

Prüfbericht-Nr.: <i>Test report no.:</i>	ULR-TC568820300000058F	Auftrags-Nr.: <i>Order no.:</i>	166450461 0030	Seite 1 von 48 Page 1 of 48
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	NA	Auftragsdatum: <i>Order date:</i>	2020-03-31	
Auftraggeber: <i>Client:</i>	DTDS Technology Private Ltd 4-4-82/22, Near Veera Reddy Nagar, Nacharam Main Road, Hyderabad - 500076			
Prüfgegenstand: <i>Test item:</i>	DTDS's 622 Module for LoRa communication			
Bezeichnung / Serien-Nr.: <i>Identification / Serial no.:</i>	DTDS's 622 Module / 20080001			
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, 15.207 & 15.203			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2020-10-12			
Prüfmuster-Nr.: <i>Test sample no:</i>	A002856270-001			
Prüfzeitraum: <i>Testing period:</i>	2020-10-12 - 2020-11-04			
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>	2020-11-04	Ausstellatum: <i>Issue date:</i>	2020-11-24	
Stellung / Position:	Rajesh M Gowda Engineer	Stellung / Position:	Mahammadgouse Kaladagi Assistant Manager	
Sonstiges / Other:	FCC ID : 2AXXTDTS-622LORAMO			
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 3 = satisfactory	4 = ausreichend N/A = nicht anwendbar 4 = sufficient N/A = not applicable
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory 3 = satisfactory	4 = sufficient N/A = not applicable 5 = mangelhaft N/T = nicht 5 = poor N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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TEST SUMMARY

Test Item	FCC	Result
Maximum conducted (Peak) output power	15.247 (b)(2)	Pass
Occupied bandwidth and 20dB Bandwidth	15.247 (a) (i)	Pass
Number of Hopping channels	15.247 (a) (i)	Pass
Carrier Frequency Separation	15.247 (a) (1)	Pass
Time of Occupancy (Dwell Time)	15.247 (a) (i)	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
Antenna requirement	15.203	Pass

Product Category: Electronics Testing

Test Discipline: EMC Test Facility

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REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
ULR-TC568820300000058F	01	Initial issue of report	2020-11-18
ULR-TC568820300000058F	02	Reviewer comments Updated	2020-11-24

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1 GENERAL REMARKS

1.1 Attachments

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

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

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2 TEST SITES

2.1 Testing Facilities

1. TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
ElectronicCityPhase1
Bangalore – 560 100,
India
2. TUV Rheinland (India) Private Limited
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	Schwarzbeck	FMZB 1519 B	1519B-00111	-	31.01.2021	Yearly	Radiated Spurious Emission
Biconical Antenna	Schwarzbeck	VHBB91 24+BBA 9106	9124-1208+9106-0525	-	16.01.2021	Yearly	
Baloon and Biconical Antenna	Schwarzbeck mess-elektronik	VHBB-9124 / BBA-9106	01028	-	16.01.2021	Yearly	
Log - Periodical Antenna	Schwarzbeck	VUSLP 9118 A	VULP9118A-0733	-	17.01.2021	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	29.01.2021	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-1944	-	30.01.2021	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
EMI Receiver	Rohde & Schwarz	ESW 44	101732	-	10.12.2020	Yearly	Antenna-Port Conducted test
Spectrum Analyser	Agilent Technologies	E4407B	US41192772	A.14.06	10.08.2021	Yearly	

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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

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3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

“LoRa communication has a long range, low power capability with a secured data transmission (AES128). It operates in the unlicensed band US: 902 to 928 MHz, The device finds its application where devices are operating on a battery and transmit only small data packets. It finds its use in indoor and outdoor applications for communication like Smart Cities, Smart Homes & Buildings, Smart Agriculture, Smart Metering and Monitoring, Smart Supply Chain and Logistics, etc...”

3.2 Ratings and System Details of Equipment under Test

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

Protocol	LoraWAN
Operating Frequency Range	902.3MHz to 914.9MHz
No. of Channels	72 Upstream, 8 downstream
Channel Spacing	200KHz
Maximum Measured Power	16.26 dBm at 908.5 MHz
Modulation	LoRa
Number of antennas	1
Antenna Gain	1.21 dBi
Antenna Type	Dipole Antenna
Supply Voltage to Product	3.3V Nominal (3.0 – 3.6V)
Environmental conditions	-40°C to +85°C
EUT Dimension	15 x 27 x 3 mm (LxWxH)

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

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3.3 Measurement Uncertainty:

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

Table 4: Measurement Uncertainty

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

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.

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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: v1.02

Software Version:

Radiated : RadioEvalApp V1.0 - Used for Channel locking

Conducted : LoRaWan V1.0.2 – Used for Enabling FHSS
RadioEvalApp V1.0 - Used for Channel locking

4.3 Special Accessories and Auxiliary Equipment

Test laptop and USB cable (1m)

4.4 Countermeasures to achieve EMC Compliance

None

4.5 List of frequencies

Frequency Band (GHz)	Channel No.	Frequency (MHz)
Sub-GHz (902 MHz – 915 MHz)	Low	902.3
	:	:
	Mid	908.5
	:	:
	High	914.9

Table 5: List of SubGHz Center frequencies

Channel used for SubGHz testing

Channel low : 902.3MHz

Channel mid : 908.5MHz

Channel High : 914.9MHz

Note:

TUV Sample Identification number : A002856270-001 – Radiated & Conducted test Sample

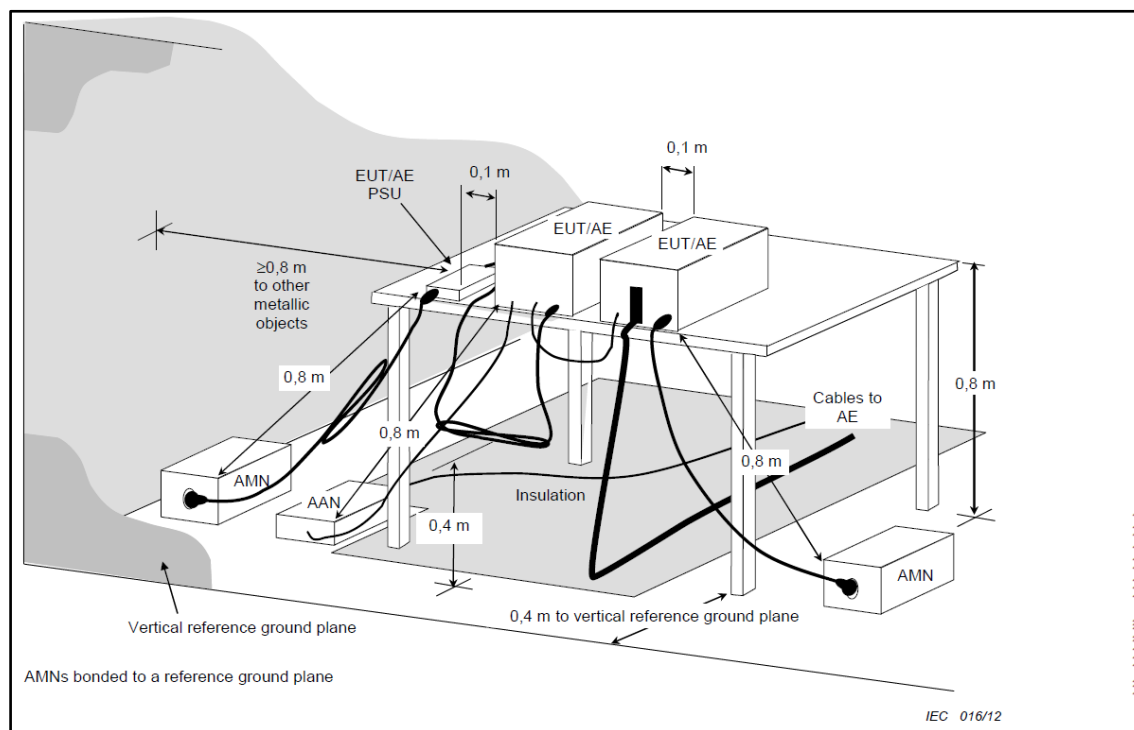
5 TEST METHODOLOGY

5.1 Conducted Spurious Emission Test on AC Power Line

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 methods are tested individually, one with an AC adaptor with 110V AC 60Hz supply and second with Wireless charger with supply 110V AC 60Hz.

5.1.1 Test Setup Configuration



5.2 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 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

5.2.1 Test Setup Configuration

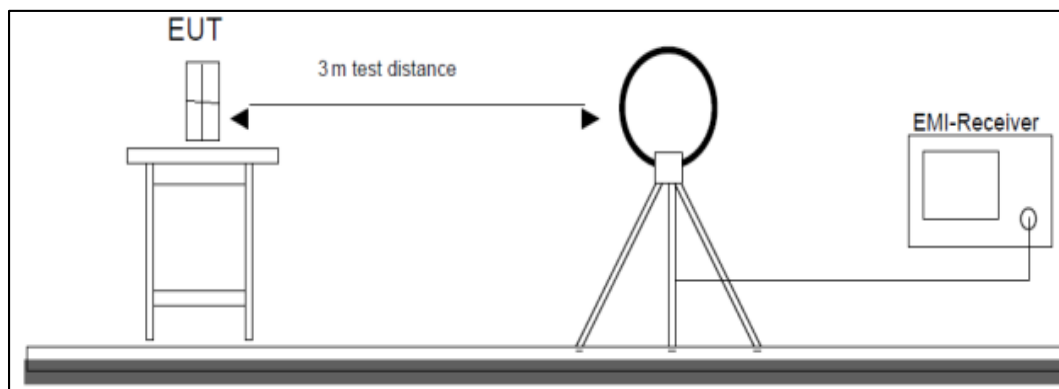


Figure 1: Frequency Range 9 kHz - 30 MHz

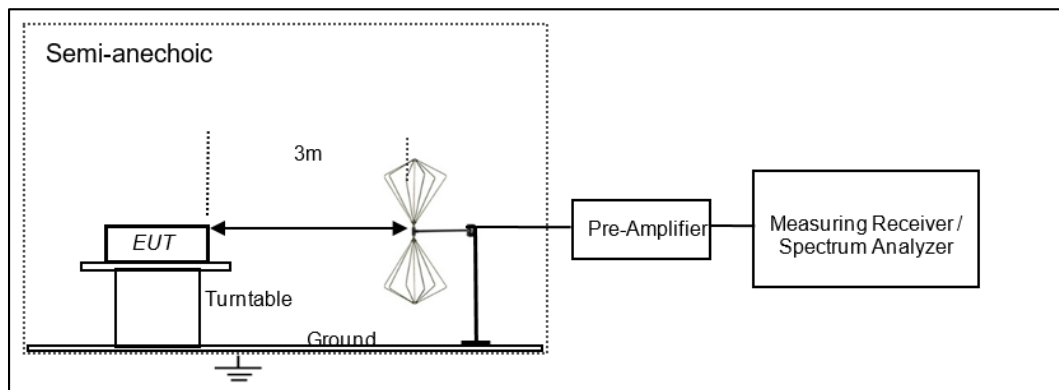


Figure 2: Frequency Range 30 MHz - 200 MHz

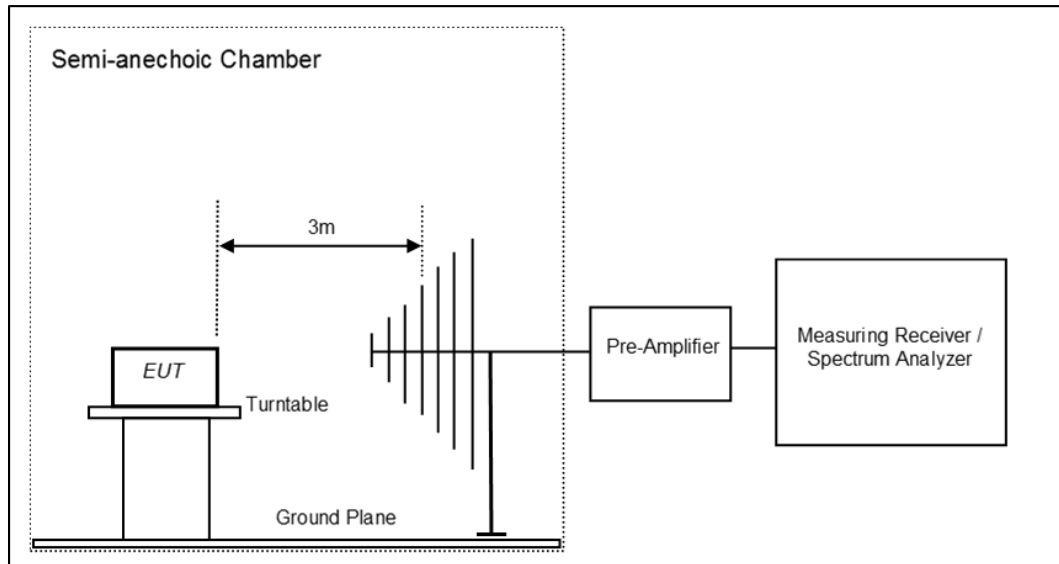


Figure 3: Frequency Range 200 MHz - 1GHz

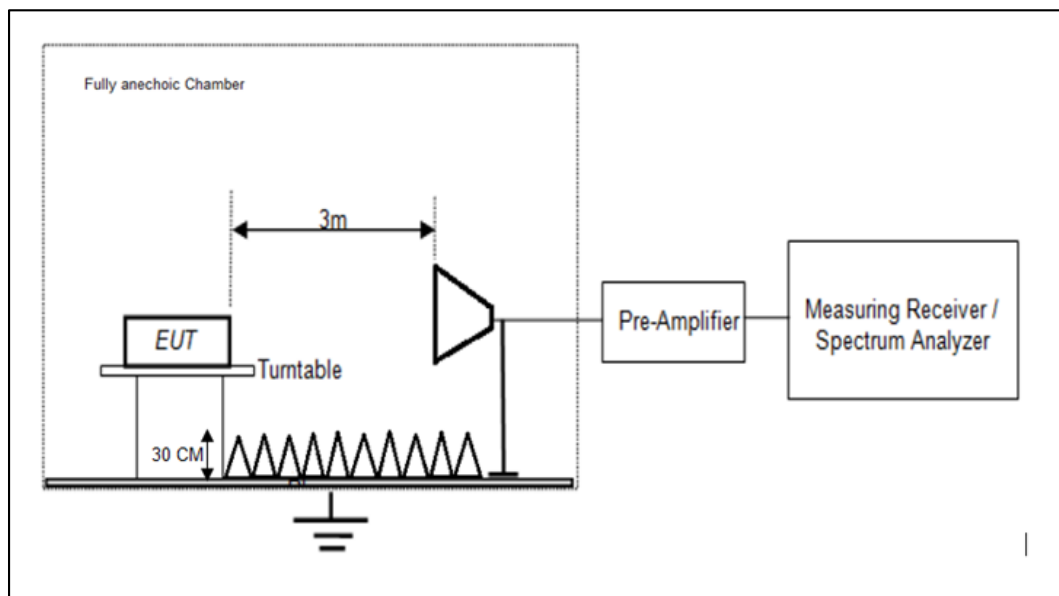


Figure 4: Frequency Range above 1 GHz

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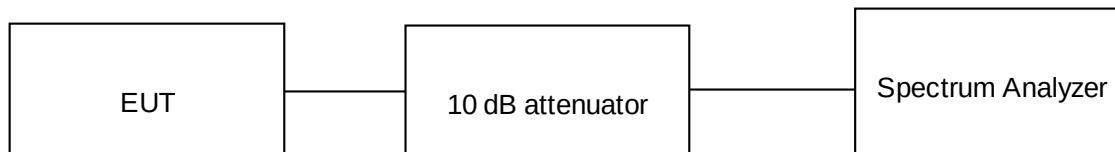
6 TEST RESULTS

