

Prüfbericht – Produkte

Test Report - Products

Prüfbericht-Nr.: <i>Test report no.:</i>	IN23ISA3 001 ULR-TC5688233000000040F	Auftrags-Nr.: <i>Order no.:</i>	146662795 190 Seite 1 von 112 <i>Page 1 of 112</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	2283344	Auftragsdatum: <i>Order date:</i>	2022.02.16
Auftraggeber: <i>Client:</i>	LifeSignals, Inc. 426 S Hillview Dr, Milpitas, CA 95035, USA		
Prüfgegenstand: <i>Test item:</i>	UbiqVue 2A Wearable Biosensor using UbiqVue 2A Wireless Patient Monitoring System		
Bezeichnung: <i>Identification .:</i>	UB2550/UX2550		
Auftrags-Inhalt: <i>Order content:</i>	Testing and issue of Test Report and Grant Certificate		
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C 15.247, 15.205 &15.209		
Wareneingangsdatum: <i>Date of sample receipt:</i>	2022.05.16		
Prüfmuster-Nr & Serien-Nr.: <i>Test sample no & serial no.:</i>	A003068621-001 A003068621-002 2021061001		
Prüfzeitraum: <i>Testing period:</i>	2022.05.20 - 2022.06.15		
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, Electronic City Phase1 Bangalore -560 100, India FCC Test site registration number: 496599 ISED Test site registration number: 3466E-1		
Prüfergebnis*: <i>Test result*:</i>	Pass		
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>		
Datum: <i>Date:</i> 2022.06.16	Ausstellatum: <i>Issue date:</i> 2023.05.08		
Stellung / Position: Yogesh V Engineer	Stellung / Position: Madhu K N Senior Engineer		
Sonstiges / Other:	FCC ID: 2AHV9-UB2550		
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
* Legende: 1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n) * Legend: 1 = very good P(ass) = passed a.m. test specification(s)	2 = gut 3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n) 3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = ausreichend N/A = nicht anwendbar 4 = sufficient N/A = not applicable	5 = N/T = nicht 5 = poor N/T = not
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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4	Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. <i>The decision rule for statements of conformity in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.</i>

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TEST SUMMARY

Test Item	Applicable Standard	Result
	FCC	
Maximum conducted (Peak) 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
IN23ISA3 001 ULR-TC5688233000000040F	01	Initial issue of report	2023.04.20
IN23ISA3 001 ULR-TC5688233000000040F	02	Reviewer comments updated	2023.05.08

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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

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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

Radiated Measurement site type :
Fully anechoic chamber (used for above 1 GHz
measurements)

Radiated Measurement site type :
Semi anechoic chamber (used for below 1 GHz
measurements)

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
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	31-01-2023	Yearly	Radiated Spurious Emission
Baloon and Biconical Antenna	Schwarzbeck Mess-Elektronik	VHBB-9124 / BBA-9106	1028	-	03-02-2023	Yearly	
Log - Periodical Antenna	Schwarzbeck Mess-Elektronik	VUSLP 9111B	9111B-111	-	04-02-2023	Yearly	
Horn Antenna	Schwarzbeck	HAX-18	HAX18-802	-	20-05-2023	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
EMI Receiver	Rohde & Schwarz	ESW 44	101732	4.73.SP5	04-08-2023	Yearly	
EMI Receiver	Rohde & Schwarz	ESW44	101773	1.72SP1	12-02-2023	Yearly	
Spectrum Analyser	Agilent Technologies	E4407B	US41192 772	A.14.06	15-12-2022	Yearly	Antenna-Port Conducted test

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™ 2A Wireless Patient Monitoring System is a wireless remote monitoring system intended for use by healthcare professionals for continuous collection physiological data in home and healthcare settings. This can include Electrocardiography, Heart Rate, SpO2%, Respiration Rate, Pulse Rate, Photoplethysmography waveform, skin temperature, body temperature, body posture, body motion, R-R Interval, Heart Rate Variability (HRV) and Blood Pressure (optional) in home and healthcare settings.

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

Radio Protocol		Wi-Fi	BLE
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)		4.92dBm	10.68dBm
Modulation		802.11b: DSSS - 1Mbps, 2Mbps, CCK - 5.5Mbps, 11Mbps)	GFSK
Number of antennas		1	
Antenna Gain		3.6dBi	
Antenna Type		Meander Line Antenna	
Supply Voltage to Product		3.3V DC	
Environmental conditions	Storage	< 30 days shall be +0°C to +45°C (32°F to 113°F) ≥ 30 days shall be +10°C to +27°C (41°F to 80.6°F)	
	Operating	+0°C to +45°C (32°F to 113°F)	
EUT Dimension		116mm x 91mm 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) : 7000000036A
 R1D Firmware Version : v6.1.11
 SPO2 Firmware : v1.1.11
 MPR : v4.17.0
 Central Server : v3.0.3
 Active monitoring portal : v3.0.1
 SPR : v4.2.1.x (x = 4th digit is build number 0 - Knox, 1 - BLE- 2 Rooted app)

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 supports 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 : A003068621-001– Radiated test Sample
A003068621-002– Conducted test Sample

5 OPERATIONAL DESCRIPTION

The UbiqVue™ 2A Wearable Biosensor [UB2550] 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™ 2A Wearable Biosensor Processor [HC1100 or LC1100]

The UbiqVue™ 2A Wearable Biosensor Processor, HC1100 or 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 generated 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. UB2550 uses LC1100 processor to radiate the power through on board printed antenna.

The BlueNRG-234 Bluetooth processor has the capability to generate and transmit signals inline 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 UB2550 is shown in the diagram below. 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 average gain of -3.6dBi and peak gain up to +3.626dBi.

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

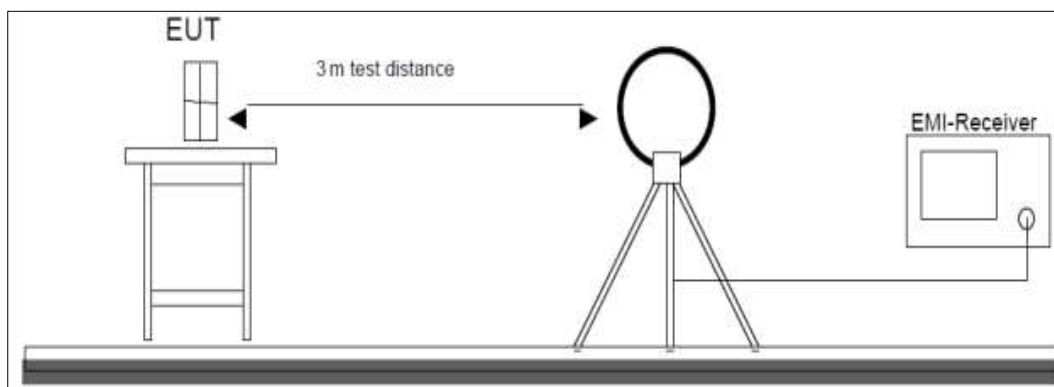


Figure 1: Frequency Range 9 kHz- 30 MHz

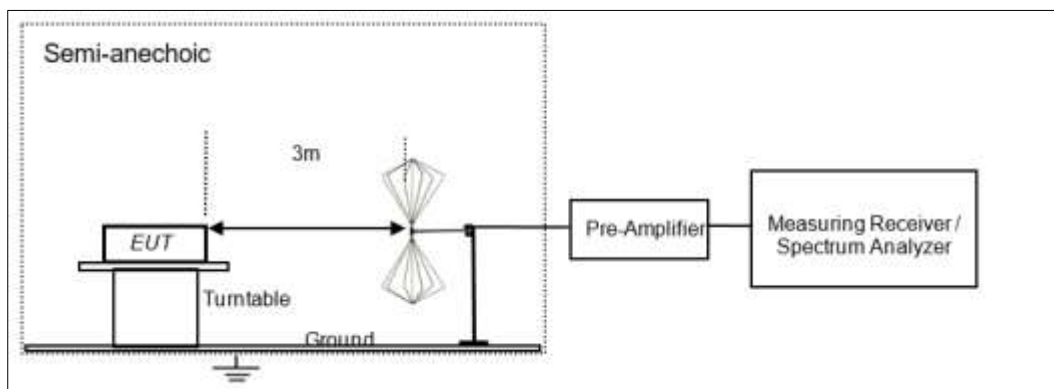


Figure 2: Frequency Range 30 MHz – 200 MHz

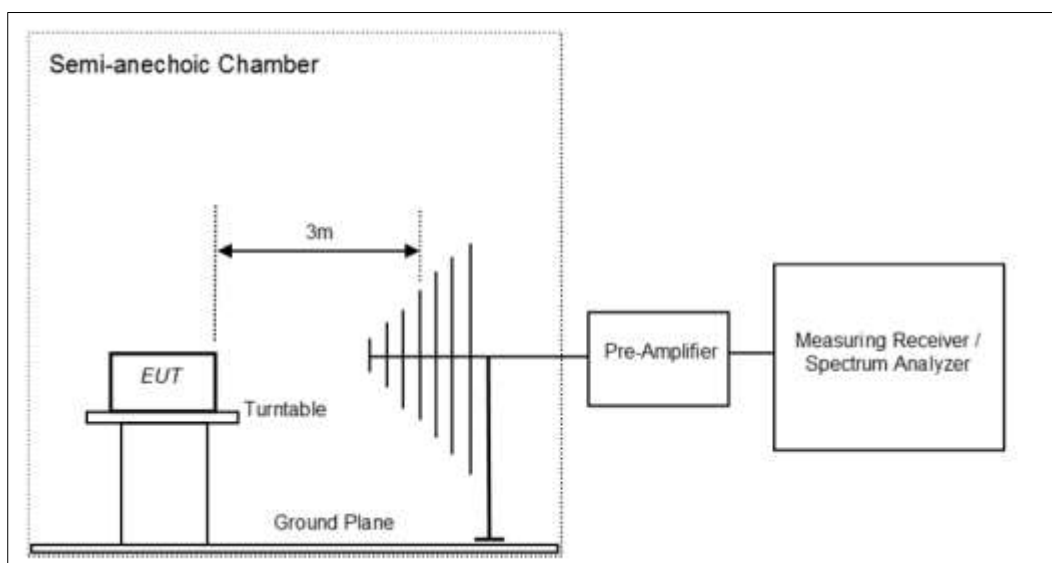


Figure 3: Frequency Range 200 MHz - 1GHz

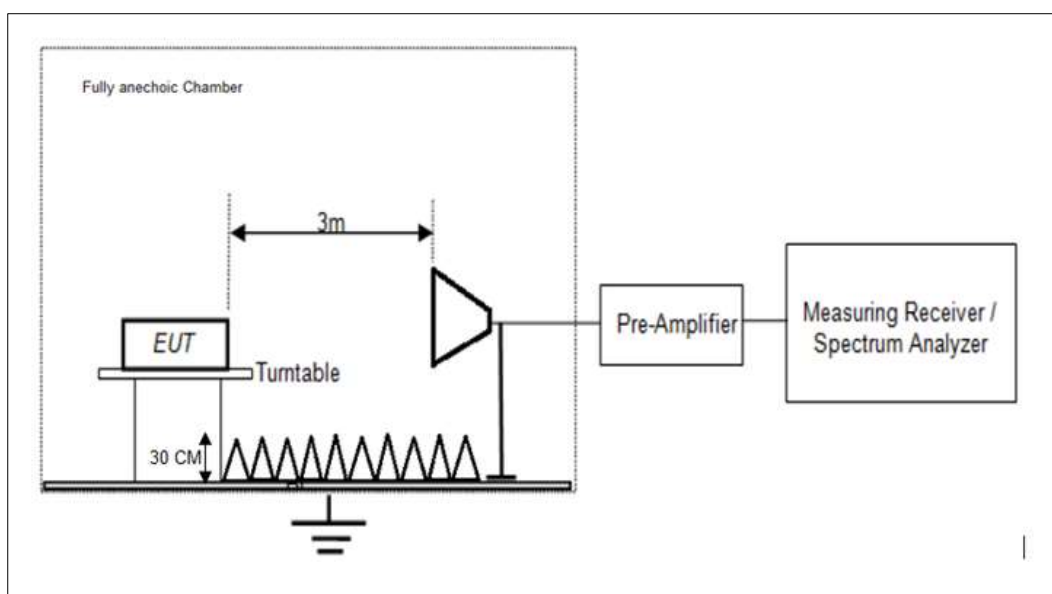


Figure 4: Frequency Range above 1 GHz

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7 TEST RESULTS FOR Wi-Fi

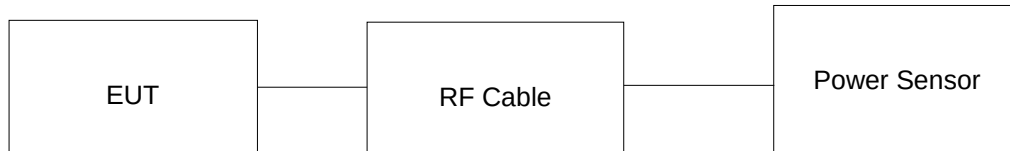
7.1 Maximum Peak Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3)
Test Method	Subclause 11.9.1.3 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 = 3.3V AC to DC Adaptor 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 Peak Output power (dBm) = Measured Peak power (dBm) + Cable loss (0.8dB)
3. Maximum (e.i.r.p) = Maximum Peak output power (dBm) + antenna gain (3.6 dBi)

Modulation: 802.11b

Data rate (Mbps)	Channel Frequency (MHz)	Measured Peak Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
1	2412	1.32	4.92	30	36
	2437	0.90	4.50	30	36
	2462	1.08	4.68	30	36

Data rate (Mbps)	Channel Frequency (MHz)	Measured Peak Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
2	2412	1.17	4.77	30	36
	2437	1.04	4.64	30	36
	2462	0.85	4.45	30	36

Data rate (Mbps)	Channel Frequency (MHz)	Measured Peak Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
5.5	2412	1.06	4.66	30	36
	2437	0.87	4.47	30	36
	2462	0.62	4.22	30	36

Data rate (Mbps)	Channel Frequency (MHz)	Measured Peak Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
11	2412	1.09	4.69	30	36
	2437	1.04	4.64	30	36
	2462	0.84	4.44	30	36

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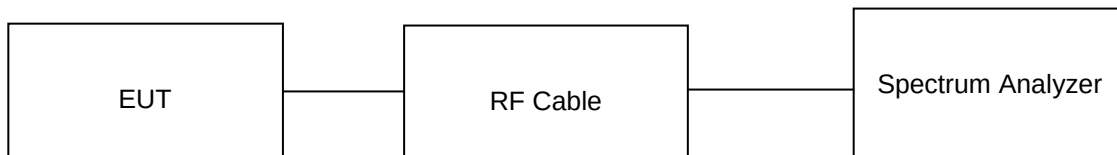
7.2 Maximum Power Spectral Density

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (e)
Test Method	Subclause 11.10.2 of ANSI C63.10
Measurement Bandwidth	100 kHz
Detector	Peak
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 = 3.3V AC to DC Adaptor 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:

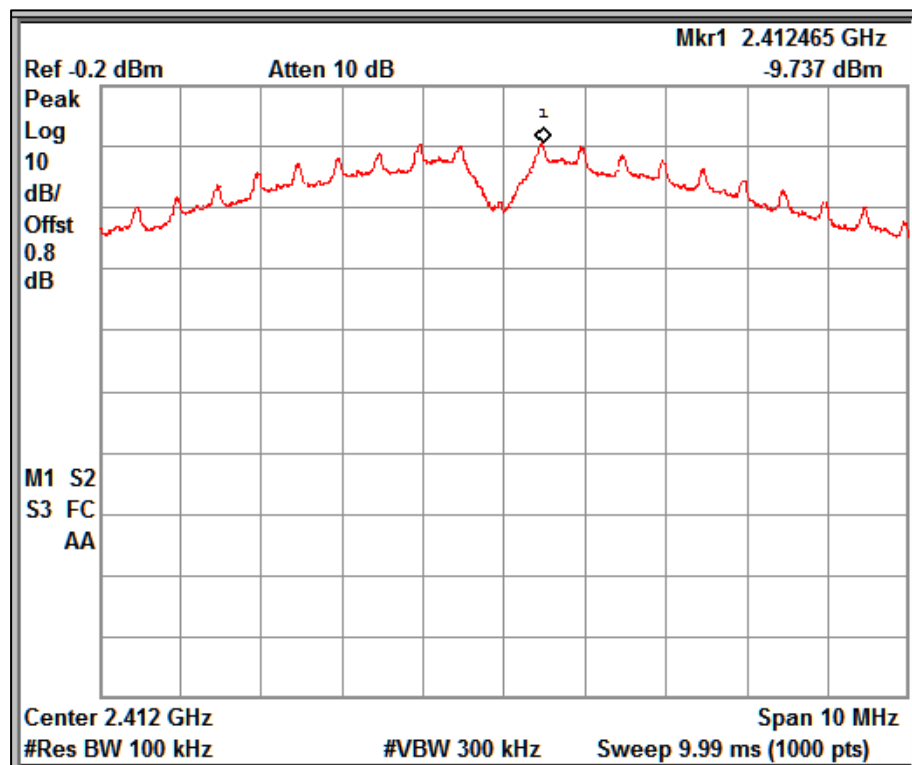
Note:

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 (0.8dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 3.6 dBi

Modulation: 802.11b

Data rate: 1Mbps

Data rate (Mbps)	Channel Frequency(MHz)	Measured average PSD (dBm/100kHz)	PSD Limit (dBm/100kHz)
1	2412	-9.73	8
	2437	-9.89	8
	2462	-9.99	8



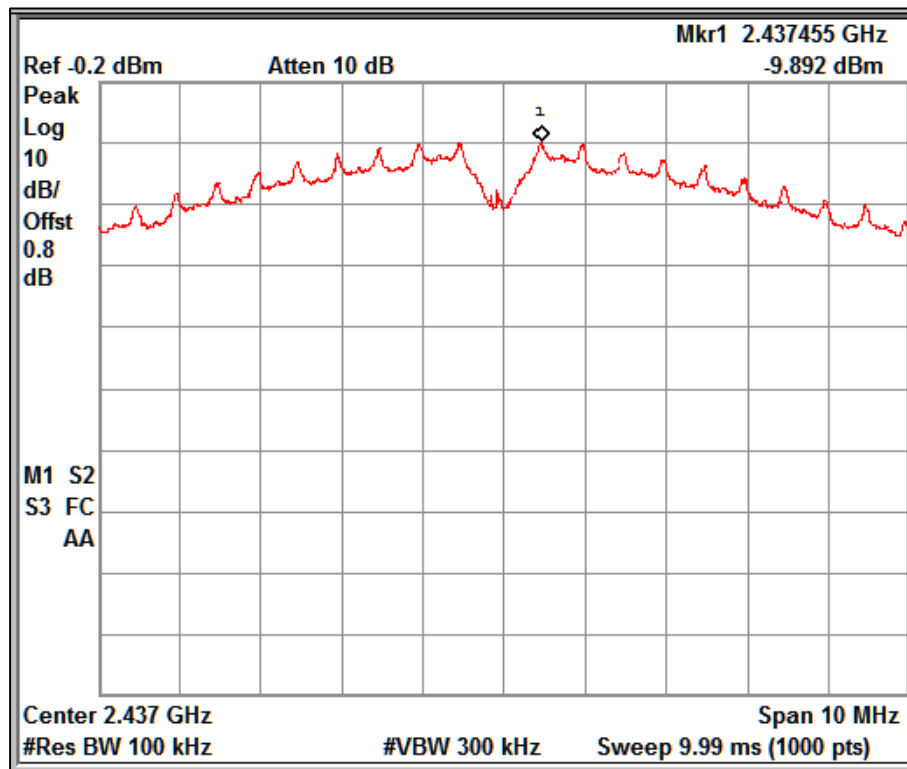
Data Rate: 1Mbps

Channel Frequency: 2412MHz

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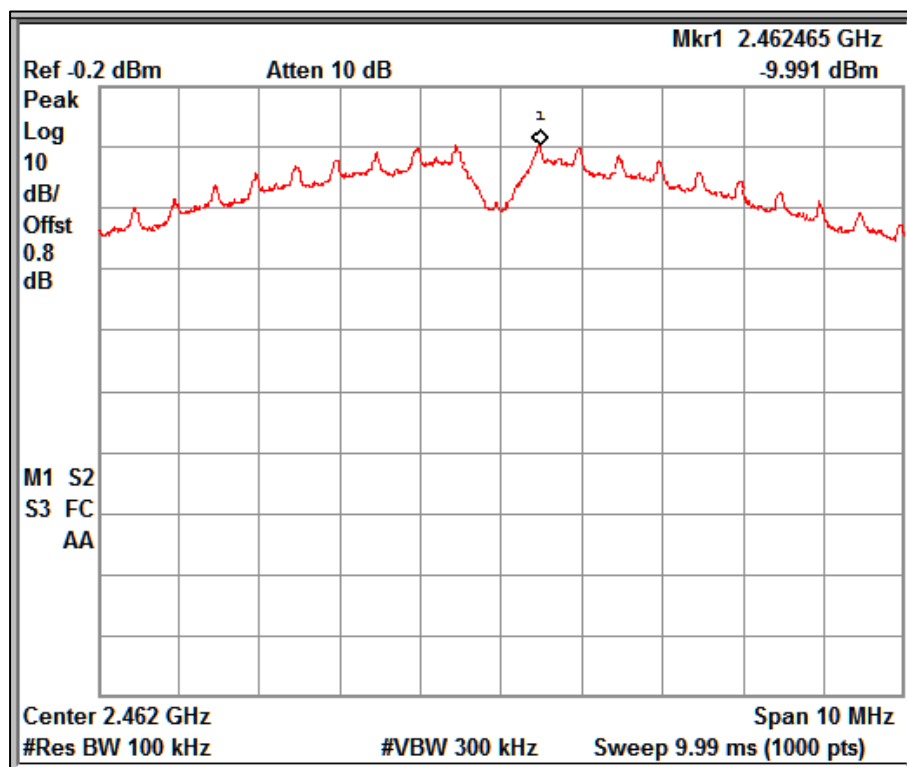
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Data Rate: 1Mbps

Channel Frequency: 2437MHz



Data Rate: 1Mbps

Channel Frequency: 2462MHz

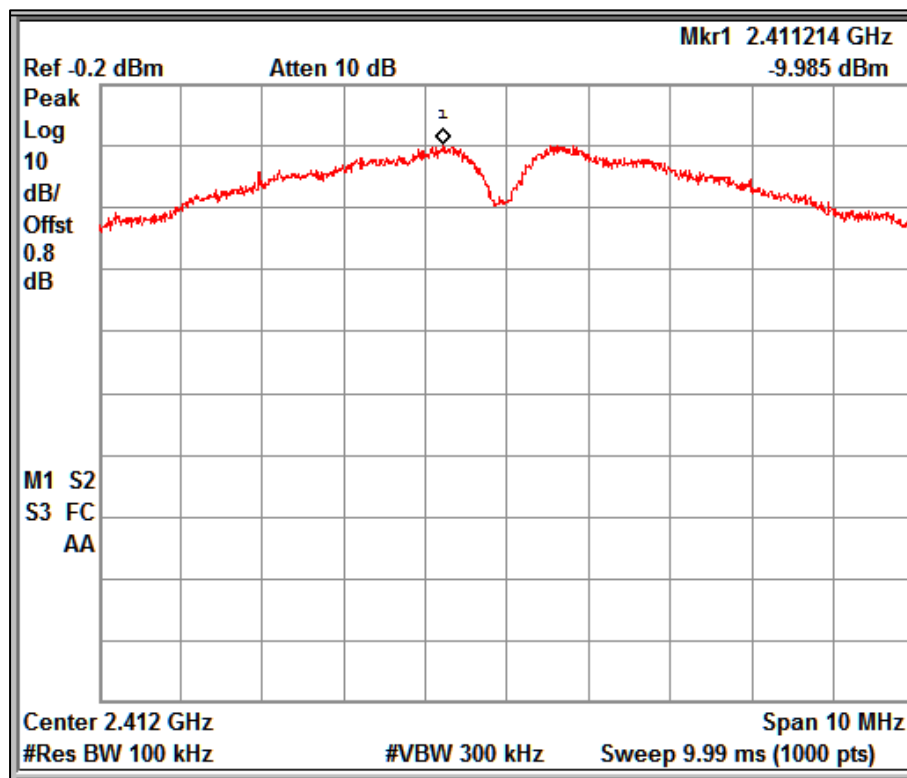
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Data rate: 2Mbps

Data rate (Mbps)	Channel Frequency(MHz)	Measured average PSD (dBm/100kHz)	PSD Limit (dBm/100kHz)
2	2412	-9.98	8
	2437	-9.69	8
	2462	-10.35	8



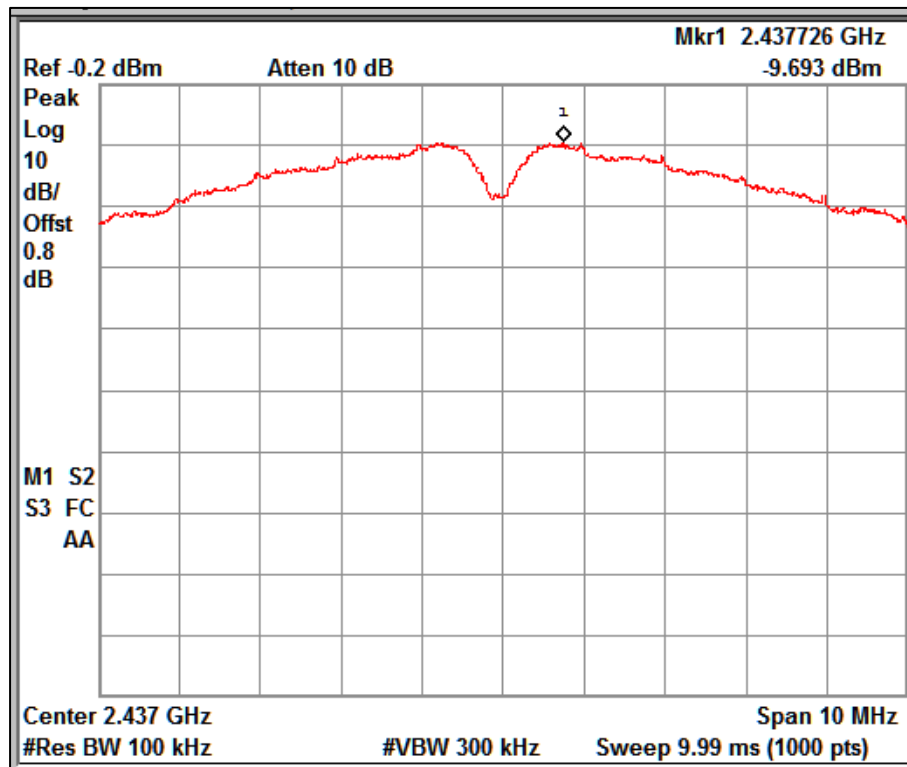
Data Rate: 2Mbps

Channel Frequency: 2412MHz

Prüfbericht - Nr.:
Test Report No.:

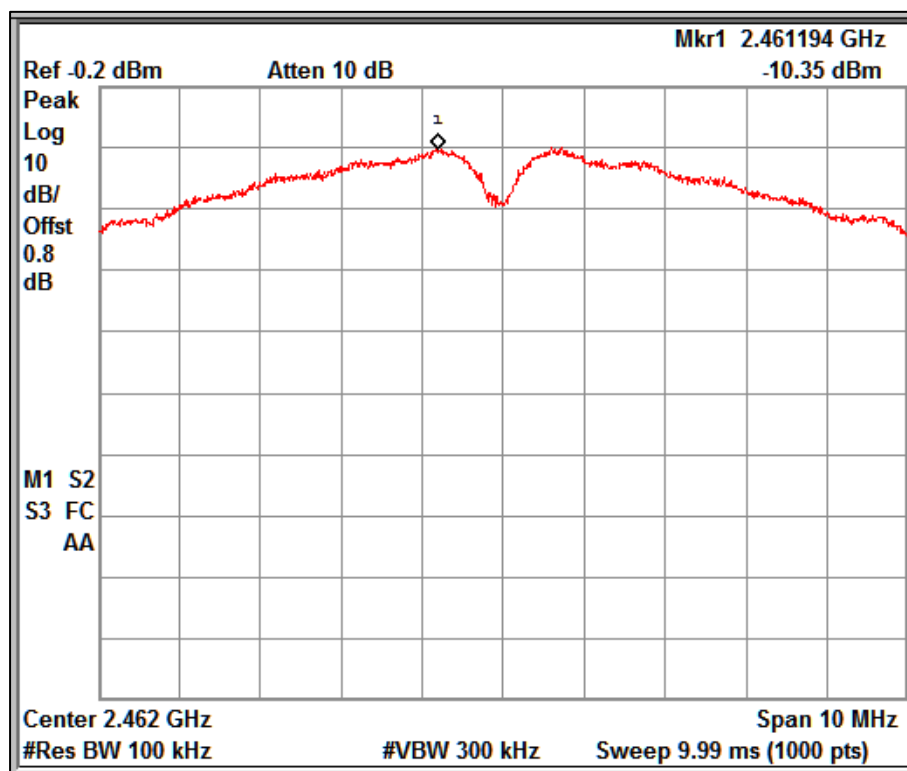
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Data Rate: 2Mbps

Channel Frequency: 2437MHz



Data Rate: 2Mbps

Channel Frequency: 2462MHz

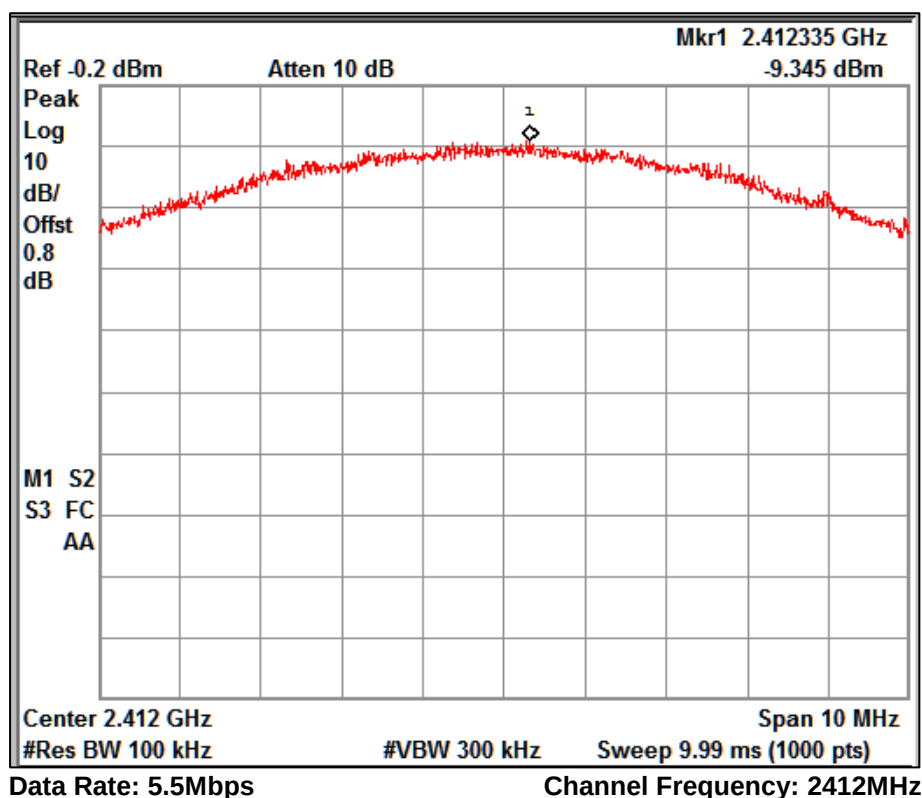
Prüfbericht - Nr.:
Test Report No.:

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Data rate: 5.5Mbps

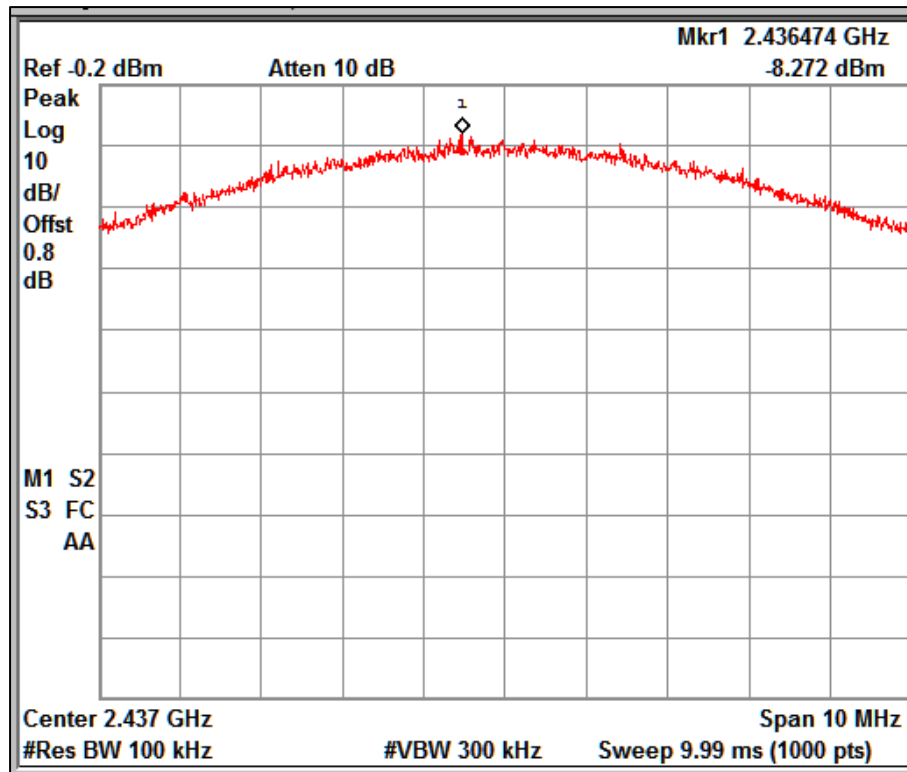
Data rate (Mbps)	Channel Frequency(MHz)	Measured average PSD (dBm/100kHz)	PSD Limit (dBm/100kHz)
5.5	2412	-9.34	8
	2437	-8.27	8
	2462	-9.18	8



Prüfbericht - Nr.:
Test Report No.:

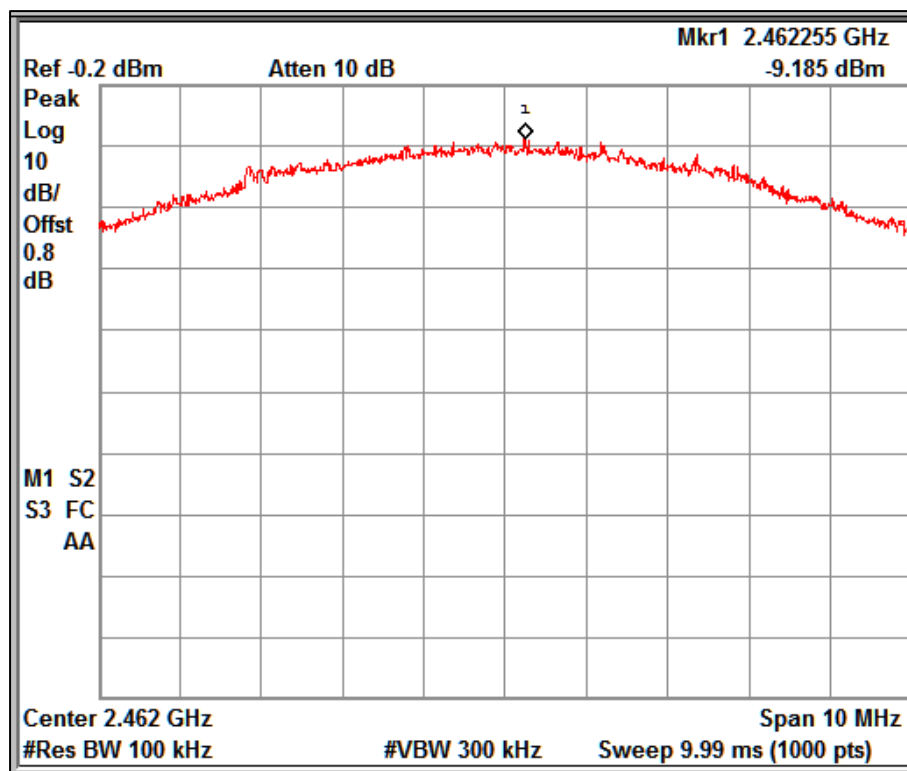
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Data Rate: 5.5Mbps

Channel Frequency: 2437MHz



Data Rate: 5.5Mbps

Channel Frequency: 2462MHz

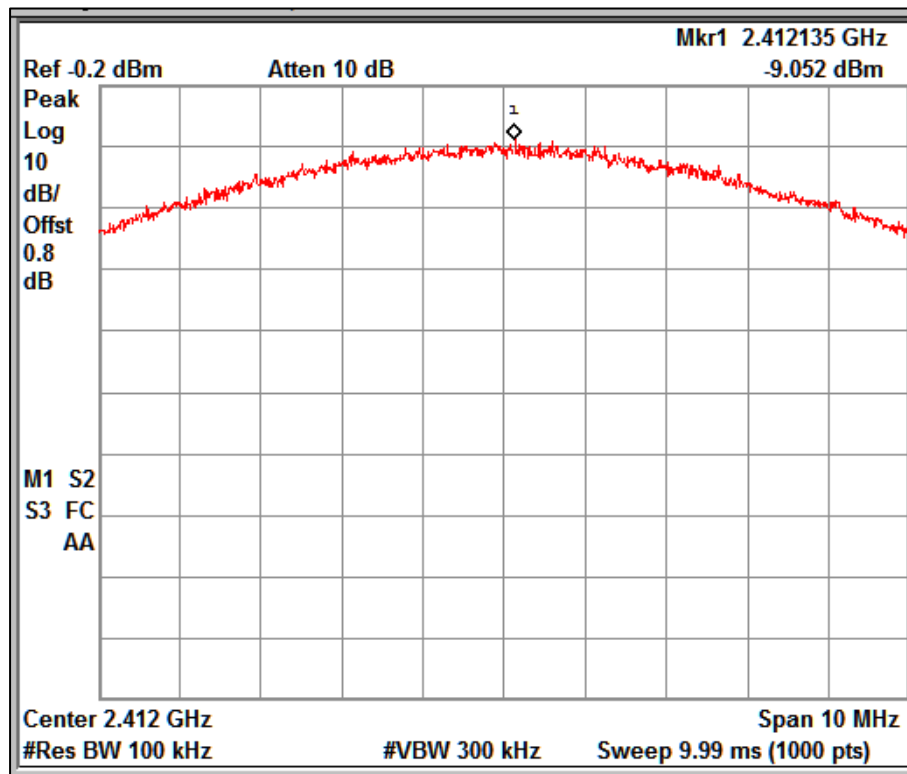
Prüfbericht - Nr.:
Test Report No.:

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Data rate: 11Mbps

Data rate (Mbps)	Channel Frequency(MHz)	Measured average PSD (dBm/100kHz)	PSD Limit (dBm/100kHz)
11	2412	-9.05	8
	2437	-9.93	8
	2462	-9.33	8



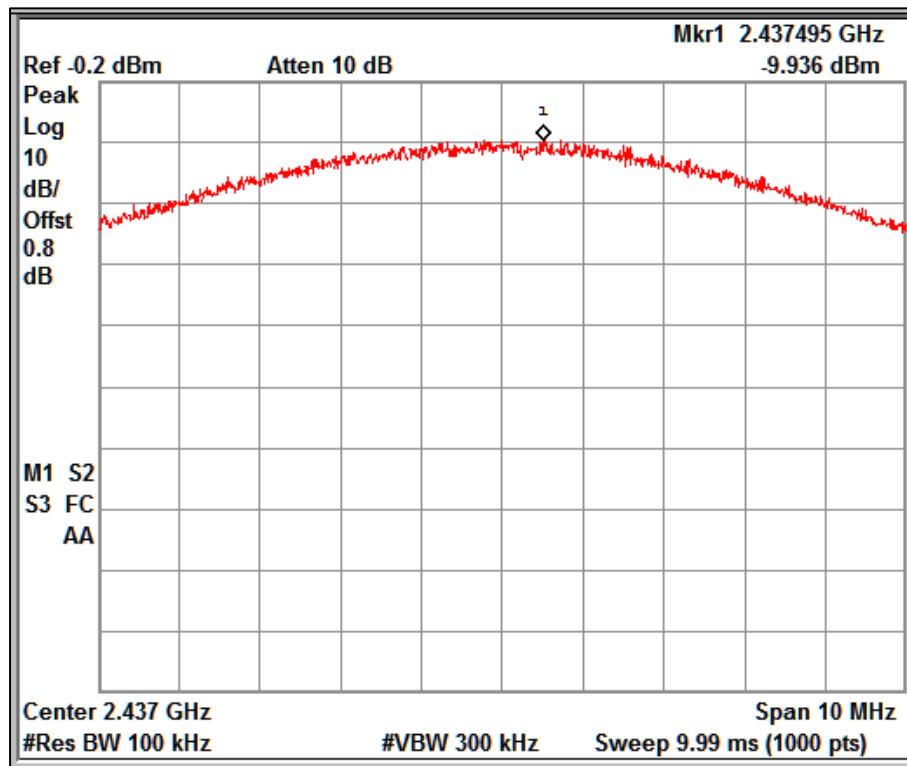
Data Rate: 11Mbps

Channel Frequency: 2412MHz

Prüfbericht - Nr.:
Test Report No.:

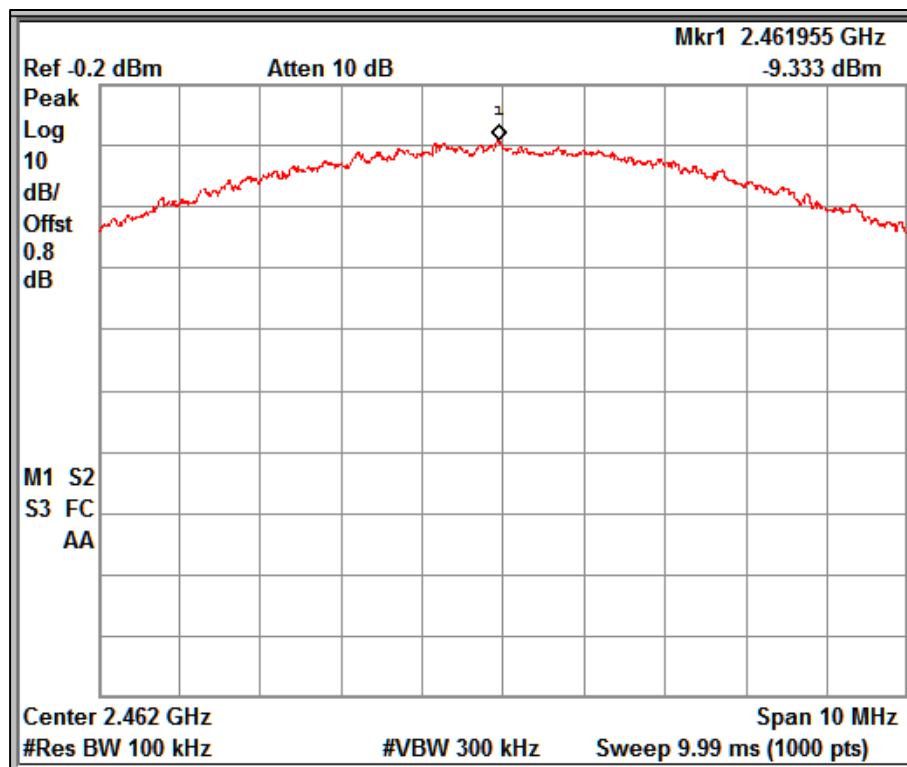
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Data Rate: 11Mbps

Channel Frequency: 2437MHz



Data Rate: 11Mbps

Channel Frequency: 2462MHz

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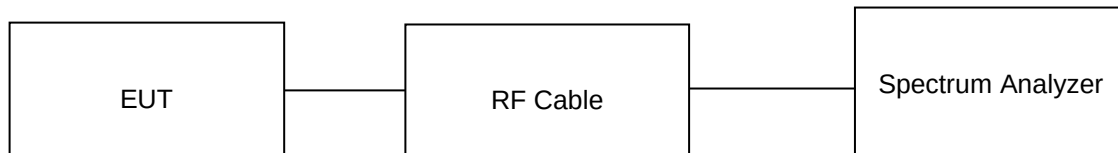
7.3 DTS Bandwidth & 99% Bandwidth

