RF TEST REPORT

SIEMIC
A Bureau Veritas Group Company

Report No.: FCC IC_RF_SL18091803-SEV-081
Supersede Report No.:

Applicant	:	RØDE Microphones
Product Name	:	Wireless Microphone System
Model No.	:	WIRELESS GO
Test Standard	:	47 CFR 15.247 RSS-247 Issue 2: Feb 2017
Test Method	:	ANSI C63.10: 2013 RSS-Gen Iss 5: April 2018 558074 D01 15.247 Meas Guidance v05r01
FCC ID	:	2AEANWGO
IC	:	20091-WGO
Dates of test	:	02/20/2019 to 02/26/2019
Issue Date	:	02/26/2019
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
	
Rachana Khanduri	**Chen Ge**
Test Engineer	Engineer Reviewer

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ilac-MRA
A2LA ACCREDITED
TESTING CERT # 2742-01

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, TELEC, 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 & RED
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_SL18091803-SEV-081	None	Original	02/26/2019

2 Executive Summary

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

Company: RØDE Microphones
Product: Wireless Microphone System
Model: WIRELESS GO

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

3 Customer information

Applicant Name	:	RØDE Microphones
Applicant Address	:	107 Carnarvon St., Silverwater, NSW, 2128, Australia
Manufacturer Name	:	RØDE Microphones
Manufacturer Address	:	107 Carnarvon St., Silverwater, NSW, 2128, Australia

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	540430
IC Test Site No.	4842D
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	Wireless Microphone System
Model No.	WIRELESS GO
Trade Name	RØDE
Serial No.	N/A
Input Power	5 VDC (USB)
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware Version	3
Software Version	V0031
Date of EUT received	02/14/2019
Equipment Class/ Category	DTS
Port/Connectors	Micro USB

6.2 Radio Description

2.4GHz :

Radio Type	2.4GHz
Operating Frequency	2402MHz-2480MHz
Modulation	GFSK
Channel Spacing	3MHz
No. of Channels	27
Antenna Type	Antenna 1 : PCB Inverted F Antenna Antenna 2 : PCB Folded Monopole
Antenna Gain	Antenna 1: 3.5dBi Antenna 2 : 3.0dBi
Antenna Connector Type	PCB microstrip line
Note	The product has 2 integrated PCB antennas with antenna diversity [switched diversity mode]. At any moment in time, only one antenna (of the two antennas) is used.

7 Supporting Equipment/Software and Cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	Latitude E5410	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	
Micro USB	EUT	Micro USB	Laptop	USB	2	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	WGo TestCmd	Set the EUT to transmit continuously in different test modes and channels

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Restricted Band of Operation	FCC	15.205	ANSI C63.10 - 2013 558074 D01 15.247 Meas. Guidance v05	☒ Pass ☐ N/A
	IC	RSS-Gen 8.10		
Antenna Requirement	FCC	15.203	ANSI C63.10 - 2013 558074 D01 15.247 Meas. Guidance v05	☒ Pass ☐ N/A
	IC	-		
AC Conducted Emissions Voltage	FCC	15.207	ANSI C63.10 - 2013 RSS Gen	☒ Pass ☐ N/A
	IC	RSS-Gen 8.8		

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
99% Occupied Bandwidth	-	-	-	-	☒ Pass ☐ N/A
	IC	RSS-Gen 6.7	IC	RSS Gen Issue 5: 2018	
6dB Bandwidth	FCC	15.247(a)(2)	FCC	558074 D01 15.247 Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS-247 5.2(a)	IC		
Band Edge and Radiated Spurious Emissions	FCC	15.247(d), 15.209	FCC	ANSI C63.10:2013 558074 D01 15.247 Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS-247 5.5, RSS-Gen 8.9	IC		
Output Power	FCC	15.247(b)	FCC	558074 D01 15.247 Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS-247 5.4(d)	IC		
Receiver Spurious Emissions	IC	RSS-Gen 4.8	IC	RSS Gen Issue 5: 2018	☐ Pass ☒ N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC	-	☐ Pass ☒ N/A
	IC	-	IC	-	
Power Spectral Density	FCC	15.247(e)	FCC	558074 D01 15.247 Meas Guidance v05r01	☒ Pass ☐ N/A
	IC	RSS-247 5.2(b)	IC		
RF Exposure requirement	FCC	15.247(i)	FCC	-	☐ Pass ☒ N/A
	IC	RSS-Gen 3.4	IC	RSS Gen Issue 5: 2018	
Remark	1. All measurement uncertainties do not take into consideration for all presented test results. 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 (100kHz 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

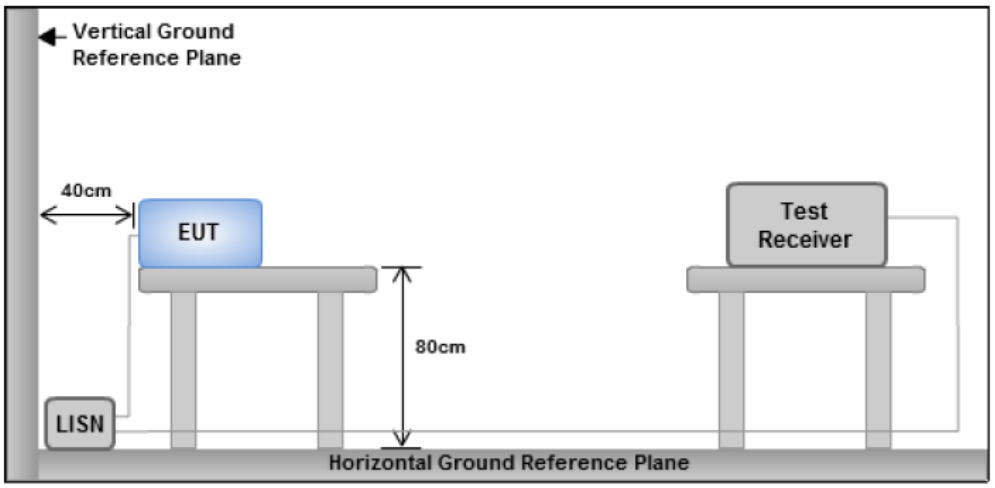
10.1 Antenna Requirement

Spec	Requirement	Applicable
§15.203	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. Antenna requirement must meet at least one of the following: 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.	☒
Remark	Antenna is permanently attached.The product has 2 integrated PCB antennas and connection type PCB microstrip line.	
Result	☒ PASS ☐ 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	Item	Requirement	Applicable
FCC 15.207 RSS-GEN Section 8.8	a)	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 µH/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	☒
Test Setup	 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		
Procedure	- 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 at 120VAC, 60Hz		
Result	☒ Pass ☐ Fail		

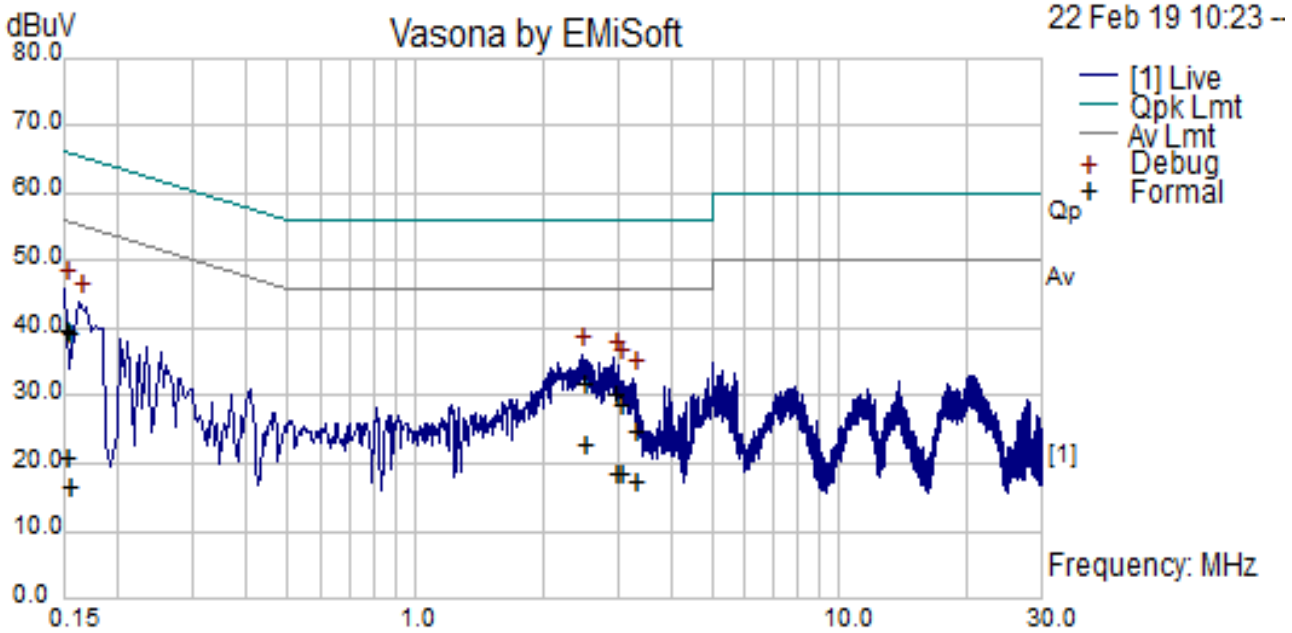
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Rachana Khanduri at Conducted Emission test site.

