

RF TEST REPORT



Report No.: FCC_RF_SL18122103-SEV-104_RF Module _Rev 1.0
Supersede Report No.:

Applicant	:	JETCO Torque Tools LLC
Product Name	:	JETCO 915 RF Module
Model No.	:	JTR-01-R
Test Standard	:	47 CFR 15.247
Test Method	:	ANSI C63.10: 2013 558074 D01 15.247 Meas Guidance v05r01r01
FCC ID	:	2ASF5-JTR01
Dates of test	:	02/02/2019 – 02/13/2019
Issue Date	:	02/14/2019
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification ☒		
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



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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/RRR, 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_RF_SL18122103-SEV-104_RF Module	None	Original	02/14/2019
FCC_RF_SL18122103-SEV-104_RF Module _Rev 1.0	1.0	Update Model Name	03/08/2019

2 Executive Summary

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

Company: JETCO Torque Tools LLC
Product: JETCO 915 RF Module
Model: JTR-01-R

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	:	JETCO Torque Tools LLC
Applicant Address	:	835 Meridian St. Duarte, CA 91010
Manufacturer Name	:	JETCO Torque Tools LLC
Manufacturer Address	:	835 Meridian St. Duarte, CA 91010

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-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	JETCO 915 RF Module
Model No.	JTR-01-R
Trade Name	JETCO
Serial No.	N/A
Input Power	3-5VDC (USB)
Product Hardware version	RF_Module_v06 181210
Product Software version	v06:190131000
Radio Hardware version	N/A
Radio Software version	N/A
Date of EUT received	02/01/2019
Equipment Class/ Category	DTS
Port/Connectors	USB-Serial connector

6.2 Radio Description

Spec for Radio:

Radio Type	
Operating Frequency	915 MHz
Modulation	GFSK
Number of Channels	1
Antenna Type	Internal helical coil
Antenna Gain	-8.9 dBi
Antenna Connector Type	Soldered on PCB

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	LATITUDE 3550	F1WPF12	Dell	-
2	Adaptor	FA65NE1-00	TN800	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-Serial	EUT	Serial	Laptop	USB	10	Shielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	VESI RF Module Test	Set the EUT to transmit continuously in diferent test modes and channels

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Antenna Requirement	FCC	15.203	ANSI C63.10 - 2013 558074 D01 15.247 Meas. Guidance v05r01	☒ Pass ☐ N/A
AC Conducted Emissions Voltage	FCC	15.207	ANSI C63.10 - 2013	☒ Pass ☐ N/A

DTS Band Requirement

Test Item	Test standard		Test Method/Procedure	Pass / Fail
6dB Bandwidth	FCC	15.247(a)(2)	FCC 558074 D01 15.247 Meas Guidance v05r01r01	☒ Pass ☐ N/A
Band Edge and Radiated Spurious Emissions	FCC	15.247(d)	FCC ANSI C63.10:2013 558074 D01 15.247 Meas Guidance v05r01r01	☒ Pass ☐ N/A
Output Power	FCC	15.247(b)	FCC 558074 D01 15.247 Meas Guidance v05r01r01	☒ Pass ☐ N/A
Antenna Gain > 6 dBi	FCC	15.247(e)	FCC -	☐ Pass ☒ N/A
Power Spectral Density	FCC	15.247(e)	FCC 558074 D01 15.247 Meas Guidance v05r01r01	☒ Pass ☐ N/A
RF Exposure requirement	FCC	15.247(i)	FCC -	☒ Pass ☐ N/A
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

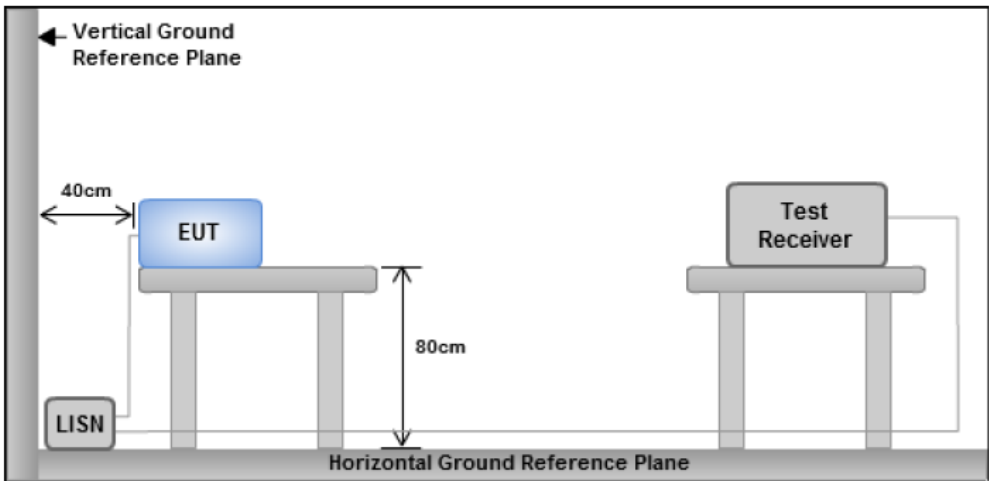
10.1 Antenna Requirement

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	
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	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 μ H/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	

