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Des-Case Corporation TEST REPORT

SCOPE OF WORK
EMC TESTING – ISOLOGIC MODULE

REPORT NUMBER
103397344LEX-002.2

ISSUE DATE	**[REVISED DATE]**
3/16/2018	8/17/2018

PAGES
31

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

EMC TEST REPORT

(FULL COMPLIANCE)

Report Number: 103397344LEX-002.2
Project Number: G103397344

Report Issue Date: 8/17/2018

Model(s) Tested: IsoLogic Module
IsoLogic VentGuard Cartridge Size 1 (VG-1)
IsoLogic VentGuard Cartridge Size 4 (VG-4)

Standards: Title 47 CFR Part 15.225
RSS-210 Issue 9
RSS-Gen Issue 4

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Dr.
Lexington, KY 40510
USA

Client:
Des-Case Corporation
675 N Main Street
Coodlettsville, TN 37072
USA

Report prepared by

Brian Lackey, Project Engineer

Report reviewed by

Bryan Taylor, Team Leader

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
6	Receiver Spurious Emissions (ANSI C63.4: 2014)	Pass
7	Transmitter Fundamental and Spurious Emissions (FCC Part 15.209, 15.225(a)-(d), RSS-210 Issue 9 § B.6(a)-(d), RSS-Gen Issue 4 § 8.9)	Pass
8	Frequency Stability (FCC Part 15.225(e), RSS-210 Issue 9 § B.6)	Pass
9	Occupied Bandwidth (RSS-Gen Issue 4 § 6.6)	Pass
10	Antenna Requirement (FCC Part 15.203, RSS-Gen Issue 4 § 8.3)	Pass
-	Conducted Emissions (ANSI C63.4: 2014)	NA[1]

[1] Test it not applicable. Unit is battery powered and does not connect directly or indirectly to AC Mains.

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Des-Case Corporation
Address:	675 N Main Street Coodlettsville, TN 37072 USA
Contact:	Jay Cooper
Telephone:	+1 (615) 672-8800
Email:	Jay.cooper@descase.com
Manufacturer Information	
Manufacturer Name:	Des-Case Corporation
Manufacturer Address:	675 N Main Street Coodlettsville, TN 37072 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	IsoLogic Module
Model Number	10000000
Serial Number	10019523
Receive Date	2/12/2018
Test Start Date	2/12/2018
Test End Date	2/23/2018
Device Received Condition	Good
Test Sample Type	Production
Rated Voltage	4.5V (3x AAA batteries)
Rated Current	60mA max, 1mA average
Rated Frequency	-
Number of Phases	-
Software Used By EUT	None
Frequency Band(s)	RFID: 13.56MHz BLE: 2400-2483.5MHz
Modulation Type(s)	RFID: AM BLE: GFSK
Test Channel(s)	RFID: N/A BLE: 0 (2402MHz), 19 (2440MHz), 39 (2480MHz)
Maximum Antenna Gain (dBi)	RFID: 0.5 (from datasheet) BLE: 2.2 (from datasheet)
Maximum Output Power (dBm)	RFID: 17.4 (from datasheet) BLE: 4 (from datasheet)

Description of Equipment Under Test (provided by client)
IsoLogic Module: Breather Module that houses the batteries and hardware (BLE and RFID) IsoLogic VentGuard Cartridge Size 1 (VG-1): Breather Filter Cartridge that houses hardware (sensor board and RFID coil) IsoLogic VentGuard Cartridge Size 4 (VG-4): Breather Filter Cartridge that houses hardware (sensor board and RFID coil)

4.1 Variant Models:

There were no variant models covered by this evaluation.

5 System Setup and Method

5.1 Method:

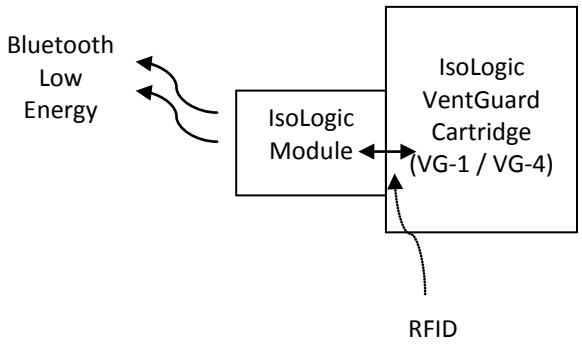
Configuration as required by ANSI C63.4: 2014

No.	Descriptions of EUT Exercising
1	Transmitting an RFID signal at 13.56MHz

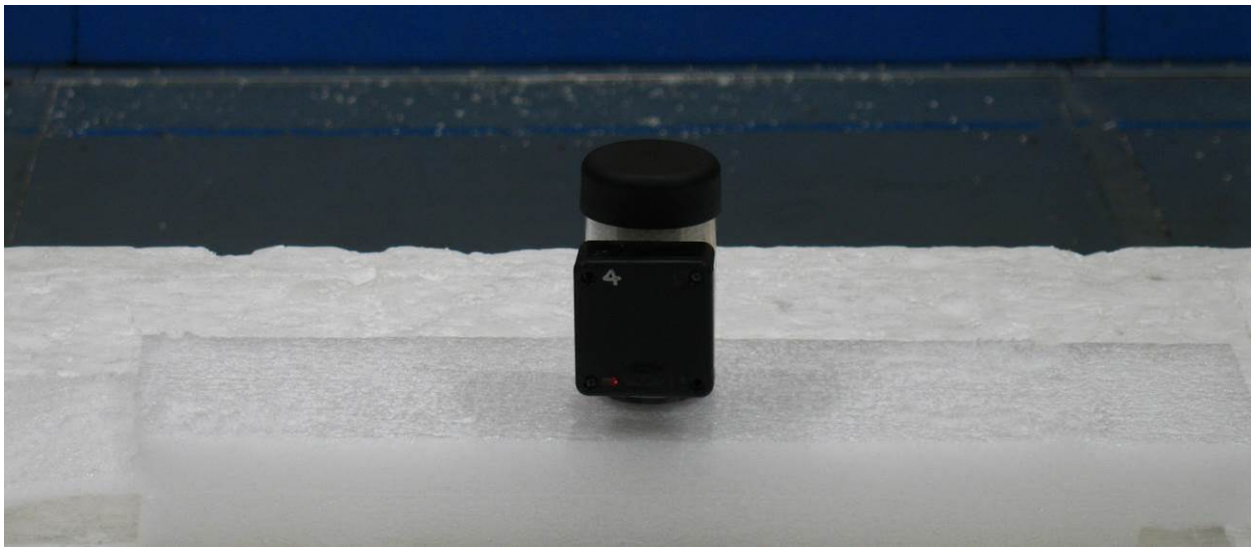
Cables					
ID	Description	Length (m)	Shielding	Ferrites	Termination

