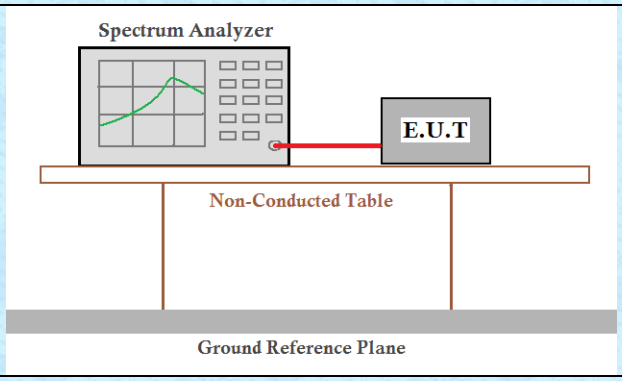
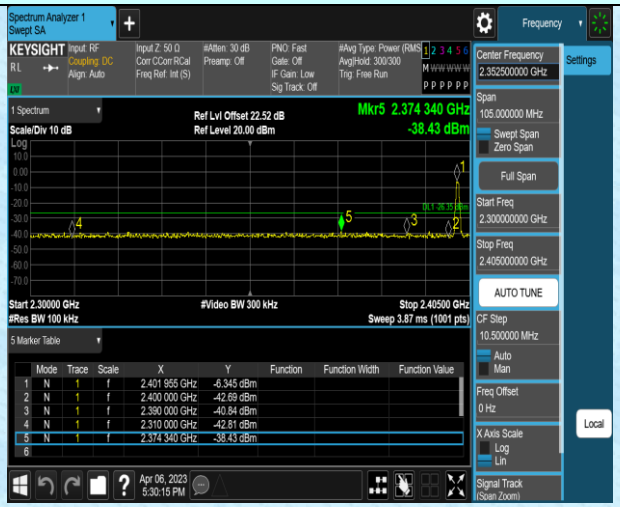
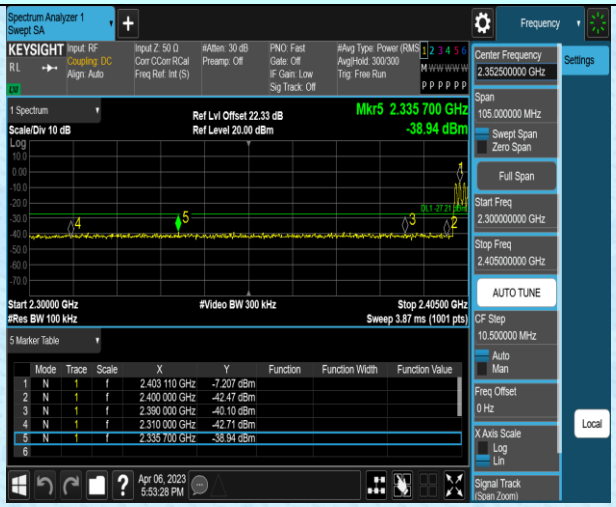
7.8 Band Edge & Spurious Emission

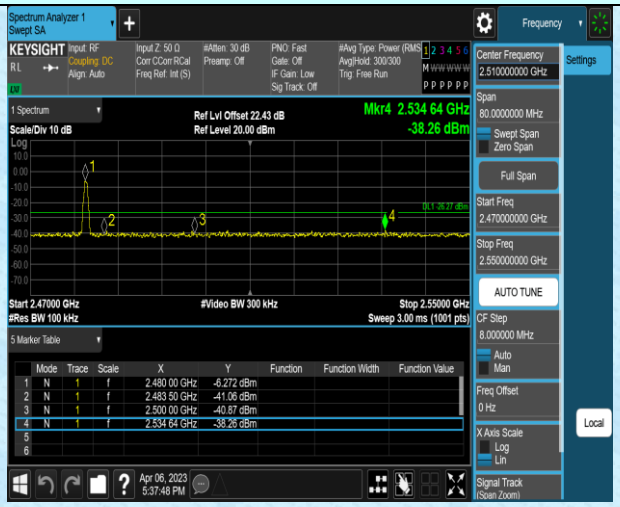
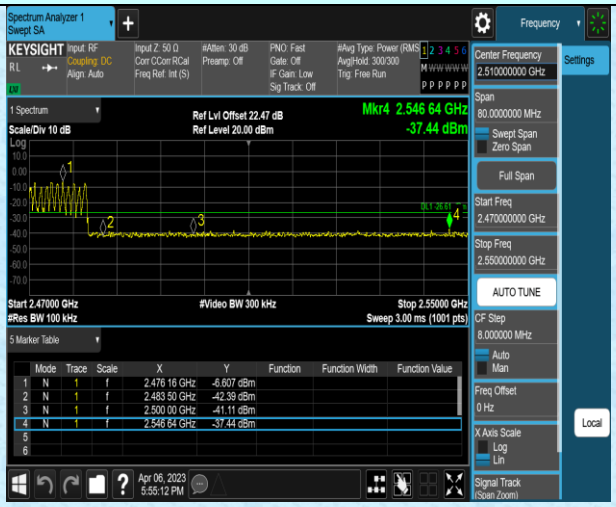
7.8.1 Conducted Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
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

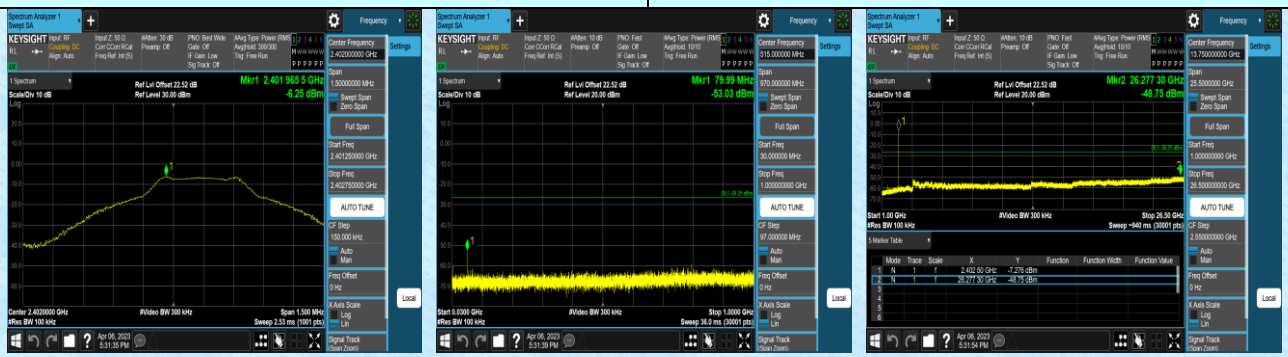
Test plot as follows:

GFSK Mode:

Test channel:	Lowest channel
	
No-hopping mode	Hopping mode

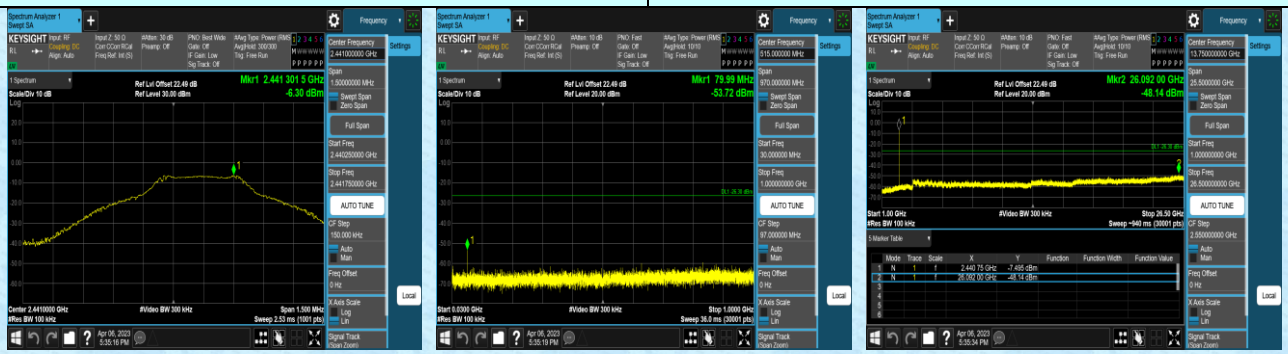
Test channel:	Highest channel
	
No-hopping mode	Hopping mode

Test channel:	Lowest channel



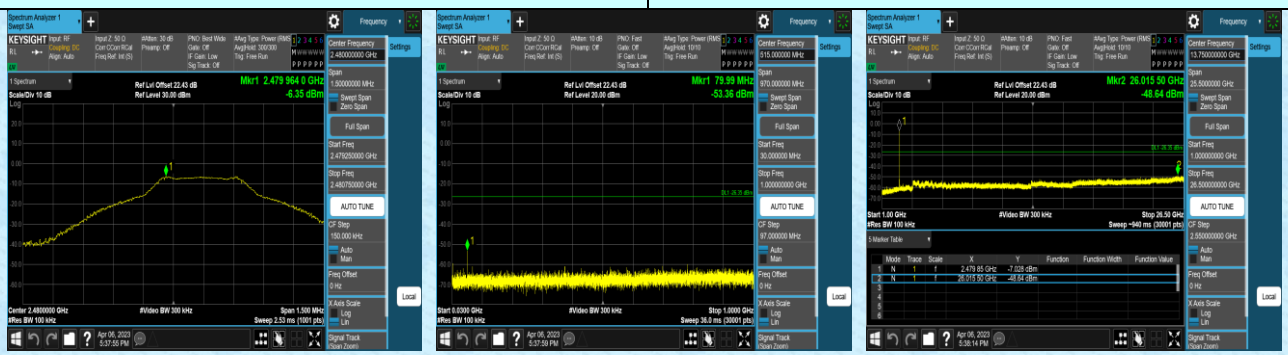
30MHz~26.5GHz

Test channel:	Middle channel



30MHz~26.5GHz

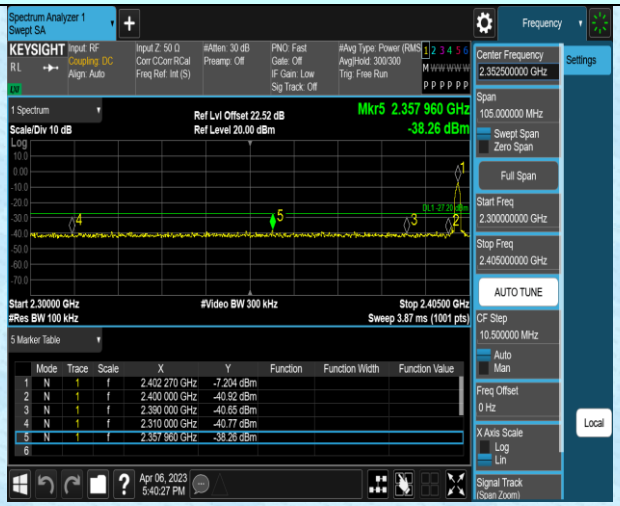
Test channel:	Highest channel



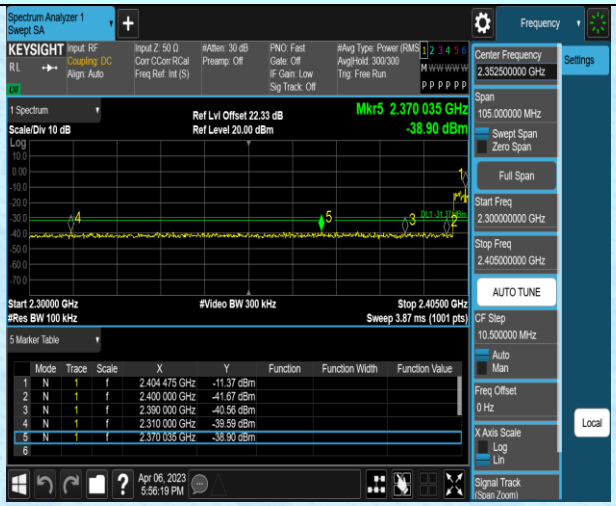
30MHz~26.5GHz

π/4-DQPSK Mode:

Test channel:	Lowest channel

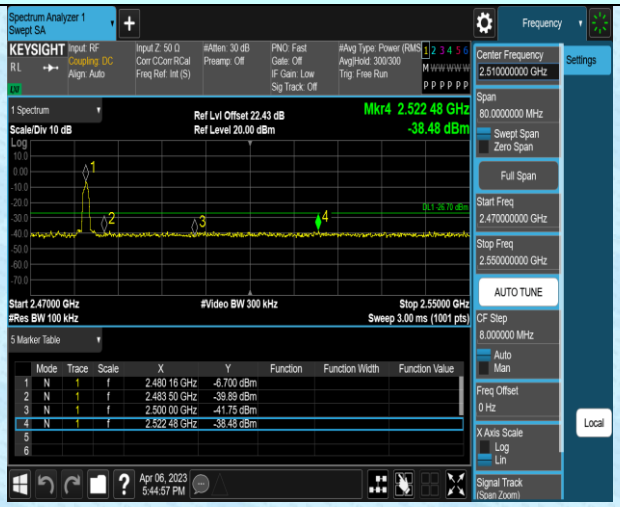


No-hopping mode

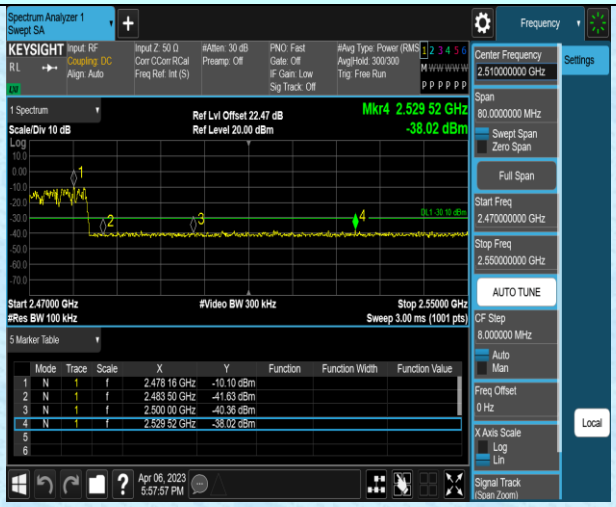


Hopping mode

Test channel:	Highest channel

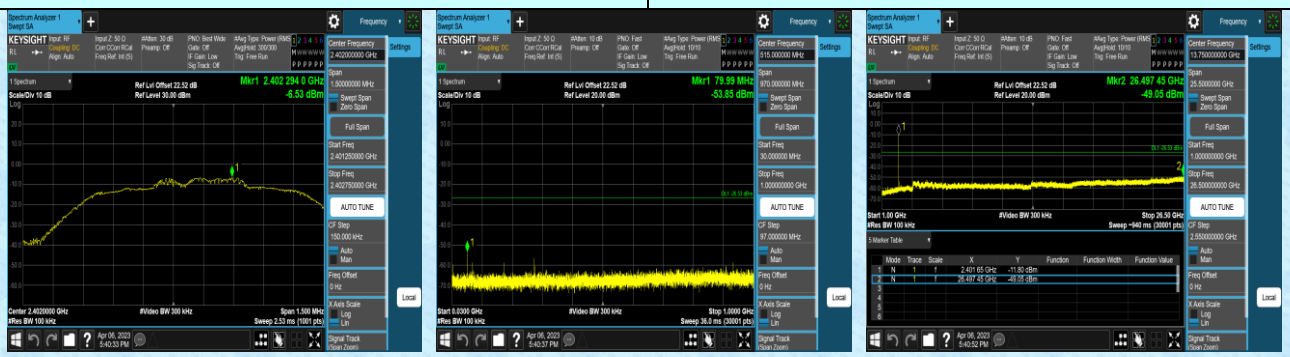


No-hopping mode



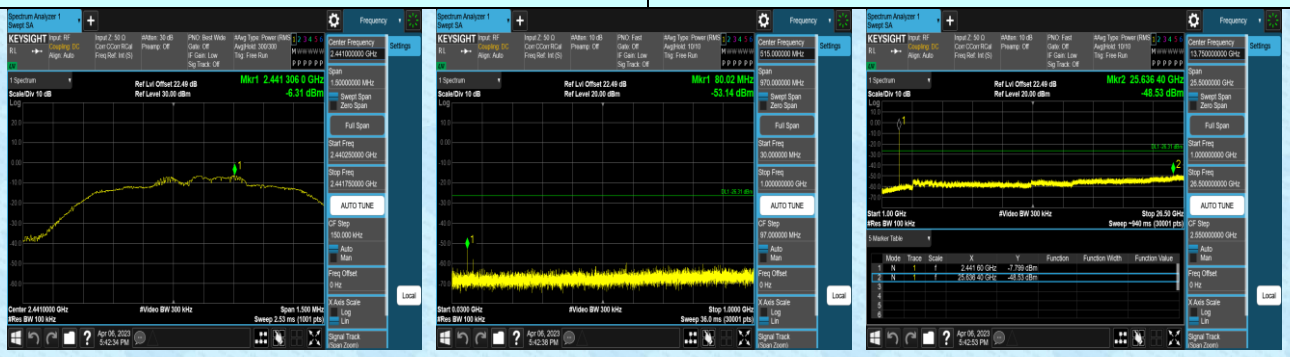
Hopping mode

Test channel:	Lowest channel



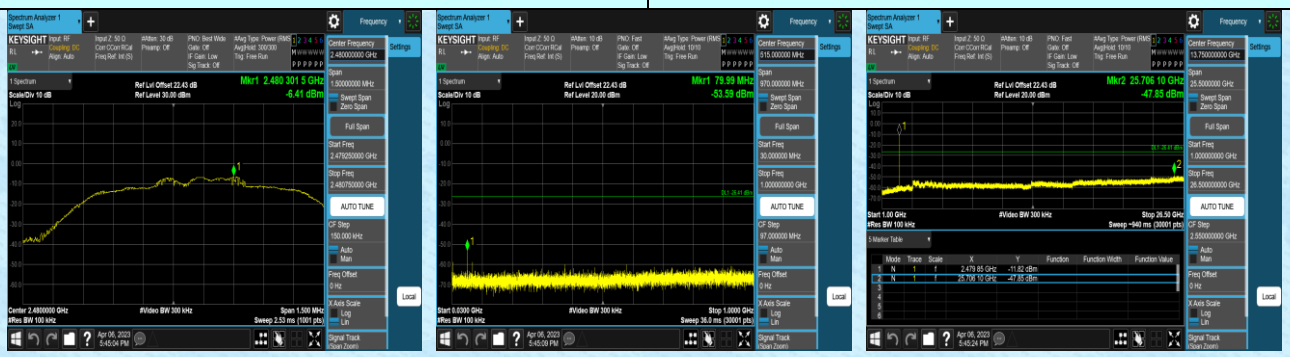
30MHz~26.5GHz

Test channel:	Middle channel



30MHz~26.5GHz

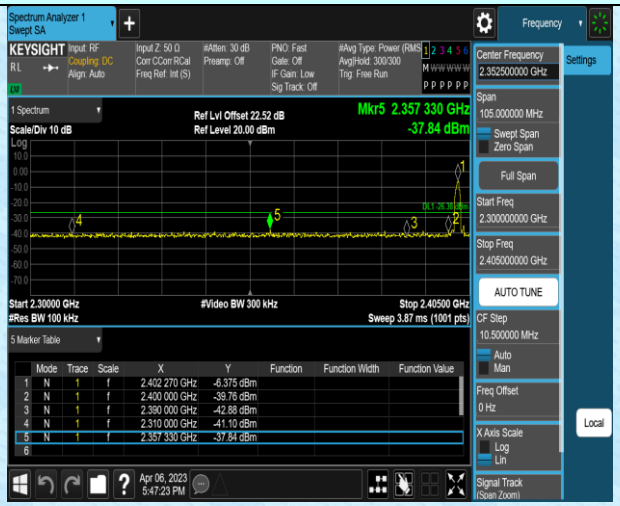
Test channel:	Highest channel



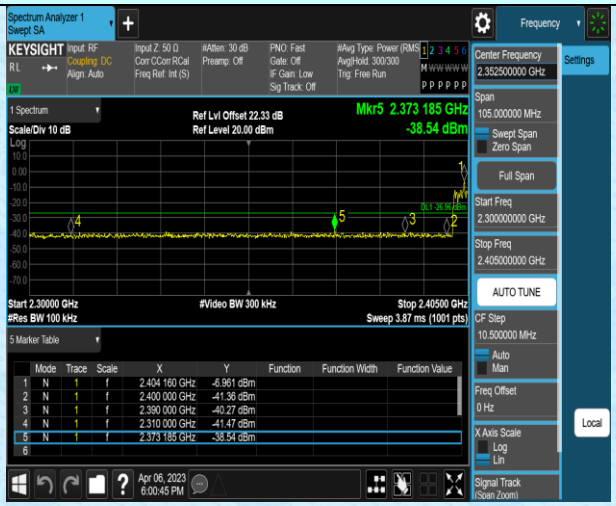
30MHz~26.5GHz

8-DPSK Mode:

Test channel:	Lowest channel

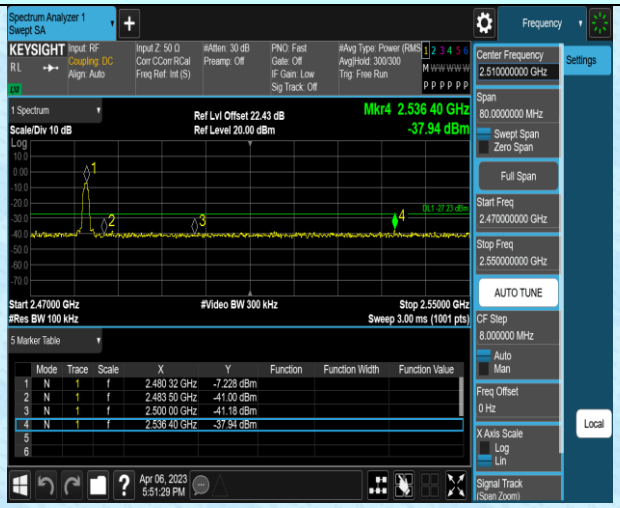


No-hopping mode

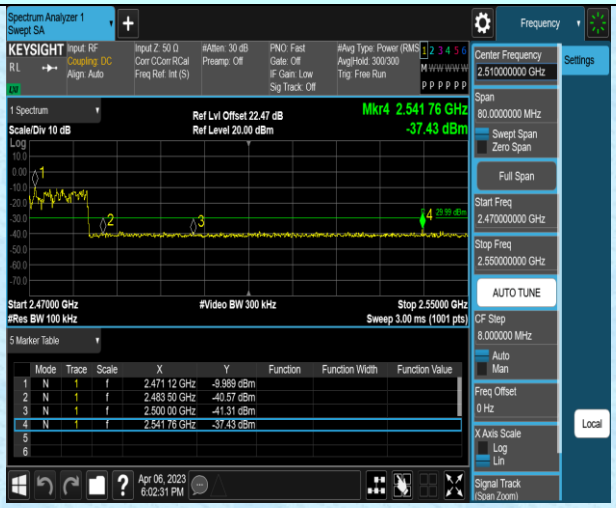


Hopping mode

Test channel:	Highest channel

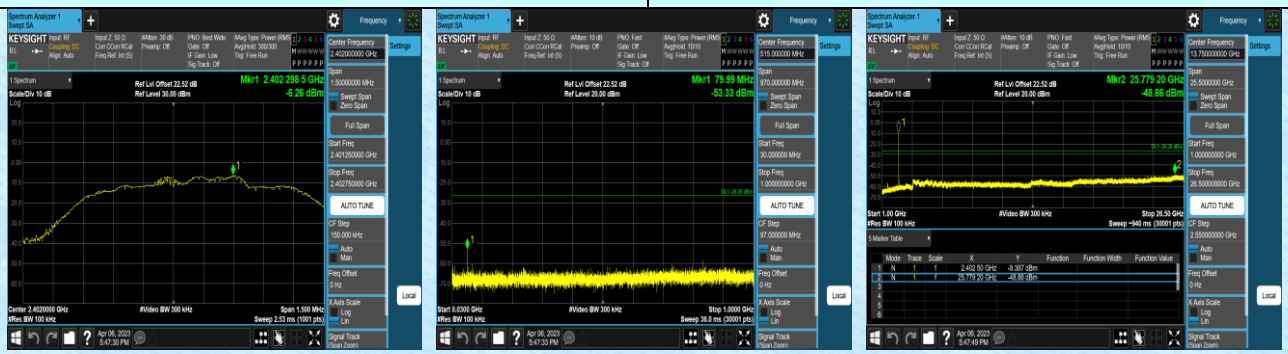


No-hopping mode



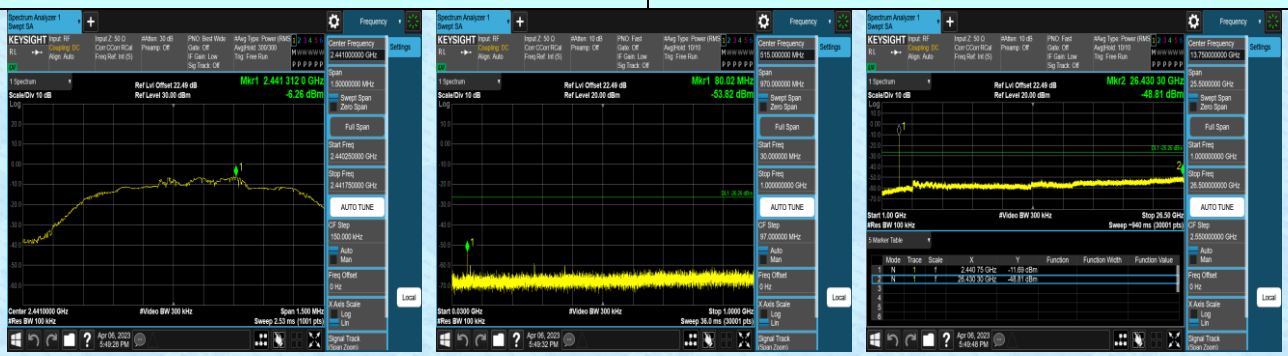
Hopping mode

Test channel:	Lowest channel



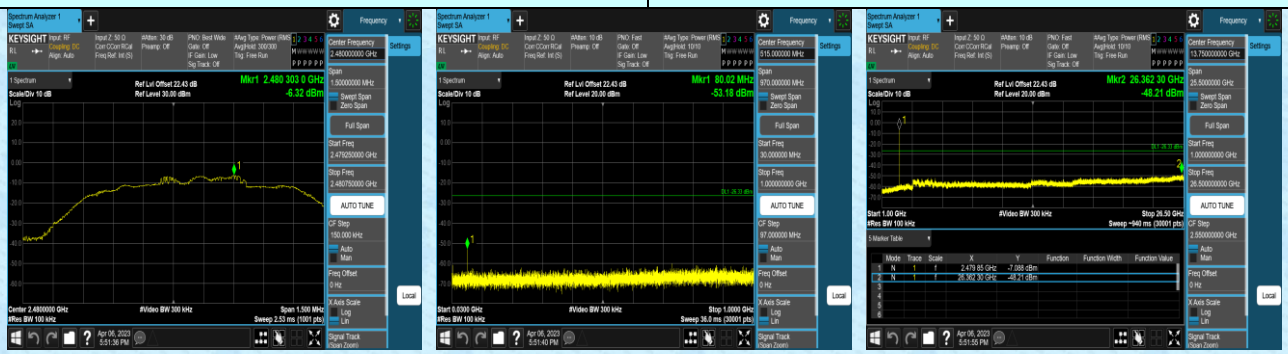
30MHz~26.5GHz

Test channel:	Middle channel



30MHz~26.5GHz

Test channel:	Highest channel



30MHz~26.5GHz

7.8.2 Radiated 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

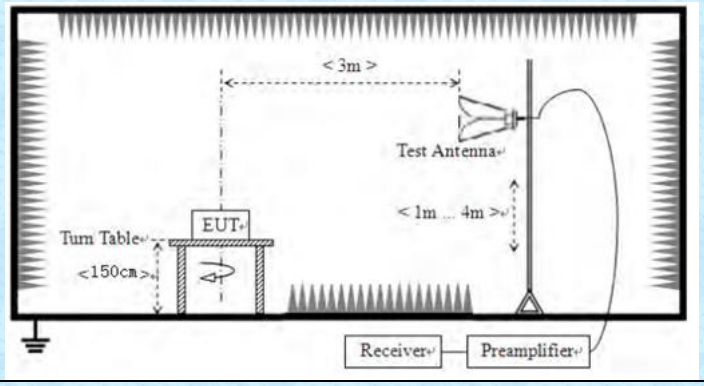
Receiver setup:

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:

Remarks:

1. *During the test, pre-scan the GFSK, π/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.*

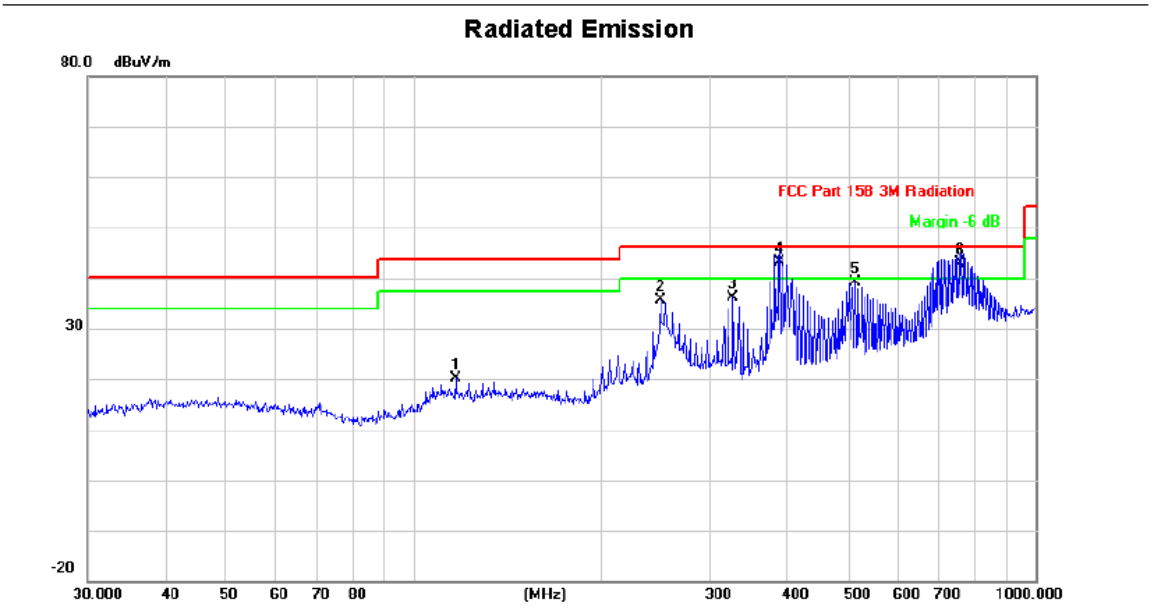
■ **9kHz~30MHz**

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**

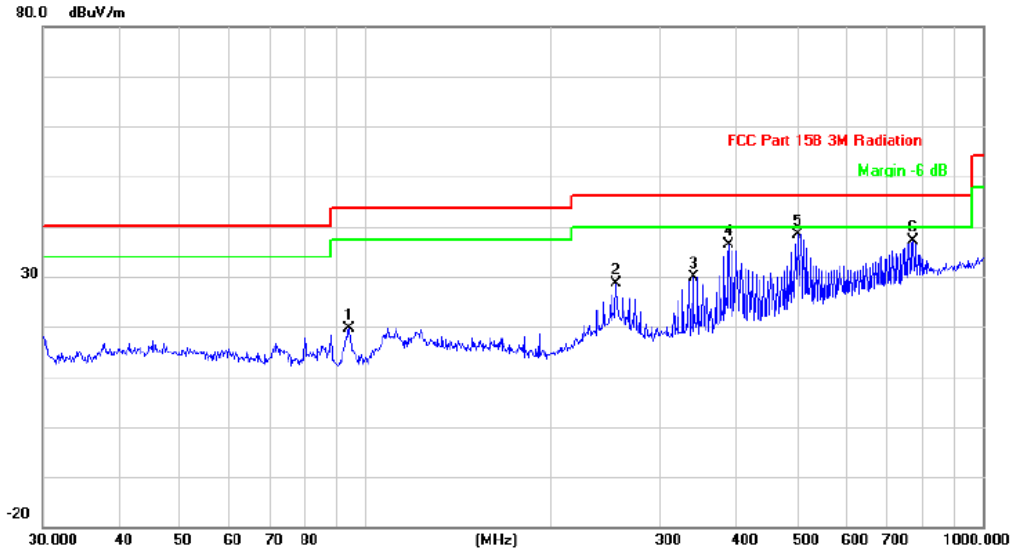
Pre-scan all test modes, found worst case at GFSK 2402MHz, and so only show the test result of GFSK 2402MHz

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		116.9495	31.44	-11.23	20.21	43.50	-23.29	QP
2		249.4250	45.20	-9.61	35.59	46.00	-10.41	QP
3		326.7395	43.64	-7.61	36.03	46.00	-9.97	QP
4	*	387.9920	49.14	-6.04	43.10	46.00	-2.90	QP
5		513.6331	42.18	-2.98	39.20	46.00	-6.80	QP
6	!	755.3873	40.82	2.03	42.85	46.00	-3.15	QP

Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		94.0978	33.61	-13.86	19.75	43.50	-23.75	QP
2		254.7283	38.03	-9.50	28.53	46.00	-17.47	QP
3		339.5887	37.18	-7.24	29.94	46.00	-16.06	QP
4		387.9920	42.32	-6.04	36.28	46.00	-9.72	QP
5	*	501.1790	41.82	-3.32	38.50	46.00	-7.50	QP
6		771.4485	34.67	2.36	37.03	46.00	-8.97	QP

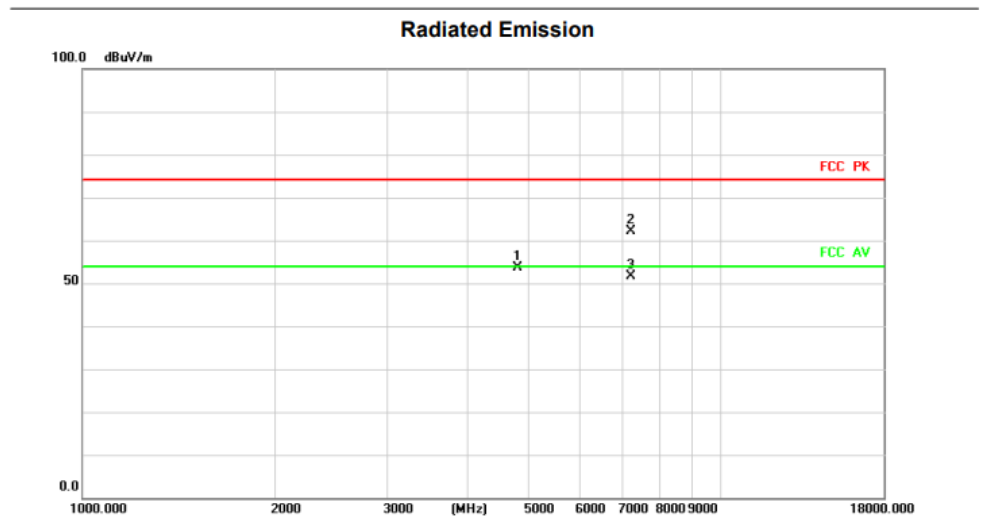
Remarks:

1. *Measurement Value = Reading Level + Correct Factor.*
2. *Margin Level = Measurement Value - Limit Value.*
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, π/4-DQPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.*