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Rachana Khanduri			
Test Date:	02/22/2019			
Remarks	Conducted @ Live			

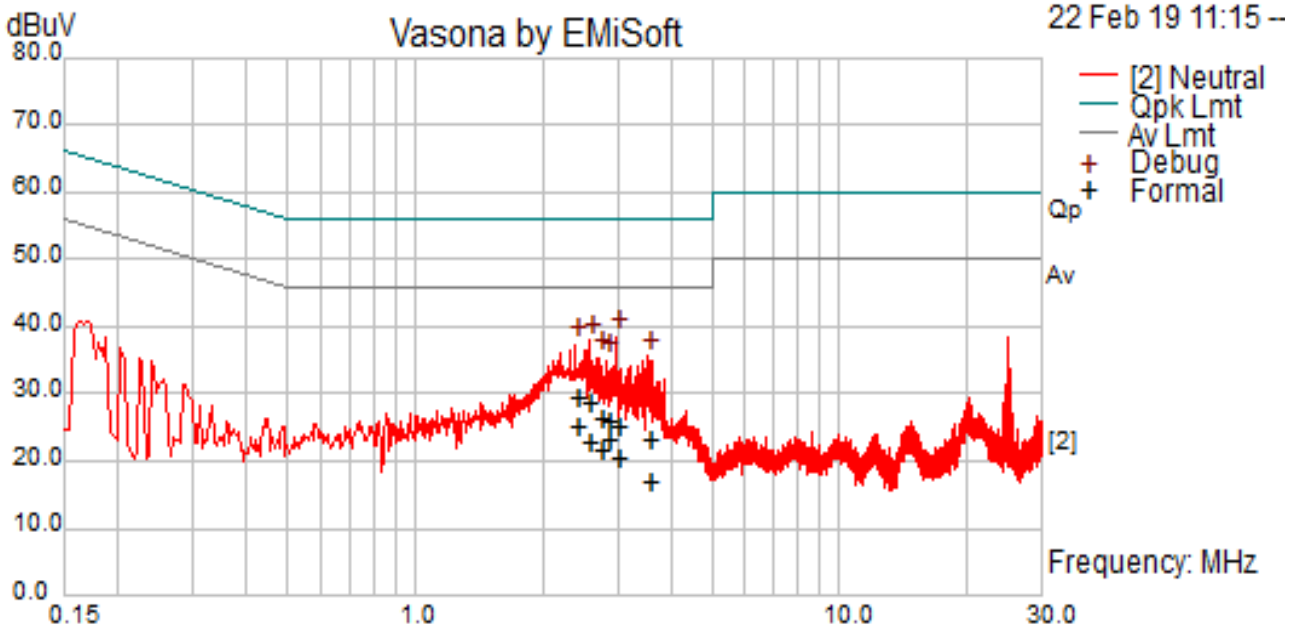


Live Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
2.48	23.79	7.91	0.07	31.77	Quasi Peak	Live	56	-24.23	Pass
0.15	32.25	7.11	0.05	39.41	Quasi Peak	Live	66	-26.59	Pass
2.95	22.29	7.93	0.07	30.29	Quasi Peak	Live	56	-25.71	Pass
0.15	32.01	7.11	0.05	39.17	Quasi Peak	Live	65.96	-26.79	Pass
3.00	20.59	7.93	0.07	28.58	Quasi Peak	Live	56	-27.42	Pass
3.28	16.50	7.96	0.07	24.53	Quasi Peak	Live	56	-31.47	Pass
2.48	14.63	7.91	0.07	22.61	Average	Live	46	-23.39	Pass
0.15	13.56	7.11	0.05	20.72	Average	Live	56	-35.28	Pass
2.95	10.28	7.93	0.07	18.28	Average	Live	46	-27.72	Pass
0.15	9.12	7.11	0.05	16.28	Average	Live	55.96	-39.67	Pass
3.00	10.42	7.93	0.07	18.42	Average	Live	46	-27.58	Pass
3.28	9.08	7.96	0.07	17.10	Average	Live	46	-28.90	Pass

Conducted Emission Test Results

Test specification:	Conducted Emissions			
Environmental Conditions:	Temp(°C):	21	Result:	☒ Pass ☐ Fail
	Humidity (%):	42		
	Atmospheric(mbar):	1021		
Mains Power:	120Vac, 60Hz			
Tested by:	Rachana Khanduri			
Test Date:	02/22/2019			
Remarks	Conducted @ Neutral			

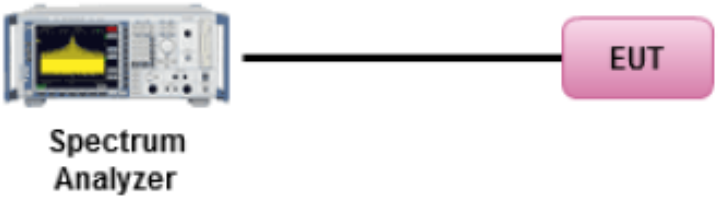


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
2.98	17.17	7.93	0.07	25.17	Quasi Peak	Neutral	56	-30.83	Pass
2.55	20.43	7.91	0.07	28.41	Quasi Peak	Neutral	56	-27.59	Pass
2.39	21.47	7.90	0.07	29.44	Quasi Peak	Neutral	56	-26.56	Pass
3.53	15.01	7.98	0.07	23.06	Quasi Peak	Neutral	56	-32.94	Pass
2.70	18.30	7.92	0.07	26.29	Quasi Peak	Neutral	56	-29.71	Pass
2.84	17.66	7.92	0.07	25.66	Quasi Peak	Neutral	56	-30.34	Pass
2.98	12.50	7.93	0.07	20.49	Average	Neutral	46	-25.51	Pass
2.55	14.79	7.91	0.07	22.77	Average	Neutral	46	-23.23	Pass
2.39	17.07	7.90	0.07	25.04	Average	Neutral	46	-20.96	Pass
3.53	8.58	7.98	0.07	16.63	Average	Neutral	46	-29.37	Pass
2.70	13.53	7.92	0.07	21.51	Average	Neutral	46	-24.49	Pass
2.84	15.11	7.92	0.07	23.10	Average	Neutral	46	-22.90	Pass

10.3 6dB & 99% Bandwidth

Requirement(s):

Spec	Requirement	Applicable
§ 15.247 RSS247 (5.2.1)	6dB BW≥500KHz;	☒
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	☒
Test Setup		
Test Procedure	558074 D01 DTS Meas Guidance v04, 8.1 DTS bandwidth 6dB Emission bandwidth measurement procedure - Set RBW = 100 kHz. - Set the video bandwidth (VBW) ⩾ 3 x RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. - 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	02/20/2019	Environmental condition: Temperature 23ºC; Relative Humidity 42%; Atmospheric Pressure 1021mbar
Remark	N/A	
Result	☒ Pass ☐ Fail	

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes ☐ N/A

Test was done by Rachana Khanduri at RF test site.

6dB & 99% Bandwidth Test Data:

Antenna 1:

Channel	Channel Frequency (MHz)	OBW	
		99% (MHz)	6dB(KHz)
Low	2402	1.07	662.0
Mid	2441	1.08	661.0
High	2480	1.07	676.9

Antenna 2:

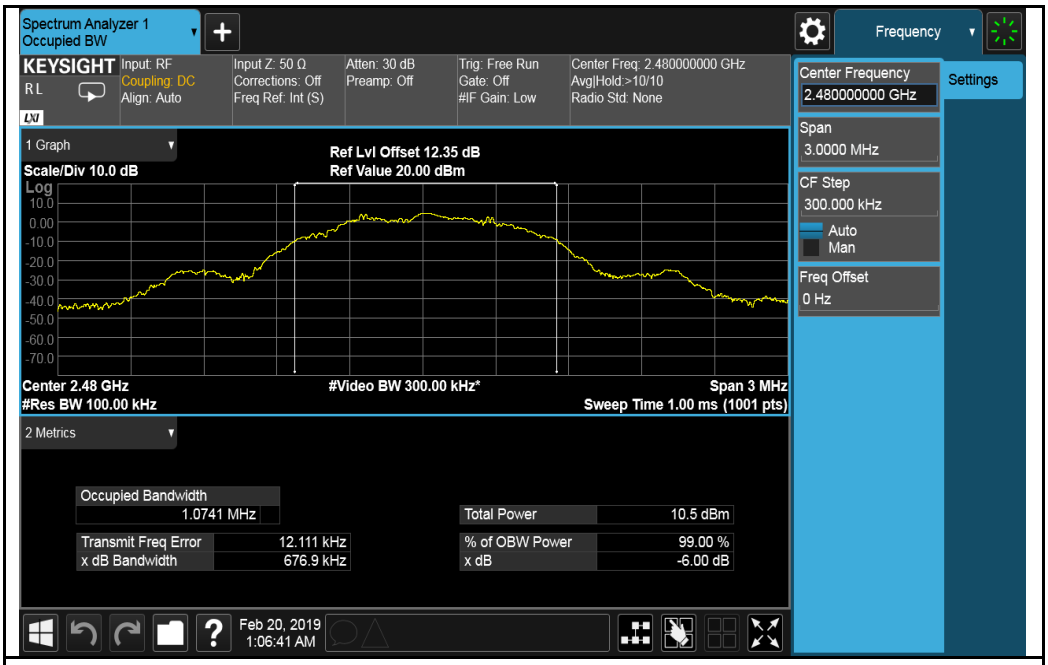
Channel	Channel Frequency (MHz)	OBW	
		99% (MHz)	6dB(KHz)
Low	2402	1.08	663.0
Mid	2441	1.07	564.7
High	2480	1.08	660.5

6dB & 99% Bandwidth Test Plots:

Antenna 1:

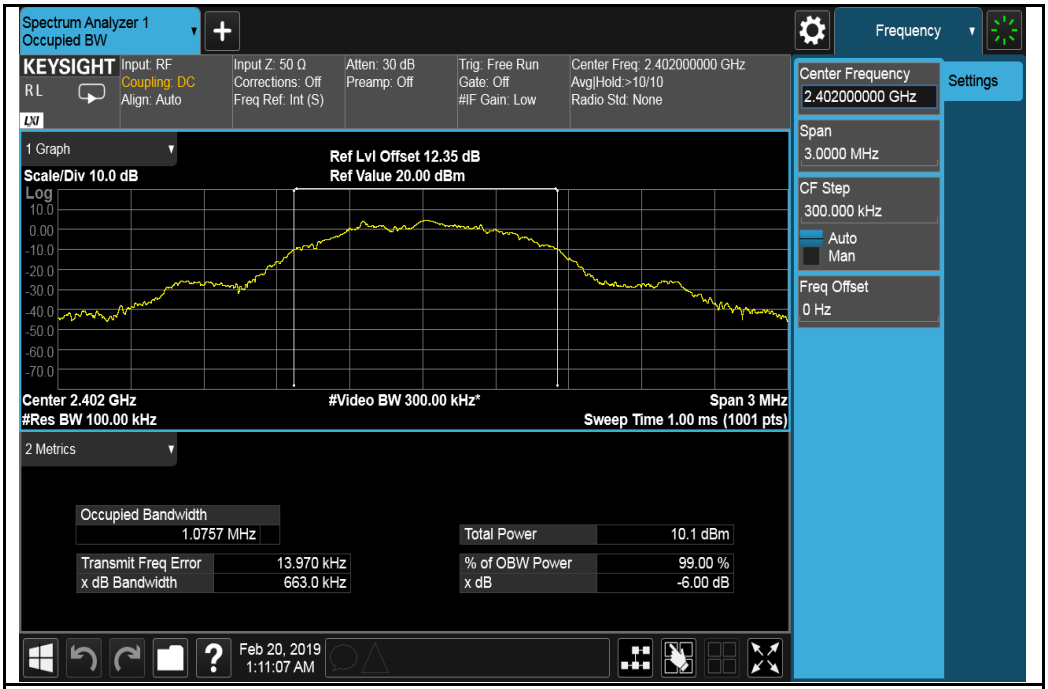
Low CH-2402MHz

Mid CH-2441MHz

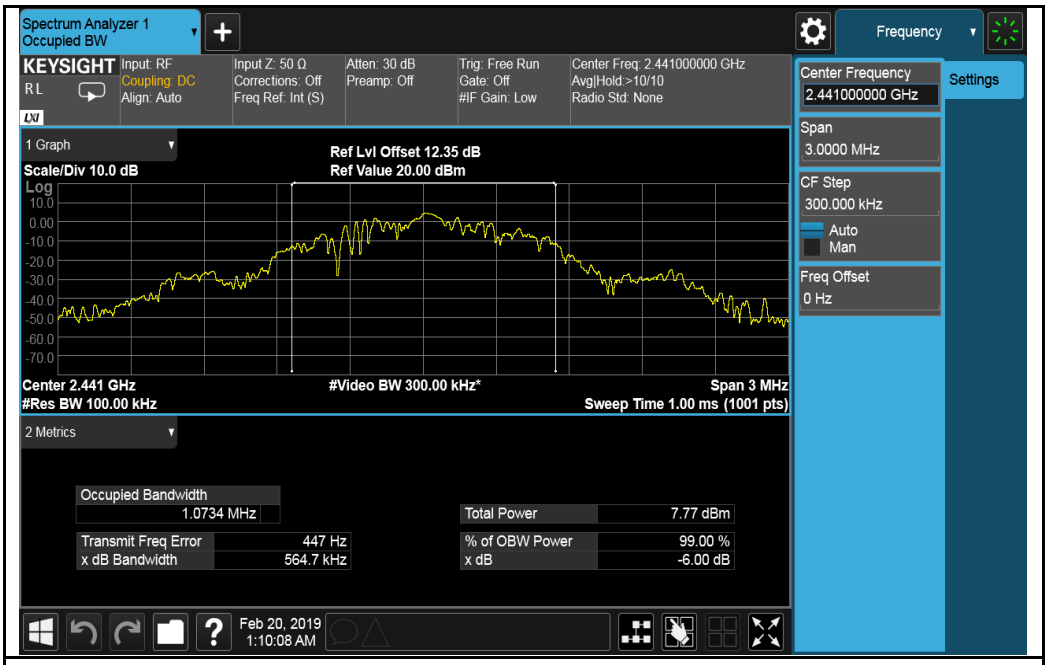


High CH-2480MHz

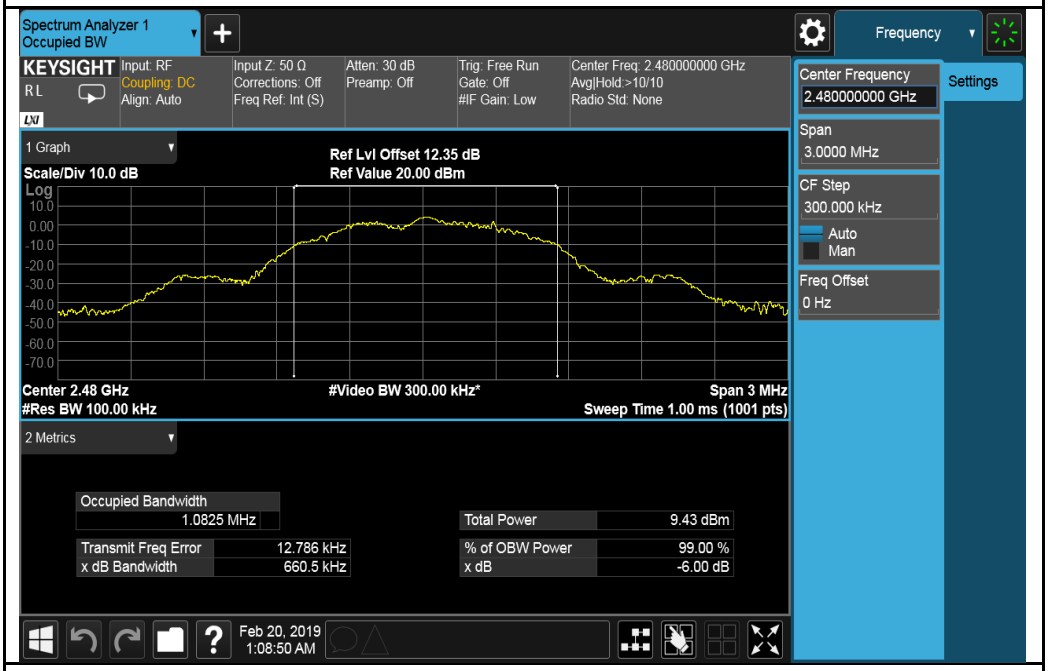
Antenna 2:



Low CH -2402MHz



Mid CH-2441MHz

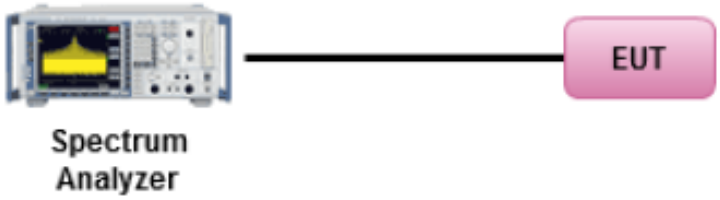


High CH-2480MHz

10.4 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247 (5.4.4)	1	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.	☒

Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v04, 9.1.1 Measurement using a Spectrum Analyzer (SA) This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth. (a) Set the RBW ≥ DTS bandwidth. (b) Set VBW ≥ 3 RBW. (c) Set span ≥ 3 RBW (d) Sweep time = auto couple. (e) Detector = peak. (f) Trace mode = max hold. (g) Allow trace to fully stabilize (h) Use peak marker function to determine the peak amplitude level.			
Test Date	02/20/2019	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 44% 1021mbar
Remark	NONE			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Rachana Khanduri at RF test site.

Output Power measurement results:

Antenna 1:

Type	Freq (MHz)	Test mode	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	2402	2.4 GHz	Low	5.42	≤30	Pass
	2441	2.4 GHz	Mid	5.29	≤30	Pass
	2480	2.4 GHz	High	4.86	≤30	Pass

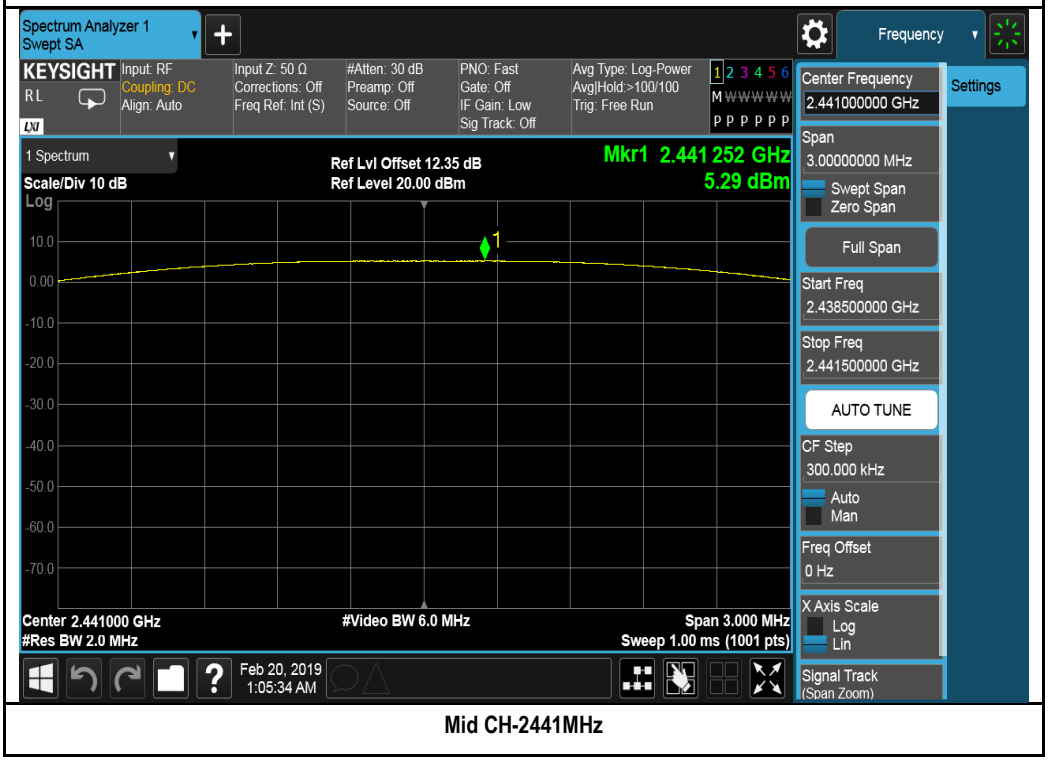
Antenna 2:

Type	Freq (MHz)	Test mode	CH	Conducted Power (dBm)	Limit (dBm)	Result
Output power	2402	2.4 GHz	Low	4.89	≤30	Pass
	2441	2.4 GHz	Mid	4.57	≤30	Pass
	2480	2.4 GHz	High	4.19	≤30	Pass

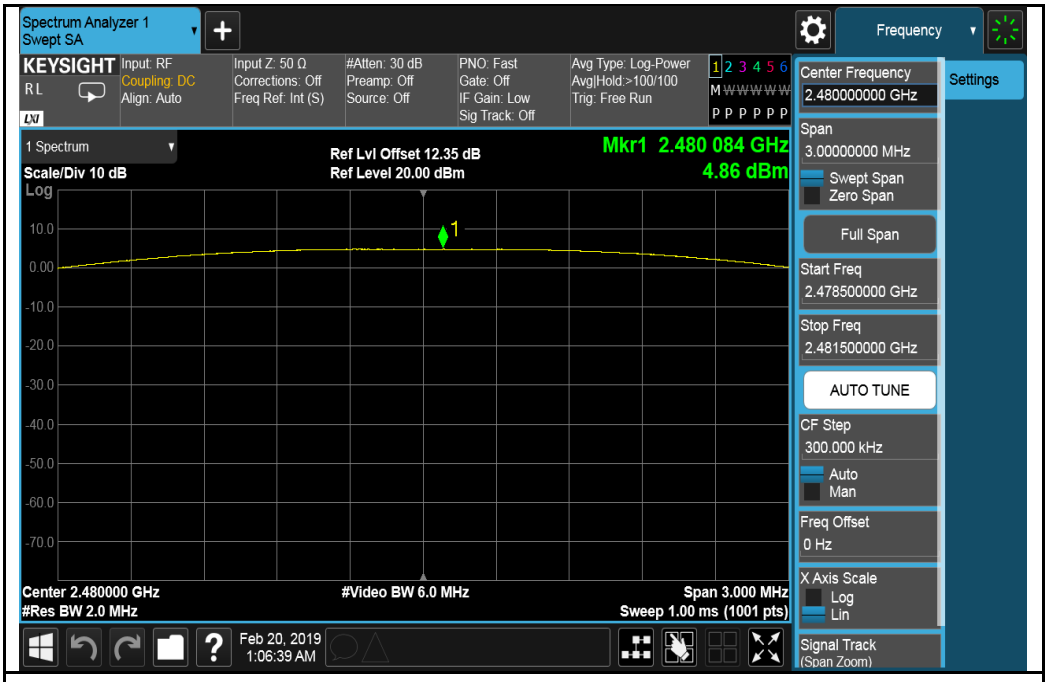
Test Plots:

Antenna 1:

Low CH-2402MHz



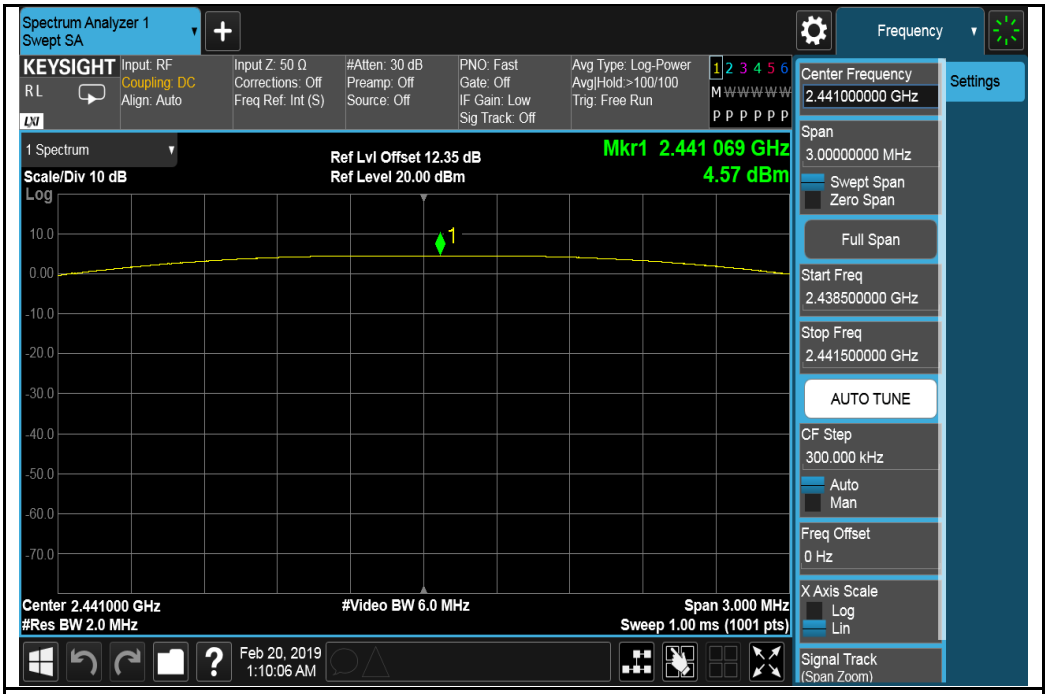
Mid CH-2441MHz



High CH-2480MHz

Antenna 2:

Low CH-2402MHz



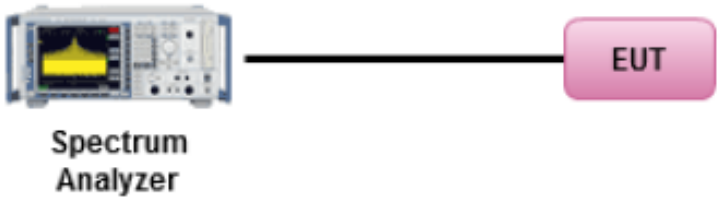
Mid CH-2441MHz

High CH-2480MHz

10.5 Band Edge and Conducted Spurious Emissions

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247 RSS247(5.5)	d)	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 ☐ 20 dB down ☒ 30 dB down	☒

Test Setup				
Test Procedure	558074 D01 DTS Meas Guidance v04 Band Edge measurement procedure 1. Set the EUT to maximum power setting and enable the EUT transmit continuously. 2. Band edge emissions must be at least 30 dB down from the highest emission level within the authorized band as a measured. The attunation shall be be 30 dB instead of 20 dB when Peak conducted output power procedure is used. 3. Change modulation and channel bandwidth then repeat step 1 to 2. 4. Measured and record the results in the test report.			
Test Date	02/20/2019	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	22°C 46% 1020mbar
Remark	-			
Result	☒ Pass ☐ Fail			

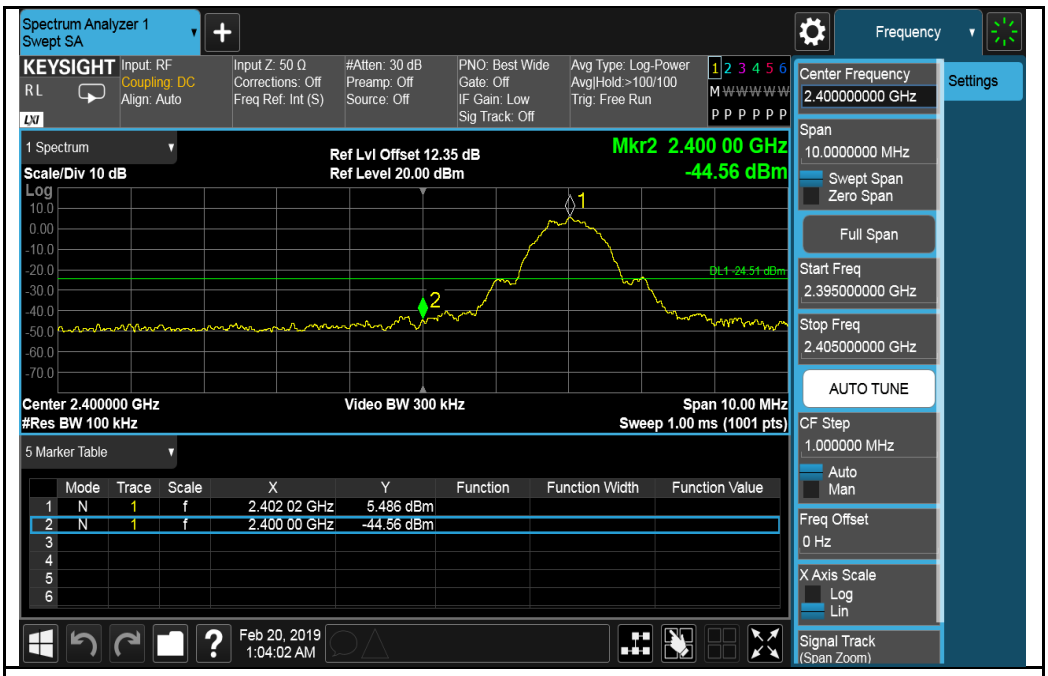
Test Data ☐ Yes ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

