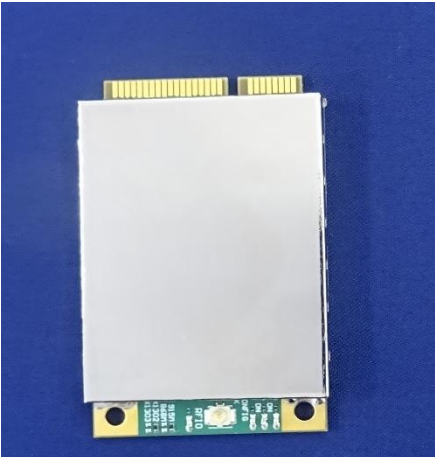


fPrüfbericht-Nr.: <i>Test report no.:</i>	IN22G172 ULR-TC568822300000103F	Auftrags-Nr.: <i>Order no.:</i>	146732643 010	Seite 1 von 52 Page 1 of 52
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	2029555	Auftragsdatum: <i>Order date:</i>	03-11-2022	
Auftraggeber: <i>Client:</i>	Bharat Electronics Ltd Central Research Laboratory, Jalahalli Bengaluru, Karnataka, IND-560013			
Prüfgegenstand: <i>Test item:</i>	LoRaWAN® Concentrator miniPCle - USB / SPI			
Bezeichnung <i>Identification</i>	BEL-LWCC-915	Serien-Nr.: <i>Serial no.:</i>	Engineering Sample	
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, 15.207 & 15.209			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2022-11-03			
Prüfmuster-Nr.: <i>Test sample no.:</i>	A003365470-006			
Prüfzeitraum: <i>Testing period:</i>	2022-11-03 - 2022-11-07			
Ort der Prüfung: <i>Place of testing:</i>	Wireless laboratory, Bangalore			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd. 27/B, 2nd cross road, Electronic city Phase 1, Bangalore-560100, India FCC Test Site Registration No: 496599			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>	genehmigt von: <i>authorized by:</i>			
Datum: <i>Date:</i>	2022-11-09	Ausstellatum: <i>Issue date:</i>	27-12-2022	
Stellung / Position:	Likhithesh M D Senior Engineer	Stellung / Position:	Madhu K N Senior Engineer	
Sonstiges / Other:	FCC ID: 2A9HG-BELLWCC915			
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)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
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>				

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 2 von 52
Page 2 of 52

TEST SUMMARY

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

Product Category: Electronics Testing
Test Discipline: EMC Test Facility

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 3 von 52
Page 3 of 52

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
ULR-TC568822300000103F	01	Initial issue of report	30-11-2022
ULR-TC568822300000103F	02	Updated Reviewer Comments	27-12-2022

Table of Contents

1	GENERAL REMARKS.....	5
1.1	Attachments	5
2	TEST SITES.....	6
2.1	Testing Facilities	6
2.2	List of Test and Measurement Instruments	6
3	GENERAL PRODUCT INFORMATION	7
3.1	Product Function and Intended Use	7
3.2	Ratings and System Details of Equipment under Test	7
3.3	Measurement Uncertainty:.....	8
4	TEST SET-UP AND OPERATION MODE.....	9
4.1	Principle of Configuration Selection.....	9
4.2	Test Operation and Test Software.....	9
4.3	Special Accessories and Auxiliary Equipment	9
4.4	Countermeasures to achieve EMC Compliance	9
4.5	List of frequencies	9
4.6	TUV Sample Identification	9
5	OPERATIONAL DESCRIPTION.....	10
6	TEST METHODOLOGY.....	11
6.1	Conducted Spurious Emission Test on AC Power lines	11
6.1.1	Test Setup Configuration.....	11
6.2	Radiated Emission Test.....	12
6.2.1	Test Setup Configuration.....	12
7	TEST RESULTS.....	14
7.1	Maximum Average Conducted Output Power.....	14
7.2	Occupied bandwidth	17
7.3	Power Spectral Density	22
7.4	Emissions in non-restricted frequency bands and Conducted Spurious Emission	25
7.4.1	Band edge and reference plots	26
7.4.2	Out-Of-Band Emissions	29
7.5	Spurious Radiated Emissions & Restricted Bands of Operation	35
7.6	Conducted spurious emission Test on AC Power lines	49
8	LIST OF TABLES	52
9	List of Figures	52

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 5 von 52
Page 5 of 52

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

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 6 von 52
Page 6 of 52

2 TEST SITES

2.1 Testing Facilities

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

2.2 List of Test and Measurement Instruments

Table 1: List of test and measurement instruments

Equipment	Manufacturer	Model Name	Serial Number	Firmware Versions	Calibration Due Date	Periodicity	Test Facility
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	US41192772	A.14.06	15-12-2022	Yearly	Antenna-Port Conducted test
EMI Receiver	Rohde & Schwarz	ESR7	101133	3.48 SP3	22-07-2023	Yearly	Conducted AC Power line Test
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100811	-	12-07-2023	Yearly	
LISN	Rohde & Schwarz	ENV216	100022	-	11-10-2023	Yearly	

Table 2: Instrument application Software versions

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

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 7 von 52
Page 7 of 52

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

This product is intended to provide a LoRa air interface at 915MHz band for data collection from sensors.

3.2 Ratings and System Details of Equipment under Test

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

Operating Frequency Band		LoRa US915
Operational Frequency		902 – 928 MHz
Frequency / channel separation		500 KHz
No. of Channel		72 UL + 8 DL
Modulation		LoRa Chirp Spread Spectrum
Max Power Measured		27.29dBm @ 927MHz
Data rate		21.9Kbps
Number of antennas		1
Antenna Gain & Type		3+/-0.5dBi Omnidirectional antenna
Supply Voltage to Product		3.3V
Dimensions (H × L × W)		4mm x 51mm x 30mm
Environmental conditions	Operational Condition	-40+85 deg C
	Storage Condition	-40+85 deg C

***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.

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 8 von 52
Page 8 of 52

3.3 Measurement Uncertainty:

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

Table 4: Measurement Uncertainty

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

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.

4.2 Test Operation and Test Software

Hardware Version: V1.0

Software Version: Mobaxterm V21.5

4.3 Special Accessories and Auxiliary Equipment

Test laptop: Windows Operating System

LAN cable: Weidmüller 1165940015

4.4 Countermeasures to achieve EMC Compliance

None

4.5 List of frequencies

Frequency Band (GHz)	Channel No.	Frequency (MHz)
Sub-GHz (903 MHz – 927 MHz)	Low	903
	:	:
	Mid	915
	:	:
	High	927

Table 5: List of SubGHz Center frequencies

Channel used for SubGHz testing

Channel Low : 903 MHz

Channel Mid : 915 MHz

Channel High : 927 MHz

4.6 TUV Sample Identification

1. TUV Sample Identification number : **A003365470-006– Radiated & Conducted test Sample**

5 OPERATIONAL DESCRIPTION

The LoRa Gateway Front end Module acts as an air interface at 915MHz band for data collection from sensors. This module in conjunction with a computing element can transmit and receive data with LoRa standard and perform remote data collection. The LoRa modem in the module can give wireless remote access with low time-on-air links with longer battery life of the system. The LoRa module needs very less power in transmit mode owing to the higher sensitivity of the receive modems. It can also sense multiple spreading factors simultaneously thereby reducing collisions on the air and better response times.

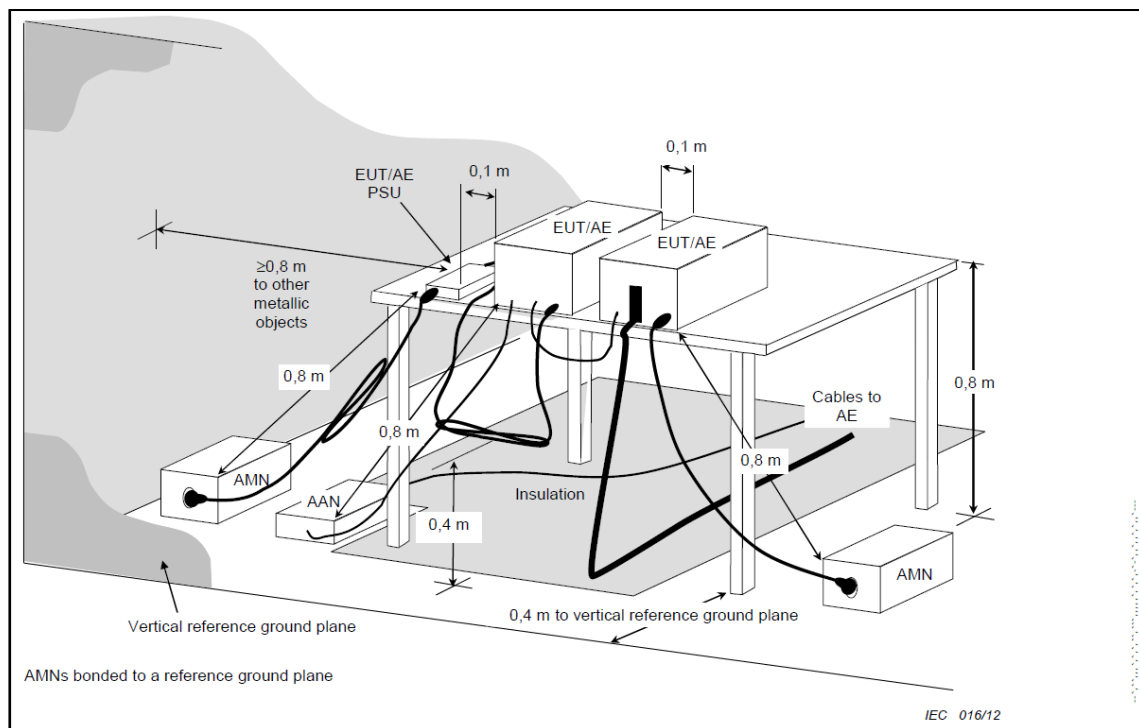
6 TEST METHODOLOGY

6.1 Conducted Spurious Emission Test on AC Power lines

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

The device is placed on the test table, raised 80cm above the reference ground plane. The vertical conducting plane is located 40cm to the rear of the device. AC Conducted emission measurement is made over frequency range from 150kHz to 30MHz, this measurement was performed with EUT powered by 2 methods and both method are tested individually, one with an AC adaptor with 110V AC 60Hz supply and second with Wireless charger with supply 110V AC 60Hz.

6.1.1 Test Setup Configuration



6.2 Radiated Emission Test

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

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

6.2.1 Test Setup Configuration

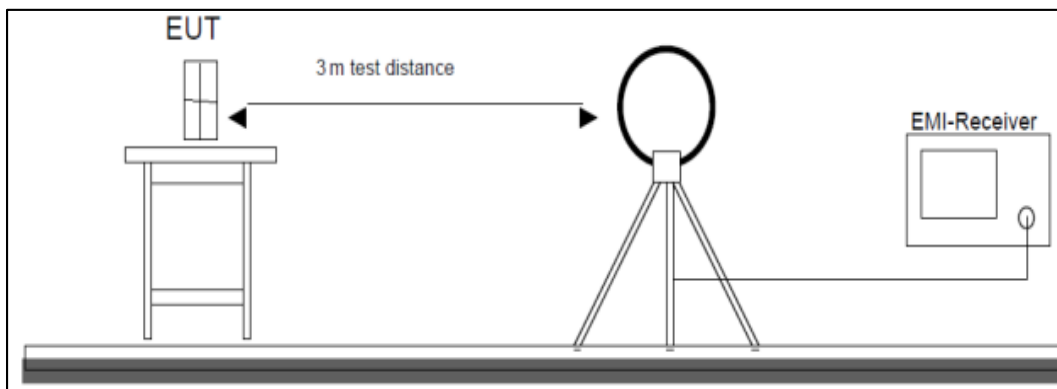


Figure 1: Frequency Range 9 kHz - 30 MHz

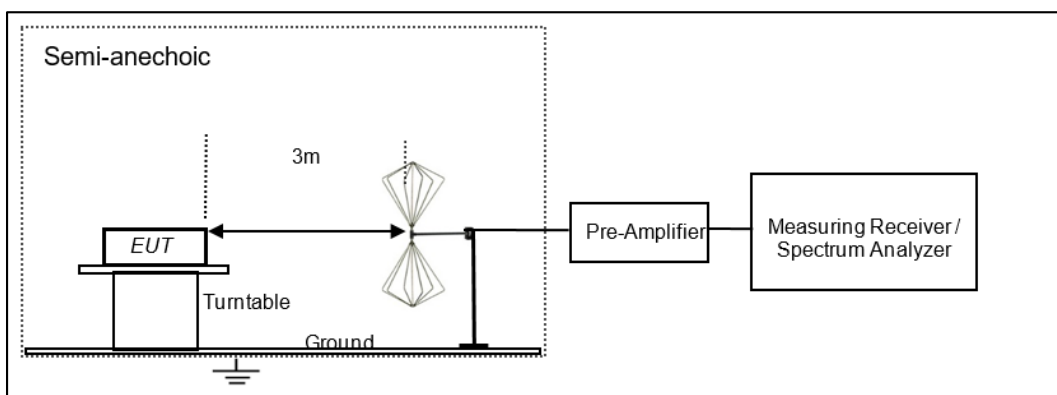


Figure 2: Frequency Range 30 MHz - 200 MHz

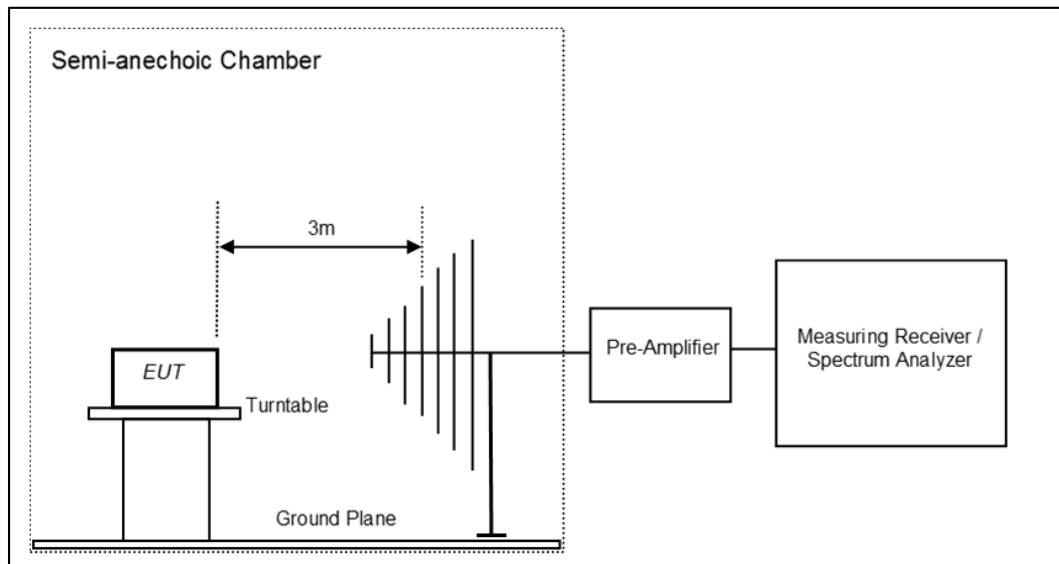


Figure 3: Frequency Range 200 MHz - 1GHz

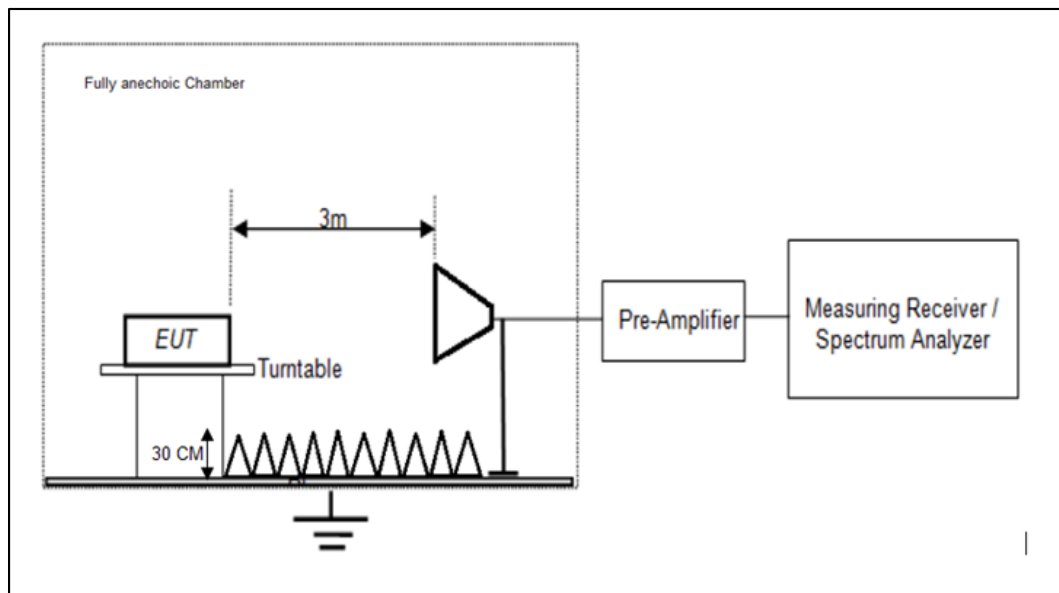


Figure 4: Frequency Range above 1 GHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 14 von 52
Page 14 of 52

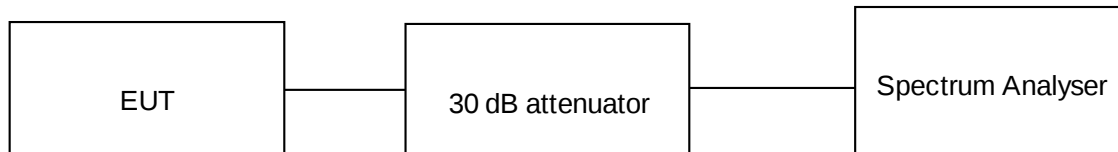
7 TEST RESULTS

7.1 Maximum Average Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3)
Test Method	Subclause 11.9.2.2.2 of ANSI C63.10
Measurement Bandwidth	10kHz
Detector	Average
Port of testing	Antenna port
Requirement	Power $\leq$ 1 W (30 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 21.5 °C Voltage = 3.3V DC through AC/DC Adapter Relative humidity: 65%

KDB Guidelines applied:

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

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000103F

Seite 15 von 52

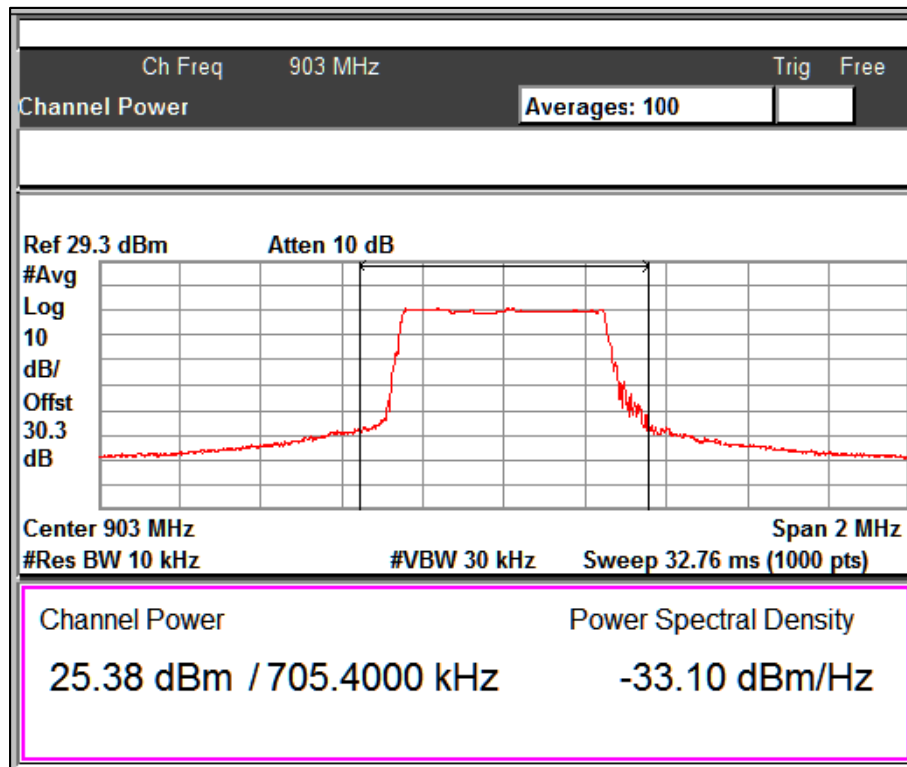
Page 15 of 52

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 (30dB) + Cable loss (0.3dB)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 3.0 dBi

Channel Frequency (MHz)	Measured Average Output Power (dBm)	Power Limit (dBm)
903	25.38	30.00
915	25.63	30.00
927	27.29	30.00



Channel Frequency: 903MHz

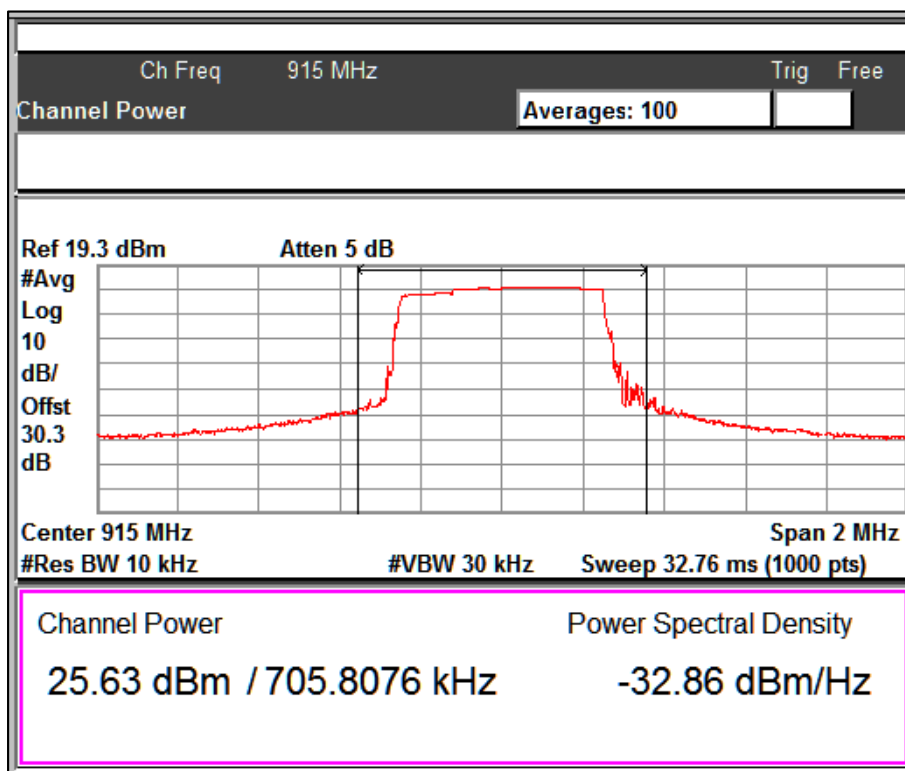
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Test Report No.:

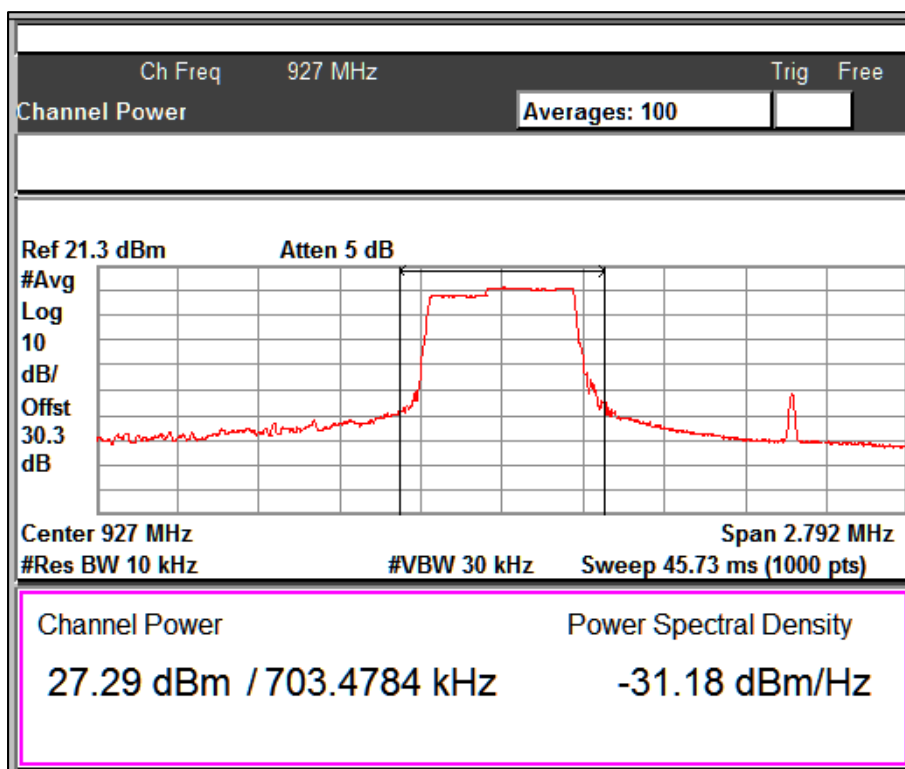
ULR-TC568822300000103F

Seite 16 von 52

Page 16 of 52



Channel Frequency: 915MHz



Channel Frequency: 927MHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 17 von 52
Page 17 of 52

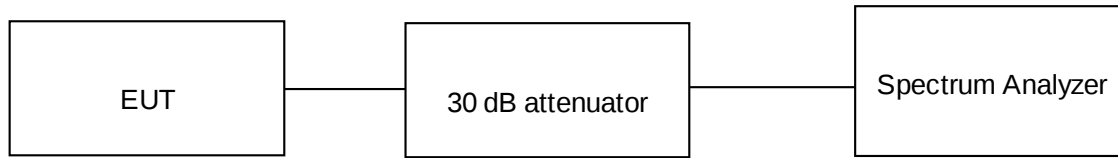
7.2 Occupied bandwidth

Result

Pass

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

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 21.5 °C Voltage = 3.3V DC through AC/DC Adapter Relative humidity: 65%

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-TC568822300000103F

Seite 18 von 52

Page 18 of 52

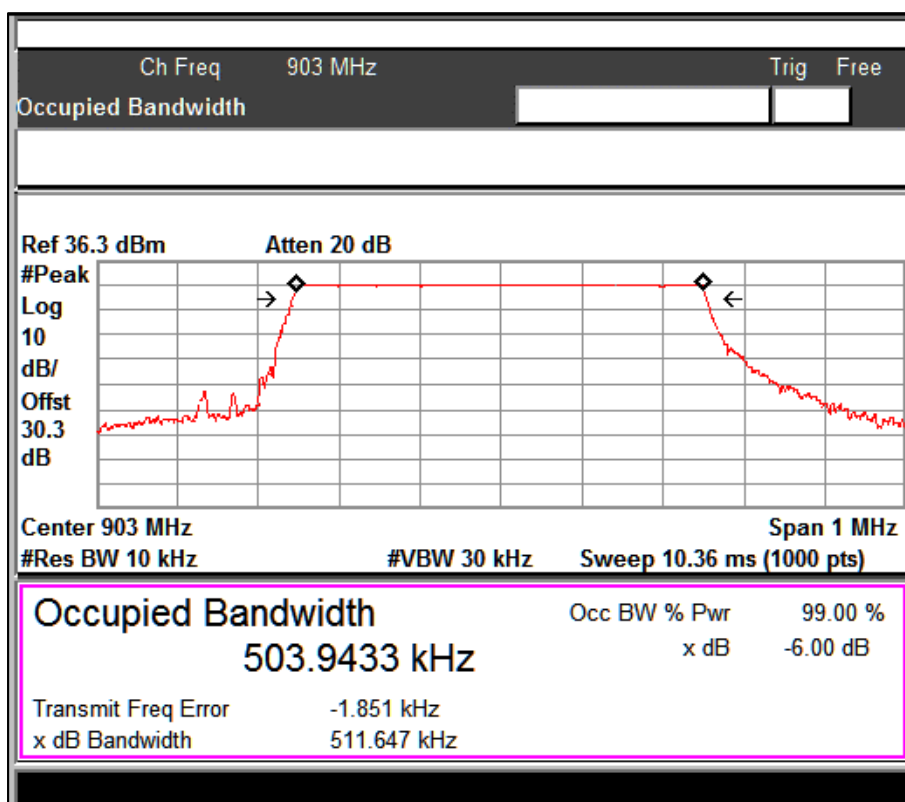
Test results:

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 (30dB) + Cable loss (0.3dB).
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 3.0 dBi.

Channel Frequency (MHz)	6 dB Bandwidth (kHz)	99% OBW (kHz)	Minimum 6dB Limit (kHz)
903.00	644.99	503.94	≥500
915.00	649.84	504.59	
927.00	644.72	502.99	

99% Bandwidth:

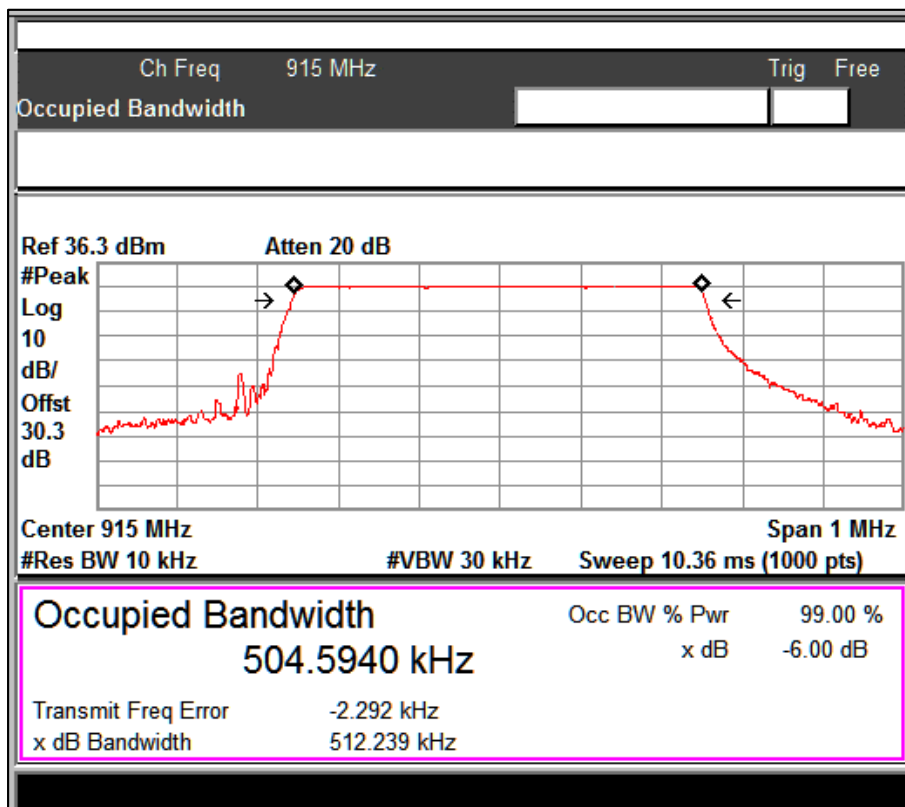


Channel frequency: 903MHz

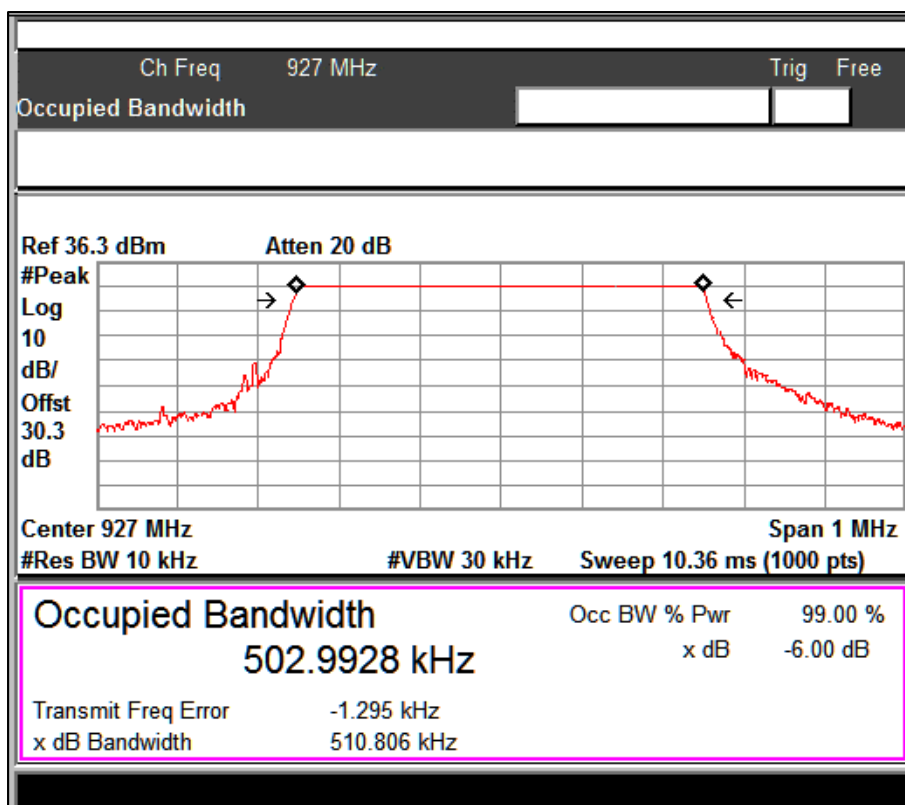
Prüfbericht- Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 19 von 52
Page 19 of 52



Channel Frequency: 915MHz



Channel Frequency: 927MHz

Prüfbericht - Nr.:

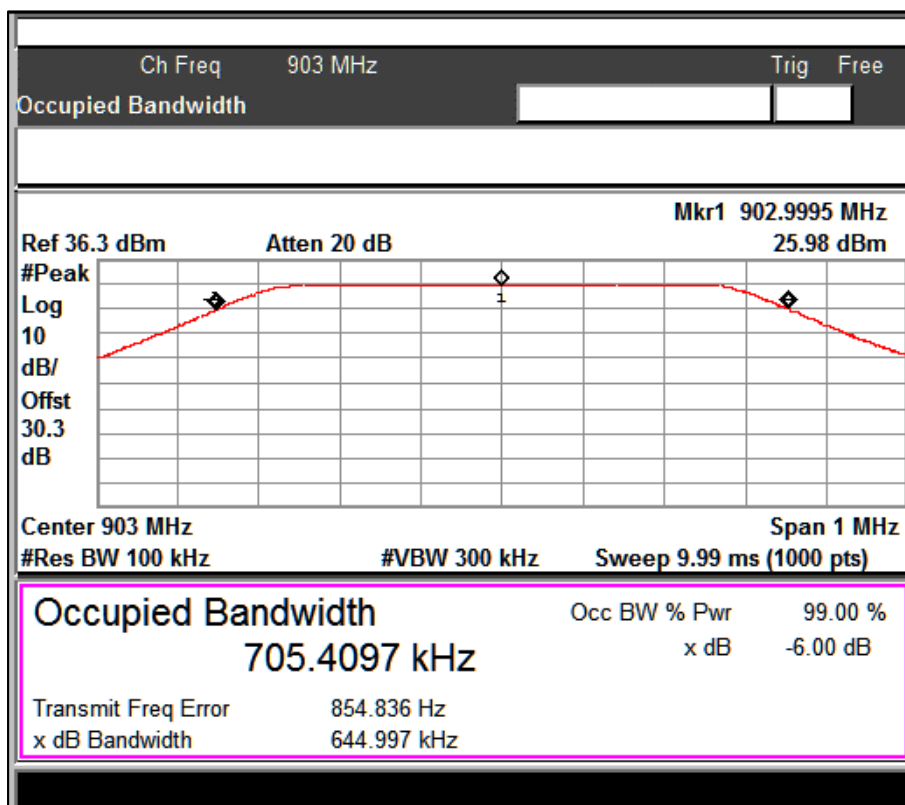
Test Report No.:

ULR-TC568822300000103F

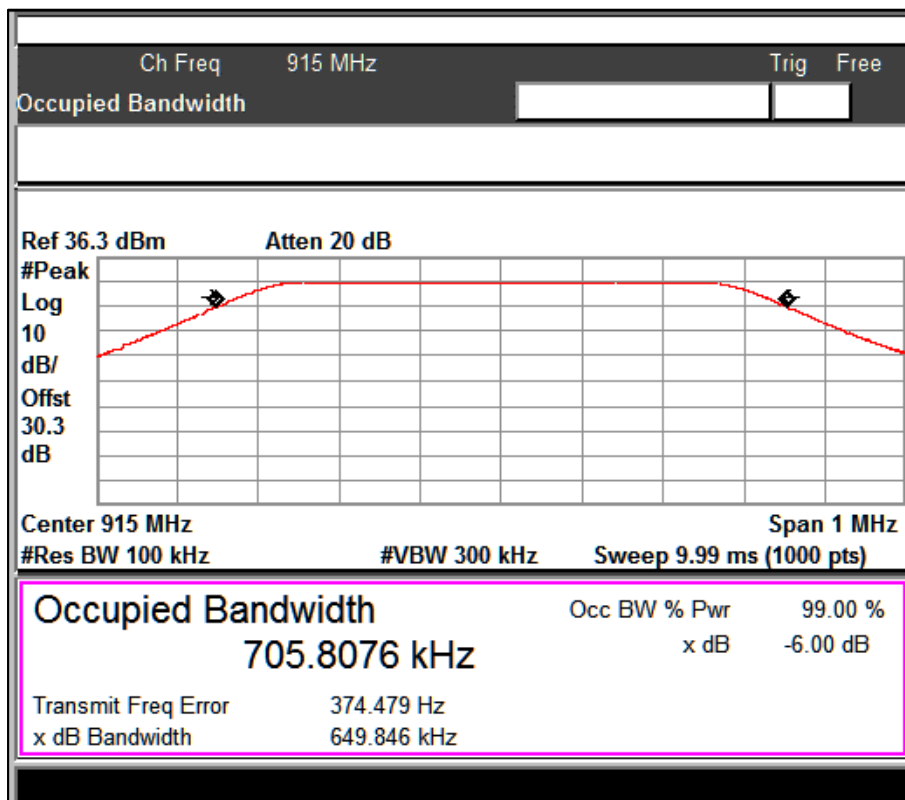
Seite 20 von 52

Page 20 of 52

DTS Bandwidth(6dB):



Channel frequency: 903MHz

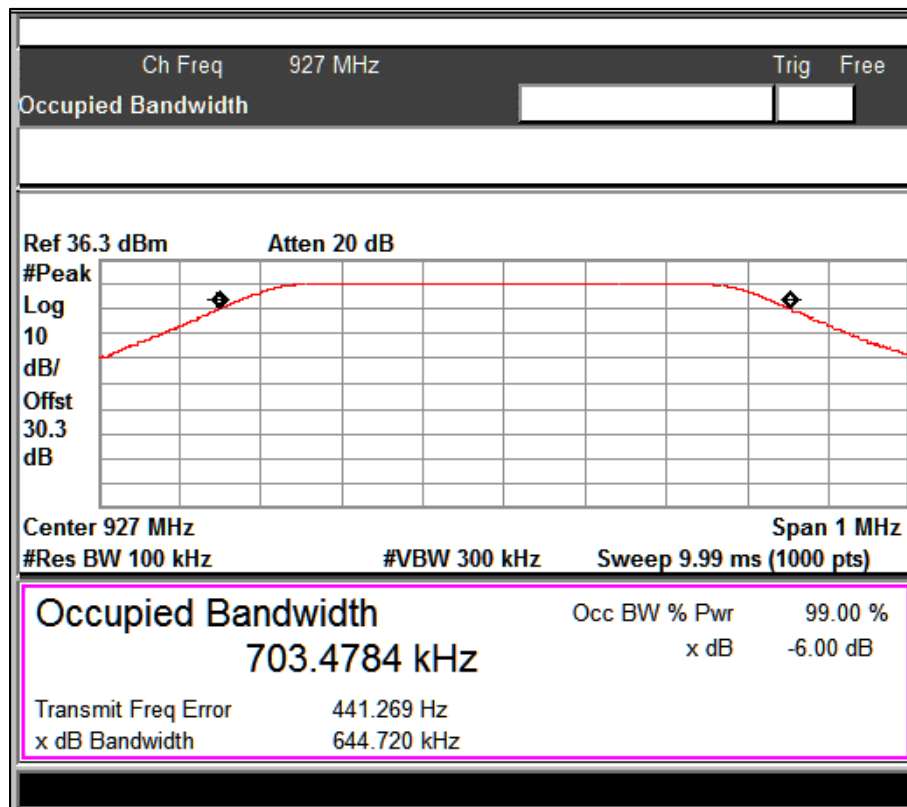


Channel Frequency: 915MHz

Prüfbericht- Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 21 von 52
Page 21 of 52



Channel Frequency: 927MHz

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000103F

Seite 22 von 52

Page 22 of 52

7.3 Power Spectral Density

Result

Pass

Test Specification

FCC Part 15 Subpart C Section 15.247 (e)

Test Method

Subclause 11.10.3 of ANSI C63.10

Measurement Bandwidth

3 kHz

Detector

Average

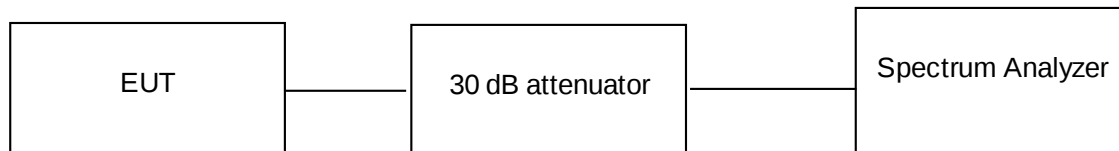
Port of testing

Antenna port

Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 21.5°C

Voltage = 3.3V DC through AC/DC Adapter

Relative humidity: 65%

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-TC568822300000103F

Seite 23 von 52

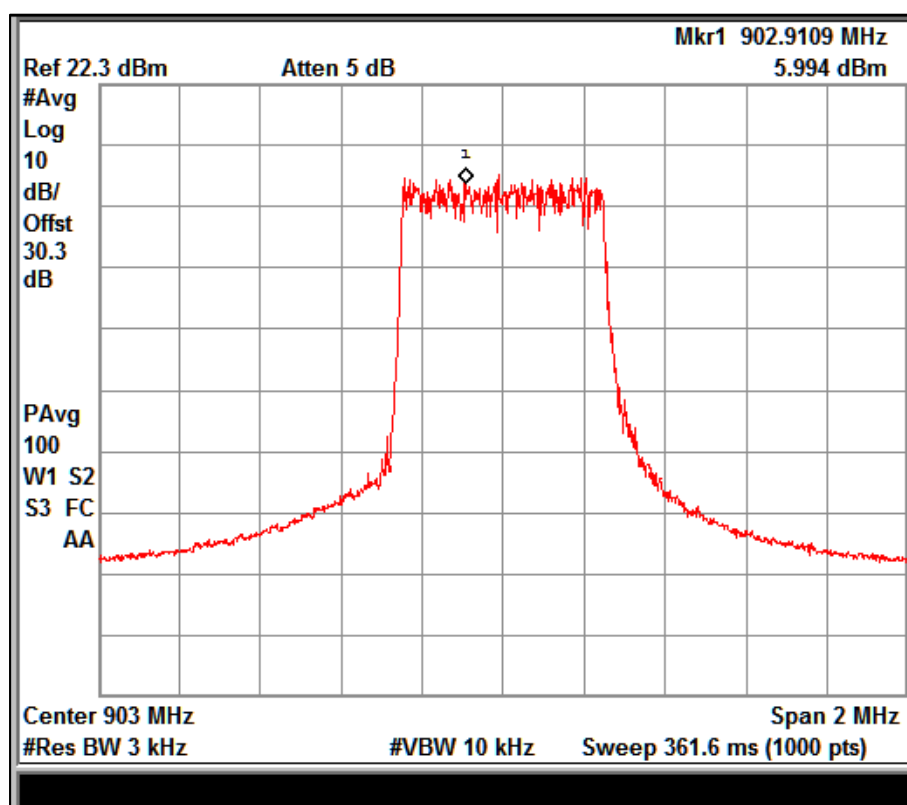
Page 23 of 52

Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Average Output PSD (dBm) = Measured Average PSD (dBm) + Attenuator factor (30dB) + Cable loss (0.3dB).

Channel Frequency (MHz)	Measured Power spectral density (dBm/3kHz)	Limit (dBm)	Margin (dB)
903	5.99	8.00	-1.92
915	6.85	8.00	-1.06
927	6.48	8.00	-1.43

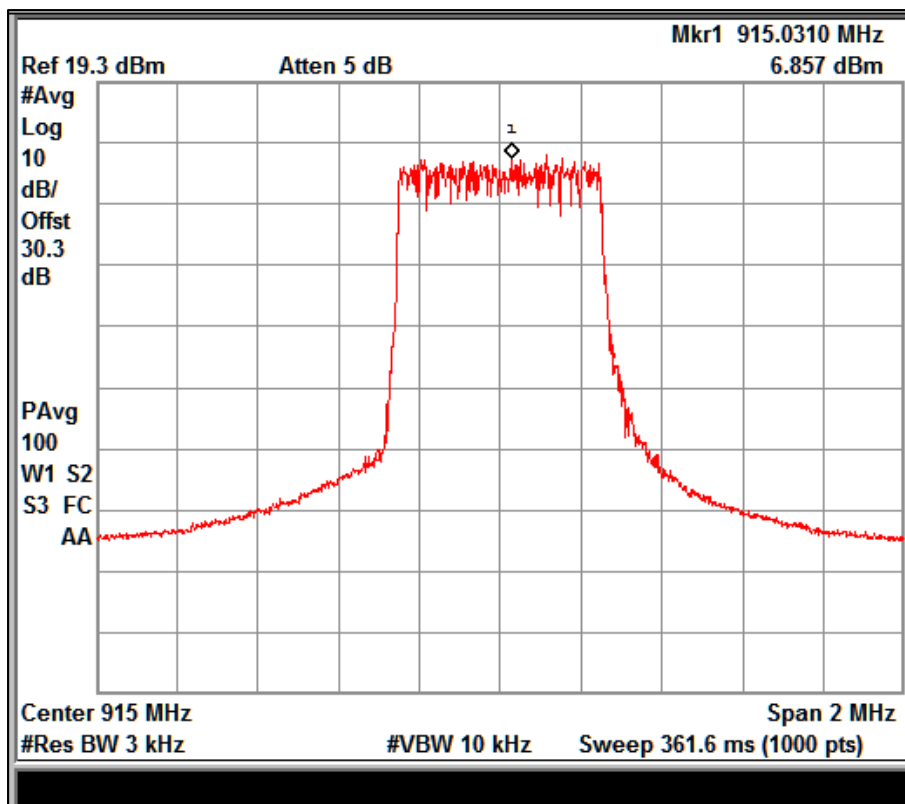


Channel Frequency: 903MHz

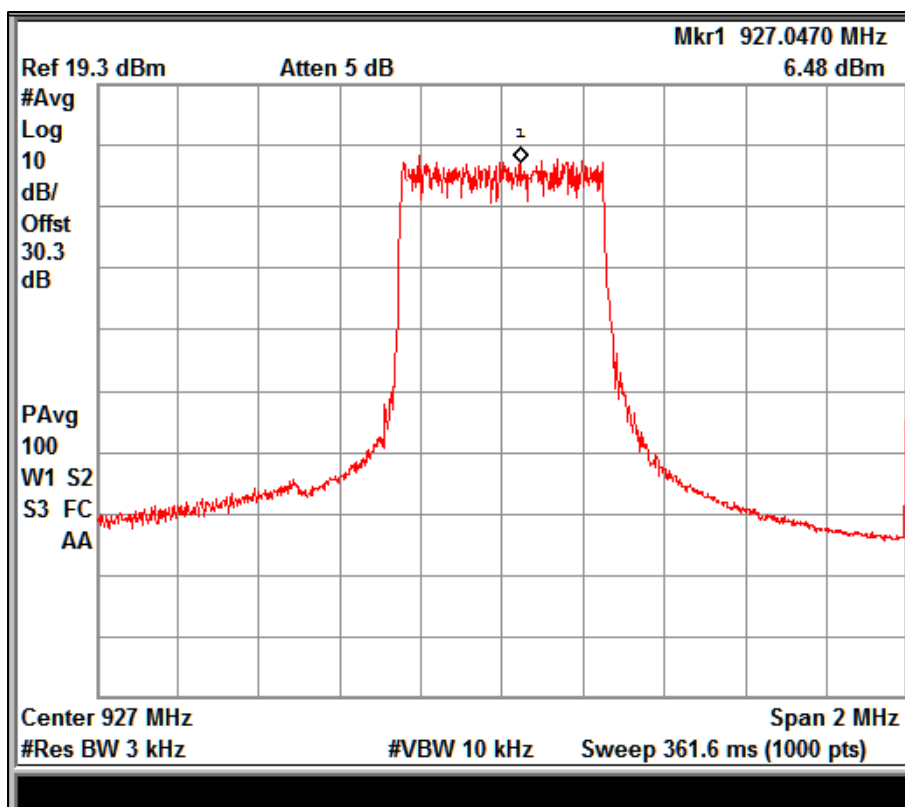
Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 24 von 52
Page 24 of 52



Channel Frequency: 915MHz



Channel Frequency: 927MHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 25 von 52
Page 25 of 52

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 11.11.3 of ANSI C63.10

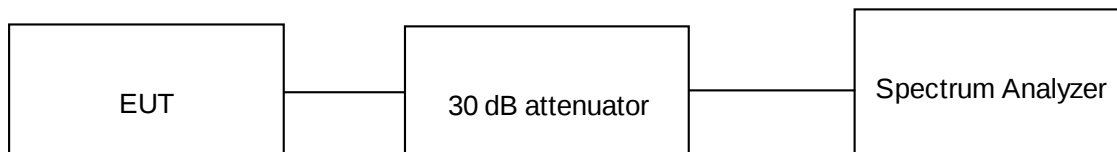
Measurement Bandwidth 100 kHz

Detector Peak

Port of testing Antenna port

Requirement In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 30dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.1 °C Voltage = 3.3V DC Battery Supply Relative humidity: 65%

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-TC568822300000103F

Seite 26 von 52
Page 26 of 52

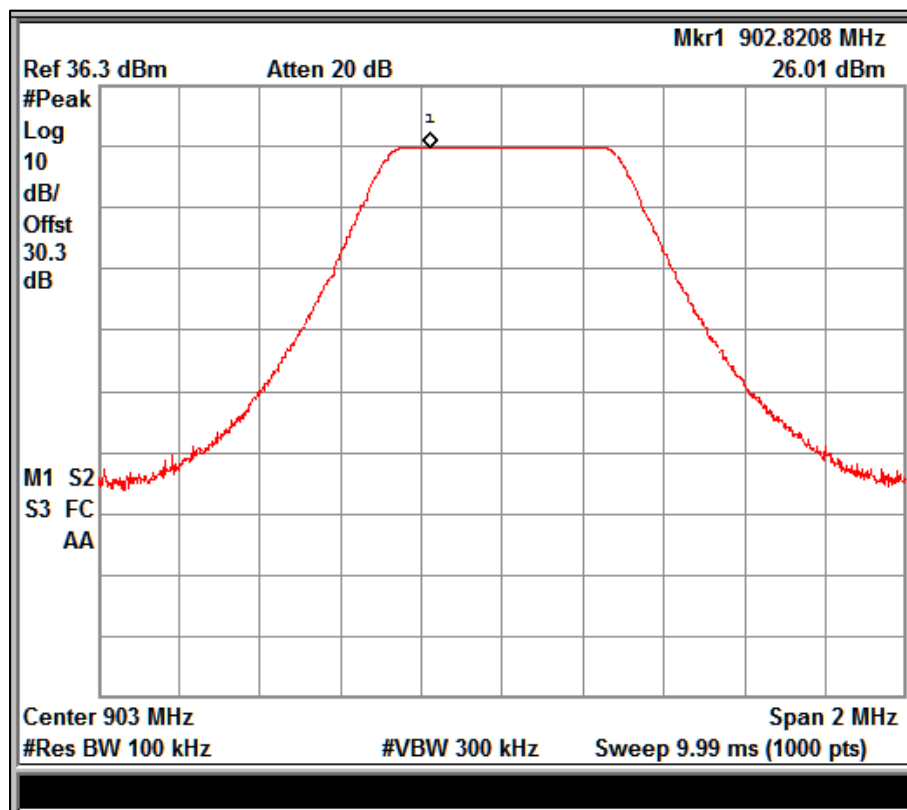
Test results:

Note:

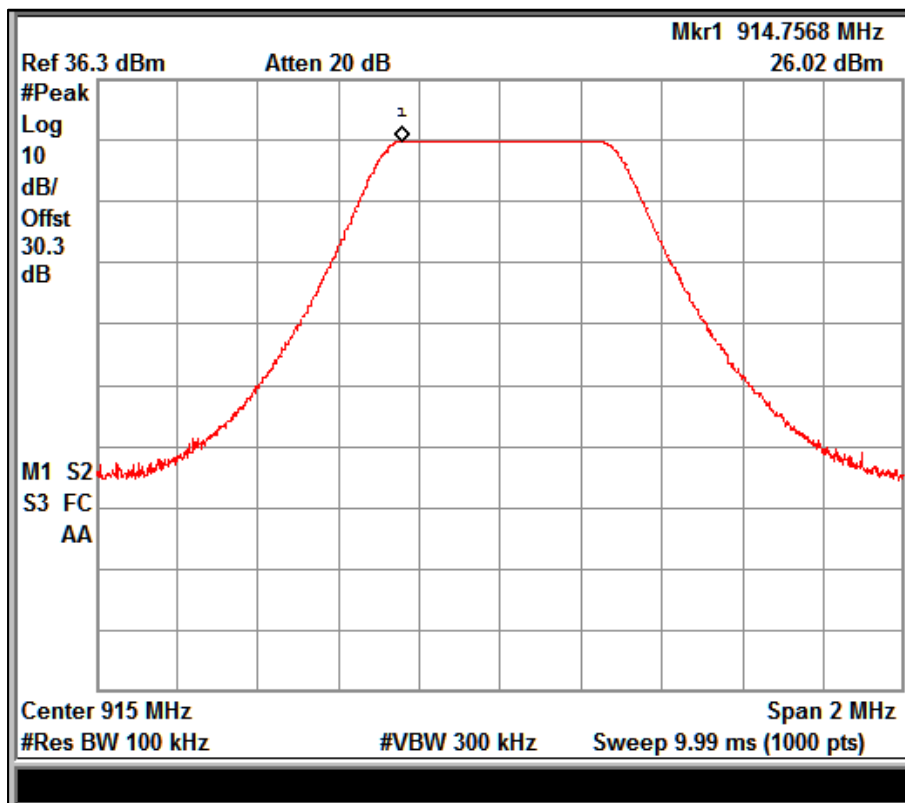
1. All the losses are included during measurement and final values are mentioned in the test report
2. Final Value (dBm) = Measured Value (dBm) + Attenuator factor (30dB) + Cable loss (0.3dB)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 3.0 dBi

