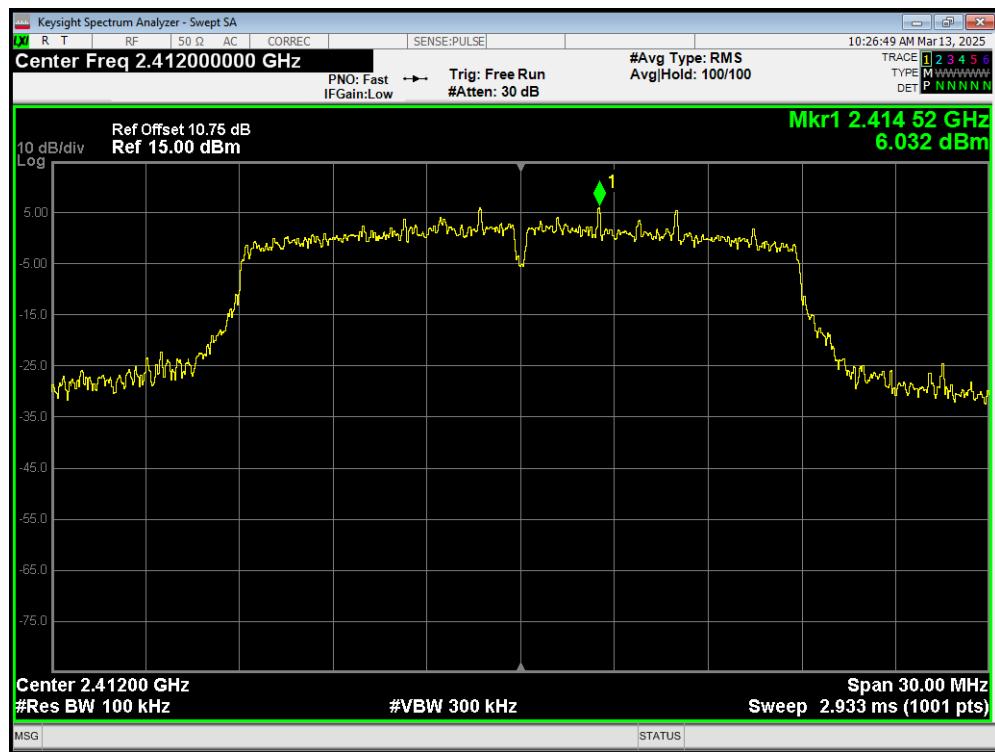
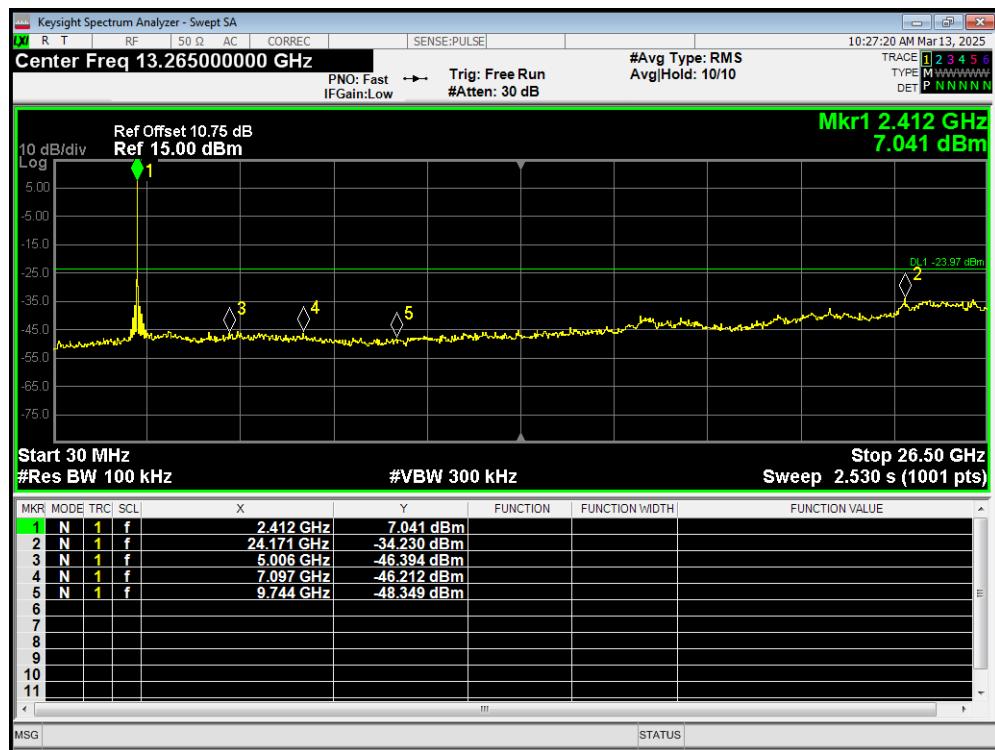
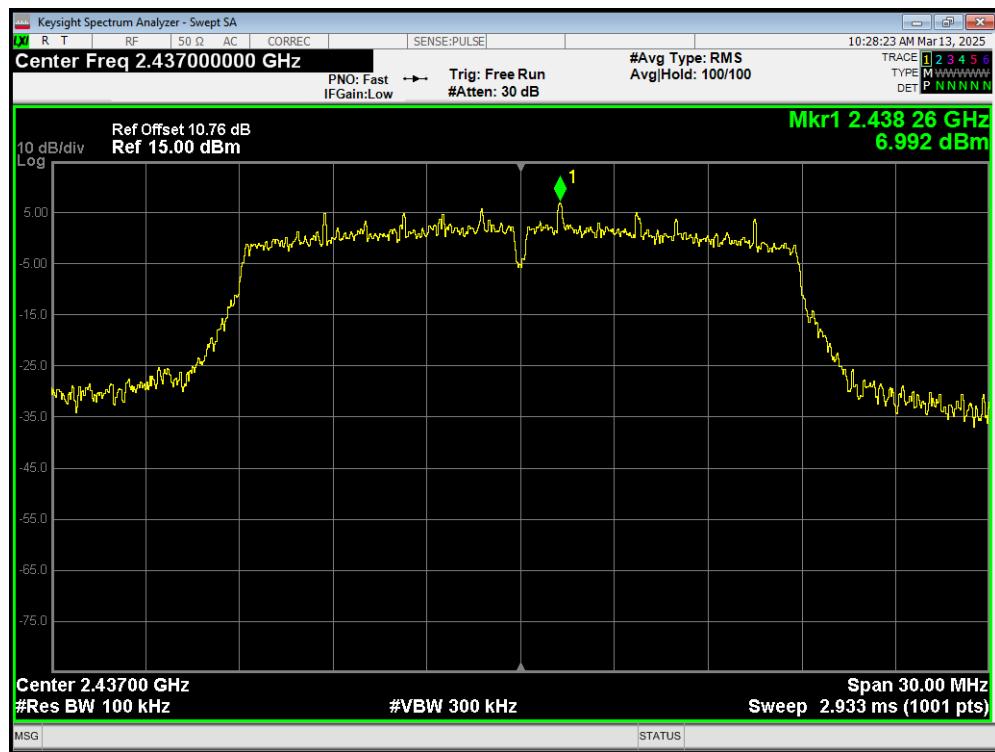
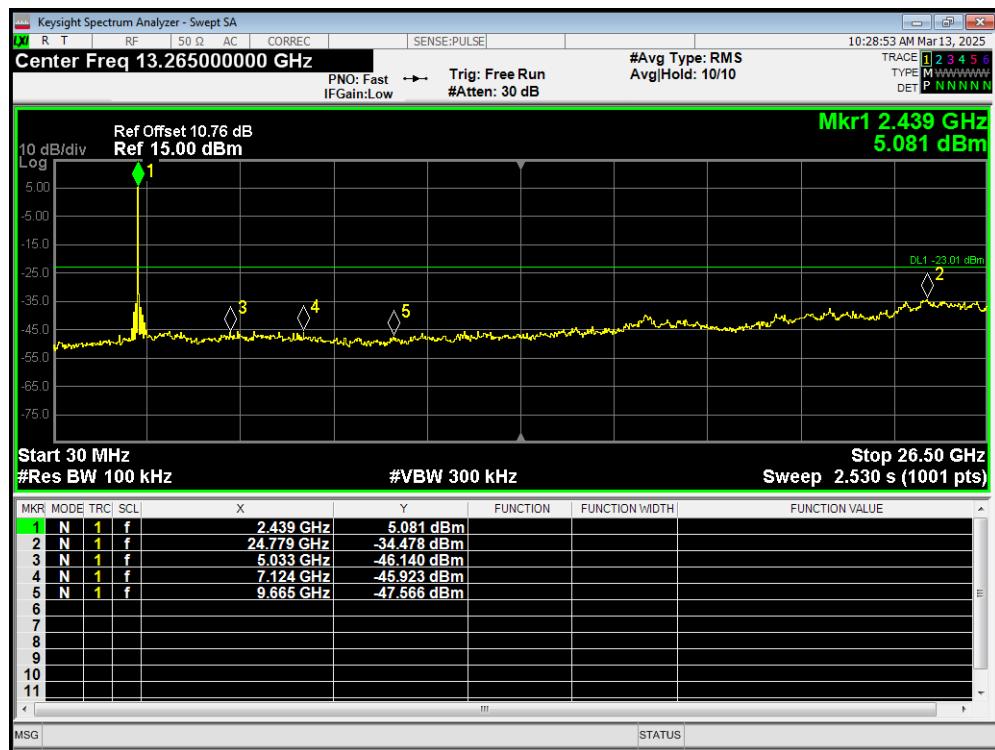
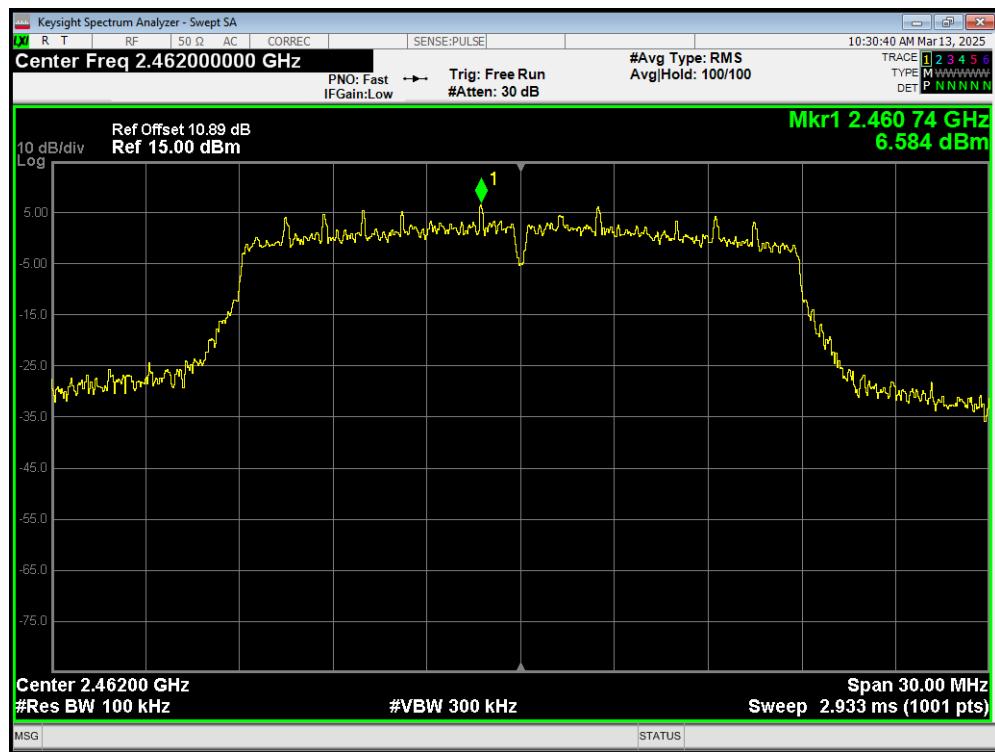
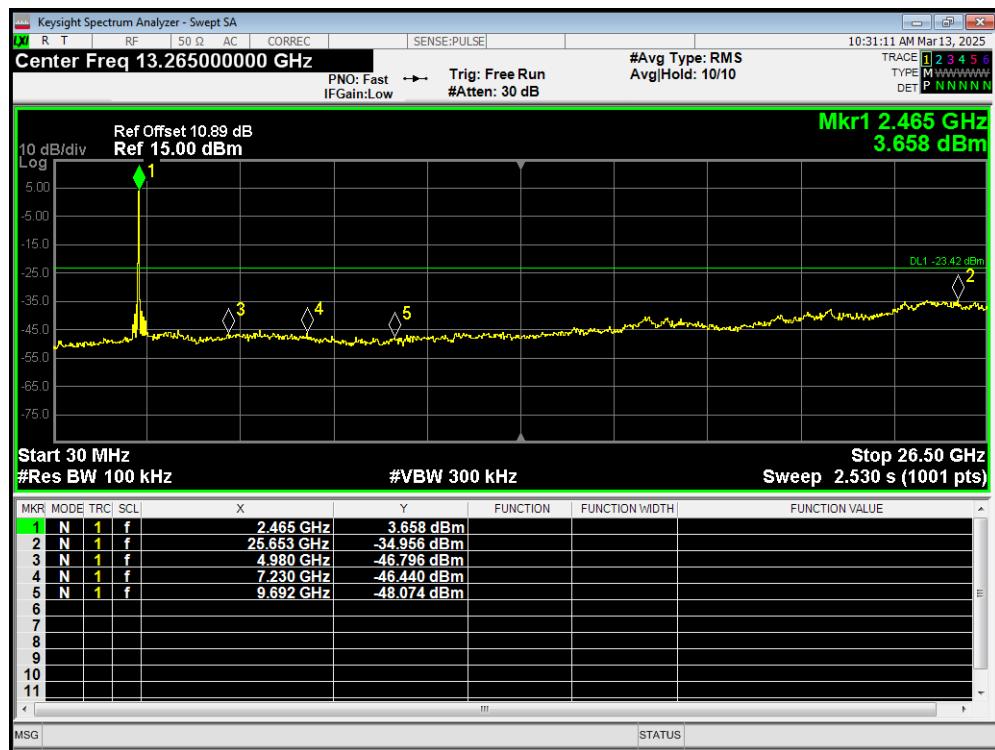
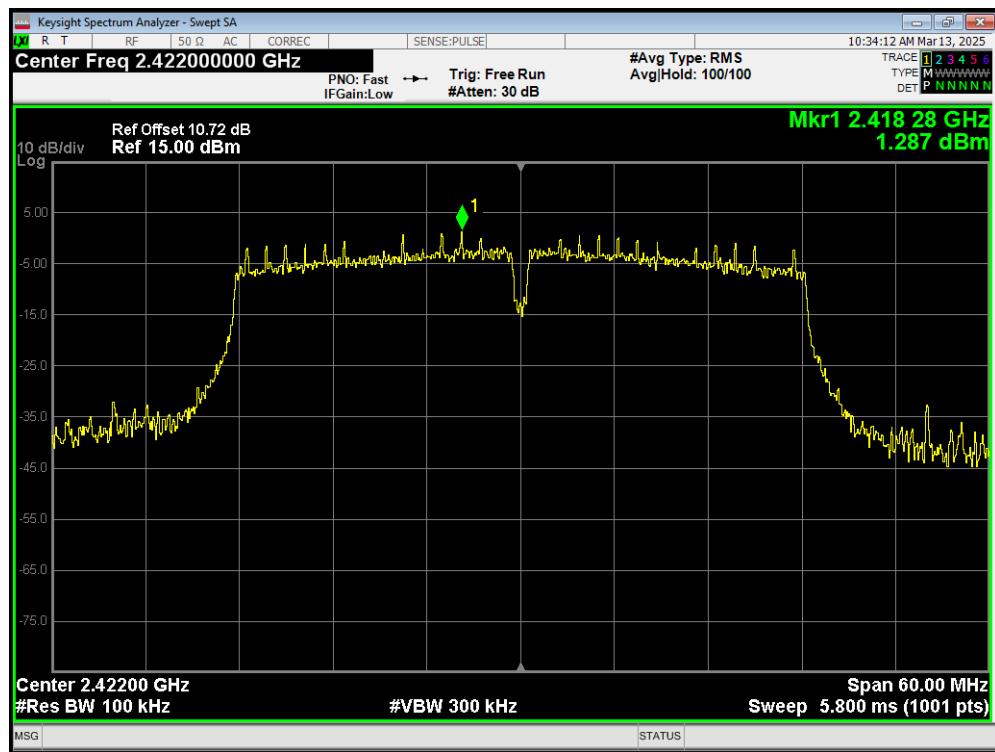
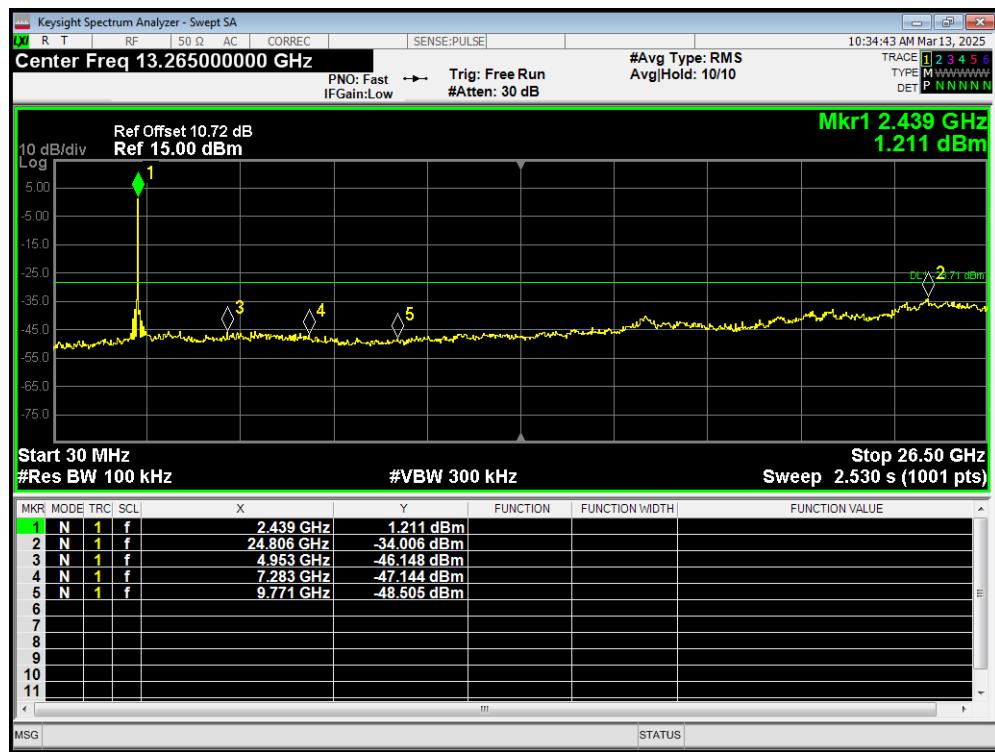
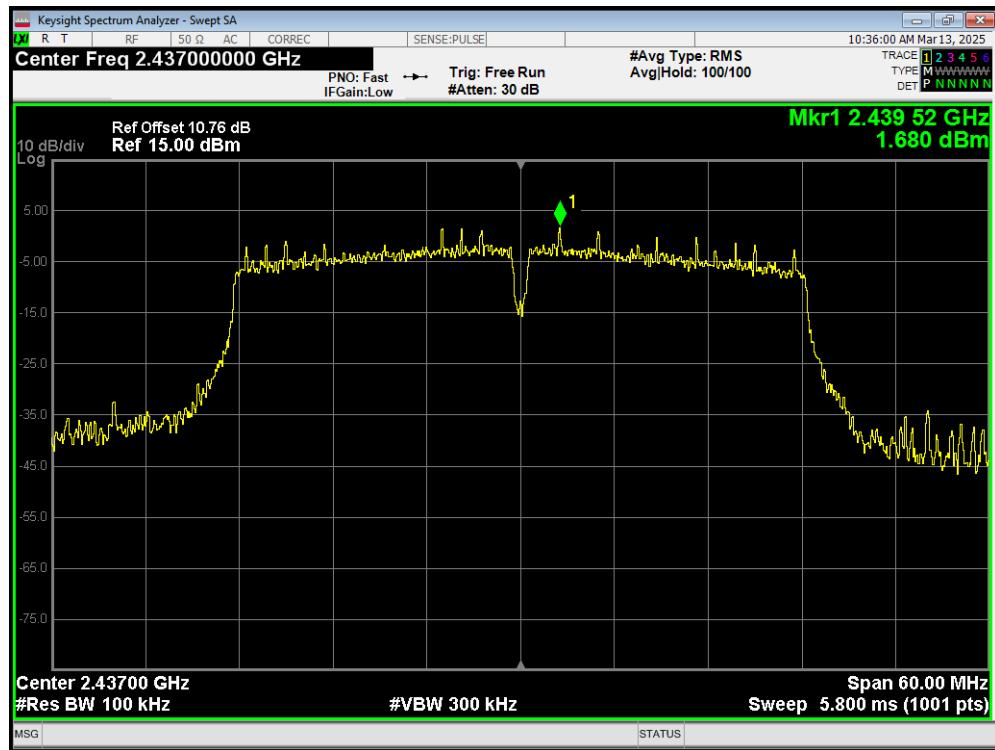
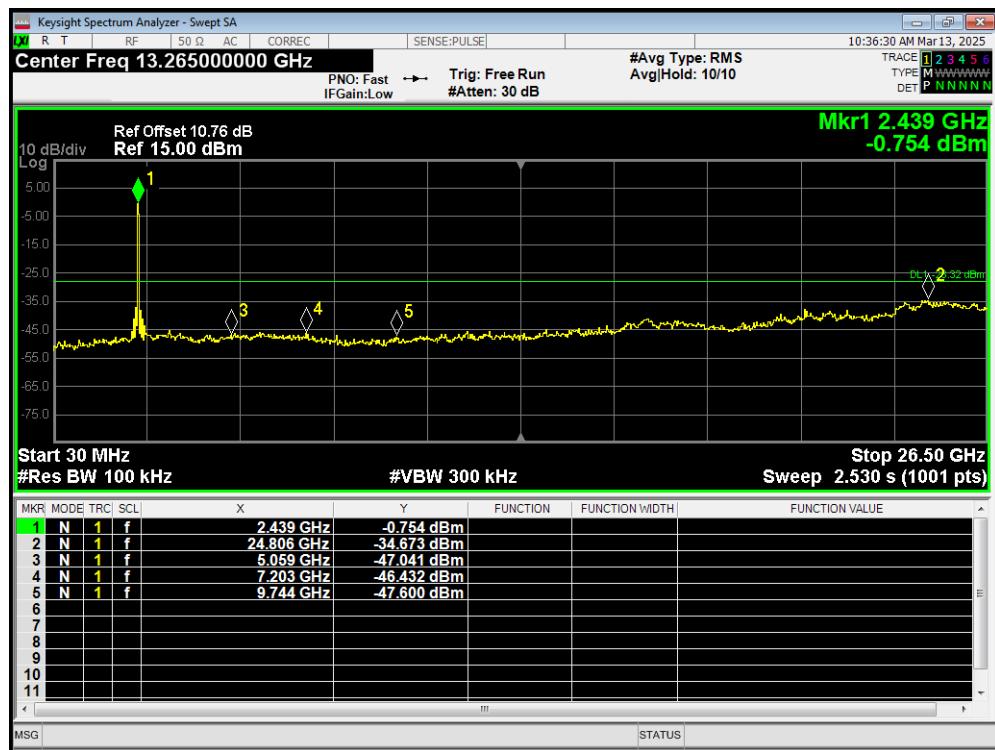


