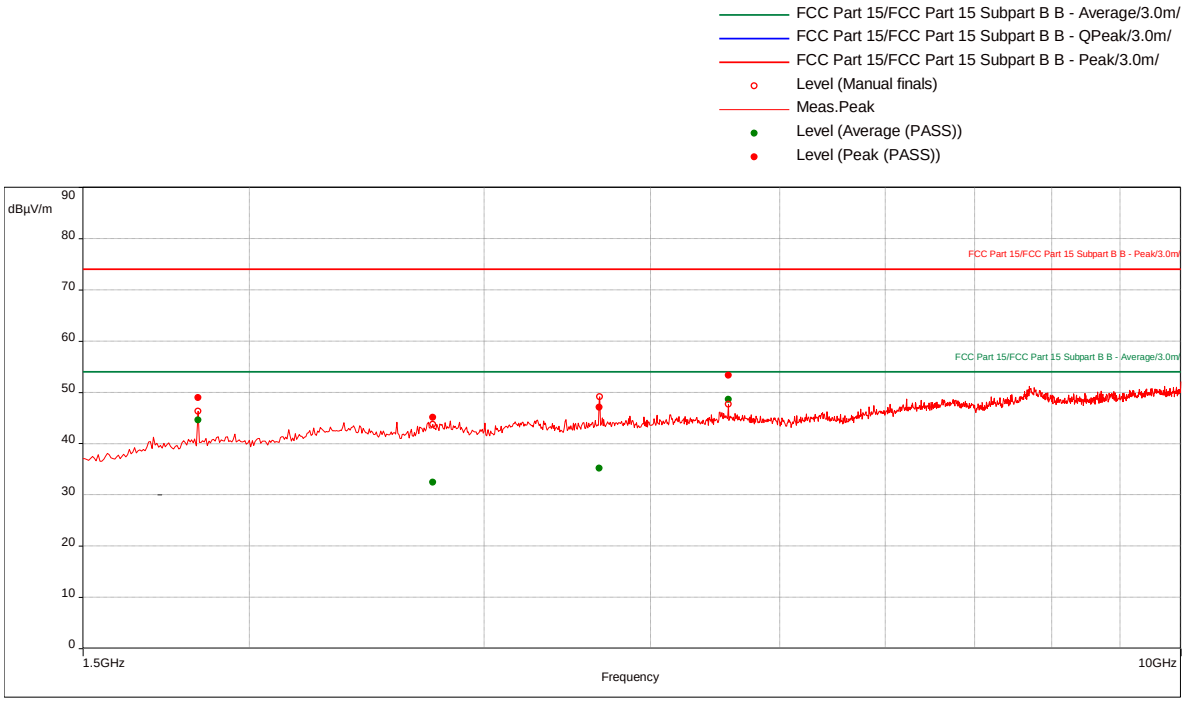
Notes: No emissions were detected. Readings above are noise floor readings.

915 MHz Case – Transmit Low Channel (Z-axis), 1-10 GHz

Test Information:

Date and Time	2/24/2019 9:27:05 AM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	1004mbar
Comments	915 MHz Case, Low Channel, Z-axis (Pointing up), 1.5-10 GHz

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1830	48.94	74.00	-25.06	327.00	1.55	Vertical	1000000.00	-1.88
2743.421053	45.13	74.00	-28.87	334.00	3.79	Vertical	1000000.00	1.63
3660.526316	47.04	74.00	-26.96	121.00	1.25	Horizontal	1000000.00	4.06
4575	53.30	74.00	-20.70	107.00	2.20	Vertical	1000000.00	6.24

Average (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1830	44.60	54.00	-9.40	327.00	1.55	Vertical	1000000.00	-1.88
2743.421053	32.47	54.00	-21.53	334.00	3.79	Vertical	1000000.00	1.63
3660.526316	35.18	54.00	-18.82	121.00	1.25	Horizontal	1000000.00	4.06
4575	48.59	54.00	-5.41	107.00	2.20	Vertical	1000000.00	6.24

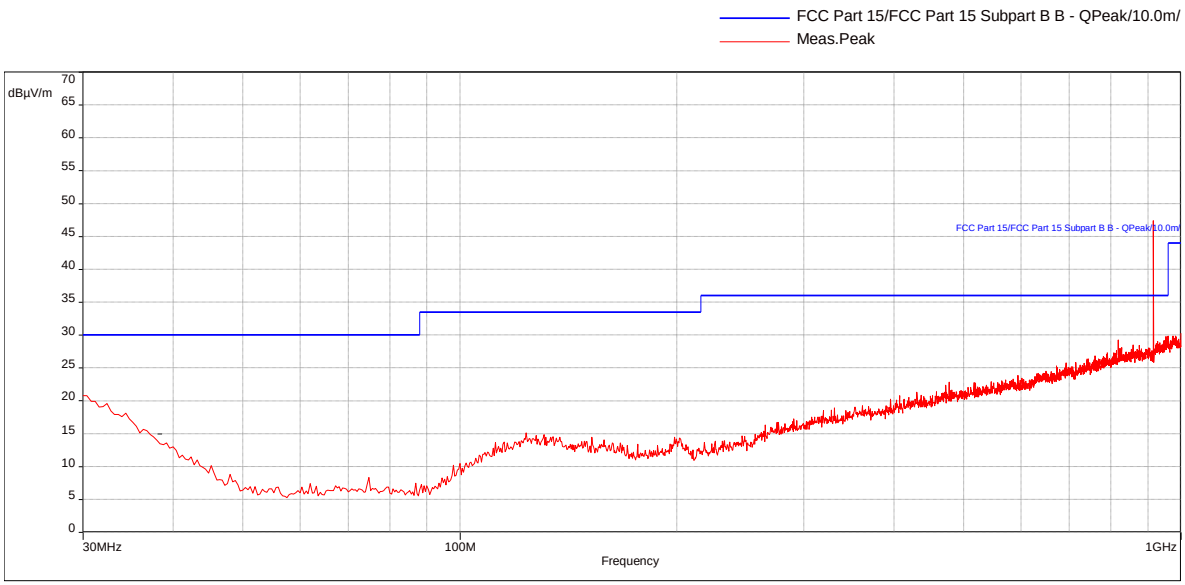
Notes: 1-1.5 GHz was performed manually with no emissions were detected.

915 MHz Case – Transmit Mid Channel (X-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 1:32:16 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, Mid Channel X-axis (Battery side up) 30-1000 MHzQuick Prescan (Antenna at 1m high)

Graph:



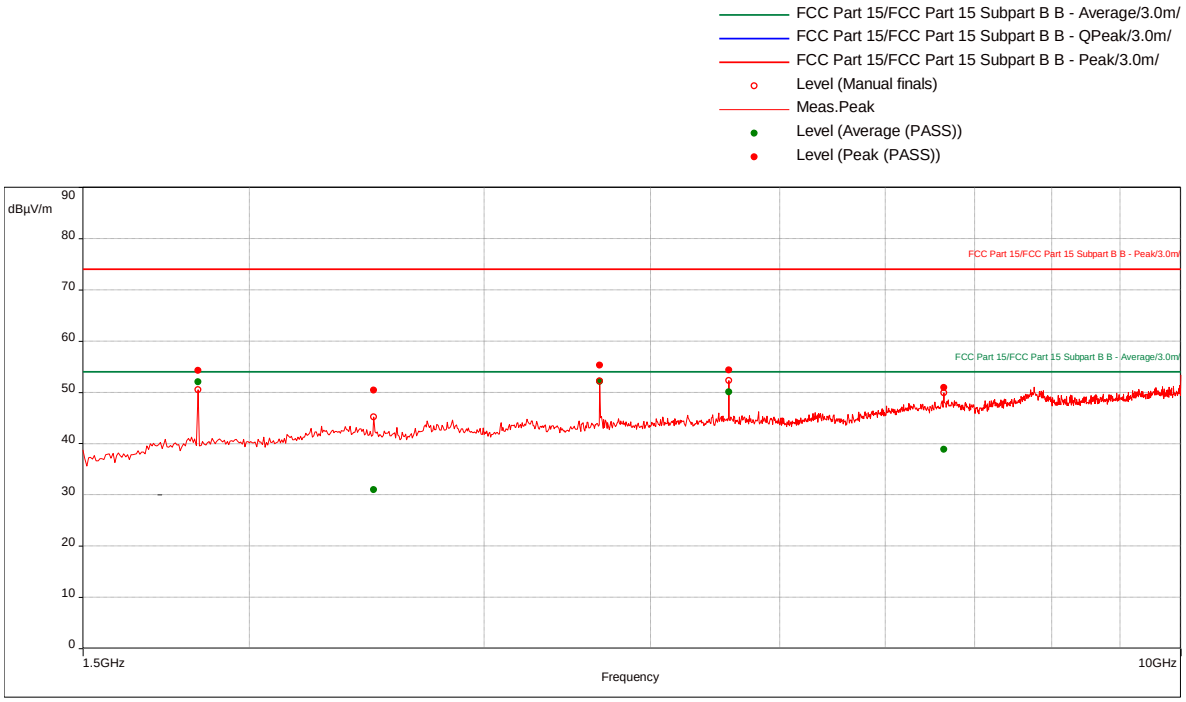
Notes: Since no emissions were detected. Only pre-scan was performed on this axis. The fundamental frequency signal (highest peak) is not being evaluated.

