

FCC TEST REPORT

FCC ID: B4OCC264BPA-S

Product : Bluetooth LE Module

Model Name : CC264BPA-S, CC265BPA-S, CC26xBPA

Brand : GT-tronics

Report No. : PTC801181160622E-FC01

Prepared for

GT-tronics HK Ltd
Unit 10, 2/F., Block B, Tonic Industrial Center 19 Lam Hing Street,
Kowloon Bay, Hong Kong

Prepared by

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TEST RESULT CERTIFICATION

Applicant's name : GT-tronics HK Ltd

Address : Unit10,2/F.,Block B,Tonic Industrial Center 19 Lam Hing Street, Kowloon Bay, Hong Kong

Manufacture's name : GT-tronics HK Limited

Address : B210, Tonic Industrial Center, 19 Lam Hing Street, Kowloon Bay, Hong Kong.

Product name : Bluetooth LE Module

Model name : CC264BPA-S, CC265BPA-S, CC26xBPA

Standards : FCC CFR47 Part 15 Section 15.247

Test procedure : ANSI C63.10:2013, KDB 558074 D01 DTS MEAS GUIDANCE V03R05

Test Date : Jun.22, 2016 ~ Jul.04, 2016

Date of Issue : Jul.05, 2016

Test Result : Pass

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

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Testing Engineer

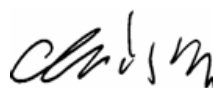
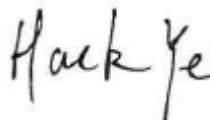
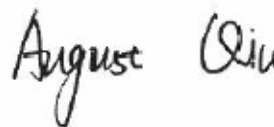
August Qiu

Technical Manager

Hack Ye

Authorized Signatory

Chris Du



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2 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207	N/A
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Conducted Spurious Emission	15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Power Spectral Density	15.247(e)	PASS
Antenna Requirement	15.203	PASS
Remark: N/A: Not Applicable		

3 General Information

3.1 General Description of E.U.T

Product Name : Bluetooth LE Module

Model Name : CC264BPA-S, CC265BPA-S, CC26xBPA

Model Description : Only the model names are different

Bluetooth Version: : BLE4.2

Frequency Range: : 2402-2480MHz, 40 channels

Antenna installation: : PCB Print Antenna

Antenna Gain: : -0.30dBi

Type of Modulation : GFSK

The lowest oscillator: : 32.768kHz

Power supply : DC 3V power by battery



3.2 Channel List

BLE							
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.3 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Modulation	Test mode	Low channel	Middle channel	High channel
GFSK(BLE)	Transmitting	2402MHz	2440MHz	2480MHz

3.4 Test Site

Dongguan Precise Testing Service Co., Ltd.

Building D,Baoding Technology Park,Guangming Road2, Dongcheng District, Dongguan,

Guangdong, China, Dongguan, 523129

China

FCC Registration Number: 371540

4 Equipment During Test

4.1 Equipments List

RF Conducted Test							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMC Analyzer (9k~26.5GHz)	Agilent	E4407B	MY45109572	July 15, 2016	July 14, 2017	1 year
2	EXA Signal Analyzer	Keysight	N9010A	MY50520207 526B25MPB W7X	July 15, 2016	July 14, 2017	1 year
3	EMI Test Receiver	R&S	ESCI	101155	July 15, 2016	July 14, 2017	1 year
Radiated Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	Rohde&Schwarz	ESCI	101417	July 15, 2016	July 14, 2017	1 year
2	Trilog Broadband Antenna	SCHWARZB ECK	VULB9160	9160-3355	July 15, 2016	July 14, 2017	1 year
3	Amplifier	EM	EM-30180	060538	July 15, 2016	July 14, 2017	1 year
4	Horn Antenna	SCHWARZB ECK	BBHA9120 D	9120D-1246	July 15, 2016	July 14, 2017	1 year
5	Coaxial Cable(below 1GHz)	LARGE	CALB1	-	July 15, 2016	July 14, 2017	1 year
6	Coaxial Cable(above 1GHz)	LARGE	CALB2	-	July 15, 2016	July 14, 2017	1 year
Conducted Emissions							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	R&S	ESCI	101155	July 15, 2016	July 14, 2017	1 year
2	LISN	SCHWARZB ECK	NSLK 8128	8128-289	July 15, 2016	July 14, 2017	1 year
3	Cable	LARGE	RF300	-	July 15, 2016	July 14, 2017	1 year



4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	$\pm 1.0\text{dB}$
Power Spectral Density, conducted	$\pm 2.2\text{dB}$
Radio Frequency	$\pm 1 \times 10^{-6}$
Bandwidth	$\pm 1.5 \times 10^{-6}$
Time	$\pm 2\%$
Duty Cycle	$\pm 2\%$
Temperature	$\pm 1^{\circ}\text{C}$
Humidity	$\pm 5\%$
DC and low frequency voltages	$\pm 3\%$
Conducted Emissions (150kHz~30MHz)	$\pm 3.64\text{dB}$
Radiated Emission(30MHz~1GHz)	$\pm 5.03\text{dB}$
Radiated Emission(1GHz~25GHz)	$\pm 4.74\text{dB}$

5 Radiated Spurious Emissions

Test Requirement: : FCC CFR47 Part 15 Section 15.209 & 15.247
 Test Method: : ANSI C63.10:2013,KDB 558074 D01 DTS MEAS GUIDANCE V03R05
 Test Result: : PASS
 Measurement Distance: : 3m
 Limit: : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

5.1 EUT Operation

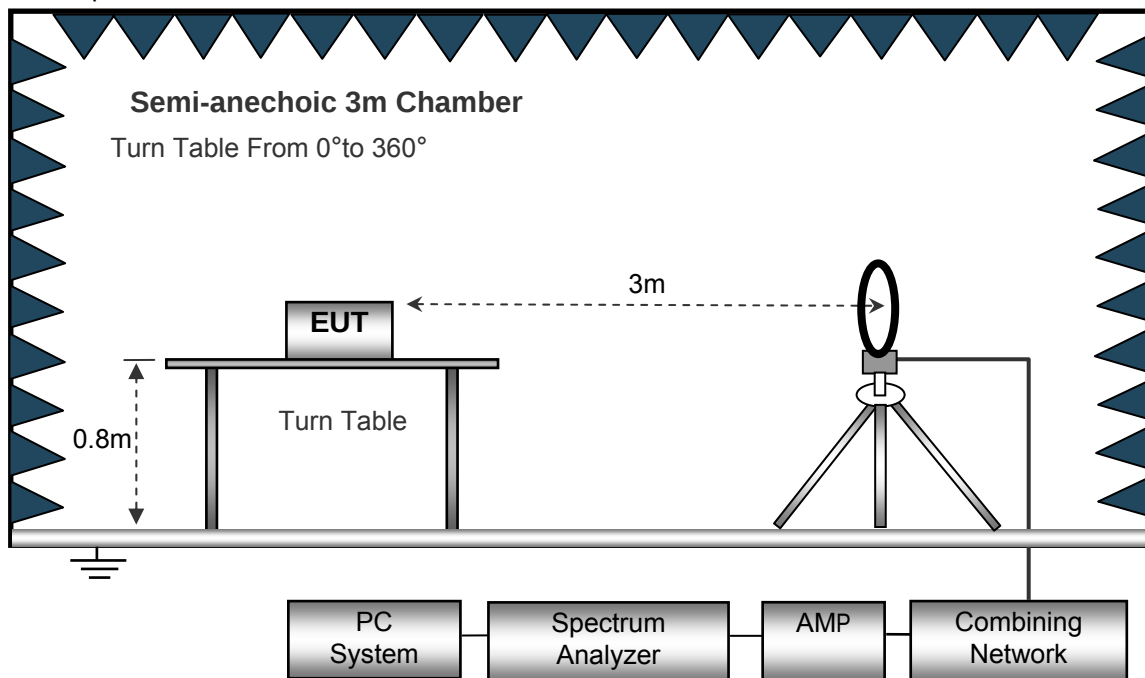
Operating Environment :

