

7. CARRIER FREQUENCY SEPARATION TEST

7.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Jun.30,19	1 Year
2.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	May.13,19	1 Year

7.2. Limit

Frequency hopping systems shall have hopping channel carrier frequency separated by a minimum of 25kHz or the 20dB 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.

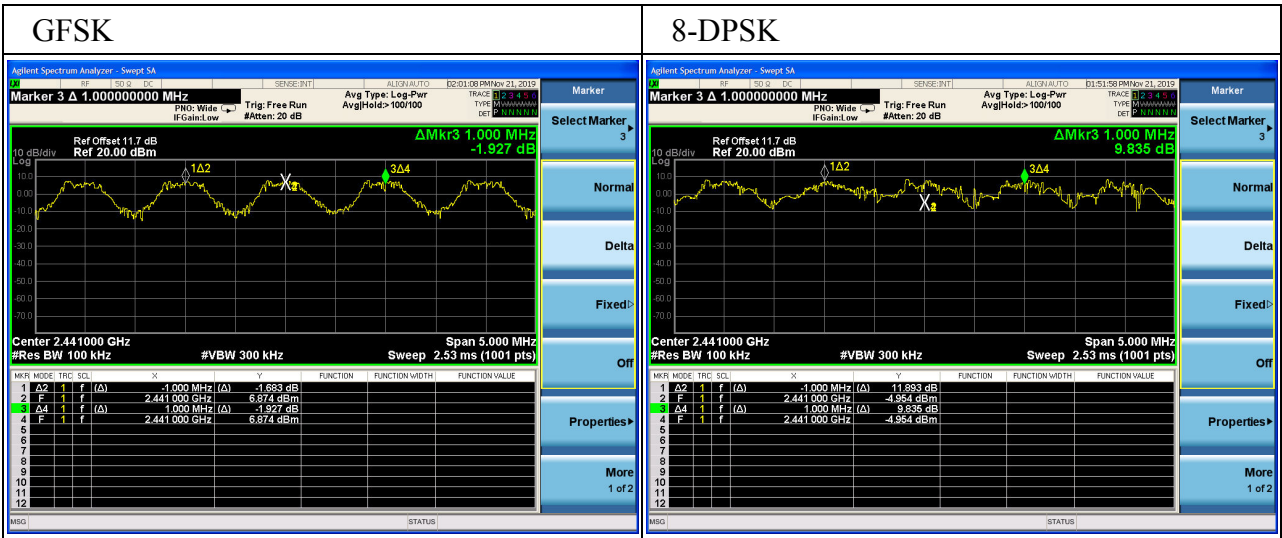
7.3. Test Procedure

Use the test method described in ANSI C63.10 clause 7.8.2:

1. Connect the antenna port of the EUT to the Spectrum analyzer.
2. Let the EUT transmit at Low/ Mid/ High channel.
3. Setting of SA is following as: RBW: 100kHz / VBW: 300kHz.Span: 3MHz
4. Use the mark Delta function of the SA measure out the channel separation.

7.4. Test Results.

EUT: WiFi module			
M/N: U9W42			
Test date: 2019-11-21		Pressure: 102.1±1.0 kpa	Humidity: 51.1±3.0%
Tested by: Garry		Test site: RF site	Temperature: 22.8±0.6 °C
Test Mode	Channel separation	Limit(KHz)	Conclusion
GFSK	1.0MHz	595.600	PASS
8-DPSK	1.0MHz	858.667	PASS



8. NUMBER OF HOPPING FREQUENCY TEST

8.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Jun.30,19	1 Year
2.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	May.13,19	1 Year

8.2. Limit

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

8.3. Test Procedure

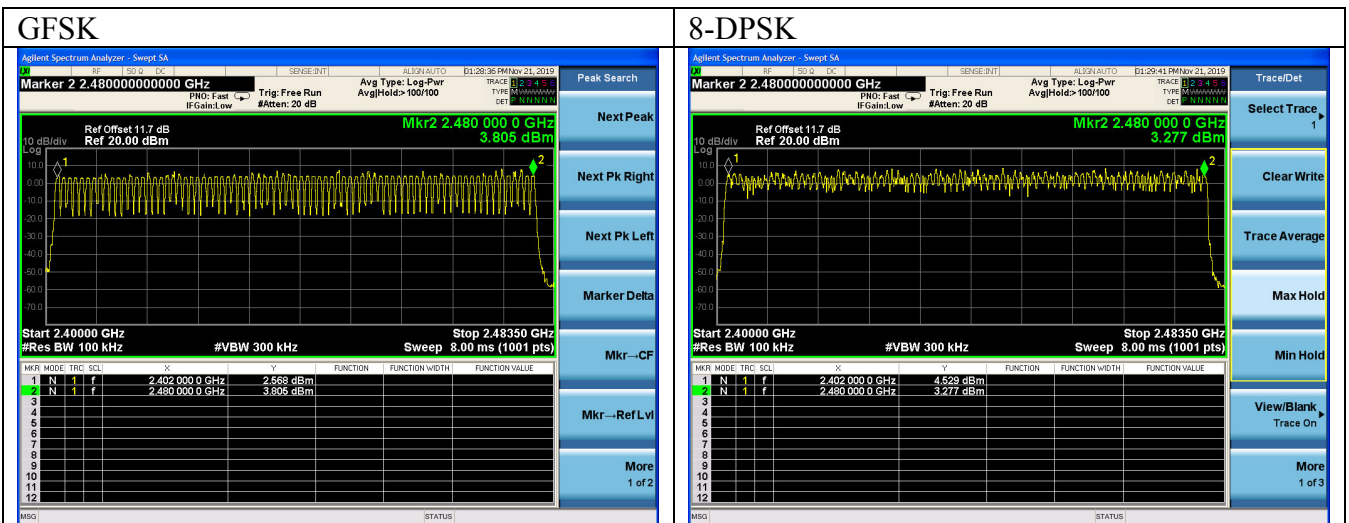
Use the test method described in ANSI C63.10 clause 7.8.3:

1. Connect the antenna of the EUT to Spectrum analyzer and let the EUT working at hopping mode.
2. Setting of SA is following as: RBW: 100kHz / VBW: 300kHz
 Start frequency: 2390MHz
 Stop frequency: 2483.5MHz
 And waiting for the hopping trace until stability, count out the number of the hopping.

