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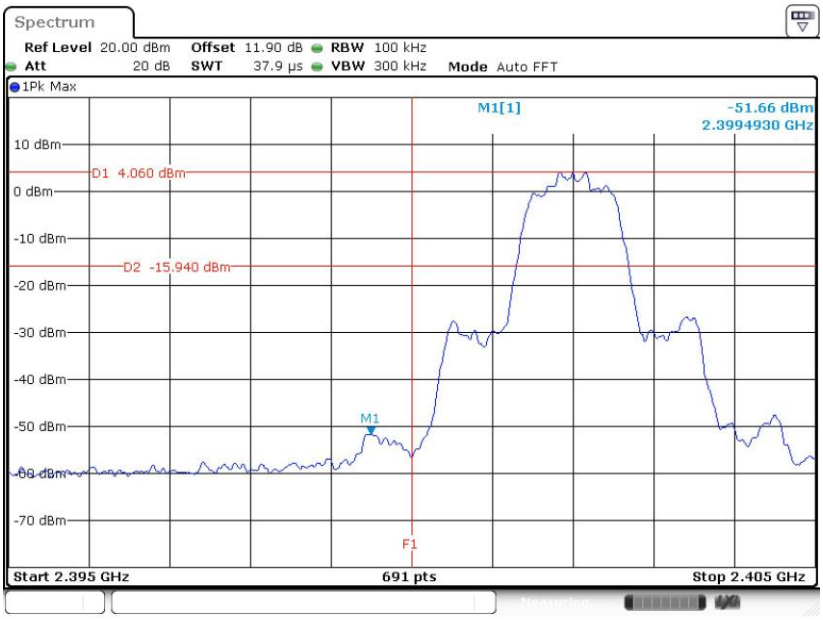
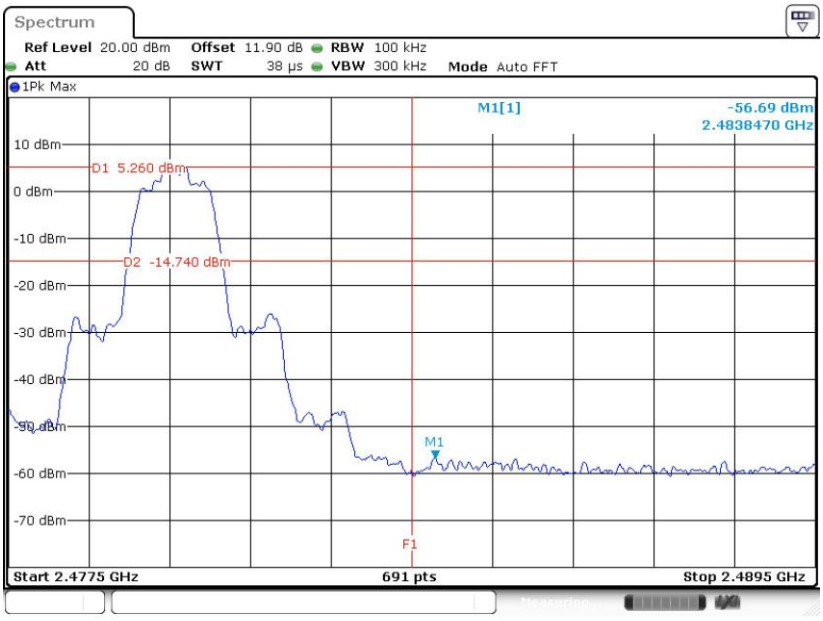
Low Band Edge Plot on Channel 00