Support Equipment			
Description	Manufacturer	Model Number	Serial Number

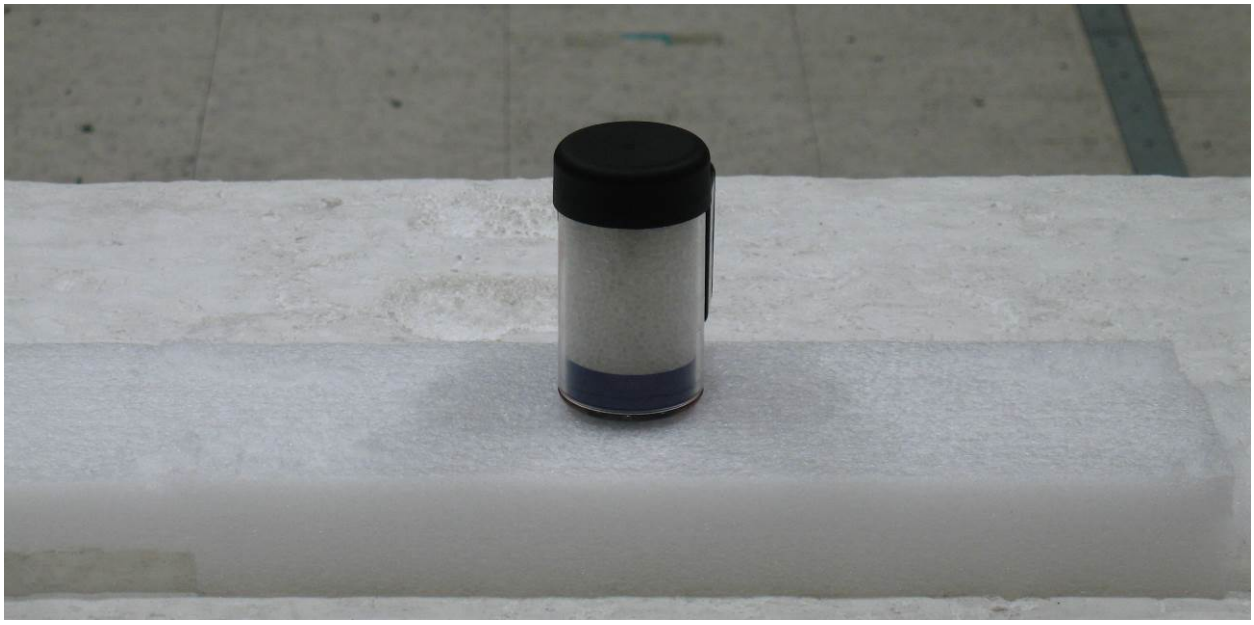
5.2 EUT Block Diagram:



5.3 EUT Photo (Front):



5.4 EUT Photo (Back):



6 Receiver Spurious Emissions

6.1 Test Method

Tests are performed in accordance with ANSI C63.4: 2014

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	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.

6.2 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

6.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	9/20/2017	9/20/2018
Bilog Antenna	3133	ETS Lindgren	3142C	4/6/2017	4/6/2018
Loop Antenna	2387	EMCO	6511	6/5/2017	6/5/2018
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
3m Cable Chamber→Control Room	2593			11/29/2017	11/29/2018
3m Cable Control Room→Receiver	2592			11/29/2017	11/29/2018
10m Cable Antenna→Preamp	3339			11/29/2017	11/29/2018

6.4 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

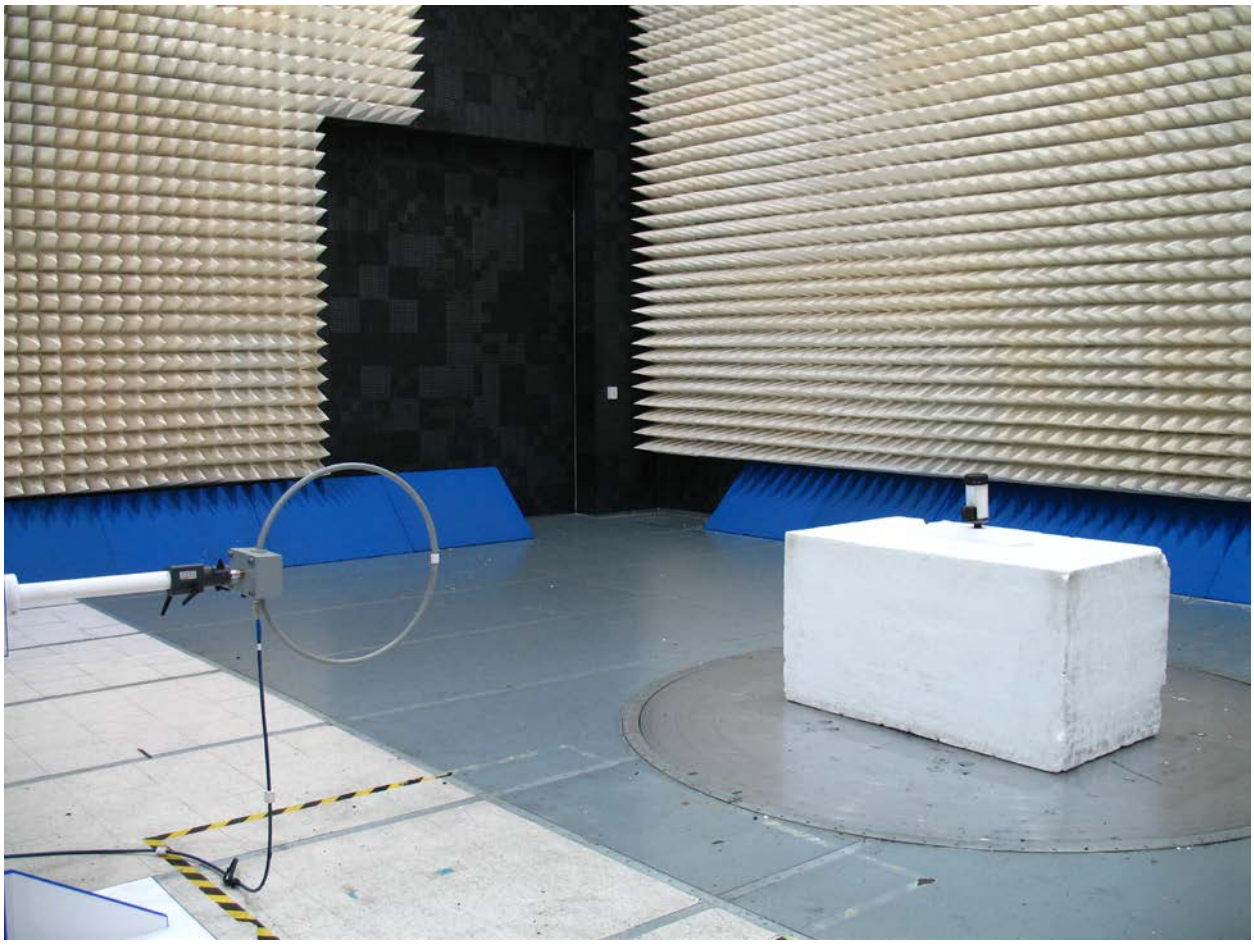
6.5 Test Results

The sample tested was found to be **compliant**.

