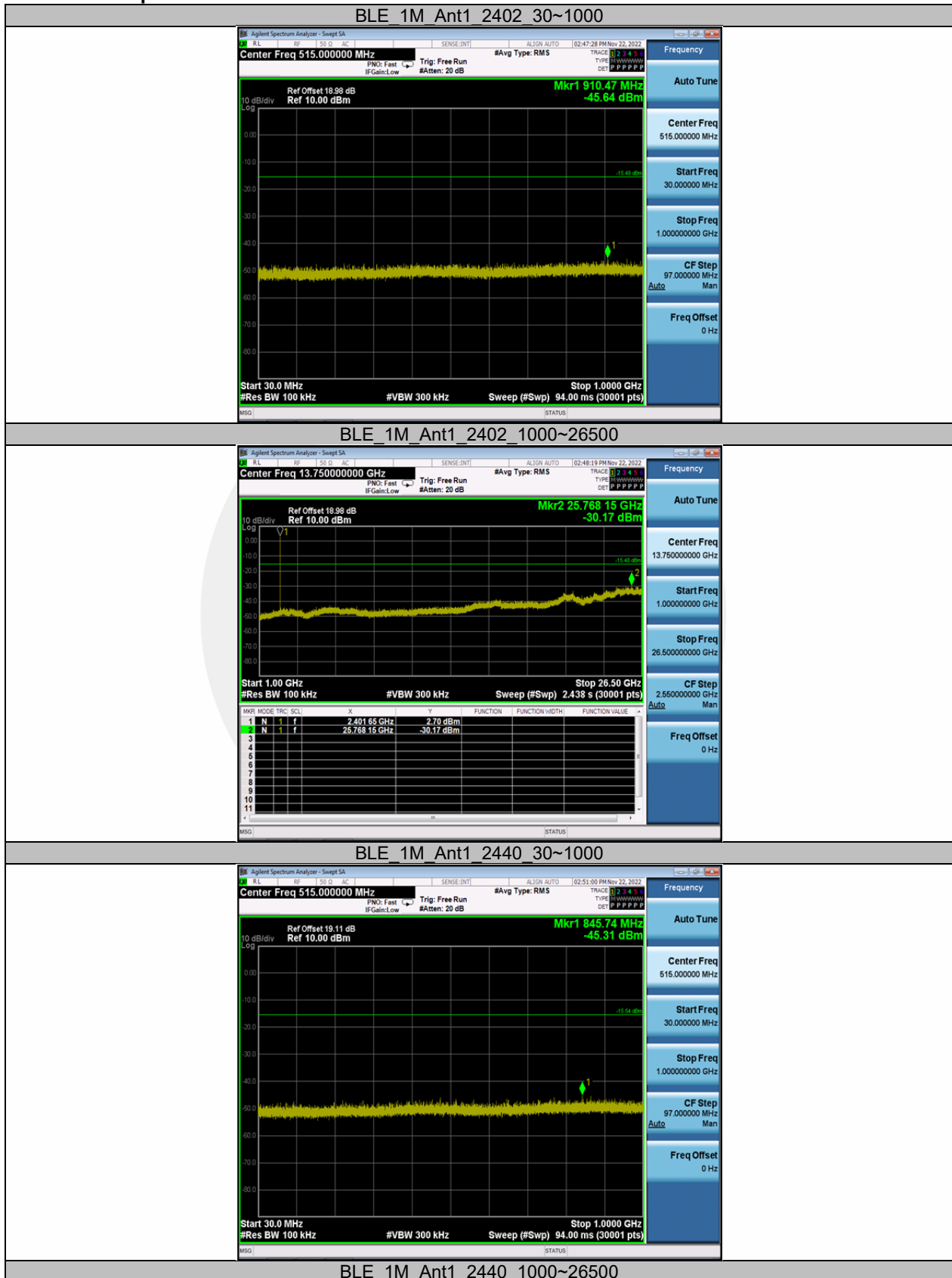
