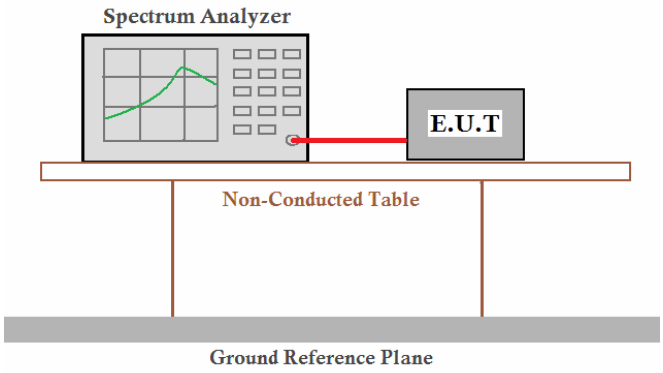
6.6 Hopping Channel Number

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data:

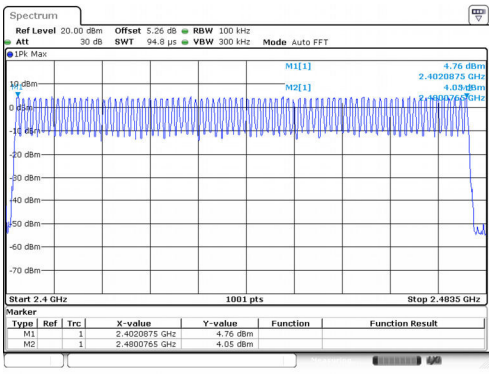
Mode	Hopping channel numbers	Limit	Result
GFSK	79	≥15CH	Pass
8-DPSK	79	≥15CH	Pass

Note:

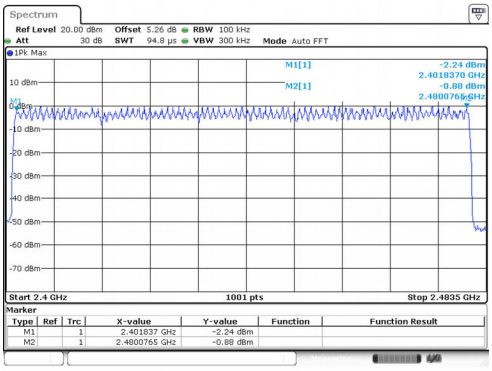
1. *During the test, pre-scan the GFSK, π/4-DQPSK, 8-DPSK modulation, found the GFSK& 8-DPSK modulation which it is worse case, and show in this report.*

Test plot as follows:

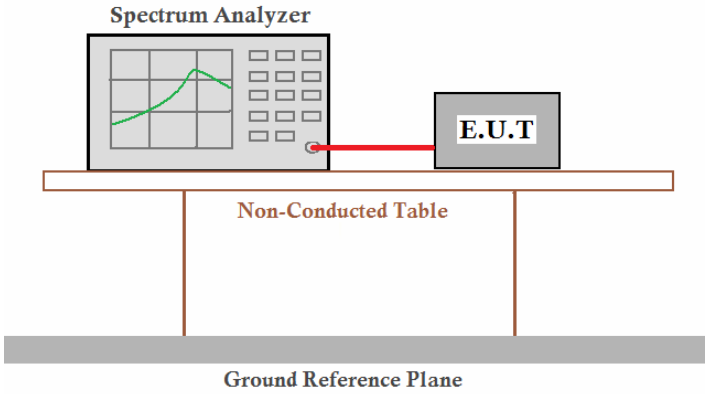
Test mode:	GFSK



Test mode:	8-DPSK



6.7 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Measurement Data

GFSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2402MHz	DH1	119.7	400	Pass
2402MHz	DH3	248.672	400	Pass
2402MHz	DH5	308.588	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2402MHz as blow

DH1 time slot=0.3817(ms)*(1600/ (2*79))*31.6=122.14ms

DH3 time slot=1.635(ms)*(1600/ (4*79))*31.6=261.60ms

DH5 time slot=2.883(ms)*(1600/ (6*79))*31.6=307.52ms

8-DPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2402MHz	3DH1	122.924	400	Pass
2402MHz	3DH3	262.56	400	Pass
2402MHz	3DH5	280.233	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2402MHz as blow

DH1 time slot=0.390(ms)*(1600/ (2*79))*31.6=124.80ms

DH3 time slot=1.64(ms)*(1600/ (4*79))*31.6=262.40ms

DH5 time slot=2.892(ms)*(1600/ (6*79))*31.6=308.48ms

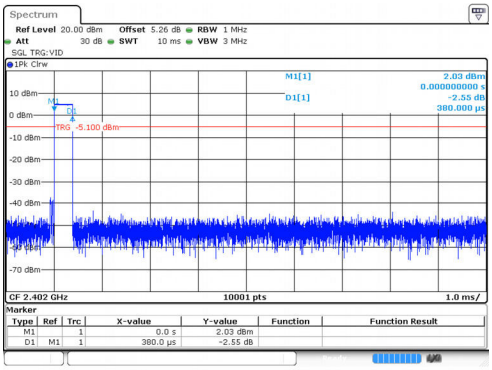
Note:

1. *During the test, pre-scan the GFSK, π/4-DQPSK, 8-DPSK modulation, found the GFSK& 8-DPSK modulation which it is worse case, and show in this report.*

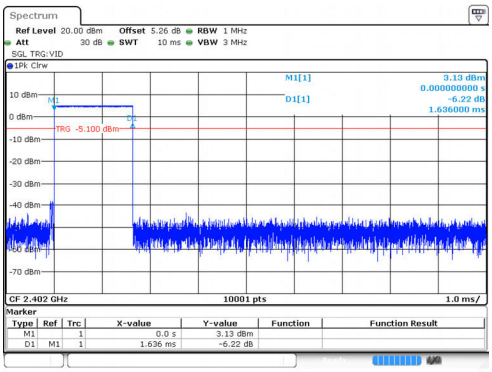
Test plot as follows:

GFSK mode:

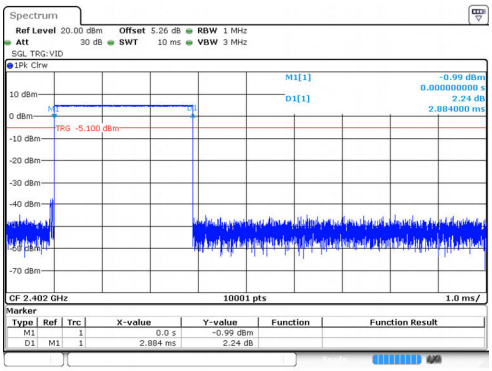
Test channel:	2402MHz



DH1



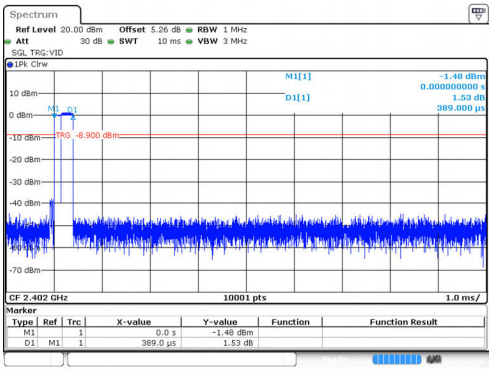
DH3



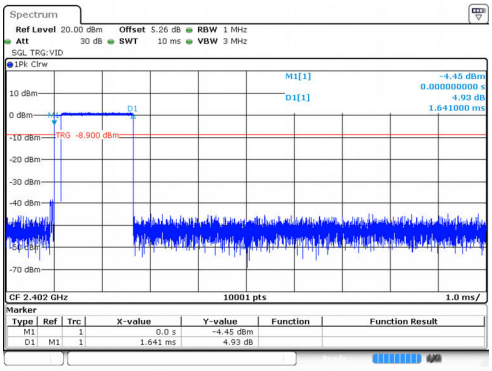
DH5

8-DPSK mode:

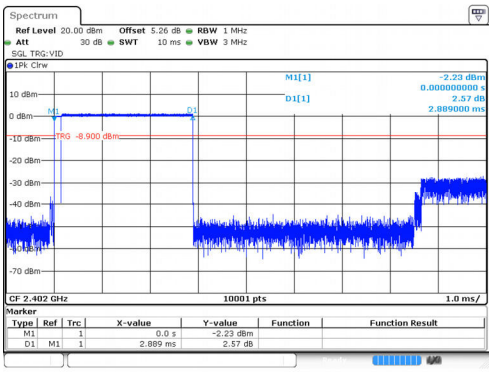
Test channel:	2402MHz



DH1



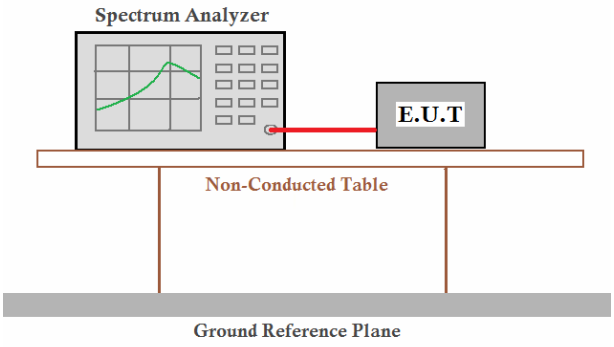
DH3



DH5

6.8 Band Edge

6.8.1 Conducted Emission Method

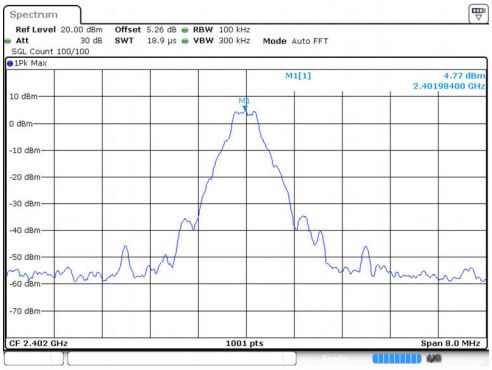
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by 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 5.0 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

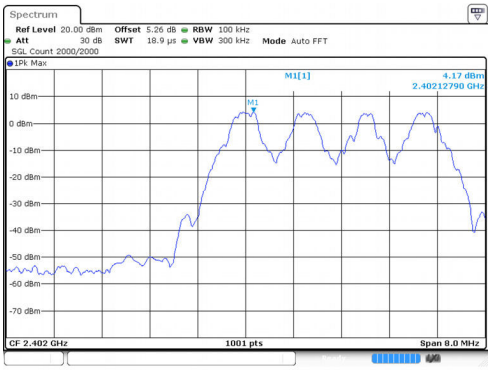
Note:

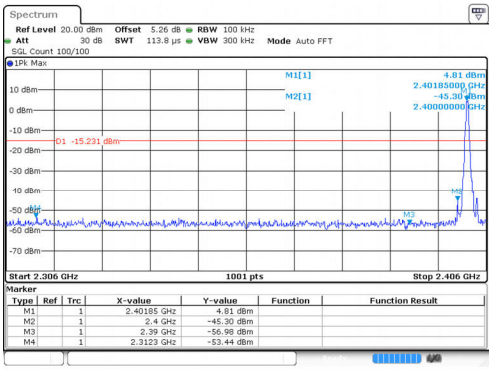
1. *During the test, pre-scan the GFSK, π/4-DQPSK, 8-DPSK modulation, found the GFSK& 8-DPSK modulation which it is worse case, and show in this report.*

