FCC - TEST REPORT

Report Number	:	**68.910.20.0001.01**	Date of Issue:	March 13, 2020
Model	:	V4		
Product Type	:	Wireless headphones		
Applicant	:	Dongguan Beevo Industrial Co., Ltd		
Address	:	No.1, Jinlong Road, Jinyuling Industrial Zone Sangyuan, Dongcheng District, Dongguan		
Manufacturer	:	Dongguan Beevo Industrial Co., Ltd		
Address	:	No.1, Jinlong Road, Jinyuling Industrial Zone Sangyuan, Dongcheng District, Dongguan		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	41		

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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 Technical Requirement 9
8.1 Conducted peak output power 9
8.2 20 dB bandwidth 13
8.3 Carrier Frequency Separation 17
8.4 Number of hopping frequencies 19
8.5 Dwell Time 21
8.6 Conducted Spurious Emission 25
8.7 Band edge testing 32
8.8 Spurious radiated emissions for transmitter 36
9 Test Equipment List 40
10 System Measurement Uncertainty 41

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2 Details about the Test Laboratory

Details about the Test Laboratory

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 518052
P.R. China

Telephone: 86 755 8828 6998
Fax: 86 755 828 5299

FCC Registration No.: 514049

3 Description of the Equipment Under Test

Product name:	Wireless headphones
Model no.:	V4
FCC ID:	2ASDY-V4
Options and accessories:	NIL
Input:	5Vdc, 210mA by USB port, or 3.7V 250mAh by internal battery
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK
Antenna Type:	Integrated antenna
Antenna Gain:	-0.58dBi
Description of the EUT:	V4 is a wireless headphones with Bluetooth function.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2019 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10 (2013).

5 Summary of Test Results

Test Condition		Test Result
§15.207	Conducted emission AC power port	N/A
§15.247(b)(1)	Conducted peak output power	Pass
§15.247(e)	Power spectral density*	N/A
§15.247(a)(2)	6dB bandwidth	N/A
§15.247(a)(1)	20dB bandwidth	Pass
§15.247(a)(1)	Min. of Hopping Channel Carrier Frequency Separation	Pass
§15.247(a)(1)(iii)	Min number of hopping frequencies	Pass
§15.247(a)(1)(iii)	Dwell Time - Average Time of Occupancy	Pass
§15.247(d)	Spurious RF conducted emissions	Pass
§15.247(d)	Band edge	Pass
§15.247(d) & §15.209 &	Spurious radiated emissions for transmitter and receiver	Pass
§15.203	Antenna requirement	See Note 2

Note 1: N/A=Not Applicable.
Note 2: The EUT uses a Integrated antenna, which gain is -0.58dBi. 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: 2ASDY-V4, complies with Section 15.209, 15.247 of the FCC Part 15, Subpart C rules.

This report is only for Bluetooth BR EDR. The TX and RX range is 2402MHz-2480MHz.

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: January 14, 2020

Testing Start Date: January 15, 2020

Testing End Date: March 16, 2020

Reviewed by:	Prepared by:	Tested by:
John Zhi	Moon Xiong	Louise Liu
Section Manager	Project Engineer	Test Engineer

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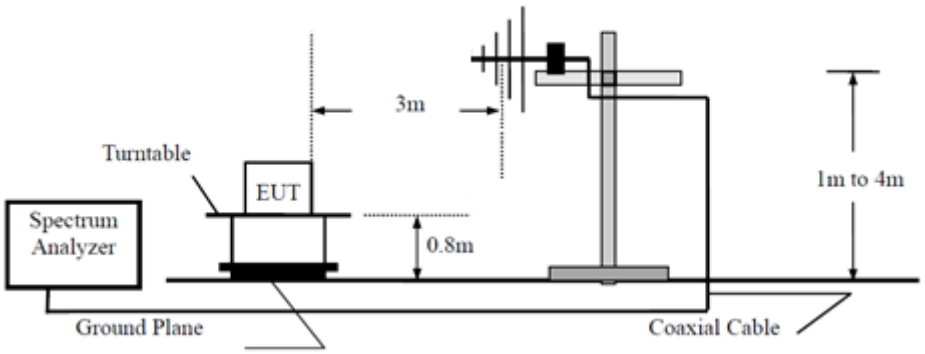
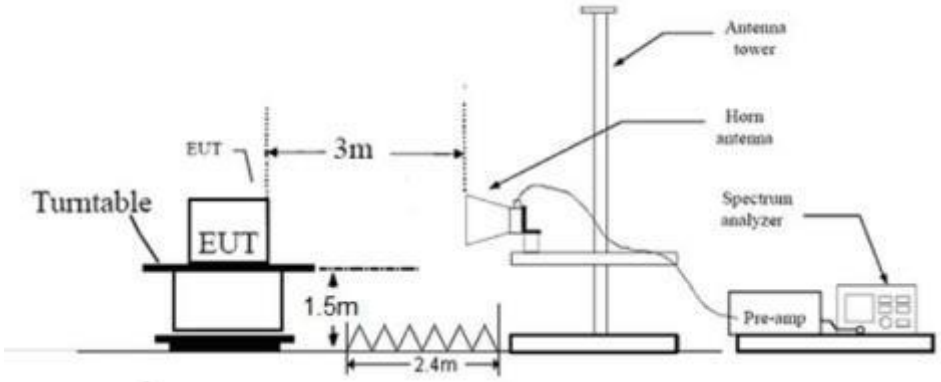
7 Test Setups

7.1 Radiated test setups

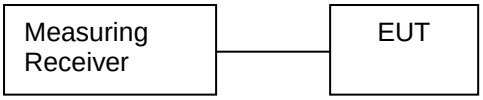
Below 1GHz



Above 1GHz



7.2 Conducted RF test setups



8 Technical Requirement

8.1 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≥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

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

Conducted peak output power

Bluetooth Mode GFSK modulation Test Result

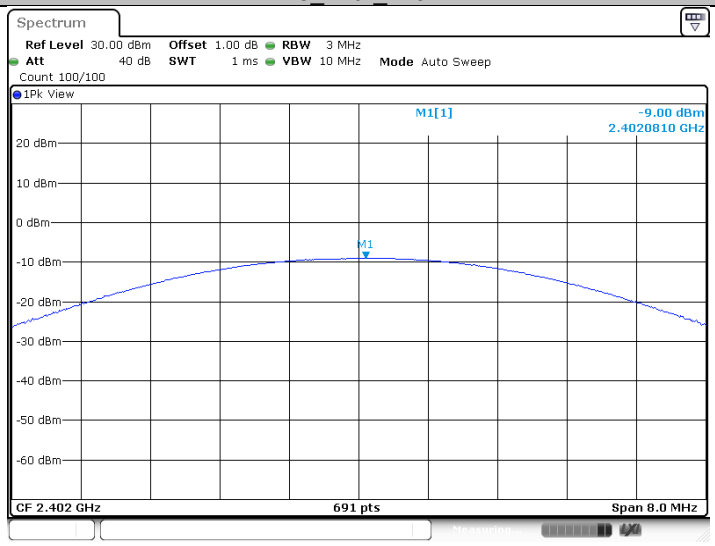
Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	-9	Pass
Middle channel 2441MHz	-8.7	Pass
High channel 2480MHz	-8.58	Pass

Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	-8.23	Pass
Middle channel 2441MHz	-7.91	Pass
High channel 2480MHz	-7.79	Pass

Test graphs

DH5_Ant1_2402



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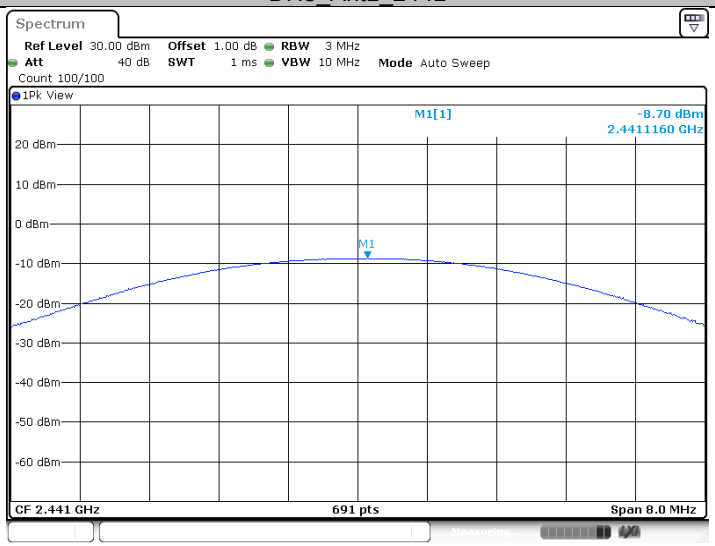
DH5_Ant1_2441