7.4.1 Band edge and reference plots

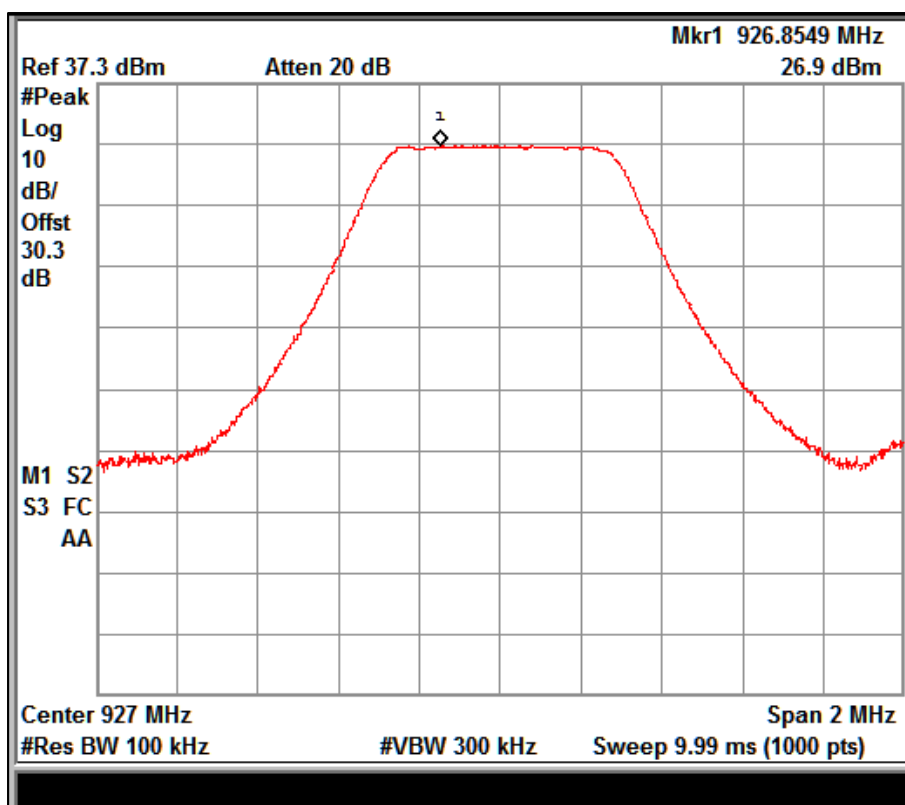
Channel Frequency (MHz)	Reference Value (B) (dBm)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	A-B (dBc)	Minimum Limit (dBc)
903.00	26.01	902.00	-27.65	-53.66	-30.00
927.00	26.90	928.00	-21.92	-48.82	-30.00



