

# RF TEST REPORT



Report No.: FCC\_IC\_RF\_SL16120201-HID-035\_RFID

Supersede Report No.: NONE

Applicant	:	HID Global Corporation
Product Name	:	Smart Card Reader with 125kHz LF, 13.56MHz HF, and 2.4GHz BLE
Model No.	:	OMNIKEY 5427 G2
Test Standard	:	FCC 15.225 RSS-210 Issue 8: 2010
Test Method	:	FCC 15.225 ANSI C63.10 2013 RSS Gen Issue 4 2014
FCC ID	:	JQ6-OK5427G2
IC ID	:	2236B-OK5427G2
Dates of test	:	02/27/2017 – 03/03/2017
Issue Date	:	05/10/2017
Test Result	:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Equipment complied with the specification [X]		
Equipment did not comply with the specification [ ]		
This test report is issued under the Authority of:		
		
Pooja Pandya	Chen Ge	
Test Engineer	Engineer Reviewer	
This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only		

Issued By:  
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## Laboratory Introduction

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### Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRR, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	EMC, RF/Wireless, Telecom, Safety
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

### Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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## 1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_IC_RF_SL16120201-HID-035_HF	-	Original	05/10/2017

## 2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: HID Global Corporation  
Product: Smart Card Reader with 125kHz LF, 13.56MHz HF, and 2.4GHz BLE  
Model: OMNIKEY 5427 G2

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1<sup>st</sup> page.

## 3 Customer information

Applicant Name	:	HID Global Corporation
Applicant Address	:	611 Center Ridge Drive, Austin, TX 78753
Manufacturer Name	:	HID Global Corporation
Manufacturer Address	:	6533 Flying Cloud Drive. Eden Prairie, MN 55344

## 4 Test site information

Lab performing tests	:	SIEMIC Laboratories
Lab Address	:	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	:	881796
IC Test Site No.	:	4842D-2
VCCI Test Site No.	:	A0133

## 5 Modification

Index	Item	Description	Note
-	-	-	-

## 6 EUT Information

### 6.1 EUT Description

Product Name	Smart Card Reader with 125kHz LF, 13.56MHz HF, and 2.4GHz BLE
Model No.	OMNIKEY 5427 G2
Trade Name	HID Global Corporation
Serial No.	N/A
Input Power	5VDC
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Date of EUT received	27/02/2017
Equipment Class/ Category	Class B / 125kHz, 13.56MHz RFID SRD / 2.4GHz BLE
Port/Connectors	USB

### 6.2 Radio Description

#### Specifications for Radio:

Radio Type	RFID
Operating Frequency	125KHz, 13.56MHz
Modulation	ASK (125KHz), ASK (13.56MHz)
Channel Spacing	None
Antenna Type	PCB Loop Antenna
Antenna Gain	1 dBi
Antenna Connector Type	N/A

#### Channel List:

Type	Mode	Channel No.	Frequency (MHz)	Available (Y/N)
RFID	125KHz	1	0.125	Y
RFID	13.56MHz	1	13.56	Y

### 6.3 EUT test modes/configuration Description

Mode	Note
RF test	EUT is set to continuously transmit at 13.56MHz and 125kHz
<b>Note:</b> None	

Test Item	Operating mode	Tested antenna port	Test frequencies
Antenna Requirement	N/A	-	125kHz  13.56MHz
Conducted Emissions Voltage	Continuous Transmit	-	
Limit in the band of 13.553 – 13.567 MHz	Continuous Transmit	-	
Limit in the band of 13.410 – 13.553 MHz and 13.567 – 13.710 MHz	Continuous Transmit	-	
Limit in the band of 13.110 – 13.410 MHz and 13.710 – 14.010 MHz	Continuous Transmit	-	
Limit outside the band of 13.110 – 14.010 MHz	Continuous Transmit	-	
Frequency Stability	Continuous Transmit	-	
Occupied Bandwidth	Continuous Transmit	-	

**Note:** EUT uses a PCB trace antenna attached to the PCB board. Only radiated measurements were performed during the test.



