

Produkte
Products

Prüfbericht - Nr.:		19660395 001		Seite 1 von 30	
<i>Test Report No.:</i>		<i>Page 1 of 30</i>			
Auftraggeber: <i>Client:</i>		The Kroger Co. 11450 Grooms Rd., Blue Ash, OH 45242, United States			
Gegenstand der Prüfung: <i>Test item:</i>		Gen 3 Zooter Camera and ZigBee Access point			
Bezeichnung: <i>Identification:</i>		SRG3ZAPWC		Serien-Nr.: <i>Serial No.</i> G3Z000200	
Wareneingangs-Nr.: <i>Receipt No.:</i>		1803351627		Eingangsdatum: <i>Date of receipt:</i> 24.09.2018	
Prüfort: <i>Testing location:</i>		Refer Page 5 of 30 for test facilities			
Prüfgrundlage: <i>Test specification:</i>		FCC Part 15 Subpart C 15.247 ANSI C63.10-2013			
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 corss, Electronic City Phase 1 Bangalore – 560 100. India FCC Test Site Registration no.: 496599			
geprüft / tested by:			kontrolliert / reviewed by:		
25.09.2018 Girish Kumar G Engineer 			05.10.2018 Shrikanth S Naik Assistant Manager 		
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other Aspects:			FCC ID : PBR-SZG3ZAPWC		
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-560100,
IndiaTel.: +9180 6723 3500 · Fax: +9180 6723 3542 · Web: <https://www.tuv.com>

Prüfbericht - Nr.:

Test Report No.:

19660395 001

Seite 2 von 30

Page 2 of 30

TEST SUMMARY

Section	Test item	Result	Remarks
15.247 (b) (3)	Maximum Conducted Output Power	*Pass	Gen 3 Zooter Camera and ZigBee Access point contains FCC certified radio modules; hence antenna port measurements of certified modules are excluded. Refer FCC ID of the certified radio modules listed in the below table.
15.247 (a) (2)	6 dB / DTS Bandwidth	NT	
15.247 (e)	Maximum Power Spectral Density	NT	
15.247 (d)	Emissions in non – restricted band	NT	
15.247 (a)(1)	Conducted Spurious Emissions	NT	
15.247 (d) / (15.209 & 15.205)	Restricted bands of Emissions and Restricted Bands of Operation.	Pass	
15.207	Conducted emission on A.C power lines	NA	

* -> RF power verified

NA -> Not Applicable, as DUT will powered through PoE

NT ->Not Tested

Gen 3 Zooter Camera and ZigBee Access point has integrated with following certified radio modules:

SI No.	Radio Protocol	FCC ID	Tested By	Report Number
1	ZigBee	PBR-SZMDLNR1	TUV Rheinland (India) Pvt. Ltd.	01200091 001
2	ZigBee	PBR-SZMDLM3BR1	TUV Rheinland (India) Pvt. Ltd.	19660372 001
3	ZigBee	PBR-SZMDLM3BR1	TUV Rheinland (India) Pvt. Ltd.	19660372 001
4	BLE	PBR-SZMDLBTNR1	TUV Rheinland (India) Pvt. Ltd.	19660373 001

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 Measurement Uncertainty:	6
4 TEST SET-UP AND OPERATION MODE	7
4.1 Principle of Configuration Selection	7
4.2 Test Operation and Test Software	7
4.3 Special Accessories and Auxiliary Equipment	7
4.4 Countermeasures to achieve EMC Compliance	7
4.5 Test modes – data rates and modulations	7
4.6 List of Frequencies and Frequency bands	8
Note:.....	9
5 RADIATED TEST METHODOLOGY	10
5.1 Radiated Emission Test	10
5.1.1 Test Setup Configuration	10
6 TEST RESULTS	13
6.1 Maximum conducted output power	13
6.2 Restricted bands of Emissions & Restricted Bands of Operation	20
All radio modules operating in low channel	27
ZigBee 2&3 operating in 25th Channel and ZigBee 1 & BLE Operating in high Channel	28
All radio modules operating in high channel	29
7 LIST OF TABLES	30
8 LIST OF FIGURES.....	30

1 GENERAL REMARKS

1.1 Complimentary Materials

All attachments are integral part of this test report.

TEST SETUP PHOTOS

EUT EXTERNAL PHOTOS

EUT INTERNAL PHOTOS

FCC LABEL AND LABEL LOCATION

BLOCK DIAGRAM

SPECIFICATION OF EUT

SCHEMATIC DIAGRAM

BILL OF MATERIAL

USER MANUAL

MAXIMUM PERMISSIBLE EXPOSURE INFORMATION

2 TEST SITES

2.1 Testing Facilities

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: Test and measurements instrument used

Equipment	Manufacturer	Model Name	Serial Number	Calibration Due Date	Periodicity	Used for Test Items
Signal Analyser	Rohde & Schwarz	FSV7	101644	15.12.2018	Yearly	Antenna - Port Conducted Measurements
EMI Test Receiver	Rohde & Schwarz	ESU 40	100288	24-10-2018	Yearly	Radiated Spurious Emission
Active loop antenna	Frankonia	LAX-10	LAX-10-800	15-01-2019	Yearly	
Biconical Antenna	Schwarzbeck mess-elektronik	VHBB-9124 / BBA-9106	9124-656	09-01-2019	Yearly	
Log-Periodic Antenna	Schwarzbeck mess-elektronik	VUSLP-9111B	9111B-111	16-01-2019	Yearly	
Broadband Horn Antenna	Frankonia	HAX-18	HAX18-802	17-05-2019	Yearly	
Emission Horn Antenna	ETS Lindgren	116706	00107323	02-11-2018	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

SRG3ZAPWC has cameras integrated in the product, which will be used for the displaying 360 degree view through LAN port/server. SRG3ZAPWC also has three ZigBee modules mounted on it. These ZigBee Modules are used for wireless data communication with other ZigBee device. SRG3ZAPWC also has BLE module mounted on it which can be used to communicate to the other BLE devices. SRG3ZAPWC is used as a camera and ZigBee access point.

Note: Product supports simultaneous transmission operation.

3.2 Ratings and System Details

Table 2: Ratings and System Details

Operating frequency range	2400 MHz to 2483.5 MHz		
Radio Protocol	ZigBee		BLE
RF Power	PBR-SZMDLNR1	0.44 dBm	-1.58 dBm
	PBR-SZMDLM3BR1	17.37 dBm	
Channel Spacing	5 MHz		2 MHz
Modulation	DSSS		GFSK
Number of antennas	3		1
Antenna type	PCB		
Antenna gain	PBR-SZMDLNR1	2.0 dBi	2.0 dBi
	PBR-SZMDLM3BR1	3.27 dBi	
Supply Voltage to Product	48 – 57 VDC - 4 pair Power Over Ethernet(as per 802.3bt Type 3 or Type 4)		
Environmental conditions	Temp: 5°c to 40°c Humidity: 20% - 80%RHG		

3.3 Measurement Uncertainty:

Table 3: Measurement Uncertainty

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

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 channels to obtain maximum emissions.

4.2 Test Operation and Test Software

Testing software was used to enable the continuous transmission on low/mid/high channels for ZigBee and BLE.

