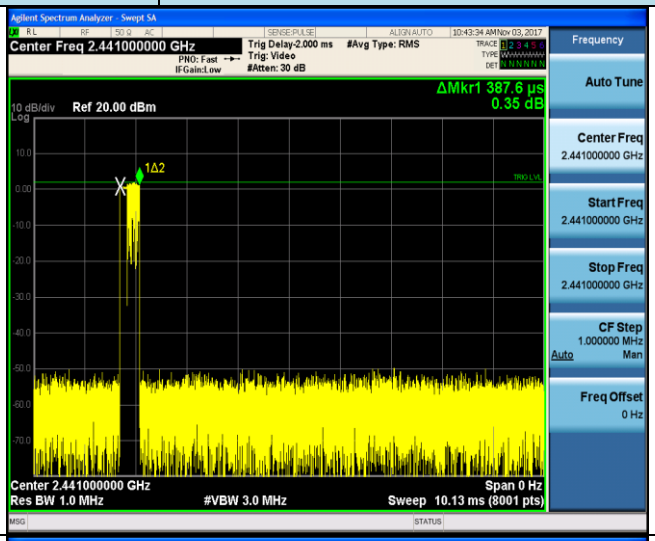
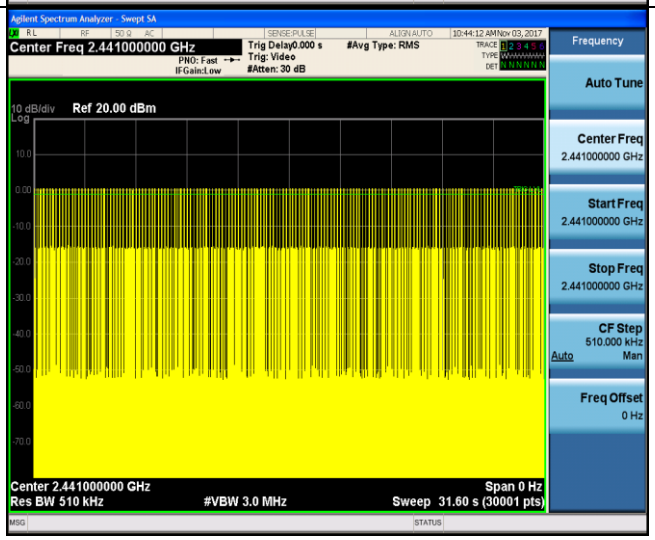
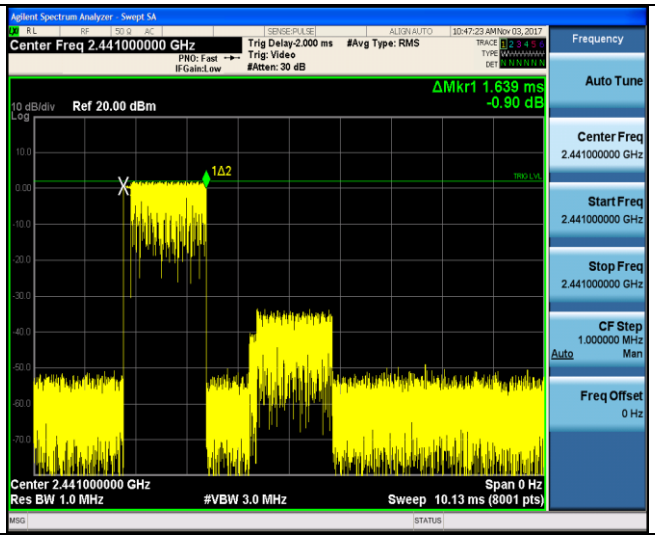
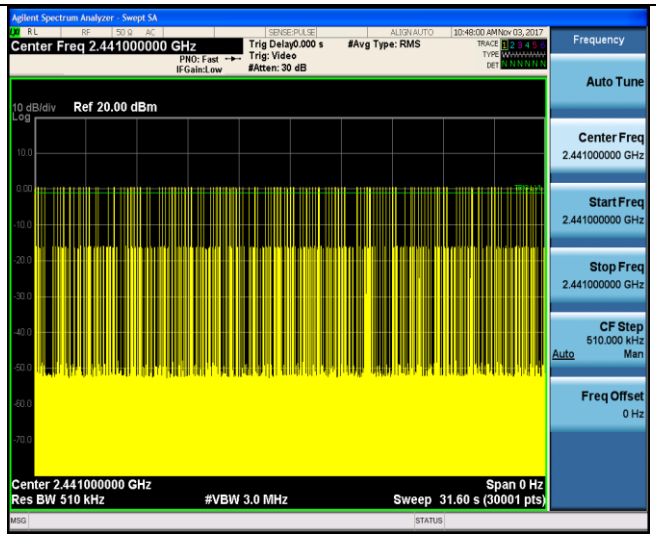
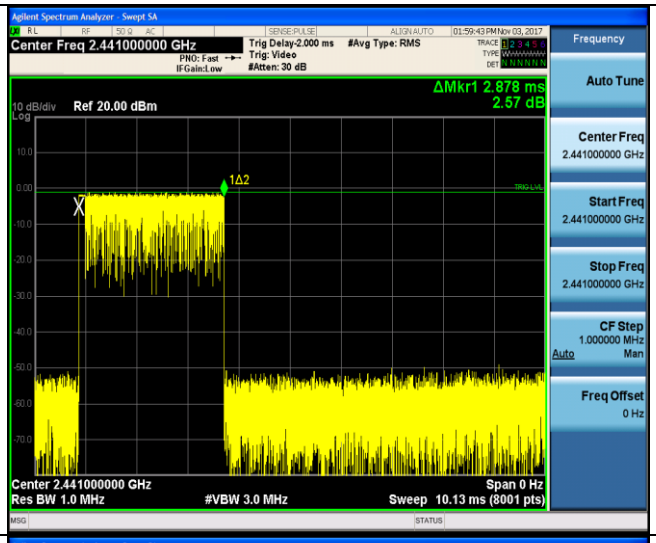
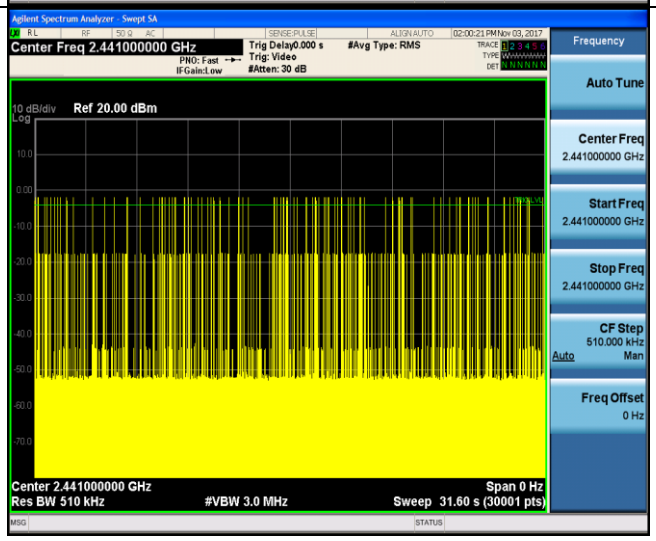
Modulation Type:		8DPSK
3DH1		
		
3DH3		

		 Agilent Spectrum Analyzer - Swept SA Center Freq 2.441000000 GHz PNO: Fast IFGain:Low Trig Delay0.000 s Trig: Video #Atten: 30 dB #Avg Type: RMS 10:48:00 AM Nov 03, 2017 Frequency Auto Tune 10 dB/div Ref 20.00 dBm Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 510.000 kHz Auto Man Freq Offset 0 Hz Center 2.441000000 GHz Res BW 510 kHz #VBW 3.0 MHz Span 0 Hz Sweep 31.60 s (30001 pts)
3DH5		 Agilent Spectrum Analyzer - Swept SA Center Freq 2.441000000 GHz PNO: Fast IFGain:Low Trig Delay-2.000 ms Trig: Video #Atten: 30 dB #Avg Type: RMS 01:59:43 PM Nov 03, 2017 Frequency Auto Tune ΔMkr1 2.878 ms 2.57 dB 10 dB/div Ref 20.00 dBm 1Δ2 Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Auto Man Freq Offset 0 Hz Center 2.441000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Span 0 Hz Sweep 10.13 ms (8001 pts)
		 Agilent Spectrum Analyzer - Swept SA Center Freq 2.441000000 GHz PNO: Fast IFGain:Low Trig Delay0.000 s Trig: Video #Atten: 30 dB #Avg Type: RMS 02:00:21 PM Nov 03, 2017 Frequency Auto Tune 10 dB/div Ref 20.00 dBm Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 510.000 kHz Auto Man Freq Offset 0 Hz Center 2.441000000 GHz Res BW 510 kHz #VBW 3.0 MHz Span 0 Hz Sweep 31.60 s (30001 pts)

