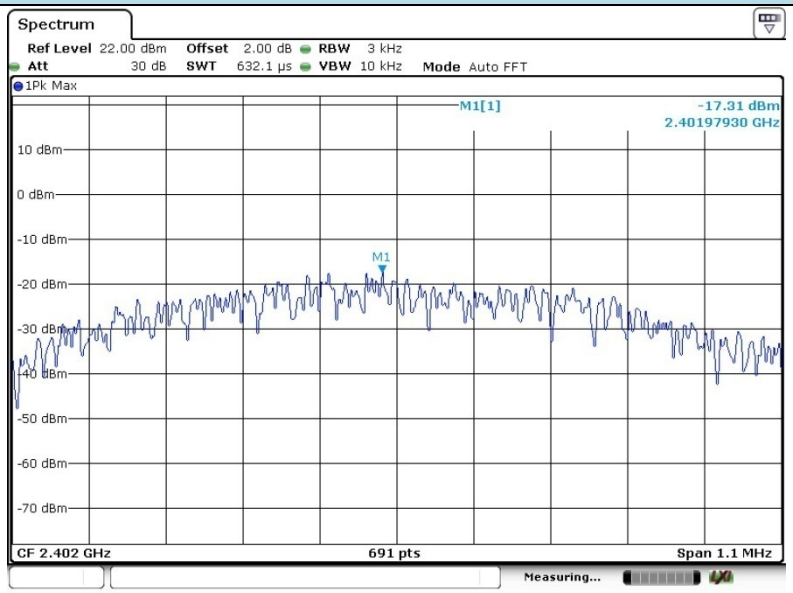
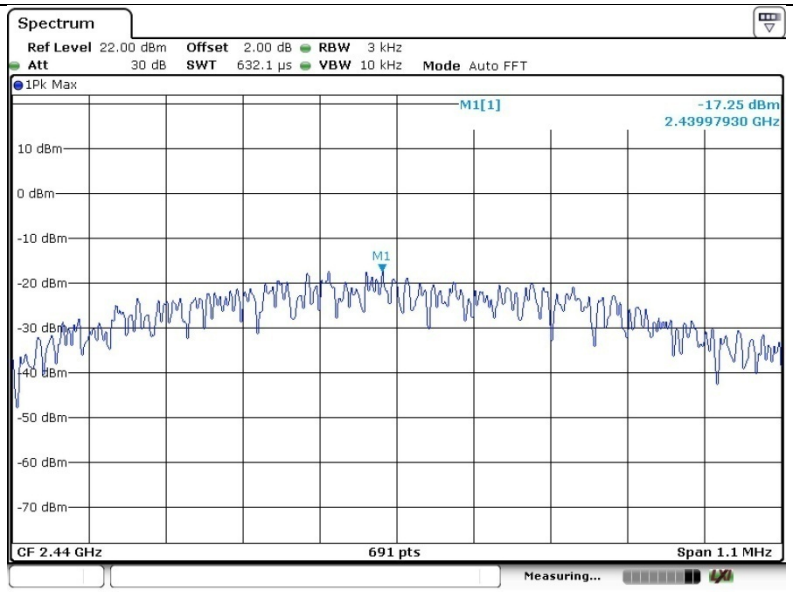
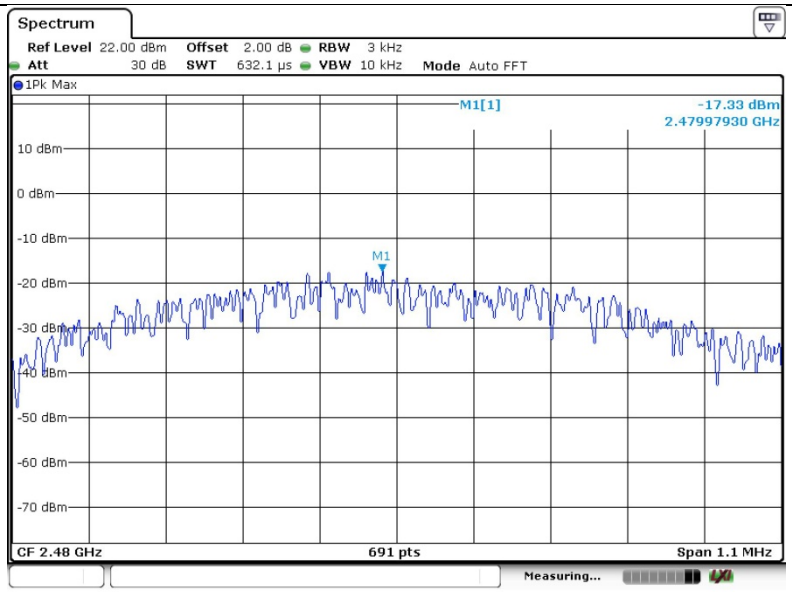
GFSK