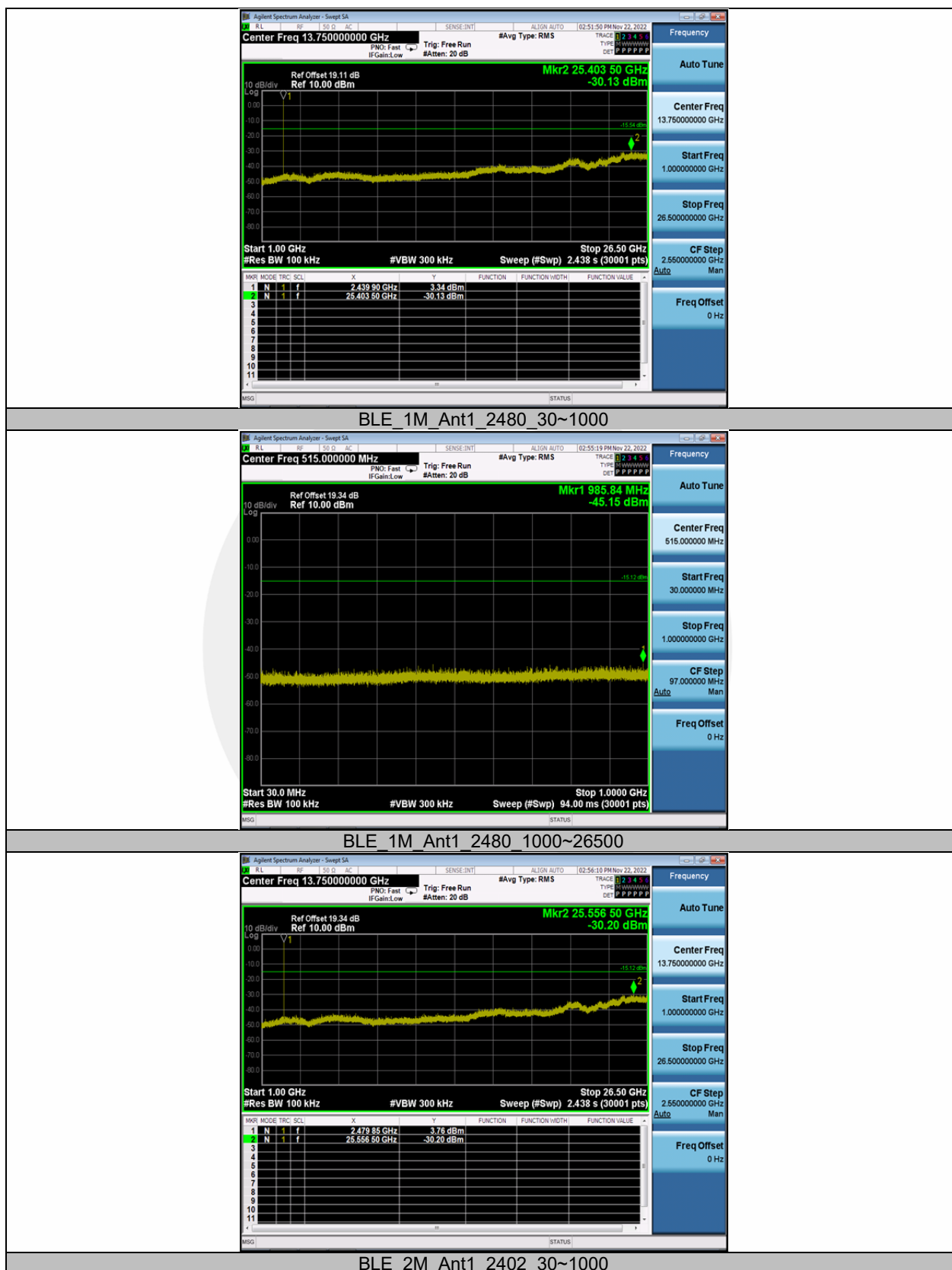
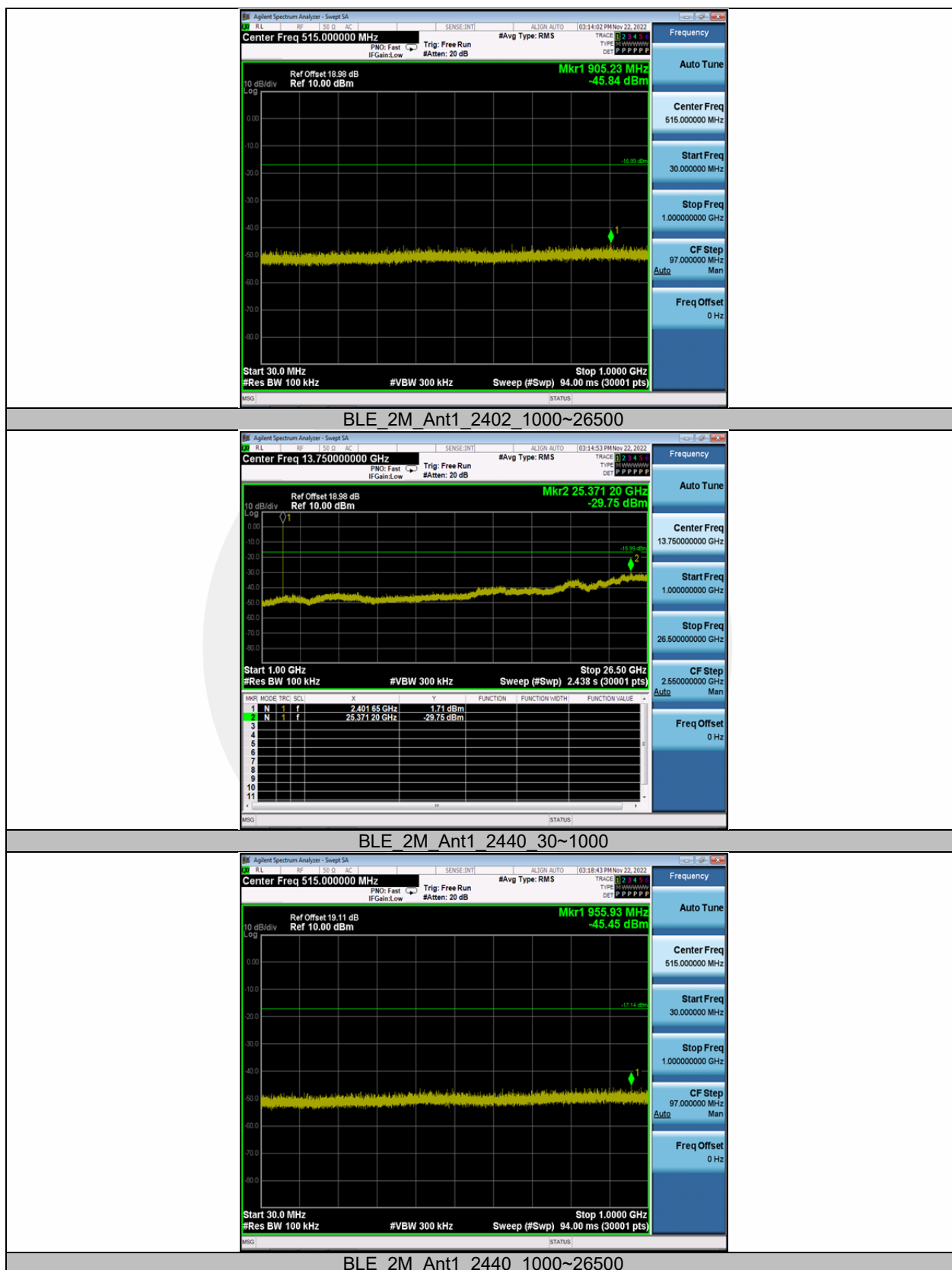
