Test Report

FCC ID: 2AKRJ-U1GOM

Date of issue: Dec. 26, 2016

Sample Description:	Bluetooth Wireless Earbuds
Model(s):	HeyGears U1 GO
Applicant:	GuangZhou HeyGears Technology Ltd.
Address:	Apt.4102, Union Town, NO.379, Zhongshan Road Centarl, Tianhe District, Guangzhou City, Guangdong Province, China
Date of Test:	Dec. 20, 2016 to Dec. 26, 2016

Shenzhen Microtest Co., Ltd.
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Address: No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China

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Test Result Certification	
Applicant's name:	**GuangZhou HeyGears Technology Ltd.**
Address:	Apt.4102, Union Town, NO.379, Zhongshan Road Centarl, Tianhe District, Guangzhou City, Guangdong Province, China
Manufacture's Name:	**GuangZhou HeyGears Technology Ltd.**
Address:	Apt.4102, Union Town, NO.379, Zhongshan Road Centarl, Tianhe District, Guangzhou City, Guangdong Province, China
Product name:	Bluetooth Wireless Earbuds
Trademark:	**Heygears**
Model name:	HeyGears U1 GO
Standards:	FCC Part 15.247
Test Procedure:	ANSI C63.10-2013 FCC public notice DA 00-705

This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

Tested by:	David Chen
	David Chen Dec. 26, 2016
Reviewed by:	Leon Chen
	Leon Chen Dec. 26, 2016
Approved by:	Ares Liu
	Ares Liu Dec. 26, 2016

Summary of Test Result

Item	FCC Part No.	Description of Test	Result
1	15.203	Antenna requirement	Pass
2	15.207	AC power line conducted emission	Pass
3	15.247(b)(1)	Peak output power	Pass
4	15.247(a)(1)	20dB emission bandwidth	Pass
5	15.247(a)(1)	Carrier frequency separation	Pass
6	15.247(a)1	Number of hopping channel	Pass
7	15.247(a)(1)	Time of occupancy (dwell time)	Pass
8	15.247(d)	Band edge spurious emission, conducted spurious emission	Pass
9	15.247(d), 15.205, 15.209	Radiated emission	Pass

1 General description

1.1 Feature of equipment under test (EUT)

Product name:	Bluetooth Wireless Earbuds
Model name:	HeyGears U1 GO
Tx/Rx frequency range:	Tx/Rx: 2402MHz~2480MHz
Bluetooth version:	V4.0 Dual-mode
Modulation Type:	GFSK, π/4-DQPSK, 8DPSK
Power Source:	DC 3.7V from Li-ion battery
Antenna Designation:	Integral antenna (Antenna Gain: -6dBi)
Remark:	2, The EUT supports Bluetooth classic rate / EDR and low energy operation, this report is for classic rate / EDR mode. For low energy mode, please refers to the report number MTi161219E066.

1.2 Operation channel list

Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz
1	2403MHz	21	2423MHz	41	2443MHz
---	---	---	---	---	---
---	---	---	---	---	---
18	2420MHz	38	2440MHz	77	2479MHz
19	2421MHz	39	2441MHz	78	2480MHz

1.3 Test Frequency Channel

Low	2402MHz
Middle	2441MHz
High	2480MHz

1.4 EUT operation mode

During testing, RF test program provided by the manufacture to control the Tx operation followed the test requirement.

1.5 Test conditions

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 20ºC~30ºC
- Humidity: 30%~70%
- Atmospheric pressure: 98kPa~101kPa

1.6 Ancillary equipment list

Equipment	Model	S/N	Manufacturer	Certificate type
Adapter	HW-050200U01	/	HUAWEI	FCC VOC

1.7 Measurement uncertainty

Measurement Uncertainty for a Level of Confidence of 95 %, U=2xUc(y)

RF frequency	1 x 10-7
RF power, conducted	± 1 dB
Conducted emission(150kHz~30MHz)	± 2.5 dB
Radiated emission(30MHz~1GHz)	± 4.2 dB
Radiated emission (above 1GHz)	± 4.3 dB
Temperature	±1 degree
Humidity	± 5 %

2 Testing site

Test Site	Shenzhen Toby Technology Co., Ltd.
Test Site Location	1 A/F., Bldg.6, Yusheng Industrial Zone The National Road No.107 Xixiang Section 467, Shenzhen, Guangdong, China
FCC Registration No.:	811562
CNAS Registration No.:	CNAS L5813

3 List of test equipment

For AC power line conducted emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
LISN	R&S	ENV216	101313	2017.12.06
LISN	SCHWARZBECK	NNLK 8129	8129245	2017.12.25
Pulse Limiter	SCHWARZBECK	VTSD 9561F	9716	2017.12.25
Test Cable	N/A	N/A	C01	2017.12.06
EMI Test Receiver	R&S	ESCI	101160	2017.12.06

For Radiated emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3058	2017.12.11
Horn Antenna	Schwarzbeck	BBHA 9120D	631	2017.12.05
Horn Antenna	Schwarzbeck	BBHA 9170	373	2017.12.05
Test Cable	United Microwave	57793	1m	2017.12.05
Test Cable	United Microwave	A30A30-5006	10m	2017.12.05
Microwave Pre-amplifier	Agilent	8449B	3008A01714	2017.12.05
Pre-Amplifier	Anritsu	MH648A	M09961	2017.12.05
EMI Test Receiver	R&S	ESCI-7	101318	2017.12.05
Spctrum analyzer	Agient	E4470B	MY41441082	2017.06.01

For RF conducted emission:

Equipment	Manufacturer	Model	Serial No.	Calibration Due
EMI Test Receiver	R&S	ESCI	101160	2017.12.06

Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

4 Test Result

4.1 Antenna requirement

4.1.1 Requirement defined in FCC 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

4.1.2 EUT antenna description

The Bluetooth antenna of EUT is an internal permanently attached antenna (PCB antenna), the maximum gain is -6dBi. So the antenna meets the requirement of this part.

4.2 Peak output power

4.3.1 Limits

Conducted peak output power limit is 125mW (21dBm)

4.3.2 Test Method

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

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission.