CH00



CH19



CH39

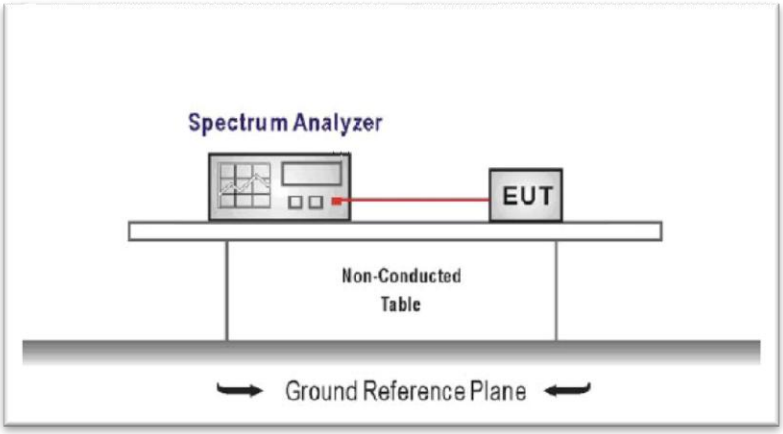
5.5. 6dB bandwidth

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2):

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
   Center Frequency =DTS channel center frequency
   Span=2 x DTS bandwidth
   RBW = 100 kHz, VBW ≥ 3 × RBW
   Sweep time= auto couple
   Detector = Peak
   Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
4. 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 6 dB relative to the maximum level measured in the fundamental emission, andrecord the pertinent measurements.

TEST MODE:

Please refer to the clause 3.3

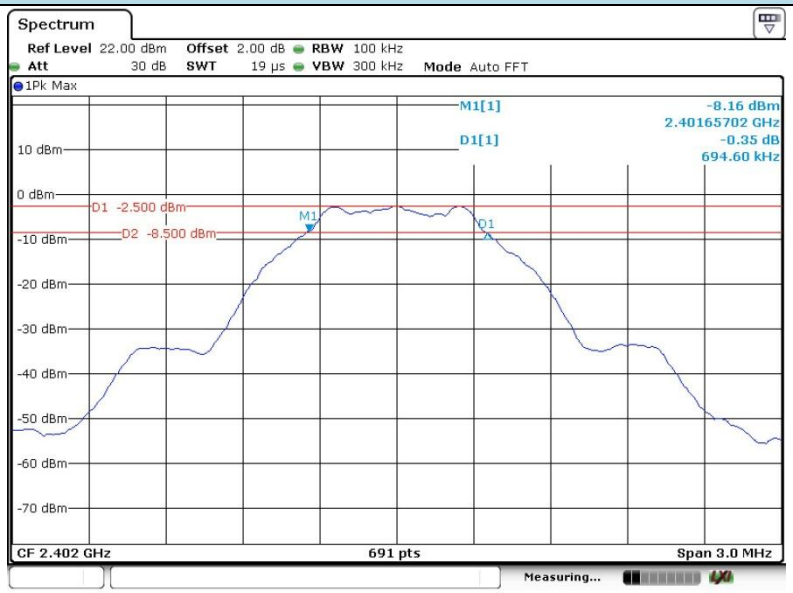
TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

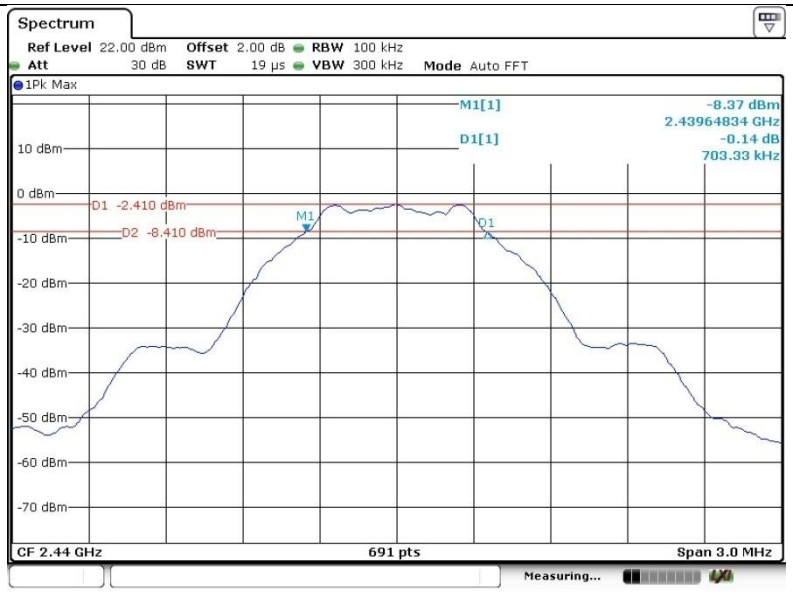
Type	Channel	6dB Bandwidth(kHz)	Limit (kHz)	Result
BT-BLE	00	694.60	⩾500	Pass
	19	703.33		
	39	690.30		