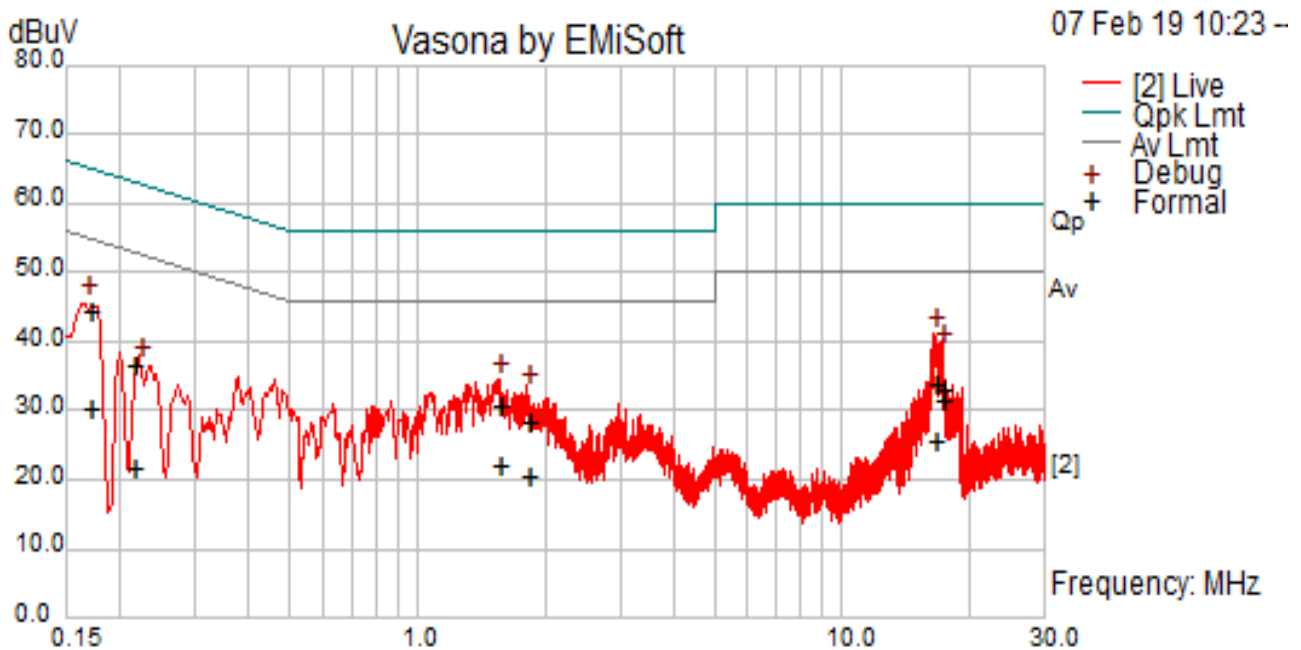
Test Data ☒ Yes ☐ N/A

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:	02/07/2019			
Remarks	Conducted @ Live			