Date: 16.NOV.2020 19:40:02

High Band Edge Plot on Channel 78



Date: 16.NOV.2020 20:10:58

3.6.6 Test Result of Conducted Hopping Mode Band Edges

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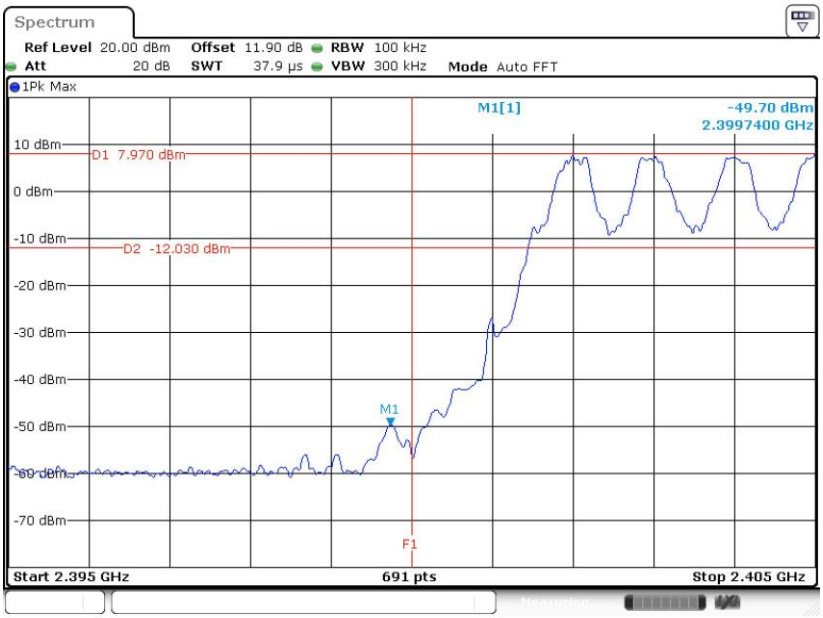
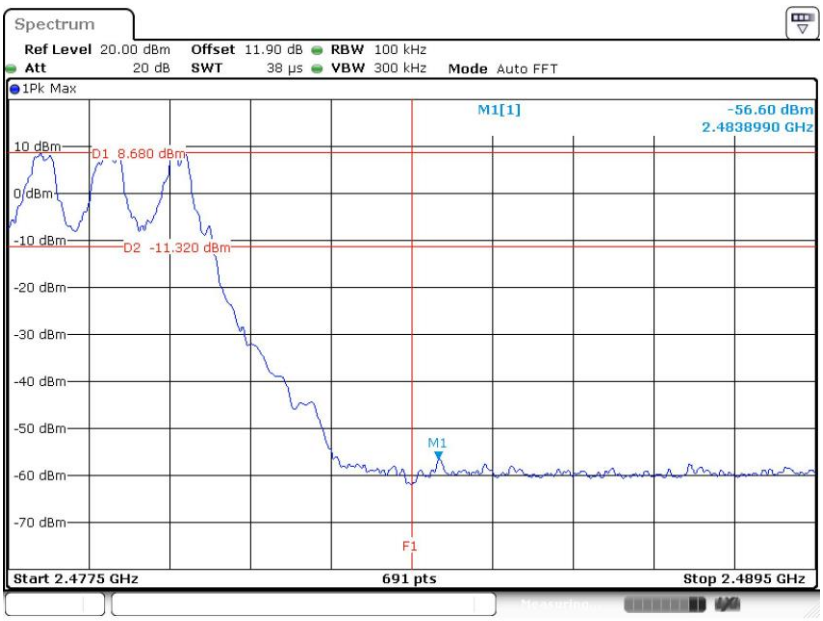
<1Mbps>

