

Prüfbericht – Produkte
Test Report - Products

Prüfbericht-Nr.: <i>Test report no.:</i>	IN23GW34 001	Auftrags-Nr.: <i>Order no.:</i>	146770883 0010	Seite 1 von 38 Page 1 of 38	
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	2338638	Auftragsdatum: <i>Order date:</i>	2023-03-10		
Auftraggeber: <i>Client:</i>	Fluid Handling LLC, 8200 N Austin Ave, Morton Grove, ILLINOIS, UNITED STATES, 60053 Phone: 8479663700				
Prüfgegenstand: <i>Test item:</i>	Boiler Wise				
Bezeichnung <i>Identification</i>	FPCe-1000	Serien -Nr.: <i>Serial no.:</i>	144709		
Auftrags-Inhalt: <i>Order content:</i>	Testing and issue of Test Report with Grant Certificate				
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C 15.247, 15.207, 15.205 & 15.209				
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-06-20				
Prüfmuster-Nr.: <i>Test sample no:</i>	A003499876-002 A003499876-003				
Prüfzeitraum: <i>Testing period:</i>	2023-06-21 - 2023-07-10				
Ort der Prüfung: <i>Place of testing:</i>	Wireless laboratory, Bangalore				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd. 27/B,2nd cross road, Electronic city Phase1, Bangalore-560100, India FCC Test Site Registration No: 496599				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>				
Datum: <i>Date:</i>	Ausstellatum: <i>Issue date:</i>				
Stellung / Position:	Likhithesh M D Senior Engineer	Stellung / Position:	Madhu K.N Assistant Manager		
Sonstiges / Other:	FCC ID: 2AAFYFPCE1000				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>				
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar	5 = mangelhaft N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable	5 = poor N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>					

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1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. <i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i>
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3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. <i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i> <i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i>
4	Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. <i>The decision rule for statements of conformity in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.</i>

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TEST SUMMARY

Test Item	FCC	Result
Maximum conducted (Peak) output power	15.247 (b)(3)	Pass
Maximum Power Spectral Density	FCC 15.247(e)	Pass
DTS Bandwidth	FCC 15.247(a)(2)	Pass
Emissions in non-restricted frequency bands	15.247 (d)	Pass
Spurious Radiated Emissions and Restricted Bands of Operation	FCC 15.247(d)/15.209 / FCC 15.205	Pass
Conducted Spurious Emission on AC Power lines	FCC 15.207	Pass

Product Category: Electronics Testing

Test Discipline: EMC Test Facility

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REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
IN23GW34 001	01	Initial issue of report	2024-05-09
IN23GW34 001	02	Duty Cycle Correction Factor has been added to the PSD.	2024-05-28

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1 GENERAL REMARKS

1.1 Attachments

All attachments are part of this test report and are issued in separate document

1. Test Setup photos
2. EUT External Photos
3. EUT Internal Photos
4. FCC Label and Label Location
5. Block Diagram
6. Specification of EUT
7. Schematic Diagrams
8. Bill of Material
9. User Manual
10. Maximum Permissible Exposure Information

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2 TEST SITES

2.1 Testing Facilities

1. TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
ElectronicCityPhase1
Bangalore – 560 100,
India
2. TUV Rheinland (India) Pvt.Ltd.,
108 , Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100,
India

2.2 List of Test and Measurement Instruments

Table 1: List of test and measurement instruments

Equipment	Manufacturer	Model Name	Serial Number	Firmware Versions	Calibration Due Date	Periodicity	Test Facility
EMI Receiver	Rohde & Schwarz	ESW 44	101732	1.72.SP1	04.08.2023	Yearly	Radiated Spurious Emission
Loop antenna	Schwarzbeck	FMZB 1519 B	1519B-00111	-	12.10.2023	Yearly	
Baloon and Biconical Antenna	Schwarzbeck Mess-Elektronik	BBA 9106+V HBB 9124	9124-1117	-	15.07.2023	Yearly	
Log Periodic Antenna	Schwarzbeck Mess-Elektronik	VUSLP 9111B	9111B-324	-	06.05.2024	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-01944	-	11.10.2023	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	13.10.2023	Yearly	
EMI Test Receiver	Rohde & Schwarz	ESW44	101773	1.72.SP1	15.02.2024	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
Spectrum Analyzer	Agilent	E4407B	ESA-E	A.14.07	21-12-2023	Yearly	Conducted Test Parameters
10dB Attenuator	H+S Electronics Pvt. Ltd	6810.17. A	770041	-	12.10.2023	Yearly	
EMI Receiver	Rohde & Schwarz	ESR7	101133	3.48 SP3	22.07.2023	Yearly	Conducted AC Power line Test
Line Impedance Stabilization Network	Rohde & Schwarz	ENV 216	101434	-	15.04.2024	Yearly	
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100811	-	12.07.2023	Yearly	

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Table 2: Instrument application Software versions

SL. No.	Test Type	Application software	Version
1	Radiated spurious emission measurement in FAC	EMC 32	10.60.20
2	Radiated spurious emission measurement in 10mtr SAC	BAT EMC	3.20.0.17

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3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

The product is a Field Configurable Control for hot water or steam boiler type.

The control unit has a Red LED light to alert personnel to a low water condition. a Green/Yellow (Auto/Manual) LED to indicate control mode and Relay to control the burner ignition.

3.2 Ratings and System Details of Equipment under Test

Table 3: Ratings and System Details as declared by Client*

Radio Protocol		Bluetooth Low Energy (BLE)
Operating Frequency Range		2402MHz - 2480MHz
No. of Channels		40
Channel Spacing		2MHz
Transmitter Power(dBm)		8dBm
Measured peak conducted power (dBm)		4.72dBm @ Low Channel(2402MHz)
Modulation		GFSK
Data Rates		2Mbps
Number of antennas		1
Antenna Gain		1.89 dBi
Antenna Type		Ceramic Monopole Antenna
Supply Voltage to Product		120VAC or 24VAC
Environmental conditions	Storage(°C)	-40 Degree C to 57 degree C
	Operating(°C)	0 Degree C to 49 Degree C
EUT Dimension(L x W) in mm		195.66 mm X 133.41 mm

***Disclaimer:** The information/data is supplied by the client and the same is considered to arrive at the final value. Any changes made apart from the specified specification, can directly impact on the tests results. Refer the products user manual for more details.

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3.3 Measurement Uncertainty:

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of $k = 2$

Table 4: Measurement Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	$\pm 5 \%$
RF output power, conducted	$\pm 1.5 \text{ dB}$
Power Spectral Density, conducted	$\pm 3 \text{ dB}$
Unwanted Emissions, conducted	$\pm 3 \text{ dB}$
All emissions, radiated	$\pm 6 \text{ dB}$
Temperature	$\pm 3 \text{ }^{\circ}\text{C}$
Supply Voltages	$\pm 3 \%$
Time	$\pm 5 \%$

4 TEST SET-UP AND OPERATION MODE

4.1 Principle of Configuration Selection

Transmission was enabled with highest possible duty cycle transmission on low, mid and high channel.

4.2 Test Operation and Test Software

Hardware Version: FPCE-1000

Software Version: BlueNRG GUI v3.1.0

Firmware Version: DTM_UART.hex

4.3 Special Accessories and Auxiliary Equipment

- None

4.4 Countermeasures to achieve EMC Compliance

- None

4.5 List of frequencies

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
2402 – 2480 BLE	0	2402
	1	2404
	2	2406
	3	2408
	:	:
	11	2424
	12	2426
	:	:
	19	2440
	20	2442
	:	:
	:	:
	:	:
	:	:
	36	2474
	37	2476
	38	2478
	39	2480

Table 5: List of BLE Center frequencies

Channel used for BLE testing.

Channel low: 2402MHz

Channel mid: 2440MHz

Channel high : 2480MHz

4.6 TUV Sample Identification

1. TUV Sample Identification number: A003499876-003 - Radiated test Sample
A003499876-002 - Conducted test Sample

5 Operational Description

The product is a Field Configurable Control. The control unit has a Red LED light to alert personnel to a low water condition and a Green/Yellow (Auto/Manual) LED to indicate control mode. At power up, all LEDs will be blinking 4 times to indicate Hot-Water boiler type or blinking 6 times to indicate Steam boiler type.

Lockout delay for manual reset units, when a low water condition occurs, the burner turns off and the Red LED begins to blink. When the water level is not restored to a level above the probe within 30 seconds, the control locks out.

To reset control, press the Test/Reset button when the water level is restored to a level above the probe.

Power interruption Auto Mode The control will automatically reset after a loss of power as long as there is water on the probe before and after the power loss occurred.

For manual reset units when the control is in a low water condition and there is an interruption of power the control remains in that condition when power is restored.

Press the Test/Reset button when the water level is restored to a level above the probe.

BLE Communication board PCBA receives data related to water level from control board PCBA over UART and reflects it on BLE app installed in users cell phone.

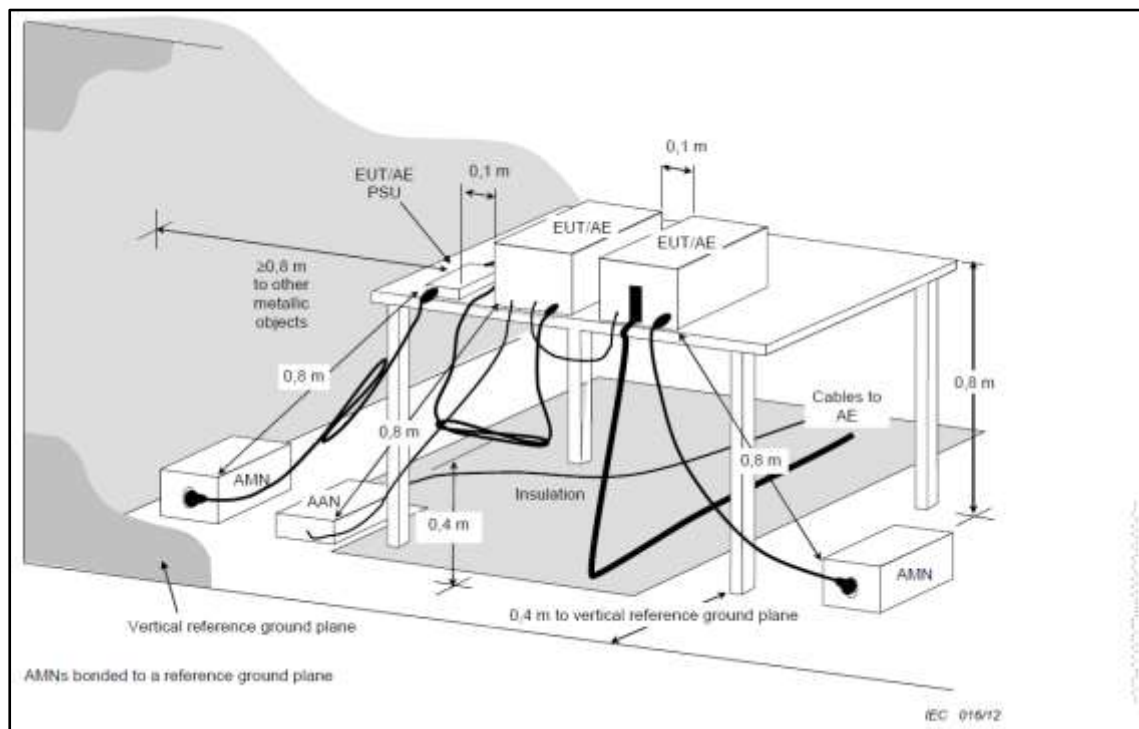
6 TEST METHODOLOGY

6.1 Conducted Spurious Emission AC Power line Test

Measured levels of ac powerline conducted emission across the 50Ω LISN port (to which the EUT is connected). All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer.