Temperature: : 23.5 °C
 Humidity: : 51.1 % RH
 Atmospheric Pressure: : 101.2kPa
 EUT Operation : : Refer to section 3.3

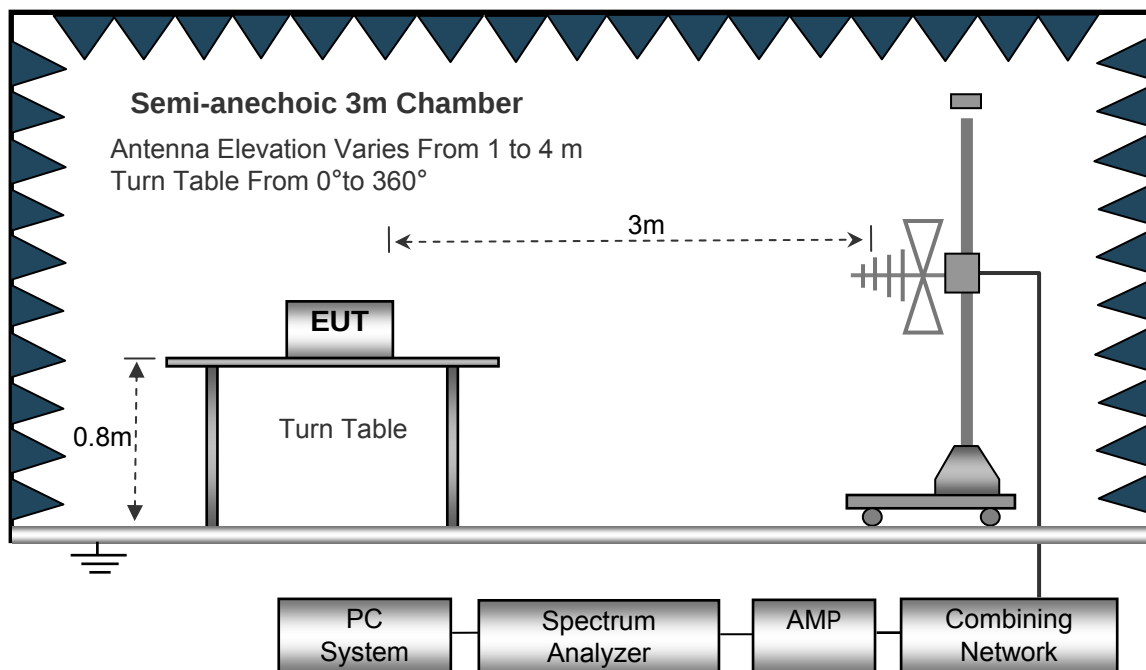
5.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

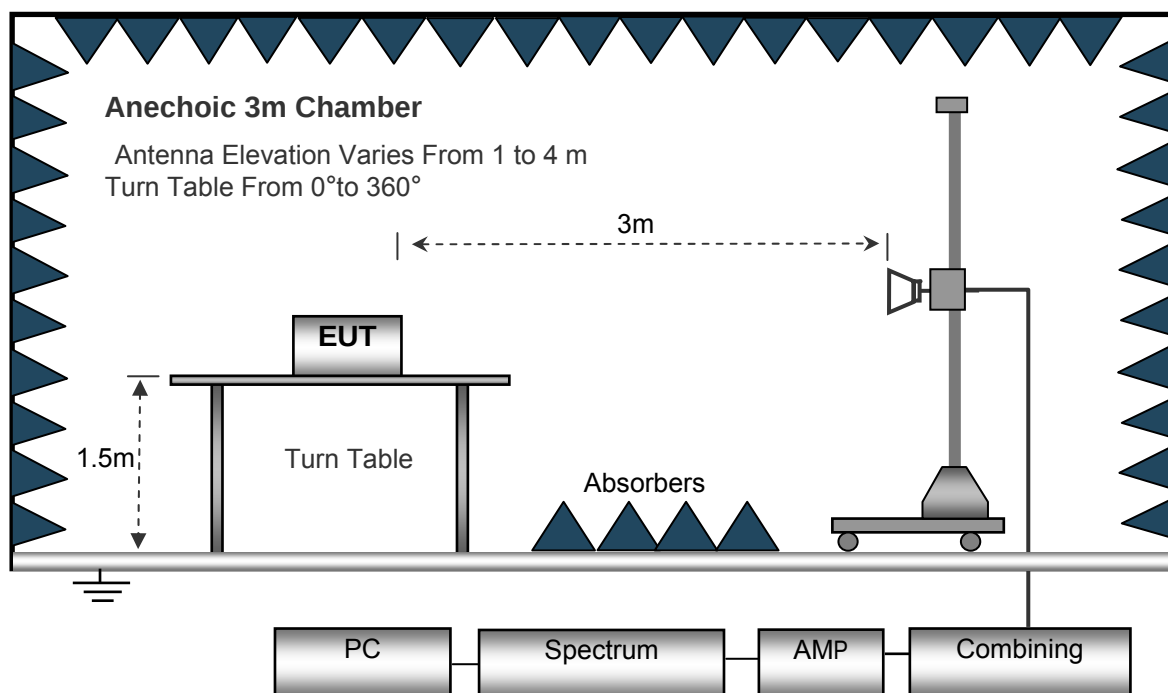
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



5.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
IF Bandwidth 10kHz
Video Bandwidth 10kHz
Resolution Bandwidth 10kHz

30MHz ~ 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth 100kHz
Video Bandwidth 300kHz

Above 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth 1MHz
Video Bandwidth 3MHz
Detector Ave.
Resolution Bandwidth 1MHz
Video Bandwidth 10Hz

5.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.



5.5 Summary of Test Results

Emission level = Receiver reading + ANT factor + cable loss – Preamp factor

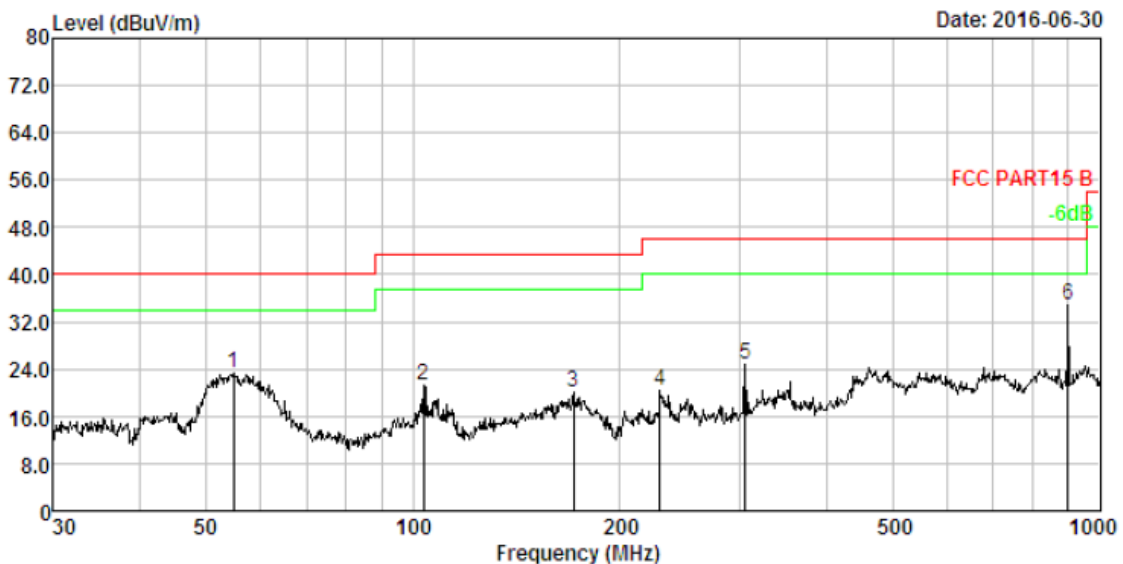
Test Frequency: Below 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 1GHz

All applicable test modes have been tested and only the worst case (BLE TX in middle channel) is recorded.