#### 6.4 EUT Photos – External



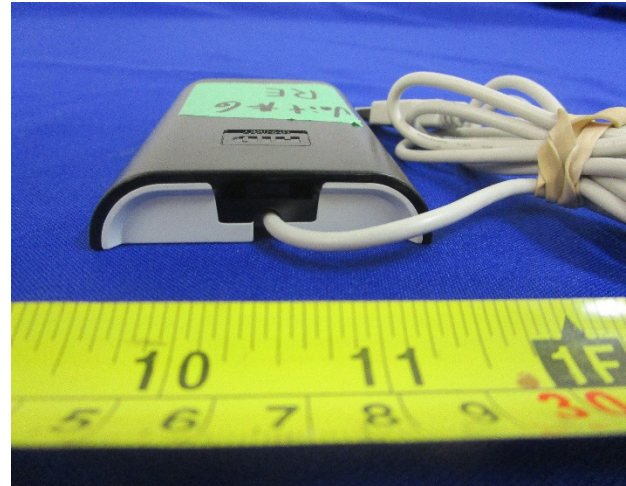
EUT Top Side View



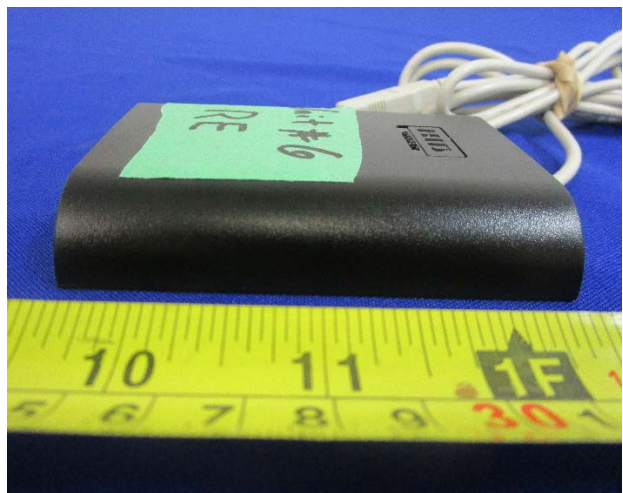
EUT Bottom Side View



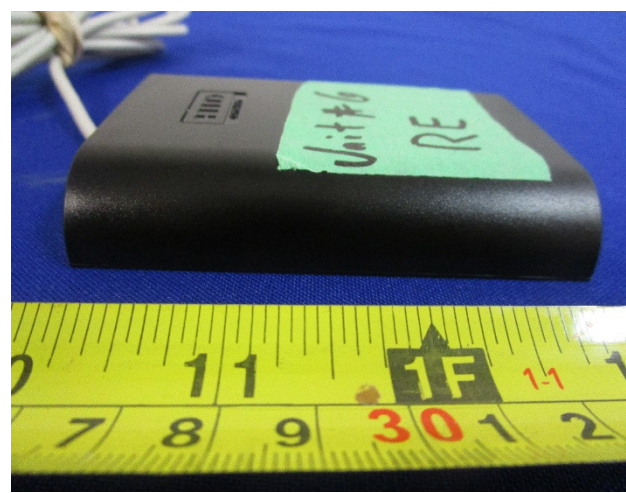
EUT Front Side View



EUT Rear Side View

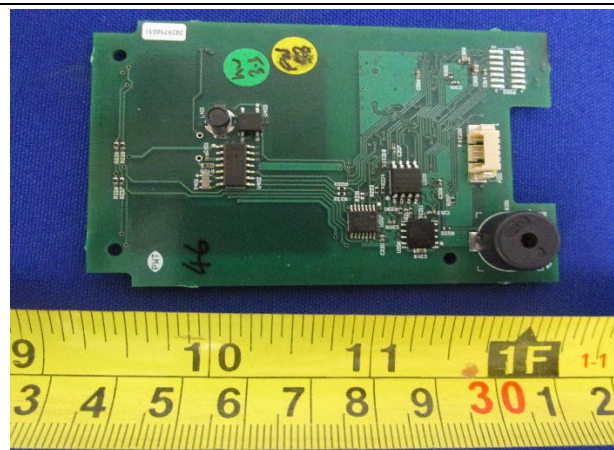
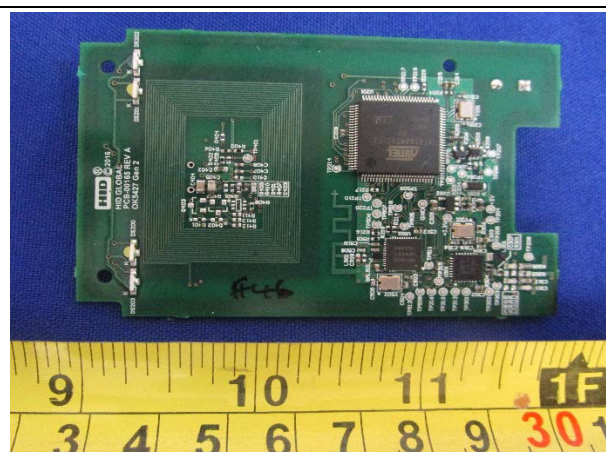
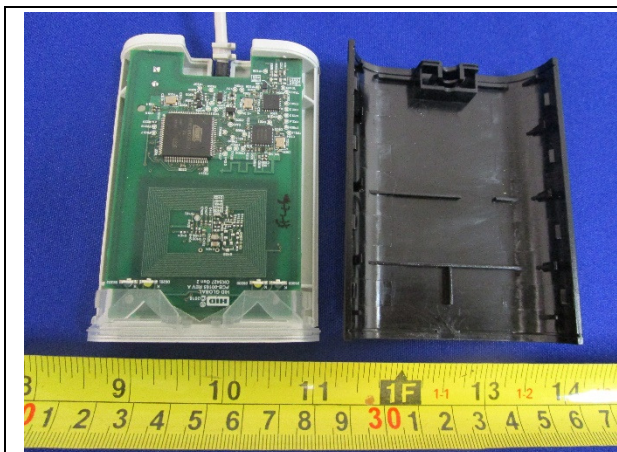


EUT Left Side View



EUT Right Side View







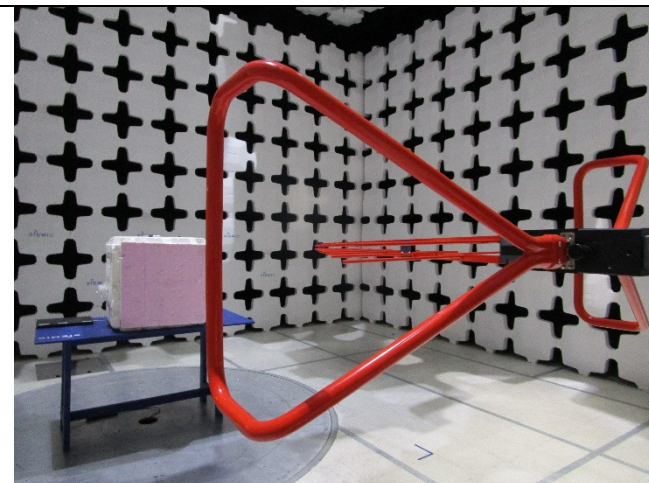
## 6.6 EUT Test Setup Photos



AC Line Conducted Emissions– Front View



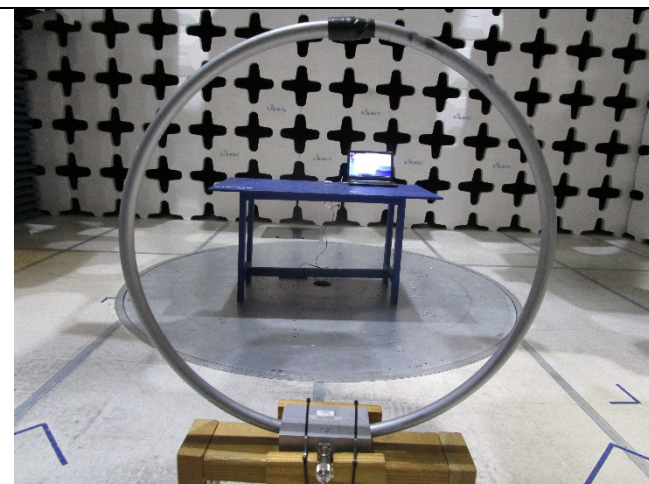
AC Line Conducted Emissions– Rear View



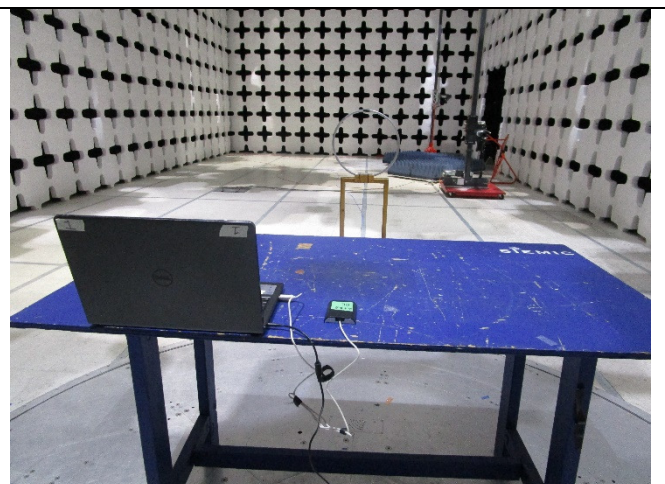
Radiated Emissions (<1GHz) – Front View



Radiated Emissions (<1GHz) – Rear View



Radiated Emissions (<30MHz) – Front View



Radiated Emissions (<30MHz) – Rear View

## 7 Supporting Equipment/Software and cabling Description

### 7.1 Supporting Equipment

Index	Supporting Equipment Description	Model	Serial No	Manu	Note
1	Laptop	Inspiron 15	9555XB2	Dell	-

### 7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
USB	EUT	USB	Laptop	USB	2m	shielded	-

### 7.3 Test Software Description

Test Item	Software	Description
RF Testing	ReaderUtility	The EUT continuously transmit itself when powered on.

## 8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Antenna Requirement	FCC	15.203	ANSI C63.10 – 2013 558074 D01 DTS Meas. Guidance v03r02	<input checked="" type="checkbox"/> Pass
	IC			<input type="checkbox"/> N/A
AC Conducted Emissions Voltage	FCC	15.225(a)	ANSI C63.10 2013 RSS Gen. 8.8	<input checked="" type="checkbox"/> Pass
	IC	RSS Gen (7.2.2)		<input type="checkbox"/> N/A
Remark	1. AC Line tests were performed on the support equipment's power adapter, laptop.			

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Limit in the band of 13.553 – 13.567 MHz	FCC	15.225(a)	FCC	ANSI C63.10 2013	<input checked="" type="checkbox"/> Pass
	IC	RSS210(A2.6)	IC	RSS Gen 6.13	<input type="checkbox"/> N/A
Limit in the band of 13.410 – 13.553 MHz and 13.567 – 13.710 MHz	FCC	15.225(b)	FCC	ANSI C63.10 2013	<input checked="" type="checkbox"/> Pass
	IC	RSS210(A2.6)	IC	RSS Gen 6.13	<input type="checkbox"/> N/A
Limit in the band of 13.110 – 13.410 MHz and 13.710 – 14.010 MHz	FCC	15.225(c)	FCC	ANSI C63.10 2013	<input checked="" type="checkbox"/> Pass
	IC	RSS210(A2.6)	IC	RSS Gen 6.13	<input type="checkbox"/> N/A
Limit outside the band of 13.110 – 14.010 MHz	FCC	15.225(d), 15.209	FCC	ANSI C63.10 2013	<input checked="" type="checkbox"/> Pass
	IC	RSS210(A2.6)	IC	RSS Gen 6.13	<input type="checkbox"/> N/A
Receiver Spurious Emission	IC	-	IC	RSS Gen 7.1	<input type="checkbox"/> Pass <input checked="" type="checkbox"/> N/A
Frequency Stability	FCC	15.225(e)	FCC	-	<input checked="" type="checkbox"/> Pass
	IC	RSS210(A2.6)	IC	RSS Gen 6.11	<input type="checkbox"/> N/A
Occupied Bandwidth	FCC	-	FCC	-	<input checked="" type="checkbox"/> Pass
	IC	RSS-210(5.9.1)	IC	RSS Gen 6.6	<input type="checkbox"/> N/A
Remark	2. All measurement uncertainties are not taken into consideration for all presented test result. 3. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual. 4. Test Method: ANSI C63.10: 2013 / RSS – Gen Issue 4: November 2014.				