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 3.3V AC to DC Adaptor 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:

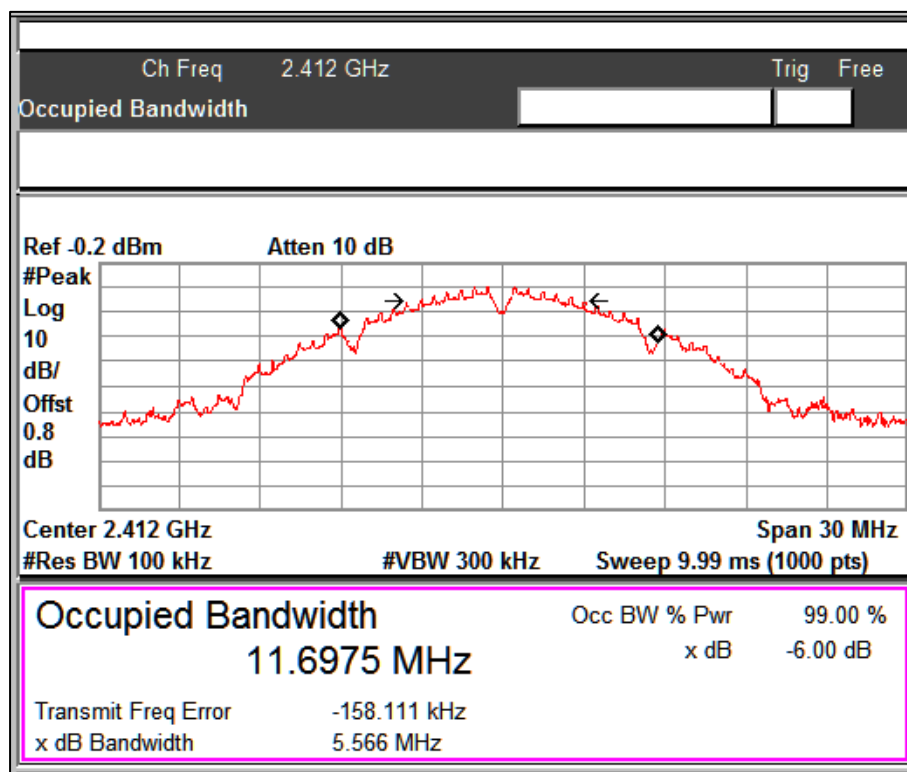
1. All the losses are included during measurement and final values are mentioned in the test report.
2. For 6 dB Bandwidth Measurements were made as per section 8.2 in KDB 558074 D01 15.247 Measurement Guidance v05r02.
3. For OCW 99 % Bandwidth measurements were made as per section 6.9.3 ANSI C63.10-2013

Modulation: 802.11b

Data rate: 1Mbps

Channel Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
2412	5.56	11.69
2437	6.02	11.55
2462	6.04	11.29

Graphs for 6 dB bandwidth measurement



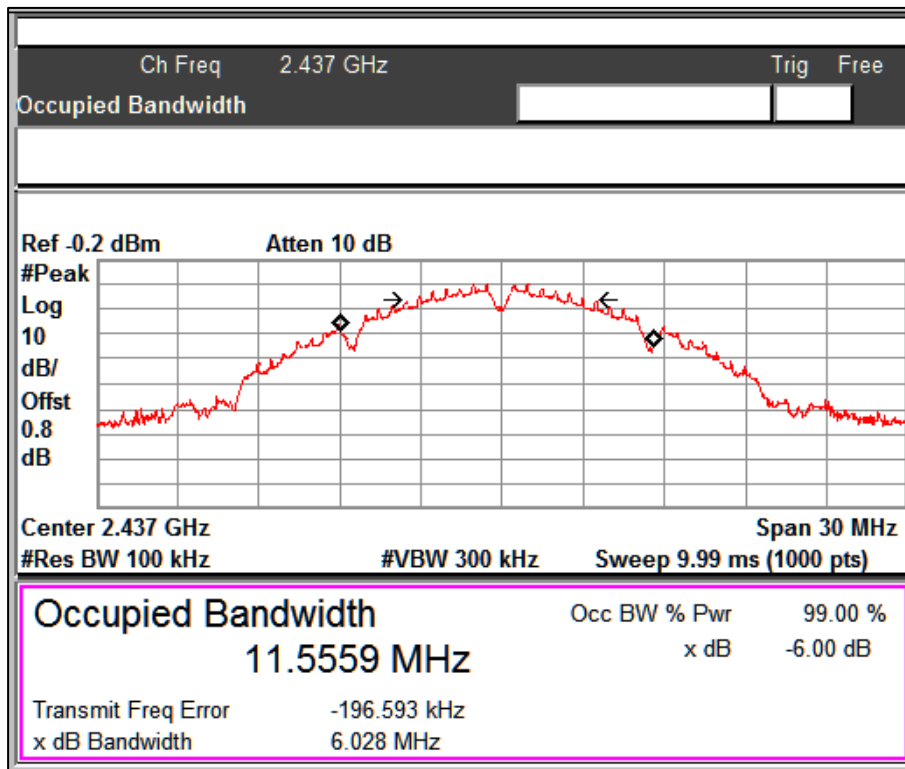
Data Rate: 1Mbps

Channel Frequency: 2412MHz

Prüfbericht - Nr.:
Test Report No.:

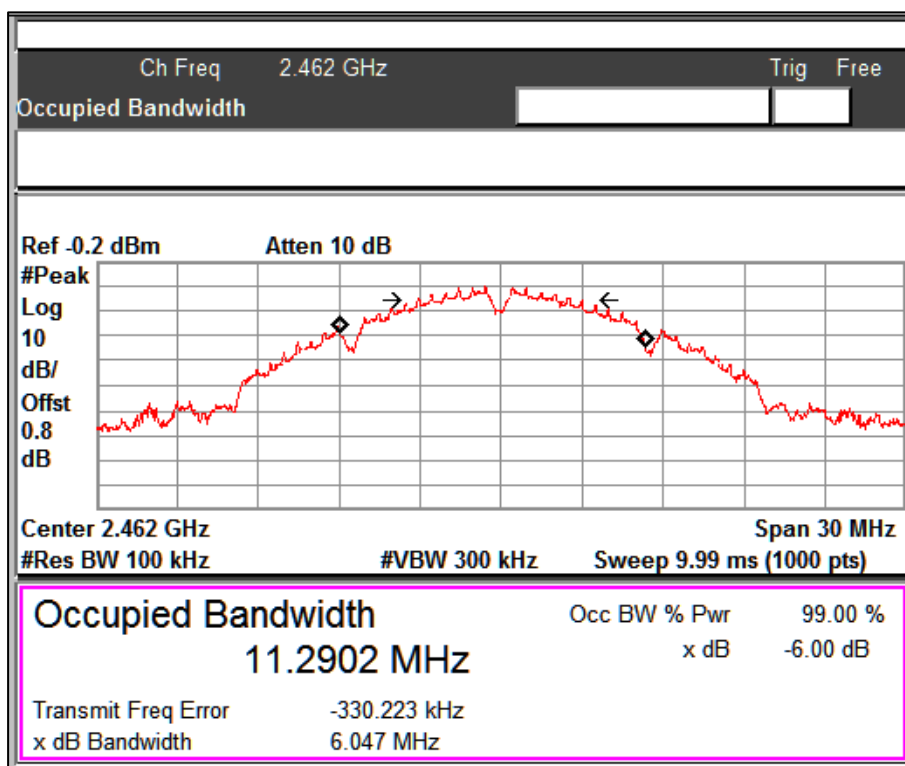
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Data Rate: 1Mbps

Channel Frequency: 2437MHz



Data Rate: 1Mbps

Channel Frequency: 2462MHz

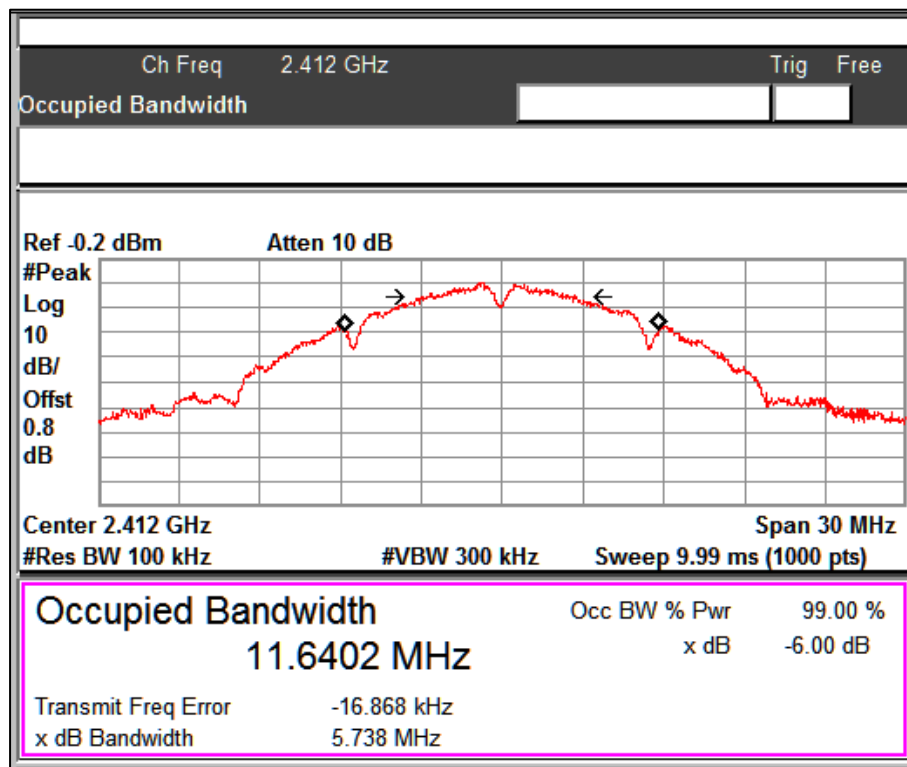
Prüfbericht - Nr.:
Test Report No.:

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Data rate: 2Mbps

Channel Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
2412	5.73	11.64
2437	5.72	11.53
2462	5.86	11.38



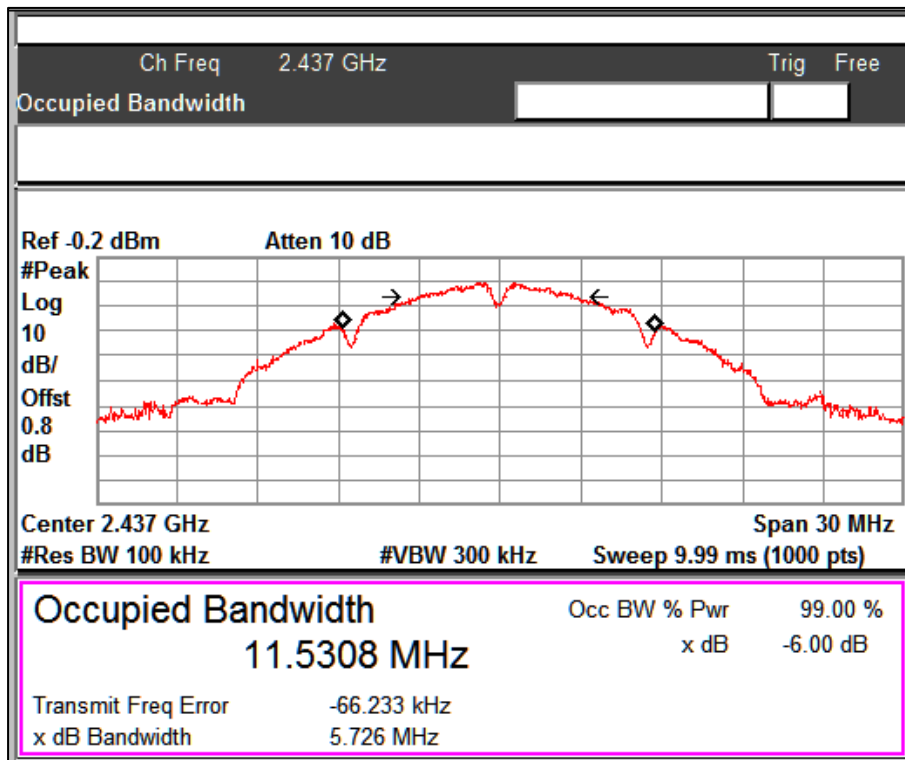
Data Rate: 2Mbps

Channel Frequency: 2412MHz

Prüfbericht - Nr.:
Test Report No.:

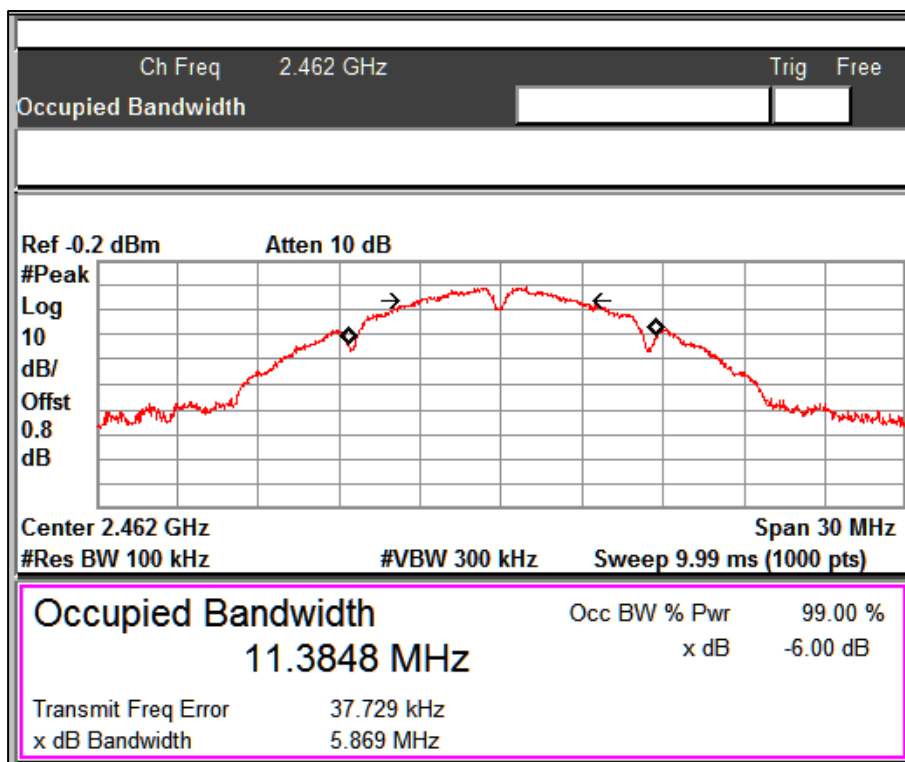
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Data Rate: 2Mbps

Channel Frequency: 2437MHz



Data Rate: 2Mbps

Channel Frequency: 2462MHz

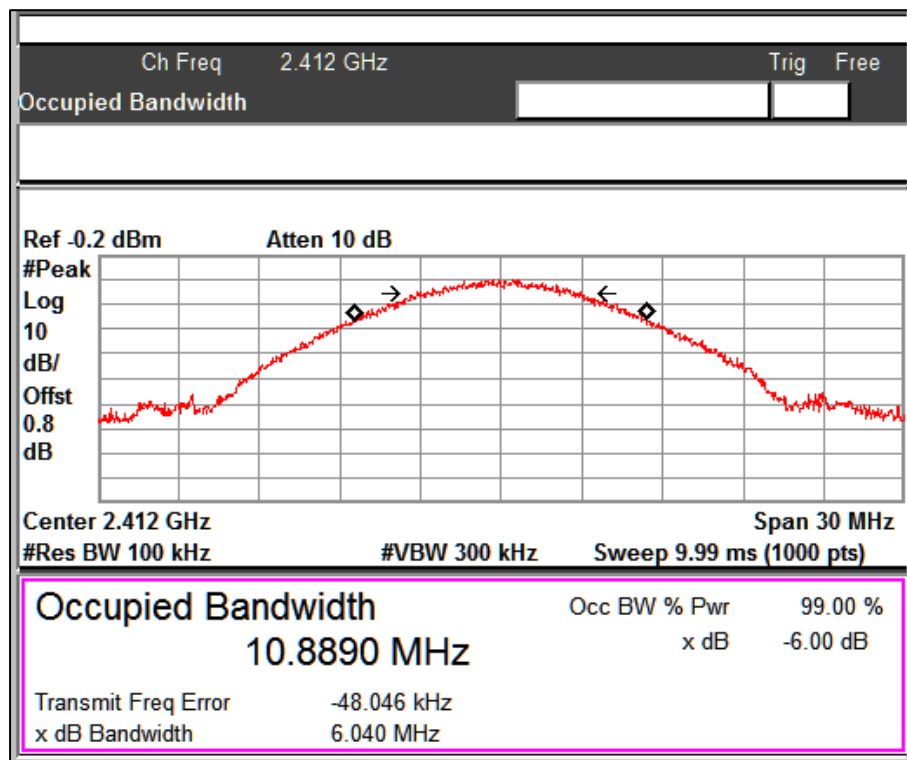
Prüfbericht - Nr.:
Test Report No.:

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Data rate: 5.5Mbps

Channel Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
2412	6.04	10.88
2437	6.00	10.90
2462	5.37	10.82



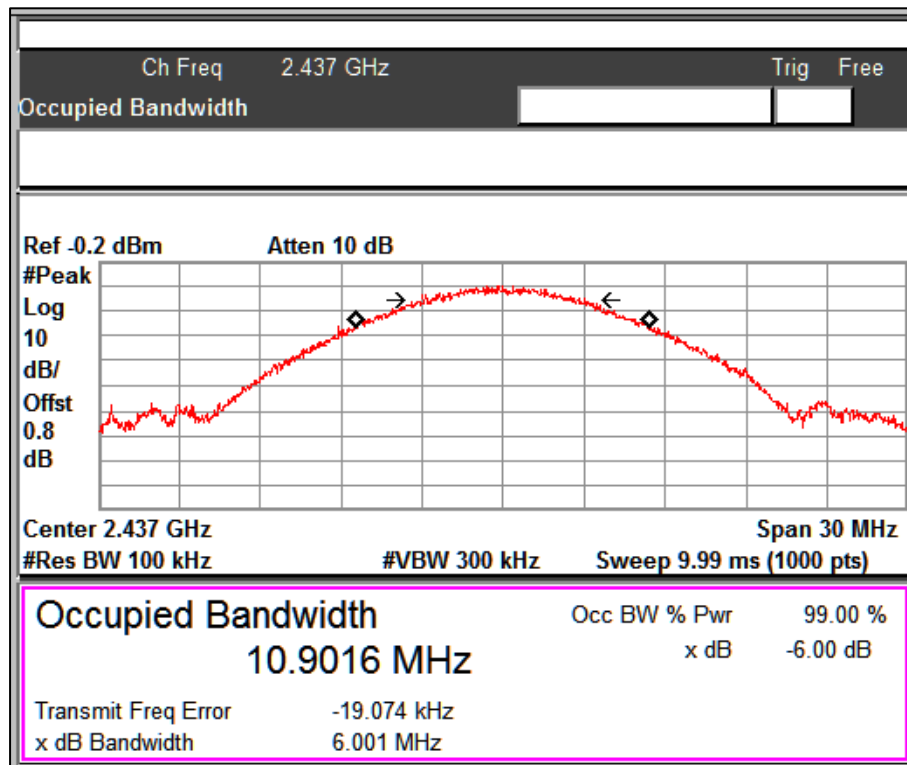
Data Rate: 5.5Mbps

Channel Frequency: 2412MHz

Prüfbericht - Nr.:
Test Report No.:

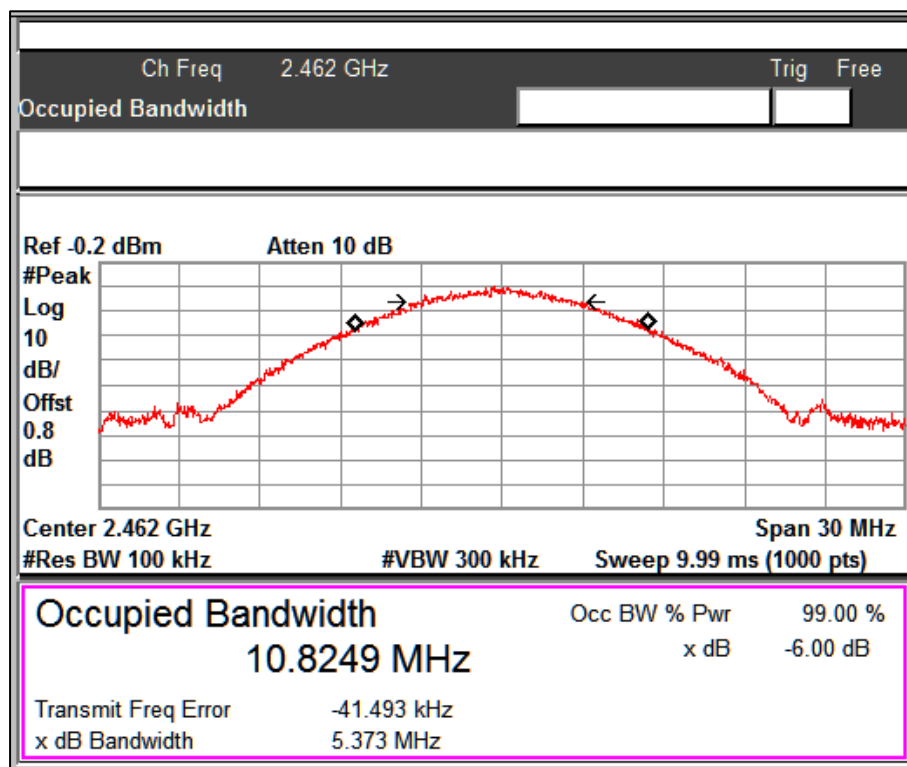
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Data Rate: 5.5Mbps

Channel Frequency: 2437MHz



Data Rate: 5.5Mbps

Channel Frequency: 2462MHz

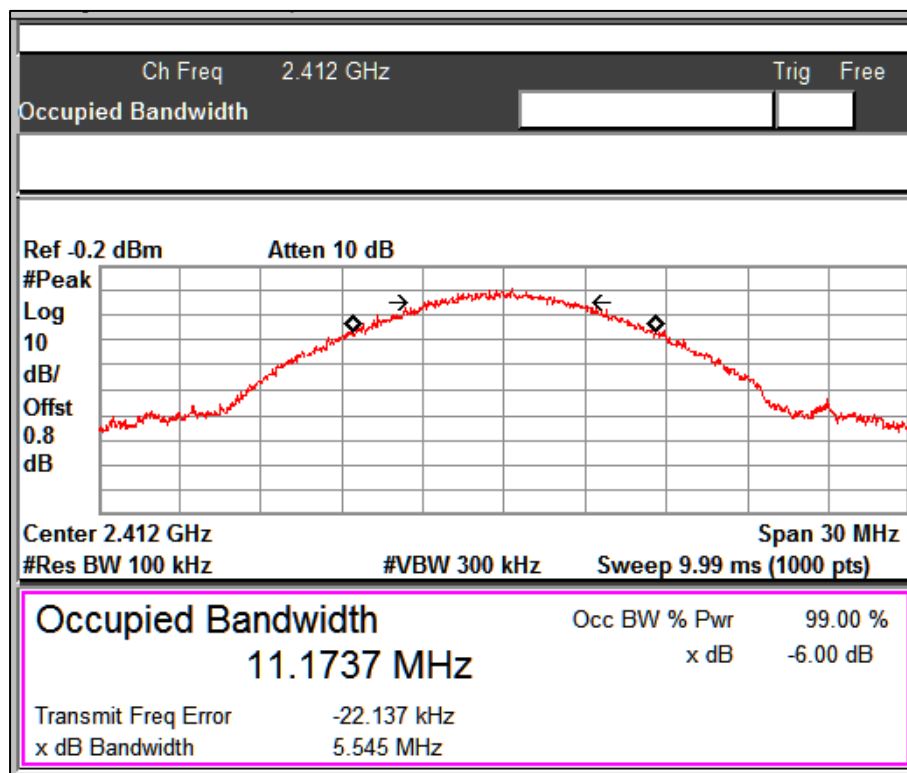
Prüfbericht - Nr.:
Test Report No.:

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Data rate: 11Mbps

Channel Frequency (MHz)	6 dB Bandwidth (MHz)	99% OBW (MHz)
2412	5.54	11.17
2437	5.83	11.14
2462	6.20	11.04



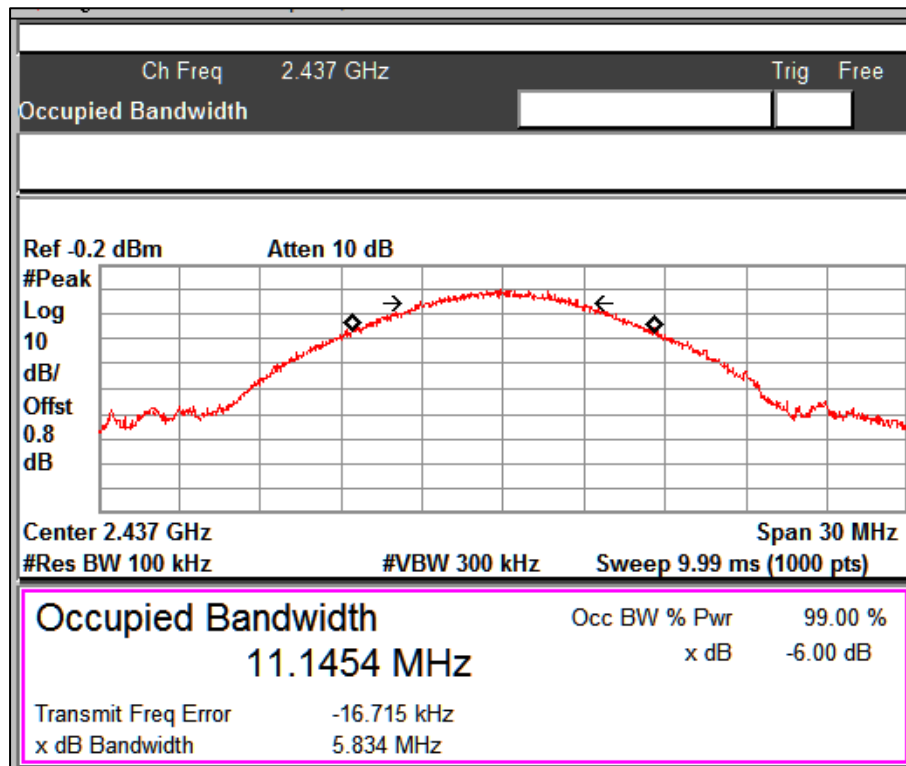
Data Rate: 11Mbps

Channel Frequency: 2412MHz

Prüfbericht - Nr.:
Test Report No.:

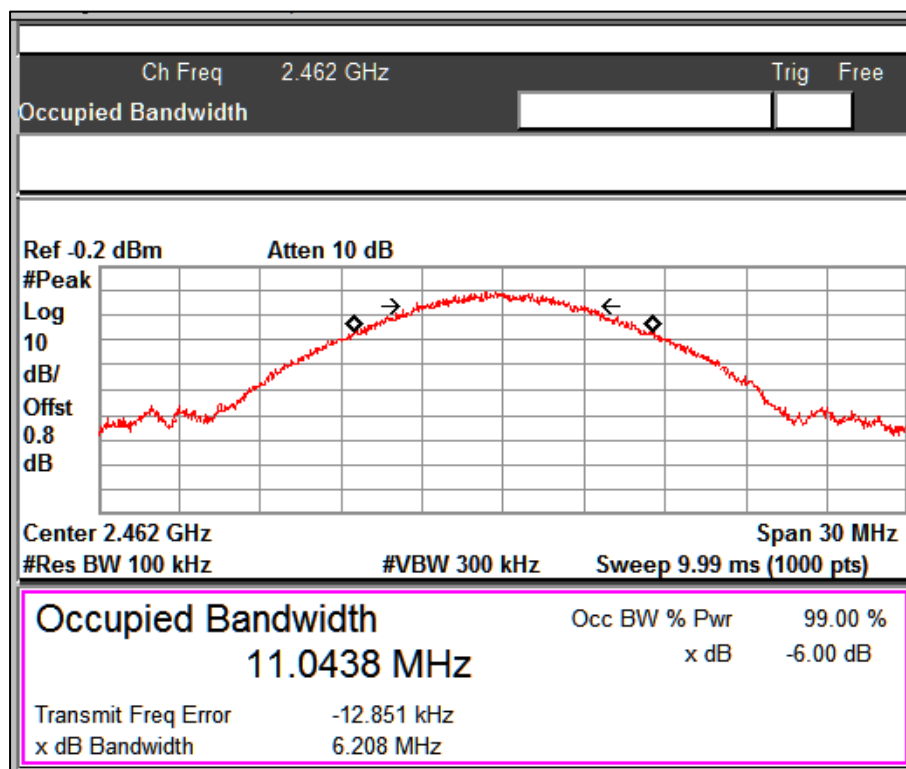
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Data Rate: 11Mbps

Channel Frequency: 2437MHz



Data Rate: 11Mbps

Channel Frequency: 2462MHz

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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)

Test Method Subclause 11.11 of ANSI C63.10

Measurement Bandwidth 100 kHz

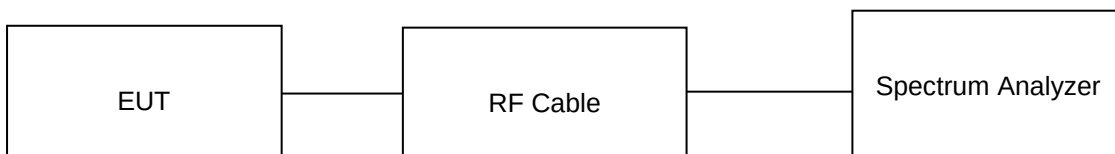
Detector Peak

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 = 3.3V AC to DC Adaptor

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:

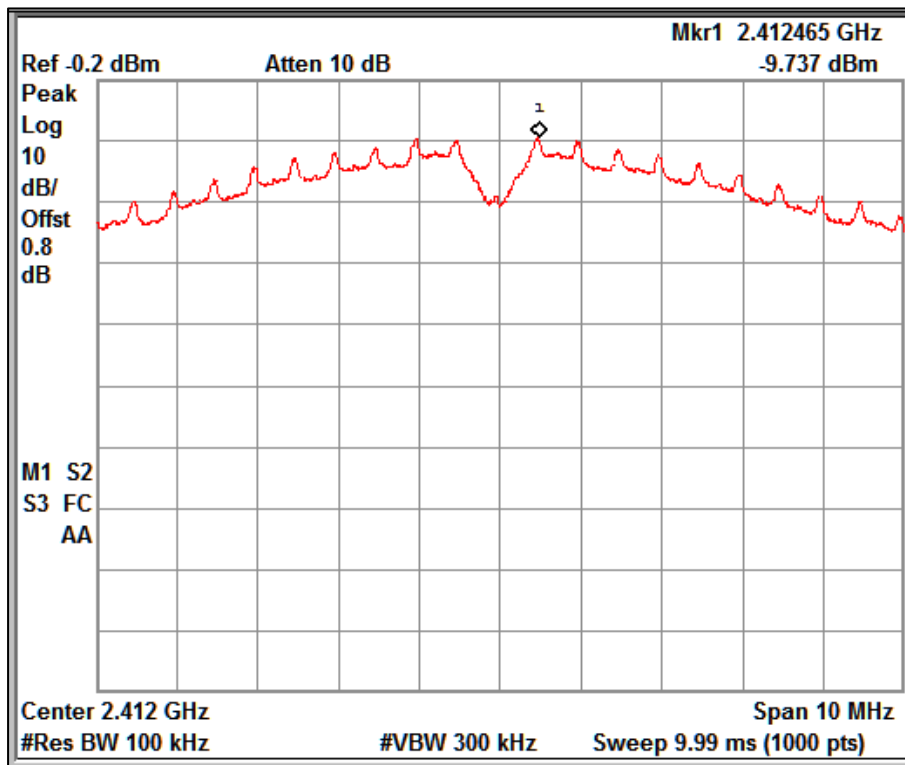
1. All the losses are included during measurement and final values are mentioned in the test report.
2. Final Value (dBm) = Measured Value (dBm) + Cable loss (0.8dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 3.6 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	2400.00	-55.44	-9.73	-45.71	-20
2462	2483.50	-68.20	-9.99	-58.21	-20



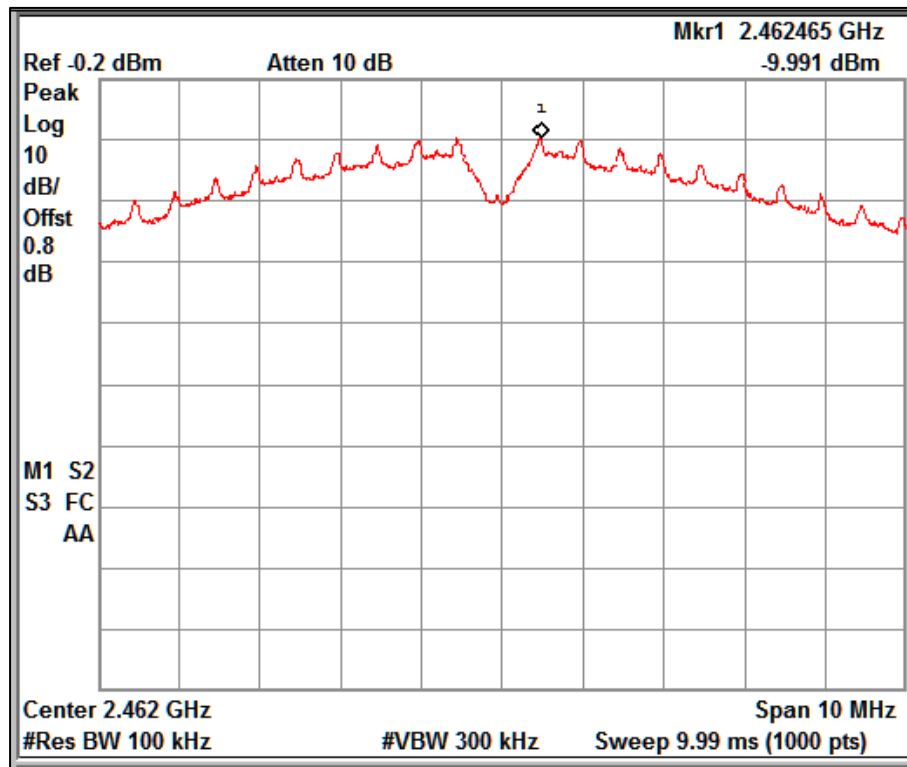
Data Rate: 1Mbps

Reference plot for 2412MHz

Prüfbericht - Nr.:
Test Report No.:

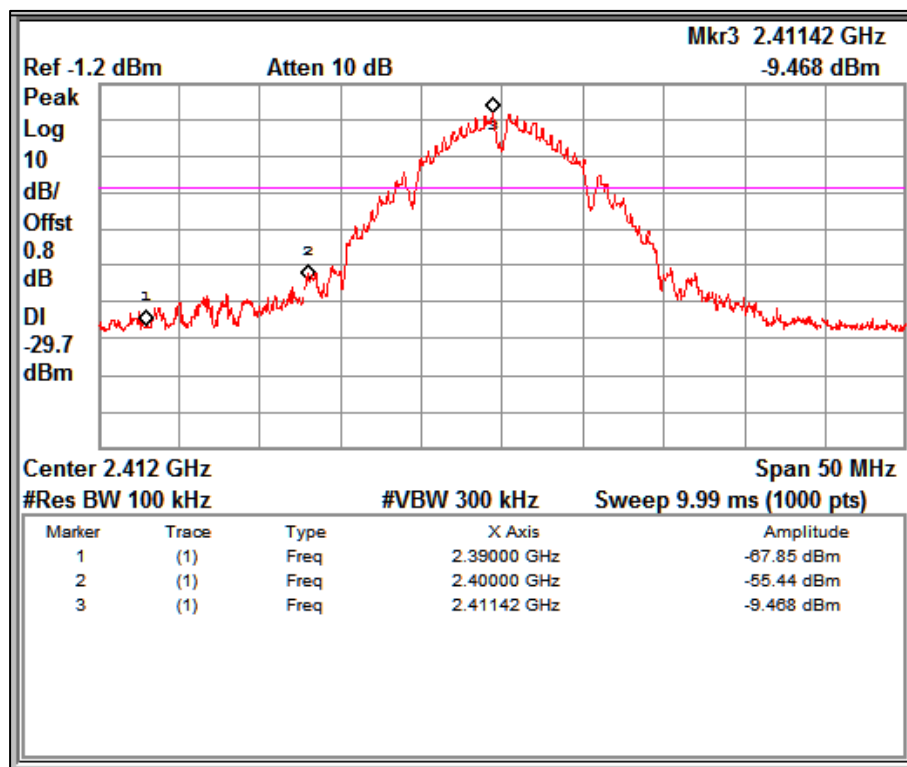
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Data Rate: 1Mbps

Reference plot for 2462MHz



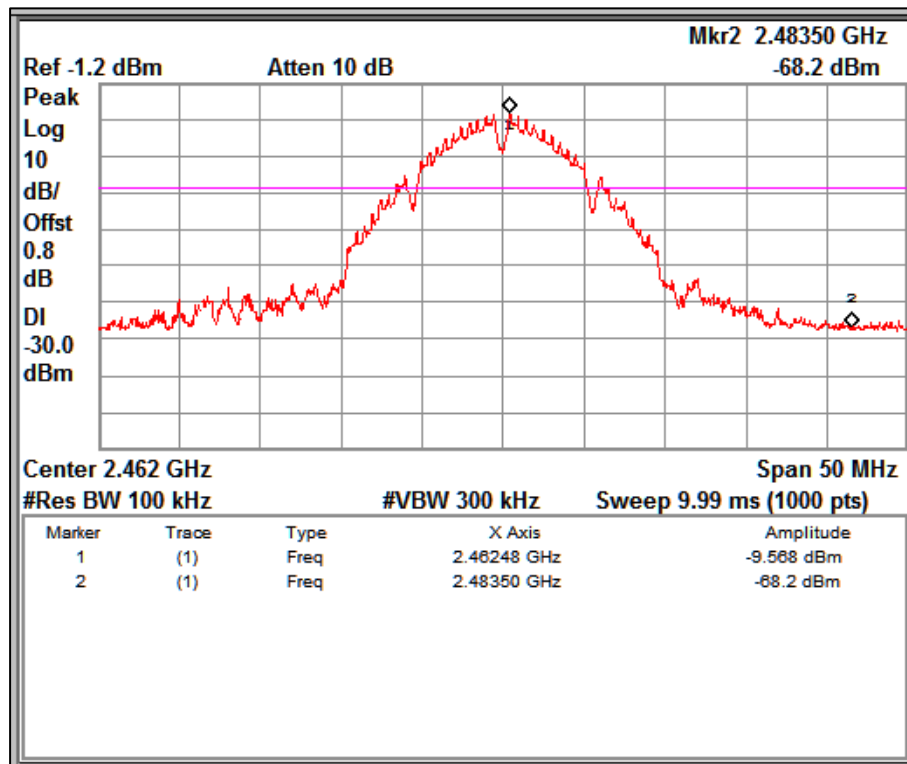
Data Rate: 1Mbps

Band edge plot for 2412MHz

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Data Rate: 1 Mbps

Band edge plot for 2462MHz

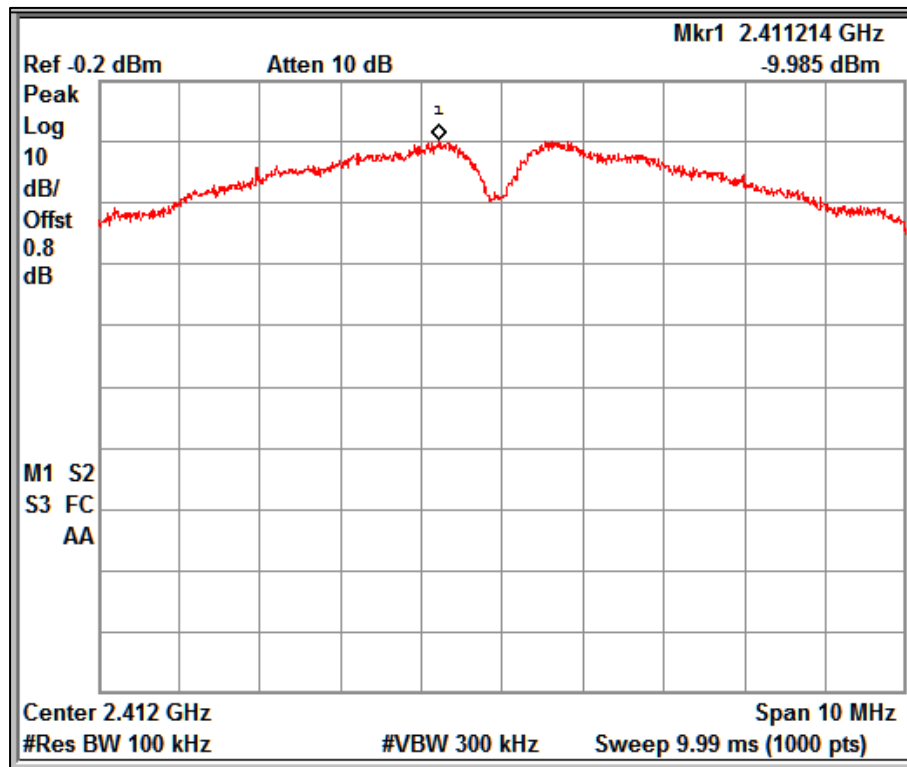
Data rate: 2Mbps

Channel Frequency (MHz)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2412	2400.00	-55.37	-9.98	-45.39	-20
24622	2483.50	-68.18	-10.35	-57.83	-20

Prüfbericht - Nr.:
Test Report No.:

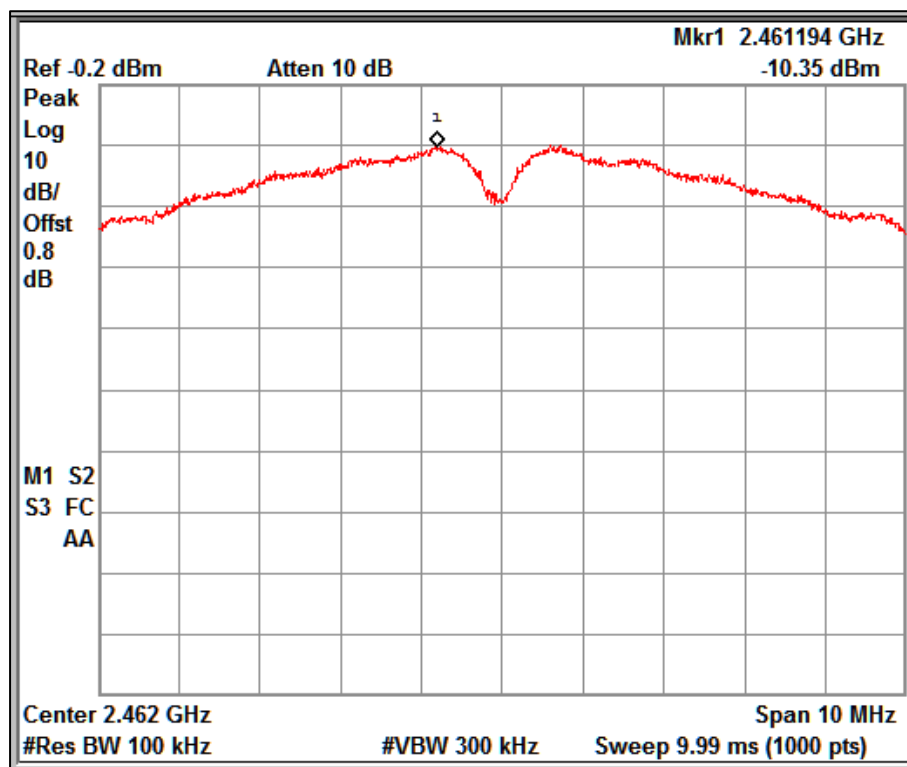
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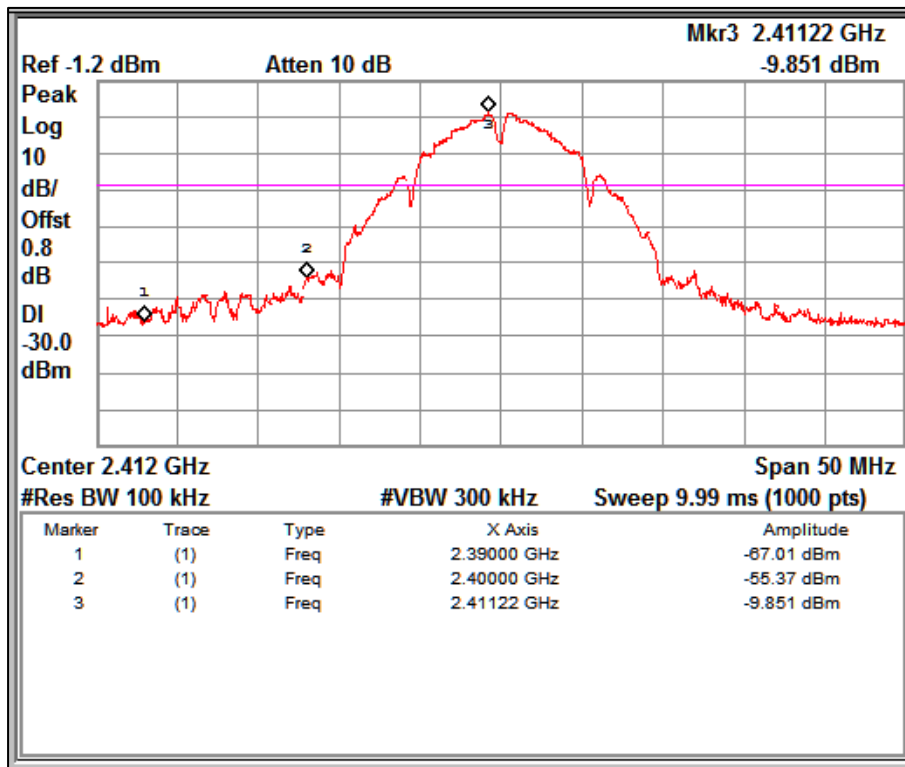
Data Rate: 2Mbps

Reference plot for 2412MHz



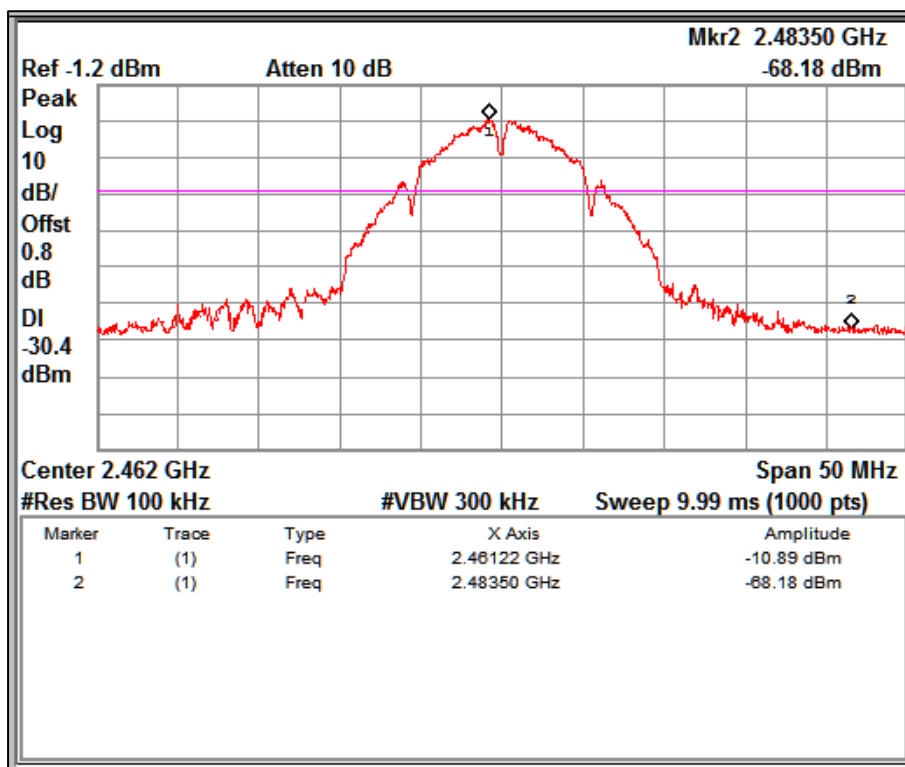
Data Rate: 2Mbps

Reference plot for 2462MHz



Data Rate: 2Mbps

Band edge plot for 2412MHz



Data Rate: 2Mbps

Band edge plot for 2462MHz

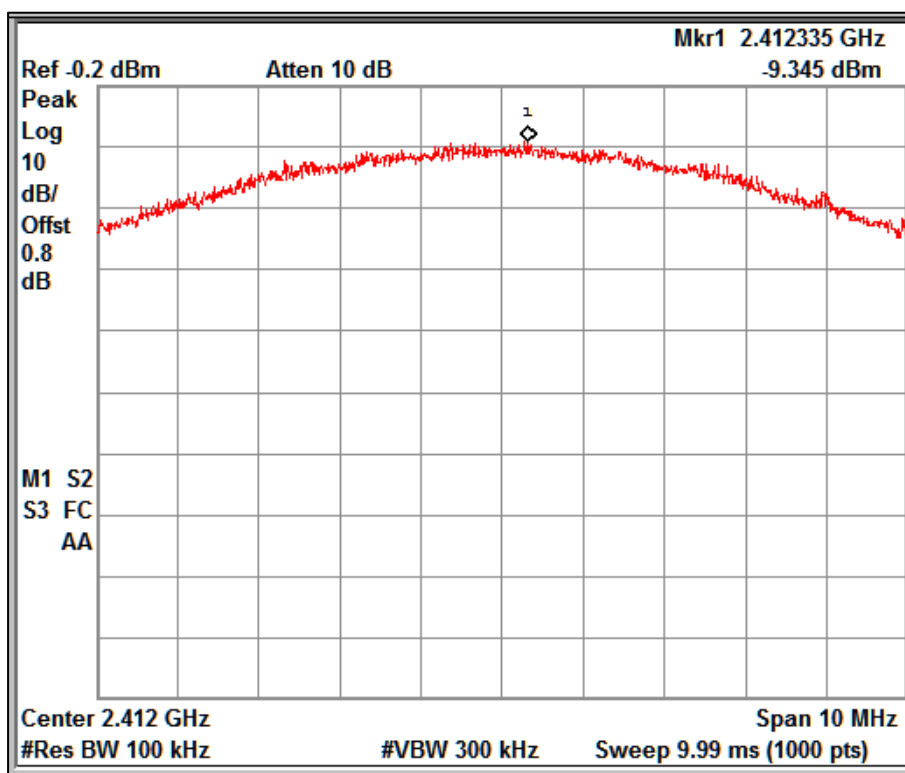
Prüfbericht - Nr.:
Test Report No.:

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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	2400.00	-59.35	-9.34	-50.01	-20
24622	2483.50	-67.68	-9.18	-58.50	-20



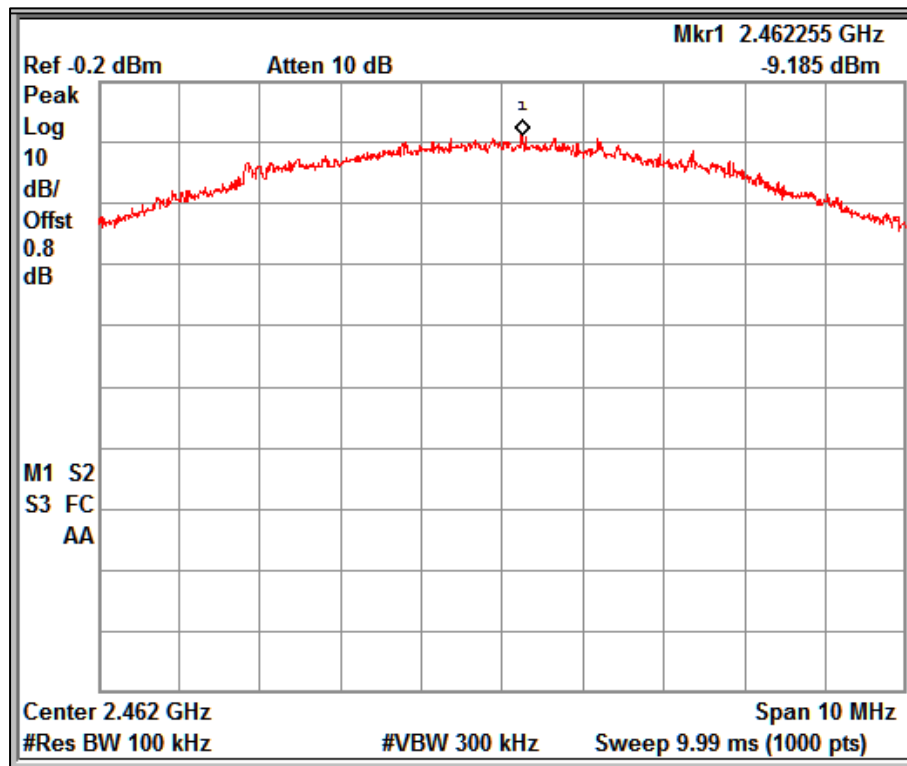
Data Rate: 5.5Mbps

Reference plot for 2412MHz

Prüfbericht - Nr.:
Test Report No.:

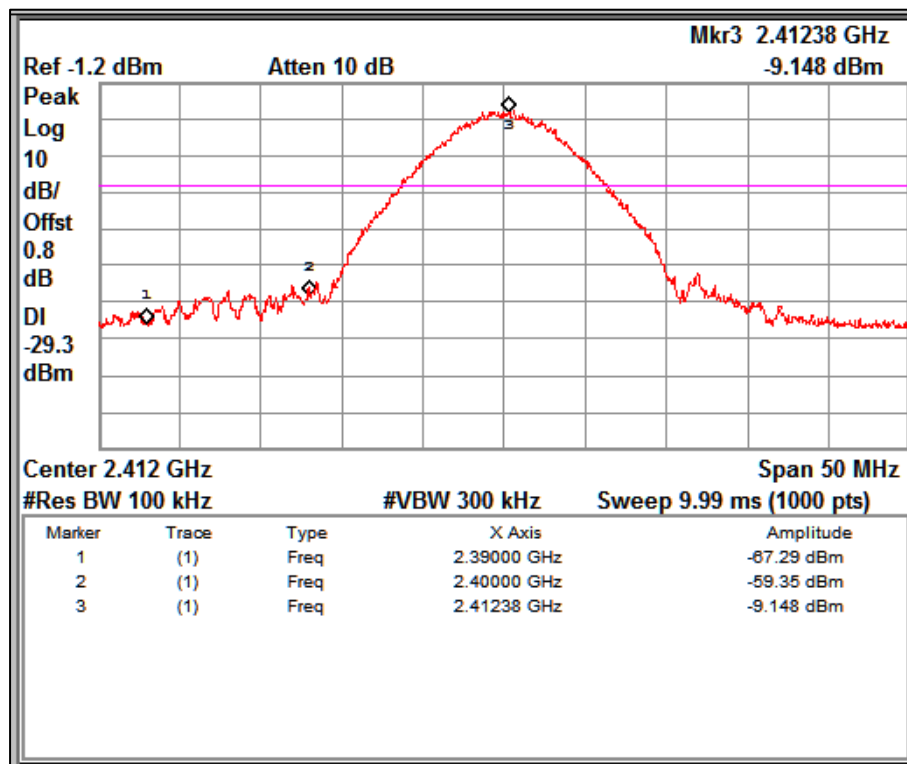
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Data Rate: 5.5Mbps

Reference plot for 2462MHz



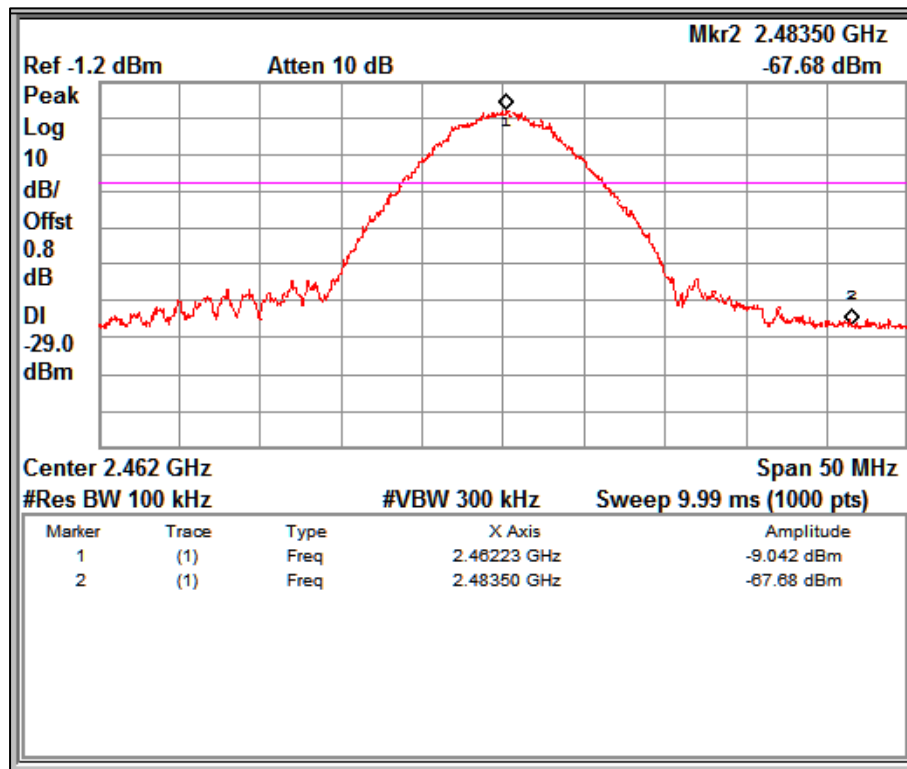
Data Rate: 5.5 Mbps

Band edge plot for 2412MHz

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Data Rate: 5.5 Mbps

Band edge plot for 2462MHz

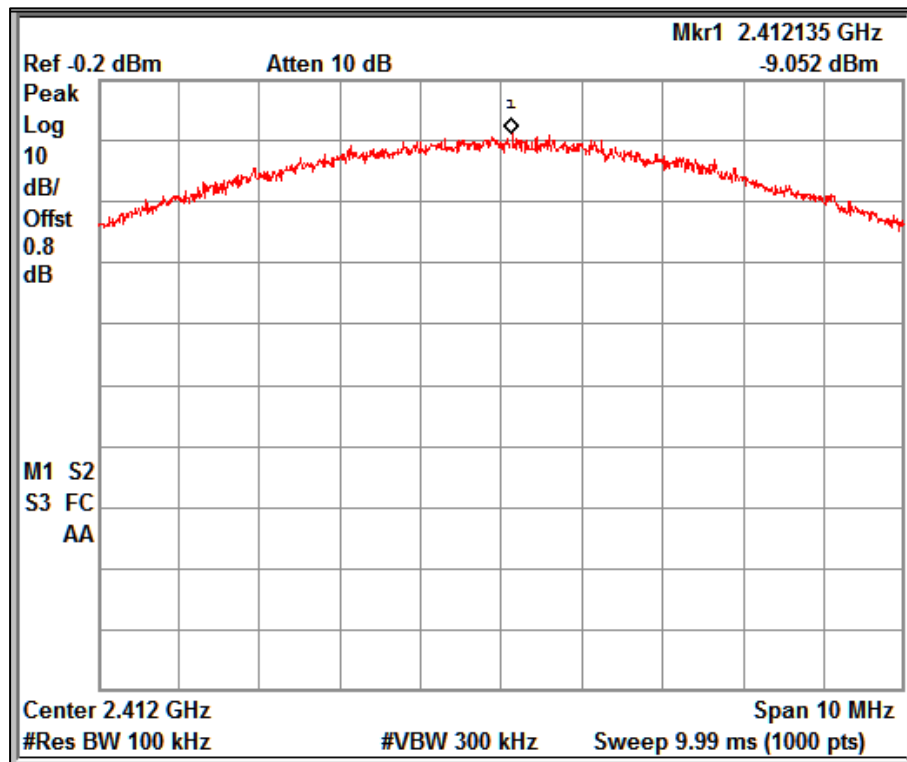
Data rate: 11Mbps

Channel Frequency (MHz)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	Reference Value (B) (dBm)	A-B (dBc)	Minimum Limit (dBc)
2412	2400.00	-58.40	-9.05	-49.35	-20
24622	2483.50	-68.03	-9.33	-58.70	-20

Prüfbericht - Nr.:
Test Report No.:

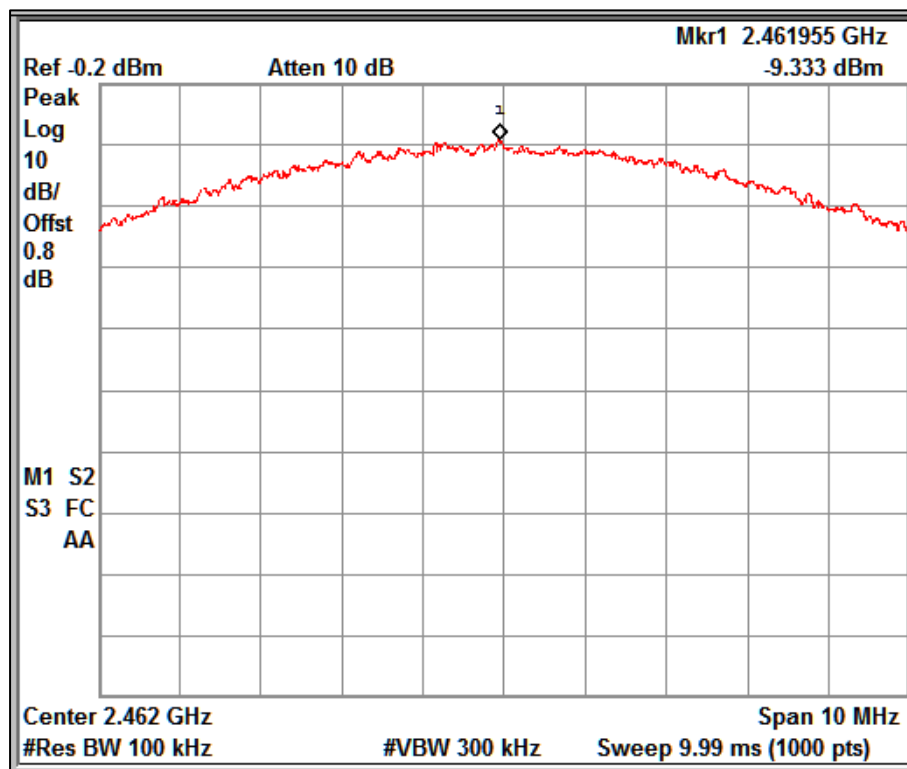
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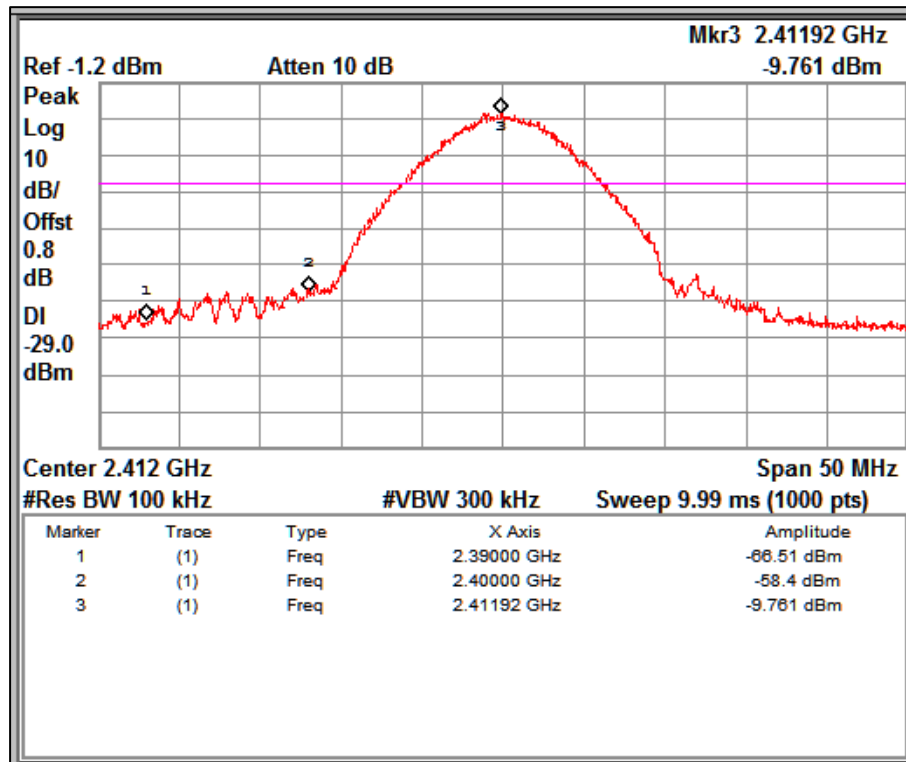
Data Rate: 11Mbps

Reference plot for 2412MHz



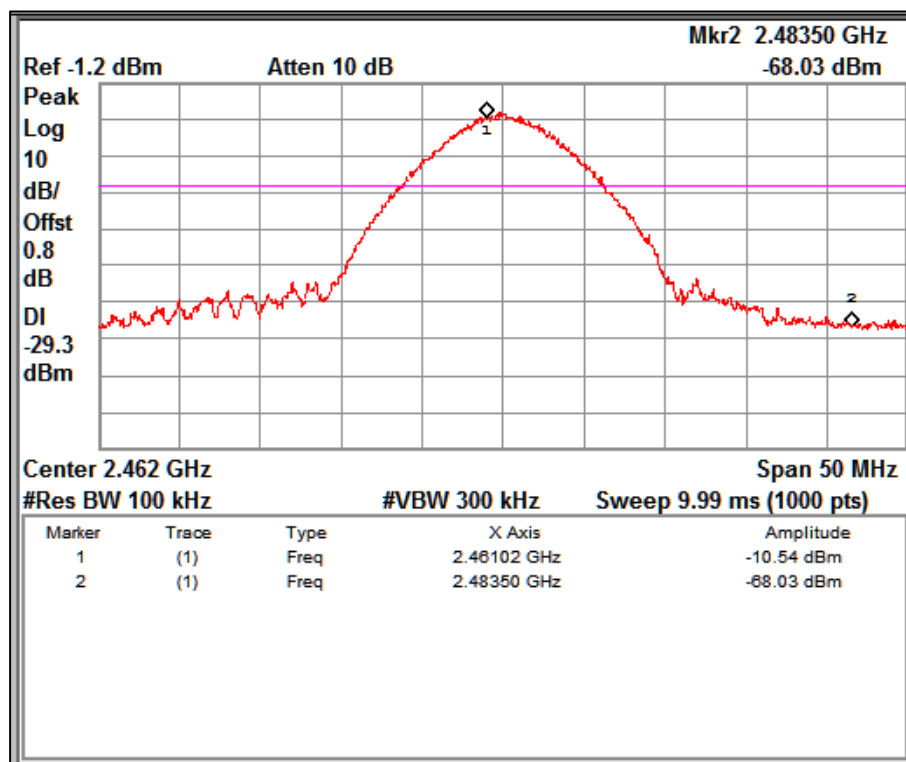
Data Rate: 11Mbps

Reference plot for 2462MHz



Data Rate: 11 Mbps

Band edge plot for 2412MHz



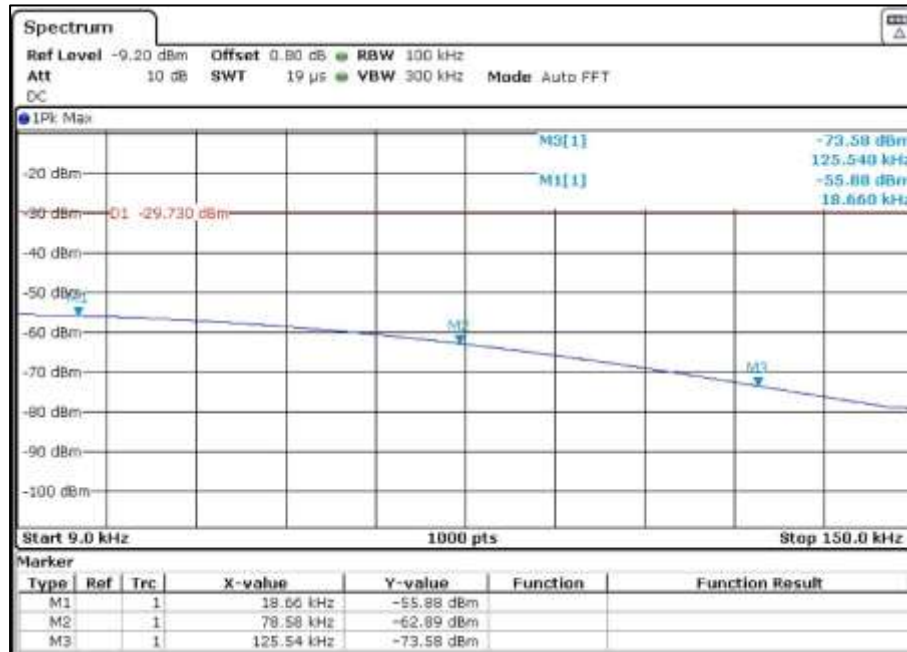
Data Rate: 11Mbps

Band edge plot for 2462MHz

7.4.2 Out-Of-Band Emissions

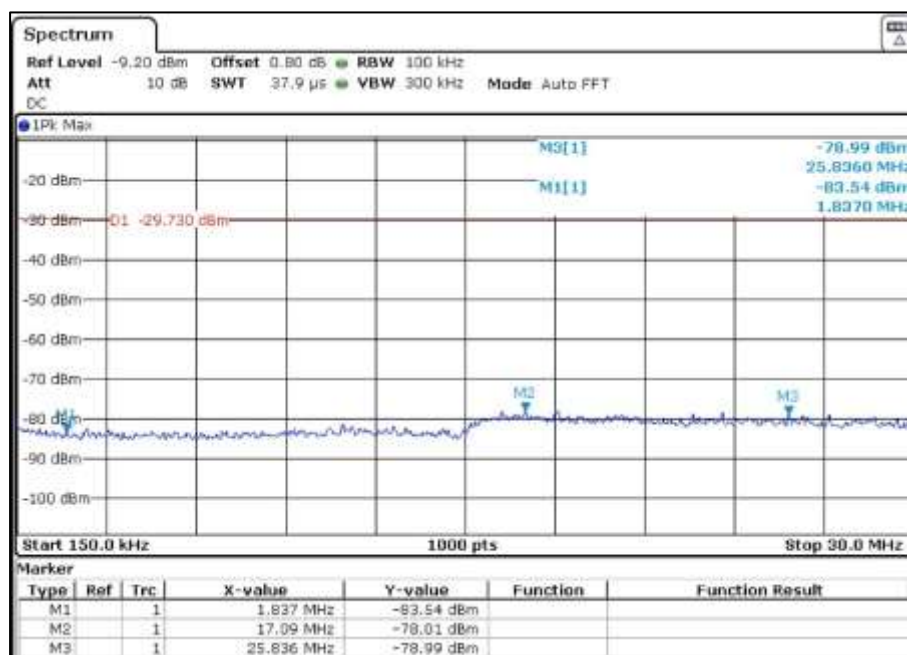
Modulation: 802.11b

Data Rate 1Mbps



Channel Frequency 2412MHz

Frequency Range 9kHz –150kHz



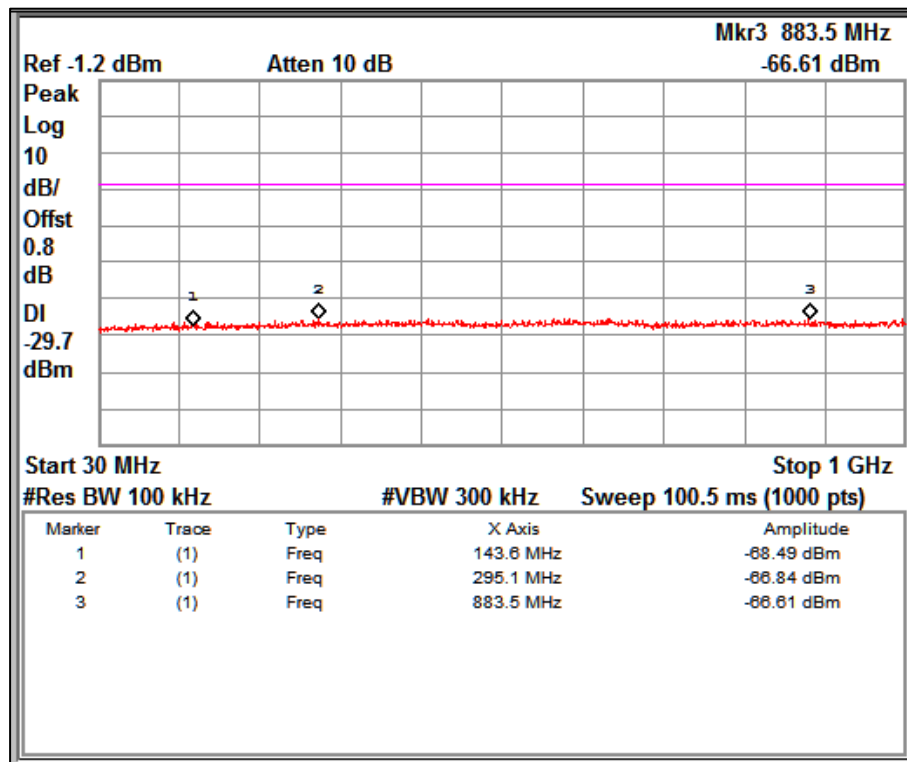
Channel Frequency 2412MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

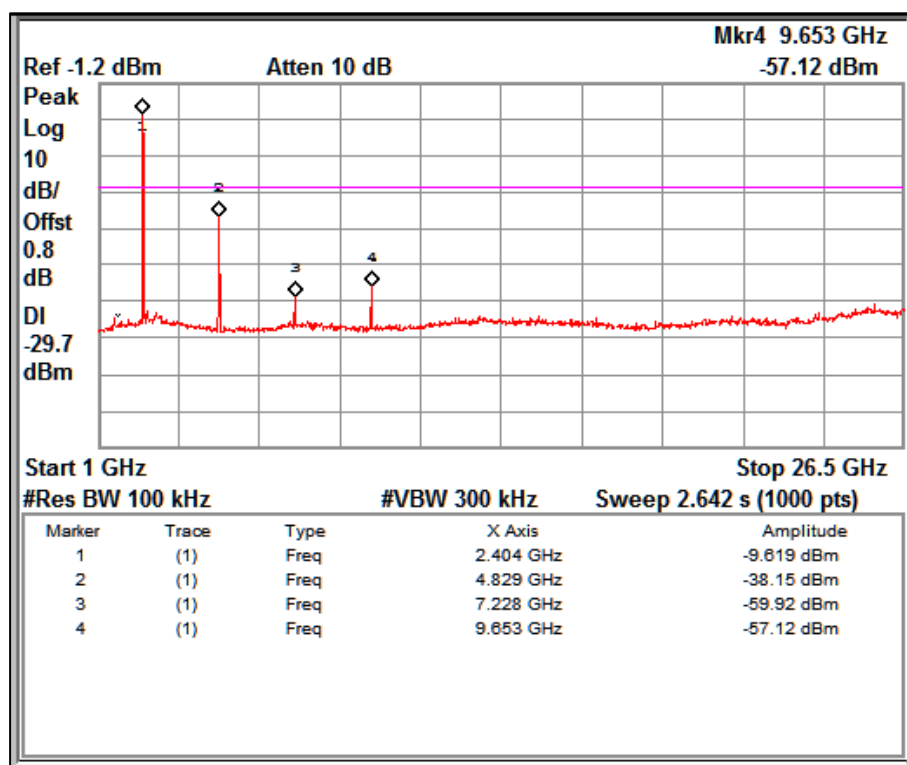
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Channel Frequency 2412MHz

Frequency Range 30MHz –1GHz



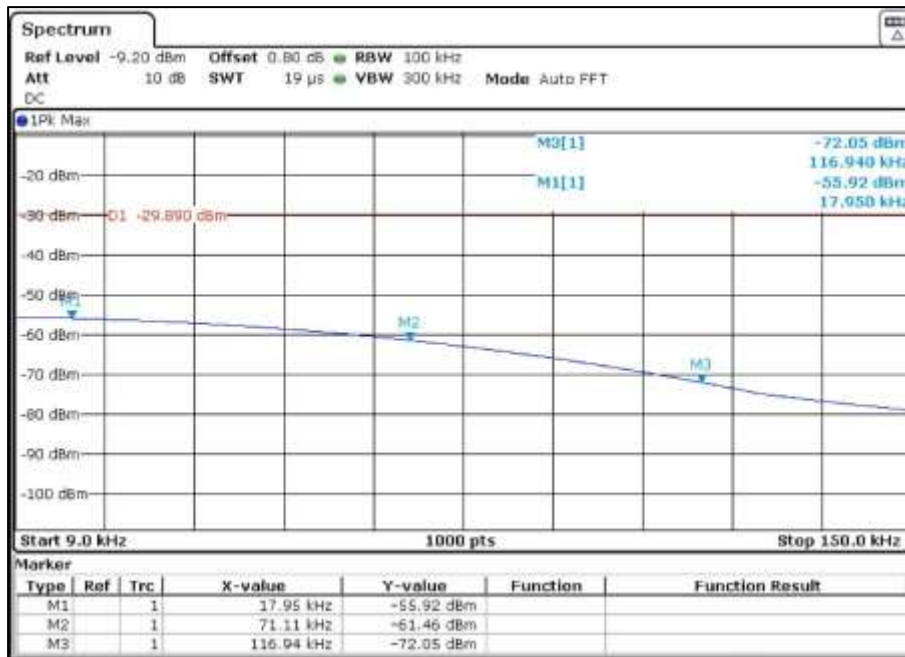
Channel Frequency 2412MHz

Frequency Range 1GHz – 26.5GHz

Prüfbericht - Nr.:
Test Report No.:

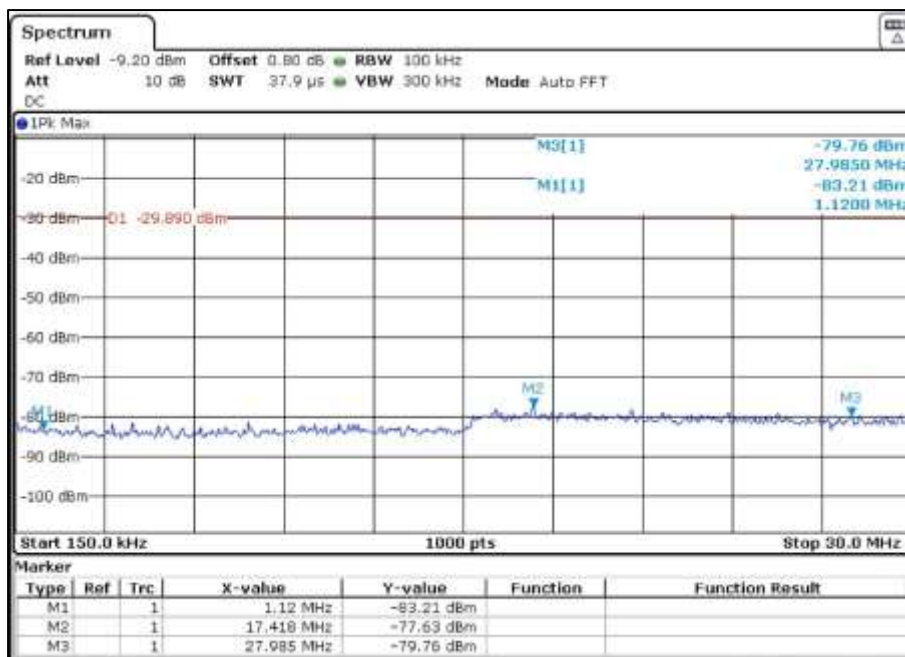
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Channel Frequency 2437MHz

Frequency Range 9kHz –150kHz



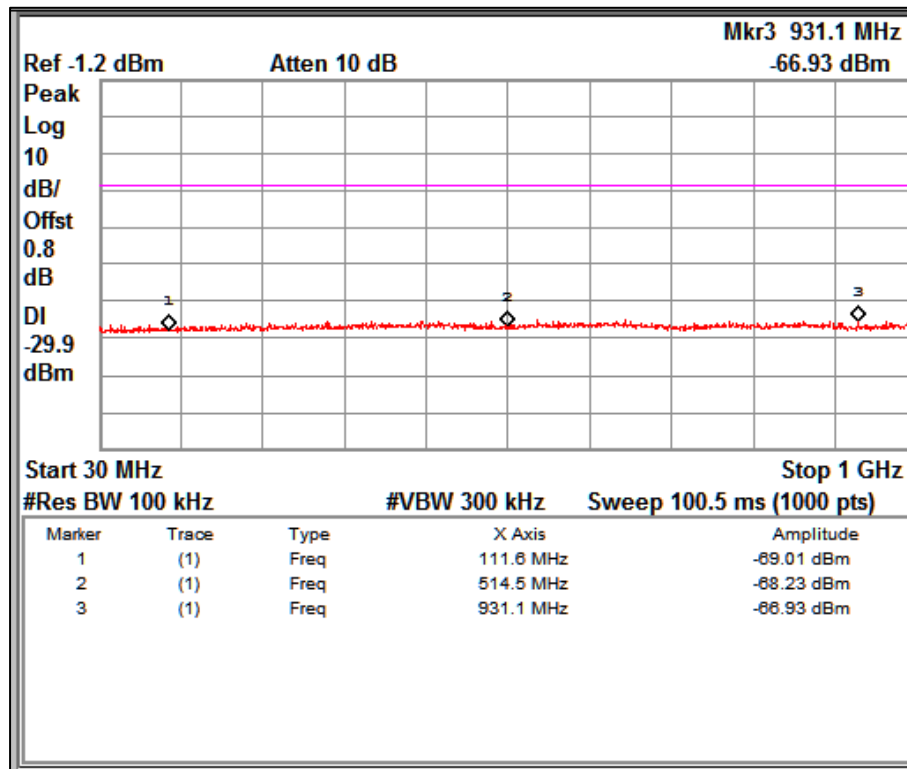
Channel Frequency 2437MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

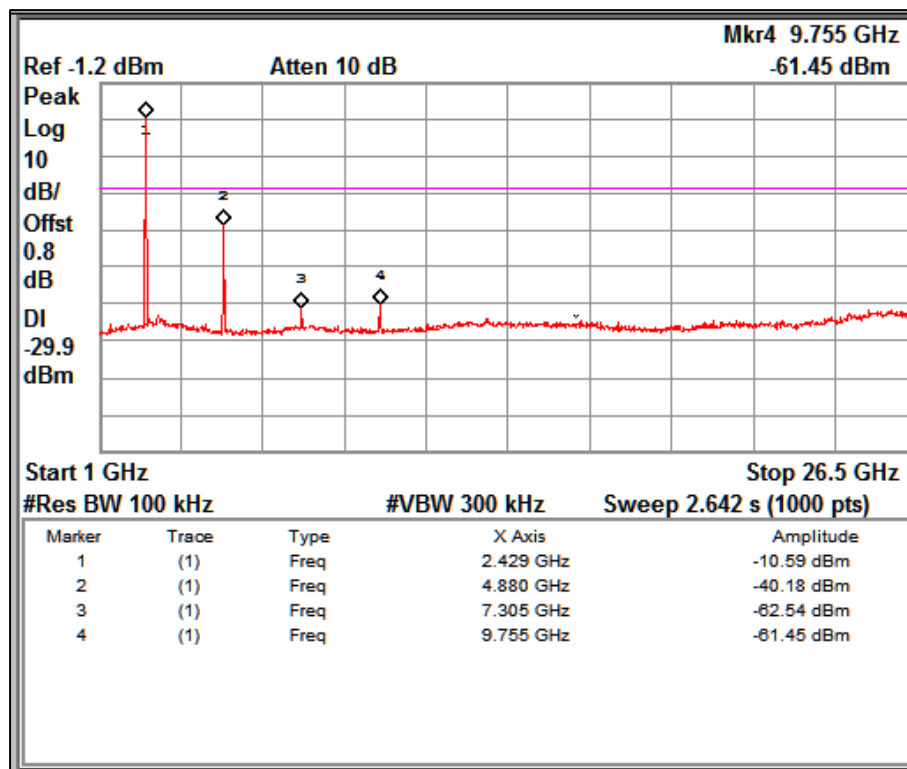
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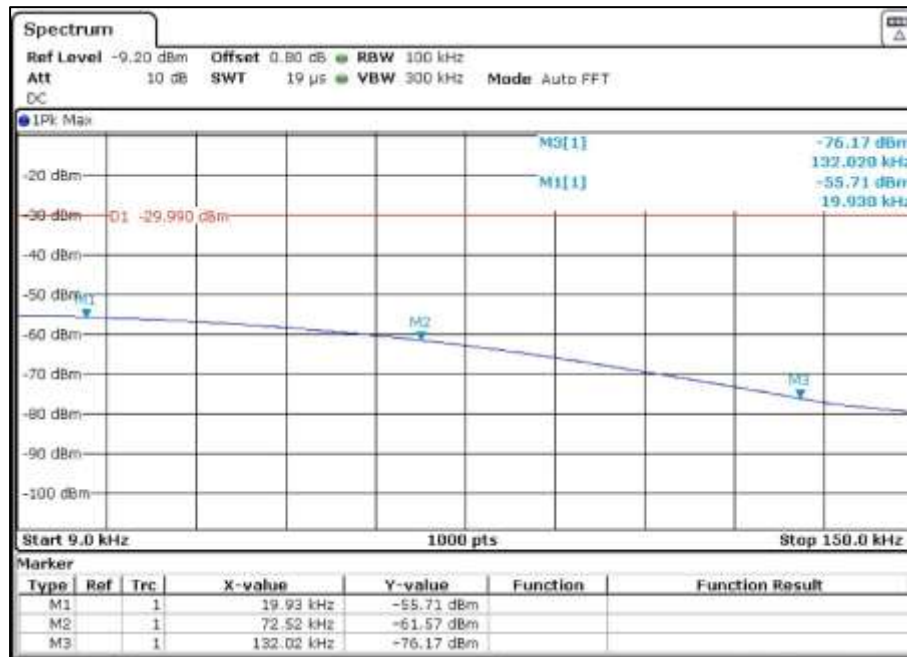
Channel Frequency 2437MHz