Hopping Mode Low Band Edge Plot



Date: 16.NOV.2020 15:17:26

Hopping Mode High Band Edge Plot



Date: 16.NOV.2020 15:18:00

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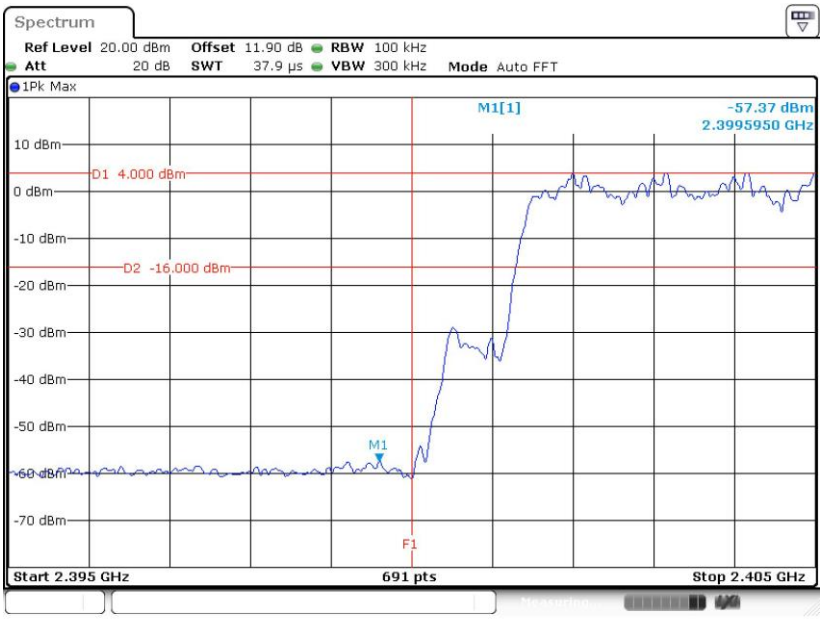
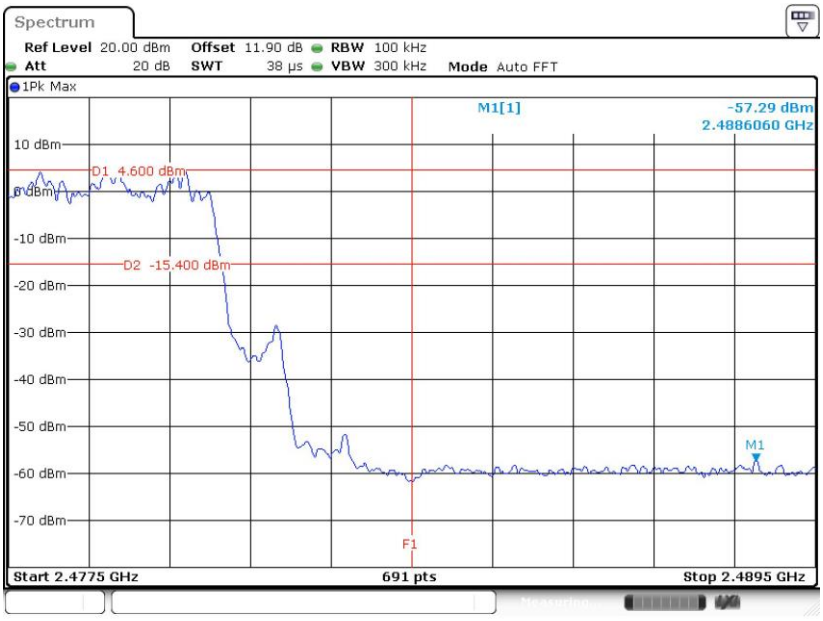
Hopping Mode Low Band Edge Plot