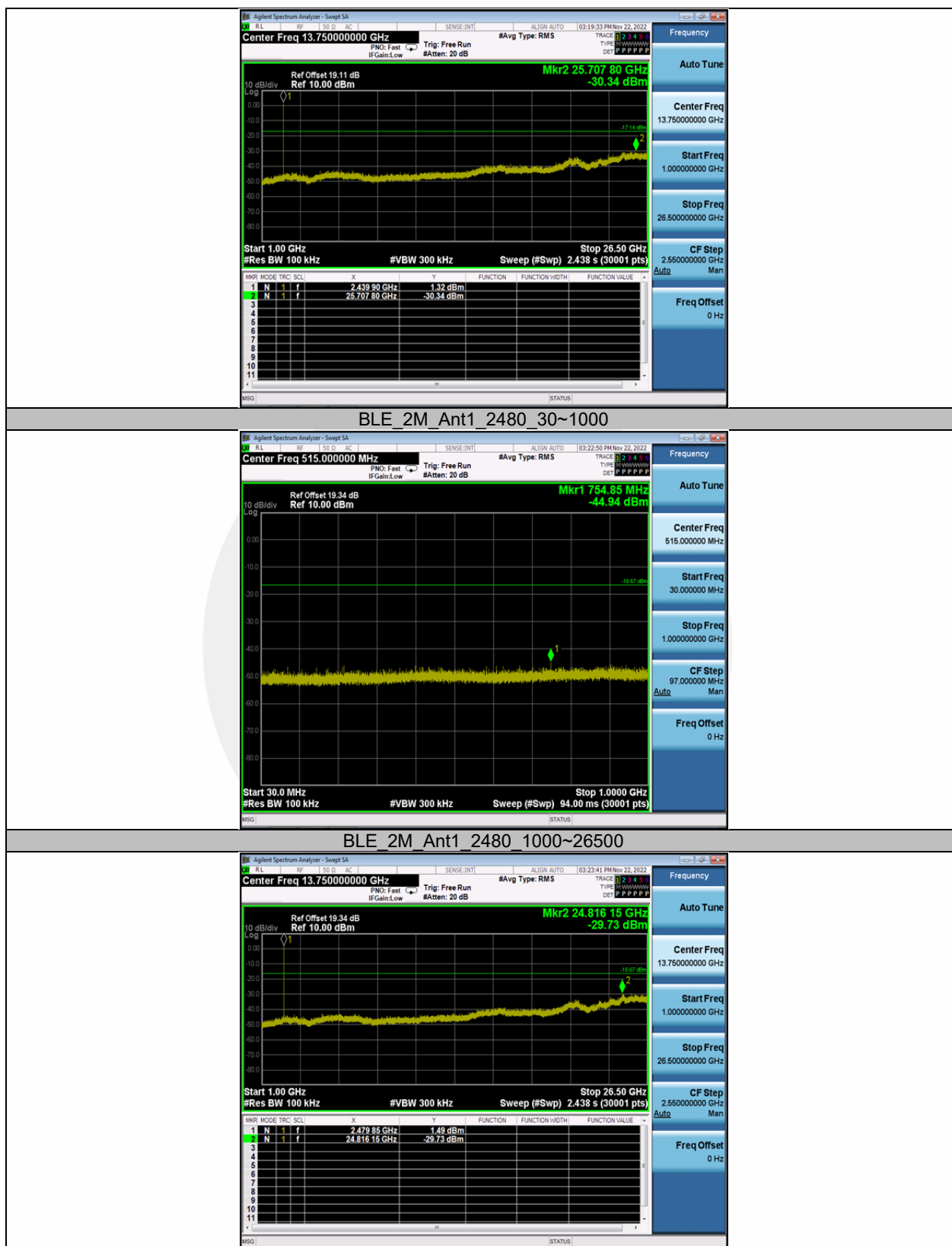


