



RF TEST REPORT



Report No.: FCC_IC_RF_SL18030702-SEN-003
Supersede Report No.:

Applicant	Sensormatic Electronics LLC		
Product Name	IDX-4000 UHF RFID Reader		
Model No.	UHIDX1801		
Test Standard	47CFR15.247 RSS-247 Issue 2 February 2017		
Test Method	ANCI C63.10: 2013 FCC Public Notice DA 00-705 RSS-Gen Issue 5 April 2018		
FCC ID	BVCUHIDX1801		
IC ID	3506-UHIDX1801		
Date of test	03/08/2018-03/15/2018		
Issue Date	07/05/2018		
Test Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		
Equipment complied with the specification		[x]	
Equipment did not comply with the specification		[]	
			
CIPHER		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

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

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/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELECOM, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety EMC, RF/Wireless, Telecom
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_SL18030702-SEN-003	None	Original	07/05/2018

2 Executive Summary

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

Company: Sensormatic Electronics LLC
Product: IDX-4000 UHF RFID Reader
Model: UHIDX1801

3 Customer information

Applicant Name	Sensormatic Electronics LLC
Applicant Address	1 Wilcox St. Sayre, PA 18840 USA
Manufacturer Name	Sensormatic Electronics LLC
Manufacturer Address	1 Wilcox St. Sayre, PA 18840 USA

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	IDX-4000 UHF RFID Reader
Model No.	UHIDX1801
Trade Name	IDX-4000 UHF RFID Reader
Serial No.	123S1815033667
Input Power	24 VDC or Power over Ethernet (POE)
Hardware version	N/A
Software version	Ver 20180531222610
Date of EUT received	06/25/2018
Equipment Class/ Category	Class III
Port/Connectors	4 monostatic RP-SMA ports 1 USB Device (Type B) port 1 USB Host (Type A) port 2 RS-485 ports (RJ45) GPIO 4 in pouts/ 4 outputs (9 Pin D Shell) 1 x 10/100base-T (RJ45) 1 x 10/100base-T Ethernet switch (RJ45)

6.2 Radio Description

Radio Type	RFID
Operating Frequency	902-928 MHz
Modulation	ASK
Radio type	RFID
Number of Channels	50
Antenna Type	Ext Antenna
Antenna Gain	6 dBi

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Supporting Equipment Description	Model	Serial No.	Manu	Note
Laptop	-	N/A	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	
Cable	EUT	USB	Laptop	USB	>1	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	IDX-4000 Firmware	Set the EUT to different modulation and channel

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	15.207	ANSI C63.10 2013 RSS Gen	<input checked="" type="checkbox"/> Pass
	IC	RSS Gen		<input type="checkbox"/> N/A

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Channel Separation Occupied Bandwidth	FCC	15.247	FCC	FCC Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS-247	IC	FCC Public Notice DA 00-705	<input type="checkbox"/> N/A
Bandwidth Band Edge and Radiated Spurious Emissions	FCC	15.247	FCC	FCC Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS-247	IC	FCC Public Notice DA 00-705	<input type="checkbox"/> N/A
Time of Occupancy	FCC	15.247	FCC	FCC Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS-247	IC	FCC Public Notice DA 00-705	<input type="checkbox"/> N/A
Channel Separation Occupied Bandwidth	FCC	15.247	FCC	FCC Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS-247	IC	FCC Public Notice DA 00-705	<input type="checkbox"/> N/A
Bandwidth Band Edge and Radiated Spurious Emissions	FCC	15.247	FCC	ANSI C63.10: 2013 FCC Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS-247	IC	RSS-Gen FCC Public Notice DA 00-705	<input type="checkbox"/> N/A
Time of Occupancy	FCC	15.247	FCC	FCC Public Notice DA 00-705	<input checked="" type="checkbox"/> Pass
	IC	RSS-247	IC	FCC Public Notice DA 00-705	<input type="checkbox"/> N/A
Remark	<ol style="list-style-type: none"> 1. All measurement uncertainties are not taken into consideration for all presented test result. 2. 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. 				

9 Measurement Uncertainty

9.1 Radiated Emissions (9kHz to 30MHz)

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

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.10	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.45	Rectangular	1.732	1	0.2598152
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.935
Expanded Uncertainty (K=2)					1.87

The total derived measurement uncertainty is +/- 1.87 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
Expanded Uncertainty (K=2)					6.0118262

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
Expanded Uncertainty (K=2)					8.4726

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
Expanded Uncertainty (K=2)					0.952174

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

10 Measurements, Examination and Derived Results

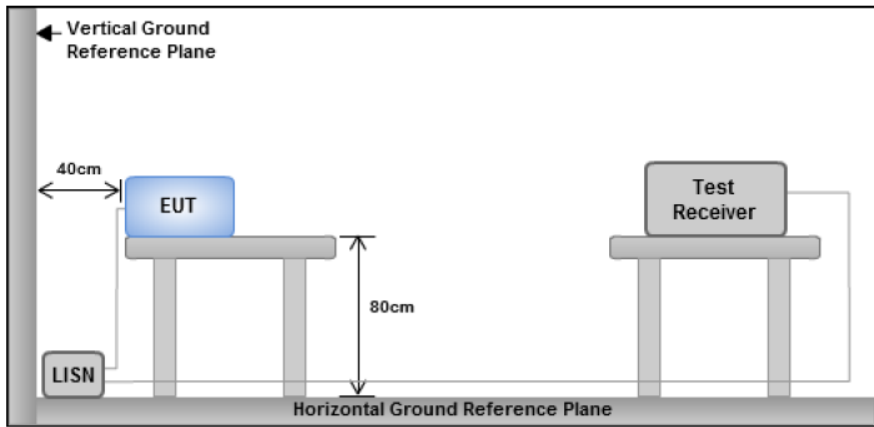
10.1 Antenna Requirement

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) Antenna must use a unique type of connector to attach to the device. c) Device must be professionally installed. Installer shall be responsible for ensuring that the correct antenna is employed with 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.	
Result	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL	

10.2 Conducted Emissions

Conducted Emission Limit

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

Spec	Requirement	Applicable
47CFR§15.207 RSS-Gen	For Low-power radio-frequency devices 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 in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	<input checked="" type="checkbox"/>
Test Setup	 <p style="text-align: center;"> 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"> - 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. - The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment was powered separately from another main supply. 	
Remark	EUT was tested in two modes of operations: (1) P.O.E Mode; (2) Power Supply Mode	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	

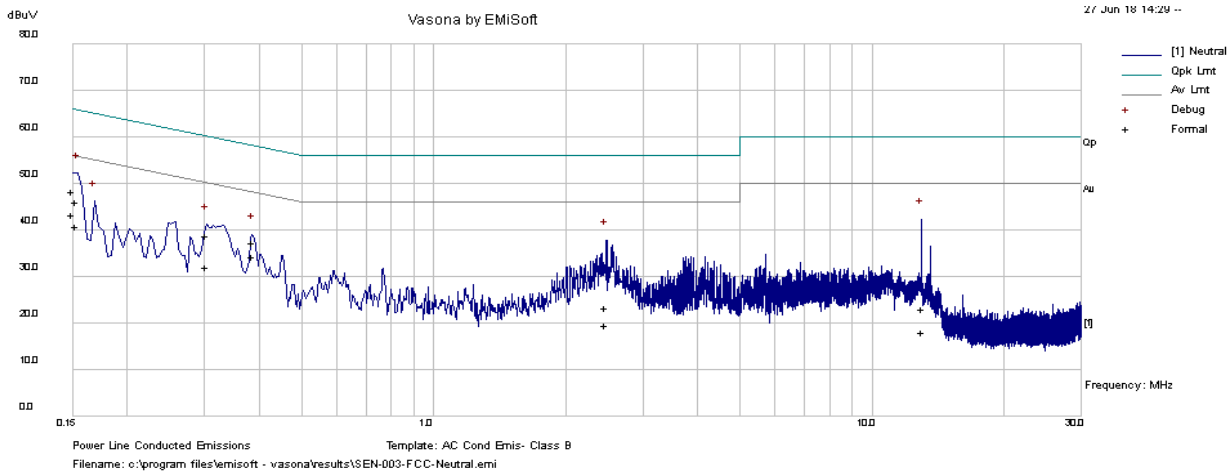
Test Data Yes N/A

Test Plot Yes (See below) N/A

Test was done by **Anish Kumar** at **Conducted Emission Test Site**.