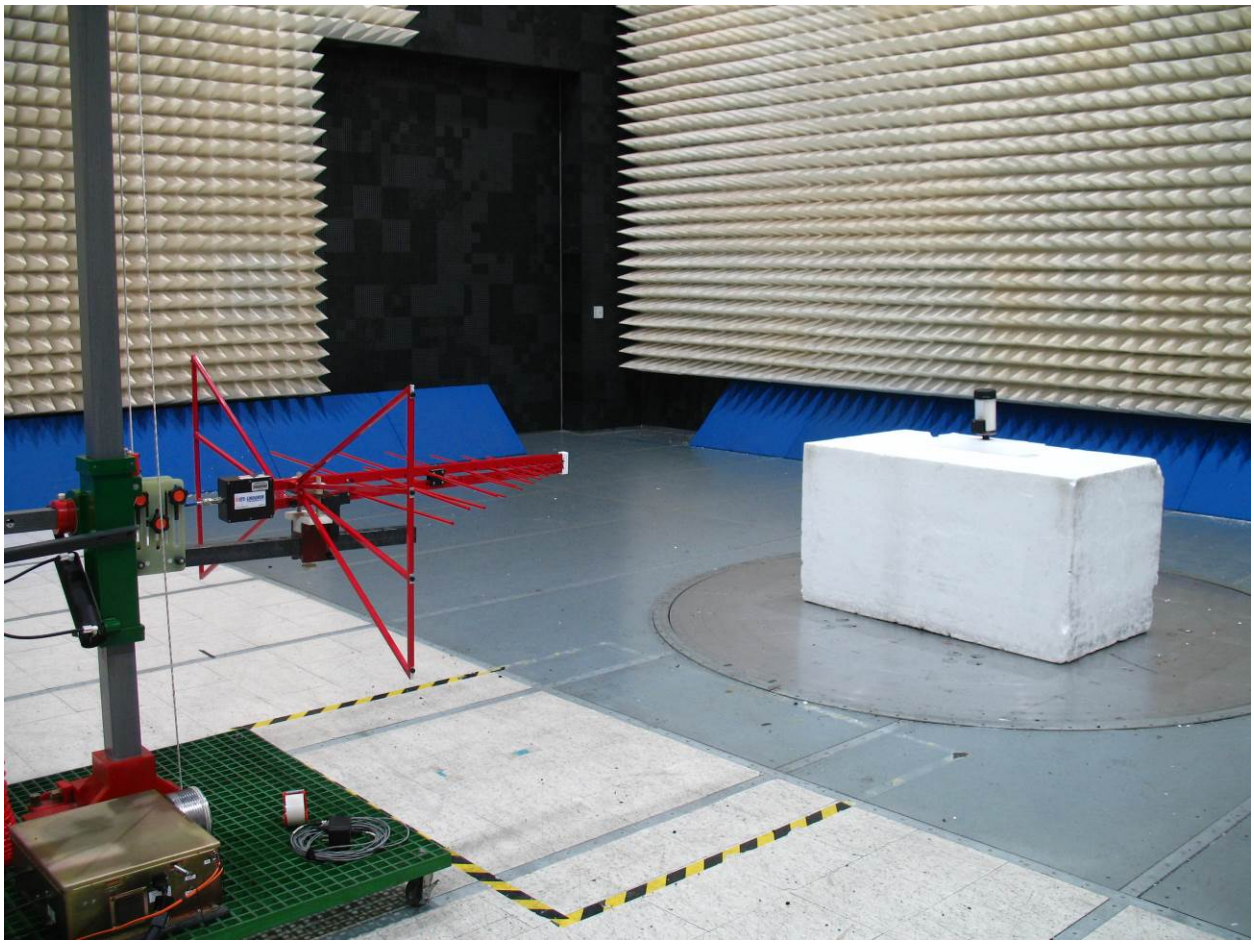
6.6 Test Conditions

Test Personnel:	B. Lackey	Test Date:	2/21/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.225 RSS-210 Issue 9	Ambient Temperature:	25.2C
Input Voltage:	Battery	Relative Humidity:	42.8%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.8mbar

