EN 300 440 Test Report

Report No.:	CE_RF_SL21121303-OMP-002
Test Model:	OPS243-A
Received Date:	01/20/2022
Test Date:	01/27/2022 to 02/27/2022
Issued Date:	03/29/2022
Applicant:	OmniPreSense
Address:	1650 Zanker Road, Suite 222, San Jose, CA 95112
Manufacturer:	OmniPreSense
Address:	1650 Zanker Road, Suite 222, San Jose, CA 95112
Issued By:	Bureau Veritas Consumer Products Services, Inc.
Lab Address:	775 Montague Expressway, Milpitas, CA 95035
Test Location (1):	775 Montague Expressway, Milpitas, CA 95035
FCC Registration / Designation Number:	540430
ISED# / CAB identifier:	4842D

ACCREDITED
TESTING CERT # 2742-01

Table of Contents

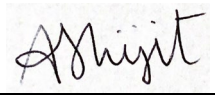
Release Control Record

Issue No.	Description	Date Issued
CE_RF_SL21121303-OMP-002	Original Release	03/07/2022

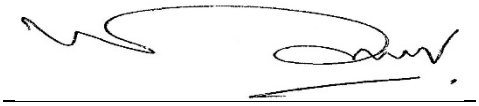
1 Certificate of Conformity

Product:	Short Range Radar Sensor
Brand:	OmniPreSense
Test Model:	OPS243-A
Sample Status:	Engineering sample
Applicant:	OmniPreSense
Test Date:	10/13/2019/-10/23/2019
Standards:	EN 300 440 V2.1.1 (2017-03)

The above equipment has been tested by **Bureau Veritas Consumer Products Services, Inc., Milpitas Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :  , **Date:** *03/29/2022*

Abhijit Patibandla, RF/EMC Engineer

Approved by :  , **Date:** *03/29/2022*

Suresh Kondapalli / Engineer Reviewer

2 Summary of Test Results

Clause	Test Item	Result	Remarks
4.2.2	Equivalent isotropically radiated power (e.i.r.p.)	PASS	Meet the requirement of limit.
4.2.3	Permitted range of operating frequencies	PASS	Meet the requirement of limit.
4.2.4	Unwanted emissions in the spurious domain	PASS	Meet the requirement of limit.
4.2.5	Duty cycle	PASS	NA (Note1)
4.3.3	Receiver Adjacent channel selectivity	PASS	NA (Note1)
4.3.4	Reciver Blocking	PASS	NA (Note1)
4.3.5	Receiver Spurious radiations	PASS	Meet the requirement of limit.

Note1: EUT single board

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.51dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	3.73dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	4.64dB
	6GHz ~ 18GHz	4.82dB
	18GHz ~ 40GHz	4.91dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Short Range Radar Sensor
Brand	OmniPreSense
Test Model	OPS243-A
Identification No. of EUT	N/A
Status of EUT	Engineering sample
Power Supply Rating	5Vdc USB powered
Modulation Type	N/A
Operating Frequency	24.089 ~ 24.161 GHz
Number of Channel	1
Antenna Type	Patch
Antenna Gain	11 dBi
Antenna Connector	N/A

3.2 Description of Test Modes

None

3.2.1 Test Mode Applicability and

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	X	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.
NOTE: "-" means no effect.

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH		
RE<1G	25deg. C, 65%RH		
PLC	25deg. C, 68%RH		

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100%.

3.4 Description of Support Units

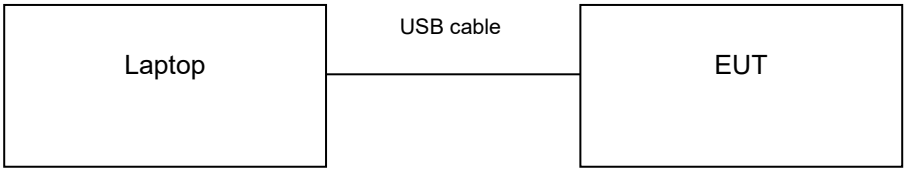
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	Dell	Latitude 4470	N/A	N/A	N/A
B.						

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Remarks
1.	USB cable	1	0.8	N	Provided by Customer

Note: The core(s) is(are) originally attached to the cable(s).

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1.1 Equivalent isotropically radiated power (e.i.r.p.)

The e.i.r.p. is defined as the maximum radiated power of the transmitter and its antenna, and is measured and calculated according to the procedure given in EN 300 440

Using the applicable measurement procedure as described in clause 4.2.2.3.2 and annex B, the power output shall be measured and recorded in the test report.

Measurements shall be performed at normal test conditions (see clause 5.6).

Where possible, the equipment shall be able to operate in a continuous transmit mode for testing purposes.

Limits

The transmitter maximum e.i.r.p. under normal and extreme test conditions is provided in table 2.

Table 2: Maximum radiated peak power (e.i.r.p.)

