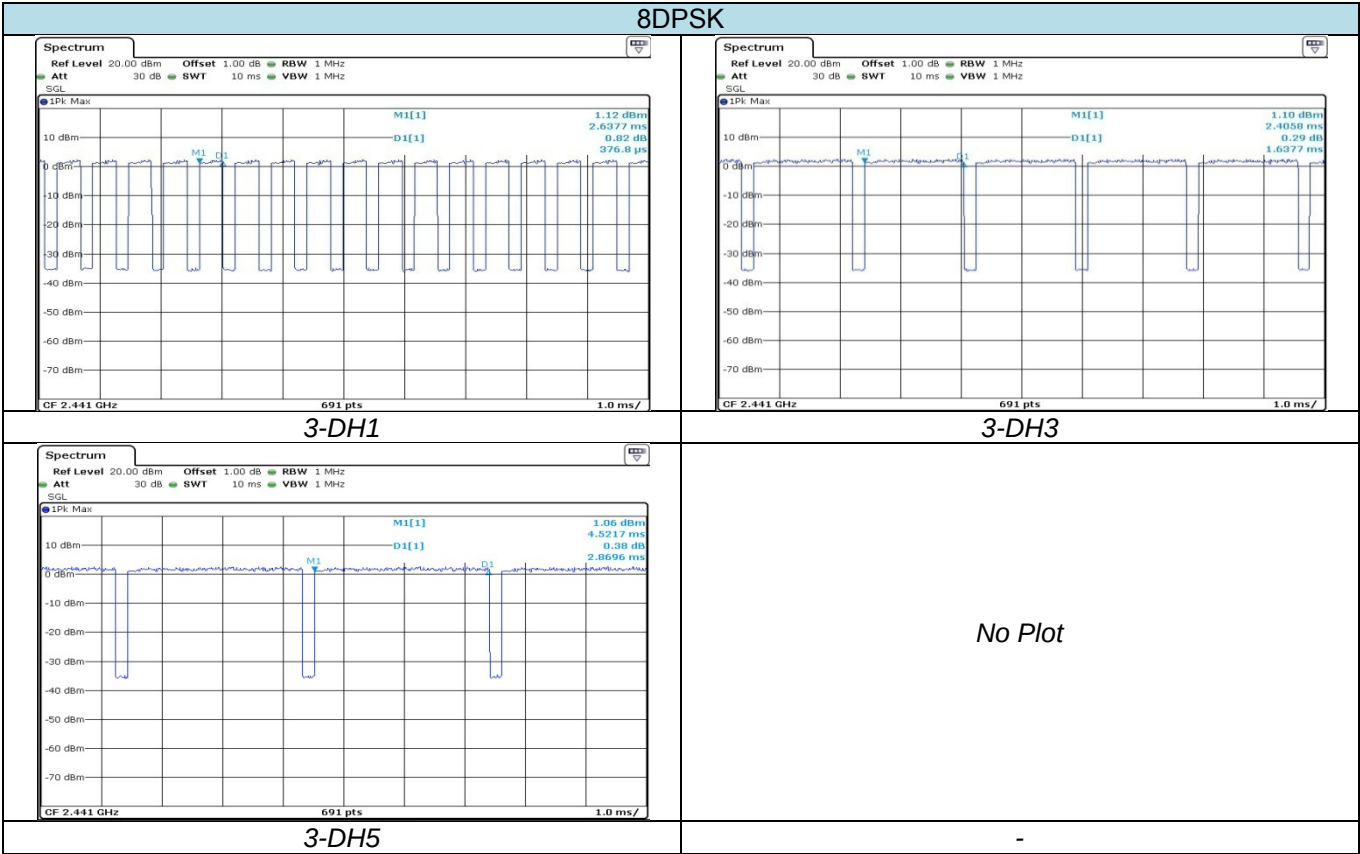






5.8. Pseudorandom Frequency Hopping Sequence

LIMIT

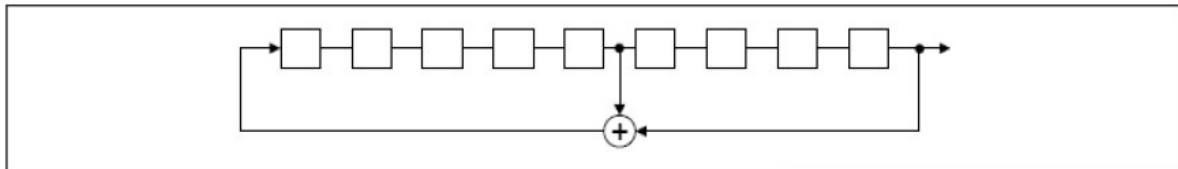
FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

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 pseudo randomly 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.

TEST RESULTS

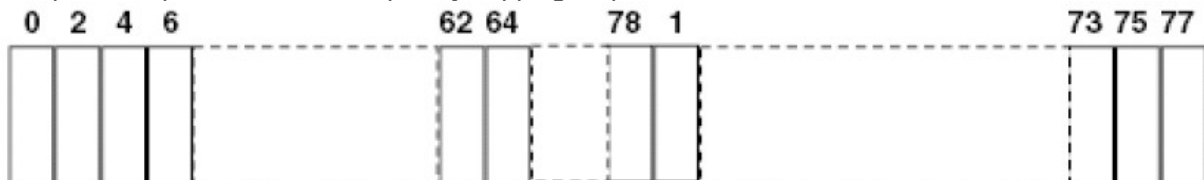
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

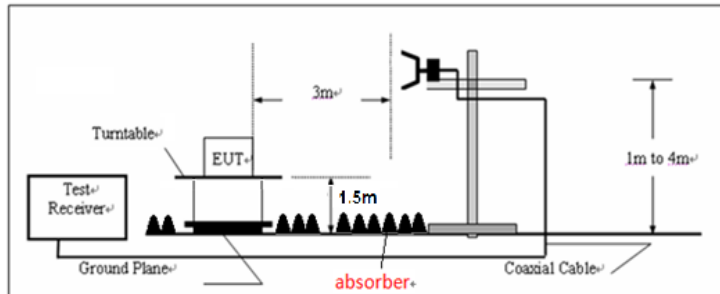
5.9. Restricted band (radiated)

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 Peak detector for Peak value
RBW=1MHz, VBW=10Hz Peak detector for Average value.

TEST MODE:

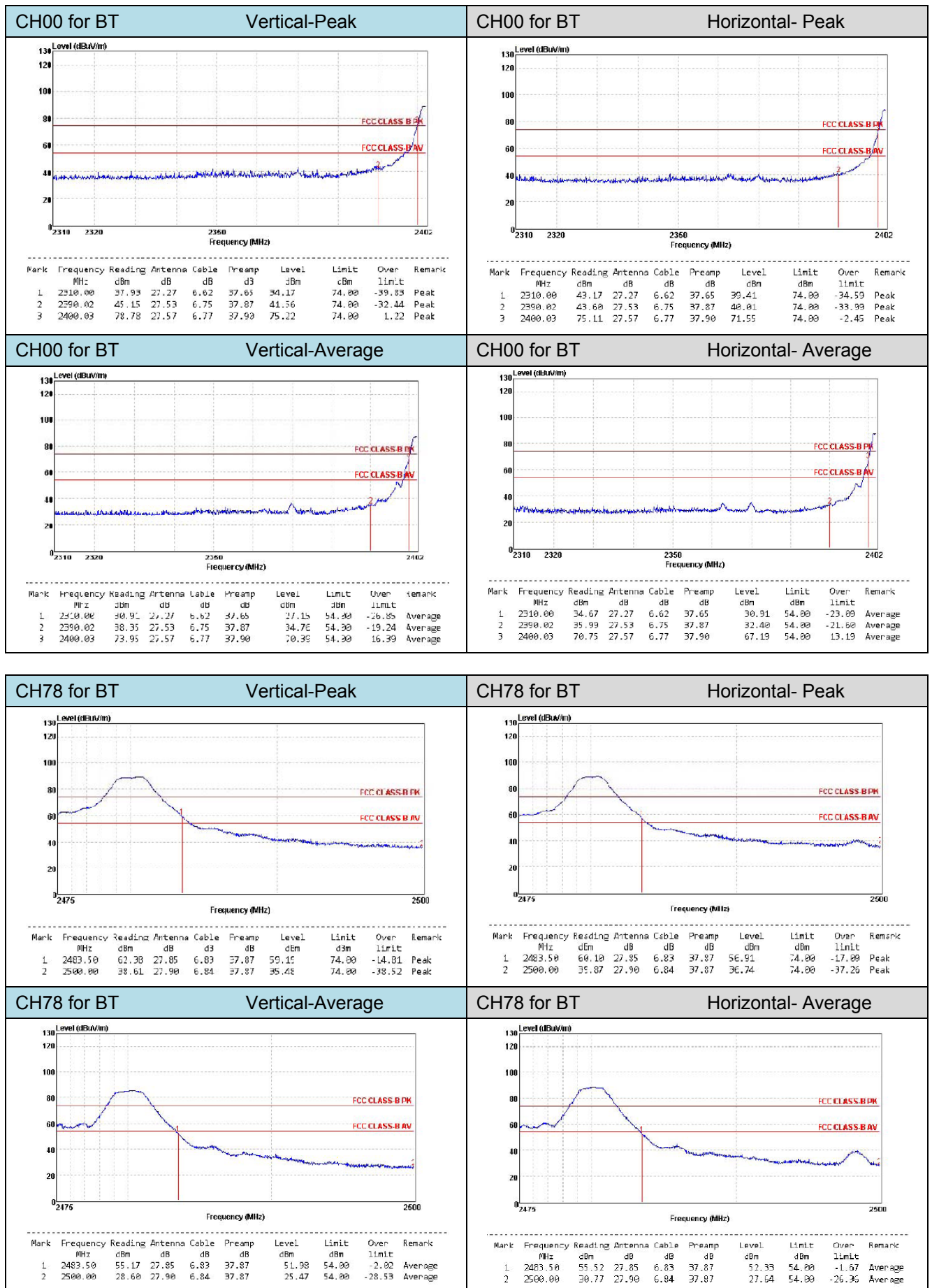
Please refer to the clause 3.3

TEST RESULTS

☒ Passed ☐ Not Applicable

Note:

- 1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor
- 2) Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report.



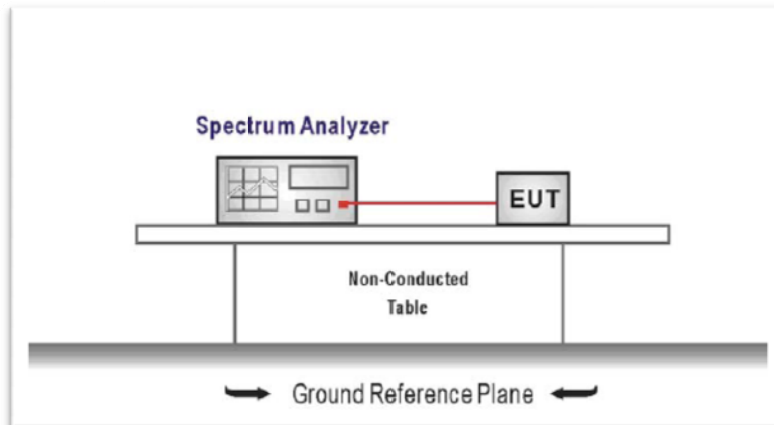
5.10. Bandedge and Spurious Emission (conducted)

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

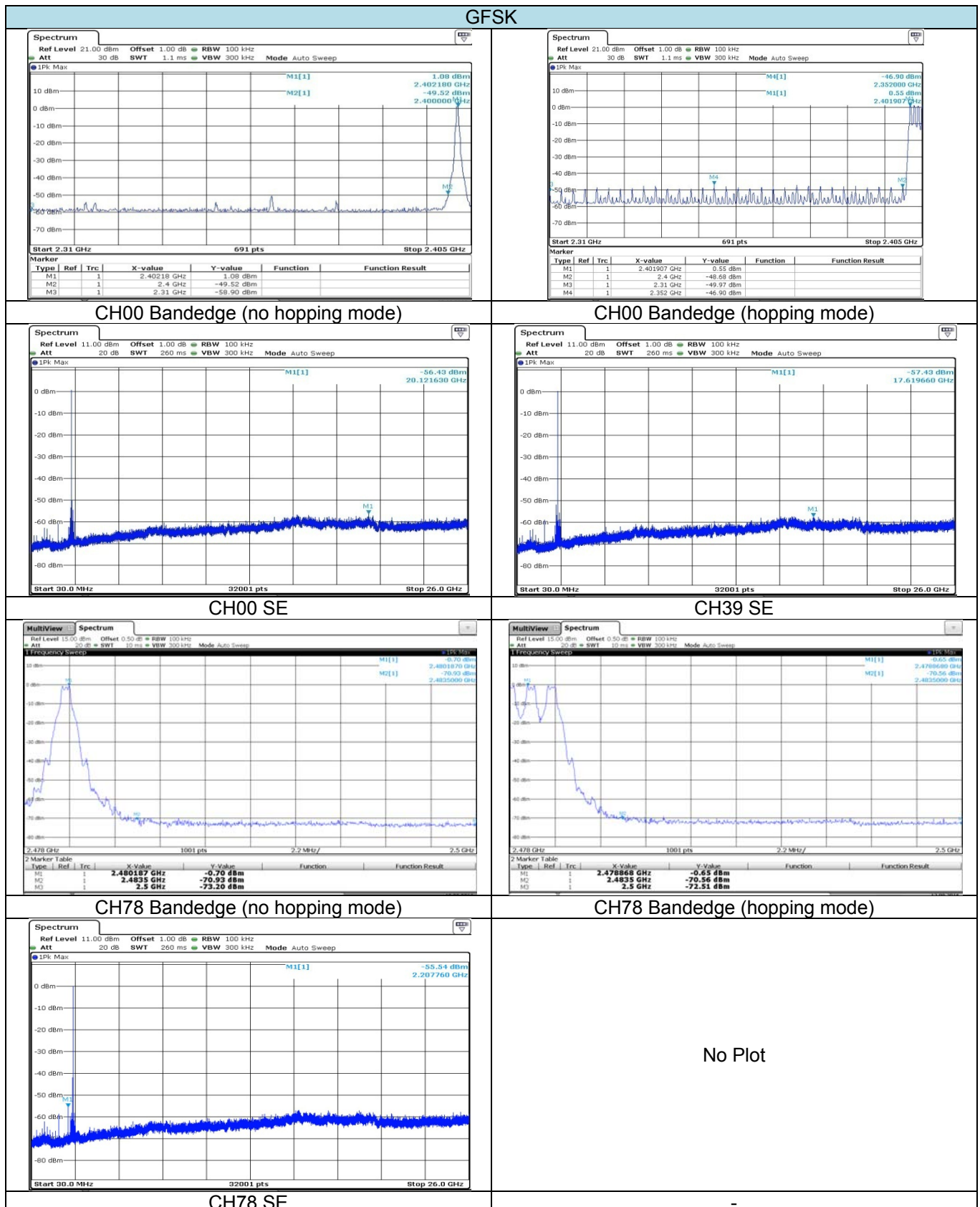
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
RBW= 100 KHz, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

