RF TEST REPORT

Report No.: FCC_IC_SL18061801-OMP-004
Supersede Report No.:

Applicant	:	OmniPreSense
Product Name	:	Short Range Radar Sensor
Model No.		OPS 242-A
Test Standard	:	47 CFR 15.245 RSS-210 issue 9
Test Method	:	ANSI C63.10:2013
FCC ID	:	2ALLL242A
IC ID	:	24107-8600250004
Dates of test	:	07/03/2018 – 07/06/2018
Issue Date	:	07/26/2018
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:	
	
Benjamin Jing	Chen Ge
Test Engineer	Engineer Reviewer

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

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 & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

CONTENTS

1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_IC_SL180061801-OMP-004	None	Original	07/26/2018

2 Executive Summary

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

Company: OmniPreSense
Product: Short Range Radar Sensor
Model: OPS 242-A

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	OmniPreSense
Applicant Address	1650 Zanker Road, Suite 222
Manufacturer Name	OmniPreSense
Manufacturer Address	1650 Zanker Road, Suite 222

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	Short Range Radar Sensor
Model No.	OPS 242-A
Trade Name	OmniPreSense
Serial No.	N/A
Input Power	5 Vdc
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	A
Software version	V1.2.0
Date of EUT received	06/21/2018
Equipment Class/ Category	B
Port/Connectors	Micro USB
Remark	

6.2 Spec for Radio

Radio Type	Radar Sener
Operating Frequency	24089 - 24161 MHz
Modulation	Continuous Wave
Channel Spacing	N/A
Antenna Type	Patch
Antenna Gain	7 dBi
Antenna Connector Type	PCB Trace

Type	Channel No.	Frequency (MHz)	Power Setting
Radar	0	24089	P0
	1	24107	P0
	2	24125	P0
	3	24143	P0
	4	24161	P0

6.3 EUT test modes/configuration Description

Mode	Note

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	Aspire 3	N/A	Acerl	-

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 Cable	Micro USB	EUT	USB	Laptop	0.3 m	no	Unshielded

7.3 Test Software Description

Test Item	Software	Description
RF Test	Tera Term	Issue commands to the EUT for power seting, etc.

8 Test Summary

Requirement

Test Item	Test standard		Test Method/Procedure		Pass / Fail
Fundamental Field Strength	FCC	15.245(b)	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A
	IC	RSS Gen	IC		
Emission Bandwidth	FCC	15.215	FCC	ANSI C63.10:2013	☒ Pass ☐N/A
	IC	RSS Gen	IC		
Harmonic Field Strength	FCC	15.245(b)(1)	FCC	ANSI C63.10:2013	☒ Pass ☐N/A
	IC	RSS Gen	IC		
Emissions Radiated Outside of the Band	FCC	15.245(b)(3)	FCC	ANSI C63.10:2013	☒ Pass ☐ N/A
	IC	RSS Gen	IC		
Frequency Stability	FCC	-	FCC	RSS Gen Issue 5	☒ Pass ☐ N/A
	IC	RSS Gen	IC		
Antenna Requirement	FCC	15.203		-	☒ Pass ☐ N/A
RF Exposure requirement	IC	2.1091 ; 2.1093	FCC	-	☒ Pass ☐ N/A
	IC	-	IC		
Remark	All measurement uncertainties do not take into consideration for all presented test results.				

9 Measurement Uncertainty

9.1 Conducted Emissions

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

Some error sources that can contribute to the total uncertainty:

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

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

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

9.2 Radiated Emissions (30MHz to 1GHz)

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

Some error sources that can contribute to the total uncertainty:

