

Measurement Data

GFSK mode:

Frequency	Packet	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit(s)	Result
2441MHz	DH1	0.389	213	0.083	0.4	Pass
2441MHz	DH3	1.645	111	0.183	0.4	Pass
2441MHz	DH5	2.893	85	0.246	0.4	Pass

$\pi/4$ -DQPSK mode:

Frequency	Packet	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit(s)	Result
2441MHz	2DH1	0.386	183	0.071	0.4	Pass
2441MHz	2DH3	1.638	110	0.18	0.4	Pass
2441MHz	2DH5	2.885	75	0.216	0.4	Pass

8-DPSK mode:

Frequency	Packet	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit(s)	Result
2441MHz	3DH1	0.385	187	0.072	0.4	Pass
2441MHz	3DH3	1.637	107	0.175	0.4	Pass
2441MHz	3DH5	2.888	76	0.219	0.4	Pass

Test plot as follows:

GFSK mode:

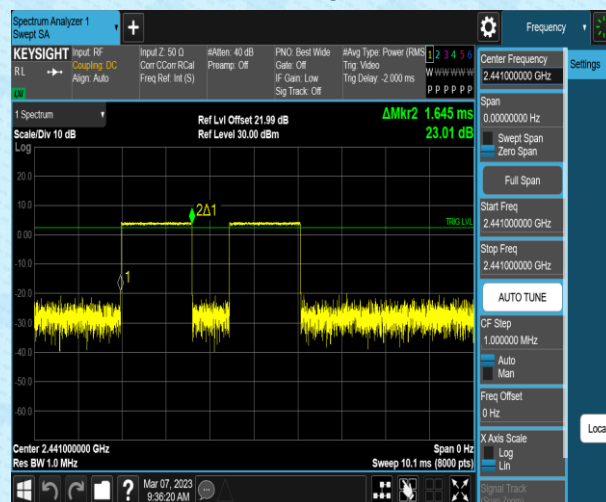
Test channel:

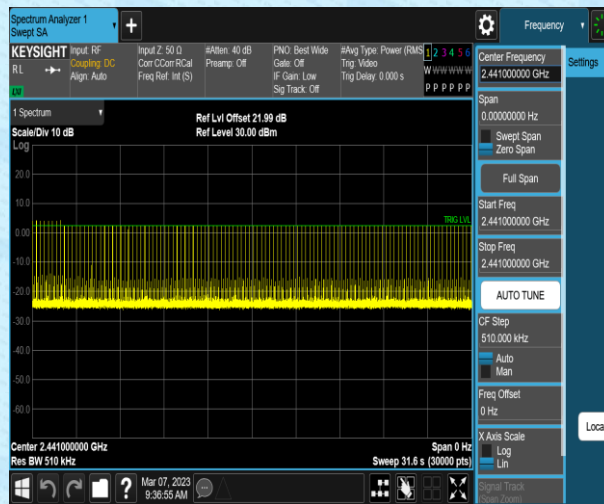
2441MHz

DH1

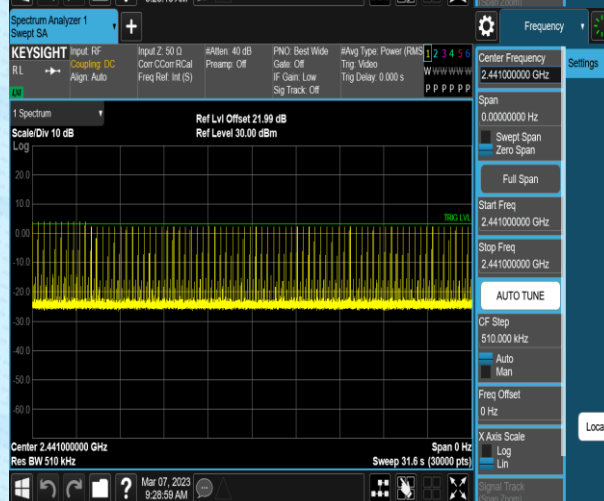


DH3





DH5



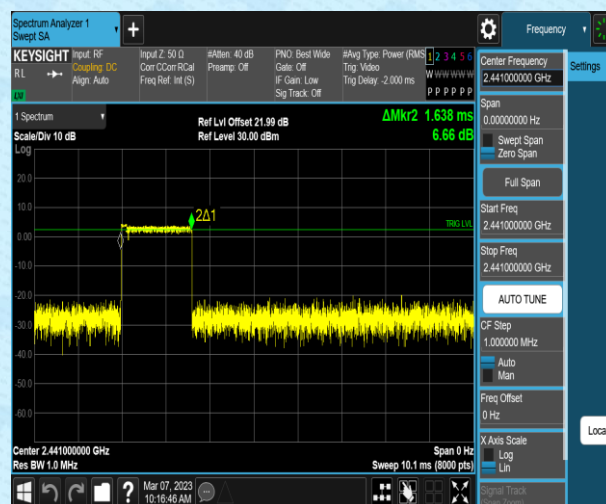
$\pi/4$ -DQPSK mode:

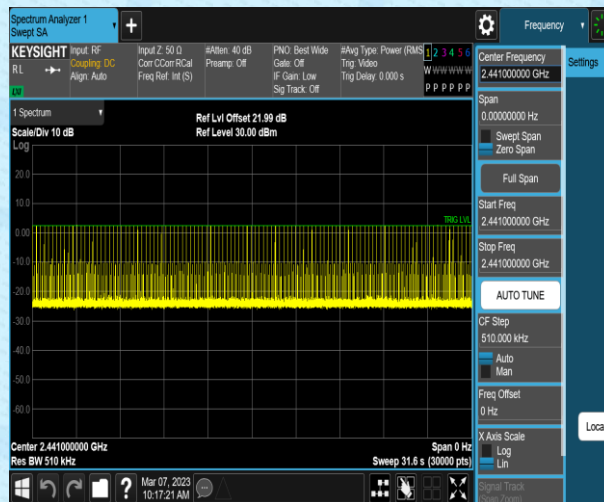
Test channel:	2441MHz
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2DH1