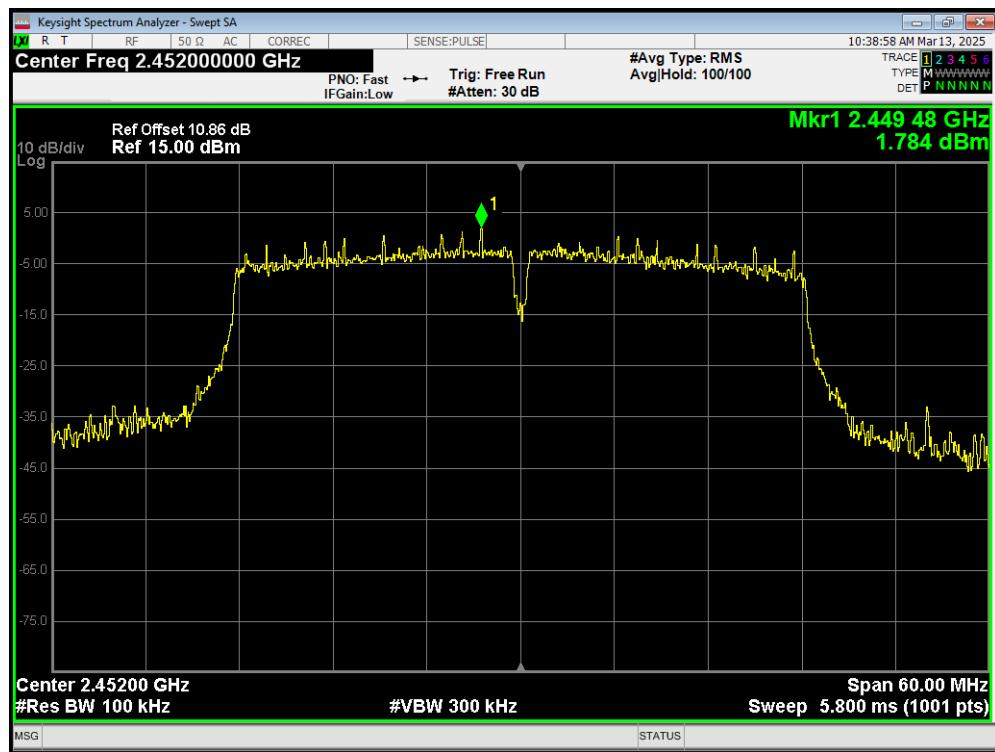
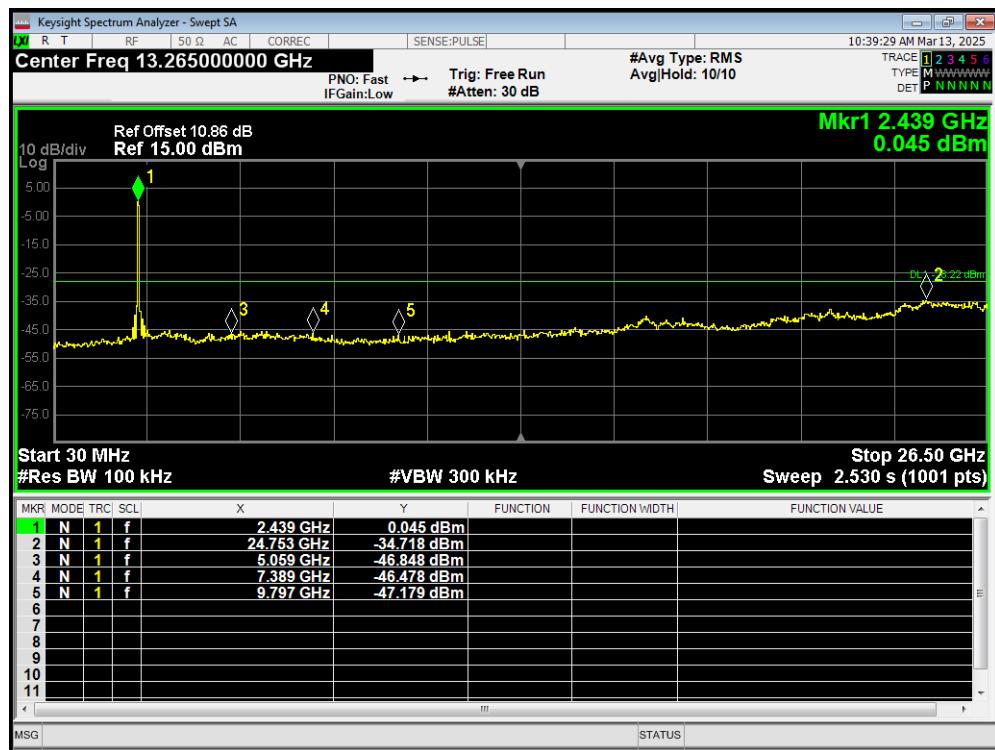
Tx. Spurious 802.11n(HT20) 2412MHz Ref

