FCC - TEST REPORT

Report Number	: **68.950.19.2755.01**	Date of Issue:	Sept 9, 2019
Model	: **HVN: ED100, HVN: MD44014**		
Product Type	: Mobile POS System		
Applicant	: NumberFour AG		
Address	: Schoenhauser Allee 8, 10119 Berlin, Germany		
Manufacturer	: NumberFour AG		
Address	: Schoenhauser Allee 8, 10119 Berlin, Germany		
Test Result	: ■ **Positive** ☐ **Negative**		
Total pages including Appendices	: 55		

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Nanshan District, Shenzhen 518052, P.R. China

2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site1

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, P. R. China
FCC Designation Number:	CN5009
FCC Registration No.:	514049
Telephone:	86 755 8828 6998
Fax:	86 755 8828 5299

3 Description of the Equipment Under Test

Product:	Mobile POS System
Model no.:	HVN: ED100, HVN: MD44014
FCC ID:	2ANTM-MD44014
Options and accessories:	Charger and power Cable
Rating:	3.85VDC, 2810mAh, (Supplied by Rechargeable Li-ion Battery) or 5VDC (Supplied by external adapter for Charging rechargeable battery)
Adapter information:	Model: DSA-18QFB FUS A Input:100-240VAC 50/60Hz, 0.8A, Output:5VDC,3A or 9V 2A or 12V 1.5A Manufacturer: Dee Van Enterprise Co., Ltd
RF Transmission Frequency:	13.56MHz for NFC 2402MHz-2480MHz for Bluetooth 2412MHz-2462MHz for 802.11b/g/n20/n40 (WIFI) 5150-5350, 5470-5825MHz for 802.11a/n20/n40/ac20/ac40/ac80 (WIFI)
No. of Operated Channel:	1 for NFC 79 for Bluetooth 11 for 802.11b/g/n20/n40 (WIFI) 43 for 802.11a/n20/n40/ac20/ac40/ac80 (WIFI)
Modulation:	ASK for NFC GFSK, π/4-DQPSK, 8DPSK for Bluetooth DSSS, OFDM for WIFI
Antenna Type:	FPC antenna
Antenna Gain:	1.2dBi max for 2.4GHz 2.0dBi max for 5GHz
Description of the EUT:	The Equipment Under Test (EUT) is a Mobile POS System which support WIFI at 2.4GHz and 5GHz, Bluetooth function operated at 2.4GHz

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2018 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

Technical Requirements			
FCC Part 15 Subpart C			
Test Condition		Test Result	Test Site
§15.207	Conducted emission AC power port	Pass	Site 1
§15.247(b)(1)	Conducted peak output power	Pass	Site 1
§15.247(e)	Power spectral density*	N/A	--
§15.247(a)(2)	6dB bandwidth	N/A	--
§15.247(a)(1)	20dB bandwidth	Pass	Site 1
§15.247(a)(1)	Min. of Hopping Channel Carrier Frequency Separation	Pass	Site 1
§15.247(a)(1)(iii)	Min number of hopping frequencies	Pass	Site 1
§15.247(a)(1)(iii)	Dwell Time - Average Time of Occupancy	Pass	Site 1
§15.247(d)	Spurious RF conducted emissions	Pass	Site 1
§15.247(d)	Band edge	Pass	Site 1
§15.247(d) & §15.209 &15.205	Spurious radiated emissions for transmitter and receiver	Pass	Site 1
§15.203	Antenna requirement	See Note 2	--

Note 1: N/A=Not Applicable.
Note 2: The EUT uses an FPC antenna, which gain is 1.2dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2ANTM-MD44014, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C.
HVN: ED100 is a Mobile POS System with Bluetooth Low Energy/Bluetooth BDR+EDR/WIFI/NFC/GPS/UMTS/LTE function. HVN: ED100 with camera models HZPV4197(Manufacturer: SHENZHEN HEZHONG IMAGE TECHNOLOGY CO. Ltd) and YGA0711(Manufacturer: Shenzhen Yigao Photoelectric Technology Limited), with internal storage models KMQE60013M-B318 (Manufacturer: Sumsung) and H9TQ17ABJTCCUR-KUM (Manufacturer: hynix).
HVN: MD44014 is identical with model: HVN: ED100 except model name and trademark (HVN: MD44014 for MEDION, HVN: ED100 for enforeDonner), unless otherwise Specification the model: HVN: ED100 was choose as representative model to perform all test items, and model: HVN: MD44014 was deemed to fulfil relevant EMC requirements without further testing.

This report is for the Bluetooth BDR +EDR part.

SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

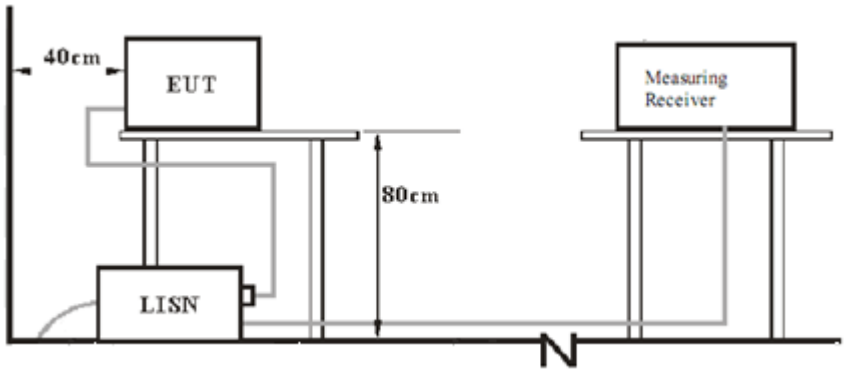
☐ - **Does not** fulfill the general approval requirements.

Sample Received Date:	August 15, 2019
Testing Start Date:	August 15, 2019
Testing End Date:	September 6, 2019

Reviewed by:	Prepared by:	Tested by:
John Zhi	Joe Gu	Tree Zhan
Section Manager	Project Engineer	Test Engineer

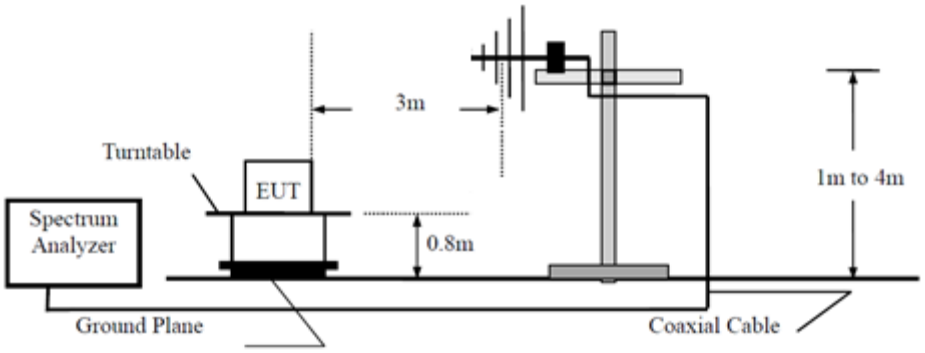
7 Test Setups

7.1 AC Power Line Conducted Emission test setups

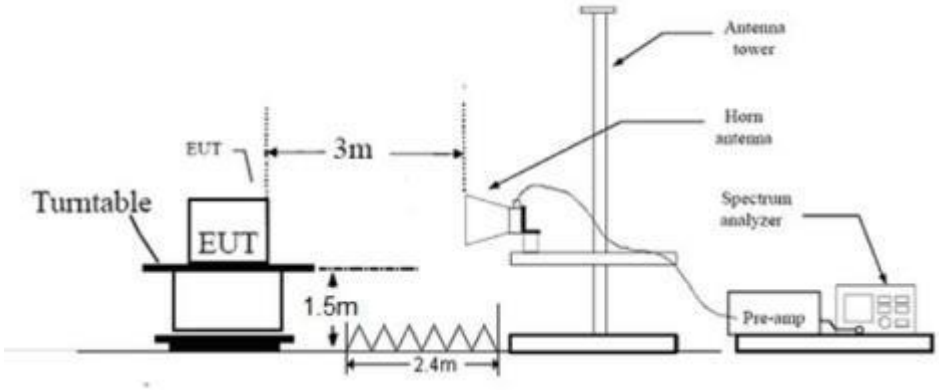


7.2 Radiated test setups

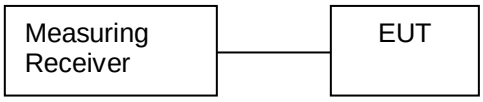
Below 1GHz



Above 1GHz



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Laptop	Lenovo	T460S	---

Test software information:

Test Software Version	HVN: ED100-1.x.x-1.x	
Modulation	Setting TX Power	Packet Type
GFSK	8	DH5
π/4-DQPSK	8	2DH5
8DPSK	8	3DH5

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

9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

Limit

According to §15.207, conducted emissions limit as below:

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreasing linearly with logarithm of the frequency

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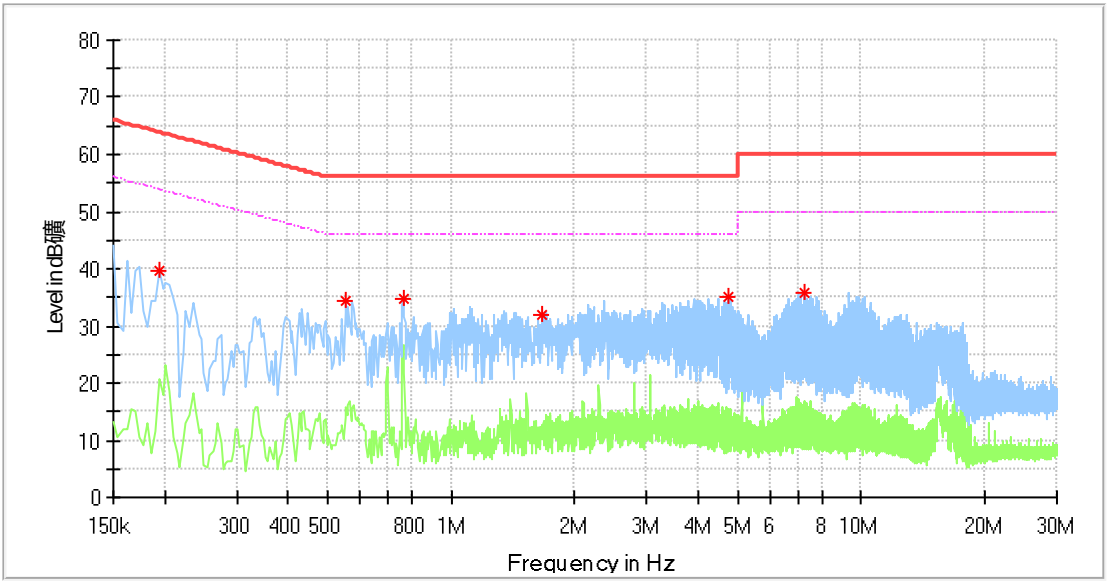
Conducted Emission

Product Type	:	Mobile POS System
M/N	:	HVN: ED100
Operating Condition	:	Charging + TX
Test Specification	:	Power Line, Live
Comment	:	AC 120V/60Hz

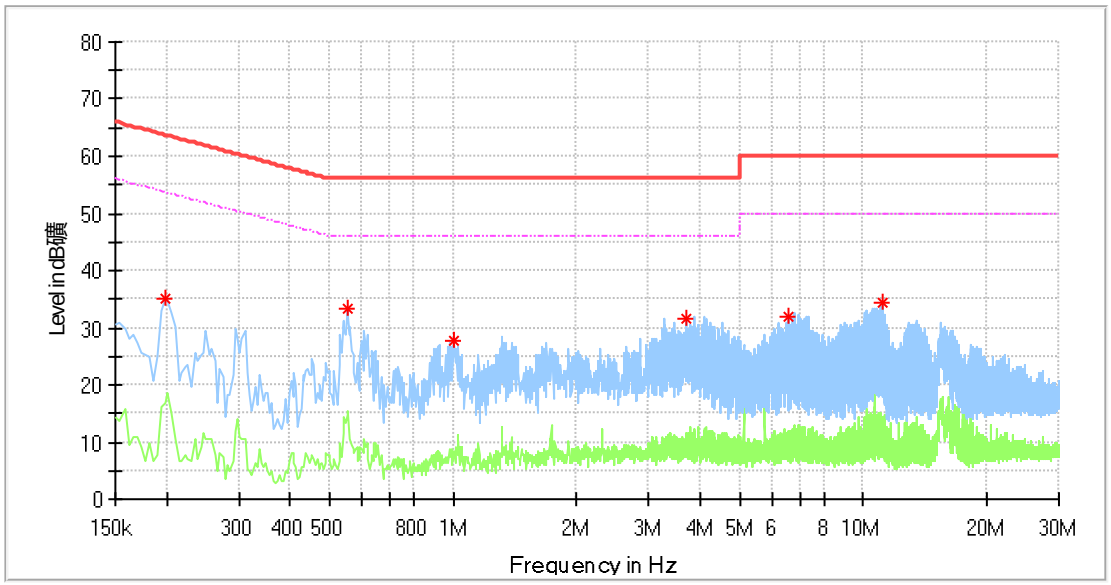


Frequency (MHz)	MaxPeak* (dBµV)	Average* (dBµV)	Limit (dBµV	Margin (dB)	Line	Corr.** (dB)
0.194000	39.55	---	63.86	24.31	L1	10.2
0.554000	34.28	---	56.00	21.72	L1	10.3
0.766000	34.87	---	56.00	21.13	L1	10.3
1.674000	32.01	---	56.00	23.99	L1	10.3
4.718000	34.94	---	56.00	21.06	L1	10.4
7.282000	35.92	---	60.00	24.08	L1	10.5

Remark：
*Level=Reading Level + Correction Factor
**Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

Conducted Emission

Product Type	:	Notebook
M/N	:	NFC7YWW01161024
Operating Condition	:	Charging + TX
Test Specification	:	Power Line, Neutral
Comment	:	AC 120V/60Hz



Frequency (MHz)	MaxPeak* (dBµV)	Average* (dBµV)	Limit (dBµV	Margin (dB)	Line	Corr.** (dB)
0.198000	35.04	---	63.69	28.65	N	10.2
0.550000	33.17	---	56.00	22.83	N	10.3
1.002000	27.60	---	56.00	28.40	N	10.3
3.698000	31.55	---	56.00	24.45	N	10.4
6.570000	31.82	---	60.00	28.18	N	10.5
11.158000	34.34	---	60.00	25.66	N	10.7

Remark：
*Level=Reading Level + Correction Factor
**Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

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9.2 Conducted peak output power

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following test receiver settings:
   Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel
   RBW > the 20dB bandwidth of the emission being measured, VBW≥RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
4. 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 and record the results in the test report.
5. Repeat above procedures until all frequencies measured were complete.

