

Prüfbericht - Nr.: ULR-TC568819300000048F 001		Seite 1 von 27 <i>Page 1 of 27</i>
<i>Test Report No.:</i>		
Auftraggeber: <i>Client:</i>	The Kroger Co 11450 Grooms Rd. Blue Ash, OH 45242, United States Phone Number : (513) 417-0926	
Gegenstand der Prüfung: <i>Test item:</i>	G2 Zooter ZigBee/2.4GHz and IEEE-802.15.4 Access Point Unit	
Bezeichnung: <i>Identification:</i>	G2Z-NCZGBAP	Serien-Nr.: Engineering sample <i>Serial No.</i>
Wareneingangs-Nr.: <i>Receipt No.:</i>	166153788	Eingangsdatum: 09-07-2019 <i>Date of receipt:</i>
Prüfart: <i>Testing location:</i>	Refer Page 5 of 27 for Test site details	
Prüfgrundlage: <i>Test specification:</i>	FCC Part 15 Subpart C - 15.247 & ANSI C63.10-2013 & RSS 247 Issue 2	
Prüfergebnis: <i>Test Result:</i>	Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test items passed the test specification(s).</i>	
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd. 27/B, 2nd Cross, Electronic City , Phase 1 Bangalore – 560 100, Karnataka FCC Test Site Registration no.: 496599 & ISED Test Site number.: 3466E-1	
geprüft / tested by:		kontrolliert / reviewed by:
10.07.2019 Srinivasa B R Datum Name/Stellung Unterschrift Date Name/Position Signature		06.08.2019 Mahammadgouse Kaladagi Datum Name/Stellung Unterschrift Date Name/Position Signature
Sonstiges / Other Aspects: FCC ID: PBR-SZG2ZBNCR1 IC ID: 24718-SZG2ZBNCR1 On receipt the equipment was in good condition		
Abkürzungen: P(ass) = entspricht Prüfgrundlage F(ail) = entspricht nicht Prüfgrundlage N/A = nicht anwendbar N/T = nicht getestet		
Abbreviations: P(ass) = passed F(ail) = failed N/A = not applicable 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 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 safety mark on this or similar products.</i>		

TÜV Rheinland (India) Pvt.Ltd., 27/B, 2nd Cross, Electronic City , Phase 1 Bangalore – 560 100, Karnataka
Tel : +91- 80- 46498110/8000Fax: +91 - 80- 46498042

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568819300000048F 001

Seite 2 von 27
Page 2 of 27

TEST SUMMARY

Test Item	FCC Clause	IC Clause	Result	Remarks
Maximum Peak Conducted Output Power	Section 15.247(b) (3)	RSS 247 Issue 2, section 5.4 (d)	Pass*	G2 Zooter ZigBee/2.4GHz and IEEE-802.15.4 Access Point Unit contains FCC & IC certified radio modules; hence, antenna port measurements are excluded. Refer FCC IDs and IC IDs of the radio modules listed in the below table.
Spurious Radiated Emissions and Restricted Bands of Operation	Section 15.209 / 15.205	RSS- Gen Issue 5 Section 8.9/8.10	Pass	
Conducted emission on A.C power lines	FCC Part 15.107	ICES Issue 6 Section 6.1	NA	

* -> RF power verified

NA -> Not Applicable, as DUT will power on over PoE. And the PoE adaptor is not supplied with the product.

G2 Zooter ZigBee/2.4GHz and IEEE-802.15.4 Access Point Unit has integrated with following certified radio modules:

SI No.	Radio Protocol	FCC ID	IC ID	Tested By
1	CC2530 ZigBee module	PBR-SZMDLNR1	24718-SZMDLNR1	TUV Rheinland India
2	CC2530 ZigBee module	PBR-SZMDLNR1	24718-SZMDLNR1	TUV Rheinland India
3	CC2538 -CC2592 ZigBee Module	PBR-SZMDLM3BR1	24718-SZMDLM3BR1	TUV Rheinland India
4	CC2538 -CC2592 ZigBee Module	PBR-SZMDLM3BR1	24718-SZMDLM3BR1	TUV Rheinland India

Product Category: Electronics Testing
Test Discipline: EMC Test Facility

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568819300000048F 001

Seite 3 von 27
Page 3 of 27

Table of Contents

1	GENERAL REMARKS	4
1.1	Complimentary Materials	4
2	TEST SITES	5
2.1	Testing Facilities.....	5
2.2	List of Test and Measurement Instruments.....	5
3	GENERAL PRODUCT INFORMATION.....	6
3.1	Product Function and Intended Use.....	6
3.2	Ratings and System Details	6
3.3	Antenna details.....	6
3.4	Power level setting used for testing	7
3.5	Measurement Uncertainty:	7
4	OPERATIONAL DESCRIPTIONS	8
5	TEST SET-UP AND OPERATION MODE.....	8
5.1	Principle of Configuration Selection	8
5.2	Test Operation and Test Software	8
5.3	Special Accessories and Auxiliary Equipment	8
5.4	Countermeasures to achieve EMC Compliance	8
5.5	Test modes – data rates and modulations.....	8
5.6	List of frequencies	9
6	TEST METHODOLOGY	10
6.1	Radiated Emission Test	10
6.1.1	Test Setup Configuration	10
7	TEST RESULTS	12
7.1	Maximum Peak Conducted Output Power.....	12
7.2	Spurious Radiated Emissions & Restricted Bands of Operation	20
8	LIST OF TABLES.....	27

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 4 von 27

Page 4 of 27

1 GENERAL REMARKS

1.1 Complimentary Materials

All attachments are integral part of this test report. This applies especially to the following items.

- 1:** TEST SETUP PHOTOS
- 2:** EUT EXTERNAL PHOTOS
- 3:** EUT INTERNAL PHOTOS
- 4:** FCC LABEL AND LABEL LOCATION
- 5:** BLOCK DIAGRAM
- 6:** SPECIFICATION OF EUT
- 7:** SCHEMATIC DIAGRAM
- 8:** BILL OF MATERIAL
- 9:** USER MANUAL
- 10:** MAXIMUM PERMISSIBLE EXPOSURE INFORMATION

2 TEST SITES

2.1 Testing Facilities

TÜV Rheinland (India) Pvt.Ltd.,
27/B, 2nd Cross,
Electronic City , Phase 1
Bangalore – 560 100,

TUV Rheinland (India) Private Limited
108 , Beside ISBR Business School,
Electronic city Phase I
Bangalore - 560 100.

2.2 List of Test and Measurement Instruments

Table 1: List of test and measurement instruments

Equipment	Manufacturer	Model Name	Serial Number	Calibration Due Date	Periodicity	Used for Test Items
Spectrum Analyser	Agilent Technologies	E4407B	US41192772	15.11.2019	Yearly	Antenna - Port Measurements
USB Peak power sensor	AIMIL Ltd	55006	10231	22.12.2019	Yearly	
EMI Test Receiver	Rohde & Schwarz	ESU 40	100288	11.10.2019	Yearly	Radiated Spurious Emission
Rohde & Schwarz	Rohde & Schwarz	ESW 44	101773	19.09.2019	Yearly	
Active loop antenna	Frankonia	LAX-10	LAX-10-800	15.01.2020	Yearly	
Biconical Antenna	Schwarzbeck mess-elektronik	VHBB-9124 / BBA-9106	9124-656	16.01.2020	Yearly	
Log-Periodic Antenna	Schwarzbeck mess-elektronik	VUSLP-9111B	9111B-111	17.01.2020	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-1944	16.01.2020	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA 9170-0904	21.01.2020	Yearly	
3m Fully Anechoic Chamber	Albatross	-	-	-	-	
10m Semi Anechoic Chamber	Frankonia	-	-	-	-	

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

G2Z-NCZGBAP has four ZigBee/2.4GHz and IEEE-802.15.4 modules mounted on it. These ZigBee/2.4GHz and IEEE-802.15.4 Modules are used for wireless data communication with other ZigBee/2.4GHz and IEEE-802.15.4 devices. It also has Ethernet interface for LAN connectivity. It is used as wired and wireless access point.