Tx. Spurious 802.11n(HT20) 2412MHz Emission


Tx. Spurious 802.11n(HT20) 2437MHz Ref

Tx. Spurious 802.11n(HT20) 2437MHz Emission


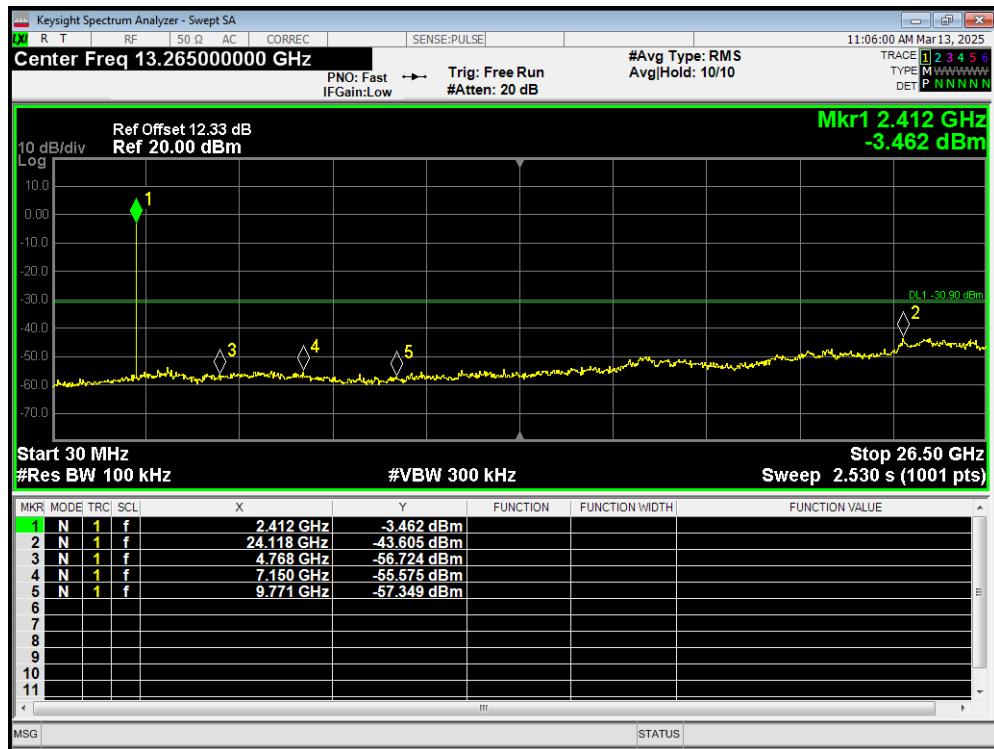
Tx. Spurious 802.11n(HT20) 2462MHz Ref

Tx. Spurious 802.11n(HT20) 2462MHz Emission


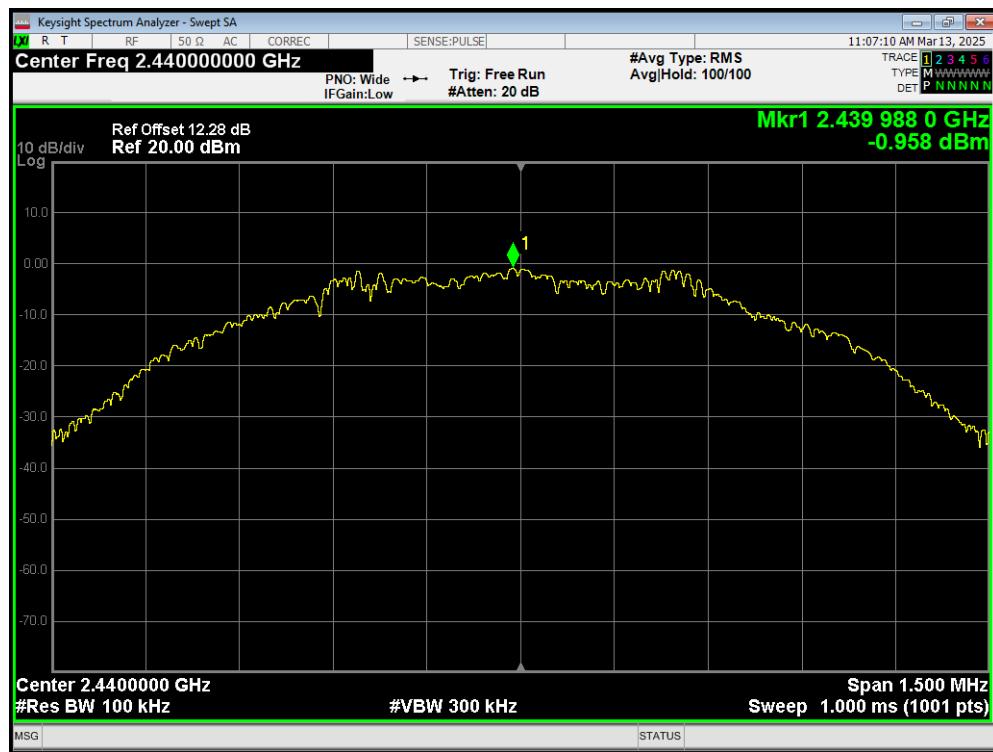
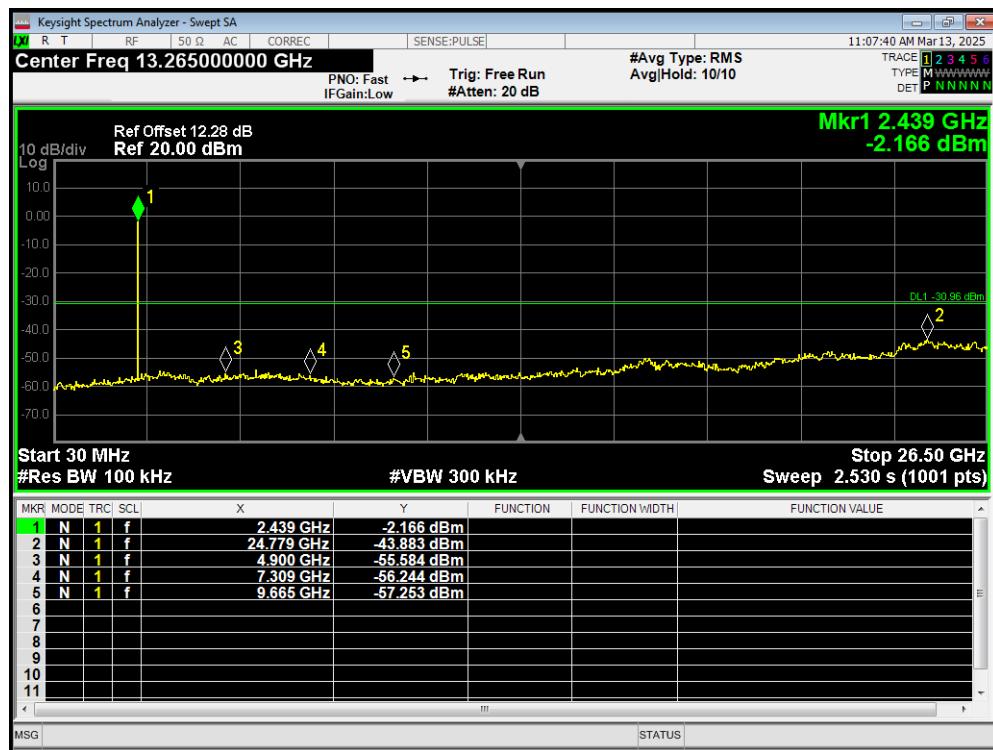
Tx. Spurious 802.11n(HT40) 2422MHz Ref