Conducted Emission Test Results

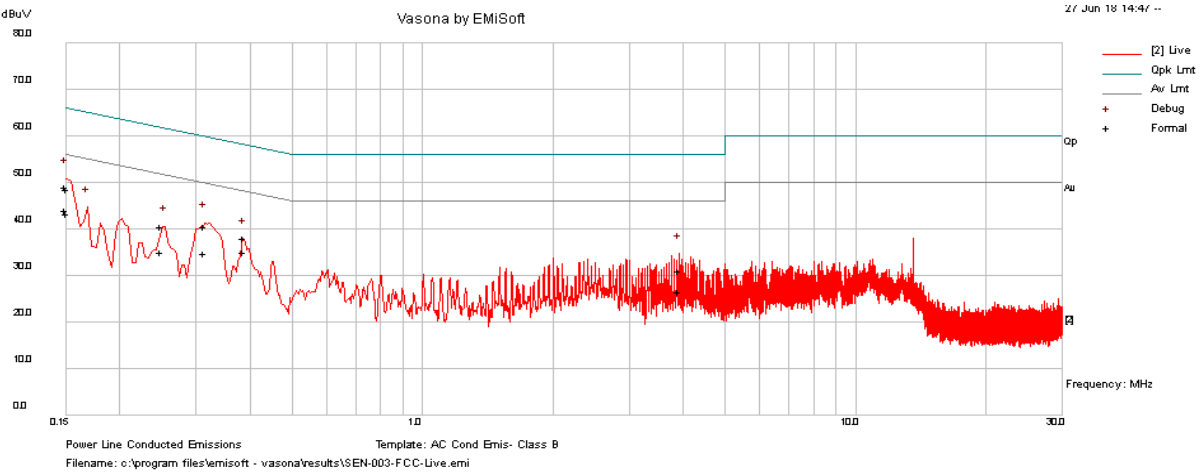
Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	25.7	Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
	Humidity (%):	43.3		
	Atmospheric(mbar):	1014.9		
Mains Power:	120VAC, 60Hz			
Tested by:	Anish Kumar			
Test Date:	06/27/2018			
Remarks	Conducted @ Neutral – POE Mode			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	39.01	9.33	0.05	48.39	Quasi Peak	Neutral	66.00	-17.61	Pass
12.99	13.45	9.37	0.31	23.13	Quasi Peak	Neutral	60.00	-36.87	Pass
2.46	14.07	9.34	0.07	23.48	Quasi Peak	Neutral	56.00	-32.52	Pass
0.15	36.72	9.33	0.05	46.10	Quasi Peak	Neutral	65.84	-19.74	Pass
0.30	29.57	9.32	0.04	38.94	Quasi Peak	Neutral	60.13	-21.19	Pass
0.38	27.97	9.33	0.04	37.33	Quasi Peak	Neutral	58.13	-20.80	Pass
0.15	34.08	9.33	0.05	43.46	Average	Neutral	56.00	-12.54	Pass
12.99	8.44	9.37	0.31	18.12	Average	Neutral	50.00	-31.88	Pass
2.46	10.13	9.34	0.07	19.54	Average	Neutral	46.00	-26.46	Pass
0.15	31.35	9.33	0.05	40.72	Average	Neutral	55.84	-15.11	Pass
0.30	22.74	9.32	0.04	32.10	Average	Neutral	50.13	-18.03	Pass
0.38	25.02	9.33	0.04	34.39	Average	Neutral	48.13	-13.75	Pass

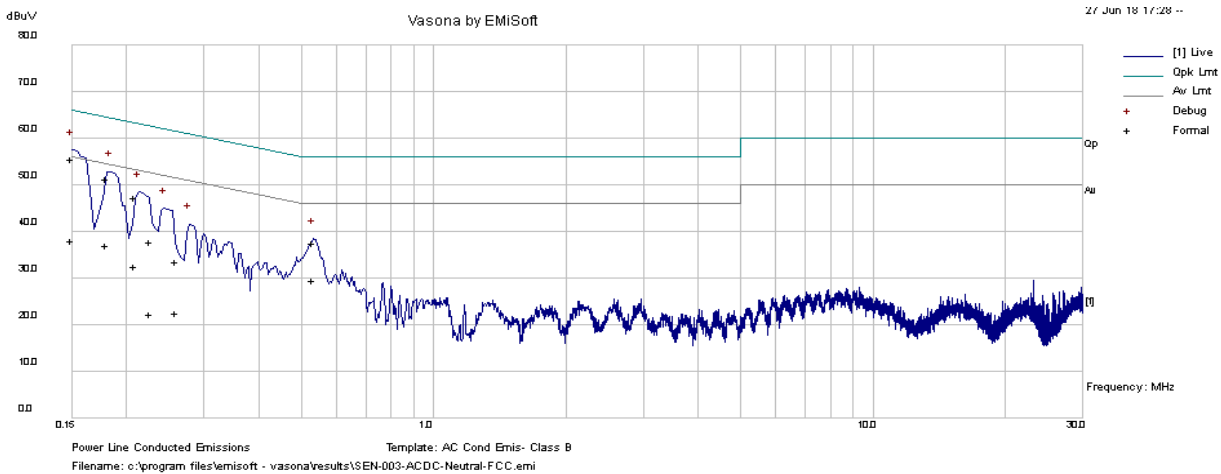
Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	25.7	Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
	Humidity (%):	43.3		
	Atmospheric(mbar):	1014.9		
Mains Power:	120VAC, 60Hz			
Tested by:	Anish Kumar			
Test Date:	06/27/2018			
Remarks	Conducted @ Live – POE Mode			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	39.76	9.33	0.05	49.14	Quasi Peak	Live	65.99	-16.85	Pass
0.31	31.13	9.32	0.04	40.50	Quasi Peak	Live	59.88	-19.38	Pass
0.38	28.64	9.33	0.04	38.00	Quasi Peak	Live	58.15	-20.15	Pass
0.15	39.19	9.33	0.05	48.57	Quasi Peak	Live	65.93	-17.37	Pass
0.24	31.13	9.32	0.04	40.5	Quasi Peak	Live	61.77	-21.27	Pass
3.89	21.62	9.34	0.07	31.03	Quasi Peak	Live	56.00	-24.97	Pass
0.15	34.67	9.33	0.05	44.05	Average	Live	55.99	-11.94	Pass
0.31	25.43	9.32	0.04	34.79	Average	Live	49.88	-15.09	Pass
0.38	25.76	9.33	0.04	35.13	Average	Live	48.15	-13.02	Pass
0.15	33.98	9.33	0.05	43.36	Average	Live	55.93	-12.57	Pass
0.24	25.67	9.32	0.04	35.03	Average	Live	51.77	-16.73	Pass
3.89	17.28	9.34	0.07	26.69	Average	Live	46.00	-19.31	Pass

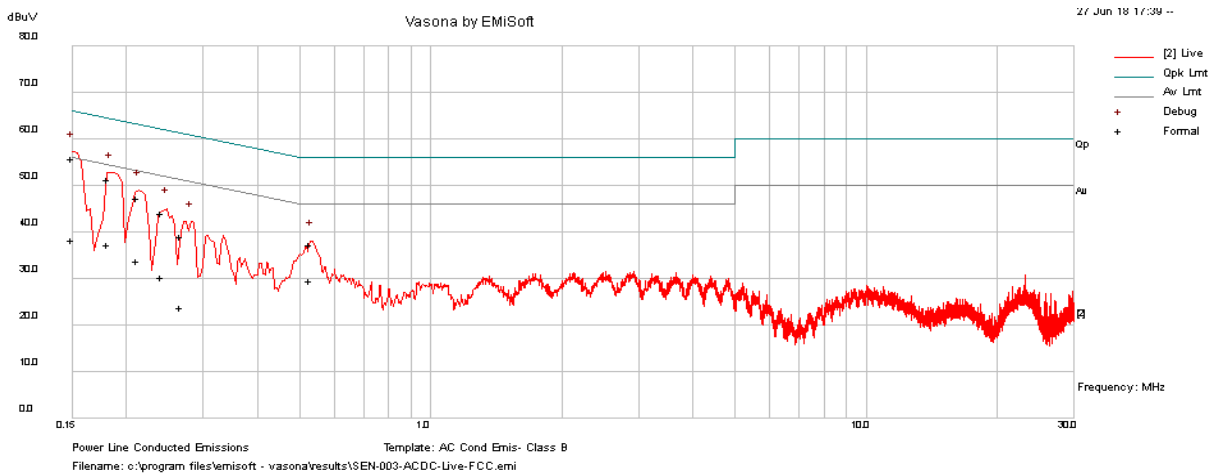
Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	25.7	Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
	Humidity (%):	43.3		
	Atmospheric(mbar):	1014.9		
Mains Power:	120VAC, 60Hz			
Tested by:	Anish Kumar			
Test Date:	06/27/2018			
Remarks	Conducted @ Neutral – Power Supply Mode			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	46.22	9.33	0.05	55.60	Quasi Peak	Live	66.00	-10.40	Pass
0.17	42.03	9.32	0.05	51.40	Quasi Peak	Live	64.49	-13.09	Pass
0.20	37.96	9.32	0.04	47.33	Quasi Peak	Live	63.25	-15.93	Pass
0.22	28.45	9.32	0.04	37.81	Quasi Peak	Live	62.60	-24.78	Pass
0.53	28.19	9.33	0.05	37.57	Quasi Peak	Live	56.00	-18.43	Pass
0.25	24.27	9.32	0.04	33.63	Quasi Peak	Live	61.46	-27.83	Pass
0.15	28.69	9.33	0.05	38.07	Average	Live	56.00	-17.93	Pass
0.17	27.85	9.32	0.05	37.22	Average	Live	54.49	-17.27	Pass
0.20	23.16	9.32	0.04	32.53	Average	Live	53.25	-20.73	Pass
0.22	12.96	9.32	0.04	22.32	Average	Live	52.60	-30.28	Pass
0.53	20.26	9.33	0.05	29.64	Average	Live	46.00	-16.36	Pass
0.25	13.36	9.32	0.04	22.72	Average	Live	51.46	-28.73	Pass

