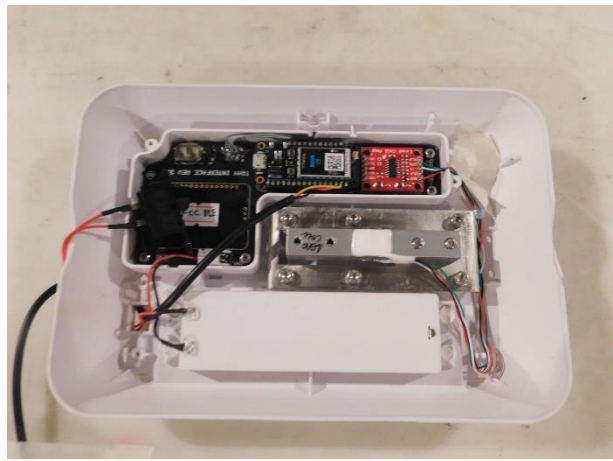


Prüfbericht-Nr.: <i>Test report no.:</i>	ULR-TC56882130000029F	Auftrags-Nr.: <i>Order no.:</i>	166542461 0010	Seite 1 von 61 Page 1 of 61
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	NA	Auftragsdatum: <i>Order date:</i>	2021-03-31	
Auftraggeber: <i>Client:</i>	The Procter & Gamble Company 1 P&G Plaza Cincinnati, OH 45202			
Prüfgegenstand: <i>Test item:</i>	Tide Smart Tray			
Bezeichnung .: <i>Identification .:</i>	3995	Serien -Nr.: <i>Serial no.:</i>	105	
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 section 15.247			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2021-04-16			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003035526-002			
Prüfzeitraum: <i>Testing period:</i>	2021-04-19 - 2021-04-22			
Ort der Prüfung: <i>Place of testing:</i>	Wireless Test Laboratory			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd, #27/B,2nd Cross Road, Electronic City Phase-1, Bengaluru-560100, India. FCC Test site registration number: 496599			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i> 2021-04-19	Ausstellatum: <i>Issue date:</i> 2021-06-11			
Stellung / Position:	Yogesh V Engineer	Stellung / Position:	Mahammadgouse Kaladagi Assistant Manager	
Sonstiges / Other:	FCC ID: 2AG9A921101			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested
<p>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></p>				

v05

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568821300000029F

Seite 2 von 61
Page 2 of 61

TEST SUMMARY

Test Item	Applicable Standard	Result
	FCC Clause	
Maximum conducted (Average) 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	15.247 (d) / (15.209 & 15.205)	Pass

Product Category: Electronics Testing
Test Discipline: EMC Test Facility

Note:

1. *N/T → Not Tested

Table of Contents

1	GENERAL REMARKS	4
1.1	Attachments	4
2	TEST SITES	5
2.1	Testing Facilities.....	5
2.2	List of Test and Measurement Instruments.....	5
3	GENERAL PRODUCT INFORMATION.....	6
3.1	Product Function and Intended Use.....	6
3.2	Ratings and System Details of Equipment under Test	6
3.3	Measurement Uncertainty:	7
4	TEST SET-UP AND OPERATION MODE	8
4.1	Principle of Configuration Selection	8
4.2	Test Operation and Test Software	8
4.3	Special Accessories and Auxiliary Equipment	8
4.4	Test-modes – data rates and modulations.....	8
4.5	Countermeasures to achieve EMC Compliance	8
4.6	Report Reference	8
4.7	Simultaneous operation	8
4.8	List of frequencies	9
5	Operational Description	10
6	Block Diagram.....	10
7	TEST METHODOLOGY	12
7.1	Radiated Emission Test	12
7.1.1	Test Setup Configuration	12
8	TEST RESULTS FOR BLUETOOTH LOW ENERGY	14
8.1	Maximum Average Conducted Output Power.....	14
8.2	Maximum Power Spectral Density	20
8.3	DTS Bandwidth	26
8.4	Emissions in non-restricted frequency bands and conducted Spurious Emission	32
8.4.1	Non restricted bands measurements results	33
8.4.2	Out of Band emissions	42
8.5	Spurious Radiated Emissions & Restricted Bands of Operation	48
9	LIST OF TABLES.....	61
10	LIST OF FIGURES.....	61

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

Seite 4 von 61
Page 4 of 61

1 GENERAL REMARKS

1.1 Attachments

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

1. TEST SETUP PHOTOS
2. EUT EXTERNAL PHOTOS
3. EUT INTERNAL PHOTOS
4. FCC LABEL AND LABEL LOCATION
5. BLOCK DIAGRAM
6. SPECIFICATION OF EUT
7. SCHEMATIC DIAGRAMS
8. BILL OF MATERIAL
9. USER MANUAL
10. Maximum Permissible Exposure Information

2 TEST SITES

2.1 Testing Facilities

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

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
EMI Receiver	Rohde & Schwarz	ESW 44	101773	1.72.SP1	27.01.2022	Yearly	Radiated Spurious Emission
Active loop antenna	Frankonia	LAX-10	LAX-10-800	-	27.02.2022	Yearly	
Baloon and Biconical Antenna	Schwarzbeck mess-elektronik	VHBB-9124 / BBA-9106	01028	-	02.09.2021	Yearly	
Log Periodic Antenna	Schwarzbeck mess-elektronik	VUSLP-9111B	9111B-111	-	31.08.2021	Yearly	
Horn Antenna	Frankonia	HAX-18	802	-	01.03.2022	Yearly	
Horn Antenna	ETS	116706	00107323	-		Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
Spectrum Analyser	Agilent Technologies	E4407B	US41192772	A.14.06	10.08.2021	Yearly	Antenna - Port Measurements
Spectrum Analyser	Rohde & Schwarz	FSV7	101644	-	15.01.2022	Yearly	
RF Cable	H+S Electronics Pvt. Ltd	ST18/SM Am/SMA m/36	-	-	09.10.2021	Yearly	

Table 2: Instrument application Software versions

SL. No.	Test Type	Application software	Version
1	Radiated spurious emission measurement in SAC	EMC 32	10.60.00
2	Radiated spurious emission measurement in FAC	EMC 32	10.60.00

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

Seite 6 von 61
Page 6 of 61

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

Tide Smart Tray is a battery powered, single product auto-replenishment tray, which can connect to internet via cellular. It has Bluetooth capability which is used for calibration.

User experience: User puts a bottle of Tide on the tray. As the bottle is used, the weight reduces. When it gets to a critical level, it automatically triggers an e-commerce purchase, which ships a replacement bottle to the consumer.

3.2 Ratings and System Details of Equipment under Test

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

Radio Protocol	Bluetooth Low energy	
Operating Frequency Range	2402MHz-2480MHz	
No. of Channels	39	
Channel Spacing	2MHz	
Transmitting Power level	8dBm	
Maximum Measured conducted power	5.99 dBm (at 2480 MHz 2Mbps)	
Modulation	FSK	
Number of antennas	1	
Antenna Gain	0dBi	
Antenna Type	PCB Antenna	
Supply Voltage to Product	6 Volts DC (4 AA Batteries - 1.5 Volts each)	
Environmental conditions	Storage	-30° C to 75° C
	Operating	10° C to 40° C
EUT Dimension (L X W X H) mm	228.6mm x 160mm x 49.4 mm	

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

3.3 Measurement Uncertainty:

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

Table 4: Measurement Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3 dB
Unwanted Emissions, conducted	±3 dB
All emissions, radiated	±6 dB
Temperature	±3 °C
Supply Voltages	±3 %
Time	±5 %

Note: The Listed Measurement Uncertainties are the worst-case uncertainty, for the respective test cases. Above Table is for reporting purpose only and not used in determining Final Pass/Fail verdict.

4 TEST SET-UP AND OPERATION MODE

4.1 Principle of Configuration Selection

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

4.2 Test Operation and Test Software

EUT Configuration and monitoring Software : nRF Connect (DTM mode)
 EUT Configuration and monitoring Software Version : v 1.1.7
 EUT Firmware name (FVIN) : direct_test_mode_pca10056.hex
 EUT Hardware Name & Number : TRAY INTERFACE
 HVIN : REV 3.0

4.3 Special Accessories and Auxiliary Equipment

Test laptop for configuration

4.4 Test-modes – data rates and modulations

- None

4.5 Countermeasures to achieve EMC Compliance

- None

4.6 Report Reference

Note: Product Tide Smart Tray has supports multiple protocols. All the supported wireless protocols and their respective test results are issued in separate test reports.

SL No:	RF Protocol	Report Name
1	LTE	ULR-TC568821300000030F
2	BLE	ULR-TC568821300000029F

4.7 Simultaneous operation

Product does not supports the simultaneous operation which means either one of the radio will work.

4.8 List of frequencies

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	2442
	:	:
	:	:
	36	2474
	37	2476
	38	2478
39	2480	

Table 5: List of BLE Center frequencies

Channel used for BLE testing

Channel low : 2402MHz

Channel mid : 2440MHz

Channel High : 2480MHz

Note:

TUV Sample Identification number : A003035526-002 – Conducted & Radiated Sample

5 Operational Description

Tide Smart Tray is a battery powered, single product auto-replenishment tray, which can connect to internet via cellular. It is calibrated using Bluetooth before being sent to consumer.

Tide Smart Tray can be made ON using a Power Switch at the bottom. After Power on Consumer puts a bottle of Tide on the Tray. For the first two hours, Tray records/stores the Tide bottle weight every 30 mins and after two hours it records/stores Tide bottle weight every one hour. After every 12 hours, it connects to internet using Cellular and transfer 12 hour weight measurement data to cloud. As the bottle is used, the weight reduces. When it gets to a critical level, it automatically triggers an e-commerce purchase, which ships a replacement bottle to the consumer.

6 Block Diagram

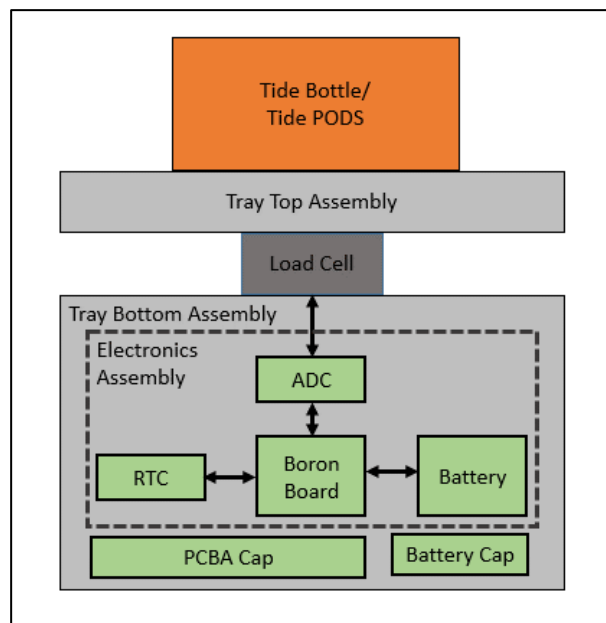
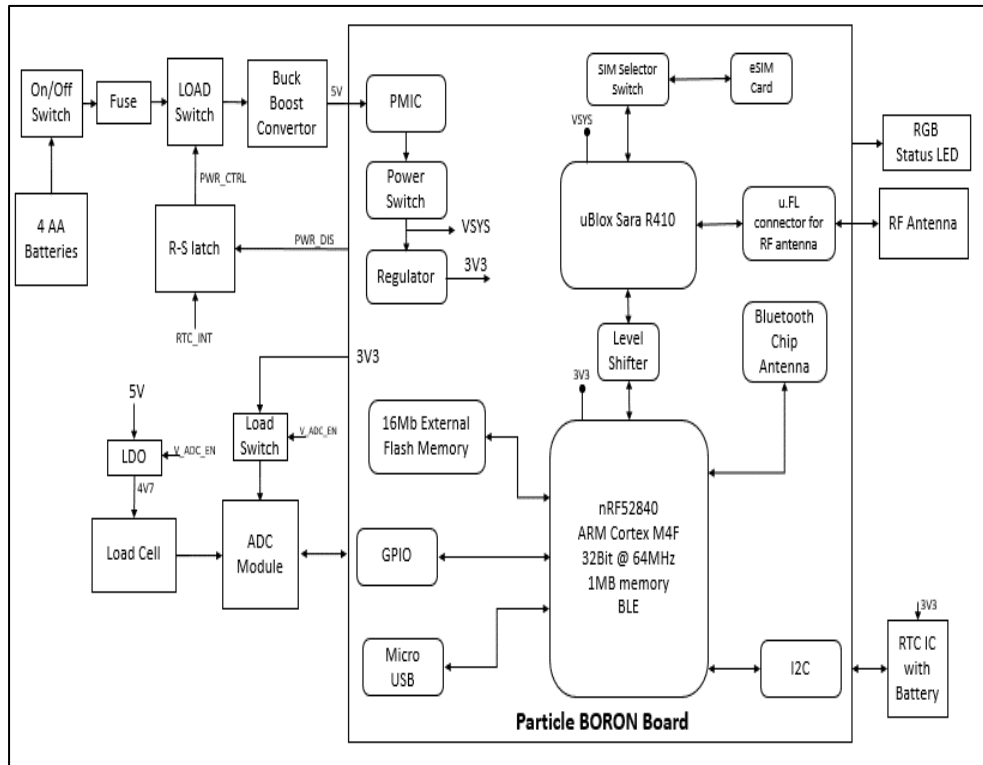


Figure 1: System Architecture



7 TEST METHODOLOGY

7.1 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

7.1.1 Test Setup Configuration

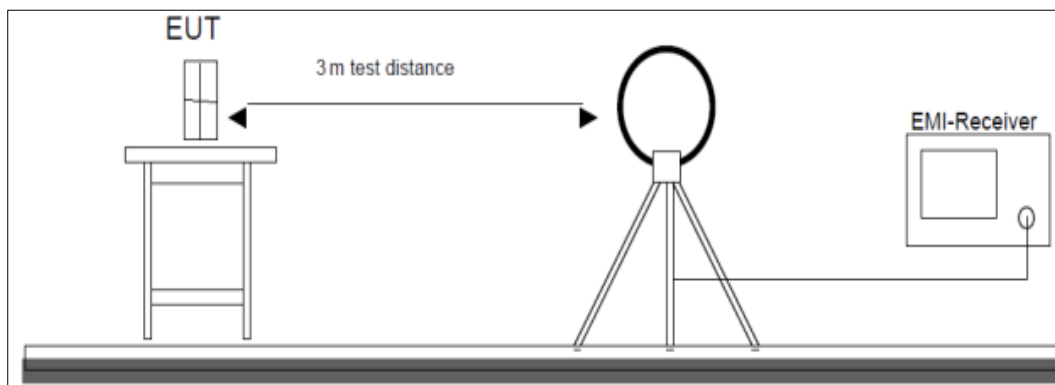


Figure 1: Frequency Range 9 kHz- 30 MHz

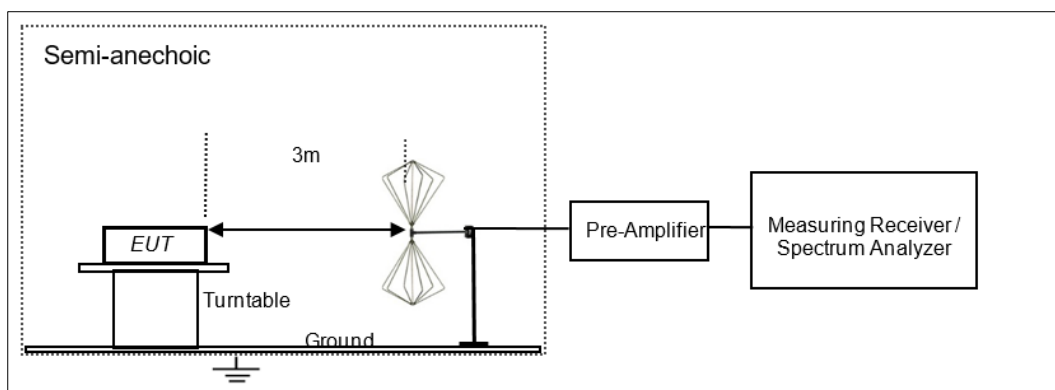


Figure 2: Frequency Range 30 MHz – 200 MHz

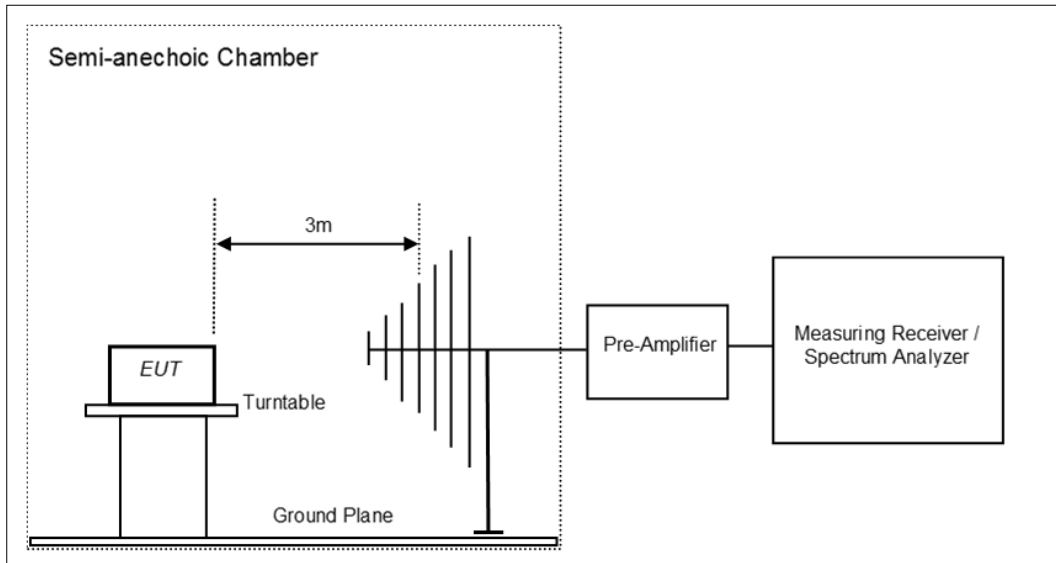


Figure 3: Frequency Range 200 MHz - 1GHz

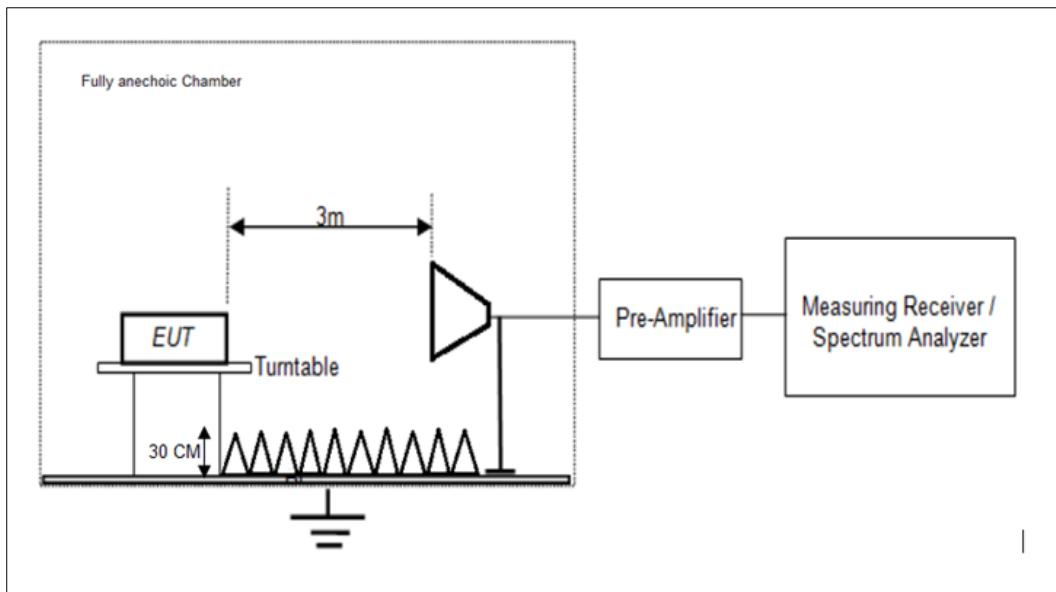
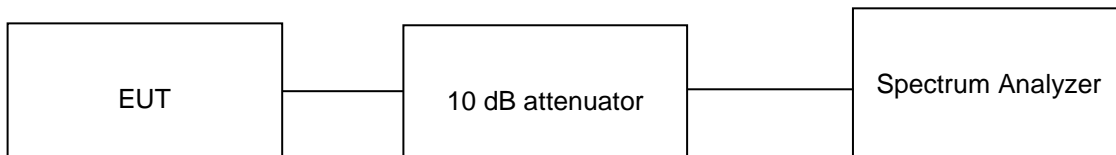


Figure 4: Frequency Range above 1 GHz

8 TEST RESULTS FOR BLUETOOTH LOW ENERGY

8.1 Maximum Average Conducted Output Power

<i>Result</i>	<i>Pass</i>
Test Specification	FCC part 15 Subpart C 15.247 (b)(3)
Test Method	Subclause 11.9.2.2 of ANSI C63.10
Measurement Bandwidth	1 MHz
Detector	Average sample detector
Port of testing	Antenna port
Requirement	Power \leq 1 W (30 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.8 °C Voltage = 6 Volts DC (4 AA Batteries - 1.5 Volts each) Relative humidity: 68%

KDB Guidelines applied:

Measurements were made as per section 8.3.2.2 in KDB 558074 D01 15.247 Measurement Guidance v05r02.