Tx. Spurious 802.11n(HT40) 2422MHz Emission


Tx. Spurious 802.11n(HT40) 2437MHz Ref

Tx. Spurious 802.11n(HT40) 2437MHz Emission


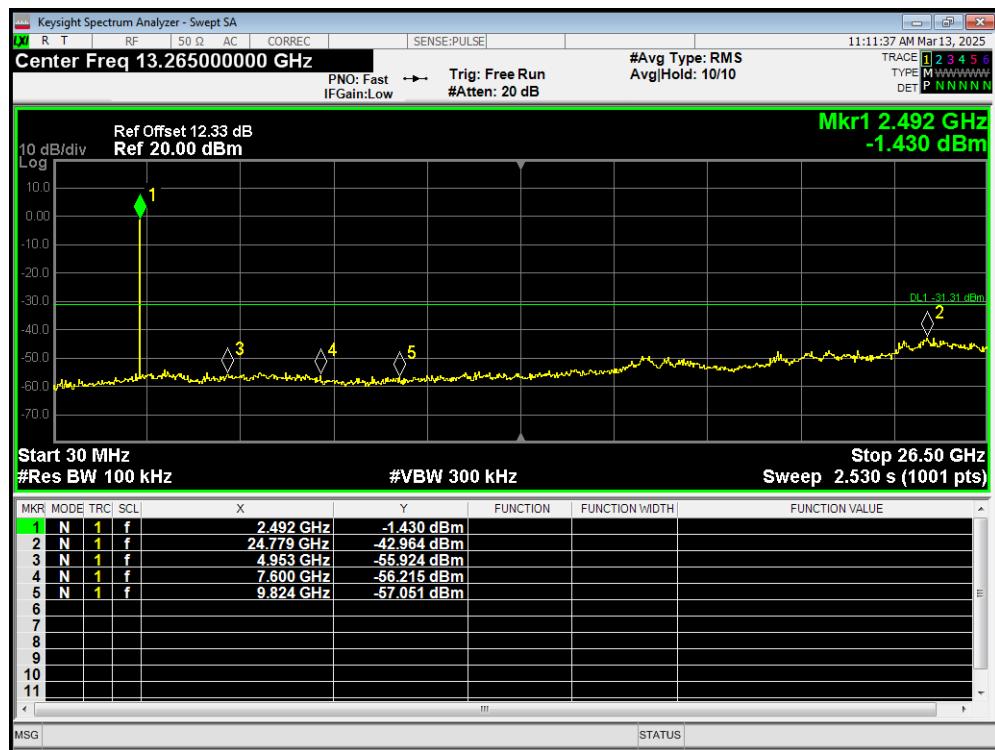
Tx. Spurious 802.11n(HT40) 2452MHz Ref

Tx. Spurious 802.11n(HT40) 2452MHz Emission


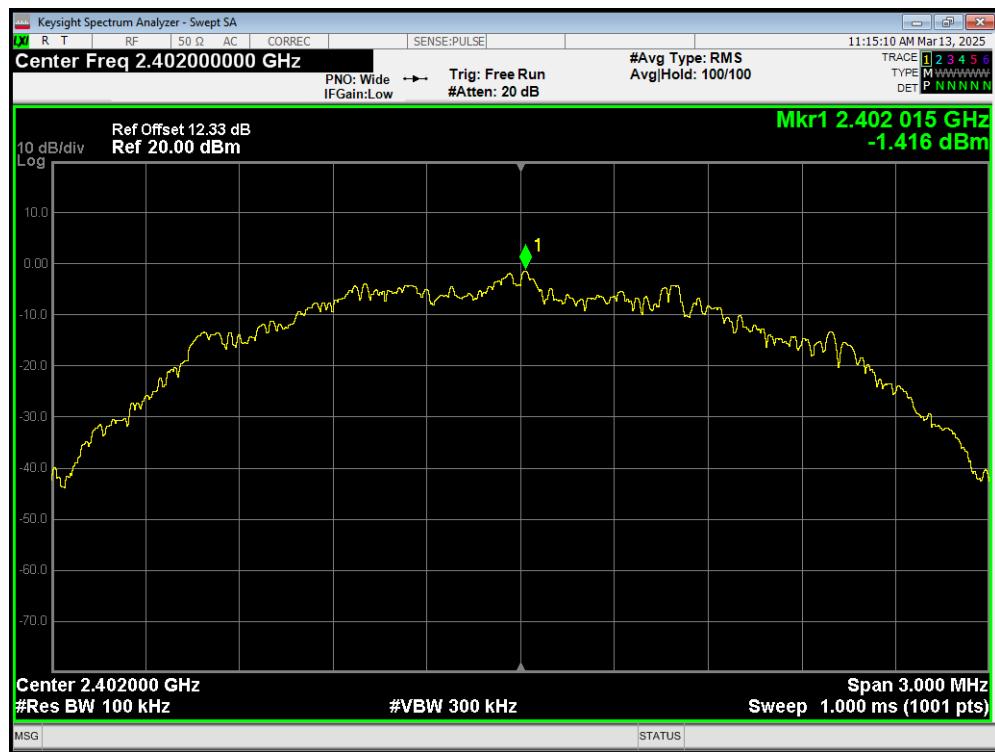
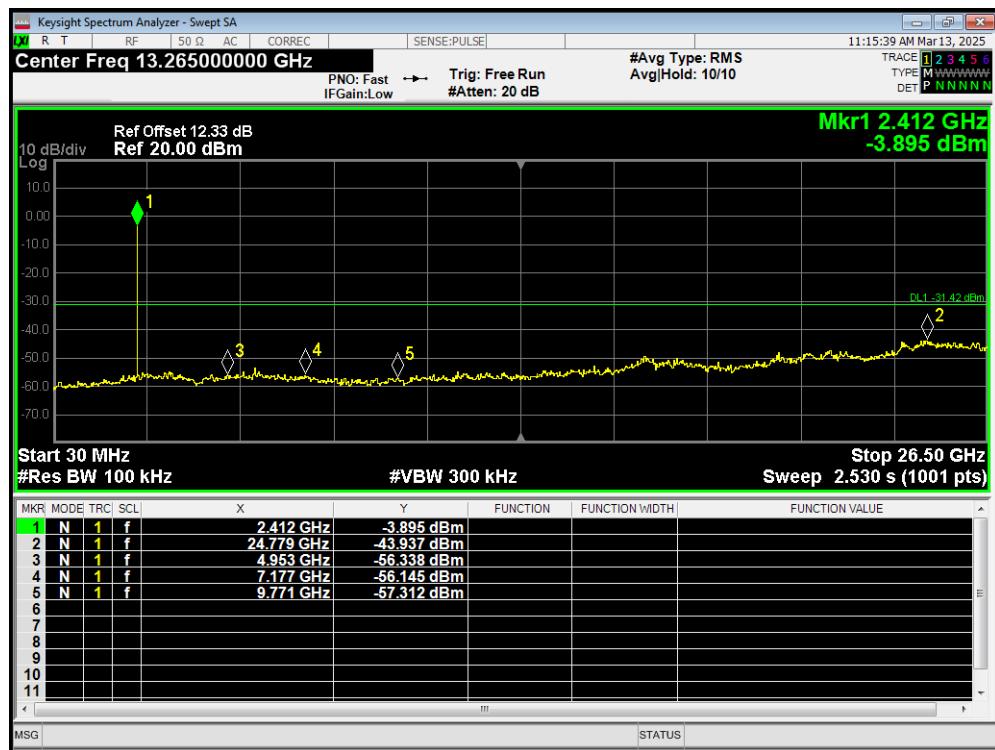
Tx. Spurious Bluetooth LE (1M) 2402MHz Ref

Tx. Spurious Bluetooth LE (1M) 2402MHz Emission


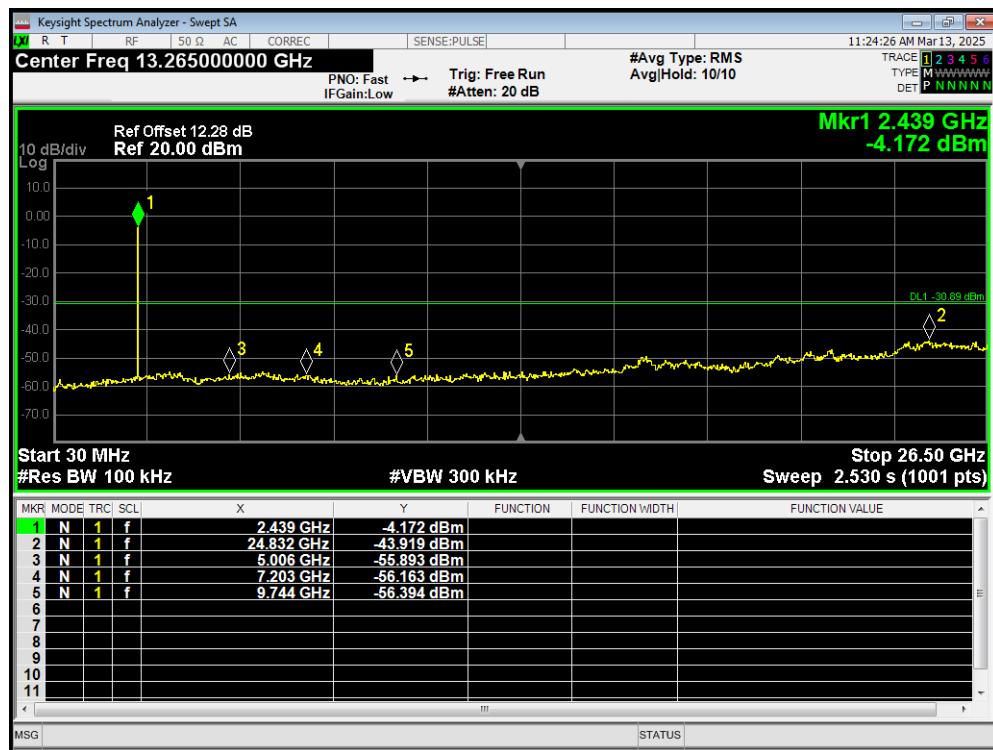
Tx. Spurious Bluetooth LE (1M) 2440MHz Ref

Tx. Spurious Bluetooth LE (1M) 2440MHz Emission


Tx. Spurious Bluetooth LE (1M) 2480MHz Ref

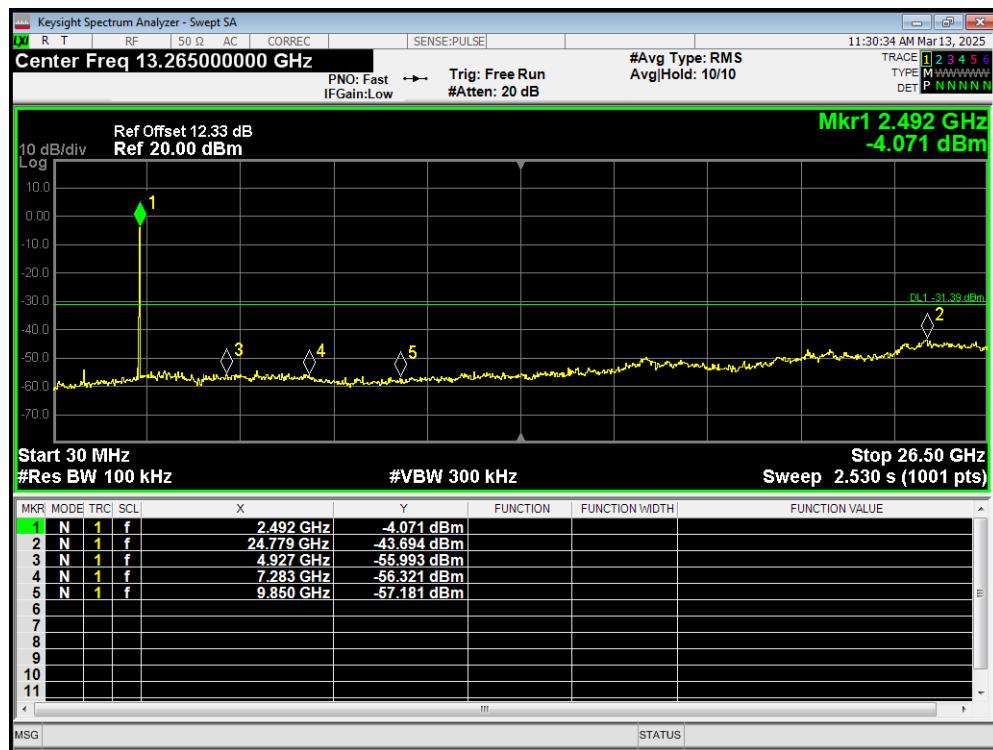
Tx. Spurious Bluetooth LE (1M) 2480MHz Emission


Tx. Spurious Bluetooth LE (2M) 2402MHz Ref

Tx. Spurious Bluetooth LE (2M) 2402MHz Emission


Tx. Spurious Bluetooth LE (2M) 2440MHz Ref

Tx. Spurious Bluetooth LE (2M) 2440MHz Emission


Tx. Spurious Bluetooth LE (2M) 2480MHz Ref

Tx. Spurious Bluetooth LE (2M) 2480MHz Emission


5.6. Unwanted Emission

Ambient Condition

Temperature	Relative humidity
15°C ~ 35°C	20% ~ 80%

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10.

