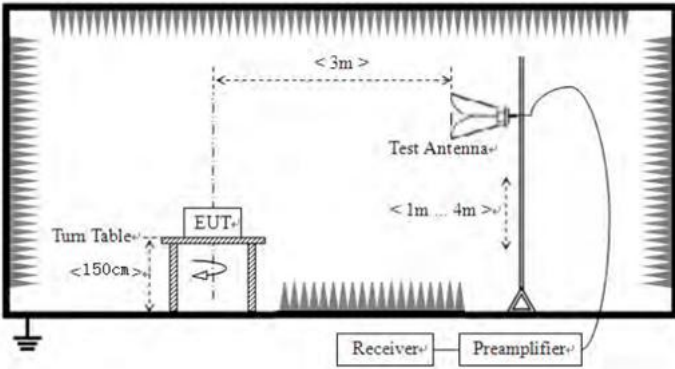


7.8.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		Peak	1MHz	10Hz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	Above 1GHz		54.00		Average Value
			74.00		Peak Value
Test setup:					
Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
Test Instruments:	Refer to section 6.0 for details				
Test mode:	Refer to section 5.2 for details				
Test results:	Pass				

Measurement Data

Test channel:	Lowest channel
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Peak value:

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
2400	49.4	33.16	3.91	34.07	52.4	74.00	-21.6	Horizontal
2354	44.28	33.05	3.96	35.07	46.22	74.00	-27.78	Horizontal
2400	52.6	33.14	3.93	36.07	53.6	74.00	-20.4	Vertical
2354	45.38	33.05	3.95	35.07	47.31	74.00	-26.69	Vertical

Average value:

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
2400	32.77	33.01	3.96	35.07	34.67	54.00	-19.33	Horizontal
2354	31.05	33.11	3.95	35.07	33.04	54.00	-20.96	Horizontal
2400	34.87	33.21	3.93	35.07	36.94	54.00	-17.06	Vertical
2354	30.06	33.11	3.94	37.07	30.04	54.00	-23.96	Vertical

Test channel:	Highest channel
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Peak value:

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
2499	40.98	33.05	3.91	33.07	44.87	74.00	-29.13	Horizontal
2536	38.26	33.32	3.93	33.07	42.44	74.00	-31.56	Horizontal
2499	48.93	33.15	3.99	39.07	47	74.00	-27	Vertical
2536	41.36	33.25	3.92	35.07	43.46	74.00	-30.54	Vertical

Average value:

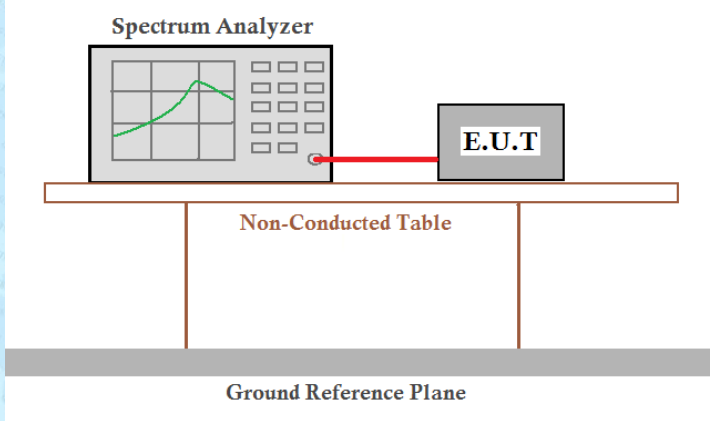
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2499	27.73	33.11	3.90	35.07	29.67	54.00	-24.33	Horizontal
2536	22.03	33.12	3.95	35.07	24.03	54.00	-29.97	Horizontal
2499	28.83	33.21	3.98	35.07	30.95	54.00	-23.05	Vertical
2536	24.14	33.09	3.91	35.07	26.07	54.00	-27.93	Vertical

Remarks:

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. The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.
4. During the test, pre-scan the GFSK, $\pi/4$ -DQPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.