The device is placed on the test table, raised 80cm above the reference ground plane. The vertical conducting plane is located 40cm to the rear of the device. AC Conducted emission measurement is made over frequency range from 150 kHz to 30MHz, this measurement was performed an AC adaptor 110V AC 60Hz supply.

6.1.1 Test Setup Configuration



6.2 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2013. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable for below 1 GHz & 1.5 m height for above 1 GHz measurement, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000 MHz was performed by horn antenna, the measurement below 30 MHz was performed by loop antenna, Measurement from 30 MHz to 200 MHz was performed by Balloon and Biconical Antenna, and measurement from 200 MHz to 1 GHz was performed by Log-Periodic Antenna.

The EUT was rotated around the X-, Y-, and Z-Axis and the results from worst case axis are recorded

6.2.1 Test Setup Configuration

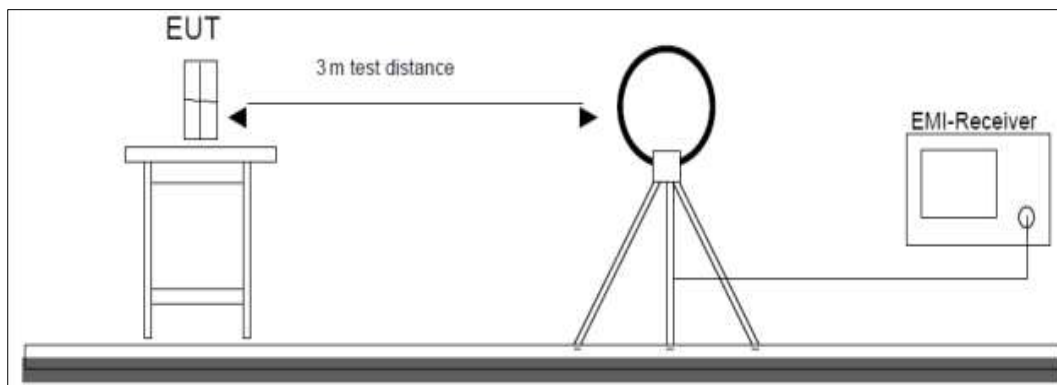


Figure 1: Frequency Range 9 kHz- 30 MHz

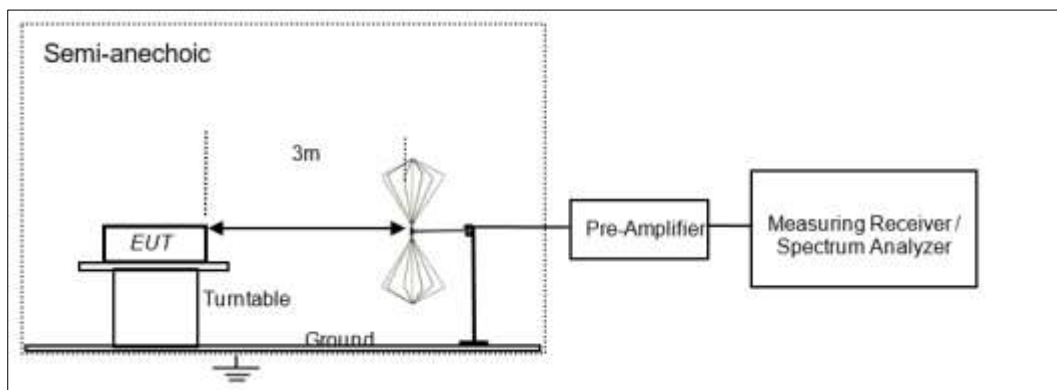


Figure 2: Frequency Range 30 MHz – 200 MHz

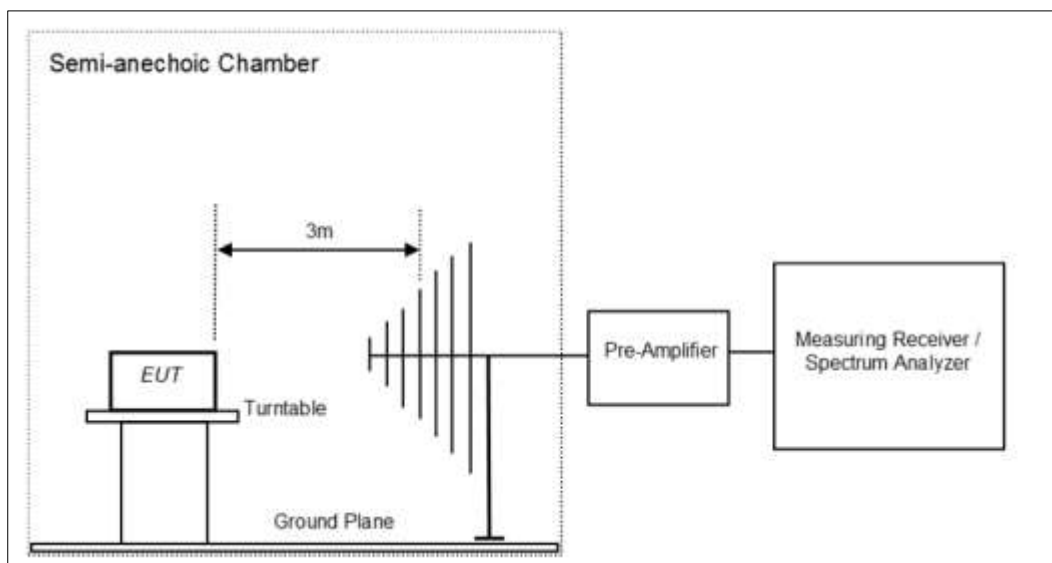


Figure 3: Frequency Range 200 MHz - 1GHz

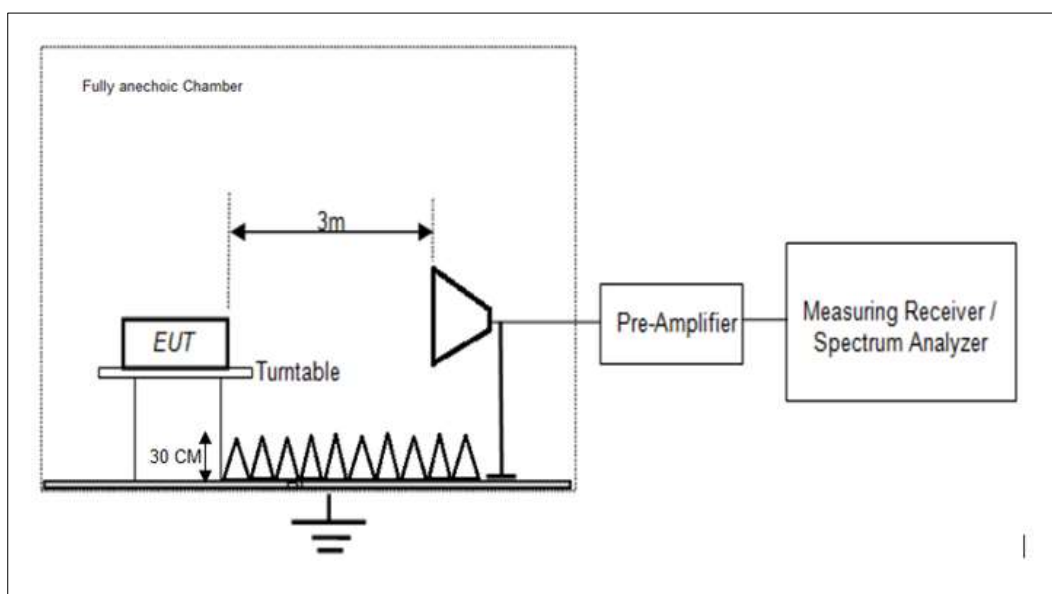


Figure 4: Frequency Range above 1 GHz

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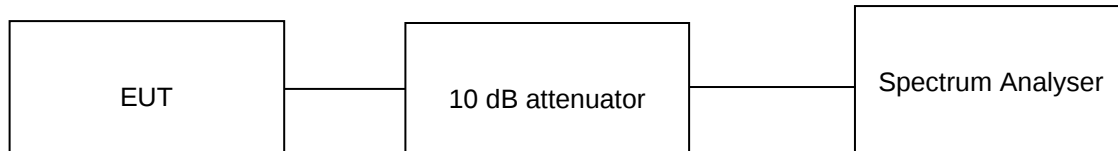
7 TEST RESULTS

7.1 Maximum Peak Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3)
Test Method	Subclause 11.9.1.1 of ANSI C63.10
Measurement Bandwidth	30kHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power $\leq$ 1 W (30 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C

Voltage = 120VAC or 24VAC

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.3.1 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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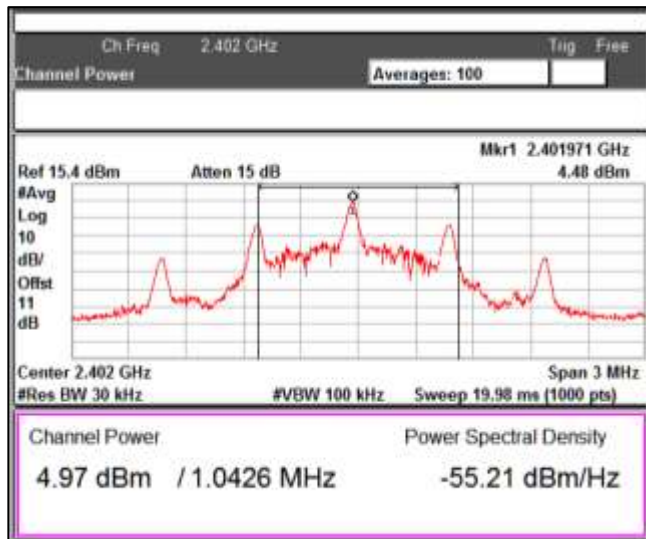
Test results:

Note:

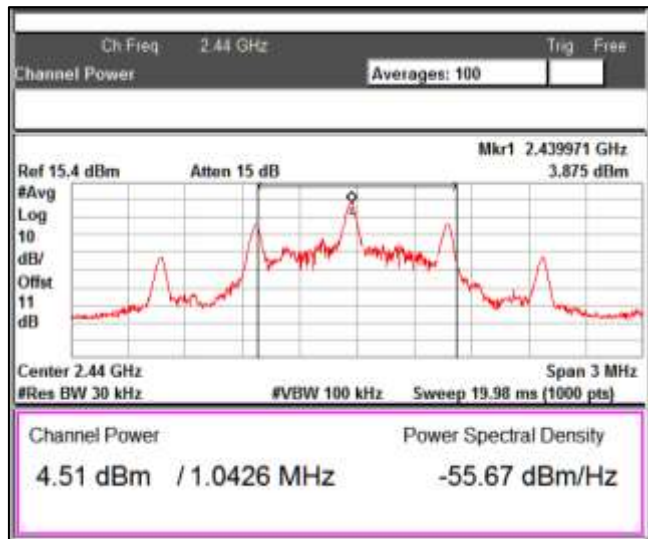
1. All the losses are included during measurement and final values are mentioned in the test report
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (1dB)

Data rate	Channel Frequency (MHz)	Measured Average power (dBm)	Duty cycle %	Duty cycle correction factor (dB)	Maximum Average output power (dBm)	Limit (dBm)
1Mbps	2402	4.97	85.2	0.70	5.67	30
	2440	4.51	84.8	0.72	5.23	30
	2480	3.73	84.8	0.72	4.45	30

