

Prüfbericht-Nr.: Test report no.:	ULR-TC568822300000033F	Auftrags-Nr.: Order no.:	146643820 010	Seite 1 von 96 Page 1 of 96
Kunden-Referenz-Nr.: Client reference no.:	2024735	Auftragsdatum: Order date:	2021-12-20	
Auftraggeber: Client:	1. HONEYWELL INTERNATIONAL INC 1860W, ROSE GARDEN LANE, AZ75,M-16-7988, PHOENIX, ARIZON, UNITED STATES 2. Honeywell LTD 500 Brooksbank Avenue, North Vancouver, BC, V7J 3S4; Canada			
Prüfgegenstand: Test item:	Field Device Access Point Gen3 Anchor			
Bezeichnung Identification	FDAP31, FDAP32, FDAP3P	Serien -Nr.: Serial no.:	FC-00	
Auftrags-Inhalt: Order content:	Testing and issue of Test Report and Grant Certificate			
Prüfgrundlage: Test specification:	FCC Part 15 Subpart C 15.247,15.205, 15.207 & 15.209 RSS 247 Issue 2,RSS Gen Issue 5			
Wareneingangsdatum: Date of sample receipt:	2022-01-27			
Prüfmuster-Nr.: Test sample no:	A003207433-001			
Prüfzeitraum: Testing period:	2022-01-27 - 2022-02-23			
Ort der Prüfung: Place of testing:	Wireless laboratory, Bangalore			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland (India) Pvt. Ltd. 27/B,2nd cross road, Electronic city Phase1, Bangalore-560100, India FCC Test Site Registration No: 496599 IC Test Site Registration No: 3665-1			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	genehmigt von: authorized by:			
Datum: Date: 2022-01-27	Ausstellatum: Issue date: 2022-05-20			
Stellung / Position:	Yogesh V Engineer	Stellung / Position:	Lokesh Ramu Manager	
Sonstiges / Other:	FCC ID: S5751308987 IC: 573W-51308987			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende:	1 = sehr gut 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. 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.				

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 2 von 96
Page 2 of 96

TEST SUMMARY

Test Item	FCC	IC	Result
Maximum conducted (Peak) output power	15.247 (b)(2)	RSS 247 Issue 2, Section 5.4 (b)	Pass
Occupied bandwidth and 20dB Bandwidth	15.247 (a) (i)	RSS 247 Issue 2, Section 5.1 (b)	Pass
Number of Hopping channels	15.247 (a) (i)	RSS 247 Issue 2, Section 5.1 (d)	Pass
Carrier Frequency Separation	15.247 (a) (1)	RSS 247 Issue 2, Section 5.1 (b)	Pass
Time of Occupancy (Dwell Time)	15.247 (a) (i)	RSS 247 Issue 2, Section 5.1 (d)	Pass
Emissions in non-restricted frequency bands	15.247 (d)	RSS 247 Issue 2, Section 5.5	Pass
Spurious Radiated Emissions and Restricted Bands of Operation	FCC 15.209 / FCC 15.205	RSS-Gen Issue 5, Section 8.9 /8.10	Pass
Conducted Emission test on AC Power Line	FCC 15.207	RSS-Gen Issue 5, Section 8.8	Pass

Product Category: Electronics Testing
Test Discipline: EMC Test Facility

Note:

- Host products Field device access point (FDAP) has following model variants, all the models are electrically identical & RF characteristics are similar, please refer the Previous FDAP Report.
Model name Model number
FDAP31
FDAP32
FDAP3P
- Radio1 (ZigBee) module Considered as approved referring to previous FDAP report FCC ID: S5751307990 and IC:573W-51307990
- BLE approved module as Listed FCC ID:XPYNINAB1 and IC 8595A-NINAB1
- FDAP unit integrated with Three Transmitters as simultaneous operation.
 - BLE transmitter
 - Radio 1(GXRM transmitter)
 - Radio2(Anchor Transmitter)

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000033F

Seite 3 von 96

Page 3 of 96

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
ULR-TC568822300000033F	01	Initial issue of report	2022-05-20
ULR-TC568822300000033F	02	Reviewer comments updated	2002-06-06

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	Antenna Details	8
3.4	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	Simultaneous Transmission	9
4.5	Countermeasures to achieve EMC Compliance	9
4.6	List of frequencies	10
4.7	Report References	10
5	Operational Description	11
6	Block Diagram.....	11
7	TEST METHODOLOGY	12
7.1	Conducted Spurious Emission Test on AC Power Line.....	12
7.1.1	Test setup Configuration	12
7.2	Radiated Emission Test	13
7.2.1	Test Setup Configuration	13
8	TEST RESULTS	15
8.1	Maximum Peak Conducted Output Power	15
8.2	Occupied bandwidth.....	22
8.3	Number of Hopping Channels.....	25
8.4	Carrier Frequency Separation.....	28
8.5	Time of Occupancy (Dwell Time)	30
8.6	Emissions in non-restricted frequency bands and Conducted Spurious Emission.....	36
8.6.1	Band edge and reference plots	37
8.6.2	Out-Of-Band Emissions.....	40
8.7	Spurious Radiated Emissions & Restricted Bands of Operation	46
8.7.1	RSE Test Results of Simultaneous Operation with Anchor 1, GXRM Transmitter and BLE:	90
8.8	Conducted spurious emission Test on AC Power lines	93
9	LIST OF TABLES.....	96
10	LIST OF FIGURES.....	96

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 5 von 96
Page 5 of 96

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-TC568822300000033F

Seite 6 von 96
Page 6 of 96

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	Schwarzbeck	FMZB 1519 B	1519B-00111	-	27.04.2022	Yearly	Radiated Spurious Emission
Balun & Biconical Antenna	Schwarzbeck Mess-Elektronik	BBA 9106+V HBB 9124	9124-1117	-	03.02.2023	Yearly	
Log - Periodical Antenna	Schwarzbeck Mess-Elektronik	VUSLP 9111B	9111B-324	-	04.02.2023	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-1944	-	11.05.2022	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	-	06.05.2022	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
EMI Receiver	Rohde & Schwarz	ESW 44	101732	4.73.SP5	19.05.2022	Yearly	
EMI Receiver	Rohde & Schwarz	ESW44	101773	1.72SP1	12.02.2023	Yearly	
Spectrum Analyzer	Agilent	E4407B	US41192 772	A.14.06	15.12.2022	Yearly	

Table 2: Instrument application Software versions

SL. No.	Test Type	Application software	Version
1	Radiated spurious emission measurement in 3Mtr - FAC	EMC 32	10.60.00
1	Radiated spurious emission measurement in 10Mtr - SAC	BAT EMC	3.20.0.17

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

The Field Device Access Point (FDAP) is a ruggedized industrial radio device intended for use in hazardous location to provide wireless connectivity for Wireless compatible field devices. As an industrial meshing access point, FDAP provides secure and reliable wireless coverage for wireless field devices. It also serves as a routing access point for wireless field devices and is located between the wired DCS network and wireless field devices. In addition to this FDAP support the Real Time Location Sensing. (RTLS) with the Help of Anchor radio.

3.2 Ratings and System Details of Equipment under Test

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

Protocol		Proprietary
Operating Frequency Range		2405MHz to 2477.5MHz
No. of Channels		120
Channel Spacing		500KHz
Tx Transmitting Power		17dBm
Maximum Measured e.i.r.p		22.32dBm with gain of 5dBi antenna and 25.32dBm with gain of 8dBi antenna
Modulation		CW-FHSS
Number of antennas		6
Antenna Gain & Antenna Type		Refer clause 3.3
Supply Voltage to Product		24V DC (AC - DC Adapter)
Environmental conditions	Storage	-40°C to +85°C
		Relative humidity 5% to 95% RH
	Operating	-40°C to +70°C
		Relative humidity 5% to 95% RH
EUT Dimension		217 x 319 x 379 mm (H x W x L)

***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-TC568822300000033F

Seite 8 von 96
Page 8 of 96

3.3 Antenna Details

Sl.No	Antenna description	Antenna gain (dBi)	Power level (dBm)	Antenna Type
1	AIR-ANT2480V-N	8	17	External antenna- Omni directional
2	AIR-ANT2450V-N	5	17	External antenna- Omni directional
3	L-COM HGV-2409U	8	17	External antenna- Omni directional
4	Laird Technologies-OD24M-5	5	17	External antenna- Omni directional
5	SG1015NM-2450-5dBi	5	17	External antenna- Omni directional
6	NINA-B112	1	Max as per original module	Integral antenna

3.4 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.

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 9 von 96
Page 9 of 96

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: FDAP 51156751-101, 102,103 (Rev B)

Software Version: FDAP Software (OW323.1-09.0)

Hardware version of identification Number (HVIN): FDAP 51156751-101, 102,103 (Rev B)

Firmware version of identification Number (FVIN): FDAP Software (OW323.1-09.0)

4.3 Special Accessories and Auxiliary Equipment

None

4.4 Simultaneous Transmission

Combinations of Simultaneous Operations performed	IEEE 802.15.4(Anchor 1)
	IEEE 802.15.4(GXRM Transmitter)
	BLE

Note: Simultaneous Operation was performed with the above mentioned combination and worst case test results are mentionrd in this report.

4.5 Countermeasures to achieve EMC Compliance

None

4.6 List of frequencies

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
2400 – 2483.5	01	2405
	02	2405.5
	-	-
	-	-
	-	-
	-	-
	59	2442
	60	2442.5
	61	2443
	-	-
	-	-
	-	-
	-	-
	119	2477
	120	2477.5

Table 5: List of EUT Center frequencies

Channel used for EUT testing

Channel low : 2405MHz

Channel mid : 2442.5MHz

Channel High : 2477.5MHz

Note:

1. TUV Sample Identification number : A003207433-001 – Radiated & Conducted test Sample

4.7 Report References

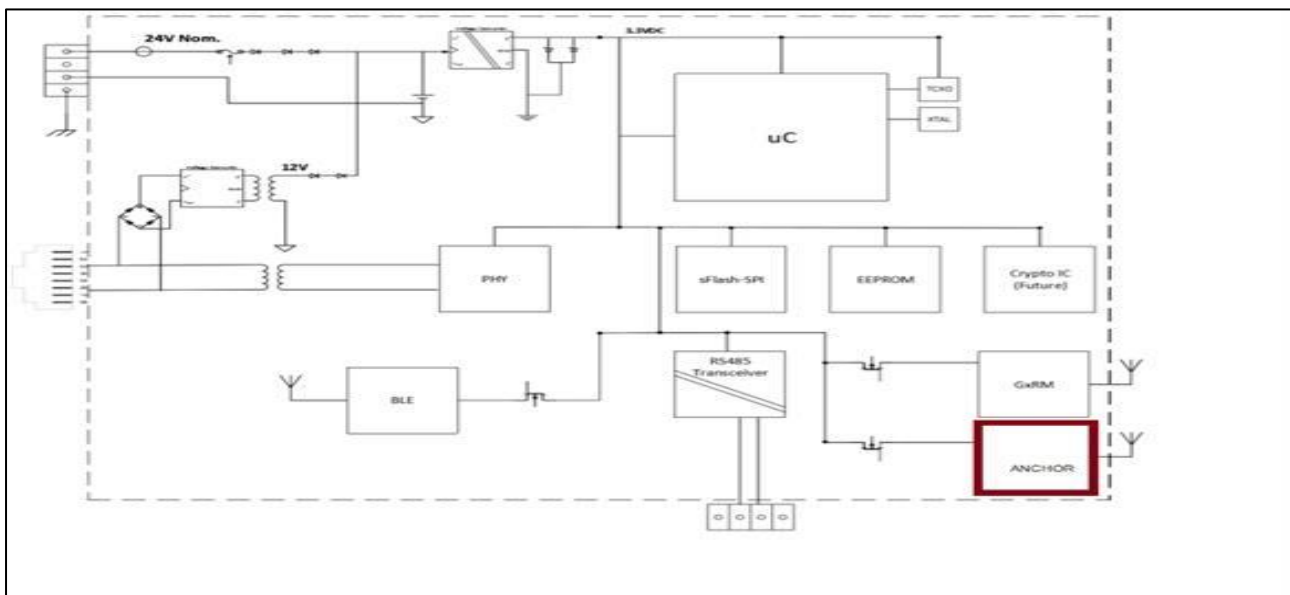
Note: Field Device Access Point (FDAP) has multiple protocols. All the supported wireless protocols and their respective test results are issued in separate test reports, following table lists the report numbers.

Radio Protocol	Report Number
RF test report for Proprietary (2.4GHz) – (This report)	ULR-TC568822300000033F
RF test report for IEEE 802.15.4 (2.4GHz)	ULR-TC568822300000032F
RF test report for Proprietary (2.4GHz)	ULR-TC568822300000034F

5 Operational Description

FDAP Gen3 Anchor: It serves as a routing access point for wireless field devices and is located between the wired DCS network and wireless-based wireless field devices. Once deployed in the field, FDAPs self-discover and selforganize into a managed, secure, and redundant wireless field device mesh network. With FDAPs, wireless field devices do not have to route data from other field devices. In addition FDAP3X Anchor work in tandem with RTLS-Tag and find the distance between the tag and Anchor. This data will be used by software to identify the location of the tag.

6 Block Diagram



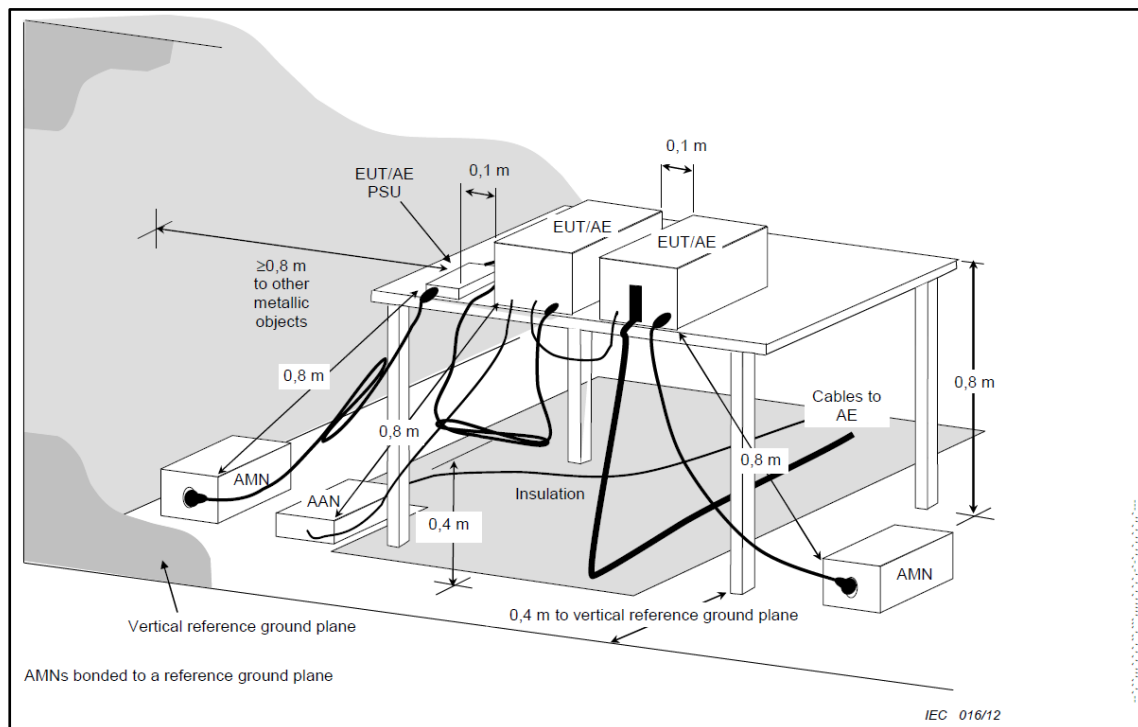
7 TEST METHODOLOGY

7.1 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.