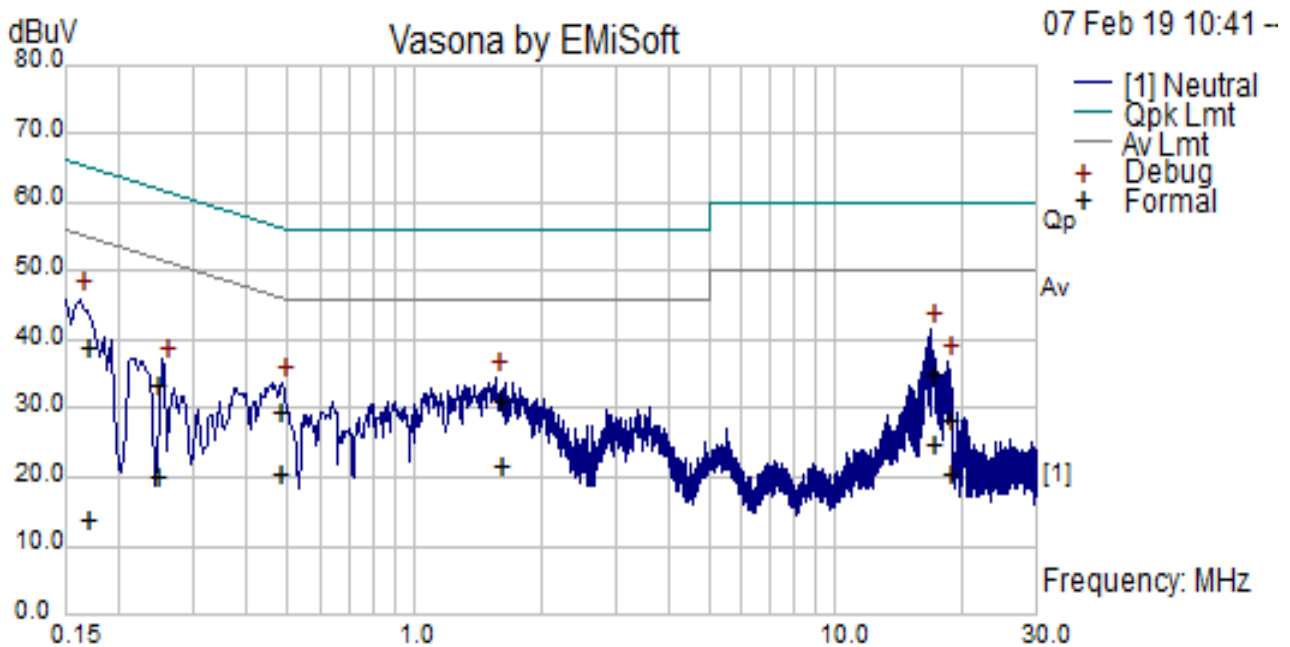


Live Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
16.46	24.38	8.96	0.38	33.72	Quasi Peak	Live	60	-26.28	Pass
0.17	36.90	7.14	0.04	44.08	Quasi Peak	Live	65	-20.92	Pass
17.00	23.45	8.97	0.39	32.81	Quasi Peak	Live	60	-27.19	Pass
1.55	22.74	7.81	0.05	30.6	Quasi Peak	Live	56	-25.40	Pass
1.81	20.15	7.85	0.06	28.06	Quasi Peak	Live	56	-27.94	Pass
0.21	28.97	7.18	0.04	36.19	Quasi Peak	Live	63.09	-26.91	Pass
16.46	16.24	8.96	0.38	25.58	Average	Live	50	-24.42	Pass
0.17	23.12	7.14	0.04	30.29	Average	Live	55	-24.70	Pass
17.00	21.75	8.97	0.39	31.11	Average	Live	50	-18.89	Pass
1.55	13.96	7.81	0.05	21.82	Average	Live	46	-24.18	Pass
1.81	12.35	7.85	0.06	20.26	Average	Live	46	-25.74	Pass
0.21	14.24	7.18	0.04	21.46	Average	Live	53.09	-31.63	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:	02/07/2019			
Remarks	Conducted @ Neutral			

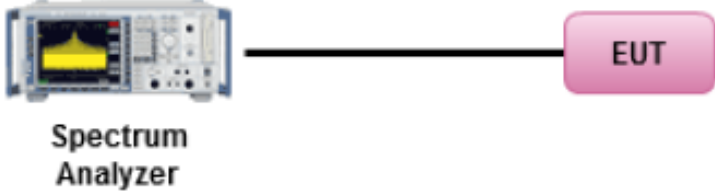


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
16.78	25.25	8.97	0.38	34.60	Quasi Peak	Neutral	60	-25.40	Pass
0.17	31.44	7.13	0.04	38.61	Quasi Peak	Neutral	65.20	-26.59	Pass
1.58	23.13	7.82	0.05	30.99	Quasi Peak	Neutral	56	-25.01	Pass
0.48	22.05	7.34	0.03	29.41	Quasi Peak	Neutral	56.41	-26.99	Pass
18.47	18.71	8.96	0.41	28.08	Quasi Peak	Neutral	60	-31.92	Pass
0.24	26.06	7.21	0.03	33.30	Quasi Peak	Neutral	62	-28.70	Pass
16.78	15.29	8.97	0.38	24.65	Average	Neutral	50	-25.35	Pass
0.17	6.50	7.13	0.04	13.68	Average	Neutral	55.20	-41.52	Pass
1.58	13.49	7.82	0.05	21.36	Average	Neutral	46	-24.64	Pass
0.48	13.13	7.34	0.03	20.50	Average	Neutral	46.41	-25.90	Pass
18.47	11.12	8.96	0.41	20.48	Average	Neutral	50	-29.52	Pass
0.24	12.57	7.21	0.03	19.80	Average	Neutral	52	-32.20	Pass

10.3 6dB & 99% Bandwidth

Requirement(s):

Spec	Requirement	Applicable									
§ 15.247	6dB BW≥500KHz	☒									
Test Setup											
Test Procedure	558074 D01 15.247 Meas Guidance v05r01, 8.1 DTS bandwidth <u>6dB Emission bandwidth measurement procedure</u> - Set RBW = 100 kHz. - Set the video bandwidth (VBW) $\geq 3 \times$ 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	02/02/2019	<table border="1"> <tr> <td>Environmental condition</td> <td>Temperature</td> <td>23°C</td> </tr> <tr> <td></td> <td>Relative Humidity</td> <td>42%</td> </tr> <tr> <td></td> <td>Atmospheric Pressure</td> <td>1021mbar</td> </tr> </table>	Environmental condition	Temperature	23°C		Relative Humidity	42%		Atmospheric Pressure	1021mbar
Environmental condition	Temperature	23°C									
	Relative Humidity	42%									
	Atmospheric Pressure	1021mbar									
Remark	N/A										
Result	☒ Pass ☐ Fail										