Limits

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

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Conducted peak output power

Bluetooth Mode GFSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	3.84	Pass
Middle channel 2441MHz	5.28	Pass
High channel 2480MHz	3.60	Pass

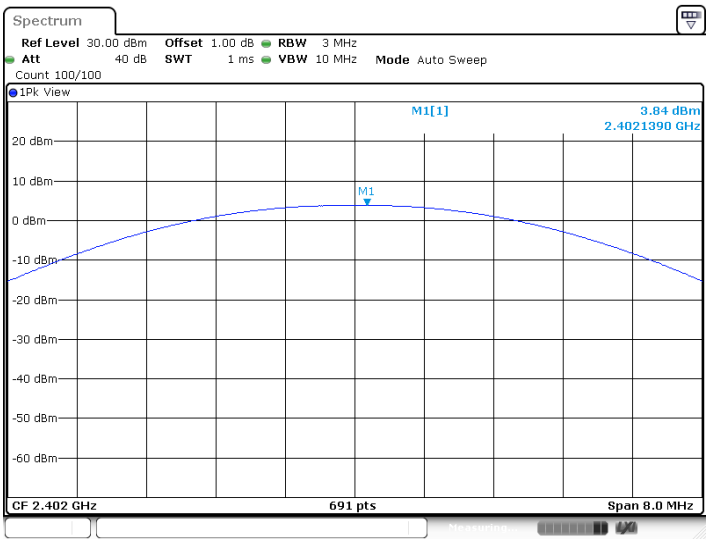
Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	3.95	Pass
Middle channel 2441MHz	5.38	Pass
High channel 2480MHz	3.63	Pass

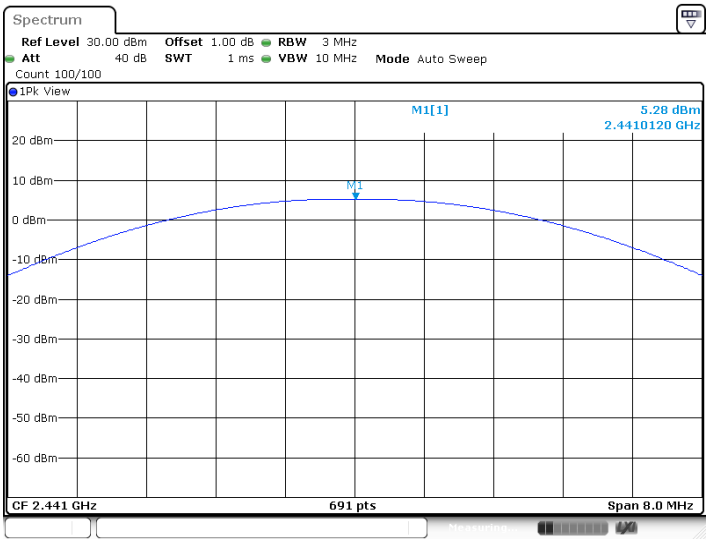
Bluetooth Mode 8DPSK modulation Test Result

Frequency MHz	Conducted Peak Output Power dBm	Result
Low channel 2402MHz	4.34	Pass
Middle channel 2441MHz	5.92	Pass
High channel 2480MHz	4.02	Pass

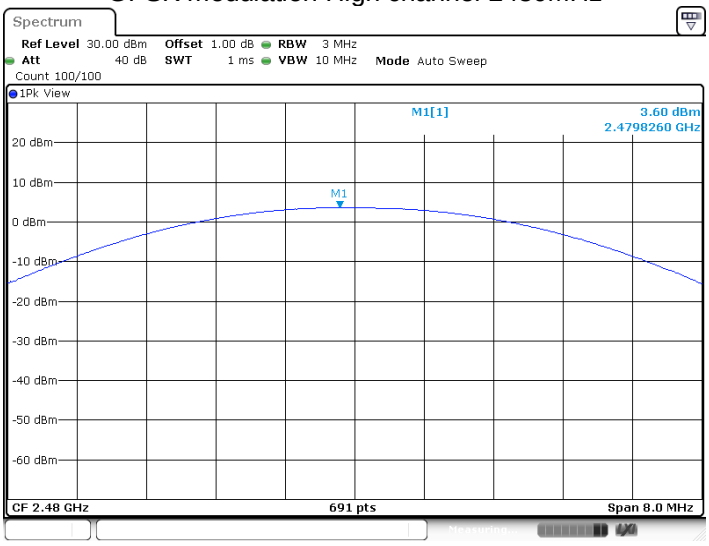
GFSK modulation Low channel 2402MHz



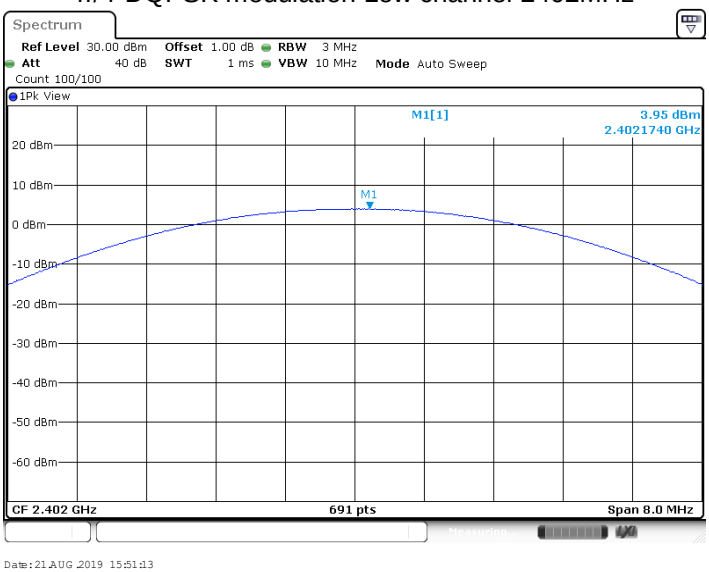
GFSK modulation Middle channel 2441MHz



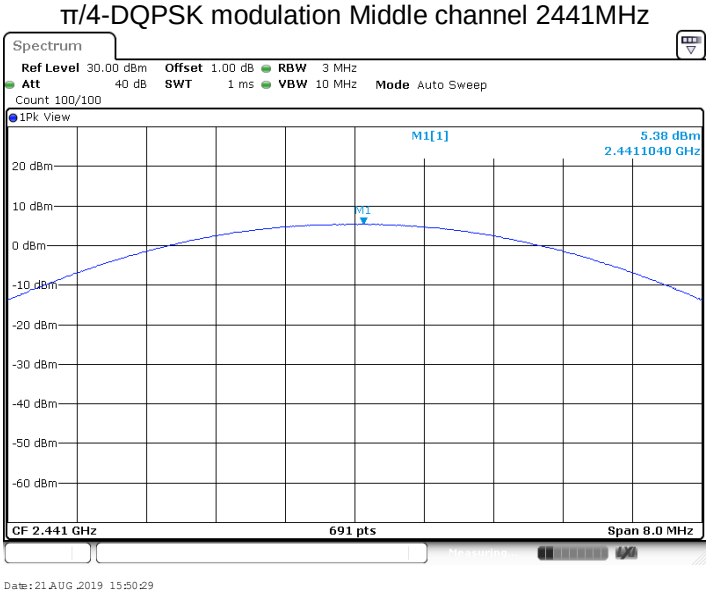
GFSK modulation High channel 2480MHz



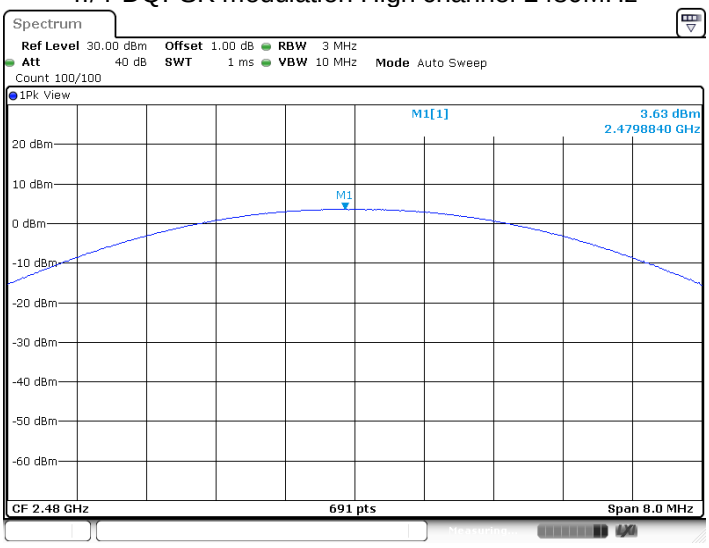
π/4-DQPSK modulation Low channel 2402MHz



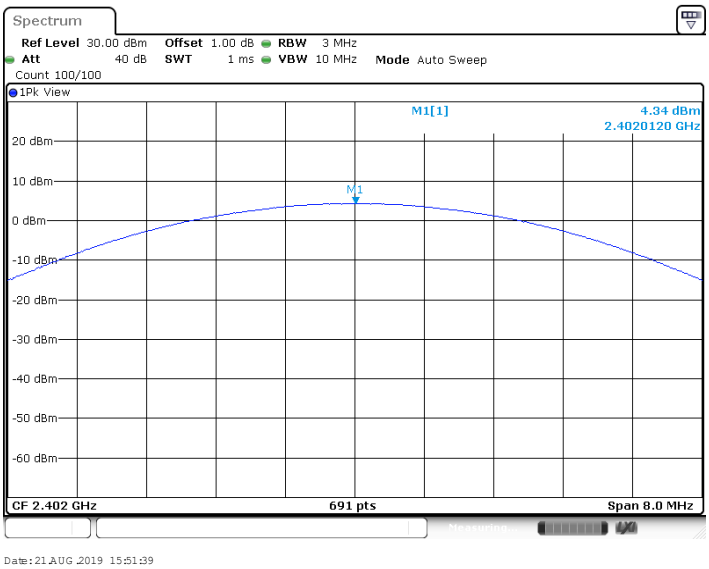
π/4-DQPSK modulation Middle channel 2441MHz



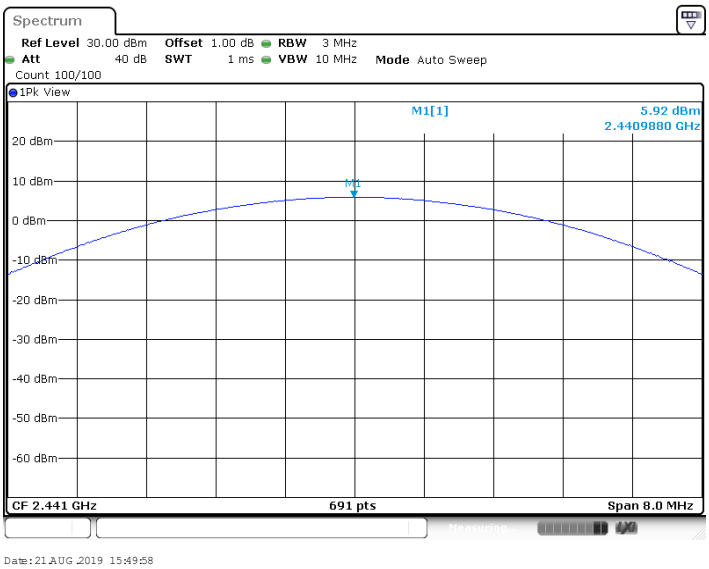
π/4-DQPSK modulation High channel 2480MHz



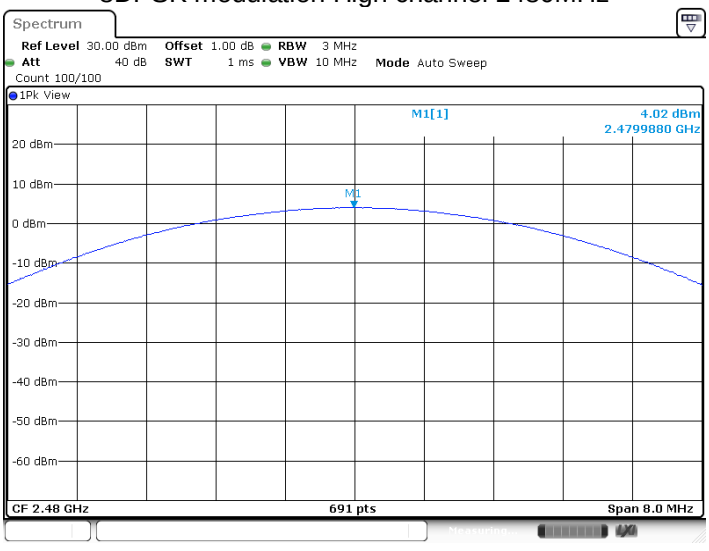
8DPSK modulation Low channel 2402MHz



8DPSK modulation Middle channel 2441MHz



8DPSK modulation High channel 2480MHz



9.3 20 dB bandwidth

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Use the following test receiver settings:
   Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel
   RBW > the 20dB bandwidth of the emission being measured, VBW≥RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth. Record the results.
5. Repeat above procedures until all frequencies measured were complete.

Limit

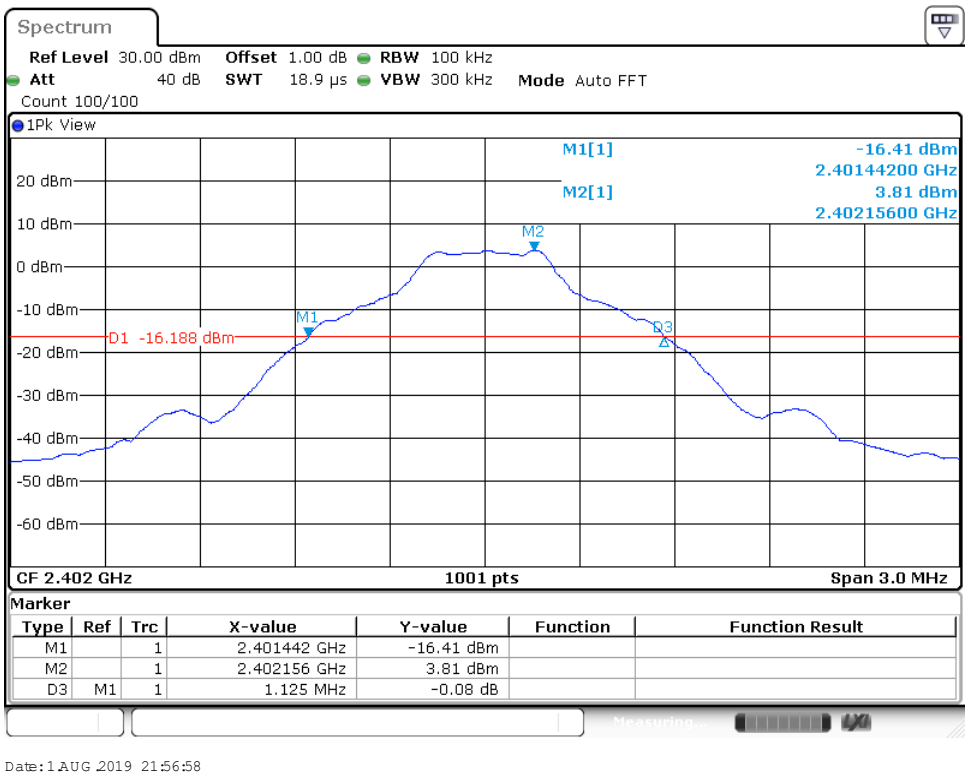
Limit [kHz]
N/A

20 dB bandwidth

Bluetooth Mode GFSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	Limit kHz	Result
2402	1125	--	Pass
2441	1122	--	Pass
2480	1122	--	Pass

Low channel 2402MHz



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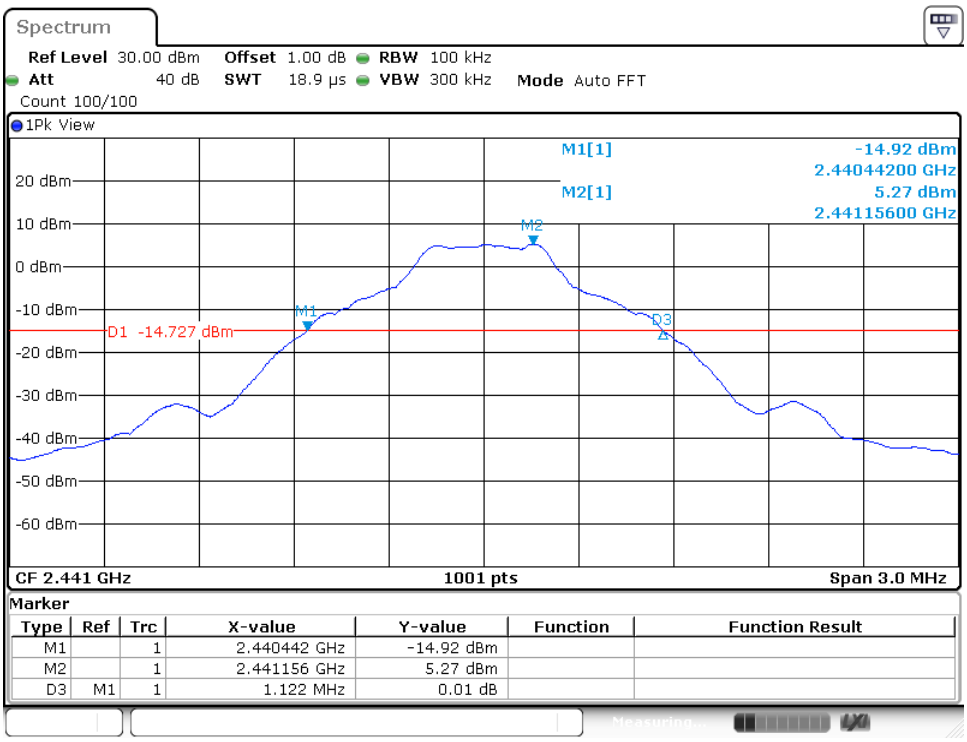
Middle channel 2441MHz