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

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

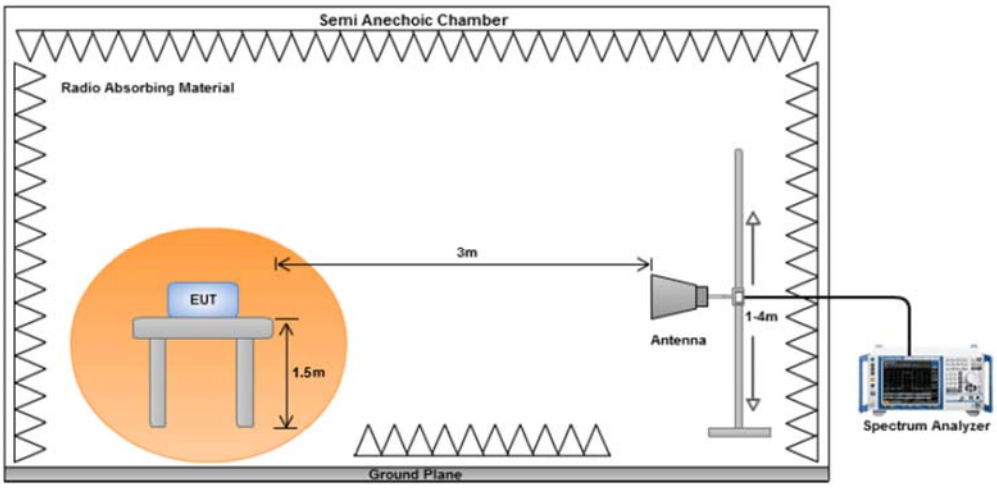
Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					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 Fundamental Field Strength

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR §15.245(b), Rss Gen	a)	Field strength of fundamental emission in 24075 - 24175 MHz , < 2500 mV /m (128 dBuV /m) at 3 meter distance.	☒
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.		
Test Date	07/06/2018		
Environmental Condition	Temperature 23 °C Relative Humidity 41 % Atmospheric Pressure 1017 mbar		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below)) ☒ N/A

Test was done by Benjamin Jing at 10m chamber.

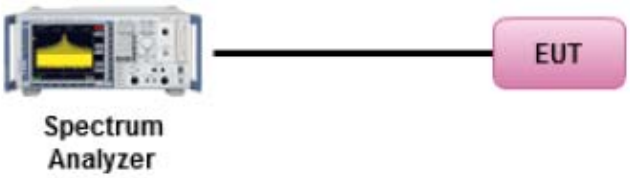
Measurement Result :

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
24089.3	91.85	9.62	2.91	104.38	Peak Max	V	266	352	128	-23.62	Pass
24125.3	91.89	9.62	2.91	104.42	Peak Max	V	266	352	128	-23.58	Pass
24161.3	91.81	9.62	2.91	104.34	Peak Max	V	266	352	128	-23.66	Pass

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

10.2 EMISSION BANDWIDTH

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR §15.215 Rss 210	a)	According to FCC §15.215(c), Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.	☒
Test Setup			
Procedure	Span = approximately 2 to 5 times the 99% occupied bandwidth, centered on a hopping channel RBW = 1% to 5 % of the 99% occupied bandwidth VBW = 3RBW Sweep = auto Detector function = peak Trace = max hold 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator. 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value. 3. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the minimum emission or emission bandwidth. 4. Repeat above procedures until all frequencies measured were complete.		
Test Date	07/26/2018		
Environmental Condition	Temperature 23 °C ; Relative Humidity 41 % ; Atmospheric Pressure 1017 mbar ;		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Benjamin Jing at RF Test Tite.

