FCC CERTIFICATION TEST REPORT

For

FCC ID: X5B-500137

IC:8814A-500137

Report Reference No.	:	19EFAB07001 0431
Date of issue	:	2019-7-15
Testing Laboratory	:	DongGuan ShuoXin Electronic Technology Co., Ltd.
Address	:	Zone A, 1F, No. 6, XinGang Road YuanGang Street, XinAn District, ChangAn Town, DongGuan City, GuangDong, China
Applicant's name	:	PERFORMANCE DESIGNED PRODUCTS, LLC
Address	:	2300 West Empire Avenue Suite 600 Burbank CA 91504
Manufacturer	:	PERFORMANCE DESIGNED PRODUCTS, LLC
Test specification:		
Test item description	:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch
Trade Mark	:	--
Model/Type reference	:	500-137
Ratings	:	I/P: DC 3.7V Li-ion Battery DC 5V From Switch Charging

Responsible Engineer :

Smile Wang

Smile Wang

Authorized Signatory:

King Wang

King Wang

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TEST REPORT DECLARE

Applicant	:	PERFORMANCE DESIGNED PRODUCTS, LLC
Address	:	2300 West Empire Avenue Suite 600 Burbank CA 91504
Equipment under Test	:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch
Model No	:	500-137
Manufacturer	:	PERFORMANCE DESIGNED PRODUCTS, LLC
Address	:	2300 West Empire Avenue Suite 600 Burbank CA 91504

Test Standard Used: FCC Rules and Regulations Part 15 Subpart C (15.247),RSS-247 Issue 2 February 2017

Test procedure used: ANSI C63.10:2013, 558074 D01 15.247 Meas Guidance v05,RSS-Gen Issue 5 March 2019

We Declare:

The equipment described above is tested by DongGuan ShuoXin Electronic Technology Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and DongGuan ShuoXin Electronic Technology Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC standards.

Report No:	19EFAB07001 0431		
Date of Test:	2019-6-28---2019-07-15	**Date of Report**:	2019-07-15

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of DongGuan ShuoXin Electronic Technology Co., Ltd.

1. SUMMARY OF TEST RESULTS

The EUT have been tested according to the applicable standards as referenced below.		
Description of Test Item	**Standard**	**Results**
Bandwidth	FCC Part 15: 15.247(a)(1) RSS-247 5.1(a) ,RSS-GEN 6.7	PASS
Carrier Frequency Separation Test	FCC Part 15: 15.247(a)(1) RSS-247 section 5.1(b)	PASS
Number Of Hopping Frequency	FCC Part 15: 15.247(a)(1)(iii) RSS-247 section 5.1(d)	PASS
Dwell Time Test	FCC Part 15: 15.247(a)(1)(iii) RSS-247 section 5.1(d)	PASS
Maximum Output Power	FCC Part 15: 15.247(b)(1) RSS-247 section 5.4(b)	PASS
Band Edge Emission	FCC Part 15: 15.247(d) RSS-247 section 5.5	PASS
Radiated Spurious Emissions	FCC Part 15.205 / 15.209 RSS-Gen section 8.9 8.10	PASS
Antenna requirement	FCC Part 15: 15.203 RSS-GEN section 6.8	PASS
Power Line Conducted Emission	FCC Part 15.207 RSS-Gen section 8.8	PASS
Frequency Stability	RSS-GEN section 6.11	PASS

2. GENERAL TEST INFORMATION

2.1. DESCRIPTION OF EUT

EUT* Name	:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch
Model Number	:	500-137
EUT function description	:	Please reference user manual of this device
Power supply	:	DC3.7V Li-ion Battery DC 5V Charging
Adaptor		N/A
Radio Technology	:	BT V5.0
Operation frequency	:	2402-2480MHz
Modulation	:	GFSK, π /4-DQPSK,8DPSK
Antenna Type	:	Internal Antenna, maximum PK gain: 1.6dBi
Date of Receipt	:	2019/07/05
Sample Type	:	Single production

2.2. ACCESSORIES OF EUT

Description of Accessories	Manufacturer	Model number or Type	Output.
/	/	/	/

2.3. ASSISTANT EQUIPMENT USED FOR TEST

Description of Assistant equipment	Manufacturer	Model number or Type	EMC Compliance	SN
/	/	/	/	/

2.4. BLOCK DIAGRAM OF EUT CONFIGURATION FOR TEST

EUT

EUT enters the engineering interface by clicking the system version ,control EUT work in Continuous TX mode, and select test channel, wireless mode and data rate.

Remark: GFSK,8DPSK, π /4DQPSK all these modulation all have been tested , GFSK is found as worst case and only reported for radiated emission.

Tested mode, channel, and data rate information			
Mode	data rate (Mpbs) (see Note)	Channel	Frequency (MHz)
GFSK	1	Low :CH0	2402
	1	Middle: CH39	2441
	1	High: CH78	2480
π /4DQPSK	2	Low :CH0	2402
	2	Middle: CH39	2441
	2	High: CH78	2480
8DPSK	3	Low :CH0	2402
	3	Middle: CH39	2441
	3	High: CH78	2480
Note: According exploratory test, EUT will have maximum output power in those data rate, so those data rate were used for all test.			

2.5. TEST ENVIRONMENT CONDITIONS

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

Temperature range:	21-25℃
Humidity range:	40-75%
Pressure range:	86-106kPa

2.6. MEASUREMENT UNCERTAINTY

Test Item	Uncertainty
Uncertainty for Conduction emission test (9kHz-150kHz)	3.7 dB
Uncertainty for Conduction emission test (150kHz-30MHz)	3.3 dB
Uncertainty for Radiation Emission test (30MHz-200MHz)	4.60 dB (Polarize: V)
	4.60 dB (Polarize: H)
Uncertainty for Radiation Emission test (200MHz-1GHz)	6.10 dB (Polarize: V)
	5.08 dB (Polarize: H)
Uncertainty for Radiation Emission test (1GHz-6GHz)	5.01 dB (Polarize: V)
	5.01 dB (Polarize: H)
Uncertainty for Radiation Emission test (6GHz-18GHz)	5.26 dB (Polarize: V)
	5.26 dB (Polarize: H)
Uncertainty for Radiation Emission test (18GHz-40GHz)	5.06 dB (Polarize: V)
	5.06 dB (Polarize: H)
Uncertainty for radio frequency	±0.048kHz
Uncertainty for conducted RF Power	±0.32dB

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

2.7. TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

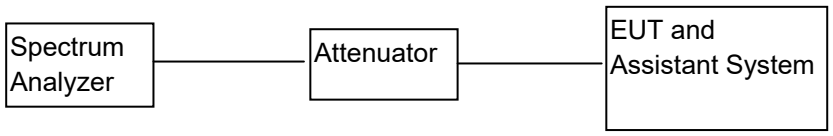
Test Software Version	Cybluetool(V0.1.55.1)		
Frequency (MHz)	2402	2441	2480
Power Parameters (GFSK)	default	default	default
Power Parameters (π/4-DQPSK)	default	default	default
Power Parameters (8DPSK)	default	default	default

3. 20dB BANDWIDTH &99% BANDWIDTH

3.1. TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2020/05/27	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2019/12/16	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2019/12/16	1 Year

3.2. BLOCK DIAGRAM OF TEST SETUP



3.3. LIMITS

No limit requirement.

3.4. TEST PROCEDURE

(1) Configure EUT and assistant system according clause 2.4 and 3.2.

(2) Connect EUT's antenna output to spectrum analyzer by RF cable.

(3) Configure EUT work in test mode as stated in clause 2.4.

(4) Set the spectrum analyzer as follows:

RBW:	30KHz
VBW:	100KHz
Detector Mode:	Peak
Sweep time:	auto
Trace mode:	Max hold

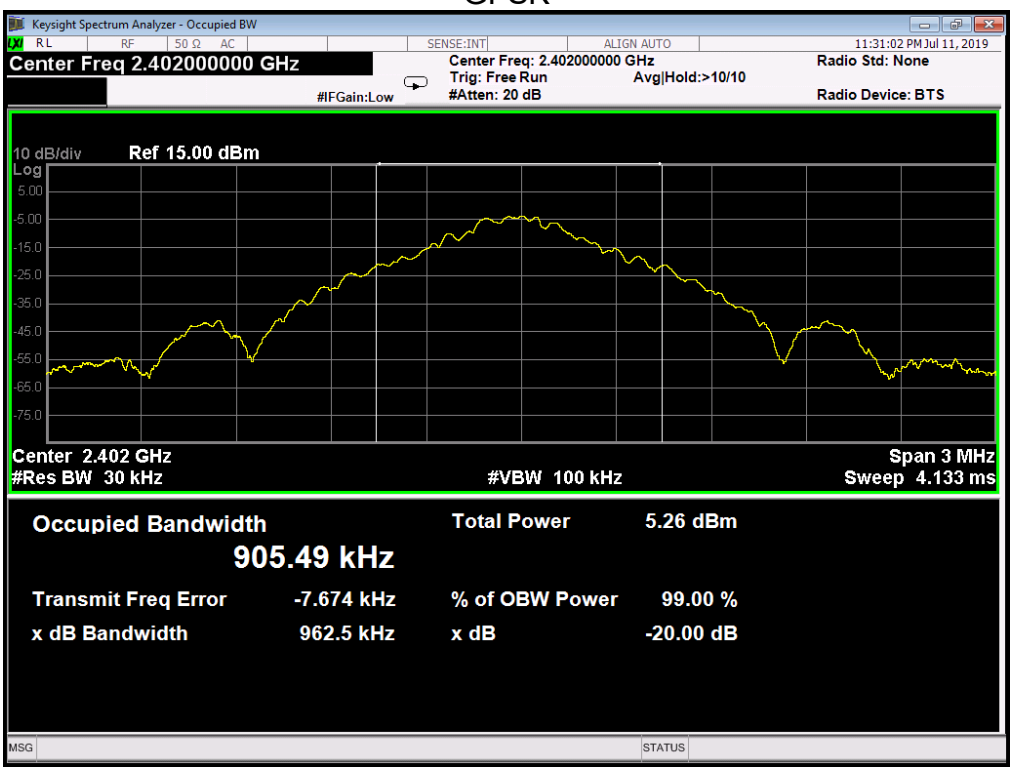
(5) Allow the trace to stabilize, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB and 99% bandwidth relative to the maximum level measured in the fundamental emission.

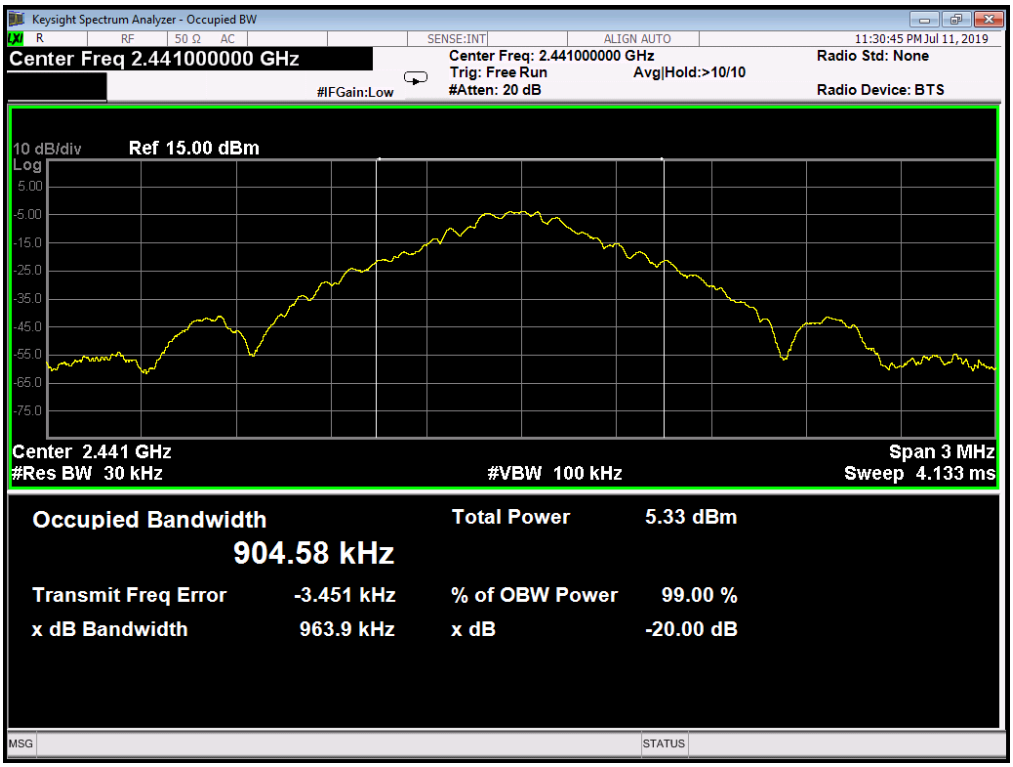
3.5. TEST RESULT

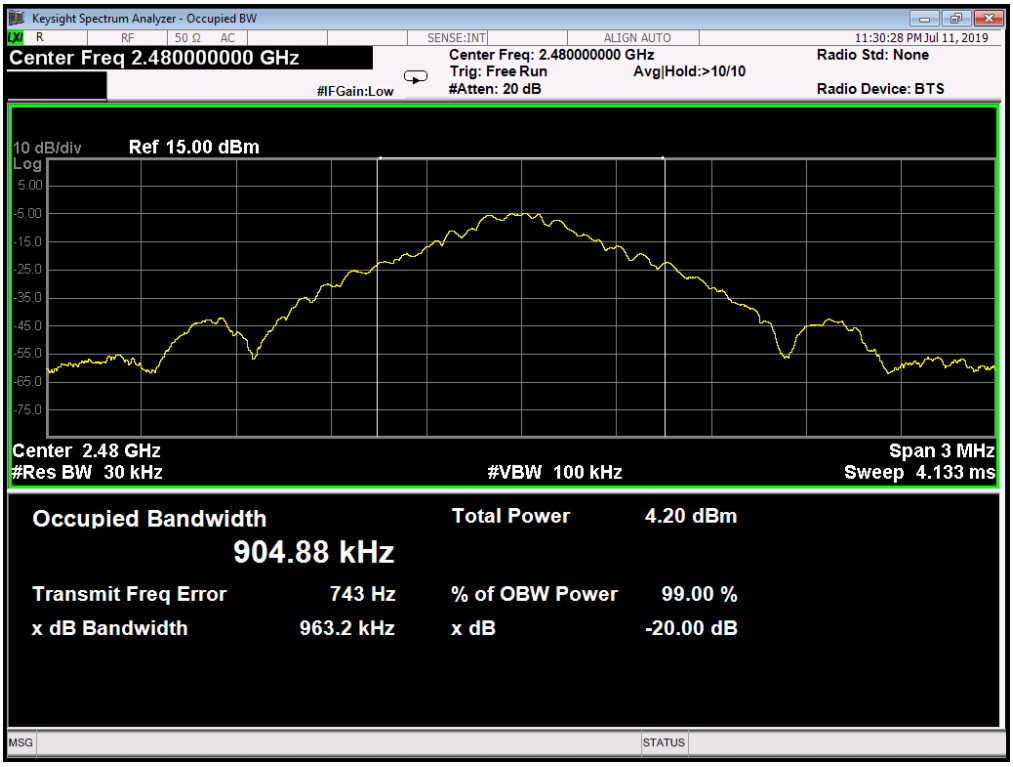
Mode	Freq (MHz)	20dB (MHz)	99%OBW (MHz)	Conclusion
GFSK	2402	0.96	0.91	PASS
	2441	0.96	0.90	PASS
	2480	0.96	0.90	PASS
π/4DQPSK	2402	1.39	1.23	PASS
	2441	1.39	1.23	PASS
	2480	1.39	1.23	PASS
8DPSK	2402	1.38	1.24	PASS
	2441	1.38	1.24	PASS
	2480	1.38	1.24	PASS

3.6. ORIGINAL TEST DATA

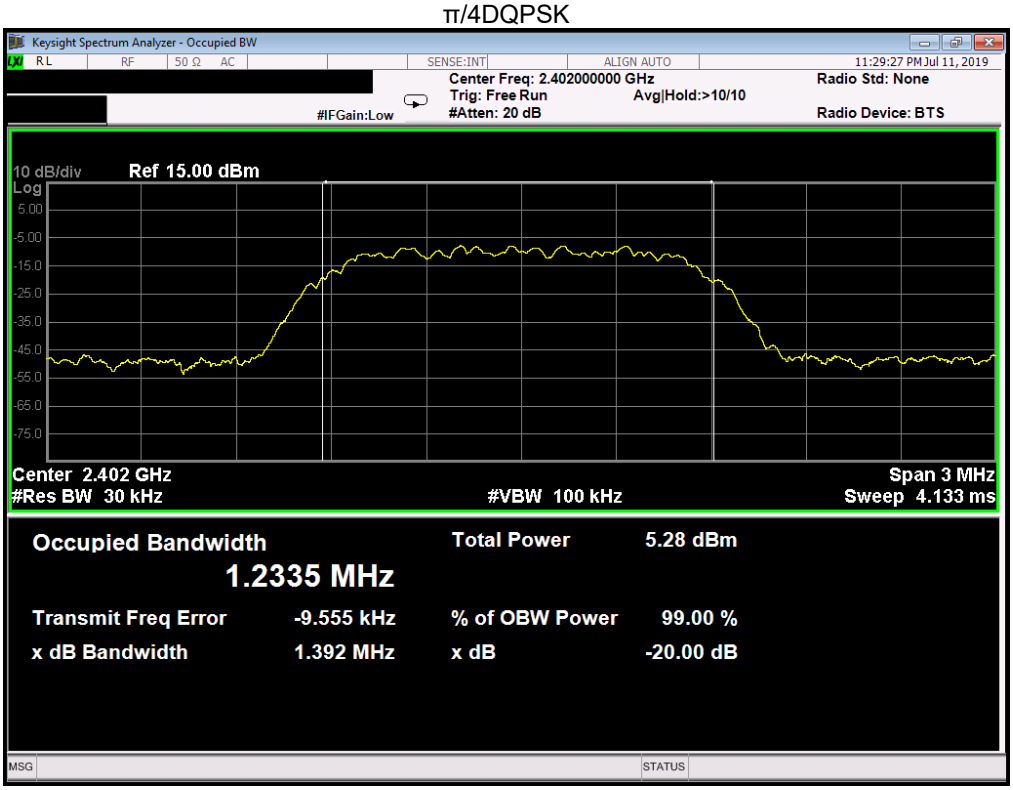
GFSK

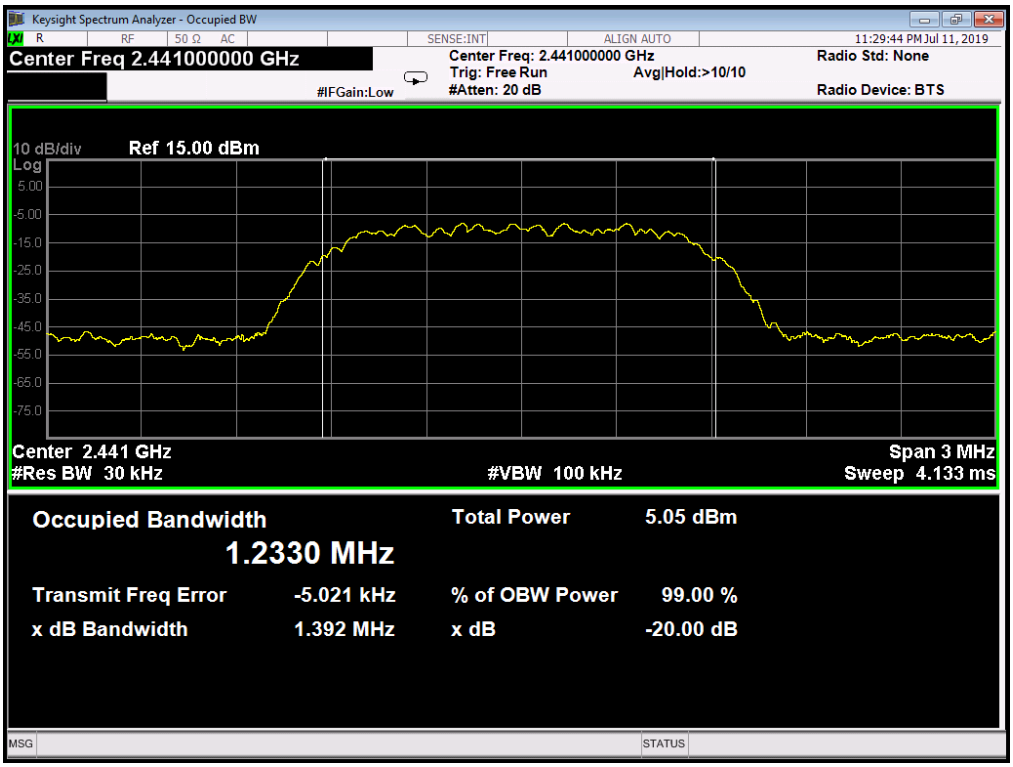


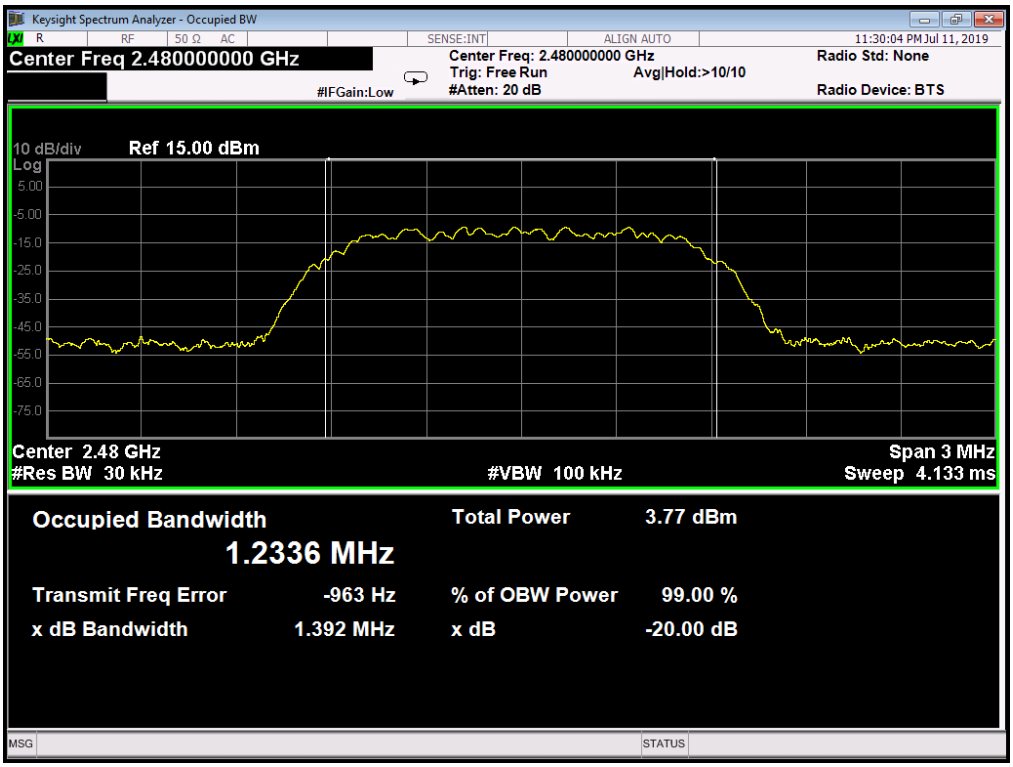

Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
11:30:45 PM Jul 11, 2019
10 dB/div
Log
Ref 15.00 dBm
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 4.133 ms
Occupied Bandwidth
904.58 kHz
Total Power 5.33 dBm
Transmit Freq Error -3.451 kHz
% of OBW Power 99.00 %
x dB Bandwidth 963.9 kHz
x dB -20.00 dB
MSG
STATUS


Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
11:30:28 PM Jul 11, 2019
10 dB/div
Log
Ref 15.00 dBm
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 4.133 ms
Occupied Bandwidth
904.88 kHz
Total Power 4.20 dBm
Transmit Freq Error 743 Hz
% of OBW Power 99.00 %
x dB Bandwidth 963.2 kHz
x dB -20.00 dB
MSG
STATUS

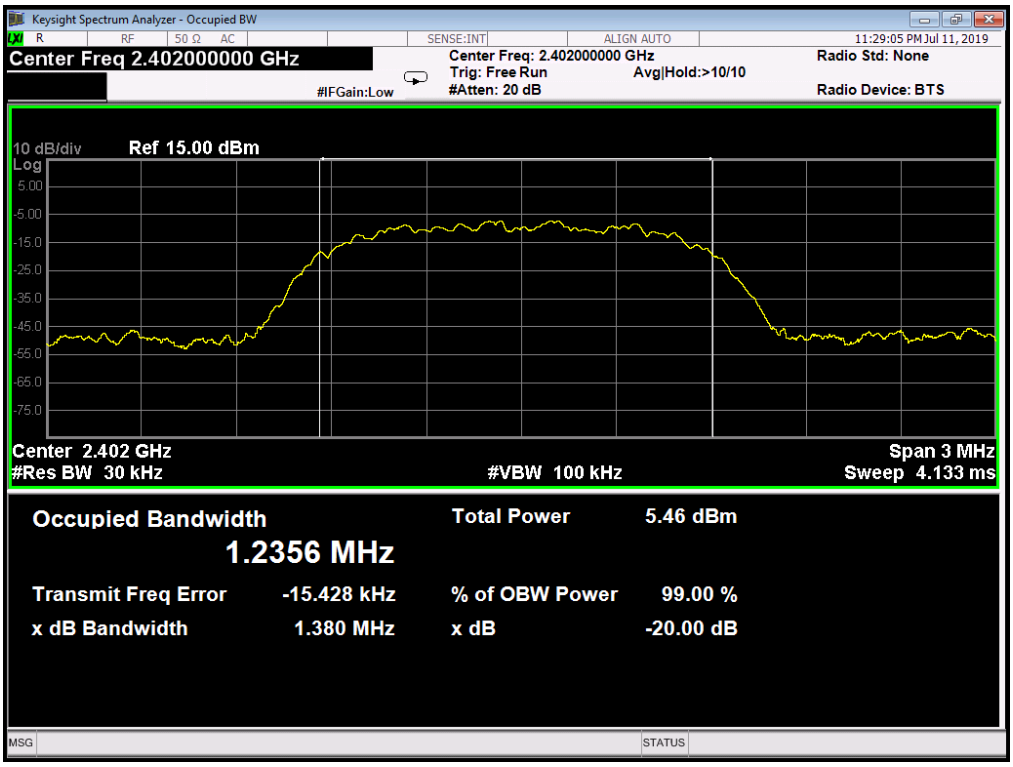
π/4DQPSK

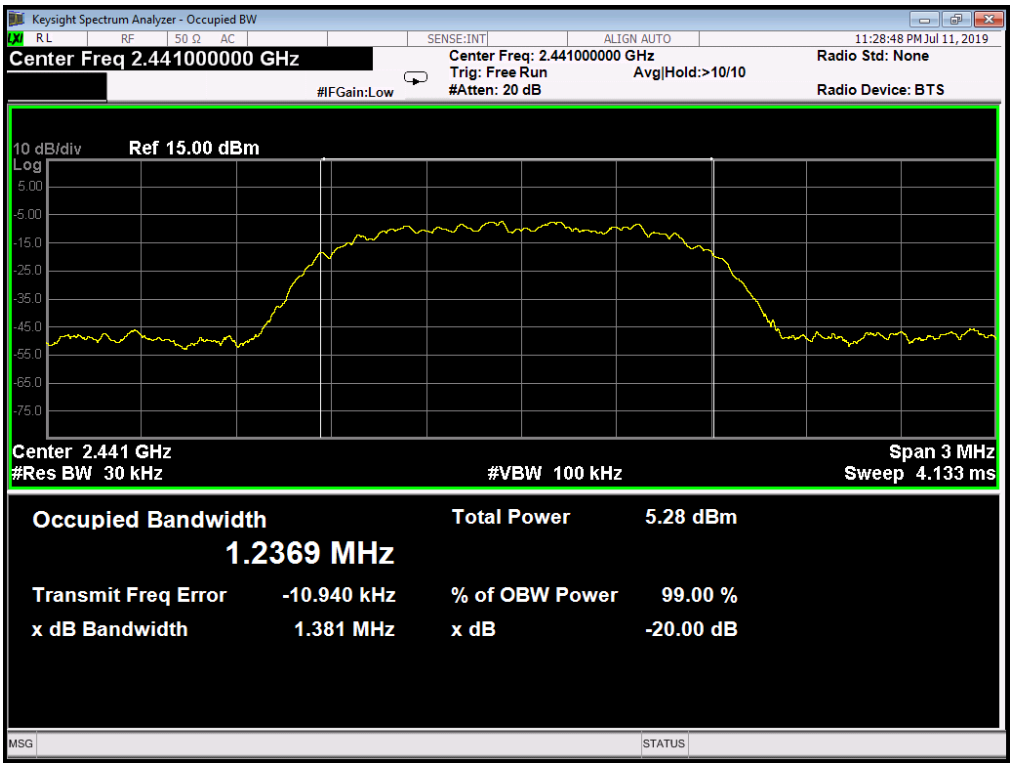

Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:29:27 PM Jul 11, 2019
Center Freq: 2.402000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 15.00 dBm
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-75.0
Center 2.402 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 4.133 ms
Occupied Bandwidth
1.2335 MHz
Total Power 5.28 dBm
Transmit Freq Error -9.555 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.392 MHz
x dB -20.00 dB
MSG
STATUS

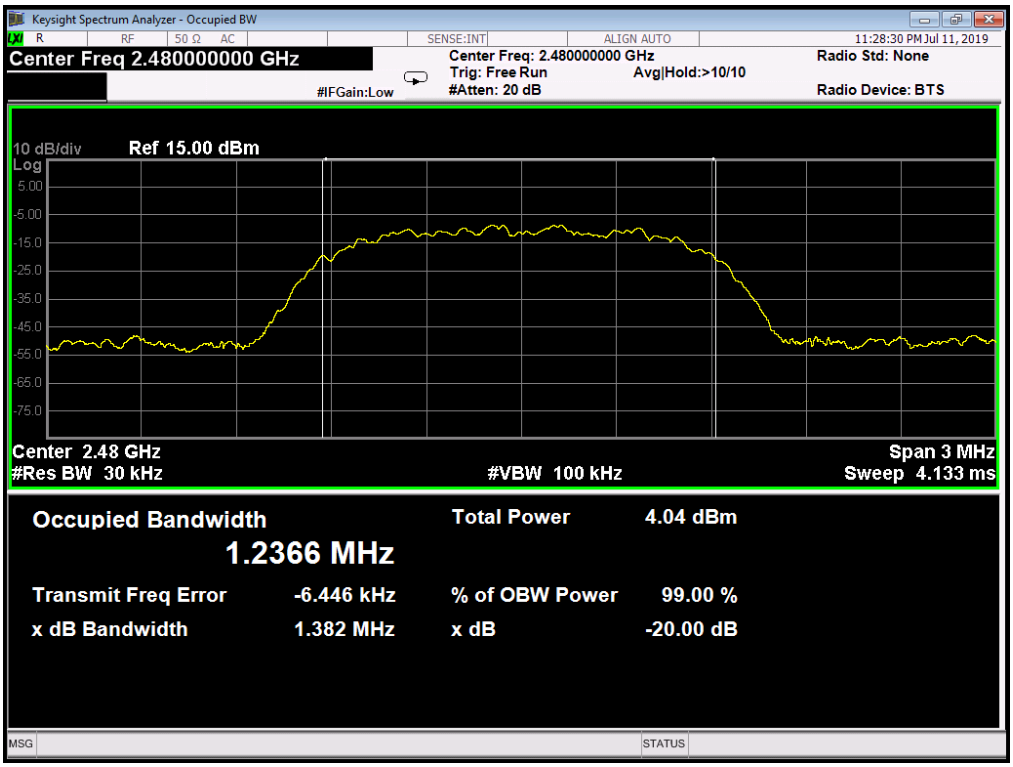

Keysight Spectrum Analyzer - Occupied BW
R
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:29:44 PM Jul 11, 2019
Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 15.00 dBm
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-75.0
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 4.133 ms
Occupied Bandwidth
1.2330 MHz
Total Power 5.05 dBm
Transmit Freq Error -5.021 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.392 MHz
x dB -20.00 dB
MSG
STATUS


Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
11:30:04 PM Jul 11, 2019
10 dB/div
Log
Ref 15.00 dBm
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 4.133 ms
Occupied Bandwidth
1.2336 MHz
Total Power 3.77 dBm
Transmit Freq Error -963 Hz
% of OBW Power 99.00 %
x dB Bandwidth 1.392 MHz
x dB -20.00 dB
MSG
STATUS

8DPSK


Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.402000000 GHz
Center Freq: 2.402000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 20 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
11:29:05 PM Jul 11, 2019
10 dB/div
Log
Ref 15.00 dBm
Center 2.402 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 4.133 ms
Occupied Bandwidth
1.2356 MHz
Total Power 5.46 dBm
Transmit Freq Error -15.428 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.380 MHz
x dB -20.00 dB
MSG
STATUS


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:28:48 PM Jul 11, 2019
Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 15.00 dBm
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-75.0
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 4.133 ms
Occupied Bandwidth
1.2369 MHz
Total Power 5.28 dBm
Transmit Freq Error -10.940 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.381 MHz
x dB -20.00 dB
MSG
STATUS


Keysight Spectrum Analyzer - Occupied BW
R
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:28:30 PM Jul 11, 2019
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 15.00 dBm
5.00
-5.00
-15.0
-25.0
-35.0
-45.0
-55.0
-65.0
-75.0
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 4.133 ms
Occupied Bandwidth
1.2366 MHz
Total Power 4.04 dBm
Transmit Freq Error -6.446 kHz
% of OBW Power 99.00 %
x dB Bandwidth 1.382 MHz
x dB -20.00 dB
MSG
STATUS

4. CARRIER FREQUENCY SEPARATION TEST

4.1. TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2020/05/27	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2019/12/16	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2019/12/16	1 Year

4.2. THE REQUIREMENT FOR SECTION 15.247(A)(1)

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated
by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively,
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, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly
ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

4.3. EUT CONFIGURATION ON MEASUREMENT

The equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

4.4. OPERATING CONDITION OF EUT

（1）Setup the EUT and simulator as shown as Section 6.1.