Frequency Bands	Power	Application	Notes
24,00 GHz to 24,25 GHz	100 mW e.i.r.p.	Non-specific shortrange devices & Radio determination devices	

Test Results:

Frequency (MHz)	Level dBuV/m (At 3m)	Measurement Type	Eirp dBm	Eirp mWatts	Limit mWatts	Margin dB	Result
24100.6	87.8	Peak	-7.4	0.2	100	-27.4	Pass

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Spectrum Analyzer KEYSIGHT	N9030B	MY57140100	09/22/2021	09/22/2022
EMI Test Receiver Rohde & Schwarz	ESW44	1328.4100K44-101662-MH	9/22/2021	9/22/2022
Horn Antenna ETS-Lindgren	3117	214309	04/21/2021	04/21/2023
Horn Antenna, Sunol	DRH-118	A070605	08/05/2020	08/05//2022
Pre-Amplifier RF-Lambda	RAMP00M50GA	18040300055	05/07/2021	05/07/2022
Biconilog Antenna, Sunol	JB1	A111717	9/4/2020	9/4/2022
Agilent Signal Generator	MXG– N5182A	MY47071065	09/22/2021	09/22/2022
Tuned Dipole Antenna 30 - 1000 MHz (4pcs set)	AD-100	40133	01/23/2022	01/23/2023
SMA Fixed Attenuator (50ohm, 2w, 30dB, DC-6GHz)	VAT-03W2+	n/a	07/21/2021	07/21/2022
FSB Antenna Cable, 0.5m (Microwave Town)	FSB360PK-KMKM-00.50M	201906110002	10/1/2021	10/1/2022
FSB Antenna Cable, 4m (Microwave Town)	FSB360PK-KMKM-400M	202103270001	10/1/2021	10/1/2022
10m Semi-Anechoic Chamber (ETS-Lindgren)	S2010BL8X8	1462	07/21/2020	07/21/2022

4.1.1 **Permitted range of Operating Frequecies**

Test method:

The permitted range of operating frequencies includes all frequencies on which the equipment may operate within an assigned frequency band. The operating frequency range shall be declared by the manufacturer.
The frequency range of the equipment is determined by the lowest and highest frequencies occupied by the power envelope in accordance with clause 4.2.2.4, table 2.

FH is the highest frequency of the power envelope, it is the frequency furthest above the frequency of maximum power where the output power envelope drops below the level of -75 dBm/Hz spectral power density (e.g. -30 dBm if measured in a 30 kHz reference bandwidth) e.i.r.p. FL is the lowest frequency of the power envelope; it is the frequency furthest below the frequency of maximum power where the output power drops below the level of -75 dBm/Hz spectral power density (e.g. -30 dBm if measured in a 30 kHz reference bandwidth) e.i.r.p.

The occupied bandwidths and OCW of the transmitter shall be declared. Where differing modes of emission are available, all modes and their associated bandwidths shall be stated. The range of frequencies, determined by clause 4.2.3, shall be specified in the test report.

Method of measurement
The method of measurement for equipment employing FHSS and stepped frequency modulation is given in clause 4.2.3.4.Using applicable conducted measurement procedures, as described in annex C, the frequency range(s) shall be measured and recorded in the test report.Where applicable, during these measurements the test data sequence as specified in clauses 5.8.1 and 5.8.1.1 shall be used. The transmitter power level shall be set to the rated power level.

These measurements shall be performed under both normal and extreme operating conditions except for the occupied bandwidth assessment for which measurement at normal operating conditions is sufficient.
The measurement procedure shall be as follows:
a) Place the spectrum analyser in video averaging mode with a minimum of 50 sweeps selected.
b) select the lowest operating frequency of the equipment under test and activate the transmitter with modulation applied. The RF emission of the equipment shall be displayed on the spectrum analyser.
c) using the marker of the spectrum analyser, find the lowest frequency below the operating frequency at which the spectral power density drops below the level given in clause 4.2.3. This frequency shall be recorded in the test report.
d) select the highest operating frequency of the equipment under test and find the highest frequency at which the spectral power density drops below the value given in clause 4.2.3. This frequency shall be recorded in the test report.
e) the difference between the frequencies measured in steps c) and d) is the operating frequency range. It shall berecorded in the test report.

This measurement shall be repeated for each frequency range declared by the manufacturer.

The width of the power spectrum envelope is fH -fL for a given operating frequency. In equipment that allows adjustment or selection of different operating frequencies, the power envelope takes up different positions in the allowed band. The frequency range is determined by the lowest value of fL and the highest value of fH resulting from the adjustment of the equipment to the lowest and highest operating frequencies.
The occupied bandwidth (i.e. the bandwidth in which 99 % of the wanted emission is contained) of the transmitter shall fall within the assigned frequency band.