5.8. Pseudorandom Frequency Hopping Sequence

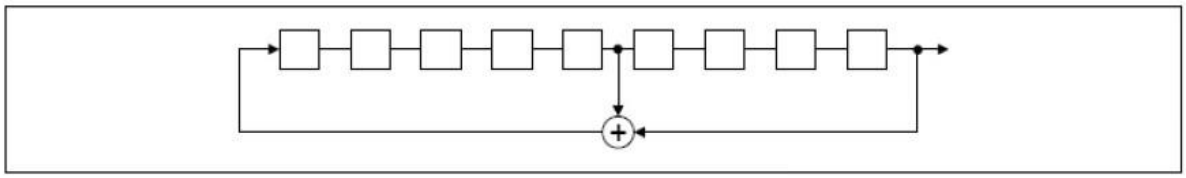
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies 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 chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

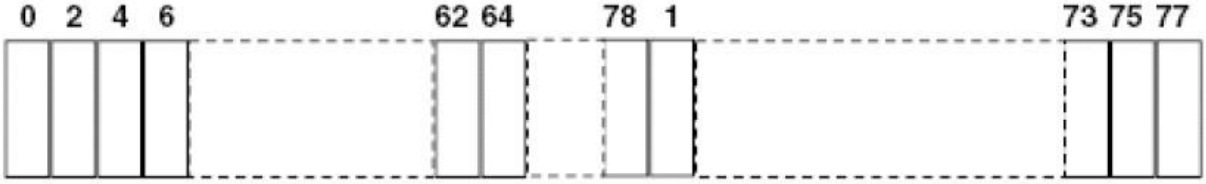
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the friststage.The sequence begins with the frist one of 9 consecutive ones,forexample:the shift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

- Number of shift register stages: 9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



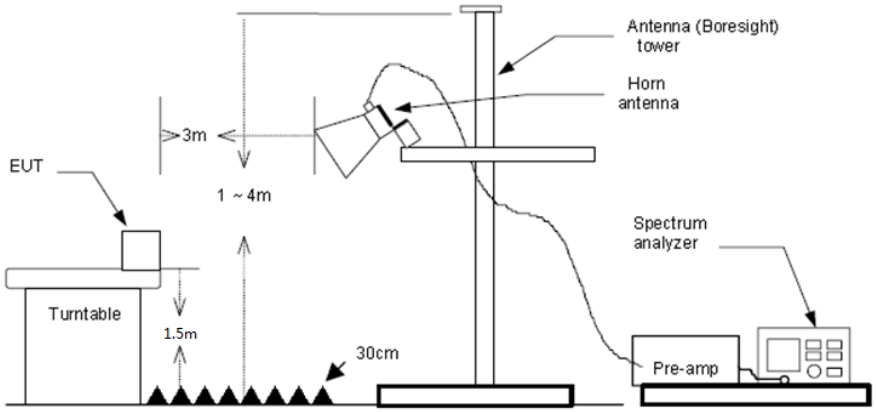
Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

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 Emissions 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 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 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=1 MHz, VBW=3 MHz Peak detector for Peak value
   RBW=1 MHz, VBW=10 Hz 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.
3) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

CH00									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	34.53	28.05	6.62	37.65	31.55	74.00	-42.45	Horizontal	Peak
2390.03	35.00	27.65	6.75	37.87	31.53	74.00	-42.47	Horizontal	Peak
2310.00	35.79	28.05	6.62	37.65	32.81	74.00	-41.19	Vertical	Peak
2390.03	34.96	27.65	6.75	37.87	31.49	74.00	-42.51	Vertical	Peak
2310.00	22.49	28.05	6.62	37.65	19.51	54.00	-34.49	Horizontal	Average
2390.03	22.14	27.65	6.75	37.87	18.67	54.00	-35.33	Horizontal	Average
2310.00	24.17	28.05	6.62	37.65	21.19	54.00	-32.81	Vertical	Average
2390.03	22.77	27.65	6.75	37.87	19.30	54.00	-34.70	Vertical	Average

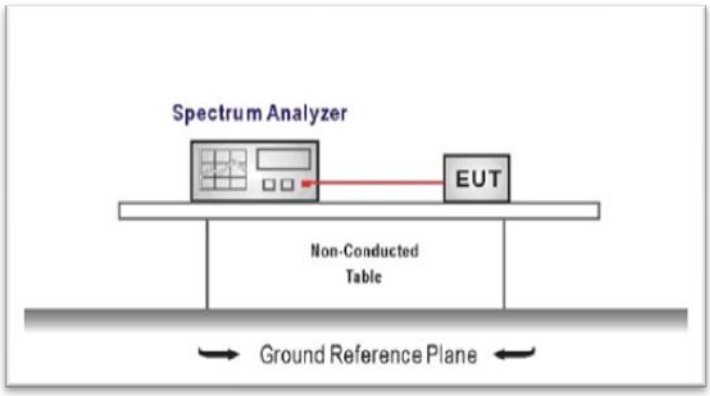
CH78									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.50	34.51	27.26	6.83	37.87	30.73	74.00	-43.27	Horizontal	Peak
2500.00	34.40	27.20	6.84	37.87	30.57	74.00	-43.43	Horizontal	Peak
2483.50	36.02	27.26	6.83	37.87	32.24	74.00	-41.76	Vertical	Peak
2500.00	33.83	27.20	6.84	37.87	30.00	74.00	-44.00	Vertical	Peak
2483.50	24.62	27.26	6.83	37.87	20.84	54.00	-33.16	Horizontal	Average
2500.00	21.79	27.20	6.84	37.87	17.96	54.00	-36.04	Horizontal	Average
2483.50	22.00	27.26	6.83	37.87	18.22	54.00	-35.78	Vertical	Average
2500.00	21.73	27.20	6.84	37.87	17.90	54.00	-36.10	Vertical	Average

5.10. Band edge and Spurious Emissions (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

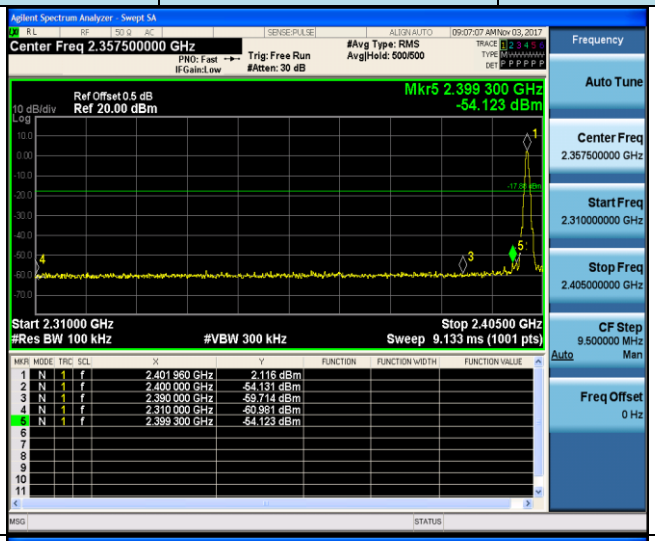
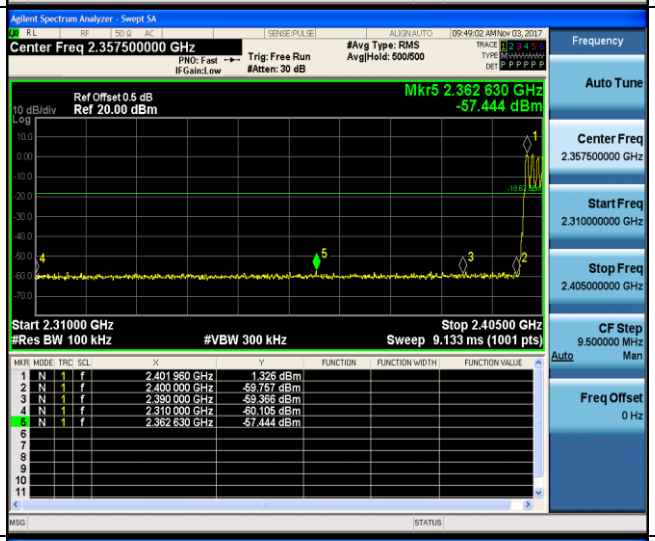
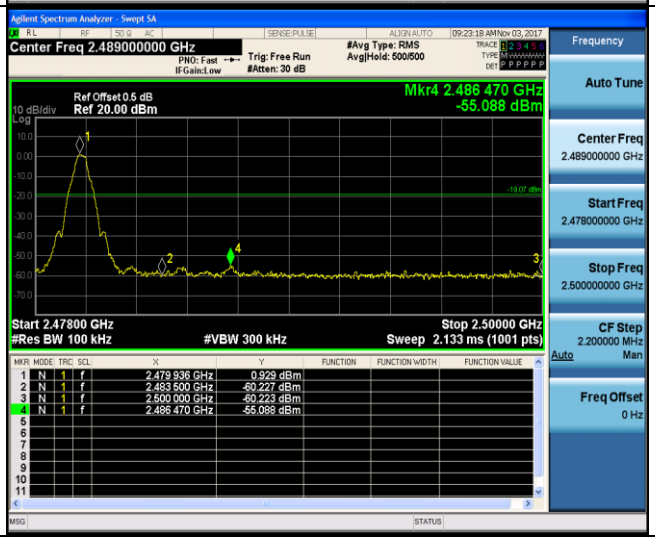
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW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