Prüfbericht - Nr.:

ULR-TC56882130000029F

Seite 15 von 61

Test Report No.:

Page 15 of 61

Test results:

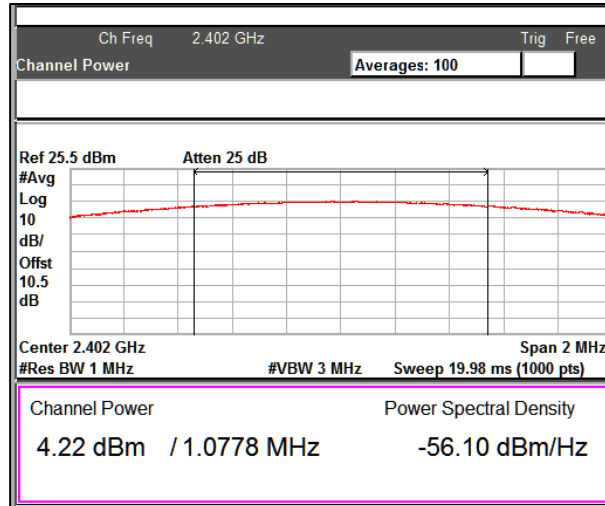
Note:

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 (0.5dB)
3. Duty Correction Factor (dB) = $10 \cdot \log(1/x)$ where x= Duty cycle

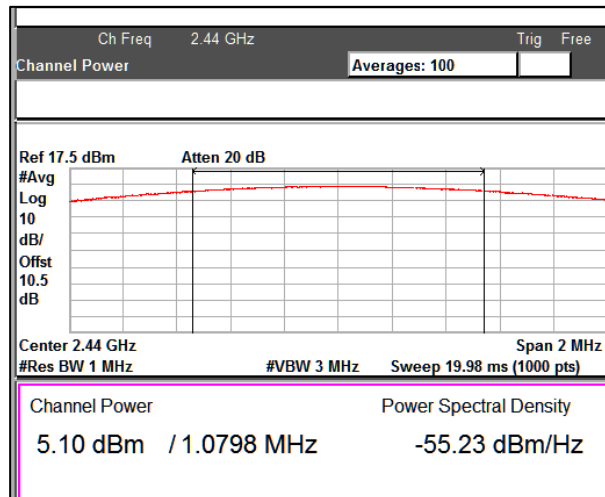
Data rate	Channel Frequency (MHz)	Measured Average Power (dBm)	Duty Correction Factor (dB)	Measured Final Average power (dBm)	Limit(dBm)
125kBps	2402	4.22	1.14	5.36	30
	2440	5.10	0.32	5.42	
	2480	5.00	0.32	5.32	
250kBps	2402	5.08	0.13	5.21	
	2440	4.92	0.13	5.05	
	2480	5.05	0.13	5.18	
1Mbps	2402	4.15	1.19	5.34	
	2440	4.20	1.19	5.39	
	2480	4.18	1.19	5.37	
2Mbps	2402	3.50	2.44	5.94	
	2440	3.52	2.44	5.96	
	2480	3.55	2.44	5.99	

Test Graphs:

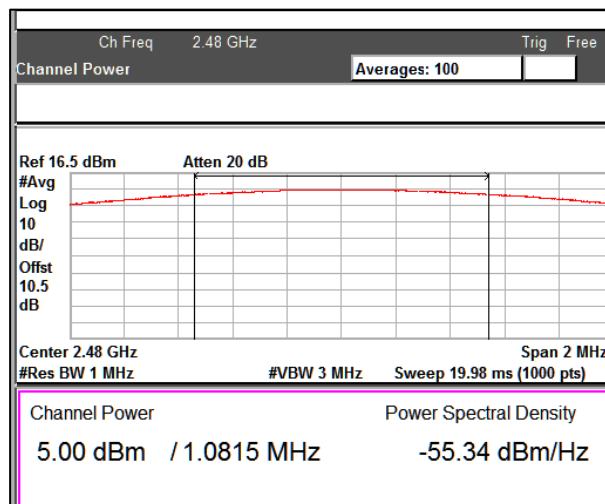
Data rate: 125Kbps



Channel Frequency: 2402MHz

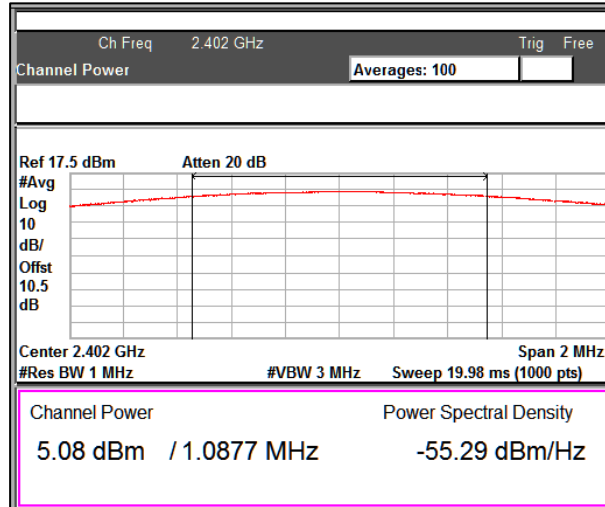


Channel Frequency: 2440MHz

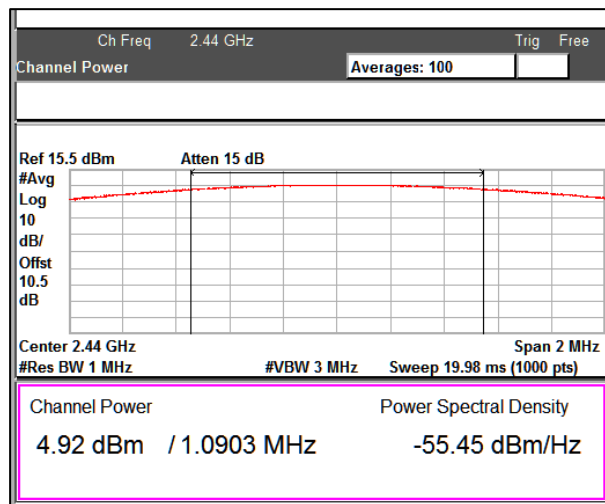


Channel Frequency: 2480MHz

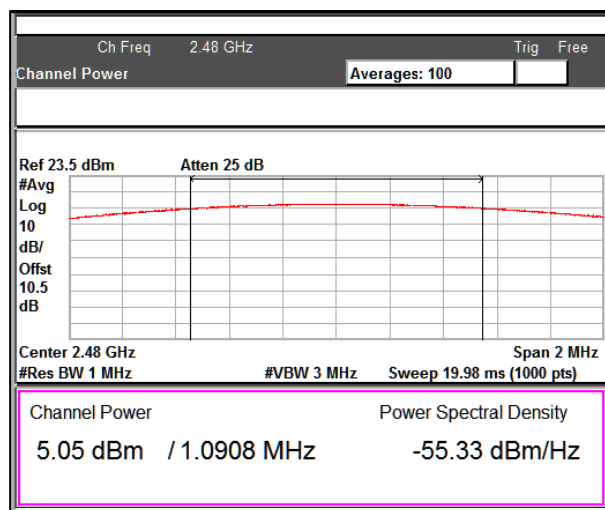
Data Rate: 250Kbps



Channel Frequency: 2402MHz

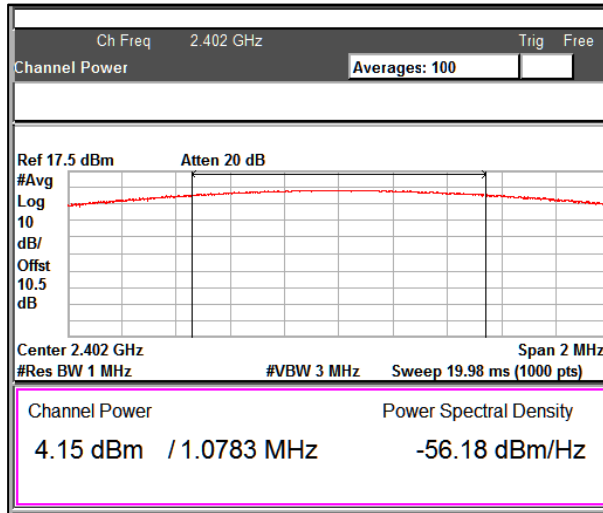


Channel Frequency: 2440MHz

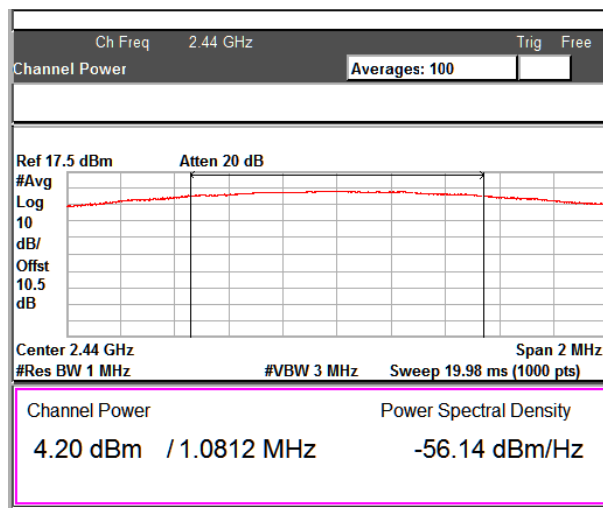


Channel Frequency: 2480MHz

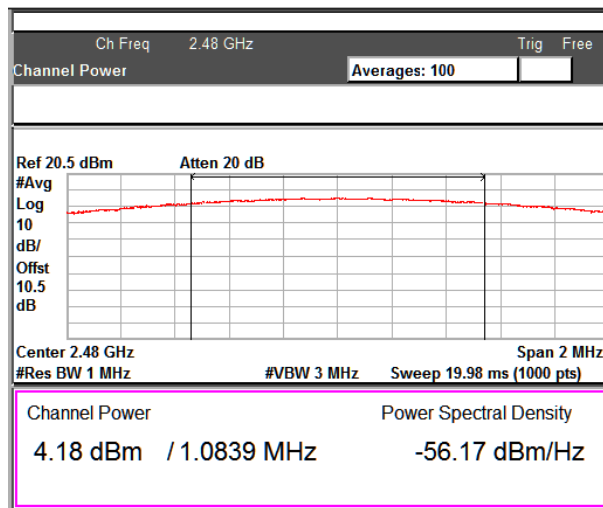
Data rate: 1Mbps



Channel Frequency: 2402MHz

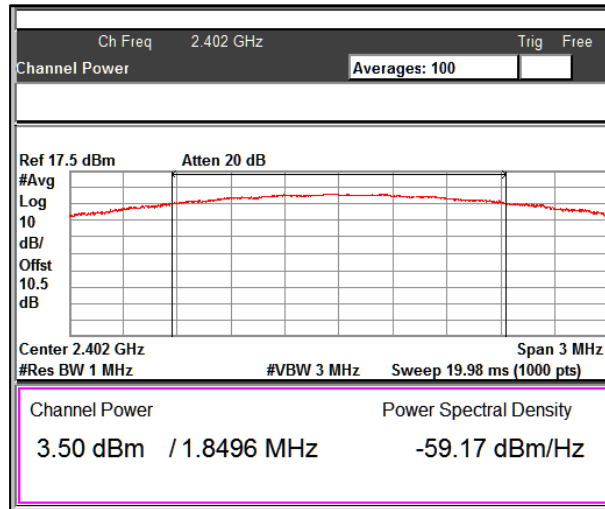


Channel Frequency: 2440MHz

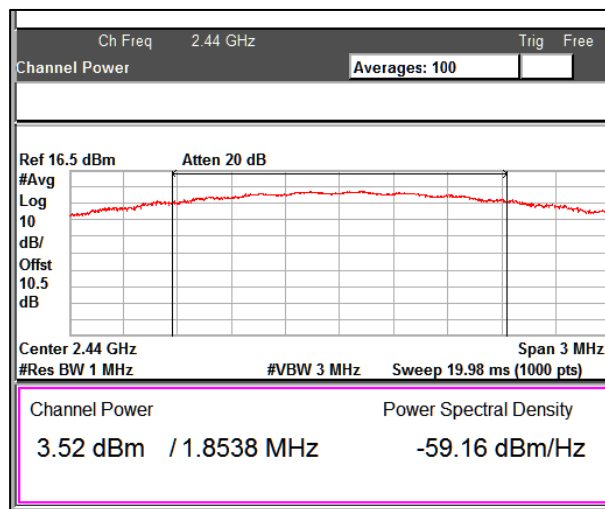


Channel Frequency: 2480MHz

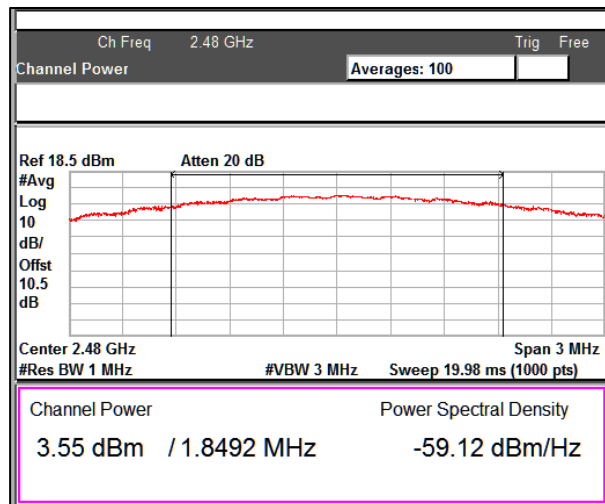
Data rate: 2Mbps



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



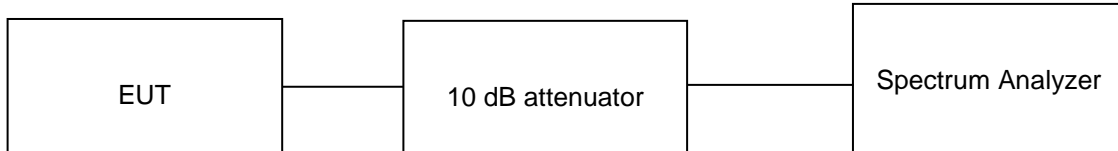
Channel Frequency: 2480MHz

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	3 kHz
Detector	Average detector
Port of testing	Antenna port
Requirement	8dBm/3kHz



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.8 °C

Voltage = 6 Volts DC (4 AA Batteries - 1.5 Volts each)

Relative humidity: 68%

KDB Guidelines applied:

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

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

Seite 21 von 61
Page 21 of 61

Test results:

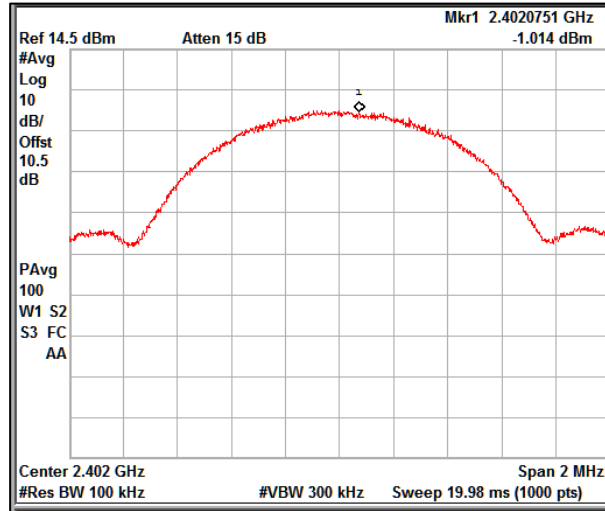
Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Average Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.5dB)
3. Duty Correction Factor (dB) = $10 \cdot \log(1/x)$
Where x= Duty cycle