Test Data ☒ Yes ☐ N/A

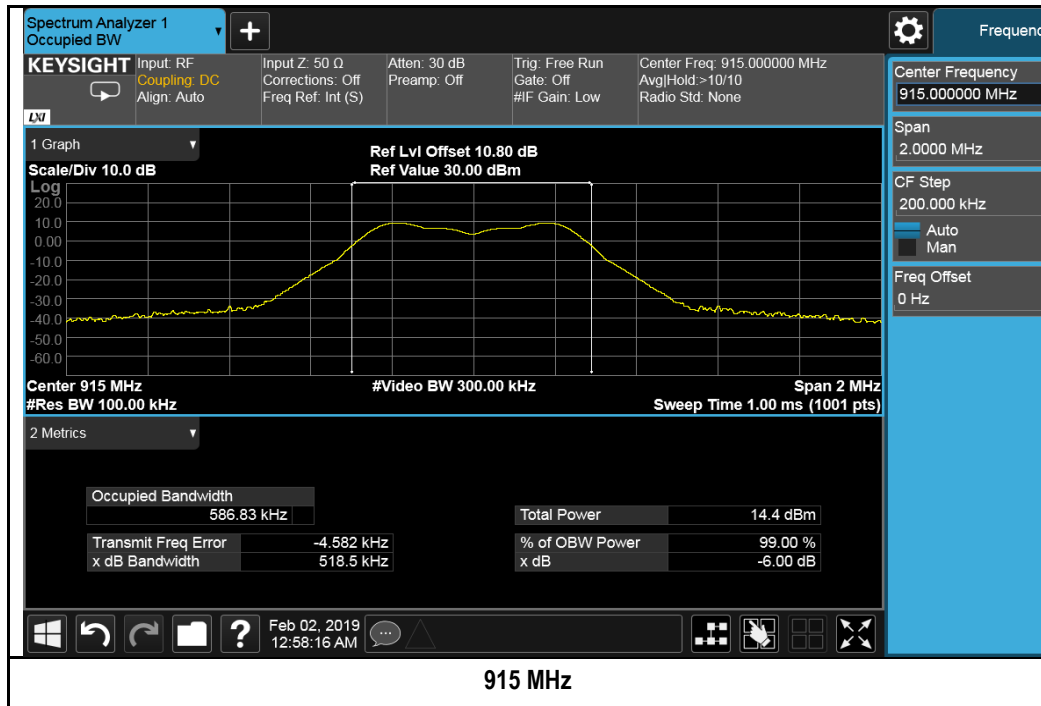
Test Plot ☒ Yes ☐ N/A

Test was done by Rachana Khanduri at RF test site.

Test Data:

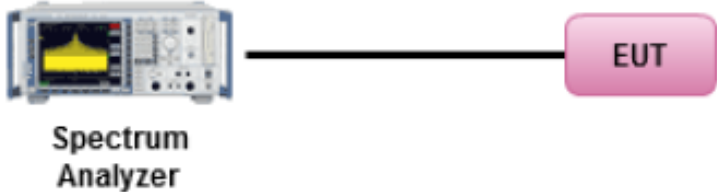
Channel Frequency (MHz)	OBW	
	99% (KHz)	6dB(KHz)
915	586.83	518.5

6dB & 99% Bandwidth Test Plots



10.4 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247	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	 Spectrum Analyzer		
Test Procedure	558074 D01 15.247 Meas Guidance v05r01 , 9.1.1 <u>Measurement using a Spectrum Analyzer (SA)</u> 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 $\geq$ DTS bandwidth. (b) Set VBW $\geq$ 3 $\times$ RBW. (c) Set span $\geq$ 3 $\times$ 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	02/02/2019	Environmental condition	Temperature 23°C Relative Humidity 44% Atmospheric Pressure 1021mbar
Remark	NONE		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