Conducted Emission Test Results

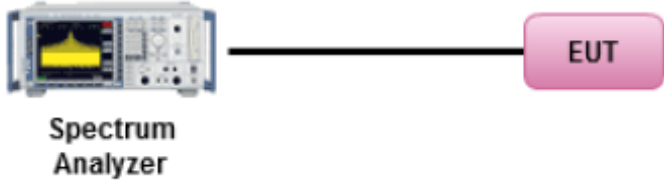
Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	25.7	Result:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
	Humidity (%):	43.3		
	Atmospheric(mbar):	1014.9		
Mains Power:	120VAC, 60Hz			
Tested by:	Anish Kumar			
Test Date:	06/27/2018			
Remarks	Conducted @ Live – Power Supply Mode			



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	46.36	9.33	0.05	55.74	Quasi Peak	Live	66.00	-10.26	Pass
0.18	41.91	9.32	0.05	51.29	Quasi Peak	Live	64.41	-13.12	Pass
0.21	38.06	9.32	0.04	47.42	Quasi Peak	Live	63.11	-15.69	Pass
0.24	34.76	9.32	0.04	44.13	Quasi Peak	Live	62.06	-17.93	Pass
0.52	28.03	9.33	0.05	37.41	Quasi Peak	Live	56.00	-18.59	Pass
0.26	29.77	9.32	0.04	39.13	Quasi Peak	Live	61.23	-22.10	Pass
0.15	28.91	9.33	0.05	38.29	Average	Live	56.00	-17.71	Pass
0.18	28.05	9.32	0.05	37.42	Average	Live	54.41	-16.99	Pass
0.21	24.55	9.32	0.04	33.91	Average	Live	53.11	-19.20	Pass
0.24	21.08	9.32	0.04	30.44	Average	Live	52.06	-21.62	Pass
0.52	20.22	9.33	0.05	29.59	Average	Live	46.00	-16.41	Pass
0.26	14.47	9.32	0.04	23.83	Average	Live	51.23	-27.39	Pass

10.3 20dB Bandwidth

Requirement(s):

Spec	Requirement	Applicable									
47 CFR §15.247	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or 20 dB bandwidth of the hopping channel, whichever is greater.	<input checked="" type="checkbox"/>									
RSS Gen	99% BW: For FCC reference only; required by IC.	<input checked="" type="checkbox"/>									
Test Setup	 <p style="text-align: center;">Spectrum Analyzer</p>										
Procedure	<p><u>20dB Emission bandwidth measurement procedure</u></p> <ol style="list-style-type: none"> 1. Set RBW \geq 1% of 20dB Bandwidth 2. Set the video bandwidth (VBW) \geq RBW. 3. Detector = Peak. 4. Trace mode = max hold. 5. Sweep = auto couple. 6. Allow the trace to stabilize. 7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. 										
Test Date	06/27/2018 to 08/03/2018	<table border="1"> <tr> <td>Environmental condition</td> <td>Temperature</td> <td>24°C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>46.3%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1019mbar</td> </tr> </table>	Environmental condition	Temperature	24°C		Relative Humidity	46.3%		Atmospheric Pressure	1019mbar
Environmental condition	Temperature	24°C									
	Relative Humidity	46.3%									
	Atmospheric Pressure	1019mbar									
Remark	-										
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail										

Test Data Yes N/A

Test Plot Yes N/A

Test was done by Cipher at RF Test Site.

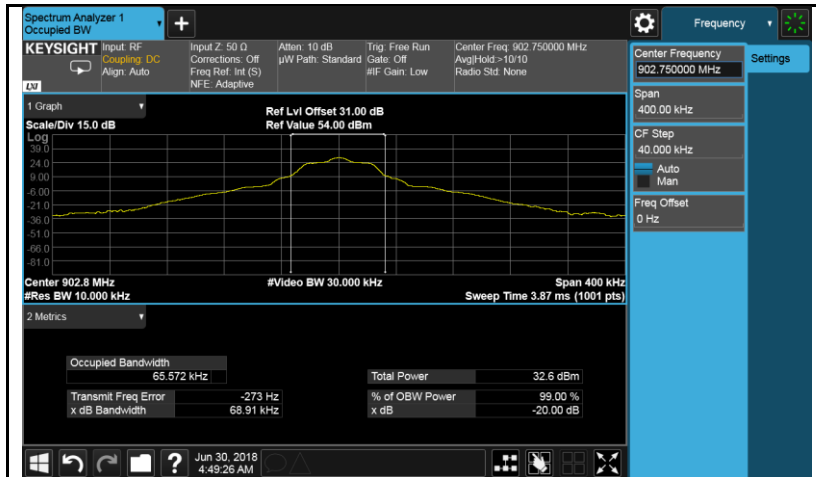
20dB Bandwidth Test Result

Type	Freq (MHz)	Test mode	CH	20dB Bandwidth (KHz)
20dB OBW	902.75	Con-TX	Low	68.91
	915.25	Con-TX	Mid	68.18
	927.25	Con-TX	High	69.21

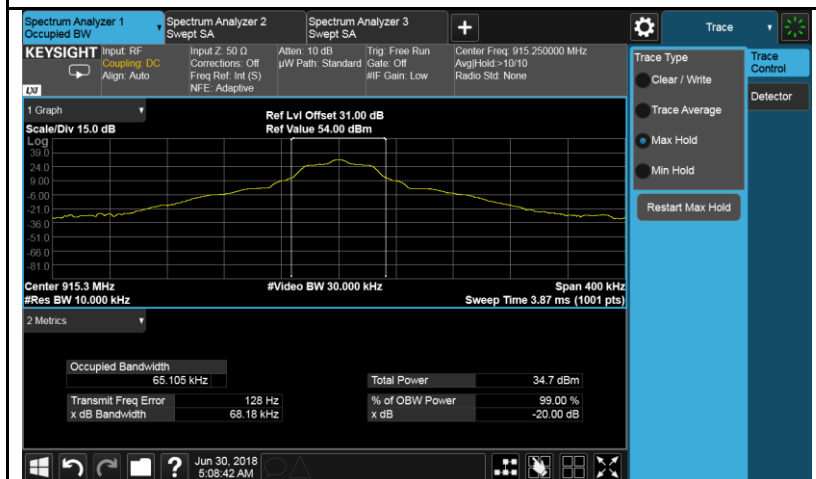
99% Bandwidth Test Result

Type	Freq (MHz)	Test mode	CH	99% Bandwidth (KHz)
99% BW	902.75	Con-TX	Low	65.57
	915.25	Con-TX	Mid	65.11
	927.25	Con-TX	High	65.97

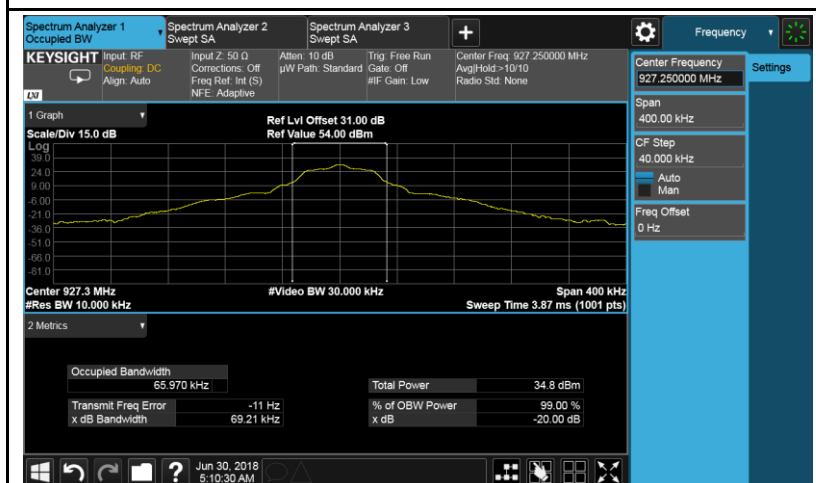
Test Plots



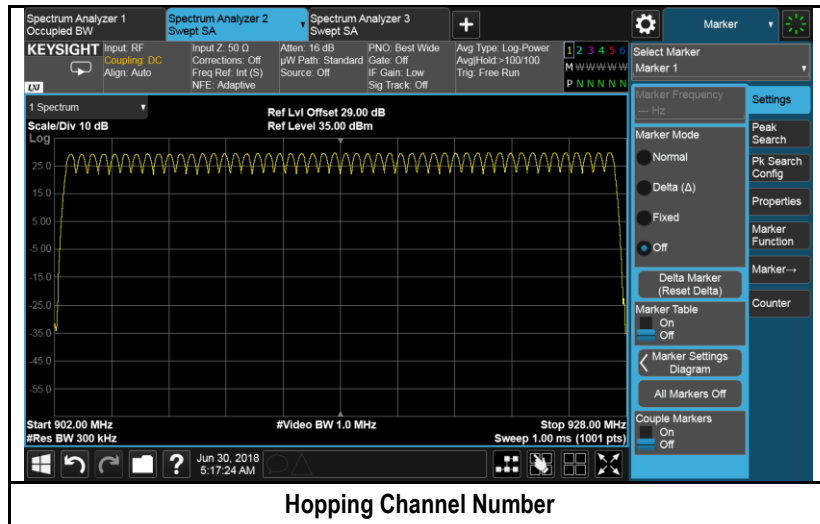
Low Channel



Mid Channel

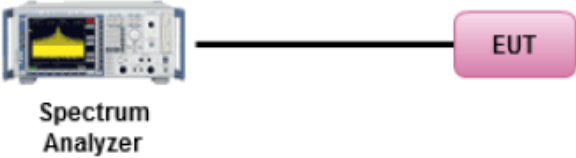


High Channel



10.4 Peak Output Power

Requirement(s):