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. Sweep the Restricted Band and the emissions less than 20 dB below the permissible value are reported.

The radiated emissions measurements were made in a typical installation configuration.

Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

This method refer to ANSI C63.10.

The procedure for peak unwanted emissions measurements above 1000 MHz is as follows:

Set the spectrum analyzer in the following:

9kHz~150 kHz

RBW=200Hz, VBW=1kHz/ Sweep=AUTO

150 kHz~30MHz

RBW=9kHz, VBW=30kHz,/ Sweep=AUTO

Below 1GHz

RBW=100kHz / VBW=300kHz / Sweep=AUTO

a) Peak emission levels are measured by setting the instrument as follows:

Above 1GHz

PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO

b) Average emission levels are measured by setting the instrument as follows:

Above 1GHz

AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO

c) Detector: The measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage

averaging. Log or dB averaging shall not be used.)

e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of $1 / D$, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

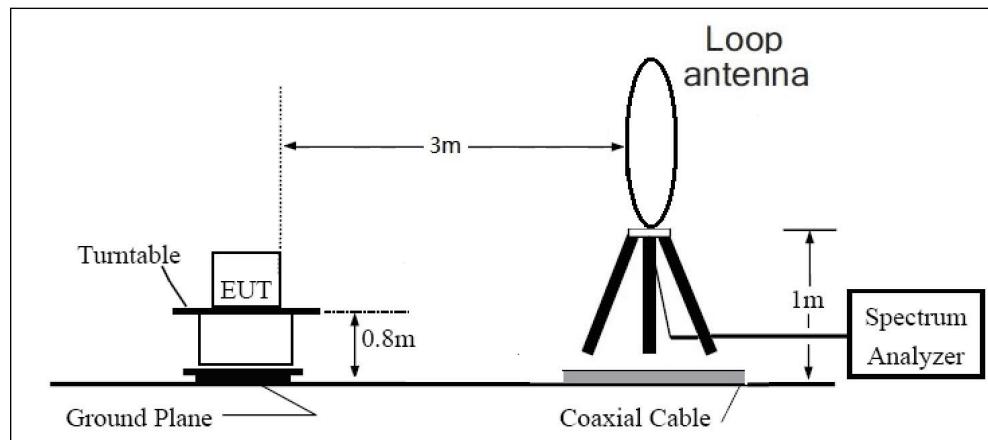
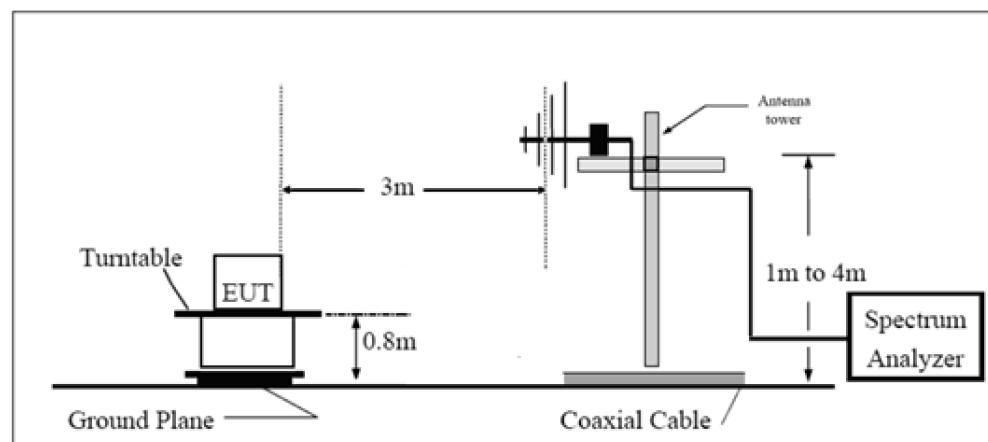
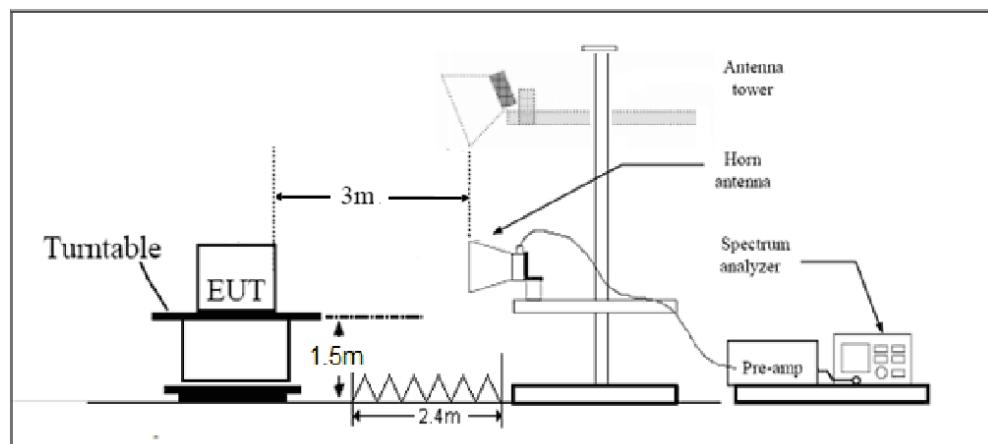
g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is $[10 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

The test is in transmitting mode.

Test Setup
9kHz~ 30MHz

30MHz~ 1GHz

Above 1GHz


Note: Area side:2.4mX3.6m

Limits

Rule Part 15.247(d) specifies that “In addition, 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)).”

Limit in restricted band

Frequency of emission (MHz)	Field strength(μ V/m)	Field strength(dB μ V/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

§15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

Peak Limit=74 dB μ V/m

Average Limit=54 dB μ V/m

Spurious Radiated Emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 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	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	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			

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

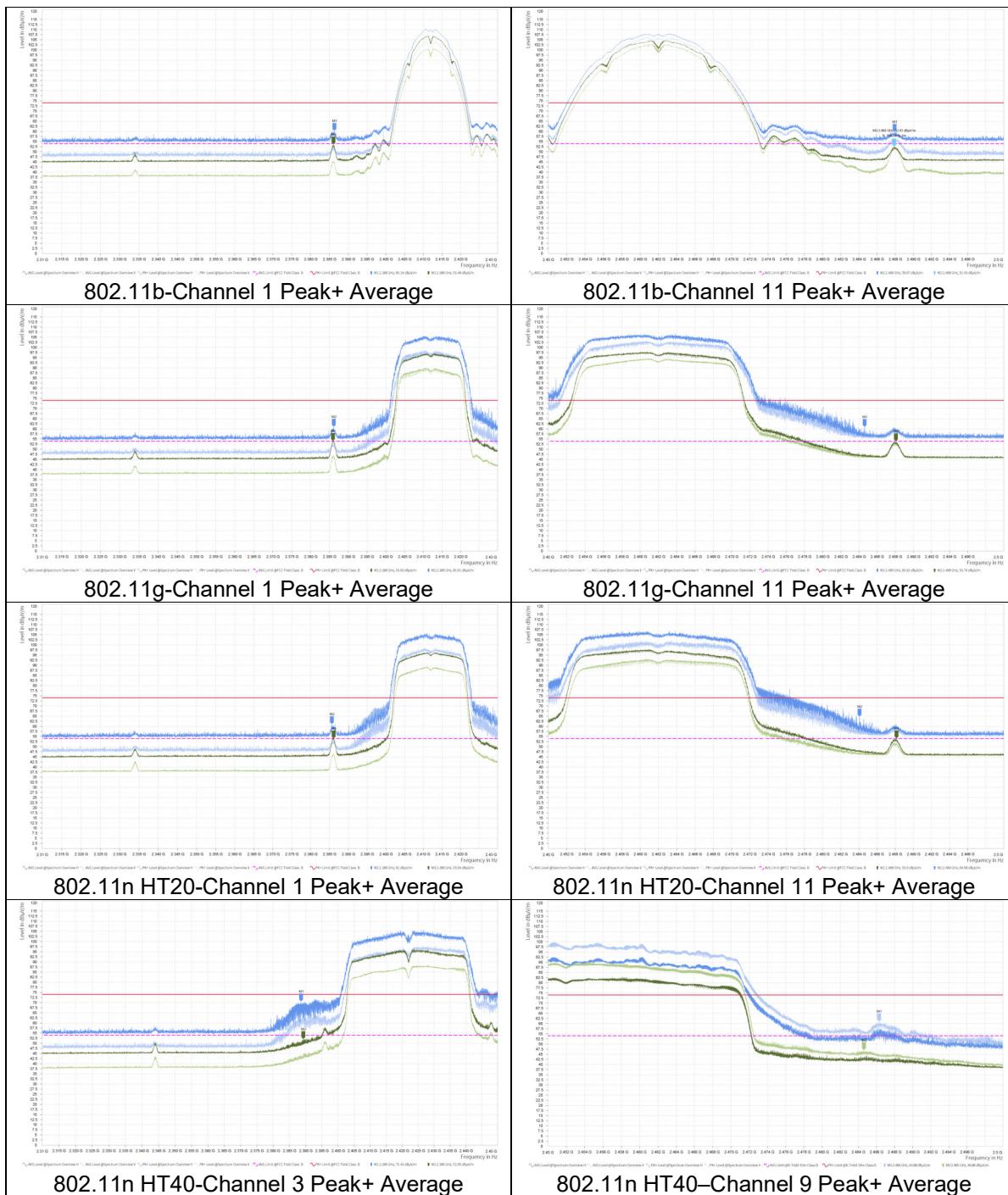
Frequency	Uncertainty
9kHz-30MHz	3.55 dB
30MHz-200MHz	4.17 dB
200MHz-1GHz	4.84 dB
1-18GHz	4.35 dB
18-26.5GHz	5.90 dB
26.5GHz~40GHz	5.92 dB

Test Results:

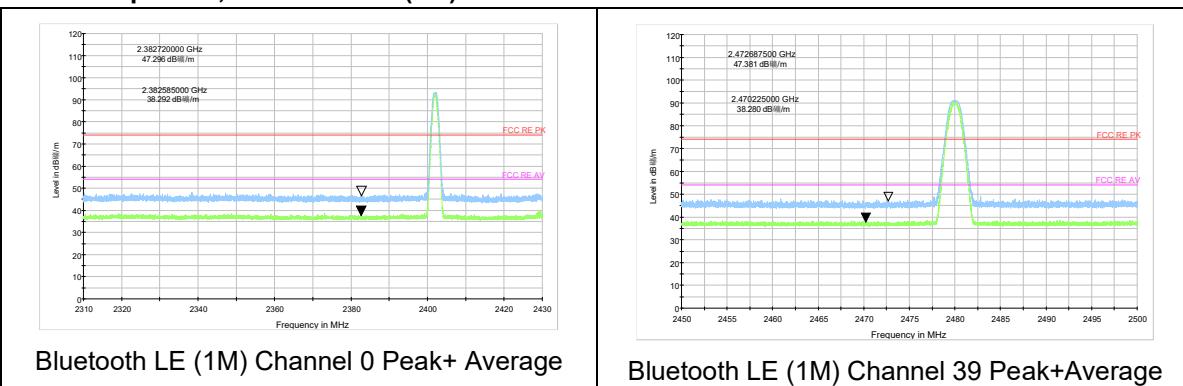
The following graphs display the maximum values of horizontal and vertical by software.