4.3.3 Test Result

GFSK

Frequency (MHz)	Peak output power (dBm)	Limit (dBm)
2402	7.05	21
2441	7.29	21
2480	7.71	21

π/4-DQPSK

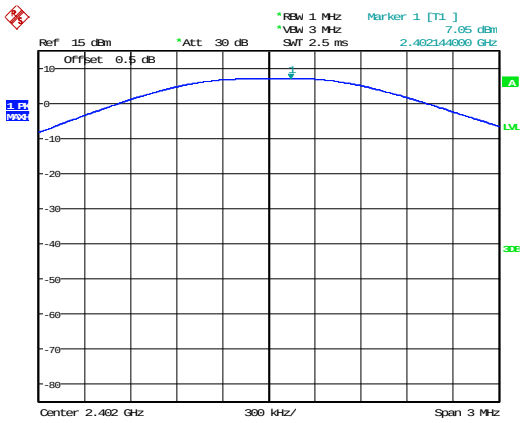
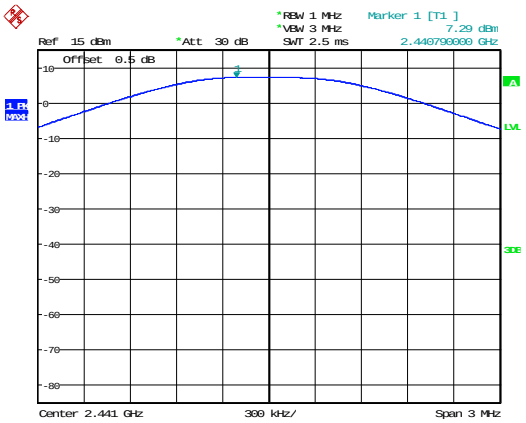
Frequency (MHz)	Peak output power (dBm)	Limit (dBm)
2402	4.11	21
2441	6.05	21
2480	6.64	21

8DPSK

Frequency (MHz)	Peak output power (dBm)	Limit (dBm)
2402	4.51	21
2441	6.27	21
2480	6.82	21

Test plots as below

GFSK

2402MHz

2441MHz

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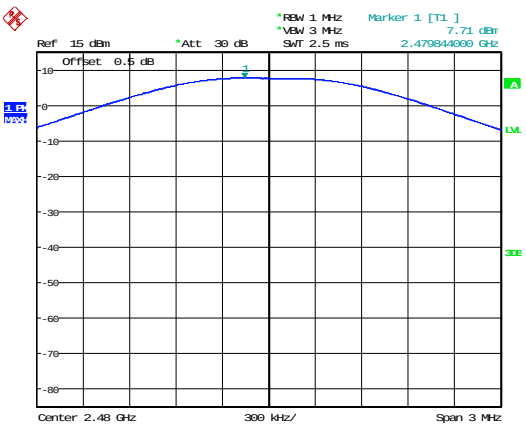
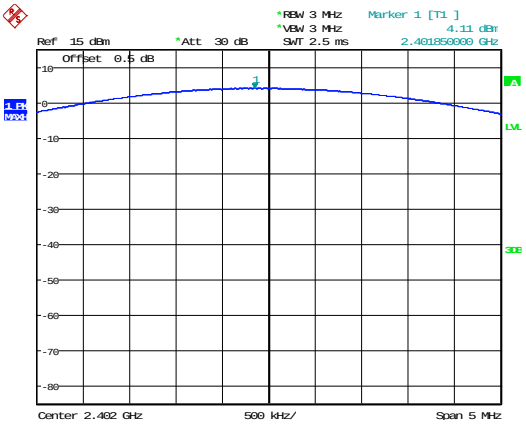


π /4-DQPSK

2402MHz

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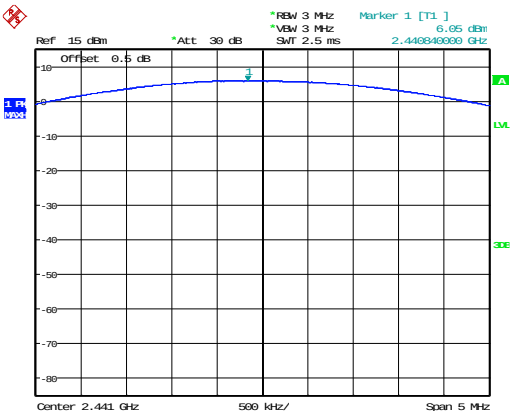
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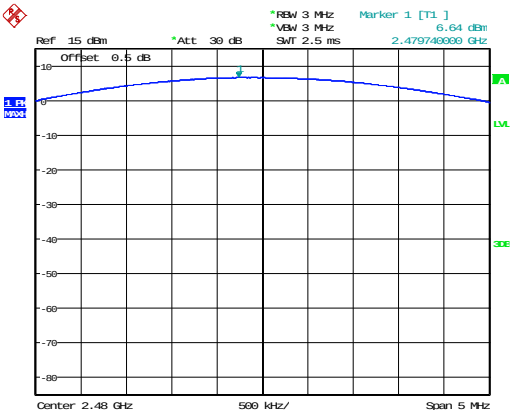
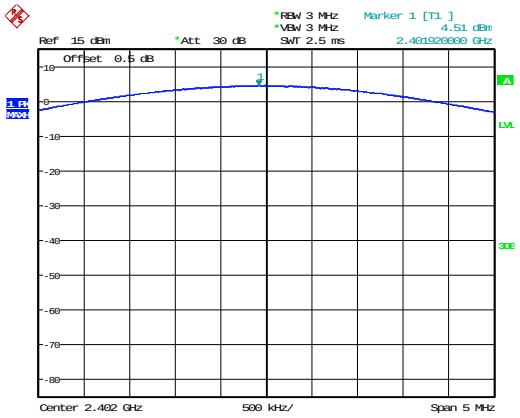


8DPSK

2402MHz

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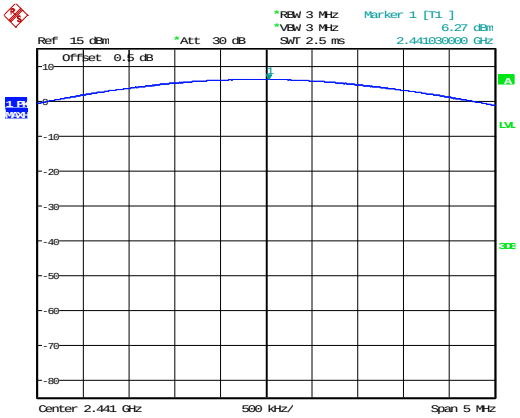
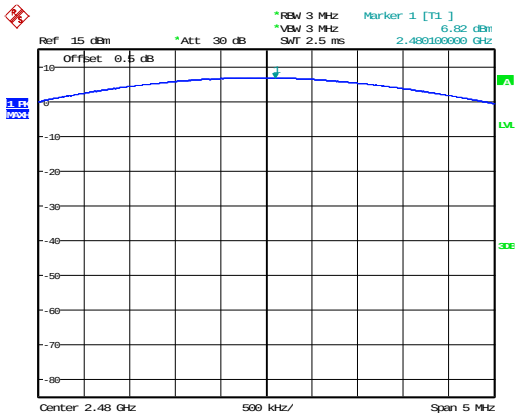

