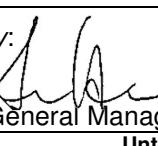


Prüfbericht-Nr.: <i>Test Report No.:</i>	50123779 001	Auftrags-Nr.: <i>Order No.:</i>	114070342	Seite 1 von 50 <i>Page 1 of 50</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	13-Oct-2017	
Auftraggeber: <i>Client:</i>	Zeroplus Technology Corporation 3F, No.121, Jian 8th Rd, Chung Ho District, New Taipei City, Taiwan			
Prüfgegenstand: <i>Test item:</i>	X1 to P4 wireless controller Adapter			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	X One Adapter			
Auftrags-Inhalt: <i>Order content:</i>	FCC test report (BDR/EDR)			
Prüfgrundlage: <i>Test specification:</i>	FCC 47CFR Part 15: Subpart C Section 15.247 FCC 47CFR Part 2: Subpart J Section 2.1091			
Wareneingangsdatum: <i>Date of receipt:</i>	15-Jan-2018			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000653375-001 A000653375-002			
Prüfzeitraum: <i>Testing period:</i>	18-Jan-2018 – 22-Jan-2018			
Ort der Prüfung: <i>Place of testing:</i>	EMC Laboratory Taipei			
Prüflaboratorium: <i>Testing laboratory:</i>	TUV Rheinland Taiwan Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
Report date / tested by:	 2018-02-05 Sam C.J. Kuo/Engineer			
Unterschrift <i>Signature</i>	kontrolliert von / reviewed by:  2018-02-05 Arvin Ho/Vice General 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>
Sonstiges / Other:				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(fail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(fail) = failed a.m. test specification(s) 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 only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				
VO4				

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TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

5.1.2 PEAK OUTPUT POWER

RESULT: Passed

5.1.3 20dB BANDWIDTH, 99% BANDWIDTH

RESULT: Passed

5.1.4 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100kHz BANDWIDTH

RESULT: Passed

5.1.5 SPURIOUS EMISSION

RESULT: Passed

5.1.6 FREQUENCY SEPARATION

RESULT: Passed

5.1.7 NUMBER OF HOPPING FREQUENCY

RESULT: Passed

5.1.8 TIME OF OCCUPANCY

RESULT: Passed

6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

6.2.1 MAINS CONDUCTED EMISSIONS

RESULT: Passed

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1. General Remarks

1.1 Complementary Materials

The following attachments are integral parts of this test report:

- Appendix P: Photo Documentation**
(File Name: 50123779APPENDIXP)
Appendix D: Test Result of Radiated Emissions
(File Name: 50123779APPENDIXD)

Test Specifications

The following standards were applied

Table 1: Applied Standard and Test Levels

Radio
FCC 47 CFR Part 15: Subpart C Section 15.247
FCC 47 CFR Part 2: Subpart J Section 2.1091
ANSI C63.10:2013
KDB447498 D01 General RF Exposure Guidance v06

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2. Test Sites

2.1 Test Facility

TUV Rheinland Taiwan Ltd.
Taipei Office

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

FCC RegistrationNo.: 340738
IC Canada Registration No.: 9465A-1
TAF Accredited NCC Test Lab. No.:0759
TAF ISO17025 Certification effective periods: 2016-Jul-1st to 2019-Jun-30th



Testing Laboratory
0759

2.2 List of Test and Measurement Instruments

Table 2: List of Test and Measurement Equipment

Kind of Equipment	Manu-facturer	Type	S/N	Last Calibration	Next Calibration
Test Software	Farad	EZ_EMC	Ver. TUV3A1	N/A	N/A
EMI Test Receiver	R&S	ESR 7	101549	2017/11/10	2018/11/10
Spectrum Analyzer	R&S	FSV 40	100921	2017/05/02	2018/05/02
Spectrum Analyzer	Agilent	N9010A	MY53470241	2017/05/23	2018/05/23
Preamplifier (30MHz -1GHz)	HP	8447F	2805A03335	2017/08/14	2018/08/14
Preamplifier (18 GHz -40 GHz)	COM-POWER	PAM-840	461257	2018/01/18	2019/01/18
Pre-Amplifier (1GHz~18GHz)	EM Electronics	EM01G18G	60649	2017/07/28	2018/07/28
Bilog Antenna	TESEQ	CBL6111D	29802	2017/07/12	2018/07/12
Horn Antenna	ETS-Lindgren	3117	138160	2017/05/25	2018/05/25
Loop Antenna	Schwarzbeck	FMZB 1513	1513-076	2017/06/14	2018/06/14
Temp. & Humid. Chamber	Giant Force	GCT-099-40-S	MAF0103-007	2017/03/09	2019/03/09
LISN (1 phase)	R&S	ENV216	101243	2017/05/24	2018/05/24
LISN	R&S	ENV216	101262	2017/06/22	2018/06/22
Test Software	Audix	e3	Ver. 9	N/A	N/A

2.3 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

2.4 Calibration

requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basics using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements:

Table 3: Emission Measurement Uncertainty

Parameter	Uncertainty
RF power, conducted	± 1.5 dB
Adjacent channel power	± 3 dB
Radiated emission of transmitter, valid up to 26 GHz	± 6 dB
Radiated emission of receiver, valid up to 26 GHz	± 6 dB
Temperature	± 2 °C
Humidity	± 10 %

3. General Product Information

3.1 Product Function and Intended Use

The EUT is a wireless controller Adapter. It contains a Bluetooth compatible module enabling the user to communicate data through a Wireless interface.
For details refer to the User Guide, Data Sheet and Circuit Diagram.

3.2 System Details and Ratings

Table 4: Basic Information of EUT

Item	EUT information
Kind of Equipment/Test Item	X1 to P4 wireless controller Adapter
Type Identification	X One Adapter
Brand Name	Brook
FCC ID	2ADKMN007

Table 5: Technical Specification of EUT

Technical Specification	Value
Operating Frequency	2402 MHz ~ 2480 MHz
Channel Spacing	1 MHz
Channel number	79
Operation Voltage	5Vdc
Modulation	GFSK, π/4 DQPSK, 8DPSK
Antenna gain	-6.72dBi

Table 6: Frequency hopping information

Technical Specification	Description
Hopping Range	Hereby we declare that the maximum frequency of this device is: 2402-2480MHz. This is according the Bluetooth Core Specification V2.1+EDR for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04).
Hopping Sequence	Example of a 79 hopping sequence in data mode: 33,04,21,44,23,42,53,46,55,48,40,59,72,29,76,31,08,73,07,75,09,45,60,39,58,13,47,11,77,52,35,50,65,54,67,56,69,62,71,64, 7,25,27,66,57,70,74,61,78,63,10,41,05,43,15,44,64,68,02,70,06,01,51,03,55,05,03,66,53,49,36,47,
Receiver input bandwidth	The input bandwidth of the receiver is 1MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings. Repeating of a packer has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

3.3 Independent Operation Modes

The basic operation modes are:

- A. Transmitting
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel

- B. Receiving
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel

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3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- Circuit Diagram
- Instruction Manual
- Rating Label
- Technical Description

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test samples provided by manufacturer can be controlled through Bluetooth test set. All testing were performed according to the procedures in ANSI C63.10: 2013

Full test was applied on all test modes, but only worst case was shown.

4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

Description	Manufacturer	Model No.	Serial No.
Notebook(EMC-06)	Lenovo	TP00048A	PB-0F8B2

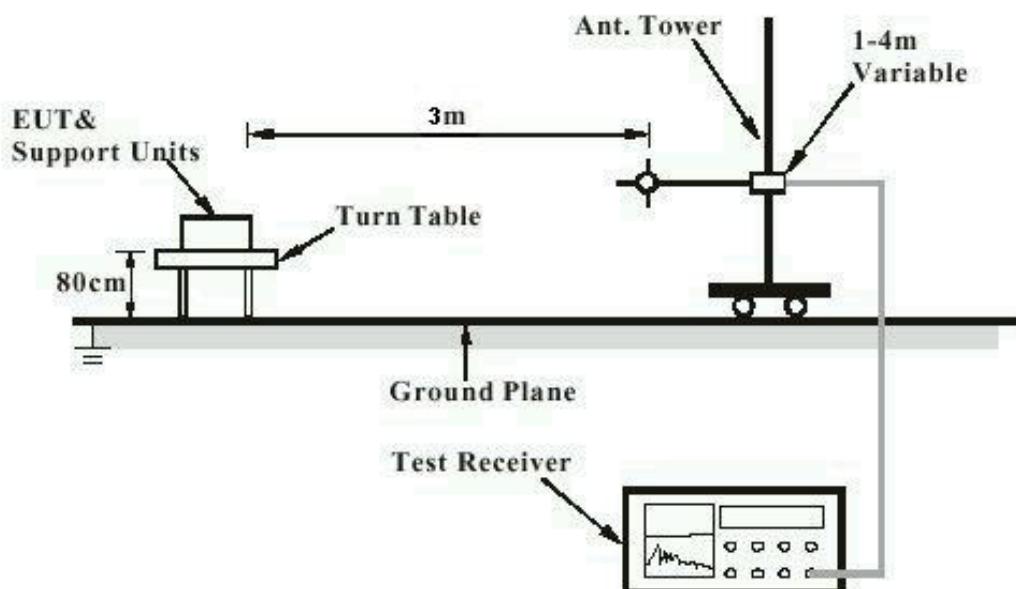
Note: Setting EUT to be a test mode which can be controlled by Bluetooth test set.

4.4 Countermeasures to achieve EMC Compliance

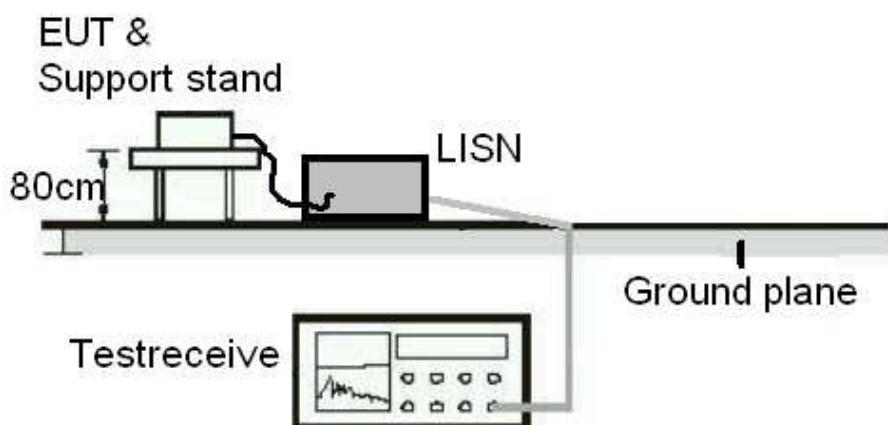
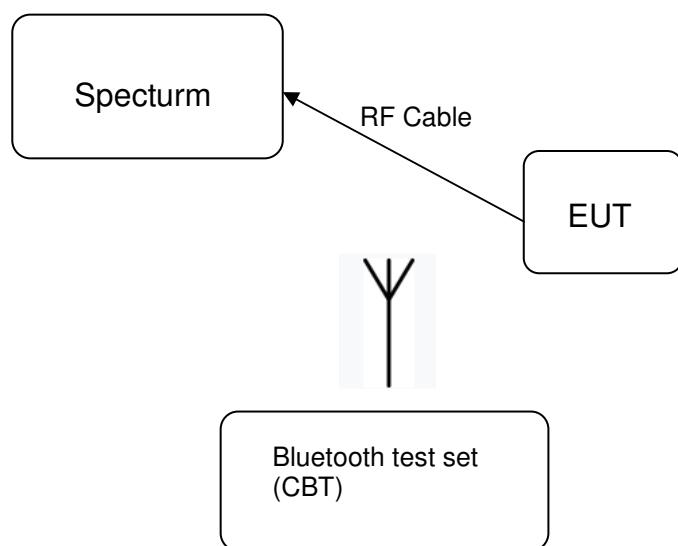
The test sample which has been tested containing the noise suppression parts as in the Photo Appendix and the Test Setup Photos. No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1 GHz are done with a table height of 1.5m

Diagram of Measurement Equipment Configuration for Mains Conduction Measurement**Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement**

Note: The field of the antenna is coupled into the stray inductance or capacitance of the PCB. It appears this is sufficient to control the EUT.