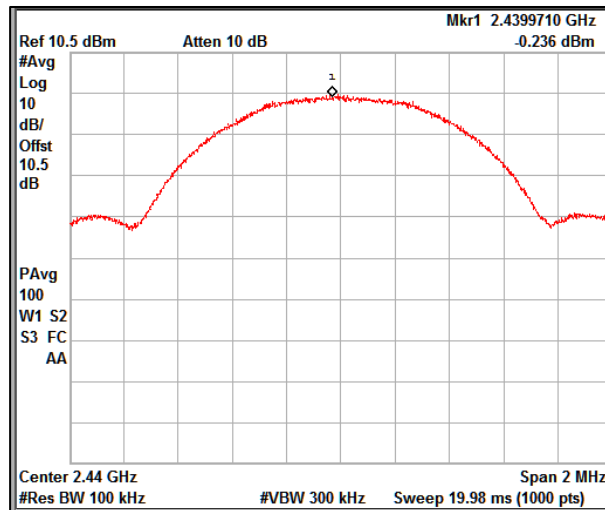
Data rate	Channel Frequency (MHz)	Measured Average PSD (dBm)	Duty Correction Factor (dB)	Measured Final Average PSD (dBm)	Limit (dBm/3kHz)
125Kbps	2402	-1.01	1.14	-2.15	8
	2440	-0.23	0.32	-0.55	
	2480	-0.69	0.32	-1.01	
250Kbps	2402	0.62	0.13	0.49	
	2440	0.74	0.13	0.61	
	2480	0.84	0.13	0.71	
1Mbps	2402	-0.95	1.19	-2.14	
	2440	-0.5	1.19	-1.69	
	2480	-1.06	1.19	-2.25	
2Mbps	2402	-3.5	2.44	-5.94	
	2440	-4.19	2.44	-6.63	
	2480	-4.15	2.44	-6.59	

Test Graphs:

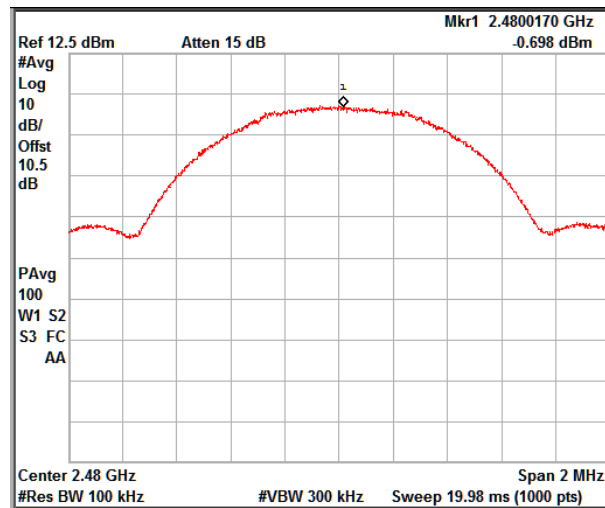
Data rate: 125Kbps



Channel Frequency: 2402MHz

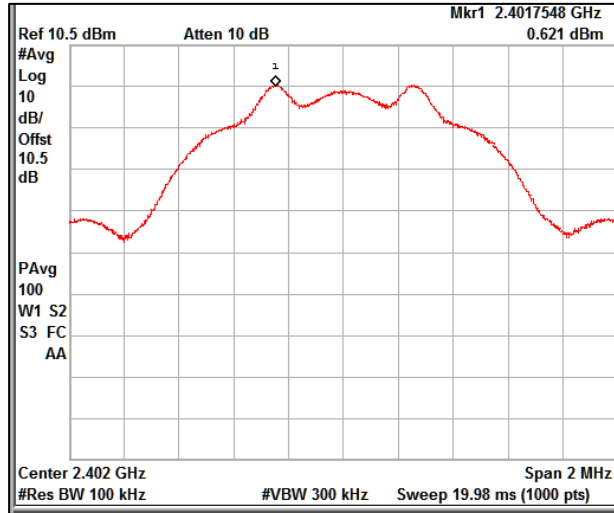


Channel Frequency: 2440MHz

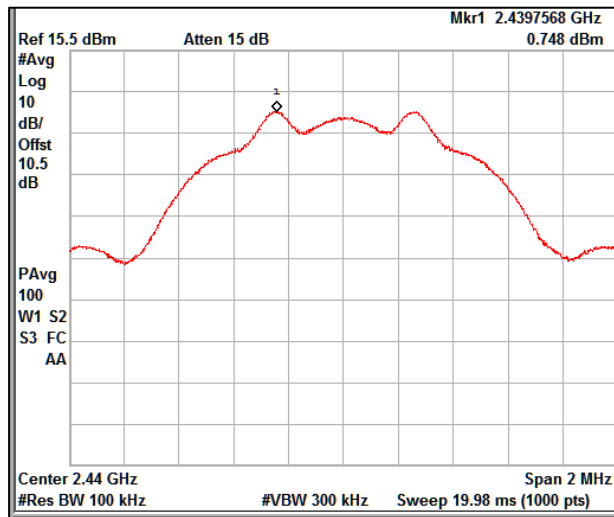


Channel Frequency: 2480MHz

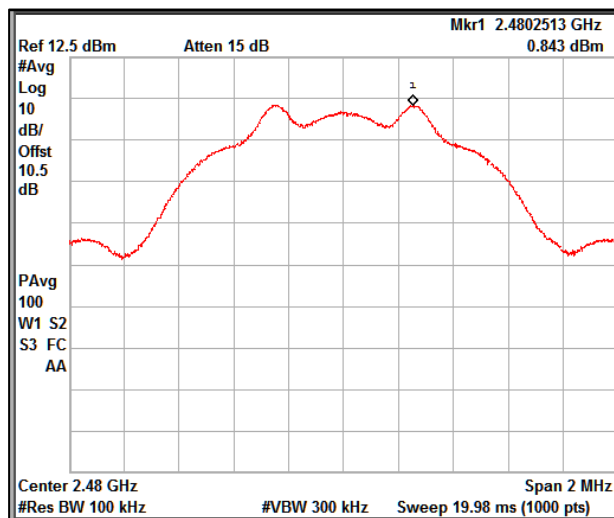
Data Rate: 250Kbps



Channel Frequency: 2402MHz

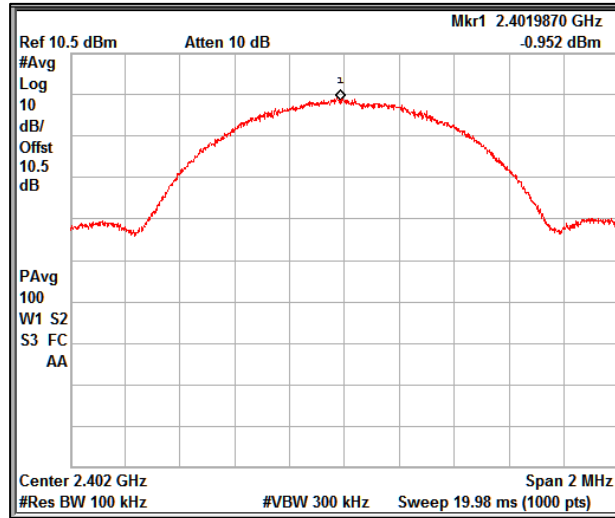


Channel Frequency: 2440MHz

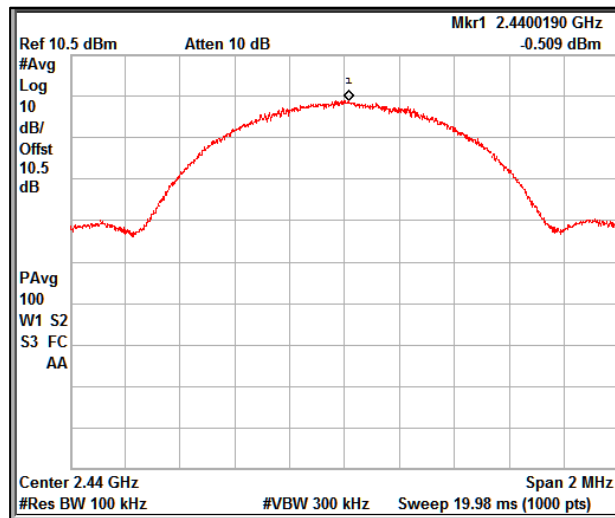


Channel Frequency: 2480MHz

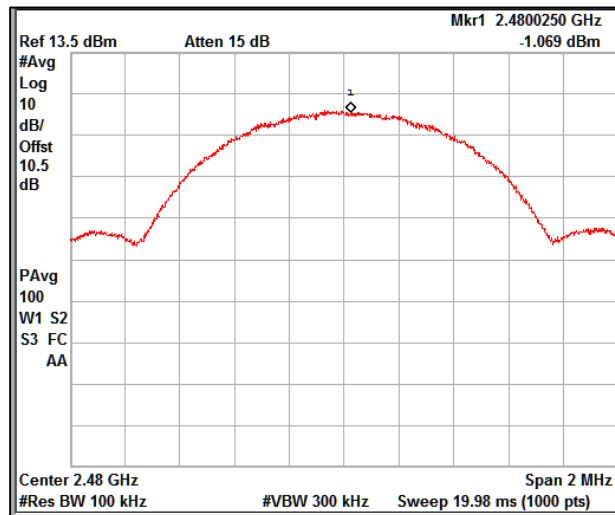
Data rate: 1Mbps



Channel Frequency: 2402MHz

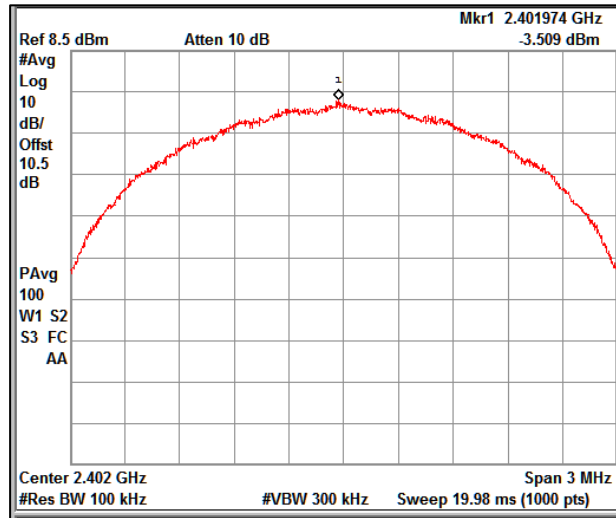


Channel Frequency: 2440MHz

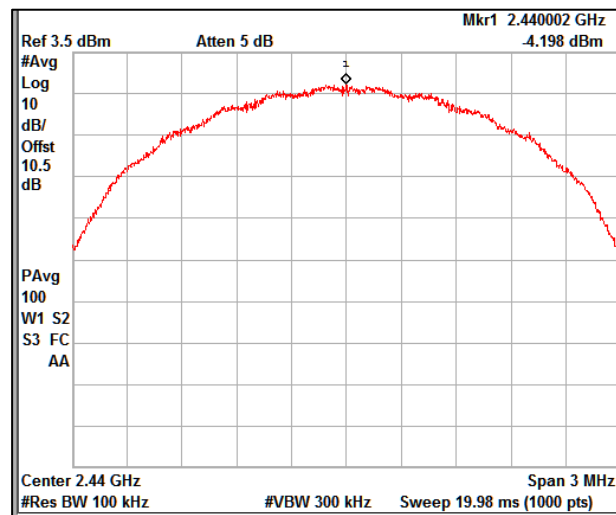


Channel Frequency: 2480MHz

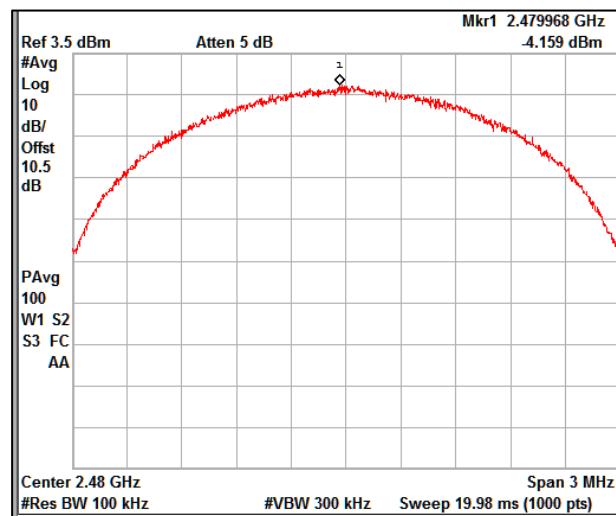
Data rate: 2Mbps



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

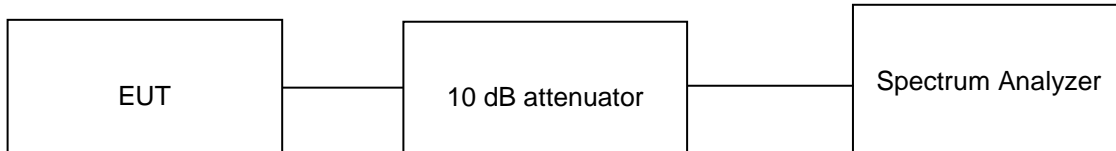
Seite 26 von 61
Page 26 of 61

8.3 DTS Bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a)(2)
Test Method	Subclause 11.8.1 of ANSI C63.10
Measurement Bandwidth	100 kHz
Detector	Peak detector
Port of testing	Antenna port
Requirement	≥500kHz



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.8 °C

Voltage = 6 Volts DC (4 AA Batteries - 1.5 Volts each)

Relative humidity: 68%

KDB Guidelines applied:

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

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

Seite 27 von 61
Page 27 of 61

Test results:

Note:

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

Data rate	Channel Frequency (MHz)	Measured 99% Bandwidth (MHz)	Measured 6dB Bandwidth (MHz)	Limit (MHz)
125kBps	2402	1.077	0.72	≥0.5
	2440	1.079	0.71	
	2480	1.081	0.73	
250kBps	2402	1.087	0.62	
	2440	1.090	0.70	
	2480	1.090	0.62	
1MBps	2402	1.078	0.74	
	2440	1.081	0.74	
	2480	1.083	0.74	
2MBps	2402	1.849	1.18	
	2440	1.853	1.17	
	2480	1.849	1.17	

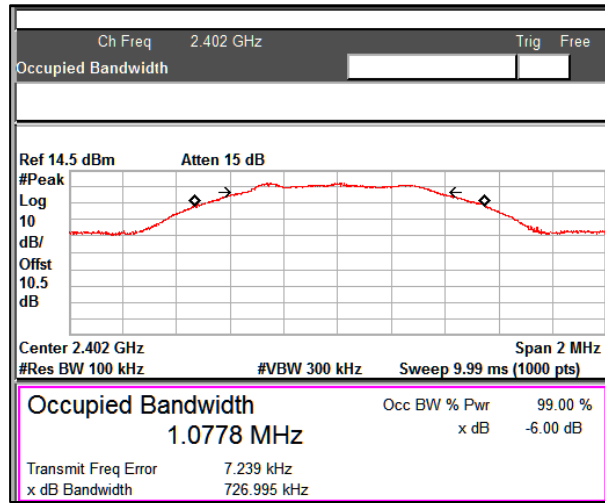
Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

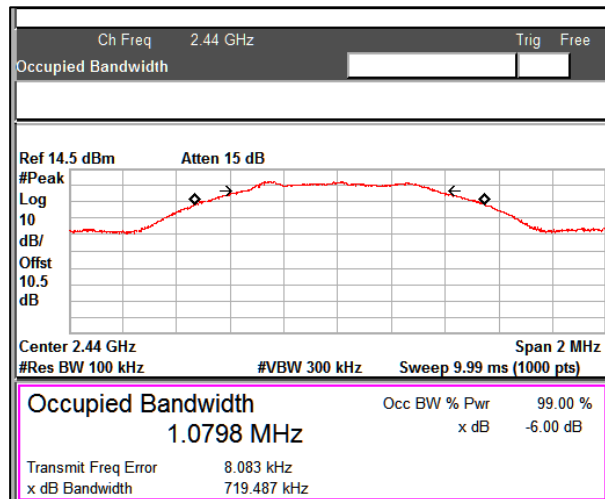
Seite 28 von 61
Page 28 of 61

Test Graphs:

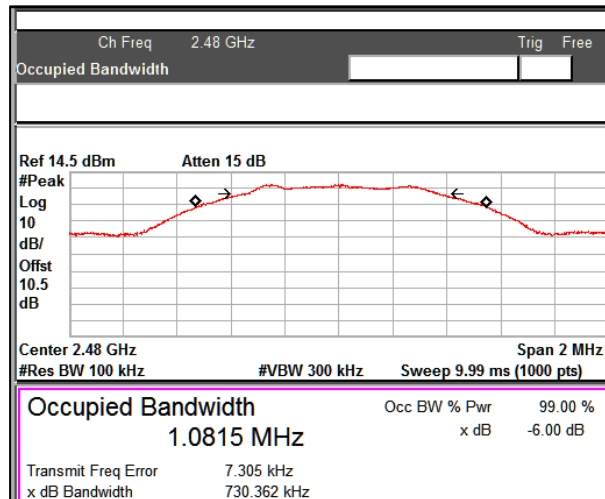
Data Rate: 125Kbps



Channel Frequency: 2402MHz

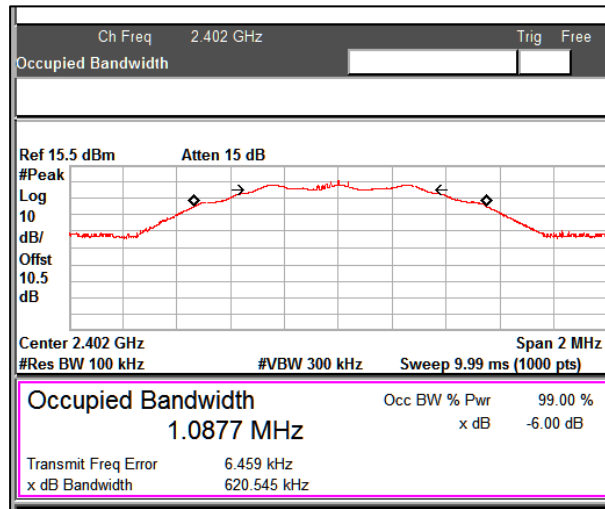


Channel Frequency: 2440MHz

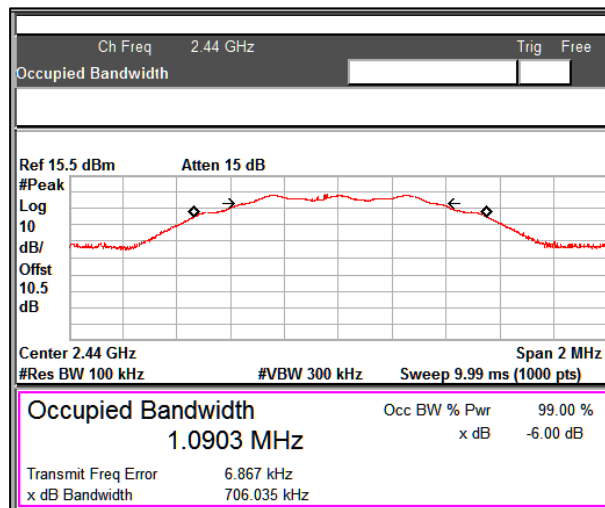


Channel Frequency: 2480MHz

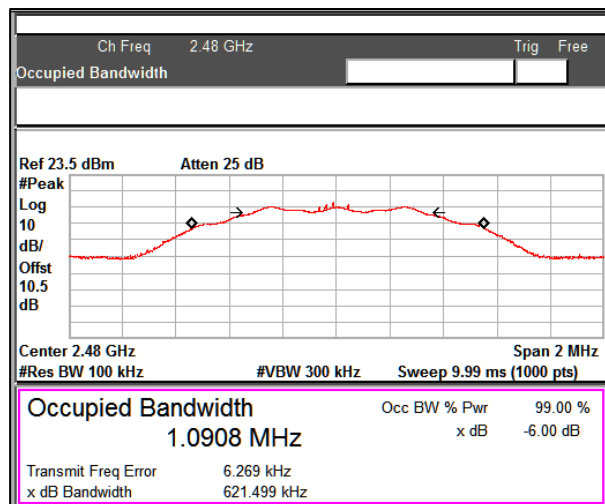
Data Rate: 250Kbps



Channel Frequency: 2402MHz

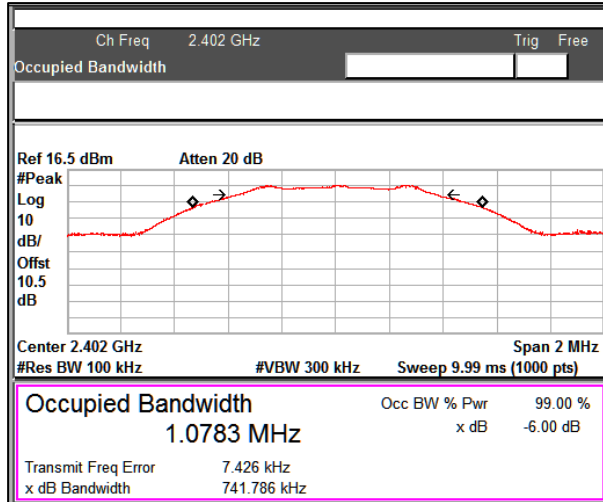


Channel Frequency: 2440MHz

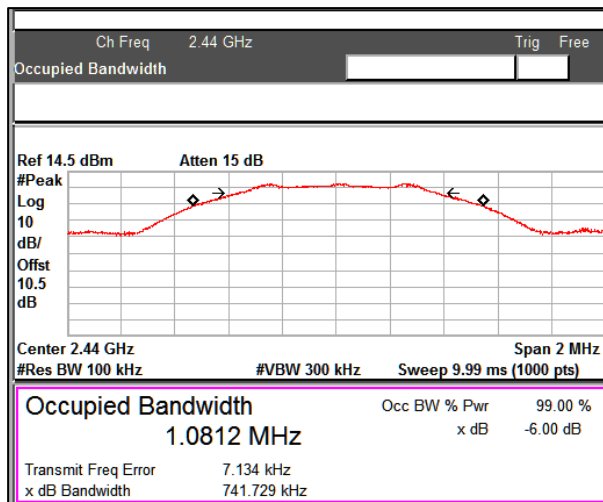


Channel Frequency: 2480MHz

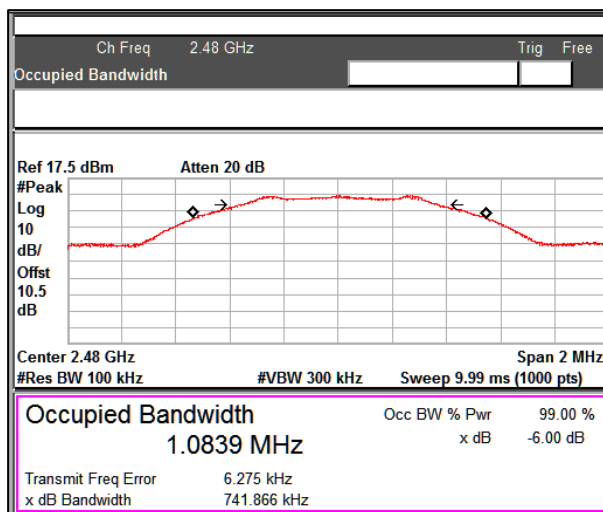
Data Rate: 1Mbps



Channel Frequency: 2402MHz

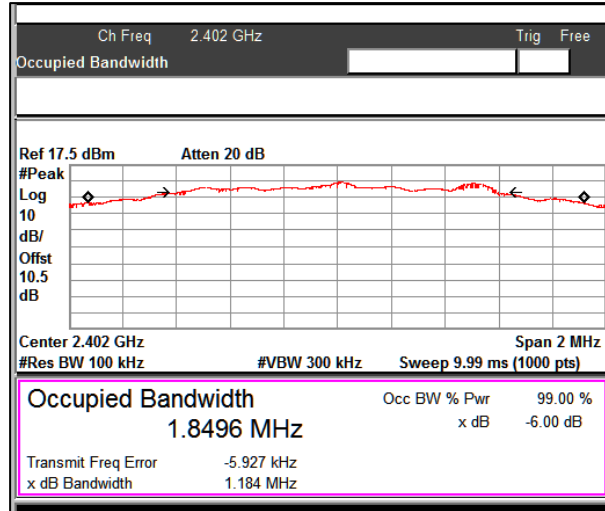


Channel Frequency: 2440MHz

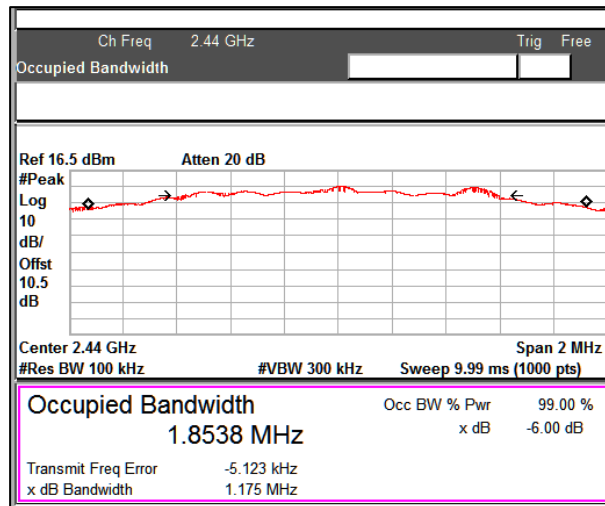


Channel Frequency: 2480MHz

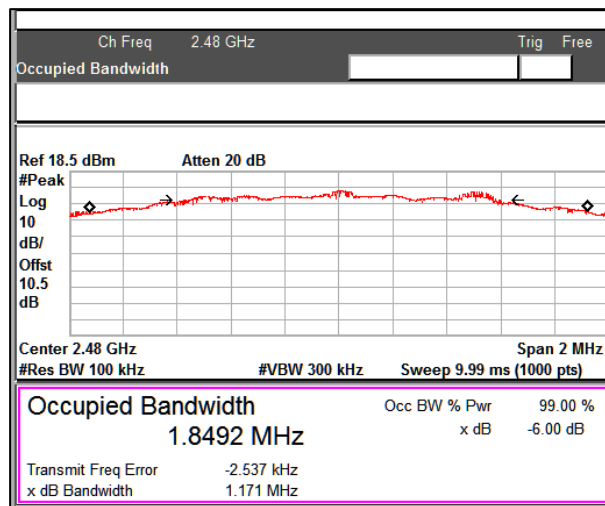
Data Rate: 2Mbps



Channel Frequency: 2402MHz



Channel Frequency: 2440MHz



Channel Frequency: 2480MHz

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

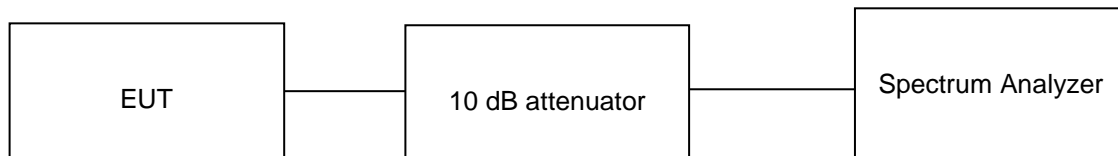
Result

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	Average detector
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



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.8 °C

Voltage = 6 Volts DC (4 AA Batteries - 1.5 Volts each)

Relative humidity: 68%

KDB Guidelines applied:

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

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

Seite 33 von 61
Page 33 of 61

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) + Attenuator factor (10dB) + Cable loss (0.5dB)

8.4.1 Non restricted bands measurements results

Data rate	Channel frequency (MHz)	Measured Band edge Frequency (MHz)	Measured Reference Value B (dBm)	Measured Band Edge Value A (dBm)	Measured A-B (dBm)	Limit (dBc)
125kBps	2402	2390	-1.01	-66.62	-65.61	-30
	2480	2483.5	-0.69	-53.22	-52.53	
250kBps	2402	2390	0.62	-67.36	-67.98	
	2480	2483.5	0.84	-60.95	-61.79	
1MBps	2402	2390	-0.95	-68.62	-67.67	
	2480	2483.5	-1.06	-61.42	-60.36	
2MBps	2402	2390	-3.5	-68.86	-65.36	
	2480	2483.5	-4.15	-59.67	-55.52	

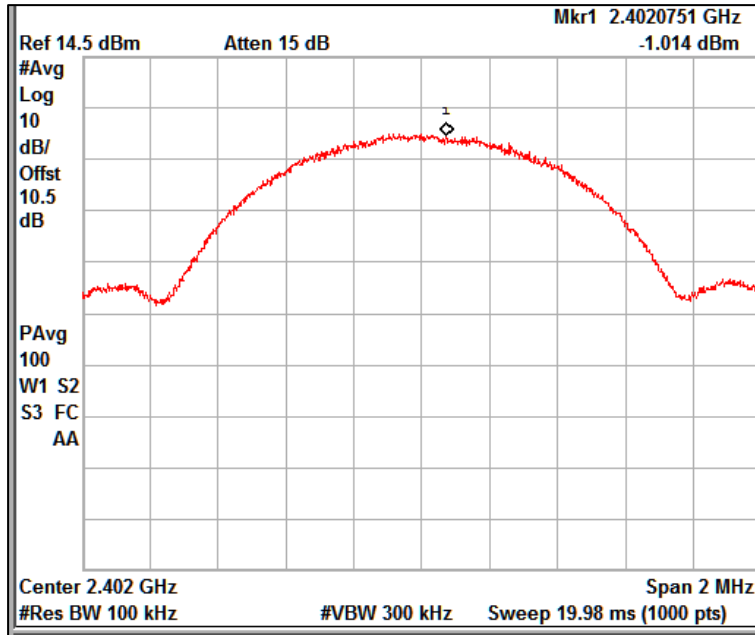
Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

