

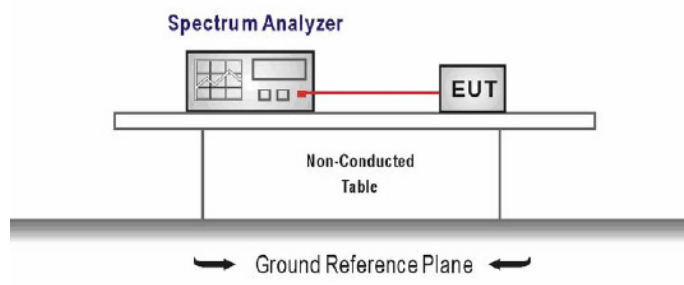
4.5. 6dB bandwidth

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2): **at least 500KHz**

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

TEST CONFIGURATION



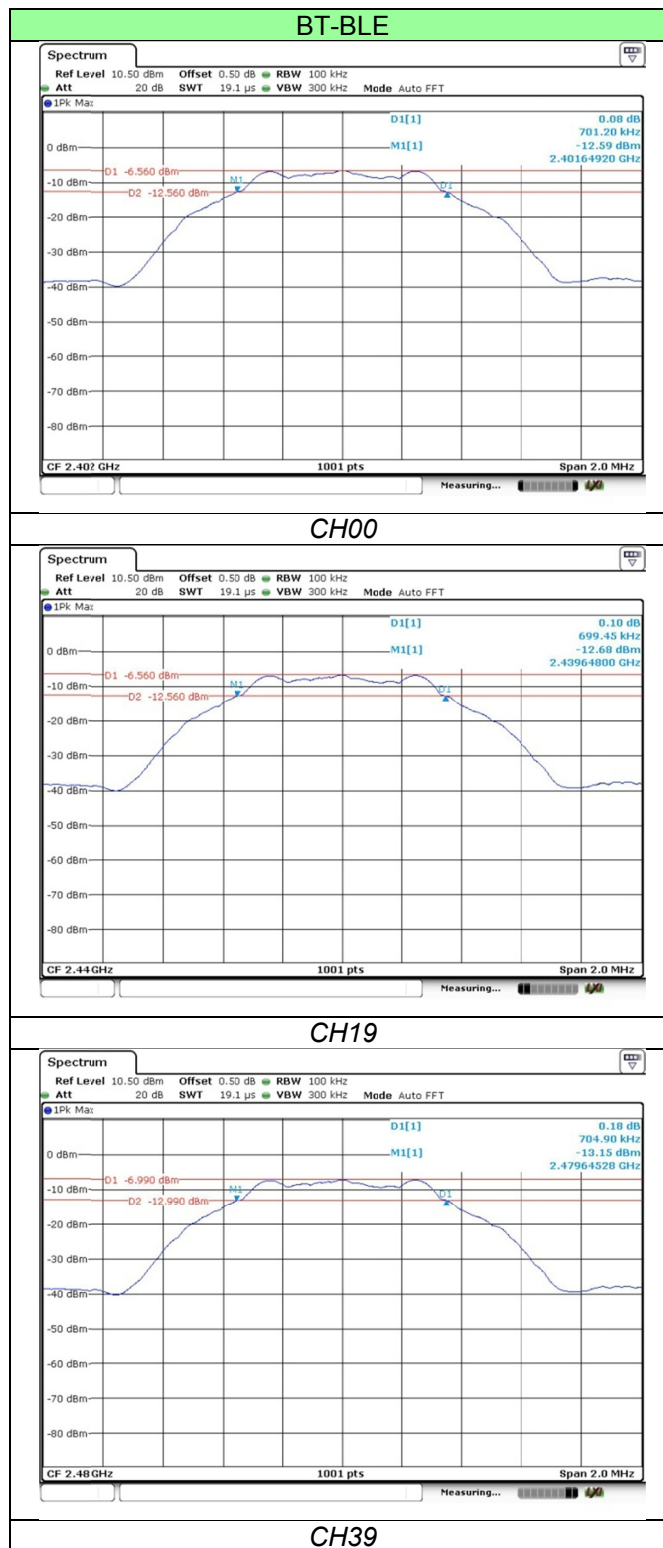
TEST PROCEDURE

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, and record the pertinent measurements.

