

Prüfbericht-Nr.: Test report no.:	IN24HKZS 001	Auftrags-Nr.: Order no.:	146960621 010	Seite 1 von 81 Page 1 of 81
Kunden-Referenz-Nr.: Client reference no.:	2283344	Auftragsdatum: Order date:	2024.09.09	
Auftraggeber: Client:	LifeSignals, Inc. 426 S Hillview Dr, Milpitas, CA 95035, USA			
Prüfgegenstand: Test item:	UbiqVue™ 2AYe Holter System			
Bezeichnung: Identification .:	UB2251/UX2251			
Auftrags-Inhalt: Order content:	Testing and issue of Test Report and Grant Certificate			
Prüfgrundlage: Test specification:	FCC Part 15 Subpart C 15.247, 15.207, 15.205 & 15.209			
Wareneingangsdatum: Date of sample receipt:	2024-09-10			
Prüfmuster-Nr & Serien-Nr.: Test sample no & serial no.:	A003825183-001 A003825183-002 ZOOYH,GRBBY			
Prüfzeitraum: Testing period:	2024.09.12 - 2024.10.04			
Ort der Prüfung: Place of testing:	Wireless laboratory, Bangalore			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (India) Pvt.Ltd., 27/B, 2nd Cross, Electronic City Phase1 Bangalore -560 100, India FCC Test site registration number: 496599 ISED Test site registration number: 3466E-1			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	genehmigt von: authorized by:			
Datum: Date: 2024-12-13	Ausstellatum: Issue date: 2024-12-13			
Stellung / Position: Yogesh V Senior Engineer	Stellung / Position: Madhu K N Assistant Manager			
Sonstiges / Other: FCC ID: 2AHV9-UB2251				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* 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. 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.				



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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	Applicable Standard	Result
	FCC	
Maximum conducted output power	FCC 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	FCC 15.247(d)	Pass
Spurious Radiated Emissions and Restricted Bands of Operation	FCC 15.209 / FCC 15.205	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
IN24HKZS 001	01	Initial issue of report	2024-12-13

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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 DIAGRAM
8. BILL OF MATERIAL
9. USER MANUAL
10. MAXIMUM PERMISSIBLE EXPOSURE INFORMATION

2 TEST SITES

2.1 Testing Facilities

- | | |
|--|---|
| <p>1. TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
ElectronicCityPhase1
Bangalore – 560 100,
India
Radiated Measurement site type :
Fully anechoic chamber (used for above 1 GHz
measurements)</p> | <p>2. TUV Rheinland (India) Pvt.Ltd.,
108, Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100.
India
Radiated Measurement site type :
Semi anechoic chamber (used for below 1 GHz
measurements)</p> |
|--|---|

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
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	23.03.2025	Yearly
Balun & Biconical Antenna	Schwarzbeck Mess-Elektronik	BBA 9106+VHBB 9124	9124-1117	-	06.03.2025	Yearly
Log Periodic Antenna	Schwarzbeck Mess-Elektronik	VUSLP 9111B	9111B-324	-	31.05.2025	Yearly
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-01944	-	28.10.2024	Yearly
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	15.01.2025	Yearly
EMI Test Receiver	Rohde & Schwarz	ESW44	101773	1.72.SP1	26.01.2025	Yearly
Semi Anechoic Chamber	Frankonia	-	-	-	-	-
Fully Anechoic Chamber	Albatross	-	-	-	-	-
Spectrum Analyzer	Agilent	E4407B	US41192 772	A.14.07	04-01-2025	Yearly

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 UbiqVue™ Holter System is intended to capture, record, analyze and report both symptomatic and asymptomatic cardiac events, along with continuous electrocardiogram (ECG) information, for long-term monitoring. Following patient monitoring using the UbiqVue™ Wearable Biosensor, a comprehensive final report is generated from the entire ECG recording. Optionally, intended users may choose to generate an interim report from periodically or intermittently transferred ECG recording wirelessly from the UbiqVue™ Wearable Biosensor. Final & interim reporting is based on the beat-to-beat information extracted from the ECG recording.

The UbiqVue™ Holter system is intended for non-critical, adult population, who are 18 years of age or older, at home and in healthcare settings, who maybe asymptomatic or who may suffer from transient symptoms such as palpitations, shortness of breath, dizziness, light-headedness, pre-syncope, syncope, fatigue, or anxiety and patients who are asymptomatic. The reports are provided for review by the intended user to render a diagnosis based on their clinical judgment and experience.

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

Radio Protocol		IEEE 802.11b	Bluetooth 5.2
Operating Frequency Range		2412MHz to 2462MHz	2402MHz to 2480MHz
No. of Channels		11 (Refer Table 5)	40 (Refer Table 6)
Channel Spacing		5MHz	2MHz
Maximum Measured Power (e.i.r.p)		2.10dBm @ 2412MHz 5Mbps	-7.43 @ 2402MHz
Modulation		802.11b: (DSSS - 1Mbps, 2Mbps, CCK - 5.5Mbps, 11Mbps)	GFSK
Number of antennas		1	
Antenna Gain		2.2dBi	
Antenna Type		Meander Line Antenna	
Supply Voltage to Product		3V DC	
Environmental conditions	Storage	<= 30 days shall be +0°C to +45°C (32°F to 113°F) >30 days shall be +5°C to +27°C (41°F to 80.6°F)	
	Operating	+0°C to +45°C (32°F to 113°F)	
EUT Dimension		116.5mm x 91.5mm x 15.5mm	

***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.

3.2 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 on low, mid and high channels.

4.2 UUT Operation and Software

Hardware Version Identification number (HVIN) : 5000000031A
Software Version : BLE FW:1.0.1 & WiFi FW:4.1.5

4.3 Special Accessories and Auxiliary Equipment

FTDI-ECP IF V1(Test Jig) Used for issuing the command to EUT for transmitting with highest possible duty cycle at different required data rate. This test jig needed for conducting tests as per this report and not needed for intended use

4.4 Simultaneous Transmission

This product does not support Simultaneous transmission.

4.5 Countermeasures to achieve EMC Compliance

- None

4.6 List of frequencies

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
Wi-Fi (2.4-2.4835)	1	2412
	2	2417
	3	2422
	4	2427
	5	2432
	6	2437
	7	2442
	8	2447
	9	2452
	10	2457
	11	2462

Table 5: List of Wi-Fi center Frequencies

Channel used for Wi-Fi 2.4GHz testing

20MHz Bandwidth

Channel Low : 2412 MHz
Channel Mid : 2437 MHz
Channel High : 2462 MHz

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Frequency Band (GHz)	Channel No.	Frequency (MHz)
BLE (2.4-2.4835)	0	2402
	1	2404
	2	2406
	3	2408
	:	:
	:	:
	18	2438
	19	2440
	20	2437
	:	:
	:	:
	36	2474
	37	2476
	38	2478
	39	2480

Table 6: List of BLE Center frequencies

Channel used for BLE testing

Channel low: 2402MHz

Channel mid: 2440MHz

Channel High: 2480MHz

Note:

TUV Sample Identification number : A003825183-001– Radiated test Sample
A003825183-002 – Conducted test Sample

5 OPERATIONAL DESCRIPTION

The UbiqVue™ 2AYe Wearable Biosensor [UB2251] combines Bluetooth and WLAN capabilities to transmit and receive signals through a common printed antenna on the PCB. Bluetooth capability is realized using the BLUENRG-234 Bluetooth SOC and the WLAN capability relies on the capabilities of the UbiqVue™ 2AYe Wearable Biosensor Processor [LC1100].

The UbiqVue™ 2AYe Wearable Biosensor Processor, LC1100, combines a flexible microcontroller and unique embedded radio into a single-chip solution for applications in healthcare and the Internet of Things (IoT). Central to this is the LC1100's radio with 2400 MHz to 2483.5 MHz WLAN (Wireless LAN, IEEE 802.11b). The processor uses 44MHz external crystal to generate required local oscillator radio frequencies as per the channels specified in IEEE 802.11b standard. The processor also includes required filtering to meet spectral mask specification mentioned in IEEE 802.11b standard. The processor also includes the required power control mechanism to keep the transmitted power before antenna feed point is within 0dBm +/- 2dB. UB2251 uses LifeSignals LC1100 processor to radiate the power through on board printed antenna.

The BlueNRG-234 Bluetooth processor has the capability to generate and transmit signals in line with the Bluetooth 5.2 specification in the 2400MHz to 2485MHz frequency range. The SOC uses a 32MHz external crystal to generate the required oscillator frequencies as per the channels specified in the Bluetooth specification.

The RF signal flow in UB2251 is shown in the below diagram. The signal is generated either by the LC1100 [WLAN] or BlueNRG-234[Bluetooth]. The RF switch is used to select the signal source [LC1100 or BleuNRG-234]. The signal is radiated after passing through the RF Switch, DC blocking capacitor, RF connector and Printed antenna on the board. Before Printed antenna there is matching network for Impedance matching and out of band filtering. The antenna has an average gain of -3.6dBi and peak gain up to +3.626dBi.

The UbiqVue™ 2AYe Holter System (UX2251) consists of following components:

1. UbiqVue™ 2AYe Wearable Biosensor (UB2251)
2. UbiqVue™ Holter Mobile App (UA2251-R)
3. UbiqVue™ Relay Bridge (UA2550-RB)
4. UbiqVue™ Holter Central Server (UA2251-S)
5. UbiqVue™ Holter Web Server (UA2251-W)
6. UbiqVue™ Holter Web Portal (UA2251-C)
7. UbiqVue™ Holter Server Analyzer (UA2251-SA)
8. UbiqVue™ Holter Desktop Analyzer (UA2251-DA)

6 TEST METHODOLOGY

6.1 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 Baloon 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

6.1.1 Test Setup Configuration

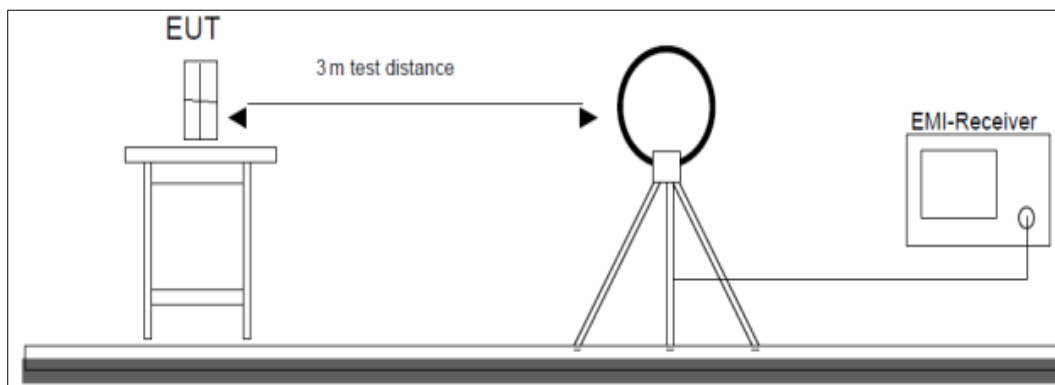


Figure 1: Frequency Range 9 kHz- 30 MHz

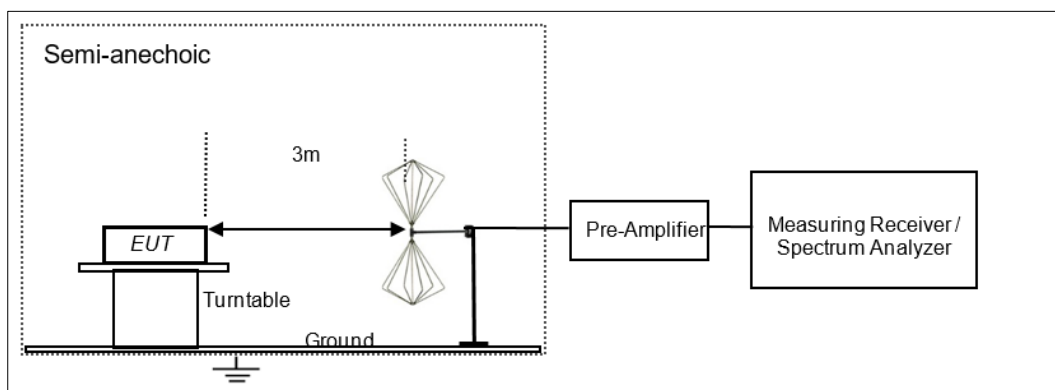


Figure 2: Frequency Range 30 MHz – 200 MHz

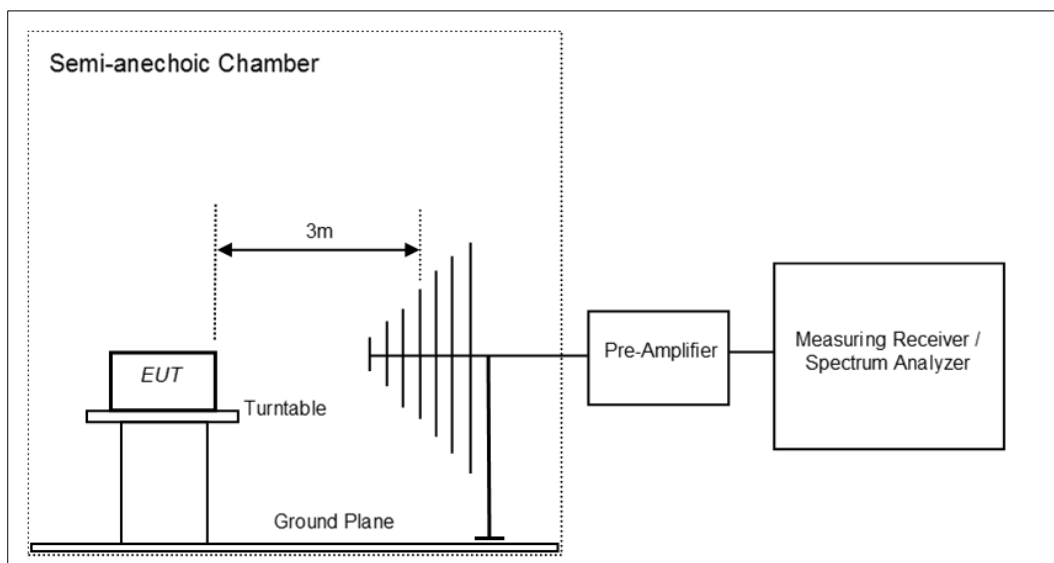


Figure 3: Frequency Range 200 MHz - 1GHz

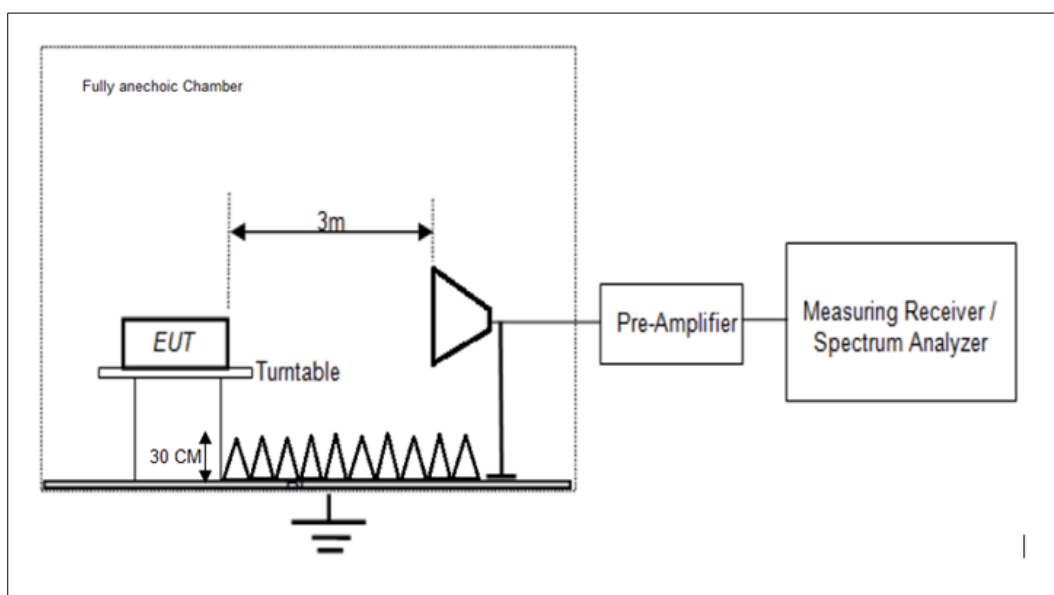


Figure 4: Frequency Range above 1 GHz

7 TEST RESULTS FOR Wi-Fi

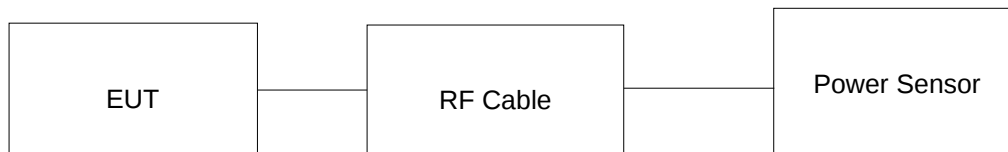
7.1 Maximum Average Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3)
Test Method	Subclause 11.9.2.2.2 of ANSI C63.10
Detector	Average detector mode
Port of testing	Antenna port
Requirement	Power ≤ 1 W (30 dBm) & e.i.r.p ≤ 4 W (36 dBm)

Test Method



Test Condition

Normal Test Condition:

Temperature (Norm) = + 25 °C

Voltage = 3V DC

Relative humidity: 62%

KDB Guidelines applied:

Measurements were made as per section 8.3.1.3 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 Average Output power (dBm) = Measured Average power (dBm) + Cable loss (0.5dB)
3. Maximum (e.i.r.p) = Maximum Average output power (dBm) + Antenna gain (2.2 dBi)

Modulation: 802.11b

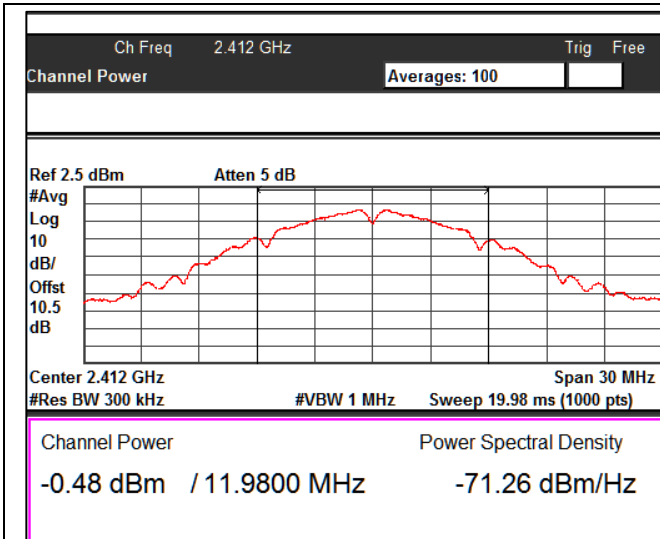
Data rate	Channel Frequency (MHz)	Measured Average Power (dBm)	Power Limit (dBm)
1Mbps	2412	-0.48	30
	2437	-0.94	30
	2462	-0.96	30
2Mbps	2412	-0.45	30
	2437	-1.03	30
	2462	-1.04	30
5.5Mbps	2412	-0.10	30
	2437	-0.68	30
	2462	-0.74	30
11Mbps	2412	-0.29	30
	2437	-0.87	30
	2462	-0.94	30

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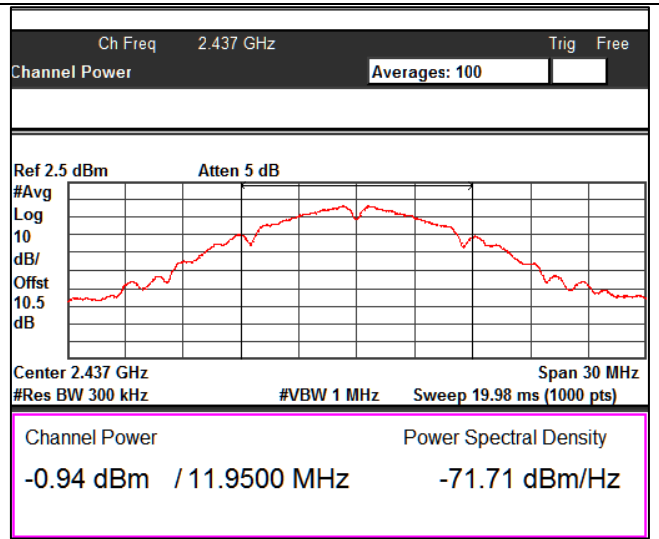
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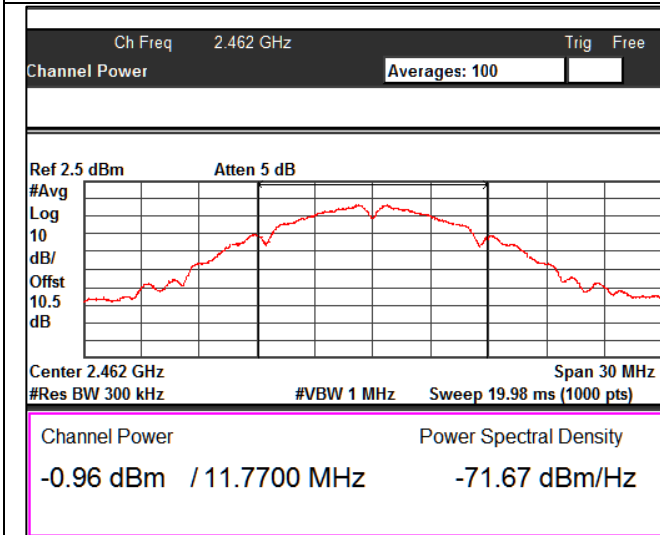
Test Plots:



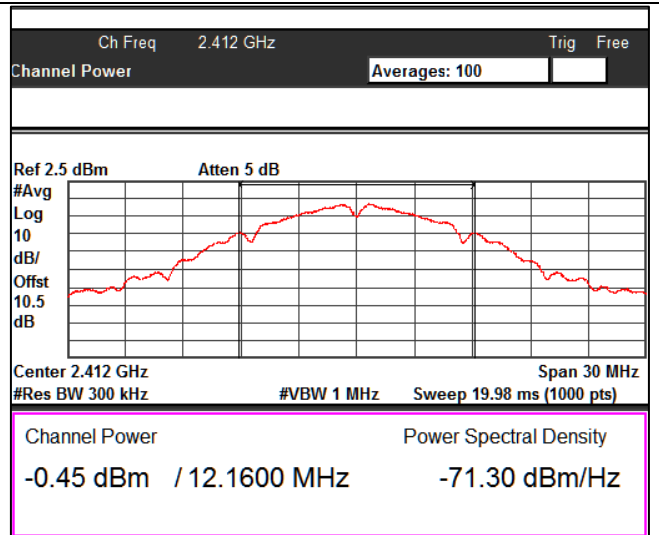
Data Rate: 1Mbps Channel Frequency: 2412MHz



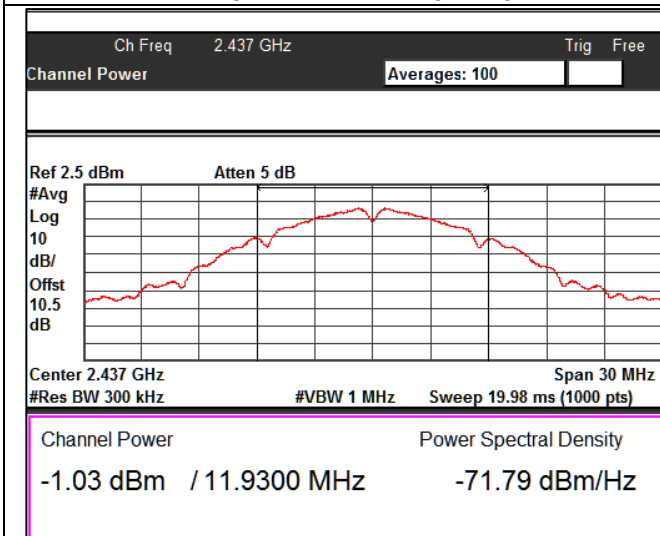
Data Rate: 1Mbps Channel Frequency: 2437MHz



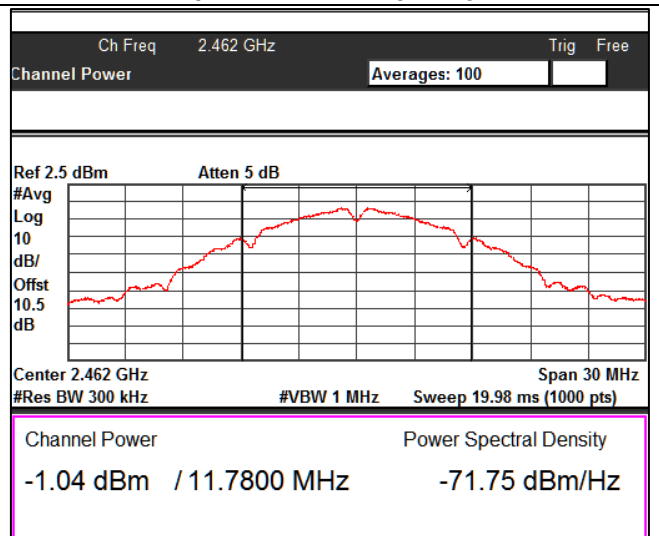
Data Rate: 1Mbps Channel Frequency: 2462MHz



Data Rate: 2Mbps Channel Frequency: 2412MHz



Data Rate: 2Mbps Channel Frequency: 2437MHz



Data Rate: 2Mbps Channel Frequency: 2462MHz

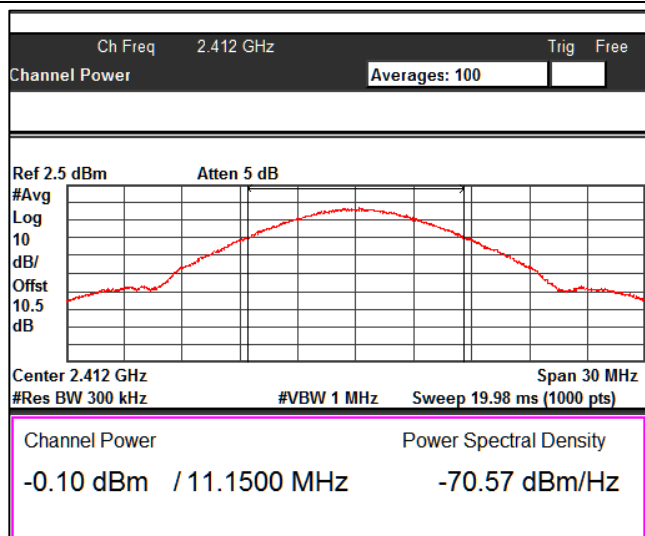
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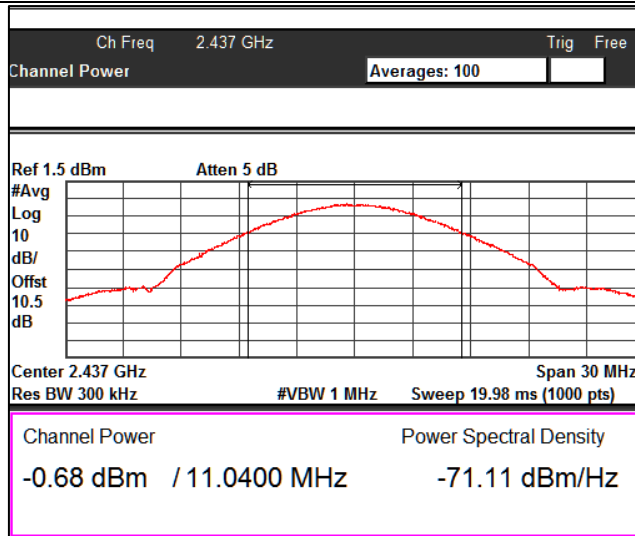
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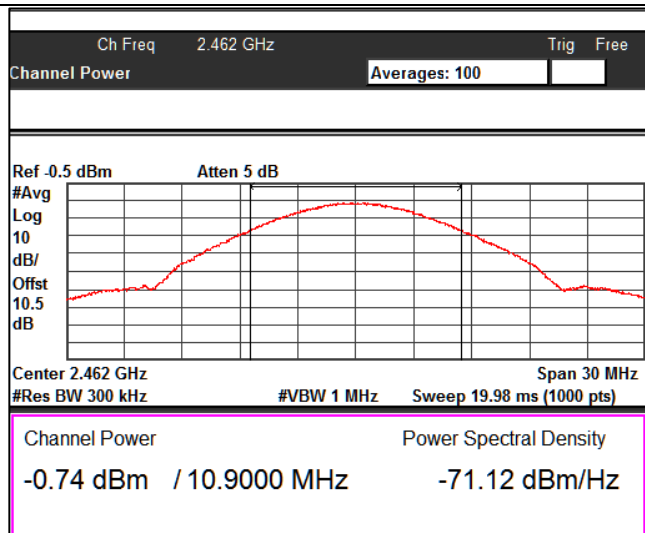
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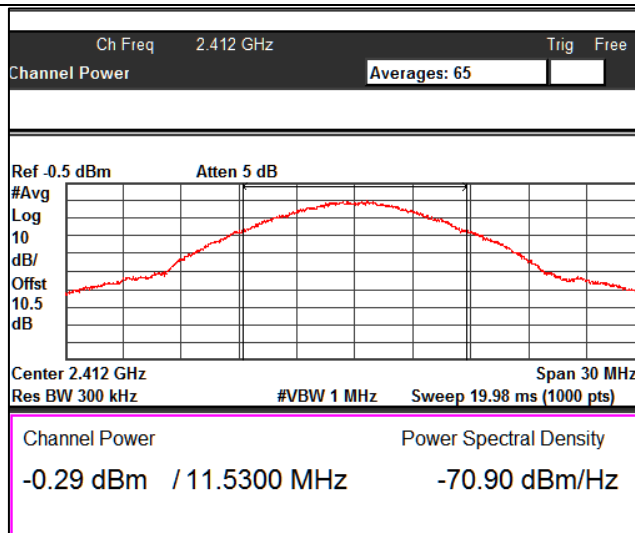
Data Rate: 5.5 Mbps Channel Frequency: 2412MHz



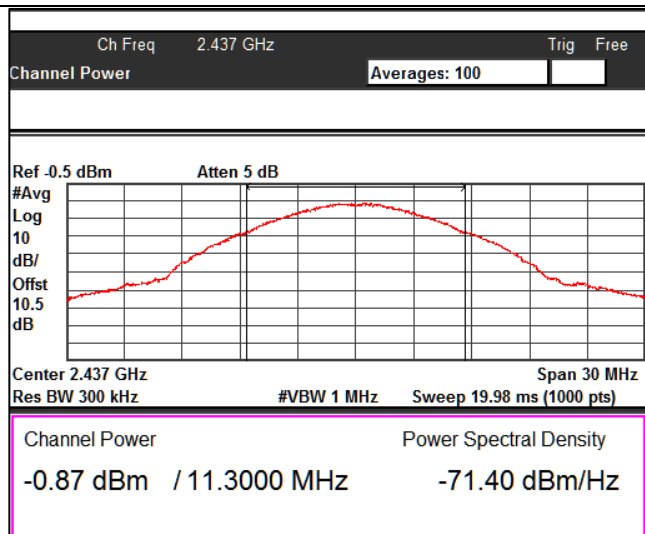
Data Rate: 5.5 Mbps Channel Frequency: 2437MHz



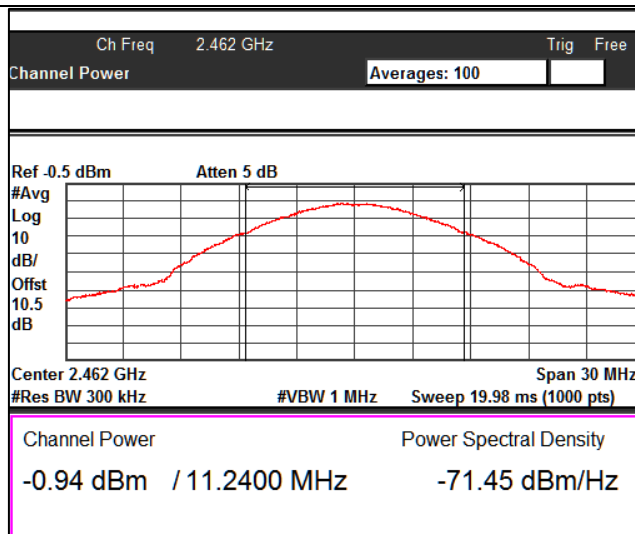
Data Rate: 5.5 Mbps Channel Frequency: 2462MHz