6.1 Maximum Peak Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(2)
Test Method	Subclause 7.8.5 of ANSI C63.10
Measurement Bandwidth	300kHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power $\leq$ 1 W (30 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 23.0 °C Voltage = 3.3V DC Battery Supply Relative humidity: 64%

KDB Guidelines applied:

Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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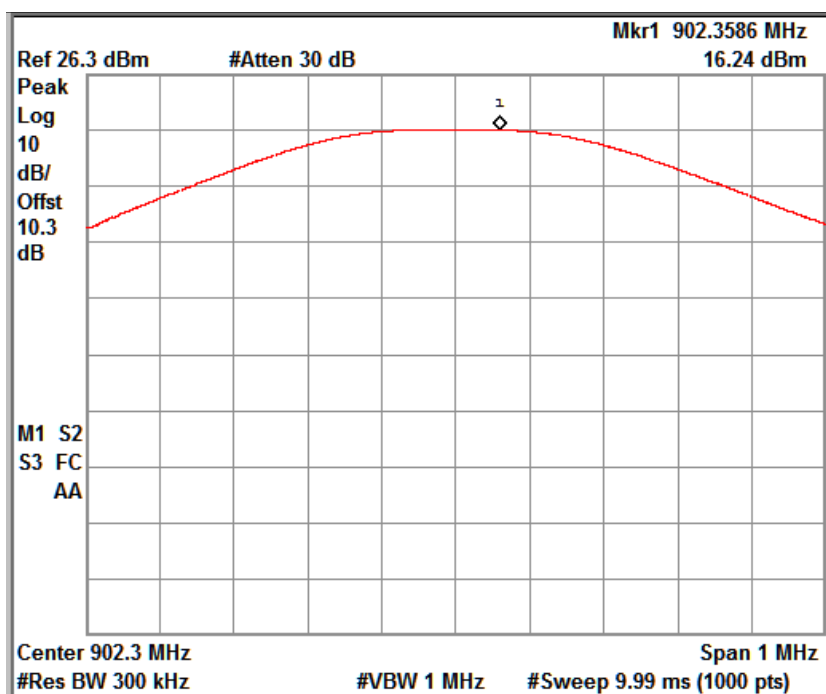
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Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.3dB)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 1.21 dBi

Data Rate (kbps)	Channel Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)	Power Limit (dBm)
125	902.3	16.24	30
	908.5	16.26	30
	914.9	16.14	30

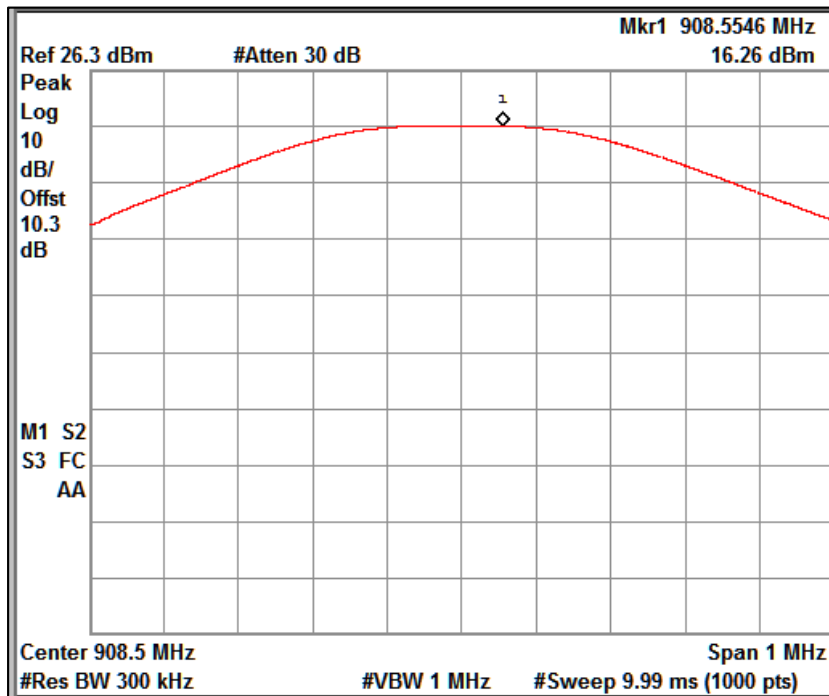


Channel Frequency:902.3MHz

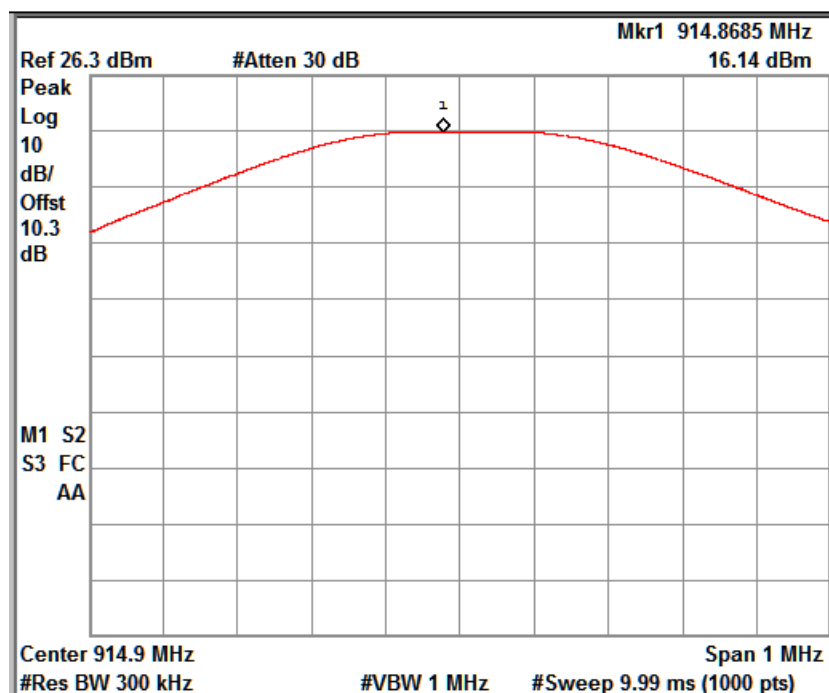
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Channel Frequency: 908.5MHz



Channel Frequency: 914.89MHz

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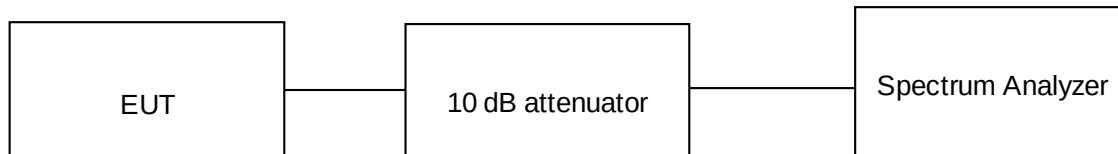
6.2 Occupied bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (i)
Test Method	Subclause 7.8.7 of ANSI C63.10
Measurement Bandwidth	30 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	The minimum 20 dB bandwidth of the hopping channel is 250 kHz use at least 50 hopping frequencies.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 23.0 °C Voltage = 3.3V DC Battery Supply Relative humidity: 64%

KDB Guidelines applied:

Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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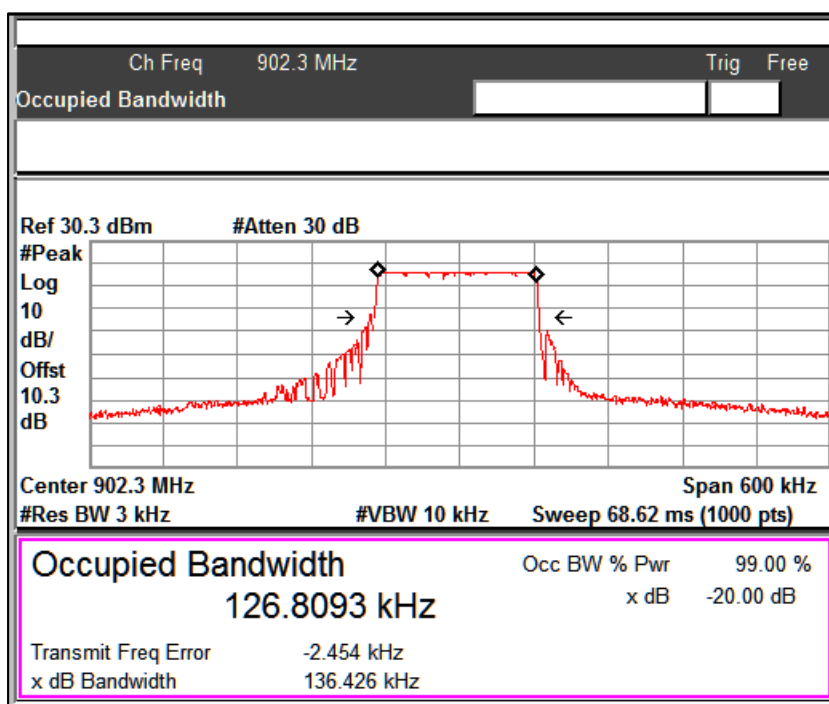
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Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.3dB)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 1.21 dBi.

Data Rate (kbps)	Channel Frequency (MHz)	20 dB Bandwidth (kHz)	99% OBW (kHz)	Minimum Limit (kHz)
	902.3	136.42	126.80	250
	908.5	138.36	127.73	250
	914.9	137.28	127.53	250

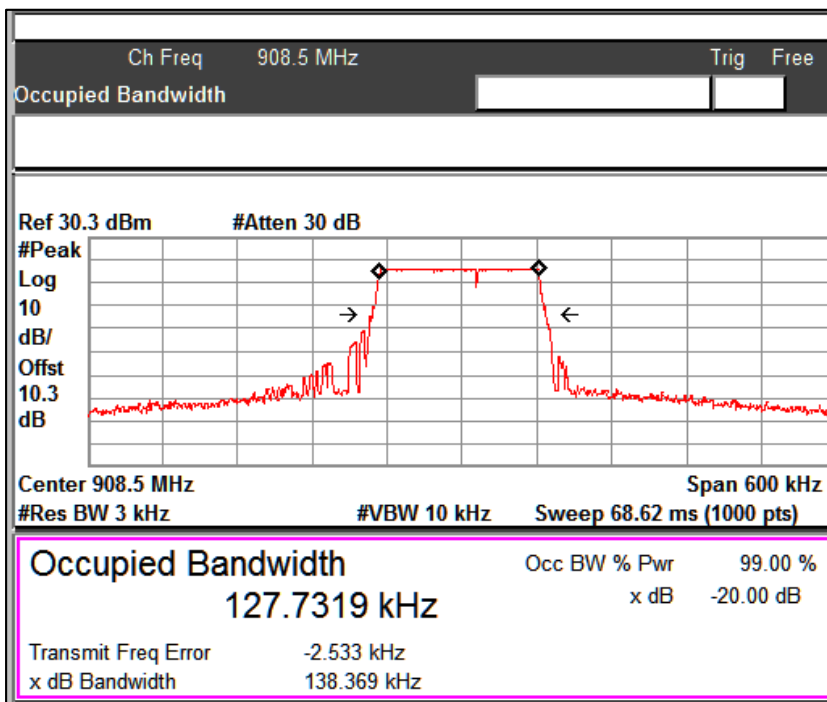


Channel Frequency: 902.3MHz

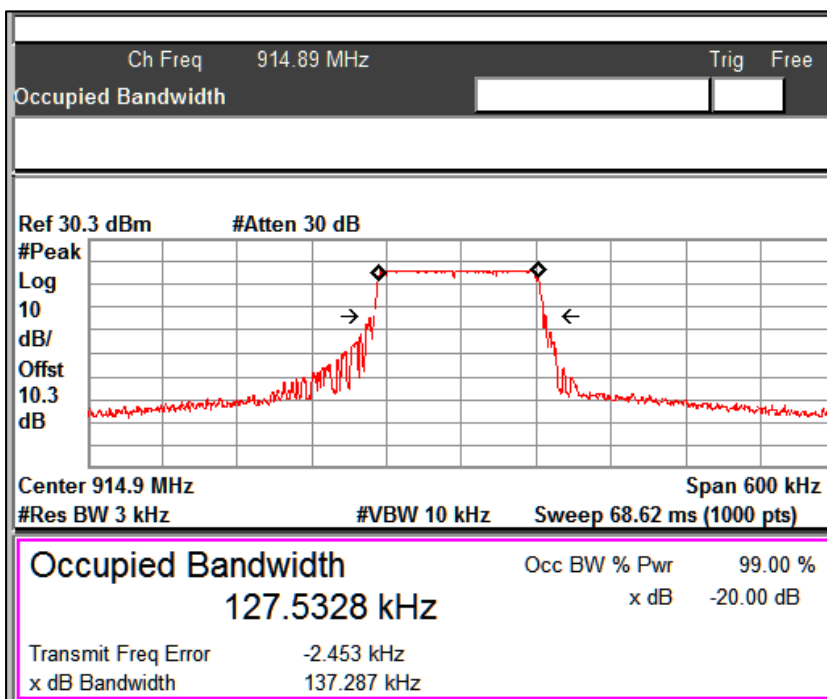
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Channel Frequency: 908.5MHz



Channel Frequency: 914.89MHz

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6.3 Number of Hopping Channels

Result

Pass

Test Specification

FCC Part 15 Subpart C Section 15.247 (a) (i)

Test Method

Subclause 7.8.3 of ANSI C63.10

Measurement Bandwidth

30 kHz*

Detector

Peak

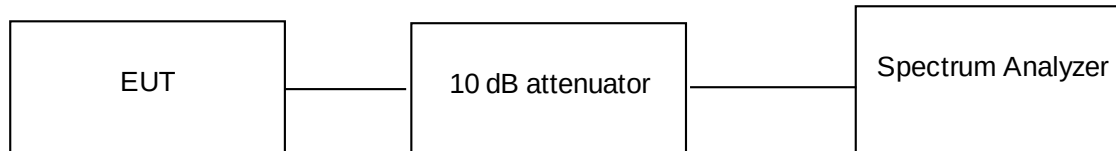
Port of testing

Antenna port

Requirement

Frequency hopping systems operating in the band 902.2-928 MHz shall use at least 50 hopping channels if the minimum 20 dB bandwidth is less than 250 kHz.