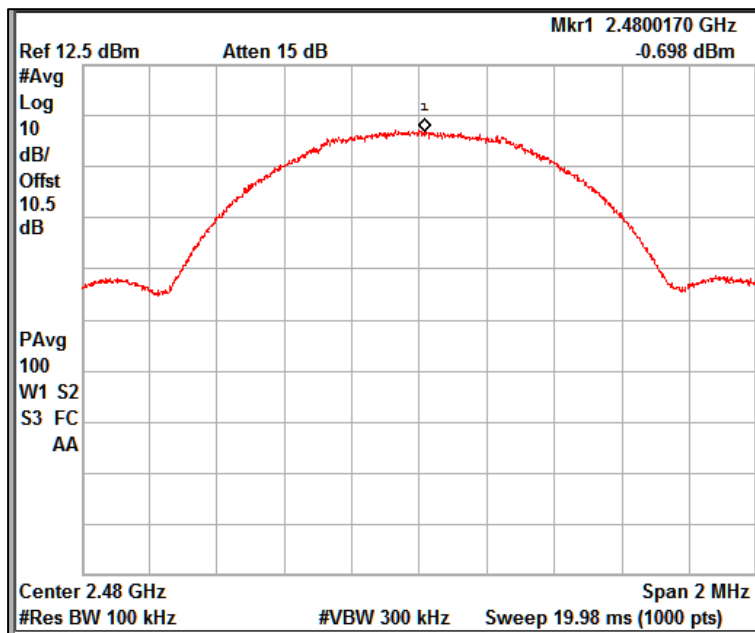
Seite 34 von 61
Page 34 of 61

Reference Plots

Data Rate: 125Kbps

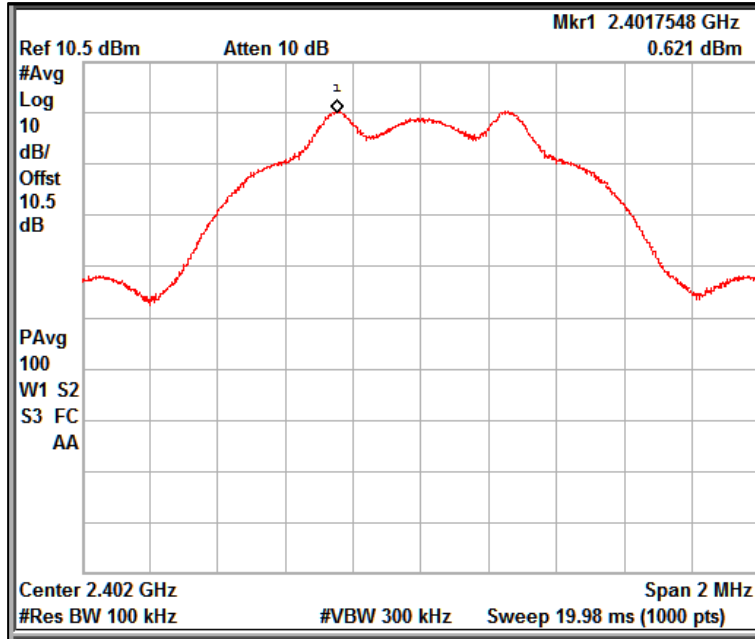


Channel Frequency: 2402MHz

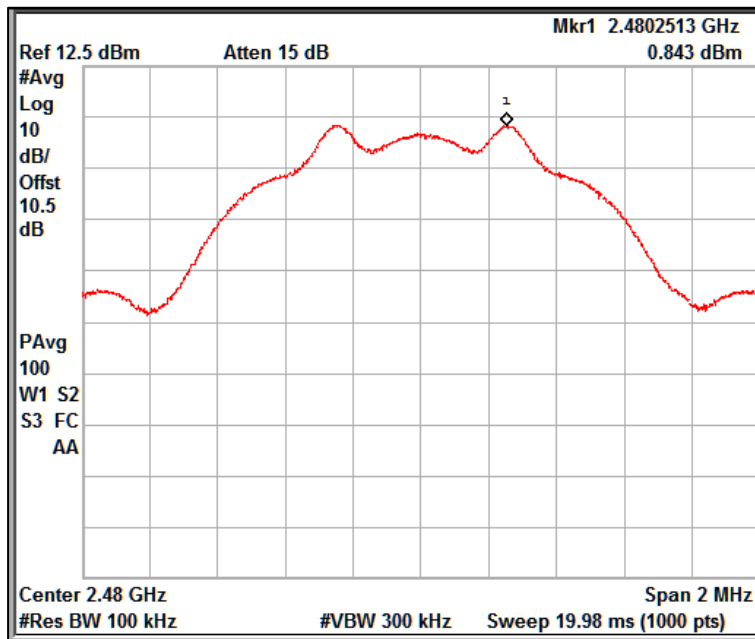


Channel Frequency: 2480MHz

Data Rate: 250Kbps

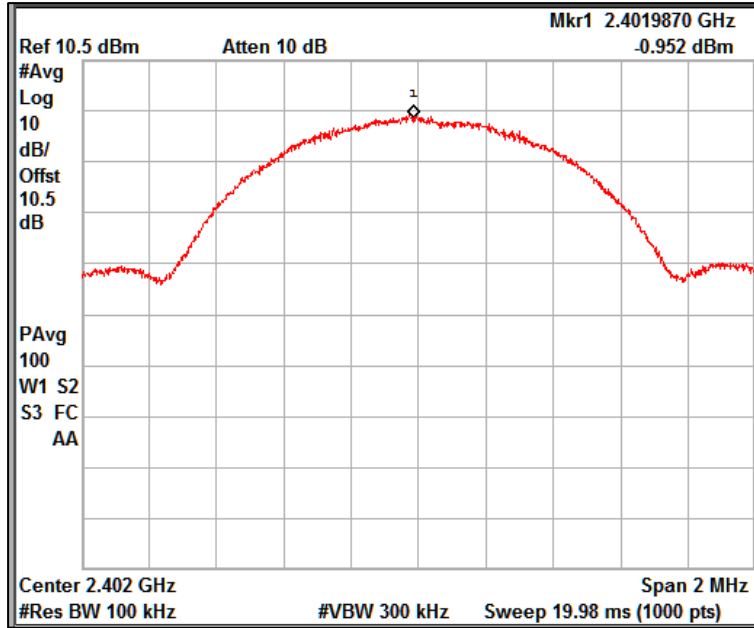


Channel Frequency: 2402MHz

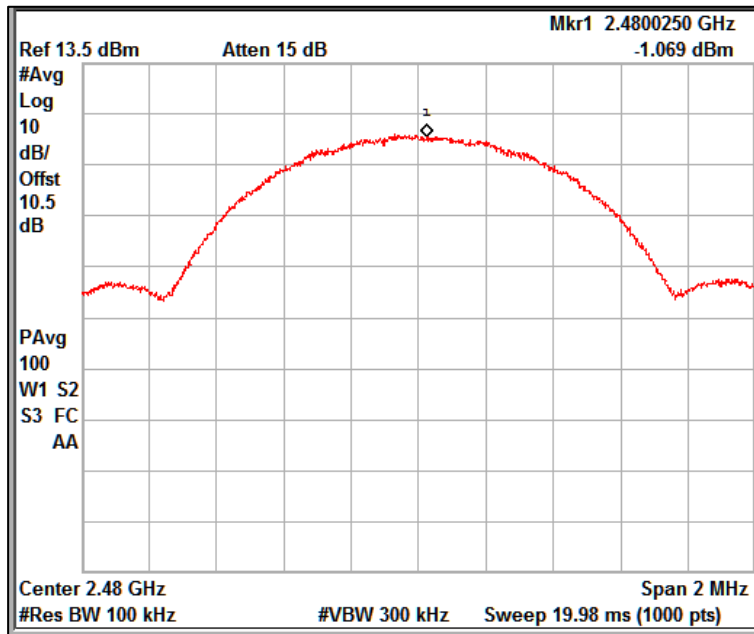


Channel Frequency: 2480MHz

Data Rate: 1Mbps

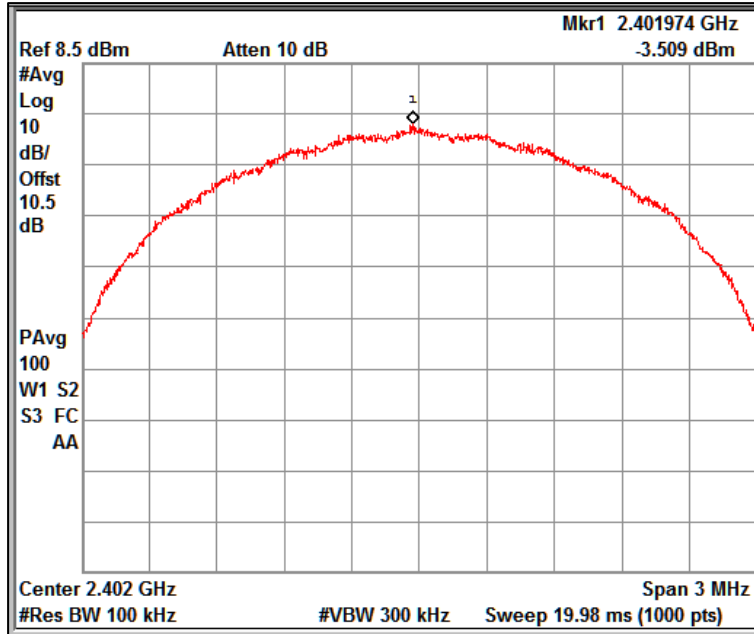


Channel Frequency: 2402MHz

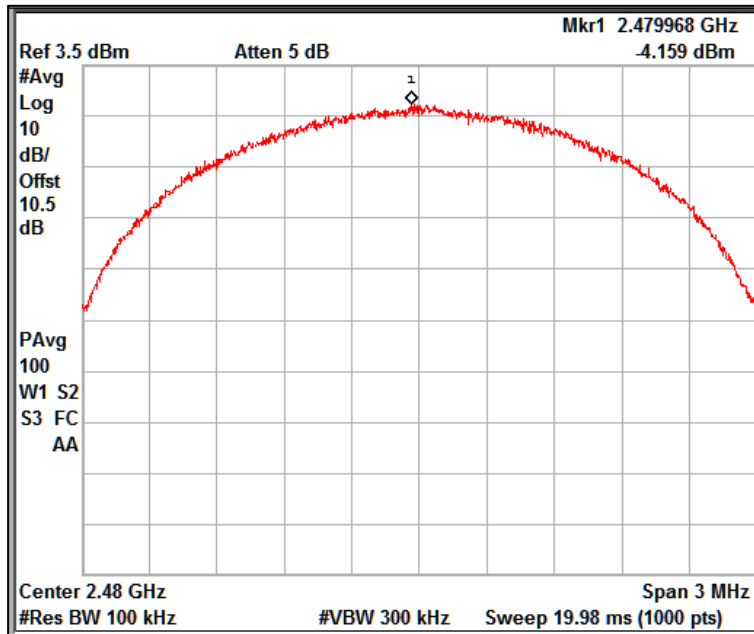


Channel Frequency: 2480MHz

Data Rate: 2Mbps



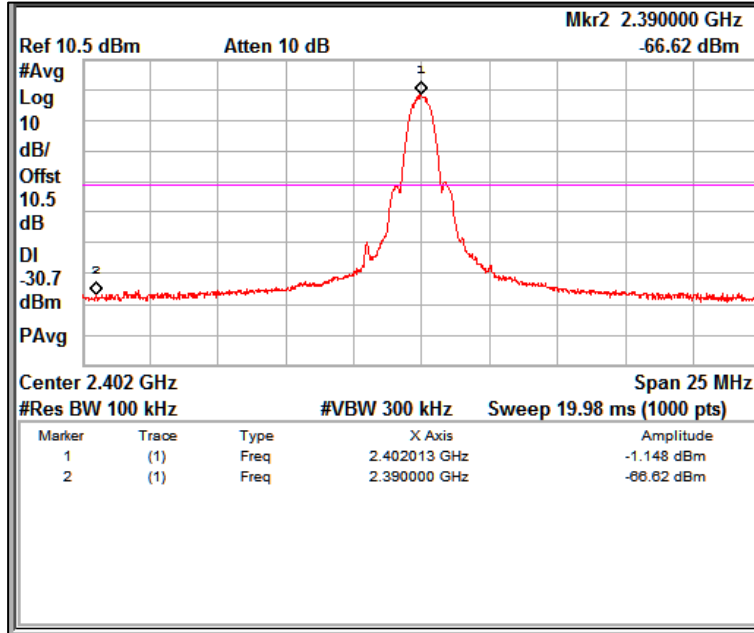
Channel Frequency: 2402MHz



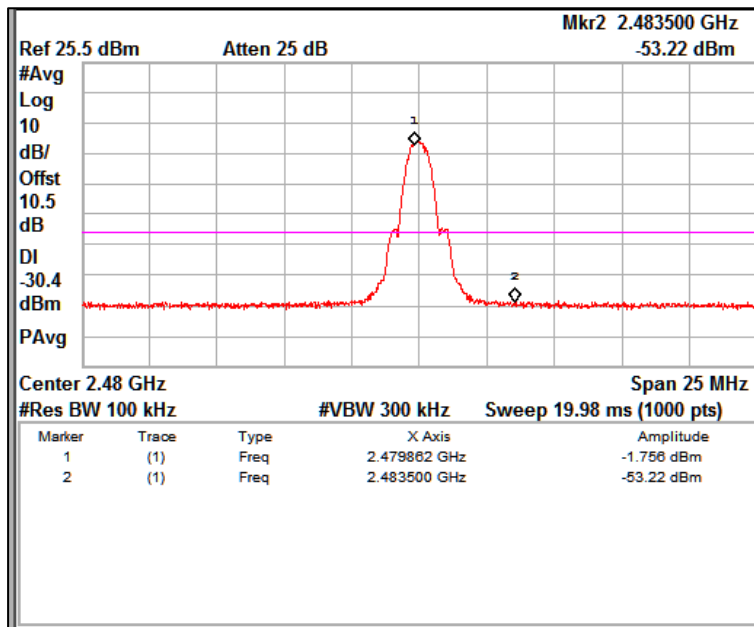
Channel Frequency: 2480MHz

Band edge Measurements

Data Rate: 125Kbps

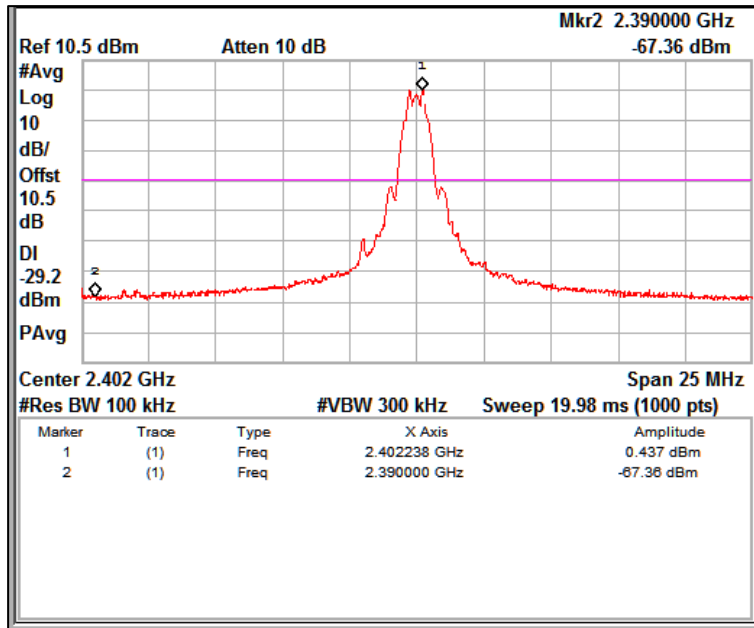


Channel Frequency: 2402MHz

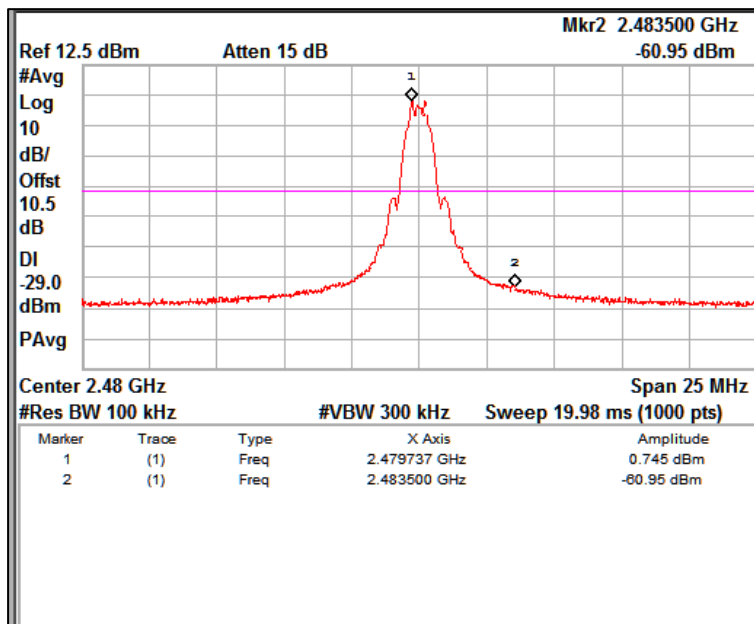


Channel Frequency: 2480MHz

Data Rate: 250Kbps

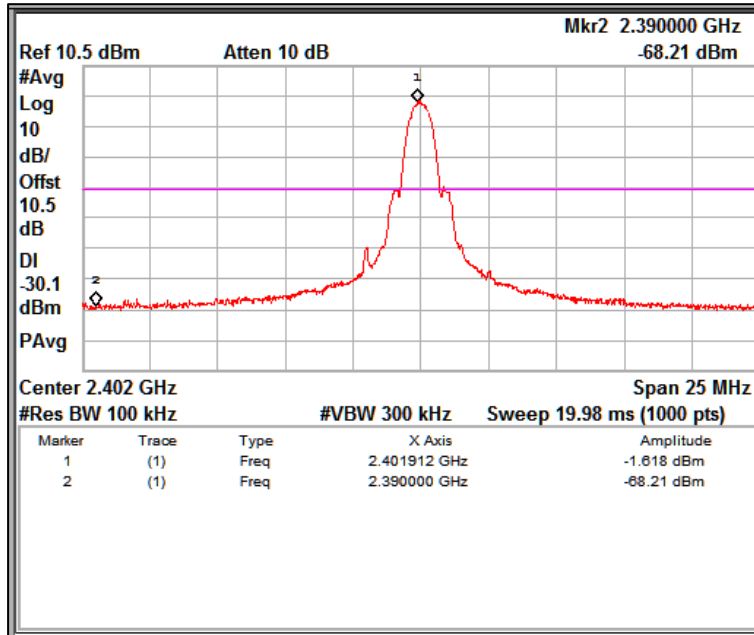


Channel Frequency: 2402MHz

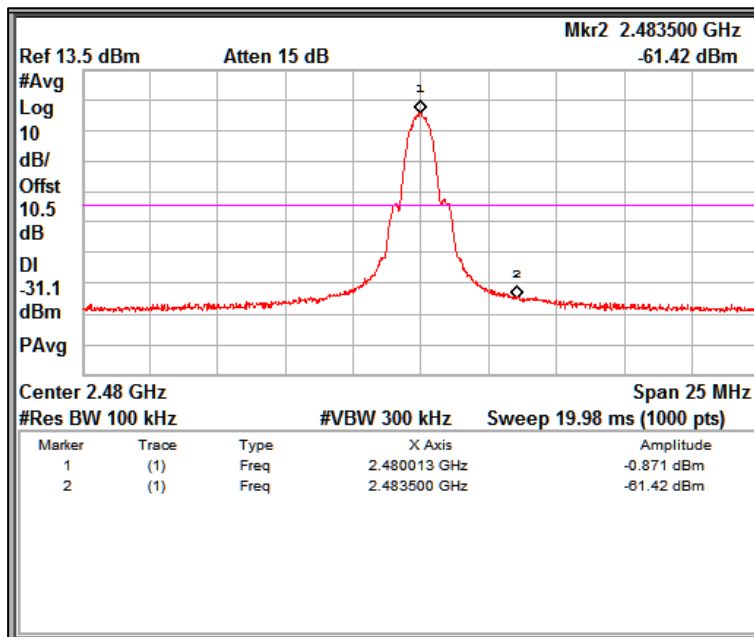


Channel Frequency: 2480MHz

Data Rate: 1Mbps

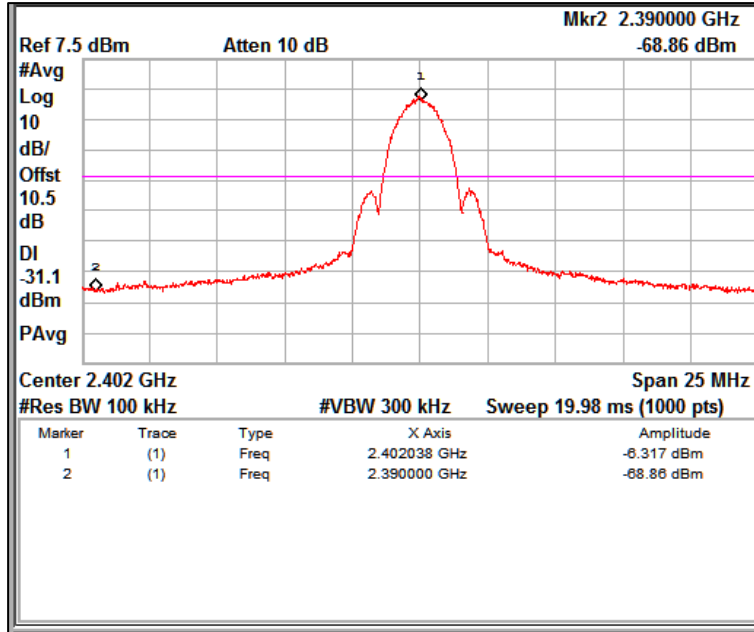


Channel Frequency: 2402MHz

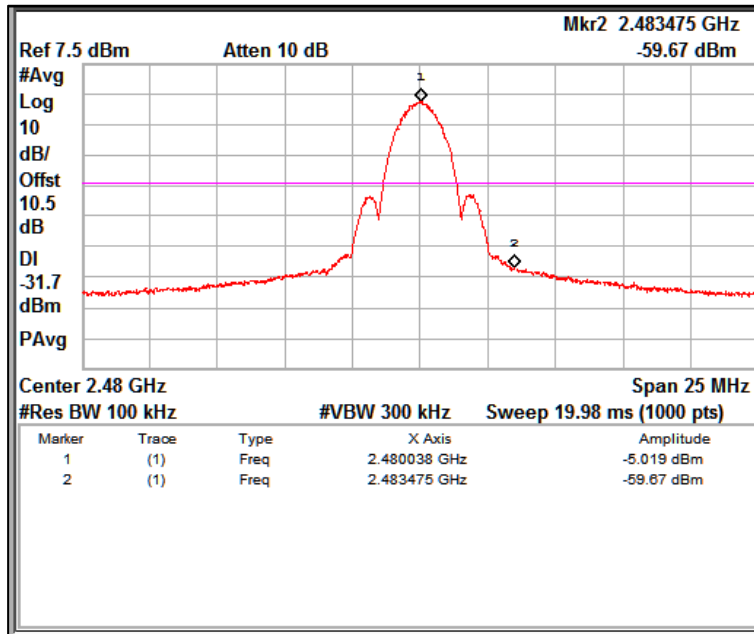


Channel Frequency: 2480MHz

Data Rate: 2Mbps

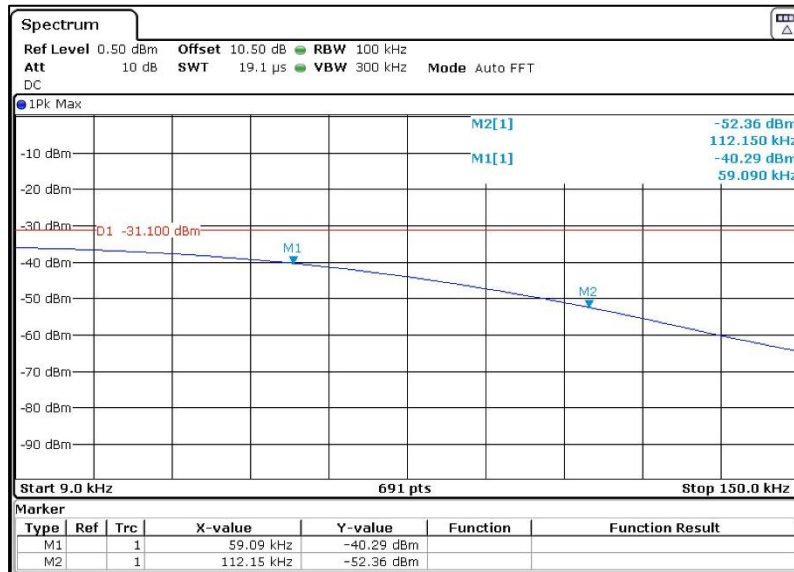


Channel Frequency: 2402MHz



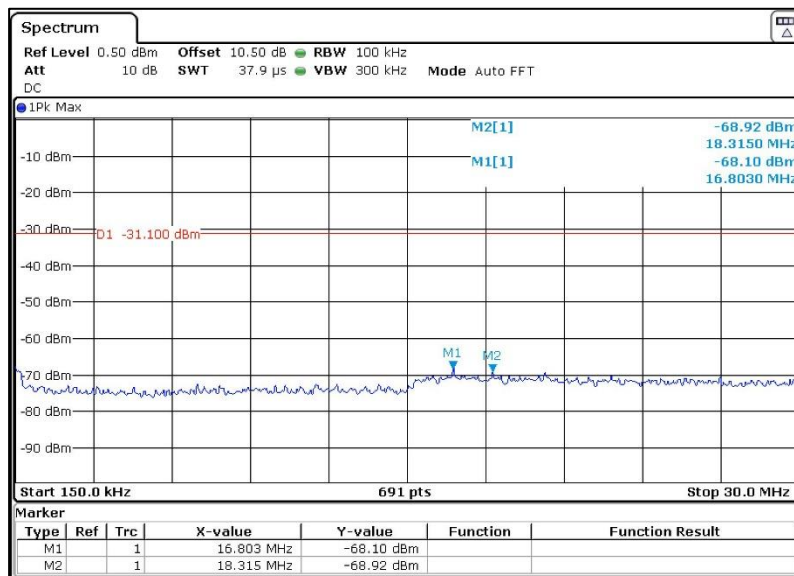
Channel Frequency: 2480MHz

8.4.2 Out of Band emissions



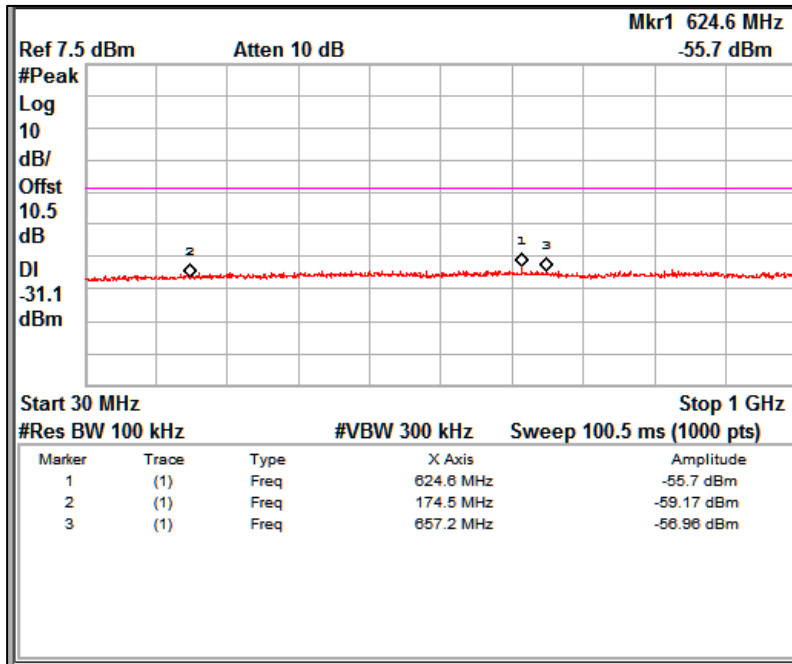
Frequency Range: 9kHz-150kHz

Channel Frequency: 2402MHz



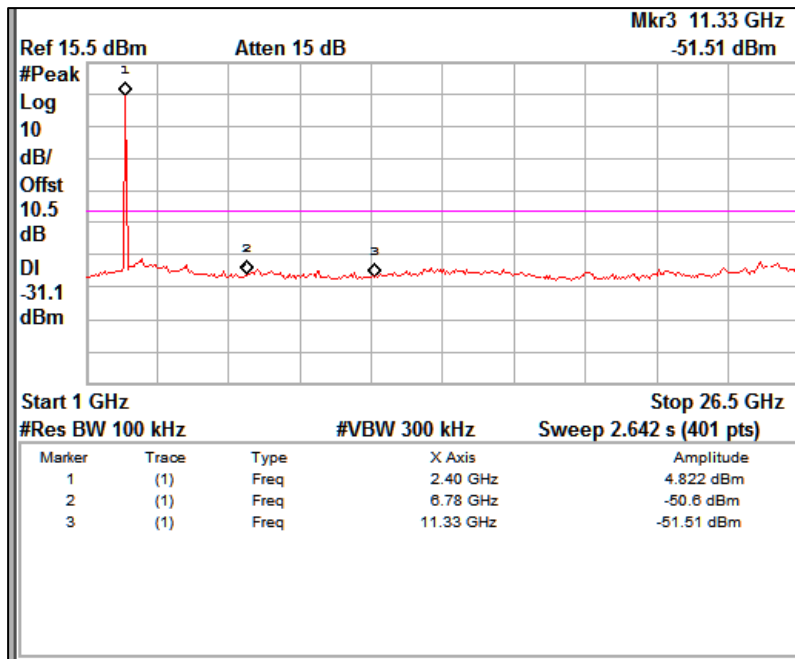