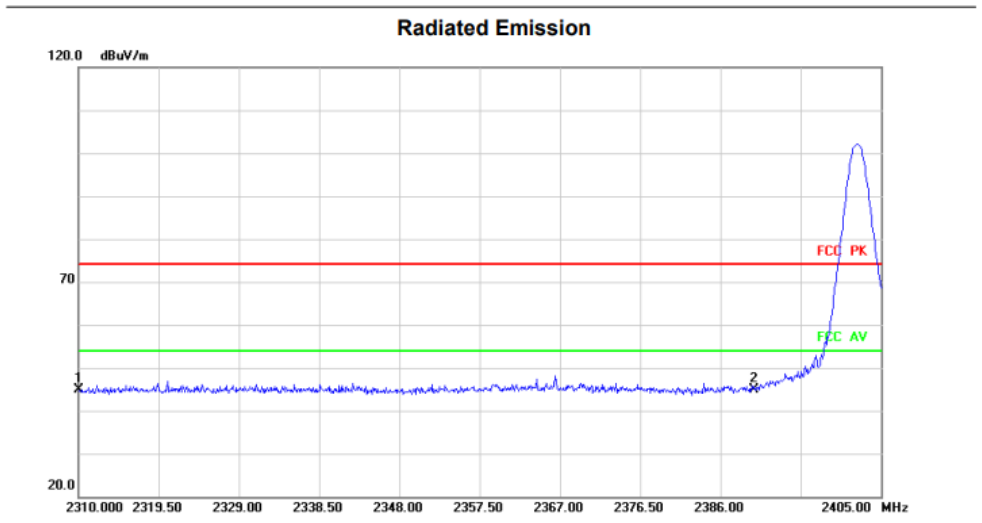
■ **Above 1GHz**

GFSK: 2402MHz

Horizontal

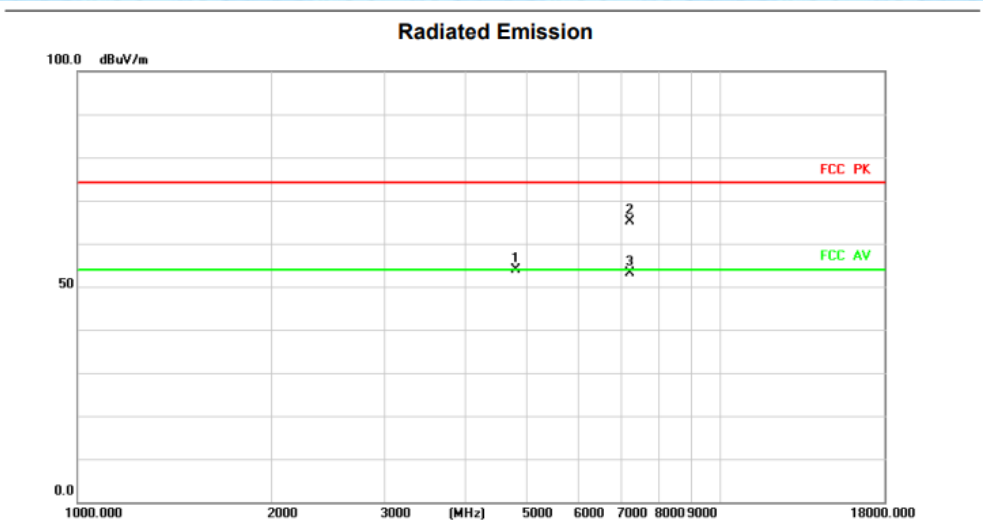


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4804.000	55.74	-1.99	53.75	74.00	-20.25	peak			
2		7206.000	57.83	4.37	62.20	74.00	-11.80	peak			
3	*	7206.000	47.17	4.37	51.54	54.00	-2.46	AVG			

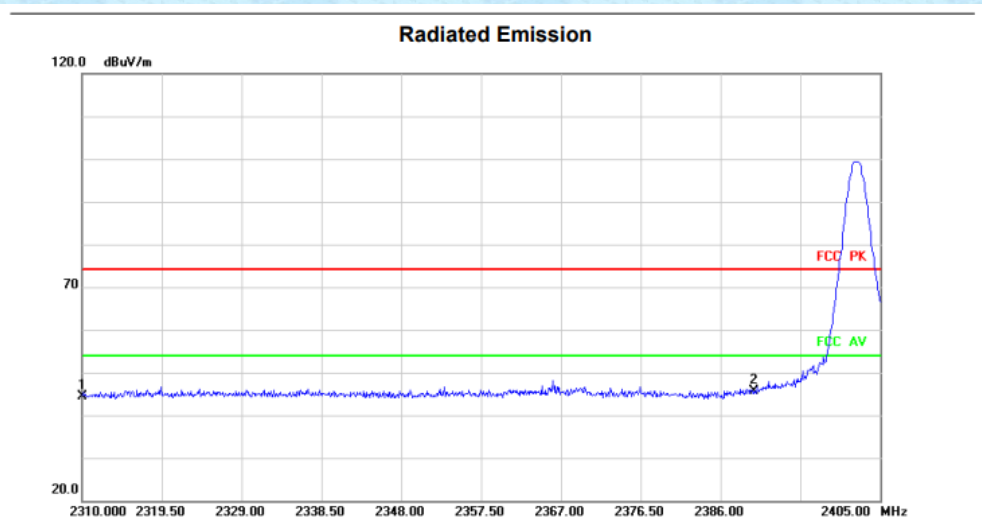


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2310.000	54.72	-9.81	44.91	74.00	-29.09	peak			
2		2390.000	54.47	-9.59	44.88	74.00	-29.12	peak			

Vertical



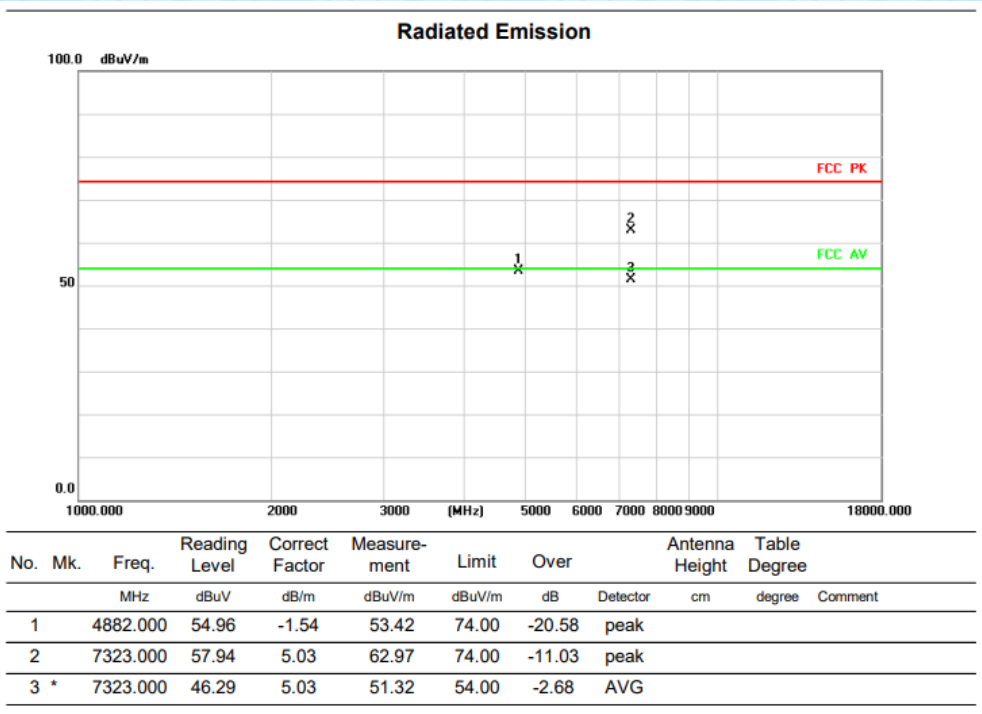
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4804.000	55.77	-1.99	53.78	74.00	-20.22	peak			
2		7206.000	60.69	4.37	65.06	74.00	-8.94	peak			
3	*	7206.000	48.65	4.37	53.02	54.00	-0.98	AVG			



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	54.11	-9.81	44.30	74.00	-29.70	peak			
2	*	2390.000	55.29	-9.59	45.70	74.00	-28.30	peak			

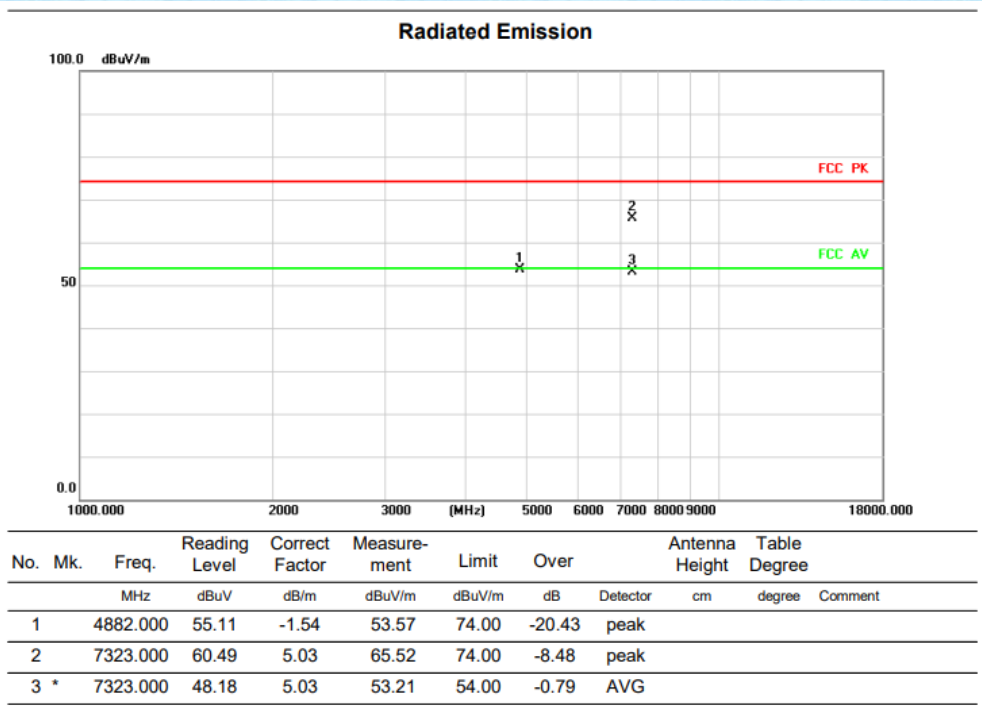
2441MHz

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4882.000	54.96	-1.54	53.42	74.00	-20.58	peak			
2		7323.000	57.94	5.03	62.97	74.00	-11.03	peak			
3	*	7323.000	46.29	5.03	51.32	54.00	-2.68	AVG			

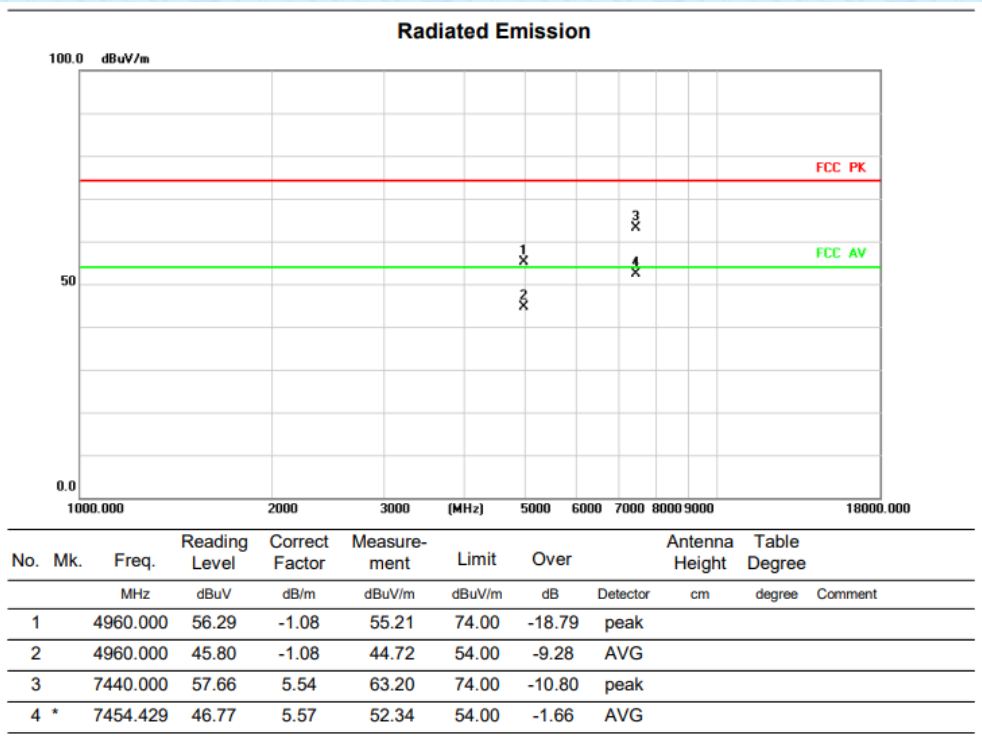
Vertical



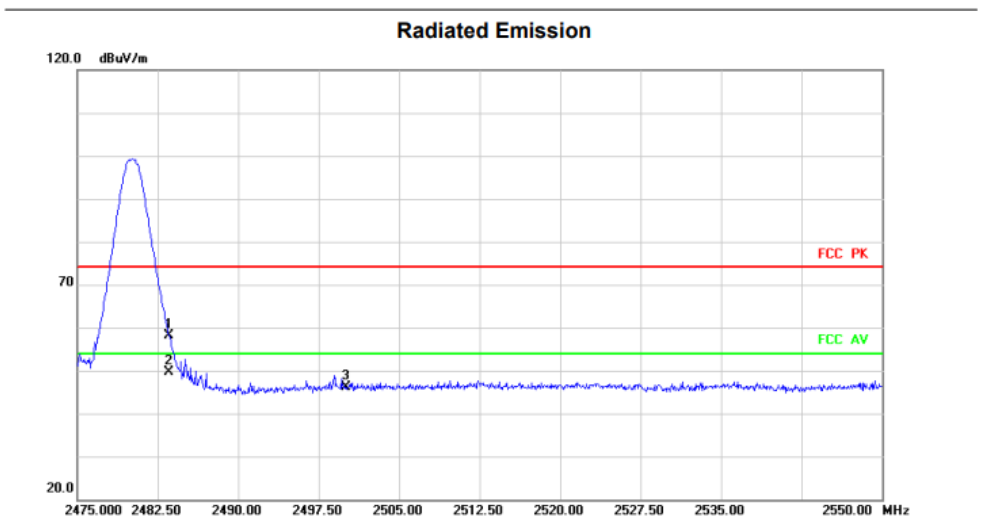
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4882.000	55.11	-1.54	53.57	74.00	-20.43	peak			
2		7323.000	60.49	5.03	65.52	74.00	-8.48	peak			
3	*	7323.000	48.18	5.03	53.21	54.00	-0.79	AVG			