7.9 Spurious Emission

7.9.1 Conducted Emission Method

Test Requirement:		FCC Part15 C Section 15.247 (d)					
Test Method:		ANSI C63.10:2013					
Limit:		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 setup:							
Test Instruments:		Refer to section 6.0 for details					
Test mode:		Refer to section 5.2 for details					
Test results:		Pass					
TestMODE	Antenna	Channel	FreqRange[MHz]	RefLevl[dBm]	Result[dBm]	Limit[dBm]	Verdict
DH5	Ante1	2402	Reference	-5.040	-5.040	-	PASS
			30~1000	-5.040	-52.002	-25.04	PASS
			1000~26500	-5.040	-50.178	-25.04	PASS
		2441	Reference	-5.170	-5.170	-	PASS
			30~1000	-5.170	-51.925	-25.17	PASS
			1000~26500	-5.170	-48.676	-25.17	PASS
		2480	Reference	-5.390	-5.390	-	PASS
			30~1000	-5.390	-51.162	-25.39	PASS
			1000~26500	-5.390	-48.781	-25.39	PASS
2DH5	Ante1	2402	Reference	-5.126	-5.126	-	PASS
			30~1000	-5.126	-51.382	-25.126	PASS
			1000~26500	-5.126	-49.924	-25.126	PASS
		2441	Reference	-5.235	-5.235	-	PASS
			30~1000	-5.235	-51.916	-25.235	PASS
			1000~26500	-5.235	-46.290	-25.235	PASS
		2480	Reference	-5.467	-5.467	-	PASS
			30~1000	-5.467	-54.608	-25.467	PASS
			1000~26500	-5.467	-46.098	-25.467	PASS
3DH5	Ante1	2402	Reference	-5.054	-5.054	-	PASS
			30~1000	-5.054	-52.190	-25.054	PASS

	2441	1000~26500	-5.054	-46.443	-25.054	PASS
		Reference	-5.197	-5.197	-	PASS
		30~1000	-5.197	-51.239	-25.197	PASS
		1000~26500	-5.197	-45.407	-25.197	PASS
	2480	Reference	-5.368	-5.368	-	PASS
		30~1000	-5.368	-52.585	-25.368	PASS
		1000~26500	-5.368	-48.434	-25.368	PASS

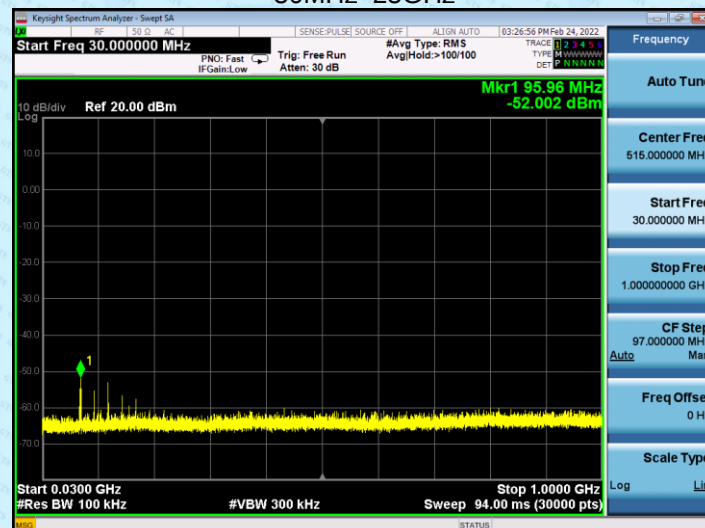
GFSK mode:

Test channel:

Lowest channel

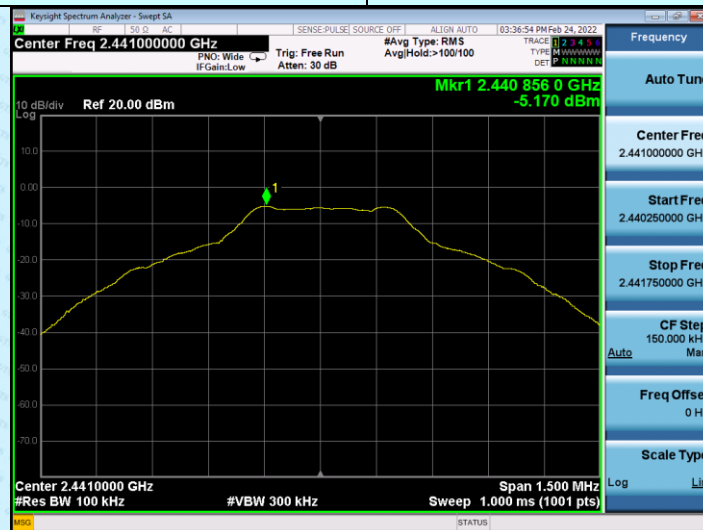


30MHz~25GHz

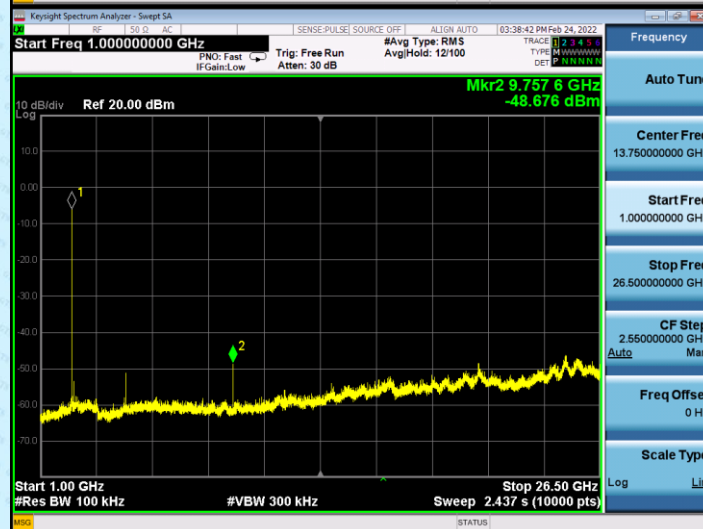
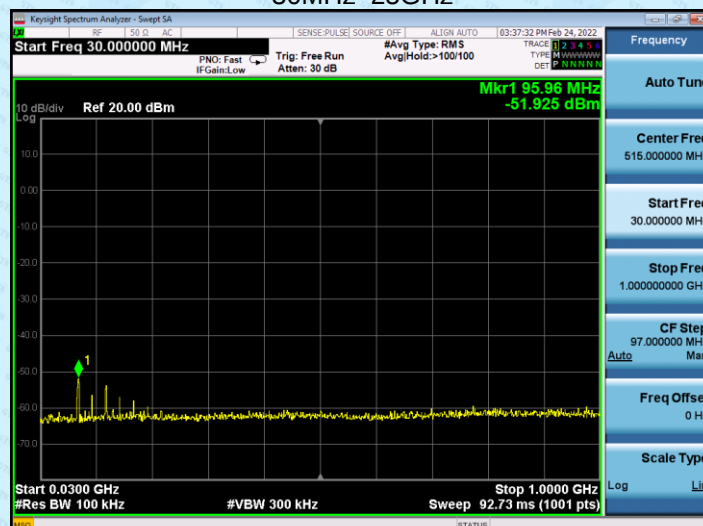


Test channel:

Middle channel



30MHz~25GHz

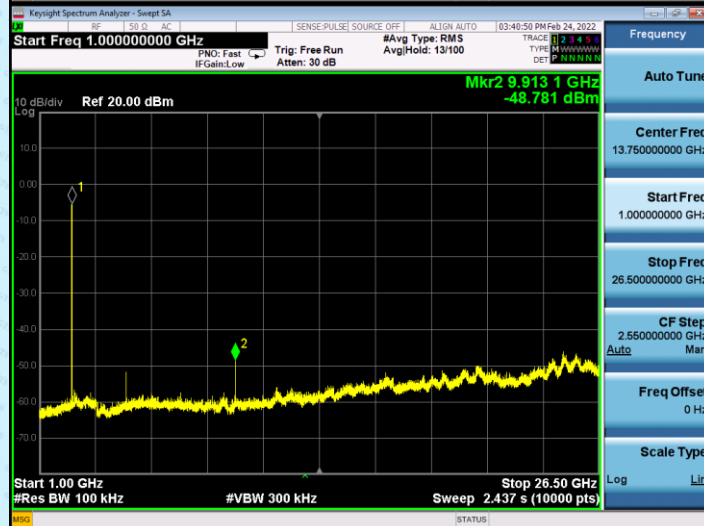
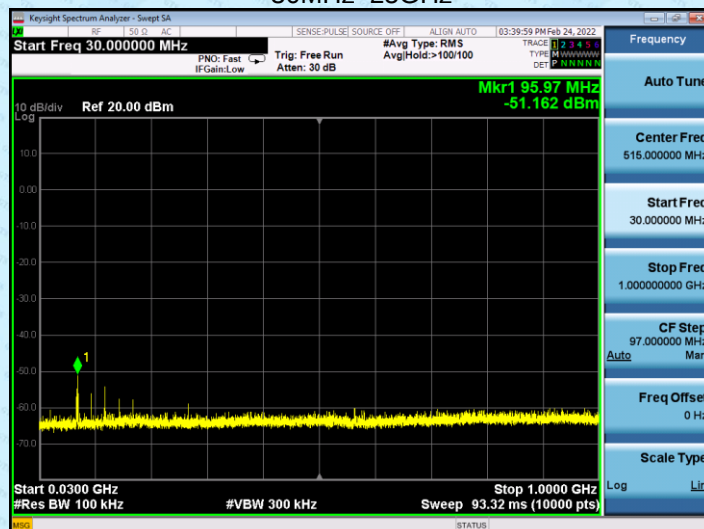


Test channel:

Highest channel



30MHz-25GHz



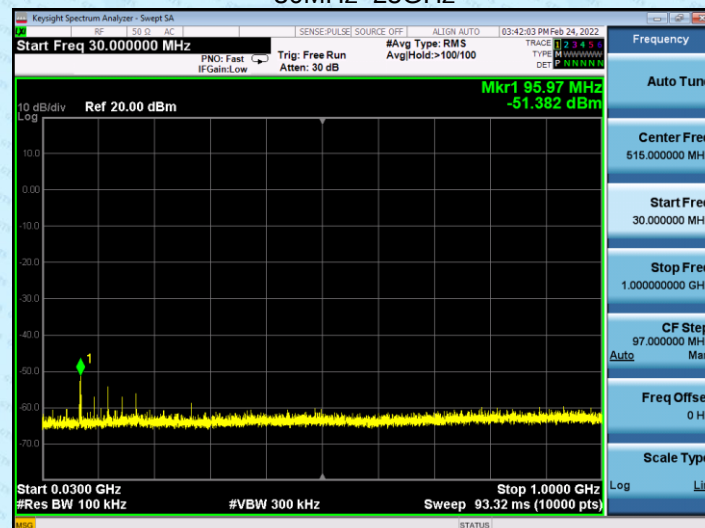
$\pi/4$ -DQPSK mode:

Test channel:

Lowest channel



30MHz~25GHz

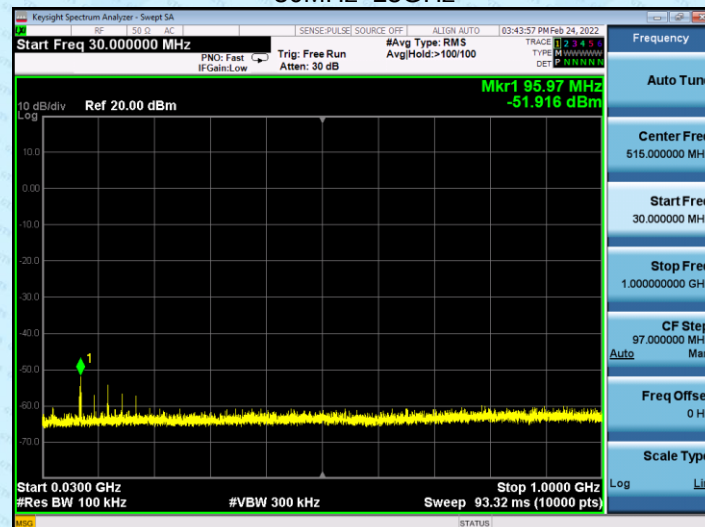


Test channel:

Middle channel



30MHz~25GHz

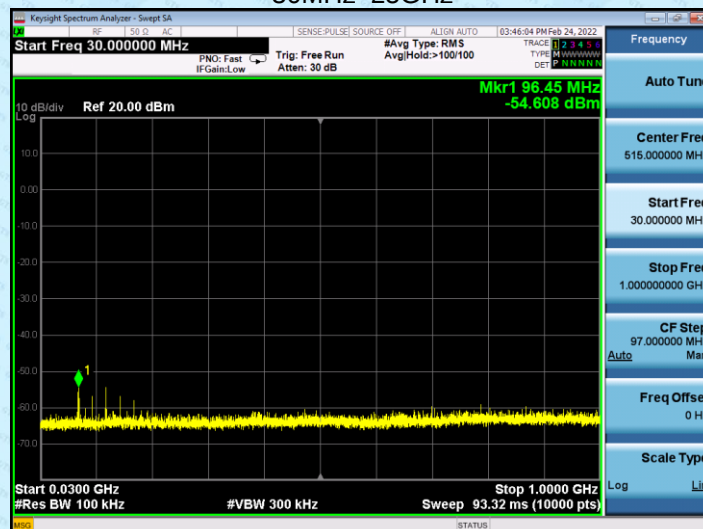


Test channel:

Highest channel



30MHz-25GHz



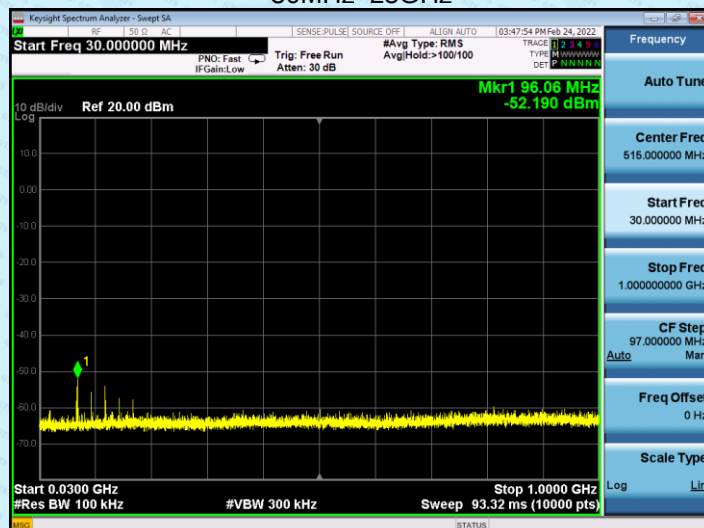
8-DPSK mode:

Test channel:

Lowest channel



30MHz~25GHz

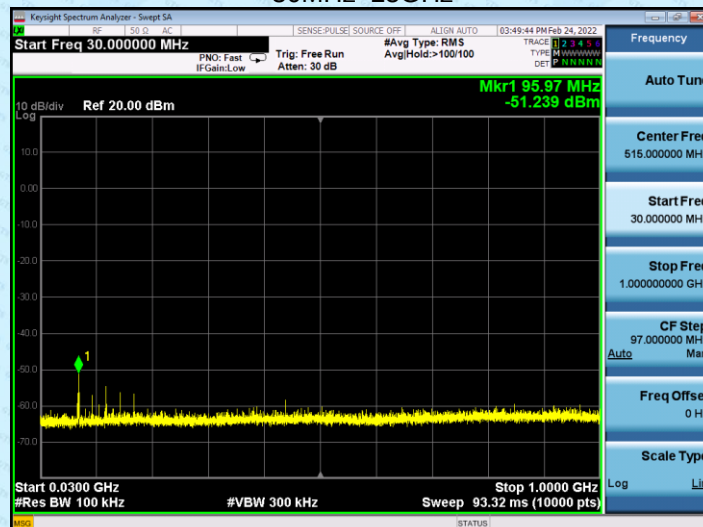


Test channel:

Middle channel



30MHz~25GHz

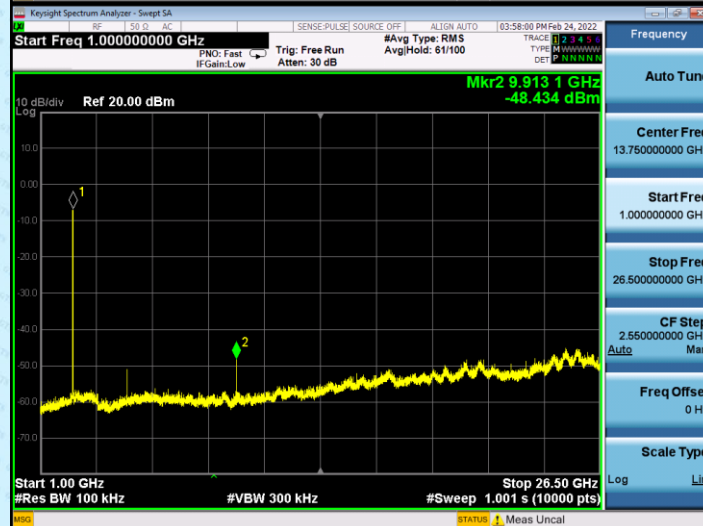
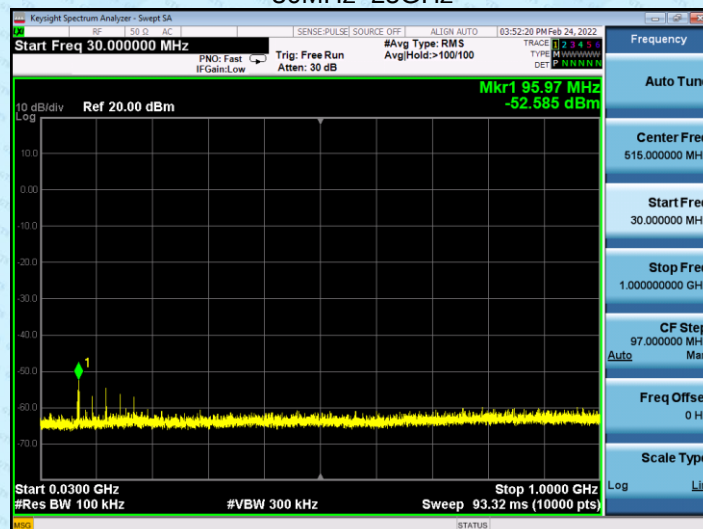


Test channel:

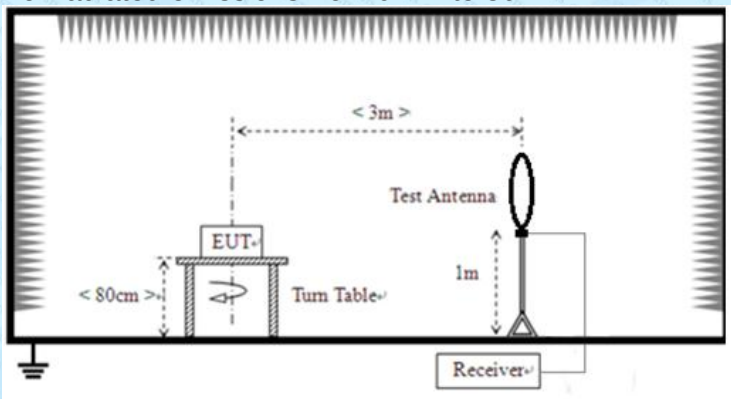
Highest channel

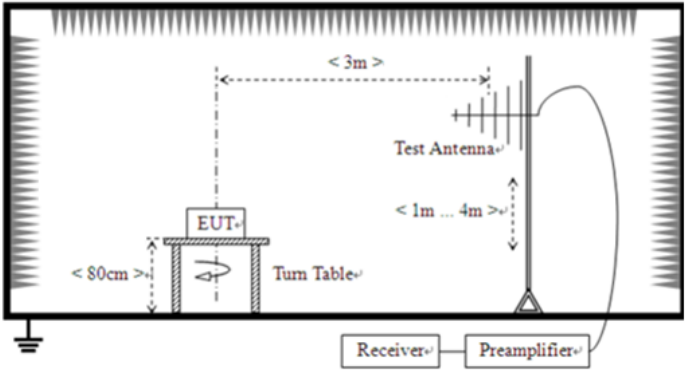
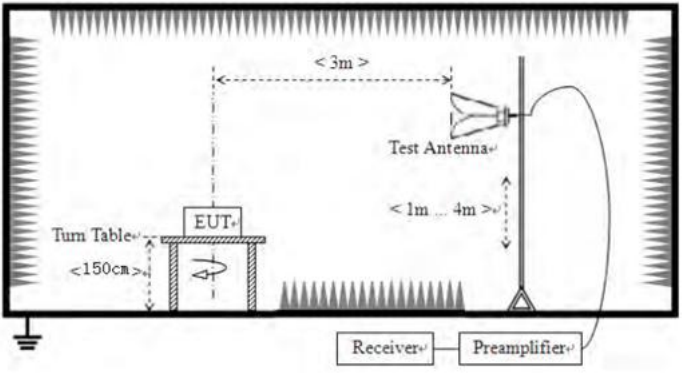


30MHz~25GHz



7.9.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Limit (uV/m)	Value	Measurement Distance	
	0.009MHz-0.490MHz	2400/F(KHz)	QP	300m	
	0.490MHz-1.705MHz	24000/F(KHz)	QP	30m	
	1.705MHz-30MHz	30	QP	30m	
	30MHz-88MHz	100	QP	3m	
	88MHz-216MHz	150	QP		
	216MHz-960MHz	200	QP		
	960MHz-1GHz	500	QP		
	Above 1GHz	500	Average		
		5000	Peak		
Test setup:	For radiated emissions from 9kHz to 30MHz				
					

	For radiated emissions from 30MHz to 1GHz  For radiated emissions above 1GHz 
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details

Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Measurement data:

Remarks:

1. During the test, pre-scan the GFSK, $\pi/4$ -DQPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.
2. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