Emission Bandwidth Measurement Result

24089 MHz

Type	Result (MHz)	Limit (MHz)	Result
-20 dB BW	0.824	-	Pass
99% OBW	0.794	-	Pass

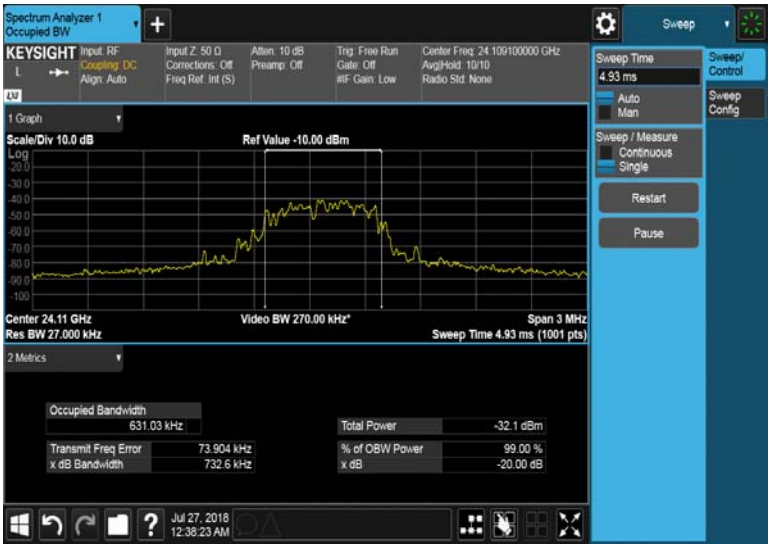
24125 MHz

Type	Result (MHz)	Limit (MHz)	Result
-20 dB BW	0.733	-	Pass
99% OBW	0.631	-	Pass

24161 MHz

Type	Result (MHz)	Limit (MHz)	Result
-20 dB BW	0.763	-	Pass
99% OBW	0.739	-	Pass

Measurement 99% OBW -20 dB Result Plot



24089 MHz

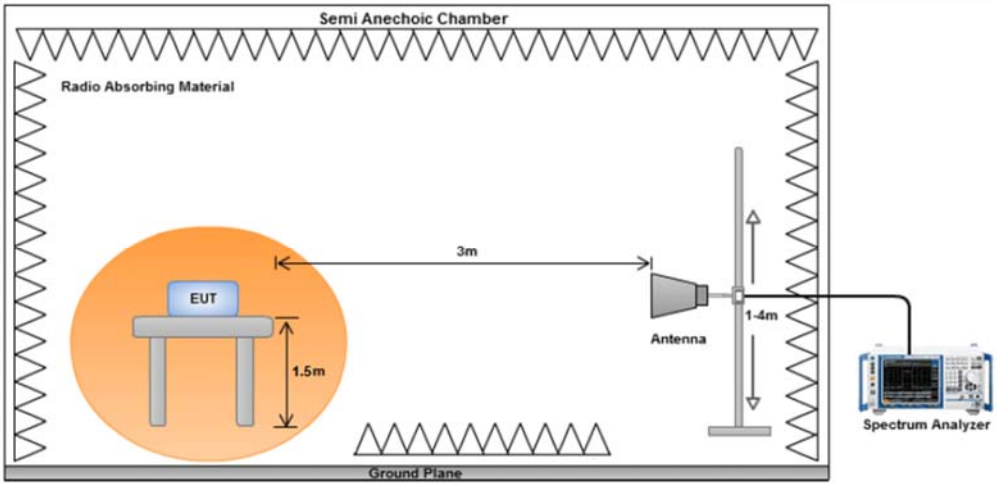
24125 MHz


Spectrum Analyzer 1
Occupied BW
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
Atten: 0 dB
Preamp: Off
Trig: Free Run
Gate: Off
#IF Gain: Low
Center Freq: 24.089282328 GHz
Avg|Hold:>10/10
Radio Std: None
Meas Setup
Avg|Hold Number
10
Settings
Averaging
On
Off
Limits
Meas Standard
Average Mode
Exponential
Advanced
% of OBW Power
99.00 %
Global
Power Ref
Total Power
x dB
-20.00 dB
IF Gain
Low Gain
Auto
Man
Meas Setup Summary Table
Auto Couple
Meas Preset
1 Graph
Scale/Div 10.0 dB
Ref Value -10.00 dBm
Log
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100
Center 24.089GHz
Res BW 27.000 kHz
Video BW 270.00 kHz*
Span 3 MHz
Sweep Time 4.93 ms (1001 pts)
2 Metrics
Occupied Bandwidth
739.36 kHz
Total Power
-45.7 dBm
Transmit Freq Error
-73.904 kHz
% of OBW Power
99.00 %
x dB Bandwidth
762.7 kHz
x dB
-20.00 dB
Aug 17, 2018
4:48:56 AM

24161 MHz

10.3 Harmonic Field Strength

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR §15.245(b)(1), Rss Gen	a)	Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits: (i) For the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m. (ii) For all other field disturbance sensors, 7.5 mV/m. (iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully comply with the limits given 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.		
Test Date	07/06/2018		
Environmental Condition	Temperature 23 °C ; Relative Humidity 41 % ; Atmospheric Pressure 1017 mbar ;		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Benjamin Jing at 10m chamber.

