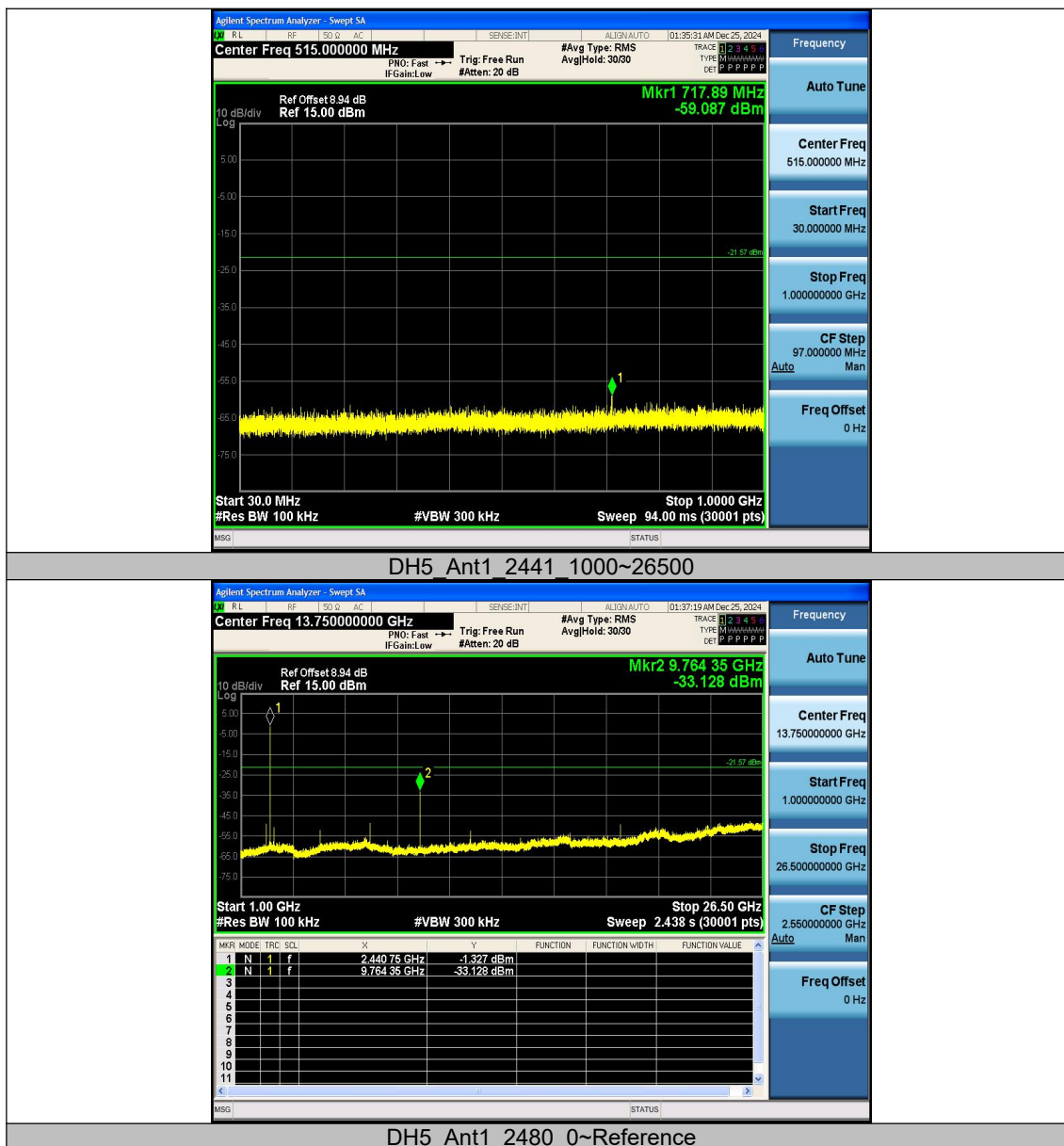
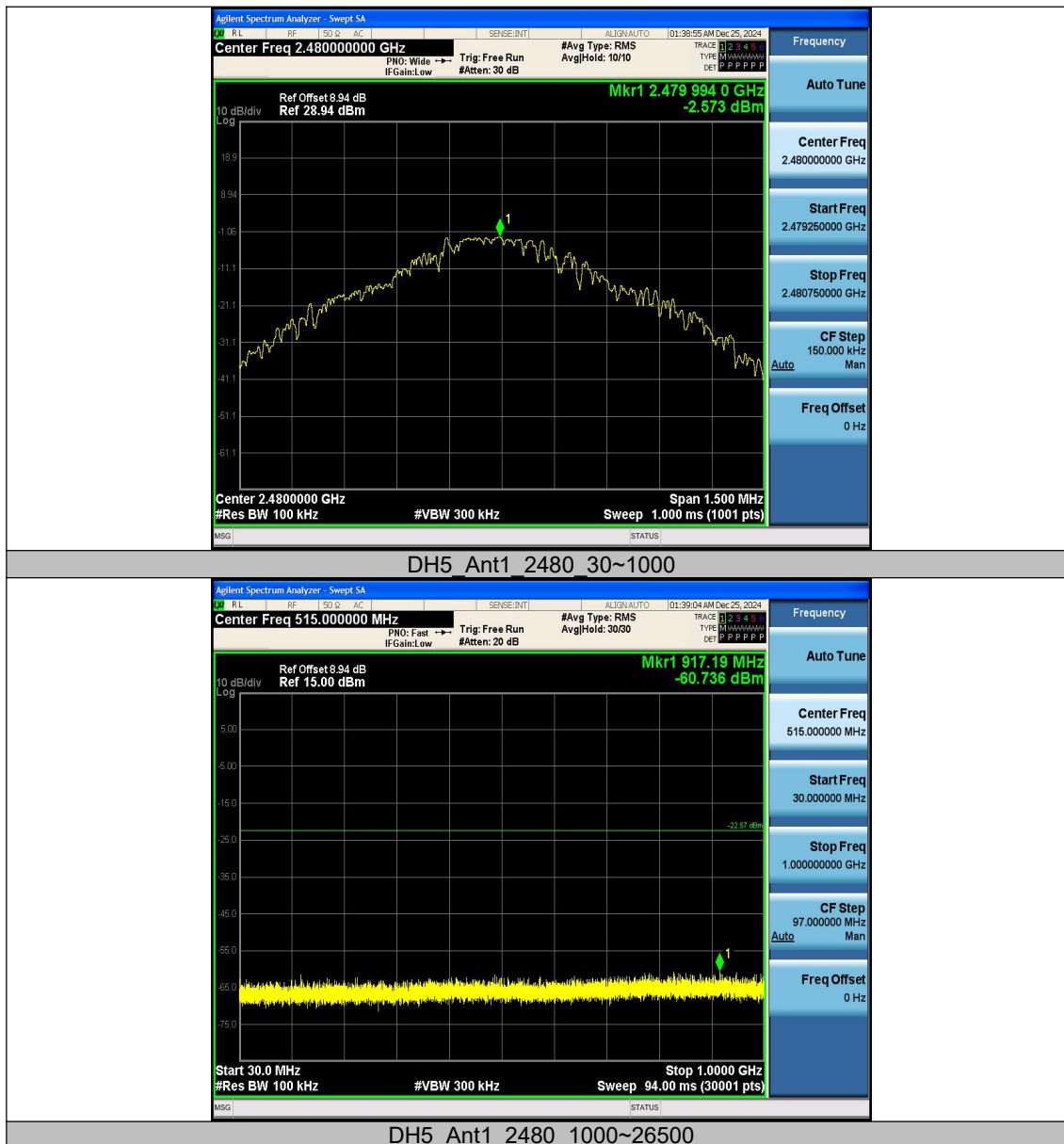


