

Prüfbericht-Nr.: <i>Test report no.:</i>		IN23HNHD 001	Auftrags-Nr.: 146741372 0010 <i>Order no.:</i>		Seite 1 von 57 Page 1 of 57
Kunden-Referenz-Nr.: <i>Client reference no.:</i>		2390953	Auftragsdatum: 2022-12-01 <i>Order date:</i>		
Auftraggeber: <i>Client:</i>		Proxim Wireless Corporation 2114 Ringwood Avenue, San Jose, CA 95131			
Prüfgegenstand: <i>Test item:</i>		Stratum™ X5			
Bezeichnung <i>Identification</i>		SX5-1040A-US & SX5-1042A-US SX5-1040A-WD & SX5-1042A-WD			
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 15.247,15.205, 15.207 & 15.209 RSS 247 Issue 3 & RSS Gen Issue 5			
Wareneingangsdatum: <i>Date of sample receipt:</i>		2023-04-11			
Prüfmuster-Nr.: Serien -Nr.: <i>Test sample no:</i> <i>Serial no.:</i>		A003453731-003			
Prüfzeitraum: <i>Testing period:</i>		2023-04-24 - 2023-06-30			
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 IC Test Site Registration No: 27711 HVIN: Gigabit 5 squad			
Prüfergebnis*: <i>Test result*:</i>		Pass			
geprüft von: <i>tested by:</i>		genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2023-07-20		Ausstellatum: <i>Issue date:</i> 2023-09-19			
Stellung / Position:		M.V.Naveen Kumar Senior Engineer		Stellung / Position: Madhu K.N Assistant Manager	
Sonstiges / Other:		FCC ID: HZB-GIGA5 IC: 1856A-GIGA5			
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 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet					
* Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable 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 | <p>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.</p> <p>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><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></p> |
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| 3 | <p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben.</p> <p>Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i></p> <p><i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p> |
| 4 | <p>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.</p> <p><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></p> |

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TEST SUMMARY

Test Item	FCC	ISED	Result
Maximum conducted (Peak) output power	15.247 (b)(3)	RSS 247 Issue 3 Section 5.4(d)	Pass
Maximum Power Spectral Density	FCC 15.247(e)	RSS 247 Issue 3 Section 5.2(b)	Pass
DTS Bandwidth & 99% Bandwidth	FCC 15.247(a)(2)	RSS 247 Issue 3 Section 5.2(a) RSS Gen Issue 5 Section 6.7	Pass
Emissions in non-restricted frequency bands	15.247 (d)	RSS 247 Issue 3 Section 5.5	Pass
Spurious Radiated Emissions and Restricted Bands of Operation	15.247 (d) / FCC 15.209 / FCC 15.205	RSS-Gen Issue 5, Section 8.9 /8.10	Pass
AC Power lines Conducted emission	FCC 15.207	RSS Gen Issue 5 Section 8.8	Pass
Antenna Requirement	FCC 15.203	RSS Gen Issue 5 Section 6.8	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
IN23HNHD 001	01	Initial issue of report	2023-09-19

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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

NOTE:

Multiple Models:

The models SX5-UUVWY-ZZ differ as below for marketing purpose.

UU can be 2 digits defining product frequency range but with no specific meaning: 10 (5 GHz), 20 (6 GHz)

...

V can be 1 digit defining MIMO capacity(V): 2 (MIMO 2x2), 4 (MIMO 4x4)

W can be 1 digit defining beam Width: 0 (connectorized), 1 (10 degree), 2 (20 degree) ... 9 (90 degree)

Y can be 1 alphanumeric defining product type: A: All-purpose unit (Base Station (1 SU max) and Client), B: Base Station (unlimited SU) and Client, C: Client only

ZZ can be 2 alphanumeric defining country of operation: WD (World), US (USA)

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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	4.73 SP5	30.07.2024	Yearly	Radiated Spurious Emission
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	02.03.2024	Yearly	
Balun & Biconical Antenna	Schwarzbeck mess-elektronik	BBA 9106+VH BB 9124	9124-1117	-	05.05.2024	Yearly	
Log-Periodic Antenna	Schwarzbeck mess-elektronik	VUSLP 9111B	9111B-111	-	06.05.2024	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-01944	-	18.10.2023	Yearly	
EMI Test Receiver	Rohde & Schwarz	ESW44	101773	1.72.SP1	15.02.2024	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	Conducted Test Parameters
Spectrum Analyzer	Agilent	E4407B	US411927 72	A.14.07	27.12.2023	Yearly	
10dB Attenuator	H+S Electronics Pvt. Ltd	6810.17. A	770041	-	06.03.2024	Yearly	
Signal Analyzer	Rohde & Schwarz	FSV7	101644	3.40	03.02.2024	Yearly	
Open Switch & Control Unit	Rohde & Schwarz	OSP120 Incl. B157	OSP120-101323 & B157-100894	1.27.0.0	16.12.2023	Yearly	
Vector Signal Generator	Rohde & Schwarz	SMBV 100A	260789	4.15.125.49	03.02.2024	Yearly	
RF and microwave Signal Generator	Rohde & Schwarz	SMB 100A	108788	3.01.203.3 2	03.02.2024	Yearly	Conducted AC Power line Test
EMI Receiver	Rohde & Schwarz	ESR7	101133	3.48 SP3	29.07.2024	Yearly	
Two Line V-Network (LISN)	Rohde & Schwarz	ENV 216	100022	-	10.10.2023	Yearly	
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100811	-	12.07.2024	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

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

The Stratum™ X5 is an outdoor wireless product that supports 11ax Wi-Fi standard Qualcomm Chipset with high power supported with MU-MIMO, Wave 3.0, OFDMA, Seamless roaming with built in BLE and GPS module. It complies with 802.11ax, 4x4 MIMO technology with two dual band radio supported (one on board 5GHz radio plus one external 2.4/5/6GHz Radio provision) with PCIe3.0 and M.2 connectors with up to 5Gbps data rates, equipped with 2.5Gbps WAN & 1Gbps LAN ports. It Supports MU-MIMO and DL/UL-OFDMA modulations. With faster Ethernet data rate, more number of users can upload or download multiple packets at the same time. With narrower subcarrier spacing, longer symbol time, improved stability and data processing efficiency, the Stratum X5 can be used in Point to Point Network and Backhaul Solutions for Service Providers and Enterprises and Point to Multipoint Network with Last mile access for WISP, Mobility and Smart City Applications.

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
Operating Frequency Range		2402MHz to 2480MHz
No. of Channels		40
Channel Spacing		2MHz
Transmitter Power(dBm)		4dBm
Measured peak Radiated power (dBm)		2.78 @ 2Mbps Channel 2402MHz
Modulation		GFSK
Data Rates		1Mbps,2Mbps
Number of antennas		1
Antenna Gain		2dBi
Antenna Type		PCB Antenna
Supply Voltage to Product		36-57V DC to EUT & 110-230V AC to PoE
Environmental conditions	Storage(°C)	-50°C to 70°C
	Operating(°C)	-40°C to 60°C
EUT Dimension(L x W x H) in mm		SX5-1042A_ 371mm x 371mm x 97mm SX5-1040A_ 250mm x 220mm x 62mm

***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: v1.0

Hardware Name: GIGABIT MB PCB P/N: 170-00028

Software Version: 4.1.2

Software Name: nRF Connect provided by the Module manufacturer

4.3 Special Accessories and Auxiliary Equipment

Model Name & Model Number	Power Adapter Ratings
Gigabit PoE Injector RP026-5601100YG/Proxim 400-00031	Input: 100-240V~50/60Hz 1.5A Max Output: 56.0VDC 1.1A 61.6W +(3,4,5,6) pins, -(1,2,7,8) pins

4.4 Countermeasures to achieve EMC Compliance

- None

4.5 List of frequencies

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
2402 – 2483.5 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 Centre frequencies

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Channel used for BLE testing.

Channel low: 2402MHz

Channel mid: 2440MHz

Channel high : 2480MHz

4.6 TUV Sample Identification

1. TUV Sample Identification number: A003453731-003– Radiated & Conducted test Sample.

4.7 Report Reference

SL. No	Radio Protocol	Report No
1	BLE	This Report (IN23HNHD 001)
2	Wi-Fi 5GHz (UNII-1 & UNII-3)	IN23HH4B 001

5 Operational Description

The Stratum™ X5 is a highly efficient radio endpoint that delivers gigabit-plus throughput in both point-to-point and multipoint wide area network configurations.

Able to operate in MIMO 4x4, with either integrated or external antenna (software switchable on some variant), the Stratum™ X5 is ideally suited to high-capacity backhaul, high-resolution video surveillance, or high-density multipoint deployments.

Powered by Proxim WOPR® (Wireless Outdoor Router Protocol), managed via web GUI, CLI, Bluetooth-enabled Proxim BlueConnect™ and SNMP for ProximVision® Advanced, this high-speed platform offers advanced Quality of Service, granular service level management, and very secure networking.

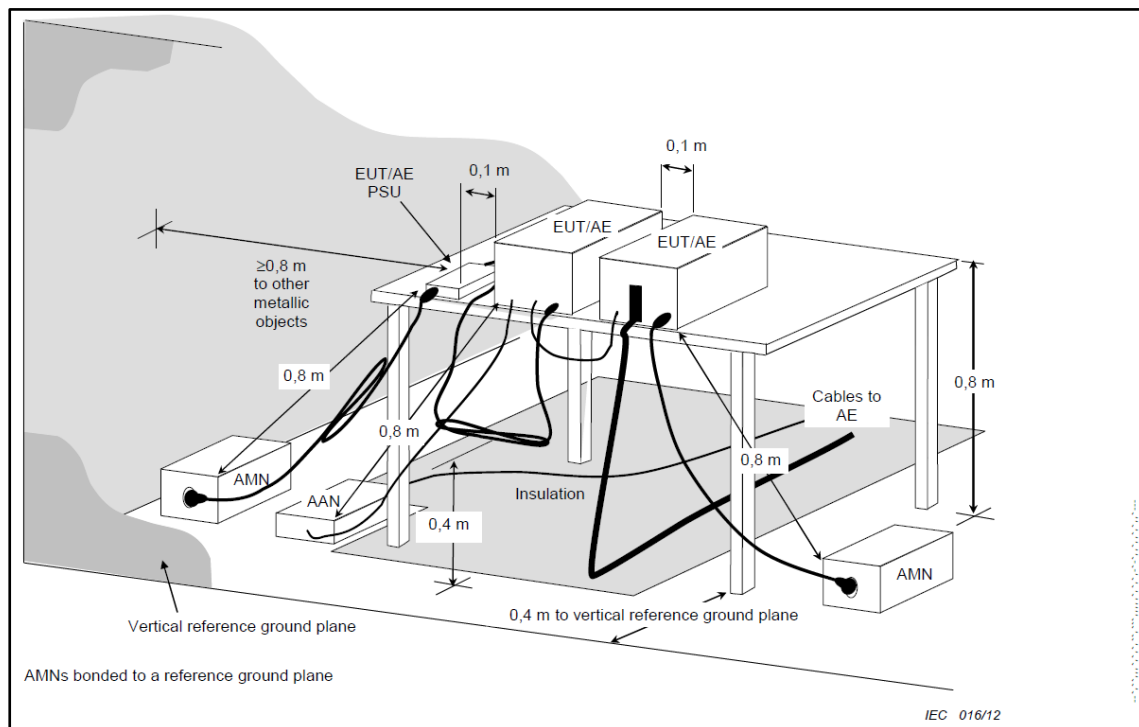
6 TEST METHODOLOGY

6.1 AC Power lines Conducted emission

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

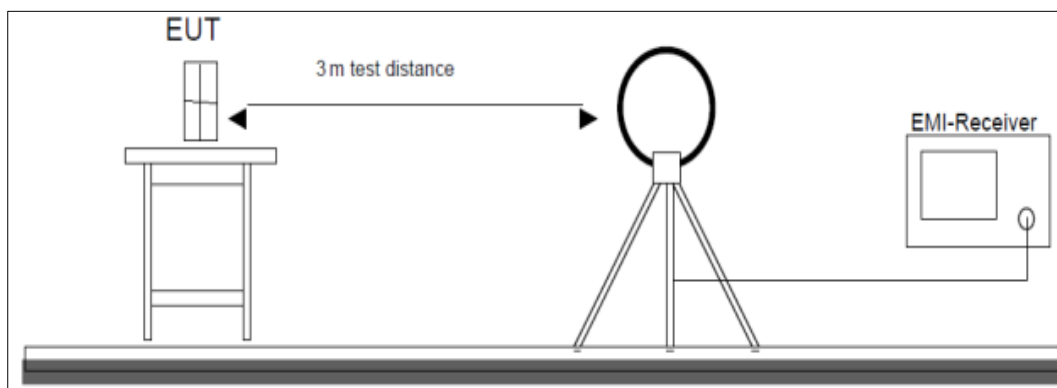


Figure 1: Frequency Range 9 kHz- 30 MHz

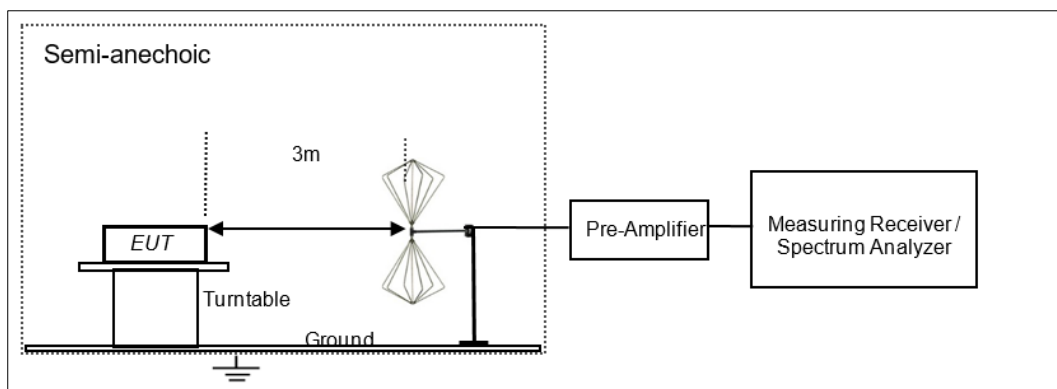


Figure 2: Frequency Range 30 MHz – 200 MHz

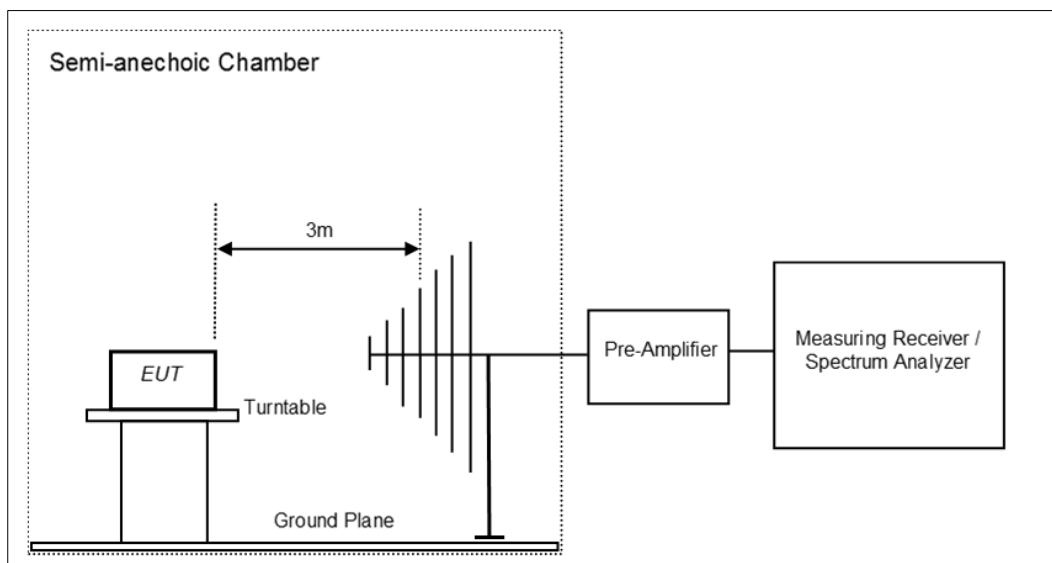


Figure 3: Frequency Range 200 MHz - 1GHz

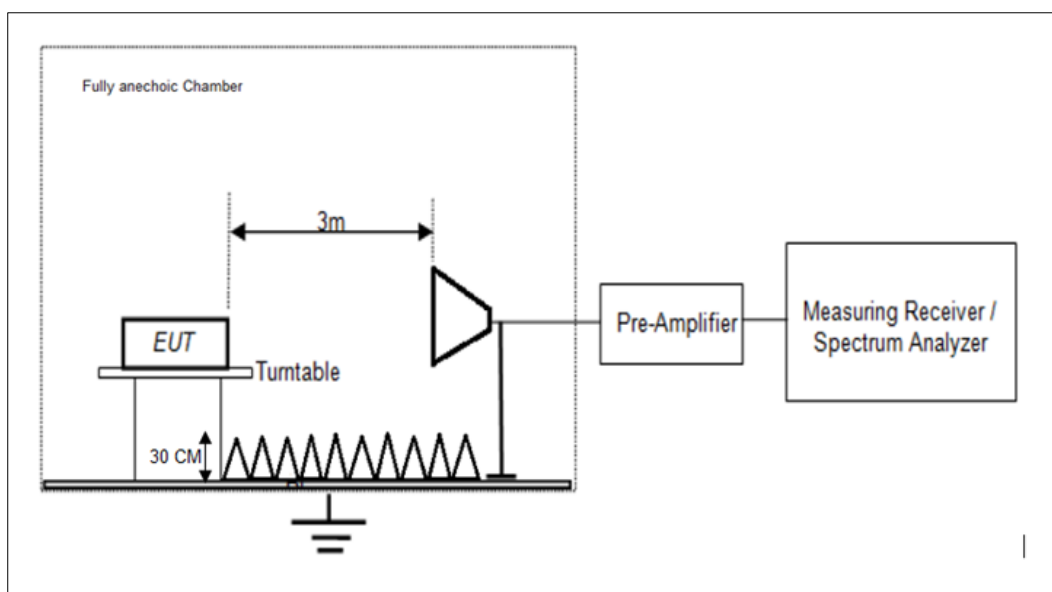


Figure 4: Frequency Range above 1 GHz

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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)/ RSS 247 Issue 3 5.4 (d)
Test Method	Subclause 11.9.1.1 of ANSI C63.10
Measurement Bandwidth	1MHz
Detector	Peak
Port of testing	Conducted mode
Requirement	Power ≤ 1 W (30 dBm) & e.i.r.p ≤ 4 W (36dBm)

Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C Voltage = 56VDC through POE Injector Relative humidity: 65%

KDB Guidelines applied:

Measurements were made as per section 8.3.1.1 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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Test results:

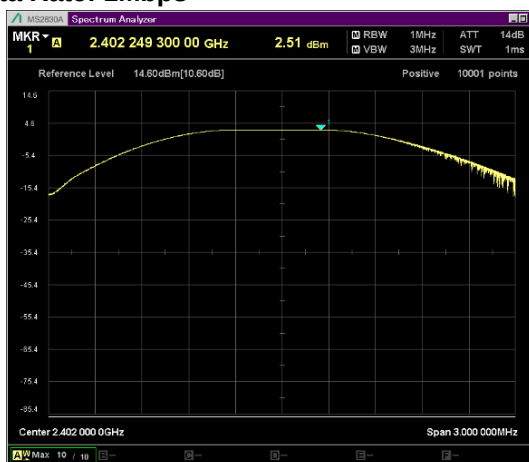
Note:

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) + Cable loss (6dB)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 2 dBi

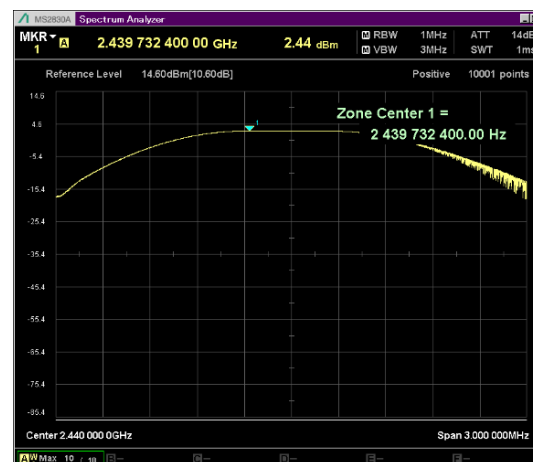
Data Rate Mbps	Channel Frequency (MHz)	Measured Peak Power (dBm)	Measured e.i.r.p (dBm)	Limit Power (dBm)	Limit e.i.r.p (dBm)
1	2402	2.51	4.51	30	36
	2440	2.44	4.44	30	36
	2480	2.17	4.17	30	36
2	2402	2.78	4.78	30	36
	2440	2.66	4.66	30	36
	2480	2.39	4.39	30	36

Test Plots:

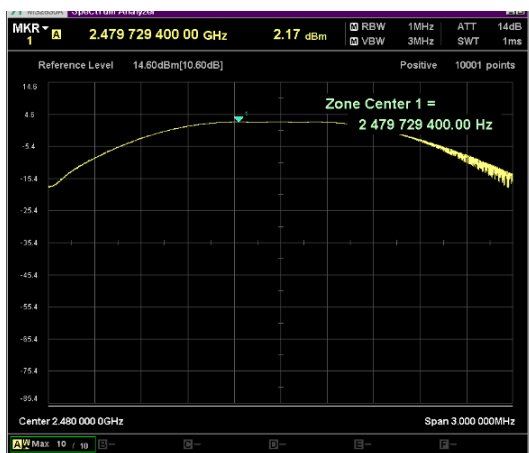
Data Rate: 1Mbps



Channel frequency: 2402MHz

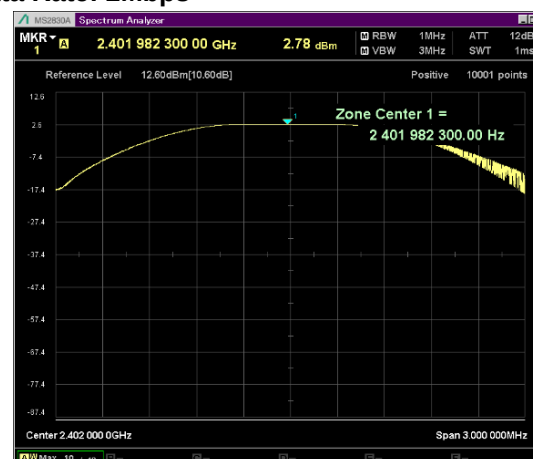


Channel frequency: 2440MHz



Channel frequency: 2480MHz

Data Rate: 2Mbps

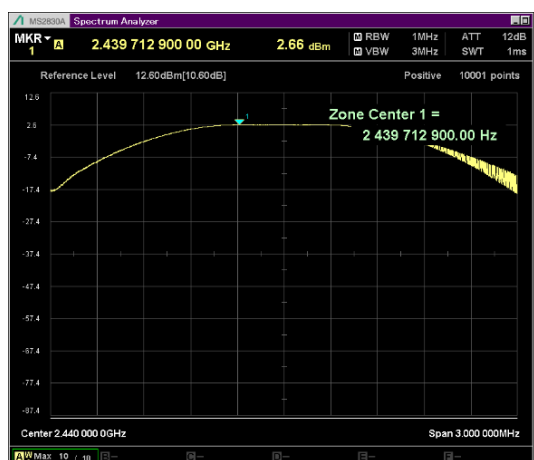


Channel frequency: 2402MHz

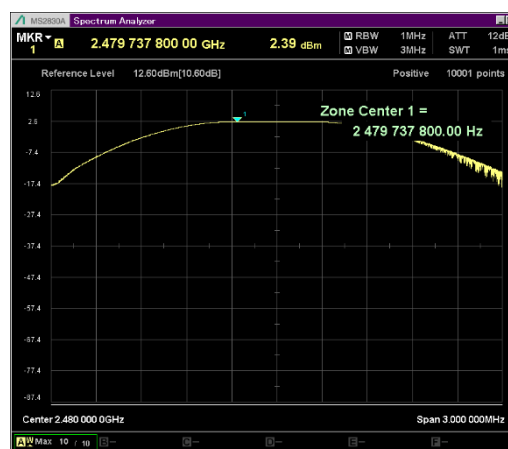
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Channel frequency: 2440MHz



Channel frequency: 2480MHz

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7.2 DTS Bandwidth & 99% Bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (2)/ RSS 247 Issue 3 Section 5.2(a)/ RSS Gen Issue 5 Section 6.7
Test Method	Subclause 11.8.2 of ANSI C63.10
Measurement Bandwidth	100 kHz for DTS Bandwidth 1% to 5% of OBW
Detector	Peak
Port of testing	Conducted mode
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 Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C Voltage = 56VDC through POE Injector 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:

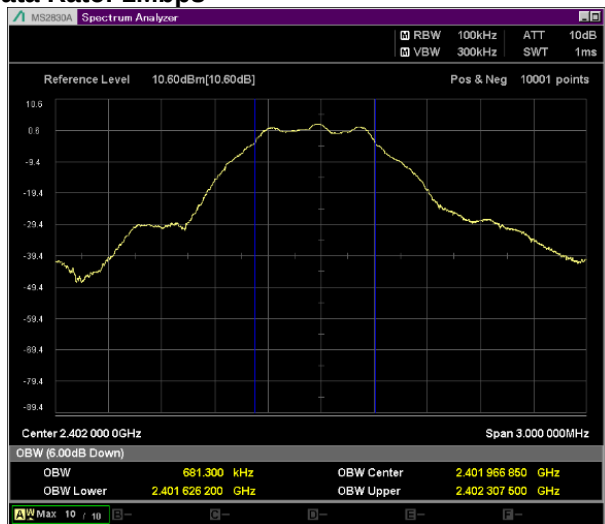
1. All the losses are included during measurement and final values are mentioned in the test report.
2. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence directional gain of the single antenna is 2 dBi.

Data Rate (Mbps)	Channel Frequency (MHz)	Measured 99% Bandwidth (MHz)	Measured 6dB Bandwidth (MHz)	Limit (MHz)
1	2402	1.024	0.681	0.5
	2440	1.022	0.669	0.5
	2480	1.019	0.667	0.5
2	2402	1.02	0.665	0.5
	2440	1.013	0.655	0.5
	2480	1.028	0.657	0.5

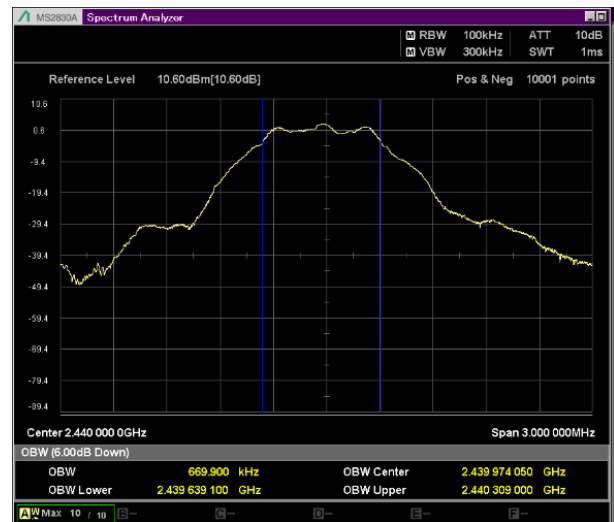
Test Plots:

DTS Bandwidth:

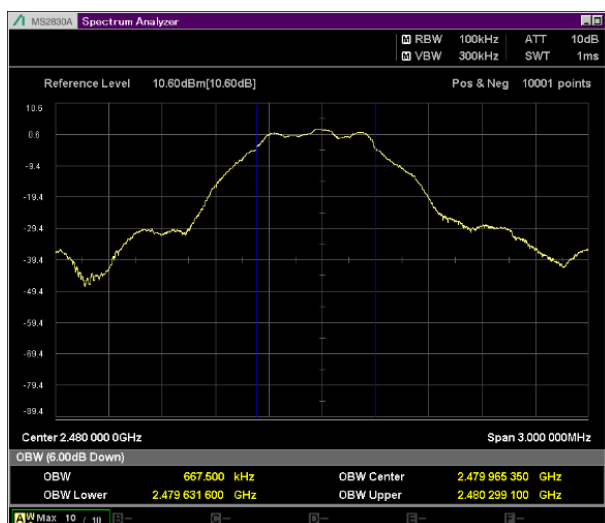
Data Rate: 1Mbps



Channel frequency: 2402MHz

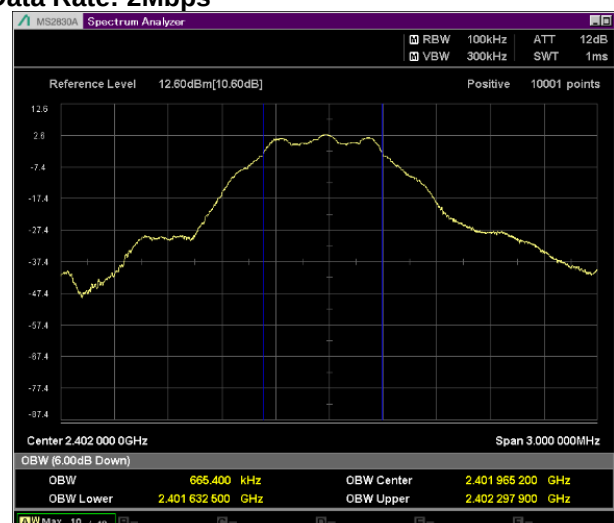


Channel frequency: 2440MHz

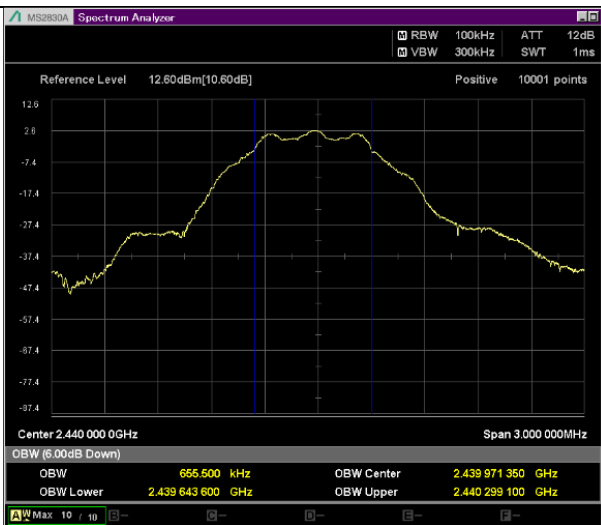


Channel frequency: 2480MHz

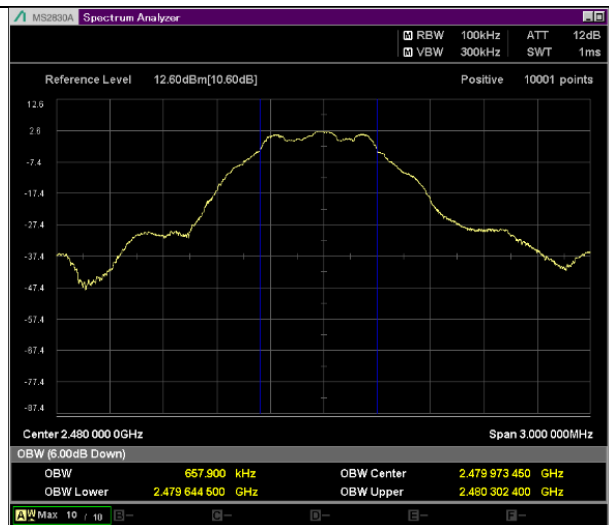
Data Rate: 2Mbps



Channel frequency: 2402MHz



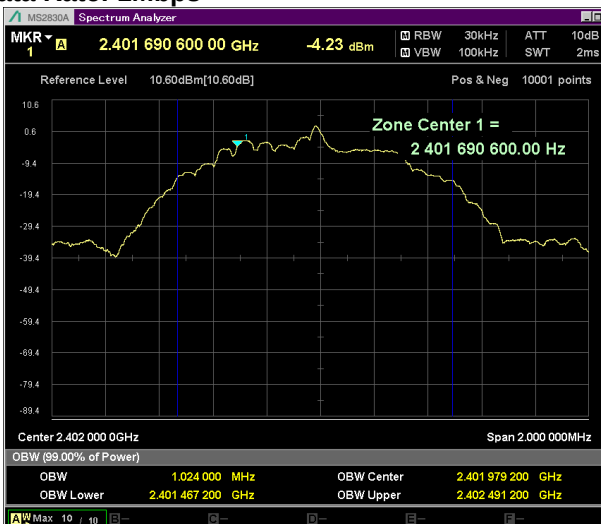
Channel frequency: 2440MHz



Channel frequency: 2480MHz

99% Bandwidth:

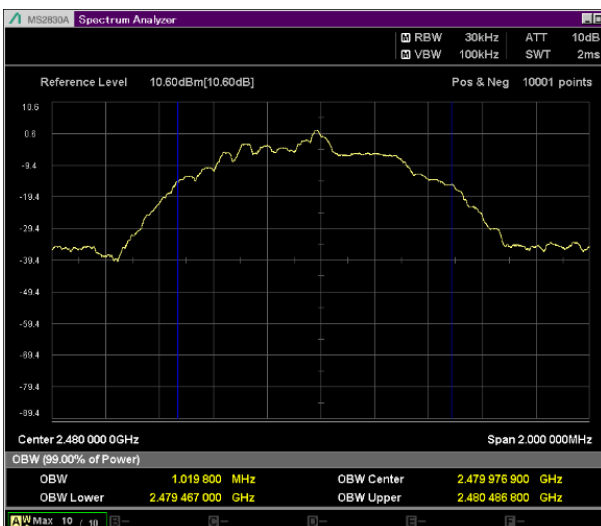
Data Rate: 1Mbps



Channel frequency: 2402MHz



Channel frequency: 2440MHz



Channel frequency: 2480MHz

Data Rate: 2Mbps

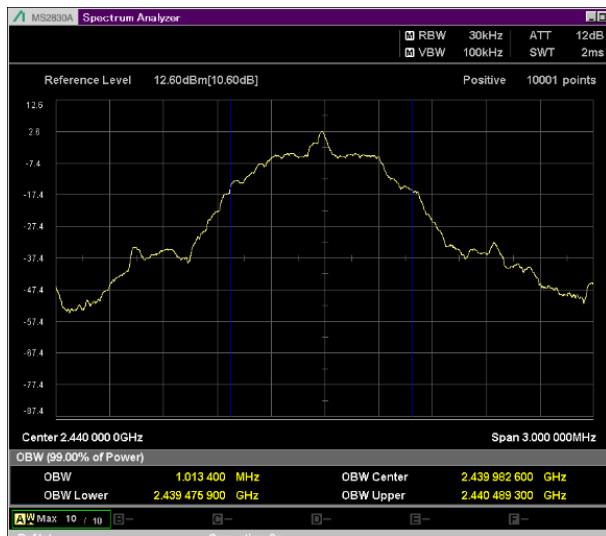


Channel frequency: 2402MHz

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Channel frequency: 2440MHz



Channel frequency: 2480MHz

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7.3 Power Spectral Density

Result

Pass

Test Specification	FCC Part 15 Subpart C Section 15.247 (e)/RSS 247 Issue 3 Section 5.2(b)
Test Method	Subclause 11.10.2 of ANSI C63.10
Measurement Bandwidth	100 kHz
Detector	Peak
Port of testing	Conducted mode
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 Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C Voltage = 56VDC through POE Injector 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:

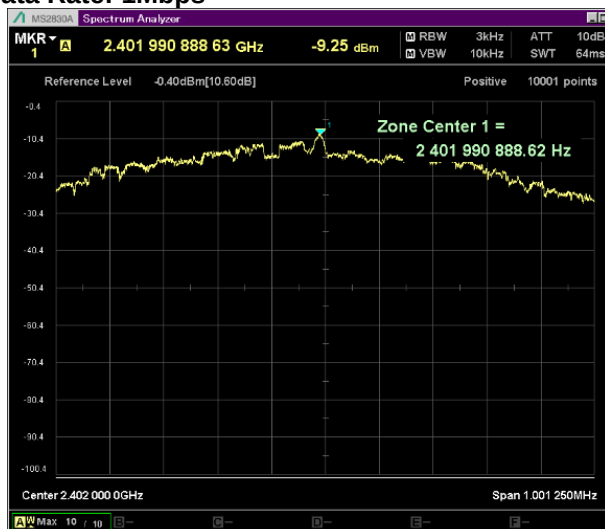
Note:

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

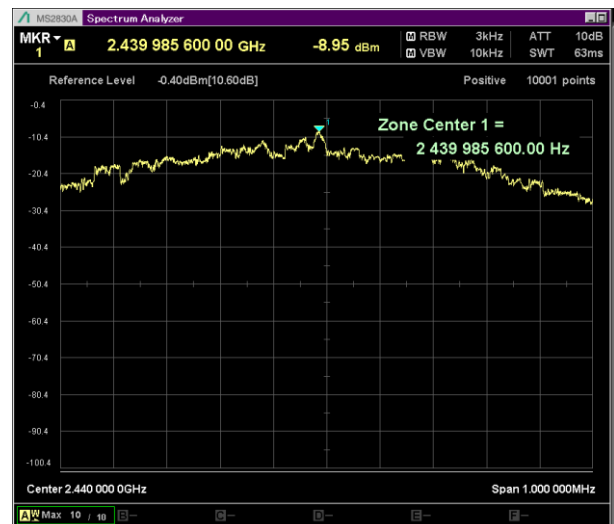
Data Rate	Channel Frequency (MHz)	Measured PSD (dBm/kHz)	Limit PSD (dBm/kHz)	Margin (dB)
1	2402	-9.25	8.00	-17.25
	2440	-8.95	8.00	-16.95
	2480	-9.94	8.00	-17.94
2	2402	-9.03	8.00	-17.03
	2440	-9.32	8.00	-17.32
	2480	-10.13	8.00	-18.13

Test Plots:

Data Rate: 1Mbps



Channel frequency: 2402MHz



Channel frequency: 2440MHz



Channel frequency: 2480MHz

Data Rate: 2Mbps

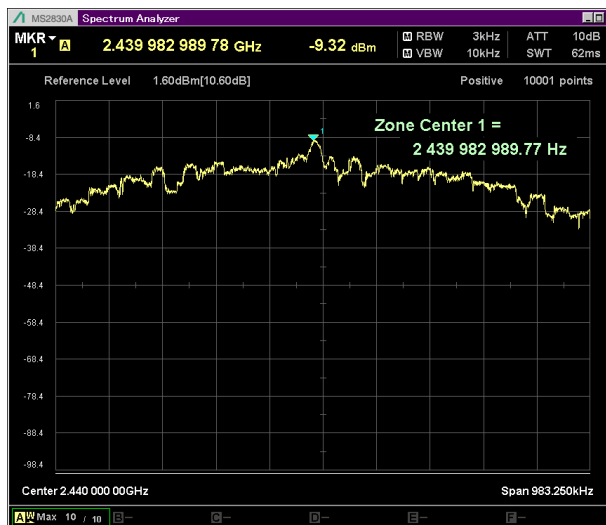


Channel frequency: 2402MHz

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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	Conducted mode
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 Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C Voltage = 56VDC through POE Injector 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:

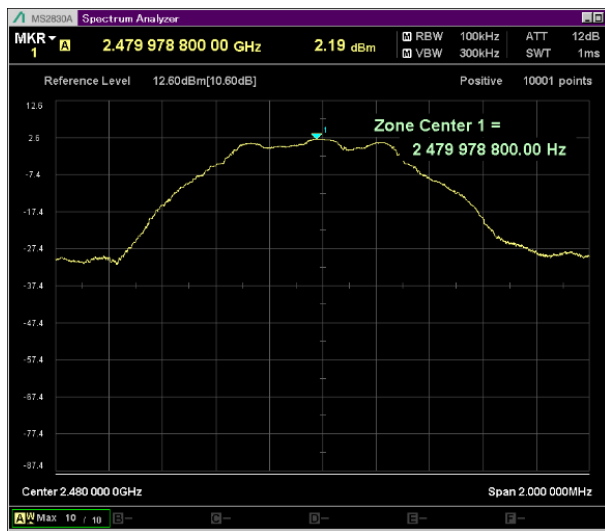
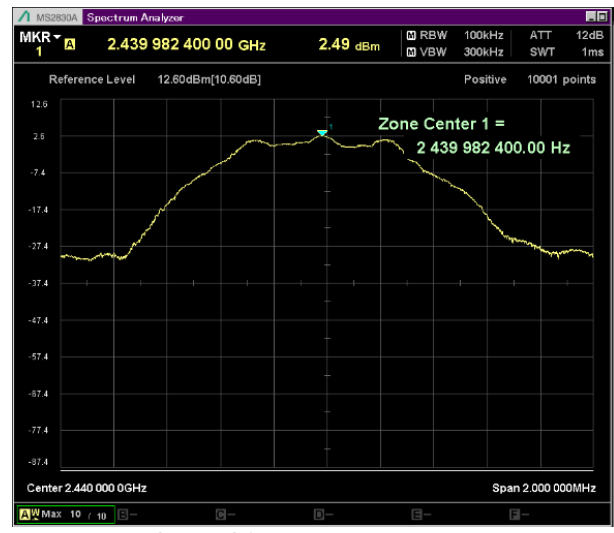
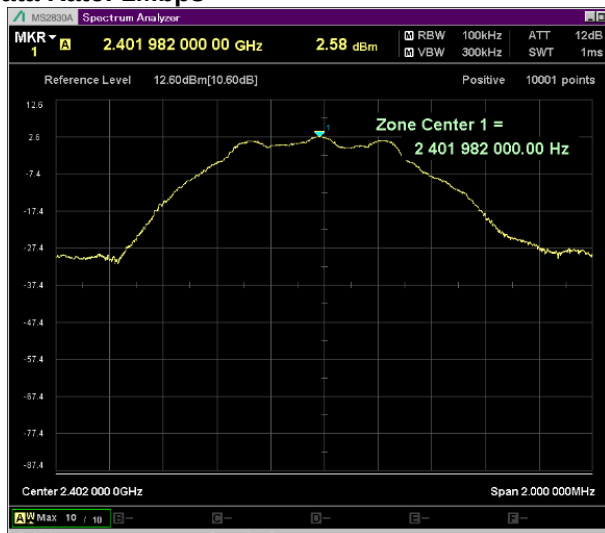
1. All the losses are included during measurement and final values are mentioned in the test report

Band edge

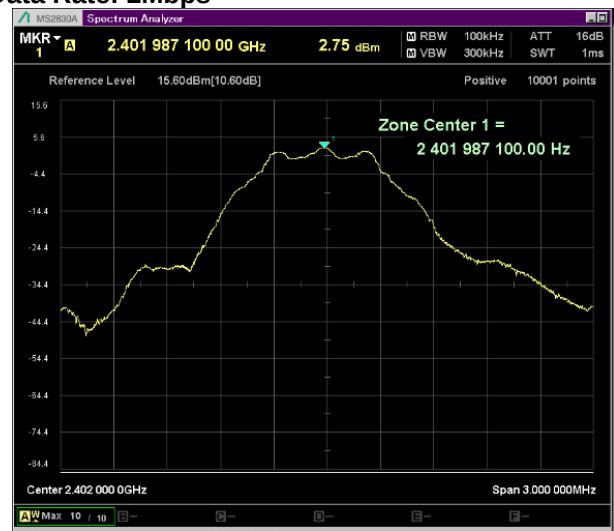
Data Rate (Mbps)	Channel Frequency (MHz)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
1	2402	2390	-54.85	2.58	-57.43	-20
	2480	2483.5	-49.64	2.19	-51.83	-20
2	2402	2390	-55.43	2.75	-58.18	-20
	2480	2483.5	-49.64	2.19	-51.83	-20

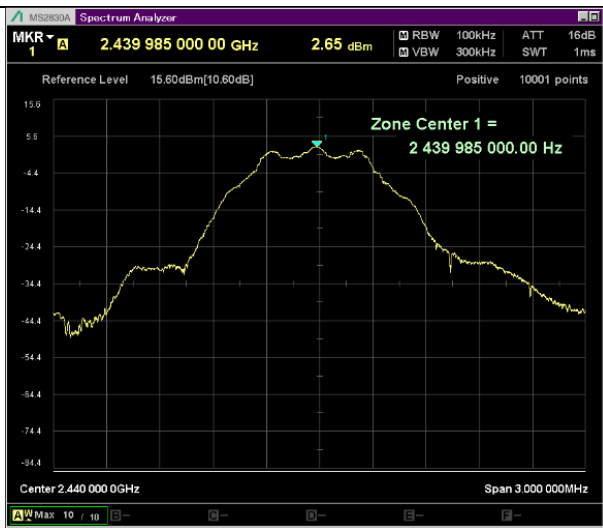
Reference Plots:

Data Rate: 1Mbps

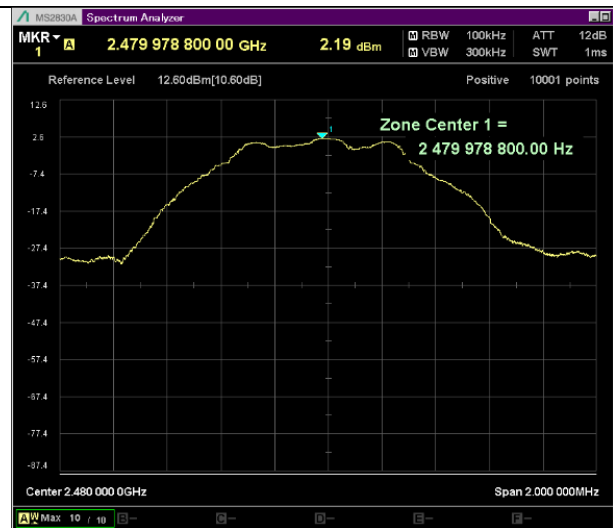


Data Rate: 2Mbps





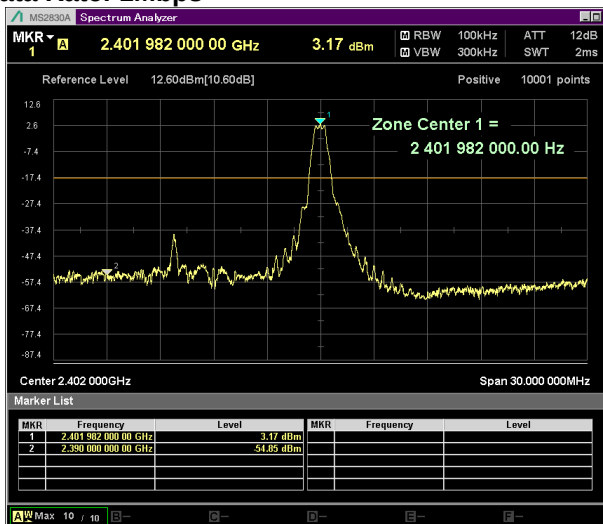
Channel frequency: 2440MHz



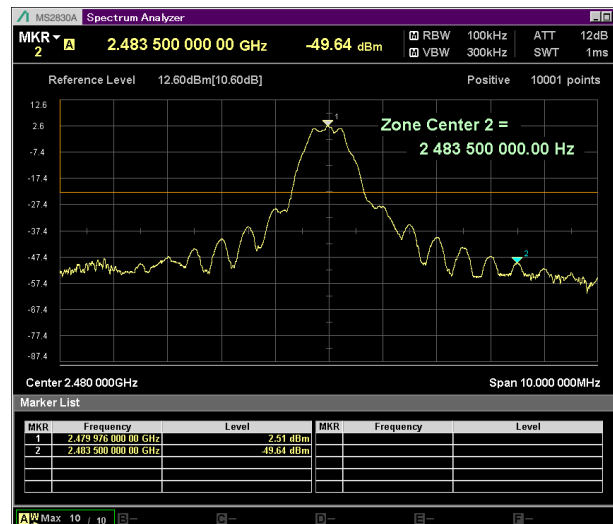
Channel frequency: 2480MHz

Bandedge Plots:

Data Rate: 1Mbps

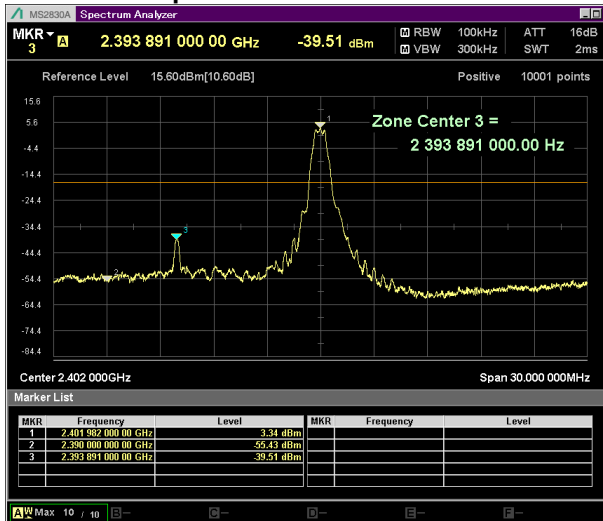


Channel frequency: 2402MHz

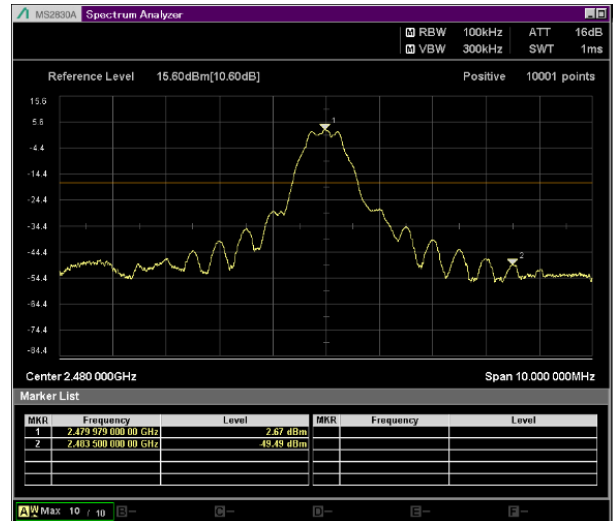


Channel frequency: 2480MHz

Data Rate: 2Mbps



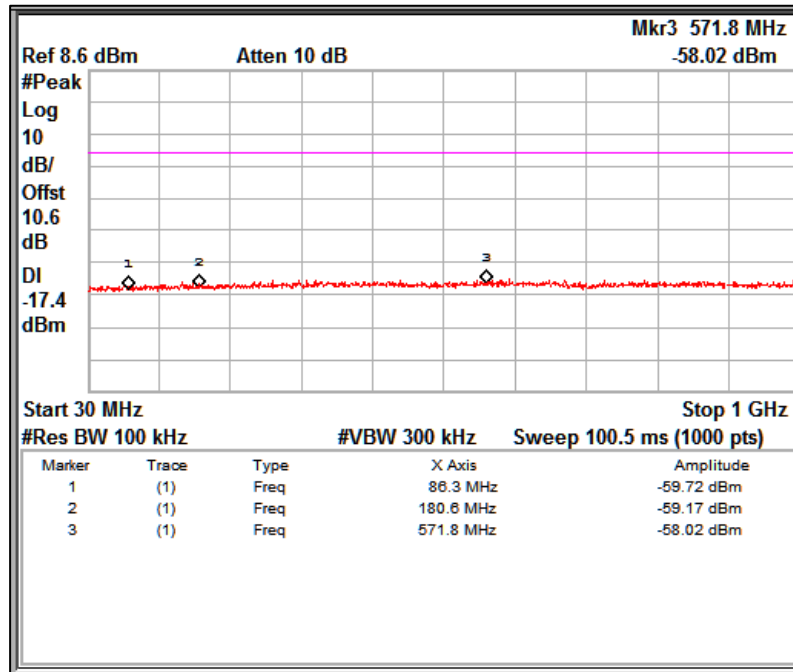
Channel frequency: 2402MHz



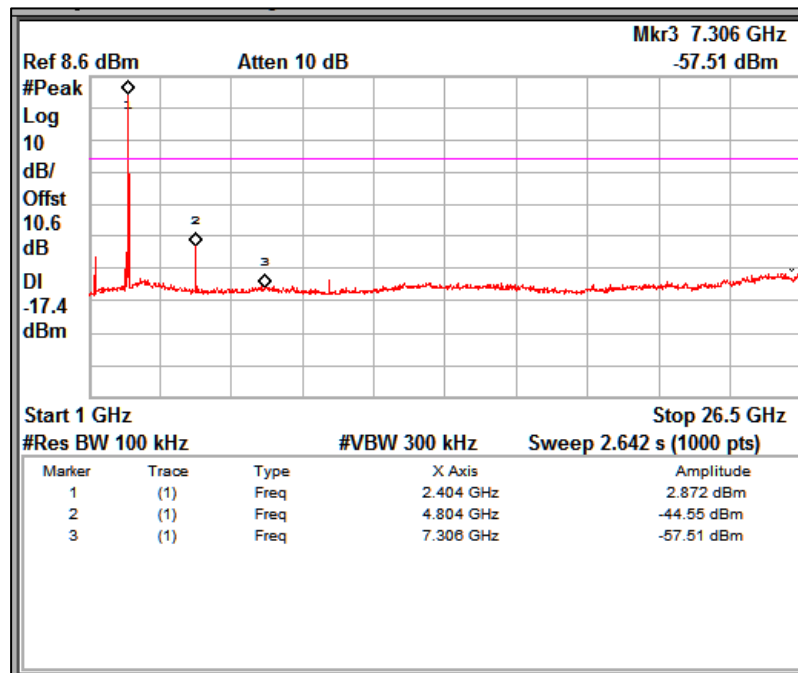
Channel frequency: 2480MHz

7.4.1 Out-Of-Band Emissions

Data Rate: 1Mbps



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

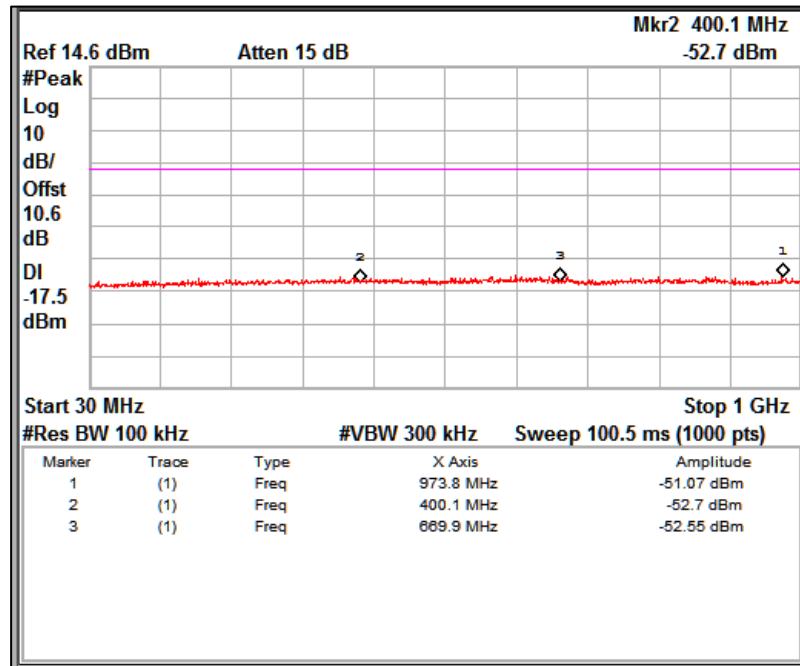


Channel Frequency: 2402 MHz Frequency Range 1 GHz to 26.5 GHz

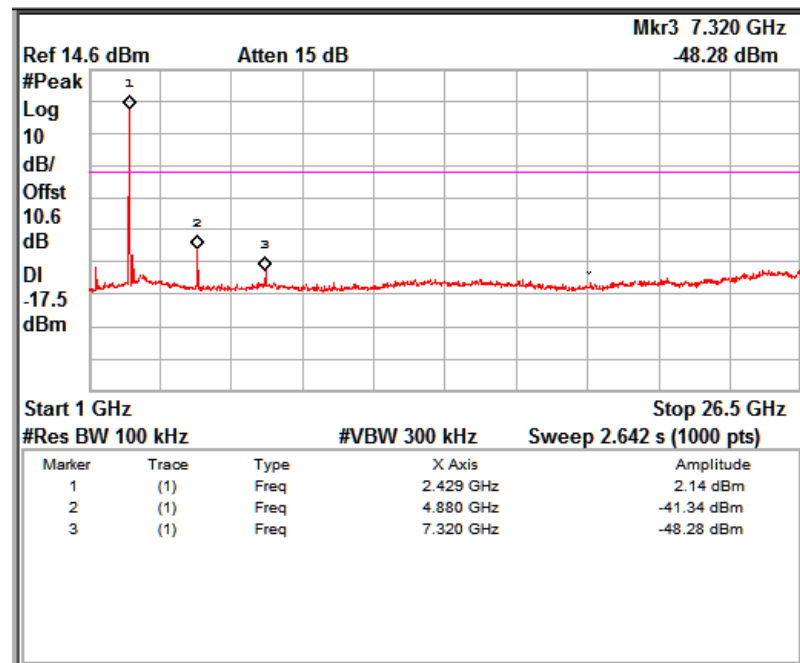
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Channel Frequency: 2440MHz Frequency Range 30MHz – 200MHz

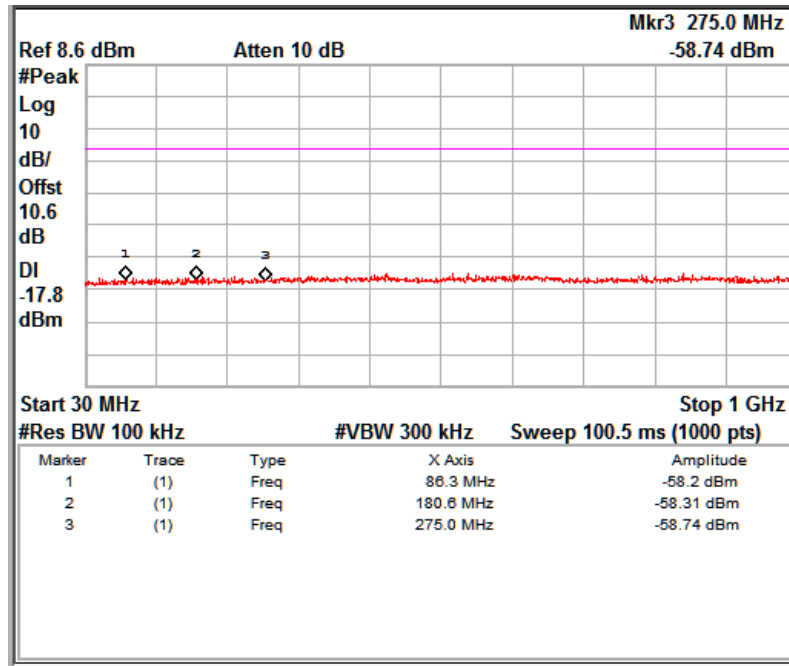


Channel Frequency: 2440MH Frequency Range: 1GHz – 26.5GHz

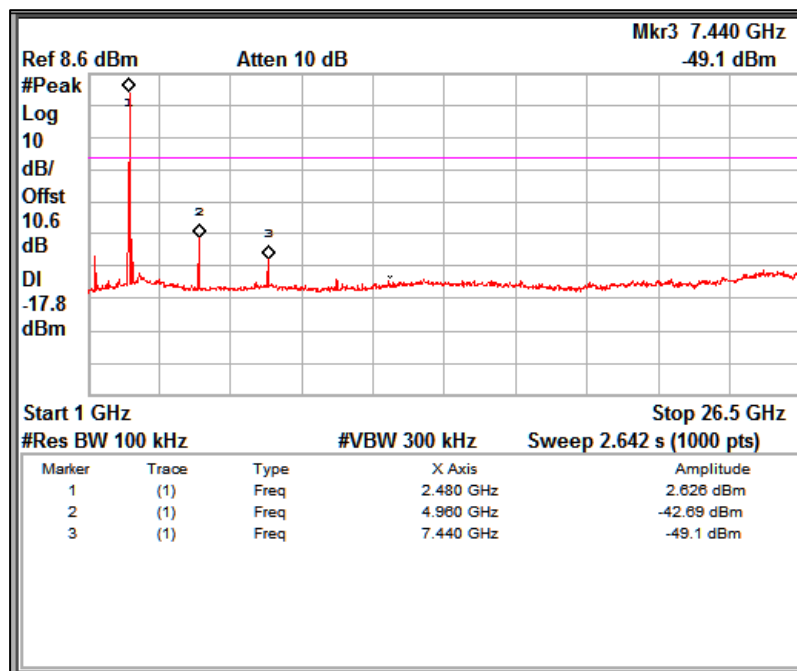
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Channel Frequency: 2480MHz Frequency Range 30MHz – 1GHz



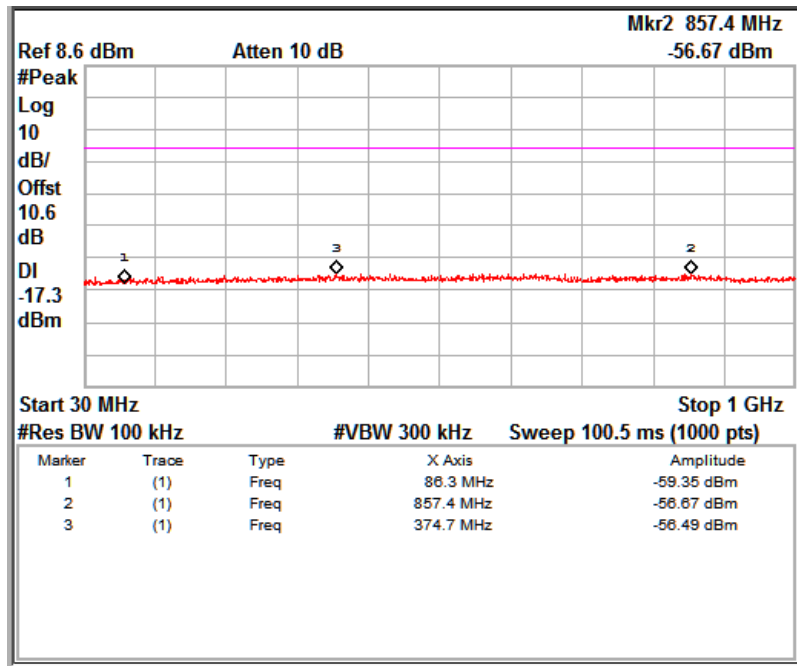
Channel Frequency: 2480MHz Frequency Range: 1GHz – 26.5GHz

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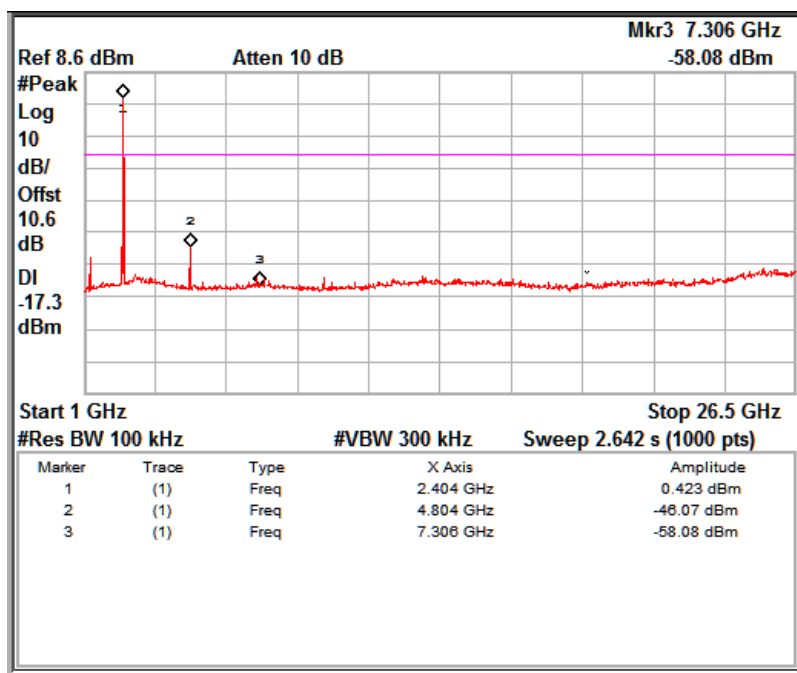
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Data Rate: 2Mbps



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

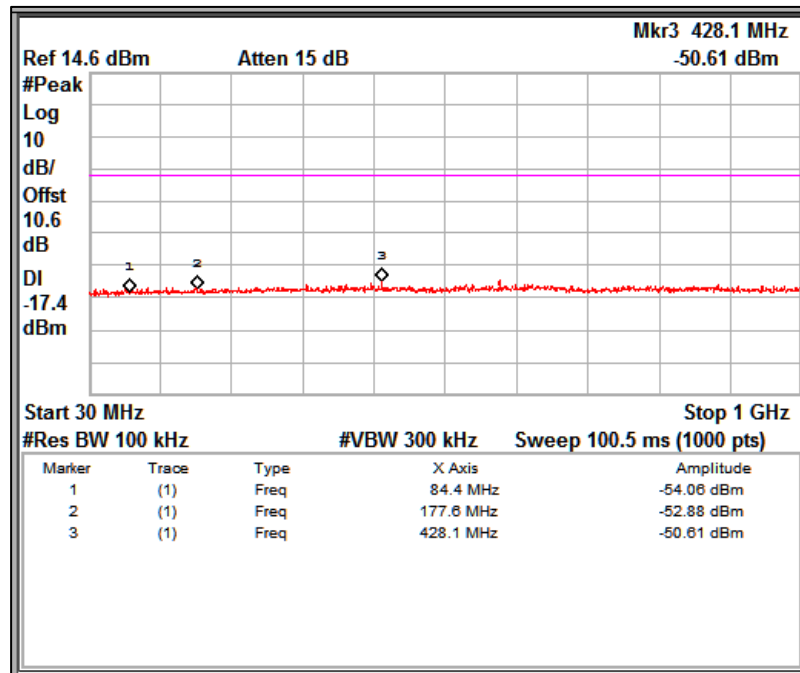


Channel Frequency: 2402MHz Frequency Range: 1GHz – 26.5GHz

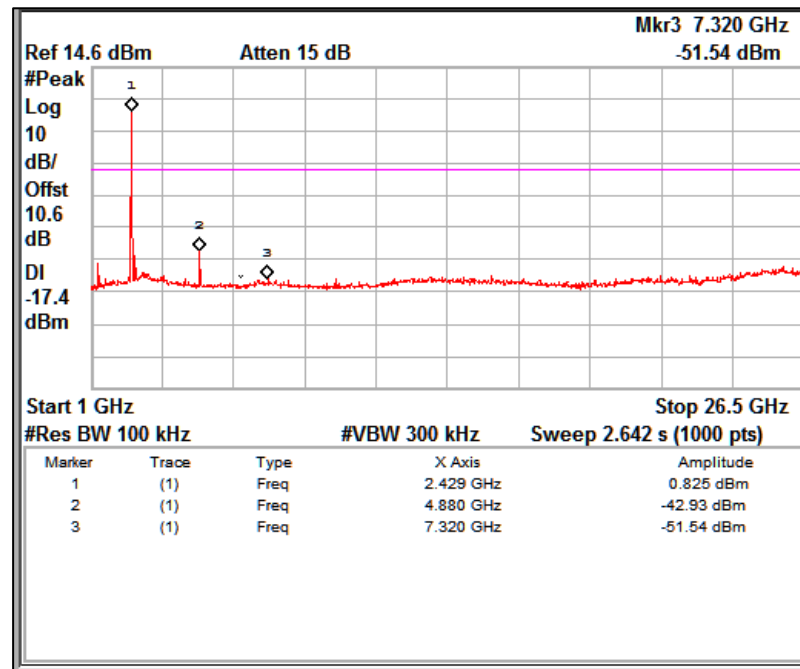
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Channel Frequency: 2440MHz Frequency Range: 30MHz – 1GHz

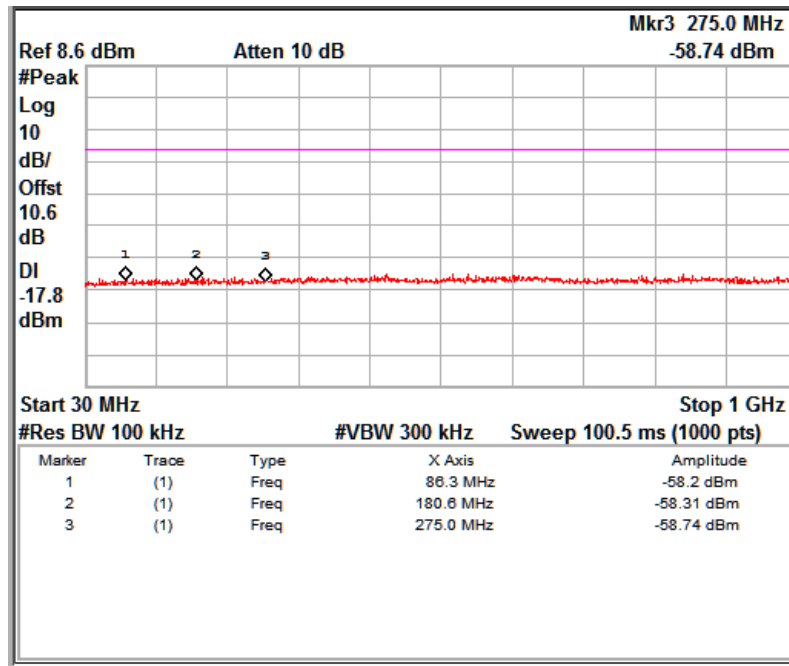


Channel Frequency: 2440MHz Frequency Range: 200MHz – 1GHz

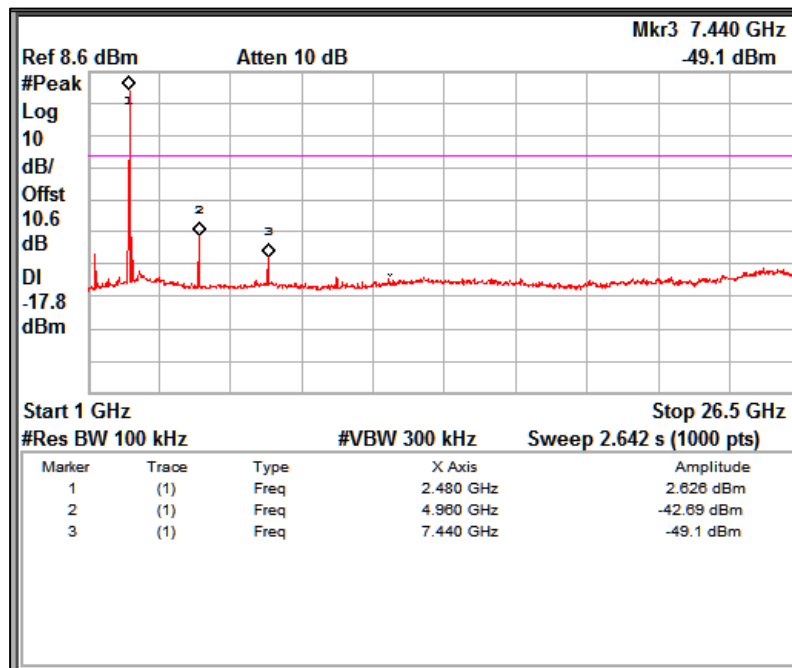
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Channel Frequency: 2480MHz Frequency Range: 30MHz – 1GHz



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)/ RSS-Gen Issue 5, Section 8.9 /8.10
Test Method	ANSI C63.10
Measurement Location	Semi Anechoic Chamber 9kHz - 1 GHz Fully Anechoic Chamber 1 GHz - 26GHz
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) = +21.5 °C

Voltage = 56VDC through POE Injector

Relative humidity: 63%

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Test results:

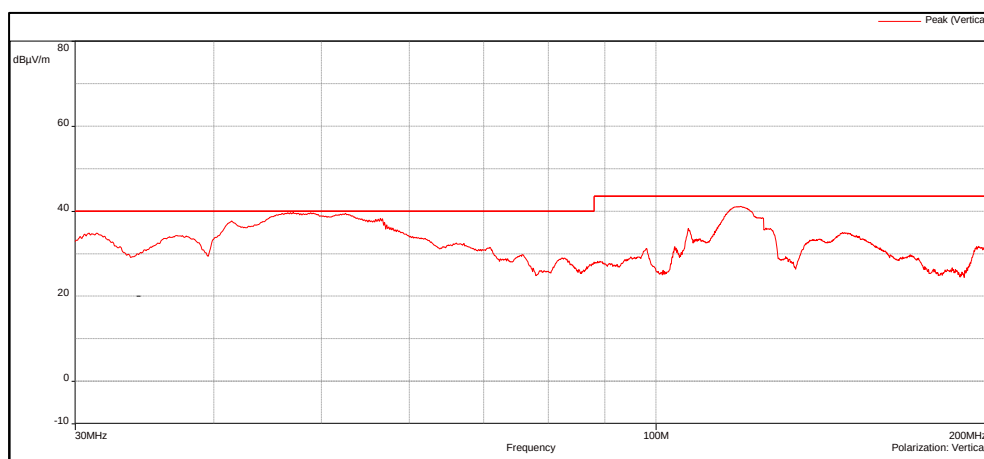
Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details

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 – 1GHz

Antenna Polarization	Measured Frequency (MHz)	Measured Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	41.37(QP)	15.85	40.00	-24.15
	46.884(QP)	23.81	40.00	-16.19
	52.35(QP)	11.12	40.00	-28.88
	57.078(QP)	23.50	40.00	-16.50
	372.71(Pk)	38.50	46.00	-7.50
	452.21(Pk)	26.90	46.00	-19.10
	711.14(Pk)	36.70	46.00	-9.30
	847.85(Pk)	35.20	46.00	-10.80
Horizontal	40.098(QP)	25.51	40.00	-14.49
	57.072(QP)	32.33	40.00	-7.67
	124.782(QP)	8.67	43.50	-34.83
	370.028(QP)	33.72	46.00	-12.28
	372.734(QP)	39.62	46.00	-6.38
	377.594(QP)	42.04	46.00	-3.96
	384.026(QP)	35.61	46.00	-10.39
	709.85(QP)	35.10	46.00	-10.90
	846.404(QP)	34.14	46.00	-11.86



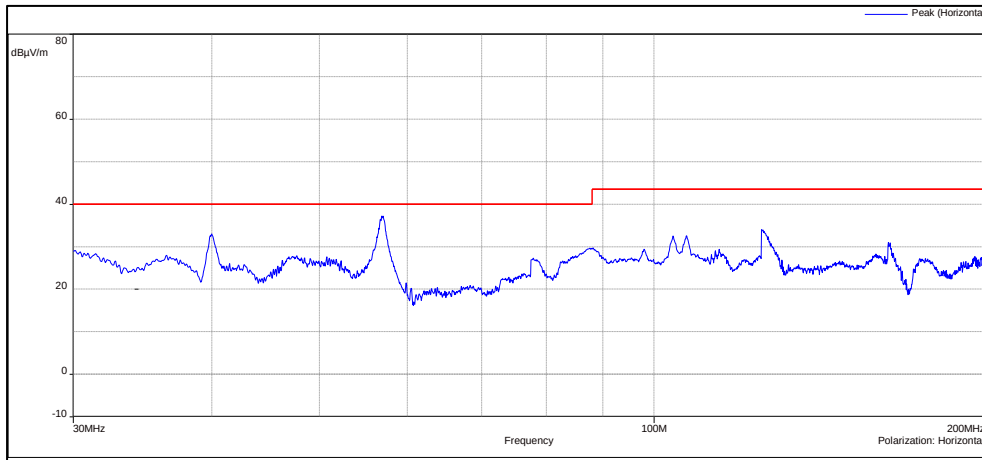
Channel Frequency 30MHz – 200MHz

Polarization Vertical

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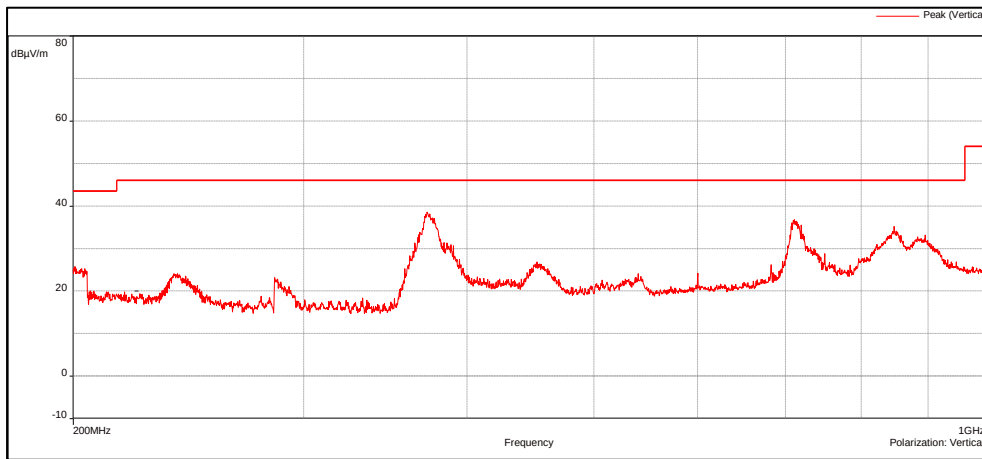
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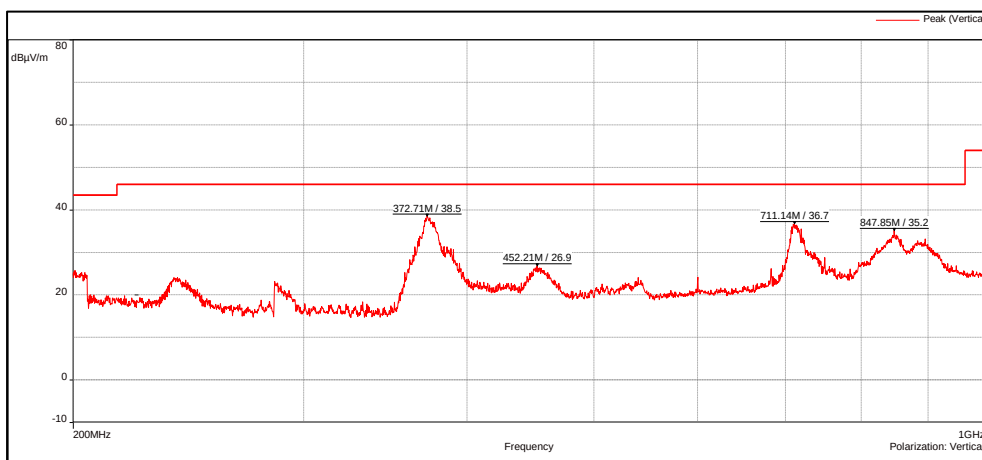
Channel Frequency 30MHz – 200MHz

Polarization Horizontal



Channel Frequency 200MHz – 1GHz

Polarization Vertical



Channel Frequency 200MHz – 1GHz

Polarization Horizontal

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Table 8: Test results for the frequencies above 1GHz:

Data Rate: 1Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2390(Pk)	Vertical	47.29	74*	-26.71
	2390(Av)		24.73	54*	-29.27
	2402(Pk)		92.38	-	-
	2402(Av)		87.40	-	-
	4804(Pk)		42.77	74	-31.23
	4804(Av)		31.65	54	-22.35
	7206(Pk)		49.63	74	-24.37
	7206(Av)		37.42	54	-16.58
	2390(Pk)	Horizontal	42.93	74*	-31.07
	2390(Av)		24.10	54*	-29.90
	2402(Pk)		87.56	-	-
	2402(Av)		82.58	-	-
	4804(Pk)		41.73	74	-32.27
	4804(Av)		29.49	54	-24.51
	7206(Pk)		47.63	74	-26.37
	7206(Av)		35.09	54	-18.91
2440	2440(Pk)	Vertical	94.39	-	-
	2440(Av)		89.39	-	-
	4880(Pk)		43.61	74	-30.39
	4880(Av)		32.06	54	-21.94
	7320(Pk)		48.12	74	-25.88
	7320(Av)		35.24	54	-18.76
	2440(Pk)	Horizontal	88.30	-	-
	2440(Av)		83.29	-	-
	4880(Pk)		41.44	74	-32.56
	4880(Av)		29.42	54	-24.58
	7320(Pk)		48.11	74	-25.89
	7320(Av)		34.85	54	-19.15
2480	2480(Pk)	Vertical	94.03	-	-
	2480(Av)		89.03	-	-
	2483.5(Pk)		59.28	74*	-14.72
	2483.5(Av)		30.08	54*	-23.92
	4960(Pk)		42.00	74	-32.00
	4960(Av)		29.76	54	-24.24
	7440(Pk)		47.17	74	-26.83
	7440(Av)		35.32	54	-18.68
	2480(Pk)	Horizontal	87.46	-	-
	2480(Av)		75.44	-	-
	2483.5(Pk)		52.85	74*	-21.15
	2483.5(Av)		26.93	54*	-27.07
	4960(Pk)		41.17	74	-32.83
	4960(Av)		29.31	54	-24.69
	7440(Pk)		47.29	74	-26.71
	7440(Av)		34.96	54	-19.04

_ → Fundamental Frequency

*→ Restricted Band edges

Pk: Peak Detector;

Av: Average Detect

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Data Rate: 2Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2390(Pk)	Vertical	47.84	74*	-26.16
	2390(Av)		24.77	54*	-29.23
	2402(Pk)		92.32	-	-
	2402(Av)		80.38	-	-
	4804(Pk)		41.54	74	-32.46
	4804(Av)		29.62	54	-24.38
	7206(Pk)		47.58	74	-26.42
	7206(Av)		35.53	54	-18.47
	2390(Pk)	Horizontal	45.23	74*	-28.77
	2390(Av)		24.38	54*	-29.62
	2402(Pk)		89.77	-	-
	2402(Av)		77.90	-	-
	4804(Pk)		41.27	74	-32.73
	4804(Av)		29.32	54	-24.68
	7206(Pk)		47.03	74	-26.97
	7206(Av)		35.01	54	-18.99
2440	2440(Pk)	Vertical	94.36	-	-
	2440(Av)		82.36	-	-
	4880(Pk)		29.38	74	-44.62
	4880(Av)		41.73	54	-12.27
	7320(Pk)		34.98	74	-39.02
	7320(Av)		47.16	54	-6.84
	2440(Pk)	Horizontal	88.54	-	-
	2440(Av)		76.52	-	-
	4880(Pk)		41.23	74	-32.77
	4880(Av)		29.31	54	-24.69
	7320(Pk)		47.30	74	-26.70
	7320(Av)		34.87	54	-19.13
2480	2480(Pk)	Vertical	85.74	-	-
	2480(Av)		73.71	-	-
	2483.5(Pk)		49.51	74*	-24.49
	2483.5(Av)		26.06	54*	-27.94
	4960(Pk)		41.40	74	-32.6
	4960(Av)		29.33	54	-24.67
	7440(Pk)		46.70	74	-27.3
	7440(Av)		34.93	54	-19.07
	2480(Pk)	Horizontal	89.95	-	-
	2480(Av)		77.96	-	-
	2483.5(Pk)		54.20	74*	-19.8
	2483.5(Av)		28.03	54*	-25.97
	4960(Pk)		40.94	74	-33.06
	4960(Av)		29.15	54	-24.85
	7440(Pk)		47.59	74	-26.41
	7440(Av)		34.90	54	-19.10

_ → Fundamental Frequency

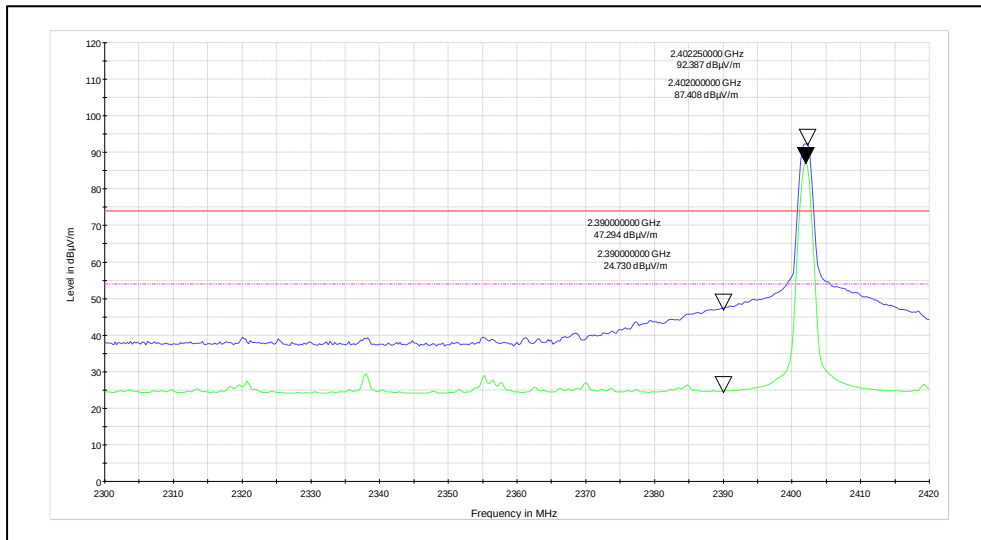
*→ Restricted Band edges

Pk: Peak Detector;

Av: Average Detect

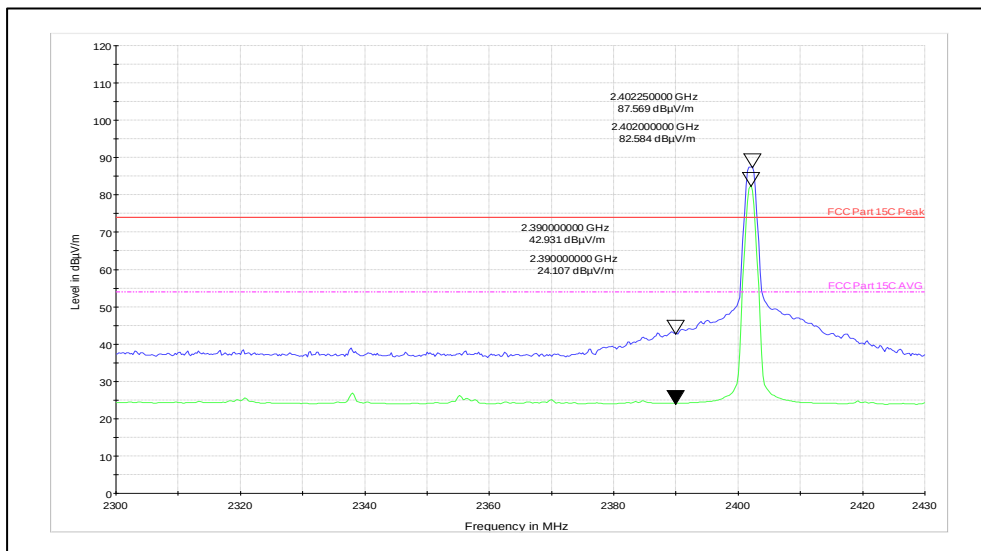
Test Plots:

Data Rate: 1Mbps



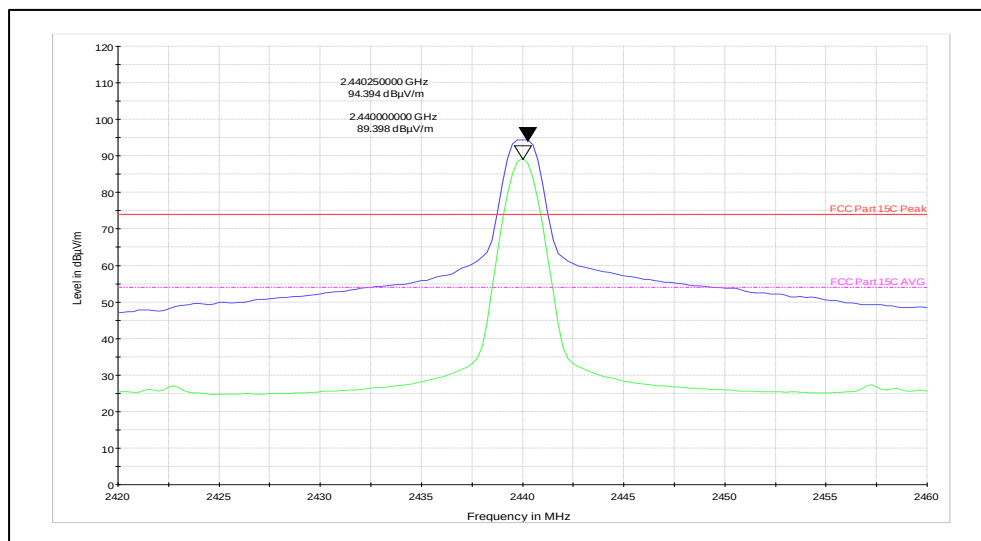
Channel Frequency: 2402MHz

Polarization: Vertical



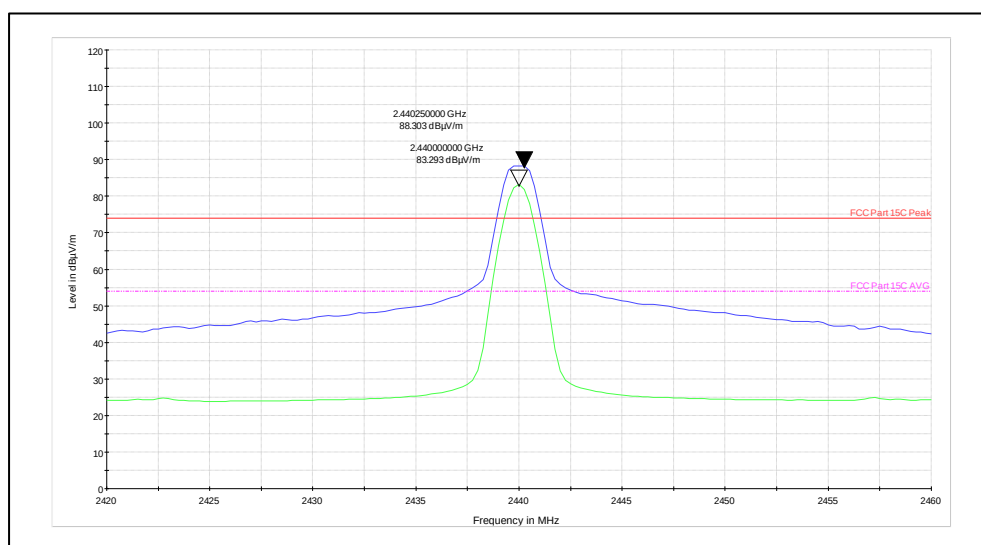
Channel Frequency: 2402MHz

Polarization: Horizontal



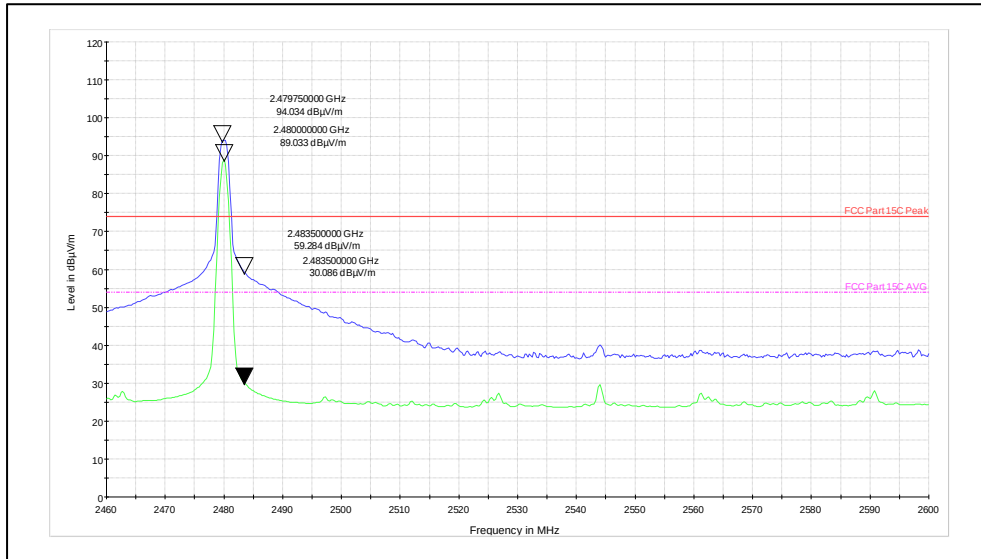
Channel Frequency: 2440MHz

Polarization: Vertical



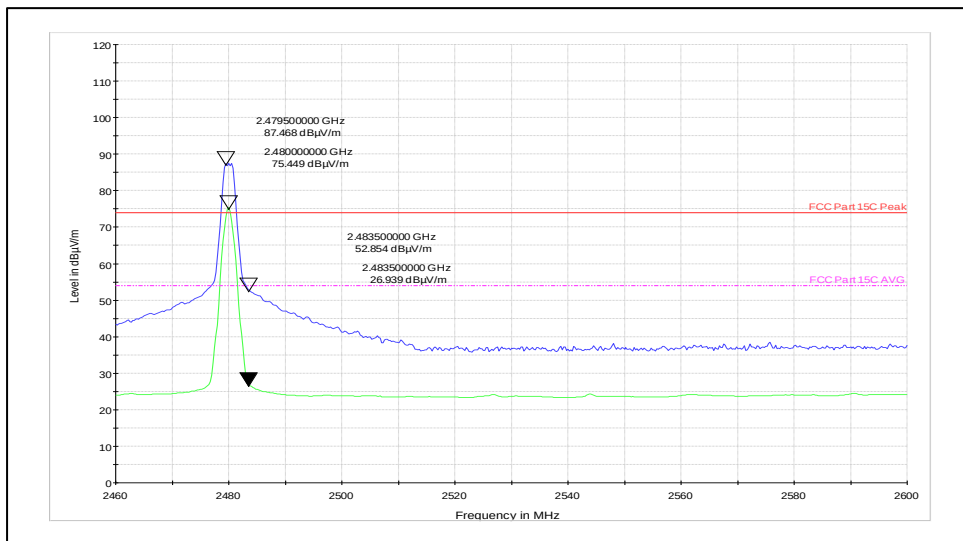
Channel Frequency: 2440MHz

Polarization: Horizontal



Channel Frequency: 2480MHz

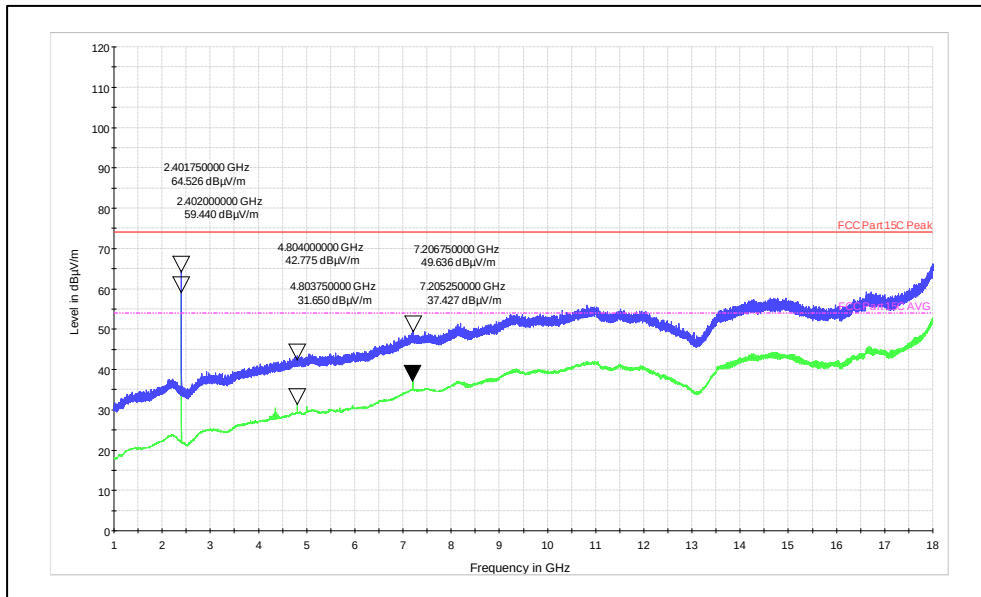
Polarization: Vertical



Channel Frequency: 2480MHz

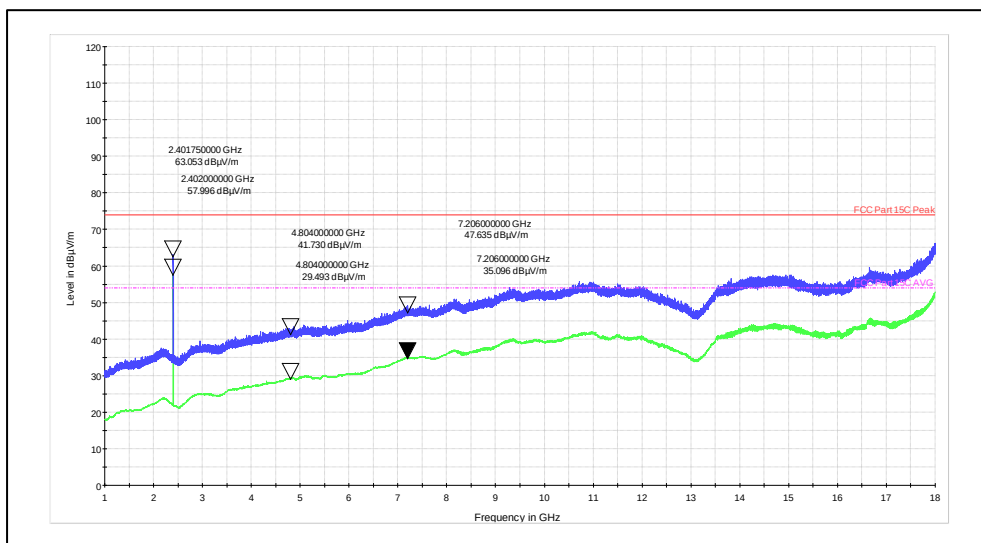
Polarization: Horizontal

Channel frequency: 2402MHz



Polarization: Vertical

Frequency range: 1GHz to 18GHz



Polarization: Horizontal

Frequency range: 1GHz to 18GHz

Prüfbericht - Nr.:

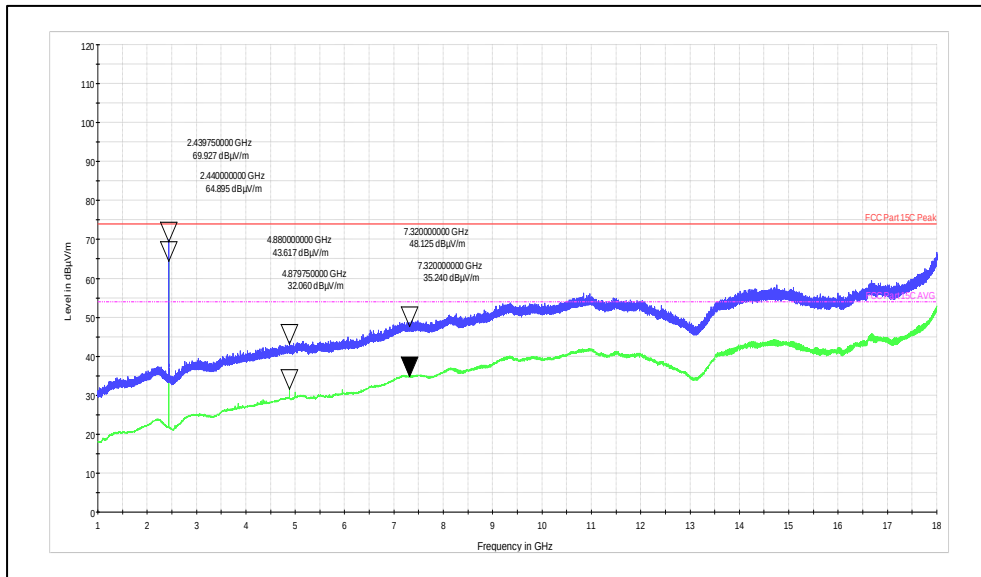
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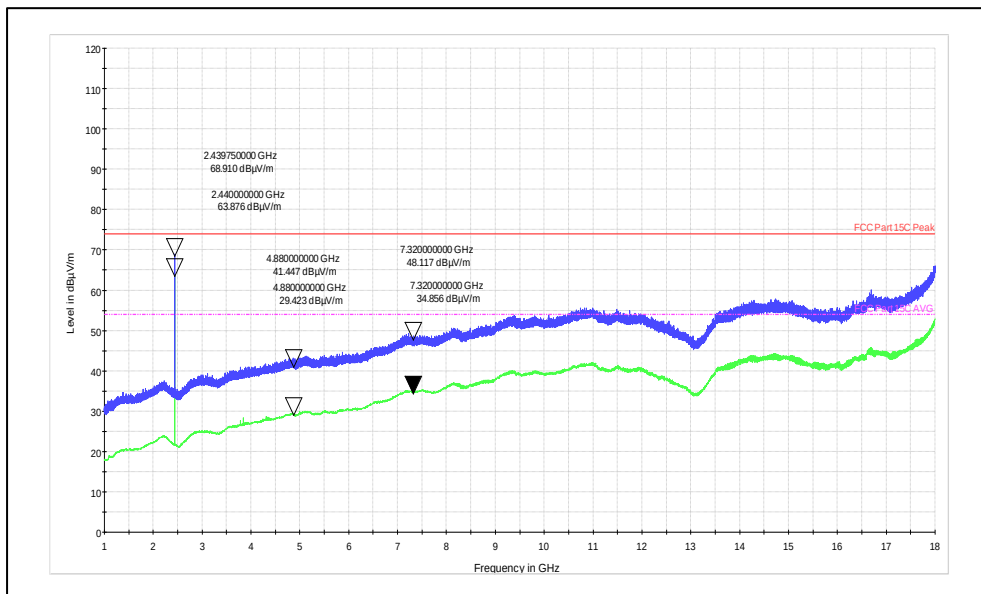
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Channel frequency:2402MHz



Polarization: Vertical

Frequency range: 1GHz to 18GHz



Polarization: Horizontal

Frequency range: 1GHz to 18GHz

Prüfbericht - Nr.:

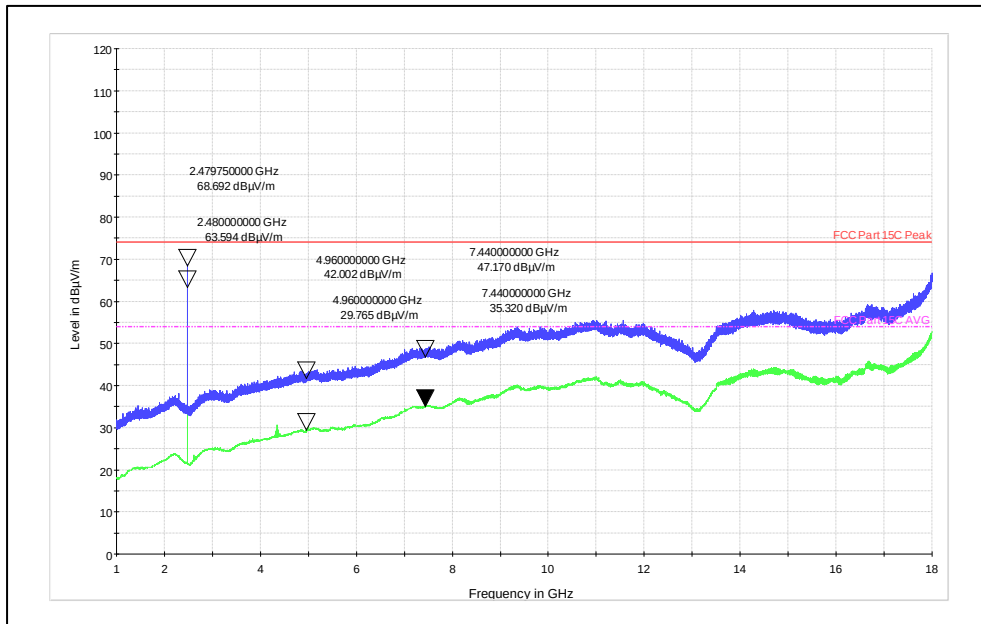
Test Report No.:

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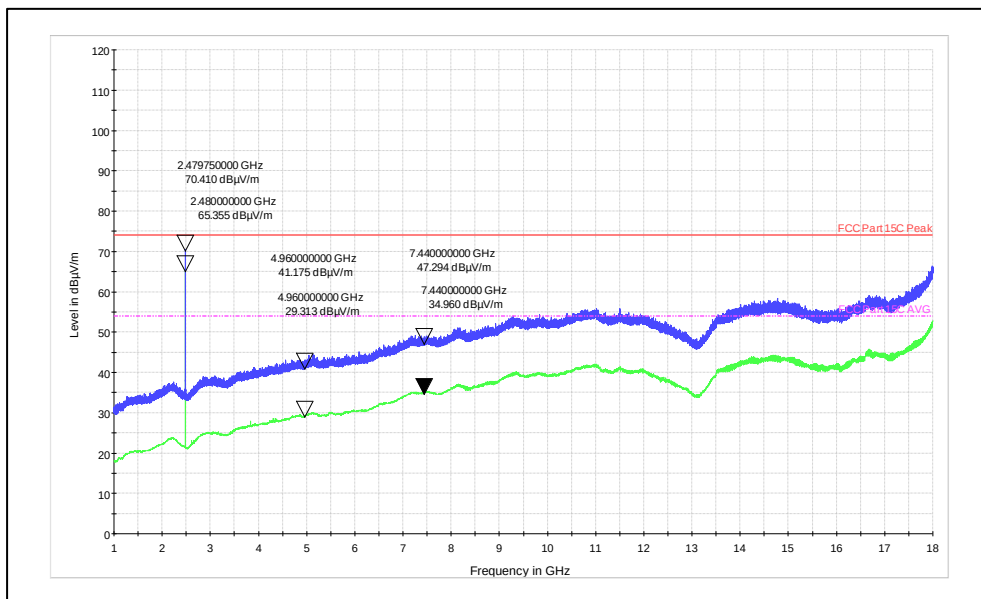
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Channel frequency: 2480MHz



Polarization: Vertical

Frequency range: 1GHz to 18GHz



Polarization: Horizontal

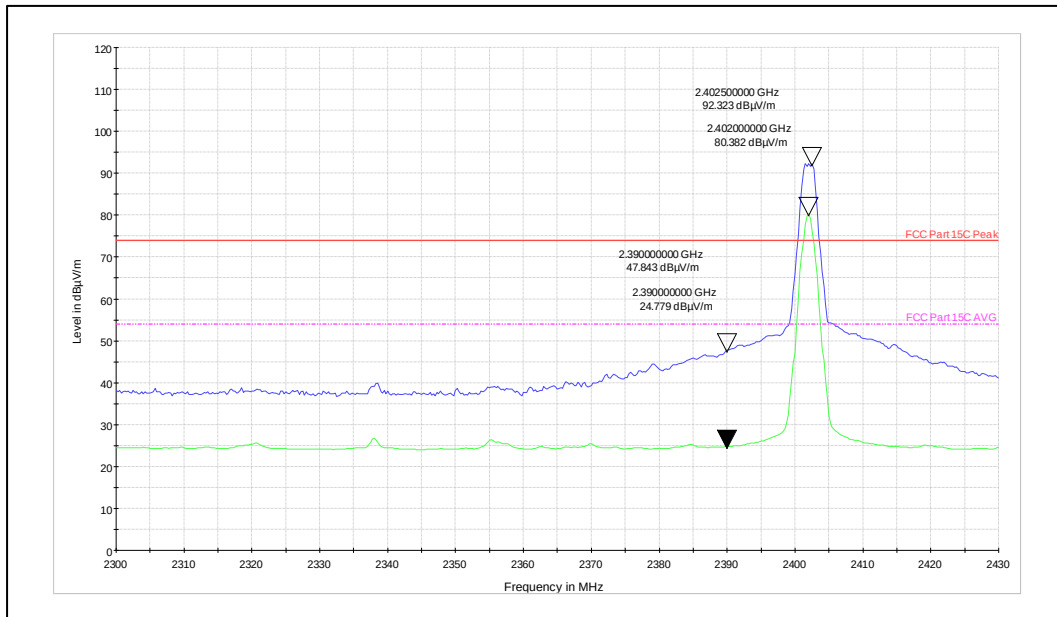
Frequency range: 1GHz to 18GHz

Prüfbericht - Nr.:
Test Report No.:

IN23HNHD 001

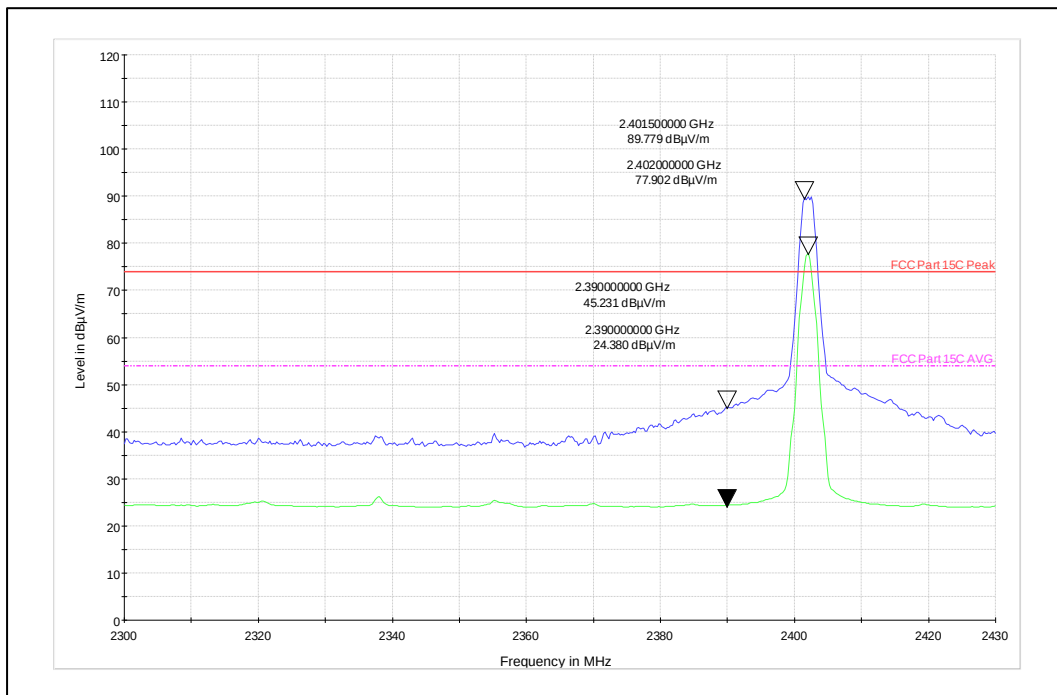
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Data Rate: 2Mbps



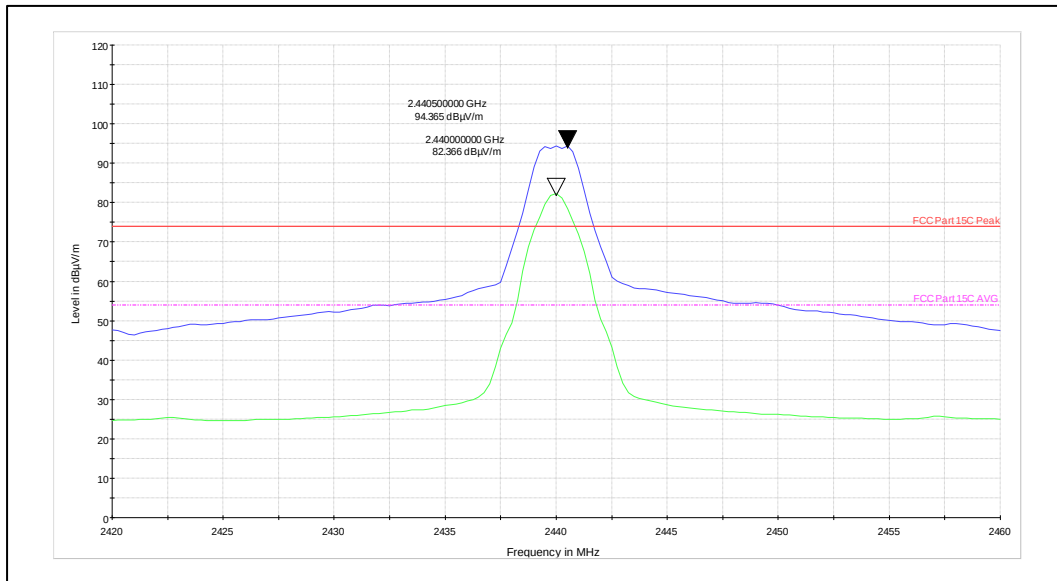
Channel frequency: 2402MHz

Polarization: Vertical



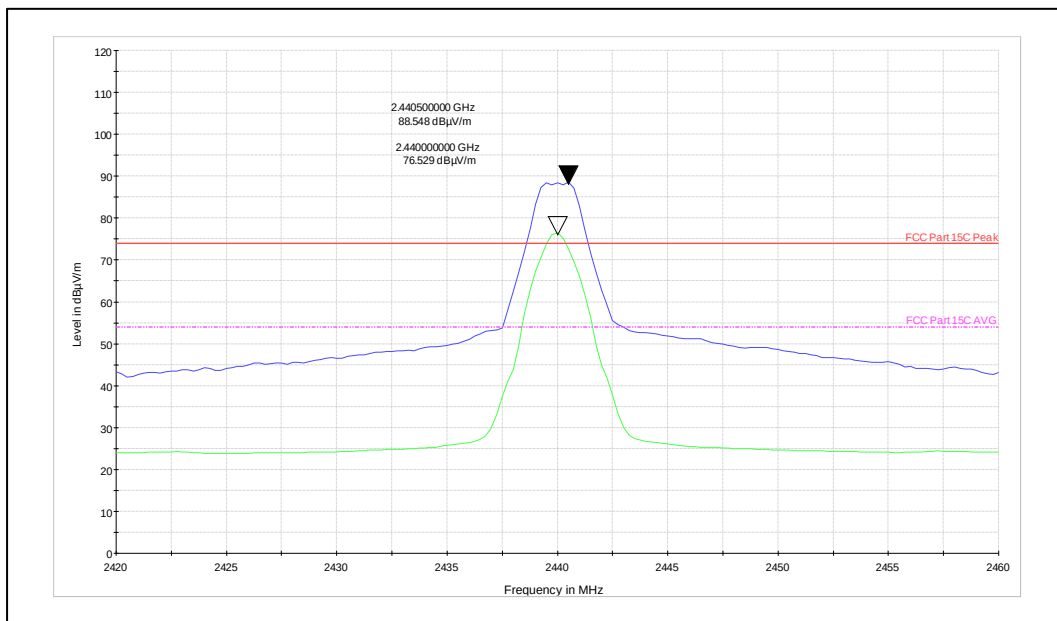
Channel frequency: 2402MHz

Polarization: Horizontal



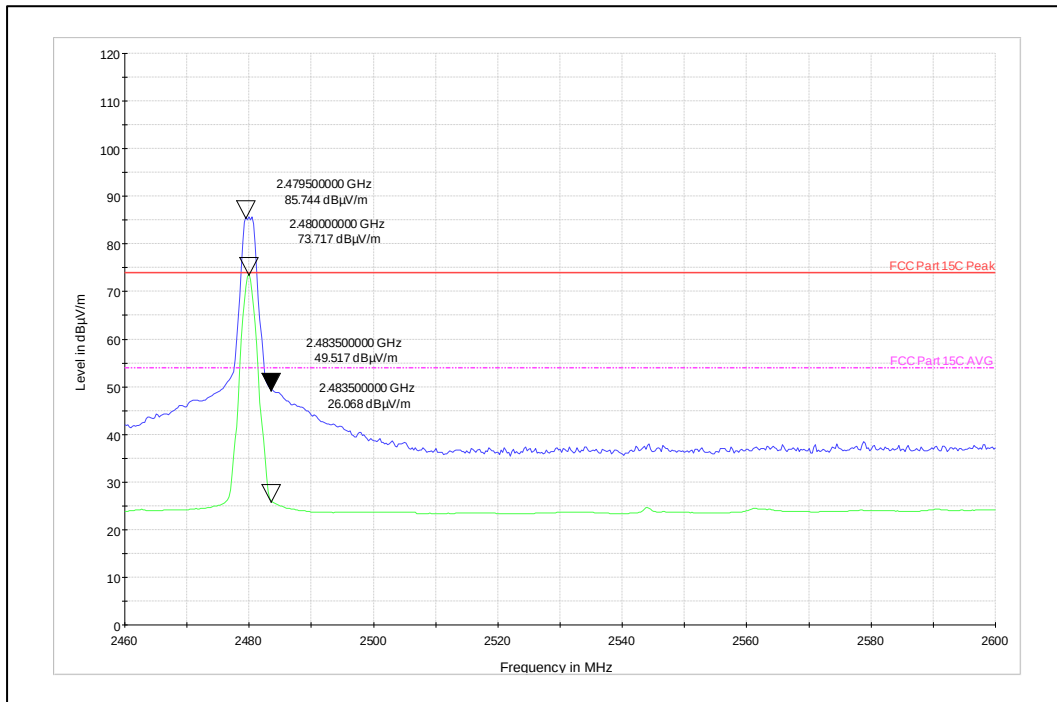
Channel frequency: 2440MHz

Polarization: Vertical



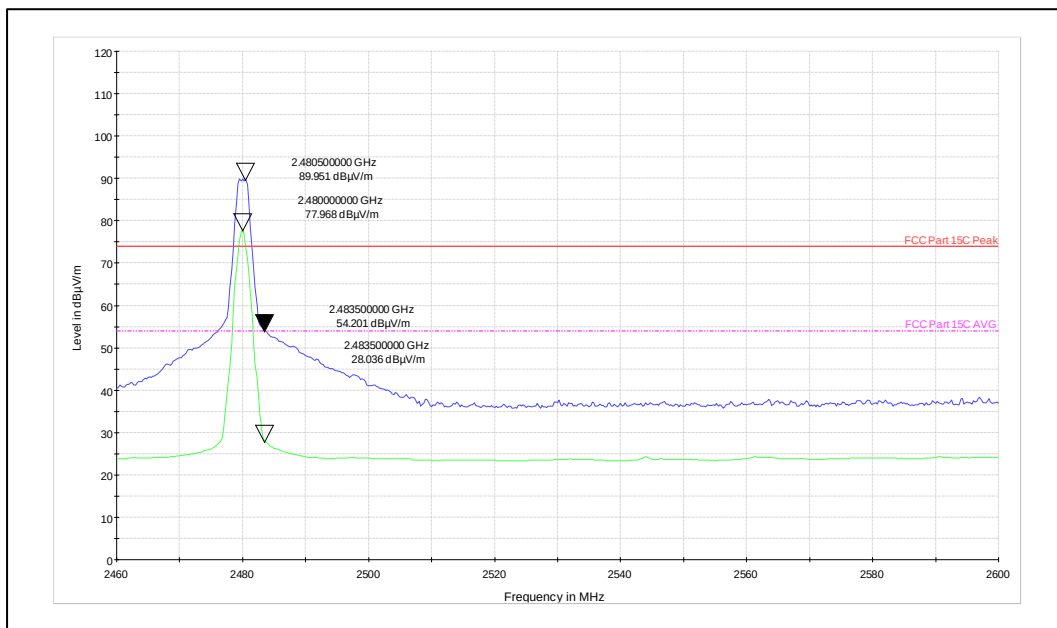
Channel frequency: 2440MHz

Polarization: Horizontal



Channel frequency: 2480MHz

Polarization: Vertical



Channel frequency: 2480MHz

Polarization: Horizontal

Prüfbericht - Nr.:

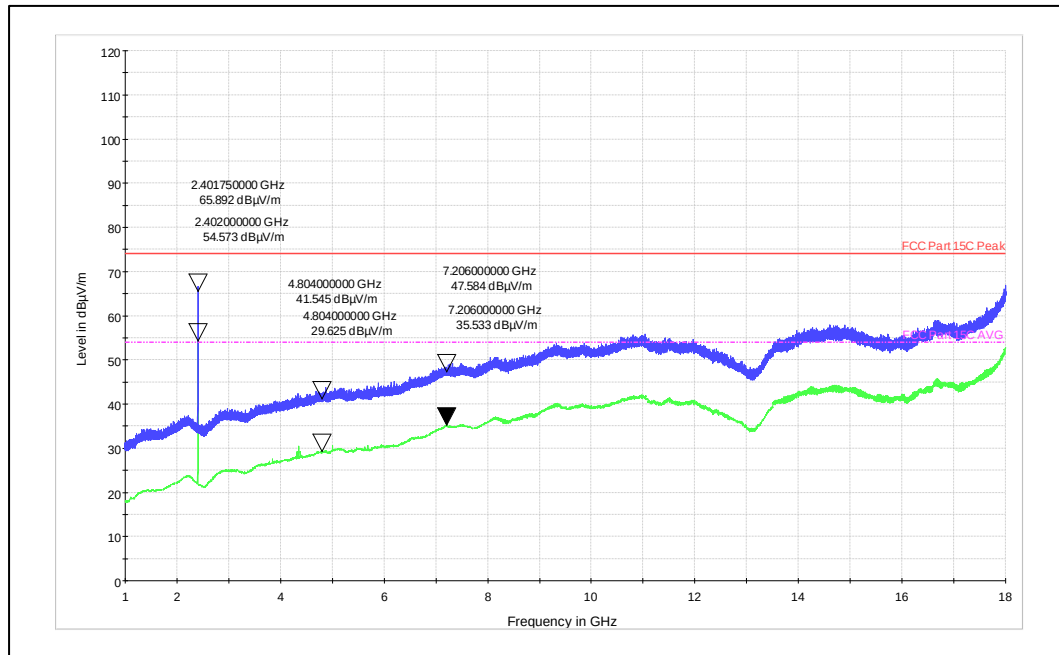
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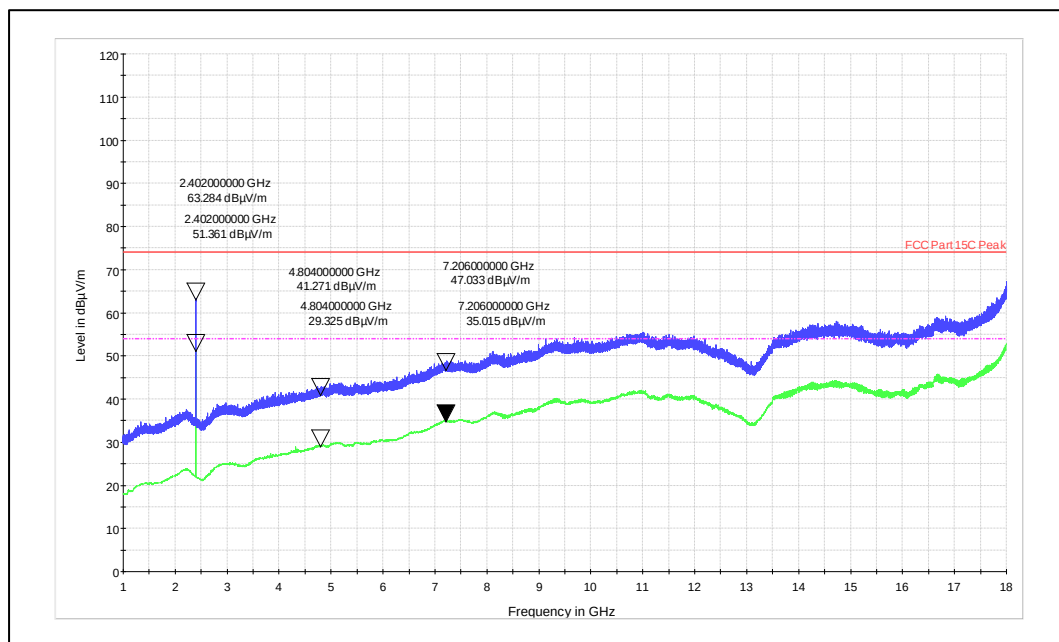
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Channel frequency: 2402MHz



Frequency range: 1GHz to 18GHz

Polarization: Vertical



Frequency range: 1GHz to 18GHz

Polarization: Horizontal

Prüfbericht - Nr.:

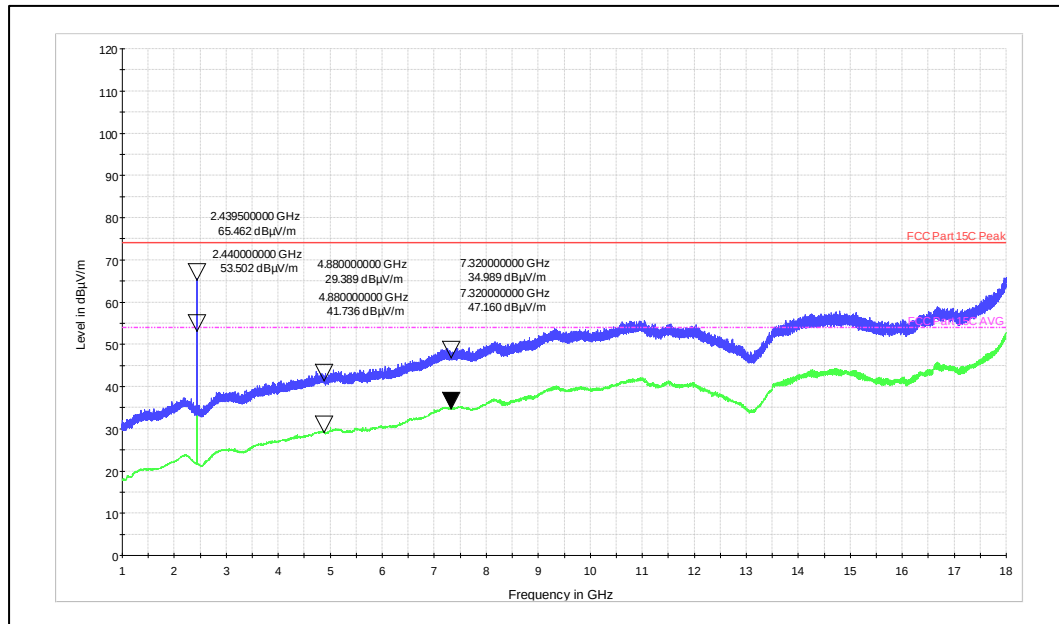
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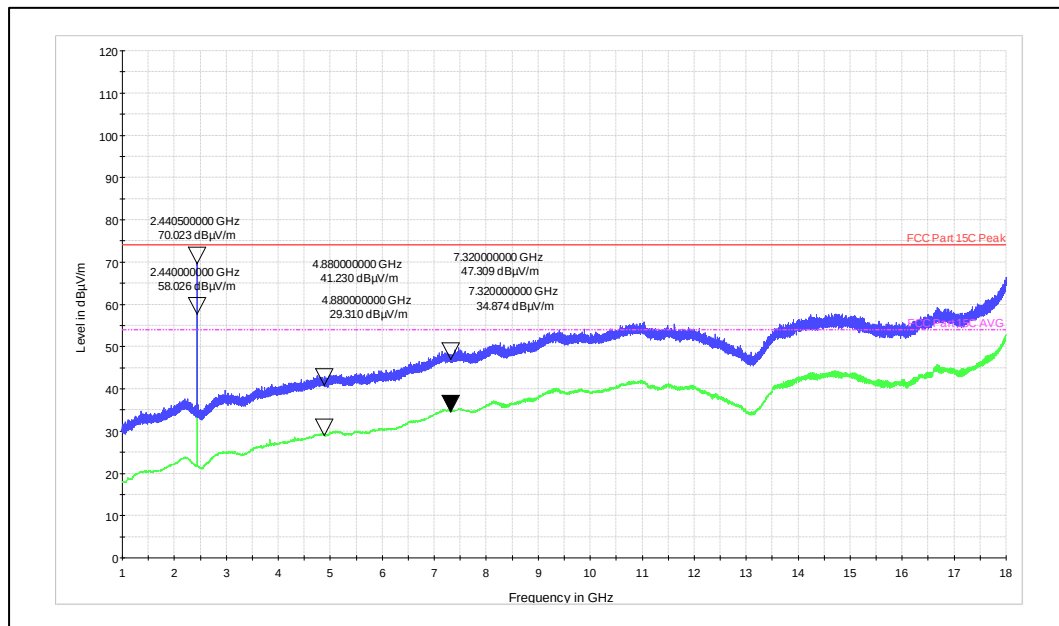
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Channel frequency: 2440MHz



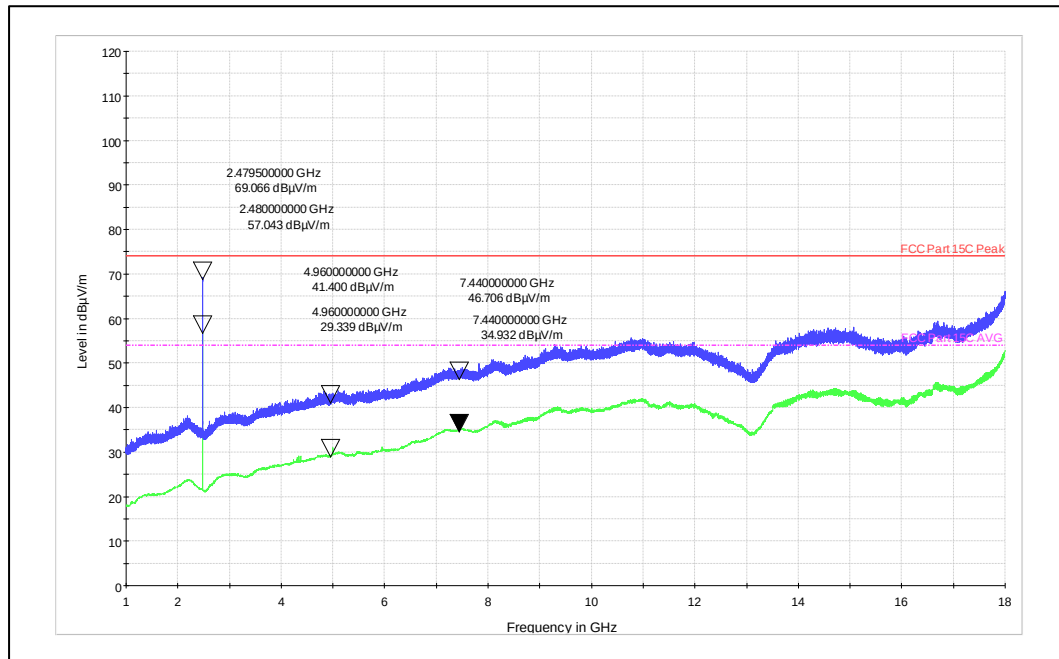
Frequency range: 1GHz to 18GHz

Polarization: Vertical



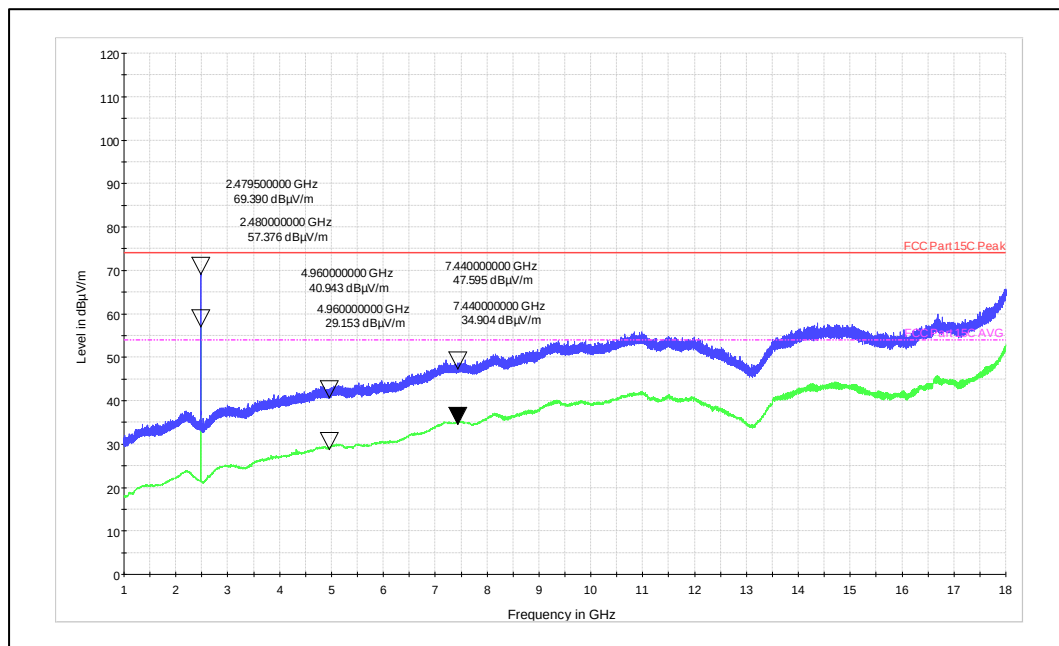
Frequency range: 1GHz to 18GHz

Polarization: Horizontal



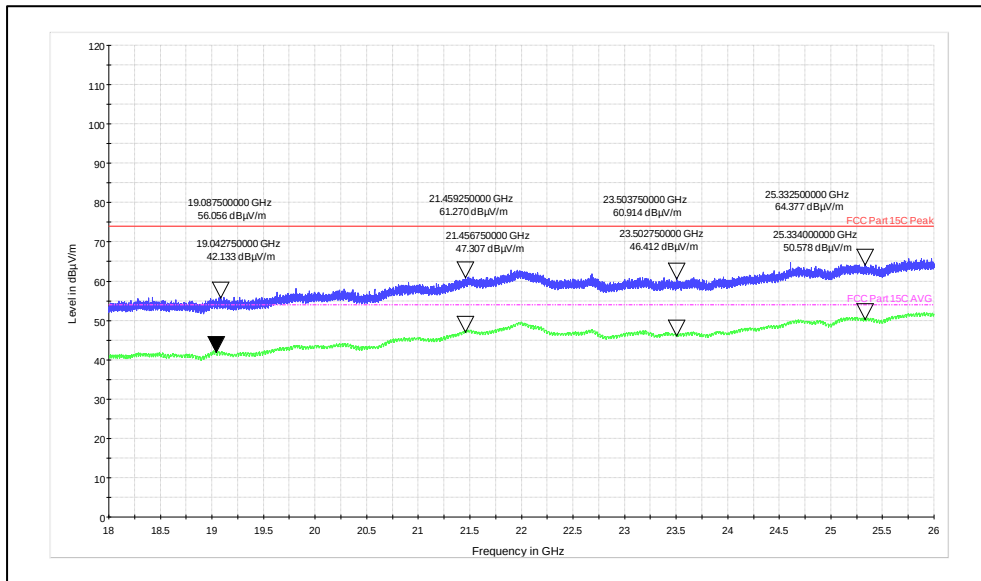
Frequency range: 1GHz to 18GHz

Polarization: Vertical



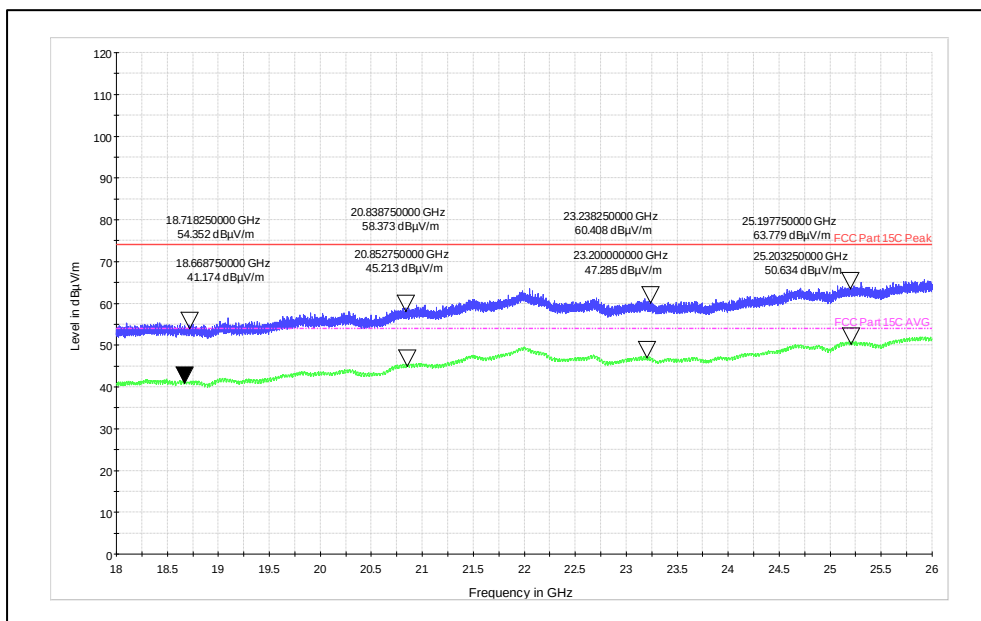
Frequency range: 1GHz to 18GHz

Polarization: Horizontal



Frequency range: 18GHz to 26GHz

Polarization: Vertical



Frequency range: 18GHz to 26GHz

Polarization: Horizontal

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7.6 AC Power lines Conducted Emission

Result

Pass

Test Specification : FCC Part 15 Section 15.207/RSS Gen Issue 5 Section 8.8
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 9: 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

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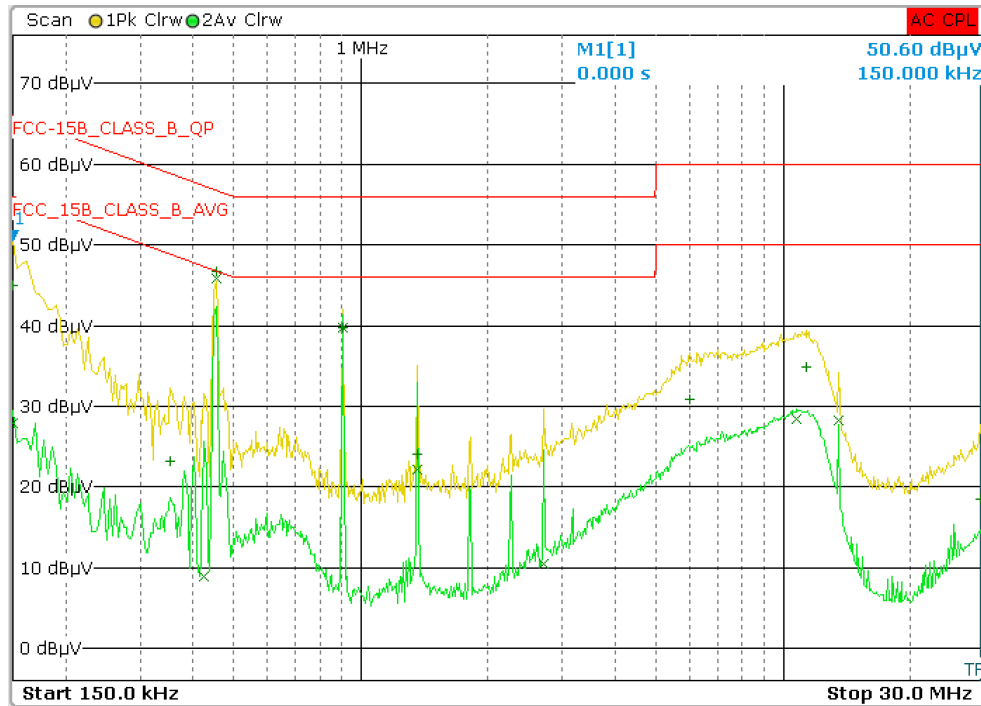
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Test Conditions:

Temperature (Norm) = +24 °C Voltage = 110V AC (Through POE Adapter) Relative humidity: 64%

Test results:

110VAC-60Hz-Line



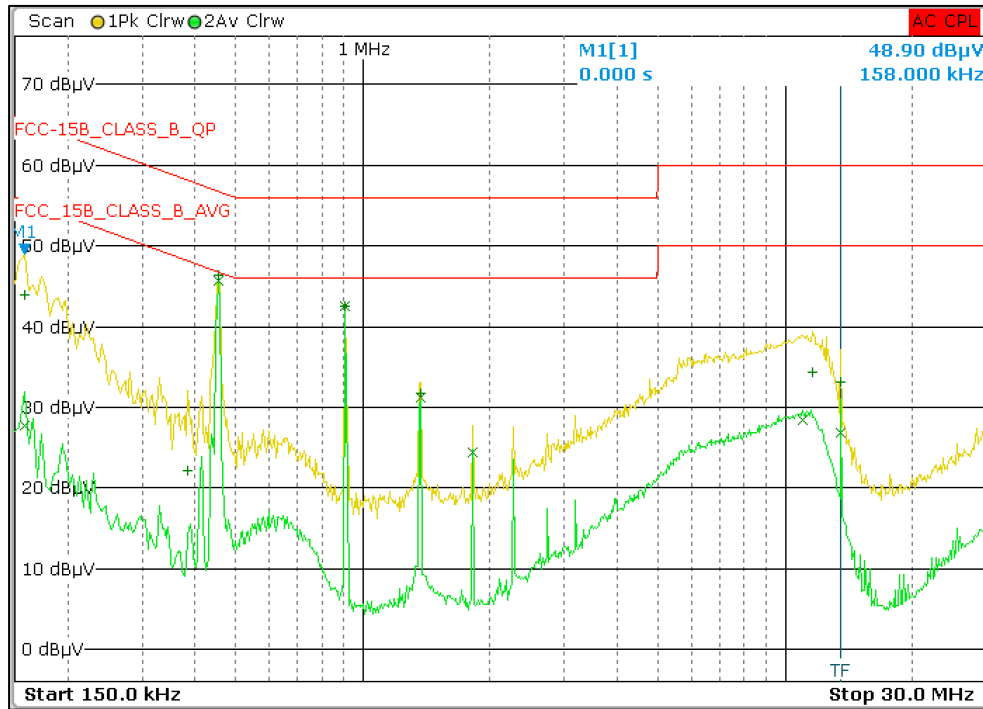
Trace	Frequency	Level (dBµV)	Phase	Detector	Delta Limit/dB
2	454.000000000 kHz	45.91		Average	-0.89
2	906.000000000 kHz	39.78		Average	-6.22
1	454.000000000 kHz	46.72		Quasi Peak	-10.08
1	906.000000000 kHz	39.80		Quasi Peak	-16.20
1	150.000000000 kHz	44.92		Quasi Peak	-21.08
2	10.778000000 MHz	28.34		Average	-21.66
2	13.562000000 MHz	28.22		Average	-21.78
2	1.358000000 MHz	22.15		Average	-23.85
1	11.326000000 MHz	34.90		Quasi Peak	-25.10
2	150.000000000 kHz	27.83		Average	-28.17
1	6.006000000 MHz	30.79		Quasi Peak	-29.21
1	1.358000000 MHz	24.14		Quasi Peak	-31.86
2	2.718000000 MHz	10.39		Average	-35.61
1	354.000000000 kHz	23.12		Quasi Peak	-35.75
2	426.000000000 kHz	8.95		Average	-38.38
1	29.266000000 MHz	18.55		Quasi Peak	-41.45

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110VAC-60Hz-Neutral:



Trace	Frequency	Level (dBµV)	Phase	Detector	Delta Limit/dB
2	454.000000000 kHz	45.73		Average	-1.07
2	910.000000000 kHz	42.56		Average	-3.44
1	454.000000000 kHz	46.35		Quasi Peak	-10.45
1	910.000000000 kHz	42.53		Quasi Peak	-13.47
2	1.366000000 MHz	31.26		Average	-14.74
2	1.818000000 MHz	24.46		Average	-21.54
1	158.000000000 kHz	44.01		Quasi Peak	-21.56
2	11.006000000 MHz	28.42		Average	-21.58
2	13.562000000 MHz	26.85		Average	-23.15
1	1.366000000 MHz	31.77		Quasi Peak	-24.23
1	11.630000000 MHz	34.34		Quasi Peak	-25.66
1	13.562000000 MHz	33.13		Quasi Peak	-26.87
2	158.000000000 kHz	27.66		Average	-27.91
1	386.000000000 kHz	22.23		Quasi Peak	-35.92

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