（2）Turn on the power of all equipment.

（3）Let the EUT work in TX (Hopping on) modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2441MHz, and 2480MHz TX frequency to transmit.

4.5. TEST PROCEDURE

（1）The transmitter output was connected to the spectrum analyzer through a low loss cable.

（2）.Set RBW of spectrum analyzer to 30 kHz and VBW to 100 kHz. Adjust Span to 3 MHz.

（3）Set the adjacent channel of the EUT maxhold another trace.

（4）Measurement the channel separation

4.6. TEST RESULT

GFSK

Channel	Frequency (MHz)	Channel Separation(MHz)	Limit (MHz)	Result
Low	2402	0.978	>(25KHz or 2/3*20dB Bandwidth)	PASS
Middle	2441	0.969	>(25KHz or 2/3*20dB Bandwidth)	PASS
High	2479	0.969	>(25KHz or 2/3*20dB Bandwidth)	PASS

π/4DQPSK

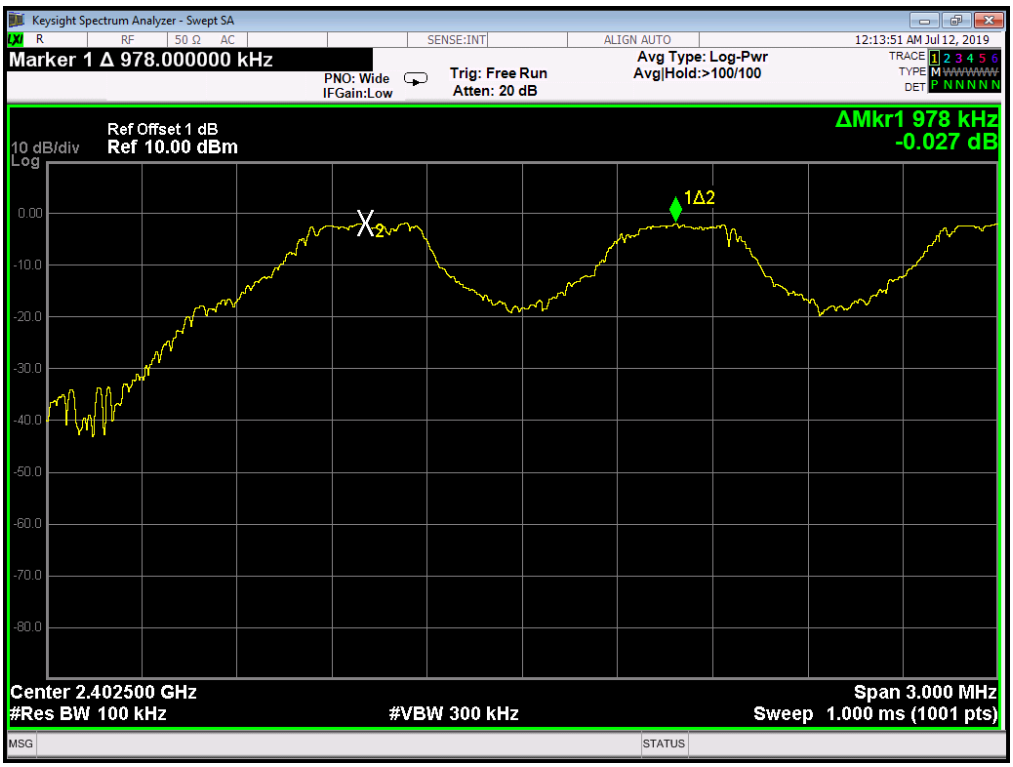
Channel	Frequency (MHz)	Channel Separation(MHz)	Limit (MHz)	Result
Low	2402	1.029	>(25KHz or 2/3*20dB Bandwidth)	PASS
Middle	2441	0.993	>(25KHz or 2/3*20dB Bandwidth)	PASS
High	2479	1.035	>(25KHz or 2/3*20dB Bandwidth)	PASS

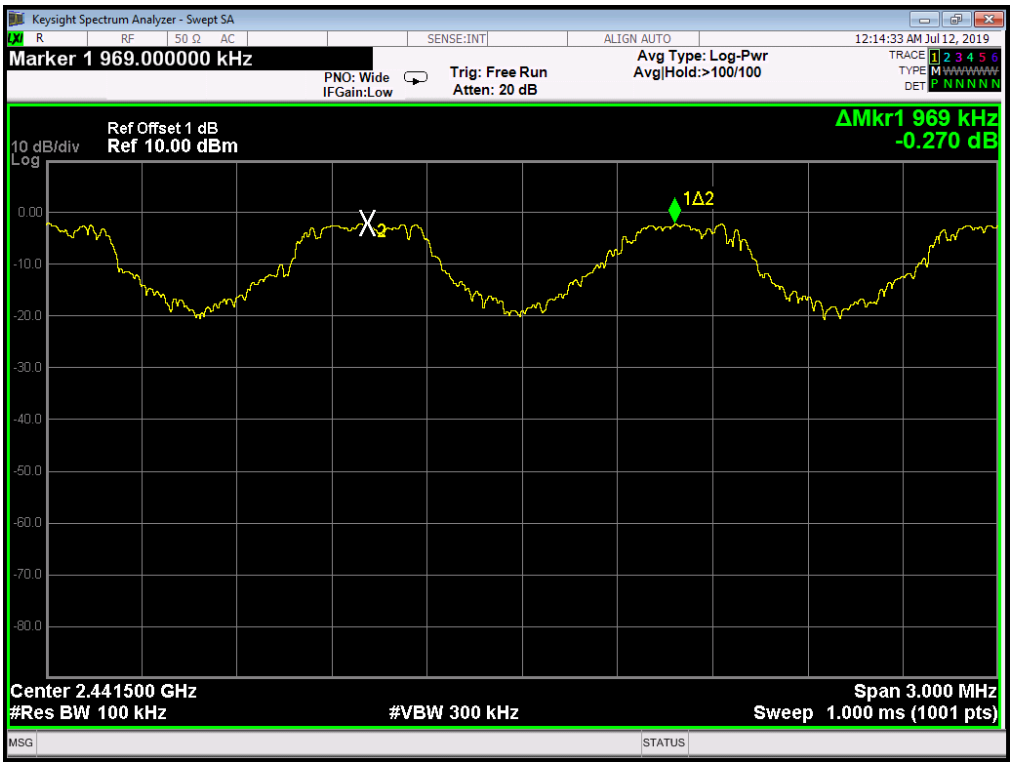
8DPSK

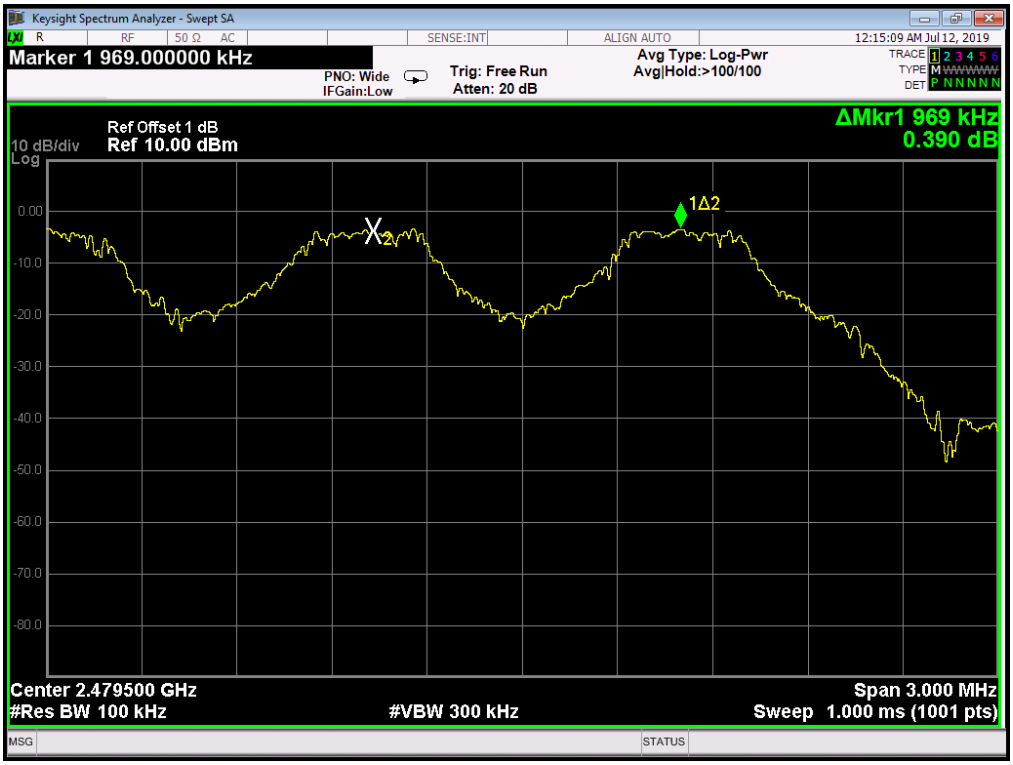
Channel	Frequency (MHz)	Channel Separation(MHz)	Limit (MHz)	Result
Low	2402	0.996	>(25KHz or 2/3*20dB Bandwidth)	PASS
Middle	2441	1.098	>(25KHz or 2/3*20dB Bandwidth)	PASS
High	2480	0.987	>(25KHz or 2/3*20dB Bandwidth)	PASS

The spectrum analyzer plots are attached as below.

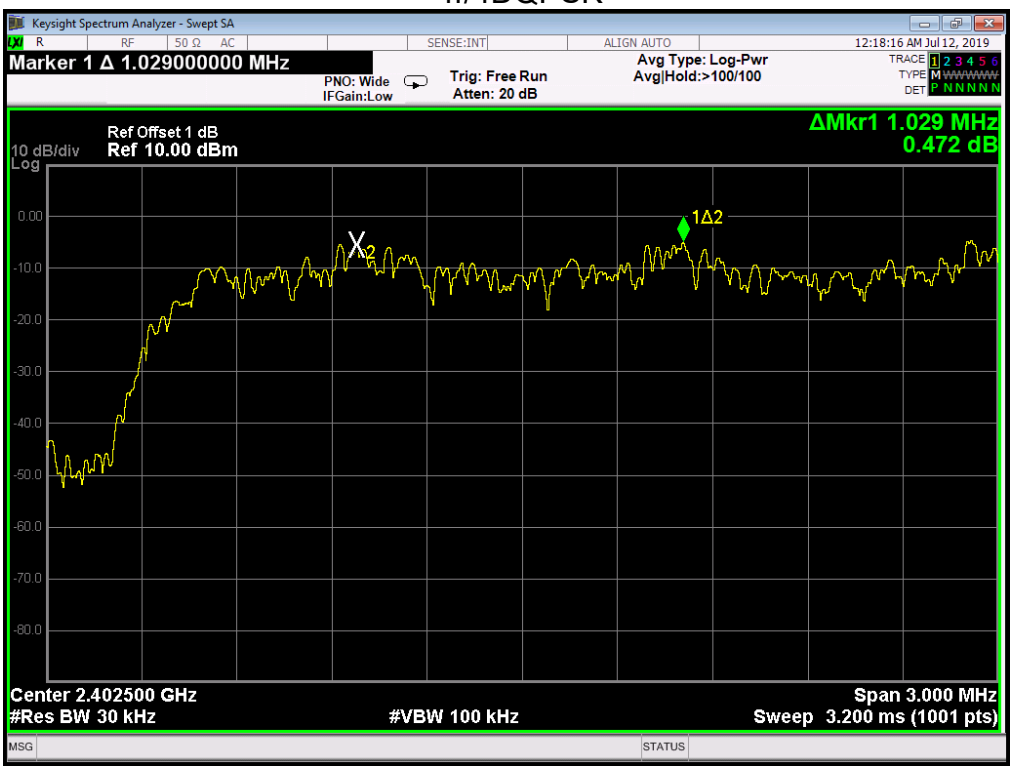
GFSK

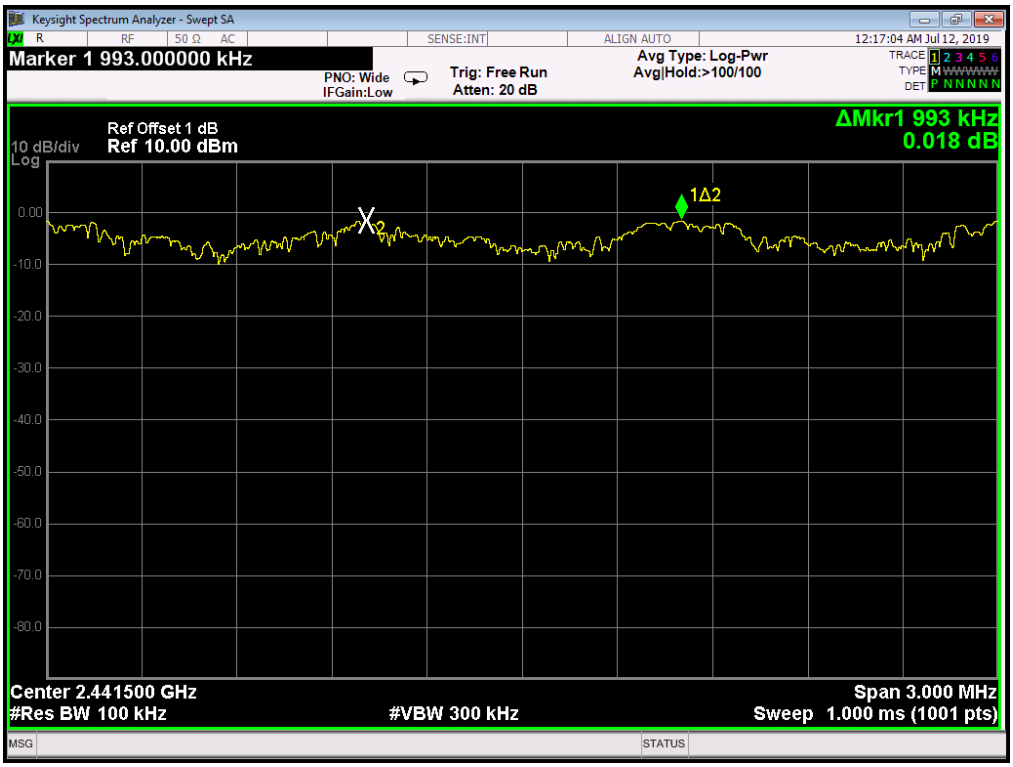

Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 978.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:13:51 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 978 kHz
-0.027 dB
Center 2.402500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)


Keysight Spectrum Analyzer - Swept SA
Marker 1 969.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:14:33 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 969 kHz
-0.270 dB
Center 2.441500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)


Keysight Spectrum Analyzer - Swept SA
Marker 1 969.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:15:09 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 969 kHz
0.390 dB
Center 2.479500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)

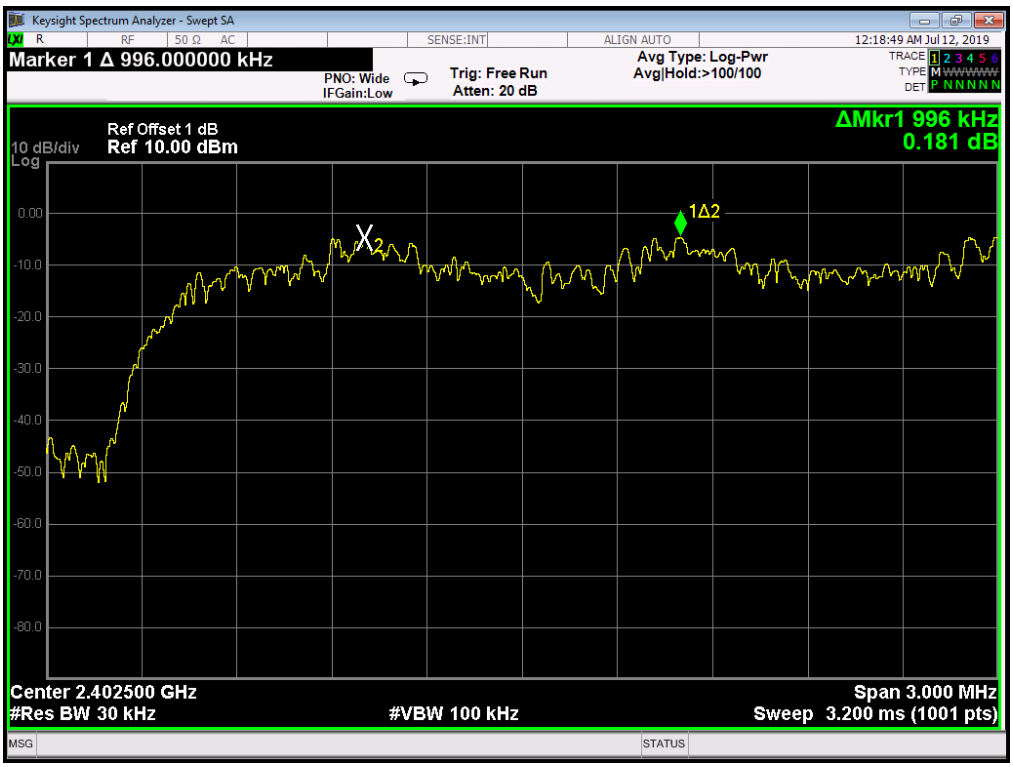
π/4DQPSK

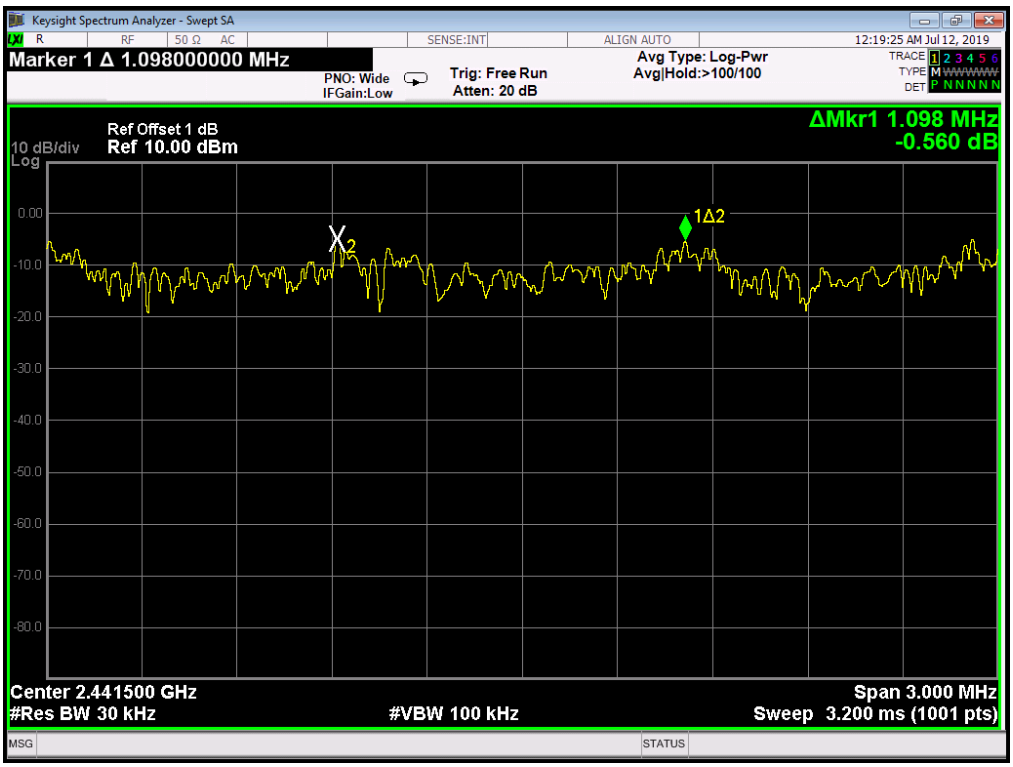

Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 1.029000000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:18:16 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 1.029 MHz
0.472 dB
Center 2.402500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.200 ms (1001 pts)

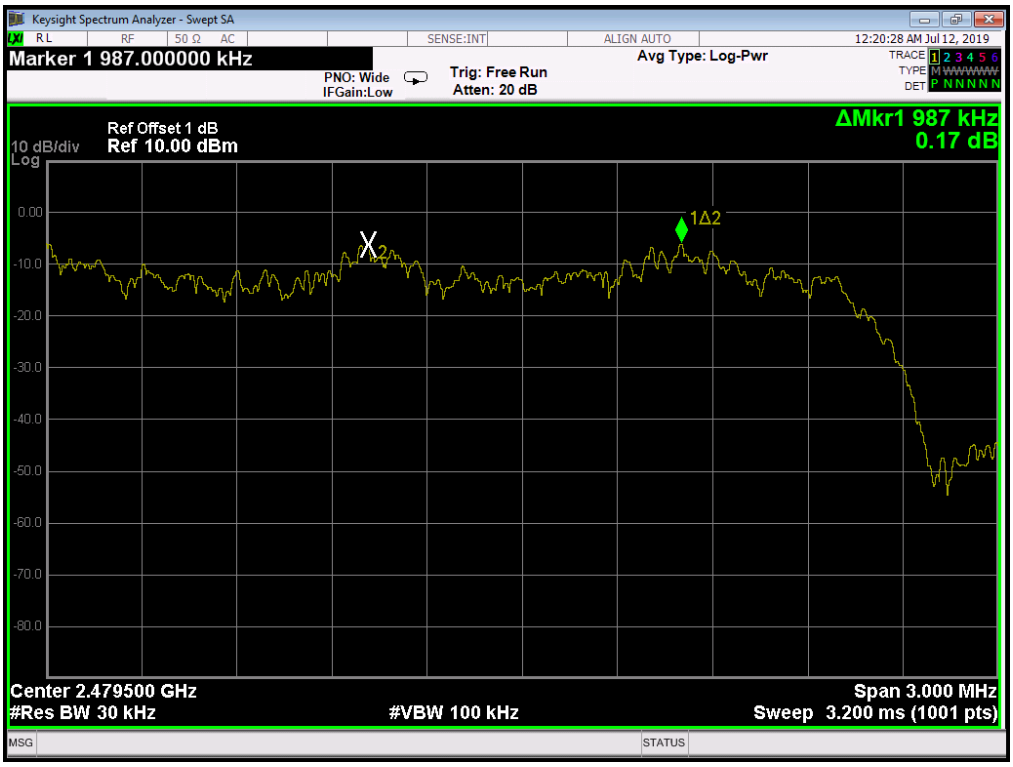

Keysight Spectrum Analyzer - Swept SA
Marker 1 993.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:17:04 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 993 kHz
0.018 dB
1Δ2
Center 2.441500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 1.035000000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:16:24 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 1.035 MHz
0.364 dB
1Δ2
Center 2.479500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.000 ms (1001 pts)

8DPSK


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 996.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:18:49 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 996 kHz
0.181 dB
Center 2.402500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.200 ms (1001 pts)


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 1.098000000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:19:25 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 1.098 MHz
-0.560 dB
Center 2.441500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.200 ms (1001 pts)


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
12:20:28 AM Jul 12, 2019
Marker 1 987.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 1 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 987 kHz
0.17 dB
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
1Δ2
Center 2.479500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3.000 MHz
Sweep 3.200 ms (1001 pts)
MSG
STATUS

5. NUMBER OF HOPPING FREQUENCY TEST

5.1. TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2020/05/27	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2019/12/16	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2019/12/16	1 Year

5.2. THE REQUIREMENT FOR SECTION 15.247(a)(1)(iii)

Section 15.247(a)(1)(iii): Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

5.3. EUT CONFIGURATION ON MEASUREMENT

The equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

5.4. OPERATING CONDITION OF EUT

（1）Setup the EUT and simulator as shown as Section 7.1.

（2）Turn on the power of all equipment.

（3）Let the EUT work in TX (Hopping on) modes measure it.

5.5. TEST PROCEDURE

（1）The transmitter output was connected to the spectrum analyzer through a low loss cable.

（2）Set the spectrum analyzer as Span=83.5MHz, RBW=100 kHz, VBW=300 kHz.

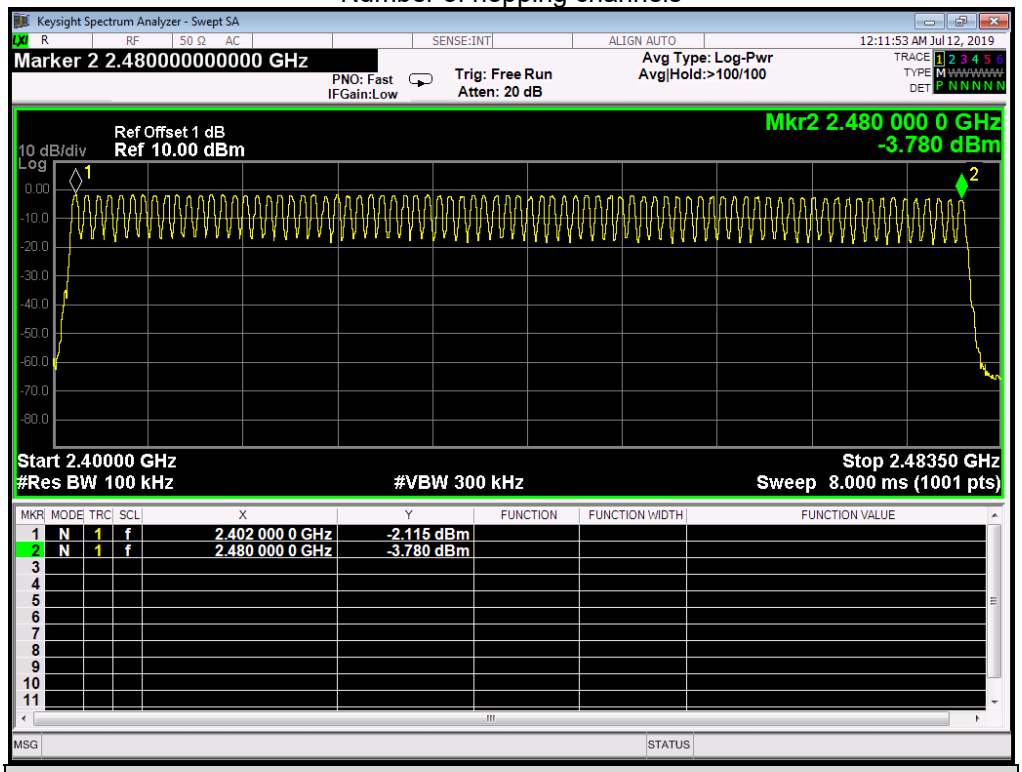
（3）Max hold, view and count how many channel in the band.

5.6. TEST RESULT

Total number of hopping channel	Measurement result(CH)	Limit(CH)
	79	≥15

The spectrum analyzer plots are attached as below

Number of hopping channels



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

6. DWELL TIME TEST

6.1. TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2020/05/27	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2019/12/16	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2019/12/16	1 Year

6.2. THE REQUIREMENT FOR SECTION 15.247(a)(1)(iii)

Section 15.247(a)(1)(iii): Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

6.3. EUT CONFIGURATION ON MEASUREMENT

The equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

6.4. OPERATING CONDITION OF EUT

（1）Setup the EUT and simulator as shown as Section 8.1.

（2）Turn on the power of all equipment.

（3）Let the EUT work in TX (Hopping on) modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2441MHz, and 2480MHz TX frequency to transmit.

6.5. TEST PROCEDURE

（1）The transmitter output was connected to the spectrum analyzer through a low loss cable.

（2）Set center frequency of spectrum analyzer = operating frequency.

（3）Detector Mode:Peak

（4）Set the spectrum analyzer as RBW=1MHz, VBW=1MHz, Span=0Hz

A Period Time = (channel number)*0.4

DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)

DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)

DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

6.6. TEST RESULT

GFSK Mode

Mode	Channel Frequency (MHz)	Pulse Time (ms)	Dwell Time (ms)	Limit (ms)
DH1	2441	0.43	137.6	400
DH3	2441	1.72	275.2	400
DH5	2441	3.04	324.3	400

π/4DQPSK Mode

Mode	Channel Frequency (MHz)	Pulse Time (ms)	Dwell Time (ms)	Limit (ms)
DH1	2441	0.43	137.6	400
DH3	2441	1.71	273.6	400
DH5	2441	3.04	324.3	400

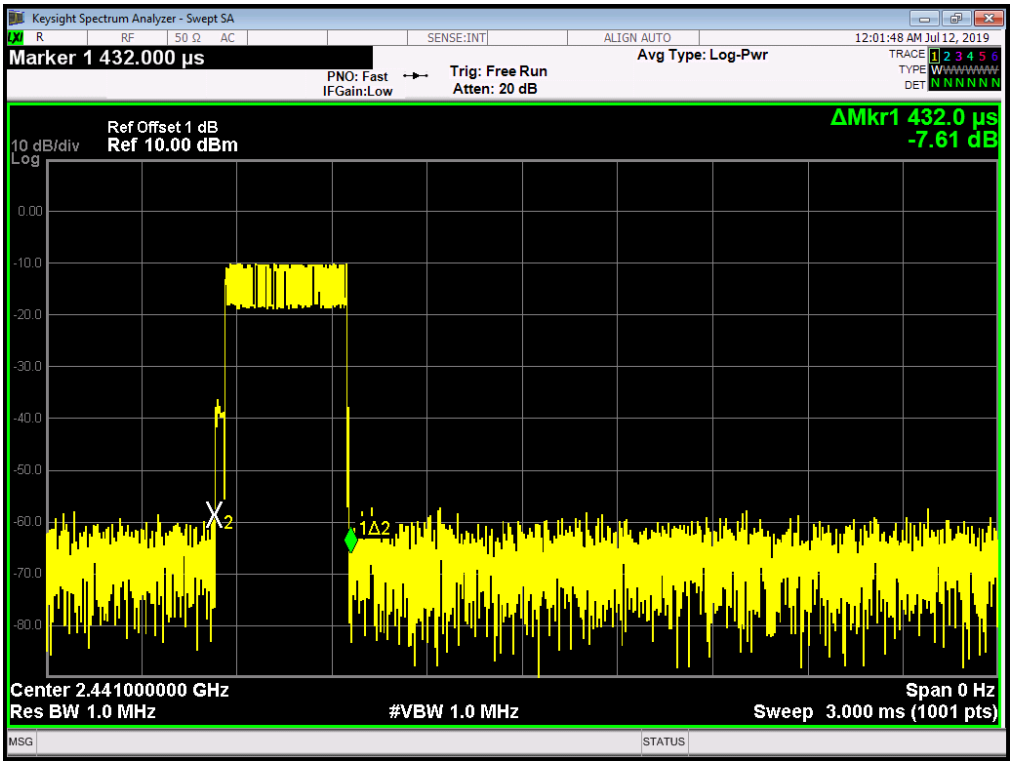
8DPSK Mode

Mode	Channel Frequency (MHz)	Pulse Time (ms)	Dwell Time (ms)	Limit (ms)
DH1	2441	0.43	137.6	400
DH3	2441	1.72	275.2	400
DH5	2441	3.00	320.0	400

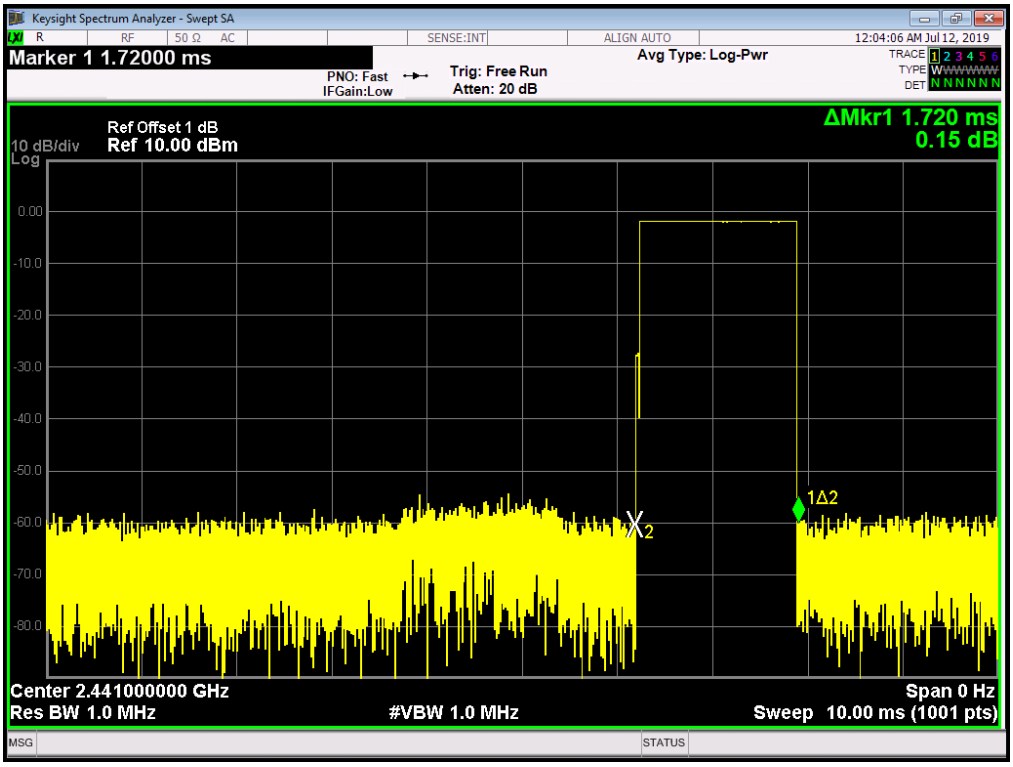
The spectrum analyzer plots are attached as below:

GFSK Mode

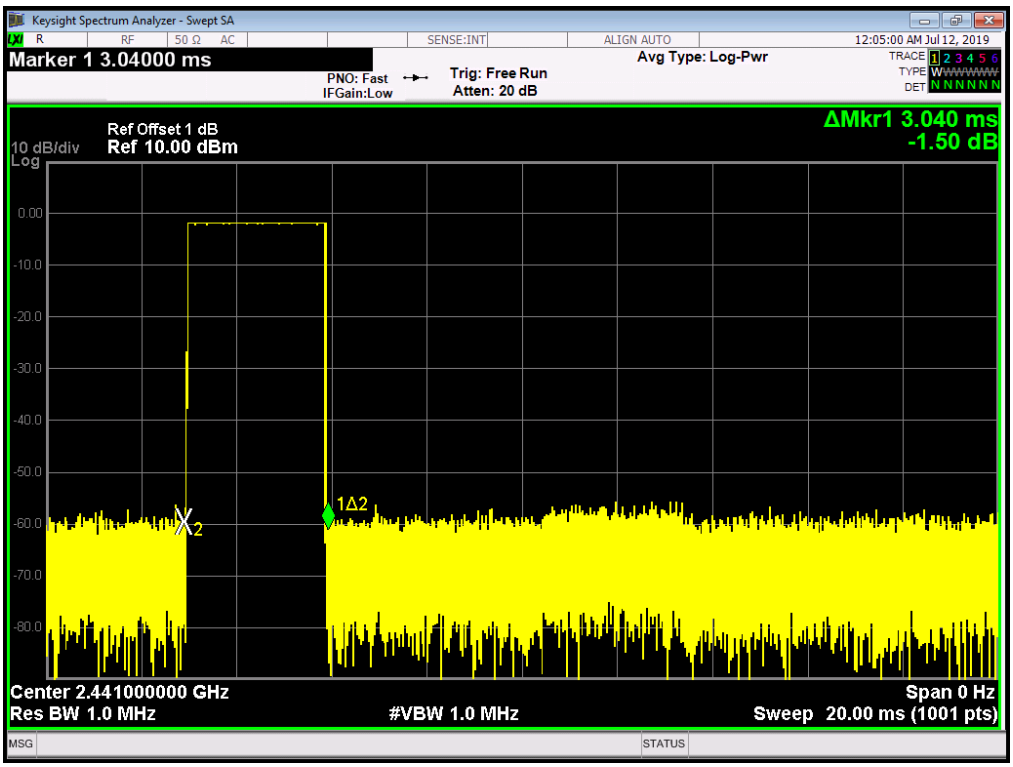
DH1



DH3

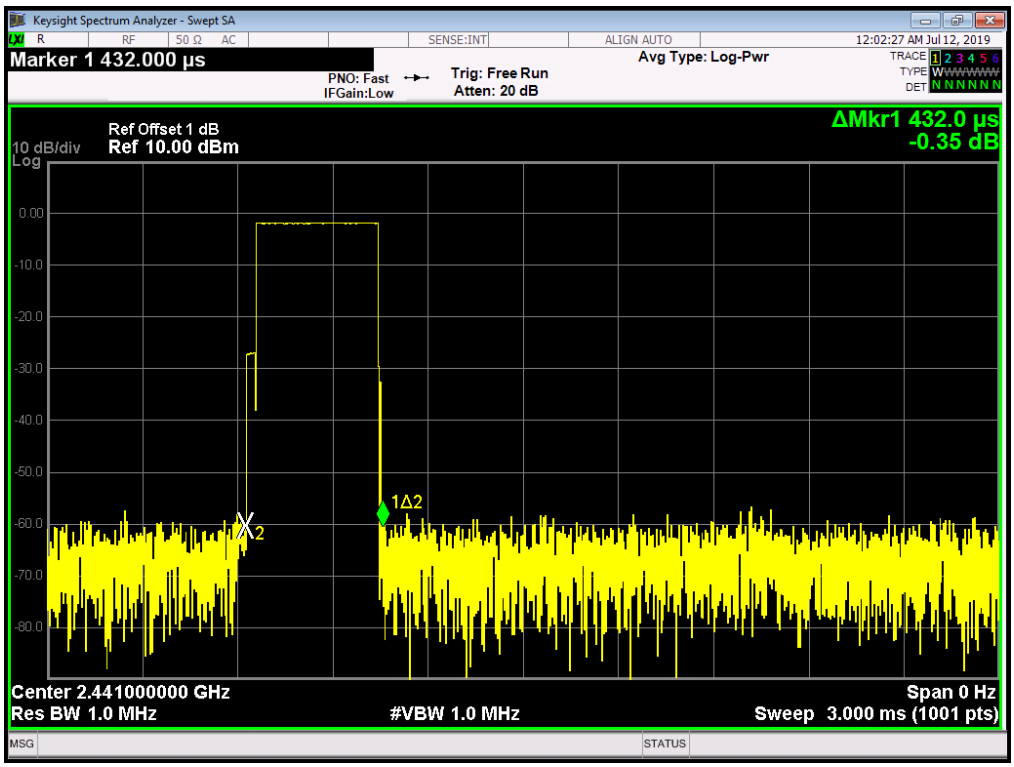


DH5

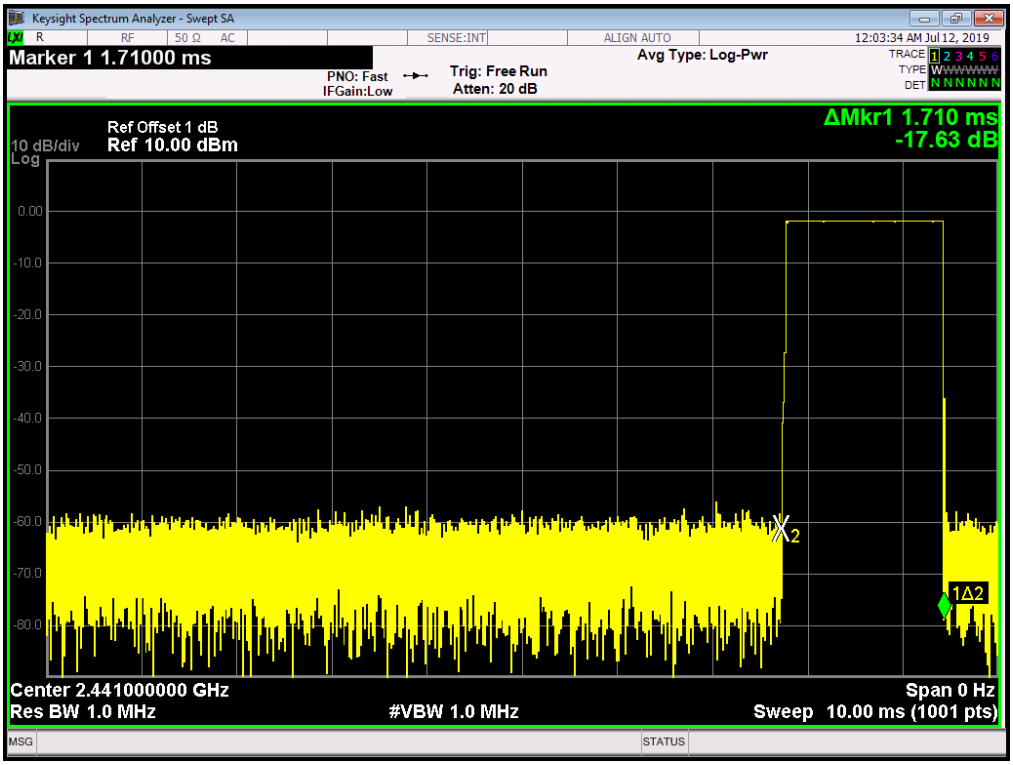


π/4DQPSK Mode

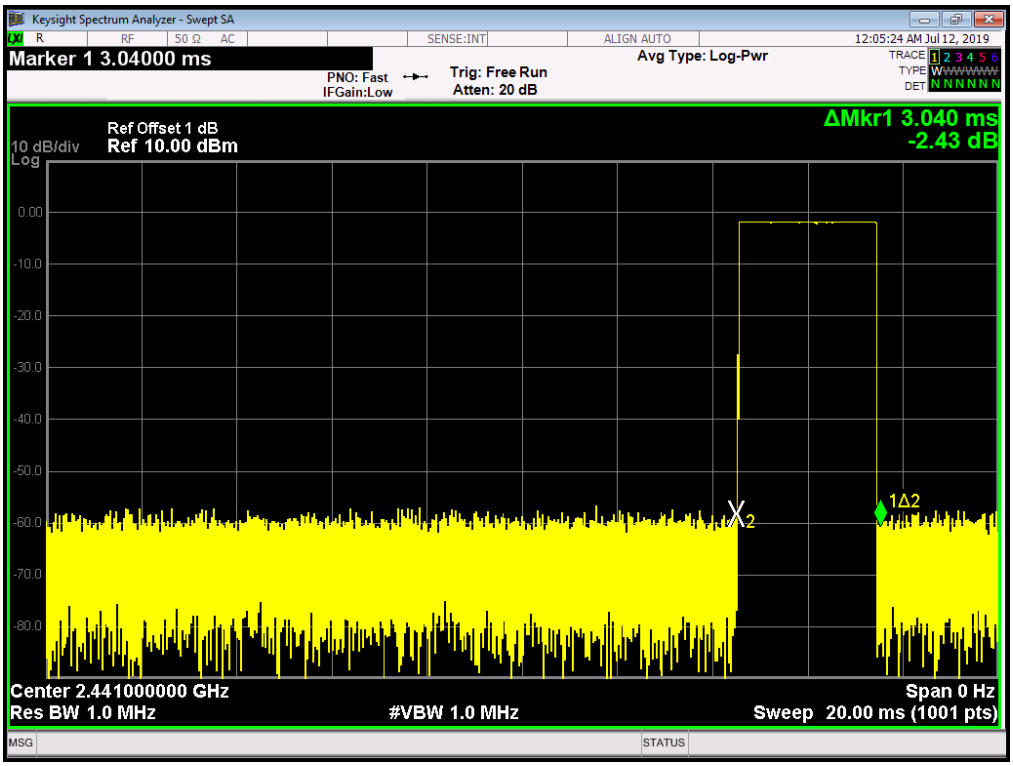
DH1



DH3

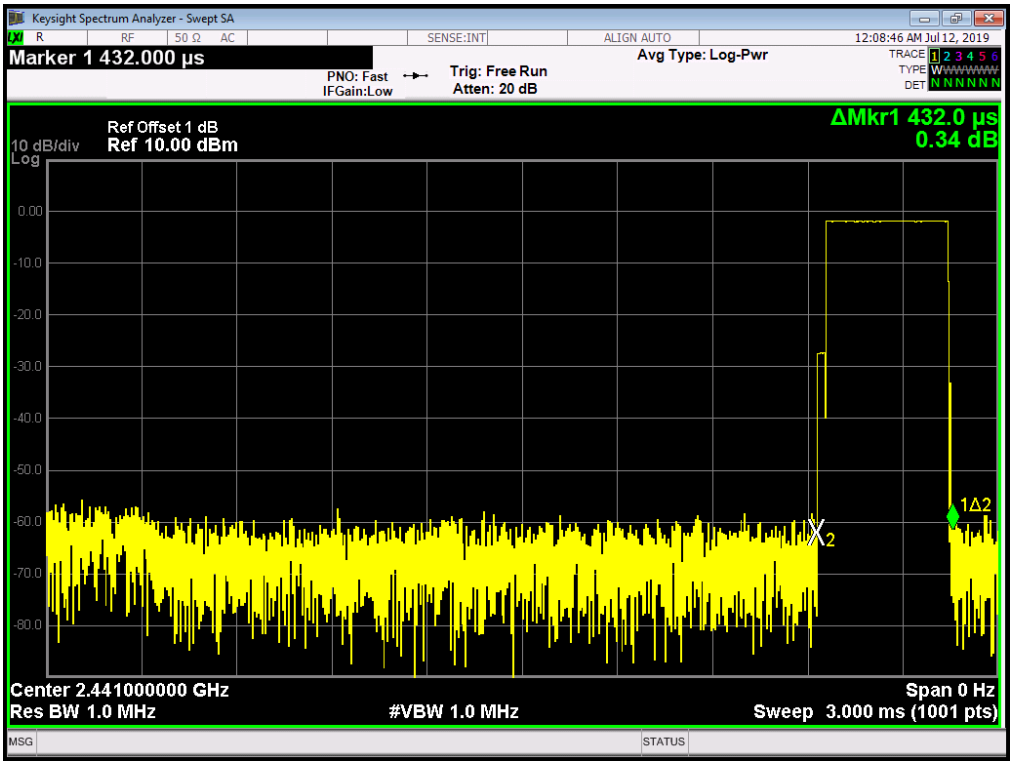

Keysight Spectrum Analyzer - Swept SA
Marker 1 1.71000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
12:03:34 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 1.710 ms
-17.63 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)

DH5

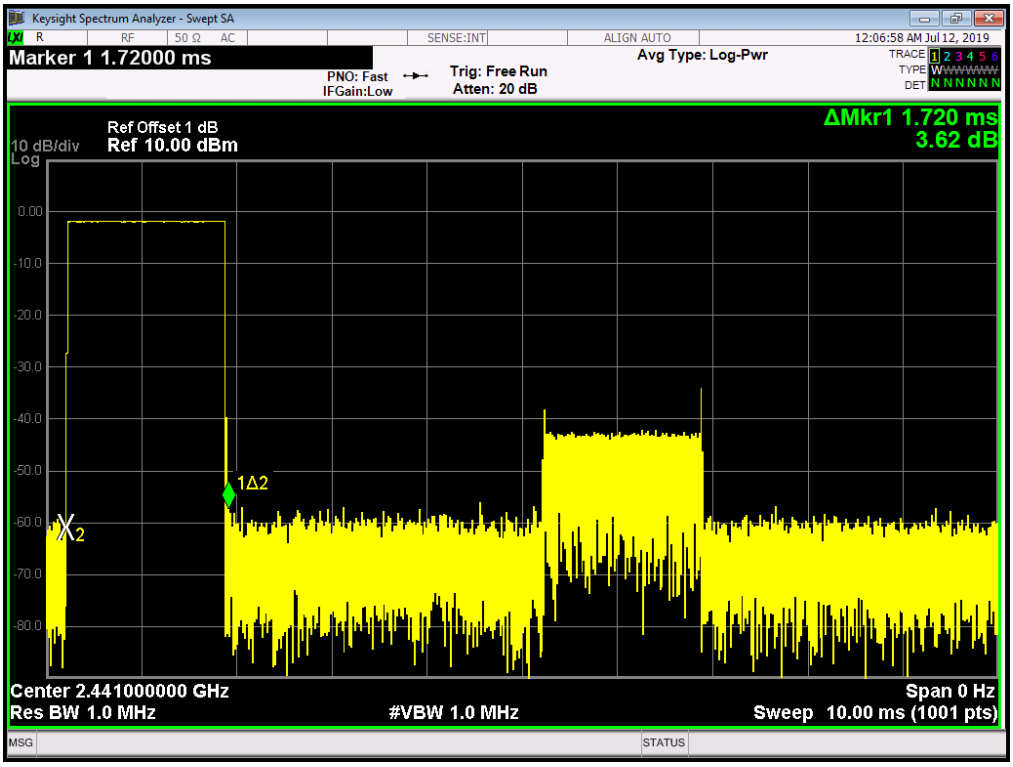

Keysight Spectrum Analyzer - Swept SA
Marker 1 3.04000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
12:05:24 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
ΔMkr1 3.040 ms
-2.43 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)

8DPSK Mode

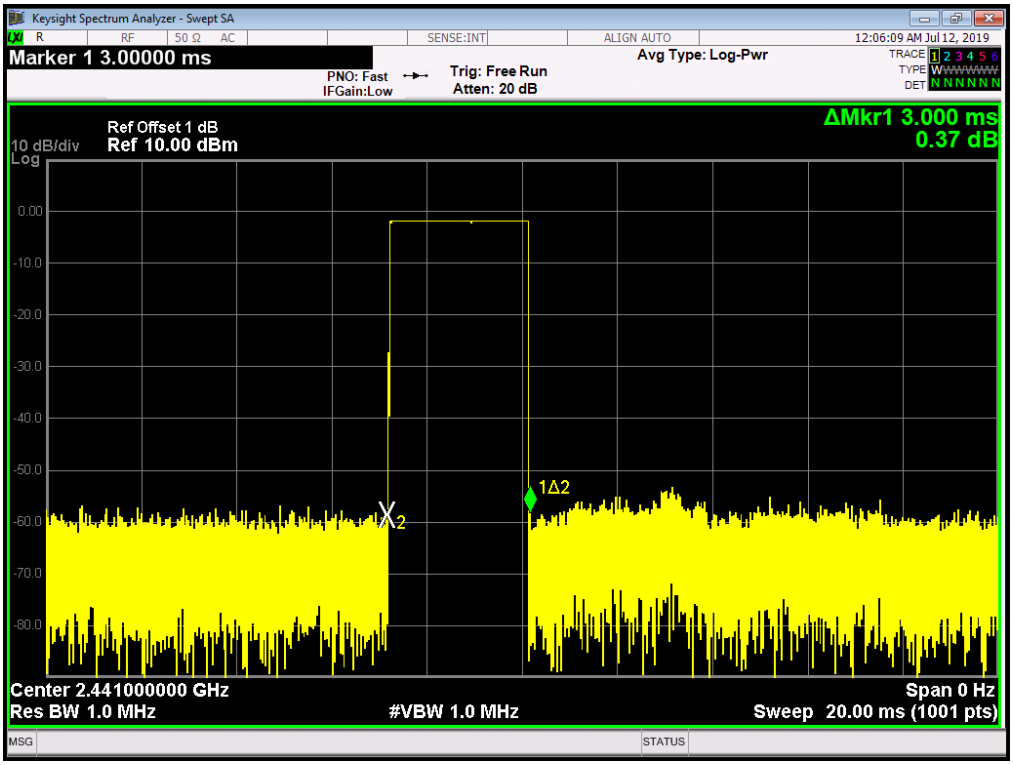
DH1



DH3



DH5


Keysight Spectrum Analyzer - Swept SA
Marker 1 3.00000 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
12:06:09 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Log
Ref 10.00 dBm
ΔMkr1 3.000 ms
0.37 dB
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
MSG
STATUS

7. MAXMUM OUTPUT POWER

7.1. TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2020/05/27	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2019/12/16	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2019/12/16	1 Year

7.2. BLOCK DIAGRAM OF TEST SETUP

FCC:Same with 3.2

7.3. LIMITS

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz bands: 0.125 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.4. TEST PROCEDURE

(1) Configure EUT and assistant system according clause 2.4 and 3.2

(2) Connect EUT's antenna output to spectrum analyzer by RF cable.

(3) Configure EUT work in test mode as stated in clause 2.4.

(4) Set the spectrum analyzer as follows:

GFSK	RBW:	1MHz
	VBW:	3MHz
π /4DQPSK	RBW:	3MHz
	VBW:	3MHz
8DPSK	RBW:	3MHz
	VBW:	3MHz
Span		>1.5x 20dB bandwidth
Detector Mode:		Peak
Sweep time:		auto
Trace mode		Max hold

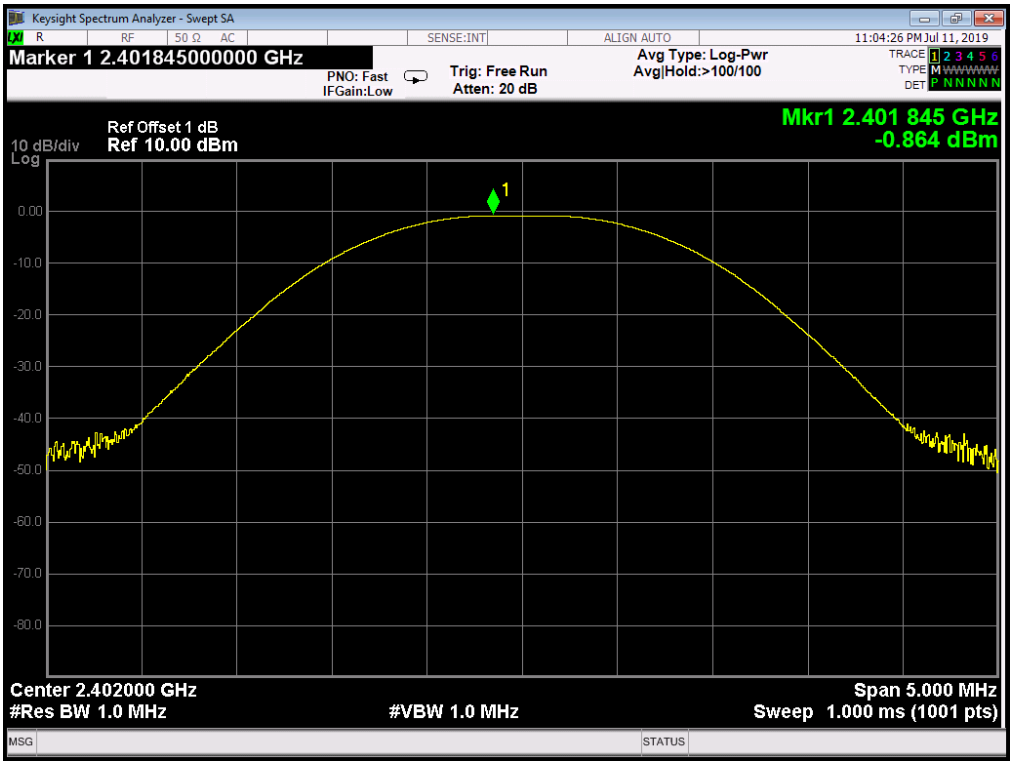
(5) Allow the trace to stabilize, Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges measure out the Average and PK output power.

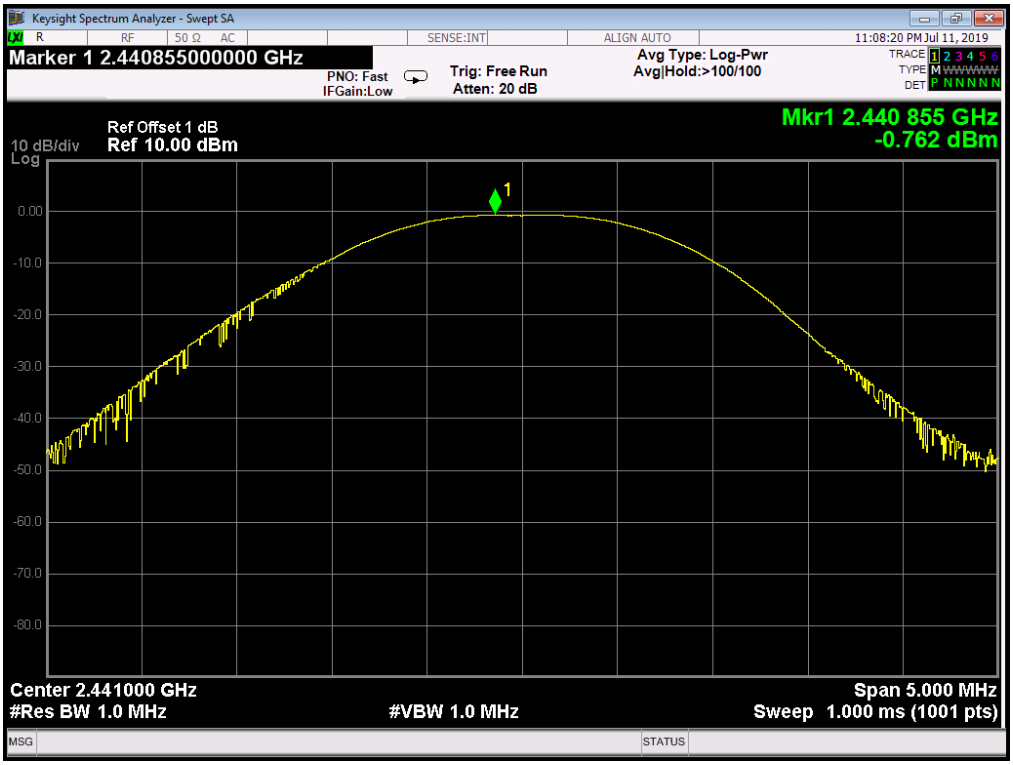
7.5. TEST RESULT

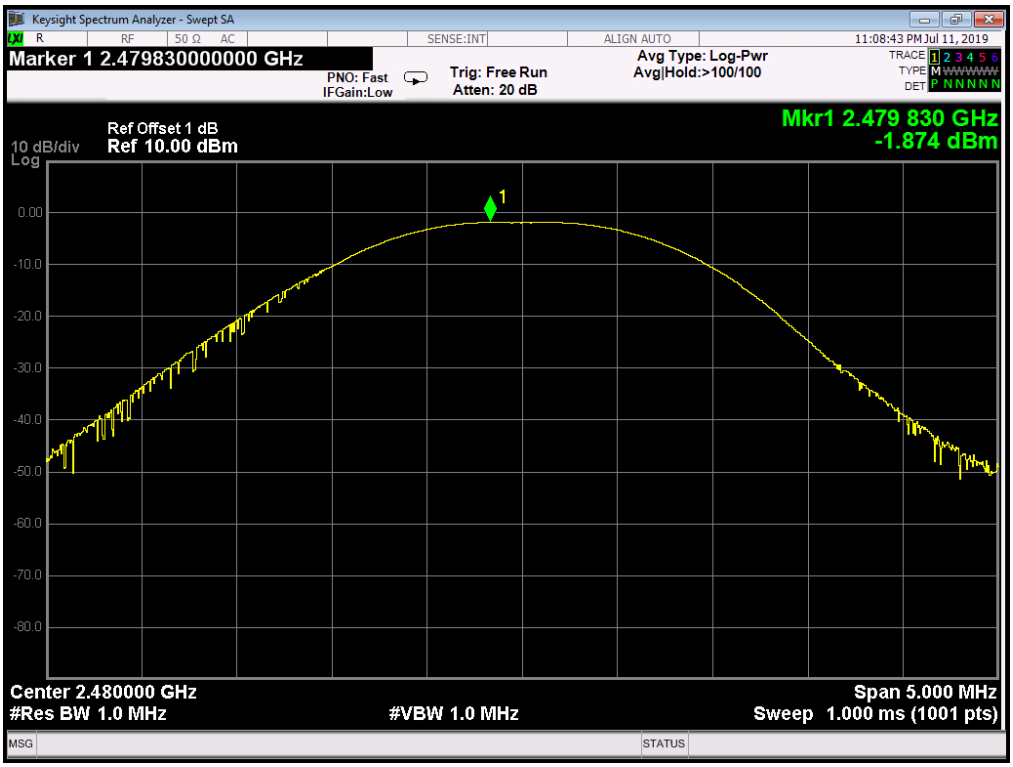
EUT Set Mode	Data Rate (Mbp/s)	Frequency (MHz)	Result(dBm)
			Peak
GFSK	1	2402	-0.864
		2441	-0.762
		2480	-1.874
π/4DQPSK	2	2402	-0.833
		2441	-0.743
		2480	-1.827
8DPSK	3	2402	-0.847
		2441	-0.727
		2480	-1.893
Limit: 21dBm		Conclusion: PASS	

Original test data

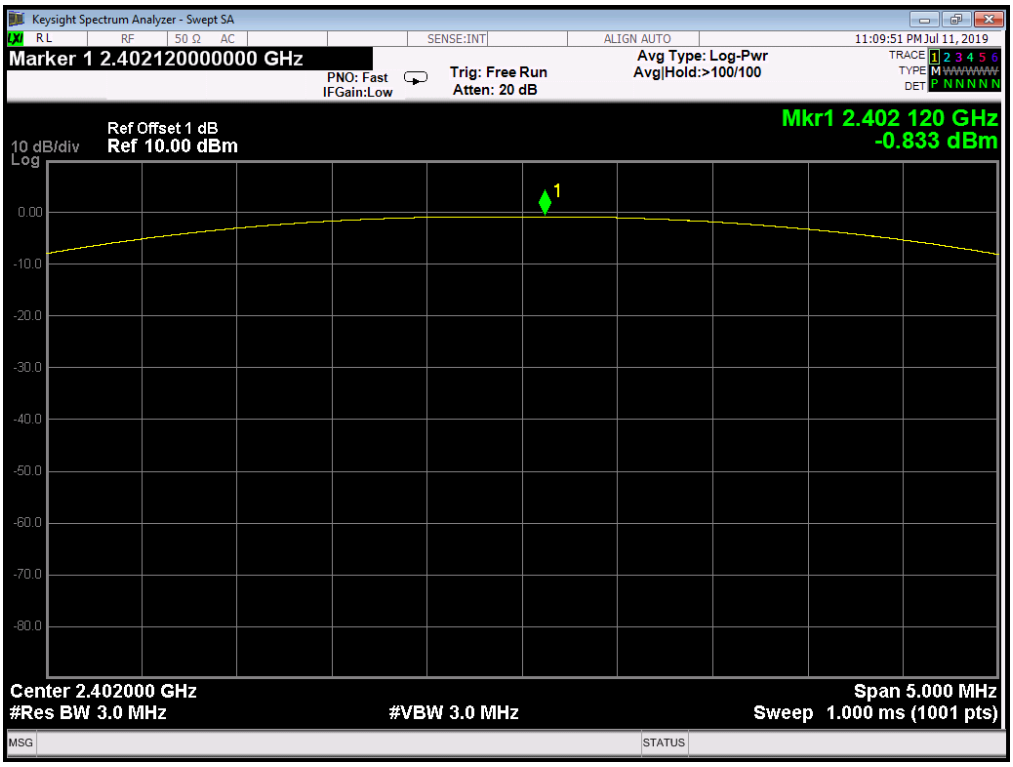
GFSK

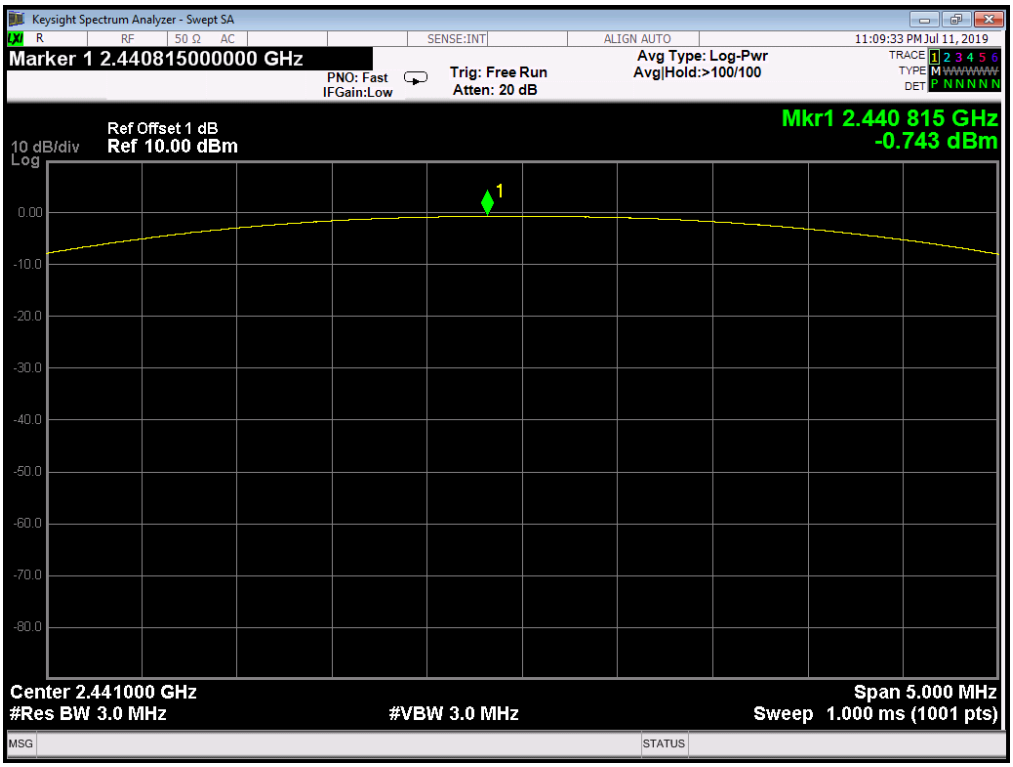


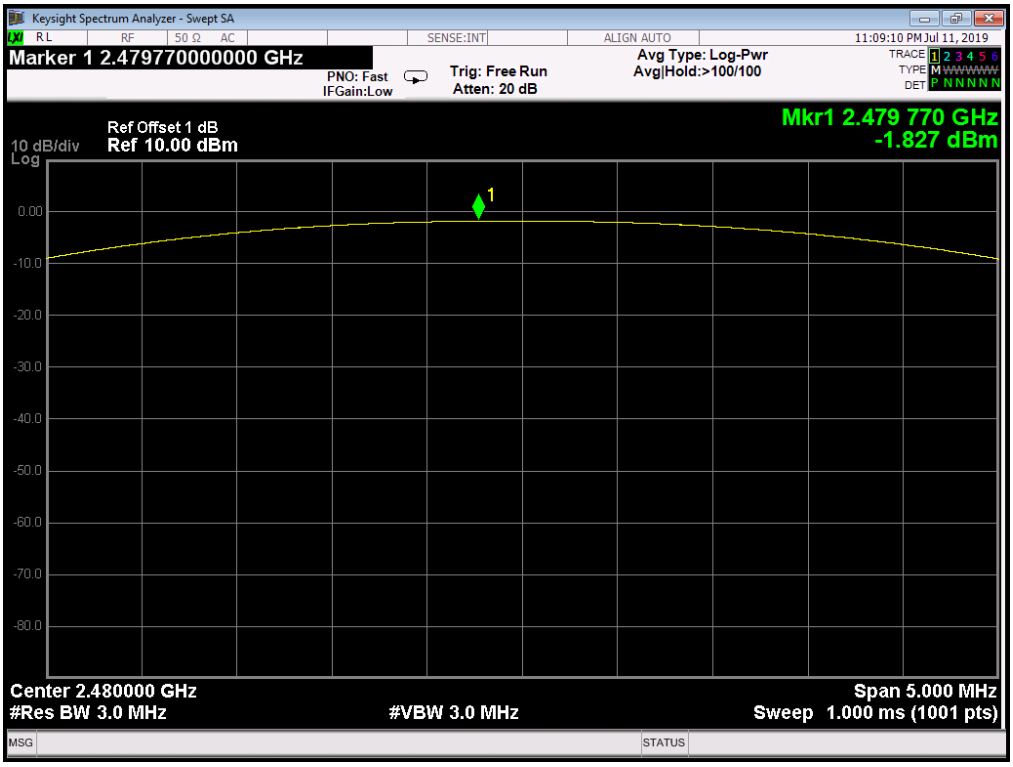



Keysight Spectrum Analyzer - Swept SA
Marker 1 2.479830000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:08:43 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Log
Ref 10.00 dBm
Mkr1 2.479 830 GHz
-1.874 dBm
Center 2.480000 GHz
#Res BW 1.0 MHz
#VBW 1.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)