Test results

At room Temp and 5V DC

Center Frequency (MHz)	Occupied BW MHz	FL MHz	FH MHz	Permitted Range MHz	Result
24100.6	15.771	24092.715	24108.485	24000 - 24025	PASS

At room Temp and 5V DC

Center Frequency (MHz)	FL MHz	FH MHz	Permitted Range MHz	Result
24116.26	24114.75	24117.76	24000 - 24025	PASS

At -10 DegC, 5V DC

Center Frequency (MHz)	FL MHz	FH MHz	Permitted Range MHz	Result
24127.50	24119.561	24135.38	24000 - 24025	PASS

At +55 DegC, 5V DC

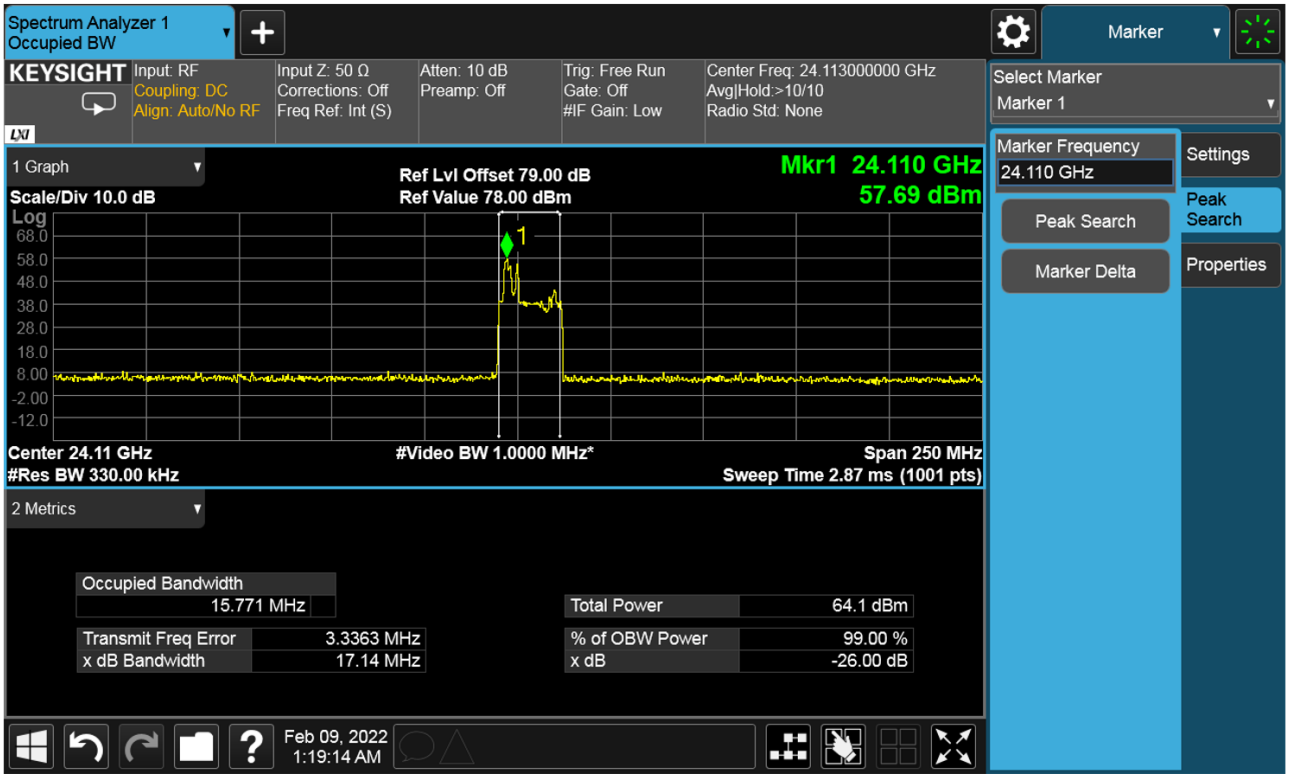
Center Frequency (MHz)	FL MHz	FH MHz	Permitted Range MHz	Result
24115.62	24107.73	24123.51	24000 - 24025	PASS

At room Temp and 6.5V DC

Center Frequency (MHz)	FL MHz	FH MHz	Permitted Range MHz	Result
24100.00	24092.11	24107.89	24000 - 24025	PASS

At room Temp and 4.5V DC

Center Frequency (MHz)	FL MHz	FH MHz	Permitted Range MHz	Result
24100.00	24092.32	24107.68	24000 - 24025	PASS