## 9 Measurement Uncertainty

### 9.1 Conducted Emissions

The test is to measure the conducted emissions to the mains port of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the LISN
- Uncertainty of cables
- Uncertainty due to the mismatches
- Etc, see the below table for details

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
LISN Insertion Loss	0.40	Normal	2	1	0.20
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch LISN - Receiver	0.25	U-Shape	1.414	1	0.1768033
LISN Impedance	2.5	Triangular	2.449	1	1.0208248
Combined Standard Uncertainty					1.928133
<b>Expanded Uncertainty (K=2)</b>					<b>3.856266</b>

The total derived measurement uncertainty is +/- 3.86 dB.

### 9.2 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
<b>Expanded Uncertainty (K=2)</b>					<b>6.0118262</b>

The total derived measurement uncertainty is +/- 6.00 dB.



### 9.3 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
<b>Expanded Uncertainty (K=2)</b>					<b>8.4726</b>

The total derived measurement uncertainty is +/- 8.47 dB.

### 9.4 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
<b>Expanded Uncertainty (K=2)</b>					<b>0.952174</b>

The total derived measurement uncertainty is +/- 0.95 dB.

## 10 Measurements, examination and derived results

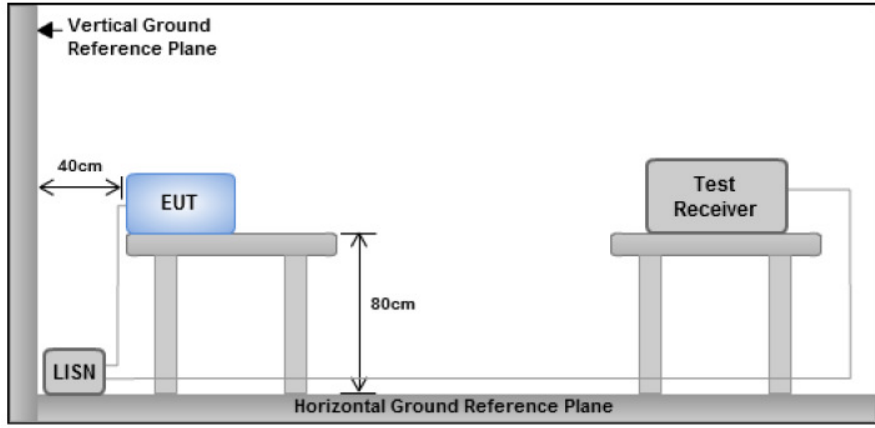
### 10.1 Antenna Requirement

Spec	Requirement	Applicable
§15.203	<p>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.</p> <p>Antenna requirement must meet at least one of the following:</p> <p>a) Antenna must be permanently attached to the device.  b) The antenna must use a unique type of connector to attach to the device.  c) Device must be professionally installed. The installer shall be responsible for ensuring that the correct antenna is employed by the device.</p>	<input checked="" type="checkbox"/>
Remark	The RFID antenna is integral to the PCB board permanently to the device which meets the requirement (See Internal Photographs submitted as another Exhibit).	
Result	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL	

## 10.2 Conducted Emissions Test Result

### Conducted Emission Limit

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
Class B devices	0.15 ~ 0.5	66 – 56	56 – 46
	0.5 ~ 5	56	46
	5 ~ 30	60	50

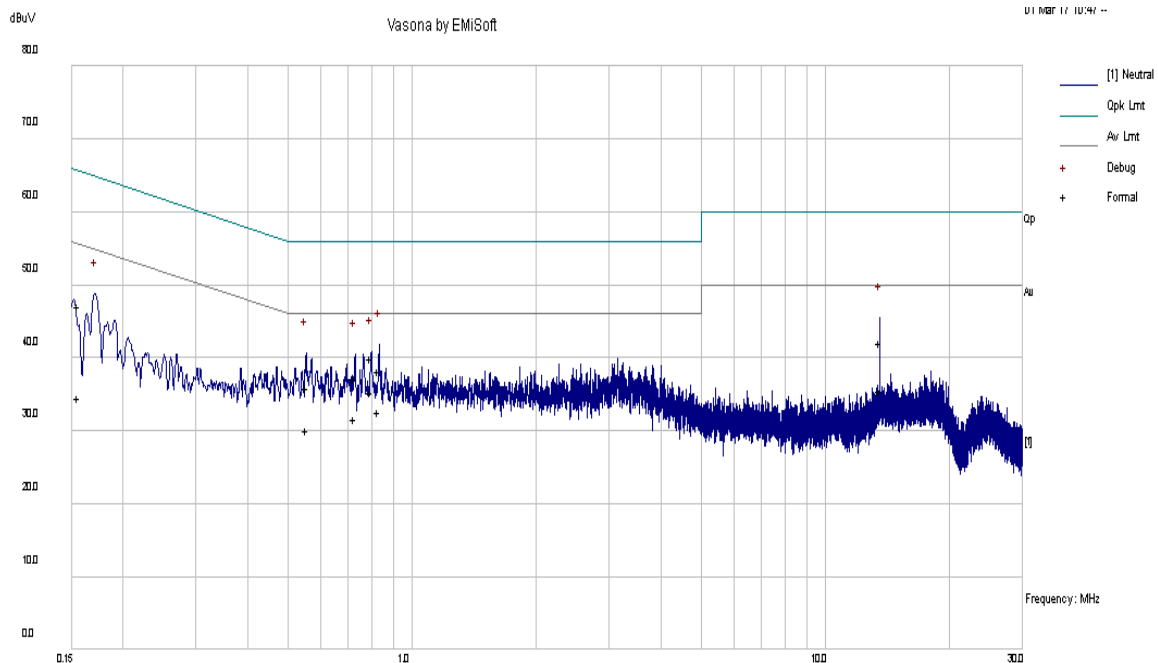
Spec	Item	Requirement	Applicable
§ 15.207, RSS210(A8.1)	a)	<p>For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits set in § 15.207, as measured using a 50 <math>\mu</math>H/50 ohms line impedance stabilization network (LISN).</p> <p>AC Line conducted emission within the band 150kHz to 30MHz</p>	<input checked="" type="checkbox"/>
Test Setup		 <p>Note: 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes</p>	
Procedure		<ul style="list-style-type: none"> <li>The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.</li> <li>The power supply for the EUT was fed through a 50<math>\Omega</math>/50<math>\mu</math>H EUT LISN, connected to filtered mains.</li> <li>The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.</li> <li>All other supporting equipment was powered separately from another main supply.</li> </ul>	
Test Date	02/27/2017	Environmental conditions	Temperature 21°C Relative Humidity 38 % Atmospheric Pressure 1025 mbar
Remark	The EUT was tested at 120VAC, 60Hz.		
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes ☐ N/A

Test was done by Pooja Pandya at Conducted Emission test site.