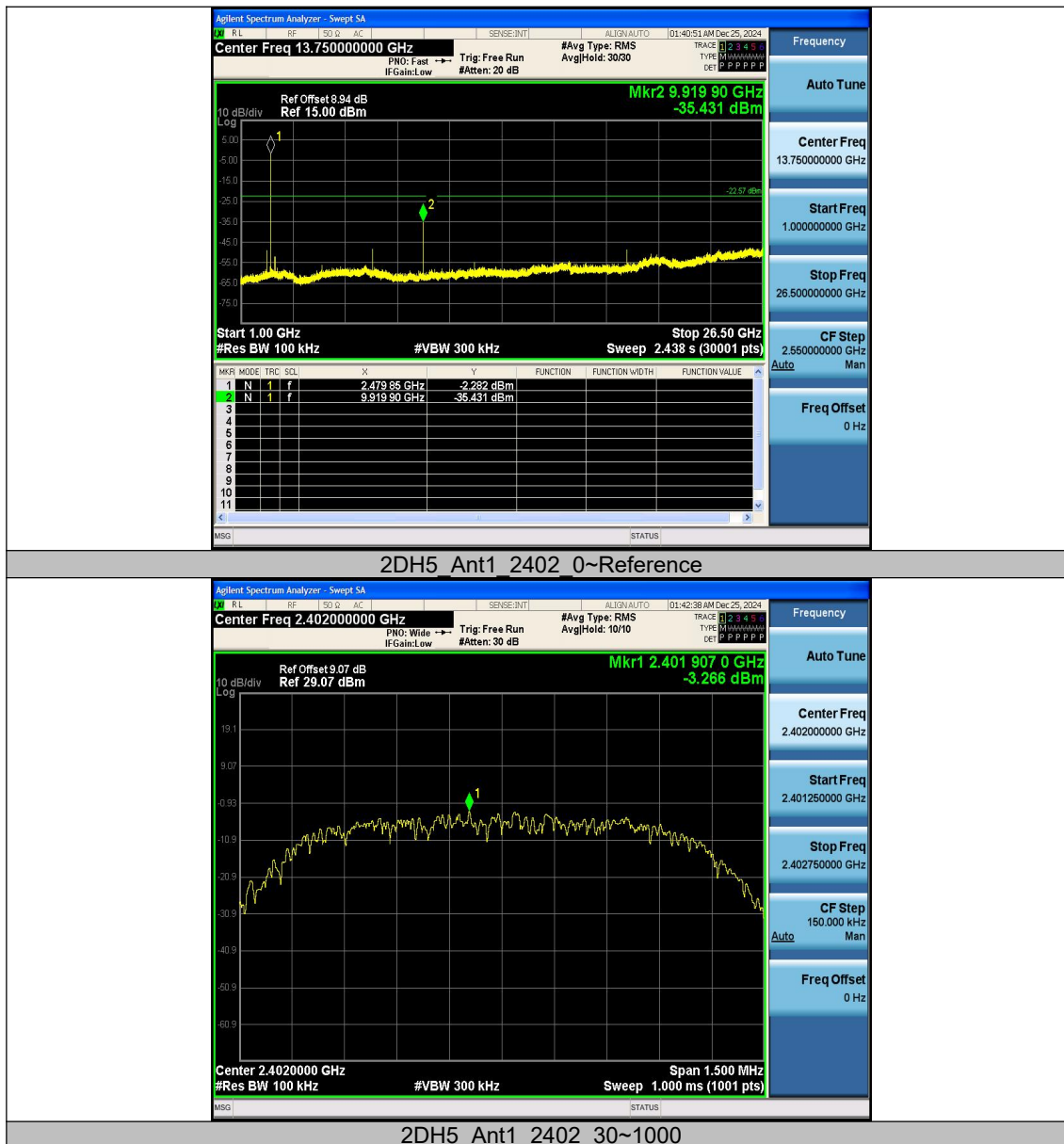
DH5_Ant1_2441_0~Reference

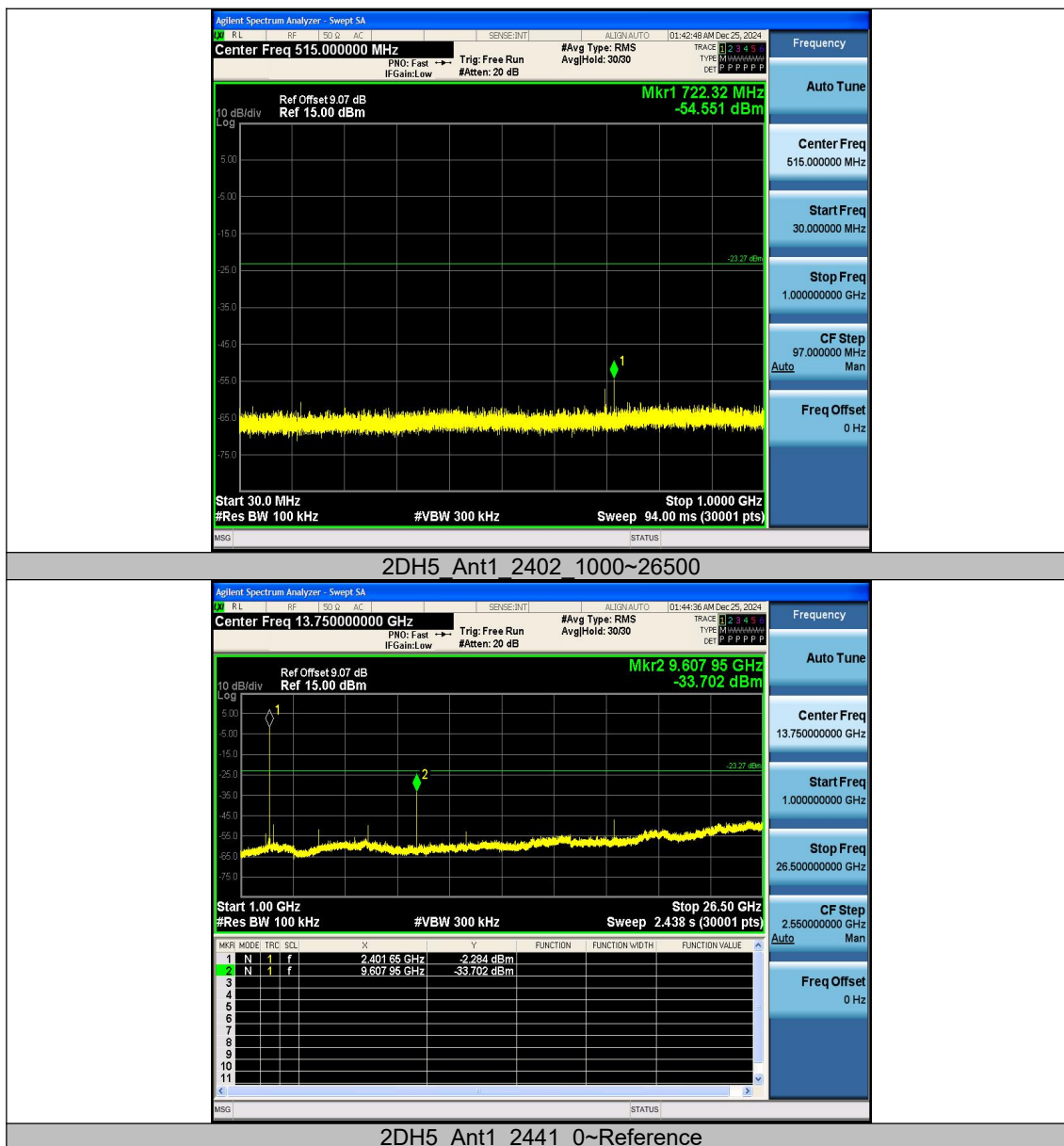


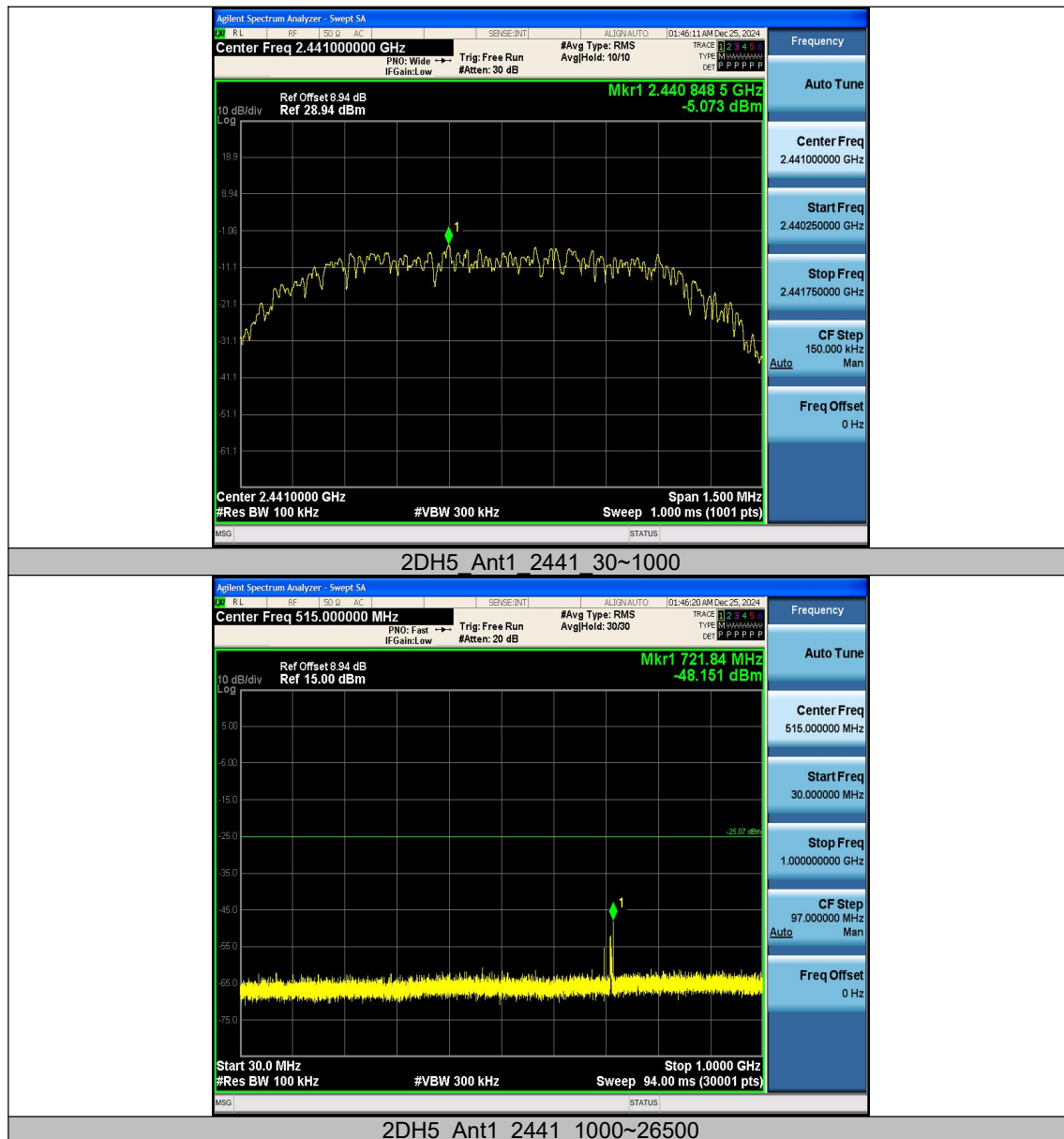
DH5_Ant1_2441_30~1000

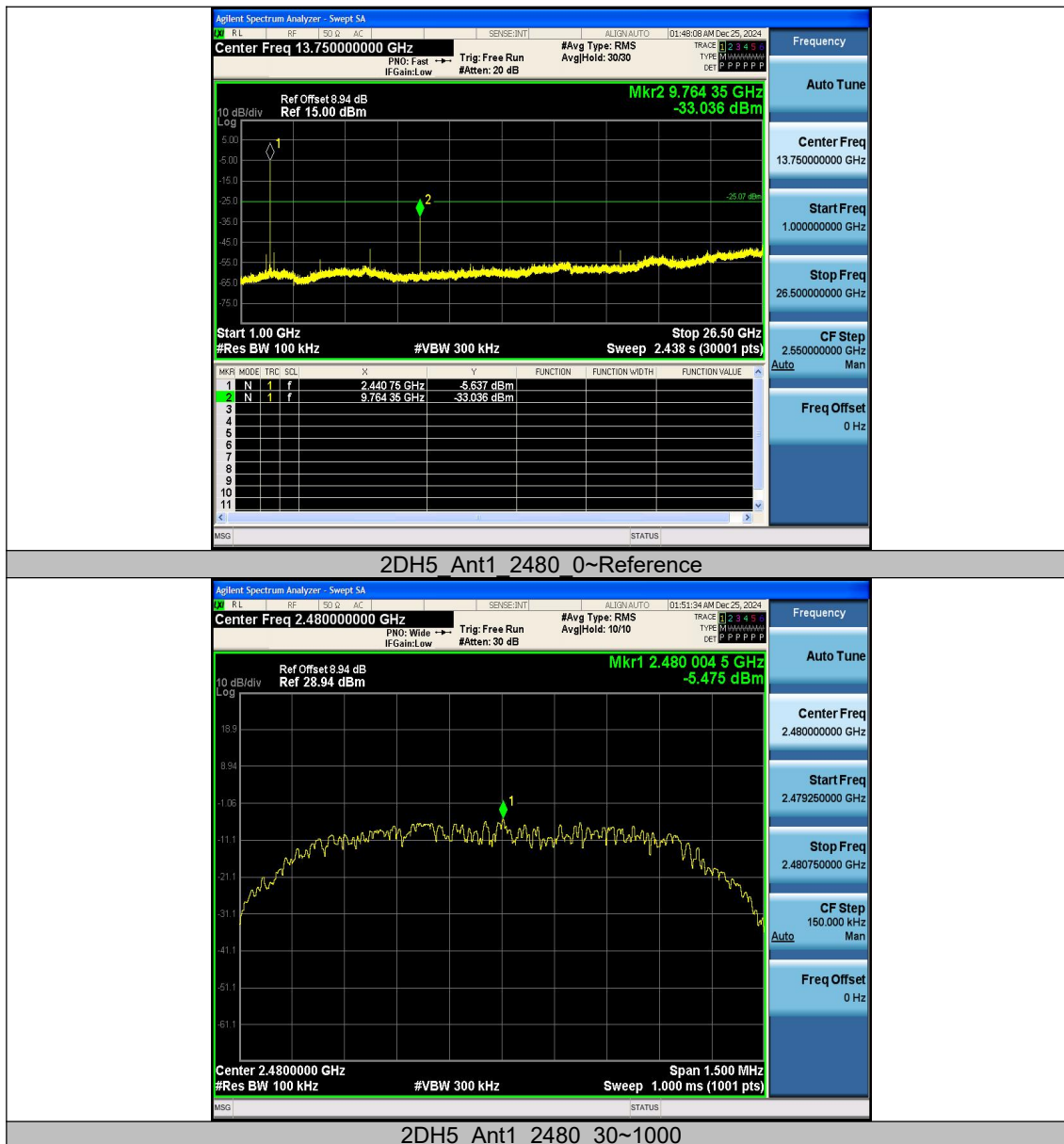


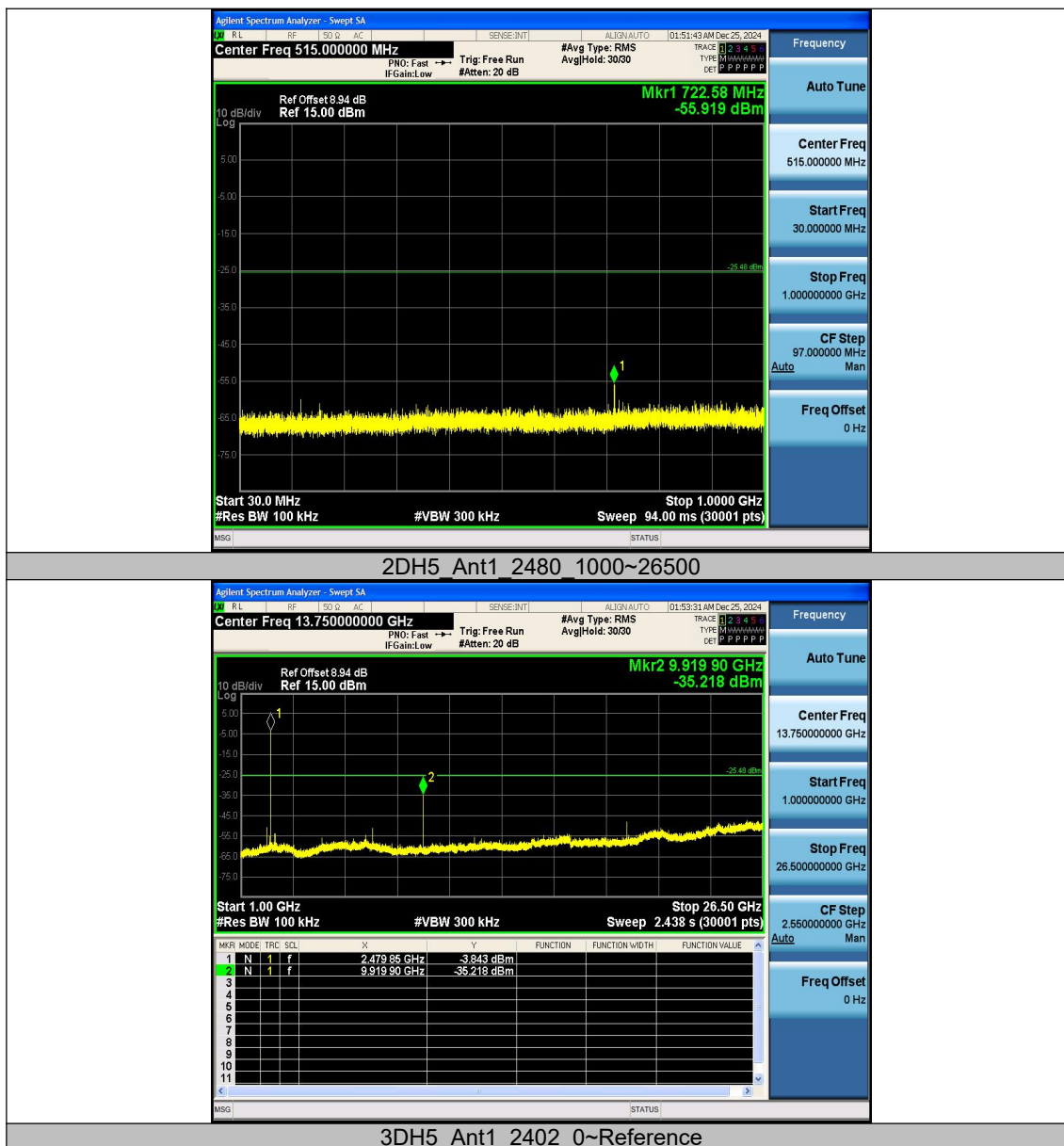


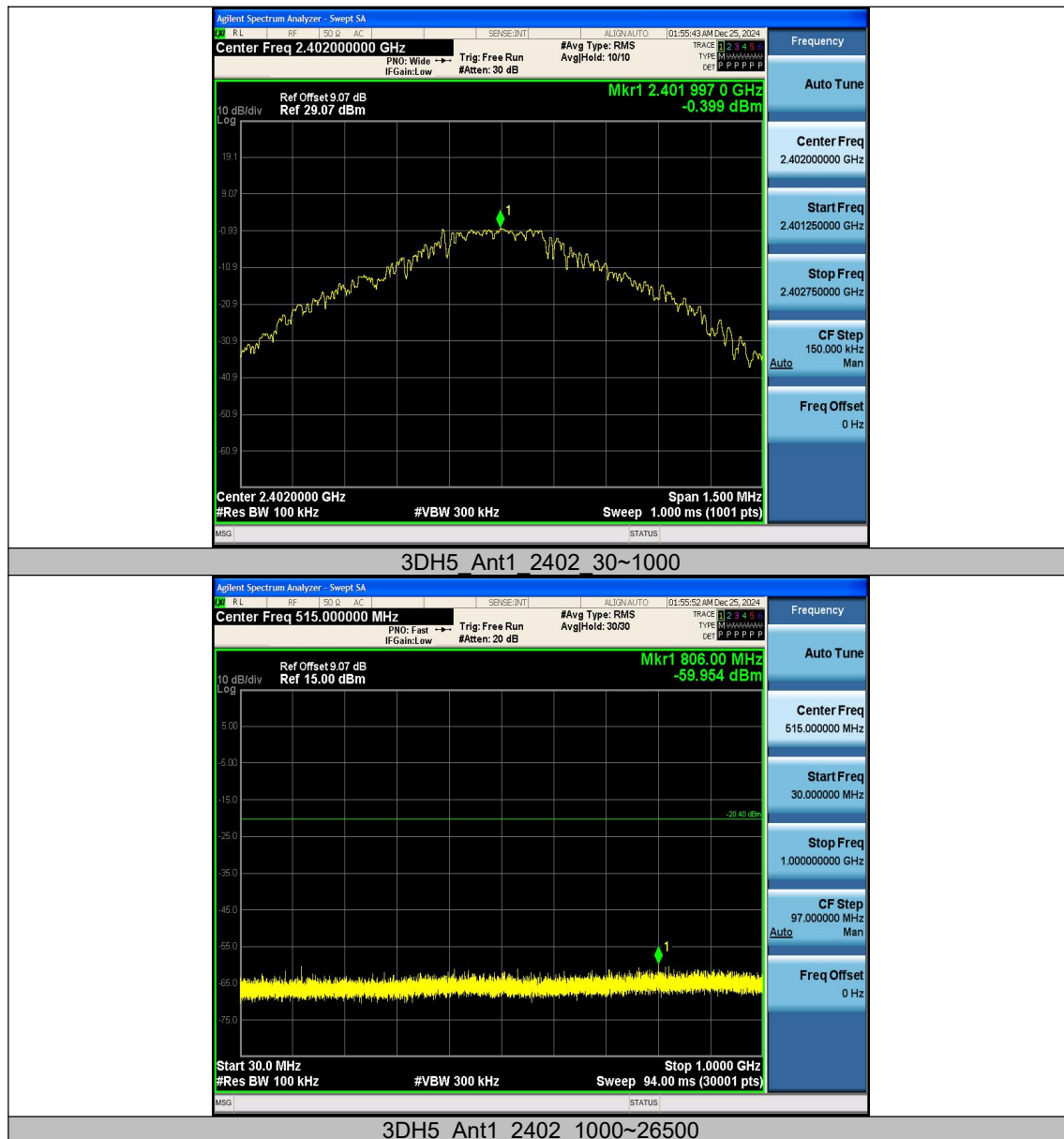










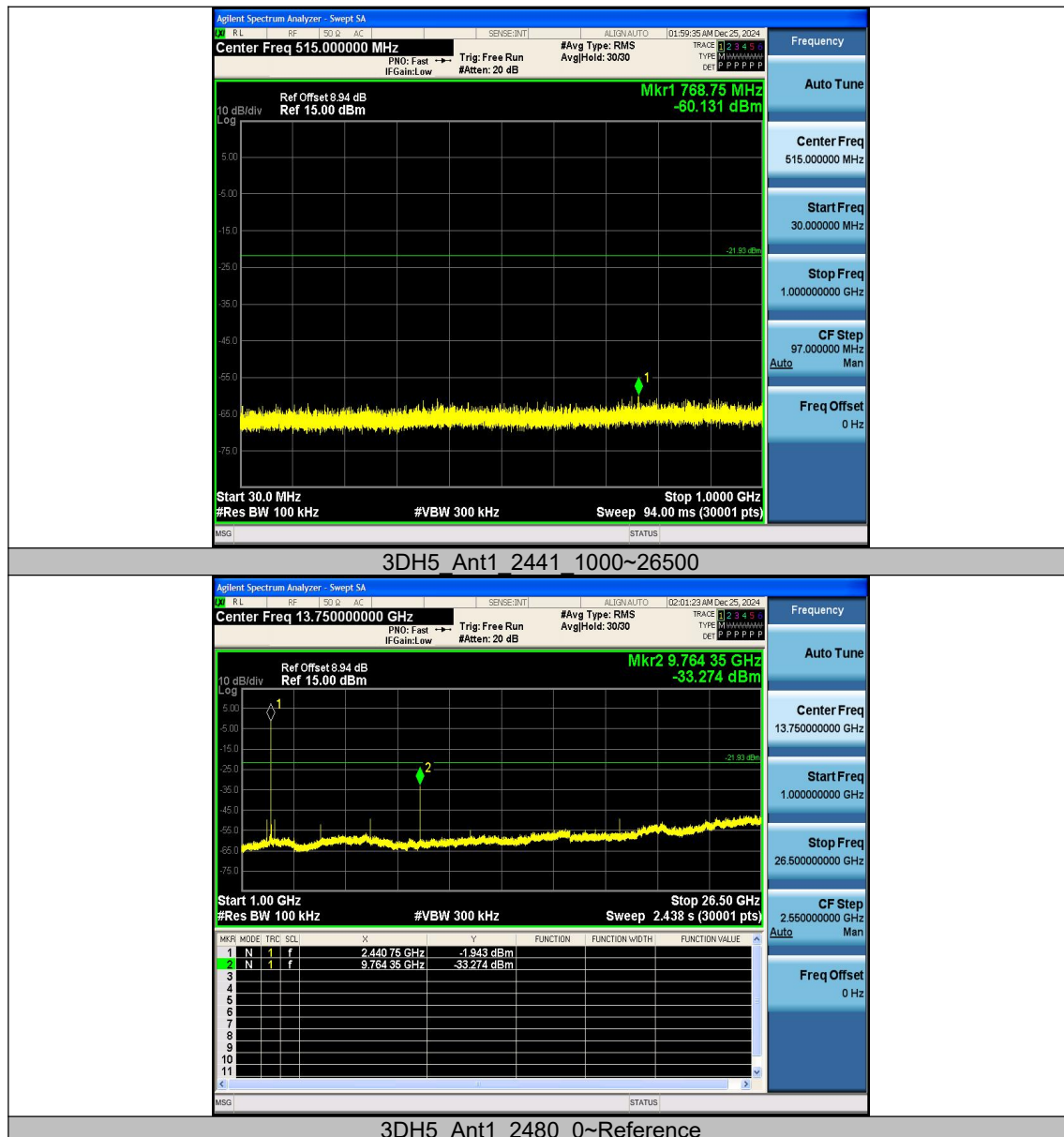




3DH5_Ant1_2441_0~Reference



3DH5_Ant1_2441_30~1000







4.7. RADIATED SPURIOUS EMISSION

4.7.1. Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02

4.7.2. Conformance Limit

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part15.205, the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength ($\mu\text{V/m}$)	Field Strength (dB $\mu\text{V/m}$)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log ($\mu\text{V/m}$)	300
0.490-1.705	24000/F(KHz)	20 log ($\mu\text{V/m}$)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

4.7.3. Test Configuration

Test according to clause 3.2 radio frequency test setup 2

4.7.4. Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

For Above 1GHz:

The EUT was placed on a turn table which is 1.5m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 1GHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 100 kHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 30MHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 9kHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

For Below 150KHz:

The EUT was placed on a turn table which is 0.8m above ground plane.

Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Span = wide enough to fully capture the emission being measured

RBW = 200Hz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

Repeat above procedures until all frequency measured was complete.

■ Spurious Emission below 30MHz (9KHz to 30MHz)

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
--	--	--	--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor = $40 \log(\text{Specific distance} / \text{test distance})$ (dB);

Limit line = Specific limits (dBμV) + distance extrapolation factor

■ Spurious Emission Above 1GHz (1GHz to 25GHz)

Bluetooth (GFSK, π/4-DQPSK, 8DPSK) mode have been tested, and the worst result(8DPSK) was report as below:

Test mode:		8DPSK		Frequency:		Channel 0: 2402MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4808	46.35	-1.01	45.34	74	-28.66	peak	V
4825	34.47	-1.02	33.45	54	-20.55	AVG	V
7001	40.64	5.77	46.41	74	-27.59	peak	V
7103	30.22	5.72	35.94	54	-18.06	AVG	V
9364	40.66	7.43	48.09	74	-25.91	peak	V
9500	29.75	7.51	37.26	54	-16.74	AVG	V
4808	48.75	-1.01	47.74	74	-26.26	peak	H
4825	35.52	-1.02	34.5	54	-19.5	AVG	H
7103	30.15	5.72	35.87	54	-18.13	AVG	H
7120	40.14	5.72	45.86	74	-28.14	peak	H
9466	40.12	7.49	47.61	74	-26.39	peak	H
9500	29.55	7.51	37.06	54	-16.94	AVG	H

Test mode:		8DPSK		Frequency:		Channel 39: 2441MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4876	45.1	-1.01	44.09	74	-29.91	peak	V
4893	32.81	-1	31.81	54	-22.19	AVG	V
7103	30.15	5.72	35.87	54	-18.13	AVG	V
7120	40.61	5.72	46.33	74	-27.67	peak	V
9330	40.04	7.41	47.45	74	-26.55	peak	V
9381	29.37	7.45	36.82	54	-17.18	AVG	V
4876	44.86	-1.01	43.85	74	-30.15	peak	H
4893	33.25	-1	32.25	54	-21.75	AVG	H
7103	29.98	5.72	35.7	54	-18.3	AVG	H
7154	39.71	5.71	45.42	74	-28.58	peak	H
9364	39.9	7.43	47.33	74	-26.67	peak	H
9500	29.74	7.51	37.25	54	-16.75	AVG	H

Test mode:		8DPSK		Frequency:		Channel 78: 2480MHz	
Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4961	46.58	-1	45.58	74	-28.42	peak	V
4978	33.7	-1.01	32.69	54	-21.31	AVG	V
7086	30.17	5.73	35.9	54	-18.1	AVG	V
7103	40.3	5.72	46.02	74	-27.98	peak	V
9381	39.98	7.45	47.43	74	-26.57	peak	V
9381	29.4	7.45	36.85	54	-17.15	AVG	V
4961	43.59	-1	42.59	74	-31.41	peak	H
4978	31.25	-1.01	30.24	54	-23.76	AVG	H
7086	40.49	5.73	46.22	74	-27.78	peak	H
7103	30.16	5.72	35.88	54	-18.12	AVG	H
9415	40.44	7.46	47.9	74	-26.1	peak	H
9483	29.49	7.51	37	54	-17	AVG	H

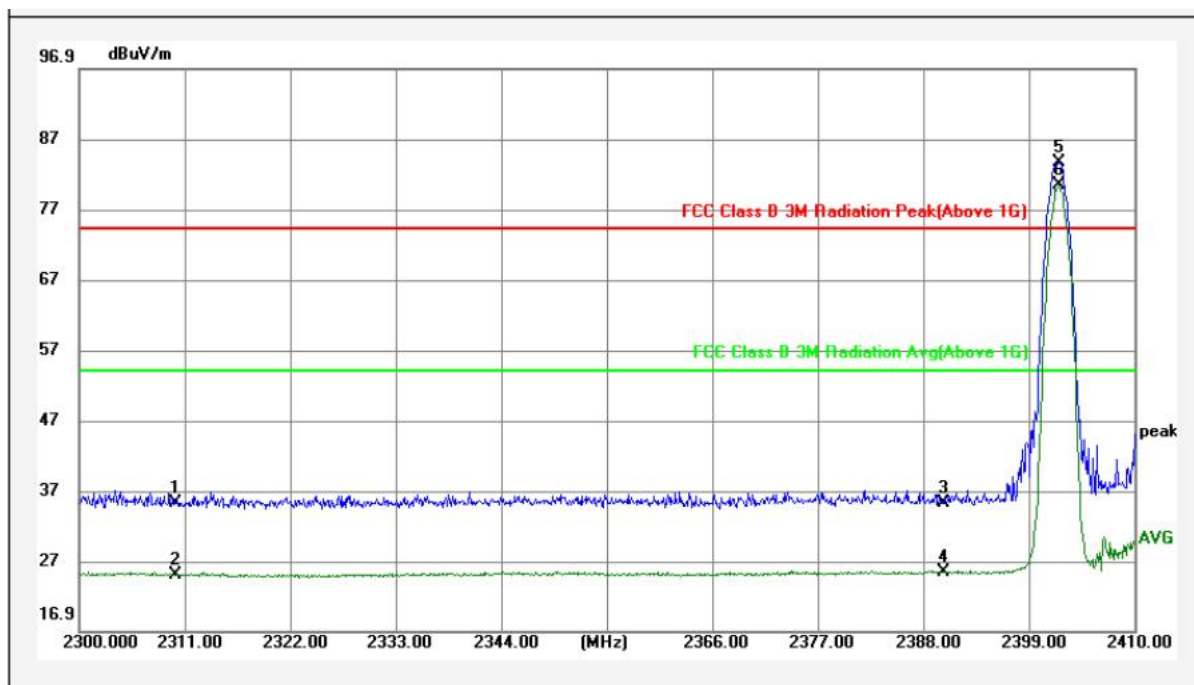
Note: (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).

(2) Emission Level= Reading Level+Probe Factor +Cable Loss.