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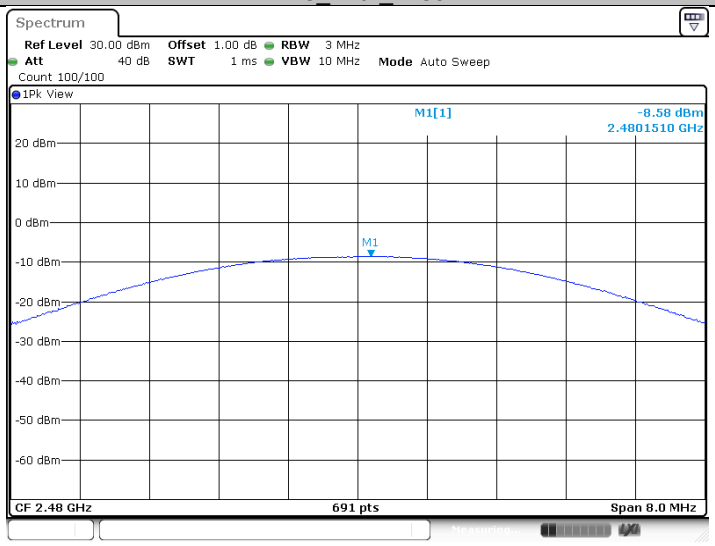
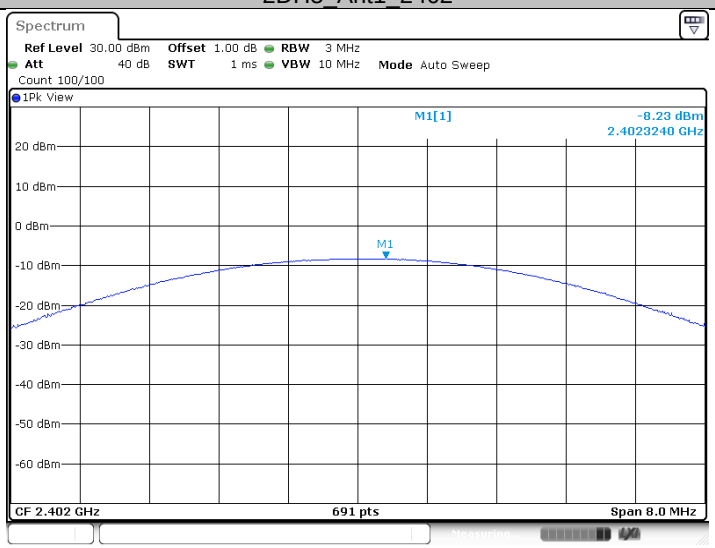


2DH5_Ant1_2402



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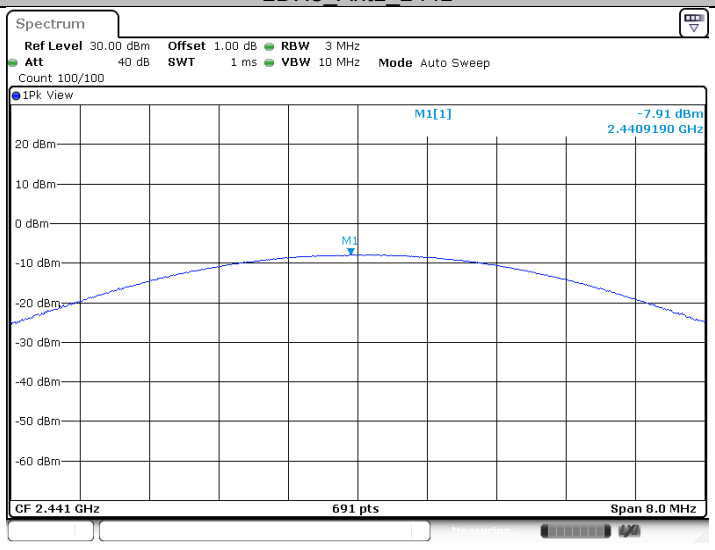

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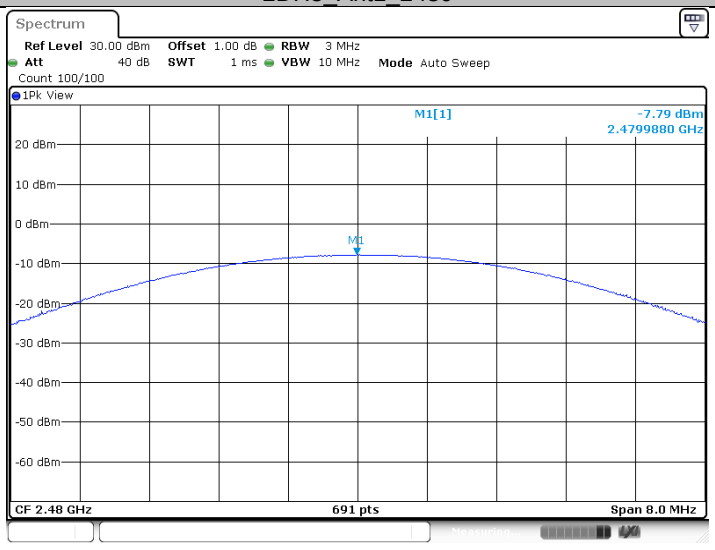


8.2 20 dB bandwidth

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

Bluetooth Mode GFSK Modulation test result

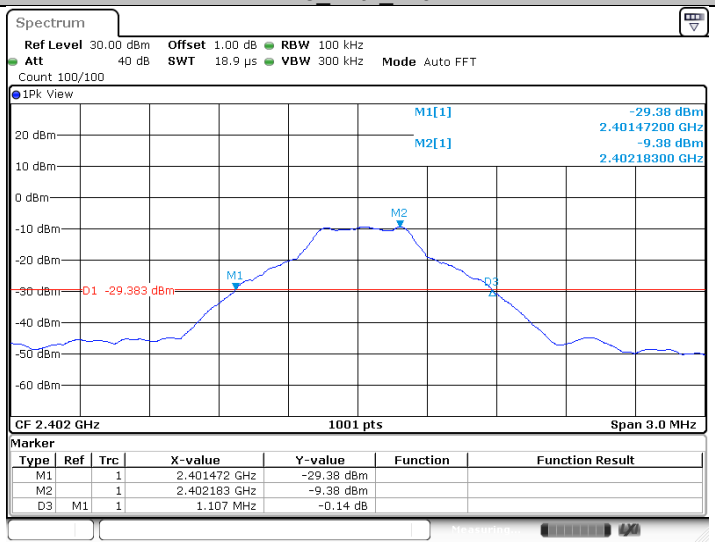
Frequency	20 dB Bandwidth	Limit	Result
MHz	kHz	kHz	
2402	1107	--	Pass
2441	1107	--	Pass
2480	1110	--	Pass

20 dB bandwidth

Bluetooth Mode π/4-DQPSK Modulation test result

Frequency	20 dB Bandwidth	Limit	Result
MHz	kHz	kHz	
2402	1377	--	Pass
2441	1377	--	Pass
2480	1374	--	Pass

DH5_Ant1_2402



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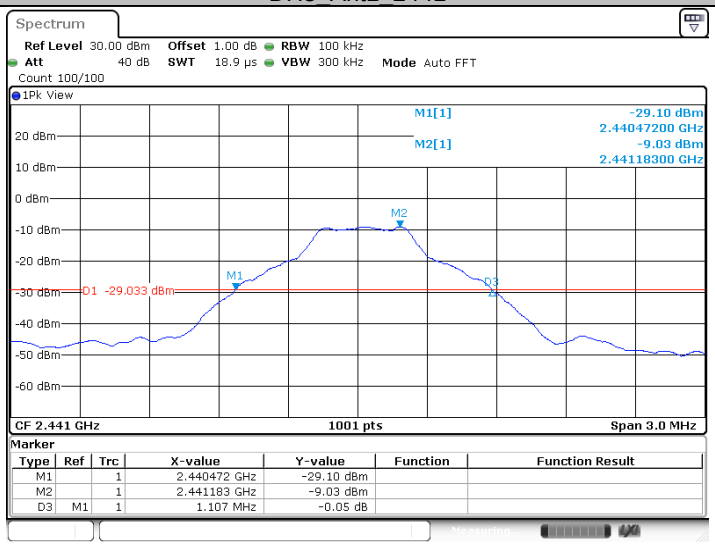

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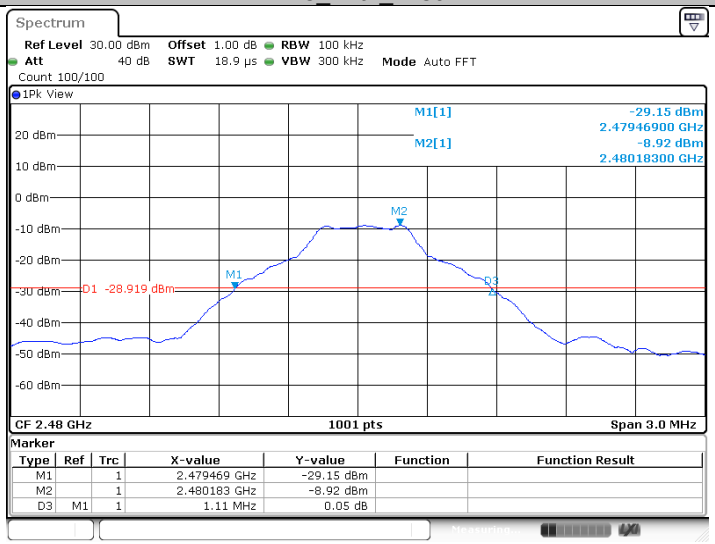
DH5_Ant1_2480