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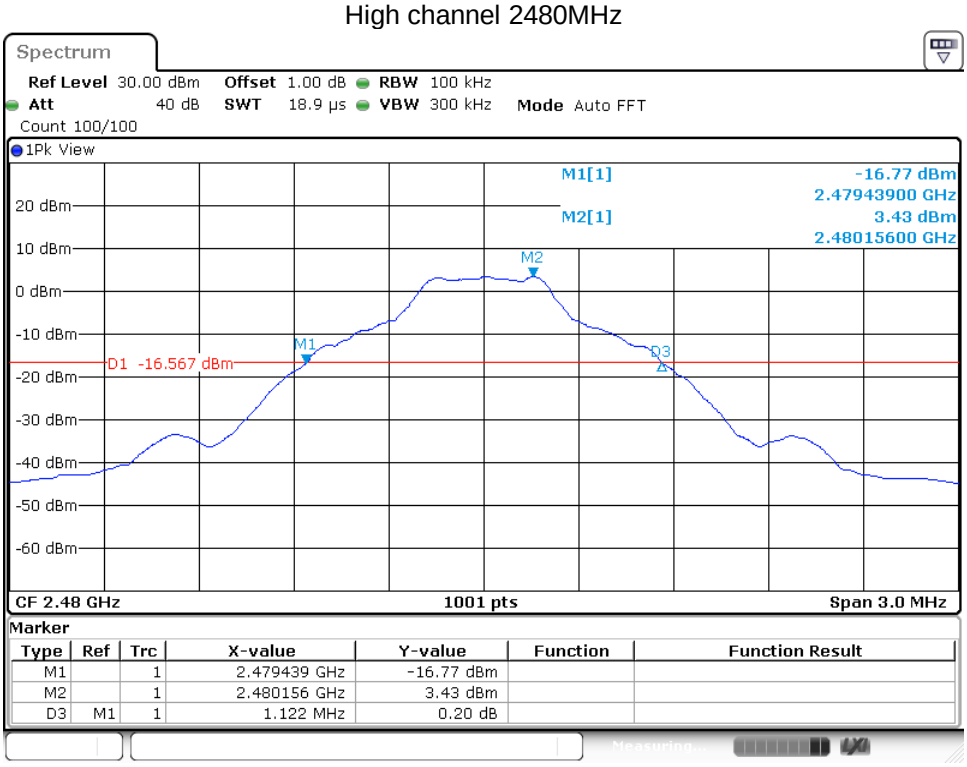
High channel 2480MHz



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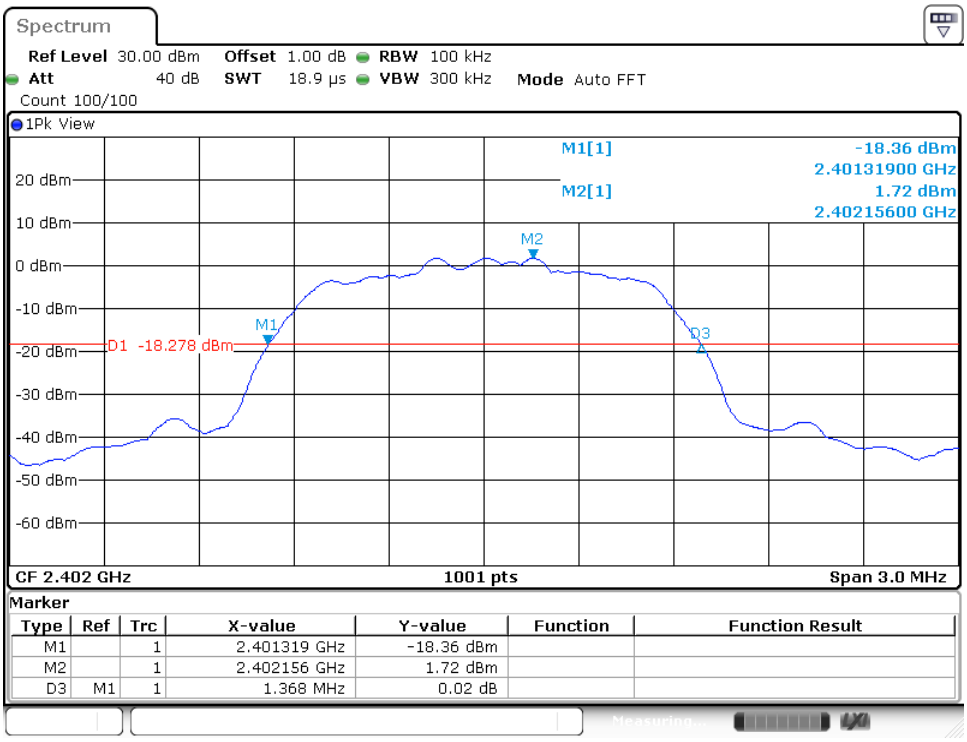
20 dB bandwidth

Bluetooth Mode π/4-DQPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	Limit kHz	Result
2402	1368	--	Pass
2441	1368	--	Pass
2480	1368	--	Pass

Low channel 2402MHz



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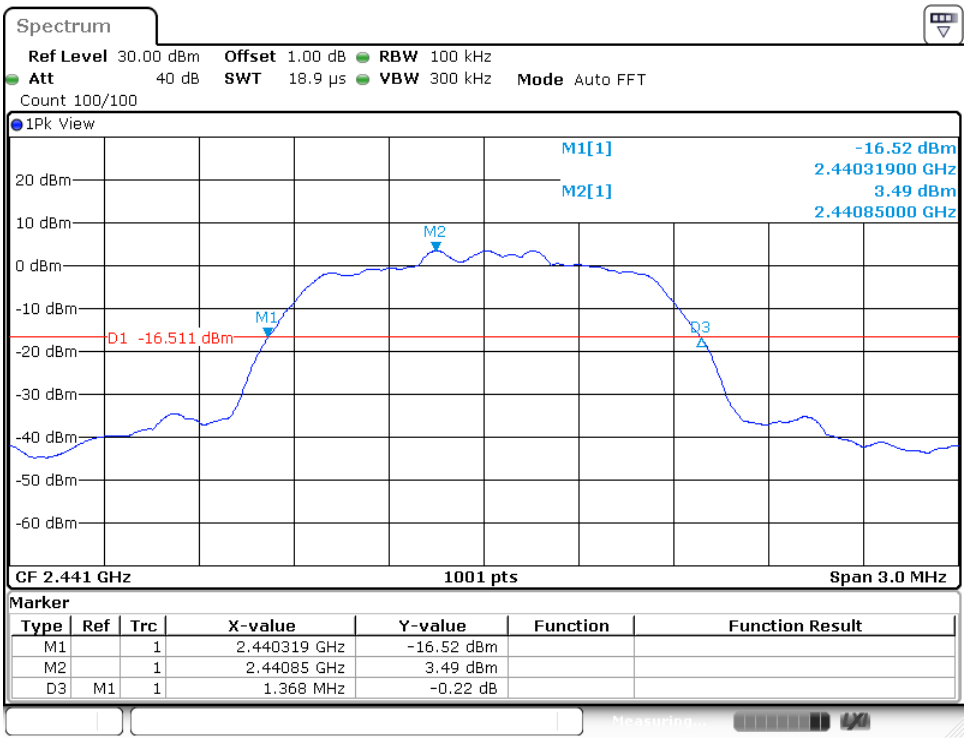
Middle channel 2441MHz



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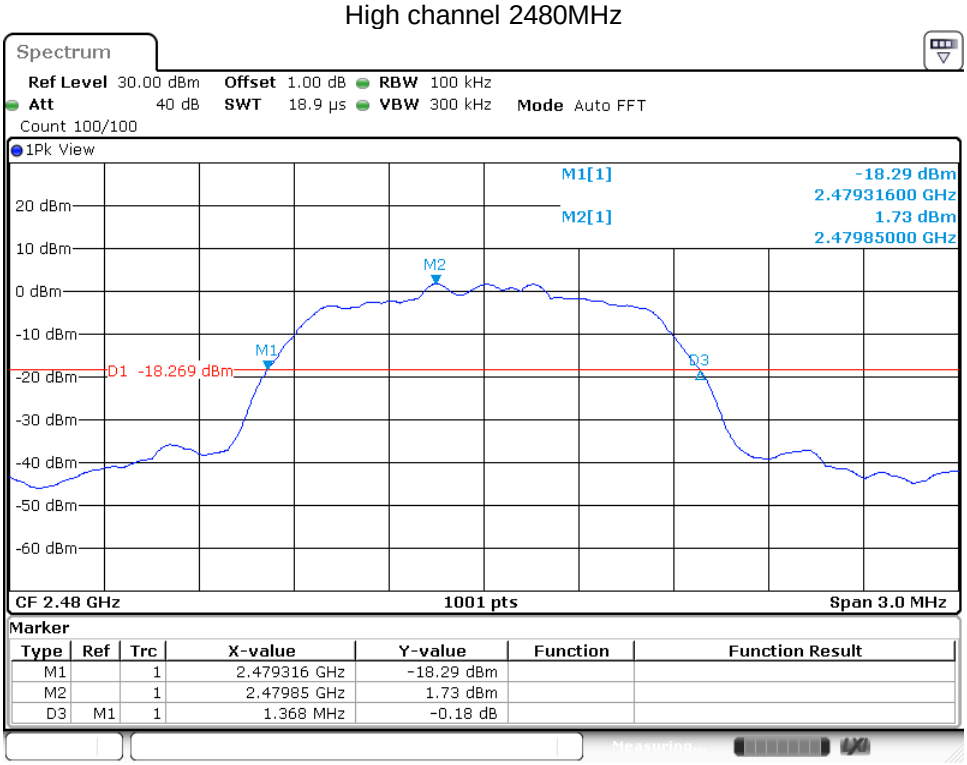
High channel 2480MHz



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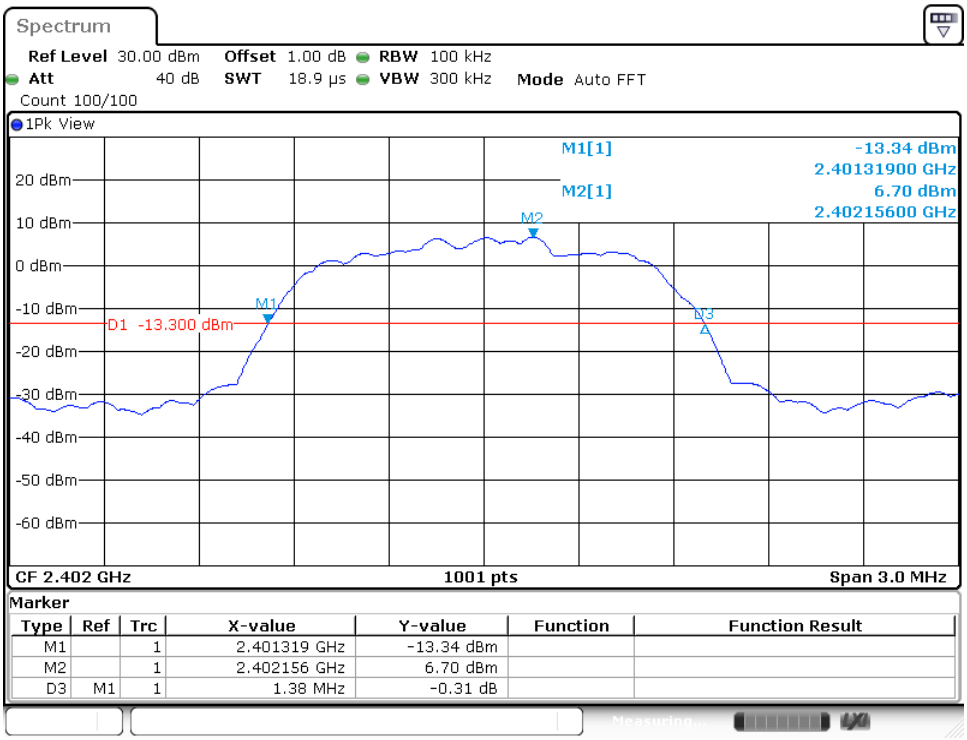
20 dB bandwidth

Bluetooth Mode 8DPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	Limit kHz	Result
2402	1380	--	Pass
2441	1380	--	Pass
2480	1380	--	Pass

Low channel 2402MHz



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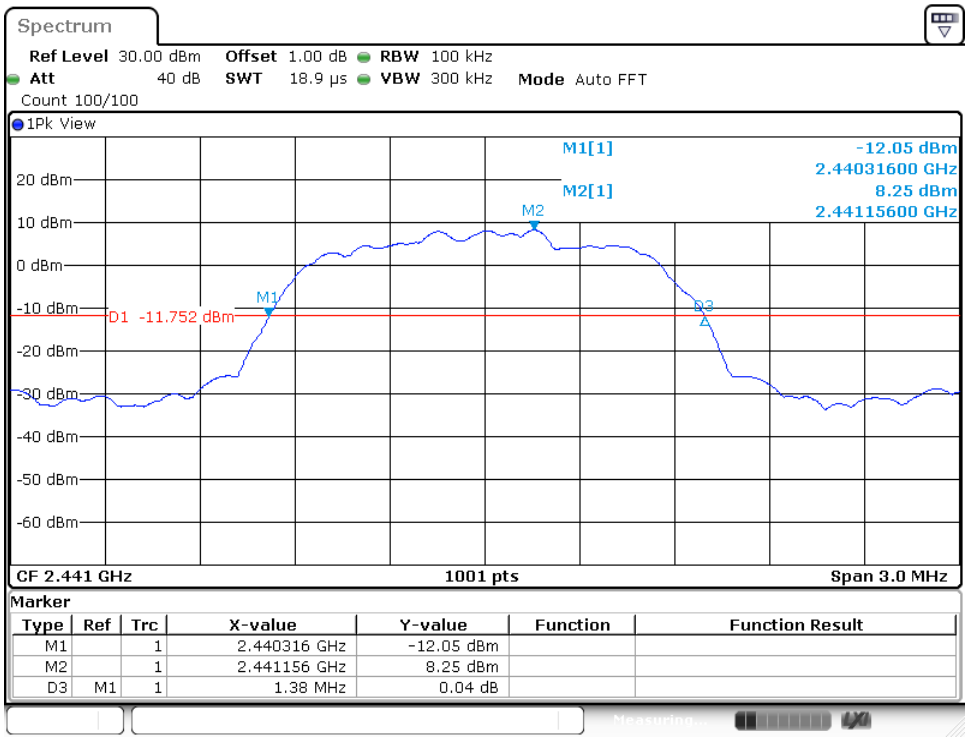
Middle channel 2441MHz



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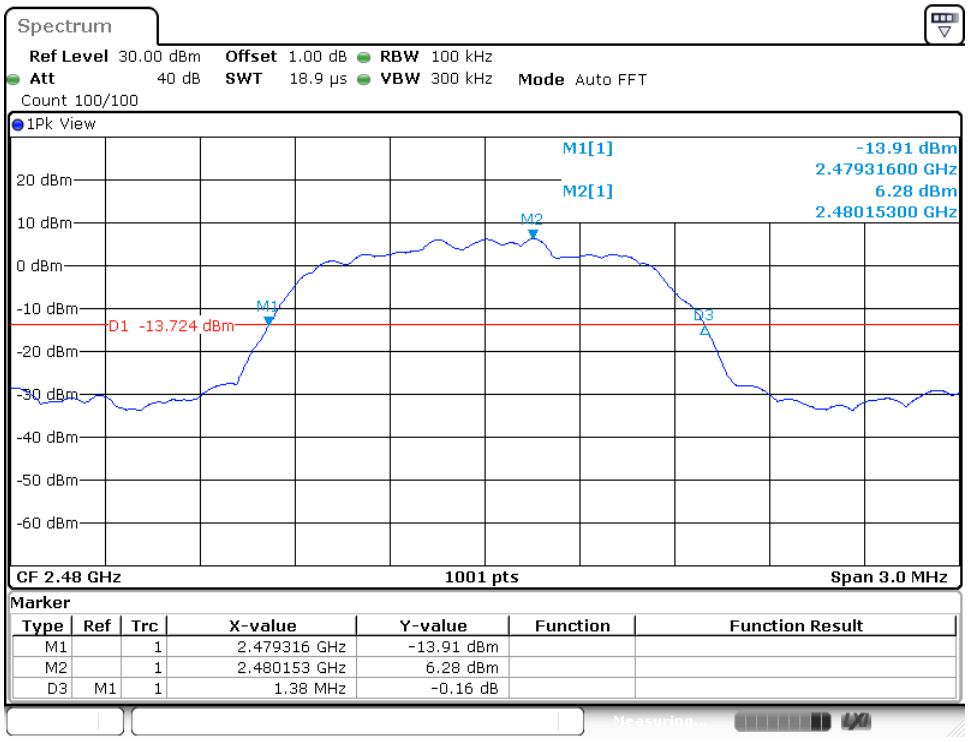
High channel 2480MHz



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9.4 Carrier Frequency Separation

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit to hopping mode.
3. 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
4. By using the Max-Hold function record the separation of two adjacent channels.
5. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function. Record the results.
6. Repeat above procedures until all frequencies measured were complete.