Spec	Requirement	Applicable									
47 CFR §15.247 RSS-247	For all other frequency hopping systems in the 902-928 MHz band: 1 Watt. The power is converted from watt to dBm, therefore, 1 watt = 30 dBm.	<input checked="" type="checkbox"/>									
Test Setup	 <p>Spectrum Analyzer</p>										
Procedure	<p><u>Maximum output power measurement procedure</u></p> <ul style="list-style-type: none"> - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel. - RBW > 1% of the 20 dB bandwidth of the emission being measured; - VBW >= RBW. - Detector = peak. - Sweep time = auto couple. - Trace mode = max hold. - Allow trace to fully stabilize. - Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power. 										
Test Date	06/27/2018 to 08/03/2018	<table border="1"> <tr> <td>Environmental condition</td> <td>Temperature</td> <td>22.1°C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>45.5%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1019mbar</td> </tr> </table>	Environmental condition	Temperature	22.1°C		Relative Humidity	45.5%		Atmospheric Pressure	1019mbar
Environmental condition	Temperature	22.1°C									
	Relative Humidity	45.5%									
	Atmospheric Pressure	1019mbar									
Remark	-										
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail										

Test Data Yes N/A

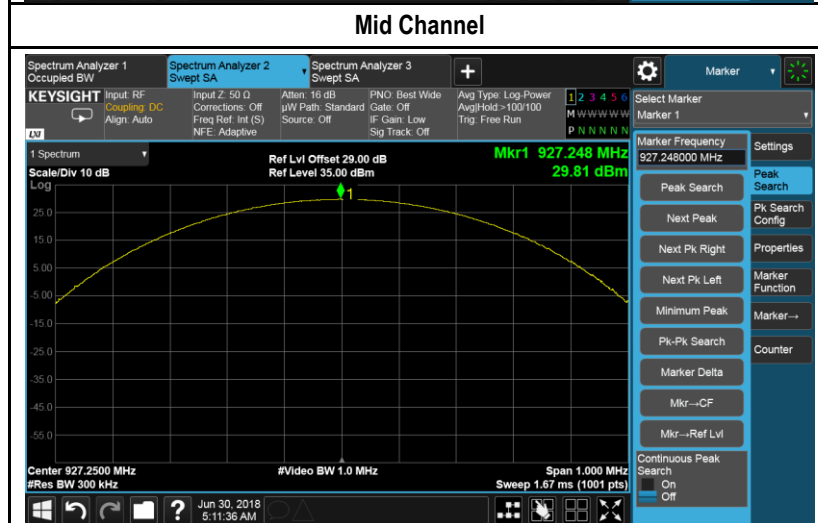
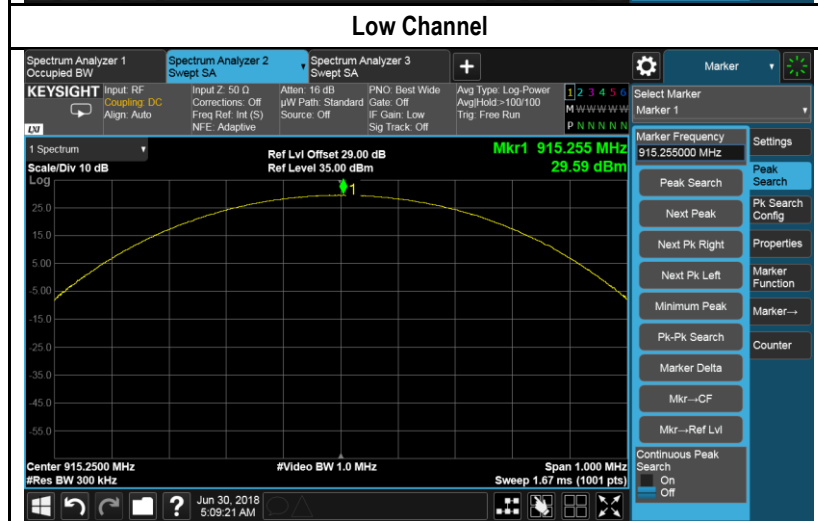
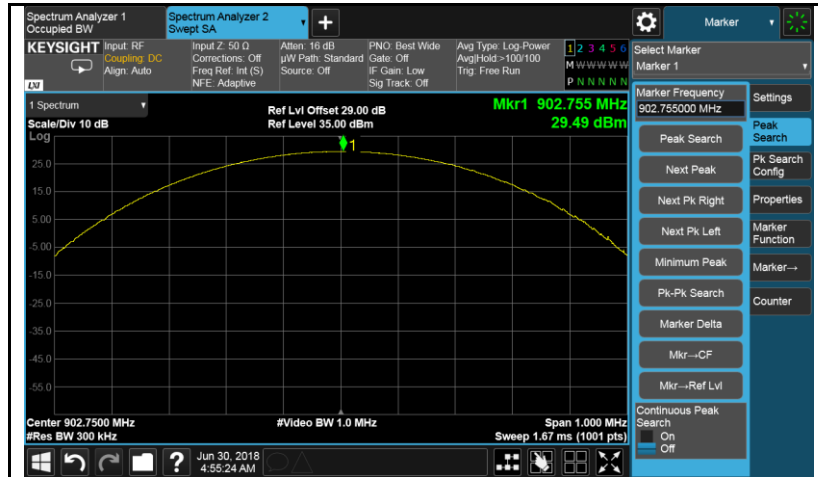
Test Plot Yes N/A

Test was done by Cipher at RF Test Site.

Output Power Test Result

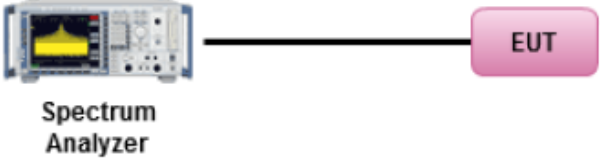
Type	Freq (MHz)	Test mode	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	902.75	Cont-TX	Low	29.49	30	Pass
Output power	915.25	Cont-TX	Mid	29.59	30	Pass
Output power	927.25	Cont-TX	High	29.81	30	Pass

Test Plots



10.5 Channel Separation

Requirement(s):

Spec	Requirement	Applicable
47 CFR §15.247 RSS-247	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.	<input checked="" type="checkbox"/>
Test Setup	 <p>Spectrum Analyzer ——— EUT</p>	
Procedure	<u>Channel Separation procedure</u> <ol style="list-style-type: none"> 1. The EUT must have its hopping function enabled. 2. Span = wide enough to capture the peaks of two adjacent channels 3. Resolution (or IF) Bandwidth (RBW) \geq 1% of the span 4. Video (or Average) Bandwidth (VBW) \geq RBW. 5. Detector = Peak. 6. Trace mode = max hold. 7. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. 	
Test Date	06/27/2018 to 08/03/2018	Environmental condition Temperature 22.1°C Relative Humidity 45.5% Atmospheric Pressure 1019mbar
Remark	-	
Result	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A	

Test Data Yes N/A

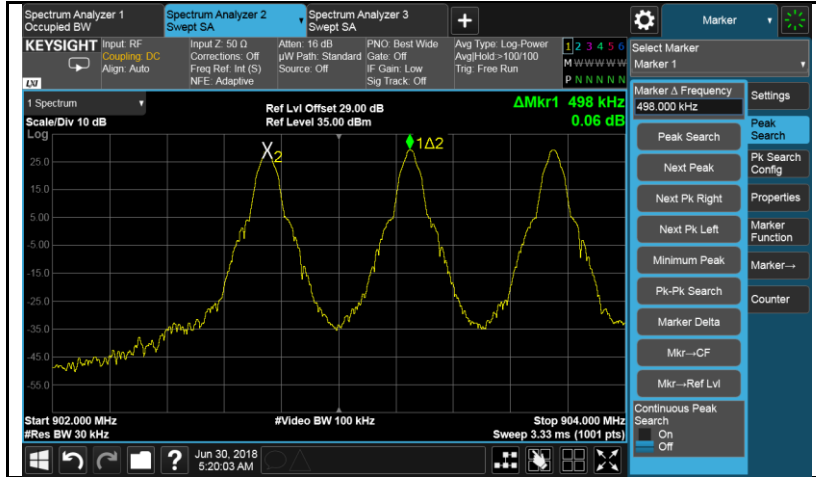
Test Plot Yes N/A

Test was done by Cipher at RF Test Site.