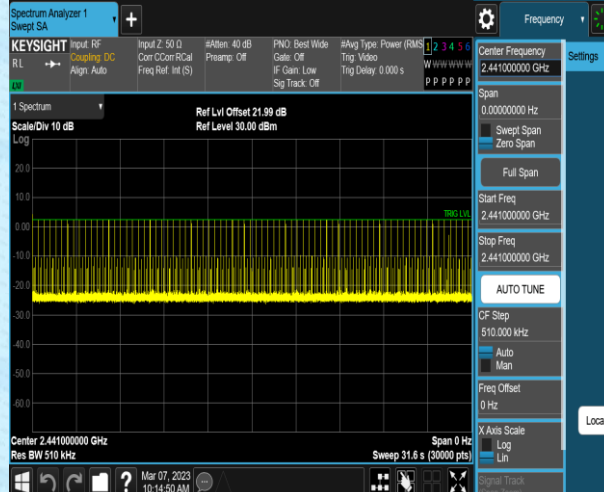


2DH3





2DH5



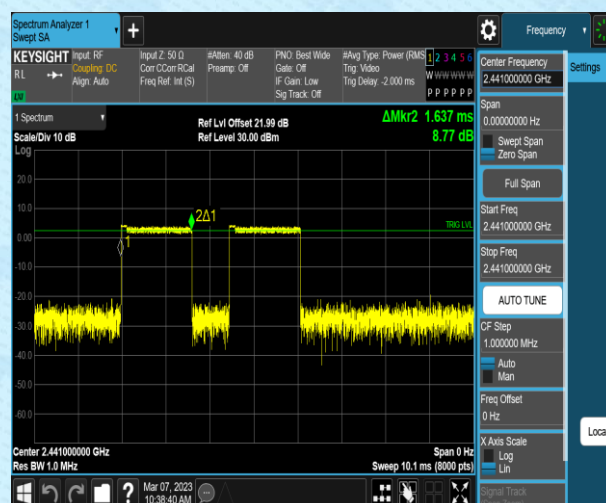
8-DPSK mode:

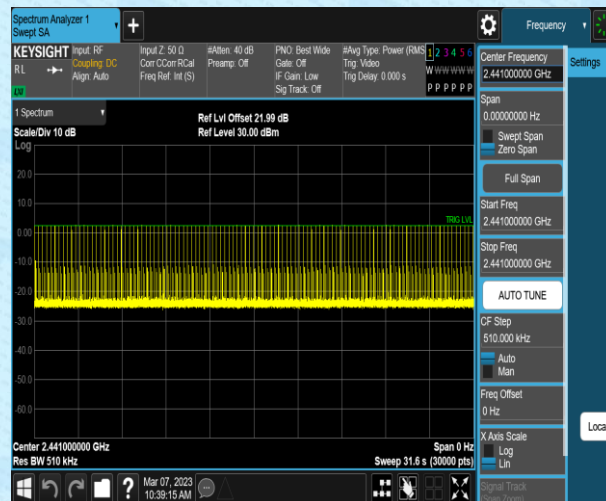
Test channel:	2441MHz
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3DH1

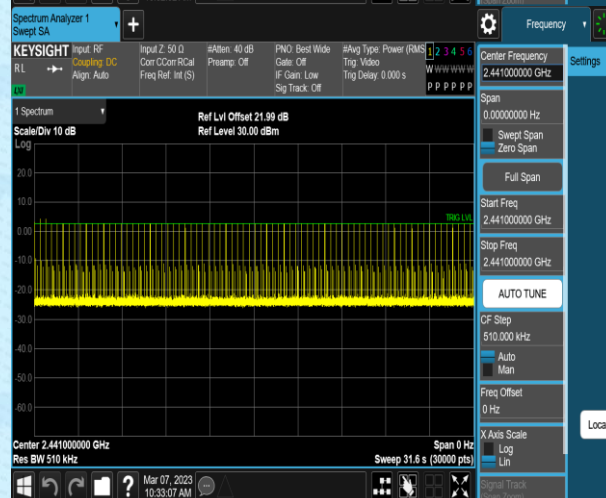
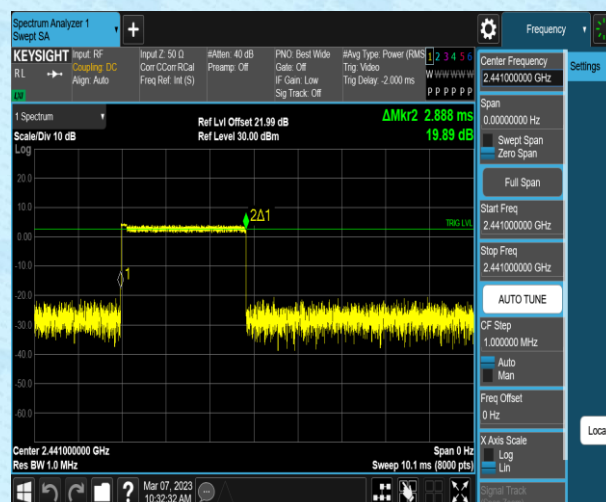


3DH3



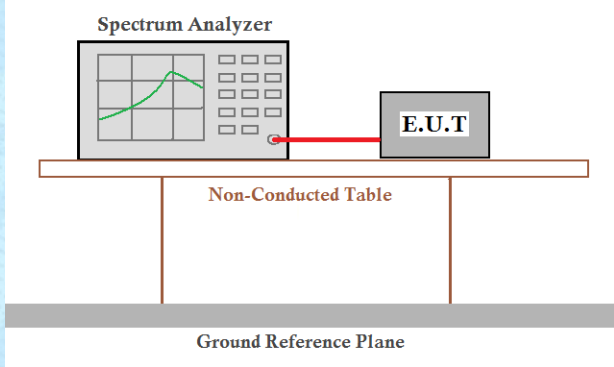


3DH5



7.8 Spurious Emission in Non-restricted & restricted Bands

7.8.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d) & RSS-247 5.5
Test Method:	ANSI C63.10:2013 and RSS-Gen
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:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a table labeled 'Non-Conducted Table'. This table is supported by a 'Ground Reference Plane'.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data:.