Conducted Spurious Emission









8.7 RADIATED SPURIOUS EMISSION

8.7.1 Applicable Standard

According to FCC Part 15.247(d), 15.205, 15.209

According to RSS-Gen and RSS-247

According to 558074 D01 15.247 Meas Guidance v05r02 Section 8.6

According to ANSI C63.10 Section 11.12

8.7.2 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 Part 15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	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	Above 38.6
13.36-13.41			

According to FCC Part 15.205, 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 (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	24000/F(KHz)	20 log (uV/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

8.7.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

8.7.4 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 average measurements the resolution bandwidth of spectrum analyzer is 1 MHz with the video bandwidth is $\geq 1/T$ with peak detector.

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 for

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 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. Submit this data.

8.7.5 Test Results

Temperature:	25 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar
Test Engineer:	XXH

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

For Spurious Emission below 30MHz (9KHz to 30MHz), was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

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

Bluetooth (BLE_1M, BLE_2M) mode have been tested, and the worst result was report as below:

Test mode: BLE_1M Frequency: Channel 0: 2402MHz

Freq.(MHz)	Ant.Pol.	Corrected Reading(dBuV/m)	Limit 3m(dBuV/m)	Margin(dB)	Remark
4803.75	V	51.96	74.00	22.04	Peak
14550	V	64.46	74.00	9.54	Peak
17611.875	V	70.17	74.00	3.83	Peak
4803.75	V	36.82	54.00	17.18	Avg
14550	V	44.79	54.00	9.21	Avg
17611.875	V	48.97	54.00	5.03	Avg
4803.75	H	52.86	74.00	21.14	Peak
14602.5	H	64.46	74.00	9.54	Peak
17634.375	H	69.91	74.00	4.09	Peak
4803.75	H	36.82	54.00	17.18	Avg
14602.5	H	44.47	54.00	9.53	Avg
17634.375	H	46.91	54.00	7.09	Avg

Test mode: BLE_1M Frequency: Channel 19: 2440MHz

Freq.(MHz)	Ant.Pol.	Corrected Reading(dBuV/m)	Limit 3m(dBuV/m)	Margin(dB)	Remark
4878.75	V	52.71	74.00	21.29	Peak
14679.375	V	64.25	74.00	9.75	Peak
17638.125	V	69.99	74.00	4.01	Peak
4878.75	V	32.79	54.00	21.21	Avg
14679.375	V	43.72	54.00	10.28	Avg
17638.125	V	45.10	54.00	8.90	Avg
4878.75	H	52.38	74.00	21.62	Peak
11508.75	H	60.72	74.00	13.28	Peak
17595	H	69.55	74.00	4.45	Peak
4878.75	H	36.78	54.00	17.22	Avg
11508.75	H	41.25	54.00	12.75	Avg
17595	H	49.04	54.00	4.96	Avg

Test mode: BLE_1M Frequency: Channel 39: 2480MHz

Freq.(MHz)	Ant.Pol.	Corrected Reading(dBuV/m)	Limit 3m(dBuV/m)	Margin(dB)	Remark
4959.375	V	53.97	74.00	20.03	Peak
14572.5	V	63.65	74.00	10.35	Peak
17596.875	V	70.66	74.00	3.34	Peak
4959.375	V	34.48	54.00	19.52	Avg
14572.5	V	44.15	54.00	9.85	Avg
17596.875	V	49.82	54.00	4.18	Avg
4959.375	H	53.22	74.00	20.78	Peak
11533.125	H	61.64	74.00	12.36	Peak
17634.375	H	70.02	74.00	3.98	Peak
4959.375	H	33.12	54.00	20.88	Avg
11533.125	H	41.63	54.00	12.37	Avg
17634.375	H	47.02	54.00	6.98	Avg

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz
Bluetooth (BLE_1M, BLE_2M) mode have been tested, and the worst result was report as below:

Test mode: BLE_1M Frequency: Channel 0: 2402MHz

Freq.(MHz)	Ant.Pol.	Corrected Reading(dBuV/m)	Limit 3m(dBuV/m)	Margin(dB)	Remark
2331.340	V	45.57	74.00	28.43	Peak
2331.3404	V	35.58	54.00	18.42	Avg
2331.207	H	45.26	74.00	28.74	Peak
2331.2071	H	35.20	54.00	18.80	Avg

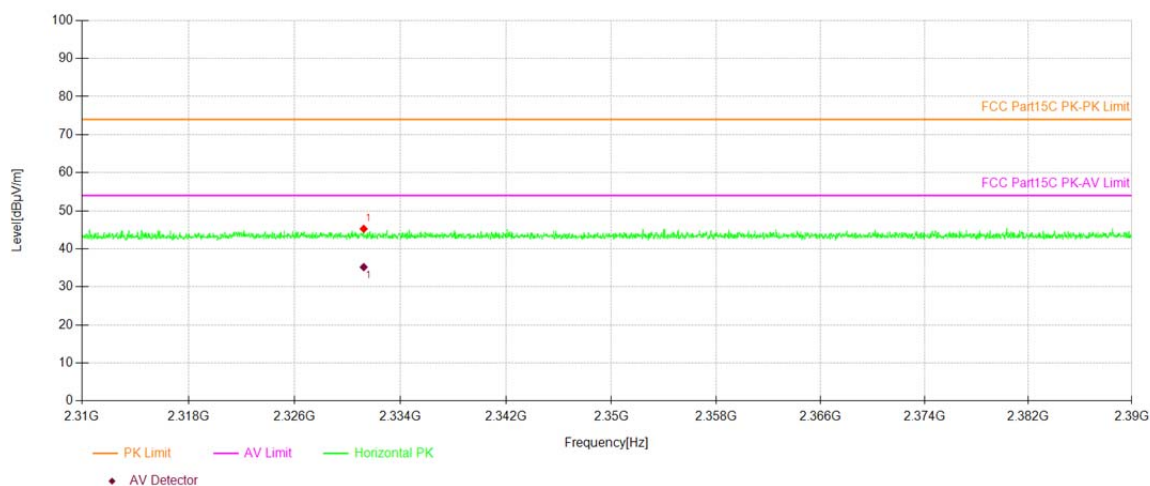
Test mode: BLE_1M Frequency: Channel 39: 2480MHz