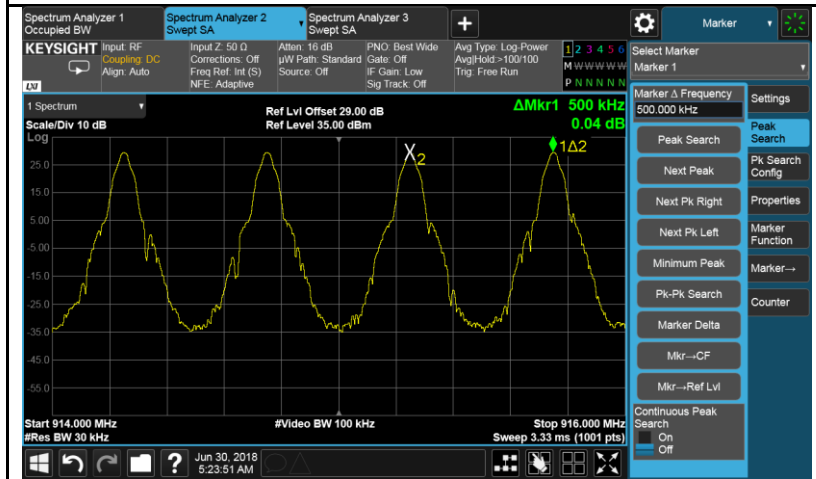
Channel Separation Test Result

Type	Freq (MHz)	Test mode	CH	Result (KHz)	20dB Bandwidth (KHz)	Result
Channel Sep	902.75	Con-TX	Low	500	68.91	Pass
Channel Sep	915.25	Con-TX	Mid	500	68.18	Pass
Channel Sep	927.25	Con-TX	High	500	69.21	Pass

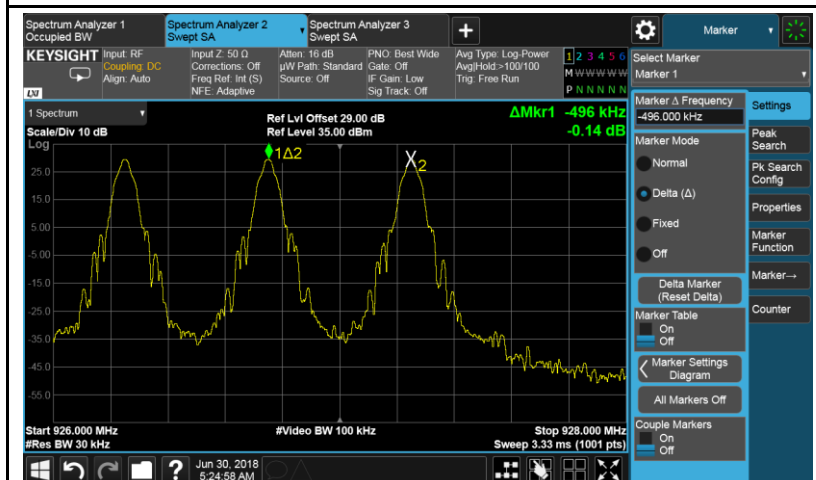
Channel Separation Test Plots



Low Channel



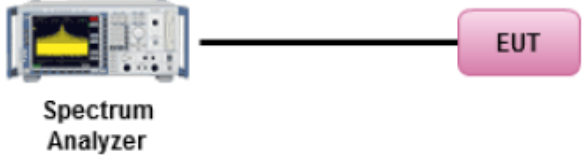
Mid Channel



High Channel

10.6 Time of Occupancy

Requirement(s):

Spec	Requirement	Applicable									
47 CFR §15.247 RSS-247	For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.	<input checked="" type="checkbox"/>									
Test Setup	 <p>Spectrum Analyzer ——— EUT</p>										
Procedure	<u>Channel Separation procedure</u> <ol style="list-style-type: none"> 1. The EUT must have its hopping function enabled. 2. Span = zero span 3. centered on a hopping channel 4. RBW = 1 MHz; VBW >= RBW 5. Sweep = as necessary to capture the entire dwell time per hopping channel. 6. Detector = Peak. 7. Trace mode = max hold. 8. If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. 										
Test Date	06/27/2018 to 08/03/2018	<table border="1"> <tr> <td>Environmental condition</td> <td>Temperature</td> <td>22.1°C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>45.5%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1019mbar</td> </tr> </table>	Environmental condition	Temperature	22.1°C		Relative Humidity	45.5%		Atmospheric Pressure	1019mbar
Environmental condition	Temperature	22.1°C									
	Relative Humidity	45.5%									
	Atmospheric Pressure	1019mbar									
Remark	-										
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail										

Test Data Yes N/A

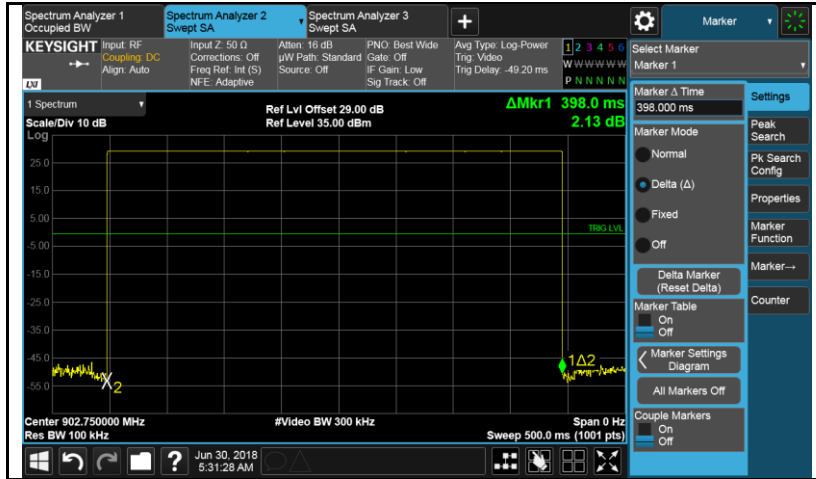
Test Plot Yes N/A

Test was done by Cipher at RF Test Site.

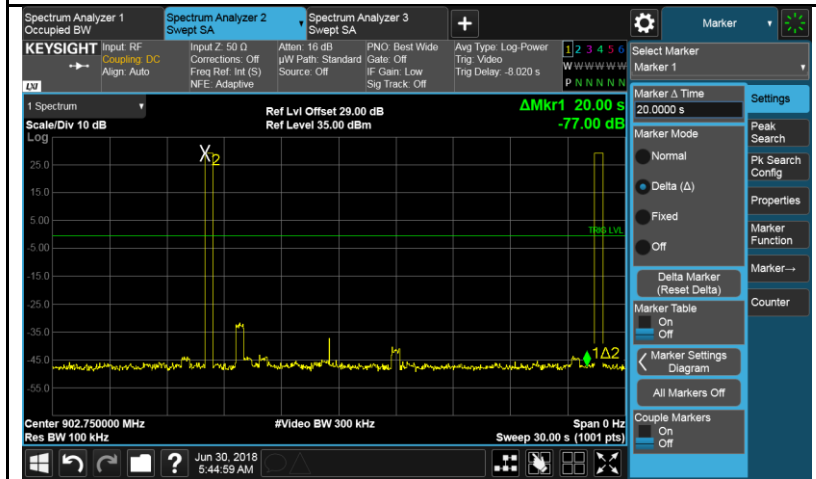
Dwell Time Test Result

Mode	Frequency (MHz)	Type	Measurement (ms)	Limit (Sec)
TX	902.75	Single Pulse time (ms)	398	0.4
TX	915.25	Single Pulse time (ms)	397.5	0.4
TX	927.25	Single Pulse time (ms)	397.5	0.4