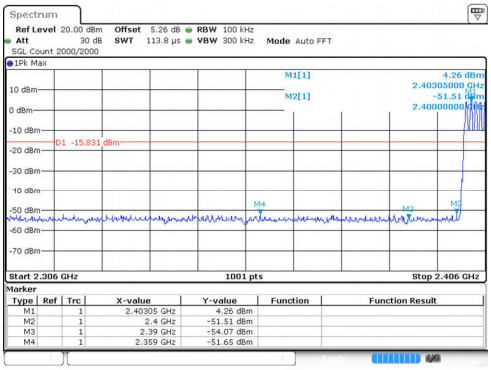
Test plot as follows:

Test channel:	Lowest channel



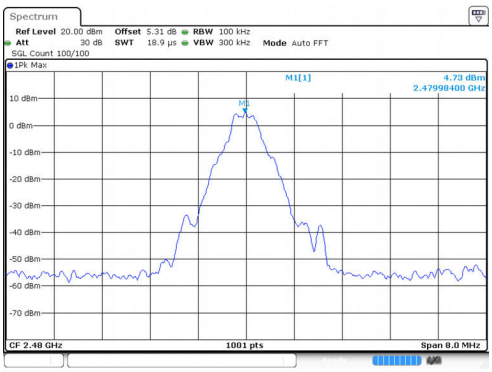


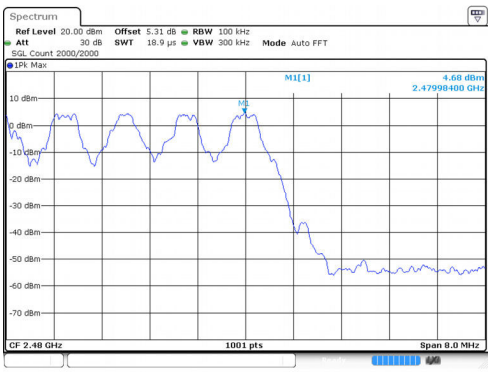


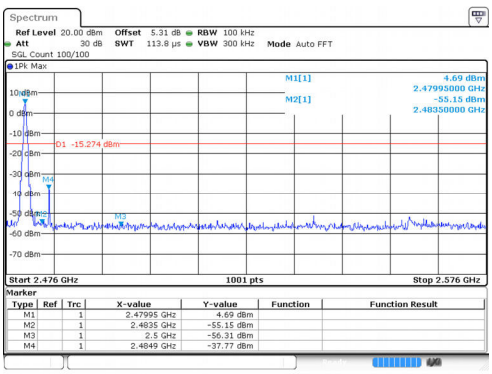


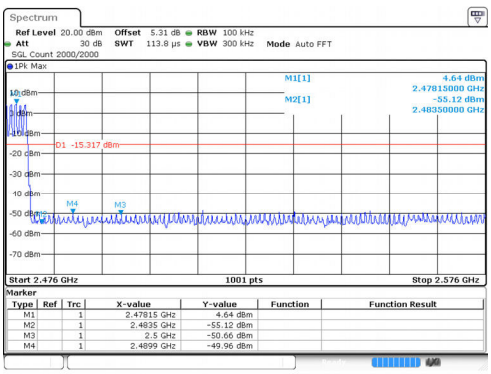
No-hopping mode Hopping mode

Test channel:	Highest channel





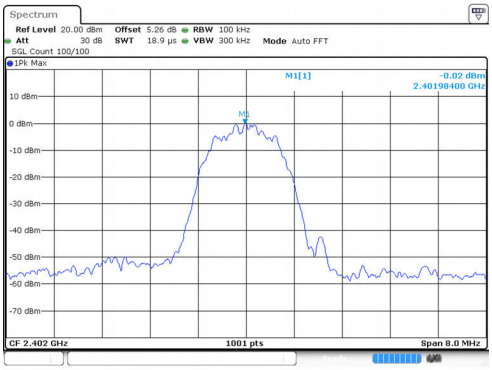


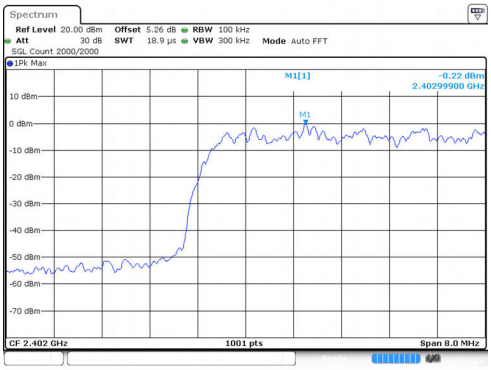


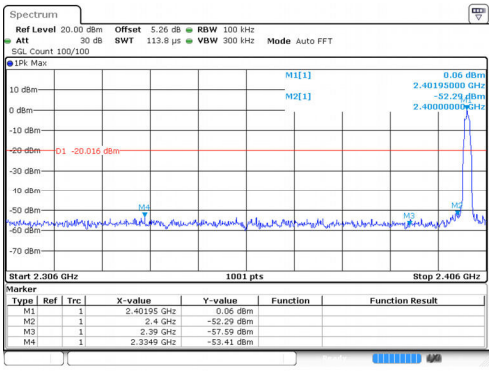
No-hopping mode Hopping mode

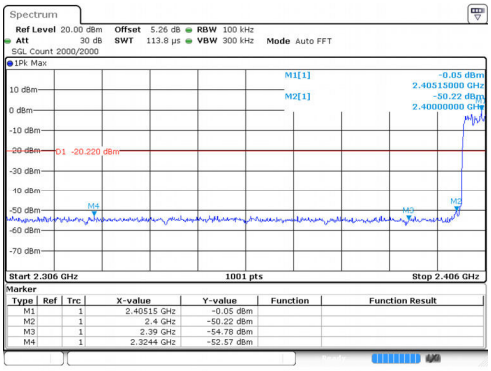
8-DPSK Mode:

Test channel:	Lowest channel



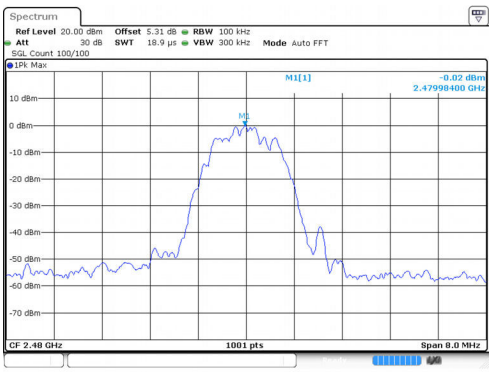


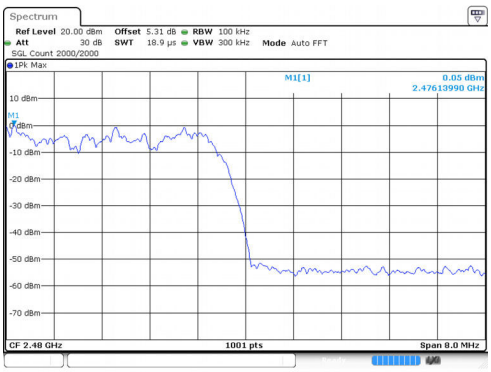


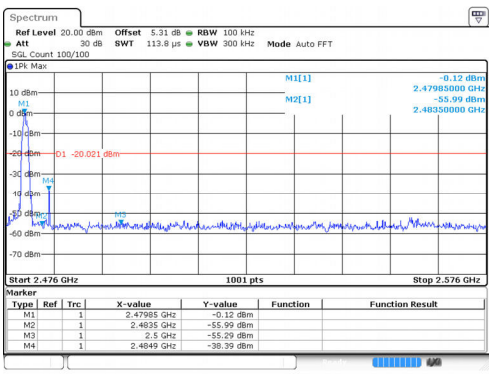


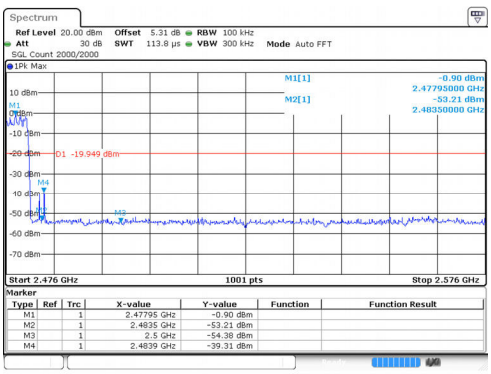
No-hopping mode Hopping mode

Test channel:	Highest channel



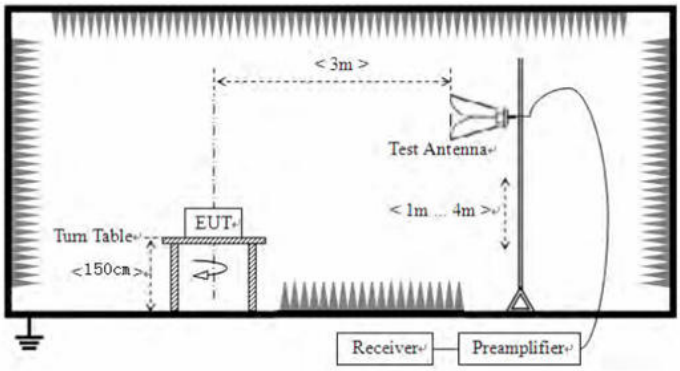






No-hopping mode Hopping mode

6.8.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>54.00</td><td>Average Value</td></tr>
<tr><td>74.00</td><td>Peak Value</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td> 
</td></tr>
<tr><td>Test Procedure:</td><td>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</td></tr>
</table>

	data sheet.
Test Instruments:	Refer to section 5.0 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Test channel:	Lowest channel

Vertical：

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2400.000	40.58	-5.70	34.88	74.00	-39.12	peak
2400.000	28.70	-5.70	23.00	54.00	-31.00	AVG

Horizontal：

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2400.000	41.74	-5.70	36.04	74.00	-37.96	peak
2400.000	29.60	-5.70	23.90	54.00	-30.10	AVG

Test channel:	Highest channel

Vertical：

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.500	41.84	-4.98	36.86	74.00	-37.14	peak
2483.500	30.31	-4.98	25.33	54.00	-28.67	AVG

Horizontal：

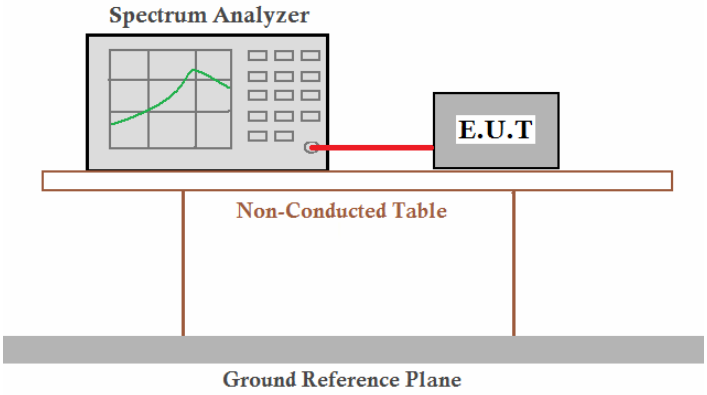
Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.500	42.75	-4.98	37.77	74.00	-36.23	peak
2483.500	31.00	-4.98	26.02	54.00	-27.98	AVG