Test plot as follows:

GFSK mode:

Test channel:

Lowest channel



30MHz~26.5GHz

Test channel:

Middle channel



30MHz~26.5GHz

Test channel:	Highest channel
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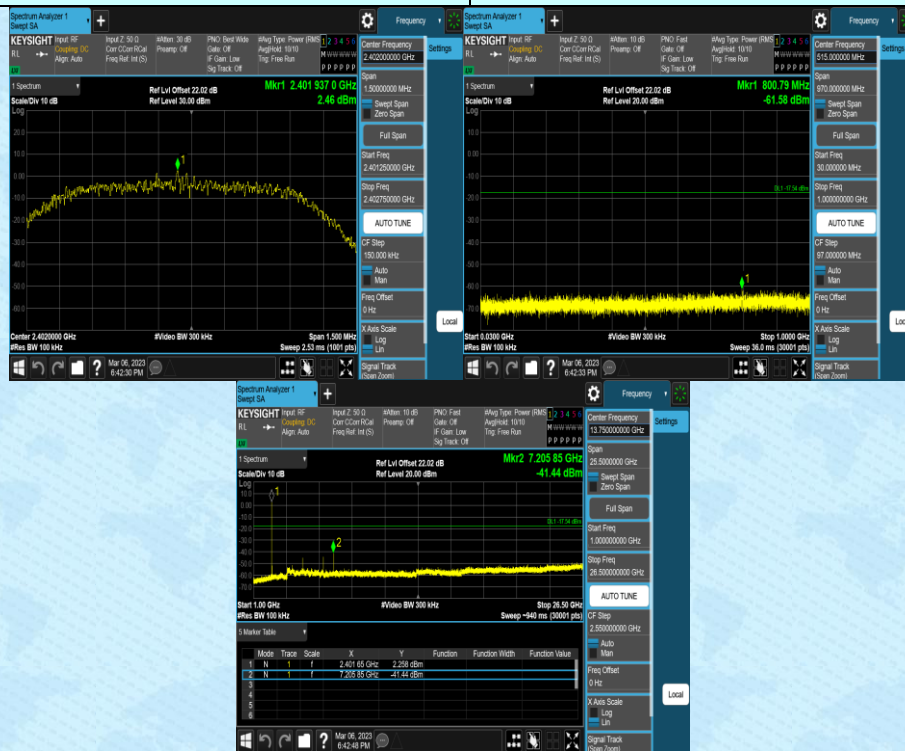


30MHz~26.5GHz

$\pi/4$ -DQPSK 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



30MHz~26.5GHz

Test channel:

Middle channel



30MHz~26.5GHz

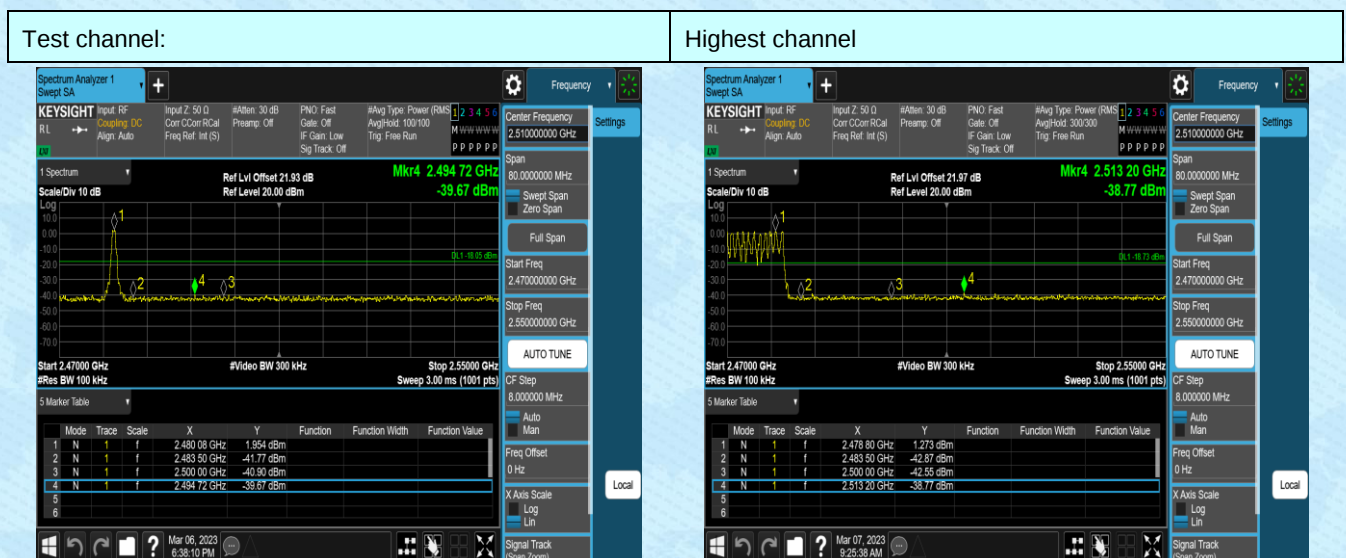
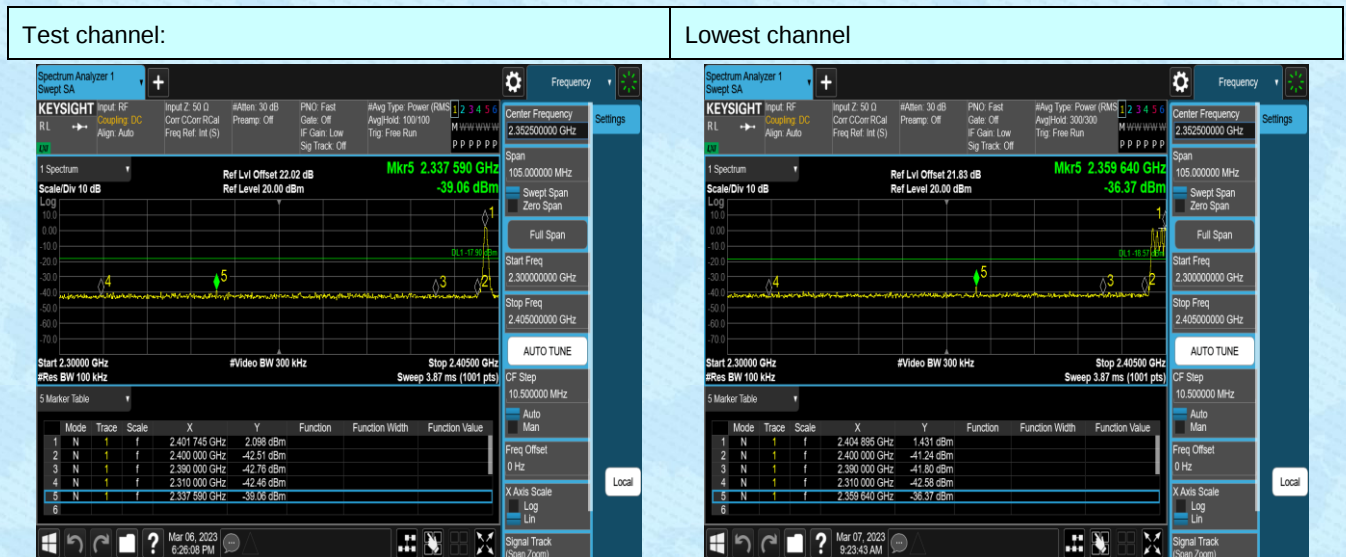
Test channel:

Highest channel



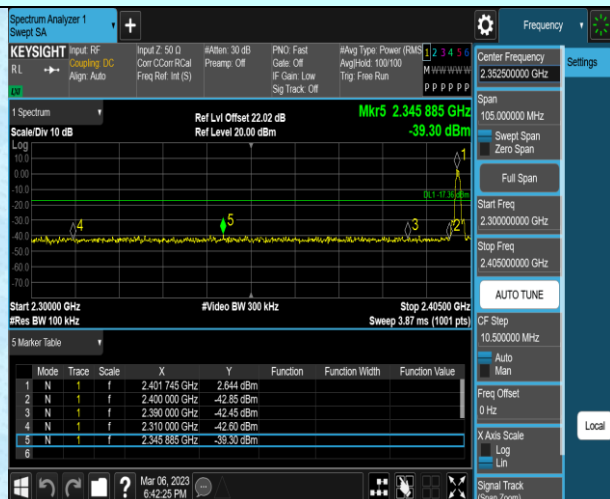
30MHz~26.5GHz

GFSK Mode:



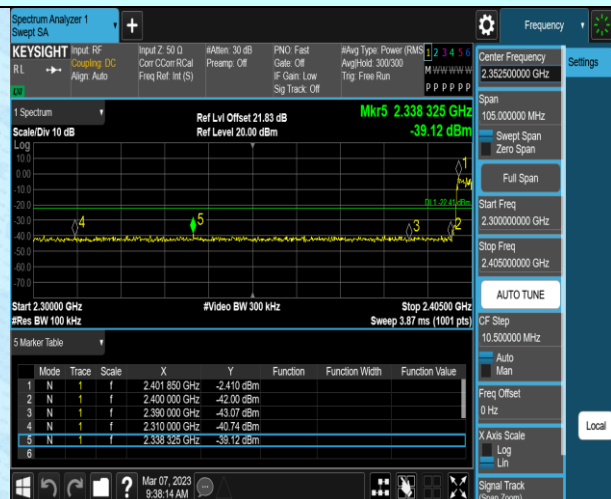
$\pi/4$ -DQPSK Mode:

Test channel:



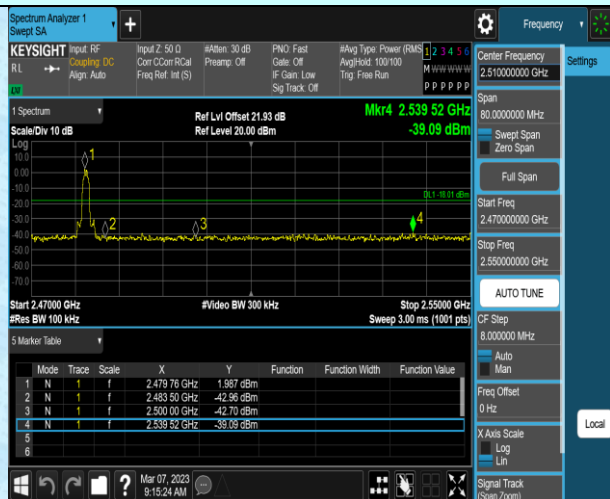
No-hopping mode

Lowest channel



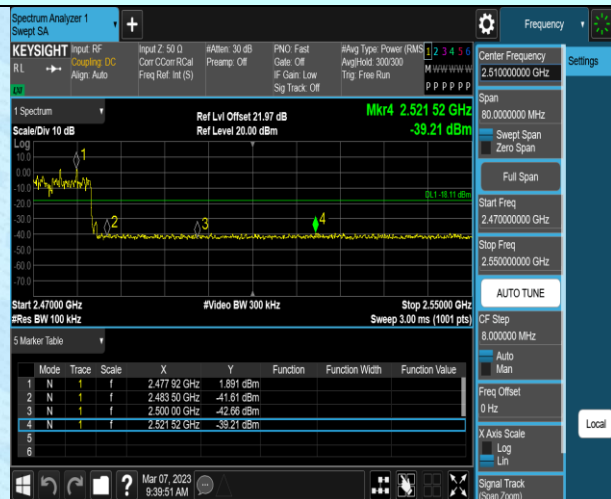
Hopping mode

Test channel:



No-hopping mode

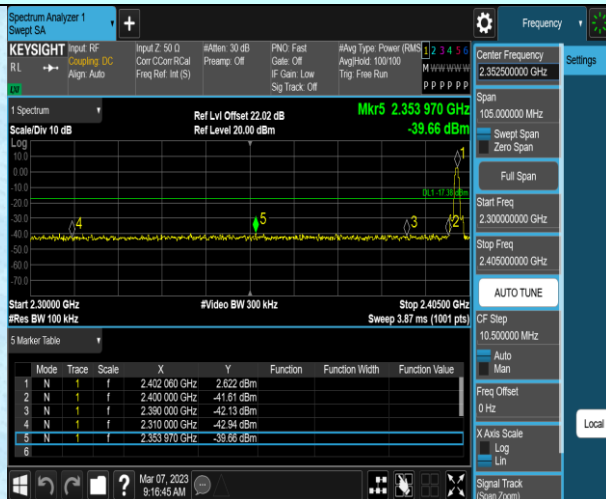
Highest channel



Hopping mode

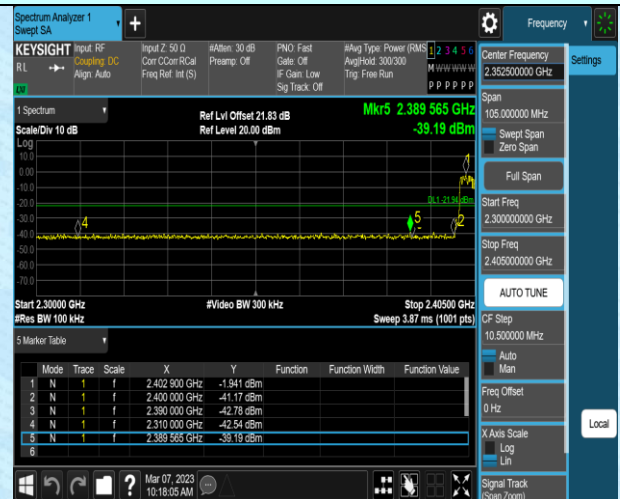
8-DPSK Mode:

Test channel:



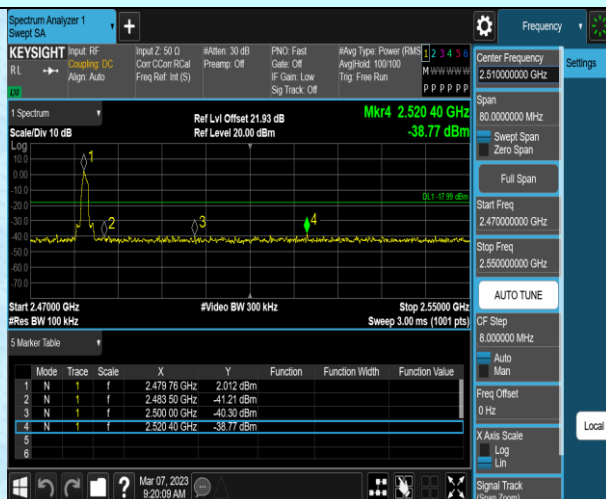
No-hopping mode

Lowest channel



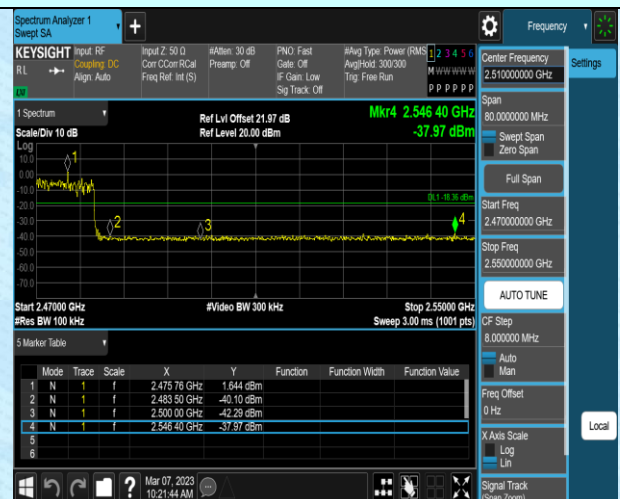
Hopping mode

Test channel:



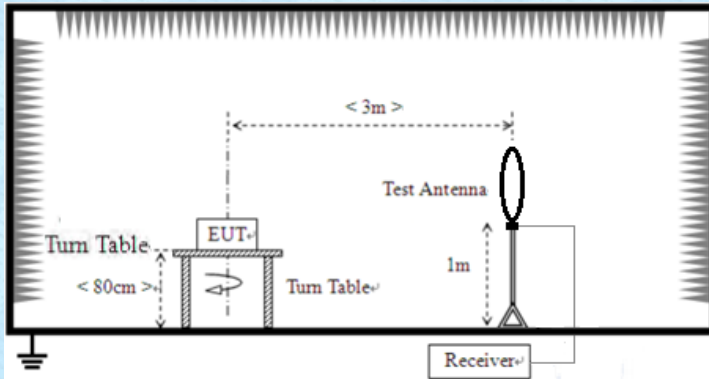
No-hopping mode

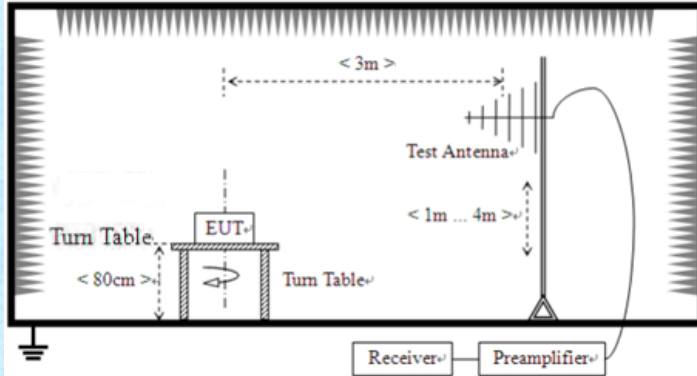
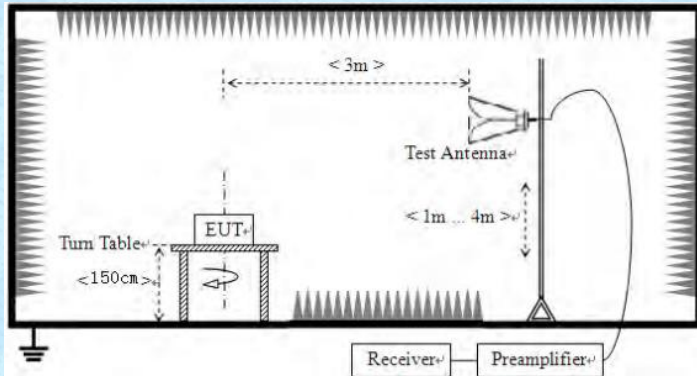
Highest channel



Hopping mode

7.8.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 & RSS-247 5.5				
Test Method:	ANSI C63.10:2013 and RSS-Gen				
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
Note: For Duty cycle $\geq 98\%$, average detector set as above For Duty cycle $< 98\%$, average detector set as below: $VBW \geq 1 / T$					
Limit:	Frequency	Limit (uV/m)	Value	Measurement Distance	
	0.009MHz-0.490MHz	2400/F(KHz)	PK/QP/AV	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				
					

	Report No.: CTS2023030175 01 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 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

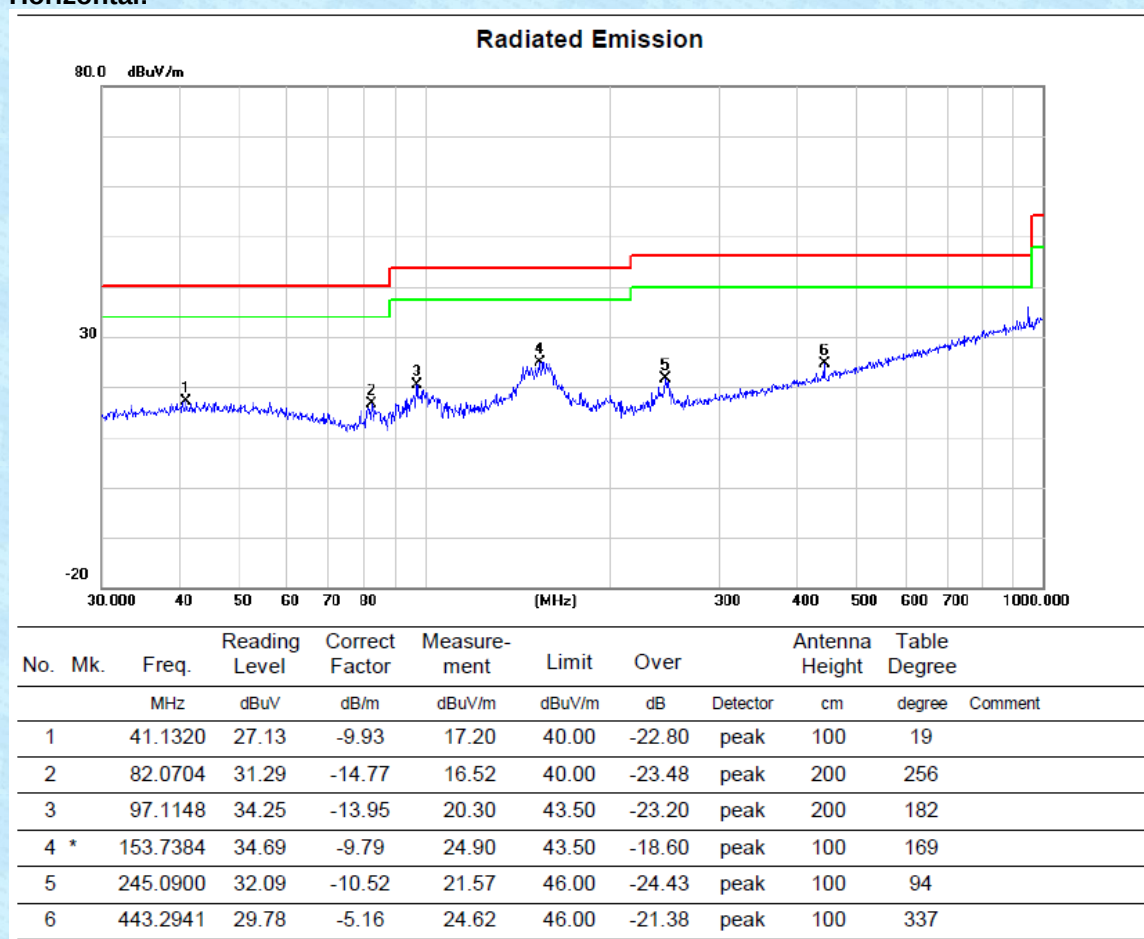
The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