3.2 Ratings and System Details

Table 2: Ratings and System Details as declared by manufacturer

Operating Frequency Range	2400 MHz – 2483.5 MHz
No. of Channel	16 (channel no 11 to 26)
RF output power	Refer table 4
Radio Protocol	IEEE 802.15.4 and ZigBee/2.4GHz Connectivity (Using ZigBee Modules - 4 Nos)
Supporting Data Rate	250 Kbps (all 4 modules support same data rate)
Modulation	DSSS
Channel Spacing	5MHz
Number of antennas	4
Antenna Gain & Type	Refer table 3
Supply Voltage to Product	Power over Ethernet (PoE):+48 VDC in PoE mode (as Par 802.3 af)
Environmental conditions	Opearting temperature is 5 °C to 40 °C
Dimensions (LxWxH)	179mm X179mm X30mm

3.3 Antenna details

Table 3: Antenna gain details

Module name	Antenna name	Gain (dBi)
CC2530 ZigBee module	Inverted F PCB 1.6mm Bd	2
CC2530 ZigBee module	Inverted F PCB 1.6mm Bd	2
CC2538 -CC2592 ZigBee module	Inverted F PCB 1.6mm Bd	3.27
CC2538 -CC2592 ZigBee module	Inverted F PCB 1.6mm Bd	3.27

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568819300000048F 001

Seite 7 von 27
Page 7 of 27

3.4 Power level setting used for testing

Table 4: Modules power level used

Module name	Channel number	Transmitter Power level setting used (dBm)
CC2530 ZigBee module	11 to 26	4.5
CC2530 ZigBee module	11 to 26	4.5
CC2538 -CC2592 ZigBee module	11 to 25	16
	26	13
CC2538 -CC2592 ZigBee module	11 to 25	16
	26	13

3.5 Measurement Uncertainty:

Table 5: Measurement Uncertainty

Parameter		Uncertainty
RF output power, PSD		±1.5 dB
All emissions, radiated in Semi Anechoic Chamber		±6 dB
All emissions, radiated in Fully Anechoic Chamber	1 GHz to 6 GHz	±5.18 dB
	6 GHz to 18 GHz	±5.48 dB
All emissions, conducted		±3 dB
Temperature		±3 °C
Supply Voltages		±3 %
Time		±5 %
Radio frequency		±0.5 ppm

Note: The test results reported in this test report are exclusive of maximum uncertainty value, and are not used to determine pass / fail criteria. Above table gives maximum uncertainty value with 95% confidence level.

4 OPERATIONAL DESCRIPTIONS

G2Z-NCZGBAP is a PoE powered Access Point. G2Z-NCZGBAP can perform data transfer over the air using On-Board ZigBee/2.4GHz and IEEE-802.15.4 modules inside ZigBee/2.4GHz and IEEE-802.15.4 network and also can transfers data through Ethernet. Thus, it can be used as a wired as well wireless access point. The product contains four ZigBee/2.4GHz and IEEE-802.15.4 Modules which can operate simultaneously on the same channel of operating frequency as per time division Multiplexing. Another mode of operation also includes operating at separate frequencies at same time. The transmitter output signals from the multiple modules are not correlated.

5 TEST SET-UP AND OPERATION MODE

5.1 Principle of Configuration Selection

- Transmission was enabled with the highest possible duty cycle on low, middle and highest operating channels to obtain maximum emissions.

5.2 Test Operation and Test Software

Module name	Software name	Software version	Hardware version
CC2530 ZigBee module	Chipconflash Utility	1	Rev C
CC2530 ZigBee module	Chipconflash Utility	1	Rev C
CC2538 -CC2592 ZigBee module	Smart RF Flashprogrammer 2	1.7.5	Rev C
CC2538 -CC2592 ZigBee module	Smart RF Flashprogrammer 2	1.7.5	Rev C

5.3 Special Accessories and Auxiliary Equipment

- Test laptop was used to configure the RF module and product was tested for PoE power supply.

5.4 Countermeasures to achieve EMC Compliance

- None

5.5 Test modes – data rates and modulations

- For Radiated spurious emissions only the worst case results i.e the emissions with less margin are reported in this report.

5.6 List of frequencies

Table 6: List of Center Frequencies

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
2400 – 2483.5	11	2405
	12	2410
	13	2415
	14	2420
	15	2425
	16	2430
	17	2435
	18	2440
	19	2445
	20	2450
	21	2455
	22	2460
	23	2465
	24	2470
	25	2475
	26	2480

TUV Sample Identification number : A000954823-002 (Conducted measurement)
A000954823-001 (Radiated measurement)