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Passed**

Test standard	:	LP0002(2018): 2.2, 3.10.1.3 FCC Part 15.247(b)(4), Part 15.203 and RSS- Gen 8.3
Requirement	:	use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of -6.72dBi. The antenna is printed antenna with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

5.1.2 Peak Output Power

RESULT:
Passed

Test standard	:	FCC Part 15.247(b)(1), RSS-247 5.4(2) LP0002(2018): 3.10.1.2
Basic standard	:	ANSI C63.10:2013 LP0002(2018) Appendix II
Kind of test site	:	Shielded room/Conducted room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Ambient temperature	:	18-25 °C
Relative humidity	:	50-65 %

Table 7: Test result of Peak Output Power, GFSK modulation

Channel	Channel Frequency (MHz)	Peak Output Power		Limit (W)
		(dBm)	(W)	
Low Channel	2402	6.88	0.00488	0.125
Middle Channel	2441	7.16	0.00520	0.125
High Channel	2480	7.16	0.00520	0.125

Table 8: Test result of Peak Output Power, 8DPSK modulation

Channel	Channel Frequency (MHz)	Peak Output Power		Limit (W)
		(dBm)	(W)	
Low Channel	2402	6.89	0.00489	0.125
Middle Channel	2441	7.17	0.00521	0.125
High Channel	2480	7.16	0.00520	0.125

Pmax: 5.21mW

5.1.3 20dB Bandwidth, 99% Bandwidth

RESULT:
Passed

Test standard	:	FCC Part 15.247(a)(1), RSS-247 5.1(1) LP0002(2018): 3.10.1.6 (1) (A)
Basic standard	:	ANSI C63.10:2013 LP0002(2018) Appendix II
Kind of test site	:	Shielded room/Conducted room

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%

Table 9: Test result of 20dB Bandwidth, GFSK modulation

Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)	Result
Low Channel	2402	948.4	1.5	Pass
Mid Channel	2441	947.8	1.5	Pass
High Channel	2480	948.9	1.5	Pass

Note: Limit is for Channel Separation of 1 MHz and a power limit of 125 mW.

Table 10: Test result of 20dB Bandwidth, 8DPSK modulation

Channel	Channel Frequency (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Result
Low Channel	2402	1.278	1.5	Pass
Mid Channel	2441	1.269	1.5	Pass
High Channel	2480	1.267	1.5	Pass

Note: Limit is for Channel Separation of 1 MHz and a power limit of 125 mW.

If the carrier separation frequency of a Bluetooth Device is set at 1 MHz due to the firmware setting and the Bluetooth Standard, then for power <125 mW the limit for the 20 dB Bandwidth, becomes 1 MHz / 0.66666 = 1.5 MHz.

Table 11: Test result of 99% Bandwidth,

Channel	Channel Frequency (MHz)	99% Bandwidth (kHz)
Low Channel	2402	873.87
Mid Channel	2441	874.64
High Channel	2480	875.05

Table 12: Test result of 99% Bandwidth,

Channel	Channel Frequency (MHz)	99% Bandwidth (MHz)
Low Channel	2402	1.1518
Mid Channel	2441	1.1555
High Channel	2480	1.1556

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Test Plot of 20dB Bandwidth, GFSK modulation

Low Channel



Middle Channel

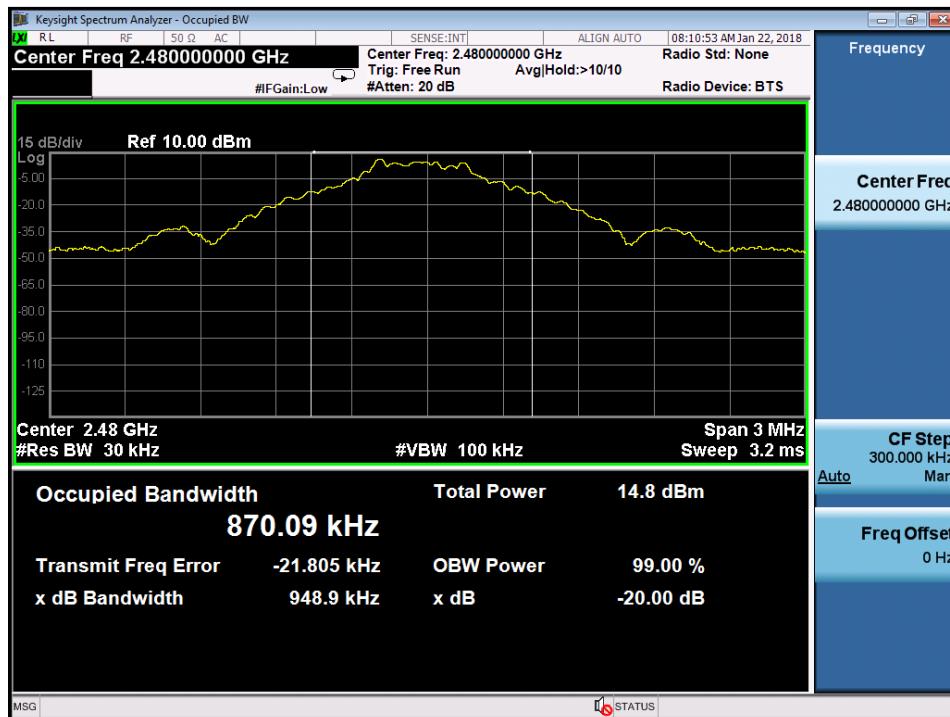


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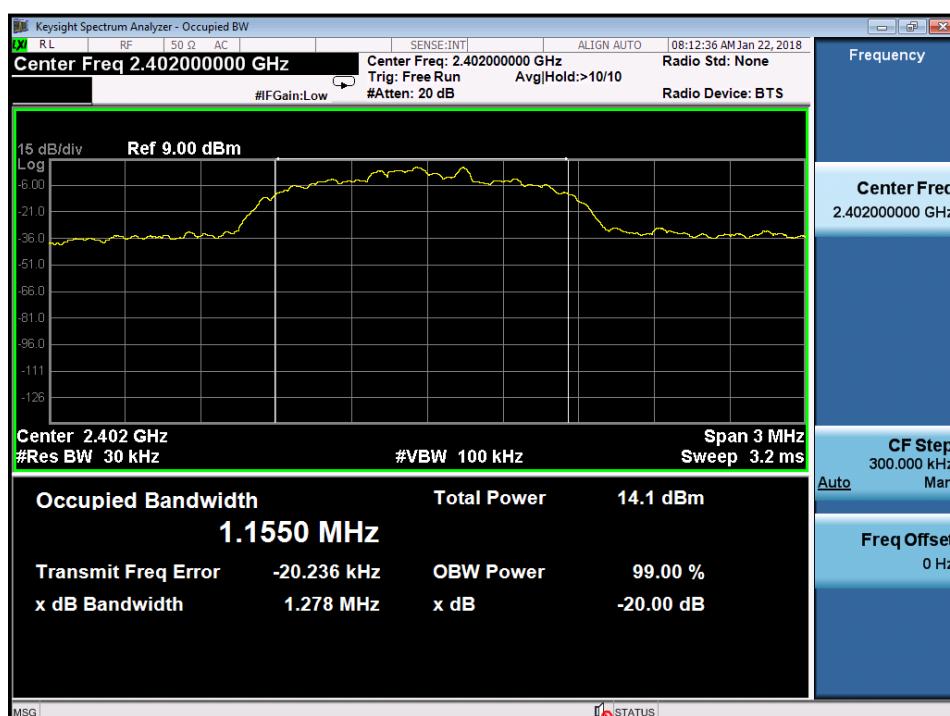
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High Channel



Test Plot of 20dB Bandwidth, 8DPSK modulation

Low Channel

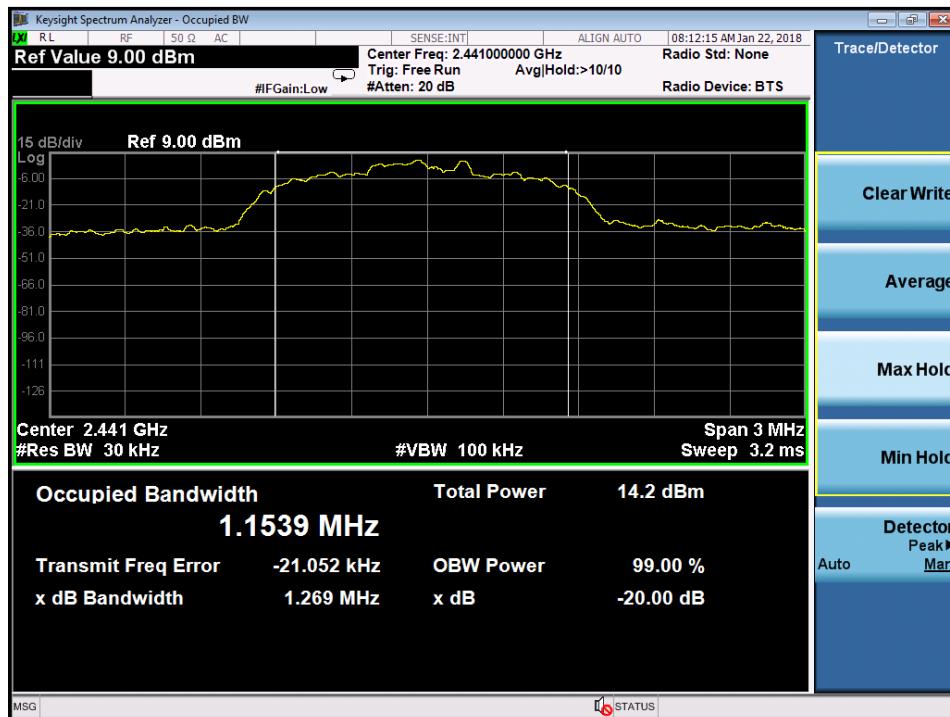


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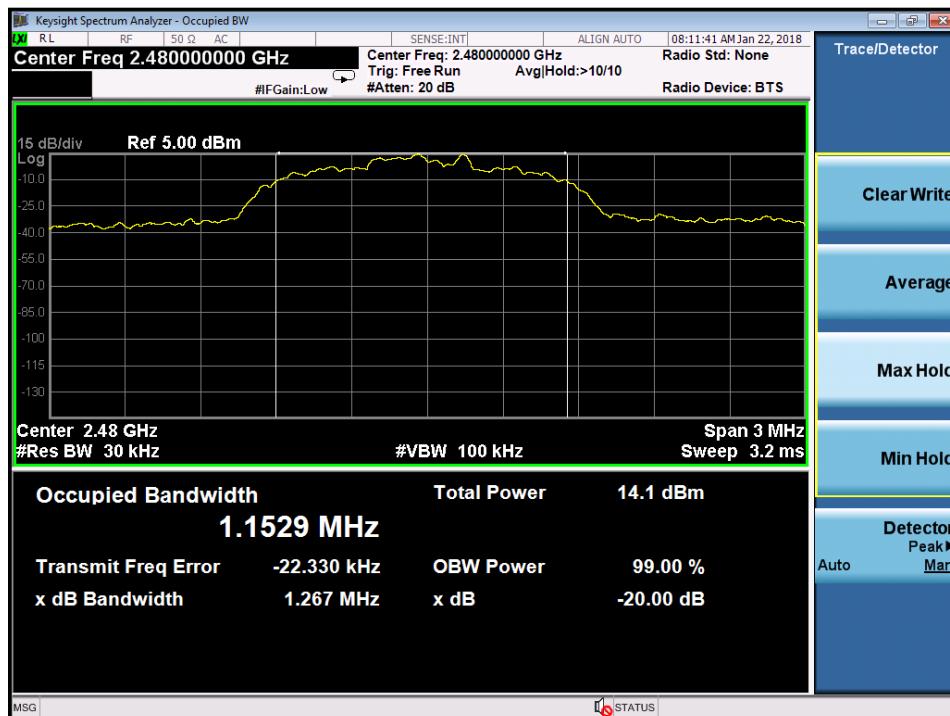
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Middle Channel