Test plot as follows:

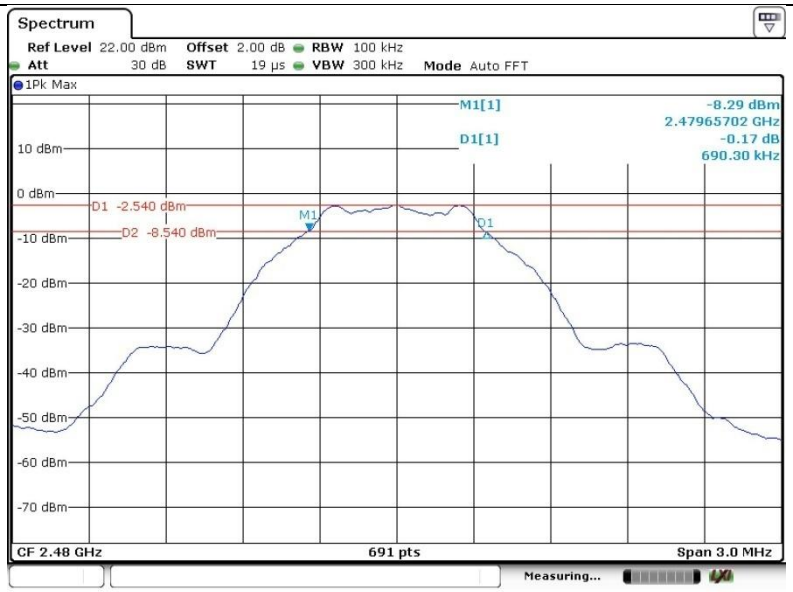
GFSK



CH00



CH19



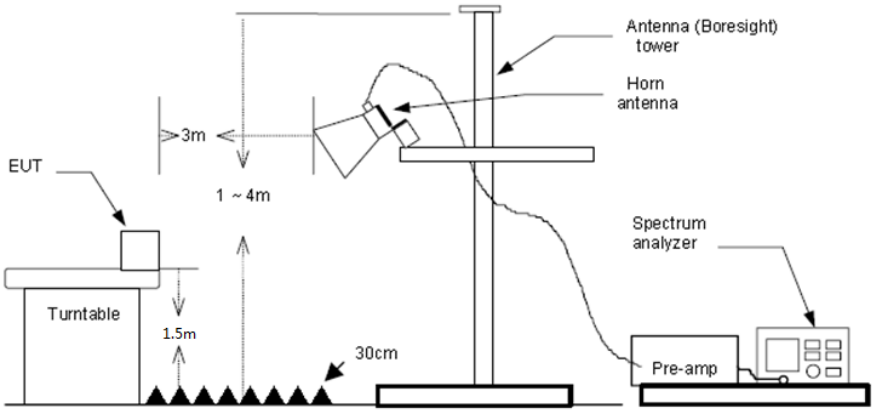
CH39

5.6. Restricted band

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, 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 CONFIGURATION



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated360 degrees to determine the position of the maximum emission level.
3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find themaximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1MHz, VBW=3MHz for Peak value

RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:
Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Note:
1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor

BT-BLE					CH00				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
2310.00	33.67	27.27	6.62	37.65	29.91	74.00	-44.09	Horizontal	Peak
2390.03	33.02	27.53	6.75	37.87	29.43	74.00	-44.57	Horizontal	
2310.00	33.07	27.27	6.62	37.65	29.31	74.00	-44.69	Vertical	
2390.03	32.82	27.53	6.75	37.87	29.23	74.00	-44.77	Vertical	
2310.00	27.83	27.27	6.62	37.65	24.07	54.00	-29.93	Horizontal	Average
2390.03	27.08	27.53	6.75	37.87	23.49	54.00	-30.51	Horizontal	
2310.00	26.92	27.27	6.62	37.65	23.16	54.00	-30.84	Vertical	
2390.03	26.42	27.53	6.75	37.87	22.83	54.00	-31.17	Vertical	