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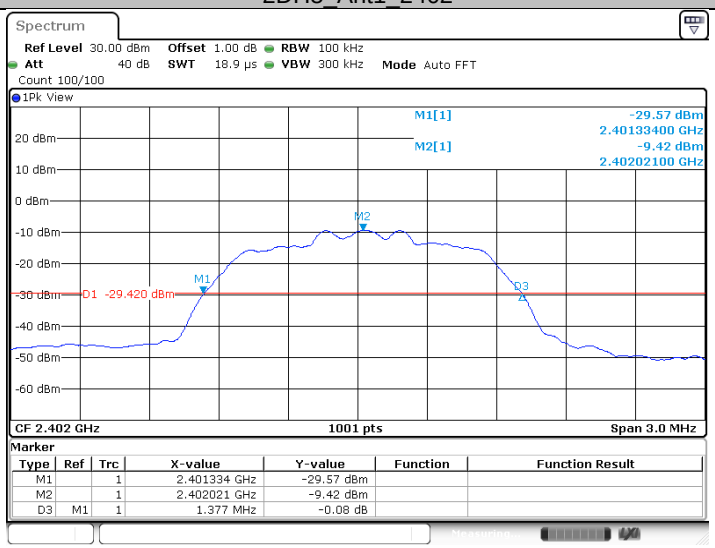
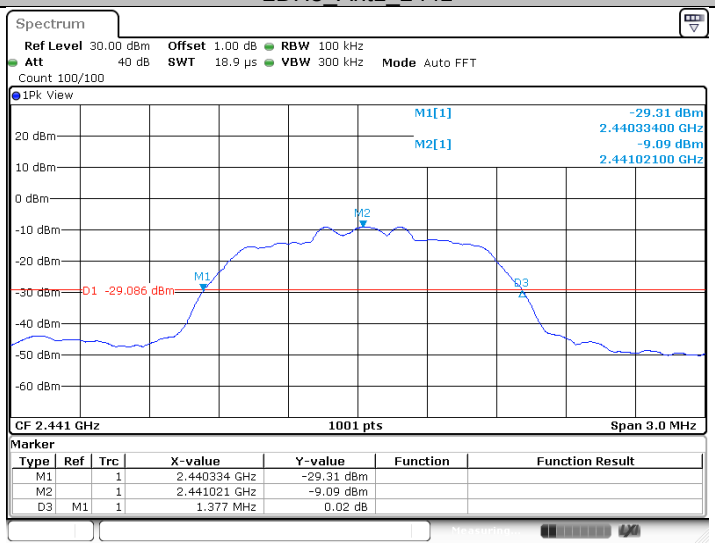
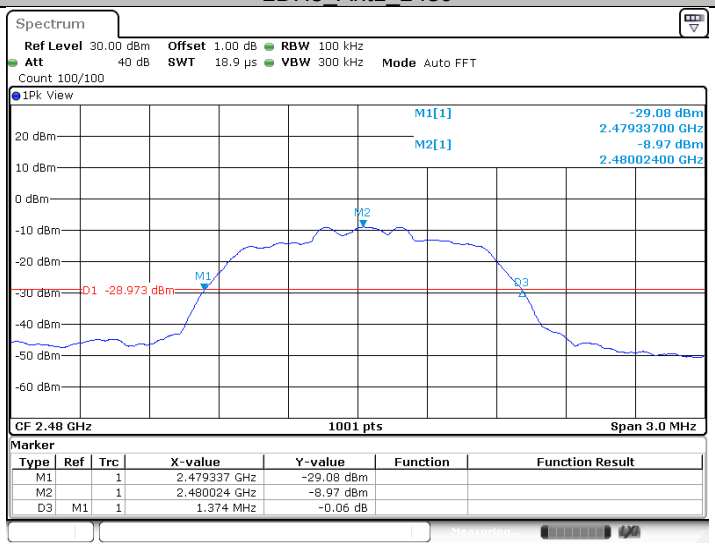


2DH5_Ant1_2441



2DH5_Ant1_2480



8.3 Carrier Frequency Separation

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥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.

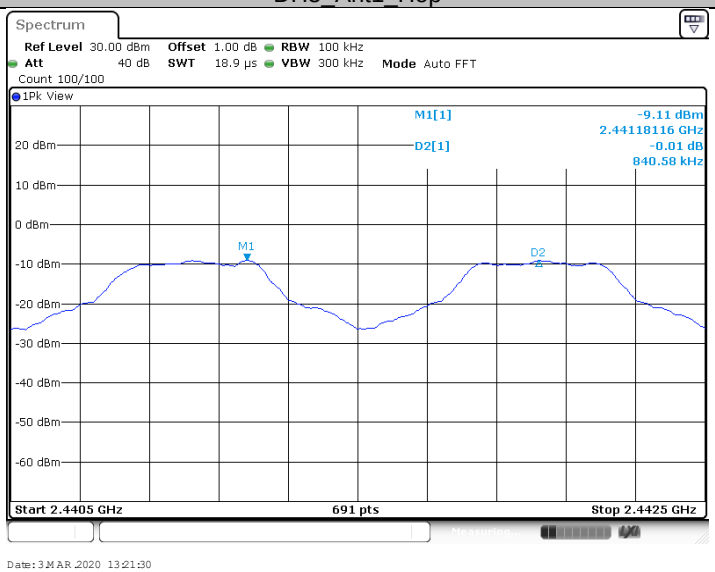
Limit

Limit kHz
⩾25KHz or 2/3 of the 20 dB bandwidth which is greater

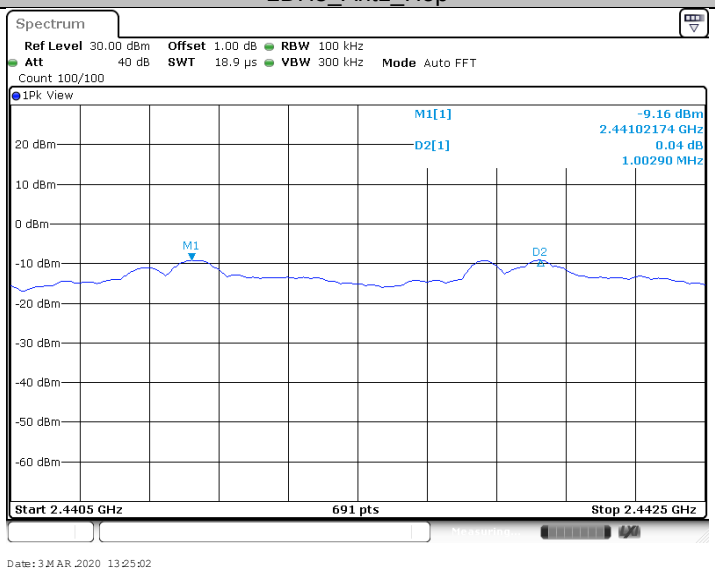
Carrier Frequency Separation

Test Mode	Antenna	Channel	Result(MHz)	Limit	Verdict
DH5	Ant1	Hop	0.841	>=0.750	PASS
2DH5	Ant1	Hop	1.003	>=0.946	PASS

DH5_Ant1_Hop



2DH5_Ant1_Hop



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8.4 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 ≥ 1% of the span, VBW) ≥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.

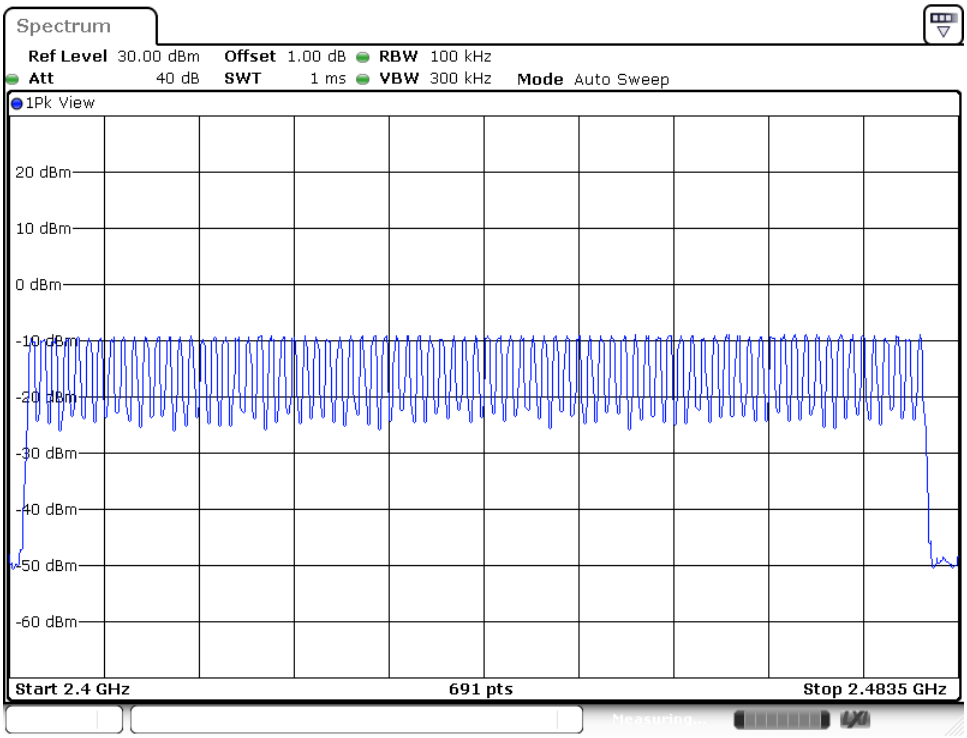
Limit

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



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8.5 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 be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. Repeat above procedures until all frequencies measured were complete.