(3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

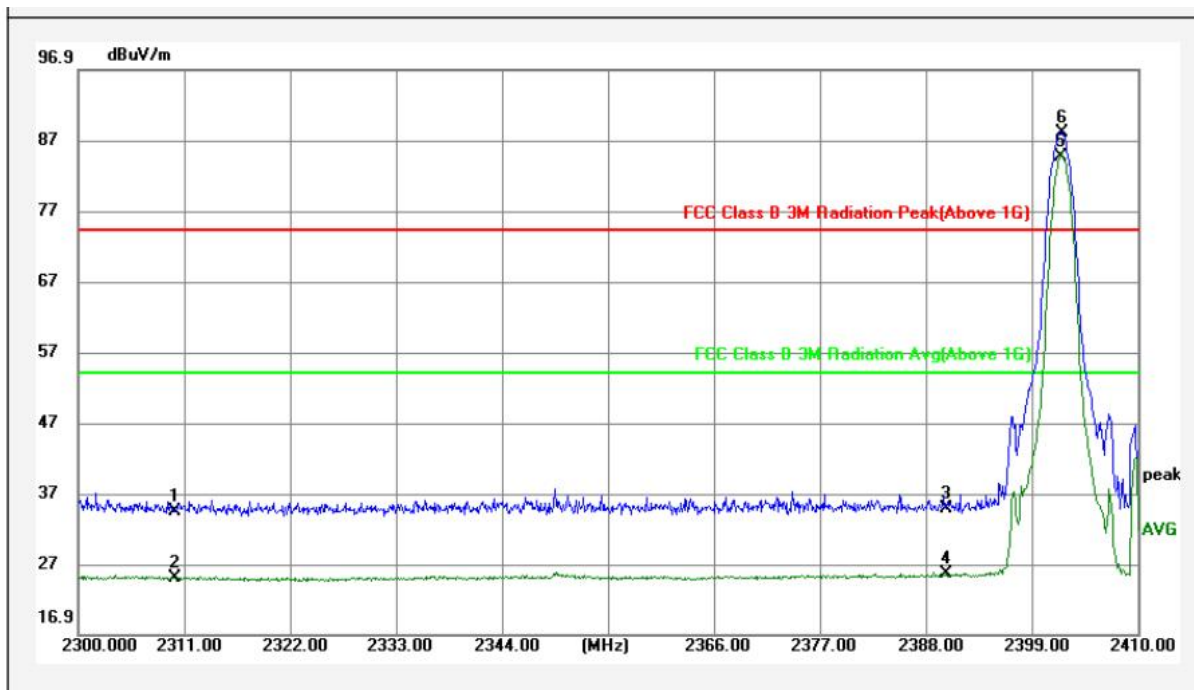
■ Spurious Emission in Restricted Band 2300-2390MHz and 2483.5-2500MHz
Bluetooth (GFSK, $\pi/4$ -DQPSK, 8DPSK, Hopping) mode have been tested, and the worst result(8DPSK) was report as below:

Test Mode:	8DPSK	2402MHz	Test Channel	Lowest
Temperature:	22.7℃		Phase:	Vertical
Relative Humidity:	47%		Pressure:	102.1KPa



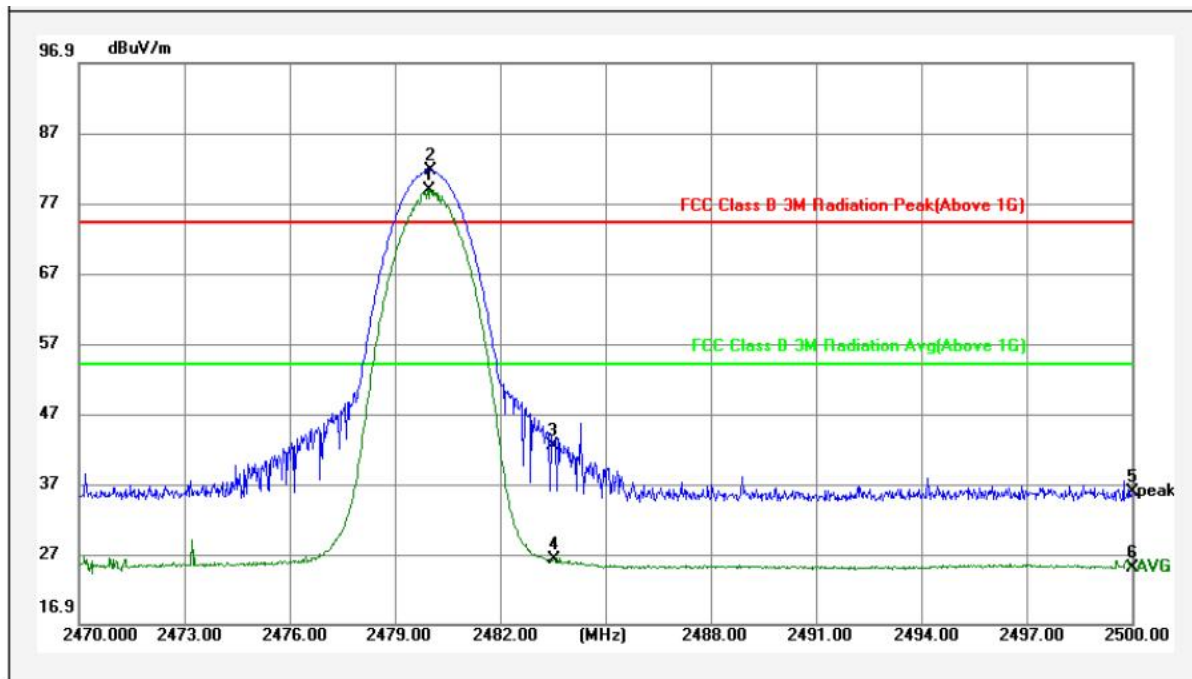
No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	2310.000	-5.12	40.38	35.26	74.00	-38.74	peak		
2	2310.010	-5.12	30.16	25.04	54.00	-28.96	AVG		
3	2390.000	-4.83	40.00	35.17	74.00	-38.83	peak		
4	2390.090	-4.83	30.15	25.32	54.00	-28.68	AVG		
5	2402.000	-4.78	88.44	83.66	74.00	9.66	peak	X	
6	2402.190	-4.78	85.23	80.45	54.00	26.45	AVG	*	

Test Mode:	8DPSK	2402MHz	Test Channel	Lowest
Temperature:	22.7℃		Phase:	Horizontal
Relative Humidity:	47%		Pressure:	102.1KPa



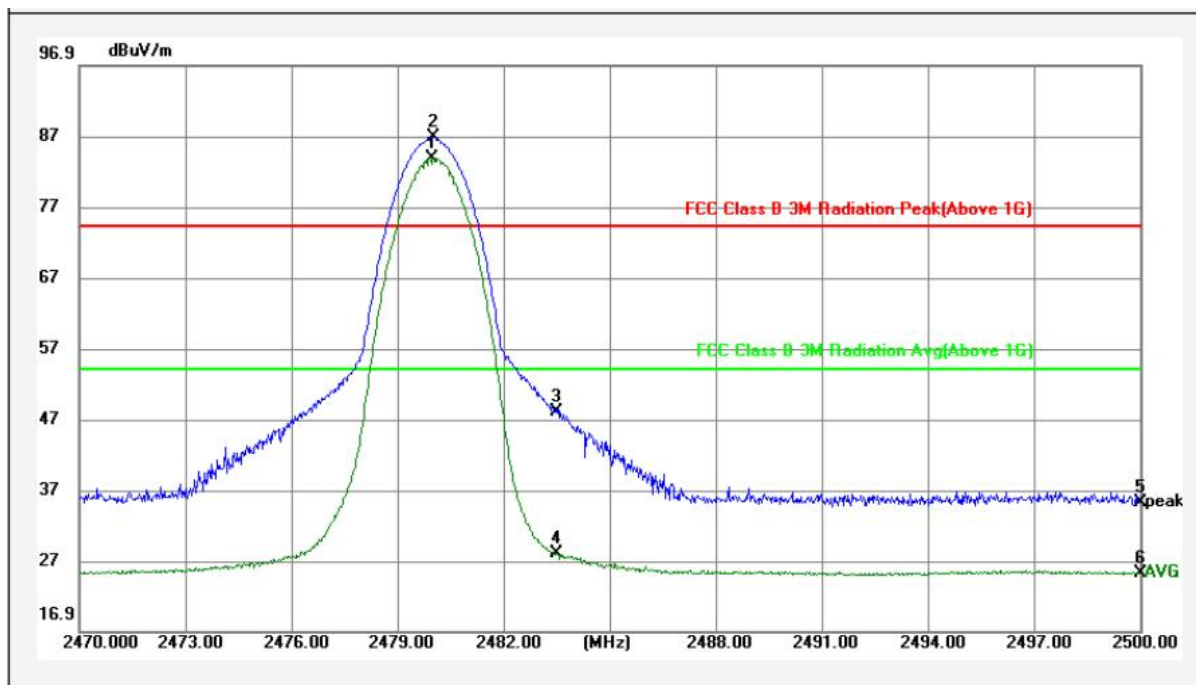
No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	2310.000	-5.12	39.46	34.34	74.00	-39.66	peak		
2	2310.010	-5.12	30.08	24.96	54.00	-29.04	AVG		
3	2390.000	-4.83	39.72	34.89	74.00	-39.11	peak		
4	2390.090	-4.83	30.39	25.56	54.00	-28.44	AVG		
5	2401.970	-4.78	89.47	84.69	54.00	30.69	AVG	*	
6	2402.000	-4.78	92.73	87.95	74.00	13.95	peak	X	

Test Mode:	8DPSK	2480MHz	Test Channel	Highest
Temperature:	22.7℃		Phase:	Vertical
Relative Humidity:	47%		Pressure:	102.1KPa