2480MHz

Horizontal

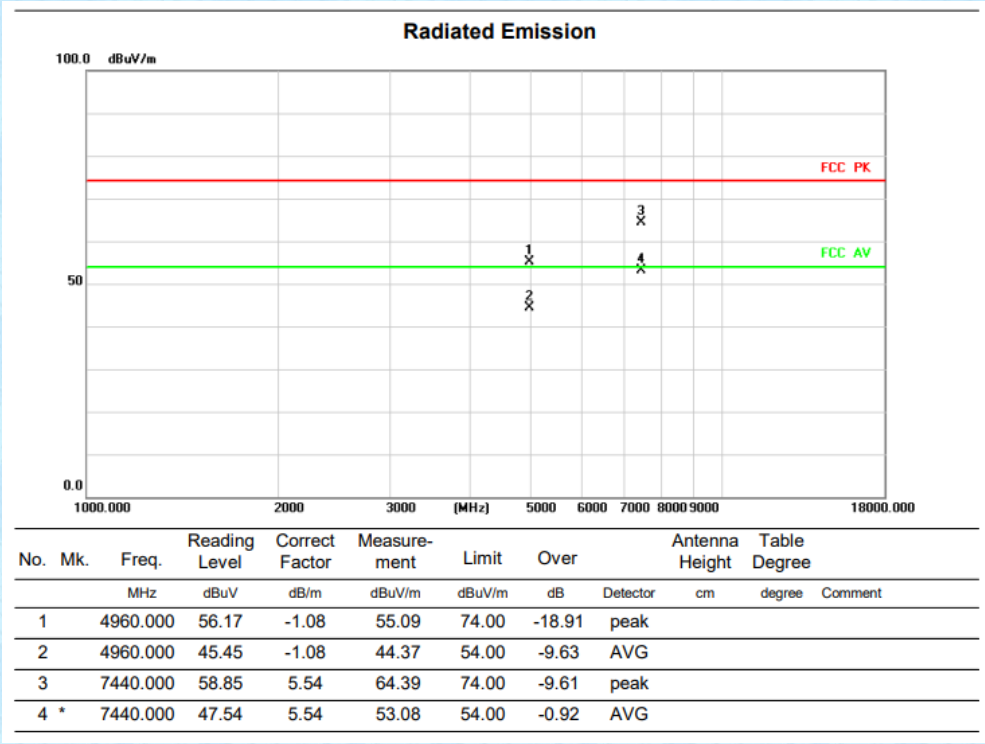


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4960.000	56.29	-1.08	55.21	74.00	-18.79	peak			
2		4960.000	45.80	-1.08	44.72	54.00	-9.28	AVG			
3		7440.000	57.66	5.54	63.20	74.00	-10.80	peak			
4	*	7454.429	46.77	5.57	52.34	54.00	-1.66	AVG			

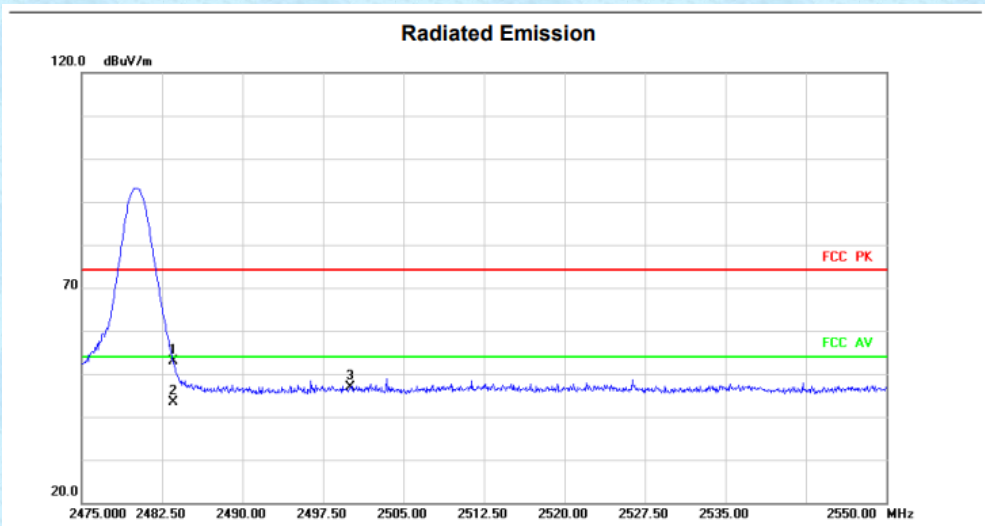


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2483.500	67.07	-8.91	58.16	74.00	-15.84	peak			
2	*	2483.500	58.48	-8.91	49.57	54.00	-4.43	AVG			
3		2500.000	54.84	-8.78	46.06	74.00	-27.94	peak			

Vertical



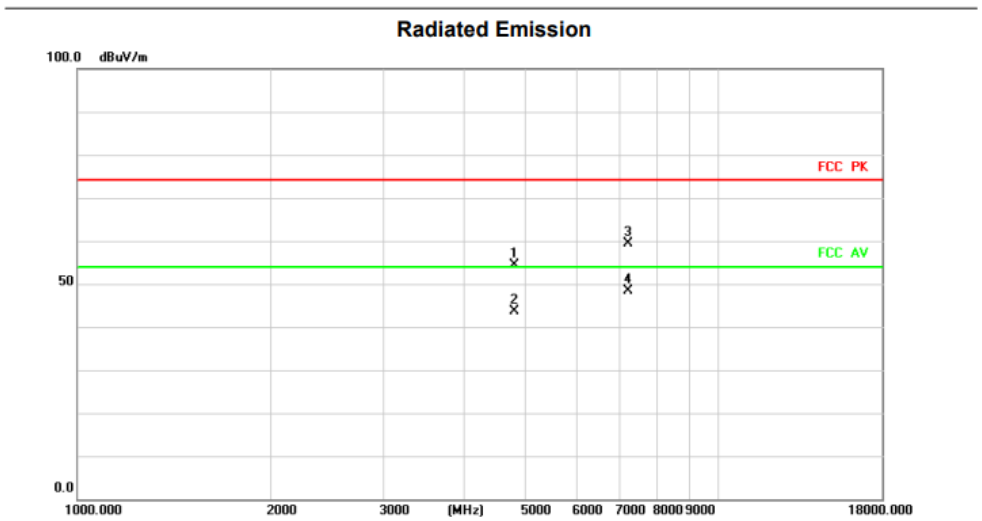
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4960.000	56.17	-1.08	55.09	74.00	-18.91	peak			
2		4960.000	45.45	-1.08	44.37	54.00	-9.63	AVG			
3		7440.000	58.85	5.54	64.39	74.00	-9.61	peak			
4	*	7440.000	47.54	5.54	53.08	54.00	-0.92	AVG			



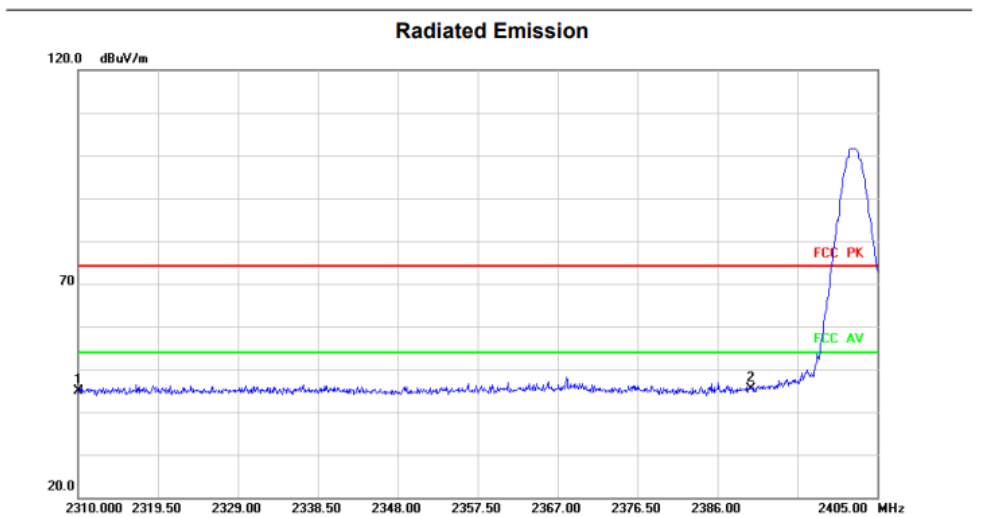
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2483.500	61.73	-8.91	52.82	74.00	-21.18	peak			
2	*	2483.500	52.37	-8.91	43.46	54.00	-10.54	AVG			
3		2500.000	55.74	-8.78	46.96	74.00	-27.04	peak			

π/4-DQPSK: 2402 MHz

Horizontal

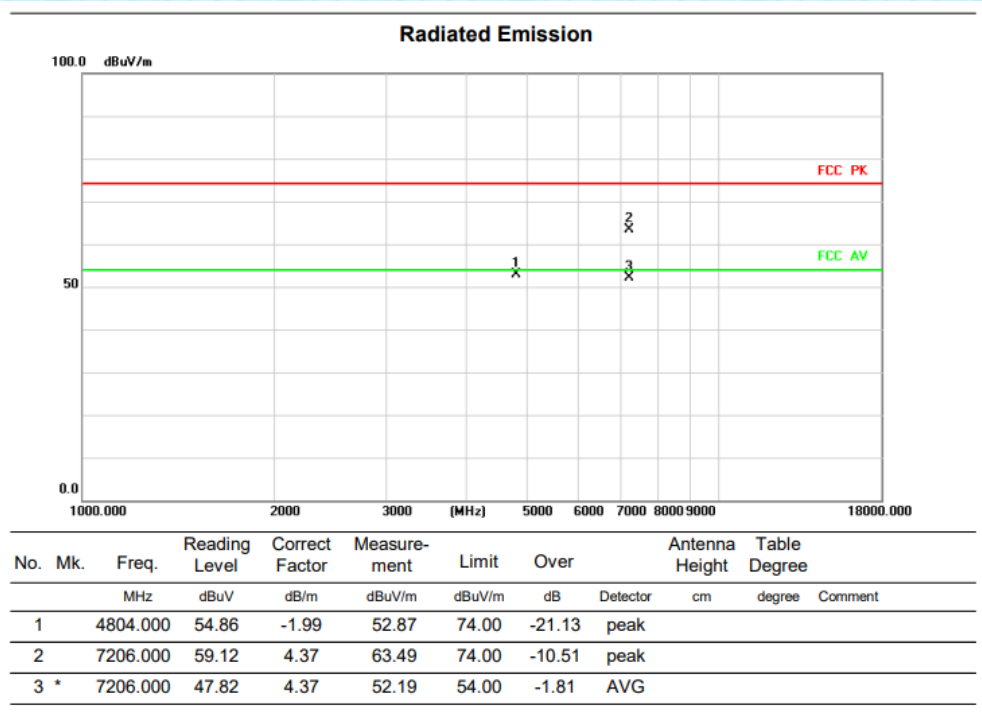


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4804.000	56.38	-1.99	54.39	74.00	-19.61	peak			
2		4804.000	45.57	-1.99	43.58	54.00	-10.42	AVG			
3		7206.000	54.93	4.37	59.30	74.00	-14.70	peak			
4	*	7206.000	43.96	4.37	48.33	54.00	-5.67	AVG			