Test Method:



*Note: RBW setting of 30 kHz is used because setting of 40.9 kHz to 41.5kHz (30% of 20 dB bandwidth) bandwidth in the receiver is not supported

Test Condition

Normal Test Condition:

Temperature (Norm) = + 23.0 °C

Voltage = 3.3V DC Battery Supply

Relative humidity: 64%

KDB Guidelines applied:

Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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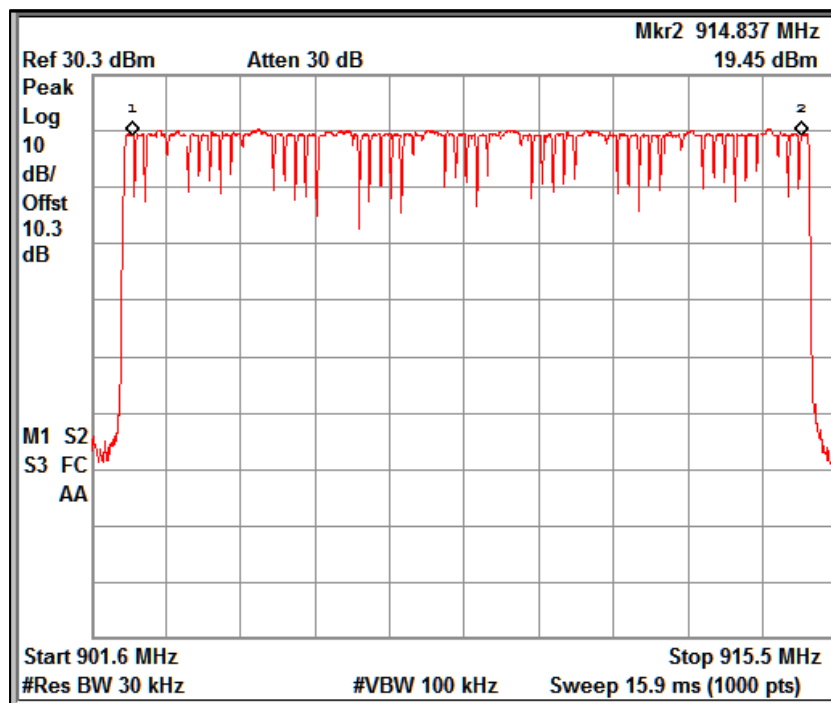
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Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.3dB).



Start hopping Frequency Observed 902.3 MHz

Stop hopping Frequency Observed 914.9 MHz

Total Number of Hopping Channels Observed = 62

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6.4 Carrier Frequency Separation

Result

Pass

Test Specification

FCC Part 15 Subpart C Section 15.247 (a) (1)

Test Method

Clause 7.8.2 of ANSI C63.10

Measurement Bandwidth

100 kHz*

Detector

Peak

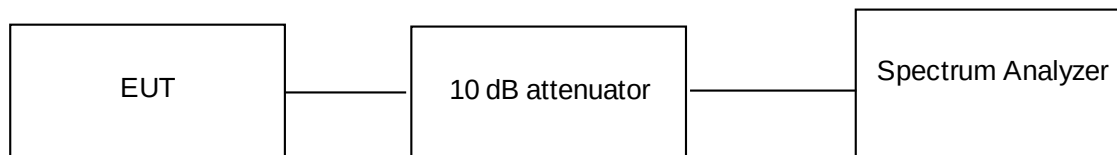
Port of testing

Antenna port

Requirement

Frequency hopping systems shall have hopping channel carrier frequency separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

Test Method:



*Note: RBW setting of 100 kHz is used because setting of 40.9 kHz to 41.5kHz (30% of 20 dB bandwidth) bandwidth in the receiver is not supported

Test Condition

Normal Test Condition:

Temperature (Norm) = + 23.0 °C

Voltage = 3.3V DC Battery Supply

Relative humidity: 64%

KDB Guidelines applied:

Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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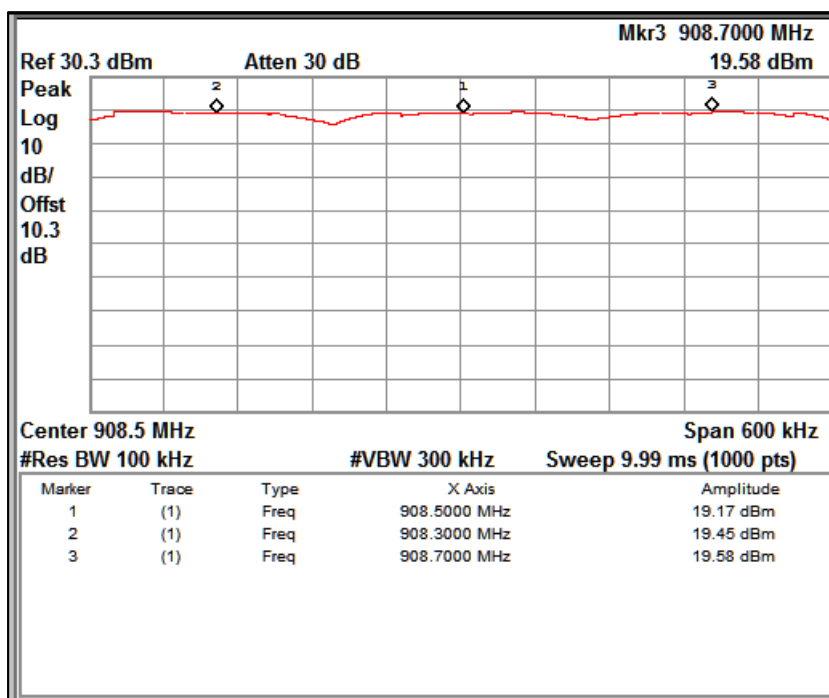
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Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report.
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.3dB)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 1.21 dBi.



Frequency (MHz)	Channel spacing Observed (KHz)	20 dB Band width (KHz)
908.3	200	138.6
908.5	200	138.6
908.7	200	138.6

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6.5 Time of Occupancy (Dwell Time)

Result

Pass

Test Specification

FCC Part 15 Subpart C Section 15.247 (a) (i)

Test Method

Clause 7.8.4 of ANSI C63.10

Measurement Bandwidth

300 kHz

Detector

Peak

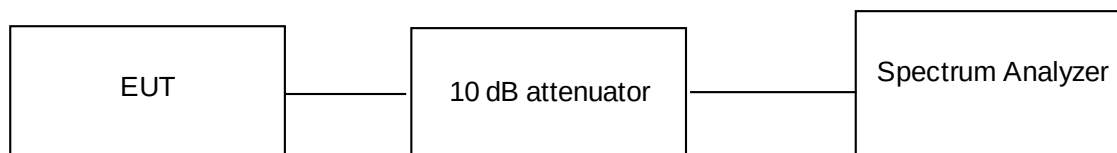
Port of testing

Antenna port

Requirement

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 23.0 °C

Voltage = 3.3V DC Battery Supply

Relative humidity: 64%

KDB Guidelines applied:

Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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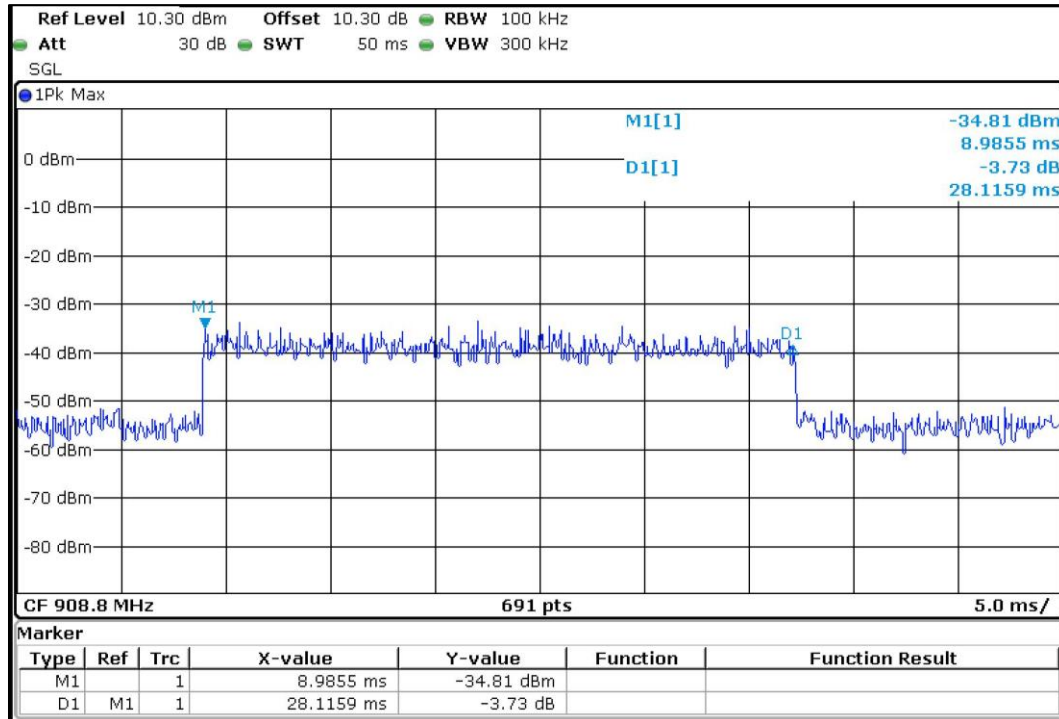
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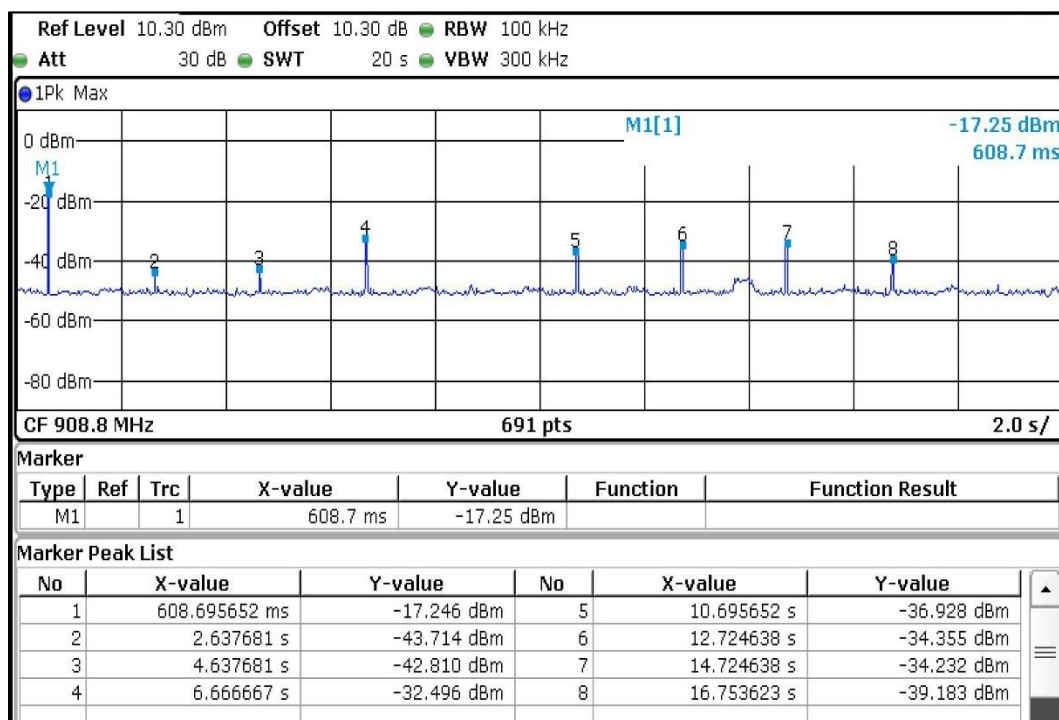
Test results:

Note:

1. All the losses are included during measurement and final values are mentioned in the test report
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.3dB)



Dwell Time



Number of Bins

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Dwell Time = 28.11ms
Total bins in 20 s =8
Max. Allowed time = 0.4s

Total time occupancy in 20s = $28.11 * 8 = 224.8\text{ms}$ (which is less than 400ms)

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6.6 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 7.8.8 of ANSI C63.10

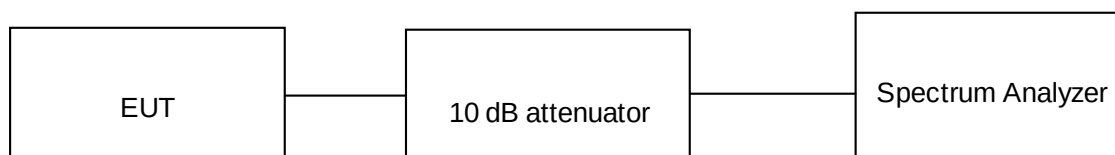
Measurement Bandwidth 100 kHz

Detector Peak

Port of testing Antenna port

Requirement In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 23.0 °C Voltage = 3.3V DC Battery Supply Relative humidity: 64%

KDB Guidelines applied:

Measurements were made as per section 9(b) in KDB 558074 D01 15.247 Measurement Guidance v05r02.