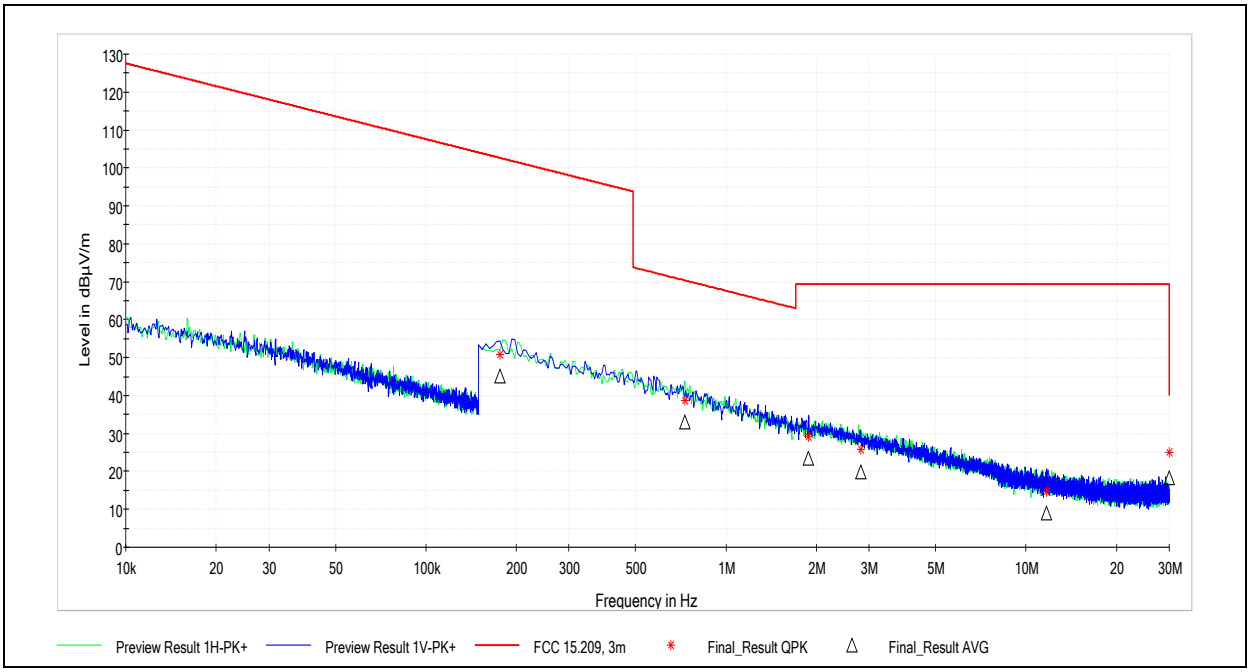
6.7 Setup Photographs: 10kHz – 30MHz



6.8 Setup Photographs: 30MHz – 1GHz



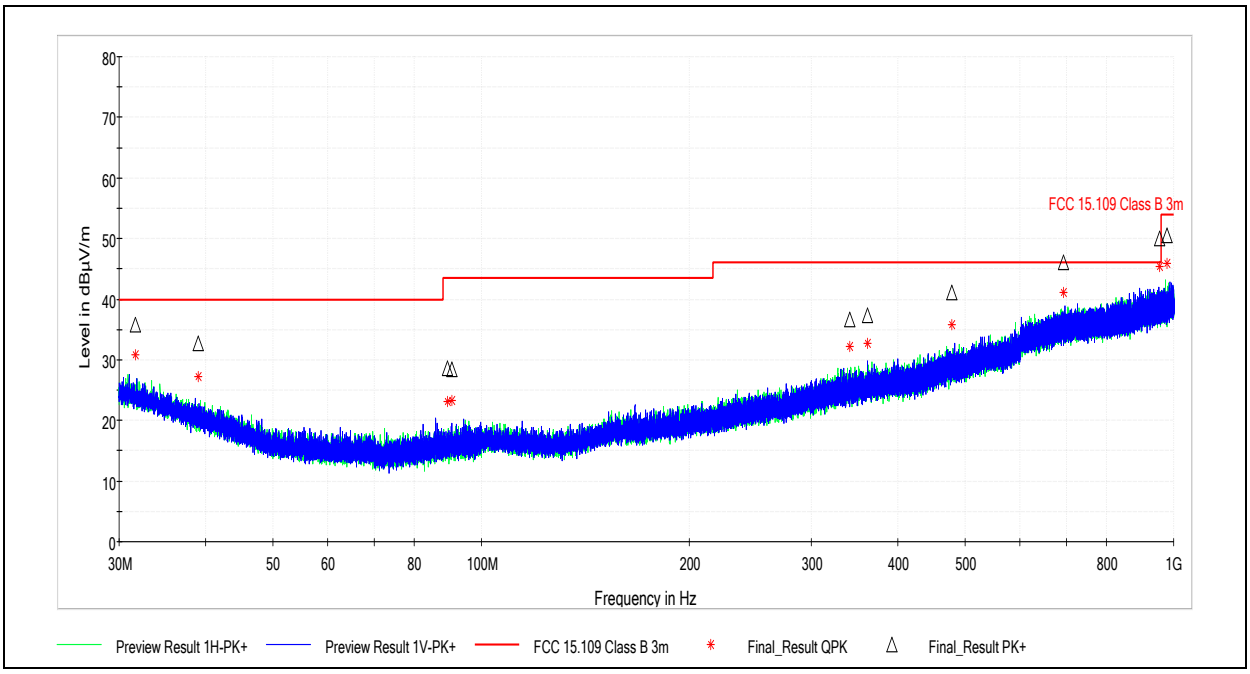
6.9 Test Data: 10kHz – 30MHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB)
0.176338	50.88	102.67	51.79	9.000	248.0	12.2
0.729441	38.74	70.35	31.61	9.000	110.0	12.3
1.883934	29.12	69.50	40.38	9.000	234.0	12.0
2.814552	25.73	69.50	43.77	9.000	211.0	11.9
11.716875	14.80	69.50	54.70	9.000	0.0	11.6
30.000000	24.91	40.00	15.09	120.000	115.0	9.4

Deviations, Additions, or Exclusions: None

6.10 Test Data: 30MHz – 1GHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.680000	35.87	60.00	24.13	120.000	140.0	H	120.0	23.9
39.071000	32.66	60.00	27.34	120.000	353.4	H	347.0	20.7
89.410000	28.64	63.52	34.88	120.000	397.1	V	239.0	16.7
90.775000	28.49	63.52	35.03	120.000	354.2	V	176.0	16.8
340.440000	36.68	66.02	29.34	120.000	377.9	H	339.0	25.1
361.520000	37.39	66.02	28.63	120.000	139.7	V	201.0	25.6
478.560000	41.07	66.02	24.95	120.000	283.2	V	230.0	28.6
694.050000	46.02	66.02	20.00	120.000	126.0	V	209.0	33.4
953.820000	49.95	66.02	16.07	120.000	309.5	V	295.0	36.4
978.340000	50.58	74.00	23.42	120.000	390.0	H	330.0	36.9

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.680000	30.76	40.00	9.24	120.000	140.0	H	120.0	23.9
39.071000	27.32	40.00	12.68	120.000	353.4	H	347.0	20.7
89.410000	23.06	43.52	20.46	120.000	397.1	V	239.0	16.7
90.775000	23.22	43.52	20.30	120.000	354.2	V	176.0	16.8
340.440000	32.20	46.02	13.82	120.000	377.9	H	339.0	25.1
361.520000	32.72	46.02	13.30	120.000	139.7	V	201.0	25.6
478.560000	35.75	46.02	10.27	120.000	283.2	V	230.0	28.6
694.050000	41.12	46.02	4.90	120.000	126.0	V	209.0	33.4
953.820000	45.41	46.02	0.61	120.000	309.5	V	295.0	36.4
978.340000	45.91	54.00	8.09	120.000	390.0	H	330.0	36.9

Deviations, Additions, or Exclusions: None

7 Transmitter Fundamental and Spurious Emissions

7.1 Test Limits

FCC Part 15.225:

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

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

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

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

FCC Part 15.209:

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

RSS-210 Issue 9 § B.6:

The field strength of any emission shall not exceed the following limits:

1. 15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz;
2. 334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz;
3. 106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz; and
4. RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

RSS-Gen Issue 4 § 8.9:

Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 and Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz	
Frequency (MHz)	**Field Strength (µv/m at 3 metres**
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 5 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Below 30 MHz			
Frequency	**Electric Field Strength (µV/m)**	**Magnetic Field Strength (H-Field) (µA/m)**	**Measurement Distance (metres)**
9-490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1,705-30 MHz	30	N/A	30

7.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013.

TEST SITE: 10m ALSE

Site Designation: 10m Chamber

Measurement Uncertainty

Measurement	Frequency Range	Expanded Uncertainty (k=2)	Ucispr
Radiated Emissions, 10m	30-1000 MHz	3.9dB	6.3 dB
Radiated Emissions, 3m	30-1000 MHz	4.0dB	6.3 dB
Radiated Emissions, 3m	1-6 GHz	4.7dB	5.2 dB
Radiated Emissions, 3m	6-15 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	15-18 GHz	4.7dB	5.5 dB
Radiated Emissions, 3m	18-40 GHz	4.7dB	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.

7.3 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

7.4 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
EMI Test Receiver	3900	Rohde&Schwarz	ESU40	9/20/2017	9/20/2018
Bilog Antenna	3133	ETS Lindgren	3142C	4/6/2017	4/6/2018
Loop Antenna	2387	EMCO	6511	6/5/2017	6/5/2018
System Controller	4096	ETS Lindgren	2090	Verify at Time of Use	Verify at Time of Use
System Controller	3957	Sunol Sciences	SC99V	Verify at Time of Use	Verify at Time of Use
3m Cable Chamber→Control Room	2593			11/29/2017	11/29/2018
3m Cable Control Room→Receiver	2592			11/29/2017	11/29/2018
10m Cable Antenna→Preamp	3339	W		11/29/2017	11/29/2018