Measurement Result (40 – 60 GHz)

Transmit 24089 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
48260	22.92	0.6	3.84	27.36	Peak Max	V	266	352	77.5	-50.14	Pass

Transmit 24125 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
48250	22.92	0.6	3.84	27.36	Peak Max	V	266	352	77.5	-50.14	Pass

Transmit 24161 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
48322	22.92	0.6	3.84	27.36	Peak Max	V	266	352	77.5	-50.14	Pass

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

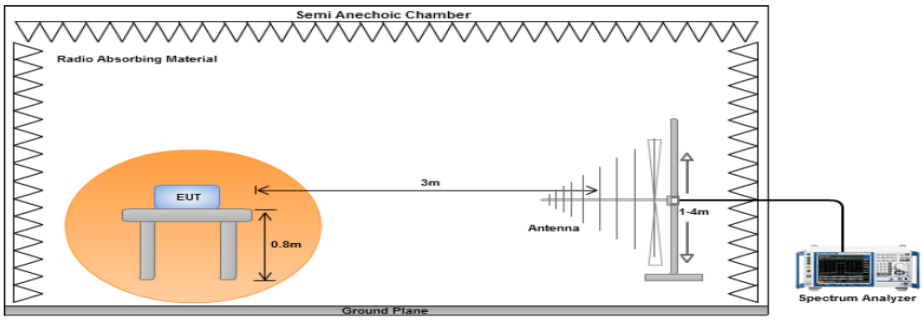
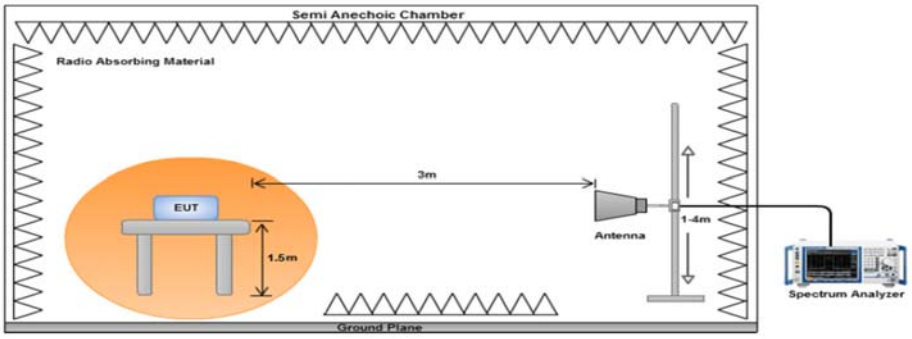
Measurement Result (60 – 100 GHz)

The 3rd harmonic level is more than 20dB below the limit.

10.4 Emission Radiated Outside of the Band

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR §15.245(b)(3), Rss Gen	a)	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation	☒

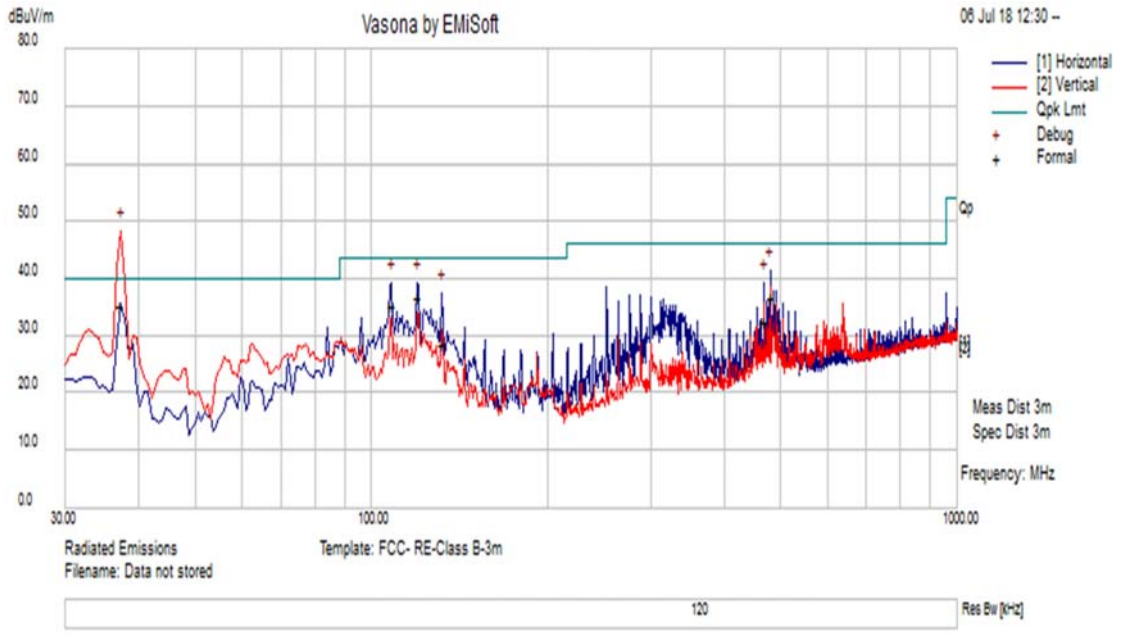
Test Setup (0.03 – 1 GHz)	30 MHz - 1 GHz 
Test Setup (1 -- 100 GHz)	1 GHz – 100 GHz 
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the 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.
Test Date	07/06/2018
Environmental Condition	Temperature 23 °C ; Relative Humidity 41 % ; Atmospheric Pressure 1017 mbar ;
Result	☒ Pass ☐ Fail