2480MHz


4.3 20dB emission bandwidth

4.4.1 Test method

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥ 1% of the 20 dB bandwidth
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

4.4.2 Test result

GFSK

Frequency (MHz)	20dB emission bandwidth (MHz)
2402	0.836
2441	0.808
2480	0.812

π/4-DQPSK

Frequency (MHz)	20dB emission bandwidth (MHz)
2402	1.22
2441	1.22
2480	1.22

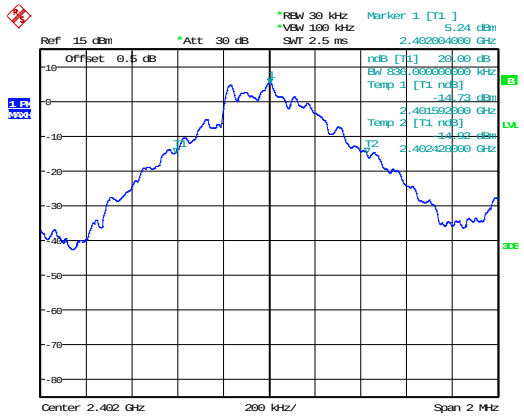
8DPSK

Frequency (MHz)	20dB emission bandwidth (MHz)
2402	1.208
2441	1.208
2480	1.212

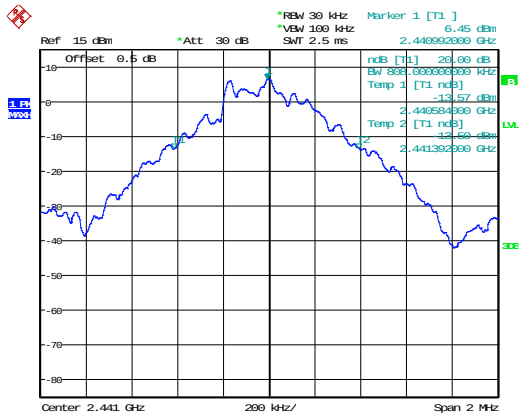
Test plots as below

GFSK

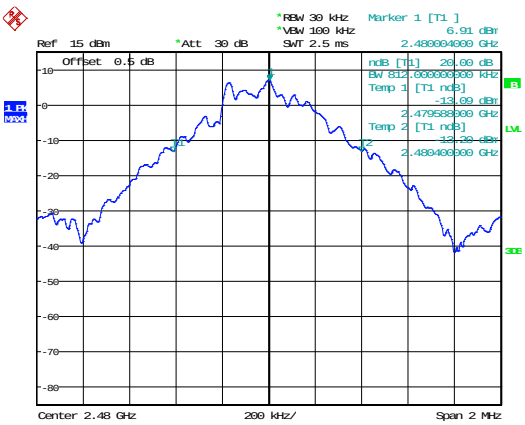
2402MHz



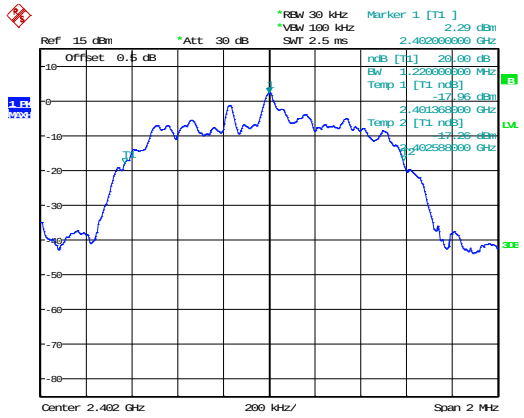
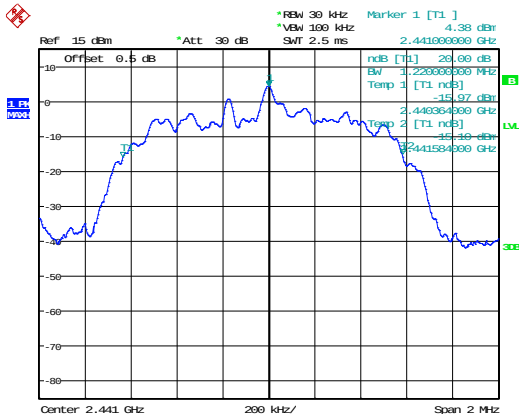
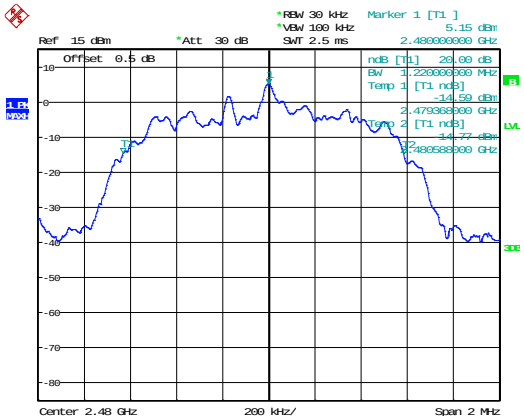
2441MHz