TEST RESULTS

Type	Channel	6dB Bandwidth(3KHz)	Limit (KHz)	Result
BT-BLE	00	701.20	≥500	Pass
	19	699.45		
	39	704.90		

Test plot as follows:



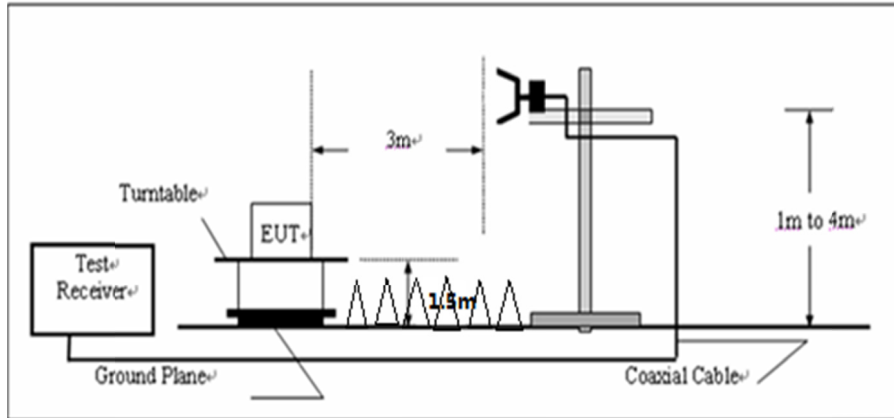
4.6. Restricted band

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 rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned 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. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum 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=10Hz for Average value.
6. Pre-scan 2310-2390MHz, 2483.5-2500MHz, and only mark the worst case data in the test report

TEST RESULTS

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
2384.38	34.38	27.53	6.81	37.24	31.48	74	-42.52	Vertical	Peak
2384.36	39.23	27.53	6.81	37.24	36.33	74	-37.67	Horizontal	
2384.69	24.37	27.53	6.81	37.24	21.47	54	-32.53	Vertical	Average
2384.38	26.68	27.53	6.81	37.24	23.78	54	-30.22	Horizontal	

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
2487.52	54.07	27.85	6.96	37.92	50.96	74	-23.04	Vertical	Peak
2486.85	55.58	27.85	6.96	37.92	52.47	74	-21.53	Horizontal	
2486.43	45.48	27.85	6.96	37.92	42.37	54	-11.63	Vertical	Average
2487.57	46.49	27.85	6.96	37.92	43.38	54	-10.62	Horizontal	

Note: Level = Read + Antenna Factor + Cable Loss - Preamp Factor

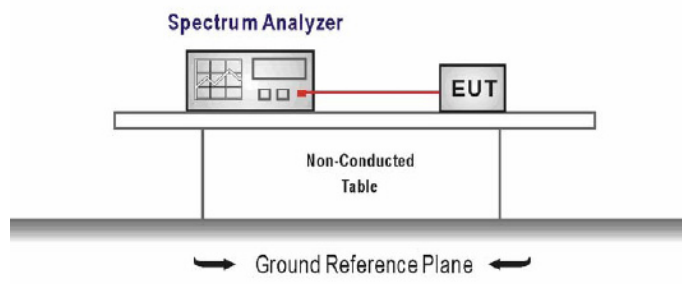
4.7. Band edge and Spurious Emission (conducted)

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 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 $\geq 3 \times$ 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