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, π/4-DQPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.*

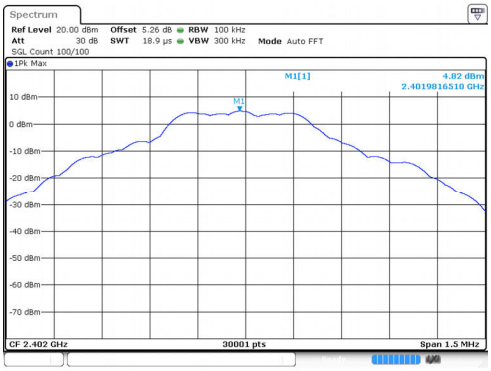
6.9 Spurious Emission

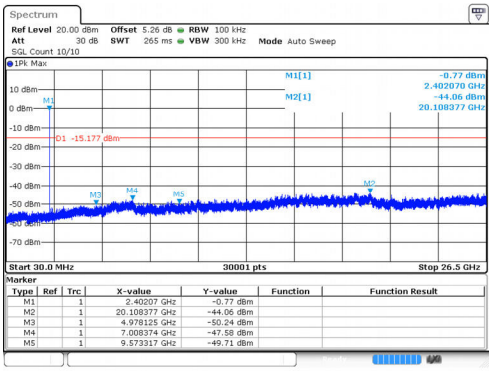
6.9.1 Conducted Emission Method

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 5.0 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

GFSK mode:

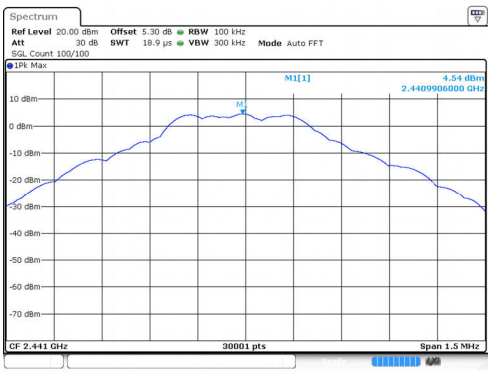
Test channel:	Lowest channel

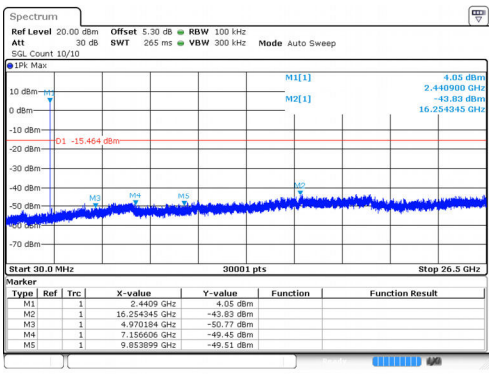




30MHz~25GHz

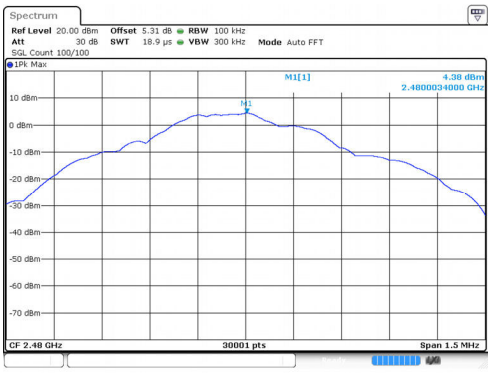
Test channel:	Middle channel

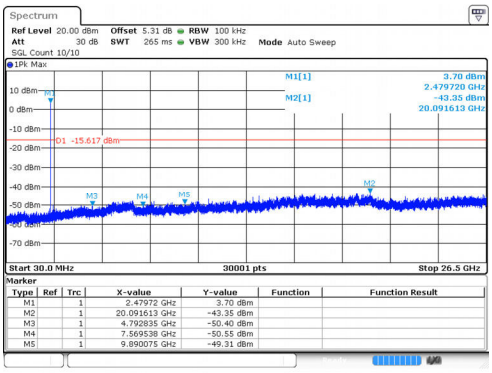




30MHz~25GHz

Test channel:	Highest channel

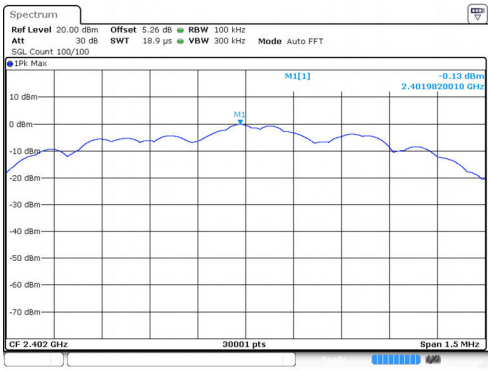


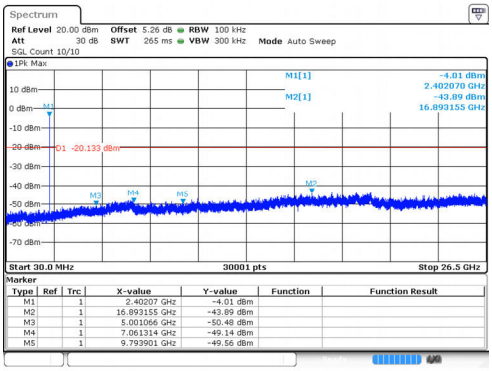


30MHz~25GHz

8-DPSK mode:

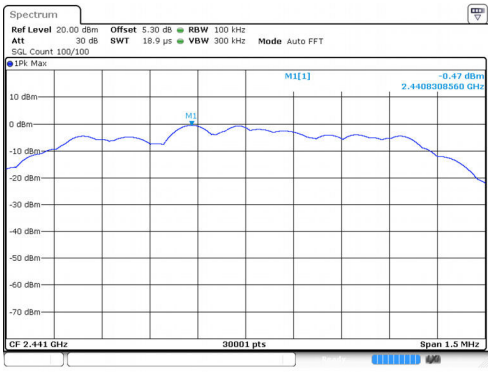
Test channel:	Lowest channel

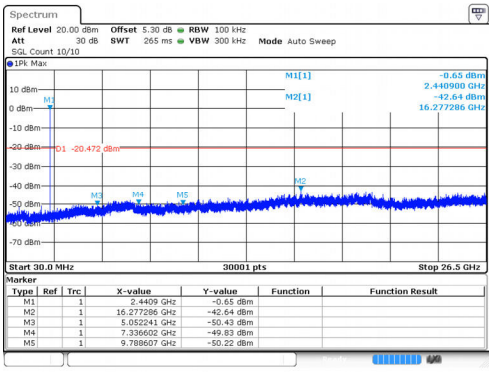




30MHz~25GHz

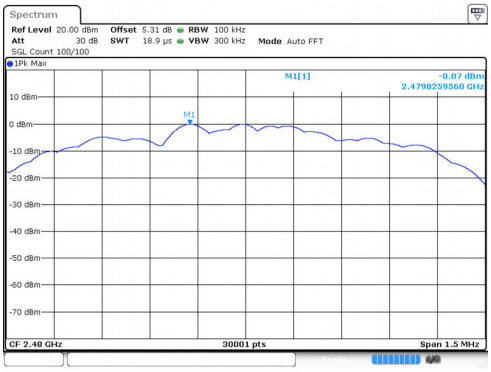
Test channel:	Middle channel

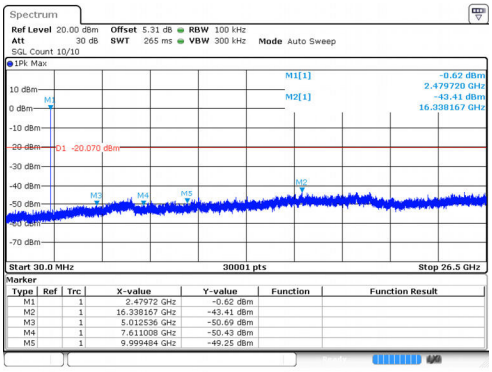




30MHz~25GHz

Test channel:	Highest channel



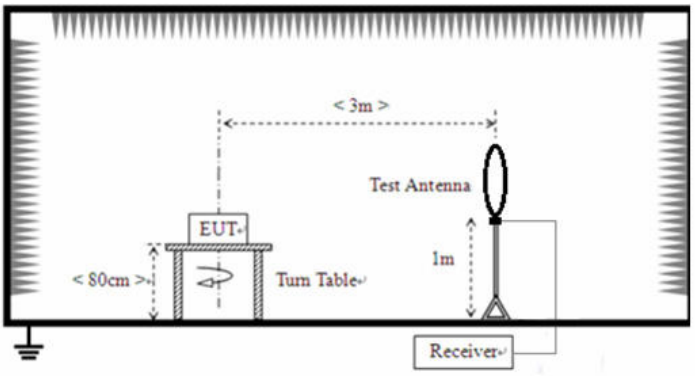


30MHz~25GHz

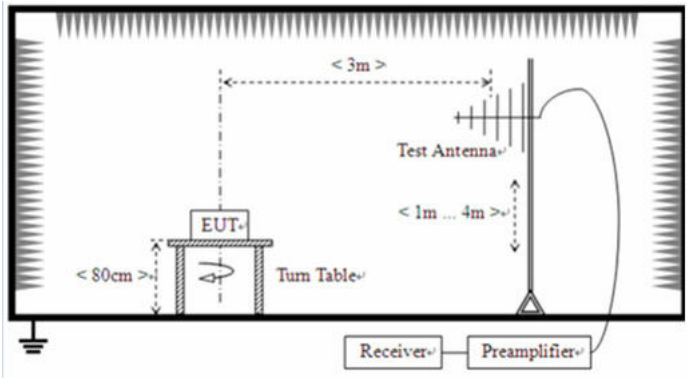
Note:

1. *During the test, pre-scan the GFSK, π/4-DQPSK, 8-DPSK modulation, found the GFSK& 8-DPSK modulation which it is worse case, and show in this report.*

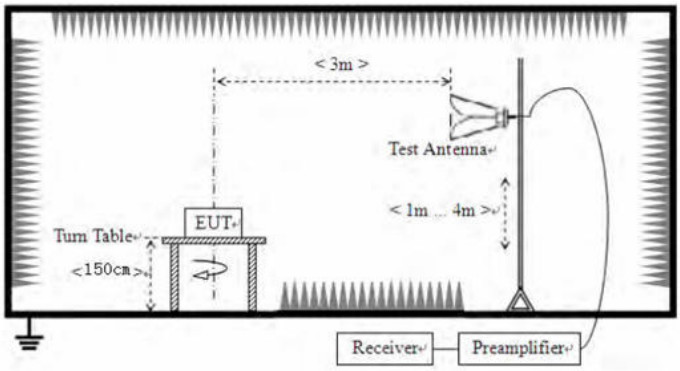
6.9.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>9kHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Value</th></tr>
<tr><td>9KHz-150KHz</td><td>Quasi-peak</td><td>200Hz</td><td>600Hz</td><td>Quasi-peak</td></tr>
<tr><td>150KHz-30MHz</td><td>Quasi-peak</td><td>9KHz</td><td>30KHz</td><td>Quasi-peak</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency</th><th>Limit (uV/m)</th><th>Value</th><th>Measurement Distance</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(KHz)</td><td>QP</td><td>30m</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>QP</td><td>30m</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>QP</td><td rowspan="6">3m</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>QP</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>QP</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>QP</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>Average</td></tr>
<tr><td>5000</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions from 9kHz to 30MHz
 