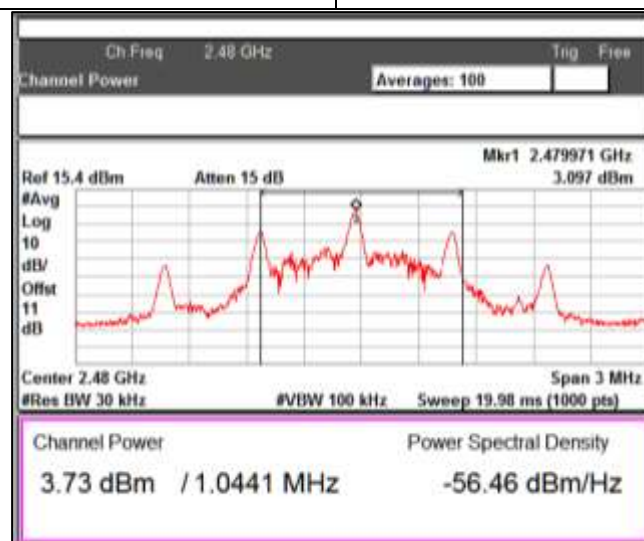
Test Plots:



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

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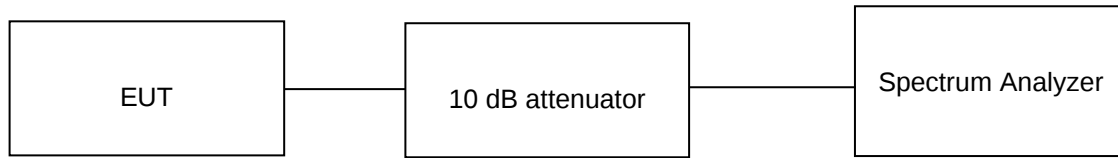
7.2 DTS Bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (2)
Test Method	Subclause 11.8.1 & 6.9.2 of ANSI C63.10
Measurement Bandwidth	100 kHz for x dB bandwidth 1 to 5% of OCB for 99% bandwidth
Detector	Peak
Port of testing	Antenna port
Requirement	Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C

Voltage = 120VAC or 24VAC

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.2 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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Test results:

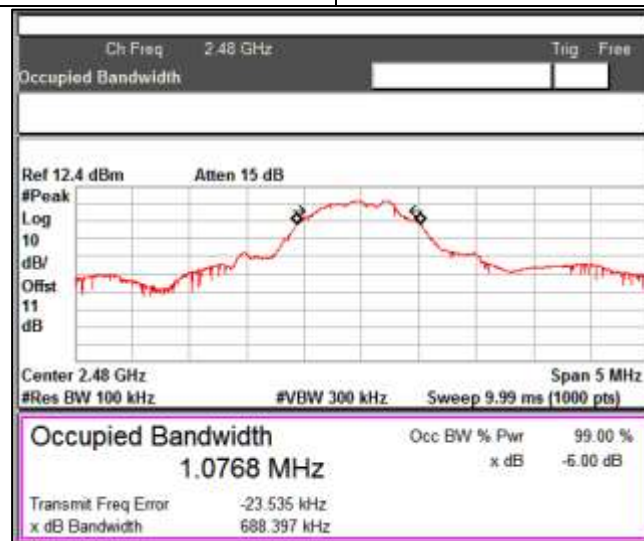
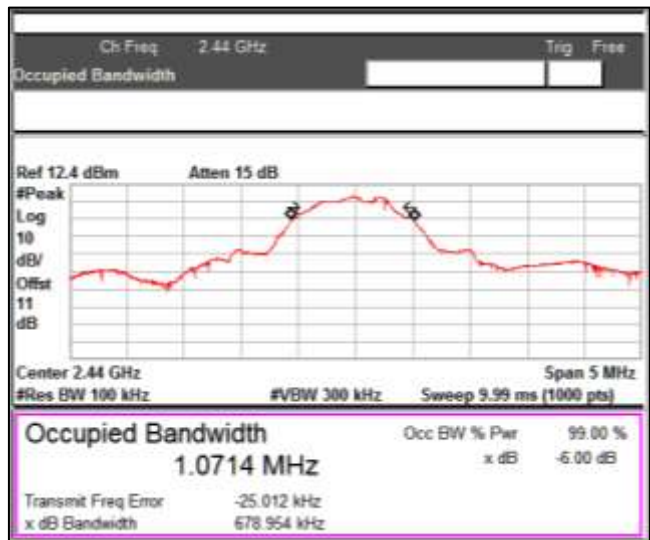
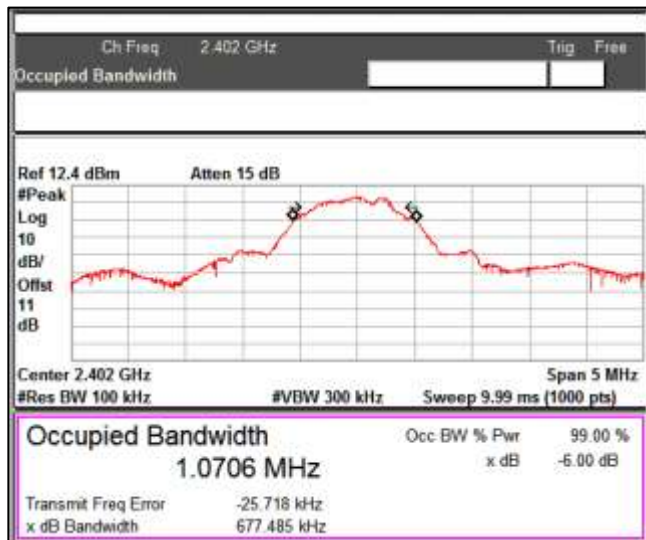
Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product does not support additional beamforming gain / directional gain, it uses single antenna and hence directional gain of the single antenna is 1.89 dBi.

Data Rate	Channel Frequency (MHz)	Measured 99% Bandwidth (MHz)	Measured 6dB Bandwidth (MHz)	Limit (MHz)
1Mbps	2402	1.0426	677.49	0.5
	2426	1.0423	678.95	0.5
	2480	1.0441	688.40	0.5

Test Plots:

6dB Emission Bandwidth:

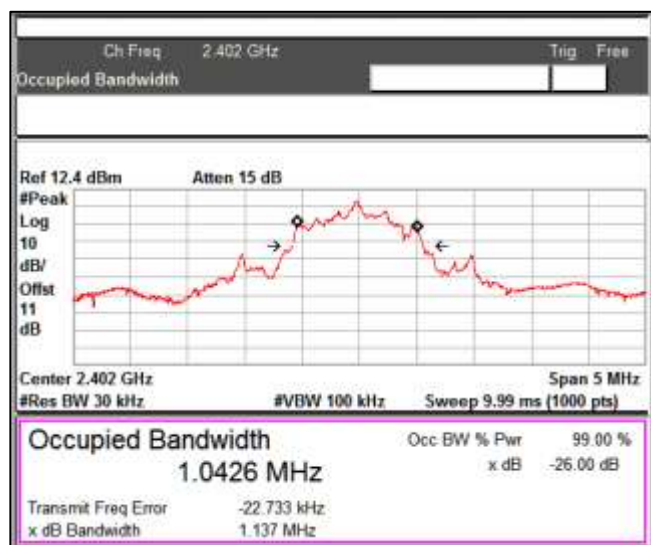


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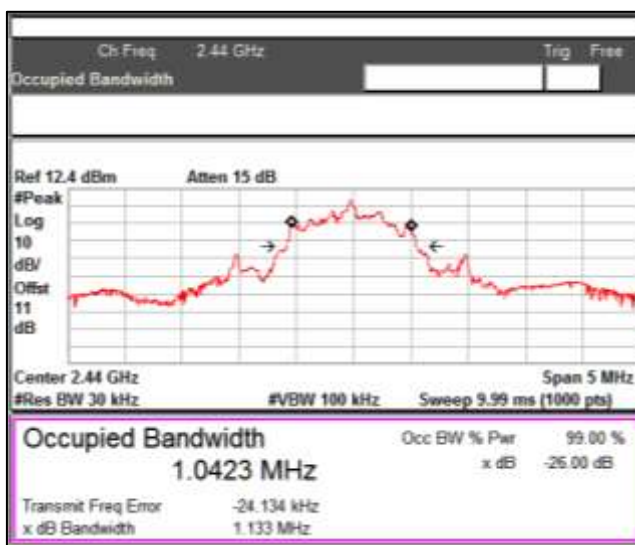
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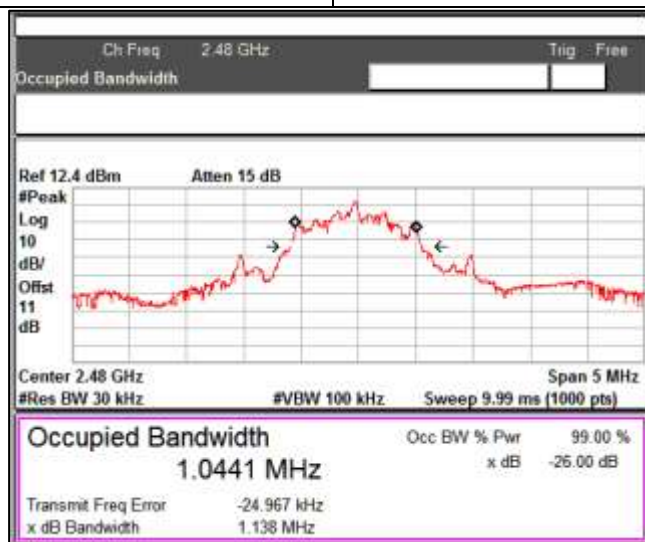
99% Bandwidth



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

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7.3 Power Spectral Density

Result

Pass

Test Specification FCC part 15 Subpart C 15.247 (e)

Test Method Subclause 11.10.2 of ANSI C63.10

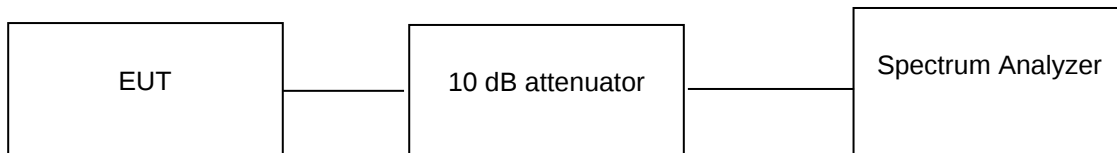
Measurement Bandwidth 100 kHz

Detector Average

Port of testing Antenna port

Requirement For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 100 kHz band during any time interval of continuous transmission.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C

Voltage = 120VAC or 24VAC

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.4 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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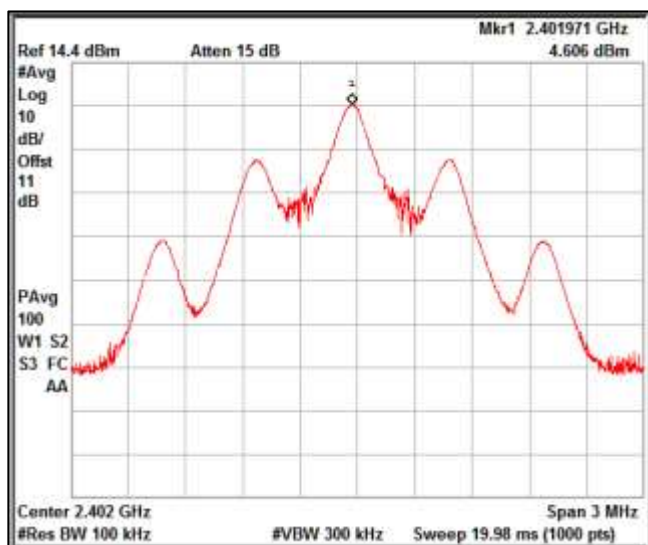
Test results:

Note:

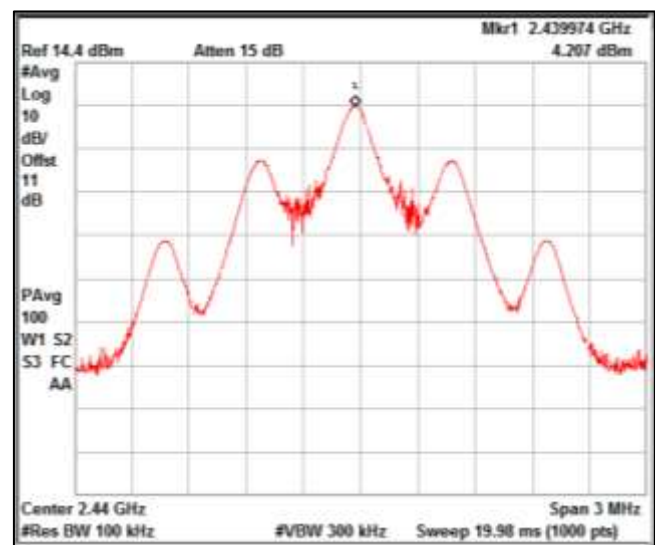
1. All the losses are included during measurement and final values are mentioned in the test report.