Limit

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

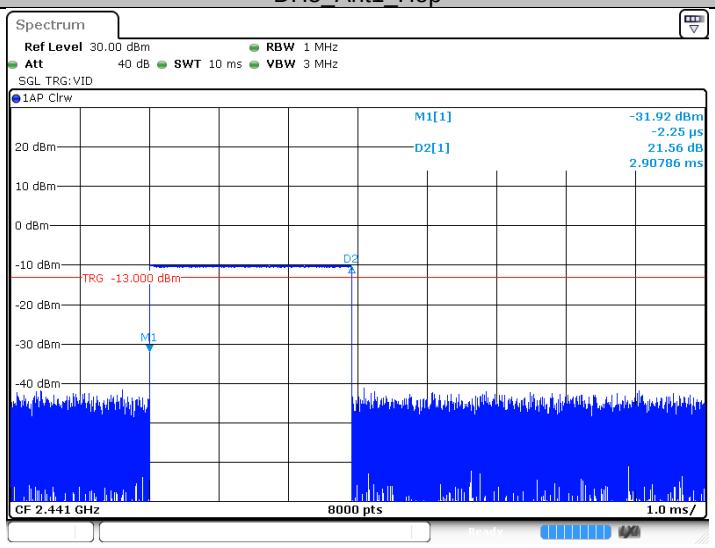
Dwell time

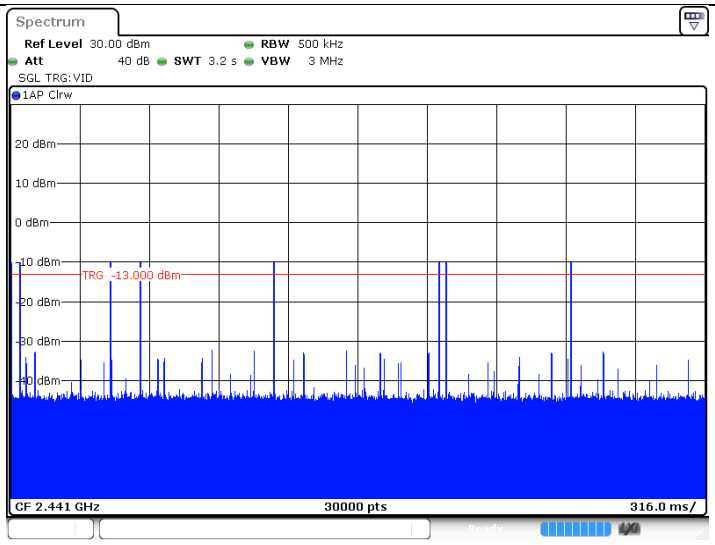
The maximum dwell time shall be 0.4 s.
The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 79 [ch] = 31.6 [s*ch];

Test Result

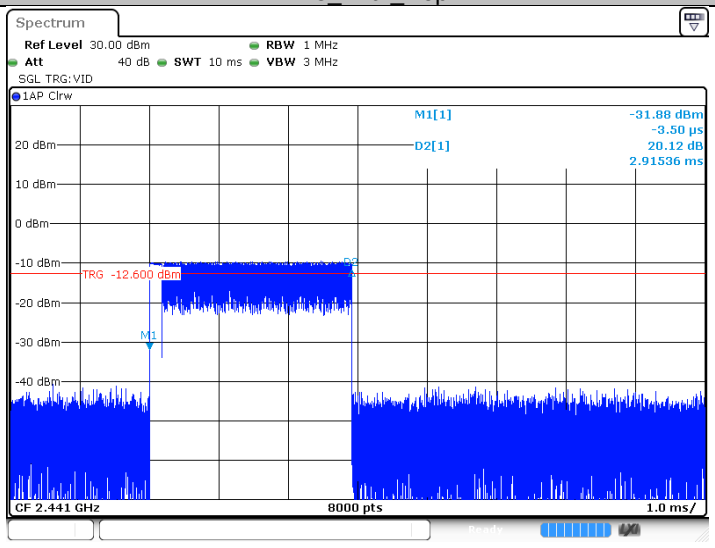
Test Mode	Antenna	Channel	Burst Width	Total Hops	Result	Limit	Verdict
DH5	Ant1	Hop	2.91	80	0.233	<=0.4	PASS
2DH5	Ant1	Hop	2.92	100	0.292	<=0.4	PASS

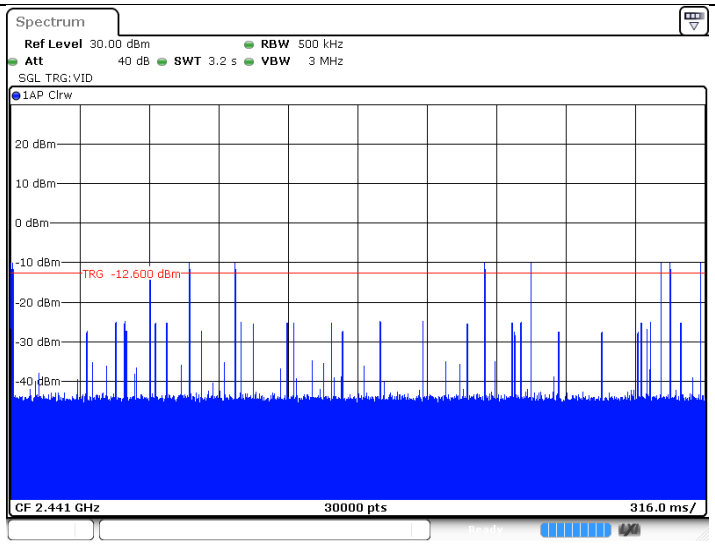
DH5_Ant1_Hop





2DH5_Ant1_Hop





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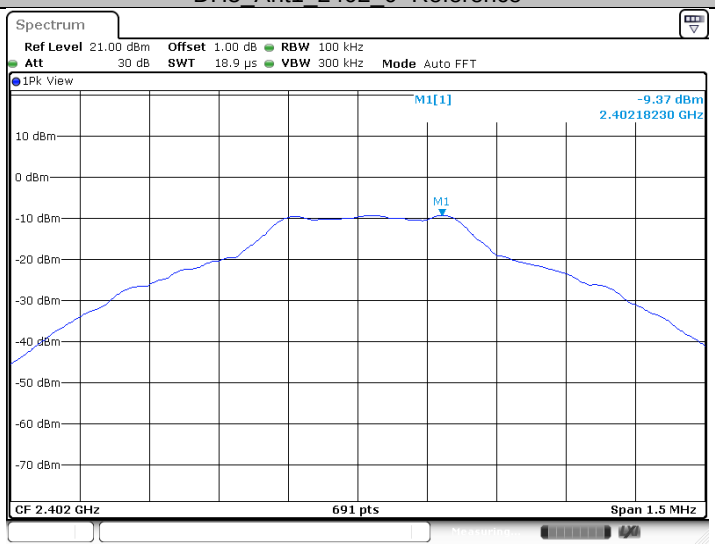
8.6 Conducted Spurious Emission

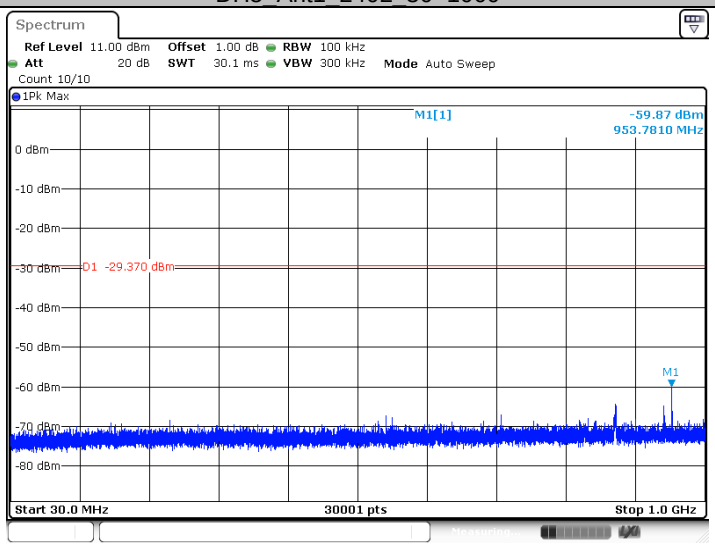
Test result:

TestMode	Channel	FreqRange(MHz)	RefLevel	Result(dBm)	Limit(dBm)	Verdict
DH5	2402	Reference	-9.37	-9.37	---	PASS
	2402	30~1000	30~1000	-59.87	<=-29.37	PASS
	2402	1000~26500	1000~26500	-52.01	<=-29.37	PASS
	2441	Reference	-9.10	-9.10	---	PASS
	2441	30~1000	30~1000	-60.75	<=-29.1	PASS
	2441	1000~26500	1000~26500	-52.39	<=-29.1	PASS
	2480	Reference	-8.85	-8.85	---	PASS
	2480	30~1000	30~1000	-62.61	<=-28.85	PASS
	2480	1000~26500	1000~26500	-52.57	<=-28.85	PASS
2DH5	2402	Reference	-9.41	-9.41	---	PASS
	2402	30~1000	30~1000	-62.66	<=-29.41	PASS
	2402	1000~26500	1000~26500	-52.05	<=-29.41	PASS
	2441	Reference	-9.18	-9.18	---	PASS
	2441	30~1000	30~1000	-64.76	<=-29.18	PASS
	2441	1000~26500	1000~26500	-52.62	<=-29.18	PASS
	2480	Reference	-8.93	-8.93	---	PASS
	2480	30~1000	30~1000	-64.26	<=-28.93	PASS
	2480	1000~26500	1000~26500	-52.66	<=-28.93	PASS