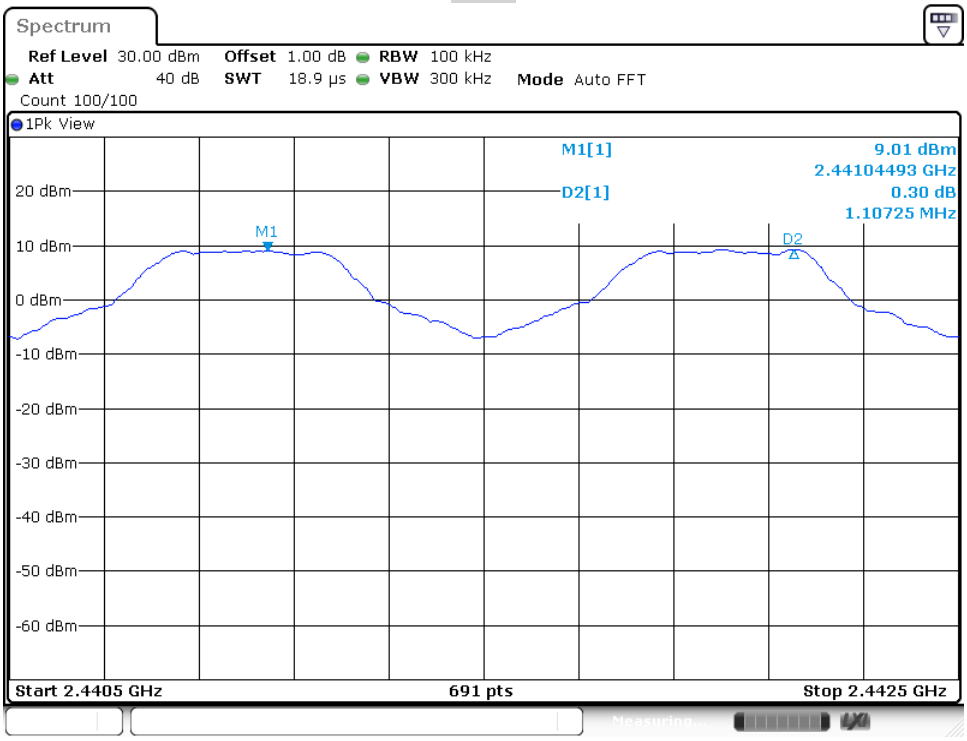
Limit

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

Carrier Frequency Separation

TestMode	Channel	Result [MHz]	Limit [MHz]	Verdict
DH5	Hop	1.107	>=0.750	PASS
2DH5	Hop	1.000	>=0.912	PASS
3DH5	Hop	1.142	>=0.920	PASS

DH5



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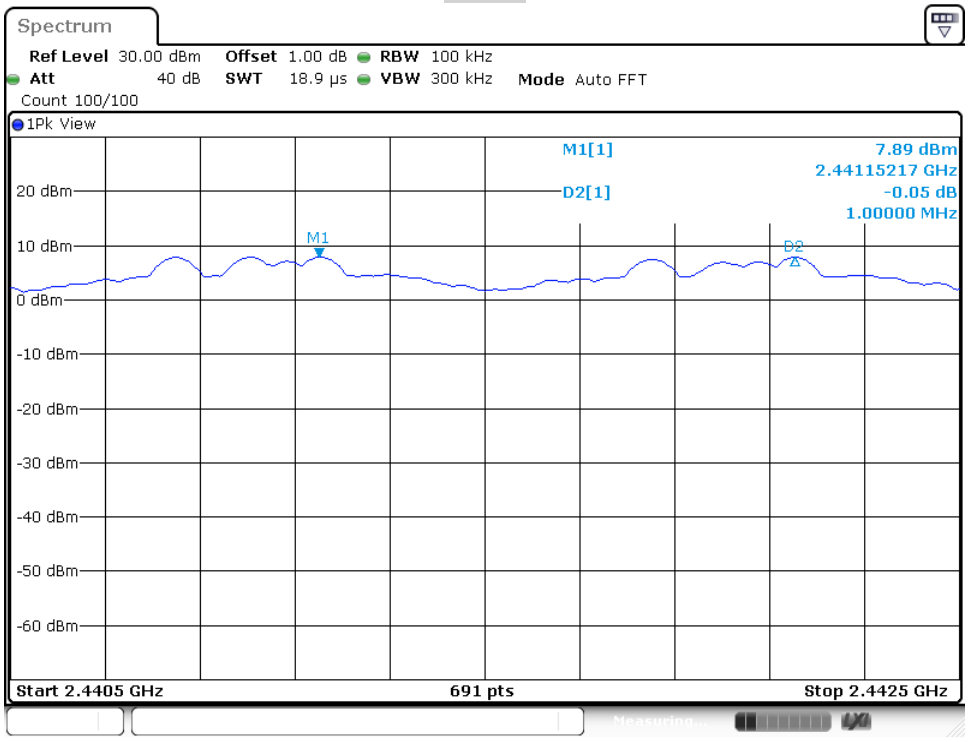
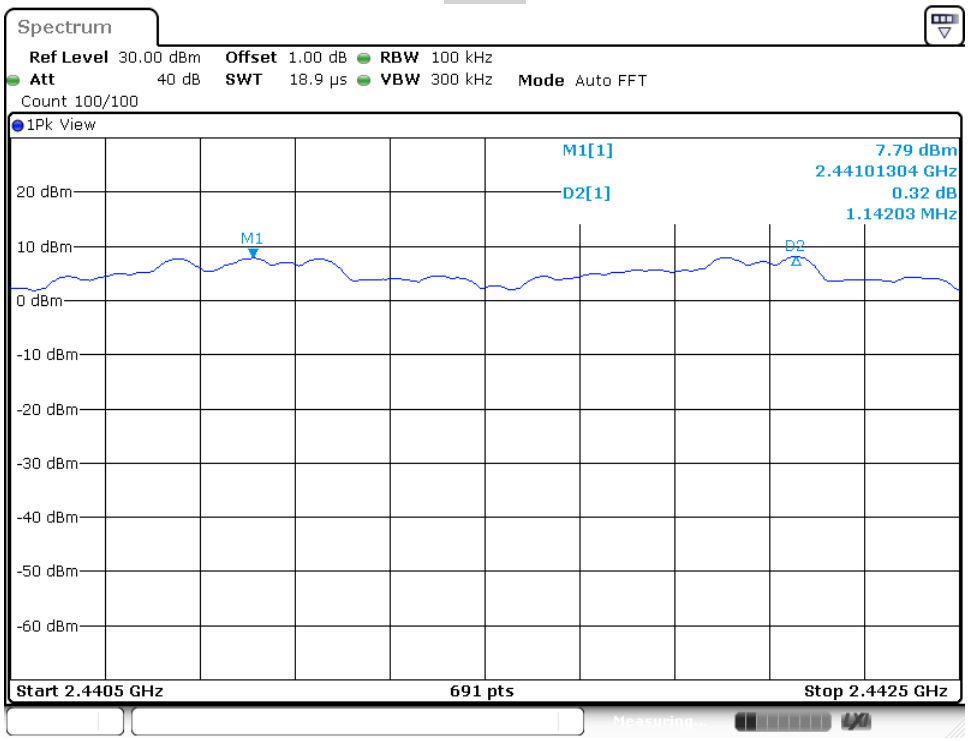
2DH5



Date: 21.AUG.2019 15:30:17

3DH5



Date: 21.AUG.2019 15:38:23

9.5 Number of hopping frequencies

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit to hopping mode.
3. 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
4. Set the spectrum analyzer on Max-Hold Mode,
5. Record all the signals from each channel until each one has been recorded.

Repeat above procedures until all frequencies measured were complete.

Limit

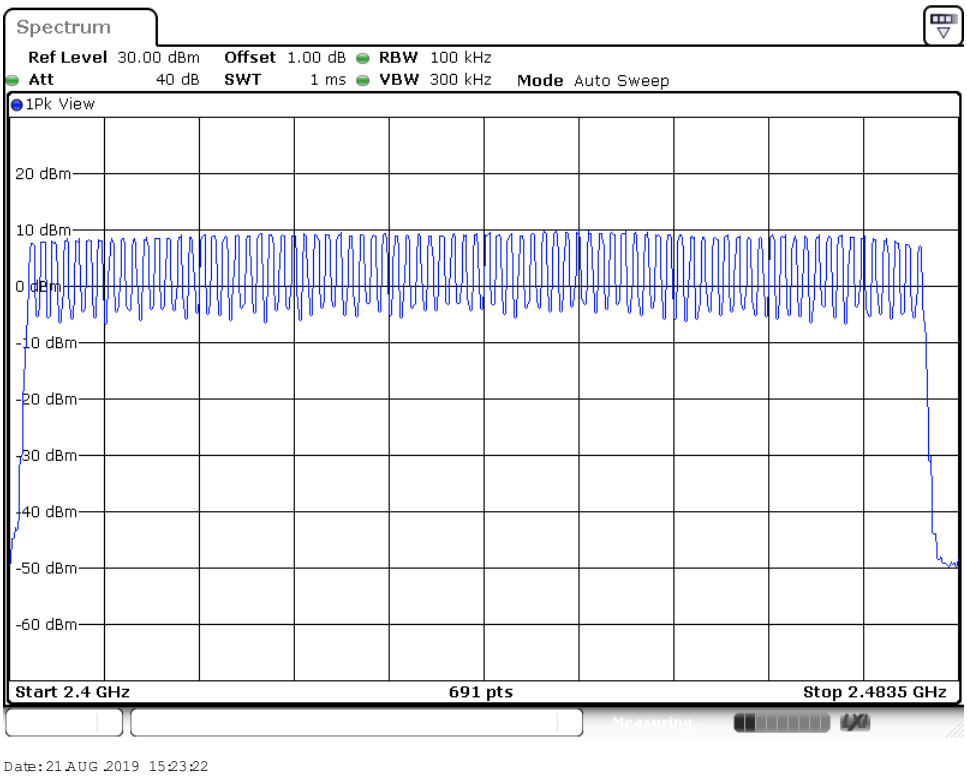
Limit number
⩾ 15

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

GFSK Mode



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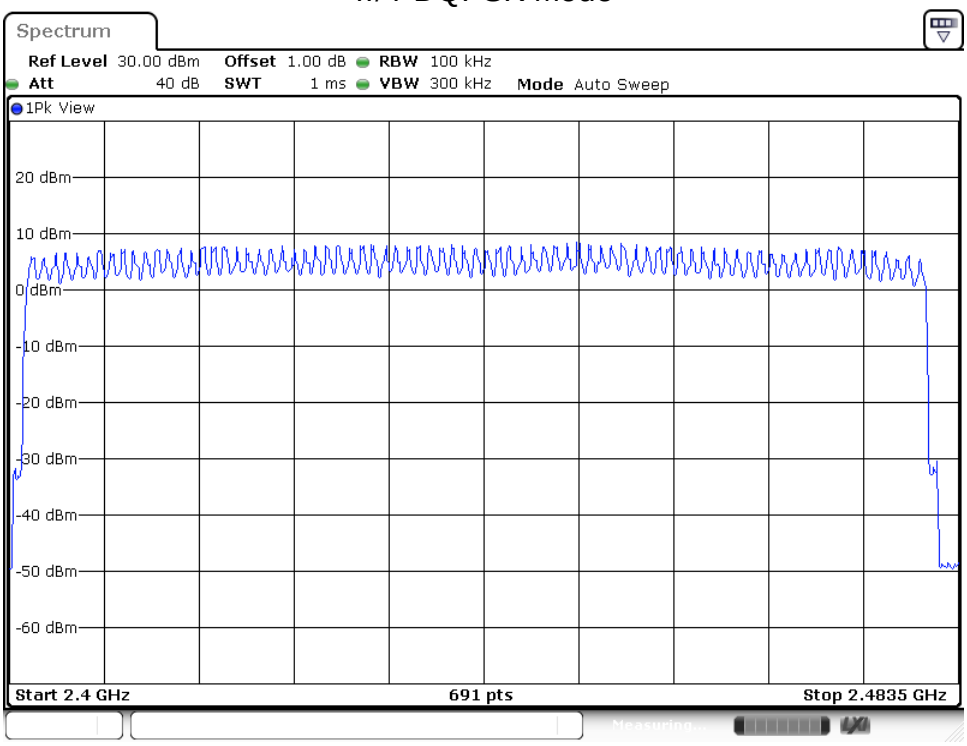
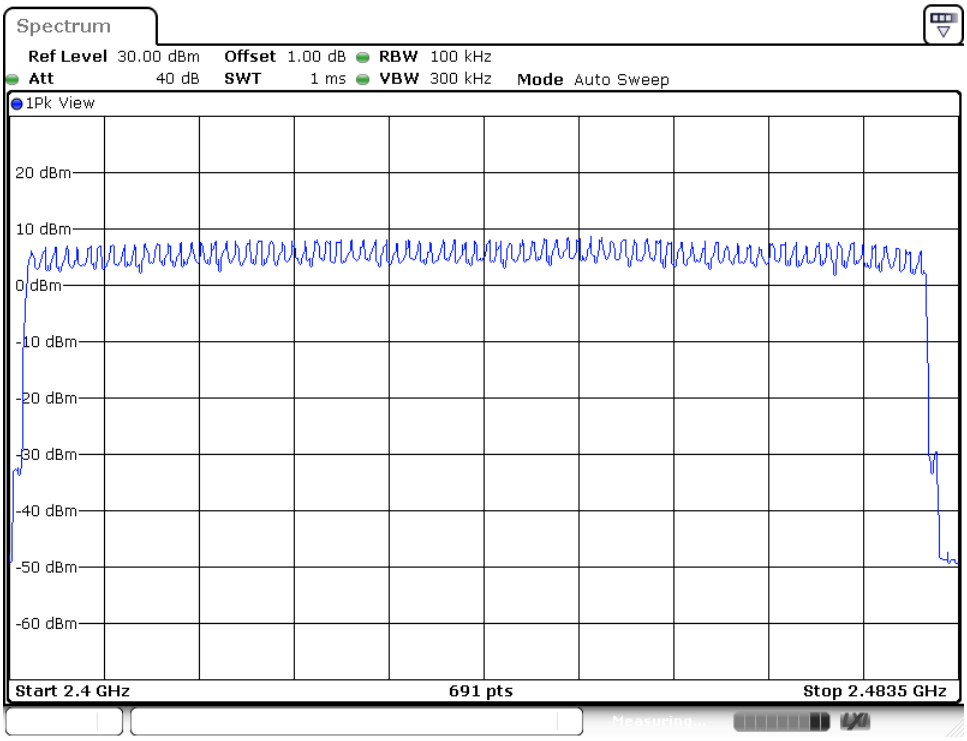
π/4-DQPSK Mode



Date: 21.AUG.2019 15:31:09

8DPSK Mode



Date: 21.AUG.2019 15:39:34

9.6 Dwell Time

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit to hopping mode.
3. Use the following spectrum analyzer settings:
   RBW: 1MHz; VBW: 3MHz; SPAN: Zero Span
   Set the spectrum analyzer on Max-Hold Mode,
4. Adjust the center frequency of spectrum analyzer on any frequency be measured.
5. Measure the Dwell Time by spectrum analyzer Marker function. Record the results.
   Dwell Time = Burst Width * Total Hops
6. 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