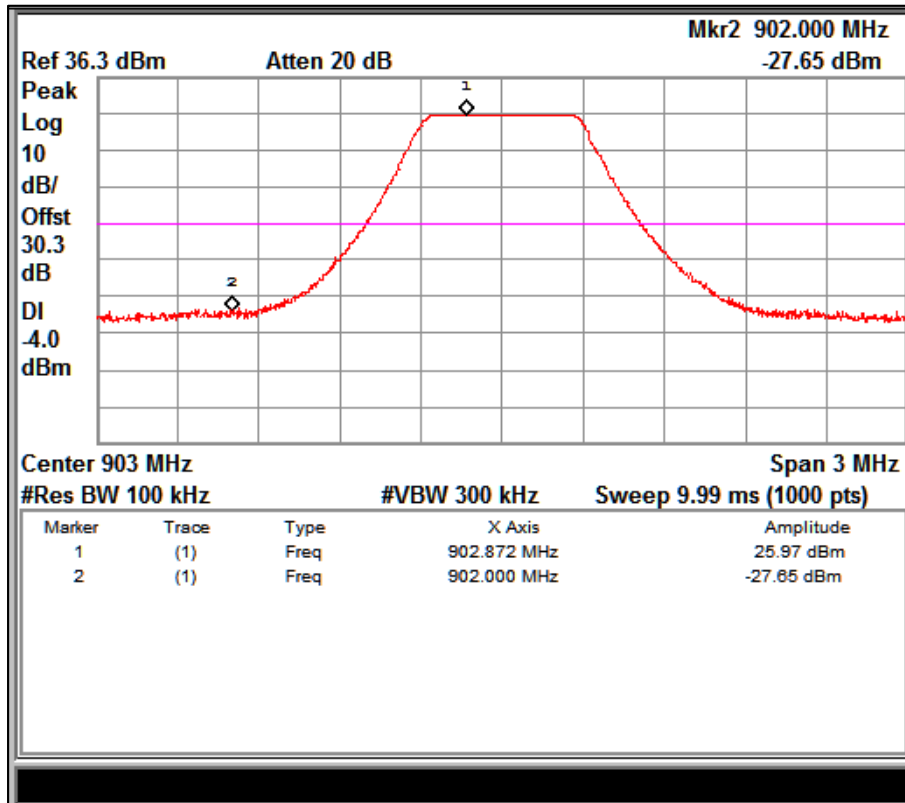
Reference plot for 903MHz



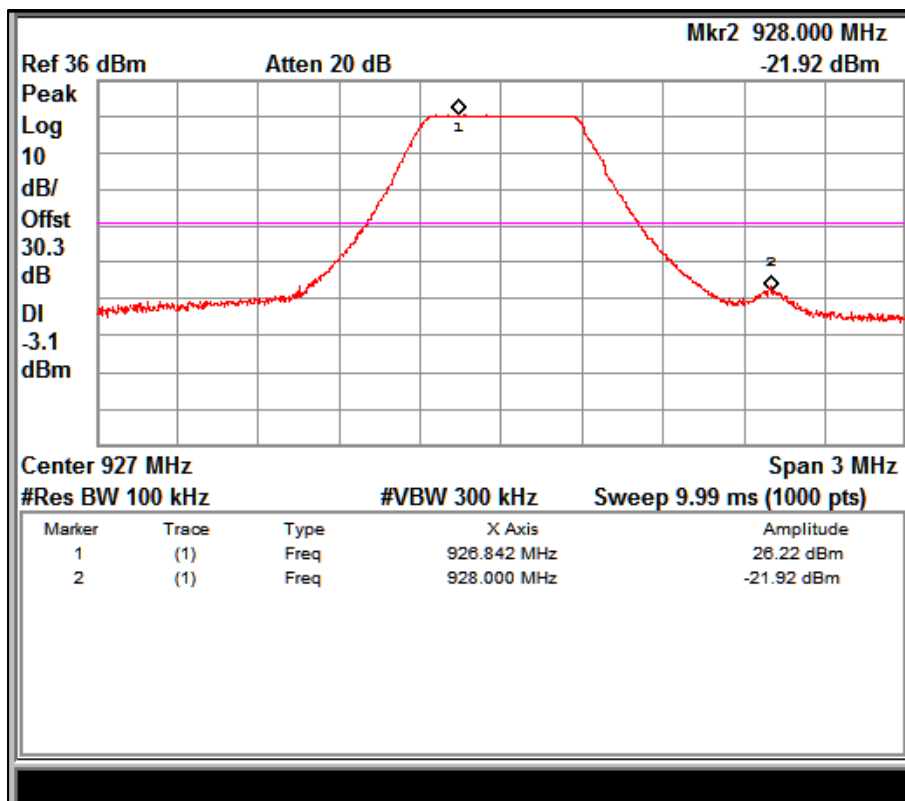
Reference plot for 915MHz



Reference plot for 927MHz

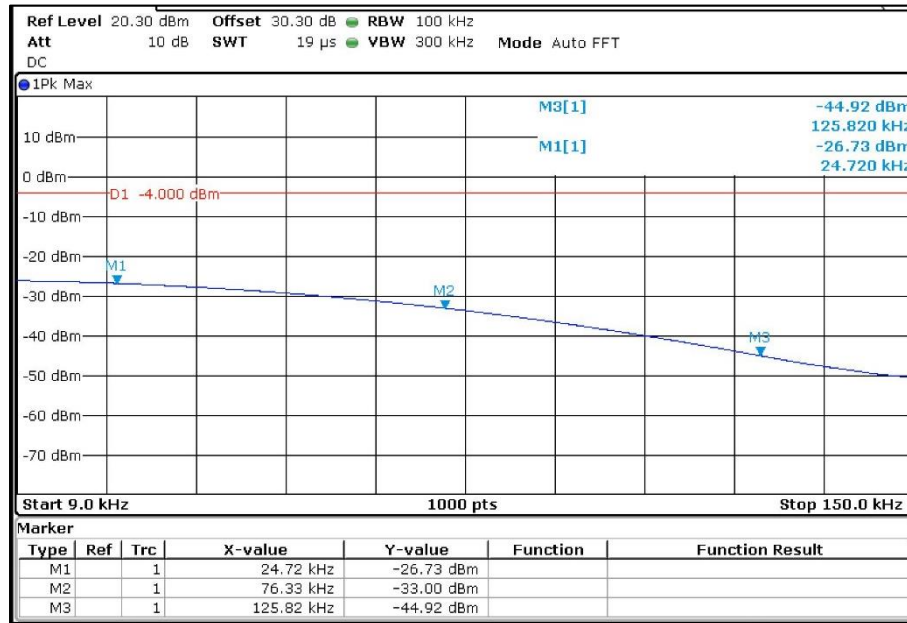


Band edge Channel Frequency 903MHz



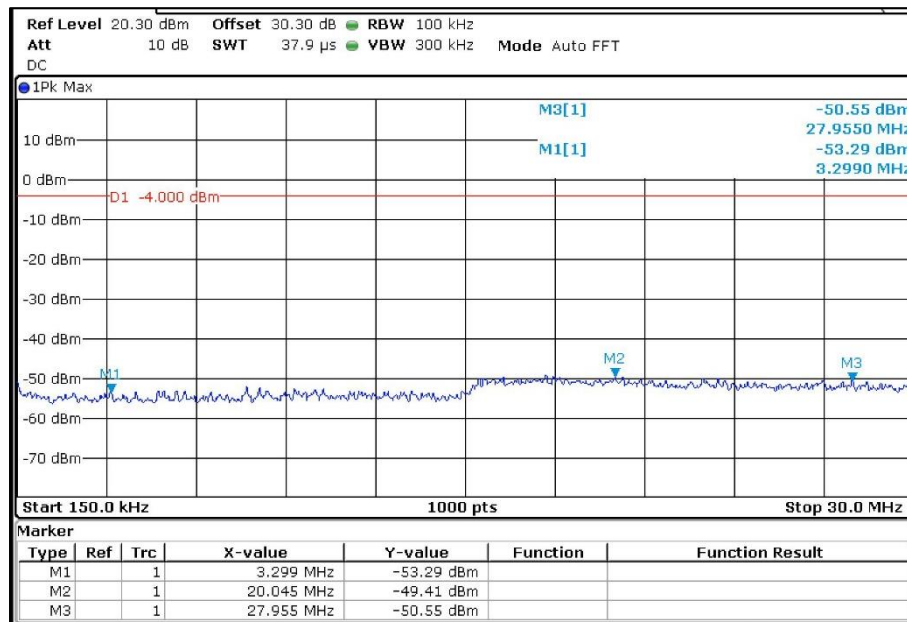
Band edge Channel Frequency 927MHz

7.4.2 Out-Of-Band Emissions



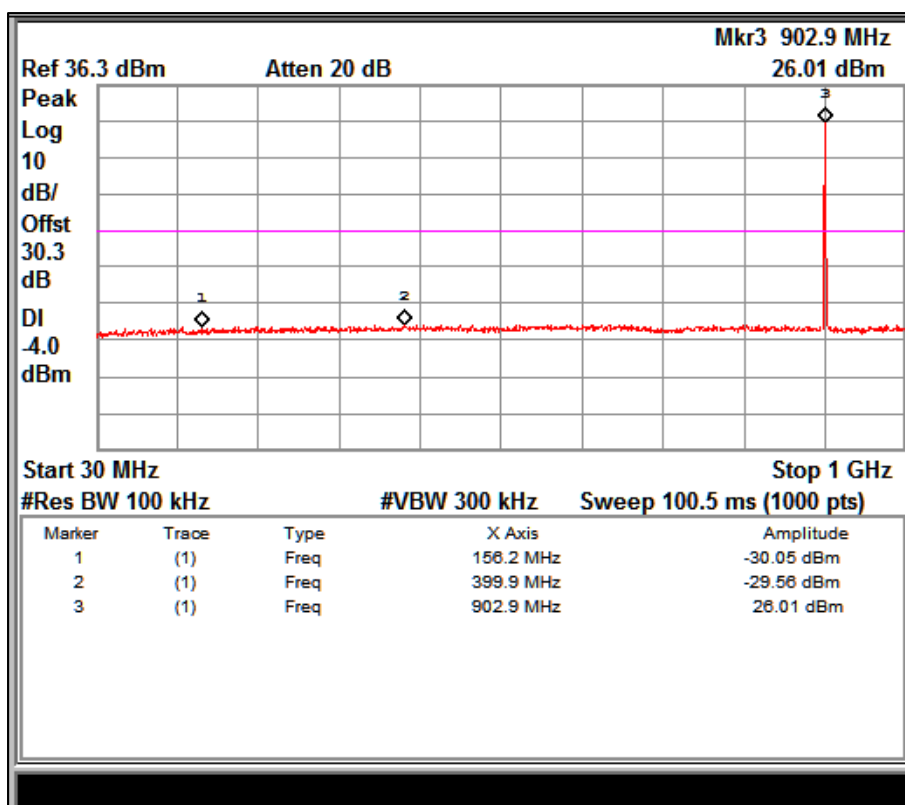
Channel Frequency 903MHz

Frequency Range 9KHz – 150KHz



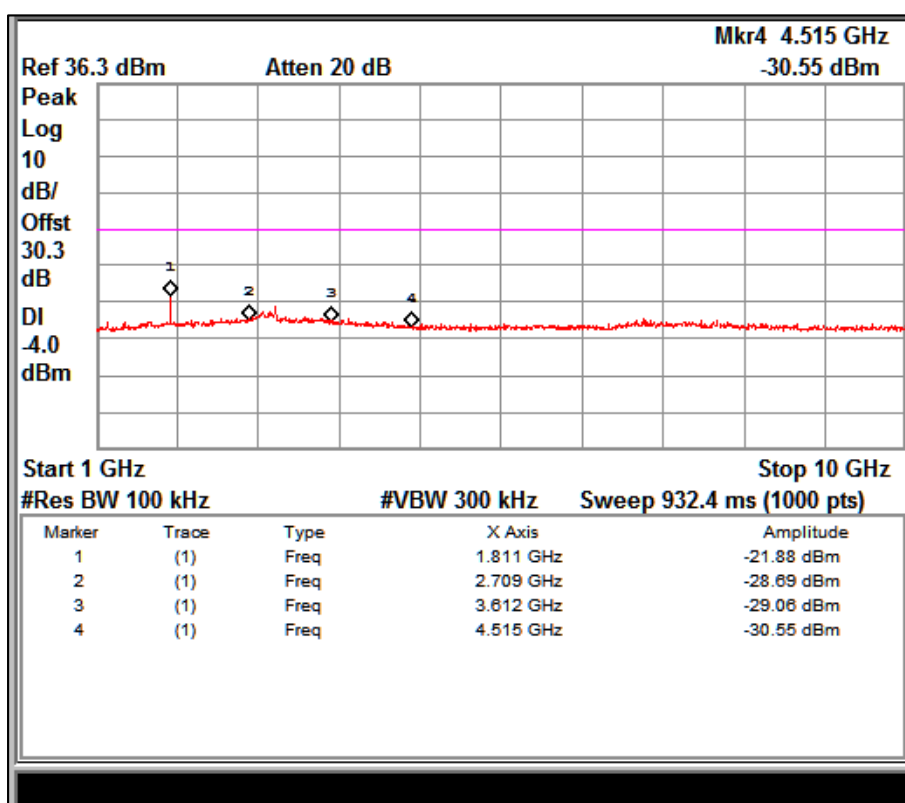
Channel Frequency 903MHz

Frequency Range 150KHz – 30MHz



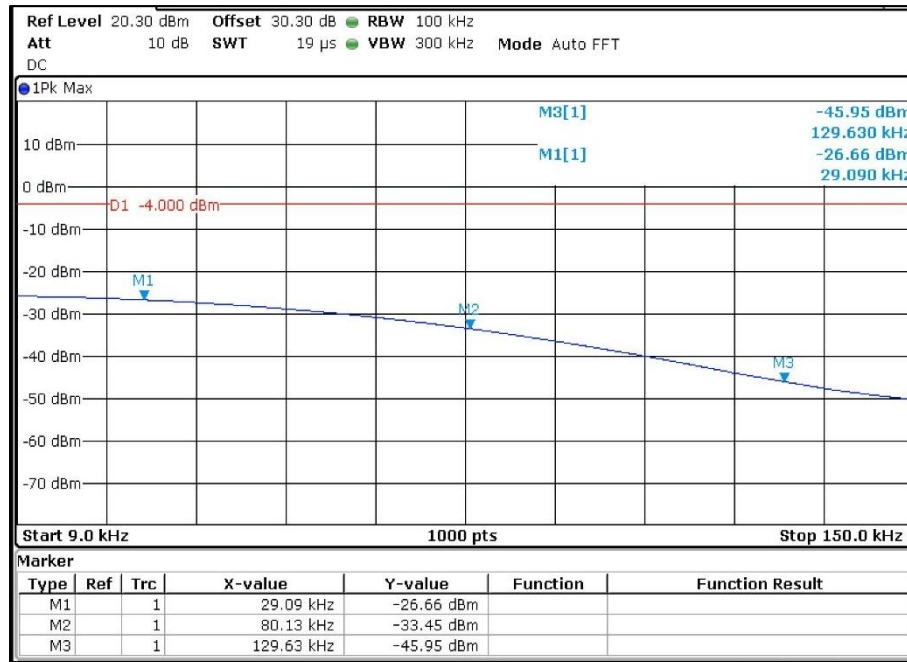
Channel Frequency 903MHz

Frequency Range 30MHz – 1GHz



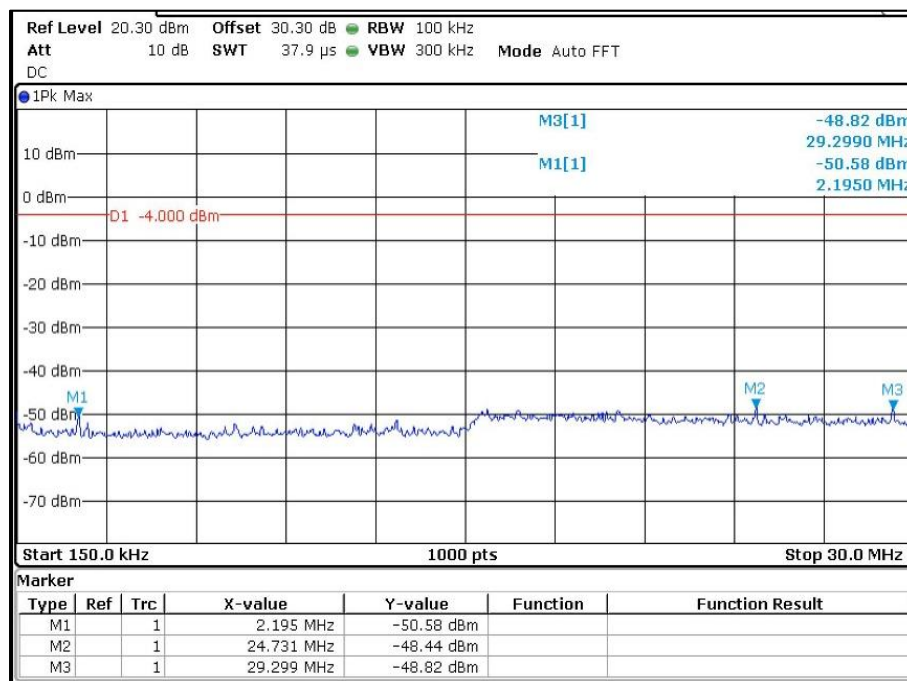
Channel Frequency 903MHz

Frequency Range 1GHz – 10GHz



Channel Frequency 915MHz

Frequency Range 9KHz – 150KHz



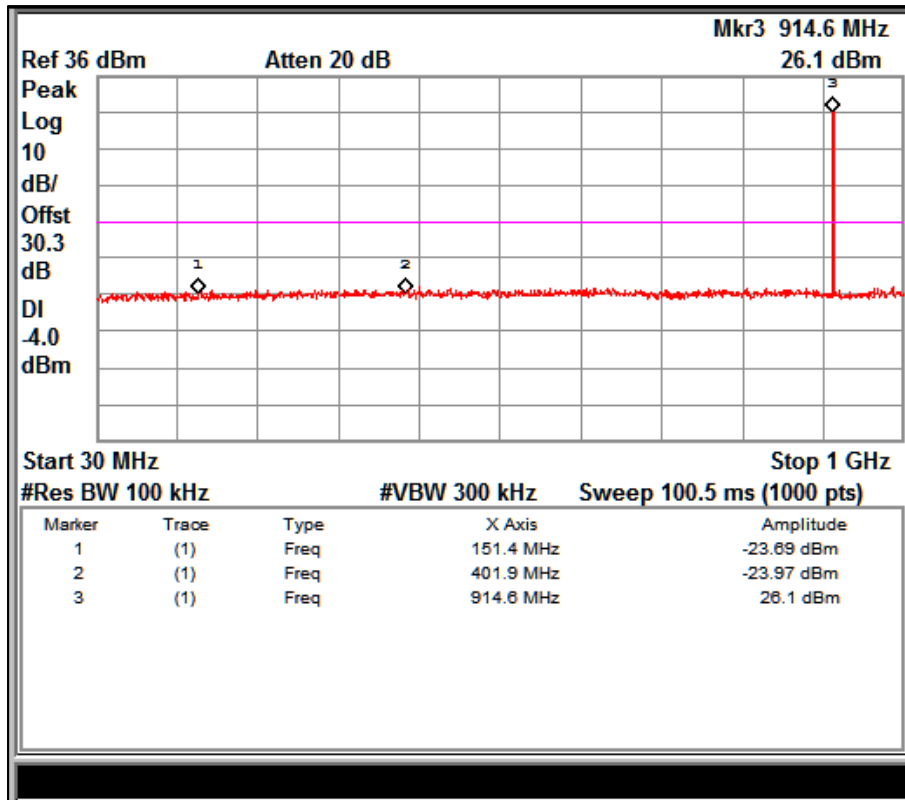
Channel Frequency 915MHz

Frequency Range 150KHz – 30MHz

Prüfbericht - Nr.:
Test Report No.:

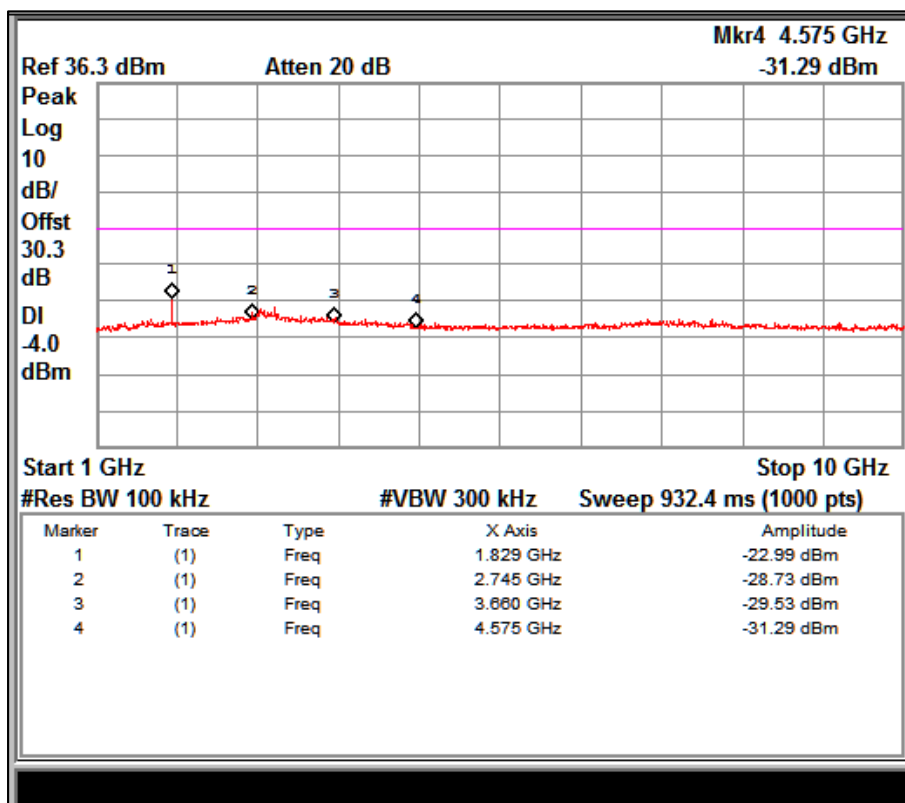
ULR-TC568822300000103F

Seite 32 von 52
Page 32 of 52



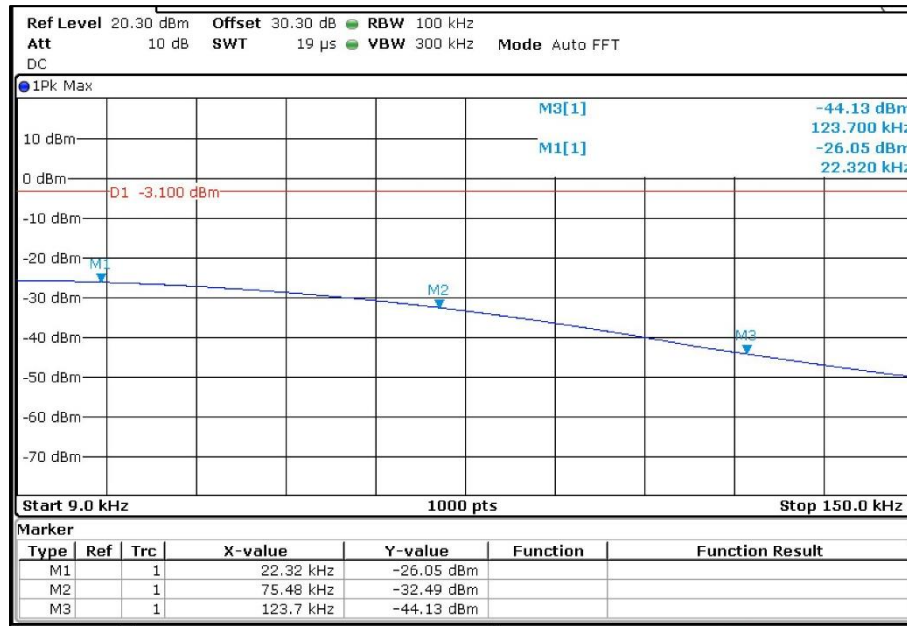
Channel Frequency 915MHz

Frequency Range 30MHz – 1GHz



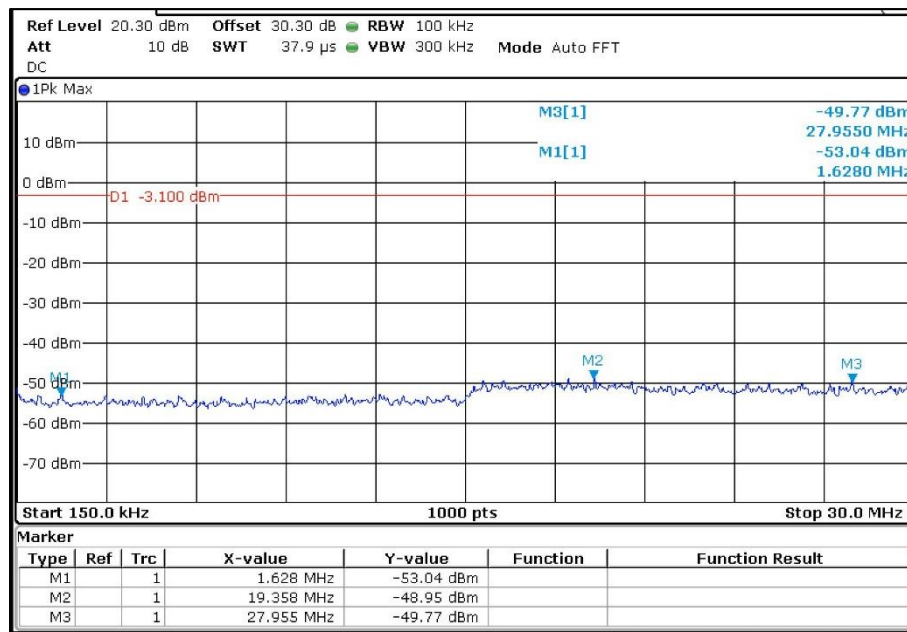
Channel Frequency 915MHz

Frequency Range 1GHz – 10GHz



Channel Frequency 927MHz

Frequency Range 9KHz – 150KHz



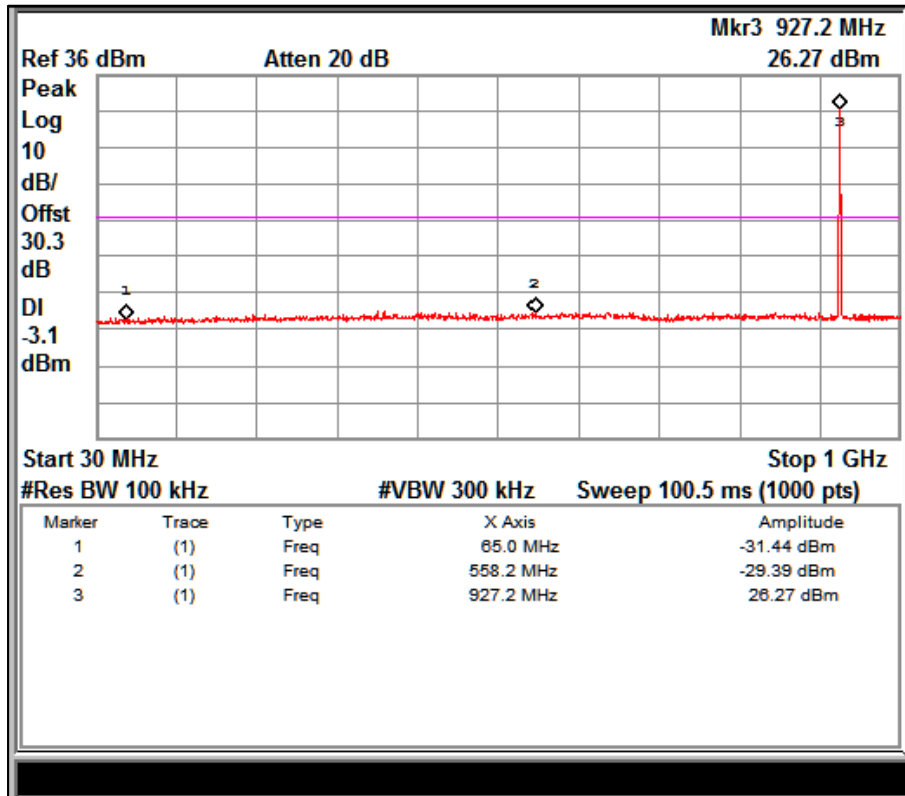
Channel Frequency 927MHz

Frequency Range 150KHz – 30MHz

Prüfbericht- Nr.:
Test Report No.:

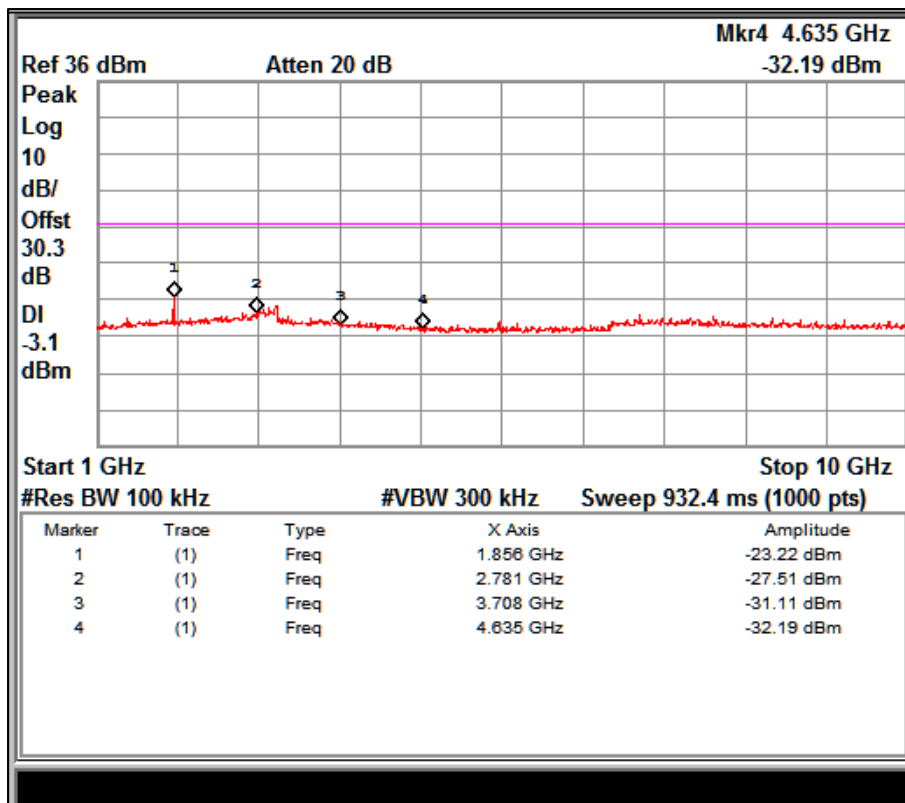
ULR-TC568822300000103F

Seite 34 von 52
Page 34 of 52



Channel Frequency 927MHz

Frequency Range 30MHz – 1GHz



Channel Frequency 927MHz

Frequency Range 1GHz – 10GHz

7.5 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

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

Table 6: Transmitter limits for Radiated emission

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

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

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

Test Conditions:

Temperature (Norm) = + 22.1 °C

Voltage = 3.3V through AC/DC Adapter

Relative humidity: 58%

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000103F

Seite 36 von 52

Page 36 of 52

Test results:

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

Test results for frequency range 9kHz – 30MHz

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

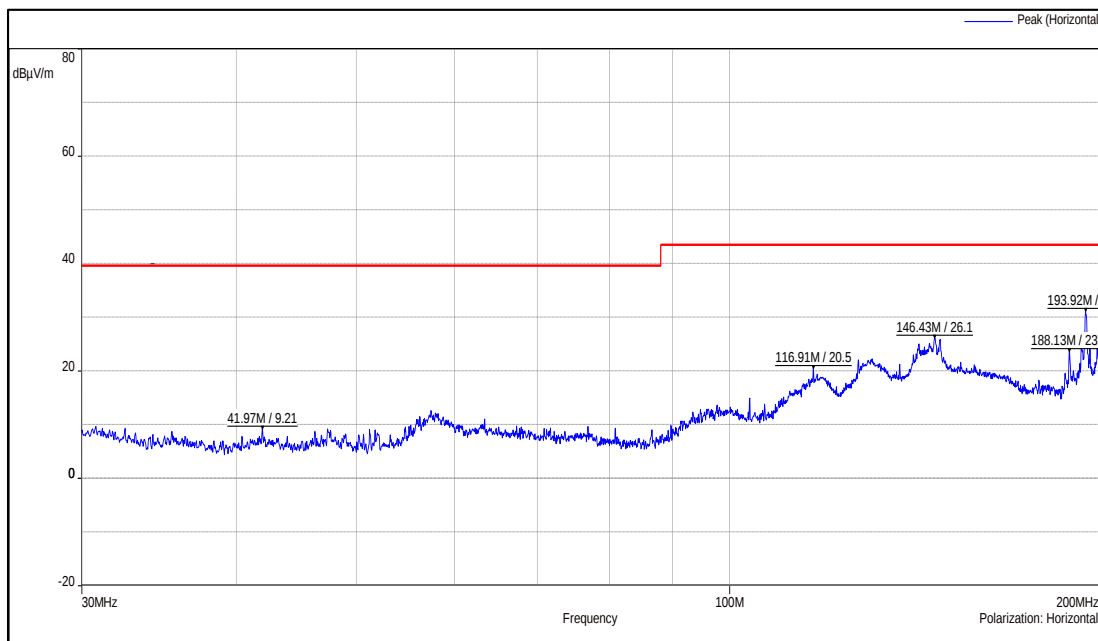
Table 7: Test results for frequency range 30MHz – 200MHz