Spectrum Analyzer 1
Occupied BW
Marker
KEYSIGHT
Input: RF
Coupling: DC
Align: Auto/No RF
Input Z: 50 Ω
Corrections: Off
Freq Ref: Int (S)
Atten: 10 dB
Preamp: Off
Trig: Free Run
Gate: Off
#IF Gain: Low
Center Freq: 24.113000000 GHz
Avg|Hold:>10/10
Radio Std: None
Select Marker
Marker 1
1 Graph
Ref Lvl Offset 79.00 dB
Ref Value 78.00 dBm
Mkr1 24.110 GHz
57.69 dBm
Scale/Div 10.0 dB
Log
68.0
58.0
48.0
38.0
28.0
18.0
8.00
-2.00
-12.0
Center 24.11 GHz
#Res BW 330.00 kHz
#Video BW 1.0000 MHz*
Span 250 MHz
Sweep Time 2.87 ms (1001 pts)
Marker Frequency
24.110 GHz
Settings
Peak Search
Marker Delta
Properties
2 Metrics
Occupied Bandwidth
15.771 MHz
Total Power
64.1 dBm
Transmit Freq Error
3.3363 MHz
% of OBW Power
99.00 %
x dB Bandwidth
17.14 MHz
x dB
-26.00 dB
Feb 09, 2022
1:19:14 AM

4.1.2 **Unwanted emissions in the spurious domain**

Test procedure

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

EUT Operating Conditions

a. Connected the EUT with the Notebook Computer which is placed on remote site.

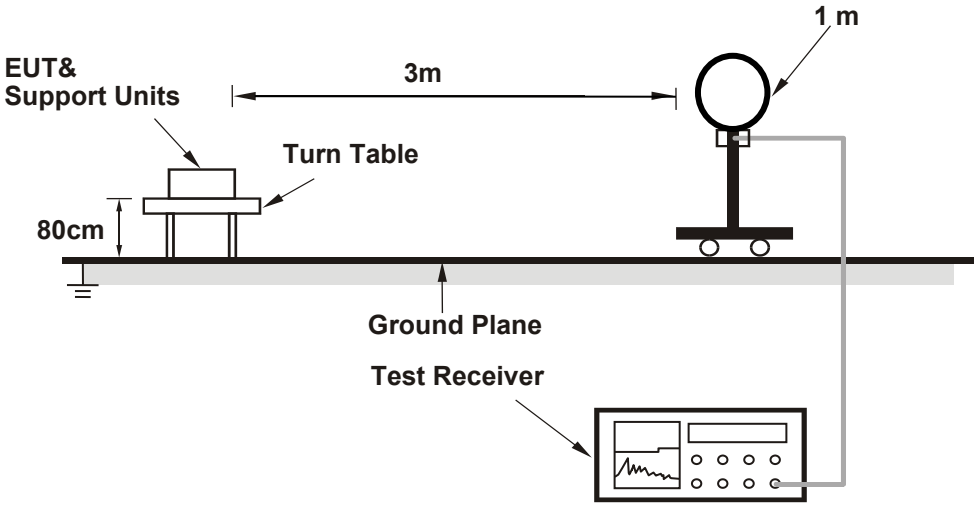
b. Controlling software has been activated to set the EUT on specific status

Deviation from Test Standard

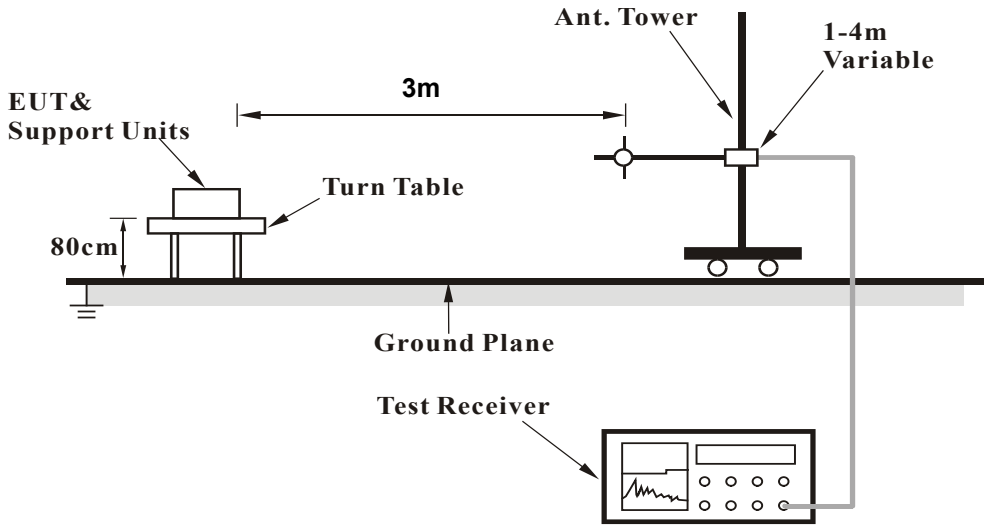
No deviation.