High Channel



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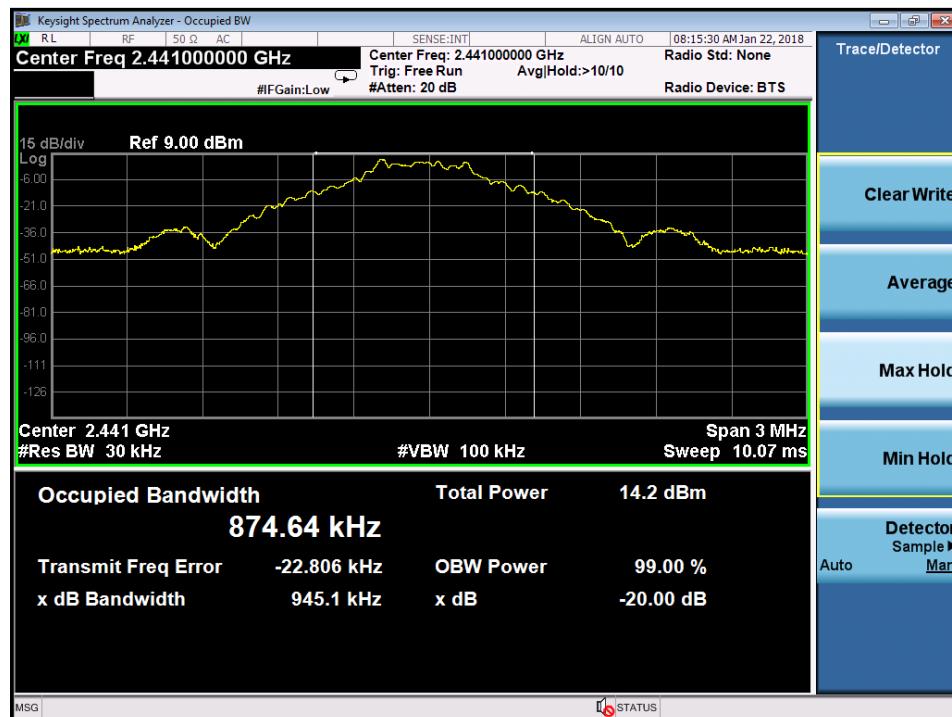
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Test Plot of 99% Bandwidth, GFSK modulation

Low Channel



Middle Channel



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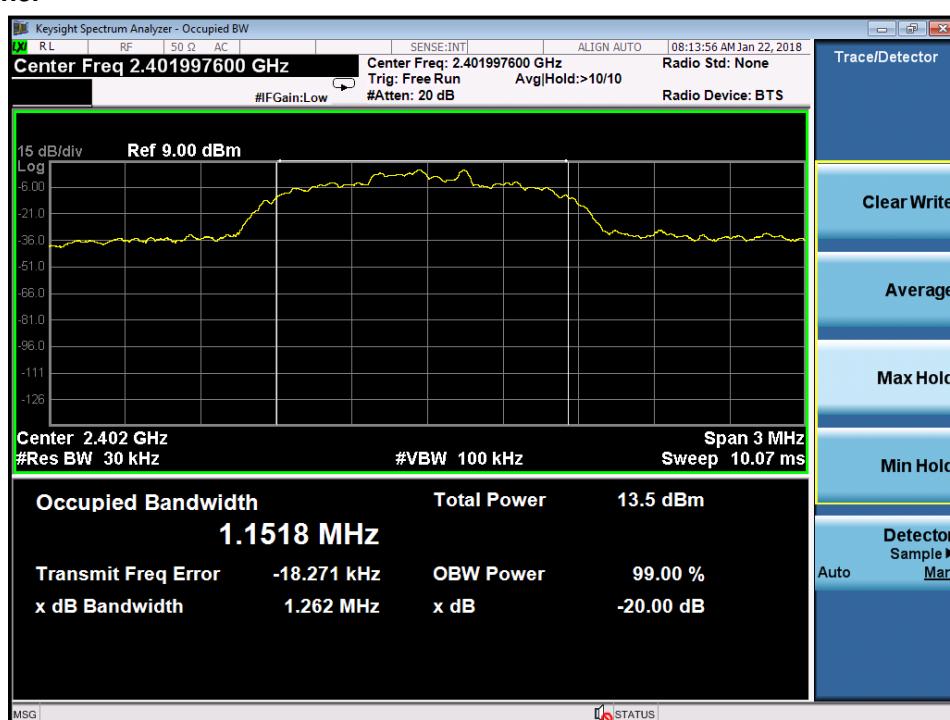
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High Channel



Test Plot of 99% Bandwidth, 8DPSK modulation

Low Channel

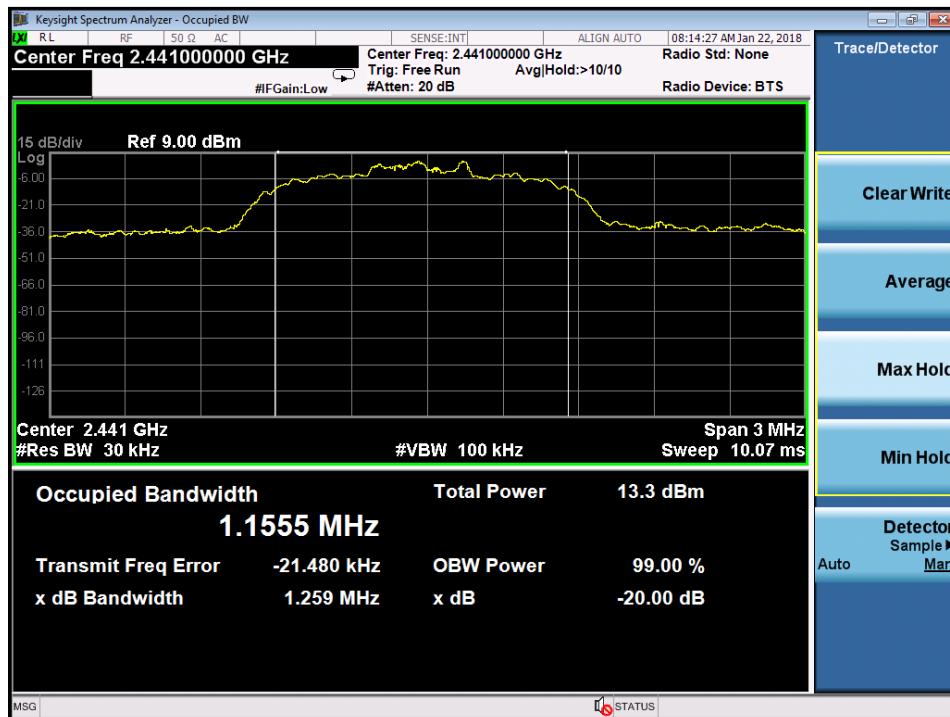


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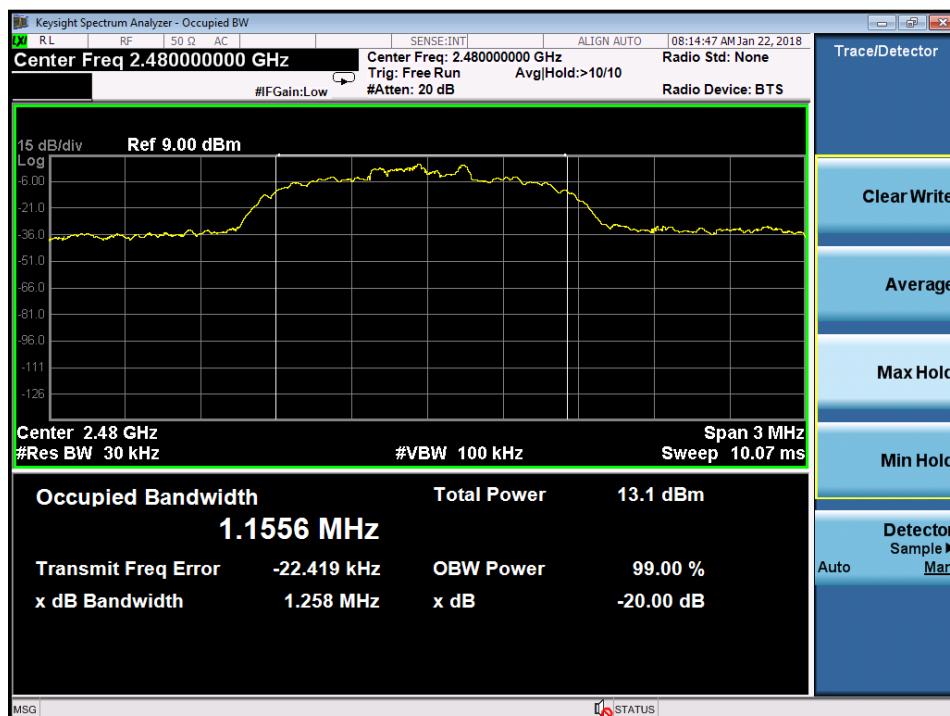
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Middle Channel



High Channel



5.1.4 Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

RESULT:**Passed**

Test standard	:	FCC part 15.247(d), RSS-247 5.5 LP0002(2018): 3.10.1.5
Basic standard	:	ANSI C63.10:2013 LP0002(2018) Appendix II
Limit	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power)
Kind of test site	:	Shielded room/Conducted room

Test setup

Test Channel	:	Low/ Middle/ High for Conducted Spurious Emissions Low/ High/ Hopping on for Frequency Band Edge
Operation Mode	:	A
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%

All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.

Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

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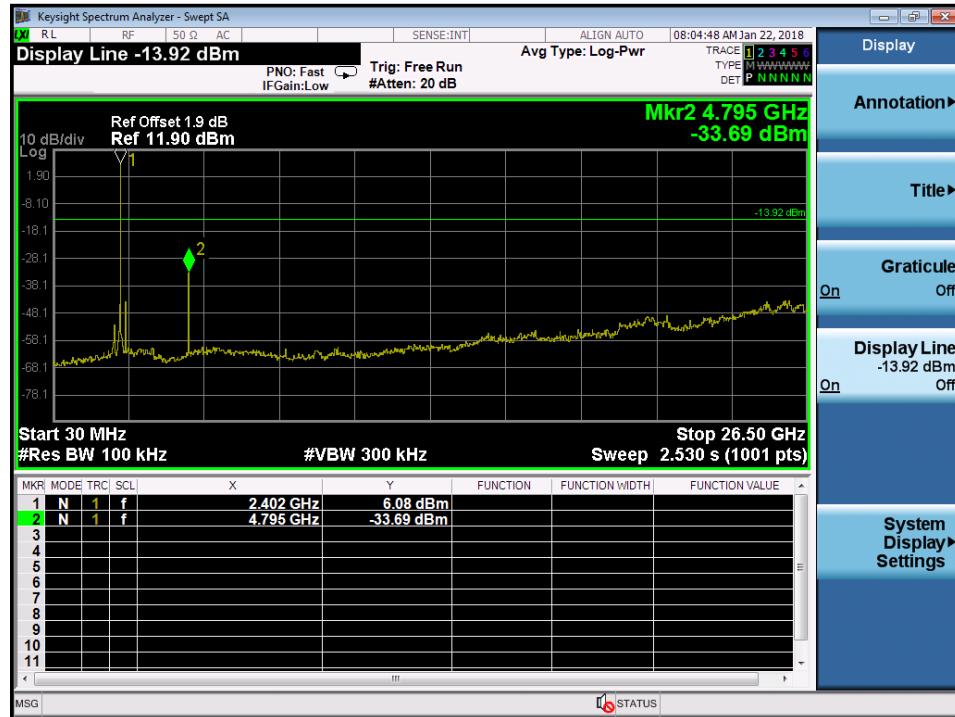
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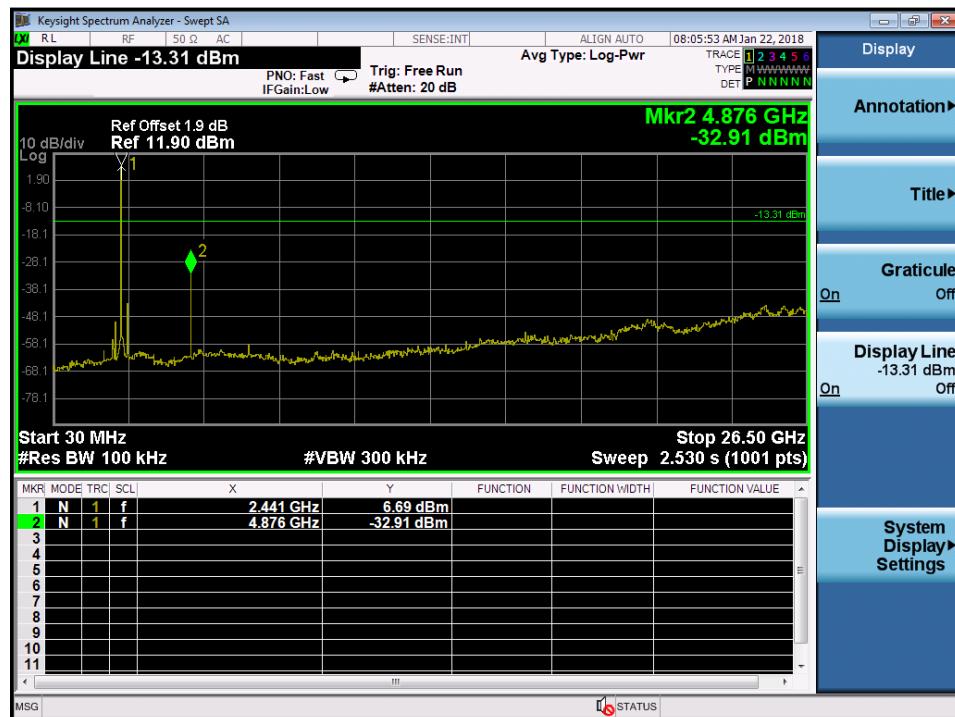
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Test Plot of 100kHz Conducted Emissions, GFSK modulation