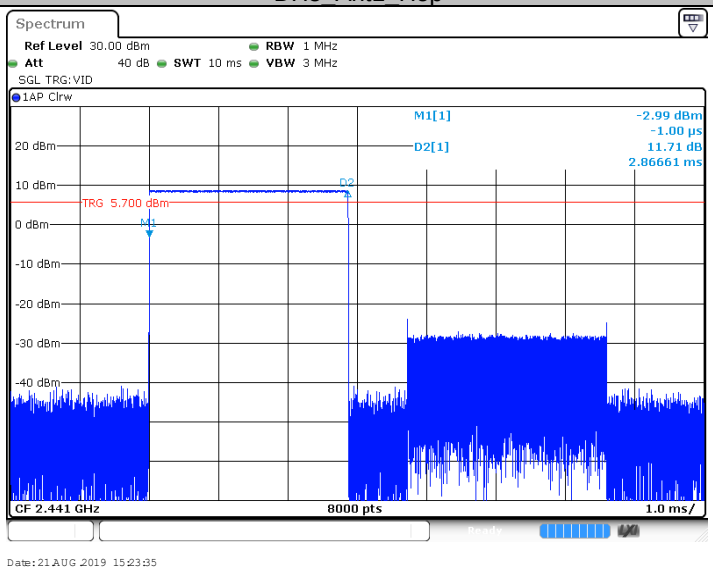
Dwell time

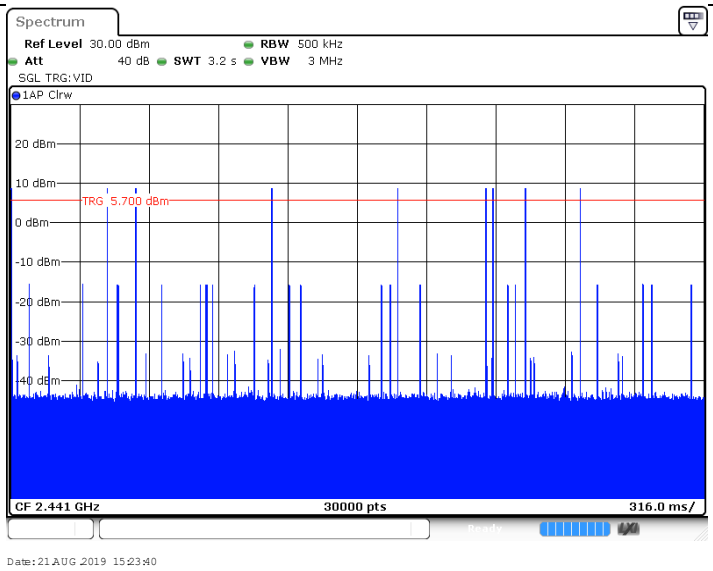
The maximum dwell time shall be 0.4 s.
The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 79 [ch] = 31.6 [s*ch];

Test Result

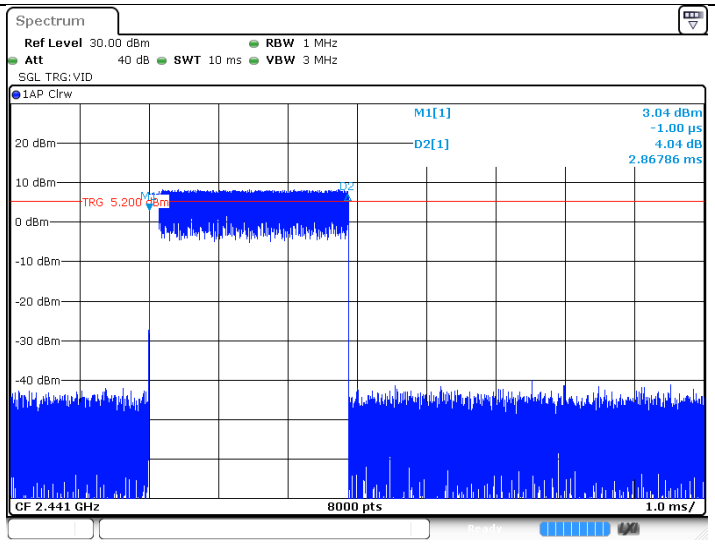
TestMode	Channel	BurstWidth [ms]	TotalHops	Result [s]	Limit [s]	Verdict
DH5	Hop	2.87	90	0.258	<=0.4	PASS
2DH5	Hop	2.87	90	0.258	<=0.4	PASS
3DH5	Hop	2.87	130	0.373	<=0.4	PASS

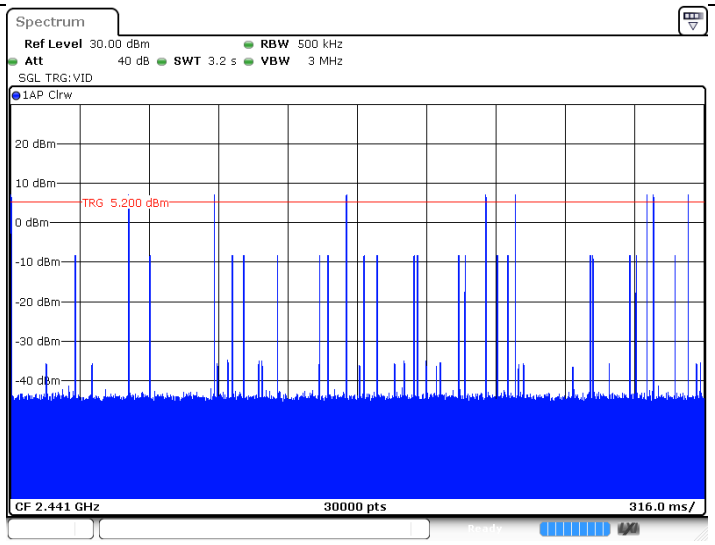
DH5_Ant1_Hop



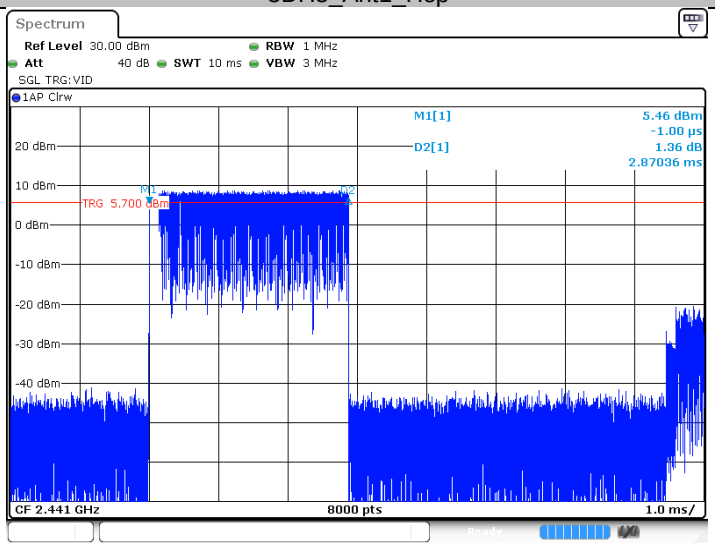


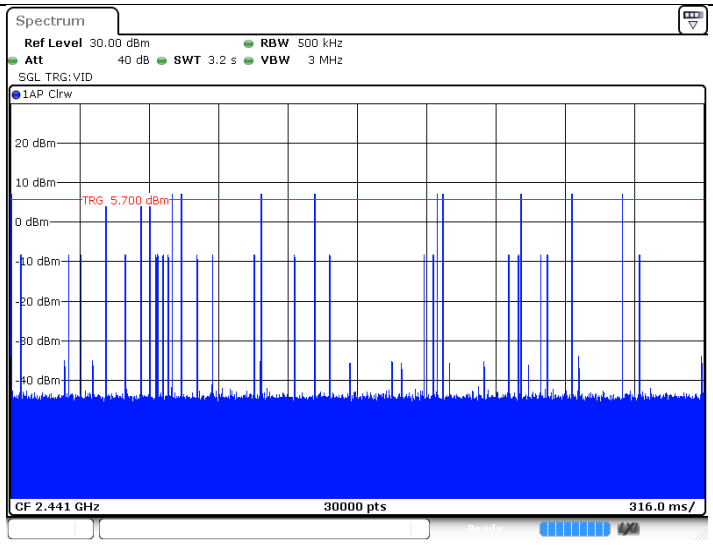
2DH5_Ant1_Hop





3DH5_Ant1_Hop




Spectrum
Ref Level 30.00 dBm
RBW 500 kHz
Att 40 dB SWT 3.2 s VBW 3 MHz
SGL TRG:VID
1AP Clrw
20 dBm
10 dBm
TRG 5.700 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
CF 2.441 GHz
30000 pts
316.0 ms/
Date: 21.AUG.2019 15:39:51

9.7 Conducted Spurious Emission

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency

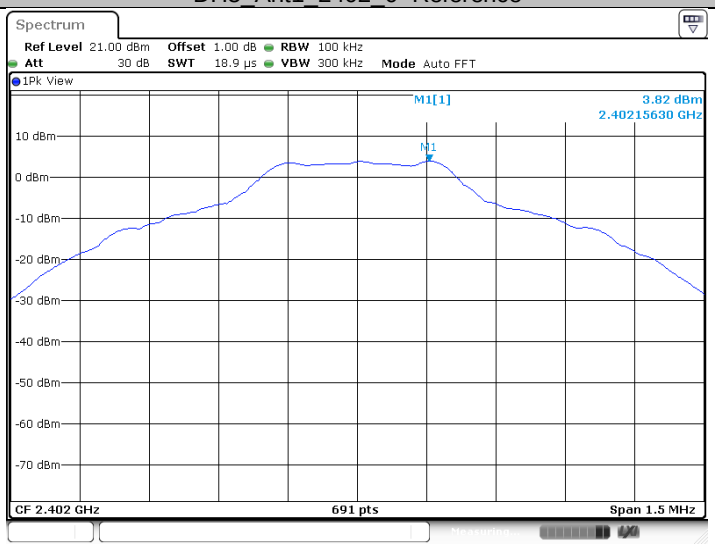
Limit

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

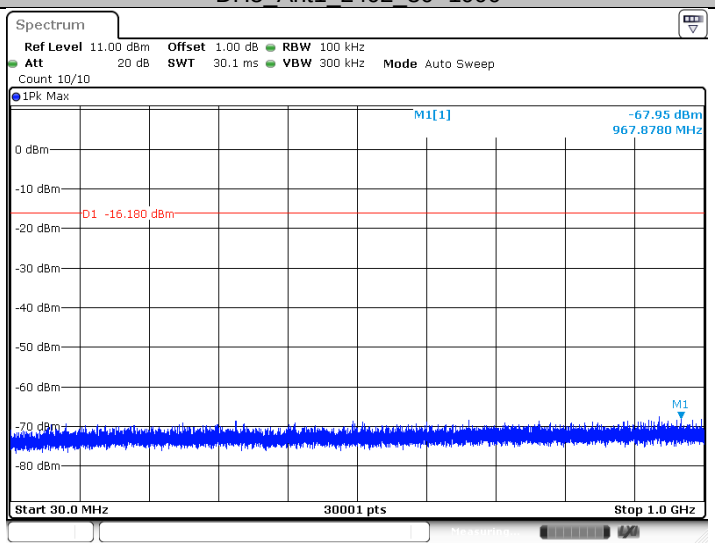
Test result:

TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
DH5	Ant1	2402	Reference	3.82	3.82	---	PASS
		2402	30~1000	30~1000	-67.95	<=-16.18	PASS
		2402	1000~26500	1000~26500	-52.18	<=-16.18	PASS
		2441	Reference	5.29	5.29	---	PASS
		2441	30~1000	30~1000	-67.6	<=-14.71	PASS
		2441	1000~26500	1000~26500	-51.95	<=-14.71	PASS
		2480	Reference	3.44	3.44	---	PASS
		2480	30~1000	30~1000	-68.16	<=-16.56	PASS
		2480	1000~26500	1000~26500	-52.61	<=-16.56	PASS
2DH5	Ant1	2402	Reference	1.73	1.73	---	PASS
		2402	30~1000	30~1000	-68.12	<=-18.27	PASS
		2402	1000~26500	1000~26500	-51.55	<=-18.27	PASS
		2441	Reference	3.49	3.49	---	PASS
		2441	30~1000	30~1000	-67.67	<=-16.51	PASS
		2441	1000~26500	1000~26500	-52.36	<=-16.51	PASS
		2480	Reference	1.74	1.74	---	PASS
		2480	30~1000	30~1000	-67.53	<=-18.26	PASS
		2480	1000~26500	1000~26500	-52.37	<=-18.26	PASS
3DH5	Ant1	2402	Reference	6.71	6.71	---	PASS
		2402	30~1000	30~1000	-67.88	<=-13.29	PASS
		2402	1000~26500	1000~26500	-52.21	<=-13.29	PASS
		2441	Reference	8.26	8.26	---	PASS
		2441	30~1000	30~1000	-67.96	<=-11.74	PASS
		2441	1000~26500	1000~26500	-52.3	<=-11.74	PASS
		2480	Reference	6.28	6.28	---	PASS
		2480	30~1000	30~1000	-68.04	<=-13.72	PASS
		2480	1000~26500	1000~26500	-52.39	<=-13.72	PASS