915 MHz Case – Transmit Mid Channel (X-axis), 1-10 GHz

Test Information:

Date and Time	2/24/2019 10:57:52 AM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	1004mbar
Comments	915 MHz Case, Mid Channel, X-axis (Battery side up), 1.5-10 GHz

Graph:



Results:

Peak (PASS) (5)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1832.105263	54.25	74.00	-19.75	225.00	1.65	Horizontal	1000000.00	-1.87
2480	50.41	74.00	-23.59	24.00	2.60	Vertical	1000000.00	1.03
3663.947368	55.29	74.00	-18.71	210.00	2.05	Horizontal	1000000.00	4.07
4580	54.34	74.00	-19.66	106.00	1.05	Horizontal	1000000.00	6.26
6642.105263	50.93	74.00	-23.07	11.00	1.60	Horizontal	1000000.00	9.78

Average (PASS) (5)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1832.105263	52.04	54.00	-1.96	225.00	1.65	Horizontal	1000000.00	-1.87
2480	30.99	54.00	-23.01	24.00	2.60	Vertical	1000000.00	1.03
3663.947368	52.07	54.00	-1.93	210.00	2.05	Horizontal	1000000.00	4.07
4580	50.09	54.00	-3.91	106.00	1.05	Horizontal	1000000.00	6.26
6642.105263	38.88	54.00	-15.12	11.00	1.60	Horizontal	1000000.00	9.78

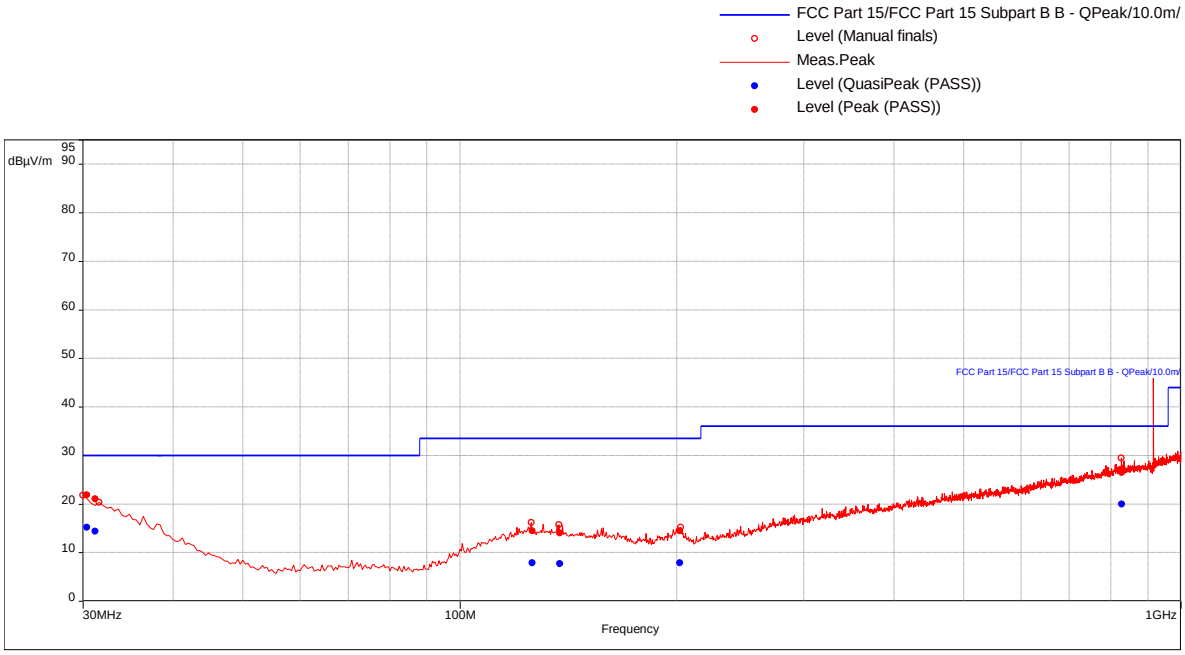
Notes: 1-1.5 GHz was performed manually with no emissions were detected.

915 MHz Case – Transmit Mid Channel (Y-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 12:45:58 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, Mid Channel, Y-Axis (Pointing down), 30-1000 MHz

Graph:



Results:

QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
30.26842105	15.15	30.00	-14.85	306.00	2.93	Horizontal	120000.00	-11.16
31.28421053	14.35	30.00	-15.65	136.00	1.81	Horizontal	120000.00	-11.95
125.8526316	7.86	33.50	-25.64	290.00	2.39	Vertical	120000.00	-18.51
137.4842105	7.68	33.50	-25.82	70.00	1.97	Vertical	120000.00	-18.83
202.1789474	7.82	33.50	-25.68	283.00	2.20	Vertical	120000.00	-18.82
827.6105263	20.00	36.00	-16.00	106.00	3.55	Horizontal	120000.00	-6.38

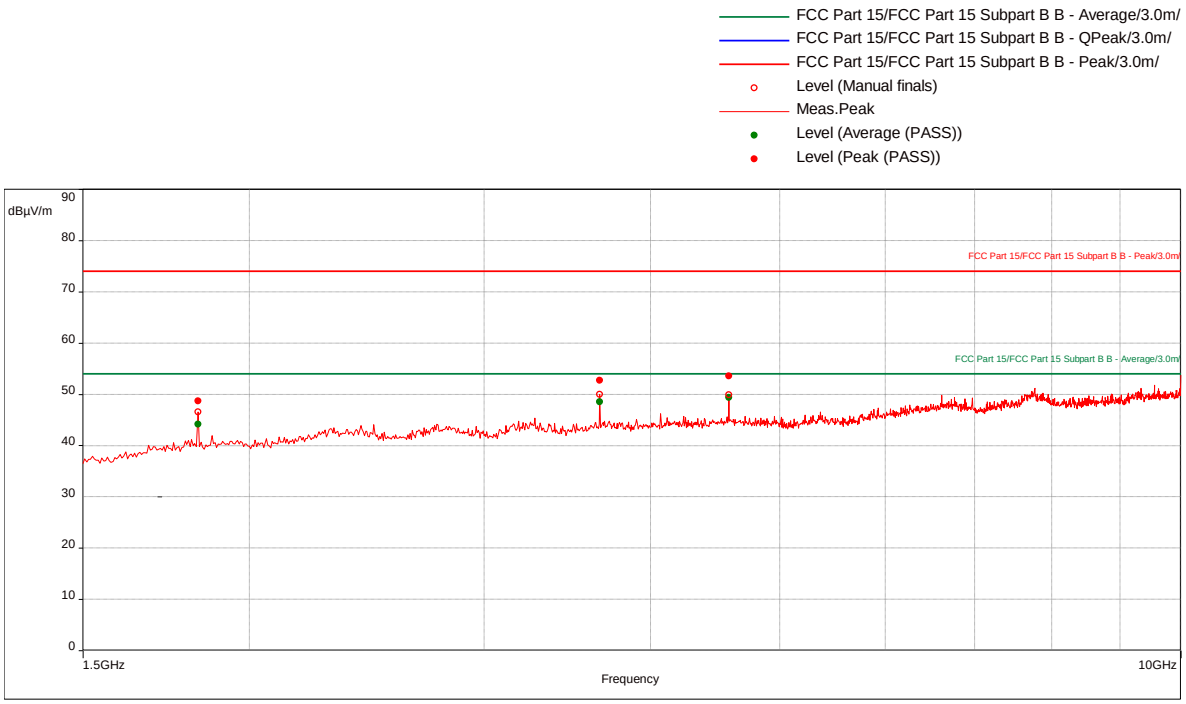
Notes: No emissions were detected. Readings above are noise floor readings. The fundamental frequency signal (highest peak) is not being evaluated.

