

SIMBEX LLC

TEST REPORT

SCOPE OF WORK

EMISSIONS TESTING – ELECTRONIC PLAYER UNIT

REPORT NUMBER

103976876BOX-001

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EMISSIONS TEST REPORT (FULL COMPLIANCE)

Report Number: 103976876BOX-001
Project Number: G103976876

Report Issue Date: October 8, 2019

Model(s) Tested: Electronic Player Unit

Model(s) Partially Tested: None

Model(s) Not Tested but declared equivalent by the client: None

Standards: CFR47 FCC Part 15.247 Subpart C: 10/2019,
CFR47 FCC Part 15 Subpart B: 10/2019,
RSS-247 Issue 2 February 2017,
ICES-003 Issue 6 Published: January 2016 Updated: April 2019,
RSS-Gen Issue 5 April 2018,
RSS-102 Issue 5 March 2015
558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

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

Client:
SIMBEX LLC
10 Water Street Suite 410
Lebanon, NH 03766
USA

Report prepared by



Kenneth Lee / Project Engineer

Report reviewed by



Kouma Sinn / EMC Staff Engineer

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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 was found Compliant with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) 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:10/2019, 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: 10/2019, Section 15.247 (a)(2) RSS-247 Issue 2 February 2017	Pass
8	Maximum Power Spectral Density CFR47 FCC Part 15 Subpart C: 10/2019, Section 15.247 (e) RSS-247 Issue 2 February 2017	Pass
9	Band Edge Compliance CFR47 FCC Part 15 Subpart C: 10/2019, Section 15.247 (d) RSS-247 Issue 2: 02/2017)	Pass
10	Transmitter spurious emissions CFR47 FCC Part 15 Subpart C: 10/2019, 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: 10/2019, ICES-003 Issue 6 Published: January 2016 Updated: April 2019	Pass
--	AC Mains Conducted Emissions FCC 47CFR Part 15.107: 10/2019 ICES-003 Issue 6 Published: January 2016 Updated: April 2019	N/A*
12	Revision History	--

Notes: * The EUT is battery powered only and has no connection to the AC mains.

3 Client Information

This EUT was tested at the request of:

Client: SIMBEX LLC
10 Water Street Suite 410
Lebanon, NH 03766
USA

Contact: Graham Clarke
Telephone: 603.448.2367 x319
Email: gdclarke@simbex.com

4 Description of Equipment Under Test and Variant Models

Manufacturer: SIMBEX LLC
10 Water Street Suite 410
Lebanon, NH 03766
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Electronic Player Unit	SIMBEX LLC	Electronic Player Unit	0200065505
Electronic Player Unit	SIMBEX LLC	Electronic Player Unit	0200030631

Receive Date:	08/21/2019
Received Condition:	Good
Type:	Production

Description of Equipment Under Test (provided by client)

The equipment under test is an Electronic Player Unit.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
3 VDC	N/A	N/A	N/A

Operating modes of the EUT:

No.	Descriptions of EUT Exercising
1	Tx mode
2	Rx mode

Software used by the EUT:

No.	Descriptions of EUT Exercising
1	N/A

Radio/Receiver Characteristics	
Frequency Band(s)	2410-2480 MHz
Modulation Type(s)	ZigBee
Maximum Output Power	8.34 dBm (Conducted Power)
Test Channels	Low (2410 MHz) Mid (2450 MHz) High (2480 MHz)
Occupied Bandwidth	Low (2410 MHz) = 2.591 MHz Mid (2450 MHz) = 2.586 MHz High (2480 MHz) = 2.595 MHz
6 dB Bandwidth	Low (2410 MHz) = 1.62 MHz Mid (2450 MHz) = 1.63 MHz High (2480 MHz) = 1.65 MHz
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)	N/A
Equipment Type	Standalone
Antenna Type and Gain	Integral, 0 dBi

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

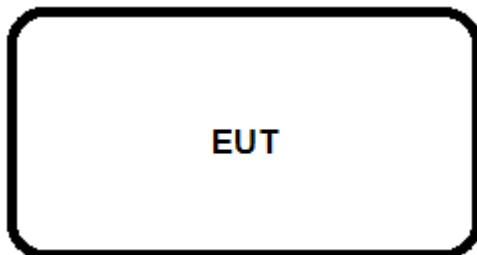
5 System Setup and Method

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

Support Equipment			
Description	Manufacturer	Model Number	Serial Number
None	N/A	N/A	N/A

5.1 Method:

Configuration as required by Configuration as required by FCC Part 15 Subpart C 15.247: 10/2019, FCC Part 15 Subpart B: 10/2019, RSS 247 Issue 2: 02/2017, ICES 003 Issue 6: 01/2016 updated 06/2016, RSS-Gen Issue 5 April 2018, RSS-102 Issue 5 March 2015, ANSI C 63.10: 2013, ANSI C 63.4: 2014, 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019.

5.2 EUT Block Diagram:

6 Maximum Peak Output Power and SAR Exclusion Calculations

6.1 Method

Tests are performed in accordance with CFR47 FCC Part 15.247, RSS-247, RSS-102, ANSI C63.10, 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019.

TEST SITE: EMC Lab and 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

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	5.6 dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.9 dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.4 dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.9 dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.6 dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.6 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 $\text{dB}\mu\text{V}/\text{m}$

RA = Receiver Amplitude (including preamplifier) in $\text{dB}\mu\text{V}$

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 $\text{dB}\mu\text{V}$ 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 $\text{dB}\mu\text{V}/\text{m}$. This value in $\text{dB}\mu\text{V}/\text{m}$ was converted to its corresponding level in $\mu\text{V}/\text{m}$.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}/\text{m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V}/\text{m}$$

To convert from $\text{dB}\mu\text{V}$ to μV or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in } \text{dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V}/\text{m}$$

6.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	02/01/2019	02/01/2020
CBLHF2012-2M-1'	2m 9Khz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/01/2019	02/01/2020
ROS005-1'	Signal and Spectrum Analyzer	Rohde & Schwarz	FSW43	100646	10/15/2018	10/15/2019
DS40'	Temp, humidity, pressure gauge	Digi Sense	68000-49	181717625	11/06/2018	11/06/2019

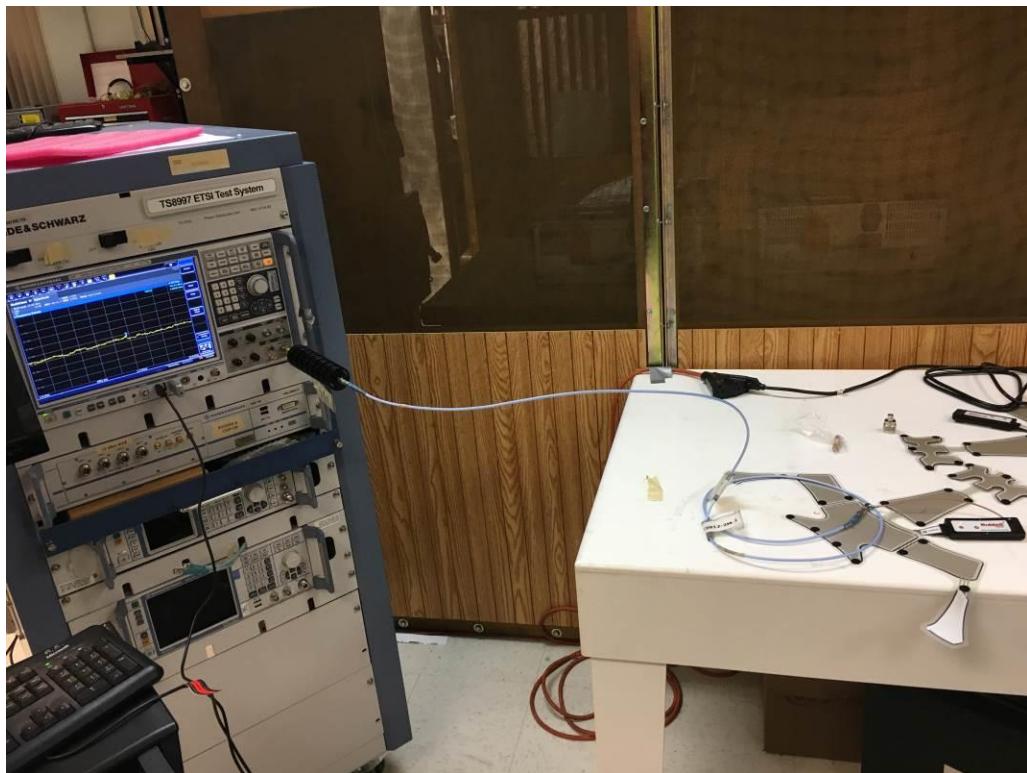
Software Utilized:

Name	Manufacturer	Version
None	--	--

6.3 Results:

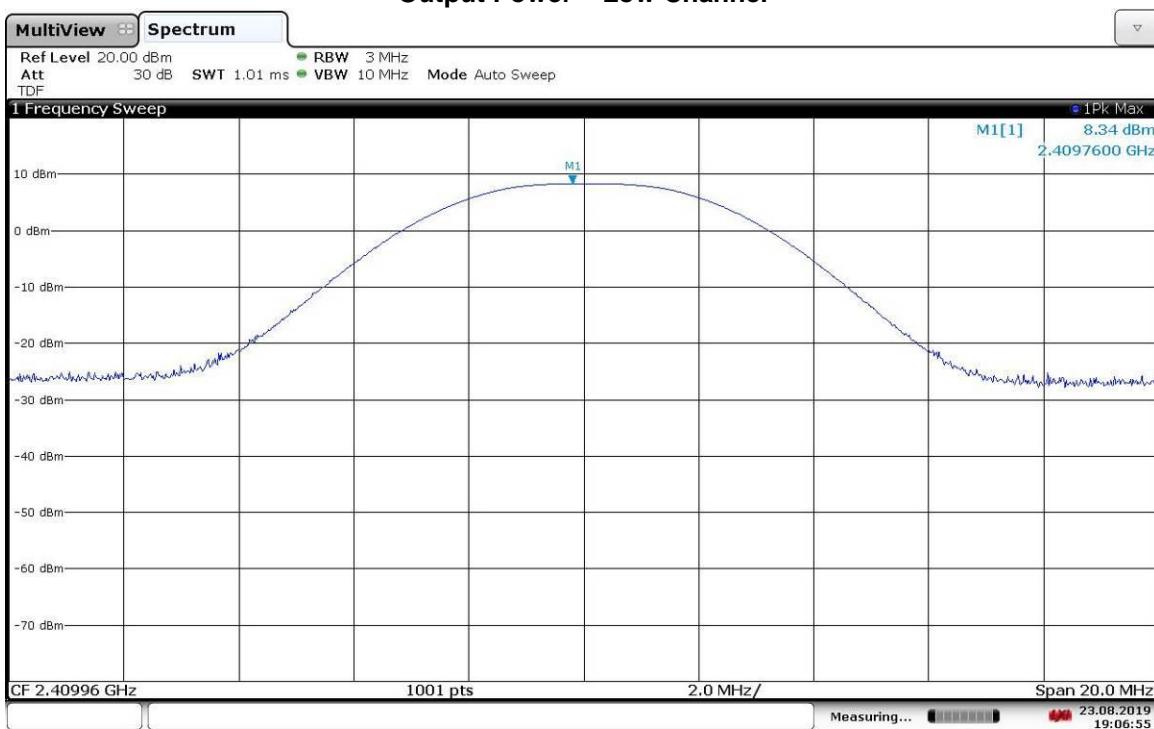
The sample tested was found to Comply.

§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.

6.4 Setup Photograph:

6.5 Plots/Data:

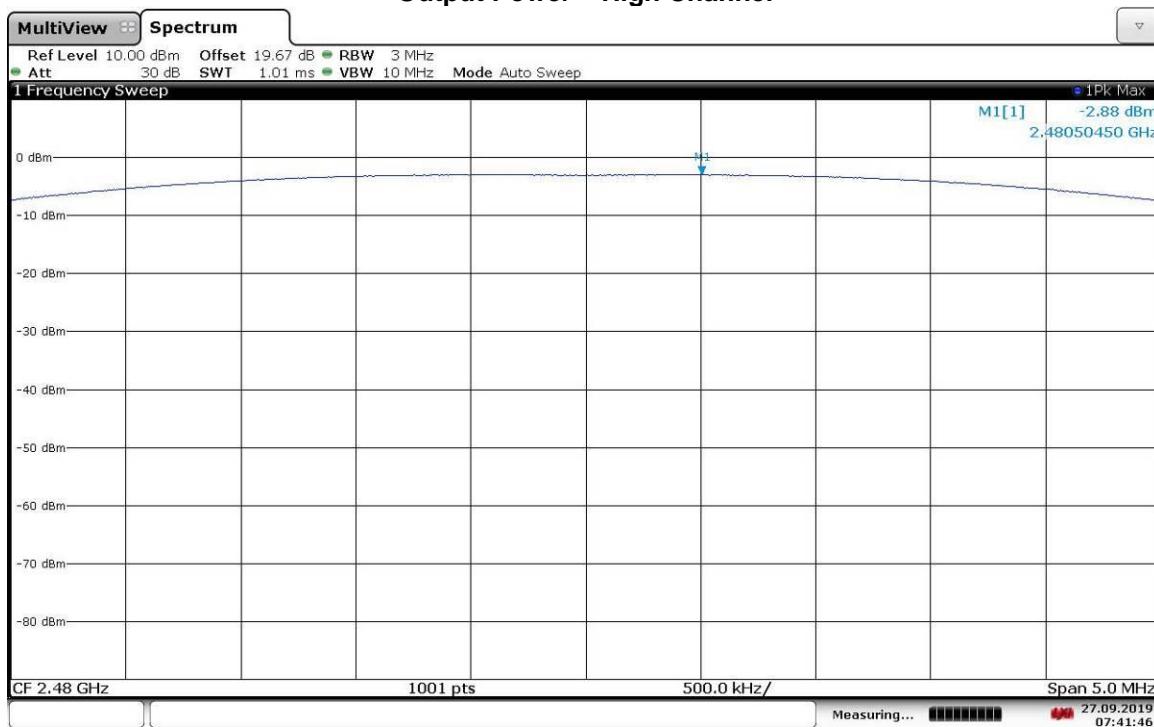
Output Power – Low Channel



Output Power – Mid Channel



Output Power – High Channel



07:41:47 27.09.2019

Output Power and EIRP

Frequency (MHz)	Measured Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Limit (dBm)	Result	EIRP (mW)
2410	8.34	0	8.34	30	Pass	6.82
2445	8.13	0	8.13	30	Pass	6.5
2480	-2.88	0	-2.88	30	Pass	0.515

SAR Exclusion

RSS-102 Issue 5 2.5.1, SAR Exclusion

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

FCC SAR Exclusion per KDB 447498 D01 General RF Exposure Guidance v06

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:

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

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz

1.2 Results:

- Maximum Conducted Output Power = 8.34 dBm = 0.00682 W = 6.82 mW
- Maximum Antenna Gain = 0 dBi
- Numerical Antenna Gain = 1

Maximum Power = 6.82 mW

T_{tx} = Total Transmission Time (T_{tx} = 32.33 ms)

Dur_{tx} = Transmission Duration (Dur_{tx} = 2.0 ms)

Duty factor = Dur_{tx}/T_{tx} (duty factor = 0.062)

EIRP = $8.34\text{dBm} + 0\text{dBi} \times 0.062 = 0.5171\text{dBm} = 1.13 \text{ mW}$

Minimum Separation = 5mm

Test Frequency = 2.41 GHz

$$\frac{6.82 \text{ mW}}{5 \text{ mm}} \times \sqrt{2.41} = 2.117497429$$

FCC 1.1310 SAR Exclusion has been met as the total, found above, is less than 3.0.

ISED RSS-102 SAR Exclusion has been met as the total EIRP is less than 4 mW.

Test Personnel:	Vathana Ven <i>VJV</i>	Test Date:	08/23/2019
Supervising/Reviewing Engineer:	Kenneth Lee <i>[Signature]</i>		09/30/2019
(Where Applicable)	N/A		
Product Standard:	CFR47 FCC Part 15.247	Limit Applied:	See report section 6.3
	RSS-247, RSS-102		
Input Voltage:	Battery power	Ambient Temperature:	22 °C
Pretest Verification w/ Ambient Signals or BB Source:	N/A	Relative Humidity:	62 %
		Atmospheric Pressure:	1010 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: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

7.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	02/01/2019	02/01/2020
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/01/2019	02/01/2020
ROS005-1'	Signal and Spectrum Analyzer	Rohde & Schwarz	FSW43	100646	10/15/2018	10/15/2019
DS40'	Temp, humidity, pressure gauge	Digi Sense	68000-49	181717625	11/06/2018	11/06/2019

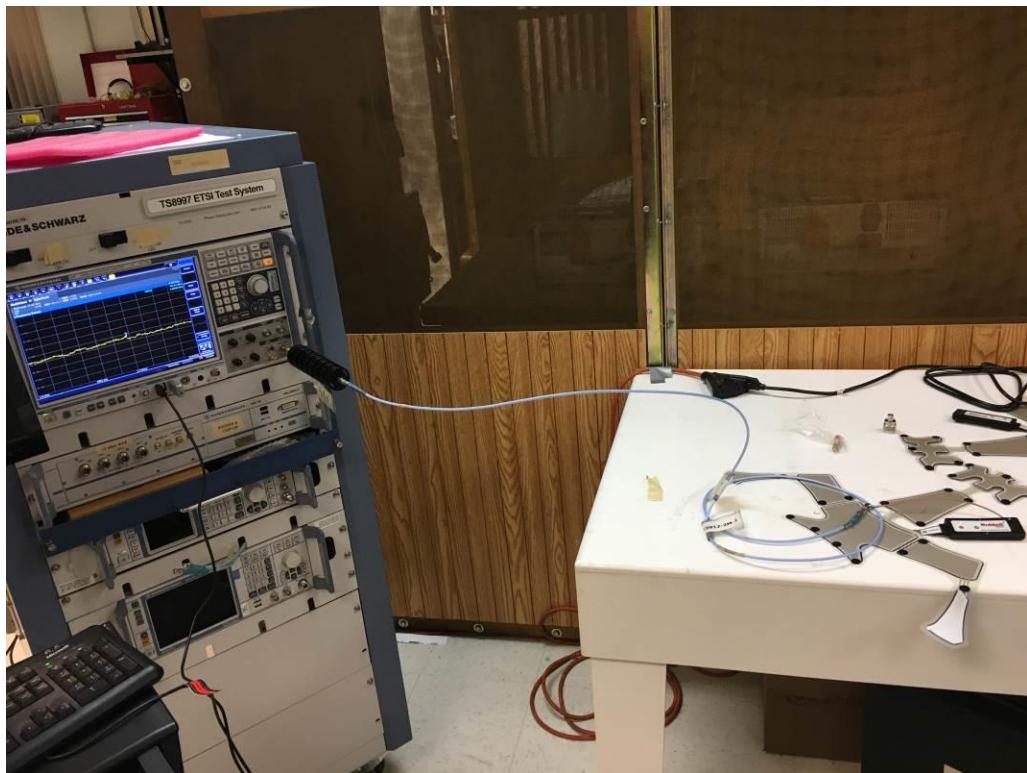
Software Utilized:

Name	Manufacturer	Version
None	--	--

7.3 Results:

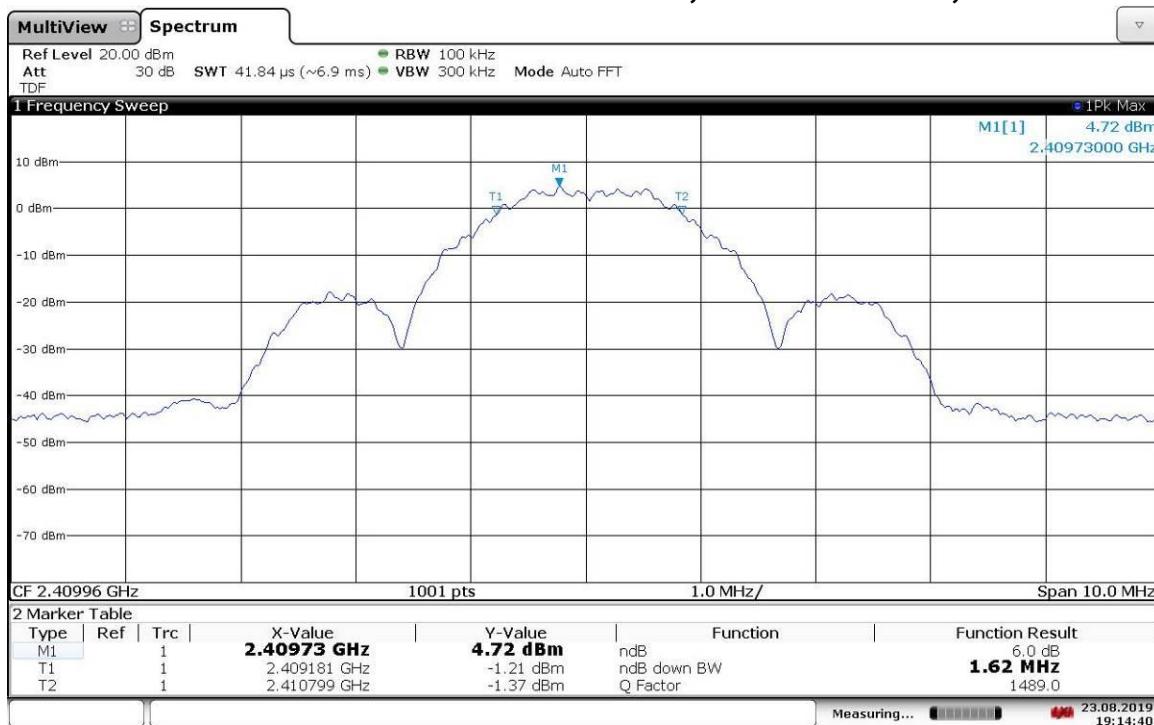
The sample tested was found to Comply.