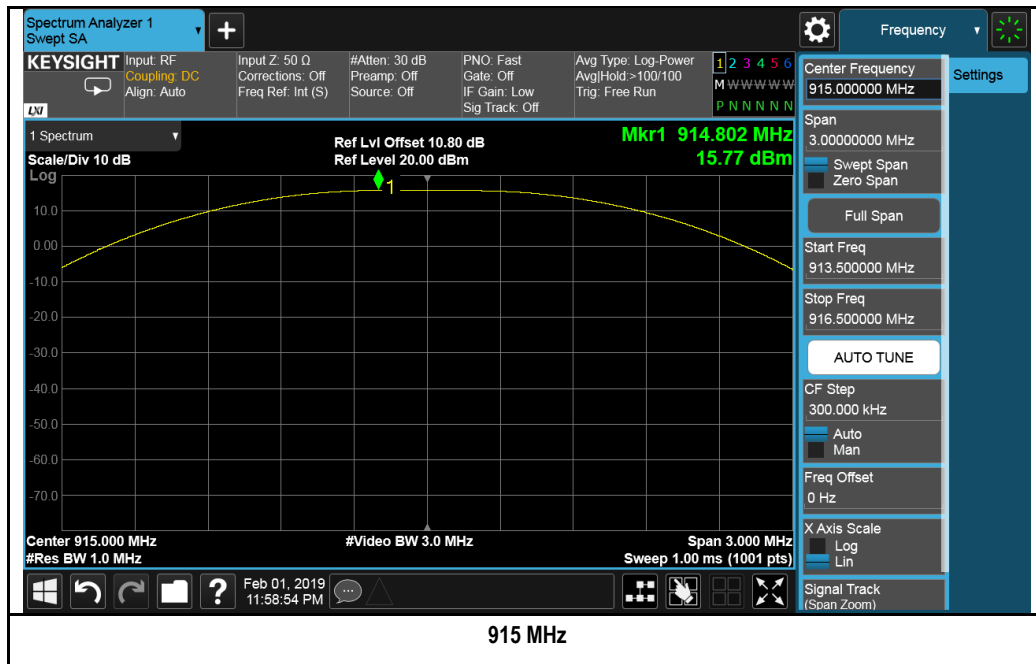
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Rachana Khanduri at RF test site.

Output Power measurement results:

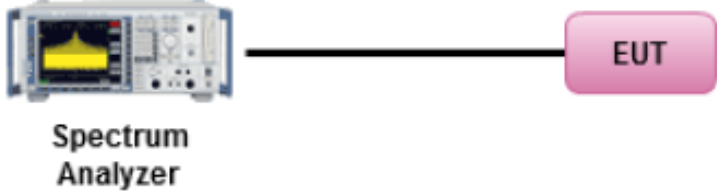
Type	Freq (MHz)	Conducted Power (dBm)	Limit (dBm)	Result
Output power	915	15.77	≤30	Pass

Test Plots:



10.5 Band Edge and Conducted Spurious emissions

Requirement(s):

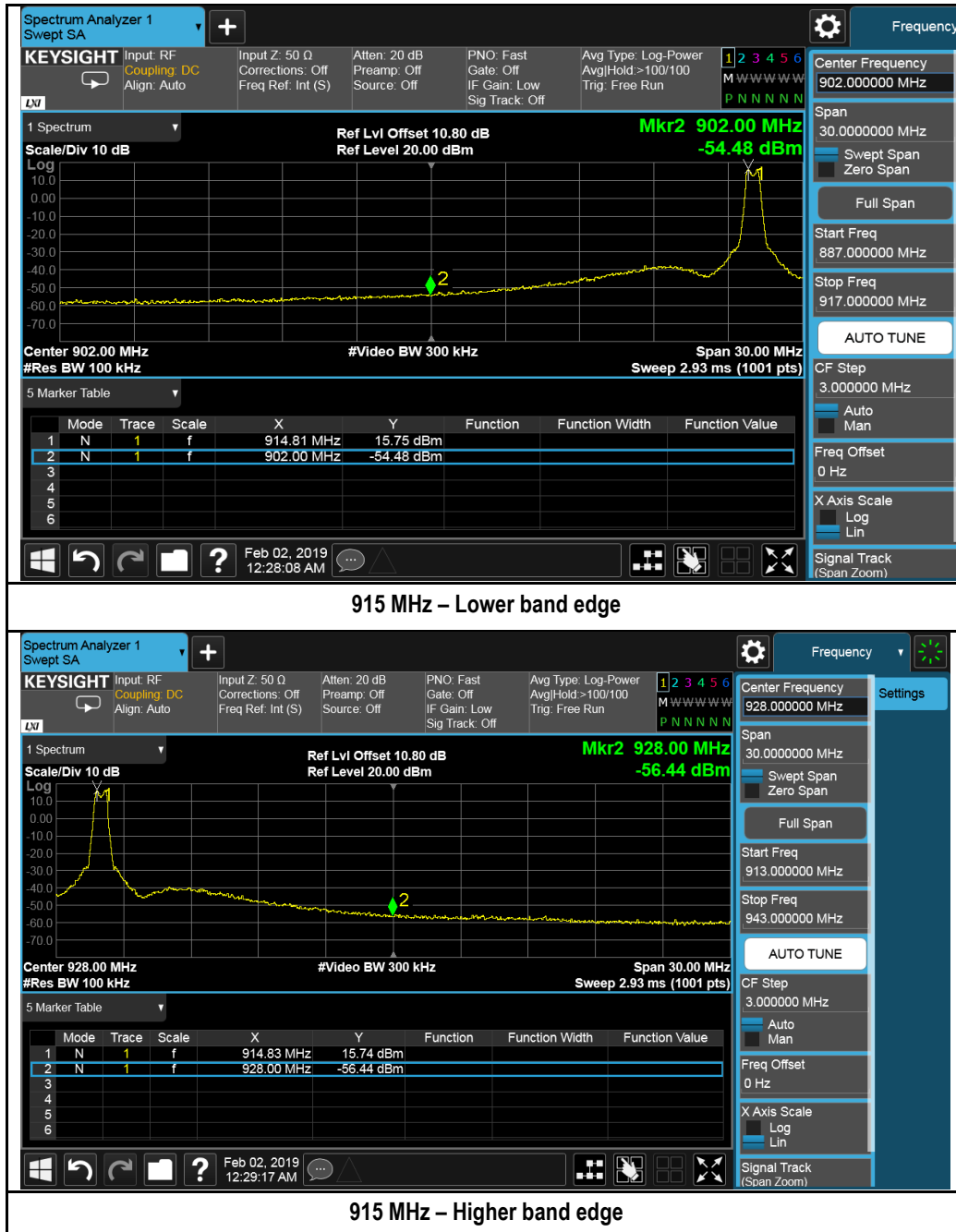
Spec	Item	Requirement	Applicable
§ 15.247	d)	For non-restricted band, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 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 15.247 Meas Guidance v05r01 <u>Band Edge measurement procedure</u> 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 attenuation shall 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	02/02/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	-		
Result	☒ Pass ☐ Fail		