915 MHz Case – Transmit Mid Channel (Y-axis), 1-10 GHz

Test Information:

Date and Time	2/24/2019 10:13:46 AM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	1004mbar
Comments	915 MHz Case, Mid Channel, Y-axis (Pointing down), 1.5-10 GHz

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1831.842105	48.69	74.00	-25.31	48.00	1.00	Vertical	1000000.00	-1.88
3663.947368	52.66	74.00	-21.34	262.00	1.15	Vertical	1000000.00	4.07
4580	53.57	74.00	-20.43	247.00	1.35	Vertical	1000000.00	6.26

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1831.842105	44.13	54.00	-9.87	48.00	1.00	Vertical	1000000.00	-1.88
3663.947368	48.50	54.00	-5.50	262.00	1.15	Vertical	1000000.00	4.07
4580	49.36	54.00	-4.64	247.00	1.35	Vertical	1000000.00	6.26

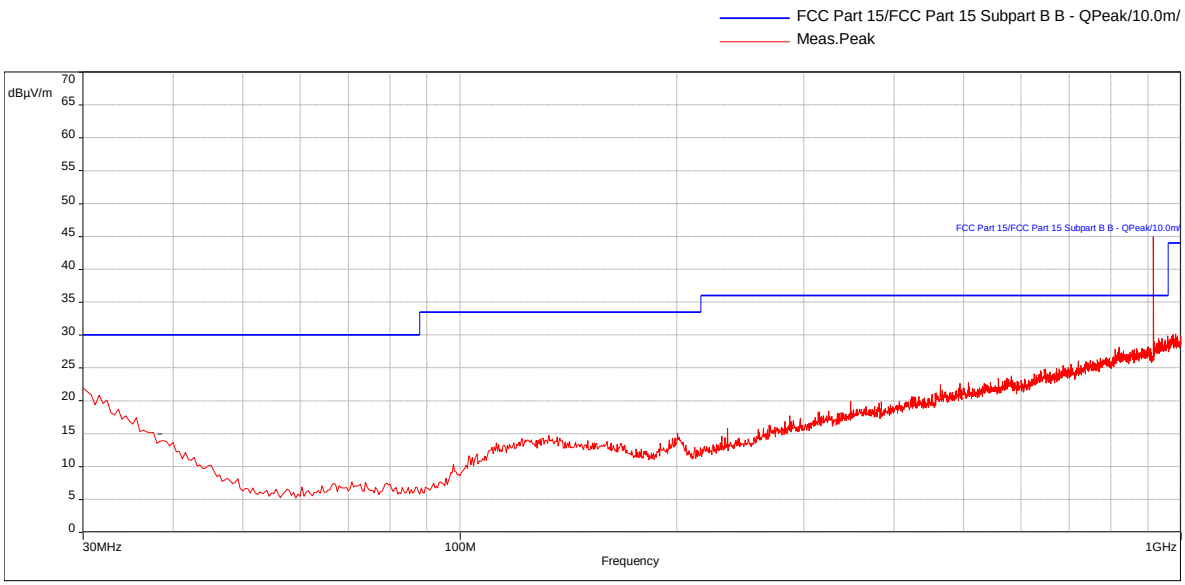
Notes: 1-1.5 GHz was performed manually with no emissions were detected.

915 MHz Case – Transmit Mid Channel (Z-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 1:41:52 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, Mid Channel Z-axis (Pointing up) 30-1000 MHz, Quick Prescan (Antenna at 1m high)

Graph:



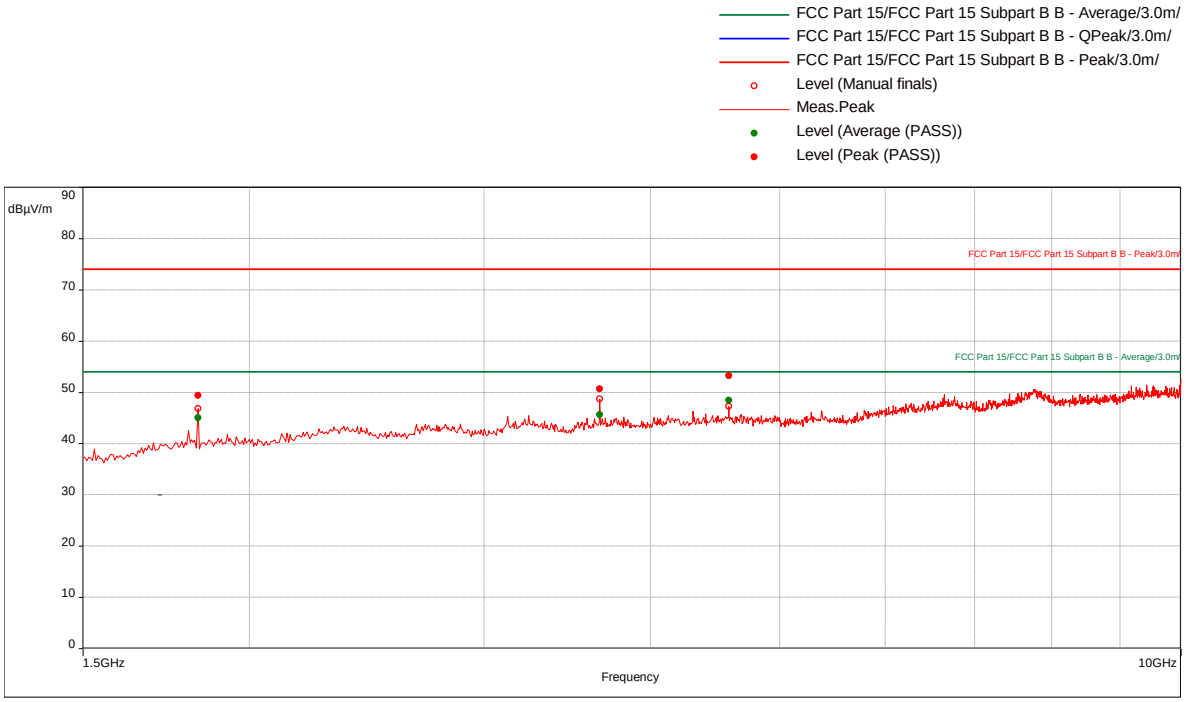
Notes: Since no emissions were detected. Only pre-scan was performed on this axis. The fundamental frequency signal (highest peak) is not being evaluated.

915 MHz Case – Transmit Mid Channel (Z-axis), 1-10 GHz

Test Information:

Date and Time	2/24/2019 10:38:39 AM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	1004mbar
Comments	915 MHz Case, Mid Channel, Z-axis (Pointing up), 1.5-10 GHz

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1832.105263	49.35	74.00	-24.65	342.00	2.25	Vertical	1000000.00	-1.87
3663.947368	50.62	74.00	-23.38	99.00	2.40	Vertical	1000000.00	4.07
4580	53.18	74.00	-20.82	99.00	2.25	Vertical	1000000.00	6.26

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1832.105263	45.04	54.00	-8.96	342.00	2.25	Vertical	1000000.00	-1.87
3663.947368	45.65	54.00	-8.35	99.00	2.40	Vertical	1000000.00	4.07
4580	48.46	54.00	-5.54	99.00	2.25	Vertical	1000000.00	6.26