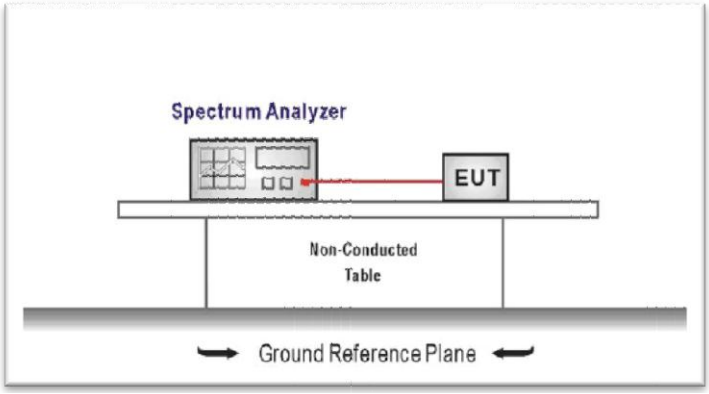
BT-BLE					CH39				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
2483.50	45.34	27.85	6.83	37.87	42.15	74.00	-31.85	Horizontal	Peak
2500.00	34.50	27.90	6.84	37.87	31.37	74.00	-42.63	Horizontal	
2483.50	44.34	27.85	6.83	37.87	41.15	74.00	-32.85	Vertical	
2500.00	36.38	27.90	6.84	37.87	33.25	74.00	-40.75	Vertical	
2483.50	41.34	27.85	6.83	37.87	38.15	54.00	-15.85	Horizontal	Average
2500.00	28.62	27.90	6.84	37.87	25.49	54.00	-28.51	Horizontal	
2483.50	40.40	27.85	6.83	37.87	37.21	54.00	-16.79	Vertical	
2500.00	29.40	27.90	6.84	37.87	26.27	54.00	-27.73	Vertical	

5.7. Band edge and Spurious Emission (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section15.247 (d):
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Establish a reference level by using the following procedure
   Center frequency=DTS channel center frequency
   The span = 1.5 times the DTS bandwidth.
   RBW = 100 kHz, VBW ≥ 3 x RBW
   Detector = peak, Sweep time = auto couple, Trace mode = max hold
   Allow trace to fully stabilize
   Use the peak marker function to determine the maximum PSD level

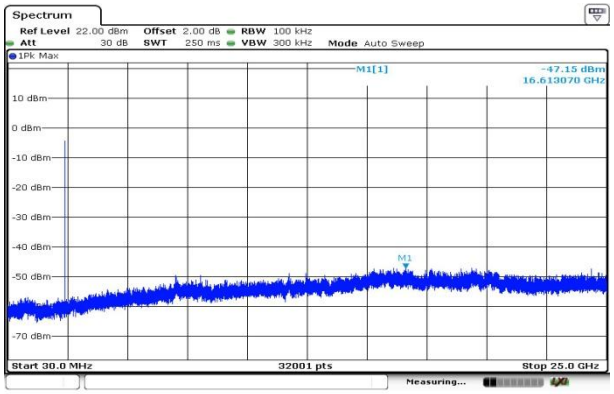
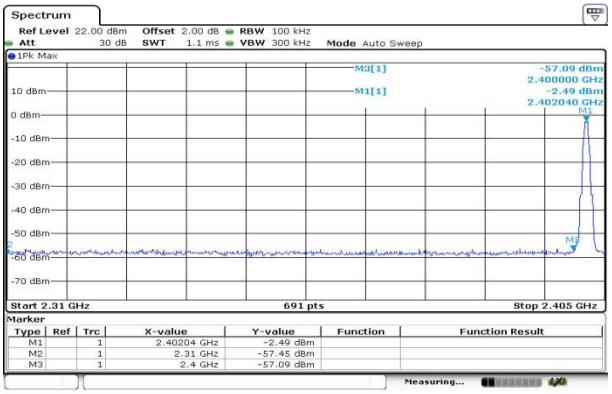
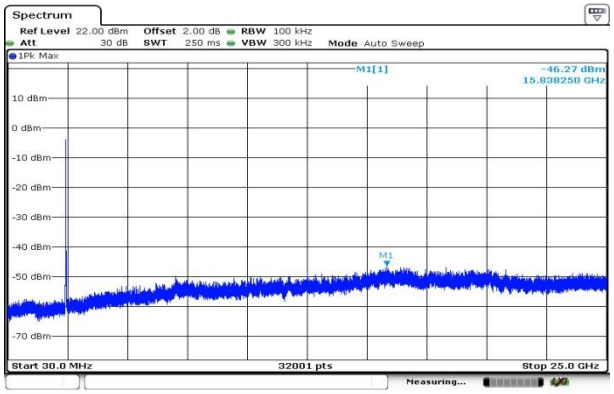
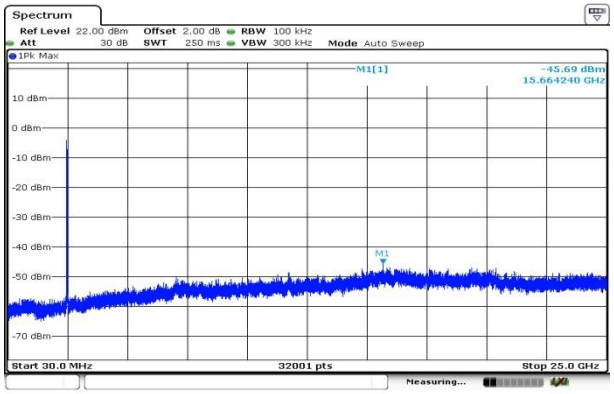
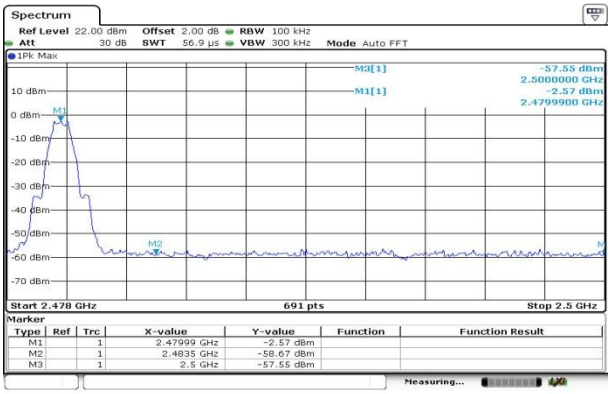
   Note that the channel found to contain the maximum PSD level can be used to establish the reference level.
3. Emission level measurement
   Set the center frequency and span to encompass frequency range to be measured
   RBW = 100 kHz, VBW ≥ 3 x RBW
   Detector = peak, Sweep time = auto couple, Trace mode = max hold
   Allow trace to fully stabilize
   Use the peak marker function to determine the maximum amplitude level.
4. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
5. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emissions relative to the limit.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