Test Data ☐ Yes ☒ N/A

Test Plot ☒ Yes (See below) ☐ N/A

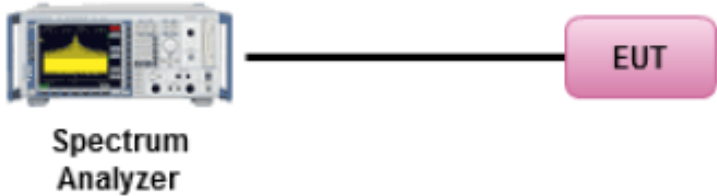
Test was done by Rachana Khanduri at RF test site.

Test Plots:



10.6 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.247(e)	e)	DSSS: $\leq 8\text{dBm}/3\text{KHz}$	☒
	f)	DSSS in hybrid sys with FH turned off: $\leq 8\text{dBm}/3\text{KHz}$	☐
Test Setup			
Test Procedure	558074 D01 15.247 Meas Guidance v05r01, 10.2 Method PKPSD (peak PSD) <u>Peak spectral density measurement procedure</u> - Set analyzer center frequency to DTS channel center frequency. - Set the span to 1.5 times the DTS bandwidth. - Set the RBW to: $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$. - Set the VBW $\geq 3 \times \text{RBW}$. - 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	02/02/2019	Environmental condition	Temperature 22°C Relative Humidity 46% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

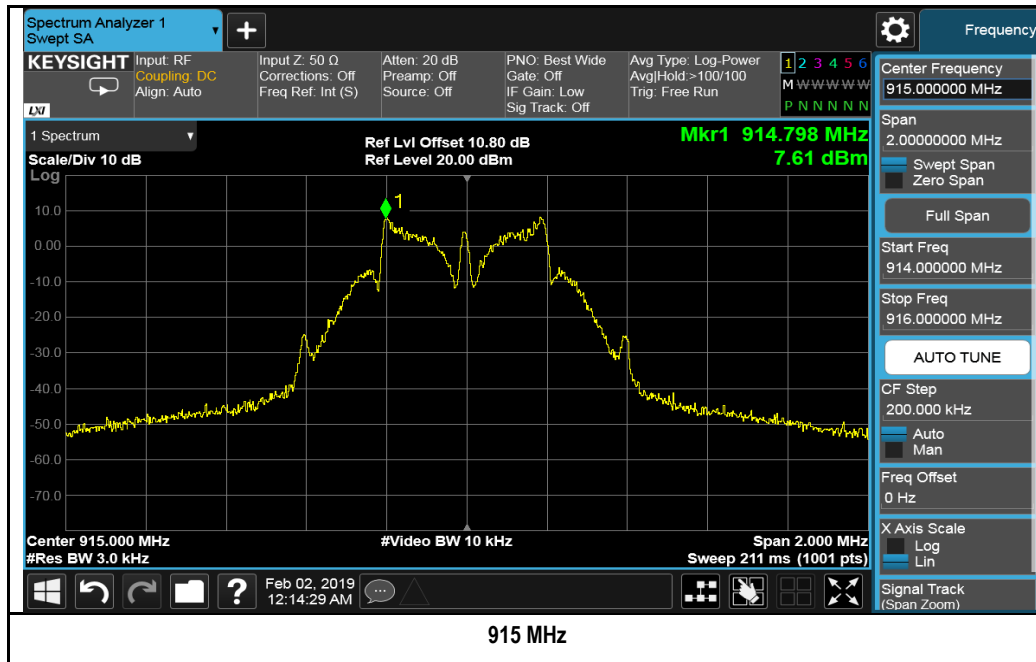
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Rachana Khanduri at RF test site.