8.4. Test Results

EUT: WiFi module		
M/N: U9W42		
Test date: 2019-11-21	Pressure: 102.1±1.0 kpa	Humidity: 51.1±3.0%
Tested by: Garry	Test site: RF site	Temperature: 22.8±0.6 °C

Test Mode	Number of channel	Limit	Conclusion
GFSK	79	≥15	PASS
8-DPSK	79	≥15	PASS



9. DWELL TIME

9.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Jun.30,19	1 Year
2.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	May.13,19	1 Year

9.2. 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.

9.3. Test Procedure

Use the test method described in ANSI C63.10 clause 7.8.4:

1. Connect the antenna of the EUT to Spectrum analyzer and let the EUT working at hopping mode.
2. Setting of SA is following as:
 RBW: 100kHz / VBW: 100kHz
 Sweep Mode: Single
 Detect mode: Positive peak
 Trace mode: Auto
 Span: 0Hz
 Sweep time: 5s and big enough to measure one hopping signal
3. Use below formula calculate the Dwell time
 Dwell time=Hopping number per second*0.4*channel number*Pulse bandwidth per hopping.

9.4. Test Results

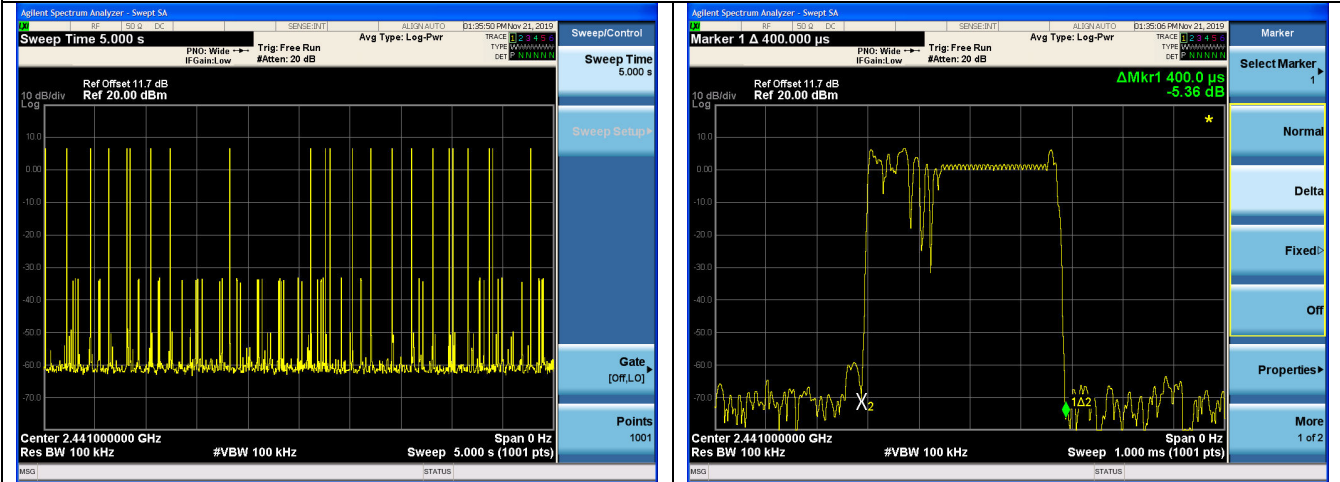
EUT: WiFi module		
M/N: U9W42		
Test date: 2019-11-21	Pressure: 102.1±1.0 kpa	Humidity: 51.1±3.0%
Tested by: Garry	Test site: RF site	Temperature: 22.8±0.6 °C

Mode	dwell time		Limit	Conclusion
GFSK	DH1	23 hops/5s*0.4*79channels* 0.400 ms =58.144ms	≤400ms	PASS
	DH3	26 hops/5s*0.4*79channels* 1.698 ms =279.015ms	≤400ms	PASS
	DH5	12 hops/5s*0.4*79channels* 2.958 ms =224.335ms	≤400ms	PASS
8-DPSK	3-DH1	28 hops/5s*0.4*79channels* 0.416 ms =73.615ms	≤400ms	PASS
	3-DH3	28 hops/5s*0.4*79channels* 1.655 ms =292.869ms	≤400ms	PASS
	3-DH5	16 hops/5s*0.4*79channels* 2.940 ms =297.293ms	≤400ms	PASS