Test Setup

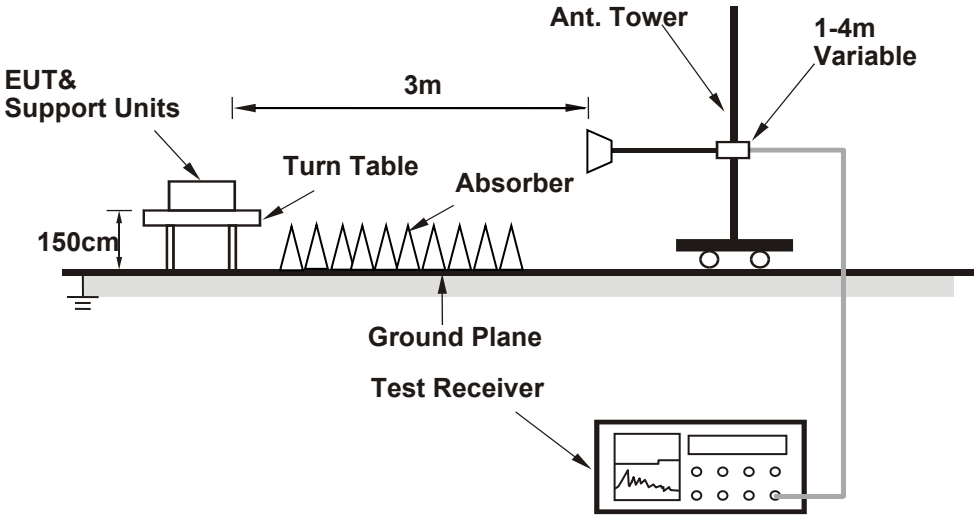
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.1.4 Test Procedures

Refer to section 4.1.3.

4.1.5 EUT Operating Conditions

Same as Item 4.3.6.

4.1.6 Test Results

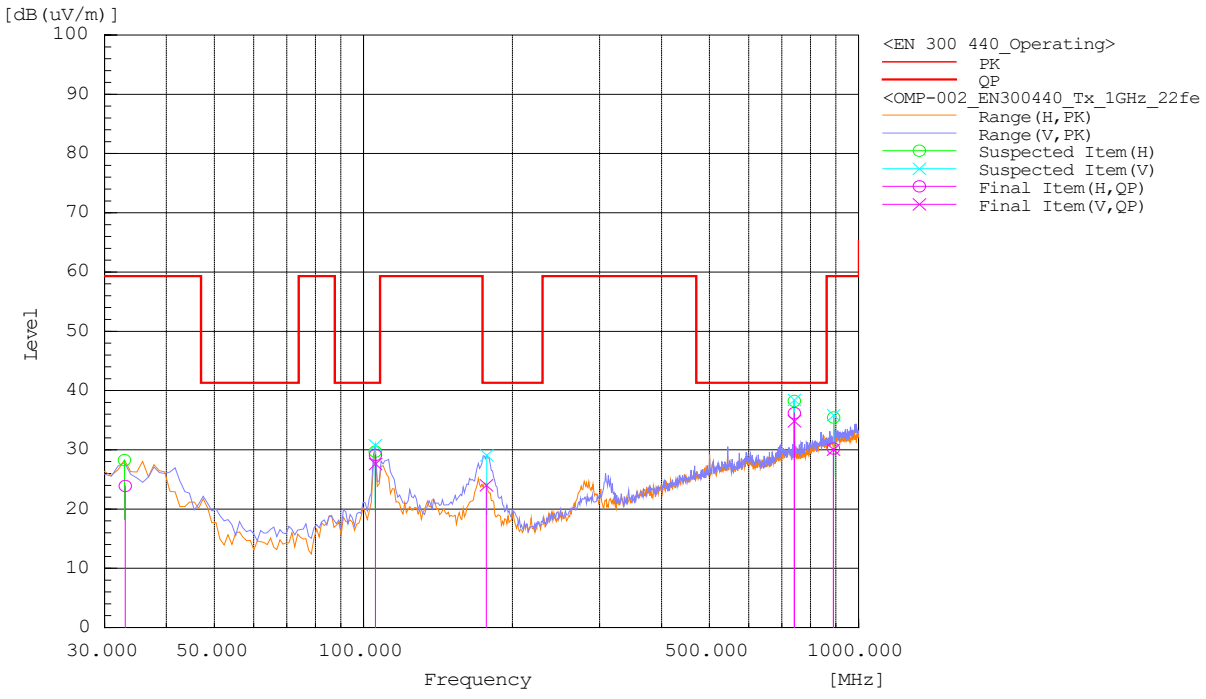
BELOW 1GHz WORST-CASE DATA:

CHANNEL	TX Channel 2	**DETECTOR FUNCTION**	Quasi Peak
FREQUENCY RANGE	30MHz – 1GHz		

Antenna Polarity & Test Distance: Vertical and Horizontal at 10m										
No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	105.779	V	10.5	17.1	27.6	41.3	-13.7	341.8	239.7	Pass
2	105.733	H	11.8	17.3	29.1	41.3	-12.2	248	329.5	Pass
3	177.096	V	6.4	17.6	24.0	41.3	-17.3	115.4	193.9	Pass
4	741.767	V	5.6	29.2	34.8	41.3	-6.5	388.9	177.4	Pass
5	741.761	H	7.5	28.7	36.2	41.3	-5.1	218.1	336.2	Pass
6	890.122	V	-1.1	31.1	30.0	59.3	-29.3	397.5	237.6	Pass
7	890.093	H	-0.3	30.5	30.2	59.3	-29.1	290.2	293.2	Pass

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value.