Blue trace uses the peak detection, Green trace uses the average detection.

A symbol ($\text{dB}_{\mu\text{V}/\text{m}}$) in the test plot below means ($\text{dB}\mu\text{V}/\text{m}$)



After the pretest, Bluetooth LE (1M) was selected as the worst Mode for Bluetooth LE.



Result of RE

Test result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the Emissions in the frequency band 18GHz-26.5GHz are more than 20dB below the limit are not reported.

The following graphs display the maximum values of horizontal and vertical by software.

For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

Continuous TX mode:

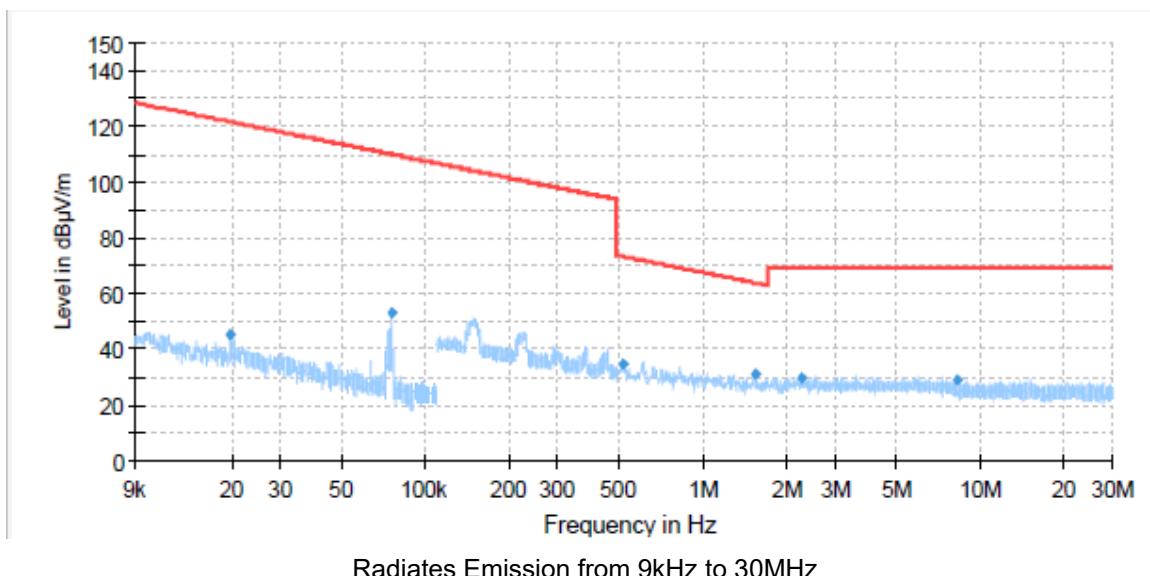
Remark:

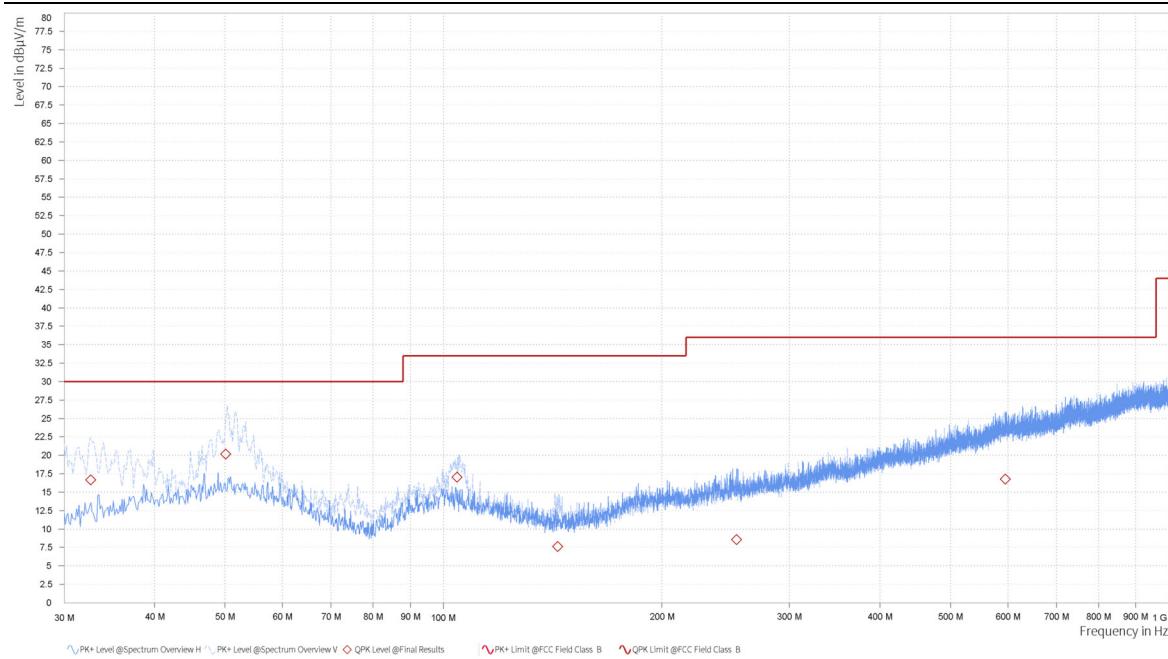
1. **Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)**
2. **Margin = Limit – Quasi-Peak/ MAX Peak/ Average**
3. **For below 1GHz**



Wi-Fi 2.4GHz

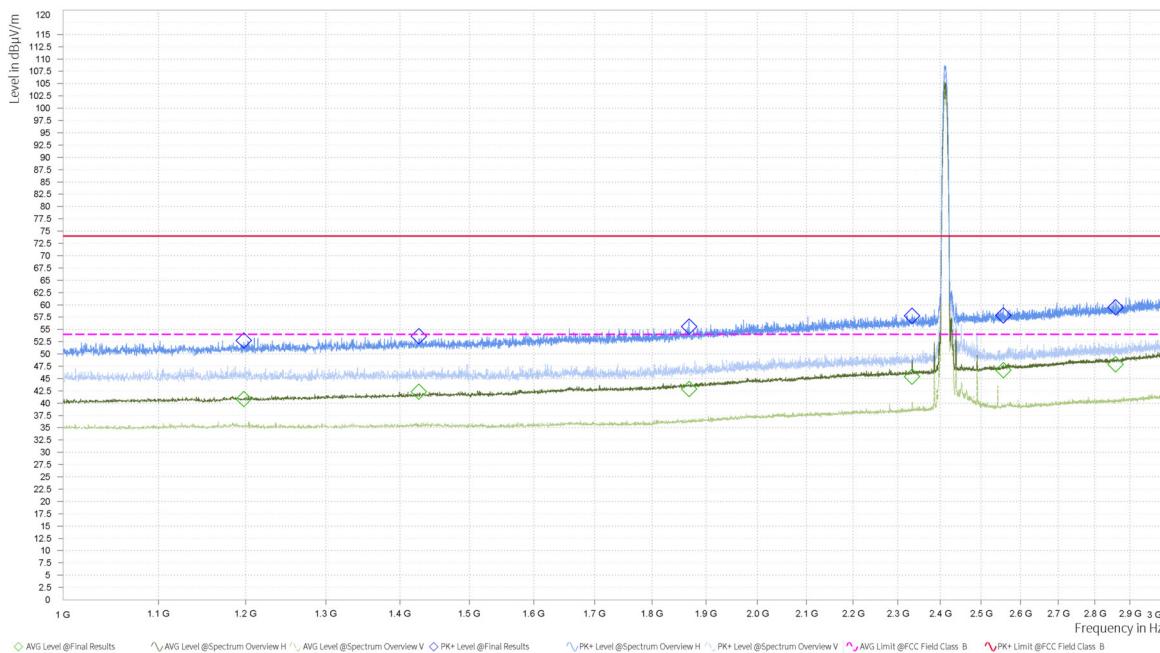
During the test, the Radiates Emission from 9kHz to 1GHz was performed in all modes with all channels. The test data of the worst-case condition was recorded in this report.




Radiates Emission from 30MHz to 1GHz

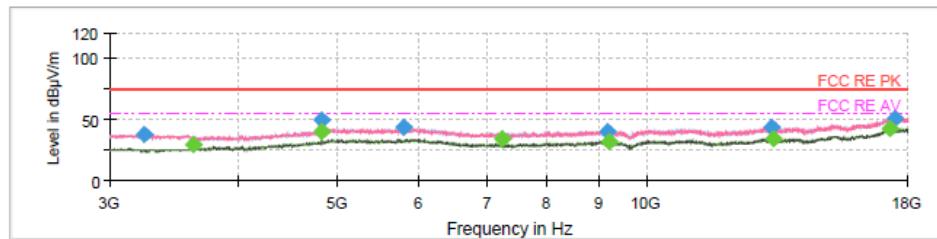
Frequency (MHz)	Quasi-Peak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (m)	Polarization	Azimuth (deg)	Correct Factor (dB)
32.641	16.67	30.00	13.33	1.25	V	102.1	-11.82
50.117	20.15	30.00	9.85	1.07	V	154.7	-8.32
104.478	17.02	33.50	16.48	1.92	V	167.2	-10.02
143.786	7.62	33.50	25.88	1.10	V	192.1	-13.24
253.588	8.58	36.00	27.42	2.20	H	220.5	-8.46
595.096	16.78	36.00	19.22	2.17	V	205	-0.75

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss)
2. Margin = Limit – Quasi-Peak

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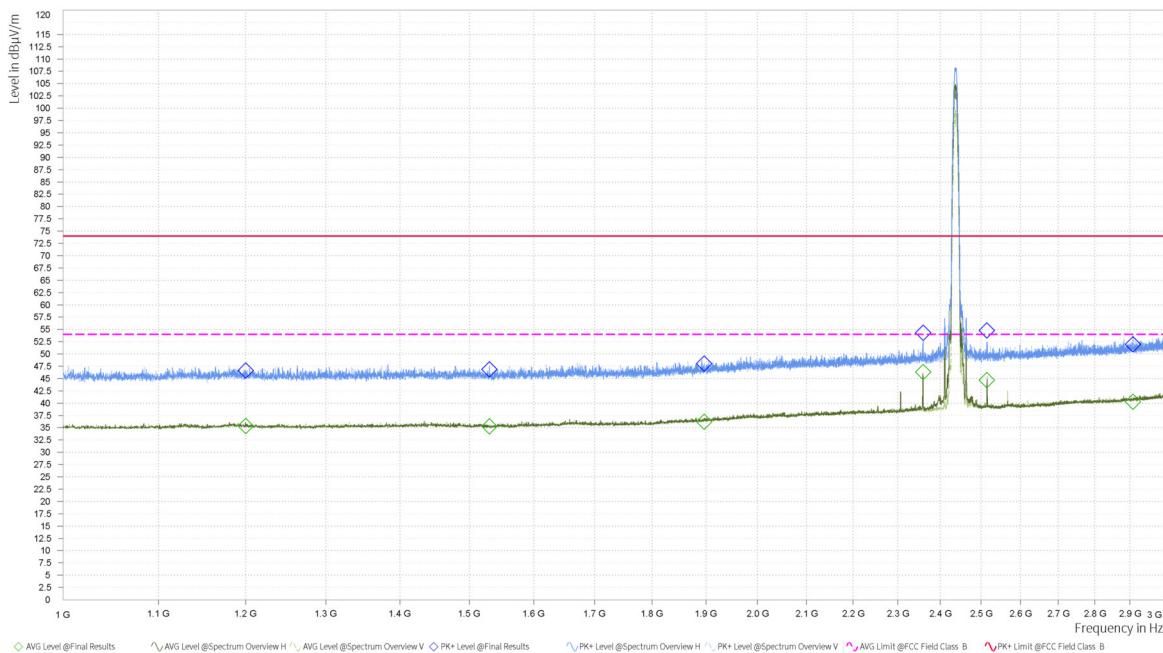
EMI Final Results