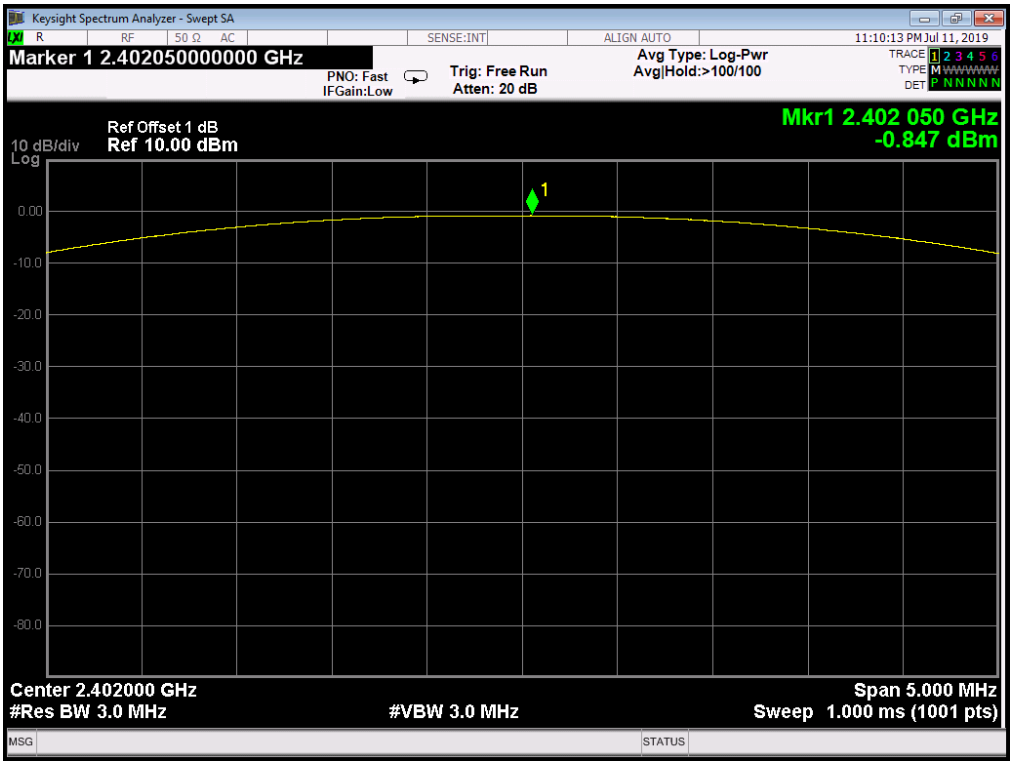
π/4DQPSK

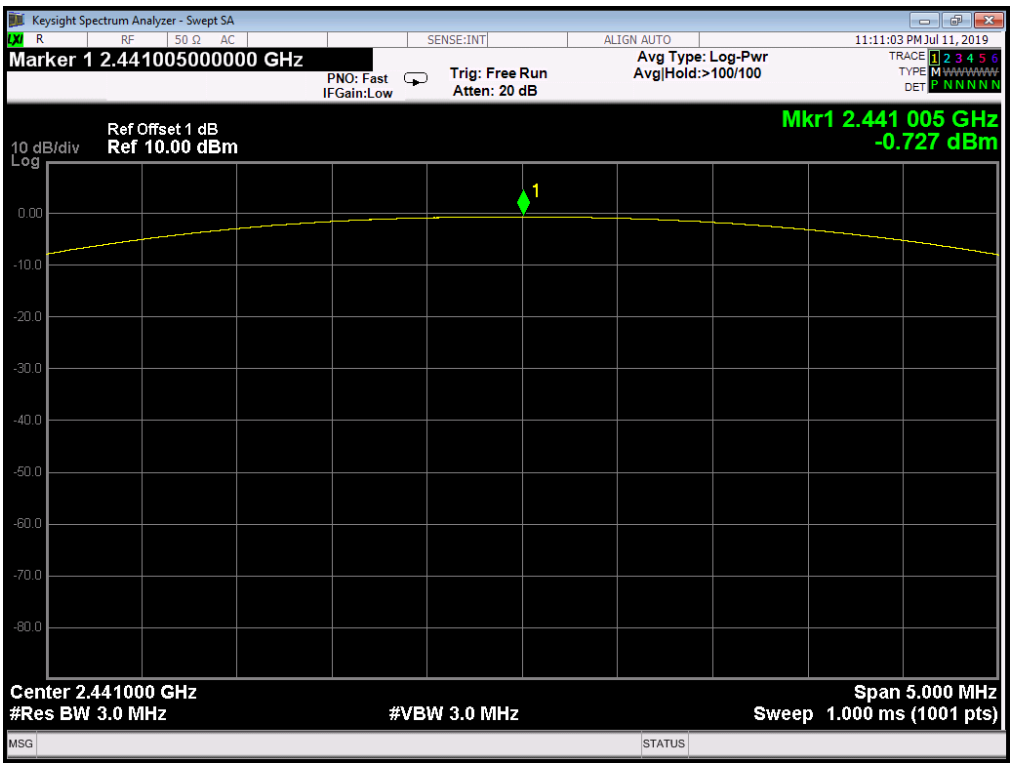

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.402120000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:09:51 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Log
Ref 10.00 dBm
Mkr1 2.402 120 GHz
-0.833 dBm
Center 2.402000 GHz
#Res BW 3.0 MHz
#VBW 3.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)

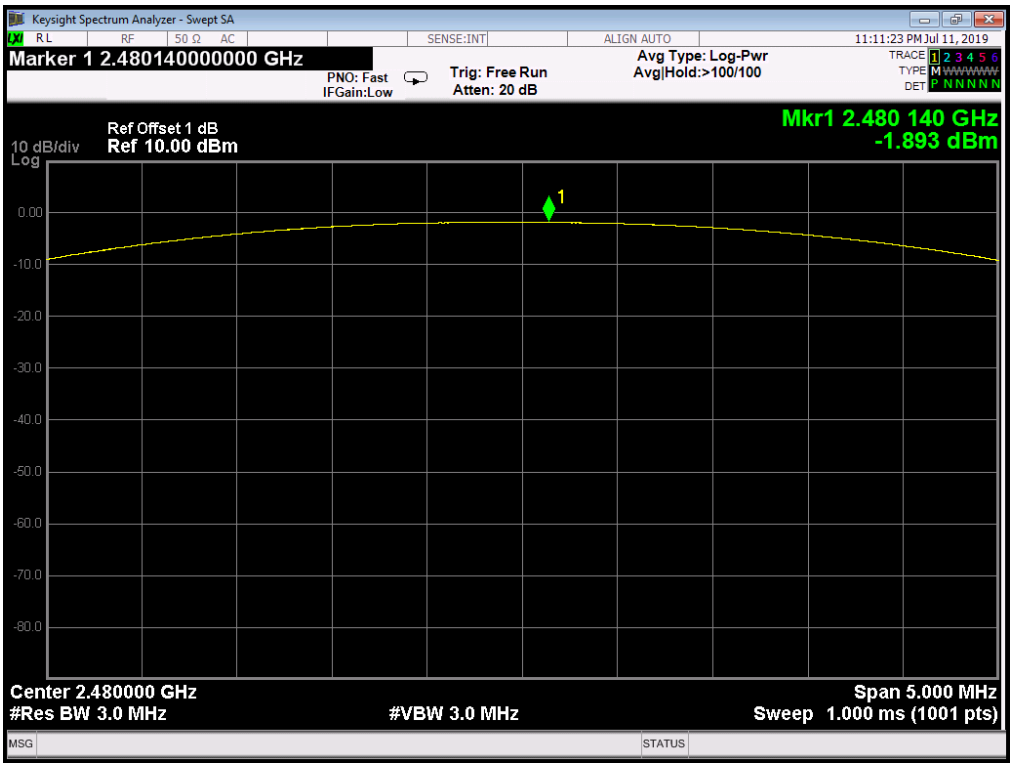

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.440815000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:09:33 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Mkr1 2.440 815 GHz
-0.743 dBm
Center 2.441000 GHz
#Res BW 3.0 MHz
#VBW 3.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.479770000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:09:10 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Mkr1 2.479 770 GHz
-1.827 dBm
Center 2.480000 GHz
#Res BW 3.0 MHz
#VBW 3.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)

8DPSK


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.402050000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:10:13 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.402 050 GHz
-0.847 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.402000 GHz
#Res BW 3.0 MHz
#VBW 3.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.441005000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:11:03 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.441 005 GHz
-0.727 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.441000 GHz
#Res BW 3.0 MHz
#VBW 3.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:11:23 PM Jul 11, 2019
Marker 1 2.480140000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 1 dB
10 dB/div
Log
Ref 10.00 dBm
Mkr1 2.480 140 GHz
-1.893 dBm
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
Center 2.480000 GHz
#Res BW 3.0 MHz
#VBW 3.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
MSG
STATUS

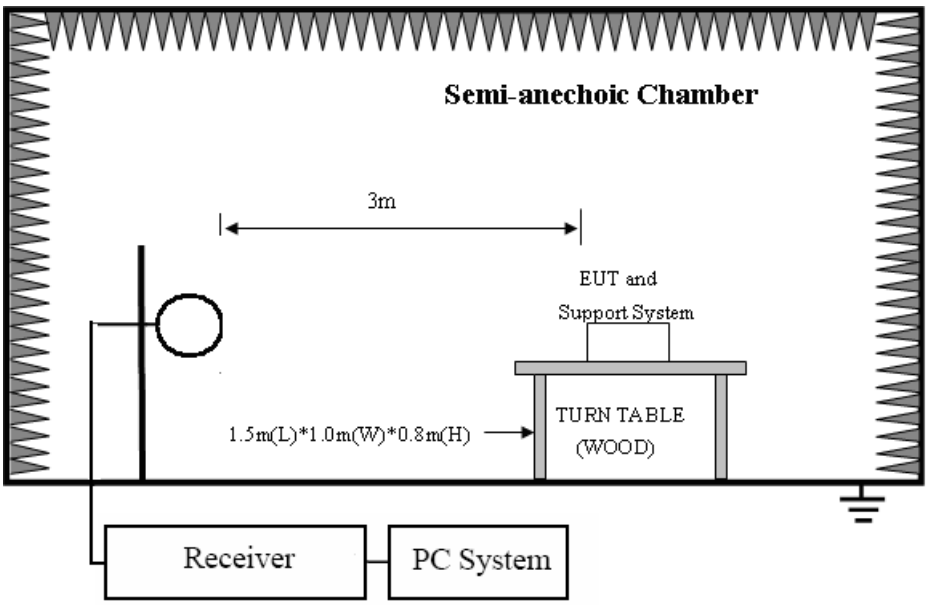
8. SPURIOUS EMISSION

8.1. Test equipment

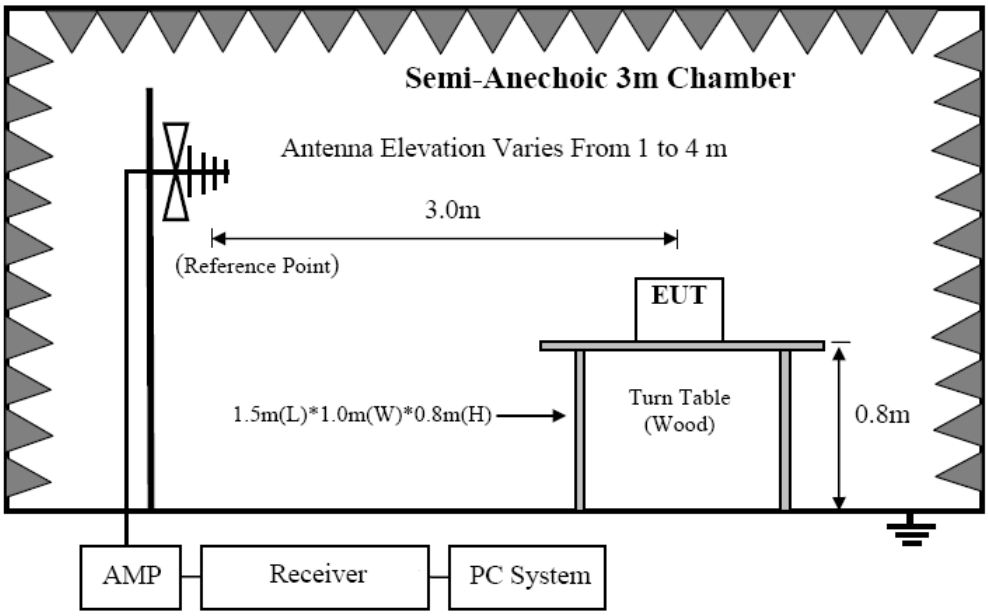
Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	EMI Test Receiver	R&S	ESCI	101307	2019/12/16	1 Year
2	Spectrum Analyzer	Agilent	E4407B	US40240708	11/20/2019	1 Year
3	Spectrum analyzer	R&S	FSU	1166.1660.26	2019/12/16	1 Year
4	Loop antenna	TESEQ	HLA6120	20129	2019/12/16	1 Year
5	Trilog Broadband Antenna	Schwarzbeck	VULB9163	9163-462	2019/12/16	1 Year
6	Double Ridged Horn Antenna	Schwarzbeck	BBHA9120D	9120D 1065	2019/12/16	1 Year
7	Horn Antenna	Schwarzbeck	BBHA 9170	9170 1248	2019/12/16	1 Year
8	Pre-amplifier	A.H.	PAM-1840VH	562	2019/12/16	1 Year
9	Pre-amplifier	R&S	AFS33-18002 650-30-8P-44	SEL0080	2019/12/16	1 Year
10	Pre-Amplifier	HP	8449B	3274A06298	2019/12/16	1 Year
11	RF Cable	R&S	R01	10403	2019/12/16	1 Year
12	RF Cable	R&S	R02	10512	2019/12/16	1 Year
13	Measurement Software	Farad	EZ-EMC (Ver.ATT-03A)	N/A	N/A	N/A

8.2. Block diagram of test setup

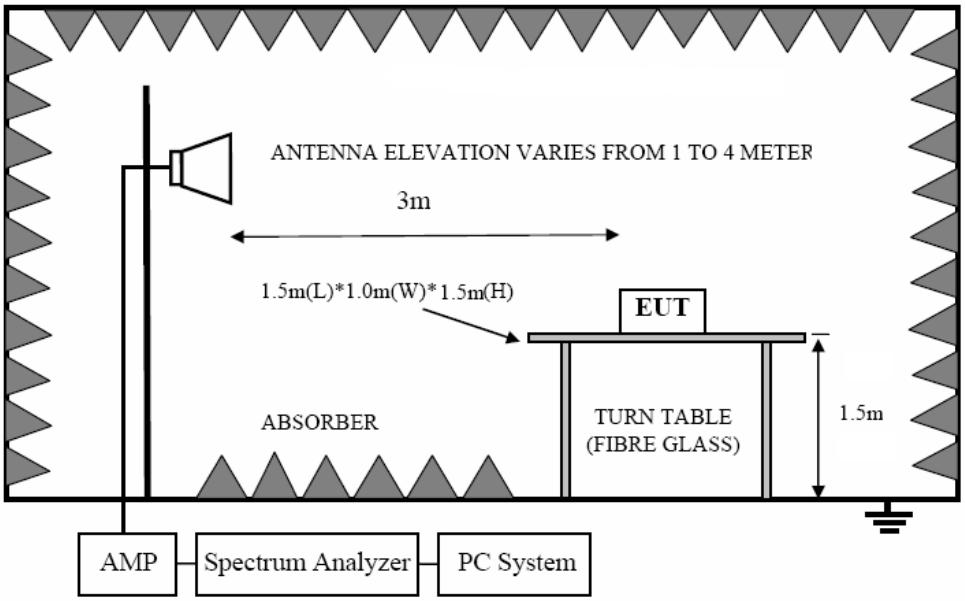
In 3m Anechoic Chamber Test Setup Diagram for 9KHz-30MHz



In 3m Anechoic Chamber Test Setup Diagram for 30MHz-1GHz



In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

8.3. Limit

8.3.1 Restricted frequency band

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]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	([2])

8.3.2. Limit.

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(KHz)	67.6-20log(F)
0.490 ~ 1.705	30	24000/F(KHz)	87.6-20log(F)
1.705 ~ 30.0	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Note: (1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90KHz, 110-490KHz and above 1000MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

(2) At frequencies below 30MHz, measurement may be performed at a distance closer then that specified, and the limit at closer measurement distance can be extrapolated by below formula:

$Limit_{3m}(dBuV/m) = Limit_{30m}(dBuV/m) + 40Log(30m/3m)$

8.3.3. Limit for this EUT

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 30dB below the fundamental emissions, or comply with 15.209 limits.

8.4. Test Procedure

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.

(2) Setup EUT and assistant system according clause 2.4 and 7.2

(3) Test antenna was located 3m from the EUT on an adjustable mast, and the antenna used as below table.

Test frequency range	Test antenna used
9KHz-30MHz	Active Loop antenna
30MHz-1GHz	Trilog Broadband Antenna
1GHz-26.5GHz	Double Ridged Horn Antenna(1GHz-26.5GHz)

According ANSI C63.10:2013 clause 6.4.4.2 and 6,5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna also be positioned with its plane horizontal at the specified distance from the EUT. The center of the loop is 1 m above the ground. for measurement above 30MHz, the Trilog Broadband Antenna or Horn Antenna was located 3m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

(4) Below pre-scan procedure was first performed in order to find prominent frequency spectrum radiated emissions from 9KHz to 25GHz:

(a) Scanning the peak frequency spectrum with the antenna specified in step (3), and the EUT was rotated 360 degree, the antenna height was varied from 1m to 4m(Except loop antenna, it's fixed 1m above ground.)

(b) Change work frequency or channel of device if practicable.

(c) Change modulation type of device if practicable.

(d) new battery is used during testing

(e) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions

(5) For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 2013 on Radiated Emission test.

(6) The emissions from 9KHz to 1GHz were measured based on CISPR QP detector except for the frequency bands 9-90KHz, 110-490KHz, for emissions from 9KHz-90KHz,110KHz-490KHz and above 1GHz were measured based on average detector, for emissions above 1GHz, peak emissions also be

measured and need comply with Peak limit.

(7) The emissions from 9KHz to 1GHz, QP or average values were measured with EMI receiver with below RBW

Frequency band	RBW
9KHz-150KHz	200Hz
150KHz-30MHz	9KHz
30MHz-1GHz	120KHz

（8）For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure; RBW is set at 1MHz, VBW is set at 10Hz for Average measure(according ANSI C63.10:2013 clause 4.2.3.2.3 procedure for average measure). Peak detector is used for Peak and AV measurement both.

8.5. Test Result

Remark: The test result is calculated as the following:
(1) Result = Reading + Correct Factor
(2) Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain + Attenuator
(3) Margin = Result - Limit

Below 30M

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	**Model No.:**	500-137
Temperature:	24℃	**Relative Humidity:**	55%
Distance:	3m	**Test Power:**	DC 3.7V Li-ion Battery
Polarization:	--	**Test Result:**	Pass
Test Mode:	Keeping TX mode	**Test By:**	Blue Qiu

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

Note:

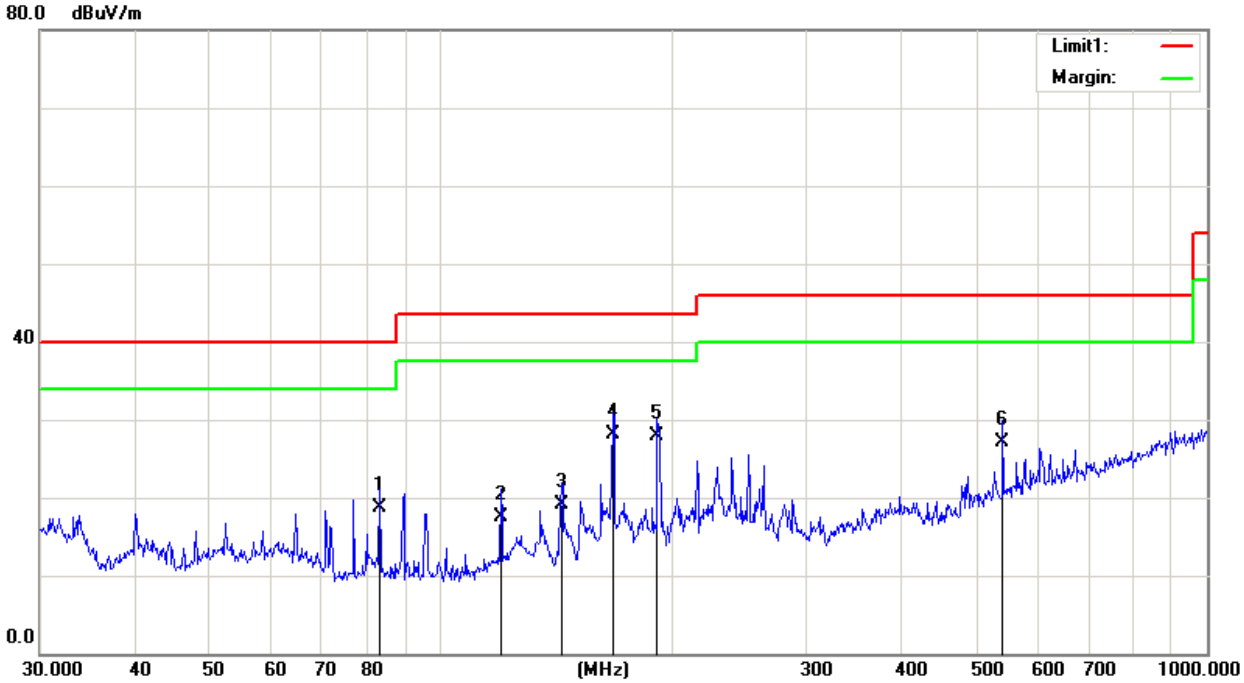
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =20 log (specific distance/test distance)(dB);

Limit line = specific limits(dBuv) + distance extrapolation factor

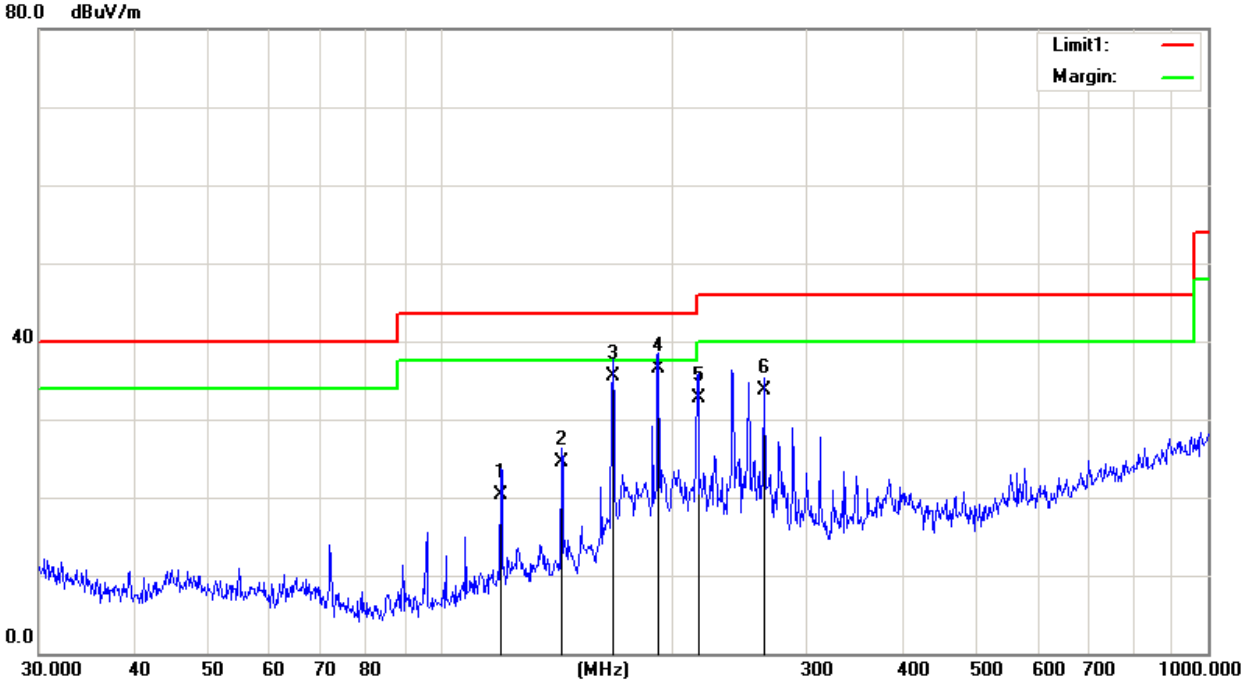
Between 30M – 1000 MHz(GFSK is worst case)

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Vertical**	**Test Result:**	**Pass**
Test Time:	**2019-7-15**	**Test By:**	**Blue**
Standard:	**(RE)FCC PART 15 class B 3m**		
Test Mode:	**DH1-2480MHz, TX**		
Note:			



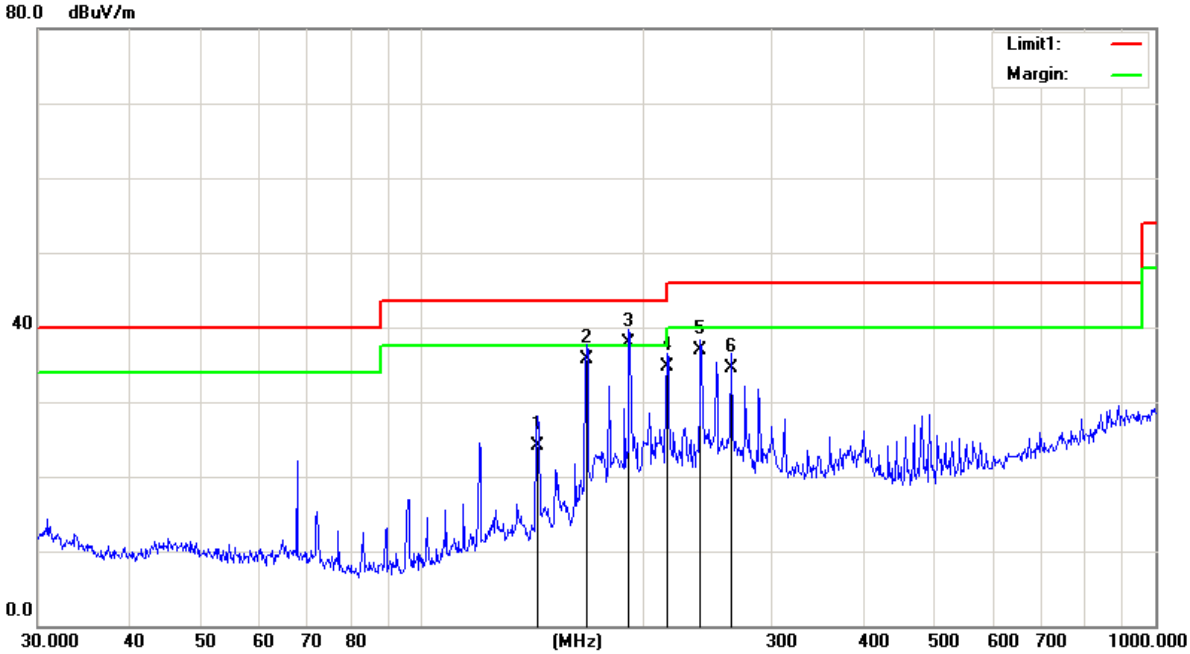
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	83.2298	34.72	-16.06	18.66	40.00	-21.34	QP
2	119.8556	31.15	-13.67	17.48	43.50	-26.02	QP
3	143.8295	31.86	-12.80	19.06	43.50	-24.44	QP
4	167.8243	39.40	-11.26	28.14	43.50	-15.36	QP
5	191.7450	40.01	-12.19	27.82	43.50	-15.68	QP
6	541.3725	33.43	-6.38	27.05	46.00	-18.95	QP

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Horizontal	Test Result:	Pass
Test Time:	2019-7-15	Test By:	Blue
Standard:	(RE)FCC PART 15 class B 3m		
Test Mode:	DH1-2480MHz, TX		
Note:			



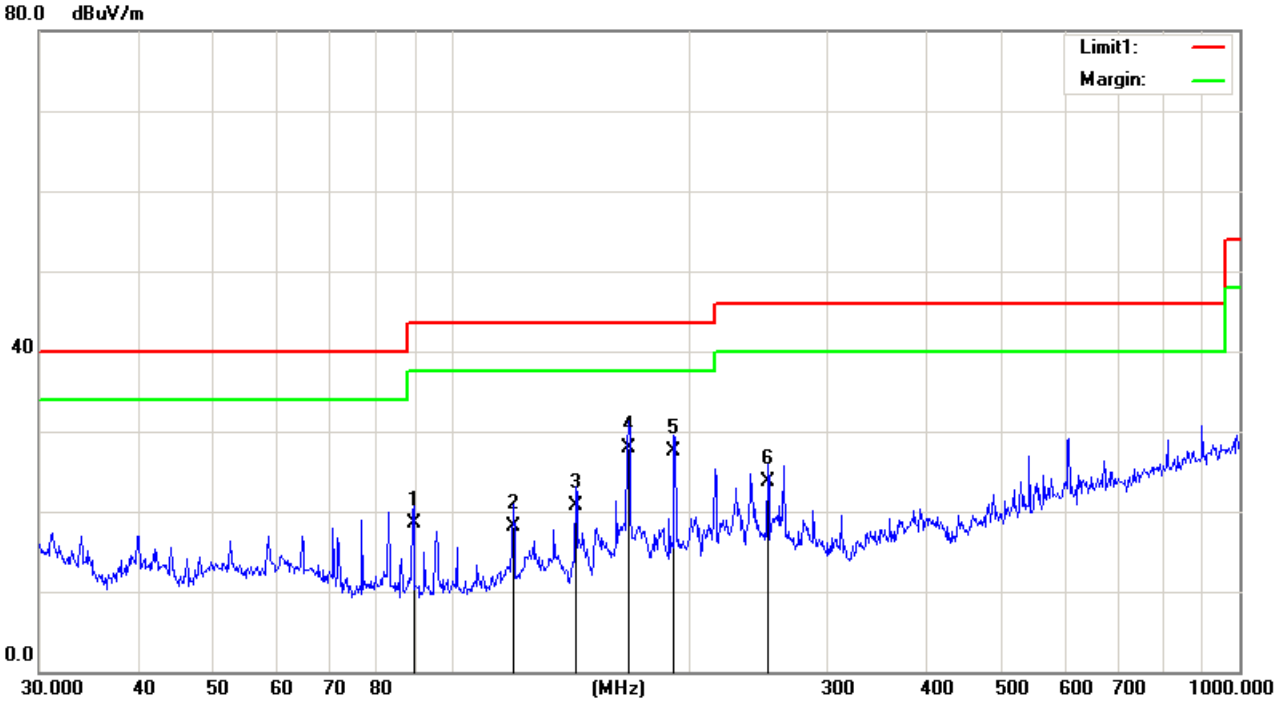
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	119.8556	34.97	-14.67	20.30	43.50	-23.20	QP
2	143.8295	38.07	-13.56	24.51	43.50	-18.99	QP
3	167.8243	47.14	-11.69	35.45	43.50	-8.05	QP
4	192.4186	46.71	-10.23	36.48	43.50	-7.02	QP
5	216.7828	42.34	-9.72	32.62	46.00	-13.38	QP
6	263.8190	39.07	-5.42	33.65	46.00	-12.35	QP

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Horizontal	Test Result:	Pass
Test Time:	2019-7-15	Test By:	Blue
Standard:	(RE)FCC PART 15 class B 3m		
Test Mode:	DH1-2441MHz, TX		
Note:			



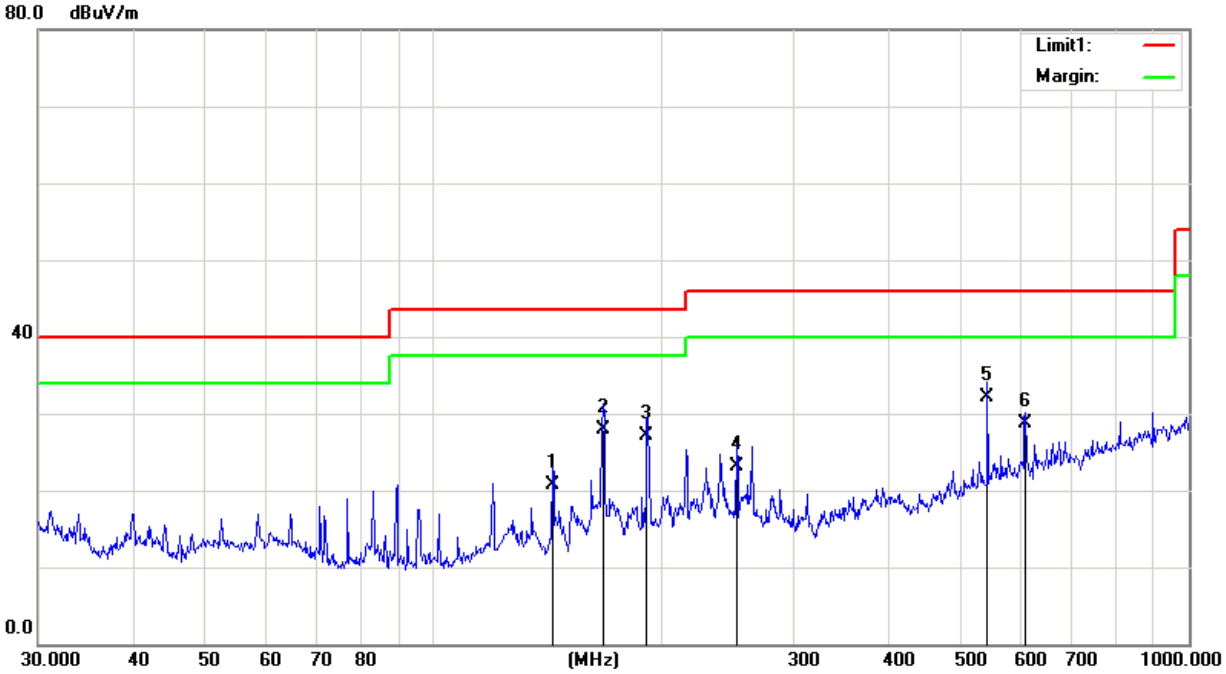
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	143.8295	37.68	-13.56	24.12	43.50	-19.38	QP
2	167.8243	47.31	-11.69	35.62	43.50	-7.88	QP
3	191.7450	48.03	-10.19	37.84	43.50	-5.66	QP
4	216.0240	44.57	-9.91	34.66	46.00	-11.34	QP
5	239.9874	43.63	-6.68	36.95	46.00	-9.05	QP
6	263.8190	39.93	-5.42	34.51	46.00	-11.49	QP

