



FCC - TEST REPORT

Report Number	: 68.950.15.078.01	Date of Issue: <u>Jun 11, 2015</u>
Model	: WIP-SH2000, DGHP-5606, BT-200, S100, DGHP-5606S	
Product Type	: WIRELESS STEREO SPORT HEADSET	
Applicant	: WINLITE INTERNATIONAL (HK) LTD	
Address	: Room 1401, Tower A, Tian An Cyber Times, Shennan Avenue, Futian District Shenzhen, China	
Production Facility	: WINLITE INTERNATIONAL (HK) LTD	
Address	: Room 1401, Tower A, Tian An Cyber Times, Shennan Avenue, Futian District Shenzhen, China	
Test Result	: <input checked="" type="checkbox"/> Positive <input type="checkbox"/> Negative	
Total pages including Appendices	: <u>38</u>	

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1 Table of Contents

1	Table of Contents	2
2	Details about the Test Laboratory	3
3	Description of the Equipment Under Test	4
4	Summary of Test Standards	5
5	Summary of Test Results	6
6	General Remarks	7
7	Test Setups	8
8	Systems test configuration	9
9	Technical Requirement	10
9.1	Conducted peak output power	10
9.2	20 dB bandwidth and 99% Occupied Bandwidth	11
9.3	Carrier Frequency Separation	18
9.4	Number of hopping frequencies	21
9.5	Dwell Time	23
9.6	Spurious RF conducted emissions	26
9.7	Band edge testing	30
9.8	Spurious radiated emissions for transmitter	35
10	Test Equipment List	37
11	System Measurement Uncertainty	38

2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052,
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Telephone: 86 755 8828 6998
Fax: 86 755 8828 5299

3 Description of the Equipment Under Test

Product:	WIRELESS STEREO SPORT HEADSET
Model no.:	WIP-SH2000, DGHP-5606, BT-200, S100, DGHP-5606S
FCC ID:	A6JSH2000
Brand Name:	Winlite®
Options and accessories:	USB Cable
Rating:	3.7VDC (supplied by Li-ion rechargeable battery) 5VDC (Charged by USB Port)
RF Transmission Frequency:	2402-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8DPSK
Duty Cycle:	77%
Antenna Type:	PCB Antenna
Antenna Gain:	1dBi
Description of the EUT:	The Equipment Under Test (EUT) is a WIRELESS STEREO SPORT HEADSET with Bluetooth function operating at 2.4GHz

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2014 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure released by FCC on March 30, 2000 and C63.10 (2009).

5 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition	Pages	Test Site	Test Result	
§15.207	Conducted emission on AC power port	---	---	N/A
§15.247(b)(1)	Conducted peak output power	10	Site 1	Pass
§15.247(a)(2)	6dB bandwidth	---	---	N/A
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	11	Site 1	Pass
§15.247(a)(1)	Carrier frequency separation	18	Site 1	Pass
§15.247(a)(1)(iii)	Number of hopping frequencies	21	Site 1	Pass
§15.247(a)(1)(iii)	Dwell Time	23	Site 1	Pass
§15.247(e)	Power spectral density*	---	---	N/A
§15.247(d)	Spurious RF conducted emissions	26	Site 1	Pass
§15.247(d)	Band edge	30	Site 1	Pass
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter and receiver	35	Site 1	Pass
§15.203	Antenna requirement	See note 2		Pass

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a permanently PCB antenna, which gain is 1dBi. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: A6JSH2000, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C.

WIP-SH2000, DGHP-5606, BT-200, S100, DGHP-5606S have the same technical construction including circuit diagram, PCB Layout, components and component layout. The difference only lies in the model name. Therefore, full test was applied on WIP-SH2000, another model deemed to fulfill the EMC requirement without further testing.

SUMMARY:

All tests according to the regulations cited on page 5 were

- - Performed
- - Not Performed

The Equipment Under Test

- - **Fulfills** the general approval requirements.
- - **Does not** fulfill the general approval requirements.

Sample Received Date: May 08, 2015

Testing Start Date: May 11, 2015

Testing End Date: Jun 10, 2015

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

Reviewed by: _____ Prepared by: _____ Tested by: _____

P. Brown

Phoebe Hu
EMC Project Manager

Calvin Weng

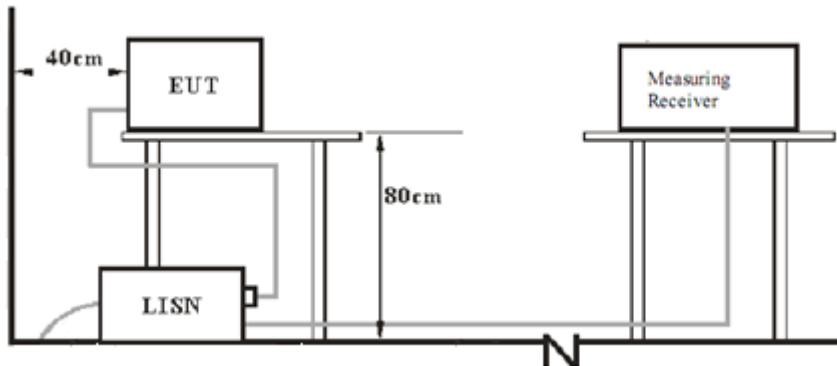
Calvin Weng
EMC Project Engineer

Leon Zhang

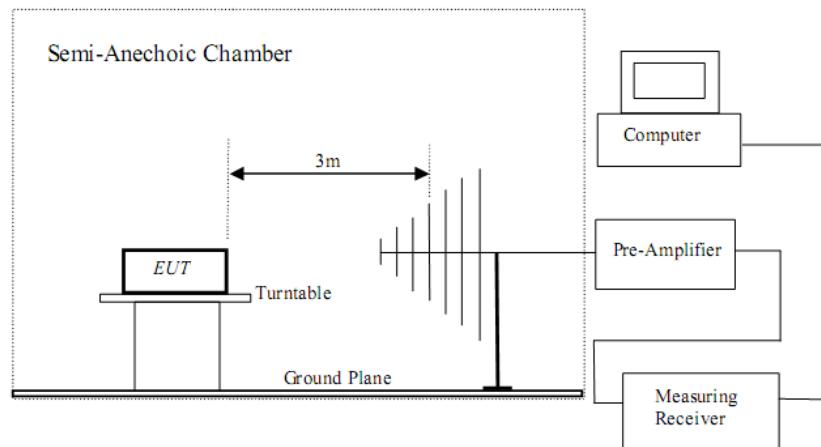
Leon Zhang
EMC Test Engineer

7 Test Setups

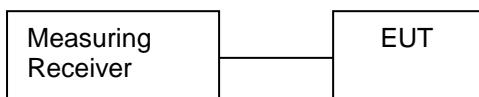
7.1 AC Power Line Conducted Emission test setups



7.2 Radiated test setups



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
NoteBook	LENOVO	X240	---

Test software: RF Control Kit v1.0.exe, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power

9 Technical Requirement

9.1 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured, $VBW \geq RBW$,
Sweep = auto, Detector function = peak, Trace = max hold
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

Limits

According to §15.247 (b) (1) , conducted peak output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤ 1	≤ 30

Test result as below table

Bluetooth Mode GFSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	2.34	Pass
Middle channel 2441MHz	2.61	Pass
High channel 2480MHz	1.14	Pass

Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	2.96	Pass
Middle channel 2441MHz	3.00	Pass
High channel 2480MHz	1.51	Pass

Bluetooth Mode 8DPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	3.26	Pass
Middle channel 2441MHz	3.37	Pass
High channel 2480MHz	1.76	Pass