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	1,197.750	52.73	74.00	21.27	40.86	54.00	13.14	-3.70	H	335.4	1.00
1	1,426.500	53.64	74.00	20.36	42.34	54.00	11.66	-3.26	H	321.8	1.00
1	1,867.750	55.59	74.00	18.41	42.84	54.00	11.16	-2.13	H	198.1	1.00
1	2,333.750	57.79	74.00	16.21	45.41	54.00	8.59	0.37	V	0	1.00
1	2,556.250	57.86	74.00	16.14	46.69	54.00	7.31	1.19	H	31.9	2.00
1	2,859.000	59.49	74.00	14.51	47.92	54.00	6.08	2.37	H	360	1.00



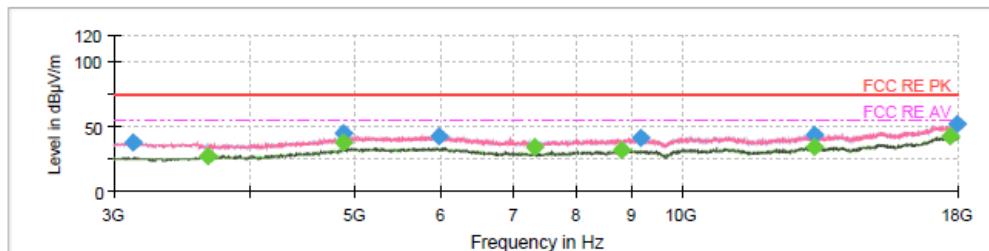
Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3238.125000	37.92	---	74.00	36.08	150.0	100.0	H	308.0	-4.5
3616.875000	---	29.42	54.00	24.58	150.0	200.0	H	166.0	-4.1
4822.500000	---	40.37	54.00	13.63	150.0	100.0	H	172.0	1.0
4822.500000	49.40	---	74.00	24.60	150.0	200.0	H	172.0	1.0
5795.625000	43.46	---	74.00	30.54	150.0	100.0	H	319.0	3.8
7233.750000	---	34.10	54.00	19.90	150.0	200.0	H	178.0	1.9
9159.375000	40.58	---	74.00	33.43	150.0	100.0	H	156.0	5.1
9206.250000	---	31.87	54.00	22.13	150.0	200.0	H	341.0	5.2
13261.875000	43.28	---	74.00	30.72	150.0	100.0	H	188.0	10.7
13293.750000	---	34.29	54.00	19.71	150.0	200.0	V	127.0	10.8
17289.375000	---	41.89	54.00	12.11	150.0	100.0	H	10.0	20.2
17490.000000	51.13	---	74.00	22.87	150.0	200.0	H	117.0	20.1

802.11b CH6


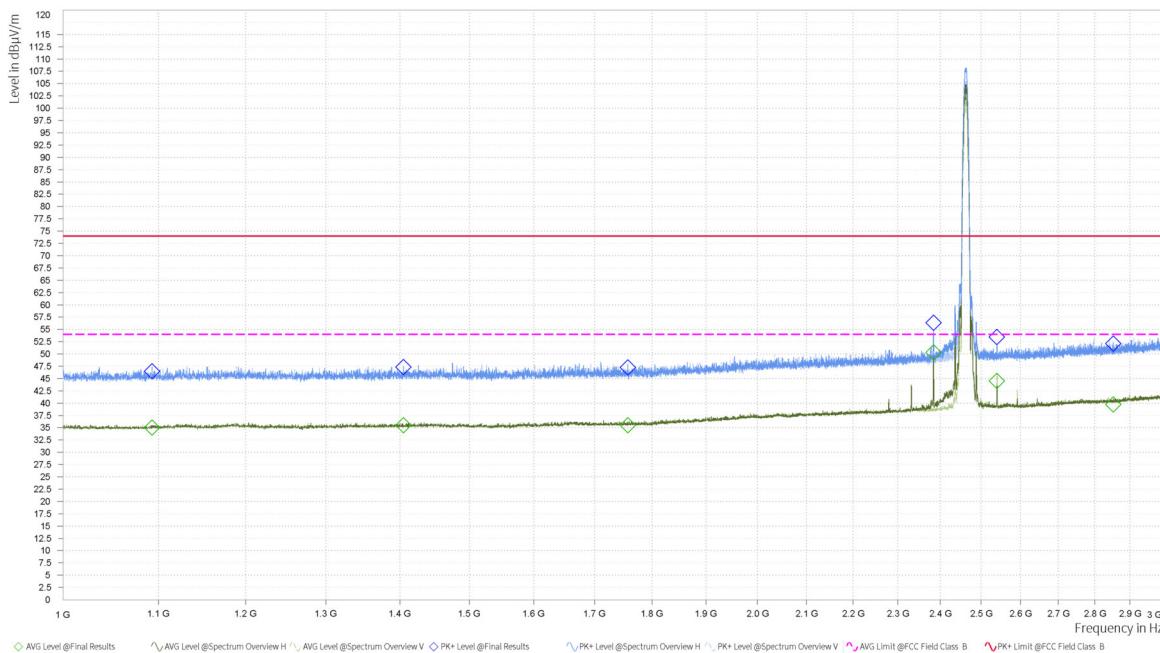
EMI Final Results

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	1,200.000	46.67	74.00	27.33	35.31	54.00	18.69	-3.67	V	360	2.00
1	1,530.500	46.84	74.00	27.16	35.26	54.00	18.74	-3.31	H	316.8	1.00
1	1,896.250	48.03	74.00	25.97	36.24	54.00	17.76	-1.87	H	358.9	1.00
1	2,359.250	54.32	74.00	19.68	46.33	54.00	7.67	0.41	H	206	1.00
1	2,514.750	54.82	74.00	19.18	44.64	54.00	9.36	1.06	H	208.3	2.00
1	2,909.250	51.97	74.00	22.03	40.26	54.00	13.74	2.71	H	212.8	1.00



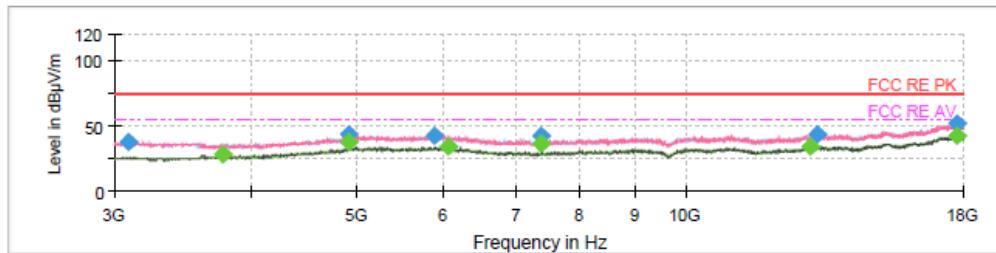
Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3121.875000	37.80	---	74.00	36.20	150.0	100.0	V	206.0	-4.8
3658.125000	---	27.15	54.00	26.85	150.0	200.0	H	295.0	-4.0
4873.125000	---	37.52	54.00	16.48	150.0	100.0	H	213.0	1.4
4873.125000	44.47	---	74.00	29.53	150.0	200.0	H	213.0	1.4
5968.125000	42.63	---	74.00	31.37	150.0	200.0	H	268.0	3.9
7312.500000	---	34.38	54.00	19.62	150.0	100.0	H	187.0	2.1
8790.000000	---	31.88	54.00	22.12	150.0	100.0	V	151.0	5.0
9172.500000	41.08	---	74.00	32.92	150.0	200.0	V	178.0	5.1
13258.125000	---	34.16	54.00	19.84	150.0	200.0	V	59.0	10.6
13265.625000	43.37	---	74.00	30.63	150.0	200.0	V	10.0	10.7
17698.125000	---	42.28	54.00	11.72	150.0	100.0	H	252.0	20.3
17923.125000	51.65	---	74.00	22.35	150.0	200.0	H	154.0	20.4

802.11b CH11


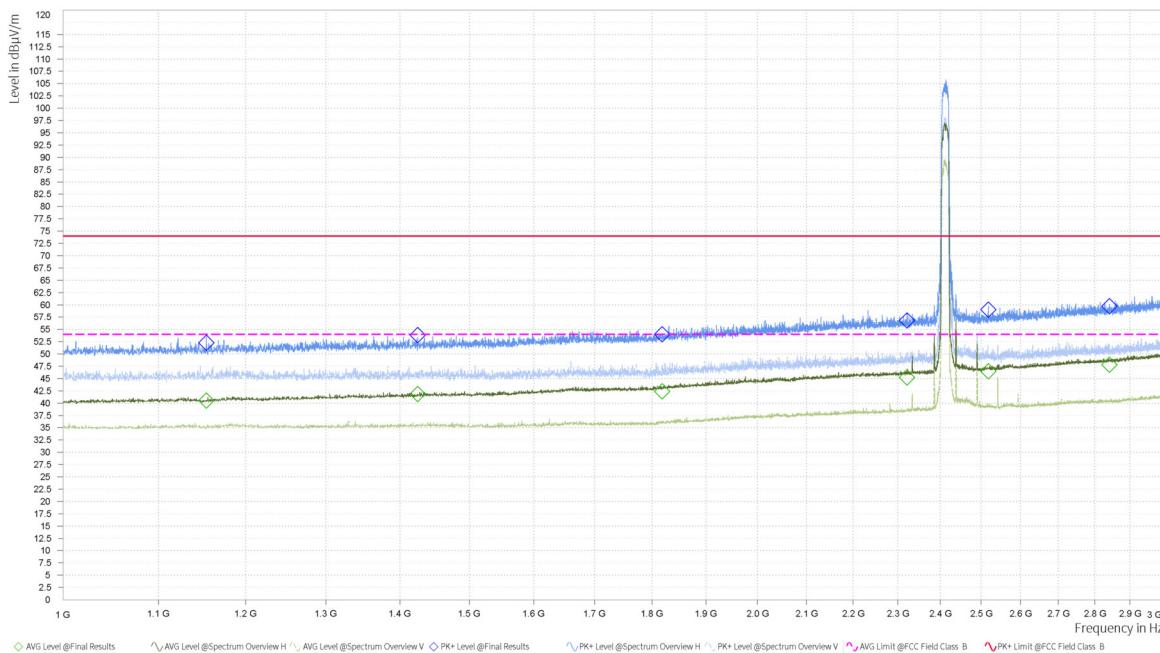
EMI Final Results

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	1,093.000	46.47	74.00	27.53	35.04	54.00	18.96	-4.29	H	276.5	2.00
1	1,404.750	47.38	74.00	26.62	35.54	54.00	18.46	-3.34	H	0	1.00
1	1,757.250	47.26	74.00	26.74	35.51	54.00	18.49	-2.80	H	117	1.00
1	2,384.000	56.37	74.00	17.63	50.34	54.00	3.66	0.44	H	199.8	1.00
1	2,540.000	53.45	74.00	20.55	44.49	54.00	9.51	0.96	H	68.8	1.00
1	2,852.500	52.16	74.00	21.84	39.77	54.00	14.23	2.36	H	193	1.00