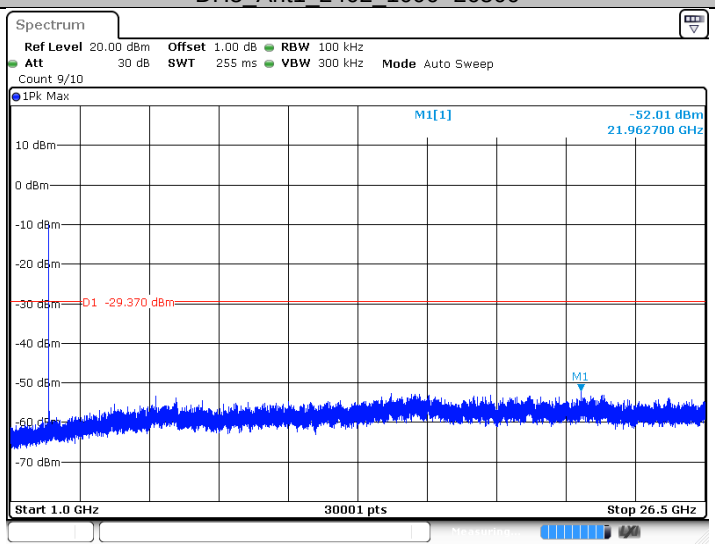
DH5_Ant1_2402_0~Reference



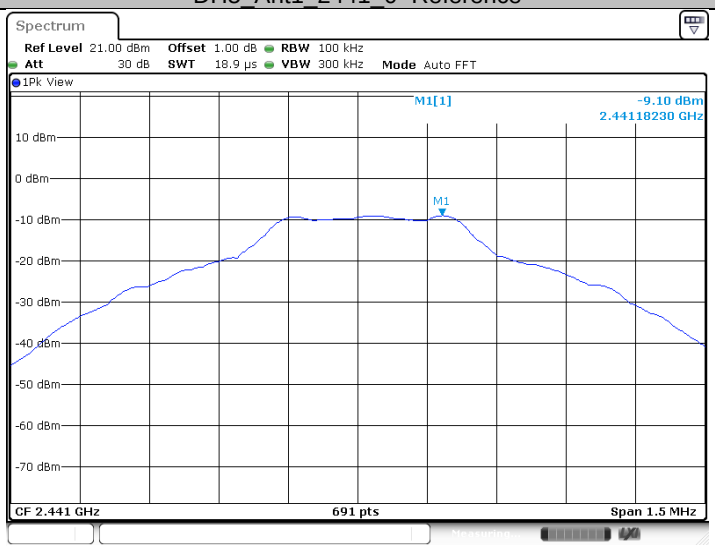
DH5_Ant1_2402_30~1000



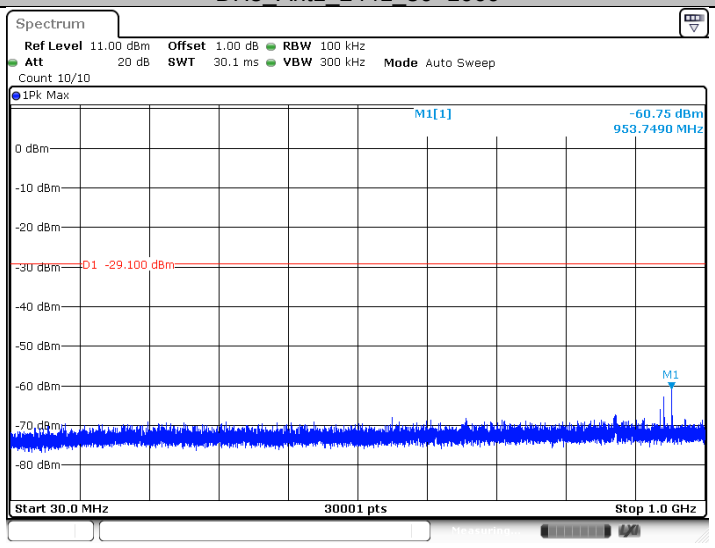
DH5_Ant1_2402_1000~26500



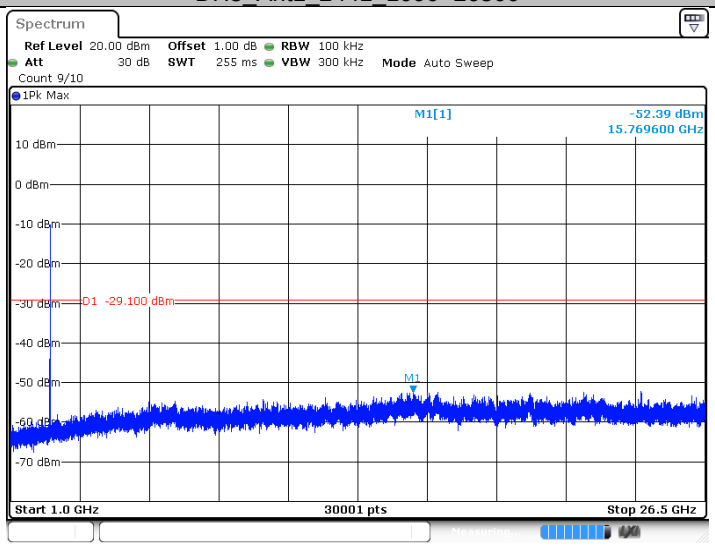
DH5_Ant1_2441_0~Reference



DH5_Ant1_2441_30~1000



DH5_Ant1_2441_1000~26500



DH5_Ant1_2480_0~Reference

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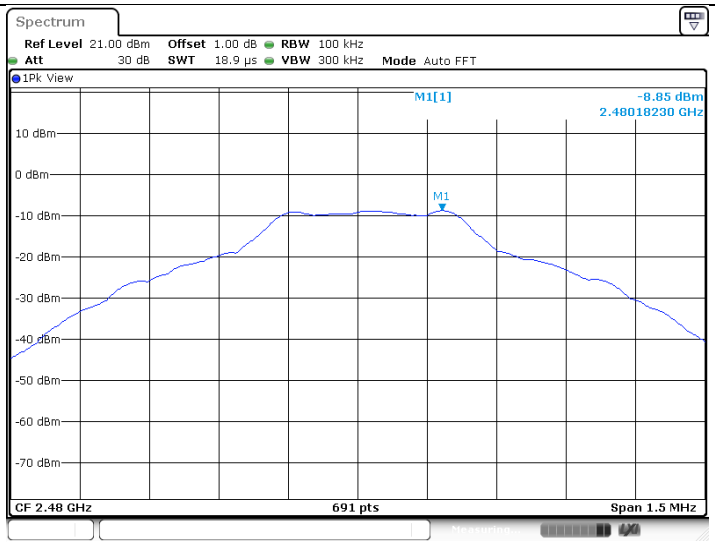
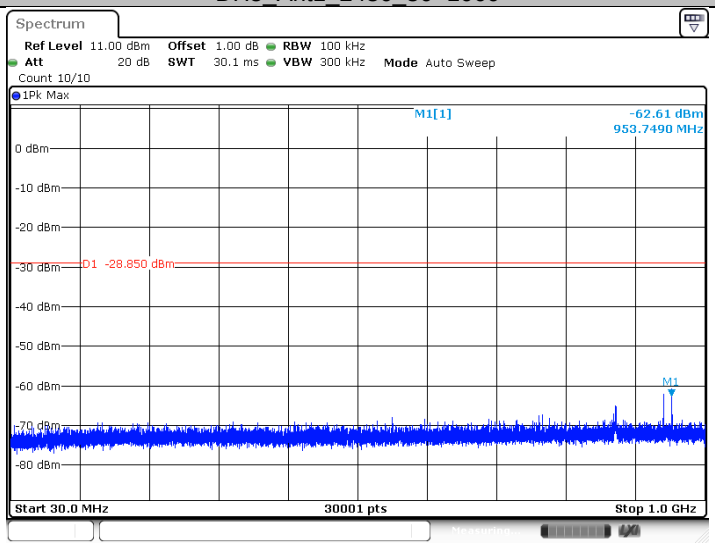
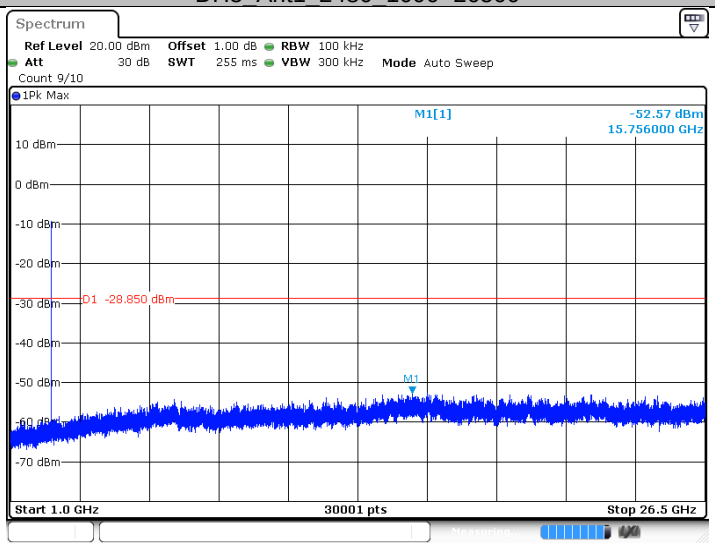