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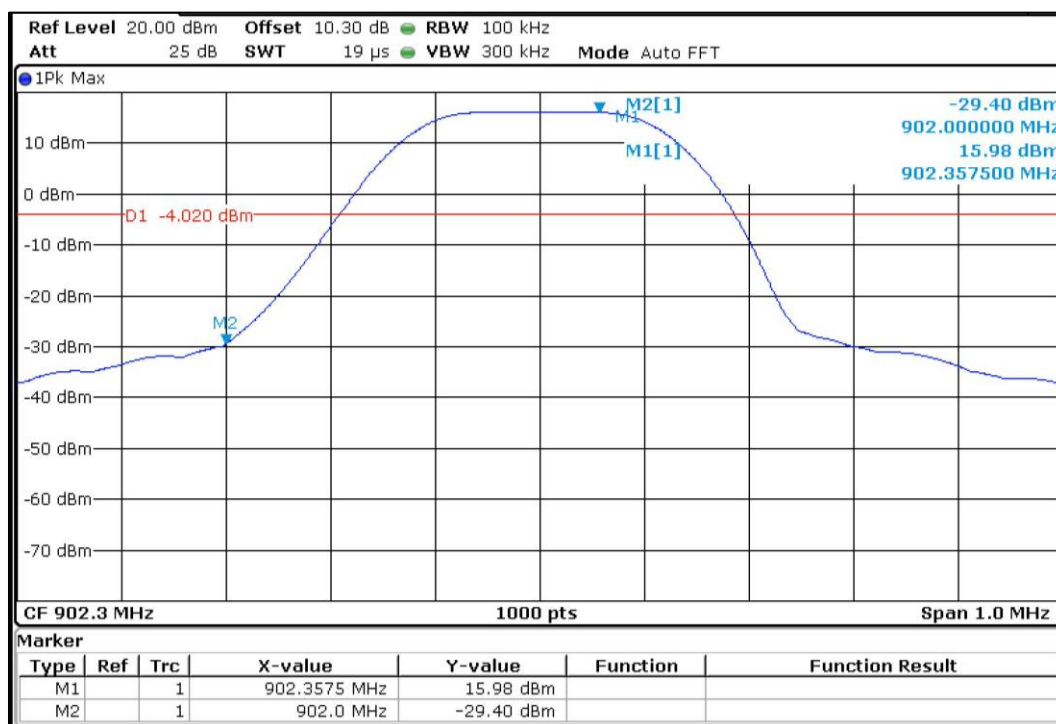
Test results:

Note:

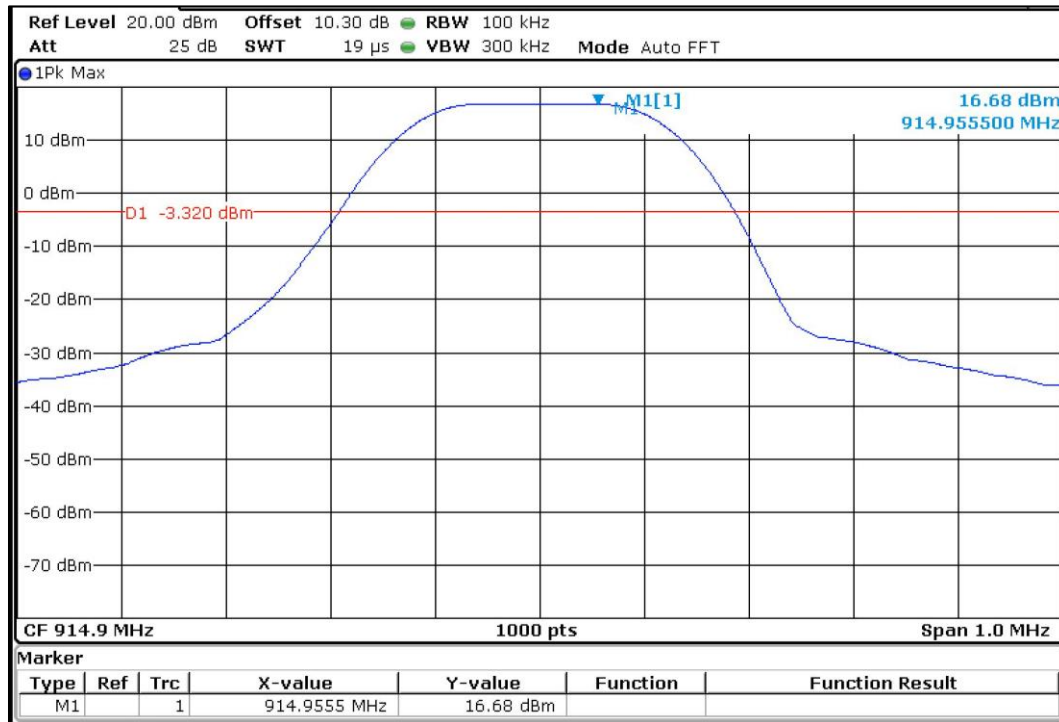
1. All the losses are included during measurement and final values are mentioned in the test report
2. Final Value (dBm) = Measured Value (dBm) + Attenuator factor (10dB) + Cable loss (0.3dB)
3. This product do not support additional beamforming gain / directional gain, it uses single antenna and hence Directional gain of the single antenna is 1.21 dBi
4. Only worst case results are reported

6.6.1 Band edge and reference plots

Data Rate (kbps)	Channel Frequency (MHz)	Reference Value (B) (dBm)	Band edge Frequency (MHz)	Value at Band edge (A) (dBm)	A-B (dBc)	Minimum Limit (dBc)
125	902.3	15.98	902	-29.40	-45.38	-20.00

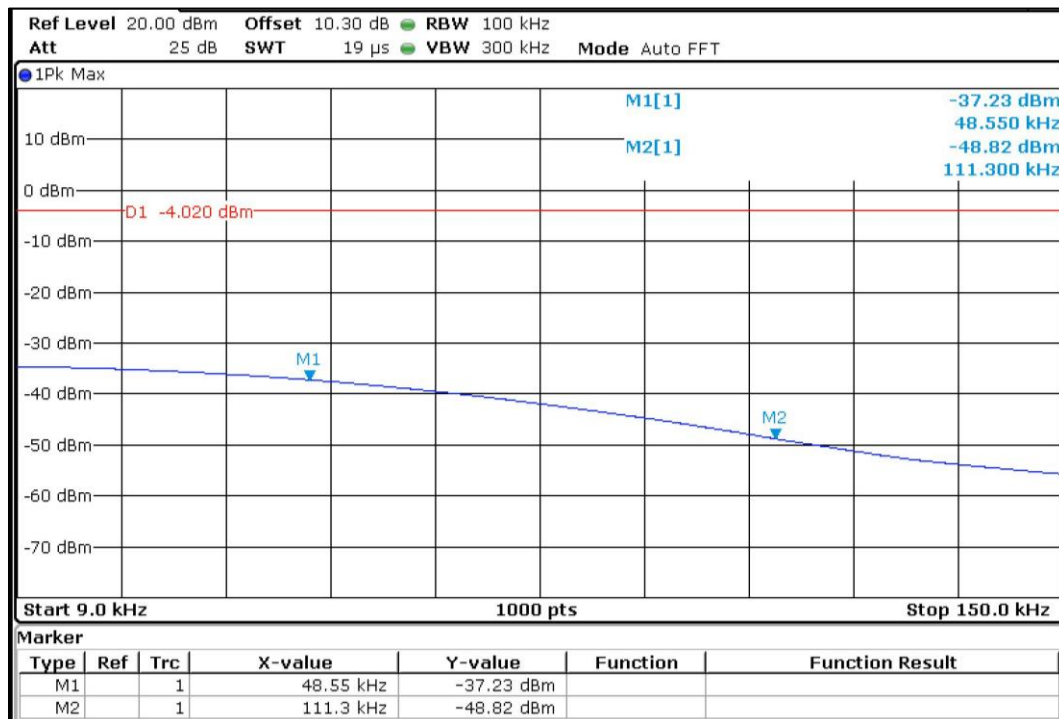


Channel Frequency 902.3MHz



Channel Frequency 914.9MHz

6.6.2 Out-Of-Band Emissions



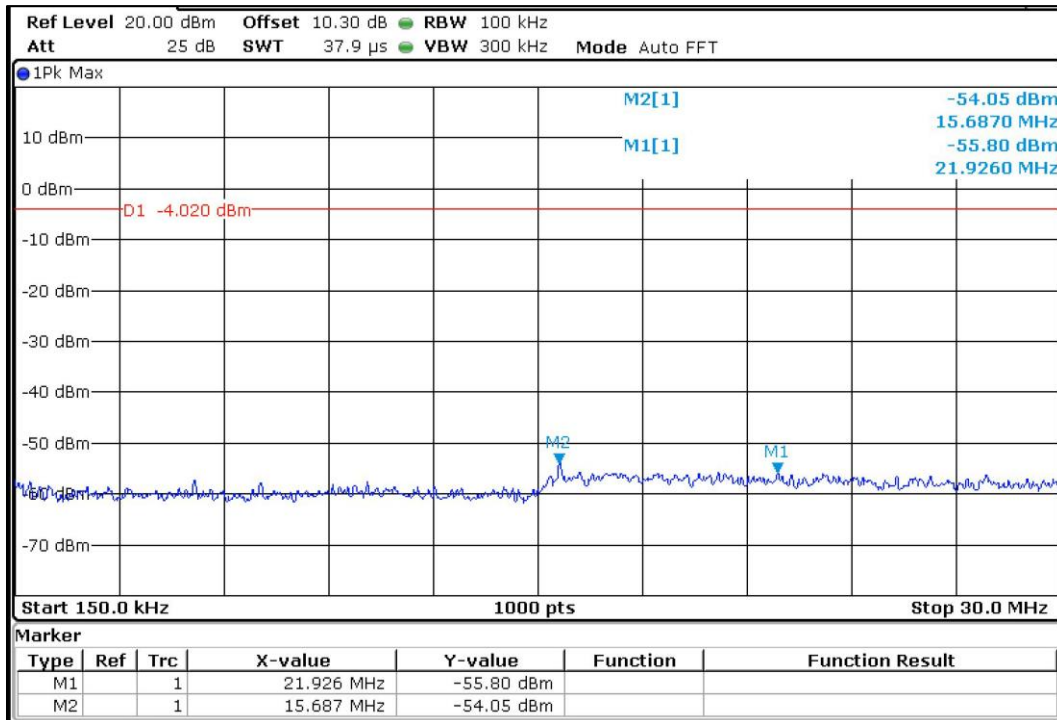
Channel Frequency 902.3MHz

Frequency Range 9KHz – 150KHz

Prüfbericht - Nr.:
Test Report No.:

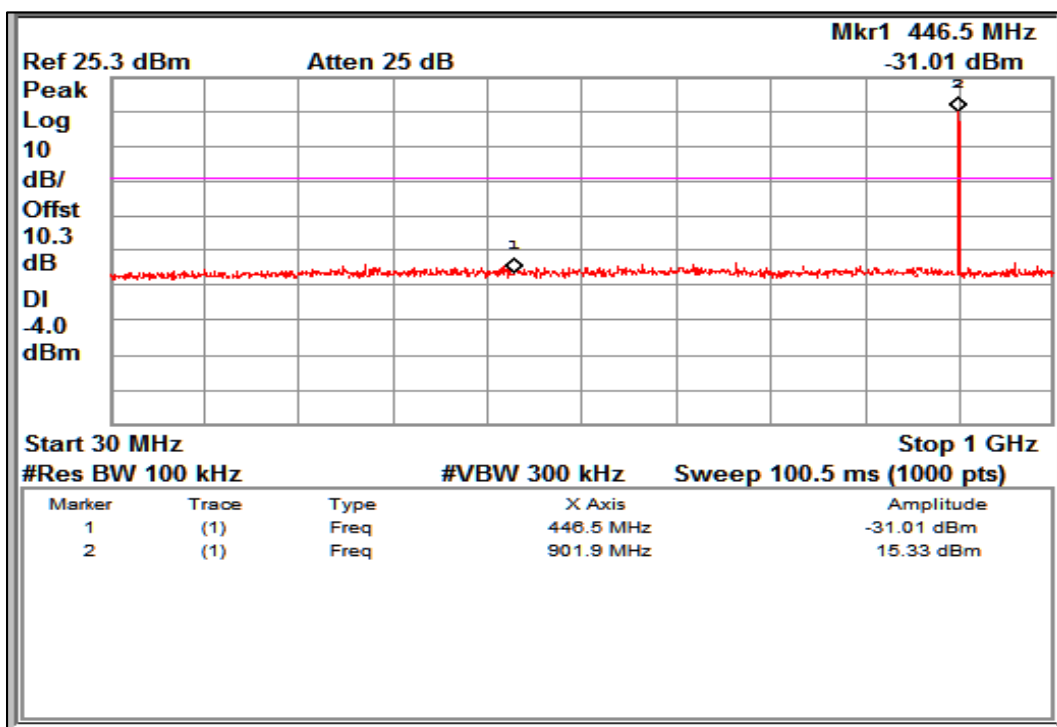
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Channel Frequency 902.3MHz