Frequency Range: 150kHz-30MHz

Channel Frequency: 2402MHz



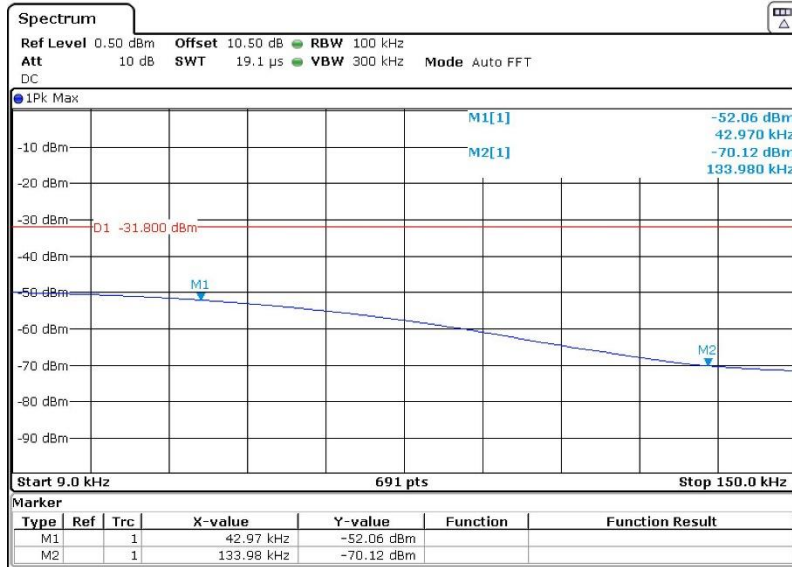
Frequency Range: 30MHz-1GHz

Channel Frequency: 2402MHz



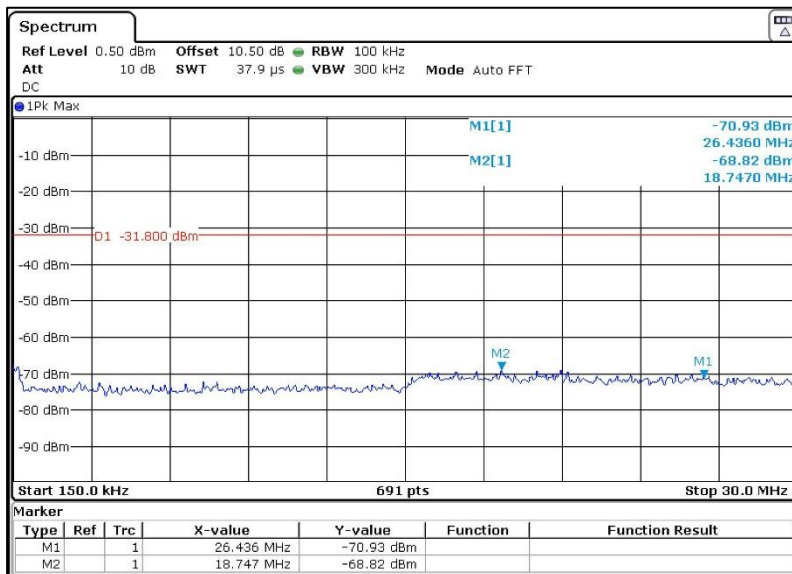
Frequency Range: 1GHz-26.5GHz

Channel Frequency: 2402MHz



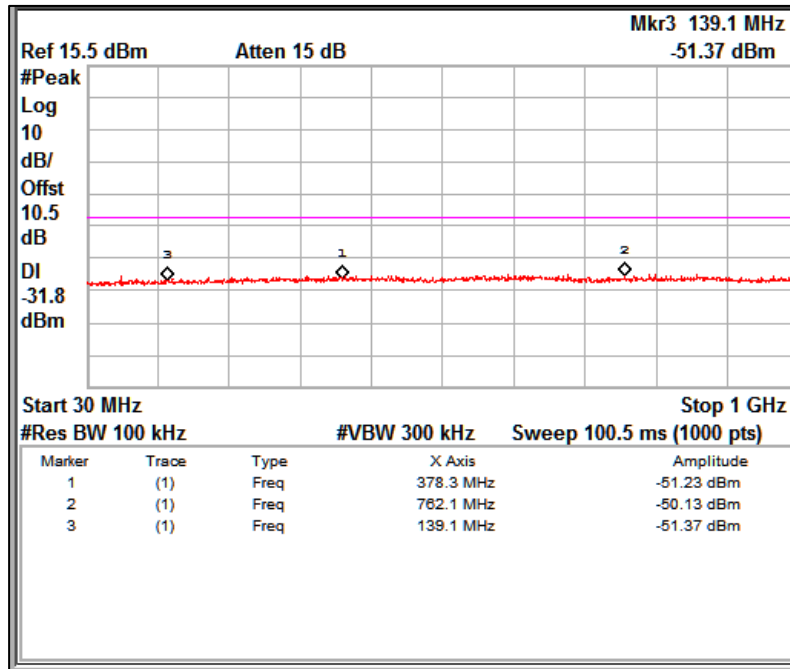
Frequency Range: 9kHz-150kHz

Channel Frequency: 2440MHz



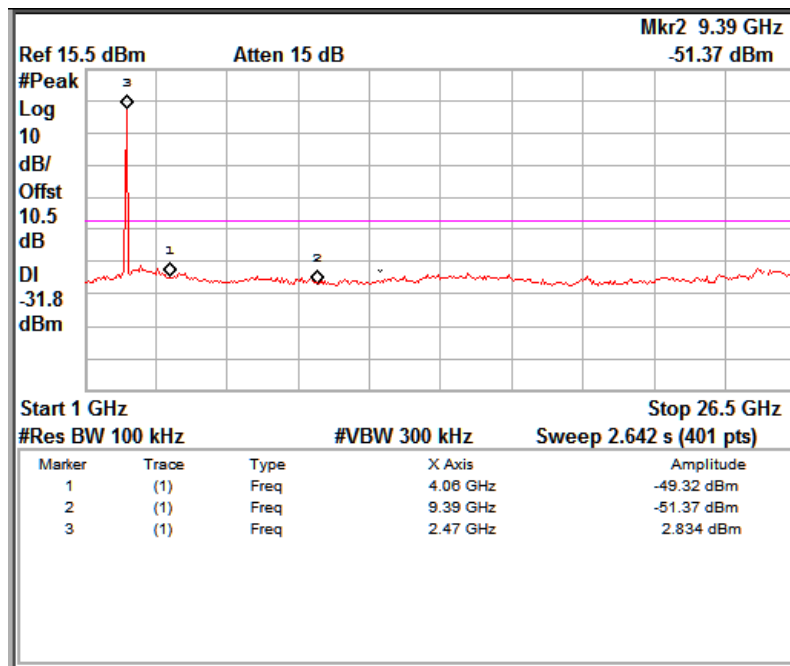
Frequency Range: 150kHz-30MHz

Channel Frequency: 2440MHz



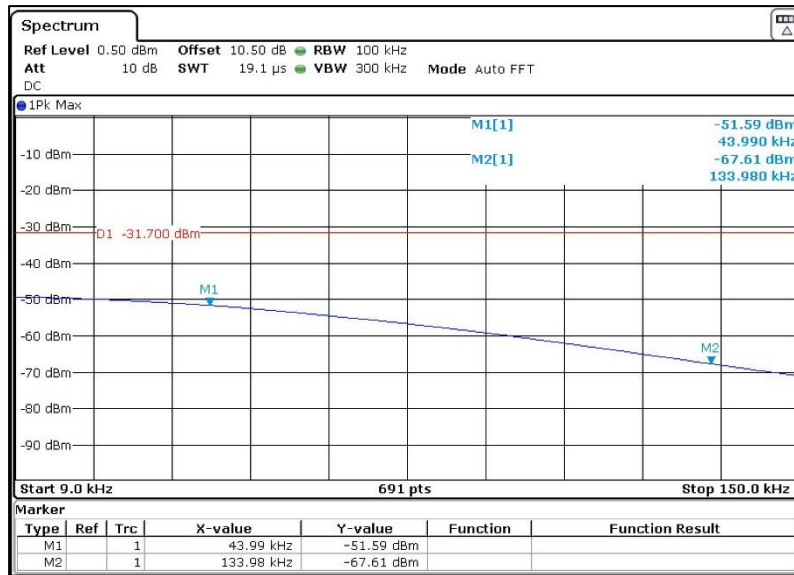
Frequency Range: 30MHz-1GHz

Channel Frequency: 2440MHz



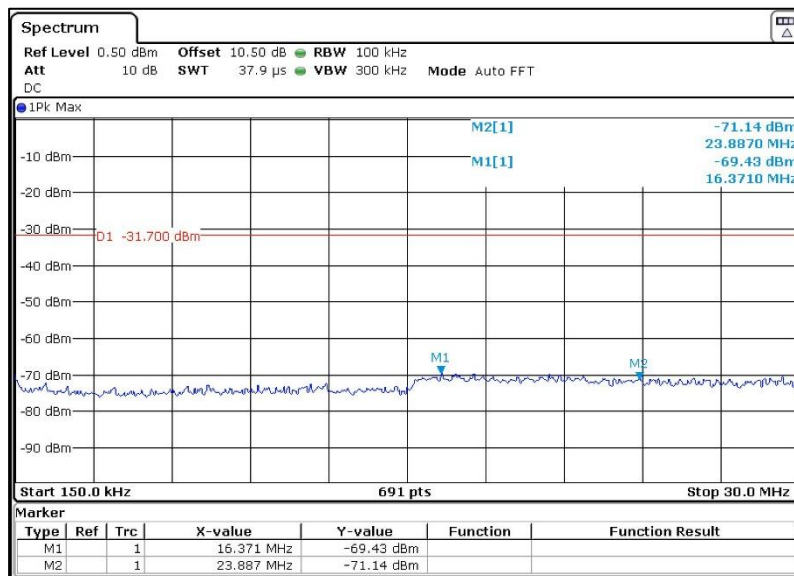
Frequency Range: 1GHz-26.5GHz

Channel Frequency: 2440MHz



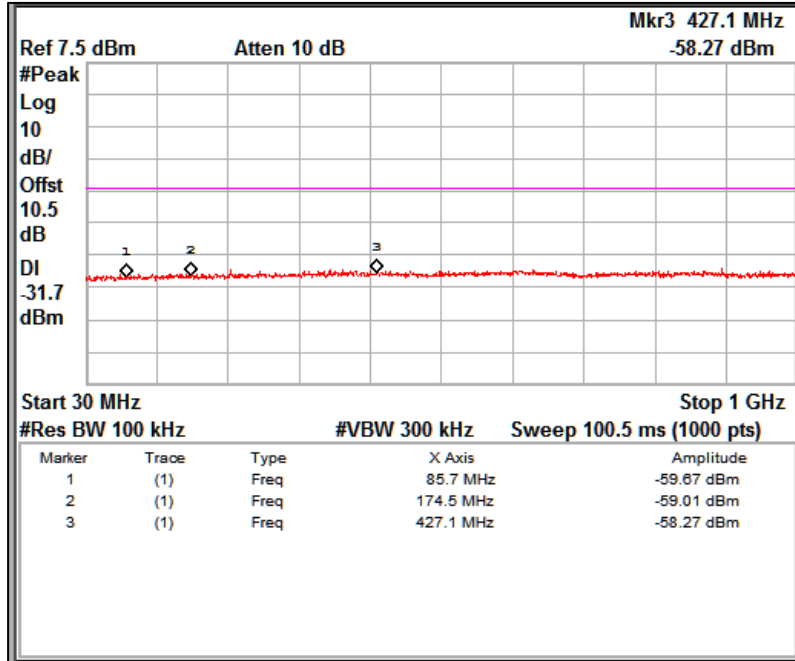
Frequency Range: 9kHz-150KHz

Channel Frequency: 2480MHz



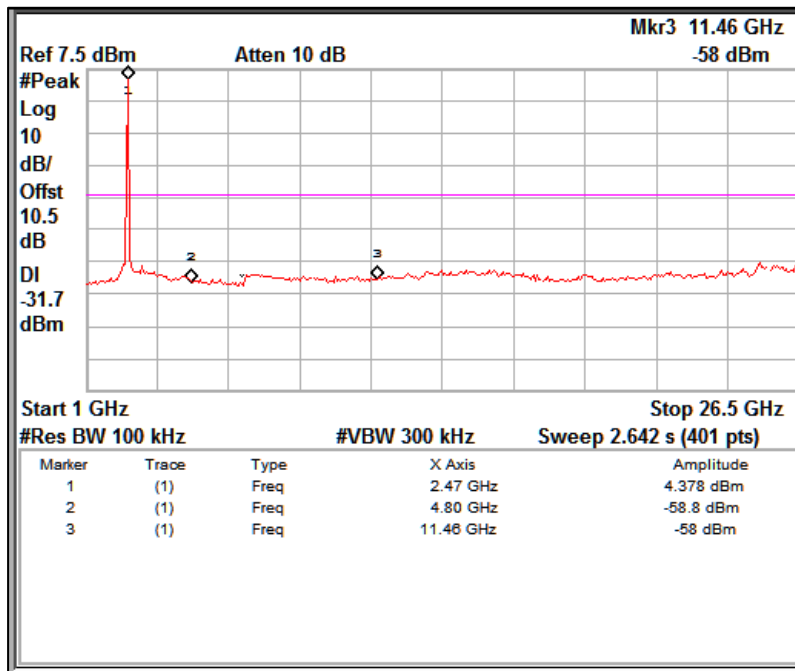
Frequency Range: 150kHz-30MHz

Channel Frequency: 2480MHz



Frequency Range: 30MHz-1GHz

Channel Frequency: 2480MHz



Frequency Range: 1GHz-26.5GHz

Channel Frequency: 2480MHz

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 C63.10-2013
Measurement Location	Semi Anechoic Chamber 30MHz - 1 GHz Fully Anechoic Chamber 1 GHz - 26GHz
Measurement Bandwidth	100 kHz for frequency range < 1GHz 1 MHz for Frequency range >1GHz
Detector	Refer remarks below
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 6: Transmitter limits for Radiated emission

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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 $\text{dB}\mu\text{V/m}$ at 3m range by extrapolation calculation and the measurement of loop antenna.