Frequency Range 30MHz –1GHz



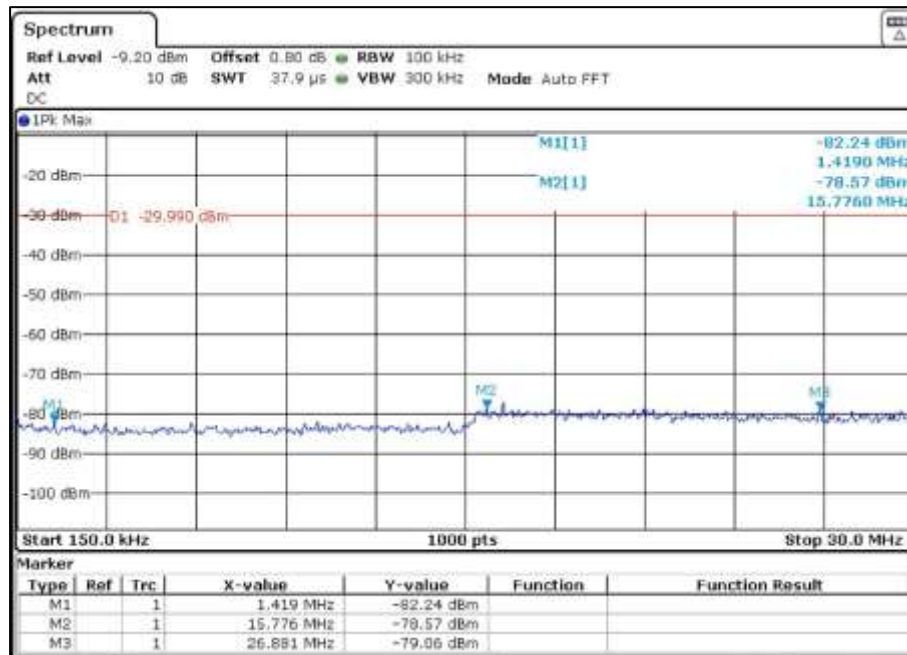
Channel Frequency 2437MHz

Frequency Range 1GHz – 26.5GHz



Channel Frequency 2462MHz

Frequency Range 9kHz –150kHz



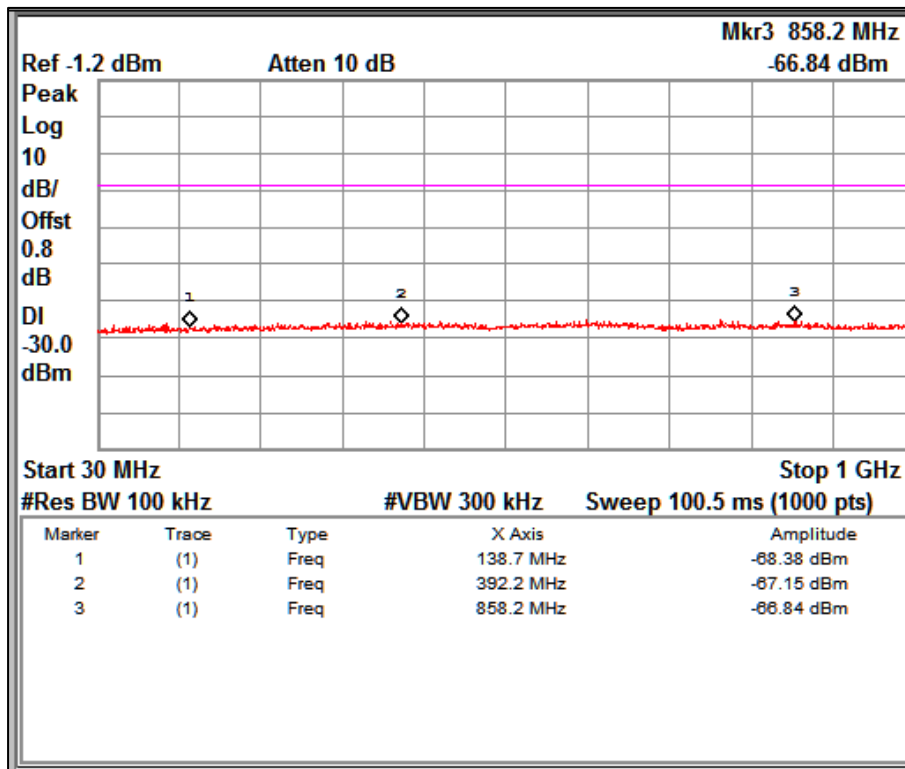
Channel Frequency 2462MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

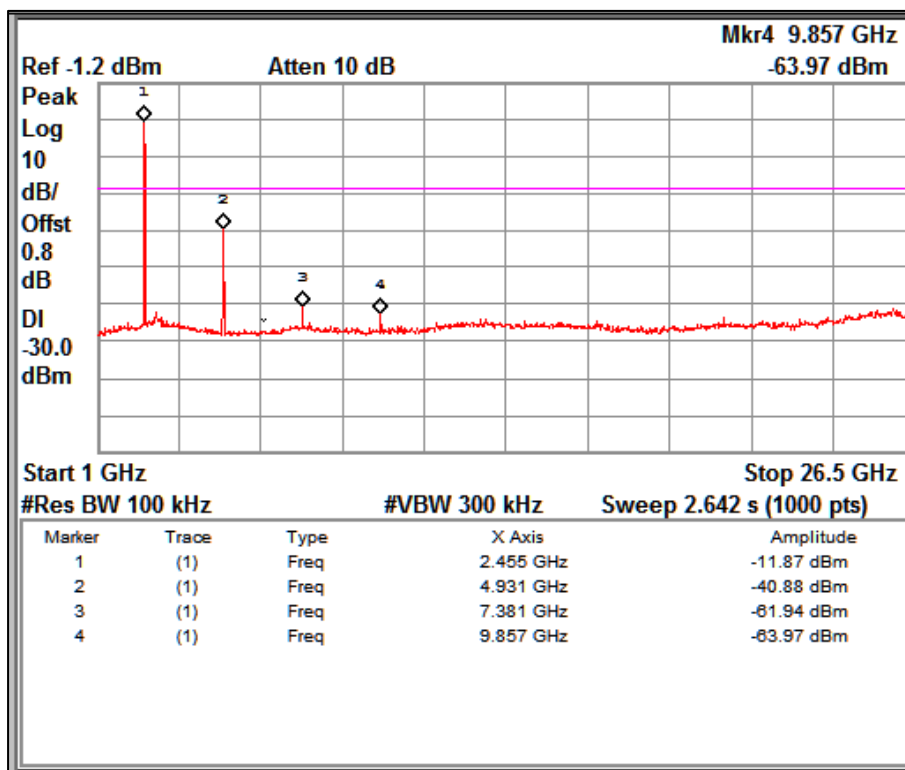
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Channel Frequency 2462MHz

Frequency Range 30MHz –1GHz



Channel Frequency 2462MHz

Frequency Range 1GHz – 26.5GHz

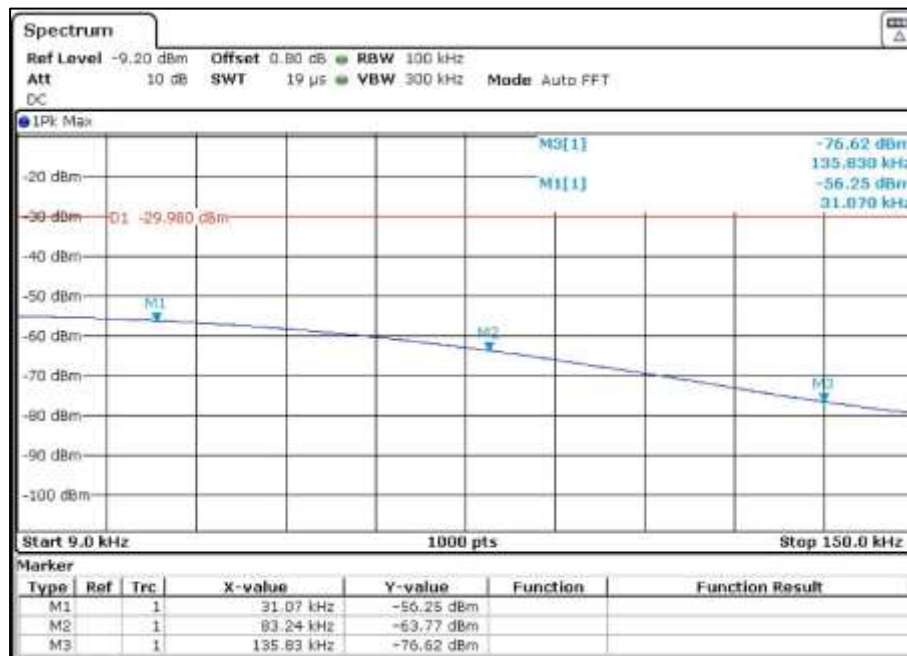
Prüfbericht - Nr.:
Test Report No.:

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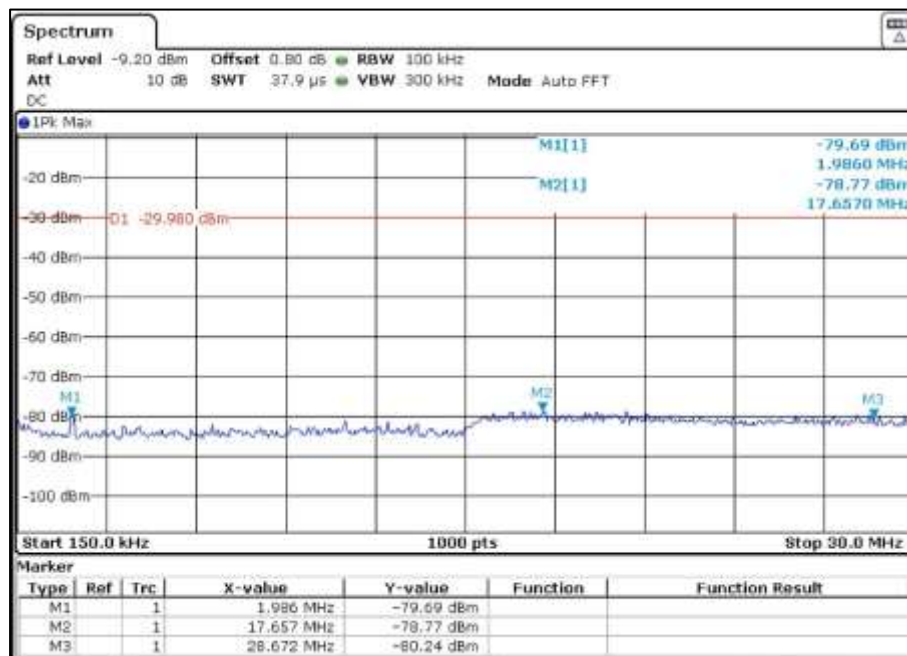
Modulation: 802.11b

Data Rate 2Mbps



Channel Frequency 2412MHz

Frequency Range 9kHz –150kHz



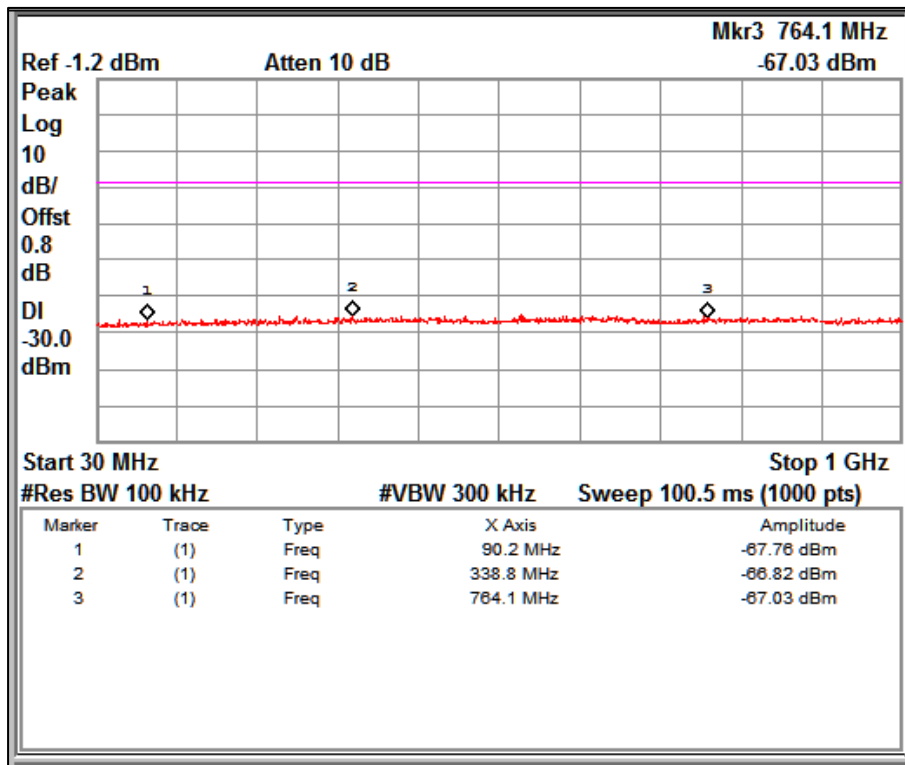
Channel Frequency 2412MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

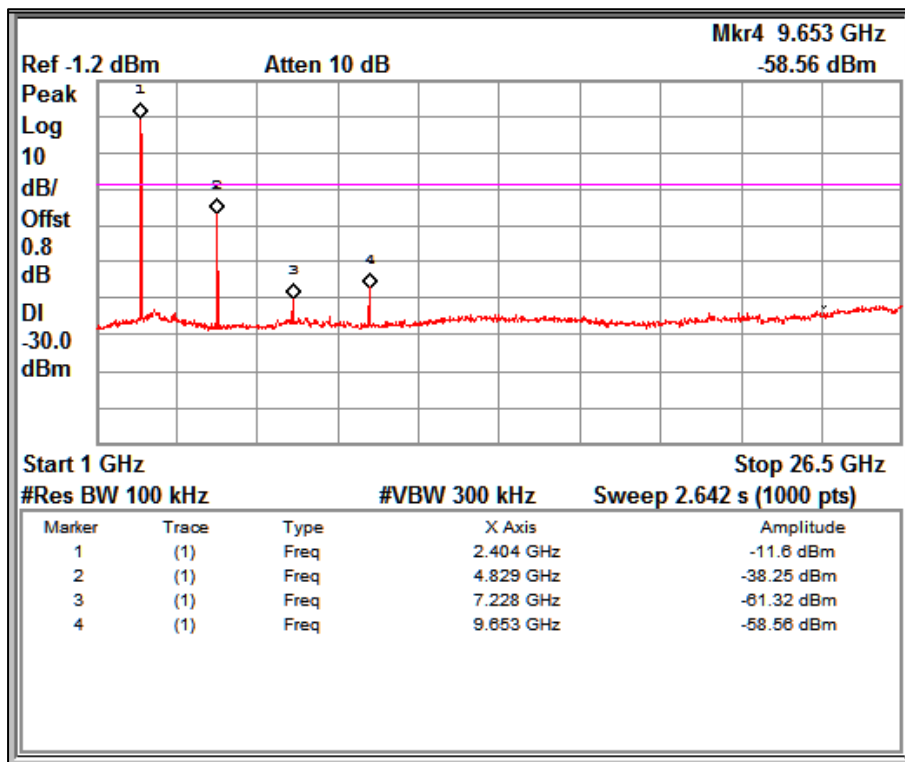
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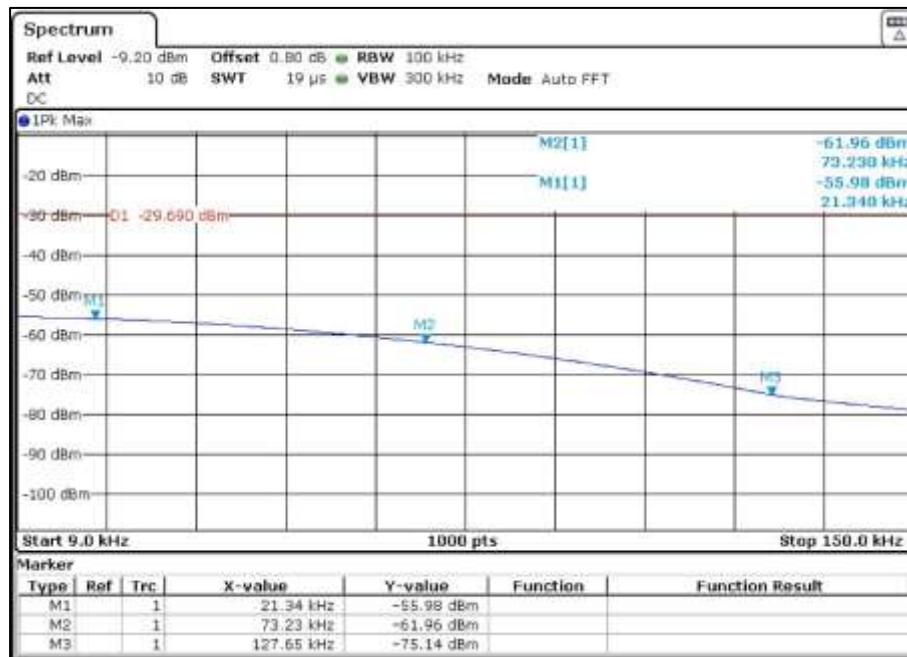
Channel Frequency 2412MHz

Frequency Range 30MHz –1GHz



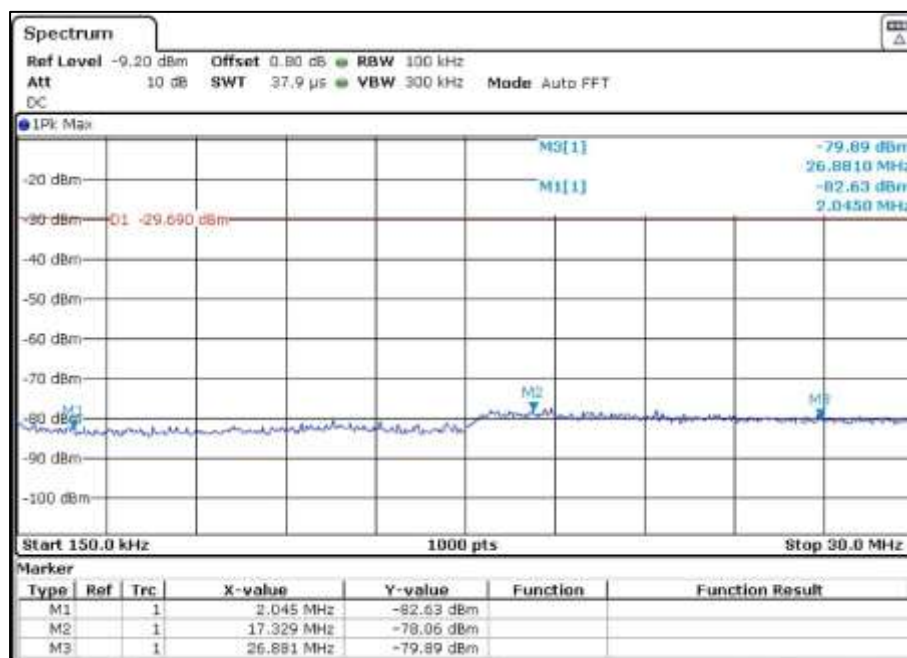
Channel Frequency 2412MHz

Frequency Range 1GHz – 26.5GHz



Channel Frequency 2437MHz

Frequency Range 9kHz –150kHz



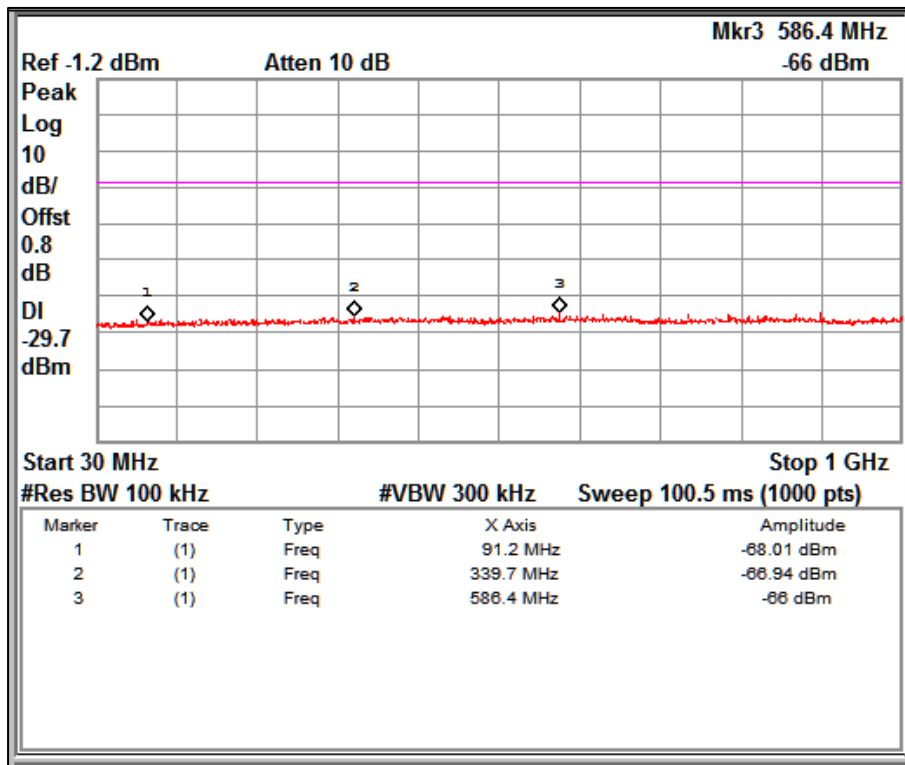
Channel Frequency 2437MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

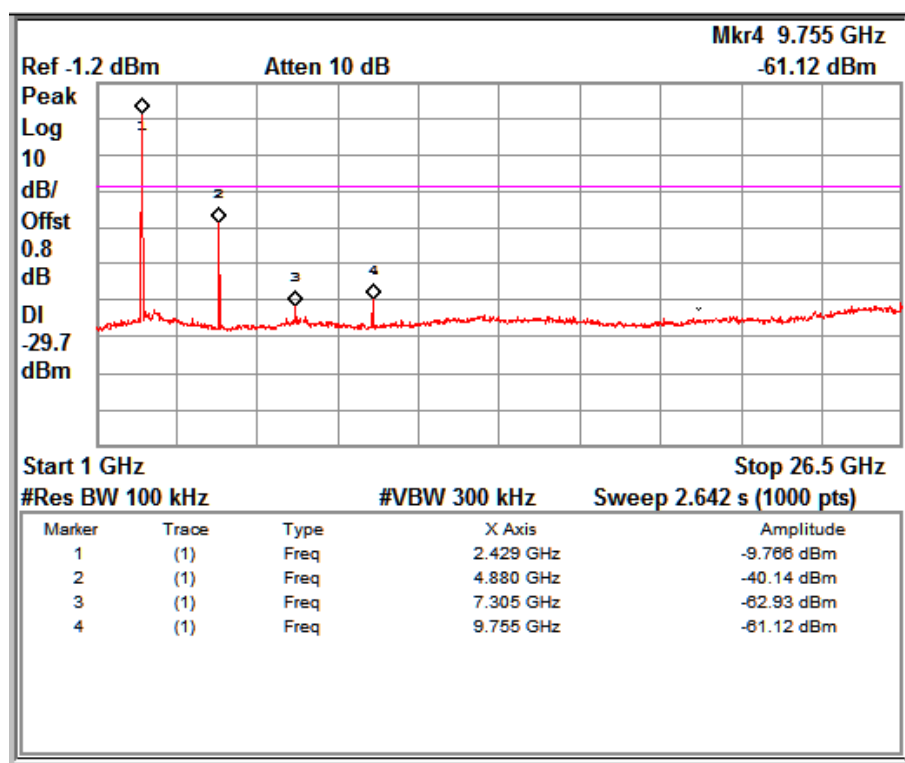
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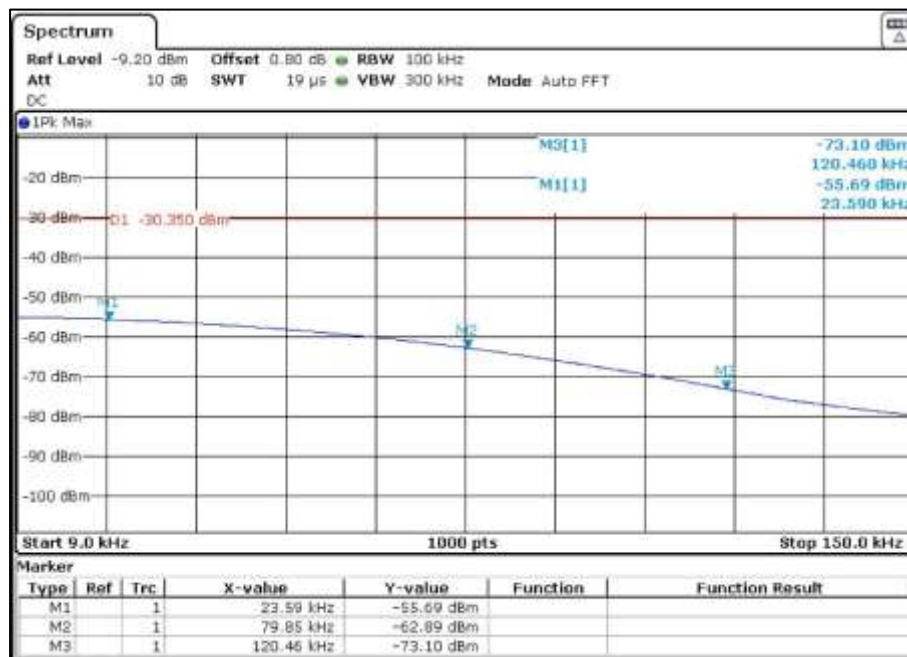
Channel Frequency 2437MHz

Frequency Range 30MHz –1GHz



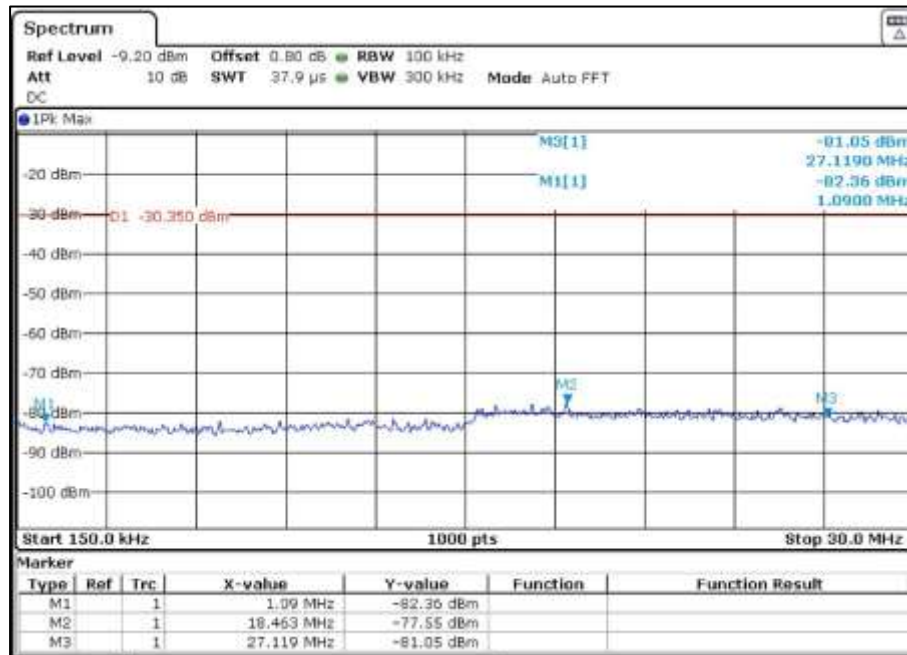
Channel Frequency 2437MHz

Frequency Range 1GHz – 26.5GHz



Channel Frequency 2462MHz

Frequency Range 9kHz –150kHz



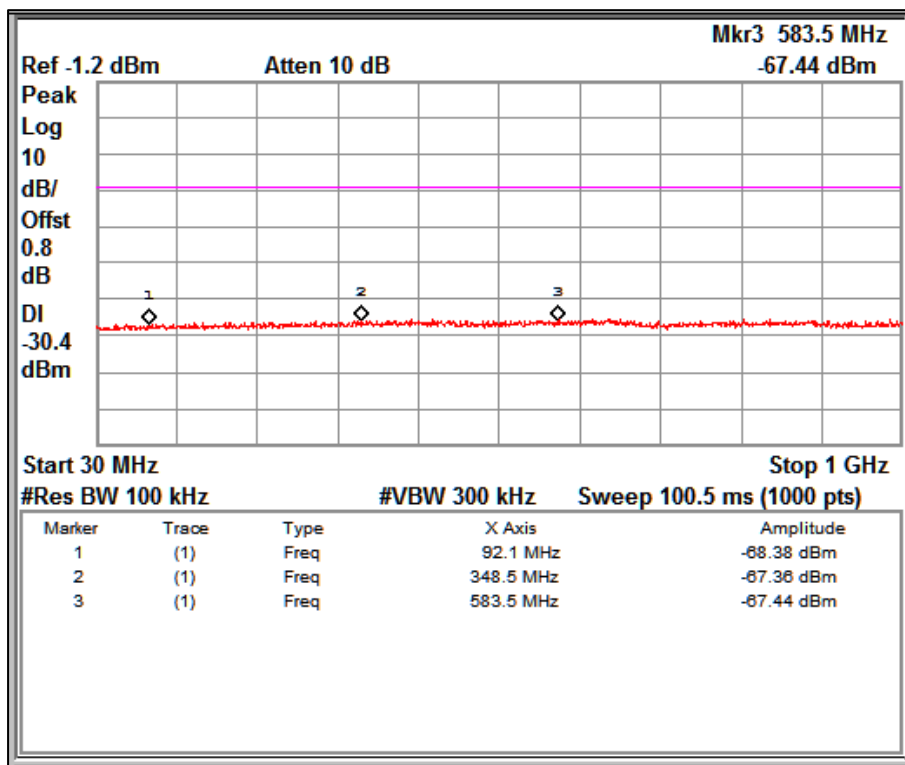
Channel Frequency 2462MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

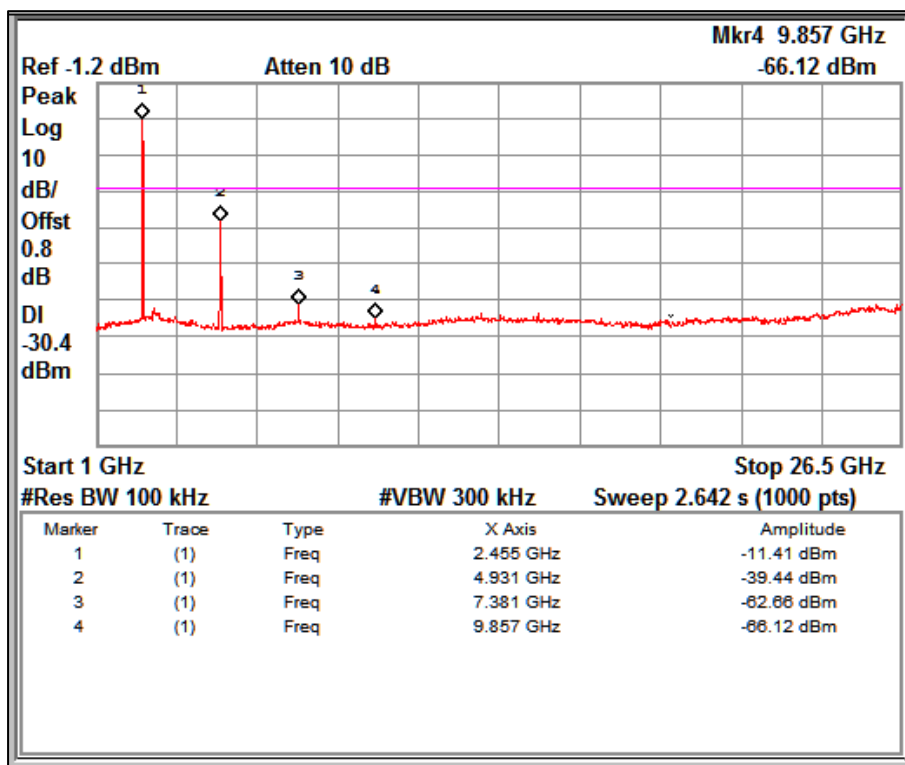
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Channel Frequency 2462MHz

Frequency Range 30MHz –1GHz



Channel Frequency 2462MHz

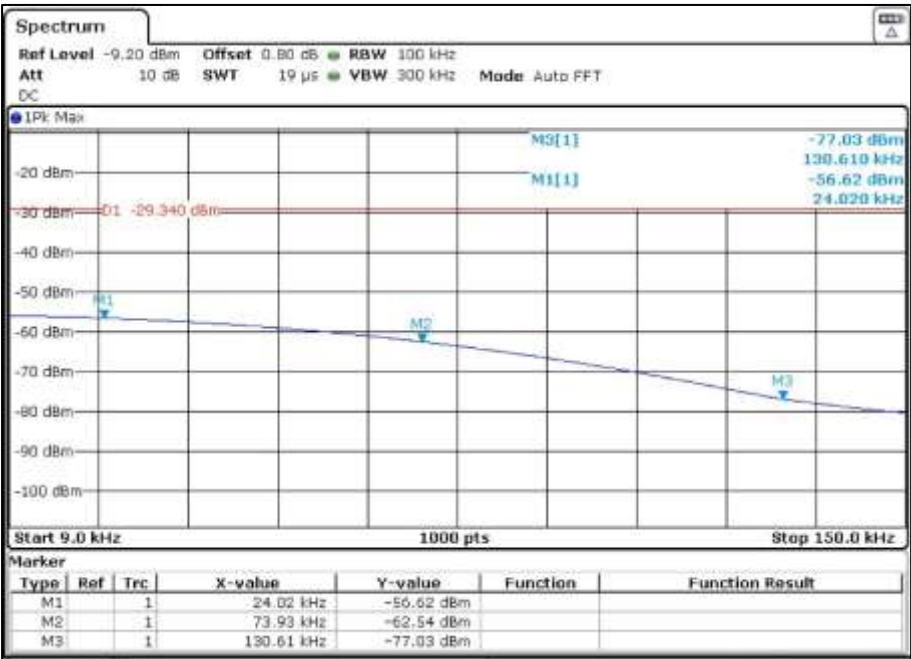
Frequency Range 1GHz – 26.5GHz

Prüfbericht - Nr.:
Test Report No.:

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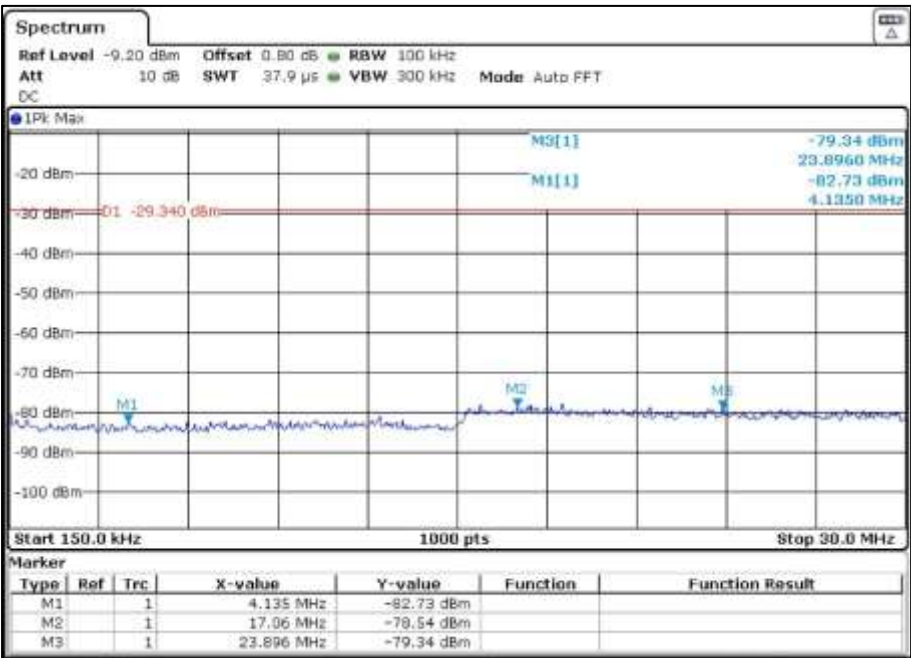
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Modulation: 802.11b
Data Rate: 5.5Mbps



Channel Frequency 2412MHz

Frequency Range 9kHz –150kHz



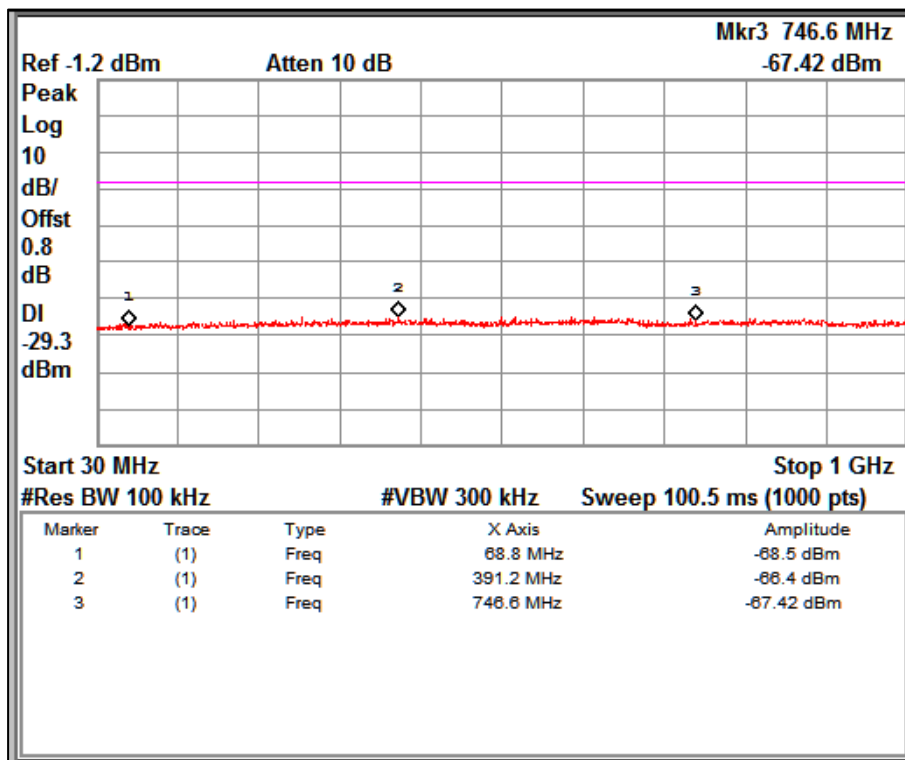
Channel Frequency 2412MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

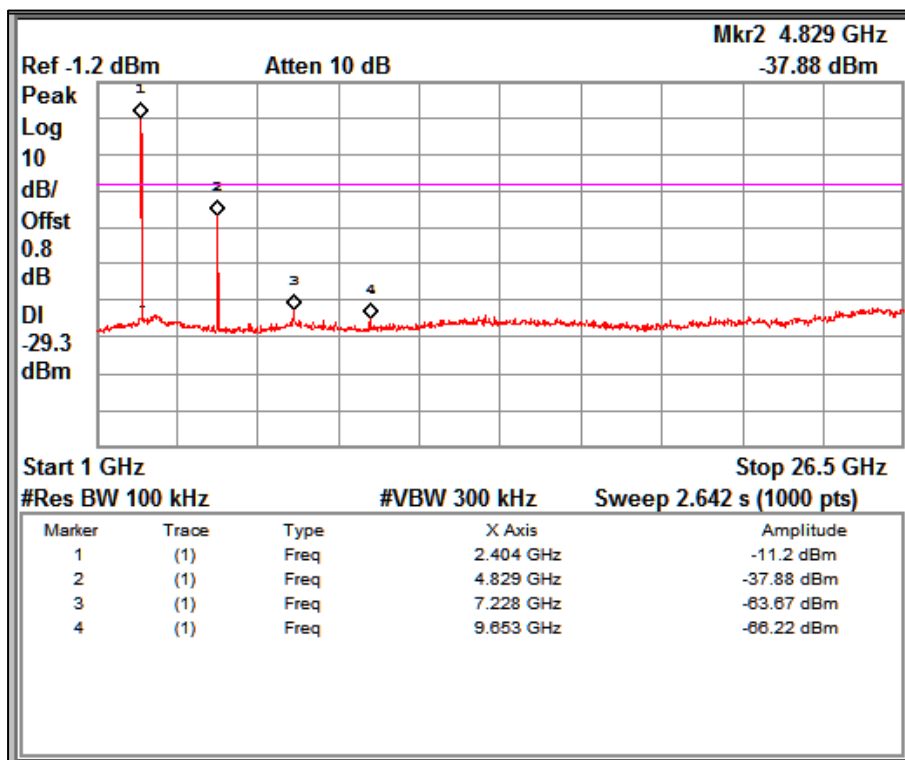
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Channel Frequency 2412MHz

Frequency Range 30MHz –1GHz



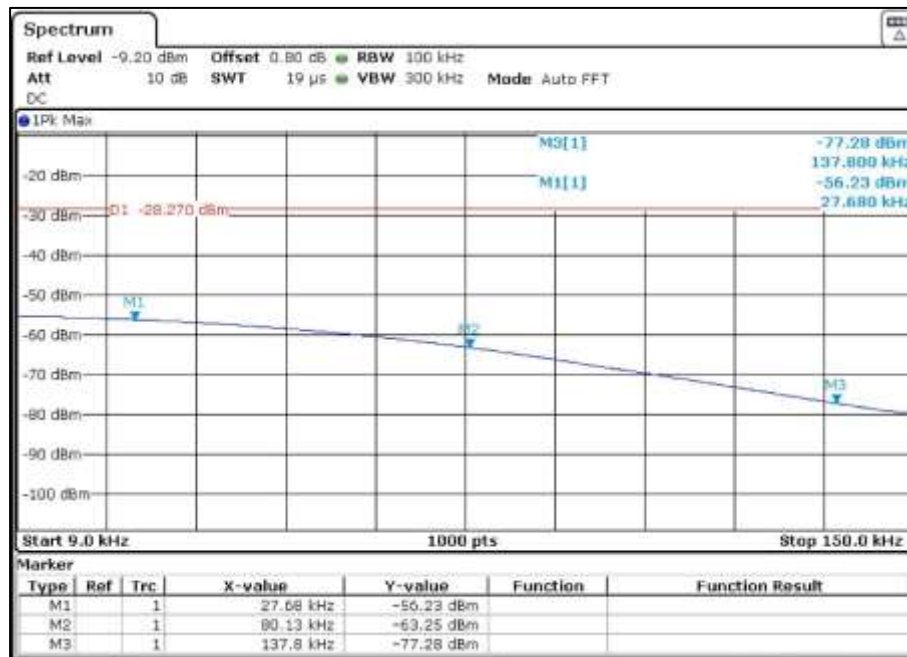
Channel Frequency 2412MHz

Frequency Range 1GHz – 26.5GHz

Prüfbericht - Nr.:
Test Report No.:

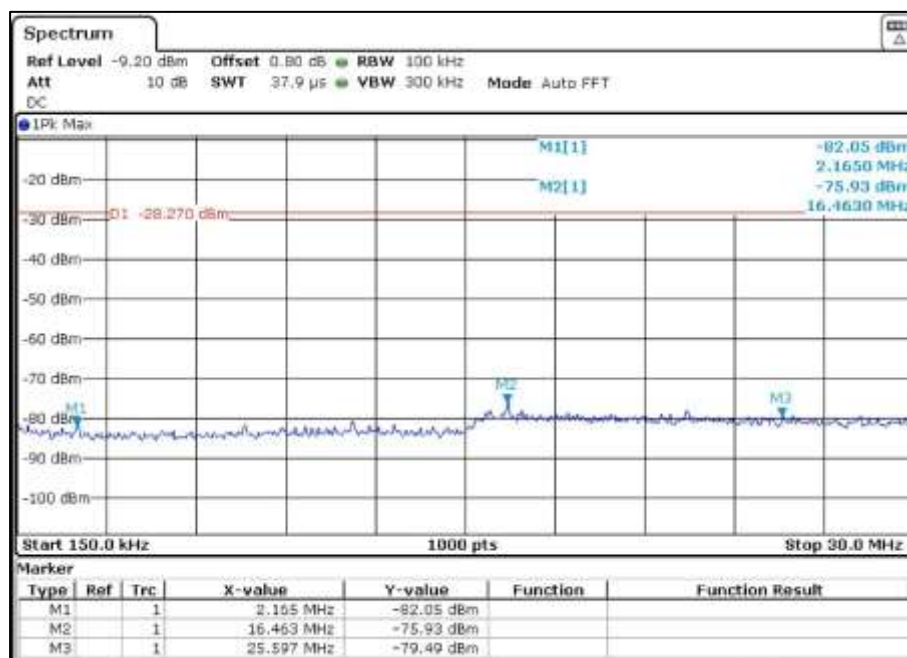
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Channel Frequency 2437MHz