■ Below 1GHz

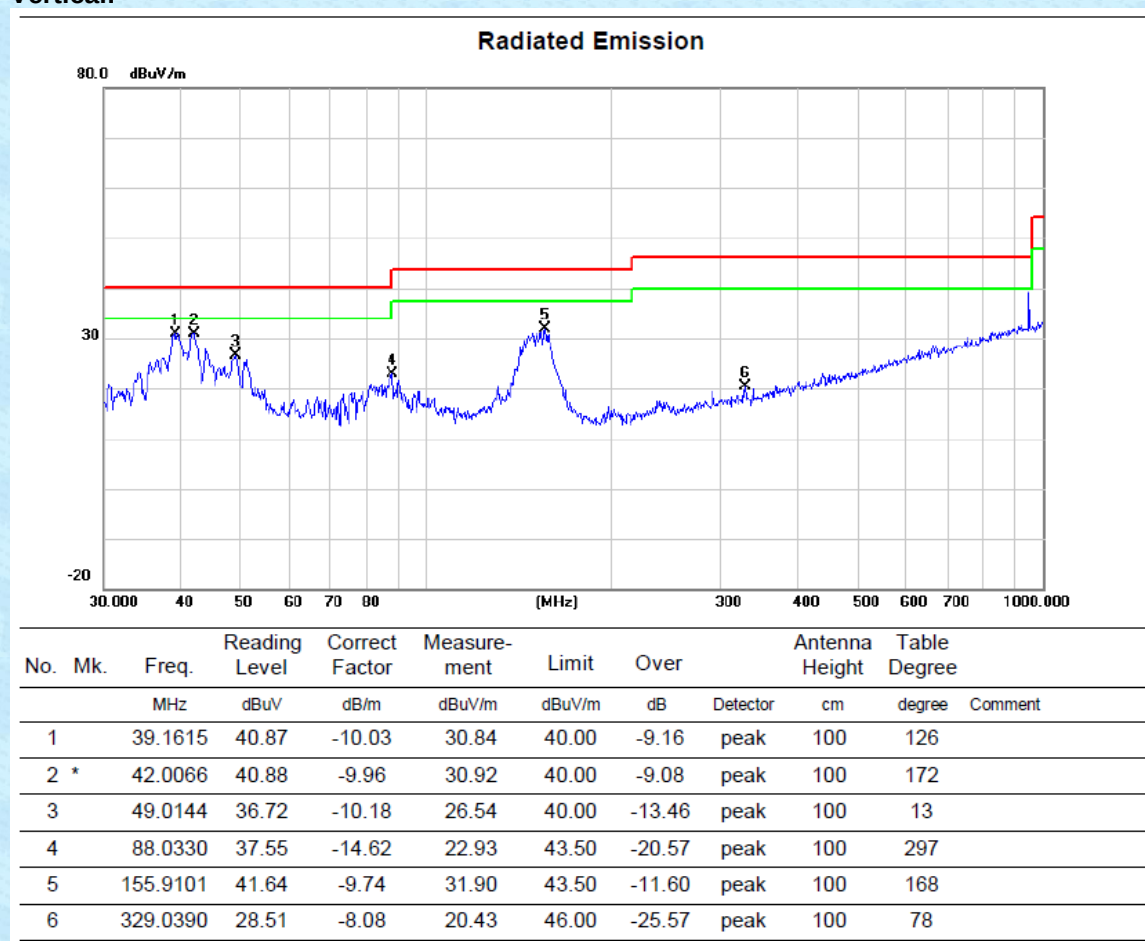
Pre-scan all test modes, found worst case at GFSK 2402MHz, and so only show the test result of it.

For SE8

Horizontal:

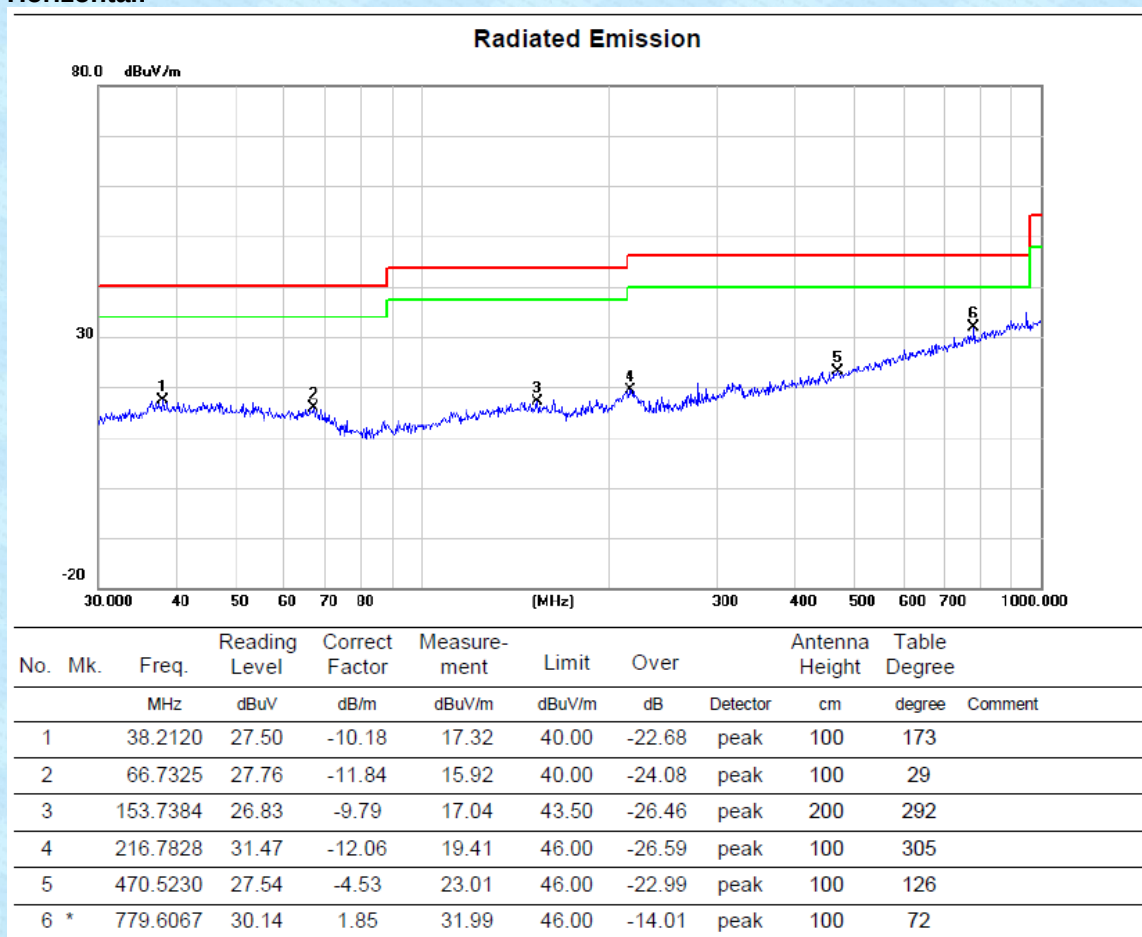


Vertical:

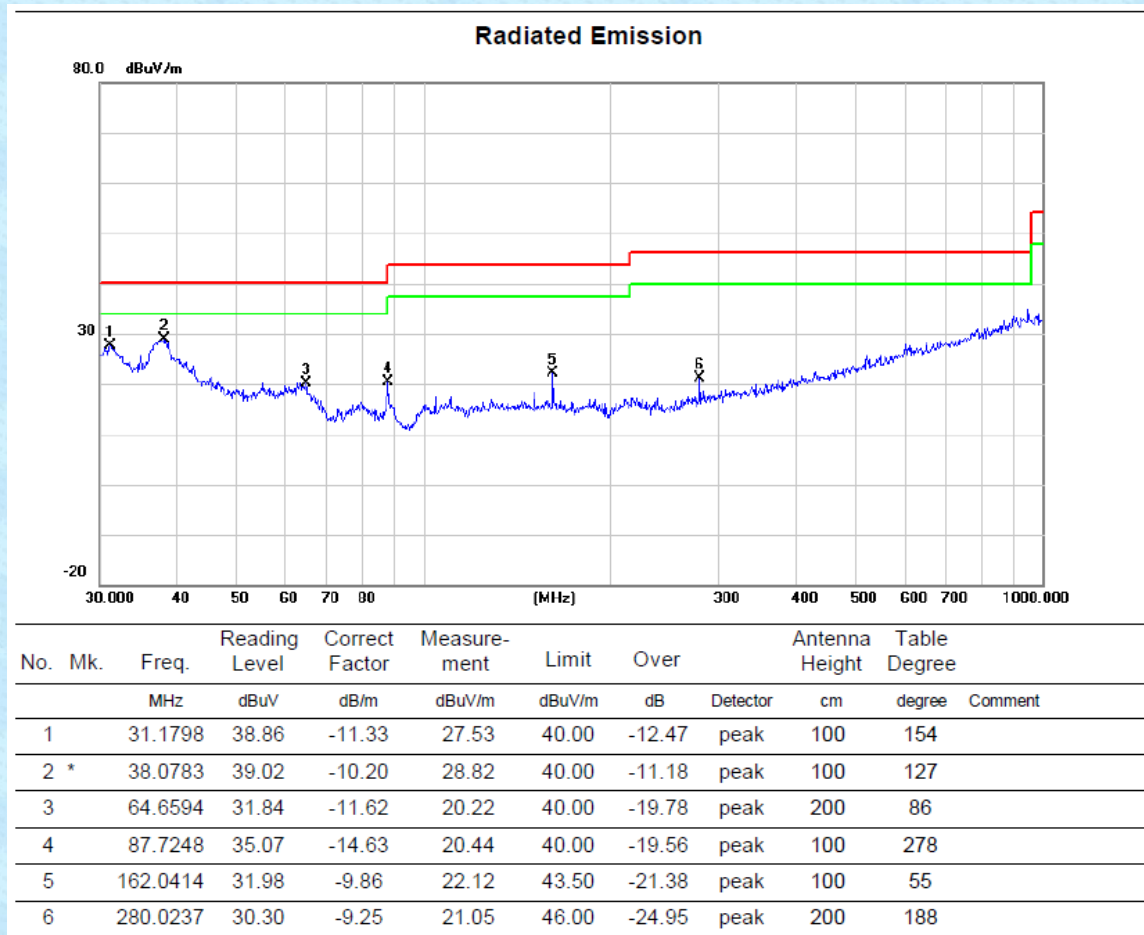


For SE7

Horizontal:



Vertical:



REMARKS:

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value - Limit Value.

■ Above 1GHz

■ Unwanted Emissions in Restricted Frequency Bands

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
4804	43.32	31.62	8.58	32.11	51.41	74	-22.59	Vertical
7206	34.63	35.89	11.63	31.92	50.23	74	-23.77	Vertical
4804	43.75	31.62	8.58	32.11	51.84	74	-22.16	Horizontal
7206	34.35	35.89	11.63	31.92	49.95	74	-24.05	Horizontal

Test channel:	Middle 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
4882	43.37	31.92	8.71	32.11	51.89	74	-22.11	Vertical
7326	33.04	36.42	11.8	31.93	49.33	74	-24.67	Vertical
4882	41.49	31.92	8.71	32.11	50.01	74	-23.99	Horizontal
7326	34.78	36.42	11.8	31.93	51.07	74	-22.93	Horizontal

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
4960	41.67	31.96	8.75	32.3	50.08	74	-23.92	Vertical
7440	33.78	36.54	11.83	31.92	50.23	74	-23.77	Vertical
4960	43.43	31.96	8.75	32.3	51.84	74	-22.16	Horizontal
7440	33.43	36.54	11.83	31.92	49.88	74	-24.12	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

■ Unwanted Emissions in Non-restricted Frequency Bands

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
2310	44.59	27.14	6.19	42.04	35.88	74	-38.12	Horizontal
2390	57.07	27.37	6.31	42.11	48.64	74	-25.36	Horizontal
2310	42.17	27.14	6.19	42.04	33.46	74	-40.54	Vertical
2390	54.31	27.37	6.31	42.11	45.88	74	-28.12	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
2483.5	45.28	27.66	6.45	42.01	37.38	74	-36.62	Horizontal
2500	56.66	27.7	6.47	42	48.83	74	-25.17	Horizontal
2483.5	39.08	27.66	6.45	42.01	31.18	74	-42.82	Vertical
2500	50.99	27.7	6.47	42	43.16	74	-30.84	Vertical

Remarks:

5. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
6. The emission levels of other frequencies are very lower than the limit and not show in test report.

8 Test Setup Photo

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

9 EUT Constructional Details

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

-----End-----