7.5 Software Utilized

Name	Manufacturer	Version
EMC32	Rohde & Schwarz	Version 9.15.02

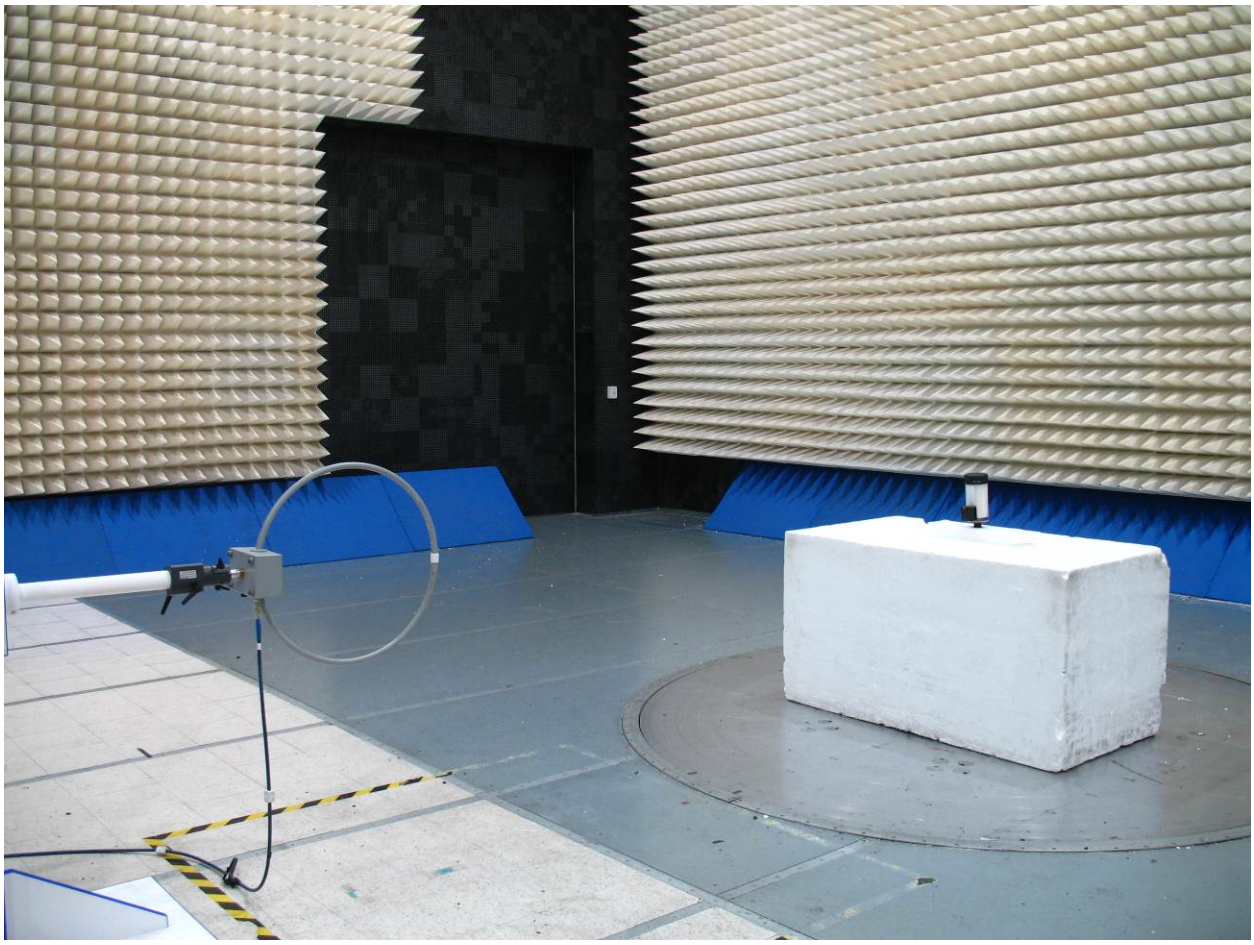
7.6 Test Results

The sample tested was found to be **compliant**.

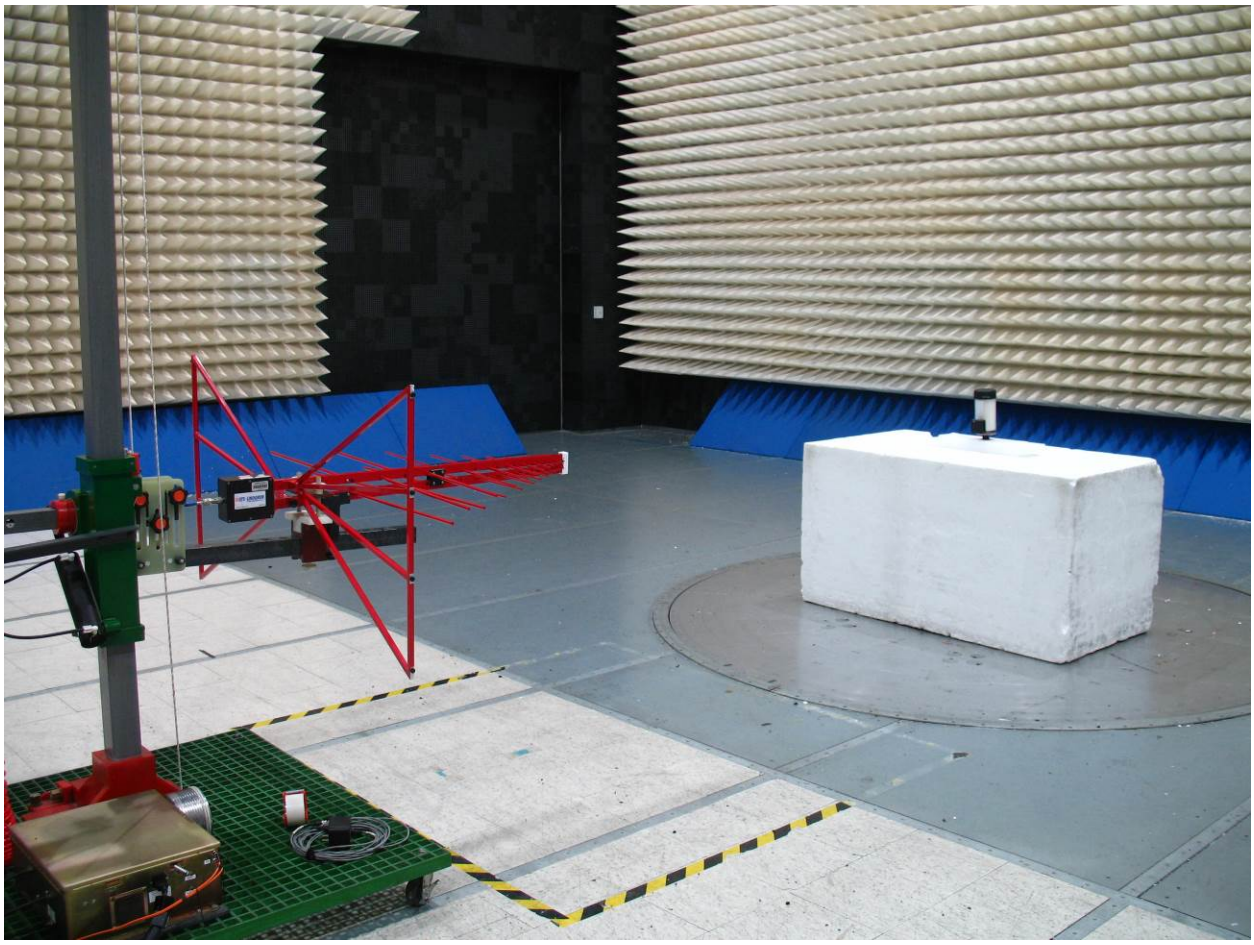
7.7 Test Conditions

Test Personnel:	B. Lackey	Test Date:	2/14/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.255 RSS-210 Issue 9	Ambient Temperature:	19.6C
Input Voltage:	Battery	Relative Humidity:	41.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