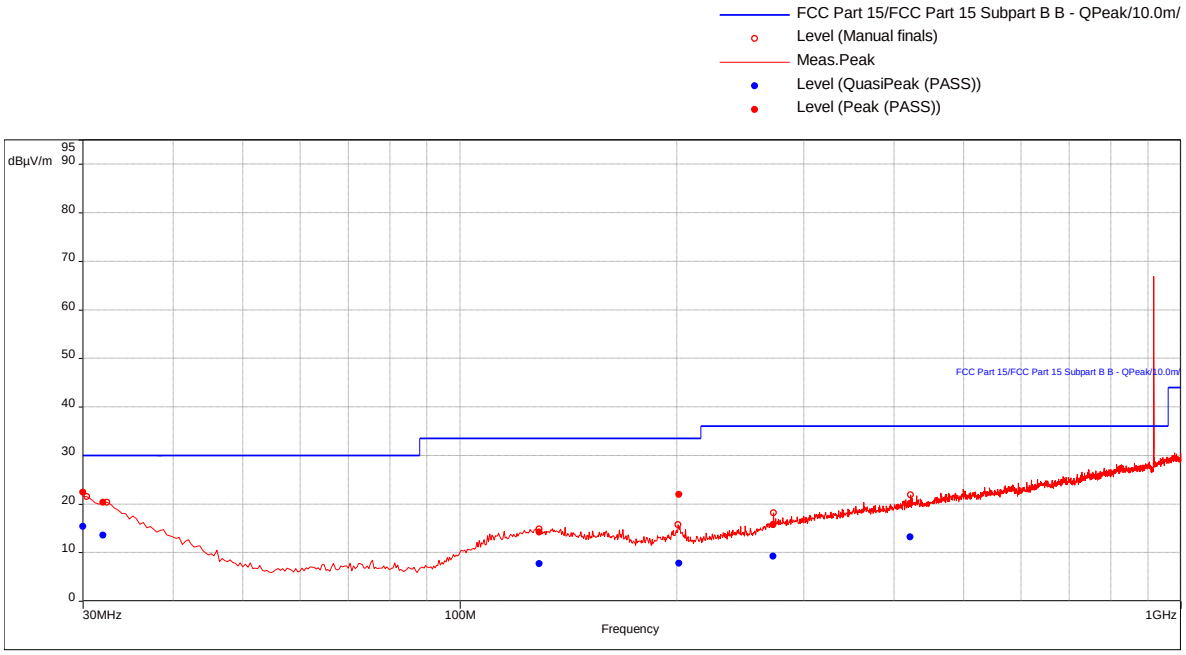
Notes: 1-1.5 GHz was performed manually with no emissions were detected.

915 MHz Case – Transmit High Channel (X-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 1:55:17 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, High Channel, X-Axis (Battery side up), 30-1000 MHz

Graph:



Results:

QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
30.05263158	15.38	30.00	-14.62	48.00	3.93	Horizontal	120000.00	-10.99
32.11578947	13.56	30.00	-16.44	158.00	2.50	Vertical	120000.00	-12.60
128.8631579	7.71	33.50	-25.79	144.00	1.37	Vertical	120000.00	-18.46
201.1473684	7.75	33.50	-25.75	158.00	2.03	Vertical	120000.00	-18.69
272.1157895	9.20	36.00	-26.80	165.00	3.15	Horizontal	120000.00	-17.97
421.4315789	13.23	36.00	-22.77	330.00	3.25	Vertical	120000.00	-14.38

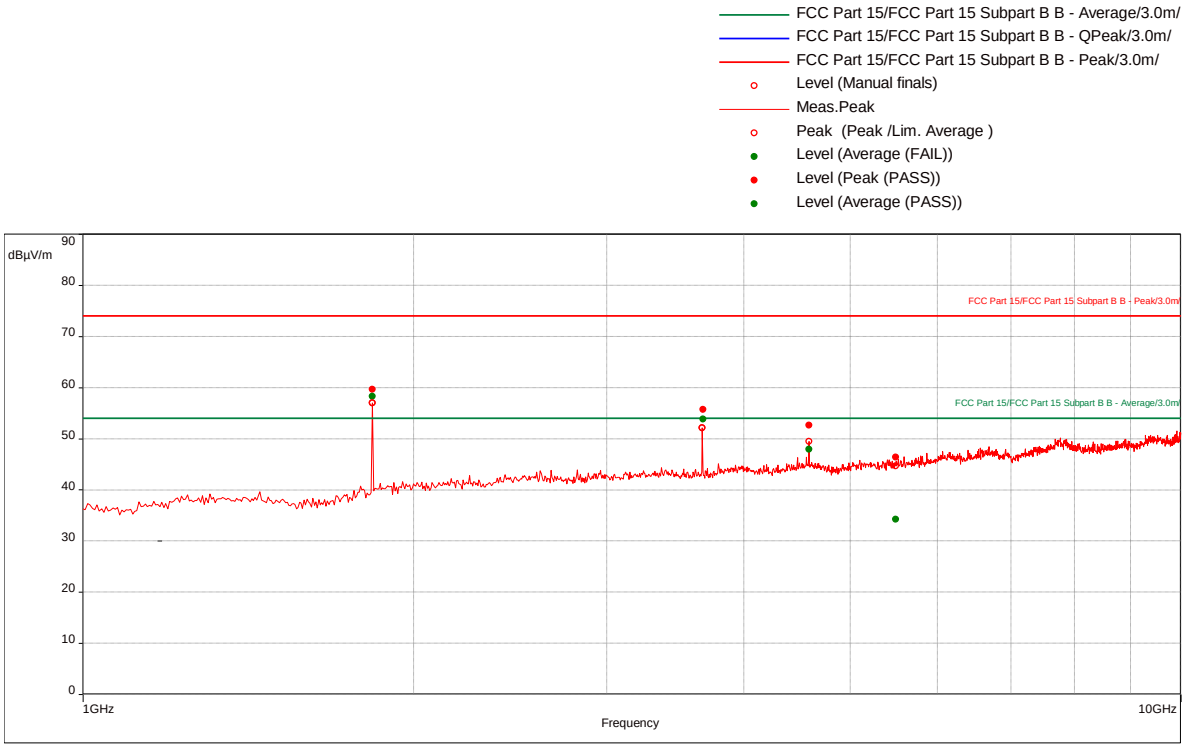
Notes: The fundamental frequency signal (highest peak) is not being evaluated.

915 MHz Case – Transmit High Channel (X-axis), 1-10 GHz

Test Information:

Date and Time	2/8/2019 7:32:38 PM
Client and Project Number	Renovia_G103622007
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	24%
Atmospheric Pressure	999 mB
Comments	RE 1 to 10 GHz_battery_Tx High channel_915 MHz CASE_X-axis

Graph:



Results:

Average (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
3667.631579	53.82	54.00	-0.18	336.00	2.00	Horizontal	1000000.00	4.08
4584.473684	47.94	54.00	-6.06	284.00	1.35	Vertical	1000000.00	6.27
5498.684211	34.21	54.00	-19.79	144.00	1.05	Horizontal	1000000.00	7.70
1833.684211	58.27	75.70	-17.43	335.00	1.40	Horizontal	1000000.00	-1.87

Peak (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1833.684211	59.66	95.70	-36.04	335.00	1.40	Horizontal	1000000.00	-1.87
3667.631579	55.74	74.00	-18.26	336.00	2.00	Horizontal	1000000.00	4.08
4584.473684	52.60	74.00	-21.40	284.00	1.35	Vertical	1000000.00	6.27
5498.684211	46.40	74.00	-27.60	144.00	1.05	Horizontal	1000000.00	7.70