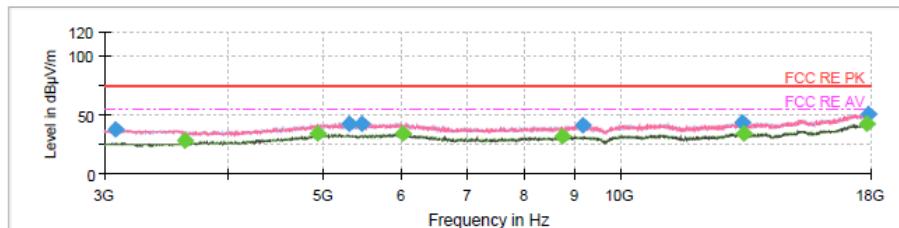
Final Result

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3091.875000	37.49	---	74.00	36.51	150.0	100.0	V	3.0	-4.9
3770.625000	---	27.79	54.00	26.21	150.0	200.0	V	130.0	-4.0
4923.750000	---	37.10	54.00	16.90	150.0	200.0	H	195.0	1.8
4923.750000	43.92	---	74.00	30.08	150.0	100.0	H	195.0	1.8
5900.625000	42.85	---	74.00	31.15	150.0	200.0	H	168.0	3.8
6067.500000	---	33.98	54.00	20.02	150.0	200.0	H	10.0	3.8
7383.750000	---	36.82	54.00	17.18	150.0	100.0	H	168.0	2.6
7385.625000	42.80	---	74.00	31.20	150.0	200.0	H	162.0	2.6
13005.000000	---	34.20	54.00	19.80	150.0	100.0	V	24.0	10.9
13190.625000	42.96	---	74.00	31.04	150.0	200.0	V	206.0	10.3
17724.375000	51.62	---	74.00	22.38	150.0	200.0	V	179.0	20.4
17726.250000	---	42.04	54.00	11.96	150.0	200.0	V	130.0	20.4

802.11g CH1


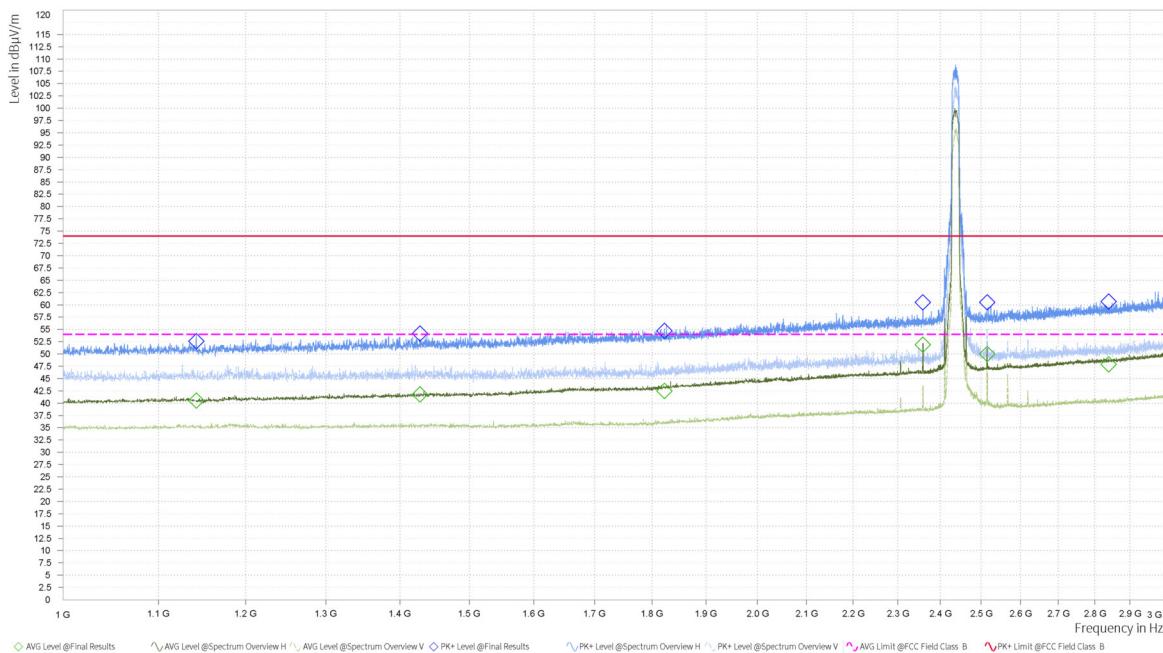
EMI Final Results

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	1,154.000	52.28	74.00	21.72	40.53	54.00	13.47	-4.09	H	314.2	1.00
1	1,424.750	53.85	74.00	20.15	41.86	54.00	12.14	-3.26	H	117.8	1.00
1	1,818.250	53.99	74.00	20.01	42.40	54.00	11.60	-2.51	H	62.2	1.00
1	2,322.000	56.82	74.00	17.18	45.26	54.00	8.74	0.29	H	244	1.00
1	2,517.750	59.06	74.00	14.94	46.45	54.00	7.55	1.11	H	230	1.00
1	2,841.250	59.69	74.00	14.31	47.83	54.00	6.17	2.34	H	292.9	1.00



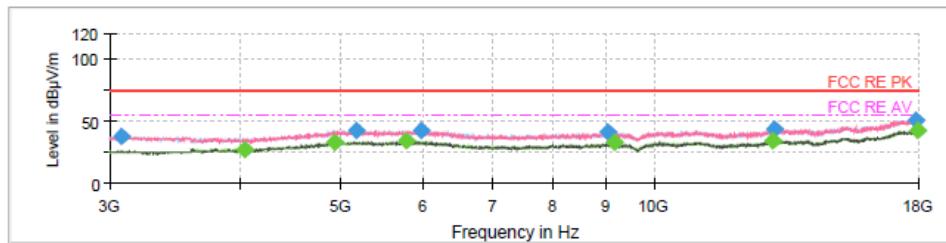
Final Result

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3075.000000	37.35	---	74.00	36.65	150.0	100.0	H	10.0	-4.8
3618.750000	---	27.73	54.00	26.27	150.0	200.0	H	172.0	-4.1
4938.750000	---	33.94	54.00	20.06	150.0	100.0	H	329.0	2.0
5311.875000	42.22	---	74.00	31.78	150.0	100.0	H	264.0	2.5
5480.625000	42.57	---	74.00	31.43	150.0	200.0	V	60.0	2.8
6022.500000	---	33.74	54.00	20.26	150.0	200.0	H	82.0	3.9
8745.000000	---	31.64	54.00	22.36	150.0	200.0	H	16.0	5.0
9174.375000	41.47	---	74.00	32.53	150.0	200.0	H	286.0	5.1
13293.750000	43.08	---	74.00	30.92	150.0	100.0	V	140.0	10.8
13329.375000	---	34.60	54.00	19.40	150.0	200.0	V	130.0	10.9
17821.875000	---	42.22	54.00	11.78	150.0	200.0	V	346.0	20.5
17851.875000	50.86	---	74.00	23.14	150.0	200.0	V	274.0	20.5

802.11g CH6


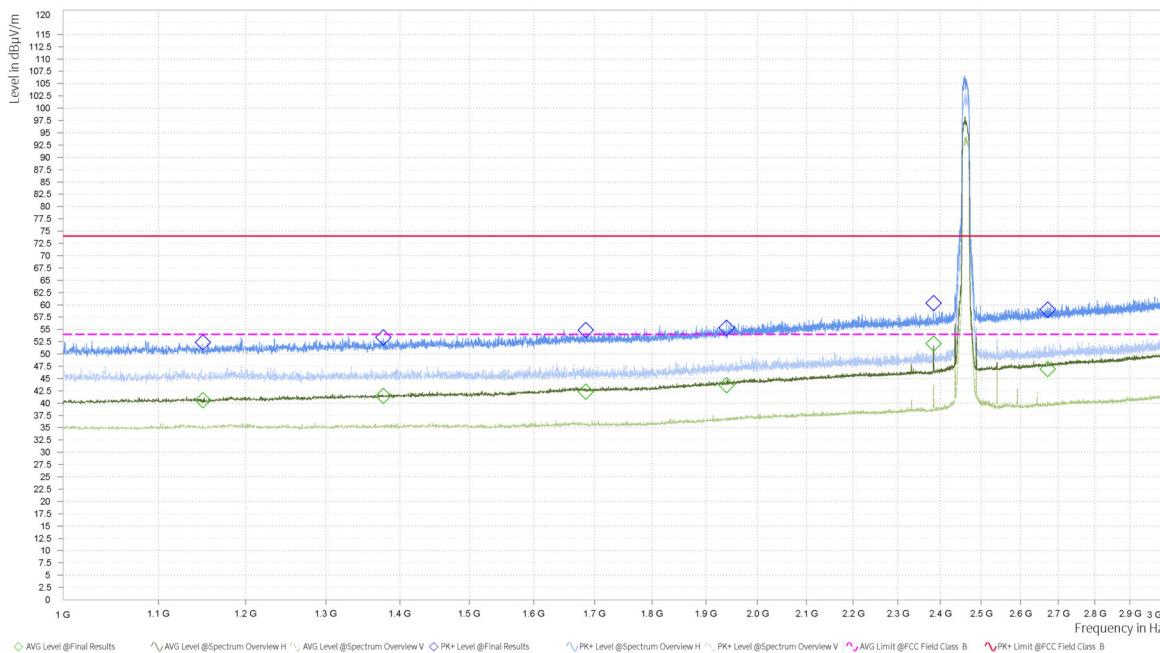
EMI Final Results

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	1,142.250	52.63	74.00	21.37	40.52	54.00	13.48	-4.04	H	153.3	1.00
1	1,428.250	54.16	74.00	19.84	41.80	54.00	12.20	-3.26	H	174.3	1.00
1	1,822.500	54.73	74.00	19.27	42.47	54.00	11.53	-2.48	H	118.3	1.00
1	2,358.750	60.50	74.00	13.50	51.90	54.00	2.10	0.42	H	195.1	1.00
1	2,515.250	60.49	74.00	13.51	49.98	54.00	4.02	1.07	H	202.1	2.00
1	2,839.750	60.69	74.00	13.31	47.88	54.00	6.12	2.34	H	343.4	1.00



Final Result

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3080.625000	37.80	---	74.00	36.20	150.0	100.0	H	146.0	-4.8
4036.875000	---	27.44	54.00	26.56	150.0	200.0	V	58.0	-3.7
4940.625000	---	33.41	54.00	20.59	150.0	100.0	H	228.0	2.0
5184.375000	42.25	---	74.00	31.75	150.0	100.0	V	204.0	2.5
5784.375000	---	33.75	54.00	20.25	150.0	200.0	V	161.0	3.8
5973.750000	42.30	---	74.00	31.70	150.0	200.0	H	332.0	3.9
9043.125000	40.86	---	74.00	33.14	150.0	100.0	H	305.0	5.0
9168.750000	---	32.50	54.00	21.50	150.0	200.0	H	276.0	5.1
13012.500000	---	34.25	54.00	19.75	150.0	200.0	V	122.0	10.9
13048.125000	43.11	---	74.00	30.89	150.0	100.0	V	85.0	10.9
17883.750000	50.99	---	74.00	23.01	150.0	200.0	V	117.0	20.5
17910.000000	---	42.22	54.00	11.78	150.0	200.0	V	355.0	20.6

802.11g CH11


EMI Final Results

Rg	Frequency [MHz]	PK+ Level [dBμV/m]	PK+ Limit [dBμV/m]	PK+ Margin [dB]	AVG Level [dBμV/m]	AVG Limit [dBμV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	1,150.000	52.38	74.00	21.62	40.58	54.00	13.42	-4.14	H	241.8	1.00
1	1,377.000	53.39	74.00	20.61	41.49	54.00	12.51	-3.39	H	1.9	2.00
1	1,685.250	54.85	74.00	19.15	42.29	54.00	11.71	-2.88	H	241.8	1.00
1	1,939.000	55.33	74.00	18.67	43.63	54.00	10.37	-1.46	H	356.1	1.00
1	2,384.000	60.39	74.00	13.61	52.11	54.00	1.89	0.44	H	192	1.00
1	2,671.500	58.98	74.00	15.02	46.98	54.00	7.02	1.52	H	56.7	1.00