Frequency Range 150KHz – 30MHz



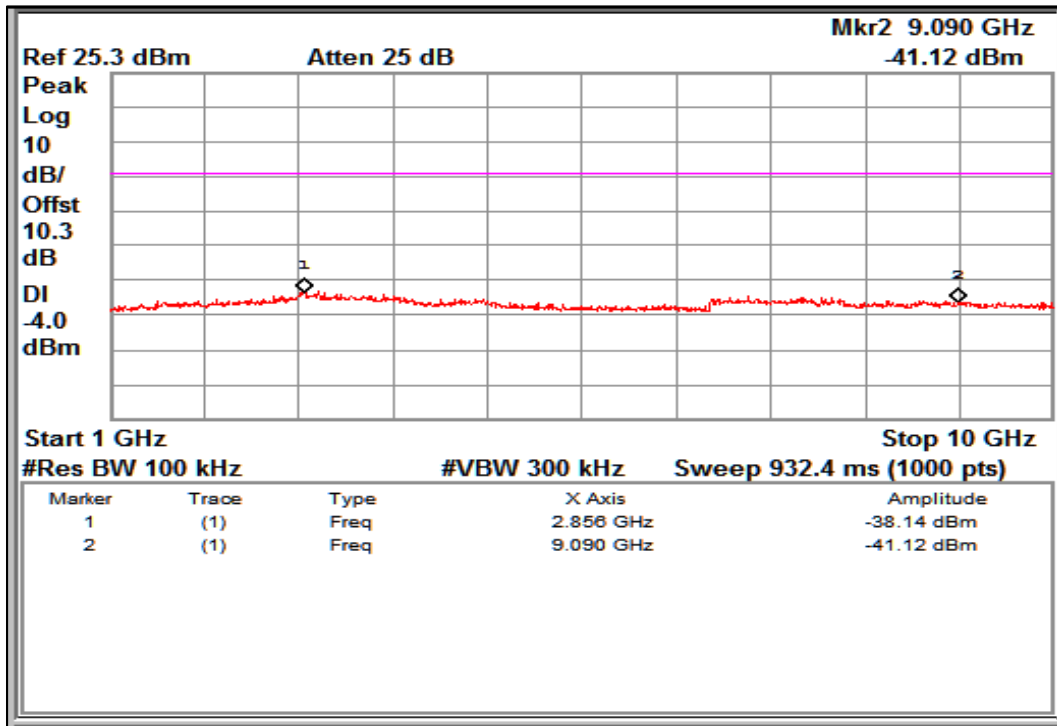
Channel Frequency 902.3MHz

Frequency Range 30MHz – 1GHz

Prüfbericht - Nr.:
Test Report No.:

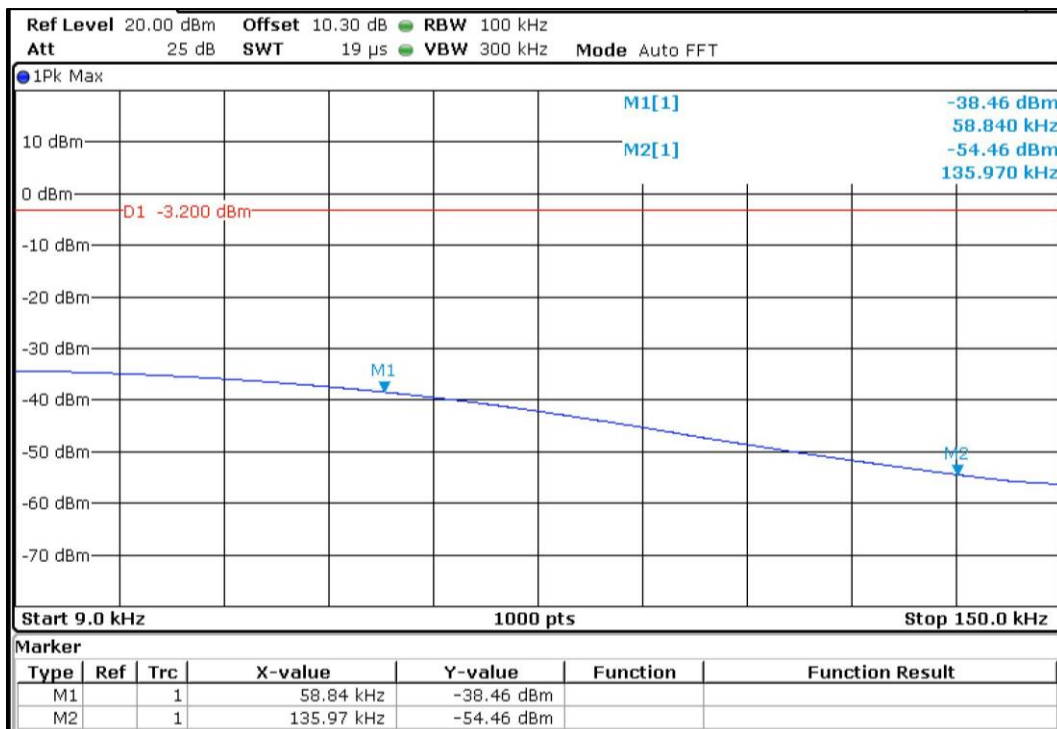
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Channel Frequency 902.3MHz

Frequency Range 1GHz – 10GHz



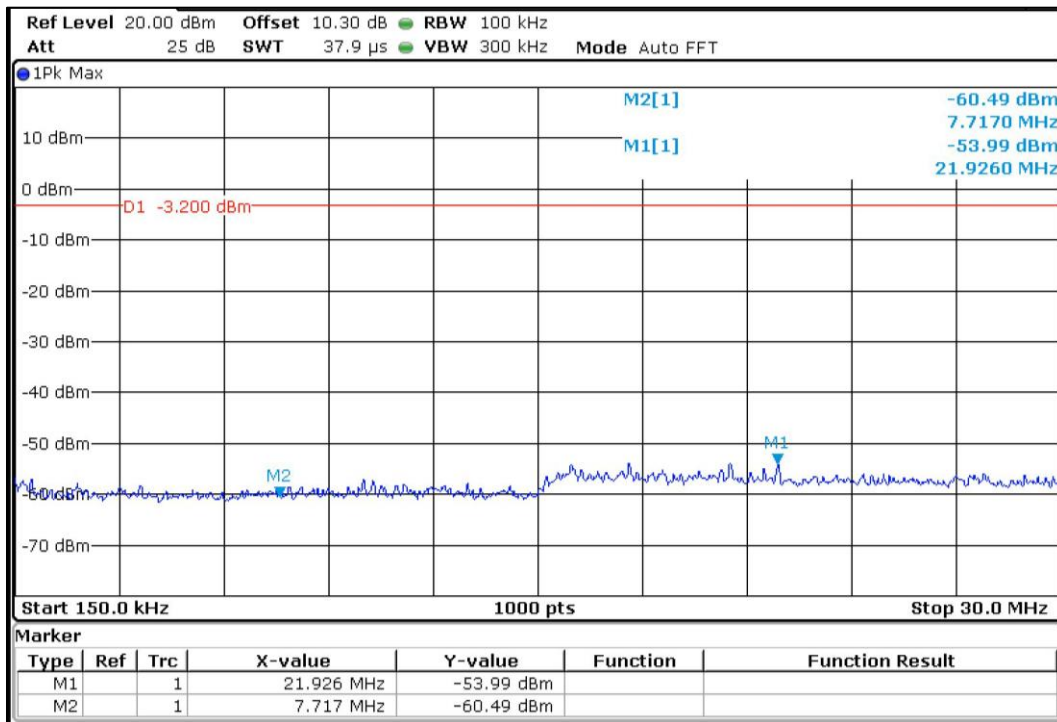
Channel Frequency 914.9MHz

Frequency Range 9KHz – 150KHz

Prüfbericht - Nr.:
Test Report No.:

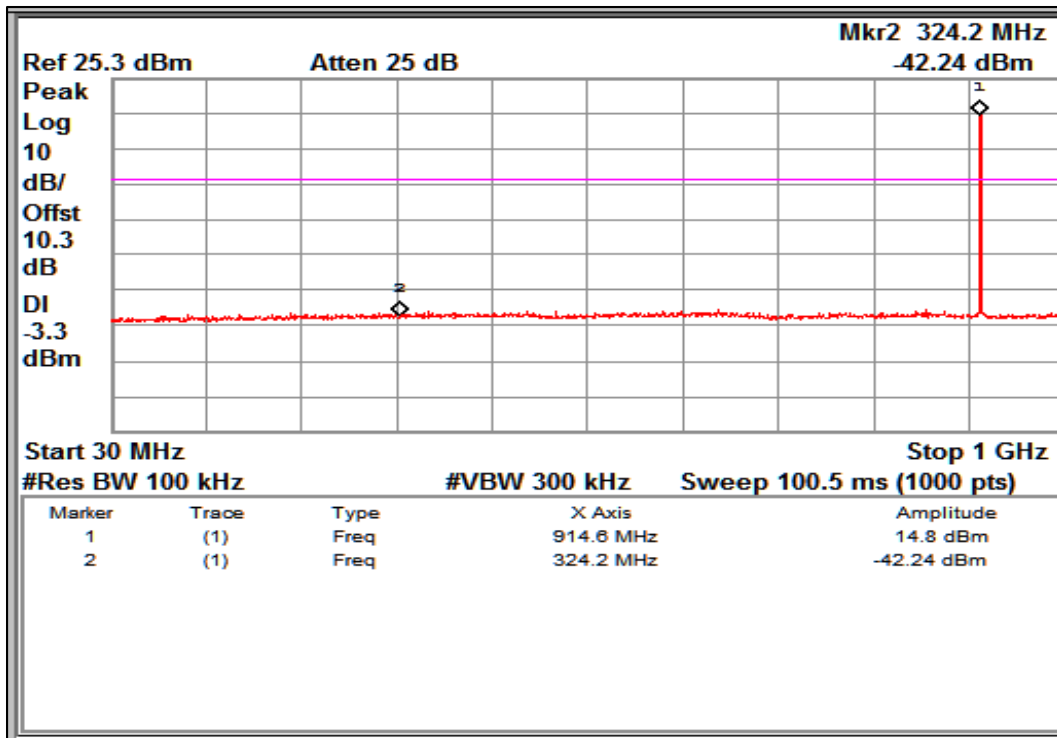
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Channel Frequency 914.9MHz

Frequency Range 150KHz – 30MHz



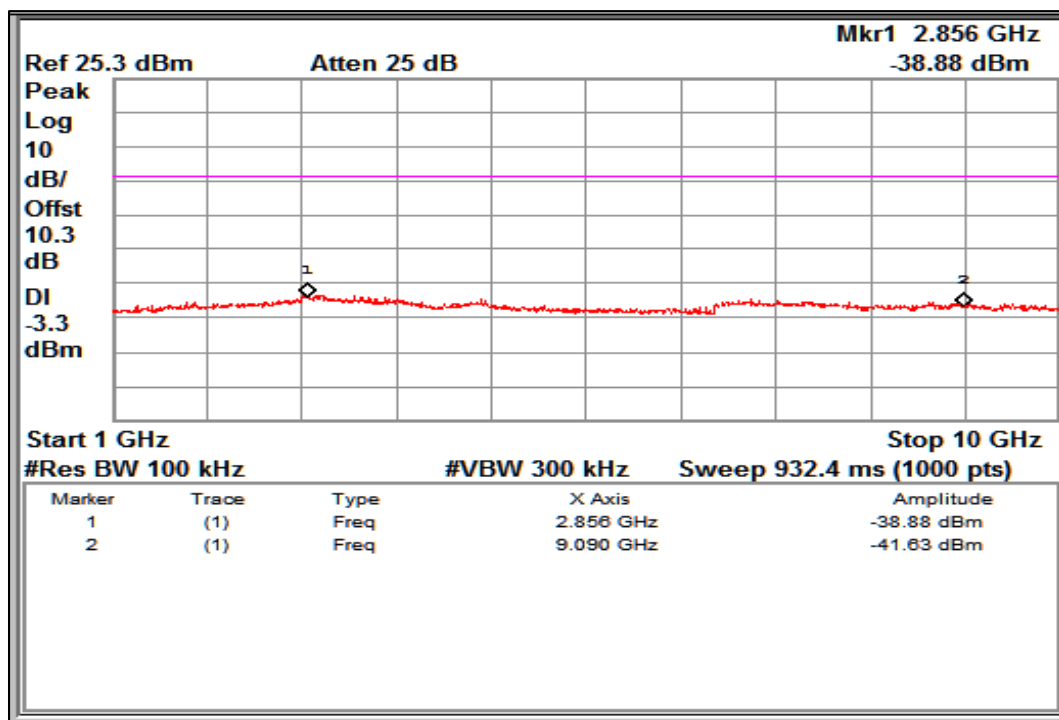
Channel Frequency 914.9MHz

Frequency Range 30MHz – 1GHz

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Channel Frequency 914.9MHz

Frequency Range 1GHz – 10GHz

6.7 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205)
Test Method	ANSI C63.10
Measurement Location	Semi Anechoic Chamber 30MHz - 1 GHz Fully Anechoic Chamber 1 GHz - 40GHz
Measurement Bandwidth	100 kHz for frequency range < 1GHz 1 MHz for Frequency range >1GHz
Detector	Refer remarks below
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 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) = + 23.5 °C

Voltage = 3.3V DC Battery Supply

Relative humidity: 63%

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Test results:

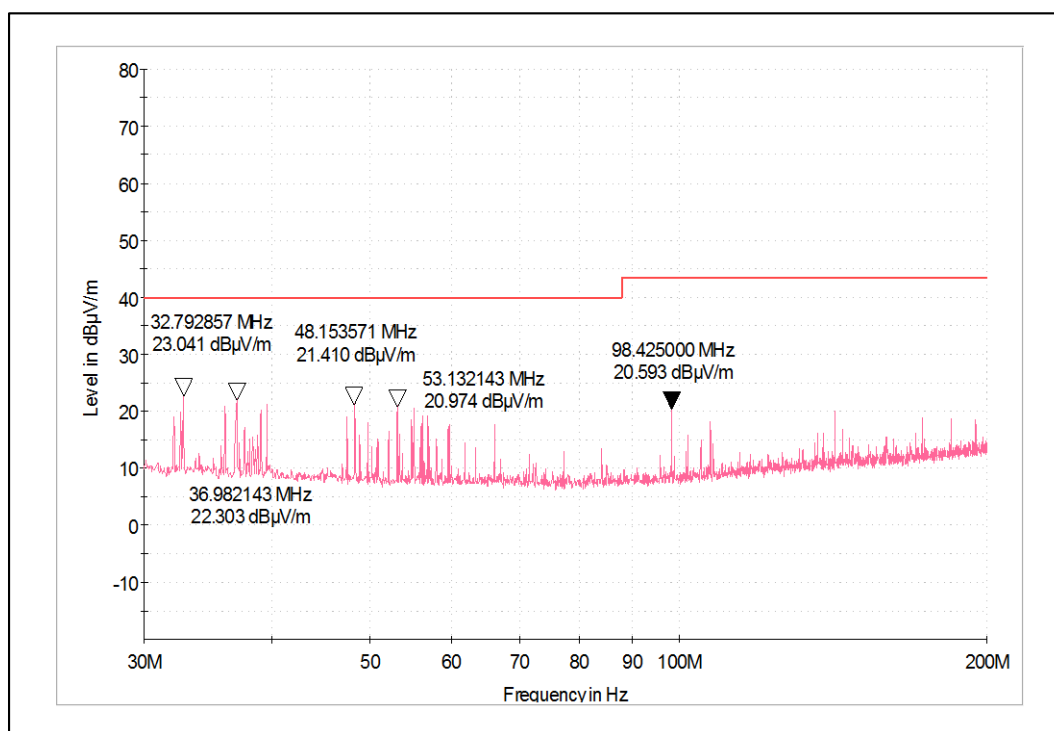
Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details