§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:

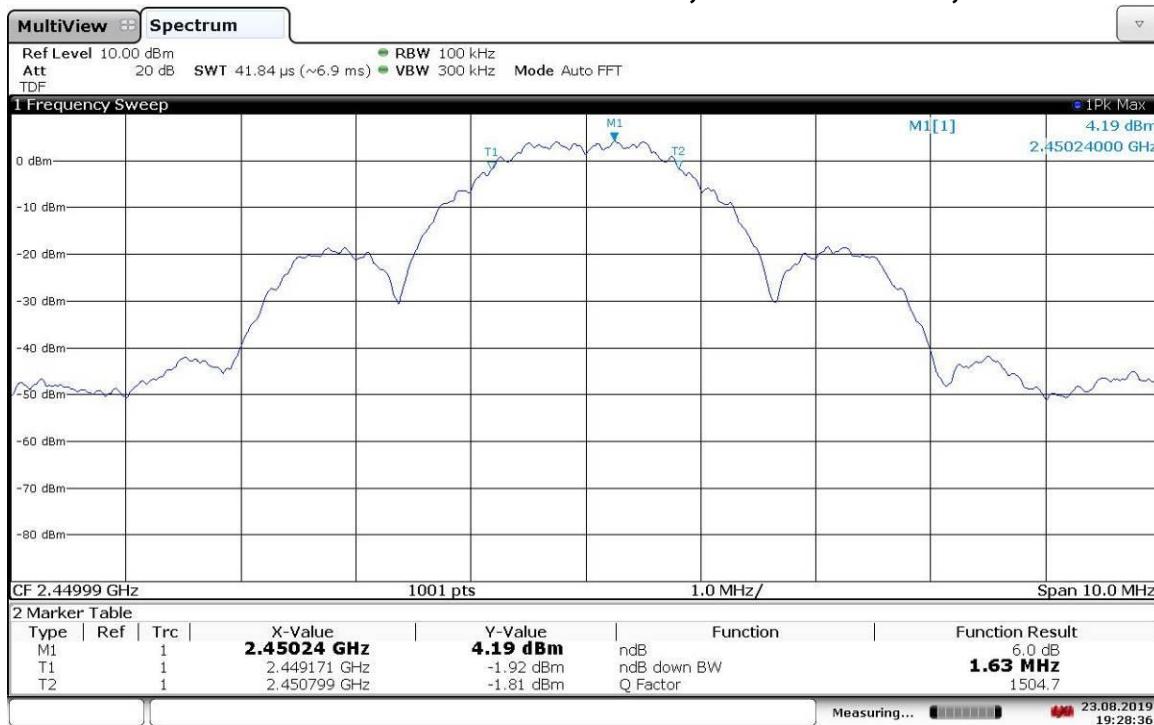
7.5 Plots/Data:

Minimum Emission Bandwidth 6 dB, Low Channel, 1.62 MHz



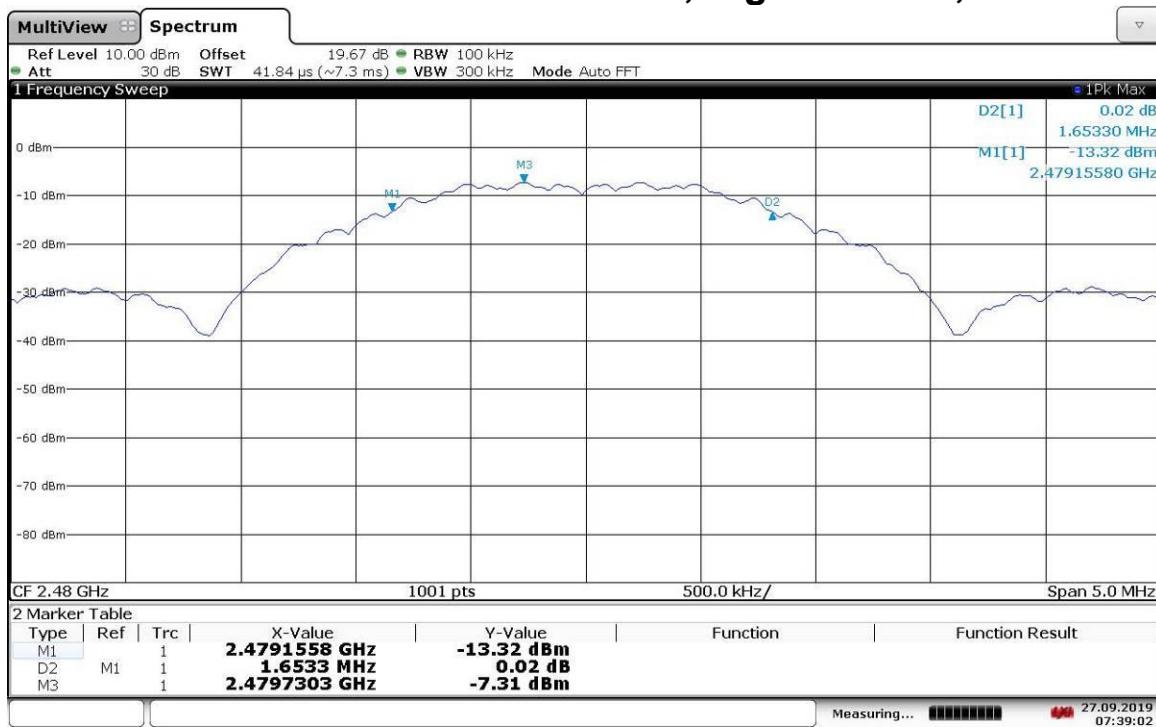
19:14:40 23.08.2019

Minimum Emission Bandwidth 6 dB, Low Channel, 1.63 MHz



19:28:37 23.08.2019

Minimum Emission Bandwidth 6 dB, High Channel, 1.65 MHz



07:39:03 27.09.2019

Occupied Bandwidth, Low Channel, 2.591 MHz



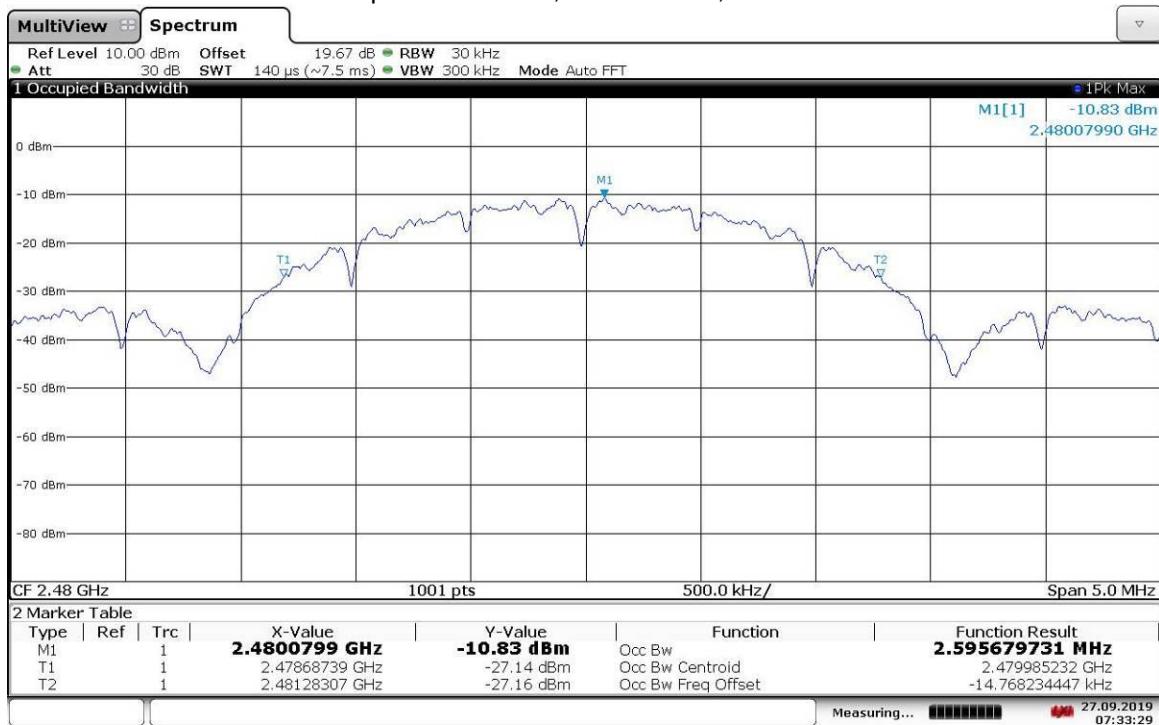
19:11:13 23.08.2019

Occupied Bandwidth, Mid Channel, 2.586 MHz



19:30:06 23.08.2019

Occupied Bandwidth, Mid Channel, 2.595 MHz



07:33:29 27.09.2019

6 dB Bandwidth

Frequency (MHz)	Measured Bandwidth (MHz)	Limit	Result
2410	2.591	≥500 kHz	Pass
2445	2.586	≥500 kHz	Pass
2480	2.595	≥500 kHz	Pass

Occupied Bandwidth

Frequency (MHz)	Measured Bandwidth (MHz)	Result
2410	1.62	Pass
2445	1.63	Pass
2480	1.65	Pass

Test Personnel: Vathana Ven *VJV* Test Date: 08/23/2019
 Supervising/Reviewing
 Engineer:
 (Where Applicable) N/A
 Product Standard: CFR47 FCC Part 15.247 Limit Applied: See report section 7.3
 Input Voltage: RSS-247, RSS-102
 Pretest Verification w/
 Ambient Signals or
 BB Source: Battery power Ambient Temperature: 22 °C
N/A Relative Humidity: 62 %
 Atmospheric Pressure: 1010 mbars

Deviations, Additions, or Exclusions: The occupied bandwidth was not performed at this time.

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: EMC Lab

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

8.2 Test Equipment Used:

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	02/01/2019	02/01/2020
CBLHF2012-2M-1'	2m 9KHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/01/2019	02/01/2020
ROS005-1'	Signal and Spectrum Analyzer	Rohde & Schwarz	FSW43	100646	10/15/2018	10/15/2019
DS40'	Temp, humidity, pressure gauge	Digi Sense	68000-49	181717625	11/06/2018	11/06/2019

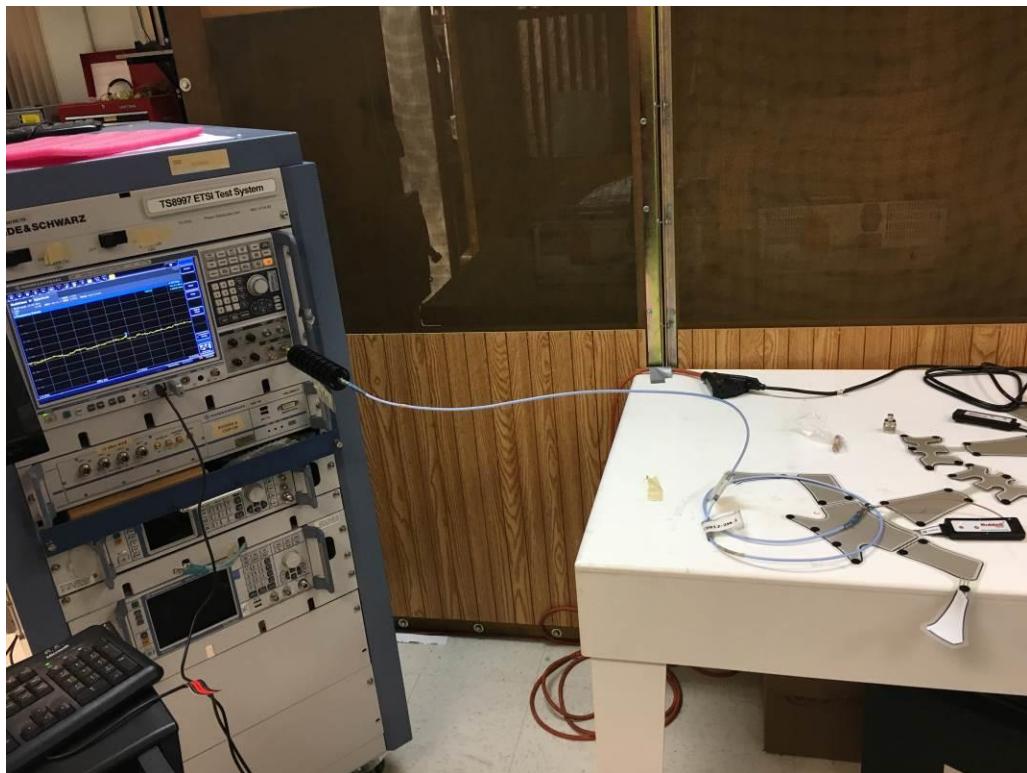
Software Utilized:

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:

Power Spectral Density, High Channel



07:43:37 27.09.2019

Power Spectral Density

Frequency (MHz)	Measured PSD (dBm)	Limit (dBm)	Result
2410	-2.52	8	Pass
2445	-3.25	8	Pass
2480	-14.41	8	Pass

Test Personnel: Vathana Ven *VJV*
 Supervising/Reviewing
 Engineer:
 (Where Applicable) N/A
 Product Standard: CFR47 FCC Part 15.247
 Input Voltage: RSS-247, RSS-102
 Pretest Verification w/
 Ambient Signals or
 BB Source: Battery power *N/A*

Test Date: 08/23/2019
 Limit Applied: See report section 8.3
 Ambient Temperature: 22 °C
 Relative Humidity: 62 %
 Atmospheric Pressure: 1010 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, ANSI C 63.10, and ANSI C 63.4.

TEST SITE: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

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 dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

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 dB μ V 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 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V/m}$$

To convert from dB μ V to μ V or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V/m}$$

9.2 Test Equipment Used:

Equipment used for conducted measurements in EMC Lab

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	02/01/2019	02/01/2020
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/01/2019	02/01/2020
ROS005-1'	Signal and Spectrum Analyzer	Rohde & Schwarz	FSW43	100646	10/15/2018	10/15/2019
DS40'	Temp, humidity, pressure gauge	Digi Sense	68000-49	181717625	11/06/2018	11/06/2019

Software Utilized:

Name	Manufacturer	Version
None	--	--

Equipment used for radiated measurements in 10m chamber

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	01/23/2019	01/23/2020
EMC02'	ANTENNA, RIDGED GUIDE, 1-18 GHZ	EMCO	3115	2784	08/16/2018	08/16/2019
145128'	EMI Receiver (20 Hz - 40 Gzh)	Rohde & Schwarz	ESIB 40	839283/001	03/28/2019	03/28/2020
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
None	--	--

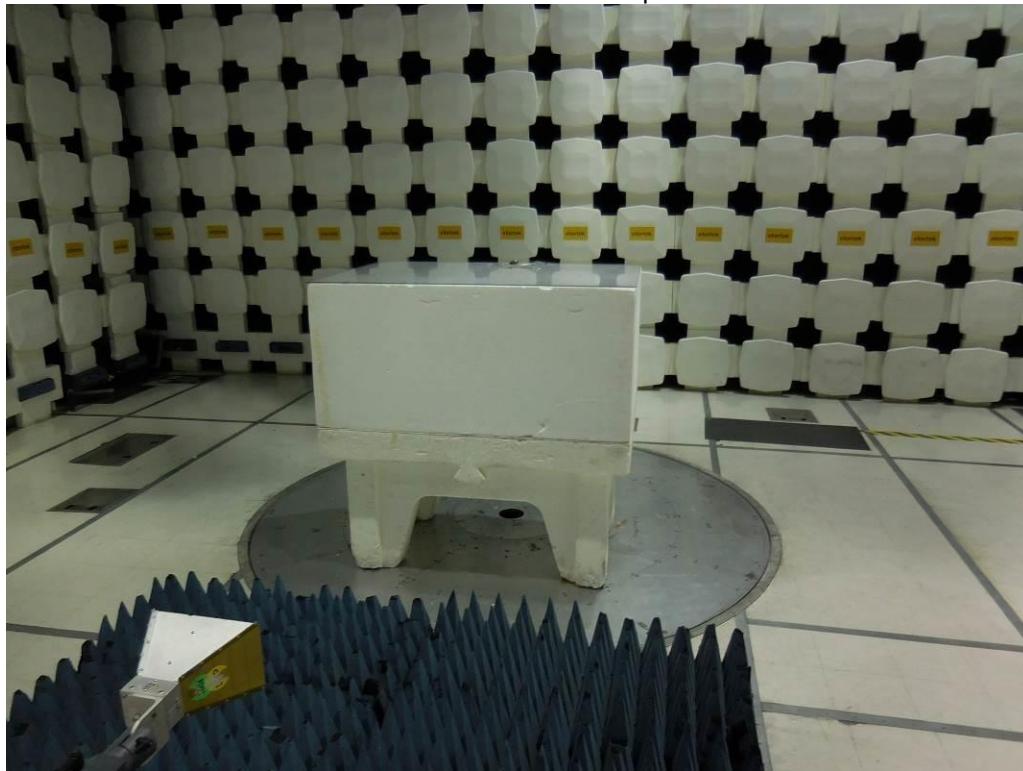
9.3 Results:

The sample tested was found to comply.