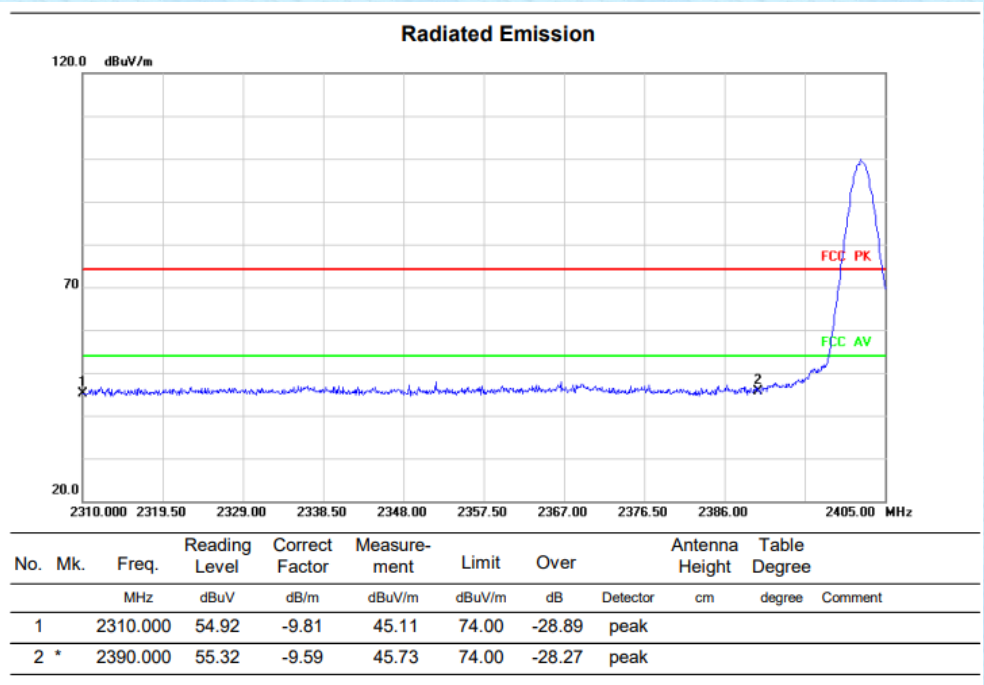


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	54.59	-9.81	44.78	74.00	-29.22	peak			
2	*	2390.000	54.92	-9.59	45.33	74.00	-28.67	peak			

Vertical



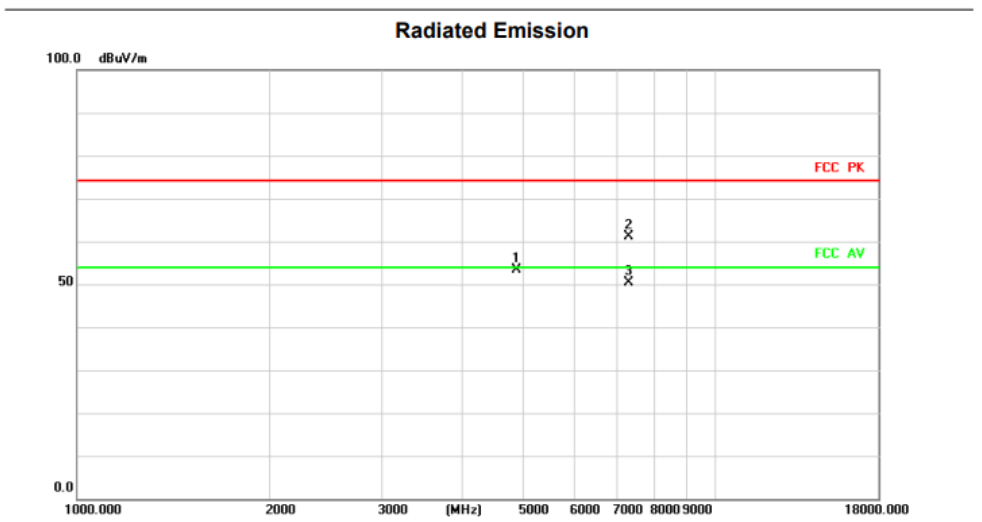
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4804.000	54.86	-1.99	52.87	74.00	-21.13	peak			
2		7206.000	59.12	4.37	63.49	74.00	-10.51	peak			
3	*	7206.000	47.82	4.37	52.19	54.00	-1.81	AVG			



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	54.92	-9.81	45.11	74.00	-28.89	peak			
2	*	2390.000	55.32	-9.59	45.73	74.00	-28.27	peak			

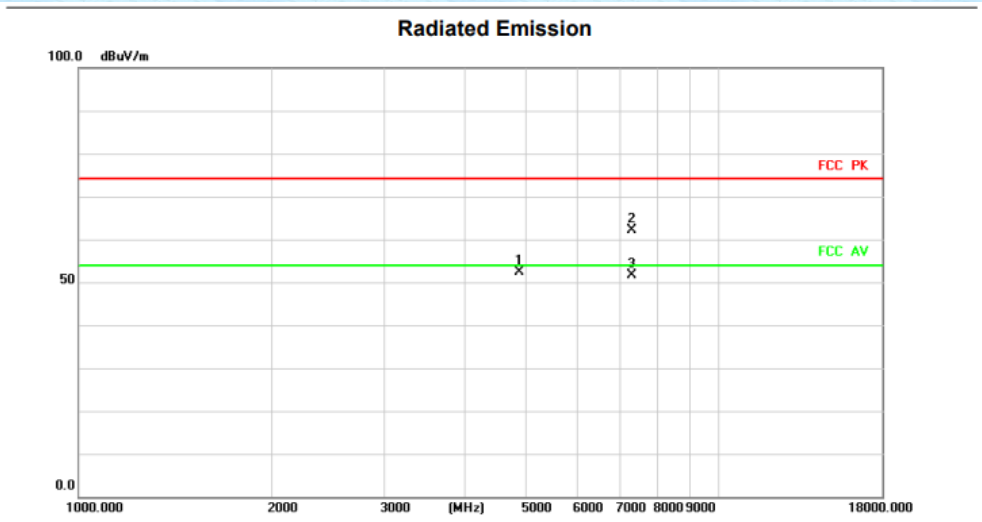
2441MHz

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4882.000	54.92	-1.54	53.38	74.00	-20.62	peak			
2		7323.000	56.04	5.03	61.07	74.00	-12.93	peak			
3	*	7323.000	45.23	5.03	50.26	54.00	-3.74	AVG			

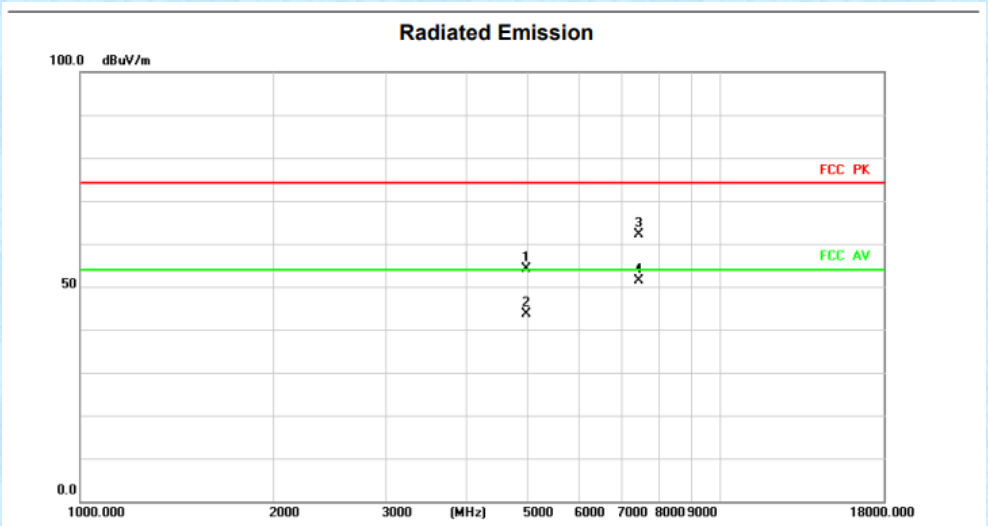
Vertical



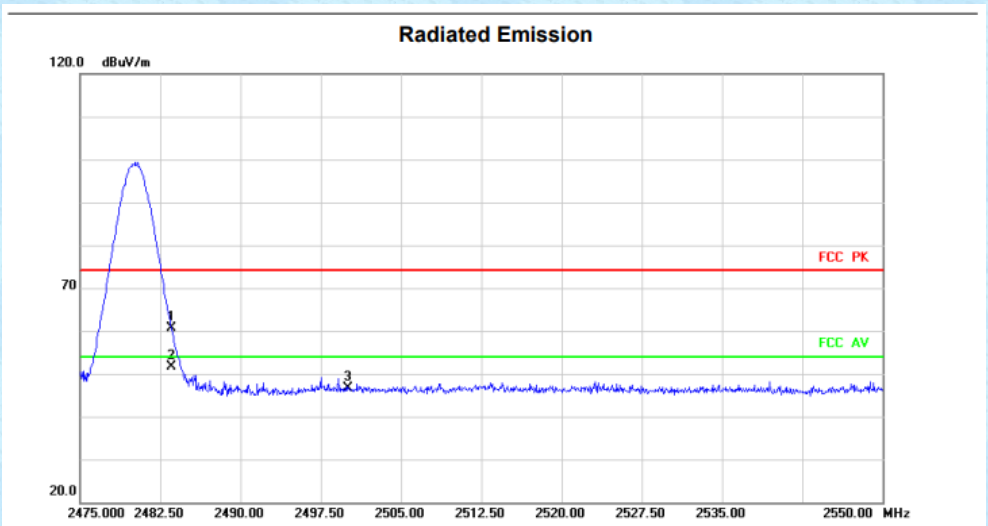
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4882.000	53.94	-1.54	52.40	74.00	-21.60	peak			
2		7323.000	57.00	5.03	62.03	74.00	-11.97	peak			
3	*	7323.000	46.60	5.03	51.63	54.00	-2.37	AVG			

2480MHz

Horizontal

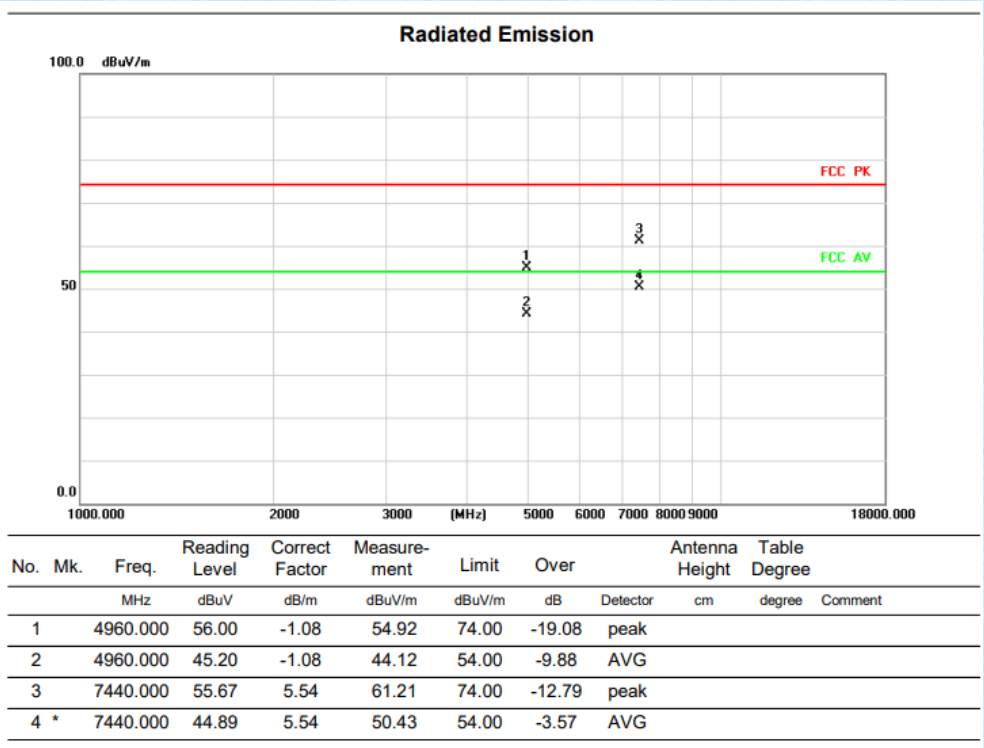


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4960.000	55.27	-1.08	54.19	74.00	-19.81	peak			
2		4960.000	44.65	-1.08	43.57	54.00	-10.43	AVG			
3		7440.000	56.51	5.54	62.05	74.00	-11.95	peak			
4	*	7440.000	45.80	5.54	51.34	54.00	-2.66	AVG			