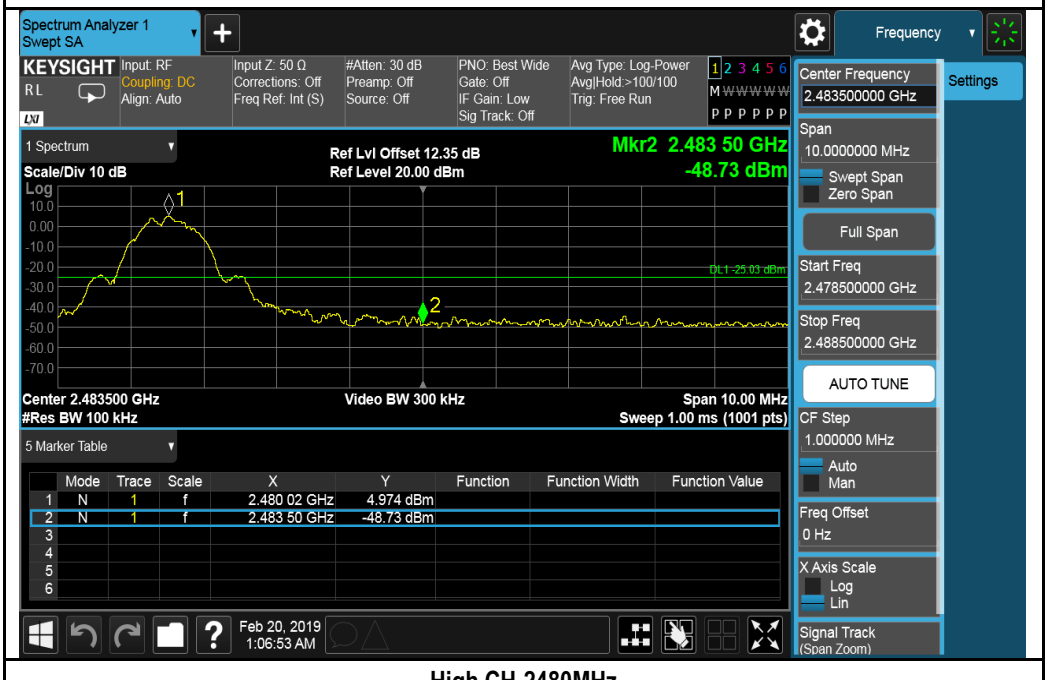
Test was done by Rachana Khanduri at RF test site.

Test Plots:

Antenna 1:

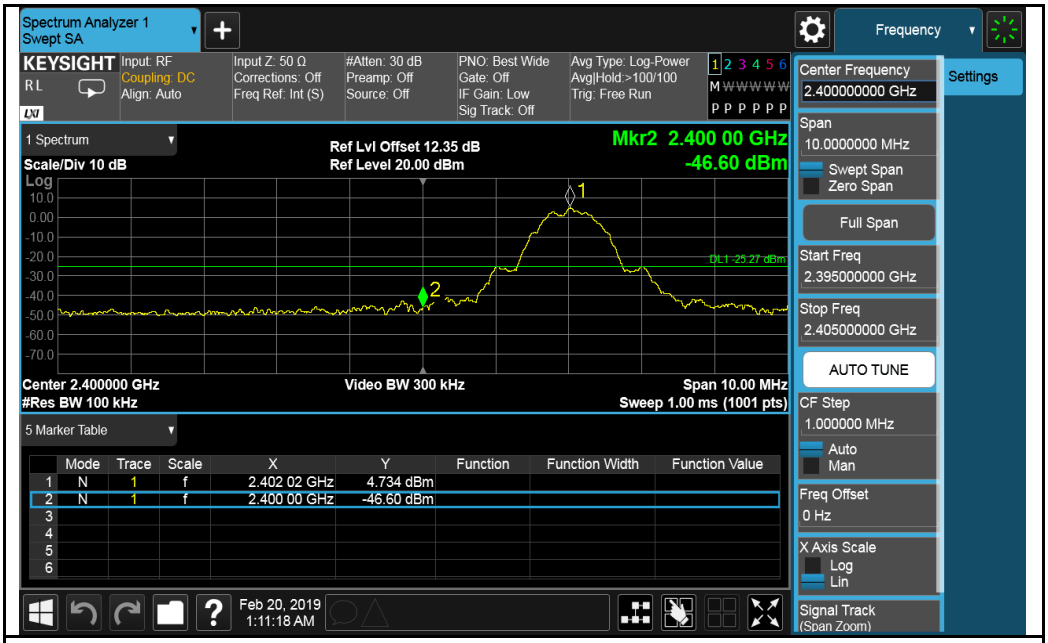


Low CH-2402MHz

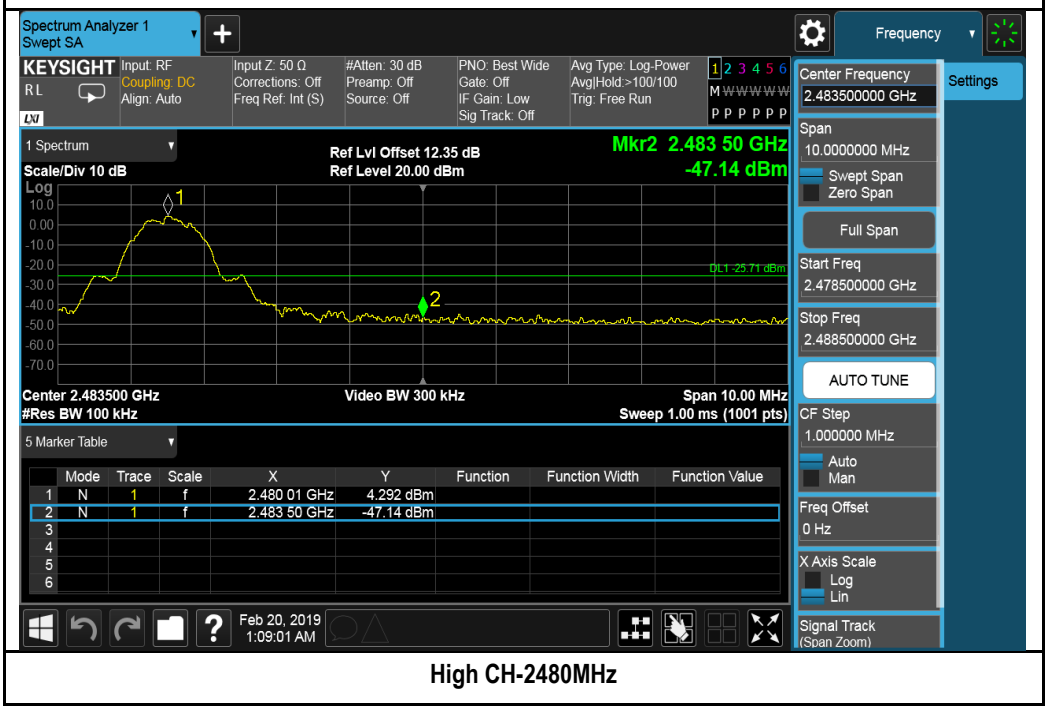


High CH-2480MHz

Antenna 2:



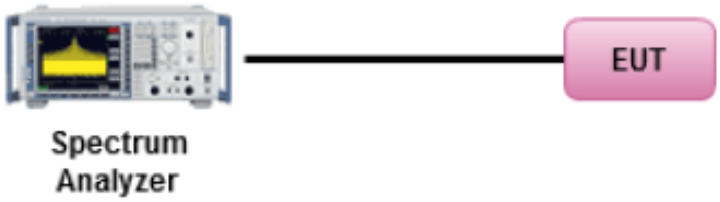
Low CH-2402MHz



High CH-2480MHz

10.6 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e) RSS247 (5.2.2)	e)	DSSS: ≤8dBm/3KHz	☒
	f)	DSSS in hybrid sys with FH turned off: ≤8dBm/3KHz	☐
Test Setup			
Test Procedure	558074 D01 DTS Meas Guidance v04, 10.2 Method PKPSD (peak PSD) Peak spectral density measurement procedure - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. - Set the VBW ≥ 3 x RBW. - Detector = Peak - Sweep time = auto couple. - Trace mode = Max Hold - Allow trace to fully stabilize. - Use the peak marker function to determine the maximum amplitude level within the RBW. - If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.		
Test Date	02/20/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Rachana Khanduri at RF test site.

PSD measurement results:

Antenna 1:

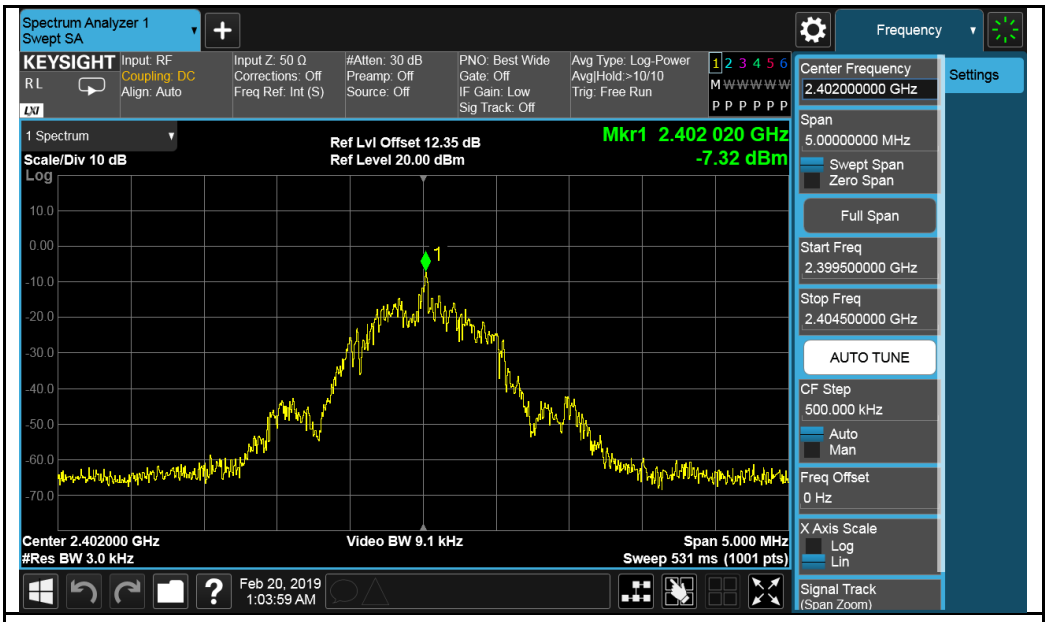
Type	Freq (MHz)	Test mode	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	2402	2.4GHz	Low	-7.32	8	Pass
	2441	2.4GHz	Mid	-7.50	8	Pass
	2480	2.4GHz	High	-8.23	8	Pass