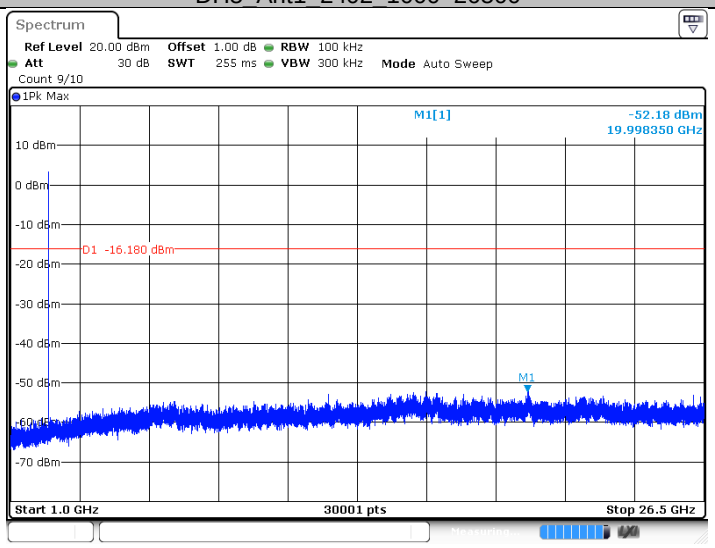
DH5_Ant1_2402_0~Reference



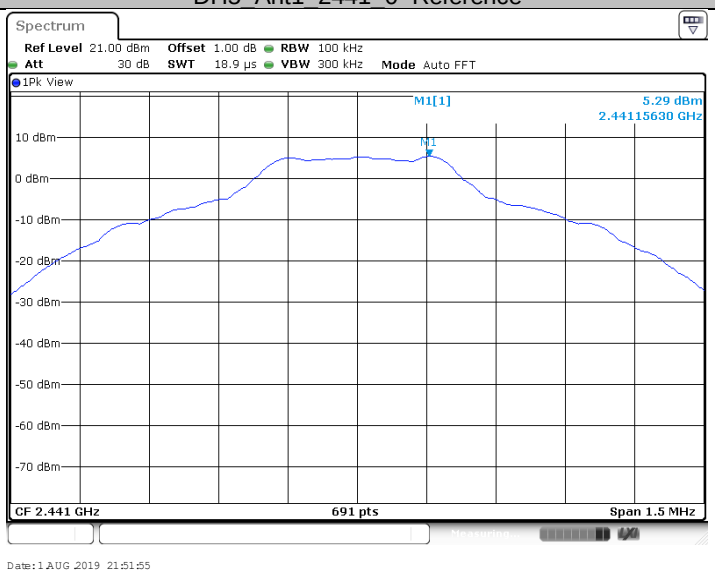
DH5_Ant1_2402_30~1000



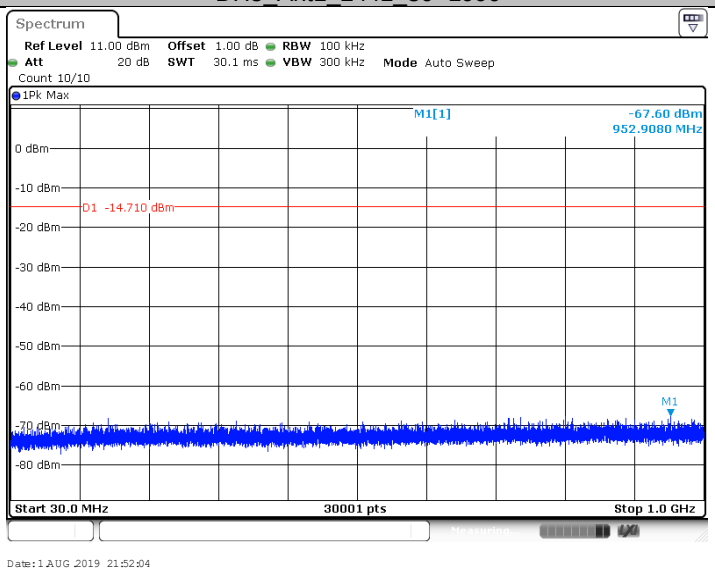
DH5_Ant1_2402_1000~26500



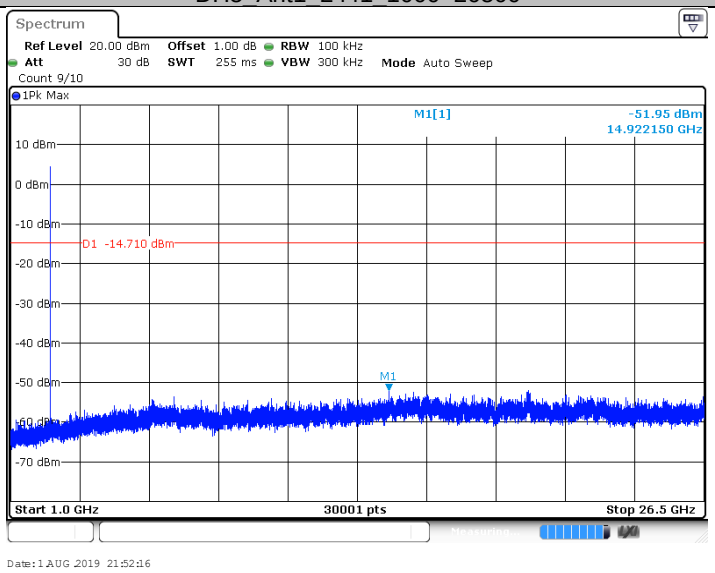
DH5_Ant1_2441_0~Reference



DH5_Ant1_2441_30~1000



DH5_Ant1_2441_1000~26500



DH5_Ant1_2480_0~Reference

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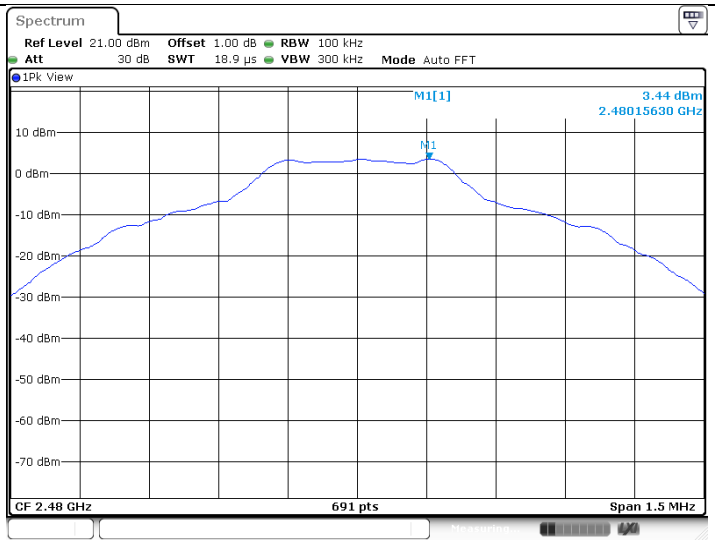
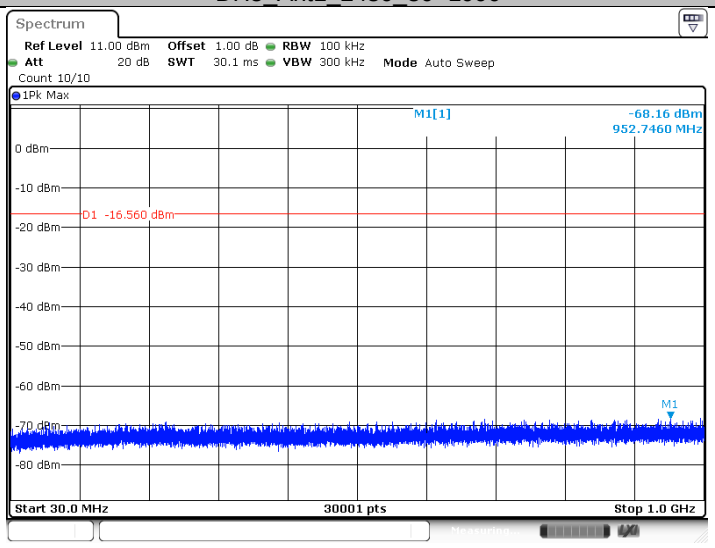
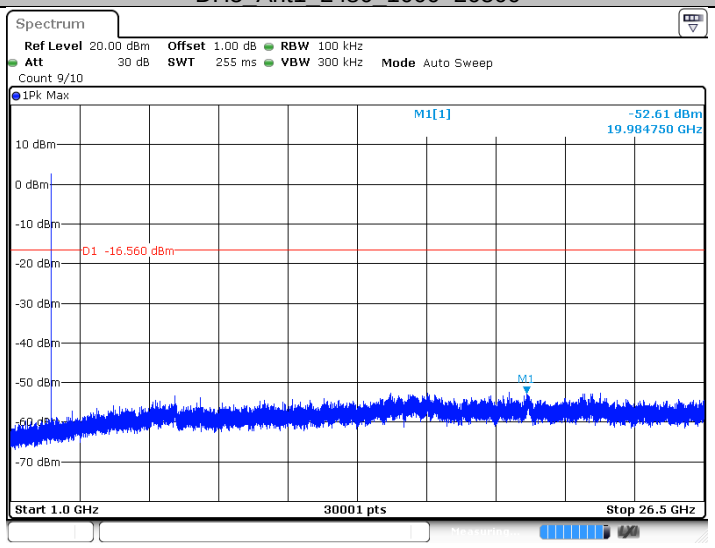


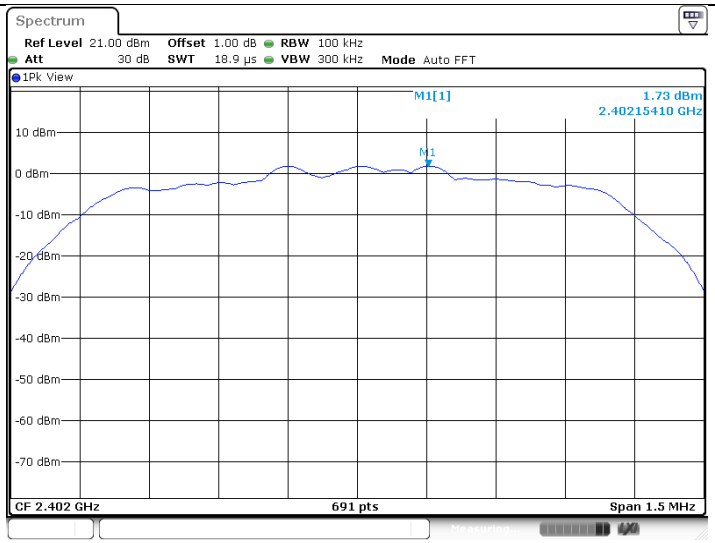
DH5_Ant1_2480_30~1000



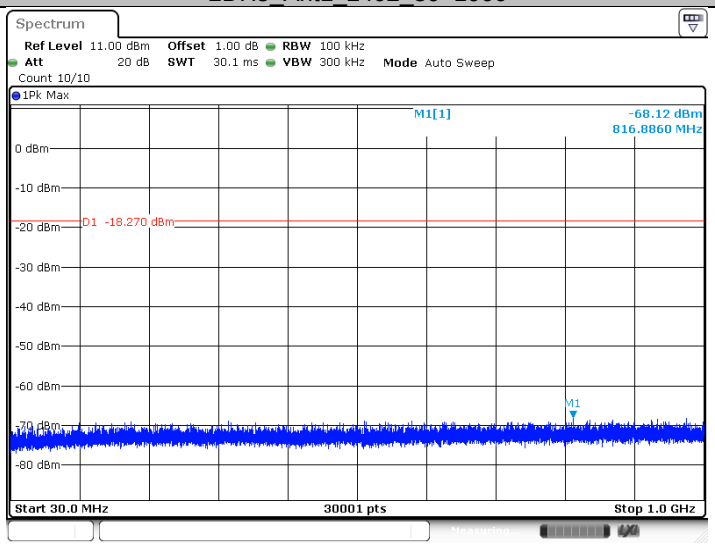
DH5_Ant1_2480_1000~26500



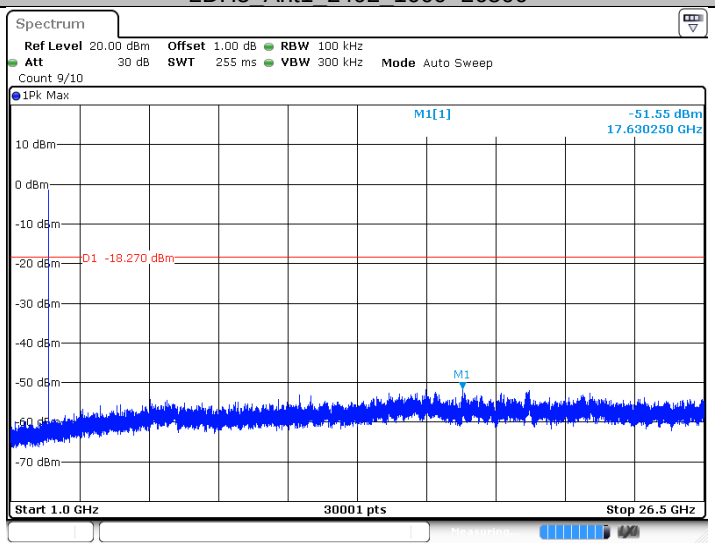
2DH5_Ant1_2402_0~Reference



2DH5_Ant1_2402_30~1000



2DH5_Ant1_2402_1000~26500



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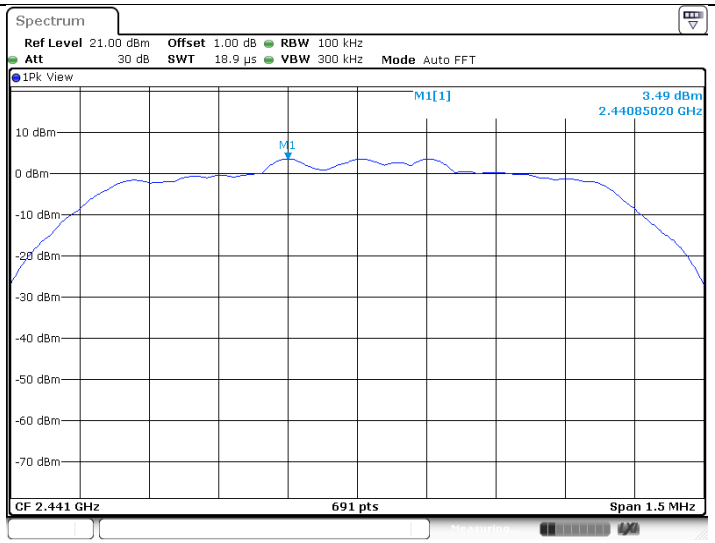
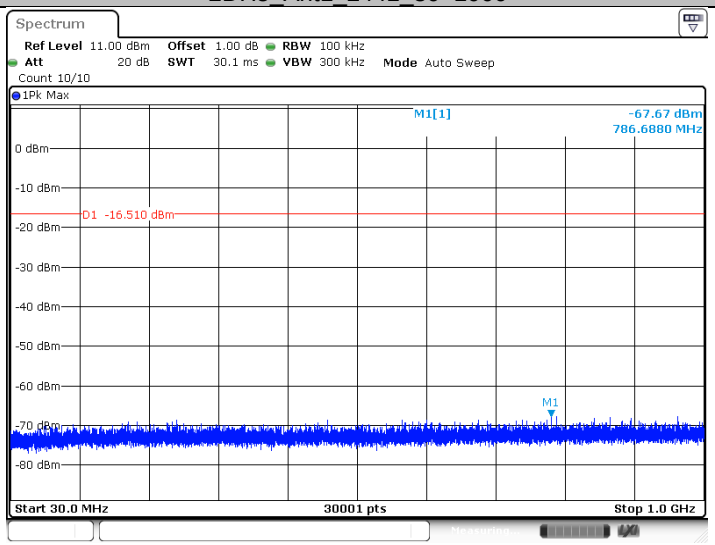
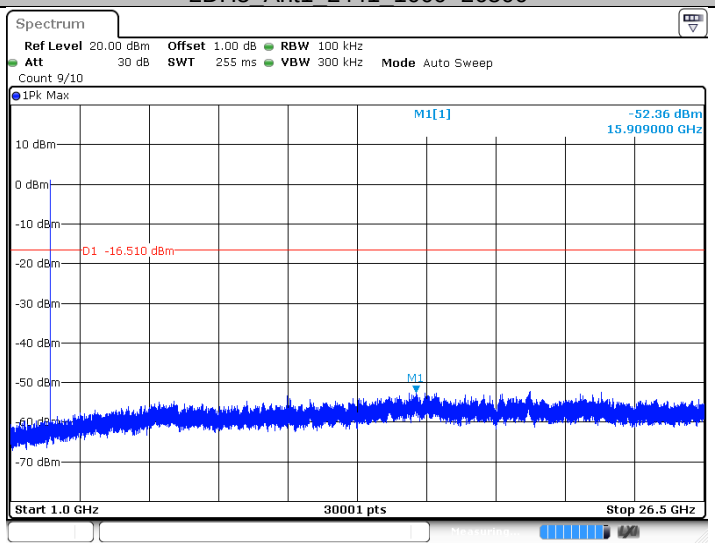


2DH5_Ant1_2441_30~1000



2DH5_Ant1_2441_1000~26500



2DH5_Ant1_2480_0~Reference

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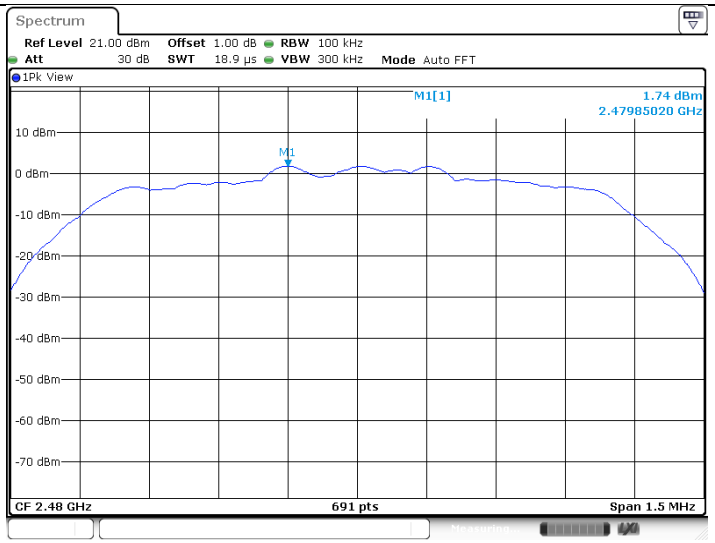
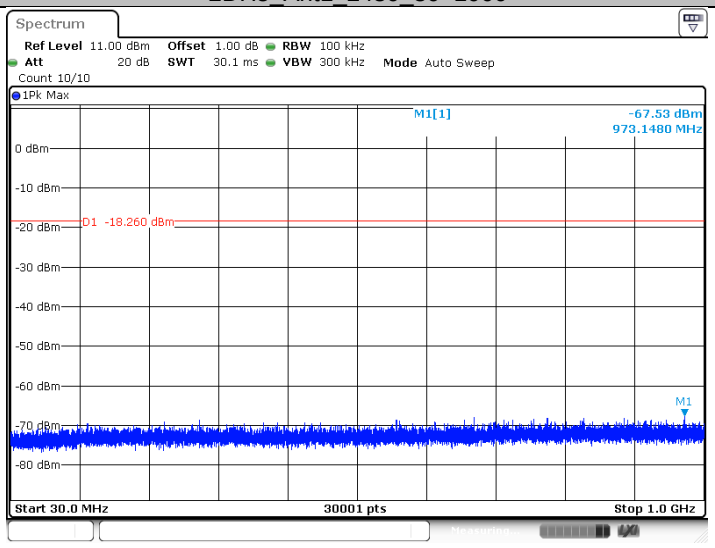
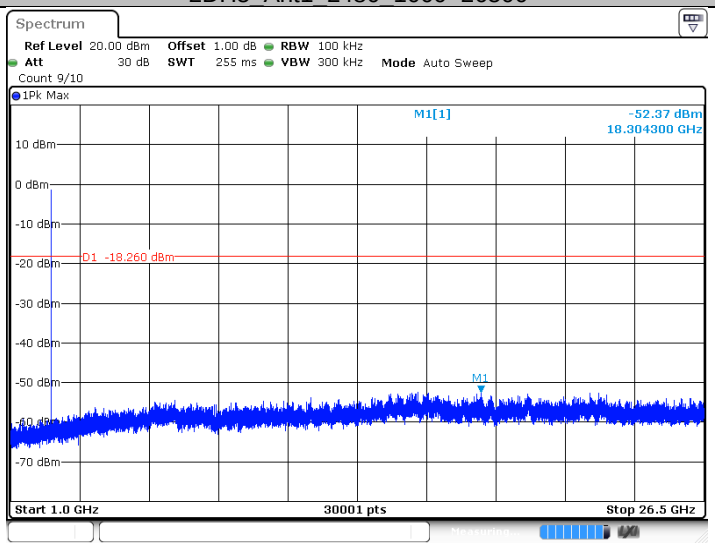