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Vertical	Test Result:	Pass
Test Time:	2019-7-15	Test By:	Blue
Standard:	(RE)FCC PART 15 class B 3m		
Test Mode:	DH1-2441MHz, TX		
Note:			



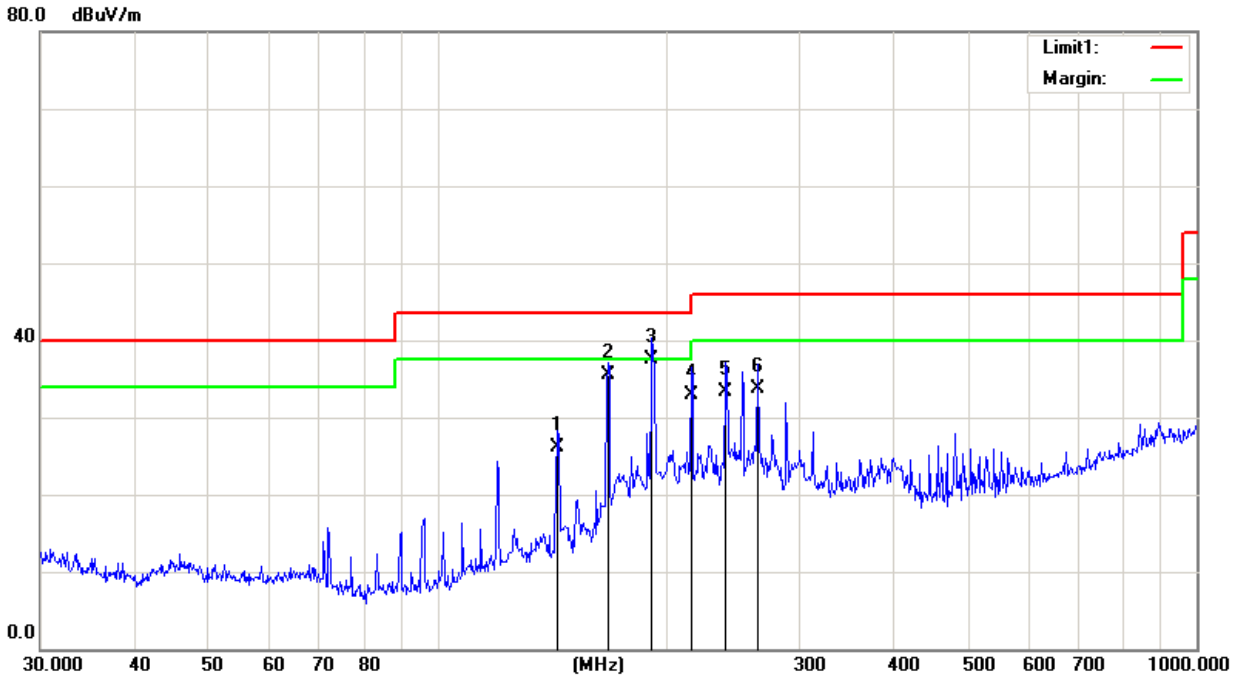
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	89.5899	34.29	-15.84	18.45	43.50	-25.05	QP
2	119.8556	31.72	-13.67	18.05	43.50	-25.45	QP
3	143.8295	33.46	-12.80	20.66	43.50	-22.84	QP
4	167.8243	39.10	-11.26	27.84	43.50	-15.66	QP
5	191.7450	39.67	-12.19	27.48	43.50	-16.02	QP
6	252.0627	32.81	-9.19	23.62	46.00	-22.38	QP

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Vertical	Test Result:	Pass
Test Time:	2019-7-15	Test By:	Blue
Standard:	(RE)FCC PART 15 class B 3m		
Test Mode:	DH1-2402MHz, TX		
Note:			



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	143.8294	33.46	-12.80	20.66	43.50	-22.84	QP
2	167.8242	39.10	-11.26	27.84	43.50	-15.66	QP
3	191.7450	39.33	-12.19	27.14	43.50	-16.36	QP
4	252.0627	32.28	-9.19	23.09	46.00	-22.91	QP
5	541.3724	38.56	-6.38	32.18	46.00	-13.82	QP
6	607.7866	32.92	-4.14	28.78	46.00	-17.22	QP

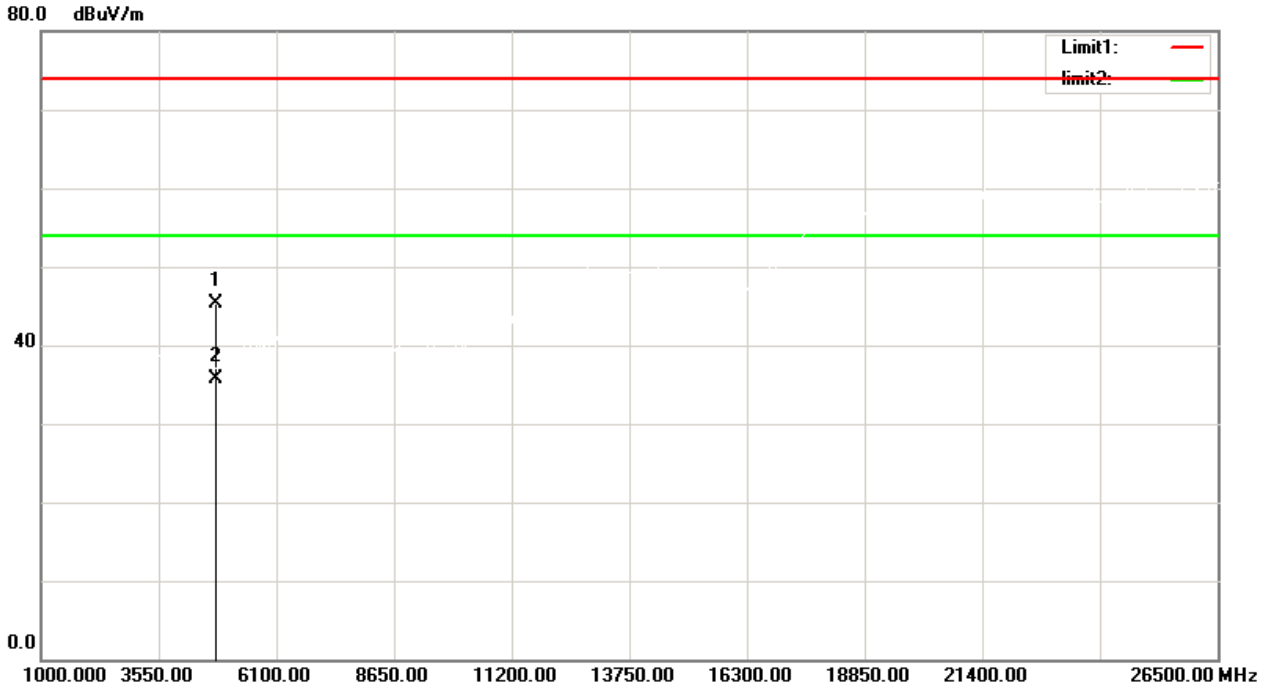
EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Horizontal	Test Result:	Pass
Test Time:	2019-7-15	Test By:	Blue
Standard:	(RE)FCC PART 15 class B 3m		
Test Mode:	DH1-2402MHz, TX		
Note:			



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	143.8295	39.68	-13.56	26.12	43.50	-17.38	QP
2	167.8243	47.17	-11.69	35.48	43.50	-8.02	QP
3	191.7450	47.63	-10.19	37.44	43.50	-6.06	QP
4	216.0240	42.86	-9.91	32.95	46.00	-13.05	QP
5	239.9874	39.97	-6.68	33.29	46.00	-12.71	QP
6	263.8190	39.20	-5.42	33.78	46.00	-12.22	QP

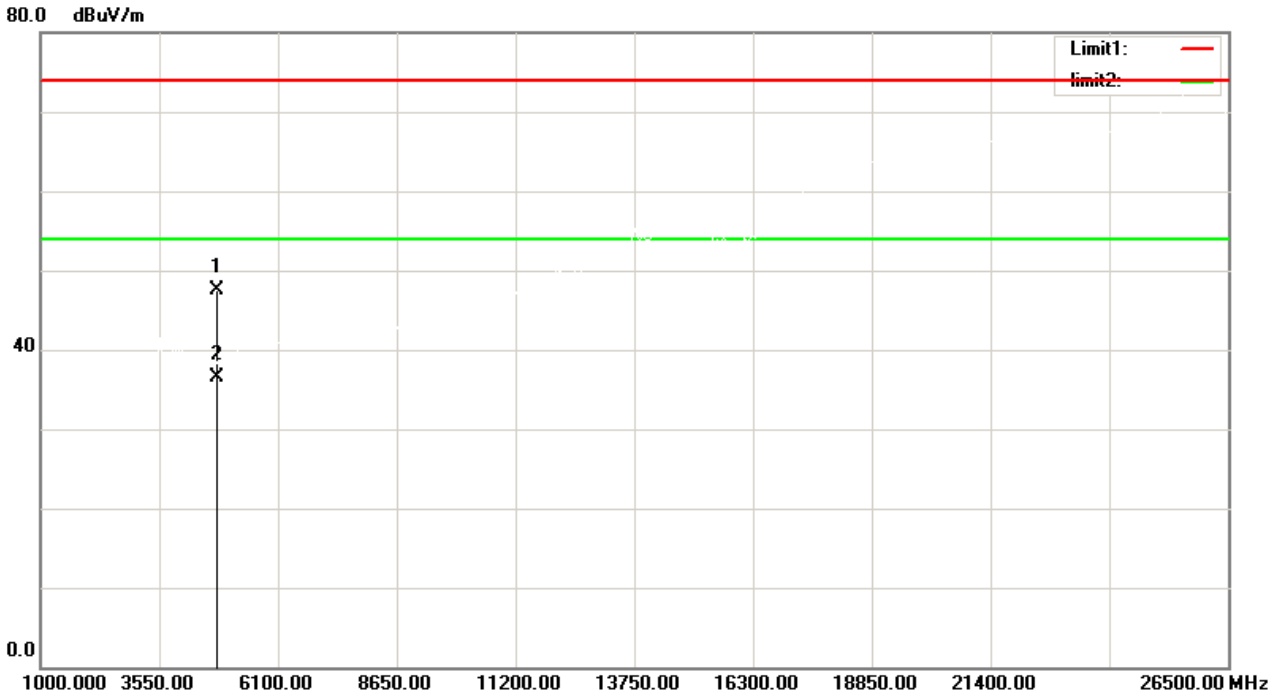
Between 1000M – 25000 MHz (GFSK is worst case)

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Vertical**	**Test Result:**	**Pass**
Test Time:	**2019-7-15**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**DH1-2402MHz, TX**		
Note:			



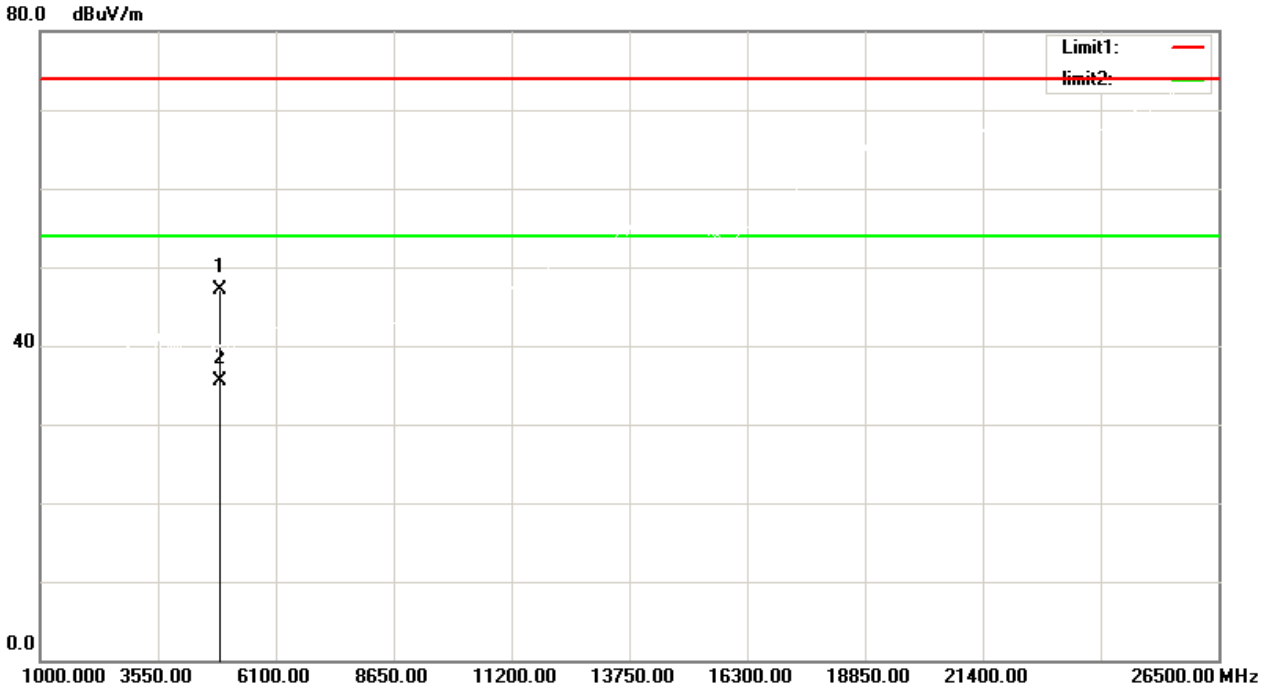
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4804.025	56.26	-10.99	45.27	74.00	-28.73	peak
2	4804.025	46.67	-10.99	35.68	54.00	-18.32	AVG

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Horizontal**	**Test Result:**	**Pass**
Test Time:	**2019-7-15**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**DH1-2402MHz, TX**		
Note:			



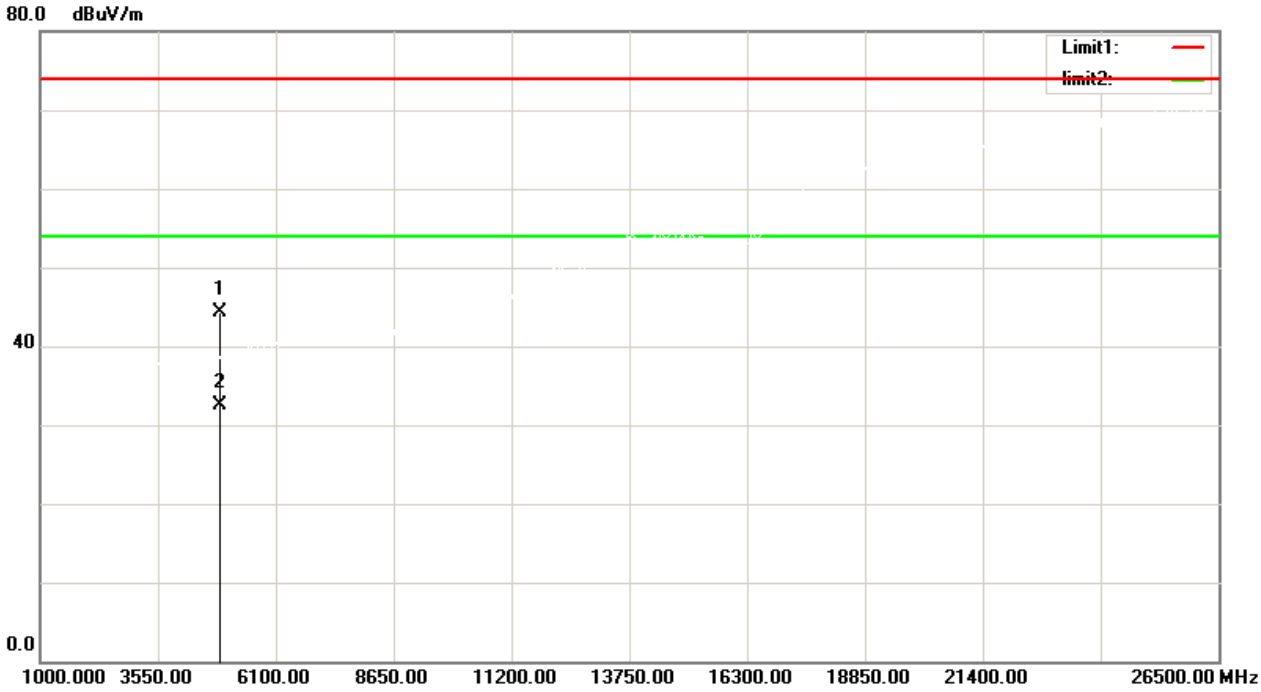
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4804.010	58.51	-10.99	47.52	74.00	-26.48	peak
2	4804.010	47.58	-10.99	36.59	54.00	-17.41	AVG

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Horizontal**	**Test Result:**	**Pass**
Test Time:	**2019-7-15**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**DH1-2441MHz, TX**		
Note:			



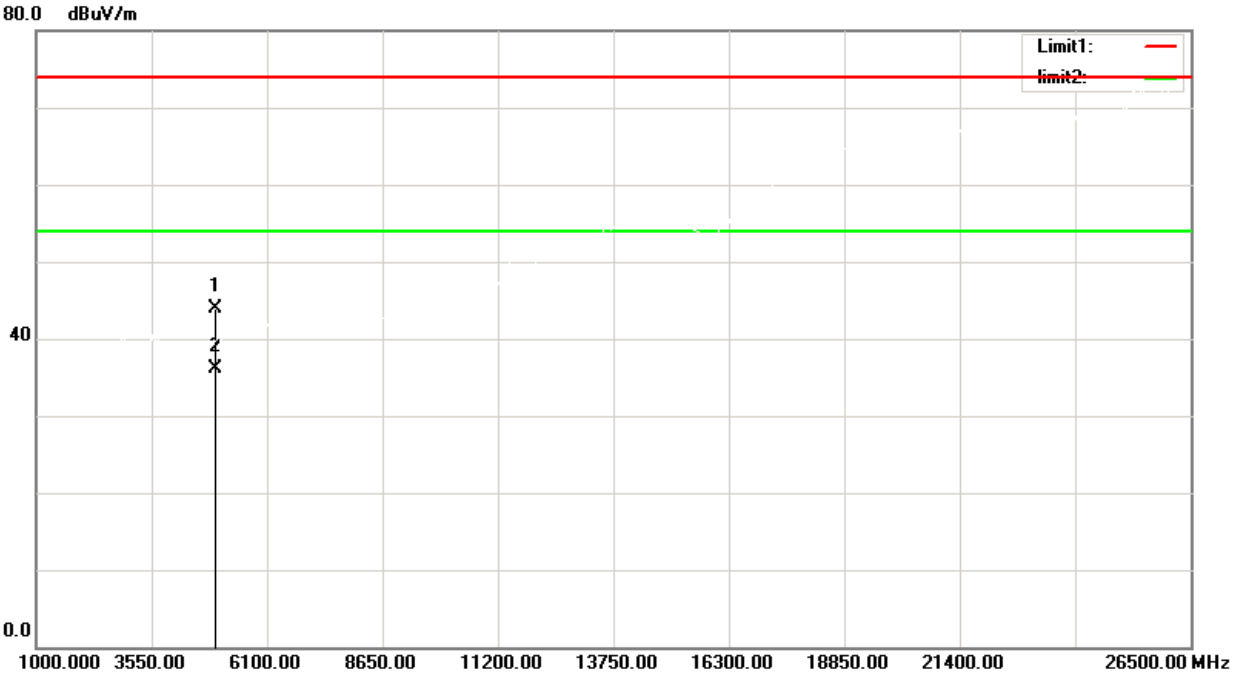
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4882.025	57.77	-10.71	47.06	74.00	-26.94	peak
2	4882.025	46.30	-10.71	35.59	54.00	-18.41	AVG

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Vertical	Test Result:	Pass
Test Time:	2019-7-15	Test By:	Blue
Standard:	FCC PART 15 C 1-26.5G PEAK		
Test Mode:	DH1-2441MHz, TX		
Note:			



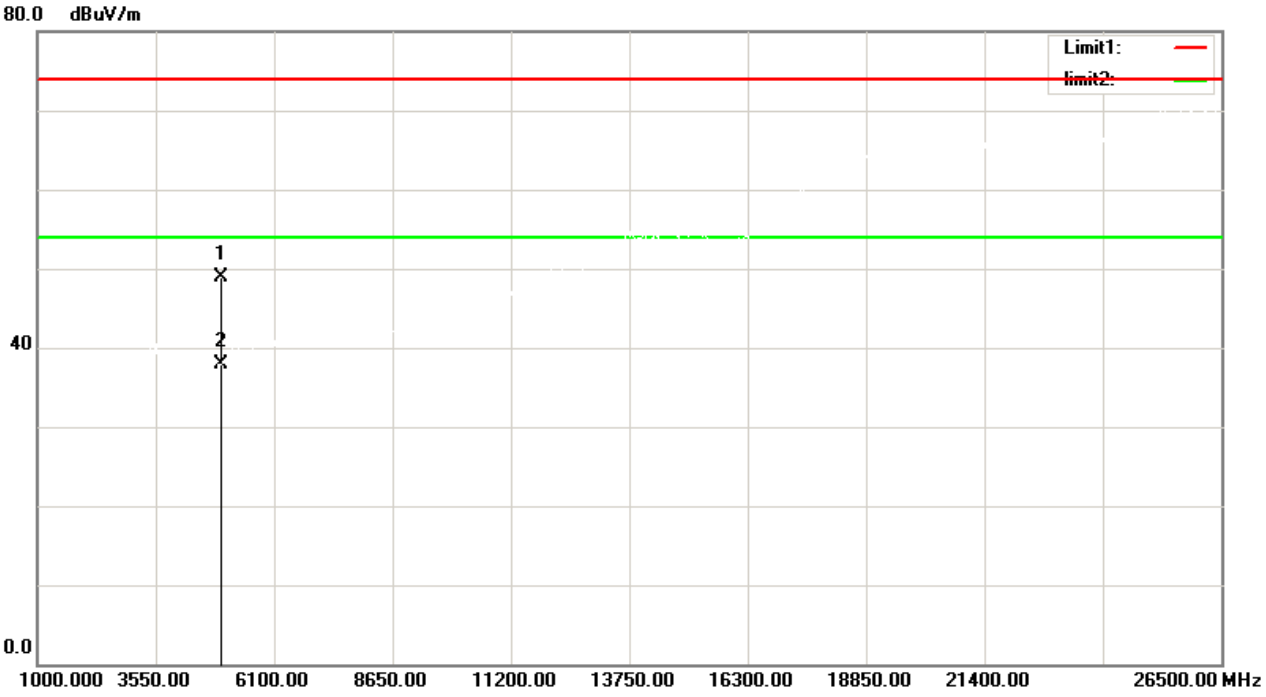
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4882.050	54.94	-10.71	44.23	74.00	-29.77	peak
2	4882.050	43.26	-10.71	32.55	54.00	-21.45	AVG

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Vertical	Test Result:	Pass
Test Time:	2019-7-15	Test By:	Blue
Standard:	FCC PART 15 C 1-26.5G PEAK		
Test Mode:	DH1-2480MHz, TX		
Note:			



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.100	54.31	-10.44	43.87	74.00	-30.13	peak
2	4960.100	46.61	-10.44	36.17	54.00	-17.83	AVG

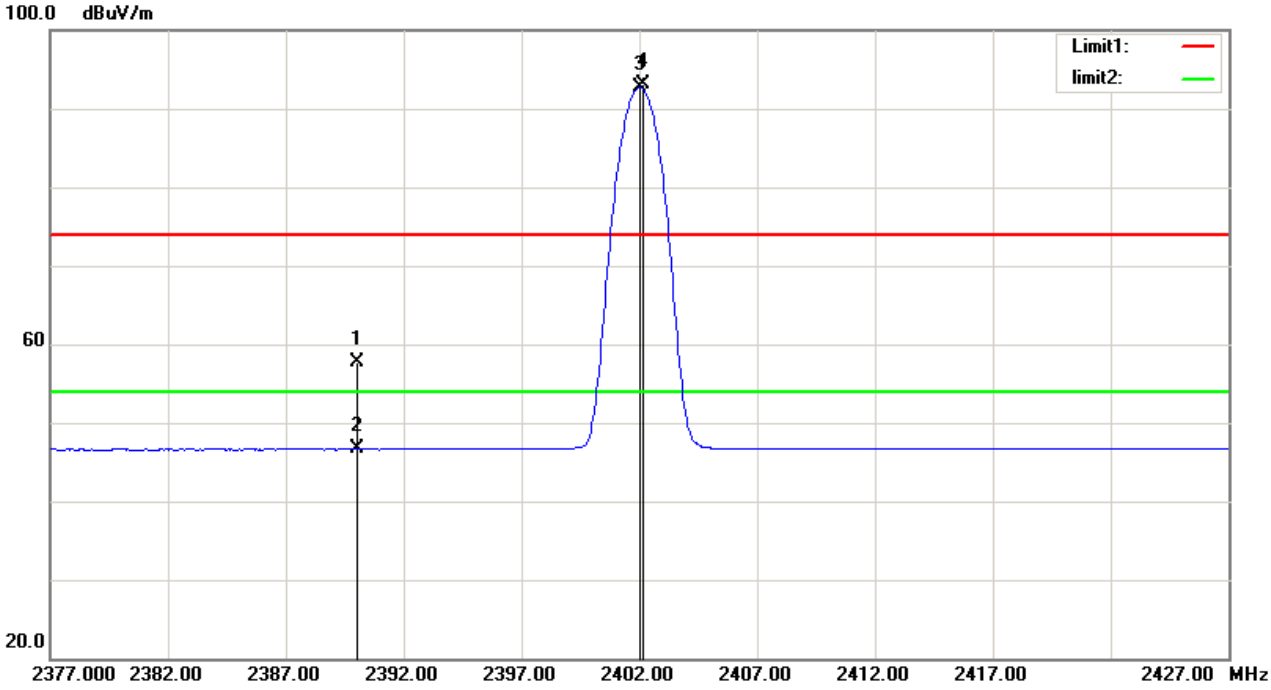
EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Horizontal**	**Test Result:**	**Pass**
Test Time:	**2019-7-15**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**DH1-2480MHz, TX**		
Note:			



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4960.050	59.36	-10.44	48.92	74.00	-25.08	peak
2	4960.050	48.39	-10.44	37.95	54.00	-16.05	AVG

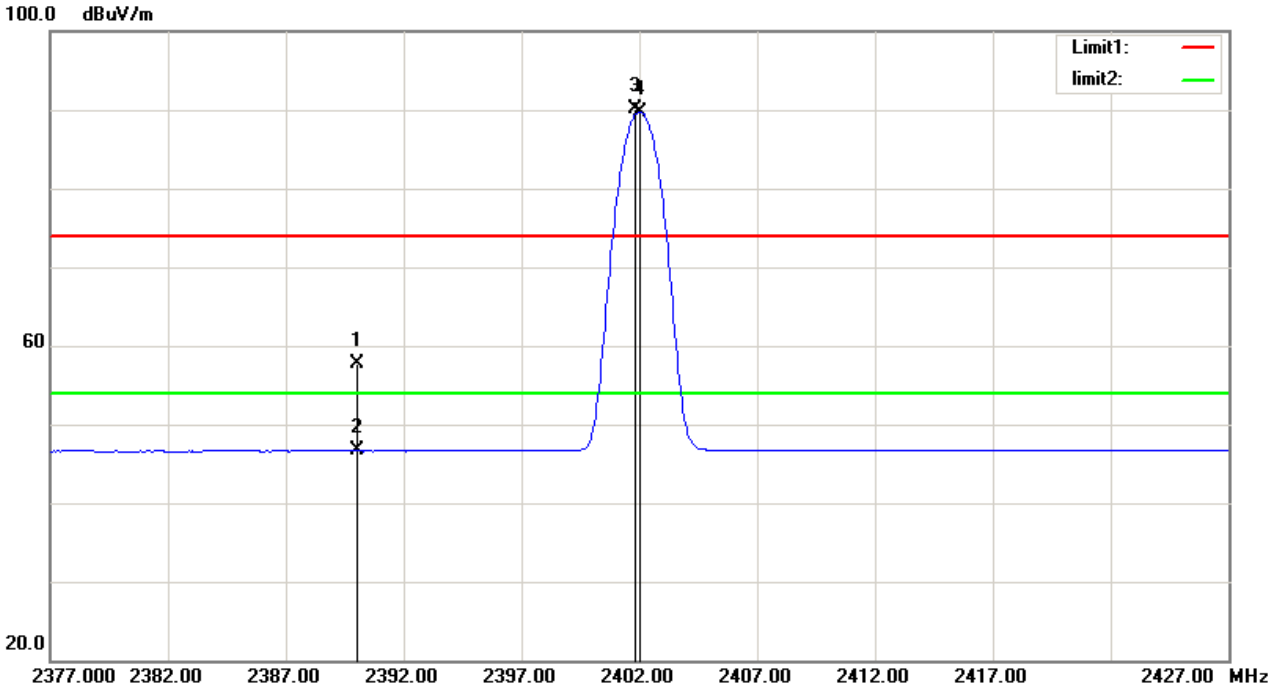
Radiated band edge:

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Horizontal	Test Result:	Pass
Test Time:	2019-7-12	Test By:	Blue
Standard:	FCC PART 15 C 1-26.5G PEAK		
Test Mode:	DH1-2402MHz, TX		
Note:			



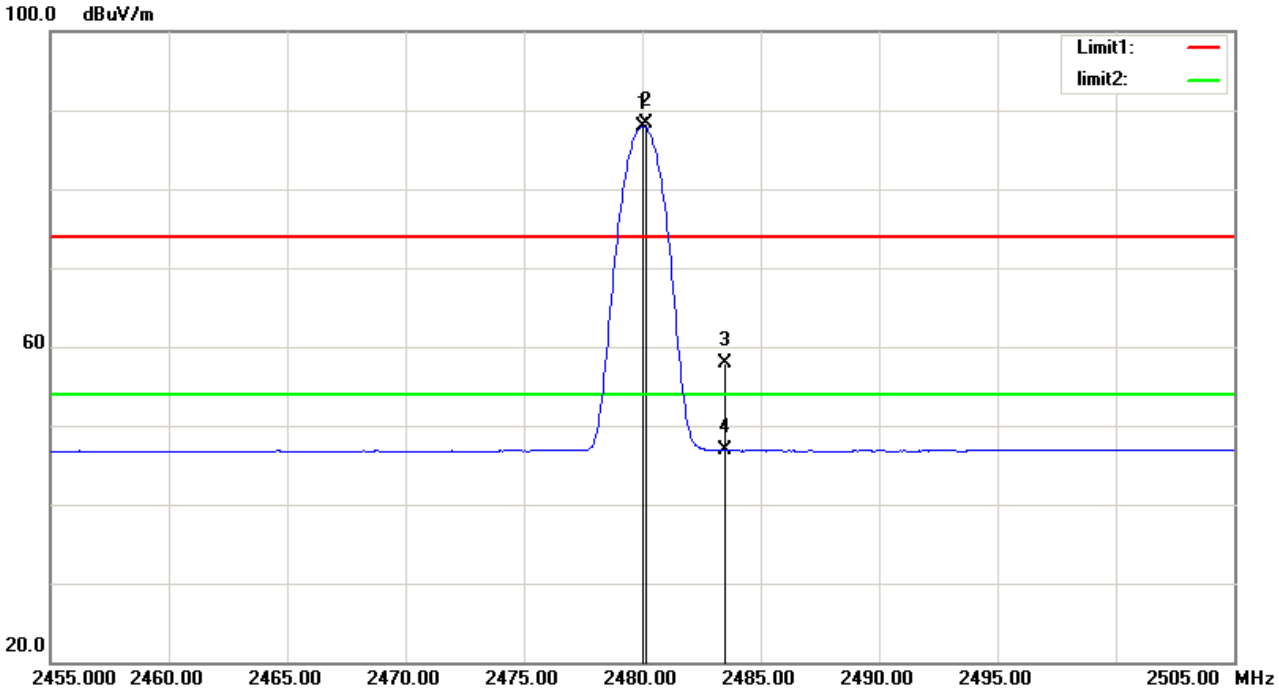
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.000	25.93	31.86	57.79	74.00	-16.21	peak
2	2390.000	14.76	31.86	46.62	54.00	-7.38	AVG
3	2402.000	60.79	31.87	92.66	/	/	AVG
4	2402.150	61.14	31.87	93.01	/	/	peak

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Vertical	Test Result:	Pass
Test Time:	2019-7-12	Test By:	Blue
Standard:	FCC PART 15 C 1-26.5G PEAK		
Test Mode:	DH1-2402MHz, TX		
Note:			