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Benjamin Jing at 10m chamber.

30 MHz - 1 GHz



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
37.18	43.17	11.25	-19.12	35.3	Quasi Max	V	108	329	40	-4.70	Pass
107.98	47.42	11.94	-24.03	35.33	Quasi Max	H	317	266	43.5	-8.17	Pass
119.93	47.56	12.07	-22.87	36.75	Quasi Max	H	257	248	43.5	-6.75	Pass
480.02	41.44	14.22	-18.7	36.96	Quasi Max	H	190	18	46	-9.04	Pass
132.01	39.54	12.18	-23.08	28.63	Quasi Max	H	213	75	43.5	-14.87	Pass
468.08	37.6	14.16	-19.03	32.73	Quasi Max	H	232	27	46	-13.27	Pass

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

1 – 18 GHz

Transmit 24089 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
4089.93	37.59	8.73	15.35	61.67	Peak Max	V	155	252	74	-12.33	Pass
6225.77	36.62	10.76	14.05	61.43	Peak Max	V	204	228	74	-12.57	Pass
4089.93	25.9	8.73	15.35	49.98	Average Max	V	155	252	54	-4.02	Pass
6225.77	24.5	10.76	14.05	49.31	Average Max	V	204	228	54	-4.69	Pass

Transmit 24125 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
4089.35	37.33	8.73	15.35	61.41	Peak Max	V	155	252	74	-12.59	Pass
6225.43	36.27	10.76	14.05	61.08	Peak Max	V	204	228	74	-12.92	Pass
4089.35	25.48	8.73	15.35	49.56	Average Max	V	155	252	54	-4.44	Pass
6225.43	24.52	10.76	14.05	49.33	Average Max	V	204	228	54	-4.67	Pass

Transmit 24161 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
4089.18	37.43	8.73	15.35	61.51	Peak Max	V	155	252	74	-12.49	Pass
6225.39	36.18	10.76	14.05	60.99	Peak Max	V	204	228	74	-13.01	Pass
4089.18	25.45	8.73	15.35	49.53	Average Max	V	155	252	54	-4.47	Pass
6225.39	24.39	10.76	14.05	49.2	Average Max	V	204	228	54	-4.8	Pass

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

18 – 40 GHz

Transmit 24089 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
38968.2	46.2	13.15	4.45	63.8	Peak Max	H	294	299	74	-10.2	Pass
28205.6	39.58	10.92	7.42	57.92	Peak Max	V	293	309	74	-16.08	Pass
19487.6	40.54	8.47	1.22	50.23	Peak Max	V	170	134	74	-23.77	Pass
38968.2	34.46	13.15	4.45	52.06	Average Max	H	294	299	54	-1.94	Pass
28205.6	27.45	10.92	7.42	45.79	Average Max	V	293	309	54	-8.21	Pass
19487.6	27.48	8.47	1.22	37.17	Average Max	V	170	134	54	-16.83	Pass