2480MHz

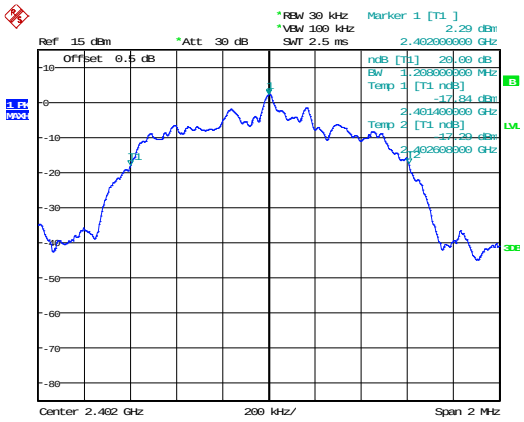


π/4-DQPSK

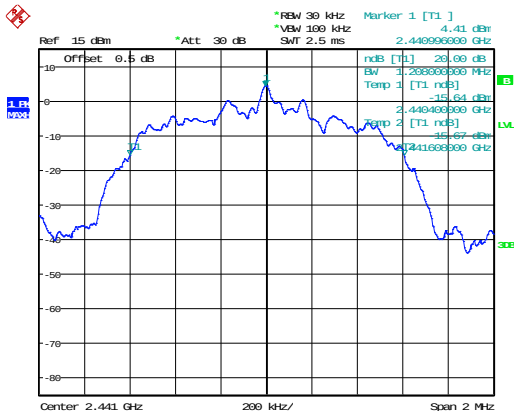
2402MHz

2441MHz

2480MHz


8DPSK

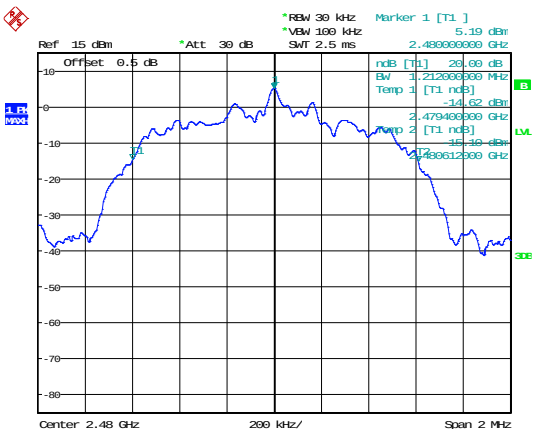
2402MHz



2441MHz



2480MHz



4.4 Carrier frequency separation

4.5.1 Limits

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

4.5.2 Test method

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels
Resolution (or IF) Bandwidth (RBW) ≥1% of the span
Video Bandwidth (VBW) ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

4.5.3 Test result

GFSK

Channels (MHz)	Separation (MHz)	Limit (MHz)
2402-2403	1.002	0.765
2441-2442	1.002	0.762
2479-2480	1.002	0.766

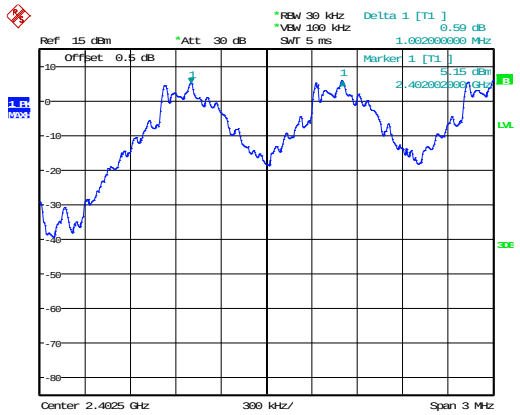
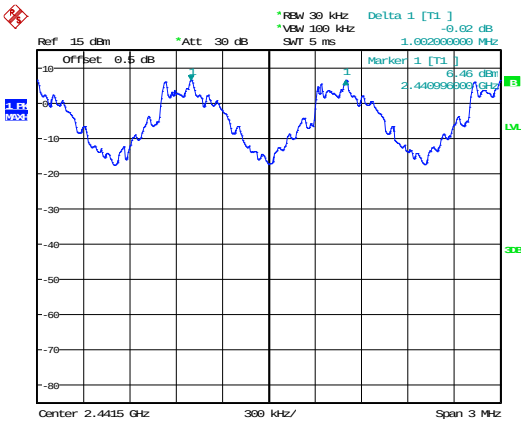
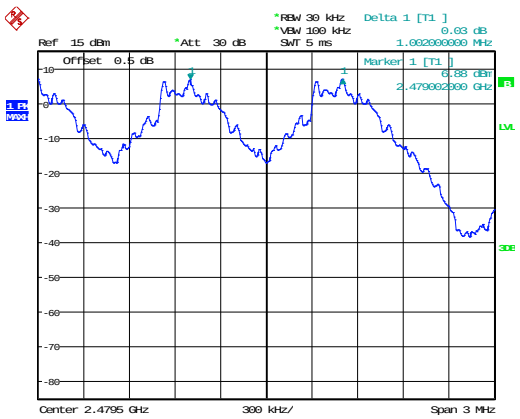
π/4-DQPSK

Channels (MHz)	Separation (MHz)	Limit (MHz)
2402-2403	1.002	0.950
2441-2442	1.002	0.953
2479-2480	1.002	0.953

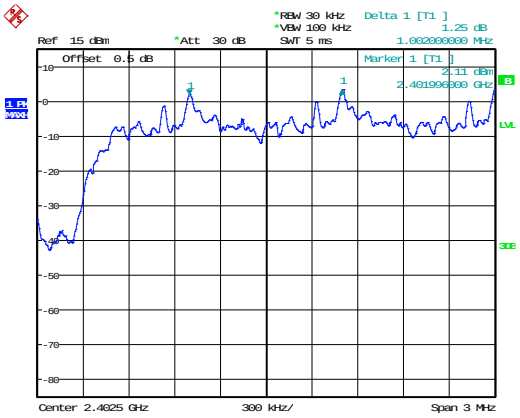
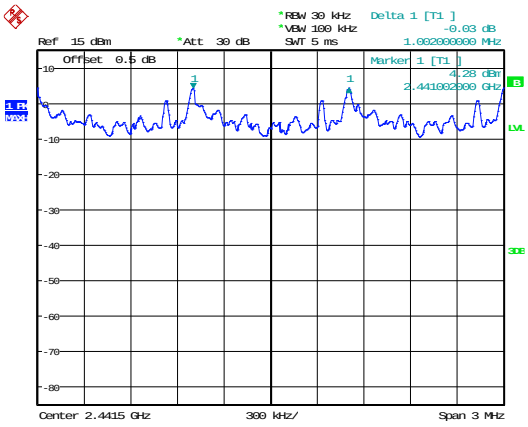
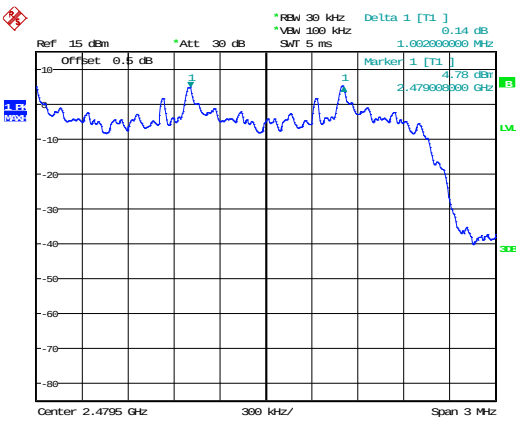
8DPSK