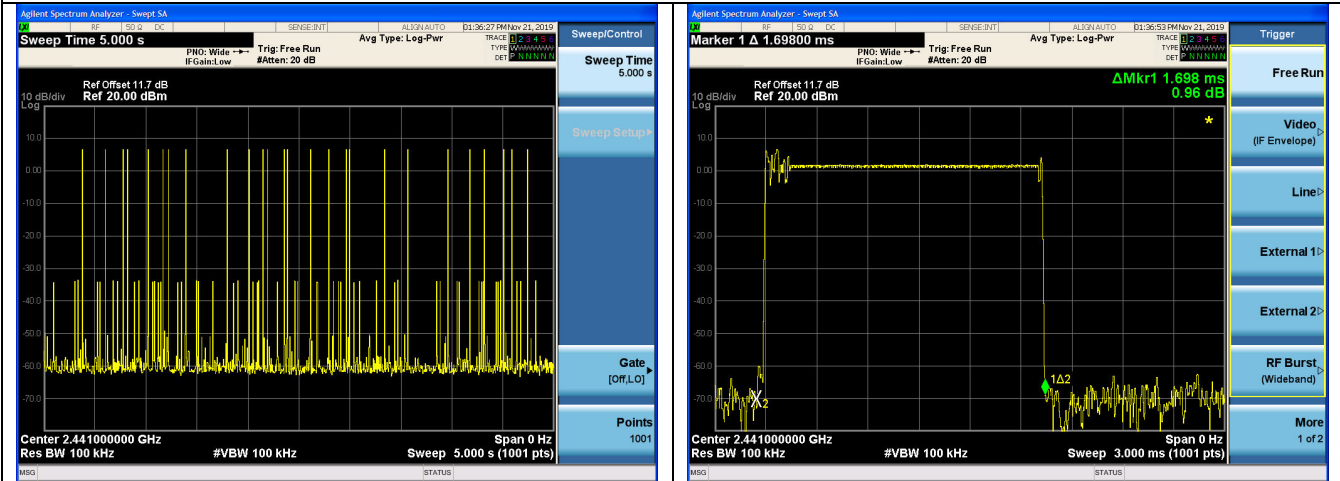
Note: All the lower levels were signaled from receiver and should not be considered in here.