Data Rate: 11 Mbps Channel Frequency: 2412MHz



Data Rate: 11 Mbps Channel Frequency: 2437MHz



Data Rate: 11 Mbps Channel Frequency: 2462MHz

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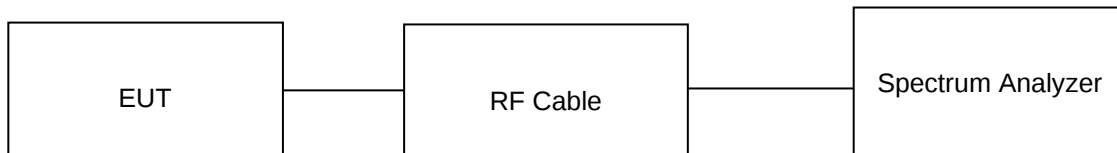
7.2 Maximum Power Spectral Density

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (e)
Test Method	Subclause 11.10.3 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

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 25°C

Voltage = 3V DC

Relative humidity: 62 %

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.
2. Total Peak PSD (dBm) = Measured Average PSD (dBm) + Cable loss (0.5dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 2.2 dBi

Modulation: 802.11b

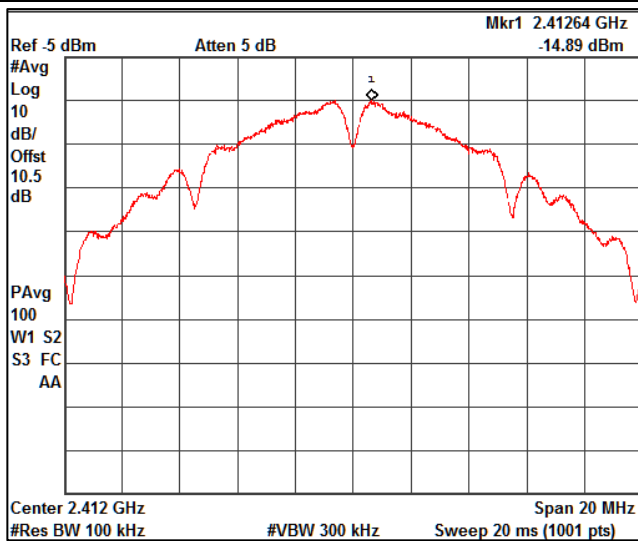
Mode	Data rate	Measured Channel Frequency (MHz)	PSD (dBm)	Limit (8dBm/ 100kHz)
b	1Mbps	2412	-14.89	8.00
		2437	-16.14	8.00
		2462	-15.98	8.00
	2Mbps	2412	-15.43	8.00
		2437	-16.14	8.00
		2462	-15.36	8.00
	5.5Mbps	2412	-15.69	8.00
		2437	-15.5	8.00
		2462	-16.6	8.00
	11Mbps	2412	-15.54	8.00
		2437	-16.39	8.00
		2462	-16.44	8.00

Test Plots:

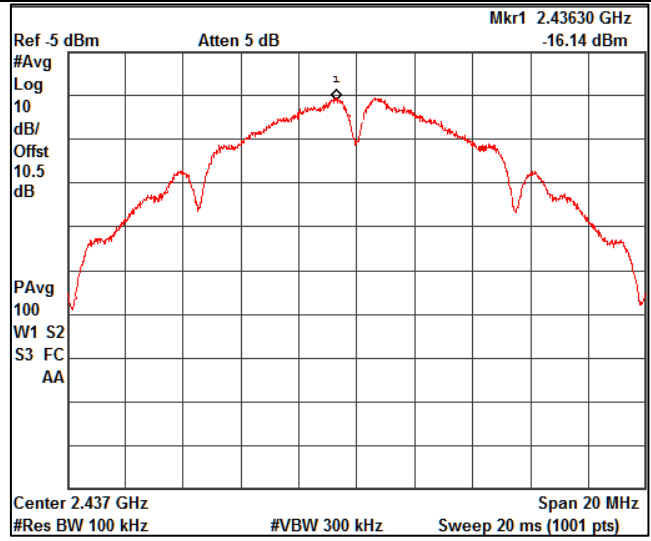
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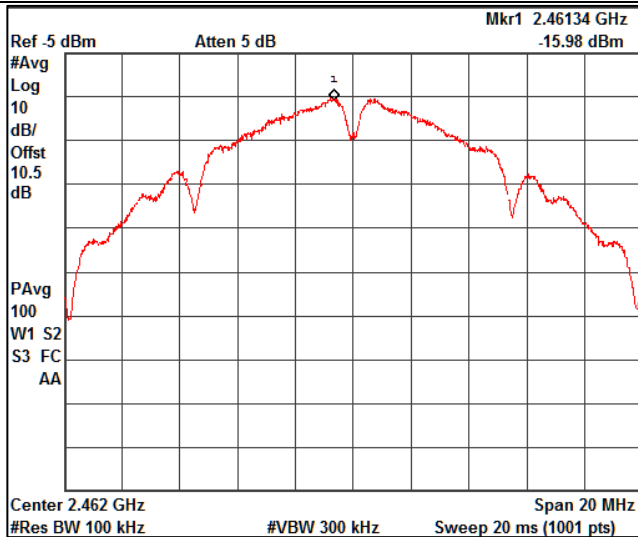
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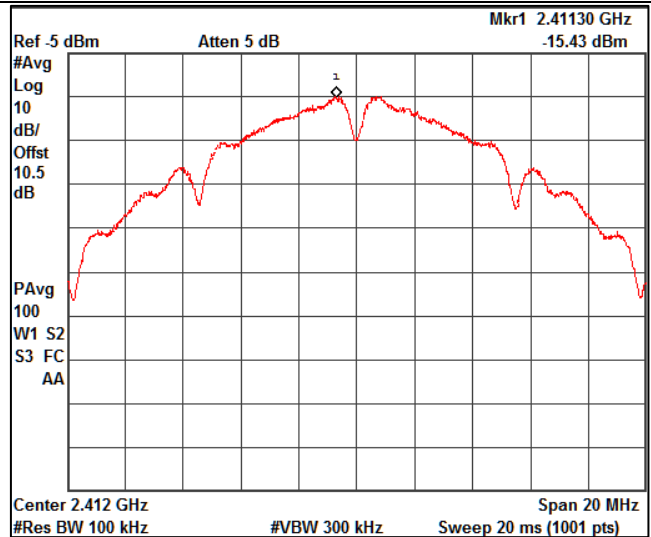
Data Rate: 1Mbps Channel Frequency: 2412MHz



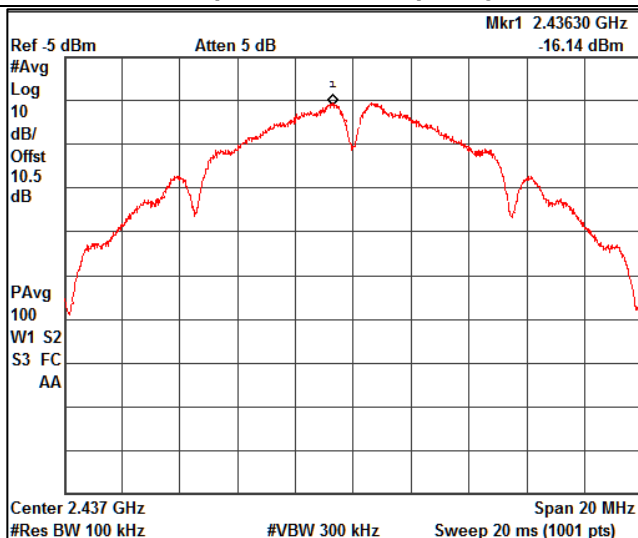
Data Rate: 1Mbps Channel Frequency: 2437MHz



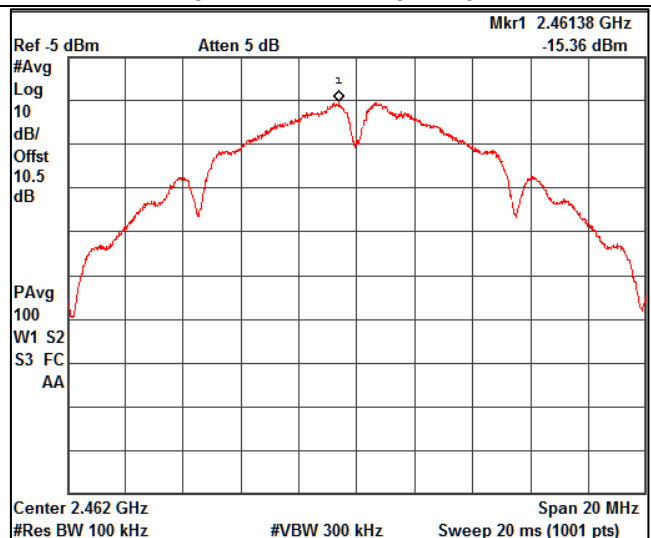
Data Rate: 1Mbps Channel Frequency: 2462MHz



Data Rate: 2Mbps Channel Frequency: 2412MHz



Data Rate: 2Mbps Channel Frequency: 2437MHz



Data Rate: 2Mbps Channel Frequency: 2462MHz

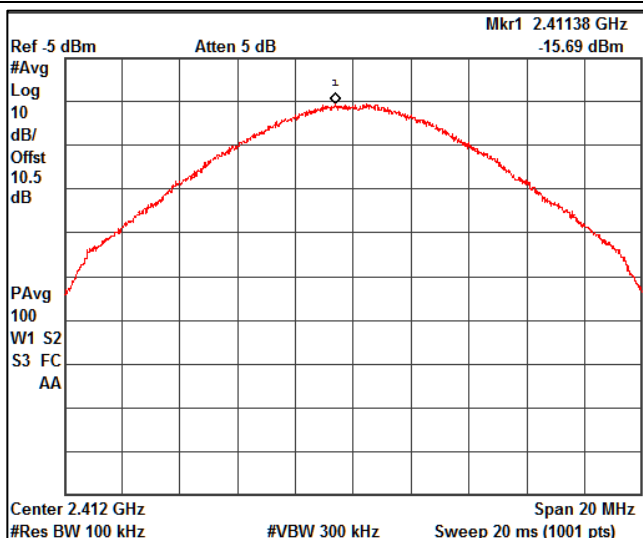
Prüfbericht - Nr.:

Test Report No.:

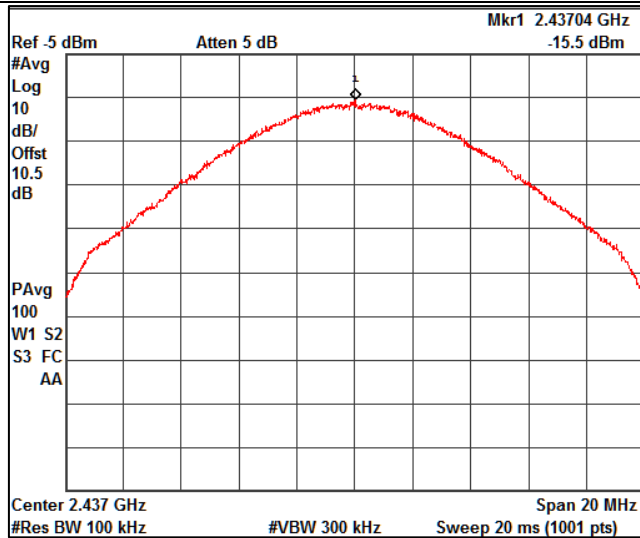
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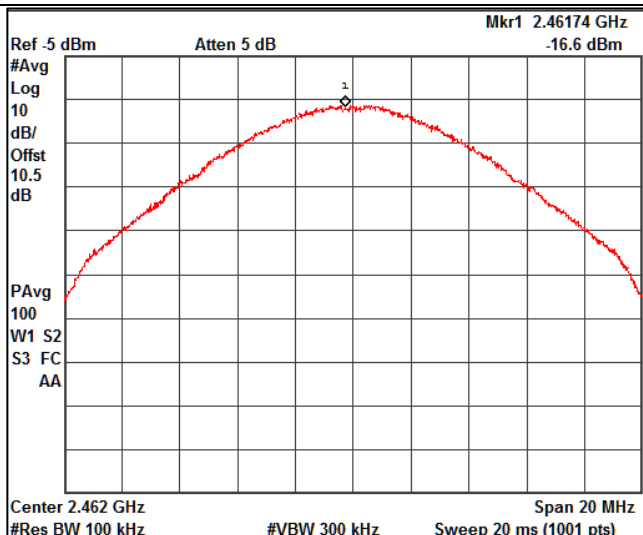
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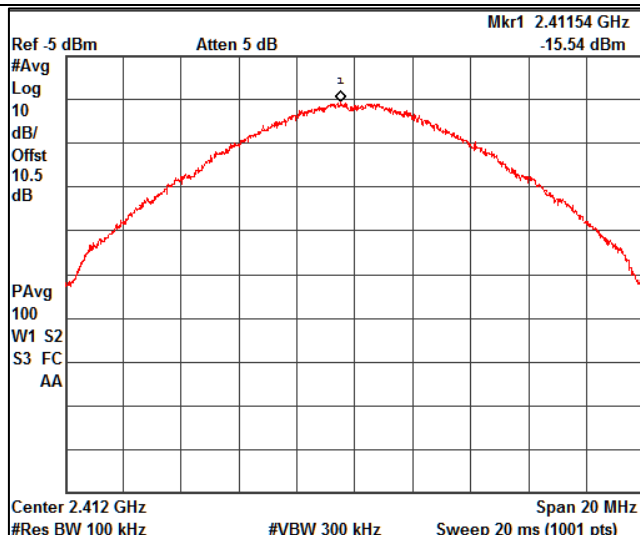
Data Rate: 5.5 Mbps Channel Frequency: 2412MHz



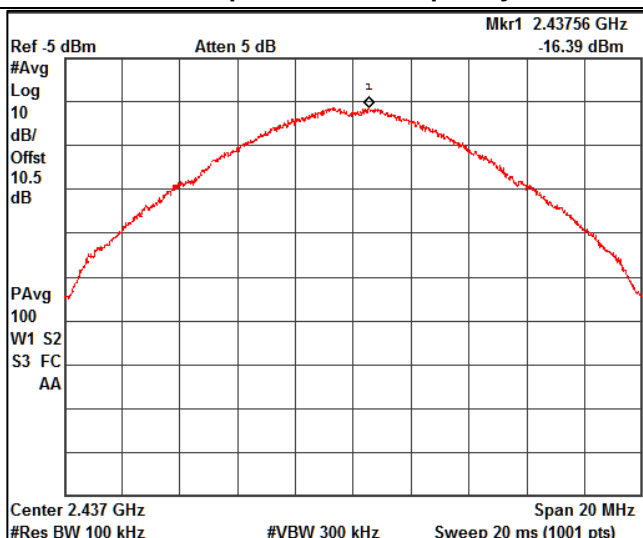
Data Rate: 5.5 Mbps Channel Frequency: 2437MHz



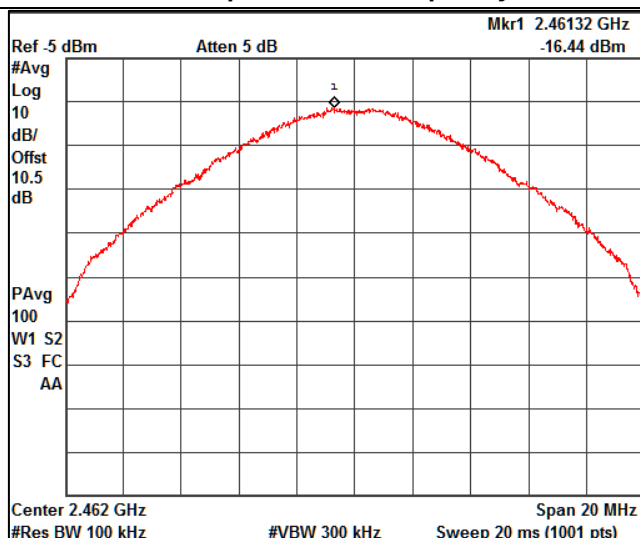
Data Rate: 5.5 Mbps Channel Frequency: 2462MHz



Data Rate: 11 Mbps Channel Frequency: 2412MHz



Data Rate: 11 Mbps Channel Frequency: 2437MHz



Data Rate: 11 Mbps Channel Frequency: 2462MHz

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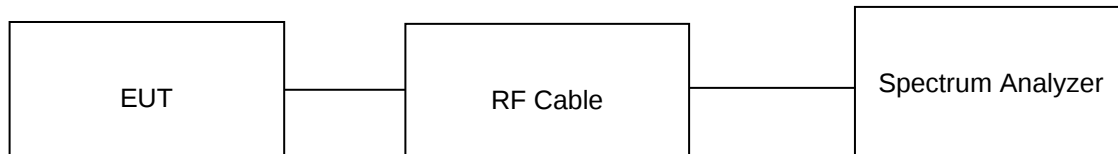
7.3 DTS Bandwidth & 99% Bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (2)
Test Method	Subclause 11.8.1 & 6.9.3 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	The minimum 6 dB bandwidth shall be at least 500 kHz

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 25 °C Voltage = 3V DC Relative humidity: 62 %

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. For 6 dB Bandwidth Measurements were made as per section 8.2 in KDB 558074 D01 15.247 Measurement Guidance v05r02.
3. For OCW 99 % Bandwidth measurements were made as per section 6.9.3 ANSI C63.10-2013

Modulation: 802.11b

Data rate: 1Mbps

Mode	Data rate	Measured Channel Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
b	1Mbps	2412	5.57	11.98
		2437	5.57	11.95
		2462	5.58	11.77
	2Mbps	2412	5.64	12.16
		2437	5.89	11.93
		2462	5.69	11.78
	5.5Mbps	2412	5.65	11.15
		2437	6.06	11.04
		2462	5.44	10.90
	11Mbps	2412	5.67	11.53
		2437	5.88	11.30
		2462	5.27	11.24

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Test Report No.:

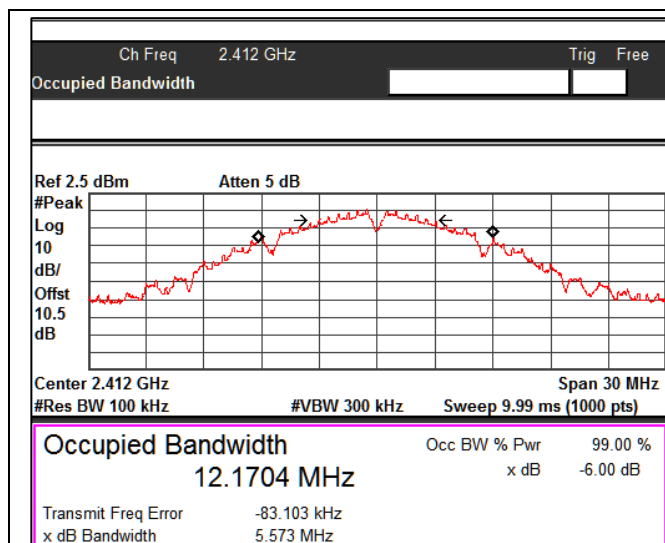
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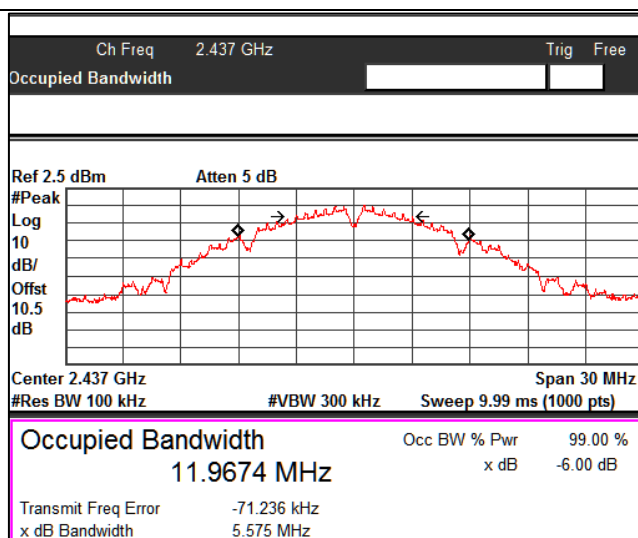
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Test Plots:

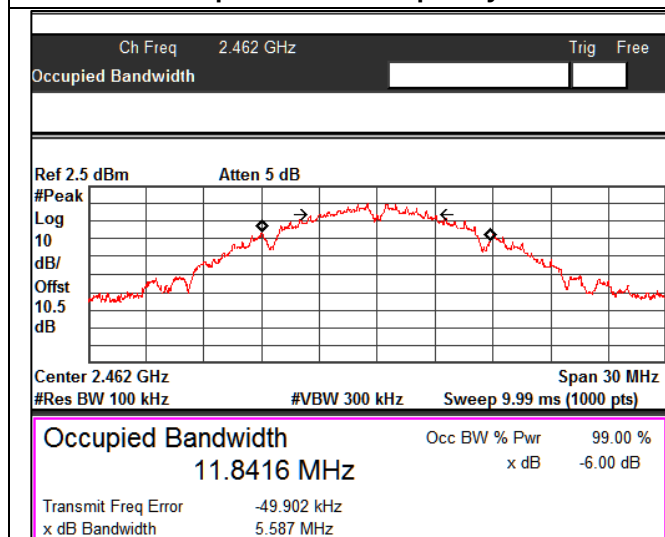
DTS Bandwidth:



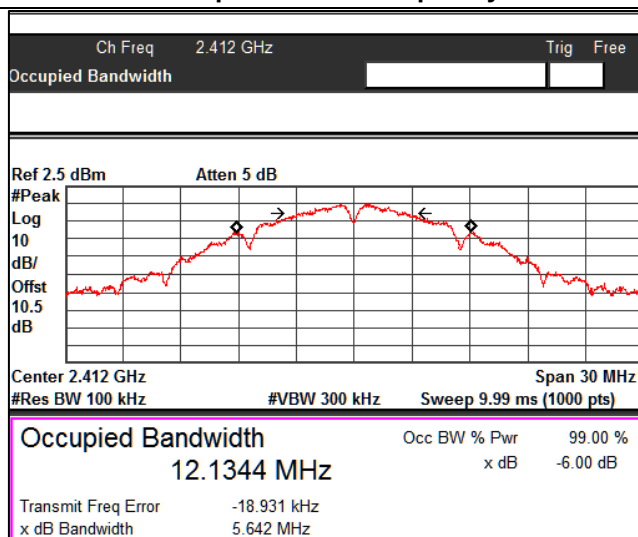
Data Rate: 1Mbps Channel Frequency: 2412MHz



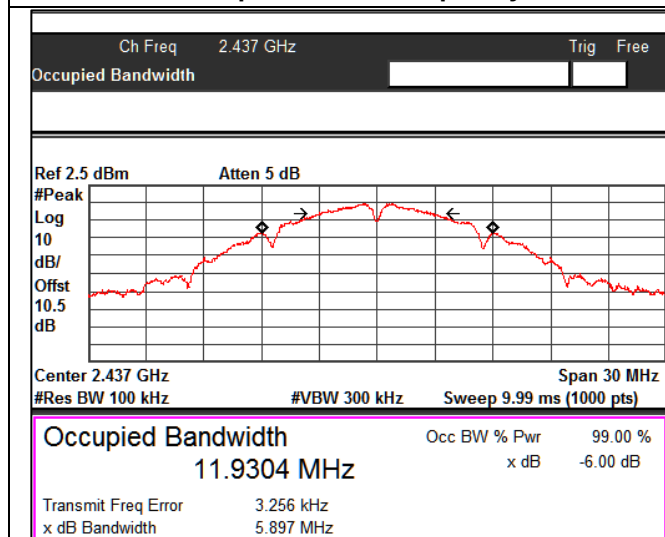
Data Rate: 1Mbps Channel Frequency: 2437MHz



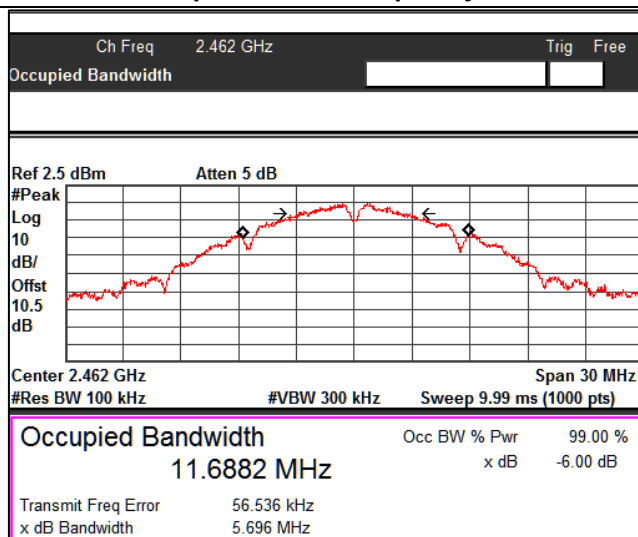
Data Rate: 1Mbps Channel Frequency: 2462MHz



Data Rate: 2Mbps Channel Frequency: 2412MHz



Data Rate: 2Mbps Channel Frequency: 2437MHz

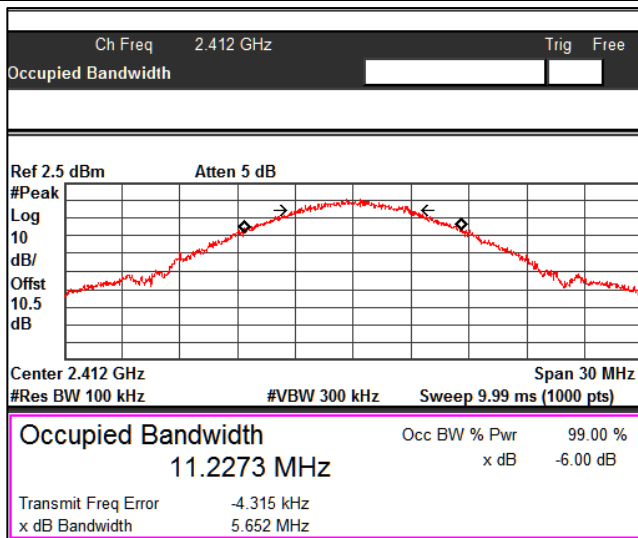


Data Rate: 2Mbps Channel Frequency: 2462MHz

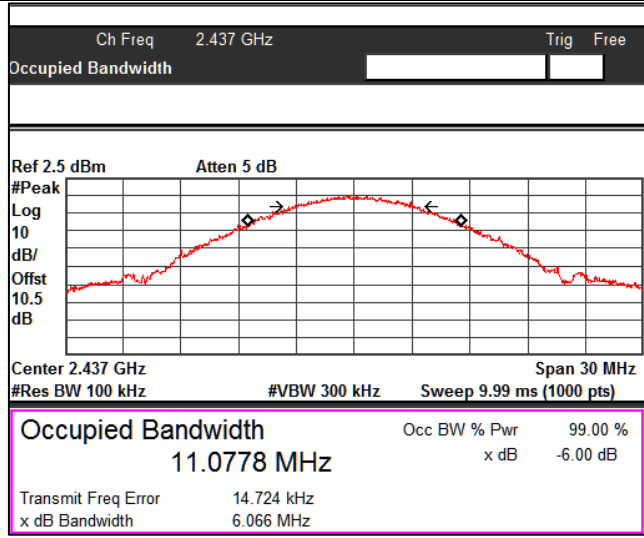
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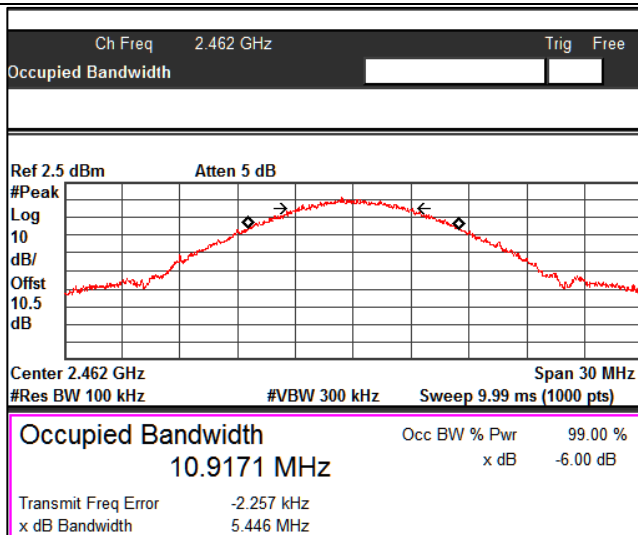
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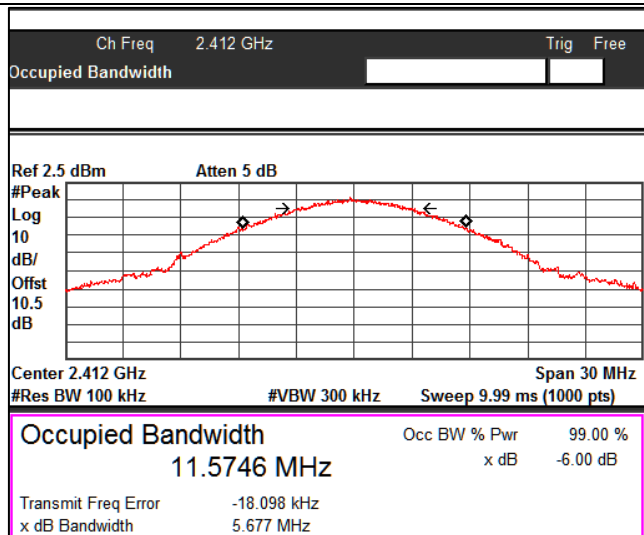
Data Rate: 5.5 Mbps Channel Frequency: 2412MHz



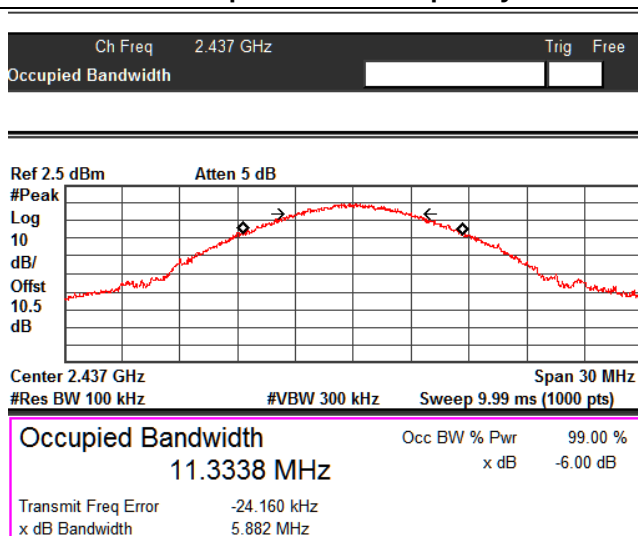
Data Rate: 5.5 Mbps Channel Frequency: 2437MHz



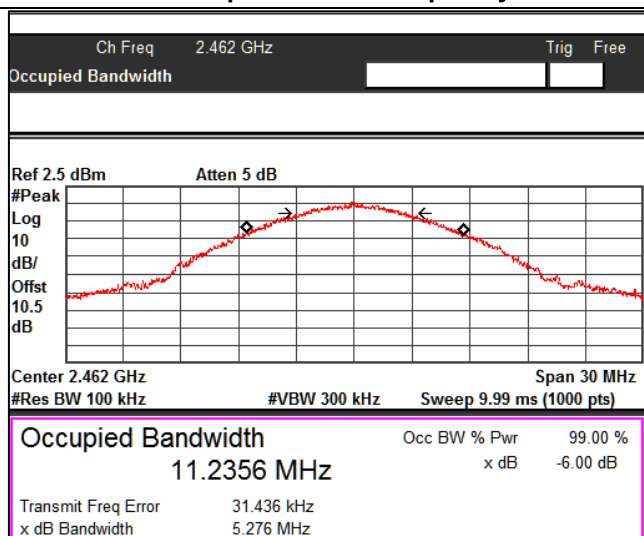
Data Rate: 5.5 Mbps Channel Frequency: 2462MHz