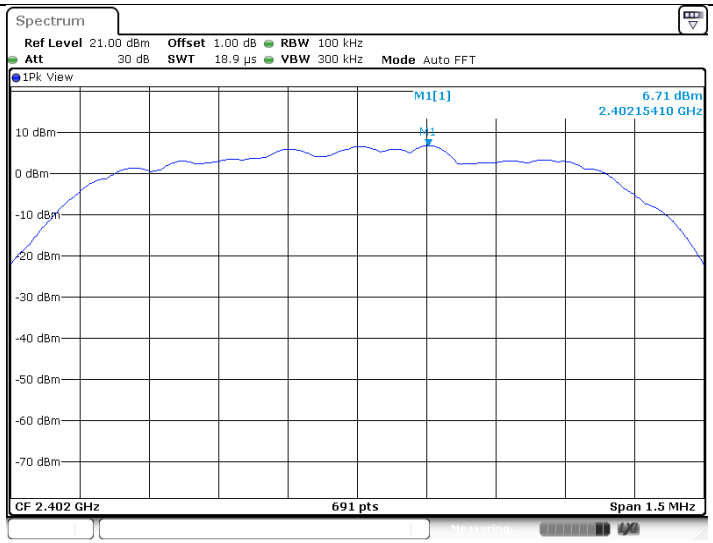
2DH5_Ant1_2480_30~1000



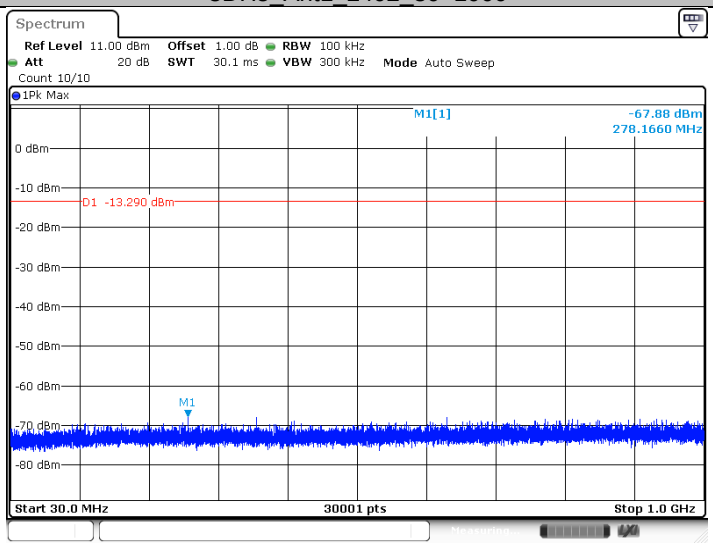
2DH5_Ant1_2480_1000~26500



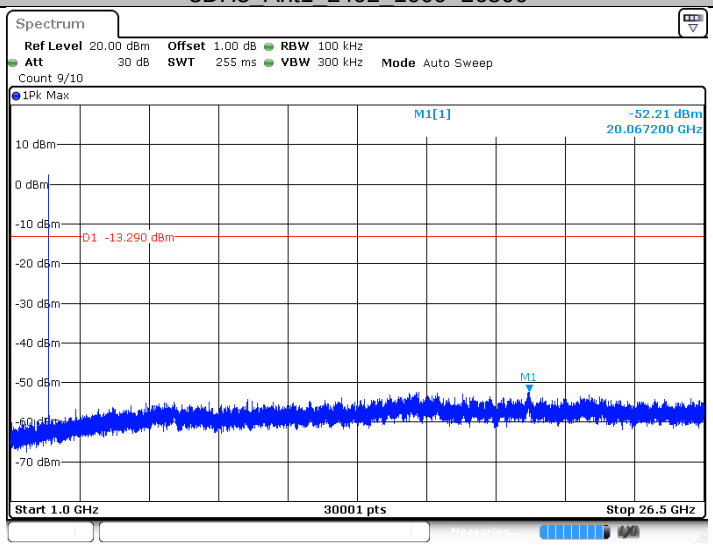
3DH5_Ant1_2402_0~Reference



3DH5_Ant1_2402_30~1000



3DH5_Ant1_2402_1000~26500



3DH5_Ant1_2441_0~Reference

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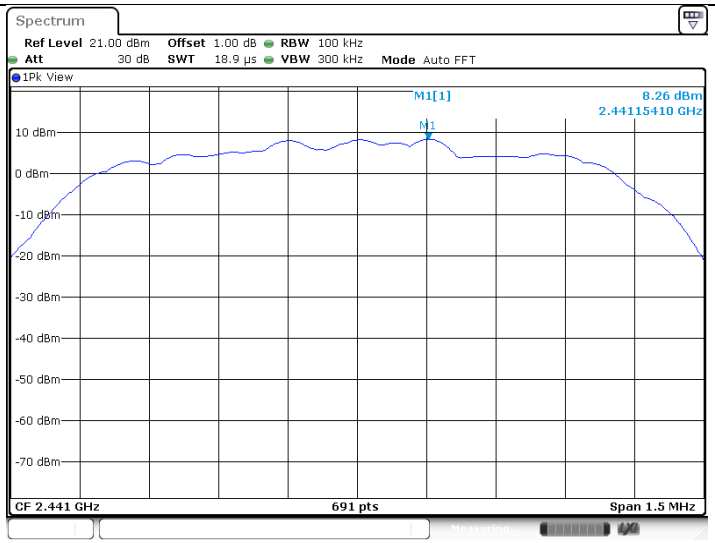
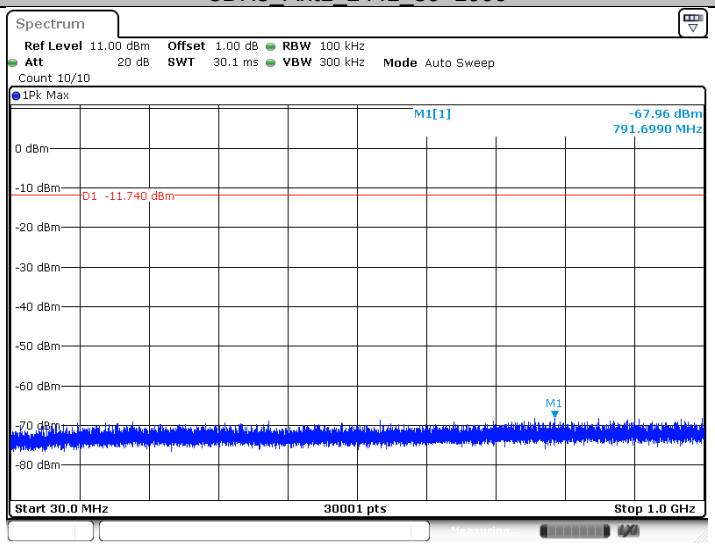
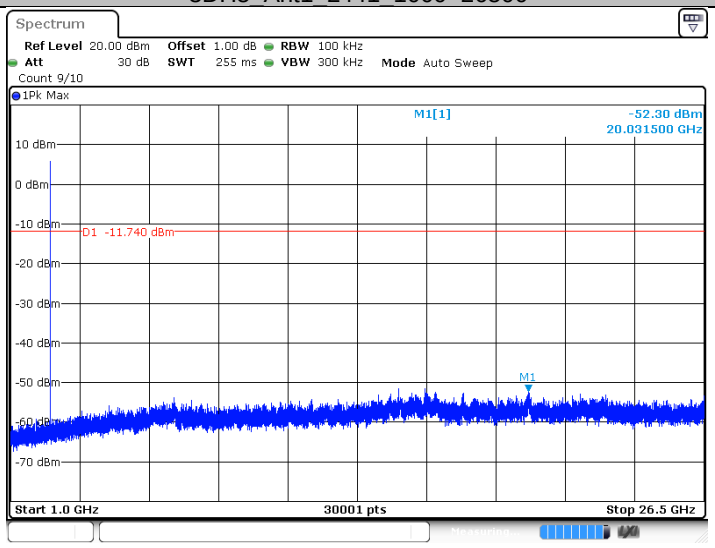


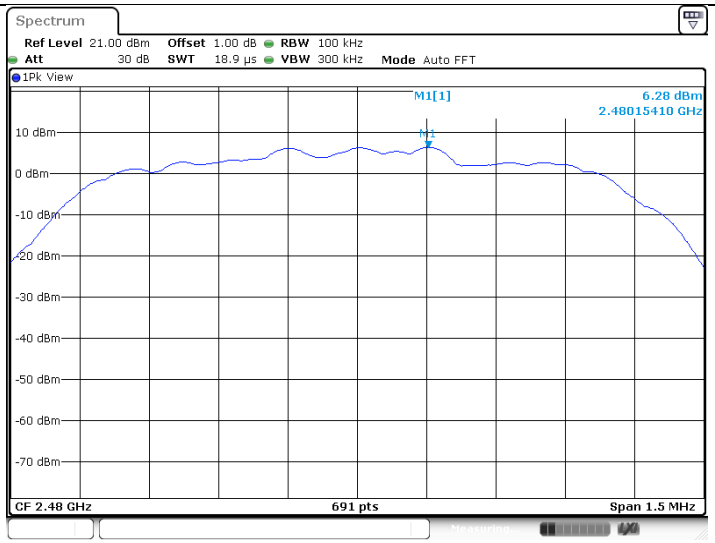
3DH5_Ant1_2441_30~1000



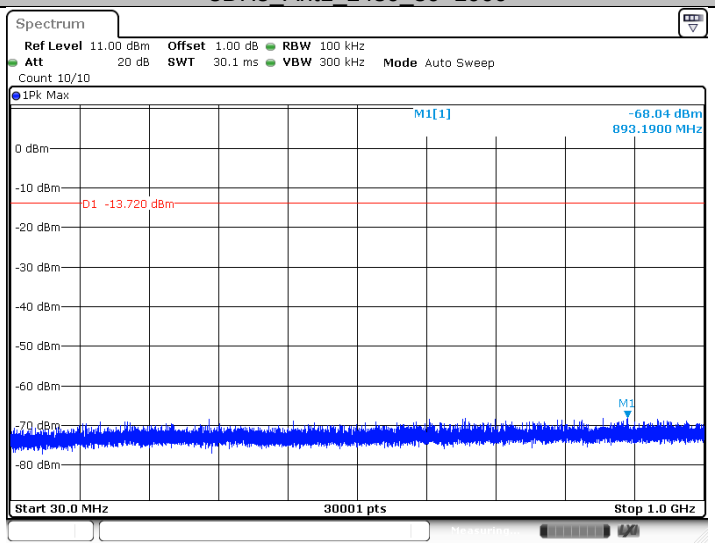
3DH5_Ant1_2441_1000~26500



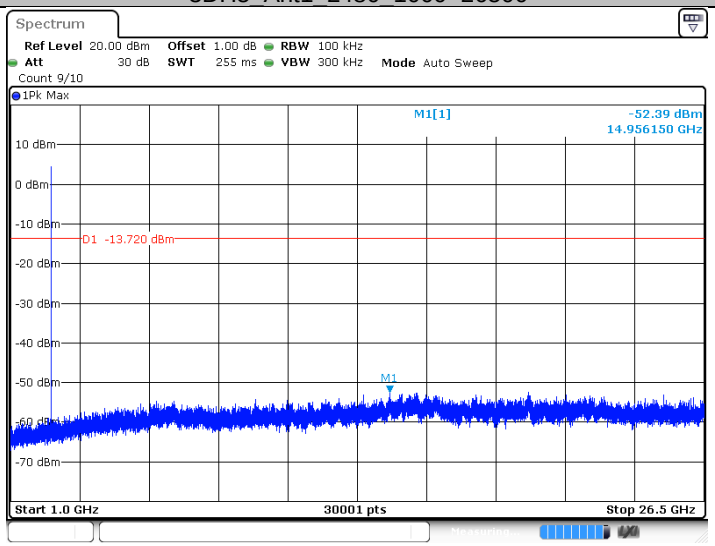
3DH5_Ant1_2480_0~Reference



3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500



9.8 Band edge testing

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency

Set to the maximum power setting and enable the EUT hopping mode, repeat the test.

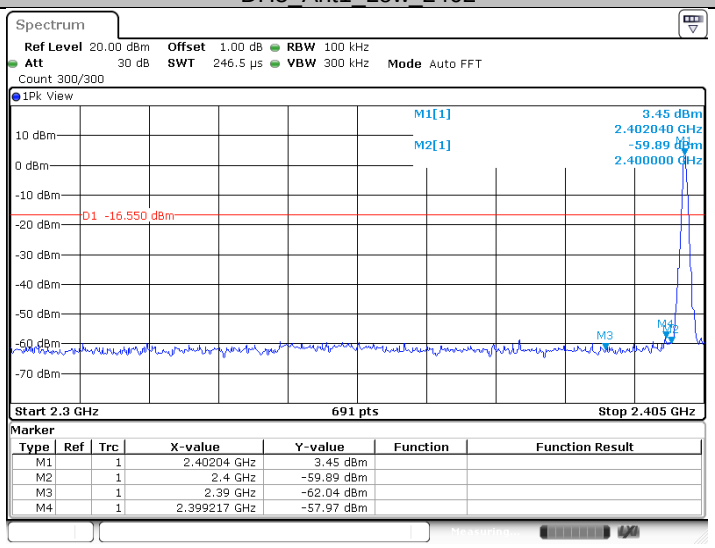
Limit:

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.

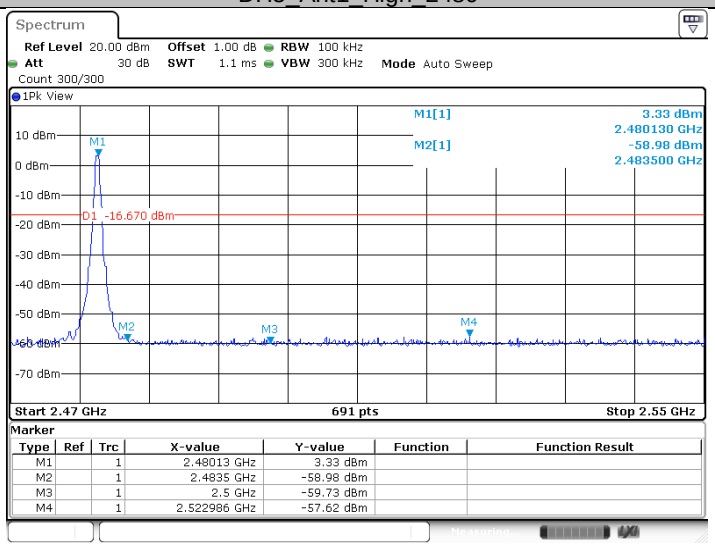
Test result:

TestMode	Antenna	ChName	Channe[MHz]l	RefLevel [dBm]	Result [dBm]	Limit	Verdict
DH5	Ant1	Low	2402	3.45	-57.97	<=-16.55	PASS
		High	2480	3.33	-57.62	<=-16.67	PASS
		Low	Hop_2402	7.38	-58.78	-12.62	PASS
		High	Hop_2480	9.10	-56.98	-10.9	PASS
2DH5	Ant1	Low	2402	1.68	-58	<=-18.32	PASS
		High	2480	1.72	-57.8	<=-18.28	PASS
		Low	Hop_2402	3.67	-58.19	-16.33	PASS
		High	Hop_2480	7.42	-57.29	-12.58	PASS
3DH5	Ant1	Low	2402	6.71	-52.45	<=-13.29	PASS
		High	2480	6.20	-57.67	<=-13.8	PASS
		Low	Hop_2402	3.28	-59.25	-16.72	PASS
		High	Hop_2480	7.46	-57.63	-12.54	PASS