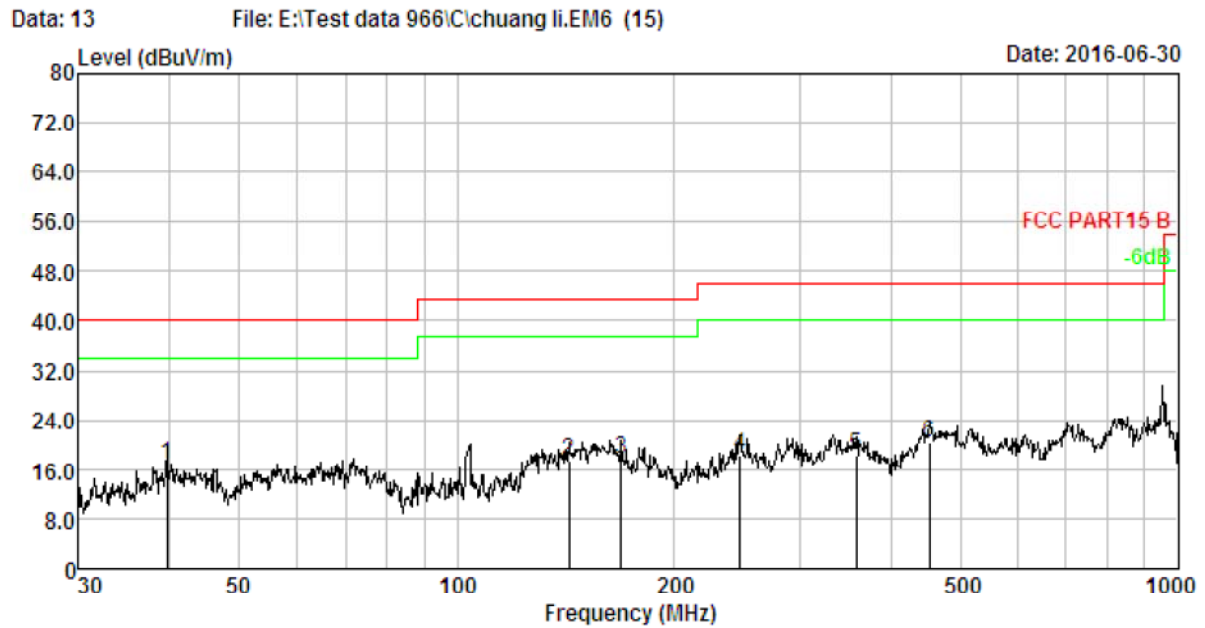
Antenna Polarization: Horizontal



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	54.835	1.60	11.91	39.87	30.18	23.20	40.00	-16.80	QP
2.	103.806	2.18	10.57	39.00	30.40	21.35	43.50	-22.15	QP
3.	171.393	2.63	13.20	34.68	30.58	19.93	43.50	-23.57	QP
4.	229.293	2.90	11.21	36.90	30.68	20.33	46.00	-25.67	QP
5.	304.610	3.15	13.30	39.07	30.78	24.74	46.00	-21.26	QP
6.	900.147	4.13	22.58	39.15	31.15	34.71	46.00	-11.29	QP



Antenna Polarization: Vertical



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	39.715	1.31	13.69	31.77	30.07	16.70	40.00	-23.30	QP
2.	142.824	2.47	13.52	31.82	30.51	17.30	43.50	-26.20	QP
3.	169.005	2.62	13.38	32.21	30.57	17.64	43.50	-25.86	QP
4.	246.815	2.96	11.86	34.33	30.70	18.45	46.00	-27.55	QP
5.	357.929	3.30	14.36	31.41	30.83	18.24	46.00	-27.76	QP
6.	452.720	3.51	16.40	31.49	30.91	20.49	46.00	-25.51	QP



Test Frequency: 1GHz ~ 18GHz

Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK(BLE) Low Channel						
Harmonic & Spurious Emission						
1184.32	44.28	PK	-18.92	25.36	74.00	-48.64
1184.32	38.51	Ave	-18.92	19.59	54.00	-34.41
4804.00	49.38	PK	-1.06	48.32	74.00	-25.68
4804.00	42.68	Ave	-1.06	41.62	54.00	-12.38
7206.00	46.83	PK	1.33	48.16	74.00	-25.84
7206.00	42.69	Ave	1.33	44.02	54.00	-9.98
Restricted bands Emission						
2348.03	45.02	PK	-13.19	31.83	74.00	-42.17
2348.03	39.30	Ave	-13.19	26.11	54.00	-27.89
2379.65	42.91	PK	-13.14	29.77	74.00	-44.23
2379.65	38.12	Ave	-13.14	24.98	54.00	-29.02
2486.01	42.47	PK	-13.08	29.39	74.00	-44.61
2486.01	40.29	Ave	-13.08	27.21	54.00	-26.79
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK(BLE) Middle Channel						
Harmonic & Spurious Emission						
1184.32	45.54	PK	-18.92	26.62	74.00	-47.38
1184.32	39.02	Ave	-18.92	20.10	54.00	-33.9
4880.00	50.12	PK	-0.93	49.19	74.00	-24.81
4880.00	42.32	Ave	-0.93	41.39	54.00	-12.61
7320.00	46.72	PK	1.67	48.39	74.00	-25.61
7320.00	42.09	Ave	1.67	43.76	54.00	-10.24
Restricted bands Emission						
2339.48	45.86	PK	-13.19	32.67	74.00	-41.33
2339.48	38.66	Ave	-13.19	25.47	54.00	-28.53
2376.97	43.06	PK	-13.14	29.92	74.00	-44.08
2376.97	37.60	Ave	-13.14	24.46	54.00	-29.54
2495.22	42.31	PK	-13.08	29.23	74.00	-44.77
2495.22	39.93	Ave	-13.08	26.85	54.00	-27.15
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						



Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK(BLE) High Channel						
Harmonic & Spurious Emission						
1184.32	45.58	PK	-18.92	26.66	74.00	-47.34
1184.32	39.86	Ave	-18.92	20.94	54.00	-33.06
4960.00	50.55	PK	-0.87	49.68	74.00	-24.32
4960.00	42.10	Ave	-0.87	41.23	54.00	-12.77
7440.00	45.90	PK	1.84	47.74	74.00	-26.26
7440.00	42.43	Ave	1.84	44.27	54.00	-9.73
Restricted bands Emission						
2334.44	45.96	PK	-13.19	32.77	74.00	-41.23
2334.44	39.50	Ave	-13.19	26.31	54.00	-27.69
2376.54	43.81	PK	-13.14	30.67	74.00	-43.33
2376.54	38.51	Ave	-13.14	25.37	54.00	-28.63
2499.86	41.65	PK	-13.08	28.57	74.00	-45.43
2499.86	40.60	Ave	-13.08	27.52	54.00	-26.48
Remark: Corrected Factor=ANT Factor + Cable Loss – Amp Gain						

**Radiated band edge:**

Frequency	Receiver Reading	Detector	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
GFSK(BLE)						
2400.00	48.63	PK	-13.12	35.51	74.00	-38.49
2400.00	41.15	PK	-13.12	28.03	74.00	-45.97
2483.50	48.25	PK	-13.06	35.19	74.00	-38.81
2483.50	43.88	PK	-13.06	30.82	74.00	-43.18
Remark: The PK value is below the AV limit, The AV value was not recorded.						