Antenna 2:

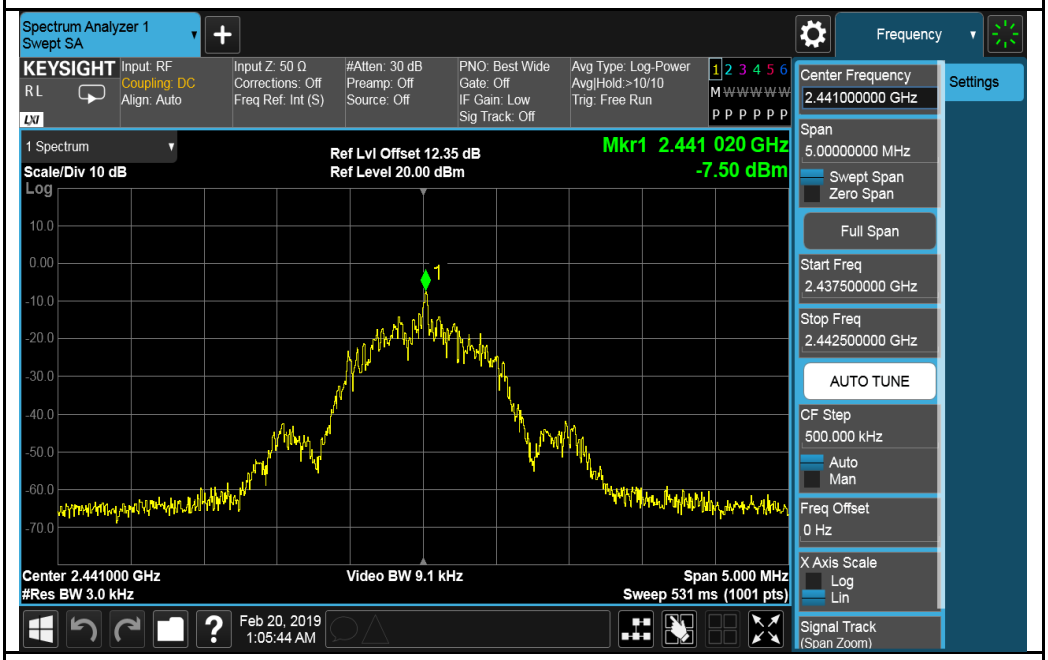
Type	Freq (MHz)	Test mode	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	2402	2.4GHz	Low	-8.04	8	Pass
	2441	2.4GHz	Mid	-8.28	8	Pass
	2480	2.4GHz	High	-8.85	8	Pass

Test Plots:

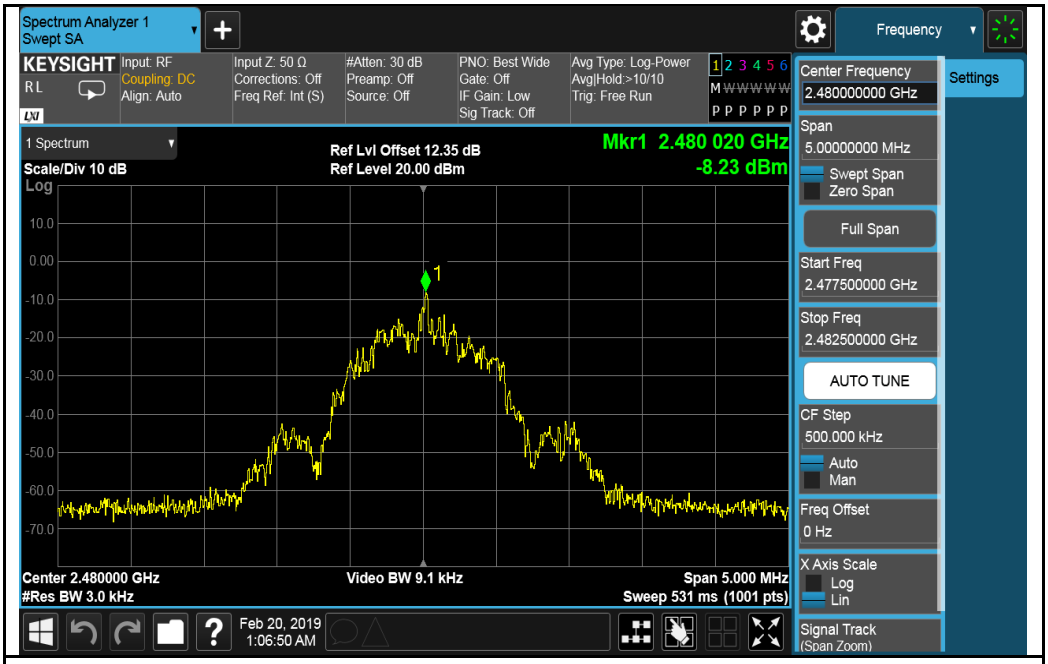
Antenna 1:



Low CH-2402MHz

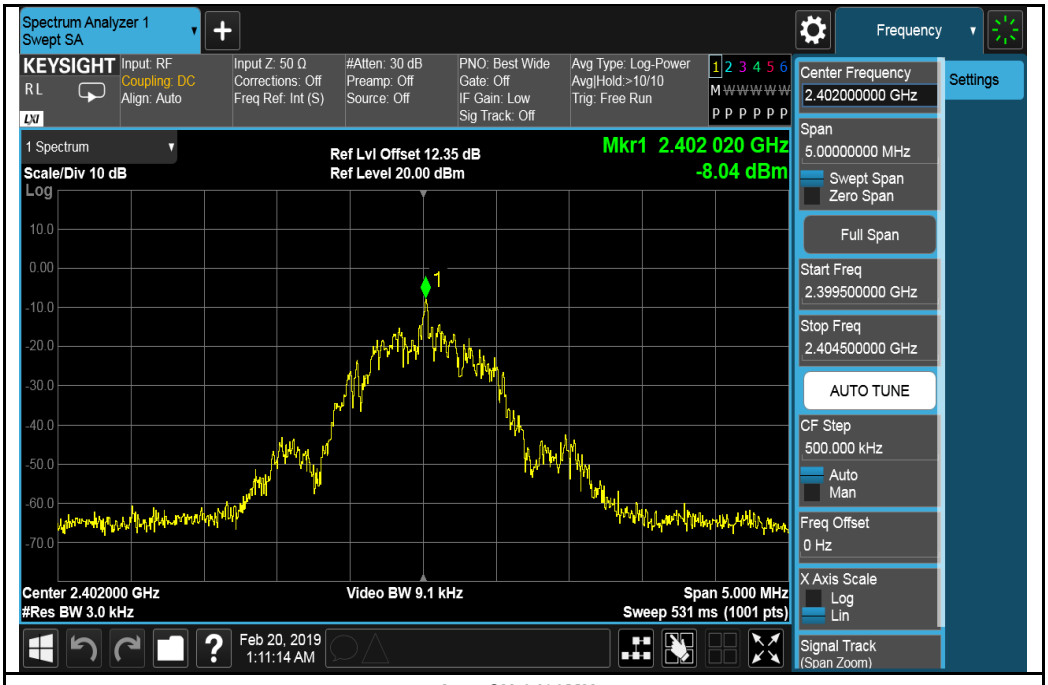


Mid CH-2441MHz

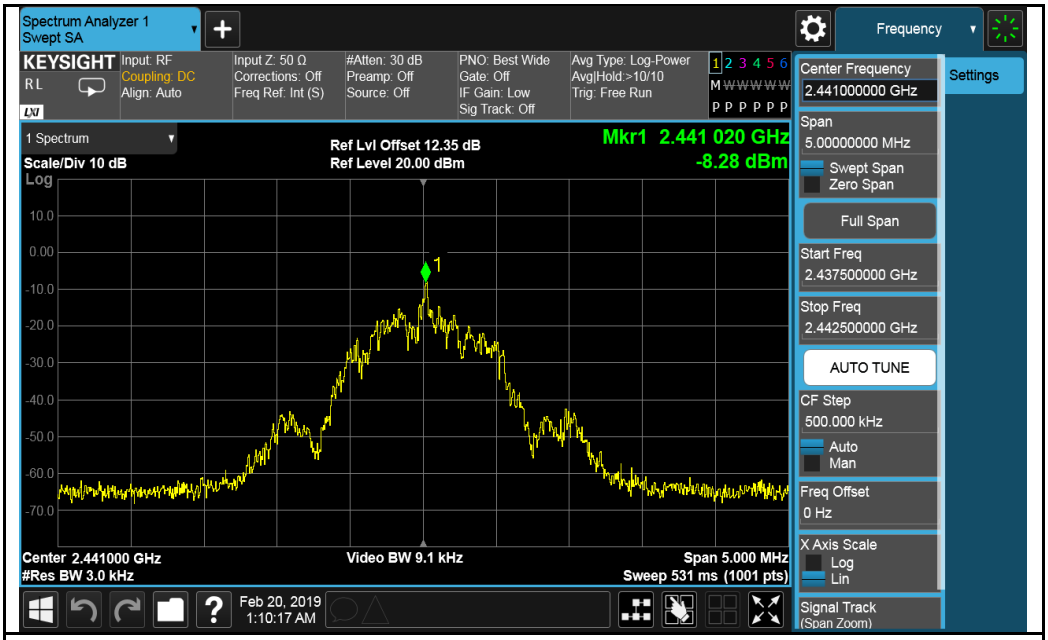


High CH-2480MHz

Antenna 2:



Low CH-2402MHz



Mid CH-2441MHz

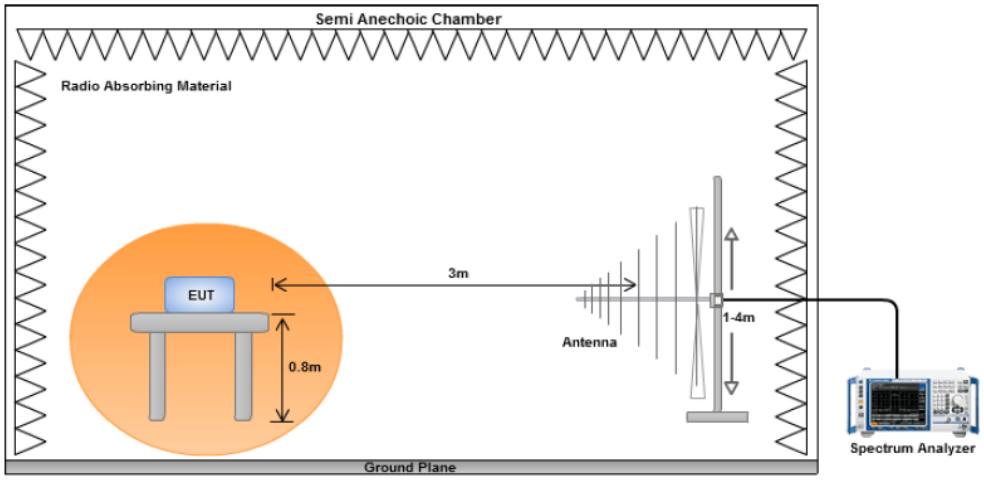
High CH-2480MHz

10.7 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d) RSS247 (5.5)	a)	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	☒

Frequency range (MHz)	Field Strength (uV/m)
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

Test Setup	
Procedure	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: 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. A Quasi-peak 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.
Remark	The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.
Result	☒ Pass ☐ Fail

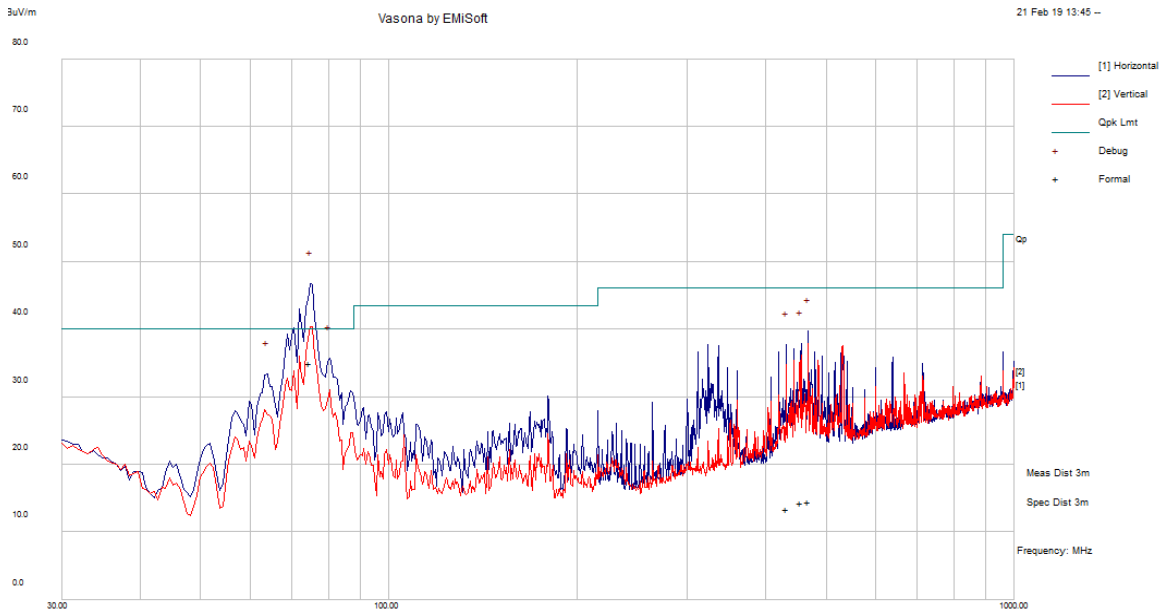
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

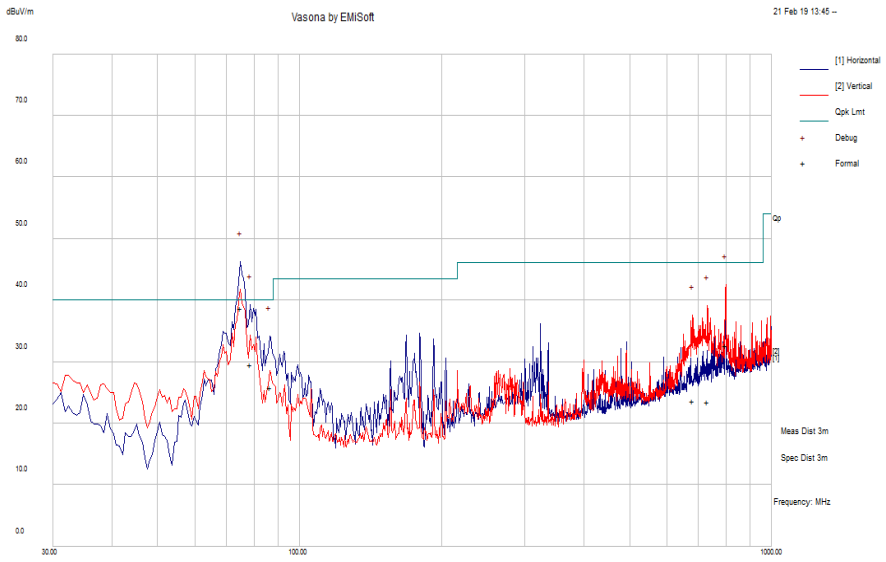
Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26	Result	Pass
	Humidity (%)	47		
	Atmospheric (mbar):	1020		
Mains Power:	5VDC			
Tested by:	Gary Chou			
Test Date:	02/21/2019			
Remarks:	Antenna 1 : Mid CH 2441MHz			



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
74.69	50.90	11.62	-27.47	35.05	Quasi Max	H	331	229	40	-4.95	Pass
80.07	-1.26	11.68	-27.75	-17.34	Quasi Max	H	303	309	40	-57.34	Pass
468.54	19.13	14.16	-18.73	14.56	Quasi Max	H	351	356	46	-31.44	Pass
63.81	-2.00	11.53	-27.30	-17.77	Quasi Max	H	336	182	40	-57.77	Pass
456.30	19.22	14.08	-18.97	14.32	Quasi Max	H	108	184	46	-31.68	Pass
431.79	18.65	14.02	-19.24	13.43	Quasi Max	H	139	275	46	-32.57	Pass

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

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26	Result	Pass
	Humidity (%)	47		
	Atmospheric (mbar):	1020		
Mains Power:	5VDC			
Tested by:	Gary Chou			
Test Date:	02/21/2019			
Remarks:	Antenna 2 : Mid CH, 2441MHz			

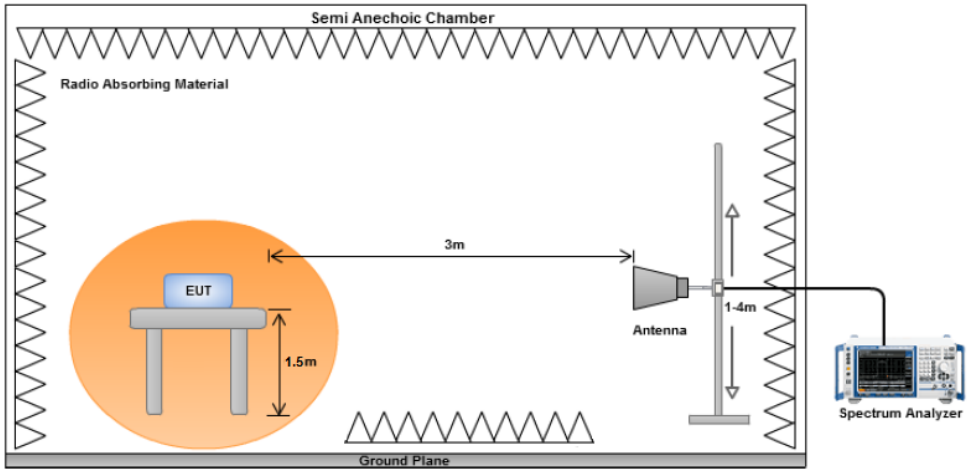


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
74.87	54.57	11.62	-27.48	38.71	Quasi Max	H	351	153	40	-1.29	Pass
78.50	45.58	11.66	-27.67	29.57	Quasi Max	H	258	122	40	-10.43	Pass
799.75	31.56	15.47	-14.27	32.76	Quasi Max	V	166	286	46	-13.24	Pass
86.50	41.85	11.75	-27.70	25.90	Quasi Max	H	234	356	40	-14.10	Pass
731.55	23.47	15.17	-15.10	23.54	Quasi Max	V	187	288	46	-22.46	Pass
680.29	24.77	14.97	-16.10	23.64	Quasi Max	V	116	285	46	-22.36	Pass

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

10.8 Radiated Spurious Emissions in restricted band

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247(A8.5)	a)	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 ☐ 20 dB down ☒ 30 dB down	☒
	b)	or restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒
Test Setup			
Procedure		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: 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.	
Remark		The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.	
Result		☒ Pass ☐ Fail	

Test Data ☐ Yes (See below) ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at 10m chamber.