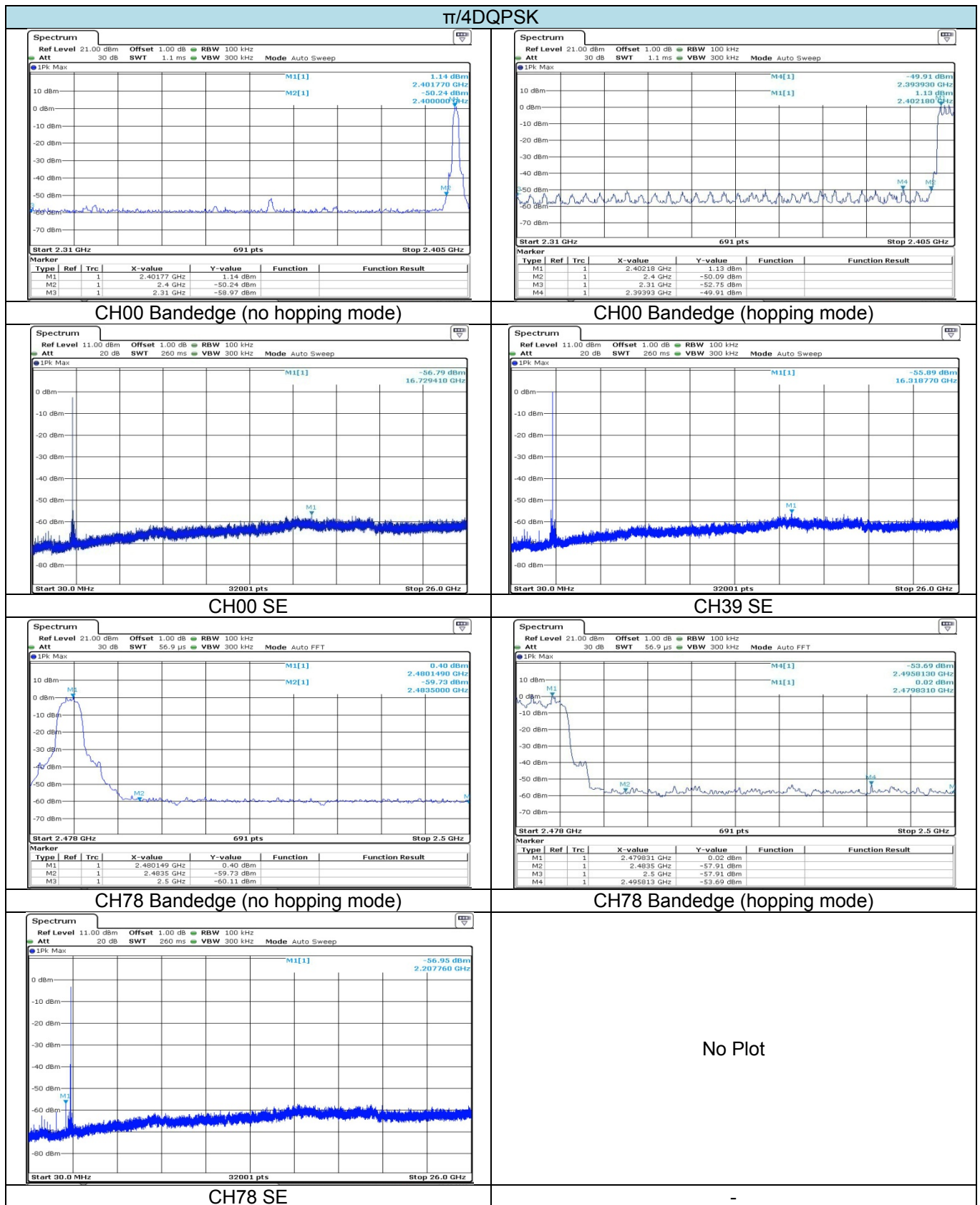
TEST MODE:

Please refer to the clause 3.3

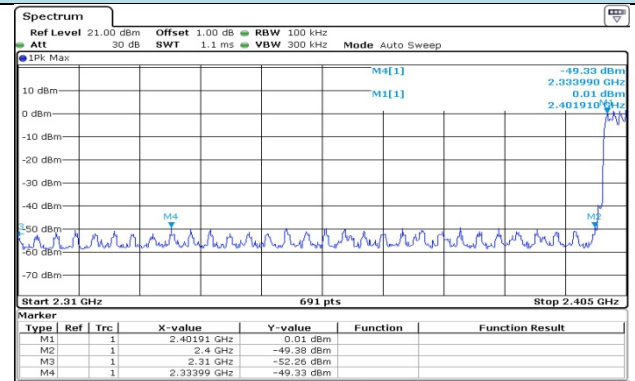
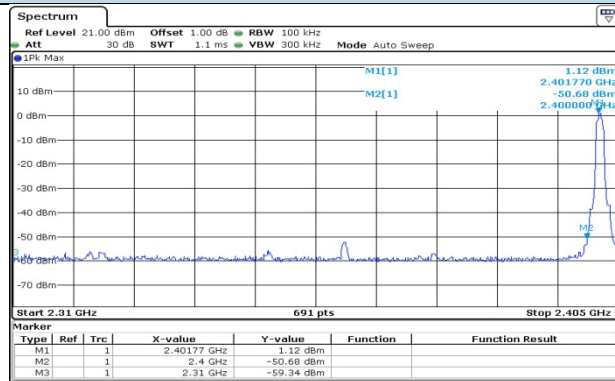
TEST RESULTS

☒ Passed ☐ Not Applicable

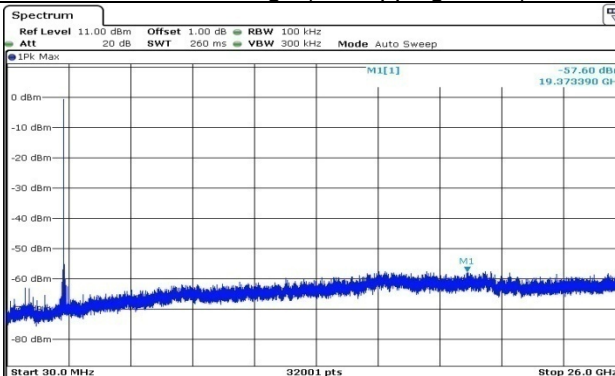




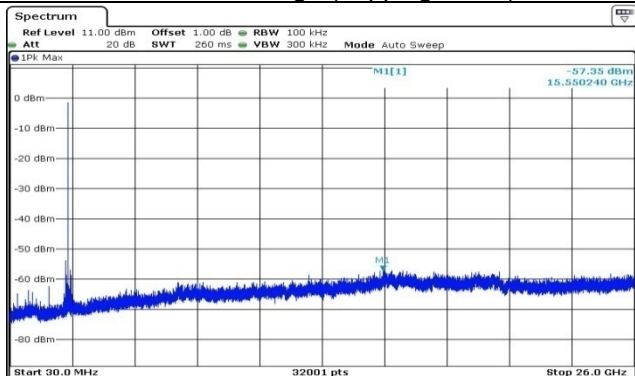
8DPSK



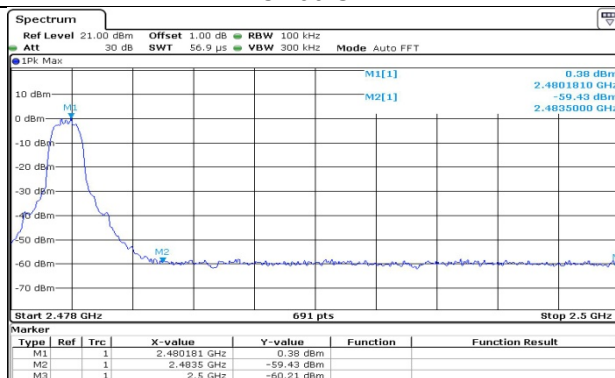
CH00 Bandedge (no hopping mode)



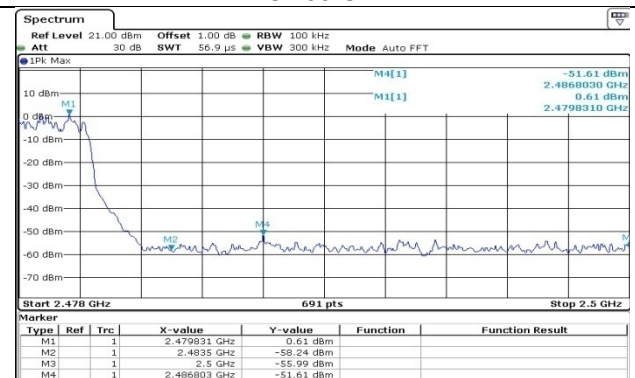
CH00 Bandedge (hopping mode)