9.2 20 dB bandwidth and 99% Occupied Bandwidth

Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Limit

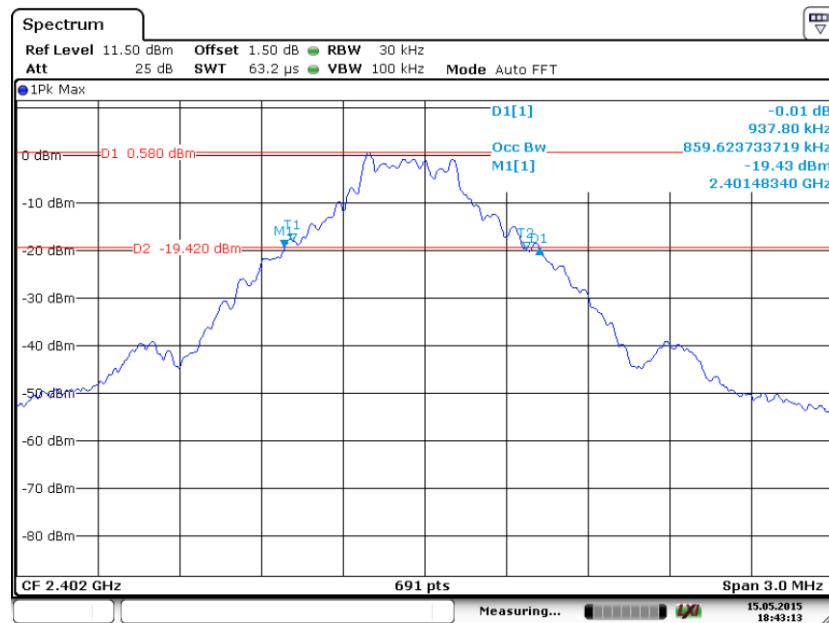
Limit [kHz]

N/A

20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

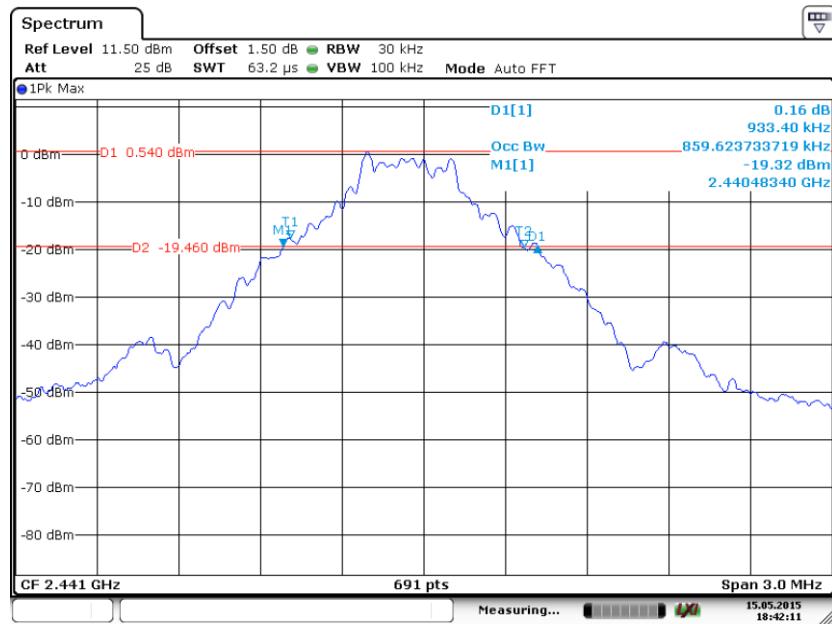
Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	937.8	859.6	--	Pass
2441	933.4	859.6	--	Pass
2480	933.4	859.6	--	Pass



Date: 15.MAY.2015 18:43:12

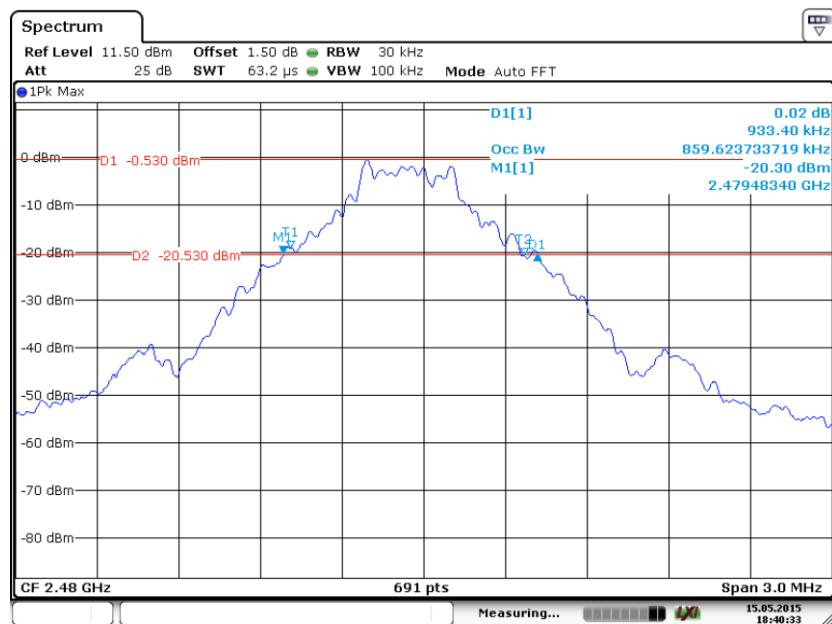
2402MHz

20 dB bandwidth and 99% Occupied Bandwidth



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2441MHz



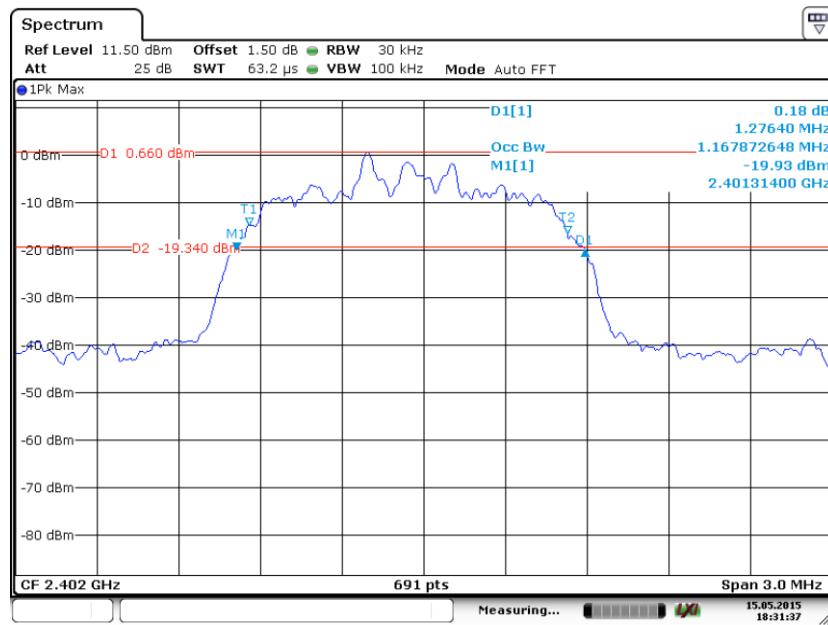
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2480MHz

20 dB bandwidth and 99% Occupied Bandwidth

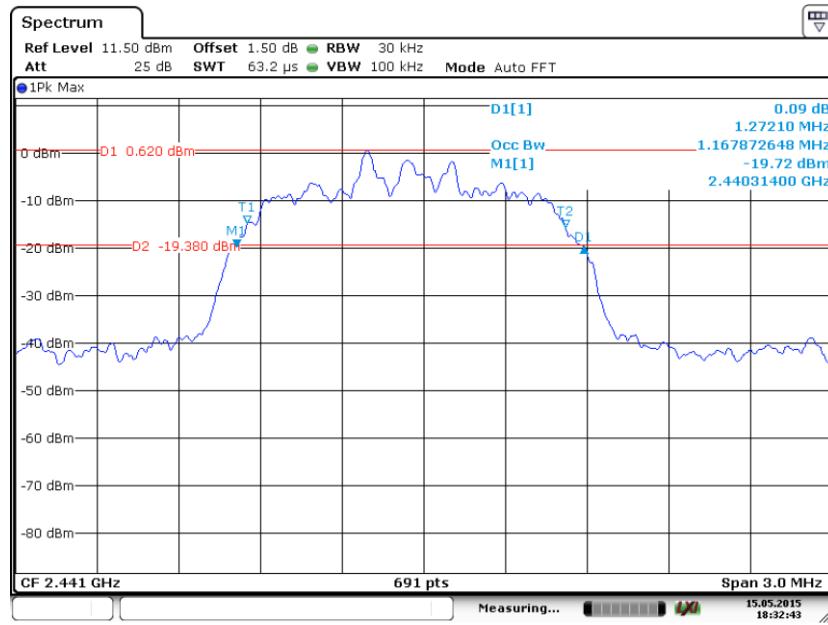
Bluetooth Mode $\pi/4$ -DQPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1276.4	1167.9	--	Pass
2441	1272.1	1167.9	--	Pass
2480	1259.0	1167.9	--	Pass

