TEST REPORT

KEL Korea EMC Laboratory	**Korea EMC Laboratory Co., Ltd.** 390 Bora-dong, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea (446-904) Tel : 82-31-286-5881 Fax : 82-31-286-2661 www.koreaemc.com	Report Ref. No : KEL10–F10039

1. Client

- Name : Cydle Corp.
- Address : 12th Floor, Kofomo Tower, 16-3, Sunae-Dong, Bundang-Gu, Sungnam-City, Kyonggi-Do, Korea
- Date of receipt : October 19, 2010

2. Use of report : -

3. Name of product / model : Multi PAD / M7

4. FCC ID : YXQM7

5. Manufacturer and country of origin : Cydle Corp. / KOREA

6. Date of test : November 01, 2010 – December 13, 2010

7. Applied standard : FCC Part 15_2010, Subpart C(Section 15.247_DSS)
ANSI C63.4_2003

8. Testing location : ☒ In Laboratory ☐ In Chamber ☐ On Site Test

9. Test results : ☒ Pass ☐ Fail

Affirmation	Tested by Name : Sang-Hoon Lee (Signature)	Technical manager Name : Su-Gil Moon (Signature)

January 11, 2011

Korea EMC Laboratory Co., Ltd.

0. REPORT REVISION HISTORY

Date	Revision	Page no.
January 11, 2011	Issued	All

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1. TEST LABORATORY

1.1 General

Name of Test Laboratory	Korea EMC Laboratory Co., Ltd.
President	Won-Hyang Oh
Address	390 Bora-dong, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea (446-904)
TEL	+82-31-286-5881
FAX	+82-31-286-2661
e-mail	webmaster@koreaemc.com

1.2 Certificate of designated testing laboratory

Area and Category	Regulation	Registration & Certification No.	Mark.
Radio Research Agency EMI(Radiated & Conducted emission) EMS(Radiated Immunity) Safety Radio Communication Part	Regulation of KCC No. 2009-48 (2009. 11. 10)	KR0002	방송통신위원회
Korea Laboratory Accreditation Scheme (KOLAS) EMI(Radiated & Conducted emission) EMS(Radiated Immunity) Safety Road Vehicle component test(EMC) Military EMC(MIL-STD-461E)	KS A ISO/IEC 17025:2006	No. 154	KOLAS
FCC Part 15 & 18 EMI(Radiated & Conducted emission)	ANSI 63.4	90751 (KR0002)	FC
VCCI EMI(Radiated & Conducted emission)	VCCI	C-2314 R-2139 R-2140	VCCI
UL Korea Ltd. Safety	Star Alliance Program	-	c UL us
European Conformity EMC & Safety	2004/108/EC 2006/95/EC	-	CE
TUV SUD Certification after Recognition of Agent's Testing EMC	ISO/IEC 17025	ROK1006C	TÜV SÜD Product Service

2. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The product specification described herein was obtained from the product data sheet or user's manual

2.1 Characteristics

Product name	Multi PAD
Model no.	M7
FCC ID	YXQM7
Operation frequency	Bluetooth(Basic/EDR) : 2402 MHz – 2480 MHz
RF power	2.24 dBm(1.67 mW)
Spread spectrum method	FHSS
Modulation type	GFSK, Π/4-DQPSK, 8DPSK
Data rate	1 / 2 / 3 Mbps
Number of channel	79 Channel
Antenna type / max. gain	Chip Antenna / 1.99 dBi
Power source	DC 5.0 V(Adapter) DC 3.7 V(Battery)
Size	181 mm X 122 mm X 20.4 mm
Interface ports	USB 2.0, HDMI, Micro SD, MIC, Audio out
Accessory	USB Cable, Adapter, Earphone

2.2 Applied standard

- FCC part 15, subpart C(15.247_DSS)
- ANSI C63.4_2003

Note : It has been verified to comply with requirements of FCC part 15, subpart B, Class B(DoC). The test report has been issued separately

2.3 Submitted documents

- Block diagram
- Schematic diagram
- Antenna specification
- Part list(B.O.M)
- User manual

2.4 Channel chart

Bluetooth(79 Channel)

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	1	2403	2	2404	3	2405
4	2406	5	2407	6	2408	7	2409
8	2410	9	2411	10	2412	11	2413
12	2414	13	2415	14	2416	15	2417
16	2418	17	2419	18	2420	19	2421
20	2422	21	2423	22	2424	23	2425
24	2426	25	2427	26	2428	27	2429
28	2430	29	2431	30	2432	31	2433
32	2434	33	2435	34	2436	35	2437
36	2438	37	2439	38	2440	39	2441
40	2442	41	2443	42	2444	43	2445
44	2446	45	2447	46	2448	47	2449
48	2450	49	2451	50	2452	51	2453
52	2454	53	2455	54	2456	55	2457
56	2458	57	2459	58	2460	59	2461
60	2462	61	2463	62	2464	63	2465
64	2466	65	2467	66	2468	67	2469
68	2470	69	2471	70	2472	71	2473
72	2474	73	2475	74	2476	75	2477
76	2478	77	2479	78	2480		

- Measurement Channel

  Low(2402 MHz), Middle(2441 MHz), High(2480 MHz)

- Test rate : 1, 3 Mbps

3. TEST CONDITIONS

3.1 Description of test configuration

The EUT has been tested as an independent unit with other necessary accessories or support unit. The following support units or accessories were used to form a representative test configuration during the tests.

3.2 List of peripherals

Type	Model no.	Serial no.	Manufacturer
EUT(Multi PAD)	M7	-	Cydle Corp.
Adapter	PA-050200SN	-	Perfect Power
Lab top	PP11L	CN-0D4571-46843-5AB-0772	Dell Asia Pacific Sdn.
Adapter	PA-1900-02DK	CN-CO1104-71815-51L-00F9	Dongguang Litepower 2nd Plant
LCD Monitor	U2410f	CN-0G550M-72312-99N-016L	Innocom Technology(Shenzhen) Co., Ltd.
MIC	-	-	-
Earphone	-	-	Cydle Corp.

3.3 Uncertainty

Measurement	Frequency	Uncertainty
Conducted Emission	150 kHz ~ 30 MHz	1.5
Radiated Emission	30 MHz ~ 1 GHz	4.4
	1 GHz ~ 40 GHz	4.1

3.4 Environment condition

Measurement	Temperature	Humidity	Atmospheric pressure
Conducted emission	24 ± 4 ℃	30 – 60 % R.H.	101.5 kPa
Radiated emission	20 ± 4 ℃	30 – 60 % R.H.	101.4 kPa

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor if *k*=2.

4. SUMMARY OF TEST RESULTS

Section	Test type	Limit	Remark	Result
15.207	▪ AC Power conducted emission	Table 15.207	Meet the requirement	Pass
15.209, 15.247	▪ Out of band emissions & Band edge	-	Meet the requirement	Pass
15.247(a)(1)	▪ Hopping channel separation ▪ 20 dB bandwidth	-	Meet the requirement	Pass
15.247(a)(1)(ii)	▪ Number of hopping frequency	> 75 Ch	Meet the requirement	Pass
15.247(a)(1)(iii)	▪ Dwell Time	< 400 ms	Meet the requirement	Pass
15.247(b)(1)	▪ Maximum peak out power	0.125 W	Meet the requirement	Pass
15.203, 15.247(b)(3)	▪ Antenna requirement	-	Meet the requirement	Pass

5. TEST AND RESULTS

5.1 AC Power conducted emission

5.1.1 Test procedures

1. The EUT was place on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5 m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω / 50 uH LISN, which is an input transducer to a Spectrum Analyzer or an EMI Test Receiver, to the input power source
3. Exploratory measurements were mode to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 kHz or to quasi-peak and average within a bandwidth of 9 kHz, The EUT was in transmitting mode during the measurements
5. The measuring level is calculated by adding the Correction Factor, Cable Loss.
   The basic equation with a sample calculation is as follow :
   Final Test Level = Receiver Reading + Correction Factor + Cable Factor

5.1.2 Limits of AC power conducted emission

Frequency of emission(MHz)	Conducted limit(dBuV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency

5.1.3 Test instruments

Description	Manufacturer	Model no.	Serial no.	Due cal.	Use
Test receiver	Rohde&Schwarz	ESCS30	10054	2011.10.02	☒
Two line V-Network	Rohde&Schwarz	ESH3-Z5	560685/005	2011.10.02	☒
LISN (for peripheral)	Kyoritsu	KNW-407	8-883-14	2011.10.02	☒

5.1.4 Test results

1. Data

Bluetooth_GFSK(DH5) : Frequency – 2441 MHz

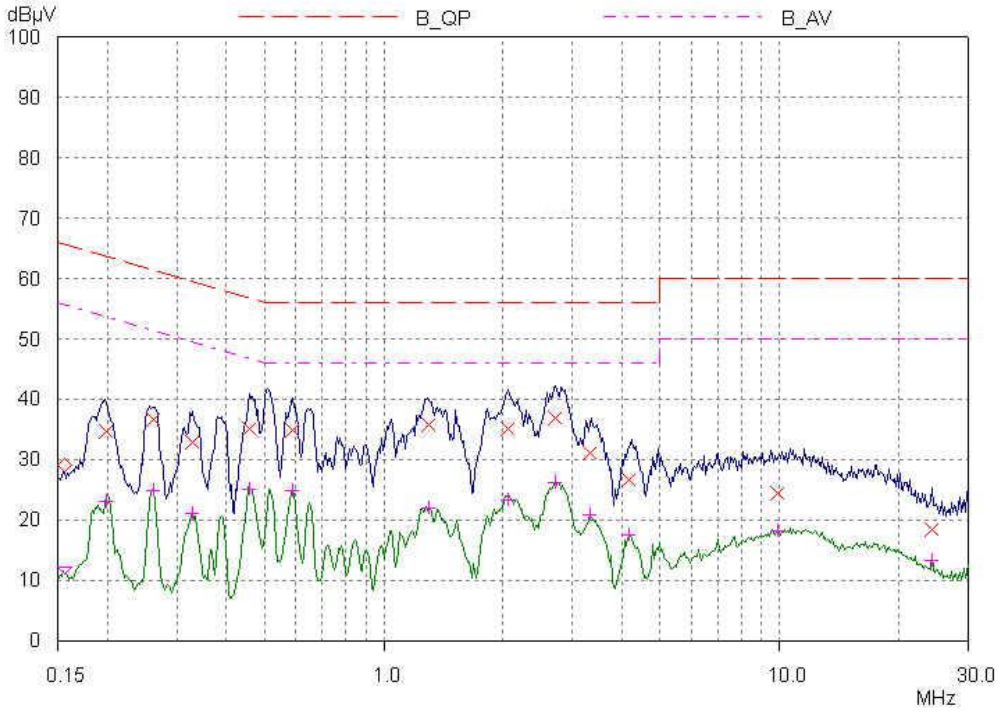
Frequency [MHz]	Correction factor		Line (H/N)	Quasi-peak			Average		
	LISN [dB]	Cable [dB]		Limit (dBuV)	Reading (dBuV)	Result (dBuV)	Limit (dBuV)	Reading (dBuV)	Result (dBuV)
0.198	0.09	0.00	H	64.63	34.70	34.79	54.63	23.11	23.20
0.261	0.09	0.00	N	62.83	38.48	38.57	52.83	29.40	29.49
0.328	0.09	0.00	N	60.91	34.24	34.33	50.91	25.36	25.45
0.458	0.09	0.00	N	57.20	40.74	40.83	47.20	31.26	31.35
0.587	0.09	0.00	N	56.00	39.92	40.01	46.00	30.71	30.80
1.300	0.11	0.00	N	56.00	40.10	40.21	46.00	27.31	27.42
2.066	0.14	0.00	N	56.00	39.63	39.77	46.00	28.92	29.06
2.688	0.14	0.00	N	56.00	**40.89**	**41.03**	46.00	**31.10**	**31.24**
3.295	0.14	0.00	N	56.00	35.25	35.39	46.00	25.32	25.46
4.138	0.14	0.00	N	56.00	30.99	31.13	46.00	21.72	21.86
9.879	0.27	0.30	N	60.00	29.32	29.89	50.00	22.63	23.20
24.160	1.12	0.60	H	60.00	18.44	20.16	50.00	13.18	14.90

Bluetooth_8DPSK(3-DH5) : Frequency – 2441 MHz

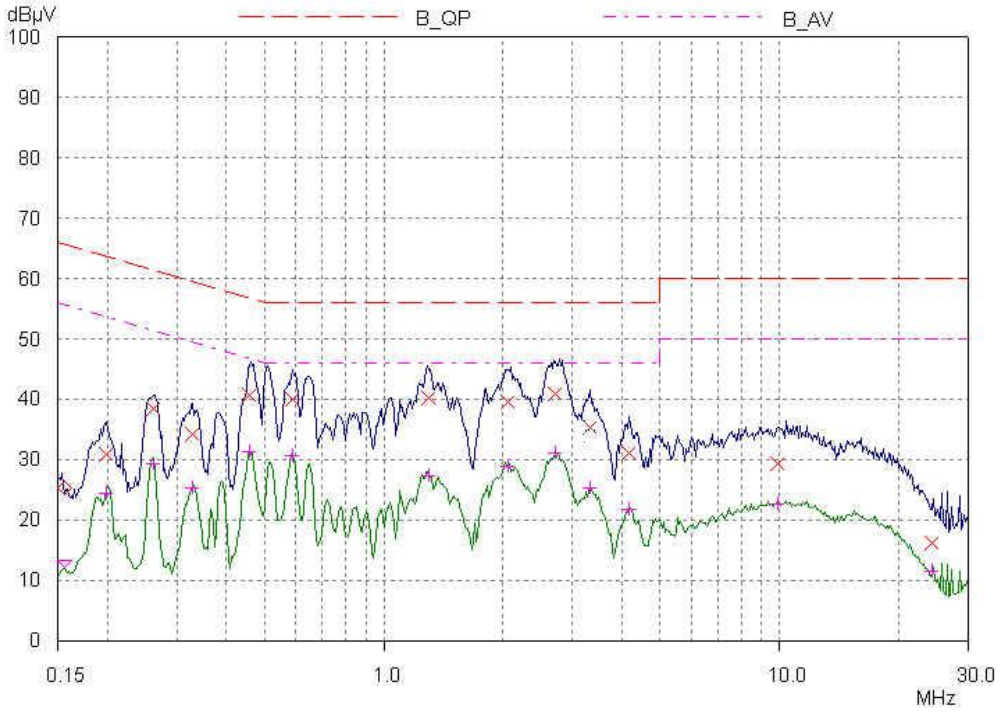
Frequency [MHz]	Correction factor		Line (H/N)	Quasi-peak			Average		
	LISN [dB]	Cable [dB]		Limit (dBuV)	Reading (dBuV)	Result (dBuV)	Limit (dBuV)	Reading (dBuV)	Result (dBuV)
0.199	0.09	0.00	H	64.60	33.82	33.91	54.60	23.27	23.36
0.259	0.09	0.00	N	62.88	38.60	38.69	52.88	30.25	30.34
0.386	0.09	0.00	N	59.26	35.18	35.27	49.26	26.13	26.22
0.460	0.09	0.00	N	56.97	41.16	41.25	46.97	31.31	31.40
0.585	0.09	0.00	N	56.00	39.86	39.95	46.00	30.77	30.86
0.651	0.09	0.00	N	56.00	40.32	40.41	46.00	28.79	28.87
1.289	0.11	0.00	N	56.00	40.62	40.73	46.00	27.47	27.58
2.041	0.14	0.00	N	56.00	39.83	39.97	46.00	29.39	29.53
2.699	0.14	0.00	N	56.00	**40.83**	**40.97**	46.00	**30.89**	**31.03**
3.295	0.14	0.00	N	56.00	35.07	35.21	46.00	24.85	24.99
15.450	0.82	0.30	N	60.00	27.04	28.16	50.00	20.89	22.01

2. Graph

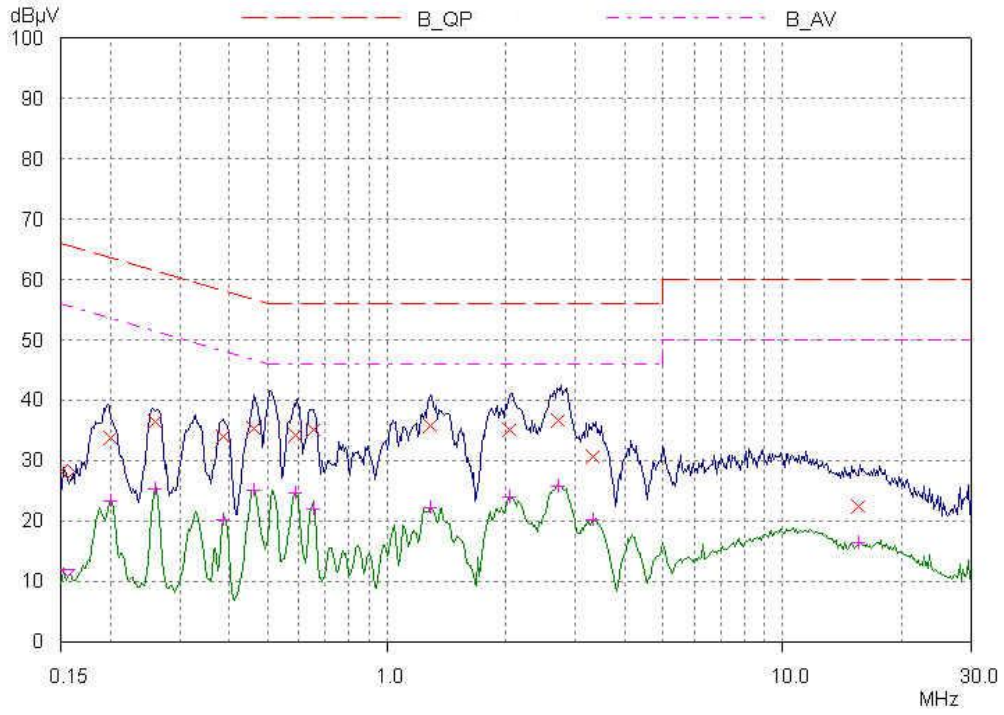
Bluetooth_GFSK(DH5) : Frequency – 2441 MHz(L1)



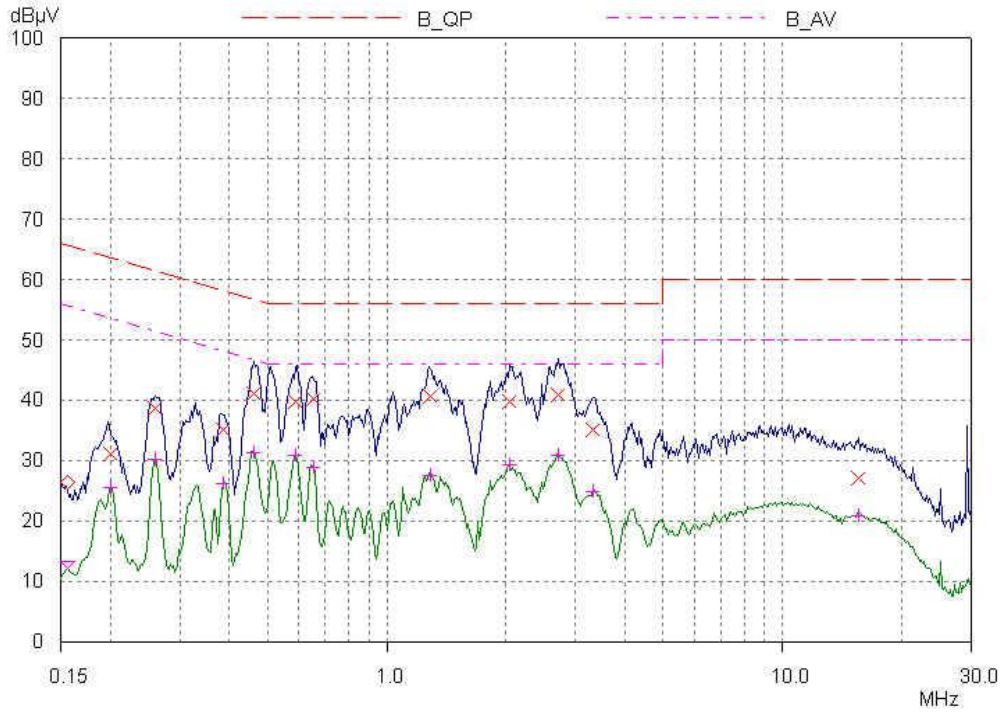
Bluetooth_GFSK(DH5) : Frequency – 2441 MHz(L2)



Bluetooth_8DPSK(3-DH5) : Frequency – 2441 MHz(L1)



Bluetooth_8DPSK(3-DH5) : Frequency – 2441 MHz(L2)



5.2 Out of band emissions & Band edge

5.2.1 Test procedures

1) Spurious RF conducted emissions :

The Out of Band emission was measured with a spectrum analyzer connected to the antenna port. At RBW = 100 kHz, VBW = 300 kHz, spurious emission in the frequency range 30 MHz – 25 GHz which was out fo 2400 – 2483.5 MHz was lower 20 dB than radio frequency power.