Channels (MHz)	Separation (MHz)	Limit (MHz)
2402-2403	1.002	0.963
2441-2442	1.002	0.962
2479-2480	1.002	0.965

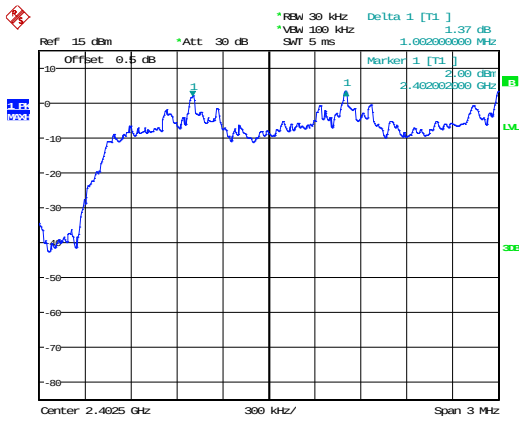
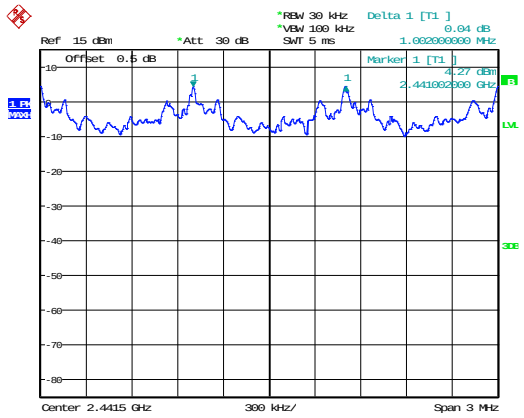
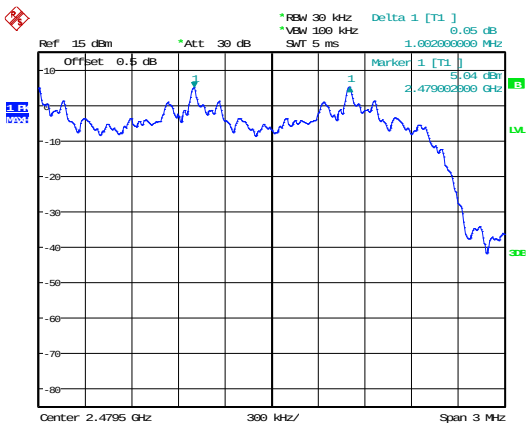
GFSK

2402MHz~2403MHz

2441MHz~2442MHz

2479MHz~2480MHz


π/4-DQPSK

2402MHz~2403MHz

2441MHz~2442MHz

2479MHz~2480MHz


8DPSK

2402MHz~2403MHz

2441MHz~2442MHz

2479MHz~2480MHz


4.5 Number of hopping channel

4.6.1 Limits

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

4.6.2 Test method

The EUT must have its hopping function enabled. Use the following spectrum analyser settings:

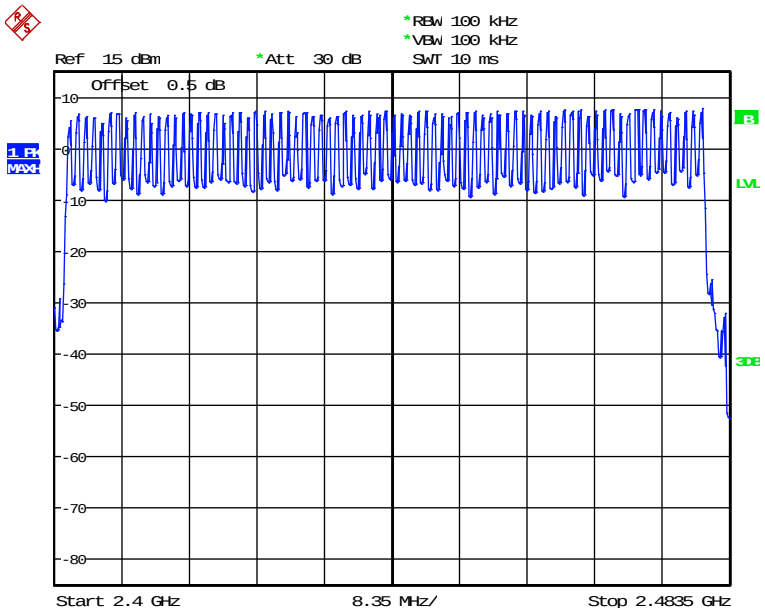
Span = the frequency band of operation
RBW ≥ 1% of the span
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