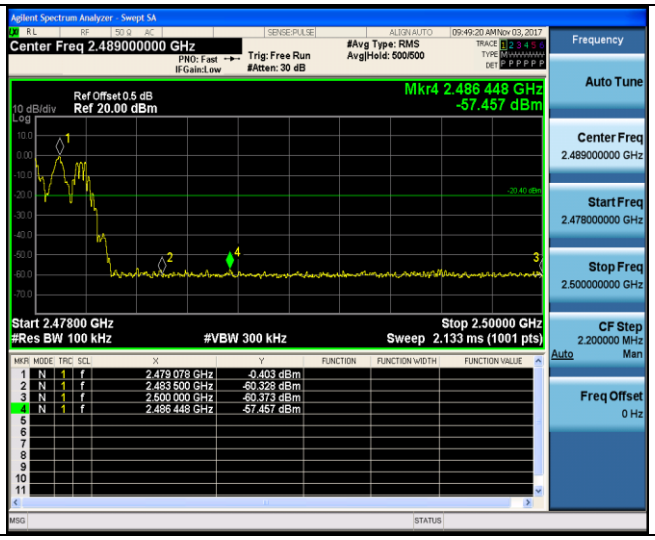
TEST MODE:

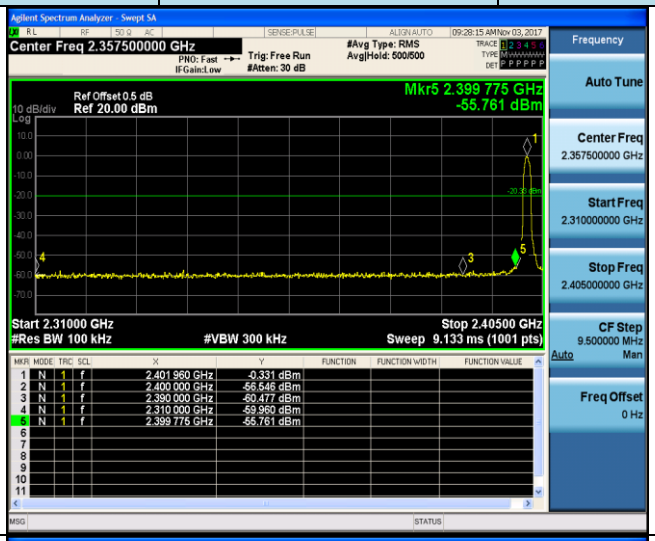
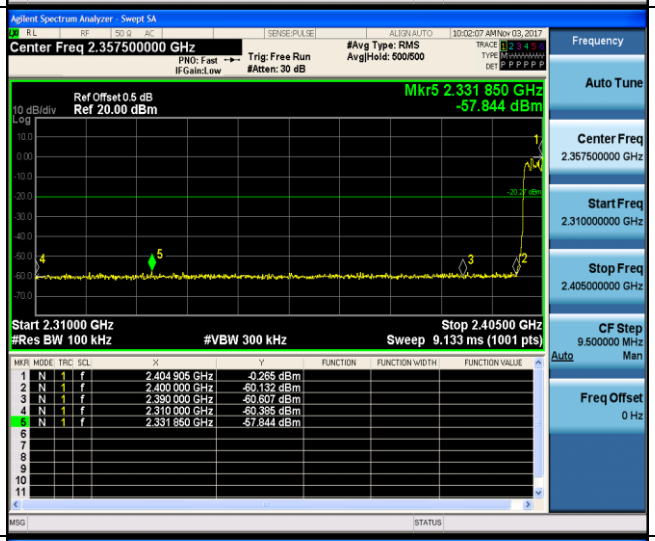
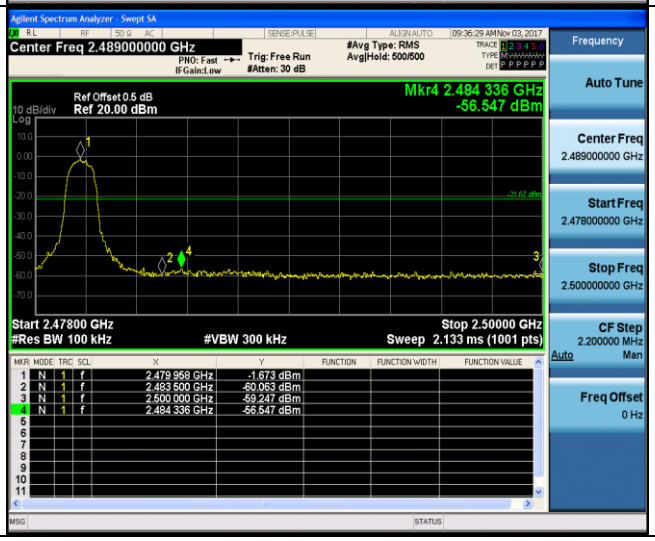
Please refer to the clause 3.3