7.1.1 Test setup Configuration



7.2 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

7.2.1 Test Setup Configuration

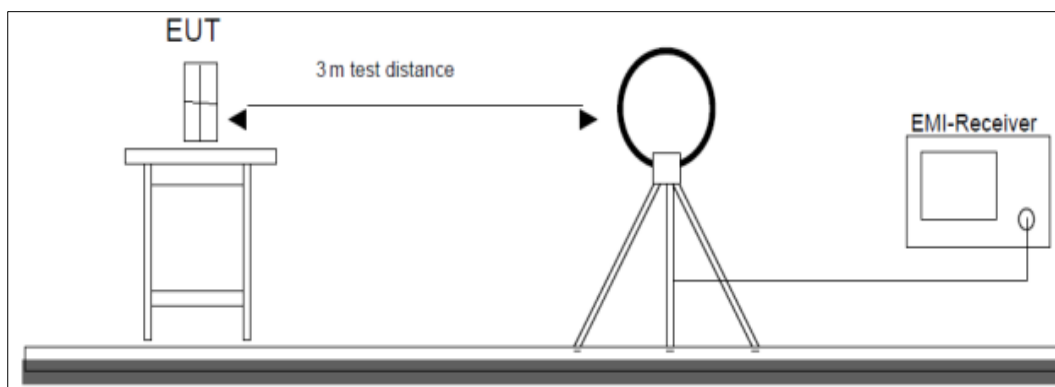


Figure 1: Frequency Range 9 kHz- 30 MHz

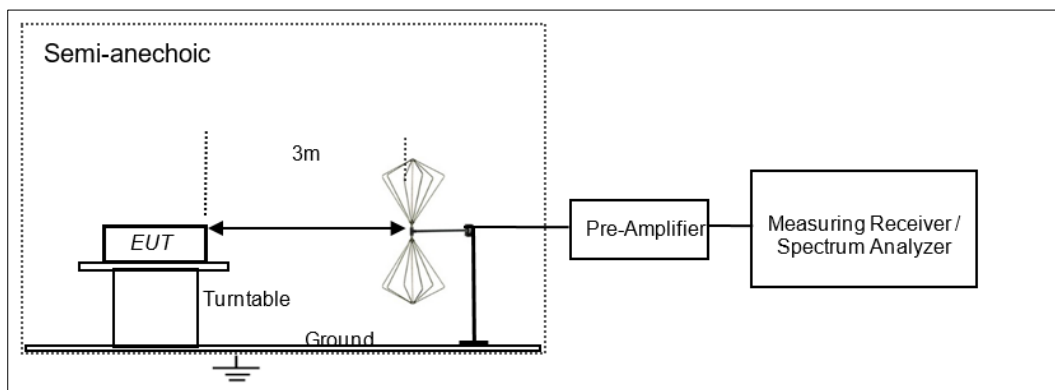


Figure 2: Frequency Range 30 MHz – 200 MHz

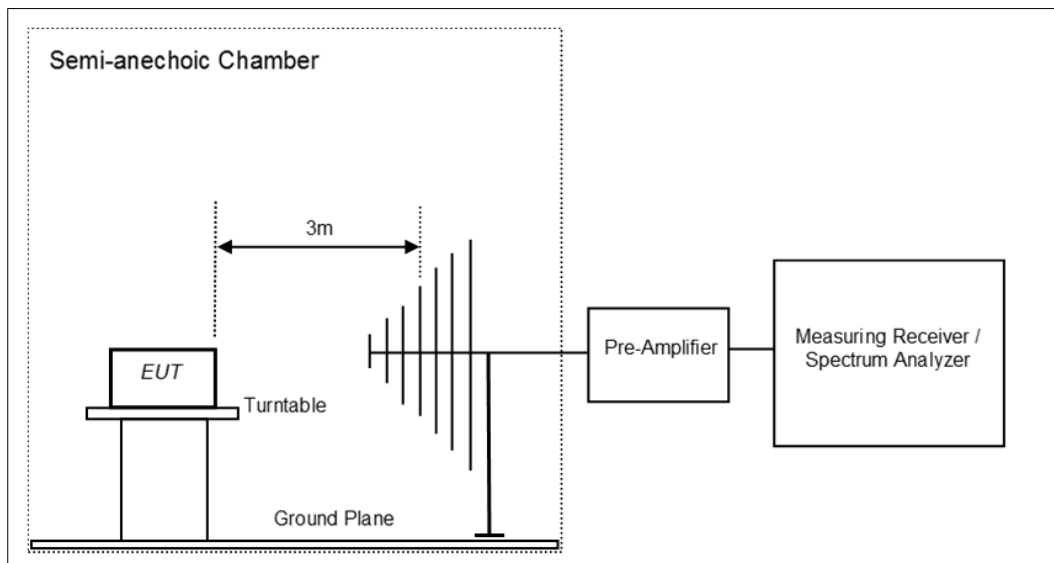


Figure 3: Frequency Range 200 MHz - 1GHz

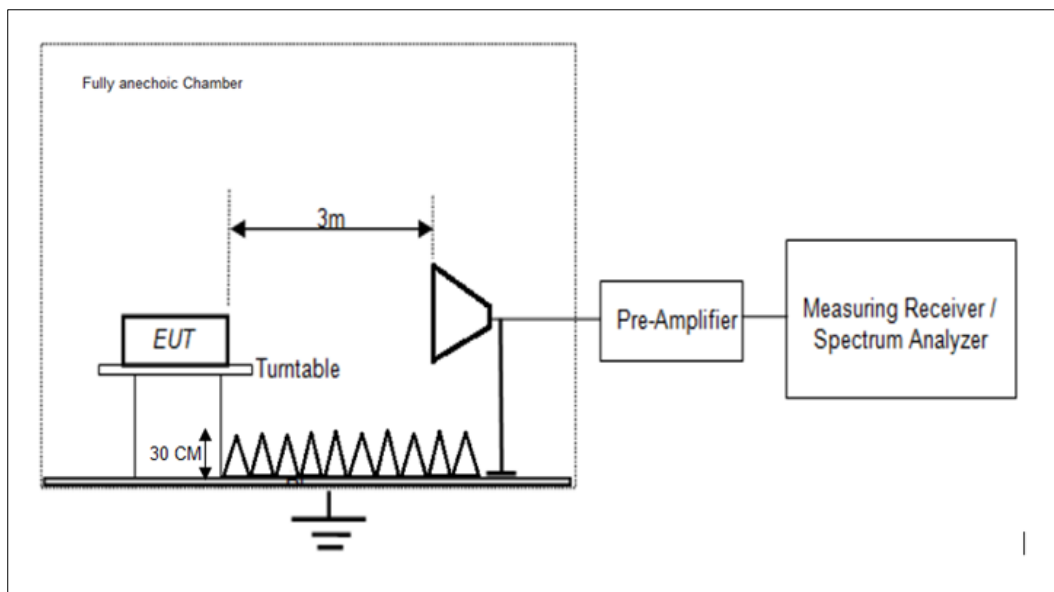


Figure 4: Frequency Range above 1 GHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 15 von 96
Page 15 of 96

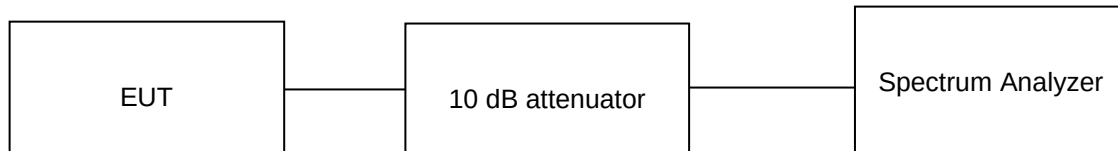
8 TEST RESULTS

8.1 Maximum Peak Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(1) / RSS 247 Issue 2 5.1(b)
Test Method	Subclause 7.8.5 of ANSI C63.10
Measurement Bandwidth	100kHz
Detector	Peak
Port of testing	Antenna port
Requirement	Power $\leq$ 1 W (30 dBm)



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.5°C

Voltage = 24V DC (AC - DC Adapter)

Relative humidity: 64%

KDB Guidelines applied:

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

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 16 von 96
Page 16 of 96

Test results:

Note:

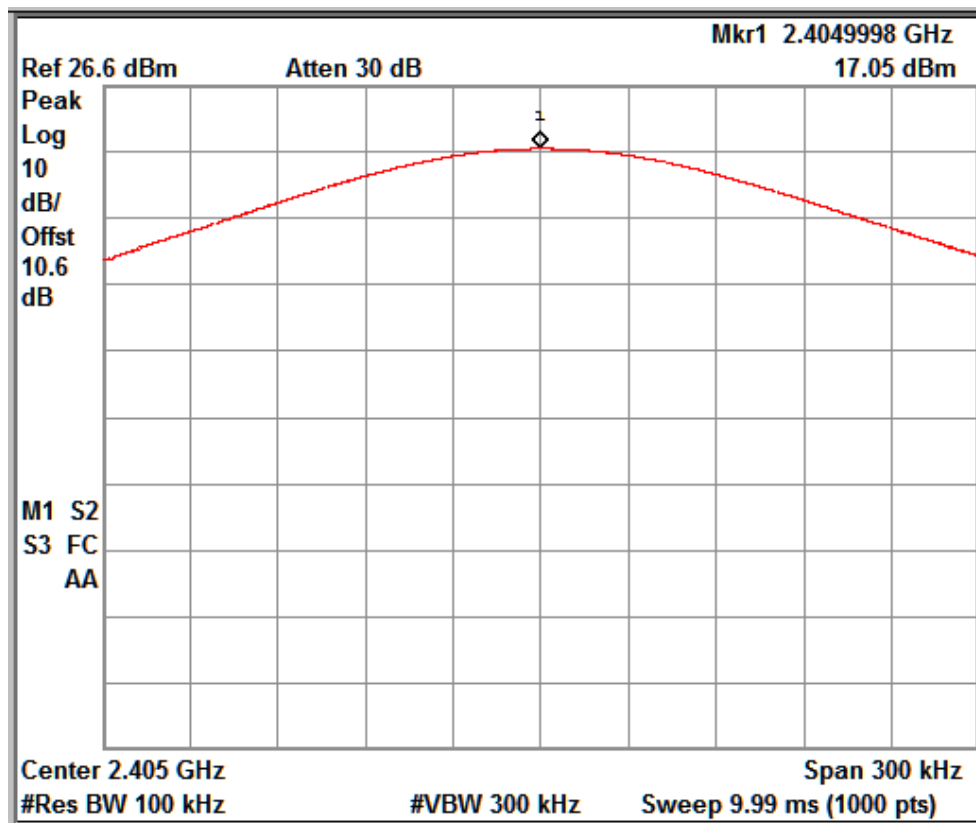
1. All the losses are included during measurement and final values are mentioned in the test report
2. Total Peak Output power (dBm) = Measured Peak power (dBm) + Attenuator factor (10dB) + Cable loss (0.6dB)
3. This product supports additional beamforming gain / directional gain, it uses dual antennas and hence Directional gain of the dual antennas are 5 dBi and 8dBi

17dBm Transmitting power with Antenna gain of 5dBi:

Channel Frequency(MHz)	Measured Peak Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
2405	17.05	22.05	30	36
2442.5	17.32	22.32	30	36
2477.5	16.76	21.76	30	36

17dBm Transmitting power with Antenna gain of 8dBi:

Channel Frequency(MHz)	Measured Peak Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
2405	17.05	25.05	30	36
2442.5	17.32	25.32	30	36
2477.5	16.76	24.76	30	36

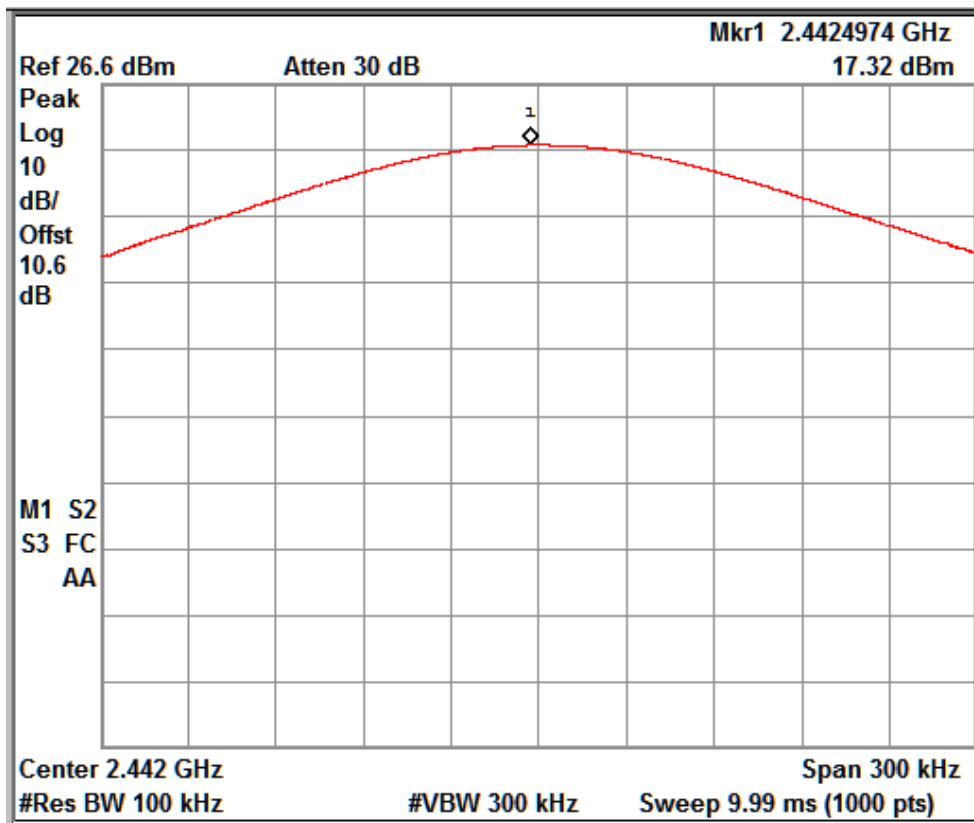


Channel Frequency: 2405MHz

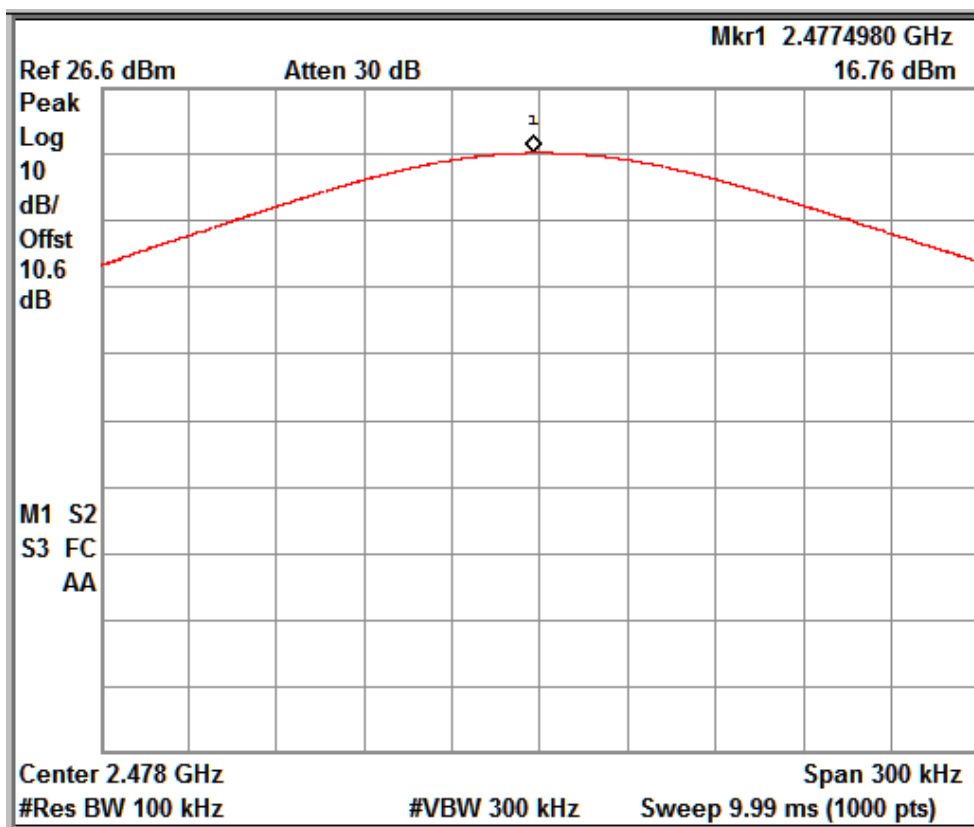
Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 17 von 96
Page 17 of 96



Channel Frequency: 2442.5MHz



Channel Frequency: 2477.5MHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

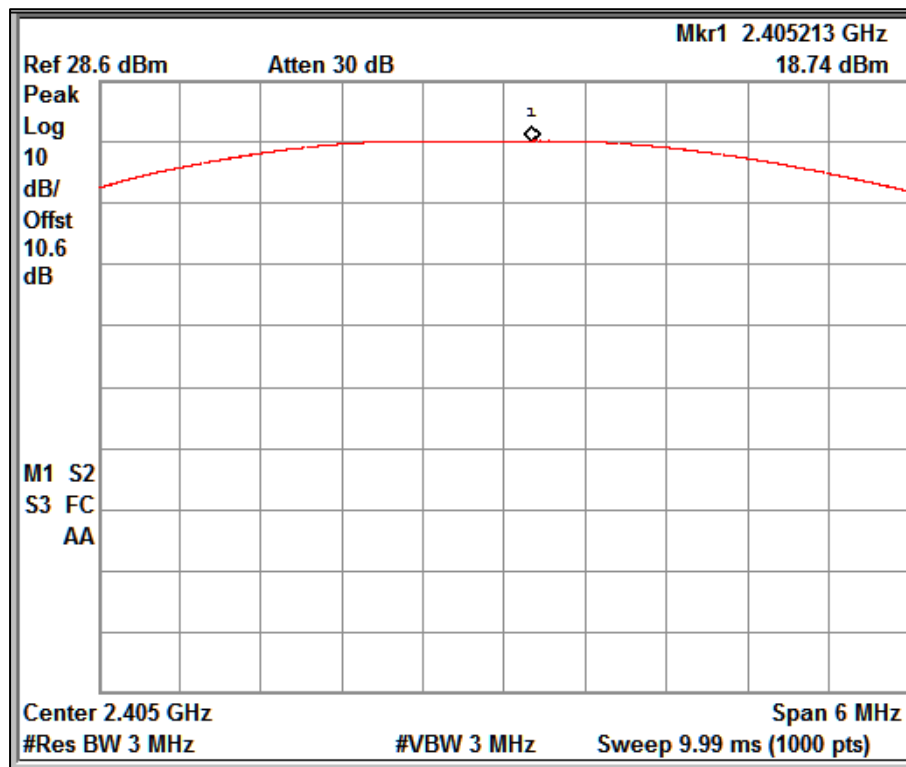
Seite 18 von 96
Page 18 of 96

Test results for spot check of Maximum Conducted Output power for GXRH Host

Transmitted power 20dBm and Antenna gain of 5dBi

Data rate (Kbps)	Channel Frequency (MHz)	Measured Average Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
250	2405	18.74	23.74	30	36
	2440	18.99	23.99	30	36
	2475	15.92	20.92	30	36

Test Plots:

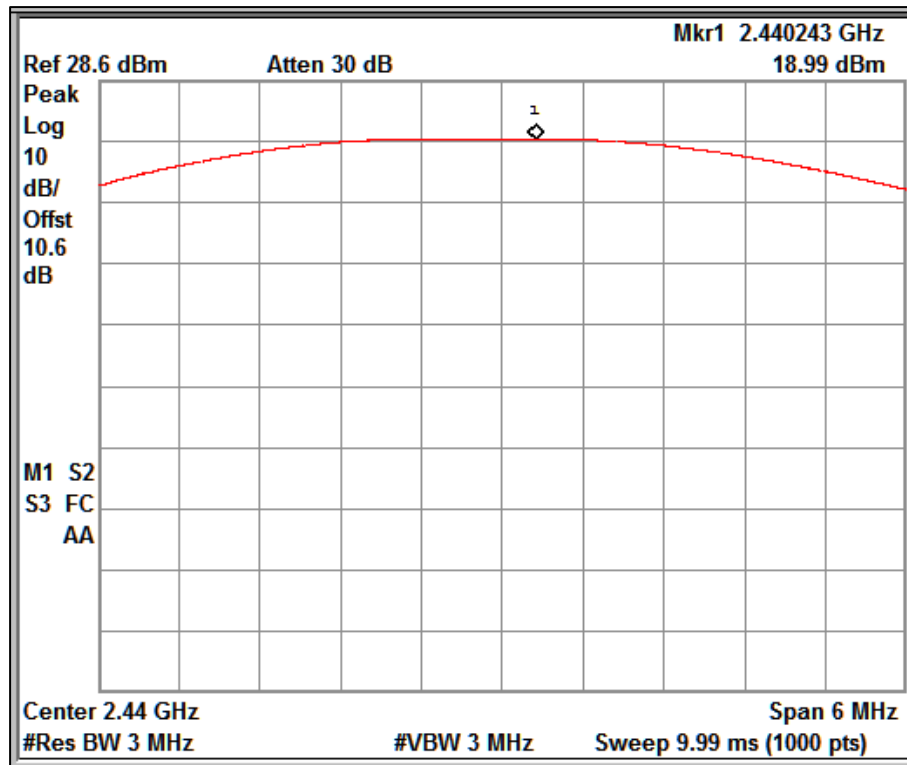


Channel Frequency: 2405MHz

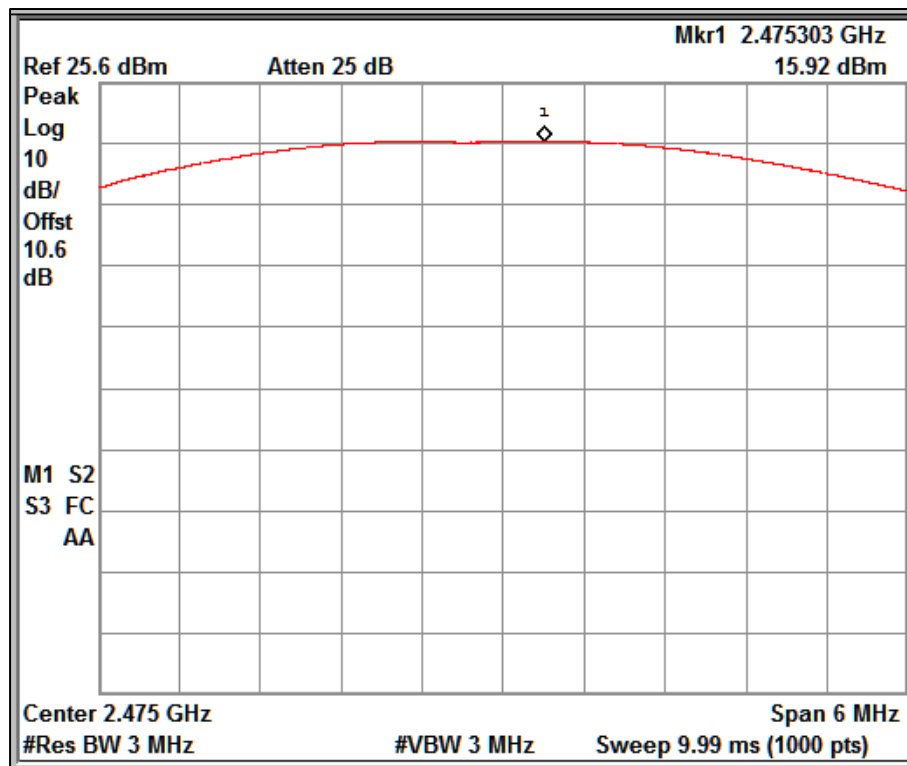
Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 19 von 96
Page 19 of 96



Channel Frequency: 2440MHz



Channel Frequency: 2475MHz

Prüfbericht - Nr.:
Test Report No.:

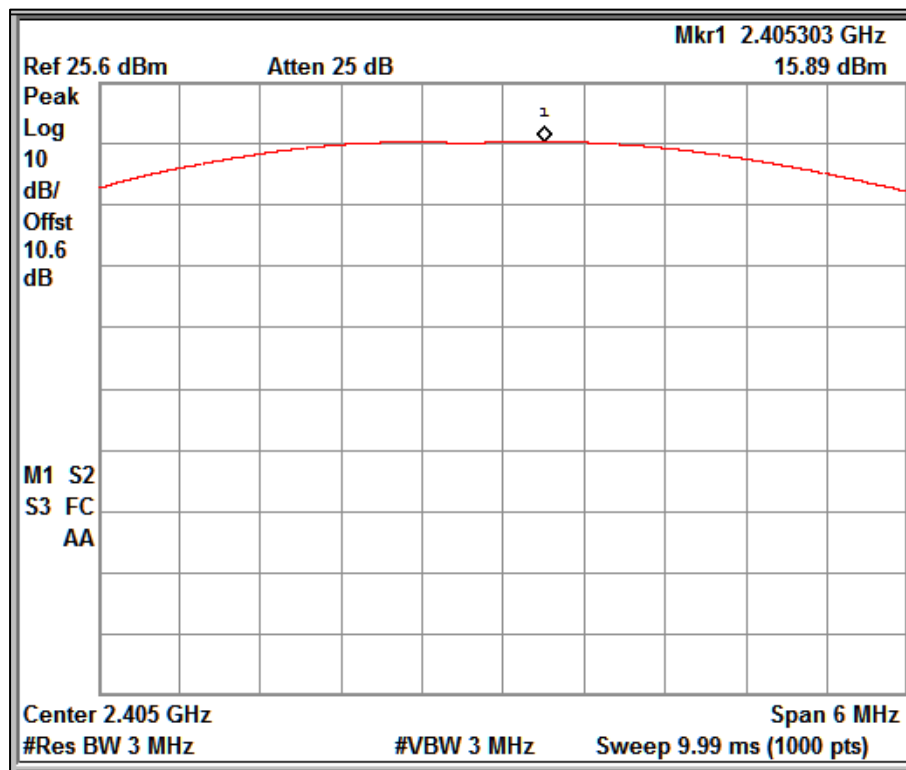
ULR-TC568822300000033F

Seite 20 von 96
Page 20 of 96

Transmitted power 17dBm and Antenna gain of 8dBi

Data rate (Kbps)	Channel Frequency (MHz)	Measured Average Power (dBm)	Maximum e.i.r.p (dBm)	Power Limit (dBm)	e.i.r.p limit (dBm)
250	2405	15.89	23.89	30	36
	2440	16.11	24.11	30	36
	2475	15.91	23.91	30	36

Test Plots:



Channel Frequency: 2405MHz

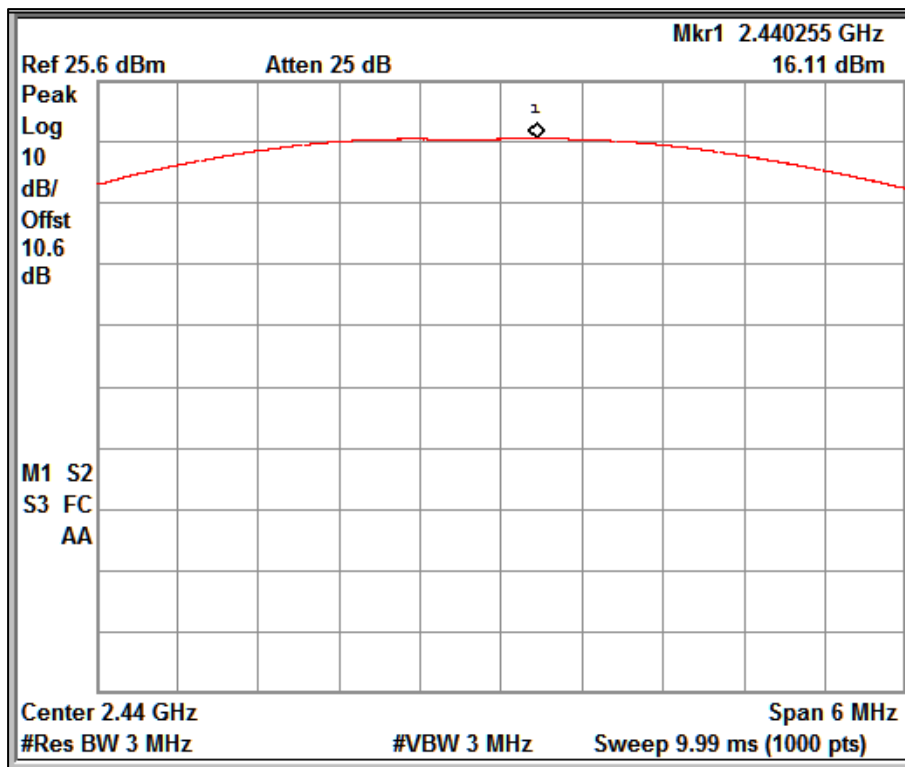
Prüfbericht - Nr.:

Test Report No.:

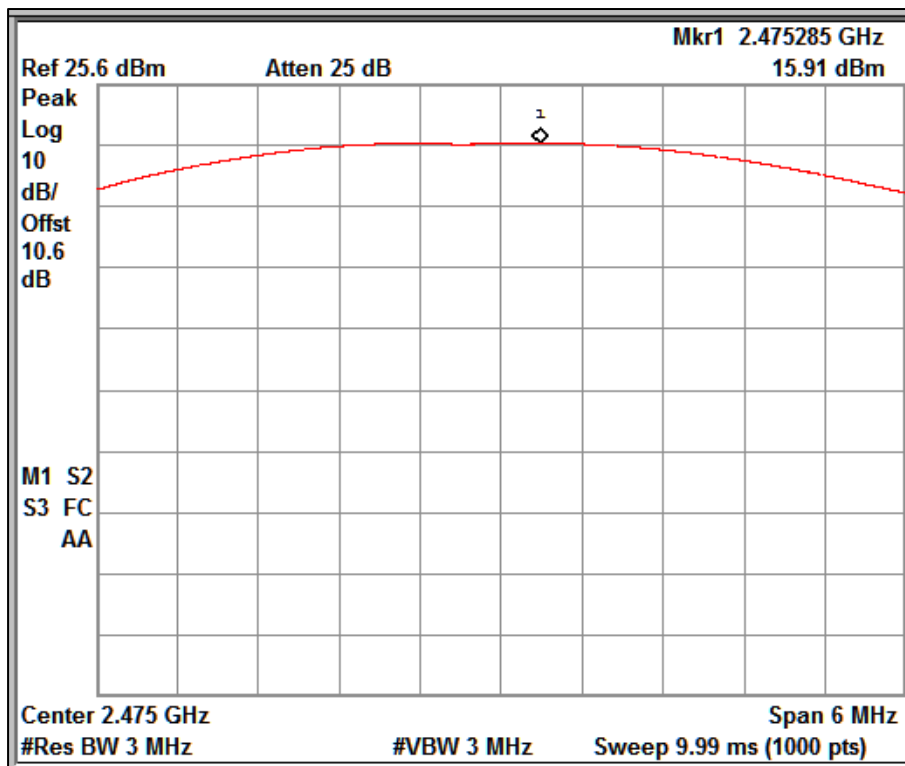
ULR-TC568822300000033F

Seite 21 von 96

Page 21 of 96



Channel Frequency: 2440MHz



Channel Frequency: 2475MHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 22 von 96
Page 22 of 96

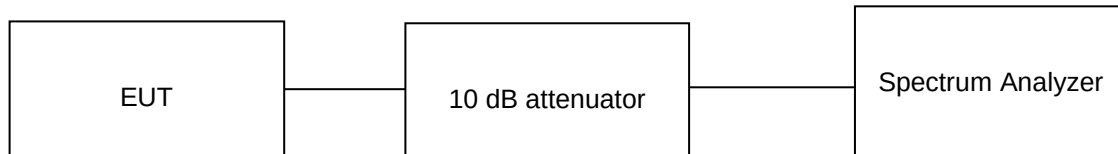
8.2 Occupied bandwidth

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (a) (i) / RSS 247 Issue 2, Section 5.1 (b)
Test Method	Subclause 7.8.7 of ANSI C63.10
Measurement Bandwidth	10 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	The bandwidth of frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system RF bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset while the long-term distribution appears evenly distributed.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.5°C

Voltage = 24V DC (AC - DC Adapter)

Relative humidity: 64%

KDB Guidelines applied:

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

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

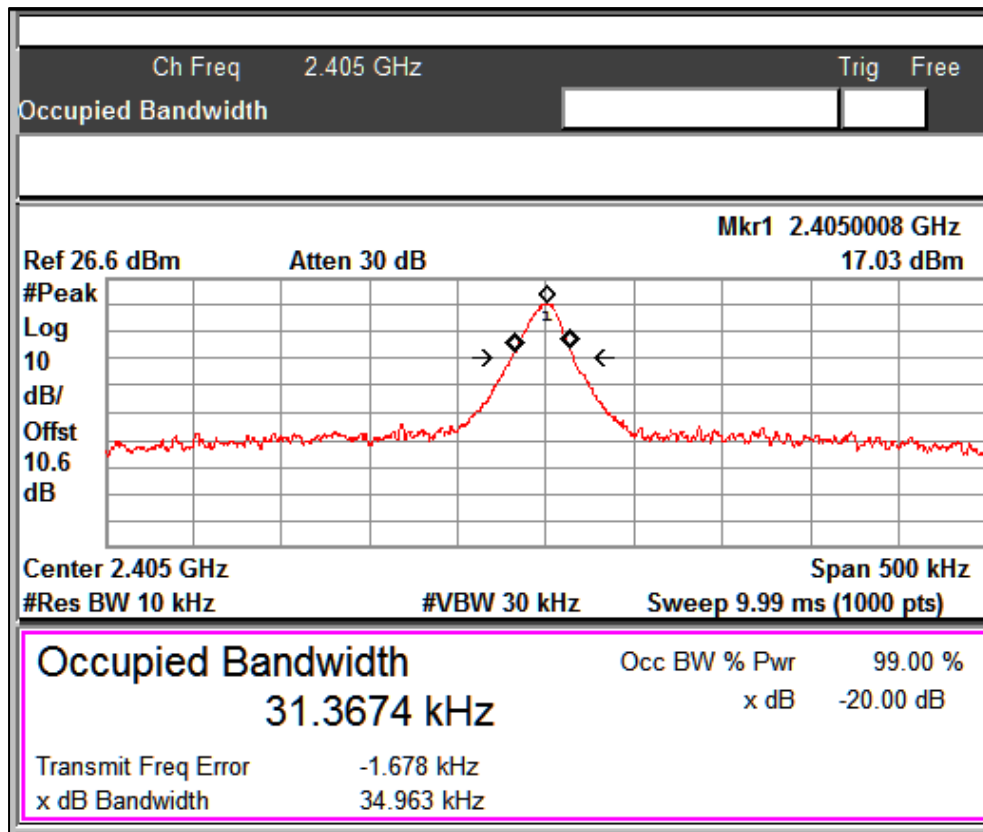
Seite 23 von 96
Page 23 of 96

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 (0.6dB)
3. This product supports additional beamforming gain / directional gain, it uses dual antennas and hence Directional gain of the dual antennas are 5 dBi and 8dBi .

Channel Frequency (MHz)	20 dB Bandwidth (KHz)	99% OBW (KHz)
2405	34.96	31.36
2442.5	34.87	31.29
2477.5	34.83	31.35

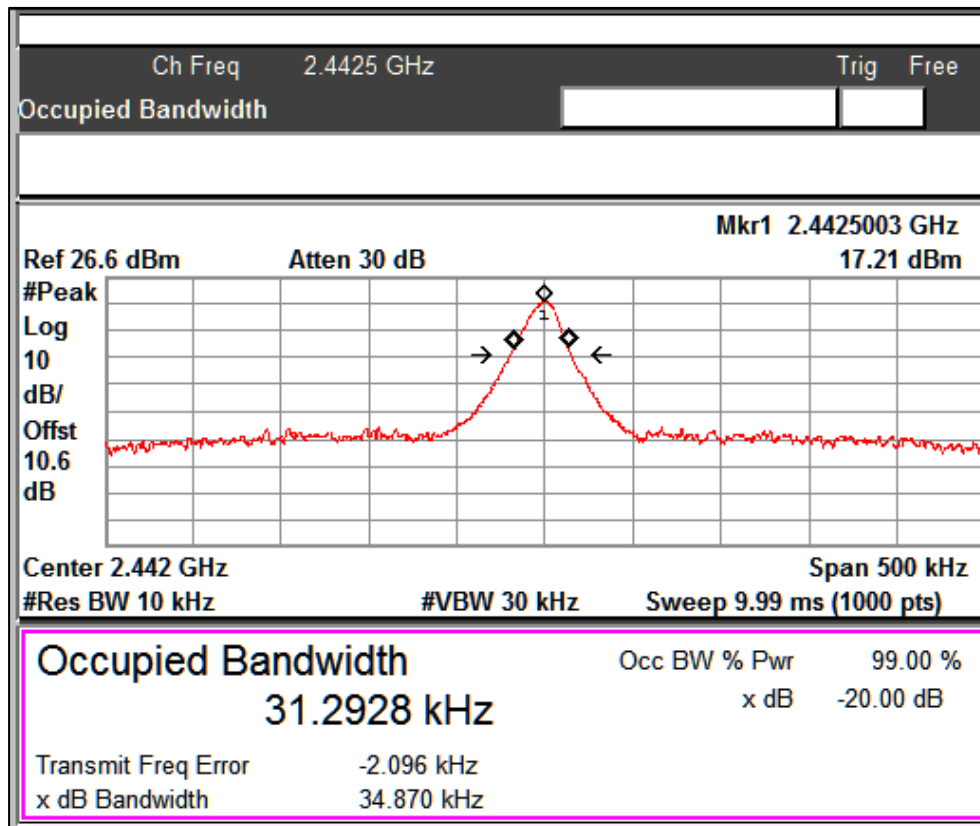


Channel Frequency: 2405MHz

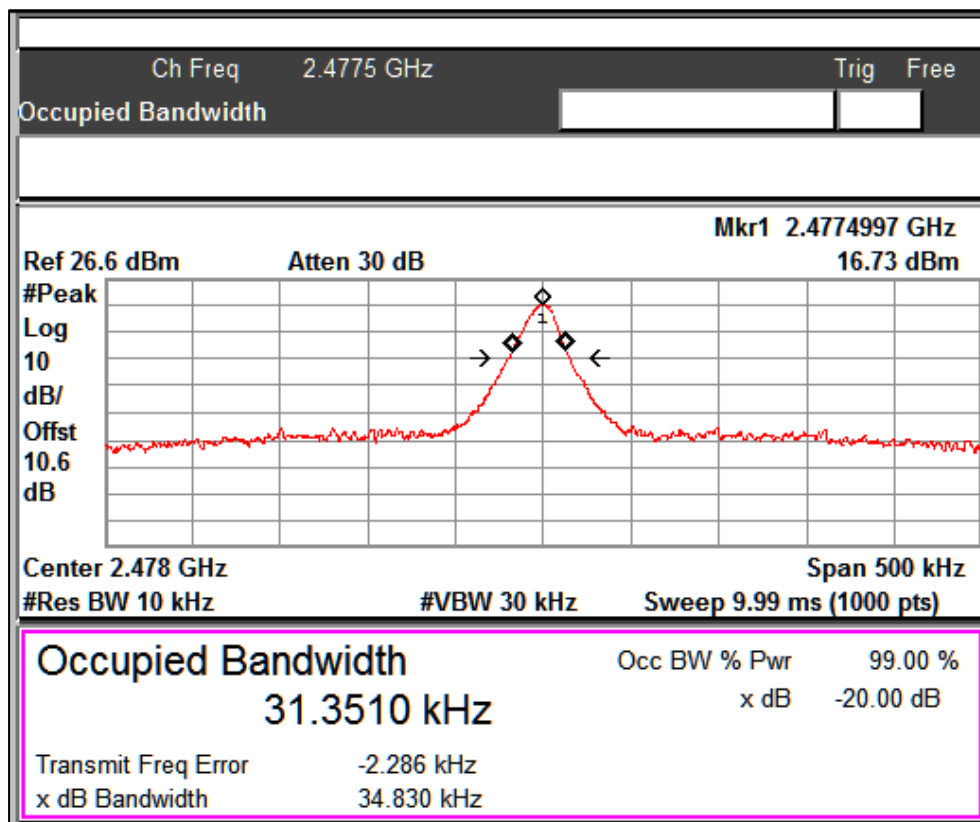
Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 24 von 96
Page 24 of 96