GFSK

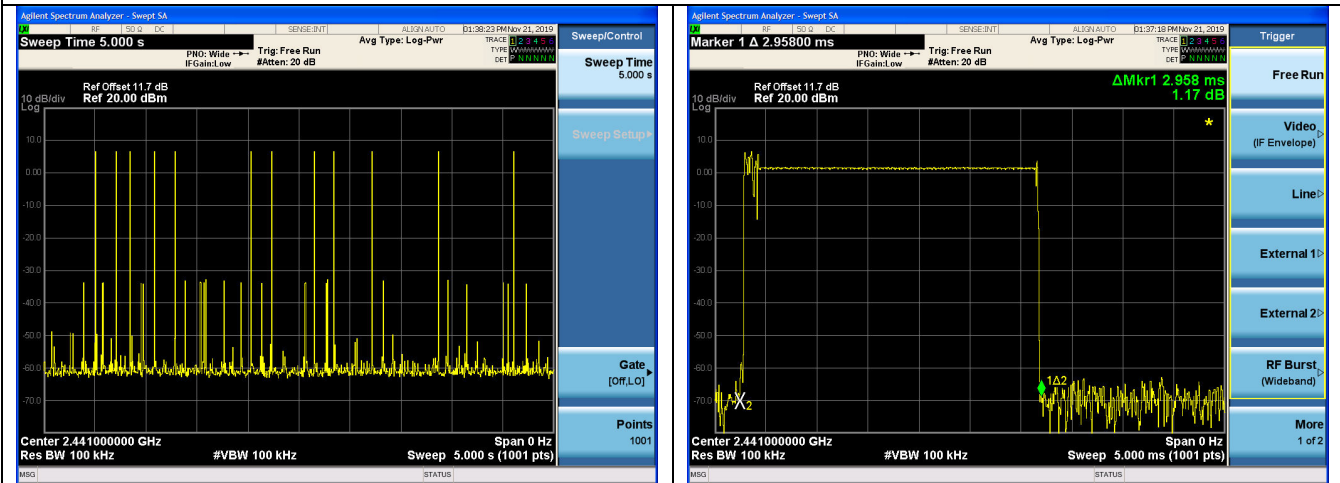
DH 1



DH 3

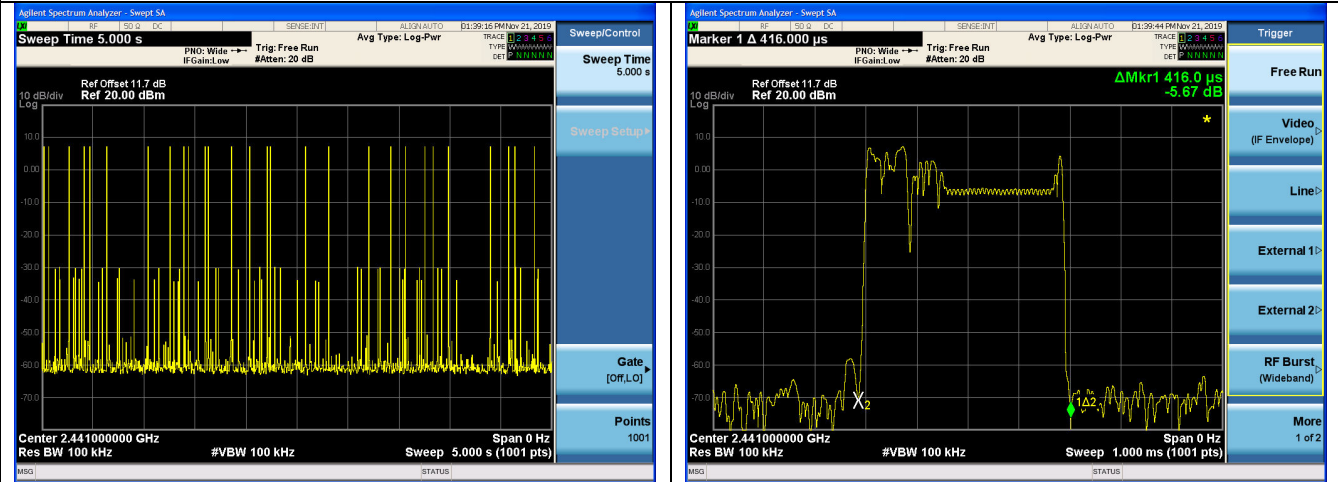


DH 5

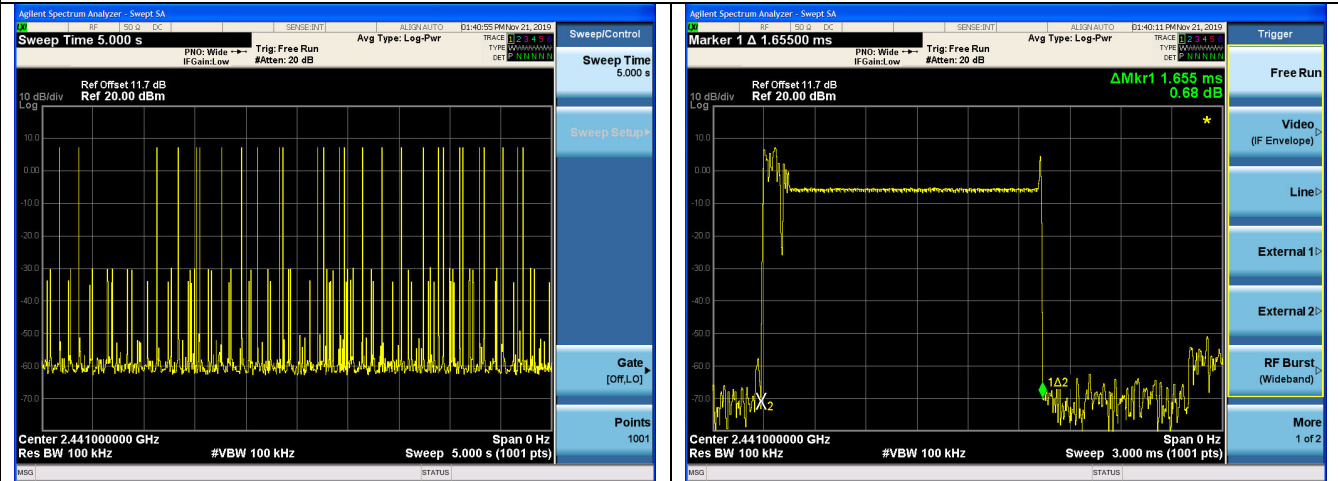


8-DPSK

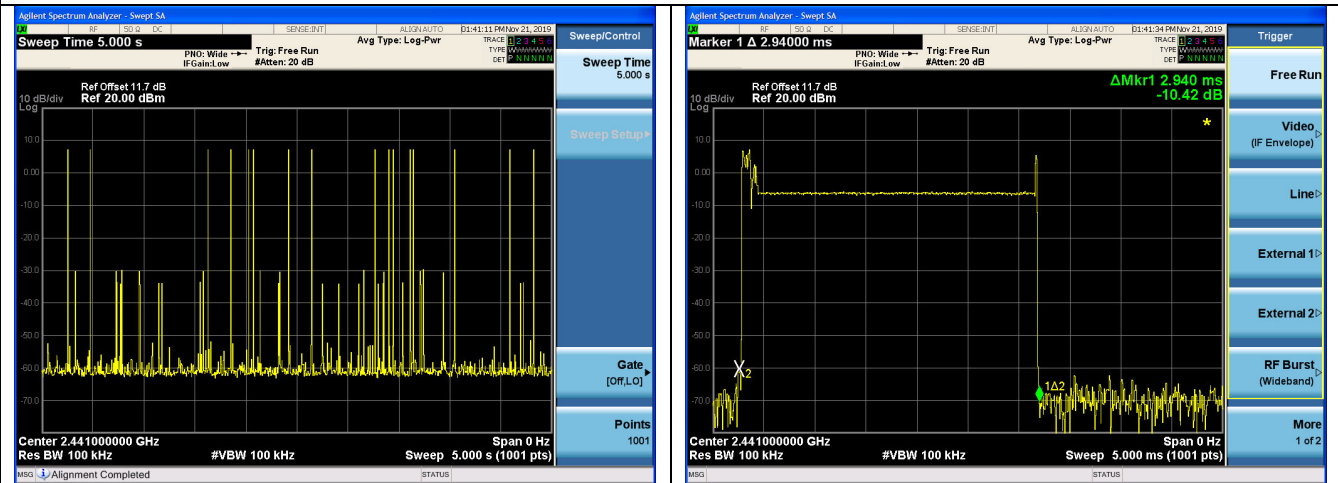
3DH 1



3DH 3



3DH 5



10. MAXIMUM PEAK OUTPUT POWER TEST

10.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Jun.30,19	1 Year
2.	Power meter	HP	436A	2016A07891	Oct.13,19	1 Year
3.	Power sensor	Agilent	8482B	MY41090514	Oct.13,19	1 Year
4.	Attenuator	Agilent	8491B	MY39269201	Oct.13,19	1 Year
5.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	May.13,19	1 Year

10.2. Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

10.3. Test Procedure

Use the test method described in ANSI C63.10 clause 7.8.5:

Connected the EUT's antenna port to Power Sensor, and use power meter to test peak output power directly.