Low Channel



Middle Channel



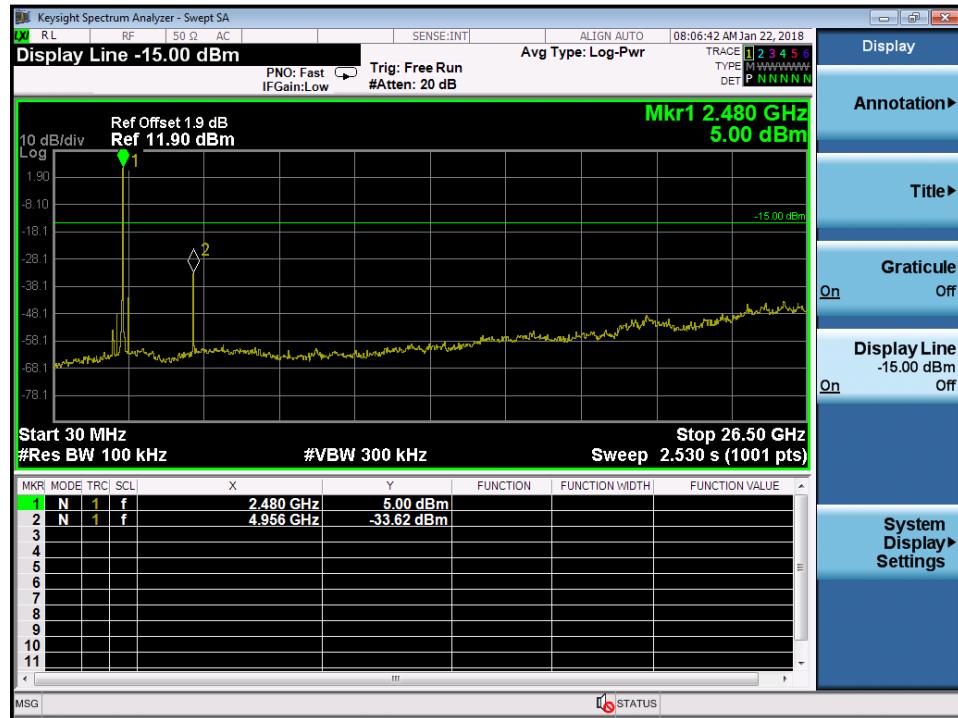
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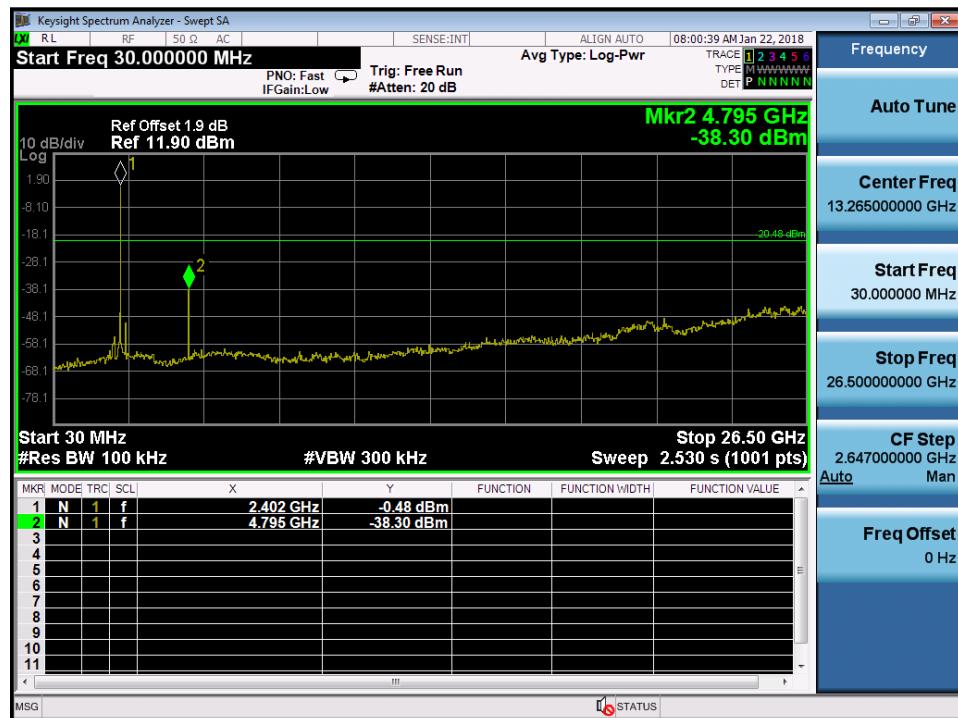
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High Channel



Test Plot of 100kHz Conducted Emissions, 8DPSK modulation

Low Channel

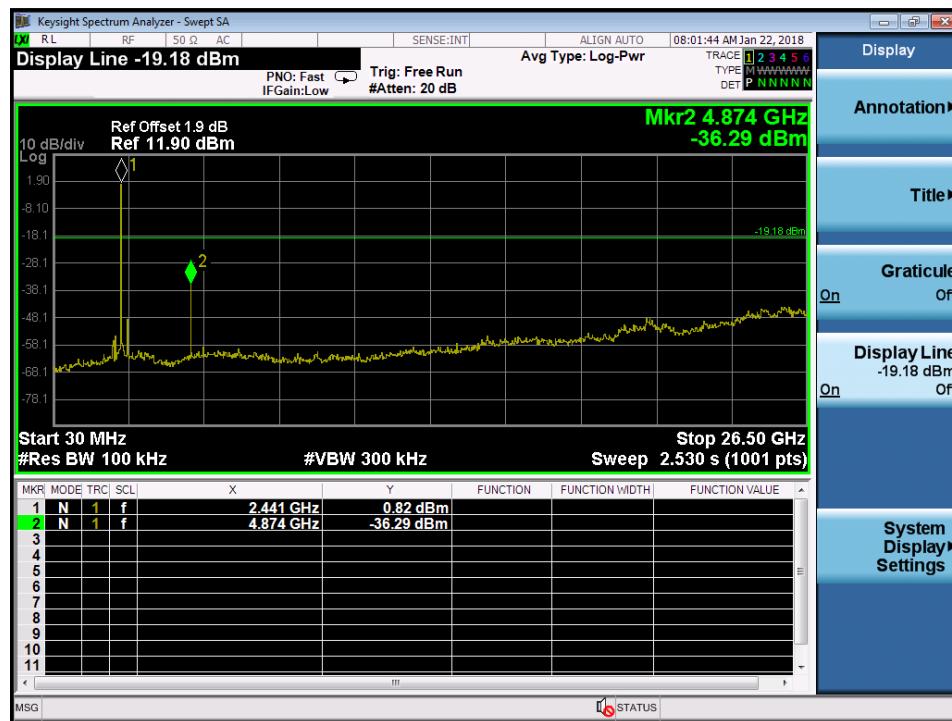


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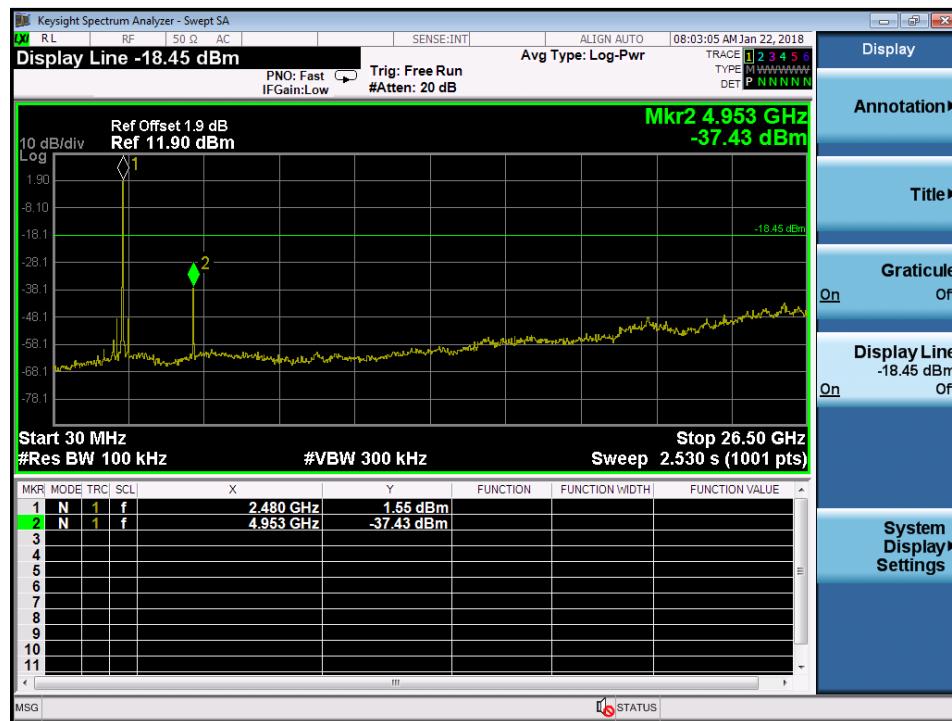
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High Channel