2) Spurious Radiated emissions :

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.

2. The EUT was placed on the top of the 0.8 m height, 1 × 1.5 m non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.

3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the Bi-Log antenna, and from 1000 MHz to 18000 MHz using the horn antenna.

4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 m at the test Site.

5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

6. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.

7. The field strength is calculated by adding the Antenna Factor, Cable factor, & preamplifier.
The basic equation with a sample calculation is as follow :
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

5.2.2 Limits of out of band emission & band edge

According to 15.209(a), for an intentional device, the general requirement of filed strength of radiated emission from intentional radiators at a distance of 3 m shall not exceed the following values :

Frequency(MHz)	Field strength(uV/m @ 3 m)	Field strength(dBuV/m @ 3 m)
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

Note : For frequency above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation

5.2.3 Test instruments

Description	Manufacturer	Model no.	Serial no.	Due cal.	Use
Spectrum Analyzer	Rohde&Schwarz	FSQ40	200062	2011.10.02	☒
Horn Antenna	AH Systems	SAS-571	500	2011.03.12	☒
Bi-Log Antenna	VULB9160	Schwarzbeck	3049	2011.12.18	☒
Pre Amplifier	8447E	HP	2434A02093	2012.01.10	☒
Pre Amplifier	87405-60021	AGILENT	10004	2012.01.04	☒
Test Receiver / Spectrum Analyzer	Rohde&Schwarz	ESCI	100561	2011.07.17	☒
Attenuator	AGILENT	8491A	51517	2011.10.08	☐

5.2.4 Test results

1) Out of band emissions & Band edge(Conducted)

1. Data

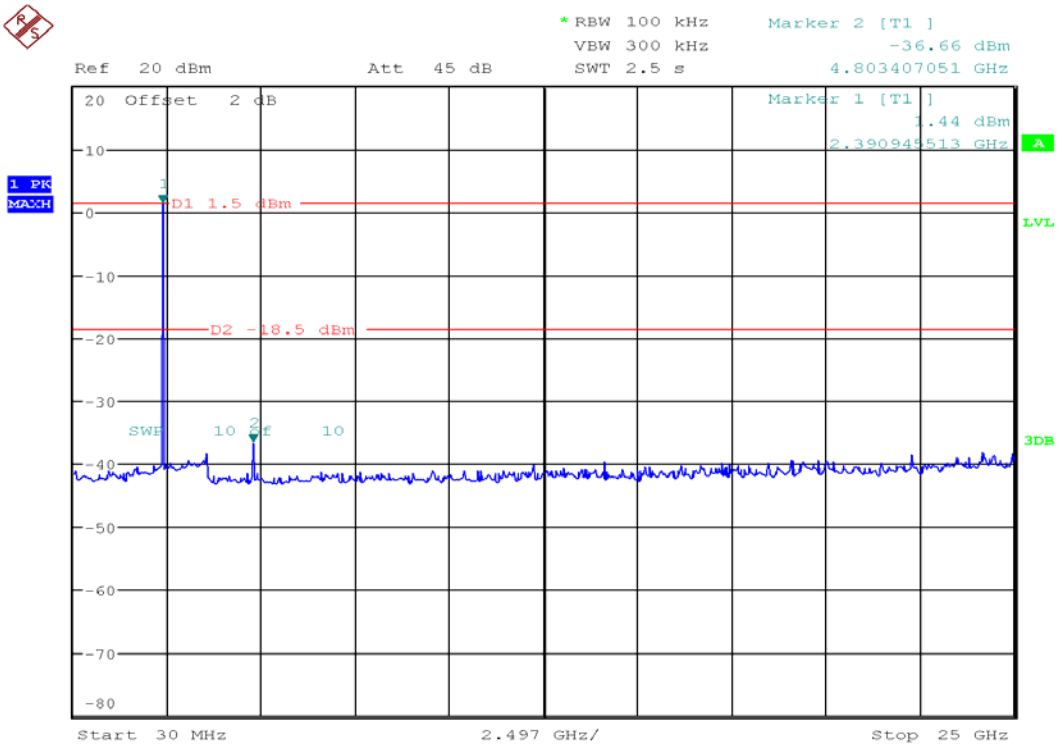
Bluetooth_GFSK(DH5)			
Frequency[MHz]	**Result[dBc]**	**Limit[dBc]**	**Margin[dB]**
2402	37.55	20	17.55
2441	40.28	20	20.28
2480	39.59	20	19.59

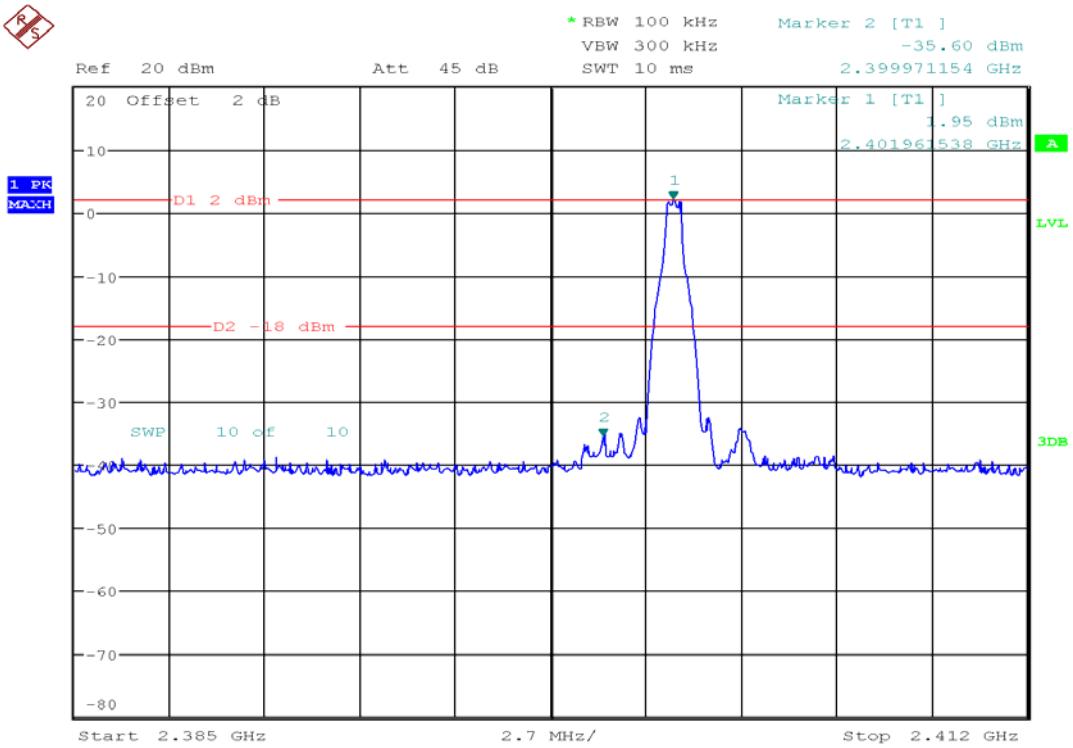
Bluetooth_8DPSK(3-DH5)			
Frequency[MHz]	**Result[dBc]**	**Limit[dBc]**	**Margin[dB]**
2402	34.37	20	14.37
2441	34.26	20	14.26
2480	32.64	20	12.64

2. Graph

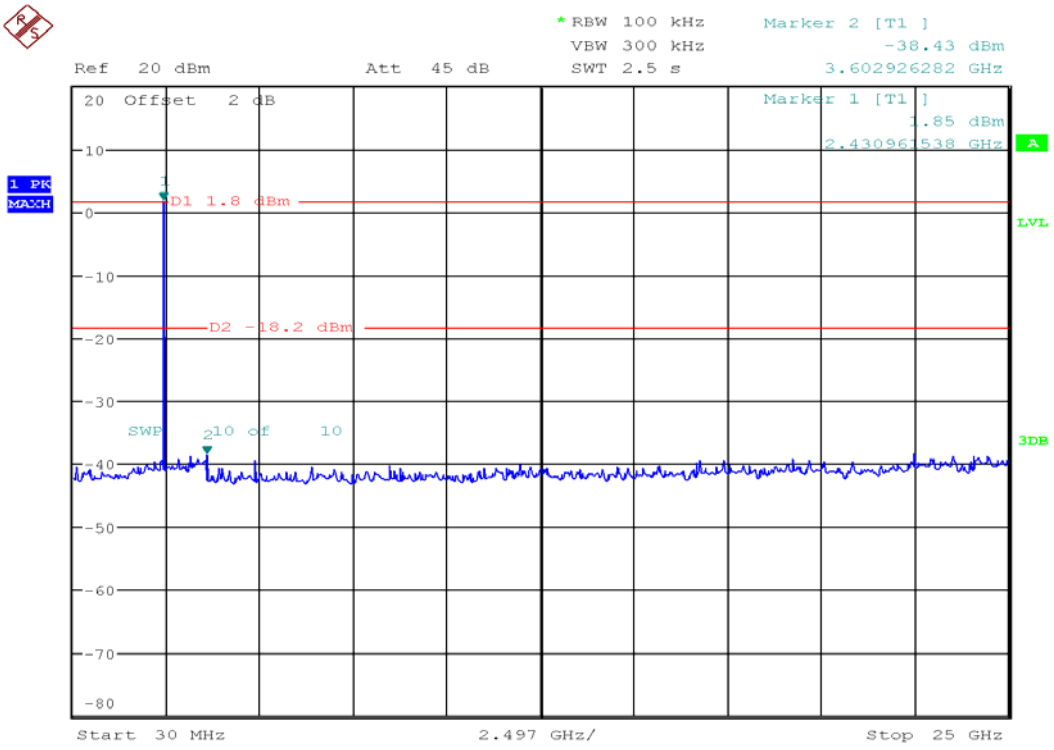
Bluetooth_GFSK(DH5)

Lowest Channel(operating at 2402 MHz)

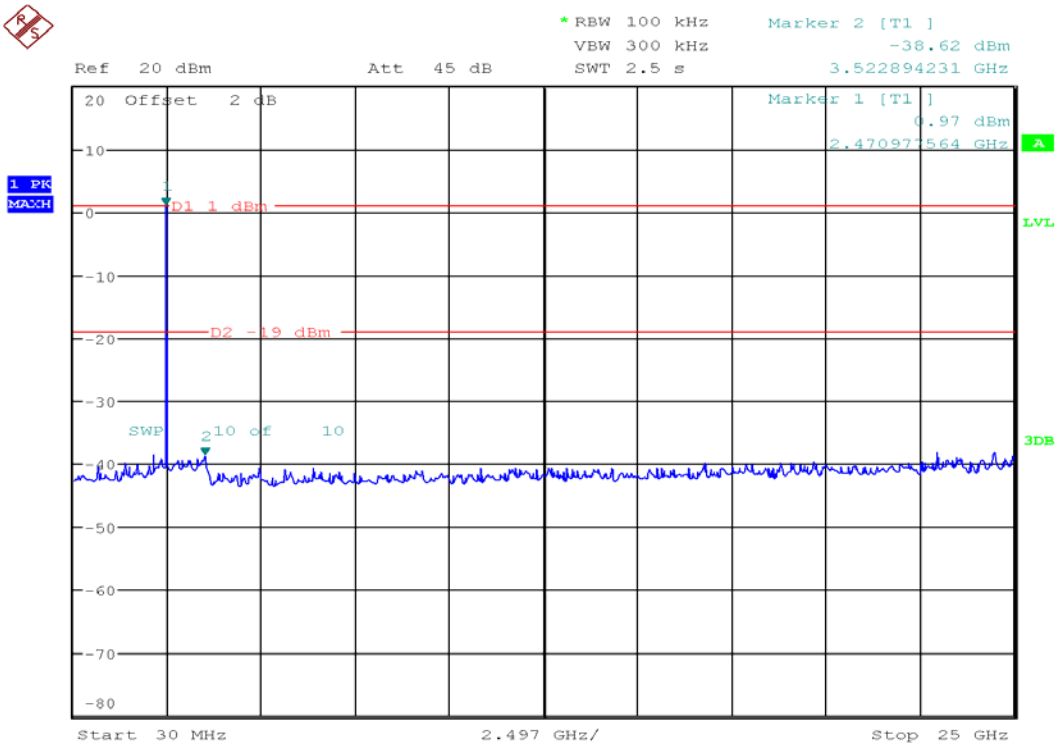


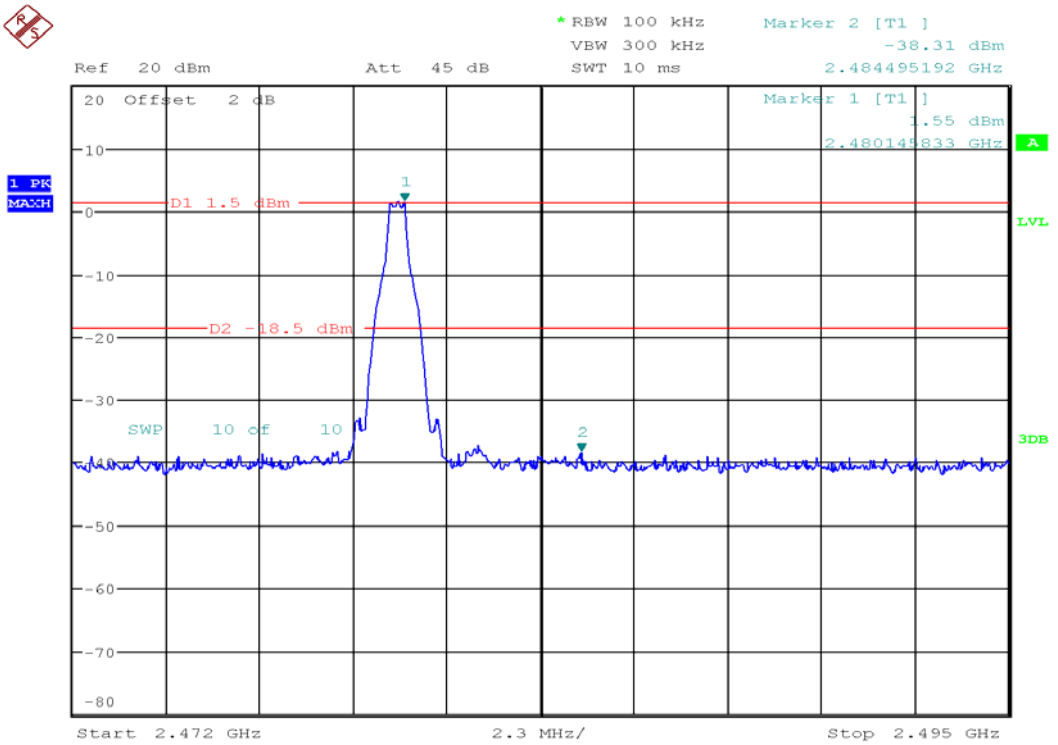


Middle Channel(operating at 2441 MHz)



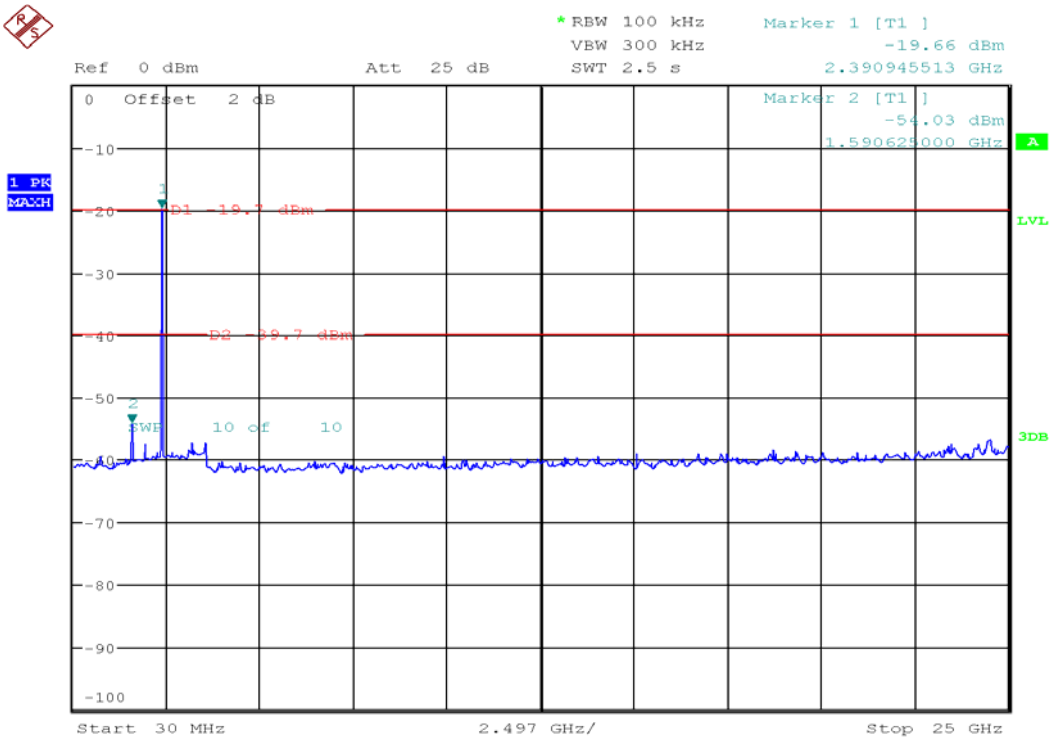
Highest Channel(operating at 2480 MHz)