Test Software, Software Version, Hardware Version used:

Protocol	FCC ID	Software used for TX	Software Version	Hardware Version
ZigBee	PBR-SZMDLNR1	Chipconflash Utility	1	Rev C
ZigBee	PBR-SZMDLM3BR1	Smart RF Flashprogrammer 2	1.7.5	Rev C
ZigBee	PBR-SZMDLM3BR1	Smart RF Flashprogrammer 2	1.7.5	Rev C
BLE	PBR-SZMDLBTNR1	Smart RF Flashprogrammer 2	1.7.5	Rev B

4.3 Special Accessories and Auxiliary Equipment

- None

4.4 Countermeasures to achieve EMC Compliance

- None

4.5 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.

4.6 List of Frequencies and Frequency bands

Frequency Band (MHz)	Channel No.	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

Table 4: List of Center Frequencies of ZigBee

Frequency Band (MHz)	Channel No.	Channel Frequency (MHz)
2400 – 2483.5	0	2402
	1	2404
	2	2406
	3	2408
	:	:
	:	:
	18	2438
	19	2440
	20	2437
	:	:
	:	:
	36	2474
	37	2476
	38	2478
	39	2480

Table 5: List of Center Frequencies of BLE

Note:

- The test was performed with the following power settings during transmission,

Protocol	FCC ID	Channel number	Power settings
ZigBee	PBR-SZMDLNR1	11 to 26	01 dBm
ZigBee	PBR-SZMDLM3BR1	11 to 25	19 dBm
		26	13 dBm
ZigBee	PBR-SZMDLM3BR1	11 to 25	19 dBm
		26	13 dBm
BLE	PBR-SZMDLBTNR1	0 to 39	0 dBm

5 RADIATED TEST METHODOLOGY

5.1 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.