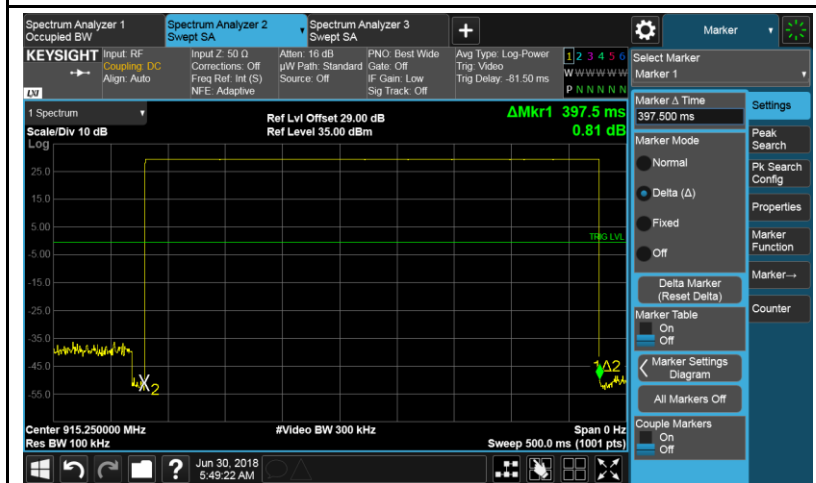
Test Plots



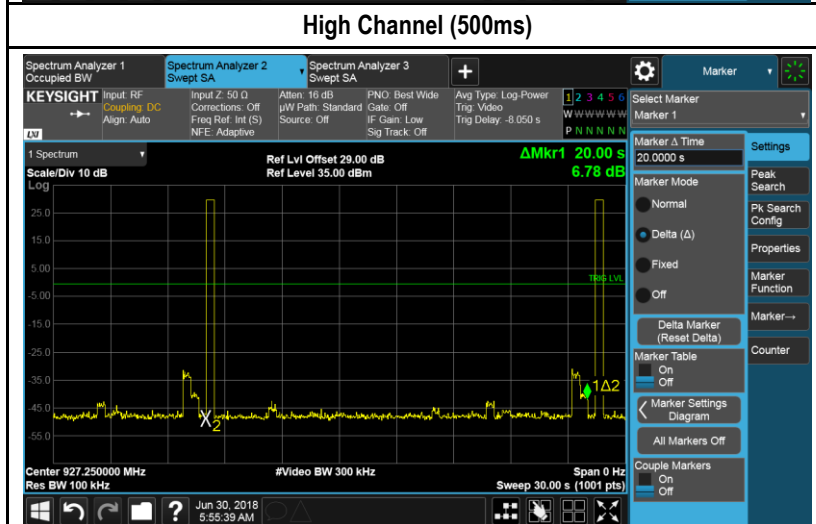
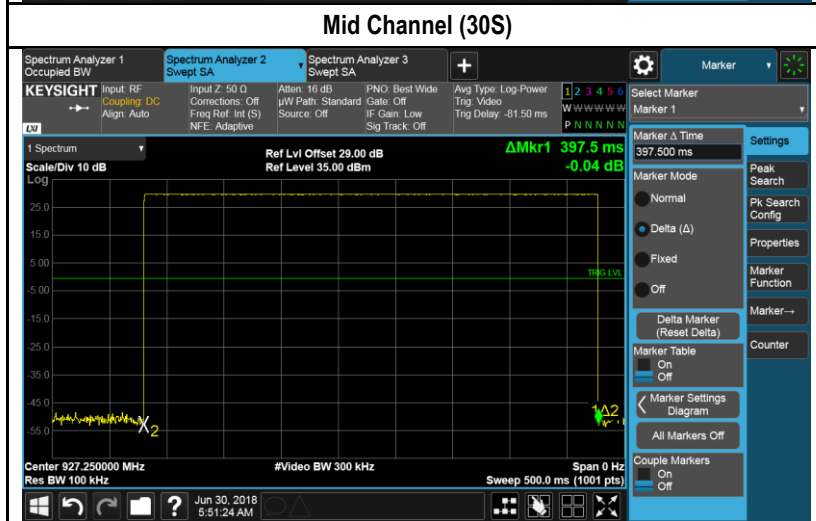
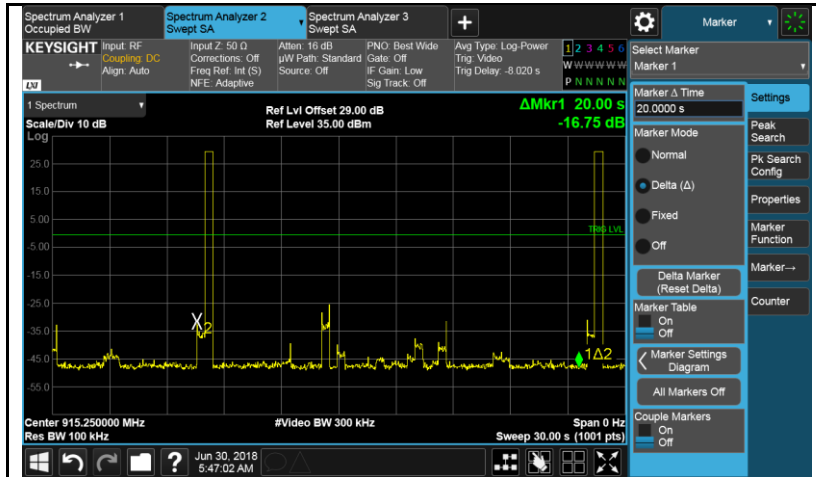
Low Channel (500ms)



Low Channel (30S)

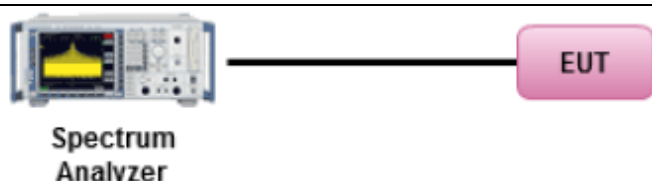


Mid Channel (500ms)



10.7 Band Edge

Requirement(s):

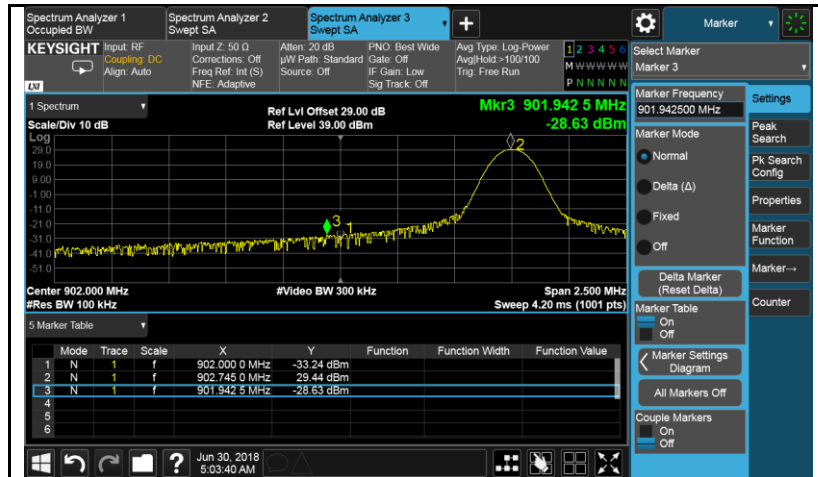
Spec	Requirement	Applicable									
§ 15.247 RSS-247	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209 (a) is not required <input checked="" type="checkbox"/> 20 dB down <input type="checkbox"/> 30 dB down	<input checked="" type="checkbox"/>									
Test Setup											
Test Procedure	<u>Band Edge measurement procedure</u> <ol style="list-style-type: none"> Set the EUT to maximum power setting and enable the EUT transmit continuously. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as a measured. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used. Change modulation and channel bandwidth then repeat step 1 to 2. Measured and record the results in the test report. 										
Test Date	06/27/2018 to 08/03/2018	<table border="1"> <tr> <td>Environmental condition</td> <td>Temperature</td> <td>22.1°C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>45.5%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1019mbar</td> </tr> </table>	Environmental condition	Temperature	22.1°C		Relative Humidity	45.5%		Atmospheric Pressure	1019mbar
Environmental condition	Temperature	22.1°C									
	Relative Humidity	45.5%									
	Atmospheric Pressure	1019mbar									
Remark	None										
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail										

Test Data Yes N/A

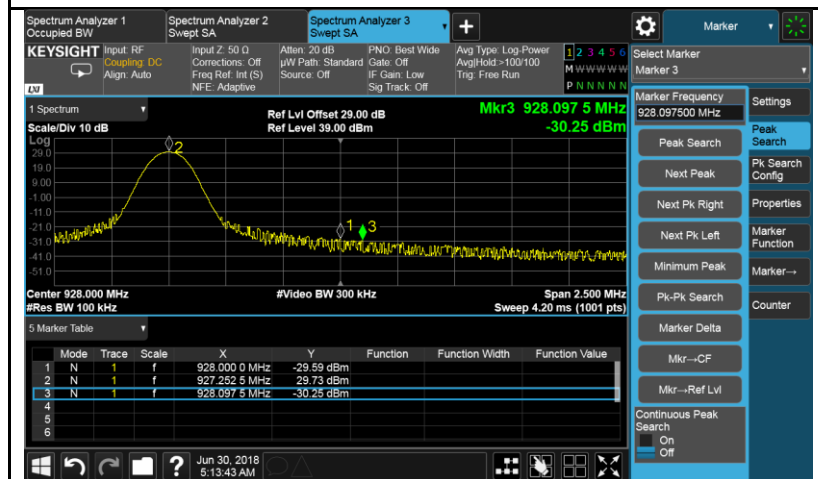
Test Plot Yes N/A

Test was done by Cipher at RF Test Site.