6 TEST METHODOLOGY

6.1 Radiated Emission Test

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

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

6.1.1 Test Setup Configuration

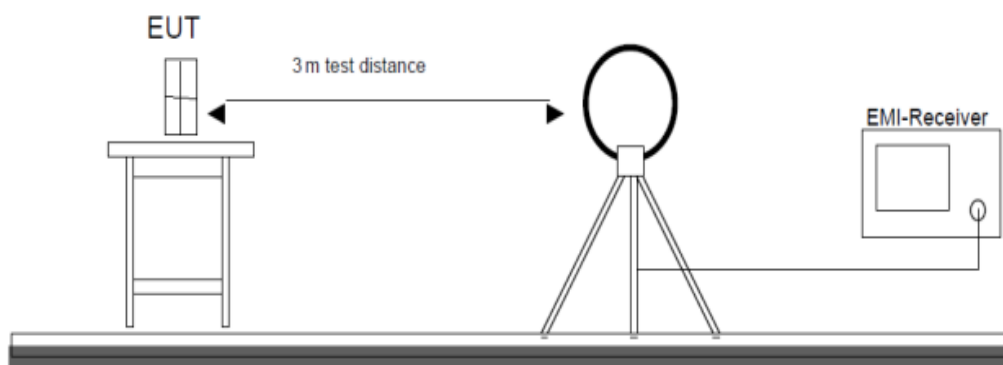


Figure 1: Frequency Range for 9 kHz- 30 MHz

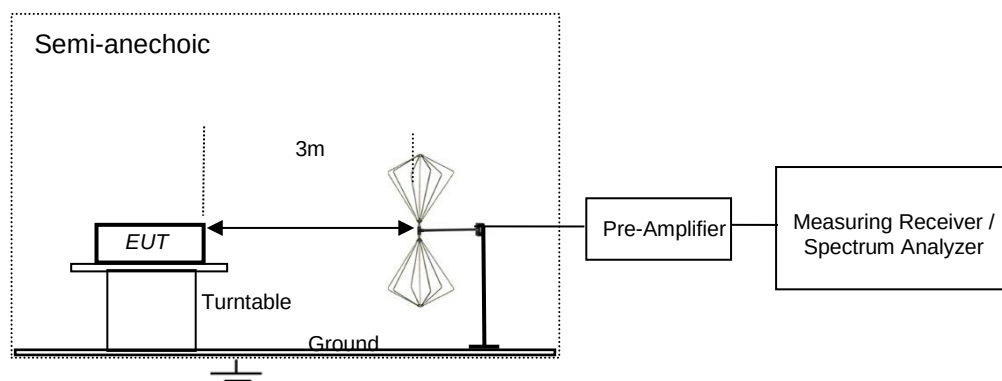


Figure 2: Frequency Range for 30 MHz – 200 MHz

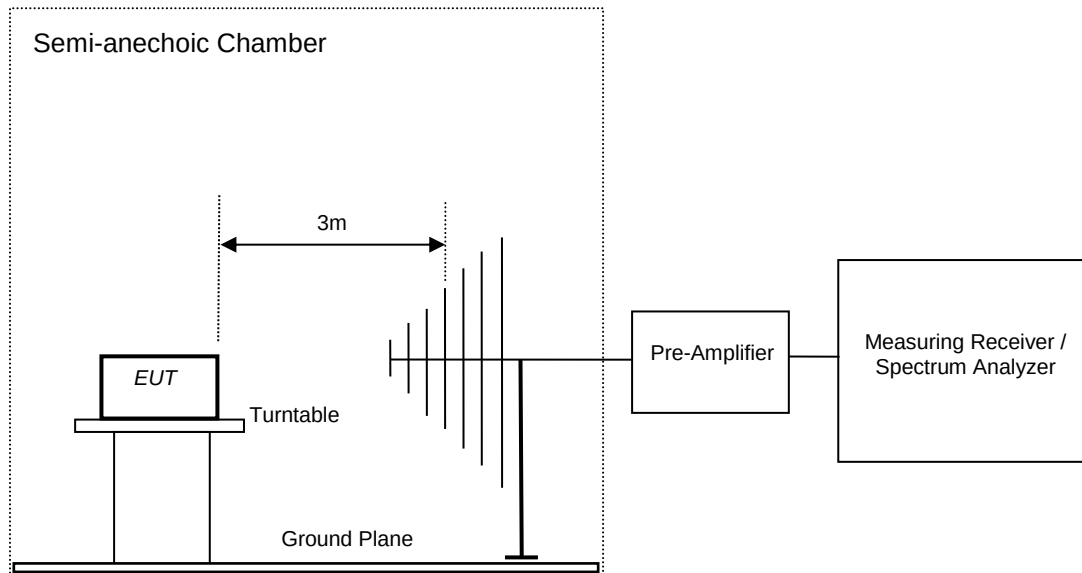


Figure 3: Frequency Range for 200 MHz - 1GHz

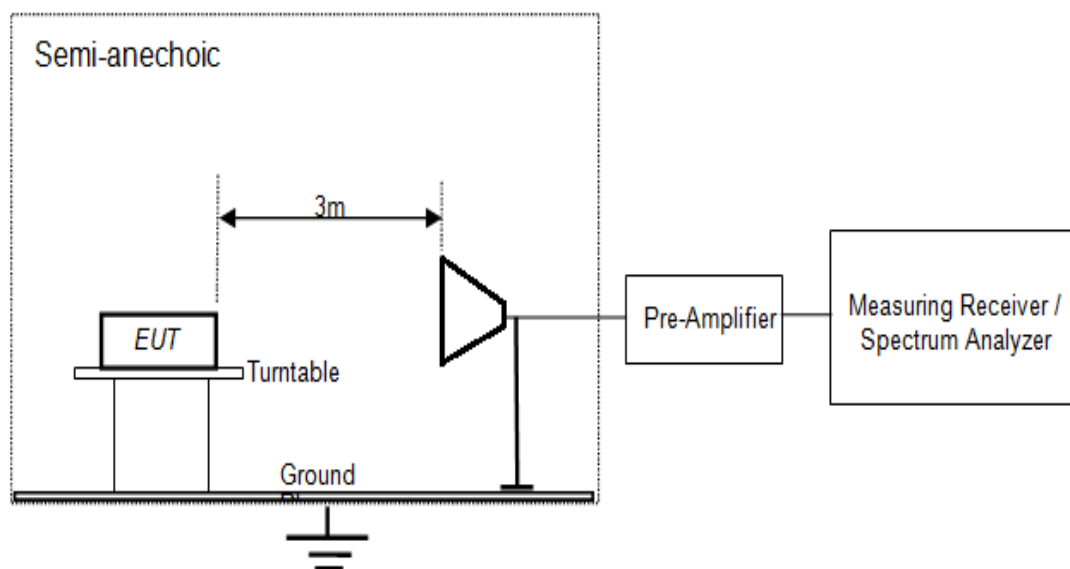


Figure 4: Frequency Range for above 1 GHz

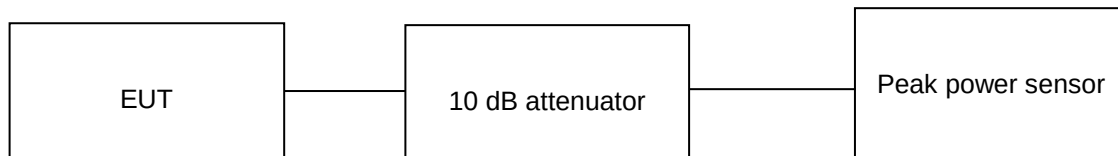
7 TEST RESULTS

7.1 Maximum Peak Conducted Output Power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3) and RSS 247 Issue 2, section 5.4 (d).
Measurement Bandwidth	1 MHz
Detector	Peak
Requirement	$\leq 1 \text{ W (30 dBm)}$



Environmental conditions:

Temperature (Norm) = + 22.3 °C

RH= 68.3 %

Test results:

Note:

Measurements were made as per KDB 558074 D01 DTS Measurement Guidance v05r02.

10 dB attenuator + 0.8 dB Cable loss = 10.8 dB offset is considered in below results

Table 7: Maximum peak conducted output power test results

Data rate (Kbps)	Module name	Channel Frequency (MHz)	Peak power (dBm)	Limit (dBm)	Margin (dB)
250	CC2530 ZigBee module	2405	3.96	30	-26.04
		2440	3.72	30	-26.28
		2480	2.61	30	-27.39
250	CC2530 ZigBee module	2405	2.41	30	-27.59
		2440	2.23	30	-27.77
		2480	2.09	30	-27.91
250	CC2538 -CC2592 ZigBee module	2405	14.65	30	-15.35
		2440	13.41	30	-16.59
		2480	8.84	30	-21.16
250	CC2538 -CC2592 ZigBee module	2405	15.75	30	-14.25
		2440	14.74	30	-15.26
		2480	10.38	30	-19.62

Prüfbericht - Nr.:

Test Report No.:

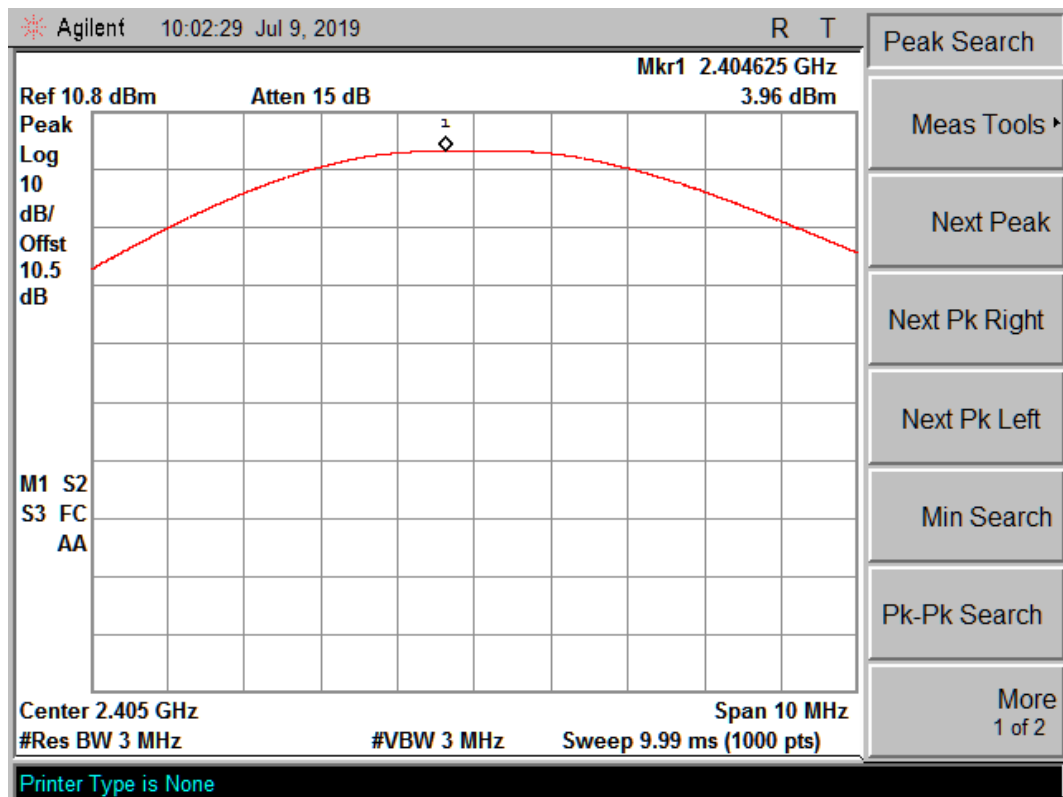
ULR-TC568819300000048F 001

Seite 13 von 27

Page 13 of 27

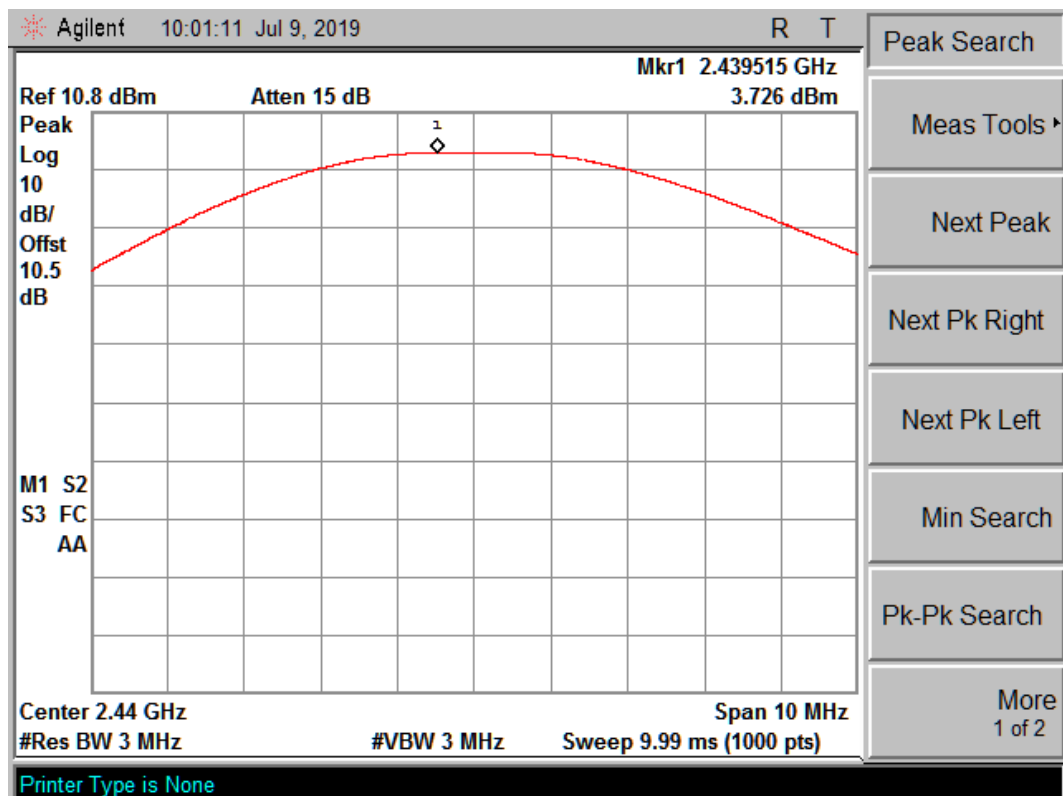
Test plots:

CC2530 ZigBee module



Data rate: 250 Kbps

Channel Low :2405MHz



Data rate: 250 Kbps

Channel Mid :2440MHz

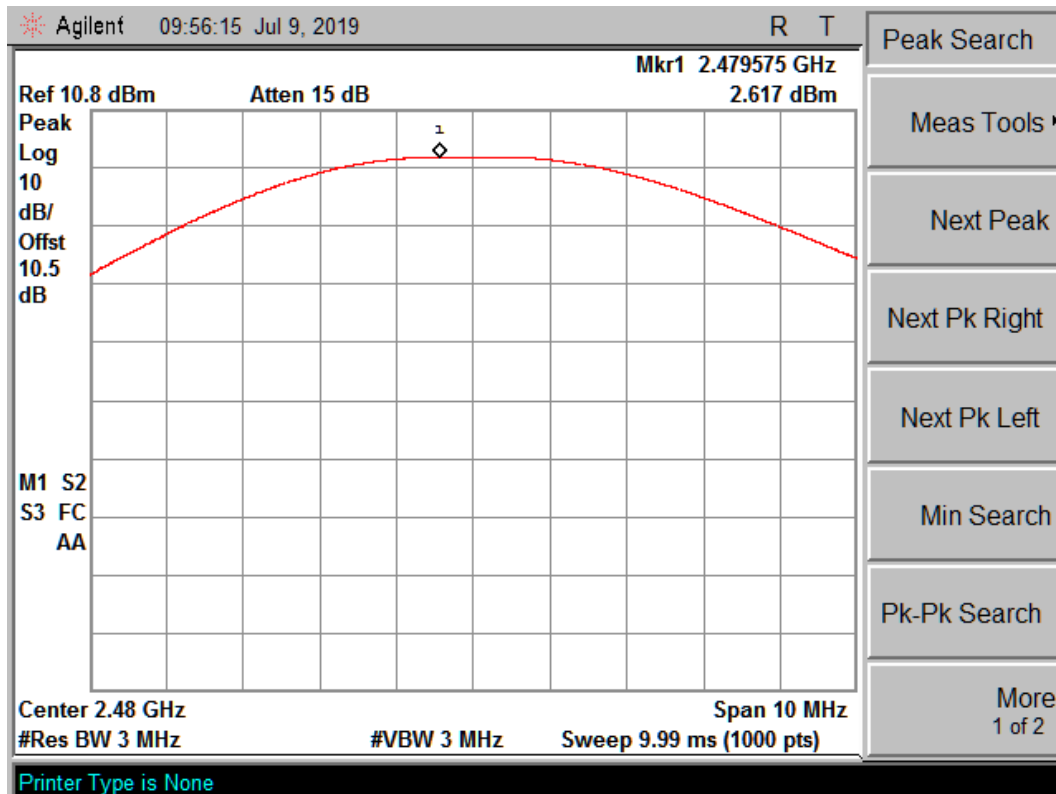
Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 14 von 27

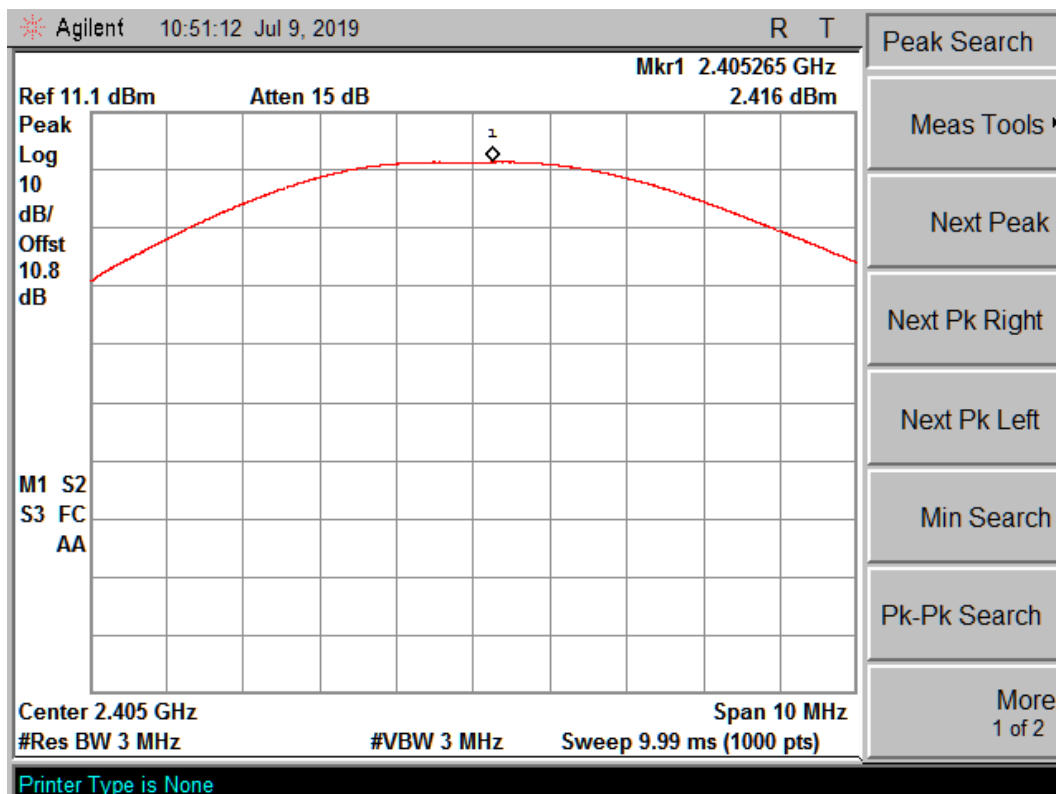
Page 14 of 27



Data rate: 250 Kbps

Channel Mid :2480MHz

CC2530 ZigBee module



Data rate: 250 Kbps

Channel Low :2405MHz

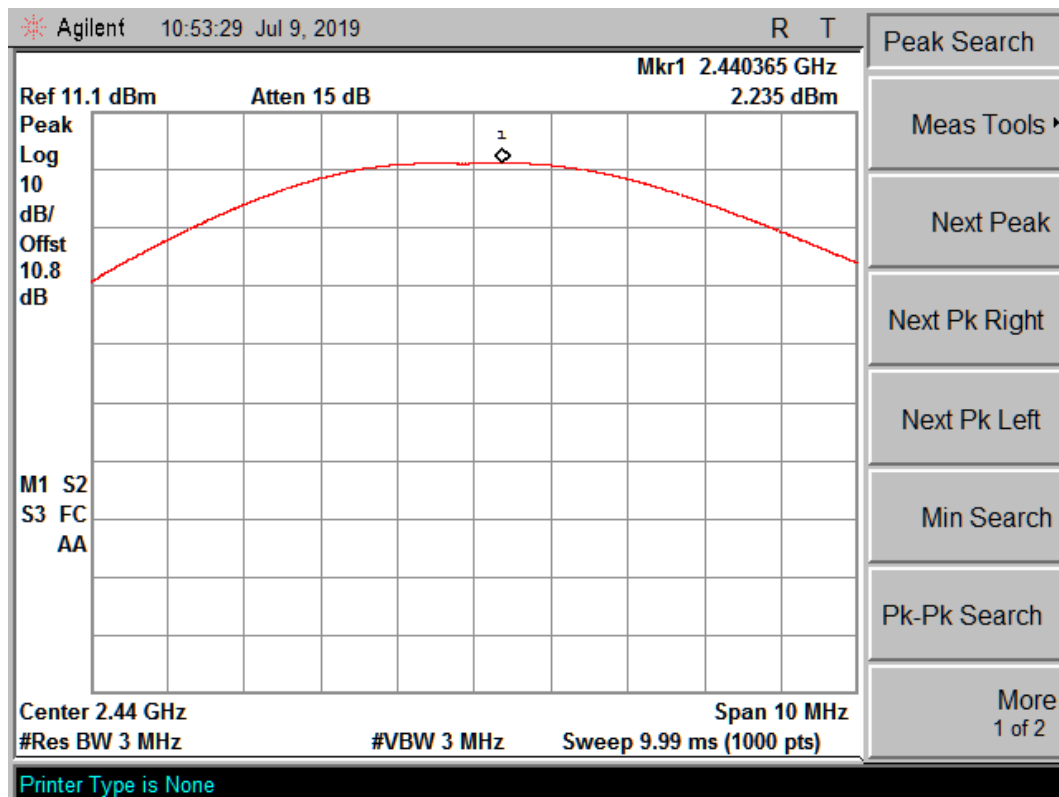
Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