Data Rate	Channel Frequency (MHz)	Measured PSD (dBm)	Duty cycle %	Duty cycle correction factor (dB)	Total PSD (dBm/kHz)	Limit (dBm/kHz)	Margin (dB)
1Mbps	2402	4.60	85.2	0.70	5.30	8.00	-2.70
	2426	4.20	84.8	0.72	4.92	8.00	-3.80
	2480	3.28	84.8	0.72	4.00	8.00	-4.00

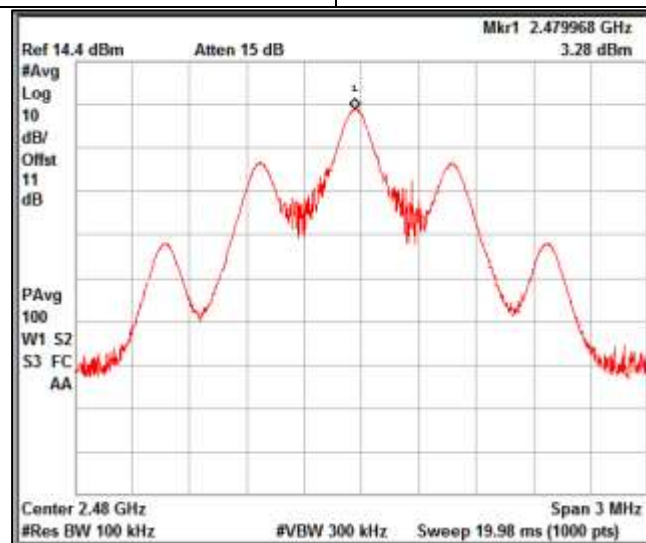
Test Plots:



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

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7.4 Emissions in non-restricted frequency bands and Conducted Spurious Emission

Result

Pass

Test Specification

FCC part 15 Subpart C 15.247 (d) / RSS 247 Issue 3, Section 5.5

Test Method

Subclause 11.11.3 of ANSI C63.10

Measurement Bandwidth

100 kHz

Detector

Peak

Port of testing

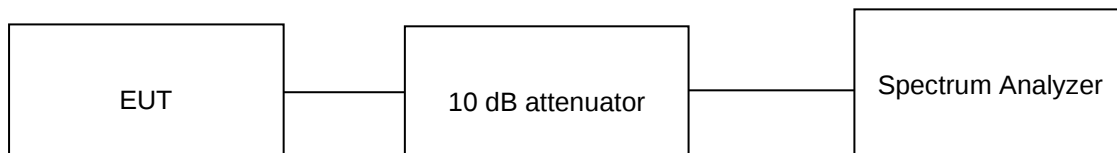
Antenna port

Requirement

In any 100kHz 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 30dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 db.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C

Voltage = 120VAC or 24VAC

Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.5 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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Test results:

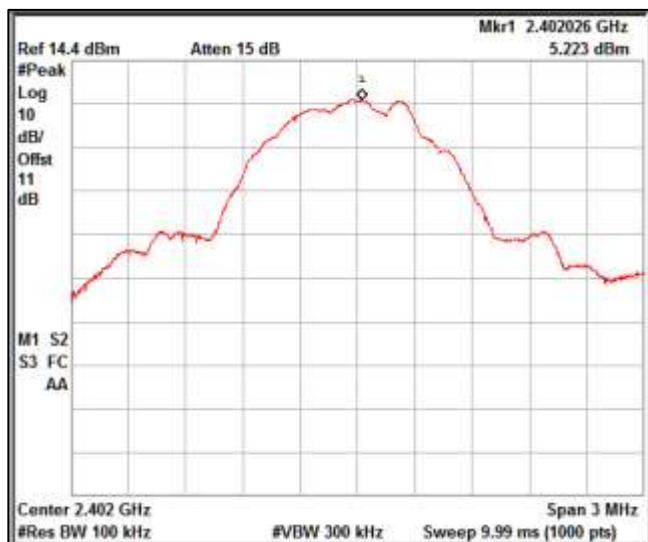
Note:

1. All the losses are included during measurement and final values are mentioned in the test report
2. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 1.89 dBi.

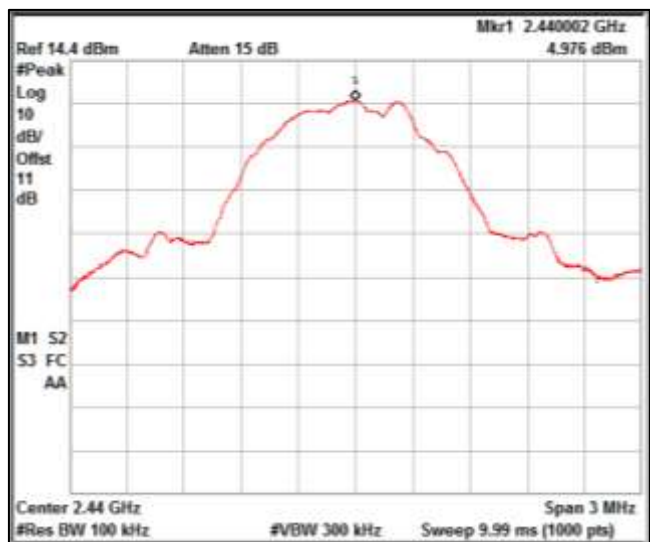
7.4.1 Band edge

Channel Frequency (MHz)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2402.00	2400.00	-48.92	5.23	-54.15	-30
2480.00	2483.50	-40.69	4.10	-44.79	-30

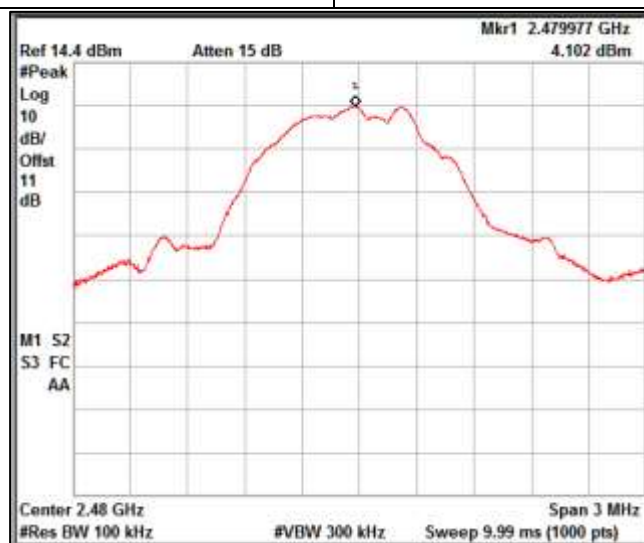
Reference Plots:



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



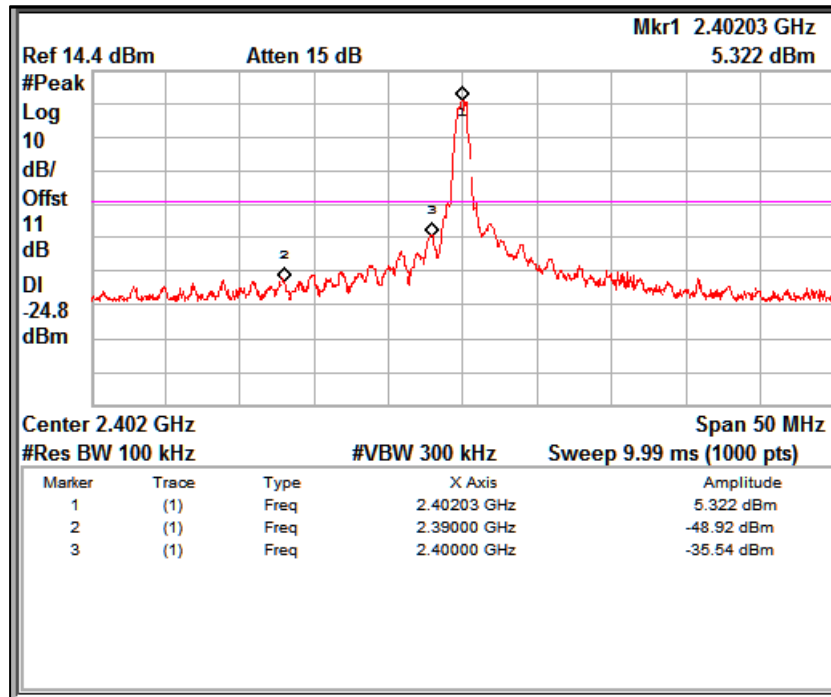
Channel Frequency: 2480MHz

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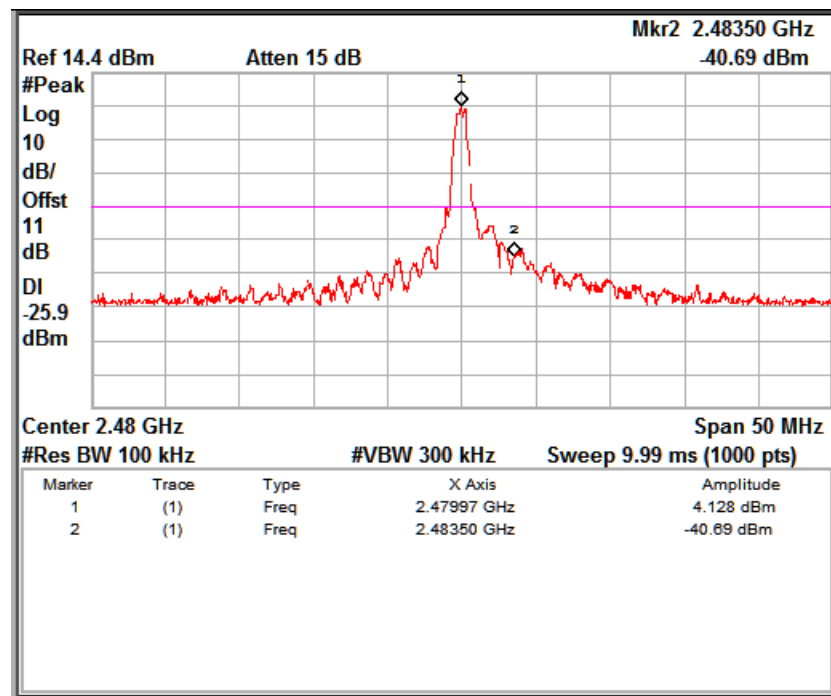
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Bandedge Plots:

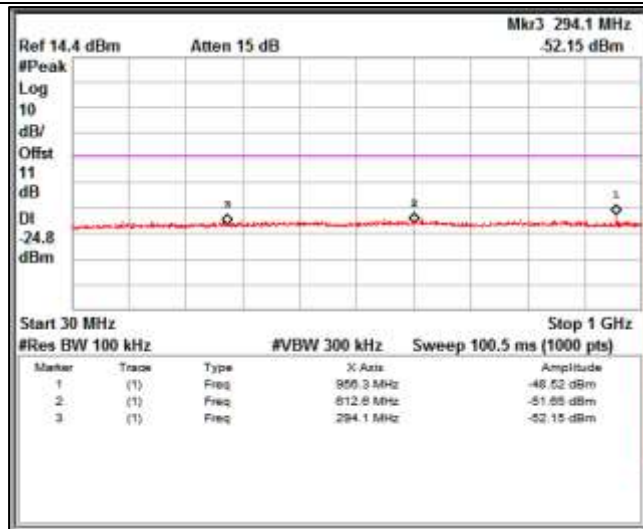


Channel Frequency:2402MHz

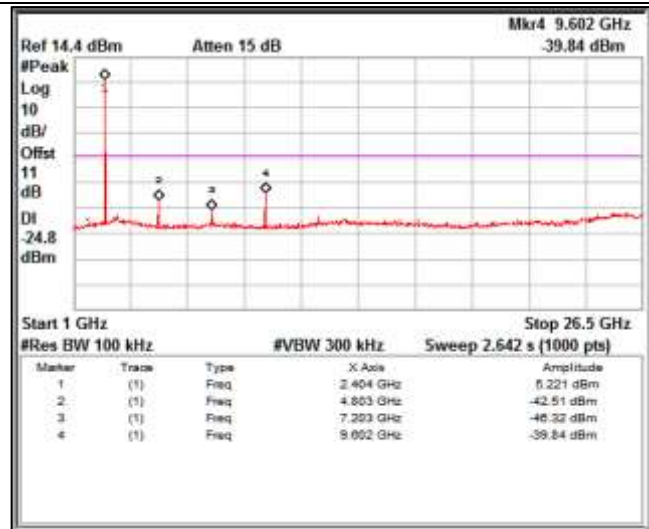


Channel Frequency:2480MHz

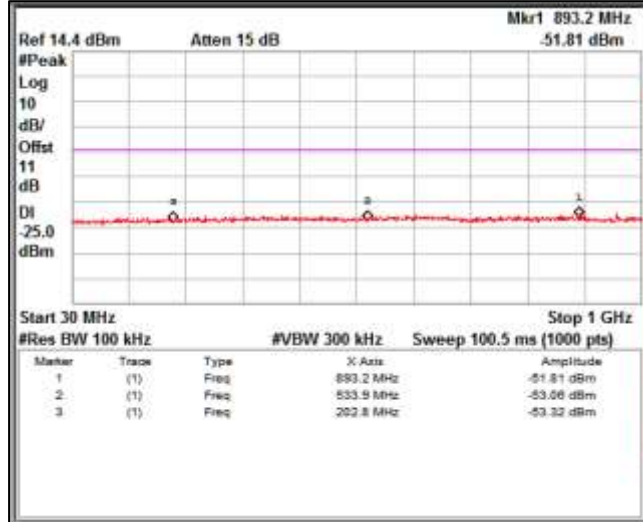
7.4.2 Out-Of-Band Emissions



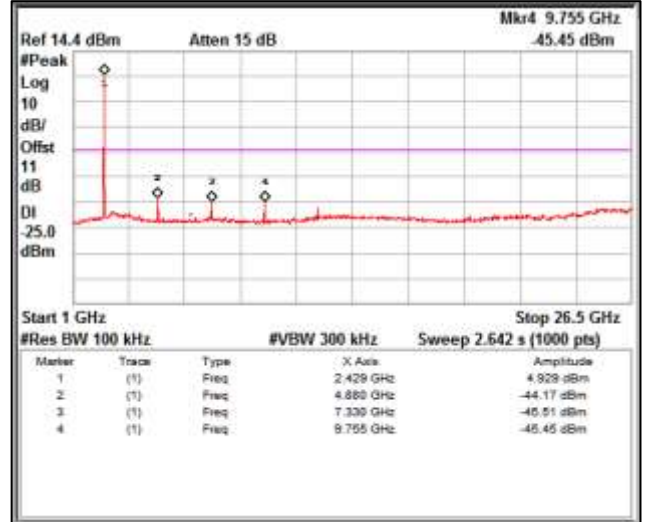
Channel Frequency: 2402MHz Frequency Range 30MHz – 1GHz



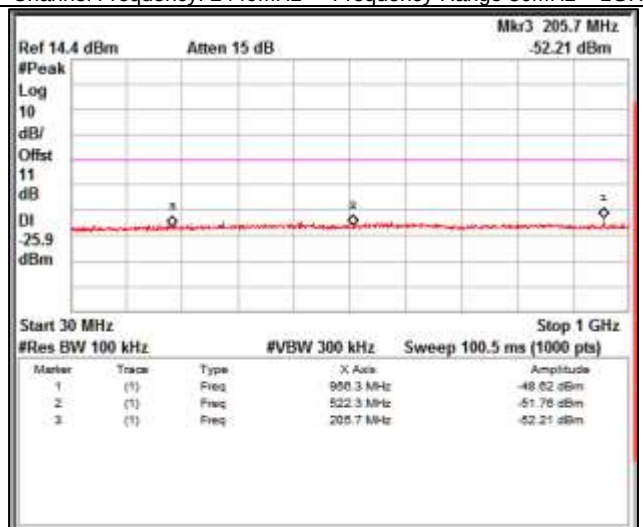
Channel Frequency: 2402MHz Frequency Range 1GHz – 26.5GHz



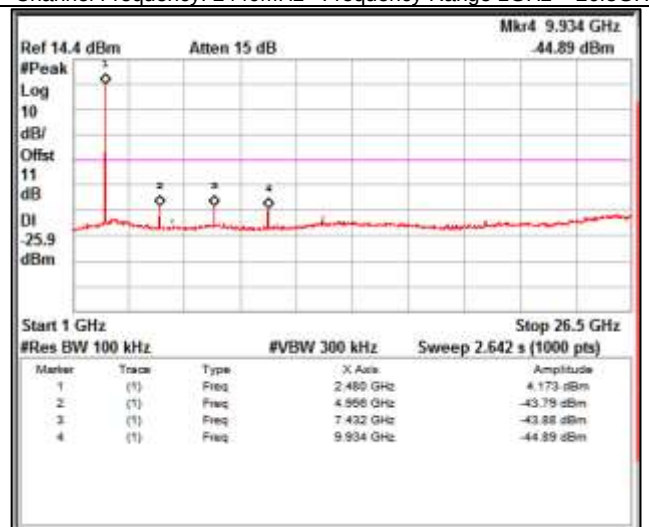
Channel Frequency: 2440MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2440MHz Frequency Range 1GHz – 26.5GHz



Channel Frequency: 2480MHz Frequency Range 30MHz – 1GHz



Channel Frequency: 2480MHz Frequency Range 1GHz – 26.5GHz

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7.5 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205)
Test Method	ANSI C63.10
Measurement Location	Semi Anechoic Chamber 9kHz - 1 GHz Fully Anechoic Chamber 1 GHz - 40GHz
Measurement Bandwidth	100 kHz for frequency range < 1GHz 1 MHz for Frequency range >1GHz
Detector	Refer remarks below
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 6: Transmitter limits for Radiated emission

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300 meter, 30 meter and 30 meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBμV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

Test Conditions:

Temperature (Norm) = + 22.1 °C

Voltage = 120VAC or 24VAC

Relative humidity: 65%

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Test results:

Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details.

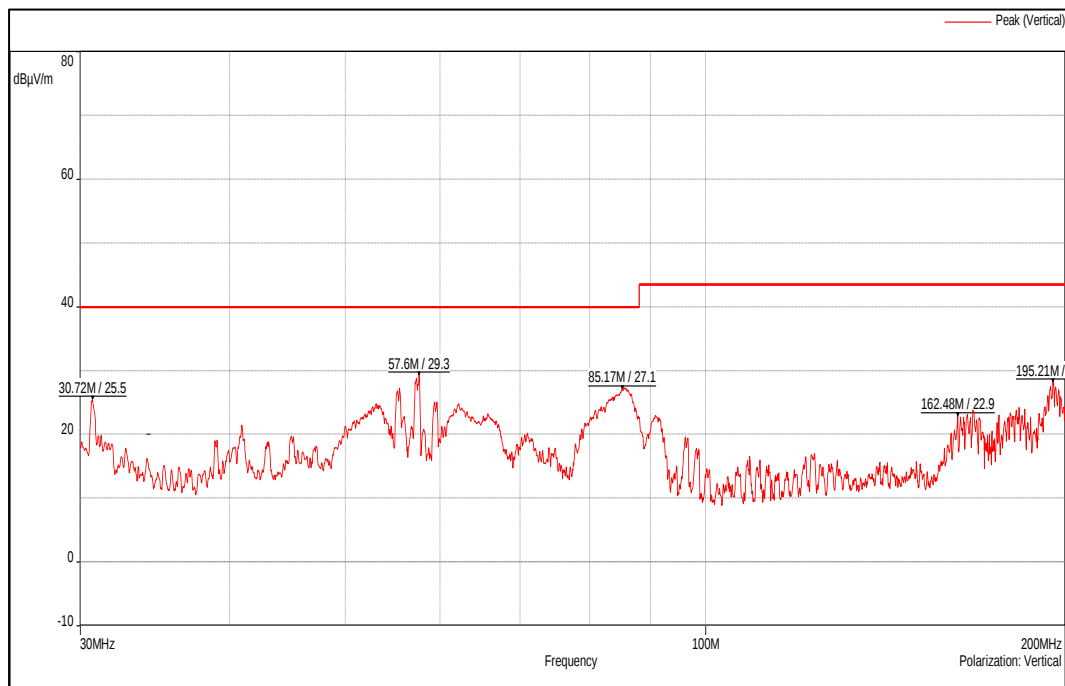
Test results for frequency range 9kHz – 30MHz

No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported.