10.4. Test Results

EUT: WiFi module		
M/N: U9W42		
Test date: 2019-11-21	Pressure: 102.3±1.0 kpa	Humidity: 53.6±3.0%
Tested by: Garry	Test site: RF site	Temperature: 25.5±0.6°C

Test Mode	Frequency	Peak output Power (dBm)	Limit (dBm)
GFSK	2402	7.286	21
	2441	8.066	21
	2480	8.281	21
8-DPSK	2402	10.581	21
	2441	11.312	21
	2480	11.394	21

Conclusion: PASS

11. BAND EDGE COMPLIANCE TEST

11.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Jun.30,19	1 Year
2.	Amplifier	Agilent	8449B	3008A02495	Apr.23,19	1 Year
3.	Horn Antenna	EMCO	3115	9510-4580	Dec.13,18	3 Year
4.	RF Cable	EMCI	EMC102-KM-KM 3500	170702	May.13,19	1 Year

11.2. Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

11.3. Test Produce

Use the test method described in ANSI C63.10 clause 7.8.6:

For upper band emissions that are up to two bandwidths(2MHz) away (2483.5MHz to 2485.5MHz) from the band-edge use below produce:

1. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 100KHz and with a video bandwidth 300KHz. Record the peak levels of the fundamental emission and the relevant band-edge emission, Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.
2. Subtract the delta measured in step (1) from the maximum field strengths measured in clause 4 .The resultant field strengths are then used to determine band-edge compliance as required by Section 15.205

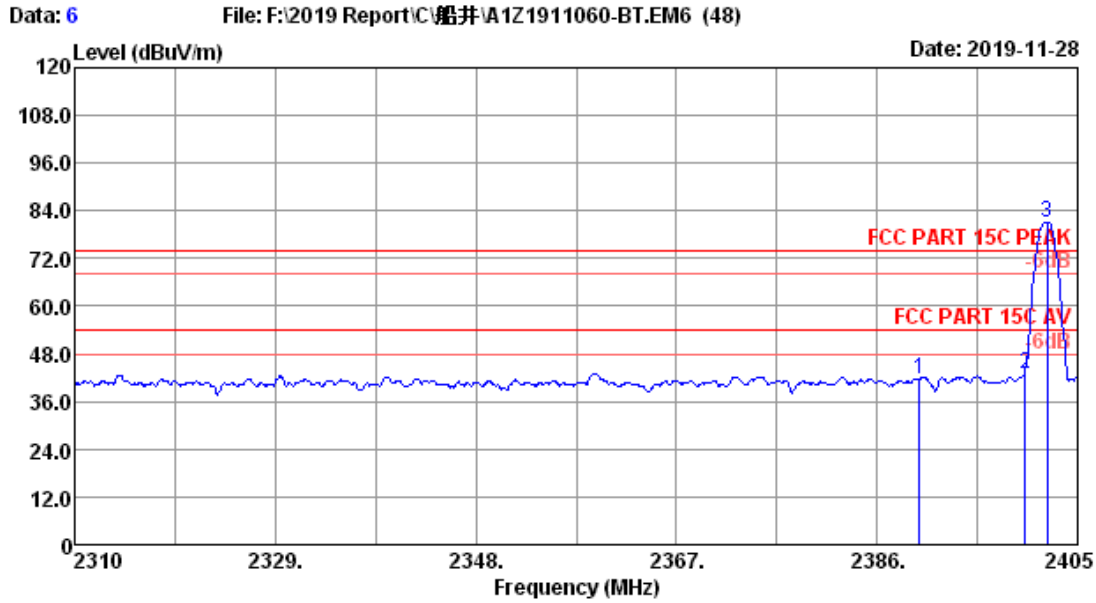
For emissions above two bandwidths away from the band-edge use below produce:

1. The EUT is placed on a insulating material (up to 12mm thick) worked at highest radiated power.
2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upperband-edges of the emission:
 - (a) PEAK: RBW=1MHz ;VBW=3MHz, PK detector, Sweep=AUTO
 - (b) This is pulse Modulation device a duty cycle factor was used to calculate average level based measured peak level.

11.4. Test Results

Pass (The testing data was attached in the next pages.)

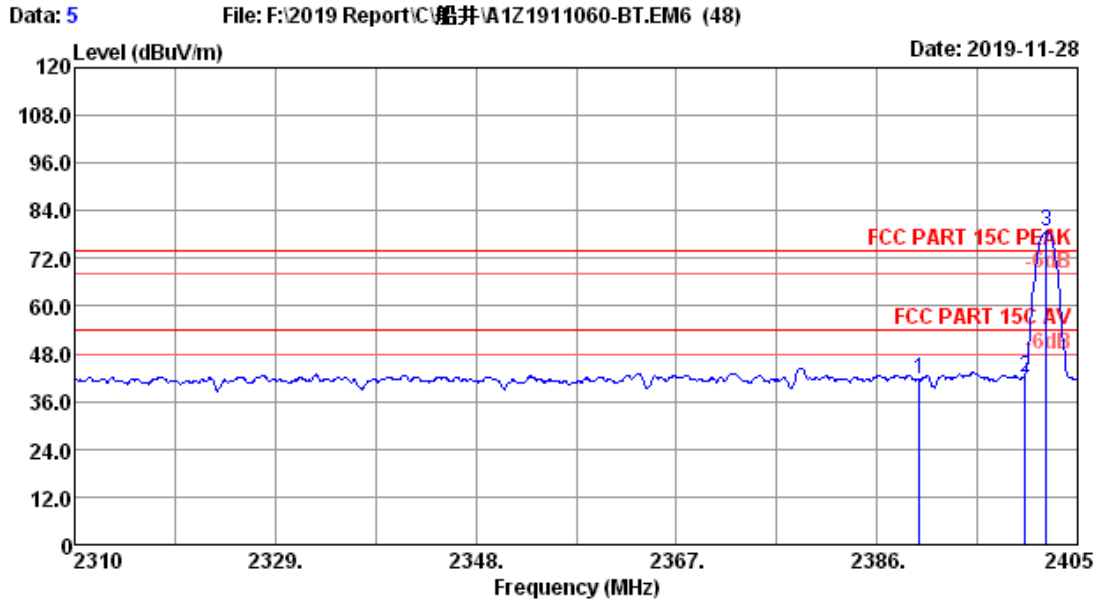
Note: If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.