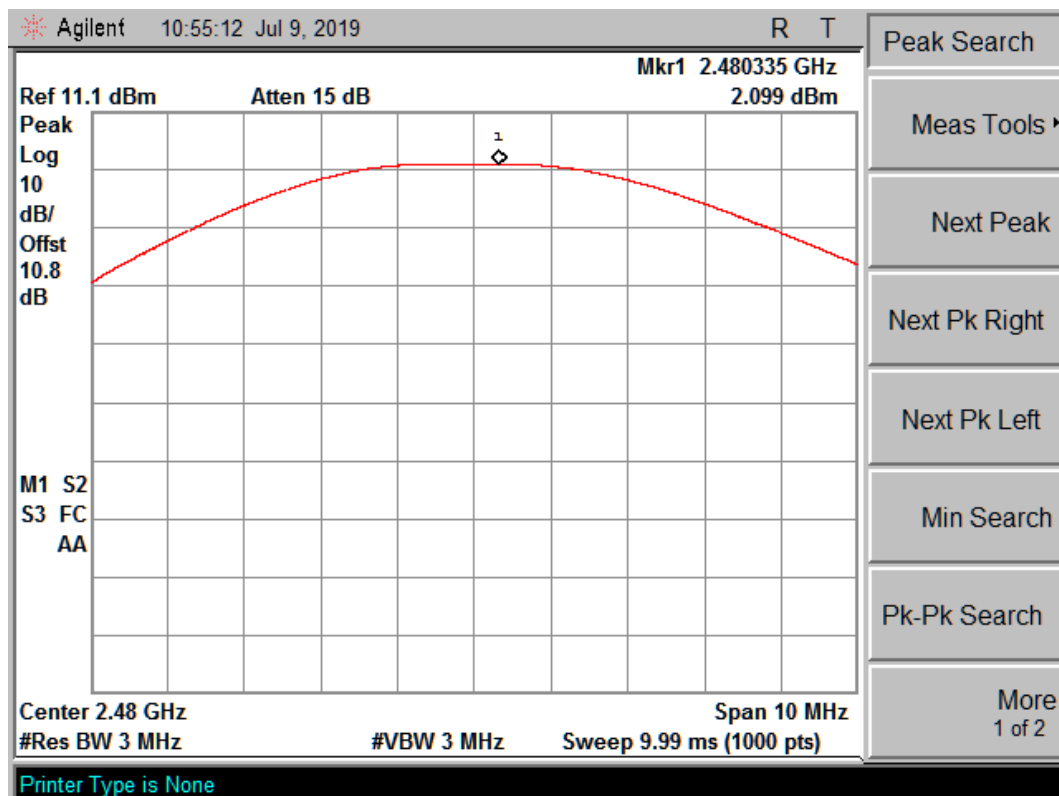
Seite 15 von 27

Page 15 of 27



Data rate: 250 Kbps

Channel Low :2440MHz



Data rate: 250 Kbps

Channel Low :2480MHz

Prüfbericht - Nr.:

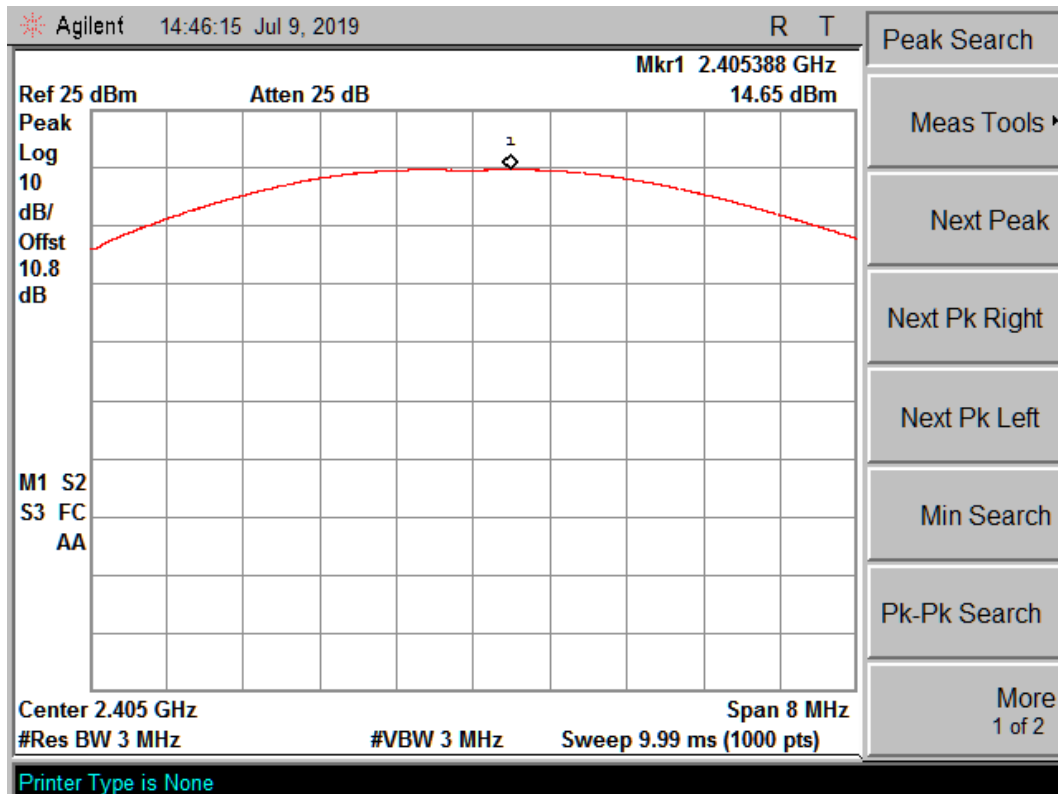
Test Report No.:

ULR-TC568819300000048F 001

Seite 16 von 27

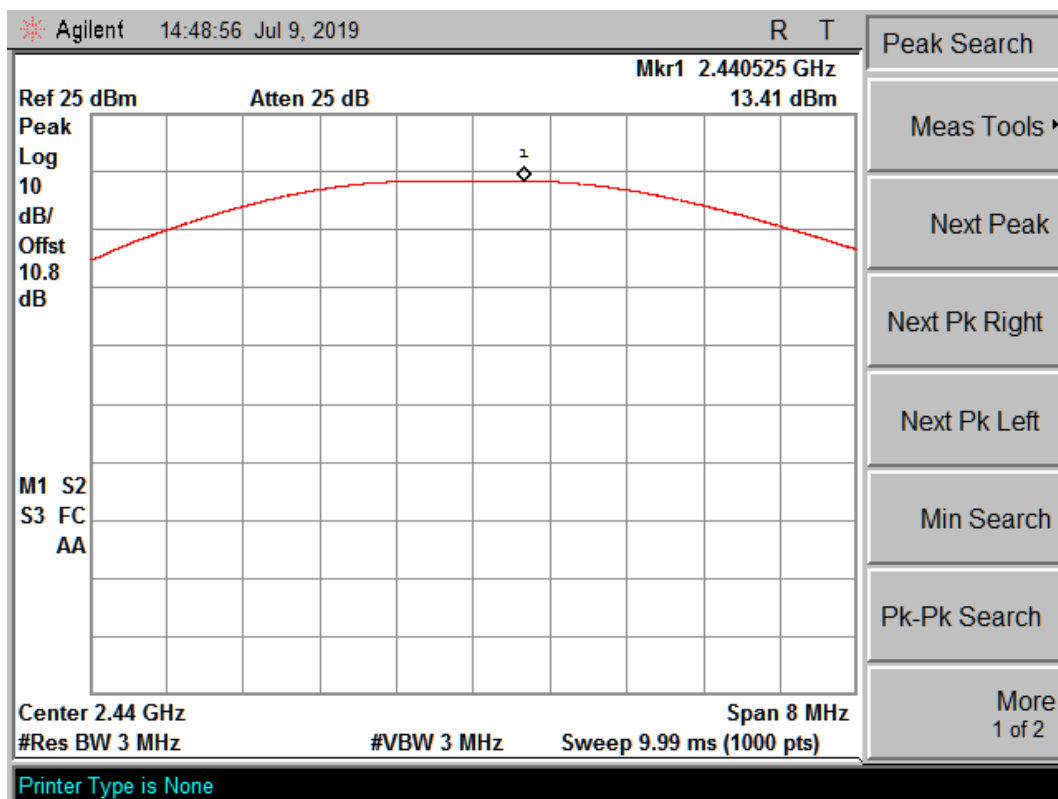
Page 16 of 27

CC2538 -CC2592 ZigBee module



Data rate: 250 Kbps

Channel Low :2405MHz



Data rate: 250 Kbps

Channel Low :2440MHz

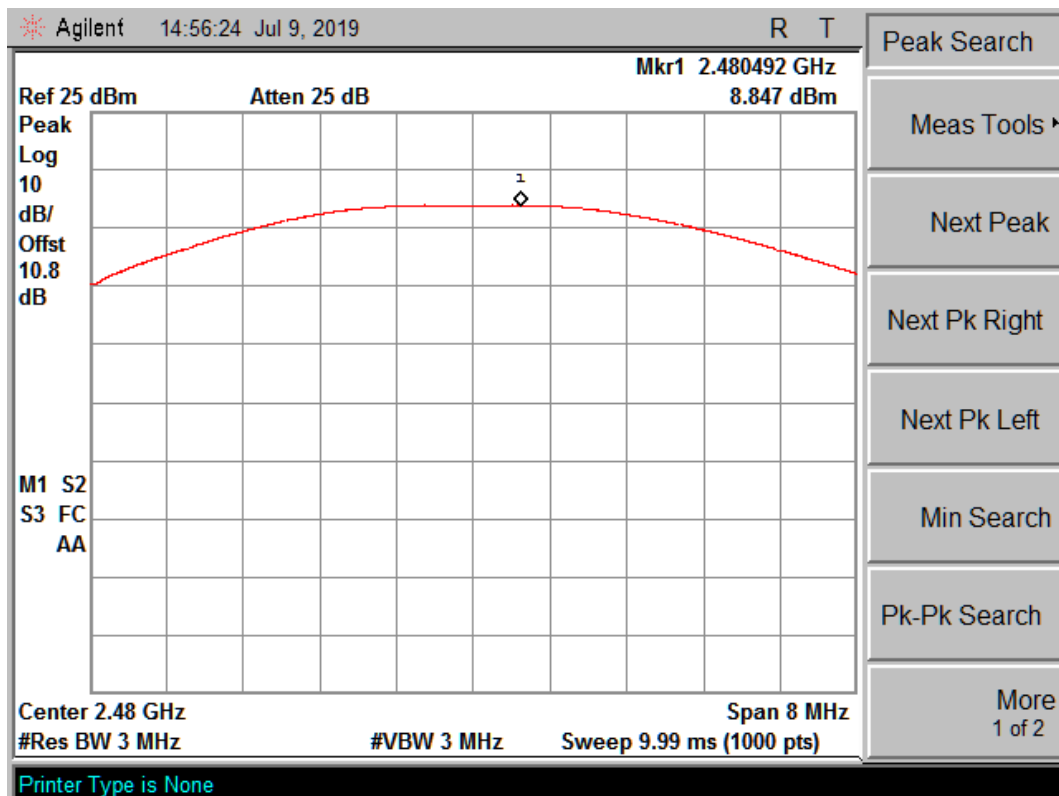
Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 17 von 27

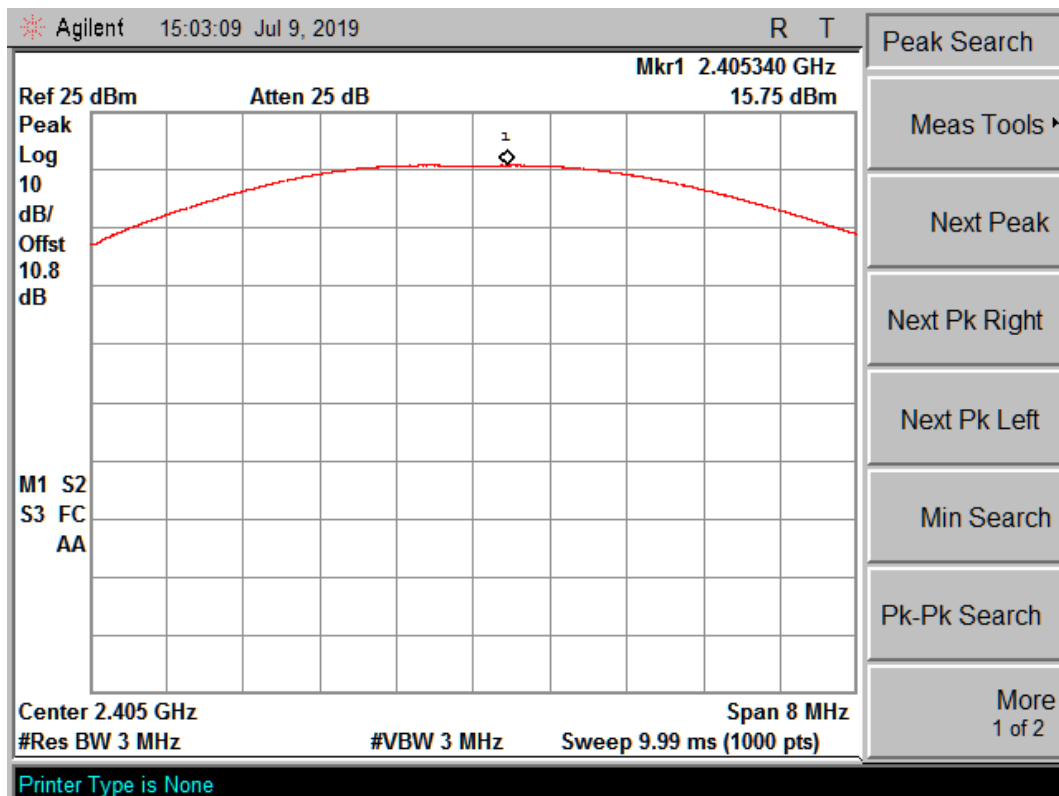
Page 17 of 27



Data rate: 250 Kbps

Channel Low :2480MHz

CC2538 -CC2592 ZigBee module



Data rate: 250 Kbps

Channel Low :2405MHz

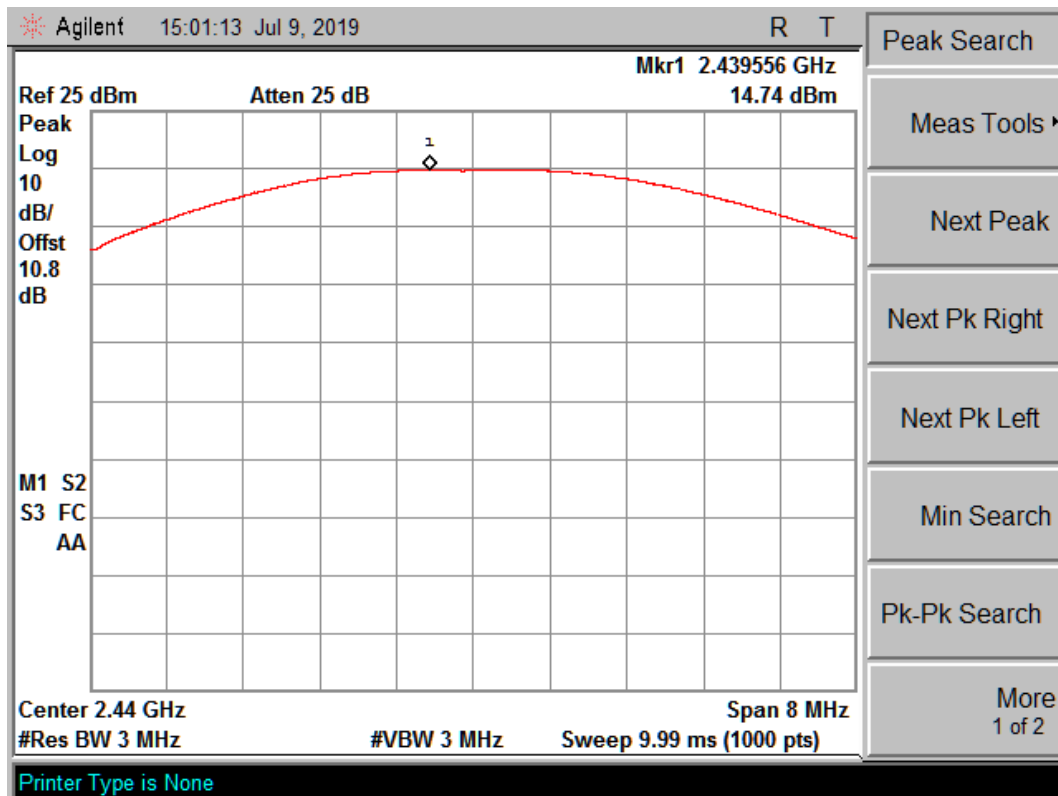
Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