ABOVE 1GHz TEST DATA:

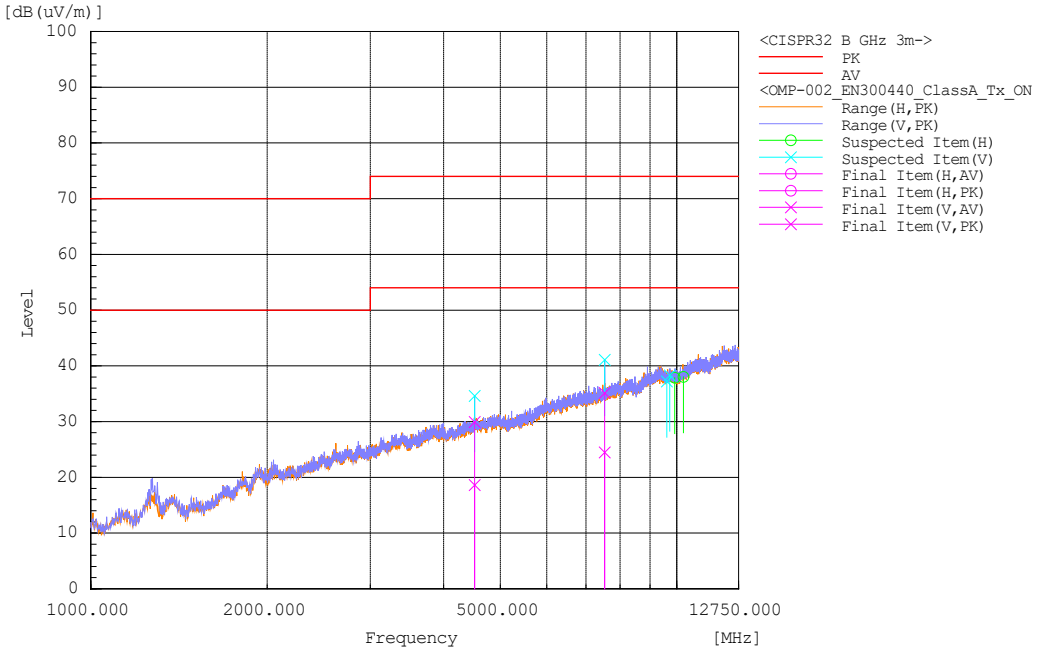
CHANNEL	TX Channel 2	**DETECTOR FUNCTION**	Peak Average
FREQUENCY RANGE	1GHz ~ 18GHz		

Freq MHz	SA Reading (EUT) dB(μV)	Sig Vg dBm	ERP* dBm	ERP Limit dBm	Margin dB
4519.63	34.6	-71.20	-60.60	-30.0	-30.60
7533.53	41.1	-65.10	-54.10	-30.0	-24.10
10265.00	38.0	-71.42	-57.22	-30.0	-27.22
9921.60	37.9	-71.30	-57.30	-30.0	-27.30
9727.80	38.3	-70.93	-56.93	-30.0	-26.93
9619.00	37.2	-72.00	-58.00	-30.0	-28.00

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Cable Loss (dB) + AF (dB)
2. AF (dB/m) = Antenna Factor (dB/m) – Preamplifier Gain (dB).
3. The emission levels of other frequencies were less than 20dB margin against the limit.
4. Margin value = Emission level – Limit value
5. Lower of the CISPR 32 B limits and EN 300 440 Llimit is used for evalaution.

Note: Both horizontal and vertical polarities were investigated, the levels emission above 40GHz of outside band emissions are below noise floor level.