Test Frequency :Above 18GHz

The measurements were more than 20 dB below the limit and not reported

Remark 1. The testing has been conformed to $10 \times 2480 = 24800$ MHz.

2. All other emissions more than 30dB below the limit.

6 Conducted Spurious Emission

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013,KDB 558074 D01 DTS MEAS GUIDANCE V03R05
Test Limit	: Regulation 15.247 (d),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)).
Test Result	: PASS

6.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

6.2 Test Result

BLE Low Channel



BLE Middle Channel



BLE High Channel



7 Band Edge Measurement

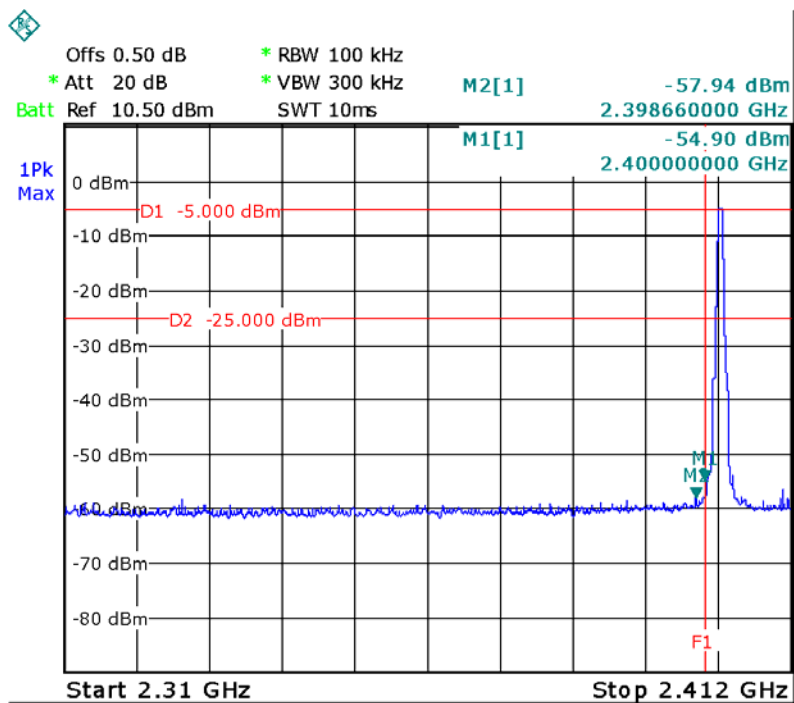
Test Requirement	: Section 15.247(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method	: ANSI C63.10:2013, KDB 558074 D01 DTS MEAS GUIDANCE V03R05
Test Limit	: Regulation 15.247 (d), 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)).
Test Mode	: Refer to section 3.3

7.1 Test Procedure

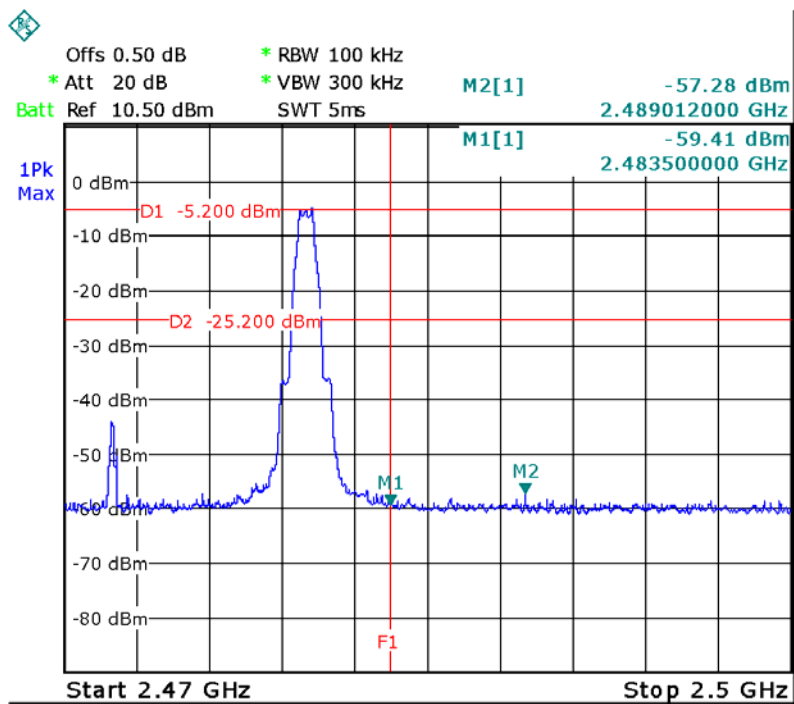
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
 2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
- Detector function = peak, Trace = max hold

7.2 Test Result

GFSK Band edge-left side



GFSK Band edge-right side



8 6dB Bandwidth Measurement

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, KDB 558074 D01 DTS MEAS GUIDANCE V03R05
Test Limit	Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Mode	: Refer to section 3.3

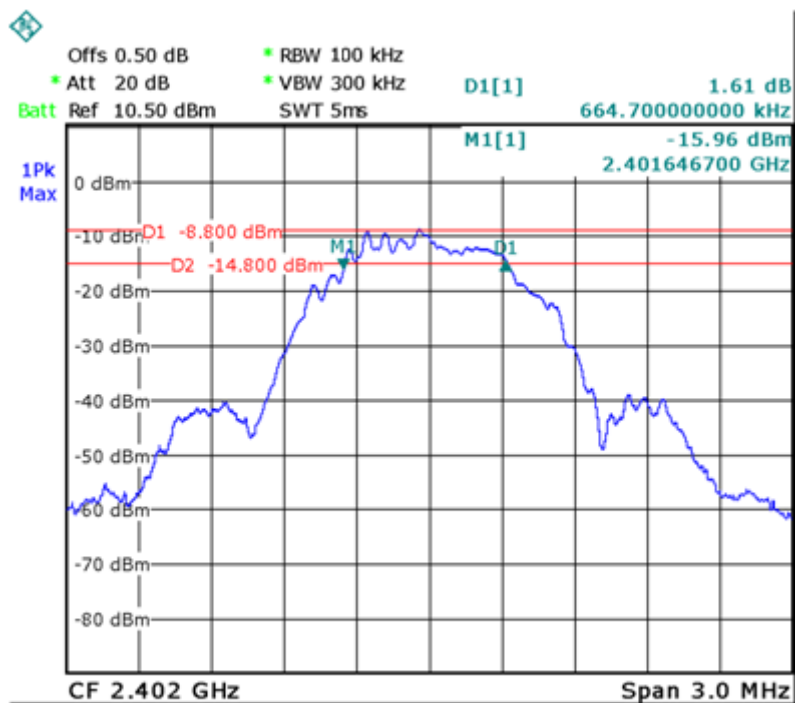
8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: For BLE, RBW = 100 kHz, VBW = 300kHz