BT-BLE	
	
CH00-SE	CH00-Bandedge
	No Plot
CH19-SE	-
	
CH39-SE	CH39-Bandedge

5.8. Spurious Emission (radiated)

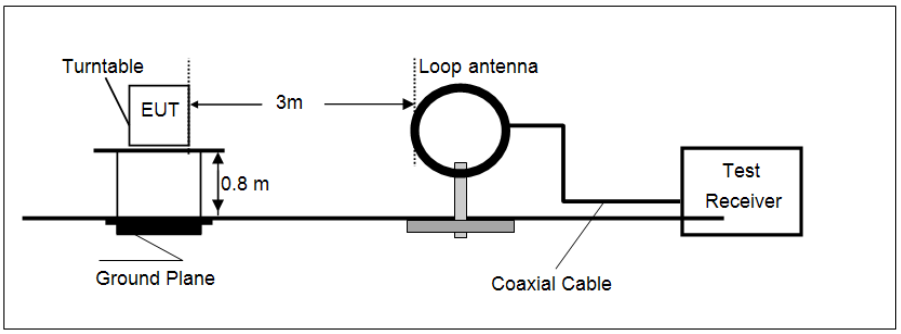
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

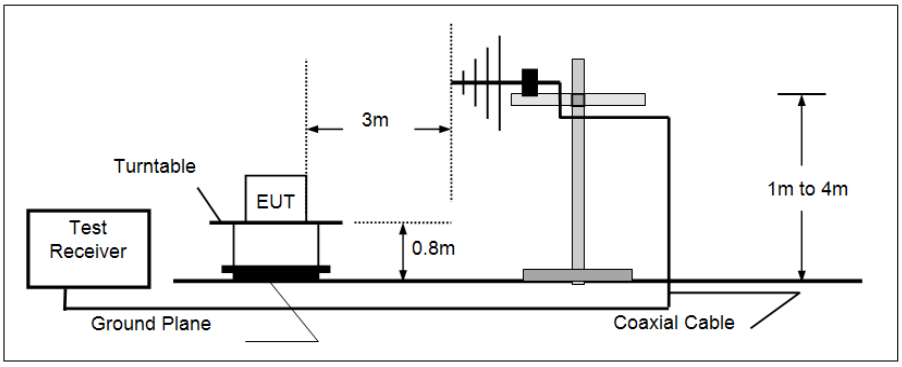
Frequency	Limit (dBuV/m @3m)	Value
30MHz-88MHz	40.00	Quasi-peak
88MHz-216MHz	43.50	Quasi-peak
216MHz-960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