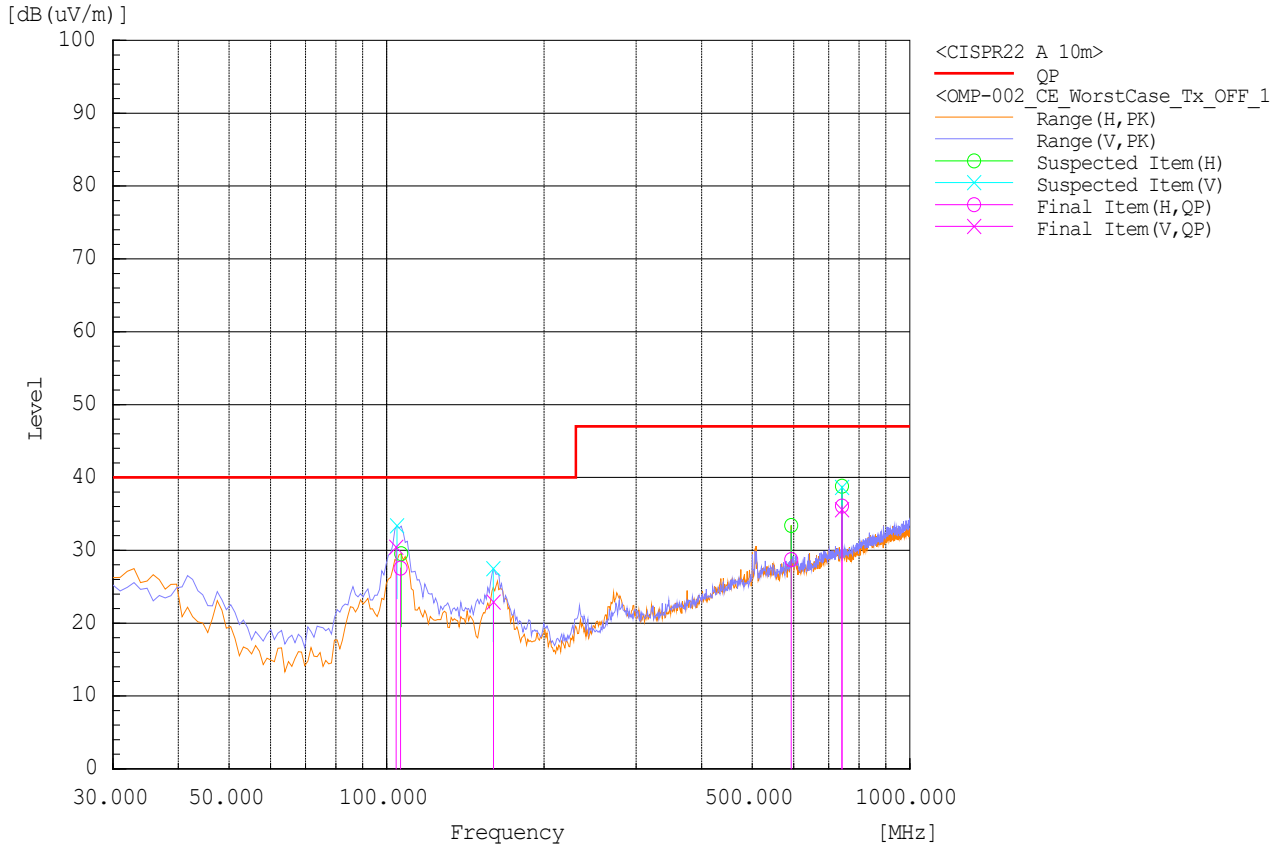
4.1.7 **Receiver spurious Emissions**

Frequency Range	30-1000 MHz		
Input Power	5V DC	Environmental Conditions	22 °C, 55% RH
Tested by	Abhijit Patibandla	Test Date	02/27/2022
Test Mode	Normal mode		

Antenna Polarity & Test Distance: Vertical and Horizontal at 10m										
No.	Frequency (MHz)	Polarization (H/V)	Reading QP [dB(uV)]	Factor [dB(1/m)]	Level QP [dB(uV/m)]	Limit\QP dB(uV/m)	Margin QP [dB]	Height (cm)	Angle (Deg)	Pass/ Fail
1	104.29	V	13.5	16.9	30.4	40	9.6	122	37.6	Pass
2	106.375	H	10.2	17.4	27.6	40	12.4	352	124	Pass
3	160.006	V	4.3	18.6	22.9	40	17.1	132	123	Pass
4	593.397	H	1.5	27.2	28.7	47	18.3	290	126	Pass
5	741.752	H	7.4	28.7	36.1	47	10.9	248	269	Pass
6	741.758	V	6.4	29.2	35.6	47	11.4	242	11.1	Pass

Remarks:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin = Limit value(dBuV/m) - Level (dBuV/m)
4. Lower of the CISPR 32 limits and EN 300 440 Llimit is used for evalaution