Frequency Range 9kHz –150kHz



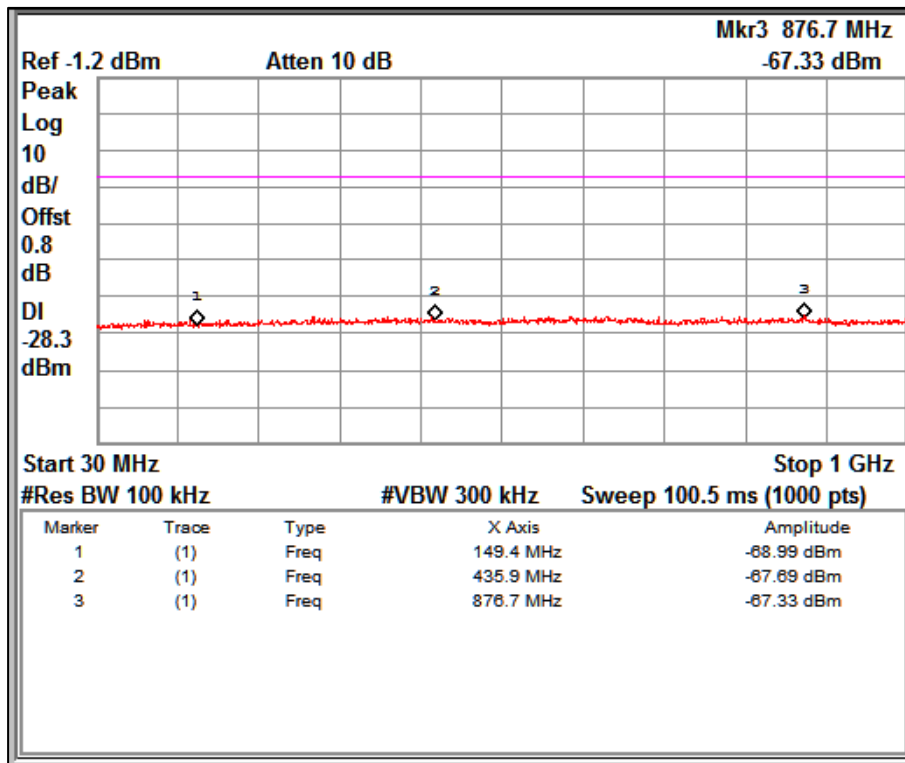
Channel Frequency 2437MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

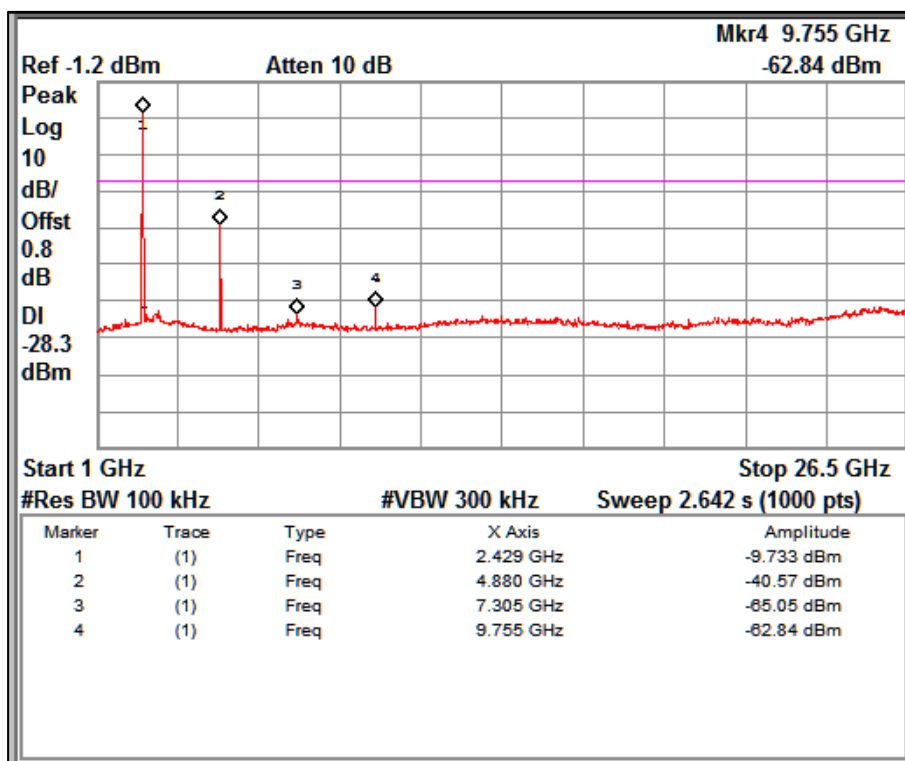
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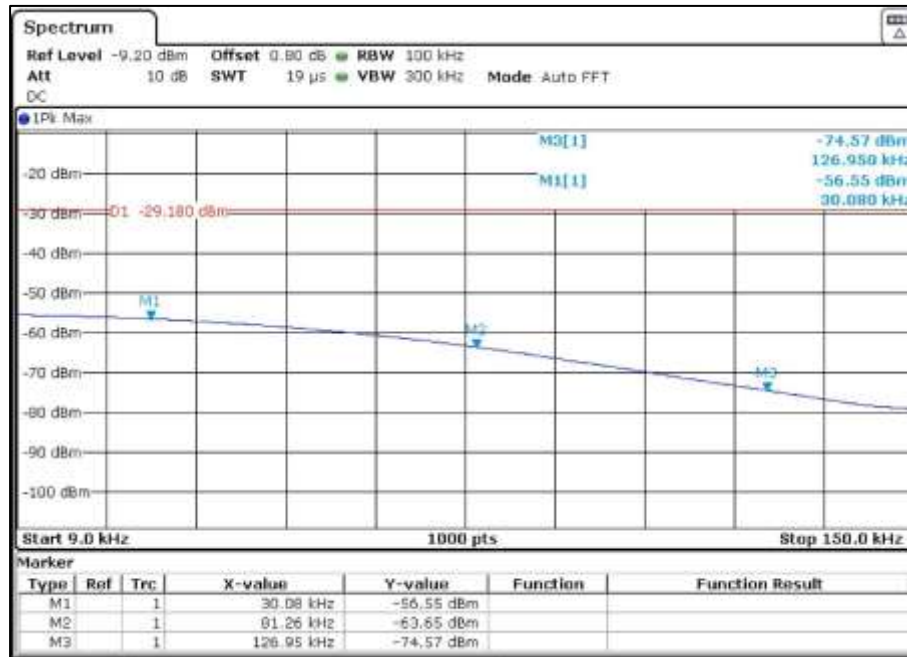
Channel Frequency 2437MHz

Frequency Range 30MHz –1GHz



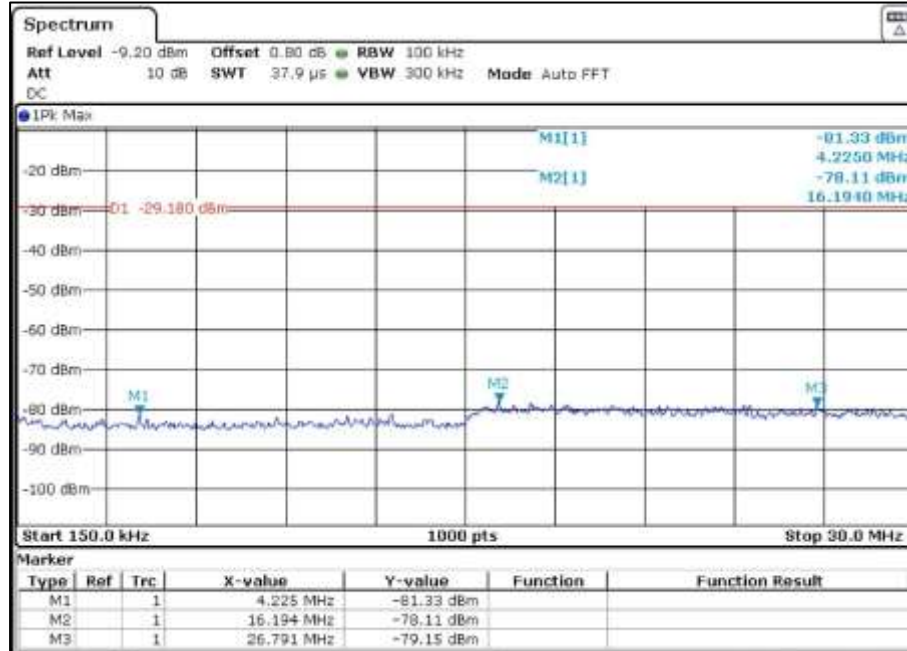
Channel Frequency 2437MHz

Frequency Range 1GHz – 26.5GHz



Channel Frequency 2462MHz

Frequency Range 9kHz –150kHz



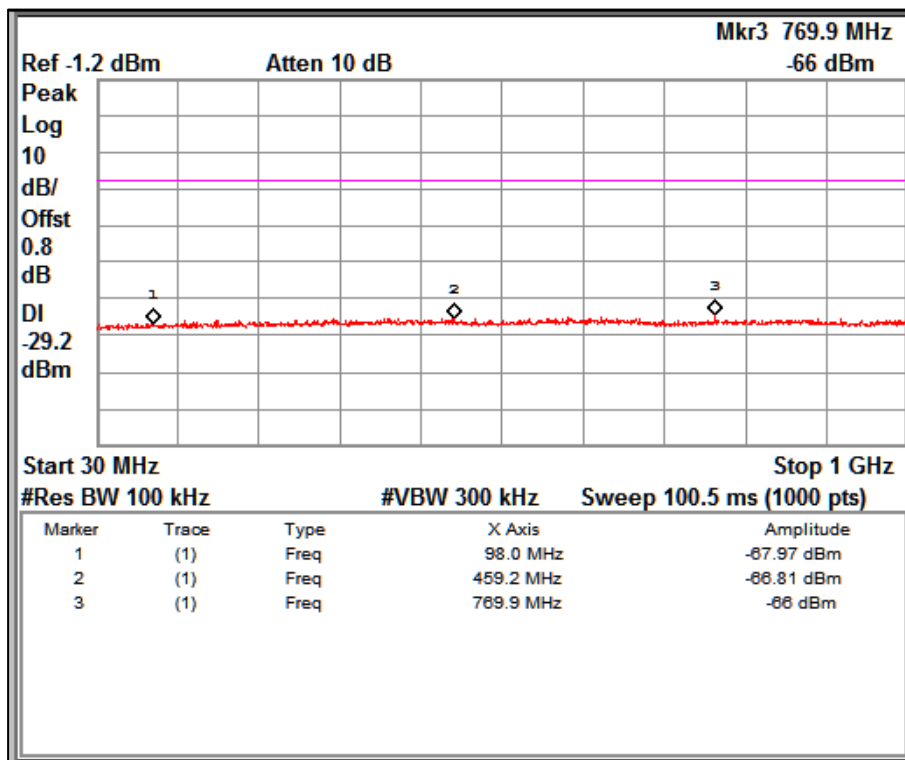
Channel Frequency 2462MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

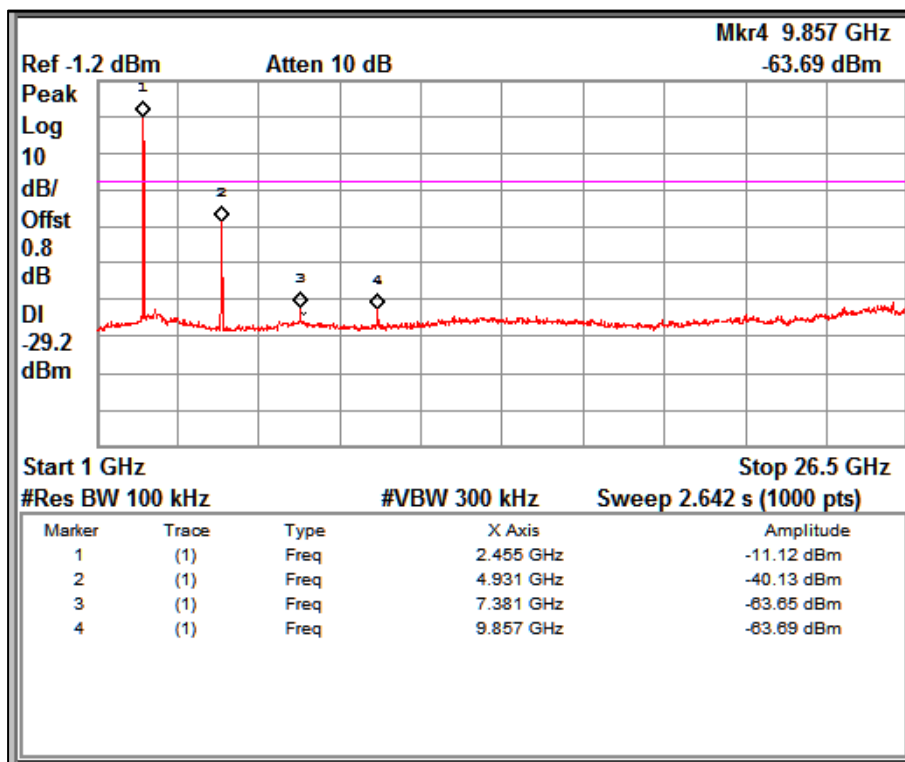
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Channel Frequency 2462MHz

Frequency Range 30MHz –1GHz



Channel Frequency 2462MHz

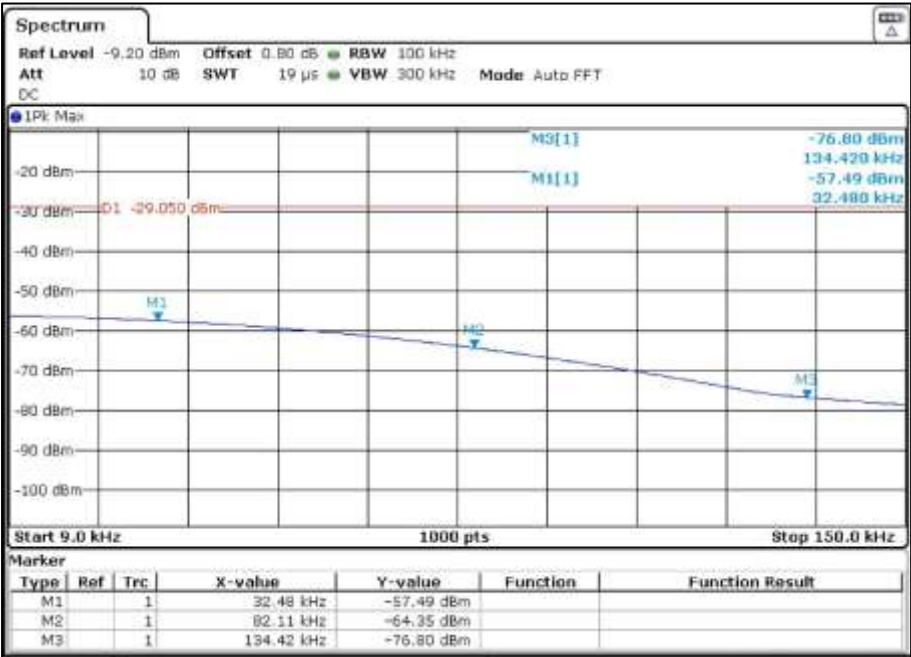
Frequency Range 1GHz – 26.5GHz

Prüfbericht - Nr.:
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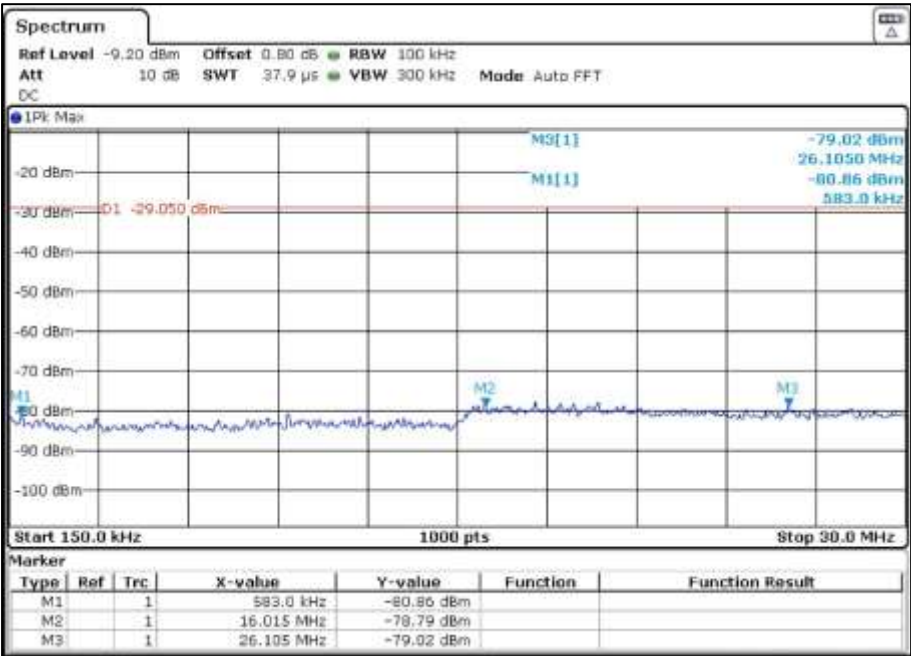
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Modulation: 802.11b
Data Rate 11Mbps



Channel Frequency 2412MHz

Frequency Range 9kHz –150kHz



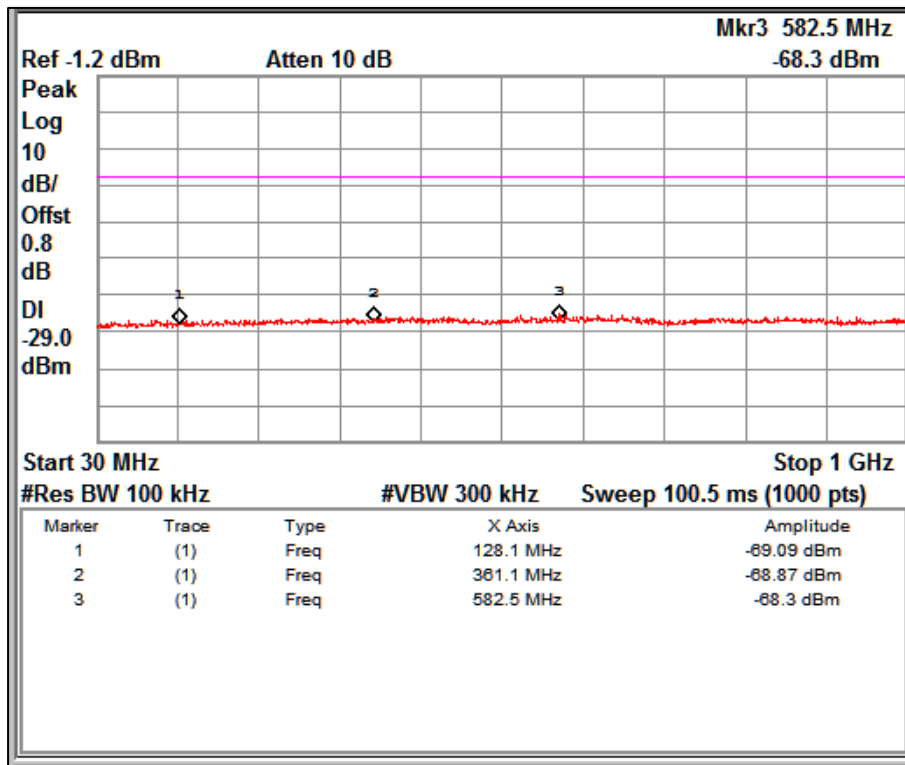
Channel Frequency 2412MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

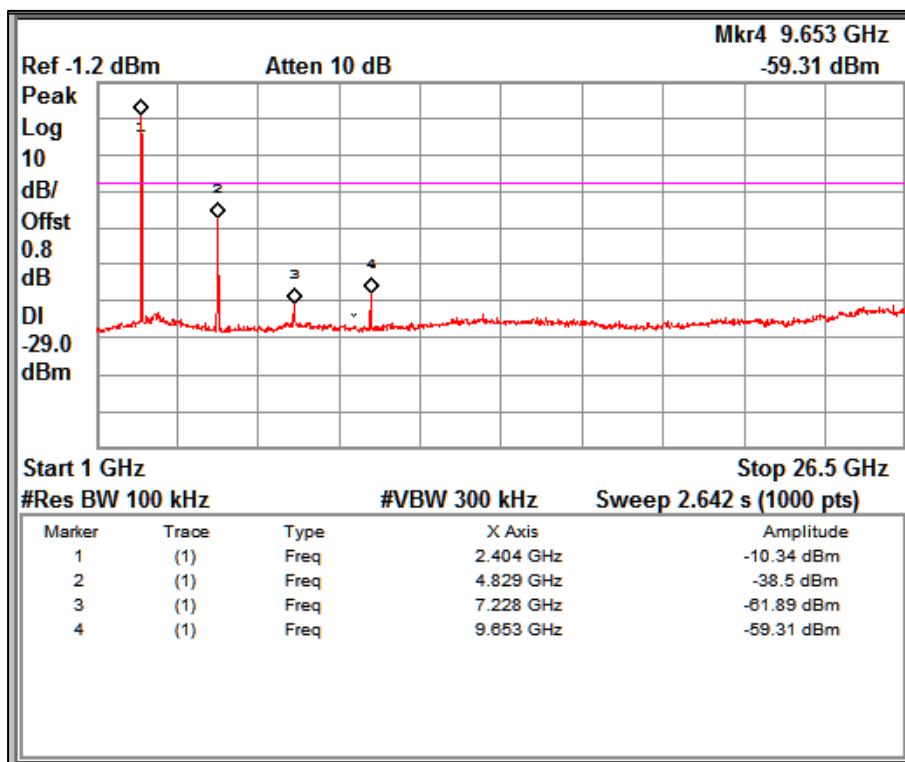
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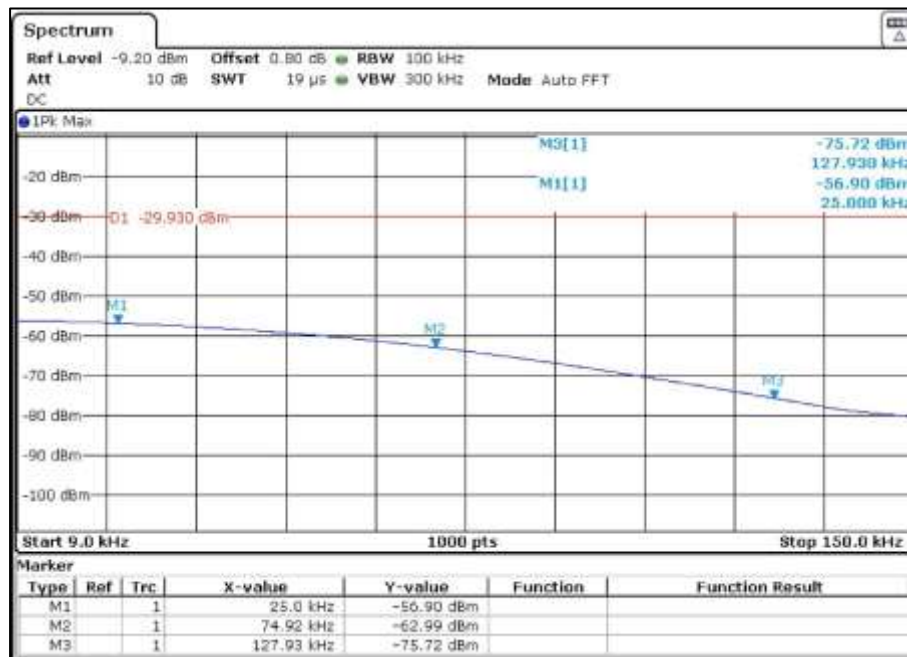
Channel Frequency 2412MHz

Frequency Range 30MHz –1GHz



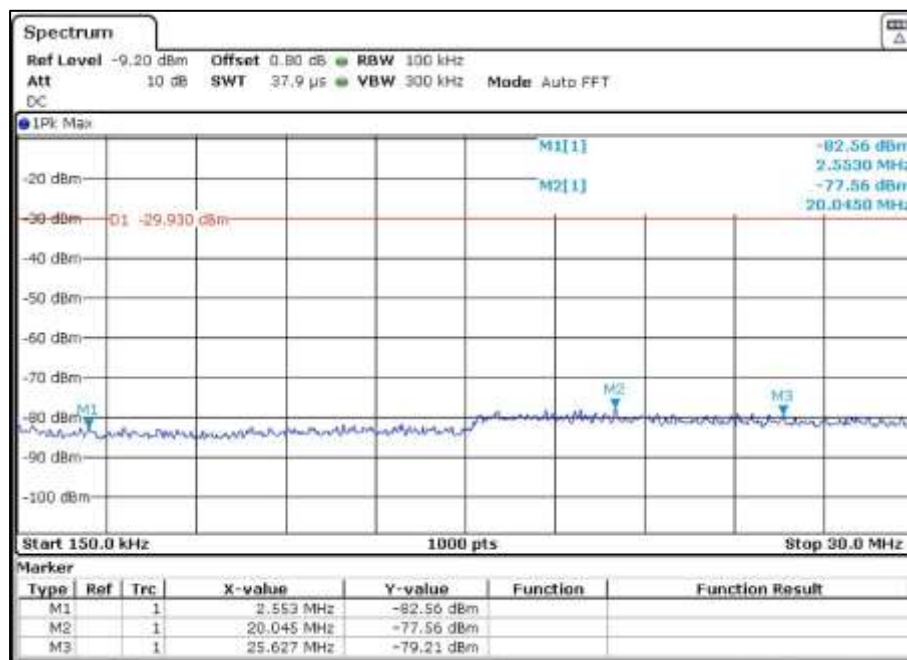
Channel Frequency 2412MHz

Frequency Range 1GHz – 26.5GHz



Channel Frequency 2437MHz

Frequency Range 9kHz –150kHz



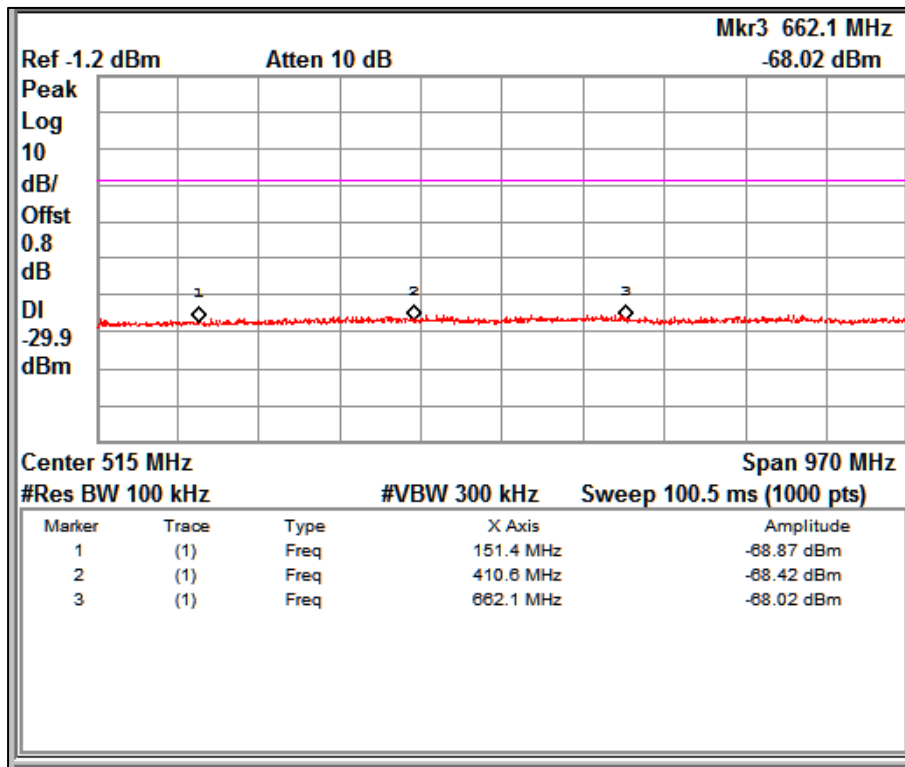
Channel Frequency 2437MHz

Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

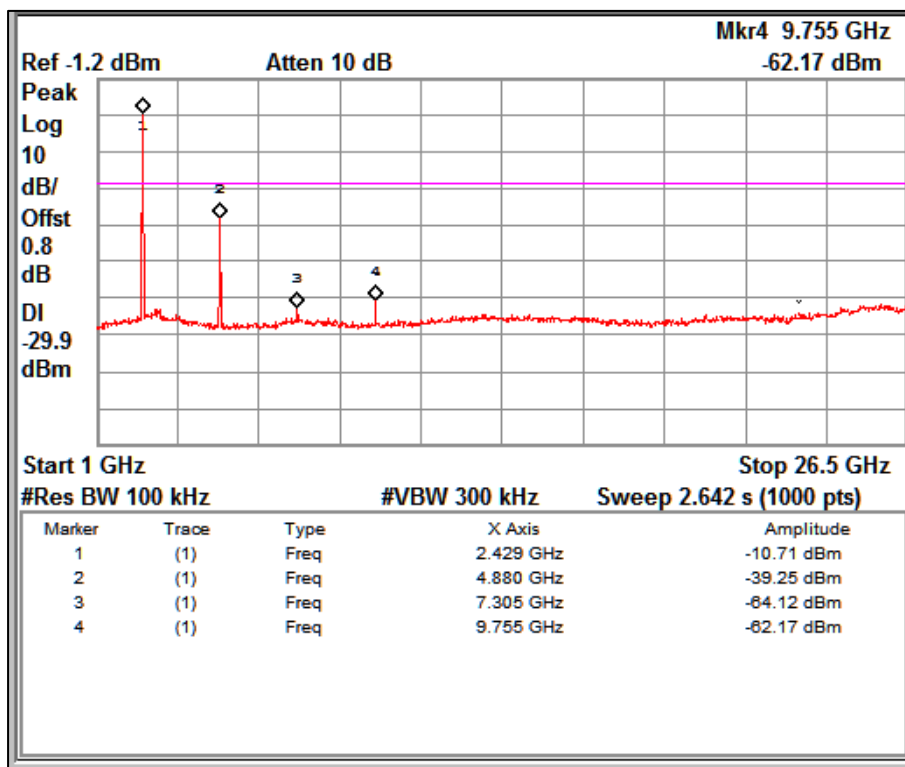
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Channel Frequency 2437MHz

Frequency Range 30MHz –1GHz



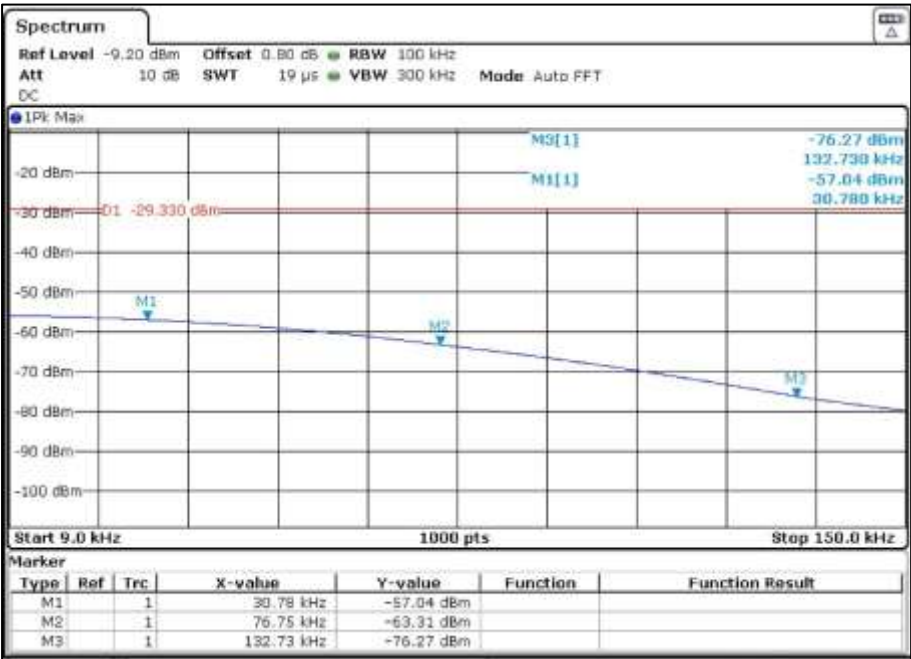
Channel Frequency 2437MHz

Frequency Range 1GHz – 26.5GHz

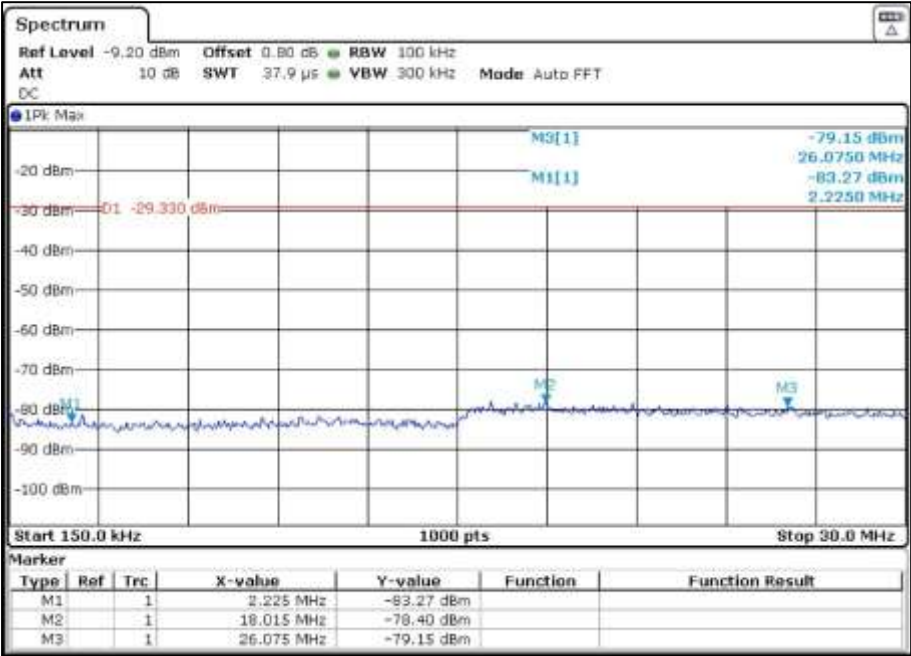
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Channel Frequency 2462MHz Frequency Range 9kHz –150kHz

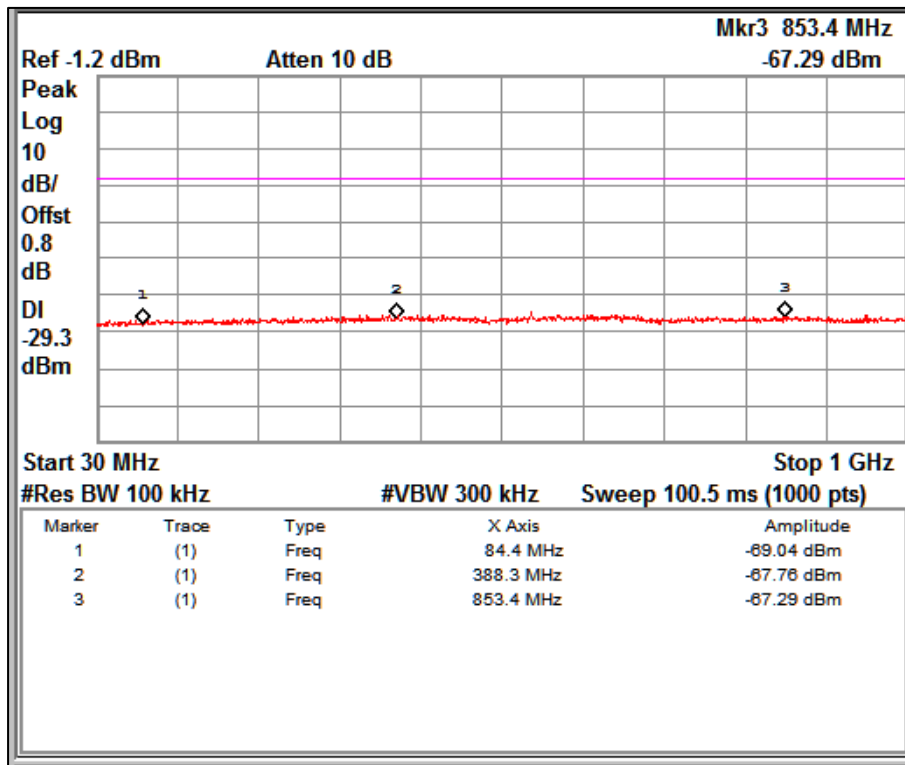


Channel Frequency 2462MHz Frequency Range 150kHz –30MHz

Prüfbericht - Nr.:
Test Report No.:

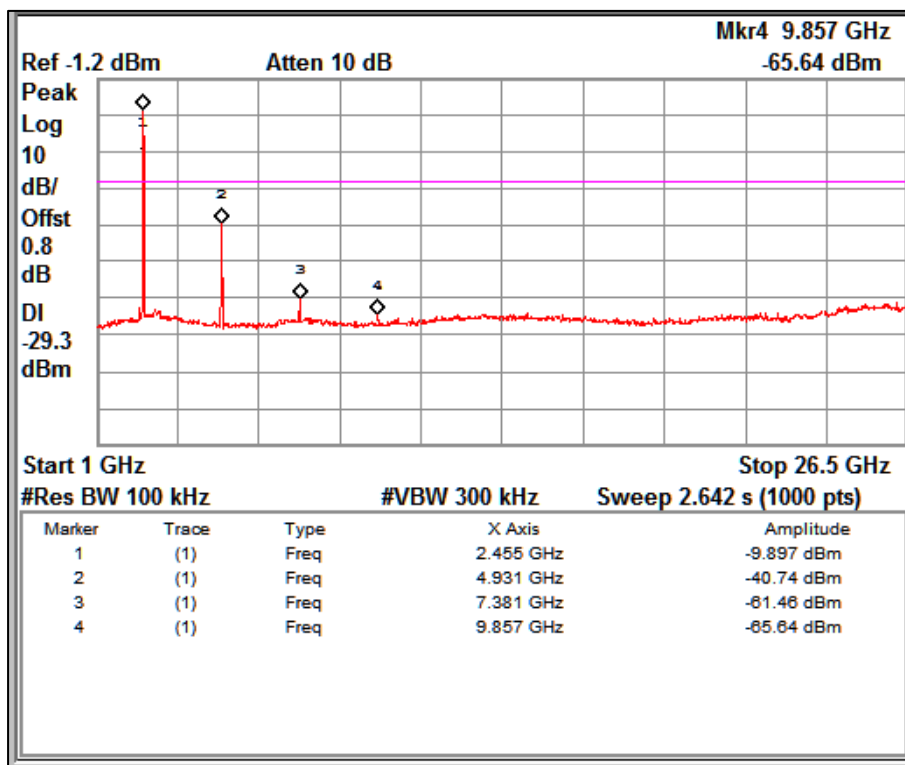
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Channel Frequency 2462MHz

Frequency Range 30MHz –1GHz



Channel Frequency 2462MHz

Frequency Range 1GHz – 26.5GHz

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7.5 Spurious Radiated Emissions & Restricted Bands of Operation

Result	Pass
Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205)
Test Method	ANSI C63.10
Measurement Location	Semi Anechoic Chamber 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 = 3.3V AC to DC Adaptor 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

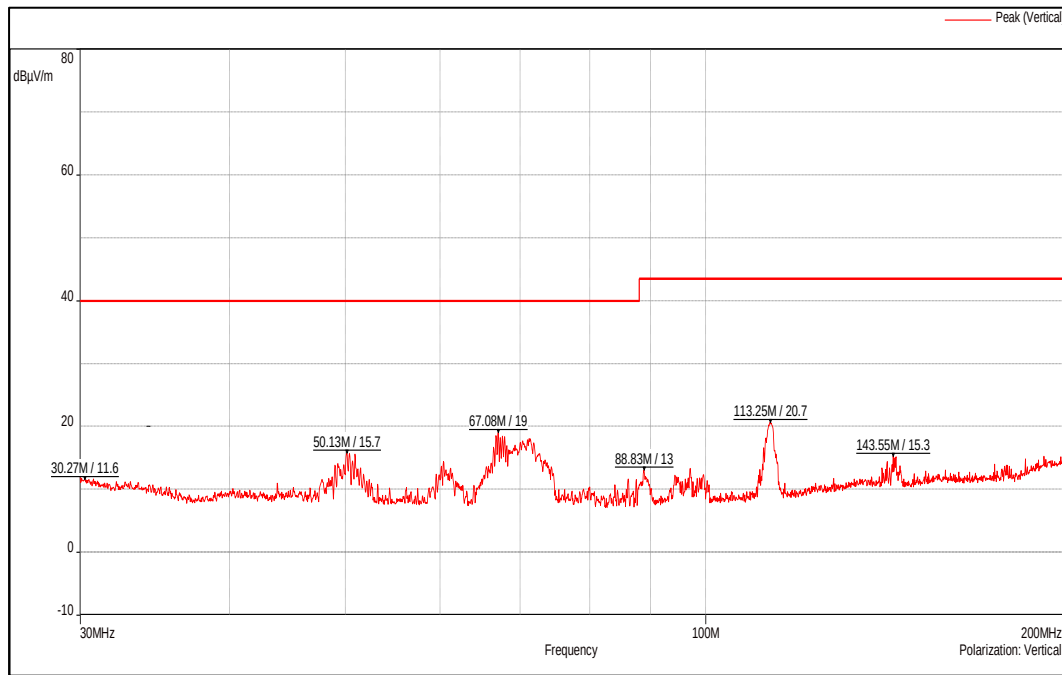
Test results for frequency range 30MHz – 1GHz

Antenna Polarization	Measured Frequency (MHz)	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	30.27	11.60	40.00	-28.40
	50.13	15.70	40.00	-24.30
	67.08	19.00	40.00	-21.00
	88.83	13.00	43.50	-30.50
	113.25	20.70	43.50	-22.80
	143.55	15.30	43.50	-28.20
	260.87	14.30	46.00	-31.70
	327.41	16.60	46.00	-29.40
	436.85	19.20	46.00	-26.80
	605.30	23.60	46.00	-22.40
	773.51	26.10	46.00	-19.90
	965.21	31.20	46.00	-14.80
Horizontal	54.54	11.80	40.00	-28.20
	78.03	23.30	40.00	-16.70
	90.36	15.70	43.50	-27.80
	113.01	21.70	43.50	-21.80
	171.57	24.70	43.50	-18.80
	195.36	18.70	43.50	-24.80
	260.06	14.10	46.00	-31.90
	355.31	17.90	46.00	-28.10
	443.48	19.90	46.00	-26.10
	612.74	24.10	46.00	-21.90
	768.98	25.20	46.00	-20.80
	924.41	28.60	46.00	-17.40