Freq.(MHz)	Ant.Pol.	Corrected Reading(dBuV/m)	Limit 3m(dBuV/m)	Margin(dB)	Remark
2483.5165	V	45.97	74.00	28.03	Peak
2483.516	V	35.97	54.00	18.03	Avg
2483.8797	H	47.47	74.00	26.53	Peak
2483.8797	H	37.75	54.00	16.25	Avg

Test Model

Spurious Emission in Restricted Band 2310-2390MHz
Channel 0: 2402MHz BLE_1M

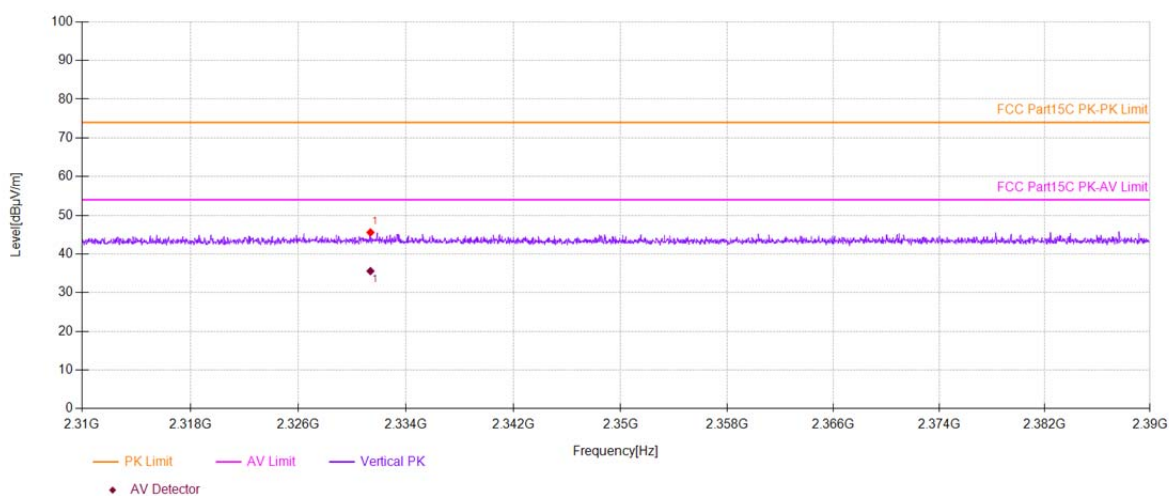
H



Test Model

Spurious Emission in Restricted Band 2310-2390MHz
Channel 0: 2402MHz BLE_1M

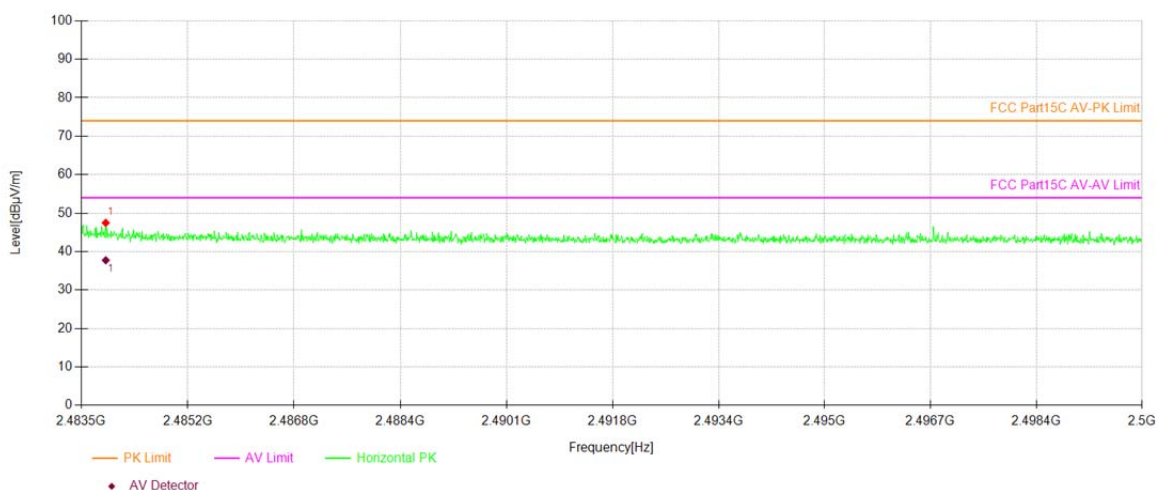