Test results for frequency range 9kHz – 30MHz

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

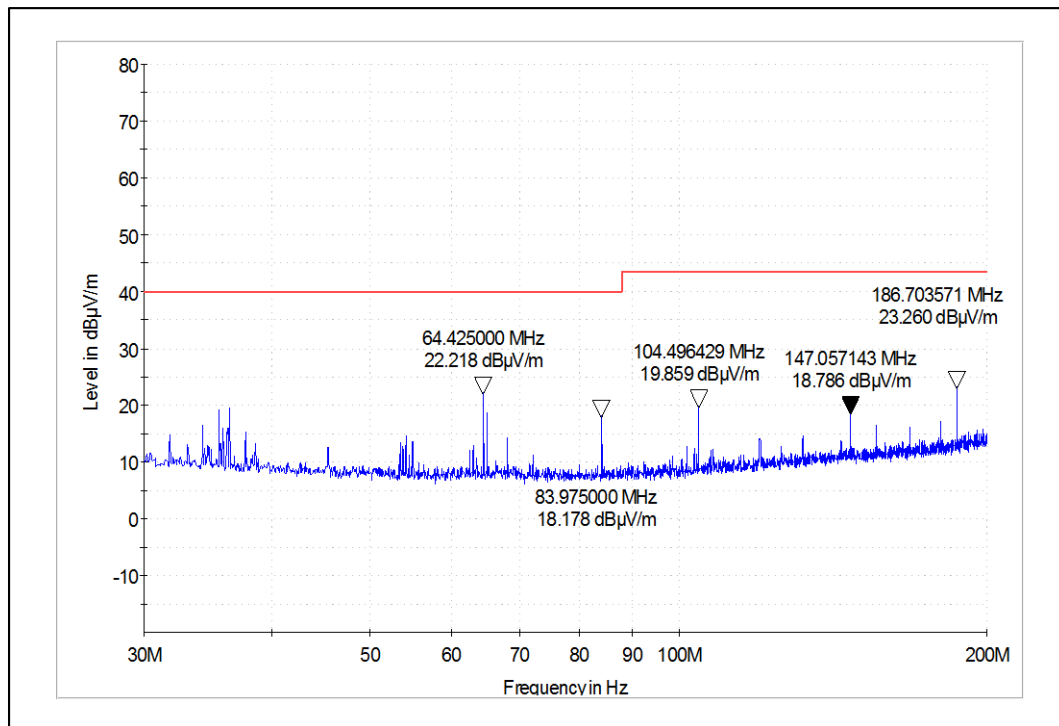
Table 7: Test results for frequency range 30MHz – 200MHz

Antenna Polarization	Frequency (MHz)	Peak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Vertical	32.79	23.04	40.0	-16.96
	48.15	21.41	40.0	-18.59
	53.13	20.97	40.0	-19.03
	98.42	20.59	43.5	-22.91
Horizontal	64.42	22.21	40.0	-17.79
	83.97	18.17	40.0	-21.83
	104.49	19.85	43.5	-23.65
	186.70	23.26	43.5	-20.24



Channel Frequency 30MHz – 200MHz

Polarization Vertical

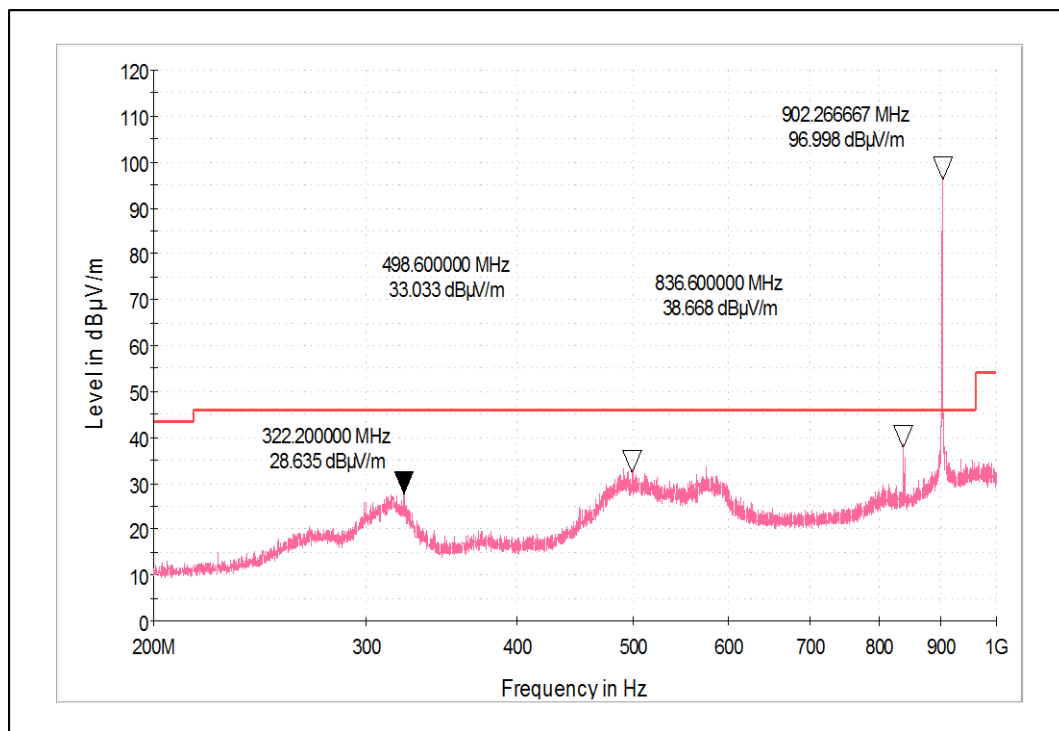


Channel Frequency 30MHz – 200MHz

Polarization Horizontal

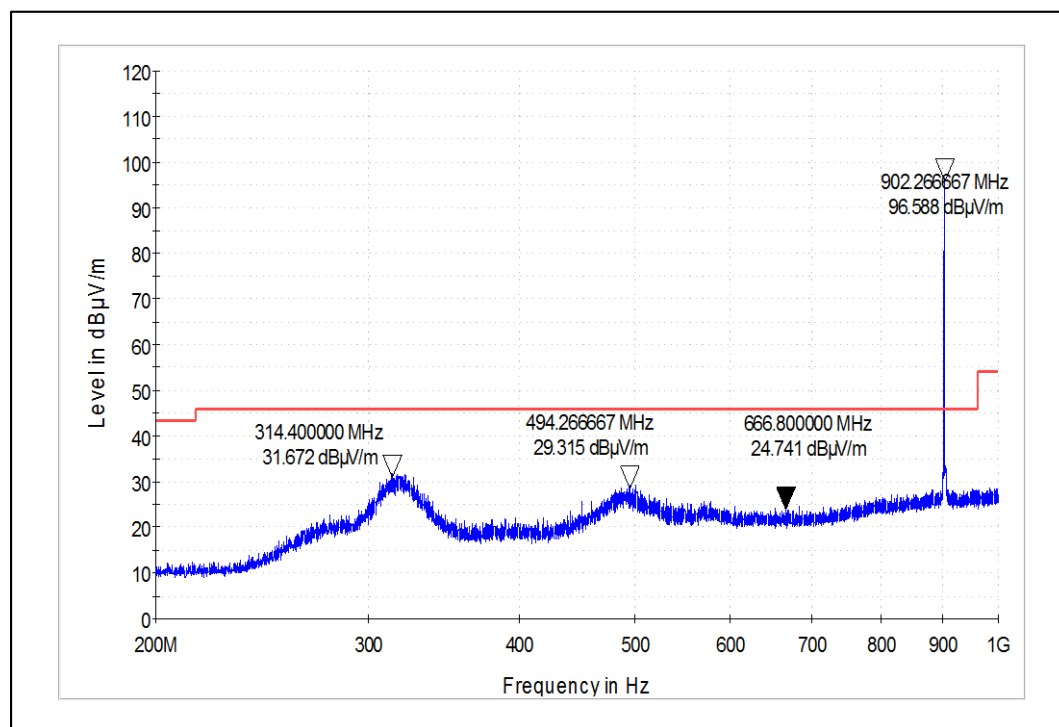
Table 8: Test results for frequency range 200MHz – 1GHz

Antenna Polarization	Frequency (MHz)	Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	322.20	28.63	46	-17.37
	498.60	33.03	46	-12.97
	836.60	38.66	46	-07.34
Horizontal	314.40	31.67	46	-14.33
	494.26	29.31	46	-16.69
	666.80	24.74	46	-21.26