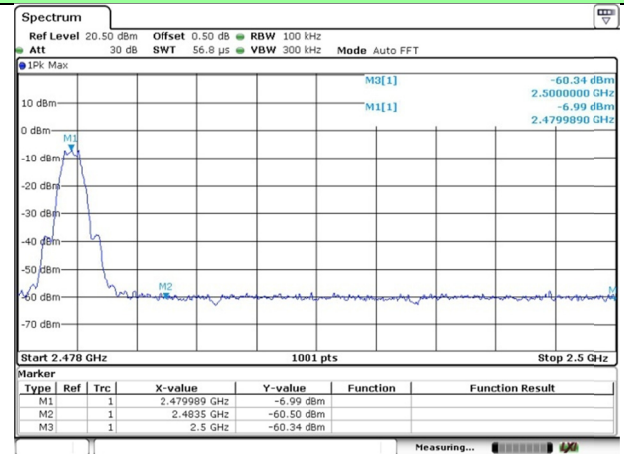
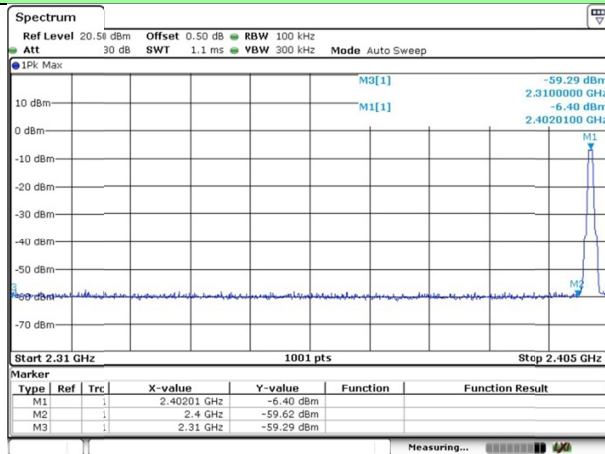
Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

3. **Emission level measurement**
Set the center frequency and span to encompass frequency range to be measured
RBW = 100 kHz, VBW $\geq 3 \times$ 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.

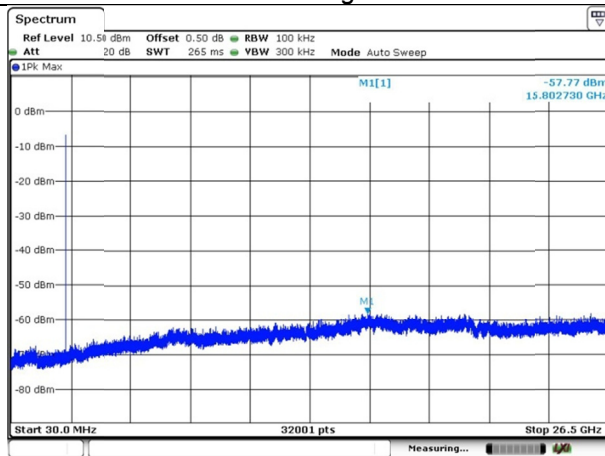
TEST RESULTS

Test plot as follows:

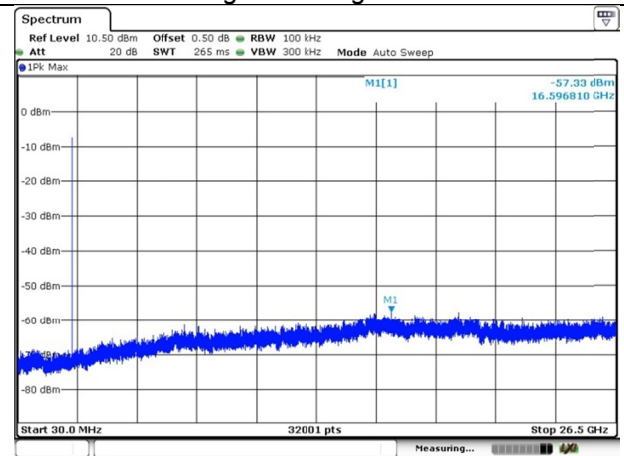
BT-BLE



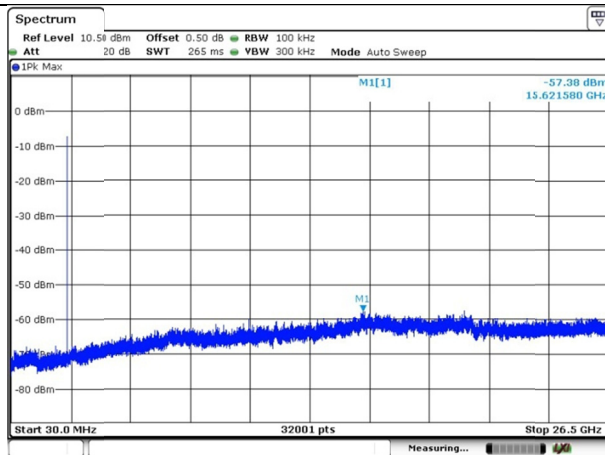
Low bandedge Plot



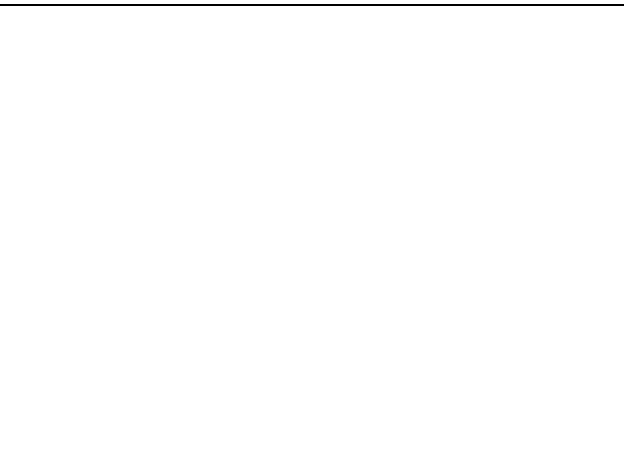
High bandedge Plot



CH00



CH19



CH39

4.8. Spurious Emission (radiated)

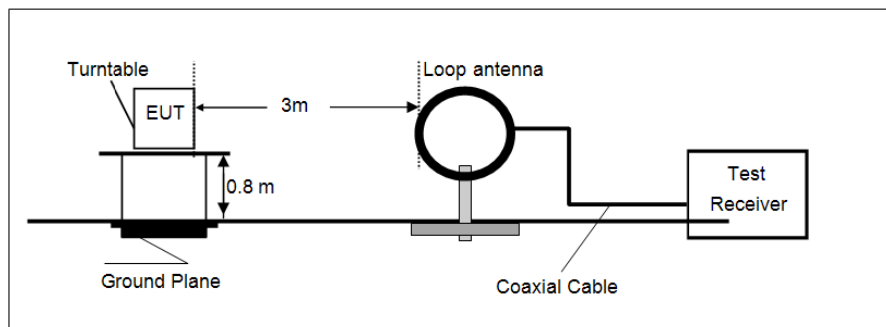
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

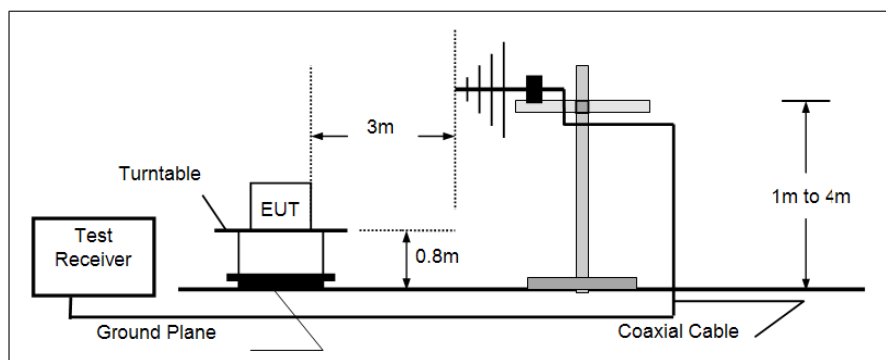
Frequency	Limit (dBuV/m @3m)	Value
30MHz-88MHz	40.00	Quasi-peak
88MHz-216MHz	43.50	Quasi-peak
216MHz-960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