V



Test Model

Spurious Emission in Restricted Band 2483.5-2500MHz
Channel 39: 2480MHz BLE_1M

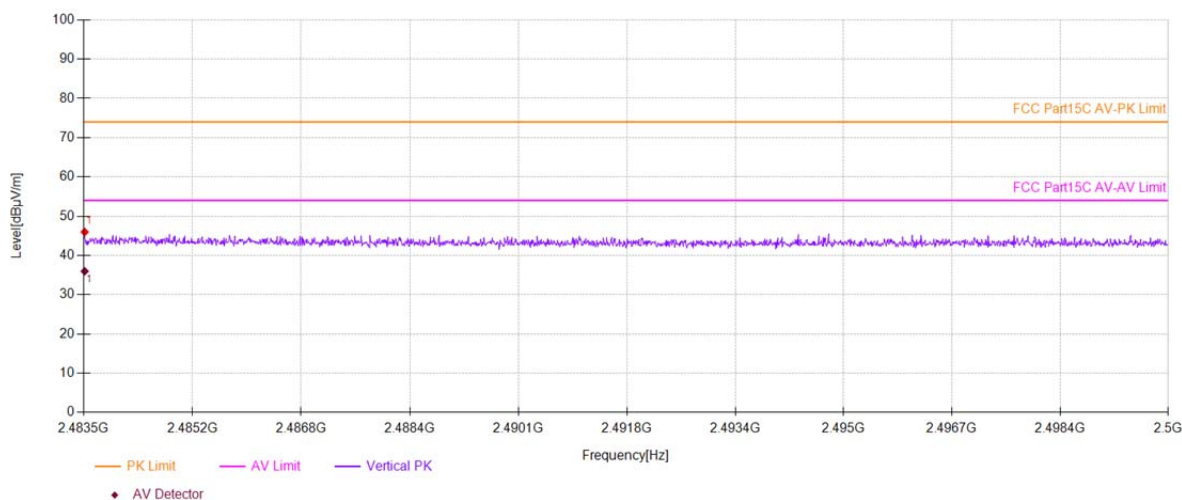
H



Test Model

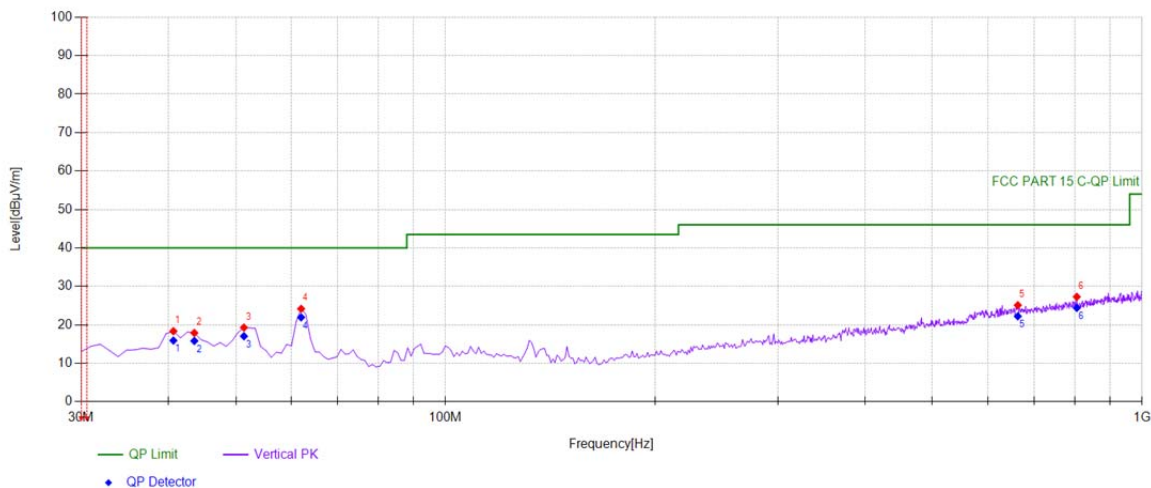
Spurious Emission in Restricted Band 2483.5-2500MHz
Channel 39: 2480MHz BLE_1M

V

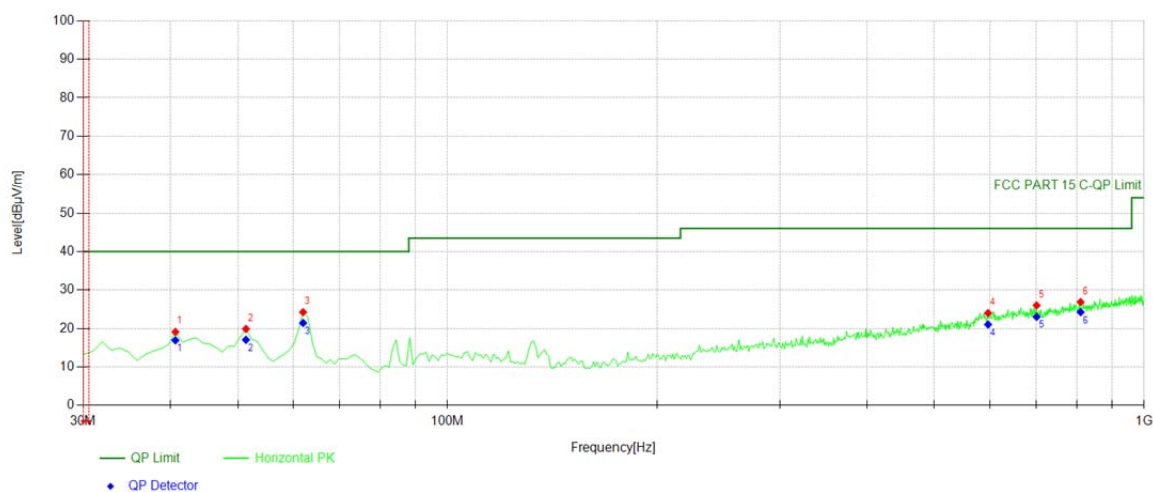


■ Spurious Emission below 1GHz (30MHz to 1GHz)

Bluetooth (BLE_1M, BLE_2M) mode have been tested, and the worst result was report as below:
2402