Allow the trace to stabilize. It

4.6.3 Test Result

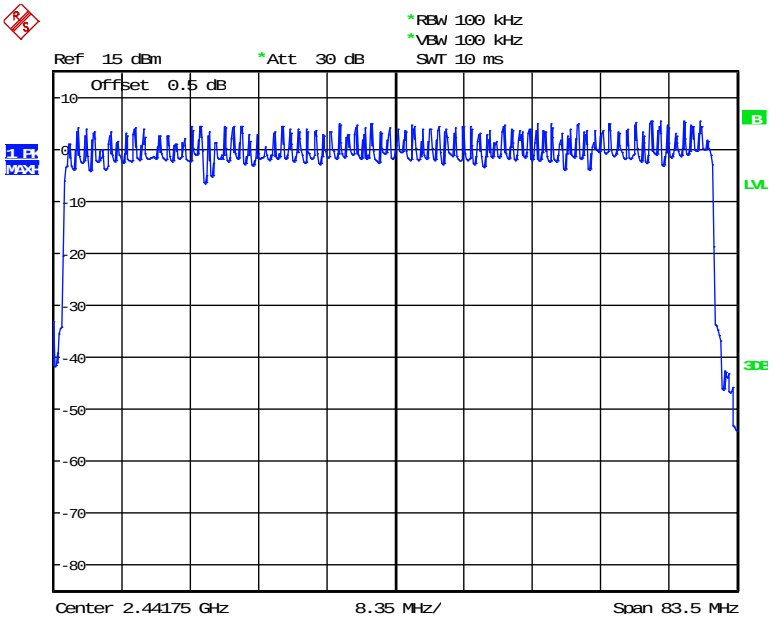
GFSK

Number of hopping channels	79



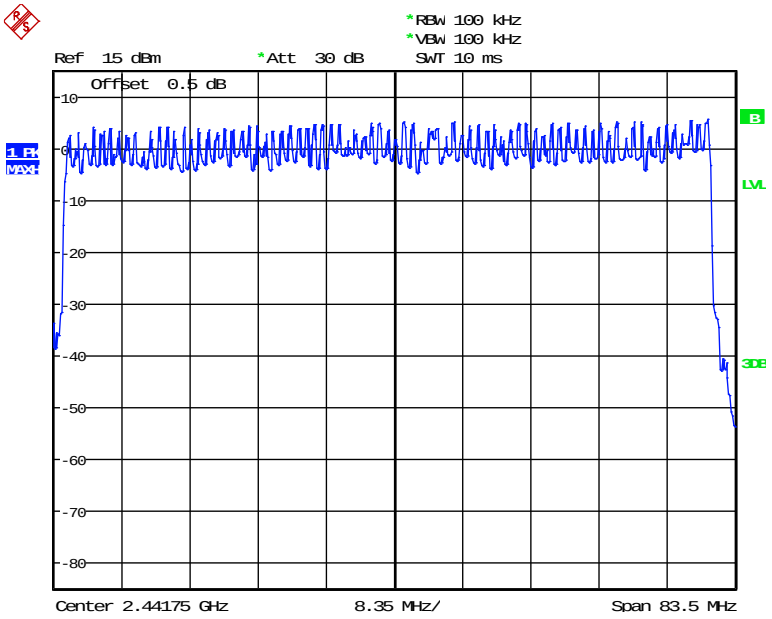
π/4-DQPSK

Number of hopping channels	79



8DPSK

Number of hopping channels	79



4.6 Time of occupancy (dwell time)

4.7.1 Limit

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 channels employed.

4.7.2 Test method

The EUT must have its hopping function enabled. Use the following spectrum analyser settings:

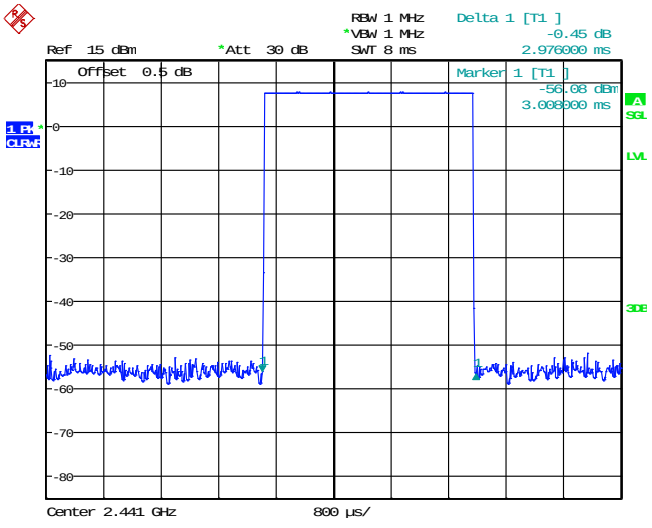
Span = zero span, centered on a hopping channel
RBW = 1 MHz
VBW ≥RBW
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace = max hold

Use the marker-delta function to determine the dwell time.

4.7.3 Test Result

GFSK

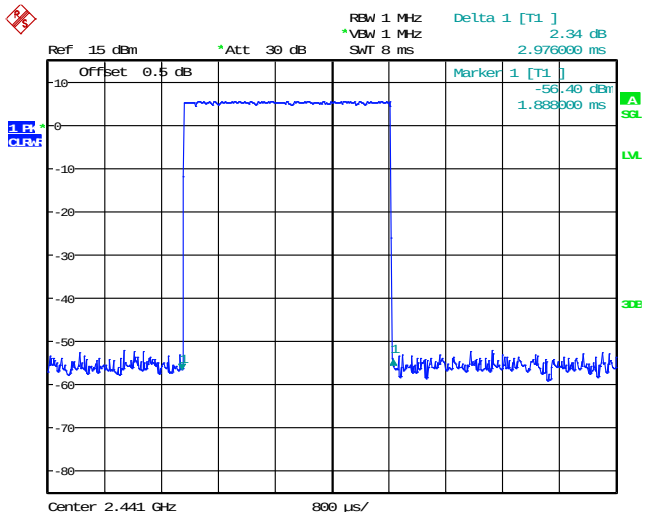
Packet type	Pulse Duration (ms)	Dwell time (s)	Limit (s)
DH5	2.976	0.317	0.4



Note: for the worst mode of DH5 packet type, in normal hopping mode, hopping rate is 1600hops/s with 6 slots in 79 hopping channel

π/4-DQPSK

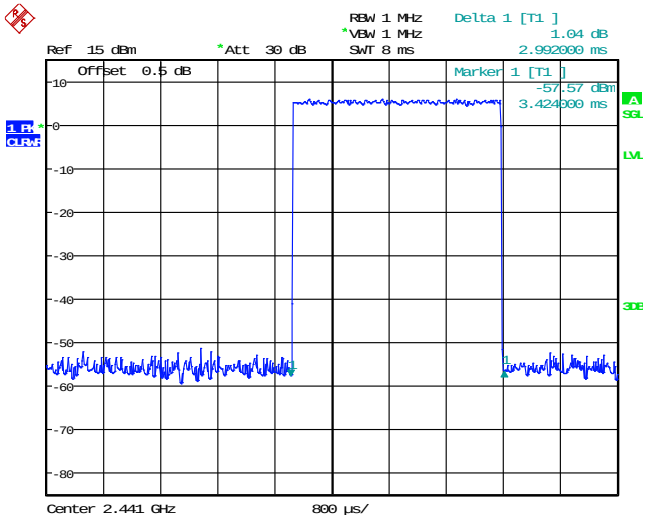
Packet type	Pulse Duration (ms)	Dwell time (s)	Limit (s)
DH5	2.976	0.317	0.4



Note: for the worst mode of DH5 packet type, in normal hopping mode, hopping rate is 1600hops/s with 6 slots in 79 hopping channel

8DPSK

Packet type	Pulse Duration (ms)	Dwell time (s)	Limit (s)
DH5	2.992	0.319	0.4



Note: for the worst mode of DH5 packet type, in normal hopping mode, hopping rate is 1600hops/s with 6 slots in 79 hopping channel

4.7 Band edge emission

4.8.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

4.8.2 Test method

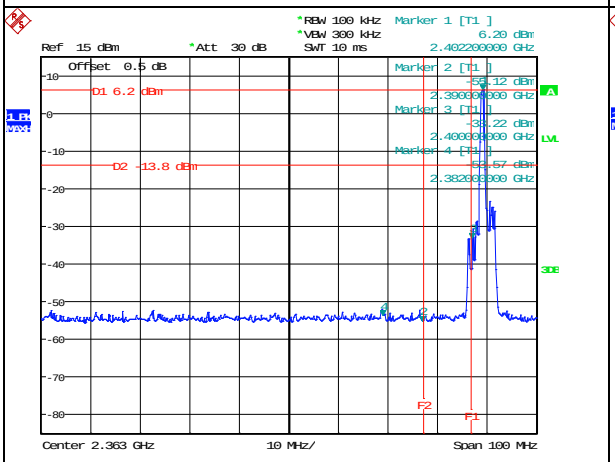
Use the following spectrum analyser settings:

Set RBW=100 kHz. VBW≥3RBW. Detector =peak, Sweep time = auto couple, Trace mode = max hold.