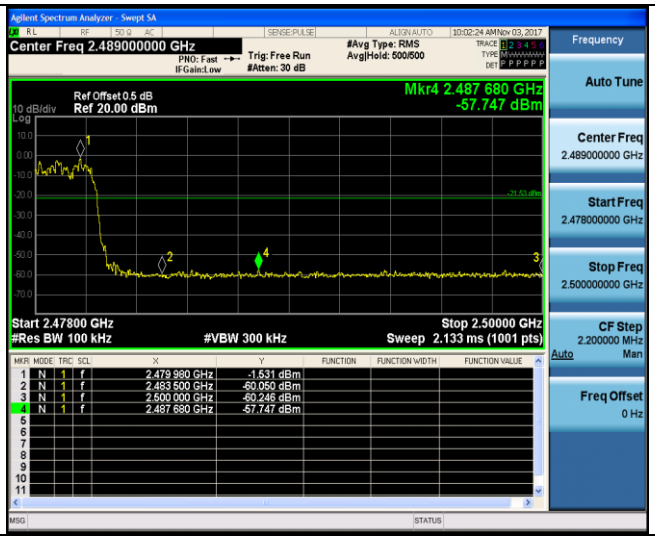
TEST RESULTS

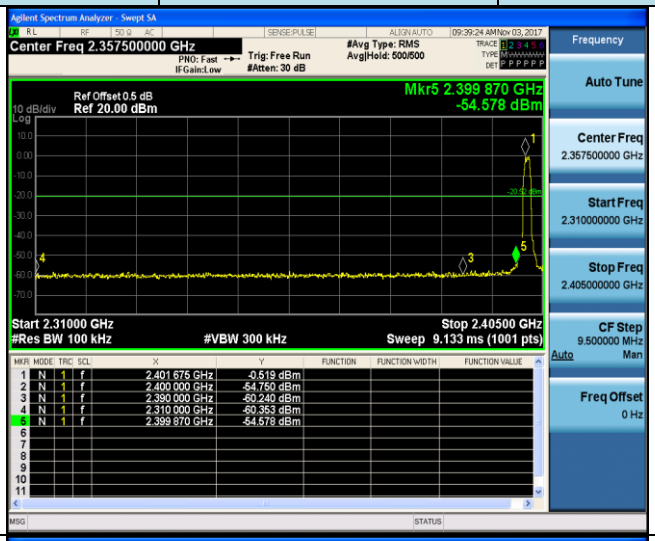
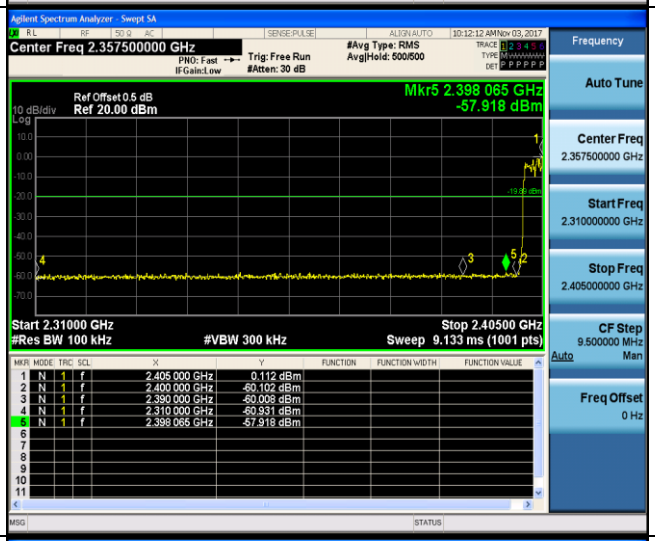
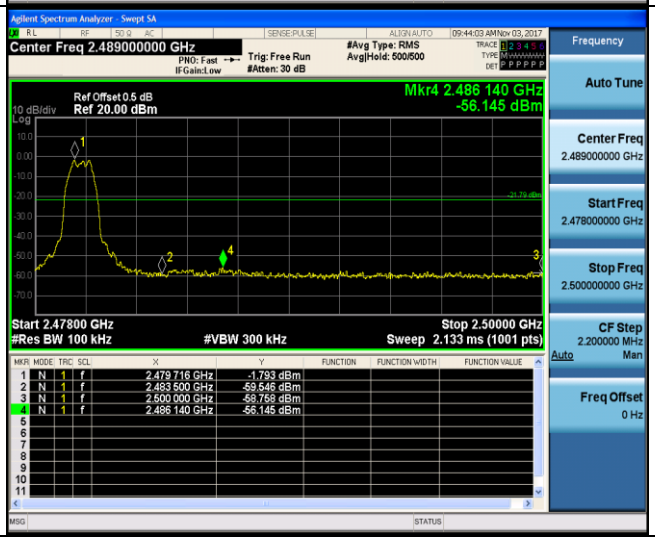
☒ **Passed** ☐ **Not Applicable**

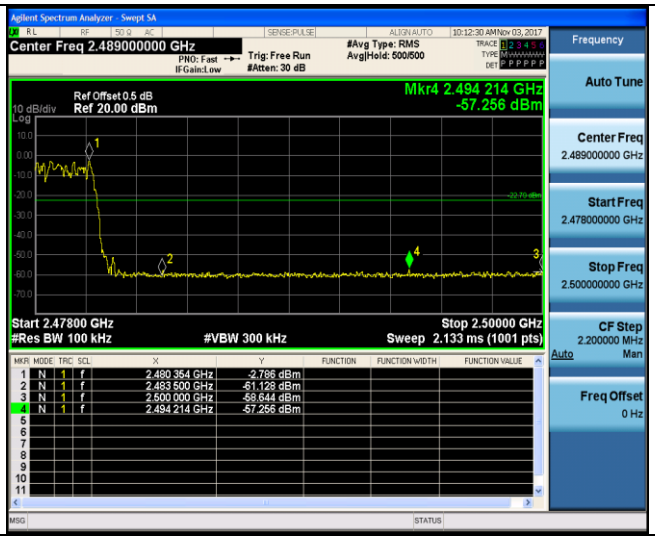
Test Item:	Band edge	Modulation type:	GFSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

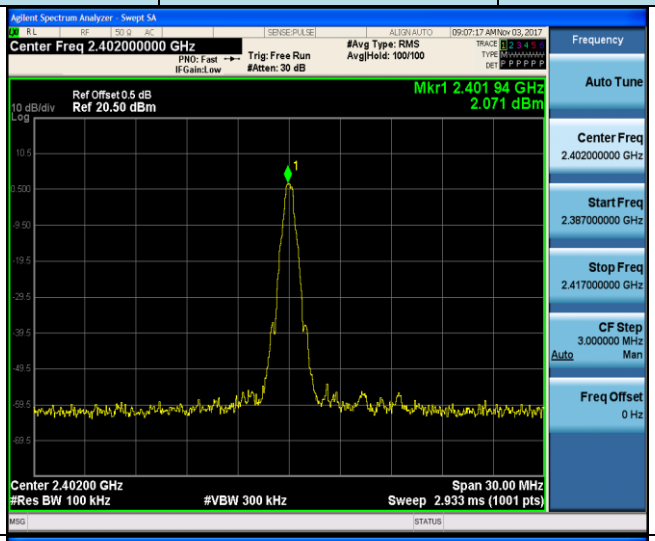
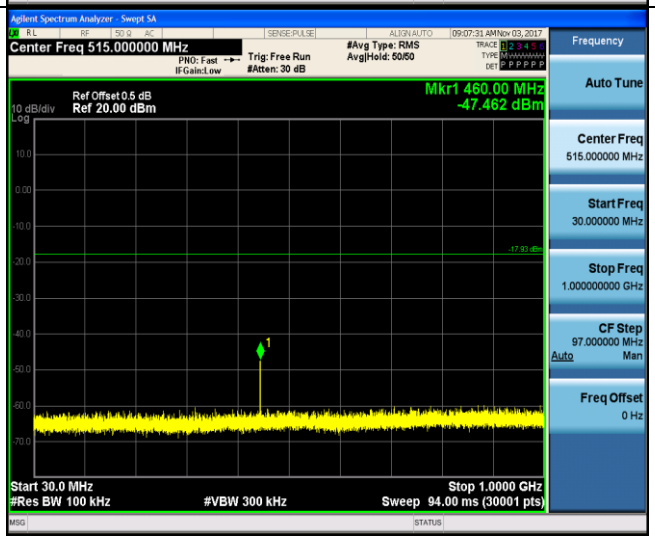
CH78 Hopping mode		

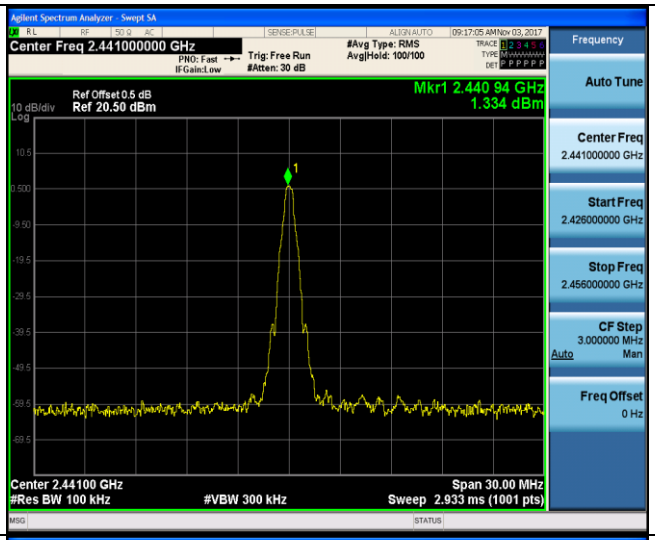
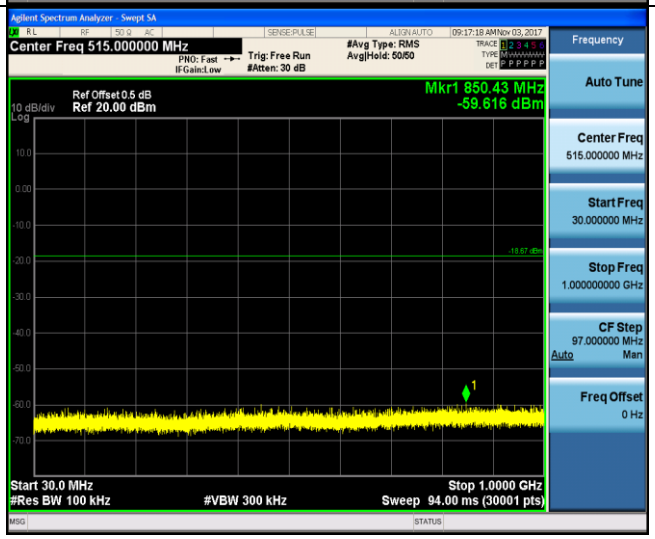
Test Item:	Band edge	Modulation type:	π/4DQPSK
CH00 No hopping mode	
CH00 Hopping mode	
CH78 No hopping mode	