Channel Frequency: 2442.5MHz



Channel Frequency: 2477.5MHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 25 von 96
Page 25 of 96

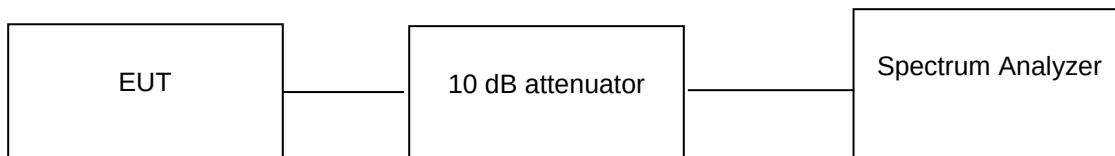
8.3 Number of Hopping Channels

Result

Pass

Test Specification	FCC Part 15 Subpart C Section 15.247 (a) (i) / RSS 247 Issue 2, Section 5.1 (d)
Test Method	Subclause 7.8.3 of ANSI C63.10
Measurement Bandwidth	100 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

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) = + 22.5°C Voltage = 24V DC (AC - DC Adapter) Relative humidity: 64%

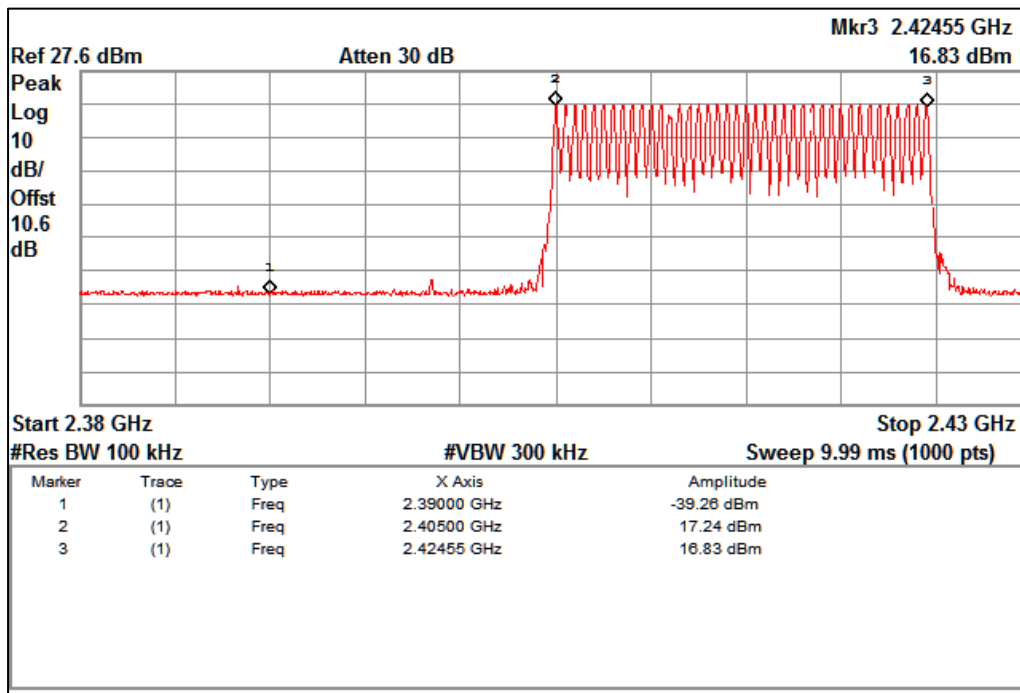
KDB Guidelines applied:

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

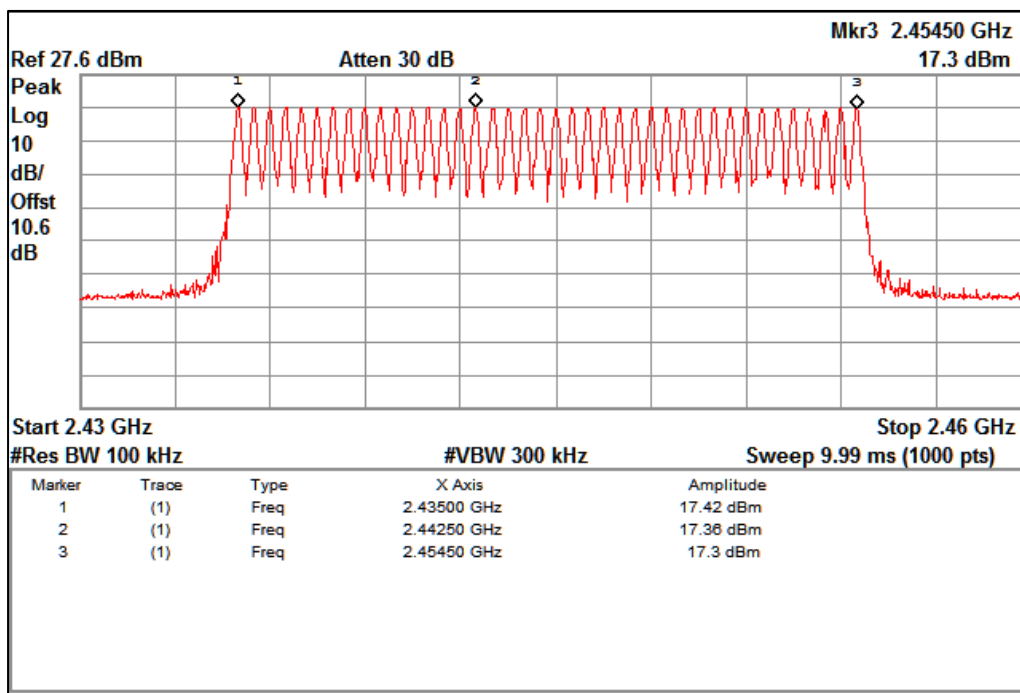
Test results:

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 (0.6dB).



Number of Hopping Frequencies 2405MHz-2425MHz



Number of Hopping Frequencies 2435MHz-2455MHz

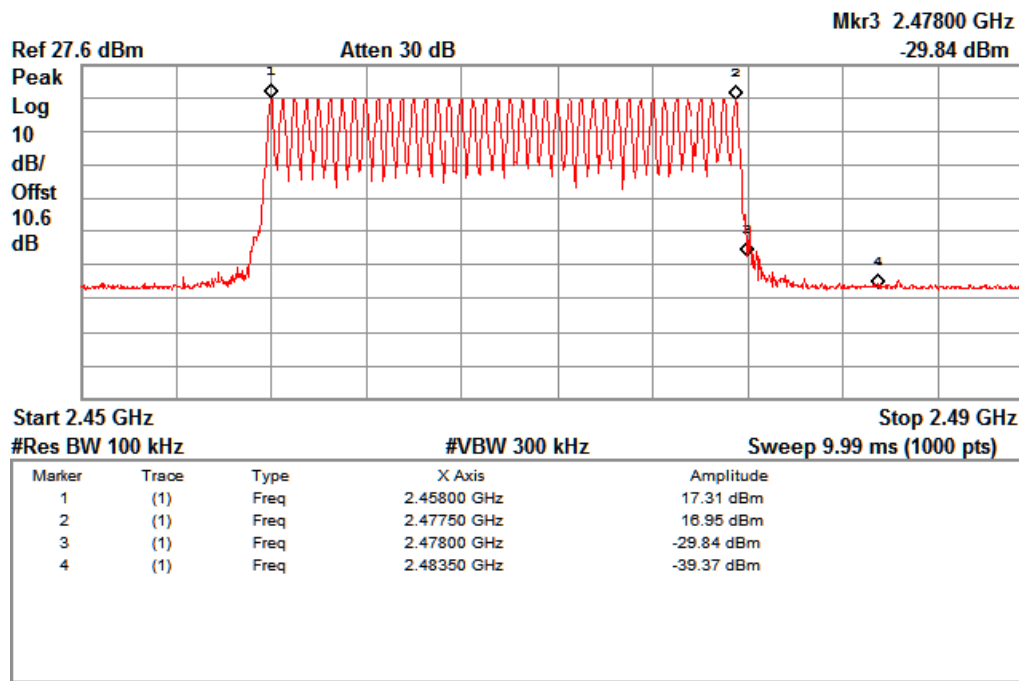
Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000033F

Seite 27 von 96

Page 27 of 96



Number of Hopping Frequencies 2458MHz-2478MHz

Start hopping Frequency Observed 2405 MHz

Stop hopping Frequency Observed 2477.5 MHz

Total Number of Hopping Channels Observed = 120

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 28 von 96
Page 28 of 96

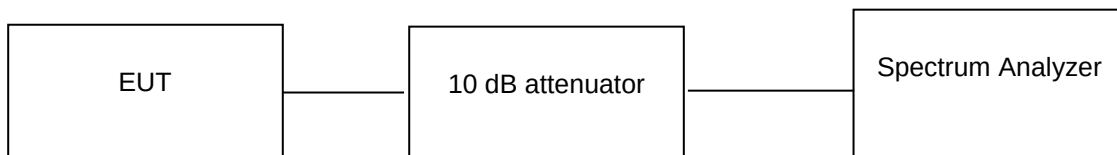
8.4 Carrier Frequency Separation

Result

Pass

Test Specification	FCC Part 15 Subpart C Section 15.247 (a) (1) / RSS 247 Issue 2, Section 5.1 (b)
Test Method	Clause 7.8.2 of ANSI C63.10
Measurement Bandwidth	300 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) = + 22.5°C

Voltage = 24V DC (AC - DC Adapter)

Relative humidity: 64%

KDB Guidelines applied:

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

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000033F

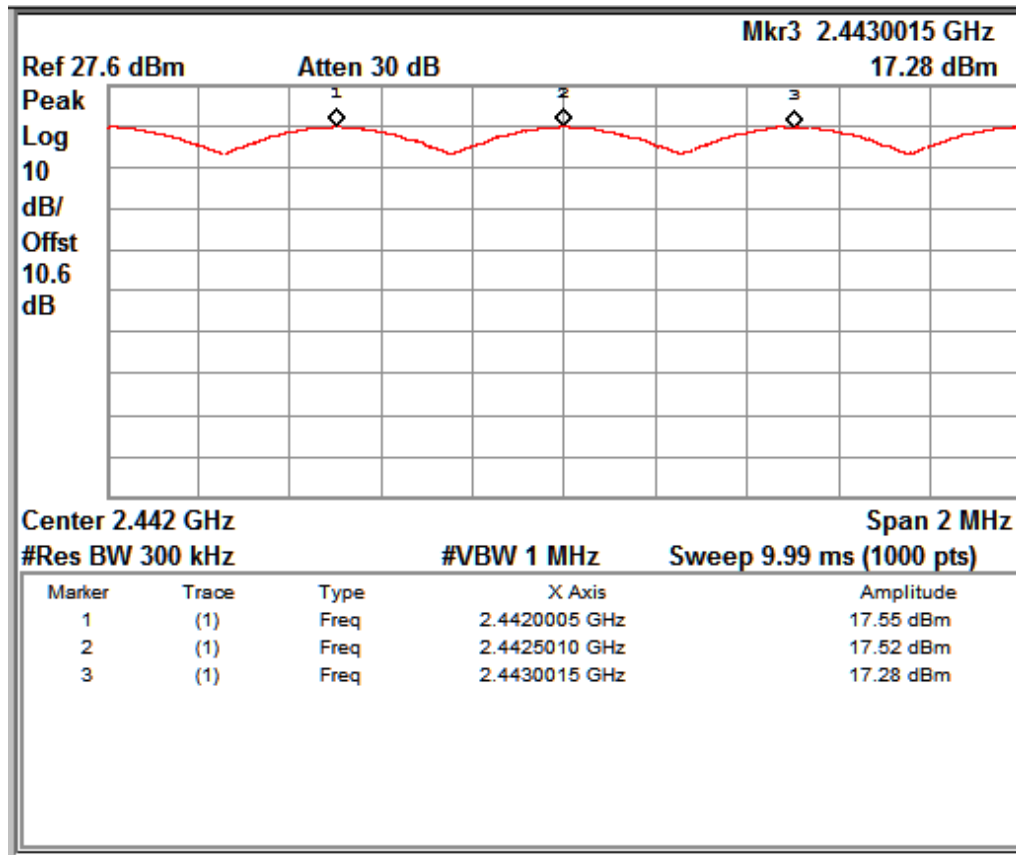
Seite 29 von 96

Page 29 of 96

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 (0.6dB)
3. This product supports additional beamforming gain / directional gain, it uses dual antennas and hence Directional gain of the dual antennas are 5 dBi and 8dBi .



Frequency (MHz)	Channel spacing Observed (KHz)
2442	500
2442.5	500
2443	500

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 30 von 96
Page 30 of 96

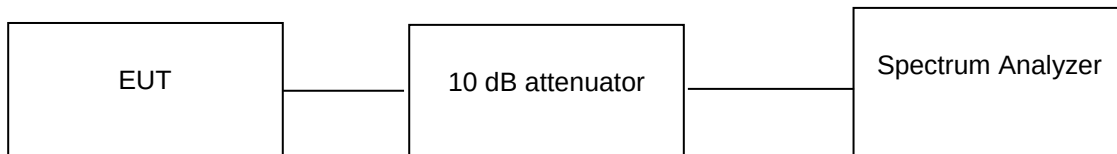
8.5 Time of Occupancy (Dwell Time)

Result

Pass

Test Specification	FCC Part 15 Subpart C Section 15.247 (a) (i) / RSS 247 Issue 2, Section 5.1 (d)
Test Method	Clause 7.8.4 of ANSI C63.10
Measurement Bandwidth	300 kHz
Detector	Peak
Port of testing	Antenna port
Requirement	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22.5°C

Voltage = 24V DC (AC - DC Adapter)

Relative humidity: 64%

KDB Guidelines applied:

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

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000033F

Seite 31 von 96

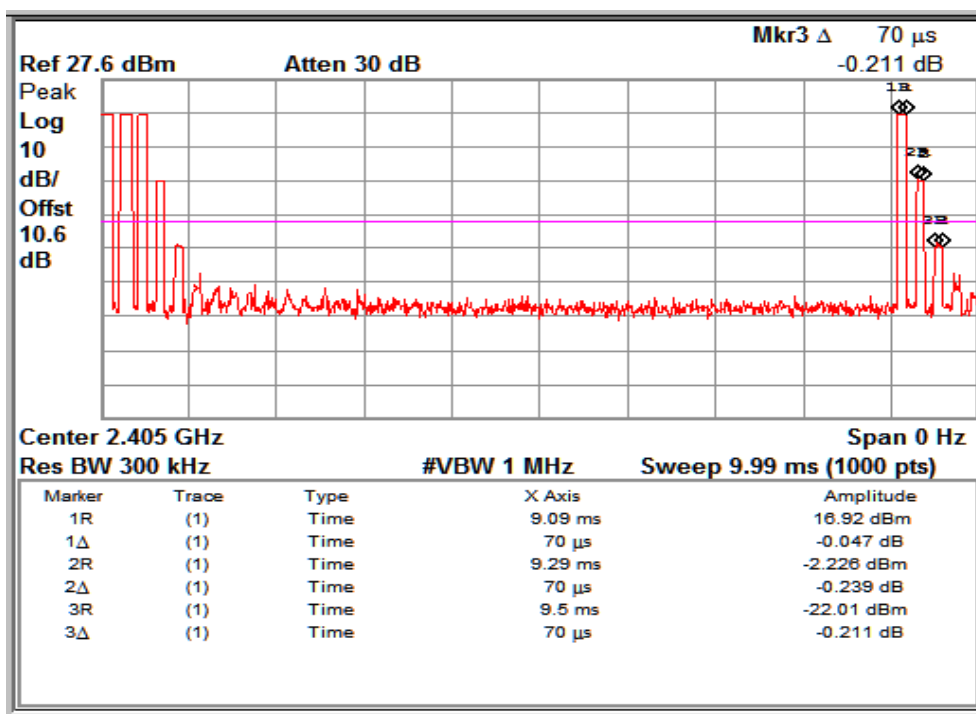
Page 31 of 96

Test results:

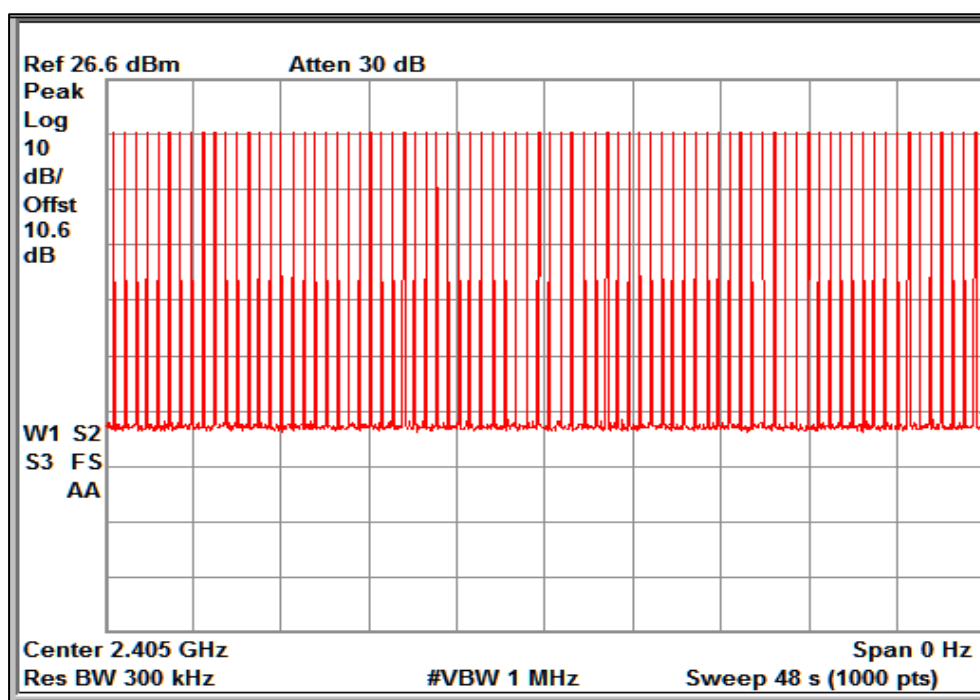
Note:

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 (0.6dB)

Channel Frequency:2405MHz



Dwell Time

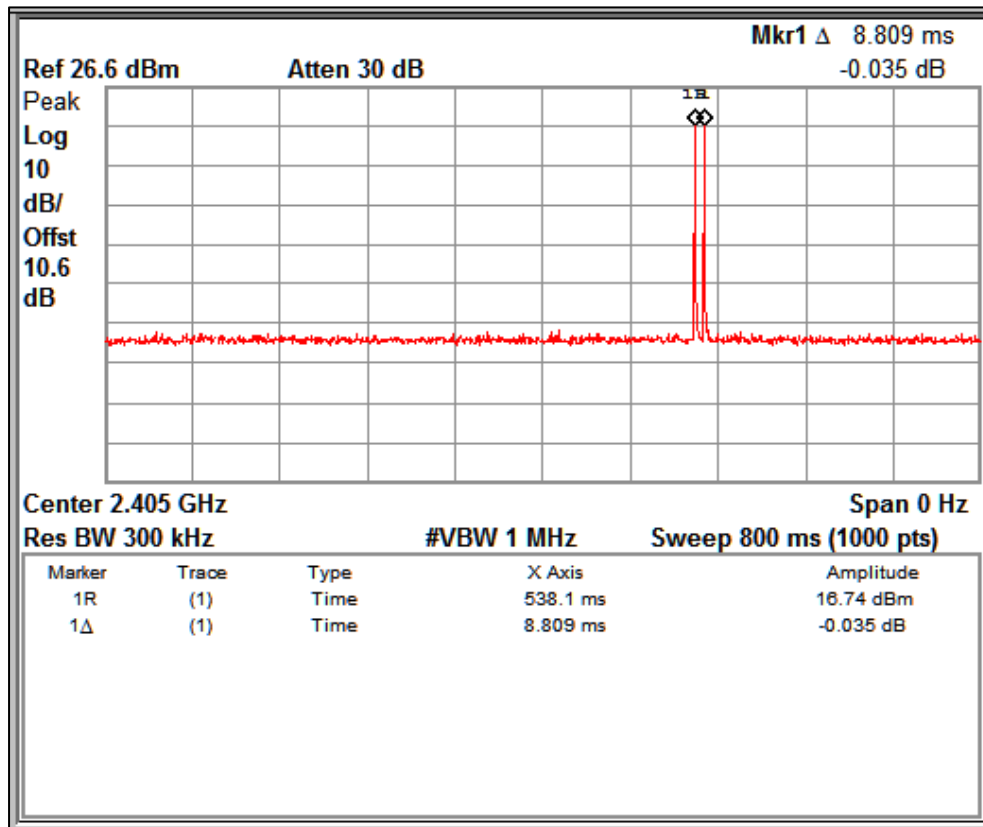


Number of Bins

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 32 von 96
Page 32 of 96



0.8s Reference plot

Dwell Time = 210μs or 0.21ms

Total bins in 48 Sec = 78

Max. Allowed time = 0.4s

Total time occupancy in 48s = 210 * 78 = 16590μs or 16.59ms or 0.01659sec (which is less than 400ms)

Prüfbericht - Nr.:

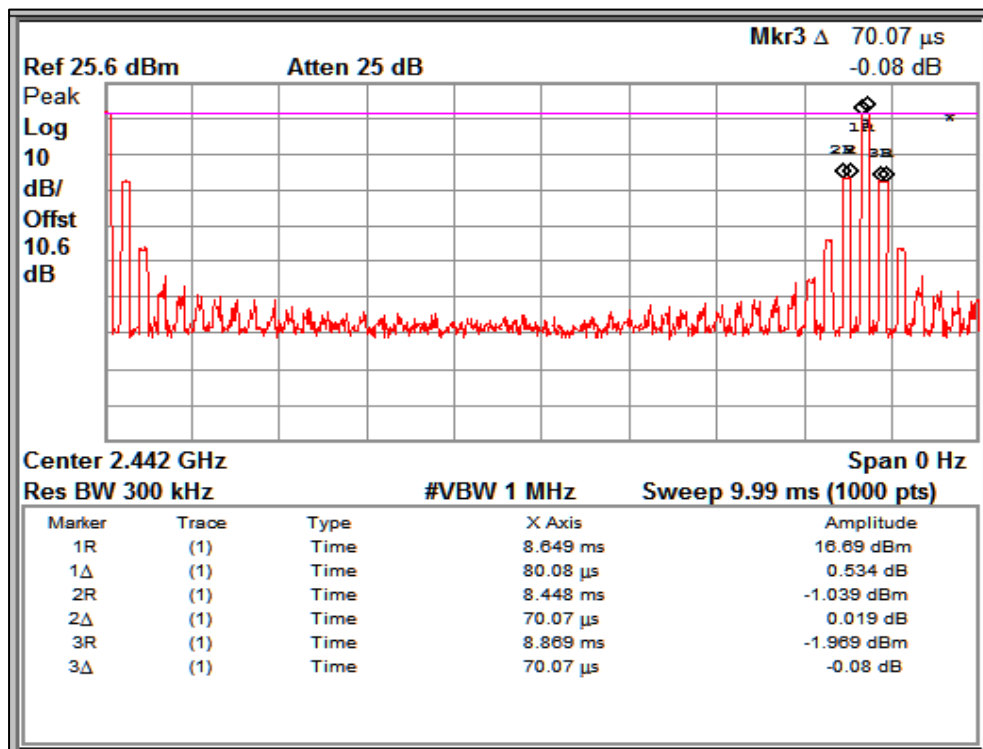
Test Report No.:

ULR-TC568822300000033F

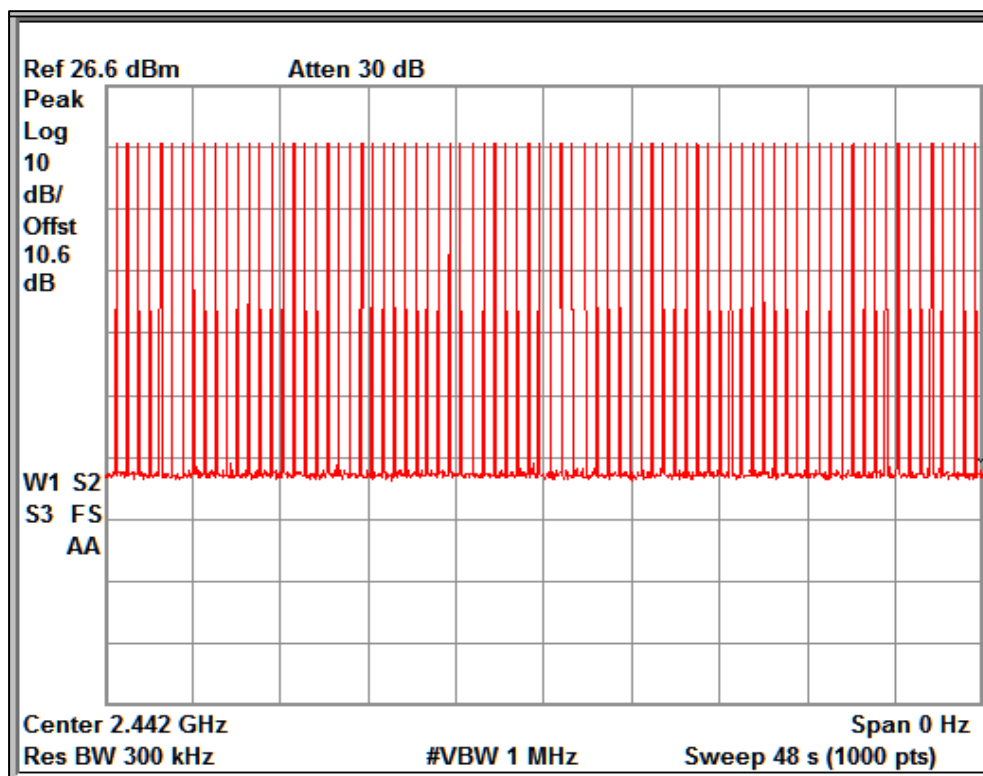
Seite 33 von 96

Page 33 of 96

Channel frequency:2442.5MHz



Dwell Time



Number of bins

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000033F

Seite 34 von 96

Page 34 of 96

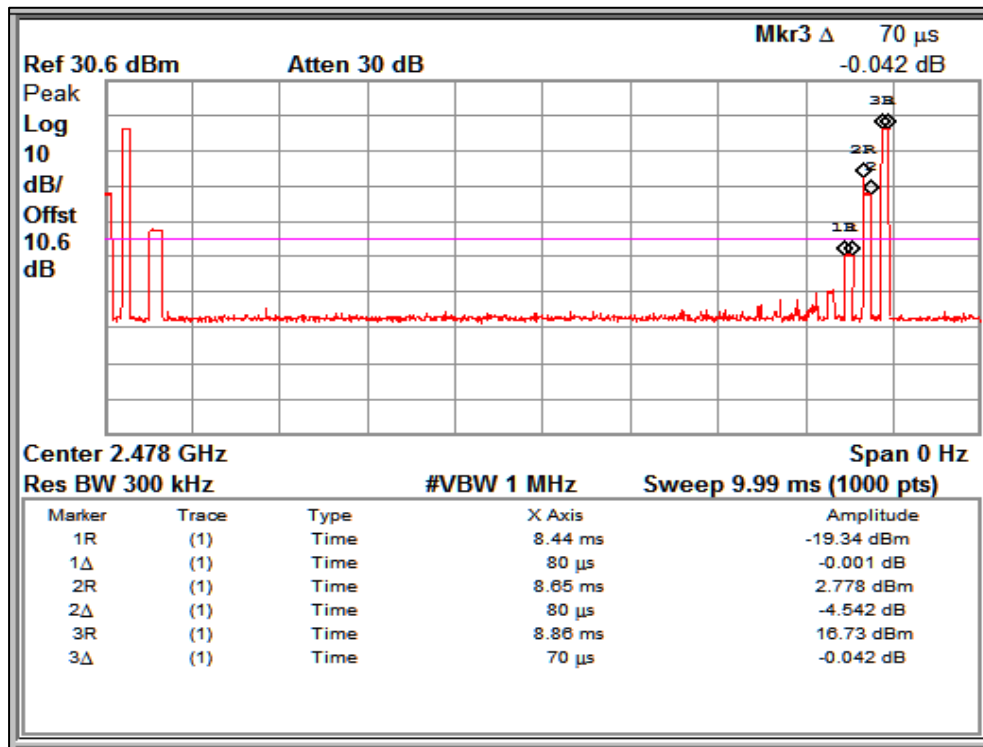
Dwell Time = 220.22µs or 0.22022ms

Total bins in 48 Sec = 78

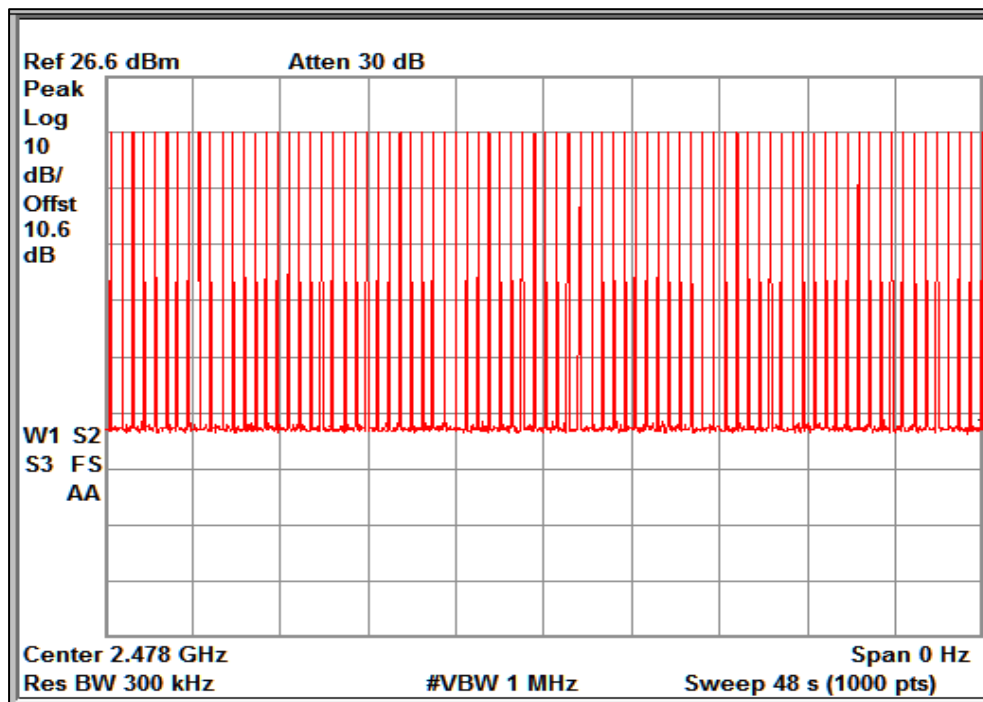
Max. Allowed time = 0.4s

Total time occupancy in 48s = 220.22 * 78 = 17177.16µs or 17.17ms or 0.01717s (which is less than 400ms)

Channel frequency:2477.5MHz



Dwell Time



Number of bins

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568822300000033F

Seite 35 von 96

Page 35 of 96

Dwell Time = 230µs or 0.23ms

Total bins in 48 Sec =78

Max. Allowed time = 0.4s

Total time occupancy in 48s = 230 * 78 = 17940µs or 17.94ms or 0.01794sec (which is less than 400ms)

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 36 von 96
Page 36 of 96

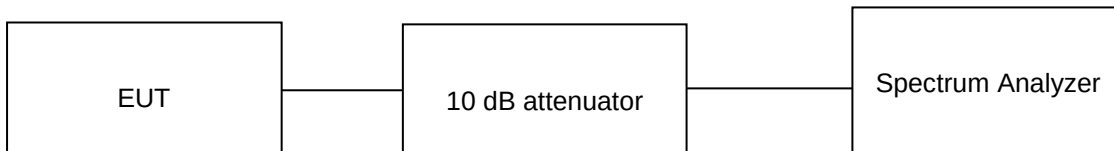
8.6 Emissions in non-restricted frequency bands and Conducted Spurious Emission

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d) / RSS 247 Issue 2, Section 5.5
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) = + 22.5°C Voltage = 24V DC (AC - DC Adapter) Relative humidity: 64%

KDB Guidelines applied:

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

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 37 von 96
Page 37 of 96

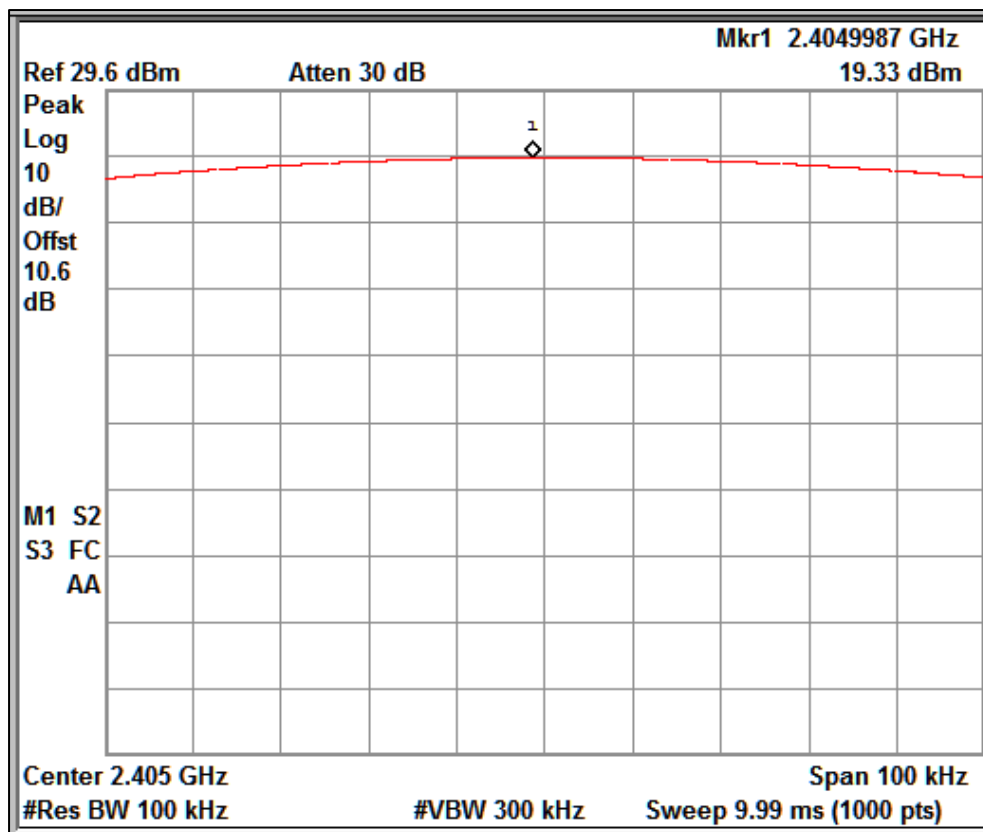
Test results:

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 (0.6dB)
3. This product supports additional beamforming gain / directional gain, it uses dual antennas and hence Directional gain of the dual antennas are 5 dBi and 8dBi
4. Only worst case results are reported

8.6.1 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)	Limit (dBc)
2405	19.33	2400.00	-37.05	-56.38	-20
2477.5	17.67	2483.50	-40.25	-57.92	-20