Restricted Band Measurement Plots:

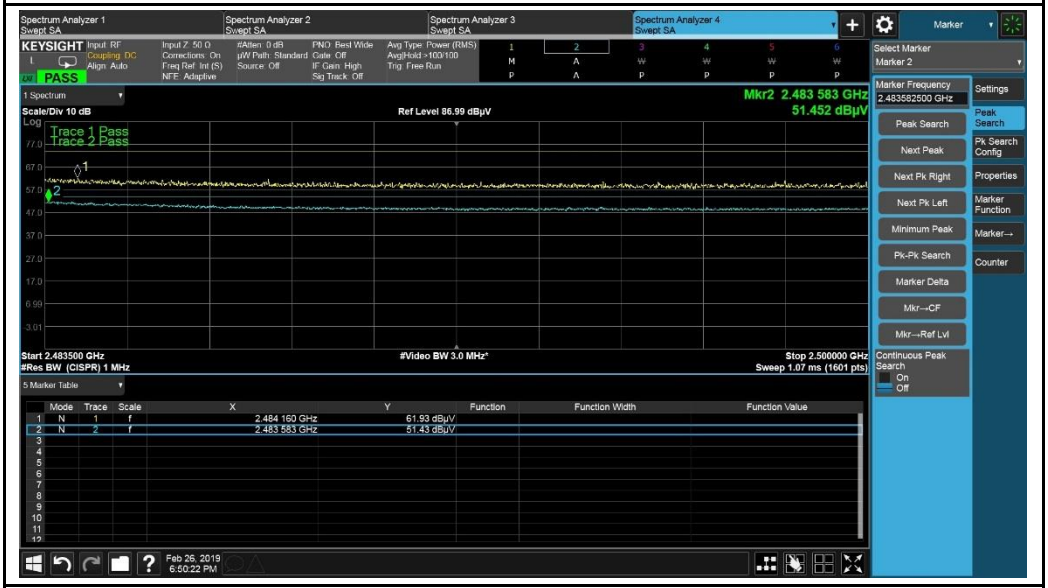
Antenna 1:

Low CH-2402MHz

High CH-2480MHz

Antenna 2:

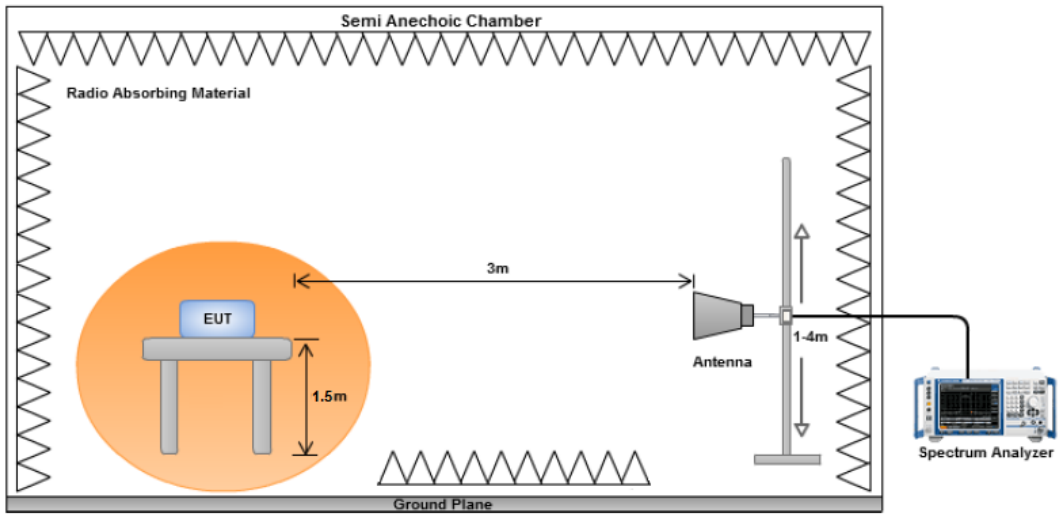
Low CH-2402MHz



High CH-2480MHz

10.9 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d), RSS247(A8.5)	a)	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 ☐ 20 dB down ☒ 30 dB down	☒
Test Setup			
Procedure	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: 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.		
Remark	The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Above 1GHz)

Antenna 1:

Above 1GHz-25GHz- Low CH - 2402MHz

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
7205.26	49.47	5.15	-0.45	54.17	Peak Max	V	124	338	74	-19.84	Pass
9608.84	44.79	5.59	0.51	50.89	Peak Max	V	113	69	74	-23.11	Pass
4804.05	44.87	4.10	-0.93	48.04	Peak Max	H	136	39	74	-25.96	Pass
7205.26	31.74	5.15	-0.45	36.43	Average Max	V	124	338	54	-17.57	Pass
9608.84	29.46	5.59	0.51	35.57	Average Max	V	113	69	54	-18.43	Pass
4804.05	30.47	4.10	-0.93	33.64	Average Max	V	129	63	54	-20.36	Pass

Above 1GHz-25GHz- Mid CH - 2441MHz

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
7320.72	46.46	5.15	-0.49	51.13	Peak Max	V	100	68	74	-22.88	Pass
9761.23	42.86	5.50	0.81	49.17	Peak Max	V	88	344	74	-24.83	Pass
4879.97	44.28	4.18	-1.00	47.46	Peak Max	V	100	63	74	-26.54	Pass
7320.72	30.90	5.15	-0.49	35.56	Average Max	H	115	224	54	-18.44	Pass
9761.23	28.82	5.50	0.81	35.13	Average Max	V	88	344	54	-18.88	Pass
4879.97	30.36	4.18	-1.00	33.54	Average Max	V	100	63	54	-20.46	Pass

Above 1GHz-25GHz-High CH - 2480MHz

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
7439.97	48.80	5.14	-0.53	53.40	Peak Max	H	105	165	74	-20.60	Pass
9918.94	42.95	5.79	1.18	49.92	Peak Max	V	155	26	74	-24.08	Pass
4960.03	44.55	4.25	-1.07	47.74	Peak Max	V	114	356	74	-26.27	Pass
7439.97	32.53	5.14	-0.53	37.13	Average Max	V	154	20	54	-16.87	Pass
9918.94	28.93	5.79	1.18	35.89	Average Max	V	155	26	54	-18.11	Pass
4960.03	30.55	4.25	-1.07	33.73	Average Max	V	114	356	54	-20.27	Pass

Antenna 2:

Above 1GHz-25GHz- Low CH - 2402MHz

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
7205.17	50.69	5.15	-0.45	55.39	Peak Max	V	148	357	74	-18.61	Pass
9607.96	47.45	5.60	0.51	53.56	Peak Max	V	146	339	74	-20.44	Pass
4804.26	44.82	4.10	-0.93	48.00	Peak Max	V	100	72	74	-26.00	Pass
7205.17	32.25	5.15	-0.45	36.94	Average Max	V	148	357	54	-17.06	Pass
9607.96	31.21	5.60	0.51	37.32	Average Max	V	146	339	54	-16.68	Pass
4804.26	30.20	4.10	-0.93	33.37	Average Max	V	100	72	54	-20.63	Pass

Above 1GHz-25GHz- Mid CH - 2441MHz

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
7320.03	46.97	5.15	-0.49	51.63	Peak Max	H	122	255	74	-22.37	Pass
9758.90	44.88	5.49	0.81	51.18	Peak Max	V	128	331	74	-22.82	Pass
4879.78	44.93	4.18	-1.00	48.11	Peak Max	H	234	321	74	-25.89	Pass
7320.03	31.61	5.15	-0.49	36.27	Average Max	H	122	255	54	-17.73	Pass
9758.90	29.31	5.49	0.81	35.61	Average Max	V	128	331	54	-18.39	Pass
4879.78	30.52	4.18	-1.00	33.7	Average Max	H	234	321	54	-20.3	Pass

Above 1GHz-25GHz- High CH - 2480MHz

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
7439.24	48.66	5.14	-0.53	53.27	Peak Max	V	151	8	74	-20.74	Pass
9919.33	41.23	5.79	1.18	48.20	Peak Max	V	147	28	74	-25.80	Pass
4960.20	45.76	4.25	-1.07	48.95	Peak Max	H	126	312	74	-25.05	Pass
7439.24	32.50	5.14	-0.53	37.10	Average Max	H	115	252	54	-16.90	Pass
9919.33	28.73	5.79	1.18	35.70	Average Max	V	147	28	54	-18.30	Pass
4960.20	30.19	4.25	-1.07	33.38	Average Max	H	126	312	54	-20.62	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	08/28/2018	1 Year	08/28/2019	☑
LISN (150 kHz - 30 MHz)	3816/2NM	214372	01/10/2019	1 Year	01/10/2020	☑
Radiated Emissions						
50GHz Spectrum Analyzer	N9030B (PXA)	MY57140374	01/25/2019	1 Year	01/25/2020	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	03/09/2018	2 Year	03/09/2020	☑
Horn Antenna (1-18GHz)	3115	10SL0059	01/26/2018	2 Year	01/26/2020	☑
RF Pre-Amplifier (9kHz - 6.5GHz)	LPA-6-30	11170601	07/23/2018	1 Year	07/23/2019	☑
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	05/16/2018	1 Year	05/16/2019	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	MY50210206	01/18/2018	2 Year	01/18/2020	☑
MXG Signal Generator	N5182A	MY47071065	08/10/2018	1 Year	08/10/2019	☑

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		**Radio**: A1. Terminal equipment for purpose of calling **Telecom**: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI **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
		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
		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
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		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
		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
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