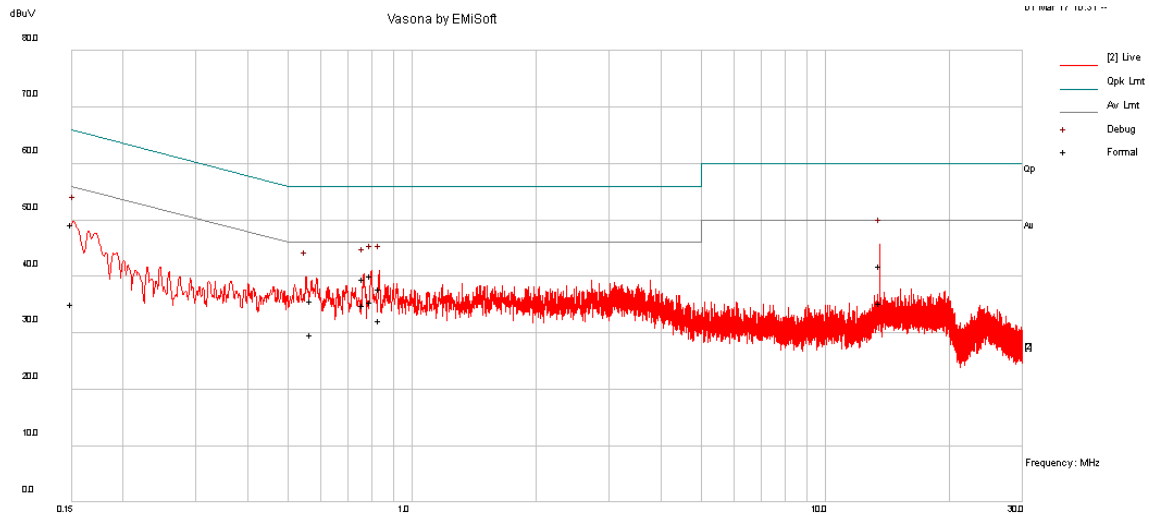
Test specification:	Conducted Emissions			
Mains Power:	120VAC, 60Hz		Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Tested by:	Pooja Pandya			
Test Date:	02/27/2017			
Remarks:	AC Line @ Neutral			



#### Neutral Measurements

Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line/ Neutral	Limit dBuV	Margin dB	Pass /Fail
0.83000	27.72	10.01	0.54	38.28	Quasi Peak	Neutral	56.00	-17.72	Pass
13.55985	31.56	10.06	0.55	42.17	Quasi Peak	Neutral	60.00	-17.83	Pass
0.795076	29.34	10.01	0.55	39.90	Quasi Peak	Neutral	56.00	-16.10	Pass
0.555176	25.37	10.01	0.61	35.98	Quasi Peak	Neutral	56.00	-20.02	Pass
0.725458	26.68	10.01	0.56	37.25	Quasi Peak	Neutral	56.00	-18.75	Pass
0.156257	35.44	10.00	1.66	47.10	Quasi Peak	Neutral	65.66	-18.56	Pass
0.832164	21.97	10.01	0.54	32.53	Average	Neutral	46.00	-13.47	Pass
13.55985	24.88	10.06	0.55	35.49	Average	Neutral	50.00	-14.51	Pass
0.795076	24.78	10.01	0.55	35.35	Average	Neutral	46.00	-10.65	Pass
0.555176	19.49	10.01	0.61	30.11	Average	Neutral	46.00	-15.89	Pass
0.725458	21.03	10.01	0.56	31.60	Average	Neutral	46.00	-14.40	Pass
0.156257	22.80	10.00	1.66	34.46	Average	Neutral	55.66	-21.20	Pass

Test specification:	Conducted Emissions			
Mains Power:	120VAC, 60Hz		Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Tested by:	Pooja Pandya			
Test Date:	02/27/2017			
Remarks:	AC Line @ Line			



#### Line Measurements

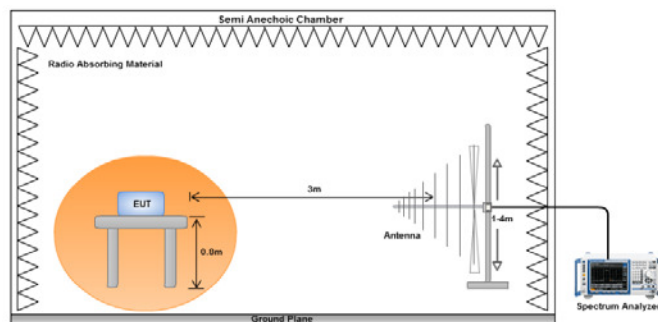
Frequency MHz	Raw dBμV	Cable Loss	Factors dB	Level dBμV	Measurement Type	Line/ Neutral	Limit dBμV	Margin dB	Pass /Fail
13.558890	31.38	10.06	0.55	41.98	Quasi Peak	Live	60.00	-18.02	Pass
0.832758	27.28	10.01	0.54	37.84	Quasi Peak	Live	56.00	-18.16	Pass
0.796767	29.53	10.01	0.55	40.09	Quasi Peak	Live	56.00	-15.91	Pass
0.761860	29.01	10.01	0.55	39.57	Quasi Peak	Live	56.00	-16.43	Pass
0.568744	25.10	10.01	0.60	35.71	Quasi Peak	Live	56.00	-20.29	Pass
0.150000	37.54	10.00	1.74	49.29	Quasi Peak	Live	66.00	-16.71	Pass
13.558890	24.64	10.06	0.55	35.24	Average	Live	50.00	-14.76	Pass
0.832758	21.66	10.01	0.54	32.22	Average	Live	46.00	-13.78	Pass
0.796767	24.98	10.01	0.55	35.55	Average	Live	46.00	-10.45	Pass
0.761860	24.33	10.01	0.55	34.90	Average	Live	46.00	-11.10	Pass
0.568744	19.04	10.01	0.60	29.65	Average	Live	46.00	-16.35	Pass
0.150000	23.40	10.00	1.74	35.14	Average	Live	56.00	-20.86	Pass



## 10.3 Radiated Measurements

### 10.3.1 Radiated Measurements 30MHz to 1GHz

#### Requirement(s):

Spec	Requirement	Applicable										
47 CFR §15.225 RSS-210 (A2.6)	<div>Operation within the band 13.110–14.010 MHz: (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.</div> <table><thead><tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr></thead><tbody><tr><td>30 – 88</td><td>100</td></tr><tr><td>88 – 216</td><td>150</td></tr><tr><td>216 960</td><td>200</td></tr><tr><td>Above 960</td><td>500</td></tr></tbody></table>	Frequency range (MHz)	Field Strength (uV/m)	30 – 88	100	88 – 216	150	216 960	200	Above 960	500	<input checked="" type="checkbox"/>
Frequency range (MHz)	Field Strength (uV/m)											
30 – 88	100											
88 – 216	150											
216 960	200											
Above 960	500											
Test Setup												
Procedure	<div>1. The EUT was switched on and allowed to warm up to its normal operating condition.</div> <div>2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:<div>a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.</div><div>b. The EUT was then rotated to the direction that gave the maximum emission.</div><div>c. Finally, the antenna height was adjusted to the height that gave the maximum emission.</div></div> <div>3. A Quasi-peak measurement was then made for that frequency point.</div> <div>4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</div>											
Test Date	03/01/2017	<table><thead><tr><th>Environmental conditions</th><th></th></tr></thead><tbody><tr><td>Temperature</td><td>20.1°C</td></tr><tr><td>Relative Humidity</td><td>36%</td></tr><tr><td>Atmospheric Pressure</td><td>1026mbar</td></tr></tbody></table>	Environmental conditions		Temperature	20.1°C	Relative Humidity	36%	Atmospheric Pressure	1026mbar		
Environmental conditions												
Temperature	20.1°C											
Relative Humidity	36%											
Atmospheric Pressure	1026mbar											
Remark	-											
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail											

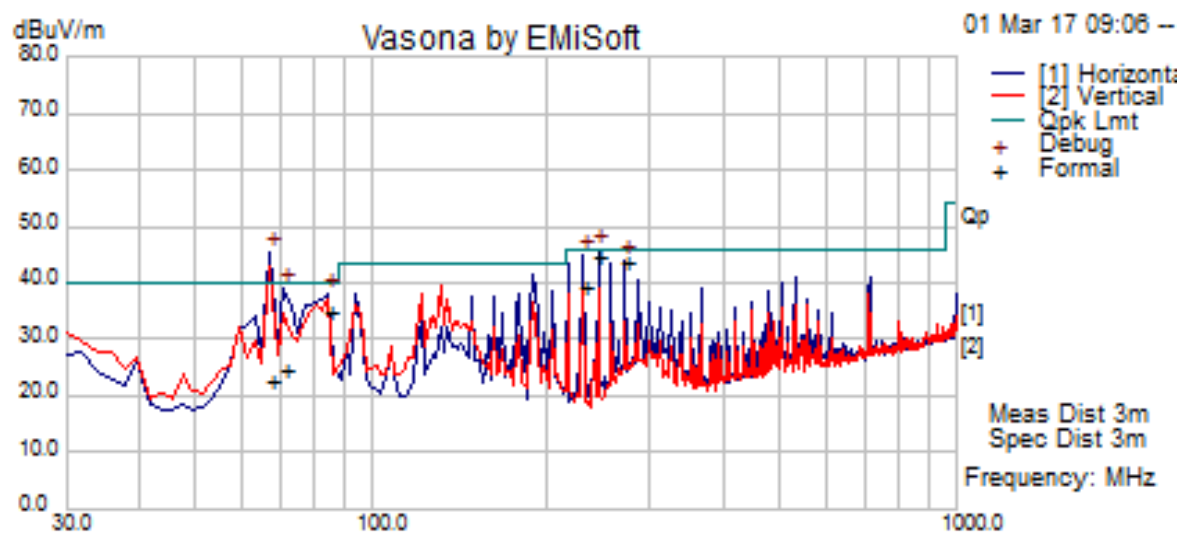
Test Data    ☒ Yes (See below)      ☐ N/A

Test Plot    ☒ Yes (See below)      ☐ N/A

Test was done by Pooja Pandya at 10 meter chamber.