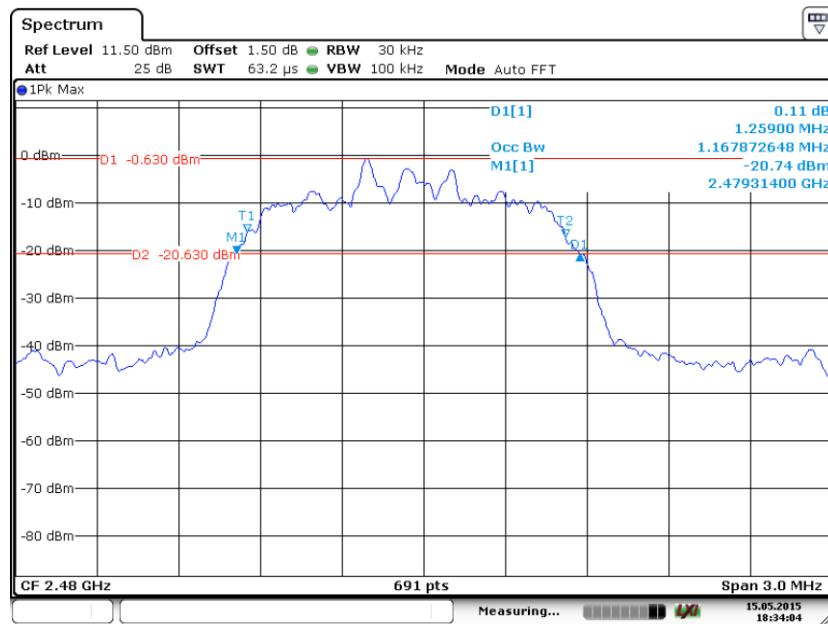


Date: 15.MAY.2015 18:31:37

2402MHz



Date: 15.MAY.2015 18:32:43

2441MHz

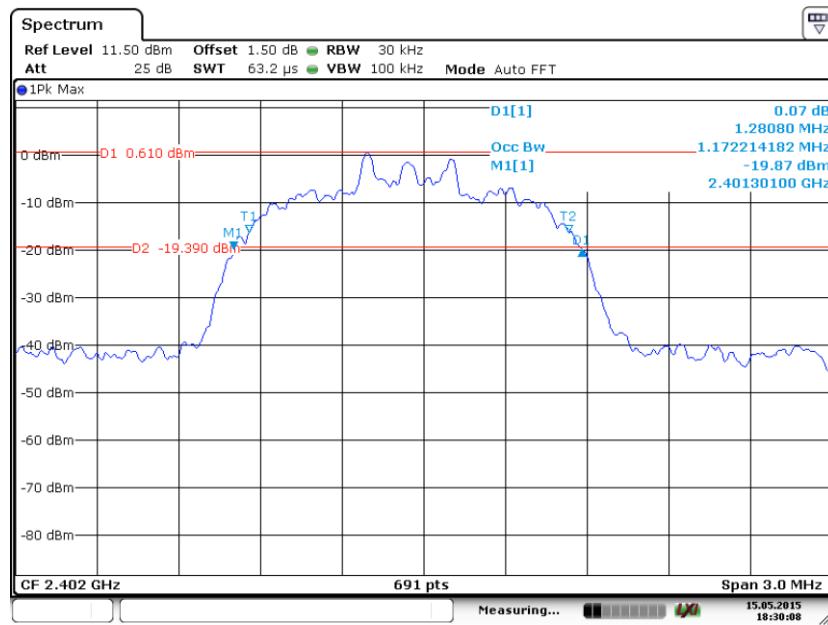
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2480MHz

20 dB bandwidth and 99% Occupied Bandwidth

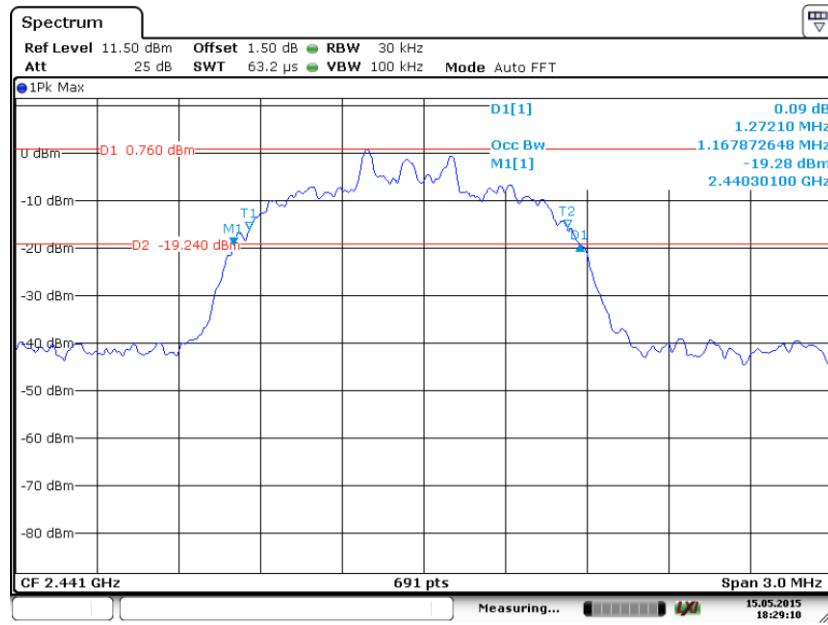
Bluetooth Mode 8DPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1280.8	1172.2	--	Pass
2441	1272.1	1167.9	--	Pass
2480	1267.7	1167.9	--	Pass

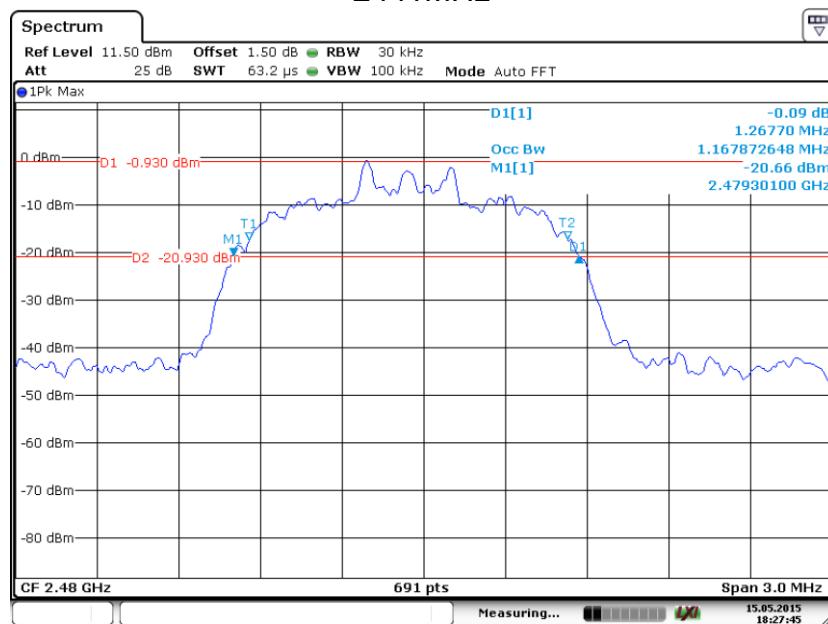


Date: 15.MAY.2015 18:30:08

2402MHz



Date: 15.MAY.2015 18:29:10

2441MHz

Date: 15.MAY.2015 18:27:45

2480MHz

9.3 Carrier Frequency Separation

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels, RBW \geq 1% of the span, VBW \geq RBW, Sweep = auto, Detector function = peak
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit kHz
$\geq 25\text{KHz}$ or 2/3 of the 20 dB bandwidth which is greater

GFSK Modulation Limit

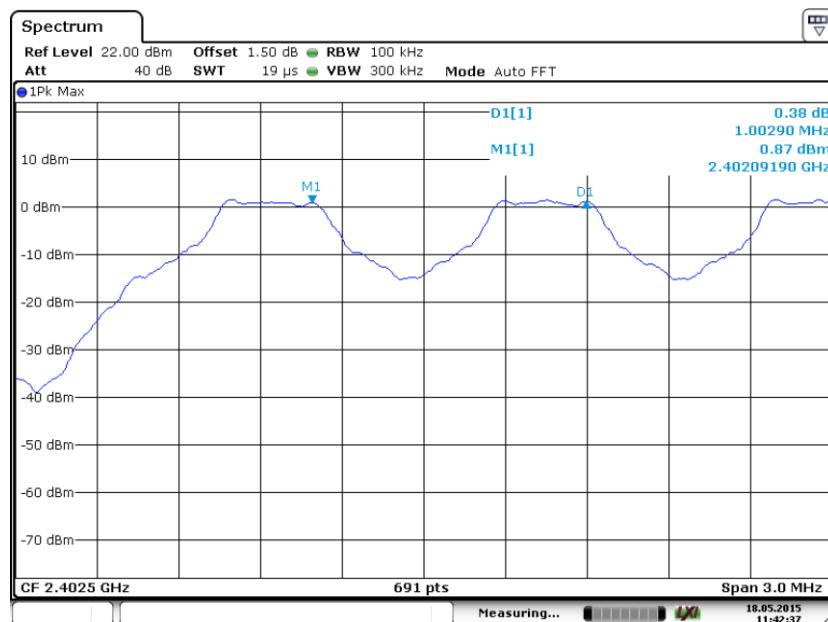
Frequency MHz	2/3 of 20 dB Bandwidth kHz
2402	625.2
2441	622.3
2480	622.3

Carrier Frequency Separation

Test result: The measurement was performed with the typical configuration (normal hopping status), here GFSK modulation mode was used to show compliance.