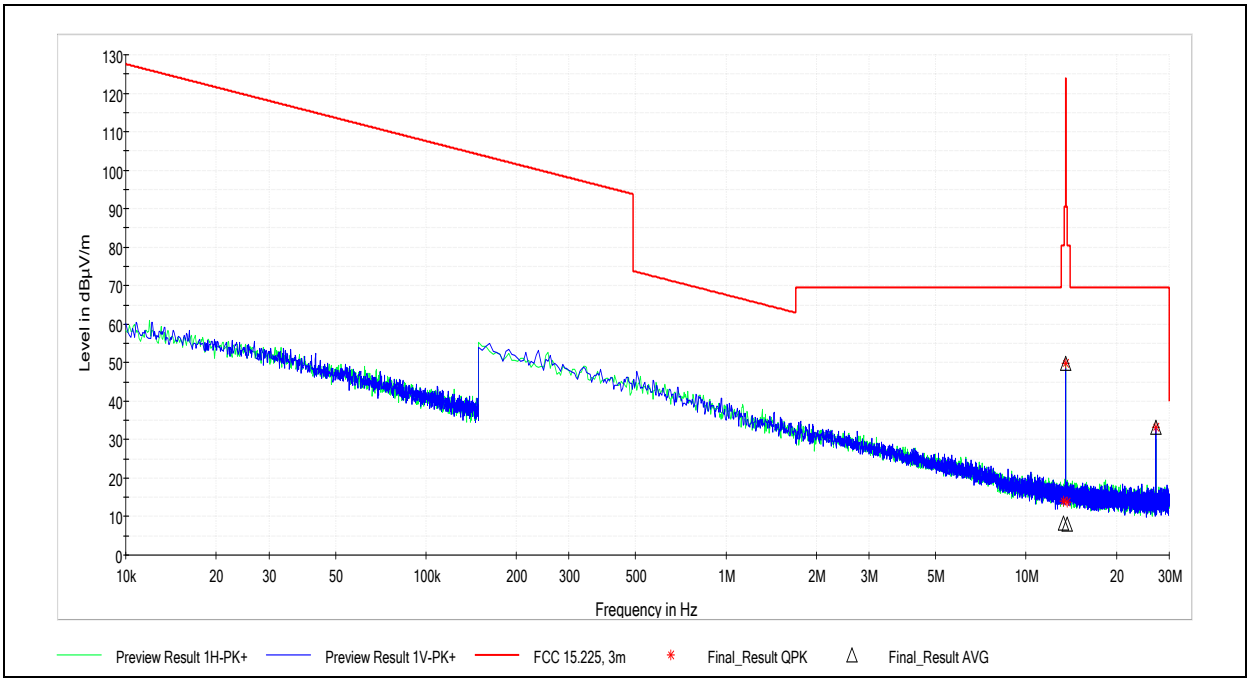
7.8 Setup Photographs: 10kHz – 30MHz



7.9 Setup Photographs: 30MHz – 1GHz



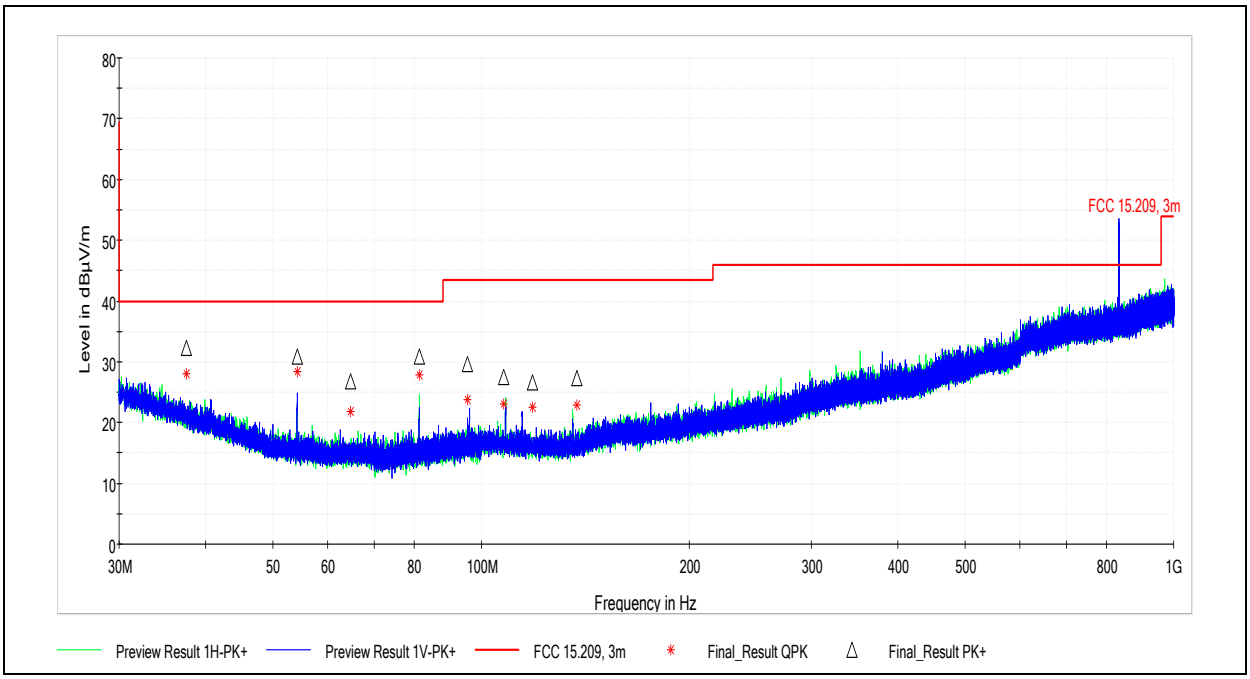
7.10 Test Data: 10kHz – 30MHz (VG-1 Tag and Sensor)



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB)
13.319118	14.01	80.50	66.49	9.000	132.0	11.6
13.560552	49.72	124.00	74.28	9.000	6.0	11.6
13.731750	13.70	80.50	66.80	9.000	312.0	11.6
27.120353	33.32	69.50	36.18	9.000	227.0	9.9

Deviations, Additions, or Exclusions: Limits were adjusted for testing at 3m by 40dB/decade per FCC Part 15.31(f)(2)