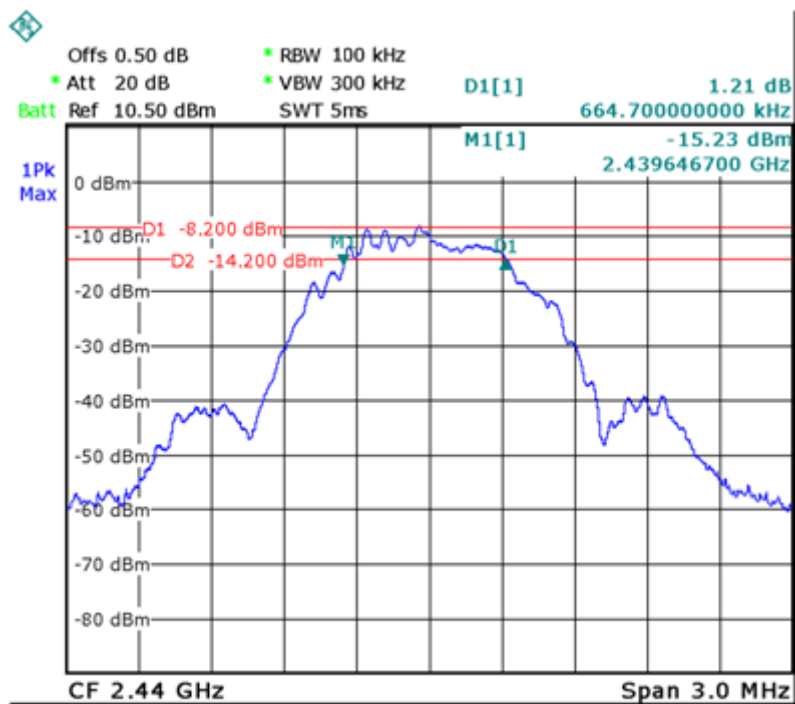
8.2 Test Result

Modulation	Bandwidth(MHz)			Limit
	Low Channel	Middle Channel	High Channel	
GFSK(BLE)	0.665	0.665	0.665	≥500kHz

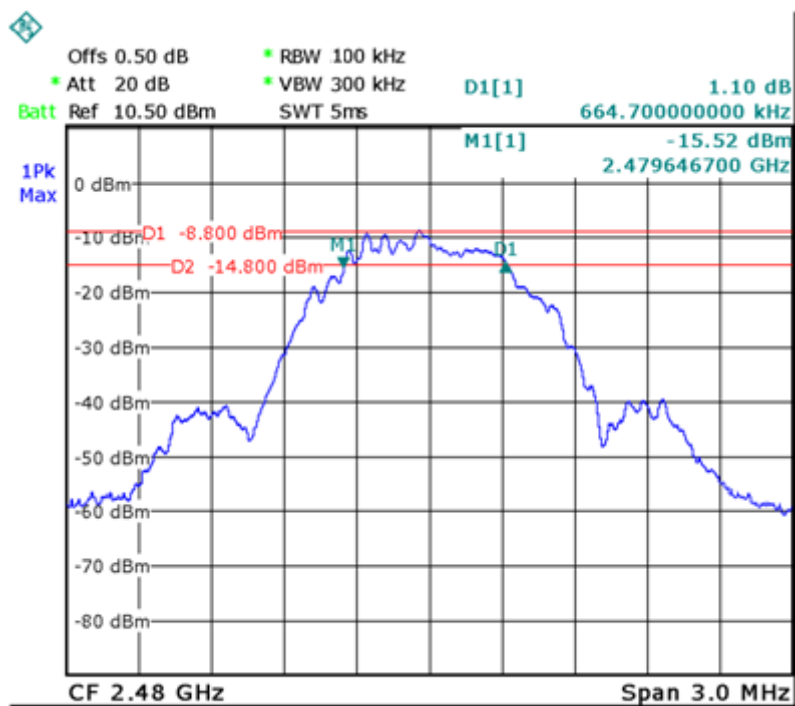
GFSK(BLE) Low Channel



GFSK(BLE) Middle Channel



GFSK(BLE) High Channel



9 Maximum Peak Output Power

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, KDB 558074 D01 DTS MEAS GUIDANCE V03R05
Test Limit	: Regulation 15.247 (b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power.
Test Mode	: Refer to section 3.3

9.1 Test Procedure

KDB 558074 D01 DTS Meas Guidance V03R05

section 9.1.1 (For BLE)

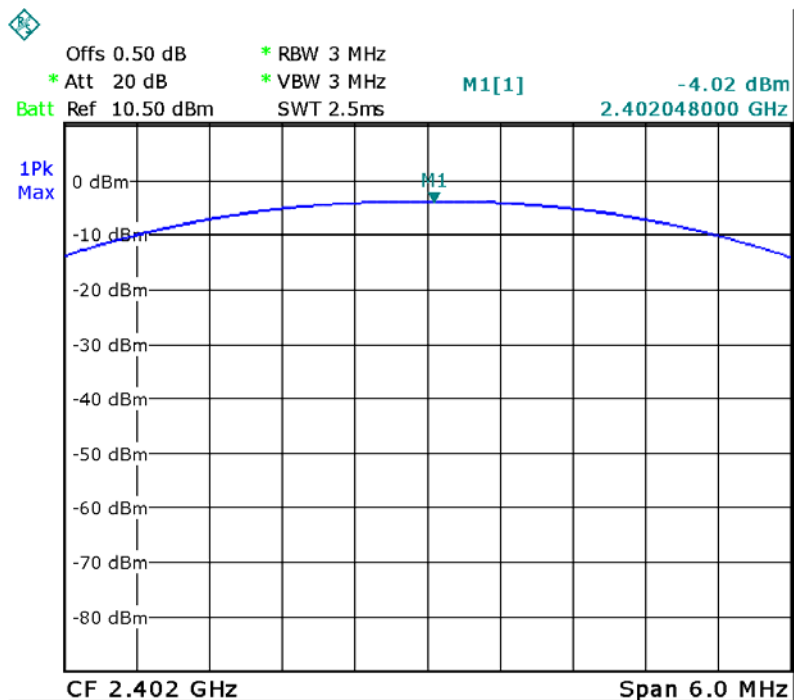
This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

- a) Set the RBW $\geq$ DTS bandwidth.
- b) Set VBW $\geq$ 3 RBW.
- c) Set span $\geq$ 3 x RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

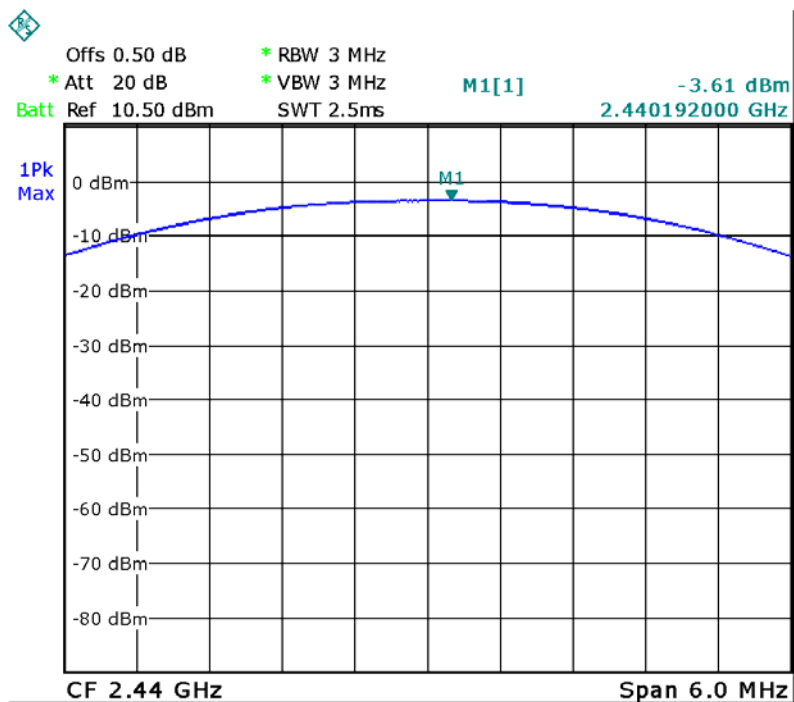
9.2 Test Result

Modulation	Maximum Peak Output Power (dBm)			Limit
	Low Channel	Middle Channel	High Channel	
GFSK(BLE)	-4.02	-3.61	-4.15	1W(30dBm)