Data Rate: 11 Mbps Channel Frequency: 2412MHz



Data Rate: 11 Mbps Channel Frequency: 2437MHz



Data Rate: 11 Mbps Channel Frequency: 2462MHz

Prüfbericht - Nr.:

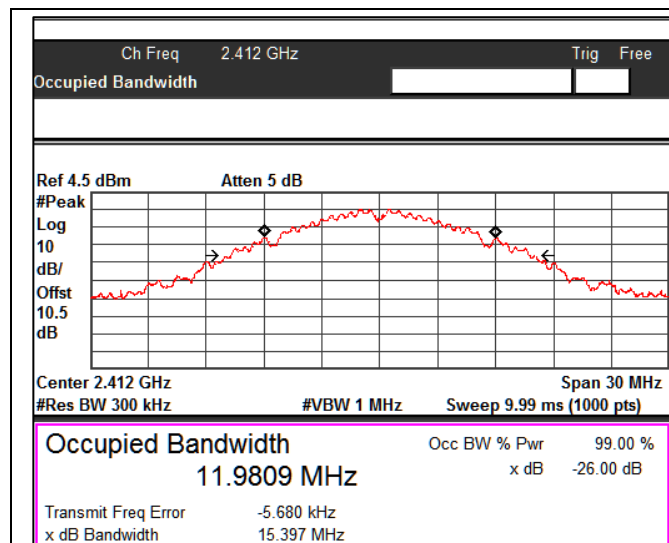
Test Report No.:

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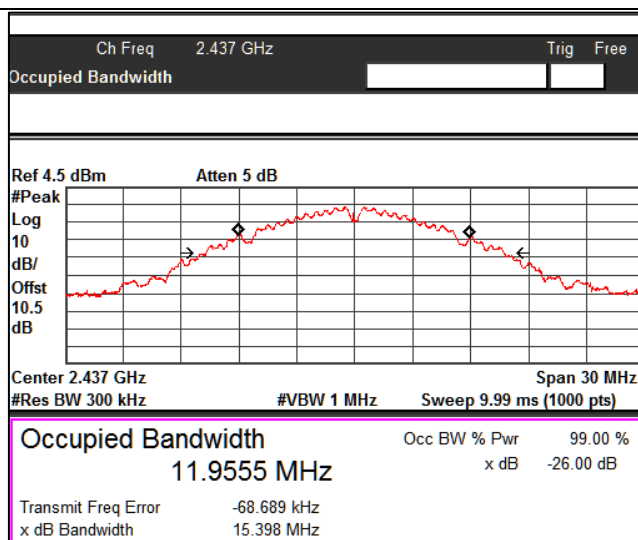
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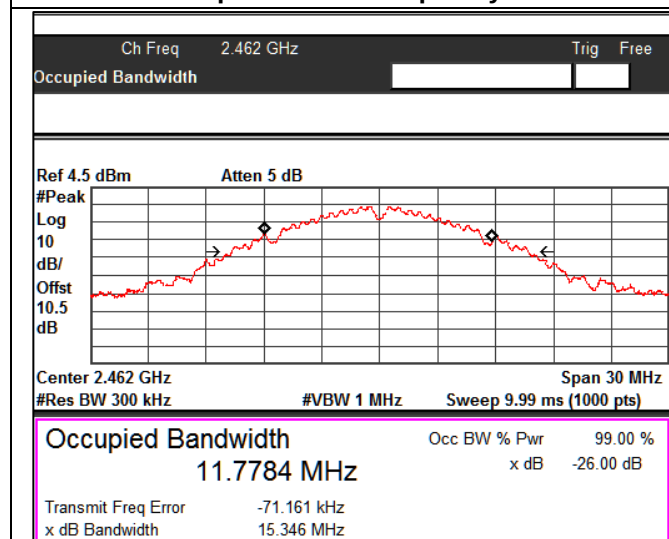
99% Bandwidth:



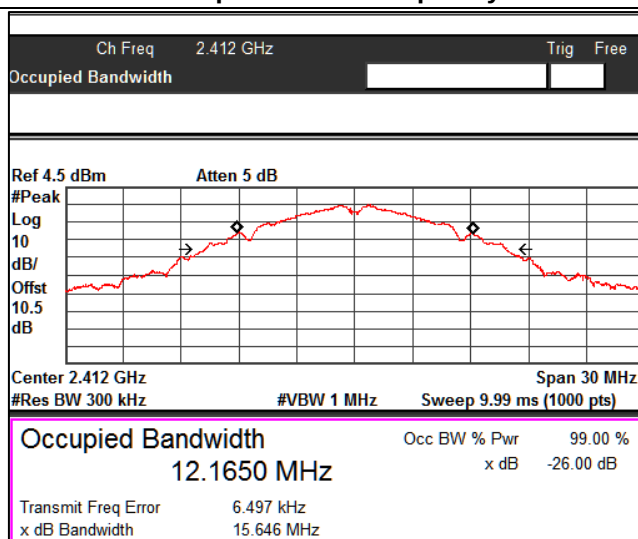
Data Rate: 1Mbps Channel Frequency: 2412MHz



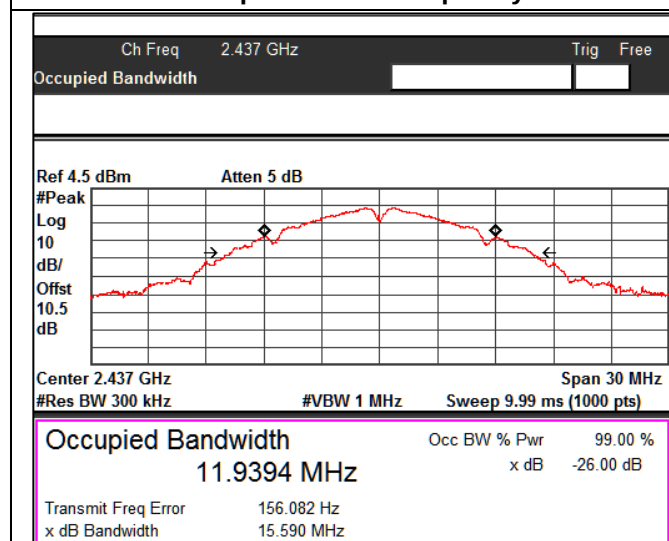
Data Rate: 1Mbps Channel Frequency: 2437MHz



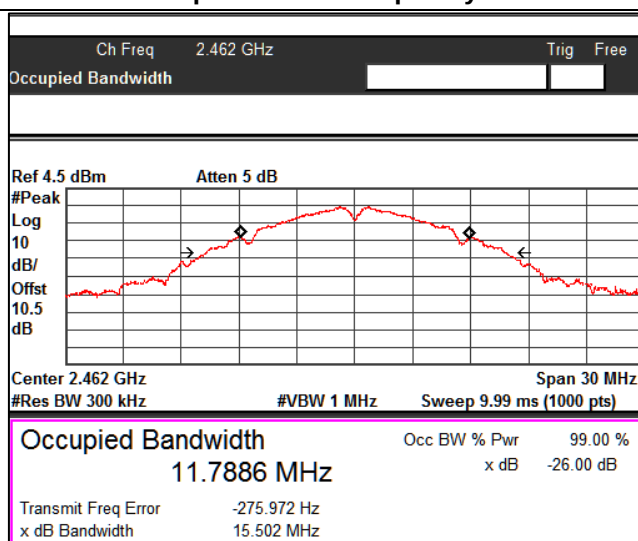
Data Rate: 1Mbps Channel Frequency: 2462MHz



Data Rate: 2Mbps Channel Frequency: 2412MHz



Data Rate: 2Mbps Channel Frequency: 2437MHz

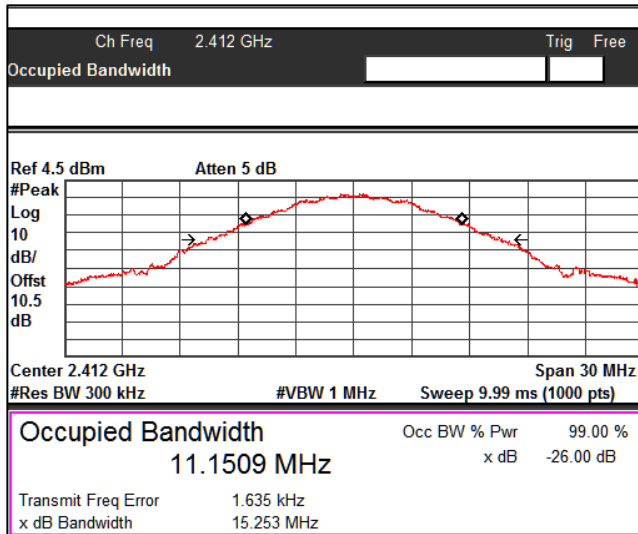


Data Rate: 2Mbps Channel Frequency: 2462MHz

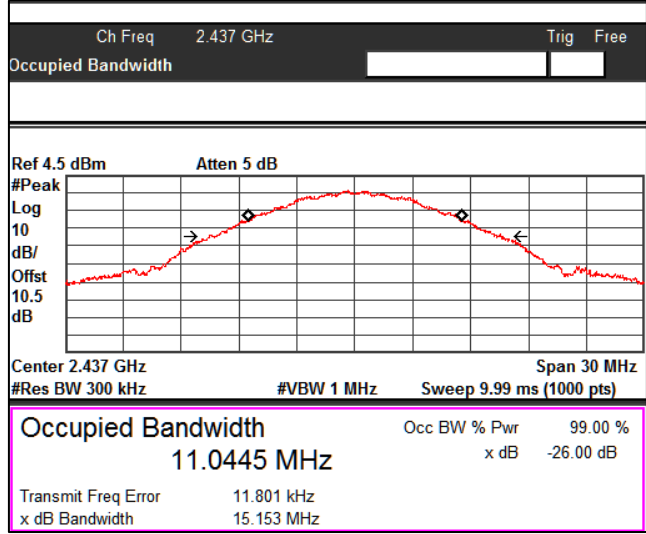
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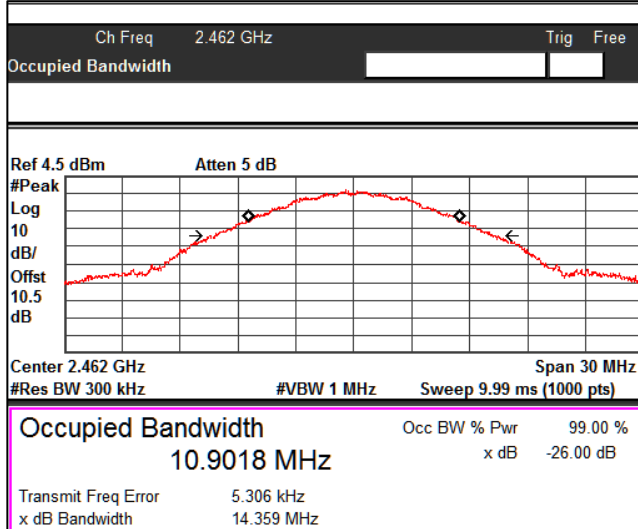
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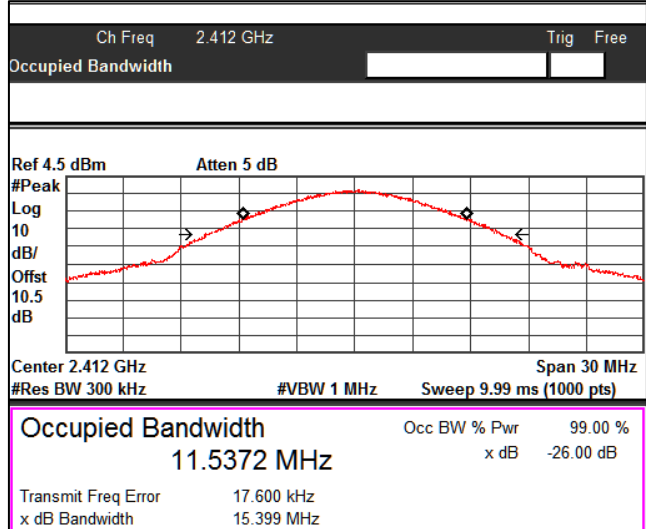
Data Rate: 5.5 Mbps Channel Frequency: 2412MHz



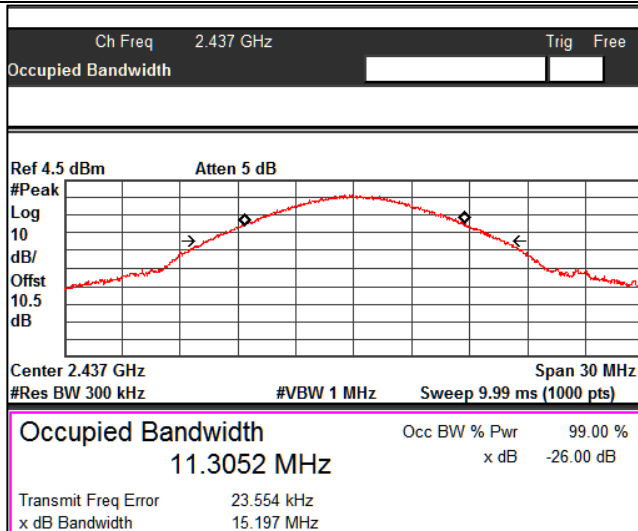
Data Rate: 5.5 Mbps Channel Frequency: 2437MHz



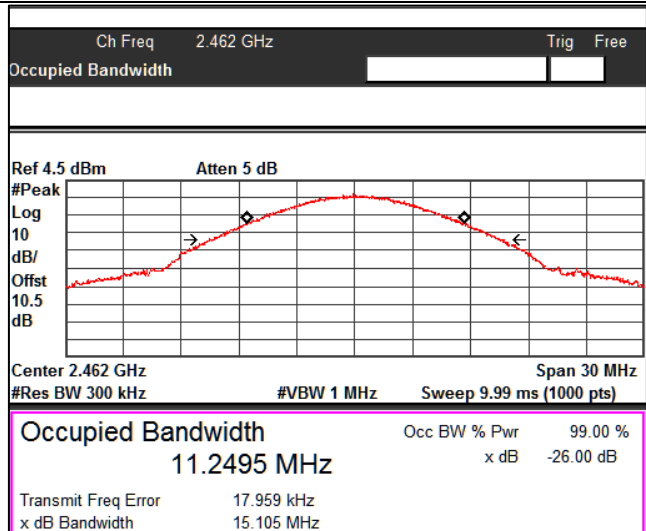
Data Rate: 5.5 Mbps Channel Frequency: 2462MHz



Data Rate: 11 Mbps Channel Frequency: 2412MHz



Data Rate: 11 Mbps Channel Frequency: 2437MHz



Data Rate: 11 Mbps Channel Frequency: 2462MHz

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

Result

Pass

Test Specification FCC part 15 Subpart C 15.247 (d)

Test Method Subclause 11.11 of ANSI C63.10

Measurement Bandwidth 100 kHz

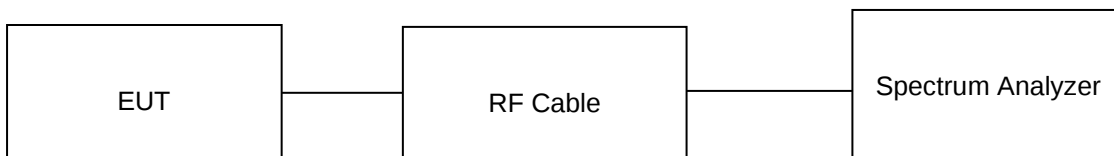
Detector Peak

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 20dB 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) = +25 °C

Voltage = 3V DC

Relative Humidity: 62%

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. Final Value (dBm) = Measured Value (dBm) + Cable loss (0.5dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 2.2 dBi

7.4.1 Band edge and reference plots.

Modulation: 802.11b

Data Rate: 1Mbps

Channel Frequency (MHz)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2412	2400	-51.81	-6.39	-45.42	-20
2462	2483.5	-67.34	-7.14	-60.20	-20

Data Rate: 2Mbps

Channel Frequency (MHz)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2412	2400	-53.15	-6.80	-46.35	-20
2462	2483.5	-67.90	-7.34	-60.56	-20

Data Rate: 5.5Mbps

Channel Frequency (MHz)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2412	2400	-51.72	-6.11	-45.61	-20
2462	2483.5	-67.54	-6.36	-61.18	-20

Data Rate: 11Mbps

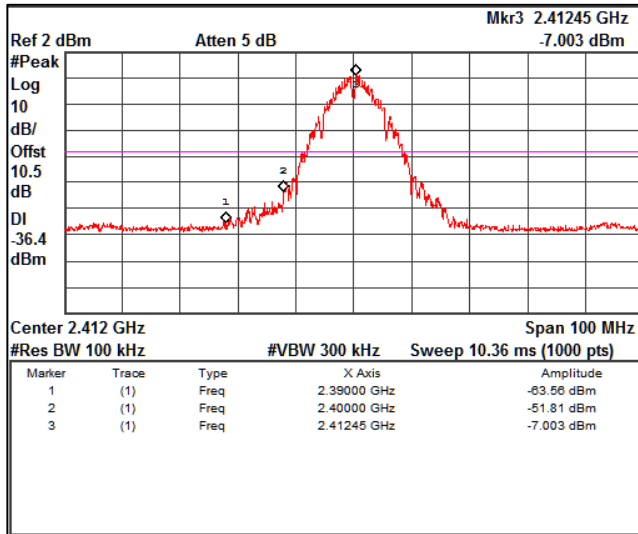
Channel Frequency (MHz)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2412	2400	-52.80	-6.82	-45.98	-20
2462	2483.5	-65.63	-7.67	-57.96	-20

Prüfbericht - Nr.:
Test Report No.:

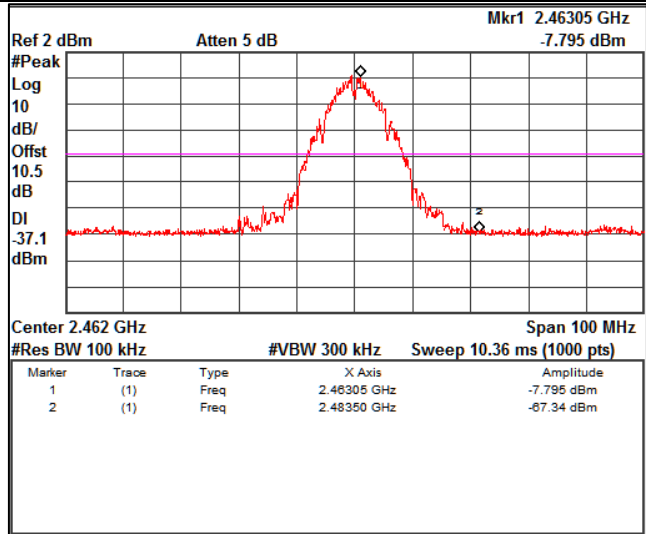
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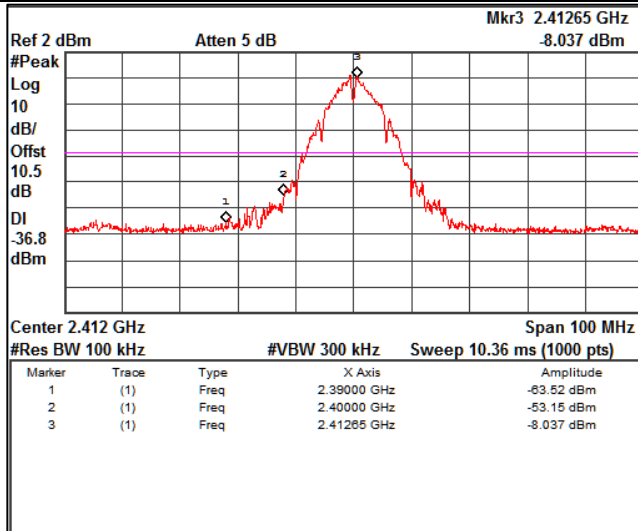
Test Plots:



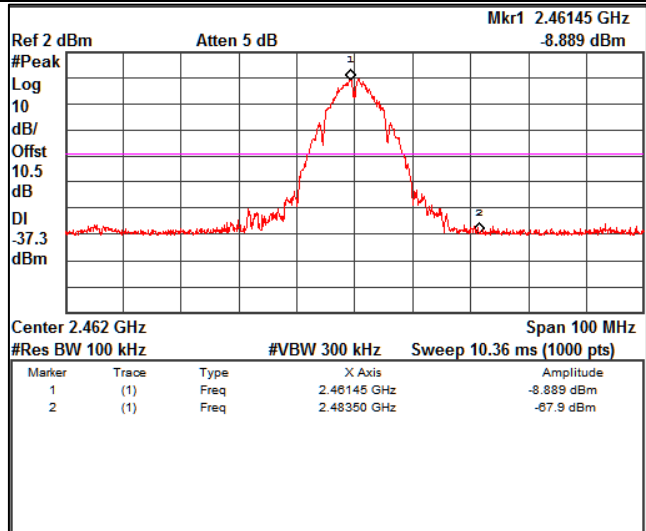
Data Rate: 1Mbps Channel Frequency: 2412MHz



Data Rate: 1Mbps Channel Frequency: 2462MHz



Data Rate: 2Mbps Channel Frequency: 2412MHz

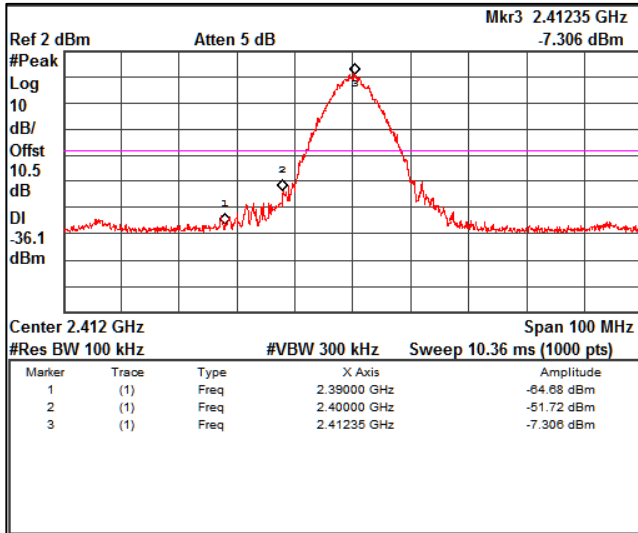


Data Rate: 2Mbps Channel Frequency: 2462MHz

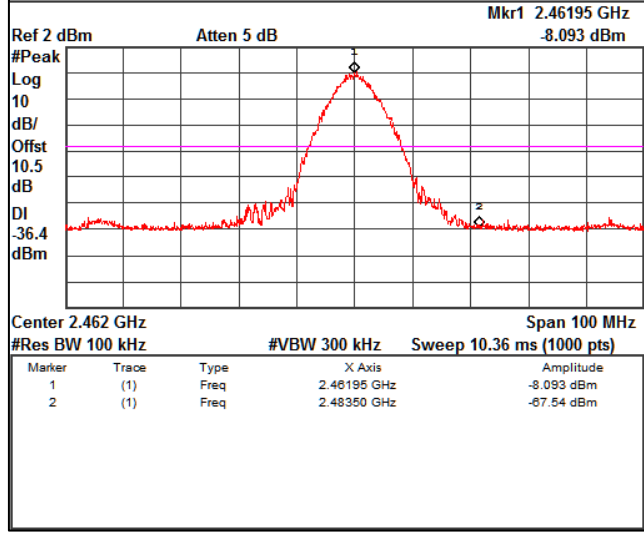
Prüfbericht - Nr.:
Test Report No.:

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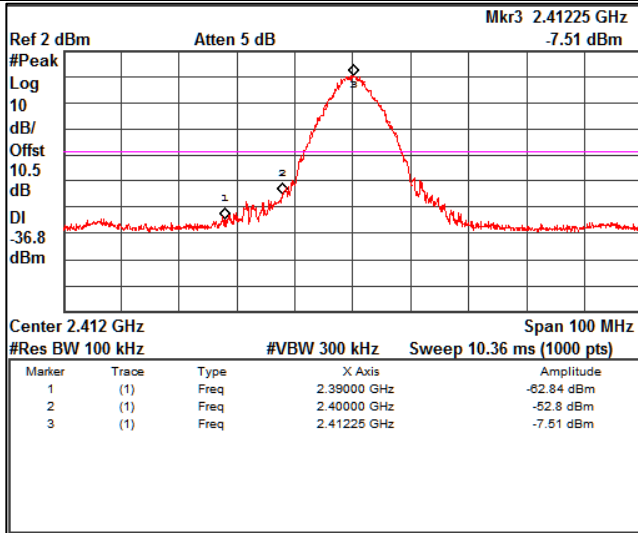
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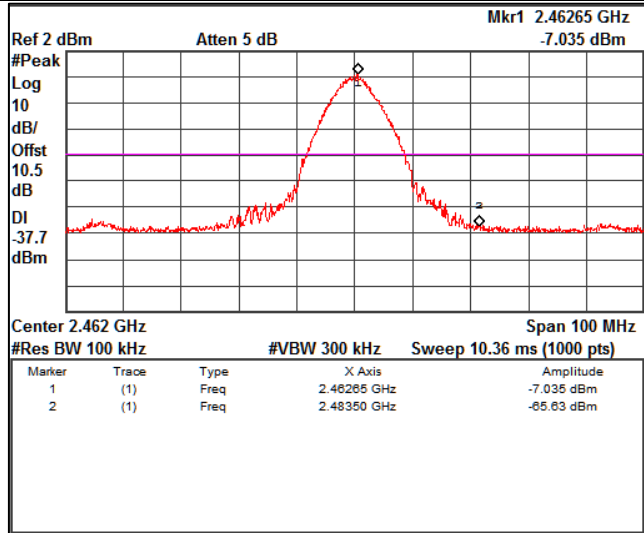
Data Rate: 5.5 Mbps Channel Frequency: 2412MHz