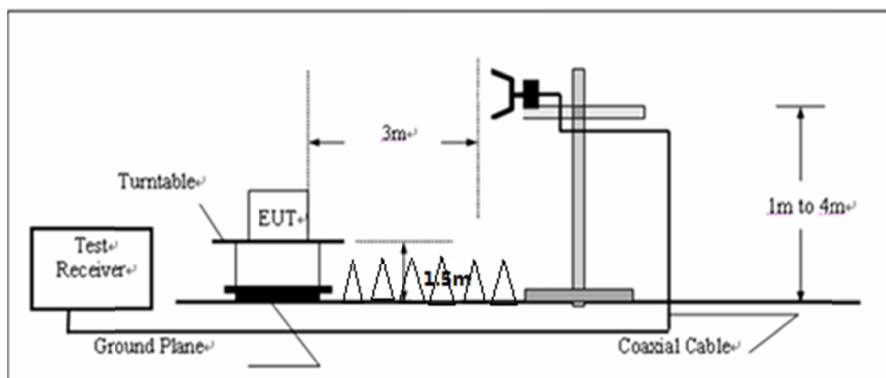
- 9KHz ~30MHz



- 30MHz ~ 1GHz



- Above 1GHz



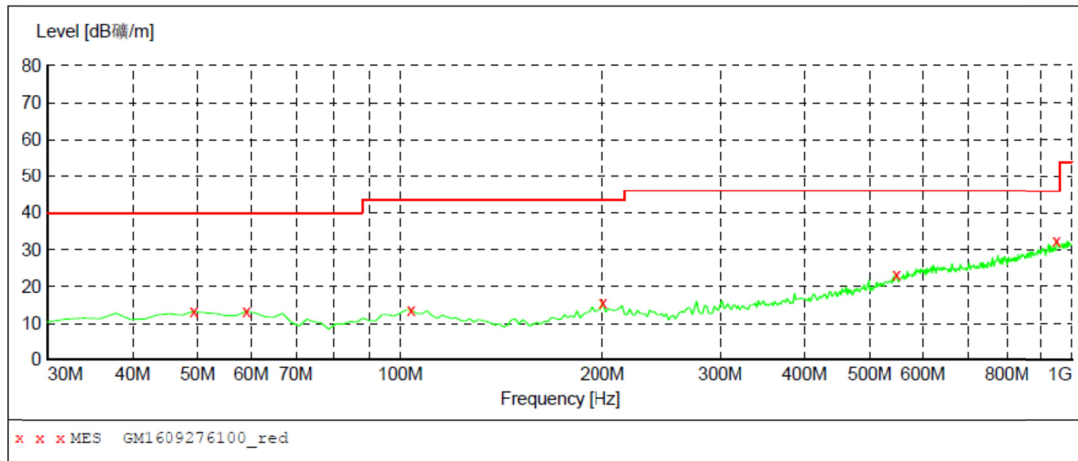
TEST PROCEDURE

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 rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned 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. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum 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=peak, Trace=max hold;
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - (3) Above 1GHz, RBW=1MHz, VBW=3MHz for Peak value
RBW=1MHz, VBW=10Hz for Average value.

TEST RESULTS**Measurement data:****■ 9kHz ~ 30MHz**

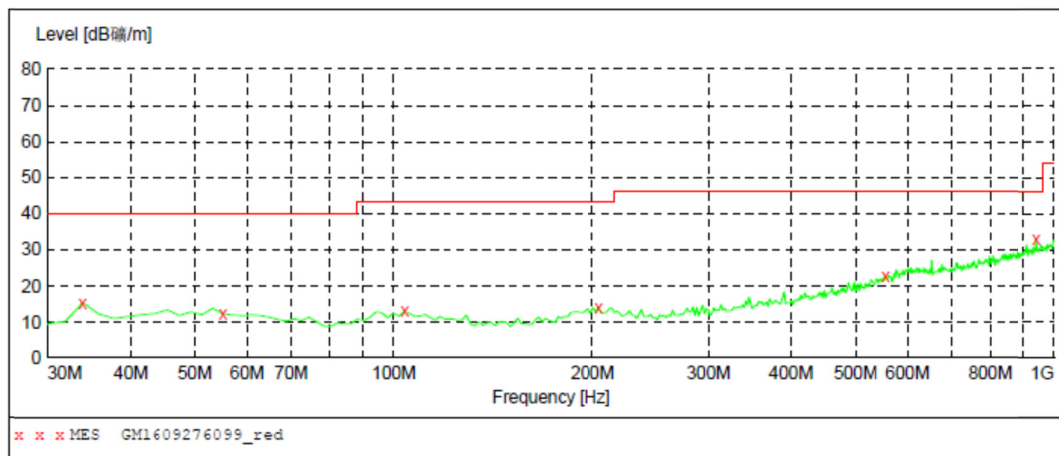
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