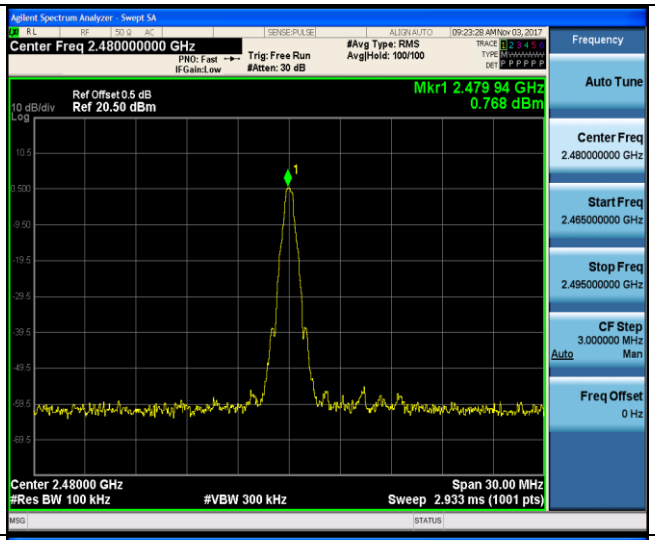
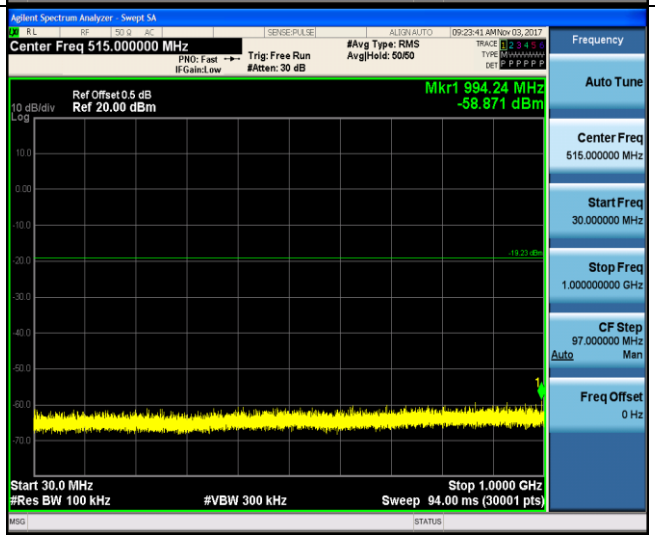
CH78 Hopping mode			

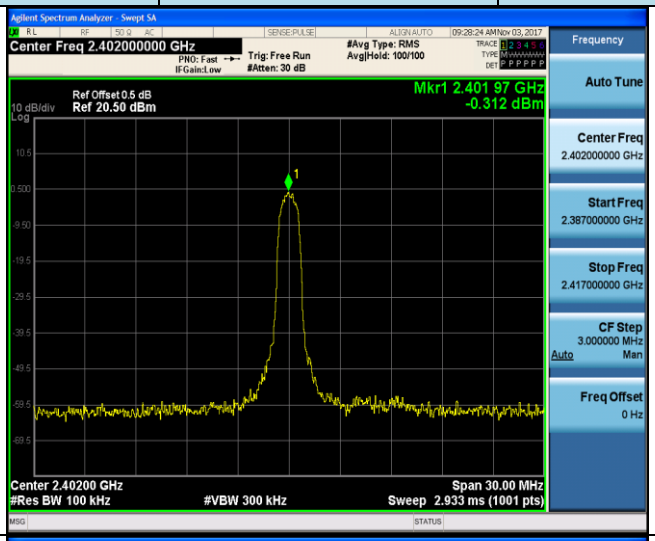
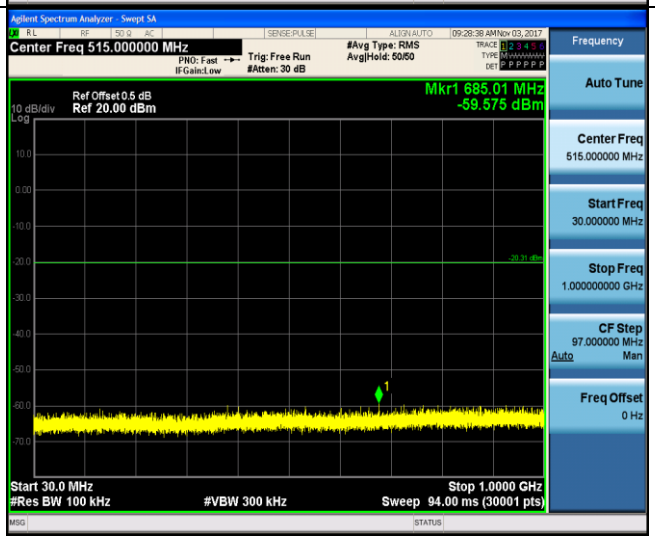
Test Item:	Band edge	Modulation type:	8DPSK
CH00 No hopping mode	
CH00 Hopping mode	
CH78 No hopping mode	

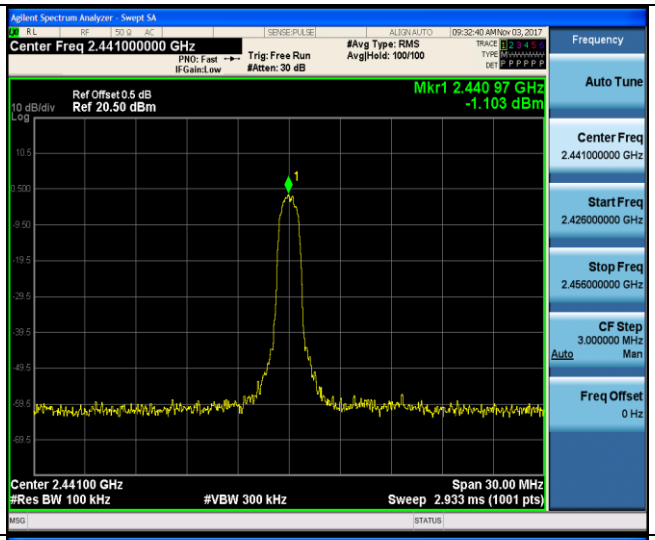
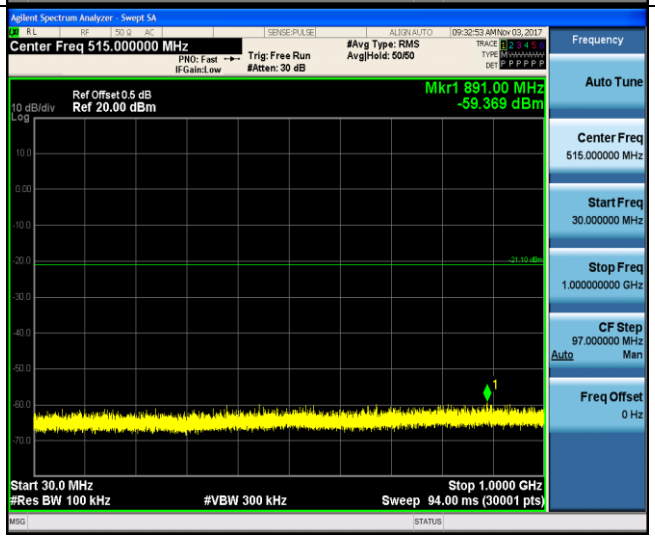
CH78 Hoppig mode			