Transmit 24125 MHz

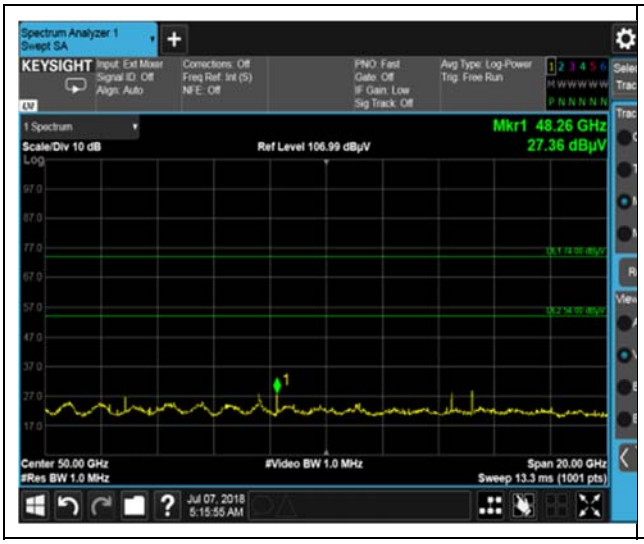
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
38968.5	46.36	13.15	4.45	63.96	Peak Max	H	294	299	74	-10.04	Pass
28205.3	39.12	10.92	7.42	57.46	Peak Max	V	293	309	74	-16.54	Pass
19487.4	40.39	8.47	1.22	50.08	Peak Max	V	170	134	74	-23.92	Pass
38968.5	34.48	13.15	4.45	52.08	Average Max	H	294	299	54	-1.92	Pass
28205.3	27.52	10.92	7.42	45.86	Average Max	V	293	309	54	-8.14	Pass
19487.4	27.17	8.47	1.22	36.86	Average Max	V	170	134	54	-17.14	Pass

Transmit 24161 MHz

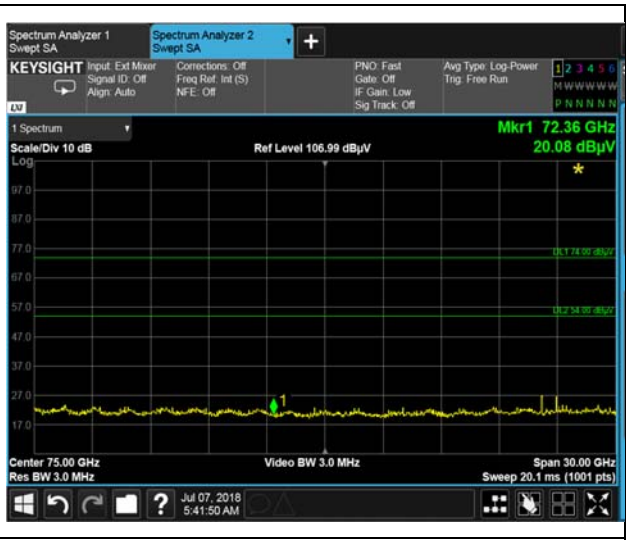
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
38968.8	46.12	13.15	4.45	63.72	Peak Max	H	294	299	74	-10.28	Pass
28205.4	39.56	10.92	7.42	57.9	Peak Max	V	293	309	74	-16.1	Pass
19487.6	40.47	8.47	1.22	50.16	Peak Max	V	170	134	74	-23.84	Pass
38968.8	34.25	13.15	4.45	51.85	Average Max	H	294	299	54	-2.15	Pass
28205.4	27.17	10.92	7.42	45.51	Average Max	V	293	309	54	-8.49	Pass
19487.6	27.39	8.47	1.22	37.08	Average Max	V	170	134	54	-16.92	Pass

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

40 - 100 GHz



40 - 60 GHz

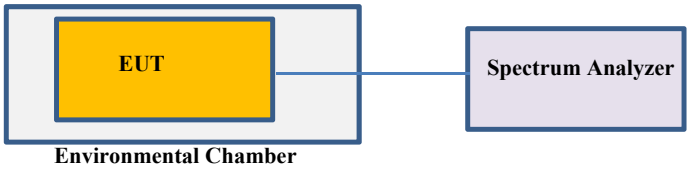


60 - 100 GHz

Note: Both horizontal and vertical polarities were investigated, the levels of outside band emissions are too low to be found .