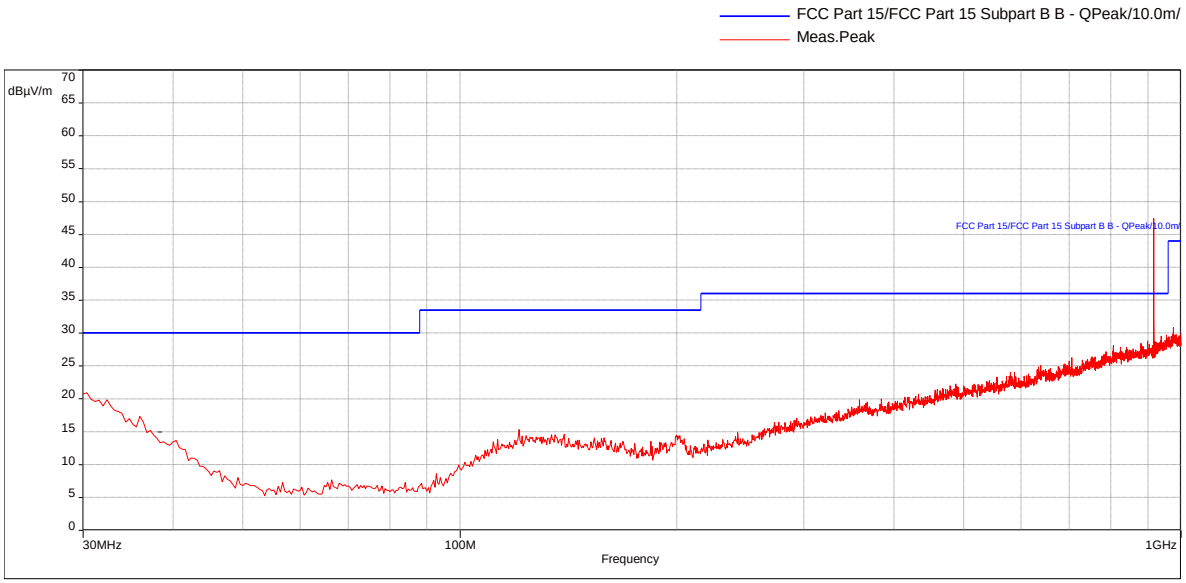
Note: The emission at 1833.684211 MHz is not in the restricted band, therefore, the average limit is 20 dB down from the fundamental power which is 95.70 dB(uV/m).

915 MHz Case – Transmit High Channel (Y-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 2:54:14 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, High Channel Y-axis (battery lead down 30-1000 MHzQuick Prescan (Antenna at 1m high)

Graph:



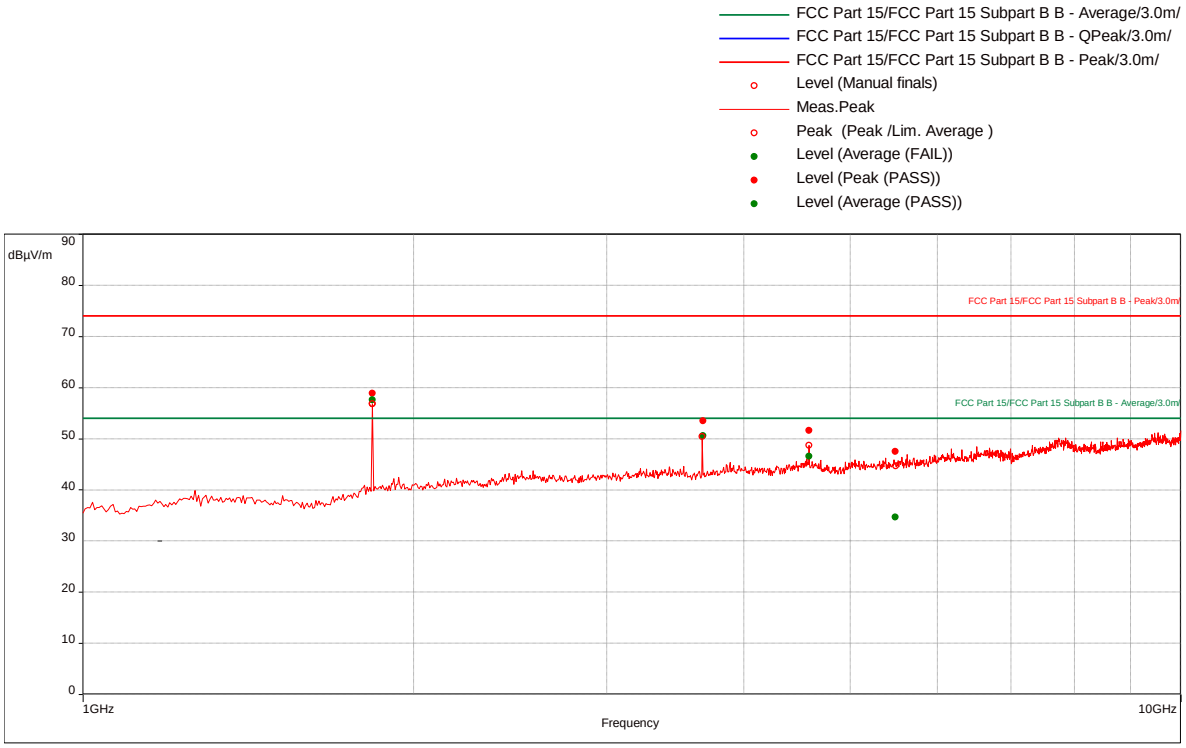
Notes: Since no emissions were detected. Only pre-scan was performed on this axis.

915 MHz Case – Transmit High Channel (Y-axis), 1-10 GHz

Test Information:

Date and Time	2/8/2019 7:54:57 PM
Client and Project Number	Renovia_G103622007
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	24%
Atmospheric Pressure	999 mB
Comments	RE 1 to 10 GHz_battery_Tx High channel_915 MHz CASE_Y-axis

Graph:



Results:

Average (PASS)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
3667.631579	50.57	54.00	-3.43	0.00	1.40	Vertical	1000000.00	4.08
4584.473684	46.55	54.00	-7.45	300.00	1.55	Horizontal	1000000.00	6.27
5495.789474	34.67	54.00	-19.33	277.00	3.69	Horizontal	1000000.00	7.70
1833.684211	57.55	78.15	-20.60	326.00	1.35	Horizontal	1000000.00	-1.87

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1833.684211	58.89	98.15	-39.26	326.00	1.35	Horizontal	1000000.00	-1.87
3667.631579	53.50	74.00	-20.50	0.00	1.40	Vertical	1000000.00	4.08
4584.473684	51.57	74.00	-22.43	300.00	1.55	Horizontal	1000000.00	6.27
5495.789474	47.50	74.00	-26.50	277.00	3.69	Horizontal	1000000.00	7.70

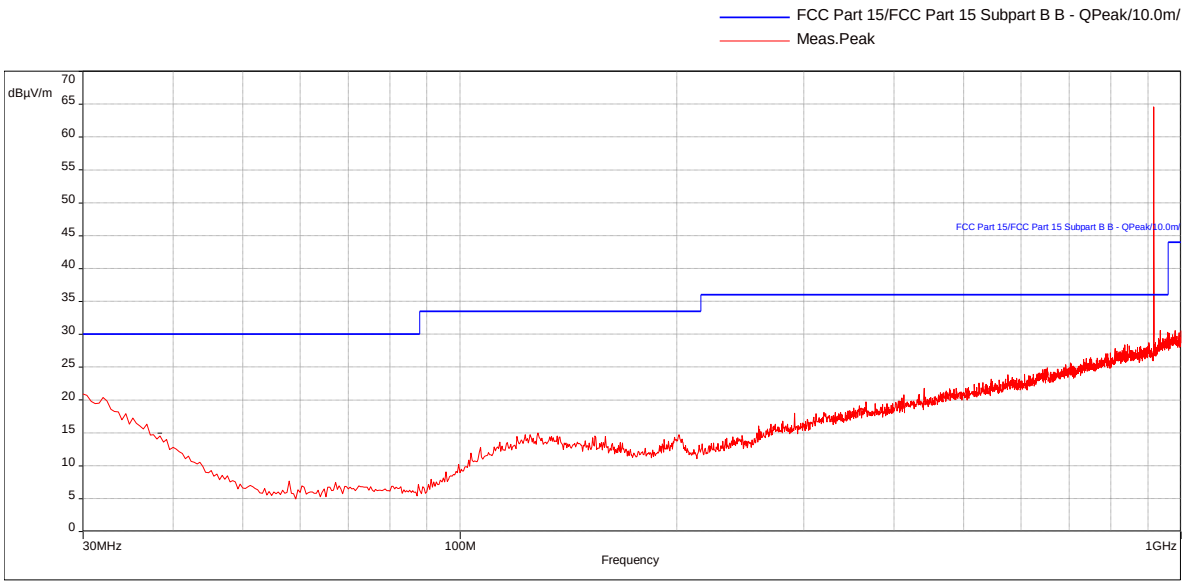
Note: The emission at 1833.684211 MHz is not in the restricted band, therefore, the average limit is 20 dB down from the fundamental power which is 98.15 dB(uV/m).