No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	2479.990	-4.48	83.24	78.76	54.00	24.76	AVG	*	
2	2480.000	-4.48	86.15	81.67	74.00	7.67	peak	X	
3	2483.500	-4.46	46.83	42.37	74.00	-31.63	peak		
4	2483.530	-4.46	30.62	26.16	54.00	-27.84	AVG		
5	2500.000	-4.41	40.13	35.72	74.00	-38.28	peak		
6	2500.000	-4.41	29.40	24.99	54.00	-29.01	AVG		

Test Mode:	8DPSK	2480MHz	Test Channel	Highest
Temperature:	22.7℃		Phase:	Horizontal
Relative Humidity:	47%		Pressure:	102.1KPa

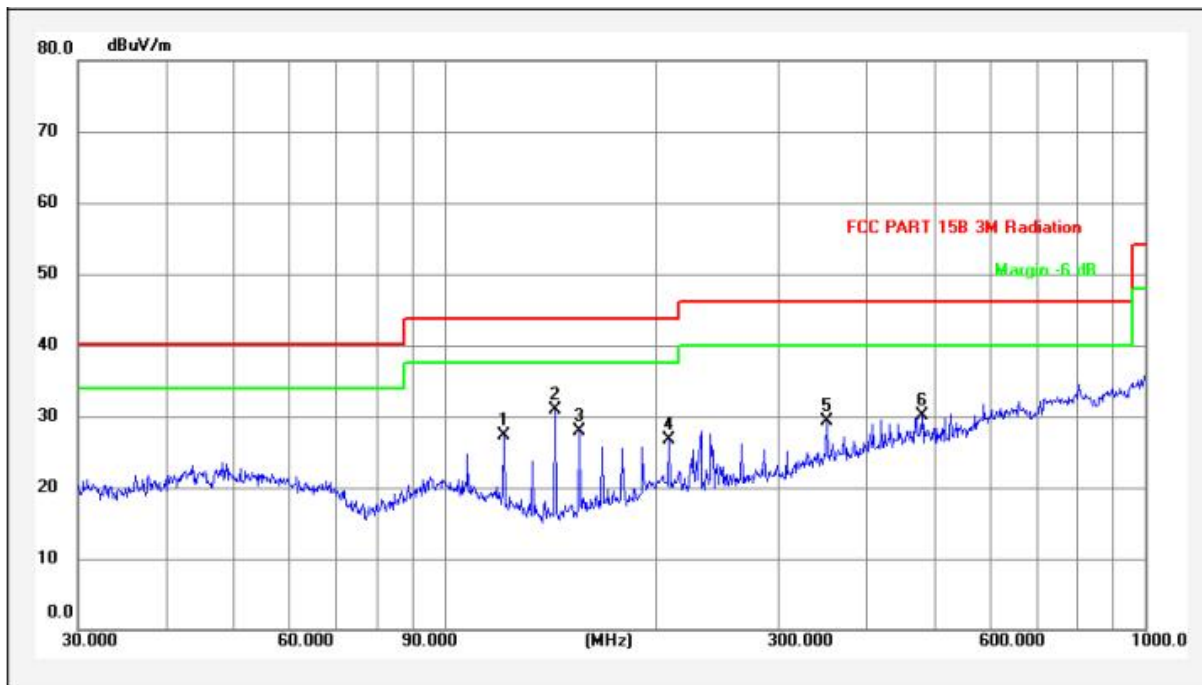


No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	2479.990	-4.48	88.35	83.87	54.00	29.87	AVG	*	
2	2480.000	-4.48	91.22	86.74	74.00	12.74	peak	X	
3	2483.500	-4.46	52.44	47.98	74.00	-26.02	peak		
4	2483.500	-4.46	32.53	28.07	54.00	-25.93	AVG		
5	2500.000	-4.41	39.67	35.26	74.00	-38.74	peak		
6	2500.000	-4.41	29.63	25.22	54.00	-28.78	AVG		

- Note:** (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

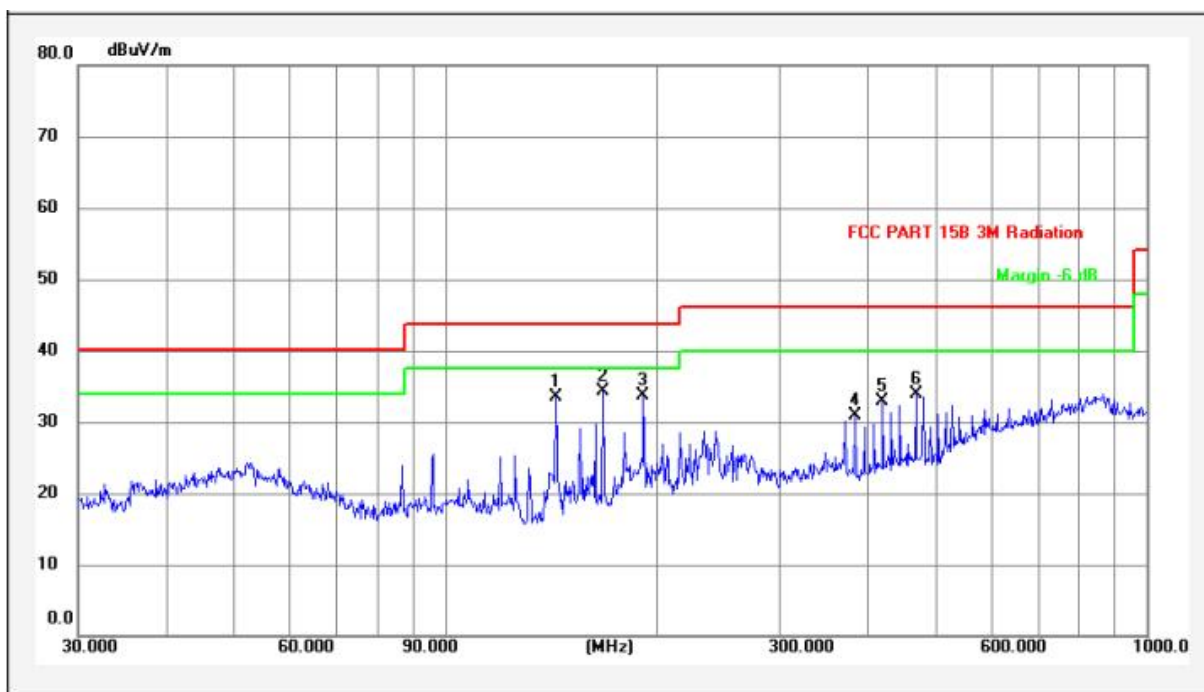
- Spurious Emission below 1GHz (30MHz to 1GHz)
Bluetooth (GFSK, $\pi/4$ -DQPSK, 8DPSK) mode have been tested, and the worst result(8DPSK) was report as below:

Test Mode:	8DPSK	2402MHz	Test Voltage:	DC 3.7V
Temperature:	22.7℃		Phase:	Vertical
Relative Humidity:	47%		Pressure:	102.1KPa



No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	121.5485	9.04	18.30	27.34	43.50	-16.16	QP		
2	143.8293	6.93	24.01	30.94	43.50	-12.56	QP	*	
3	155.9100	7.71	20.26	27.97	43.50	-15.53	QP		
4	209.3129	10.87	15.92	26.79	43.50	-16.71	QP		
5	351.7078	14.55	14.77	29.32	46.00	-16.68	QP		
6	480.5276	15.81	14.28	30.09	46.00	-15.91	QP		

Test Mode:	8DPSK	2402MHz	Test Voltage:	DC 3.7V
Temperature:	22.7℃		Phase:	Horizontal
Relative Humidity:	47%		Pressure:	102.1KPa



No.	Frequency (MHz)	Factor (dBuV/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	MK.	Remark
1	143.8292	6.93	26.64	33.57	43.50	-9.93	QP		
2	167.8240	8.47	25.81	34.28	43.50	-9.22	QP	*	
3	191.7450	9.48	24.16	33.64	43.50	-9.86	QP		
4	383.9318	14.63	16.32	30.95	46.00	-15.05	QP		
5	420.5803	15.08	17.78	32.86	46.00	-13.14	QP		
6	468.8761	15.77	18.08	33.85	46.00	-12.15	QP		

4.8. CONDUCTED EMISSION TEST

4.8.1. Applicable Standard

According to FCC Part 15.207(a)

4.8.2. Conformance Limit

Conducted Emission Limit		
Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50
Note: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.		

Remark: Test results were obtained from the following equation:

Measurement (dBμV) = LISN Factor (dB) + Cable Loss (dB) + Reading (dBμV)

Margin (dB) = Measurement (dBμV) - Limit (dBμV)

4.8.3. Test Configuration

Test according to clause 3.3 conducted emission test setup

4.8.4. Test Procedure

The EUT was placed on a table which is 0.8m above ground plane.