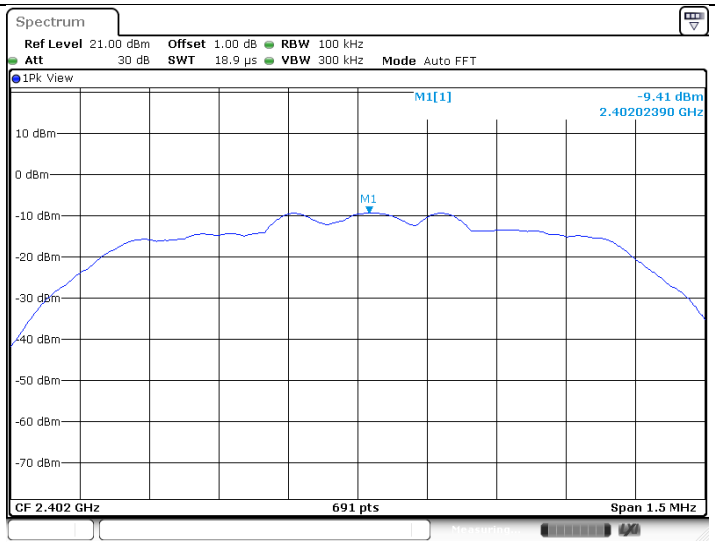
DH5_Ant1_2480_30~1000



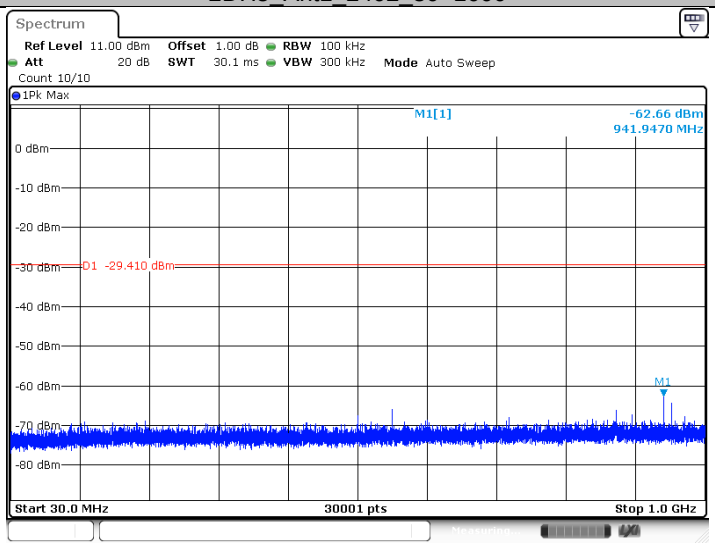
DH5_Ant1_2480_1000~26500



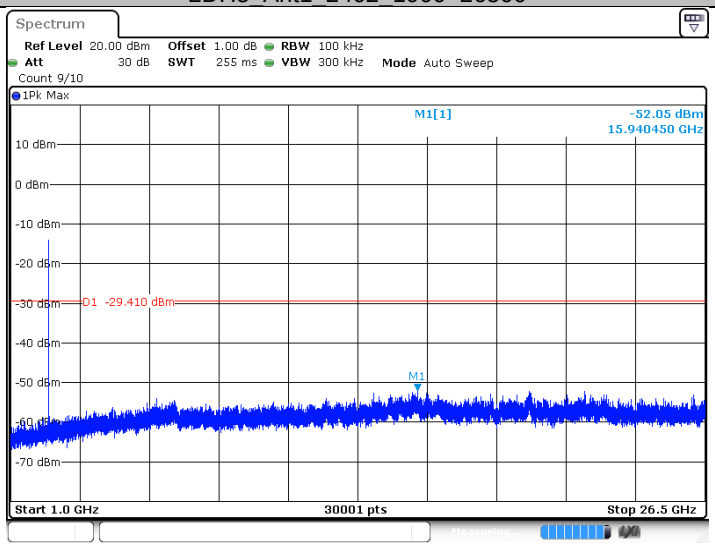
2DH5_Ant1_2402_0~Reference



2DH5_Ant1_2402_30~1000



2DH5_Ant1_2402_1000~26500



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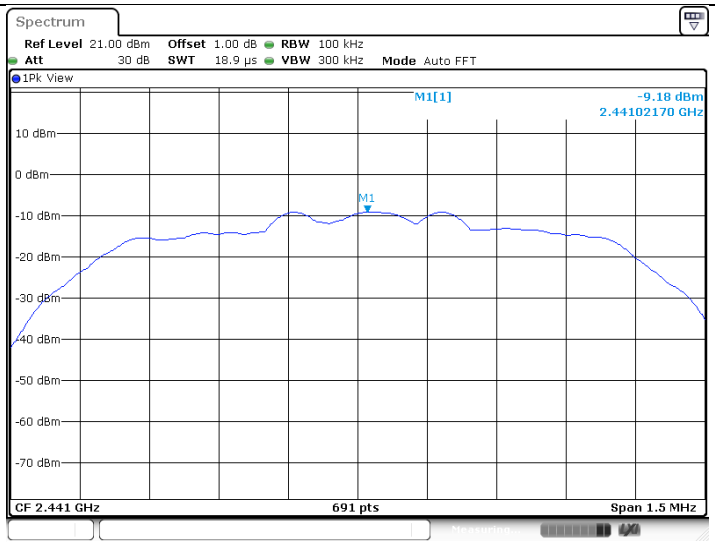
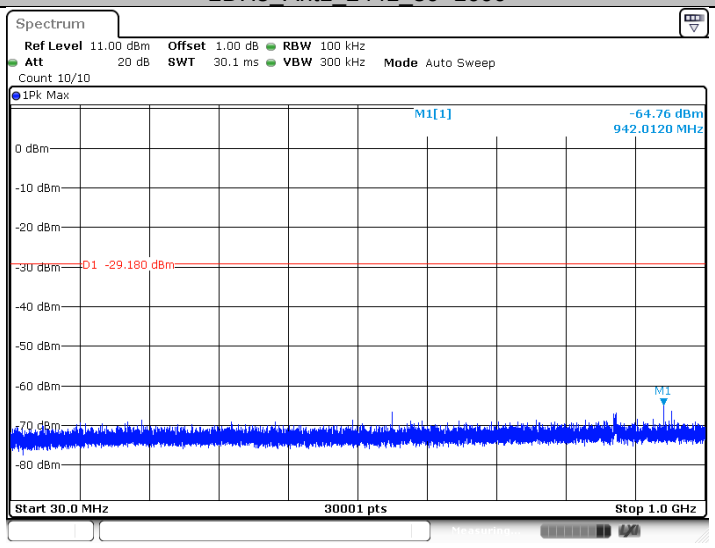
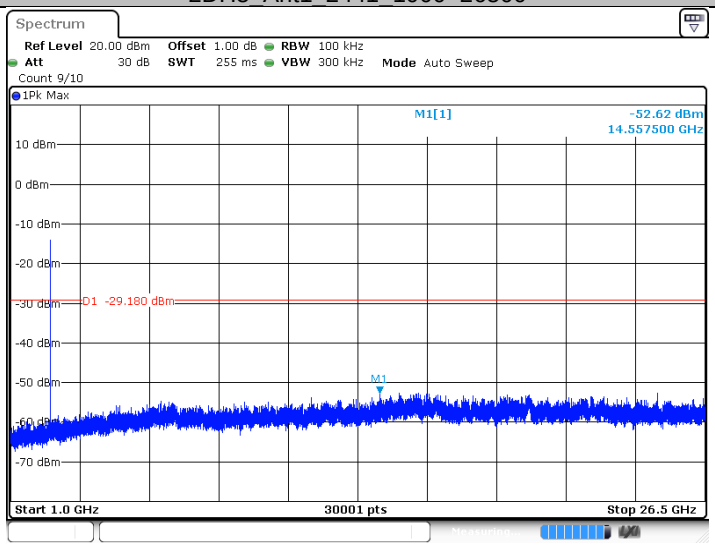