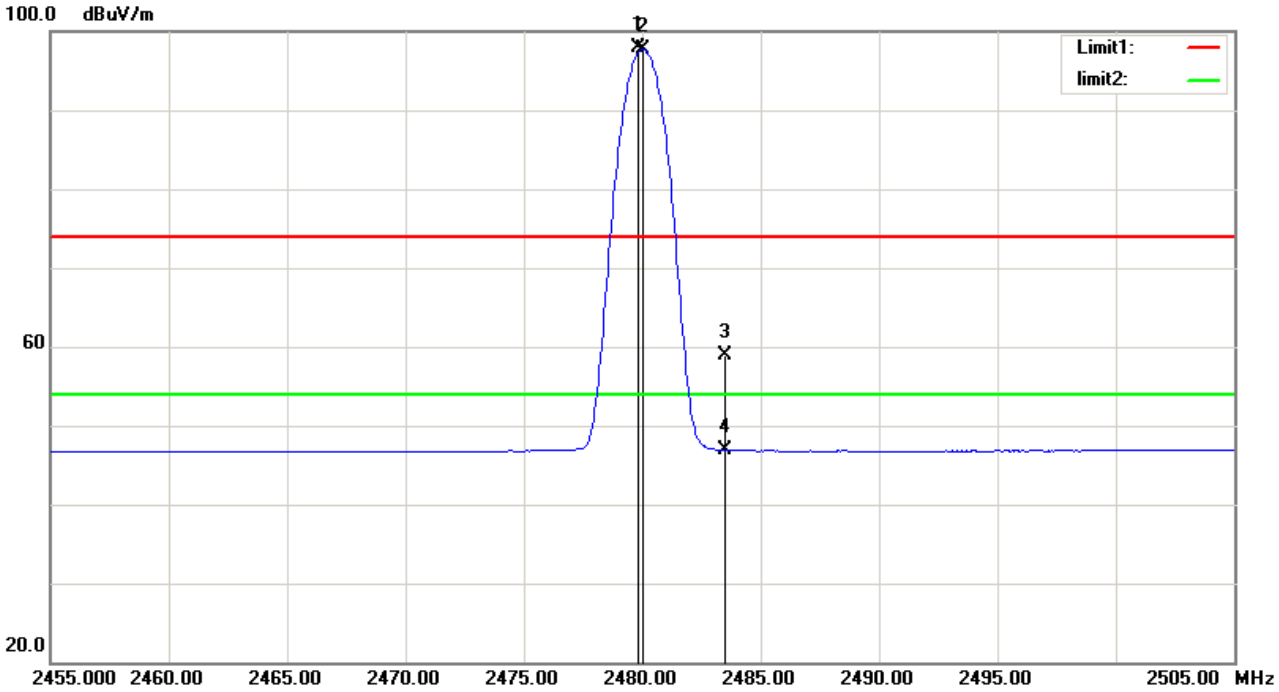
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2390.000	25.80	31.86	57.66	74.00	-16.34	peak
2	2390.000	14.79	31.86	46.65	54.00	-7.35	AVG
3	2401.850	58.23	31.87	90.10	/	/	peak
4	2402.000	57.83	31.87	89.70	/	/	AVG

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Vertical	Test Result:	Pass
Test Time:	2019-7-12	Test By:	Blue
Standard:	FCC PART 15 C 1-26.5G PEAK		
Test Mode:	DH1-2480MHz, TX		
Note:			



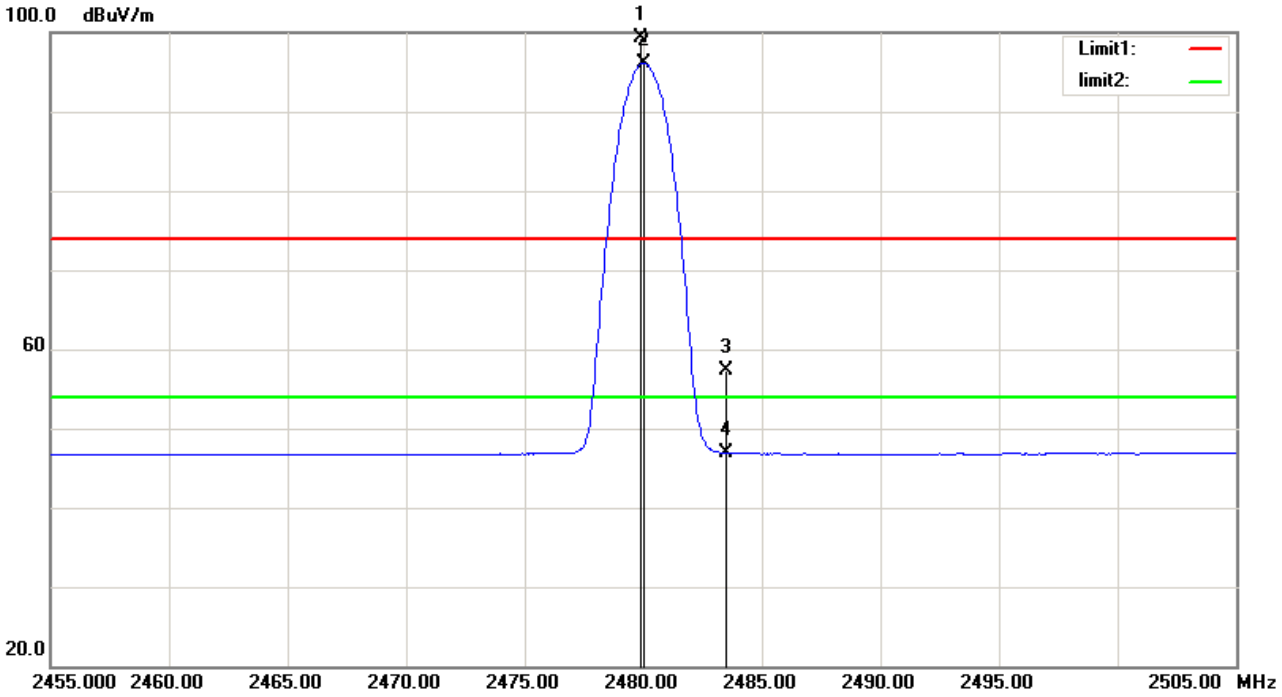
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.050	55.88	31.98	87.86	/	/	AVG
2	2480.200	56.28	31.98	88.26	/	/	peak
3	2483.500	26.01	31.98	57.99	74.00	-16.01	peak
4	2483.500	14.88	31.98	46.86	54.00	-7.14	AVG

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Horizontal**	**Test Result:**	**Pass**
Test Time:	**2019-7-12**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**DH1-2480MHz, TX**		
Note:			



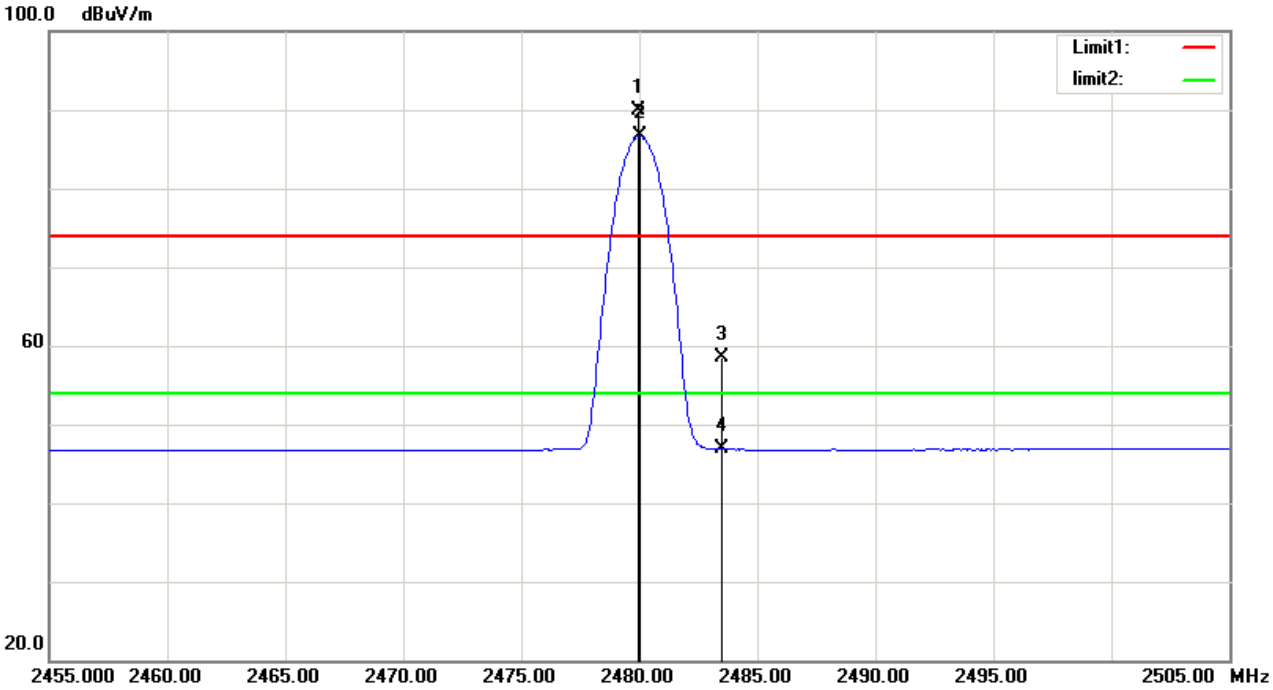
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.850	65.97	31.98	97.95	/	/	peak
2	2480.050	65.70	31.98	97.68	/	/	AVG
3	2483.500	26.83	31.98	58.81	74.00	-15.19	peak
4	2483.500	14.90	31.98	46.88	54.00	-7.12	AVG

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Horizontal	Test Result:	Pass
Test Time:	2019-7-12	Test By:	Blue
Standard:	FCC PART 15 C 1-26.5G PEAK		
Test Mode:	2DH1-2480MHz, TX		
Note:			



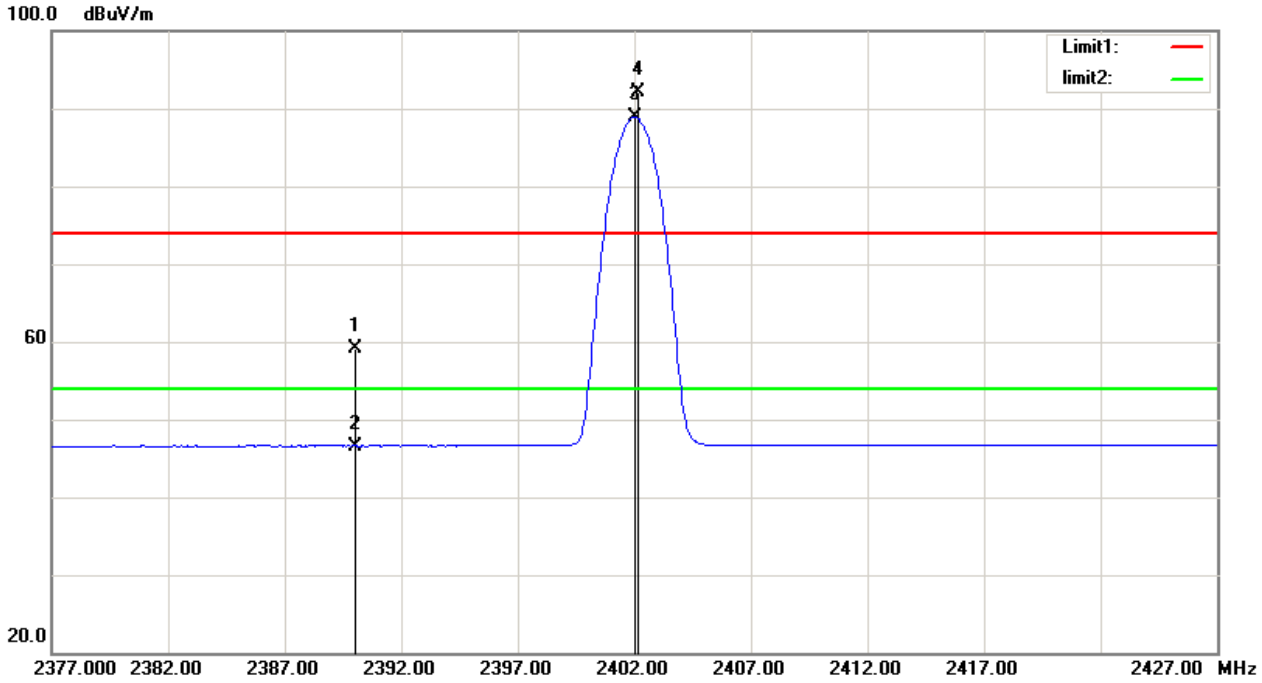
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.900	67.27	31.98	99.25	/	/	peak
2	2480.000	64.14	31.98	96.12	/	/	AVG
3	2483.500	25.25	31.98	57.23	74.00	-16.77	peak
4	2483.500	14.90	31.98	46.88	54.00	-7.12	AVG

EUT:	Afterglow Wireless Deluxe Ctrl for Nintendo Switch	Model No.:	500-137
Temperature:	24	Relative Humidity:	66%
Distance:	3m	Test Power:	DC 3.7V Li-ion Battery
Polarization:	Vertical	Test Result:	Pass
Test Time:	2019-7-12	Test By:	Blue
Standard:	FCC PART 15 C 1-26.5G PEAK		
Test Mode:	2DH1-2480MHz, TX		
Note:			



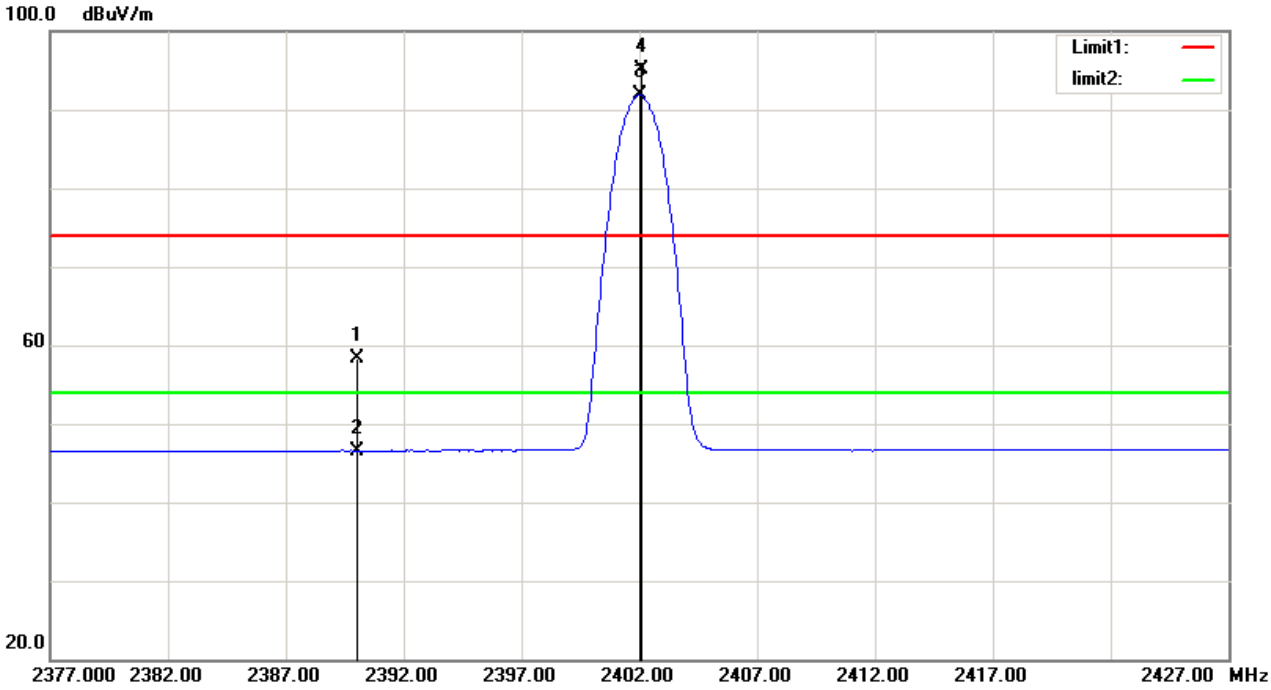
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.950	58.01	31.98	89.99	/	/	peak
2	2480.000	54.76	31.98	86.74	/	/	AVG
3	2483.500	26.62	31.98	58.60	74.00	-15.40	peak
4	2483.500	14.88	31.98	46.86	54.00	-7.14	AVG

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Vertical**	**Test Result:**	**Pass**
Test Time:	**2019-7-12**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**2DH1-2402MHz, TX**		
Note:			



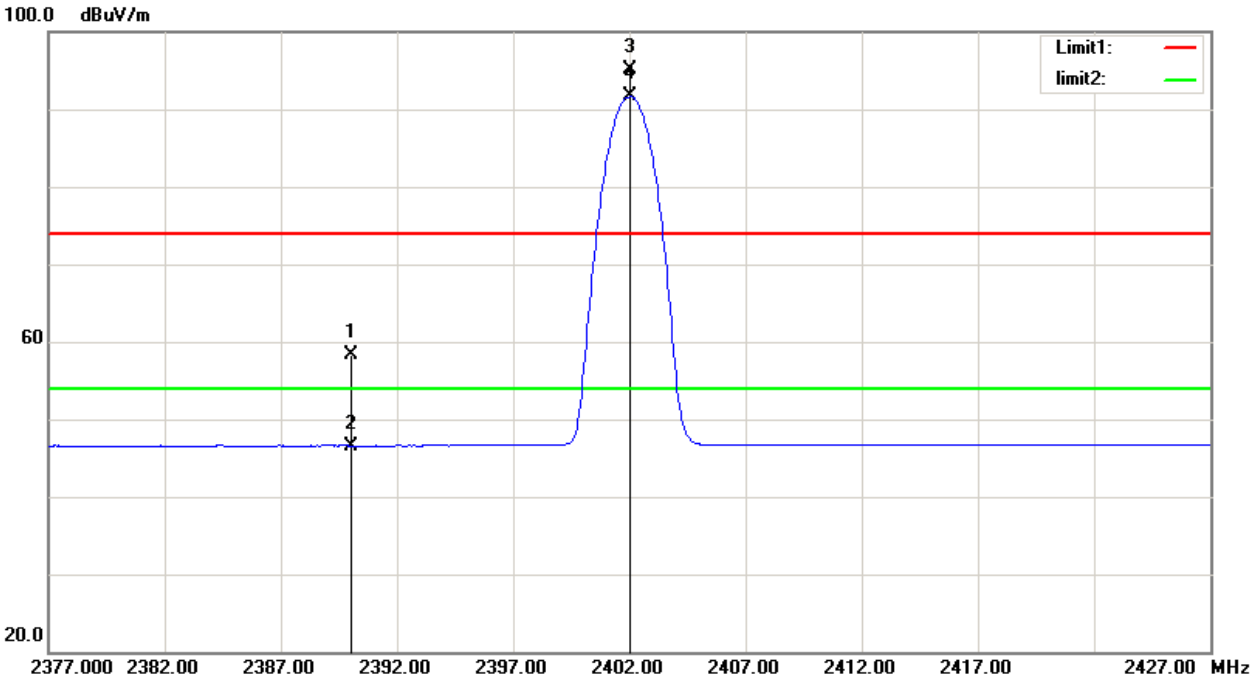
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.000	27.15	31.86	59.01	74.00	-14.99	peak
2	2390.000	14.74	31.86	46.60	54.00	-7.40	AVG
3	2402.000	57.05	31.87	88.92	/	/	AVG
4	2402.200	60.23	31.87	92.10	/	/	peak

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Horizontal**	**Test Result:**	**Pass**
Test Time:	**2019-7-12**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**2DH1-2402MHz, TX**		
Note:			



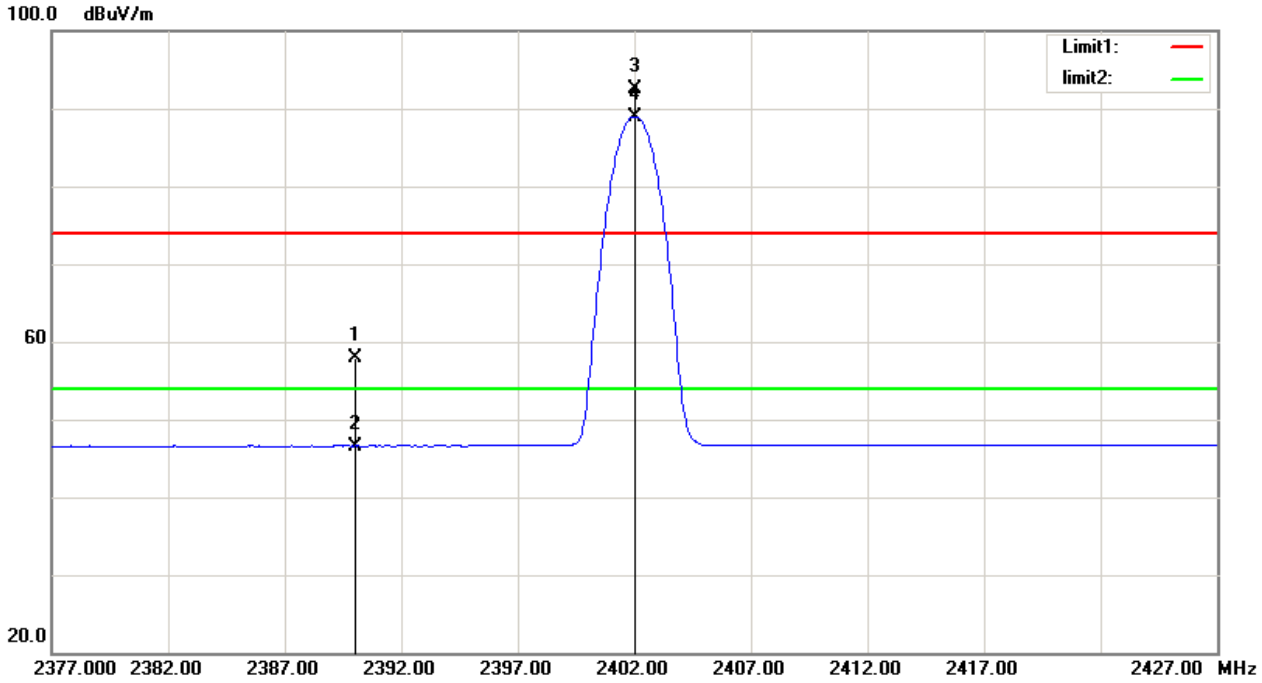
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.000	26.49	31.86	58.35	74.00	-15.65	peak
2	2390.000	14.66	31.86	46.52	54.00	-7.48	AVG
3	2402.000	60.00	31.87	91.87	/	/	AVG
4	2402.100	63.23	31.87	95.10	/	/	peak

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Horizontal**	**Test Result:**	**Pass**
Test Time:	**2019-7-12**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**3DH1-2402MHz, TX**		
Note:			



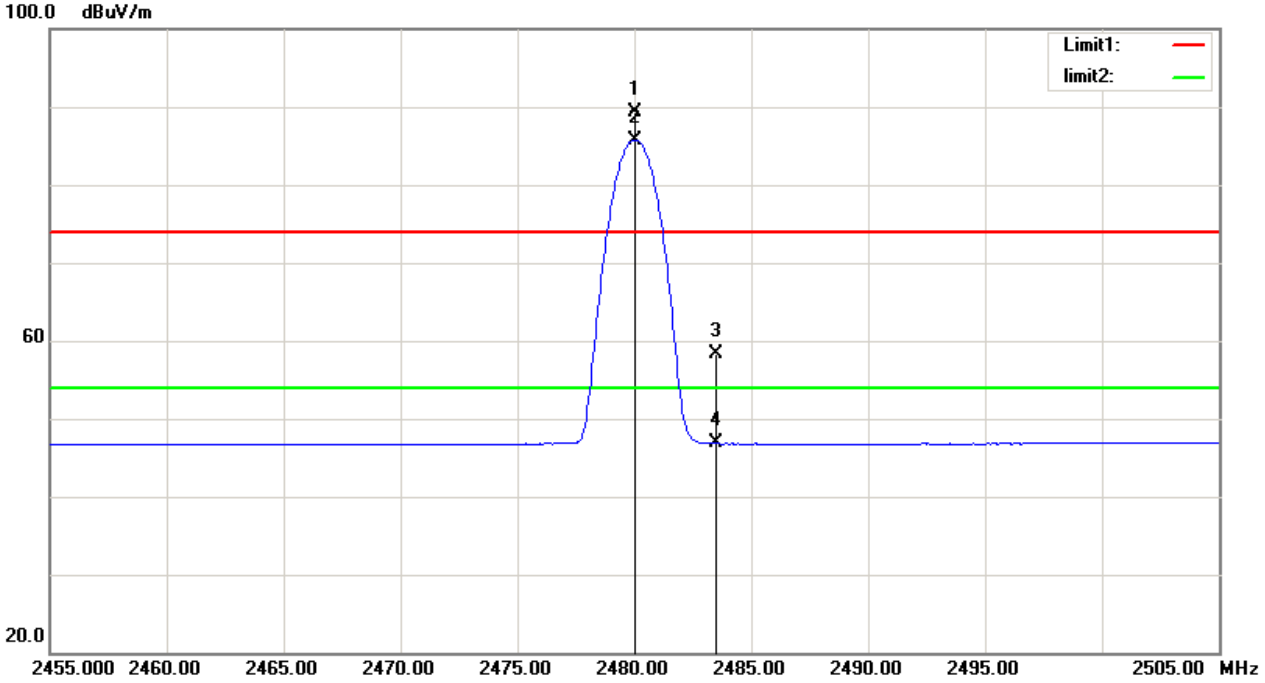
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.000	26.35	31.86	58.21	74.00	-15.79	peak
2	2390.000	14.72	31.86	46.58	54.00	-7.42	AVG
3	2402.050	63.26	31.87	95.13	/	/	peak
4	2402.050	59.76	31.87	91.63	/	/	AVG

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Vertical**	**Test Result:**	**Pass**
Test Time:	**2019-7-12**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**3DH1-2402MHz, TX**		
Note:			



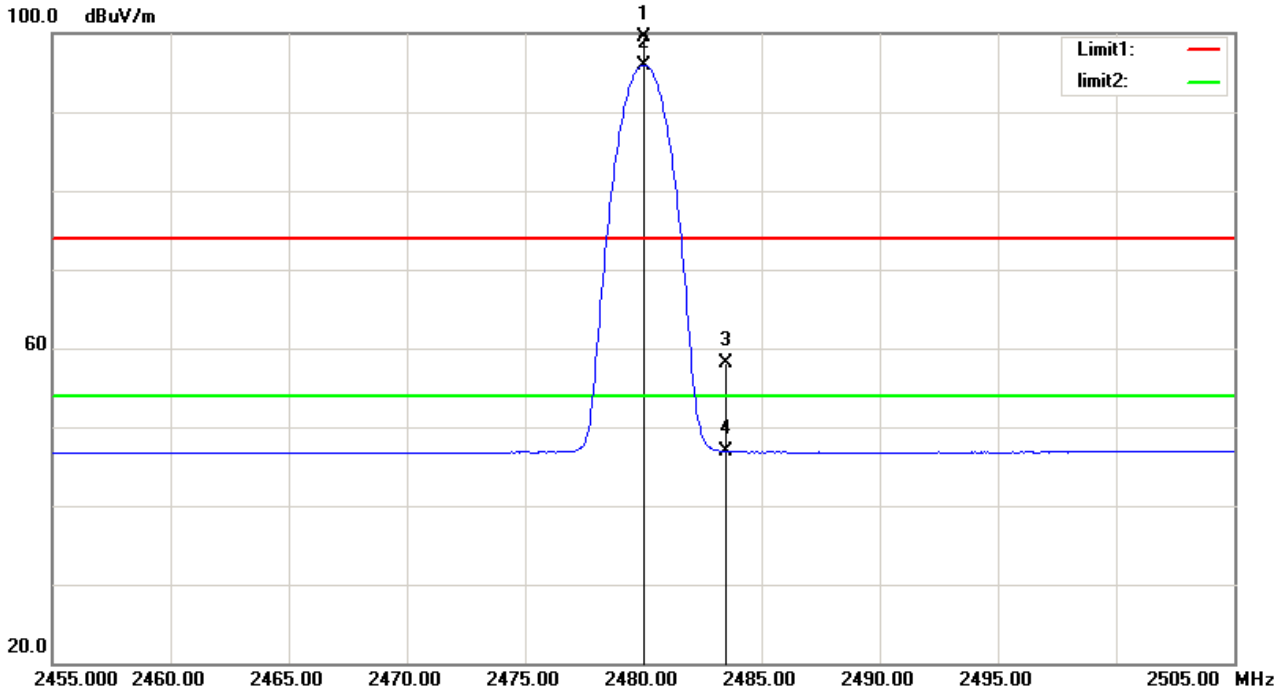
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.000	26.03	31.86	57.89	74.00	-16.11	peak
2	2390.000	14.74	31.86	46.60	54.00	-7.40	AVG
3	2402.000	60.69	31.87	92.56	/	/	peak
4	2402.000	57.13	31.87	89.00	/	/	AVG

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Vertical**	**Test Result:**	**Pass**
Test Time:	**2019-7-12**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**3DH1-2480MHz, TX**		
Note:			



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.000	57.24	31.98	89.22	/	/	peak
2	2480.050	53.79	31.98	85.77	/	/	AVG
3	2483.500	26.37	31.98	58.35	74.00	-15.65	peak
4	2483.500	14.87	31.98	46.85	54.00	-7.15	AVG

EUT:	**Afterglow Wireless Deluxe Ctrl for Nintendo Switch**	**Model No.:**	**500-137**
Temperature:	**24**	**Relative Humidity:**	**66%**
Distance:	**3m**	**Test Power:**	**DC 3.7V Li-ion Battery**
Polarization:	**Horizontal**	**Test Result:**	**Pass**
Test Time:	**2019-7-12**	**Test By:**	**Blue**
Standard:	**FCC PART 15 C 1-26.5G PEAK**		
Test Mode:	**3DH1-2480MHz, TX**		
Note:			



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.050	67.44	31.98	99.42	/	/	peak
2	2480.050	63.99	31.98	95.97	/	/	AVG
3	2483.500	26.04	31.98	58.02	74.00	-15.98	peak
4	2483.500	14.93	31.98	46.91	54.00	-7.09	AVG

9. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE

9.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2020/05/27	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2019/12/16	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2019/12/16	1 Year

9.2. 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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) (see §15.205(c)).

9.3. Test Procedure

a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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.
c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
e) Repeat above procedures until all measured frequencies were complete.

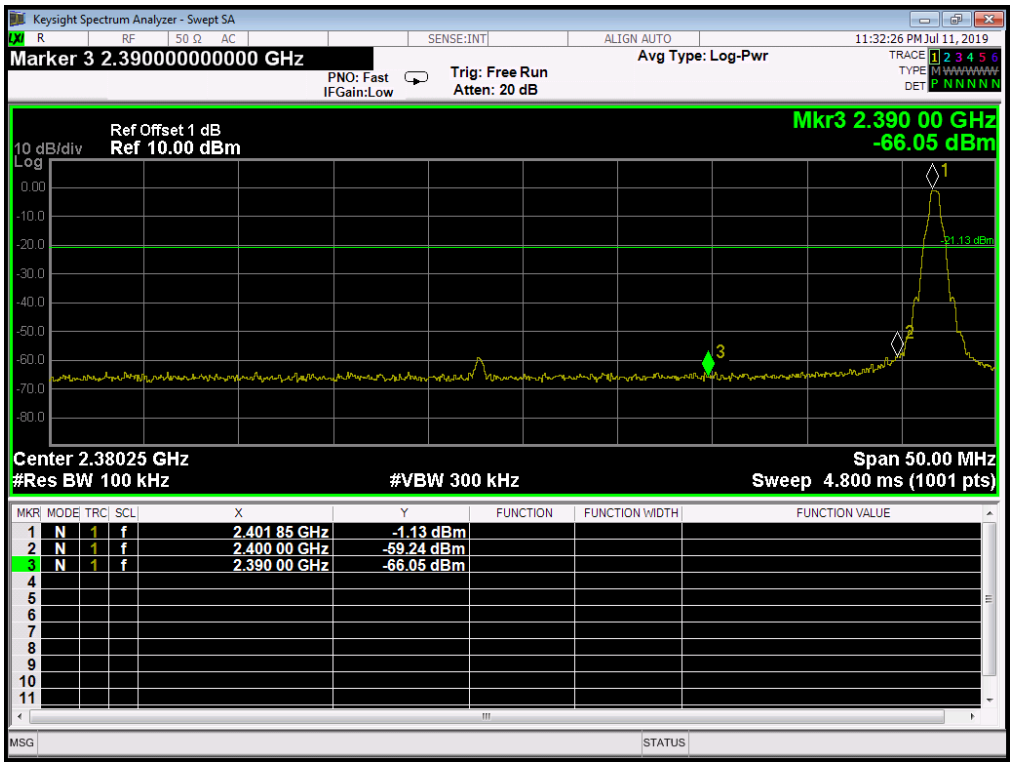
9.4. Test result

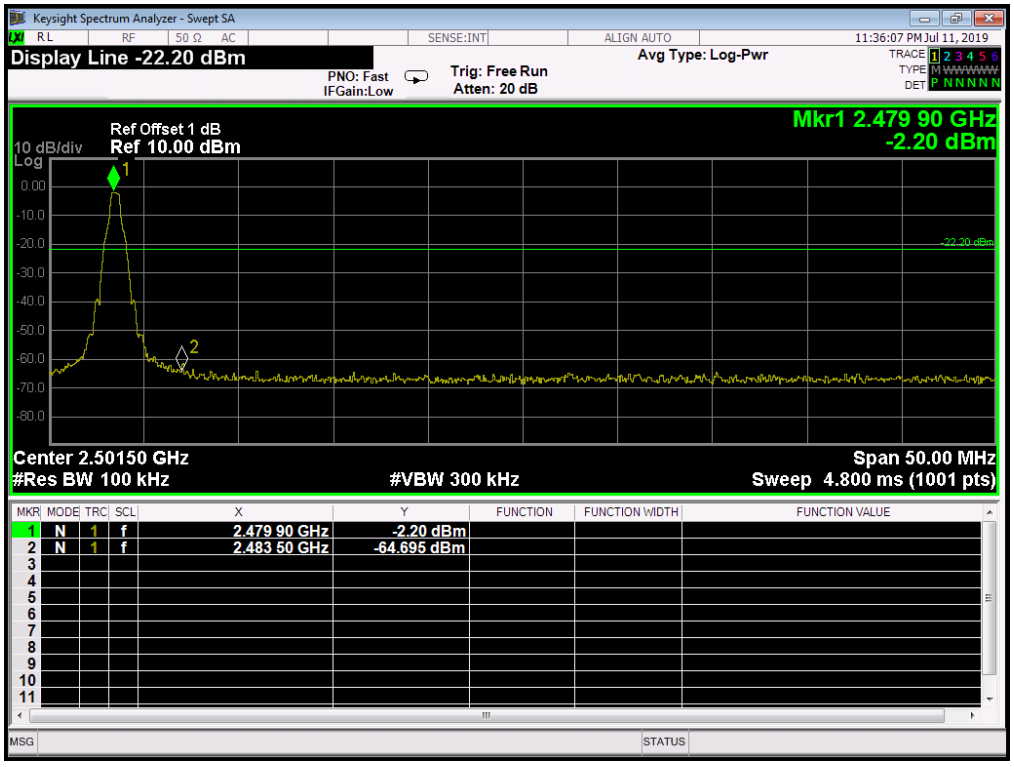
PASS (**See below detailed test result**.)