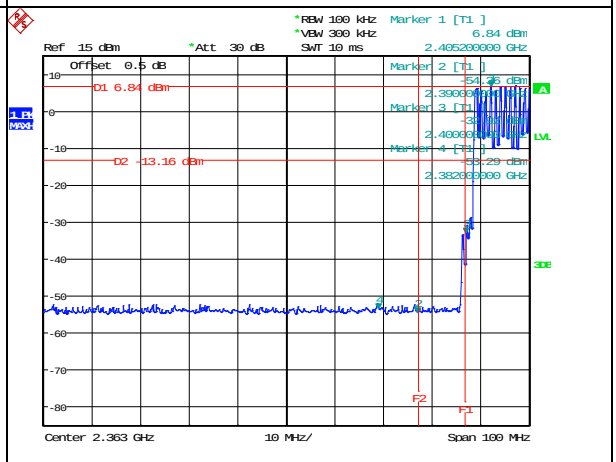
4.8.3 Test Result

Band edge (GFSK mode)

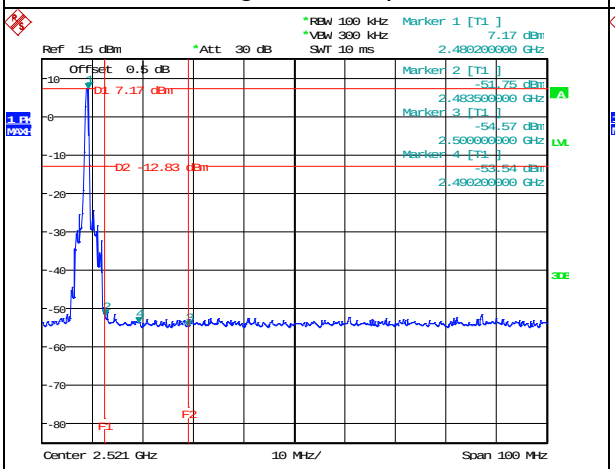
Left – no hop



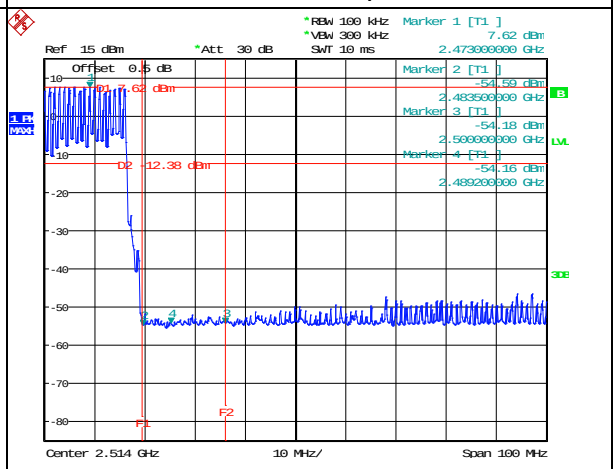
Left – hop



Right – no hop

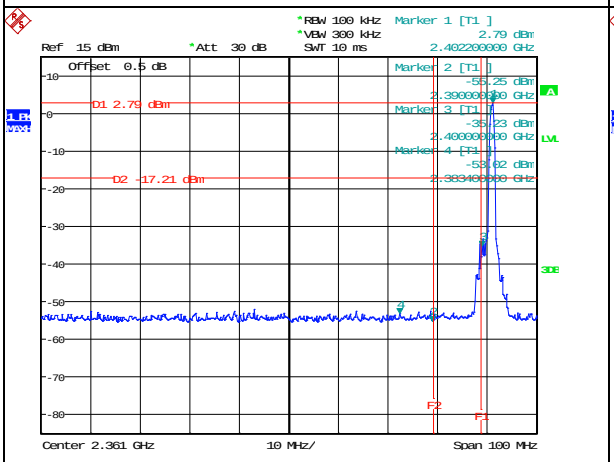


2480 – hop

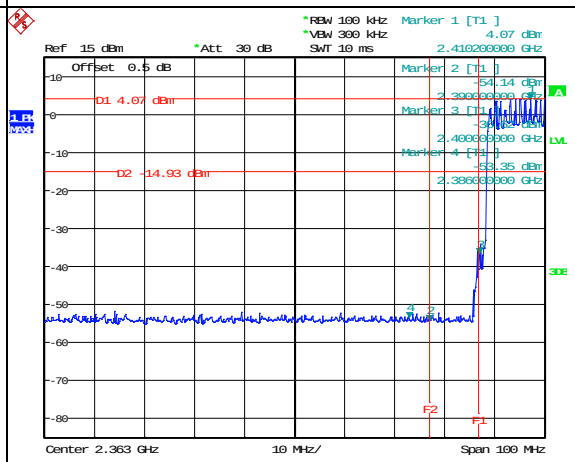


Band edge (π/4-DQPSK mode)