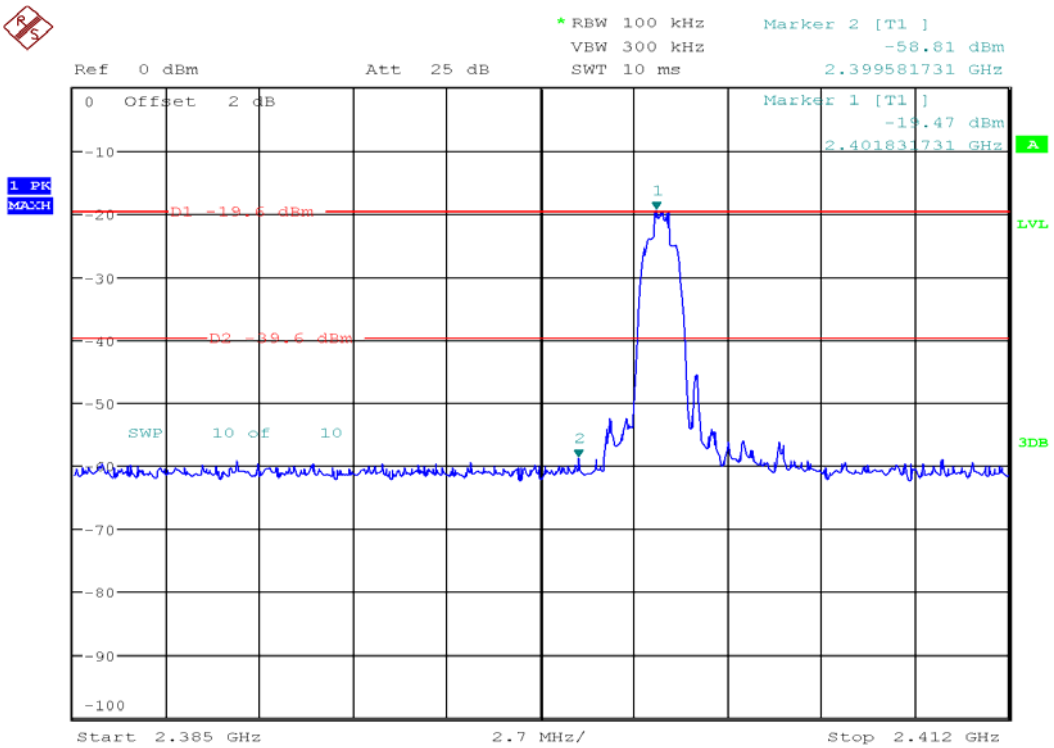




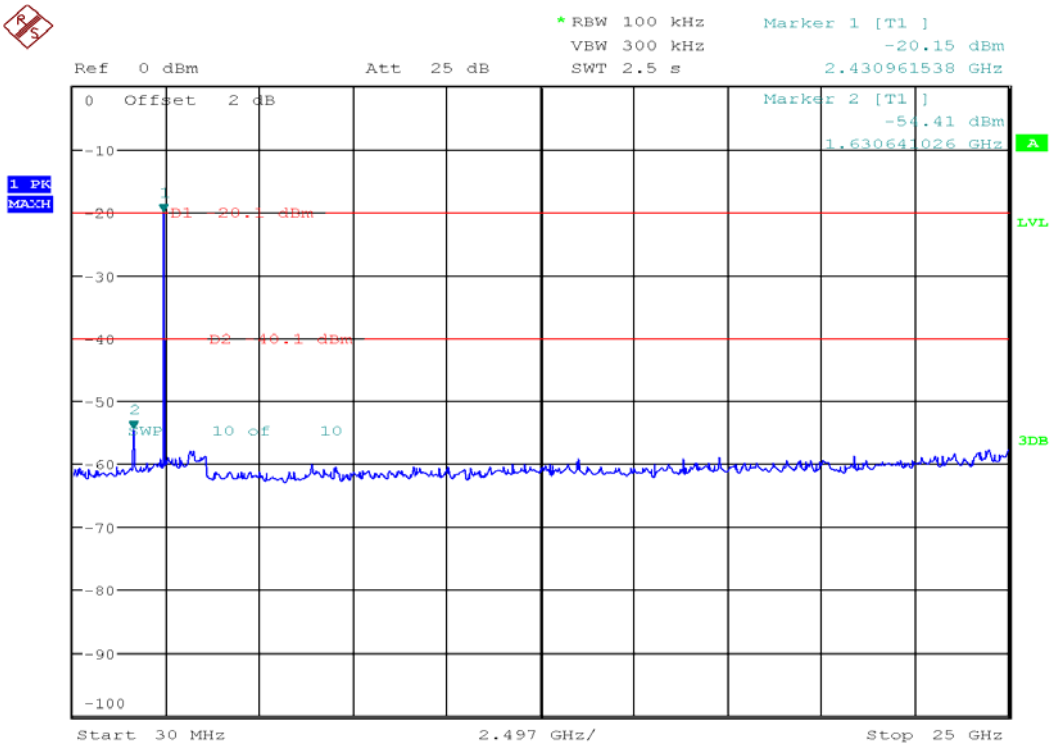
Bluetooth_8PSK(3-DH5)

Lowest Channel(operating at 2402 MHz)

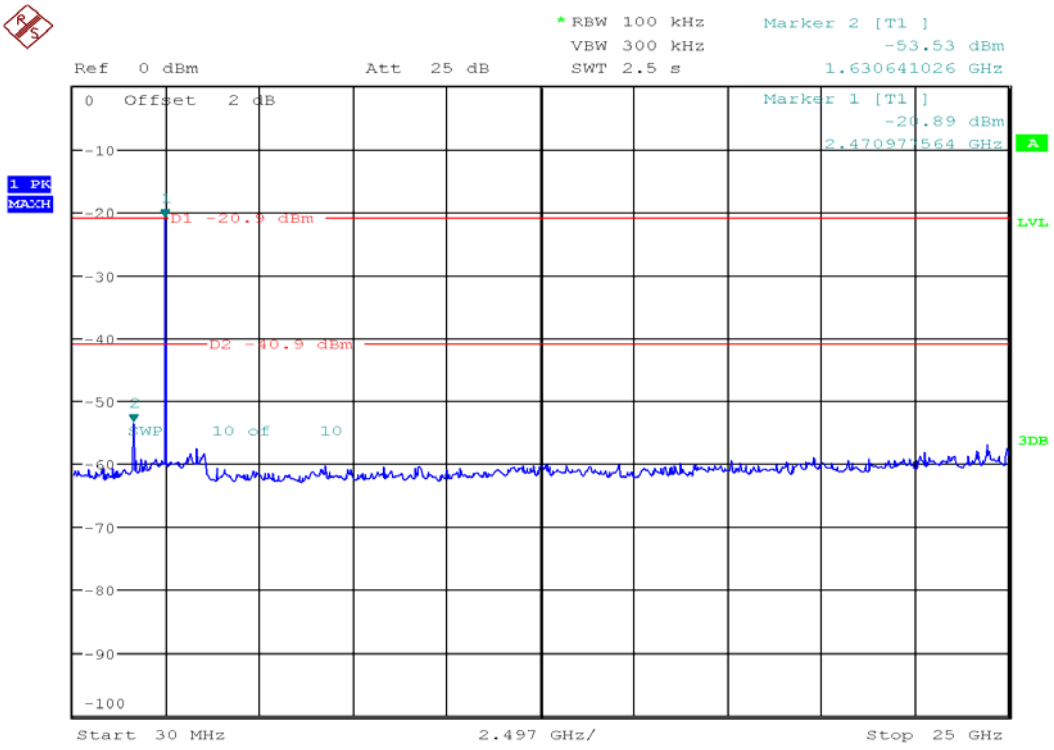


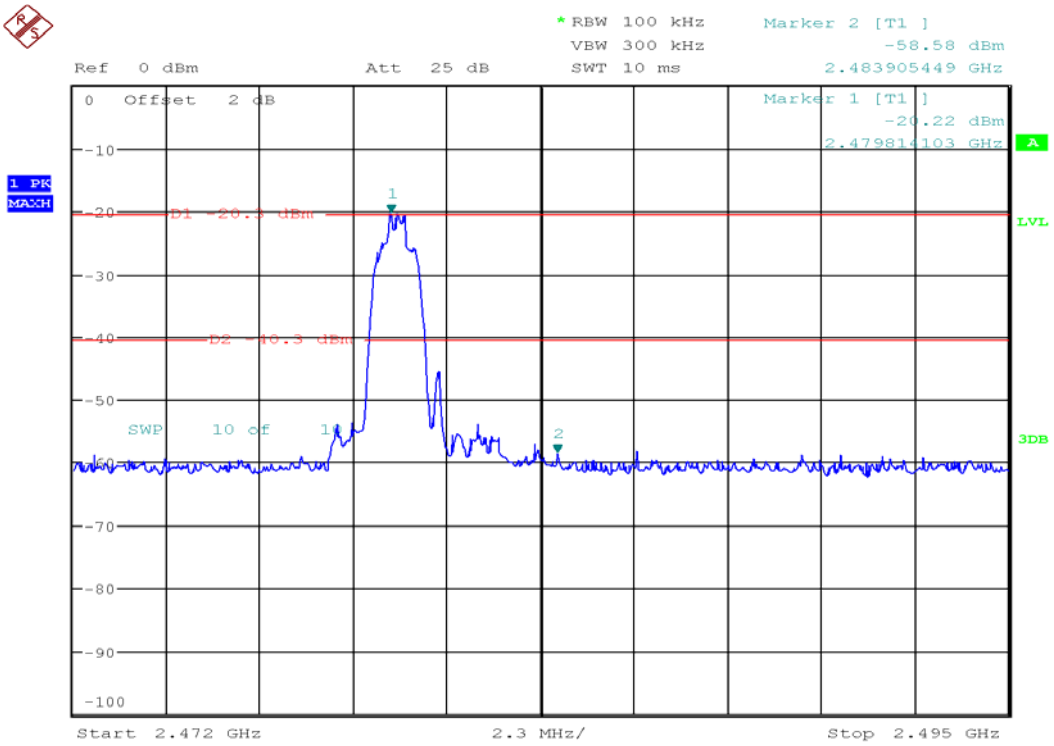


Middle Channel(operating at 2441 MHz)



Highest Channel(operating at 2480 MHz)





2) Out of band emissions & Band edge(Radiated)

1. Above 1000 MHz

Bluetooth_GFSK(DH5) : Frequency – 2402 MHz(above 1000 MHz)								
Frequency [MHz]	Reading [dBuV]	Pol. [H/V]	Height [m]	Correction Factor		Result Value		
				Ant. Factor [dB]	Cable+Amp. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]
Average data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 10 Hz)								
2389.09*	26.6	V	1.3	30.1	25.0	54.0	31.7	22.3
2402	76.9	V	1.3	30.1	25.0	-	82.0	-
4804	40.5	H	1.1	34.5	23.5	54.0	51.5	**2.5**
Peak data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 3 MHz)								
2389.09*	40.3	V	1.3	30.1	25.0	74.0	45.4	28.6
2402	87.2	V	1.3	30.1	25.0	-	92.3	-
4804	46.6	H	1.1	34.5	23.5	74.0	57.6	16.4

Bluetooth_GFSK(DH5) : Frequency – 2441 MHz(above 1000 MHz)								
Frequency [MHz]	Reading [dBuV]	Pol. [H/V]	Height [m]	Correction Factor		Result Value		
				Ant. Factor [dB]	Cable+Amp. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]
Average data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 10 Hz))								
2441	72.9	V	1.2	30.3	24.8	-	78.4	-
4882	34.9	H	1.1	34.6	23.5	54.0	46.0	**8.0**
Peak data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 3 MHz)								
2441	84.9	V	1.2	30.3	24.8	-	90.4	-
4882	46.8	H	1.1	34.6	23.5	74.0	57.9	16.1

Bluetooth_GFSK(DH5) : Frequency – 2480 MHz(above 1000 MHz)								
Frequency [MHz]	Reading [dBuV]	Pol. [H/V]	Height [m]	Correction Factor		Result Value		
				Ant. Factor [dB]	Cable+Amp. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]
Average data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 10 Hz)								
2480	72.5	V	1.2	30.4	24.8	-	78.1	-
2483.68*	29.7	V	1.2	30.4	24.8	54.0	35.3	18.7
4960	40.0	H	1.1	34.8	23.5	54.0	51.3	**2.7**
Peak data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 3 MHz)								
2480	84.1	V	1.3	30.4	24.8	-	89.7	-
2483.68*	47.4	V	1.3	30.4	24.8	74.0	53.0	21.0
4960	46.7	H	1.1	34.8	23.5	74.0	58.0	16.0

Note : * Restricted band

Bluetooth_8DPSK(3-DH5) : Frequency – 2402 MHz(above 1000 MHz)								
Frequency [MHz]	Reading [dBuV]	Pol. [H/V]	Height [m]	Correction Factor		Result Value		
				Ant. Factor [dB]	Cable+Amp. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]
Average data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 10 Hz)								
2364.05*	26.4	V	1.3	30.1	25.0	54.0	31.5	22.5
2402	53.9	V	1.3	30.1	25.0	-	59.0	-
4804	25.7	H	1.1	34.5	23.5	54.0	36.7	**17.3**
Peak data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 3 MHz)								
2364.05*	40.6	V	1.3	30.1	25.0	74.0	45.7	28.3
2402	64.4	V	1.3	30.1	25.0	-	69.5	-
4804	35.2	H	1.1	34.5	23.5	74.0	46.2	27.8

Bluetooth_8DPSK(3-DH5) : Frequency – 2441 MHz(above 1000 MHz)								
Frequency [MHz]	Reading [dBuV]	Pol. [H/V]	Height [m]	Correction Factor		Result Value		
				Ant. Factor [dB]	Cable+Amp. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]
Average data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 10 Hz)								
2441	52.7	V	1.2	30.3	24.8	-	58.2	-
4882	25.4	H	1.1	34.6	23.5	54.0	36.5	**17.5**
Peak data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 3 MHz)								
2441	63.0	V	1.2	30.3	24.8	-	68.5	-
4882	35.1	H	1.1	34.6	23.5	74.0	46.2	27.8

Bluetooth_8DPSK(3-DH5) : Frequency – 2480 MHz(above 1000 MHz)								
Frequency [MHz]	Reading [dBuV]	Pol. [H/V]	Height [m]	Correction Factor		Result Value		
				Ant. Factor [dB]	Cable+Amp. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]
Average data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 10 Hz)								
2480	51.5	V	1.2	30.4	24.8	-	57.1	-
2492.60*	25.9	V	1.2	30.4	24.8	54.0	31.5	22.5
4960	24.3	H	1.1	34.8	23.5	54.0	35.6	**18.4**
Peak data, emissions above 1000 MHz(RBW = 1 MHz, VBW = 3 MHz)								
2480	62.2	V	1.3	30.4	24.8	-	67.8	-
2492.60*	39.7	V	1.3	30.4	24.8	74.0	45.3	28.7
4960	34.5	H	1.1	34.8	23.5	74.0	45.8	28.2

Note : * Restricted band

2. Below 1000 MHz

Worst case - Bluetooth_GFSK(DH5) : Below 1000 MHz								
Frequency [MHz]	Reading [dBuV]	Pol. [H/V]	Height [m]	Correction Factor		Result Value		
				Ant. Factor [dB]	Cable+Amp. [dB]	Limit [dBuV/m]	Result [dBuV/m]	Margin [dB]
36.45	42.1	V	1.0	11.4	23.0	40.0	30.5	9.5
91.41	47.0	V	1.0	8.3	22.1	43.5	33.2	10.3
148.02	43.2	V	1.1	12.7	22.0	43.5	33.9	9.6
296.72	47.1	H	2.1	12.4	21.2	46.0	38.3	7.7
395.31	36.9	H	1.5	14.7	20.9	46.0	30.7	15.3
455.15	37.4	V	1.3	16.3	20.7	46.0	33.0	13.0
594.18	30.5	H	1.3	18.8	19.9	46.0	29.4	16.6
741.24	40.6	H	1.1	20.9	19.3	46.0	42.2	**3.8**
890.05	32.7	H	1.1	22.3	18.1	46.0	36.9	9.1

5.3 Channel bandwidth

5.3.1 Test procedures

1. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.

2. Set a reference level on the measuring instrument equal to the highest peak value.

3. Measure the frequency difference of tow 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.

5.3.2 Limit of channel bandwidth

At least 25 kHz or two-third of 20 dB hopping channel bandwidth(whichever is greater).