</td></tr>
</table>

For radiated emissions from 30MHz to1GHz



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 5.0 for details					
Test mode:	Refer to section 4.1 for details					
Test environment:	Temp.:	24.6 °C	Humid.:	52.4%	Press.:	101mbar
Test voltage:	AC 120V, 60Hz					
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.*

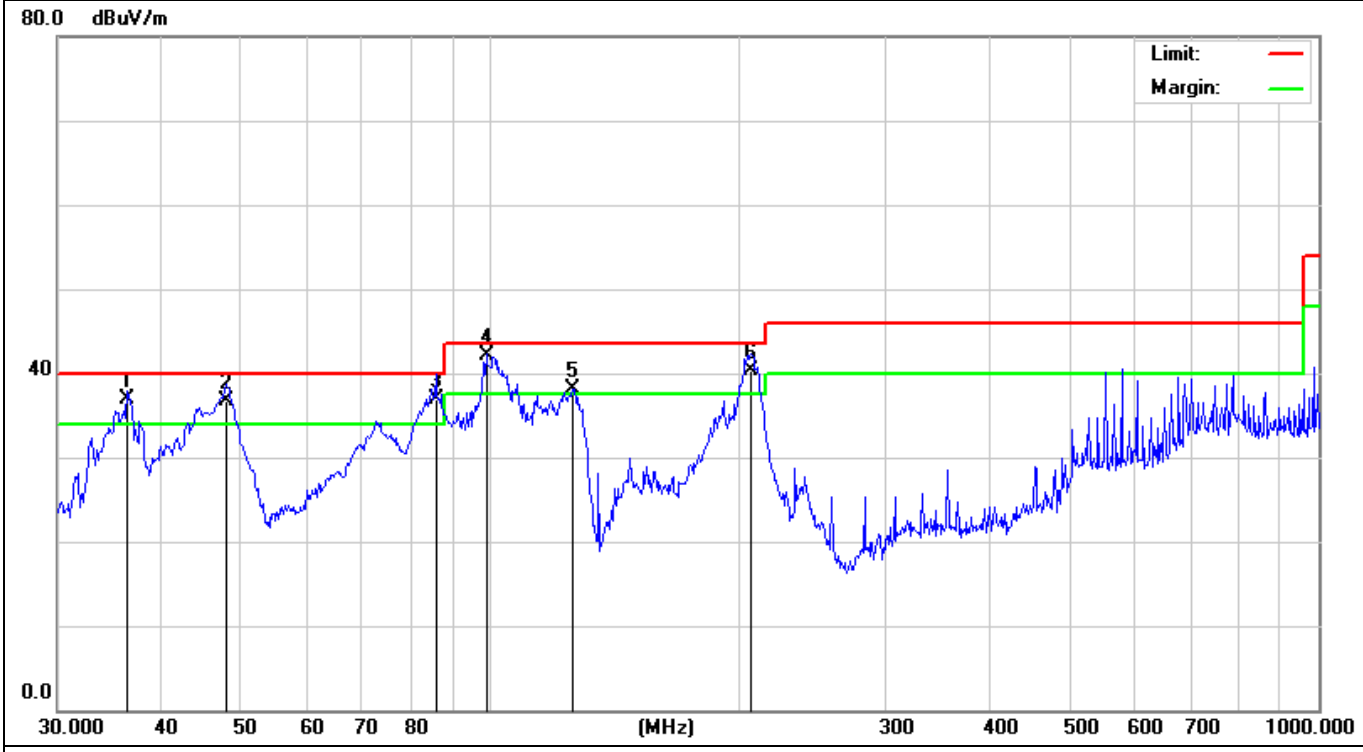
■ **9kHz~30MHz**

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 2480MHz, and so only show the test result of GFSK 2480MHz