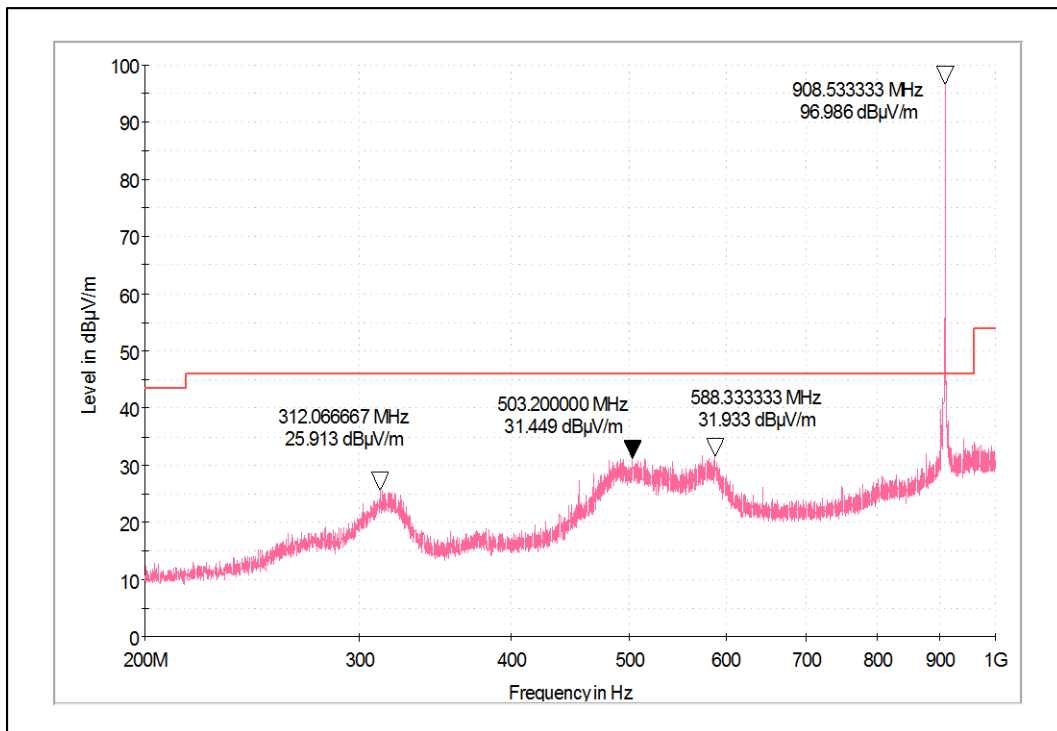
Channel Frequency 200MHz – 1GHz

Polarization Vertical



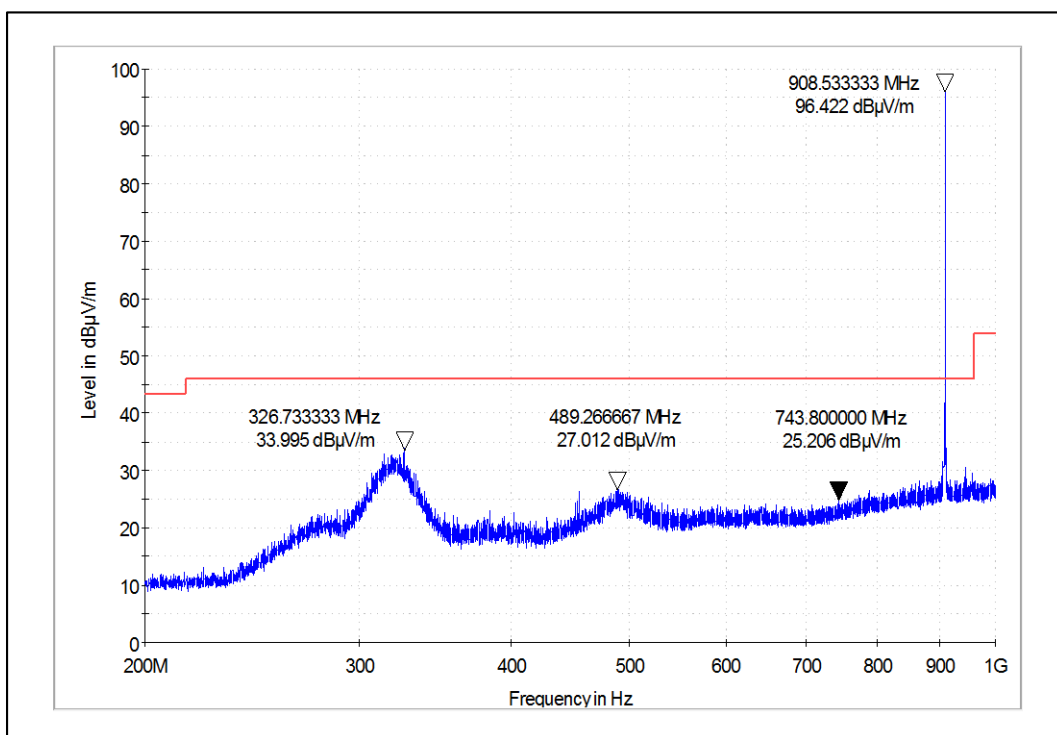
Channel Frequency 200MHz – 1GHz

Polarization Horizontal



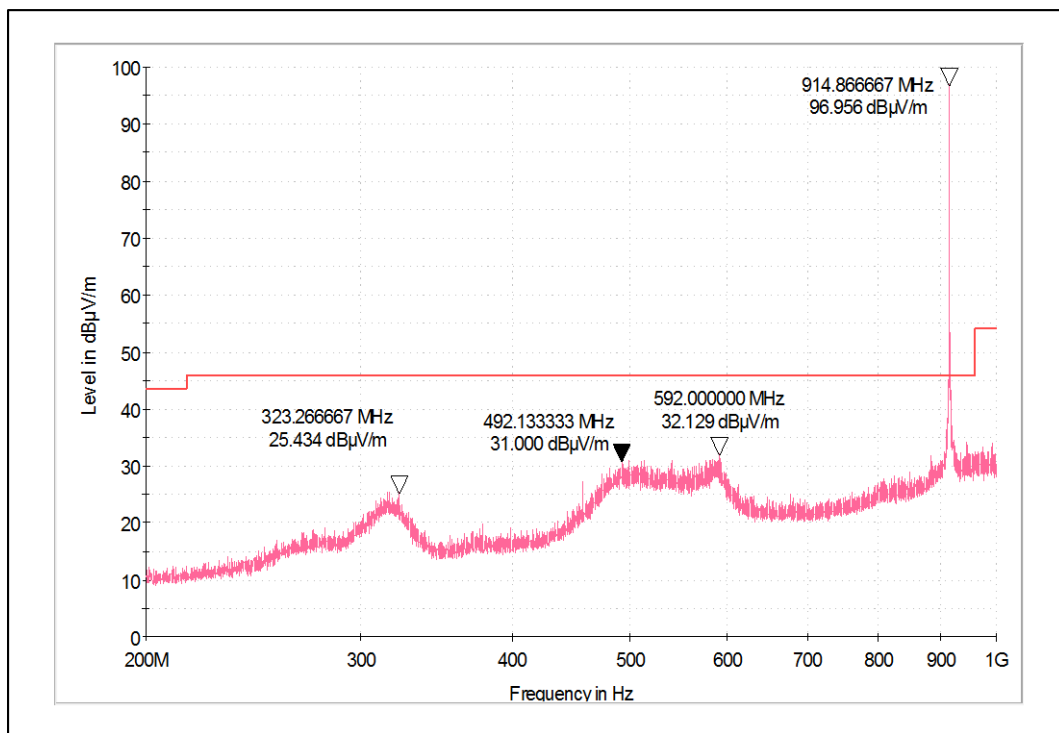
Channel Frequency 200MHz – 1GHz

Polarization Vertical



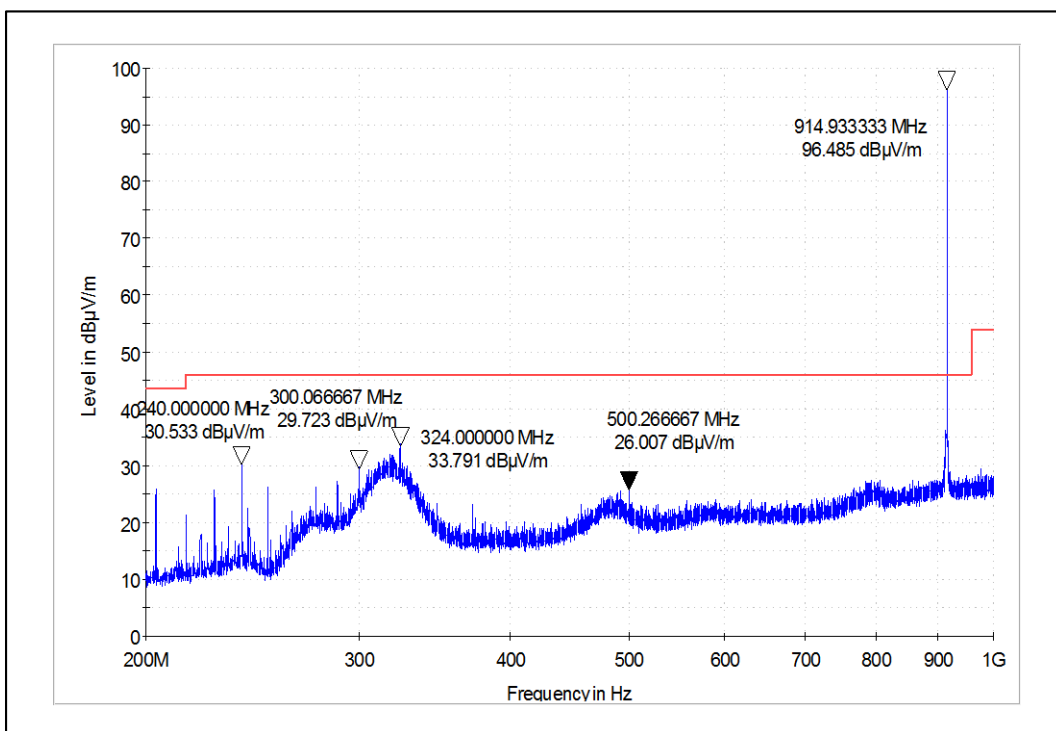
Channel Frequency 200MHz – 1GHz

Polarization Horizontal



Channel Frequency 200MHz – 1GHz

Polarization Vertical



Channel Frequency 200MHz – 1GHz

Polarization Horizontal

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

Channel Frequency (MHz)	Antenna Polarization	Measured Frequency (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
902.3	Vertical	902.3 (Pk)	96.99	-	-
		1804.6 (Pk)	52.41	74	-21.59
		1804.6 (Av)	40.08	54	-13.92
		2706.9 (Pk)	57.83	74	-16.17
		2706.9 (Av)	45.19	54	-8.81
		3609.2 (Pk)	58.83	74	-15.17
		3609.2 (Av)	46.03	54	-7.97
		4511.5 (Pk)	64.79	74	-9.21
		4511.5 (Av)	51.08	54	-2.92
		5413.8 (Pk)	65.79	74	-8.21
		5413.8 (Av)	53.23	54	-0.77
	Horizontal	902.3 (Pk)	96.58	-	-
		1804.6 (Pk)	51.78	74	-22.22
		1804.6 (Av)	40.08	54	-13.92
		2706.9 (Pk)	57.27	74	-16.73
		2706.9 (Av)	45.19	54	-8.81
		3609.2 (Pk)	57.98	74	-16.02
		3609.2 (Av)	46.03	54	-7.97
		4511.5 (Pk)	62.62	74	-11.38
		4511.5 (Av)	51.08	54	-2.92
		5413.8 (Pk)	65.79	74	-8.21
		5413.8 (Av)	53.23	54	-0.77

Pk: Peak Detector;
Av: Average Detect

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Channel Frequency (MHz)	Antenna Polarization	Measured Frequency (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
908.5	Vertical	908.5 (Pk)	96.98	-	-
		1817 (Pk)	53.07	74	-20.93
		1817 (Av)	40.13	54	-13.87
		2725.5 (Pk)	57.73	74	-16.27
		2725.5 (Av)	45.16	54	-8.84
		3634.0 (Pk)	58.72	74	-15.28
		3634.0 (Av)	46.12	54	-7.88
		4542.5 (Pk)	62.94	74	-11.06
		4542.5 (Av)	51.03	54	-2.97
		5451.0 (Pk)	65.65	74	-8.35
		5451.0 (Av)	53.46	54	-0.54
	Horizontal	908.5 (Pk)	96.42	-	-
		1817.0 (Pk)	52.93	74	-21.07
		1817.0 (Av)	40.29	54	-13.71
		2725.5 (Pk)	57.73	74	-16.27
		2725.5 (Av)	44.83	54	-9.17
		3634.0 (Pk)	58.72	74	-15.28
		3634.0 (Av)	46.27	54	-7.73
		4542.5 (Pk)	62.94	74	-11.06
		4542.5 (Av)	50.68	54	-3.32
		5451.0 (Pk)	65.64	74	-8.36
		5451.0 (Av)	53.26	54	-0.74

Pk: Peak Detector;
Av: Average Detector

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Channel Frequency (MHz)	Antenna Polarization	Measured Frequency (MHz)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
914.9	Vertical	914.86 (Pk)	96.95	-	-
		1831.78 (Pk)	51.72	74	-22.28
		1831.78 (Av)	39.17	54	-14.83
		2747.67 (Pk)	58.45	74	-15.55
		2747.67 (Av)	45.14	54	-8.86
		3663.56 (Pk)	59.72	74	-14.28
		3663.56 (Av)	46.47	54	-7.53
		4579.45 (Pk)	63.84	74	-10.16
		4579.45 (Av)	51.25	54	-2.75
		5495.34 (Pk)	66.38	74	-7.62
		5495.34 (Av)	53.46	54	-0.54
	Horizontal	914.90 (Pk)	96.34	-	-
		1831.78(Pk)	51.81	74	-22.19
		1831.78(Av)	39.32	54	-14.68
		2747.67(Pk)	58.45	74	-15.55
		2747.67(Av)	45.21	54	-8.79
		3663.56 (Pk)	59.72	74	-14.28
		3663.56 (Av)	45.9	54	-8.1
		4579.45 (Pk)	63.84	74	-10.16
		4579.45 (Av)	50.98	54	-3.02
		5495.34 (Pk)	66.38	74	-7.62
		5495.34 (Av)	53.19	54	-0.81

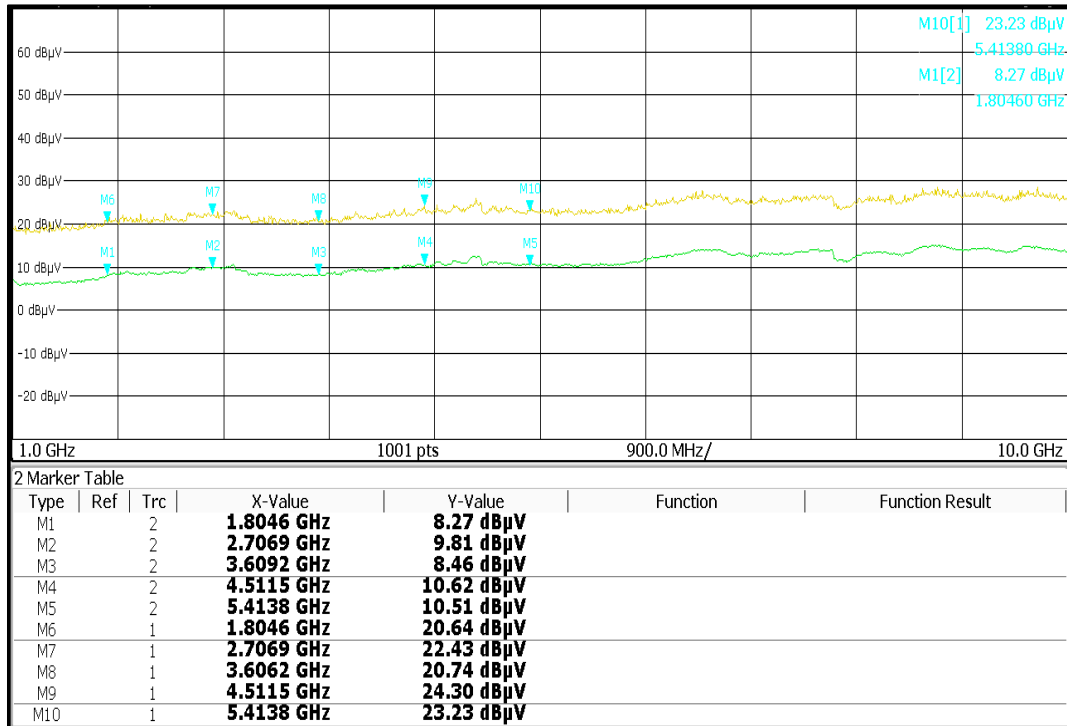
Pk: Peak Detector;
Av : Average Detector

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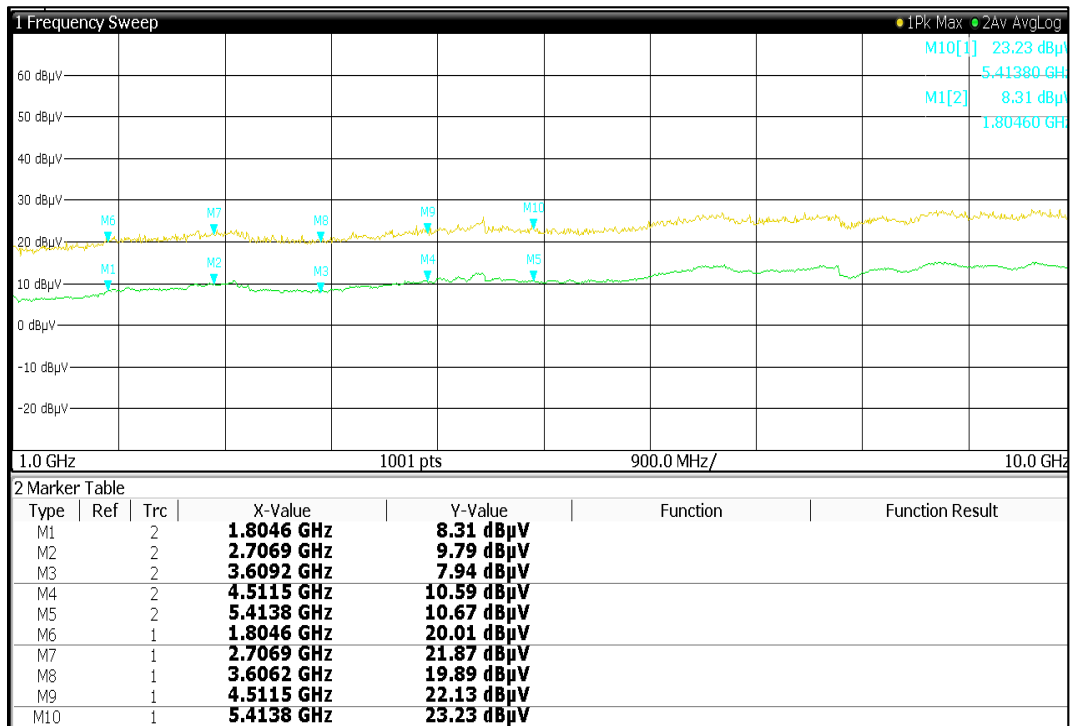
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Worst case Plots
Channel Frequency 902.3MHz