PSD measurement results :

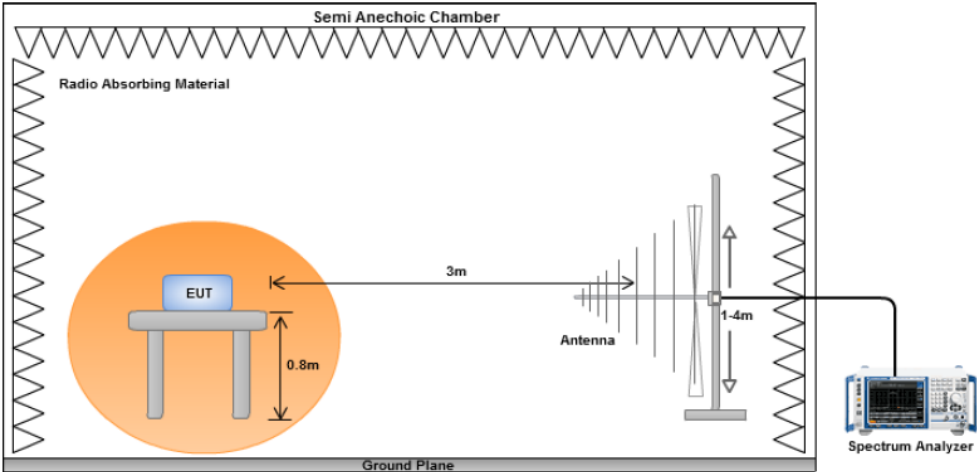
Type	Freq (MHz)	CH	Conducted PSD (dBm/3KHz)	Limit (dBm/3KHz)	Result
PSD	915	Low	7.61	8	Pass

Test Plot:



10.7 Radiated Spurious Emissions below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable										
47CFR§15.247(d)	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 <table><tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr><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></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	1. 2. 3. 4. 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: a. b. c. 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	The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.												
Result	☒ Pass ☐ Fail												

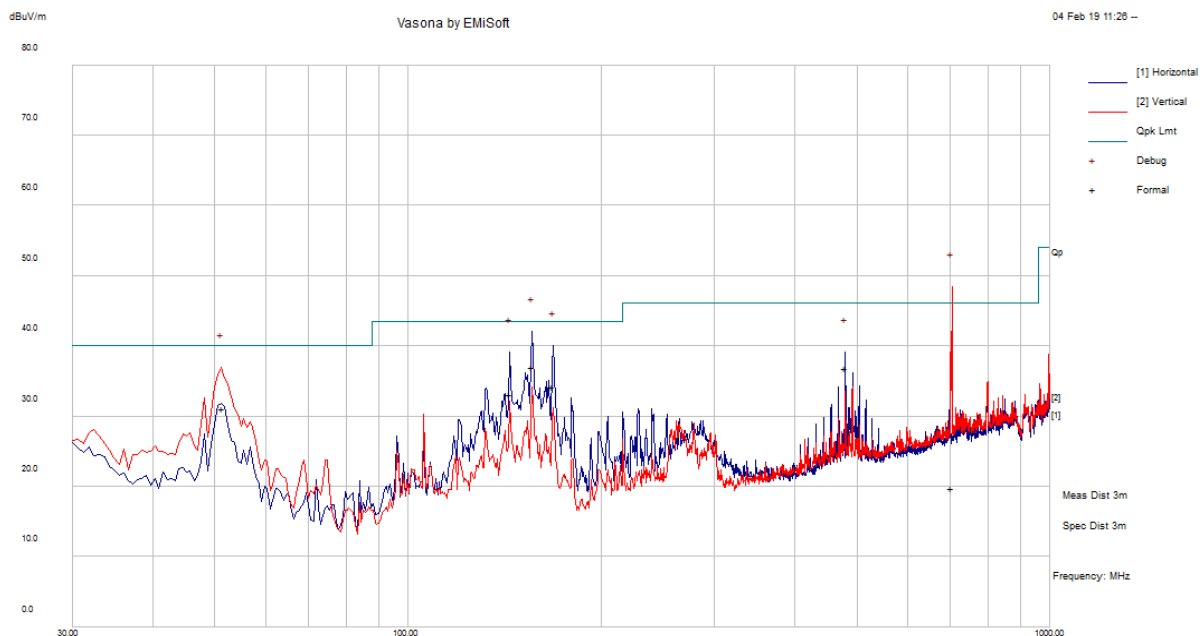
Test Data ☒ Yes (See below) ☐ N/A

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:	02/13/2019			
Remarks:	915 MHz			