Antenna Polarization	Measured Frequency (MHz)	Measured Emission (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Vertical	41.76	23.00	40.00	-17.00
	47.46	32.10	40.00	-7.90
	55.95	29.60	40.00	-10.40
	97.65	25.60	43.50	-17.90
	193.86	33.20	43.50	-10.30
Horizontal	41.97	9.21	40.00	-30.79
	116.91	20.50	43.50	-23.00
	146.43	26.10	43.50	-17.40
	188.13	23.70	43.50	-19.80
	193.92	34.10	43.50	-9.40



Channel Frequency 30MHz – 200MHz

Polarization Vertical



Channel Frequency 30MHz – 200MHz

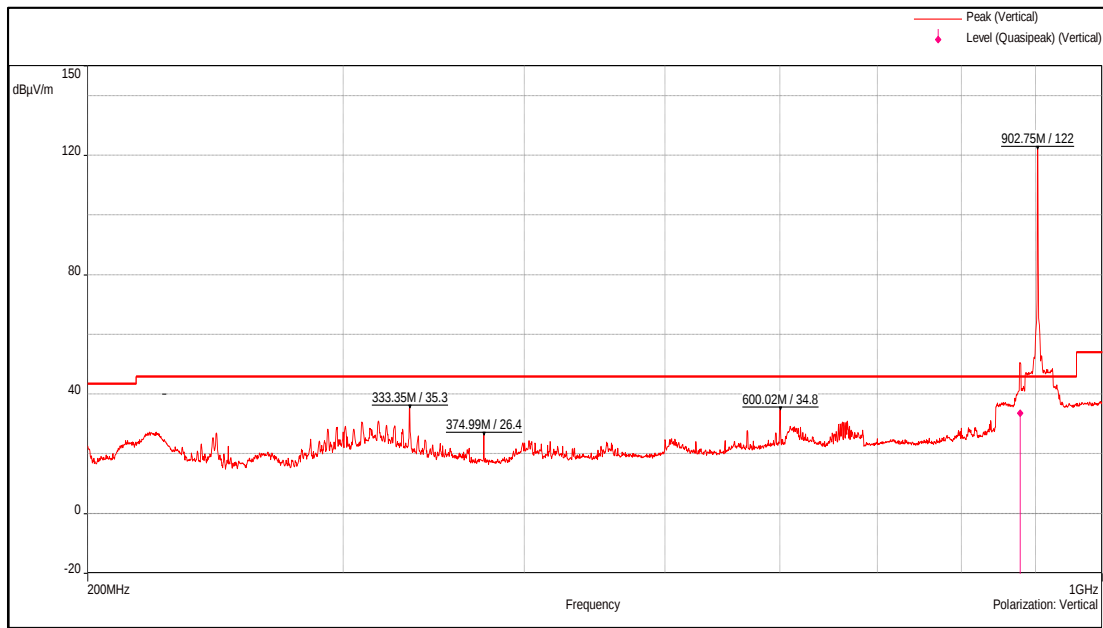
Polarization Horizontal

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

Note: Testing has been performed for low, mid & high channel frequency and for reporting purpose worst case data is reported.

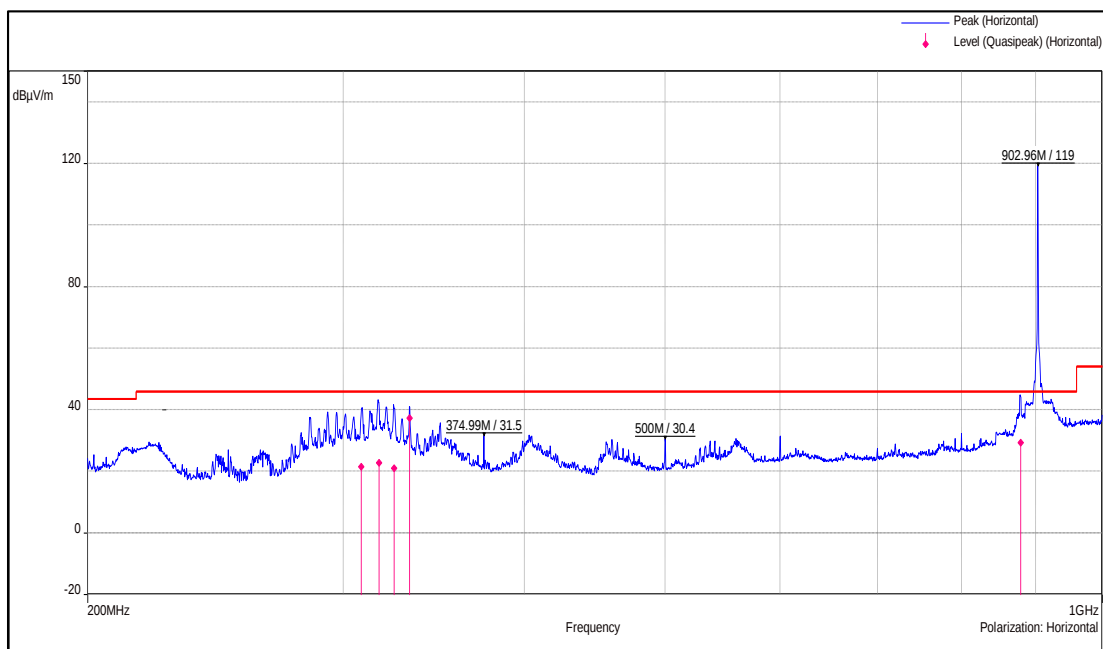
Antenna Polarization	Measured Frequency (MHz)	Measured Emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Vertical	333.35(Pk)	35.30	46.00	-10.70
	374.99(Pk)	26.40	46.00	-19.60
	600.02(Pk)	34.80	46.00	-11.20
	878.05(QP)	33.62	46.00	-12.38
	902.75(Pk)	122.00	-	-
Horizontal	308.69(QP)	21.52	46.00	-24.48
	317.48(QP)	22.73	46.00	-23.27
	325.07(QP)	20.96	46.00	-25.04
	333.33(QP)	37.24	46.00	-8.76
	374.99(Pk)	31.50	46.00	-14.50
	500.00(Pk)	30.40	46.00	-15.60
	878.79(QP)	29.28	46.00	-16.72
	902.96(Pk)	119.00	-	-

Note: -indicates the Nominal Frequency of a device



Channel Frequency 200MHz – 1GHz

Polarization Vertical



Channel Frequency 200MHz – 1GHz

Polarization Horizontal

Prüfbericht- Nr.:

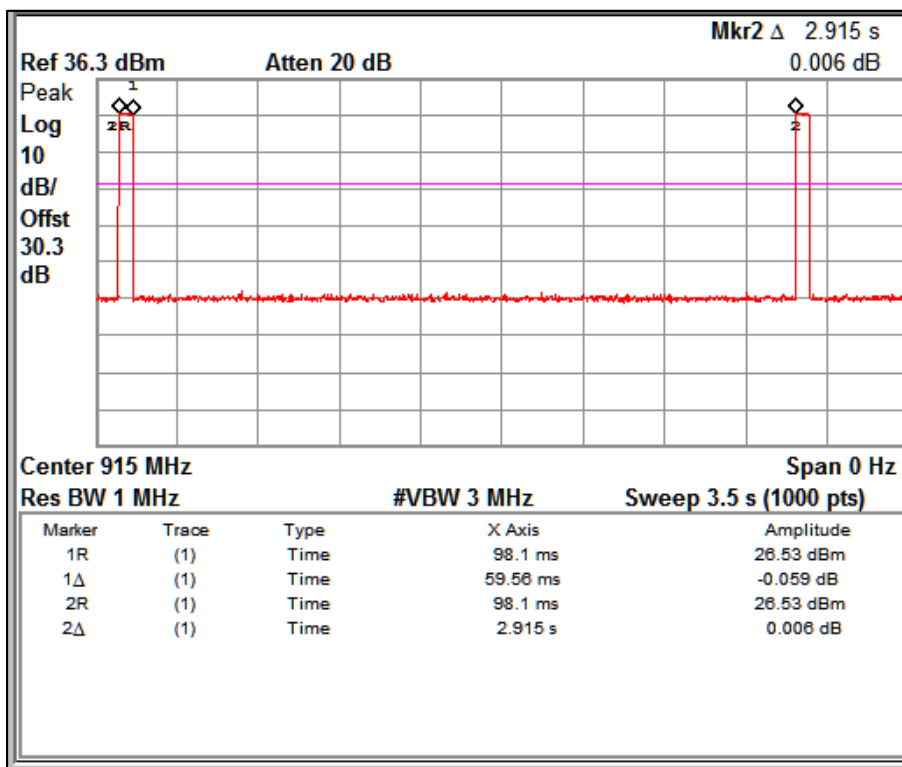
Test Report No.:

ULR-TC568822300000103F

Seite 39 von 52

Page 39 of 52

Duty Cycle reference plot :



Duty Cycle

Note: Duty Cycle Correction Factor: $20 \cdot \log(1/x)$

Where X → Duty Cycle

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000103F

Seite 40 von 52

Page 40 of 52

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

Channel Frequency: 903MHz

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Spurious emission (dBµV/m)	Duty Cycle correction factor (dB)	Final Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
903	1806(Pk)	Vertical	67.19	-	67.19	74.00	-6.81
	1806(Av)		65.21	-34.42	30.79	54.00	-23.21
	2709(Pk)		46.55	-	46.55	74.00	-27.45
	2709(Av)		39.95	-34.42	5.53	54.00	-48.47
	3612(Pk)		41.55	-	41.55	74.00	-32.45
	3612(Av)		30.23	-34.42	-4.19	54.00	-58.19
	4515(Pk)		49.55	-	49.55	74.00	-24.45
	4515(Av)		40.04	-34.42	5.62	54.00	-48.38
	5418(Pk)		50.44	-	50.44	74.00	-23.56
	5418(Av)		40.09	-34.42	5.67	54.00	-48.33
	6321(Pk)		52.32	-	52.32	74.00	-21.68
	6321(Av)		40.52	-34.42	6.10	54.00	-47.90
	7224(Pk)		50.70	-	50.70	74.00	-23.30
	7224(Av)		38.14	-34.42	3.72	54.00	-50.28
	8127(Pk)		53.88	-	53.88	74.00	-20.12
	8127(Av)		40.26	-34.42	5.84	54.00	-48.16
	9030(Pk)		54.91	-	54.91	74.00	-19.09
	9030(Av)		41.78	-34.42	7.36	54.00	-46.64
	1806(Pk)	Horizontal	56.58	-	56.58	74.00	-17.42
	1806(Av)		53.85	-34.42	19.43	54.00	-34.57
	2709(Pk)		43.47	-	43.47	74.00	-30.53
	2709(Av)		35.47	-34.42	1.05	54.00	-52.95
	3612(Pk)		39.32	-	39.32	74.00	-34.68
	3612(Av)		27.99	-34.42	-6.43	54.00	-60.43
	4515(Pk)		44.14	-	44.14	74.00	-29.86
	4515(Av)		33.23	-34.42	-1.19	54.00	-55.19
	5418(Pk)		44.14	-	44.14	74.00	-28.60
	5418(Av)		33.19	-34.42	-1.23	54.00	-55.23
	6321(Pk)		46.76	-	46.76	74.00	-27.24
	6321(Av)		33.86	-34.42	-0.56	54.00	-54.56
	7224(Pk)		48.45	-	48.45	74.00	-25.55
	7224(Av)		34.79	-34.42	0.37	54.00	-53.63
	8127(Pk)		50.13	-	50.13	74.00	-23.87
	8127(Av)		37.02	-34.42	37.02	54.00	-51.40
	9030(Pk)		49.86	-	49.86	74.00	-24.14
	9030(Av)		37.43	-34.42	3.01	54.00	-50.99

Pk: Peak Detector;
Av: Average Detect

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000103F

Seite 41 von 52

Page 41 of 52

Channel Frequency: 915MHz

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Spurious emission (dBμV/m)	Duty Cycle correction factor (dB)	Final Spurious emission (dBμV/m)	Limit (dBμV/m)	Margin (dB)
915	1830(Pk)	Vertical	67.64	-	67.64	74.00	-6.36
	1830(Av)		65.72	-34.42	31.30	54.00	-22.70
	2745(Pk)		46.68	-	46.68	74.00	-27.32
	2745(Av)		40.82	-34.42	6.40	54.00	-47.60
	3660(Pk)		42.43	-	42.43	74.00	-31.57
	3660(Av)		32.38	-34.42	-2.04	54.00	-56.04
	4575(Pk)		50.00	-	50.00	74.00	-24.00
	4575(Av)		40.95	-34.42	6.53	54.00	-47.47
	5490(Pk)		52.90	-	52.90	74.00	-21.10
	5490(Av)		43.61	-34.42	9.19	54.00	-44.81
	6405(Pk)		52.40	-	52.40	74.00	-21.60
	6405(Av)		41.47	-34.42	7.05	54.00	-46.95
	7320(Pk)		52.84	-	52.84	74.00	-21.16
	7320(Av)		40.74	-34.42	6.32	54.00	-47.68
	8235(Pk)		55.21	-	55.21	74.00	-18.79
	8235(Av)		42.48	-34.42	8.06	54.00	-45.94
	9150(Pk)		53.01	-	53.01	74.00	-20.99
	9150(Av)		39.56	-34.42	5.14	54.00	-48.86
	1830(Pk)	Horizontal	56.81	-	56.81	74.00	-17.19
	1830(Av)		54.23	-34.42	19.81	54.00	-34.19
	2745(Pk)		42.65	-	42.65	74.00	-31.35
	2745(Av)		33.80	-34.42	-0.62	54.00	-54.62
	3660(Pk)		41.08	-	41.08	74.00	-32.92
	3660(Av)		29.27	-34.42	-5.15	54.00	-59.15
	4575(Pk)		45.43	-	45.43	74.00	-28.57
	4575(Av)		34.69	-34.42	0.27	54.00	-53.73
	5490(Pk)		46.59	-	46.59	74.00	-27.41
	5490(Av)		34.67	-34.42	0.25	54.00	-53.75
	6405(Pk)		46.59	-	46.59	74.00	-27.41
	6405(Av)		34.00	-34.42	-0.42	54.00	-54.42
	7320(Pk)		47.62	-	47.62	74.00	-26.38
	7320(Av)		35.58	-34.42	1.16	54.00	-52.84
	8235(Pk)		48.70	-	48.70	74.00	-25.30
	8235(Av)		36.50	-34.42	2.08	54.00	-51.92
	9150(Pk)		50.93	-	50.93	74.00	-23.07
	9150(Av)		38.53	-34.42	4.11	54.00	-49.89

Pk: Peak Detector;
Av: Average Detector

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000103F

Seite 42 von 52

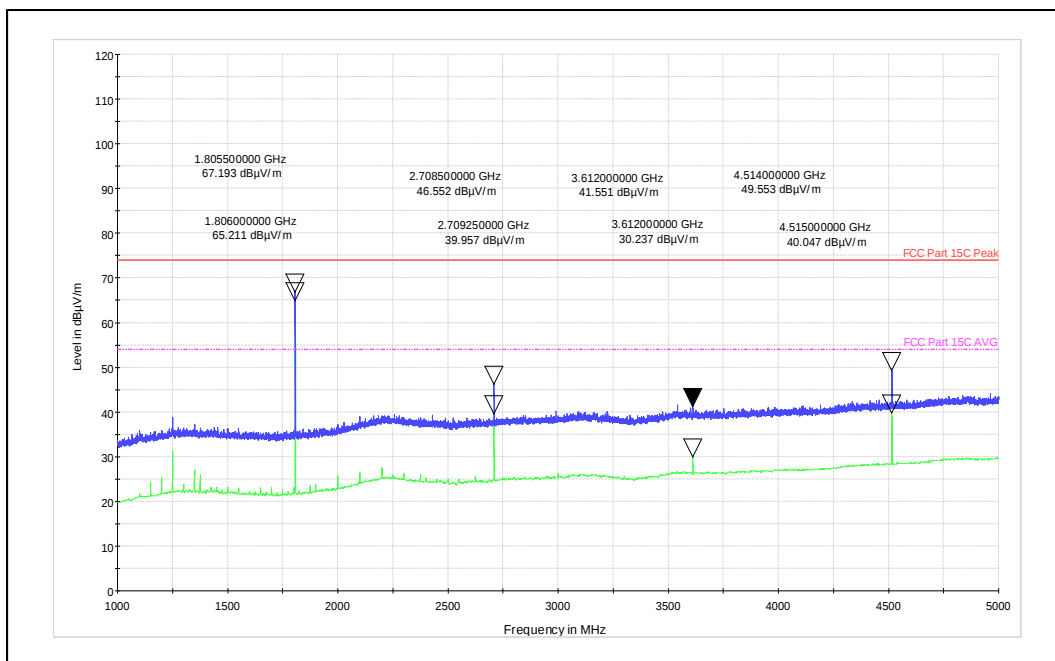
Page 42 of 52

Channel Frequency: 927MHz

Channel Frequency (MHz)	Measured Frequency (MHz)	Antenna Polarization	Measured Spurious emission (dBµV/m)	Duty Cycle correction factor (dB)	Final Spurious emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
927	1854(Pk)	Vertical	70.29	-	70.29	74.00	-3.71
	1854(Av)		68.23	-34.42	33.81	54.00	-20.19
	2781(Pk)		50.06	-	50.06	74.00	-23.94
	2781(Av)		45.18	-34.42	10.76	54.00	-43.24
	3708(Pk)		43.97	-	43.97	74.00	-30.03
	3708(Av)		34.55	-34.42	0.13	54.00	-53.87
	4635(Pk)		52.28	-	52.28	74.00	-21.72
	4635(Av)		43.62	-34.42	9.20	54.00	-44.80
	5562(Pk)		53.85	-	53.85	74.00	-20.15
	5562(Av)		44.92	-34.42	10.50	54.00	-43.50
	6489(Pk)		52.96	-	52.96	74.00	-21.04
	6489(Av)		40.42	-34.42	6.00	54.00	-48.00
	7416(Pk)		53.45	-	53.45	74.00	-20.55
	7416(Av)		41.66	-34.42	7.24	54.00	-46.76
	8343(Pk)		58.54	-	58.54	74.00	-15.46
	8343(Av)		46.74	-34.42	12.32	54.00	-41.68
	9270(Pk)		55.40	-	55.40	74.00	-18.60
	9270(Av)		42.46	-34.42	8.04	54.00	-45.96
	1854(Pk)	Horizontal	61.32	-	61.32	74.00	-12.68
	1854(Av)		59.08	-34.42	24.66	54.00	-29.34
	2781(Pk)		44.72	-	44.72	74.00	-29.28
	2781(Av)		38.30	-34.42	3.88	54.00	-50.12
	3708(Pk)		42.87	-	42.87	74.00	-31.13
	3708(Av)		32.37	-34.42	-2.05	54.00	-56.05
	4635(Pk)		46.96	-	46.96	74.00	-27.04
	4635(Av)		36.49	-34.42	2.07	54.00	-51.93
	5562(Pk)		48.45	-	48.45	74.00	-25.55
	5562(Av)		37.22	-34.42	2.80	54.00	-51.20
	6489(Pk)		47.40	-	47.40	74.00	-26.60
	6489(Av)		34.52	-34.42	0.10	54.00	-53.90
	7416(Pk)		48.50	-	48.50	74.00	-25.50
	7416(Av)		35.36	-34.42	0.94	54.00	-53.06
	8343(Pk)		49.99	-	49.99	74.00	-24.01
	8343(Av)		37.48	-34.42	3.06	54.00	-50.94
	9270(Pk)		52.19	-	52.19	74.00	-21.81
	9270(Av)		39.06	-34.42	4.64	54.00	-49.36