Date: 16.NOV.2020 15:19:44

Hopping Mode High Band Edge Plot



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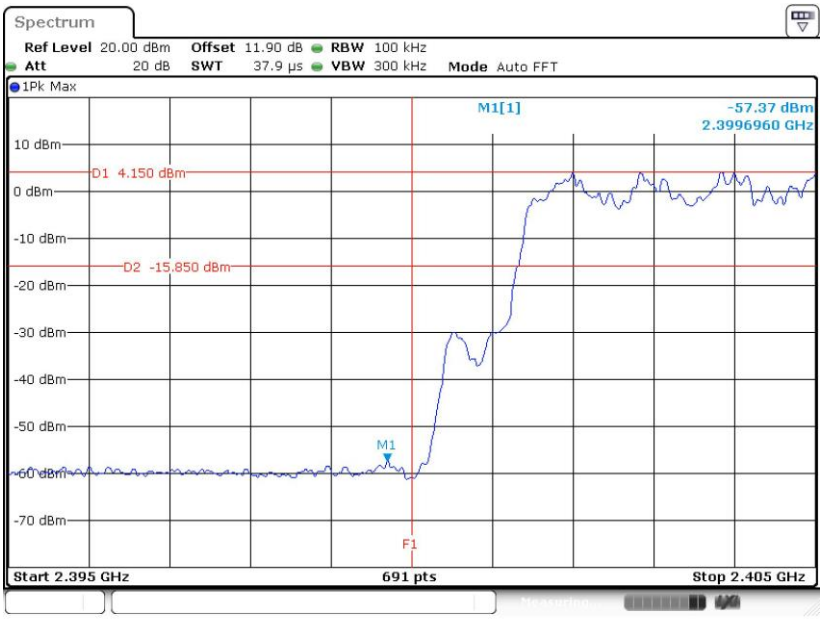

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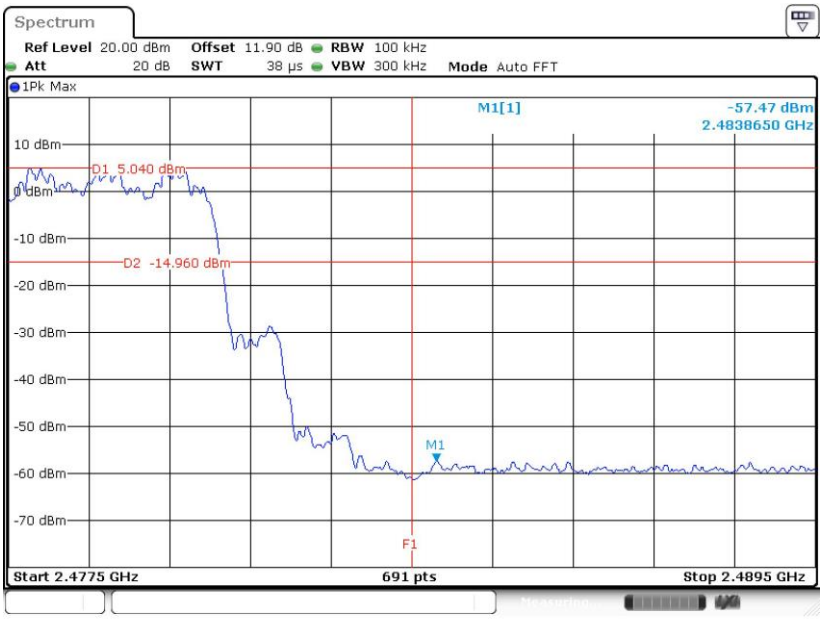
Hopping Mode High Band Edge Plot



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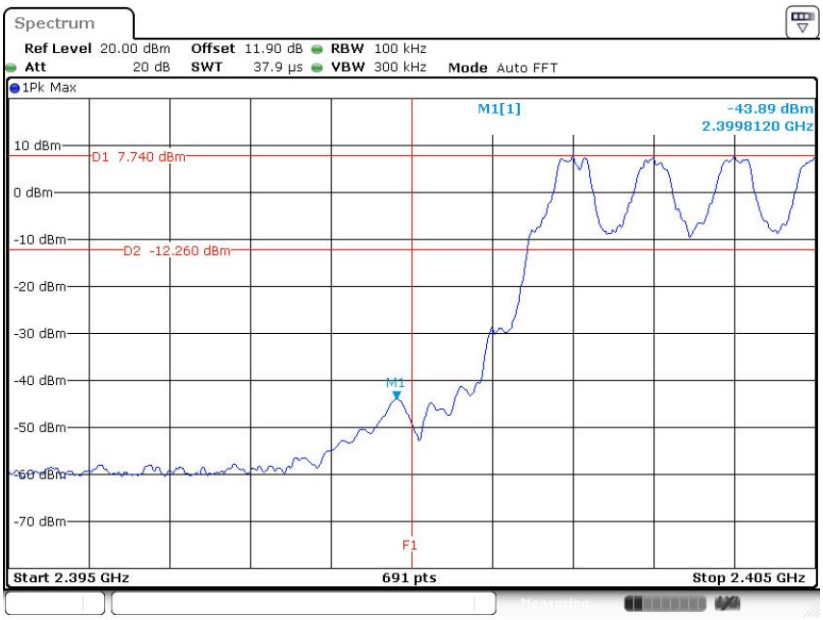