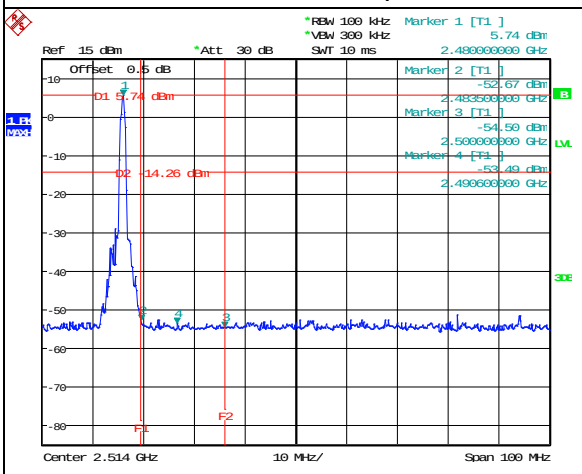
2402MHz – no hop



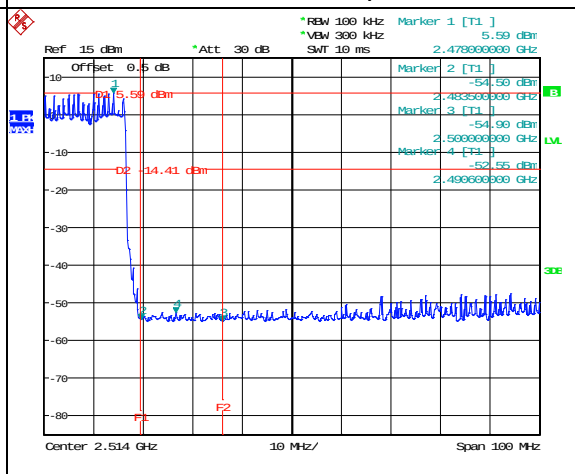
2402MHz – hop



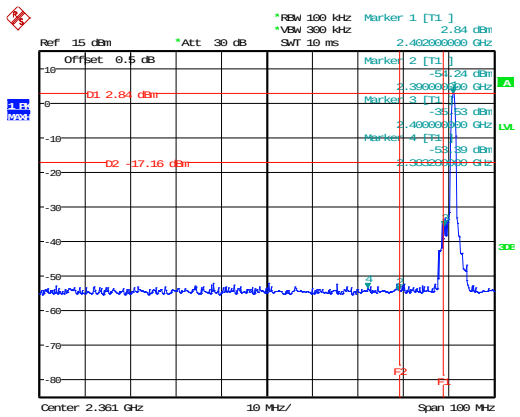
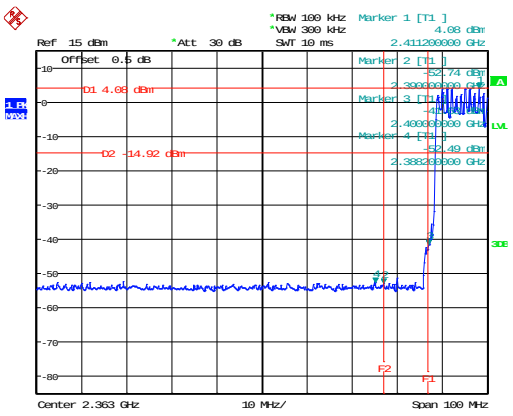
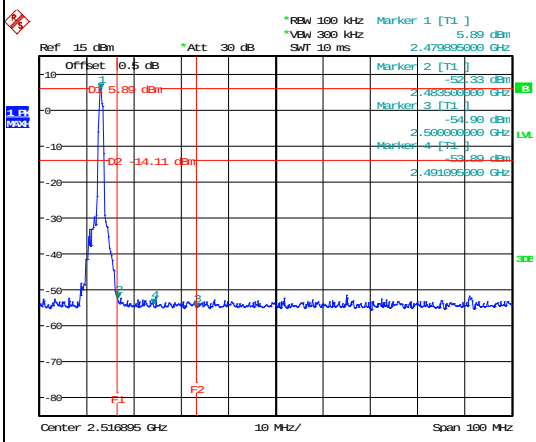
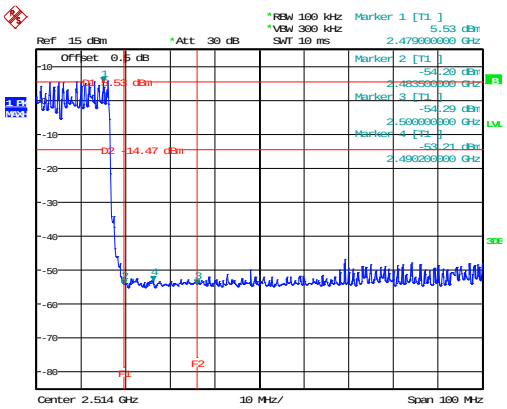
2480 – no hop



2480 – hop



Band edge (8DPSK mode)

2402MHz – no hop	2402MHz – hop
	
2480 – no hop	**2480 – hop**
	

4.8 Radiated emission

4.9.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Field strength μV/m	Field strength dBμV/m	Detector	Measurement distance
30-88	100	40	QP	3m
88-216	150	43.5	QP	
216-960	200	46	QP	
960-1000	500	46	QP	
Above 1000	500	54	AV	
Above 1000	5000	74	PK	

Restricted bands defined in FCC 15.205:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

4.9.2 Test method

1. The EUT is placed on a turntable, which is 0.8m above ground plane for test frequency range blew 1GHz, and 1.5m above ground plane for test frequency range above 1GHz.

2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.

3. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured, RBW = 1 MHz for f ≥ 1GHz, 100 kHz for f < 1 GHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold

4. Follow the guidelines in ANSI C63.4-2014 with respect to maximizing the emission by rotating the EUT, adjusting the measurement antenna height and polarization, etc. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, submit this data. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

5. The peak level, once corrected, must comply with the limit specified in Section 15.209. Set the RBW = 1MHz, VBW = 3MHz, Detector = RMS for AV value, while maintaining all of the other instrument settings.

4.9.3 Test Result

Radiated emission (GFSK mode)

Transmitter channel: 2402MHz					
Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
87.2	V	32.9	43.5	QP	Pass
87.2	H	31.8	43.5	QP	
2390	V	43.67	74	PK	
2390	H	41.05	74	PK	
4804	V	51.64	74	PK	
4804	H	50.73	74	PK	
Transmitter channel: 2441MHz					
Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
173.5	V	37.24	43.5	QP	
173.5	H	31.18	43.5	QP	
4882	V	51.35	74	PK	
4882	H	50.78	74	PK	
Transmitter channel: 2480MHz					
Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
146.8	V	34.76	40	QP	
146.8	H	29.65	40	QP	
2483.5	V	43.28	74	PK	
2483.5	H	42.47	74	PK	
4960	V	52.76	74	PK	
4960	H	51.38	74	PK	

Note:
If the PK measured values lower than average mode limit, the EUT shall be deemed to meet average limits and then no additional average mode measurement performed.
all three modes (GFSK, π/4-DQPSK and 8DPSK modes of EUT have been tested, only the data of worst case GFSK mode is reported.

----END OF REPORT----