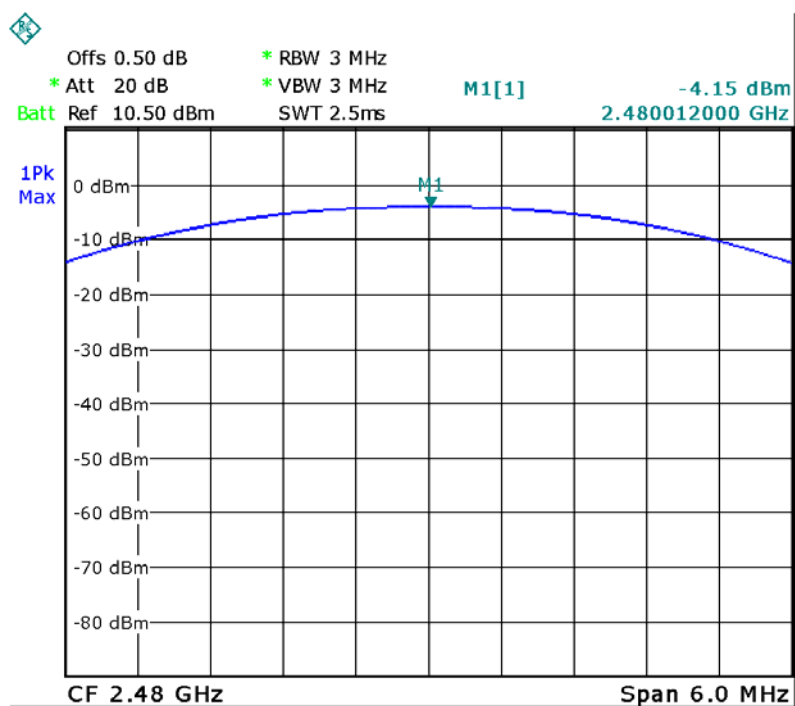
GFSK(BLE) Low Channel



GFSK(BLE) Middle Channel



GFSK(BLE) High Channel



10 Power Spectral density

Test Requirement	: FCC CFR47 Part 15 Section 15.247
Test Method	: ANSI C63.10:2013, KDB 558074 D01 DTS MEAS GUIDANCE V03R05
Test Limit	: Regulation 15.247(f) The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
Test Mode	: Refer to section 3.3

10.1 Test Procedure

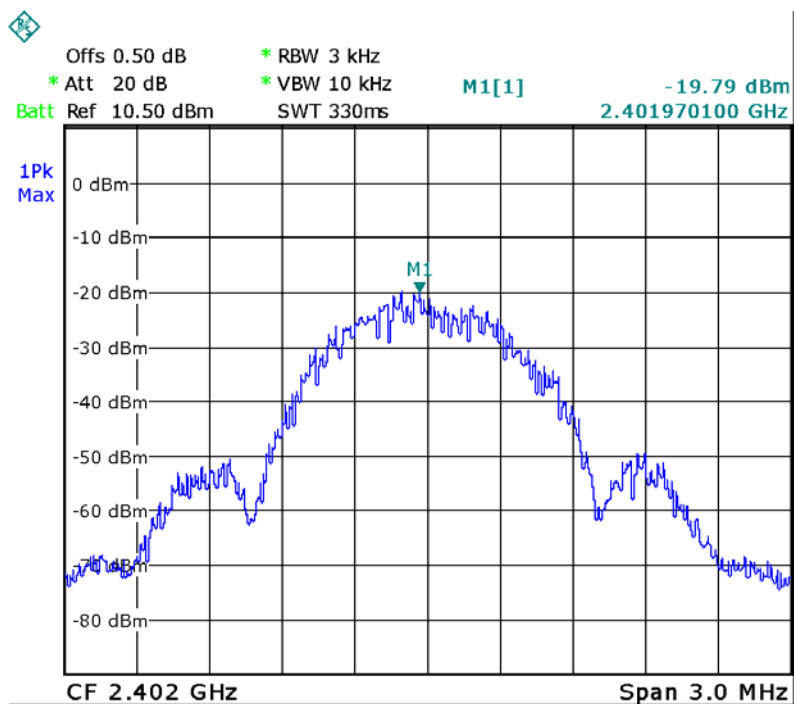
KDB 558074 D01 DTS Meas Guidance V03R05

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

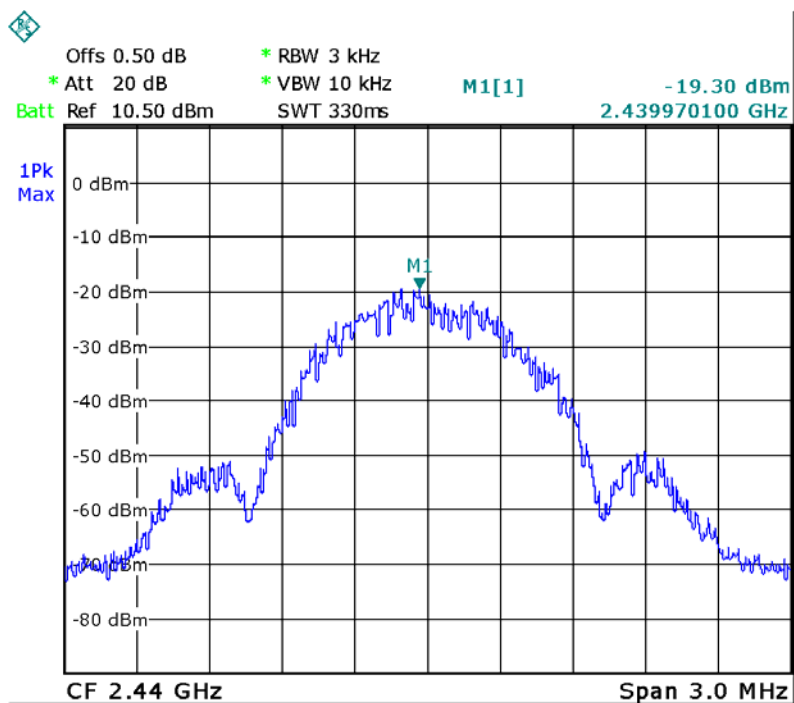
10.2 Test Result

Modulation	Power Spectral density (dBm/3kHz)			Limit
	Low Channel	Middle Channel	High Channel	
GFSK(BLE)	-19.79	-19.30	-19.75	8dBm/3kHz