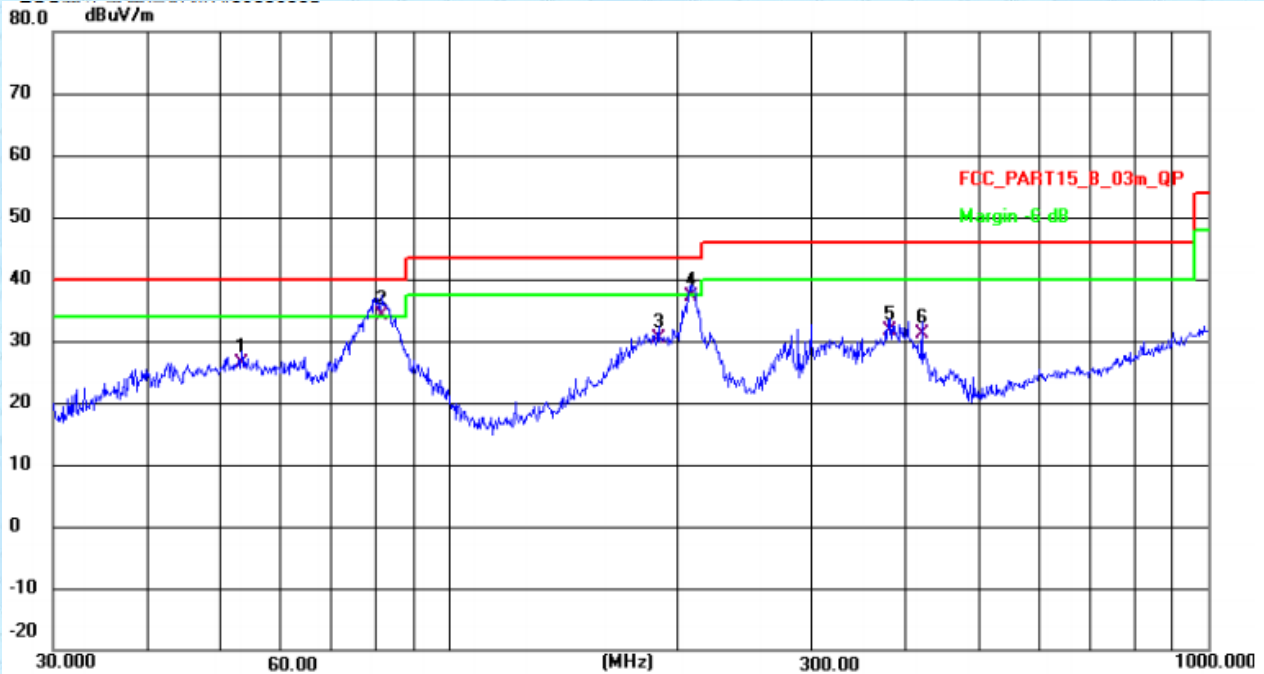
■ 9kHz~30MHz

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.

■ Below 1GHz

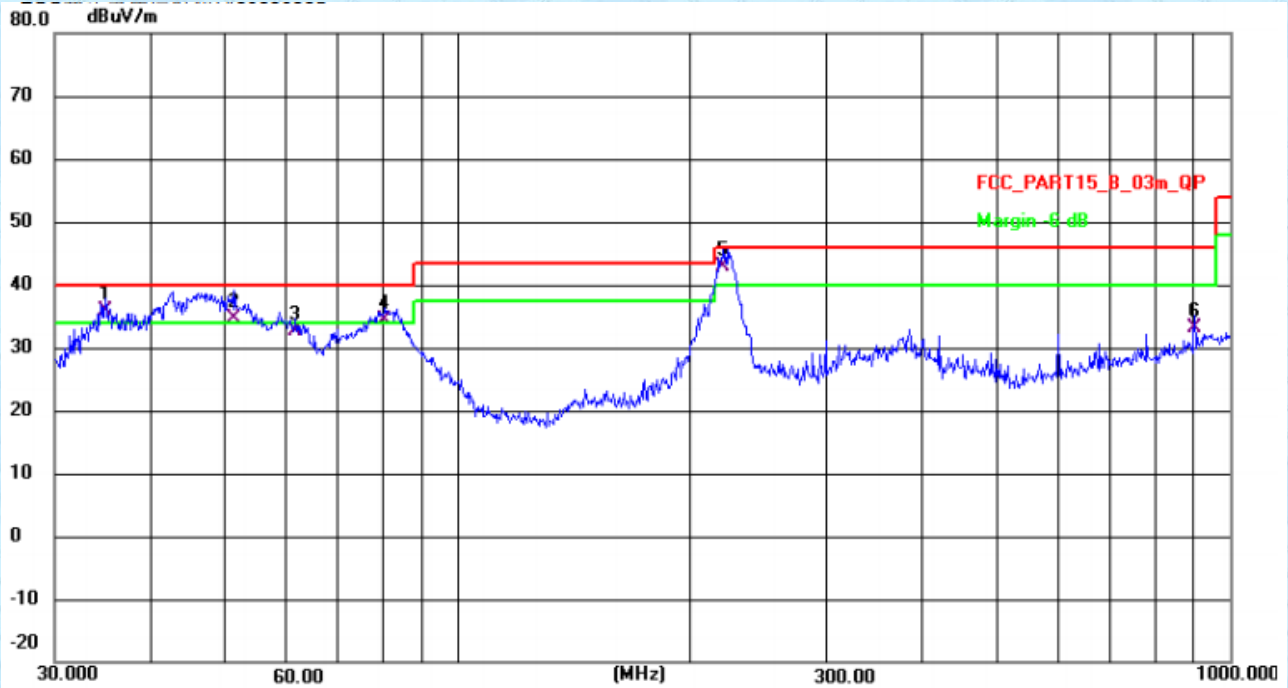
Pre-scan all test modes, found worst case at GFSK 2480MHz, and so only show the test result of GFSK 2480MHz

Horizontal:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F
1	53.1313	39.99	-13.71	26.28	40.00	-13.72	QP	100	210	P
2 *	81.4970	49.18	-15.08	34.10	40.00	-5.90	QP	200	330	P
3	188.4125	46.94	-16.61	30.33	43.50	-13.17	QP	100	141	P
4	208.5801	53.92	-16.89	37.03	43.50	-6.47	QP	200	321	P
5	381.2485	42.69	-11.07	31.62	46.00	-14.38	QP	100	159	P
6	419.1081	41.47	-10.31	31.16	46.00	-14.84	QP	100	184	P