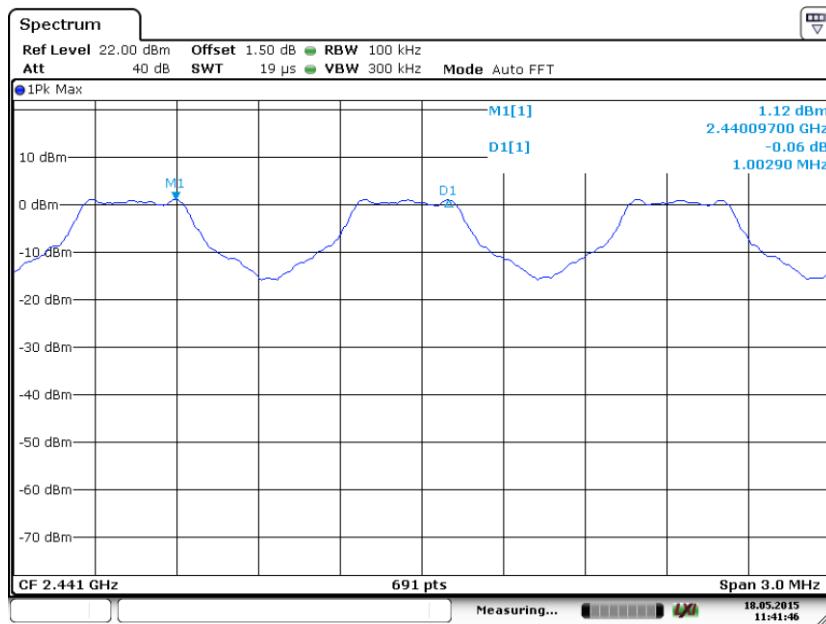
GFSK Modulation test result

Frequency MHz	Carrier Frequency Separation kHz	Result
2402	1003	Pass
2440	1003	Pass
2480	1007	Pass

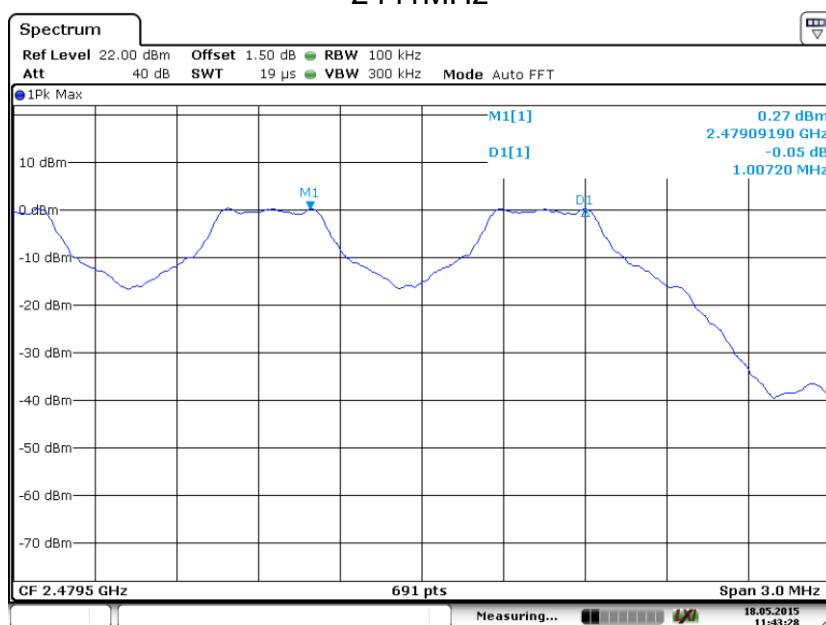


Date: 18.MAY.2015 11:42:37

2402MHz



Date: 18.MAY.2015 11:41:46

2441MHz

Date: 18.MAY.2015 11:43:28

2480MHz

9.4 Number of hopping frequencies

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels, RBW \geq 1% of the span, VBW \geq RBW, Sweep = auto, Detector function = peak
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
3. Record all the signals from each channel until each one has been recorded.
4. Repeat above procedures until all frequencies measured were complete.

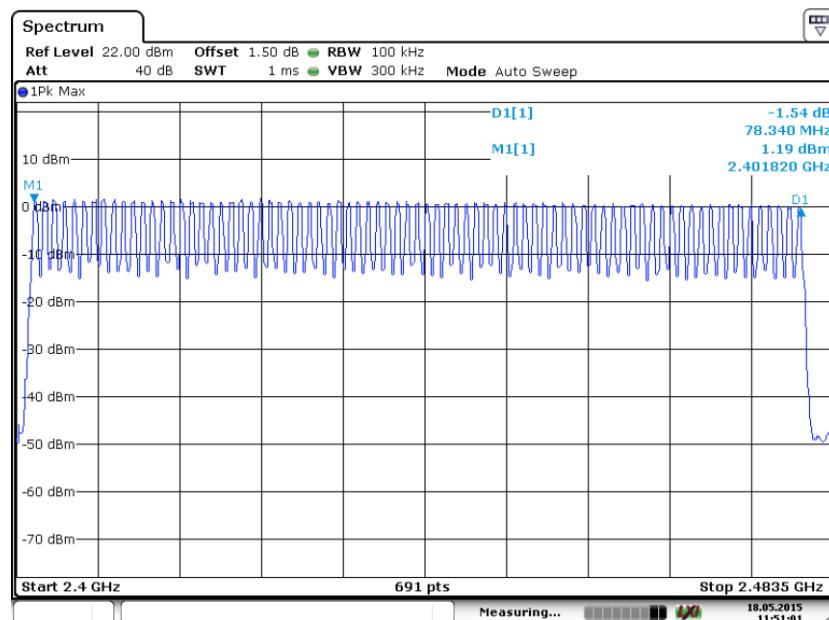
Limit

Limit number
≥ 15

Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.

Number of hopping frequencies	Result
79	Pass



Date: 18.MAY.2015 11:51:02

9.5 Dwell Time

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
3. Adjust the center frequency of spectrum analyzer on any frequency to be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. Repeat above procedures until all frequencies measured were complete.

Limit

According to §15.247(a)(1)(iii) . The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Dwell Time

Dwell time

The maximum dwell time shall be 0,4 s.

According to the Bluetooth Core Specification, the worse result (DH5 mode) was reported to show compliance.

The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:

The duration for dwell time calculation: $0.4 \text{ [s]} * \text{hopping number} = 0.4 \text{ [s]} * 79 \text{ [ch]} = 31.6 \text{ [s*ch]}$;

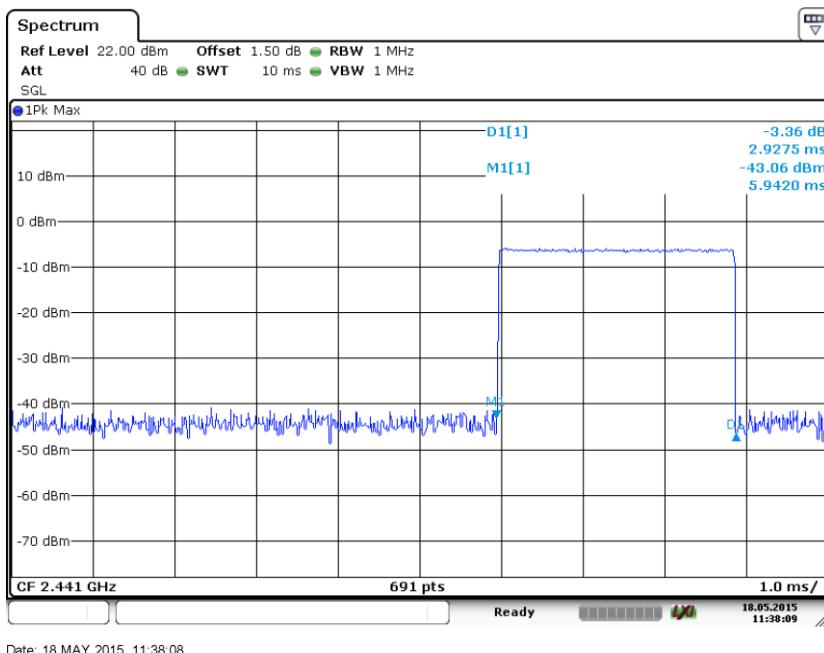
The burst width, which is directly measured, refers to the duration on one channel hop.