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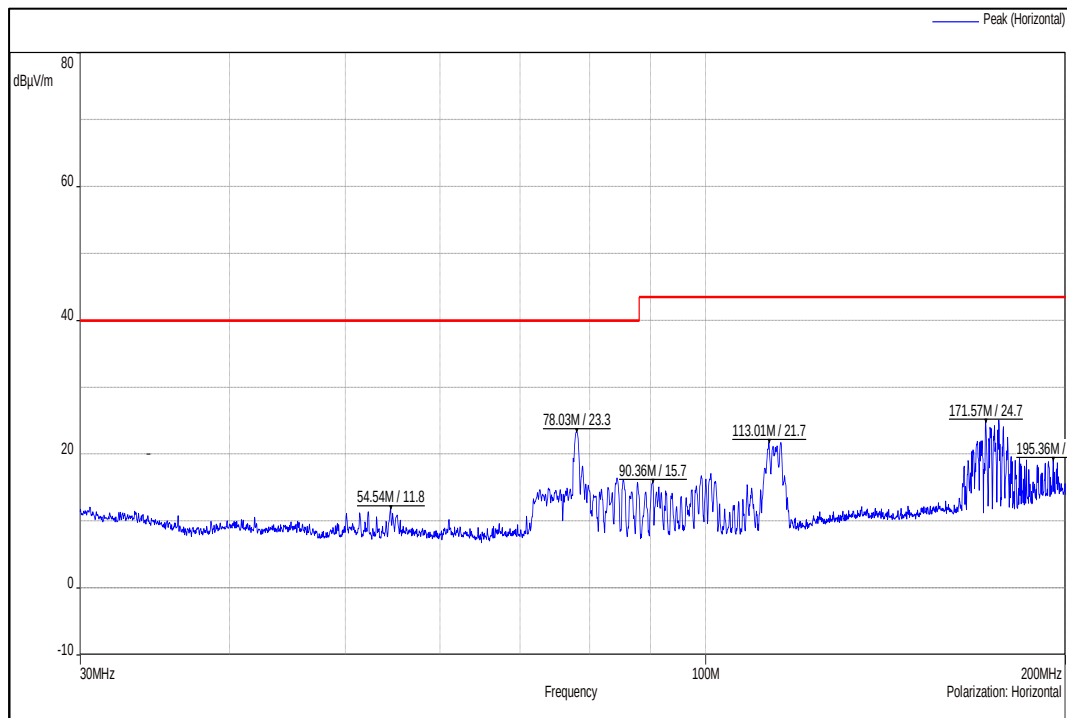
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Channel Frequency 30MHz – 200MHz

Polarization Vertical



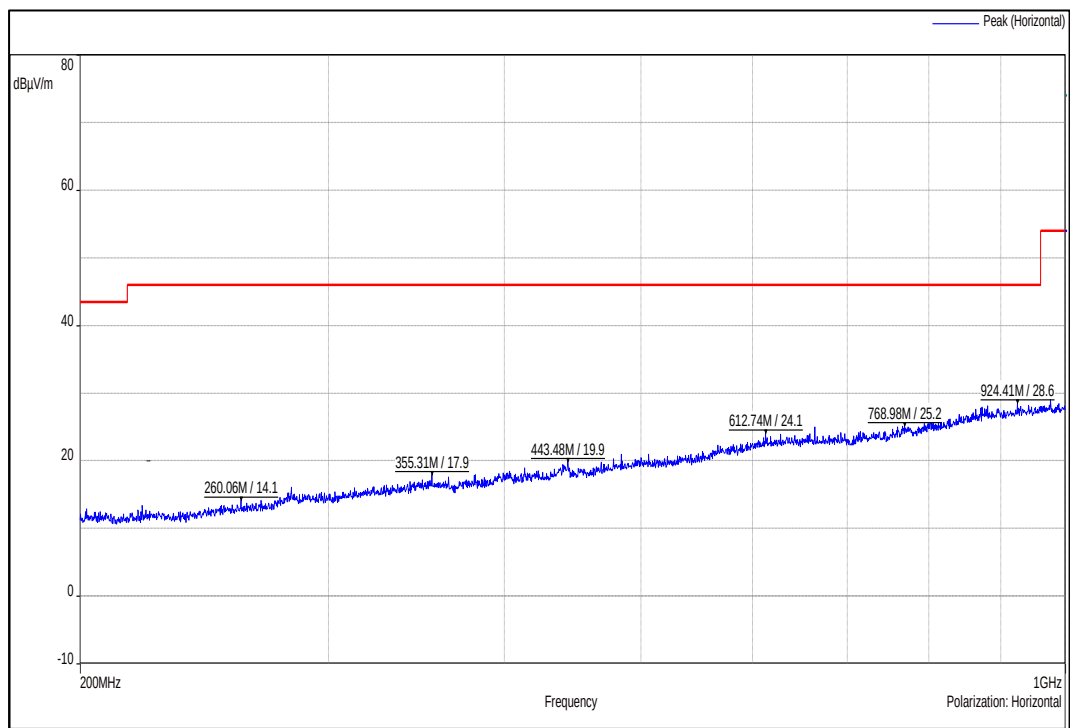
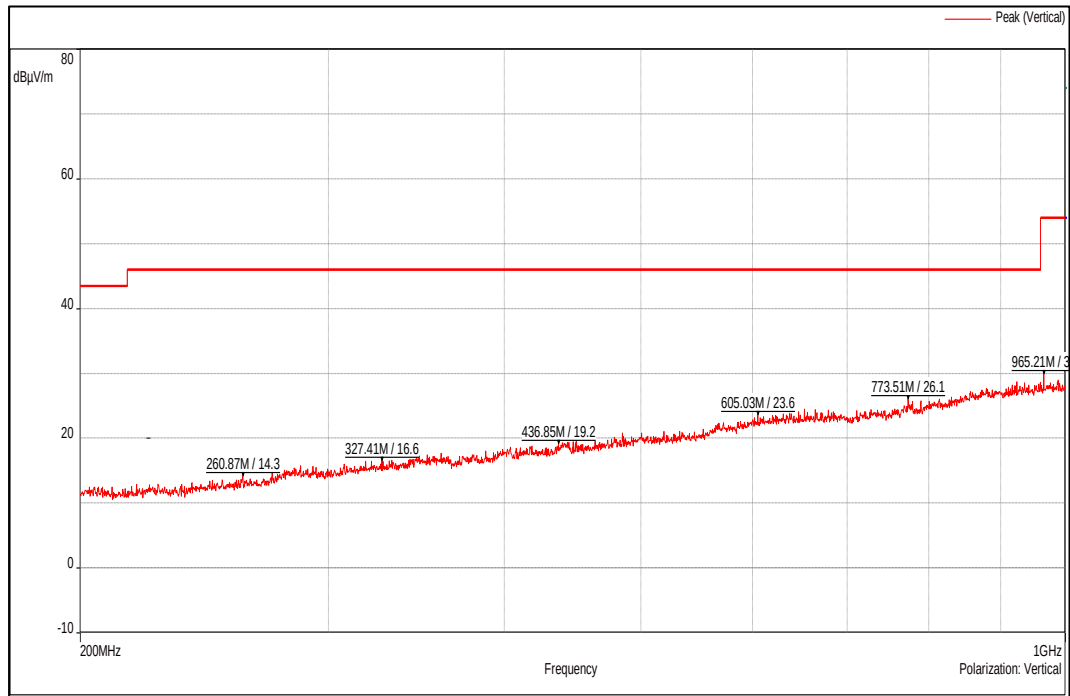
Channel Frequency 30MHz – 200MHz

Polarization Horizontal

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Test results for the frequencies in the range 1 GHz to 26.5 GHz

Modulation: 802.11b

Data Rate: 1Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Emission level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2412	2412(Pk)	Vertical	79.90	*	-
	2412(Av)		73.16	*	-
	2390(Pk)		36.00	74	-38.00
	2390(Av)		22.23	54	-31.77
	4824(Pk)		44.70	74	-29.30
	4824(Av)		37.94	54	-16.06
	7236(Pk)		No Harmonics Found		
	7236(Av)		No Harmonics Found		
	2412(Pk)	Horizontal	90.46	*	-
	2412(Av)		83.73	*	-
	2390(Pk)		38.11	74	-35.89
	2390(Av)		25.14	54	-28.86
	4824(Pk)		45.43	74	-28.57
	4824(Av)		39.55	54	-14.45
	7236(Pk)		No Harmonics Found		
	7236(Av)		No Harmonics Found		
2437	2437Pk)	Vertical	80.96	*	-
	2437(Av)		74.26	*	-
	4874(Pk)		44.94	74	-29.06
	4874(Av)		38.07	54	-15.93
	7311(Pk)		No Harmonics Found		
	7311(Av)		No Harmonics Found		
	2437Pk)	Horizontal	89.89	*	-
	2437(Av)		83.10	*	-
	4874(Pk)		45.03	74	-28.97
	4874(Av)		38.55	54	-15.45
	7311(Pk)		No Harmonics Found		
	7311(Av)		No Harmonics Found		
2462	2483.5(Pk)	Vertical	36.18	74	-37.82
	2483.5(Av)		22.64	54	-31.36
	2462(Pk)		80.23	*	-
	2462(Av)		73.43	*	-
	4924(Pk)		43.63	74	-30.37
	4924(Av)		35.39	54	-18.61
	7386(Pk)		No Harmonics Found		
	7386(Av)		No Harmonics Found		
	2483.5(Pk)	Horizontal	36.58	74	-37.42
	2483.5(Av)		24.44	54	-29.56
	2462(Pk)		89.42	*	-
	2462(Av)		82.65	*	-
	4924(Pk)		43.96	74	-30.04
	4924(Av)		34.90	54	-19.10
	7386(Pk)		No Harmonics Found		
	7386(Av)		No Harmonics Found		

*- : Indicate restricted band of operation §15.205

Pk: Peak Detector; Av: Average Detector

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Data Rate: 2Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Emission level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2412	2412(Pk)	Vertical	79.86	*	-
	2412(Av)		73.20	*	-
	2390(Pk)		35.48	74	-38.52
	2390(Av)		22.18	54	-31.82
	4824(Pk)		45.25	74	-28.75
	4824(Av)		37.12	54	-16.88
	7236(Pk)		No Harmonics Found		
	7236(Av)				
	2412(Pk)	Horizontal	90.46	*	-
	2412(Av)		83.80	*	-
	2390(Pk)		38.67	74	-35.33
	2390(Av)		24.82	54	-29.18
	4824(Pk)		44.90	74	-29.10
	4824(Av)		36.32	54	-17.68
	7236(Pk)		No Harmonics Found		
	7236(Av)				
2437	2437(Pk)	Vertical	81.04	*	-
	2437(Av)		74.36	*	-
	4874(Pk)		44.61	74	-29.39
	4874(Av)		35.70	54	-18.30
	7311(Pk)	Horizontal	No Harmonics Found		
	7311(Av)				
	2437(Pk)		90.32	*	-
	2437(Av)		83.53	*	-
	4874(Pk)		45.14	74	-28.86
	4874(Av)		36.83	54	-17.17
	7311(Pk)		No Harmonics Found		
	7311(Av)				
2480	2483.5(Pk)	Vertical	36.37	74	-37.63
	2483.5(Av)		22.74	54	-31.26
	2462(Pk)		80.37	*	-
	2462(Av)		73.66	*	-
	4924(Pk)		43.54	74	-30.46
	4924(Av)		34.67	54	-19.33
	7386(Pk)		No Harmonics Found		
	7386(Av)				
	2483.5(Pk)	Horizontal	36.67	74	-37.33
	2483.5(Av)		24.78	54	-29.22
	2462(Pk)		89.62	*	-
	2462(Av)		83.04	*	-
	4924(Pk)		45.01	74	-28.99
	4924(Av)		35.19	54	-18.81
	7386(Pk)		No Harmonics Found		
	7386(Av)				

*- : Indicate restricted band of operation §15.205
Pk: Peak Detector; Av: Average Detector

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Data Rate: 5.5Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Emission level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2412	2412(Pk)	Vertical	81.02	*	-
	2412(Av)		72.93	*	-
	2390(Pk)		35.67	74	-38.33
	2390(Av)		22.15	54	-31.85
	4824(Pk)		44.25	74	-29.75
	4824(Av)		31.77	54	-22.23
	7236(Pk)		No Harmonics Found		
	7236(Av)				
	2412(Pk)	Horizontal	91.41	*	-
	2412(Av)		83.32	*	-
	2390(Pk)		39.20	74	-34.80
	2390(Av)		24.77	54	-29.23
	4824(Pk)		44.03	74	-29.97
	4824(Av)		31.30	54	-22.70
	7236(Pk)		No Harmonics Found		
	7236(Av)				
2437	2437(Pk)	Vertical	81.81	*	-
	2437(Av)		73.64	*	-
	4874(Pk)		44.10	74	-29.90
	4874(Av)		31.45	54	-22.55
	7311(Pk)		No Harmonics Found		
	7311(Av)				
	2437(Pk)	Horizontal	91.31	*	-
	2437(Av)		83.05	*	-
	4874(Pk)		45.00	74	-29.00
	4874(Av)		31.77	54	-22.23
	7311(Pk)		No Harmonics Found		
	7311(Av)				
2480	2483.5(Pk)	Vertical	35.94	74	-38.06
	2483.5(Av)		22.59	54	-31.41
	2462(Pk)		81.35	*	-
	2462(Av)		73.15	*	-
	4924(Pk)		42.62	74	-31.38
	4924(Av)		30.71	54	-23.29
	7386(Pk)		No Harmonics Found		
	7386(Av)				
	2483.5(Pk)	Horizontal	37.34	74	-36.66
	2483.5(Av)		23.95	54	-30.05
	2462(Pk)		90.75	*	-
	2462(Av)		82.59	*	-
	4924(Pk)		43.39	74	-30.61
	4924(Av)		30.99	54	-23.01
	7386(Pk)		No Harmonics Found		
	7386(Av)				

*- : Indicate restricted band of operation §15.205
Pk: Peak Detector; Av: Average Detector

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Data Rate: 11Mbps

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Emission level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2412	2412(Pk)	Vertical	81.04	*	-
	2412(Av)		72.36	*	-
	2390(Pk)		36.32	74	-37.68
	2390(Av)		22.18	54	-31.82
	4824(Pk)		44.43	74	-29.57
	4824(Av)		33.88	54	-20.12
	7236(Pk)		No Harmonics Found		
	7236(Av)				
	2412(Pk)	Horizontal	91.70	*	-
	2412(Av)		82.98	*	-
	2390(Pk)		39.48	74	-34.52
	2390(Av)		24.85	54	-29.15
	4824(Pk)		44.22	74	-29.78
	4824(Av)		32.54	54	-21.46
	7236(Pk)		No Harmonics Found		
	7236(Av)				
2437	2437(Pk)	Vertical	82.75	*	-
	2437(Av)		73.51	*	-
	4874(Pk)		44.93	74	-29.07
	4874(Av)		3.72	54	-50.28
	7311(Pk)		No Harmonics Found		
	7311(Av)				
	2437(Pk)	Horizontal	91.91	*	-
	2437(Av)		82.40	*	-
	4874(Pk)		44.06	74	-29.94
	4874(Av)		32.54	54	-21.46
	7311(Pk)		No Harmonics Found		
	7311(Av)				
2480	2483.5(Pk)	Vertical	36.28	74	-37.72
	2483.5(Av)		22.63	54	-31.37
	2462(Pk)		81.90	*	-
	2462(Av)		72.81	*	-
	4924(Pk)		44.68	74	-29.32
	4924(Av)		33.00	54	-21.00
	7386(Pk)		No Harmonics Found		
	7386(Av)				
	2483.5(Pk)	Horizontal	37.99	74	-36.01
	2483.5(Av)		24.16	54	-29.84
	2462(Pk)		91.26	*	-
	2462(Av)		82.24	*	-
	4924(Pk)		44.13	74	-29.87
	4924(Av)		31.95	54	-22.05
	7386(Pk)		No Harmonics Found		
	7386(Av)				

*- : Indicate restricted band of operation §15.205
Pk: Peak Detector; Av: Average Detector

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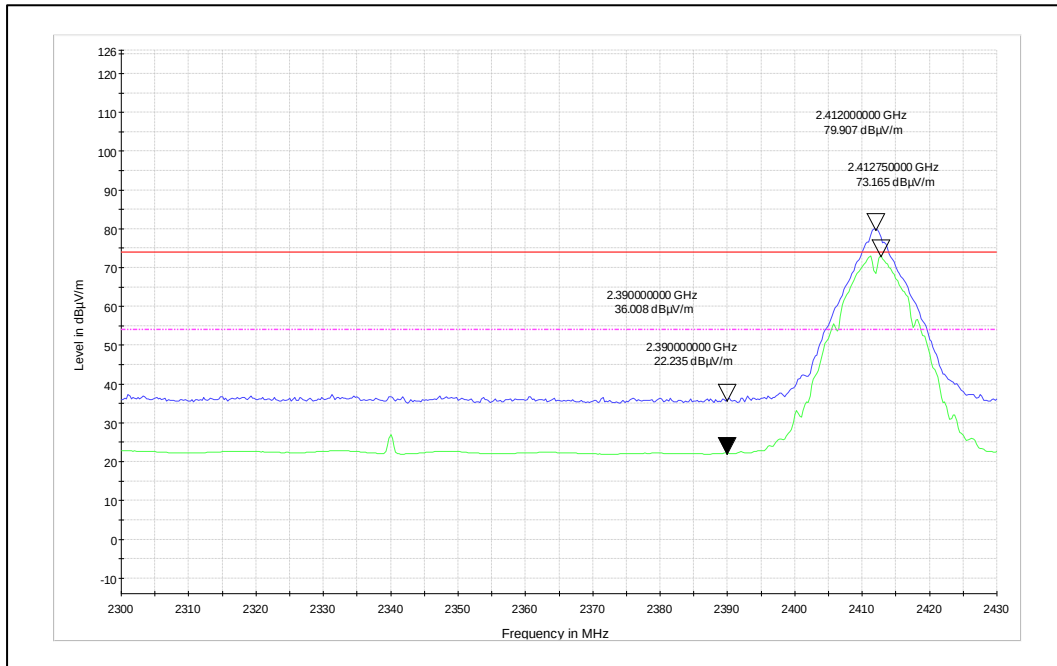
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Worst case Plots

Modulation: 802.11b

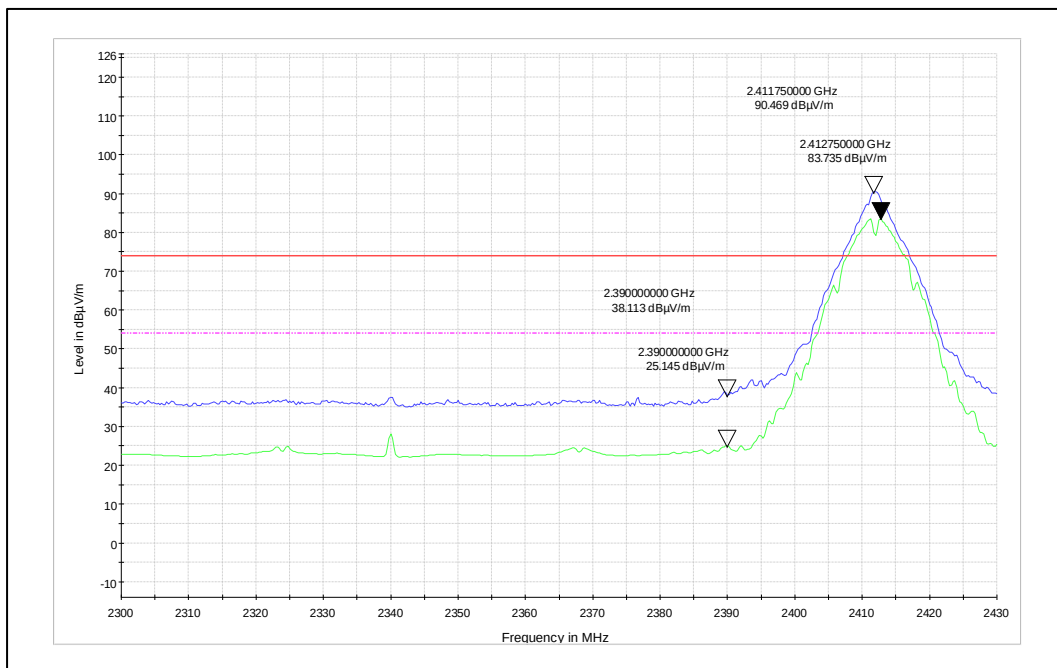
Data Rate: 1Mbps

Channel Frequency 2412MHz



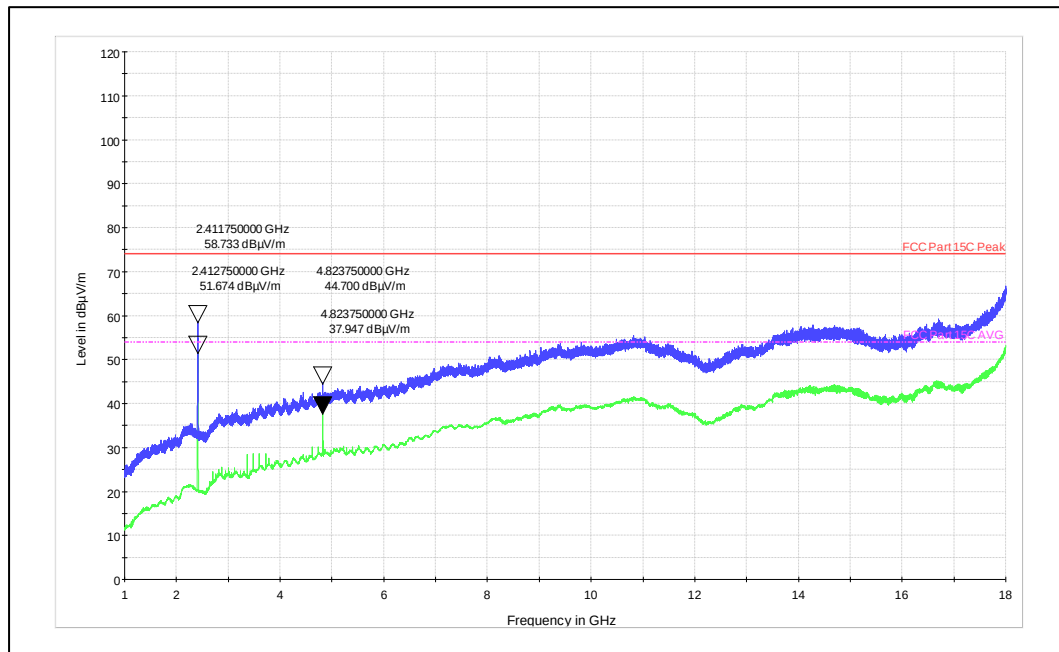
Channel Frequency: 2412MHz

Polarization: Vertical



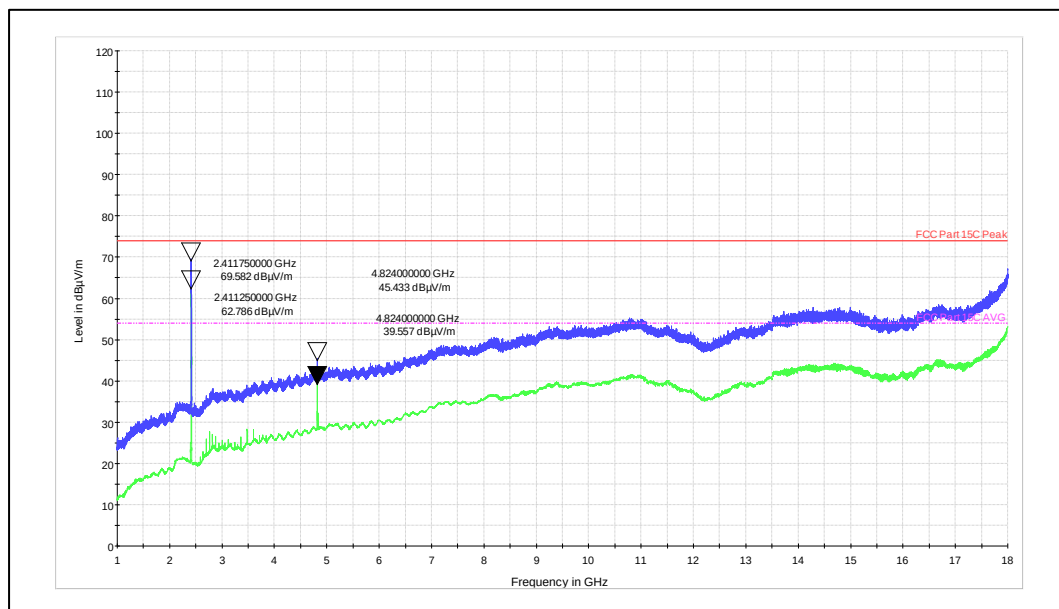
Channel Frequency: 2412MHz

Polarization: Horizontal



Frequency range: 1 – 18 GHz

Polarization: Vertical



Frequency range: 1 – 18 GHz

Polarization: Horizontal

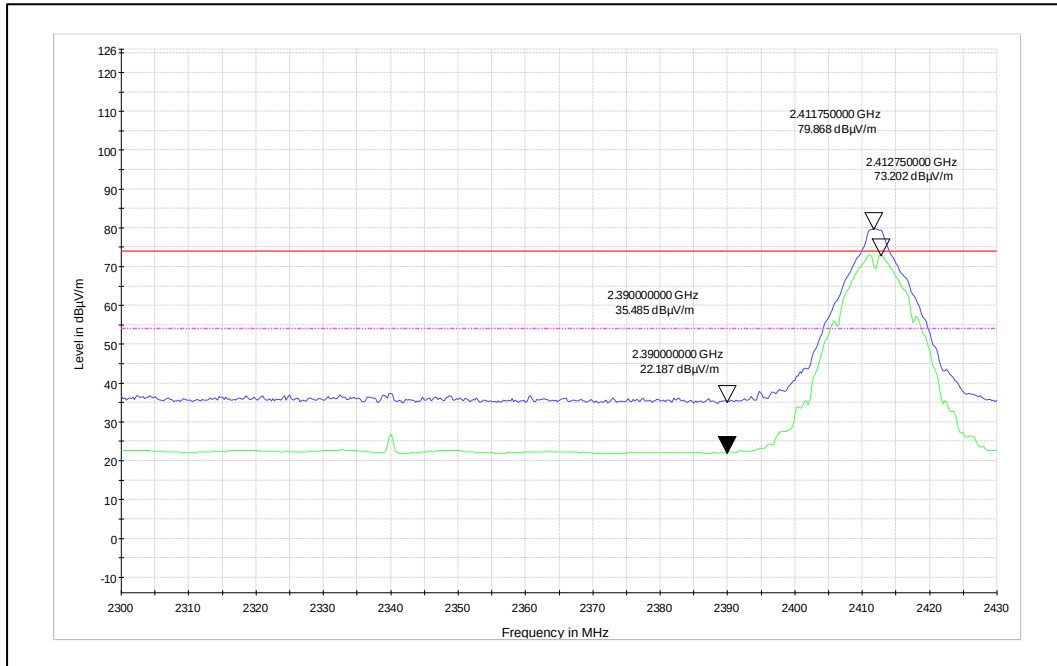
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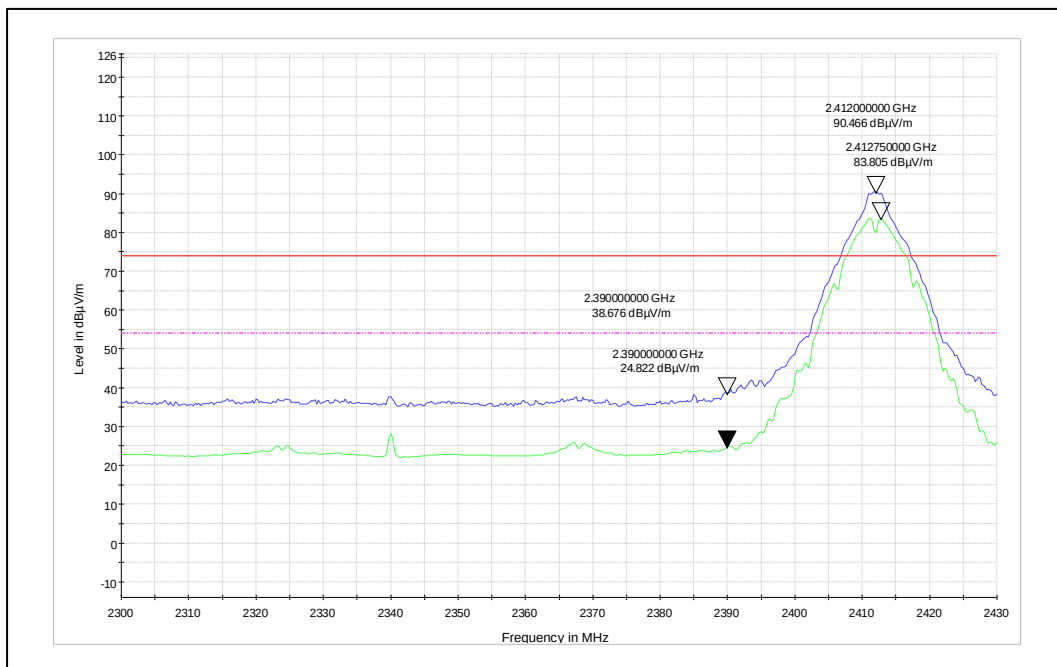
Data Rate: 2Mbps