Site no. : 3m Chamber Data no. : 6
 Dis. / Ant. : 3m 2018 3115-4580 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4*C/52.9% Engineer : Garry
 Power rating : DC 3.3V
 Test Mode : BT3.0 GFSK 2402MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.71	3.04	45.71	35.04	41.42	74.00	32.58	Peak
2	2400.00	27.71	3.04	47.45	35.04	43.16	74.00	30.84	Peak
3	2402.15	27.71	3.04	85.42	35.04	81.13	74.00	-7.13	Peak

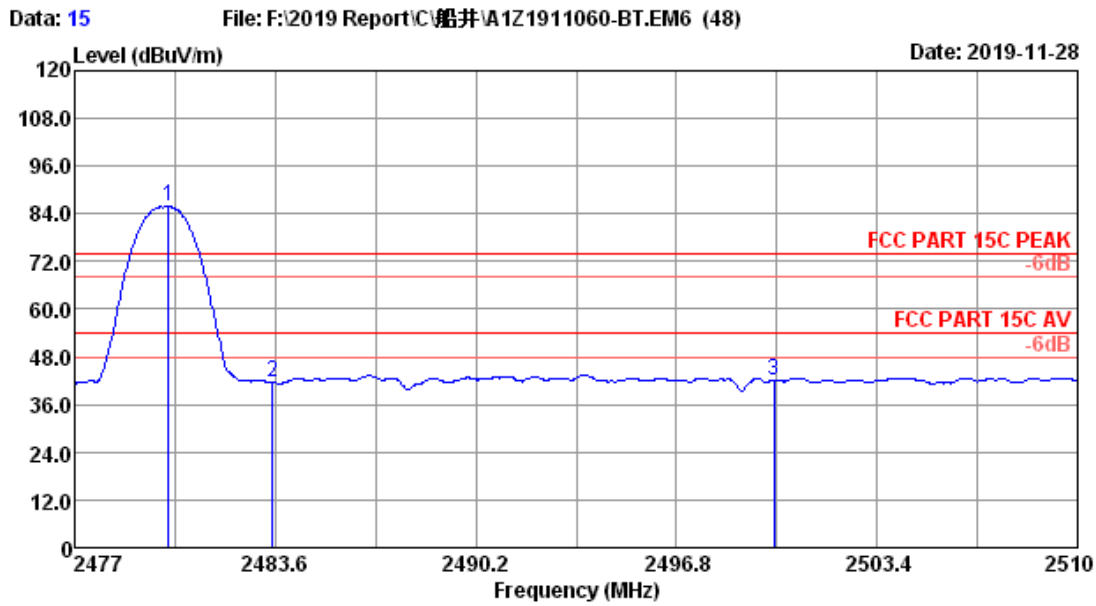
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 5
 Dis. / Ant. : 3m 2018 3115-4580 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4*C/52.9% Engineer : Garry
 Power rating : DC 3.3V
 Test Mode : BT3.0 GFSK 2402MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.71	3.04	45.79	35.04	41.50	74.00	32.50	Peak
2	2400.00	27.71	3.04	46.44	35.04	42.15	74.00	31.85	Peak
3	2402.06	27.71	3.04	83.09	35.04	78.80	74.00	-4.80	Peak

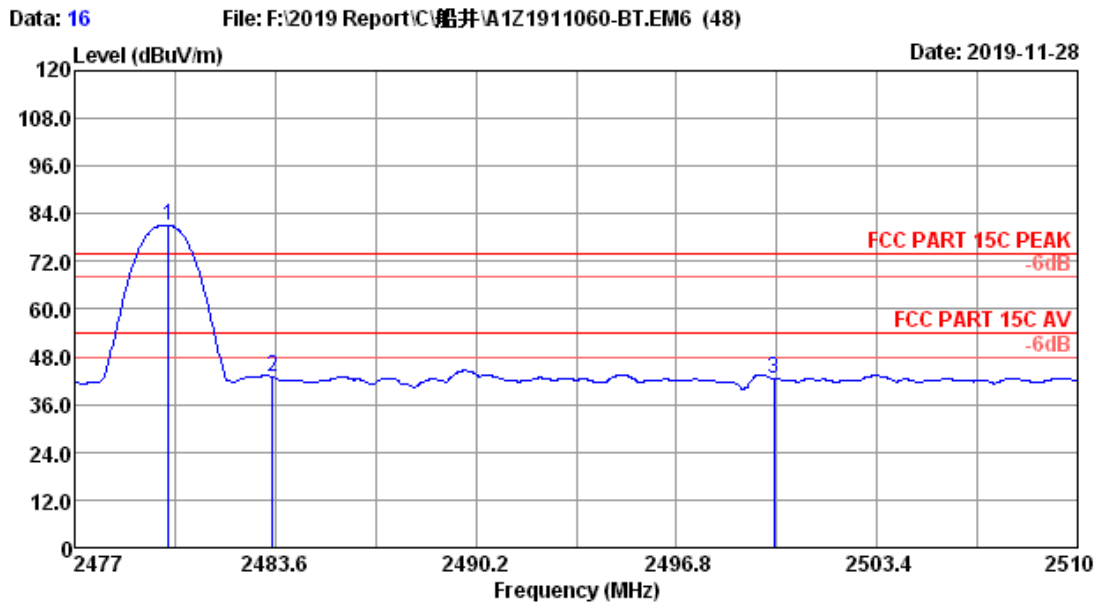
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 15
 Dis. / Ant. : 3m 2018 3115-4580 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4*C/52.9% Engineer : Garry
 Power rating : DC 3.3V
 Test Mode : BT3.0 GFSK 2480MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.10	27.98	3.10	89.69	35.01	85.76	74.00	-11.76	Peak
2	2483.50	27.98	3.10	45.42	35.01	41.49	74.00	32.51	Peak
3	2500.00	28.03	3.11	45.95	35.00	42.09	74.00	31.91	Peak