Data Rate: 5.5 Mbps Channel Frequency: 2462MHz



Data Rate: 11 Mbps Channel Frequency: 2412MHz

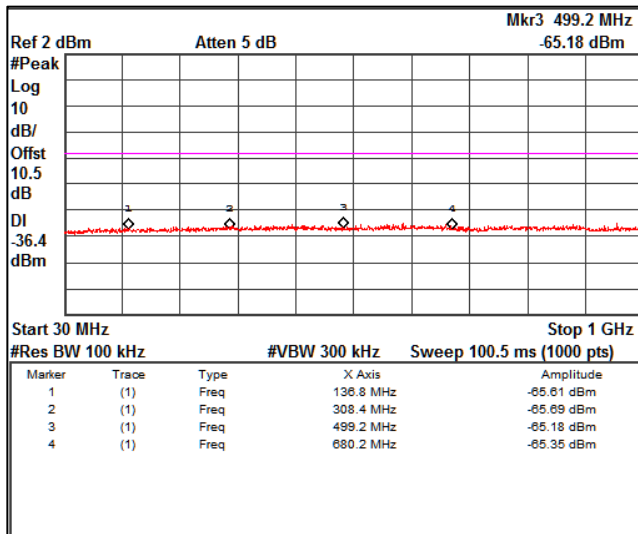


Data Rate: 11 Mbps Channel Frequency: 2462MHz

Conducted Spurious emissions

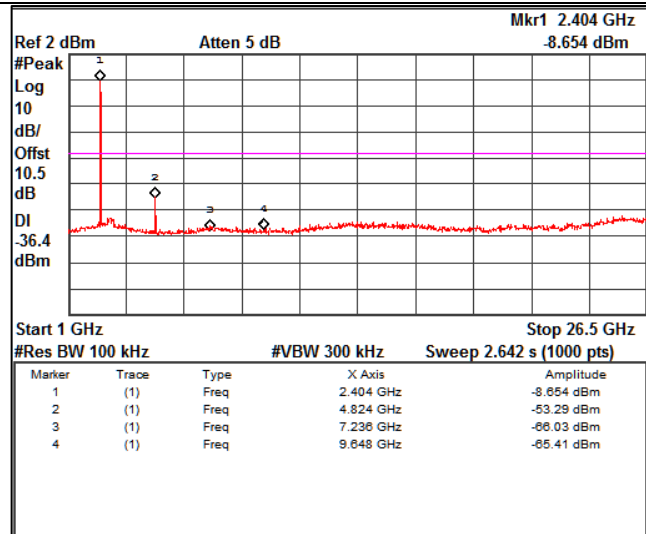
Data Rate: 1Mbps

Frequency Range: 30MHz-1GHz

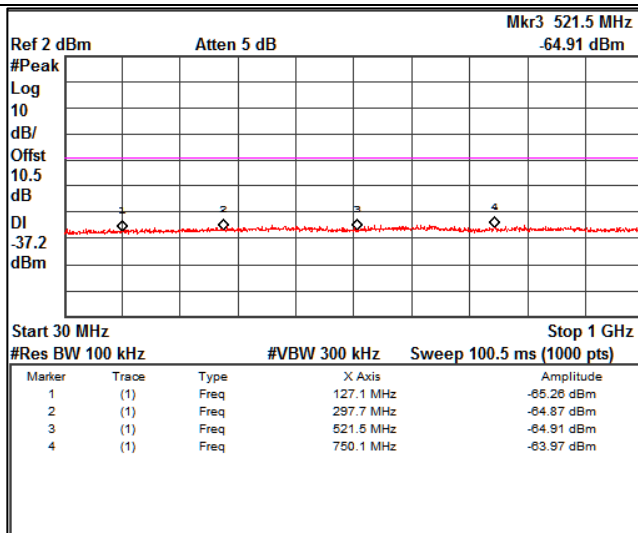


Channel Frequency: 2412MHz

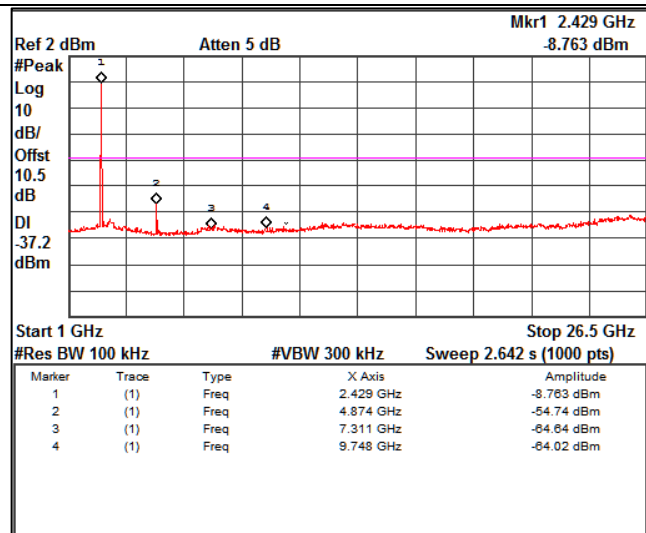
Frequency Range: 1GHz-26GHz



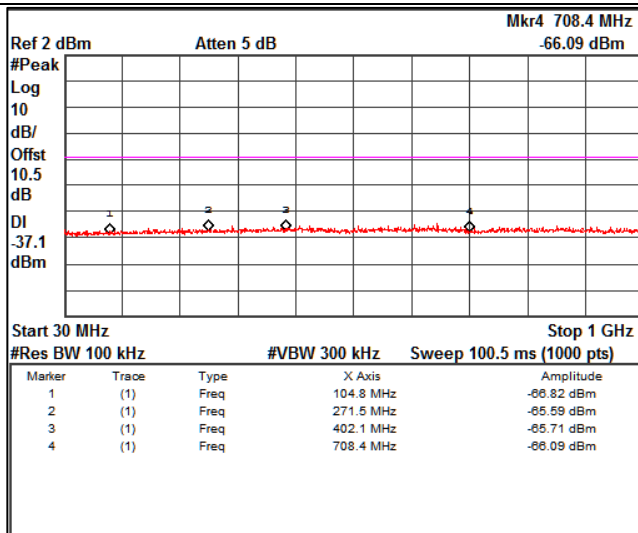
Channel Frequency: 2412MHz



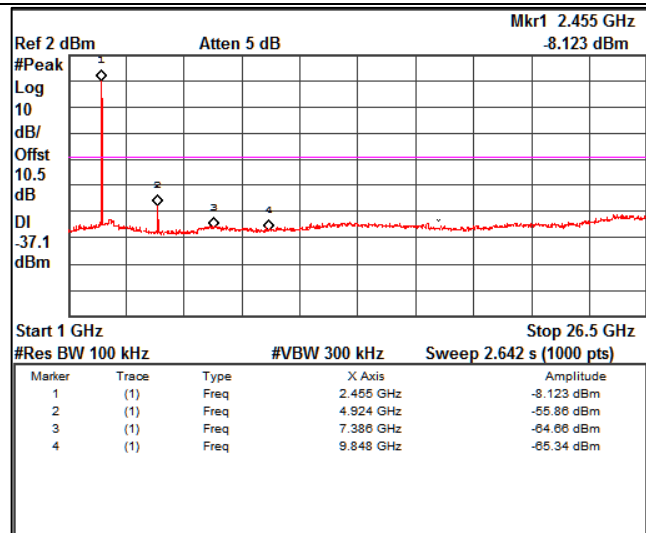
Channel Frequency: 2437MHz



Channel Frequency: 2437MHz



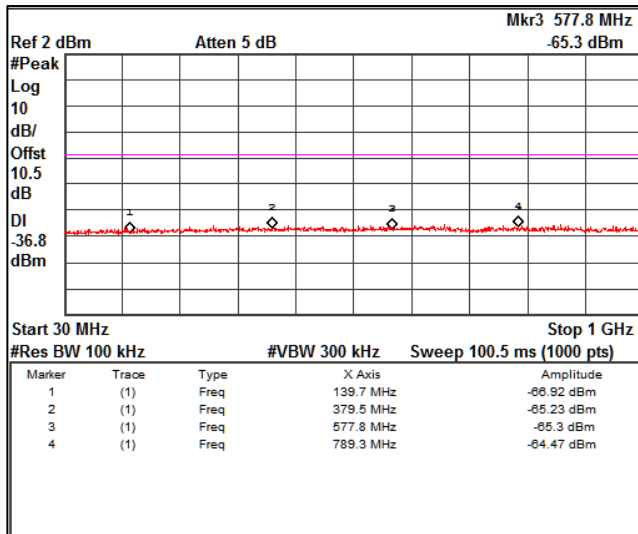
Channel Frequency: 2462MHz



Channel Frequency: 2462MHz

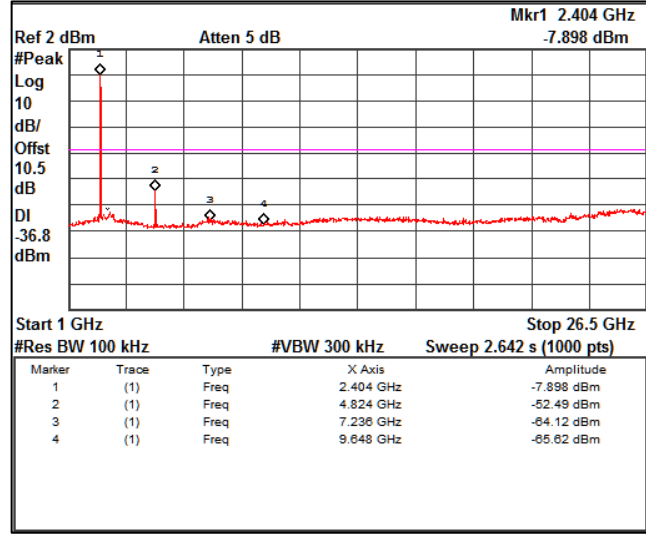
Data Rate: 11Mbps

Frequency Range: 30MHz-1GHz

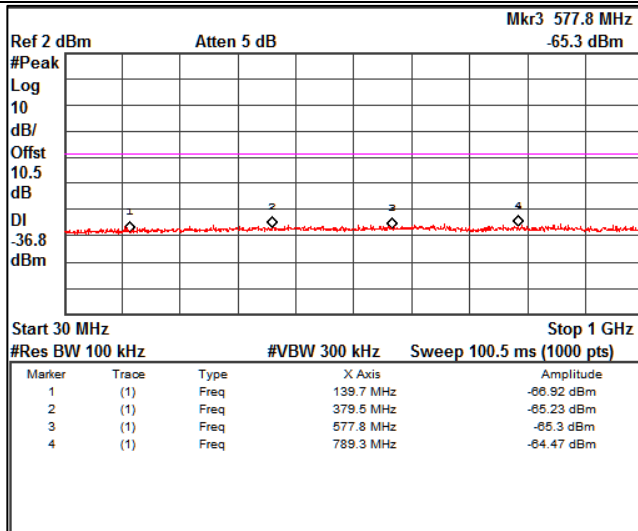


Channel Frequency: 2412MHz

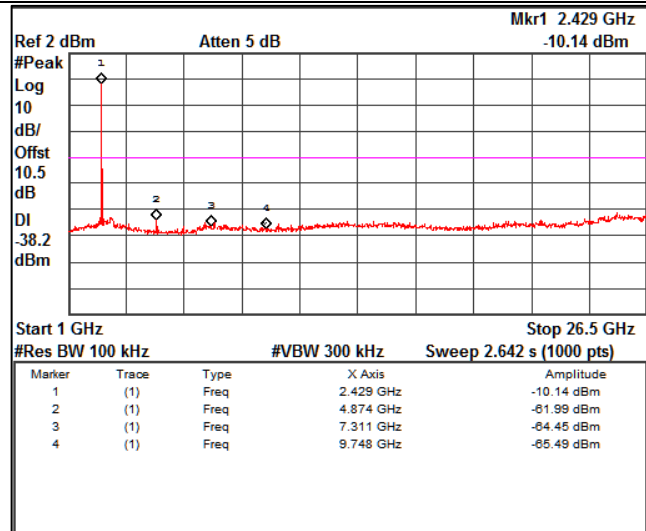
Frequency Range: 1GHz-26GHz



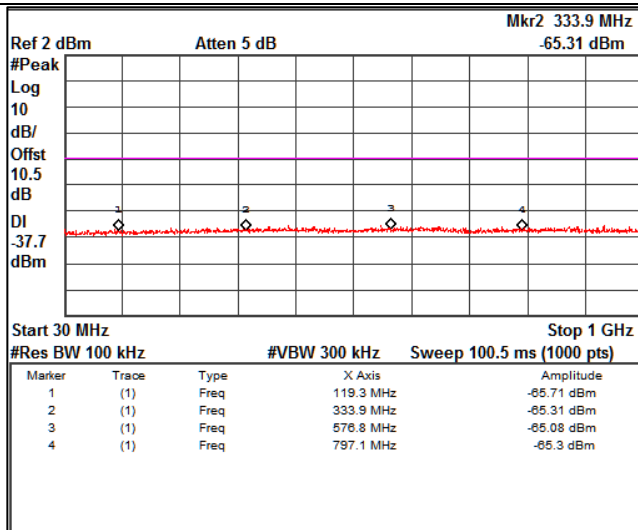
Channel Frequency: 2412MHz



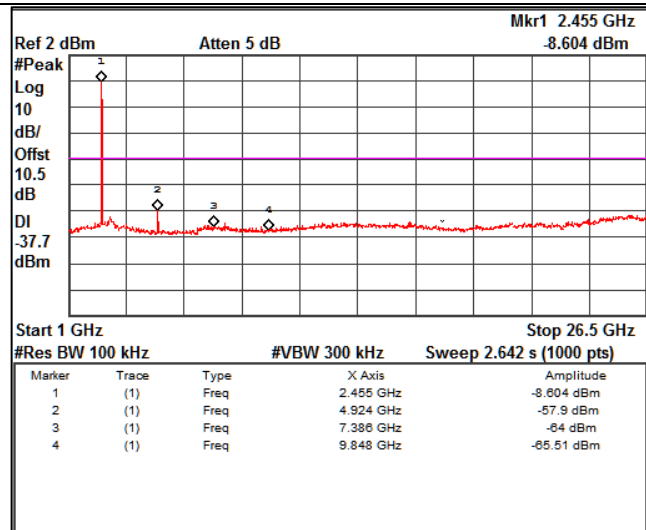
Channel Frequency: 2437MHz



Channel Frequency: 2437MHz



Channel Frequency: 2462MHz



Channel Frequency: 2462MHz

7.5 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d)
Test Method	ANSI C63.10
Measurement Location	Semi Anechoic Chamber 30MHz - 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 Clause 7 TEST METHODOLOGY

Table 7: 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) = + 25 °C

Voltage = 3V DC

Relative humidity = 62 %

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Test results:

Note: All the losses are included during measurement and final values are mentioned in the test report. Refer Clause 7 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

Test results for frequency range 30MHz – 1GHz

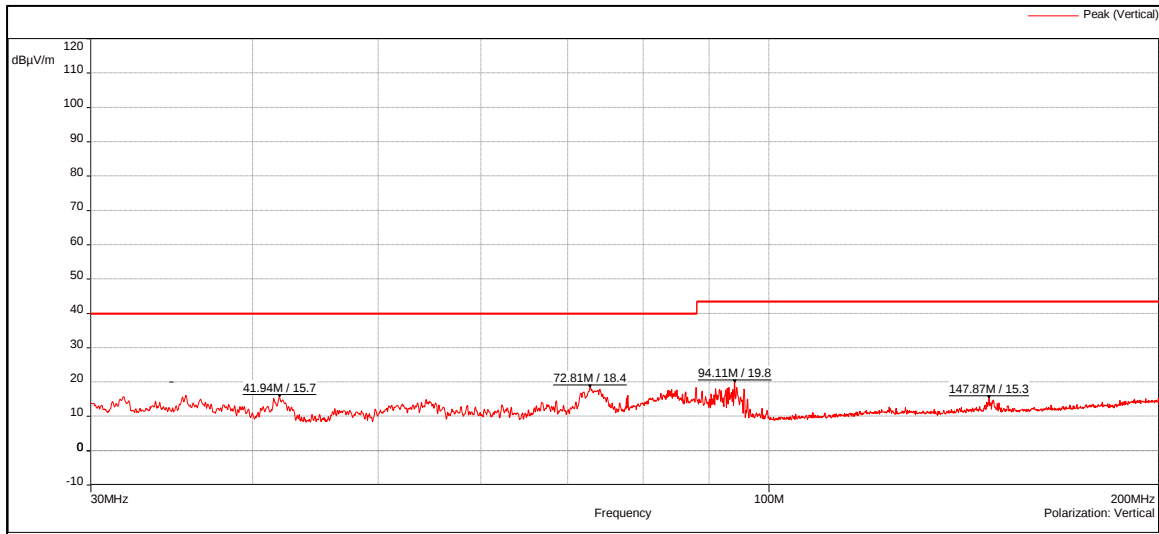
Antenna Polarization	Measured Frequency (MHz)	Measured Value (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Vertical	41.94	15.70	40	-24.30
	72.81	18.40	40	-21.60
	94.11	19.80	43.5	-23.70
	147.87	15.30	43.5	-28.20
	245.2	18.10	46	-27.90
	264.98	33.30	46	-12.70
	279.02	25.00	46	-21.00
	656.18	26.70	46	-19.30
Horizontal	51.36	16.00	40	-24.00
	77.52	22.90	40	-17.10
	86.07	17.50	40	-22.50
	199.6	18.60	43.5	-24.90
	288.68	24.80	46	-21.20
	304.49	34.00	46	-12.00
	625.88	24.70	46	-21.30

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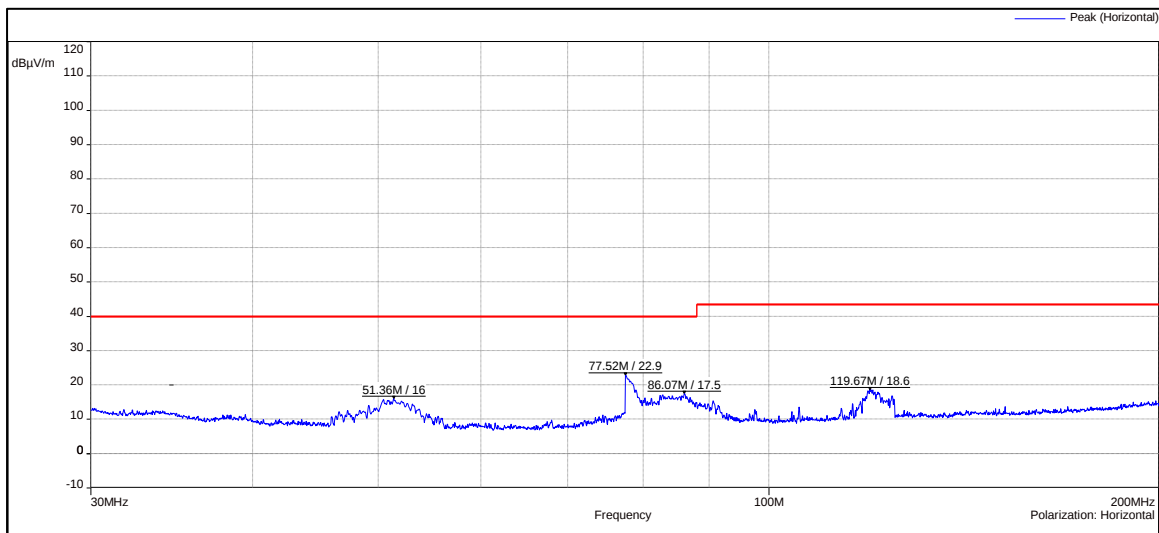
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Test Plots: 30MHz-1GHz



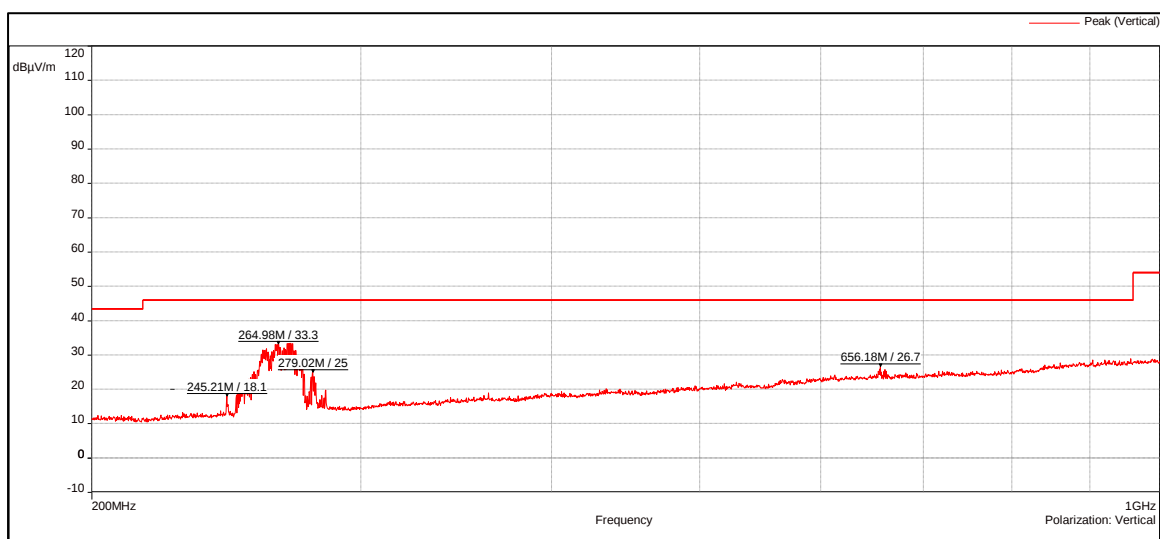
Frequency Range: 30MHz-200MHz

Polarization: Vertical



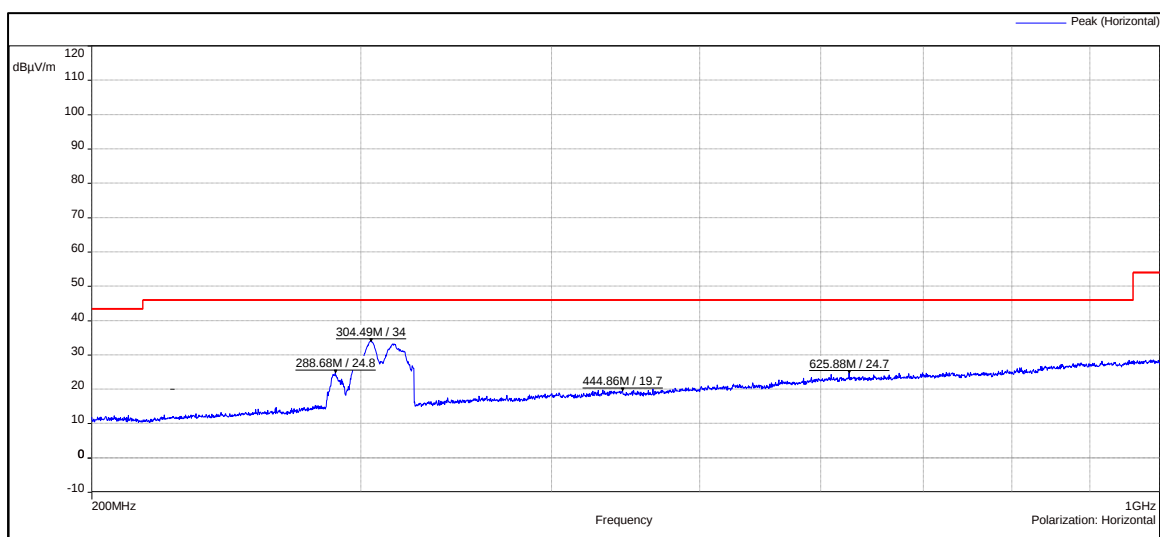
Frequency Range: 30MHz-200MHz

Polarization: Horizontal



Frequency Range: 200MHz – 1GHz

Polarization: Vertical



Frequency Range: 200MHz – 1GHz

Polarization: Horizontal

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Test Results for Above 1GHz

Data Rate: b mode 1Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2412	2412(Pk)	Vertical	91.23	*	-
	2412(Av)		83.61	*	-
	2390(Pk)		39.98	74	-34.02
	2390(Av)		27.07	54	-26.93
	4824(Pk)		41.50	74	-32.50
	4824(Av)		29.83	54	-24.17
	7236(Pk)		47.23	74	-26.77
	7236(Av)		35.27	54	-18.73
	2412(Pk)	Horizontal	95.84	*	-
	2412(Av)		87.82	*	-
	2390(Pk)		40.85	74	-33.15
	2390(Av)		28.22	54	-25.78
	4824(Pk)		42.22	74	-31.78
	4824(Av)		30.52	54	-23.48
	7236(Pk)		46.83	74	-27.17
	7236(Av)		35.25	54	-18.75
2437	2437(Pk)	Vertical	90.96	*	-
	2437(Av)		84.15	*	-
	4874(Pk)		41.03	74	-32.97
	4874(Av)		30.09	54	-23.91
	7311(Pk)		48.36	74	-25.64
	7311(Av)		35.10	54	-18.90
	2437(Pk)	Horizontal	94.23	*	-
	2437(Av)		87.46	*	-
	4874(Pk)		41.63	74	-32.37
	4874(Av)		30.16	54	-23.84
	7311(Pk)		47.22	74	-26.78
	7311(Av)		35.02	54	-18.98
2462	2462(Pk)	Vertical	91.08	*	-
	2462(Av)		83.92	*	-
	2483.5(Pk)		39.31	74	-34.69
	2483.5(Av)		24.84	54	-29.16
	4924(Pk)		40.79	74	-33.21
	4924(Av)		29.17	54	-24.83
	7386(Pk)		46.78	74	-27.22
	7386(Av)		35.18	54	-18.82
	2462(Pk)	Horizontal	95.35	*	-
	2462(Av)		88.42	*	-
	2483.5(Pk)		38.22	74	-35.78
	2483.5(Av)		25.74	54	-28.26
	4924(Pk)		40.96	74	-33.04
	4924(Av)		29.03	54	-24.97
	7386(Pk)		47.18	74	-26.82
	7386(Av)		35.18	54	-18.82

Note: *- indicates fundamental frequency

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Data Rate: b mode 2Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2412	2412(Pk)	Vertical	90.39	*	-
	2412(Av)		83.25	*	-
	2390(Pk)		39.08	74	-34.92
	2390(Av)		26.43	54	-27.57
	4824(Pk)		40.85	74	-33.15
	4824(Av)		29.54	54	-24.46
	7236(Pk)		46.75	74	-27.25
	7236(Av)		35.16	54	-18.84
	2412(Pk)	Horizontal	94.84	*	-
	2412(Av)		87.70	*	-
	2390(Pk)		40.16	74	-33.84
	2390(Av)		27.81	54	-26.19
	4824(Pk)		41.47	74	-32.53
	4824(Av)		30.13	54	-23.87
	7236(Pk)		48.08	74	-25.92
	7236(Av)		35.20	54	-18.80
2437	2437(Pk)	Vertical	91.25	*	-
	2437(Av)		84.18	*	-
	4874(Pk)		41.60	74	-32.40
	4874(Av)		29.47	54	-24.53
	7311(Pk)		46.72	74	-27.28
	7311(Av)		35.06	54	-18.94
	2437(Pk)	Horizontal	94.31	*	-
	2437(Av)		87.23	*	-
	4874(Pk)		41.30	74	-32.70
	4874(Av)		29.22	54	-24.78
	7311(Pk)		46.75	74	-27.25
	7311(Av)		35.06	54	-18.94
2462	2462(Pk)	Vertical	89.90	*	-
	2462(Av)		83.08	*	-
	2483.5(Pk)		38.26	74	-35.74
	2483.5(Av)		24.30	54	-29.70
	4924(Pk)		41.48	74	-32.52
	4924(Av)		29.52	54	-24.48
	7386(Pk)		47.37	74	-26.63
	7386(Av)		35.19	54	-18.81
	2462(Pk)	Horizontal	94.89	*	-
	2462(Av)		87.74	*	-
	2483.5(Pk)		39.88	74	-34.12
	2483.5(Av)		26.79	54	-27.21
	4924(Pk)		40.36	74	-33.64
	4924(Av)		28.92	54	-25.08
	7386(Pk)		47.18	74	-26.82
	7386(Av)		35.20	54	-18.80

Note: *- indicates fundamental frequency

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Data Rate: b mode 5.5Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2412	2412(Pk)	Vertical	91.32	*	-
	2412(Av)		82.84	*	-
	2390(Pk)		39.50	74	-34.50
	2390(Av)		26.51	54	-27.49
	4824(Pk)		40.72	74	-33.28
	4824(Av)		29.09	54	-24.91
	7236(Pk)		47.14	74	-26.86
	7236(Av)		35.16	54	-18.84
	2412(Pk)	Horizontal	95.38	*	-
	2412(Av)		86.84	*	-
	2390(Pk)		40.34	74	-33.66
	2390(Av)		27.80	54	-26.20
	4824(Pk)		41.65	74	-32.35
	4824(Av)		29.28	54	-24.72
	7236(Pk)		47.19	74	-26.81
	7236(Av)		35.15	54	-18.85
2437	2437(Pk)	Vertical	91.59	*	-
	2437(Av)		83.44	*	-
	4874(Pk)		40.76	74	-33.24
	4874(Av)		29.11	54	-24.89
	7311(Pk)	Horizontal	46.65	74	-27.35
	7311(Av)		35.08	54	-18.92
	2437(Pk)		95.18	*	-
	2437(Av)		86.59	*	-
	4874(Pk)		41.22	74	-32.78
	4874(Av)		29.12	54	-24.88
	7311(Pk)		47.38	74	-26.62
	7311(Av)		35.11	54	-18.89
2462	2462(Pk)	Vertical	91.86	*	-
	2462(Av)		82.94	*	-
	2483.5(Pk)		38.95	74	-35.05
	2483.5(Av)		25.03	54	-28.97
	4924(Pk)		41.67	74	-32.33
	4924(Av)		28.83	54	-25.17
	7386(Pk)		48.06	74	-25.94
	7386(Av)		35.15	54	-18.85
	2462(Pk)	Horizontal	94.64	*	-
	2462(Av)		86.61	*	-
	2483.5(Pk)		39.63	74	-34.37
	2483.5(Av)		26.71	54	-27.29
	4924(Pk)		40.55	74	-33.45
	4924(Av)		28.86	54	-25.14
	7386(Pk)		46.93	74	-27.07
	7386(Av)		35.21	54	-18.79

Note: *- indicates fundamental frequency

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Data Rate: b mode 11Mbps

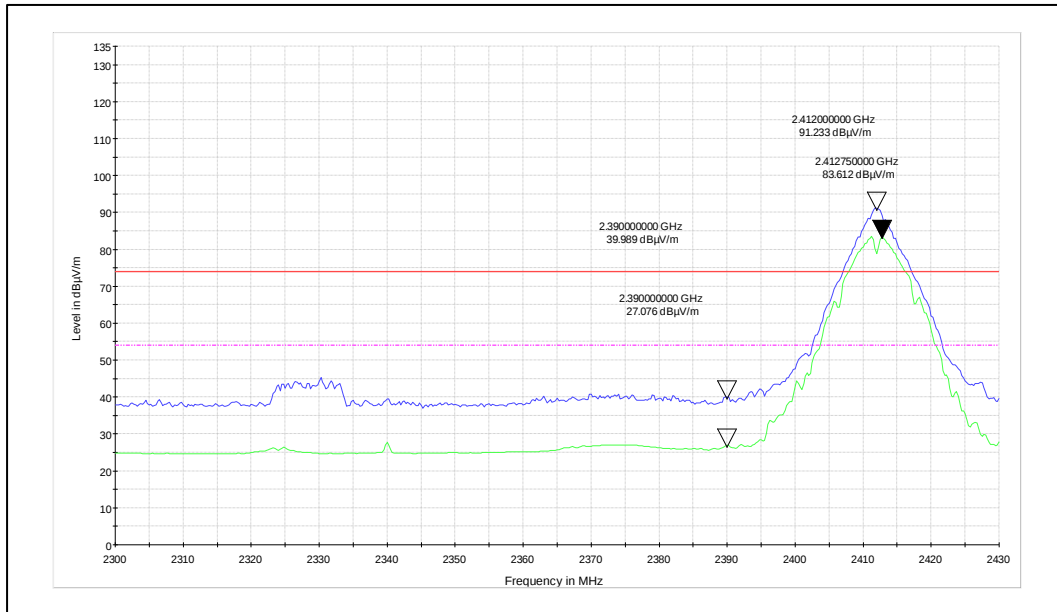
Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2412	2412(Pk)	Vertical	91.69	*	-
	2412(Av)		82.65	*	-
	2390(Pk)		39.36	74	-34.64
	2390(Av)		27.32	54	-26.68
	4824(Pk)		42.09	74	-31.91
	4824(Av)		29.74	54	-24.26
	7236(Pk)		47.65	74	-26.35
	7236(Av)		35.31	54	-18.69
	2412(Pk)	Horizontal	96.03	*	-
	2412(Av)		86.87	*	-
	2390(Pk)		40.51	74	-33.49
	2390(Av)		28.24	54	-25.76
	4824(Pk)		41.93	74	-32.07
	4824(Av)		30.01	54	-23.99
	7236(Pk)		47.81	74	-26.19
	7236(Av)		35.28	54	-18.72
2437	2437(Pk)	Vertical	92.29	*	-
	2437(Av)		83.04	*	-
	4874(Pk)		41.69	74	-32.31
	4874(Av)		29.75	54	-24.25
	7311(Pk)		47.15	74	-26.85
	7311(Av)		35.26	54	-18.74
	2437(Pk)	Horizontal	95.37	*	-
	2437(Av)		86.25	*	-
	4874(Pk)		41.49	74	-32.51
	4874(Av)		30.02	54	-23.98
	7311(Pk)		47.56	74	-26.44
	7311(Av)		35.26	54	-18.74
2462	2462(Pk)	Vertical	91.34	*	-
	2462(Av)		82.67	*	-
	2483.5(Pk)		38.52	74	-35.48
	2483.5(Av)		25.33	54	-28.67
	4924(Pk)		40.99	74	-33.01
	4924(Av)		29.04	54	-24.96
	7386(Pk)		47.26	74	-26.74
	7386(Av)		35.29	54	-18.71
	2462(Pk)	Horizontal	96.40	*	-
	2462(Av)		86.86	*	-
	2483.5(Pk)		39.97	74	-34.03
	2483.5(Av)		26.89	54	-27.11
	4924(Pk)		41.11	74	-32.89
	4924(Av)		29.40	54	-24.60
	7386(Pk)		47.31	74	-26.69
	7386(Av)		35.30	54	-18.70

Note: *- indicates fundamental frequency

No emissions found above 18GHz

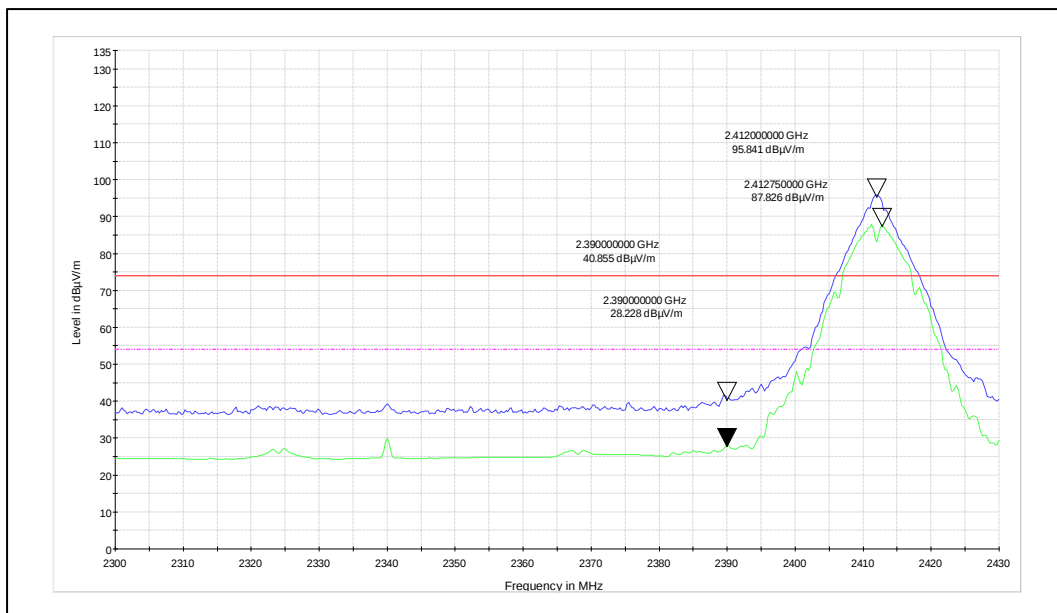
Test Plots: Restricted Bands of Operation