7.11 Test Data: 30MHz – 1GHz (VG-1 Tag and Sensor)

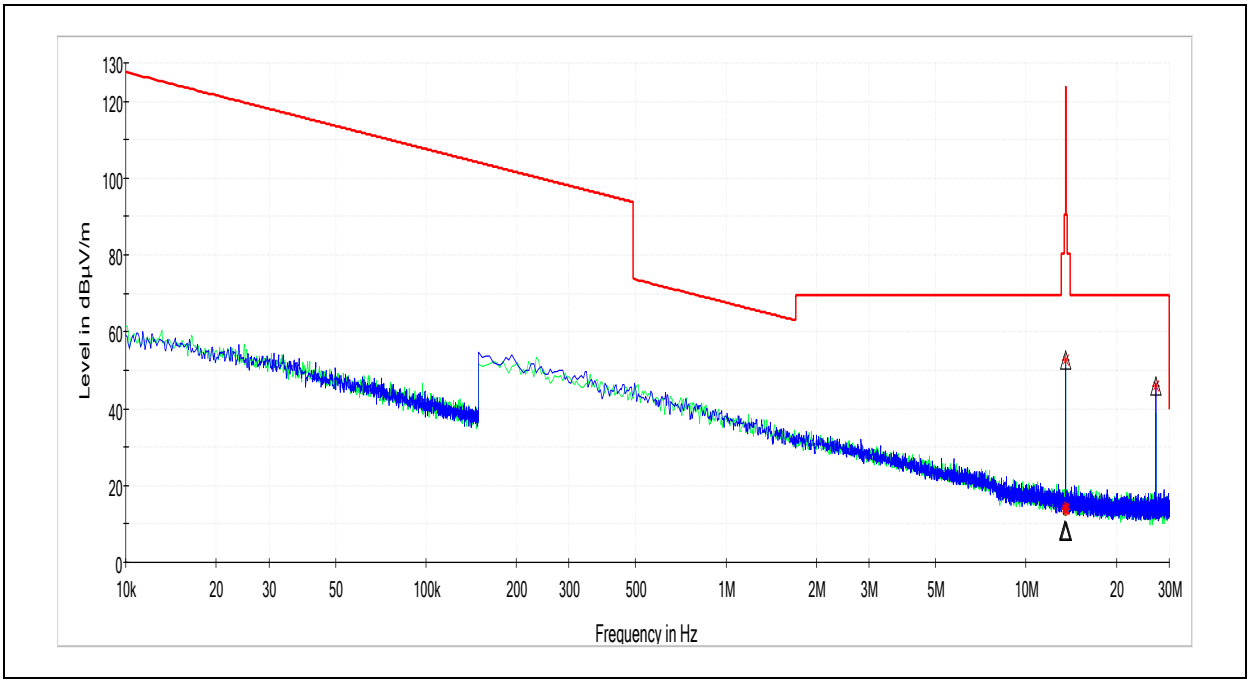


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.555000	32.29	60.00	27.71	120.000	388.7	V	265.0	21.3
54.227000	30.89	60.00	29.11	120.000	98.5	V	222.0	15.9
64.840000	26.76	60.00	33.24	120.000	339.7	V	276.0	15.1
81.345000	30.88	60.00	29.12	120.000	211.1	H	137.0	15.9
95.536000	29.65	63.50	33.85	120.000	397.2	V	28.0	16.9
107.880000	27.49	63.50	36.01	120.000	321.9	H	108.0	16.8
118.580000	26.53	63.50	36.97	120.000	270.2	V	37.0	16.3
137.620000	27.25	63.50	36.25	120.000	247.1	H	329.0	16.4

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
37.555000	27.95	40.00	12.05	120.000	388.7	V	265.0	21.3
54.227000	28.38	40.00	11.62	120.000	98.5	V	222.0	15.9
64.840000	21.75	40.00	18.25	120.000	339.7	V	276.0	15.1
81.345000	27.81	40.00	12.19	120.000	211.1	H	137.0	15.9
95.536000	23.79	43.50	19.71	120.000	397.2	V	28.0	16.9
107.880000	23.10	43.50	20.40	120.000	321.9	H	108.0	16.8
118.580000	22.57	43.50	20.93	120.000	270.2	V	37.0	16.3
137.620000	22.81	43.50	20.69	120.000	247.1	H	329.0	16.4

Deviations, Additions, or Exclusions: None

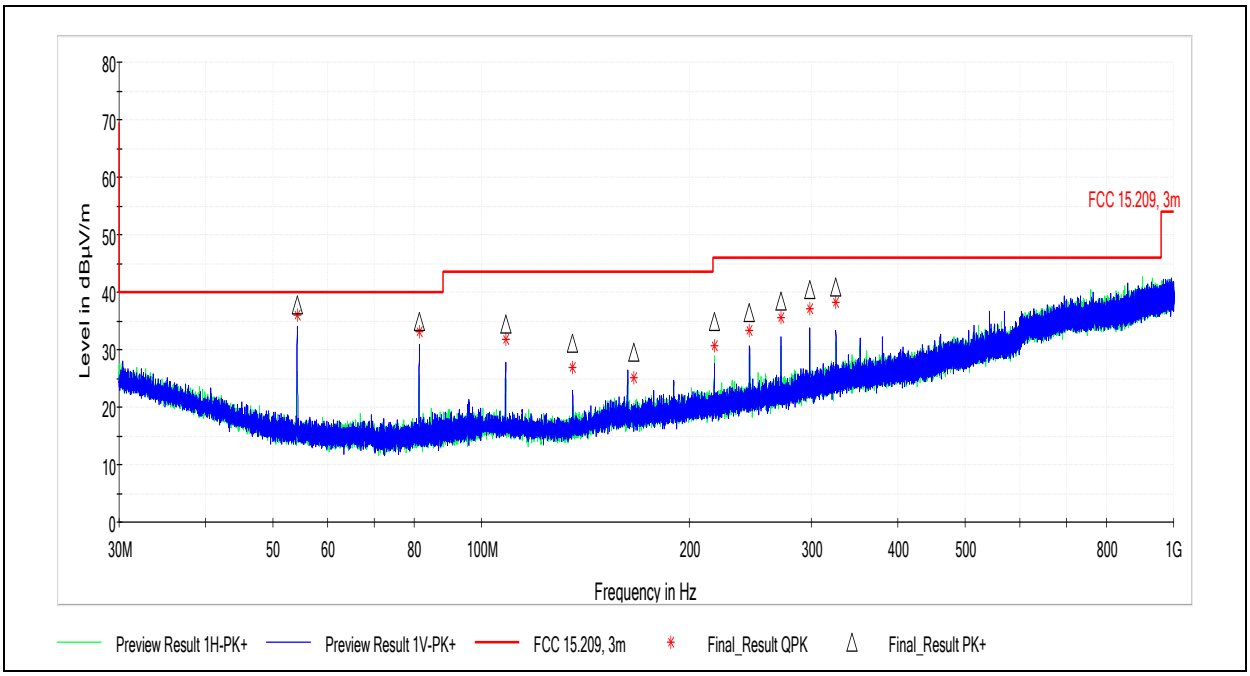
7.12 Test Data: 10kHz – 30MHz (VG-4 Tag and Sensor)



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Azimuth (deg)	Corr. (dB)
13.490316	14.08	90.50	76.42	9.000	73.0	11.6
13.503485	13.95	90.50	76.55	9.000	0.0	11.6
13.538603	13.98	90.50	76.52	9.000	8.0	11.6
13.560552	52.62	124.00	71.38	9.000	8.0	11.6
13.595669	13.76	90.50	76.74	9.000	92.0	11.6
27.120353	45.84	69.50	23.66	9.000	244.0	9.9

Deviations, Additions, or Exclusions: Limits were adjusted for testing at 3m by 40dB/decade per FCC Part 15.31(f)(2)

7.13 Test Data: 30MHz – 1GHz (VG-4 Tag and Sensor)



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
54.234000	37.88	60.00	22.12	120.000	97.9	V	228.0	15.9
81.352000	34.92	60.00	25.08	120.000	98.6	V	254.0	15.9
108.480000	34.54	63.50	28.96	120.000	98.4	V	228.0	16.8
135.580000	31.11	63.50	32.39	120.000	98.0	V	228.0	16.3
166.120000	29.47	63.50	34.03	120.000	350.2	V	164.0	18.3
216.980000	34.84	66.00	31.16	120.000	103.0	H	154.0	20.1
244.080000	36.35	66.00	29.65	120.000	186.5	V	226.0	21.4
271.180000	38.39	66.00	27.61	120.000	187.5	V	128.0	22.2
298.320000	40.42	66.00	25.58	120.000	175.6	V	329.0	23.5
325.440000	40.80	66.00	25.20	120.000	140.1	V	248.0	24.7

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
54.234000	35.97	40.00	4.03	120.000	97.9	V	228.0	15.9
81.352000	33.10	40.00	6.90	120.000	98.6	V	254.0	15.9
108.480000	31.73	43.50	11.77	120.000	98.4	V	228.0	16.8
135.580000	26.91	43.50	16.59	120.000	98.0	V	228.0	16.3
166.120000	25.09	43.50	18.41	120.000	350.2	V	164.0	18.3
216.980000	30.74	46.00	15.26	120.000	103.0	H	154.0	20.1
244.080000	33.25	46.00	12.75	120.000	186.5	V	226.0	21.4
271.180000	35.58	46.00	10.42	120.000	187.5	V	128.0	22.2
298.320000	37.05	46.00	8.95	120.000	175.6	V	329.0	23.5
325.440000	38.29	46.00	7.71	120.000	140.1	V	248.0	24.7

Deviations, Additions, or Exclusions: None

8 Frequency Stability

8.1 Test Limits

FCC Part 15.225:

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

RSS-210 Issue 9 § B.6:

Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

8.2 Test Method

Tests are performed in accordance with ANSI C63.10:2013.