5.1.1 Test Setup Configuration

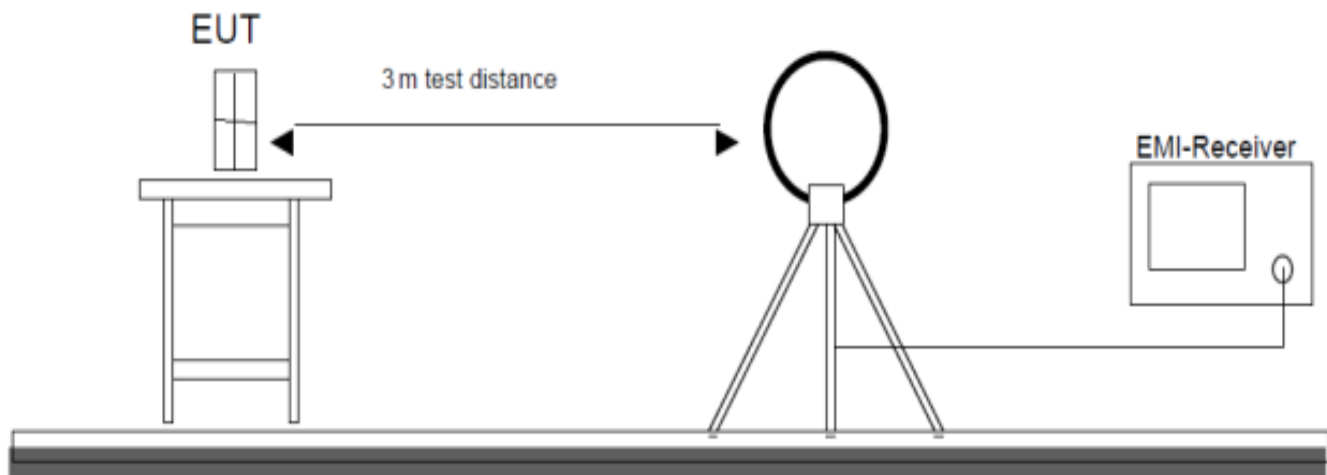


Figure 1: Frequency Range 9 kHz- 30 MHz

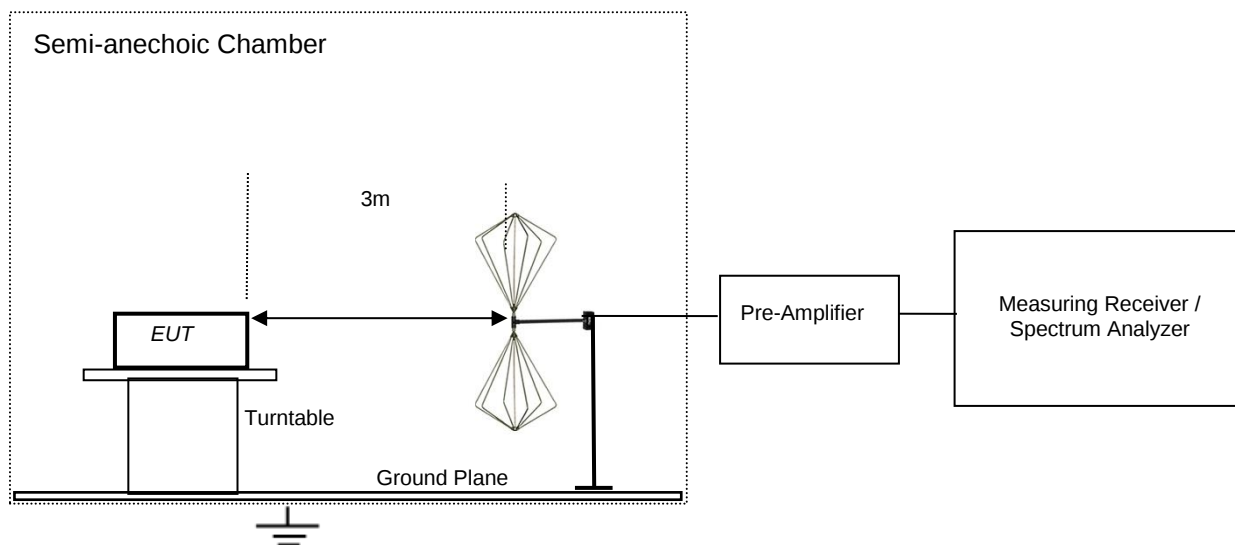


Figure 2: Frequency Range 30 MHz – 200 MHz

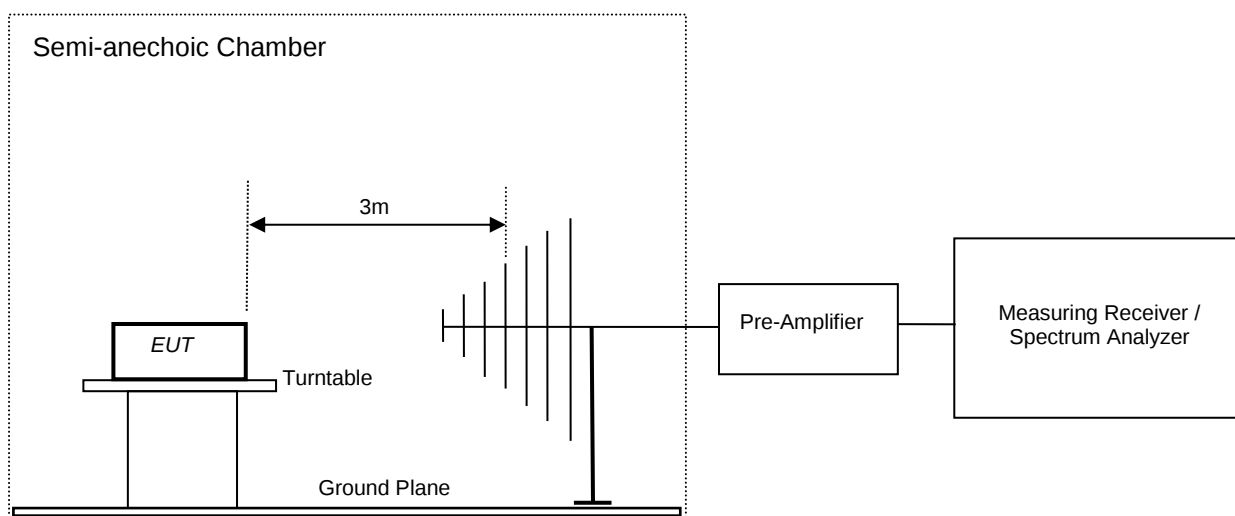


Figure 3: Frequency Range 200 MHz - 1GHz

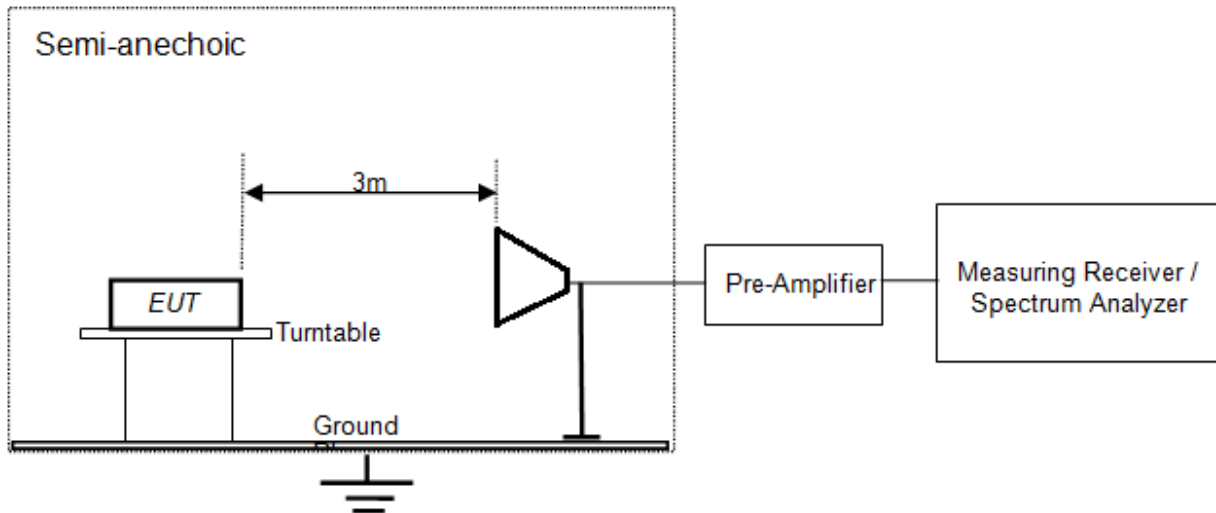


Figure 4: Frequency Range above 1 GHz

6 Test Results

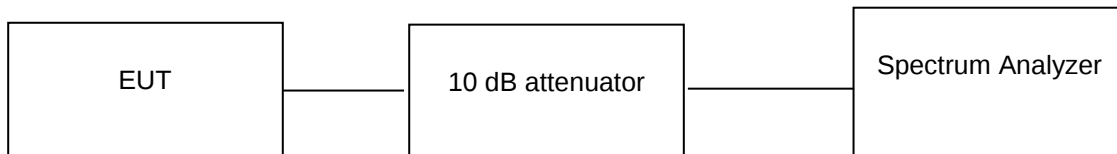
6.1 Maximum conducted output power

Result

Pass

Test Specification	FCC part 15 Subpart C 15.247 (b)(3)
Measurement Bandwidth	1 MHz
Detector	Peak
Requirement	$\leq 1 \text{ W}$ (30 dBm)

Test Method:

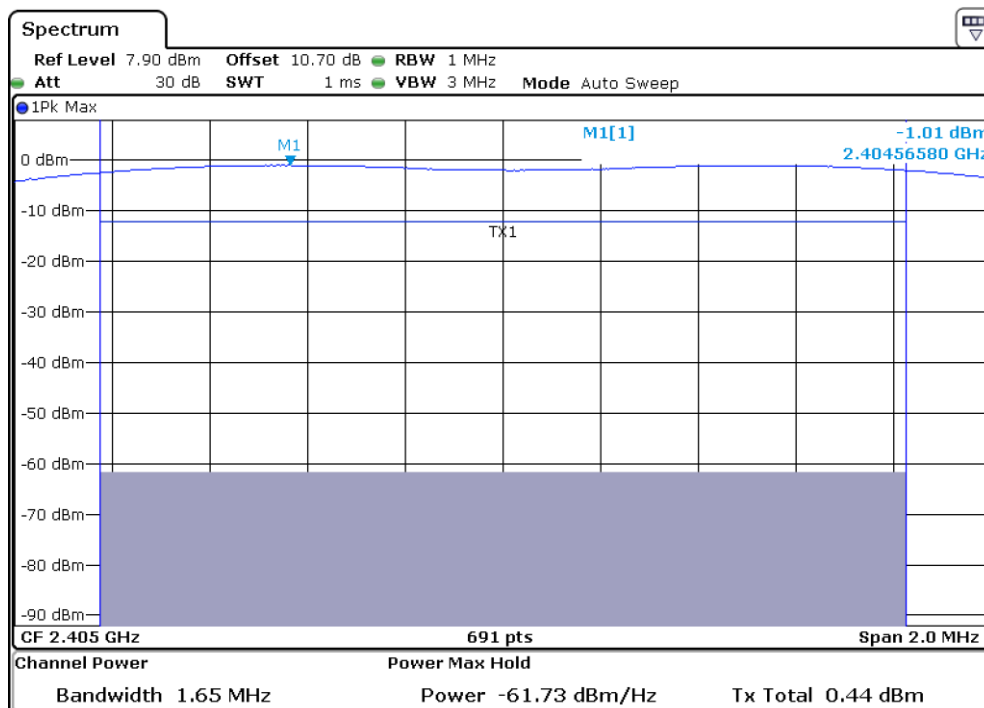


Test results:

10 dB attenuator + 0.7 Cable loss = 10.7 dB offset is considered in below result

Note: Measurements were made as per section 8.3.1 in KDB 558074 D01 15.247 Meas Guidance v05

ZigBee 1:



Channel low

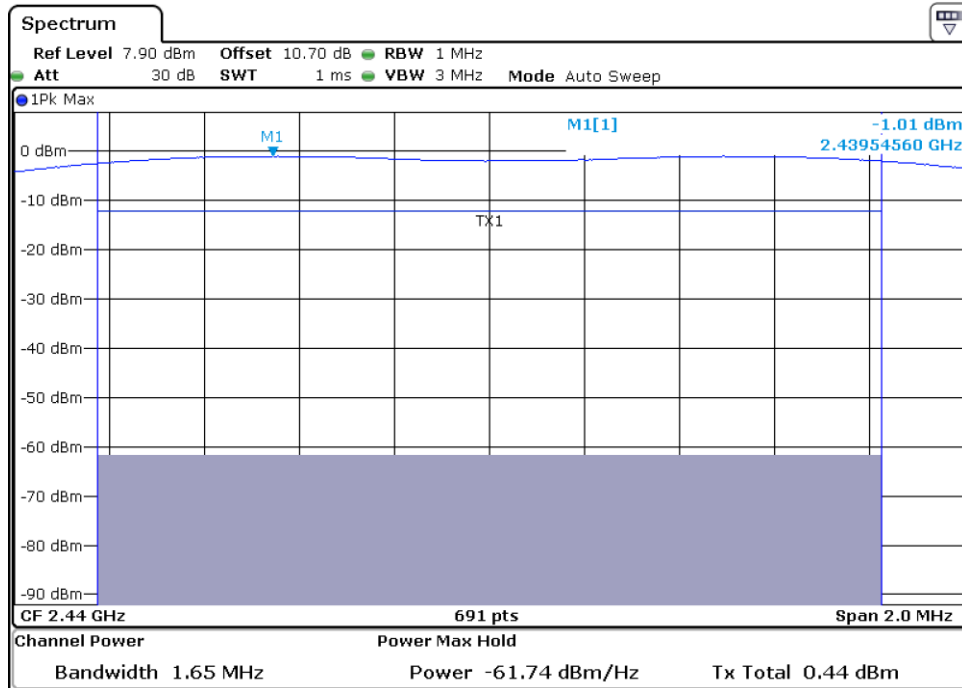
Prüfbericht - Nr.:

Test Report No.:

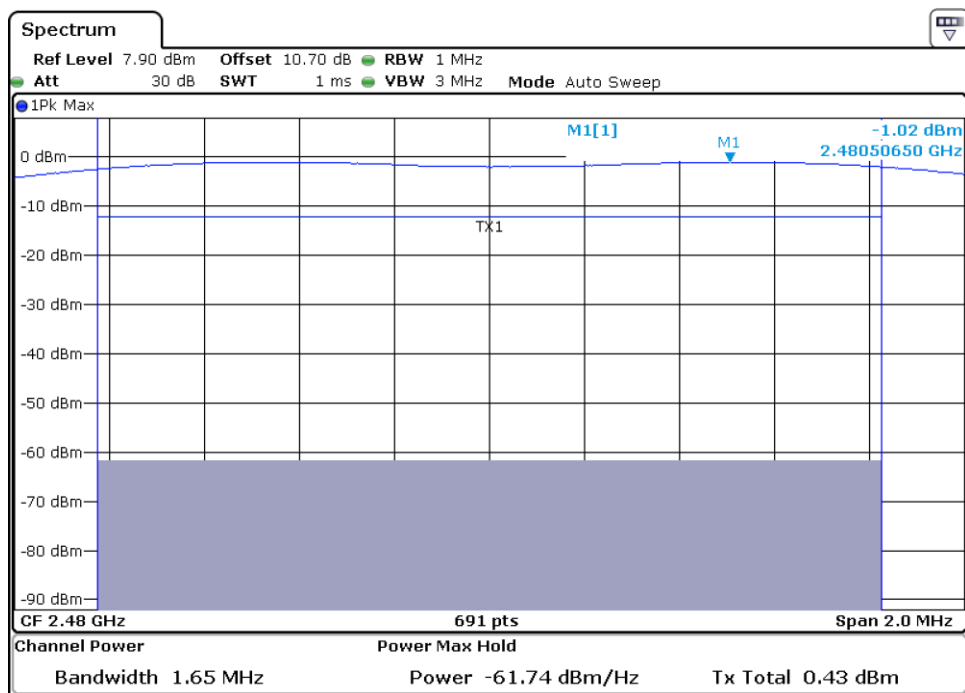
19660395 001

Seite 14 von 30

Page 14 of 30



Channel mid

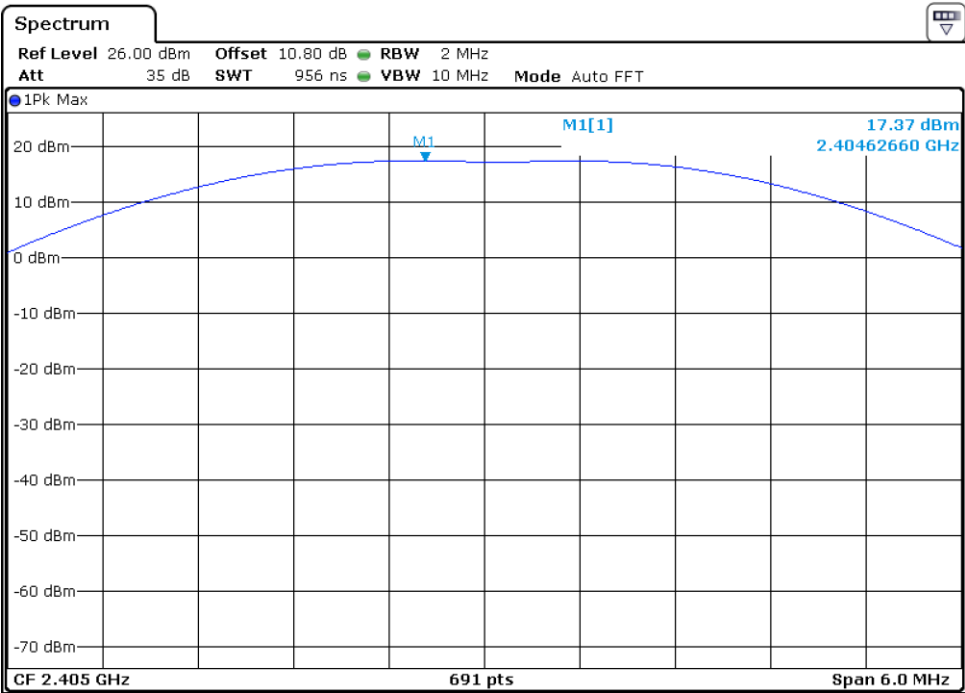


Channel high

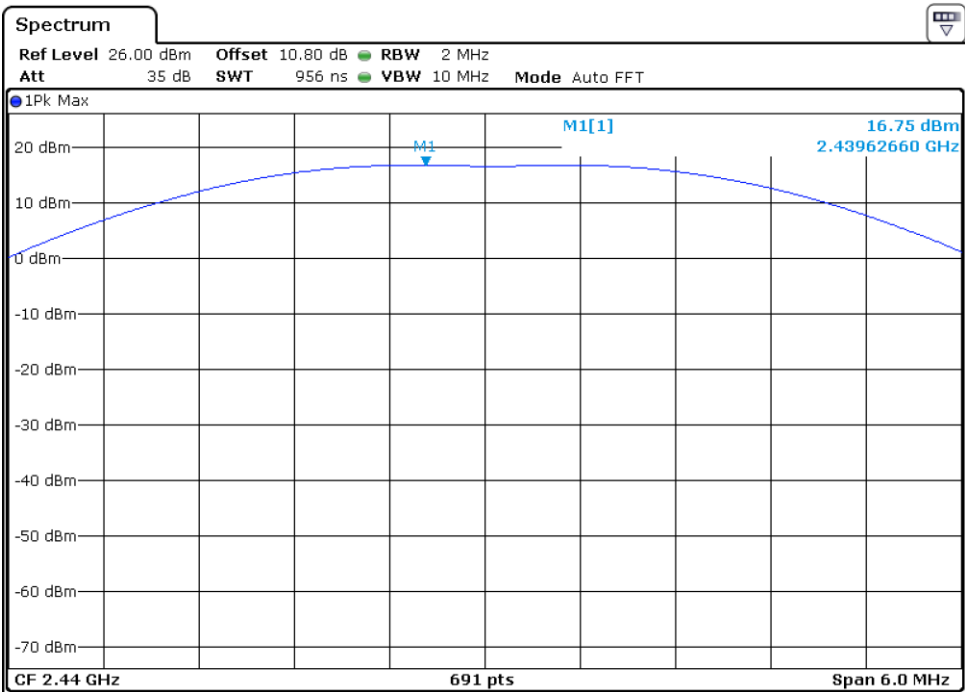
Test Results:

Channel	Channel Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	2405	0.44	30	-29.56
Mid	2440	0.44	30	-29.56
High	2480	0.43	30	-29.57

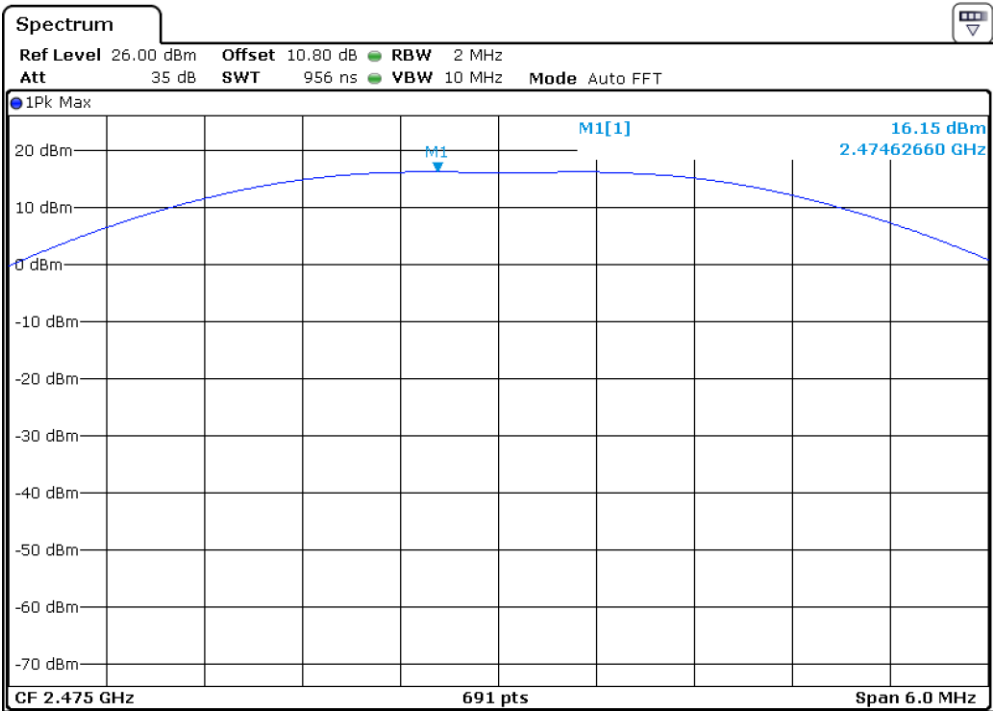
ZigBee 2 & 3:



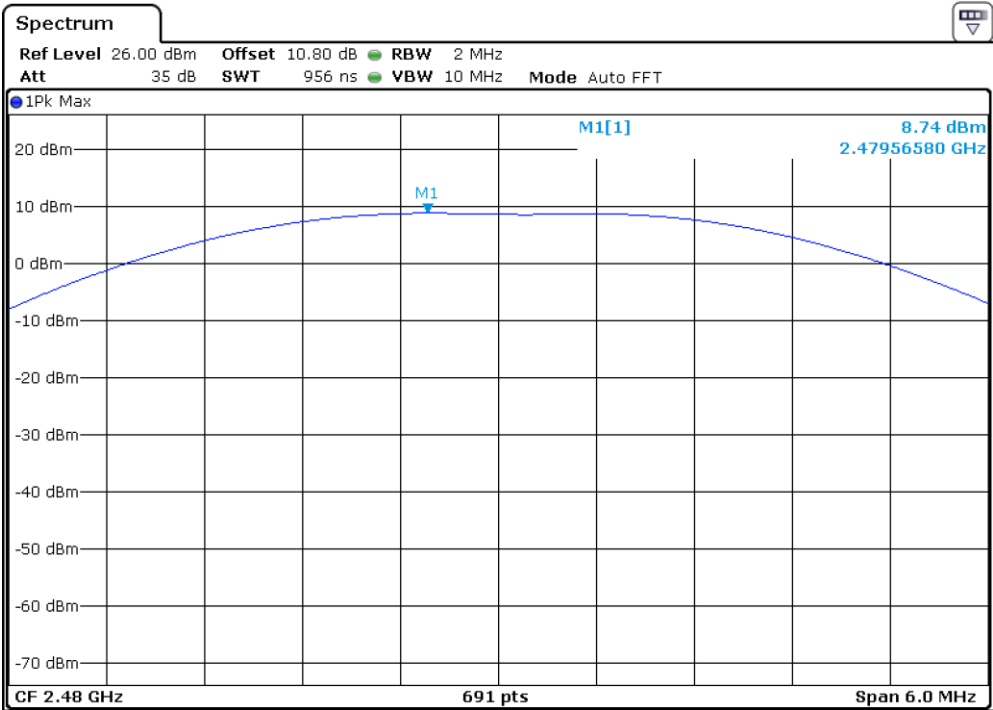
Channel low



Channel mid



Channel number 25



Channel high

Prüfbericht - Nr.:

19660395 001

Seite 17 von 30

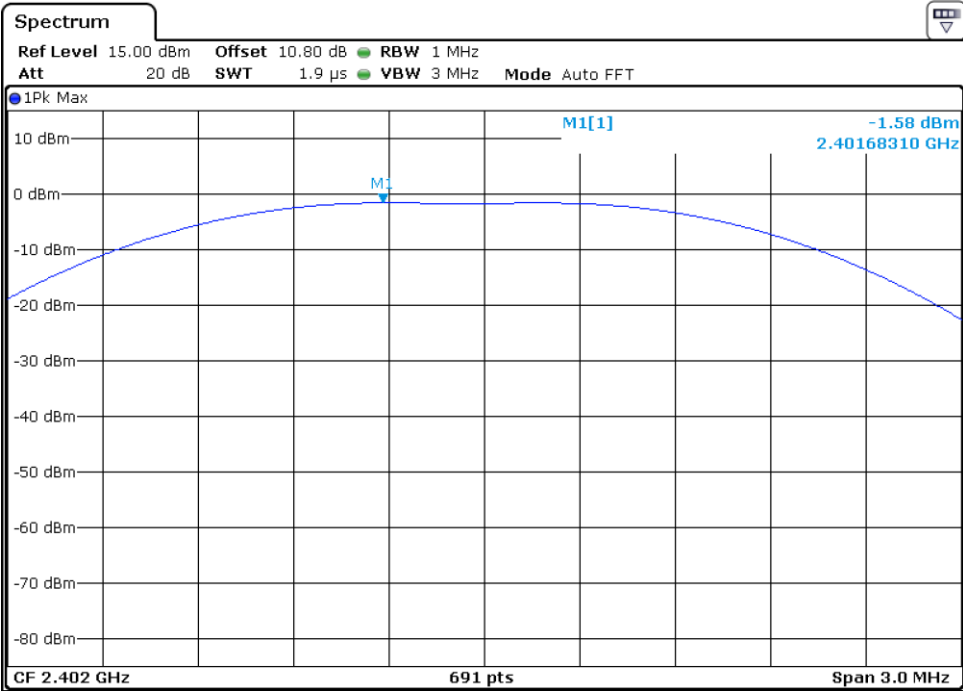
Test Report No.:

Page 17 of 30

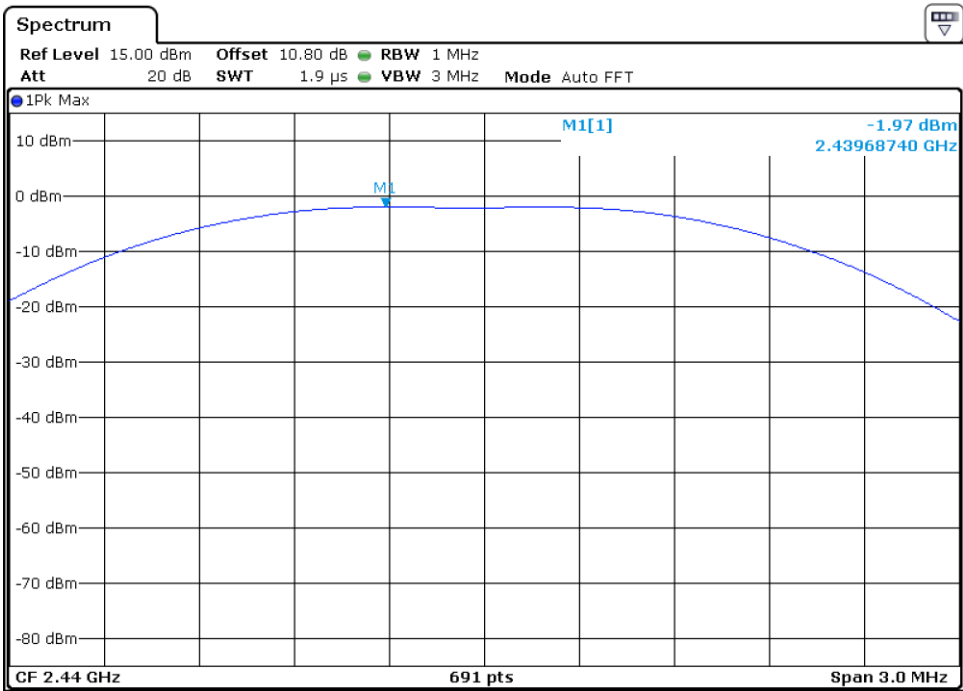
Test Results:

Channel	Channel Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	2405	17.37	30	-12.63
Mid	2440	16.75	30	-13.25
25	2475	16.15	30	-13.85
High	2480	8.74	30	-21.26

Bluetooth Low Energy:



Channel low



Channel mid

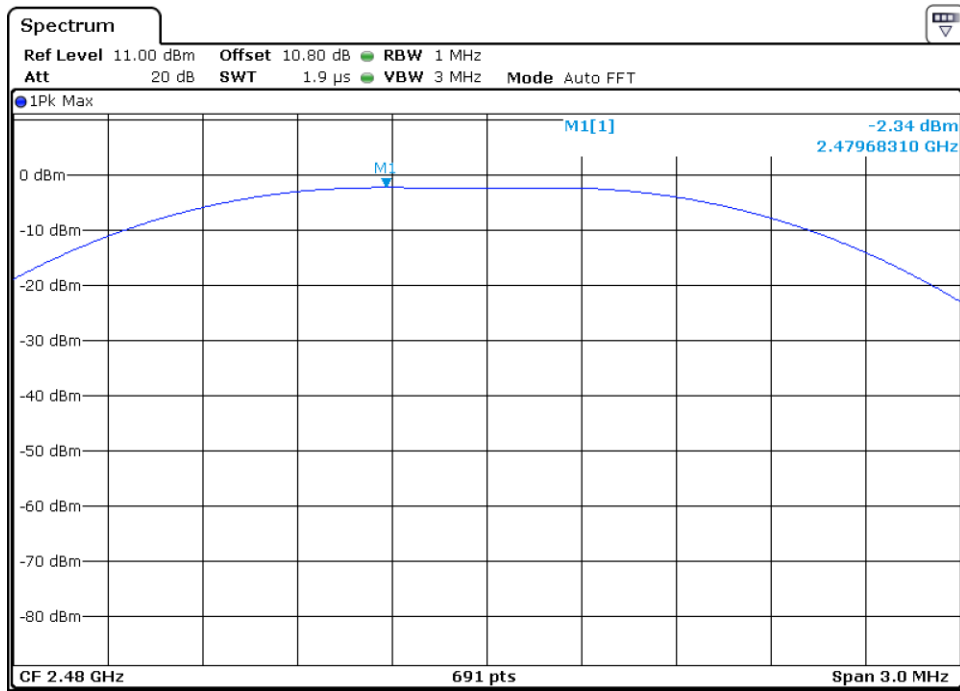
Prüfbericht - Nr.:

Test Report No.:

19660395 001

Seite 19 von 30

Page 19 of 30



Channel high

Test Results:

Channel	Channel Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-1.58	30	-31.58
Mid	2440	-1.97	30	-31.97
High	2480	-2.34	30	-32.34

Power Table for Simultaneous Transmission (Only the worst case readings are tabulated)

ZigBee 1	ZigBee 2	ZigBee 3	BLE	Sum	Sum
mW	mW	mW	mW	mW	dBm
1.106	54.575	54.575	0.695	110.951	20.451
1.106	47.315	47.315	0.635	96.371	19.839
1.104	7.481	7.481	0.583	16.649	12.213

Maximum power in Simultaneous transmission mode = 1.106mW + 54.575mW + 54.575mW + 0.695mW = **110.951 mW**

Note: Customer has declared that transmitter output signals from the modules are not correlated.

6.2 Restricted bands of Emissions & Restricted Bands of Operation

Result

Pass

Test Specification	FCC part 15 Subpart C Section 15.247 (d) / (15.209 & 15.205)
Test Method	ANSI C 63.10 – 2013
Measurement Location	Semi Anechoic Chamber
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

Limits for Radiated Emission of Section 15.209:

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 128-93.8, 73.80-62.95, 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 results:

No emissions found in frequency 9 kHz to 30 MHz

Test results for frequencies in the range 30 MHz – 1 GHz

Note: The product has digital device which cannot control the functions of intentional radiator (ZigBee, BLE)) in such condition Radiated spurious emission for the frequency range from 30MHz to 1GHz was performed as per FCC part 15 subpart B 15.109, Class A requirement. Only worst case test results are reported.