5.3.3 Test instruments

Description	Manufacturer	Model no.	Serial no.	Due cal.	Use
Spectrum analyzer	Rohde&Schwarz	FSQ40	200062	2011.10.02	☒

5.3.4 Test results

1. Data

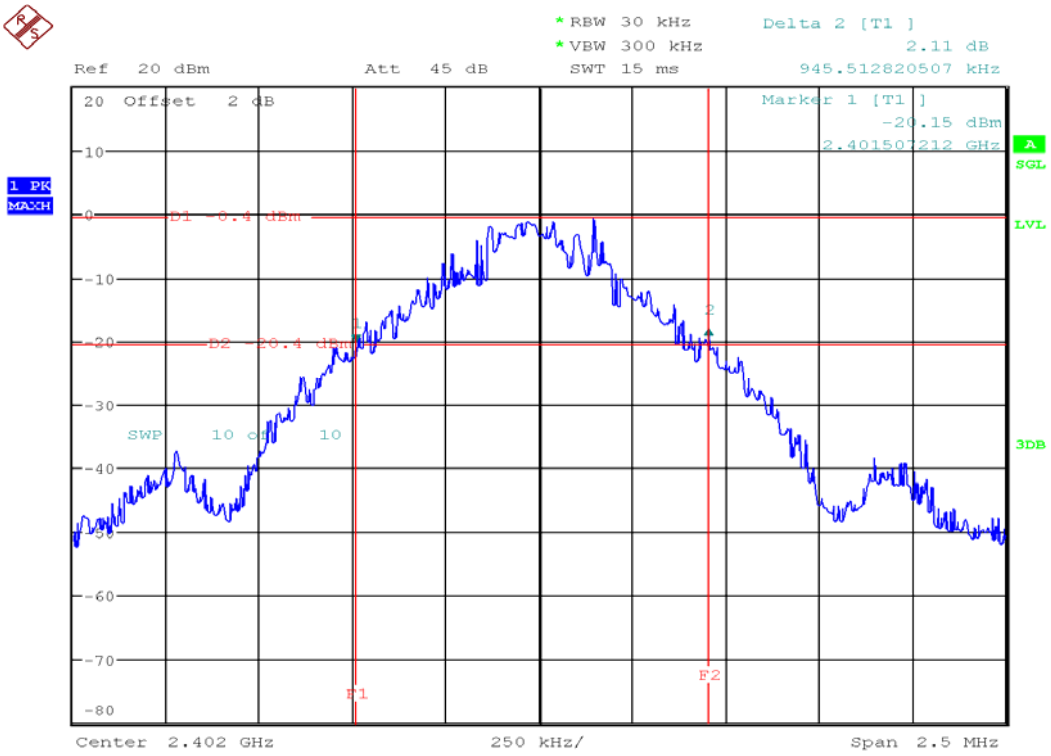
Bluetooth_GFSK(DH5)	
Frequency[MHz]	**20 dB Bandwidth[MHz]**
2402	0.945
2441	0.949
2480	0.945

Bluetooth_8DPSK(3-DH5)	
Frequency[MHz]	**20 dB Bandwidth[MHz]**
2402	1.266
2441	1.278
2480	1.270

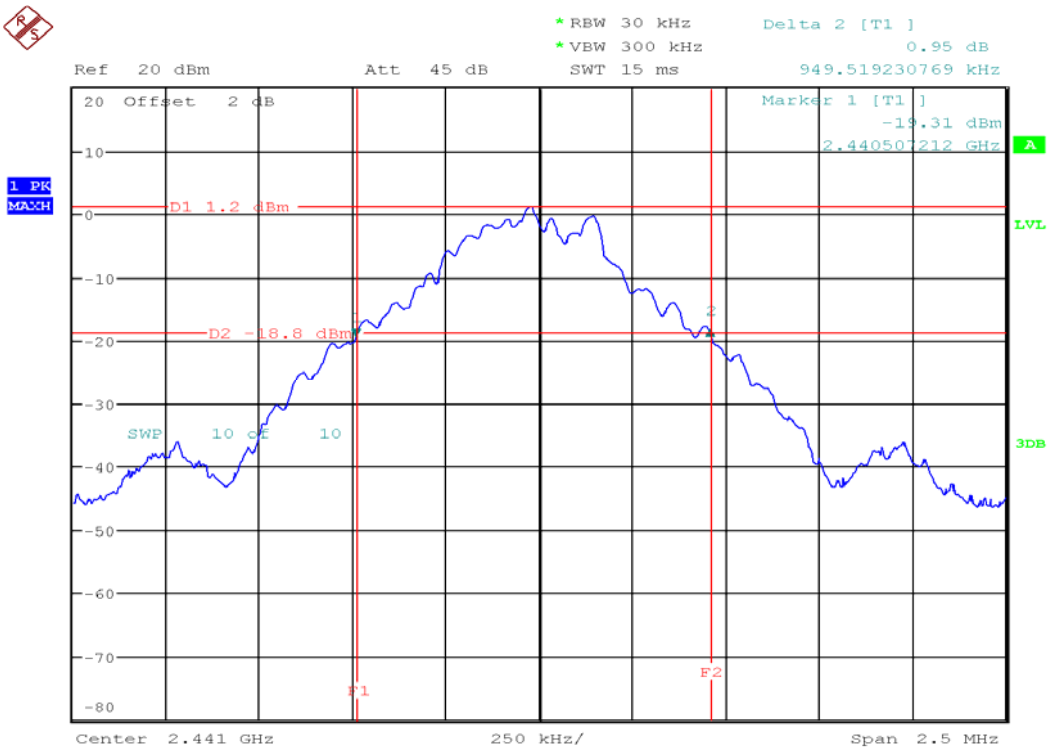
2. Graph

Bluetooth_GFSK(DH5)

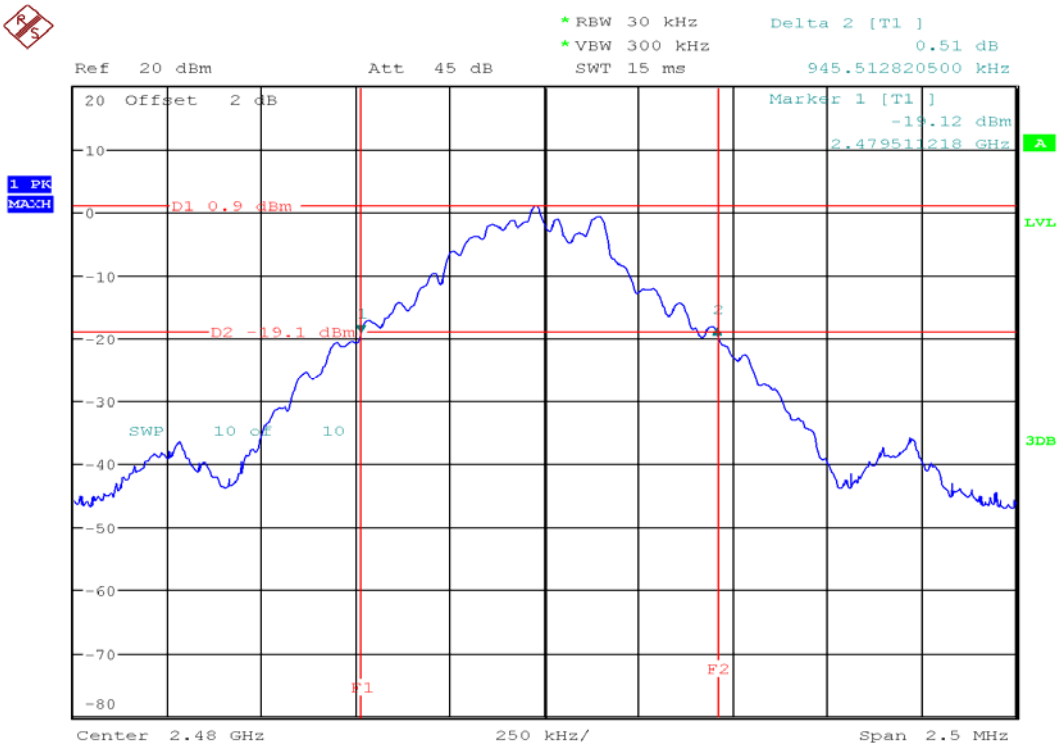
Lowest Channel(operating at 2402 MHz)



Middle Channel(operating at 2441 MHz)

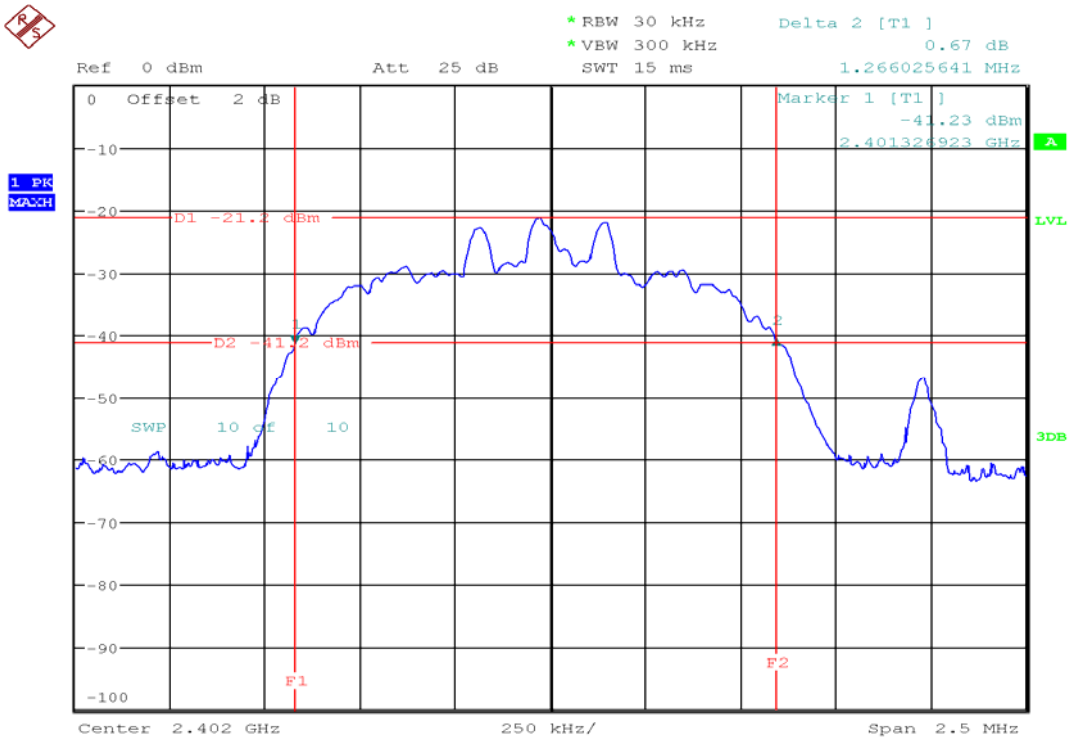


Highest Channel(operating at 2480 MHz)

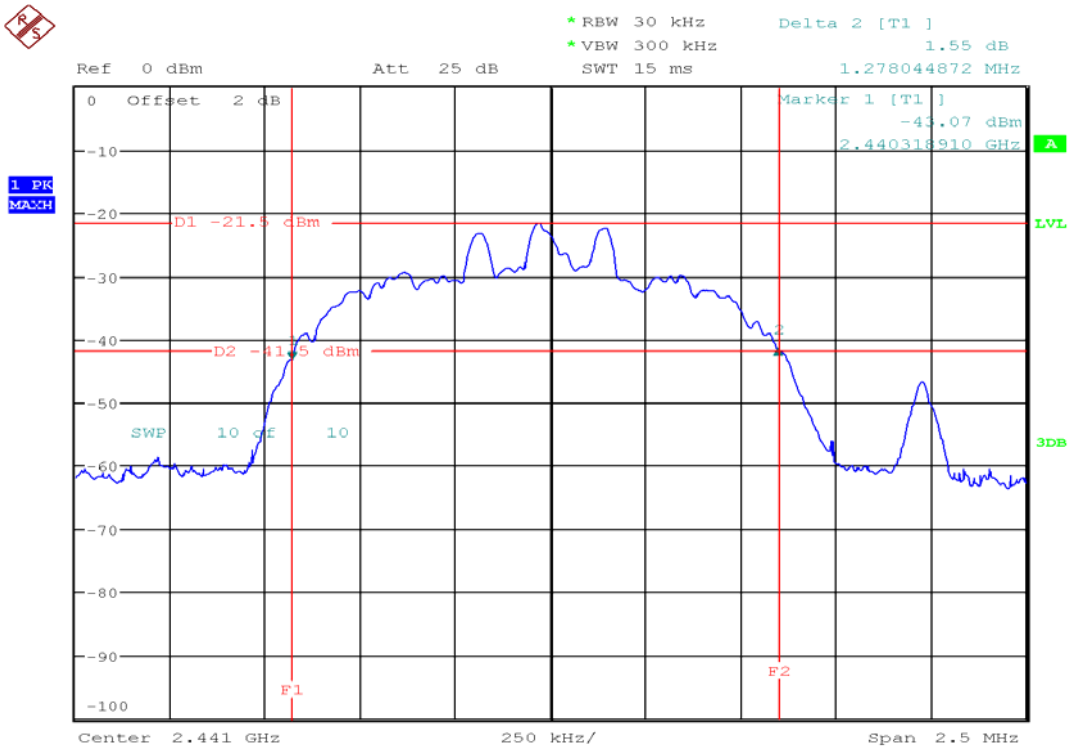


Bluetooth_8DPSK(3-DH5)

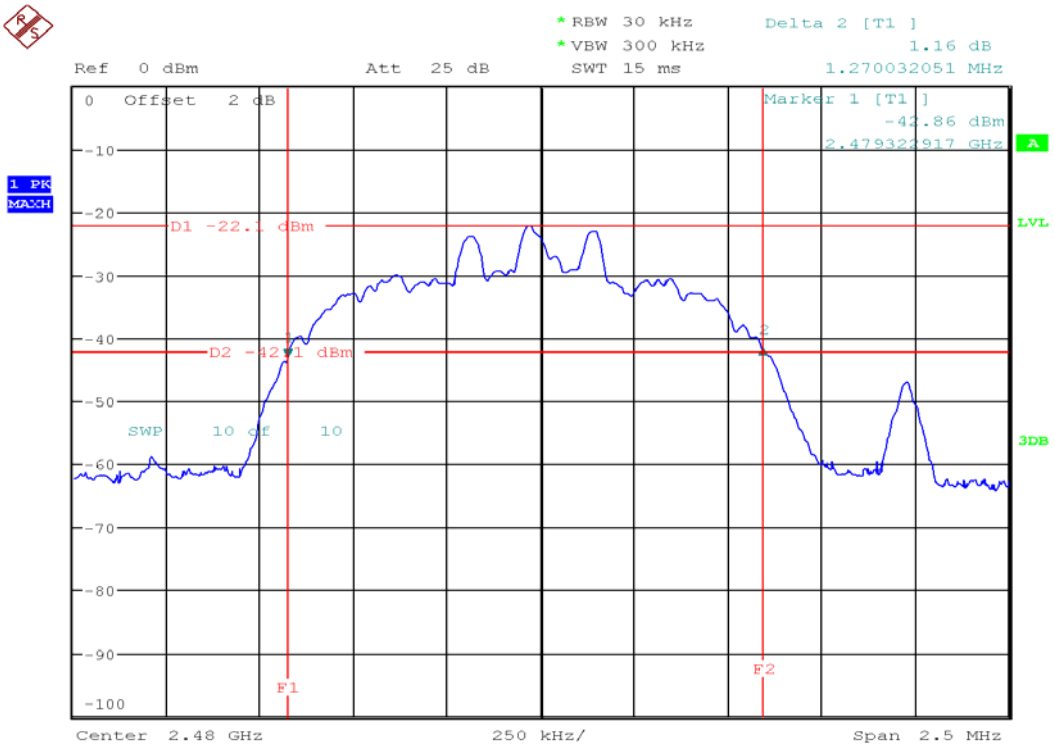
Lowest Channel(operating at 2402 MHz)



Middle Channel(operating at 2441 MHz)



Highest Channel(operating at 2480 MHz)



5.4 Hopping channel separation

5.4.1 Test procedures

1. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.

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 Mark function. And then plot the result on Spectrum Analyzer screen.

4. Repeat above procedures until all frequencies measured were complete.

5.4.2 Limit of hopping channel separation

At least 25 kHz or two-third of 20 dB hopping channel bandwidth(whichever is greater).

5.4.3 Test instruments

Description	Manufacturer	Model no.	Serial no.	Due cal.	Use
Spectrum analyzer	Rohde&Schwarz	FSQ40	200062	2011.10.02	☒

5.4.4 Test results

1. Data

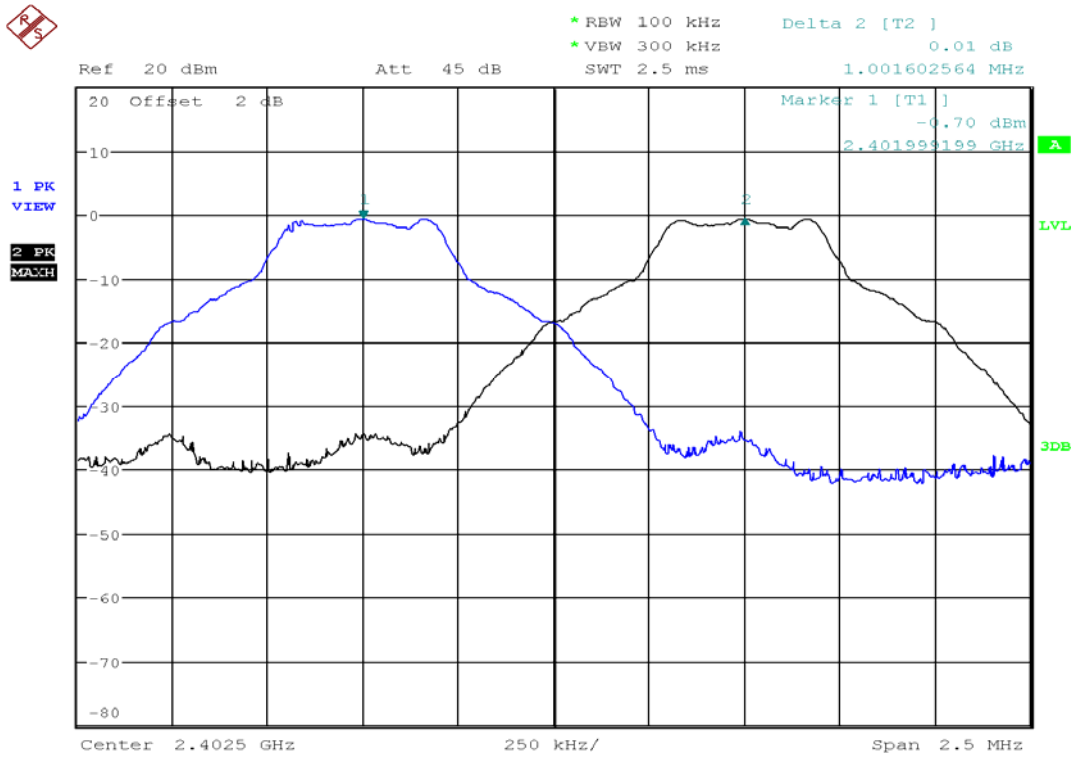
Bluetooth_GFSK(DH5)				
Frequency [MHz]	**Adjacent channel separation [MHz]**	**20 dB bandwidth [MHz]**	**Minimum limit [MHz]**	**Results**
2402	1.001	0.945	0.630	Pass
2441	1.001	0.949	0.633	Pass
2480	1.001	0.945	0.630	Pass