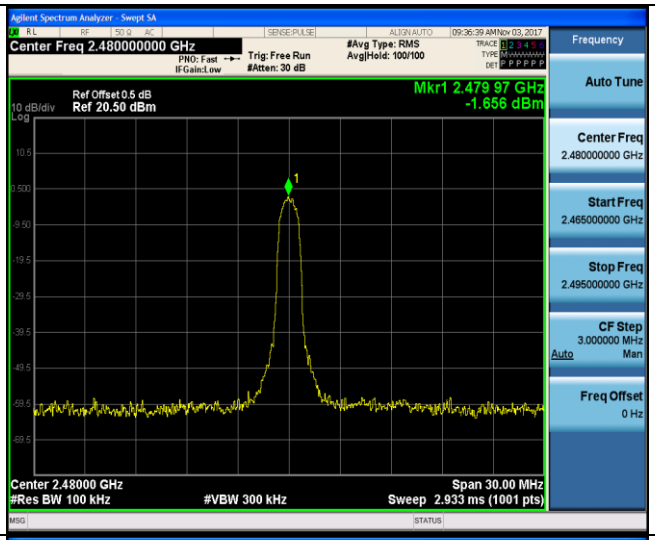
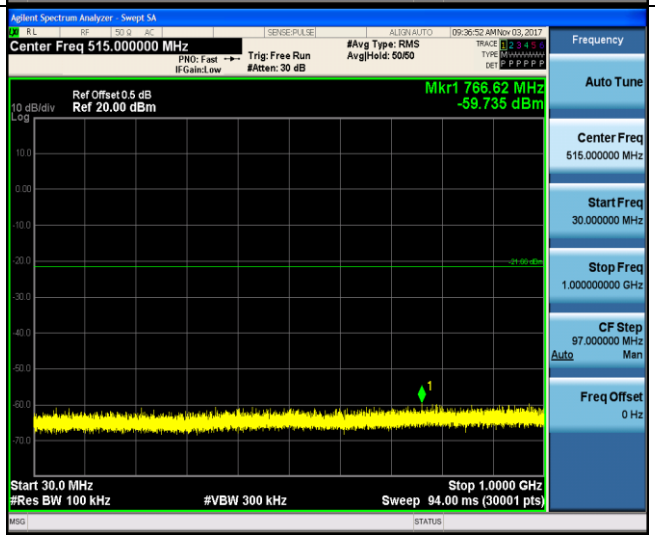
Test Item:	SE	Modulation type:	GFSK
reference level CH00			
CH00			
			

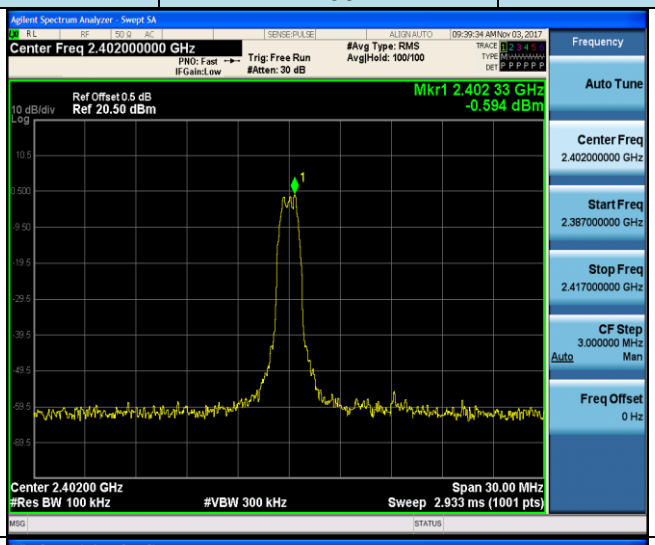
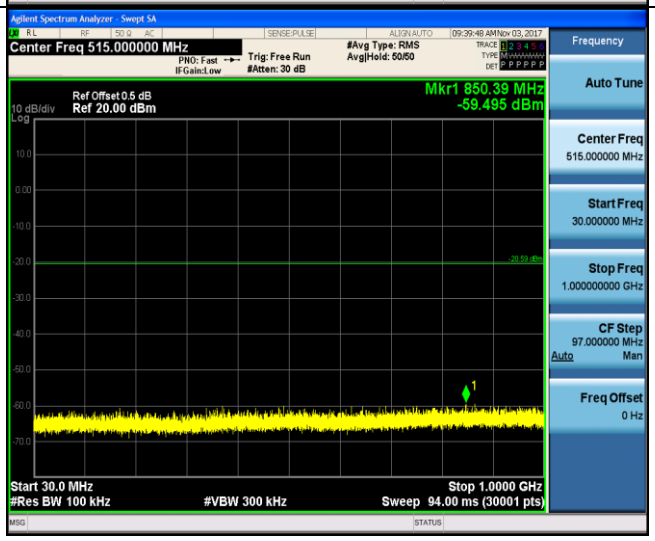
reference level CH39		
CH39		
		

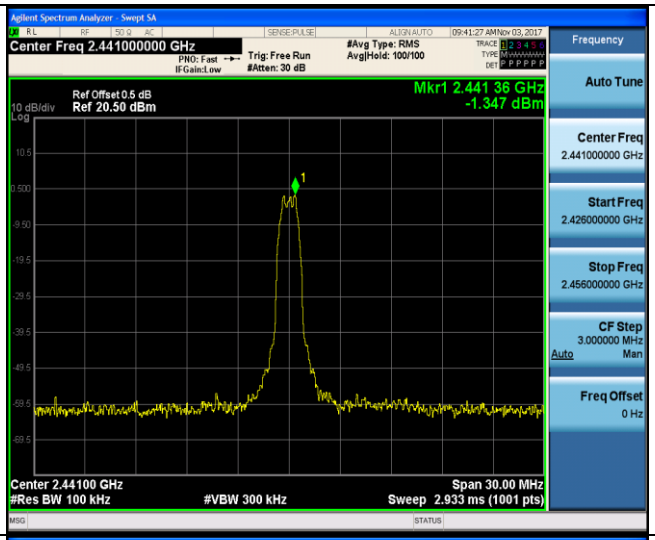
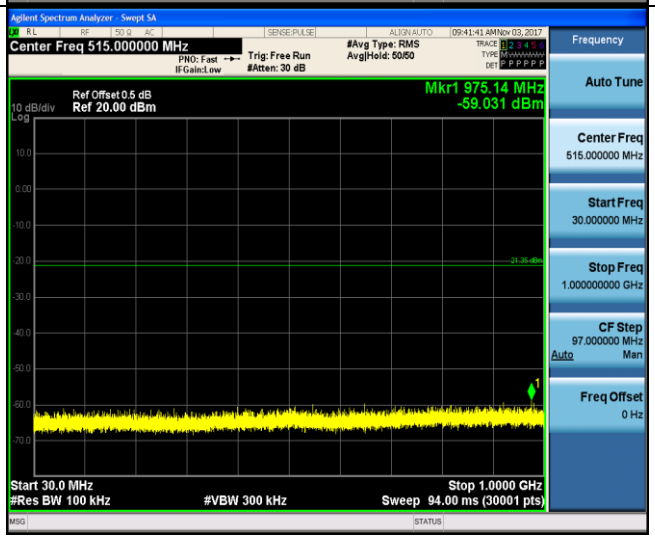
reference level CH78		
CH78		
		

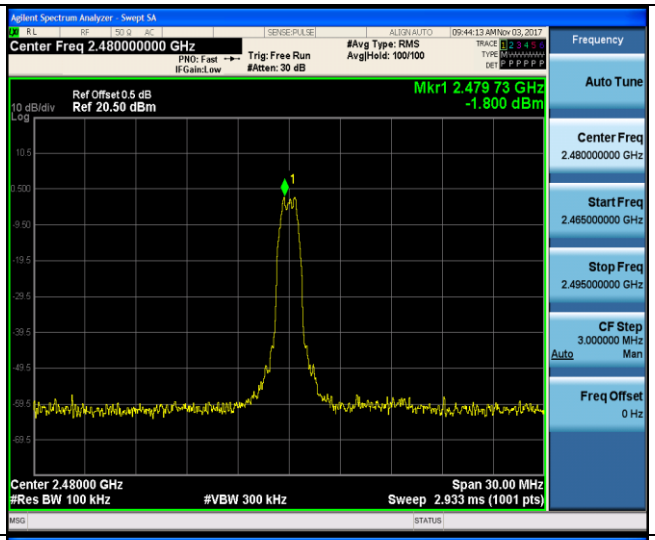
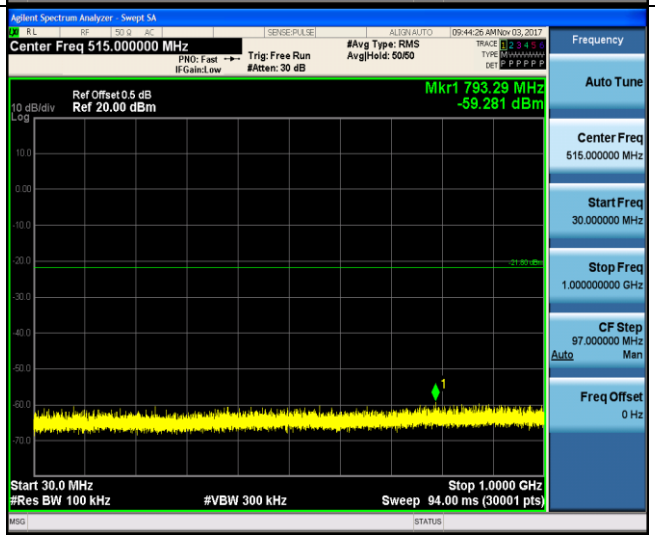
Test Item:	SE	Modulation type:	π/4DQPSK
reference level CH00			
CH00			
			