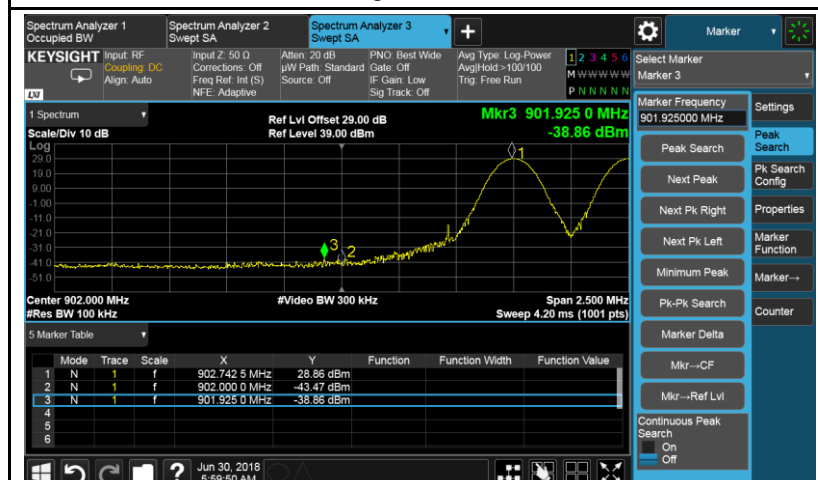
Test Plots



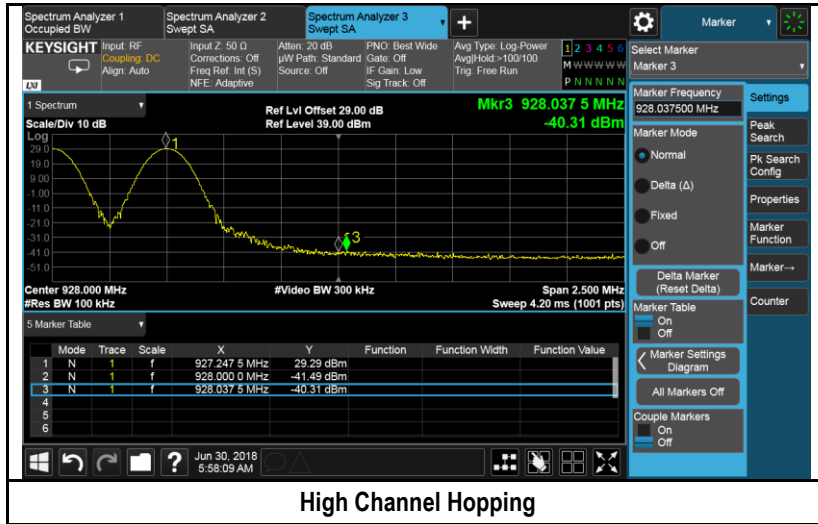
Low Channel



High Channel

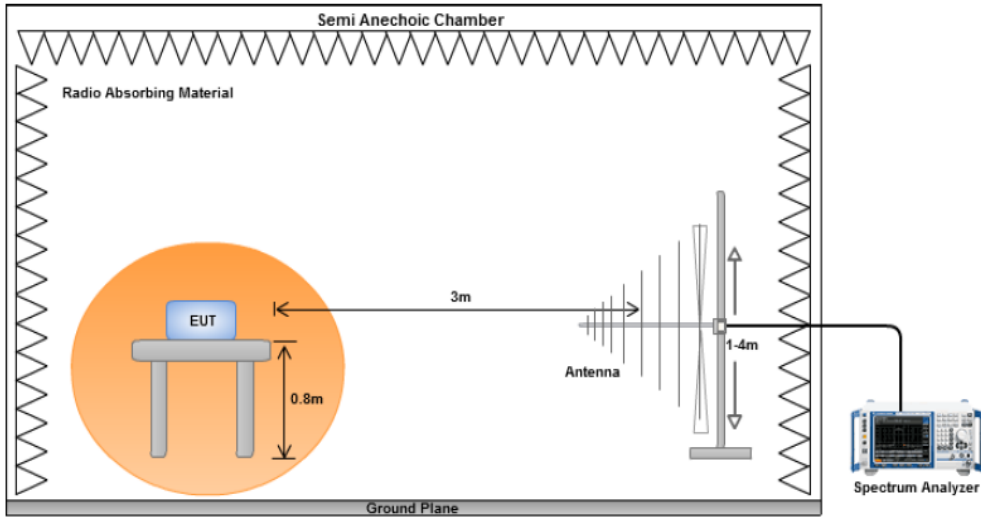


Low Channel Hopping



10.8 Radiated Emissions below 1GHz

Requirement(s):

Spec	Requirement	Applicable										
47CFR§15.247 RSS-247	<p>Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges</p> <table border="1"> <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	☒
Frequency range (MHz)	Field Strength (uV/m)											
30 – 88	100											
88 – 216	150											
216 960	200											
Above 960	500											
Test Setup												
Procedure	<ol style="list-style-type: none"> The EUT was switched on and allowed to warm up to its normal operating condition. 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: <ol style="list-style-type: none"> Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. The EUT was then rotated to the direction that gave the maximum emission. Finally, the antenna height was adjusted to the height that gave the maximum emission. A Quasi-peak measurement was then made for that frequency point. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured. 											
Remark	Different EUT orientations were evaluated. Only the worst case is presented in this report.											
Result	☒ Pass ☐ Fail											

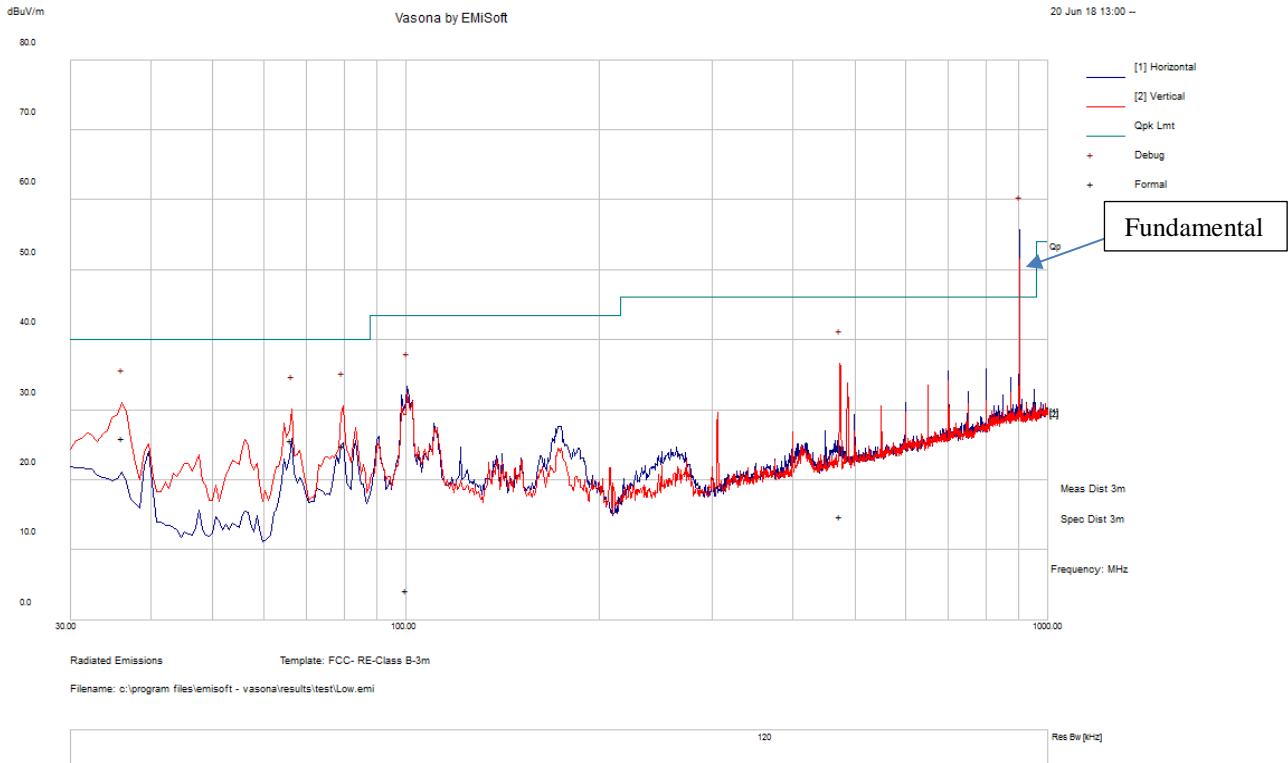
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Cipher at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	Below 1GHz		Result	Pass
Environmental Conditions:	Temp (°C):	20		
	Humidity (%)	38		
	Atmospheric (mbar):	1019		
Mains Power:	120VAC,60Hz			
Tested by:	Cipher			
Test Date:	06/27/2018 to 08/03/2018			
Remarks:	Continuous TX at 927.25MHz			