Vertical:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F
1 !	34.8823	51.44	-15.57	35.87	40.00	-4.13	QP	100	189	P
2 !	51.3005	51.31	-16.61	34.70	40.00	-5.30	QP	100	155	P
3	61.5618	50.35	-17.64	32.71	40.00	-7.29	QP	100	189	P
4 !	80.3619	56.06	-21.68	34.38	40.00	-5.62	QP	100	327	P
5 *	220.6171	55.85	-12.85	43.00	46.00	-3.00	QP	100	138	P
6	900.1474	34.00	-0.90	33.10	46.00	-12.90	QP	100	319	P

Notes:

Final Level = Receiver Read level + Factor

■ Above 1GHz

Test channel:	Lowest channel
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804	57.25	33.15	3.91	35.04	59.27	74.00	-14.73	Vertical
7206	50.5	33.18	3.92	35.04	52.56	74.00	-21.44	Vertical
9608	61.10	33.22	3.94	35.04	63.22	74.00	-10.78	Vertical
12010	46.23	33.11	3.89	35.04	48.19	74.00	-25.81	Vertical
4804	56.35	33.15	3.91	35.04	58.37	74.00	-15.63	Horizontal
7206	50.01	33.18	3.92	35.04	52.07	74.00	-21.93	Horizontal
9608	59.88	33.22	3.94	35.04	62.00	74.00	-12.00	Horizontal
12010	45.53	33.11	3.89	35.04	47.49	74.00	-26.51	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804	33.01	33.15	3.91	35.04	35.03	54.00	-18.97	Vertical
7206	24.84	33.18	3.92	35.04	26.9	54.00	-27.1	Vertical
9608	34.77	33.22	3.94	35.04	36.89	54.00	-17.11	Vertical
4804	30.33	33.18	3.91	35.04	32.38	54.00	-21.62	Horizontal
7208	23.64	33.22	3.92	35.04	25.74	54.00	-28.26	Horizontal
9608	32.97	33.11	3.94	35.04	34.98	54.00	-19.02	Horizontal

Test channel:	Middle channel
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4882	55.09	33.24	3.96	35.04	57.25	74.00	-16.75	Vertical
7323	50.33	33.20	3.93	35.04	52.42	74.00	-21.58	Vertical
9764	60.09	33.24	3.96	35.04	62.25	74.00	-11.75	Vertical
4882	57.67	33.16	3.91	35.04	59.70	74.00	-14.30	Horizontal
7323	48.93	33.20	3.93	35.04	51.02	74.00	-22.98	Horizontal
9764	59.09	33.24	3.96	35.04	61.25	74.00	-12.75	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4882	34.94	33.17	3.91	35.04	36.98	54.00	-17.02	Vertical
7323	24.79	33.2	3.93	35.04	26.88	54.00	-27.12	Vertical
9764	35.58	33.23	3.96	35.04	37.73	54.00	-16.27	Vertical
4882	33.64	33.17	3.91	35.04	35.68	54.00	-18.32	Horizontal
7323	22.99	33.20	3.93	35.04	25.08	54.00	-28.92	Horizontal
9764	34.18	33.23	3.96	35.04	36.33	54.00	-17.67	Horizontal

Test channel:	Highest channel
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960	58.8	33.19	3.91	35.04	60.86	74.00	-13.14	Vertical
7440	49.72	33.23	3.97	35.04	51.88	74.00	-22.12	Vertical
9920	60.19	33.26	3.99	35.04	62.4	74.00	-11.6	Vertical
4960	57.82	33.19	3.91	35.04	59.88	74.00	-14.12	Horizontal
7440	47.95	33.23	3.97	35.04	50.11	74.00	-23.89	Horizontal
9920	59.39	33.26	3.99	35.04	61.6	74.00	-12.4	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960	32.76	33.19	3.91	35.04	34.82	54.00	-19.18	Vertical
7440	24.39	33.22	3.97	35.04	26.54	54.00	-27.46	Vertical
9920	36.23	33.25	3.99	35.04	38.43	54.00	-15.57	Vertical
4960	31.86	33.19	3.91	35.04	33.92	54.00	-20.08	Horizontal
7440	23.59	33.22	3.97	35.04	25.74	54.00	-28.26	Horizontal
9920	35.73	33.25	3.99	35.04	37.93	54.00	-16.07	Horizontal

Remarks:

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.
4. The test data shows only the worst case GFSK mode

8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Construcrtional Details

Reference to the **appendix II** for details.

-----End-----