Test specification:	Radiated Emissions			
Mains Power:	120VAC, 60Hz		Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Tested by:	Pooja Pandya			
Test Date:	03/01/2017			
Remarks:	N/A			

**$f=30\text{MHz} - 1000\text{MHz}$  plot and 3 meter distance**

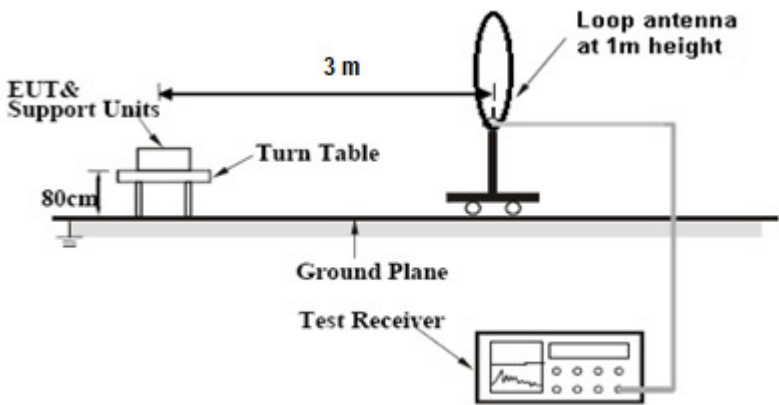


**$f=30\text{MHz} - 1000\text{MHz}$  Measurements**

Frequency MHz	Raw dBuV/m	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
67.10	49.75	1.46	-28.46	22.75	Quasi Max	H	329	156	40	-17.25	Pass
244.07	66.15	2.78	-24.54	44.40	Quasi Max	H	129	49	46	-1.60	Pass
70.85	51.26	1.48	-28.17	24.57	Quasi Max	H	252	179	40	-15.43	Pass
230.47	61.73	2.63	-25.12	39.24	Quasi Max	H	135	41	46	-6.76	Pass
84.18	61.87	1.55	-28.46	34.96	Quasi Max	H	242	23	40	-5.04	Pass
271.20	63.98	2.81	-23.32	43.47	Quasi Max	H	108	39	46	-2.53	Pass

### 10.3.2 Radiated Measurements below 30MHz

#### Requirement(s):

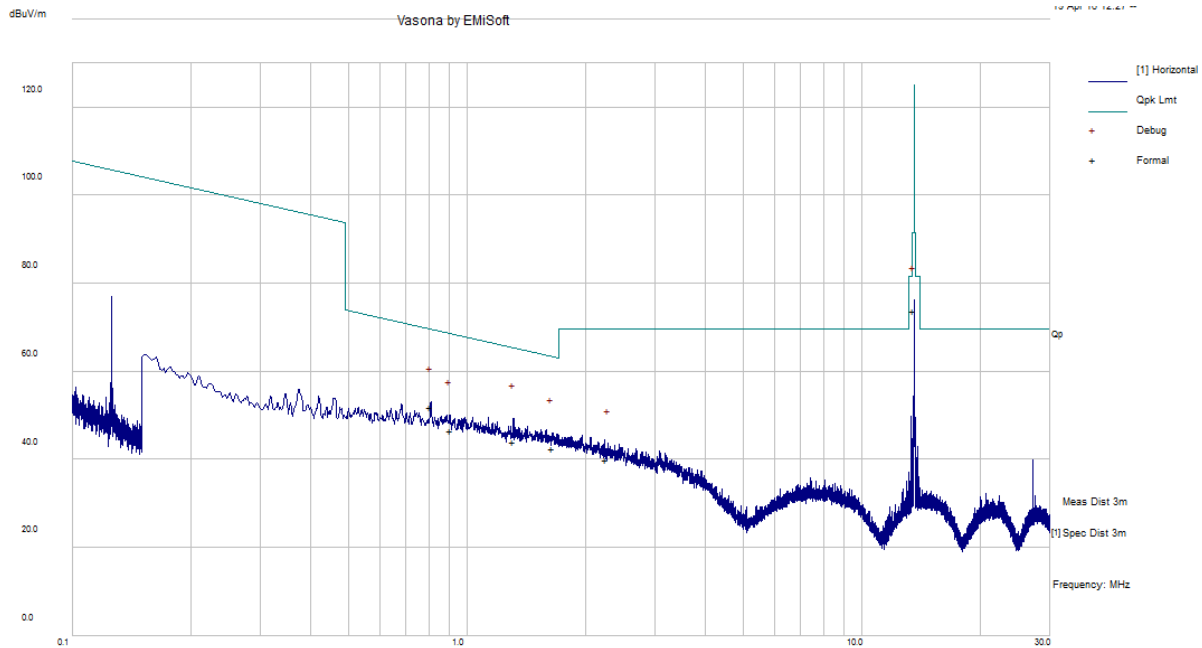
Spec	Requirement	Applicable
47 CFR §15.225 RSS-210 (A2.6)	<p>Operation within the band 13.110–14.010 MHz</p> <p>(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.</p> <p>(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.</p> <p>(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.</p> <p>(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.</p>	<input checked="" type="checkbox"/>
Test Setup		
Procedure	<p>For &lt; 30MHz, Radiated emissions were measured according to ANSI C63.10. The EUT was set to transmit at the highest output power.</p> <p>The EUT was set 3 meter away from the measuring antenna. The loop antenna was positioned 1 meter above the ground from the center of the loop. The measuring bandwidth was set to 10 kHz.</p> <p>The limit is converted from microvolt/meter to decibel microvolt/meter.</p>	
Test Date	02/27/2017	Environmental conditions
		<p>Temperature 22°C</p> <p>Relative Humidity 40%</p> <p>Atmospheric Pressure 1026mbar</p>
Remark	-	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