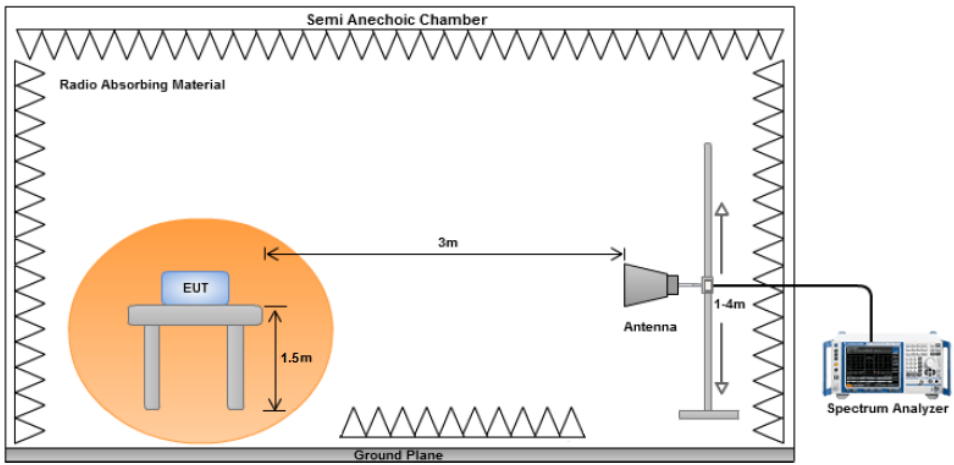
30MHz – 1000MHz at 3 meters

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
36.12	33.03	11.22	-18.29	25.95	Quasi Max	V	127	239	40	-14.05	Pass
79.68	41.43	11.67	-28.17	24.93	Quasi Max	V	140	144	40	-15.07	Pass
474.49	19.51	14.2	-18.85	14.87	Quasi Max	V	184	117	46	-31.13	Pass
66.30	41.75	11.55	-27.62	25.68	Quasi Max	V	101	191	40	-14.32	Pass
100.11	17.81	11.88	-25.45	4.24	Quasi Max	H	177	73	43.5	-39.26	Pass

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

10.9 Radiated Spurious Emissions above 1GHz

Requirement(s):

Spec	Requirement	Applicable									
47CFR§15.247 RSS-247	<p>For non-restricted band, 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 or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required</p> <p><input checked="" type="checkbox"/> 20 dB down <input type="checkbox"/> 30 dB down</p>	<input checked="" type="checkbox"/>									
Test Setup											
Procedure	<ol style="list-style-type: none"> 1. The EUT was switched on and allowed to warm up to its normal operating condition. 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: <ol style="list-style-type: none"> a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured. 										
Test Date	06/27/2018 to 08/03/2018	<table border="0"> <tr> <td>Environmental condition</td> <td>Temperature</td> <td>23°C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>53%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1009mbar</td> </tr> </table>	Environmental condition	Temperature	23°C		Relative Humidity	53%		Atmospheric Pressure	1009mbar
Environmental condition	Temperature	23°C									
	Relative Humidity	53%									
	Atmospheric Pressure	1009mbar									
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 Cipher at 10m chamber.

1GHz-10GHz – Continuous Tx at 902.75MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1804.02	51.84	7.04	-9.35	49.53	Peak Max	V	142	154	74	-24.47	Pass
5970.56	42.81	13.57	5.61	61.98	Peak Max	V	112	358	74	-12.02	Pass
1462.41	57.5	6.16	-12.73	50.93	Peak Max	V	129	4	74	-23.07	Pass
1726.14	50.42	6.76	-10.67	46.52	Peak Max	H	100	136	74	-27.48	Pass
2127.42	45.77	7.55	-7.88	45.44	Peak Max	V	189	321	74	-28.56	Pass
1599.84	57.76	6.48	-12.09	52.15	Peak Max	V	136	17	74	-21.85	Pass
1804.02	32.24	7.04	-9.35	29.93	Average Max	V	142	154	54	-24.07	Pass
5970.56	29.71	13.57	5.61	48.88	Average Max	V	112	358	54	-5.12	Pass
1462.41	36.7	6.16	-12.73	30.13	Average Max	V	129	4	54	-23.87	Pass
1726.14	33.41	6.76	-10.67	29.51	Average Max	H	100	136	54	-24.49	Pass
2127.42	31.6	7.55	-7.88	31.27	Average Max	V	189	321	54	-22.73	Pass
1599.84	37.09	6.48	-12.09	31.48	Average Max	V	136	17	54	-22.52	Pass

1GHz-10GHz – Continuous Tx at 915.25MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1833.63	60.39	7.05	-9.26	58.17	Peak Max	V	150	61	74	-15.83	Pass
5950.20	42.56	13.54	4.91	61	Peak Max	V	146	151	74	-13	Pass
1466.67	62.43	6.17	-12.74	55.86	Peak Max	V	147	92	74	-18.14	Pass
1726.07	56.98	6.76	-10.67	53.08	Peak Max	H	125	357	74	-20.92	Pass
1599.78	58.7	6.48	-12.09	53.09	Peak Max	V	162	26	74	-20.91	Pass
1995.71	52.51	7.3	-8.08	51.74	Peak Max	V	126	356	74	-22.26	Pass
1833.63	33.26	7.05	-9.26	31.04	Average Max	V	150	61	54	-22.96	Pass
5950.20	29.55	13.54	4.91	48	Average Max	V	146	151	54	-6	Pass
1466.67	34.15	6.17	-12.74	27.58	Average Max	V	147	92	54	-26.42	Pass
1726.07	33.41	6.76	-10.67	29.5	Average Max	H	125	357	54	-24.5	Pass
1599.78	39.2	6.48	-12.09	33.59	Average Max	V	162	26	54	-20.41	Pass
1995.71	31.89	7.3	-8.08	31.12	Average Max	V	126	356	54	-22.88	Pass

1GHz-10GHz – Continuous Tx at 927.25MHz
















Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
6000.93	43.02	13.61	6.06	62.7	Peak Max	H	127	342	74	-11.3	Pass
1855.54	60.78	7.04	-9.31	58.51	Peak Max	V	119	68	74	-15.49	Pass
1462.32	60.62	6.16	-12.73	54.05	Peak Max	V	192	67	74	-19.95	Pass
1727.31	58.43	6.76	-10.67	54.52	Peak Max	H	160	13	74	-19.48	Pass
1595.47	57.62	6.47	-12.17	51.91	Peak Max	H	141	350	74	-22.09	Pass
2127.65	45.51	7.55	-7.88	45.18	Peak Max	V	145	272	74	-28.82	Pass
6000.93	29.67	13.61	6.06	49.34	Average Max	H	127	342	54	-4.66	Pass
1855.54	33.37	7.04	-9.31	31.1	Average Max	V	119	68	54	-22.9	Pass
1462.32	34.8	6.16	-12.73	28.23	Average Max	V	192	67	54	-25.77	Pass
1727.31	33.3	6.76	-10.67	29.4	Average Max	H	160	13	54	-24.6	Pass
1595.47	38.44	6.47	-12.17	32.74	Average Max	H	141	350	54	-21.26	Pass
2127.65	31.45	7.55	-7.88	31.12	Average Max	V	145	272	54	-22.88	Pass








Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
R & S Receiver	ESIB 40	100179	06/08/2018	1 Year	06/08/2019	<input checked="" type="checkbox"/>
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	03/30/2018	1 Year	03/30/2019	<input checked="" type="checkbox"/>
RF Preamplifier	LPA-6-30	11140711	02/10/2018	1 Year	02/10/2019	<input checked="" type="checkbox"/>
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	07/08/2017	1 Year	07/08/2018	<input checked="" type="checkbox"/>
Horn Antenna (1-26.5GHz)	3115	10SL0059	08/11/2017	1 Year	08/11/2018	<input checked="" type="checkbox"/>
RF Conducted Measurement						
Agilent Spectrum Analyzer	N9010A	MY50210206	10/27/2017	1 Year	10/27/2018	<input checked="" type="checkbox"/>
Conducted Emissions						
EMI Test Receiver	ESIB 40	100179	7/21/2017	1 Year	7/21/2018	<input checked="" type="checkbox"/>
Transient Limiter (9kHz - 100MHz)	EM-7600	287	9/7/207	1 Year	9/7/2018	<input checked="" type="checkbox"/>
LISN (150 kHz - 30 MHz)	3816/2NM	214372	9/27/2017	1 Year	9/27/2018	<input checked="" type="checkbox"/>

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		A1 , A2 , A3 , A4 , B1 , B2 , B3 , B4 , 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		Radio & Telecommunications Terminal Equipment: EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I , Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		(Phase II) OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		Radio: Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		<p>Radio: A1. Terminal equipment for purpose of calling</p> <p>Telecom: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law</p>
Korea CAB Accreditation		<p>EMI: KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI</p> <p>EMS: 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>Radio: 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>Telecom: 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 Measurement</p>
Australia CAB Recognition		<p>EMC: AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4</p>
		<p>Radio communications: 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>Telecommunications: 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