8.3 Test Equipment Used

Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	10/18/2017	10/18/2018

8.4 Test Results

The sample tested was found to be **compliant**. The device was tested with fresh batteries.

8.5 Test Conditions

Test Personnel:	B. Lackey	Test Date:	2/14/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.255 RSS-210 Issue 9	Ambient Temperature:	19.6C
Input Voltage:	Battery	Relative Humidity:	41.0%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	982.0mbar

8.6 Test Data

Temperature (C)	Frequency (MHz)	Deviation (Hz)	Deviation (%)	Limit (%)	Result
-30	13.559644	-356	-0.003	±0.01	Pass
-20	13.559665	-335	-0.002	±0.01	Pass
-10	13.559657	-343	-0.003	±0.01	Pass
0	13.559643	-357	-0.003	±0.01	Pass
10	13.559631	-369	-0.003	±0.01	Pass
20	13.559621	-379	-0.003	±0.01	Pass
30	13.559581	-419	-0.003	±0.01	Pass
40	13.559600	-400	-0.003	±0.01	Pass
50	13.559572	-428	-0.003	±0.01	Pass

Deviations, Additions, or Exclusions: None

9 Occupied Bandwidth

9.1 Test Method

Tests are performed in accordance with ANSI C63.10:2013.

9.2 Test Equipment Used

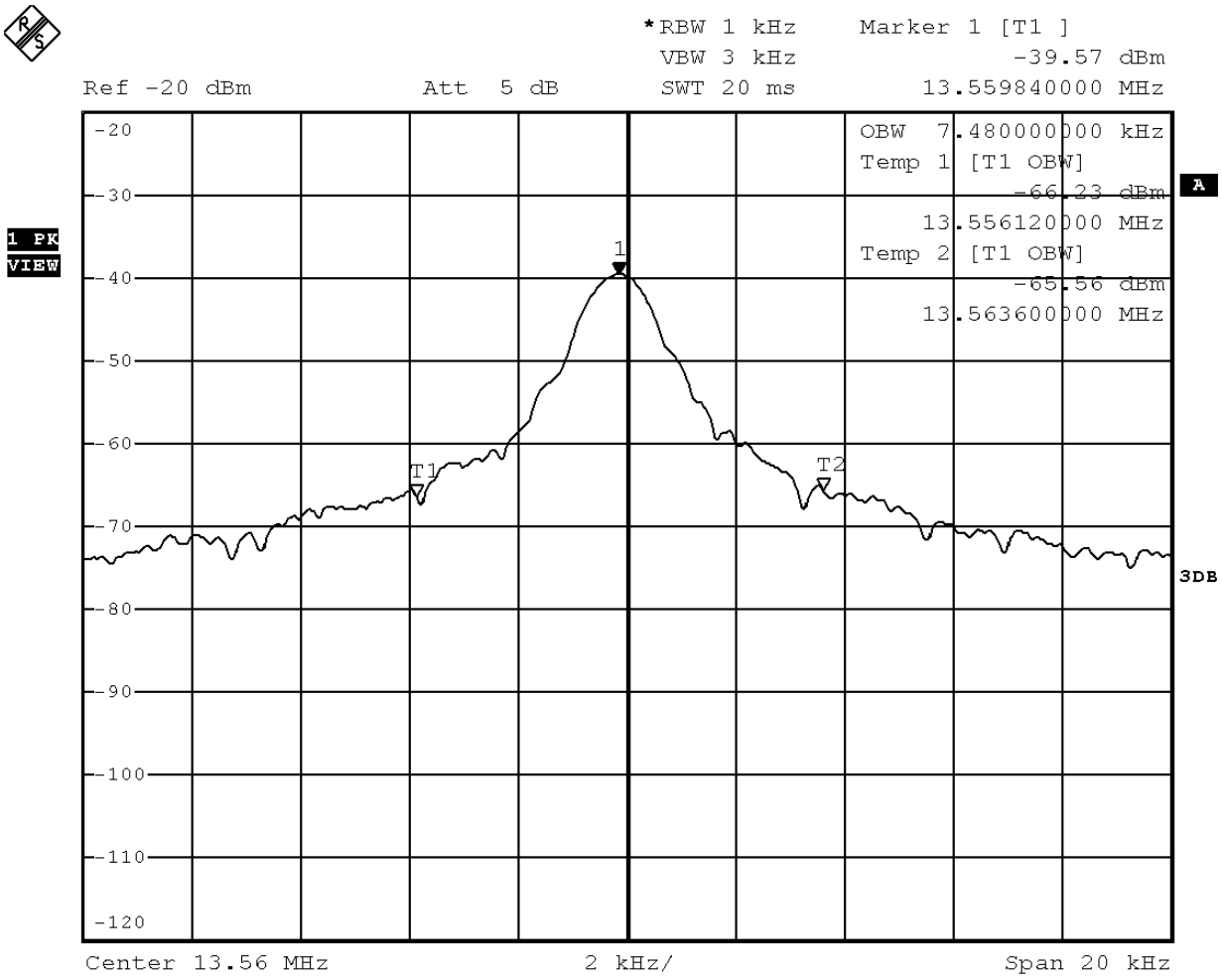
Description	Asset	Manufacturer	Model	Cal Date	Cal Due
Spectrum Analyzer	3099	Rohde & Schwarz	FSP7	10/18/2017	10/18/2018

9.3 Test Conditions

Test Personnel:	B. Lackey	Test Date:	2/21/2018
Supervising/Reviewing Engineer: (Where Applicable)	NA	Limit Applied:	See Above
Product Standard:	FCC Part 15.255 RSS-210 Issue 9	Ambient Temperature:	23.8C
Input Voltage:	Battery	Relative Humidity:	46.4%
Pretest Verification w / Ambient Signals or BB Source:	Yes	Atmospheric Pressure:	988.8mbar

9.4 Test Data

RBW	VBW	99% BW
1 kHz	3 kHz	7.48 kHz



99% Occupied Bandwidth

Deviations, Additions, or Exclusions: None

10 Antenna Requirement

10.1 Test Limits

FCC Part 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

RSS-Gen Issue 4 § 8.3:

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

10.2 Test Results

The device was found to be **compliant**. The device has an internal, permanently affixed antenna.

11 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	3/16/2018	103397344LEX-002	BL	BCT	Original Issue
1	3/22/2018	103397344LEX-002.1	BL	BCT	Updated contact information
2	8/17/2018	103397344LEX-002.2	BL	BCT	Updated occupied bandwidth measurement