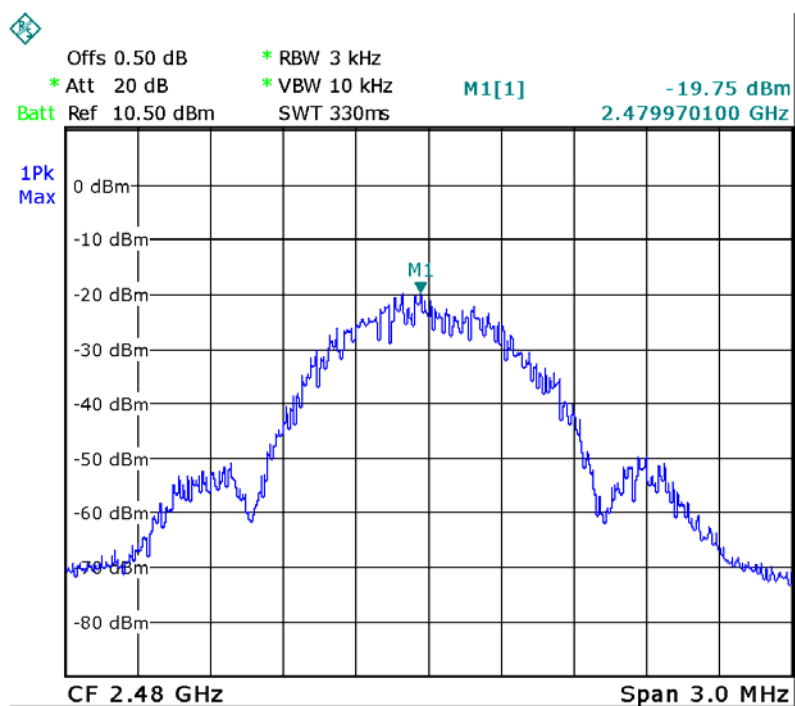
GFSK(BLE) Low Channel



GFSK(BLE) Middle Channel



GFSK(BLE) High Channel



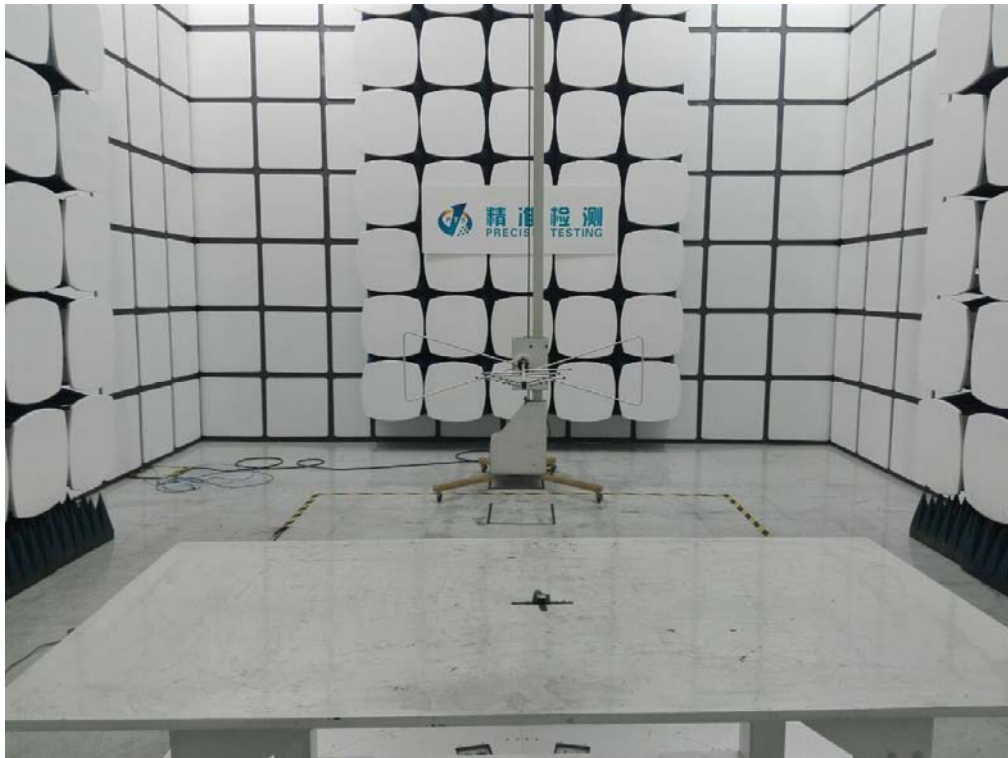


11 Antenna Requirement

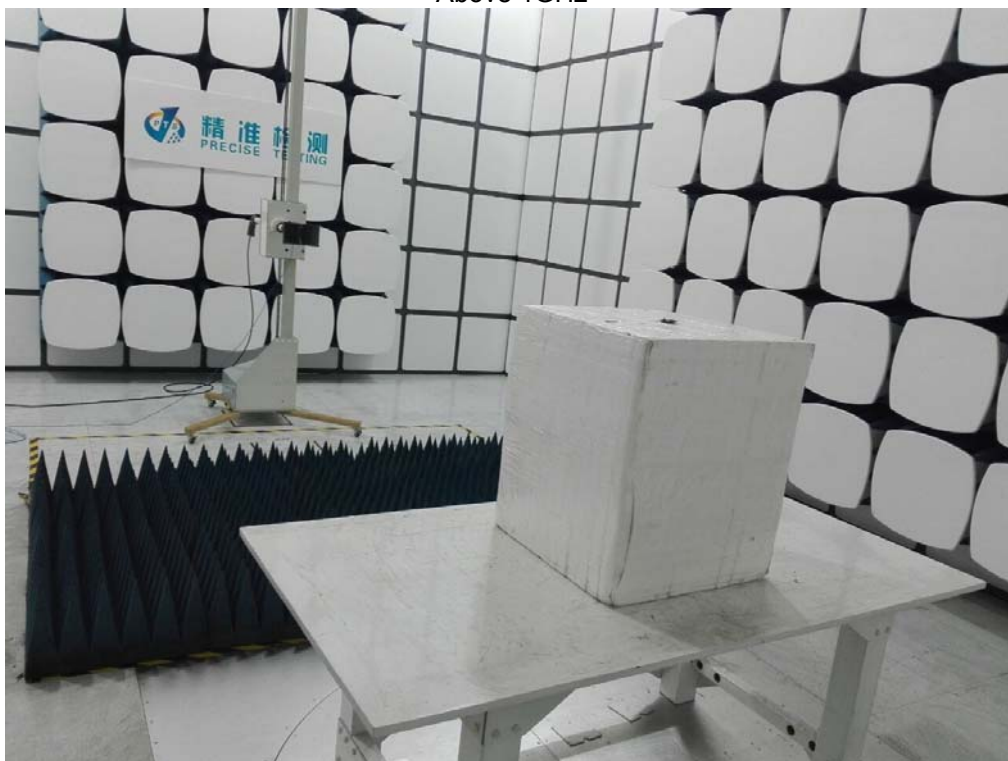
According to the FCC part15.203, a transmitter can only be sold or operated with antennas with which it was approved. This product has an PCB print antenna which meet the requirement of this section.