**Test Data**    ☒ Yes (See below)      ☐ N/A

**Test Plot**    ☒ Yes (See below)      ☐ N/A

**Test was done by Pooja Pandya at 10 meter chamber.**

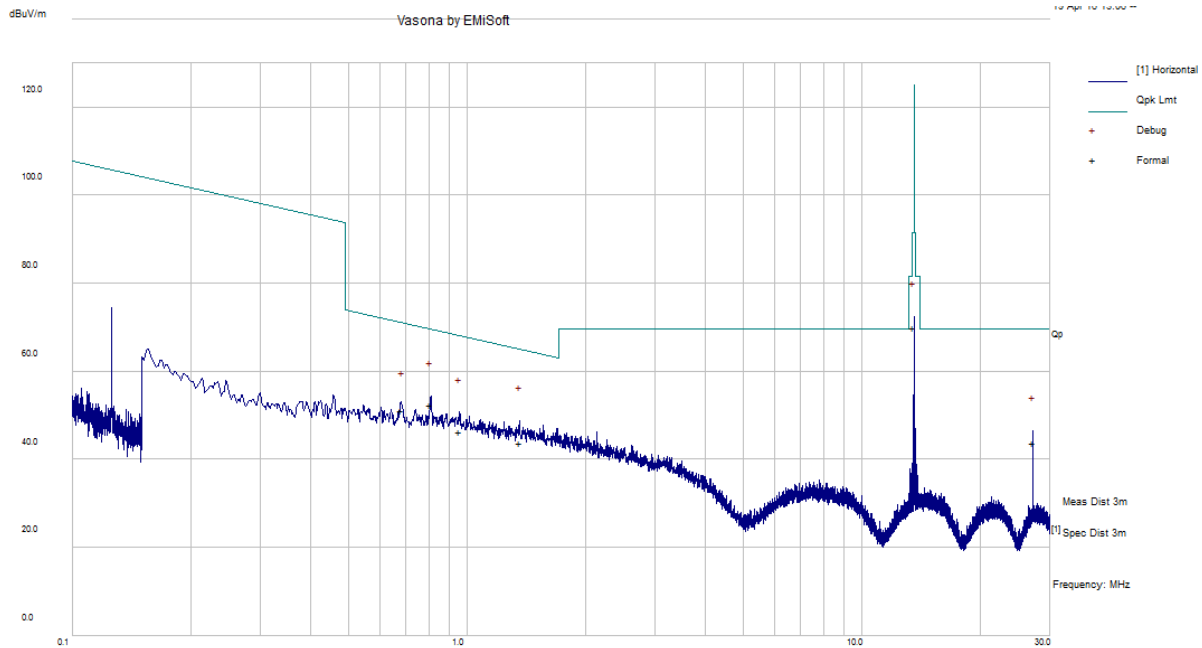
Test specification:	Radiated Spurious Emissions			
Mains Power:	120VAC, 60Hz		Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Tested by:	Pooja Pandya			
Test Date:	02/27/2017			
Remarks:	<b><i>f</i> = 100kHz – 30MHz plot, and loop antenna at 0 degree</b>			



### Quasi Max Measurement

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol (0/90)	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1.31	34.19	0.23	9.50	43.92	Quasi Max	0	100	311	65.24	-21.32	Pass
0.80	37.88	0.20	13.89	51.97	Quasi Max	0	100	189	69.45	-17.48	Pass
1.65	34.61	0.25	7.65	42.51	Quasi Max	0	100	211	63.26	-20.76	Pass
0.91	33.45	0.21	13.00	46.65	Quasi Max	0	100	52	68.43	-21.78	Pass
2.26	34.48	0.29	5.15	39.91	Quasi Max	0	100	227	69.54	-29.63	Pass
13.56	74.72	0.62	-1.51	73.83	Quasi Max	0	100	190	124.92	-51.09	Pass

Test specification:	Radiated Spurious Emissions			
Mains Power:	120VAC, 60Hz		Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Tested by:	Pooja Pandya			
Test Date:	02/02/2017			
Remarks:	f= 100kHz – 30MHz plot, and loop antenna at 90 degree			

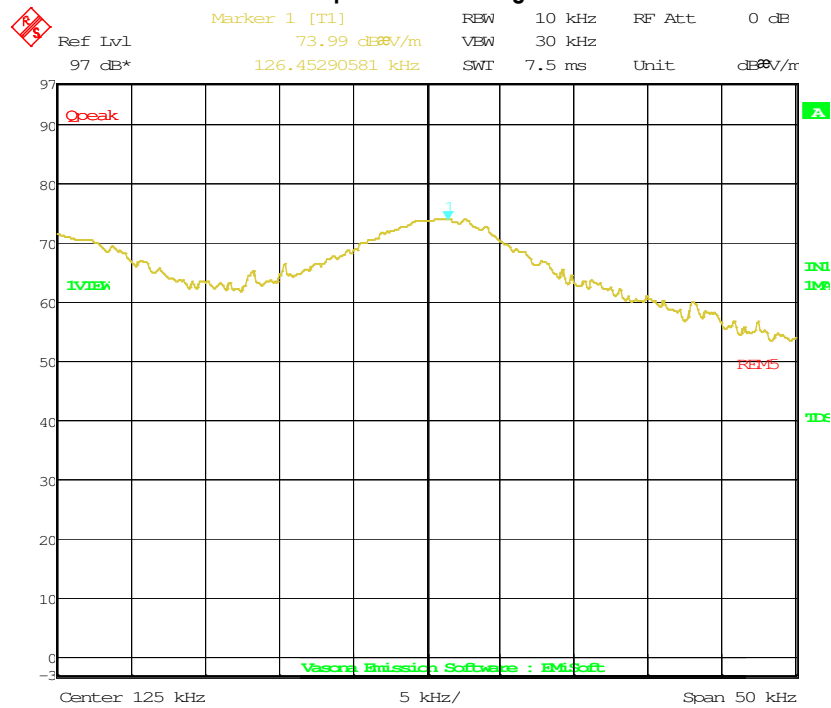


### Quasi Max Measurement

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol (0/90)	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
0.81	38.44	0.2	13.88	52.52	Quasi Max	90	100	271	69.44	-16.92	Pass
1.37	34.33	0.24	9.18	43.74	Quasi Max	90	100	170	64.90	-21.15	Pass
0.96	33.61	0.21	12.58	46.40	Quasi Max	90	100	144	68.00	-21.60	Pass
0.68	35.77	0.19	15.26	51.22	Quasi Max	90	100	142	70.94	-19.72	Pass
27.12	46.00	0.82	-3.11	43.71	Quasi Max	90	100	55	69.54	-25.83	Pass
13.56	70.91	0.62	-1.51	70.02	Quasi Max	90	100	92	124.92	-54.90	Pass

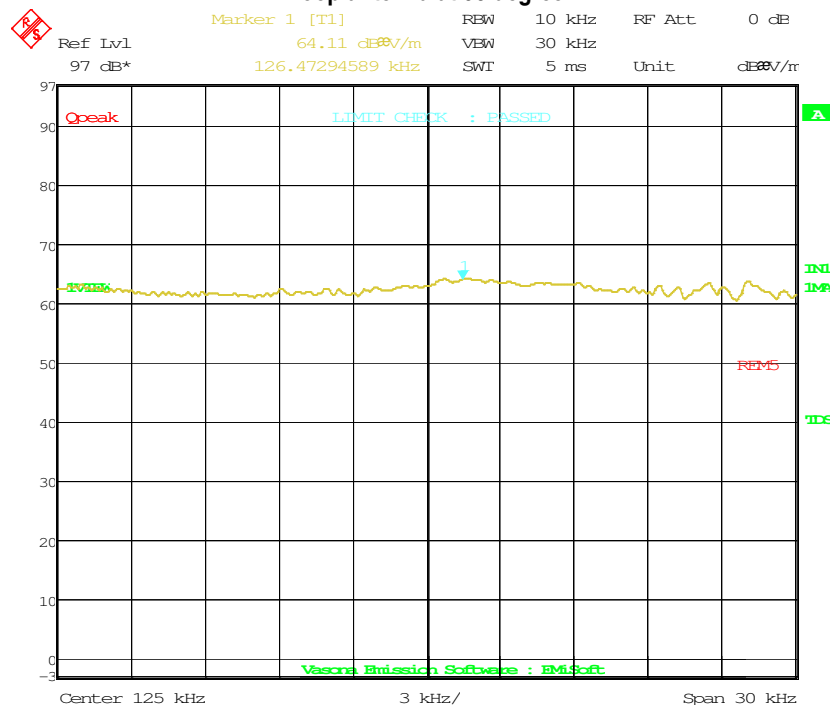


### Loop antenna at 0 degree



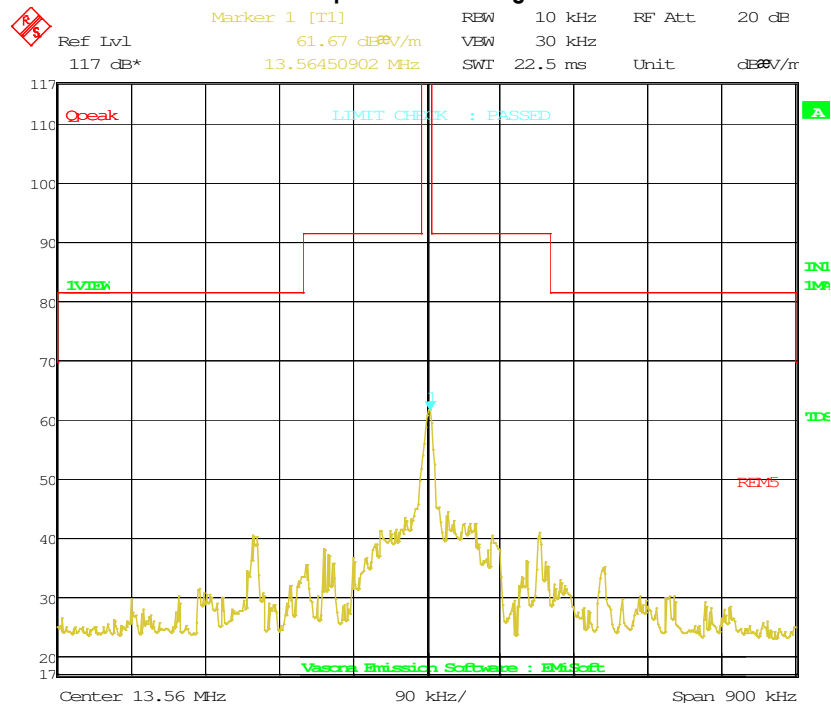
Frequency (kHz)	Amplitude (dB $\mu$ V)
126.452	73.99