915 MHz Case – Transmit High Channel (Z-axis), 30-1000 MHz

Test Information:

Date and Time	2/16/2019 2:42:49 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	22%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, High Channel Z-axis (EUT sits straight up) 30-1000 MHzQuick Prescan (Antenna at 1m high)

Graph:



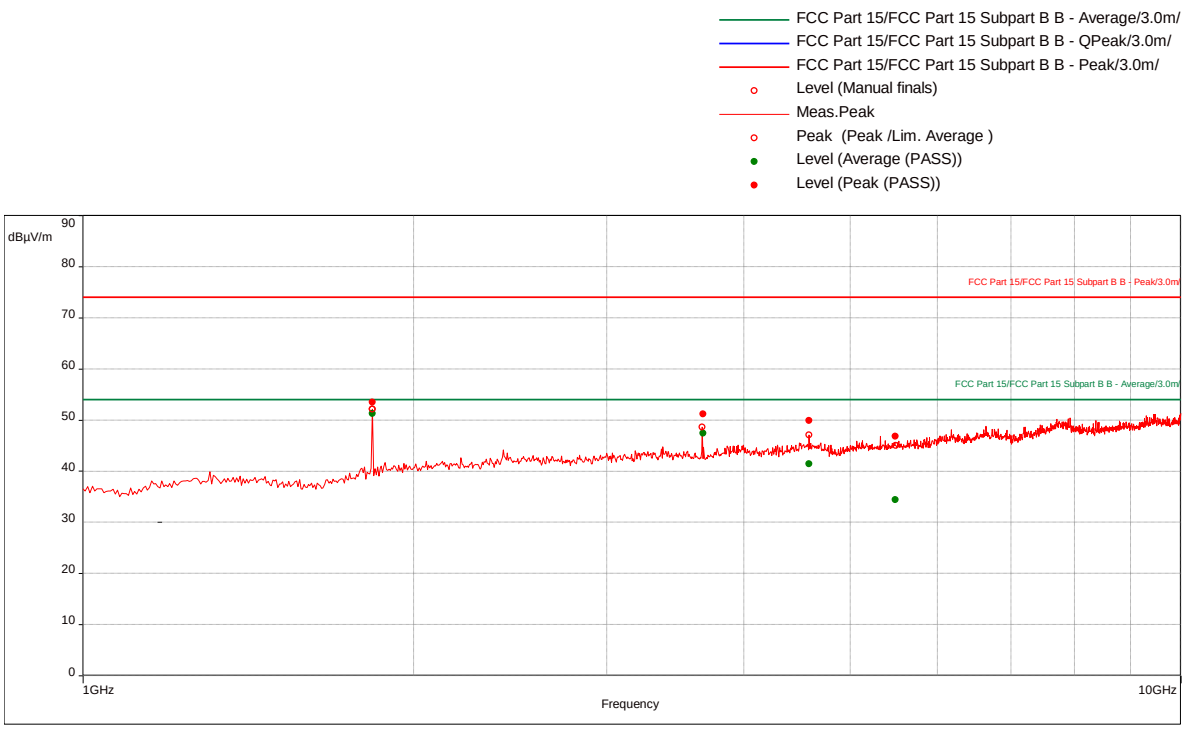
Notes: Since no emissions were detected. Only pre-scan was performed on this axis.

915 MHz Case – Transmit High Channel (Z-axis), 1-10 GHz

Test Information:

Date and Time	2/8/2019 8:16:31 PM
Client and Project Number	Renovia_G103622007
Engineer	Vathana Ven
Temperature	21 deg C
Humidity	24%
Atmospheric Pressure	999 mB
Comments	RE 1 to 10 GHz_battery_Tx High channel_915 MHz CASE_Z-axis

Graph:



Results:

Peak (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1833.684211	53.47	96.57	-43.10	113.00	1.00	Vertical	1000000.00	-1.87
3667.631579	51.16	74.00	-22.84	291.00	1.00	Vertical	1000000.00	4.08
4584.473684	49.85	74.00	-24.15	77.00	3.49	Horizontal	1000000.00	6.27
5496.052632	46.81	74.00	-27.19	47.00	1.70	Vertical	1000000.00	7.70

Average (PASS) (4)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1833.684211	51.27	76.57	-25.30	113.00	1.00	Vertical	1000000.00	-1.87
3667.631579	47.42	54.00	-6.58	291.00	1.00	Vertical	1000000.00	4.08
4584.473684	41.44	54.00	-12.56	77.00	3.49	Horizontal	1000000.00	6.27
5496.052632	34.41	54.00	-19.59	47.00	1.70	Vertical	1000000.00	7.70

Note: The emission at 1833.684211 MHz is not in the restricted band, therefore, the average limit is 20 dB down from the fundamental power which is 95.70 dB(uV/m).

Test Personnel:	Kouma Sinn KPS	Test Date:	02/08/2019, 02/16/2019, 02/24/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247	Limit Applied:	See report section 10.3
Input Voltage:	Internal Battery Powered		
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Ambient Temperature:	21, 21, 21 ºC
		Relative Humidity:	24, 22, 22 %
		Atmospheric Pressure:	999, 998, 1004 mbars

Deviations, Additions, or Exclusions: None

11 Digital Device and Receiver Radiated Spurious Emissions

11.1 Method

Tests are performed in accordance with FCC Part 15 Subpart B, ICES 003, and ANSI C 63.4.

TEST SITE: 10m ALSE

The 10m ALSE is 13m (Length) x 21m (Depth) x 10m (Height) with the effective size in terms of space from the tips of the absorber is 12m (Length) x 20m (Depth) x 8.5m (Height). This chamber achieves broadband performance using a unique arrangement of hybrid and ferrite tile absorber. This chamber has a built in 3m diameter turntable (Embedded type). The metal structure of the table makes electrical connection around the entire circumference of the turntable to the ground plane with a metal brush type connection. The turntable is located on one end of the chamber and the antennas are mounted 3 and 10 meters away at the other end of the chamber on the adjustable an Antenna Mast. The antenna mast is a non-conductive bore sighted type with remote control of antenna height and polarization. The Antenna Mast and the turntable can be remotely controlled through the controller located in the adjacent Control room. A Styrofoam table 80 cm high is used for table-top equipment.

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	4.6dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	5.3 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.5 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	5.2 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	5.0 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	5.0 dB	5.5 dB

As shown in the table above our radiated emissions U_{lab} is less than the corresponding U_{CISPR} reference value in CISPR 16-4-2 Table 1, hence the compliance of the product is only based on the measured value, and no measurement uncertainty correction is required, based on CISPR 22 and CISPR 11 (for 2006 and later revisions) Clause 11.

Sample 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 with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV
NF = Net Reading in dBμV

Example:

FS = RA + AF + CF – AG = 52.0 + 7.4 + 1.6 – 29.0 = 32.0
$UF = 10^{(32\ dB\mu V / 20)}$ = 39.8 μV/m

Alternately, when BAT-EMC Emission Software is used, the “Level” includes all losses and gains and is compared directly in the “Margin” column to the “Limit”. The “Correction” includes Antenna Factor, Preamp, and Cable Loss. These are already accounted for in the “Level” column.

11.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
BAR1'	Digital 4 Line Barometer	Mannix	0ABA116	BAR1	04/30/2018	04/30/2019
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/22/2018	03/22/2019
145-410'	Cables 145-420 145-421 145-422 145-406	Huber + Suhner	10m Track A Cables	multiple	07/25/2018	07/25/2019
PRE11'	50dB gain pre-amp	Keith H	PRE11	PRE11	12/02/2017	12/02/2018
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	05/16/2018	05/16/2019
ETS005'	1-18GHz horn antenna	ETS-Lindgren	3117	00218279	05/14/2018	05/14/2019
145014'	Preamplifier (1 GHz to 26.5 GHz)	Hewlett Packard	8449B	3008A00232	06/14/2018	06/14/2019
REA008'	band reject filter 2.4GHz	Reactel, Inc	12RX7-2441.75-x140 S	17-01	07/13/2018	07/13/2019
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019

Software Utilized:

Name	Manufacturer	Version
BAT-EMC	Nexio	3.17.0.3

11.3 Results:

The sample tested was found to Comply.