10.5 Frequency Satbility

Spec	Item	Requirement	Applicable
RSS Gen	1	The frequency stability shall be sufficient to ensure that the 40 dB bandwidth stays within the operating frequency band when tested at the temperature and supply voltage variations specified the frequency stability measurement in RSS-Gen. For licence-exempt devices, the following conditions apply: a) at the temperatures of -20°C (-4°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage b) at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage	☒

Test Setup				
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The bandwidth of the measuring receiver was set to 300Hz. 3. A test horn antenna was used to receive and monitor the EUT transmiting .. 4. The horn antenna output was connected to spectrum analyser. 5. Max hold the trace on spectrum analyser, record the fundamental signal and its 40 dB points.			
Test Date	07/06/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23 °C 41 % 1017 mbar
Remark	NONE			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A

Test was done by Benjamin Jing at RF test site.

Test Result :

Transmit 24089 MHz

Temperature	DC Voltage	Nominal Frequency (MHz)	Measured Frequency (MHz)	Measured 40dB Low Point (MHz)	Measured 40dB High Point (MHz)	Requirement (MHz)	Result
Norm Temp (20 °C)	Normal 5V	24089	24089.34	24088.73	24189.95	Within 24075 I 24175	Pass
	Low 4.25V	24089	24089.34	24088.73	24189.95		
	High 5.75V	24089	24089.34	24088.73	24189.95		
Low Temp (- 20 °C)	Normal 5V	24089	24089.46	24088.85	24090.07		
High Temp (50 °C)	Normal 5V	24089	24089. 28	24088.67	24089.89		

Transmit 24125 MHz

Temperature	DC Voltage	Nominal Frequency (MHz)	Measured Frequency (MHz)	Measured 40dB Low Point (MHz)	Measured 40dB High Point (MHz)	Requirement (MHz)	Result
Norm Temp (20 °C)	Normal 5V	24125	24125. 32	24124.33	24145. 37	Within 24075 I 24175	Pass
	Low 4.25V	24125	24125. 32	24105. 31	24145. 37		
	High 5.75V	24125	24125. 32	24105. 31	24145. 37		
Low Temp (- 20 °C)	Normal 5V	24125	24125. 38	24124.71	24126.05		
High Temp (50 °C)	Normal 5V	24125	24125. 29	24124.62	24125.96		

Transmit 24160 MHz

Temperature	DC Voltage	Nominal Frequency (MHz)	Measured Frequency (MHz)	Measured 40dB Low Point (MHz)	Measured 40dB High Point (MHz)	Requirement (MHz)	Result
Norm Temp (20 °C)	Normal 5V	24161	24160.35	24162.65	24162.05	Within 24075 I 24175	Pass
	Low 4.25V	24161	24160.35	24162.65	24162.05		
	High 5.75V	24161	24160.35	24162.65	24162.05		
Low Temp (- 20 °C)	Normal 5V	24161	24161.43	24160.73	24162.13		
High Temp (50 °C)	Normal 5V	24161	24161.33	24160.63	24162.03		

10.6 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.	☒
Remark	N/A	
Result	☒ Pass ☐ Fail	

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

Antenna Connector Construction

Antenna Type	Patch
Antenna Gain (Peak)	7 dBi
Antenna Connector Type	PCB Trace
Note	The antenna connector is a unique type which meet the requirement.

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
EMI Test Receiver	ESIB 40	100179	04/21/2018	1 Year	04/21/2019	☑
Transient Limiter (9kHz - 100MHz)	EM-7600-5	106	09/07/2017	1 Year	09/07/2018	☑
LISN (9kHz - 30MHz)	3816/2NM	214372	09/27/2017	1 Year	09/27/2018	☑
Radiated Emissions						
Keysight EXA 44GHz Spectrum Analyzer	N9010A	MY51440112	11/02/2017	1 Year	11/02/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	01/13/2018	1 Year	01/13/2019	☑
Horn Antenna (1GHz~26GHz)	3115	100059	08/11/2017	1 Year	08/11/2018	☑
Pre-Amplifier (1-40GHz)	SAS-474	579	05/04/2018	1 Year	05/04/2019	☑
Preamplifier (100KHz-7GHz)	LPA-6-30	11140711	02/09/2018	1 Year	02/09/2019	☑
3 Meters SAC	3M	N/A	09/09/2017	1 Year	09/09/2018	☐
10 Meters SAC	10M	N/A	10/06/2017	1 Year	10/06/2018	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	10SL0219	11/16/2017	1 Year	11/16/2018	☑

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