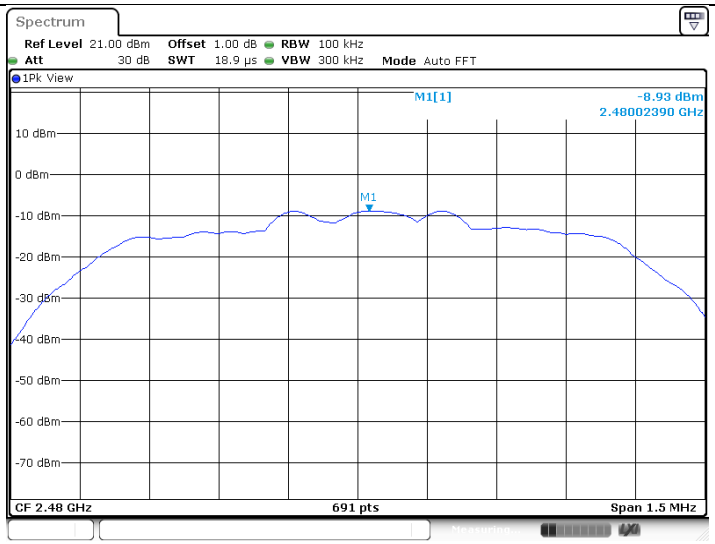
2DH5_Ant1_2441_30~1000



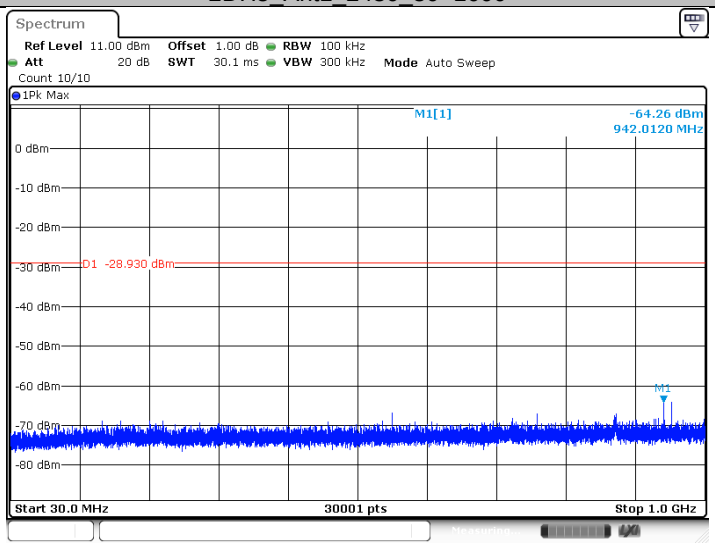
2DH5_Ant1_2441_1000~26500



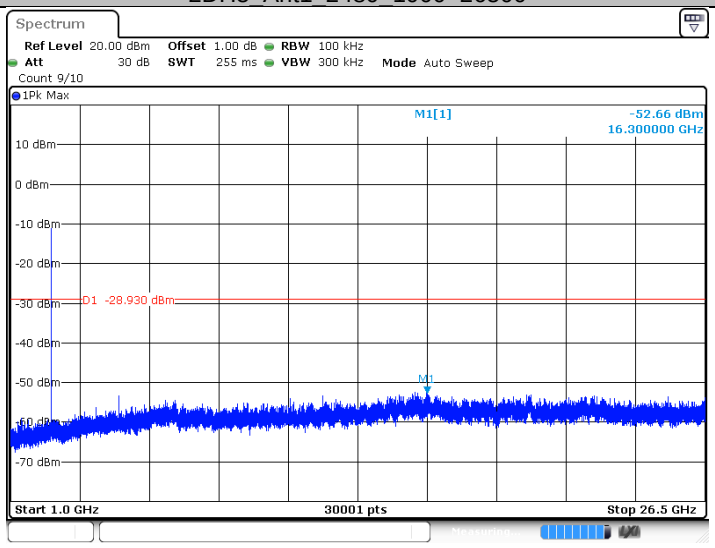
2DH5_Ant1_2480_0~Reference



2DH5_Ant1_2480_30~1000



2DH5_Ant1_2480_1000~26500



8.7 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≥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.

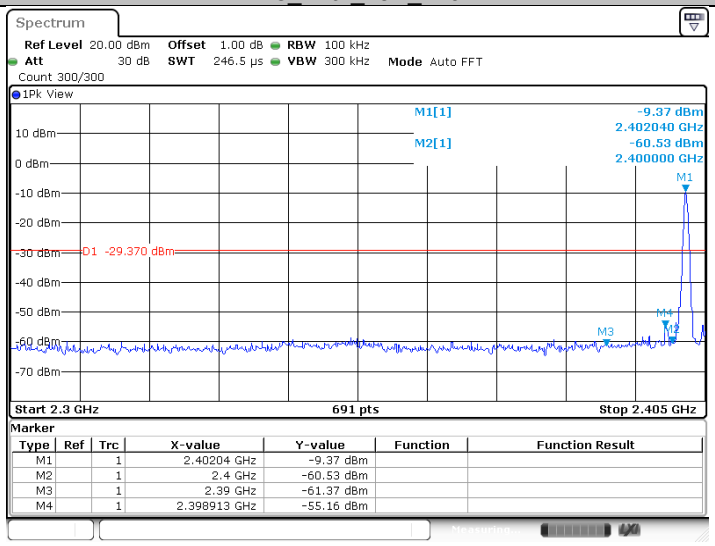
Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the100 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 that the transmitter demonstrates compliance with the peak conducted power limits.

Test result:

TestMode	ChName	Channel	RefLevel	Result	Limit	Verdict
DH5	Low	2402	-9.37	-55.16	<=-29.37	PASS
	High	2480	-8.87	-54.74	<=-28.87	PASS
	Low	Hop_2402	-10.69	-58.38	-30.69	PASS
	High	Hop_2480	-8.93	-54.84	-28.93	PASS
2DH5	Low	2402	-9.36	-55.89	<=-29.36	PASS
	High	2480	-8.88	-56.5	<=-28.88	PASS
	Low	Hop_2402	-10.57	-58.27	-30.57	PASS
	High	Hop_2480	-8.89	-58.1	-28.89	PASS

DH5_Ant1_Low_2402

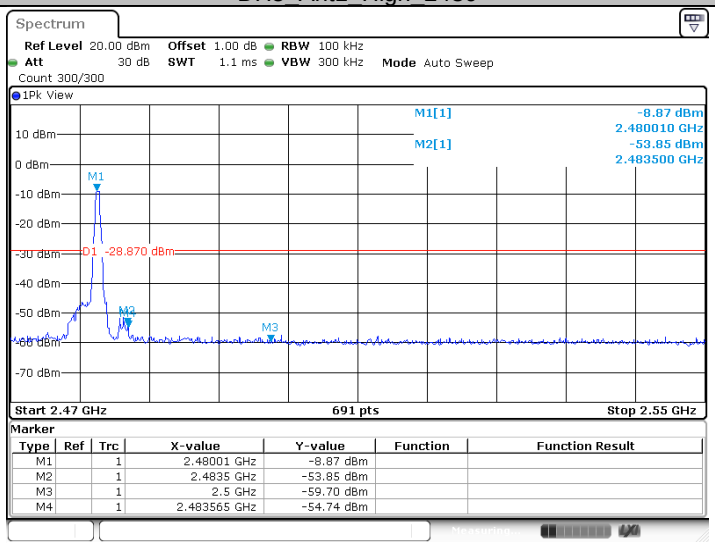


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40204 GHz	-9.37 dBm		
M2		1	2.4 GHz	-60.53 dBm		
M3		1	2.39 GHz	-61.37 dBm		
M4		1	2.398913 GHz	-55.16 dBm		

Date: 3.MAR.2020 12:57:15

DH5_Ant1_High_2480

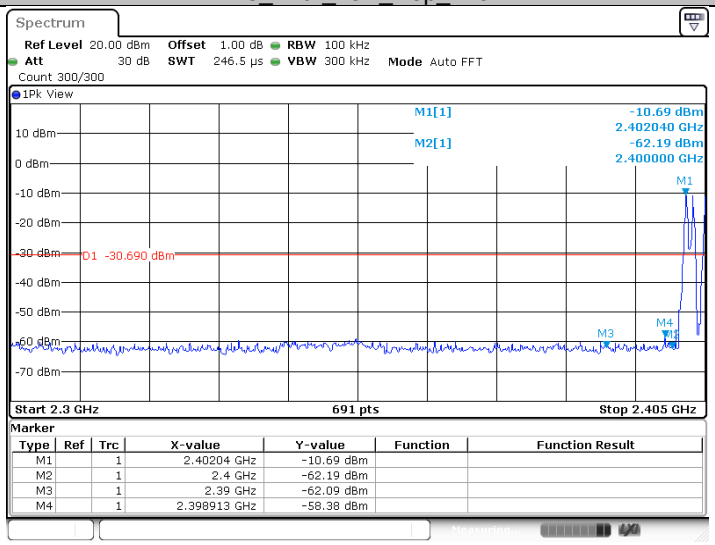


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48001 GHz	-8.87 dBm		
M2		1	2.4835 GHz	-53.85 dBm		
M3		1	2.5 GHz	-59.70 dBm		
M4		1	2.483565 GHz	-54.74 dBm		

Date: 3.MAR.2020 13:10:47

DH5_Ant1_Low_Hop_2402

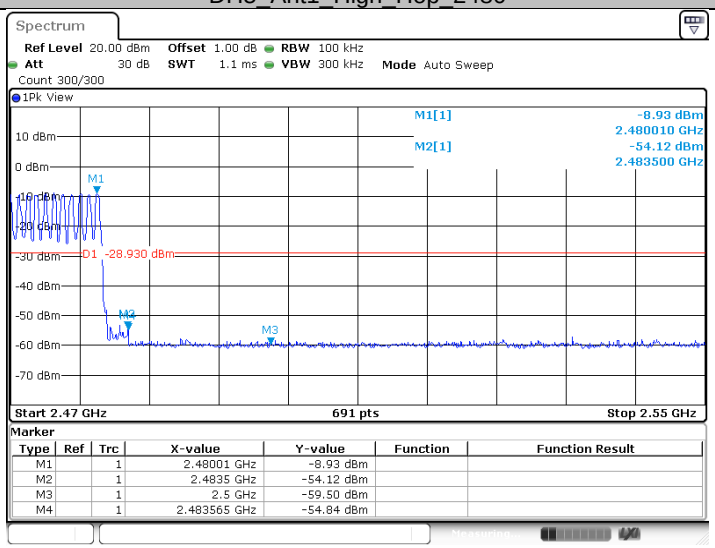


Marker

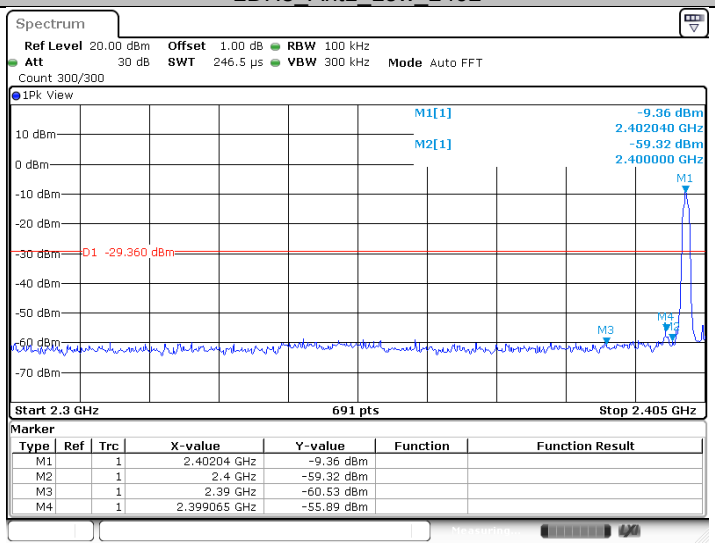
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40204 GHz	-10.69 dBm		
M2		1	2.4 GHz	-62.19 dBm		
M3		1	2.39 GHz	-62.09 dBm		
M4		1	2.398913 GHz	-58.38 dBm		