Table 7: Test results for frequency range 30MHz – 200MHz

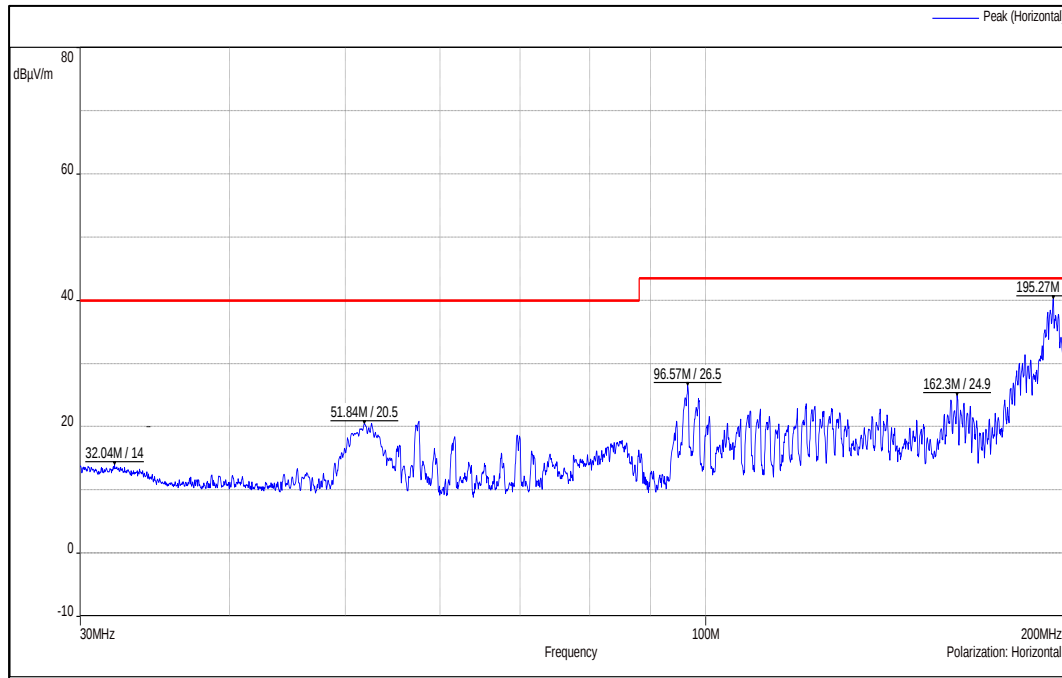
Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Vertical	30.72	25.50	40.00	-14.50
	57.60	29.30	40.00	-10.70
	85.17	27.10	40.00	-12.90
	162.48	22.90	43.50	-20.60
Horizontal	32.04	14.00	40.00	-26.00
	51.84	20.50	40.00	-19.50
	96.57	26.50	43.50	-17.00
	162.30	24.90	43.50	-18.60
	195.22*	28.17	43.50	-15.33

Note: * Indicates QP value reported



Channel Frequency 30MHz – 200MHz

Polarization Vertical



Channel Frequency 30MHz – 200MHz

Polarization Horizontal

Table 8: Test results for frequency range 200MHz – 1GHz

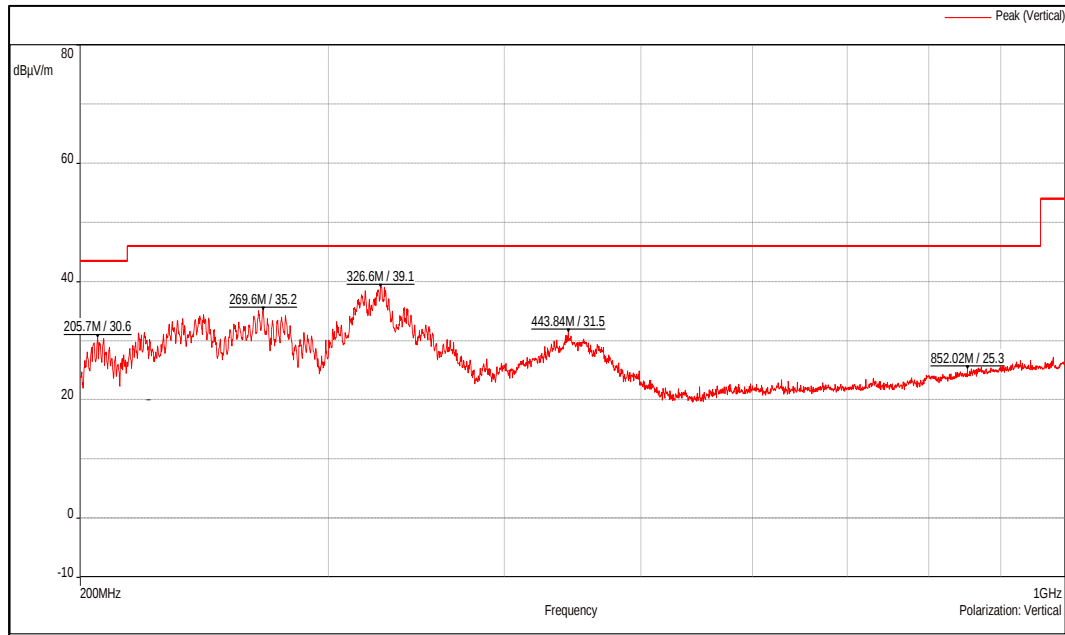
Antenna Polarization	Measured Frequency (MHz)	Measured Peak Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	205.70	25.50	43.50	-18.00
	269.60	29.30	46.00	-16.70
	326.60	27.10	46.00	-18.90
	443.84	22.90	46.00	-23.10
	852.02	25.30	46.00	-20.70
Horizontal	203.33*	30.82	43.50	-12.68
	244.70*	37.96	46.00	-8.04
	326.60*	35.29	46.00	-10.71
	443.09	34.90	46.00	-11.10
	855.77	25.60	46.00	-20.40

Note: * indicates the QP value reported.

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Test Report No.:

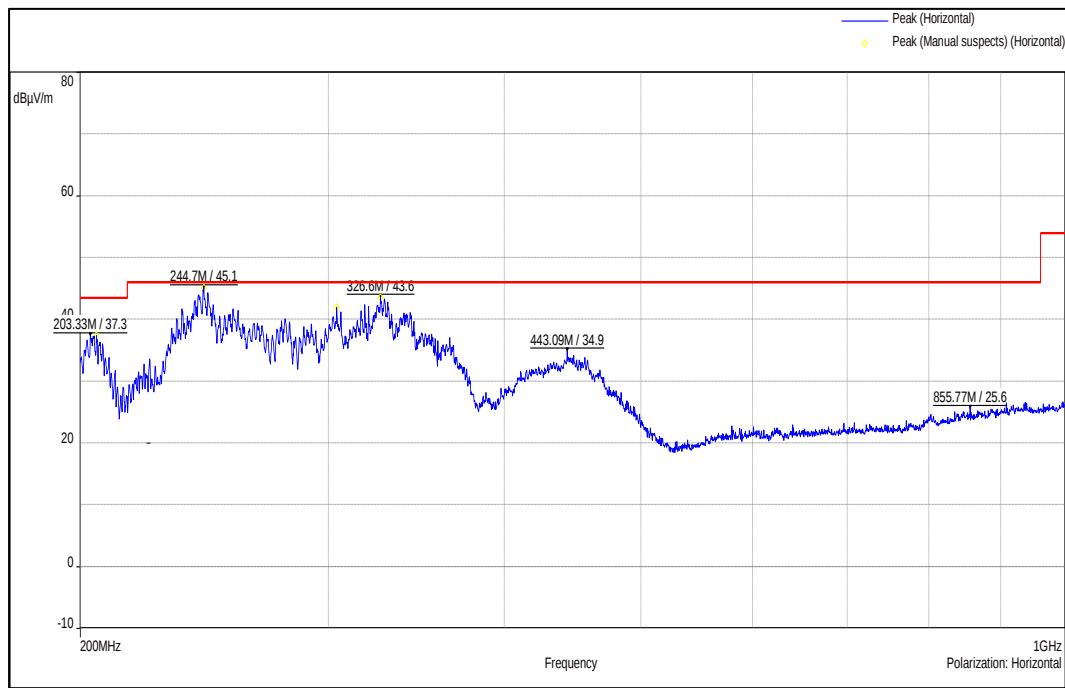
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Channel Frequency 200MHz – 1GHz

Polarization Vertical



Channel Frequency 200MHz – 1GHz

Polarization Horizontal

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Table 9: Test results for the frequencies above 1GHz:

Data Rate: 1Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Emission level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2402(Pk)	Vertical	102.00	-	-
	2402(Av)		100.23	-	-
	2390(Pk)		55.38	74*	-18.62
	2390(Av)		29.69	54*	-24.31
	4804(Pk)		49.25	74	-24.75
	4804(Av)		29.02	54	-24.98
	7206(Pk)		51.09	74	-22.91
	7206(Av)		42.08	54	-11.92
	2402(Pk)	Horizontal	100.69	-	-
	2402(Av)		98.96	-	-
	2390(Pk)		55.35	74*	-18.65
	2390(Av)		29.60	54*	-24.40
	4804(Pk)		41.08	74	-32.92
	4804(Av)		29.00	54	-25.00
	7206(Pk)		51.93	74	-22.07
	7206(Av)		42.98	54	-11.02
2440	2440(Pk)	Vertical	101.94	-	-
	2440(Av)		100.16	-	-
	4880(Pk)		41.11	74	-32.89
	4880(Av)		28.88	54	-25.12
	7320(Pk)		50.49	74	-23.51
	7320(Av)		40.30	54	-13.70
	2440(Pk)	Horizontal	100.18	-	-
	2440(Av)		98.39	-	-
	4880(Pk)		41.15	74	-32.85
	4880(Av)		28.85	54	-25.15
	7320(Pk)		50.44	74	-23.56
	7320(Av)		41.16	54	-12.84
2480	2480(Pk)	Vertical	101.30	-	-
	2480(Av)		99.54	-	-
	2483.5(Pk)		68.59	74*	-5.41
	2483.5(Av)		42.00	54*	-12.00
	4960(Pk)		41.12	74	-32.88
	4960(Av)		28.55	54	-25.45
	7440(Pk)		50.23	74	-23.77
	7440(Av)		40.10	54	-13.90
	2480(Pk)	Horizontal	101.40	-	-
	2480(Av)		99.61	-	-
	2483.5(Pk)		68.46	74*	-5.54
	2483.5(Av)		42.10	54*	-11.90
	4960(Pk)		40.84	74	-33.16
	4960(Av)		28.46	54	-25.54
	7440(Pk)		48.72	74	-25.28
	7440(Av)		37.53	54	-16.47

→ Fundamental Frequency

*→ Restricted Band edges

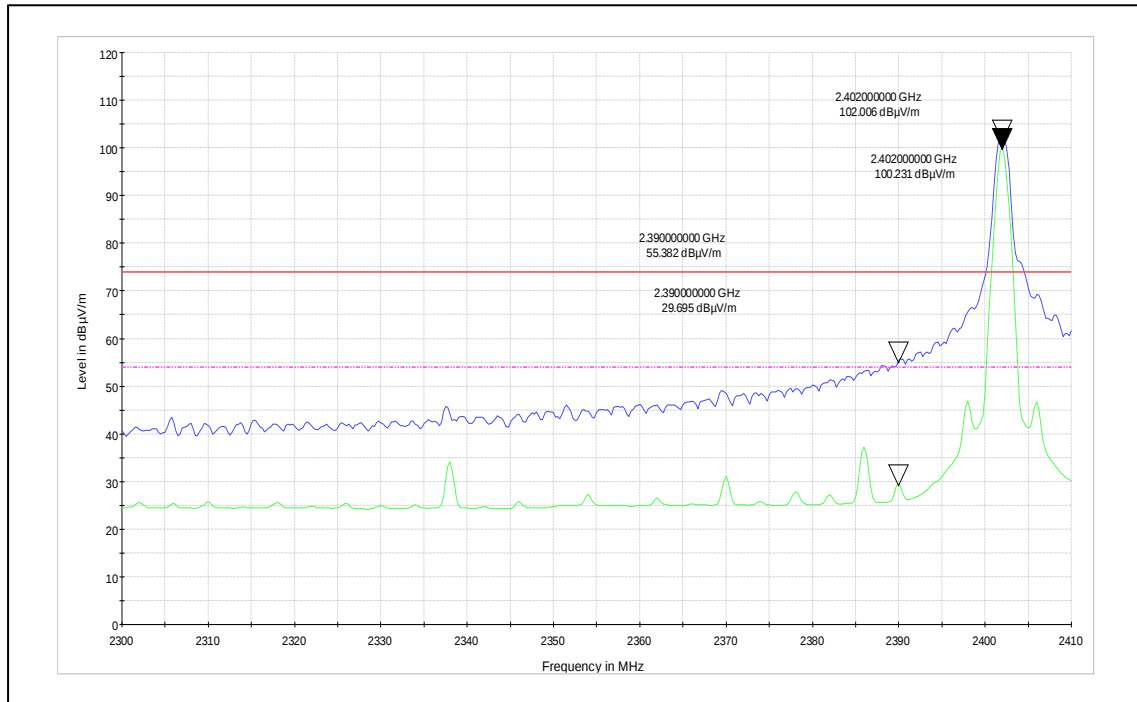
Pk: Peak Detector.