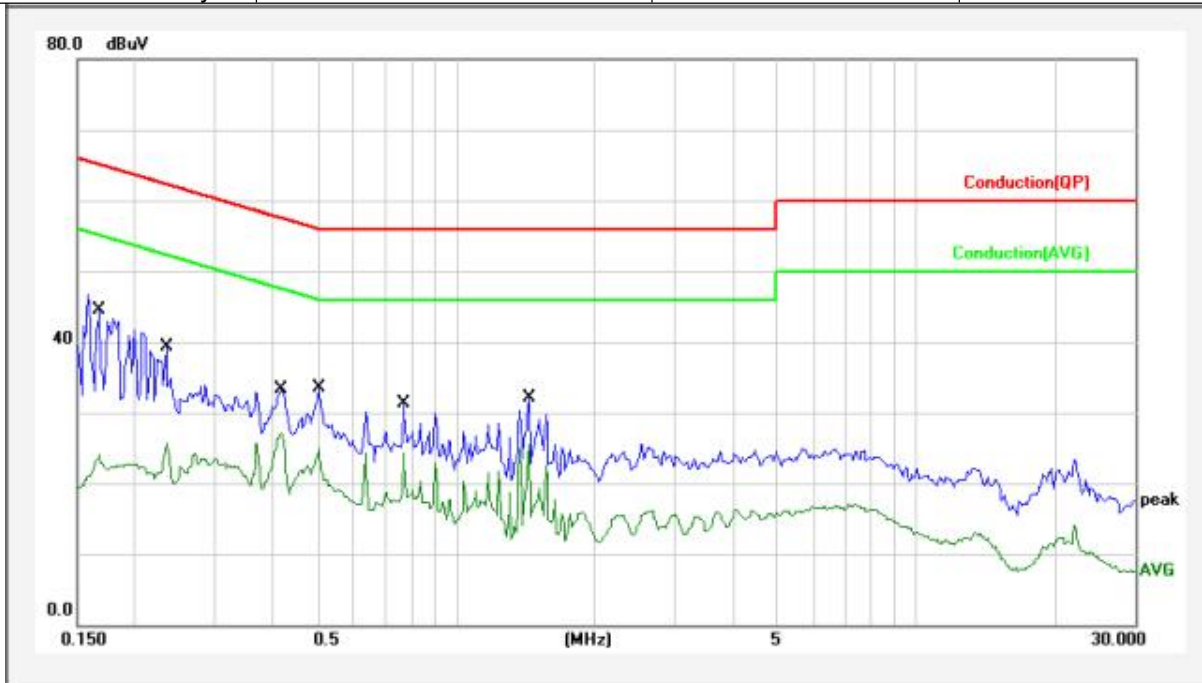
Maximum procedure was performed on the highest emissions to ensure EUT compliance.

Repeat above procedures until all frequency measured were complete.

Test Results :PASS

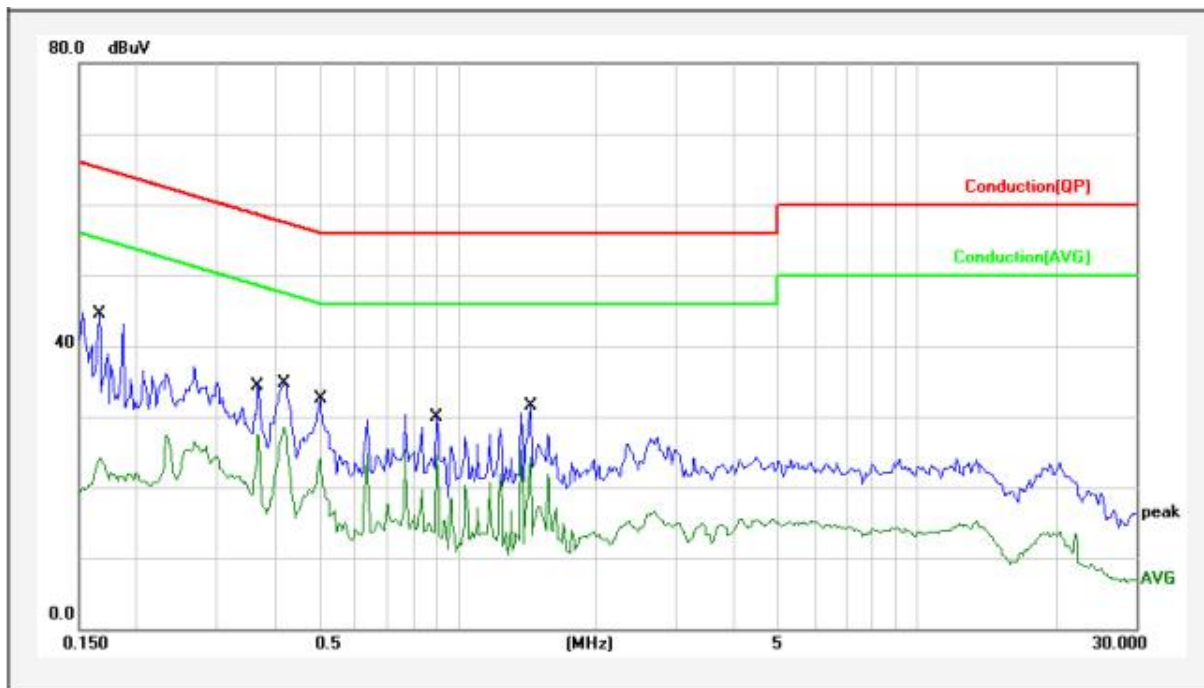
Bluetooth (GFSK, π/4-DQPSK, 8DPSK) mode have been tested, and the worst result(8DPSK) was report as below:

Test Mode:	8DPSK	2480MHz	Test Voltage:	AC 120V/60Hz
Temperature:	22.6℃		Phase:	L1
Relative Humidity:	39%		Pressure:	101.5KPa



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1677	10.30	31.19	41.49	65.07	-23.58	QP	P	
2	0.1677	10.30	13.73	24.03	55.07	-31.04	AVG	P	
3	0.2343	10.33	26.02	36.35	62.30	-25.95	QP	P	
4	0.2343	10.33	15.39	25.72	52.30	-26.58	AVG	P	
5	0.4160	10.38	19.94	30.32	57.53	-27.21	QP	P	
6	0.4160	10.38	16.73	27.11	47.53	-20.42	AVG	P	
7	0.5036	10.40	20.06	30.46	56.00	-25.54	QP	P	
8	0.5036	10.40	14.56	24.96	46.00	-21.04	AVG	P	
9	0.7681	10.48	17.76	28.24	56.00	-27.76	QP	P	
10	0.7681	10.48	13.92	24.40	46.00	-21.60	AVG	P	
11	1.4417	10.57	18.58	29.15	56.00	-26.85	QP	P	
12	1.4417	10.57	15.02	25.59	46.00	-20.41	AVG	P	

Test Mode:	8DPSK	2480MHz	Test Voltage:	AC 120V/60Hz
Temperature:	22.6℃		Phase:	N
Relative Humidity:	39%		Pressure:	101.5KPa



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1663	10.35	31.06	41.41	65.14	-23.73	QP	P	
2	0.1663	10.35	13.75	24.10	55.14	-31.04	AVG	P	
3	0.3690	10.40	20.96	31.36	58.52	-27.16	QP	P	
4	0.3690	10.40	17.10	27.50	48.52	-21.02	AVG	P	
5	0.4192	10.41	21.27	31.68	57.46	-25.78	QP	P	
6	0.4192	10.41	18.01	28.42	47.46	-19.04	AVG	P	
7	0.5036	10.43	19.16	29.59	56.00	-26.41	QP	P	
8	0.5036	10.43	13.76	24.19	46.00	-21.81	AVG	P	
9	0.9010	10.52	16.44	26.96	56.00	-29.04	QP	P	
10	0.9010	10.52	13.90	24.42	46.00	-21.58	AVG	P	
11	1.4417	10.56	17.95	28.51	56.00	-27.49	QP	P	
12	1.4417	10.56	13.81	24.37	46.00	-21.63	AVG	P	

4.9. ANTENNA APPLICATION

4.9.1. Antenna Requirement

Standard	Requirement
FCC CRF Part 15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.9.2. Result

PASS.

The EUT has 1 antenna: Chip Antenna for BT with classic mode, the gain is 1.7dBi;

- ☒ Antenna use a permanently attached antenna which is not replaceable.
- ☐ Not using a standard antenna jack or electrical connector for antenna replacement
- ☐ The antenna has to be professionally installed (please provide method of installation)

Note: which in accordance to section 15.203, please refer to the internal photos.

----- END OF REPORT -----