FCC Part 15 Subpart B 15.109 Class A limits

Frequency MHz	Field Strength uV/m	Measurement Distance (meter)	Field Strength (dBµV/m)
30-88	90.00	10.00	39.08
88-216	150.00	10.00	43.52
216-960	210.00	10.00	46.43
above 960	300.00	10.00	49.54

Test results for frequencies in the range 30 MHz to 1GHz

Polarization	Frequency (MHz)	Measured value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	69.865	30.59	39.08	-08.49
	175.554	32.31	43.52	-11.21
	250	34.03	46.43	-12.40
	400	35.34	46.43	-11.09
	532	35.19	46.43	-11.24
Horizontal	70.375	21.33	39.08	-17.75
	250	28.69	46.43	-17.74
	400	30.13	46.43	-16.30
	420	30.85	46.43	-15.58
	600	30.88	46.43	-15.55
	797.68	34.09	46.43	-12.34

Prüfbericht - Nr.:

Test Report No.:

19660395 001

Seite 22 von 30

Page 22 of 30

For frequency range: Above 1 GHz

Test results:

ZigBee 1(with FCC ID: PBR-SZMDLNR1))

Channel	Polarization	Frequency (MHz)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low	Vertical	2390(Pk)	42.59	74	-31.41
		2390(Av)	29.66	54	-24.34
		2405(Pk)	88.43	-	*
		2405(Av)	84.92	-	*
		4810(Pk)	54.47	74	-19.53
		4810(Av)	42.4	54	-11.6
	Horizontal	2390(Pk)	40.93	74	-33.07
		2390(Av)	29.54	54	-24.46
		2405(Pk)	89.22	-	*
		2405(Av)	85.71	-	*
		4810(Pk)	54.18	74	-19.82
		4810(Av)	42.4	54	-11.6
Mid	Vertical	2440(Pk)	88.67	-	*
		2440(Av)	85.17	-	*
		4880(Pk)	55.02	74	-18.98
		4880(Av)	42.68	54	-11.32
	Horizontal	2440(Pk)	90.18	-	*
		2440(Av)	86.69	-	*
		4880(Pk)	55.05	74	-18.95
		4880(Av)	42.61	54	-11.39
High	Vertical	2480(Pk)	84.95	-	*
		2480(Av)	81.42	-	*
		2483.5(Pk)	45.62	74	-28.38
		2483.5(Av)	36.85	54	-17.15
		4960(Pk)	55.36	74	-18.64
		4960(Av)	43.29	54	-10.71
	Horizontal	2480(Pk)	88.51	-	*
		2480(Av)	85.02	-	*
		2483.5(Pk)	47.63	74	-26.37
		2483.5(Av)	39.5	54	-14.5
		4960(Pk)	55.68	74	-18.32
		4960(Av)	43.12	54	-10.88

*-> Fundamental frequency
Pk-> Peak
Av-> Average

Channel Low = 2405 MHz
Channel Mid = 2440 MHz
Channel 25 = 2475 MHz
Channel High = 2480 MHz

Prüfbericht - Nr.:

Test Report No.:

19660395 001

Seite 23 von 30

Page 23 of 30

ZigBee 2(with FCC ID: PBR-SZMDLM3BR1)

Channel	Polarization	Frequency (MHz)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low	Vertical	2390(Pk)	44.97	74	-29.03
		2390(Av)	33.44	54	-20.56
		2405(Pk)	105.12	-	*
		2405(Av)	101.22	-	*
		4810(Pk)	54.55	74	-19.45
		4810(Av)	42.41	54	-11.59
	Horizontal	2390(Pk)	44.01	74	-29.99
		2390(Av)	34.94	54	-19.06
		2405(Pk)	106.8	-	*
		2405(Av)	103.15	-	*
		4810(Pk)	54.23	74	-19.77
		4810(Av)	42.46	54	-11.54
Mid	Vertical	2440(Pk)	104.69	-	*
		2440(Av)	101.18	-	*
		4880(Pk)	54.67	74	-19.33
		4880(Av)	42.56	54	-11.44
	Horizontal	2440(Pk)	106.41	-	*
		2440(Av)	102.09	-	*
		4880(Pk)	55.7	74	-18.3
		4880(Av)	42.51	54	-11.49
25	Vertical	2475(Pk)	105.3	-	*
		2475(Av)	101.77	-	*
		2483.5(Pk)	47.29	74	-20.83
		2483.5(Av)	35.38	54	-11.39
		4950(Pk)	55.53	74	-21.87
		4950(Av)	42.94	54	-12.12
	Horizontal	2475(Pk)	105.31	-	*
		2475(Av)	101.96	-	*
		2483.5(Pk)	46.07	74	-22.42
		2483.5(Av)	36.14	54	-17.8
		4950(Pk)	55.71	74	-20.32
		4950(Av)	42.92	54	-11.61

Prüfbericht - Nr.:

Test Report No.:

19660395 001

Seite 24 von 30

Page 24 of 30

High	Vertical	2480(Pk)	98.34	-	*
		2480(Av)	94.71	-	*
		2483.5(Pk)	56.59	74	-17.41
		2483.5(Av)	50.17	54	-3.83
		4960(Pk)	55.44	74	-18.56
		4960(Av)	42.94	54	-11.06
	Horizontal	2480(Pk)	100	-	*
		2480(Av)	96.55	-	*
		2483.5(Pk)	57.62	74	-16.38
		2483.5(Av)	50.71	54	-3.29
		4960(Pk)	55.76	74	-18.24
		4960(Av)	42.96	54	-11.04

*-> Fundamental frequency
Pk-> Peak
Av-> Average

ZigBee 3(with FCC ID: PBR-SZMDLM3BR1)

Channel	Polarization	Frequency (MHz)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low	Vertical	2390(Pk)	43.51	74	-30.49
		2390(Av)	31.58	54	-22.42
		2405(Pk)	104.42	-	*
		2405(Av)	100.49	-	*
		4810(Pk)	57.42	74	-16.58
		4810(Av)	46.25	54	-7.75
	Horizontal	2390(Pk)	45.23	74	-28.77
		2390(Av)	34.19	54	-19.81
		2405(Pk)	107.45	-	*
		2405(Av)	104.32	-	*
		4810(Pk)	56.7	74	-17.3
		4810(Av)	45.08	54	-8.92
Mid	Vertical	2440(Pk)	106.7	-	*
		2440(Av)	102.37	-	*
		4880(Pk)	56.62	74	-17.38
		4880(Av)	43.91	54	-10.09
	Horizontal	2440(Pk)	106.84	-	*
		2440(Av)	103.08	-	*
		4880(Pk)	56.33	74	-17.67
		4880(Av)	43.73	54	-10.27

Prüfbericht - Nr.:

Test Report No.:

19660395 001

Seite 25 von 30

Page 25 of 30

25	Vertical	2475(Pk)	104.04	-	*
		2475(Av)	100.1	-	*
		2483.5(Pk)	46.55	74	-27.45
		2483.5(Av)	35.18	54	-18.82
		4950(Pk)	56.71	74	-17.29
		4950(Av)	43.62	54	-10.38
	Horizontal	2475(Pk)	107.28	-	*
		2475(Av)	103.71	-	*
		2483.5(Pk)	53.94	74	-20.06
		2483.5(Av)	39.72	54	-14.28
		4950(Pk)	55.8	74	-18.2
		4950(Av)	43.22	54	-10.78
High	Vertical	2480(Pk)	96.25	-	*
		2480(Av)	93	-	*
		2483.5(Pk)	54.41	74	-19.59
		2483.5(Av)	47.29	54	-6.71
		4960(Pk)	55.17	74	-18.83
		4960(Av)	43	54	-11
	Horizontal	2480(Pk)	100.93	-	*
		2480(Av)	97.38	-	*
		2483.5(Pk)	58.69	74	-15.31
		2483.5(Av)	52.83	54	-1.17
		4960(Pk)	56.61	74	-17.39
		4960(Av)	43.02	54	-10.98