Bluetooth_8DPSK(3-DH5)				
Frequency [MHz]	**Adjacent channel separation [MHz]**	**20 dB bandwidth [MHz]**	**Minimum limit [MHz]**	**Results**
2402	1.001	1.266	0.844	Pass
2441	1.001	1.278	0.852	Pass
2480	1.001	1.270	0.630	Pass

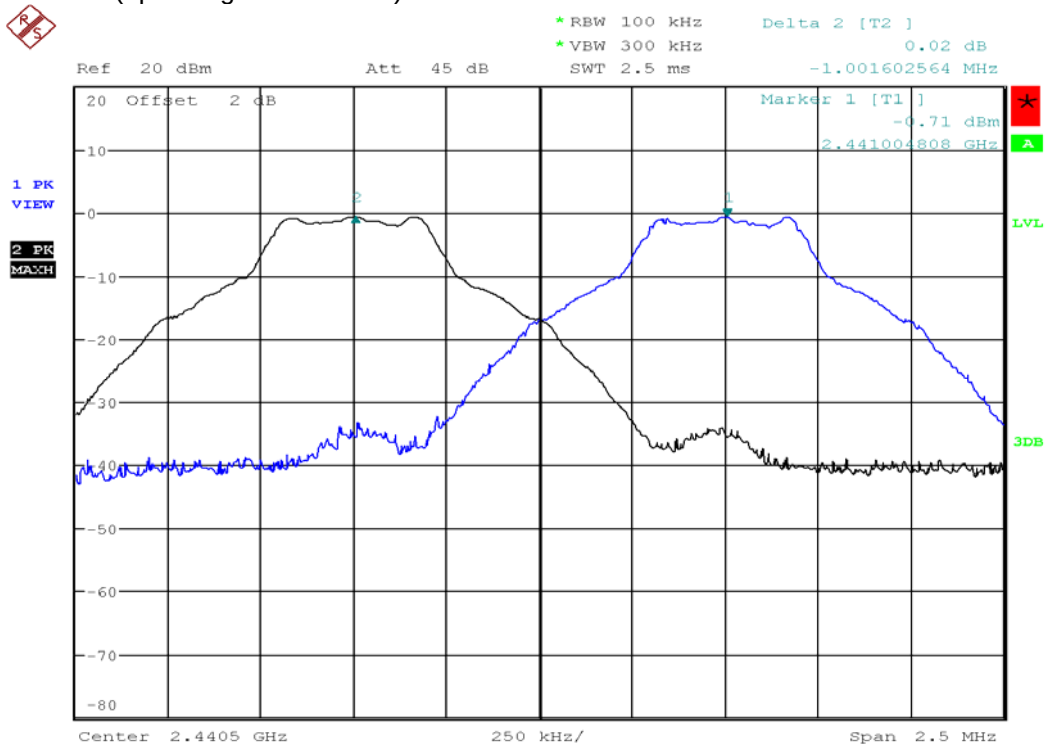
2. Graph

Bluetooth_GFSK(DH5)

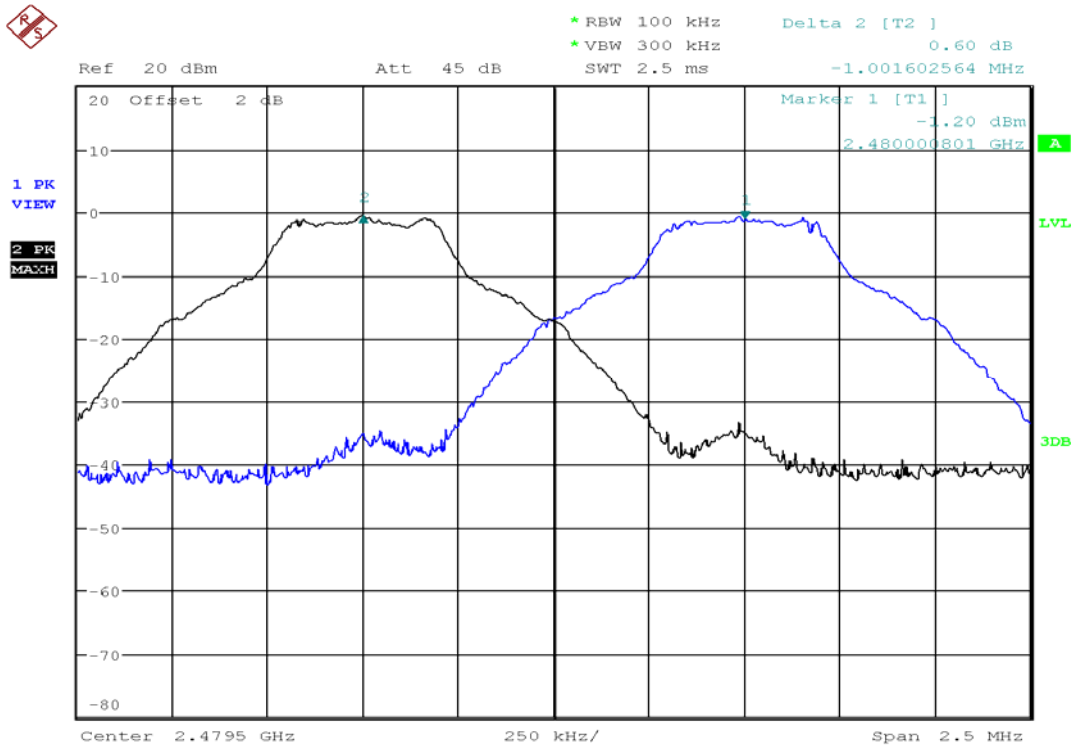
Lowest Channel(operating at 2402 MHz)



Middle Channel(operating at 2441 MHz)

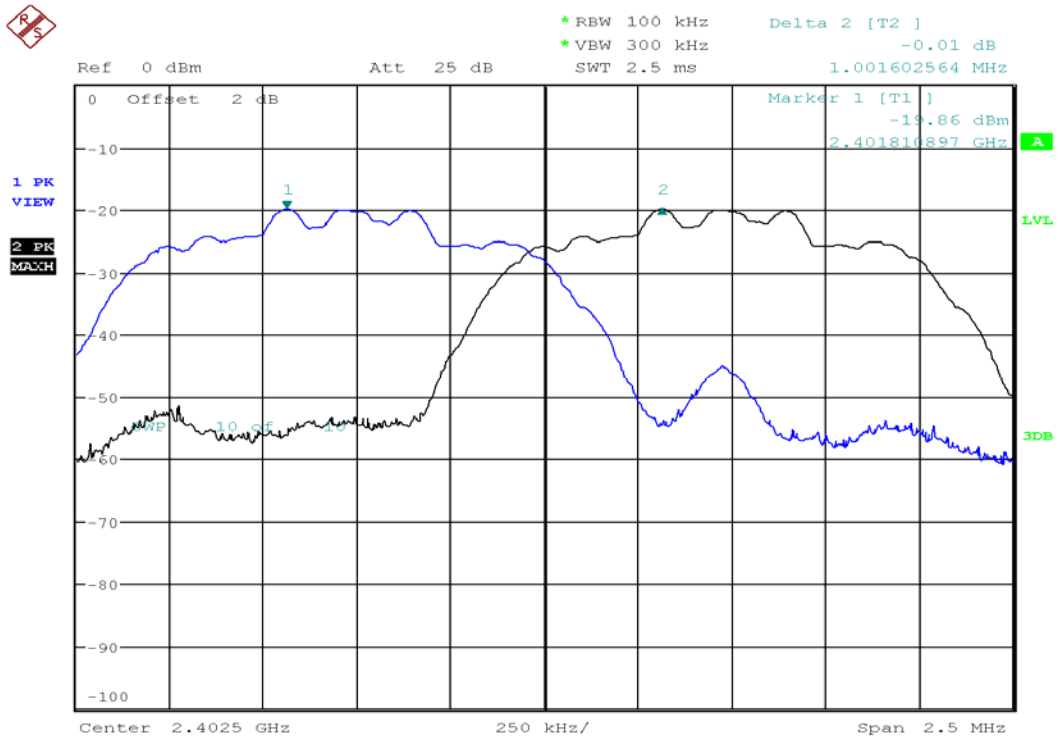


Highest Channel(operating at 2480 MHz)

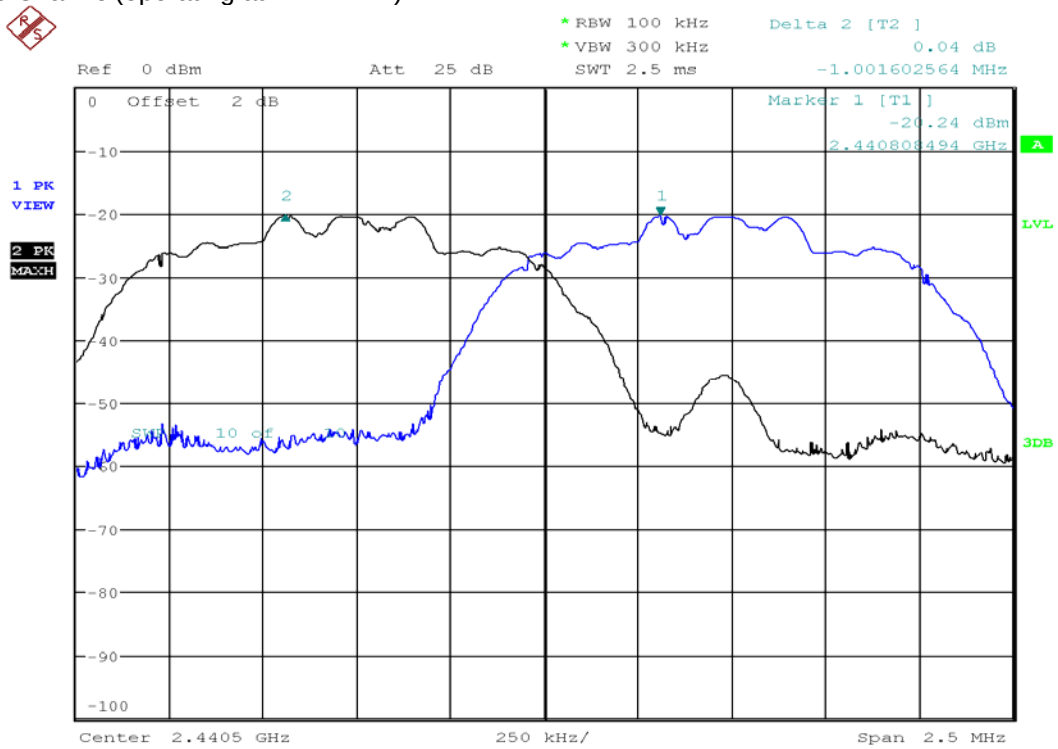


Bluetooth_8DPSK(3-DH5)

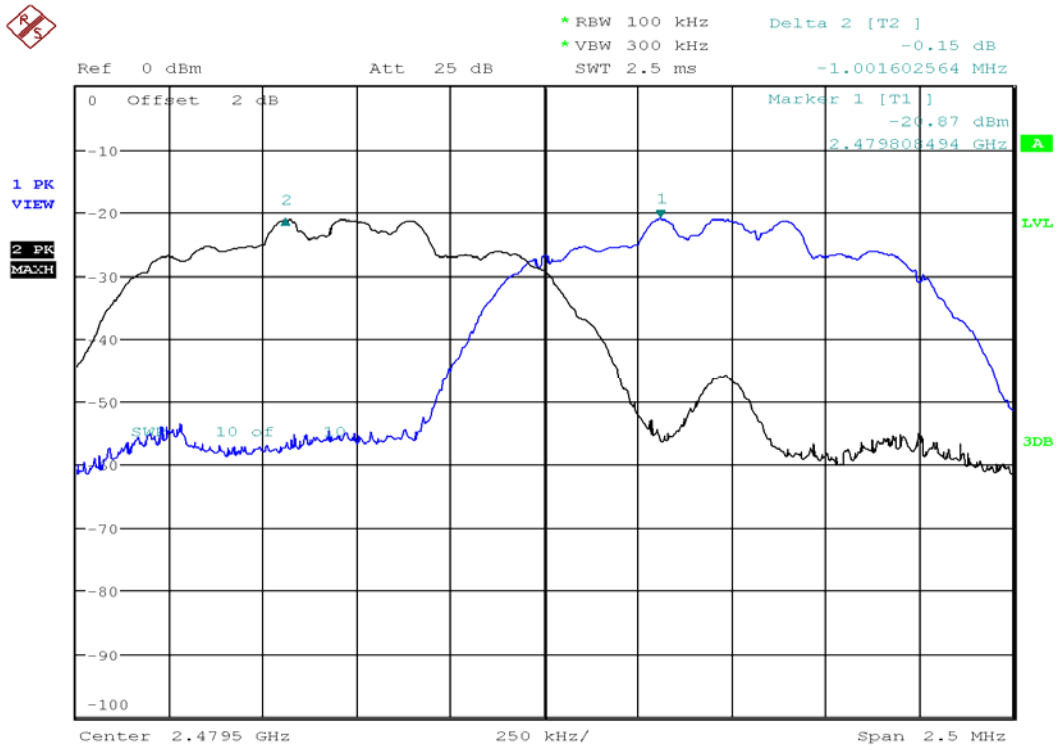
Lowest Channel(operating at 2402 MHz)



Middle Channel(operating at 2441 MHz)



Highest Channel(operating at 2480 MHz)



5.5 Number of hopping frequency

5.5.1 Test procedures

1. Turn on the EUT and connect it antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

2. Set the Spectrum analyzer on Max. hold mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.

3. Set the Spectrum analyzer on view mode and then plot the result on Spectrum analyzer screen.

4. Repeat above procedures until all frequencies measured were complete.

5.5.2 Limit of hopping frequency number

At least 15 channels frequencies, and should be equally spaced.

5.5.3 Test instruments

Description	Manufacturer	Model no.	Serial no.	Due cal.	Use
Spectrum analyzer	Rohde&Schwarz	FSQ40	200062	2011.10.02	☒

5.5.4 Test Results

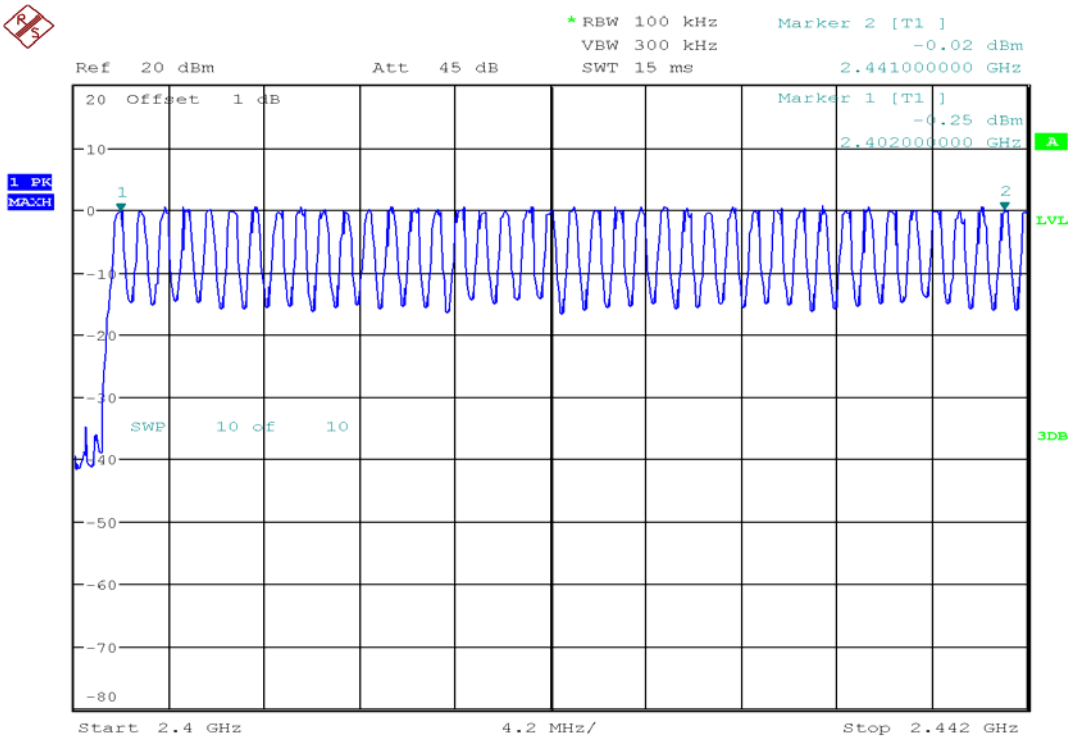
1. Data

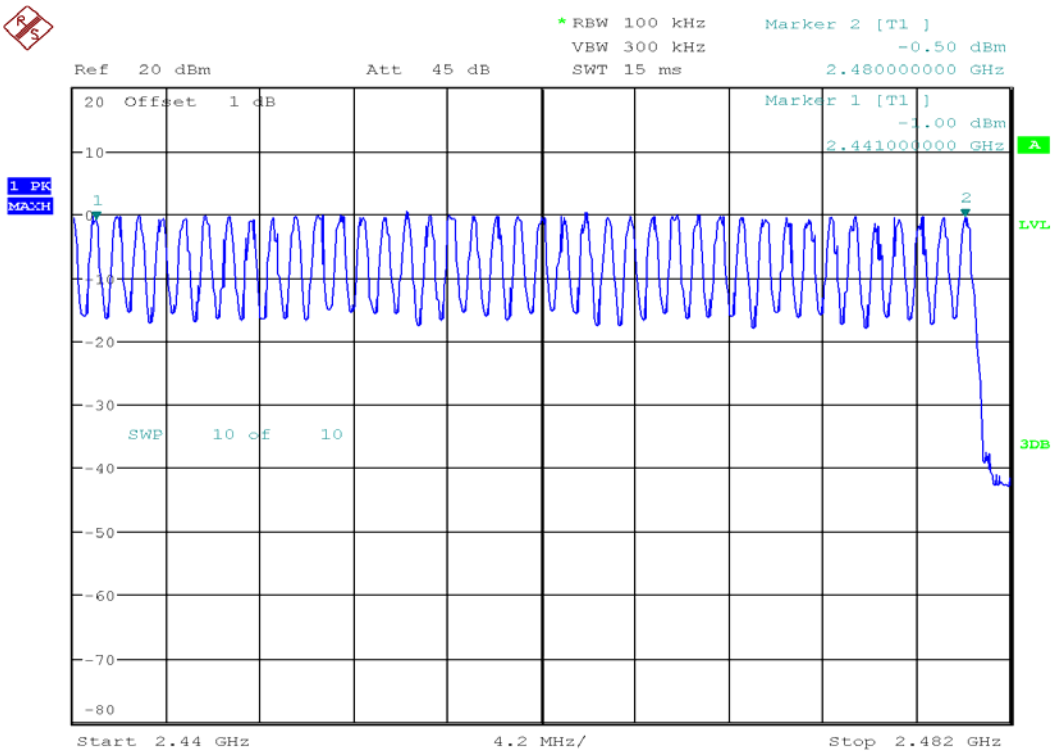
Bluetooth_GFSK(DH5)	
Number of hopping frequency	**Result**
79	Pass