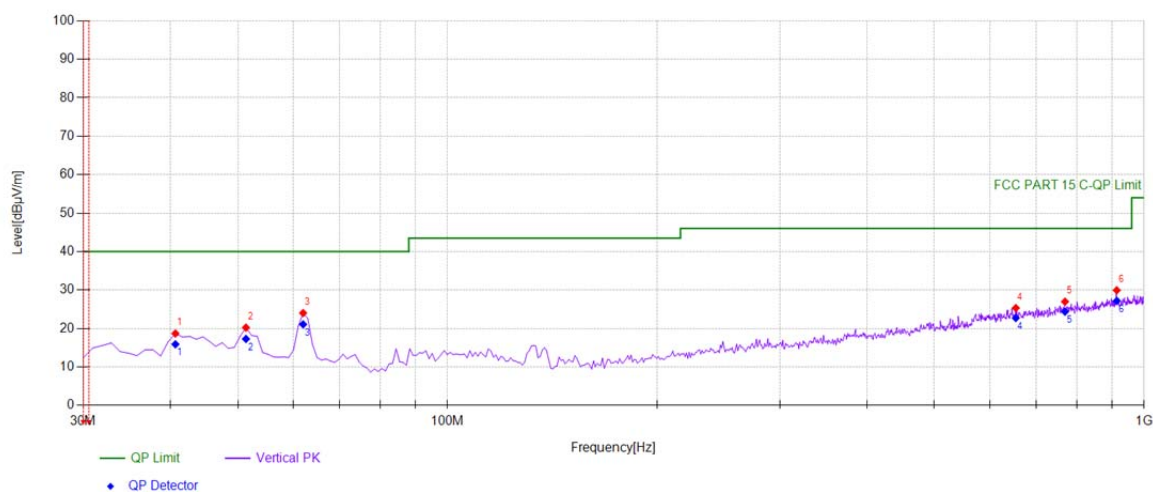
Suspected Data List							
NO.	Freq. [MHz]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6807	18.36	40.00	21.64	100	233	Vertical
2	43.5936	17.90	40.00	22.10	100	247	Vertical
3	51.3614	19.29	40.00	20.71	100	321	Vertical
4	62.042	24.18	40.00	15.82	100	109	Vertical
5	663.0731	25.11	46.00	20.89	100	30	Vertical
6	805.8058	27.29	46.00	18.71	100	196	Vertical



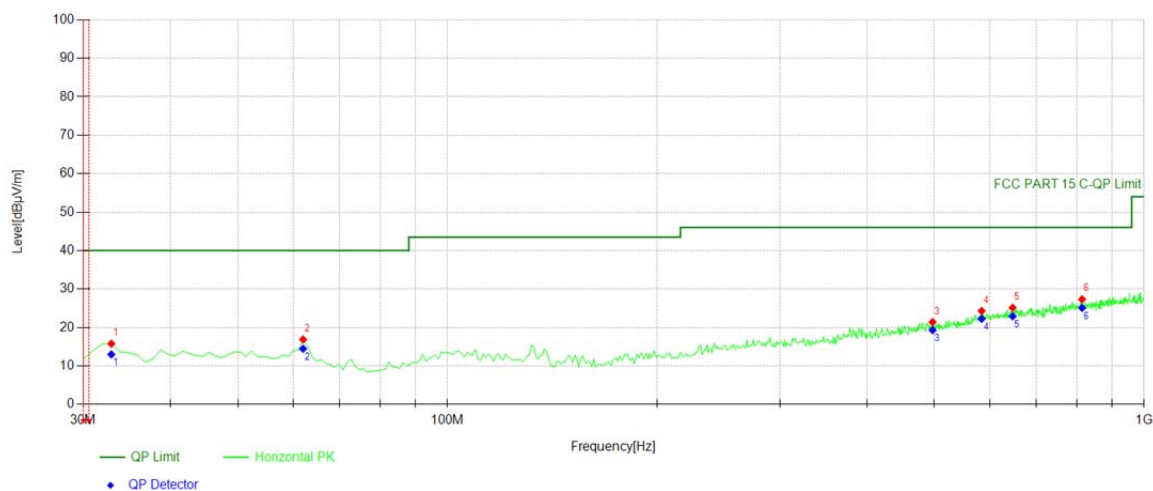
Suspected Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6807	19.11	40.00	20.89	100	0	Horizontal
2	51.3614	19.88	40.00	20.12	100	150	Horizontal
3	62.042	24.25	40.00	15.75	100	30	Horizontal
4	597.047	24.01	46.00	21.99	100	251	Horizontal
5	700.9409	26.01	46.00	19.99	100	274	Horizontal
6	810.6607	26.88	46.00	19.12	100	311	Horizontal