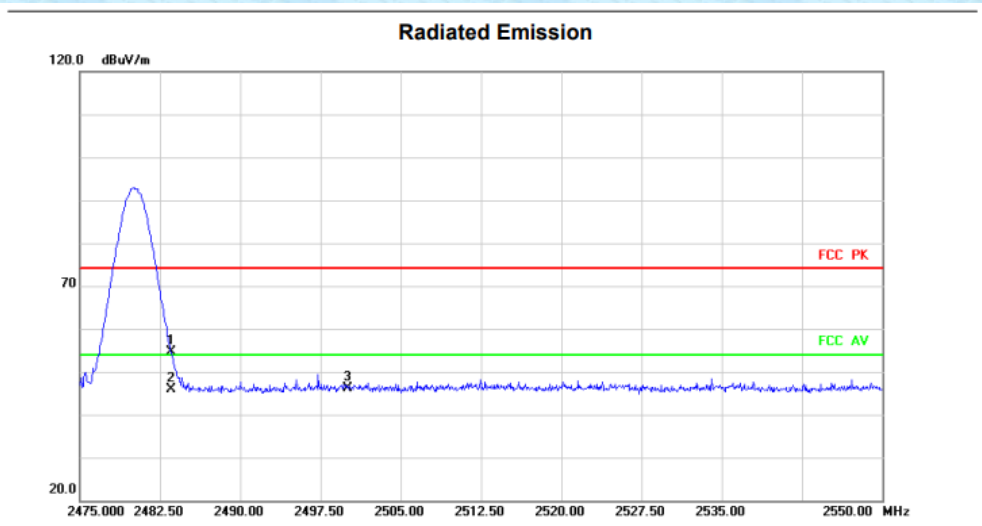


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2483.500	69.47	-8.91	60.56	74.00	-13.44	peak			
2	*	2483.500	60.53	-8.91	51.62	54.00	-2.38	AVG			
3		2500.000	55.41	-8.78	46.63	74.00	-27.37	peak			

Vertical



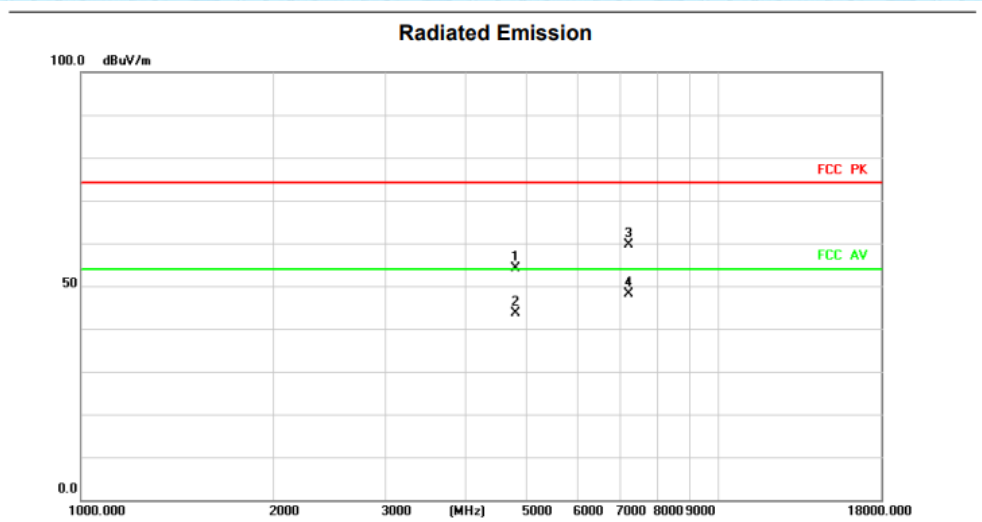
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4960.000	56.00	-1.08	54.92	74.00	-19.08	peak			
2		4960.000	45.20	-1.08	44.12	54.00	-9.88	AVG			
3		7440.000	55.67	5.54	61.21	74.00	-12.79	peak			
4	*	7440.000	44.89	5.54	50.43	54.00	-3.57	AVG			



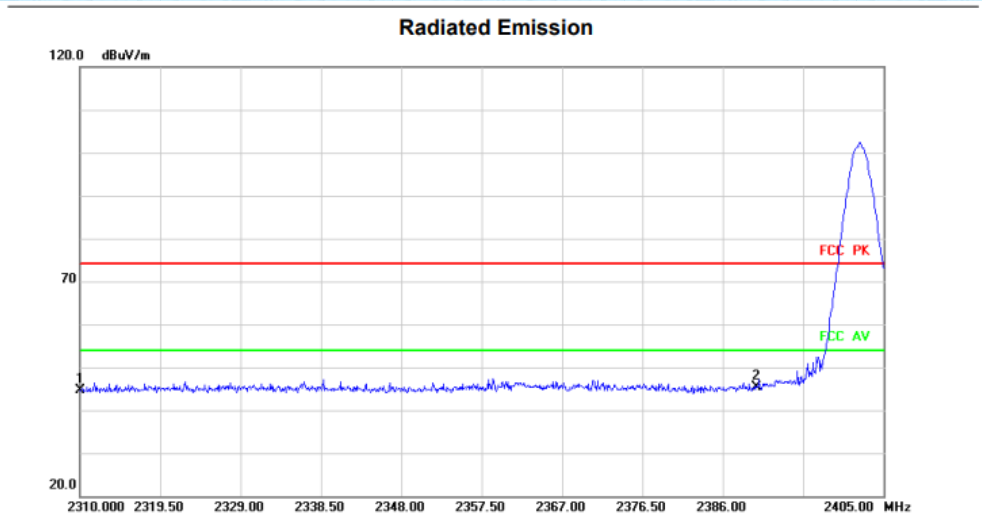
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2483.500	63.52	-8.91	54.61	74.00	-19.39	peak			
2	*	2483.500	54.86	-8.91	45.95	54.00	-8.05	AVG			
3		2500.000	55.01	-8.78	46.23	74.00	-27.77	peak			

8-DPSK: 2402 MHz

Horizontal

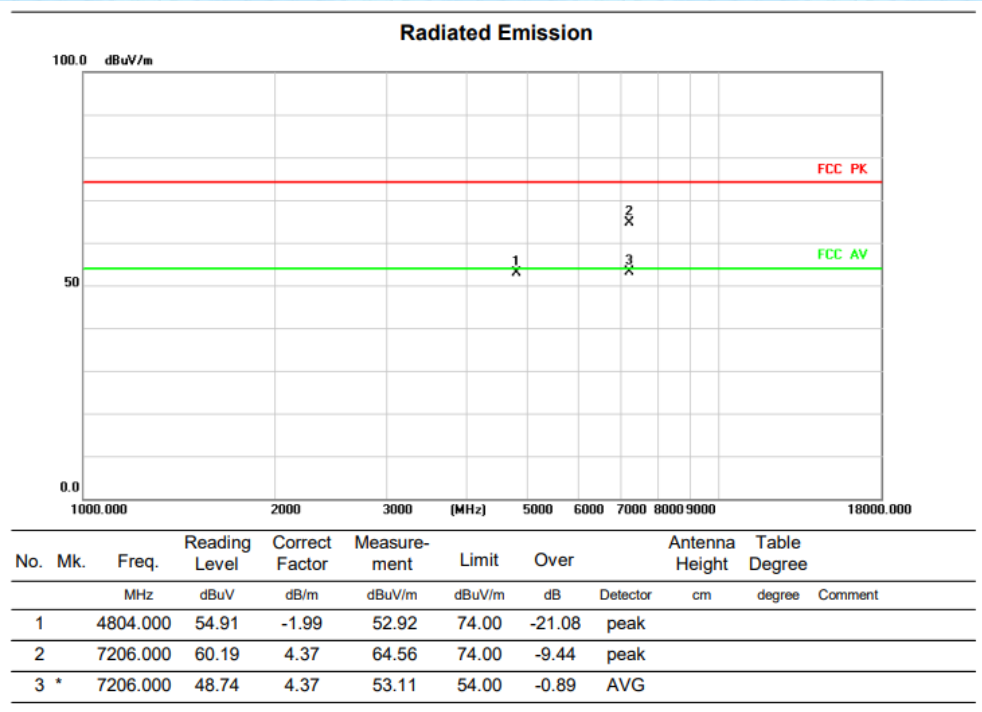


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4804.000	56.11	-1.99	54.12	74.00	-19.88	peak			
2		4804.000	45.52	-1.99	43.53	54.00	-10.47	AVG			
3		7206.000	55.30	4.37	59.67	74.00	-14.33	peak			
4	*	7206.000	43.85	4.37	48.22	54.00	-5.78	AVG			

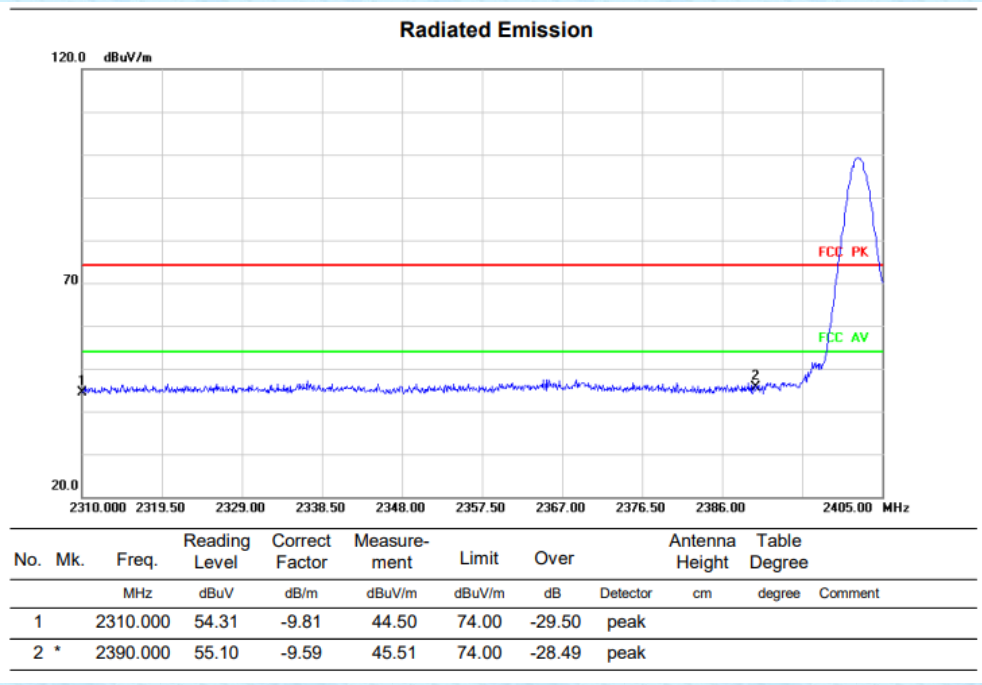


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	54.40	-9.81	44.59	74.00	-29.41	peak			
2	*	2390.000	54.97	-9.59	45.38	74.00	-28.62	peak			

Vertical



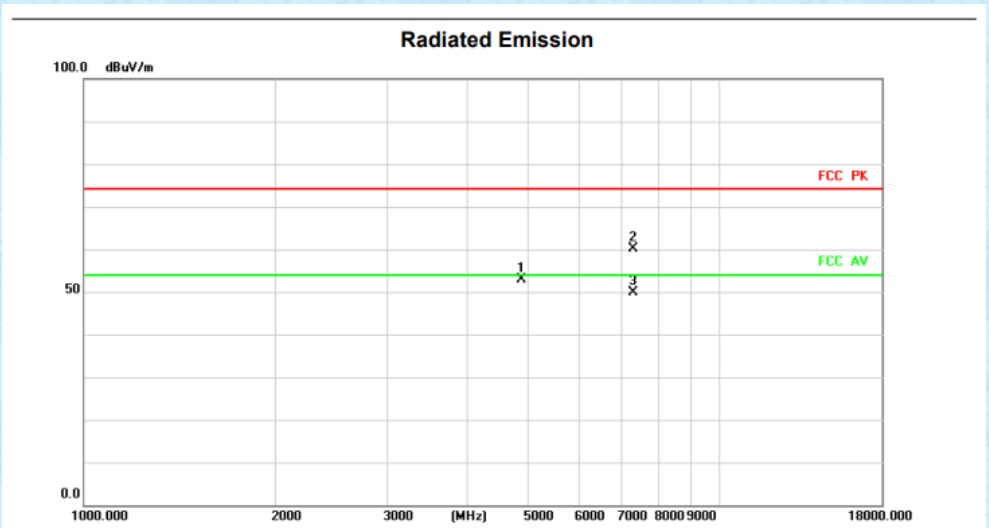
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4804.000	54.91	-1.99	52.92	74.00	-21.08	peak			
2		7206.000	60.19	4.37	64.56	74.00	-9.44	peak			
3	*	7206.000	48.74	4.37	53.11	54.00	-0.89	AVG			