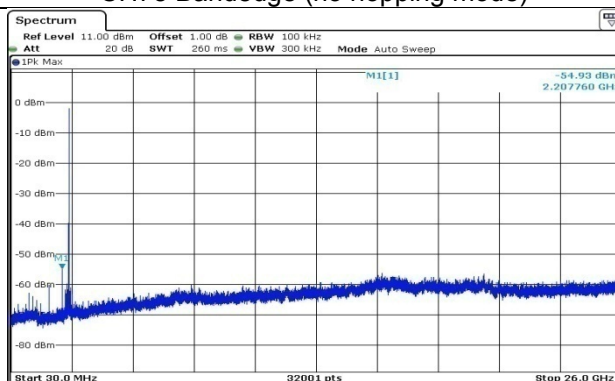
CH00 SE



CH39 SE



CH78 Bandedge (no hopping mode)



CH78 Bandedge (hopping mode)

No Plot

CH78 SE

5.11. Spurious Emission (radiated)

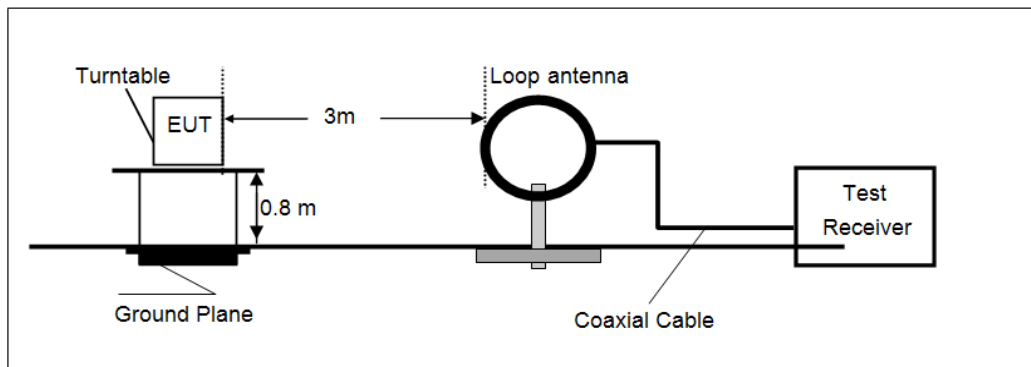
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

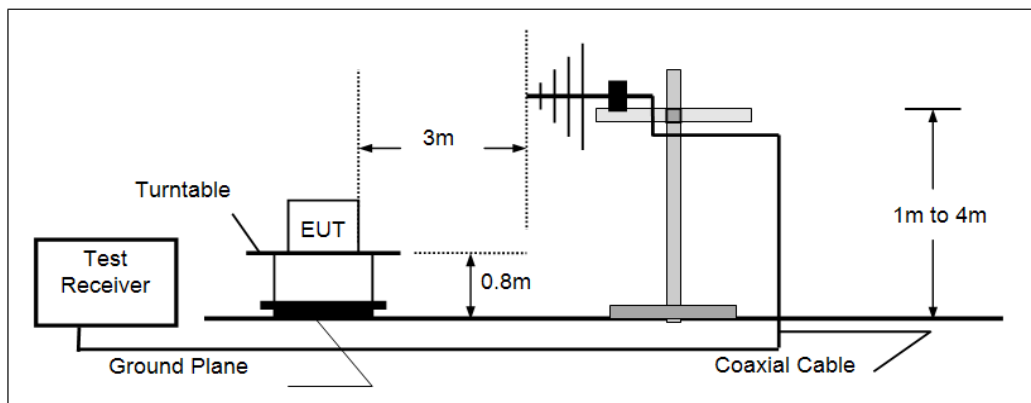
Frequency	Limit (dBuV/m @3m)	Value
30MHz-88MHz	40.00	Quasi-peak
88MHz-216MHz	43.50	Quasi-peak
216MHz-960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

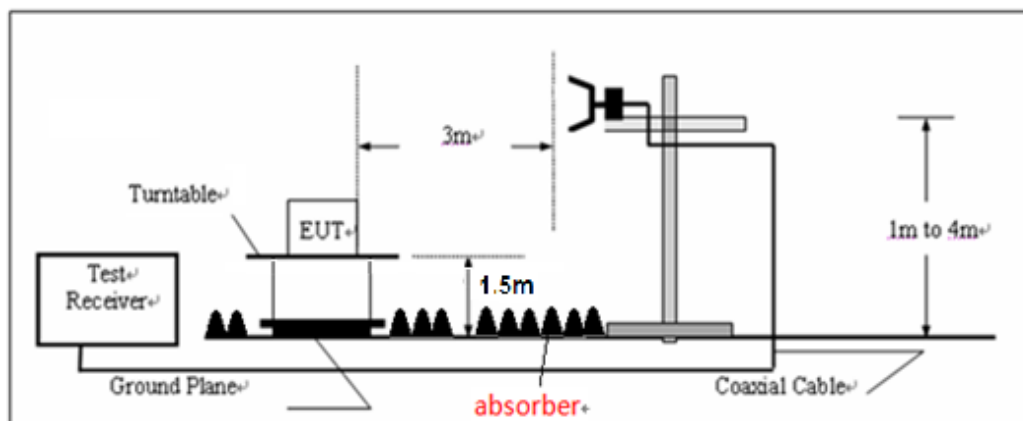
➤ 9KHz ~30MHz



➤ 30MHz ~ 1GHz



➤ Above 1GHz



TEST PROCEDURE

1. The EUT was 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. 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.
5. Use the following spectrum analyzer settings
 - (1) Span shall be 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 Peak detector for Peak value
RBW=1MHz, VBW=10Hz Peak detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

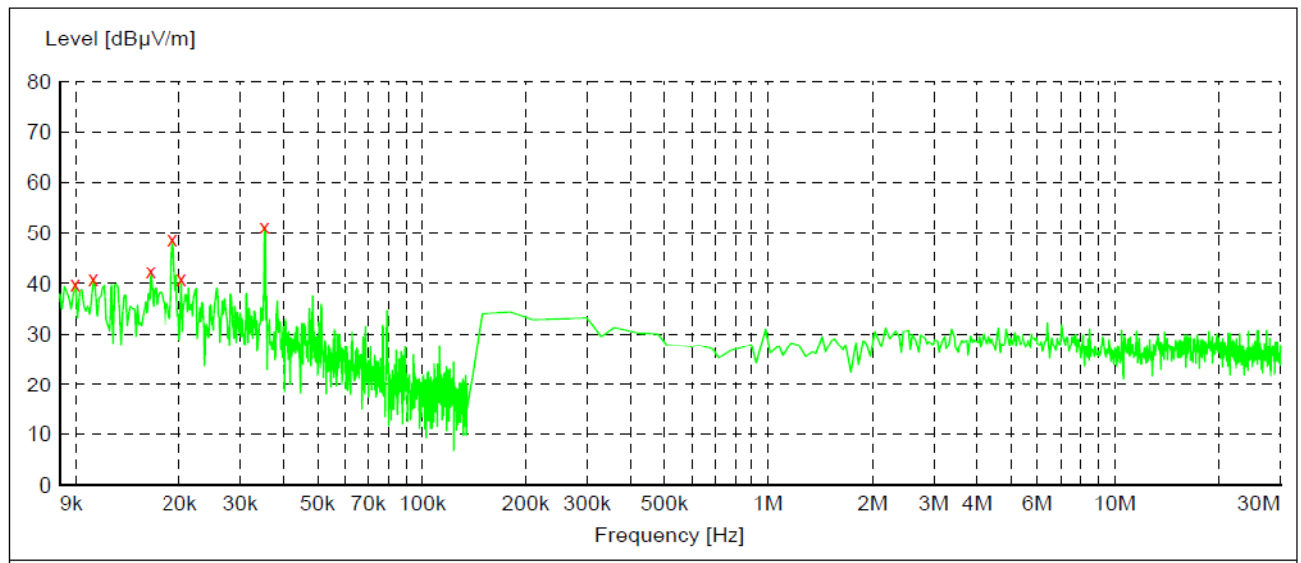
☒ **Passed** ☐ **Not Applicable**

Note:

- 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 shown in test report.*
- 4) *Have pre-scan all modulation modes, found the GFSK modulation which it was the worst case, so only the worst case's data is shown in the test report.*

➤ 9kHz ~ 30MHz

Test mode	Worst case mode	Polarization	Horizontal
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Frequency MHz	Level dBμV/m	Transd dB	Limit (dBμV/m @3m)	Margin dB	Det.	Result
0.009967	39.57	22.3	127.63	88.06	Avg.	Pass
0.012626	41.02	22.3	125.58	84.56	Avg.	Pass
0.017282	42.35	22.2	122.85	80.50	Avg.	Pass
0.019015	48.52	22.1	122.02	73.50	Avg.	Pass
0.021562	41.09	22.1	120.93	79.84	Avg.	Pass
0.035464	51.35	21.9	116.61	65.26	Avg.	Pass

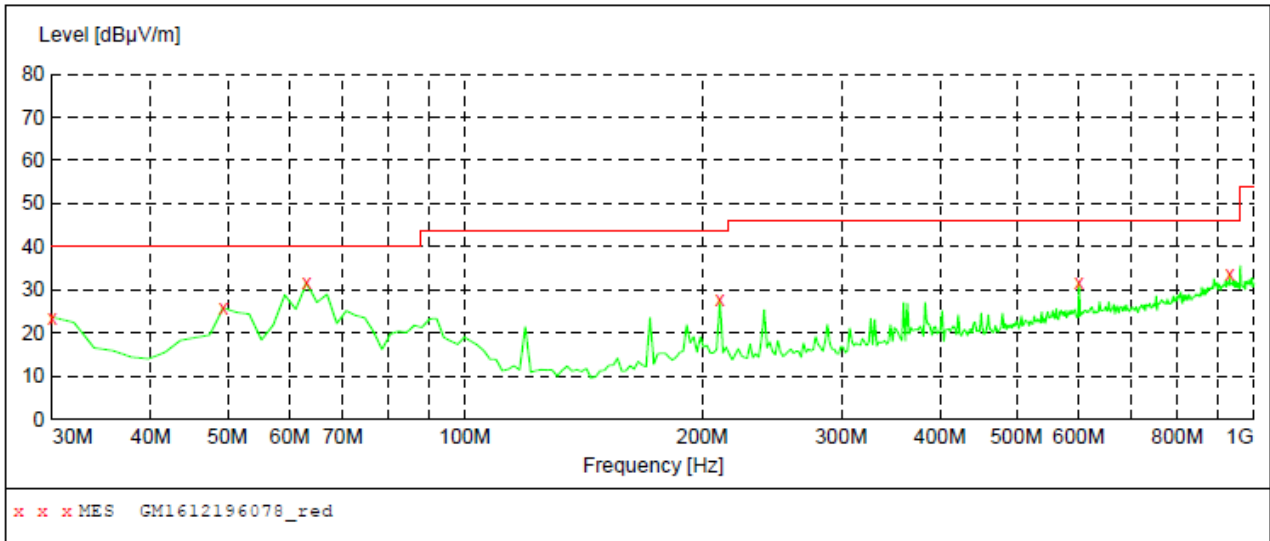
Remark:

1. Level = Receiver Read level + Transd
2. Transd = Antenna Factor + Cable Loss
3. The loop antenna rotated about both vertical and horizontal to find the maximum emission, so only the worst position (horizontal) was reported.
4. According to the clause 15.31(2), Limit (dBμV/m @3m) = Limit (dBμV/m @300m) + 40log(300m/3m)
5. §15.209(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

➤ 30MHz ~ 1GHz

Polarization:

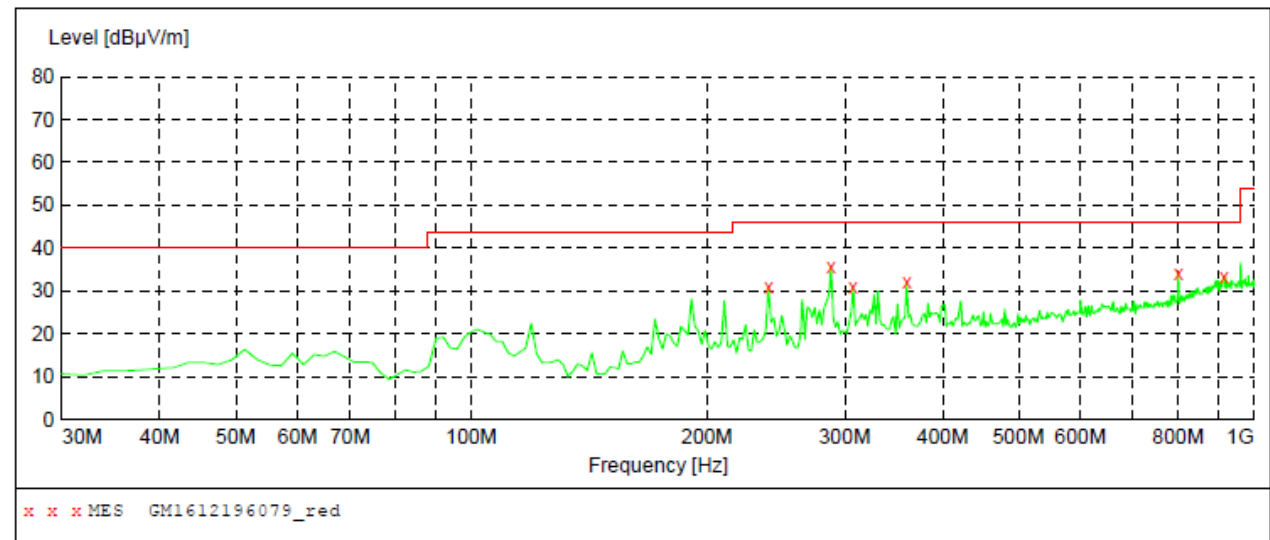
Vertical



Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	23.60	-18.6	40.0	16.4	QP	100.0	152.00	VERTICAL
49.400000	25.80	-16.2	40.0	14.2	QP	100.0	127.00	VERTICAL
62.980000	31.60	-17.7	40.0	8.4	QP	100.0	192.00	VERTICAL
210.420000	27.60	-15.6	43.5	15.9	QP	100.0	116.00	VERTICAL
600.360000	31.50	-4.8	46.0	14.5	QP	100.0	192.00	VERTICAL
932.100000	33.60	1.4	46.0	12.4	QP	100.0	290.00	VERTICAL