12 Test Setup

Radiated Spurious Emissions From 30MHz-1000MHz

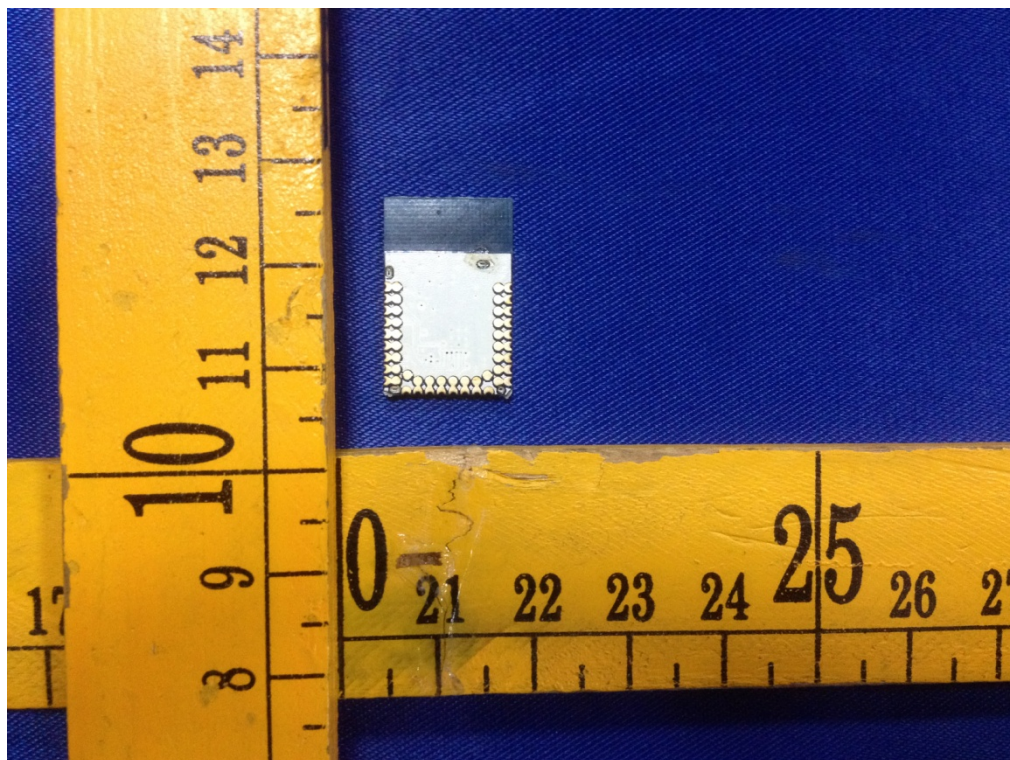
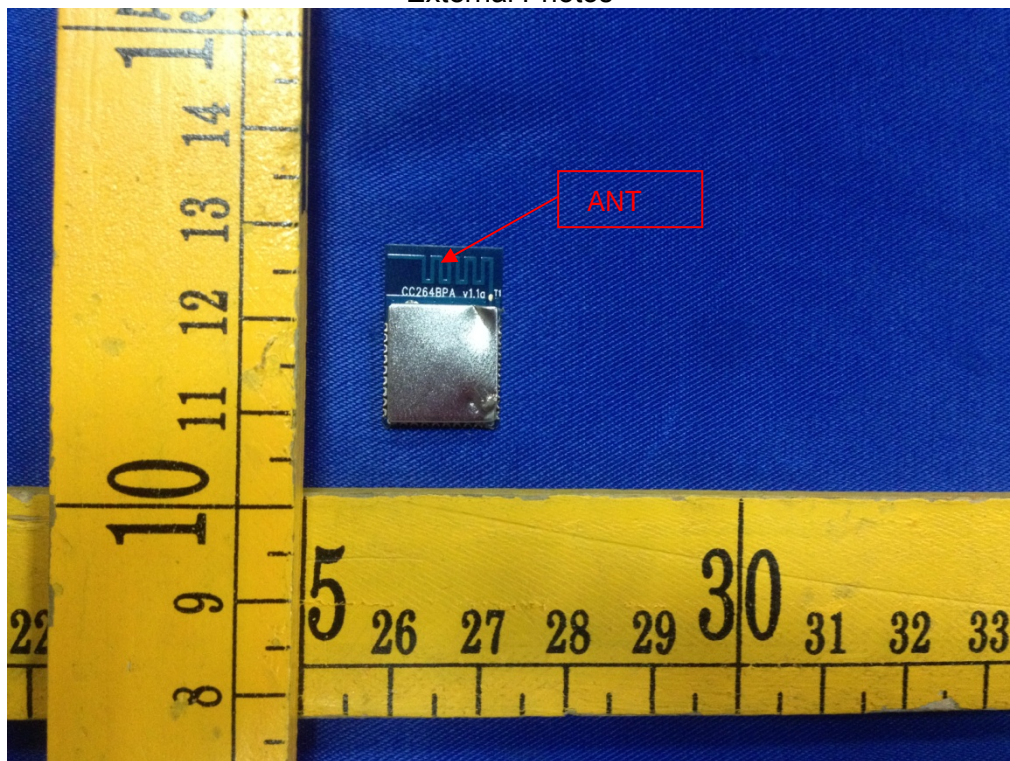


Above 1GHz

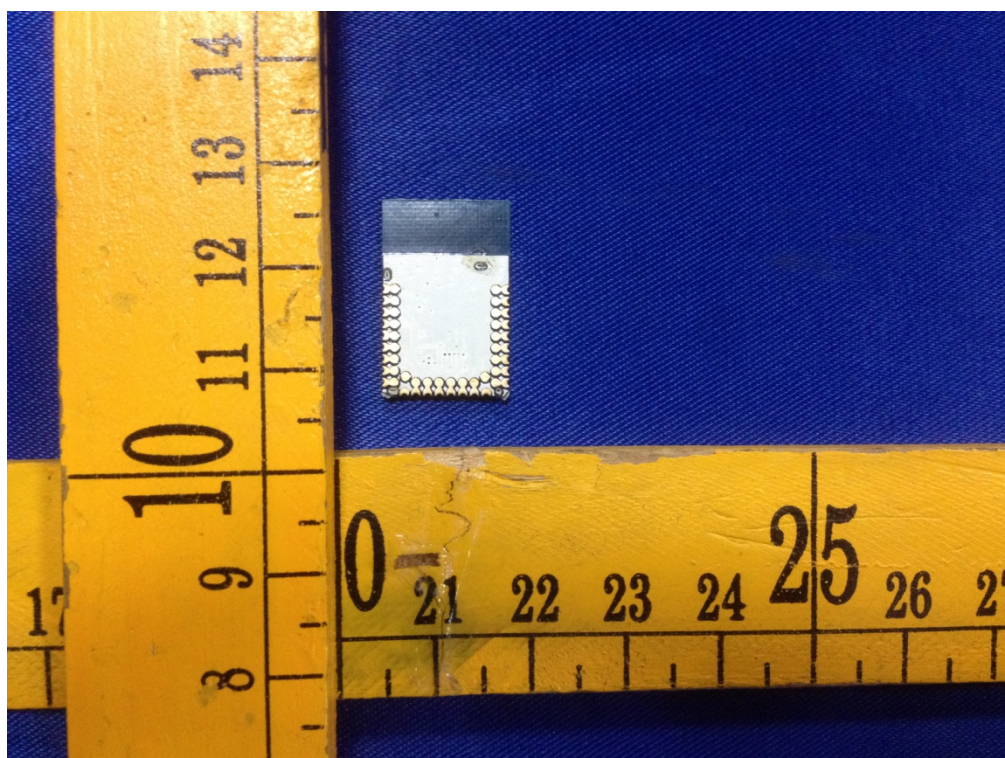
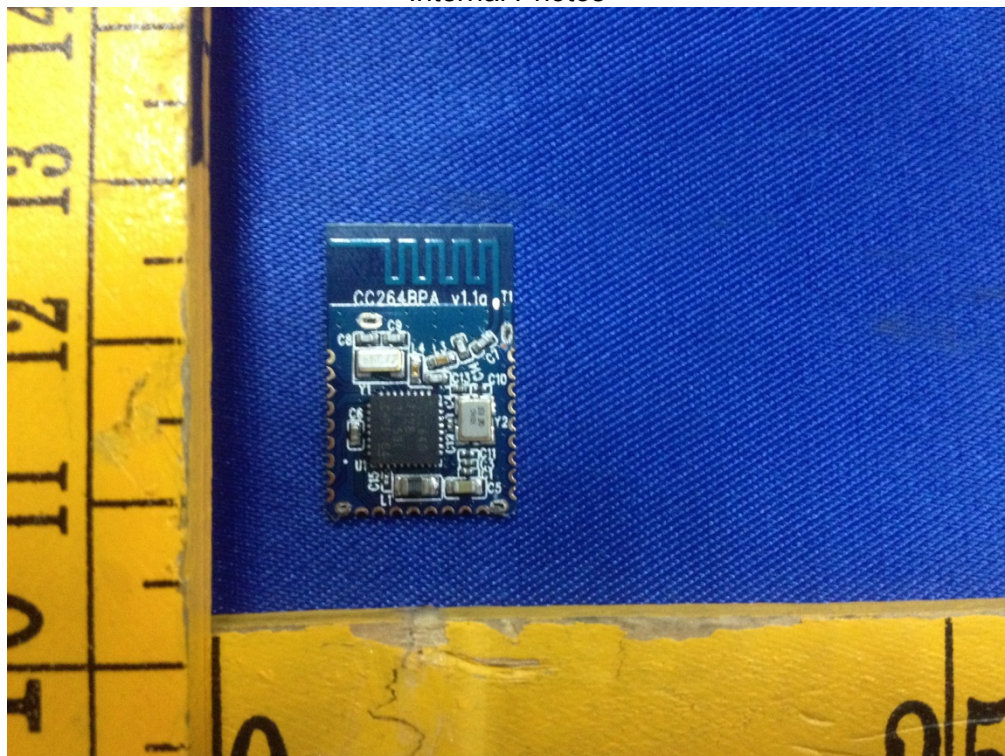


13 EUT Photos

External Photos



Internal Photos



*****THE END REPORT*****