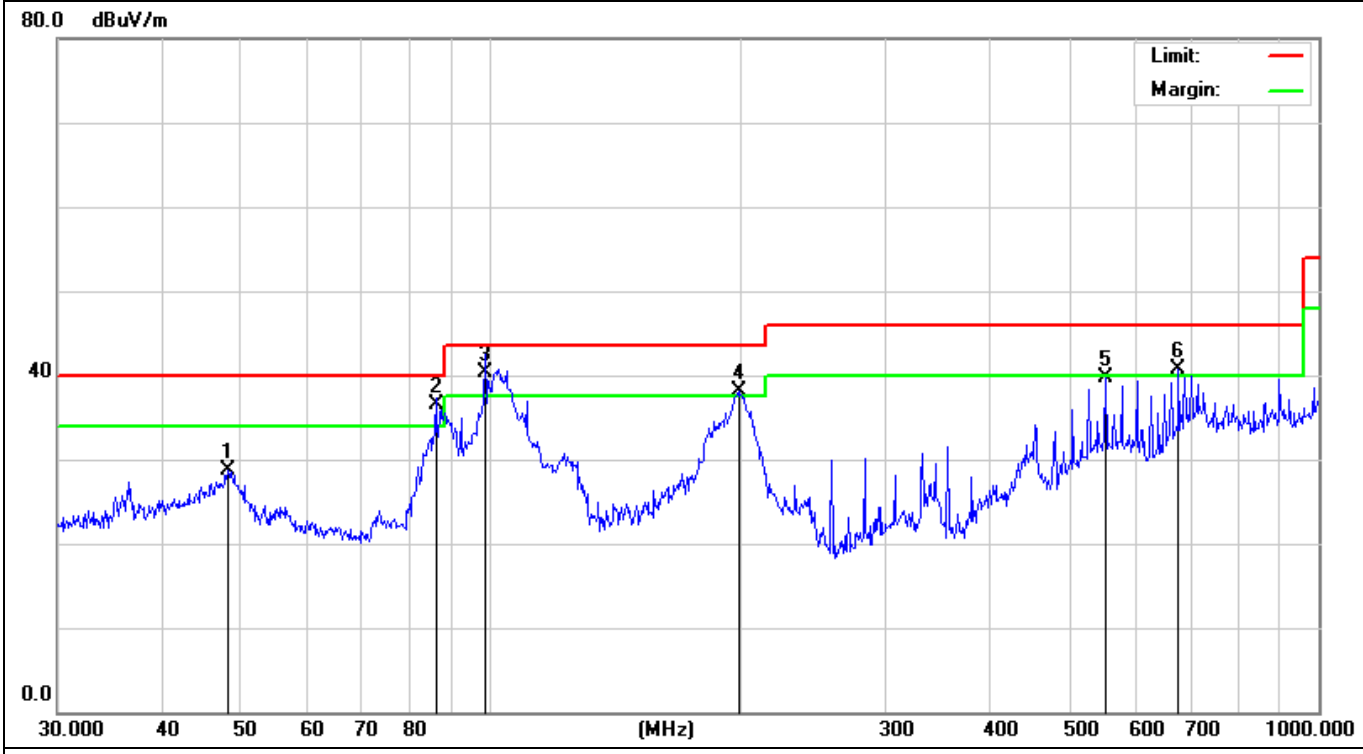
Model name:	LV14	Test Date :	2021-08-26
Polarization :	Vertical	Test Result:	☒ Pass ☐ Fail



Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Measurement Result=Reading Level +Correct Factor;
Over Limit= Measurement Result- Limit;

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	!	36.3814	41.50	-4.63	36.87	40.00	-3.13	QP
2	!	47.9940	42.20	-5.44	36.76	40.00	-3.24	QP
3	!	85.8983	47.50	-10.61	36.89	40.00	-3.11	QP
4	*	98.8324	51.07	-8.87	42.20	43.50	-1.30	QP
5	!	125.4457	47.87	-9.75	38.12	43.50	-5.38	QP
6	!	206.3976	45.30	-4.93	40.37	43.50	-3.13	QP

Model name:	LV14	Test Date :	2021-08-26
Polarization :	Vertical	Test Result:	☒ Pass ☐ Fail



Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Measurement Result=Reading Level +Correct Factor;
Over Limit= Measurement Result- Limit;

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		48.1626	31.72	-3.00	28.72	40.00	-11.28	QP
2	!	85.8984	46.60	-10.11	36.49	40.00	-3.51	QP
3	*	98.4865	48.30	-7.99	40.31	43.50	-3.19	QP
4	!	199.2855	45.48	-7.33	38.15	43.50	-5.35	QP
5		552.8832	35.06	4.58	39.64	46.00	-6.36	QP
6	!	677.5798	34.50	6.18	40.68	46.00	-5.32	QP

■ **Above 1GHz**

Test channel:	Lowest channel

H

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4804.000	50.32	5.06	55.38	74.00	-18.62	PEAK
4804.000	40.98	5.06	46.04	54.00	-7.96	AVG
7206.000	43.84	7.03	50.87	74.00	-23.13	PEAK
7206.000	32.35	7.03	39.38	54.00	-14.62	AVG

V

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4804.000	49.53	5.06	54.59	74.00	-19.41	PEAK
4804.000	41.06	5.06	46.12	54.00	-7.88	AVG
7206.000	43.90	7.03	50.93	74.00	-23.07	PEAK
7206.000	32.50	7.03	39.53	54.00	-14.47	AVG

Test channel:	Middle channel

H

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4882.000	49.66	5.14	54.80	74.00	-19.20	PEAK
4882.000	41.38	5.14	46.52	54.00	-7.48	AVG
7323.000	44.67	7.52	52.19	74.00	-21.81	PEAK
7323.000	31.23	7.52	38.75	54.00	-15.25	AVG

V

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
4882.000	49.60	5.14	54.74	74.00	-19.26	PEAK
4882.000	41.31	5.14	46.45	54.00	-7.55	AVG
7323.000	43.61	7.52	51.13	74.00	-22.87	PEAK
7323.000	32.09	7.52	39.61	54.00	-14.39	AVG

Test channel:	Highest channel

H

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4960.000	50.55	5.22	55.77	74.00	-18.23	PEAK
4960.000	40.86	5.22	46.08	54.00	-7.92	AVG
7440.000	44.08	8.06	52.14	74.00	-21.86	PEAK
7440.000	31.44	8.06	39.50	54.00	-14.50	AVG

V

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4960.000	49.40	5.22	54.62	74.00	-19.38	PEAK
4960.000	41.57	5.22	46.79	54.00	-7.21	AVG
7440.000	43.67	8.06	51.73	74.00	-22.27	PEAK
7440.000	32.83	8.06	40.89	54.00	-13.11	AVG

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*

7 Test Setup Photo

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

8 EUT Constructional Details

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

End of report