The maximum number of hopping channels in 31.6s for DH5=1600 / 6 / 79 *31.6=106.67

Test Result

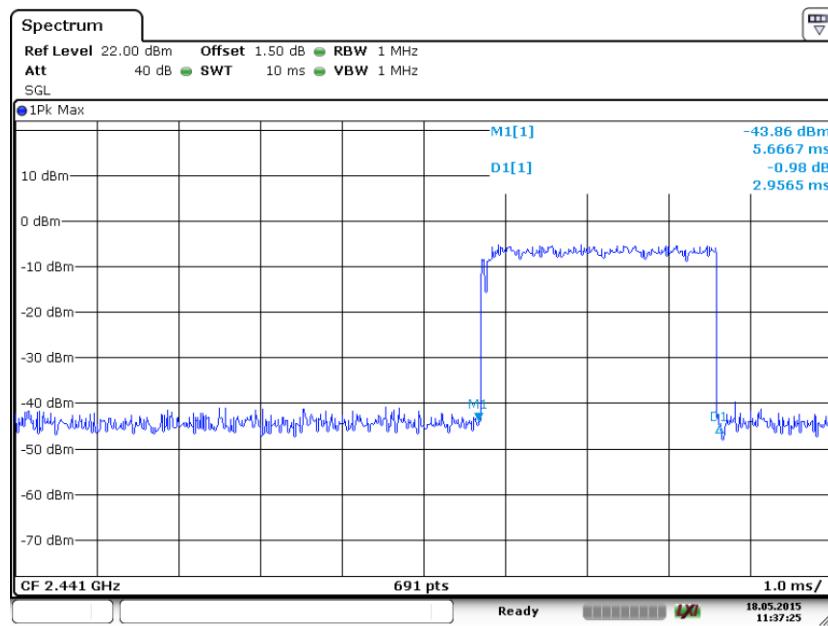
Modulation	Mode	Reading (μs)	Total Hops	Test Result (ms)	Limit (ms)	Result
GFSK	DH5	2927	106.67	312.22	< 400	Pass
$\pi/4$ -DQPSK	2DH5	2957	106.67	315.42	< 400	Pass
8-DPSK	3DH5	2986	106.67	318.52	< 400	Pass

GFSK Modulation



DH5

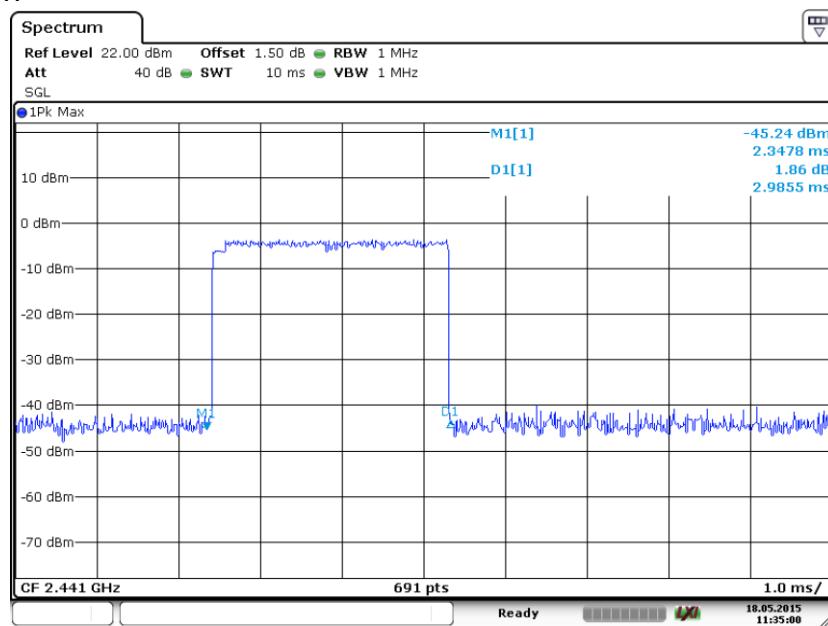
π/4-DQPSK Modulation



Date: 18.MAY.2015 11:37:25

2DH5

8-DPSK Modulation



Date: 18.MAY.2015 11:35:00

3DH5

9.6 Spurious RF conducted emissions

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

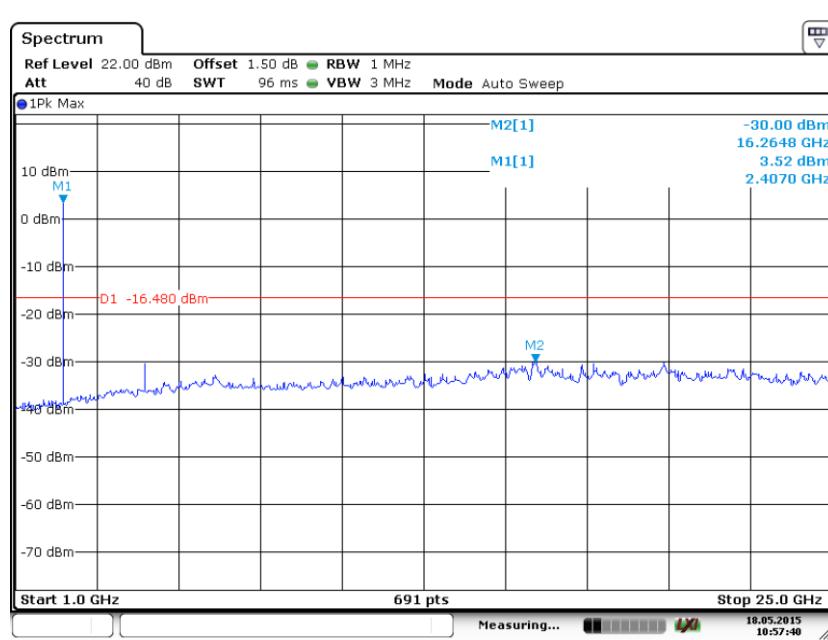
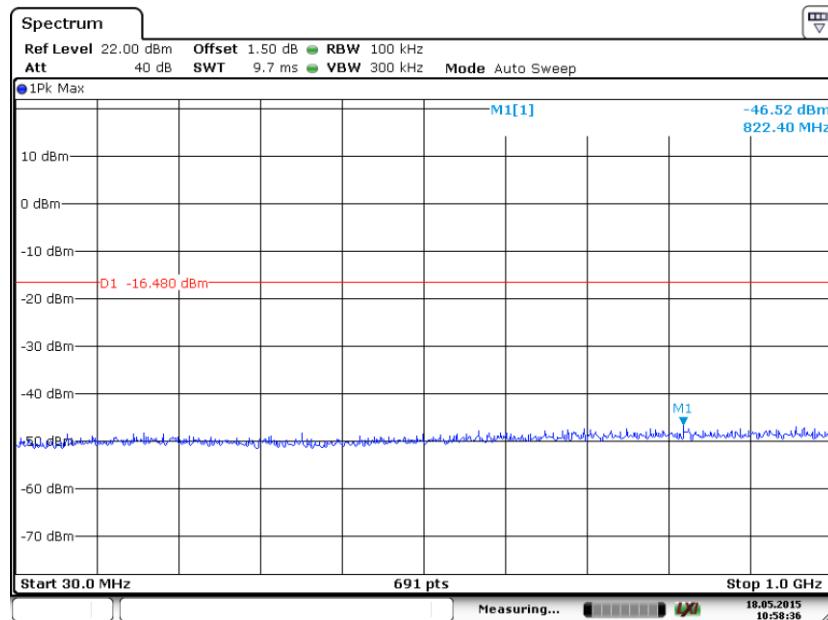
Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