### Loop antenna at 90 degree



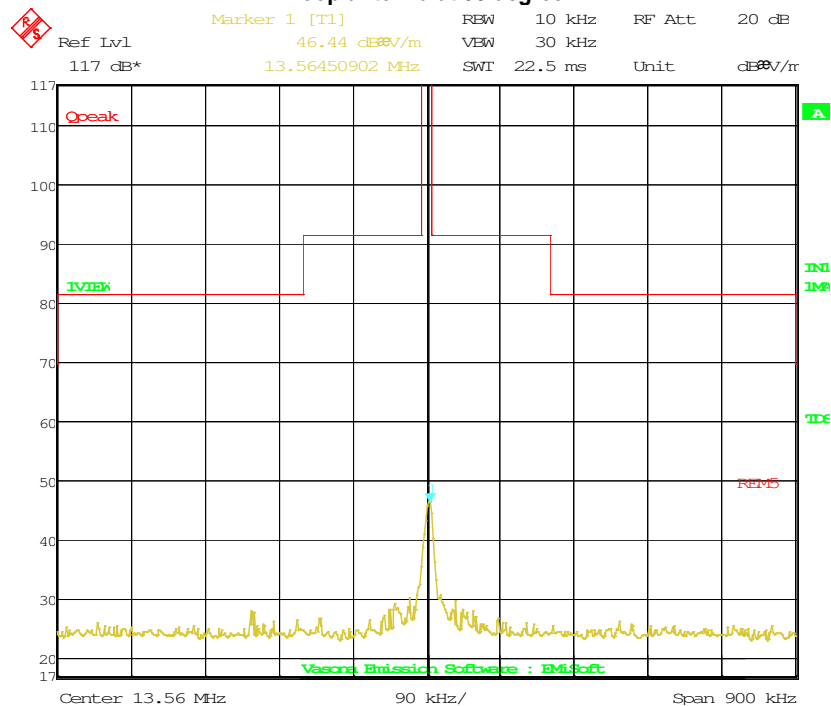
Frequency (kHz)	Amplitude (dB $\mu$ V)
126.472	64.11

### Loop antenna at 0 degree



Frequency (MHz)	Amplitude (dB $\mu$ V/m)
13.564	61.67

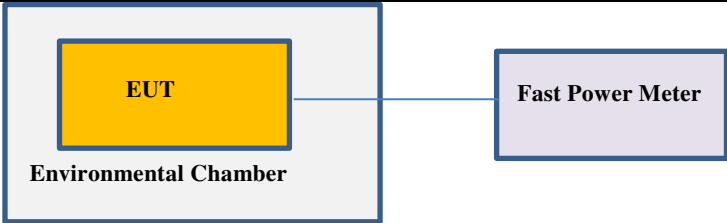
### Loop antenna at 90 degree



Frequency (MHz)	Amplitude (dB $\mu$ V/m)
13.5645	46.44

### 10.3.3 Frequency Stability

#### Requirement(s):

Spec	Requirement	Applicable									
47 CFR §15.225 e) RSS-210 (A2.6)	Limit: $\pm 0.01\%$ of 13.56 MHz = 1356 Hz	<input checked="" type="checkbox"/>									
Test Setup	 <ol style="list-style-type: none"> <li>The EUT was set up inside an environmental chamber.</li> <li>The EUT was placed in the centre of the environmental.</li> </ol>										
Procedure	Frequency Stability was measured according to 47 CFR §2.1055. Measurement was taken with spectrum analyzer. The spectrum analyzer bandwidth and span was set to read in hertz. A voltmeter was used to monitor when varying the voltage.										
Test Date	03/03/2017	<table border="1"> <tr> <td>Environmental conditions</td> <td>Temperature</td> <td>20°C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>41%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1026mbar</td> </tr> </table>	Environmental conditions	Temperature	20°C		Relative Humidity	41%		Atmospheric Pressure	1026mbar
Environmental conditions	Temperature	20°C									
	Relative Humidity	41%									
	Atmospheric Pressure	1026mbar									
Remark	None										
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail										

**Test Data** ☒ Yes (See below) ☐ N/A

**Test Plot** ☐ Yes (See below) ☒ N/A

**Test was done by Pooja Pandya at RF test site.**

## Test Result for 125 KHz Radio

**Frequency Stability versus Temperature:** The Frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  at normal supply voltage.

Reference Frequency: 125 KHz at  $20^{\circ}\text{C}$  and  $+50^{\circ}\text{C}$

Temperature ( $^{\circ}\text{C}$ )	Measured Freq. (KHz)	Freq. Drift (Hz)	Freq. Deviation (Limit: 0.01%)	Pass/Fail
50	125.07521	0.08	<0.01	Pass
40	125.07521	0.08	<0.01	Pass
30	125.07521	0.08	<0.01	Pass
20	125.0748	0.07	<0.01	Pass
10	125.0748	0.07	<0.01	Pass
0	125.0748	0.07	<0.01	Pass
-10	125.0748	0.07	<0.01	Pass
-20	125.0748	0.07	<0.01	Pass

**Frequency Stability versus Input Voltage:** The Frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$ , the frequency of the transmitter was measured at 85% and at 115% of the rated power supply voltage at  $20^{\circ}\text{C}$  environmental temperature.

Carrier Frequency: 125 at  $20^{\circ}\text{C}$  at 12 VDC

Measured Voltage $\pm 15\%$ of nominal (DC)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (Limit: 0.01%)	Pass/Fail
13.8	125.0748	0.07	<0.01	Pass
10.2	125.0748	0.07	<0.01	Pass

## Test Result for 13.56MHz Radio

**Frequency Stability versus Temperature:** The Frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$  at normal supply voltage.

Reference Frequency: 13.56 MHz at  $20^{\circ}\text{C}$  at 12 VDC

Temperature ( $^{\circ}\text{C}$ )	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (Limit: 0.01%)	Pass/Fail
50	13.56	0	<0.01	Pass
40	13.56	0	<0.01	Pass
30	13.56	0	<0.01	Pass
20	13.56	0	<0.01	Pass
10	13.56	0	<0.01	Pass
0	13.56	0	<0.01	Pass
-10	13.56	0	<0.01	Pass
-20	13.56	0	<0.01	Pass

**Frequency Stability versus Input Voltage:** The Frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$ , the frequency of the transmitter was measured at 85% and at 115% of the rated power supply voltage at a  $20^{\circ}\text{C}$  environmental temperature.