Frequency Band	Delta Peak to band emission (dBc)	＞Limit (dBc)	Result
1Mbps Non-hopping			
2400	58.11	20	Pass
2483.5	62.50	20	Pass
2Mbps Non-hopping			
2400	56.15	20	Pass
2483.5	59.50	20	Pass
3Mbps Non-hopping			
2400	57.08	20	Pass
2483.5	60.00	20	Pass

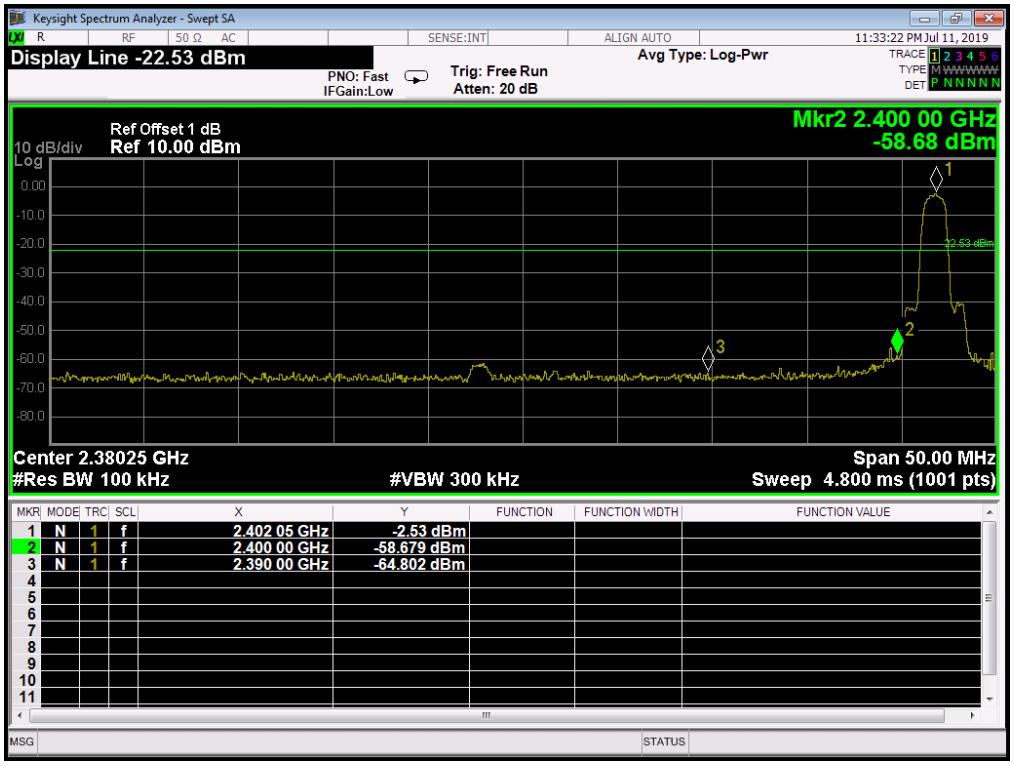
Frequency Band	Delta Peak to band emission (dBc)	＞Limit (dBc)	Result
1Mbps hopping			
2400	59.16	20	Pass
2483.5	63.11	20	Pass
2Mbps hopping			
2400	59.20	20	Pass
2483.5	64.05	20	Pass
3Mbps hopping			
2400	60.88	20	Pass
2483.5	63.96	20	Pass

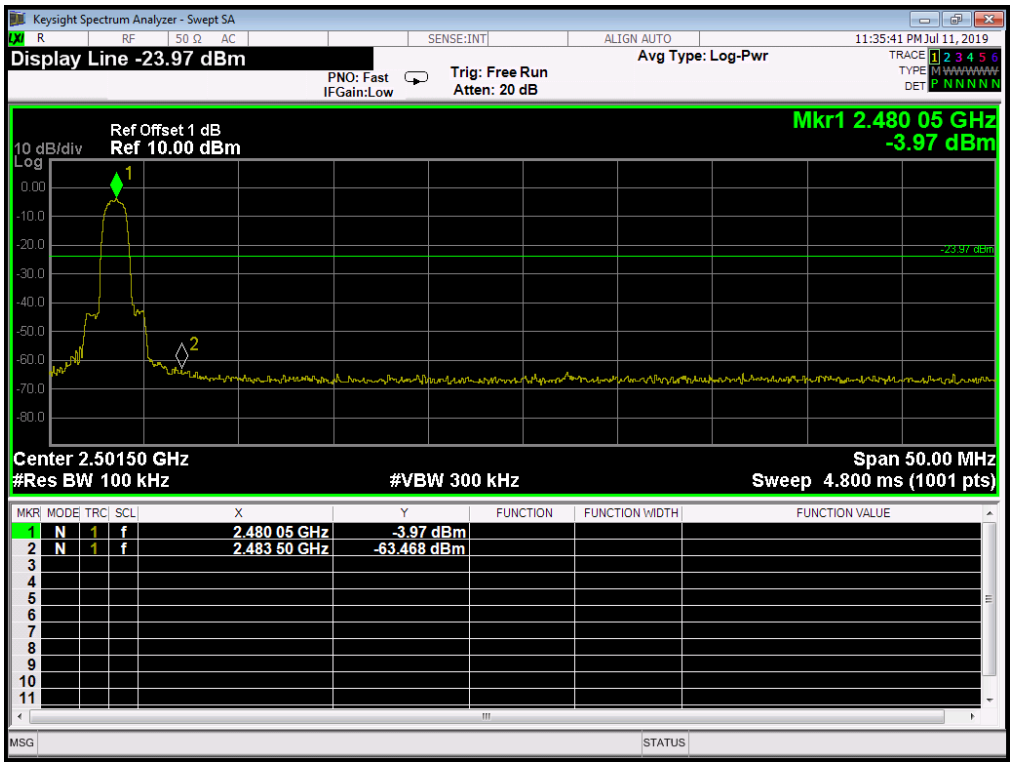
GFSK


Keysight Spectrum Analyzer - Swept SA
Marker 3 2.390000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
11:32:26 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr3 2.390 00 GHz
-66.05 dBm
-21.13 dBm
Center 2.38025 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
1 N 1 f 2.401 85 GHz -1.13 dBm
2 N 1 f 2.400 00 GHz -59.24 dBm
3 N 1 f 2.390 00 GHz -66.05 dBm

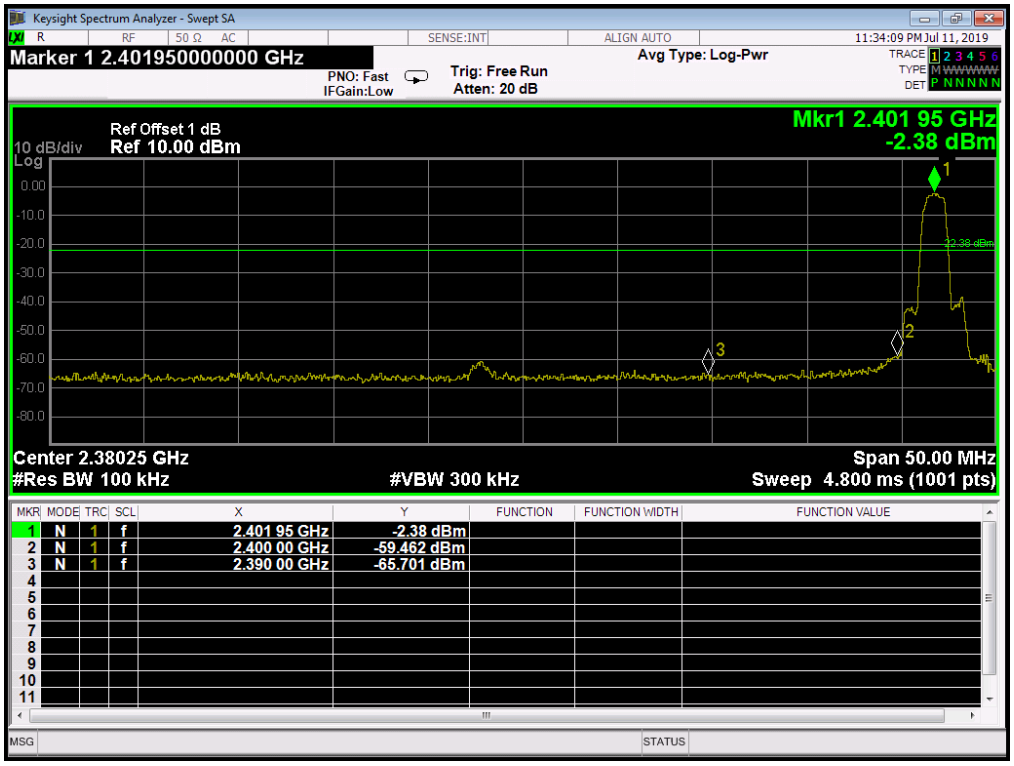

Keysight Spectrum Analyzer - Swept SA
Display Line -22.20 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
11:36:07 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.479 90 GHz
-2.20 dBm
-22.20 dBm
Center 2.50150 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
1 N 1 f 2.479 90 GHz -2.20 dBm
2 N 1 f 2.483 50 GHz -64.695 dBm

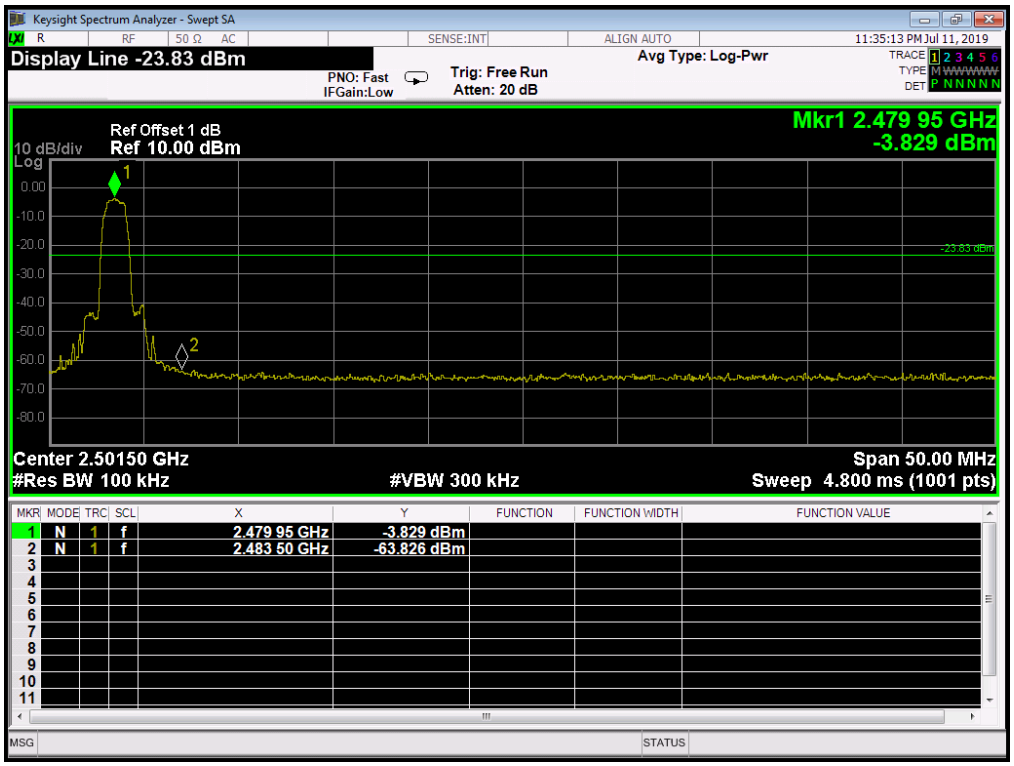
π/4DQPSK


Keysight Spectrum Analyzer - Swept SA
Display Line -22.53 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
11:33:22 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr2 2.400 00 GHz
-58.68 dBm
-22.53 dBm
Center 2.38025 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
1 N 1 f 2.402 05 GHz -2.53 dBm
2 N 1 f 2.400 00 GHz -58.679 dBm
3 N 1 f 2.390 00 GHz -64.802 dBm

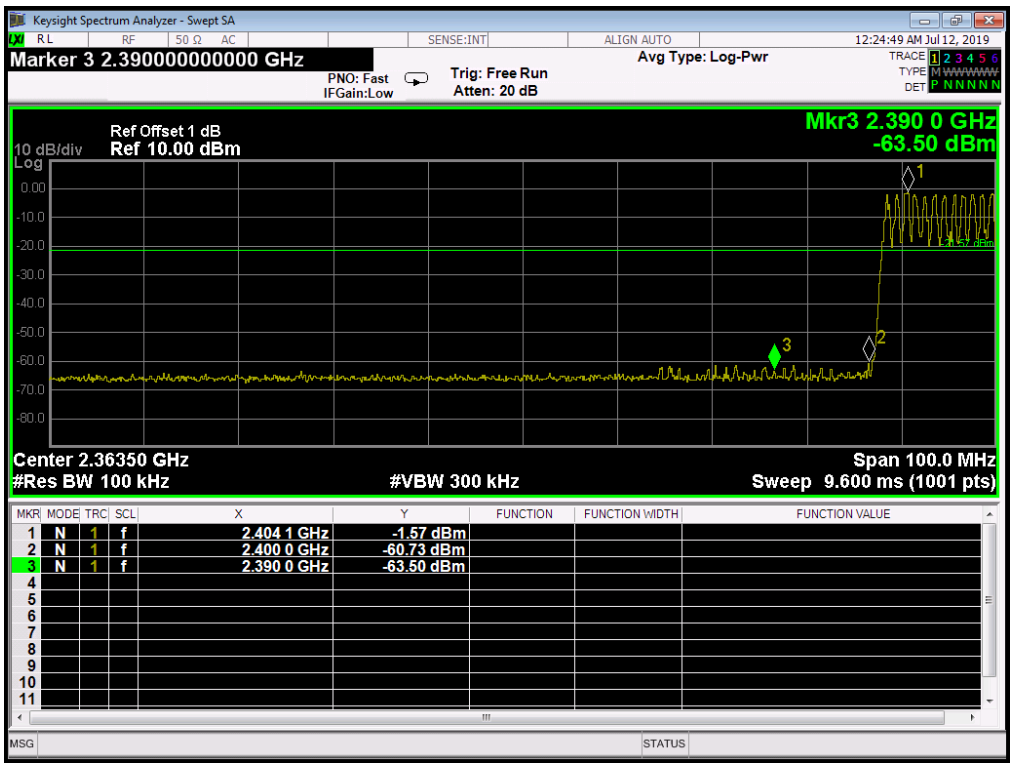

Keysight Spectrum Analyzer - Swept SA
Display Line -23.97 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
11:35:41 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.480 05 GHz
-3.97 dBm
-23.97 dBm
Center 2.50150 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
1 N 1 f 2.480 05 GHz -3.97 dBm
2 N 1 f 2.483 50 GHz -63.468 dBm

8DPSK

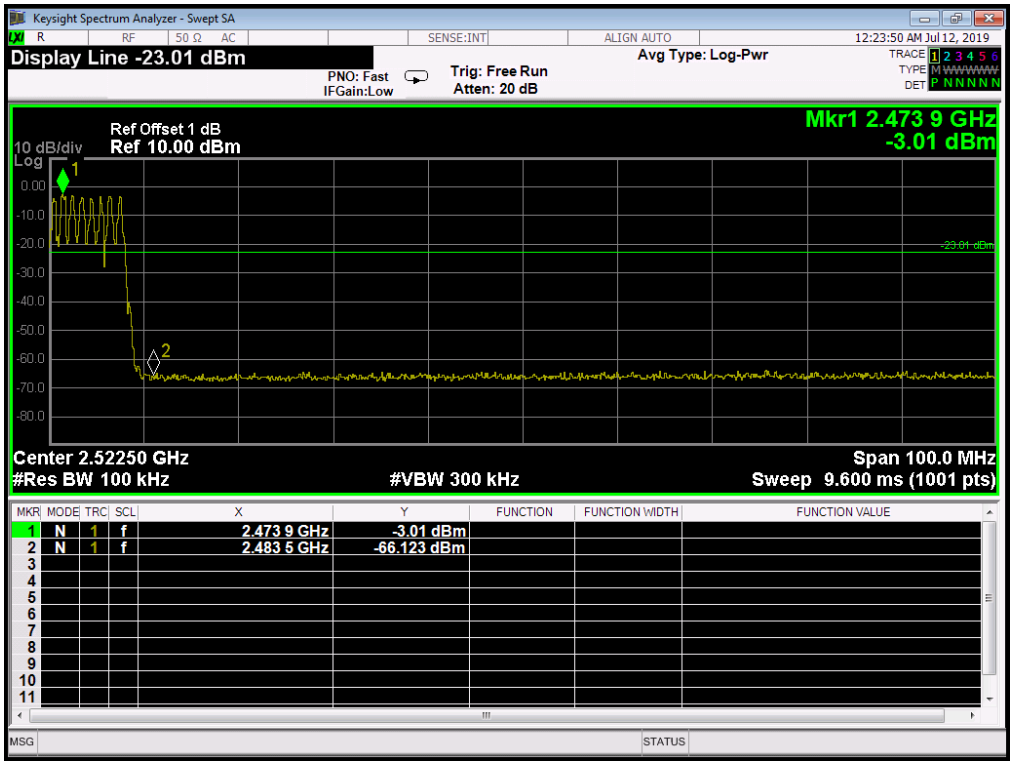

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.401950000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
11:34:09 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.401 95 GHz
-2.38 dBm
-2.38 dBm
Center 2.38025 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
1 N 1 f 2.401 95 GHz -2.38 dBm
2 N 1 f 2.400 00 GHz -59.462 dBm
3 N 1 f 2.390 00 GHz -65.701 dBm


Keysight Spectrum Analyzer - Swept SA
Display Line -23.83 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
11:35:13 PM Jul 11, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.479 95 GHz
-3.829 dBm
-23.83 dBm
Center 2.50150 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 50.00 MHz
Sweep 4.800 ms (1001 pts)
1 N 1 f 2.479 95 GHz -3.829 dBm
2 N 1 f 2.483 50 GHz -63.826 dBm

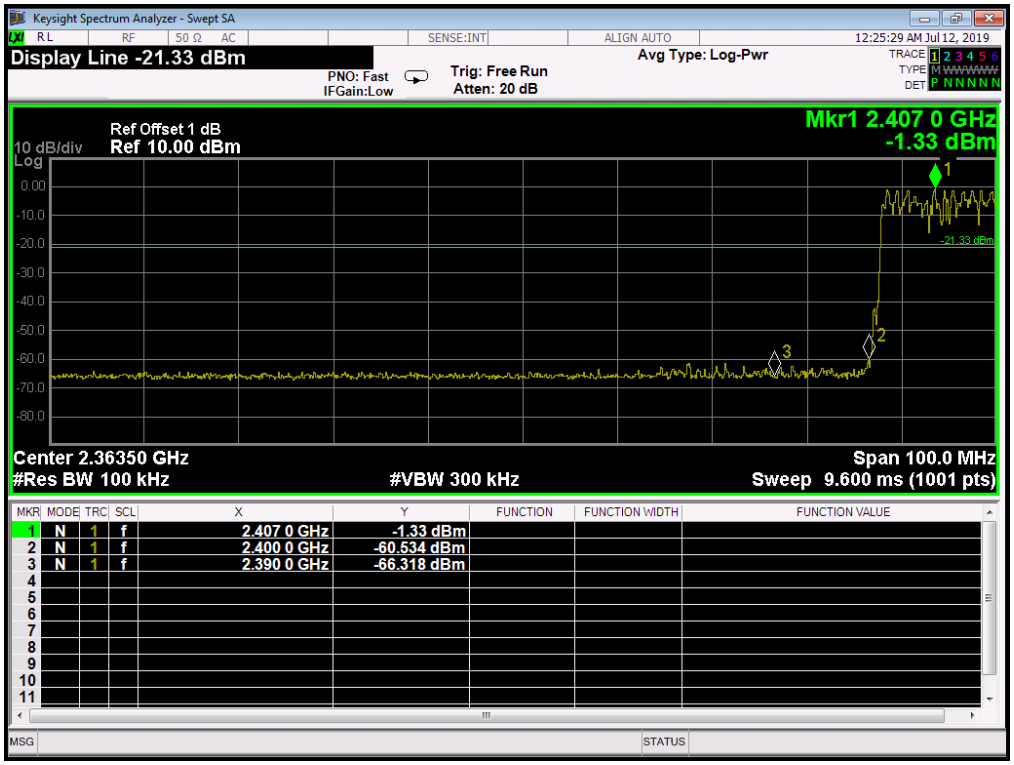
GFSK


Keysight Spectrum Analyzer - Swept SA
Marker 3 2.390000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
12:24:49 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr3 2.390 0 GHz
-63.50 dBm
Center 2.36350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 100.0 MHz
Sweep 9.600 ms (1001 pts)
1 N 1 f 2.404 1 GHz -1.57 dBm
2 N 1 f 2.400 0 GHz -60.73 dBm
3 N 1 f 2.390 0 GHz -63.50 dBm

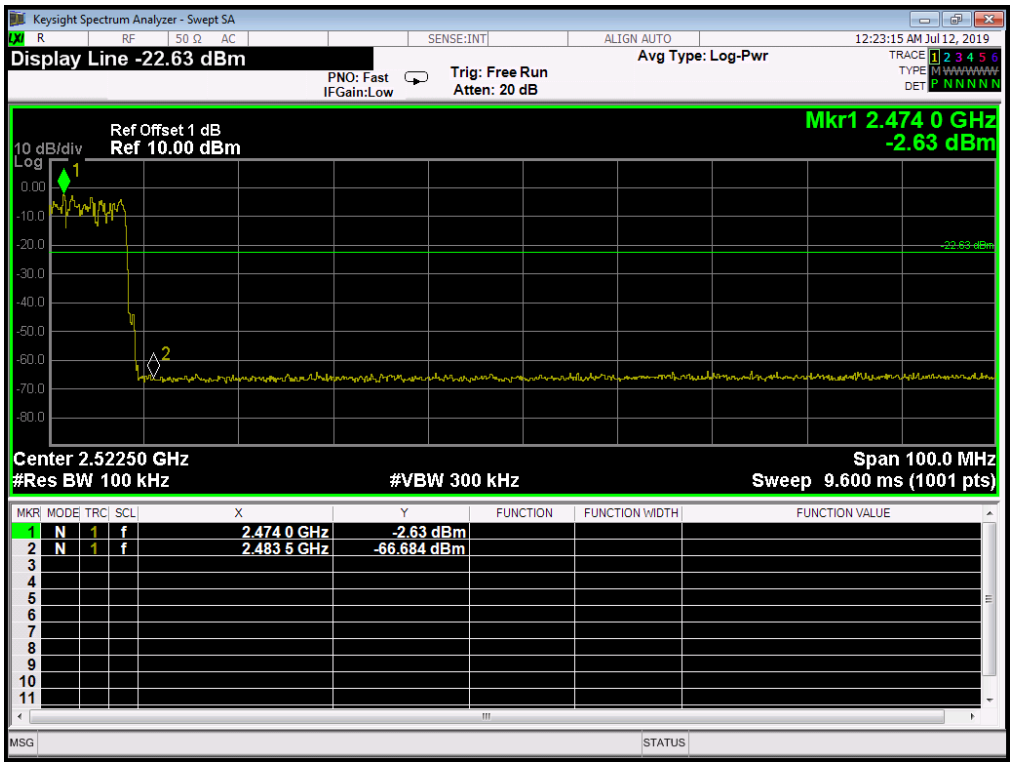
GFSK


Keysight Spectrum Analyzer - Swept SA
Display Line -23.01 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
12:23:50 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.473 9 GHz
-3.01 dBm
-23.01 dBm
Center 2.52250 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 100.0 MHz
Sweep 9.600 ms (1001 pts)
1 N 1 f 2.473 9 GHz -3.01 dBm
2 N 1 f 2.483 5 GHz -66.123 dBm

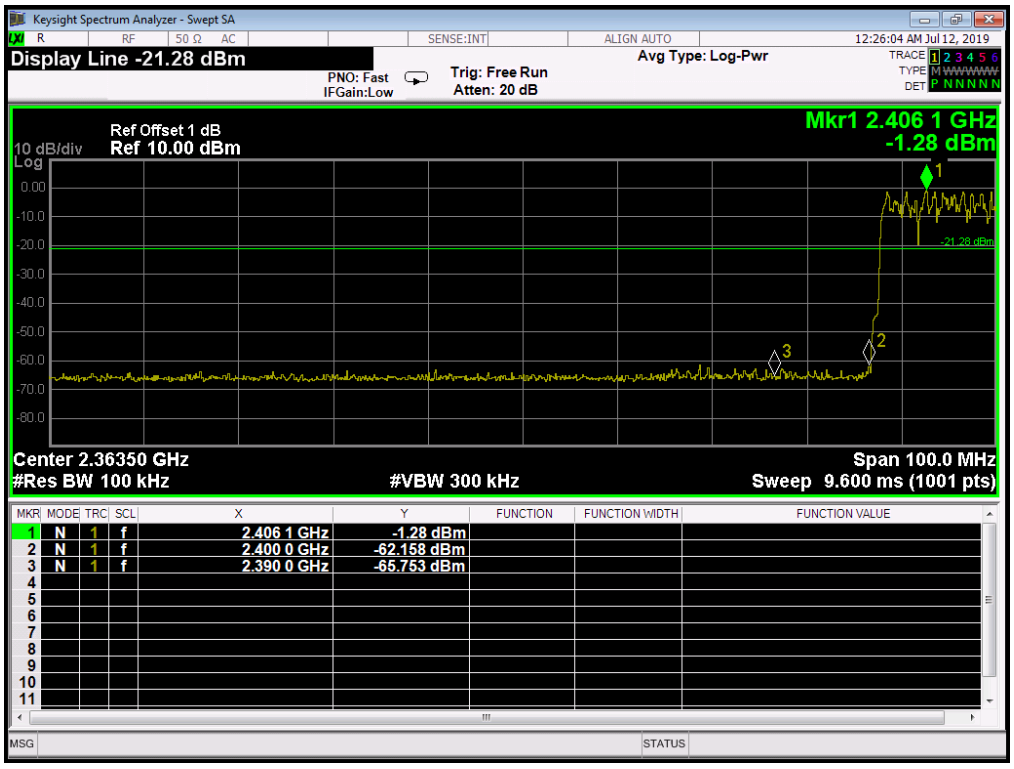
π/4DQPSK



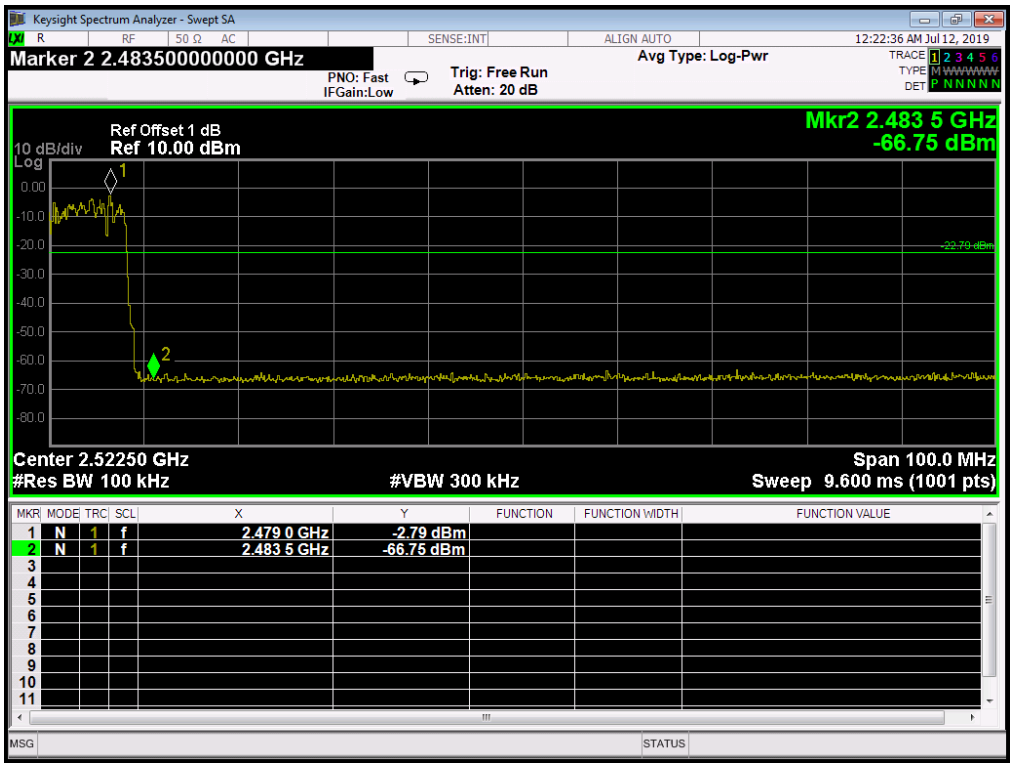
π/4DQPSK



8DPSK

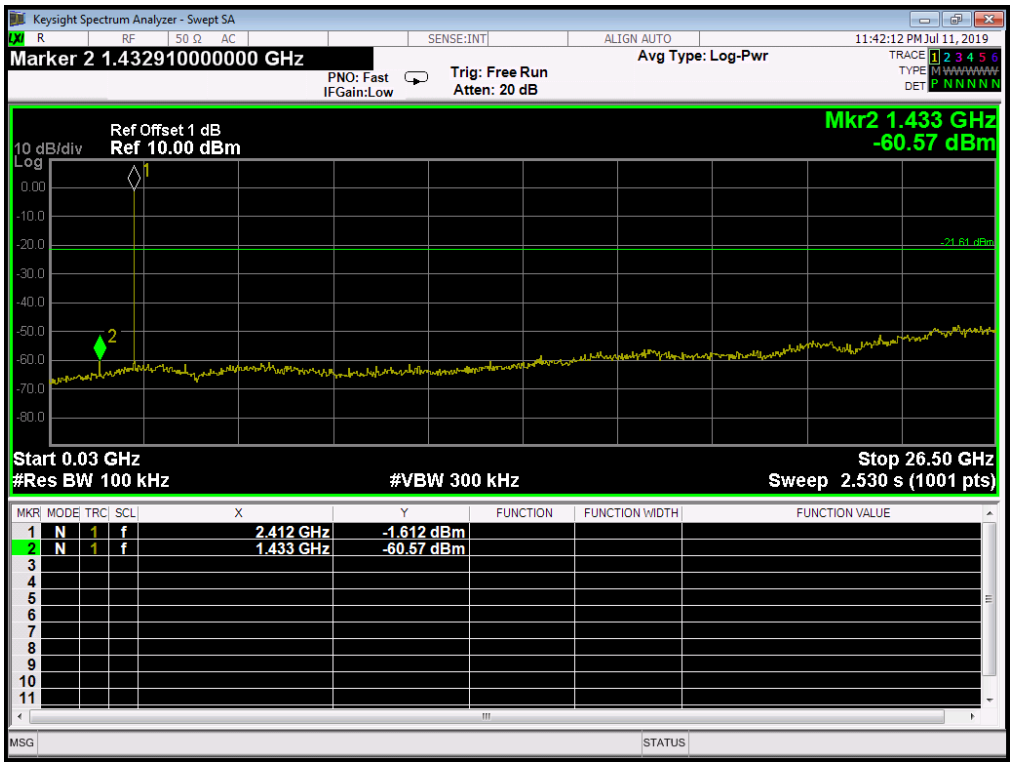

Keysight Spectrum Analyzer - Swept SA
Display Line -21.28 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
12:26:04 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.406 1 GHz
-1.28 dBm
-21.28 dBm
Center 2.36350 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 100.0 MHz
Sweep 9.600 ms (1001 pts)
1 N 1 f 2.406 1 GHz -1.28 dBm
2 N 1 f 2.400 0 GHz -62.158 dBm
3 N 1 f 2.390 0 GHz -65.753 dBm