Spurious RF conducted emissions

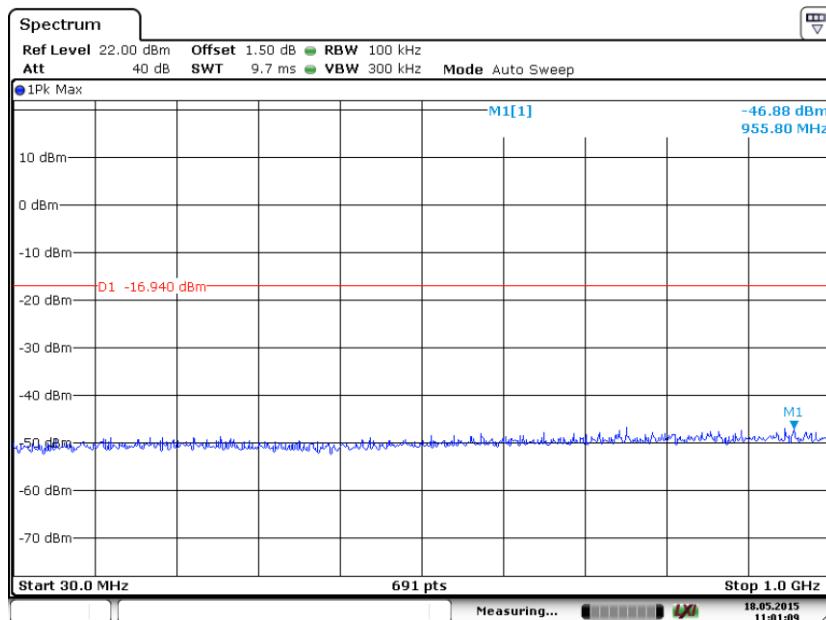
Only the worse case (which is subject to the maximum EIRP, 8DPSK mode) test result is listed in the report.

2402MHz

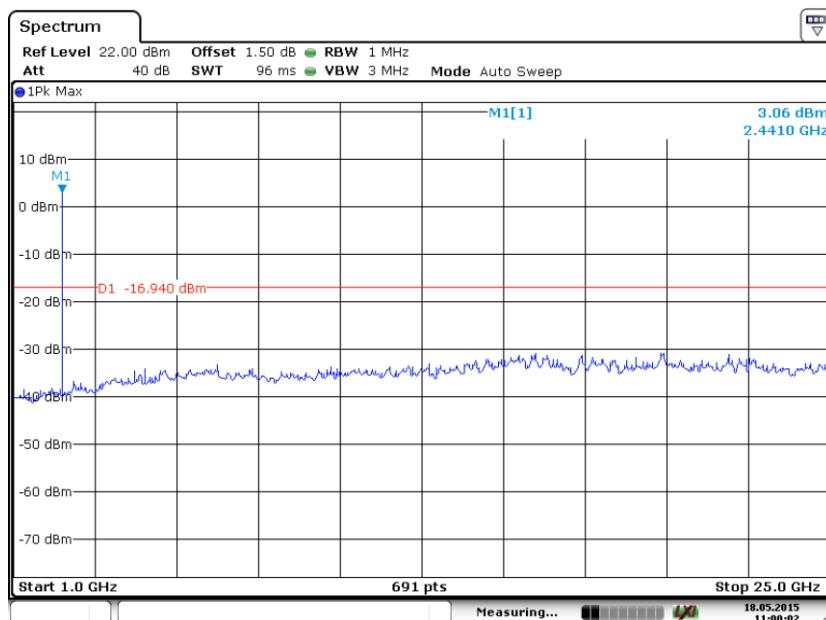


Spurious RF conducted emissions

2441MHz



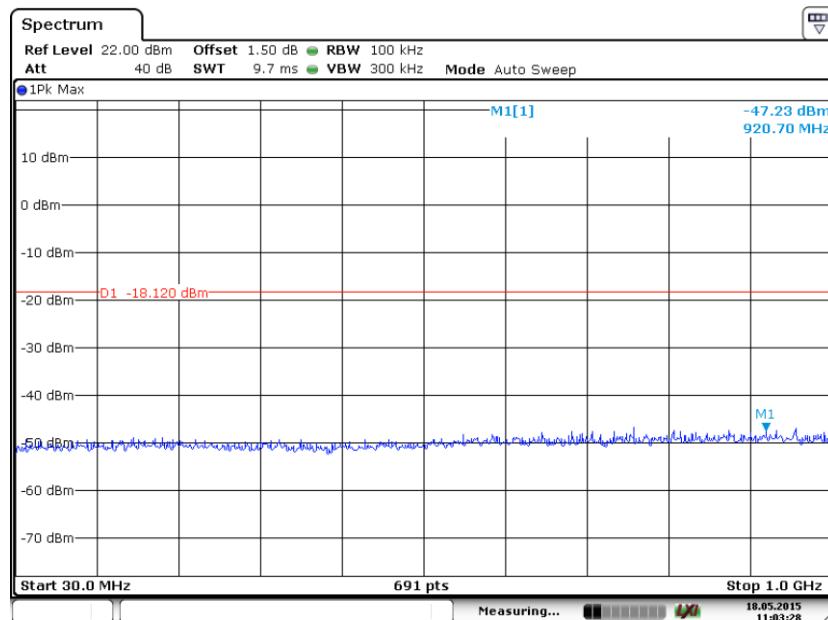
Date: 18.MAY.2015 11:01:09



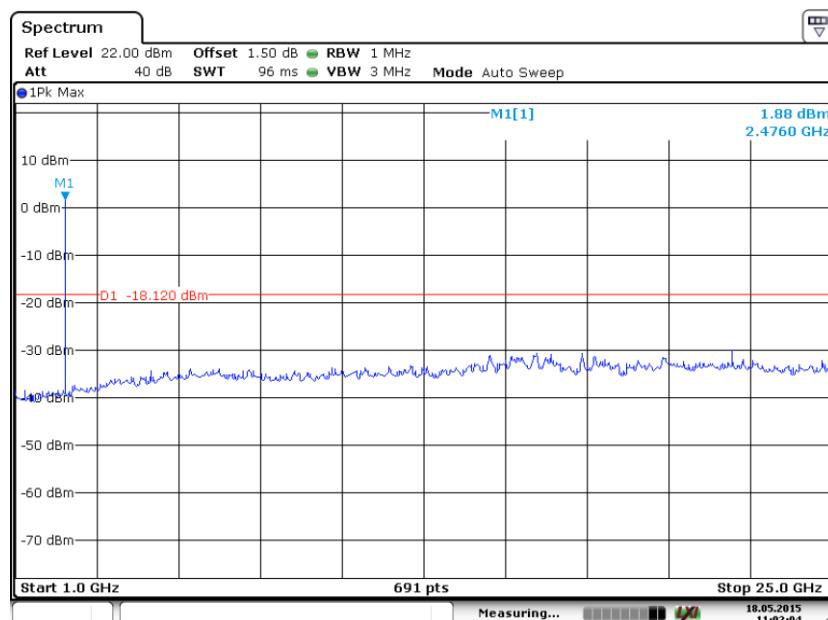
Date: 18.MAY.2015 11:00:02

Spurious RF conducted emissions

2480MHz



Date: 18.MAY.2015 11:03:28



Date: 18.MAY.2015 11:02:03

9.7 Band edge testing

Test Method

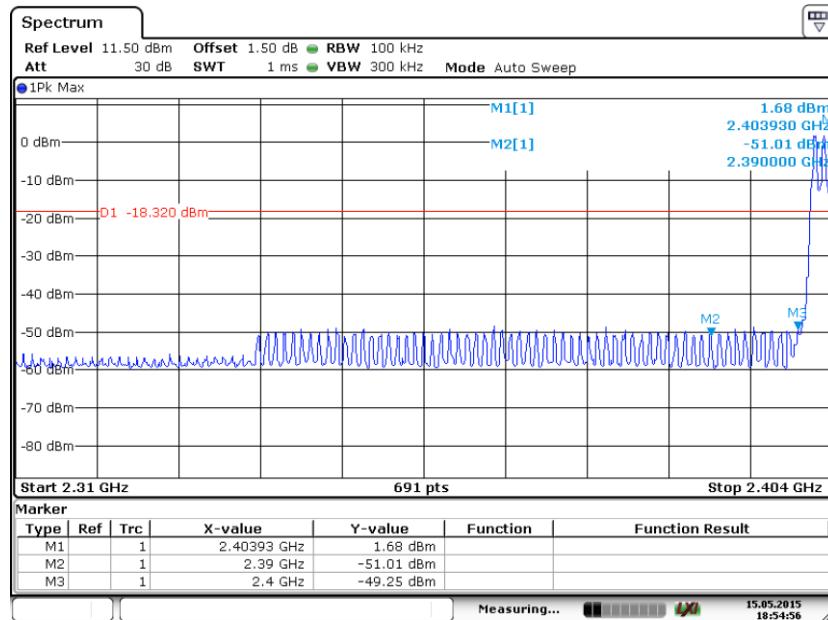
- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max
hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