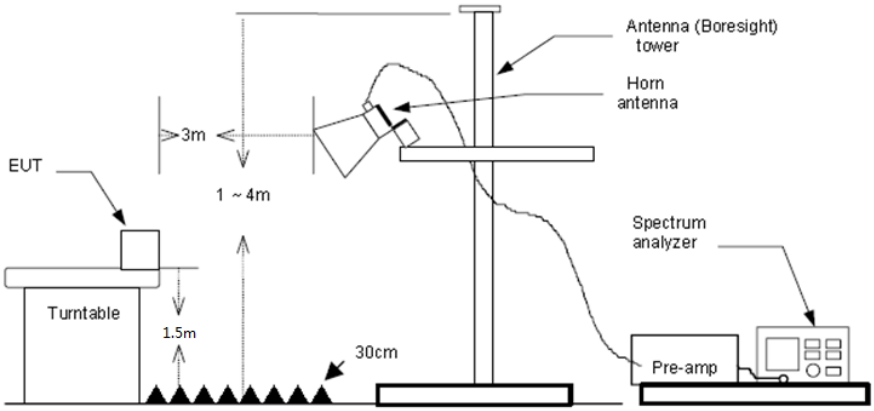
- 9KHz ~30MHz



- 30MHz ~ 1GHz



- Above 1GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1GHz,and 1.5m for above 1GHz. The turn table is rotated360 degrees to determine the position of the maximum emission level.
3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find themaximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. Use the following spectrum analyzer settings
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Below 1GHz, RBW=120KHz, VBW=300KHz, Sweep=auto, Detector function=QP, Trace=max hold; If the emission level of the EUT measured by the peak detectoris 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, theemission measurement will be repeated using the quasi-peak detector and reported.
   (3) Above 1GHz, RBW=1MHz, VBW=3MHz for Peak value
   RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

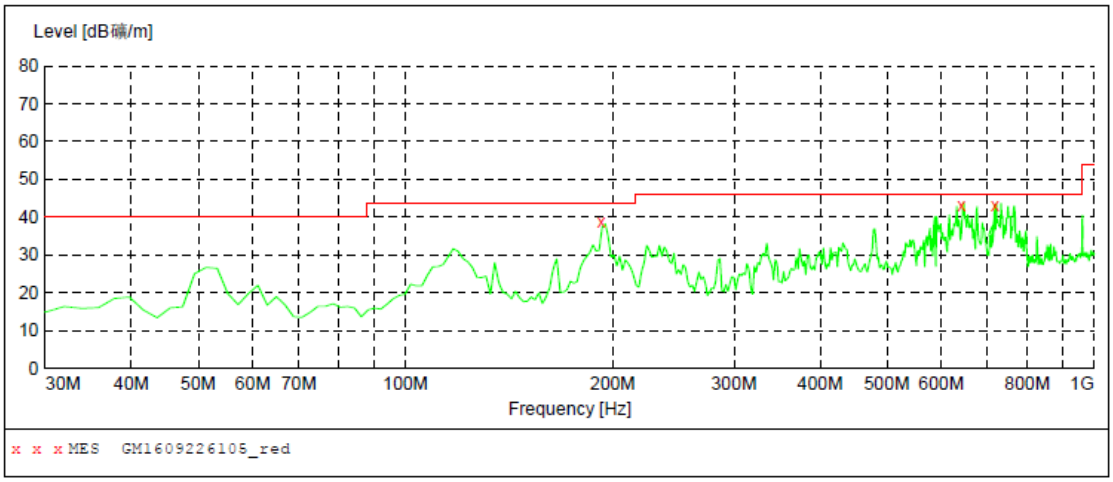
Note:
1) Above 1GHz Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2) The emission levels of other frequencies are very lower than the limit and not show in test report.

- **9kHz ~ 30MHz**
  The EUT was pre-scanned the frequency band (9KHz~30MHz), found the radiated level lower than the limit, so don't show on the report.

- **30MHz ~1000MHz**
  Have pre-scan all modulation mode, found the BT-BLE mode CH39 which it was worst case, so only the worst case's data on the test report.