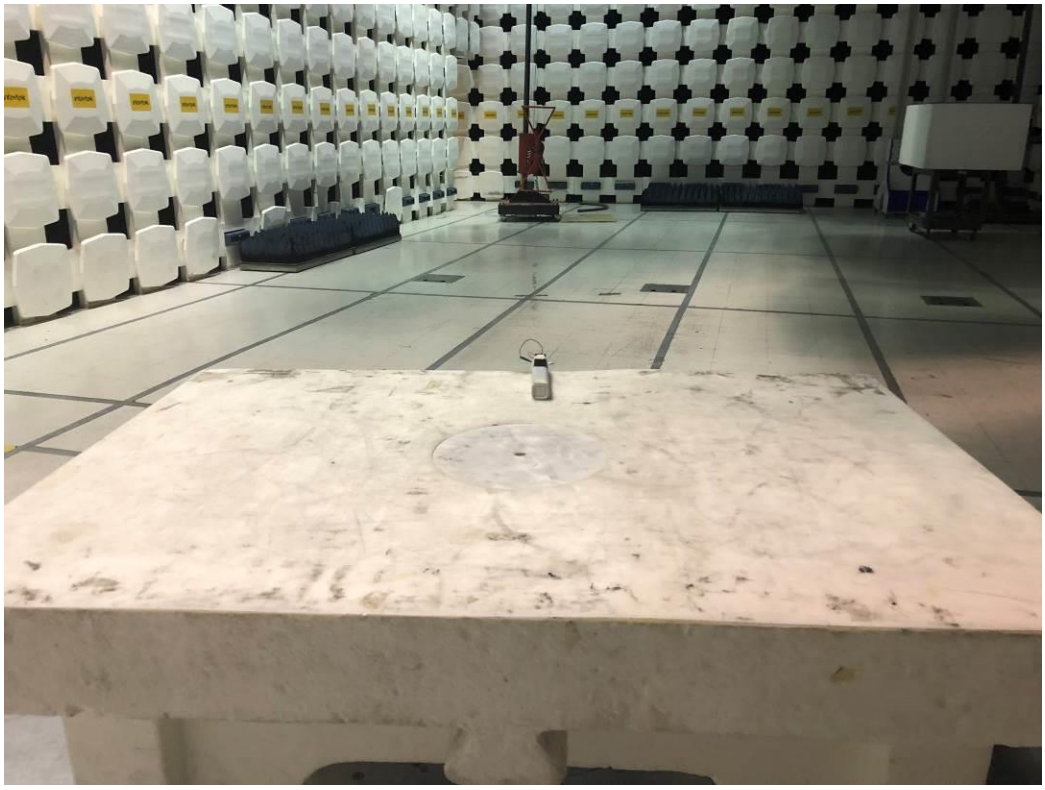
§15.109 Radiated emission limits.

The field strength of radiated emissions form unintentional radiators at a distance of 3 meters shall not exceed the following values.

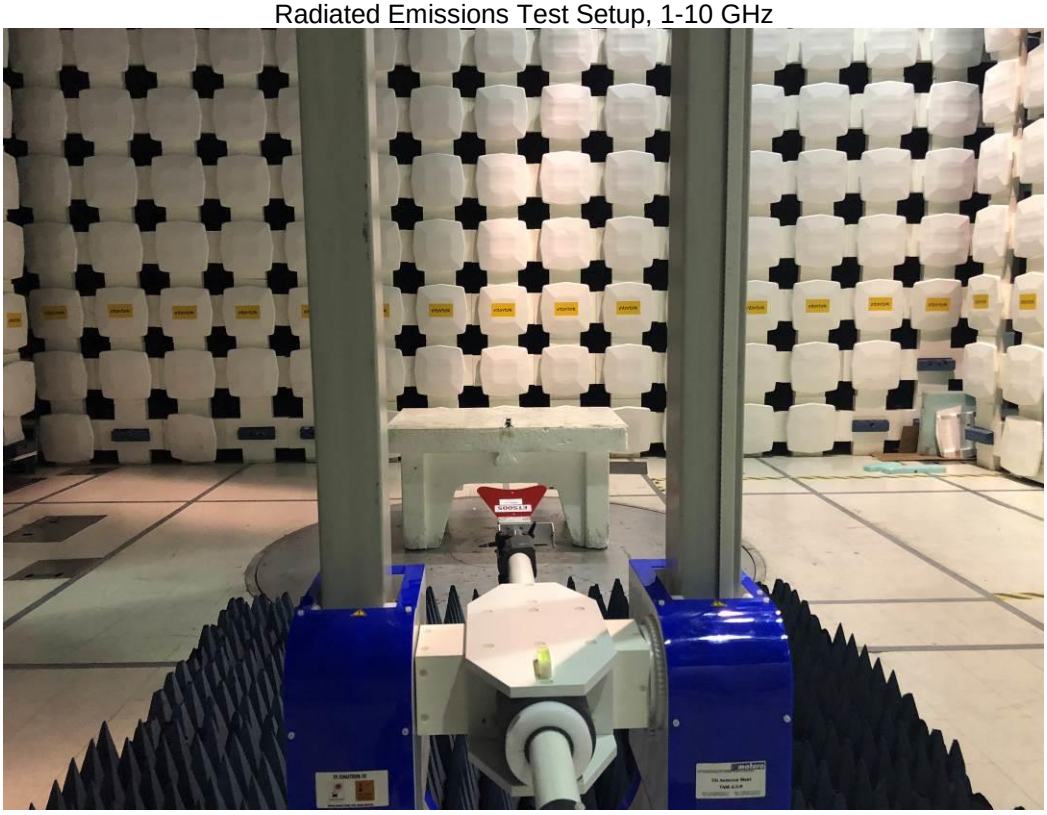
Frequency of emission (MHz)	Field strength (microvolts/meter)	Field strength (dBµV/m)
30-88	100	40.00
88-216	150	43.52
216-960	200	46.02
Above 960	500	54.00

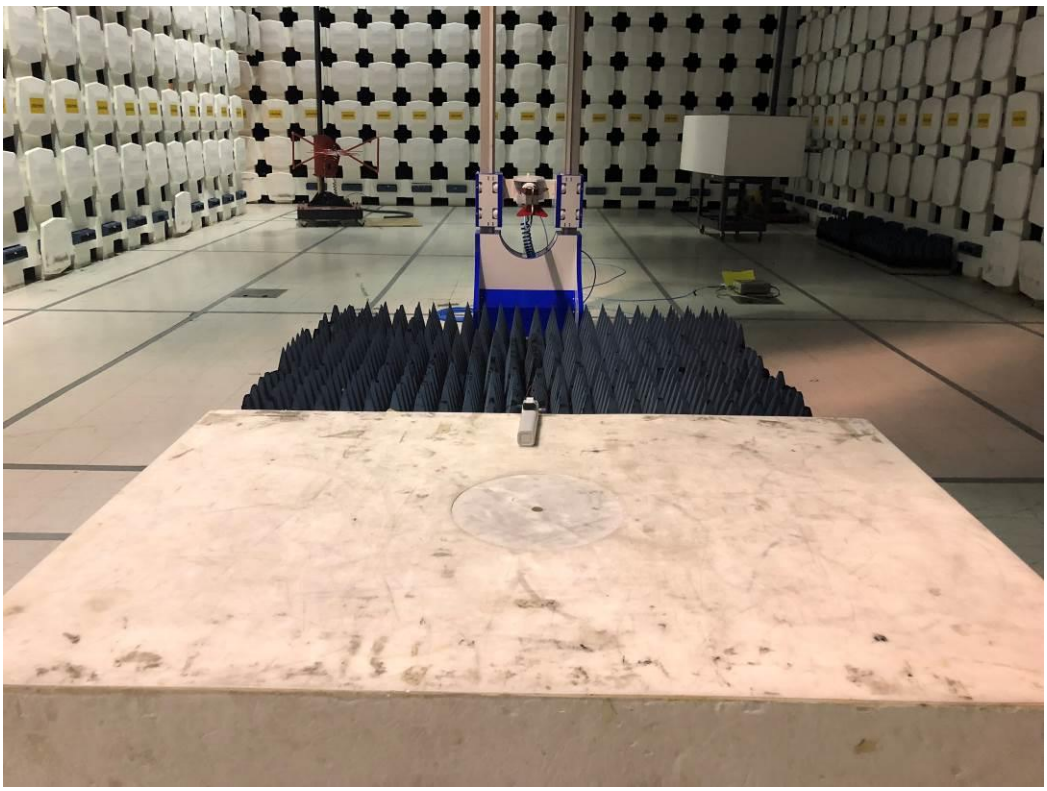
11.4 Setup Photographs:

Radiated Emissions Test Setup, 30-1000 MHz



Radiated Emissions Test Setup, 1-10 GHz





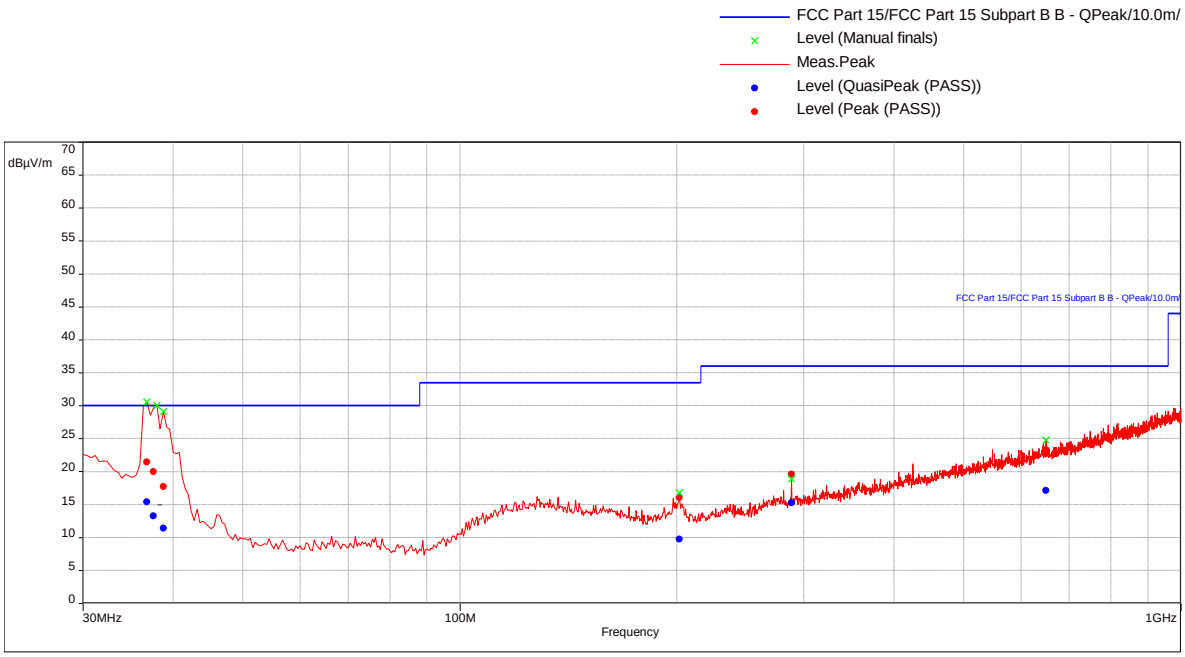
11.5 Plots/Data:

915 MHz Case, Receive Mode, 30-1000MHz

Test Information:

Date and Time	3/31/2019 3:23:47 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	29%
Atmospheric Pressure	998mbar
Comments	915 MHz Case, receive mode, X-axis, 30-1000MHz

Graph:



Results:

QuasiPeak (PASS) (6)

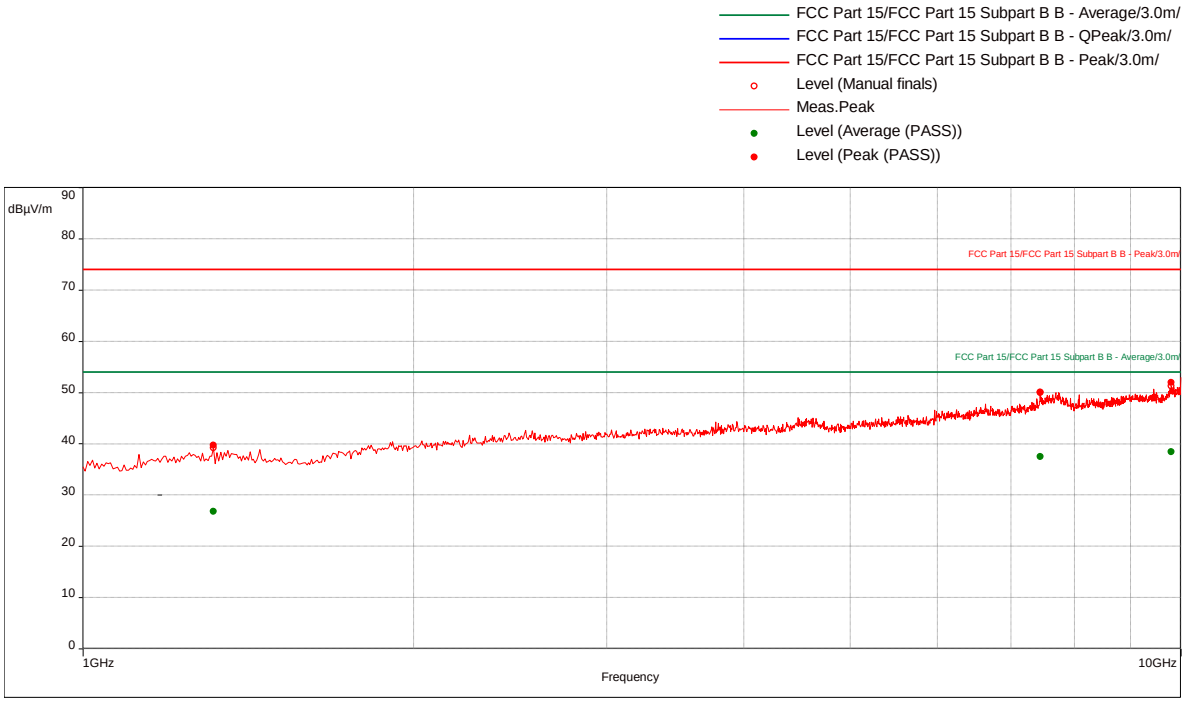
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
36.89473684	15.37	30.00	-14.63	88.00	2.18	Vertical	120000.00	-16.26
37.49473684	13.27	30.00	-16.73	69.00	1.74	Vertical	120000.00	-16.74
38.83157895	11.39	30.00	-18.61	49.00	3.21	Vertical	120000.00	-17.71
201.6315789	9.73	33.50	-23.77	42.00	1.65	Vertical	120000.00	-18.74
288.5578947	15.24	36.00	-20.76	10.00	2.83	Horizontal	120000.00	-17.79
650.2736842	17.12	36.00	-18.88	54.00	1.52	Vertical	120000.00	-9.60

915 MHz Case, Receive Mode, 1 to 10 GHz

Test Information:

Date and Time	3/30/2019 12:28:01 PM
Client and Project Number	Renovia
Engineer	Kouma Sinn
Temperature	21C
Humidity	27%
Atmospheric Pressure	1011mbar
Comments	915 MHz Case Receive Mode, X-axis (Side Battery on Top), 1 to 10 GHz

Graph:



Results:

Peak (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1316.052632	39.73	74.00	-34.27	147.00	3.84	Horizontal	1000000.00	-4.91
7445.263158	49.97	74.00	-24.03	133.00	1.00	Horizontal	1000000.00	10.73
9800.526316	51.93	74.00	-22.07	341.00	1.05	Horizontal	1000000.00	12.15

Average (PASS) (3)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°) (dB)	Height (m) (dB)	Pol. (dB)	RBW (dB)	Correction (dB)
1316.052632	26.76	54.00	-27.24	147.00	3.84	Horizontal	1000000.00	-4.91
7445.263158	37.44	54.00	-16.56	133.00	1.00	Horizontal	1000000.00	10.73
9800.526316	38.38	54.00	-15.62	341.00	1.05	Horizontal	1000000.00	12.15

Test Personnel:	Kouma Sinn KPS	Test Date:	03/30/2019, 03/31/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247 RSS-247	Limit Applied:	See report section 11.3
Input Voltage:	Internal Battery	Ambient Temperature:	21, 21 ºC
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Relative Humidity:	27, 29 %
		Atmospheric Pressure:	998 mbars

Deviations, Additions, or Exclusions: None

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	07/12/2019	103511832BOX-012c	KPS	MFM	Original Issue