reference level CH39		
CH39		
		

reference level CH78		
CH78		
		

Test Item:	SE	Modulation type:	8DPSK
reference level CH00			
CH00			
			

reference level CH39		
CH39		
		

reference level CH78		
CH78		
		

5.11. Spurious Emissions (radiated)

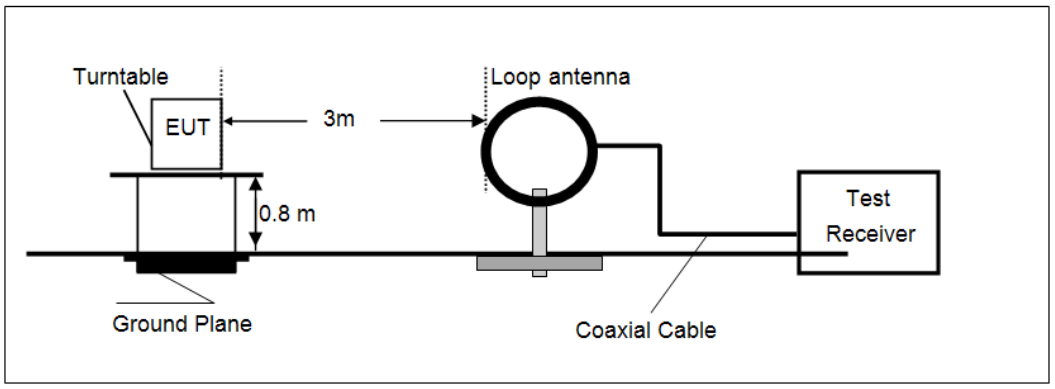
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

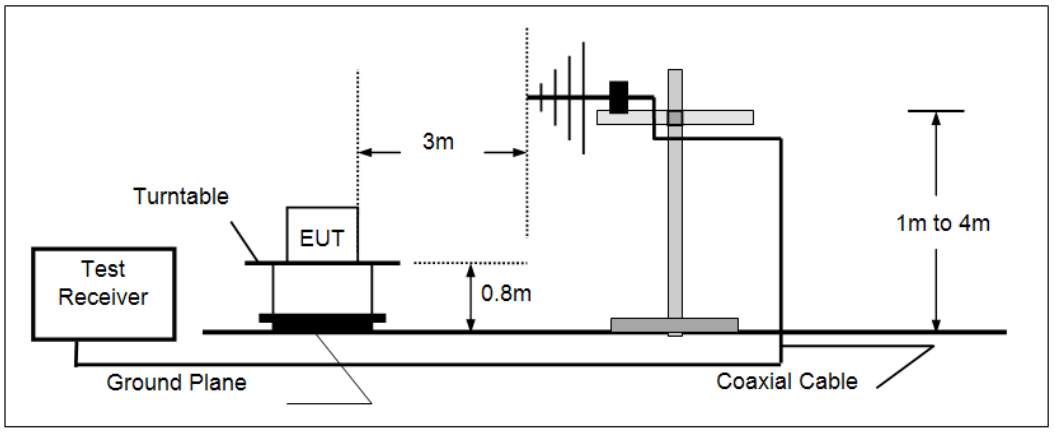
Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

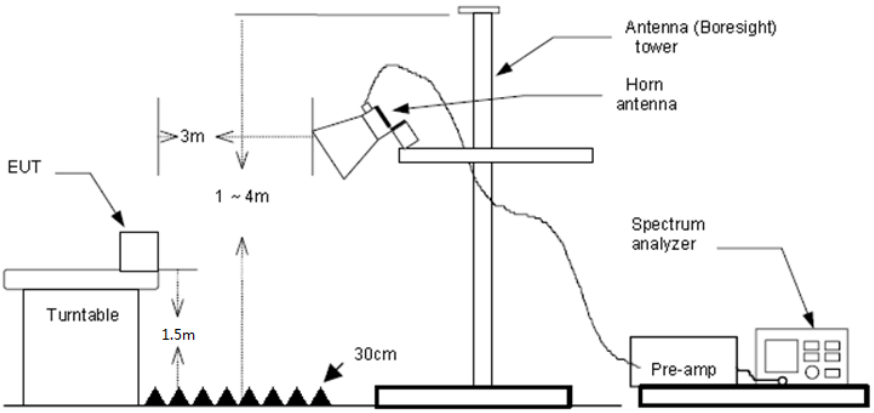
- Below 30 MHz



- 30 MHz ~1000 MHz



- Above 1 GHz



TEST PROCEDURE

1. The EUT was tested according to ANSI C63.10:2013.
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 wide enough to fully capture the emission being measured;
   (2) Below 1 GHz, RBW=120 kHz, VBW=300 kHz, 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, the emission measurement will be repeated using the quasi-peak detector and reported.
   (3) Above 1 GHz, RBW=1 MHz, VBW=3 MHz Peak detector for Peak value
   RBW=1 MHz, VBW=10 Hz Peak detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Note:

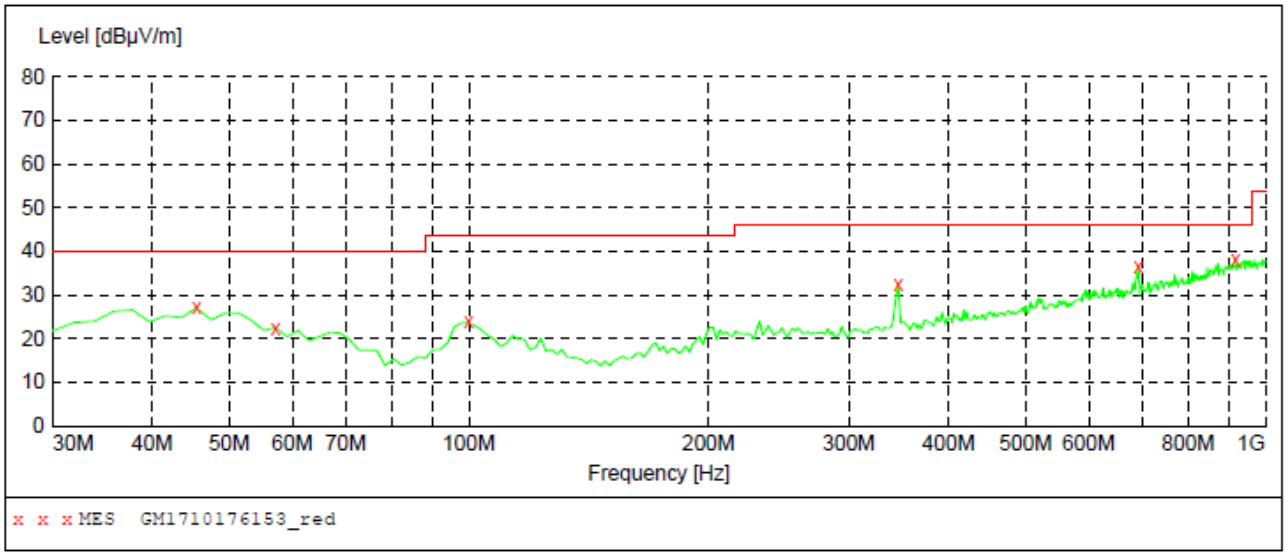
1) Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2) The emission levels of other frequencies are very lower than the limit and not show in test report.
3) Below 1 GHz,Have pre-scan all modulation mode, found the GFSK modulation High channel which it was worst case, so only the worst case's data on the test report.
4) Above 1 GHz,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) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