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

Test Conditions:

Temperature (Norm) = + 22.8 °C Voltage = 6 Volts DC (4 AA Batteries - 1.5 Volts each)
Relative humidity = 68 %

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

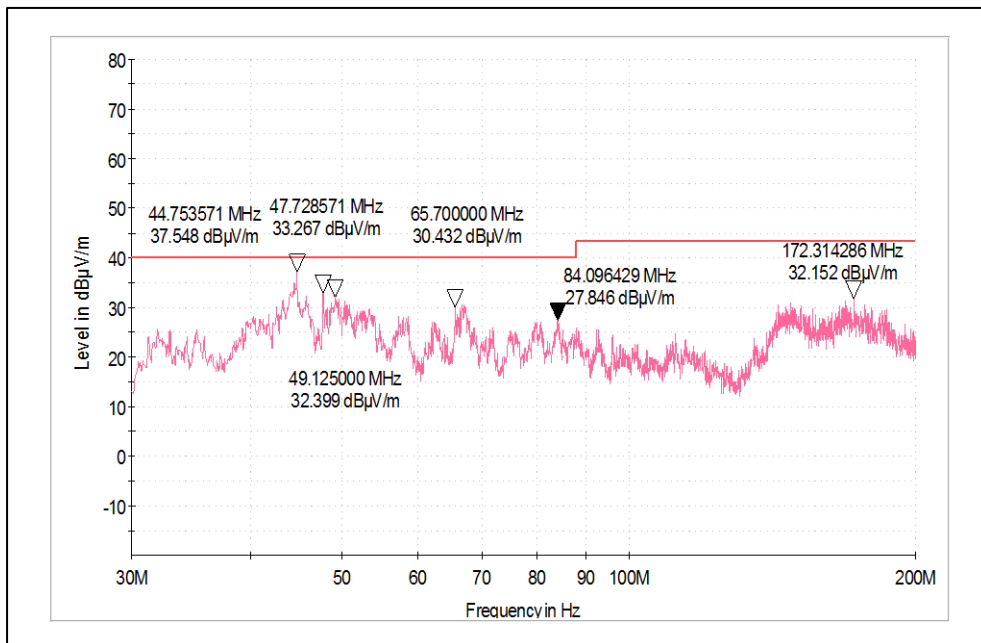
Test results for frequency range 9kHz – 30MHz

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 – 200MHz

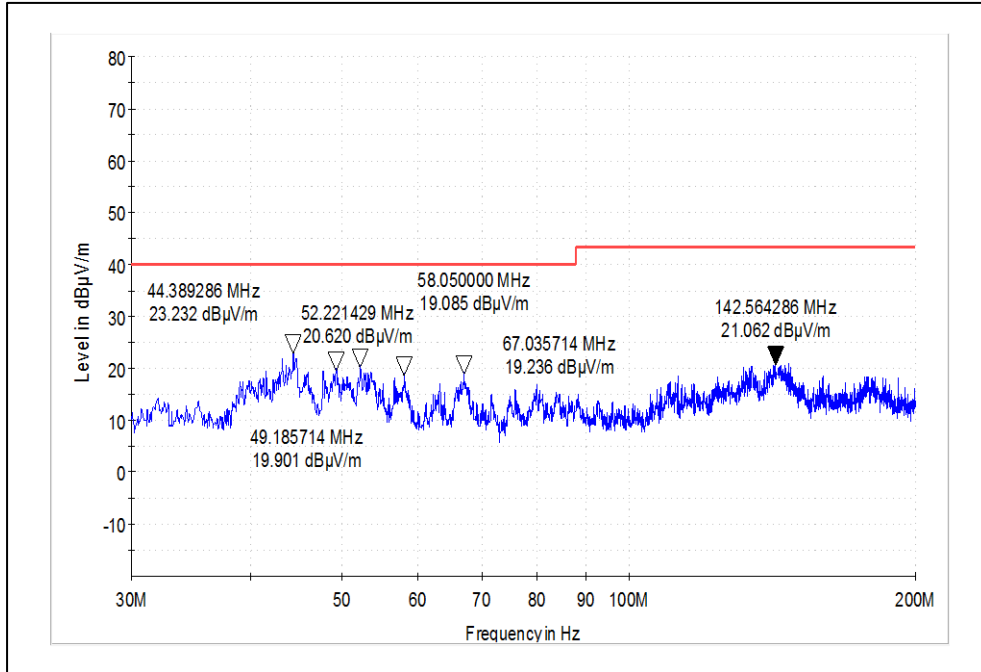
Antenna Polarization	Measured Frequency (MHz)	Measured Emission Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	44.75(Pk)	37.54	40.00	-2.46
	44.72(Qp)	39.30	40.00	-0.70
	47.72(Pk)	33.26	40.00	-6.74
	47.79(Qp)	35.36	40.00	-4.64
	49.12(Pk)	32.39	40.00	-7.61
	173.31(Pk)	32.15	43.50	-11.35
Horizontal	44.38(pk)	23.23	40.00	-16.77
	52.22(pk)	20.62	40.00	-19.38
	58.05(pk)	19.08	40.00	-20.92
	67.03(pk)	19.23	40.00	-20.77
	142.56(pk)	21.06	43.50	-22.44

QP: Measured in Quasi peak detector
Pk: Measured in Peak detector



Channel Frequency 30MHz – 200MHz

Polarization: Vertical



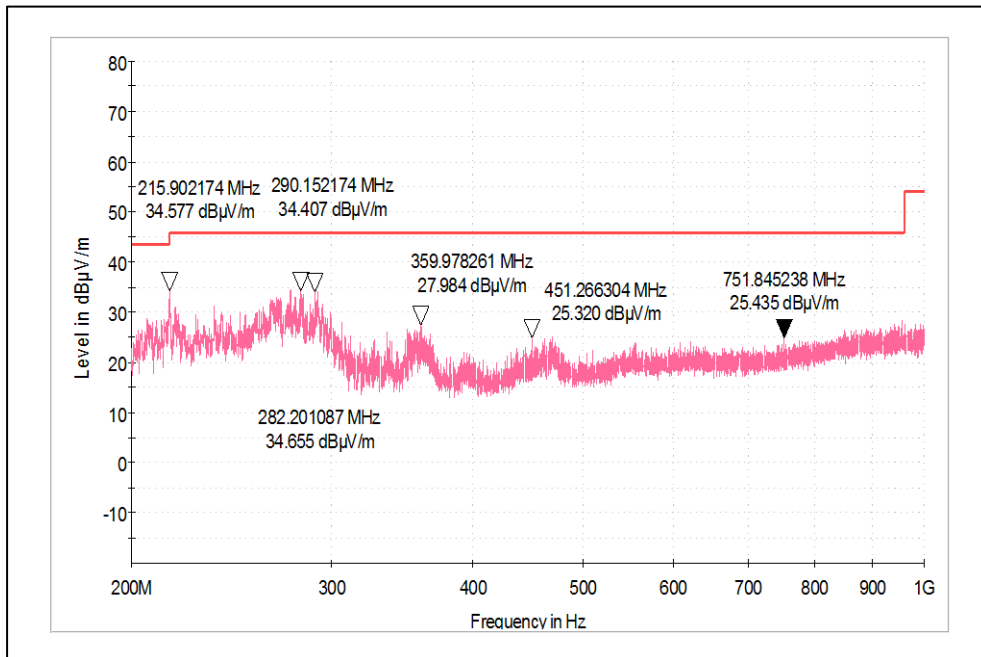
Channel Frequency 30MHz – 200MHz

Polarization: Horizontal

Test results for frequency range 200MHz – 1GHz

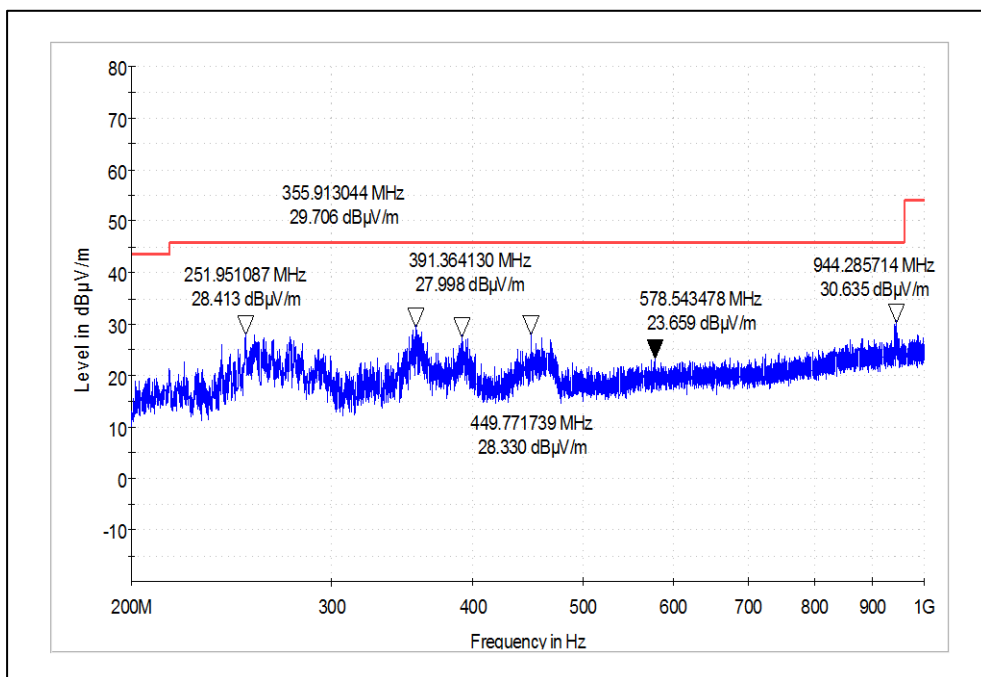
Antenna Polarization	Measured Frequency (MHz)	Measured Emission Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	215.90	34.57	43.50	-8.93
	282.20	34.65	46.00	-11.35
	359.97	27.98	46.00	-18.02
	451.26	25.32	46.00	-20.68
	751.84	25.43	46.00	-20.57
Horizontal	251.95	28.41	46.00	-17.59
	355.91	29.70	46.00	-16.3
	391.36	27.99	46.00	-18.01
	449.77	28.33	46.00	-17.67
	944.28	30.63	46.00	-15.37

QP: Measured in Quasi peak detector
Pk: Measured in Peak detector



Channel Frequency 200MHz – 1GHz

Polarization: Vertical



Channel Frequency 200MHz – 1GHz

Polarization: Horizontal

Test results for the frequencies range above 1GHz

Data rate:125 Kbps

Channel Frequency (MHz)	Polarization	Frequency (MHz)	Emission level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	Vertical	2390(Pk)	36.48	74*	-37.52
		2390(Av)	23.02	54*	-30.98
		2402(Pk)	66.45	-	-
		2402(Av)	63.96	-	-
		4804(Pk)	39.95	74	-34.05
		4804(Av)	28.55	54	-25.45
		7206(Pk)	No Harmonics		
	7206(Av)				
	Horizontal	2390(Pk)	35.95	74*	-38.05
		2390(Av)	22.99	54*	-31.01
		2402(Pk)	68.27	-	-
		2402(Av)	65.84	-	-
		4804(Pk)	39.42	74	-34.58
		4804(Av)	28.42	54	-25.58
7206(Pk)		No Harmonics			
7206(Av)					
2440	Vertical	2440(Pk)	67.67	-	-
		2440(Av)	65.19	-	-
		4880(Pk)	40.34	74	-33.66
		4880(Av)	28.53	54	-25.47
		7320(Pk)	No Harmonics		
	7320(Av)				
	Horizontal	2440(Pk)	70.35	-	-
		2440(Av)	67.95	-	-
		4880(Pk)	39.99	74	-34.01
		4880(Av)	28.77	54	-25.23
7320(Pk)		No Harmonics			
7320(Av)					
2480	Vertical	2480(Pk)	66.37	-	-
		2480(Av)	63.89	-	-
		2483.5(Pk)	36.59	74*	-37.41
		2483.5(Av)	23.29	54*	-30.71
		4960(Pk)	39.67	74	-34.33
		4960(Av)	28.39	54	-25.61
		7440(Pk)	No Harmonics		
	7440(Av)				
	Horizontal	2480(Pk)	69.88	-	-
		2480(Av)	67.41	-	-
		2483.5(Pk)	36.88	74*	-37.12
		2483.5(Av)	23.31	54*	-30.69
		4960(Pk)	41.92	74	-32.08
		4960(Av)	27.88	54	-26.12
7440(Pk)		No Harmonics			
7440(Av)					

*- : Indicate restricted band of operation §15.205

- : Fundamental emission

Pk: Peak Detector; Av: Average Detector

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

Seite 53 von 61
Page 53 of 61

Data rate: 250Kbps

Channel Frequency(MHz)	Polarization	Frequency (MHz)	Emission level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2402	Vertical	2390(Pk)	35.38	74*	-38.62
		2390(Av)	22.44	54*	-31.56
		2402(Pk)	67.29	-	-
		2402(Av)	58.21	-	-
		4804(Pk)	43.7	74	-30.3
		4804(Av)	30.9	54	-23.1
		7206(Pk)	No Harmonics		
	7206(Av)				
	Horizontal	2390(Pk)	35.54	74*	-38.46
		2390(Av)	22.43	54*	-31.57
		2402(Pk)	71.76	-	-
		2402(Av)	62.67	-	-
		4804(Pk)	42.62	74	-31.38
		4804(Av)	29.89	54	-24.11
7206(Pk)		No Harmonics			
7206(Av)					
2440	Vertical	2440(Pk)	66.94	-	-
		2440(Av)	57.82	-	-
		4880(Pk)	43.91	74	-30.09
		4880(Av)	31.91	54	-22.09
		7320(Pk)	No Harmonics		
	7320(Av)				
	Horizontal	2440(Pk)	72.15	-	-
		2440(Av)	63.09	-	-
		4880(Pk)	42.06	74	-31.94
		4880(Av)	29.46	54	-24.54
7320(Pk)		No Harmonics			
7320(Av)					
2480	Vertical	2480(Pk)	66.95	-	-
		2480(Av)	57.86	-	-
		2483.5(Pk)	36.01	74*	-37.99
		2483.5(Av)	22.71	54*	-31.29
		4960(Pk)	42.99	74	-31.01
		4960(Av)	30.69	54	-23.31
		7440(Pk)	No Harmonics		
	7440(Av)				
	Horizontal	2480(Pk)	71.78	-	-
		2480(Av)	62.7	-	-
		2483.5(Pk)	36.34	74*	-37.66
		2483.5(Av)	22.74	54*	-31.26
		4960(Pk)	41.69	74	-32.31
		4960(Av)	29.53	54	-24.47
7440(Pk)		No Harmonics			
7440(Av)					

*- : Indicate restricted band of operation §15.205

- : Fundamental emission

Pk: Peak Detector; Av: Average Detector

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

Seite 54 von 61
Page 54 of 61

Data rate: 1Mbps

Channel Frequency (MHz)	Polarization	Frequency (MHz)	Emission level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2402	Vertical	2390(Pk)	36.39	74*	-37.61
		2390(Av)	23.01	54*	-30.99
		2402(Pk)	69.07	-	-
		2402(Av)	66.63	-	-
		4804(Pk)	43.16	74	-30.84
		4804(Av)	32.61	54	-21.39
		7206(Pk)	No Harmonics		
	7206(Av)				
	Horizontal	2390(Pk)	36.77	74*	-37.23
		2390(Av)	23.01	54*	-30.99
		2402(Pk)	70.91	-	-
		2402(Av)	68.52	-	-
		4804(Pk)	41.79	74	-32.21
		4804(Av)	31.03	54	-22.97
7206(Pk)		No Harmonics			
7206(Av)					
2440	Vertical	2440(Pk)	69.88	-	-
		2440(Av)	67.45	-	-
		4880(Pk)	42.01	74	-31.99
		4880(Av)	31.05	54	-22.95
		7320(Pk)	No Harmonics		
	7320(Av)				
	Horizontal	2440(Pk)	72.73	-	-
		2440(Av)	70.32	-	-
		4880(Pk)	41.36	74	-32.64
		4880(Av)	30.8	54	-23.2
7320(Pk)		No Harmonics			
7320(Av)					
2480	Vertical	2480(Pk)	68.93	-	-
		2480(Av)	66.45	-	-
		2483.5(Pk)	37.1	74*	-36.9
		2483.5(Av)	23.28	54*	-30.72
		4960(Pk)	42.25	74	-31.75
		4960(Av)	29.51	54	-24.49
		7440(Pk)	No Harmonics		
	7440(Av)				
	Horizontal	2480(Pk)	72.45	-	-
		2480(Av)	70.05	-	-
		2483.5(Pk)	37.73	74*	-36.27
		2483.5(Av)	23.39	54*	-30.61
		4960(Pk)	41.24	74	-32.76
		4960(Av)	28.73	54	-25.27
7440(Pk)		No Harmonics			
7440(Av)					

*- : Indicate restricted band of operation §15.205

- : Fundamental emission

Pk: Peak Detector; Av: Average Detector

Prüfbericht - Nr.:
Test Report No.:

ULR-TC56882130000029F

Seite 55 von 61
Page 55 of 61

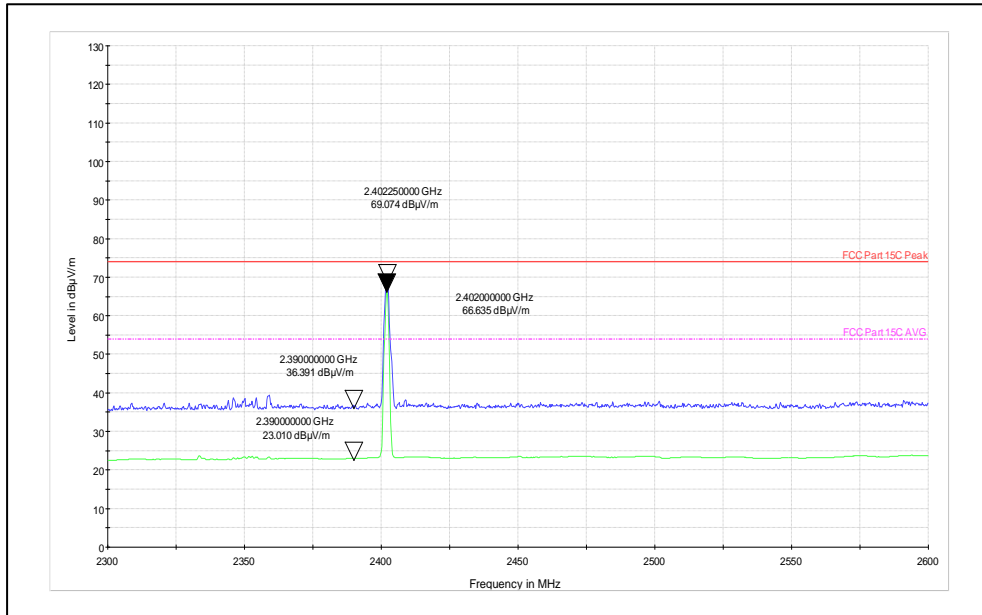
Data rate: 2Mbps

Channel Frequency (MHz)	Polarization	Frequency (MHz)	Emission level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2402	Vertical	2390(Pk)	35.34	74*	-38.66
		2390(Av)	22.07	54*	-31.93
		2402(Pk)	66.78	-	-
		2402(Av)	45.29	-	-
		4804(Pk)	44.15	74	-29.85
		4804(Av)	29	54	-25
		7206(Pk)	No Harmonics		
	7206(Av)				
	Horizontal	2390(Pk)	34.81	74*	-39.19
		2390(Av)	22.15	54*	-31.85
		2402(Pk)	71.32	-	-
		2402(Av)	49.67	-	-
		4804(Pk)	42.83	74	-31.17
		4804(Av)	28.52	54	-25.48
7206(Pk)		No Harmonics			
7206(Av)					
2440	Vertical	2440(Pk)	66.74	-	-
		2440(Av)	45.46	-	-
		4880(Pk)	43.94	74	-30.06
		4880(Av)	29.82	54	-24.18
		7320(Pk)	No Harmonics		
	7320(Av)				
	Horizontal	2440(Pk)	72.04	-	-
		2440(Av)	50.64	-	-
		4880(Pk)	42.45	74	-31.55
		4880(Av)	28.74	54	-25.26
7320(Pk)		No Harmonics			
7320(Av)					
2480	Vertical	2480(Pk)	66.86	-	-
		2480(Av)	45.39	-	-
		2483.5(Pk)	35.36	74*	-38.64
		2483.5(Av)	22.67	54*	-31.33
		4960(Pk)	42.35	74	-31.65
		4960(Av)	29.25	54	-24.75
		7440(Pk)	No Harmonics		
	7440(Av)				
	Horizontal	2480(Pk)	71.26	-	-
		2480(Av)	49.61	-	-
		2483.5(Pk)	36.62	74*	-37.38
		2483.5(Av)	22.51	54*	-31.49
		4960(Pk)	43.12	74	-30.88
		4960(Av)	29.63	54	-24.37
7440(Pk)		No Harmonics			
7440(Av)					