■ 30MHz ~ 1GHz

**MEASUREMENT RESULT: "GM1609276100_red"**

9/27/2016 9:11PM

Frequency MHz	Level dB/m	Transd dB	Limit dB/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
49.400000	13.30	-14.4	40.0	26.7	QP	100.0	161.00	HORIZONTAL
59.100000	13.30	-14.8	40.0	26.7	QP	100.0	208.00	HORIZONTAL
103.720000	13.70	-14.6	43.5	29.8	QP	300.0	334.00	HORIZONTAL
200.720000	15.60	-13.6	43.5	27.9	QP	300.0	208.00	HORIZONTAL
547.980000	23.40	-4.9	46.0	22.6	QP	300.0	334.00	HORIZONTAL
949.560000	32.40	3.7	46.0	13.6	QP	300.0	104.00	HORIZONTAL

**MEASUREMENT RESULT: "GM1609276099_red"**

9/27/2016 9:06PM

Frequency MHz	Level dB/m	Transd dB	Limit dB/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
33.880000	15.50	-16.2	40.0	24.5	QP	100.0	178.00	VERTICAL
55.220000	12.40	-14.6	40.0	27.6	QP	100.0	96.00	VERTICAL
103.720000	13.00	-14.6	43.5	30.5	QP	100.0	353.00	VERTICAL
204.600000	14.10	-13.8	43.5	29.4	QP	100.0	259.00	VERTICAL
555.740000	22.60	-4.6	46.0	23.4	QP	100.0	238.00	VERTICAL
939.860000	33.00	3.5	46.0	13.0	QP	100.0	319.00	VERTICAL

Remark: Transd=Cable lose+ Antenna factor- Pre-amplifier; Margin=Limit -Level

■ Above 1GHz

CH00 for BT-BLE									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
4804	38.21	31.28	5.66	35.29	39.86	74	-34.14	Vertical	Peak
7206	34.64	36.22	6.87	35.15	42.58	74	-31.42	Vertical	
9608	34.84	37.85	8.8	35.55	45.94	74	-28.06	Vertical	
1221.16	*							Vertical	
4804	38	31.28	5.66	35.29	39.65	74	-34.35	Horizontal	
7206	35.9	36.22	6.87	35.15	43.84	74	-30.16	Horizontal	
9608	35.56	37.85	8.8	35.55	46.66	74	-27.34	Horizontal	
1221.16	*							Horizontal	
4804	33.2	31.28	5.66	35.29	34.85	54	-19.15	Vertical	Average
7206	29.5	36.22	6.87	35.15	37.44	54	-16.56	Vertical	
9608	28.75	37.85	8.8	35.55	39.85	54	-14.15	Vertical	
1221.16	*							Vertical	
4804	32.99	31.28	5.66	35.29	34.64	54	-19.36	Horizontal	
7206	29.9	36.22	6.87	35.15	37.84	54	-16.16	Horizontal	
9608	28.55	37.85	8.8	35.55	39.65	54	-14.35	Horizontal	
1221.16	*							Horizontal	
CH19 for BT-BLE									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
4880	37.83	31.26	5.65	35.27	39.47	74	-34.53	Vertical	Peak
7320	35.59	36.2	6.86	35.13	43.52	74	-30.48	Vertical	
9760	34.75	37.83	8.79	35.53	45.84	74	-28.16	Vertical	
13472.51	*							Vertical	
4880	37.72	31.26	5.65	35.27	39.36	74	-34.64	Horizontal	
7320	35.59	36.2	6.86	35.13	43.52	74	-30.48	Horizontal	
9760	34.89	37.83	8.79	35.53	45.98	74	-28.02	Horizontal	
13472.51	*							Horizontal	
4880	33.01	31.26	5.65	35.27	34.65	54	-19.35	Vertical	Average
7320	29.23	36.2	6.86	35.13	37.16	54	-16.84	Vertical	
9760	28.79	37.83	8.79	35.53	39.88	54	-14.12	Vertical	
13472.51	*							Vertical	
4880	32.61	31.26	5.65	35.27	34.25	54	-19.75	Horizontal	
7320	29.93	36.2	6.86	35.13	37.86	54	-16.14	Horizontal	
9760	27.97	37.83	8.79	35.53	39.06	54	-14.94	Horizontal	
13472.51	*							Horizontal	

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*” means this data is 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.