Data Rate: b mode 1Mbps



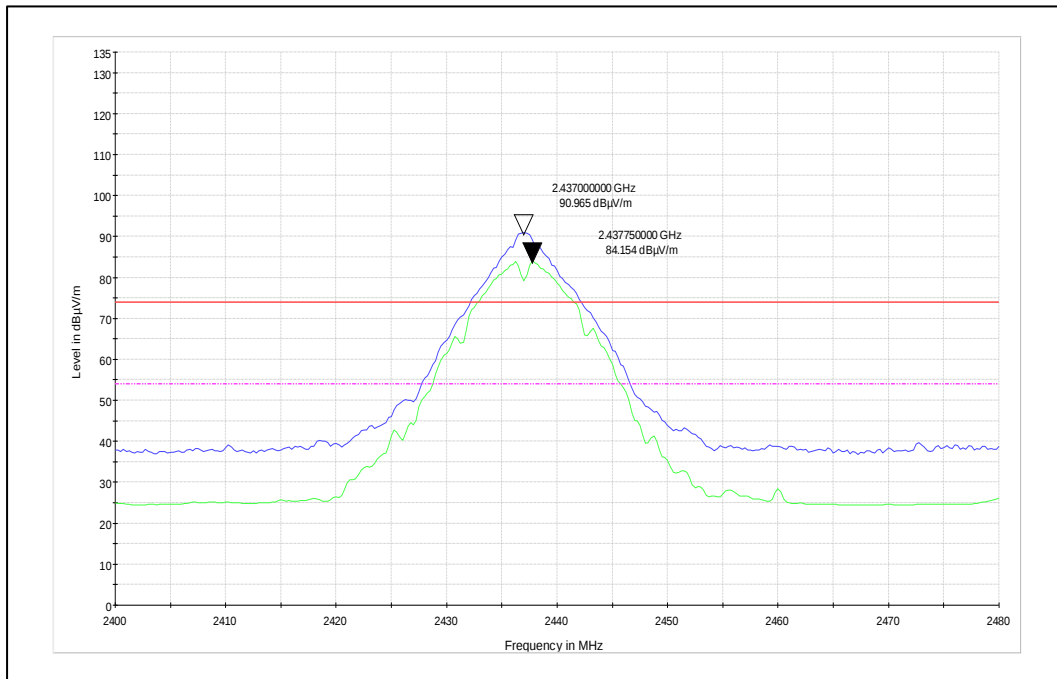
Channel Frequency: 2412MHz

Polarization: Vertical



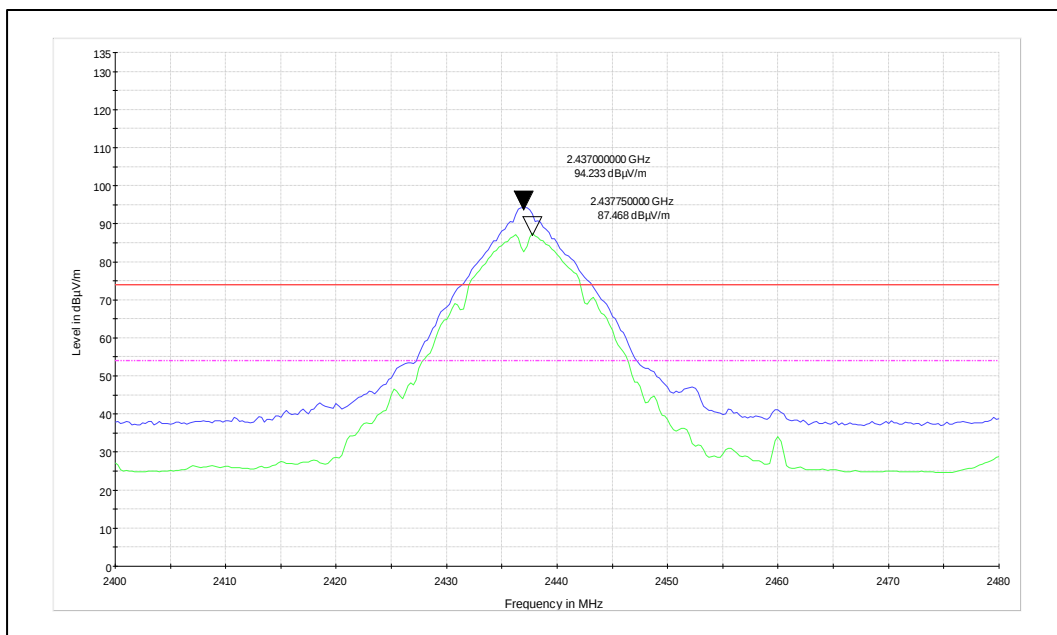
Channel Frequency: 2412MHz

Polarization: Horizontal



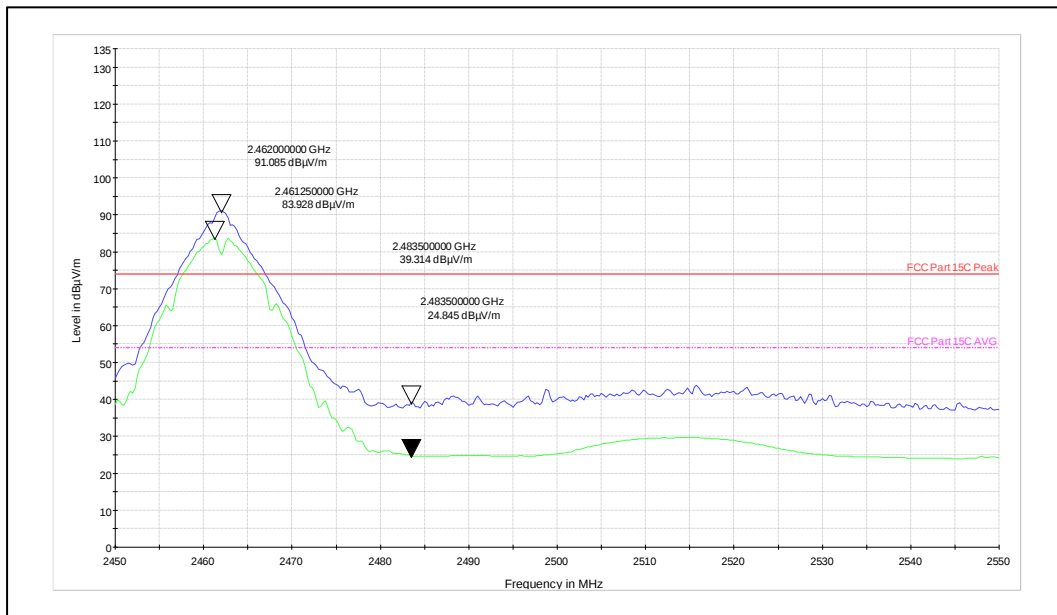
Channel Frequency: 2437MHz

Polarization: Vertical



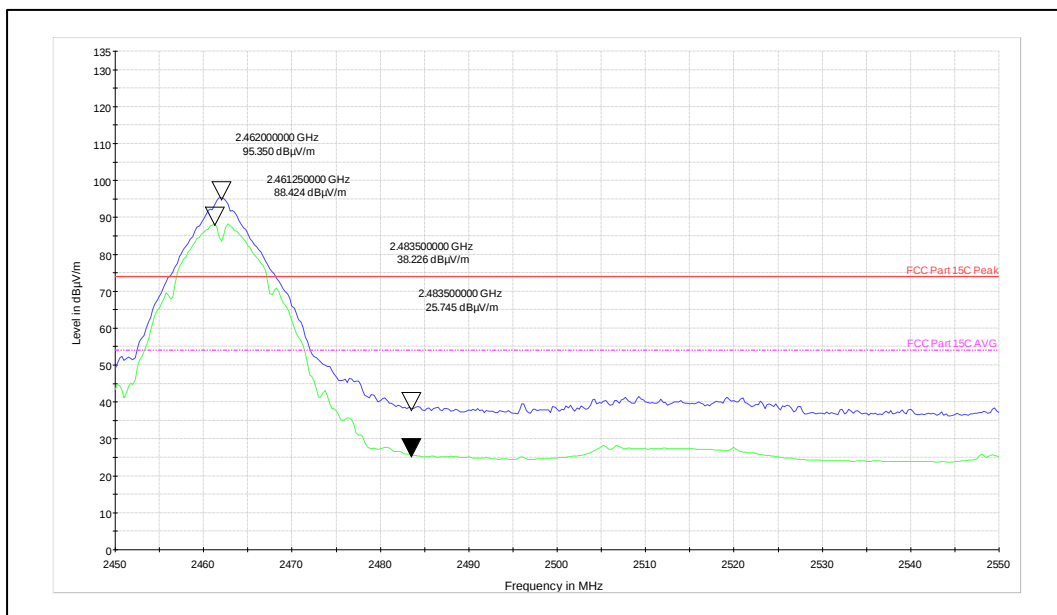
Channel Frequency: 2437MHz

Polarization: Horizontal



Channel Frequency: 2462MHz

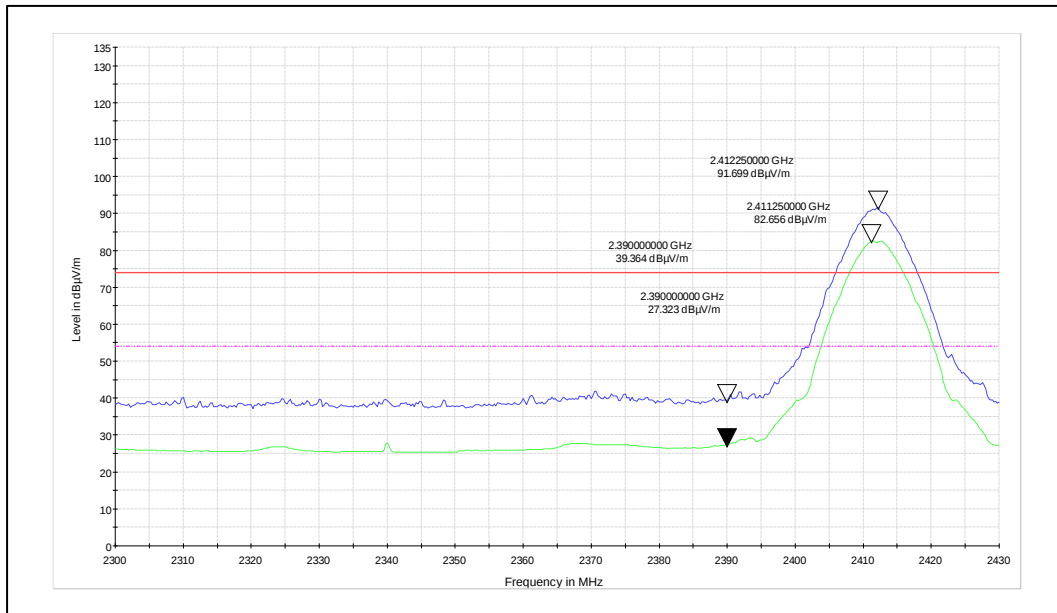
Polarization: Vertical



Channel Frequency: 2462MHz

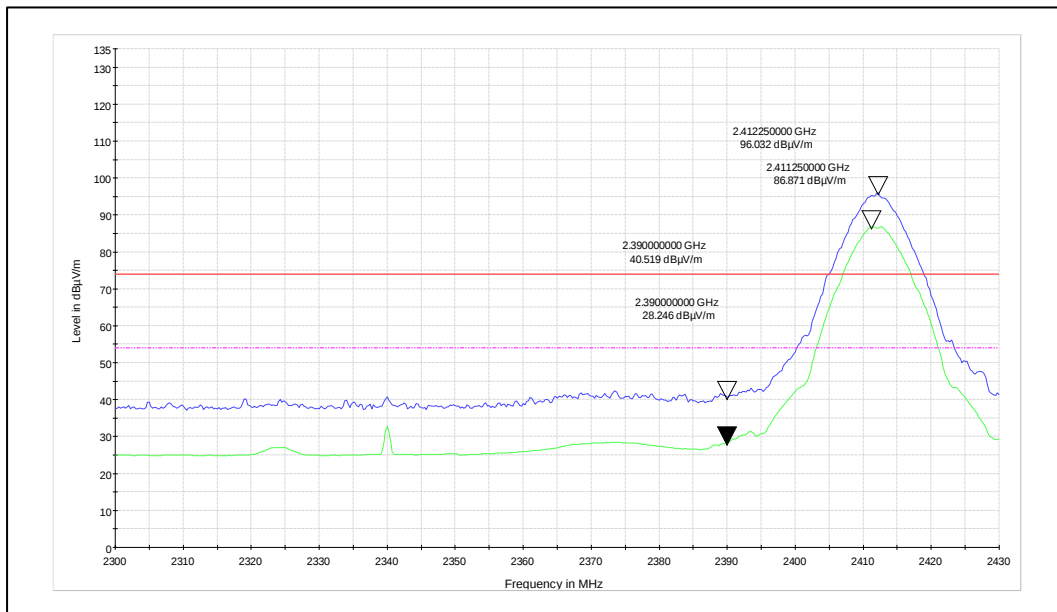
Polarization: Horizontal

Data Rate: b mode 11Mbps



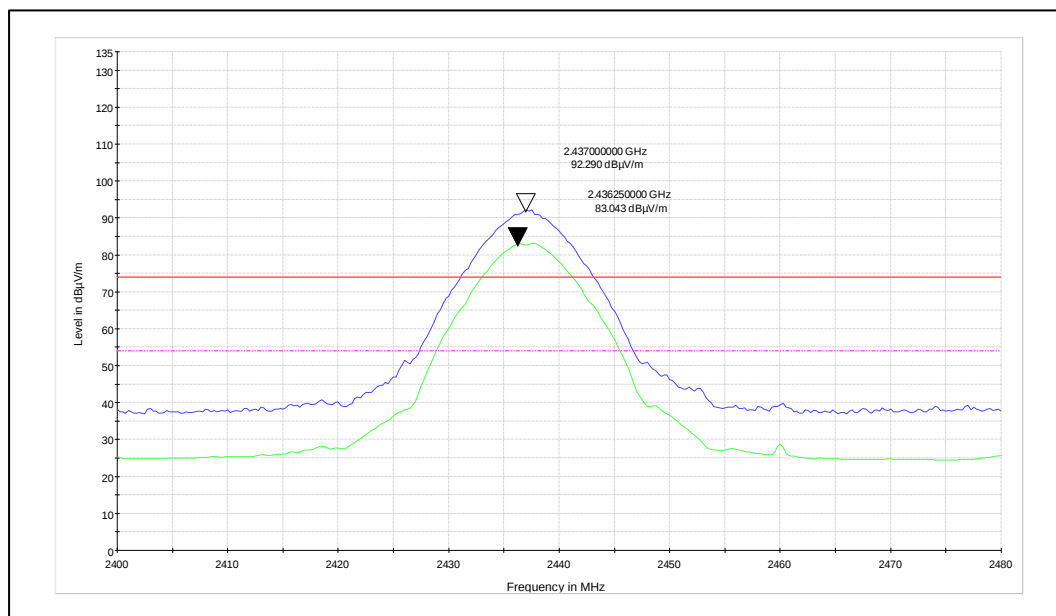
Channel Frequency: 2412MHz

Polarization: Vertical



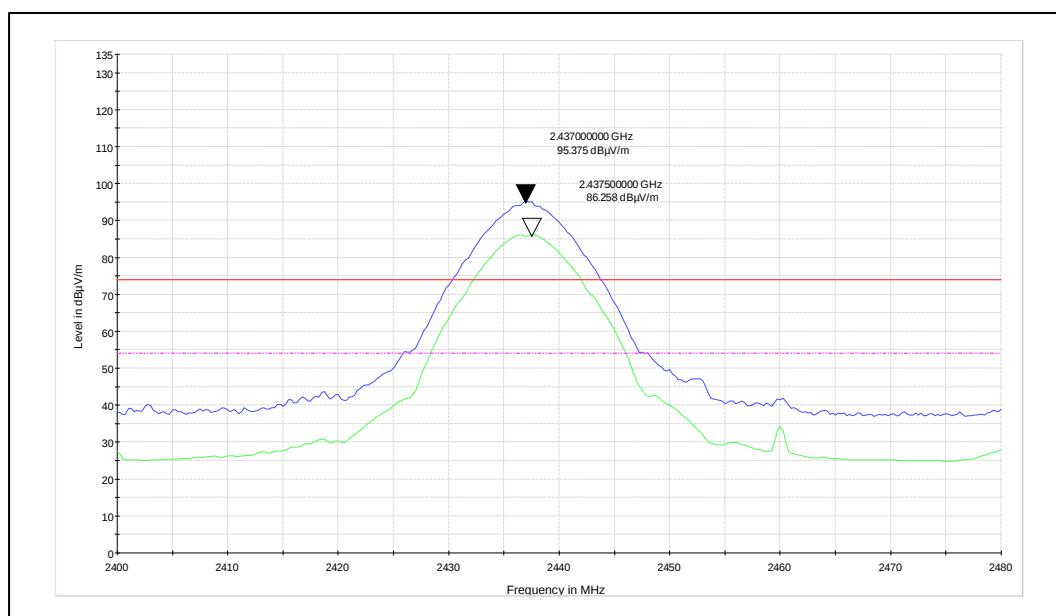
Channel Frequency: 2412MHz

Polarization: Horizontal



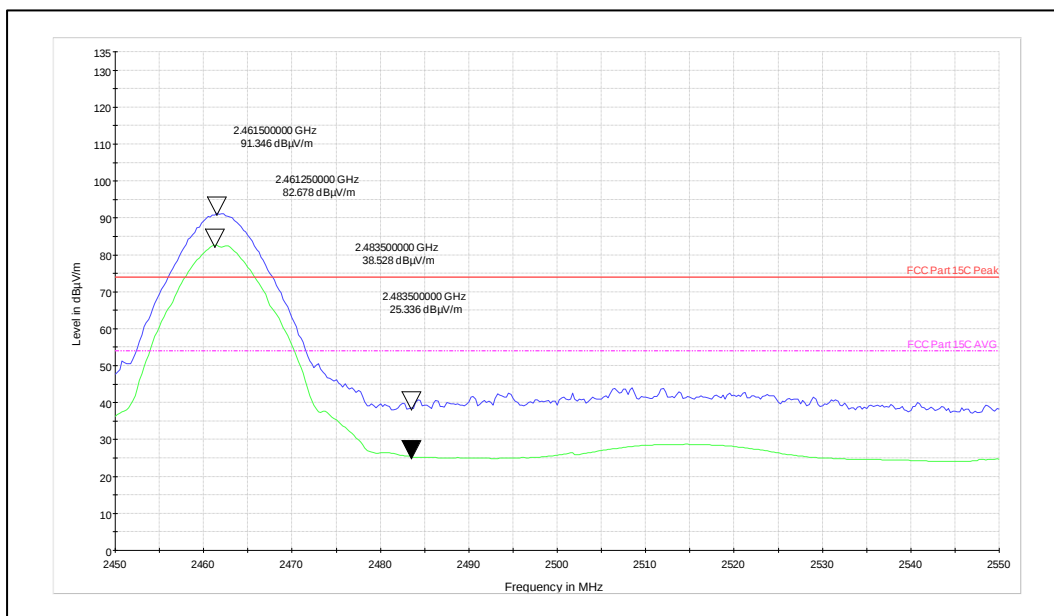
Channel Frequency: 2437MHz

Polarization: Vertical



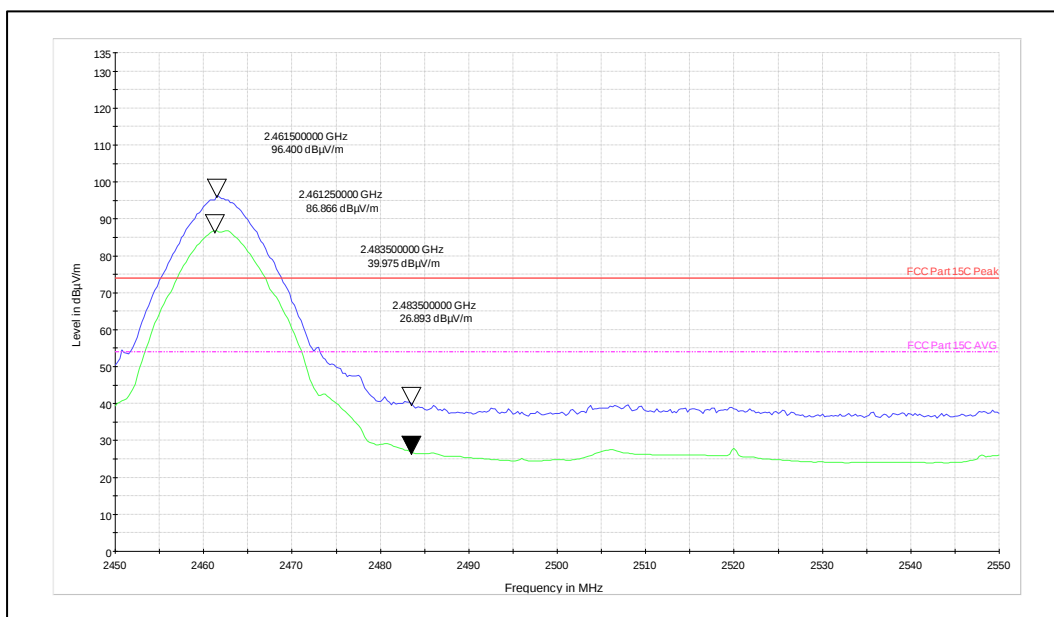
Channel Frequency: 2437MHz

Polarization: Horizontal



Channel Frequency: 2462MHz

Polarization: Vertical



Channel Frequency: 2462MHz

Polarization: Horizontal

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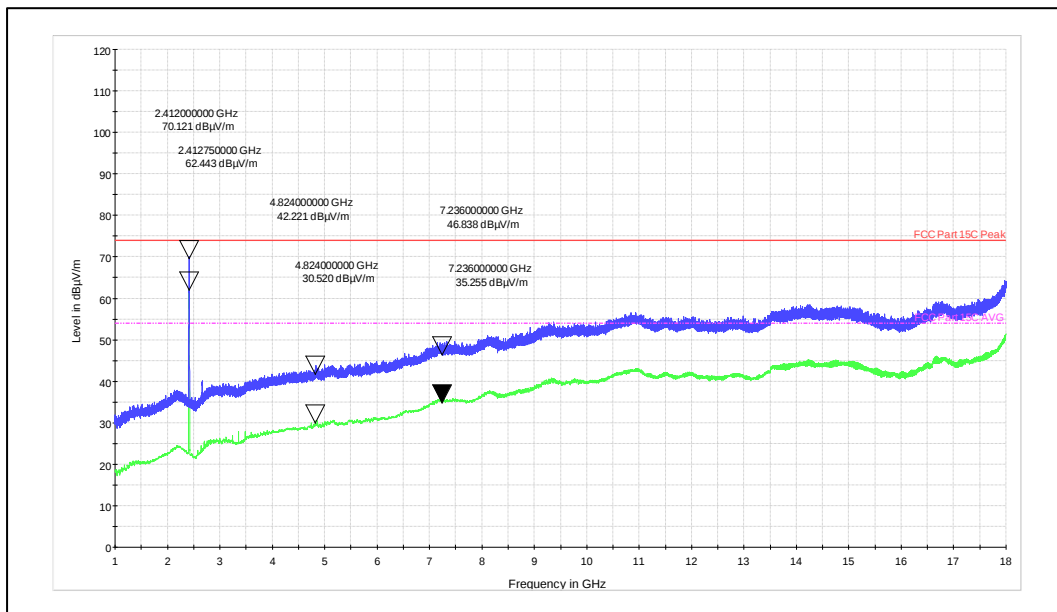
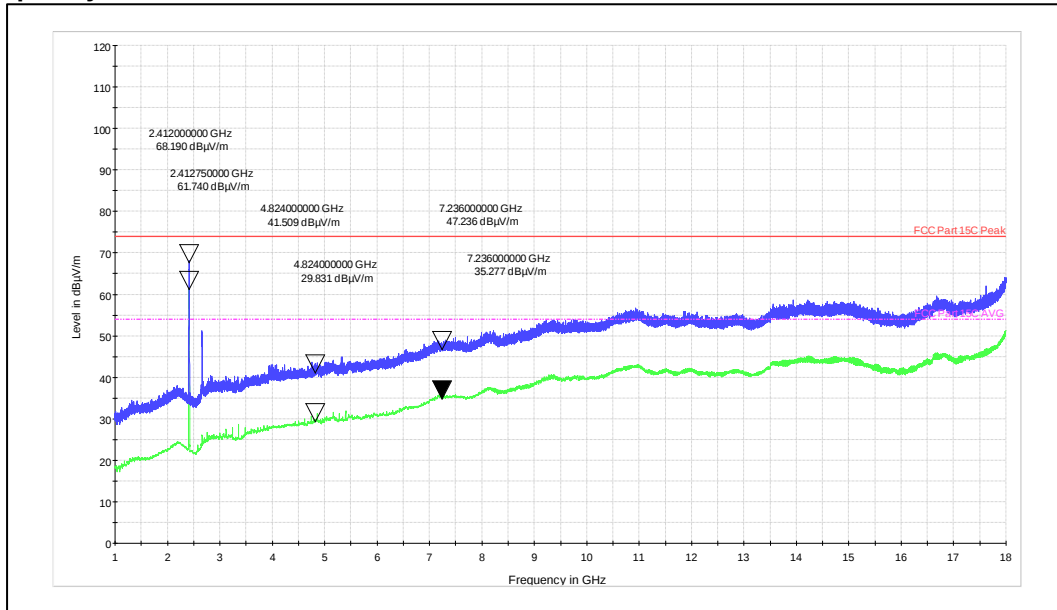
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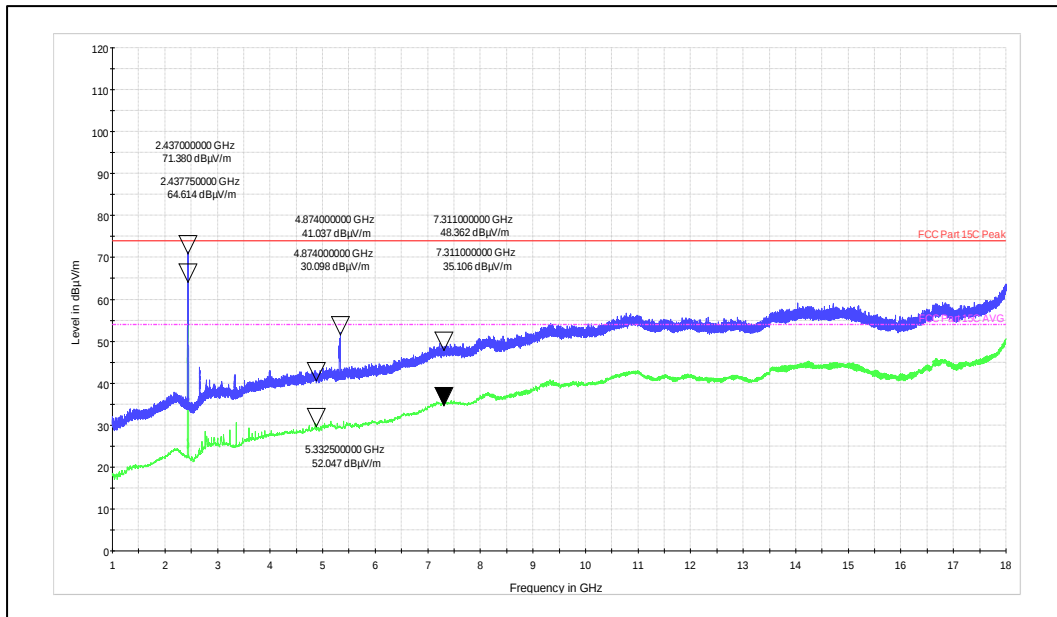
Test Plots: Radiated Spurious emissions

Data Rate: b mode 1Mbps

Channel Frequency: 2412MHz

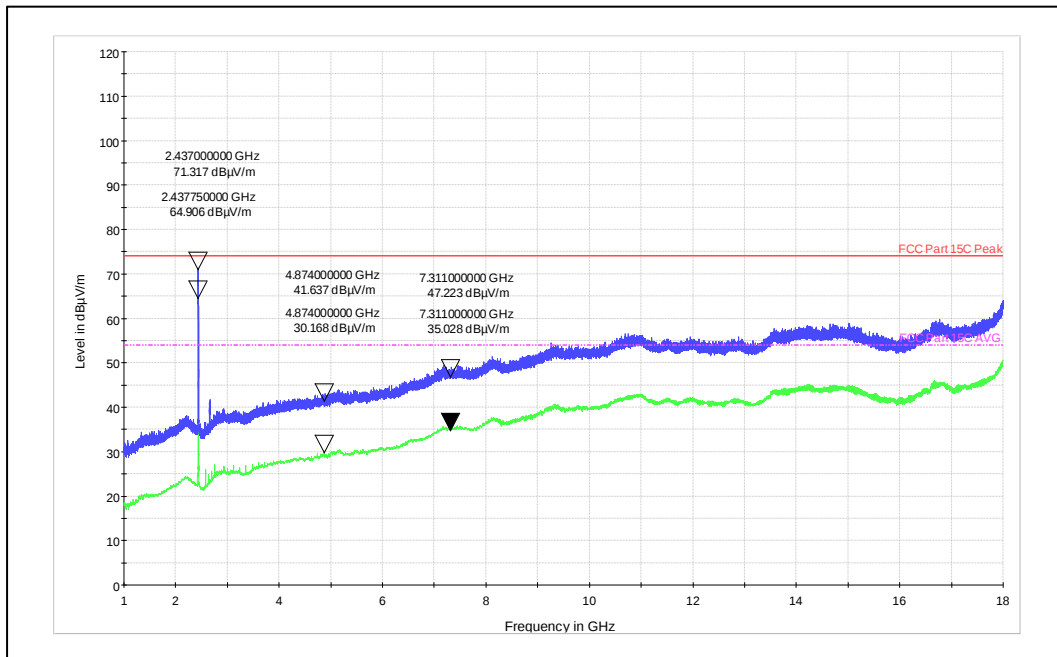


Channel Frequency: 2437MHz



Frequency Range: 1-18GHz

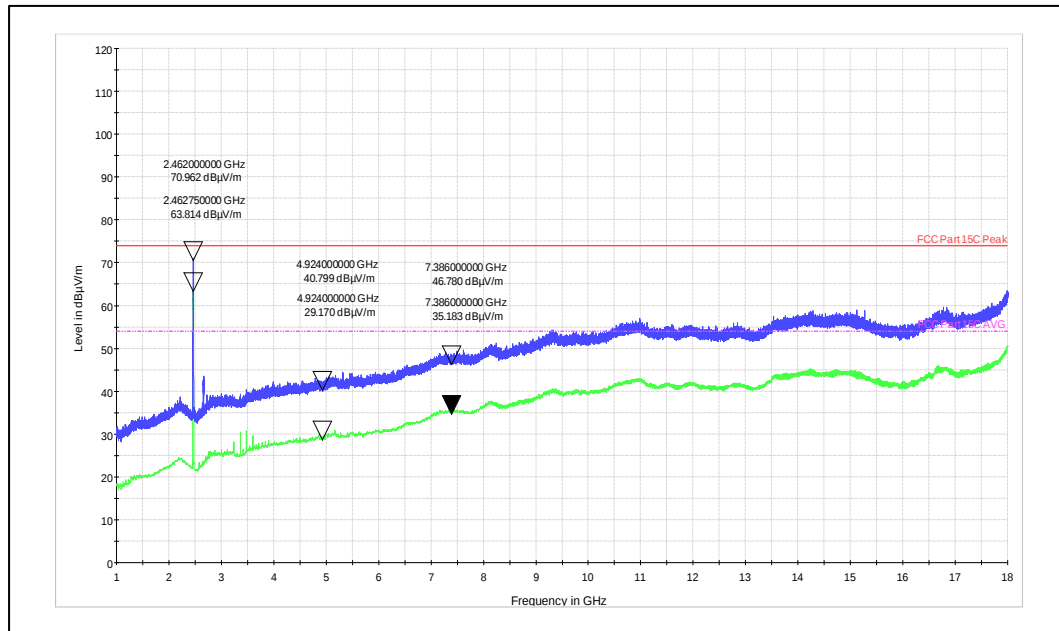
Polarization: Vertical



Frequency Range: 1-18GHz

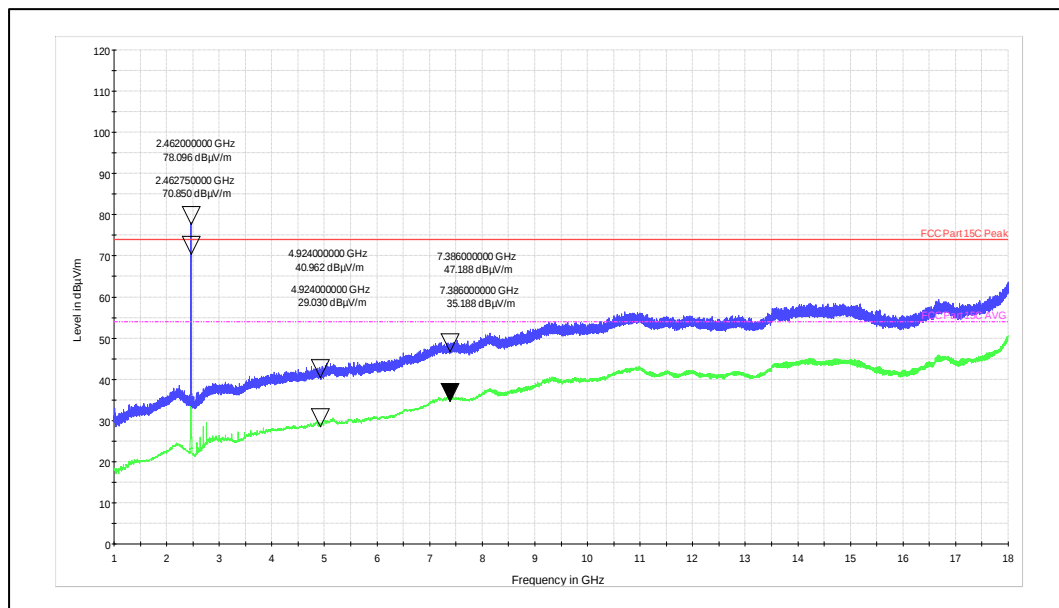
Polarization: Horizontal

Channel Frequency: 2462MHz



Frequency Range: 1-18GHz

Polarization: Vertical



Frequency Range: 1-18GHz

Polarization: Horizontal

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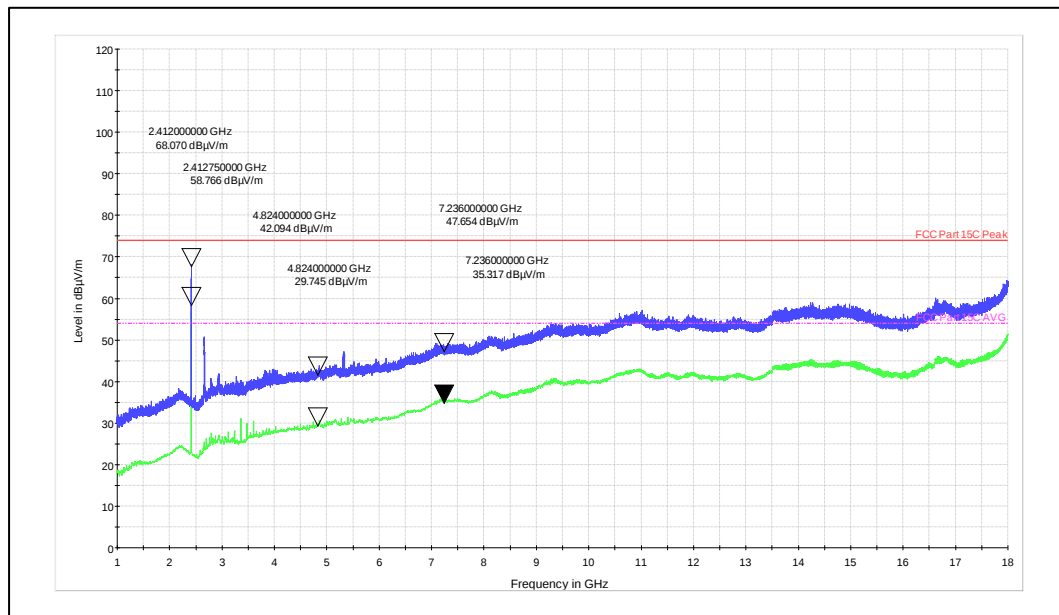
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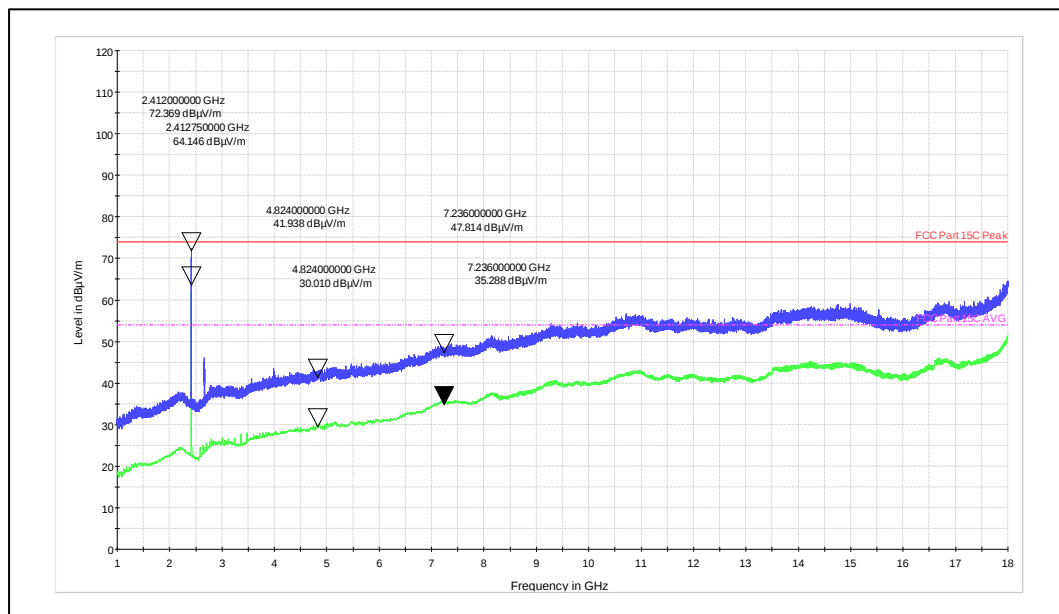
Data Rate: 11Mbps