Channel Frequency 2412MHz



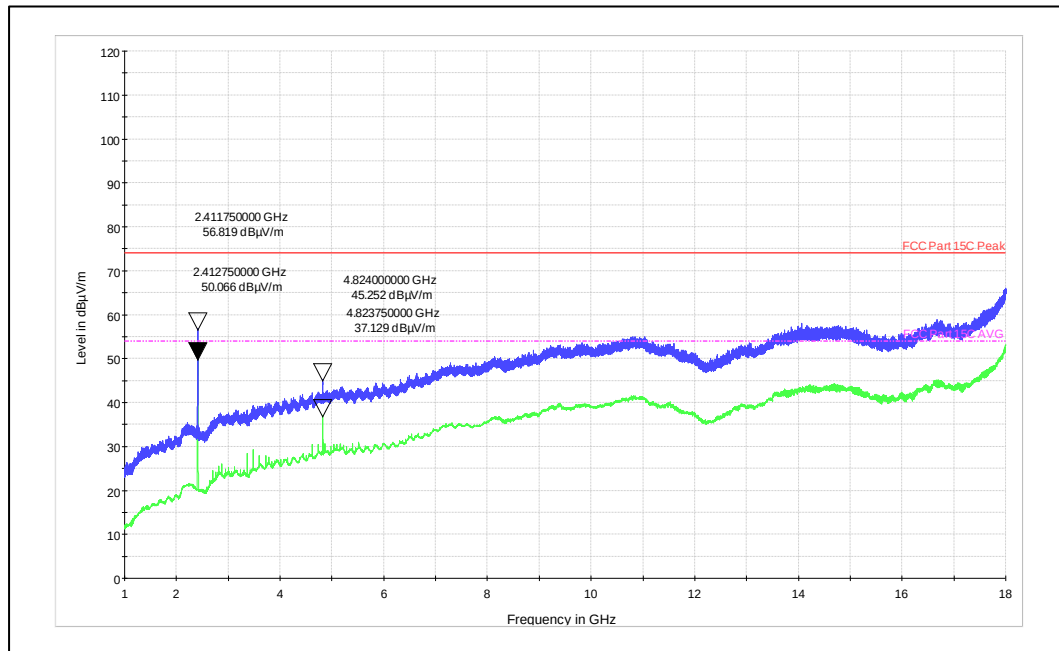
Channel Frequency: 2412MHz

Polarization: Vertical



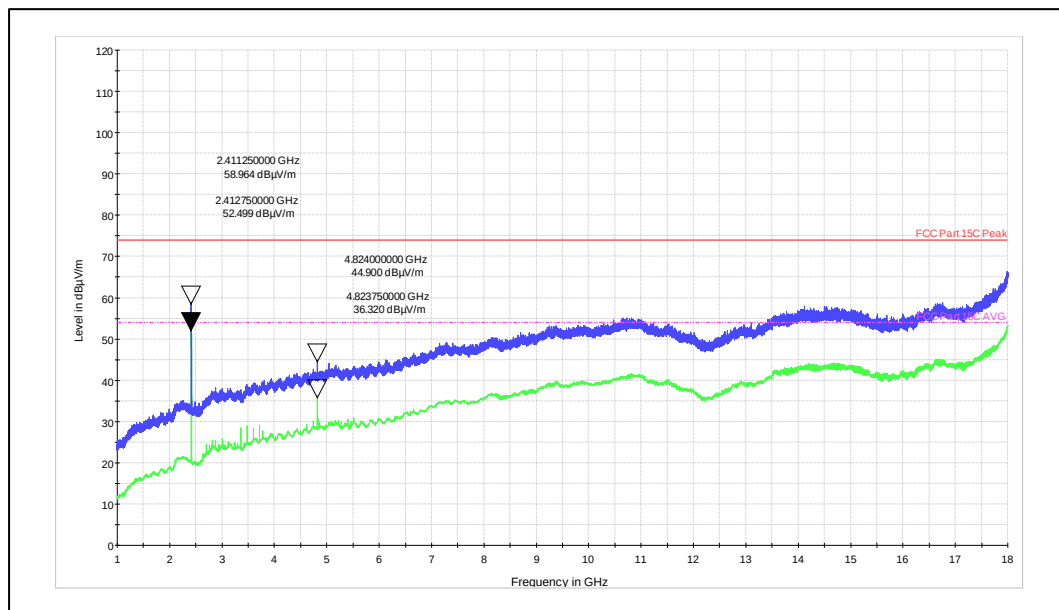
Channel Frequency: 2412MHz

Polarization: Horizontal



Frequency range: 1 – 18 GHz

Polarization: Vertical

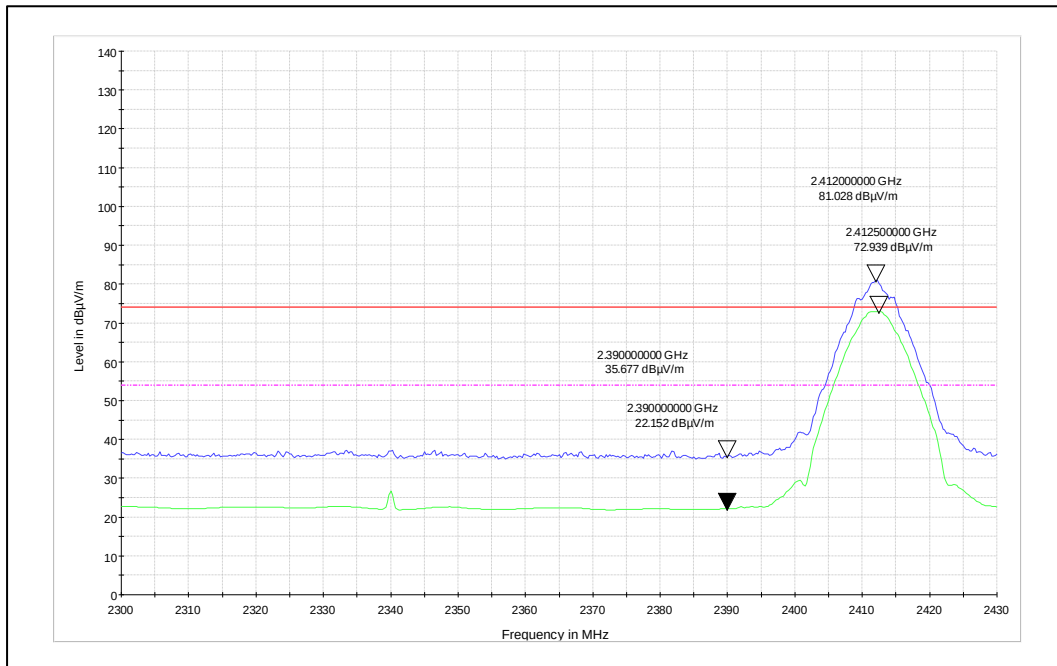


Frequency range: 1 – 18 GHz

Polarization: Horizontal

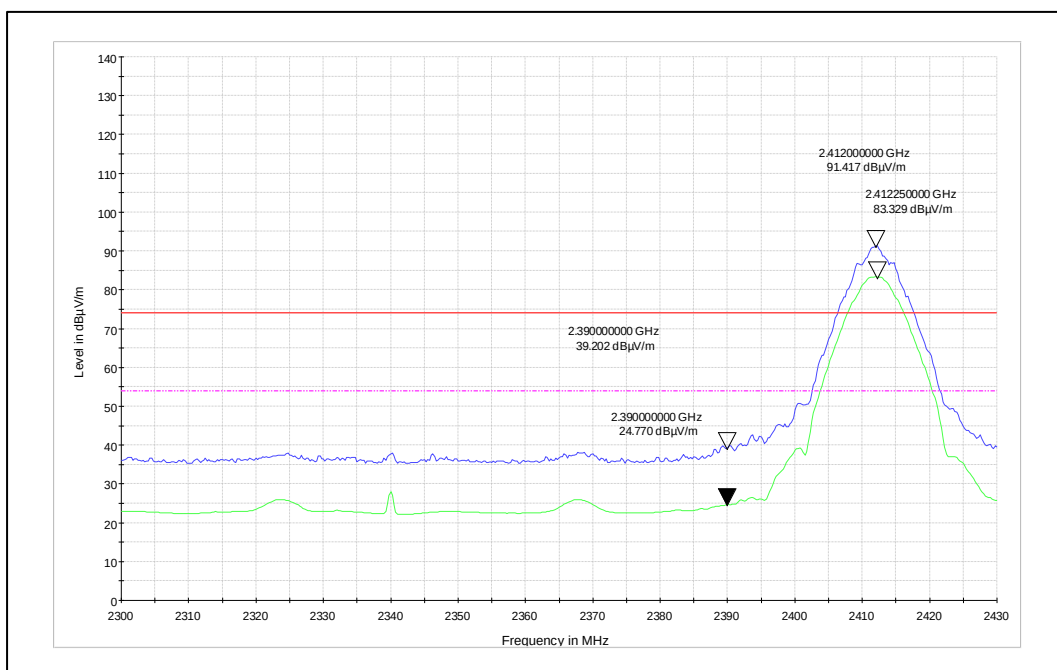
Data Rate: 5.5Mbps

Channel Frequency 2412MHz



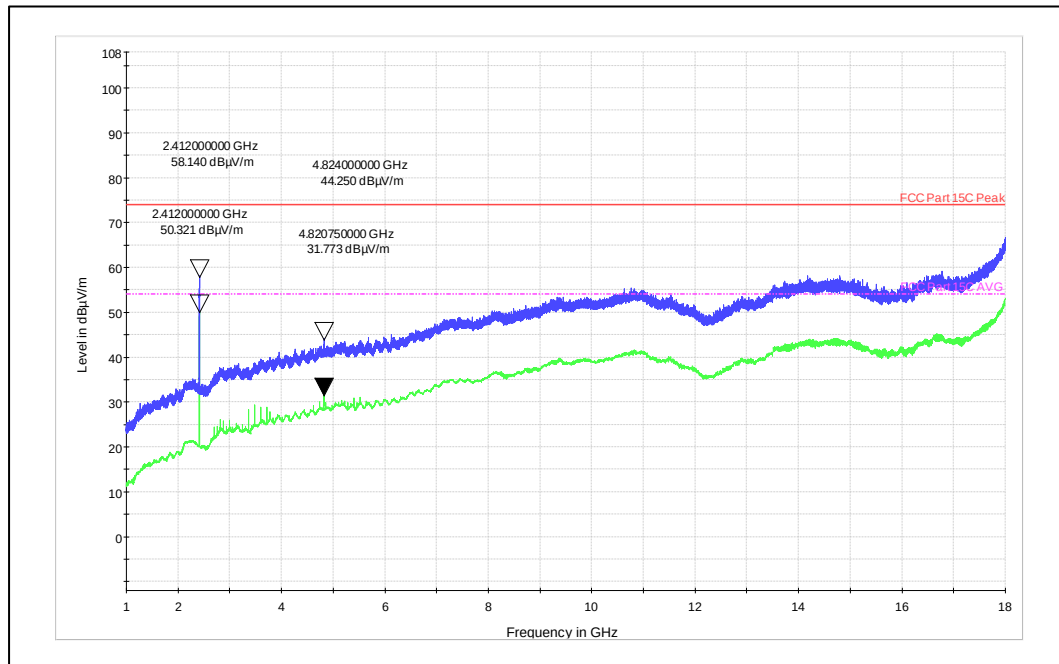
Channel Frequency: 2412MHz

Polarization: Vertical



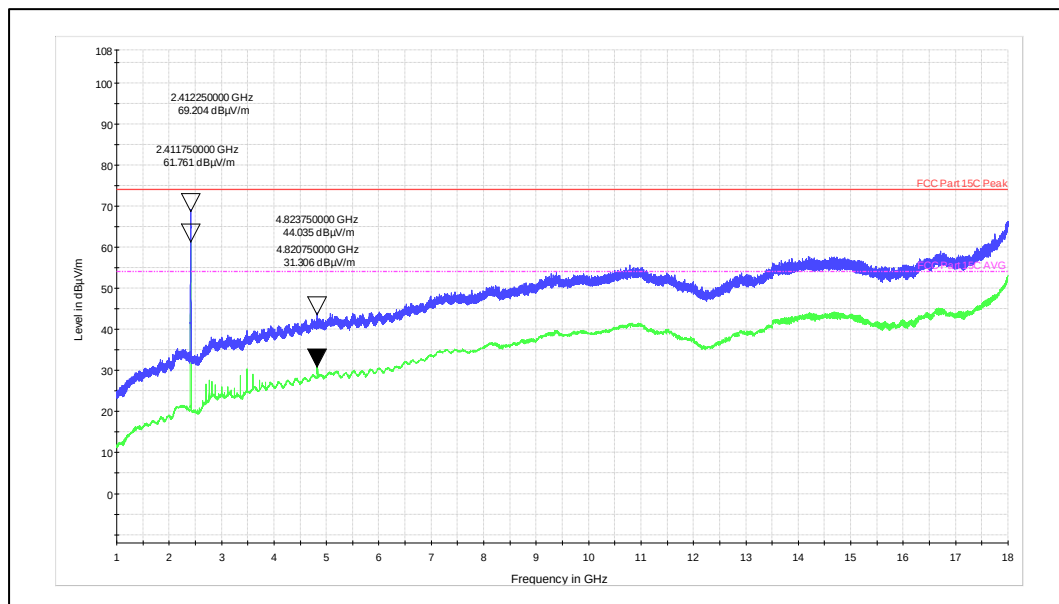
Channel Frequency: 2412MHz

Polarization: Horizontal



Frequency range: 1 – 18 GHz

Polarization: Vertical

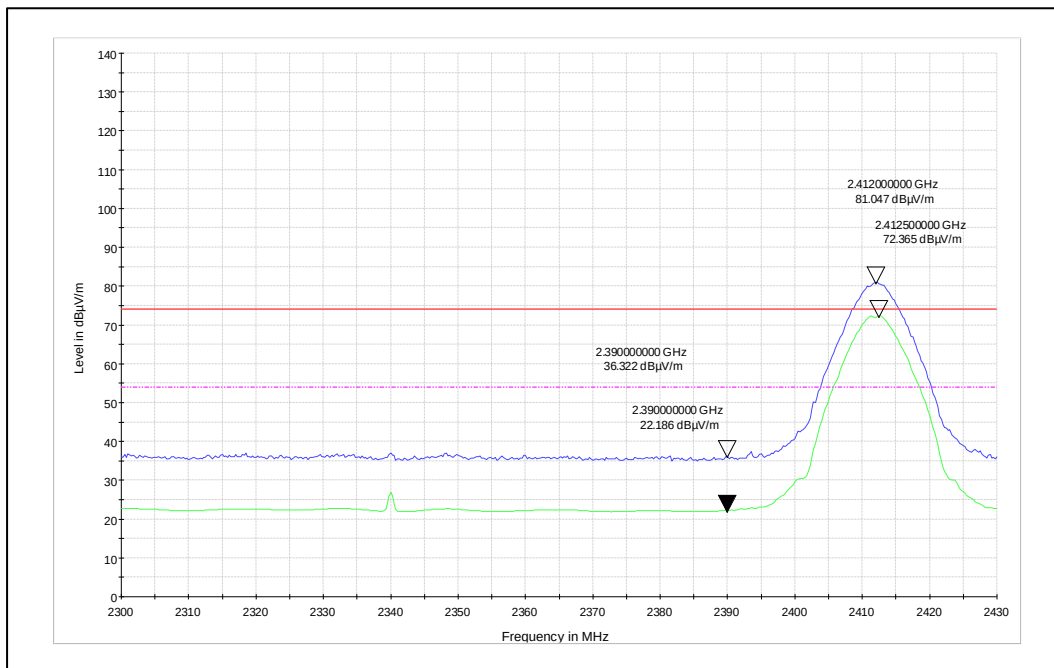


Frequency range: 1 – 18 GHz

Polarization: Horizontal

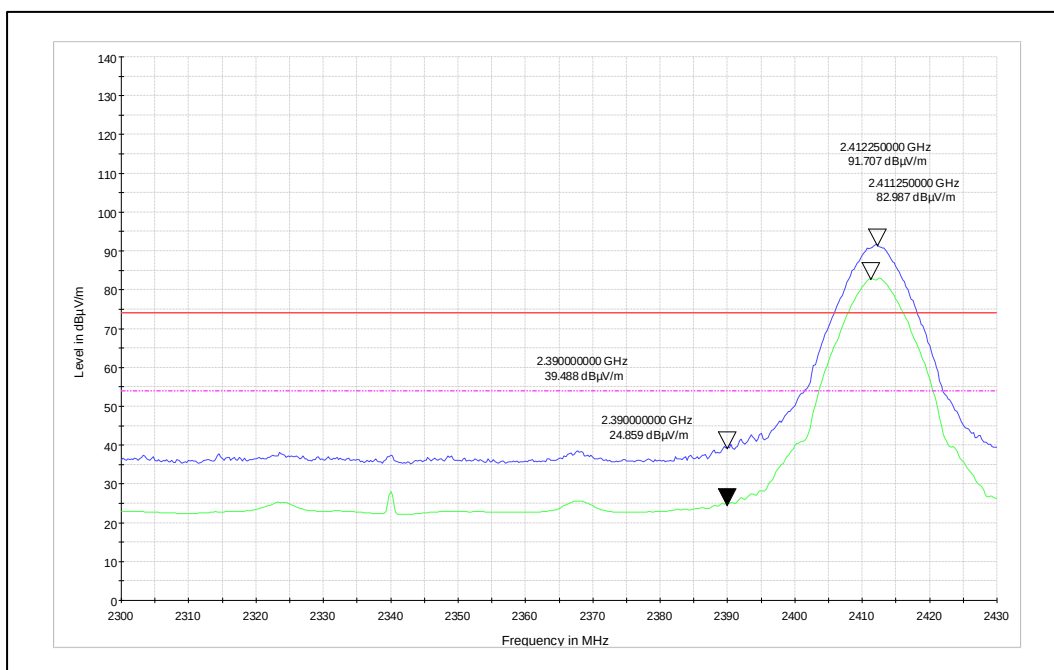
Data Rate: 11Mbps

Channel Frequency 2412MHz



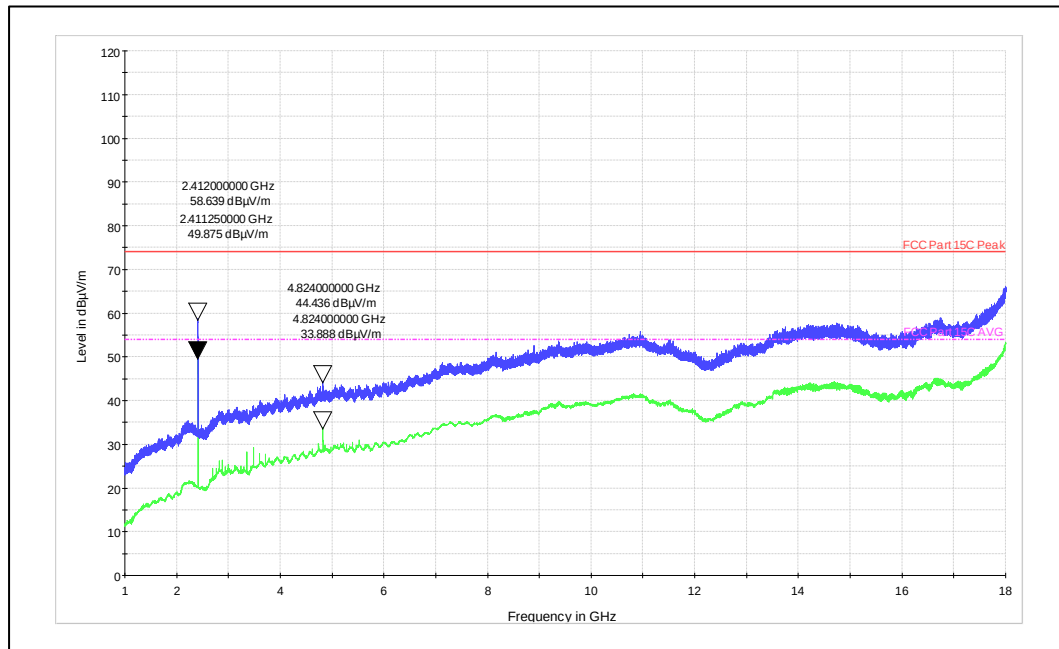
Channel Frequency: 2412MHz

Polarization: Vertical



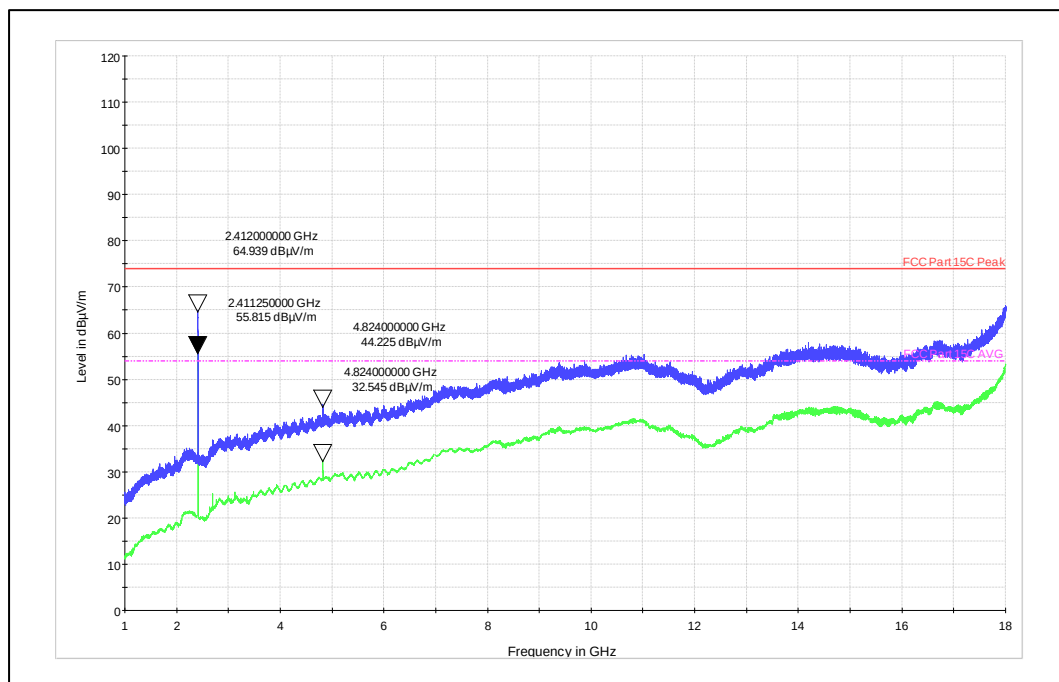
Channel Frequency: 2412MHz

Polarization: Horizontal



Frequency range: 1 – 18 GHz

Polarization: Vertical



Frequency range: 1 – 18 GHz

Polarization: Horizontal

No emissions found above 18GHz

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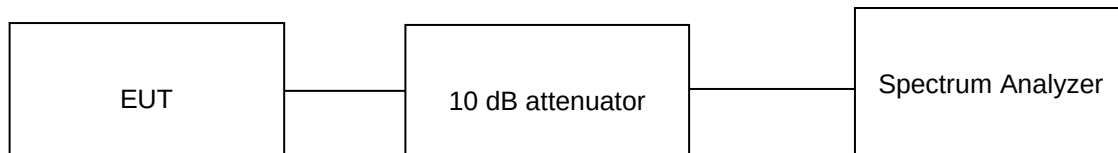
8 TEST RESULTS FOR BLUETOOTH LOW ENERGY

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 = 3.3V AC to DC Adaptor 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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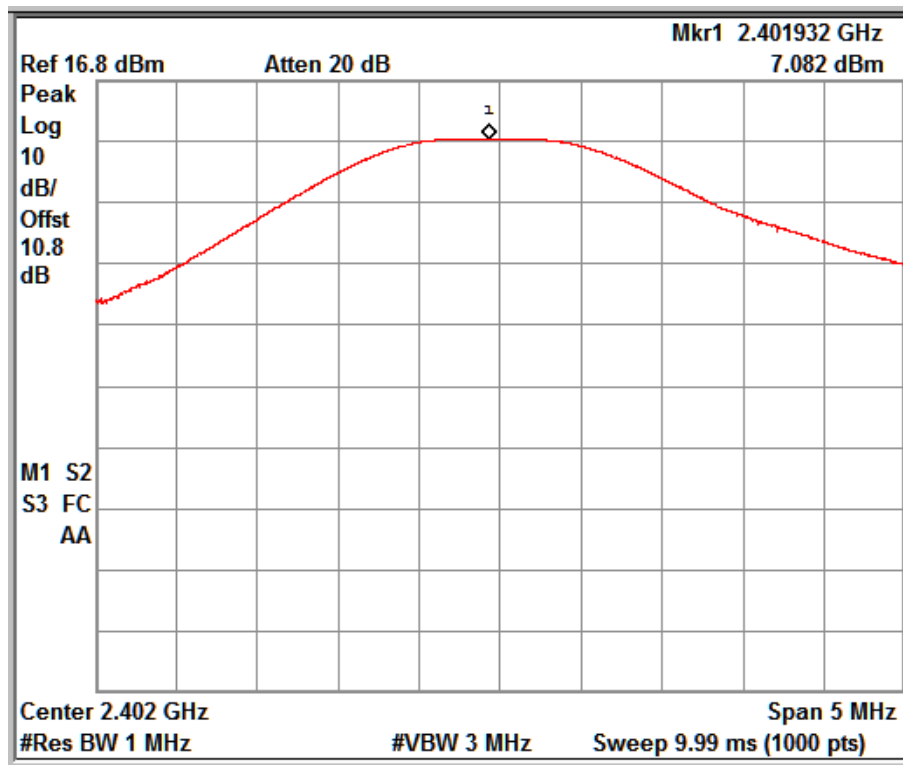
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Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.8dB)
3. Maximum (e.i.r.p) = Maximum Peak output power (dBm) + antenna gain (3.6 dBi)

Data rate (Mbps)	Channel Frequency(MHz)	Measured Peak Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
1	2402	7.08	10.68	30	36
	2440	6.96	10.56	30	36
	2480	6.68	10.28	30	36

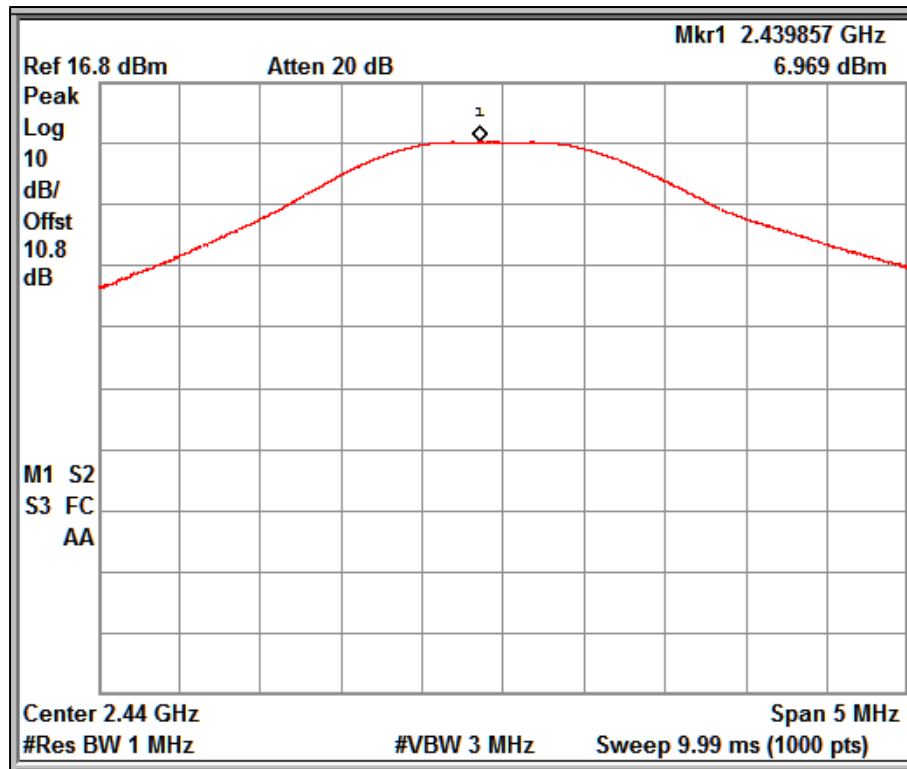


Channel Frequency: 2402MHz

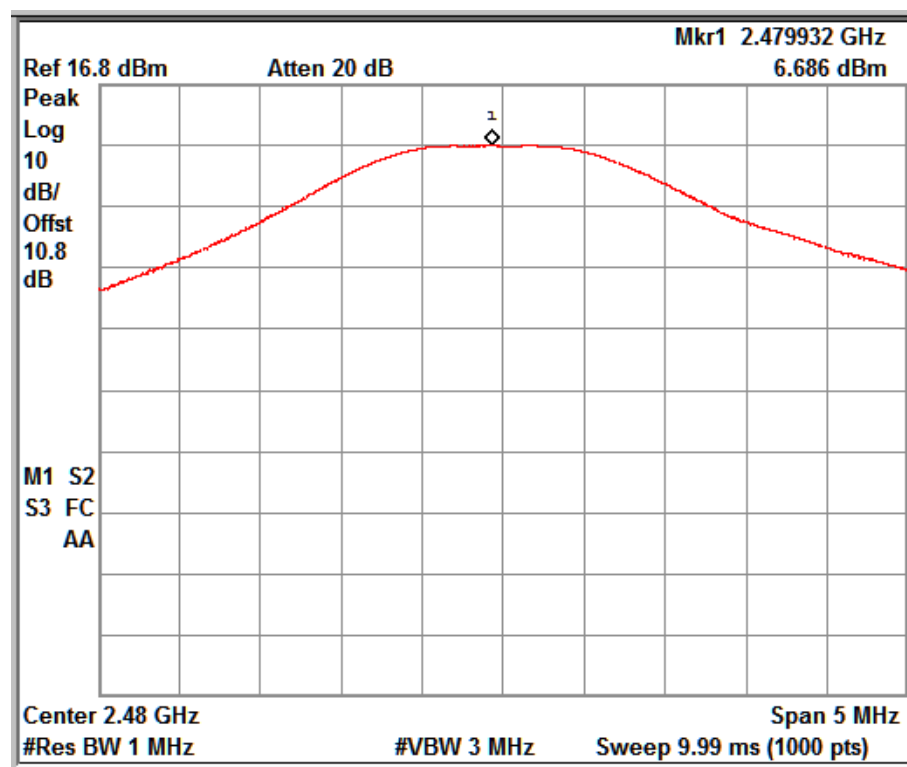
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Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

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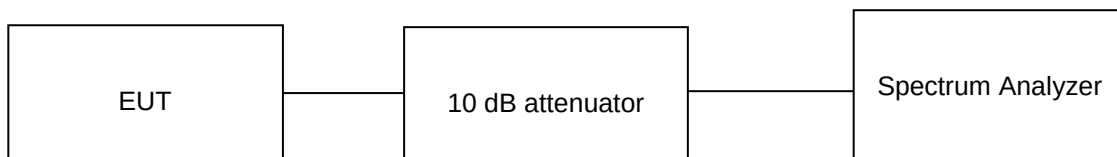
8.2 Maximum Power Spectral Density

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 = 3.3V AC to DC Adaptor 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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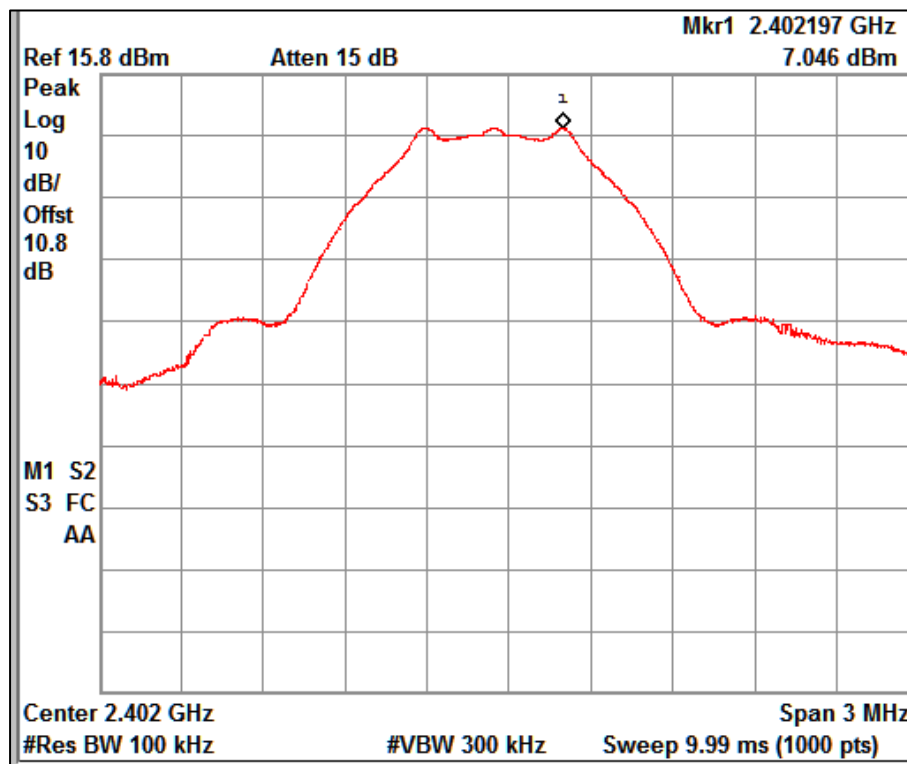
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Test results:

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 (0.8dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 3.6 dBi

Data rate (Mbps)	Channel Frequency(MHz)	Measured peak PSD (dBm/100kHz)	PSD Limit (dBm/100kHz)
1	2402	7.04	8
	2440	6.80	8
	2480	6.63	8

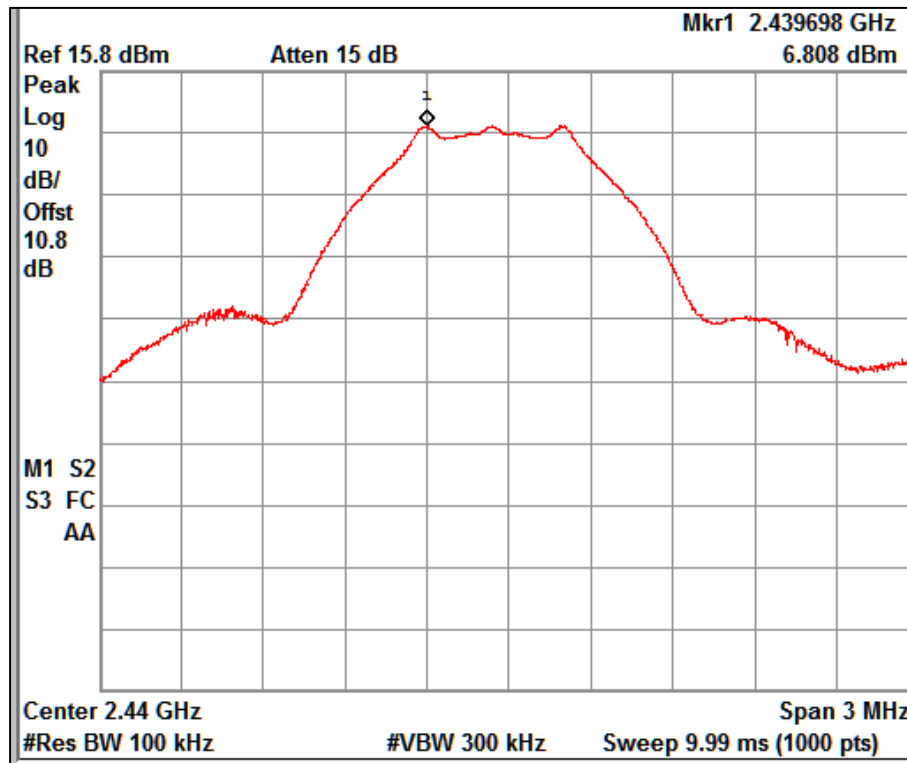


Channel Frequency: 2402MHz

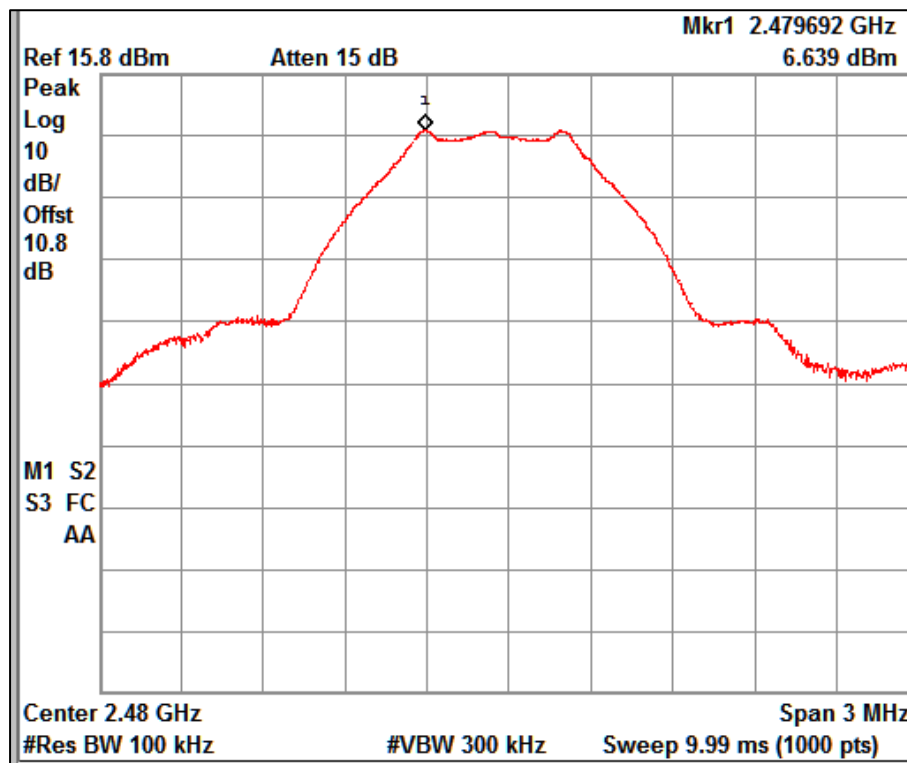
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Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

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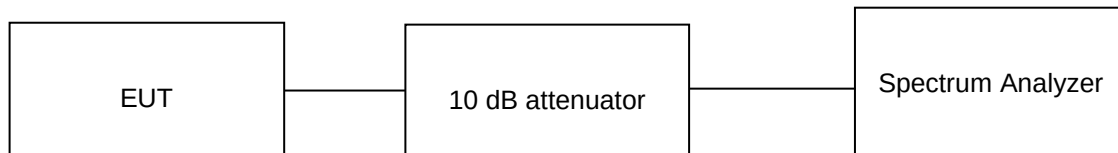
8.3 DTS Bandwidth & 99% Bandwidth

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 = 3.3V AC to DC Adaptor 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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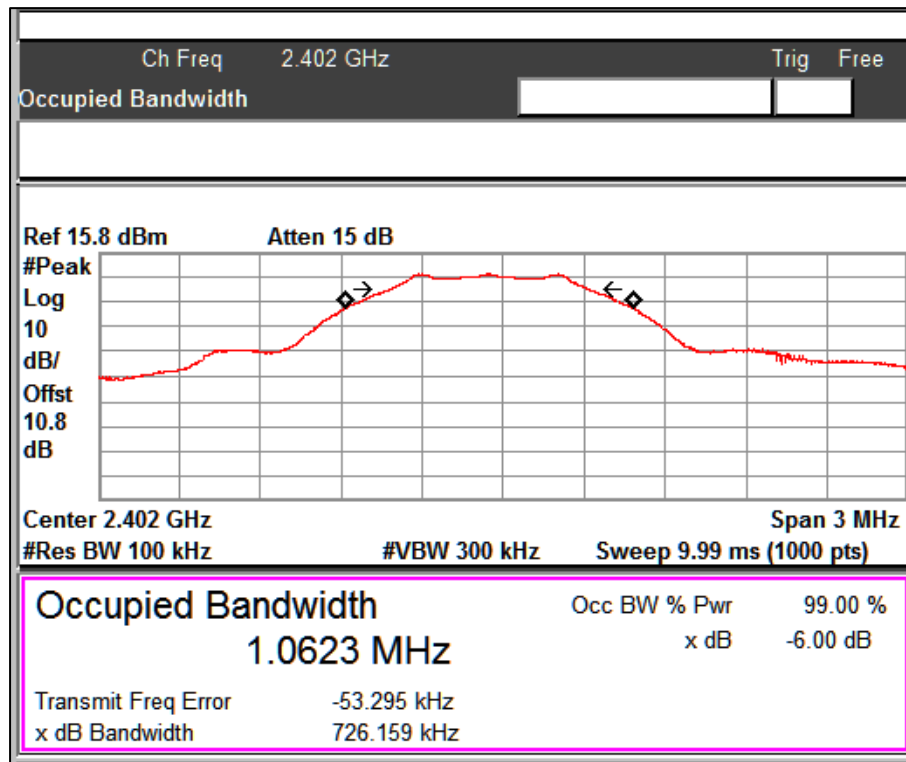
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Test results:

Note:

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

Channel Frequency (MHz)	6 dB Bandwidth (kHz)	99% OBW (MHz)
2402	726.15	1.06
2440	726.53	1.06
2480	739.93	1.06

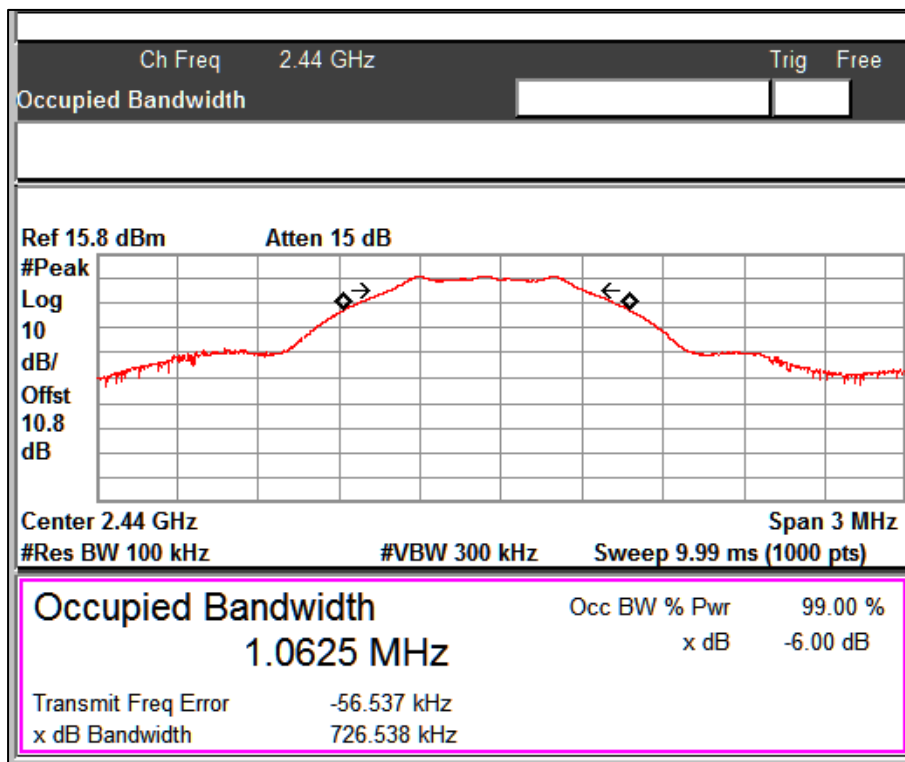


Channel Frequency: 2402MHz

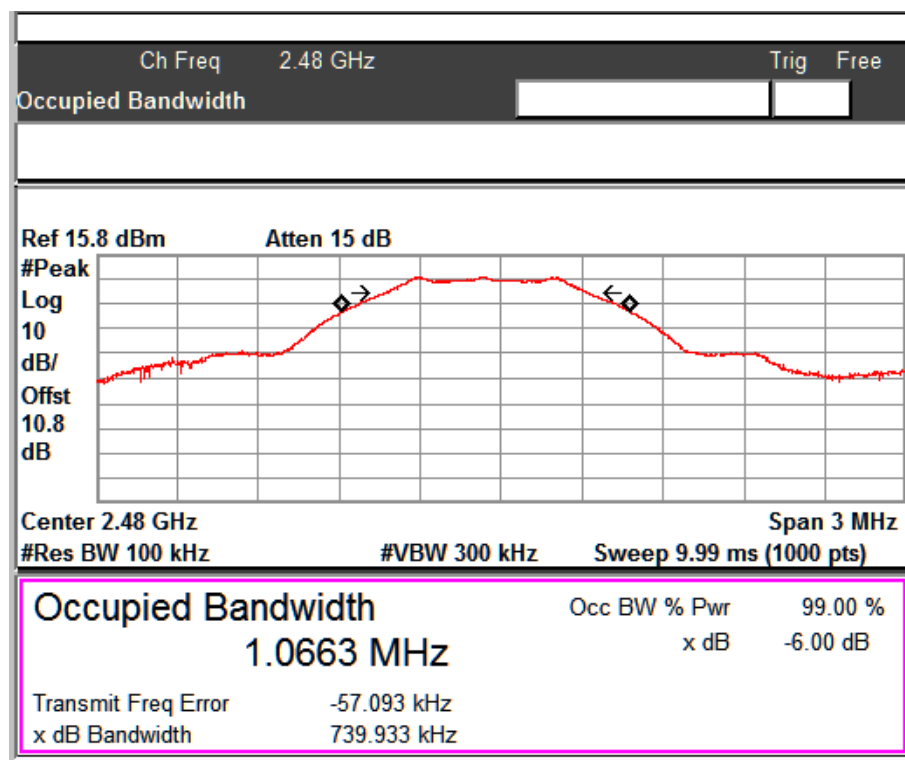
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Channel Frequency: 2440MHz



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

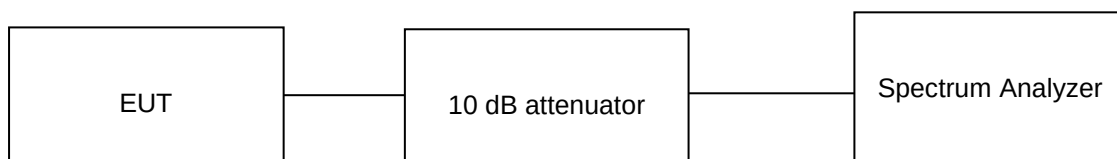
Port of testing Antenna port

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 = 3.3V AC to DC Adaptor

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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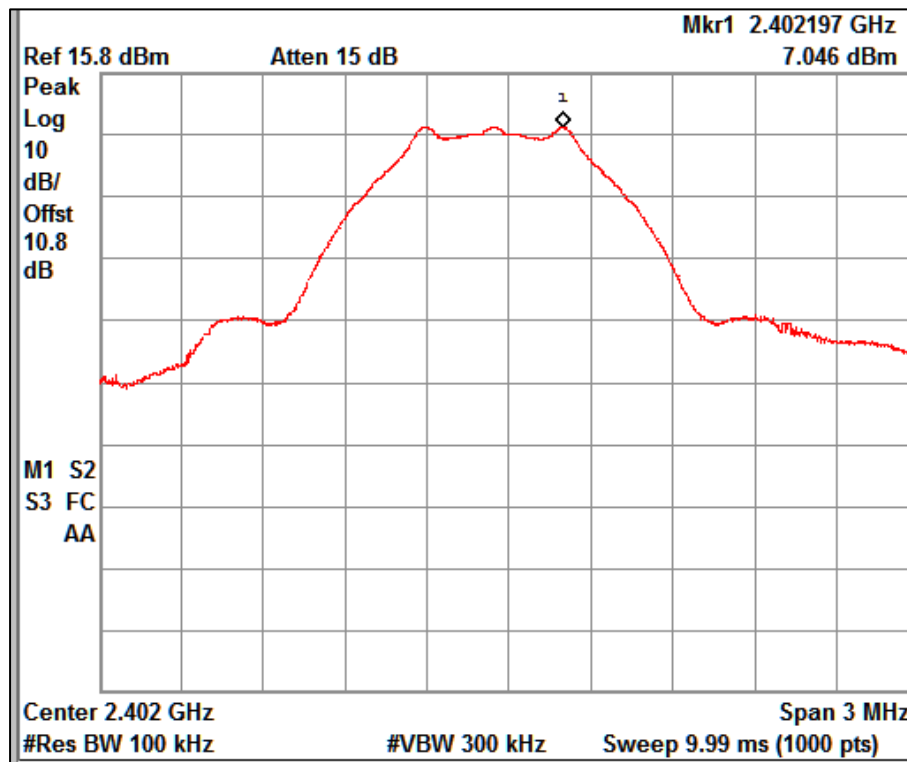
Test results:

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 (0.8dB)
3. This product do not support additional beamforming gain / directional gain, it uses signal antenna and hence directional gain of the single antenna is 3.6 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	2400.00	-34.13	7.04	-41.17	-20
2480	2483.50	-36.32	6.63	-42.95	-20

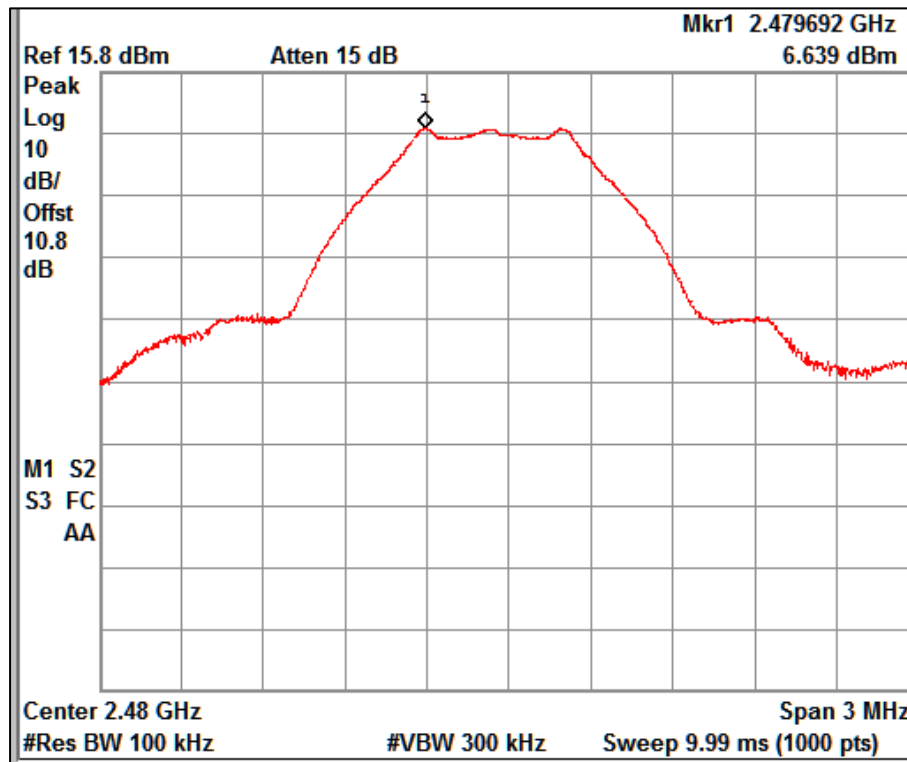


Reference Plot for Channel Frequency 2402MHz

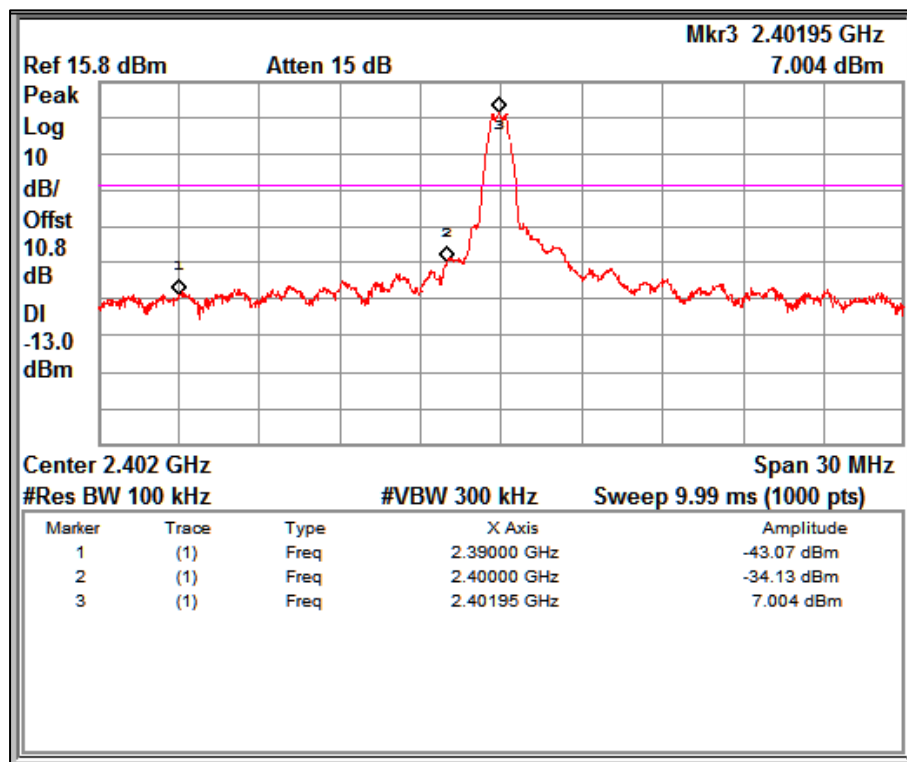
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Reference Plot for Channel Frequency 2480MHz

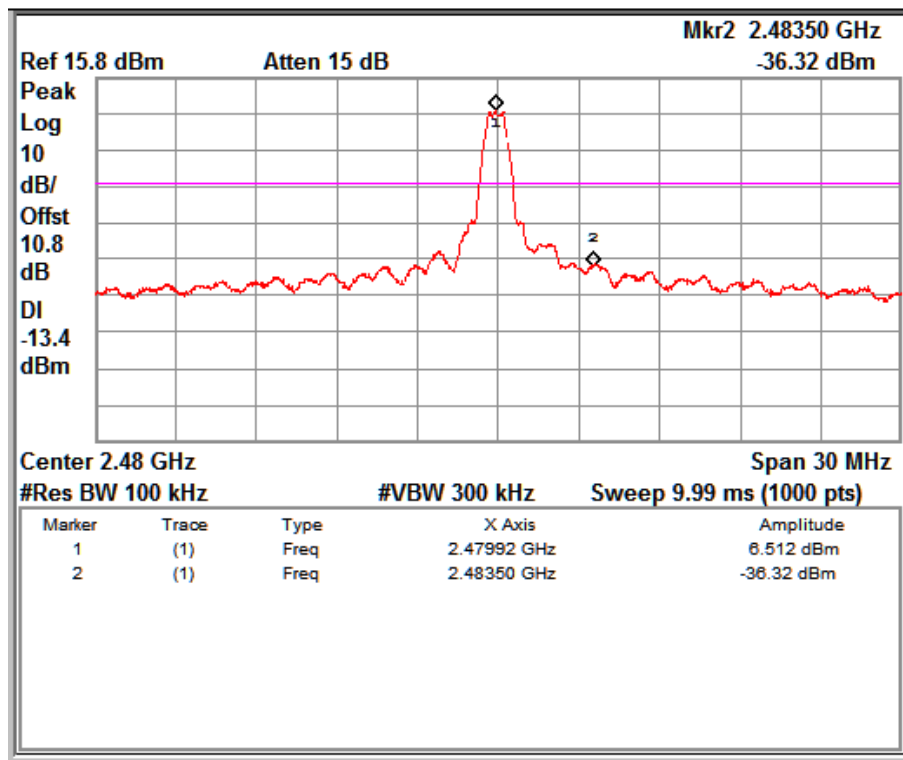


Channel Frequency: 2402MHz

Prüfbericht - Nr.:
Test Report No.:

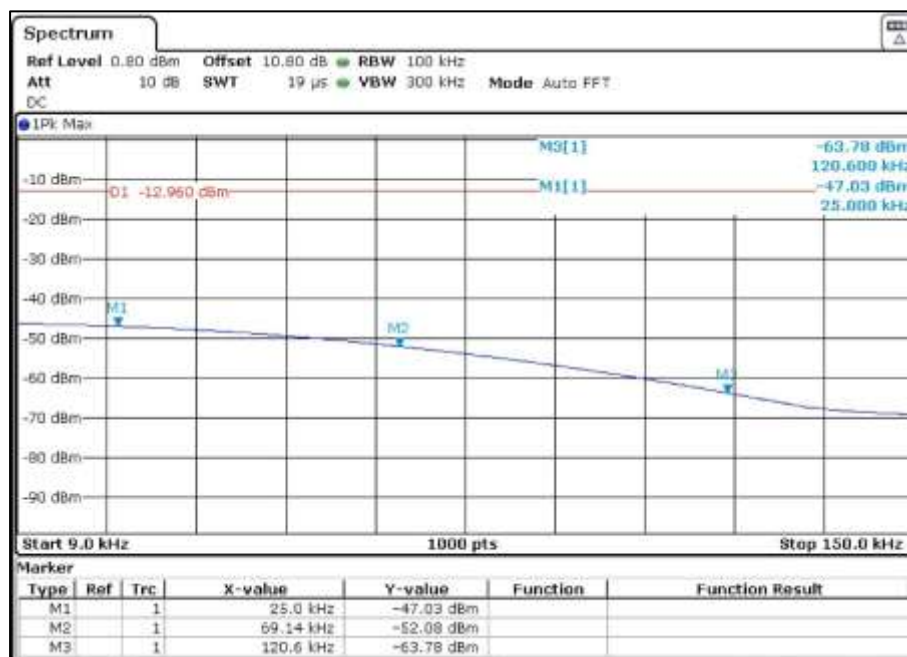
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Channel Frequency: 2480MHz

8.4.2 Out-Of-Band Emissions



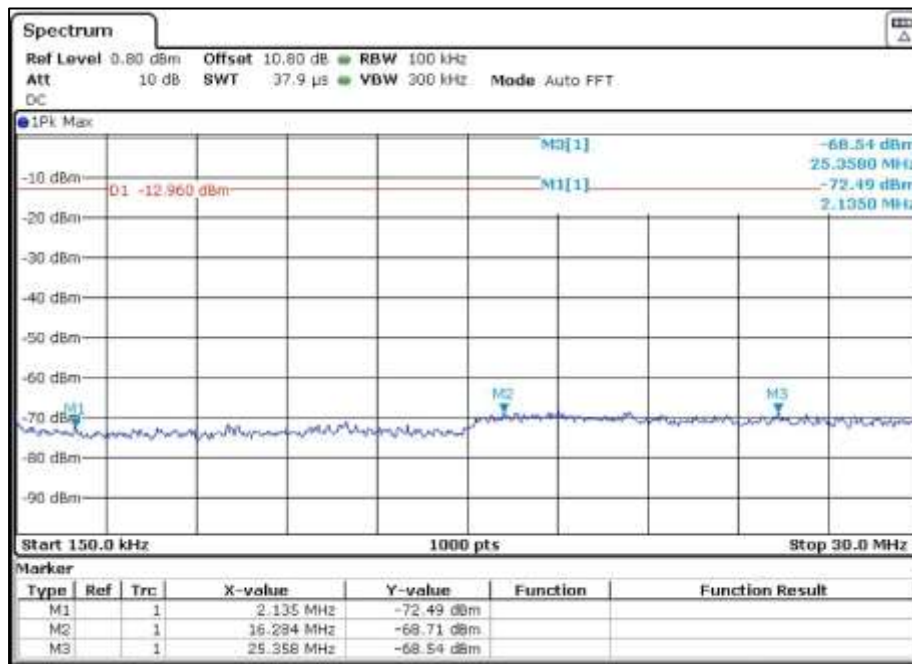
Channel Frequency 2402MHz

Frequency Range 9 kHz – 150 kHz

Prüfbericht - Nr.:
Test Report No.:

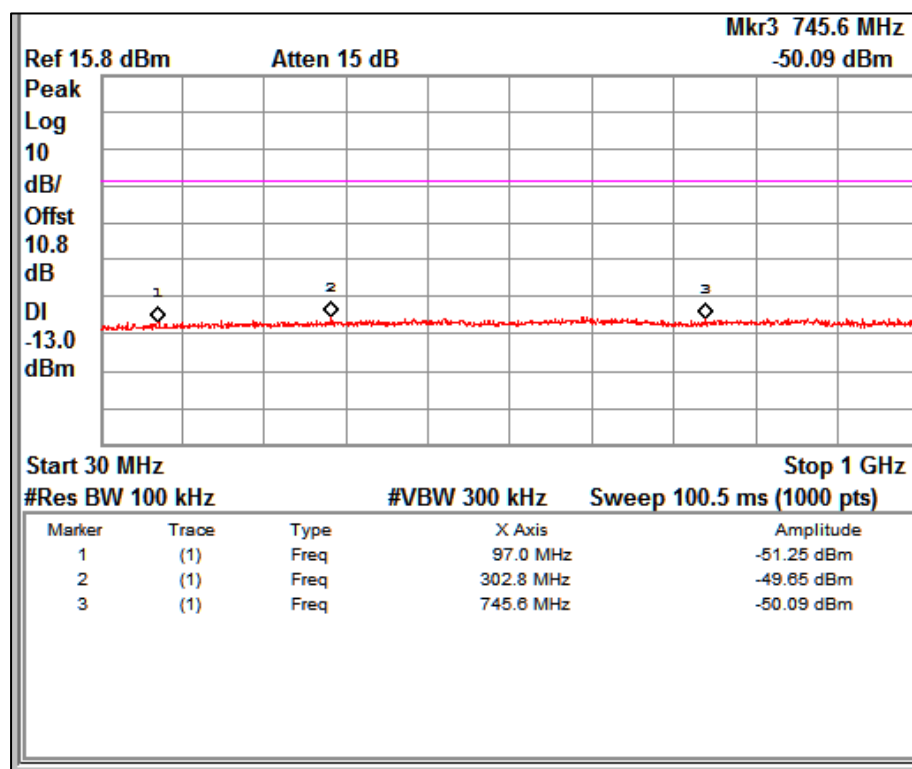
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Channel Frequency 2402MHz

Frequency Range 150 kHz – 30 MHz



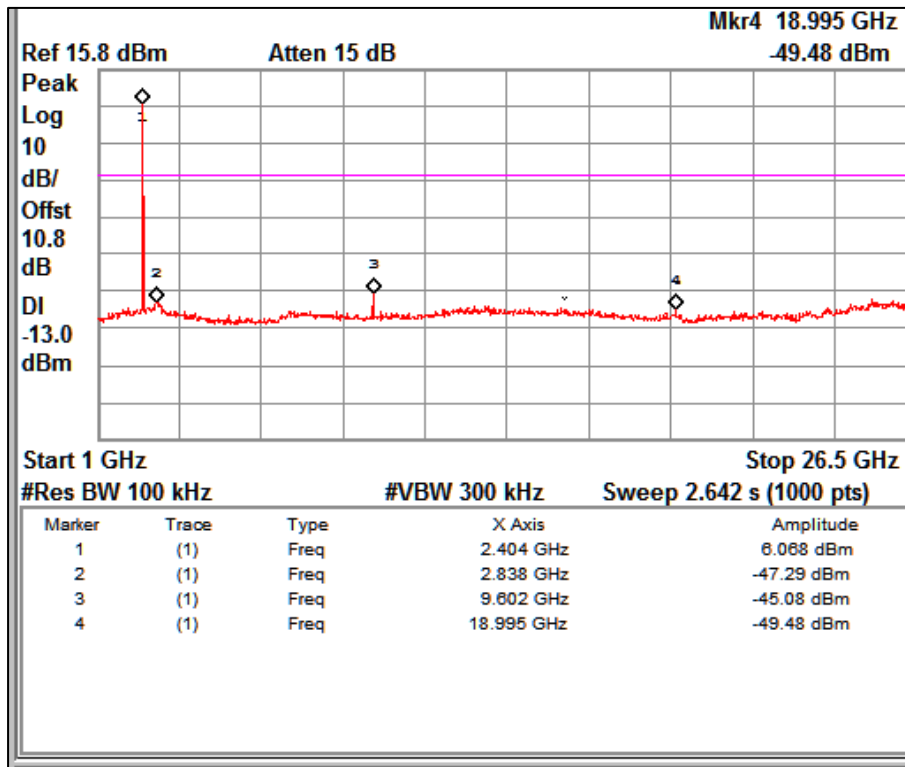
Channel Frequency 2402MHz

Frequency Range 30 MHz – 1GHz

Prüfbericht - Nr.:
Test Report No.:

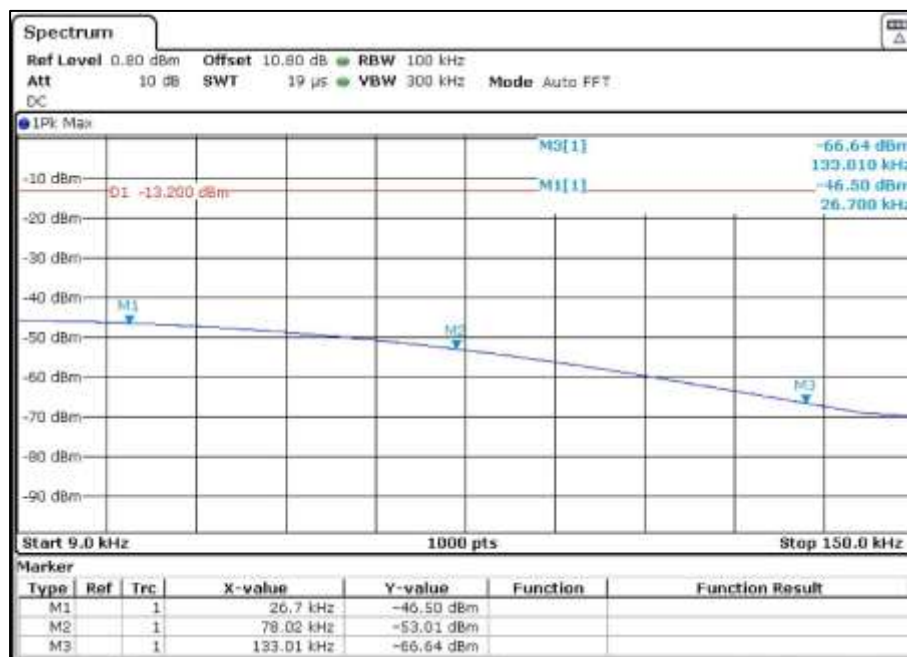
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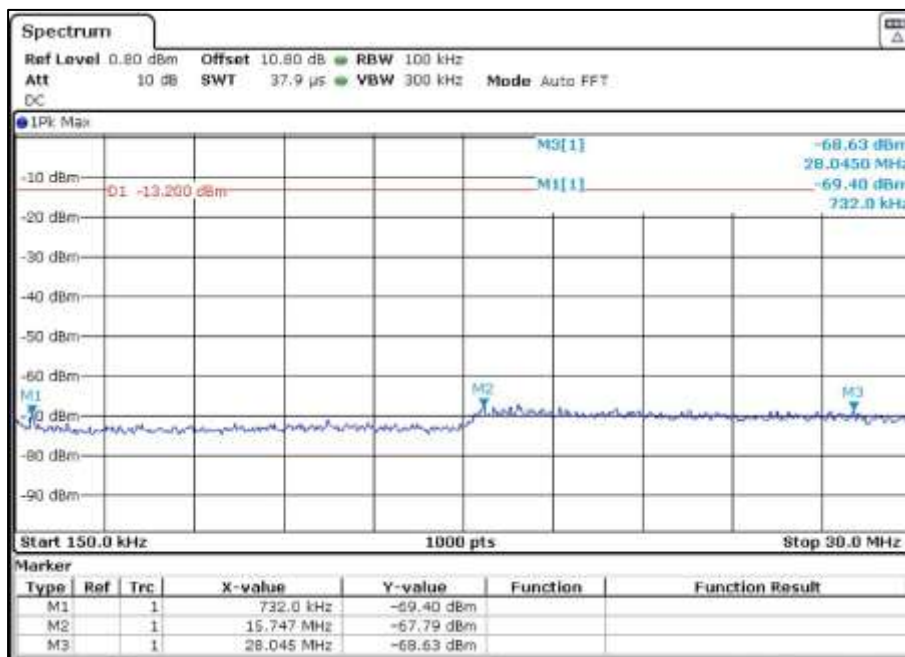
Channel Frequency 2402MHz

Frequency Range 1 GHz – 26.5GHz



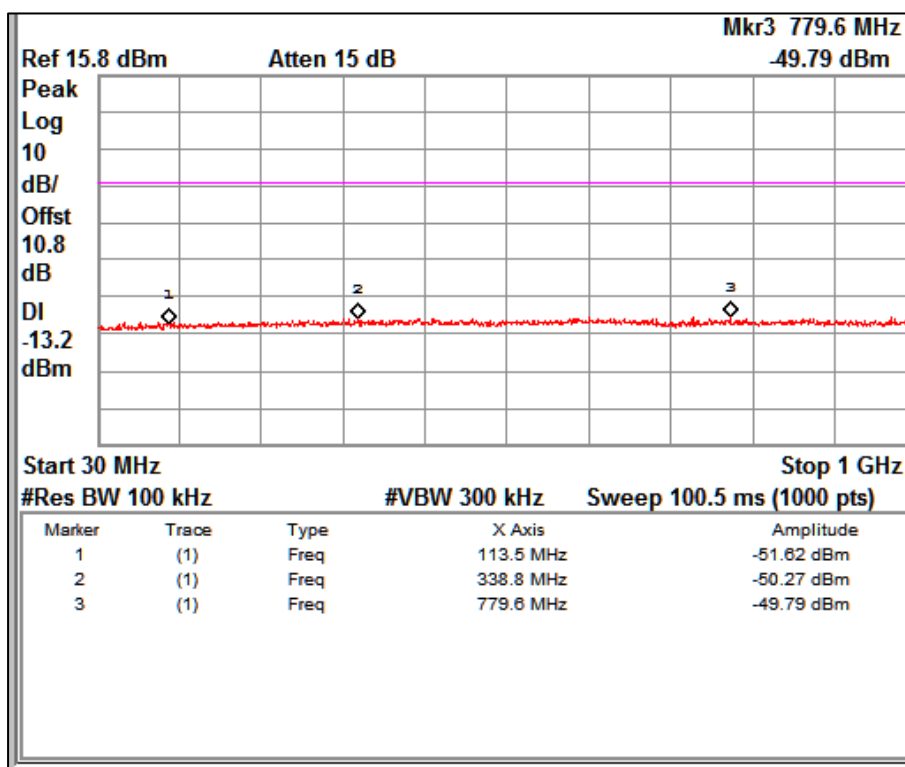
Channel Frequency 2440MHz

Frequency Range 9 kHz – 150 kHz



Channel Frequency 2440MHz

Frequency Range 150 kHz – 30 MHz



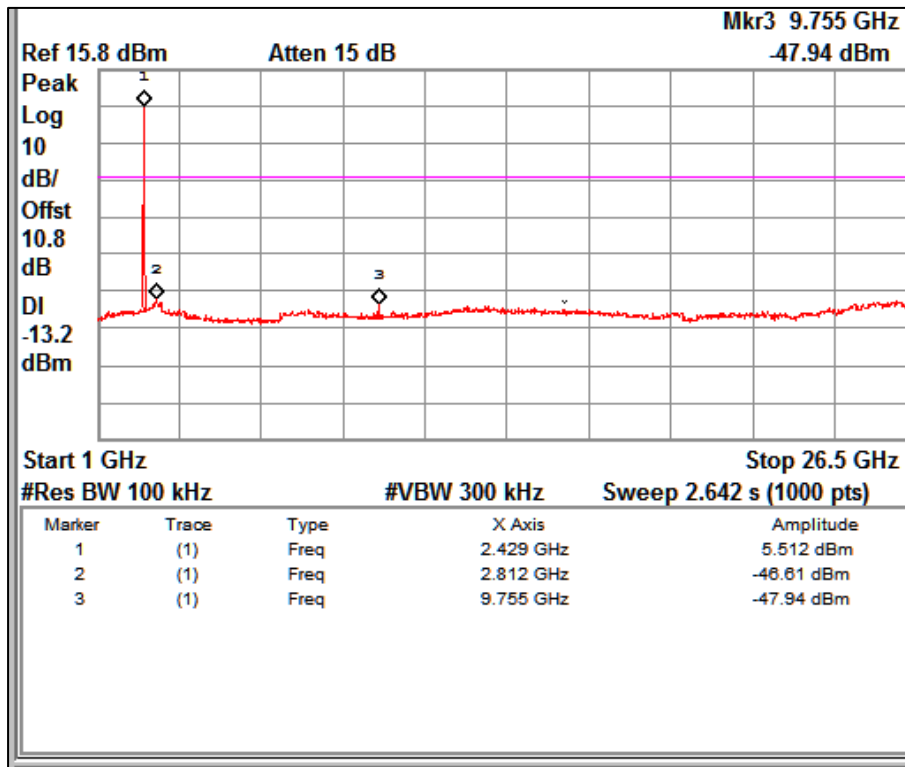
Channel Frequency 2440MHz

Frequency Range 30 MHz – 1GHz

Prüfbericht - Nr.:
Test Report No.:

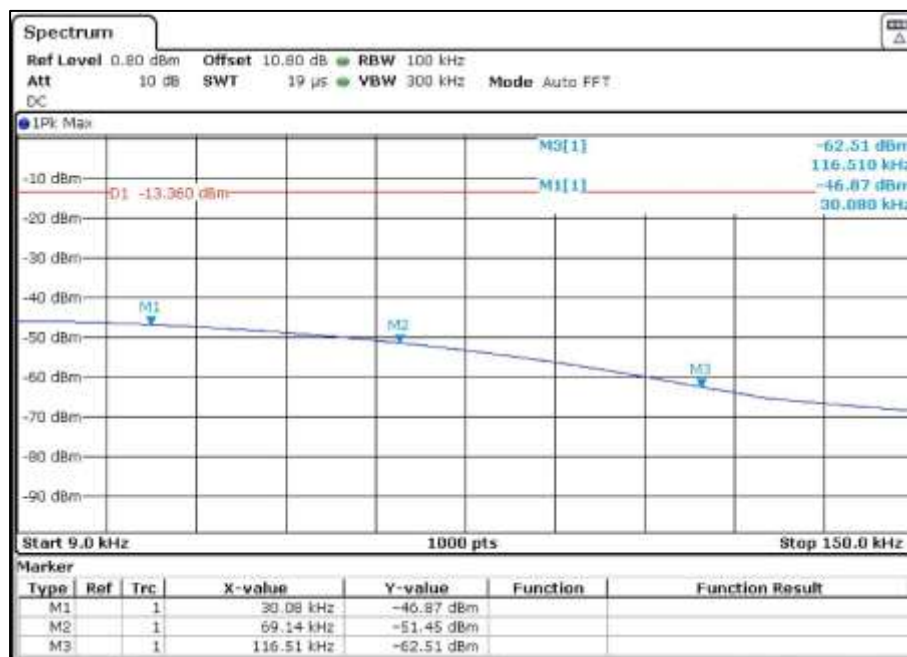
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Channel Frequency 2440MHz

Frequency Range 1 GHz – 26.5GHz



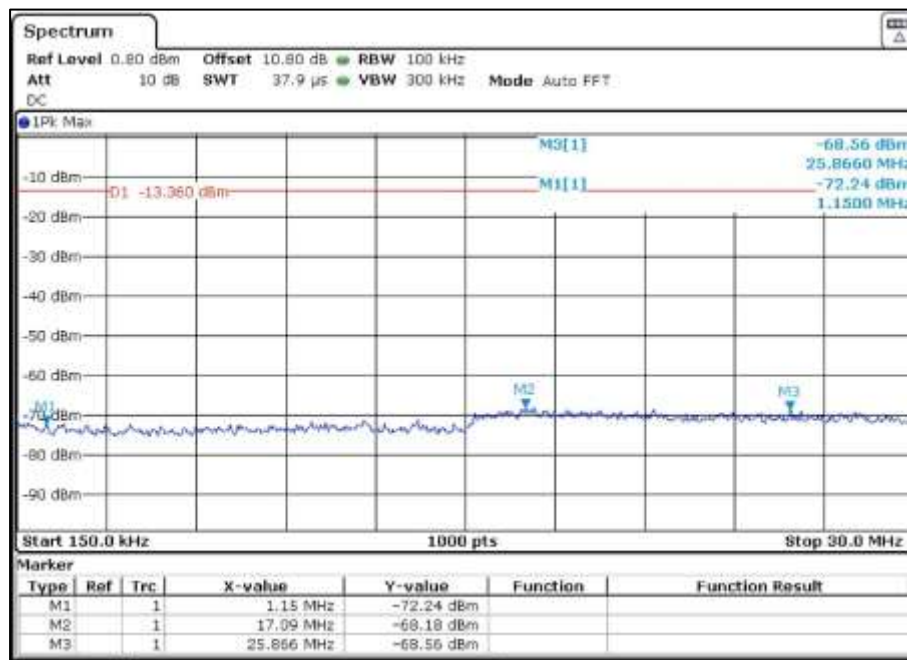
Channel Frequency 2480MHz

Frequency Range 9 kHz – 150 kHz

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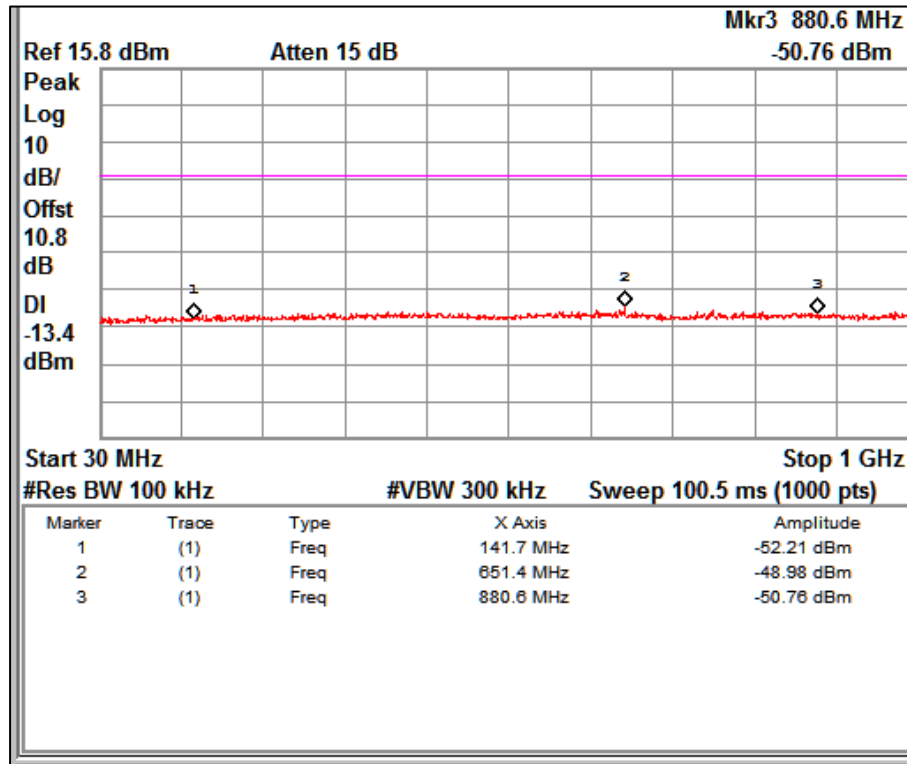
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Channel Frequency 2480MHz

Frequency Range 150 kHz – 30 MHz



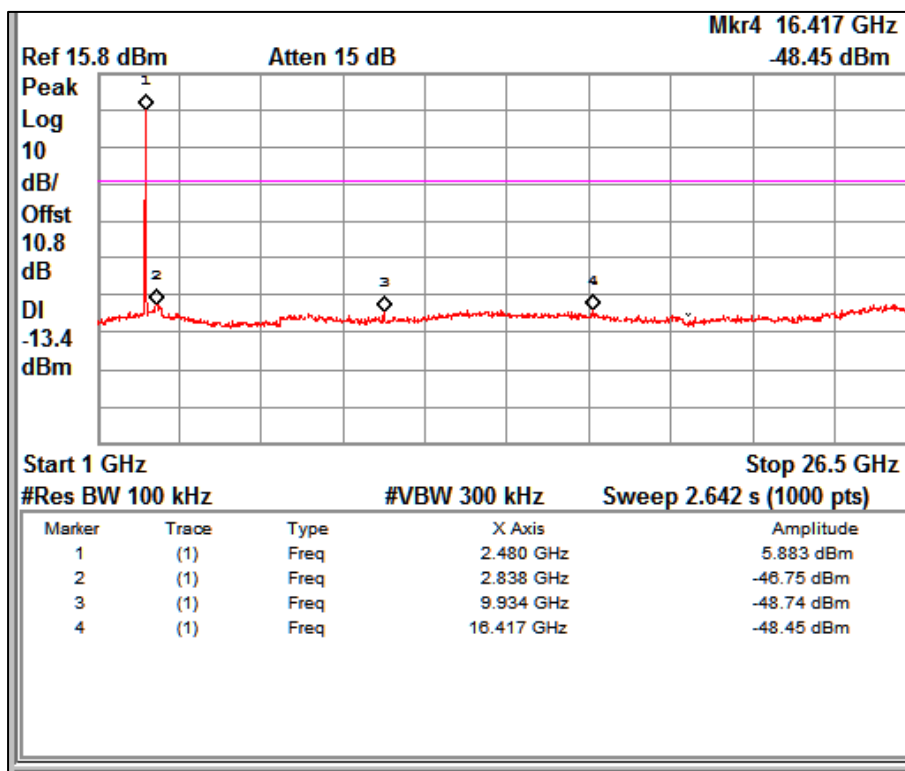
Channel Frequency 2480MHz

Frequency Range 30 MHz – 1GHz

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Channel Frequency 2480MHz

Frequency Range 1 GHz – 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) / (15.209 & 15.205)
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 = 3.3V AC to DC Adaptor 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

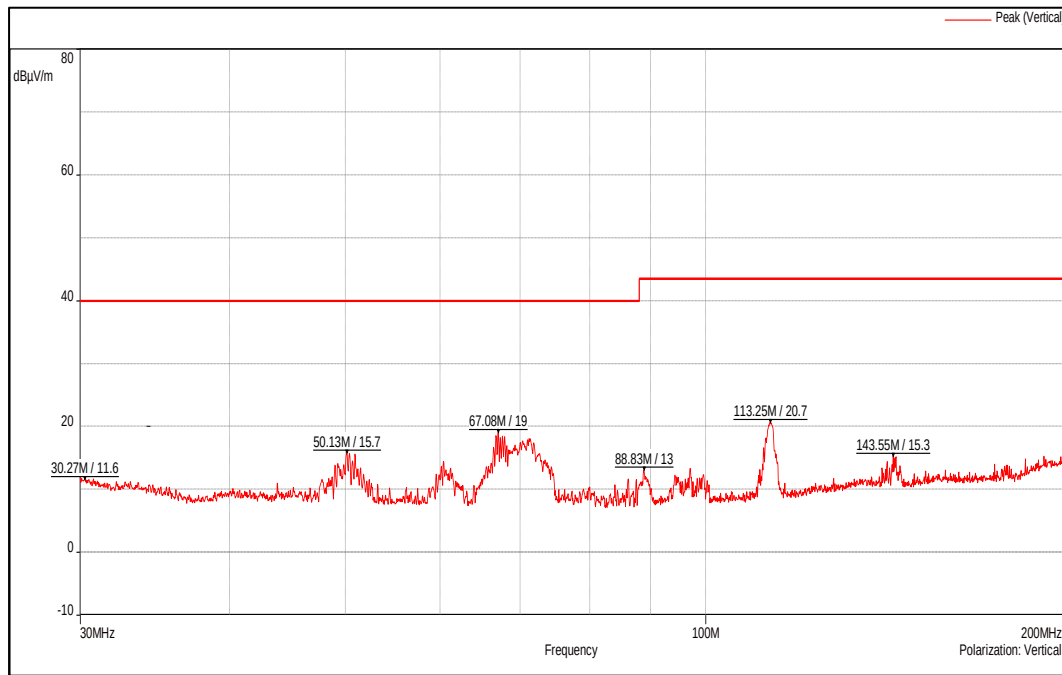
Test results for frequency range 30MHz – 1GHz

Antenna Polarization	Measured Frequency (MHz)	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	30.27	11.60	40.00	-28.40
	50.13	15.70	40.00	-24.30
	67.08	19.00	40.00	-21.00
	88.83	13.00	43.50	-30.50
	113.25	20.70	43.50	-22.80
	143.55	15.30	43.50	-28.20
	260.87	14.30	46.00	-31.70
	327.41	16.60	46.00	-29.40
	436.85	19.20	46.00	-26.80
	605.30	23.60	46.00	-22.40
	773.51	26.10	46.00	-19.90
	965.21	31.20	46.00	-14.80
Horizontal	54.54	11.80	40.00	-28.20
	78.03	23.30	40.00	-16.70
	90.36	15.70	43.50	-27.80
	113.01	21.70	43.50	-21.80
	171.57	24.70	43.50	-18.80
	195.36	18.70	43.50	-24.80
	260.06	14.10	46.00	-31.90
	355.31	17.90	46.00	-28.10
	443.48	19.90	46.00	-26.10
	612.74	24.10	46.00	-21.90
	768.98	25.20	46.00	-20.80
	924.41	28.60	46.00	-17.40

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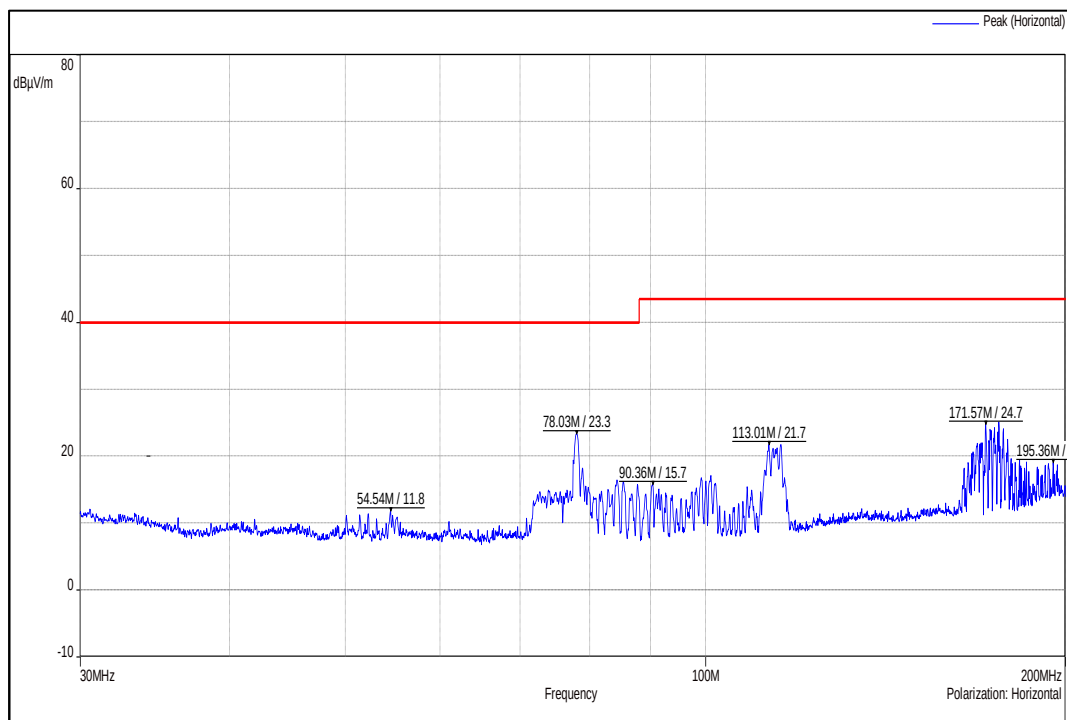
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Channel Frequency 30MHz – 200MHz

Polarization Vertical



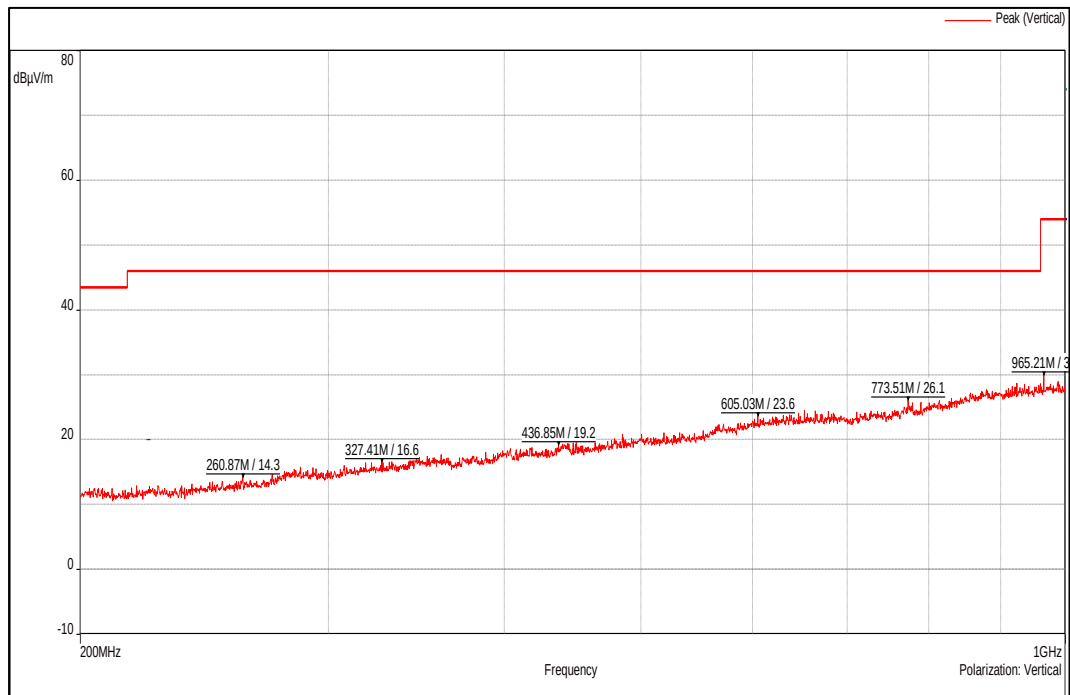
Channel Frequency 30MHz – 200MHz

Polarization Horizontal

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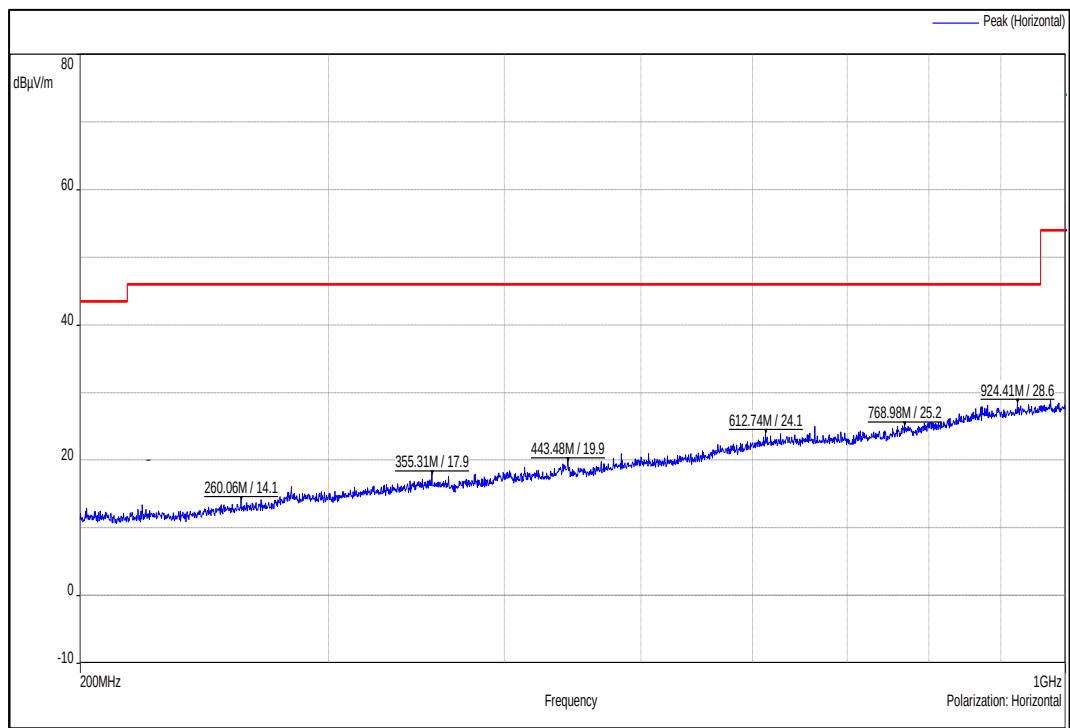
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Channel Frequency 200MHz – 1GHz

Polarization Vertical



Channel Frequency 200MHz – 1GHz

Polarization Horizontal

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Test results for the frequencies above 1GHz

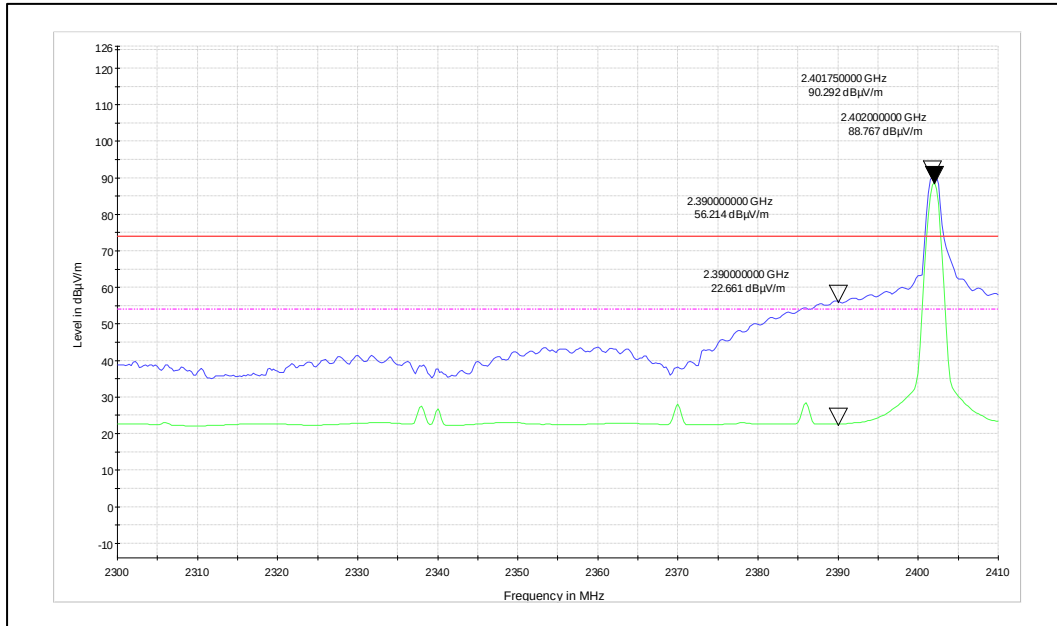
Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	2402(Pk)	Vertical	90.29	*	-
	2402(Av)		88.76	*	-
	2390(Pk)		56.21	74	-17.79
	2390(Av)		22.66	54	-31.34
	4804(Pk)		41.04	74	-32.96
	4804(Av)		28.94	54	-25.06
	7206(Pk)		46.52	74	-27.48
	7206(Av)		35.31	54	-18.69
	2402(Pk)	Horizontal	101.65	*	-
	2402(Av)		100.15	*	-
	2390(Pk)		66.97	74	-7.03
	2390(Av)		25.63	54	-28.37
	4804(Pk)		41.41	74	-32.59
	4804(Av)		28.72	54	-25.28
	7206(Pk)		46.07	74	-27.93
	7206(Av)		34.53	54	-19.47
2440	2440(Pk)	Vertical	90.46	*	-
	2440(Av)		88.95	*	-
	4880(Pk)		41.19	74	-32.81
	4880(Av)		29.49	54	-24.51
	7320(Pk)		47.87	74	-26.13
	7320(Av)		36.35	54	-17.65
	2440(Pk)	Horizontal	101.53	*	-
	2440(Av)		100.03	*	-
	4880(Pk)		41.77	74	-32.23
	4880(Av)		29.39	54	-24.61
	7320(Pk)		48.40	74	-25.60
	7320(Av)		34.80	54	-19.20
2480	2483.5(Pk)	Vertical	62.40	74	-11.60
	2483.5(Av)		29.19	54	-24.81
	2480(Pk)		89.97	*	-
	2480(Av)		88.45	*	-
	4960(Pk)		41.30	74	-32.70
	4960(Av)		29.26	54	-24.74
	7440(Pk)		50.43	74	-23.57
	7440(Av)		38.52	54	-15.48
	2483.5(Pk)	Horizontal	72.99	74	-1.01
	2483.5(Av)		38.89	54	-15.11
	2480(Pk)		100.54	*	-
	2480(Av)		99.05	*	-
	4960(Pk)		42.07	74	-31.93
	4960(Av)		30.45	54	-23.55
	7440(Pk)		47.28	74	-26.72
	7440(Av)		34.90	54	-19.10

*- : Indicate restricted band of operation §15.205

Pk: Peak Detector; Av: Average Detector

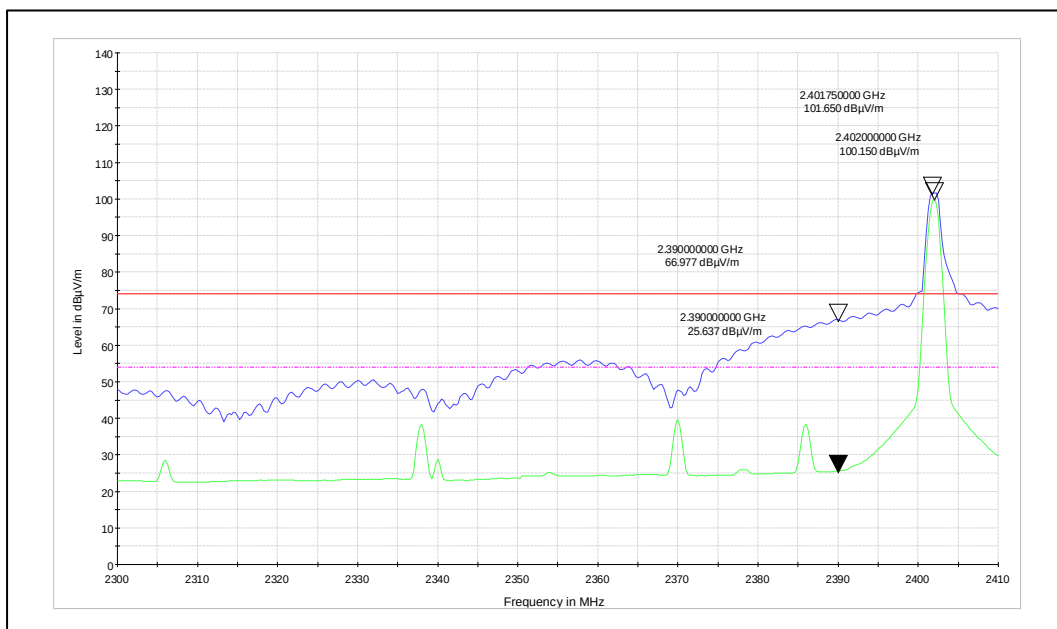
Worst case Plots

Channel Frequency 2402MHz



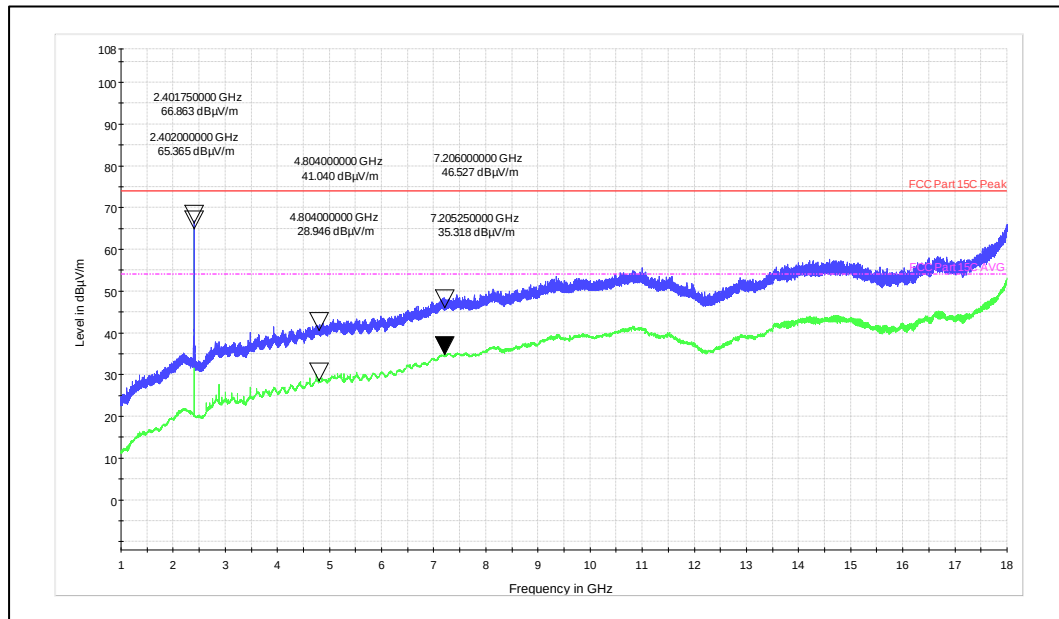
Channel Frequency: 2402MHz

Polarization: Vertical



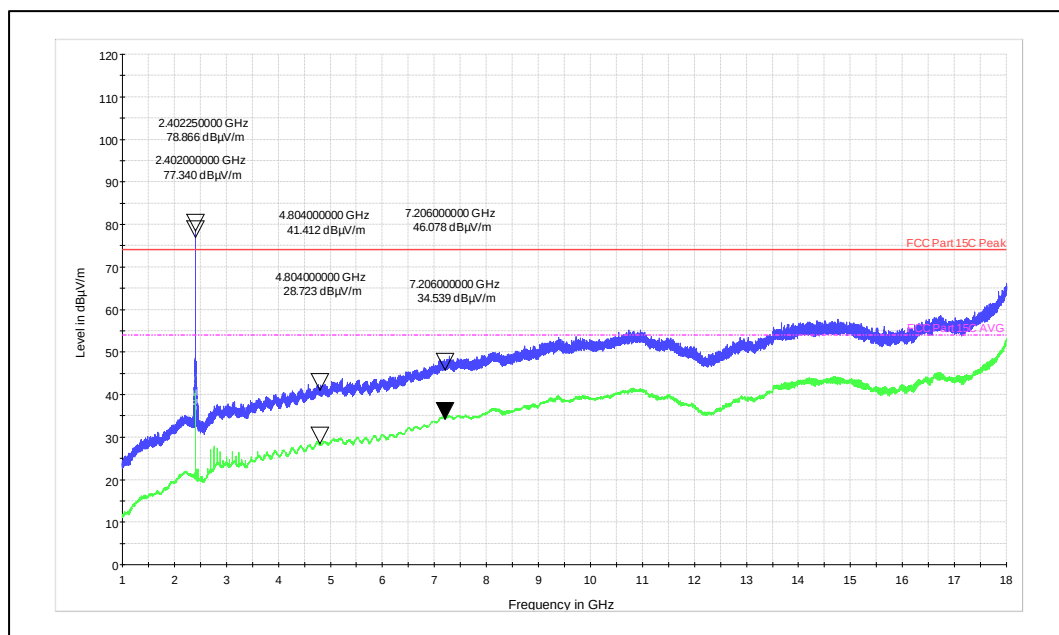
Channel Frequency: 2402MHz

Polarization: Horizontal



Frequency range: 1 – 18 GHz

Polarization: Vertical



Frequency range: 1 – 18 GHz

Polarization: Horizontal

No emissions found above 18GHz

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