➢ **9 kHz ~ 30 MHz**

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

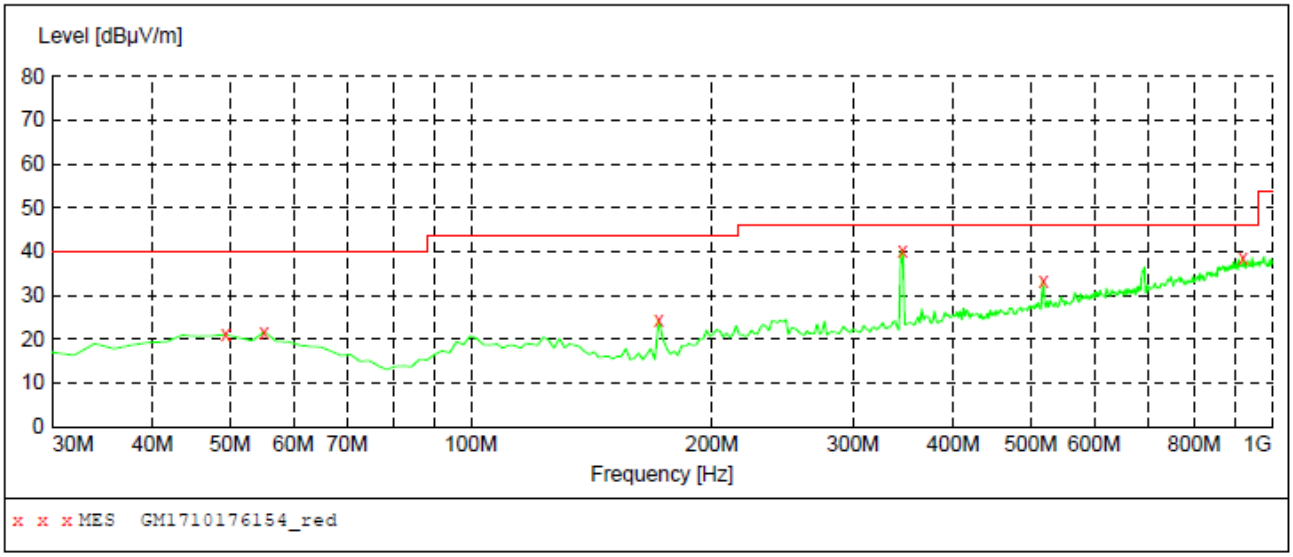
➢ **30 MHz ~ 1 GHz**

Polarization:	Vertical



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
45.520000	27.10	-8.8	40.0	12.9	QP	100.0	95.00	VERTICAL
57.160000	22.50	-9.4	40.0	17.5	QP	100.0	198.00	VERTICAL
99.840000	23.80	-10.6	43.5	19.7	QP	100.0	95.00	VERTICAL
346.220000	32.40	-5.4	46.0	13.6	QP	100.0	84.00	VERTICAL
693.480000	36.70	2.4	46.0	9.3	QP	100.0	56.00	VERTICAL
916.580000	38.10	6.9	46.0	7.9	QP	100.0	275.00	VERTICAL

Polarization:	Horizontal



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
49.400000	21.10	-8.7	40.0	18.9	QP	300.0	23.00	HORIZONTAL
55.220000	21.70	-9.2	40.0	18.3	QP	100.0	0.00	HORIZONTAL
171.620000	24.40	-12.9	43.5	19.1	QP	100.0	281.00	HORIZONTAL
346.220000	40.20	-5.4	46.0	5.8	QP	100.0	309.00	HORIZONTAL
518.880000	33.40	-1.3	46.0	12.6	QP	100.0	31.00	HORIZONTAL
920.460000	38.70	7.0	46.0	7.3	QP	300.0	58.00	HORIZONTAL

➢ **1 GHz ~ 25 GHz**

CH00									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1198.10	52.51	26.29	4.66	36.57	46.89	74.00	-27.11	Vertical	Peak
2987.92	48.79	28.59	7.47	38.24	46.61	74.00	-27.39	Vertical	Peak
4996.69	43.76	31.50	9.67	36.41	48.52	74.00	-25.48	Vertical	Peak
7099.75	32.40	35.60	11.85	34.93	44.92	74.00	-29.08	Vertical	Peak
1198.10	54.13	26.29	4.66	36.57	48.51	74.00	-25.49	Horizontal	Peak
1993.40	43.63	26.24	6.26	37.29	38.84	74.00	-35.16	Horizontal	Peak
2987.92	44.19	28.59	7.47	38.24	42.01	74.00	-31.99	Horizontal	Peak
5217.66	34.78	31.46	9.86	36.25	39.85	74.00	-34.15	Horizontal	Peak

CH39									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1195.05	50.74	26.26	4.65	36.57	45.08	74.00	-28.92	Vertical	Peak
1663.80	46.69	25.09	5.69	36.85	40.62	74.00	-33.38	Vertical	Peak
2995.54	51.67	28.60	7.48	38.23	49.52	74.00	-24.48	Vertical	Peak
4996.69	45.56	31.50	9.67	36.41	50.32	74.00	-23.68	Vertical	Peak
1663.80	46.69	25.09	5.69	36.85	40.62	74.00	-33.38	Horizontal	Peak
2995.54	51.67	28.60	7.48	38.23	49.52	74.00	-24.48	Horizontal	Peak
4256.33	45.40	30.11	8.99	37.62	46.88	74.00	-27.12	Horizontal	Peak
4996.69	42.56	31.50	9.67	36.41	47.32	74.00	-26.68	Horizontal	Peak

CH78									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1201.15	49.76	26.30	4.66	36.57	44.15	74.00	-29.85	Vertical	Peak
1899.28	41.80	25.30	6.11	37.22	35.99	74.00	-38.01	Vertical	Peak
3681.47	42.40	29.30	8.36	38.25	41.81	74.00	-32.19	Vertical	Peak
4996.69	45.41	31.50	9.67	36.41	50.17	74.00	-23.83	Vertical	Peak
1204.21	48.84	26.30	4.67	36.57	43.24	74.00	-30.76	Horizontal	Peak
2987.92	44.99	28.59	7.47	38.24	42.81	74.00	-31.19	Horizontal	Peak
4983.99	37.57	31.48	9.66	36.44	42.27	74.00	-31.73	Horizontal	Peak
8002.06	33.76	37.10	12.30	34.53	48.63	74.00	-25.37	Horizontal	Peak

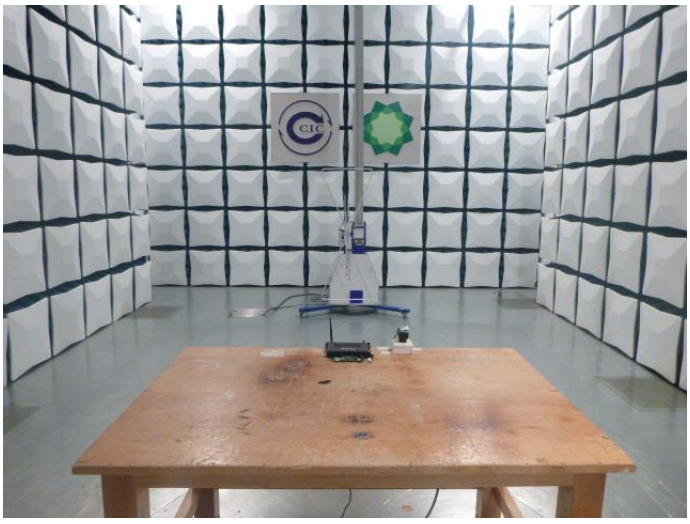
Remark:

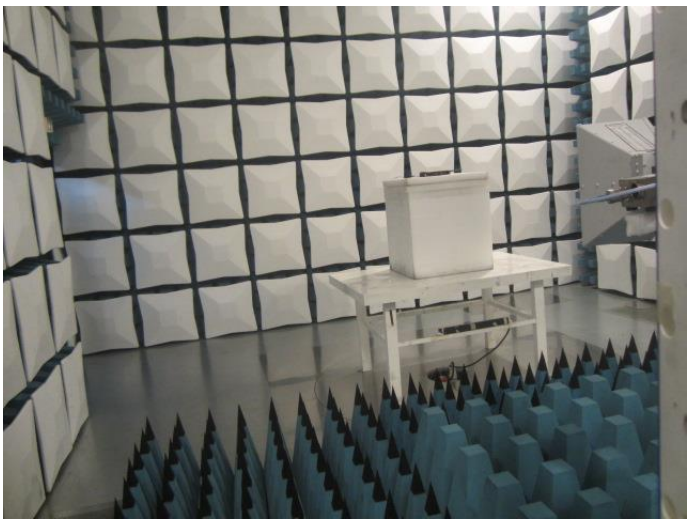
1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies(test frequency band is 1GHz to 25GHz) are very lower than the limit and not show in test report.

6. TEST SETUP PHOTOS

Conducted Emissions

Radiated Emissions





7. EXTERANAL AND INTERNAL PHOTOS

Reference to the test report No.: TRE1710003401.

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