Av: Average Detect

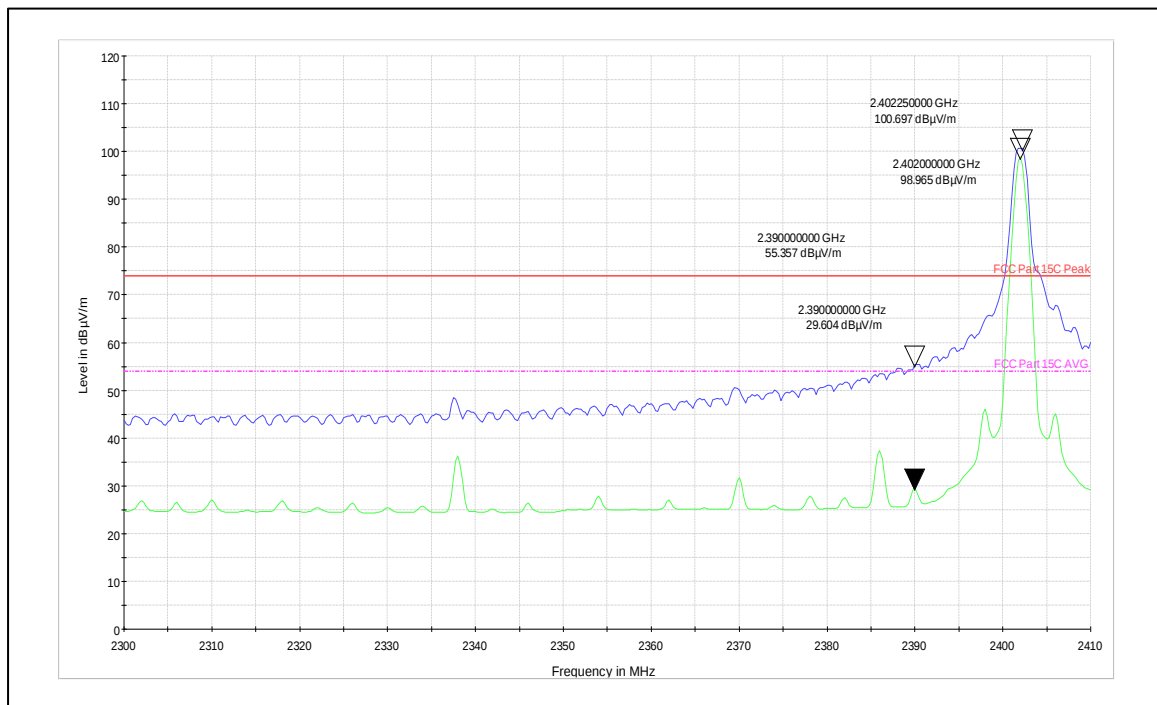
Worst Cases Plots:

Data Rate: 1Mbps

Channel Frequency: 2402MHz_Vertical Polarization



Channel Frequency: 2402MHz_Horizontal Polarization



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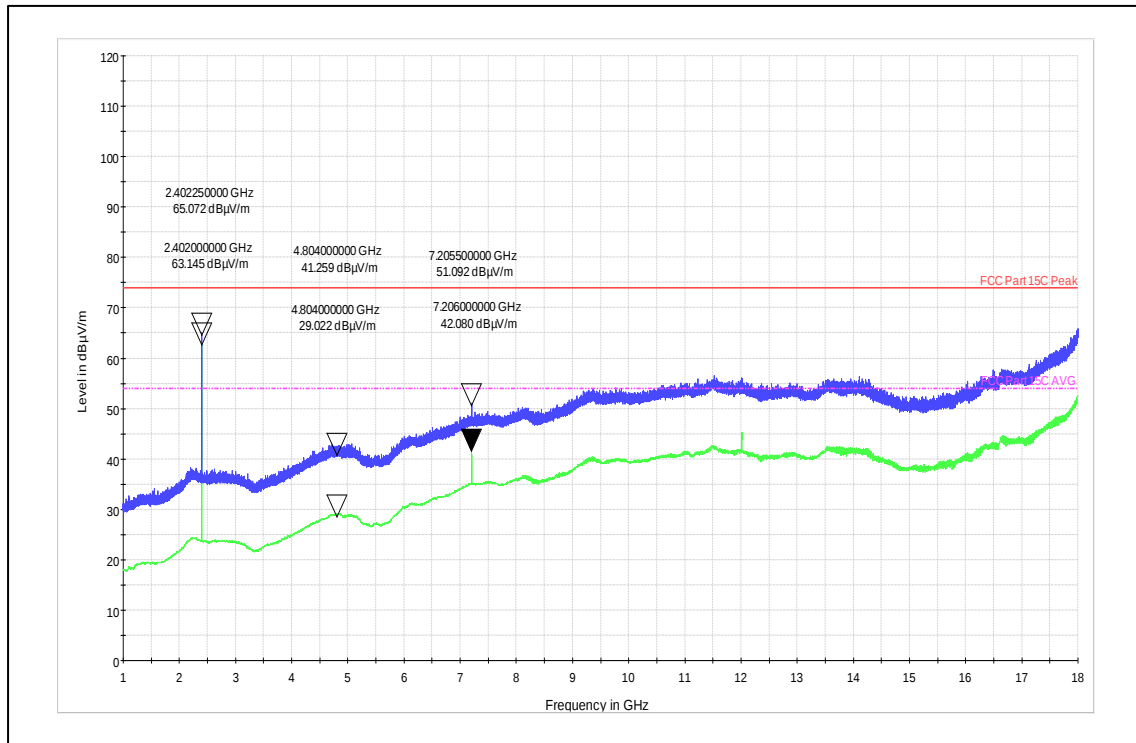
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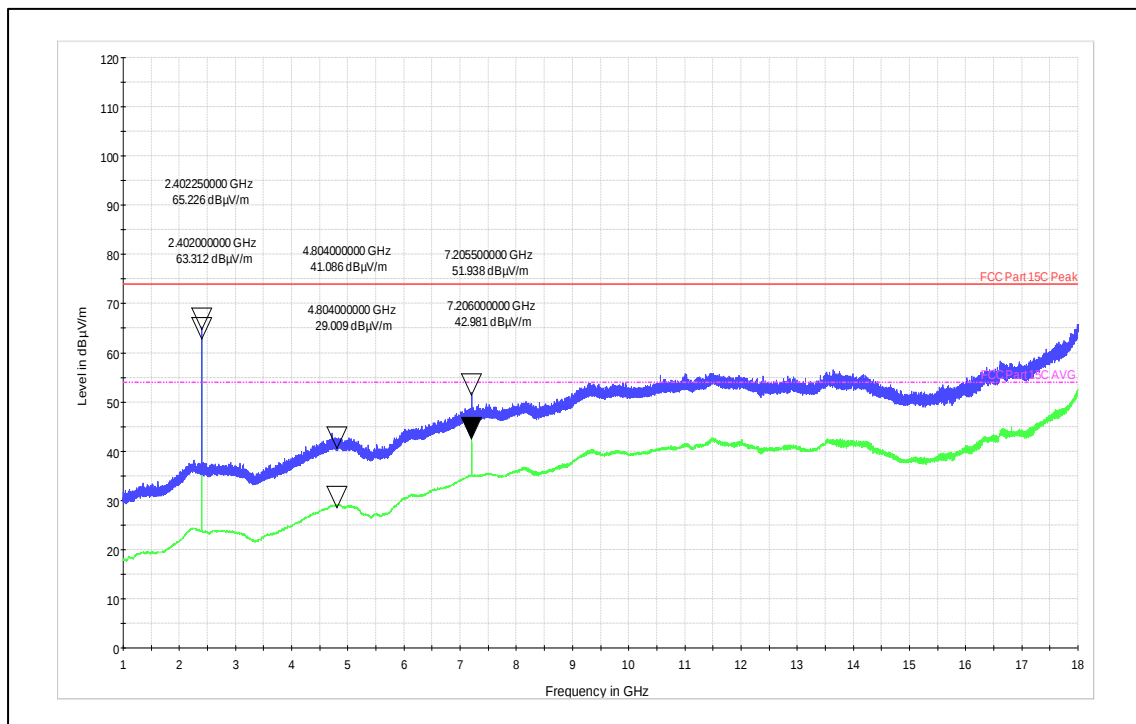
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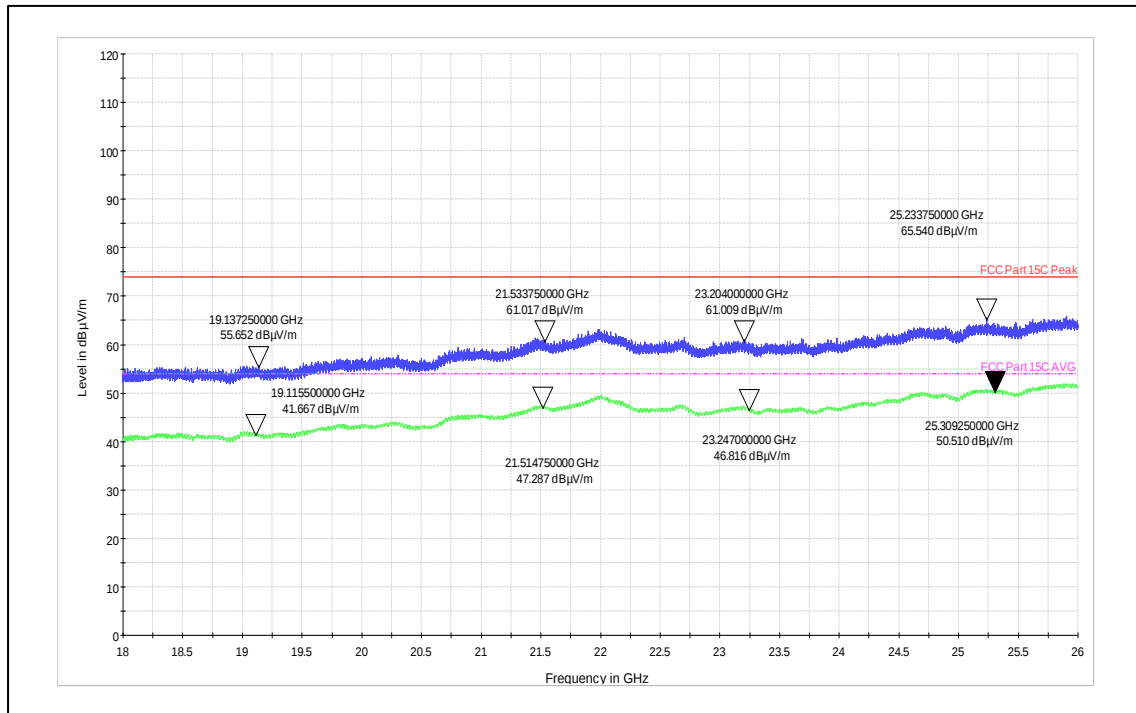
Channel Frequency: 2402MHz_Vertical Polarization