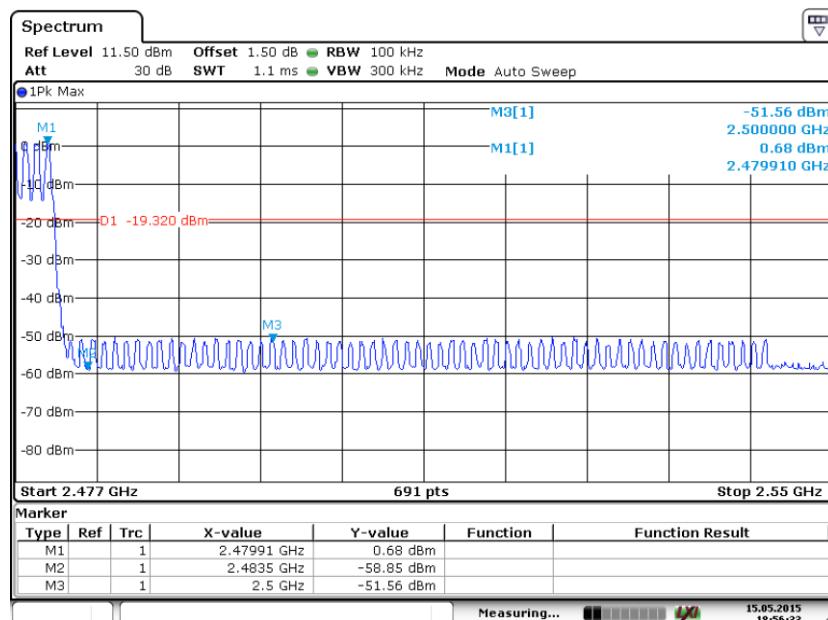
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Band edge testing

GFSK Modulation Test Result:
Hopping on mode:



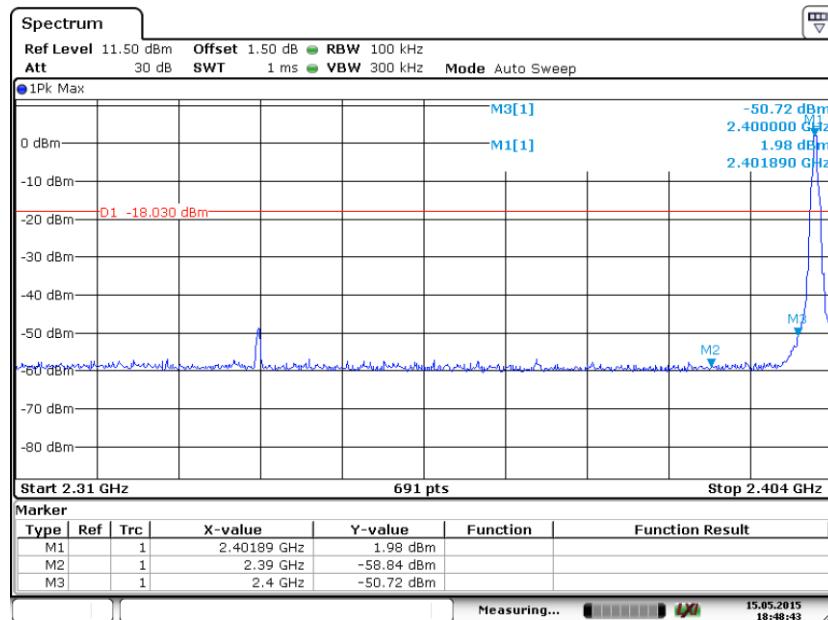
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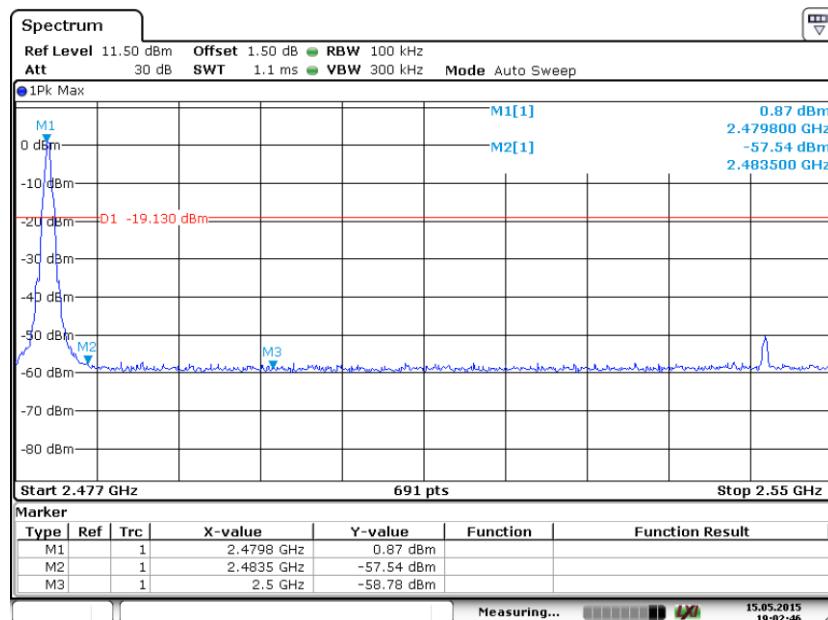
Date: 15.MAY.2015 18:56:33

Band edge testing

Hopping off mode:



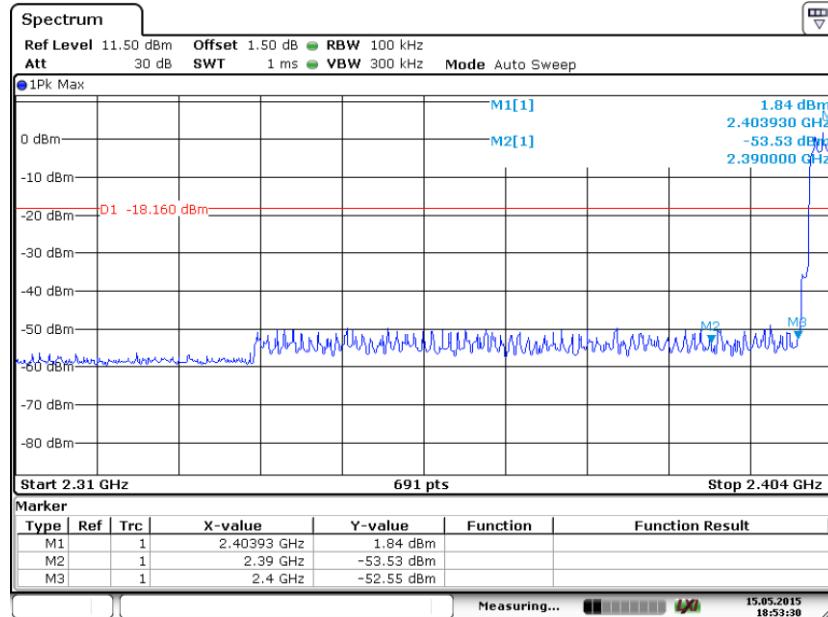
Date: 15.MAY.2015 18:48:44



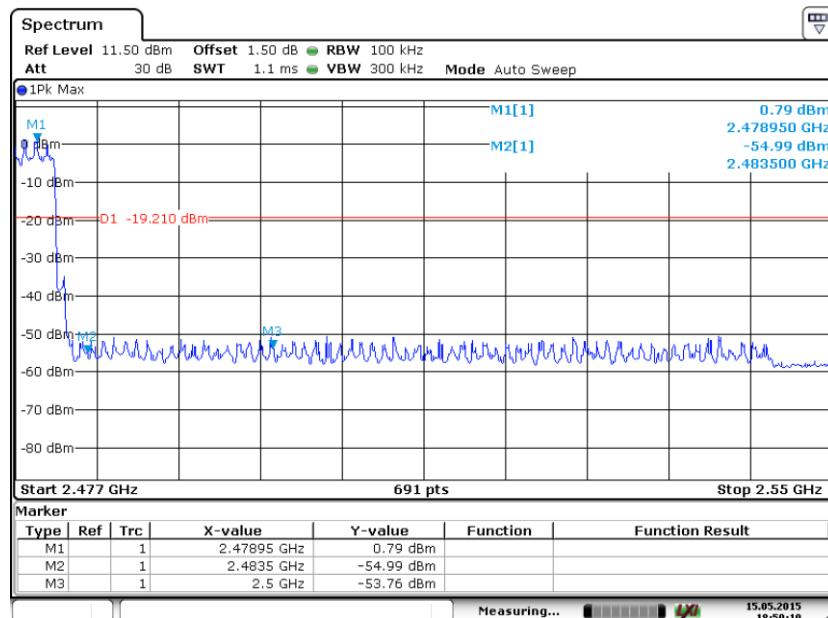
Date: 15.MAY.2015 19:02:46

Band edge testing

8DPSK Modulation Test Result:
Hopping on mode:



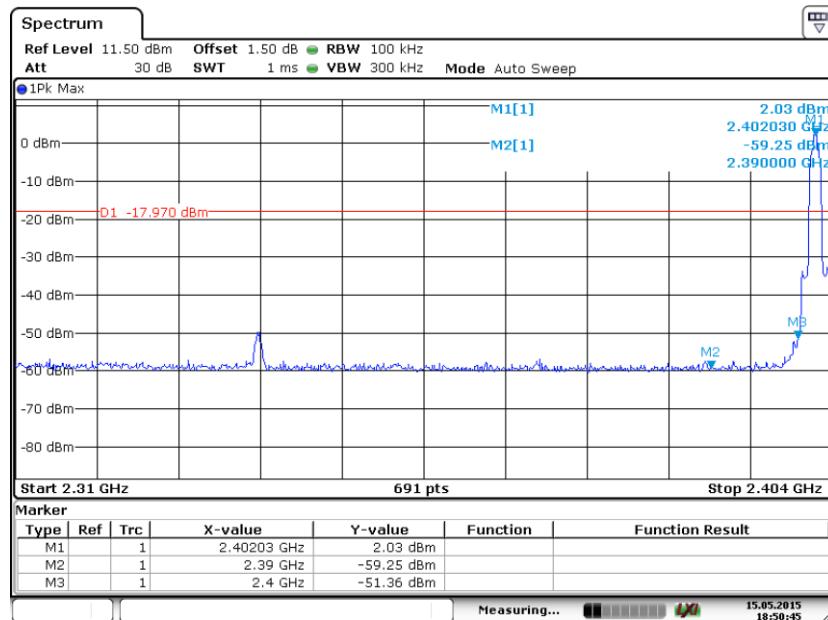
Date: 15.MAY.2015 18:53:30



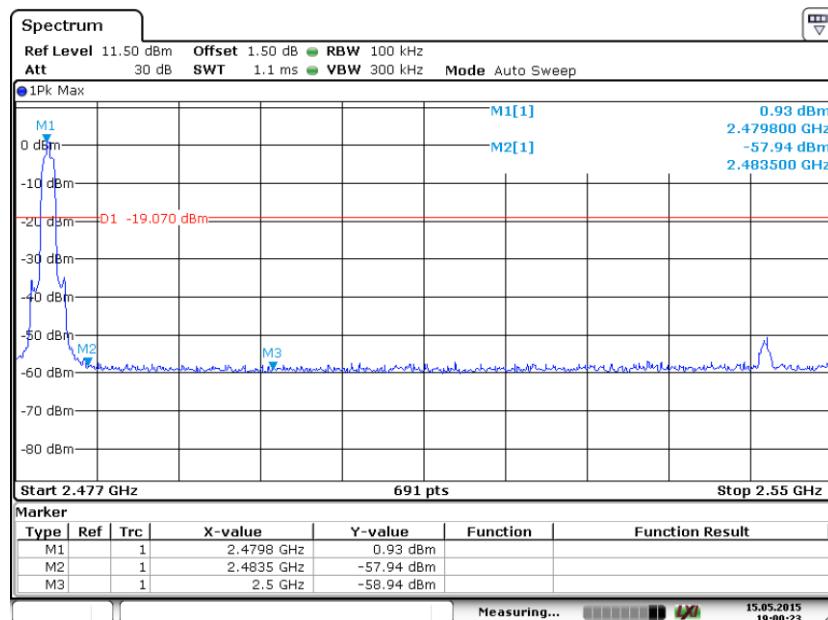
Date: 15.MAY.2015 18:59:10

Band edge testing

Hopping off mode:



Date: 15.MAY.2015 18:50:44



Date: 15.MAY.2015 19:00:23

9.8 Spurious radiated emissions for transmitter

Test Method

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for $f \geq 1\text{GHz}$, 100 kHz for $f < 1\text{ GHz}$, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Follow the guidelines in ANSI C63.4-2009 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the duty cycle per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from $20\log(\text{duty cycle}/100\text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Limit

According to part 15.247(d), the radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, 8DPSK mode) test result is listed in the report.

Transmitting spurious emission test result as below:

Bluetooth Mode 8DPSK Modulation 2402MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dB _u V/m		dB _u V/m		
208	31.56	Horizontal	43.5	QP	Pass
51	16.65	Vertical	40	QP	Pass
*4804	59.92	Horizontal	74	PK	Pass
*4804	36.24	Horizontal	54	AV	Pass
*4804	55.30	Vertical	74	PK	Pass
*4804	36.14	Vertical	54	AV	Pass

Bluetooth Mode 8DPSK Modulation 2441MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dB _u V/m		dB _u V/m		
*4882	63.24	Horizontal	74	PK	Pass
*4882	43.90	Horizontal	54	AV	Pass
*4882	55.78	Vertical	74	PK	Pass
*4882	37.04	Vertical	54	AV	Pass

Bluetooth Mode 8DPSK Modulation 2480MHz Test Result

Frequency	Emission Level	Polarization	Limit	Detector	Result
MHz	dB _u V/m		dB _u V/m		
*4960	63.43	Horizontal	74	PK	Pass
*4960	39.38	Horizontal	54	AV	Pass
*4960	55.97	Vertical	74	PK	Pass
*4960	35.48	Vertical	54	AV	Pass

Remark:

- (1) AV Emission Level= PK Emission Level+20log(dutycycle)=PK Emission Level-9.6
- (2) Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (3) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

10 Test Equipment List

List of Test Instruments

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE	
CE	EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2015-8-17	<input checked="" type="checkbox"/>
	LISN	Rohde & Schwarz	ENV4200	100249	2015-8-17	<input checked="" type="checkbox"/>
	LISN	Rohde & Schwarz	ENV216	100326	2015-8-17	<input type="checkbox"/>
	ISN	Rohde & Schwarz	ENY81	100177	2015-8-17	<input type="checkbox"/>
	ISN	Rohde & Schwarz	ENY81-CAT6	101664	2015-8-17	<input type="checkbox"/>
	High Voltage Probe	Rohde & Schwarz	TK9420(VT9 420)	9420-58	2015-8-17	<input type="checkbox"/>
	RF Current probe	Rohde & Schwarz	EZ-17	100816	2015-8-17	<input type="checkbox"/>
C	Signal Analyzer	Rohde & Schwarz	FSV40	101030	2015-8-17	<input checked="" type="checkbox"/>
RE	EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2015-8-17	<input checked="" type="checkbox"/>
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2017-8-17	<input checked="" type="checkbox"/>
	Horn Antenna	Rohde & Schwarz	HF907	102294	2017-8-17	<input checked="" type="checkbox"/>
	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2015-8-17	<input checked="" type="checkbox"/>
	Pre-amplifier	Rohde & Schwarz	SCU 40A	100432	2015-8-17	<input checked="" type="checkbox"/>
	3m Semi-anechoic chamber	TDK	9X6X6	----	2019-5-29	<input checked="" type="checkbox"/>

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth*
- 20dB bandwidth and 99% Occupied Bandwidth
- Carrier frequency separation
- Number of hopping frequencies
- Dwell Time
- Power spectral density*
- Spurious RF conducted emissions
- Band edge

Note: '*' means the test item doesn't apply.

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

Items	Extended Uncertainty
Radiated spurious emission	4.32dB (30MHz-1GHz) 2.27dB (1GHz -25GHz)
Conducted spurious emission	2.10dB(30MHz-25GHz)
Bandwidth test	1×10^{-9}