Channel Frequency: 2412MHz



Frequency Range: 1-18GHz

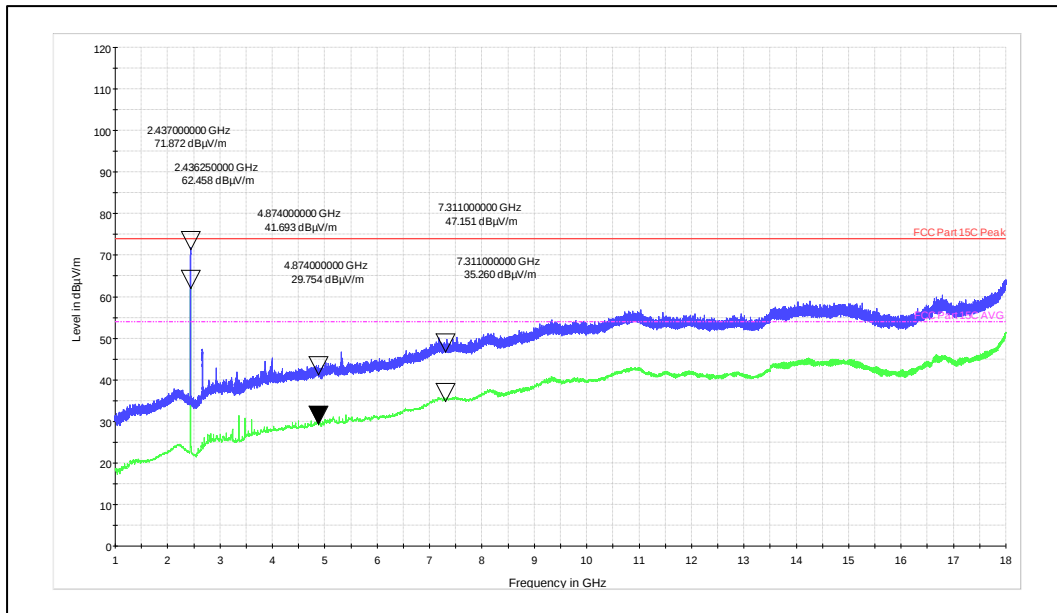
Polarization: Vertical



Frequency Range: 1-18GHz

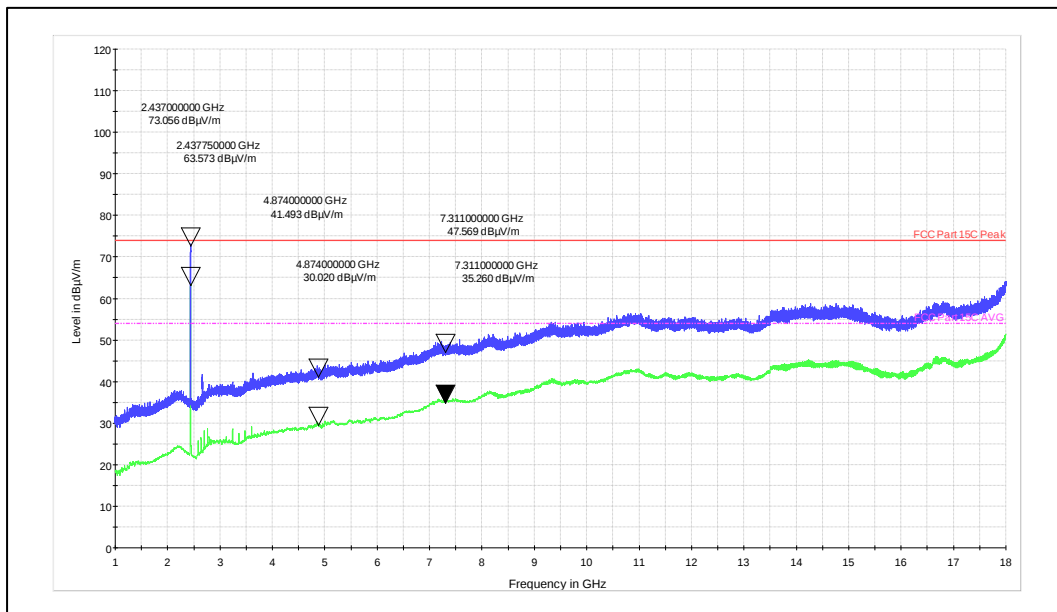
Polarization: Horizontal

Channel Frequency: 2437MHz



Frequency Range: 1-18GHz

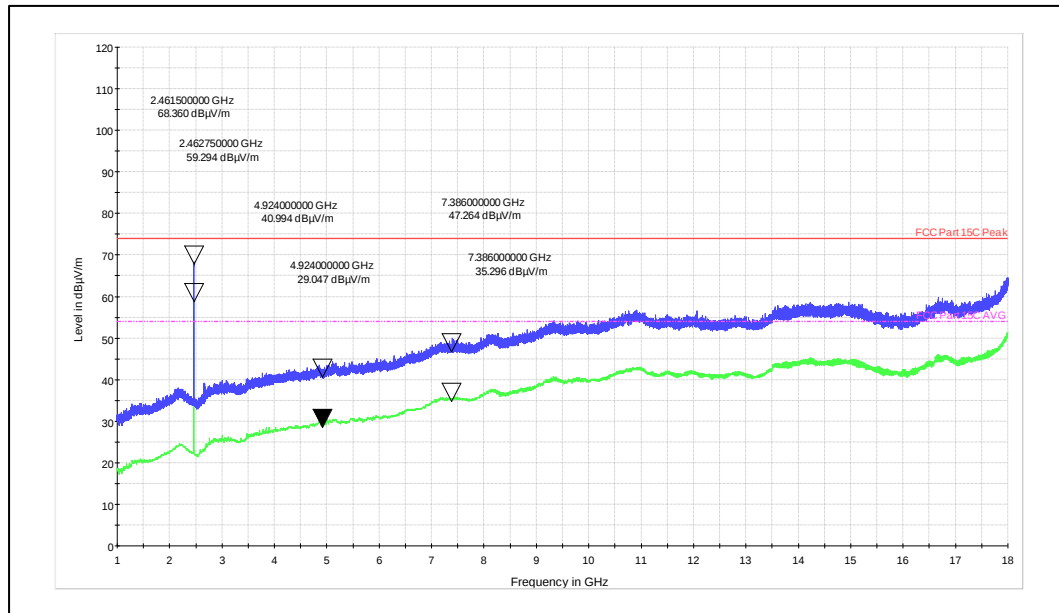
Polarization: Vertical



Frequency Range: 1-18GHz

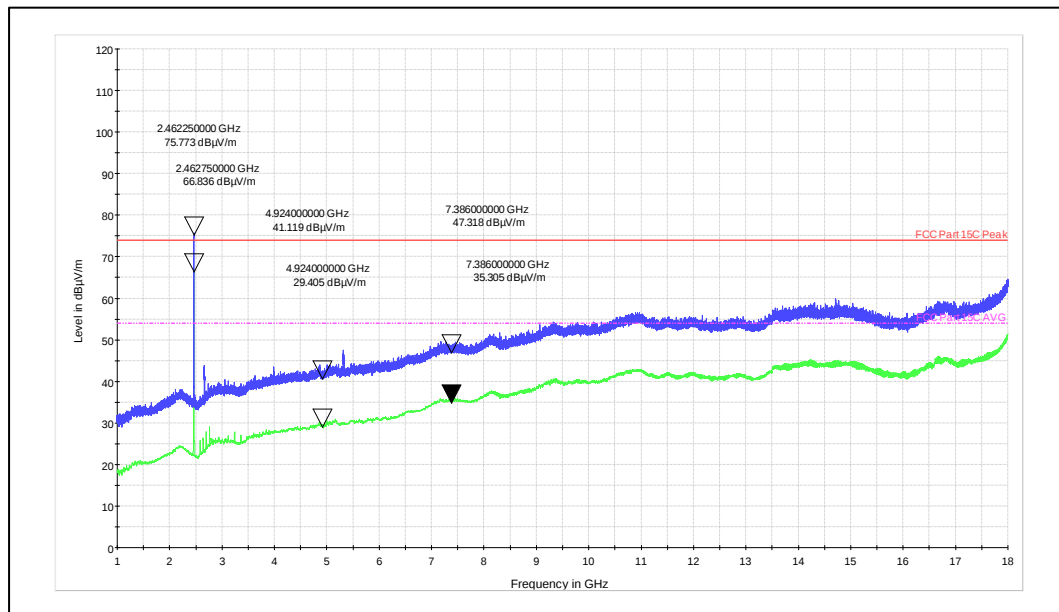
Polarization: Horizontal

Channel Frequency: 2462MHz



Frequency Range: 1-18GHz

Polarization: Vertical



Frequency Range: 1-18GHz

Polarization: Horizontal

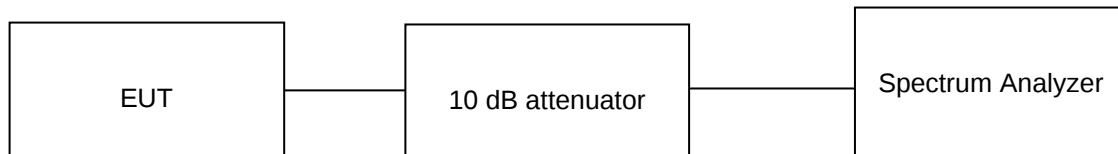
8 TEST RESULTS FOR BLUETOOTH LOW ENERGY

8.1 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	1 MHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power ≤ 1 W (30 dBm) & e.i.r.p ≤ 4 W (36 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 25 °C

Voltage = 3V DC

Relative humidity: 62%

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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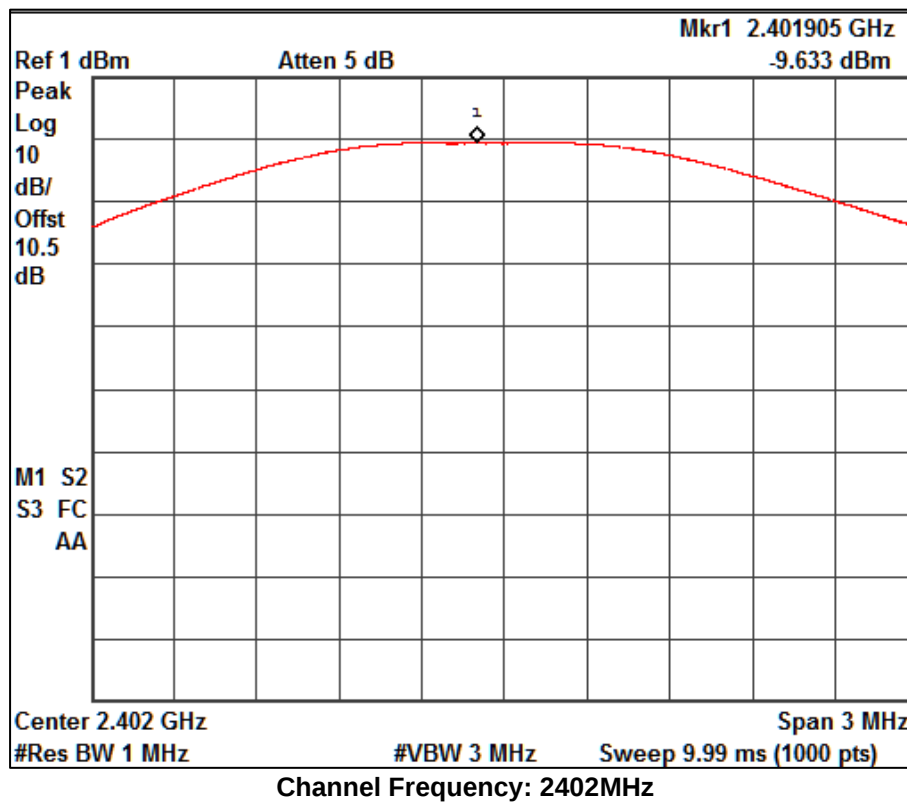
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Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Average Output power (dBm) = Measured Average power (dBm) + Cable loss (0.5dB)
3. Maximum (e.i.r.p) = Maximum Average output power (dBm) + Antenna gain (2.2 dBi)

Data rate	Channel frequency	Measured power (dBm)	Limit (dBm)
1Mbps	2402	-9.63	30
	2440	-11.86	30
	2480	-10.81	30



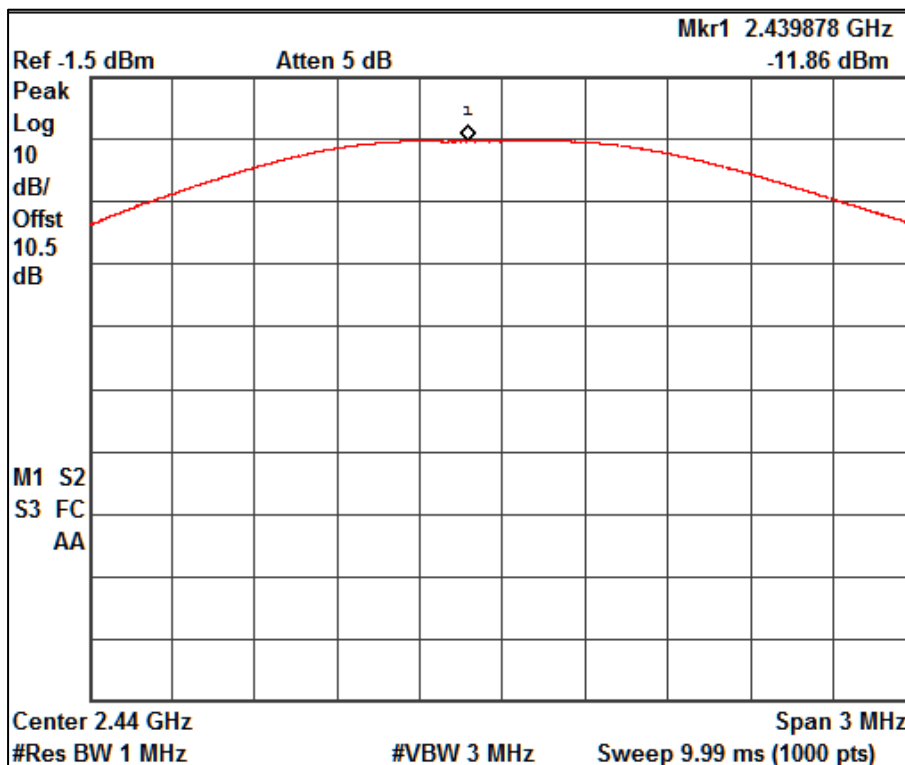
Prüfbericht - Nr.:

Test Report No.:

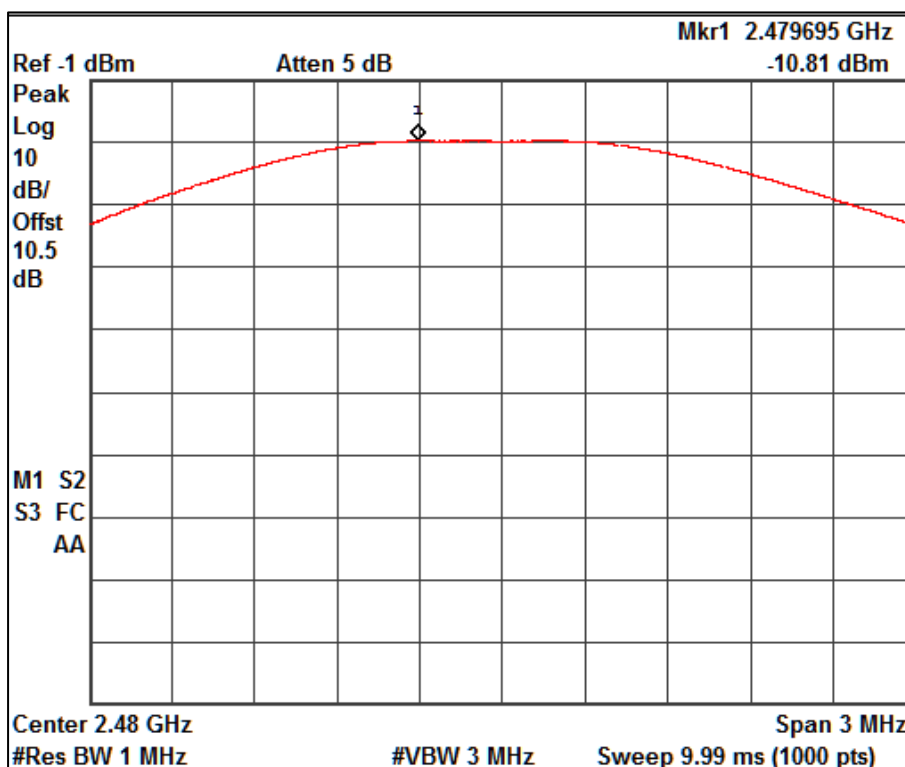
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Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

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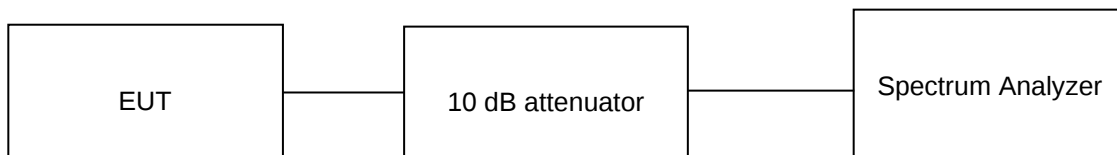
8.2 Maximum Power Spectral Density

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	Peak detector
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

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 25°C

Voltage = 3V DC

Relative humidity: 62 %

KDB Guidelines applied:

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

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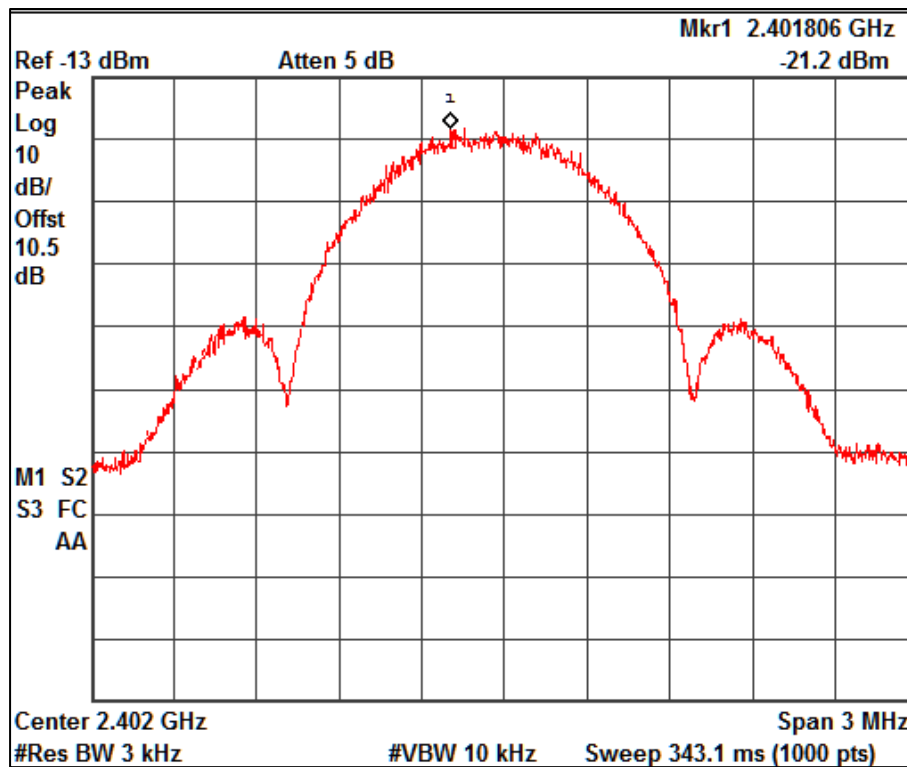
Test results:

Note:

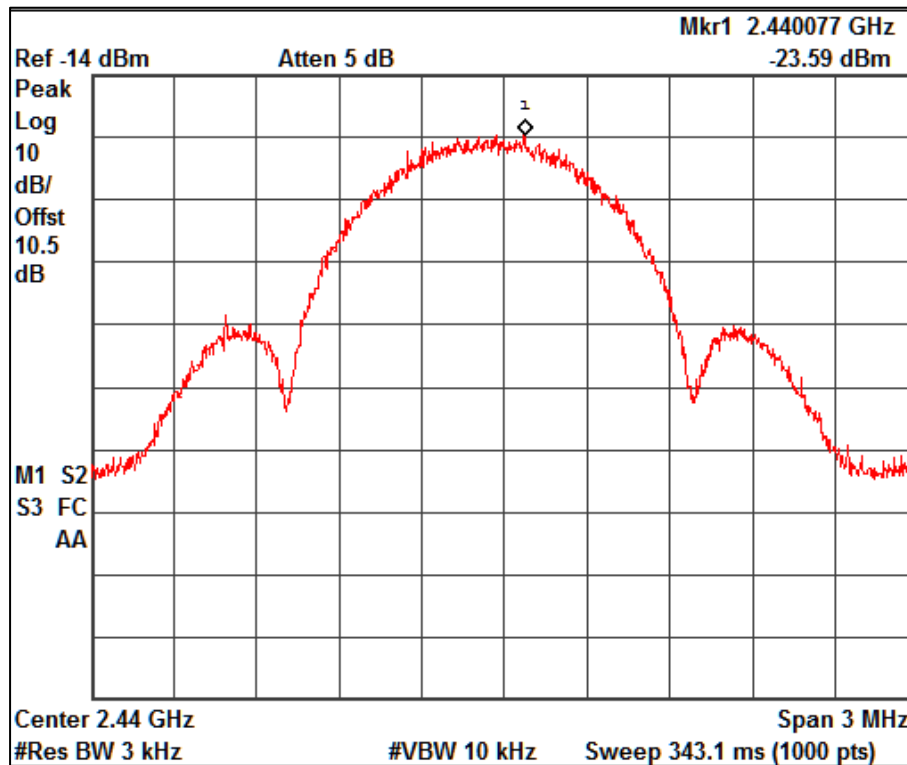
1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Peak PSD (dBm) = Measured Peak PSD (dBm) + Attenuator factor (10dB) + Cable loss (0.5dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 2.2 dBi

Data rate	Channel frequency	PSD (dBm)	Limit (dBm in any 3kHz)
1Mbps	2402	-21.20	8
	2440	-23.59	8
	2480	-22.28	8

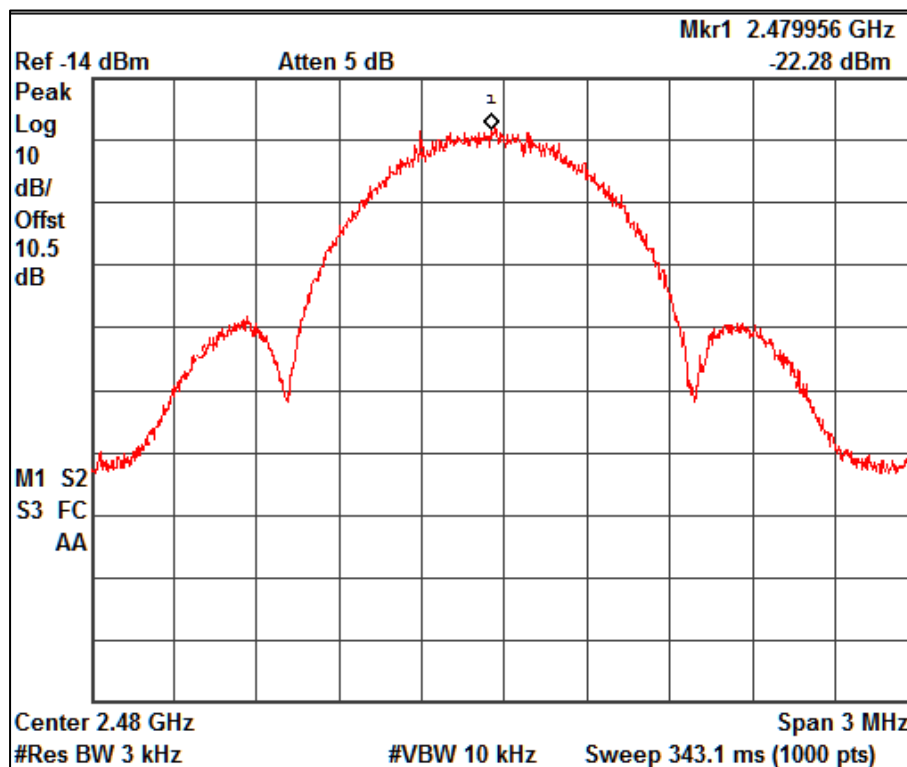
Test Plots:



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

Prüfbericht - Nr.:
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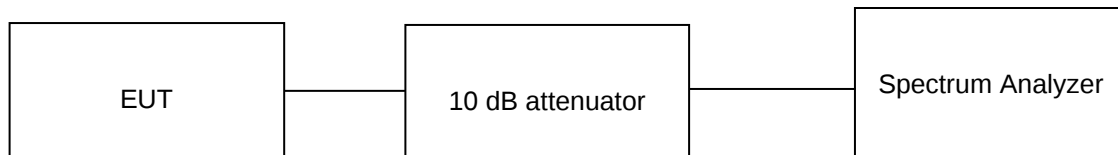
8.3 DTS Bandwidth & 99% Bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (2)
Test Method	Subclause 11.8.1 & 6.9.3 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	The minimum 6 dB bandwidth shall be at least 500 kHz

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 25 °C

Voltage = 3V DC

Relative humidity: 62 %

KDB Guidelines applied:

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

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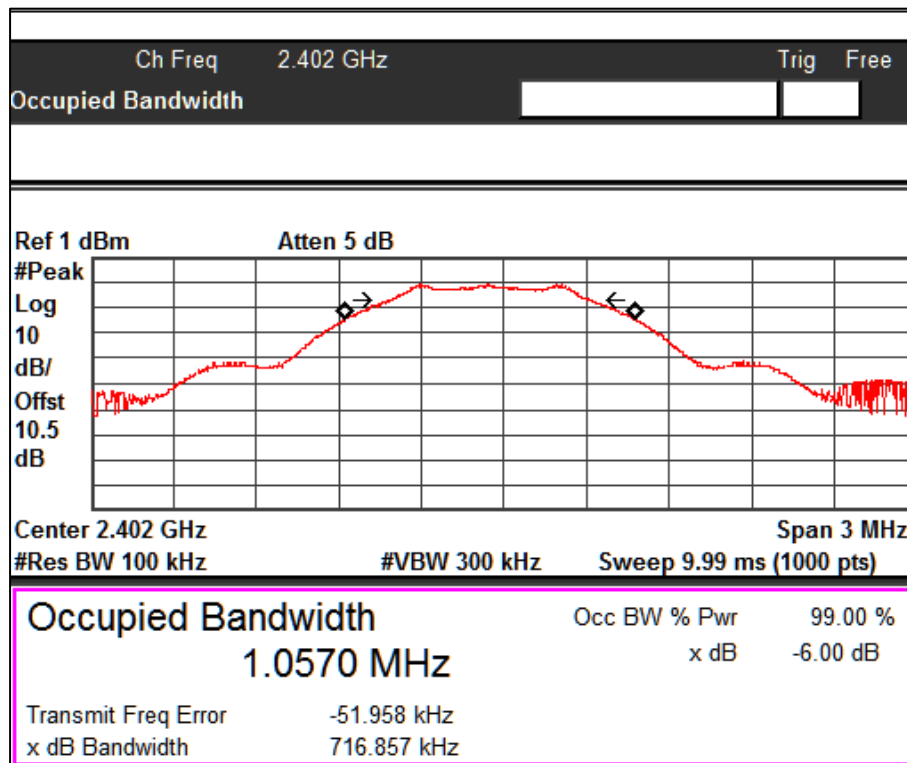
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Test results:

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

Data rate	Channel frequency	99% (MHz)	6dB BW (kHz)	Limit (MHz)
1Mbps	2402	1.057	716.85	0.5
	2440	1.058	714.06	0.5
	2480	1.057	643.92	0.5

DTS Bandwidth:

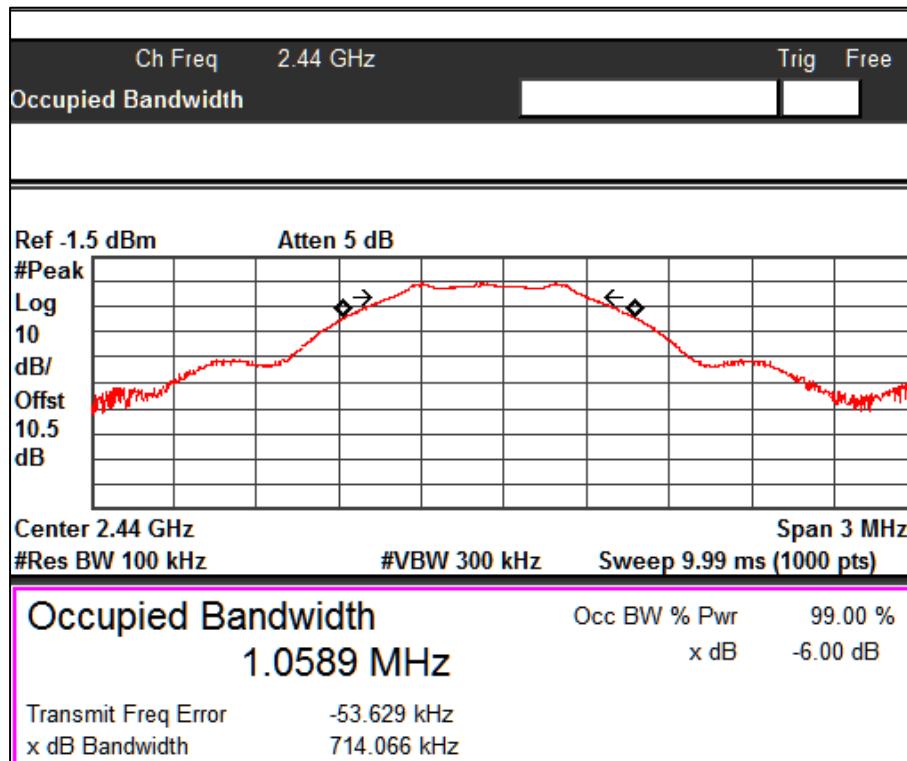


Channel Frequency: 2402MHz

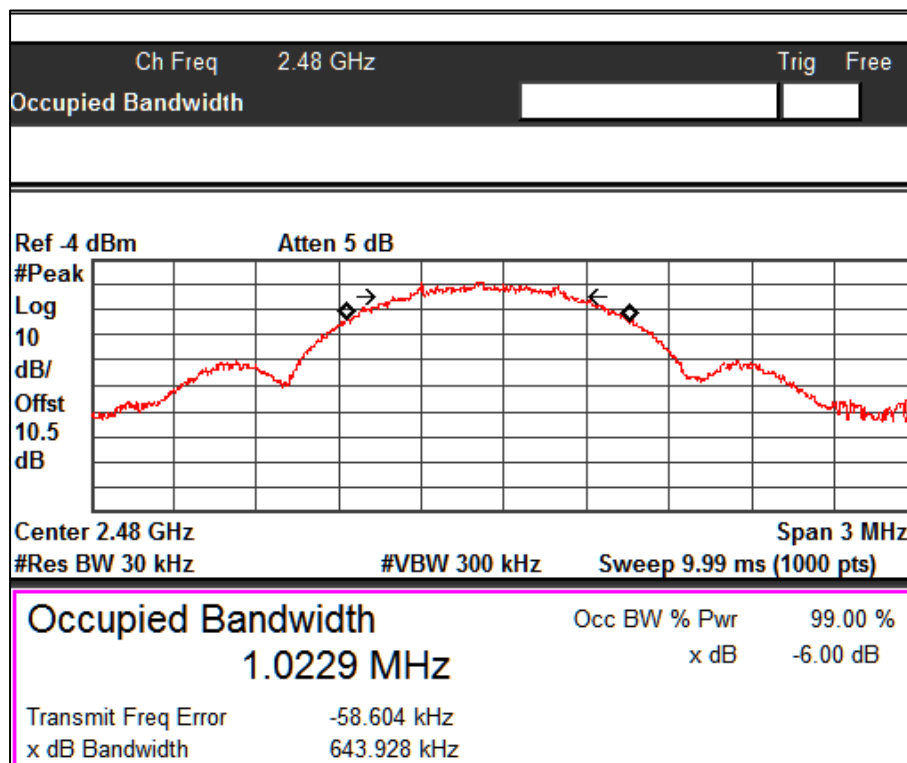
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Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

Prüfbericht - Nr.:

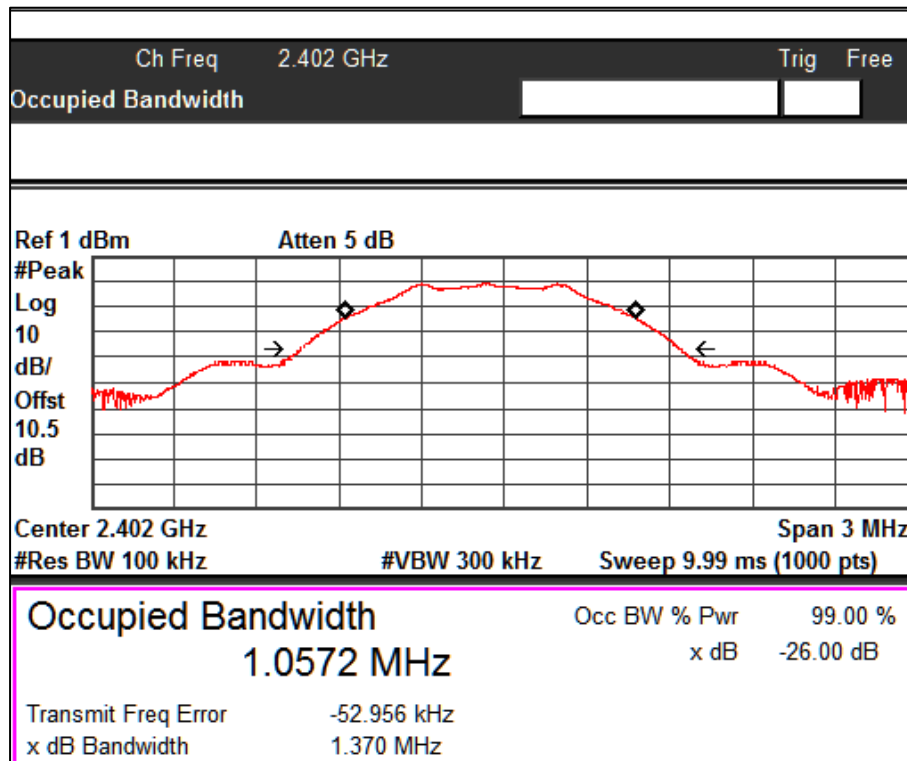
Test Report No.:

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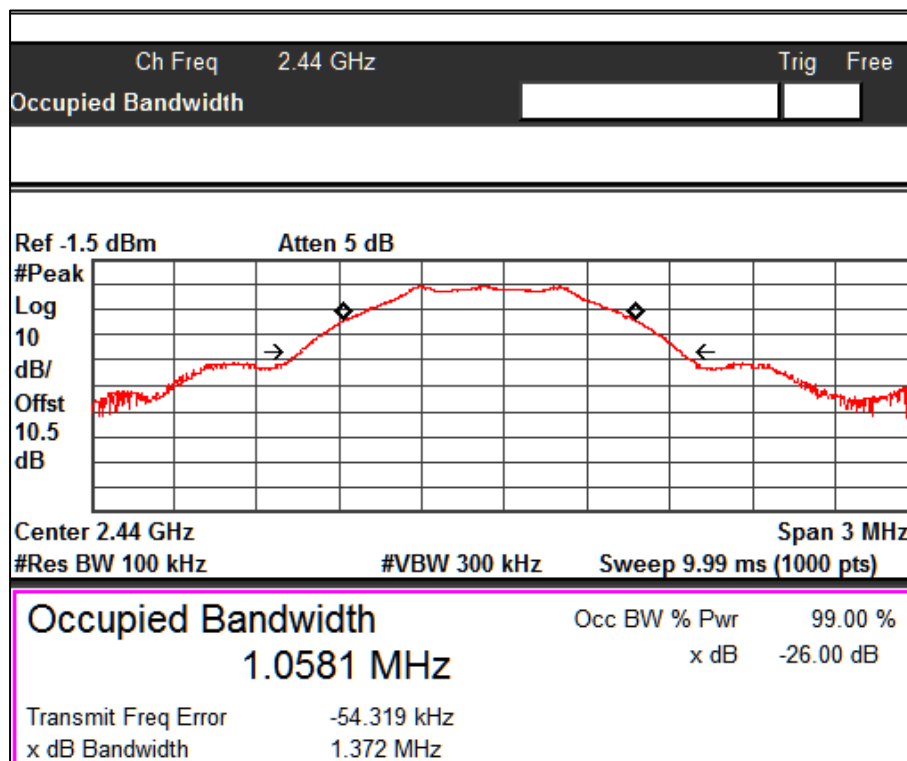
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99% Bandwidth:



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz

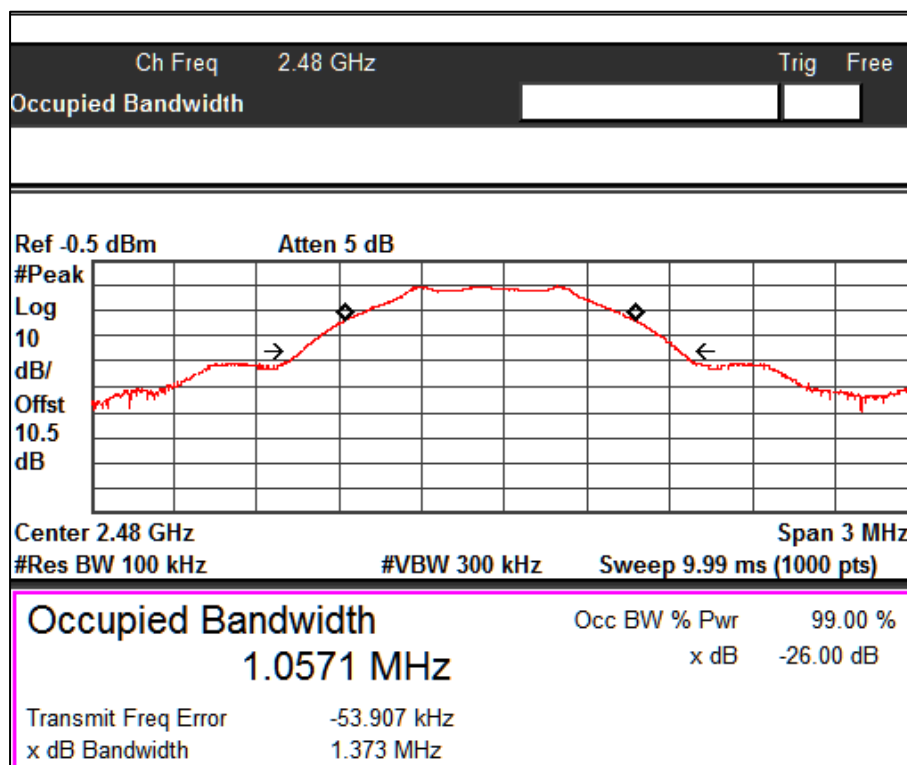
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Channel Frequency: 2480MHz

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

Result

Pass

Test Specification FCC part 15 Subpart C 15.247 (d)

Test Method Subclause 11.11 of ANSI C63.10

Measurement Bandwidth 100 kHz

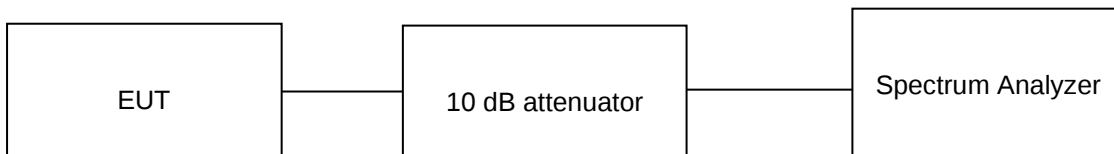
Detector Peak

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) = +25 °C

Voltage = 3V DC

Relative humidity: 62%

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:

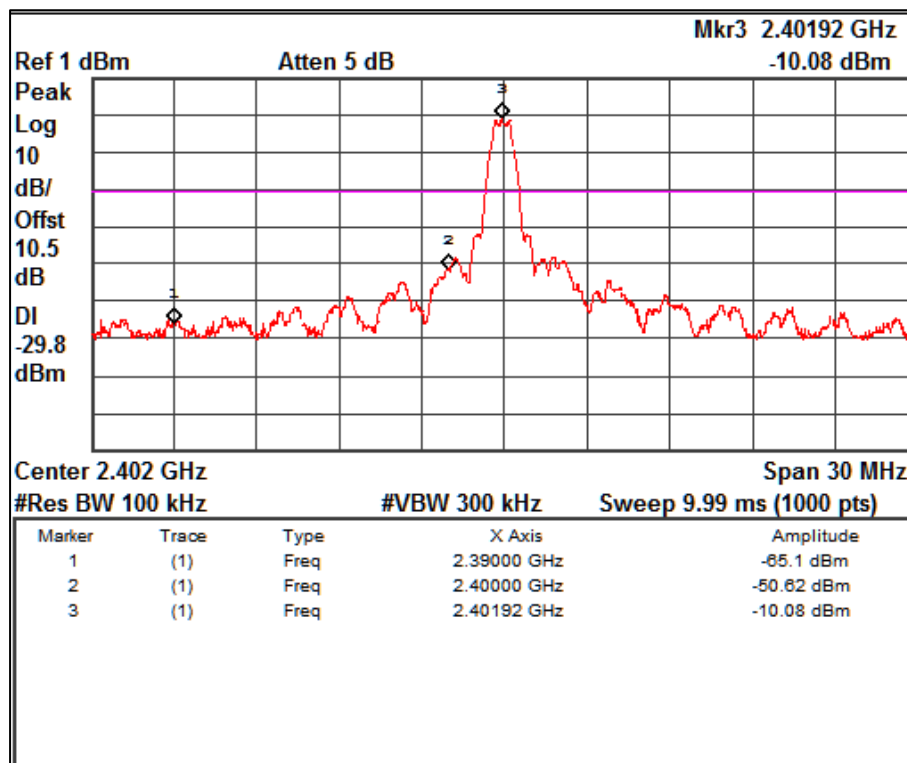
Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Final Value (dBm) = Measured Value (dBm) + Attenuator factor (10dB) + Cable loss (0.5dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 2.2 dBi

8.4.1 Band edge and reference plots

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	-50.62	-9.77	-40.85	-20
2480.00	2483.50	-57.06	-11.07	-45.99	-20

Test Plots:

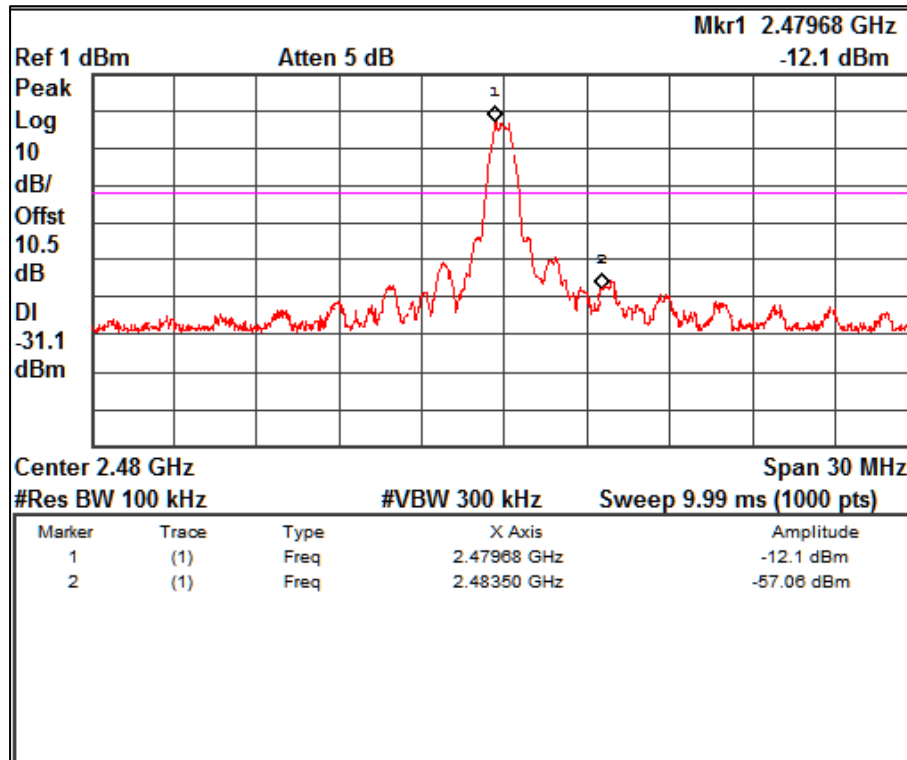


Channel Frequency: 2402MHz

Prüfbericht - Nr.:
Test Report No.:

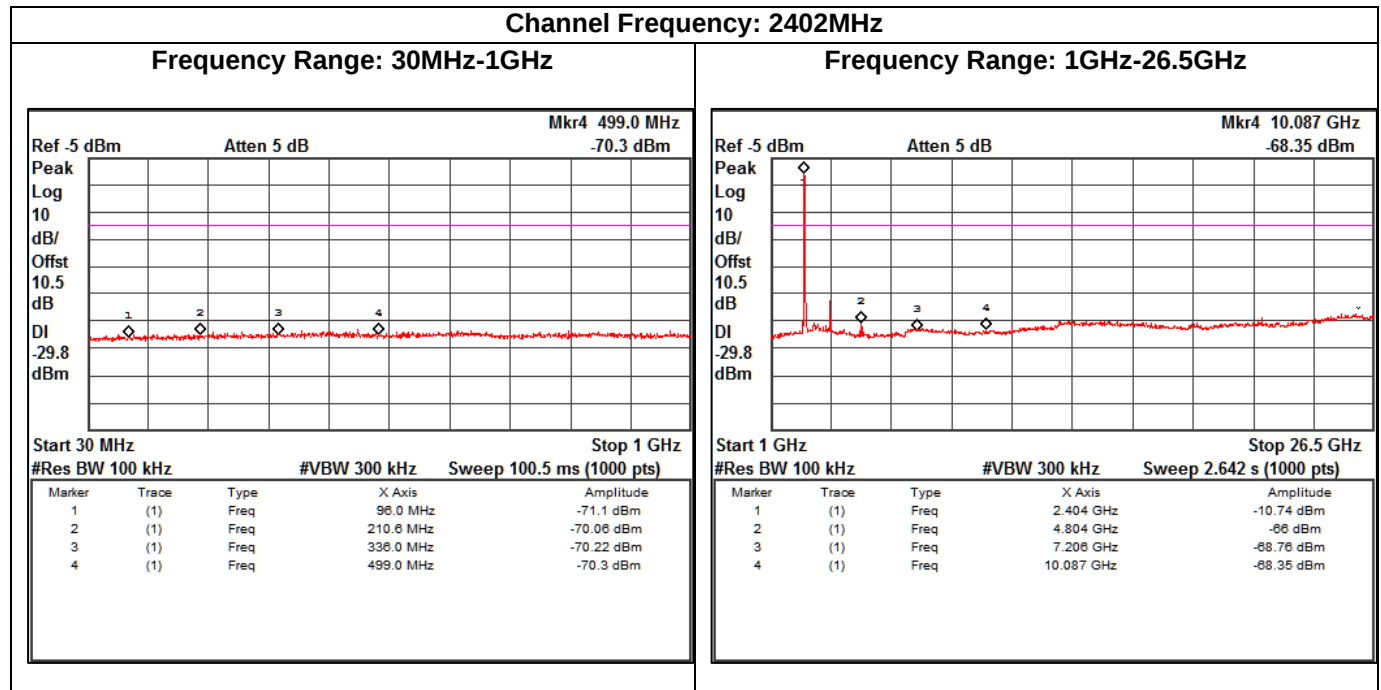
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Channel Frequency: 2480MHz

Test Plots for conducted spurious emissions



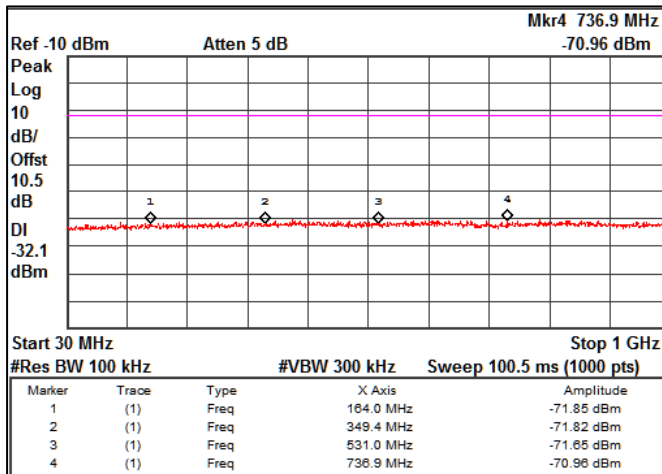
Prüfbericht - Nr.:
Test Report No.:

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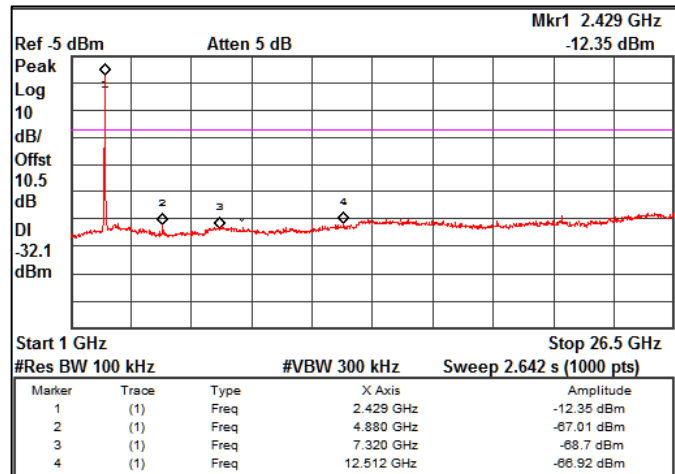
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Channel Frequency: 2440MHz

Frequency Range: 30MHz-1GHz

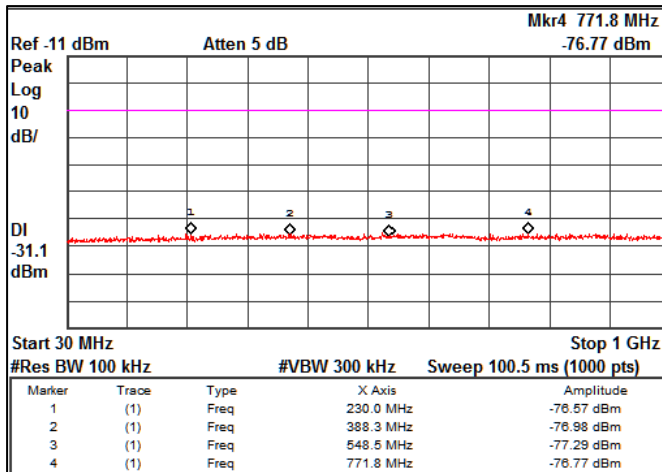


Frequency Range: 1GHz-26.5GHz

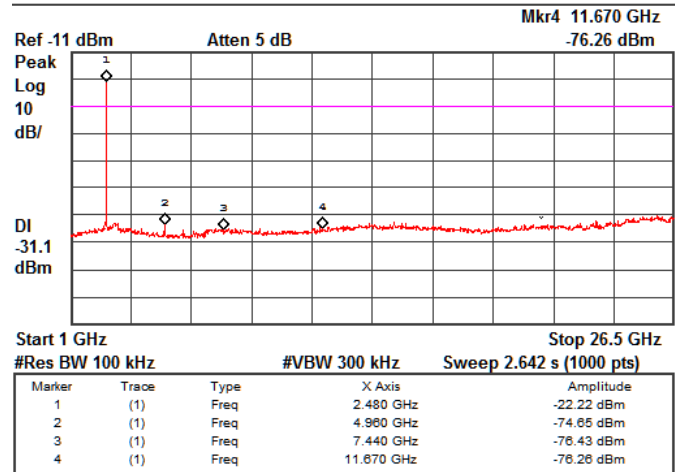


Channel Frequency: 2480MHz

Frequency Range: 30MHz-1GHz



Frequency Range: 1GHz-26.5GHz



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8.5 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d)
Test Method	ANSI C63.10
Measurement Location	Semi Anechoic Chamber 30MHz - 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 8: 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) = + 25 °C

Voltage = 3V DC

Relative humidity = 62%

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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

Test results for frequency range 30MHz – 1GHz

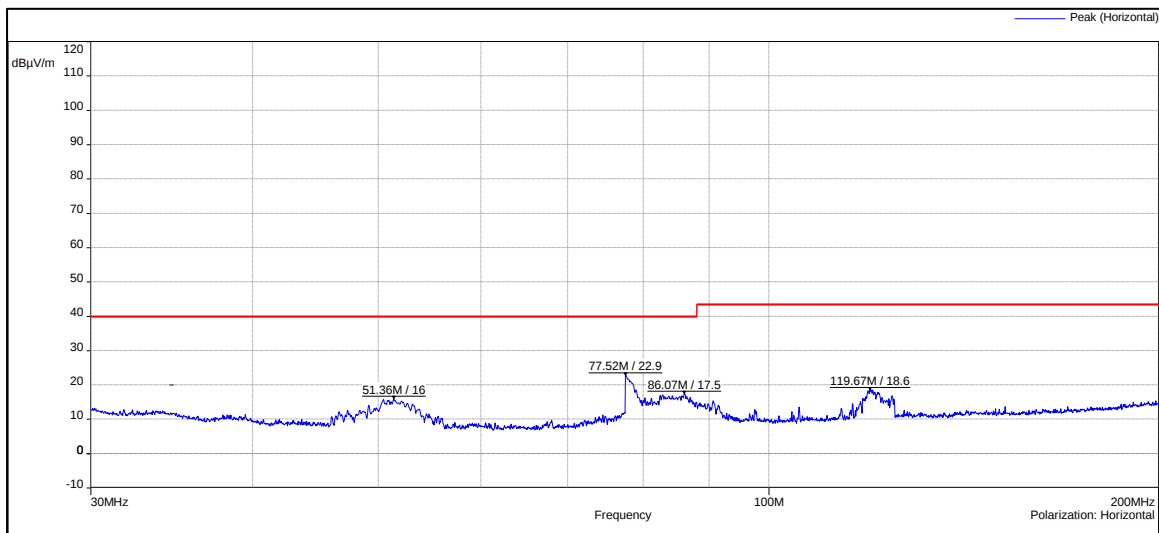
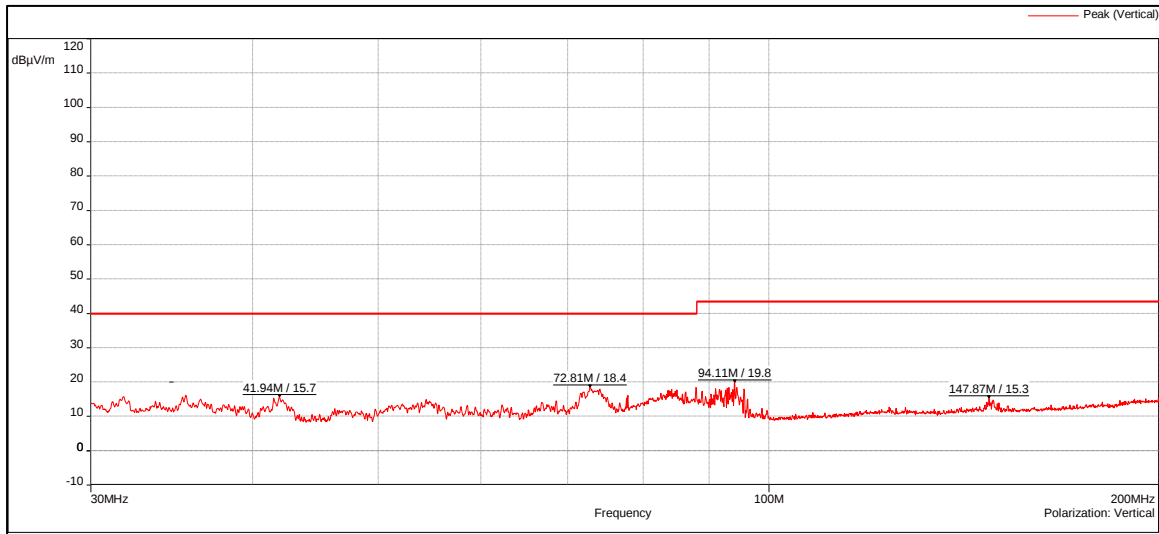
Antenna Polarization	Measured Frequency (MHz)	Measured Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	41.94	15.70	40	-24.30
	72.81	18.40	40	-21.60
	94.11	19.80	43.5	-23.70
	147.87	15.30	43.5	-28.20
	245.2	18.10	46	-27.90
	264.98	33.30	46	-12.70
	279.02	25.00	46	-21.00
	656.18	26.70	46	-19.30
Horizontal	51.36	16.00	40	-24.00
	77.52	22.90	40	-17.10
	86.07	17.50	40	-22.50
	199.6	18.60	43.5	-24.90
	288.68	24.80	46	-21.20
	304.49	34.00	46	-12.00
	625.88	24.70	46	-21.30

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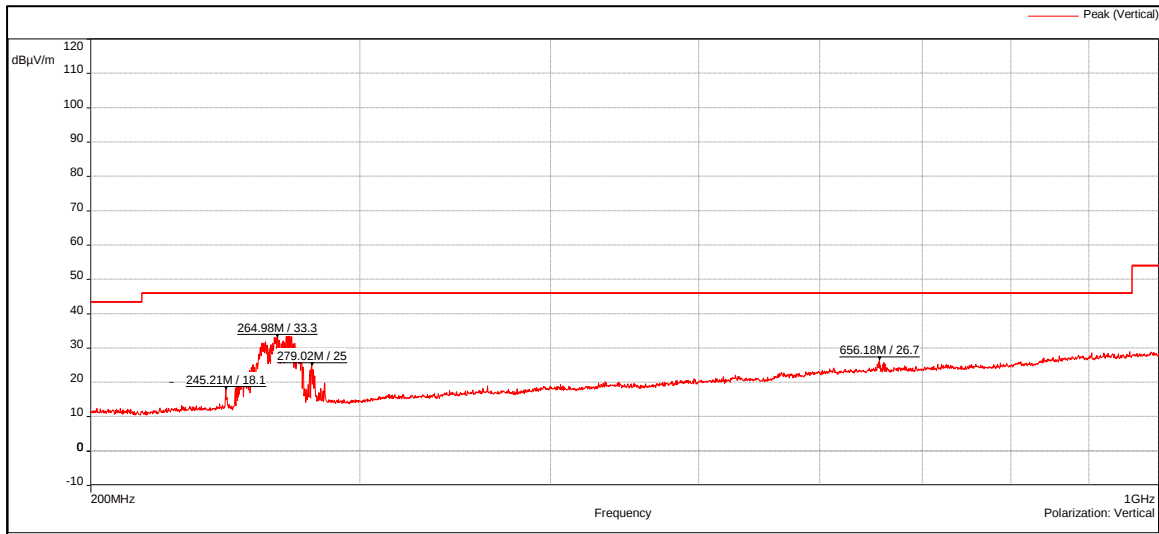
Test Plots: 30MHz-1GHz