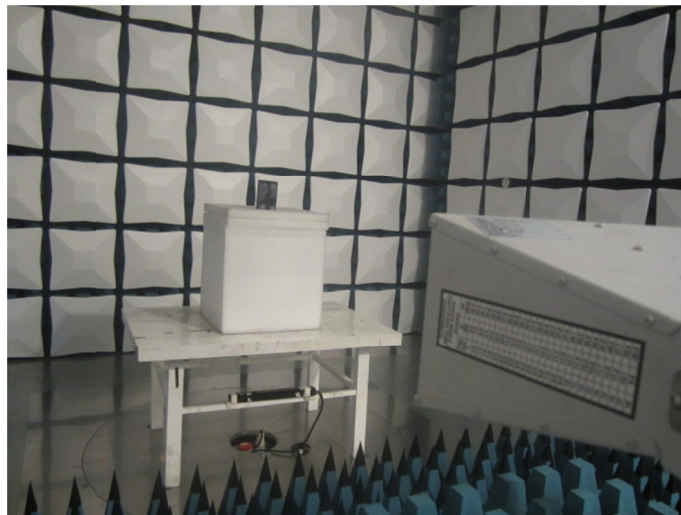
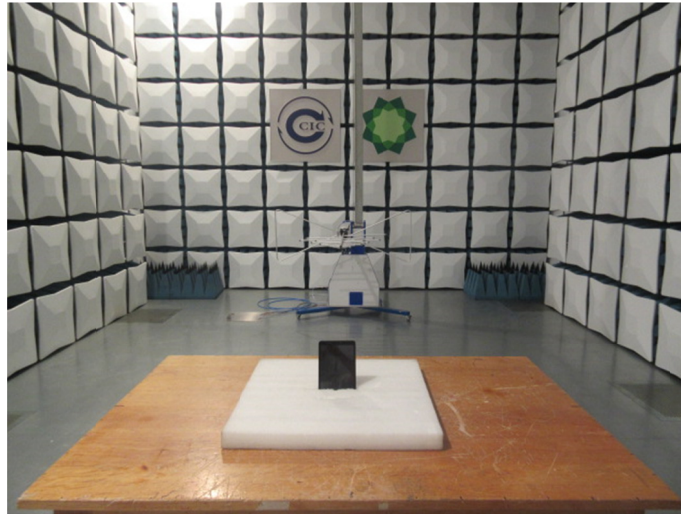
CH39 for BT-BLE									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
4960	38	31.44	5.87	35.46	39.85	74	-34.15	Vertical	Peak
7440	34.38	36.38	7.08	35.32	42.52	74	-31.48	Vertical	
9920	33.78	38.01	9.01	35.72	45.08	74	-28.92	Vertical	
12366.25	*							Vertical	
4960	37.48	31.44	5.87	35.46	39.33	74	-34.67	Horizontal	
7440	35.33	36.38	7.08	35.32	43.47	74	-30.53	Horizontal	
9920	34.59	38.01	9.01	35.72	45.89	74	-28.11	Horizontal	
12366.25	*							Horizontal	
4960	32.93	31.42	5.87	35.46	34.76	54	-19.24	Vertical	Average
7440	29.46	36.36	7.08	35.32	37.58	54	-16.42	Vertical	
9920	27.97	37.99	9.01	35.72	39.25	54	-14.75	Vertical	
12366.25	*							Vertical	
4960	32.83	31.42	5.87	35.46	34.66	54	-19.34	Horizontal	
7440	29.4	36.36	7.08	35.32	37.52	54	-16.48	Horizontal	
9920	28.58	37.99	9.01	35.72	39.86	54	-14.14	Horizontal	
12366.25	*							Horizontal	

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means 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.

5. Test Setup Photos of the EUT

Radiated Emission



Conducted Emission (AC Mains)



6. External and Internal Photos of the EUT

Reference to Test Report No.: TRE1609005901.

.....End of Report.....