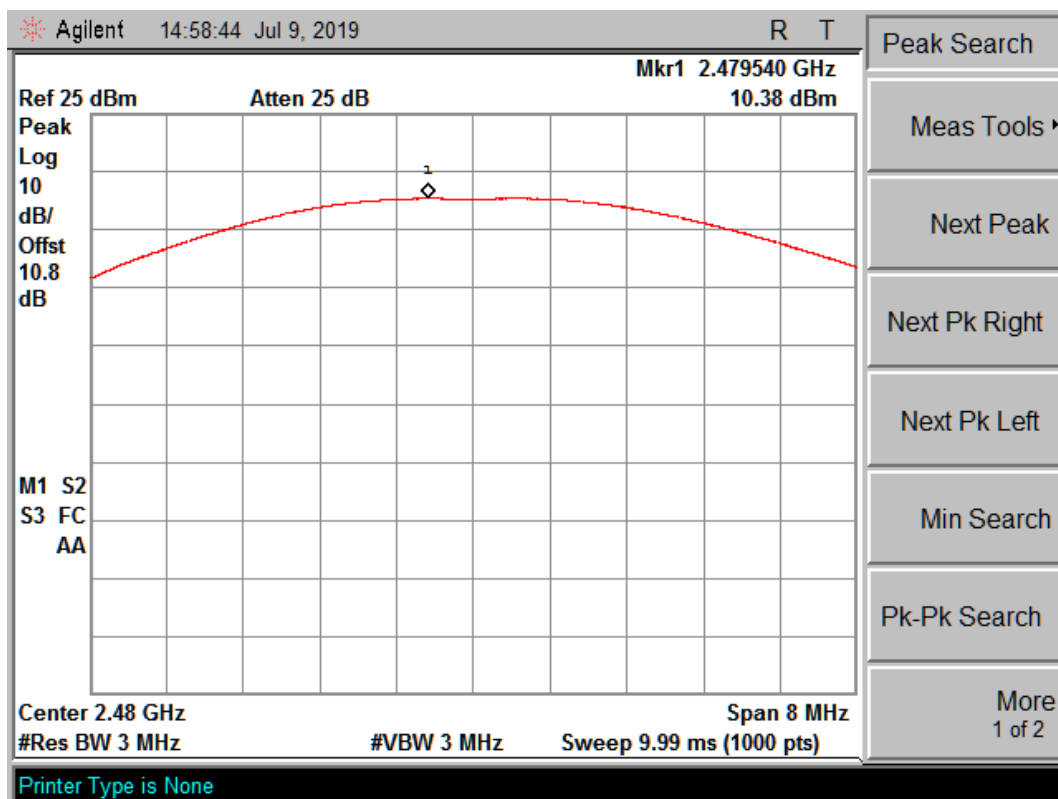
Seite 18 von 27

Page 18 of 27



Data rate: 250 Kbps

Channel Low :2440MHz



Data rate: 250 Kbps

Channel Low :2480MHz

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 19 von 27

Page 19 of 27

Table 8:Power table for simultaneous transmissions of the ZigBee modules

Channel frequency (MHz)	ZigBee (PBR-SZMDLNR1) mW	ZigBee (PBR-SZMDLNR1) mW	ZigBee (PBR-SZMDLM3BR1) mW	ZigBee (PBR-SZMDLM3BR1) mW	Sum mW	Sum dBm
2405	3.96	2.41	14.65	15.75	36.77	15.65
2440	3.72	2.23	13.41	14.74	34.10	15.32
2480	2.61	2.09	8.84	10.38	23.92	13.78

Maximum possible power value = 3.96 mW + 2.41 mW + 14.65 mW + 15.75 mW = 36.77 mW = 15.65 dBm

7.2 Spurious Radiated Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C Section 15.247 (d)/(15.209 & 15.205) and RSS- Gen Issue 5 Section 8.9/8.10
Test Method	ANSI C 63.10 - 2013
Measurement Location	Semi Anechoic Chamber < 1GHz Fully Anechoic Chamber > 1 GHz
Measuring Distance	3 m
Detector	QP for frequency below 1 GHz, average for frequency above 1 GHz
Requirement	As per the limits mentioned in the below table

Table 9: 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 and 30meter 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:

Supply Voltage: Voltage =110 VAC, 60Hz to PoE Adaptor

Environmental conditions:

Temperature: +23.5 °C RH: 58.3 %

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 21 von 27

Page 21 of 27

Test results:

Test results for frequencies in the range 9 KHz–30MHz

No emissions found in frequency range 9 kHz to 30 MHz

Table 10:Test results for frequencies in the range 30 MHz – 200MHz

Polarization	Measured Frequency (MHz)	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	30.02	31.49	40	-8.51
	30.57	33.22	40	-6.78
	55.89	28.84	40	-11.16
	81.20	27.46	40	-12.54
	98.48	27.61	43.5	-15.89
	125.00	24.2	43.5	-19.30
	141.37	24.85	43.5	-18.65
Horizontal	55.30	15.22	40	-24.78
	125.03	23.48	43.5	-20.02

Table 11:Test results for frequencies in the range 200 MHz – 1GHz

Polarization	Measured Frequency (MHz)	Measured Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	210.74	21.22	43.5	-22.28
	250.00	34.03	46	-11.97
	374.98	27.34	46	-18.66
	424.96	22.99	46	-23.01
	499.97	31.41	46	-14.59
Horizontal	214.64	25.42	43.5	-18.08
	250.00	37.57	46	-8.43
	300.00	23.24	46	-22.76
	375.01	24.65	46	-21.35
	424.98	21.57	46	-24.43

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 22 von 27

Page 22 of 27

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

Table 12: CC2530 ZigBee module with FCC ID : PBR-SZMDLBR1

Channel frequency (MHz)	Antenna polarization	Measured frequency (MHz)	Measured Emissions (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2405	Vertical	2390(Pk)	37.65	74	-36.35
		2390(Av)	24.05	54	-29.95
		2405(Pk)	84.29	-	*
		2405(Av)	80.79	-	*
		4810(Pk)	43.34	74	-30.66
		4810(Av)	35.17	54	-18.83
		7215(Pk)	48.55	74	-25.45
		7215(Av)	35.38	54	-18.62
	Horizontal	2390(Pk)	41.97	74	-32.03
		2390(Av)	29.88	54	-24.12
		2405(Pk)	99.63	-	*
		2405(Av)	96.16	-	*
		4810(Pk)	45.16	74	-28.84
		4810(Av)	38.10	54	-15.90
		7215(Pk)	49.63	74	-24.37
		7215(Av)	34.91	54	-19.09
2440	Vertical	2440(Pk)	86.11	-	*
		2440(Av)	82.61	-	*
		4880(Pk)	43.17	74	-30.83
		4880(Av)	35.69	54	-18.31
		7320(Pk)	49.29	74	-24.71
		7320(Av)	35.80	54	-18.20
	Horizontal	2440(Pk)	98.97	-	*
		2440(Av)	95.48	-	*
		4880(Pk)	45.54	74	-28.46
		4880(Av)	40.01	54	-13.99
		7320(Pk)	47.50	74	-26.50
		7320(Av)	34.20	54	-19.80
2480	Vertical	2483.5(Pk)	45.15	74	-28.85
		2483.5(Av)	36.50	54	-17.50
		2480(Pk)	84.82	-	*
		2480(Av)	81.35	-	*
		4960(Pk)	43.13	74	-30.87
		4960(Av)	35.70	54	-18.30
		7440(Pk)	46.20	74	-27.80
		7440(Av)	35.12	54	-18.88
	Horizontal	2483.5(Pk)	56.96	74	-17.04
		2483.5(Av)	49.19	54	-4.81
		2480(Pk)	97.64	-	*
		2480(Av)	94.15	-	*
		4960(Pk)	44.99	74	-30.87
		4960(Av)	40.00	54	-18.30
		7440(Pk)	47.20	74	-26.80
		7440(Av)	35.00	54	-19.00

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 23 von 27

Page 23 of 27

Table 13: CC2530 ZigBee module with FCC ID : PBR-SZMDLBR1

Channel frequency (MHz)	Antenna polarization	Measured frequency (MHz)	Measured Emissions (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2405	Vertical	2390(Pk)	37.46	74	-36.54
		2390(Av)	24.68	54	-29.32
		2405(Pk)	86.51	-	*
		2405(Av)	83.00	-	*
		4810(Pk)	42.83	74	-31.17
		4810(Av)	32.20	54	-21.80
		7215(Pk)	49.09	74	-24.91
		7215(Av)	36.85	54	-17.15
	Horizontal	2390(Pk)	43.18	74	-30.82
		2390(Av)	31.16	54	-22.84
		2405(Pk)	100.64	-	*
		2405(Av)	97.14	-	*
		4810(Pk)	44.18	74	-29.82
		4810(Av)	37.83	54	-16.17
		7215(Pk)	50.07	74	-23.93
		7215(Av)	34.99	54	-19.01
2440	Vertical	2440(Pk)	84.66	-	*
		2440(Av)	81.15	-	*
		4880(Pk)	42.33	74	-31.67
		4880(Av)	32.60	54	-21.40
		7320(Pk)	48.79	74	-25.21
		7320(Av)	36.27	54	-17.73
	Horizontal	2440(Pk)	101.43	-	*
		2440(Av)	97.96	-	*
		4880(Pk)	44.56	74	-29.44
		4880(Av)	37.89	54	-16.11
2480	Vertical	7320(Pk)	49.77	74	-24.23
		7320(Av)	35.30	54	-18.70
		2483.5(Pk)	46.20	74	-27.80
		2483.5(Av)	35.17	54	-18.83
		2480(Pk)	80.82	-	*
		2480(Av)	83.62	-	*
		4960(Pk)	43.71	74	-30.29
		4960(Av)	32.82	54	-21.18
	Horizontal	7440(Pk)	49.83	74	-24.17
		7440(Av)	36.25	54	-17.75
		2483.5(Pk)	59.77	74	-14.23
		2483.5(Av)	52.02	54	-1.98
		2480(Pk)	83.63	-	*
		2480(Av)	80.81	-	*
		4960(Pk)	44.30	74	-30.29
		4960(Av)	37.97	54	-21.18
		7440(Pk)	49.31	74	-24.69
		7440(Av)	34.92	54	-19.08