2440



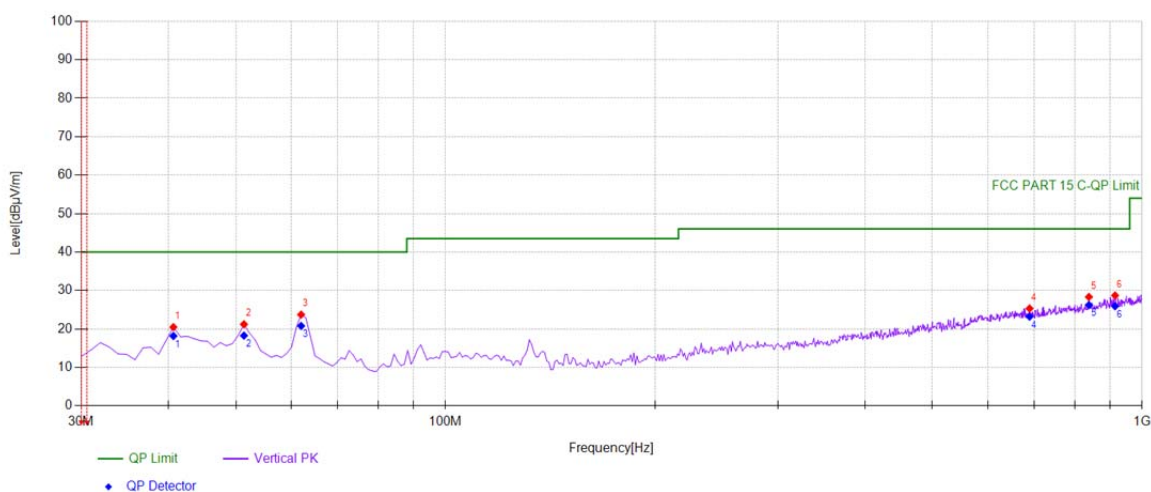
Suspected Data List							
NO.	Freq. [MHz]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6807	18.70	40.00	21.30	100	357	Vertical
2	51.3614	20.24	40.00	19.76	100	90	Vertical
3	62.042	24.03	40.00	15.97	100	109	Vertical
4	654.3343	25.33	46.00	20.67	100	169	Vertical
5	769.8799	26.98	46.00	19.02	100	339	Vertical
6	913.5836	29.95	46.00	16.05	100	238	Vertical



Suspected Data List

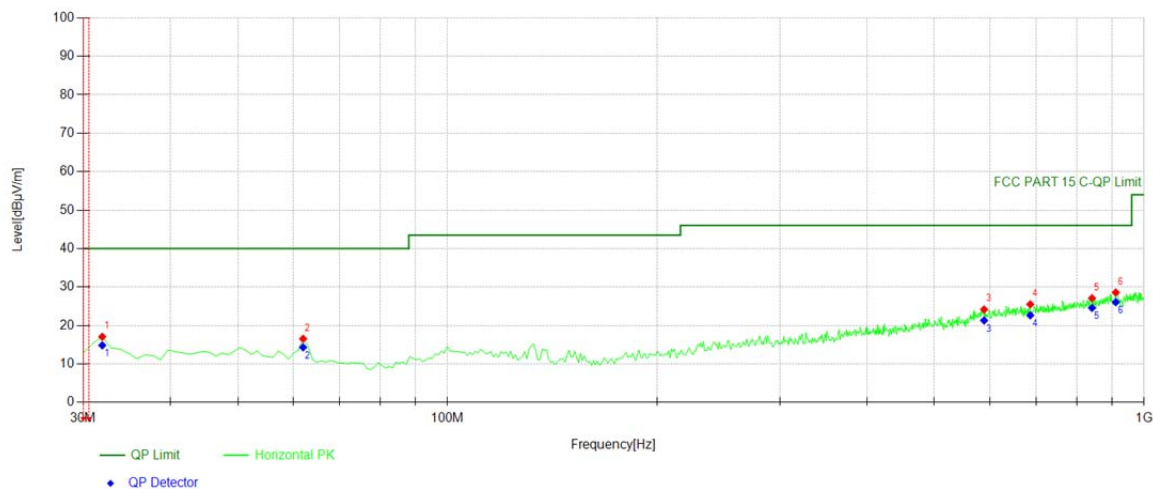
NO.	Freq. [MHz]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	32.9129	15.78	40.00	24.22	100	86	Horizontal
2	62.042	16.89	40.00	23.11	100	228	Horizontal
3	497.037	21.39	46.00	24.61	100	233	Horizontal
4	584.4244	24.32	46.00	21.68	100	178	Horizontal
5	647.5375	25.14	46.00	20.86	100	160	Horizontal
6	814.5445	27.33	46.00	18.67	100	219	Horizontal

2480



Suspected Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6807	20.48	40.00	19.52	100	348	Vertical
2	51.3614	21.22	40.00	18.78	100	30	Vertical
3	62.042	23.74	40.00	16.26	100	54	Vertical
4	689.2893	25.33	46.00	20.67	100	329	Vertical
5	838.8188	28.33	46.00	17.67	100	191	Vertical
6	914.5546	28.70	46.00	17.30	100	30	Vertical



Suspected Data List							
NO.	Freq. [MHz]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	31.9419	17.07	40.00	22.93	100	214	Horizontal
2	62.042	16.55	40.00	23.45	100	274	Horizontal
3	589.2793	24.18	46.00	21.82	100	159	Horizontal
4	686.3764	25.51	46.00	20.49	100	132	Horizontal
5	841.7317	27.09	46.00	18.91	100	173	Horizontal
6	910.6707	28.59	46.00	17.41	100	256	Horizontal

8.8 CONDUCTED EMISSIONS TEST

8.8.1 Applicable Standard

According to FCC Part 15.207(a)
According to IC RSS-Gen 8.8

8.8.2 Conformance Limit

Frequency(MHz)	Conducted Emission Limit	
	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.

8.8.3 Test Configuration

Test according to clause 7.3 conducted emission test setup

8.8.4 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.

8.8.5 Test Results

N/A

8.9 ANTENNA APPLICATION

8.9.1 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. 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. The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list. If the transmitter employs an antenna system that emits multiple directional beams, but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device (i.e. the sum of the power supplied to all antennas, antenna elements, staves, etc., and summed across all carriers or frequency channels) shall not exceed the applicable output power limit. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or staff having the highest gain.
FCC 47 CFR Part 15.247 (b)	
RSS-Gen Section 6.8	
RSS-247 Section 5.4	

8.9.2 Result

PASS.

- Note:
- ☒ 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)

Please refer to the attached document Internal Photos to show the antenna connector.

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