Channel Frequency: 1GHz – 10GHz

Polarization: Vertical



Channel Frequency: 1GHz -10GHz

Polarization: Horizontal

Prüfbericht - Nr.:

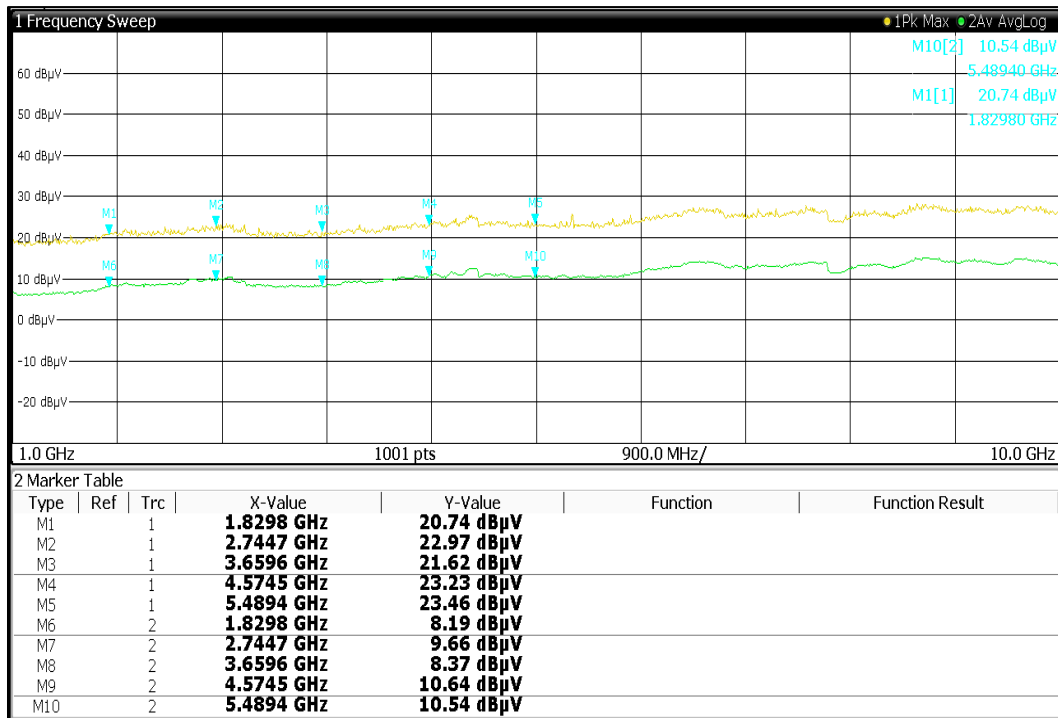
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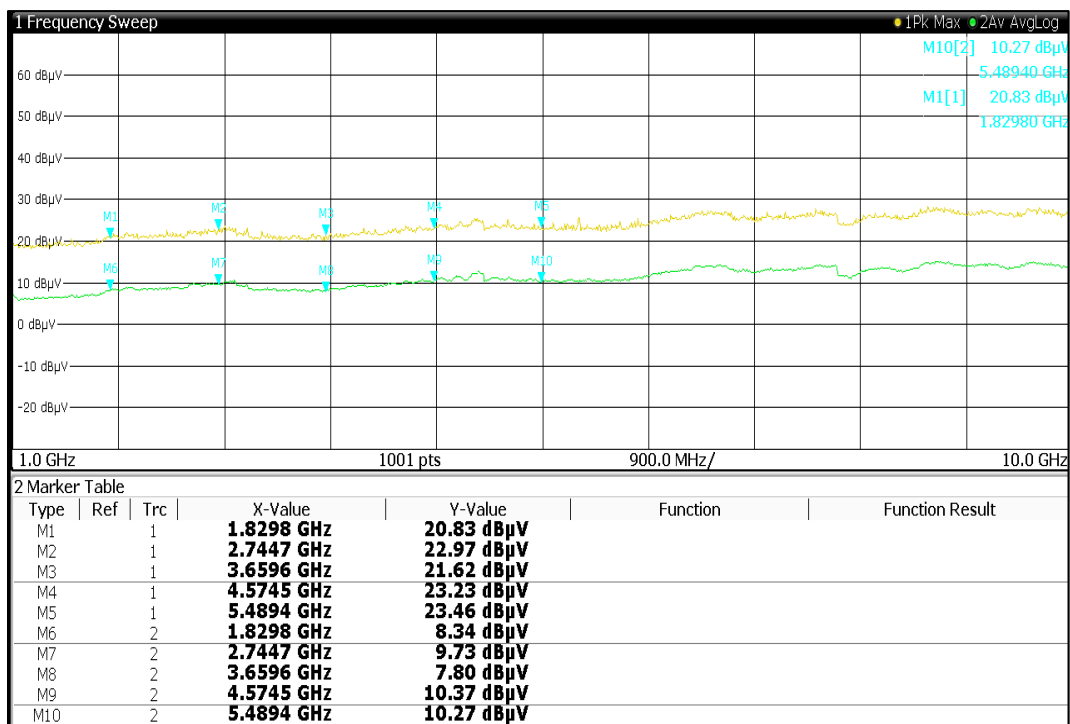
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Channel Frequency 914.9MHz



Channel Frequency: 1GHz -10GHz

Polarization: vertical



Channel Frequency: 1GHz -10GHz

Polarization: Horizontal

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7 Conducted Spurious Emission test on AC Power Line

Result

Pass

Test Specification : FCC Part 15 Section 15.207 / RSS Gen Issue 5 Section 8.8
Test Method : ANSI C 63.10-2013
Testing Location : Screened room
Measurement Bandwidth : 9kHz
Frequency Range : 150kHz – 30MHz
Supply Voltage : 110VAC,60Hz
Test Method : TEST METHODOLOGY

***Note: The product has tested with AC to DC adapter.**

Limits of section 15.207

Frequency of emission (MHz)	QP Limit (dBμV)	AV Limit (dBμV/m)
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:

Normal Temperature = +24°C Voltage (V norm) = 110V AC (Through AC to DC Adapter)
RH = 64 %

Prüfbericht - Nr.:

Test Report No.:

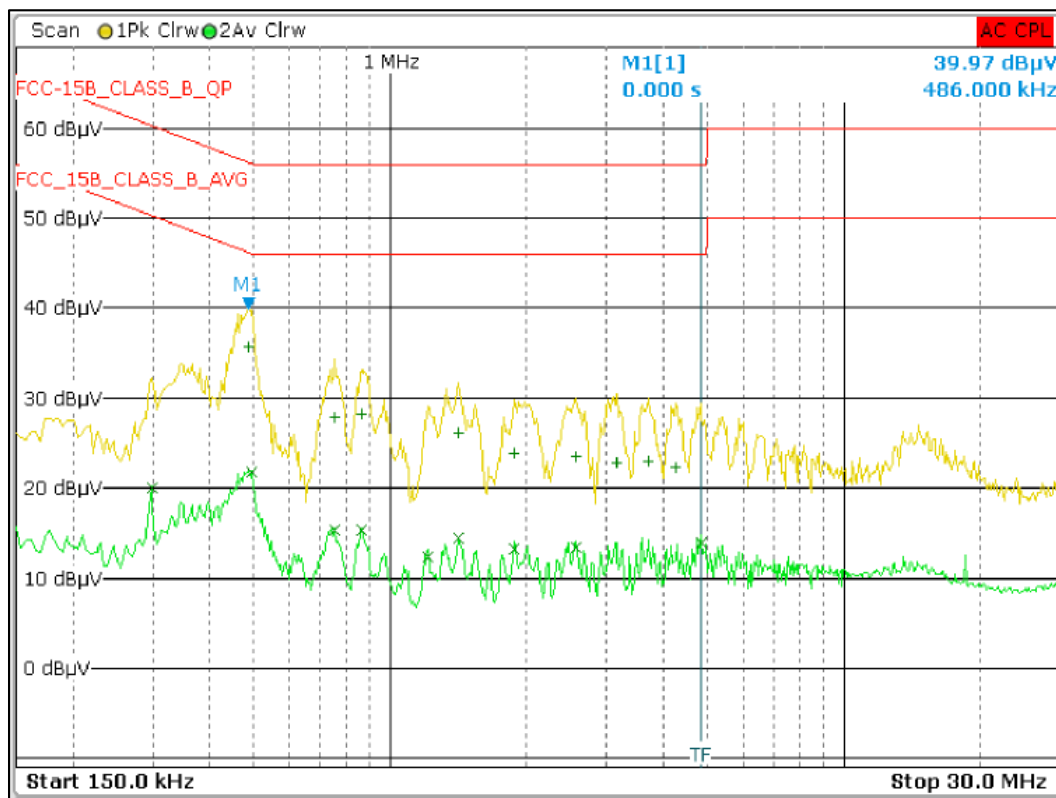
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Test result:

Power: 110V 60HZ_LINE



Line Graph

Trace	Frequency	Level (dBµV)	Phase	Detector	Delta Limit/dB
1	486.00000000 kHz	35.70		Quasi Peak	-20.54
2	494.00000000 kHz	21.75		Average	-24.35
1	866.00000000 kHz	28.16		Quasi Peak	-27.84
1	754.00000000 kHz	27.87		Quasi Peak	-28.13
1	1.418000000 MHz	26.19		Quasi Peak	-29.81
2	298.00000000 kHz	20.11		Average	-30.19
2	754.00000000 kHz	15.27		Average	-30.73
2	866.00000000 kHz	15.25		Average	-30.75
2	1.414000000 MHz	14.36		Average	-31.64
2	4.838000000 MHz	13.92		Average	-32.08
1	1.882000000 MHz	23.83		Quasi Peak	-32.17
1	2.566000000 MHz	23.52		Quasi Peak	-32.48
2	2.566000000 MHz	13.47		Average	-32.53
2	1.870000000 MHz	13.21		Average	-32.79
1	3.702000000 MHz	22.91		Quasi Peak	-33.09
1	3.154000000 MHz	22.87		Quasi Peak	-33.13
2	1.210000000 MHz	12.44		Average	-33.56
1	4.246000000 MHz	22.26		Quasi Peak	-33.74

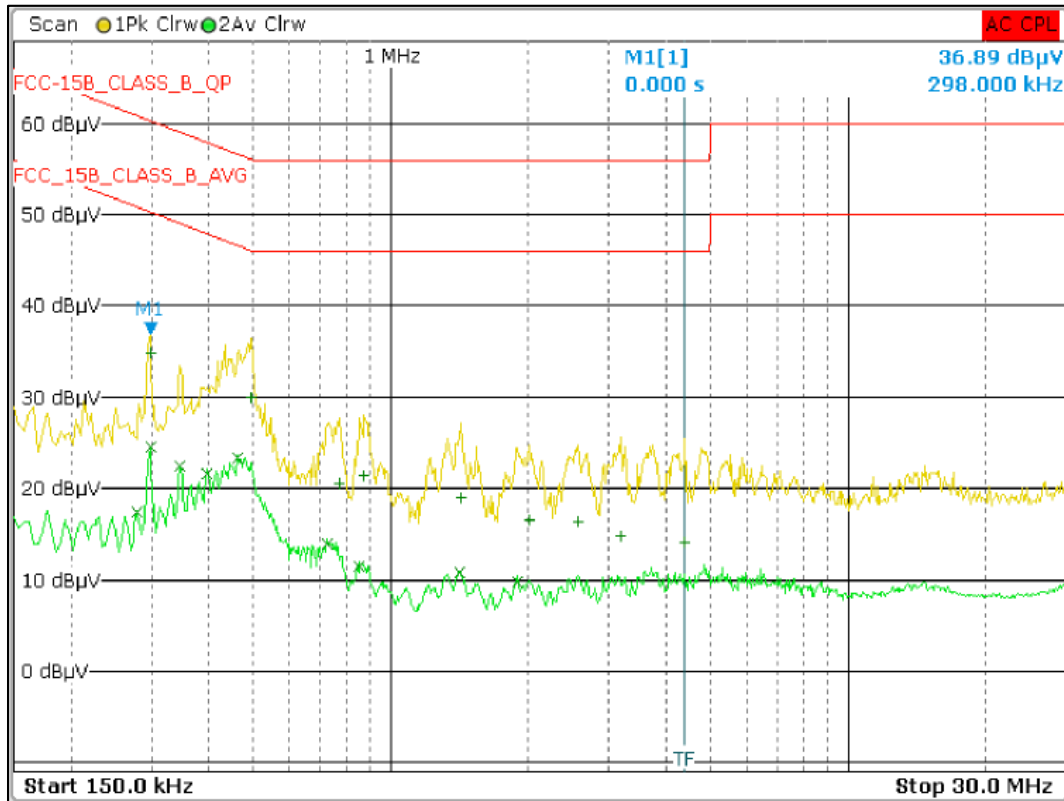
Line Table

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Power: 110V60HZ_NEUTRAL



Line Graph

Trace	Frequency	Level (dBµV)	Phase	Detector	Delta Limit/dB
2	462.000000000 kHz	23.39		Average	-23.27
1	298.000000000 kHz	34.86		Quasi Peak	-25.44
2	298.000000000 kHz	24.52		Average	-25.78
1	494.000000000 kHz	30.01		Quasi Peak	-26.09
2	398.000000000 kHz	21.66		Average	-26.24
2	346.000000000 kHz	22.49		Average	-26.57
2	726.000000000 kHz	13.86		Average	-32.14
2	278.000000000 kHz	17.41		Average	-33.47
2	854.000000000 kHz	11.48		Average	-34.52
1	874.000000000 kHz	21.46		Quasi Peak	-34.54
2	1.414000000 MHz	10.86		Average	-35.14
1	770.000000000 kHz	20.56		Quasi Peak	-35.44
2	1.894000000 MHz	9.78		Average	-36.22
1	1.430000000 MHz	18.96		Quasi Peak	-37.04
1	2.018000000 MHz	16.52		Quasi Peak	-39.48
1	2.562000000 MHz	16.29		Quasi Peak	-39.71
1	3.194000000 MHz	14.75		Quasi Peak	-41.25
1	4.394000000 MHz	14.13		Quasi Peak	-41.87

Line Table

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