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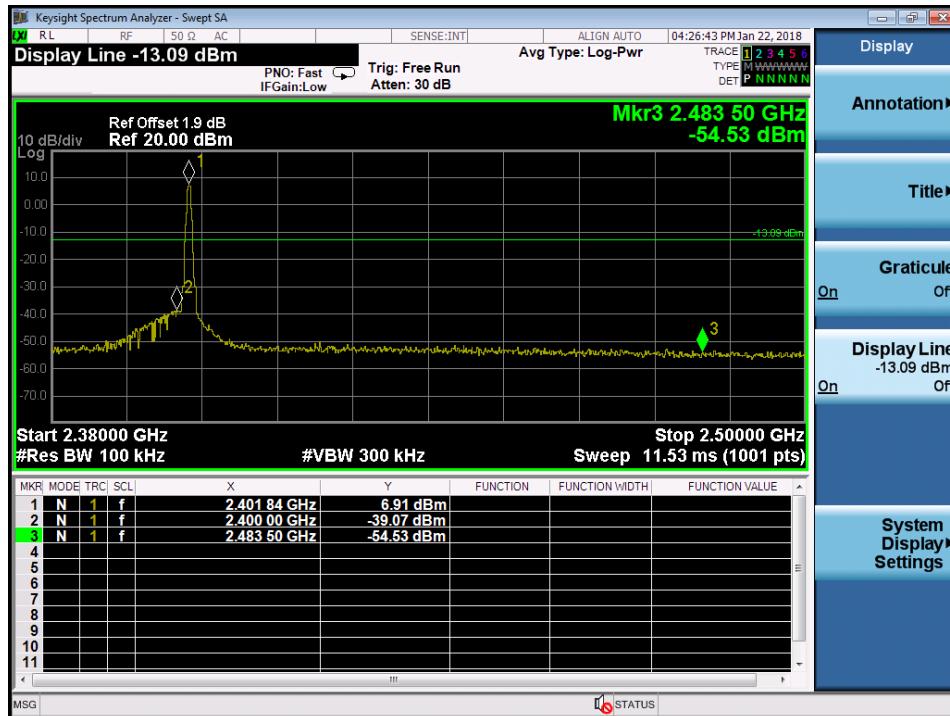
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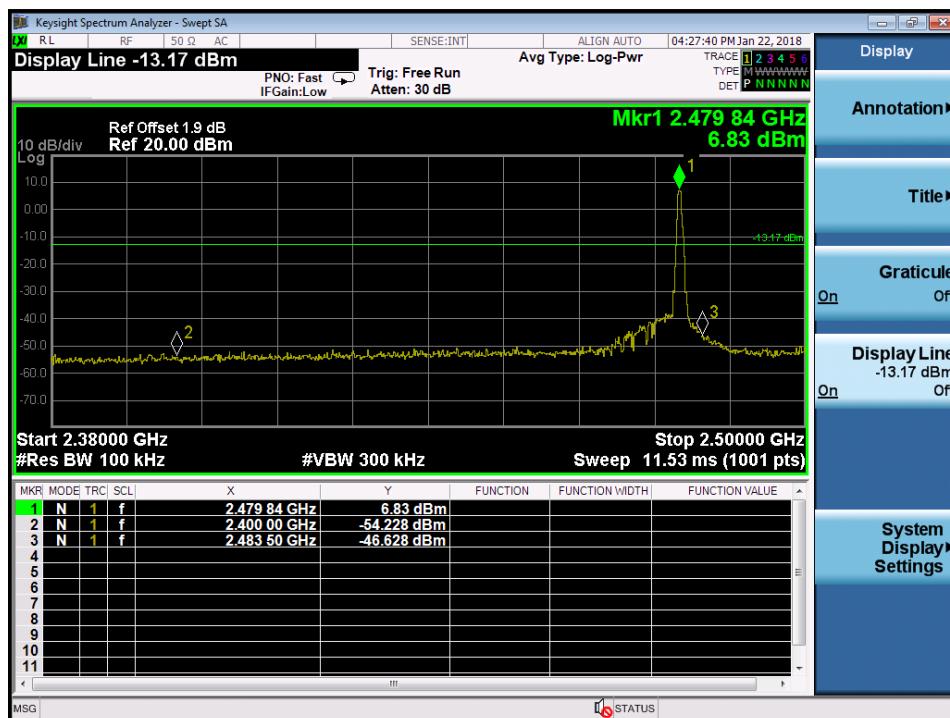
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Test Plot of 100kHz Bandwidth of Frequency Band Edge, GFSK modulation

Low Channel



High Channel



Produkte

Products

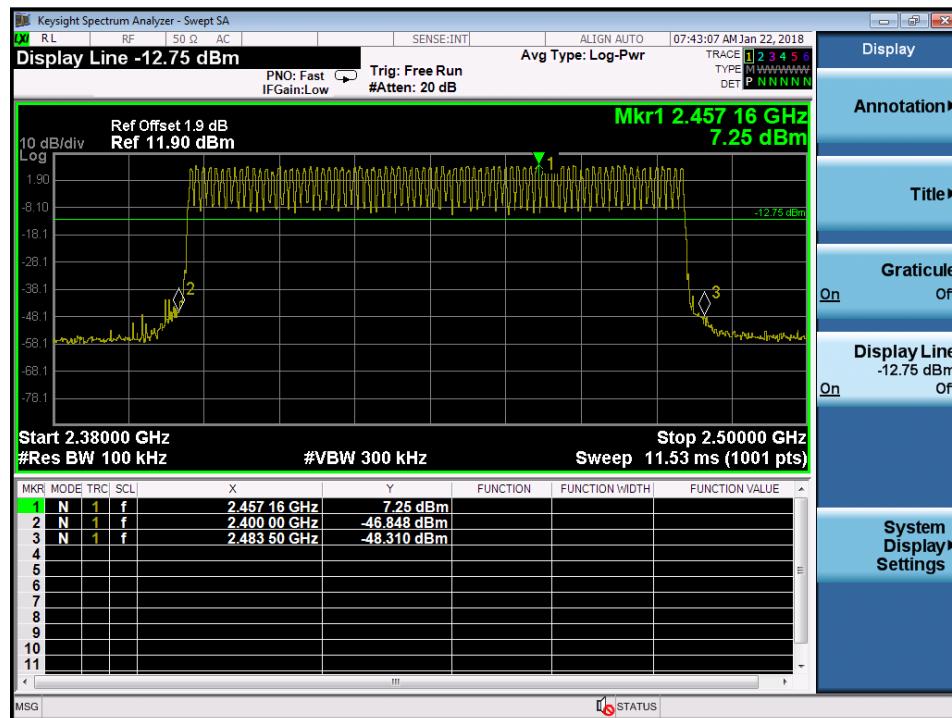
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Hopping ON



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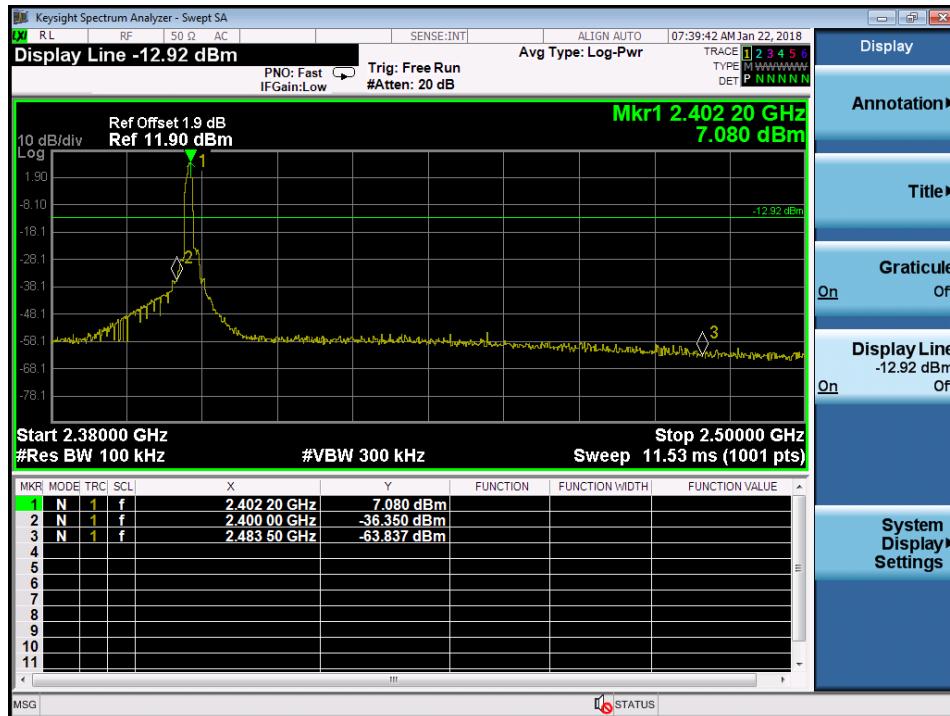
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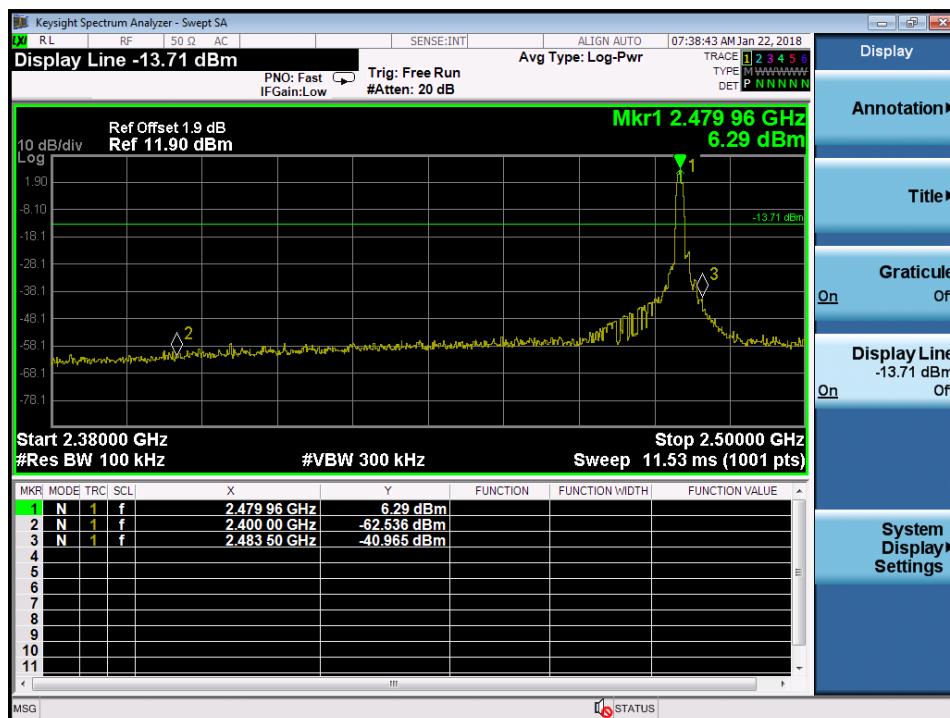
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Test Plot of 100kHz Bandwidth of Frequency Band Edge, 8DPSK modulation

Low Channel



High Channel

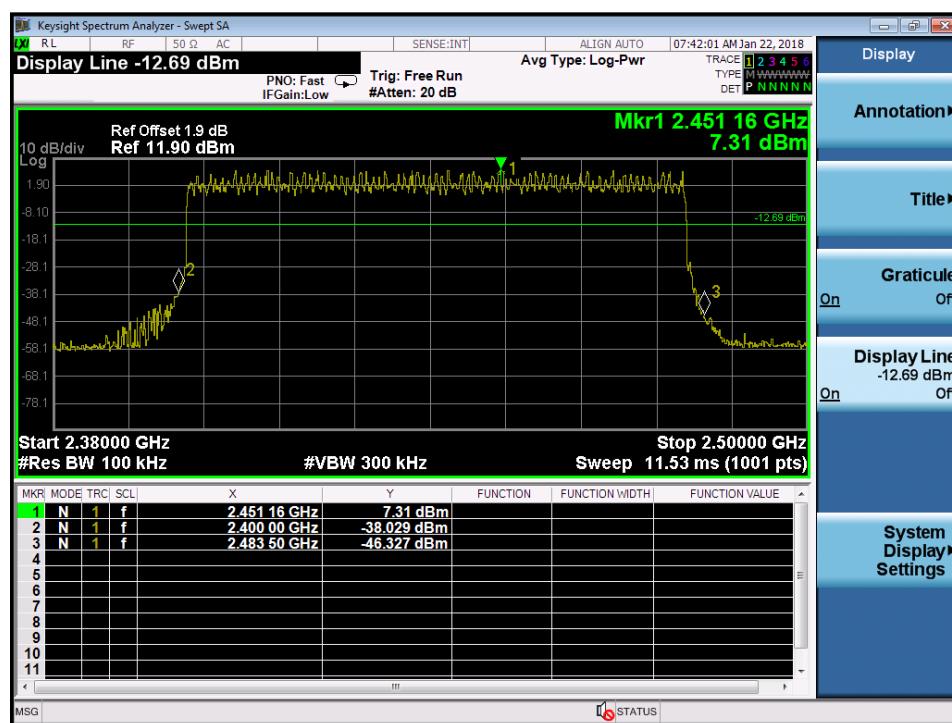


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5.1.5 Spurious Emission

RESULT:**Passed**

Test standard	:	FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-210 2.2, RSS-247 5.5 and RSS-Gen 8.9 LP0002(2018): 3.10.1.5
Basic standard Limits	:	Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen i4, 8.9 (Table 6), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen i4, 8.9 (Table 4 and 5). Radiated emissions which fall in the restricted bands, as defined in LP0002(2018): 2.7 , must comply with the radiated emission limits specified in LP0002(2018): 2.8
	:	Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) and FCC 15.249(a), RSS-Gen i4, 8.9 (Table 4 and 5) and RSS-210 A2.9(a). Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in LP0002(2018): 2.8
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/ Middle/ High
Operation Mode	:	A, B
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%

Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic. For details refer to Appendix D. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report. Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

5.1.6 Frequency Separation

RESULT:

Passed

Test standard	:	FCC part 15.247(a)(1) RSS-247 5.1 LP0002(2018): 3.10.1.6 (1) (A)
Basic standard	:	ANSI C63.10:2013 LP0002(2018) Appendix II

Test setup

Test Channel	:	Middle
Operation Mode	:	A
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%

Table 13: Test result of Frequency Separation

GFSK

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Record Channel	2440	1	$\geq 25\text{kHz}$ or 2/3 of 20dB bandwidth	Pass
Record Channel adj 1	2441			
Record Channel adj 2	2442			

8DPSK

Channel	Channel Frequency (MHz)	Measured Channel Separation (MHz)	Limit (kHz)	Result
Record Channel	2440	1	$\geq 25\text{kHz}$ or 2/3 of 20dB bandwidth	Pass
Record Channel adj 1	2441			
Record Channel adj 2	2442			

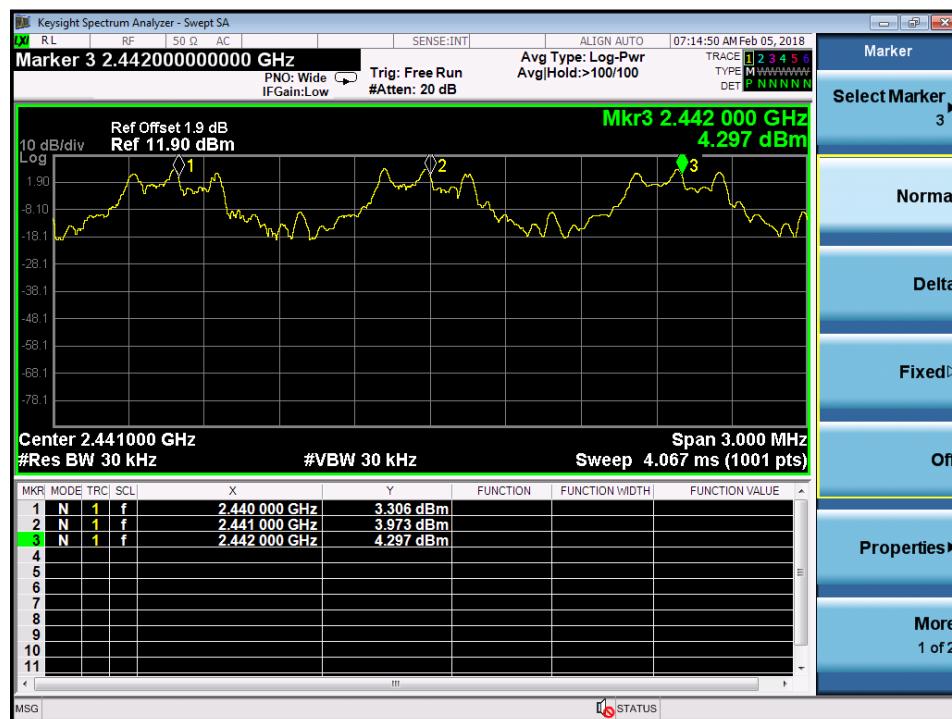
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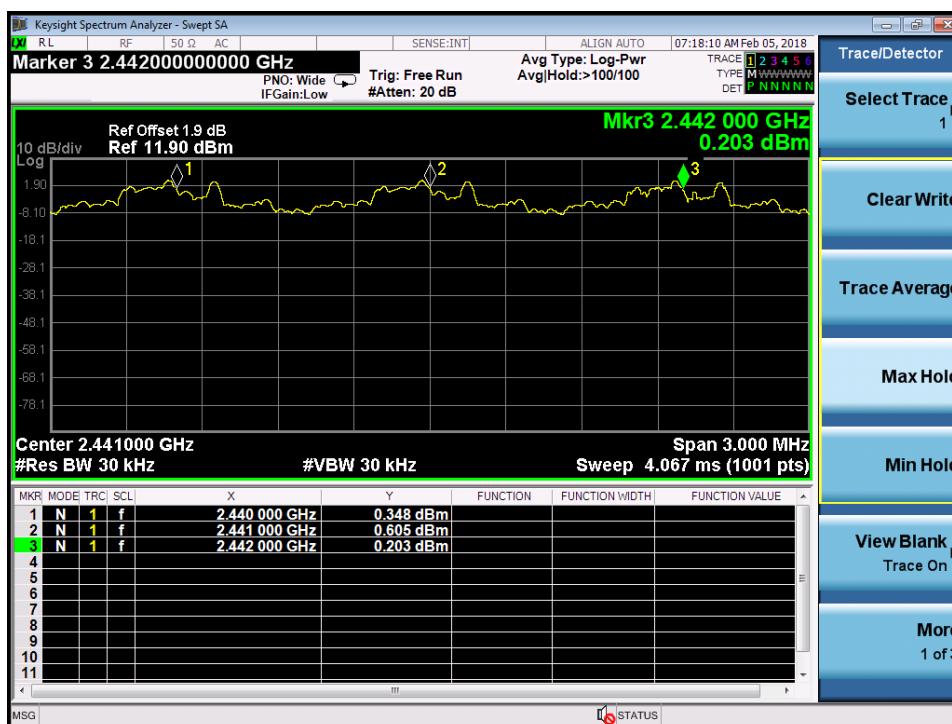
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Test Plot of Frequency Separation

GFSK



8DPSK



5.1.7 Number of hopping frequency

RESULT:**Passed**

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 5.1(5)
Basic standard	:	LP0002(2018): 3.10.1.6 (1) (A) (a) ANSI C63.10:2013
Kind of test site	:	LP0002(2018) Appendix II Shield room/Conducted room

Test setup

Test Channel	:	Hopping On
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%

Table 14: Test result of Number of hopping frequency

Frequency Range	Measured Quantity of Hopping Channel	Limit	Result
2400 to 2483.5 MHz	79	≥15	Pass

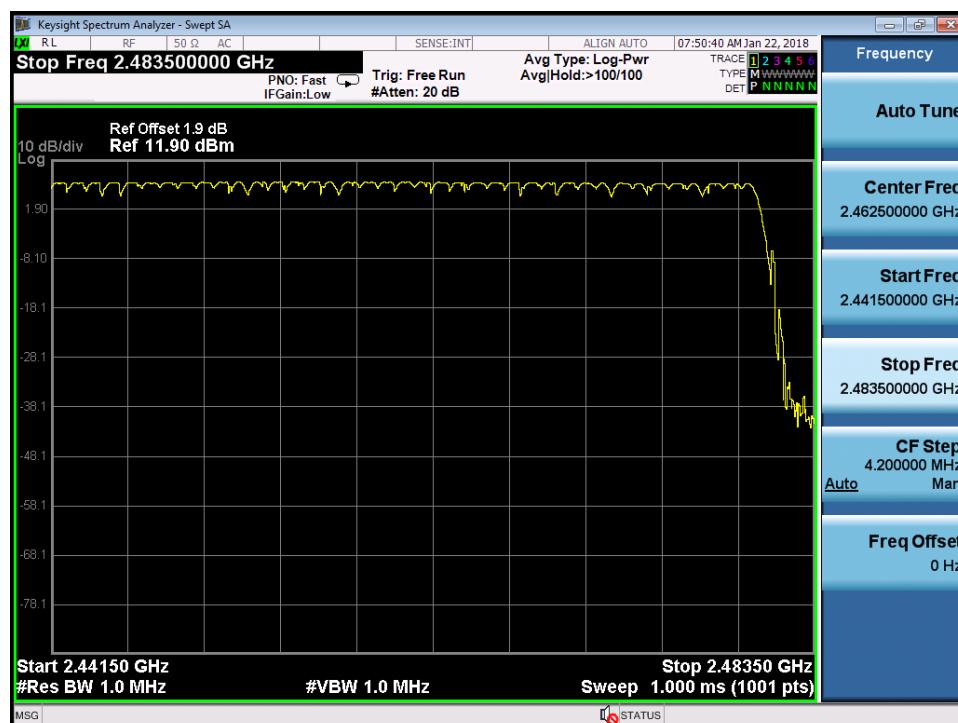
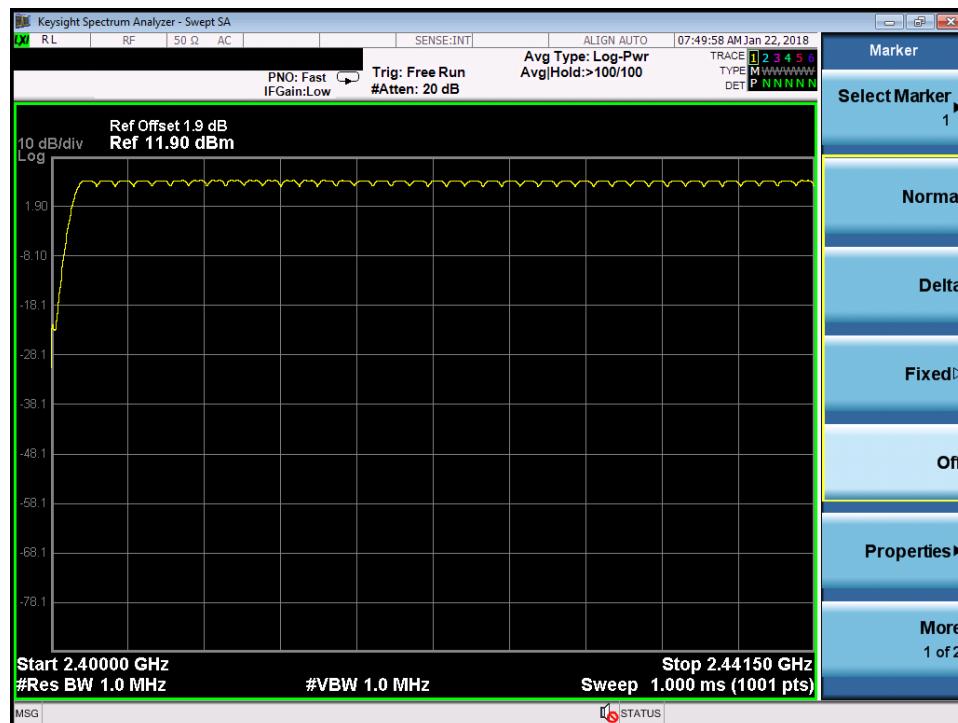
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Test Plot of Number of hopping frequencies

GFSK



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8DPSK



5.1.8 Time of Occupancy

RESULT:
Passed

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 5.1(5)
Basic standard	:	LP0002(2018): 3.10.1.6 (1) (A) (a) ANSI C63.10:2013
Kind of test site	:	LP0002(2018) Appendix II Shield room/Conducted room

Test setup

Test Channel	:	Low
Operation Mode	:	A
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%

Table 15: Test result of Time of Occupancy

Data Mode	Captured Burst (s)	Dwell time (s)	On+Off time (s)	Limit (s)	Result
DH5	0.00291	0.3112	0.00374	0.4	Pass
3DH5	0.00291	0.3112	0.00374	0.4	Pass

Note:

Dwell time = Pulse width x (Hopping rate / Number of channels) x Period

Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds.