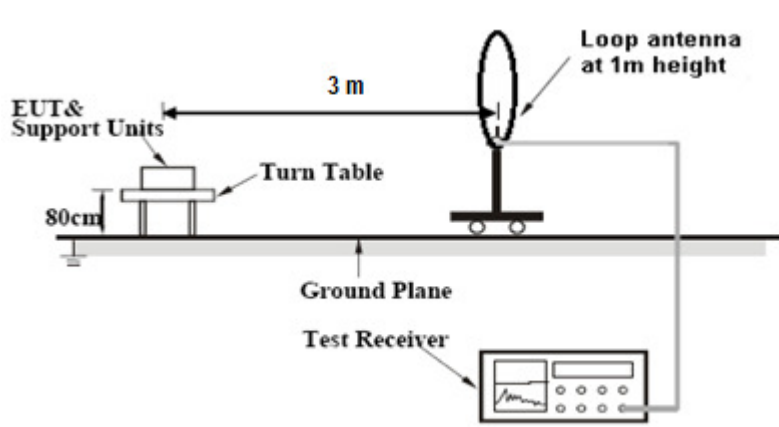
Carrier Frequency: 13.56 MHz at  $20^{\circ}\text{C}$  at 12 VDC

Measured Voltage $\pm 15\%$ of nominal (AC)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (Limit: 0.01%)	Pass/Fail
13.8	13.56	0	<0.01	Pass
10.2	13.56	0	<0.01	Pass



#### 10.3.4 Occupied bandwidth

##### Requirement(s):

Spec	Requirement	Applicable									
RSS-Gen 4.6.1	The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual. The trace data points are recovered and directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.	<input checked="" type="checkbox"/>									
Test Setup											
Procedure	<ol style="list-style-type: none"> <li>The EUT was switched on and allowed to warm up to its normal operating condition.</li> <li>To measure conducted, a SMA cable was used to replace the EUT antenna. To measure radiated, an external antenna was used to detect EUT transmission signal.</li> <li>Measurement of the 99% Occupied Bandwidth of EUT transmission signal and make record.</li> </ol>										
Test Date	03/02/2017	<table border="1"> <tr> <td>Environmental conditions</td> <td>Temperature</td> <td>22° C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>39%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1025mbar</td> </tr> </table>	Environmental conditions	Temperature	22° C		Relative Humidity	39%		Atmospheric Pressure	1025mbar
Environmental conditions	Temperature	22° C									
	Relative Humidity	39%									
	Atmospheric Pressure	1025mbar									
Remark	-										
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail										

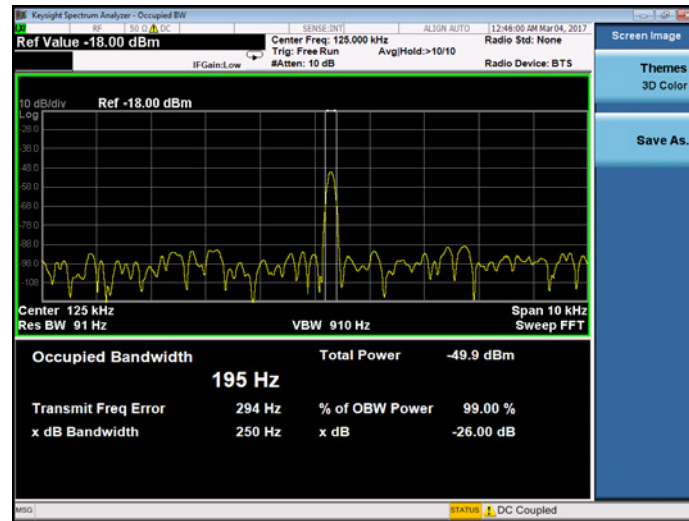
Test Data    ☐ Yes (See below)      ☒ N/A

Test Plot    ☒ Yes (See below)      ☐ N/A

Test was done by Pooja Pandya at 10 meter chamber.

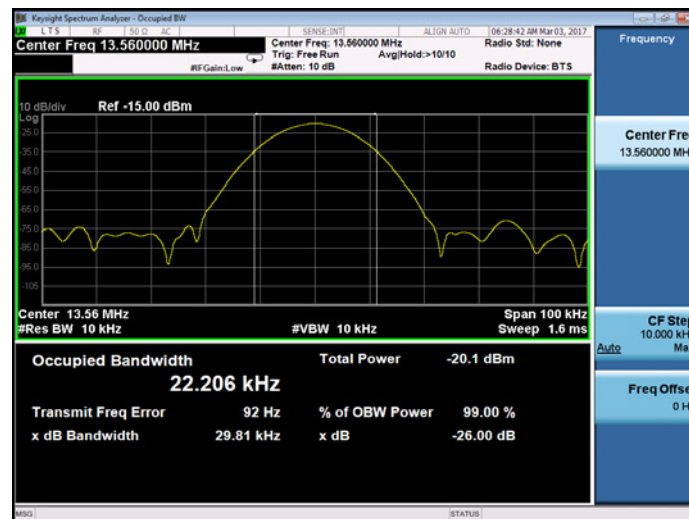
## Test results:

### 125 kHz



Frequency (kHz)	Occupied Bandwidth (Hz)
125.00	195

### 13.56 MHz



Frequency (MHz)	Occupied Bandwidth (KHz)
13.56	22.206
















## Annex A. TEST INSTRUMENT








Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
<b>Conducted Emissions</b>						
R & S Receiver	ESIB 40	100179	06/08/2016	1 Year	06/08/2017	<input checked="" type="checkbox"/>
CHASE LISN	MN2050B	1018	08/16/2016	1 Year	08/16/2017	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>						
R & S Receiver	ESL6	100178	08/17/2016	1 Year	08/17/2017	<input checked="" type="checkbox"/>
R & S Receiver	ESIB 40	100179	06/08/2016	1 Year	06/08/2017	<input checked="" type="checkbox"/>
Pre-Amplifier (1 - 40GHz)	J532-00104000-58-5P	1960351	05/10/2016	1 Year	05/10/2017	<input checked="" type="checkbox"/>
RF Pre-Amplifier (9kHz - 6.5GHz)	LPA-6-30	11140711	02/09/2017	1 Year	02/09/2018	<input checked="" type="checkbox"/>
ETS-Lingren Loop Antenna	6512	00049120	07/14/2016	1 Year	07/14/2017	<input checked="" type="checkbox"/>
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	01/13/2017	1 Year	01/13/2018	<input checked="" type="checkbox"/>
3 Meters SAC	3M	N/A	06/09/2016	1 Year	06/09/2017	<input checked="" type="checkbox"/>
10 Meters SAC	10M	N/A	03/15/2016	1 Year	03/15/2017	<input checked="" type="checkbox"/>
<b>RF Conducted Measurement</b>						
Spectrum Analyzer	N9010A	10SL0219	11/16/2016	1 Year	11/16/2017	<input checked="" type="checkbox"/>
R & S Receiver	ESIB 40	100179	06/08/2016	1 Year	06/08/2017	<input checked="" type="checkbox"/>
Test Equity Environment Chamber	1007H	61201	07/21/2016	1 Year	07/21/2017	<input checked="" type="checkbox"/>
USB RF Power Sensor	7002-006	10SL0190	11/15/2016	1 Year	11/15/2017	<input checked="" type="checkbox"/>

## Test Software Version

Test Item	Vendor	Software	Version
Radiated Emission	EMISoft	EMISoft Vasona	V5.0
Conducted Emission	EMISoft	EMISoft Vasona	V5.0

## Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		<a href="#">A1</a> , <a href="#">A2</a> , <a href="#">A3</a> , <a href="#">A4</a> , <a href="#">B1</a> , <a href="#">B2</a> , <a href="#">B3</a> , <a href="#">B4</a> , C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		<b>Radio &amp; Telecommunications Terminal Equipment:</b> EN45001 – EN ISO/IEC 17025
		<b>Electromagnetic Compatibility:</b> EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		<a href="#">Phase I</a> , <a href="#">Phase II</a>
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		<b>(Phase II)</b> OFCA Foreign Certification Body for Radio and Telecom
		<b>(Phase I)</b> Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		<b>Radio:</b> Scope A – All Radio Standard Specification in Category I
		<b>Telecom:</b> CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		<p><b>Radio:</b> A1. Terminal equipment for purpose of calling</p> <p><b>Telecom:</b> B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law</p>
Korea CAB Accreditation		<p><b>EMI:</b> KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI</p> <p><b>EMS:</b> KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS</p> <p><b>Radio:</b> RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68</p> <p><b>Telecom:</b> President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4</p>
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		<p>R-3083: Radiation 3 meter site</p> <p>C-3421: Main Ports Conducted Interference Measurement</p> <p>T-1597: Telecommunication Ports Conducted Interference Measurements</p>
Australia CAB Recognition		<p><b>EMC:</b> AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4</p> <p><b>Radio communications:</b> AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771</p> <p><b>Telecommunications:</b> AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06, AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1</p>
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016, AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2