➢ **30MHz ~ 1GHz**

Polarization:	Vertical

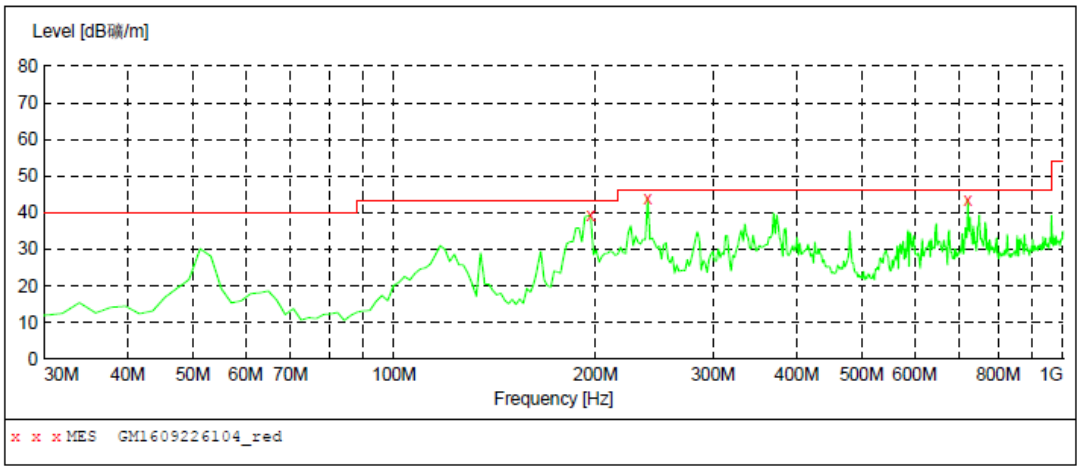


MEASUREMENT RESULT: "GM1609226105_red"

3/28/2017 7:41PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
192.920000	39.00	-14.0	43.5	4.5	QP	100.0	3.00	VERTICAL
646.920000	42.10	-2.3	46.0	3.9	QP	100.0	193.00	VERTICAL
720.640000	42.30	-1.3	46.0	3.7	QP	100.0	9.00	VERTICAL

Polarization:	Horizontal



MEASUREMENT RESULT: "GM1609226104_red"

3/28/2016 7:38PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
196.840000	39.30	-13.9	43.5	4.2	QP	100.0	158.00	HORIZONTAL
239.520000	42.80	-15.1	46.0	3.2	QP	300.0	173.00	HORIZONTAL
720.640000	42.60	-1.3	46.0	3.4	QP	100.0	203.00	HORIZONTAL

➢ **Above 1GHz**

BT-BLE					CH00				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
1597.40	41.07	25.01	5.56	36.72	34.92	74.00	-39.08	Vertical	Peak
3033.91	36.53	28.52	7.52	38.22	34.35	74.00	-39.65	Vertical	Peak
4797.27	42.16	31.09	9.54	36.96	45.83	74.00	-28.17	Vertical	Peak
7117.84	32.98	35.90	11.86	34.96	45.78	74.00	-28.22	Vertical	Peak
1597.40	41.86	25.01	5.56	36.72	35.71	74.00	-38.29	Horizontal	Peak
3192.37	36.65	28.58	7.71	38.20	34.74	74.00	-39.26	Horizontal	Peak
4809.50	38.94	31.09	9.55	36.93	42.65	74.00	-31.35	Horizontal	Peak
6886.15	32.56	35.66	11.71	34.90	45.03	74.00	-28.97	Horizontal	Peak

BT-BLE					CH19				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
1593.34	43.02	24.99	5.55	36.71	36.85	74.00	-37.15	Vertical	Peak
3200.50	36.85	28.58	7.72	38.20	34.95	74.00	-39.05	Vertical	Peak
4883.52	37.28	31.14	9.59	36.73	41.28	74.00	-32.72	Vertical	Peak
7117.84	32.19	35.90	11.86	34.96	44.99	74.00	-29.01	Vertical	Peak
1541.48	49.44	24.84	5.40	36.64	43.04	74.00	-30.96	Horizontal	Peak
2124.37	43.00	26.59	6.38	37.32	38.65	74.00	-35.35	Horizontal	Peak
4883.52	40.00	31.14	9.59	36.73	44.00	74.00	-30.00	Horizontal	Peak
6235.36	33.19	34.08	11.01	35.29	42.99	74.00	-31.01	Horizontal	Peak

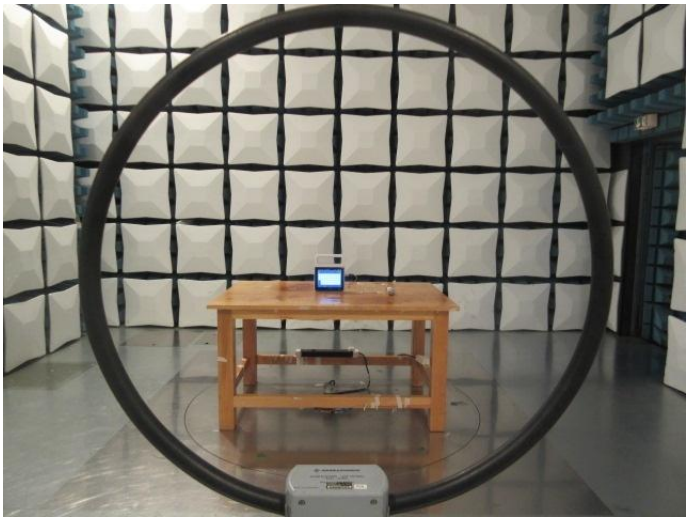
BT-BLE					CH39				
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
1593.34	42.80	24.99	5.55	36.71	36.63	74.00	-37.37	Vertical	Peak
3192.37	38.13	28.58	7.71	38.20	36.22	74.00	-37.78	Vertical	Peak
4958.68	37.38	31.18	9.64	36.52	41.68	74.00	-32.32	Vertical	Peak
8814.77	31.68	37.66	13.12	34.29	48.17	74.00	-25.83	Vertical	Peak
1597.40	41.27	25.01	5.56	36.72	35.12	74.00	-38.88	Horizontal	Peak
3993.90	35.22	29.48	8.77	38.11	35.36	74.00	-38.64	Horizontal	Peak
4958.68	38.04	31.18	9.64	36.52	42.34	74.00	-31.66	Horizontal	Peak
8022.46	33.00	36.72	12.35	34.53	47.54	74.00	-26.46	Horizontal	Peak