Hopping rate for DH5 = 1 / (On+Off time) = 267 Hz

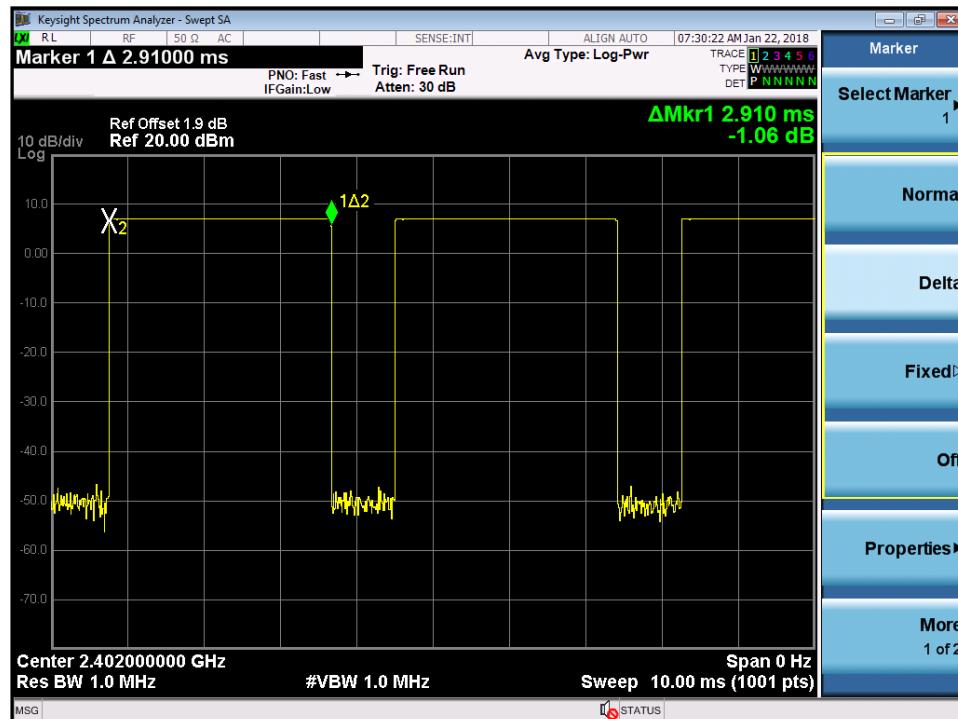
Hopping rate for 3DH5 = 1 / (On+Off time) = 267 Hz

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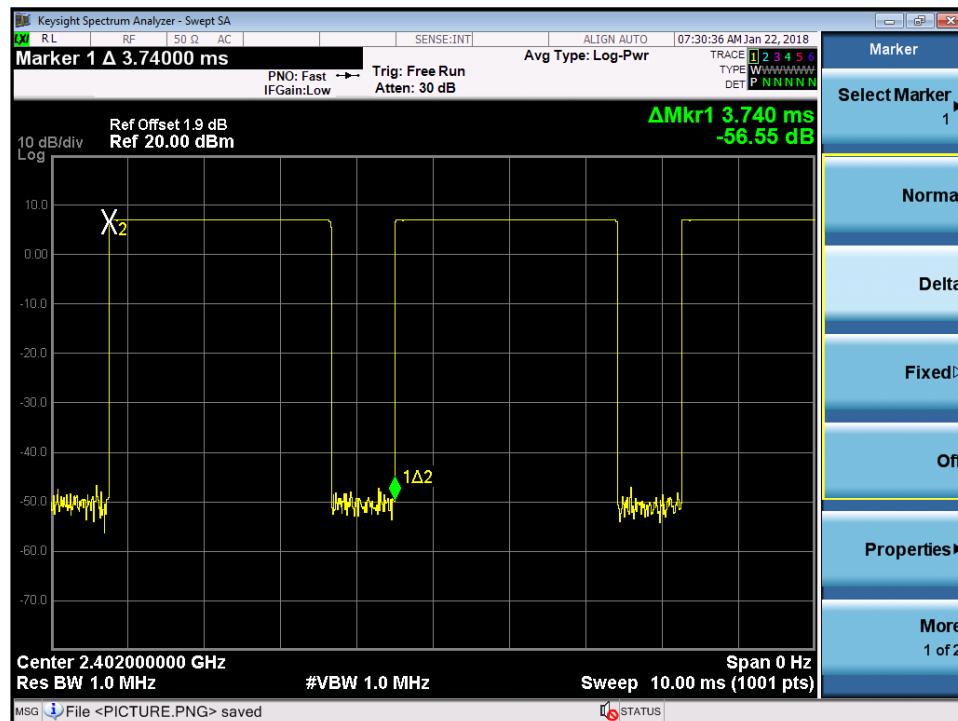
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Test Plot of Time of Occupancy, GFSK modulation ON



ON+OFF

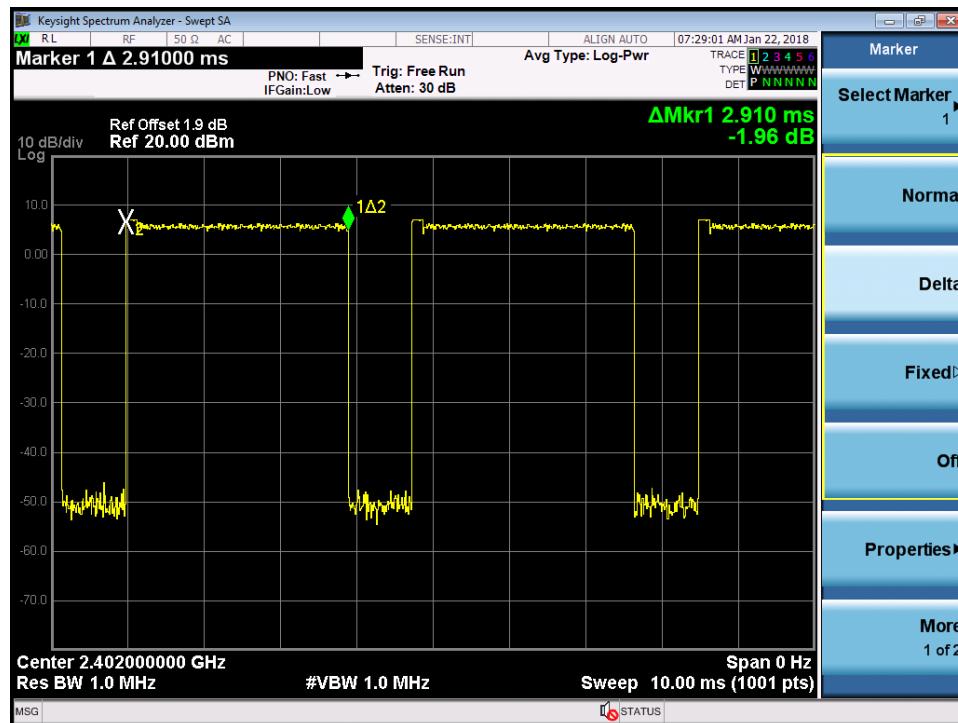


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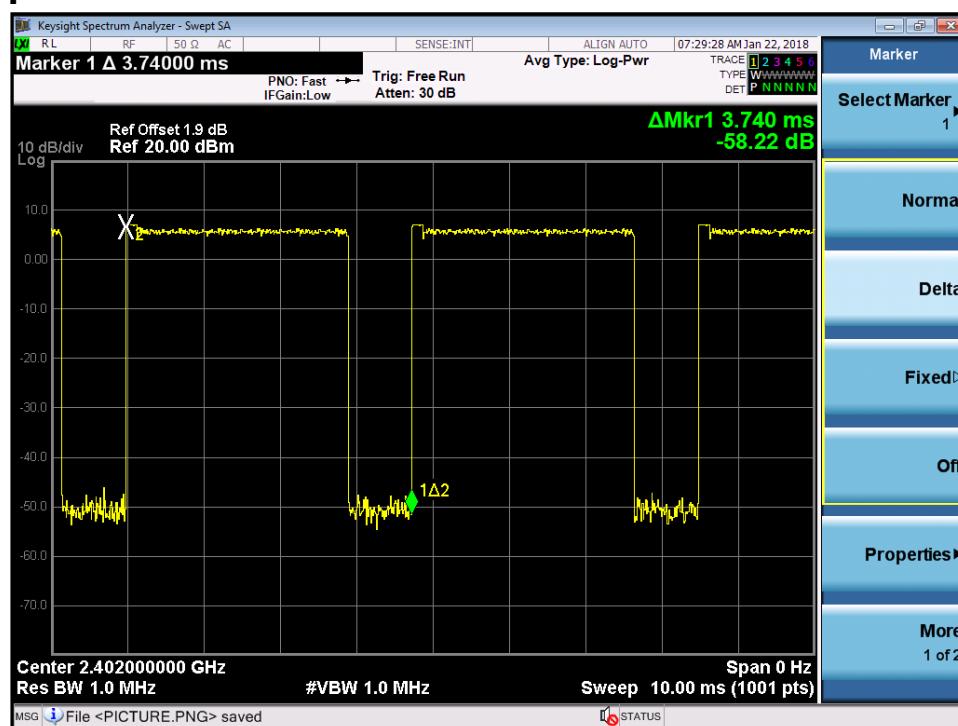
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Test Plot of Time of Occupancy, 8DPSK modulation
ON



ON+OFF



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6. Safety Human exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:

Passed

Test standard : FCC KDB Publication 447498 D01 v06

FCC:

Since maximum peak output power of the transmitter is **5.21mW < 10mW**, hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498: Mobile Portable RF Exposure

6.2 Mains Emissions

6.2.1 Mains Conducted Emissions

RESULT:**Passed**

Test standard	:	FCC Part 15.207 FCC Part 15.107 RSS-Gen 8.8 LP0002(2018): 2.3
Limits	:	Mains Conducted emissions as defined in above test standards must comply with the mains conducted emission limits specified
Kind of test site	:	Shielded Room

Test setup

Test Channel	:	Middle
Operation mode	:	A
Ambient temperature	:	18-25°C
Relative humidity	:	50-65%

Remark: For details refer to Appendix D.

7. Photographs of the Test Set-Up

Photograph 1: Set-up for Spurious Emissions (Front View)

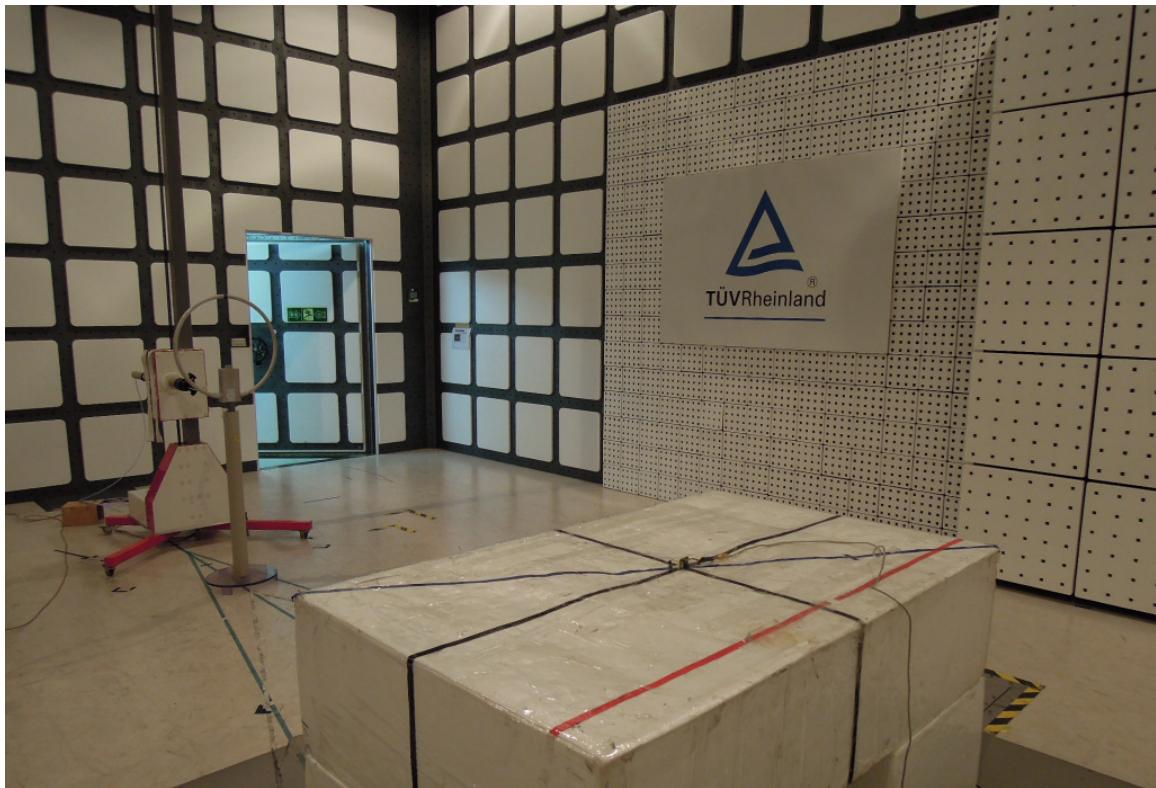


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Photograph 2: Set-up for Spurious Emissions (Back View 1)