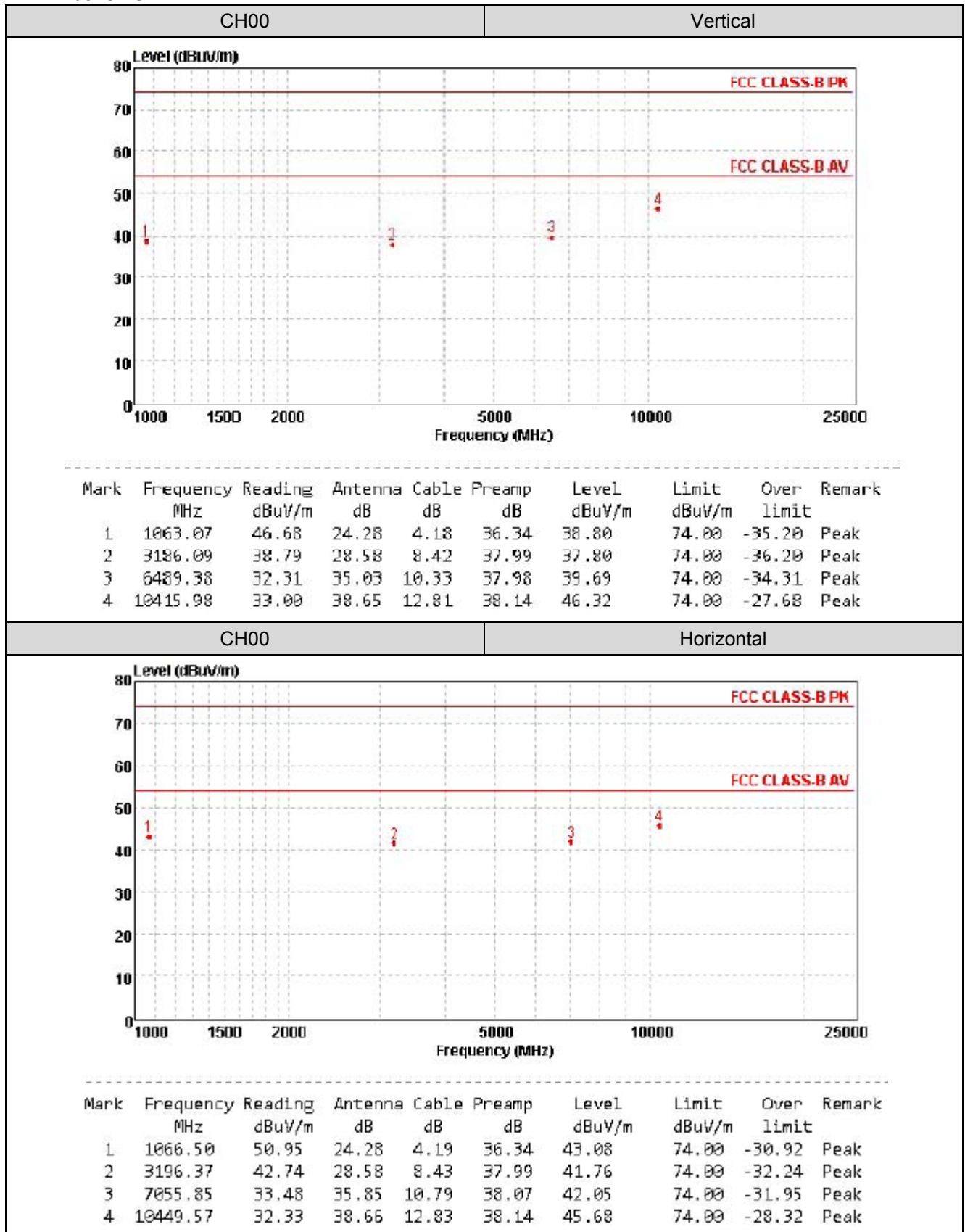
Polarization:

Horizontal



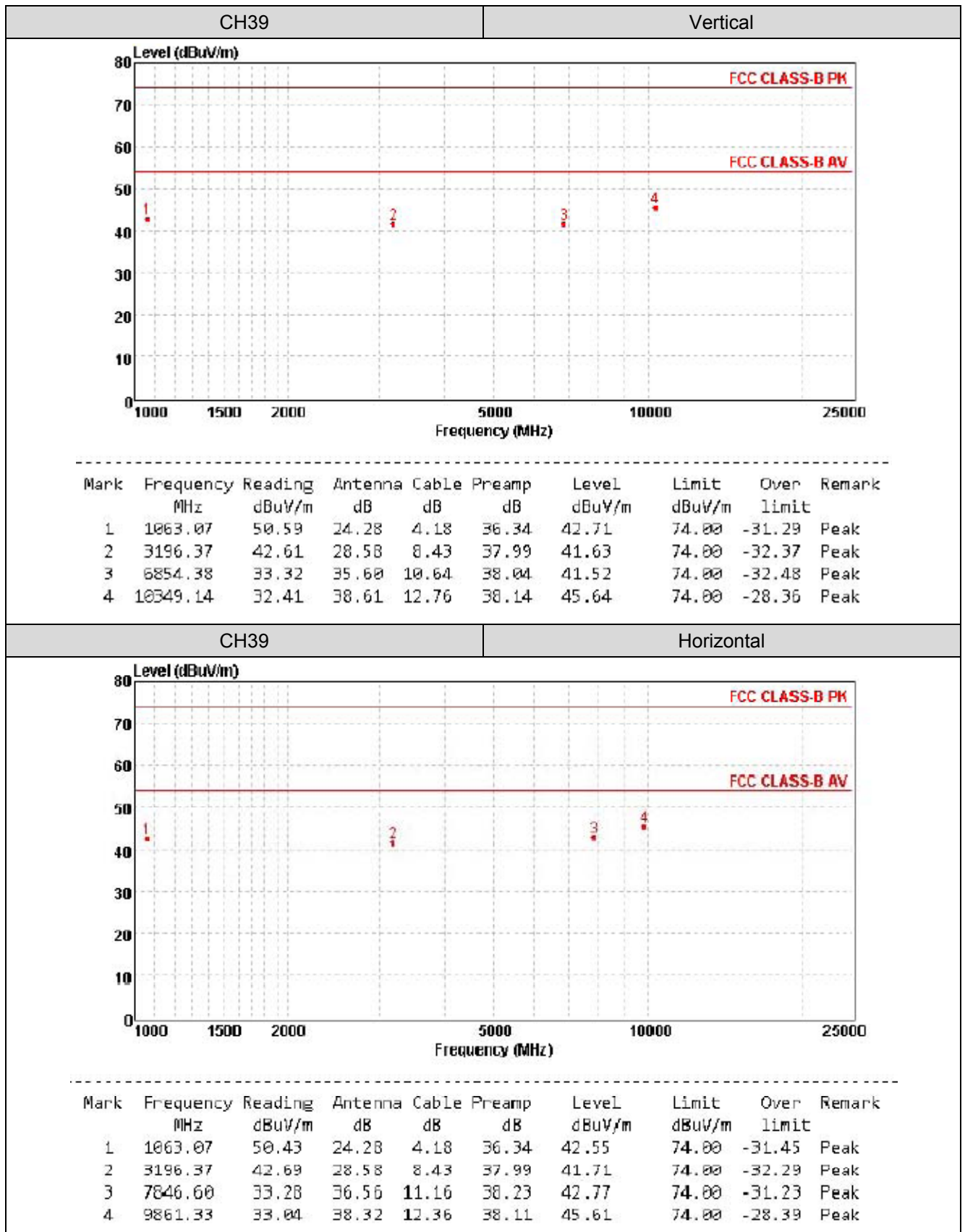
Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
239.520000	31.00	-14.6	46.0	15.0	QP	100.0	91.00	HORIZONTAL
288.020000	35.60	-13.3	46.0	10.4	QP	100.0	142.00	HORIZONTAL
307.420000	30.80	-12.8	46.0	15.2	QP	100.0	130.00	HORIZONTAL
359.800000	31.90	-11.5	46.0	14.1	QP	100.0	194.00	HORIZONTAL
800.180000	34.00	-1.1	46.0	12.0	QP	100.0	206.00	HORIZONTAL
914.640000	33.20	1.3	46.0	12.8	QP	100.0	29.00	HORIZONTAL