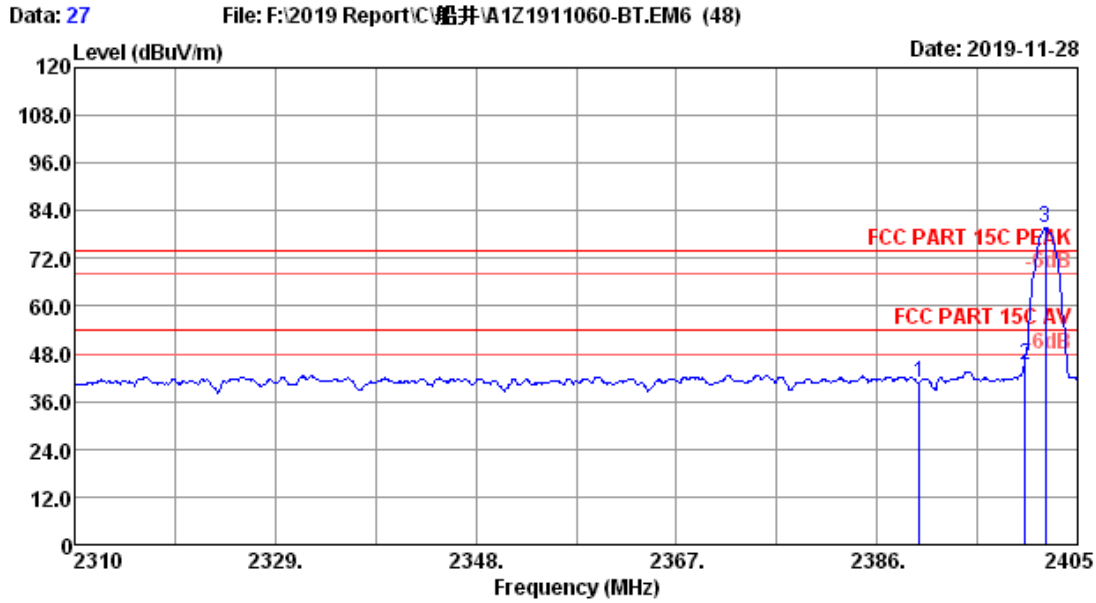
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 16
 Dis. / Ant. : 3m 2018 3115-4580 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4*C/52.9% Engineer : Garry
 Power rating : DC 3.3V
 Test Mode : BT3.0 GFSK 2480MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.10	27.98	3.10	84.96	35.01	81.03	74.00	-7.03	Peak
2	2483.50	27.98	3.10	46.94	35.01	43.01	74.00	30.99	Peak
3	2500.00	28.03	3.11	46.35	35.00	42.49	74.00	31.51	Peak

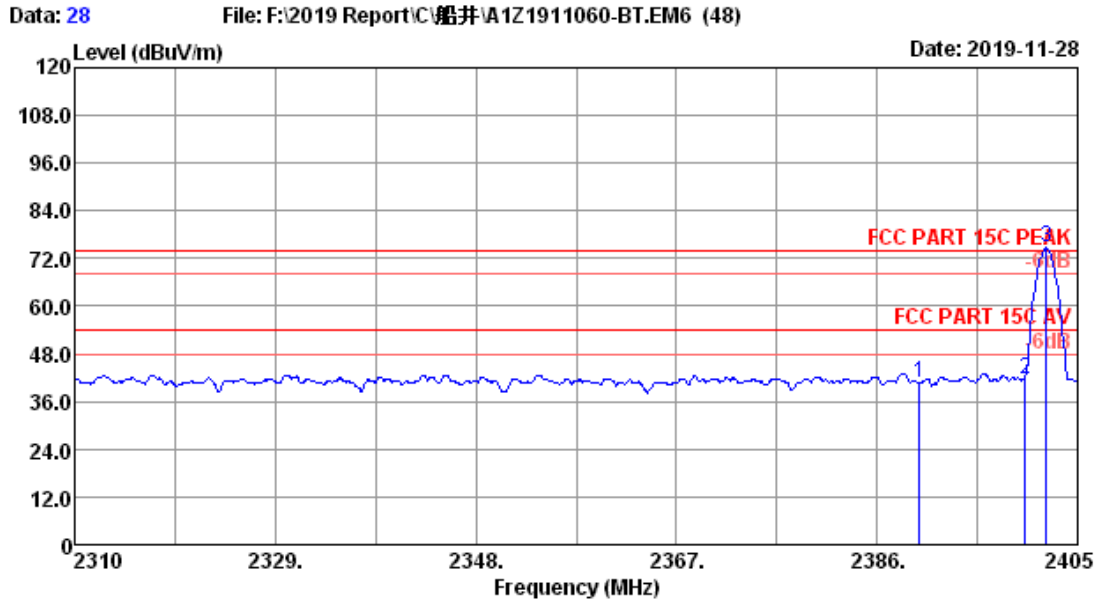
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 27
 Dis. / Ant. : 3m 2018 3115-4580 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4*C/52.9% Engineer : Garry
 Power rating : DC 3.3V
 Test Mode : BT3.0 8-DPSK 2402MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.71	3.04	45.22	35.04	40.93	74.00	33.07	Peak
2	2400.00	27.71	3.04	49.47	35.04	45.18	74.00	28.82	Peak
3	2401.96	27.71	3.04	84.16	35.04	79.87	74.00	-5.87	Peak