Bluetooth_8DPSK(3-DH5)	
Number of hopping frequency	**Result**
79	Pass

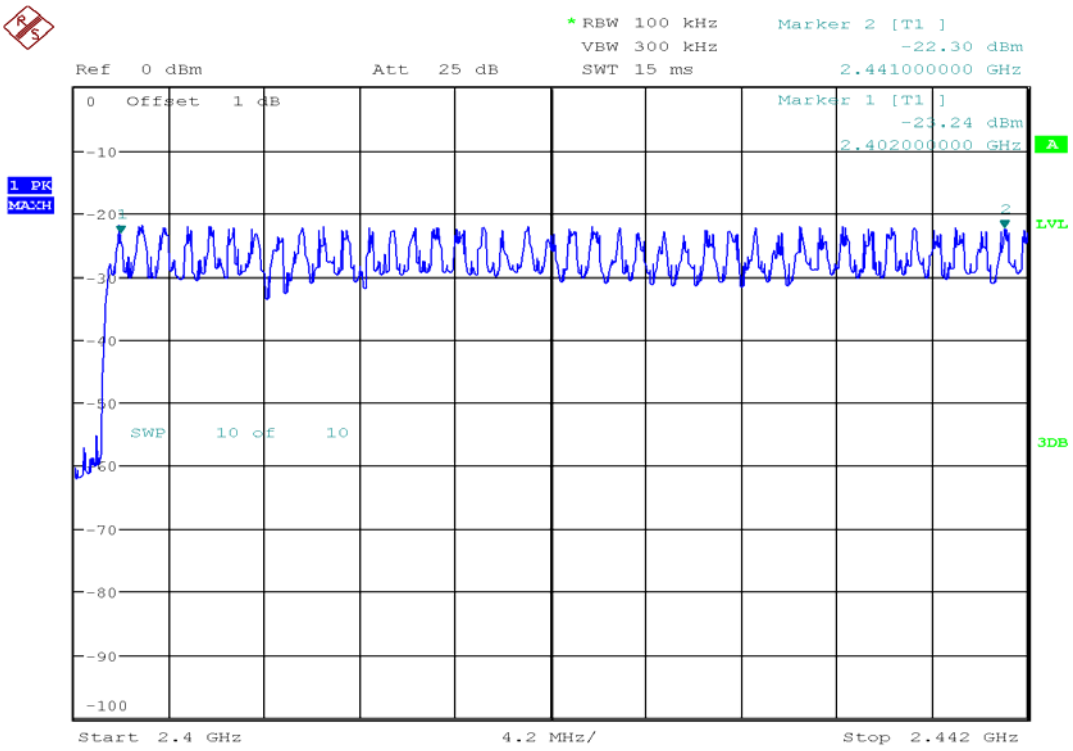
2. Graph

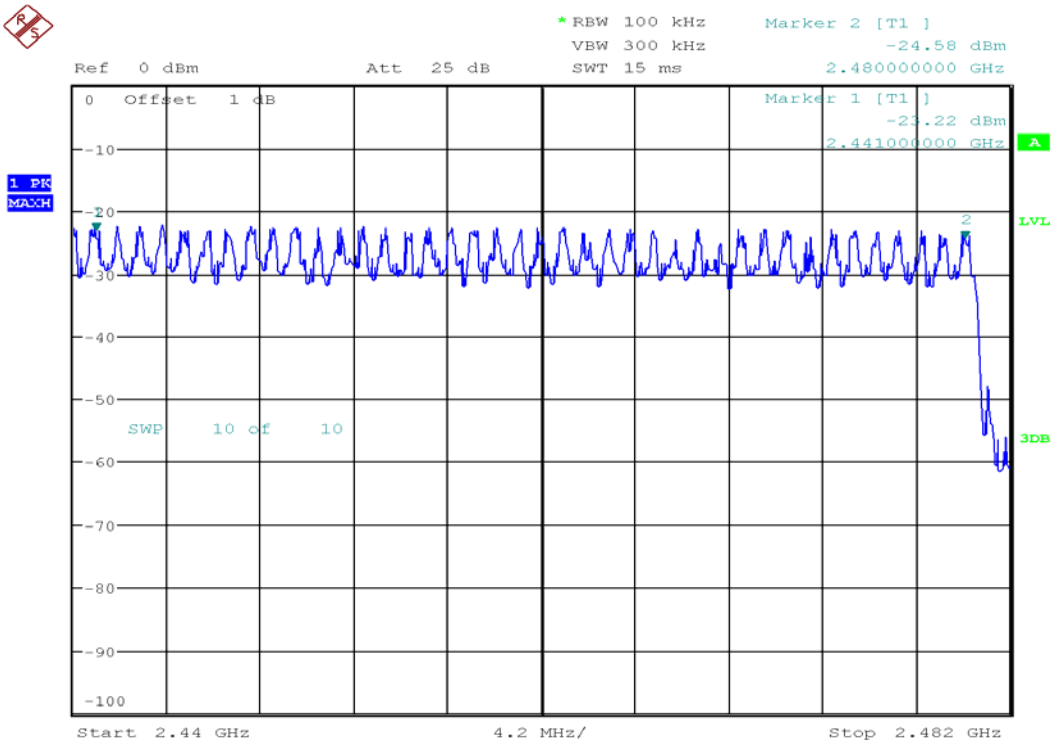
Bluetooth_GFSK(DH5)





Bluetooth_8DPSK(3-DH5)





5.6 Dwell time

5.6.1 Test procedures

1. Turn on the EUT and connect it antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

2. Adjust the center frequency of Spectrum analyzer on any frequency be measured and set Spectrum analyzer to zero span mode. And then, set RBW and VBW of Spectrum analyzer to proper value.

3. Measure the time duration of one transmission on the measured frequency.
And then plot the result with time difference of this duration.

4. Repeat above procedures until all difference time-slot modes have been completed.

5.6.2 Limit of dwell time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channel employed.

5.6.3 Test instruments

Description	Manufacturer	Model no.	Serial no.	Due cal.	Use
Spectrum analyzer	Rohde&Schwarz	FSQ40	200062	2011.10.02	☒

5.6.4 Test Results

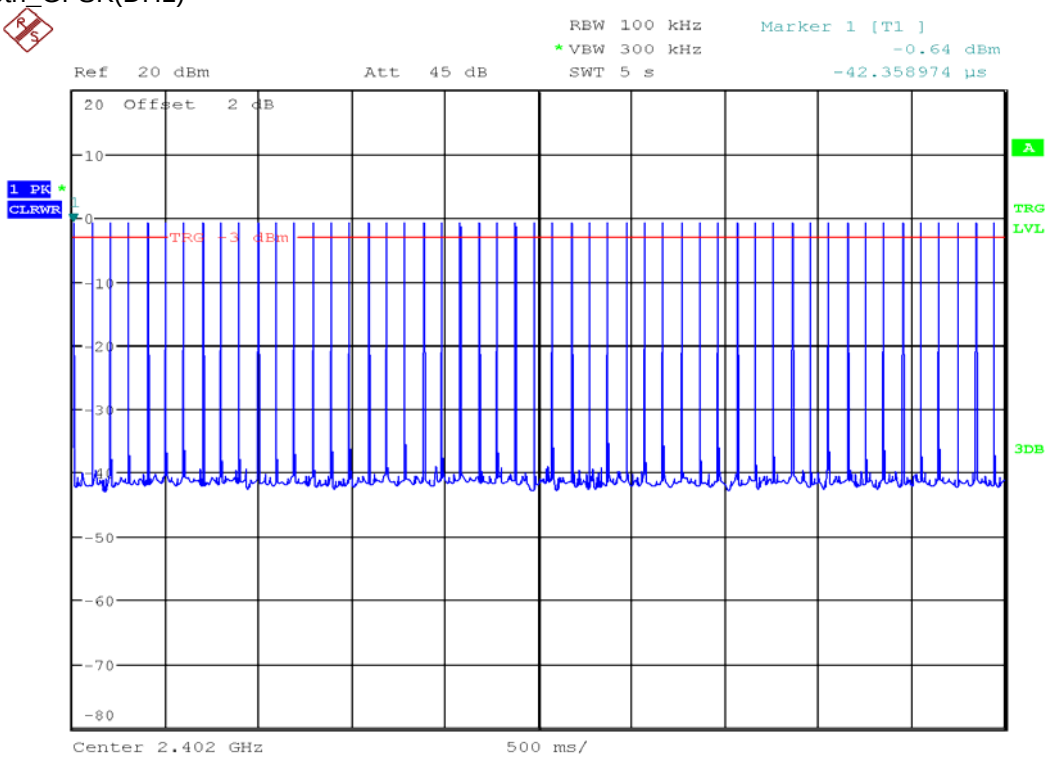
1. Data

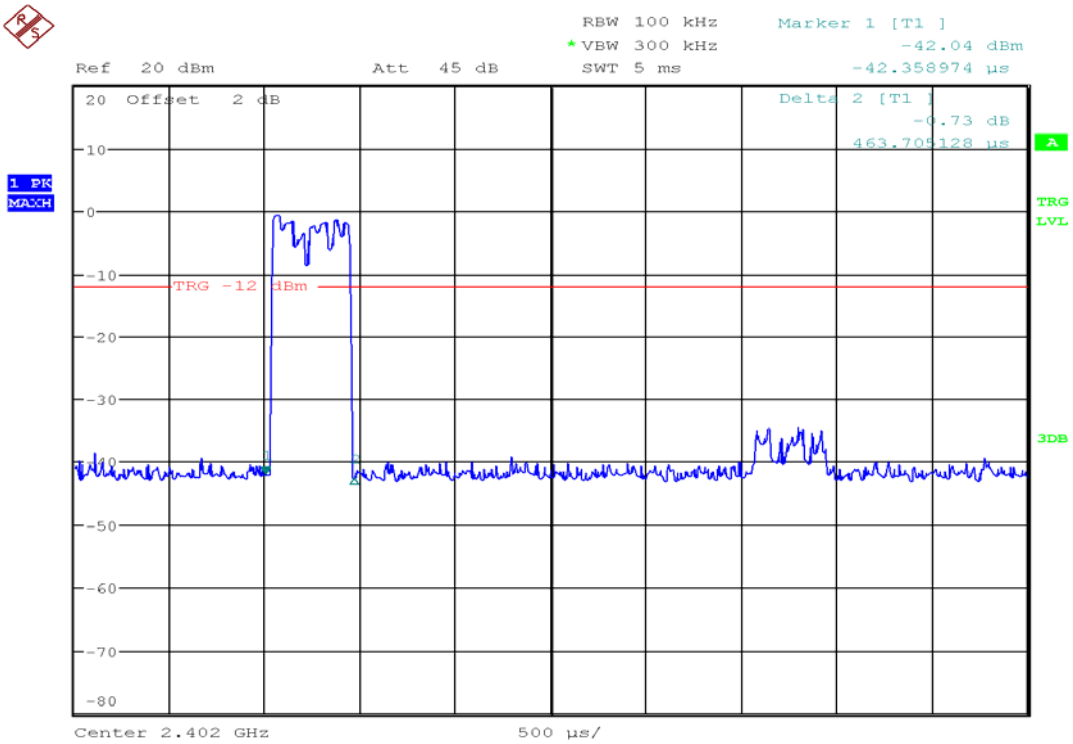
Bluetooth_GFSK				
Mode	**Number of transmission in a 31.6(79 hopping * 0.4)**	**Length of transmission time[ms]**	**Limit [ms]**	**Results [ms]**
DH1	50(time / 5 s) * 6.32 = 316.00 times	0.463	400	146.3
DH3	26(time / 5 s) * 6.32 = 164.32 times	1.713	400	281.4
DH5	17(time / 5 s) * 6.32 = 107.44 times	2.963	400	318.3

Bluetooth_8DPSK				
Mode	**Number of transmission in a 31.6(79 hopping * 0.4)**	**Length of transmission time[ms]**	**Limit [ms]**	**Results [ms]**
3-DH1	50(time / 5 s) * 6.32 = 316.00 times	0.463	400	146.3
3-DH3	26(time / 5 s) * 6.32 = 164.32 times	1.713	400	281.4
3-DH5	17(time / 5 s) * 6.32 = 107.44 times	2.963	400	318.3

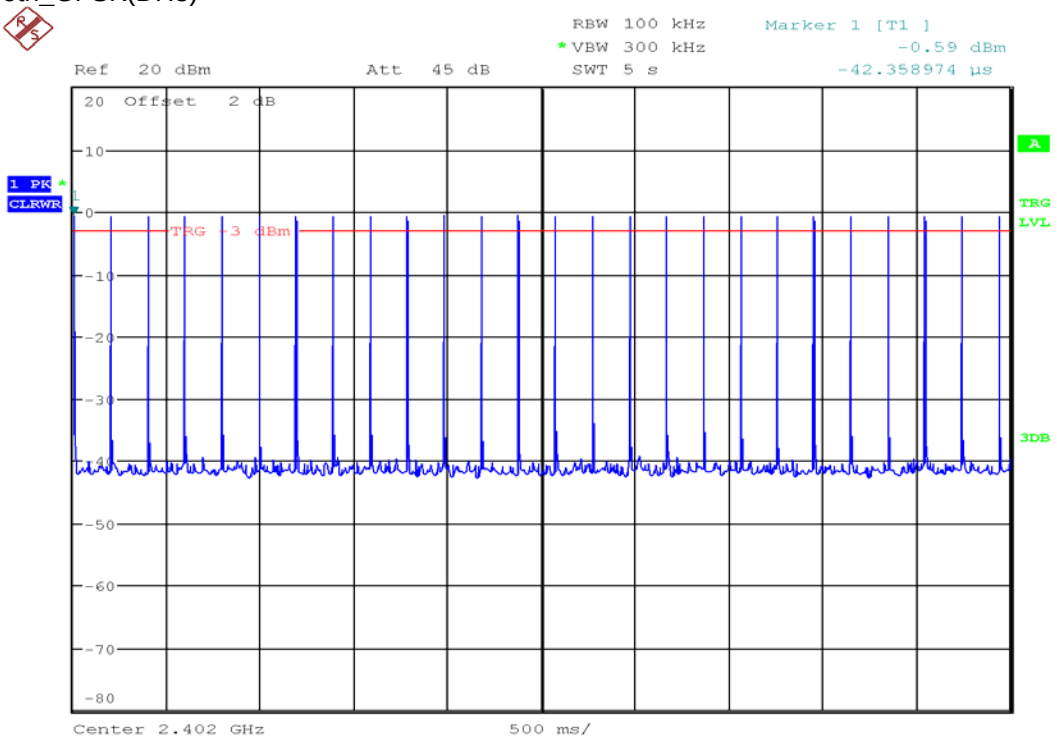
2. Graph

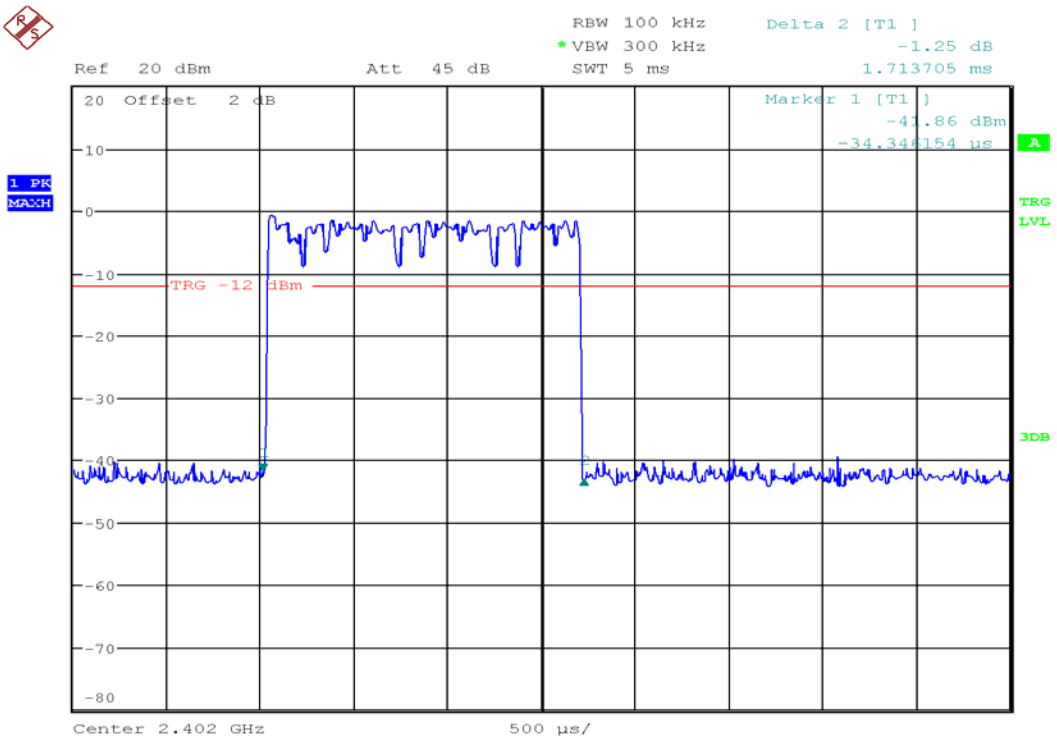
Bluetooth_GFSK(DH1)