➤ Above 1GHz



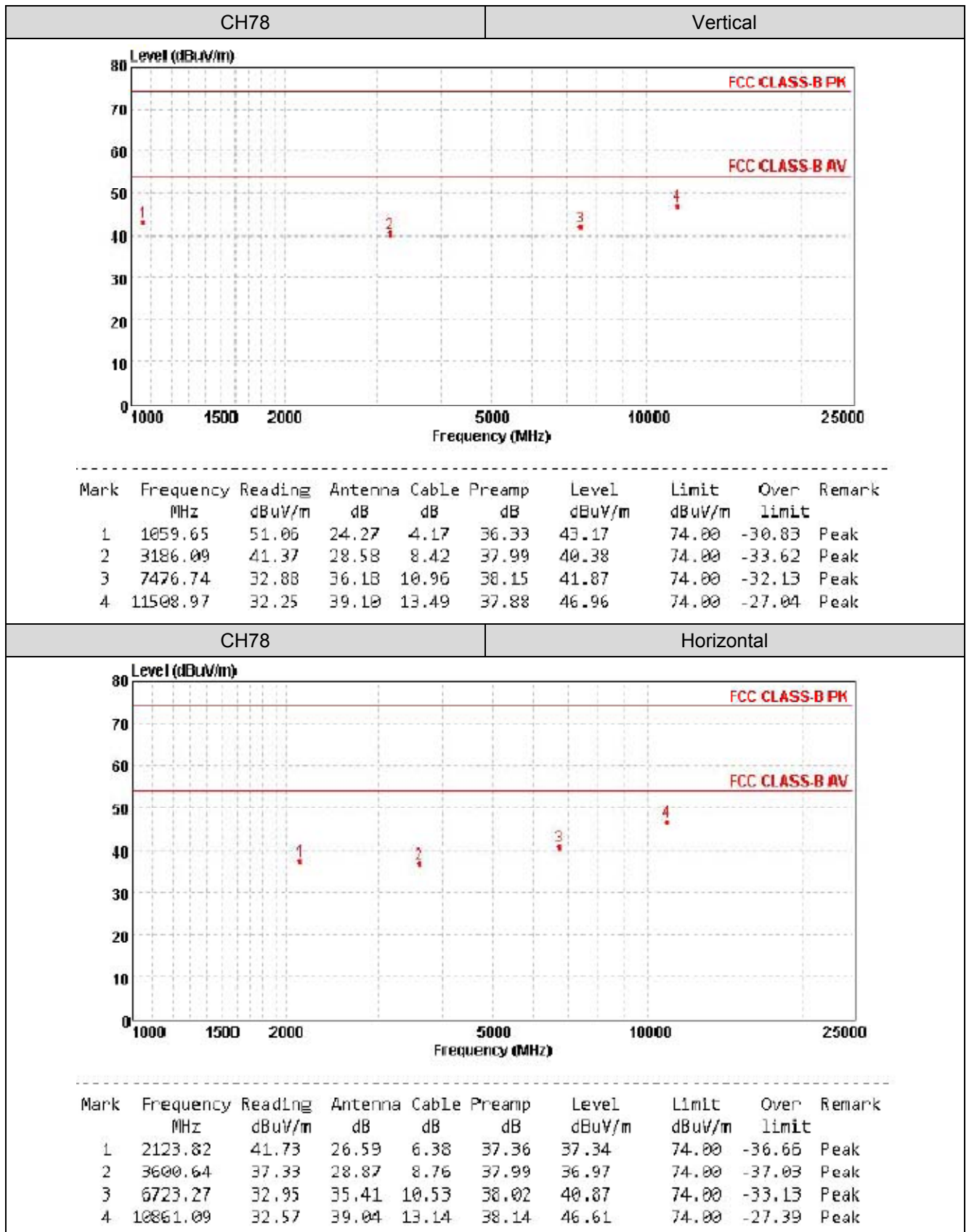
Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The peak level is lower than average limit (54 dBuV/m), 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 shown in test report.



Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The peak level is lower than average limit (54 dBuV/m), 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 shown in test report.

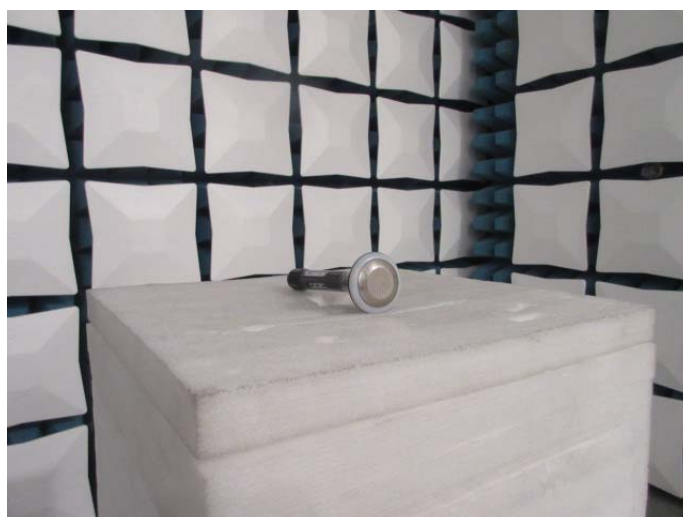
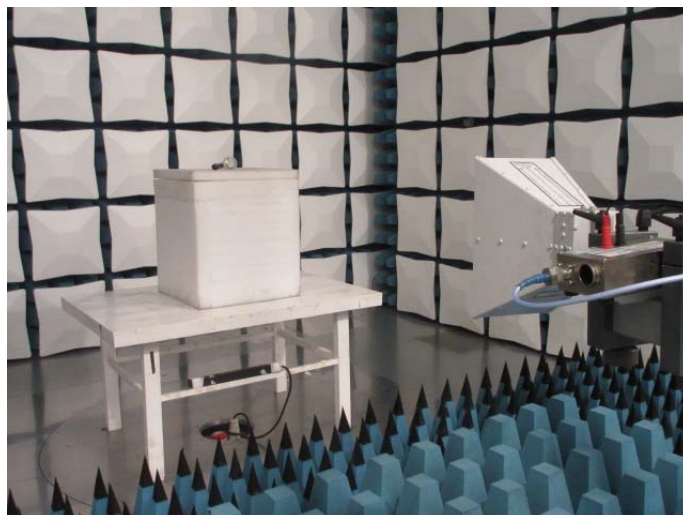


Remark:

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.

Conducted Emission (AC Mains)

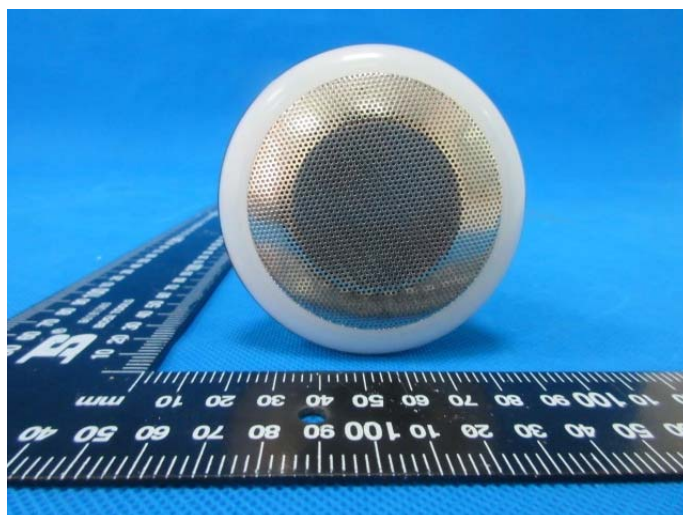
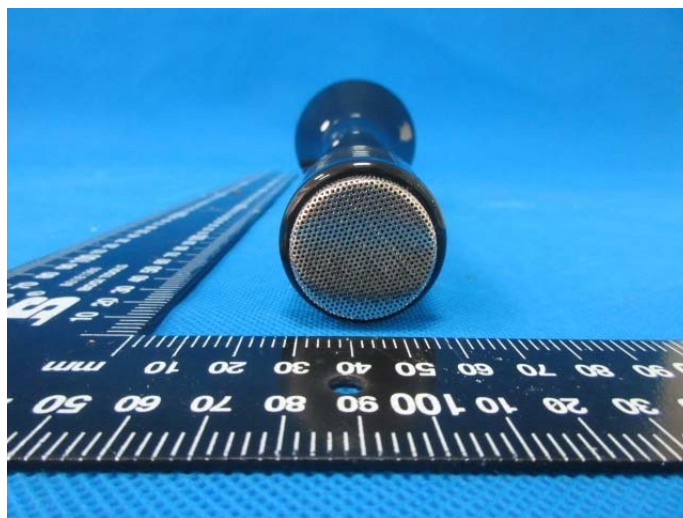