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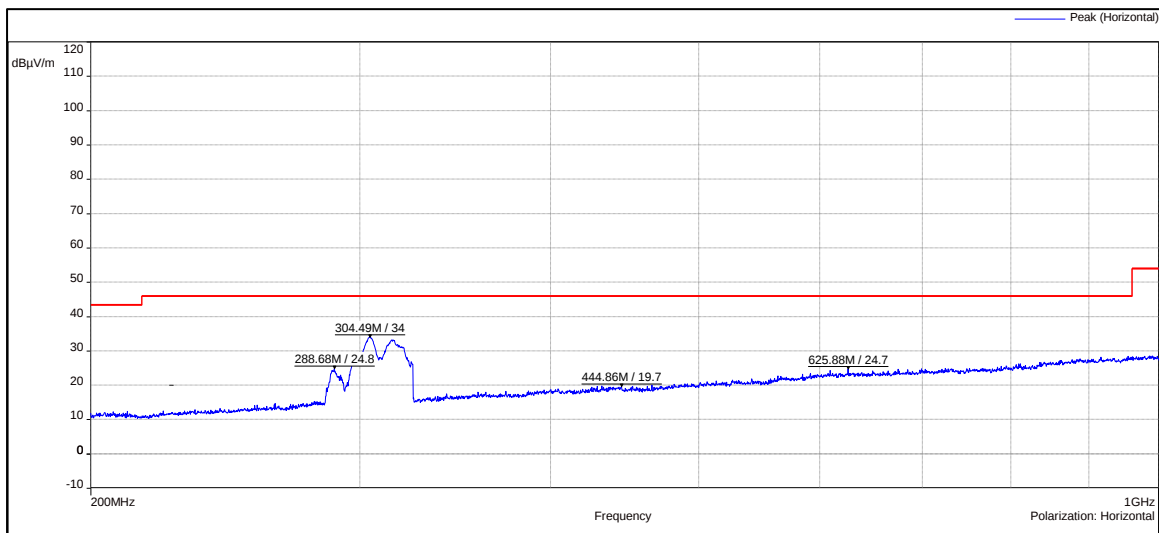
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Frequency Range: 200MHz – 1GHz

Polarization: Vertical



Frequency Range: 200MHz – 1GHz

Polarization: Horizontal

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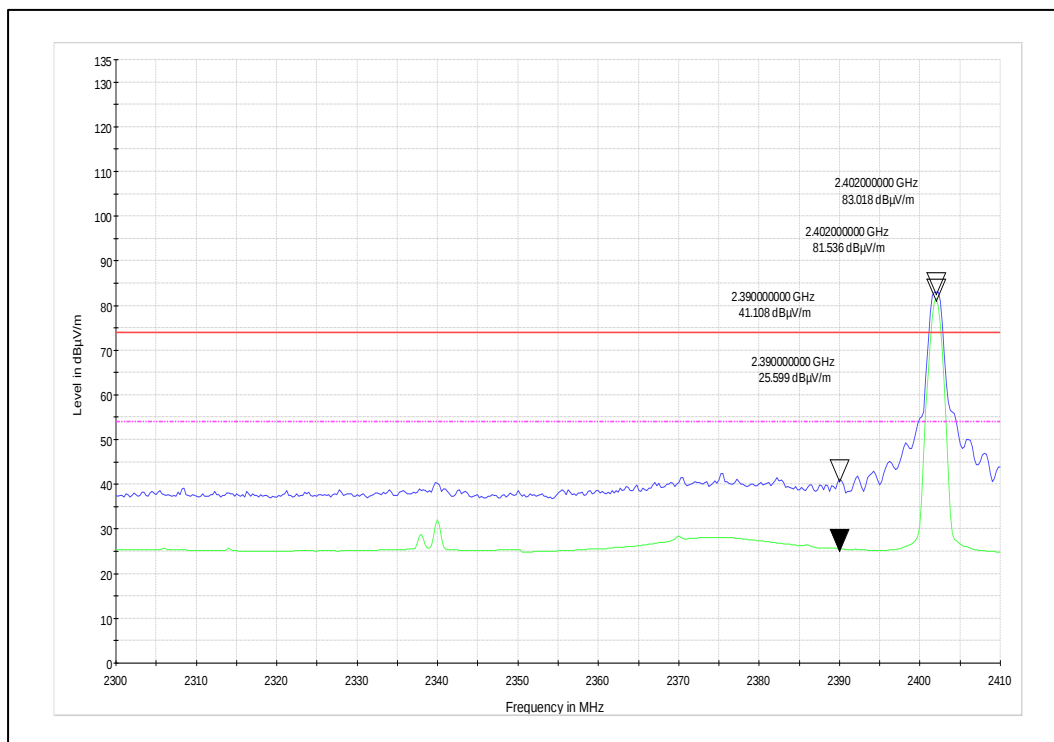
Test Results for Above 1GHz

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2402(Pk)	Vertical	83.01	*	-
	2402(Av)		81.53	*	-
	2390(Pk)		41.10	74	-32.90
	2390(Av)		25.59	54	-28.41
	4804(Pk)		41.50	74	-32.50
	4804(Av)		29.83	54	-24.17
	7206(Pk)		47.23	74	-26.77
	7206(Av)		35.27	54	-18.73
	2402(Pk)	Horizontal	87.67	*	-
	2402(Av)		86.24	*	-
	2390(Pk)		43.85	74	-30.15
	2390(Av)		24.95	54	-29.05
	4804(Pk)		42.22	74	-31.78
	4804(Av)		30.52	54	-23.48
	7206(Pk)		46.83	74	-27.17
	7206(Av)		35.25	54	-18.75
2440	2440(Pk)	Vertical	82.26	*	-
	2440(Av)		80.71	*	-
	4880(Pk)		41.03	74	-32.97
	4880(Av)		30.09	54	-23.91
	7320(Pk)		48.36	74	-25.64
	7320(Av)		35.10	54	-18.90
	2440(Pk)	Horizontal	86.45	*	-
	2440(Av)		84.96	*	-
	4880(Pk)		41.63	74	-32.37
	4880(Av)		30.16	54	-23.84
	7320(Pk)		47.22	74	-26.78
	7320(Av)		35.02	54	-18.98
2480	2480(Pk)	Vertical	80.11	*	-
	2480(Av)		78.66	*	-
	2483.5(Pk)		46.79	74	-27.21
	2483.5(Av)		24.70	54	-29.30
	4960(Pk)		40.79	74	-33.21
	4960(Av)		29.17	54	-24.83
	7440(Pk)		46.78	74	-27.22
	7440(Av)		35.18	54	-18.82
	2480(Pk)	Horizontal	84.99	*	-
	2480(Av)		83.46	*	-
	2483.5(Pk)		51.59	74	-22.41
	2483.5(Av)		26.38	54	-27.62
	4960(Pk)		40.96	74	-33.04
	4960(Av)		29.03	54	-24.97
	7440(Pk)		47.18	74	-26.82
	7440(Av)		35.18	54	-18.82

Note: *- indicates fundamental frequency

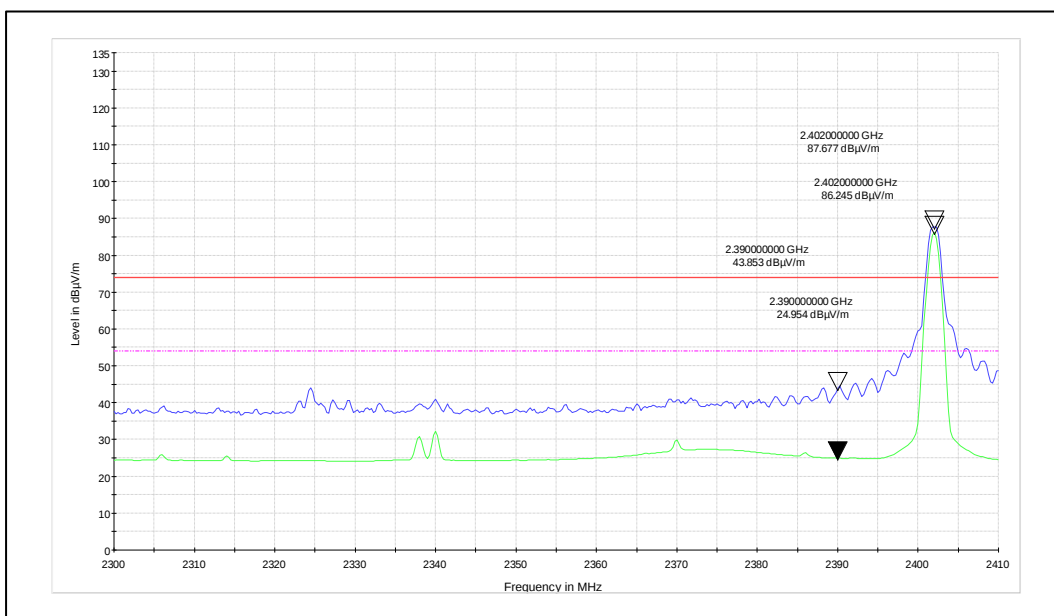
No emissions found above 18GHz

Test Plots: Restricted Bands of Operation



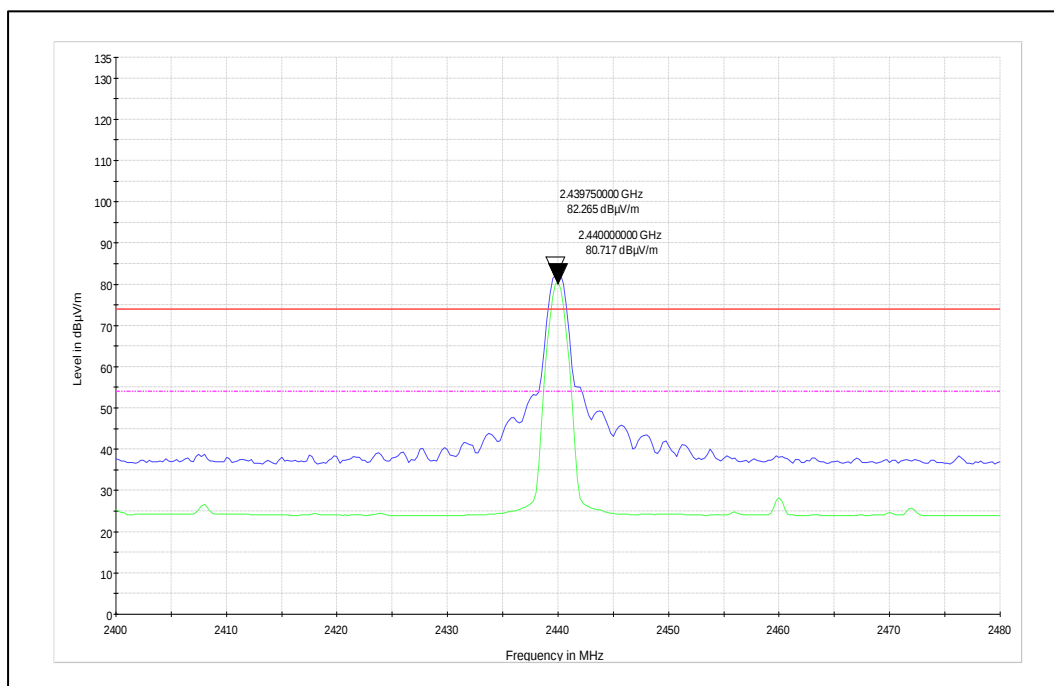
Channel Frequency: 2402MHz

Polarization: Vertical



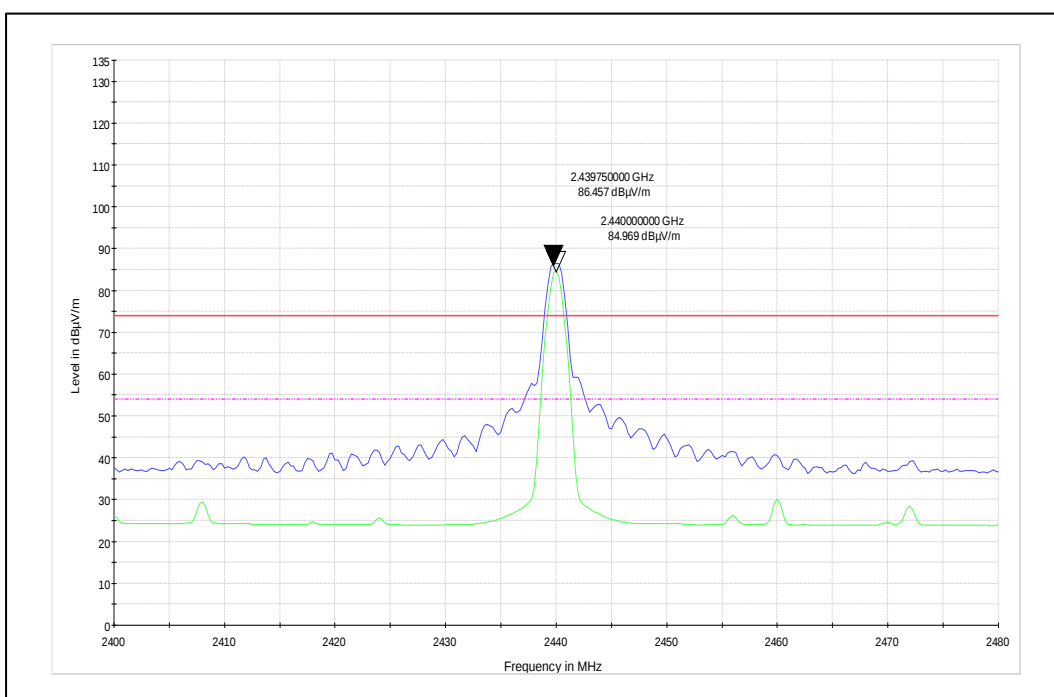
Channel Frequency: 2402MHz

Polarization: Horizontal



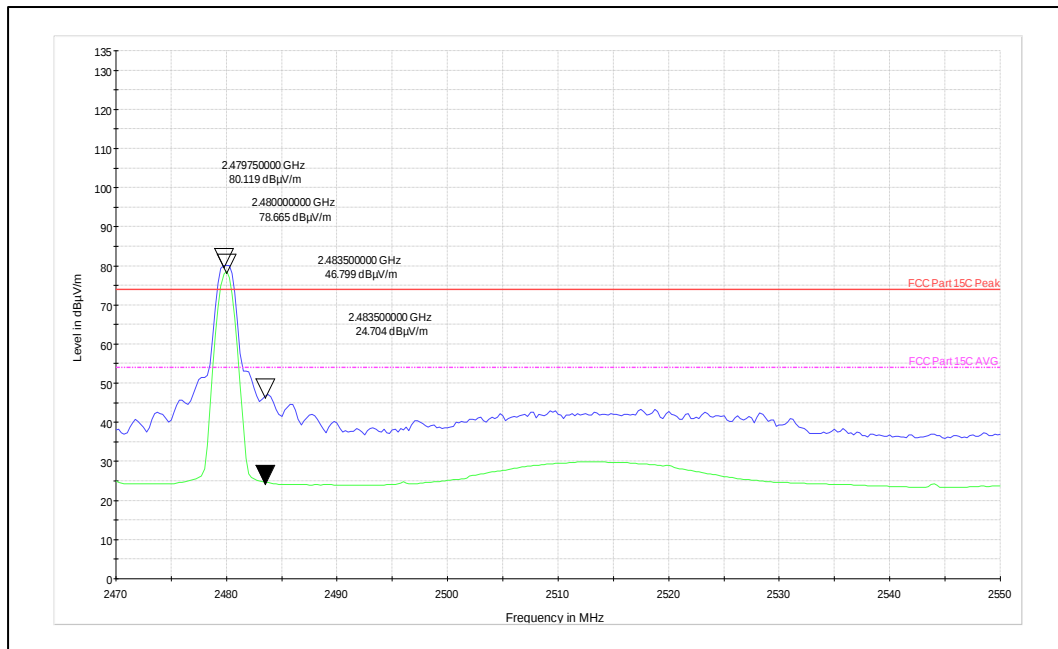
Channel Frequency: 2440MHz

Polarization: Vertical



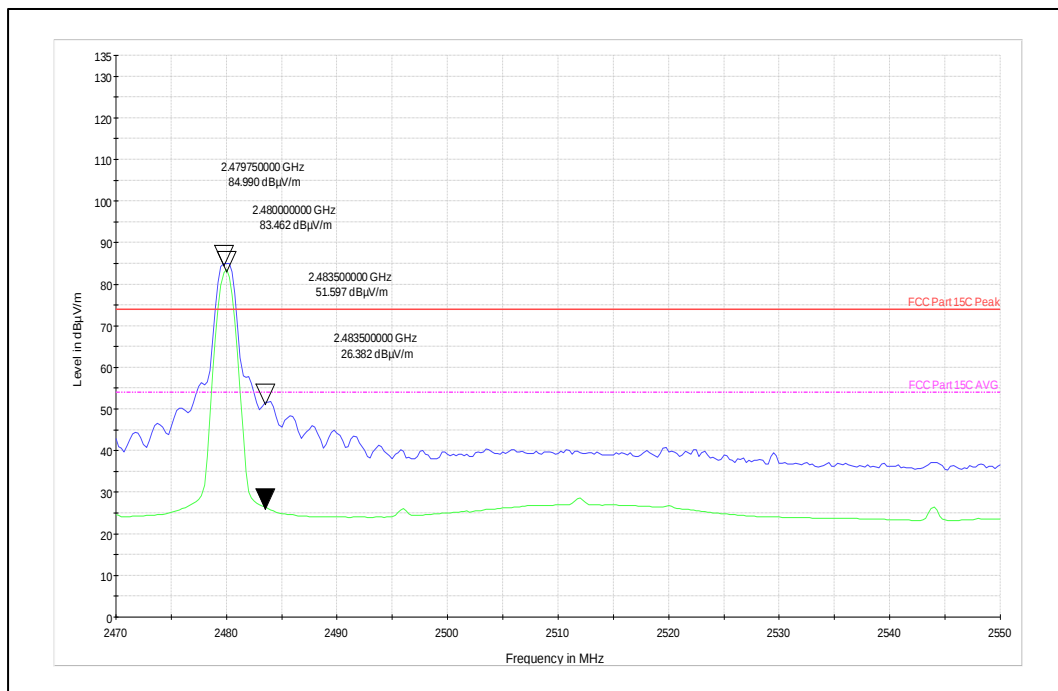
Channel Frequency: 2440MHz

Polarization: Horizontal



Channel Frequency: 2480MHz

Polarization: Vertical



Channel Frequency: 2480MHz

Polarization: Horizontal

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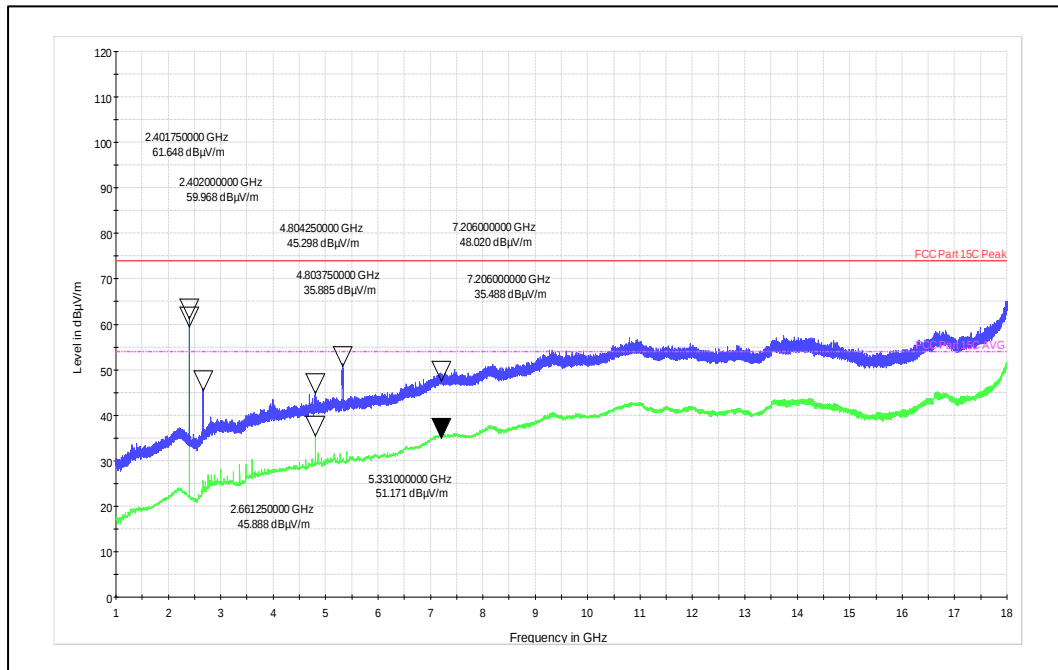
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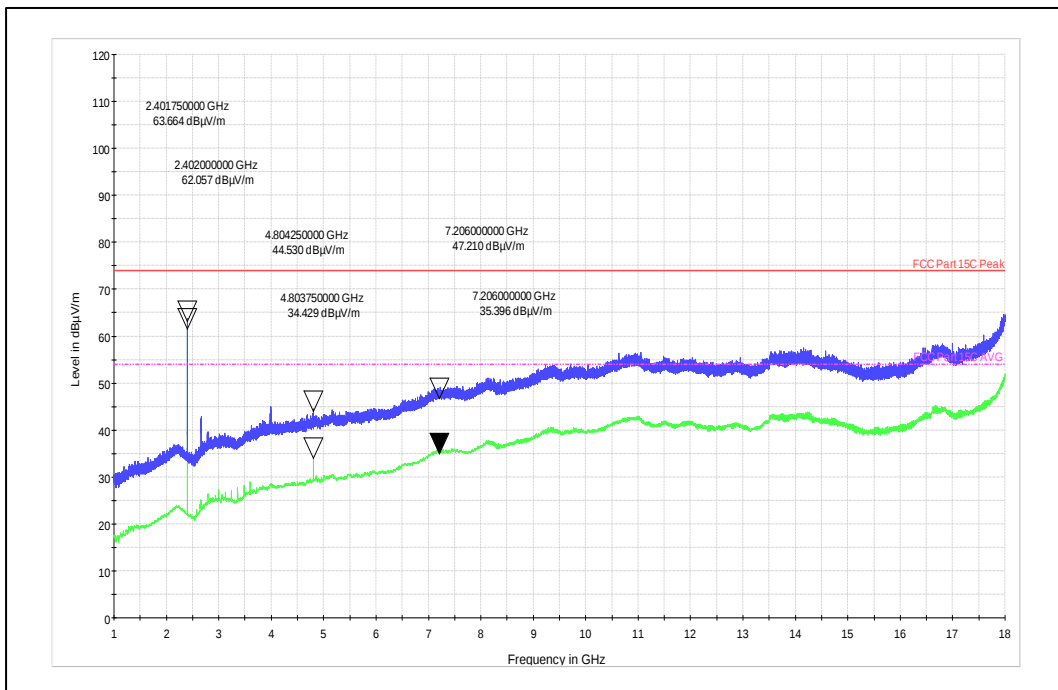
Test Plots: Radiated Spurious emissions

Channel Frequency: 2402MHz



Frequency Range: 1-18GHz

Polarization: Vertical



Frequency Range: 1-18GHz

Polarization: Horizontal

Prüfbericht - Nr.:

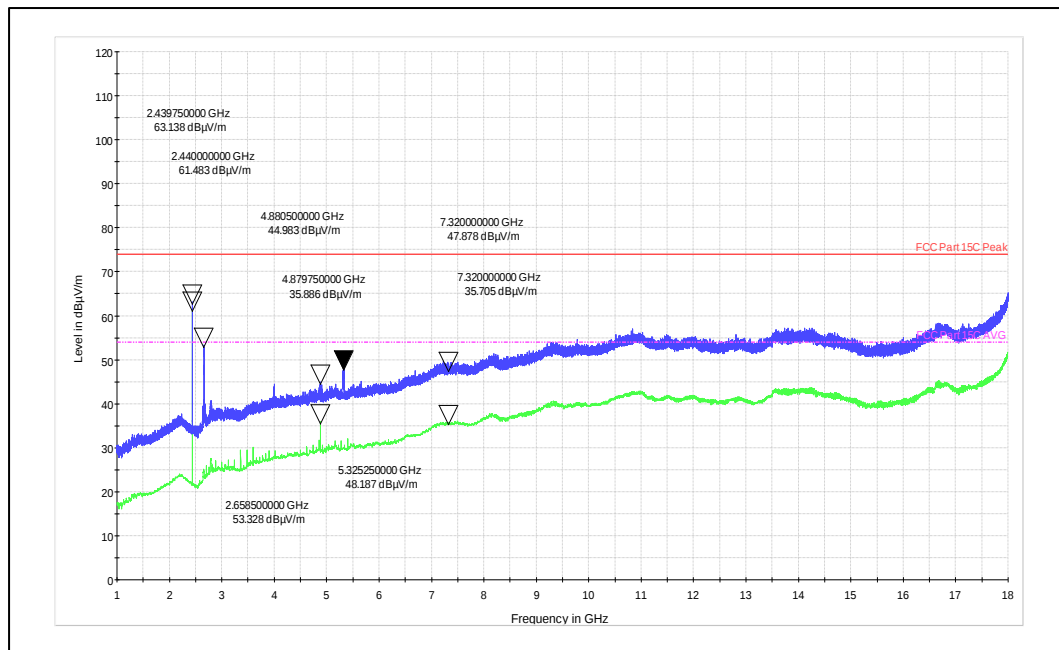
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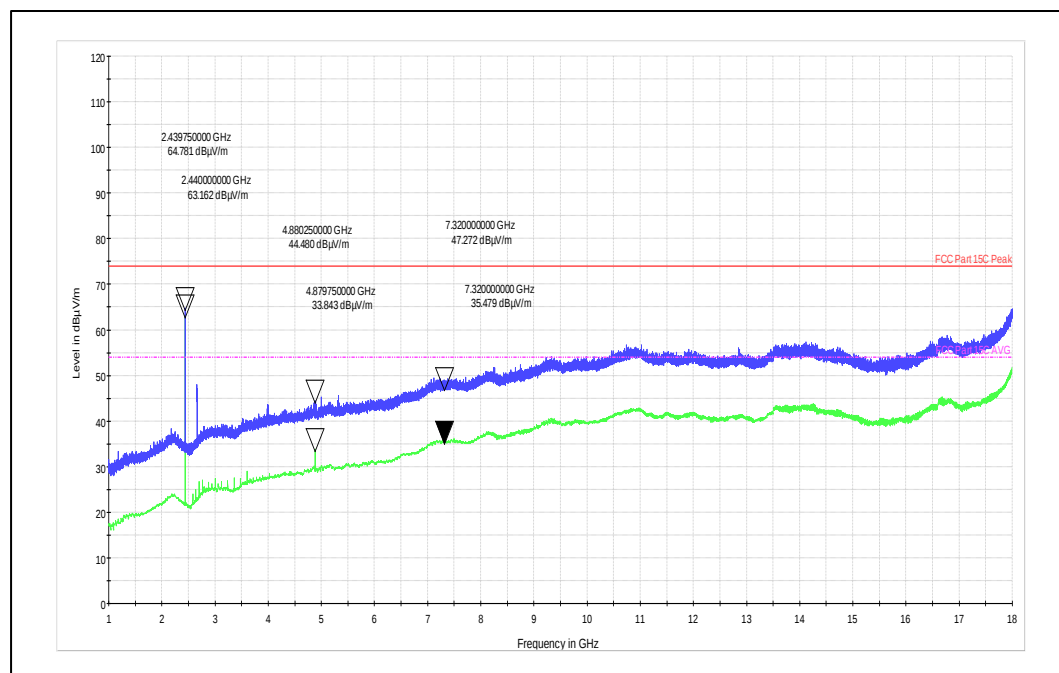
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Channel Frequency: 2440MHz



Frequency Range: 1-18GHz

Polarization: Vertical



Frequency Range: 1-18GHz

Polarization: Horizontal

Prüfbericht - Nr.:

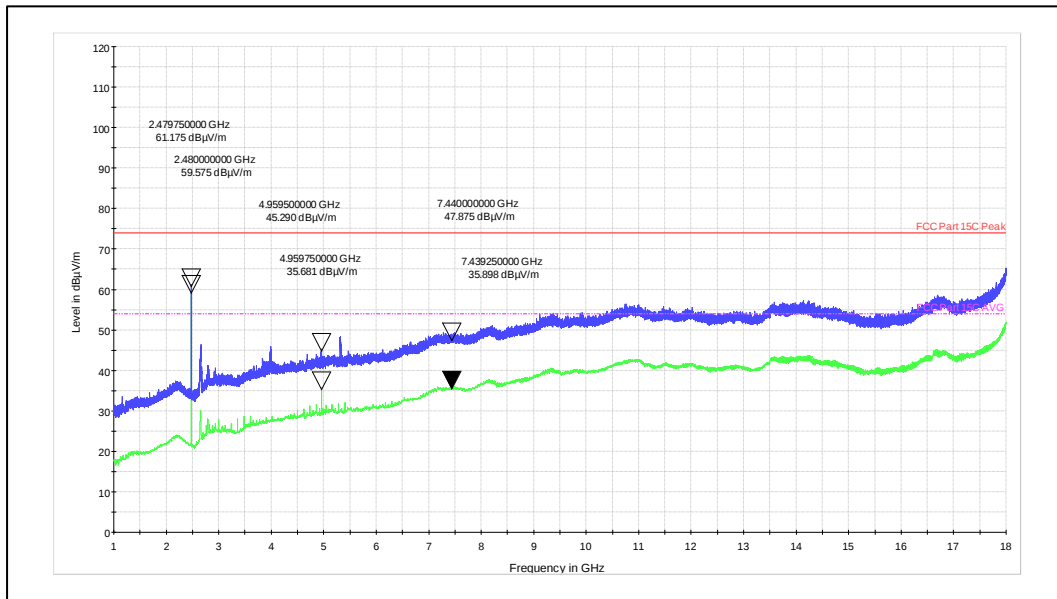
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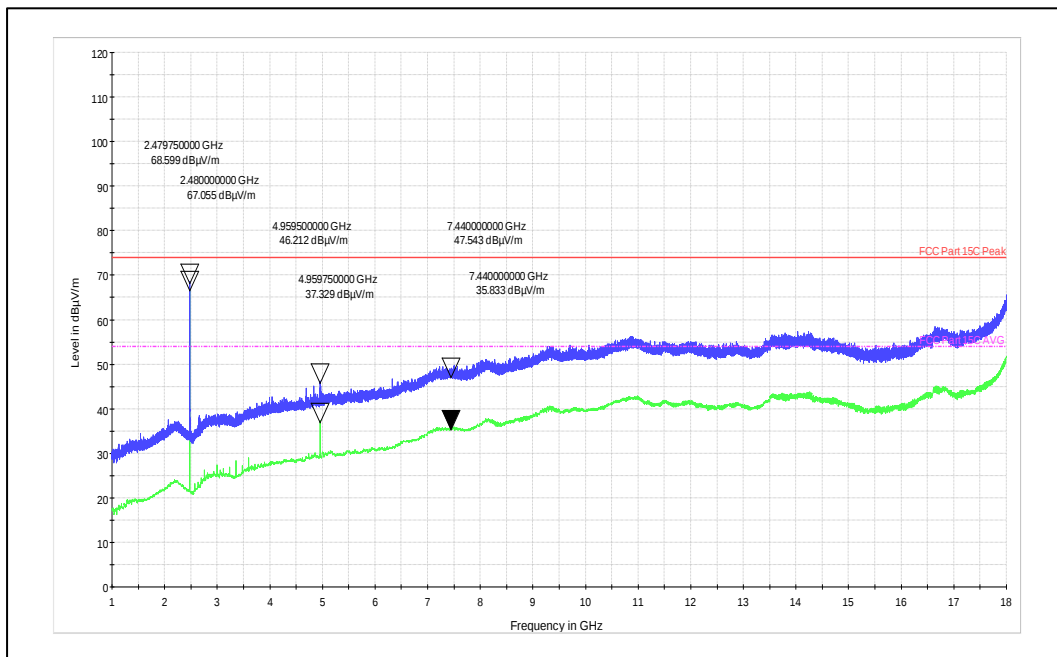
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Channel Frequency: 2480MHz



Frequency Range: 1-18GHz

Polarization: Vertical



Frequency Range: 1-18GHz

Polarization: Horizontal

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*****END OF TEST REPORT*****