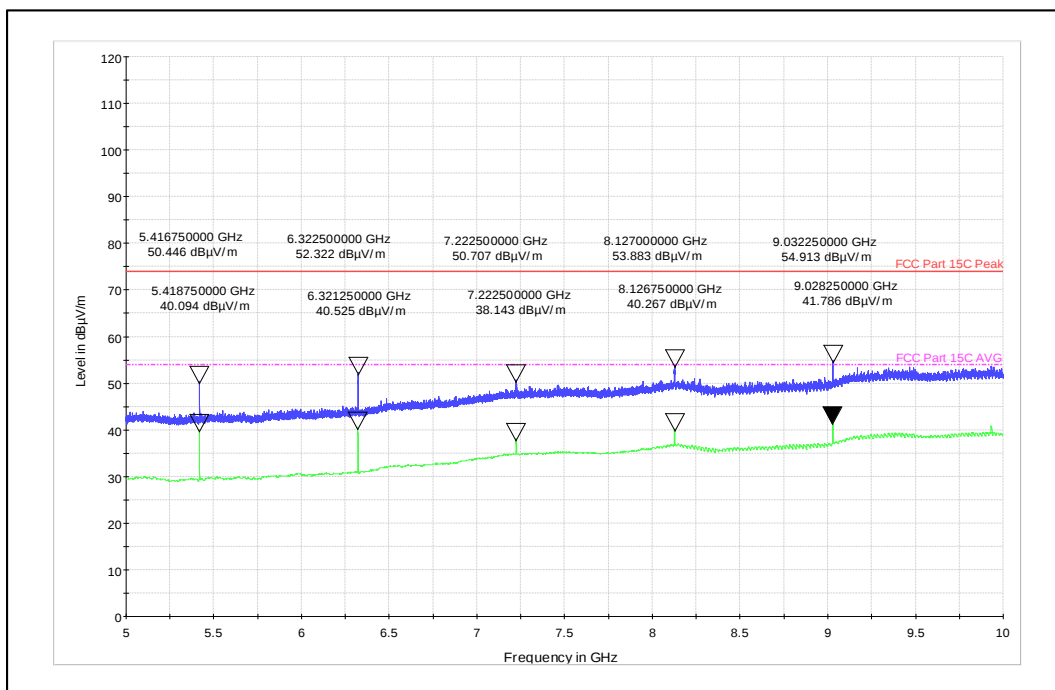
Pk: Peak Detector;
Av: Average Detector

Channel Frequency 903MHz



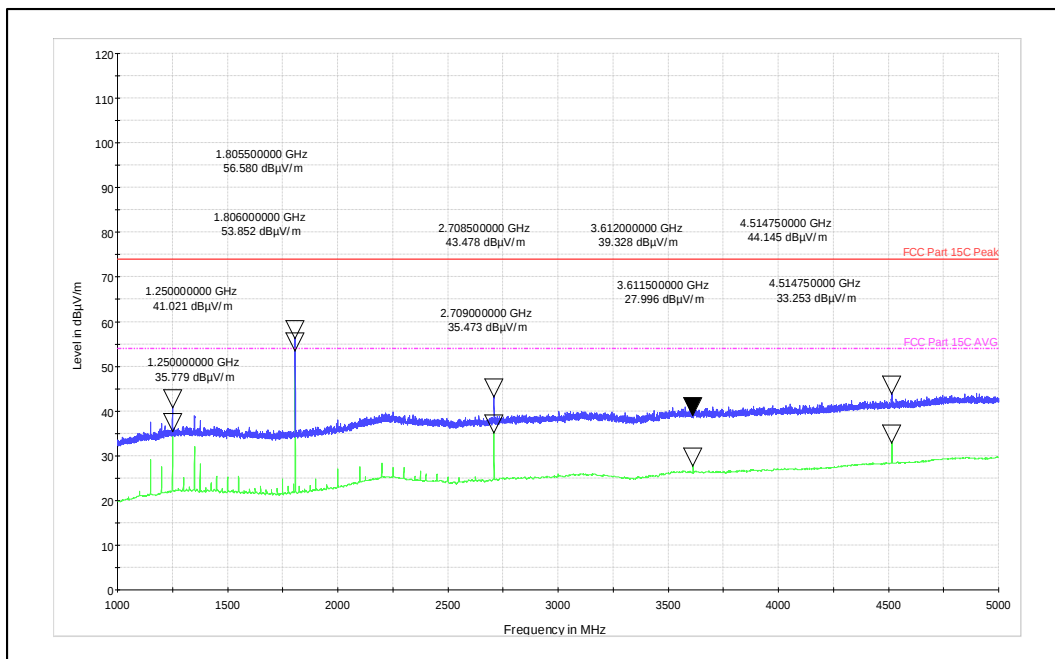
Channel Frequency: 1GHz – 5GHz

Polarization: Vertical



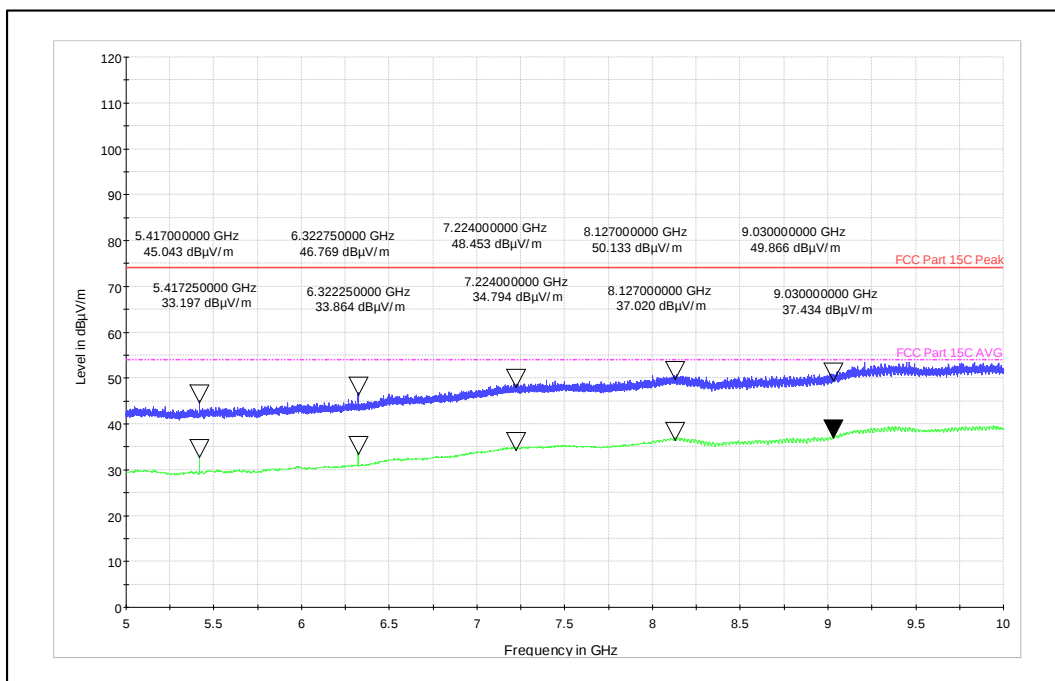
Channel Frequency: 5GHz -10GHz

Polarization: Vertical



Channel Frequency: 1GHz – 5GHz

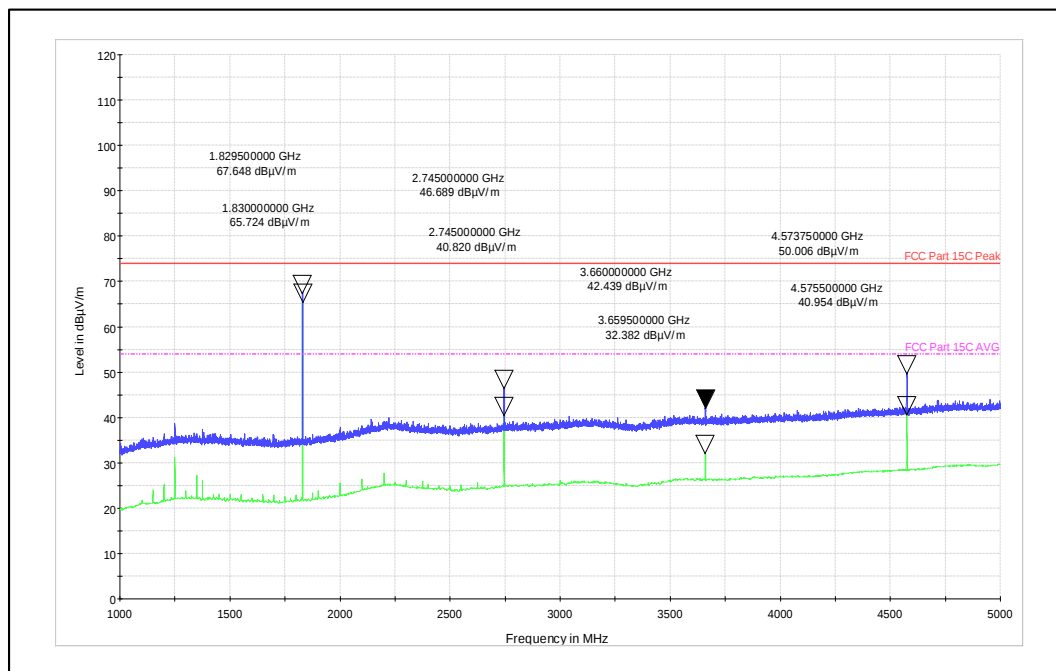
Polarization: Horizontal



Channel Frequency: 5GHz – 10GHz

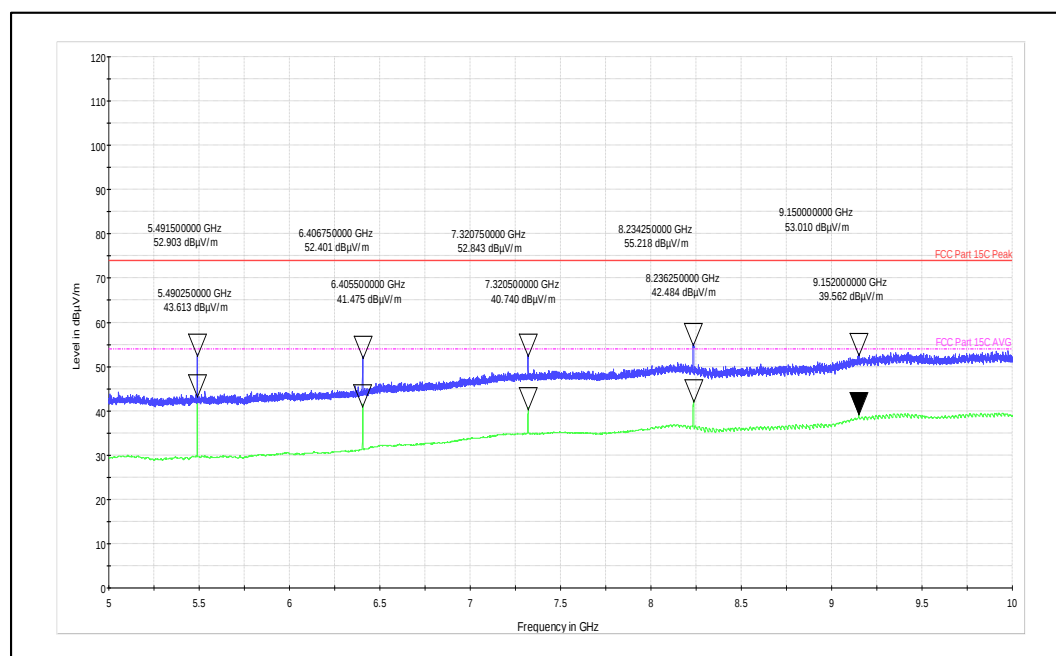
Polarization: Horizontal

Channel Frequency 915MHz



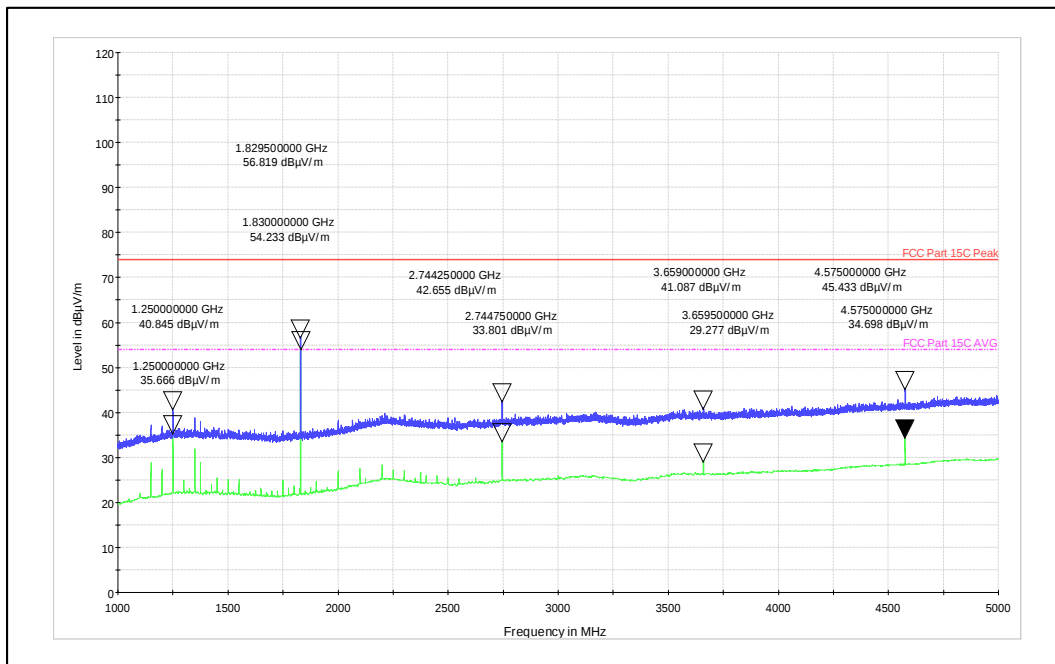
Channel Frequency: 1GHz – 5GHz

Polarization: Vertical



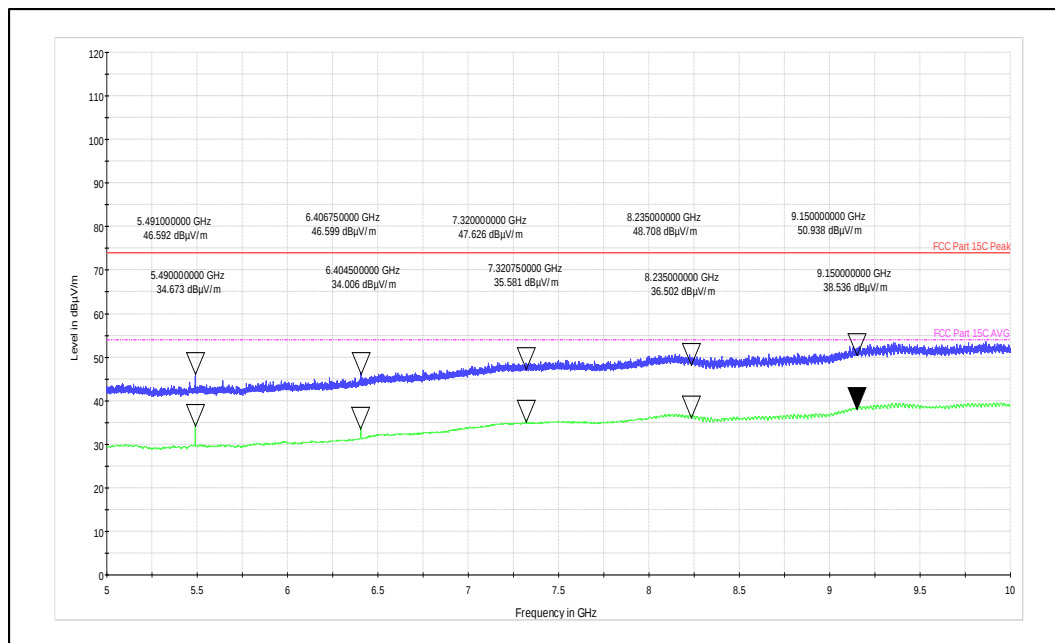
Channel Frequency: 5GHz -10GHz

Polarization: Vertical



Channel Frequency: 1GHz – 5GHz

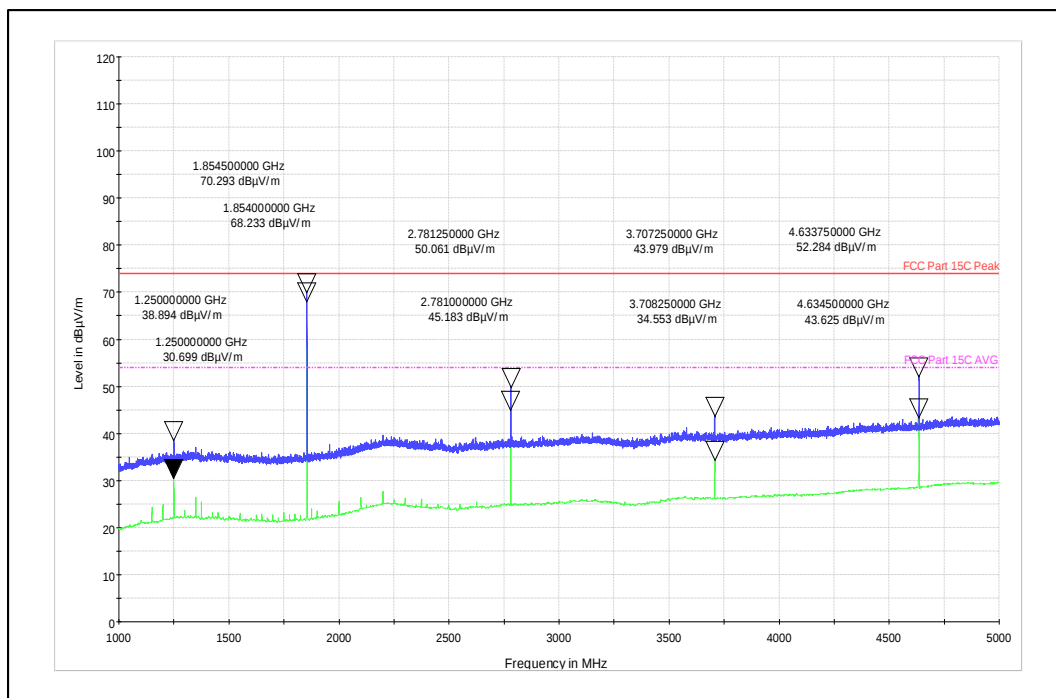
Polarization: Horizontal



Channel Frequency: 5GHz – 10GHz

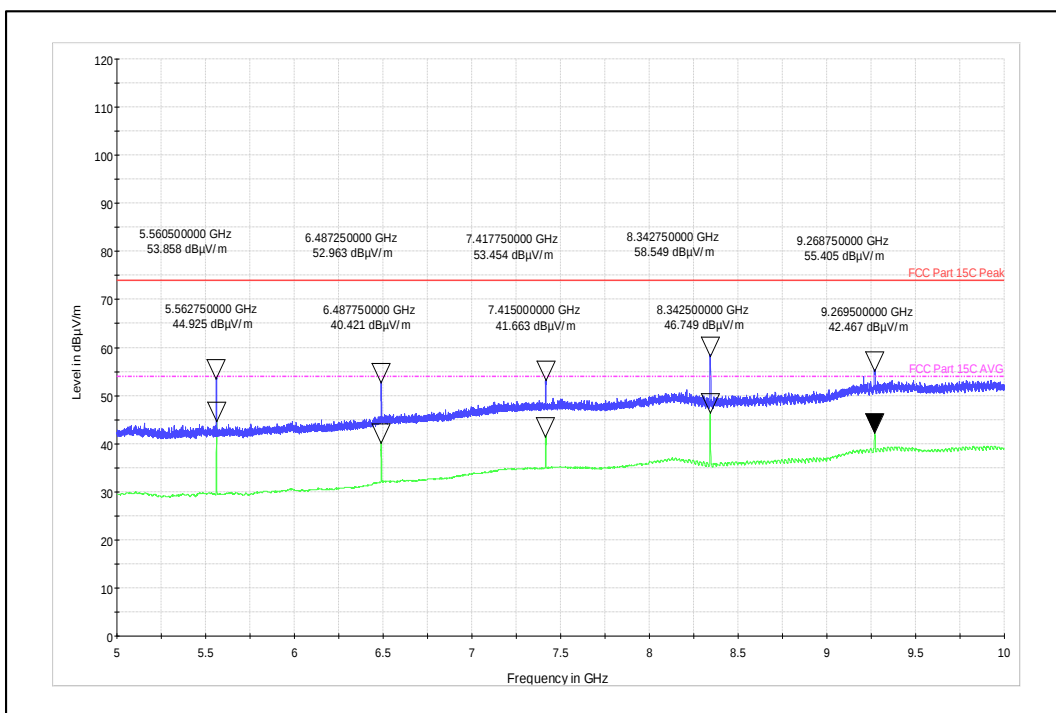
Polarization: Horizontal

Channel Frequency 927MHz



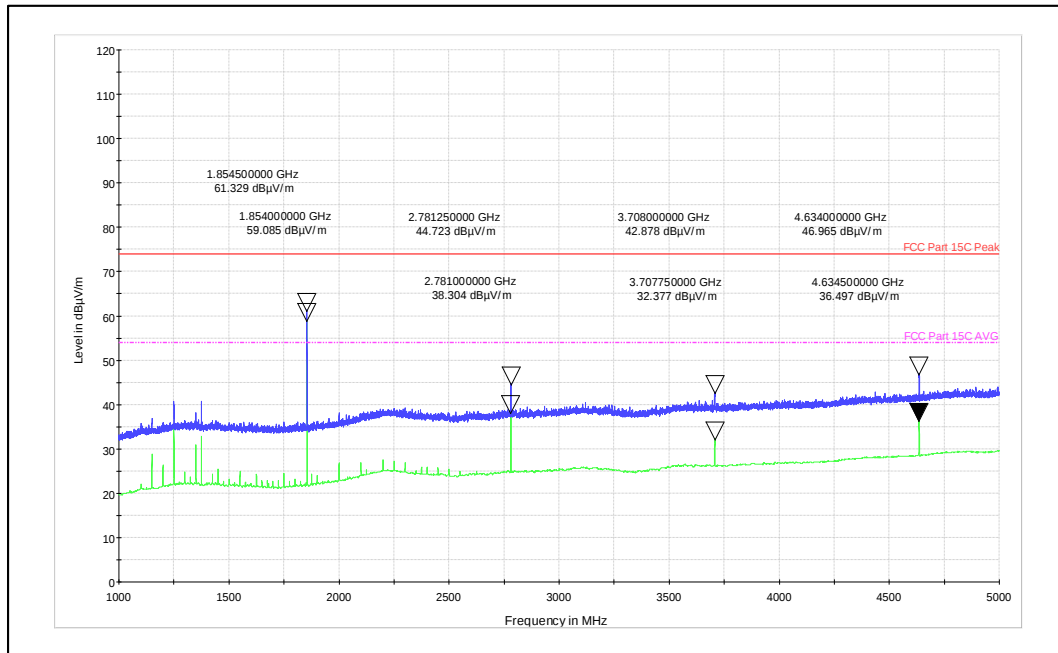
Channel Frequency: 1GHz – 5GHz

Polarization: Vertical



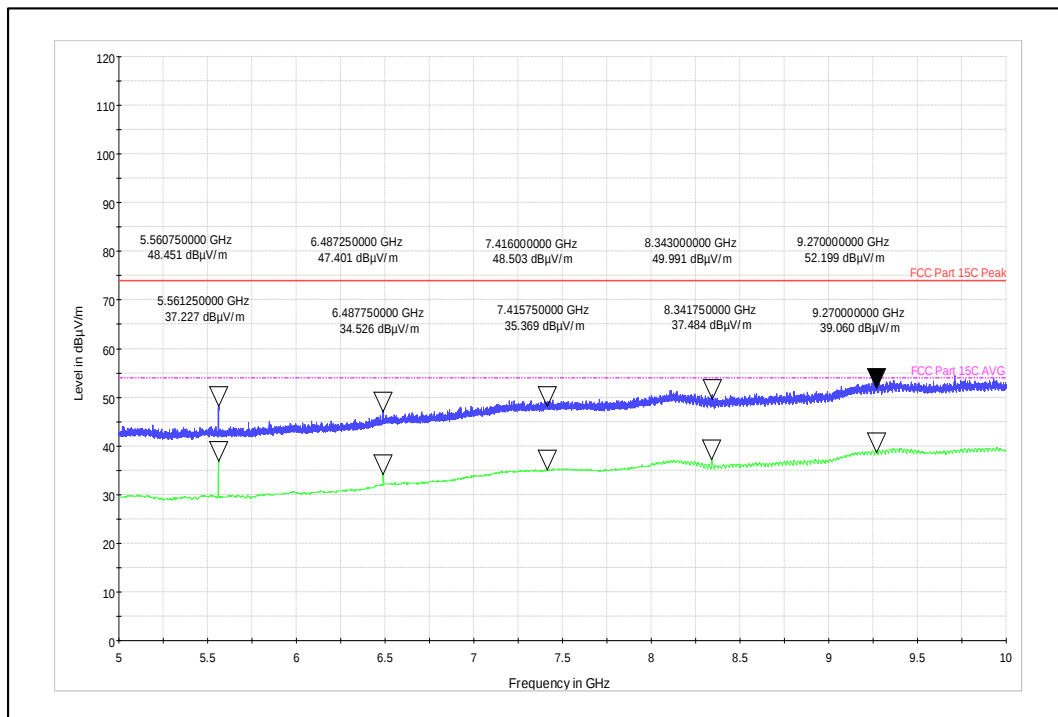
Channel Frequency: 5GHz – 10GHz

Polarization: Vertical



Channel Frequency: 1GHz – 5GHz

Polarization: Horizontal



Channel Frequency: 5GHz – 10GHz

Polarization: Horizontal

Prüfbericht- Nr.:
Test Report No.:

ULR-TC568822300000103F

Seite 49 von 52
Page 49 of 52

7.6 Conducted spurious emission Test on AC Power lines

Result

Pass

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

Table 10: Limits for Conducted poweline emission

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak (dBµV)	Average (dBµV)
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

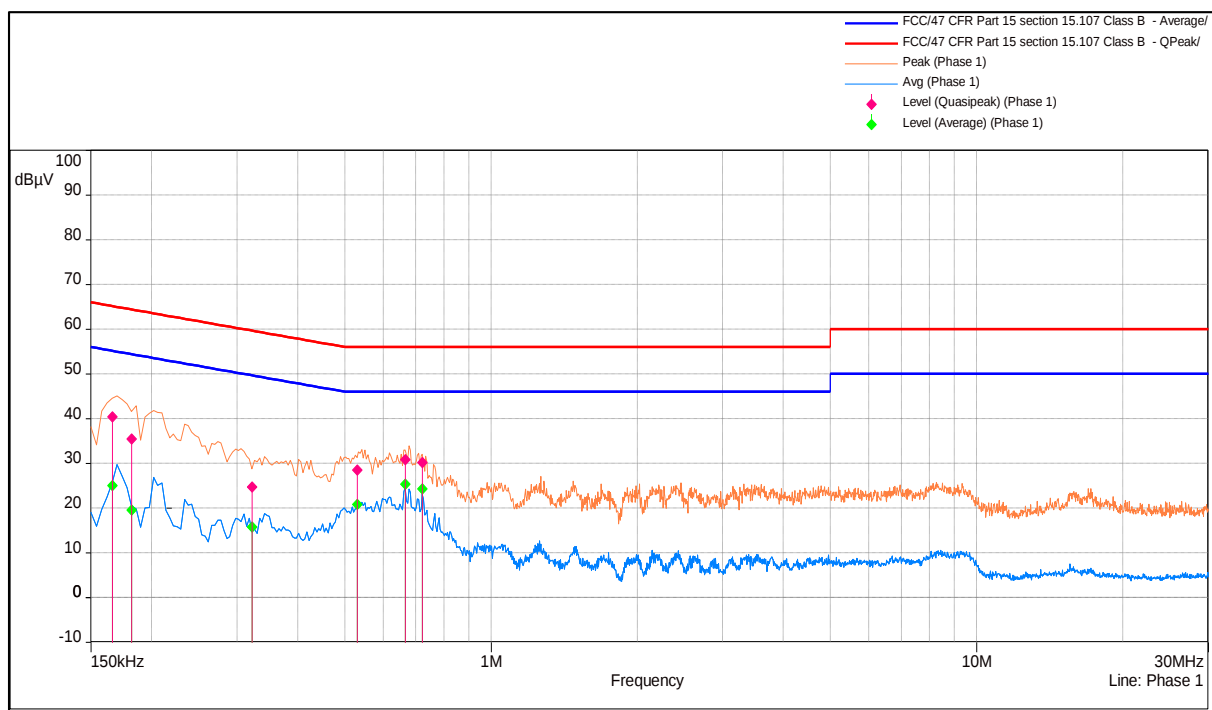
* Decreases with the logarithm of the frequency

Test Conditions:

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

Test results:

110VAC-60Hz-Line



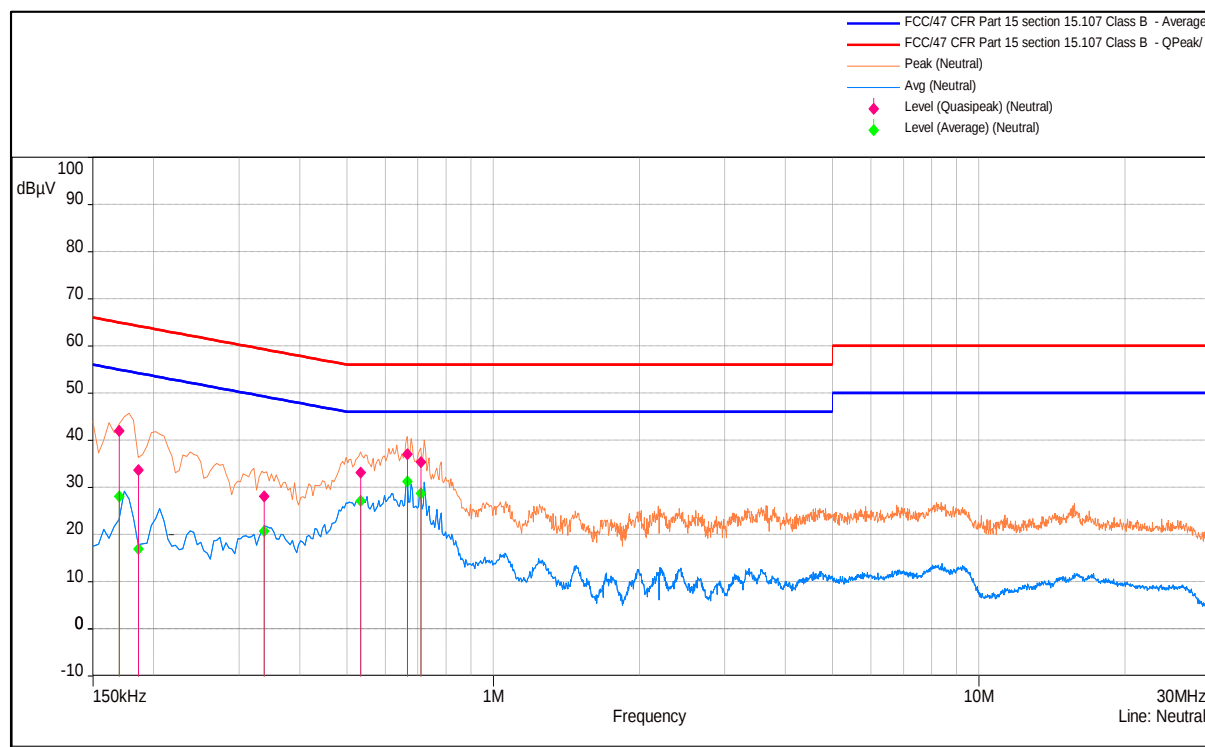
Quasipeak

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Remarks