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

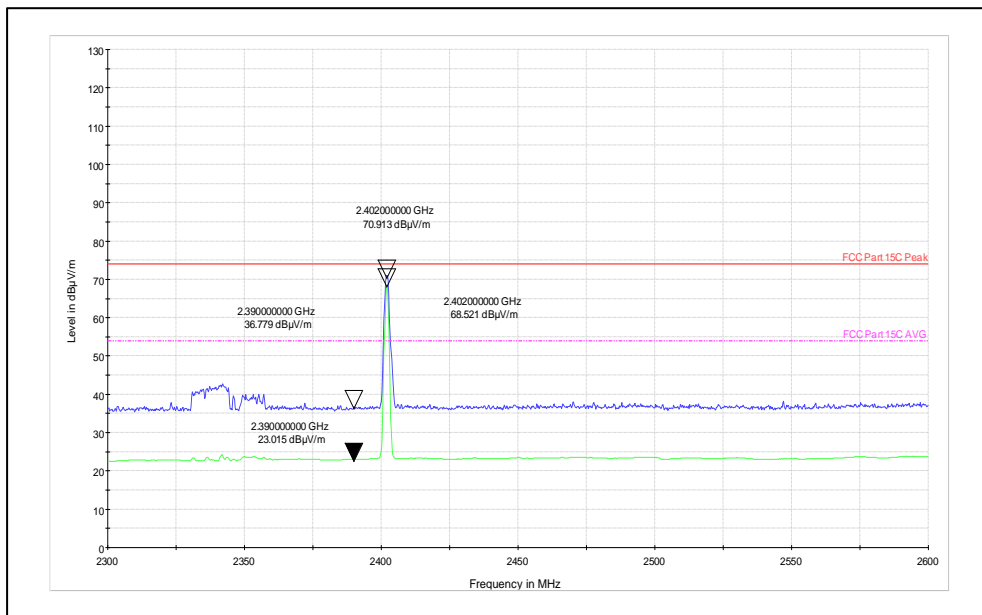
Worst case Test Plots

Data rate: 1Mbps



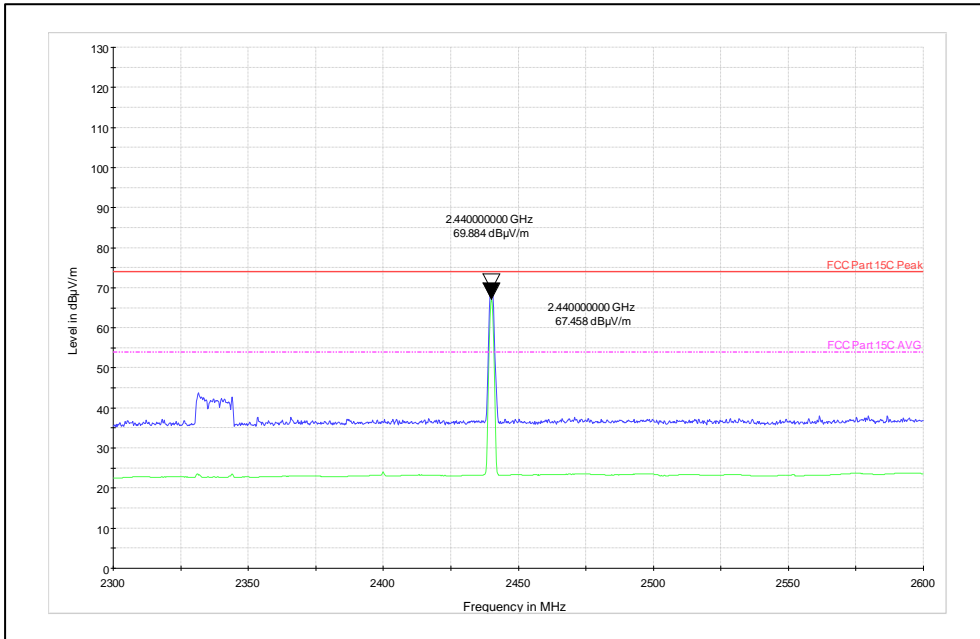
Channel Frequency: 2402MHz

Polarization: Vertical



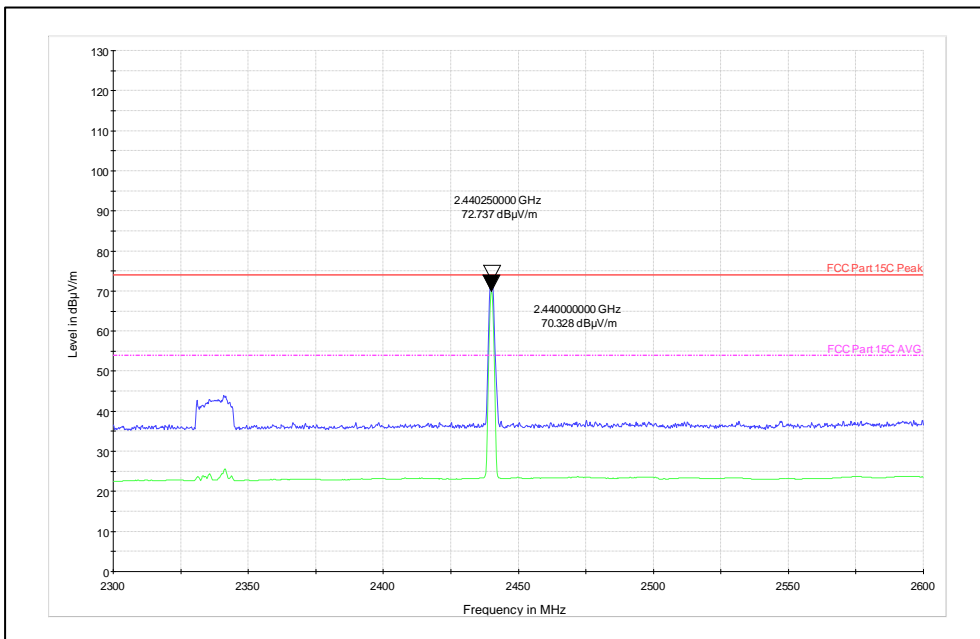
Channel Frequency: 2402MHz

Polarization: Horizontal



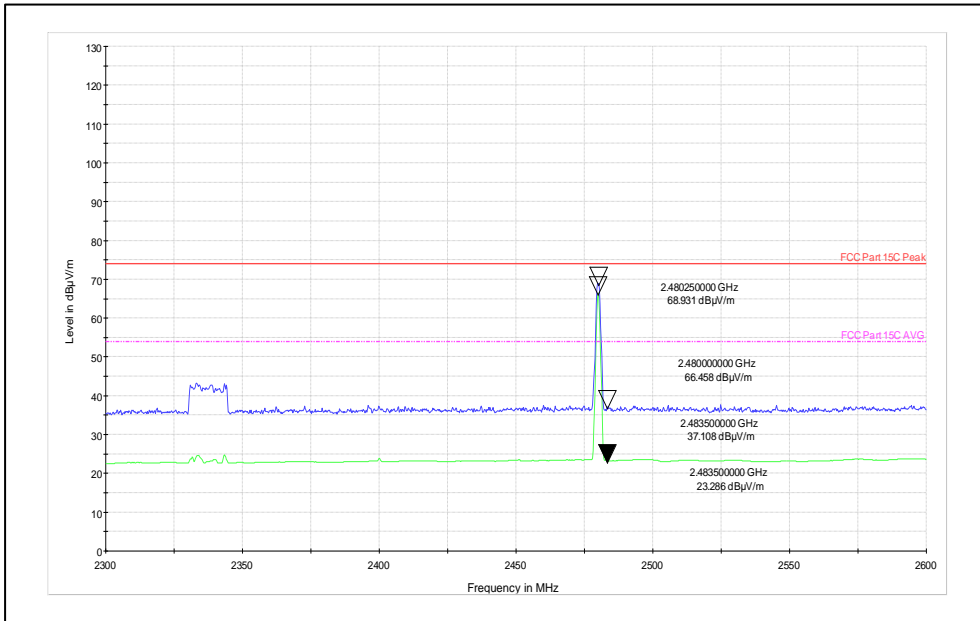
Channel Frequency: 2440MHz

Polarization: Vertical



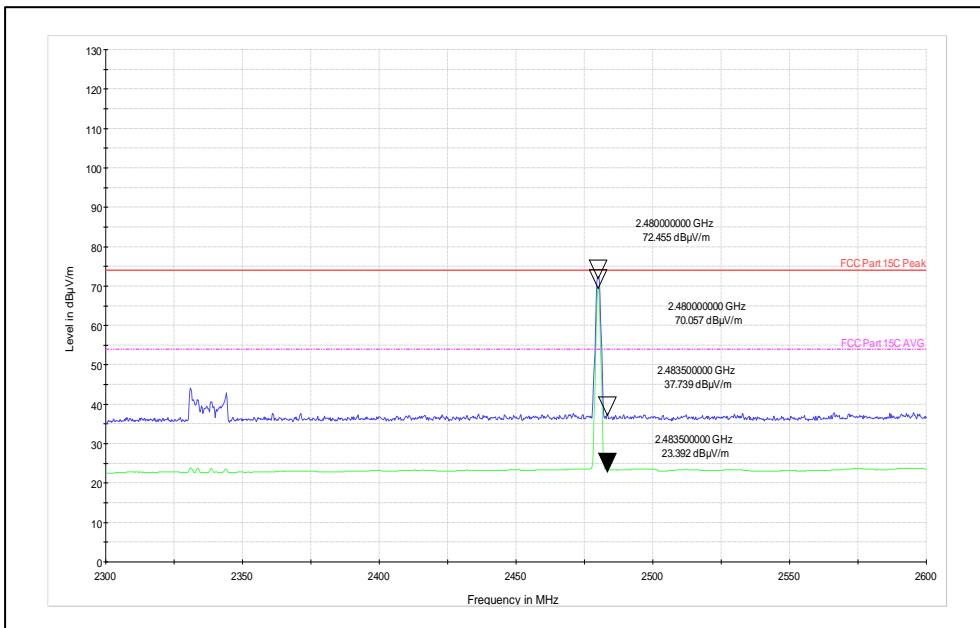
Channel Frequency: 2440MHz

Polarization: Horizontal



Channel Frequency: 2480MHz

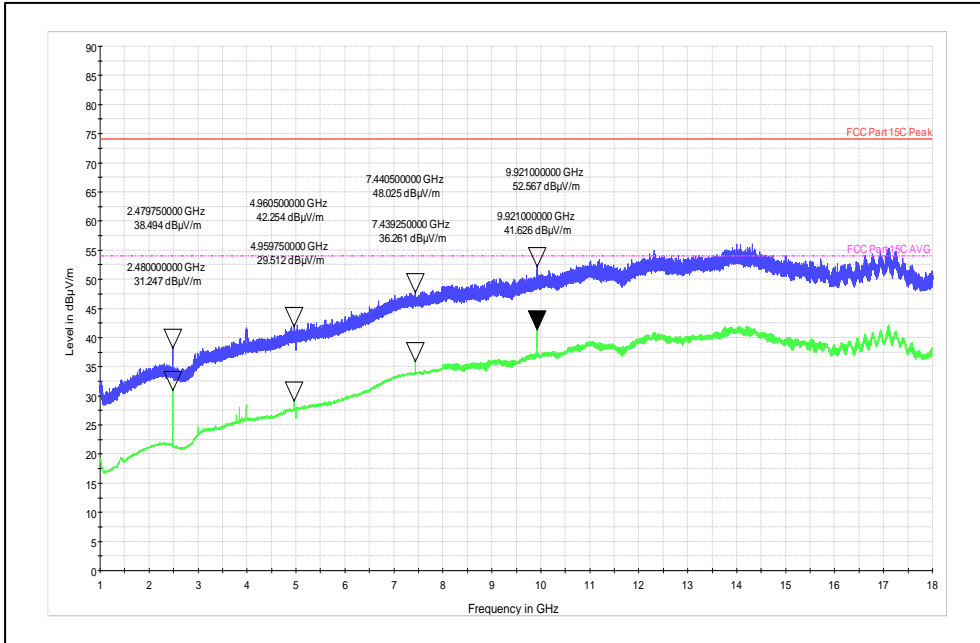
Polarization: Vertical



Channel Frequency: 2480MHz

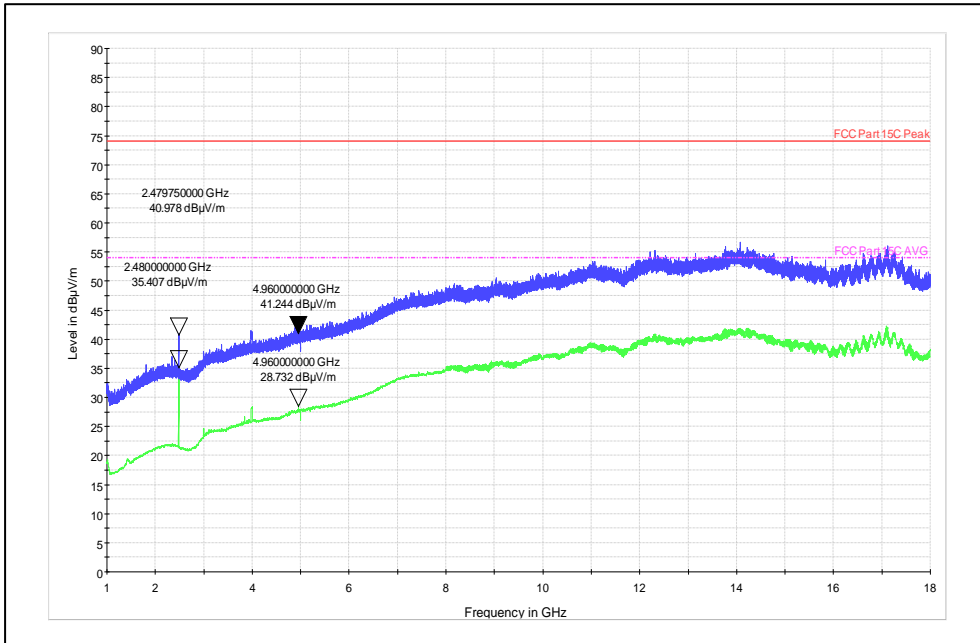
Polarization: Horizontal

Channel frequency: 2480MHz



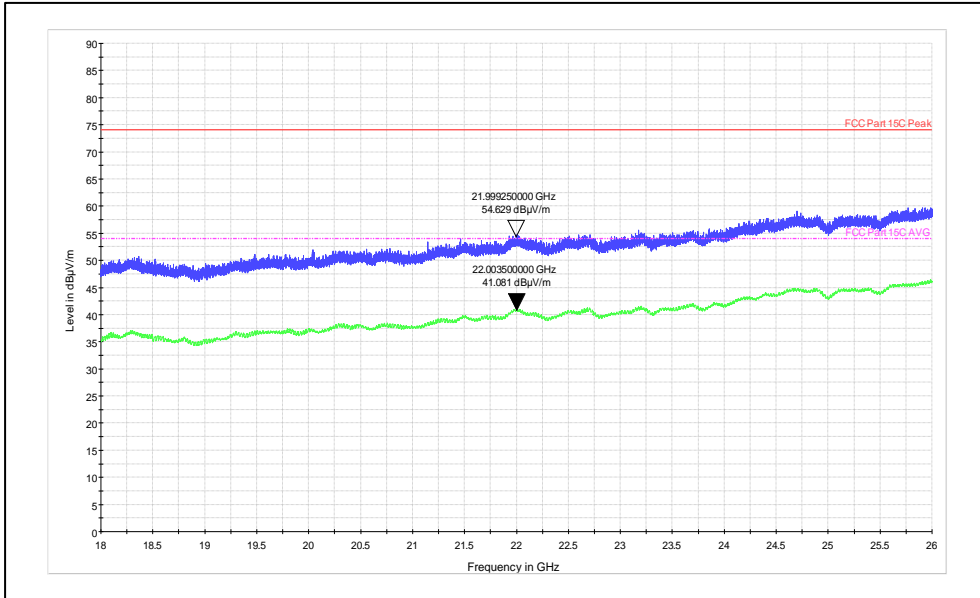
Frequency range: 1GHz-18GHz

Polarization: Vertical



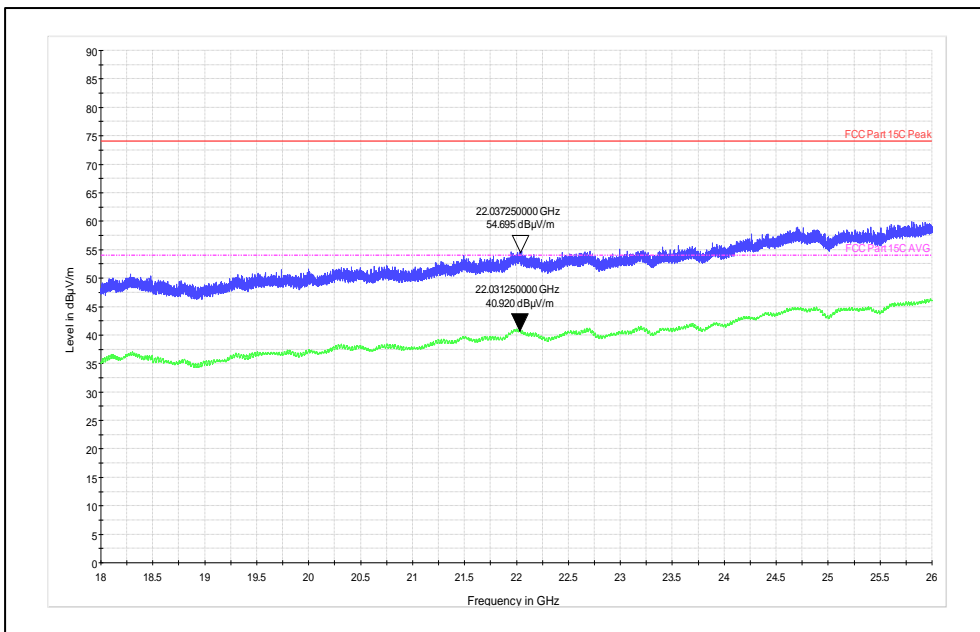
Frequency range: 1GHz-18GHz

Polarization: Horizontal



Channel Frequency: 18 - 26 GHz

Polarization: Vertical



Channel Frequency: 18 - 26 GHz

Polarization: Horizontal

9 LIST OF TABLES

Table 1: List of test and measurement instruments	5
Table 2: Instrument application Software versions	5
Table 3: Ratings and System Details as declared by Client*	6
Table 4: Measurement Uncertainty	7
Table 5: List of BLE Center frequencies	9
Table 6: Transmitter limits for Radiated emission	48

10 LIST OF FIGURES

Figure 1: Frequency Range 9 kHz- 30 MHz	12
Figure 2: Frequency Range 30 MHz – 200 MHz	12
Figure 3: Frequency Range 200 MHz - 1GHz	13
Figure 4: Frequency Range above 1 GHz	13

******End of the Test Report******