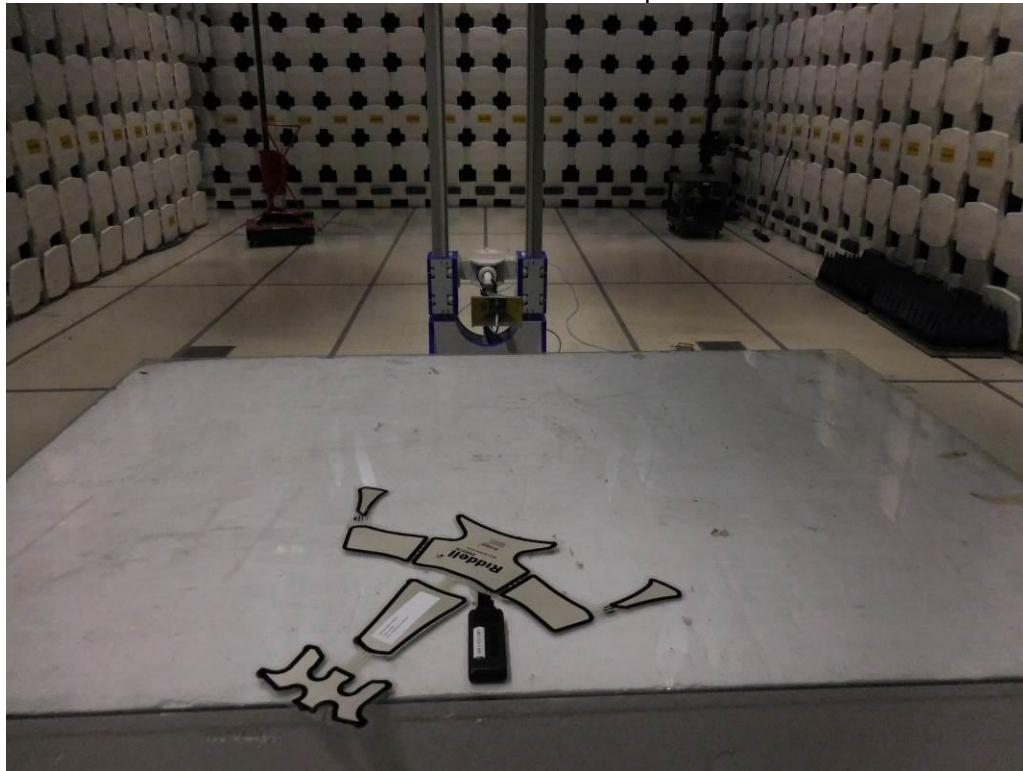
15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that 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 Photographs:

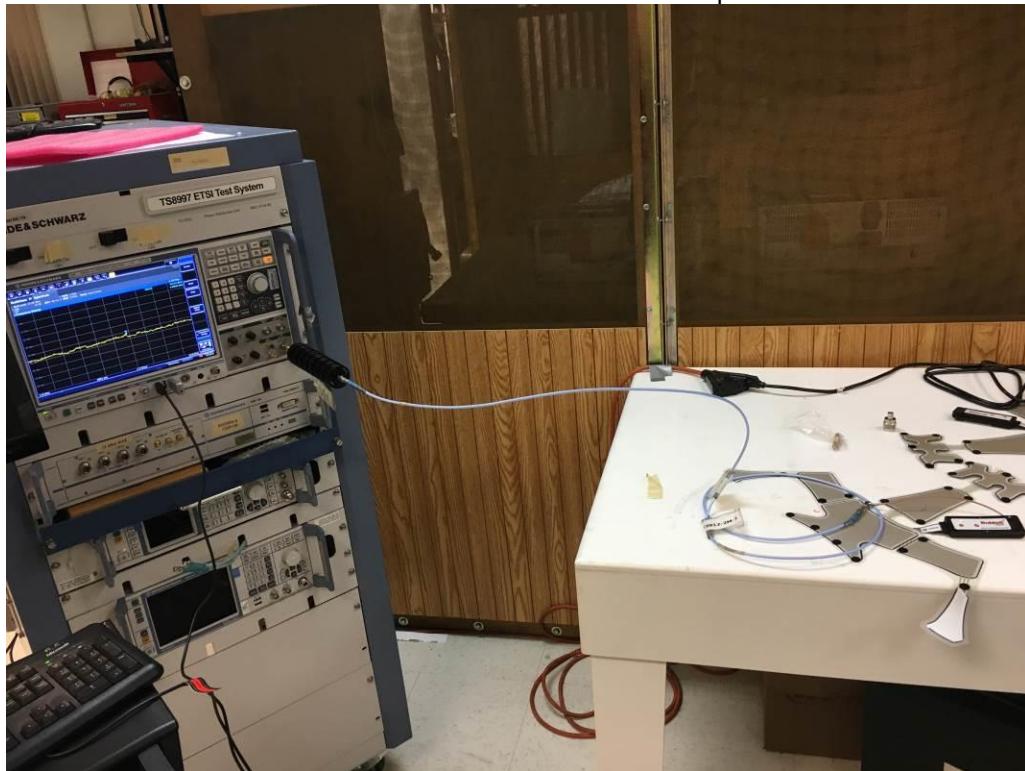
Radiated Emissions Test Setup – Front



Radiated Emissions Test Setup – Rear

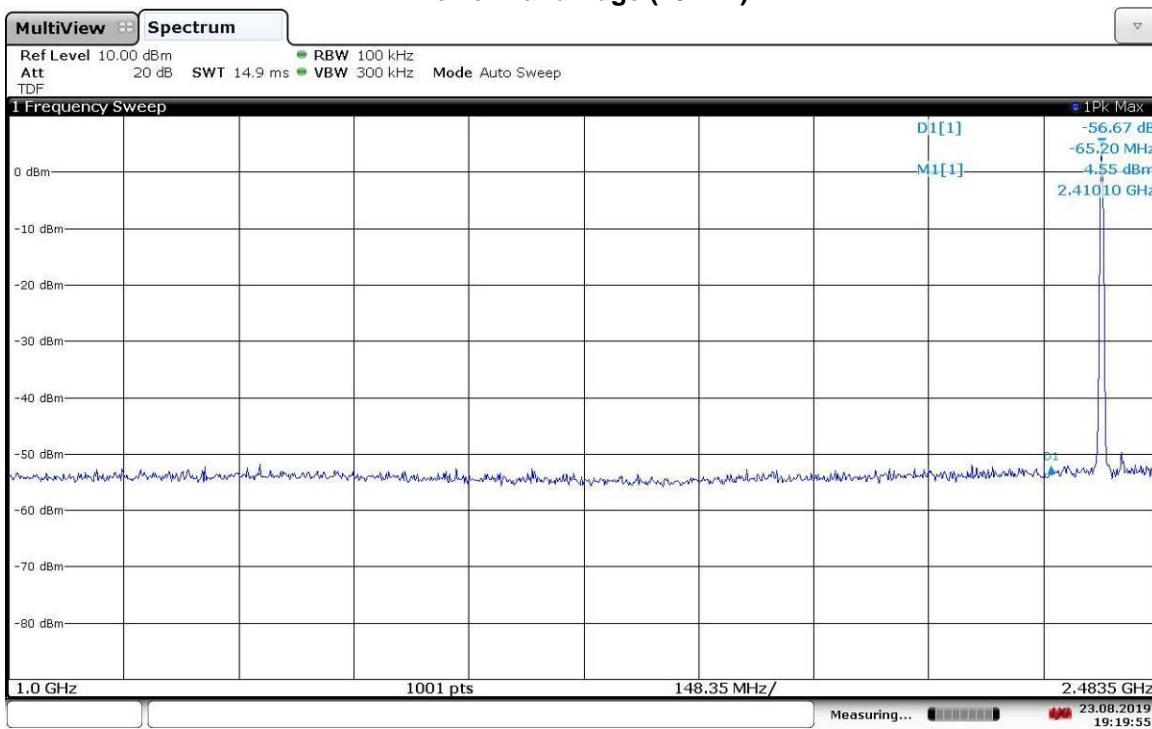


Antenna Port Conducted Test Setup



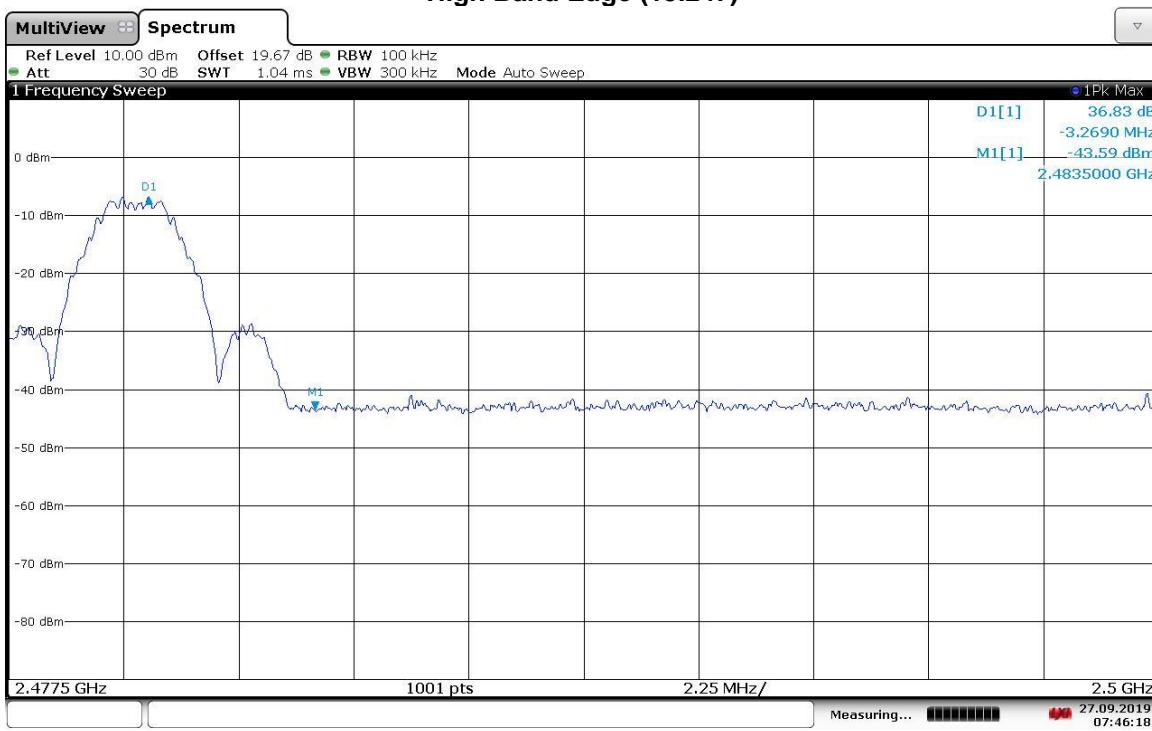
9.5 Plots/Data:

Lower Band Edge (15.247)



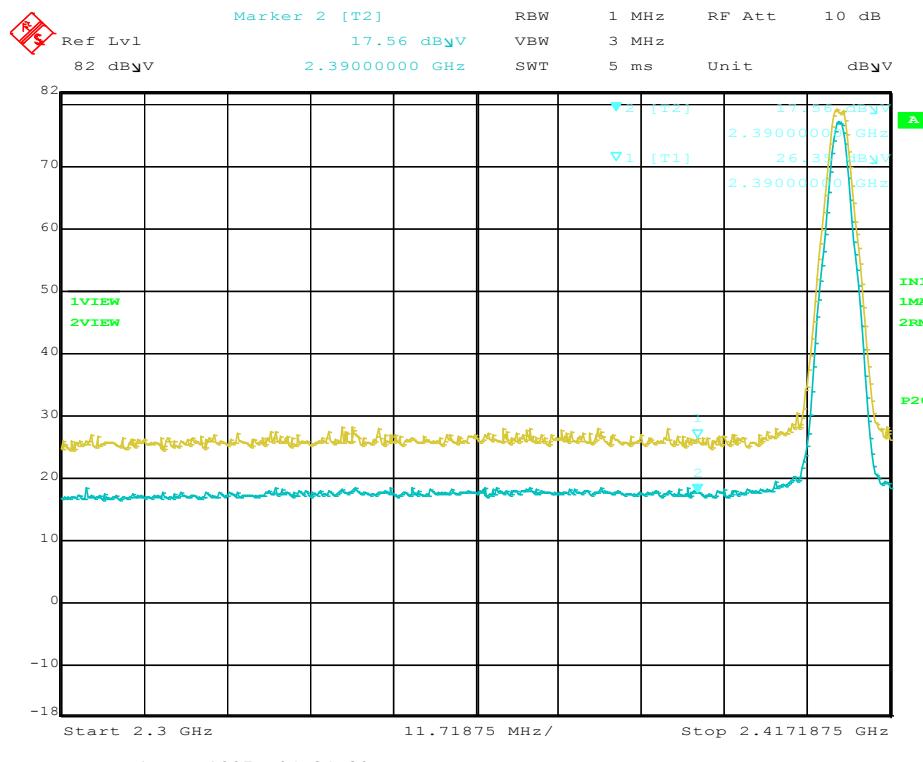
19:19:55 23.08.2019

High Band Edge (15.247)

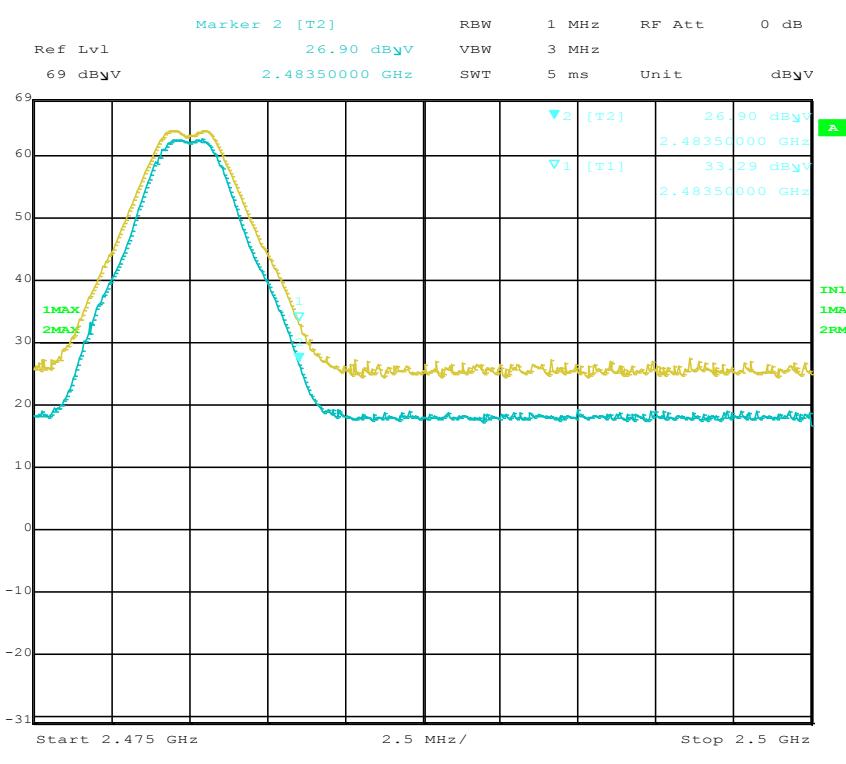


07:46:19 27.09.2019

Lower Band Edge (15.209)



High Band Edge (15.209)



Band Edge Compliance Corrected Readings

Project #:	G103976876		Date(s):	09/27/19													
Standard:	FCC Part 15.247						Temp/Humidity/Pressure:	24 deg C	53%	1002 mB							
Receiver:	R&S ESI (145-128) 03-28-2019						Limit Distance (m):	3									
PreAmp:	NONE.						Test Distance (m):	1									
PreAmp Used? (Y or N):	N		Voltage/Frequency:	120VAC 60Hz		Frequency Range:	See below										
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	Ant.	Pol.	Frequency	Reading	Antenna Factor	Cable Loss	Pre-amp Factor	Distance Factor	Net	Limit	Margin	Bandwidth					
Type	(V/H)		MHz	dB(uV)	dB(1/m)	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB						
Lower BEC																	
PK	H	2390.000	26.33	28.35	6.49	0.00	9.54	51.63	74.00	-22.37	1/3 MHz						
AVG	H	2390.000	17.36	28.35	6.49	0.00	9.54	42.66	54.00	-11.34	1/3 MHz						
Upper BEC																	
PK	H	2483.500	33.29	28.77	6.44	0.00	9.54	58.96	74.00	-15.04	1/3 MHz						
AVG	H	2483.500	26.90	28.77	6.44	0.00	9.54	52.57	54.00	-1.43	1/3 MHz						

Test Personnel: Kenneth Lee 
 Vathana Ven 
 Test Date: 08/22/2019,
 09/27/2019
 Supervising/Reviewing
 Engineer:
 (Where Applicable) N/A
 Product Standard: CFR47 FCC Part 15.247
 Input Voltage: RSS-247, RSS-102
 Pretest Verification w/
 Ambient Signals or
 BB Source: N/A Limit Applied: See report section 9.3
 Ambient Temperature: 23, 22 °C
 Relative Humidity: 57, 62 %
 Atmospheric Pressure: 1001, 1010 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: EMC Lab & 10m ALSE

The EMC Lab has one Semi-anechoic Chamber and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference ground-planes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

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 $\text{dB}\mu\text{V}/\text{m}$

RA = Receiver Amplitude (including preamplifier) in $\text{dB}\mu\text{V}$

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 $\text{dB}\mu\text{V}$ 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 $\text{dB}\mu\text{V}/\text{m}$. This value in $\text{dB}\mu\text{V}/\text{m}$ was converted to its corresponding level in $\mu\text{V}/\text{m}$.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}/\text{m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V}/\text{m}$$

To convert from $\text{dB}\mu\text{V}$ to μV or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in } \text{dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V}/\text{m}$$

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:

Equipment used for measurements in EMC Lab

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
CEN001'	DC-40GHz attenuator 20dB	Centric RF	C411-20	CEN001	02/01/2019	02/01/2020
CBLHF2012-2M-1'	2m 9kHz-40GHz Coaxial Cable - SET1	Huber & Suhner	SF102	252675001	02/01/2019	02/01/2020
ROS005-1'	Signal and Spectrum Analyzer	Rohde & Schwarz	FSW43	100646	10/15/2018	10/15/2019
DS40'	Temp, humidity, pressure gauge	Digi Sense	68000-49	181717625	11/06/2018	11/06/2019

Software Utilized:

Name	Manufacturer	Version
None	--	--

Equipment used for measurements in 10m Chamber

Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	01/23/2019	01/23/2020
145128'	EMI Receiver (20 Hz - 40 Ghz)	Rohde & Schwarz	ESIB 40	839283/001	03/28/2019	03/28/2020
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	10/27/2018	10/27/2019
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	06/12/2019	06/12/2020
HORN3'	HORN ANTENNA	EMCO	3115	9610-4980	05/30/2019	05/30/2020
BON001'	METER, POWER	Boonton	4232A	55601	01/23/2019	01/23/2020
REA008'	band reject filter 2.4GHz	Reactel, Inc	12RX7-2441.75-x140 S	17-01	07/11/2019	07/11/2020
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2019	07/25/2020
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	10/26/2018	10/26/2019
REA004'	3GHz High Pass Filter	Reactel, Inc	7HSX-3G/18G-S11	06-1	02/25/2019	02/25/2020
CBLSHF103'	Cable, SMA - SMA, < 18GHz	Sucoflex (Huber Suhn)	104PE	CBLSHF103	02/25/2019	02/25/2020
CBLSHF102'	Cable, SMA - SMA, 9kHz-40GHz (Cable Kit 5)	Sucoflex (Huber Suhn)	104PE	CBLSHF102	08/25/2017	10/25/2019
PRE8'	PREAMPLIFIER 1- 40 GHz	MITEQ	NSP4000-NF	507145	10/25/2018	10/25/2019

Software Utilized:

Name	Manufacturer	Version
BAT EMC (10m Chamber)	Nexio	3.18.0.16
EMI Boxborough.xls	Intertek	08/27/2010

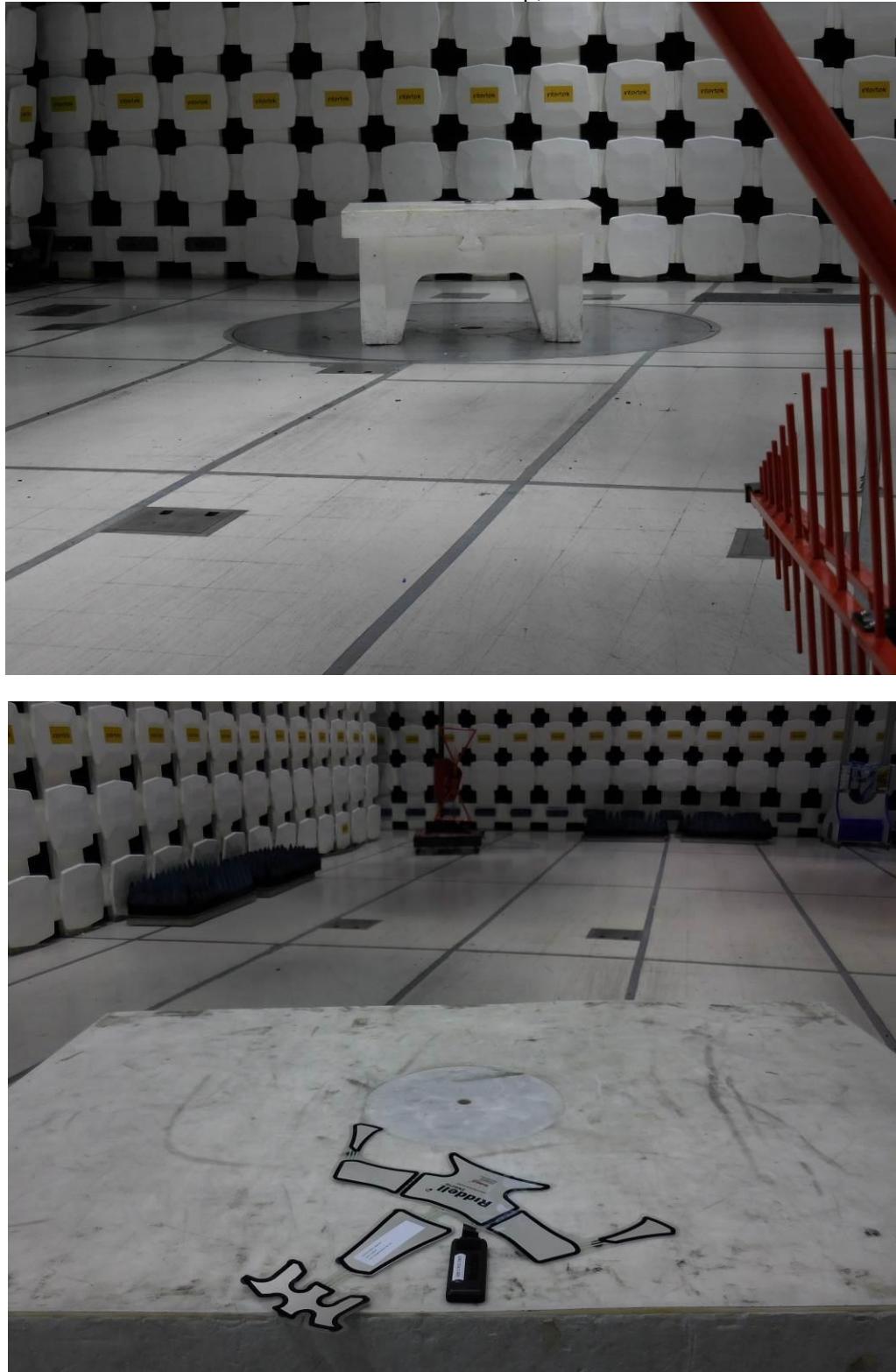
10.3 Results:

The sample tested was found to Comply.