Date: 3.MAR.2020 13:21:09

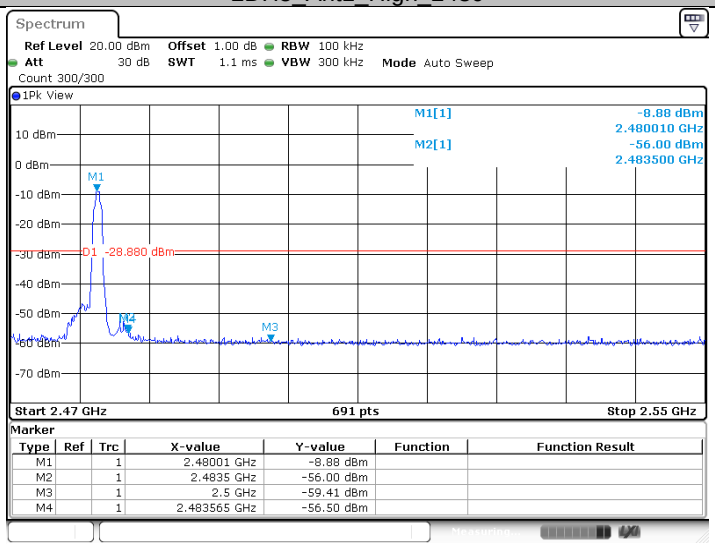
DH5_Ant1_High_Hop_2480



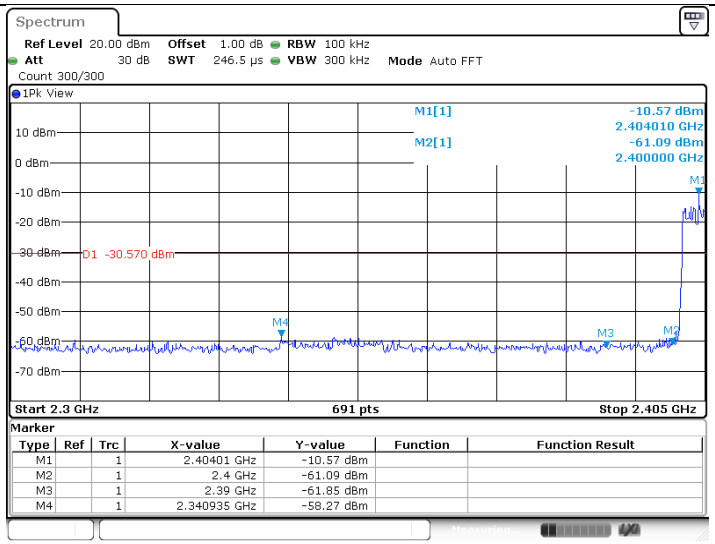
2DH5_Ant1_Low_2402



2DH5_Ant1_High_2480



2DH5_Ant1_Low_Hop_2402

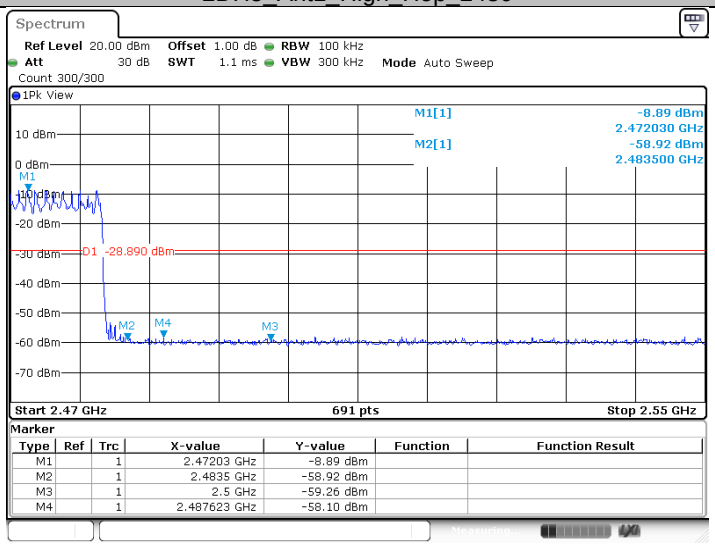


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40401 GHz	-10.57 dBm		
M2		1	2.4 GHz	-61.09 dBm		
M3		1	2.39 GHz	-61.85 dBm		
M4		1	2.340935 GHz	-58.27 dBm		

Date: 3.MAR.2020 13:24:38

2DH5_Ant1_High_Hop_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47203 GHz	-8.89 dBm		
M2		1	2.4835 GHz	-58.92 dBm		
M3		1	2.5 GHz	-59.26 dBm		
M4		1	2.487623 GHz	-58.10 dBm		

Date: 3.MAR.2020 13:29:55

8.8 Spurious radiated emissions for transmitter

Test Method

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3-meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Below 1GHz

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≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.

2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.

3: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log (1/duty cycle)).

4: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

Limit

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 section15.205, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/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, π/4DQPSK mode) test result is listed in the report.

Transmitting spurious emission test result as below:

π/4DQPSK Modulation 2402MHz Test Result

Frequency Band	Frequency	Emission level	Correct factor	Polarization	Limit	Detector	Margin	Result
	MHz	dBuV/m	dBuV/m		dBμV/m		dBuV/m	
30-1000MHz	383.996111	35.46	-24.2	H	46	QP	12.60	Pass
	762.026667	32.45	-17.5	V	46	QP	13.55	Pass
1000-25000MHz	16816.000000	51.85	16.5	H	74	PK	22.15	Pass
	17745.000000	51.38	17.8	V	74	PK	22.62	Pass

π/4DQPSK Modulation 2441MHz Test Result

Frequency Band	Frequency	Emission level	Correct factor	Polarization	Limit	Detector	Margin	Result
	MHz	dBuV/m	dBuV/m		dBμV/m		dBuV/m	
30-1000MHz	383.996111	35.46	-24.2	H	46	QP	12.60	Pass
	762.026667	32.45	-17.5	V	46	QP	13.55	Pass
1000-25000MHz	6934.000000	51.59	16.5	H	74	PK	22.41	Pass
	17894.000000	51.37	17.7	V	74	PK	22.63	Pass

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π/4DQPSK Modulation 2480MHz Test Result

Frequency Band	Frequency	Emission level	Correct factor	Polarization	Limit	Detector	Margin	Result
	MHz	dBuV/m	dBuV/m		dBµV/m		dBuV/m	
30-1000MHz	383.996111	35.46	-24.2	H	46	QP	12.60	Pass
	762.026667	32.45	-17.5	V	46	QP	13.55	Pass
1000-25000MHz	16919.500000	52.46	16.8	H	74	PK	21.54	Pass
	17758.000000	51.72	17.6	V	74	PK	22.28	Pass

Remark:

(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

(2) Data of measurement within this frequency range shown "--" in the table above means the reading of emissions are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(3) Corrected Amplitude= Read level + Corrector factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Pre-amplifier
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

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Nanshan District, Shenzhen 518052, P.R. China

9 Test Equipment List

List of Test Instruments

Radiated Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2020-6-28
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	68-4-80-14-002	707	1	2020-8-20
Horn Antenna	Rohde & Schwarz	HF907	68-4-80-14-005	102294	1	2020-6-22
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	1	2020-7-7
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2020-6-28
Signal Generator	Rohde & Schwarz	SMY01	68-4-48-16-001	839369/005	1	2020-6-28
Attenuator	Agilent	8491A	68-4-81-16-001	MY39264334	1	2020-6-28
3m Semi-anechoic chamber	TDK	9X6X6	68-4-90-14-001	----	3	2020-7-7
Test software	Rohde & Schwarz	EMC32	68-4-90-14-001-A10	Version9.15.00	N/A	N/A

TS8997 Test System

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	1	2020-6-28
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	1	2020-6-28
10dB Attenuator	Weinschel	4M-10	43152	1	2020-6-28
Test software	Rohde & Schwarz	EMC32	Version 10.38.00	N/A	N/A
Test software	Tonscend	System for BT/WIFI	Version 2.6	N/A	N/A

10 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	
Test Items	Extended Uncertainty
Uncertainty for Radiated Spurious Emission 30MHz-1000MHz	Horizontal: 5.12dB; Vertical: 5.10dB;
Uncertainty for Radiated Spurious Emission 1000MHz-18000MHz	Horizontal: 5.01dB; Vertical: 5.00dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 4.89dB; Vertical: 4.87dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10^{-7} or 1%