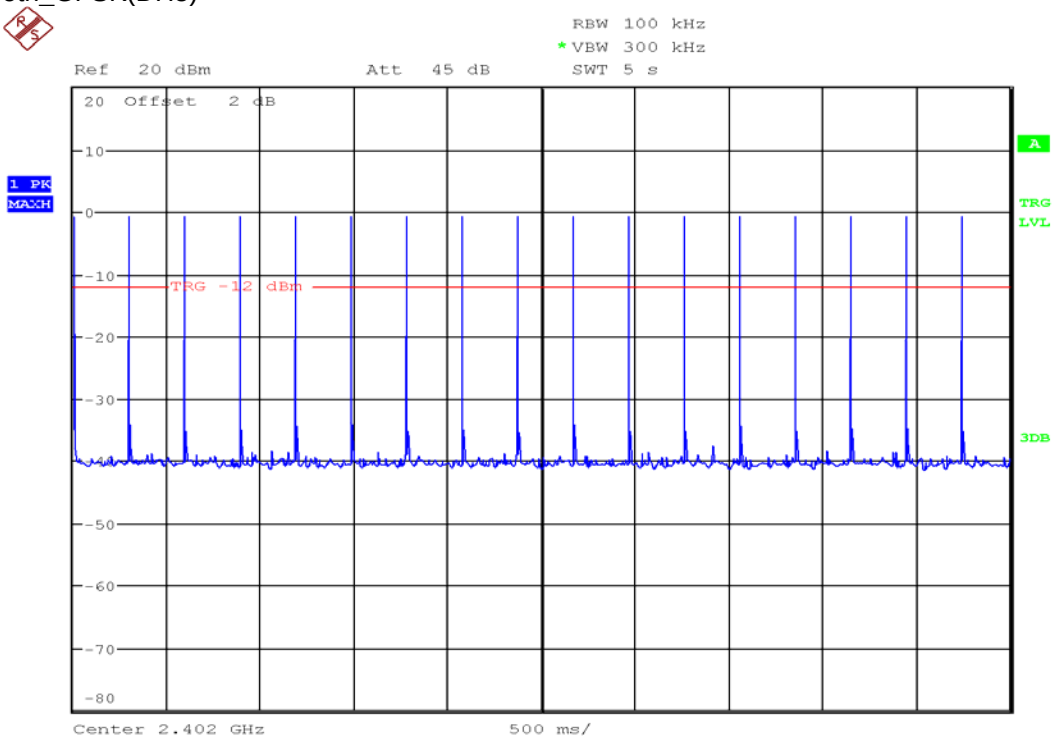


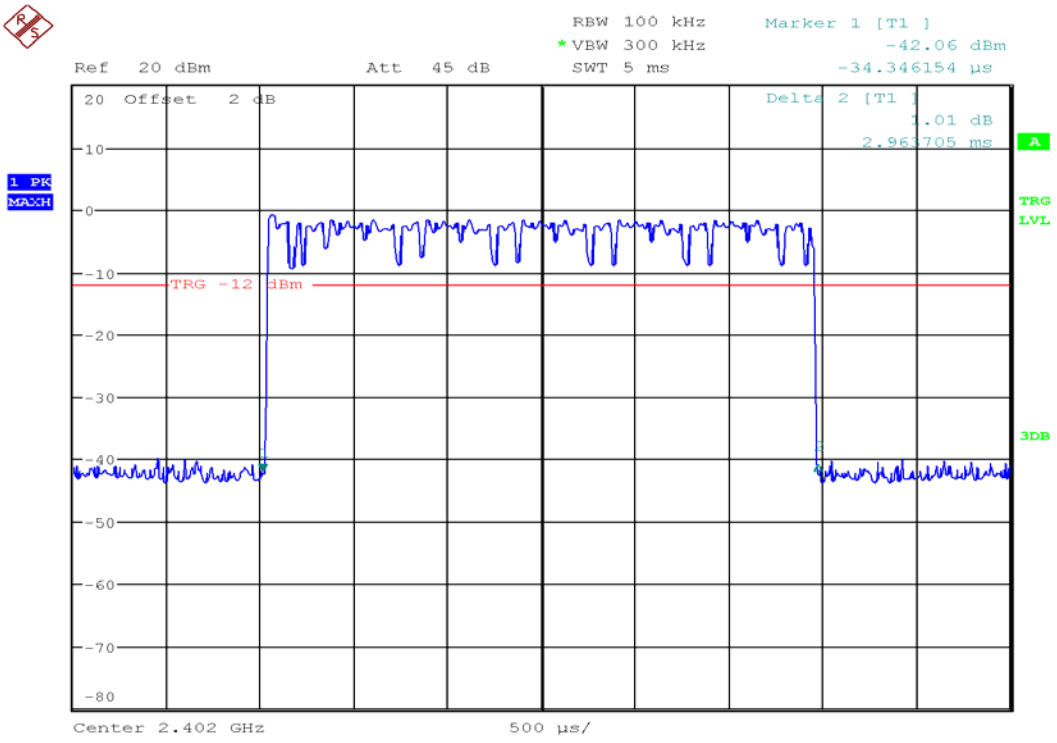
Bluetooth_GFSK(DH3)



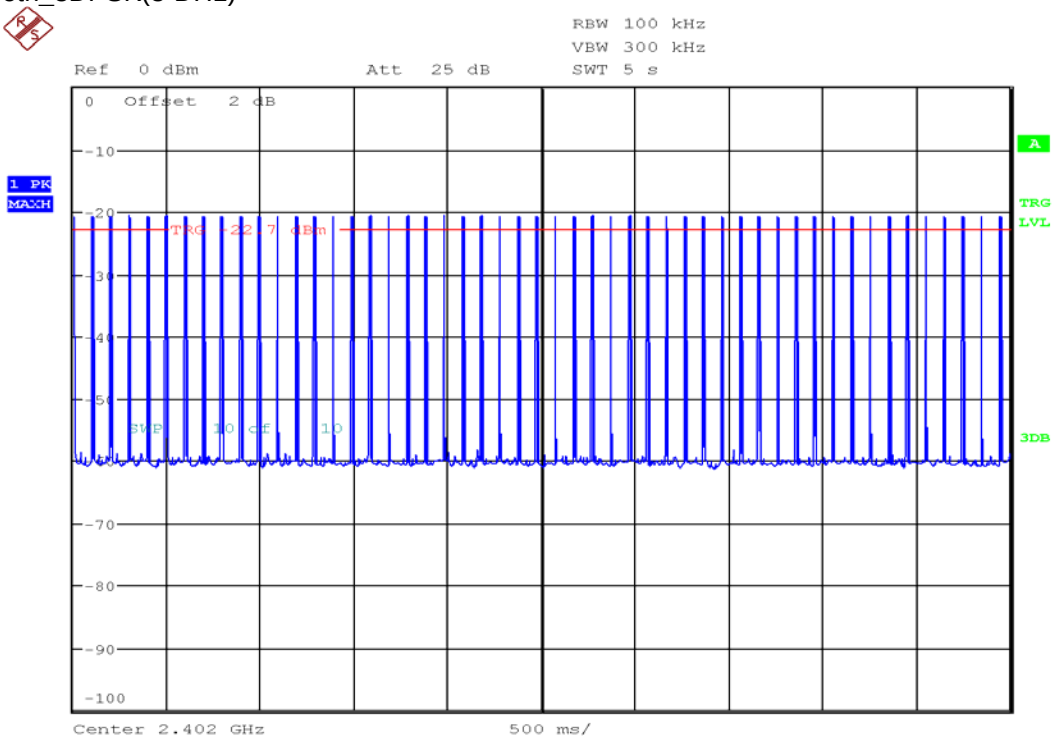


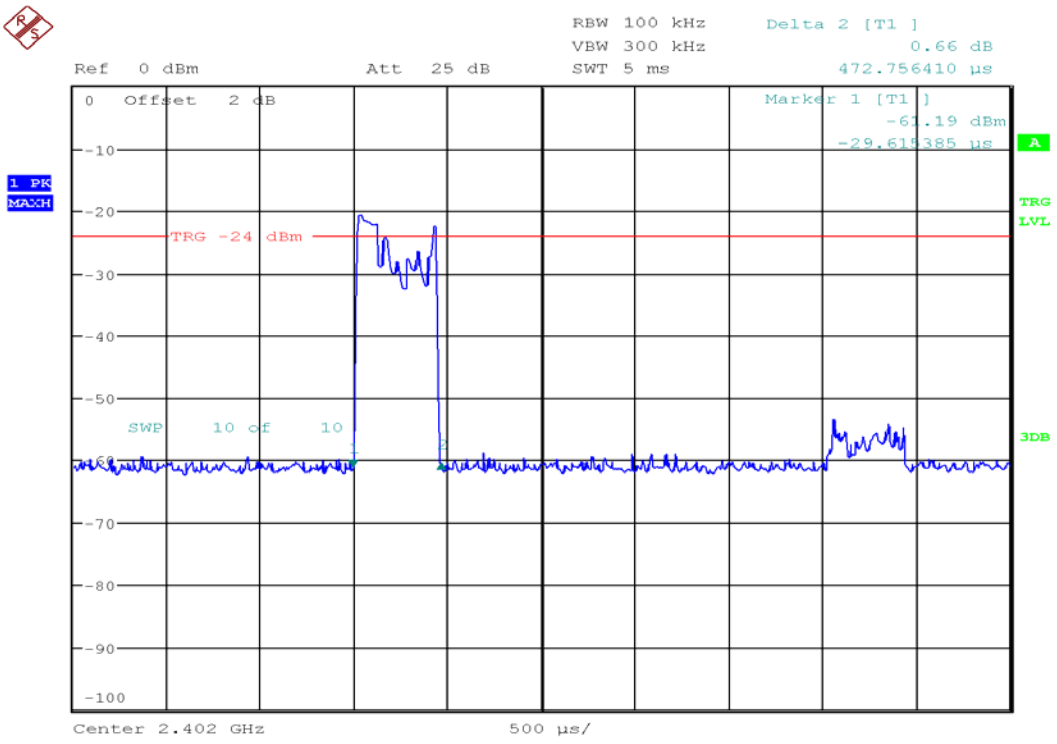
Bluetooth_GFSK(DH5)



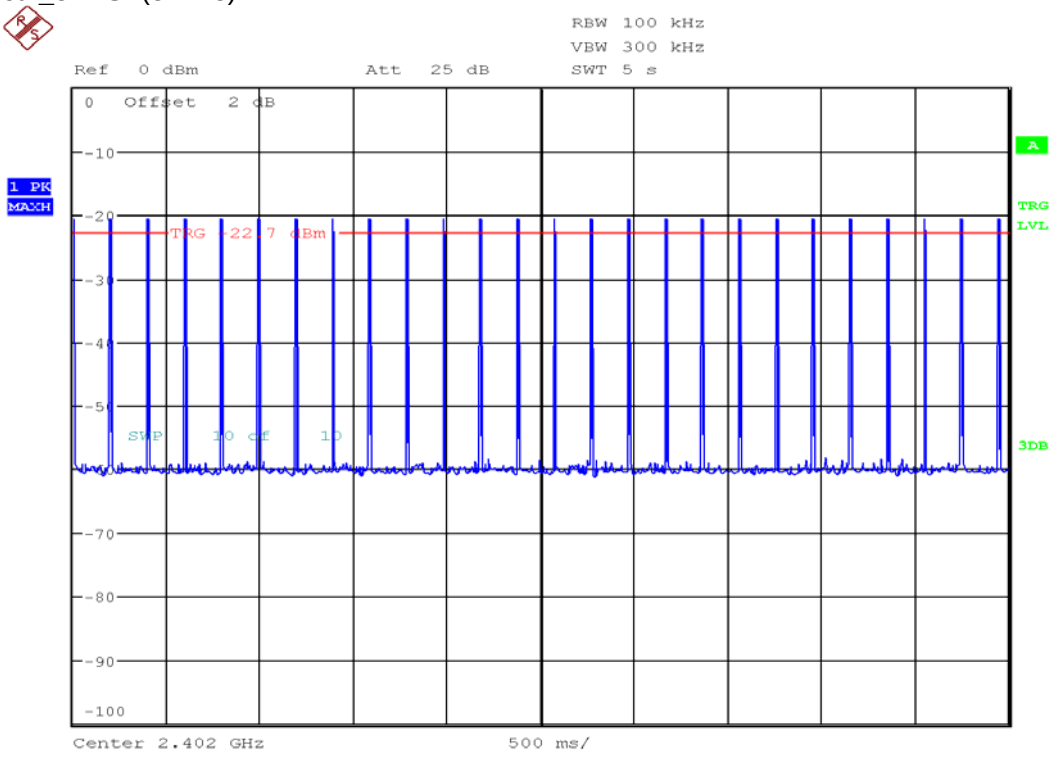


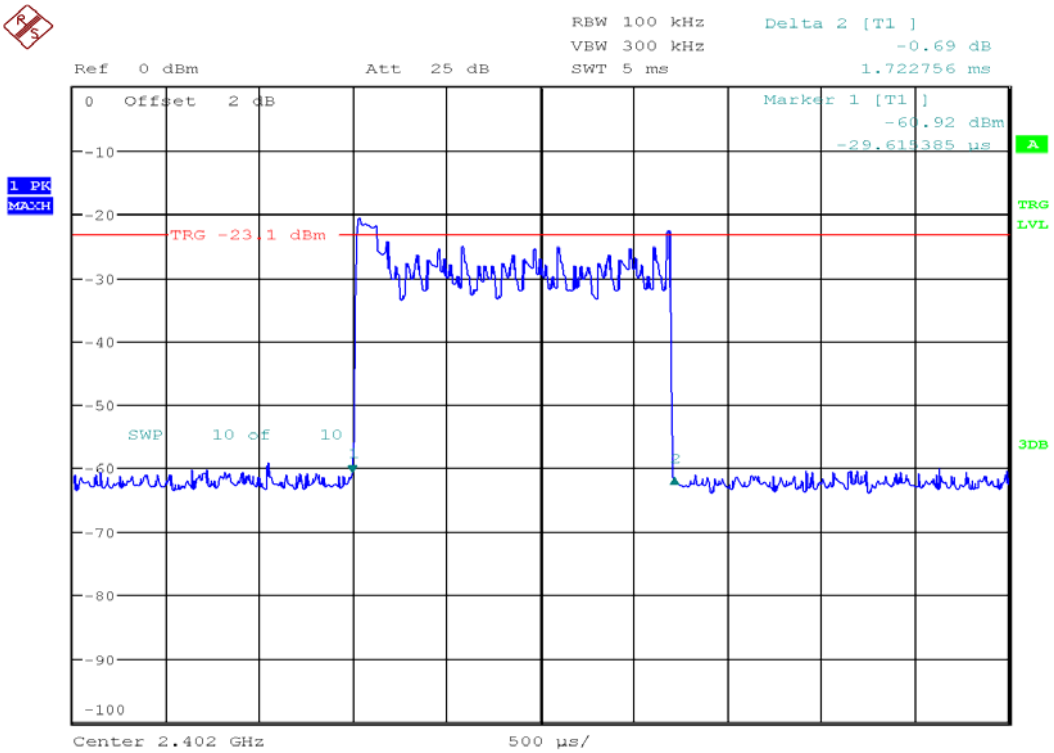
Bluetooth_8DPSK(3-DH1)



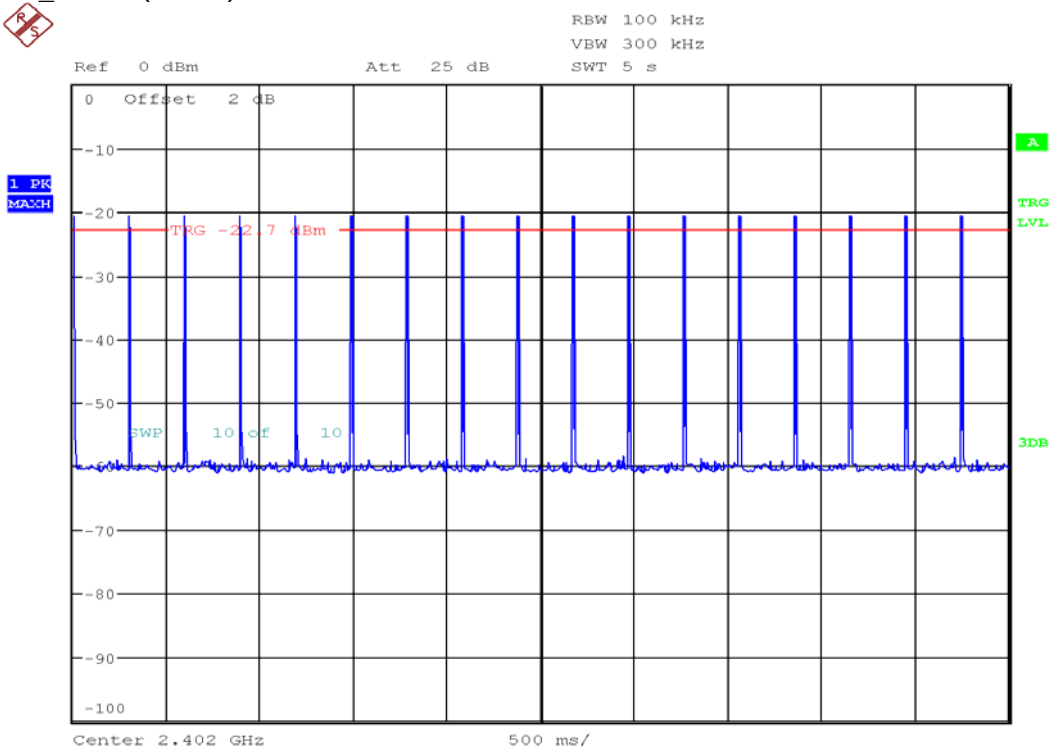


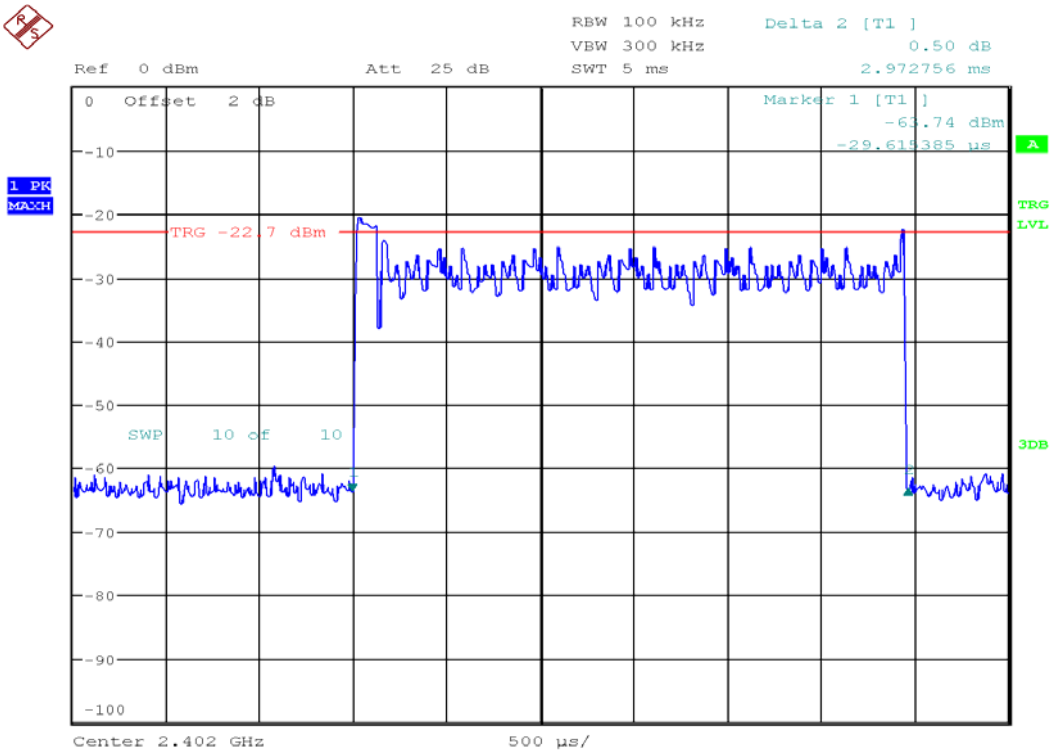
Bluetooth_8DPSK(3-DH3)





Bluetooth_8DPSK(3-DH5)





5.7 Maximum peak out power

5.7.1 Test procedures

1. 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

2. The center frequency of the Spectrum analyzer is set to the fundamental frequency and using RBW = 3 MHz and VBW = 10 MHz.