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2310.000	54.31	-9.81	44.50	74.00	-29.50	peak			
2	*	2390.000	55.10	-9.59	45.51	74.00	-28.49	peak			

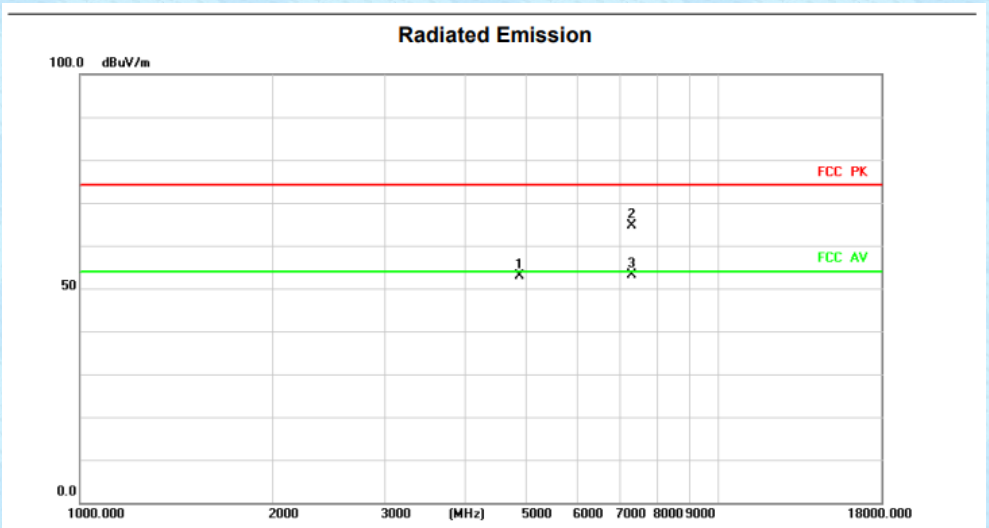
2441MHz

Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4882.000	54.41	-1.54	52.87	74.00	-21.13	peak			
2		7323.000	55.20	5.03	60.23	74.00	-13.77	peak			
3	*	7323.000	44.78	5.03	49.81	54.00	-4.19	AVG			

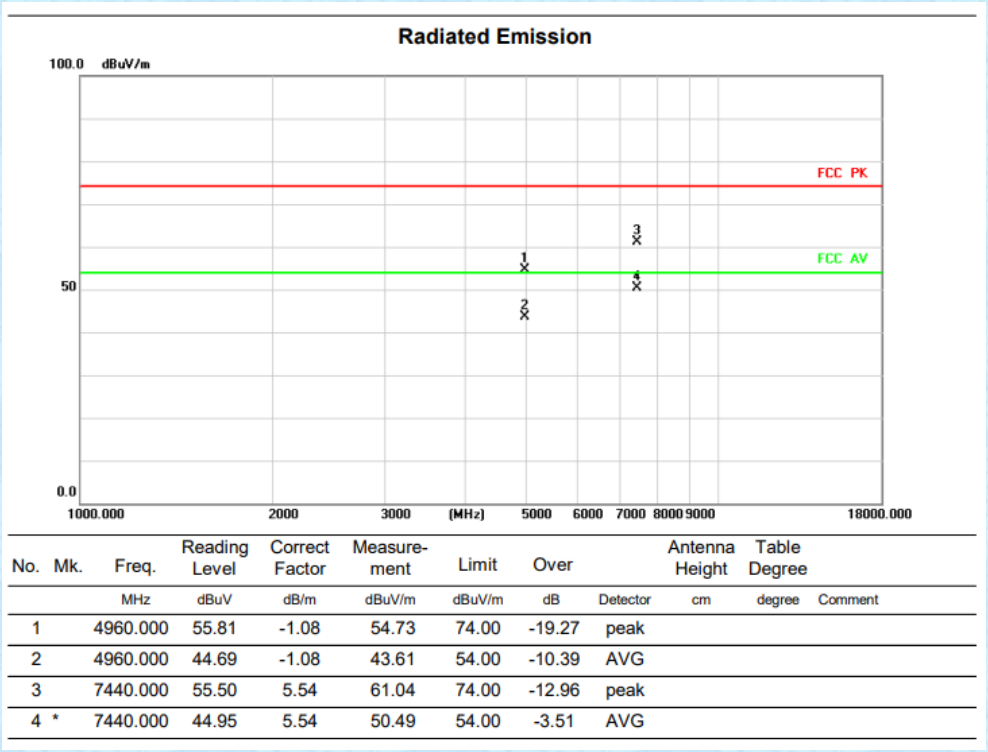
Vertical



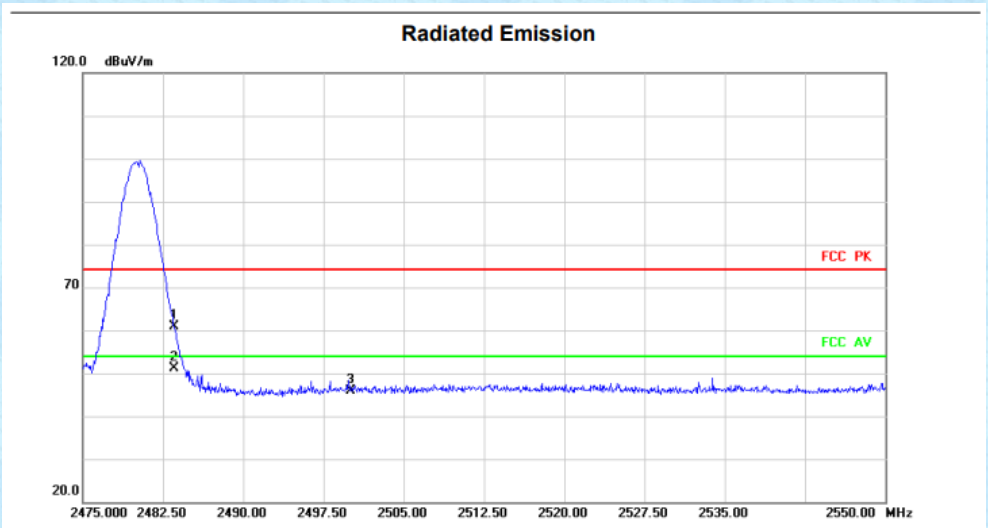
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4882.000	54.50	-1.54	52.96	74.00	-21.04	peak			
2		7323.000	59.53	5.03	64.56	74.00	-9.44	peak			
3	*	7323.000	48.07	5.03	53.10	54.00	-0.90	AVG			

2480MHz

Horizontal

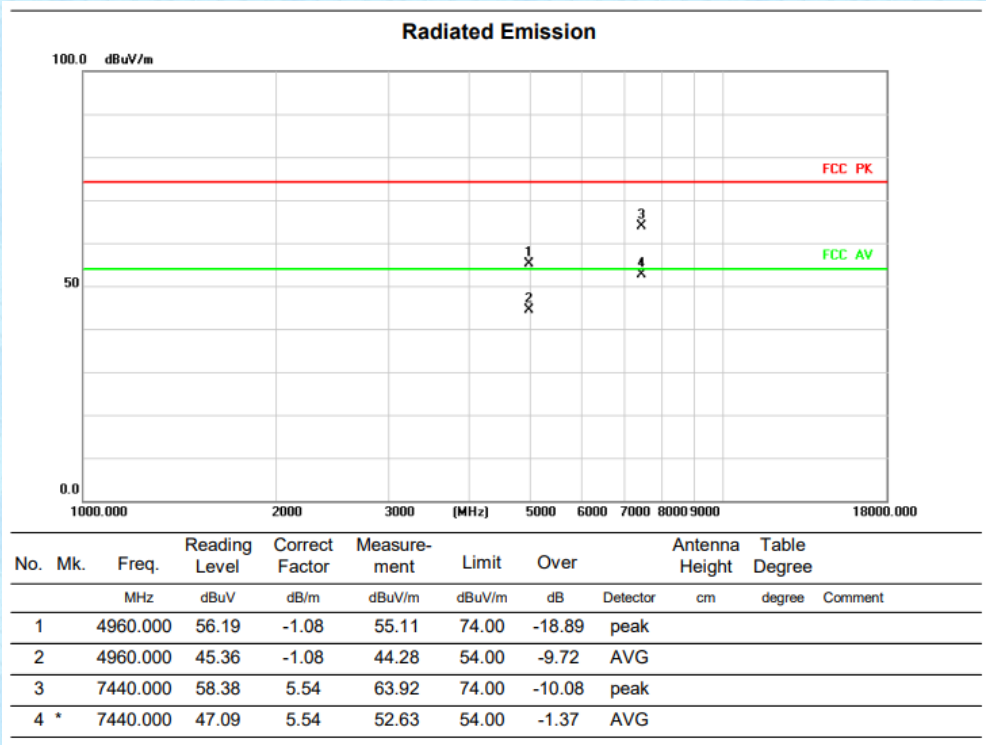


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4960.000	55.81	-1.08	54.73	74.00	-19.27	peak			
2		4960.000	44.69	-1.08	43.61	54.00	-10.39	AVG			
3		7440.000	55.50	5.54	61.04	74.00	-12.96	peak			
4	*	7440.000	44.95	5.54	50.49	54.00	-3.51	AVG			

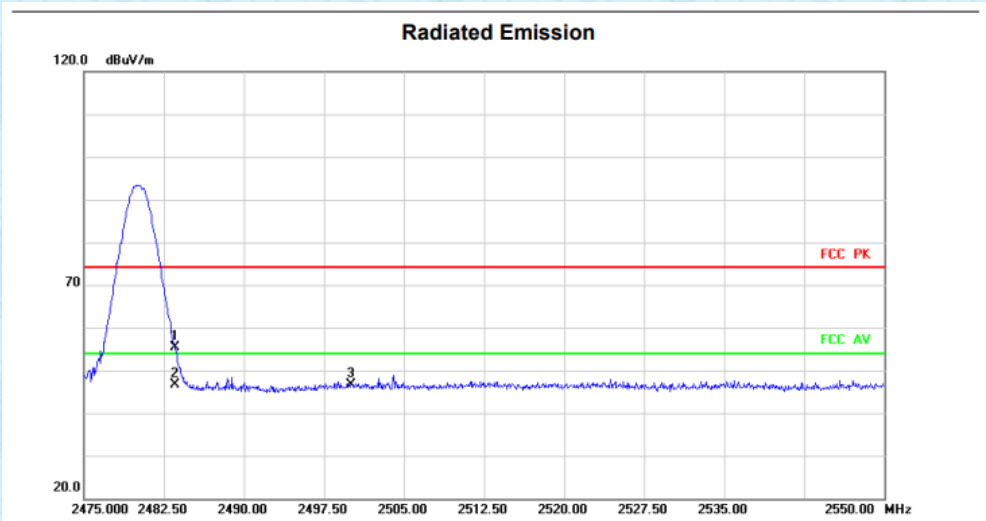


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2483.500	69.77	-8.91	60.86	74.00	-13.14	peak			
2	*	2483.500	59.96	-8.91	51.05	54.00	-2.95	AVG			
3		2500.000	54.57	-8.78	45.79	74.00	-28.21	peak			

Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		4960.000	56.19	-1.08	55.11	74.00	-18.89	peak			
2		4960.000	45.36	-1.08	44.28	54.00	-9.72	AVG			
3		7440.000	58.38	5.54	63.92	74.00	-10.08	peak			
4	*	7440.000	47.09	5.54	52.63	54.00	-1.37	AVG			



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2483.500	64.18	-8.91	55.27	74.00	-18.73	peak			
2	*	2483.500	55.64	-8.91	46.73	54.00	-7.27	AVG			
3		2500.000	55.52	-8.78	46.74	74.00	-27.26	peak			

Remarks:

1. *Measurement Value = Reading Level + Correct Factor.*
2. *Margin Level = Measurement Value - Limit Value.*
3. *The pre-test were performed on lowest, middle and highest frequencies, all datas was showed.*

8 Test Setup Photo

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

9 EUT Constructional Details

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

------End------