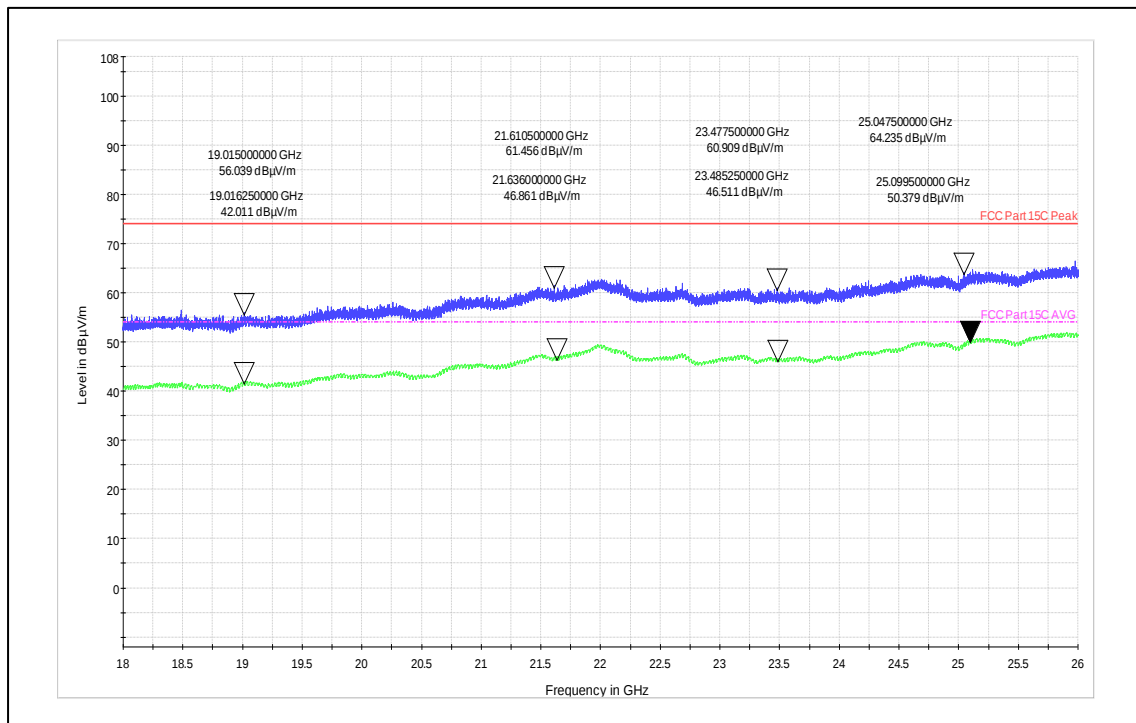
Channel Frequency: 2402MHz_Horizontal Polarization



Channel Frequency: 2402MHz_Vertical Polarization



Channel Frequency: 2402MHz_Horizontal Polarization



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7.6 Conducted spurious emission Test on AC Power lines

Result

Pass

Test Specification : FCC Part 15 Section 15.207
Test Method : ANSI C 63.10-2013
Testing Location : Screened room
Measurement Bandwidth : 9kHz
Frequency Range : 150kHz – 30MHz
Supply Voltage : 110VAC,60Hz
Test Method : Refer TEST METHODOLOGY

Table 10: Limits for Conducted power line emission.

Frequency of emission (MHz)	QP Limit (dBμV)	AV Limit (dBμV)
0.15 – 0.5	66 – 56*	56 – 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency

Test Conditions:

Temperature (Norm) = +24 °C Voltage = 110V AC (Through AC to DC Supply) Relative humidity: 64%

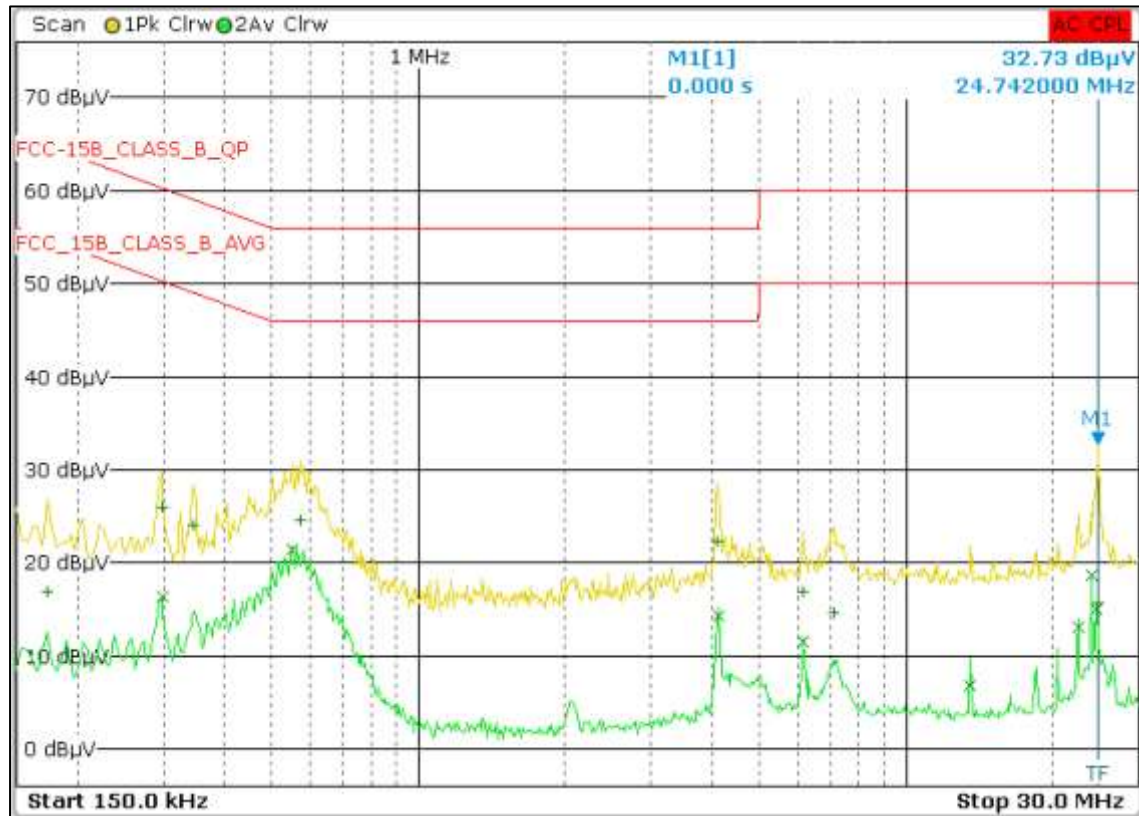
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Test results:

110VAC-60Hz-Line



Line-Graph

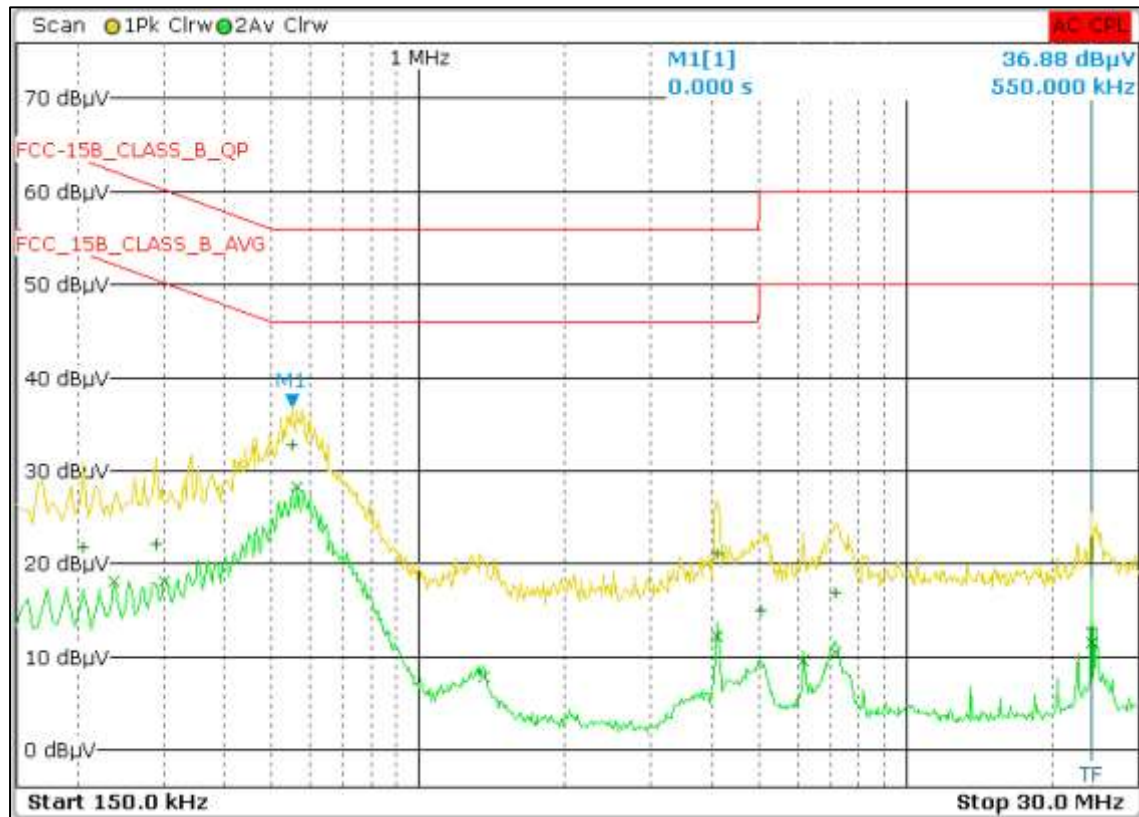
Trace	Frequency	Level (dBμV)	Phase	Detector	Delta Limit/dB
2	550.000000000 kHz	21.51		Average	-24.49
2	24.042000000 MHz	18.65		Average	-31.35
1	574.000000000 kHz	24.58		Quasi Peak	-31.42
2	4.114000000 MHz	14.23		Average	-31.77
1	4.102000000 MHz	22.33		Quasi Peak	-33.67
2	298.000000000 kHz	16.39		Average	-33.91
1	298.000000000 kHz	26.04		Quasi Peak	-34.26
1	346.000000000 kHz	24.07		Quasi Peak	-34.99
2	24.610000000 MHz	14.97		Average	-35.03
2	22.546000000 MHz	13.00		Average	-37.00
2	6.150000000 MHz	11.49		Average	-38.51
1	6.146000000 MHz	16.84		Quasi Peak	-43.16
2	13.558000000 MHz	6.74		Average	-43.26
1	24.742000000 MHz	15.72		Quasi Peak	-44.28
1	7.090000000 MHz	14.61		Quasi Peak	-45.39
1	174.000000000 kHz	16.83		Quasi Peak	-47.94

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110VAC-60Hz-Neutral:



Neutral Graph

Trace	Frequency	Level (dBμV)	Phase	Detector	Delta Limit/dB
2	566.000000000 kHz	28.32		Average	-17.68
1	550.000000000 kHz	32.82		Quasi Peak	-23.18
2	302.000000000 kHz	18.09		Average	-32.10
2	4.102000000 MHz	12.26		Average	-33.74
2	238.000000000 kHz	18.09		Average	-34.08
1	4.106000000 MHz	21.12		Quasi Peak	-34.88
2	1.358000000 MHz	7.92		Average	-38.08
1	290.000000000 kHz	22.08		Quasi Peak	-38.44
2	24.042000000 MHz	11.50		Average	-38.50
2	7.166000000 MHz	10.38		Average	-39.62
2	6.166000000 MHz	9.56		Average	-40.44
1	206.000000000 kHz	21.79		Quasi Peak	-41.58
1	7.166000000 MHz	16.98		Quasi Peak	-43.02
1	5.050000000 MHz	15.06		Quasi Peak	-44.94
1	24.042000000 MHz	13.08		Quasi Peak	-46.92

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*****End of test report*****