3. Measure the captured power within the band and recording the plot.

4. Repeat above procedures until all frequencies required were complete.

5.7.2 Limit of maximum peak out power

The maximum out peak power = 125 ㎽

5.7.3 Test instruments

Description	Manufacturer	Model no.	Serial no.	Due cal.	Use
Spectrum analyzer	Rohde&Schwarz	FSQ40	200062	2011.10.02	☒
Power sensor	AGILENT	N1921A	MY45200258	2011.10.02	☒
Power meter	AGILENT	N1911A	MY45101189	2011.10.02	☒

5.7.4 Test Results

1. Data

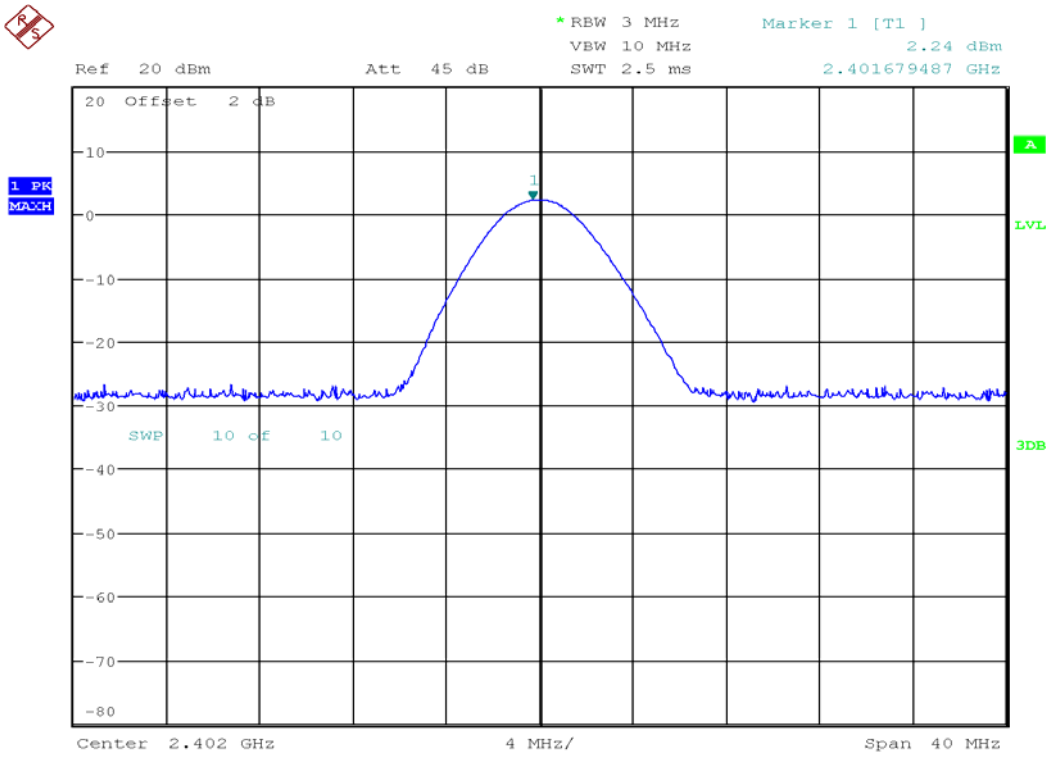
Bluetooth_GFSK(DH5)				
Frequency [MHz]	**Out power [dBm]**	**Out power [mW]**	**Out power limit [mW]**	**Result**
2402	2.24	1.67	125	Pass
2441	2.13	1.63	125	Pass
2480	1.79	1.51	125	Pass

Bluetooth_8DPSK(3-DH5)				
Frequency [MHz]	**Out power [dBm]**	**Out power [mW]**	**Out power limit [mW]**	**Result**
2402	-18.97	0.012	125	Pass
2441	-19.44	0.011	125	Pass
2480	-20.06	0.009	125	Pass

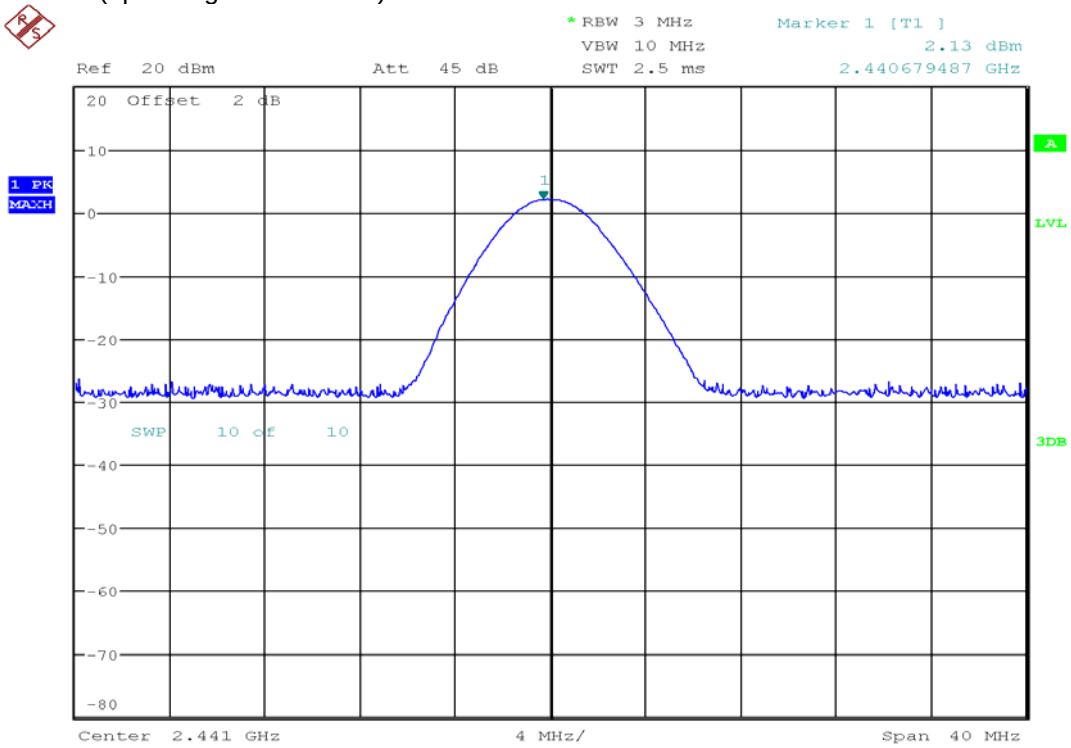
2. Graph

Bluetooth_GFSK(DH5)

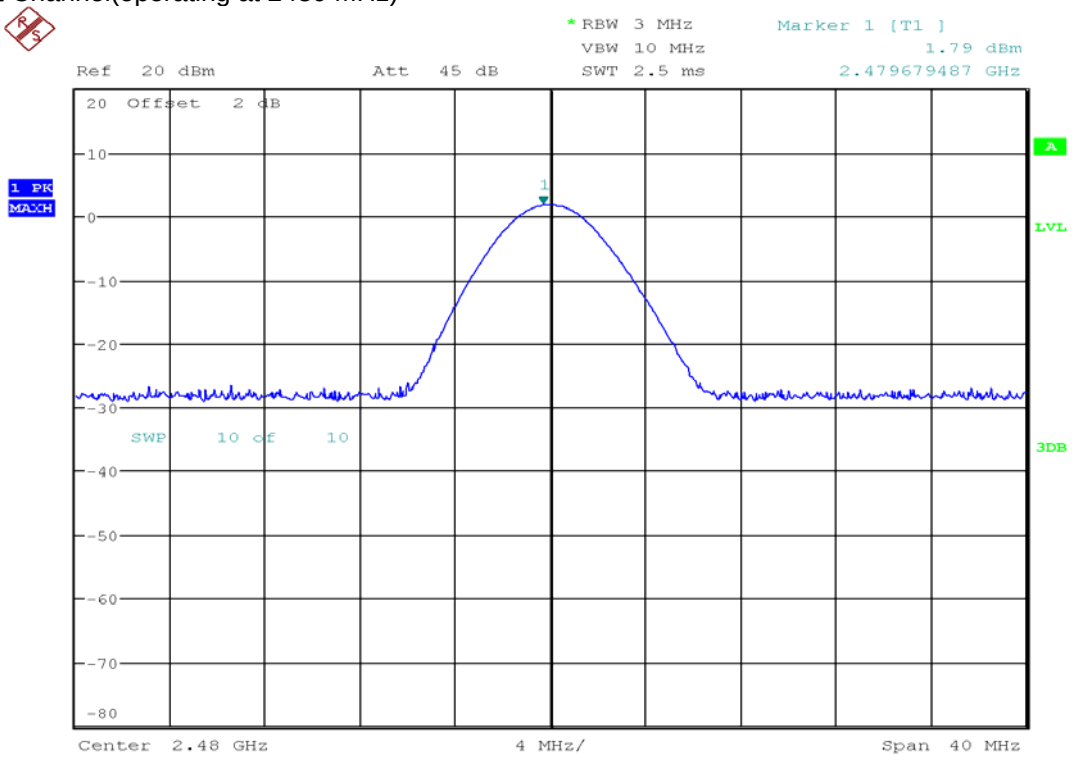
Lowest Channel(operating at 2402 MHz)



Middle Channel(operating at 2441 MHz)

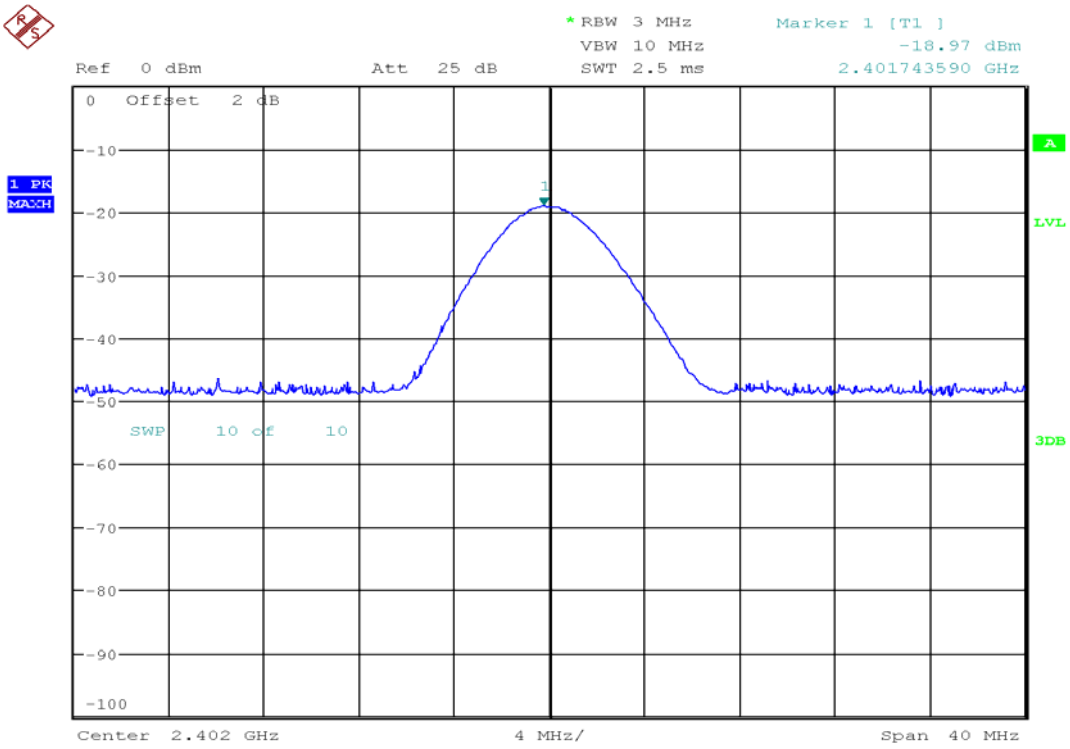


Highest Channel(operating at 2480 MHz)

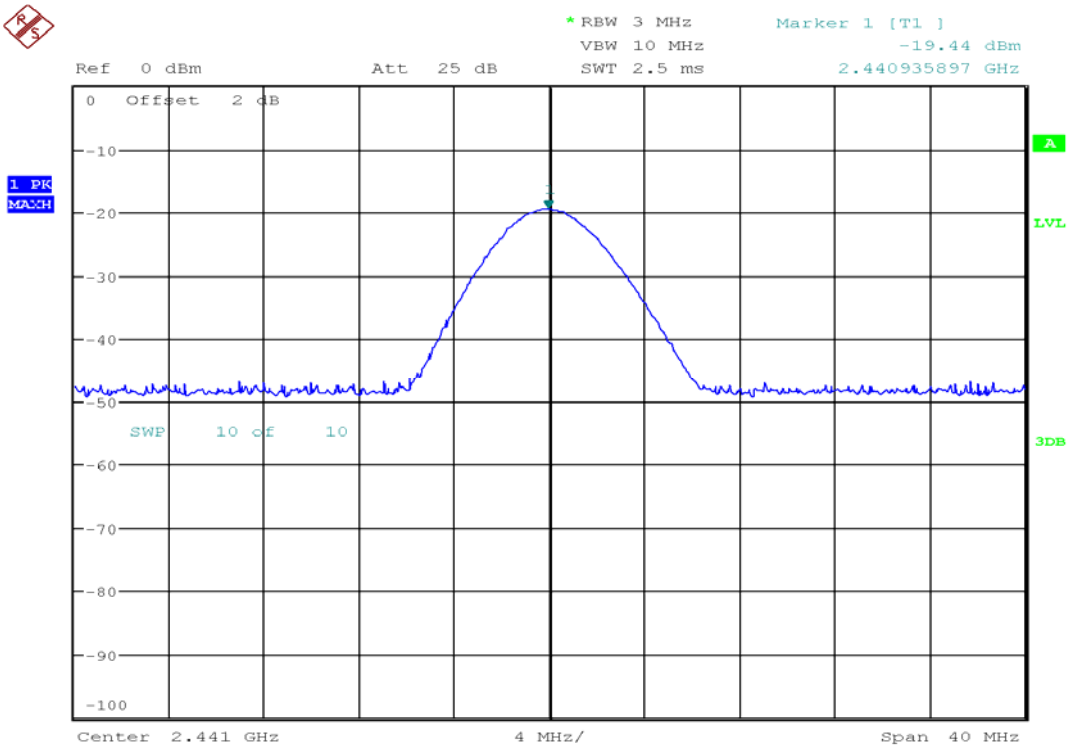


Bluetooth_8DPSK(3-DH5)

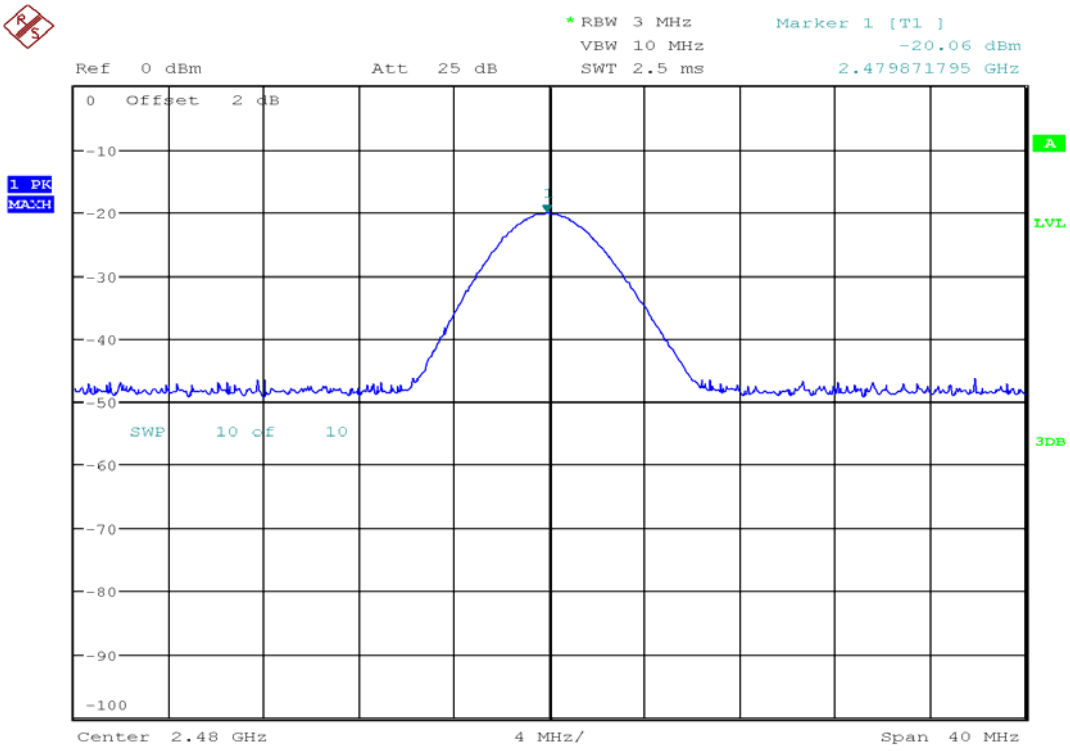
Lowest Channel(operating at 2402 MHz)



Middle Channel(operating at 2441 MHz)



Highest Channel(operating at 2480 MHz)



5.8 Antenna requirement

5.8.1 Regulation

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.24

5.8.2 Antenna connected construction

The antenna types used in this product are integral antenna.

Chip antenna(gain : 1.99 dBi)

5.9 RF exposure

No SAR Evaluation required if power is below the following threshold : Bluetooth

Bluetooth Tunable range			
F(GHz) Low	**F(GHz) High**	**Center of tunable band (GHz)**	**60/f SAR Limitation (mW)**
2.402	2.480	2.441	24.58

Maximum measured transmitter power :

Pout Conducted (dBm)	Pout Conducted (mW)	Maximum Antenna Gain (dBi)	Pout EIRP(mW)
2.24	1.67	1.99	2.64 mW

Conclusion : No SAR evaluation required since maximum transmitter pout(both conducted and EIRP) is below FCC threshold