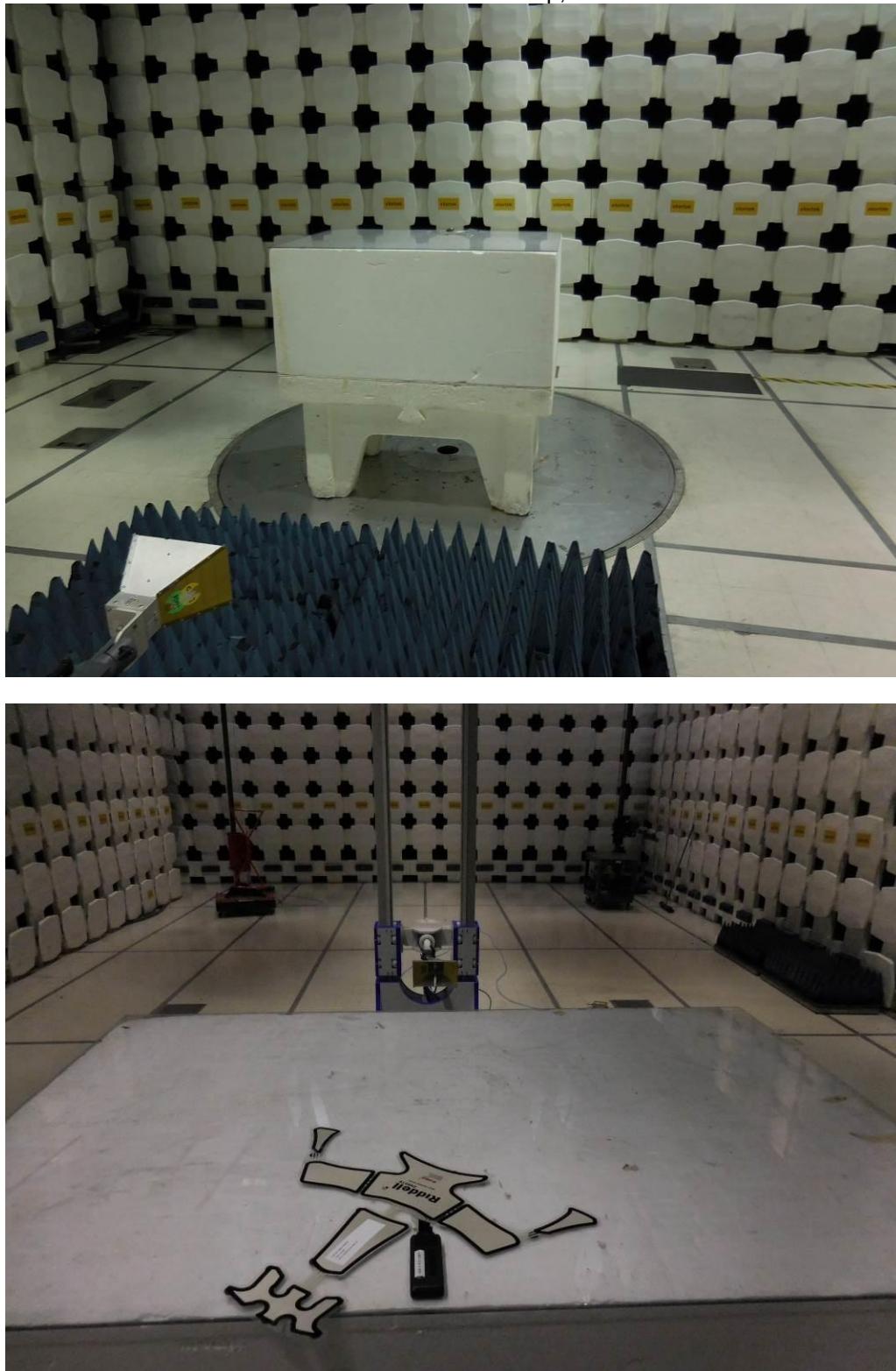
15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that 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))

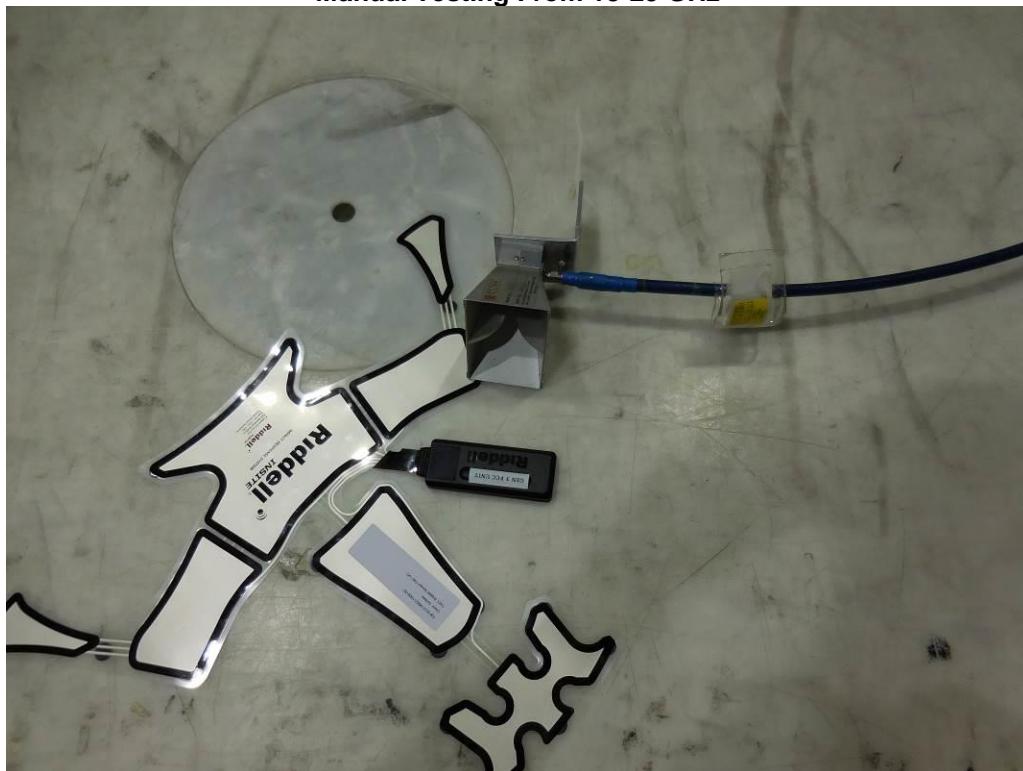
10.4 Setup Photographs:

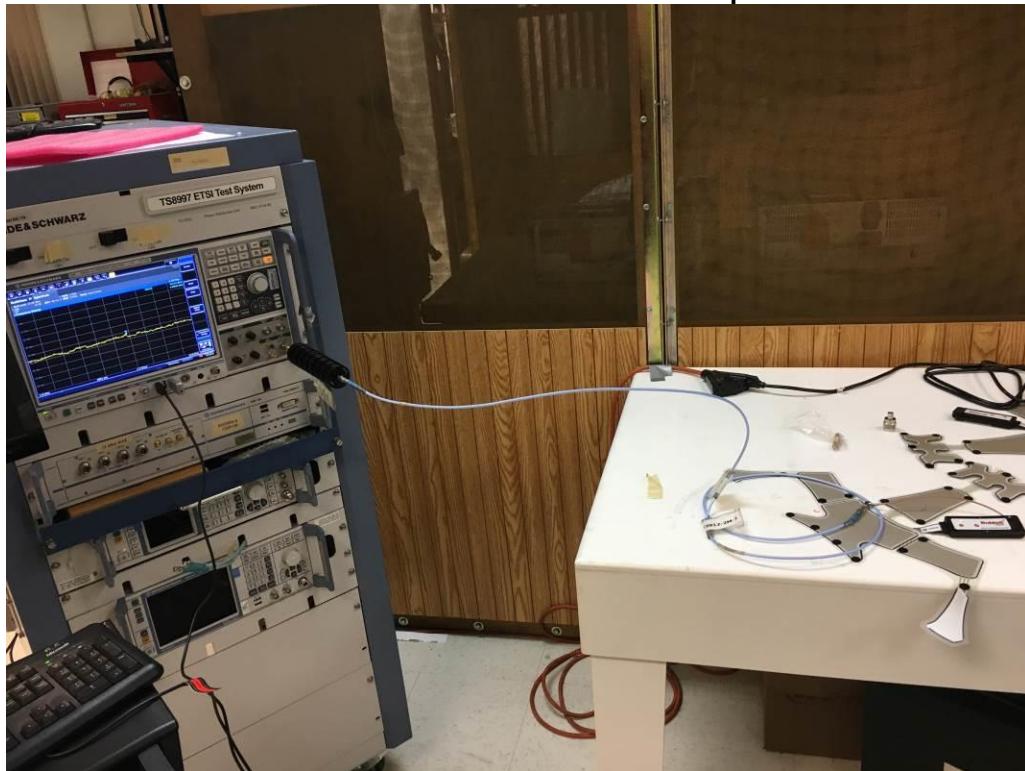
Radiated Emissions Test Setup, 30 -1000 MHz