0.1662	40.41	65.16	-24.75	Phase 1	Pass
0.6642	30.82	56.00	-25.18	Phase 1	Pass
0.7224	30.21	56.00	-25.79	Phase 1	Pass
0.5316	28.54	56.00	-27.46	Phase 1	Pass
0.1831	35.44	64.39	-28.95	Phase 1	Pass
0.3204	24.75	59.66	-34.90	Phase 1	Pass

Average

Frequency (MHz)	Level (dBμV)	Limit (dBμV)	Margin (dB)	Pos	Remarks
0.6642	25.42	46.00	-20.58	Phase 1	Pass
0.7224	24.32	46.00	-21.68	Phase 1	Pass
0.5316	20.87	46.00	-25.13	Phase 1	Pass
0.1662	25.03	55.16	-30.13	Phase 1	Pass
0.3204	15.82	49.66	-33.84	Phase 1	Pass
0.1831	19.56	54.39	-34.83	Phase 1	Pass

110VAC-60Hz-Neutral



Quasipeak

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Pos	Remarks
0.6666	37.06	56.00	-18.94	Neutral	Pass
0.7094	35.33	56.00	-20.67	Neutral	Pass
0.5335	33.20	56.00	-22.80	Neutral	Pass
0.1717	41.97	64.96	-22.99	Neutral	Pass
0.1853	33.65	64.21	-30.56	Neutral	Pass
0.3362	28.11	59.25	-31.14	Neutral	Pass

Average

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Pos	Remarks
0.6666	31.32	46.00	-14.68	Neutral	Pass
0.7094	28.69	46.00	-17.31	Neutral	Pass
0.5335	27.20	46.00	-18.80	Neutral	Pass
0.1717	28.07	54.96	-26.89	Neutral	Pass
0.3362	20.75	49.25	-28.50	Neutral	Pass
0.1853	17.00	54.21	-37.22	Neutral	Pass

8 LIST OF TABLES

Table 1: List of test and measurement instruments.....	6
Table 2: Instrument application Software versions.....	6
Table 3: Ratings and System Details as declared by Client*.....	7
Table 4: Measurement Uncertainty	8
Table 5: List of SubGHz Center frequencies	9
Table 6: Transmitter limits for Radiated emission	35
Table 7: Test results for frequency range 30MHz – 200MHz.....	36
Table 8: Test results for frequency range 200MHz – 1GHz.....	37
Table 9: Test results for the frequencies above 1GHz:.....	40
Table 10: Limits for Conducted poweline emission	49

9 List of Figures

Figure 1: Frequency Range 9 kHz- 30 MHz	11
Figure 2: Frequency Range 30 MHz – 200 MHz	11
Figure 3: Frequency Range 200 MHz - 1GHz	12
Figure 4: Frequency Range above 1 GHz	12

End of test report