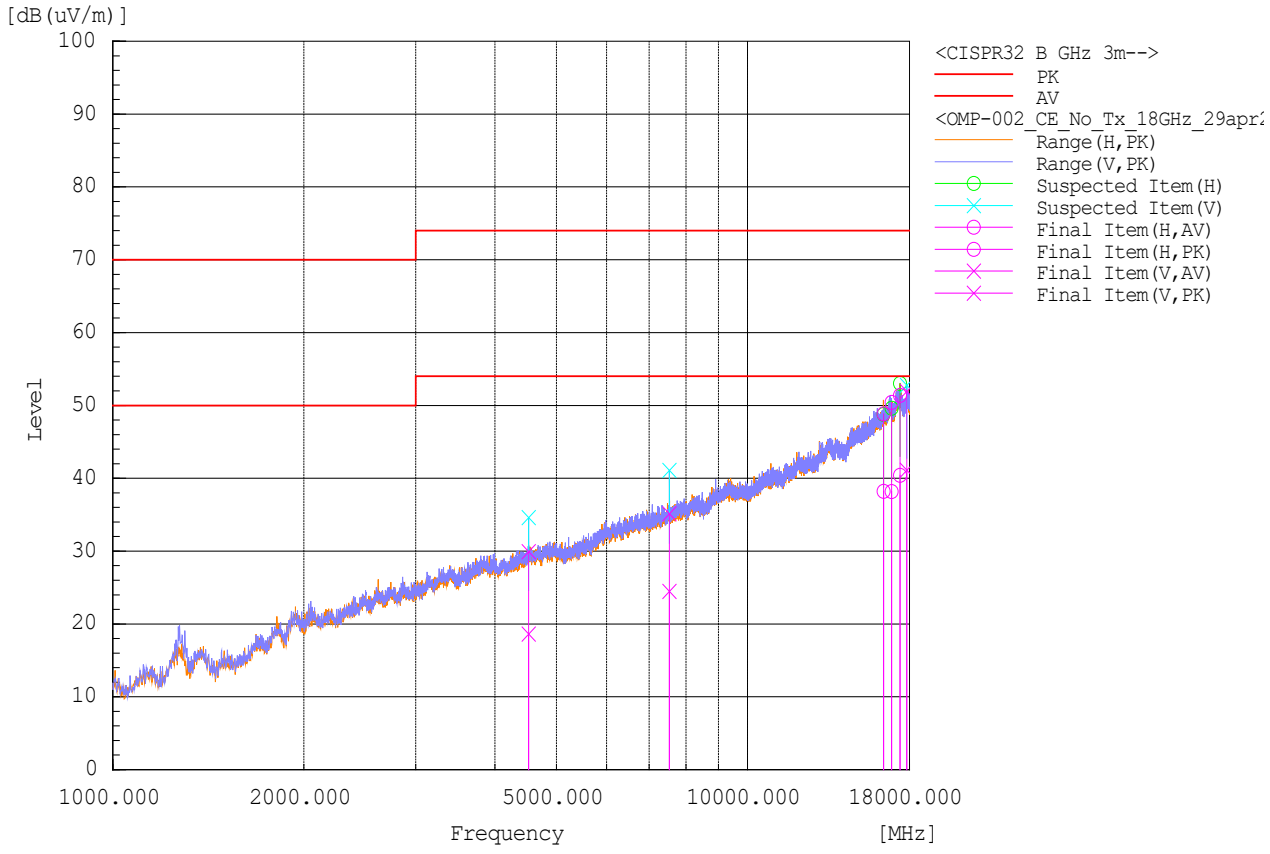

[dB(uV/m)]
100
90
80
70
60
50
40
30
20
10
0
Level
30.000
50.000
100.000
500.000
1000.000
Frequency
[MHz]
<CISPR22 A 10m>
QP
<OMP-002_CE_WorstCase_Tx_OFF_1
Range(H,PK)
Range(V,PK)
Suspected Item(H)
Suspected Item(V)
Final Item(H,QP)
Final Item(V,QP)

Frequency Range	30-1000 MHz		
Input Power	5V DC	Environmental Conditions	22 °C, 55% RH
Tested by	Abhijit Patibandla	Test Date	02/27/2022
Test Mode	Normal mode		

Freq MHz	SA Reading (EUT) dB(µV)	Sig Vg dBm	ERP* dBm	ERP Limit dBm	Margin dB
4519.638	36.4	-69.20	-58.80	-30.0	-28.80
7533.534	34.9	-71.32	-60.32	-30.0	-30.32
16380.64	34.9	-71.52	-60.32	-30.0	-30.32
16867.94	35.2	-71.32	-60.02	-30.0	-30.02
17385.30	35.7	-70.92	-59.52	-30.0	-29.52
17823.74	35.4	-71.20	-59.80	-30.0	-29.80

Remarks:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB)
3. Margin = Limit value(dBuV/m) - Level (dBuV/m)



5 Pictures of Test Arrangements

Please see setup photo file.

Appendix – Information on the Testing Laboratories

Bureau Veritas is a global leader in testing, inspection and certification (TIC) services. We help businesses improve safety, sustainability and productivity; and our clients include the majority of leading brands in retail, manufacturing and other industries. With a presence in every major country around the world, our quality assurance and compliance solutions are vital in helping our customers enhance product quality and concept-to-consumer journeys. We also assist with increasing speed to market, profitability and brand equity throughout the supply chain. Bureau Veritas is a leading wireless/IoT testing, inspection, audit and certification provider, with a global network of test laboratories to support the IoT industry in areas of connectivity, security, interoperability as well as quality, health & safety, and environmental/chemical requirements.

If you have any comments, please feel free to contact us at the following:

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775 Montague Expressway, Milpitas, CA 95035
Tel: +1 408 526 1188

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The address and road map of all our labs can be found in our web site also.

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