Reference plot for 2405MHz

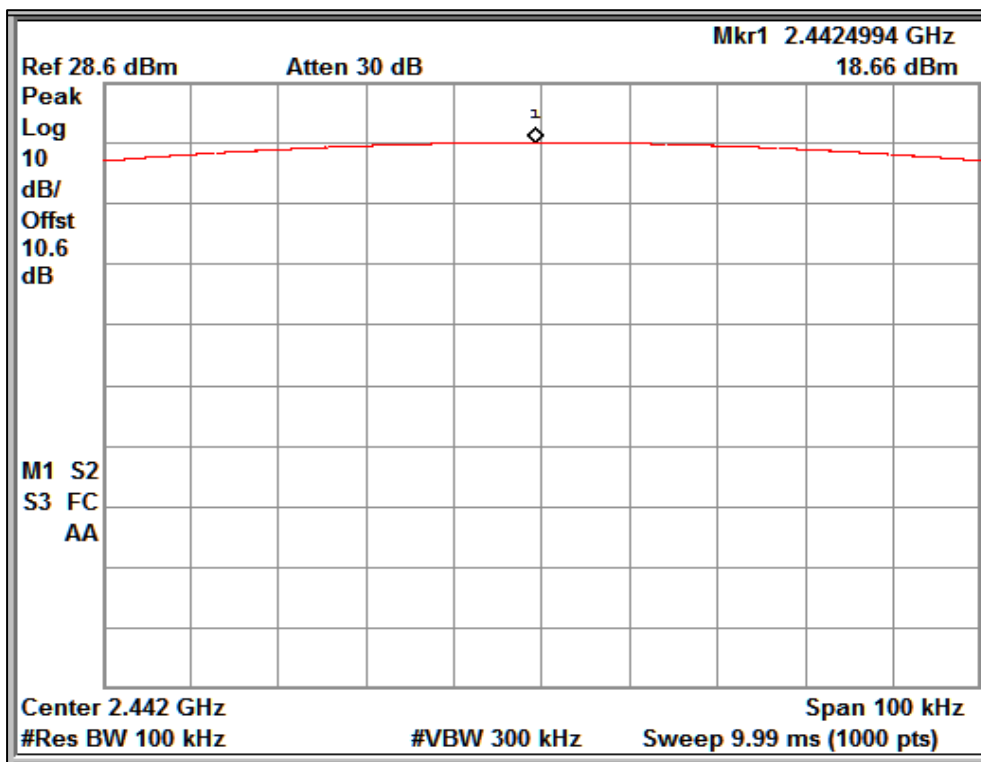
Prüfbericht - Nr.:

Test Report No.:

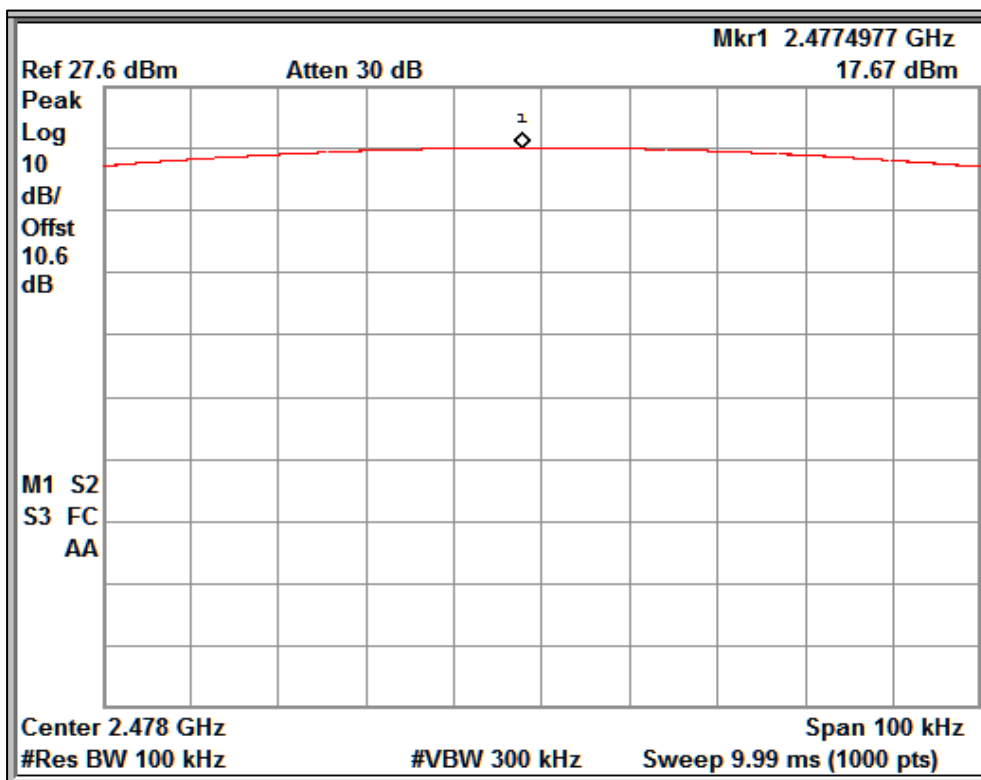
ULR-TC568822300000033F

Seite 38 von 96

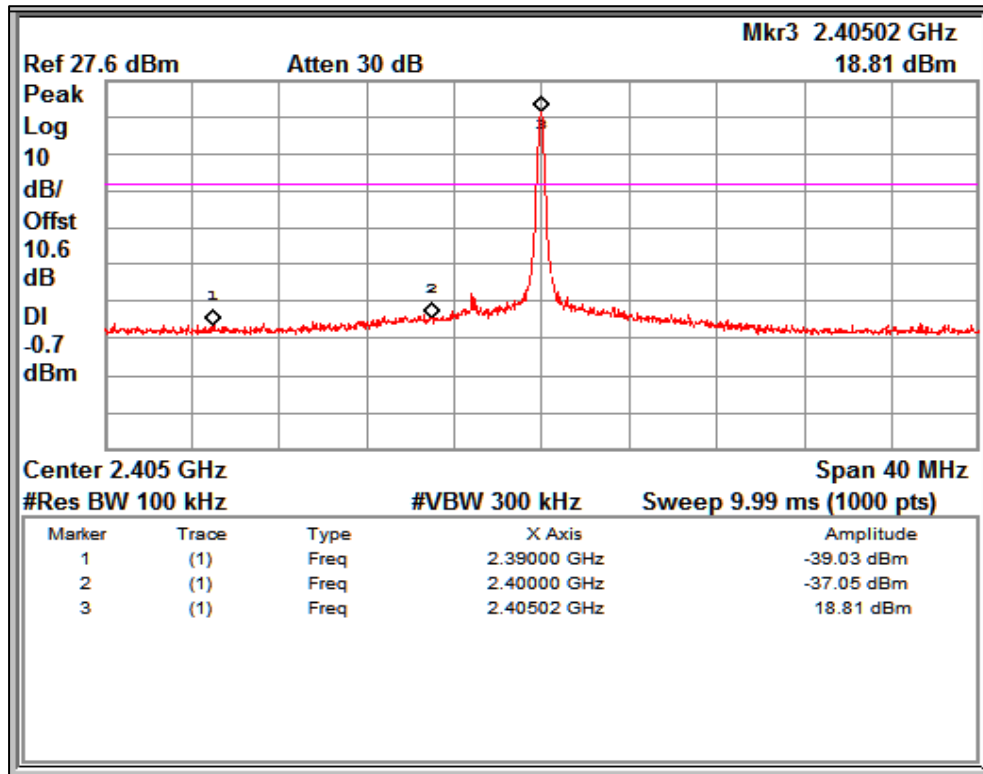
Page 38 of 96



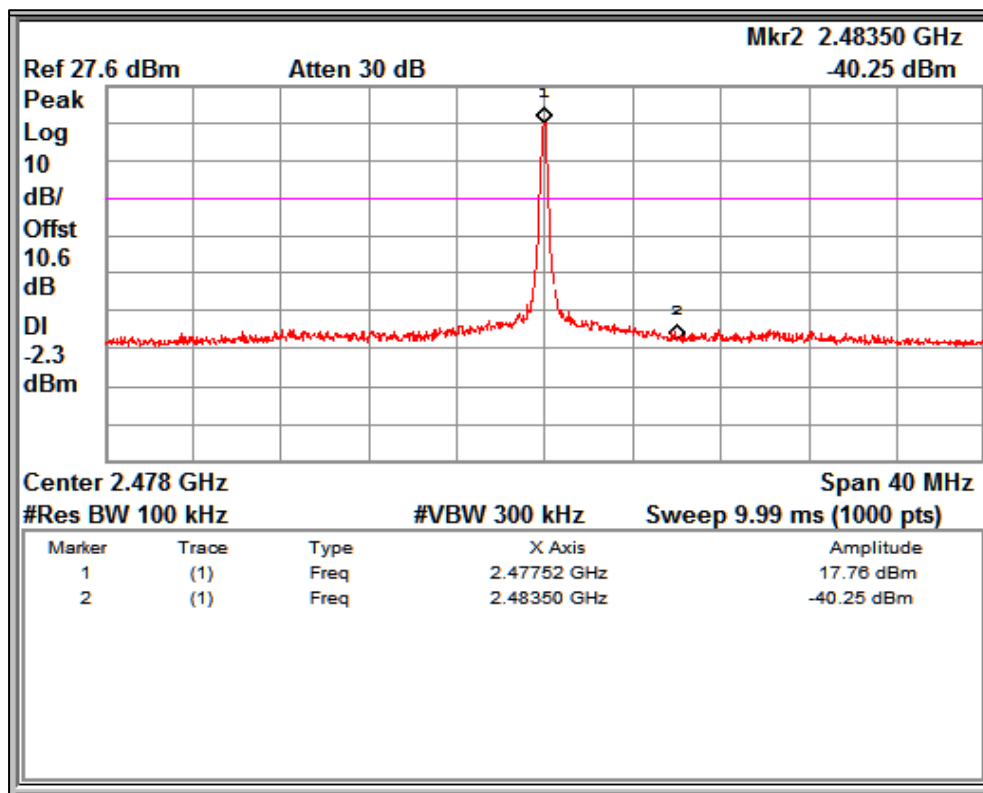
Reference plot for 2442.5MHz



Reference plot for 2477.5MHz

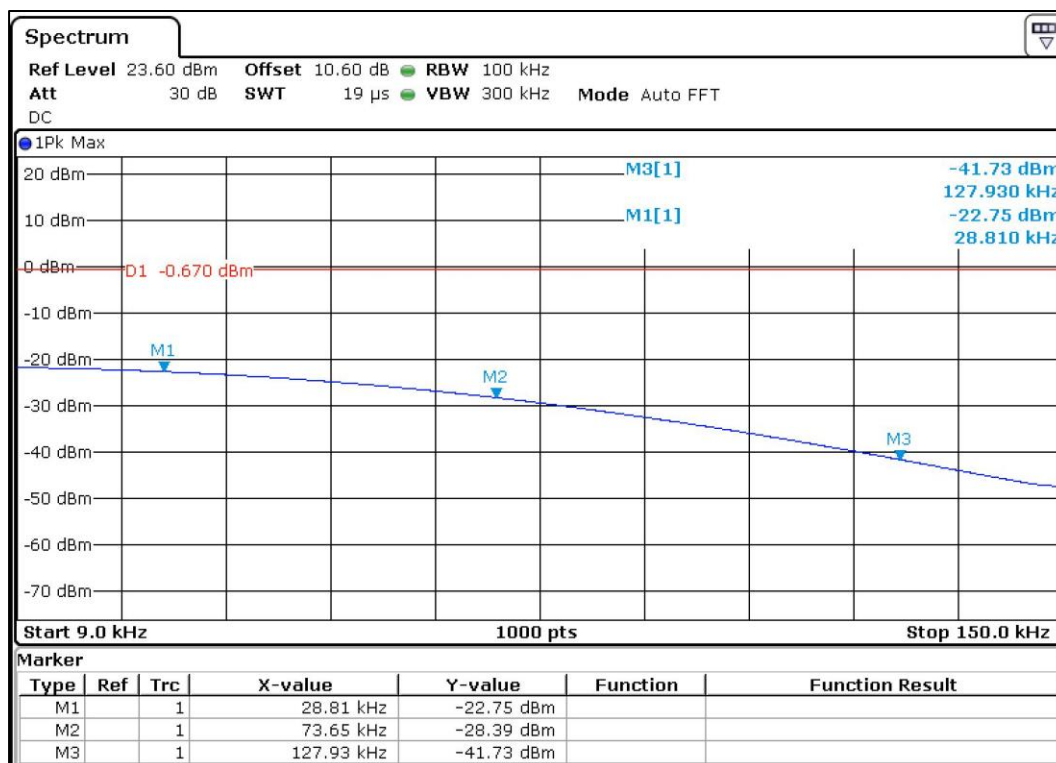


Band edge Channel Frequency 2405MHz



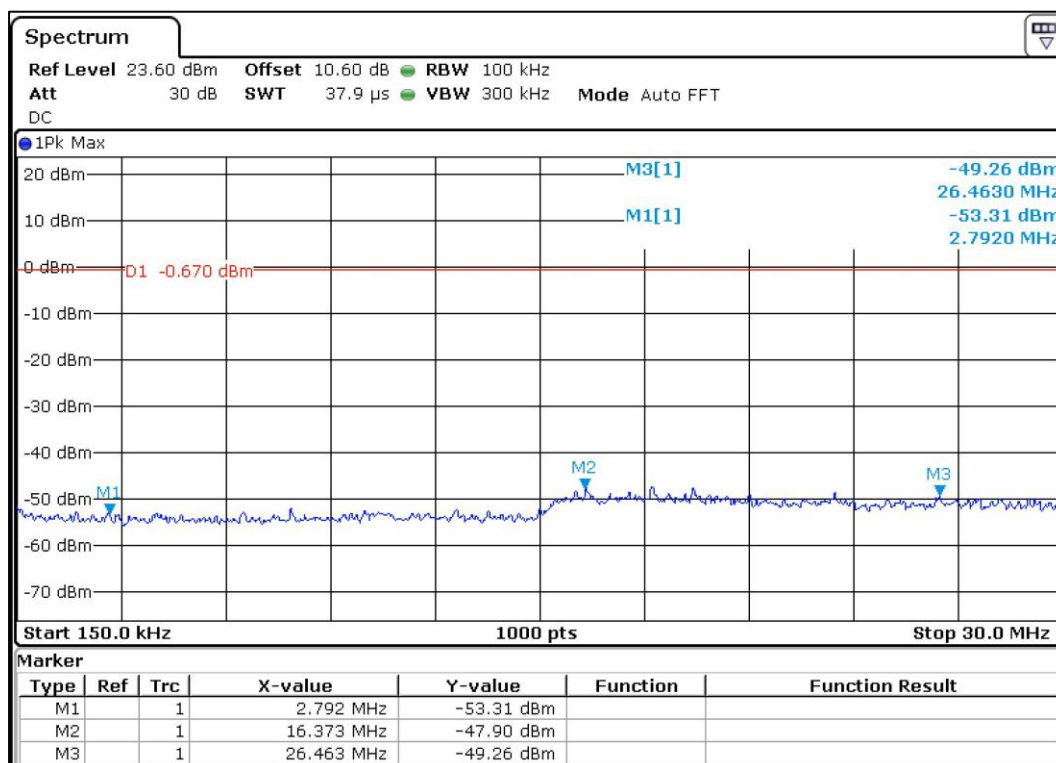
Band edge Channel Frequency 2477.5MHz

8.6.2 Out-Of-Band Emissions



Channel Frequency 2405MHz

Frequency Range 9KHz – 150KHz



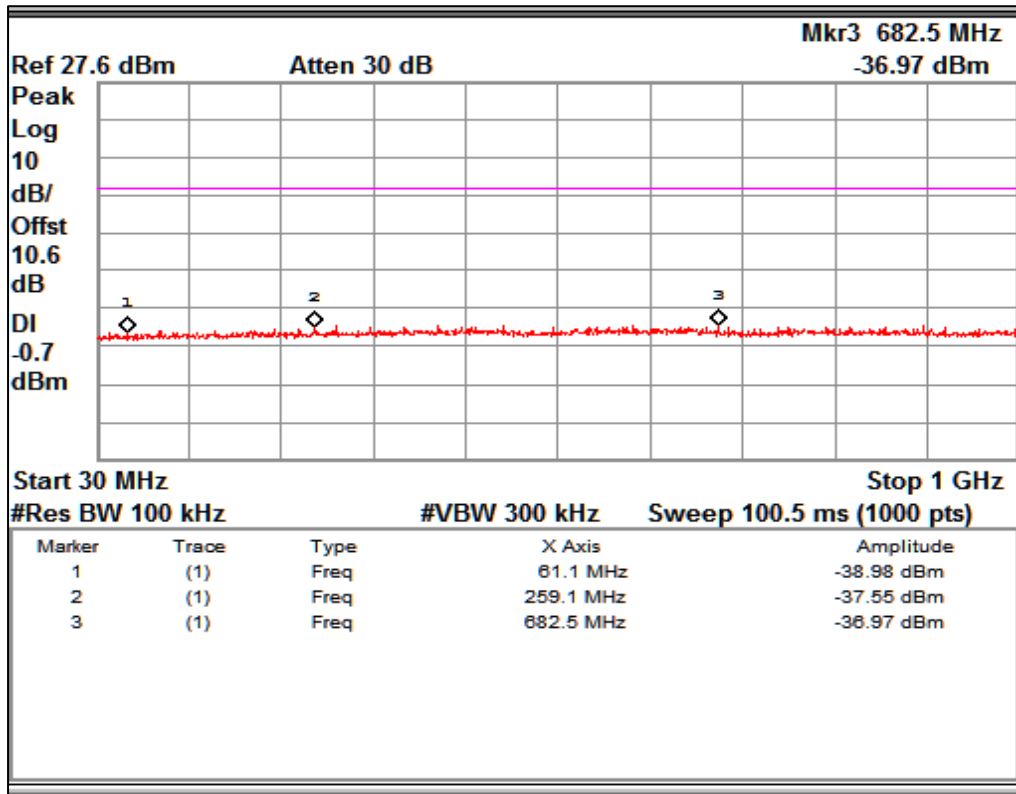
Channel Frequency 2405MHz

Frequency Range 150KHz – 30MHz

Prüfbericht - Nr.:
Test Report No.:

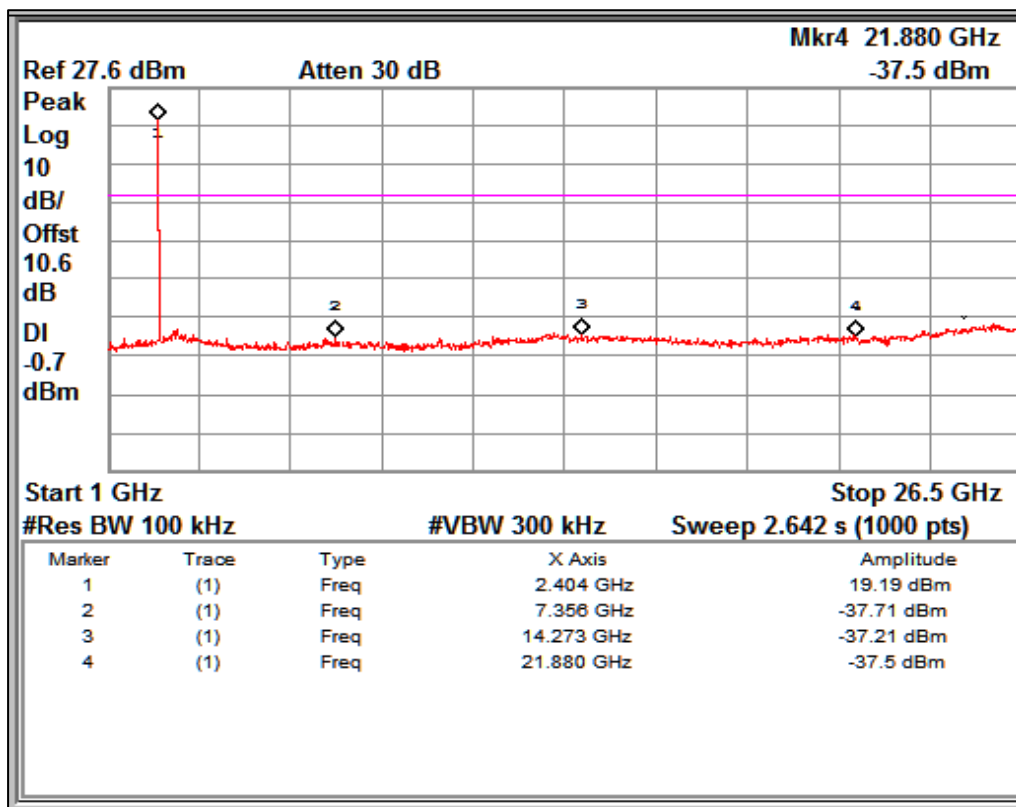
ULR-TC568822300000033F

Seite 41 von 96
Page 41 of 96



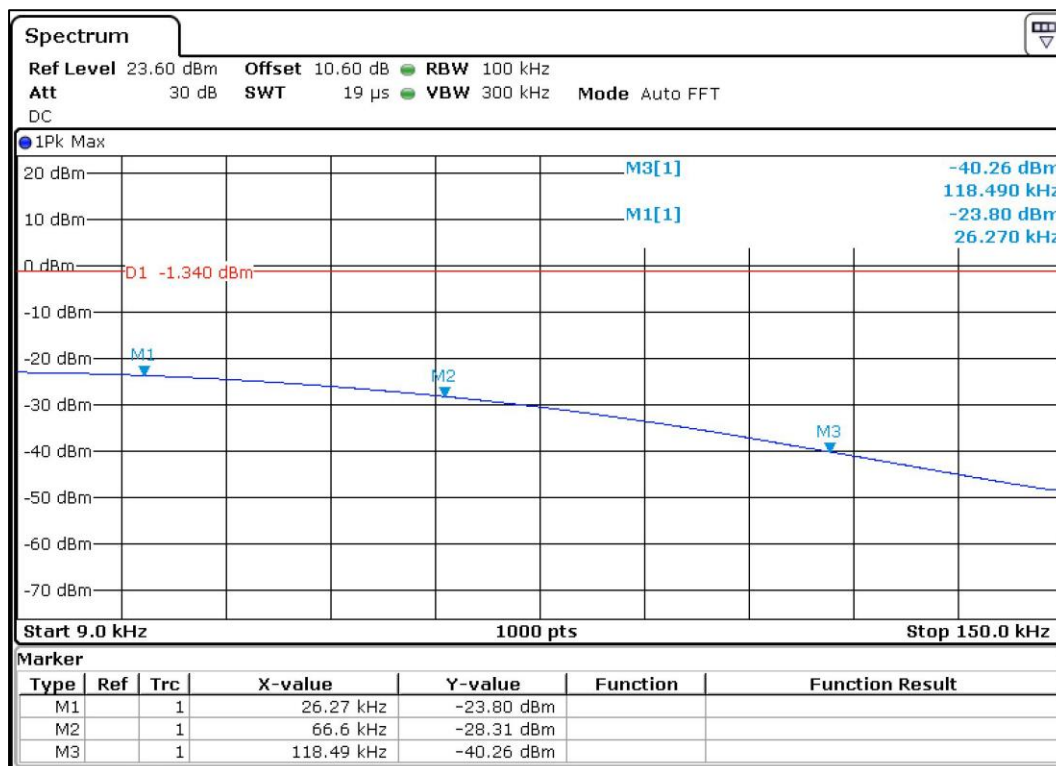
Channel Frequency 2405MHz

Frequency Range 30MHz – 1GHz



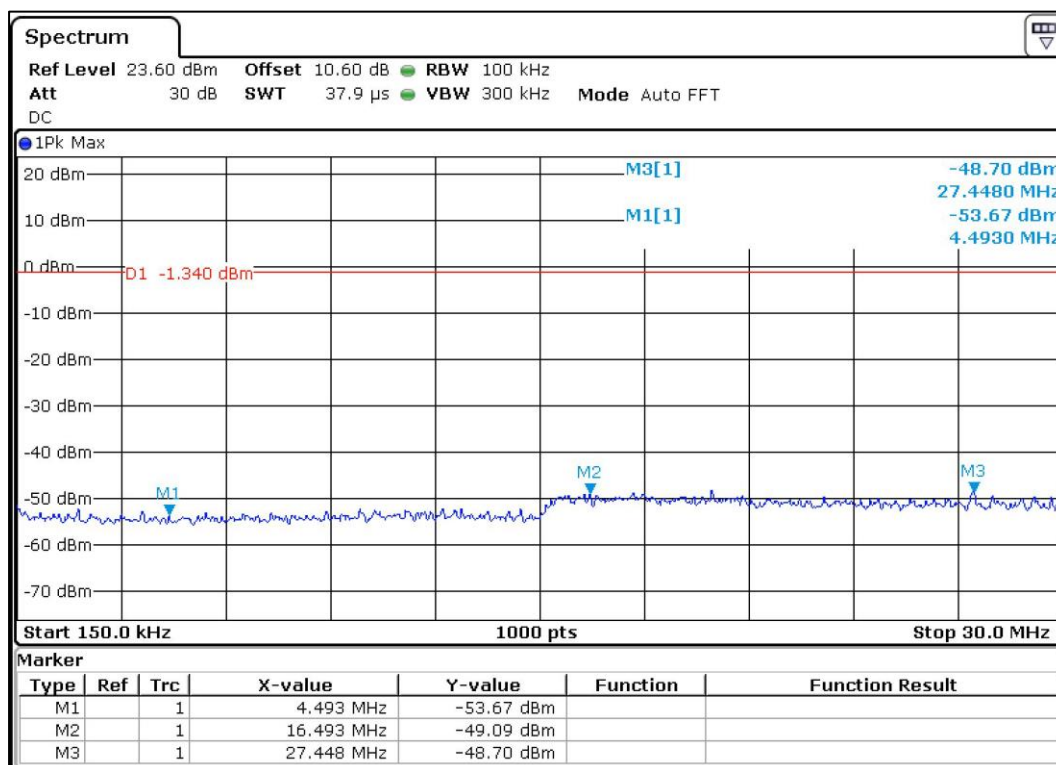
Channel Frequency 2405MHz

Frequency Range 1GHz – 26GHz



Channel Frequency 2442.5MHz

Frequency Range 9KHz – 150KHz



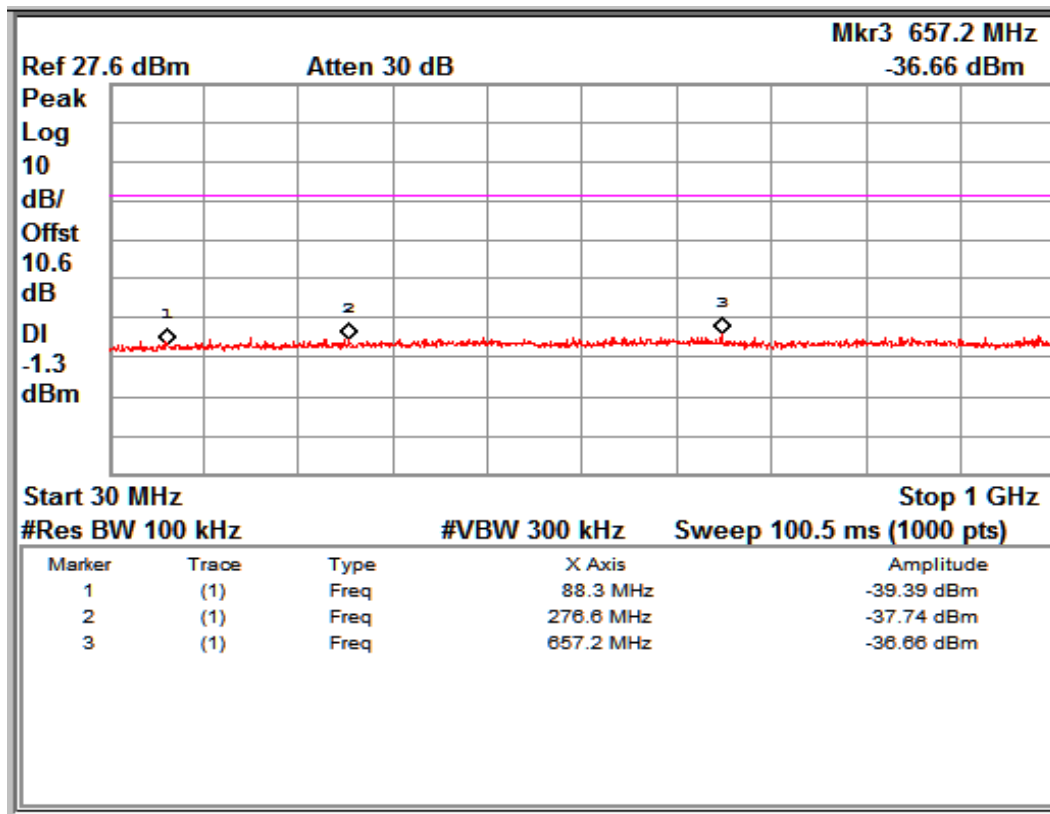
Channel Frequency 2442.5MHz

Frequency Range 150KHz – 30MHz

Prüfbericht - Nr.:
Test Report No.:

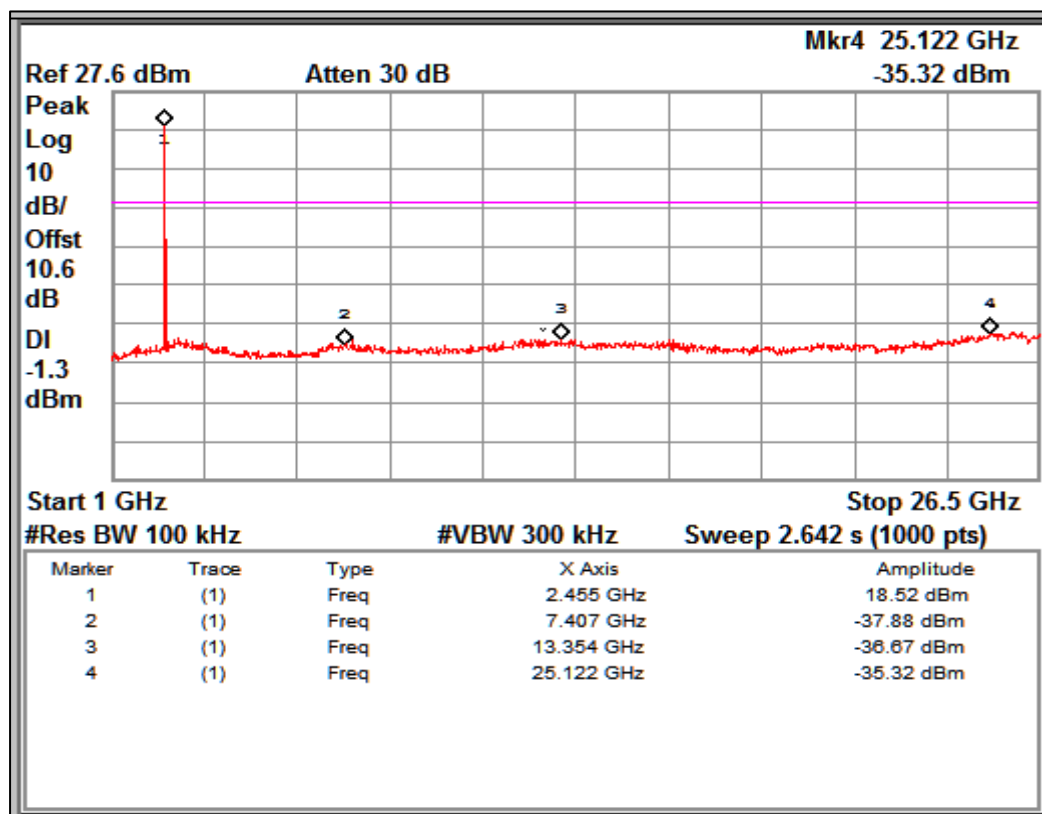
ULR-TC568822300000033F

Seite 43 von 96
Page 43 of 96



Channel Frequency 2442.5MHz

Frequency Range 30MHz – 1GHz



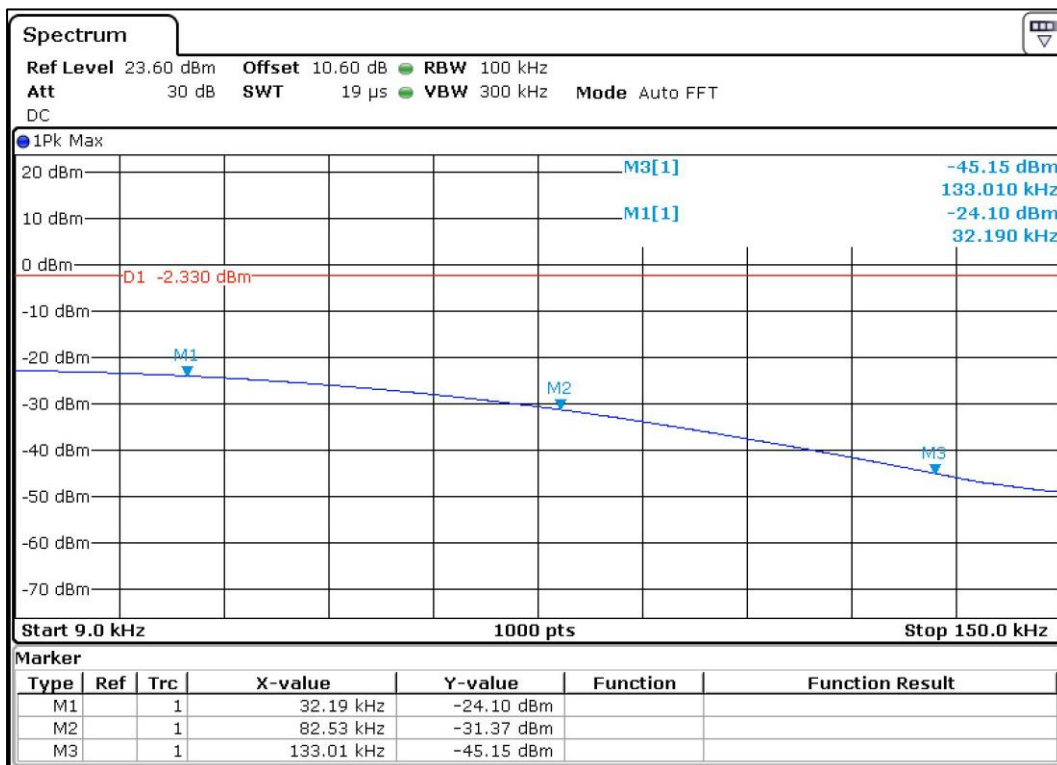
Channel Frequency 2442.5MHz

Frequency Range 1GHz – 26GHz

Prüfbericht - Nr.:
Test Report No.:

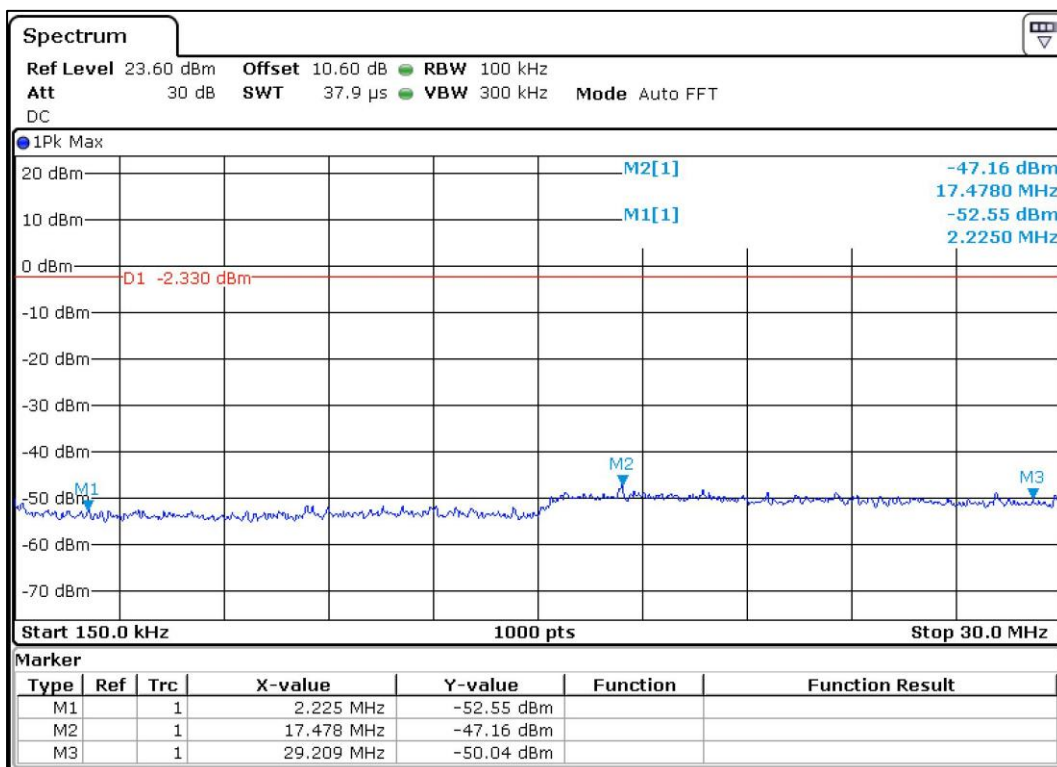
ULR-TC568822300000033F

Seite 44 von 96
Page 44 of 96



Channel Frequency 2477.5MHz

Frequency Range 9KHz – 150KHz



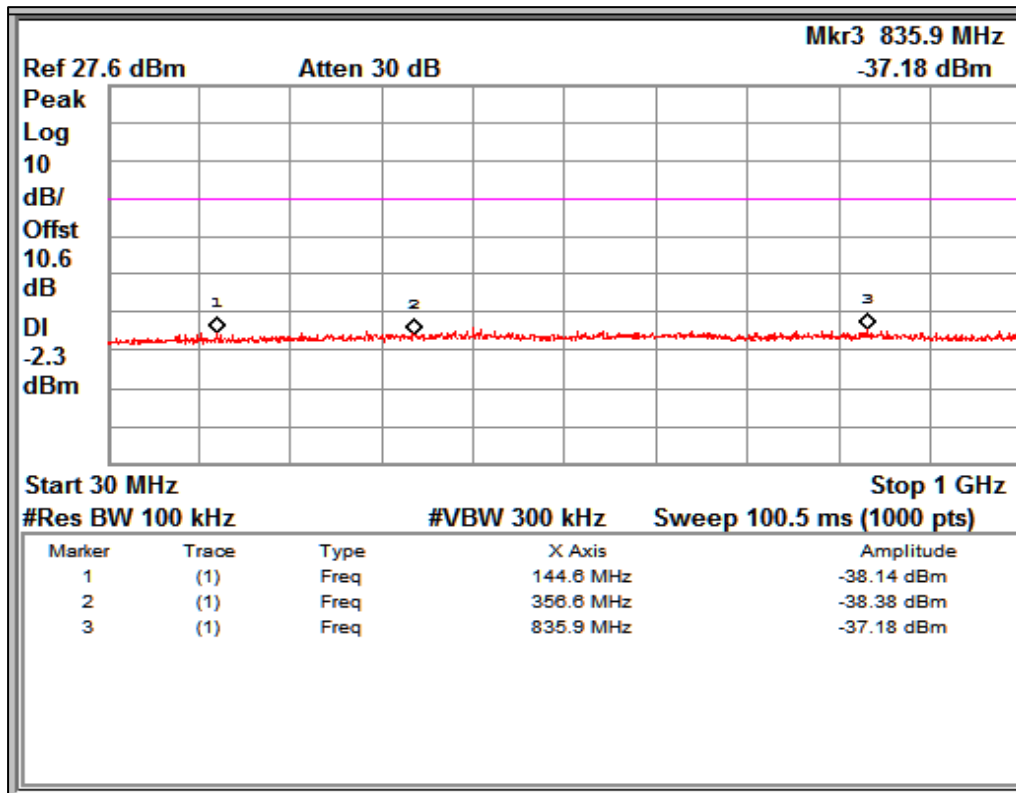
Channel Frequency 2477.5MHz

Frequency Range 150KHz – 30MHz

Prüfbericht - Nr.:
Test Report No.:

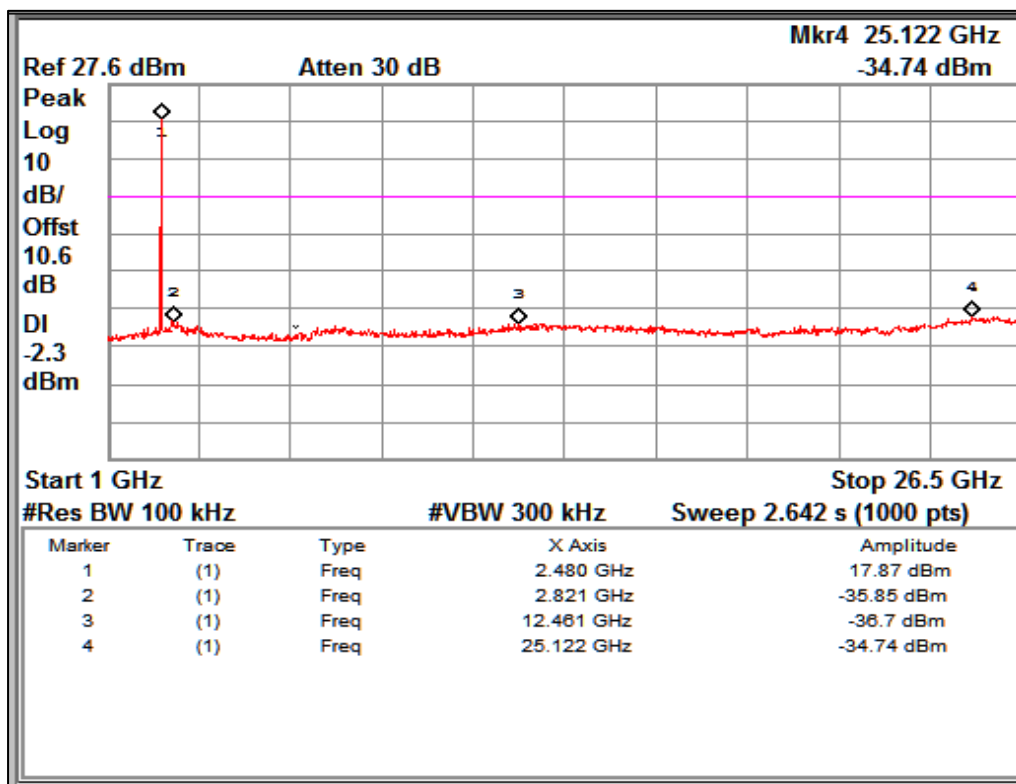
ULR-TC568822300000033F

Seite 45 von 96
Page 45 of 96



Channel Frequency 2477.5MHz

Frequency Range 30MHz – 1GHz



Channel Frequency 2477.5MHz

Frequency Range 1GHz – 26GHz

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 46 von 96
Page 46 of 96

8.7 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205) / IC RSS-GEN, Section 8.9 and 8.10
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 7 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) = + 22.6 °C

Voltage = 24V DC (AC - DC Adapter)

Relative humidity: 61%

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 47 von 96
Page 47 of 96

Test results:

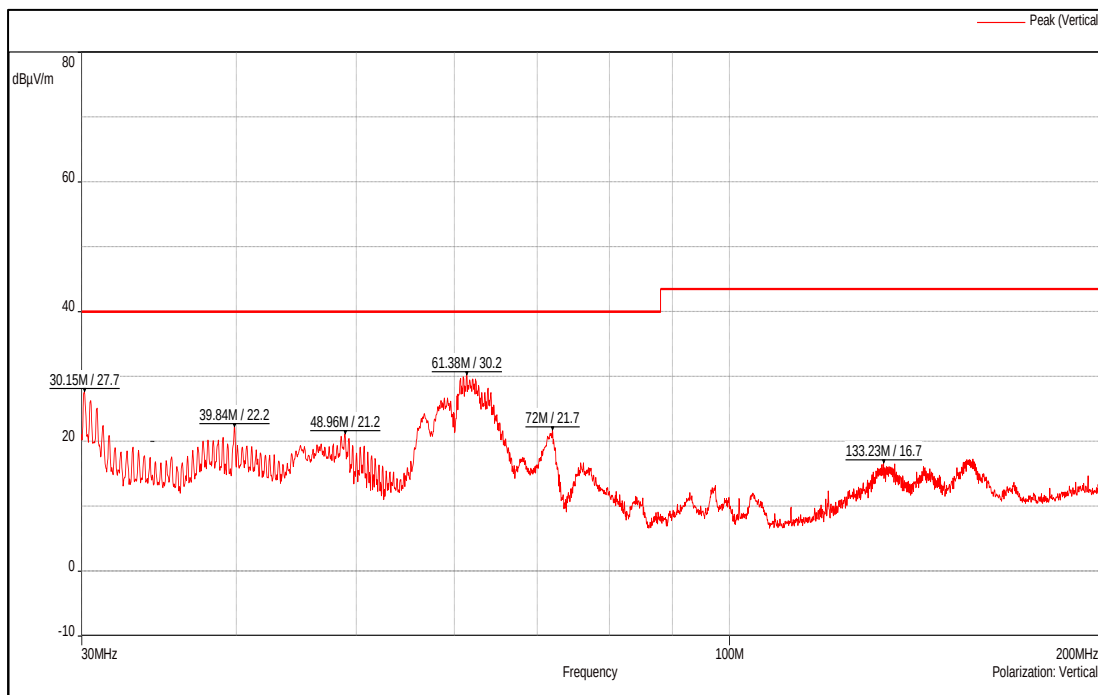
Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details

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	30.15	27.70	40.00	-12.30
	39.84	22.20	40.00	-17.80
	48.96	21.20	40.00	-18.80
	61.38	30.20	40.00	-9.80
	72.00	21.70	40.00	-18.30
	133.23	16.70	43.50	-26.80
Horizontal	63.87	19.80	40.00	-20.20
	72.03	16.90	40.00	-23.10
	133.56	13.50	43.50	-30.00
	168.00	13.30	43.50	-30.20



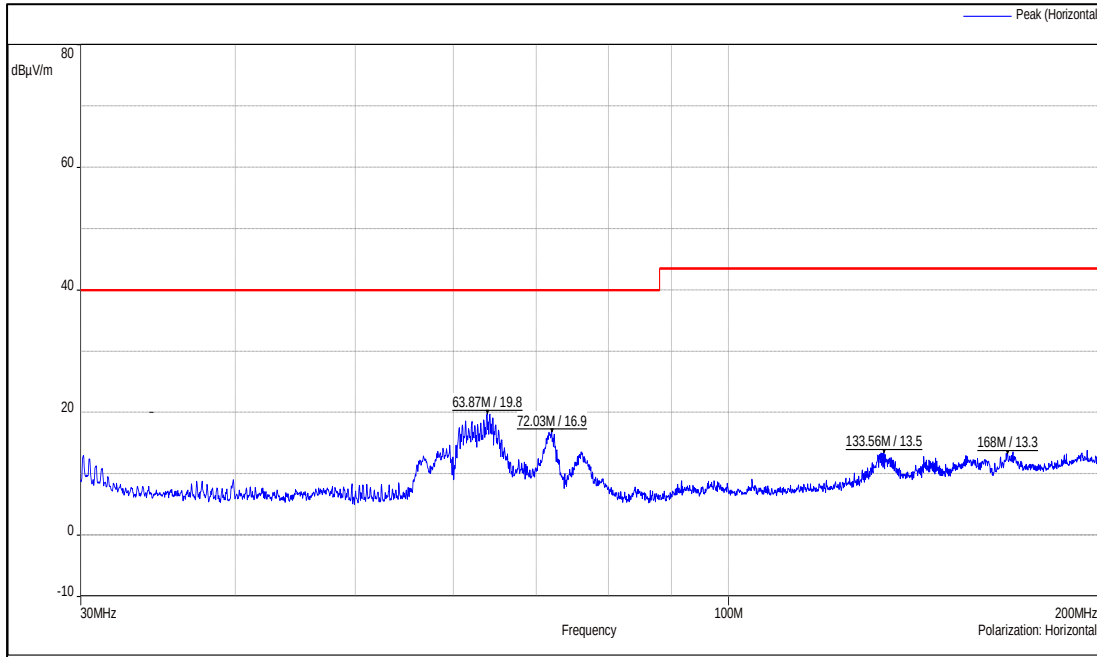
Channel Frequency 30MHz – 200MHz

Polarization Vertical

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 48 von 96
Page 48 of 96

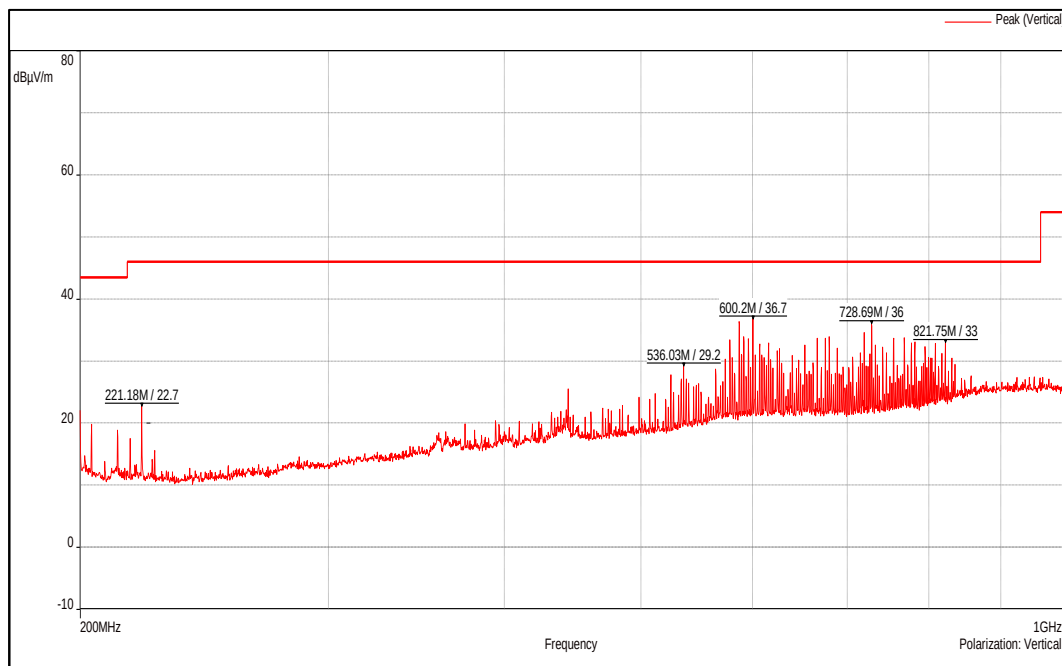


Channel Frequency 30MHz – 200MHz

Polarization Horizontal

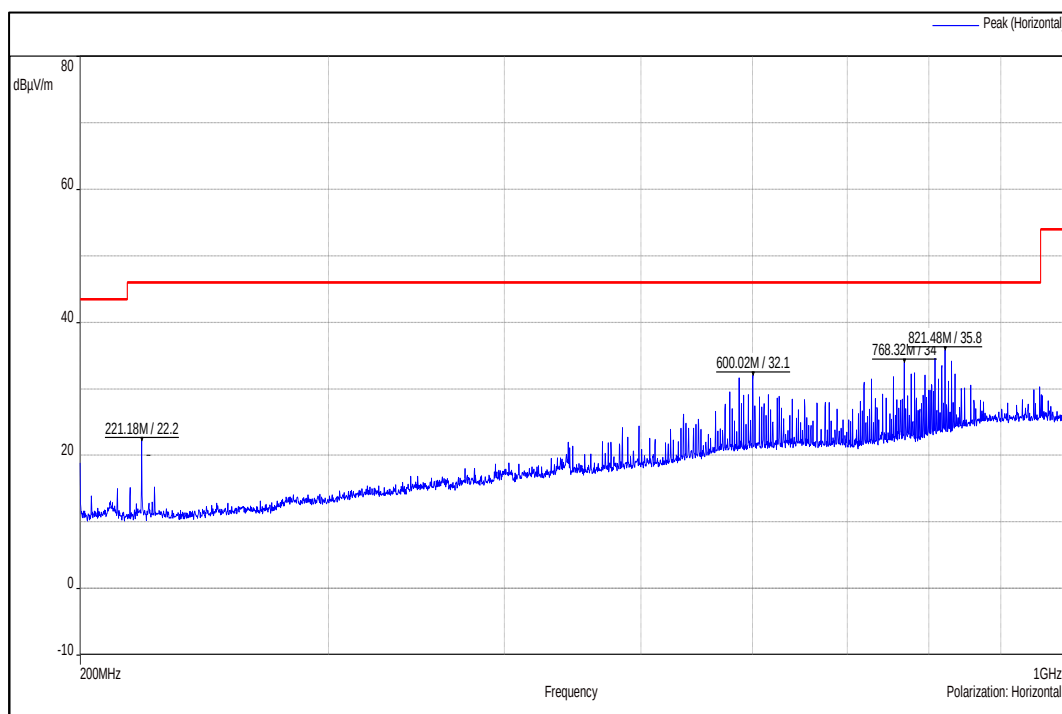
Table 8: Test results for frequency range 200MHz – 1GHz

Antenna Polarization	Measured Frequency (MHz)	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	221.18	22.70	46.00	-23.30
	536.03	29.20	46.00	-16.80
	600.20	36.70	46.00	-9.30
	728.69	36.00	46.00	-10.00
	821.75	33.00	46.00	-13.00
Horizontal	221.18	22.20	46.00	-23.80
	600.02	32.10	46.00	-13.90
	768.32	34.00	46.00	-12.00
	821.48	35.80	46.00	-10.20



Channel Frequency 200MHz – 1GHz

Polarization Vertical



Channel Frequency 200MHz – 1GHz

Polarization Horizontal

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568822300000033F

Seite 50 von 96
Page 50 of 96

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

AIR-ANT2480V-N:

Channel Frequency (MHz)	Frequency (MHz)	Polarization	Measured Emission (dBμV/m)	Limit (dBm)	Margin (dB)
2405	2405(Pk)	Vertical	115.64	-	-
	2405(Av)		115.64	-	-
	2390(Pk)		54.74	74*	-19.26
	2390(Av)		42.13	54*	-11.87
	4810(Pk)		42.10	74	-31.90
	4810(Av)		32.51	54	-21.49
	7215(Pk)		47.33	74	-26.67
	7215(Av)		36.38	54	-17.62
	2405(Pk)	Horizontal	97.91	-	-
	2405(Av)		97.86	-	-
	2390(Pk)		38.69	74*	-35.31
	2390(Av)		26.68	54*	-27.32
	4810(Pk)		41.98	74	-32.02
	4810(Av)		32.01	54	-21.99
	7215(Pk)		47.67	74	-26.33
	7215(Av)		35.55	54	-18.45
2442.5	2442.5(Pk)	Vertical	117.55	-	-
	2442.5(Av)		117.55	-	-
	4885(Pk)		43.46	74	-30.54
	4885(Av)		35.65	54	-18.35
	7327.5(Pk)		47.26	74	-26.74
	7327.5(Av)		39.36	54	-14.64
	2442.5(Pk)	Horizontal	98.76	-	-
	2442.5(Av)		98.76	-	-
	4885(Pk)		43.77	74	-30.23
	4885(Av)		32.74	54	-21.26
	7327.5(Pk)		47.94	74	-26.06
	7327.5(Av)		39.70	54	-14.30
2477.5	2483.5(Pk)	Vertical	115.44	-	-
	2483.5(Av)		115.41	-	-
	2477.5(Pk)		61.84	74*	-12.16
	2477.5(Av)		49.88	54*	-4.12
	4955(Pk)		42.77	74	-31.23
	4955(Av)		34.55	54	-19.45
	7432.5(Pk)		49.30	74	-24.70
	7432.5(Av)		39.41	54	-14.59
	2483.5(Pk)	Horizontal	99.87	-	-
	2483.5(Av)		99.83	-	-
	2477.5(Pk)		46.70	74*	-27.30
	2477.5(Av)		34.97	54*	-19.03
	4955(Pk)		30.92	74	-43.08
	4955(Av)		41.79	54	-12.21
	7432.5(Pk)		35.77	74	-38.23
	7432.5(Av)		47.10	54	-6.90

Pk: Peak Detector;
Av: Average Detector;
*→ Restricted Bands
- → Fundamental Frequency