Radiated Emissions Test Setup, 1-18 GHz



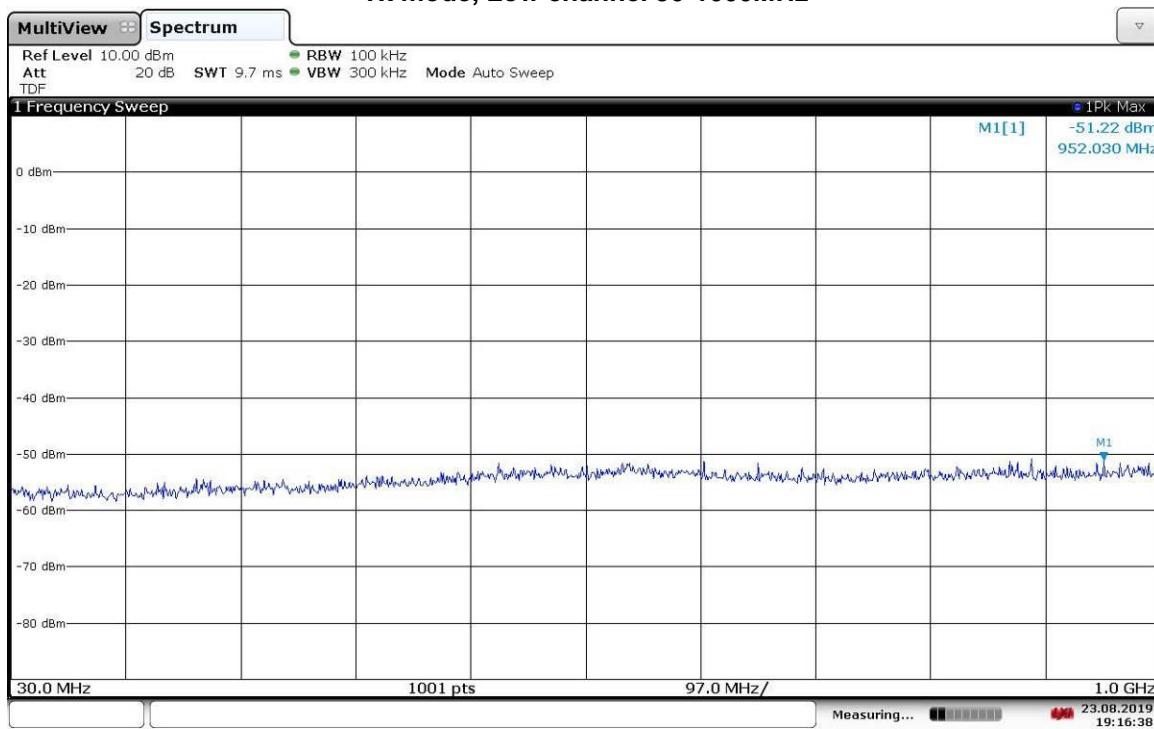
Manual Testing From 18-25 GHz

Antenna Port Conducted Test Setup

10.5 Plots/Data:

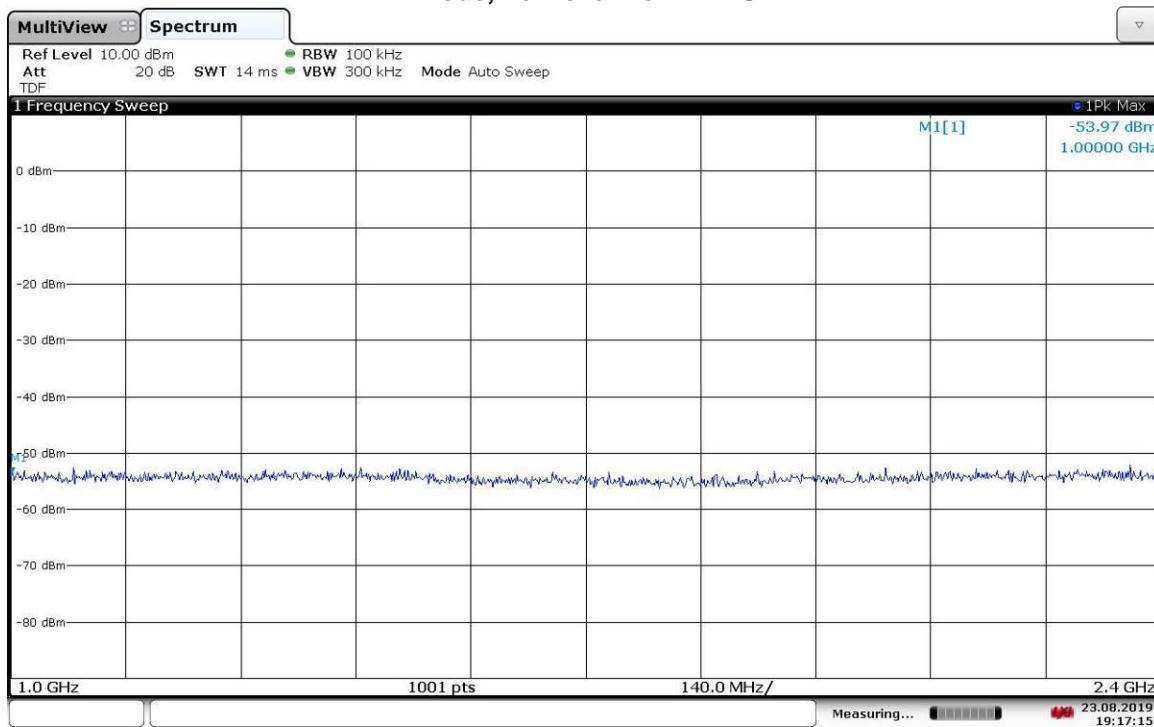
Antenna Port Conducted Spurious

Tx mode, Low channel 30-1000MHz



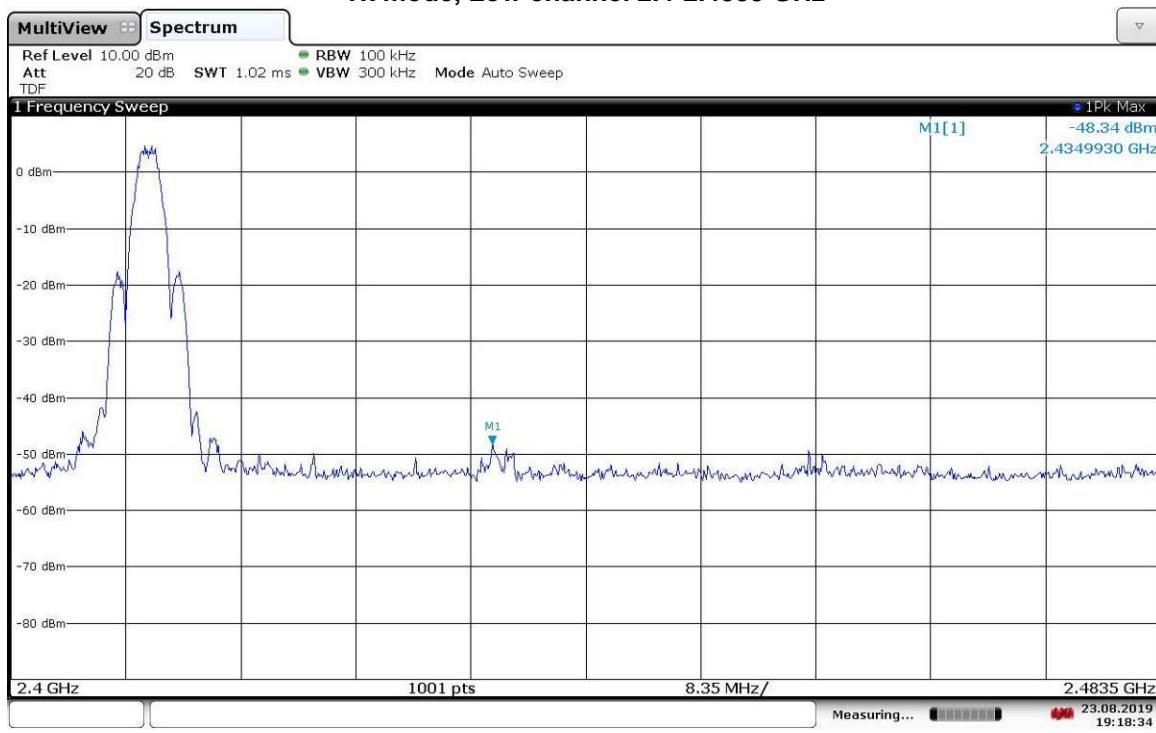
19:16:38 23.08.2019

Tx mode, Low channel 1-2.4 GHz



19:17:15 23.08.2019

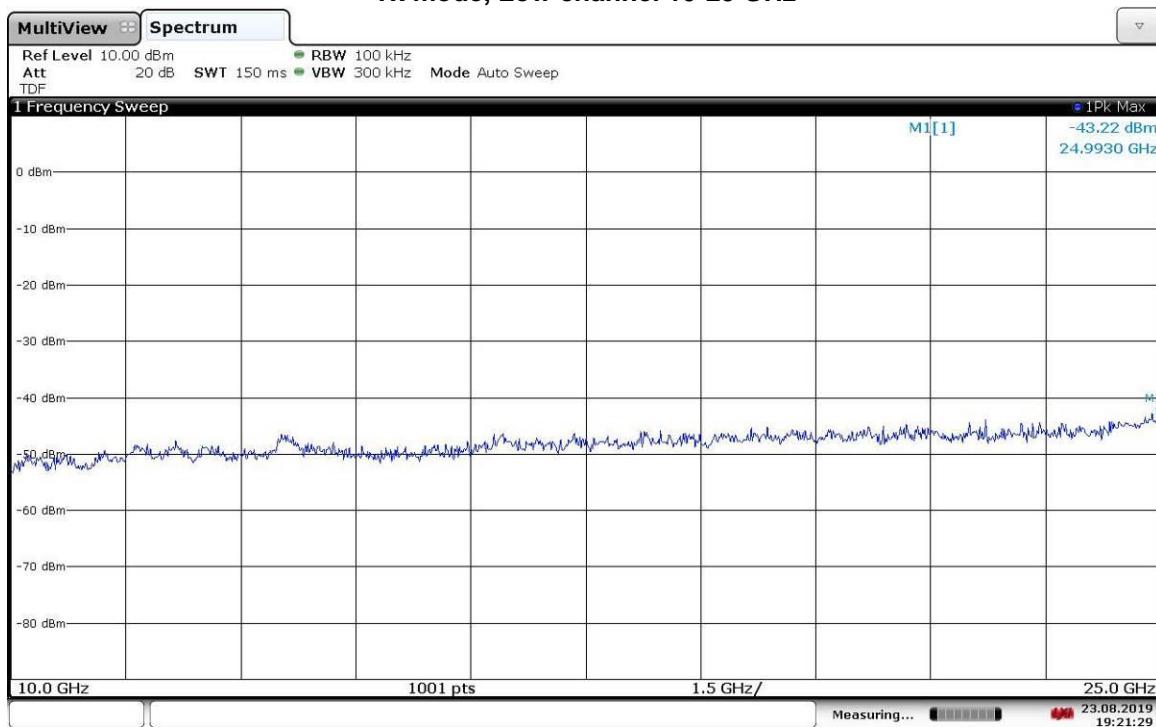
Tx mode, Low channel 2.4-2.4835 GHz



Tx mode, Low channel 2.4835-10 GHz

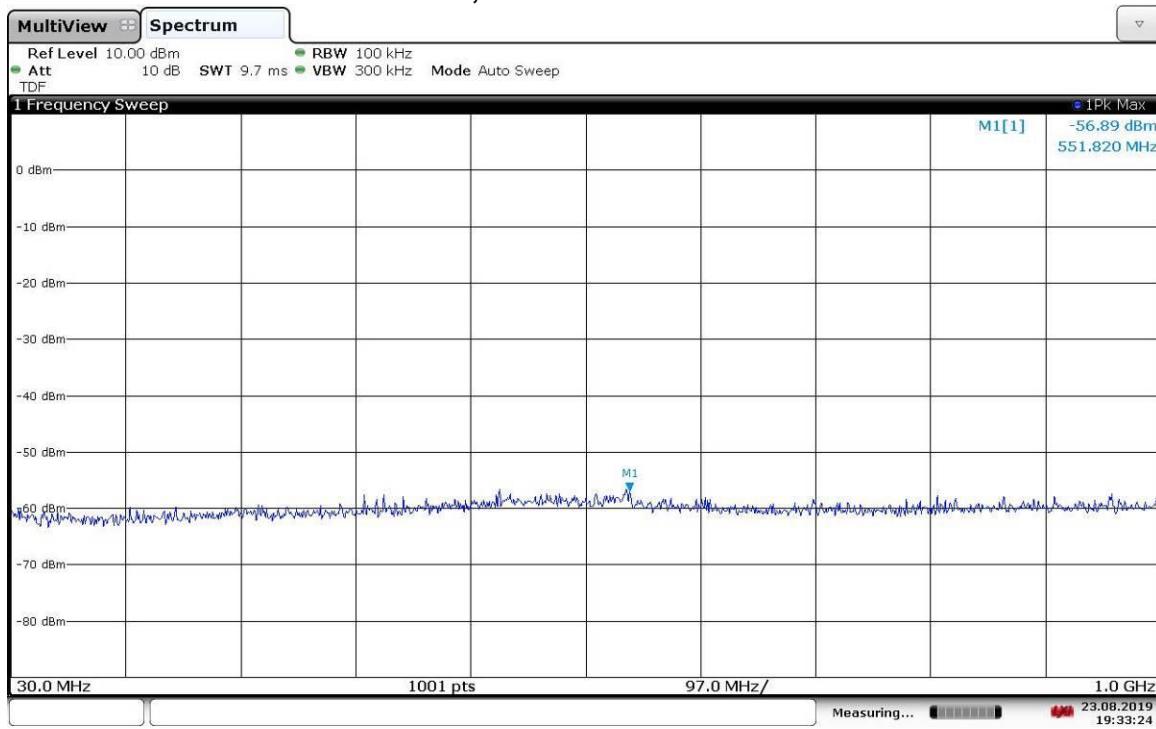


Tx mode, Low channel 10-25 GHz



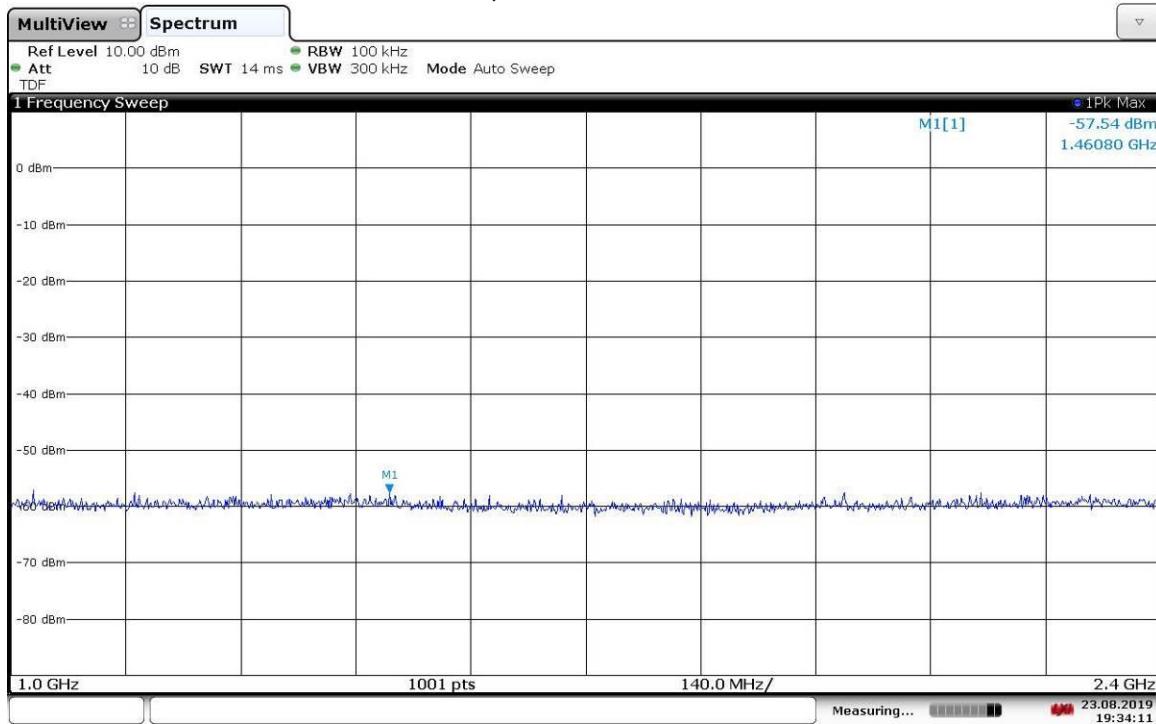
19:21:30 23.08.2019

Tx mode, Mid channel 30-1000 MHz



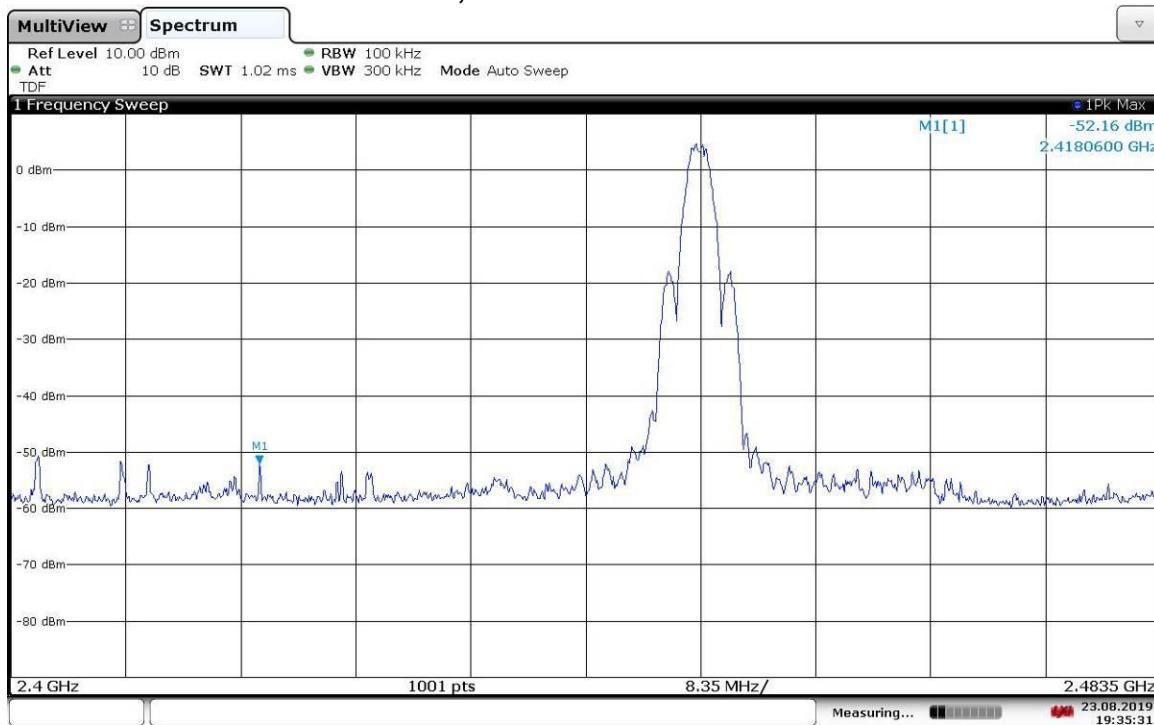
19:33:24 23.08.2019

Tx mode, Mid channel 1-2.4 GHz

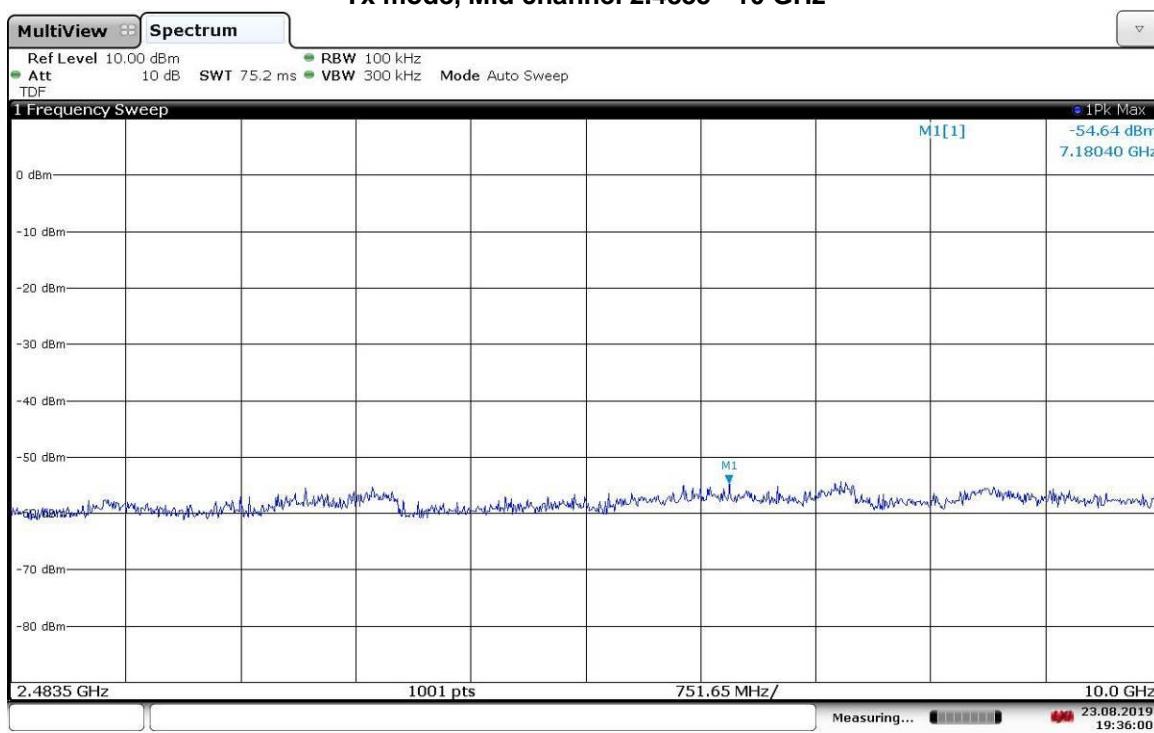


19:34:11 23.08.2019

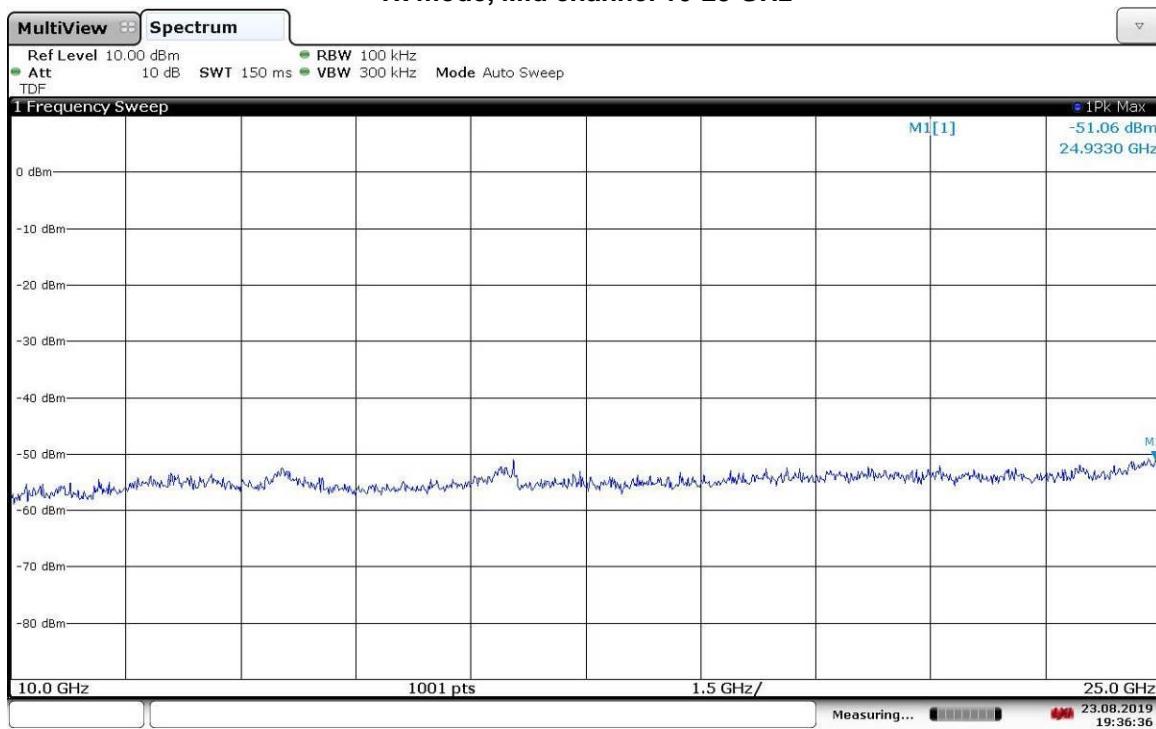
Tx mode, Mid channel 2.4-2.4835 GHz



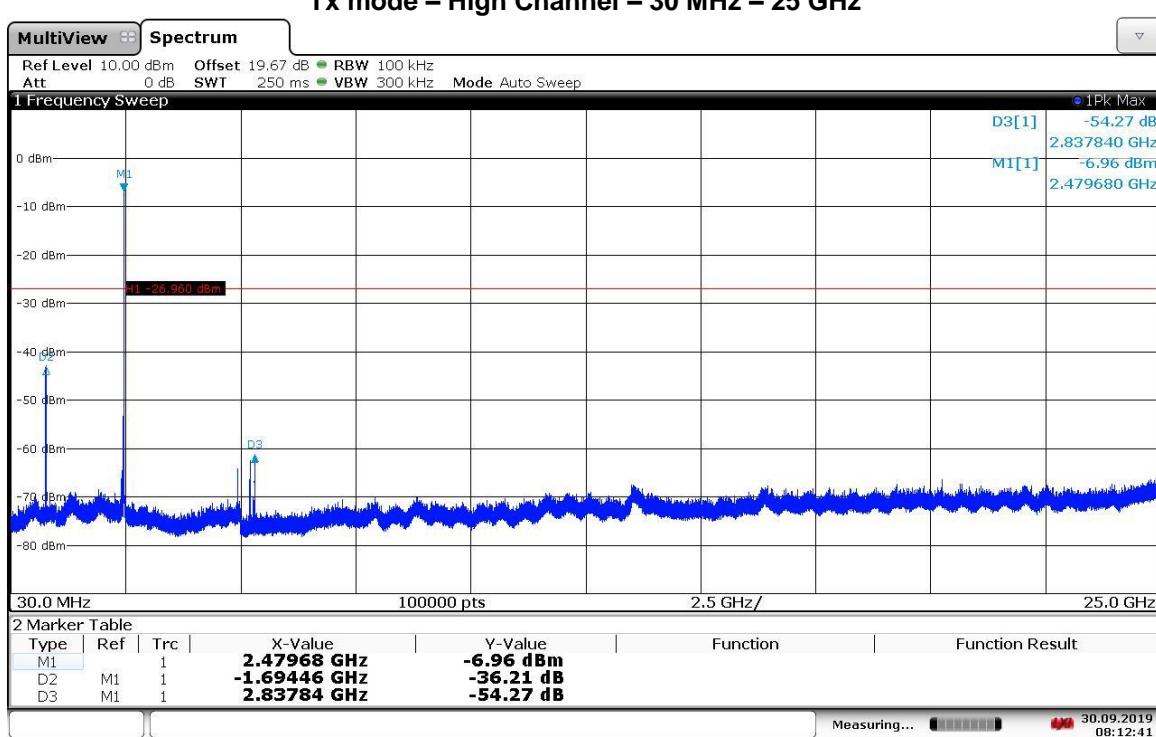
Tx mode, Mid channel 2.4835 - 10 GHz



Tx mode, Mid channel 10-25 GHz



Tx mode – High Channel – 30 MHz – 25 GHz

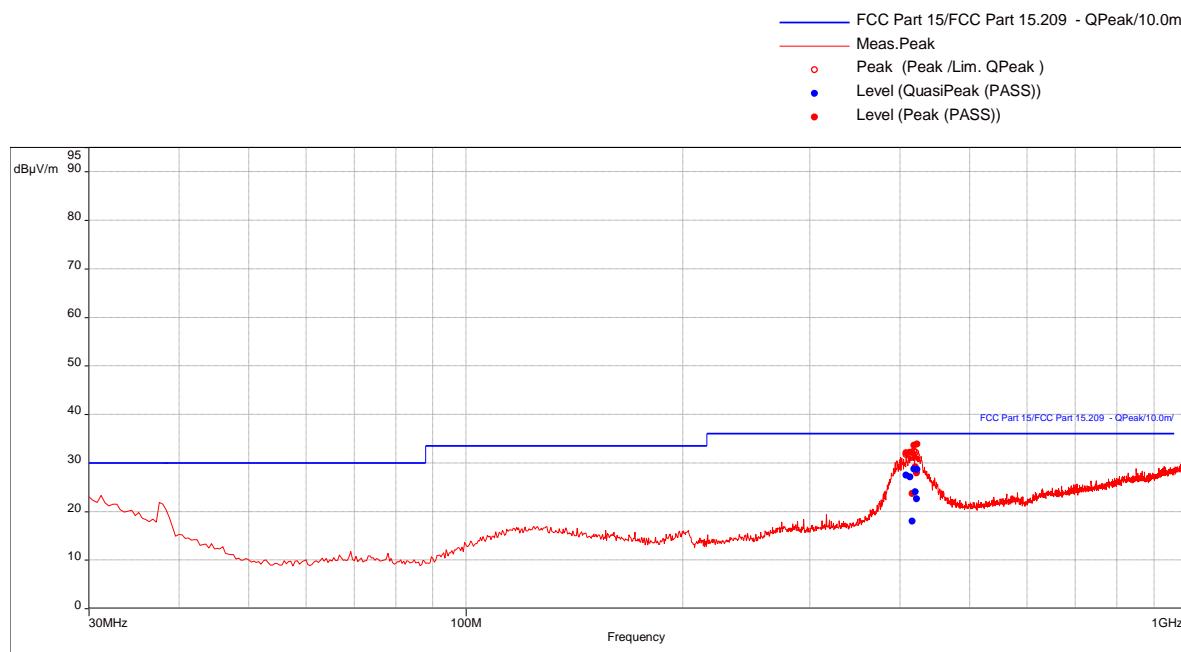


Radiated Spurious

Low Channel, 30 to 1000 MHz

Test Information:

Date and Time	8/23/2019 8:01:12 AM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	22
Humidity	52
Atmospheric Pressure	1005
Comments	Low Ch - RE 30-1000MHz SA mode

Graph:Results:

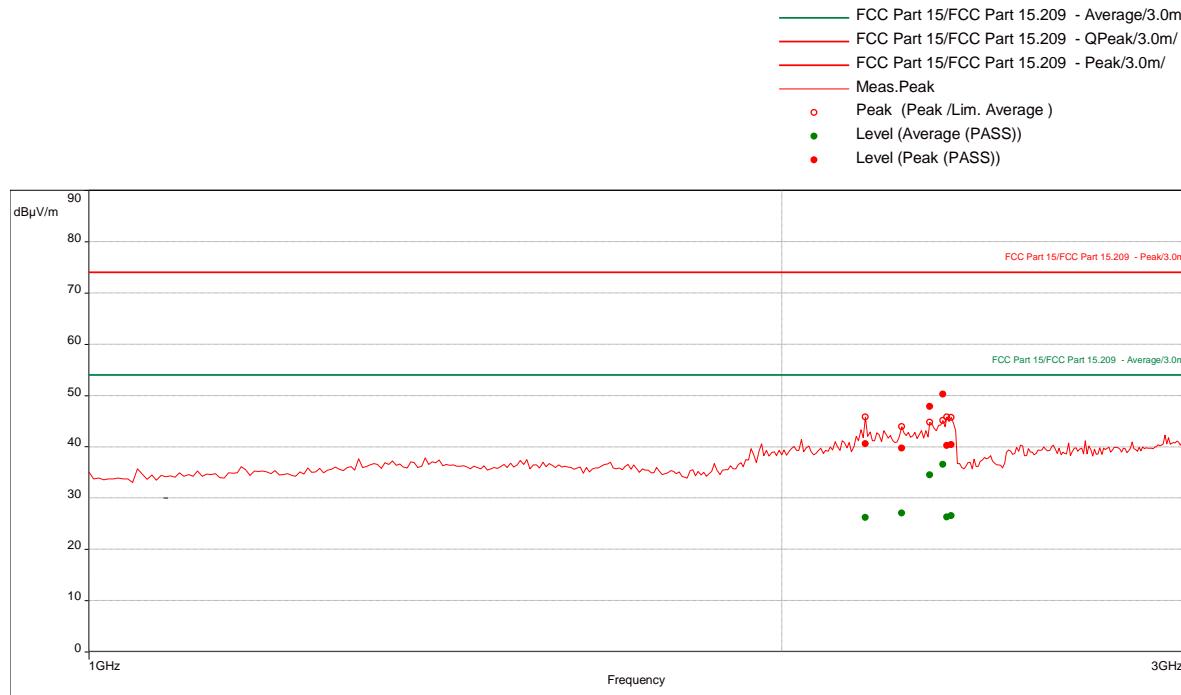
QuasiPeak (PASS) (7)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
407.9052632	27.46	36.00	-8.54	216.00	2.60	Horizontal	120000.00	-15.25
413.1052632	27.14	36.00	-8.86	247.00	2.10	Horizontal	120000.00	-15.02
415.9684211	18.00	36.00	-18.00	232.00	1.88	Horizontal	120000.00	-14.93
418.4947368	28.76	36.00	-7.24	231.00	2.03	Horizontal	120000.00	-14.82
420.4842105	23.98	36.00	-12.02	92.00	2.60	Horizontal	120000.00	-14.82
422.1473684	22.61	36.00	-13.39	91.00	1.38	Horizontal	120000.00	-14.81
422.5684211	28.59	36.00	-7.41	232.00	2.03	Horizontal	120000.00	-14.81

Low Channel, 1 to 3 GHz

Test Information:

Date and Time	8/22/2019 12:18:05 PM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	23
Humidity	57
Atmospheric Pressure	1001
Comments	Low Ch - RE 1 to 3 GHz SA mode

Graph:Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
2173.684211	40.59	74.00	-33.41	306.00	1.45	Horizontal	1000000.00	-20.69
2253.157895	39.73	74.00	-34.27	201.00	3.74	Horizontal	1000000.00	-20.79
2320.789474	47.84	74.00	-26.16	84.00	1.90	Horizontal	1000000.00	-20.40
2349.473684	50.23	74.00	-23.77	83.00	1.55	Horizontal	1000000.00	-20.10
2360.526316	40.23	74.00	-33.77	77.00	1.25	Horizontal	1000000.00	-20.04
2368.421053	40.40	74.00	-33.60	76.00	1.15	Horizontal	1000000.00	-19.99

Average (PASS) (6)

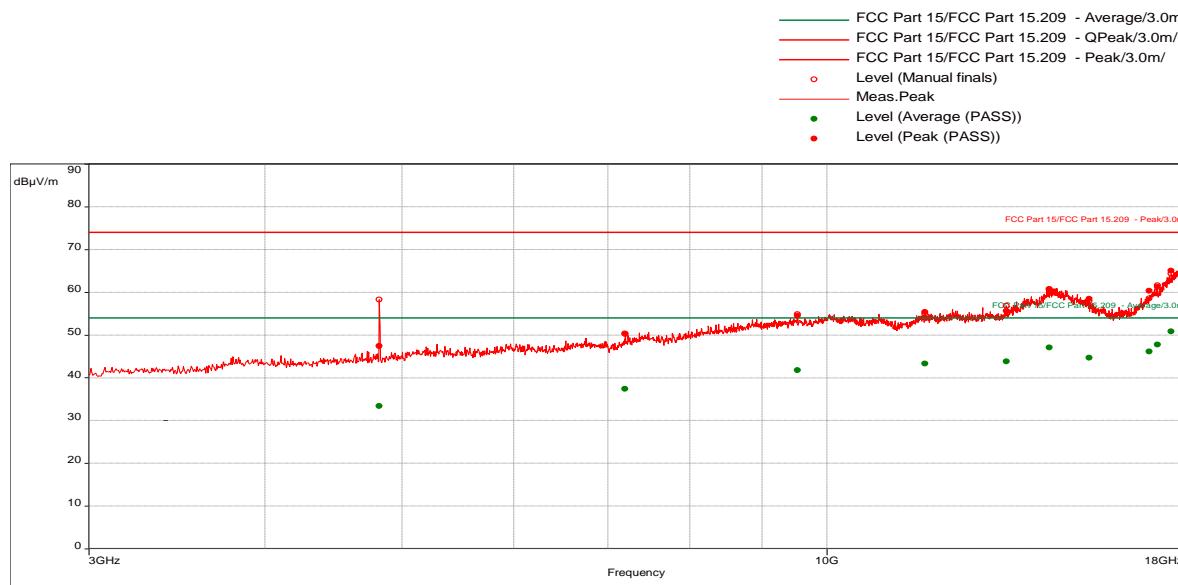
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
2173.684211	26.16	54.00	-27.84	306.00	1.45	Horizontal	1000000.00	-20.69
2253.157895	27.07	54.00	-26.93	201.00	3.74	Horizontal	1000000.00	-20.79
2320.789474	34.47	54.00	-19.53	84.00	1.90	Horizontal	1000000.00	-20.40
2349.473684	36.51	54.00	-17.49	83.00	1.55	Horizontal	1000000.00	-20.10
2360.526316	26.26	54.00	-27.74	77.00	1.25	Horizontal	1000000.00	-20.04
2368.421053	26.51	54.00	-27.49	76.00	1.15	Horizontal	1000000.00	-19.99

Low Channel, 3 to 18 GHz

Test Information:

Date and Time	8/22/2019 12:22:10 PM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	23
Humidity	57
Atmospheric Pressure	1001
Comments	Low Ch - RE 3 to 18 GHz SA mode

Graph:



Results:

Peak (PASS) (11)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
4818.684211	47.40	74.00	-26.60	274.00	2.40	Horizontal	1000000.00	-11.12
7196.315789	50.30	74.00	-23.70	158.00	3.64	Horizontal	1000000.00	-5.97
9535	54.51	74.00	-19.49	342.00	2.15	Horizontal	1000000.00	-0.59
11740	55.37	74.00	-18.63	83.00	3.20	Vertical	1000000.00	2.62
13408.68421	55.64	74.00	-18.36	180.00	3.59	Vertical	1000000.00	5.42
14382.63158	60.57	74.00	-13.43	291.00	2.15	Horizontal	1000000.00	9.44
15345.78947	58.48	74.00	-15.52	263.00	1.00	Vertical	1000000.00	6.68
16926.57895	60.30	74.00	-13.70	262.00	2.50	Horizontal	1000000.00	7.28
17155.78947	61.29	74.00	-12.71	284.00	2.40	Horizontal	1000000.00	9.23
17543.68421	65.00	74.00	-9.00	0.00	3.94	Vertical	1000000.00	12.25
17972.63158	67.09	74.00	-6.91	99.00	2.00	Horizontal	1000000.00	14.47

Average (PASS) (11)

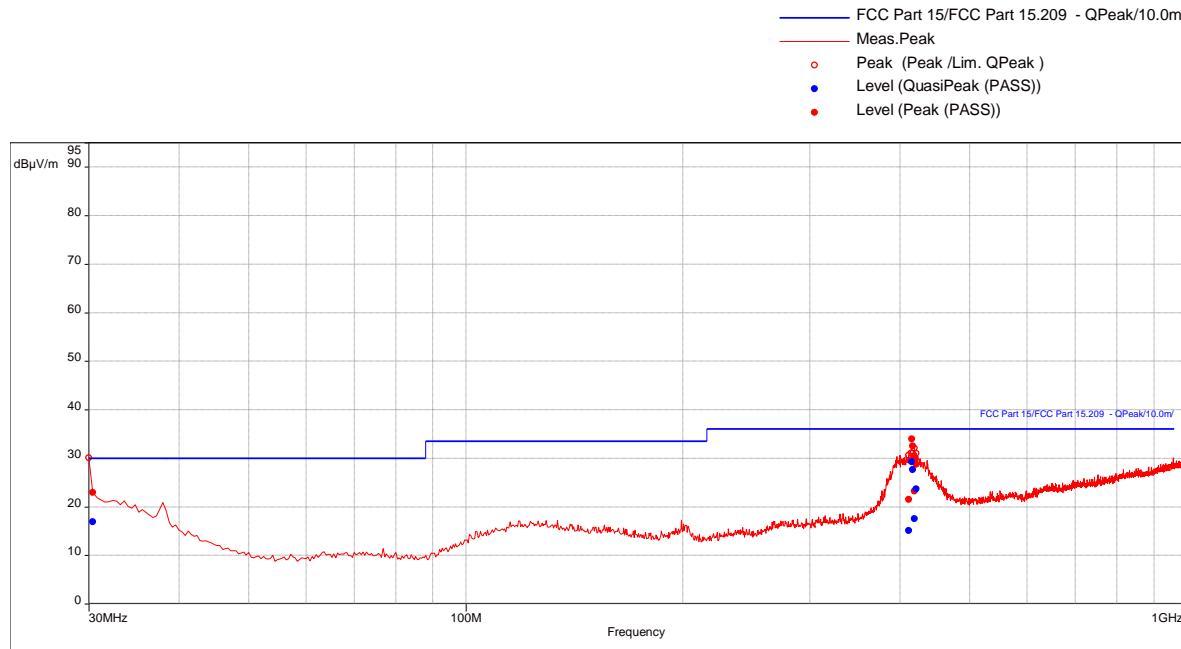
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
4818.684211	33.36	54.00	-20.64	274.00	2.40	Horizontal	1000000.00	-11.12
7196.315789	37.42	54.00	-16.58	158.00	3.64	Horizontal	1000000.00	-5.97
9535	41.74	54.00	-12.26	342.00	2.15	Horizontal	1000000.00	-0.59
11740	43.31	54.00	-10.69	83.00	3.20	Vertical	1000000.00	2.62
13408.68421	43.78	54.00	-10.22	180.00	3.59	Vertical	1000000.00	5.42
14382.63158	47.09	54.00	-6.91	291.00	2.15	Horizontal	1000000.00	9.44
15345.78947	44.69	54.00	-9.31	263.00	1.00	Vertical	1000000.00	6.68
16926.57895	46.08	54.00	-7.92	262.00	2.50	Horizontal	1000000.00	7.28
17155.78947	47.71	54.00	-6.29	284.00	2.40	Horizontal	1000000.00	9.23
17543.68421	50.82	54.00	-3.18	0.00	3.94	Vertical	1000000.00	12.25
17972.63158	52.94	54.00	-1.06	99.00	2.00	Horizontal	1000000.00	14.47

Note: No emissions were detected from 18-25 GHz, only noise floor was discovered.

Mid Channel, 30 to 1000 MHz

Test Information:

Date and Time	8/23/2019 9:55:48 AM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	22
Humidity	52
Atmospheric Pressure	1005
Comments	Mid Ch - RE 30-1000MHz SA mode

Graph:Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
30.26842105	22.99	30.00	-7.01	350.00	1.73	Horizontal	120000.00	-12.57
411.2210526	21.51	36.00	-14.49	47.00	3.36	Horizontal	120000.00	-15.12
415.2421053	33.92	36.00	-2.08	224.00	2.50	Horizontal	120000.00	-14.93
416.5578947	32.50	36.00	-3.50	231.00	1.44	Horizontal	120000.00	-14.93
418.9473684	23.24	36.00	-12.76	218.00	2.78	Horizontal	120000.00	-14.82
421.6631579	28.68	36.00	-7.32	99.00	1.59	Horizontal	120000.00	-14.82

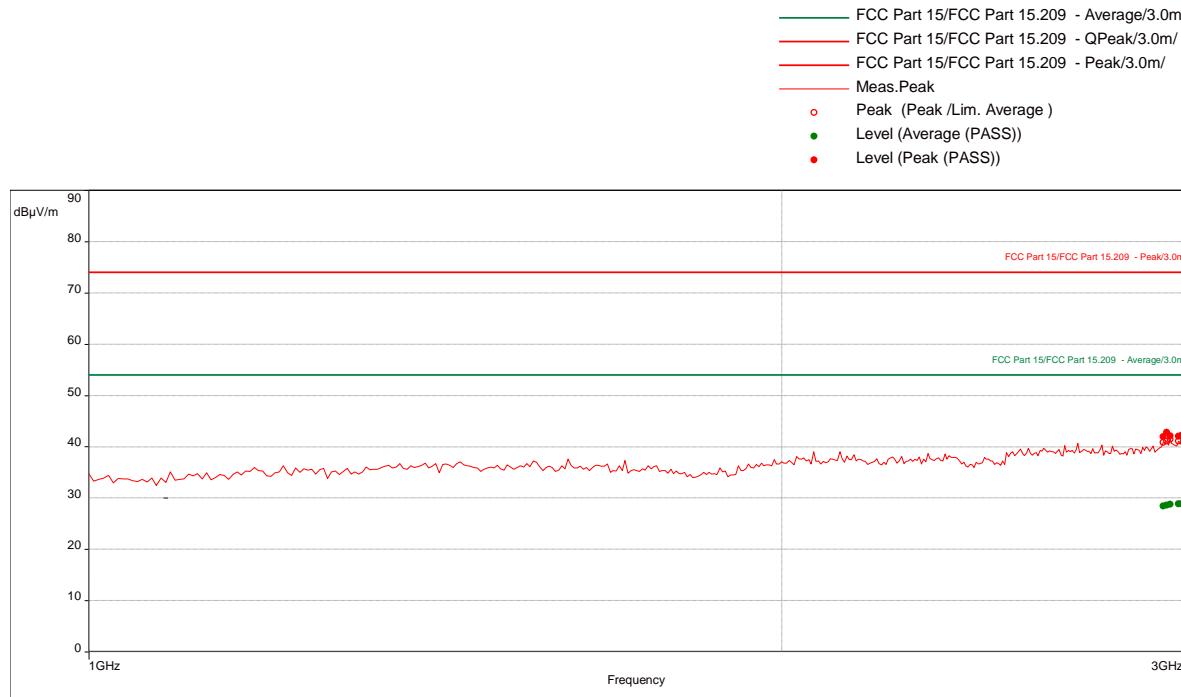
QuasiPeak (PASS) (6)

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
30.26842105	16.92	30.00	-13.08	350.00	1.73	Horizontal	120000.00	-12.57
411.2210526	15.07	36.00	-20.93	47.00	3.36	Horizontal	120000.00	-15.12
415.2421053	29.27	36.00	-6.73	224.00	2.50	Horizontal	120000.00	-14.93
416.5578947	27.68	36.00	-8.32	231.00	1.44	Horizontal	120000.00	-14.93
418.9473684	17.57	36.00	-18.43	218.00	2.78	Horizontal	120000.00	-14.82
421.6631579	23.68	36.00	-12.32	99.00	1.59	Horizontal	120000.00	-14.82

Mid Channel, 1 to 3 GHz

Test Information:

Date and Time	8/22/2019 3:02:51 PM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	23
Humidity	57
Atmospheric Pressure	1001
Comments	Mid Ch - RE 1 to 3 GHz SA mode

Graph:Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
2929.736842	41.92	74.00	-32.08	179.00	1.05	Vertical	1000000.00	-17.94
2938.157895	42.79	74.00	-31.21	165.00	2.05	Horizontal	1000000.00	-17.86
2951.842105	42.14	74.00	-31.86	92.00	1.75	Vertical	1000000.00	-17.73
2977.368421	42.03	74.00	-31.97	320.00	1.55	Vertical	1000000.00	-17.55
2985.263158	42.23	74.00	-31.77	47.00	1.55	Vertical	1000000.00	-17.49
2996.052632	42.16	74.00	-31.84	351.00	1.80	Vertical	1000000.00	-17.42