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 24 von 27

Page 24 of 27

Table 14: CC2538 -CC2592 ZigBee module with FCC ID : PBR-SZMDLM3BR1

Channel frequency (MHz)	Antenna polarization	Measured frequency (MHz)	Measured Emissions (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2405	Vertical	2390(Pk)	38.45	74	-35.55
		2390(Av)	24.75	54	-29.25
		2405(Pk)	88.73	-	*
		2405(Av)	77.38	-	*
		4810(Pk)	43.13	74	-30.87
		4810(Av)	30.21	54	-23.79
		7215(Pk)	52.62	74	-21.38
		7215(Av)	38.91	54	-15.09
	Horizontal	2390(Pk)	53.23	74	-20.77
		2390(Av)	32.56	54	-21.44
		2405(Pk)	109.03	-	*
		2405(Av)	97.05	-	*
		4810(Pk)	47.50	74	-26.50
		4810(Av)	34.50	54	-19.50
		7215(Pk)	45.92	74	-28.08
		7215(Av)	35.12	54	-18.88
2440	Vertical	2440(Pk)	87.86	-	*
		2440(Av)	75.16	-	*
		4880(Pk)	42.94	74	-31.06
		4880(Av)	28.76	54	-25.24
	Horizontal	2440(Pk)	109.86	-	*
		2440(Av)	97.13	-	*
		4880(Pk)	49.24	74	-24.76
		4880(Av)	36.22	54	-17.78
2480	Vertical	2483.5(Pk)	47.79	74	-26.21
		2483.5(Av)	33.95	54	-20.05
		2480(Pk)	89.31	-	*
		2480(Av)	76.79	-	*
		4960(Pk)	43.39	74	-30.61
		4960(Av)	30.88	54	-23.12
		7440(Pk)	48.62	74	-25.38
		7440(Av)	35.28	54	-18.72
	Horizontal	2483.5(Pk)	63.41	74	-10.59
		2483.5(Av)	47.76	54	-6.24
		2480(Pk)	105.29	-	*
		2480(Av)	92.92	-	*
		4960(Pk)	46.39	74	-27.61
		4960(Av)	33.08	54	-20.92
		7440(Pk)	46.20	74	-27.80
		7440(Av)	35.00	54	-19.00

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 25 von 27

Page 25 of 27

Table 15: CC2538 -CC2592 ZigBee module with FCC ID : PBR-SZMDLM3BR1

Channel frequency (MHz)	Antenna polarization	Measured frequency (MHz)	Measured Emissions (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2405	Vertical	2390(Pk)	40.86	74	-33.14
		2390(Av)	25.61	54	-28.39
		2405(Pk)	96.35	-	*
		2405(Av)	83.48	-	*
		4810(Pk)	42.52	74	-31.48
		4810(Av)	31.13	54	-22.87
		7215(Pk)	52.40	74	-21.60
		7215(Av)	39.13	54	-14.87
	Horizontal	2390(Pk)	52.38	74	-21.62
		2390(Av)	33.88	54	-20.12
		2405(Pk)	109.58	-	*
		2405(Av)	97.36	-	*
		4810(Pk)	47.51	74	-26.49
		4810(Av)	34.31	54	-19.69
		7215(Pk)	48.75	74	-25.25
		7215(Av)	34.84	54	-19.16
2440	Vertical	2440(Pk)	95.23	-	*
		2440(Av)	82.30	-	*
		4880(Pk)	42.93	74	-31.07
		4880(Av)	31.10	54	-22.90
		7320(Pk)	53.30	74	-20.70
		7320(Av)	39.43	54	-14.57
	Horizontal	2440(Pk)	110.32	-	*
		2440(Av)	97.67	-	*
		4880(Pk)	49.34	74	-24.66
		4880(Av)	36.07	54	
2480	Vertical	7320(Pk)	49.37	74	
		7320(Av)	35.31	54	-18.69
	Horizontal	2483.5(Pk)	48.98	74	-25.02
		2483.5(Av)	34.14	54	-19.86
		2480(Pk)	90.10	-	*
		2480(Av)	77.40	-	*
		4960(Pk)	42.63	74	-31.37
		4960(Av)	30.19	54	-23.81
		7440(Pk)	49.93	74	-24.07
		7440(Av)	36.27	54	-17.73
		2483.5(Pk)	64.40	74	-9.60
		2483.5(Av)	48.45	54	-5.55
		2480(Pk)	106.07	-	*
		2480(Av)	93.25	-	*
		4960(Pk)	47.89	74	-26.11
		4960(Av)	34.63	54	-19.37
		7440(Pk)	50.15	74	-23.85
		7440(Av)	35.23	54	-18.77

Prüfbericht - Nr.:

Test Report No.:

ULR-TC568819300000048F 001

Seite 26 von 27

Page 26 of 27

Table 16: Simultaneous transmission on all modules

Channel frequency (MHz)	Antenna polarization	Measured frequency (MHz)	Measured Emissions (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2405	Vertical	2390(Pk)	41.03	74	-32.97
		2390(Av)	26.19	54	-27.82
		2405(Pk)	99.50	-	*
		2405(Av)	88.09	-	*
		4810(Pk)	44.73	74	-29.27
		4810(Av)	34.46	54	-19.54
		7215(Pk)	54.08	74	-19.92
		7215(Av)	40.24	54	-13.77
	Horizontal	2390(Pk)	52.92	74	-21.09
		2390(Av)	34.94	54	-19.07
		2405(Pk)	113.27	-	*
		2405(Av)	102.79	-	*
		4810(Pk)	48.29	74	-25.71
		4810(Av)	39.22	54	-14.78
		7215(Pk)	47.60	74	-26.40
		7215(Av)	35.50	54	-18.50
2440	Vertical	2440(Pk)	98.51	-	*
		2440(Av)	86.94	-	*
		4880(Pk)	45.47	74	-28.53
		4880(Av)	36.17	54	-17.83
		7320(Pk)	51.83	74	-22.17
		7320(Av)	38.28	54	-15.72
	Horizontal	2440(Pk)	112.45	-	*
		2440(Av)	101.53	-	*
		4880(Pk)	48.87	74	-25.13
		4880(Av)	40.07	54	-13.93
2480	Vertical	2483.5(Pk)	51.13	74	-22.87
		2483.5(Av)	38.87	54	-15.13
		2480(Pk)	93.77	-	*
		2480(Av)	83.70	-	*
		4960(Pk)	42.73	74	-31.27
		4960(Av)	33.01	54	-20.99
		7440(Pk)	No Harmonic found		
		7440(Av)			
	Horizontal	2483.5(Pk)	65.86	74	-8.14
		2483.5(Av)	53.29	54	-0.71
		2480(Pk)	108.09	-	*
		2480(Av)	98.40	-	*
		4960(Pk)	47.84	74	-26.17
		4960(Av)	37.92	54	-16.08
		7440(Pk)	No Harmonic found		
		7440(Av)			

Note: Measured Emissions (dBuV/m) = Received Emissions(dBμV) + Antenna Factor(dB/m)+ Cable Loss(dB) – Pre-amplifier Gain(dBi)

Note: *: Fundamental frequency

Pk: Peak Detector

Av: Average Detector

Prüfbericht - Nr.:
Test Report No.:

ULR-TC568819300000048F 001

Seite 27 von 27
Page 27 of 27

8 LIST OF TABLES

Table 1: List of test and measurement instruments.....	5
Table 2: Ratings and System Details as declared by manufacturer.....	6
Table 3: Antenna gain details.....	6
Table 4: Modules power level used	7
Table 5: Measurement Uncertainty	7
Table 6: List of Center Frequencies	9
Table 7: Maximum peak conducted output power test results.....	12
Table 8: Power table for simultaneous transmissions of the ZigBee modules	19
Table 9: Transmitter limits for Radiated emission.....	20
Table 10: Test results for frequencies in the range 30 MHz – 200MHz.....	21
Table 11: Test results for frequencies in the range 200 MHz – 1GHz.....	21
Table 12: CC2530 ZigBee module with FCC ID : PBR-SZMDLBR1	22
Table 13: CC2530 ZigBee module with FCC ID : PBR-SZMDLBR1	23
Table 14: CC2538 -CC2592 ZigBee module with FCC ID : PBR-SZMDLM3BR1.....	24
Table 15: CC2538 -CC2592 ZigBee module with FCC ID : PBR-SZMDLM3BR1.....	25
Table 16: Simultaneous transmission on all modules.....	26

*****END OF TEST REPORT*****