*-> Fundamental frequency
Pk-> Peak
Av-> Average

Prüfbericht - Nr.:

19660395 001

Seite 26 von 30

Test Report No.:

Page 26 of 30

Bluetooth Low Energy

Channel	Polarization	Frequency (MHz)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Low	Vertical	2390(Pk)	42.2	74	-31.8
		2390(Av)	29.28	54	-24.72
		2402(Pk)	92.27	-	*
		2402(Av)	91.19	-	*
		4804(Pk)	55.96	74	
		4804(Av)	43.55	54	
	Horizontal	2390(Pk)	41.61	74	-32.39
		2390(Av)	29.47	54	-24.53
		2402(Pk)	94.07	-	*
		2402(Av)	93.1	-	*
		4804(Pk)	56.48	74	-17.52
		4804(Av)	43.19	54	-10.81
Mid	Vertical	2440(Pk)	93.06	-	*
		2440(Av)	92.02	-	*
		4880(Pk)	55.86	74	-18.14
		4880(Av)	43.31	54	-10.69
	Horizontal	2440(Pk)	95.13	-	*
		2440(Av)	94.85	-	*
		4880(Pk)	54.99	74	-19.01
		4880(Av)	42.92	54	-11.08
High	Vertical	2480(Pk)	93.75	-	*
		2480(Av)	92.62	-	*
		2483.5(Pk)	43.52	74	-30.48
		2483.5(Av)	33	54	-21
		4960(Pk)	56.19	74	-17.81
		4960(Av)	43.72	54	-10.28
	Horizontal	2480(Pk)	95.19	-	*
		2480(Av)	94.25	-	*
		2483.5(Pk)	45.32	74	-28.68
		2483.5(Av)	34.1	54	-19.9
		4960(Pk)	55.91	74	-18.09
		4960(Av)	43.77	54	-10.23

*-> Fundamental frequency

Pk-> Peak

Av-> Average

Channel Low = 2402 MHz

Channel Mid = 2440 MHz

Channel High = 2480 MHz

Test results: Simultaneous transmission of ZigBee, Bluetooth Low Energy modules

All radio modules operating in low channel

Channel	Polarization	Frequency (MHz)	Field strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Low	Vertical	2390(Pk)	42.95	74	-31.05
		2390(Av)	32.38	54	-21.62
		2402(Pk)	91.69	-	*
		2402(Av)	90.14	-	*
		2405(Pk)	105.71	-	*
		2405(Av)	99.34	-	*
		4804(Pk)	55.59	74	-18.41
		4804(Av)	43.73	54	-10.27
		7206(Pk)	61.48	74	-12.52
		7206(Av)	49.29	54	-4.71
		4810(Pk)	58.66	74	-15.34
		4810(Av)	46.89	54	-7.11
		7215(Pk)	62.04	74	-11.96
		7215(Av)	49.31	54	-4.69
	Horizontal	2390(Pk)	46.11	74	-27.89
		2390(Av)	34.78	54	-19.22
		2402(Pk)	92.95	-	*
		2402(Av)	91.5	-	*
		2405(Pk)	110.59	-	*
		2405(Av)	103.84	-	*
		4804(Pk)	56.26	74	-17.74
		4804(Av)	43.21	54	-10.79
		7206(Pk)	61.24	74	-12.76
		7206(Av)	49.28	54	-4.72
		4810(Pk)	57.52	74	-16.48
		4810(Av)	45.52	54	-8.48
		7215(Pk)	61.24	74	-12.76
		7215(Av)	49.66	54	-4.34

*-> Fundamental frequency
Pk-> Peak
Av-> Average

ZigBee 2&3 operating in 25th Channel and ZigBee 1 & BLE Operating in high Channel

Channel	Polarization	Frequency (MHz)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
High	Vertical	2475(Pk)	107.43	-	*
		2475(Av)	100.76	-	*
		2480(Pk)	90.84	-	*
		2480(Av)	89.73	-	*
		2483.5(Pk)	59.62	74	-14.38
		2483.5(Av)	45.58	54	-8.42
		4950(Pk)	55.8	74	-18.2
		4950(Av)	43.2	54	-10.8
		7425(Pk)	63.17	74	-10.83
		7425(Av)	49.74	54	-4.26
		4960(Pk)	56.13	74	-17.87
		4960(Av)	44.08	54	-9.92
		7440(Pk)	62.27	74	-11.73
		7440(Av)	49.72	54	-4.28
	Horizontal	2475(Pk)	112.18	-	*
		2475(Av)	104.83	-	*
		2480(Pk)	93.72	-	*
		2480(Av)	92.68	-	*
		2483.5(Pk)	63	74	-11
		2483.5(Av)	50.5	54	-3.5
		4950(Pk)	56.29	74	-17.71
		4950(Av)	43.37	54	-10.63
		7425(Pk)	62.02	74	-11.98
		7425(Av)	49.76	54	-4.24
		4960(Pk)	55.41	74	-18.59
		4960(Av)	43.63	54	-10.37
		7440(Pk)	61.57	74	-12.43
		7440(Av)	49.84	54	-4.16

*-> Fundamental frequency
Pk-> Peak
Av-> Average

All radio modules operating in high channel

Channel	Polarization	Frequency (MHz)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
High	Vertical	2480(Pk)	101.43	-	*
		2480(Av)	94.87	-	*
		2483.5(Pk)	57.2	74	-16.8
		2483.5(Av)	49.87	54	-4.13
		4960(Pk)	55.87	74	-18.13
		4960(Av)	44.14	54	-9.86
		7440(Pk)	62.02	74	-11.98
		7440(Av)	49.77	54	-4.23
	Horizontal	2480(Pk)	105.43	-	*
		2480(Av)	97.88	-	*
		2483.5(Pk)	62.13	74	-11.87
		2483.5(Av)	53.95	54	-0.05
		4960(Pk)	56.5	74	-17.5
		4960(Av)	44.35	54	-9.65
		7440(Pk)	61.91	74	-12.09
		7440(Av)	49.73	54	-4.27

*-> Fundamental frequency
Pk-> Peak
Av-> Average

Note: Field strength(dBuv/m) = Measured value(dBuv) + Antenna Factor(dB/m) + Cable loss(dB) – Pre-Amplifier Gain(dB)

7 LIST OF TABLES

Table 1: Test and measurements instrument used..... 5

Table 2: Ratings and System Details 6

Table 3: Measurement Uncertainty 6

Table 4: List of Center Frequencies of ZigBee 8

Table 5: List of Center Frequencies of BLE 8

8 LIST OF FIGURES

Figure 1: Frequency Range 9 kHz- 30 MHz 10

Figure 2: Frequency Range 30 MHz – 200 MHz 11

Figure 3: Frequency Range 200 MHz - 1GHz 11

Figure 4: Frequency Range above 1 GHz 12

END OF TEST REPORT