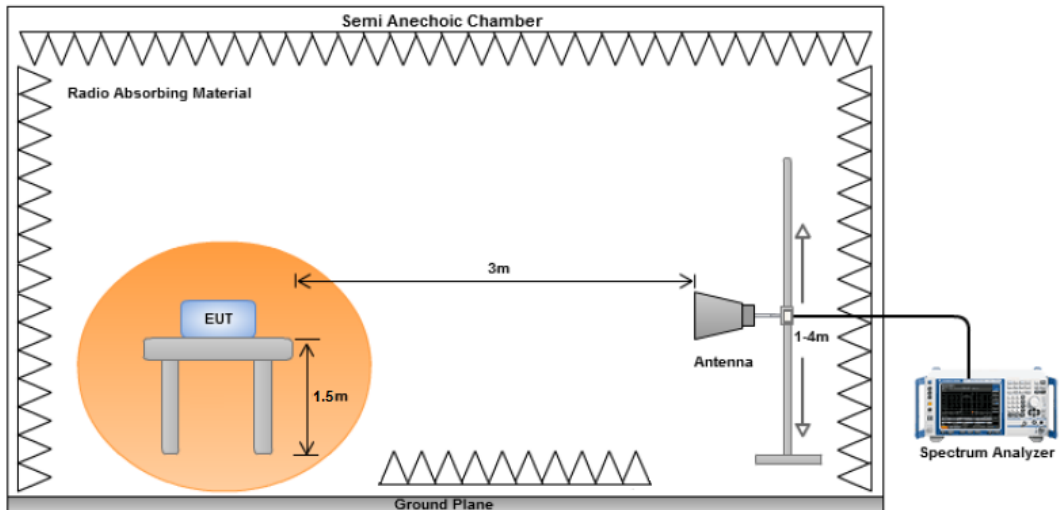


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
156.10	48.16	12.23	-23.30	37.09	Quasi Max	H	207	316	43.5	-6.41	Pass
168.07	45.57	12.34	-23.68	34.23	Quasi Max	H	142	164	43.5	-9.27	Pass
479.99	41.11	14.22	-18.49	36.85	Quasi Max	H	174	258	46.0	-9.16	Pass
143.91	44.38	12.20	-23.39	33.19	Quasi Max	H	167	319	43.5	-10.31	Pass
51.46	46.35	11.45	-26.66	31.15	Quasi Max	V	107	298	40.0	-8.86	Pass
703.38	19.89	15.16	-15.27	19.77	Quasi Max	V	241	335	46.0	-26.23	Pass

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

10.8 Radiated Spurious Emissions between 1GHz – 25GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§15.247(d),	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	- 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: - 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. - An average 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	-		
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)

Above 1GHz- 915 MHz

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
2744.25	43.87	3.15	-2.66	44.36	Peak Max	V	119	78	74	-29.64	Pass
3658.92	41.98	3.57	-1.32	44.24	Peak Max	V	100	213	74	-29.77	Pass
4576.08	40.57	4.18	-1.05	43.71	Peak Max	H	149	201	74	-30.29	Pass
5488.31	40.75	4.45	-1.00	44.2	Peak Max	H	119	356	74	-29.8	Pass
6405.99	39.99	4.77	-0.25	44.5	Peak Max	H	183	209	74	-29.5	Pass
7319.35	40.01	5.15	-0.49	44.67	Peak Max	V	100	8	74	-29.33	Pass
8235.98	40.41	5.35	-0.74	45.02	Peak Max	V	100	355	74	-28.98	Pass
9149.95	40.25	5.72	0.11	46.09	Peak Max	H	184	113	74	-27.91	Pass
10063.04	39.76	5.93	1.36	47.05	Peak Max	V	114	162	74	-26.95	Pass
1829.55	56.51	2.63	-3.33	55.81	Peak Max	V	100	61	74	-18.19	Pass
2744.25	32.76	3.15	-2.66	33.25	Average Max	V	119	78	54	-20.75	Pass
3658.92	29.57	3.57	-1.32	31.83	Average Max	V	100	213	54	-22.17	Pass
4576.08	27.81	4.18	-1.05	30.94	Average Max	V	100	110	54	-23.06	Pass
5488.31	28.10	4.45	-1.00	31.55	Average Max	V	100	62	54	-22.45	Pass
6405.99	27.84	4.77	-0.25	32.35	Average Max	V	100	40	54	-21.65	Pass
7319.35	27.88	5.15	-0.49	32.55	Average Max	V	100	8	54	-21.46	Pass
8235.98	27.89	5.35	-0.74	32.5	Average Max	V	100	355	54	-21.5	Pass
9149.95	27.82	5.72	0.11	33.66	Average Max	V	100	48	54	-20.35	Pass
10063.04	28.04	5.93	1.36	35.33	Average Max	H	106	62	54	-18.67	Pass
1829.55	50.22	2.63	-3.33	49.52	Average Max	V	100	61	54	-4.49	Pass

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

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