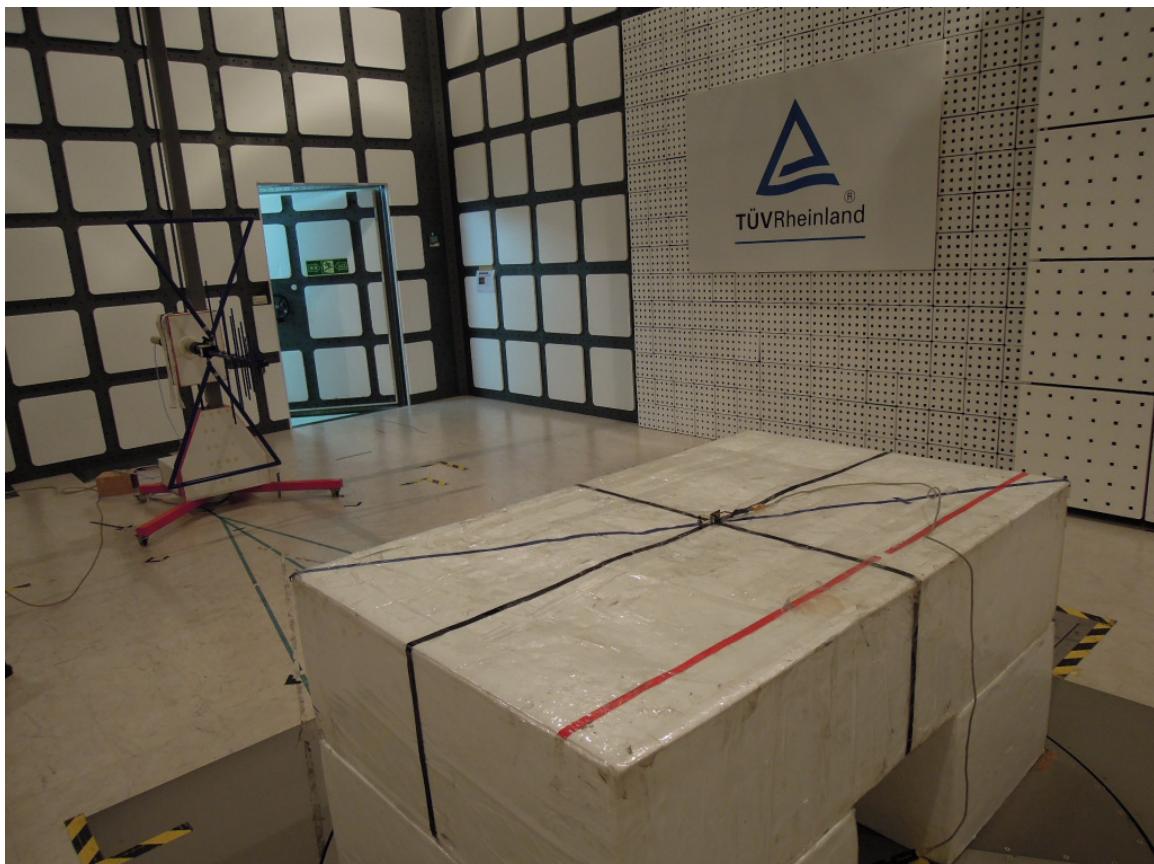


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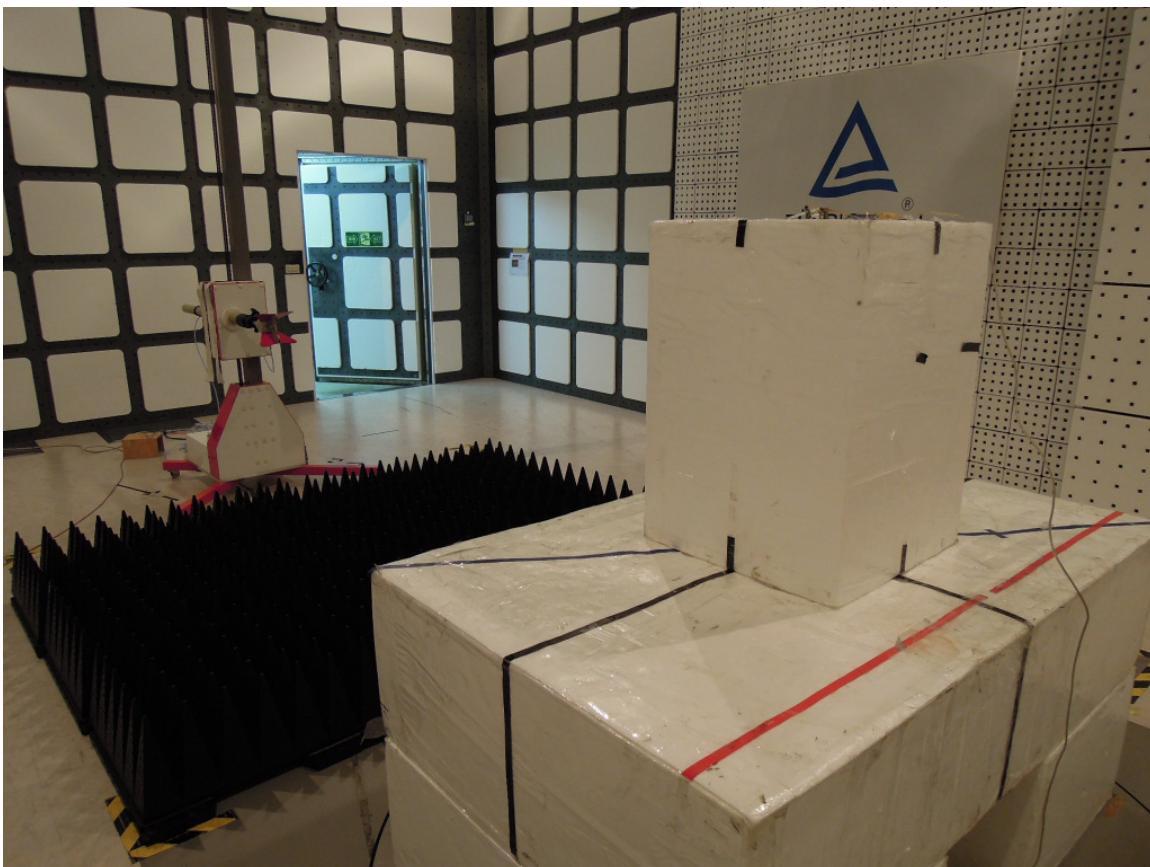
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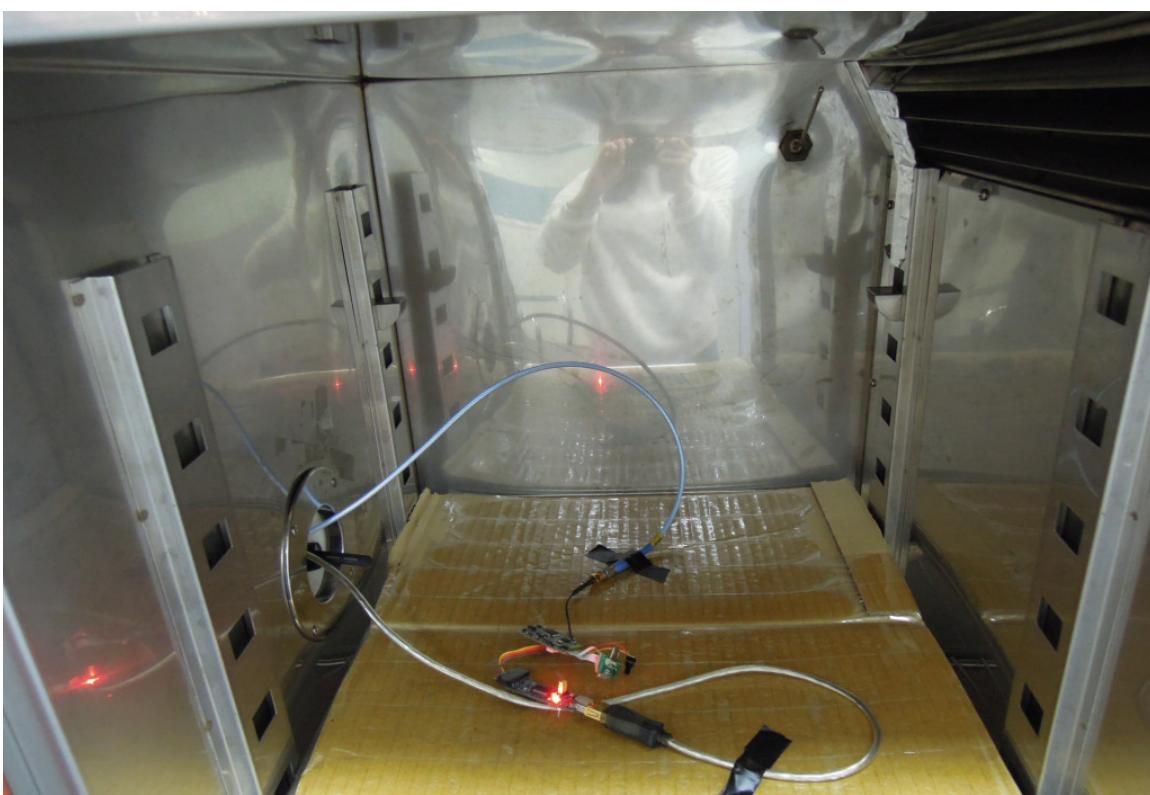
Photograph 3: Set-up for Spurious Emissions (Back View 2)



Photograph 4: Set-up for Spurious Emissions (Back View 3)



Photograph 5: Set-up for Conducted testing



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Photograph 6: Set-up for Conducted testing

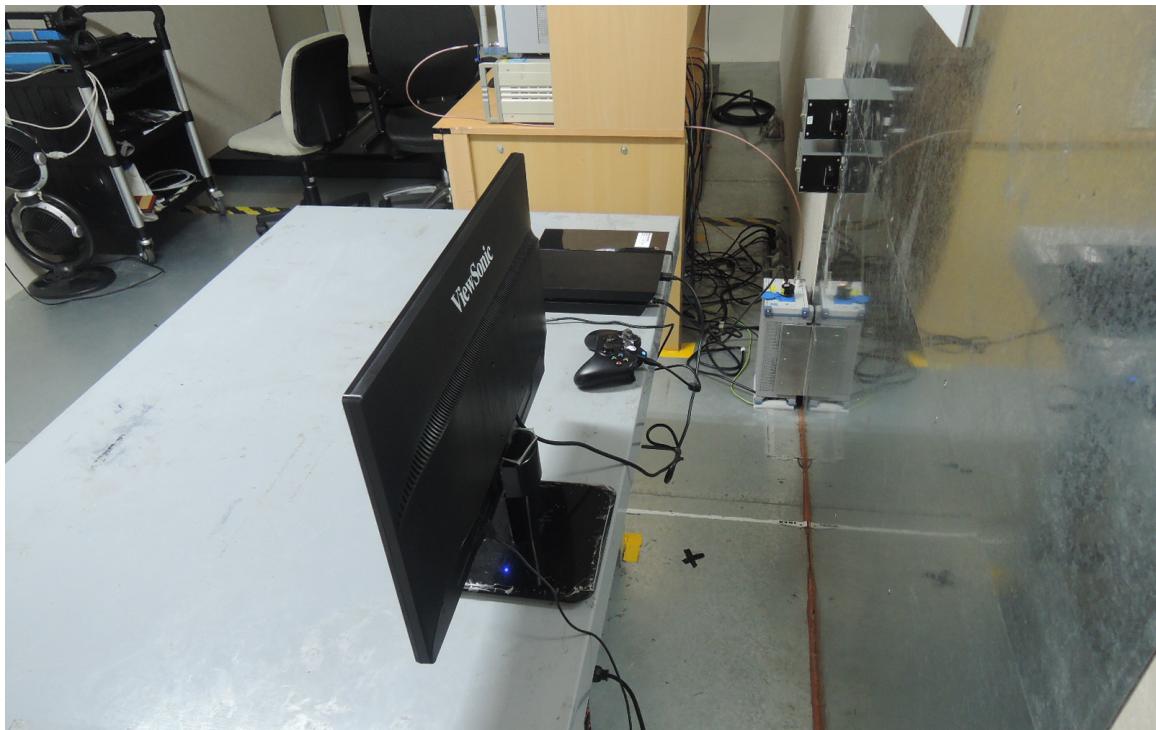


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Photograph 7: Set-up for Mains Conducted testing (Back view)



Photograph 8: Set-up for Mains Conducted testing (Front view)



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