DH5_Ant1_Low_2402



DH5_Ant1_High_2480



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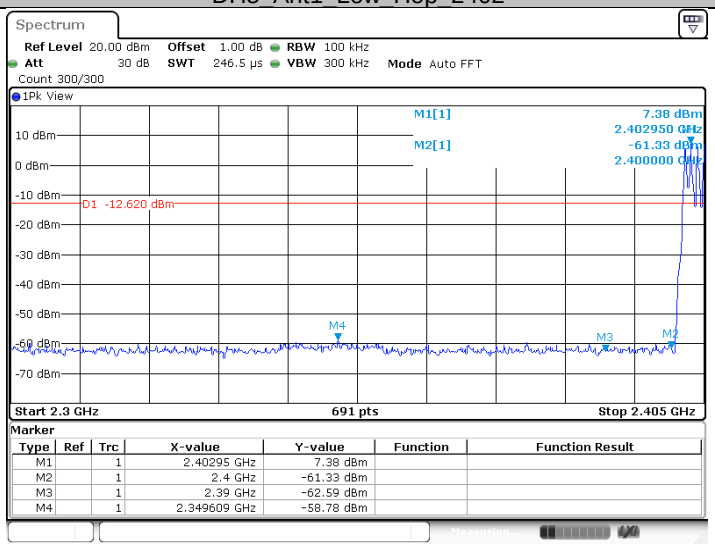
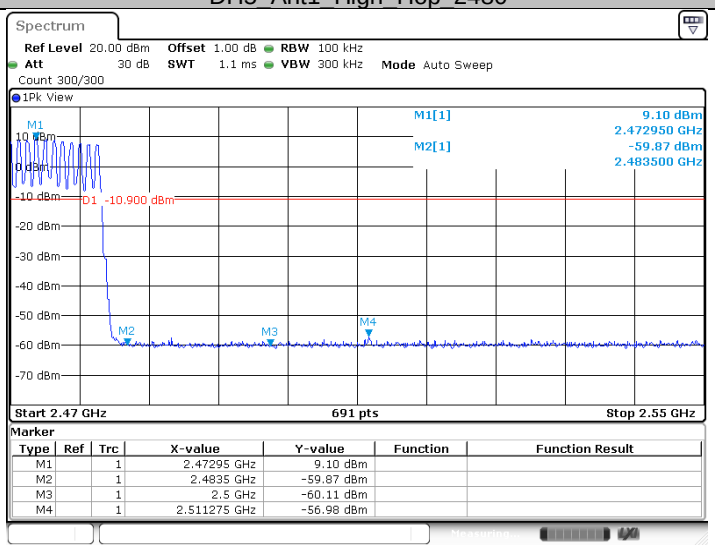


DH5_Ant1_High_Hop_2480

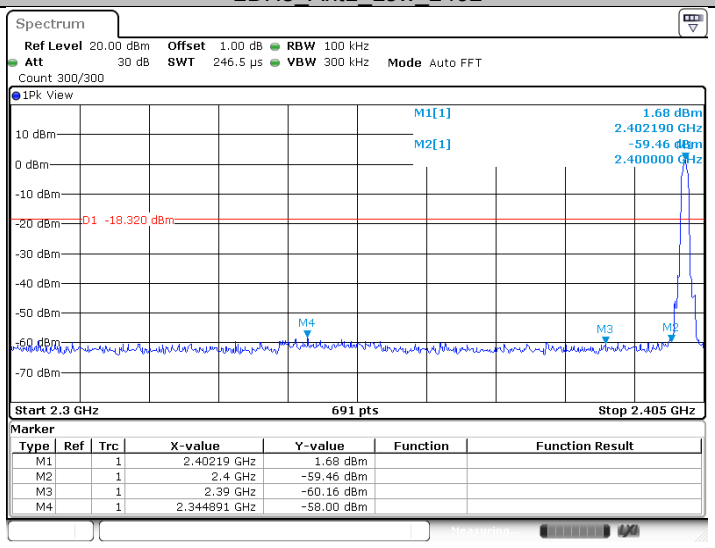


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47295 GHz	9.10 dBm		
M2		1	2.4835 GHz	-59.87 dBm		
M3		1	2.5 GHz	-60.11 dBm		
M4		1	2.511275 GHz	-56.98 dBm		

Date: 21.AUG.2019 15:26:52

2DH5_Ant1_Low_2402

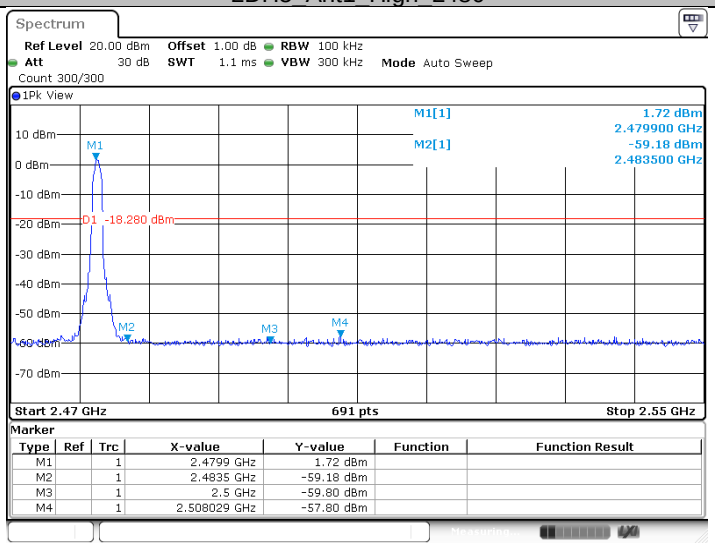


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40219 GHz	1.68 dBm		
M2		1	2.4 GHz	-59.46 dBm		
M3		1	2.39 GHz	-60.16 dBm		
M4		1	2.344891 GHz	-58.00 dBm		

Date: 1.AUG.2019 22:00:17

2DH5_Ant1_High_2480

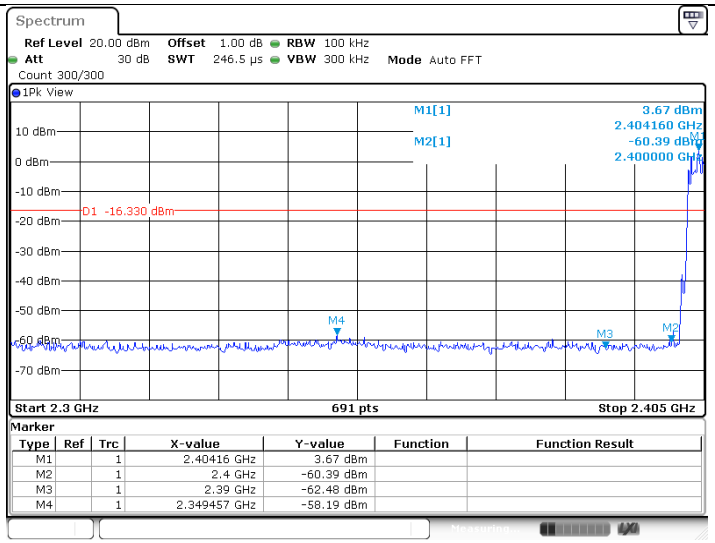


Marker

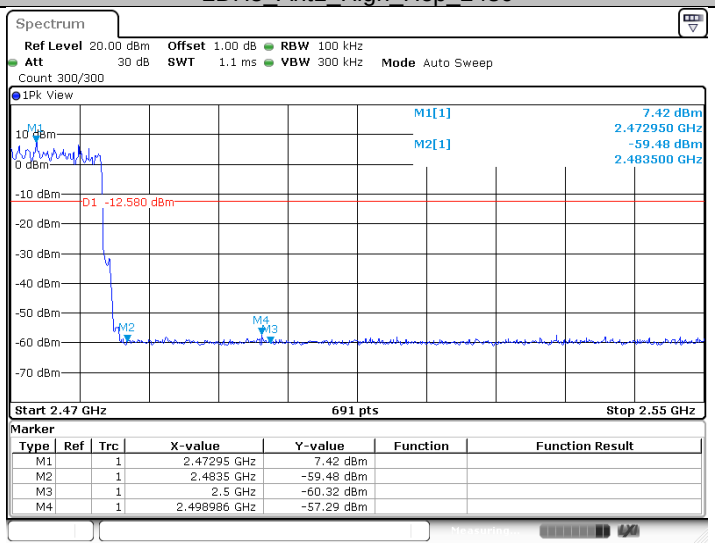
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799 GHz	1.72 dBm		
M2		1	2.4835 GHz	-59.18 dBm		
M3		1	2.5 GHz	-59.80 dBm		
M4		1	2.508029 GHz	-57.80 dBm		

Date: 1.AUG.2019 22:09:11

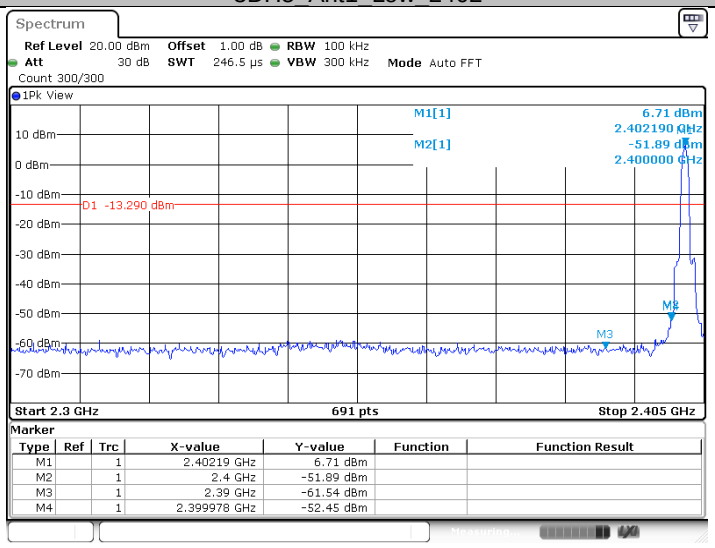
2DH5_Ant1_Low_Hop_2402



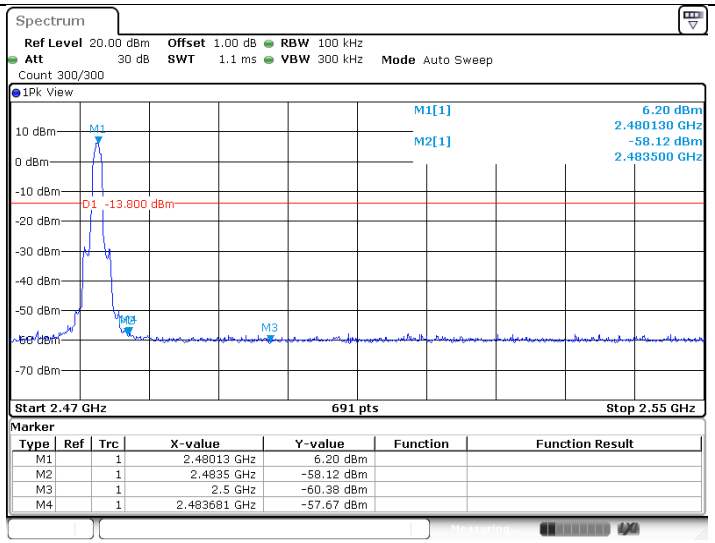
2DH5_Ant1_High_Hop_2480



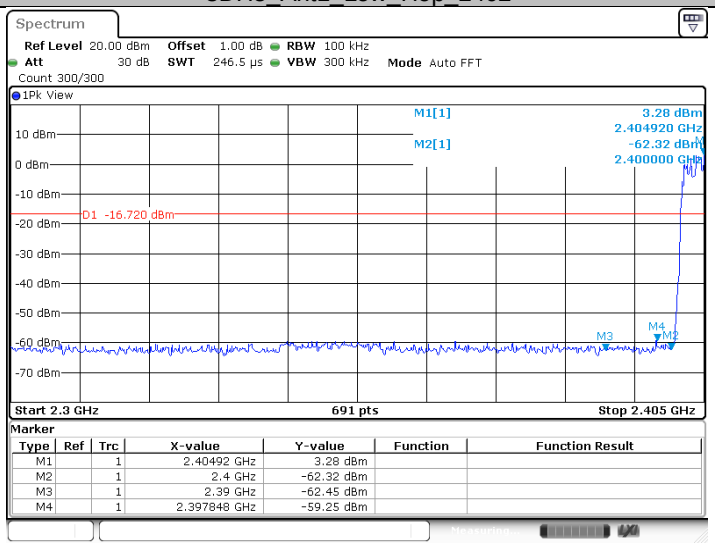
3DH5_Ant1_Low_2402



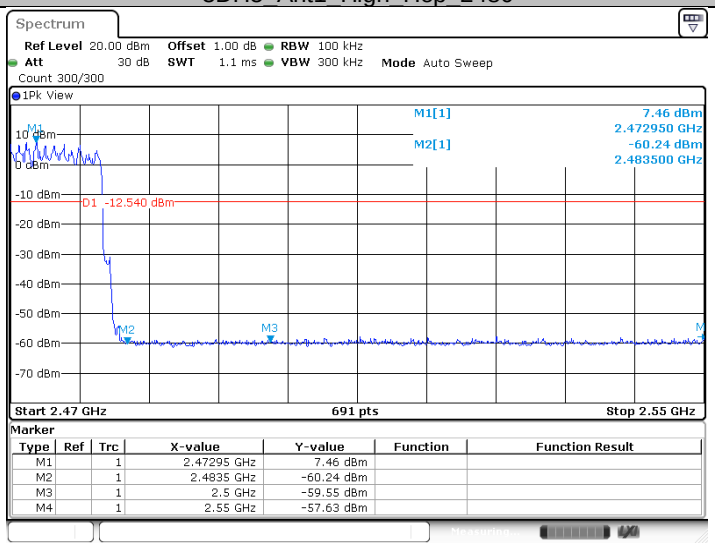
3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



3DH5_Ant1_High_Hop_2480



9.9 Spurious radiated emissions for transmitter

Test Method

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 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 to 120KHz, VBW≥RBW for peak measurement, Sweep = auto,
Detector function = peak, Trace = max hold.

For Peak unwanted emissions 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 ,Sweep = auto,
Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW=10Hz, Sweep = auto, Detector function = peak, Trace = max hold.
If the dwell time 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 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit.

If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correct factor, derived from the appropriate the duty cycle calculation.

The setting method can refer to DA00-705.

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 8DPSK mode) test result is listed in the report.

Transmitting spurious emission test result as below:
8DPSK Modulation 2402MHz Test Result

Frequency Band	Frequency	Emission level	Polarization	Limit	Detector	Margin	Corr.	Result
	MHz	dBuV/m		dBµV/m		dBuV/m	dB/m	
30-1000MHz	*174.43	31.22	H	43.50	QP	12.28	-29.7	Pass
	35.24	35.55	V	40.00	QP	4.45	-26.8	Pass
1000-25000MHz	13151.25	45.39	H	74	PK	28.61	13.9	Pass
	*9374.53	41.49	V	74	PK	32.51	8.6	Pass

8DPSK Modulation 2441MHz Test Result

Frequency Band	Frequency	Emission level	Polarization	Limit	Detector	Margin	Corr.	Result
	MHz	dBuV/m		dBµV/m		dBuV/m	dB/m	
30-1000MHz	--	--	H	40	QP	--		Pass
	--	--	V	40	QP	--		Pass
1000-25000MHz	*9373.13	40.49	H	74	PK	33.51	8.6	Pass
	*12421.41	41.51	V	74	PK	32.49	11.8	Pass

8DPSK Modulation 2480MHz Test Result

Frequency Band	Frequency	Emission level	Polarization	Limit	Detector	Margin	Corr.	Result
	MHz	dBuV/m		dBµV/m		dBuV/m	dB/m	
30-1000MHz	--	--	H	40	QP	--		Pass
	--	--	V	40	QP	--		Pass
1000-25000MHz	15339.84	49.67	H	74	PK	24.33	18.6	Pass
	*12335.63	41.17	V	74	PK	32.83	11.5	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)

10 Test Equipment List

List of Test Instruments

Conducted Emission Test

Description	Manufacturer	Model no.	Serial no.	cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2020-6-28
LISN	Rohde & Schwarz	ENV4200	100249	2020-6-28
Attenuator	Shanghai Huaxiang	TS2-26-3	080928189	2020-6-28
Test software	Rohde & Schwarz	EMC32	Version9.15.00	N/A

Radiated Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2020-6-28
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2020-6-29
Horn Antenna	Rohde & Schwarz	HF907	102295	2020-6-22
Wideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	12827	2020-7-12
Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2020-6-28
Attenuator	Agilent	8491A	MY39264334	2020-6-28
3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version 9.15.00	N/A

RF conducted test

DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	101030	2020-6-28
RF Switch Module	Rohde & Schwarz	OSP120/OSP-B157	101226/100851	2020-6-28
Power Splitter	Weinschel	1580	SC319	2020-7-7
Test software	Tonscend	System for BT/WIFI	Version 2.6	N/A

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	
Test Items	Extended Uncertainty
Uncertainty for Radiated Spurious Emission 30MHz-1000MHz	Horizontal: 4.91dB; Vertical: 4.89dB;
Uncertainty for Radiated Spurious Emission 1000MHz-18000MHz	Horizontal: 4.80dB; Vertical: 4.79dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 5.05dB; Vertical: 5.04dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10-7 or 1%

---THE END OF REPORT---