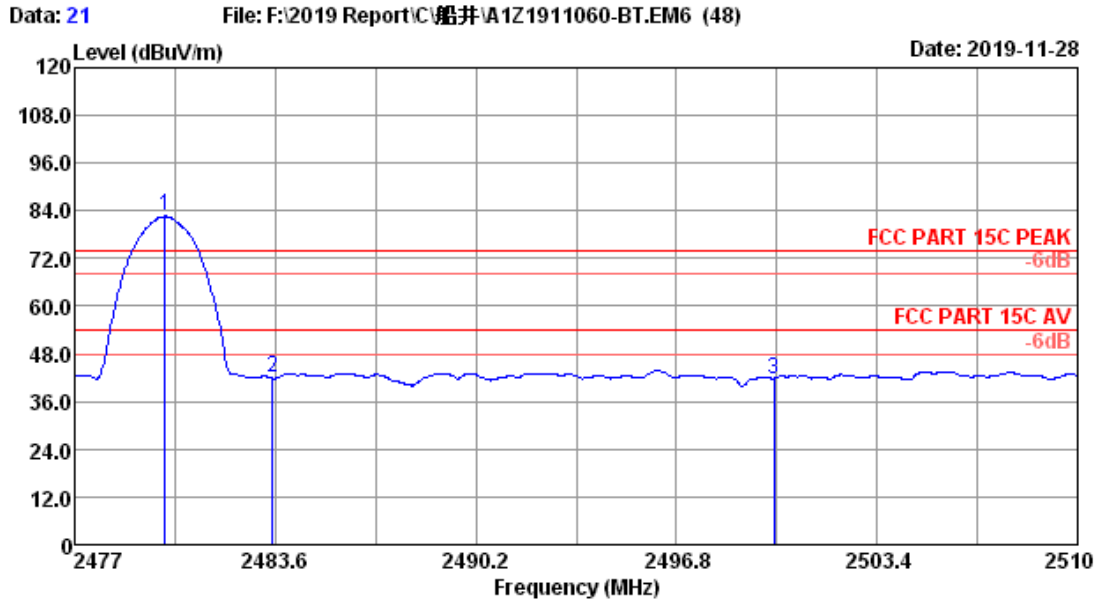
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 28
 Dis. / Ant. : 3m 2018 3115-4580 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4*C/52.9% Engineer : Garry
 Power rating : DC 3.3V
 Test Mode : BT3.0 8-DPSK 2402MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.71	3.04	45.13	35.04	40.84	74.00	33.16	Peak
2	2400.00	27.71	3.04	46.01	35.04	41.72	74.00	32.28	Peak
3	2402.06	27.71	3.04	79.01	35.04	74.72	74.00	-0.72	Peak

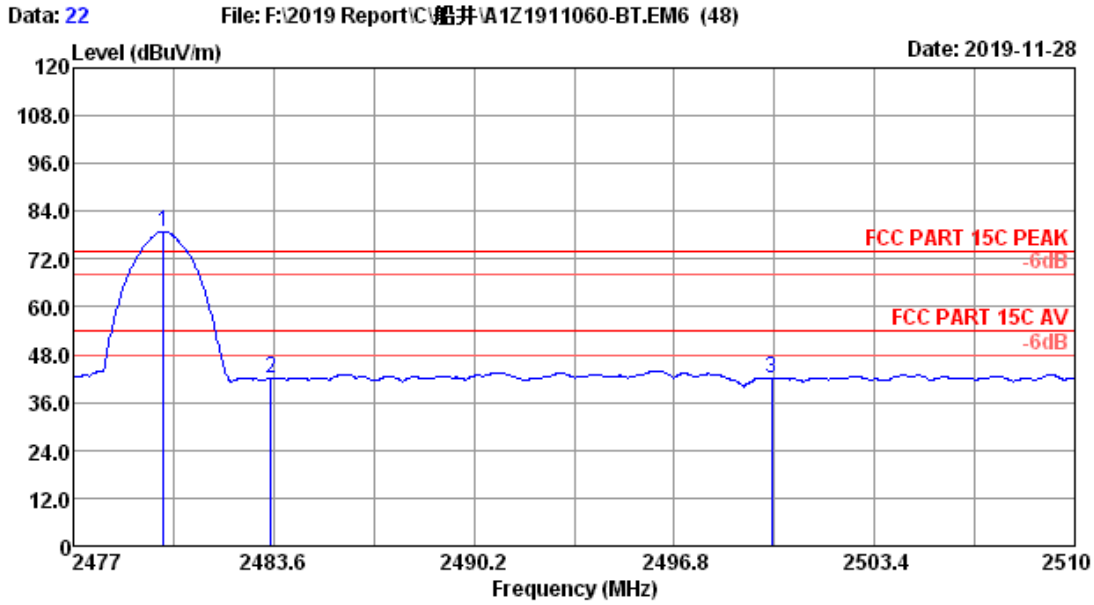
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 21
 Dis. / Ant. : 3m 2018 3115-4580 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4*C/52.9% Engineer : Garry
 Power rating : DC 3.3V
 Test Mode : BT3.0 8-DPSK 2480MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.97	27.98	3.10	86.54	35.01	82.61	74.00	-8.61	Peak
2	2483.50	27.98	3.10	45.81	35.01	41.88	74.00	32.12	Peak
3	2500.00	28.03	3.11	45.65	35.00	41.79	74.00	32.21	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 22
 Dis. / Ant. : 3m 2018 3115-4580 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 23.4*C/52.9% Engineer : Garry
 Power rating : DC 3.3V
 Test Mode : BT3.0 8-DPSK 2480MHz Tx Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2479.97	27.98	3.10	82.92	35.01	78.99	74.00	-4.99	Peak
2	2483.50	27.98	3.10	45.95	35.01	42.02	74.00	31.98	Peak
3	2500.00	28.03	3.11	45.78	35.00	41.92	74.00	32.08	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

12. ANTENNA REQUIREMENT

12.1. Standard Applicable

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. Antenna Connected Construction

The antennas used for this product are PCB antenna that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is -7.4dBi.

13.DEVIATION TO TEST SPECIFICATIONS

[NONE]

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