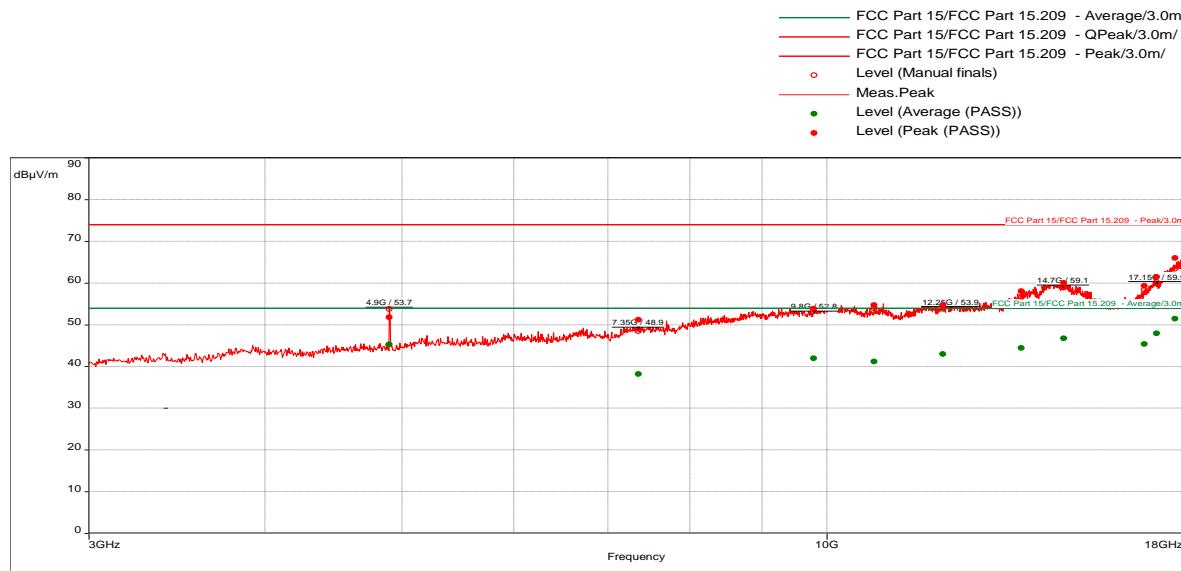
Average (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
2929.736842	28.41	54.00	-25.59	179.00	1.05	Vertical	1000000.00	-17.94
2938.157895	28.61	54.00	-25.39	165.00	2.05	Horizontal	1000000.00	-17.86
2951.842105	28.75	54.00	-25.25	92.00	1.75	Vertical	1000000.00	-17.73
2977.368421	28.85	54.00	-25.15	320.00	1.55	Vertical	1000000.00	-17.55
2985.263158	28.81	54.00	-25.19	47.00	1.55	Vertical	1000000.00	-17.49
2996.052632	28.75	54.00	-25.25	351.00	1.80	Vertical	1000000.00	-17.42

Mid Channel, 3 to 18 GHz

Test Information:

Date and Time	8/22/2019 1:35:58 PM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	23
Humidity	57
Atmospheric Pressure	1001
Comments	Mid Ch - RE 3 to 18 GHz SA mode

Graph:Results:

Peak (PASS) (11)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
4899.473684	51.77	74.00	-22.23	158.00	2.95	Vertical	1000000.00	-10.90
7353.157895	51.15	74.00	-22.85	245.00	3.74	Horizontal	1000000.00	-5.24
9788.421053	53.78	74.00	-20.22	289.00	2.05	Horizontal	1000000.00	-0.15
10803.15789	54.66	74.00	-19.34	220.00	1.20	Horizontal	1000000.00	0.61
12090	54.64	74.00	-19.36	11.00	3.79	Horizontal	1000000.00	3.24
13741.57895	58.00	74.00	-16.00	224.00	3.44	Horizontal	1000000.00	6.47
14729.47368	59.99	74.00	-14.01	39.00	1.05	Vertical	1000000.00	9.38
16790.26316	59.28	74.00	-14.72	223.00	3.05	Horizontal	1000000.00	6.25
17138.42105	61.44	74.00	-12.56	144.00	2.85	Vertical	1000000.00	9.10
17648.42105	65.95	74.00	-8.05	76.00	1.30	Vertical	1000000.00	13.05
17946.84211	68.03	74.00	-5.97	217.00	2.20	Horizontal	1000000.00	14.36

Average (PASS) (11)

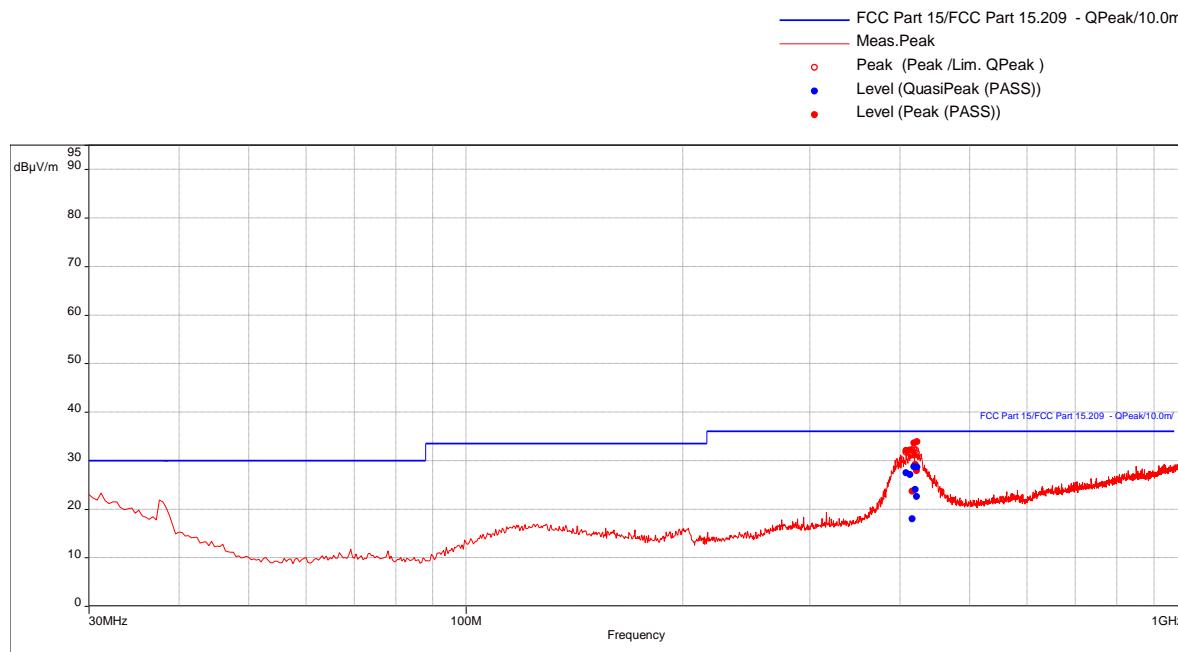
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
4899.473684	45.22	54.00	-8.78	158.00	2.95	Vertical	1000000.00	-10.90
7353.157895	38.16	54.00	-15.84	245.00	3.74	Horizontal	1000000.00	-5.24
9788.421053	41.93	54.00	-12.07	289.00	2.05	Horizontal	1000000.00	-0.15
10803.15789	41.14	54.00	-12.86	220.00	1.20	Horizontal	1000000.00	0.61
12090	42.98	54.00	-11.02	11.00	3.79	Horizontal	1000000.00	3.24
13741.57895	44.42	54.00	-9.58	224.00	3.44	Horizontal	1000000.00	6.47
14729.47368	46.72	54.00	-7.28	39.00	1.05	Vertical	1000000.00	9.38
16790.26316	45.37	54.00	-8.63	223.00	3.05	Horizontal	1000000.00	6.25
17138.42105	47.94	54.00	-6.06	144.00	2.85	Vertical	1000000.00	9.10
17648.42105	51.41	54.00	-2.59	76.00	1.30	Vertical	1000000.00	13.05
17946.84211	52.63	54.00	-1.37	217.00	2.20	Horizontal	1000000.00	14.36

Note: No emissions were detected from 18-25 GHz, only noise floor was discovered.

High Channel, 30 to 1000 MHz

Test Information:

Date and Time	8/23/2019 8:01:12 AM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	21
Humidity	54
Atmospheric Pressure	1009
Comments	High Ch - RE 30-1000MHz SA mode

Graph:Results:

Peak (PASS) (7)

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
407.9052632	32.07	36.00	-3.93	216.00	2.60	Horizontal	120000.00	-15.25
413.1052632	32.14	36.00	-3.86	247.00	2.10	Horizontal	120000.00	-15.02
415.9684211	23.67	36.00	-12.33	232.00	1.88	Horizontal	120000.00	-14.93
418.4947368	33.58	36.00	-2.42	231.00	2.03	Horizontal	120000.00	-14.82
420.4842105	29.19	36.00	-6.81	92.00	2.60	Horizontal	120000.00	-14.82
422.1473684	27.91	36.00	-8.09	91.00	1.38	Horizontal	120000.00	-14.81
422.5684211	33.84	36.00	-2.16	232.00	2.03	Horizontal	120000.00	-14.81

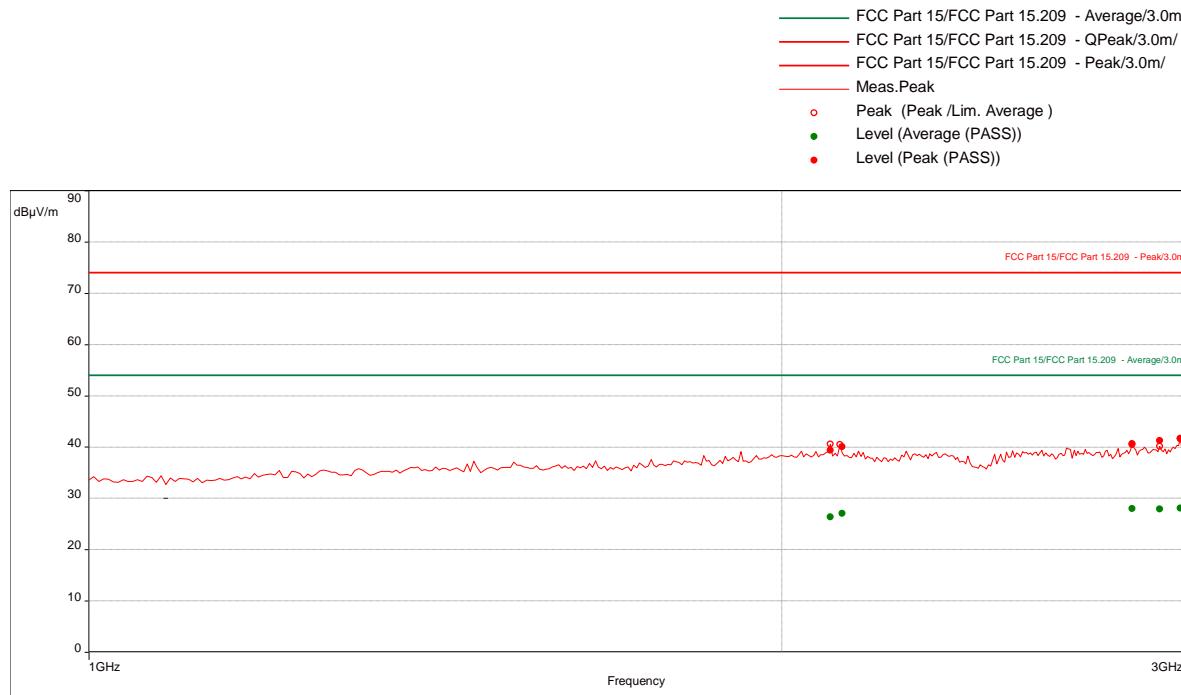
QuasiPeak (PASS) (7)

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
407.9052632	27.46	36.00	-8.54	216.00	2.60	Horizontal	120000.00	-15.25
413.1052632	27.14	36.00	-8.86	247.00	2.10	Horizontal	120000.00	-15.02
415.9684211	18.00	36.00	-18.00	232.00	1.88	Horizontal	120000.00	-14.93
418.4947368	28.76	36.00	-7.24	231.00	2.03	Horizontal	120000.00	-14.82
420.4842105	23.98	36.00	-12.02	92.00	2.60	Horizontal	120000.00	-14.82
422.1473684	22.61	36.00	-13.39	91.00	1.38	Horizontal	120000.00	-14.81
422.5684211	28.59	36.00	-7.41	232.00	2.03	Horizontal	120000.00	-14.81

High Channel, 1 to 3 GHz

Test Information:

Date and Time	9/27/2019 9:25:21 AM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	21
Humidity	54
Atmospheric Pressure	1009
Comments	High Ch - RE 1 to 3 GHz SA mode

Graph:Results:

Peak (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
2098.947368	39.37	74.00	-34.63	342.00	1.20	Horizontal	1000000.00	-20.57
2123.684211	40.08	74.00	-33.92	336.00	1.00	Horizontal	1000000.00	-20.60
2838.157895	40.66	74.00	-33.34	26.00	3.84	Vertical	1000000.00	-18.77
2922.368421	41.21	74.00	-32.79	17.00	1.15	Horizontal	1000000.00	-18.01
2979.473684	41.69	74.00	-32.31	158.00	3.98	Horizontal	1000000.00	-17.53
2995.526316	41.90	74.00	-32.10	336.00	2.20	Vertical	1000000.00	-17.42

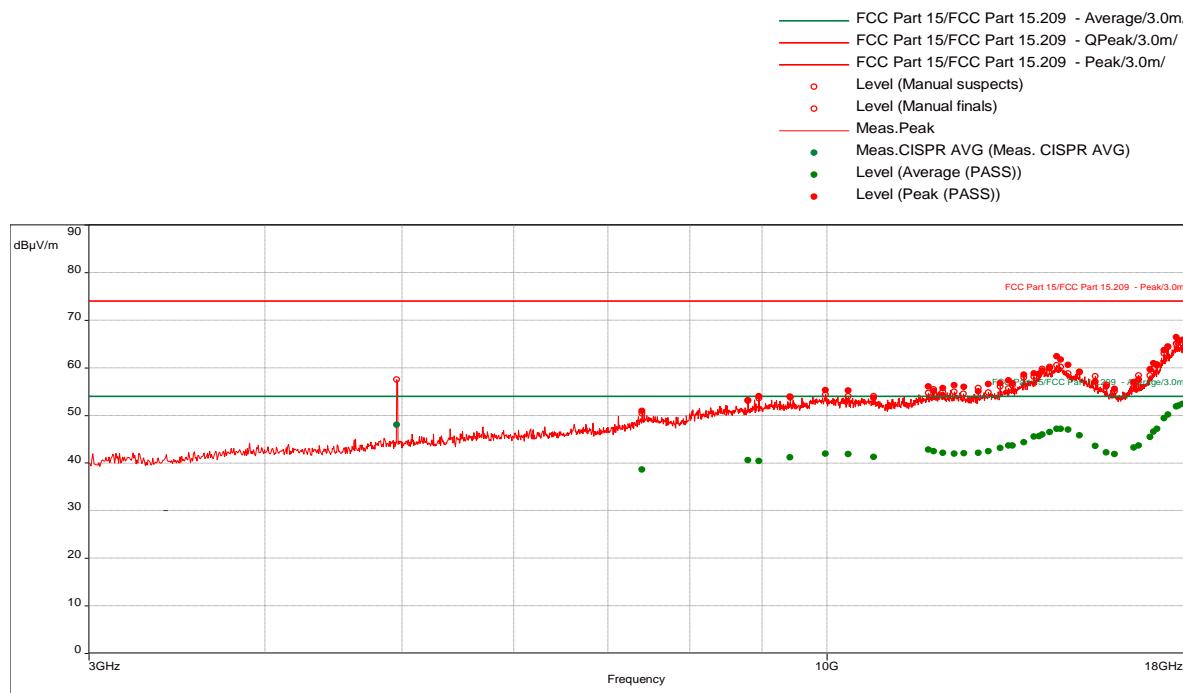
Average (PASS) (6)

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
2098.947368	26.32	54.00	-27.68	342.00	1.20	Horizontal	1000000.00	-20.57
2123.684211	27.08	54.00	-26.92	336.00	1.00	Horizontal	1000000.00	-20.60
2838.157895	28.01	54.00	-25.99	26.00	3.84	Vertical	1000000.00	-18.77
2922.368421	27.90	54.00	-26.10	17.00	1.15	Horizontal	1000000.00	-18.01
2979.473684	28.06	54.00	-25.94	158.00	3.98	Horizontal	1000000.00	-17.53
2995.526316	28.51	54.00	-25.49	336.00	2.20	Vertical	1000000.00	-17.42

High Channel, 3 to 18 GHz

Test Information:

Date and Time	9/27/2019 11:09:59 AM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	21
Humidity	54
Atmospheric Pressure	1009
Comments	High Ch - RE 3 to 18 GHz SA mode

Graph:

Results:

Peak (PASS) (40)

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
7398.684211	50.87	74.00	-23.13	216.00	2.40	Horizontal	1000000.00	-5.18
8792.631579	53.09	74.00	-20.91	84.00	1.00	Vertical	1000000.00	-1.92
8955.526316	53.96	74.00	-20.04	180.00	1.40	Vertical	1000000.00	-1.70
9422.105263	53.93	74.00	-20.07	341.00	3.39	Horizontal	1000000.00	-0.79
9983.157895	55.27	74.00	-18.73	349.00	2.95	Vertical	1000000.00	0.40
10360.52632	55.15	74.00	-18.85	342.00	3.44	Vertical	1000000.00	0.71
10793.68421	53.65	74.00	-20.35	128.00	1.55	Horizontal	1000000.00	0.60
11803.15789	56.02	74.00	-17.98	4.00	1.05	Vertical	1000000.00	2.83
11910.78947	55.14	74.00	-18.86	306.00	1.90	Vertical	1000000.00	3.12
12091.31579	55.70	74.00	-18.30	106.00	1.00	Vertical	1000000.00	3.24
12321.84211	56.29	74.00	-17.71	225.00	3.79	Horizontal	1000000.00	3.39
12509.47368	55.96	74.00	-18.04	90.00	3.64	Vertical	1000000.00	3.35
12805	55.02	74.00	-18.98	0.00	2.40	Vertical	1000000.00	3.71
13019.21053	56.54	74.00	-17.46	304.00	3.30	Vertical	1000000.00	4.22
13276.31579	56.70	74.00	-17.30	238.00	2.40	Horizontal	1000000.00	5.11
13453.94737	57.30	74.00	-16.70	62.00	1.80	Vertical	1000000.00	5.56
13542.89474	56.74	74.00	-17.26	99.00	3.69	Horizontal	1000000.00	5.86
13796.57895	58.51	74.00	-15.49	217.00	1.30	Vertical	1000000.00	6.76
14022.63158	58.77	74.00	-15.23	231.00	1.10	Horizontal	1000000.00	8.03
14144.21053	58.74	74.00	-15.26	113.00	1.00	Vertical	1000000.00	8.57
14222.36842	59.40	74.00	-14.60	268.00	2.00	Horizontal	1000000.00	8.94
14391.31579	59.92	74.00	-14.08	151.00	3.15	Vertical	1000000.00	9.46
14556.05263	62.35	74.00	-11.65	196.00	1.15	Vertical	1000000.00	9.74
14650.78947	61.66	74.00	-12.34	32.00	2.60	Vertical	1000000.00	9.64
14829.73684	60.54	74.00	-13.46	313.00	2.50	Horizontal	1000000.00	9.08
15110.78947	59.17	74.00	-14.83	232.00	3.15	Horizontal	1000000.00	7.99
15505	57.10	74.00	-16.90	254.00	1.65	Horizontal	1000000.00	6.21
15786.31579	56.04	74.00	-17.96	158.00	2.75	Horizontal	1000000.00	4.87
15993.68421	55.57	74.00	-18.43	314.00	3.84	Vertical	1000000.00	4.39
16507.36842	57.01	74.00	-16.99	201.00	2.80	Horizontal	1000000.00	4.84
16641.05263	57.48	74.00	-16.52	188.00	2.00	Horizontal	1000000.00	5.46
16948.68421	59.64	74.00	-14.36	313.00	3.30	Horizontal	1000000.00	7.47
17056.57895	60.94	74.00	-13.06	128.00	2.80	Vertical	1000000.00	8.47
17148.68421	60.63	74.00	-13.37	48.00	3.15	Vertical	1000000.00	9.17
17341.05263	63.64	74.00	-10.36	142.00	1.00	Horizontal	1000000.00	10.74
17448.15789	64.31	74.00	-9.69	335.00	1.20	Horizontal	1000000.00	11.55
17695.52632	66.36	74.00	-7.64	320.00	1.40	Vertical	1000000.00	13.45
17754.21053	65.67	74.00	-8.33	357.00	2.75	Horizontal	1000000.00	13.64
17868.15789	65.80	74.00	-8.20	335.00	2.20	Horizontal	1000000.00	14.06
17988.68421	66.42	74.00	-7.58	181.00	2.90	Horizontal	1000000.00	14.54

Average (PASS) (40)