8DPSK

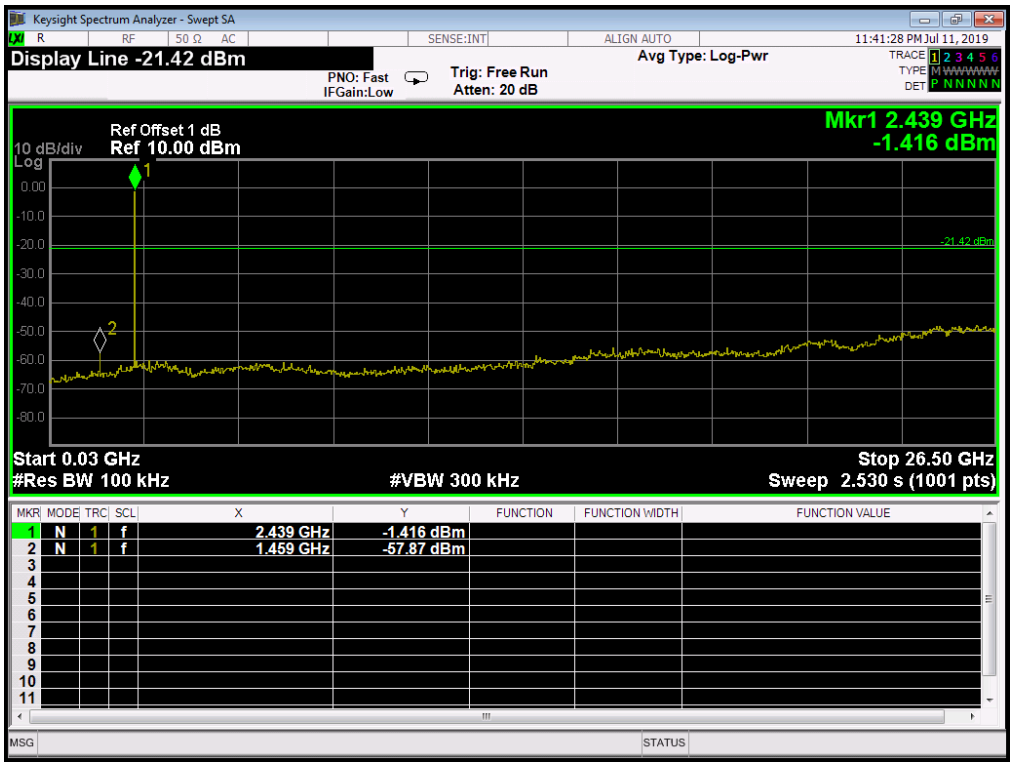

Keysight Spectrum Analyzer - Swept SA
Marker 2 2.483500000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
12:22:36 AM Jul 12, 2019
Ref Offset 1 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr2 2.483 5 GHz
-66.75 dBm
-22.79 dBm
Center 2.52250 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 100.0 MHz
Sweep 9.600 ms (1001 pts)
1 N 1 f 2.479 0 GHz -2.79 dBm
2 N 1 f 2.483 5 GHz -66.75 dBm

Conducted Emission

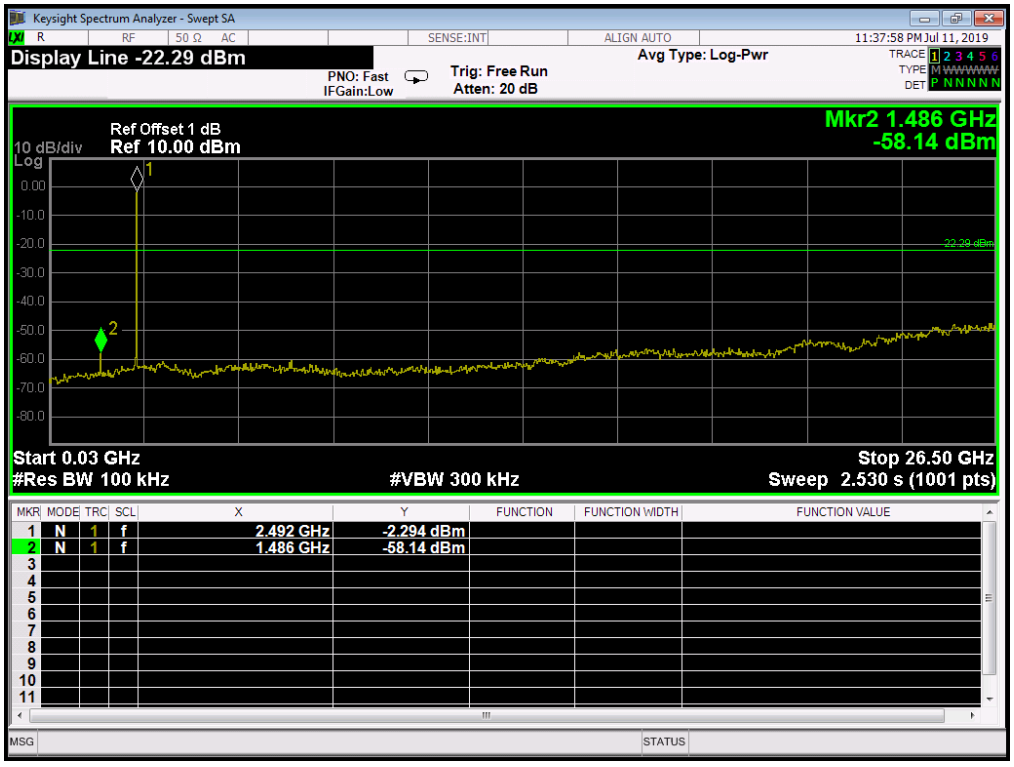
GFSK 2402MHz



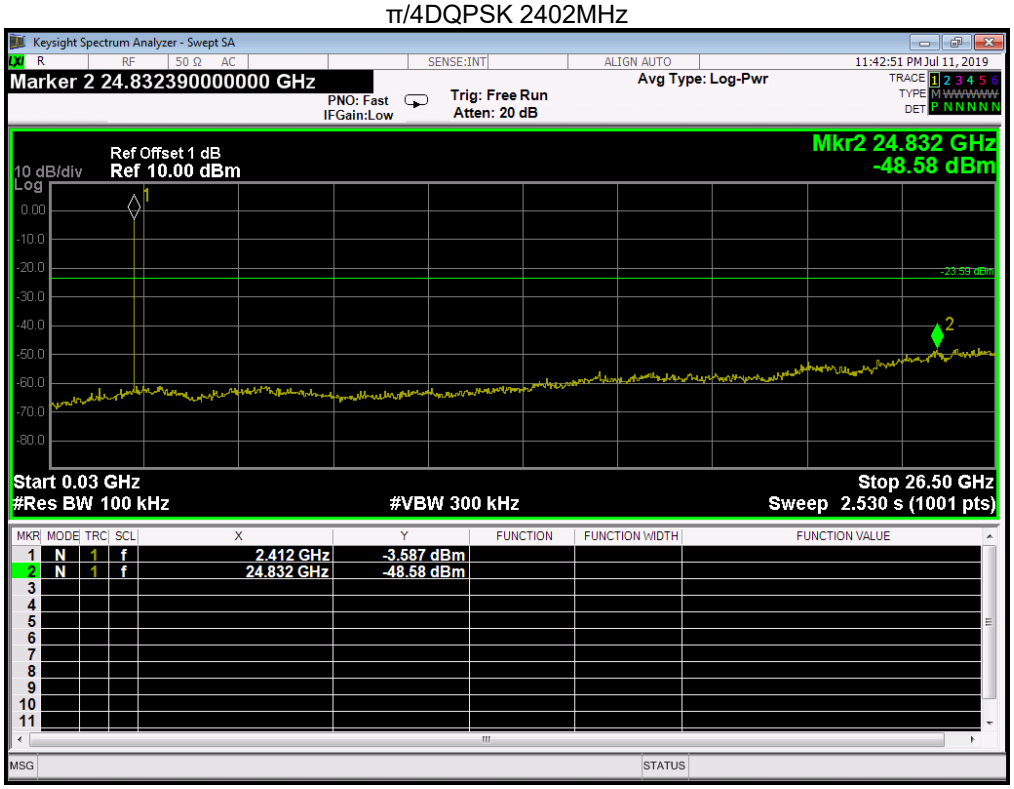
GFSK 2441MHz



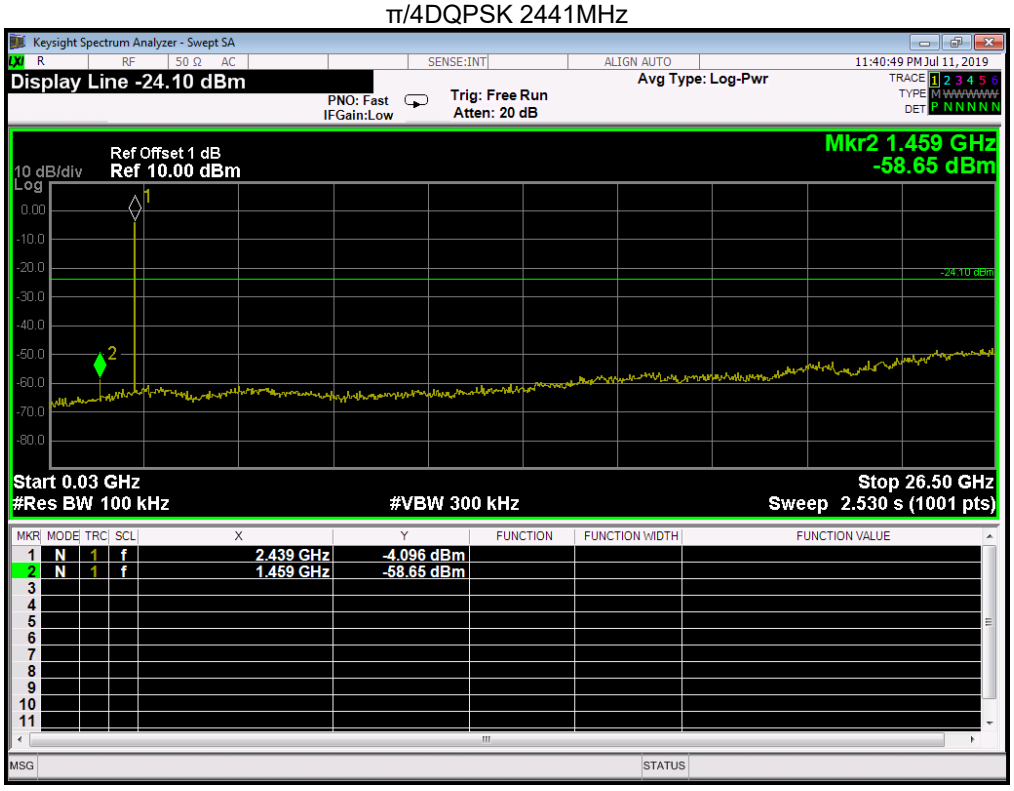
GFSK 2480MHz



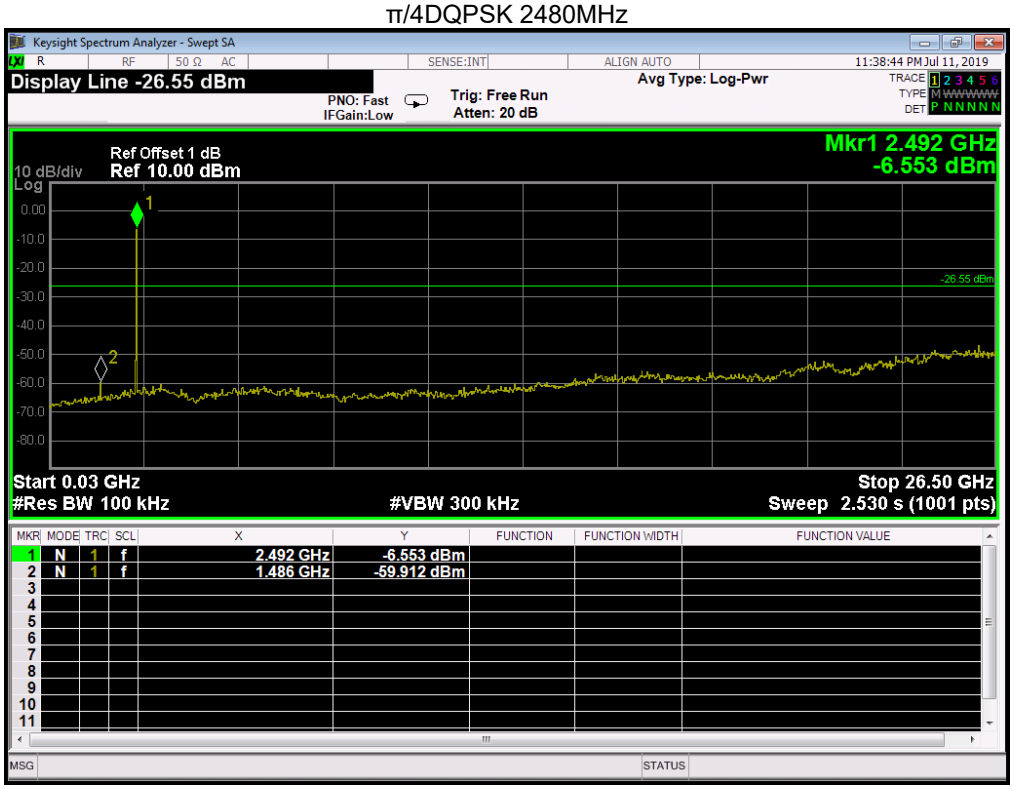
π/4DQPSK 2402MHz



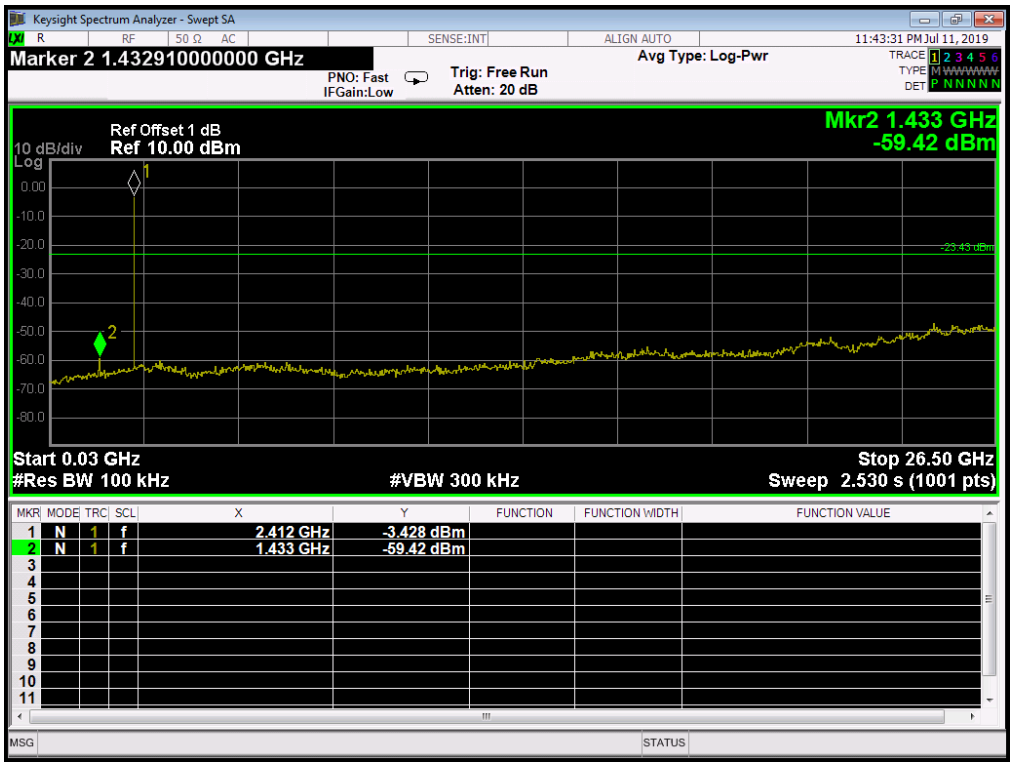
π/4DQPSK 2441MHz



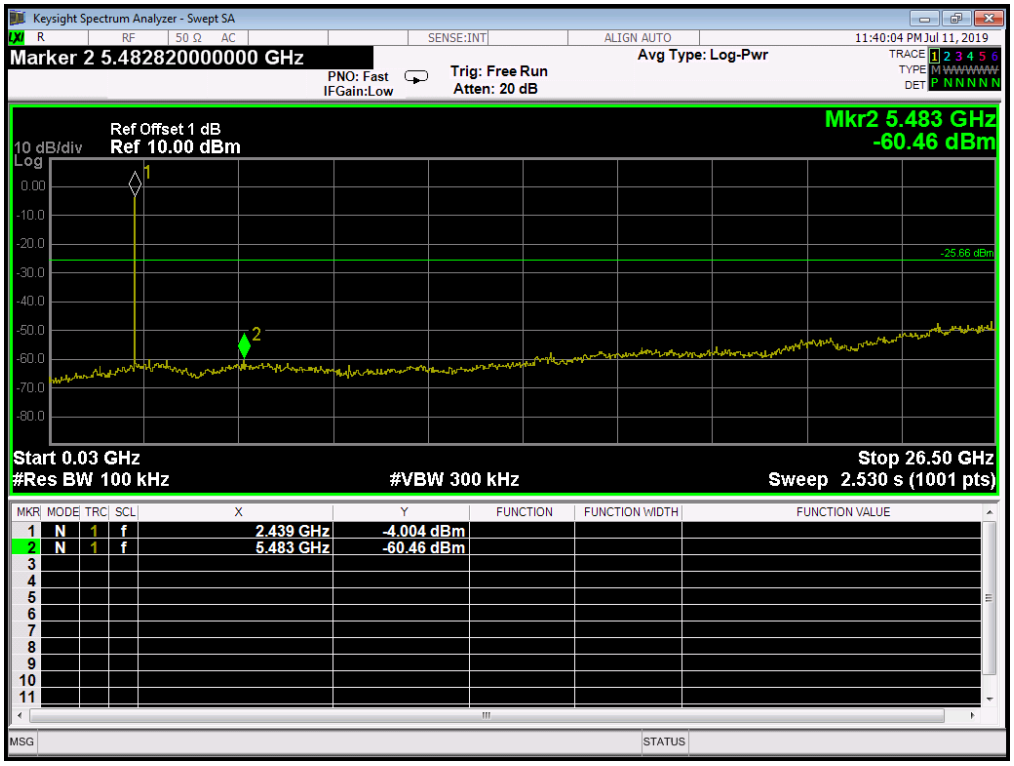
π/4DQPSK 2480MHz



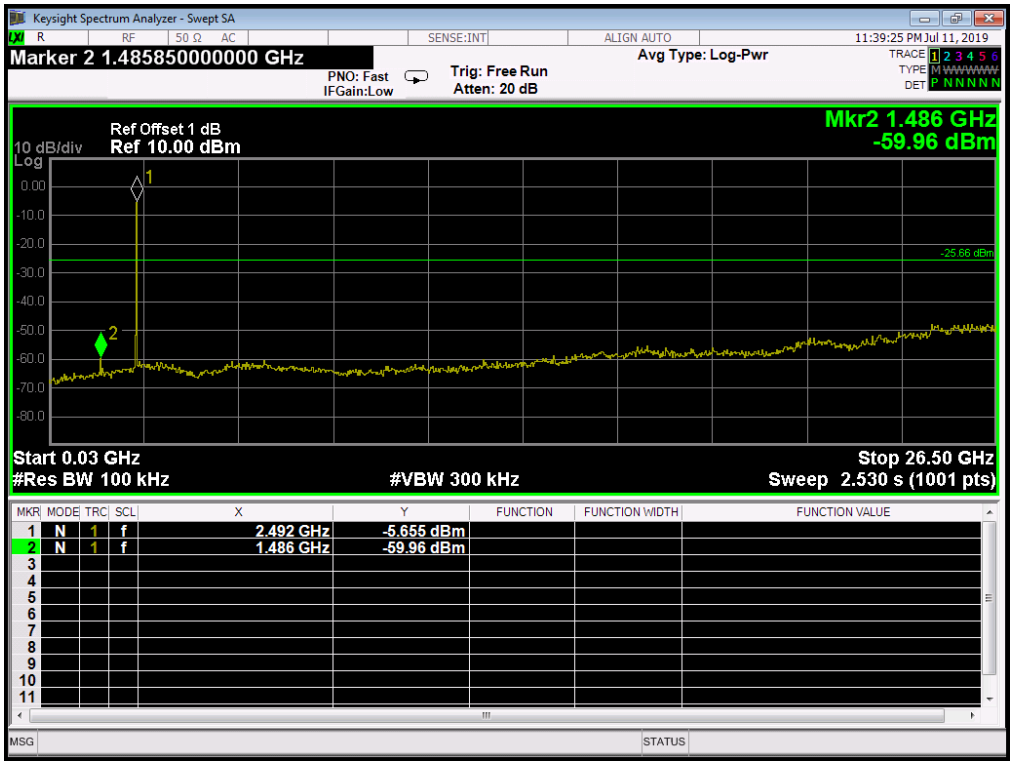
8DPSK 2402MHz



8DPSK 2441MHz



8DPSK 2480MHz

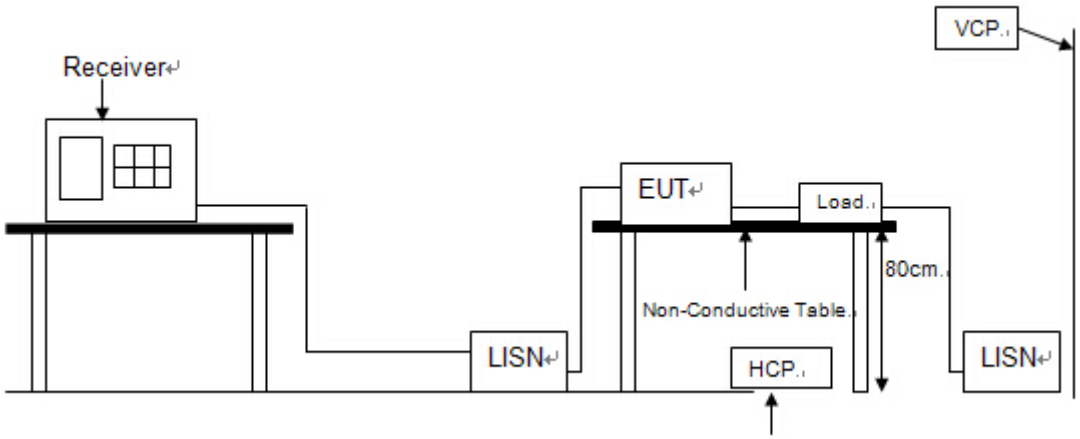


10. POWER LINE CONDUCTED EMISSION

10.1 Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Pulse Limiter	MTS-systemtechnik	MTS-IMP-136	261115-010-0024	12/16/2019
2	EMI Test Receiver	R&S	ESCI	101308	12/16/2019
3	LISN	AFJ	LS16	16011103219	12/16/2019
4	LISN	Schwarzbeck	NSLK 8127	8127-432	12/16/2019
5	Measurement Software	Farad	EZ-EMC (Ver.ATT-03A)	N/A	N/A
6	MeasurementSoftware	Farad	EZ-EMC (Ver.ATT-03A)	N/A	N/A

10.2 Block diagram of test setup



10.3 Power Line Conducted Emission Limits(Class B)

Frequency	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Note 1: * Decreasing linearly with logarithm of frequency.

Note 2: The lower limit shall apply at the transition frequencies.

10.4 Test Procedure

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 10.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.

All support equipment power received from a second LISN.

Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in clause 2.4 were scanned during the preliminary test.

After the preliminary scan, we found the test mode producing the highest emission level.

The EUT configuration and worse cable configuration of the above highest emission levels were recorded for reference of the final test.

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Neutral and Line, recording at least the six highest emissions.

Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

The bandwidth of test receiver is set at 9 KHz.

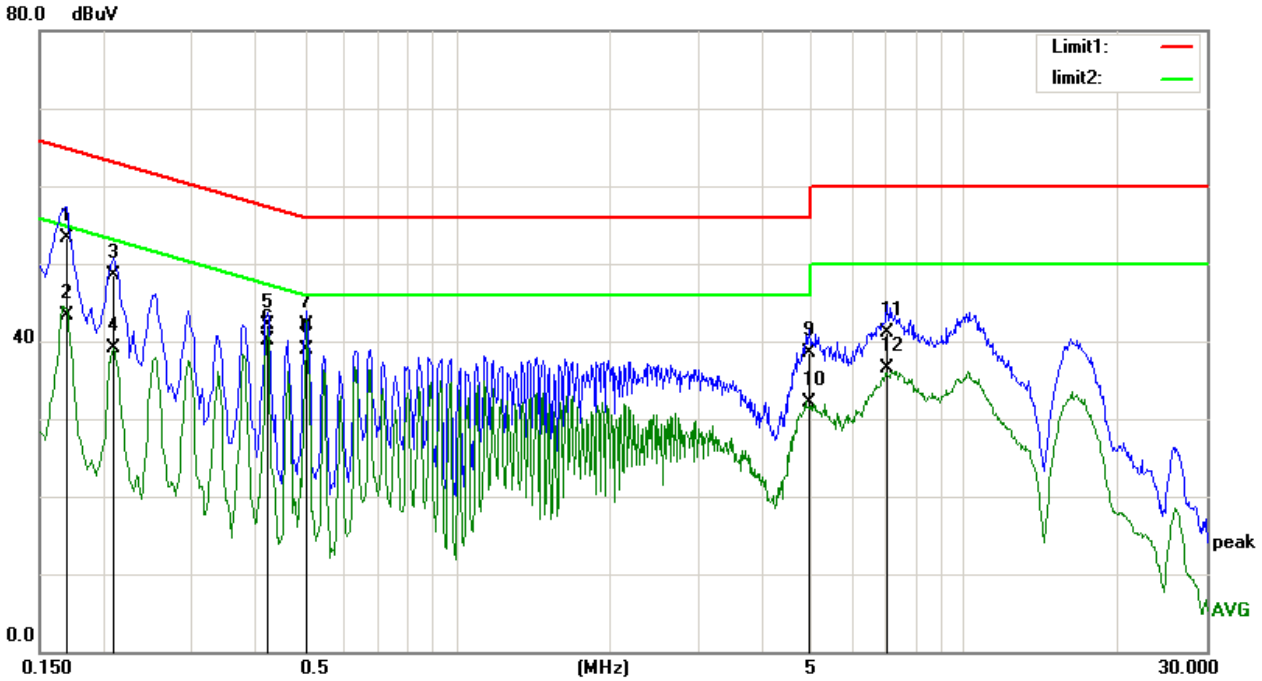
10.5 Test Result

PASS. (See below detailed test result)

Note1: All emissions not reported below are too low against the prescribed limits.

Note2: “-----” means peak detection; “-----” mans average detection

EUT:	Afterglow Wireless Deluxe Ctrl for	Model No.:	500-137
Temperature:	24	Relative Humidity:	55%
		Test Power:	DC 5V From Switch Charging
Probe:	L1	Test Result:	Pass
Test Time:	2019-6-29	Test By:	Carson
Standard:	(CE)FCC PART 15 class B_QP		
Test Mode:	WORKING		
Note:			



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1700	41.98	11.32	53.30	64.96	-11.66	QP
2	0.1700	31.94	11.32	43.26	54.96	-11.70	AVG
3	0.2100	37.43	11.05	48.48	63.20	-14.72	QP
4	0.2100	28.15	11.05	39.20	53.20	-14.00	AVG
5	0.4220	31.85	10.28	42.13	57.41	-15.28	QP
6	0.4220	29.84	10.28	40.12	47.41	-7.29	AVG
7	0.5060	31.85	10.18	42.03	56.00	-13.97	QP
8	0.5060	28.81	10.18	38.99	46.00	-7.01	AVG
9	4.9499	28.28	10.21	38.49	56.00	-17.51	QP
10	4.9499	21.81	10.21	32.02	46.00	-13.98	AVG
11	7.0499	30.87	10.24	41.11	60.00	-18.89	QP
12	7.0499	26.22	10.24	36.46	50.00	-13.54	AVG

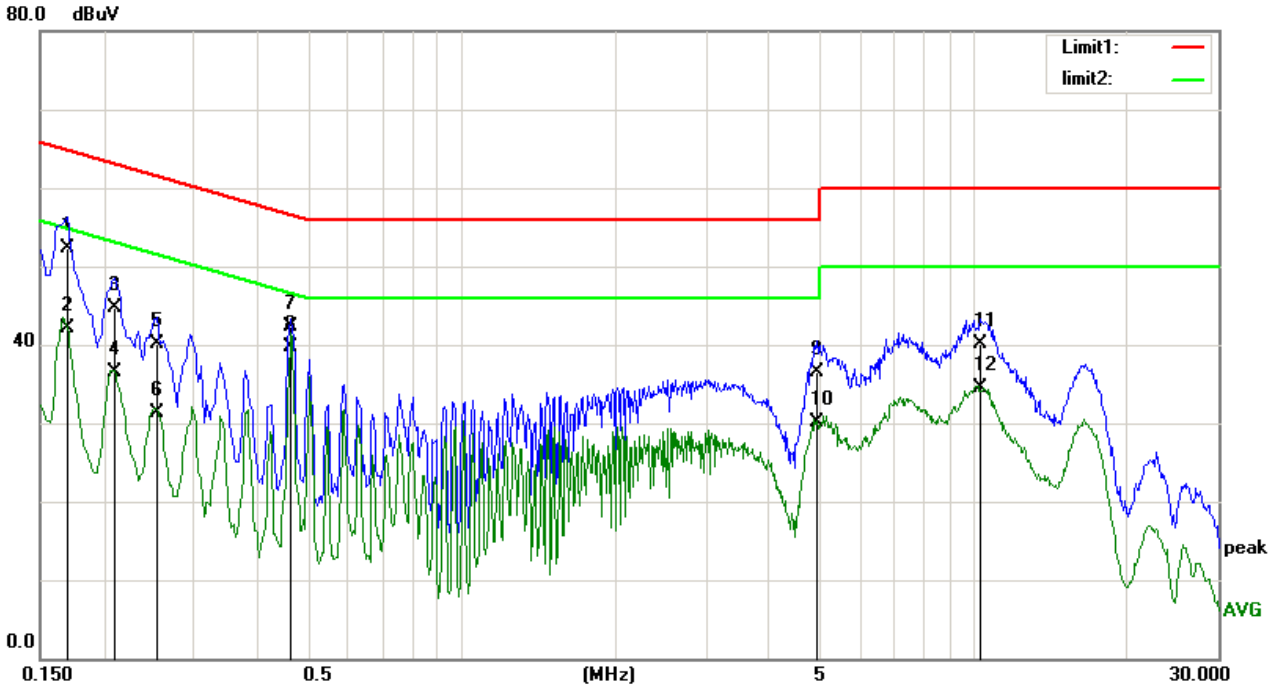
The test result is calculated as the following:

(1) Result = Reading + Correct Factor

(2) Correct Factor = (LISN, ISN, PLC or Current Probe) Factor + Cable Loss +Attenuator

(3) Margin = Result - Limit

EUT:	Afterglow Wireless Deluxe Ctrl for	Model No.:	500-137
Temperature:	24	Relative Humidity:	55%
		Test Power:	DC 5V From Switch Charging
Probe:	N	Test Result:	Pass
Test Time:	2019-6-29	Test By:	Carson
Standard:	(CE)FCC PART 15 class B_QP		
Test Mode:	WORKING		
Note:			



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1700	40.91	11.32	52.23	64.96	-12.73	QP
2	0.1700	30.88	11.32	42.20	54.96	-12.76	AVG
3	0.2100	33.56	11.05	44.61	63.20	-18.59	QP
4	0.2100	25.40	11.05	36.45	53.20	-16.75	AVG
5	0.2540	29.46	10.74	40.20	61.62	-21.42	QP
6	0.2540	20.48	10.74	31.22	51.62	-20.40	AVG
7	0.4620	32.07	10.23	42.30	56.66	-14.36	QP
8	0.4620	29.40	10.23	39.63	46.66	-7.03	AVG
9	4.9459	26.35	10.21	36.56	56.00	-19.44	QP
10	4.9459	19.93	10.21	30.14	46.00	-15.86	AVG
11	10.2899	29.88	10.27	40.15	60.00	-19.85	QP
12	10.2899	24.32	10.27	34.59	50.00	-15.41	AVG

The test result is calculated as the following:

(1) Result = Reading + Correct Factor

(2) Correct Factor = (LISN, ISN, PLC or Current Probe) Factor + Cable Loss +Attenuator

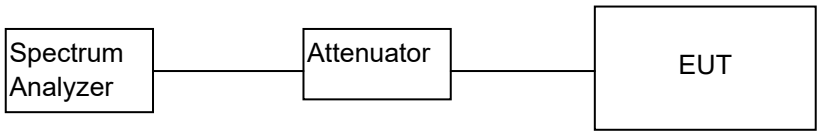
(3)Margin = Result - Limit

11. FREQUENCY STABILITY

11.1.Test equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Due.	Cal. Interval
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2019/05/25	1 Year
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2018/12/17	1 Year
3	RF Cable	Micable	C10-01-01-1	100309	2018/12/17	1 Year
4	Temperature conditioning	Guan Jian.HTH1000	-20-130℃	GJ1000-10D 001	2018/12/17	1.Year
5	DC Power Supply	G.KE	IPR-10010D	010931954	2018/12/17	1.Year

11.2.Block diagram of test setup



11.3.Test Result

GFSK

	Temperature vs. Frequency Stability	
Voltage	**Temperature**	**Measurement Frequency (MHz)**
3.7V	**(℃)**	**2402**
	-20	2401.971
	20	2401.975
	50	2401.968
2.8V	**20**	2401.970
	Max. Deviation (MHz)	**2401.968**
	Max. Deviation (ppm)	**-13.32**

Voltage	**Temperature**	**Measurement Frequency (MHz)**
3.7V	**(℃)**	**2441**
	-20	2440.980
	20	2440.975
	50	2440.977
2.8V	**20**	2440.981
	Max. Deviation (MHz)	**2440.975**
	Max. Deviation (ppm)	**-10.24**

Voltage	**Temperature**	**Measurement Frequency (MHz)**
3.7V	**(℃)**	**2480**
	-20	2479.969
	20	2479.974
	50	2479.977
2.8V	**20**	2479.979
	Max. Deviation (MHz)	**2479.965**
	Max. Deviation (ppm)	**-14.11**

Note:2.7V is the end point voltage,and products below 2.7Vwill cease working

12 Antenna Requirements

12.1 Limit

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 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

12.2 EUT Antenna

The EUT antenna is permanent attached antenna. It comply with the standard requirement.

END OF REPORT