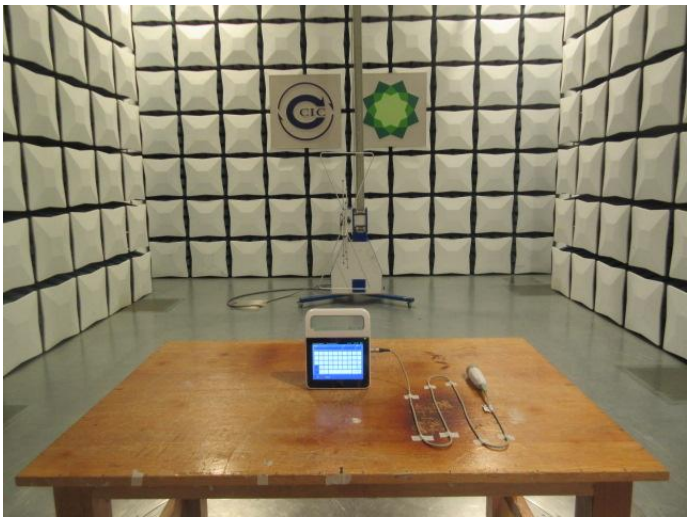
Remark:
1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The peak level is lower than average limit (54dBuV/m), this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

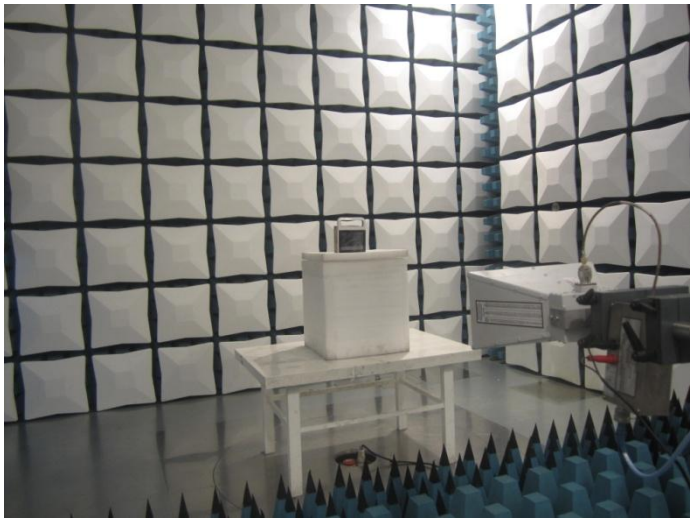
6. Test Setup Photos of the EUT

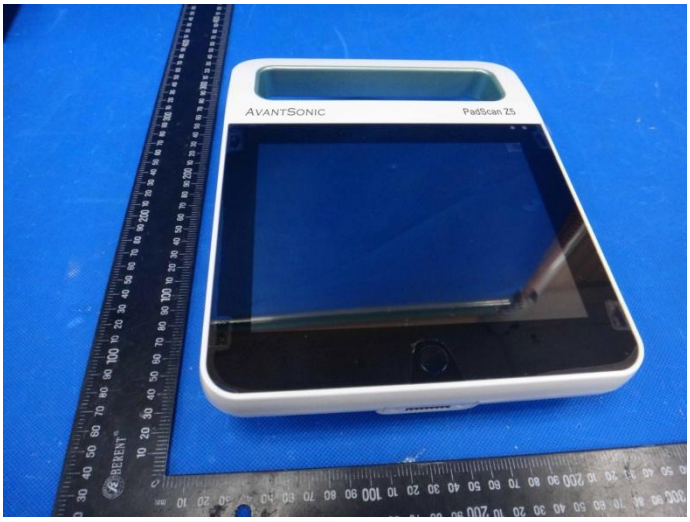
Conducted Emission (AC Mains)

Radiated Emission







7. External and Internal Photos of the EUT

External Photos