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
7398.684211	38.60	54.00	-15.40	216.00	2.40	Horizontal	1000000.00	-5.18
8792.631579	40.59	54.00	-13.41	84.00	1.00	Vertical	1000000.00	-1.92
8955.526316	40.38	54.00	-13.62	180.00	1.40	Vertical	1000000.00	-1.70
9422.105263	41.16	54.00	-12.84	341.00	3.39	Horizontal	1000000.00	-0.79
9983.157895	41.96	54.00	-12.04	349.00	2.95	Vertical	1000000.00	0.40
10360.52632	41.88	54.00	-12.12	342.00	3.44	Vertical	1000000.00	0.71
10793.68421	41.25	54.00	-12.75	128.00	1.55	Horizontal	1000000.00	0.60
11803.15789	42.77	54.00	-11.23	4.00	1.05	Vertical	1000000.00	2.83
11910.78947	42.45	54.00	-11.55	306.00	1.90	Vertical	1000000.00	3.12
12091.31579	42.11	54.00	-11.89	106.00	1.00	Vertical	1000000.00	3.24
12321.84211	41.92	54.00	-12.08	225.00	3.79	Horizontal	1000000.00	3.39
12509.47368	42.00	54.00	-12.00	90.00	3.64	Vertical	1000000.00	3.35
12805	42.07	54.00	-11.93	0.00	2.40	Vertical	1000000.00	3.71
13019.21053	42.42	54.00	-11.58	304.00	3.30	Vertical	1000000.00	4.22
13276.31579	43.09	54.00	-10.91	238.00	2.40	Horizontal	1000000.00	5.11
13453.94737	43.60	54.00	-10.40	62.00	1.80	Vertical	1000000.00	5.56
13542.89474	43.64	54.00	-10.36	99.00	3.69	Horizontal	1000000.00	5.86
13796.57895	44.32	54.00	-9.68	217.00	1.30	Vertical	1000000.00	6.76
14022.63158	45.52	54.00	-8.48	231.00	1.10	Horizontal	1000000.00	8.03
14144.21053	45.63	54.00	-8.37	113.00	1.00	Vertical	1000000.00	8.57
14222.36842	45.97	54.00	-8.03	268.00	2.00	Horizontal	1000000.00	8.94
14391.31579	46.49	54.00	-7.51	151.00	3.15	Vertical	1000000.00	9.46
14556.05263	47.11	54.00	-6.89	196.00	1.15	Vertical	1000000.00	9.74
14650.78947	47.17	54.00	-6.83	32.00	2.60	Vertical	1000000.00	9.64
14829.73684	46.98	54.00	-7.02	313.00	2.50	Horizontal	1000000.00	9.08
15110.78947	45.75	54.00	-8.25	232.00	3.15	Horizontal	1000000.00	7.99
15505	43.59	54.00	-10.41	254.00	1.65	Horizontal	1000000.00	6.21
15786.31579	42.21	54.00	-11.79	158.00	2.75	Horizontal	1000000.00	4.87
15993.68421	41.83	54.00	-12.17	314.00	3.84	Vertical	1000000.00	4.39
16507.36842	43.25	54.00	-10.75	201.00	2.80	Horizontal	1000000.00	4.84
16641.05263	43.68	54.00	-10.32	188.00	2.00	Horizontal	1000000.00	5.46
16948.68421	45.48	54.00	-8.52	313.00	3.30	Horizontal	1000000.00	7.47
17056.57895	46.52	54.00	-7.48	128.00	2.80	Vertical	1000000.00	8.47
17148.68421	47.16	54.00	-6.84	48.00	3.15	Vertical	1000000.00	9.17
17341.05263	49.39	54.00	-4.61	142.00	1.00	Horizontal	1000000.00	10.74
17448.15789	50.12	54.00	-3.88	335.00	1.20	Horizontal	1000000.00	11.55
17695.52632	51.85	54.00	-2.15	320.00	1.40	Vertical	1000000.00	13.45
17754.21053	52.06	54.00	-1.94	357.00	2.75	Horizontal	1000000.00	13.64
17868.15789	52.37	54.00	-1.63	335.00	2.20	Horizontal	1000000.00	14.06
17988.68421	52.53	54.00	-1.47	181.00	2.90	Horizontal	1000000.00	14.54

Meas. CISPR AVG (1)

Frequency (MHz)	Meas. CISPR AVG (dB μ V/m)	Limit (dB μ V/m)	Meas. - Lim. (dB)	Height(m) (dB)	Angle(°) (dB)	Polarization / Comments	Correction (dB)
4960.021053	47.98	54.00	-6.02	3.00	181.00	Horizontal /	-10.80

Notes: Manual scan was performed from 18-25 GHz, in low mid and high channels, no emissions were detected above the measuring equipment noise floor.

Test Personnel:	Kenneth Lee Vathana Ven 	Test Date:	08/22/2019 08/23/2019
Supervising/Reviewing Engineer: (Where Applicable)	N/A	Product Standard:	CFR47 FCC Part 15.247 RSS-247 Input Voltage: 120 VAC @ 60 Hz
Pretest Verification w/ Ambient Signals or BB Source:	BB Source	Limit Applied:	See report section 10.3
		Ambient Temperature:	21, 22 °C
		Relative Humidity:	53, 52 %
		Atmospheric Pressure:	1002, 1010 mbars

Deviations, Additions, or Exclusions:

Testing performed was to ensure no restricted band spurious emissions were present.

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 $\text{dB}\mu\text{V}/\text{m}$

RA = Receiver Amplitude (including preamplifier) in $\text{dB}\mu\text{V}$

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 $\text{dB}\mu\text{V}$ 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 $\text{dB}\mu\text{V}/\text{m}$. This value in $\text{dB}\mu\text{V}/\text{m}$ was converted to its corresponding level in $\mu\text{V}/\text{m}$.

$$RA = 52.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}/\text{m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 32 \text{ dB}\mu\text{V}/\text{m}$$

To convert from $\text{dB}\mu\text{V}$ to μV or mV the following was used:

$$UF = 10^{(NF/20)} \text{ where } UF = \text{Net Reading in } \mu\text{V}$$

$$NF = \text{Net Reading in } \text{dB}\mu\text{V}$$

Example:

$$FS = RA + AF + CF - AG = 52.0 + 7.4 + 1.6 - 29.0 = 32.0$$

$$UF = 10^{(32 \text{ dB}\mu\text{V} / 20)} = 39.8 \mu\text{V}/\text{m}$$

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
DAV001'	Weather Station	Davis Instruments	7400	PE80519A61	01/23/2019	01/23/2020
145128'	EMI Receiver (20 Hz - 40 Gzh)	Rohde & Schwarz	ESIB 40	839283/001	03/28/2019	03/28/2020
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	10/27/2018	10/27/2019
145145'	Broadband Hybrid Antenna 30 MHz - 3 GHz	Sunol Sciences Corp.	JB3	A122313	06/12/2019	06/12/2020
EMC02'	ANTENNA, RIDGED GUIDE, 1-18 GHZ	EMCO	3115	2784	08/16/2018	08/16/2019
BON001'	METER, POWER	Boonton	4232A	55601	01/23/2019	01/23/2020
145-416'	Cables 145-420 145-423 145-425 145-408	Huber + Suhner	3m Track B cables	multiple	07/25/2018	07/25/2019
EMC04'	ANTENNA, RIDGED GUIDE, 18-40 GHZ	EMCO	3116	2090	10/26/2018	10/26/2019

Software Utilized:

Name	Manufacturer	Version
BAT EMC (10m Chamber)	Nexio	3.18.0.16

11.3 Results:

The sample tested was found to Comply.

§15.109 Radiated emission limits.

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

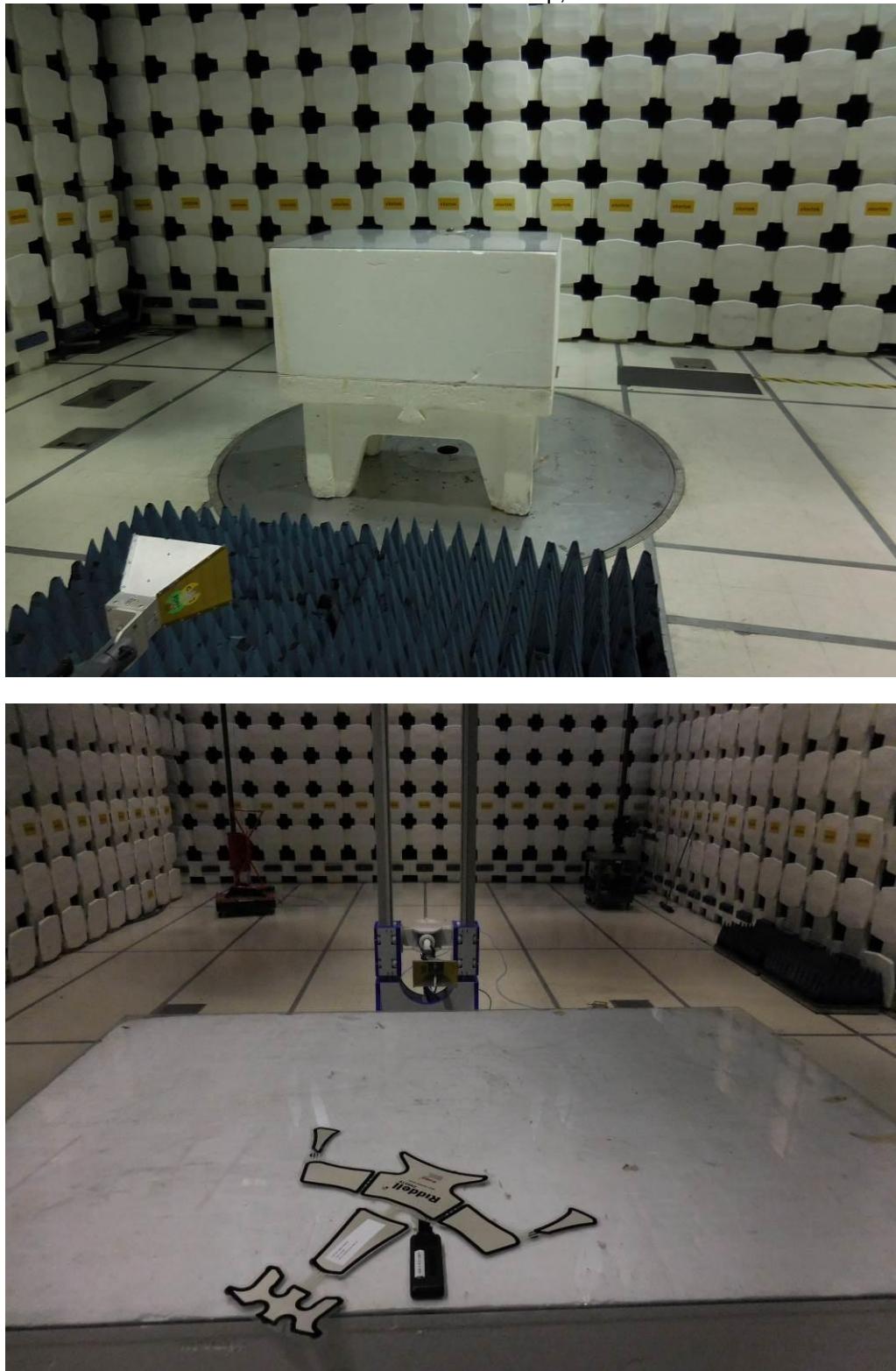
Frequency of emission (MHz)	Field strength (microvolts/meter)	Field strength (dB μ V/m)
30-88	100	40.00
88-216	150	43.52
216-960	200	46.02
Above 960	500	54.00

11.4 Setup Photographs:

Radiated Emissions Test Setup, 30 -1000 MHz

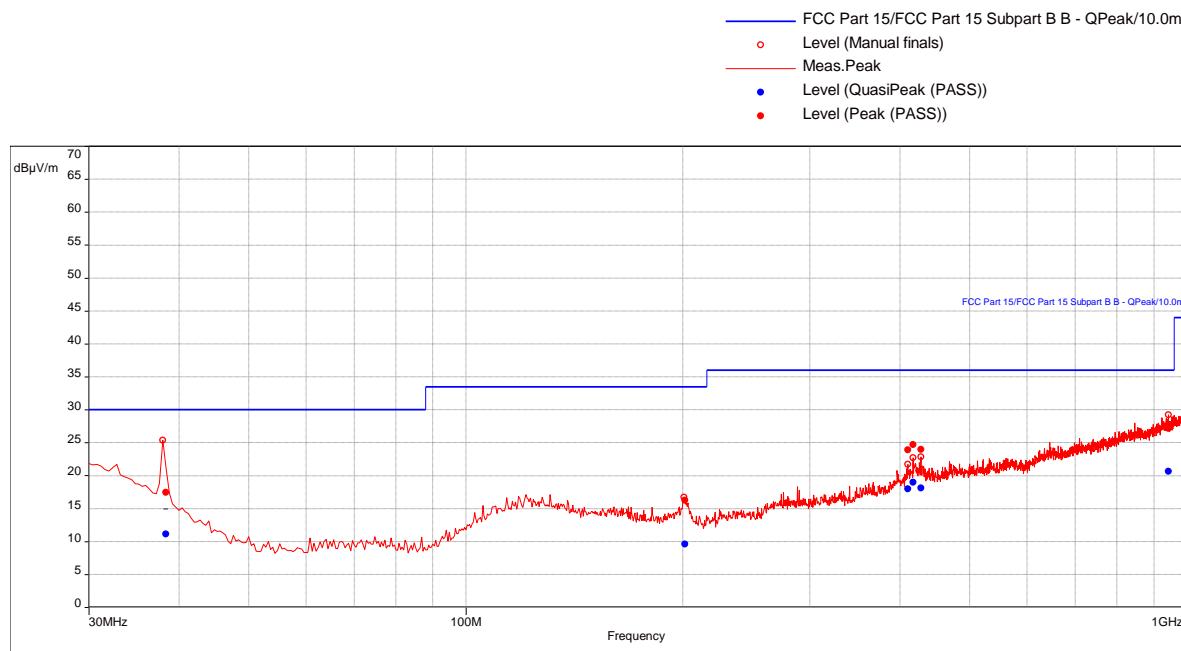


Radiated Emissions Test Setup, 1-18 GHz



11.5 Plots/Data:**30-1000MHz, Receive Mode, 802.11b****Test Information:**

Date and Time	8/23/2019 12:02:59 PM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	22
Humidity	52
Atmospheric Pressure	1005
Comments	Receive Mode - RE 30-1000MHz SA mode

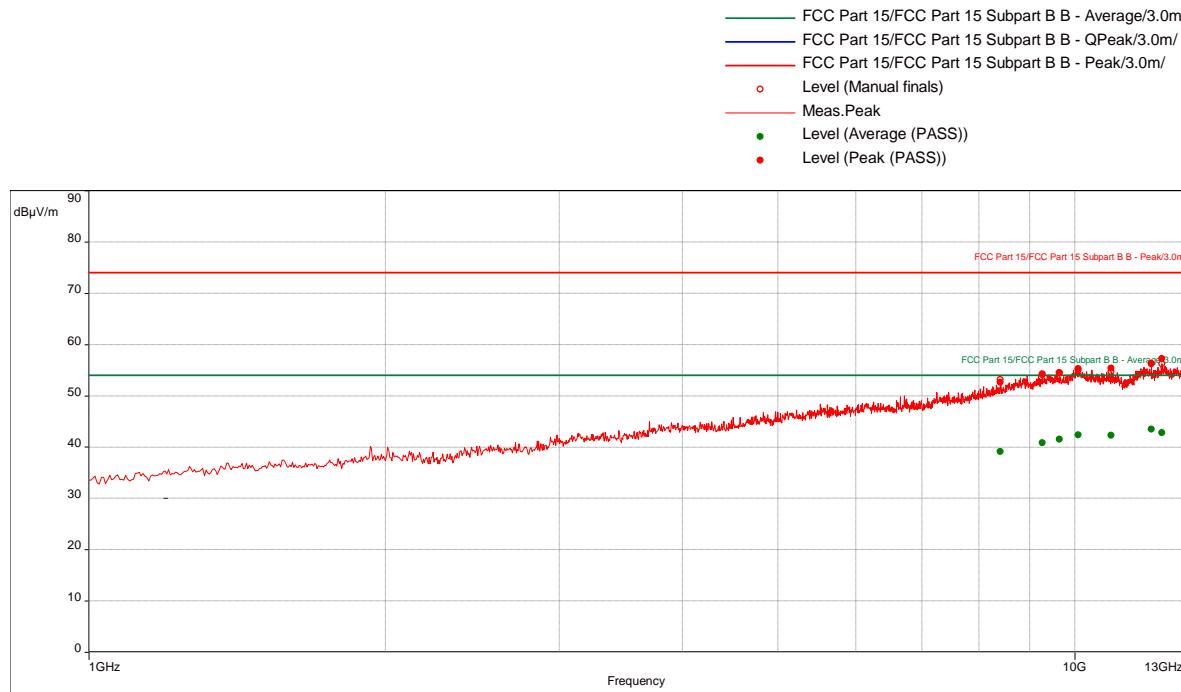
Graph:**Results:****QuasiPeak (PASS) (6)**

Frequency (MHz)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
38.34736842	30.00	-18.88	25.00	3.94	Vertical	120000.00	-18.17
201.1157895	33.50	-23.92	313.00	2.40	Vertical	120000.00	-19.46
409.9052632	36.00	-18.06	225.00	2.26	Horizontal	120000.00	-15.15
417.0421053	36.00	-17.06	239.00	2.33	Horizontal	120000.00	-14.92
427.5052632	36.00	-17.91	232.00	2.25	Horizontal	120000.00	-14.74
942.4631579	36.00	-15.37	113.00	3.88	Vertical	120000.00	-5.46

1-13 GHz, Receive Mode, 802.11b

Test Information:

Date and Time	8/23/2019 12:54:50 PM
Client and Project Number	Simbex - G103976876
Engineer	Ken Lee
Temperature	22
Humidity	52
Atmospheric Pressure	1005
Comments	Receive Mode - RE 1 to 13 GHz SA mode

Graph:Results:

Peak (PASS) (7)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
8408.421053	52.58	74.00	-21.42	121.00	2.14	Vertical	1000000.00	-3.16
9276.052632	54.25	74.00	-19.75	180.00	3.80	Vertical	1000000.00	-1.36
9655.789474	54.44	74.00	-19.56	298.00	2.96	Vertical	1000000.00	-0.53
10087.63158	55.23	74.00	-18.77	232.00	3.13	Horizontal	1000000.00	0.65
10896.05263	55.37	74.00	-18.63	40.00	2.83	Vertical	1000000.00	0.80
11966.05263	56.34	74.00	-17.66	343.00	1.00	Horizontal	1000000.00	3.17
12264.47368	57.26	74.00	-16.74	330.00	2.78	Vertical	1000000.00	3.33

Average (PASS) (7)

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (°)	Height (m)	Pol.	RBW (Hz)	Correction (dB)
8408.421053	39.08	54.00	-14.92	121.00	2.14	Vertical	1000000.00	-3.16
9276.052632	40.85	54.00	-13.15	180.00	3.80	Vertical	1000000.00	-1.36
9655.789474	41.49	54.00	-12.51	298.00	2.96	Vertical	1000000.00	-0.53
10087.63158	42.39	54.00	-11.61	232.00	3.13	Horizontal	1000000.00	0.65
10896.05263	42.23	54.00	-11.77	40.00	2.83	Vertical	1000000.00	0.80
11966.05263	43.46	54.00	-10.54	343.00	1.00	Horizontal	1000000.00	3.17
12264.47368	42.74	54.00	-11.26	330.00	2.78	Vertical	1000000.00	3.33

Test Personnel: Vathana Ven
Supervising/Reviewing
Engineer:
(Where Applicable) N/A
Product Standard: CFR47 FCC Part 15.247
RSS-247
Input Voltage: 120 VAC @ 60 Hz

Test Date: 06/13/2019

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

Limit Applied: See report section 11.3

Ambient Temperature: 24 °C

Relative Humidity: 47 %

Atmospheric Pressure: 1007 mbars

Deviations, Additions, or Exclusions: None

12 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	10/08/2019	103976876BOX-001	KL 	KPS 	Original Issue