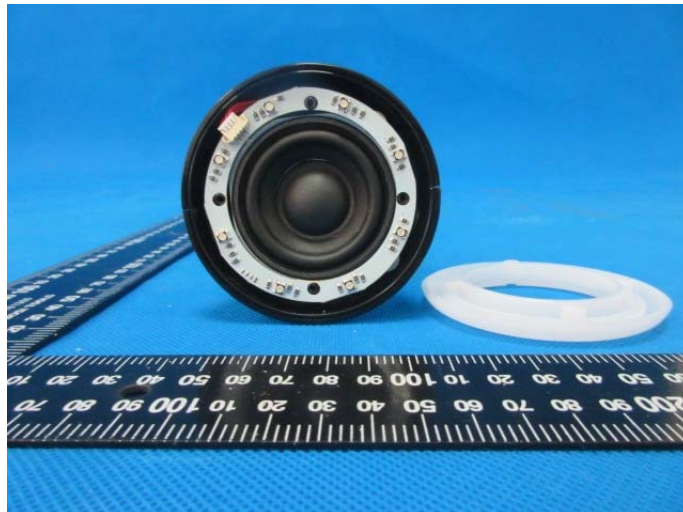
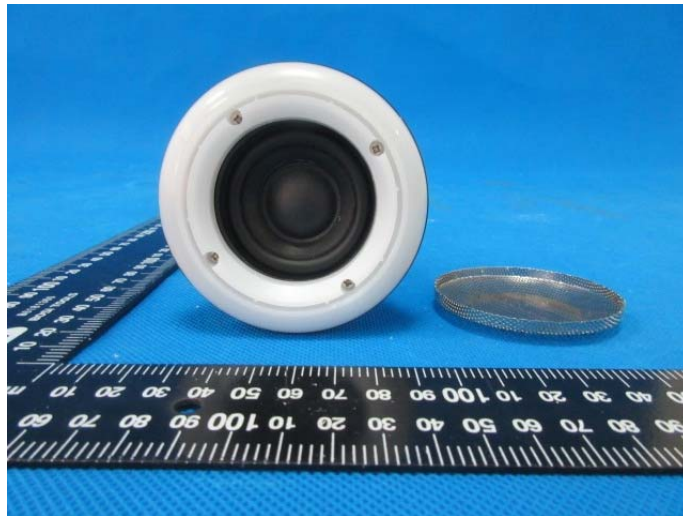
7. External and Internal Photos of the EUT

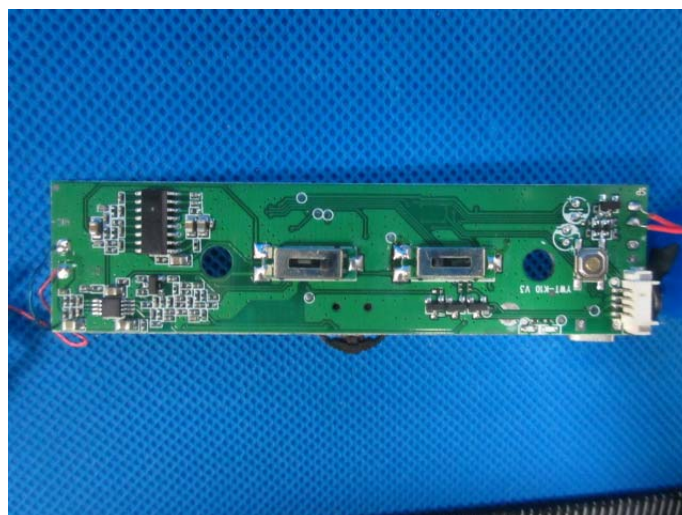
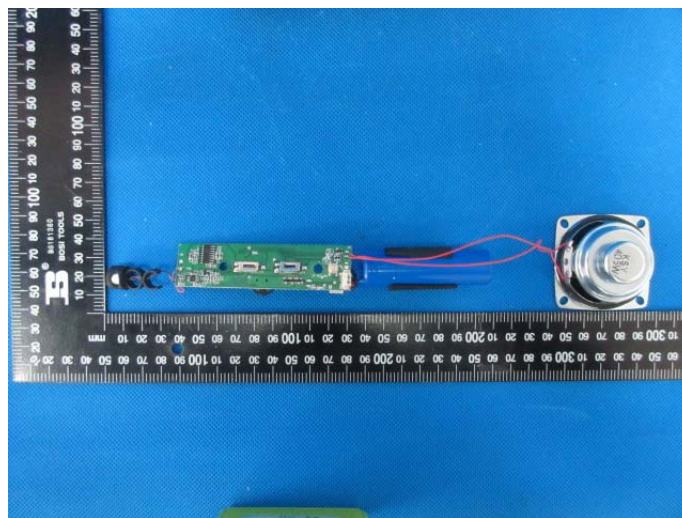
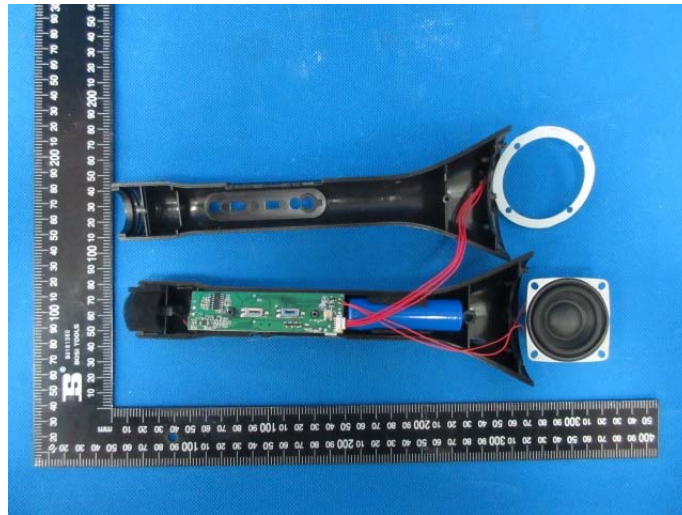
External Photos

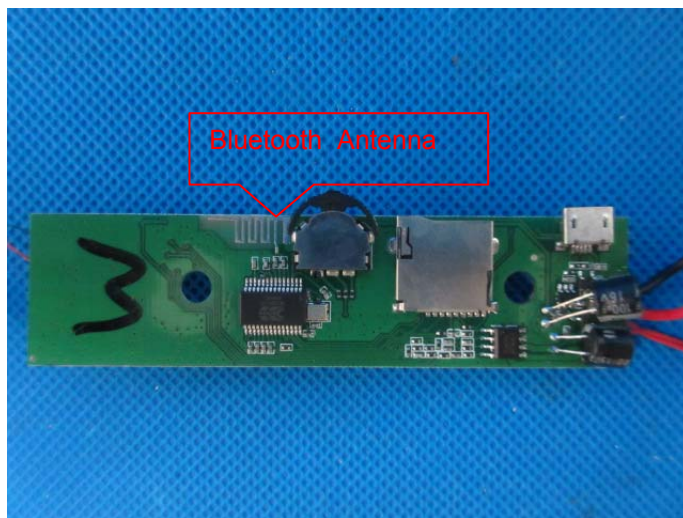
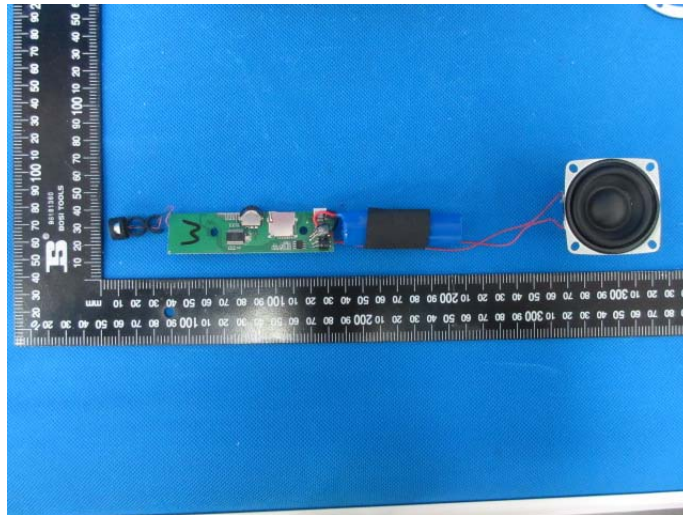




Internal Photos







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