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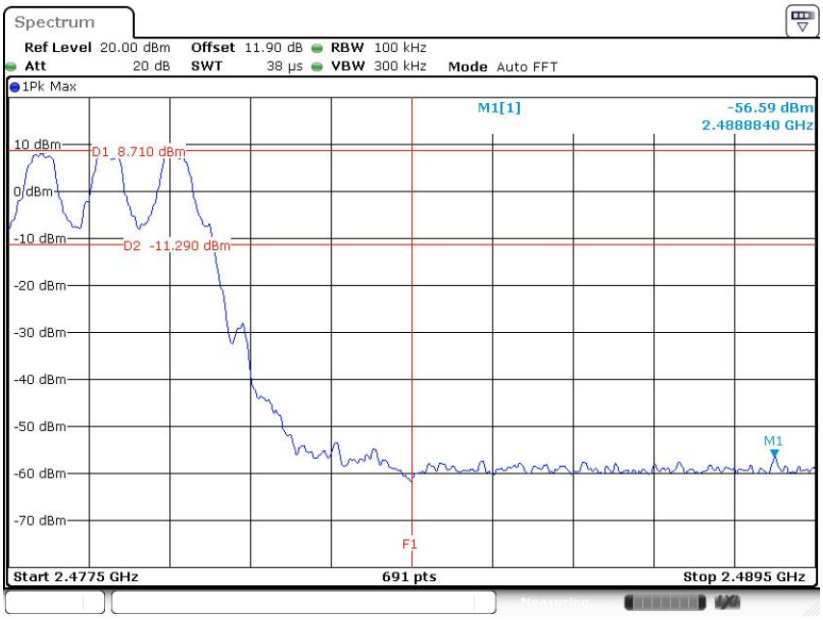

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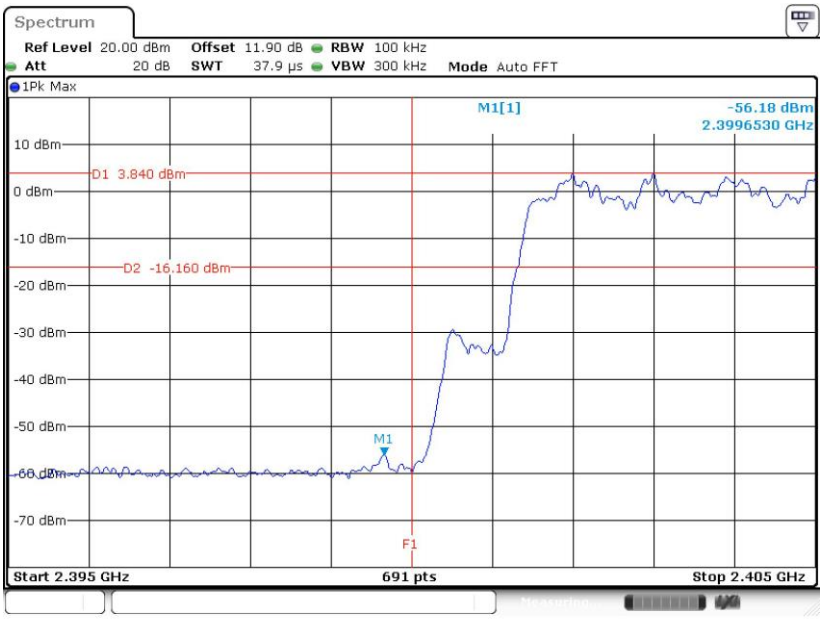

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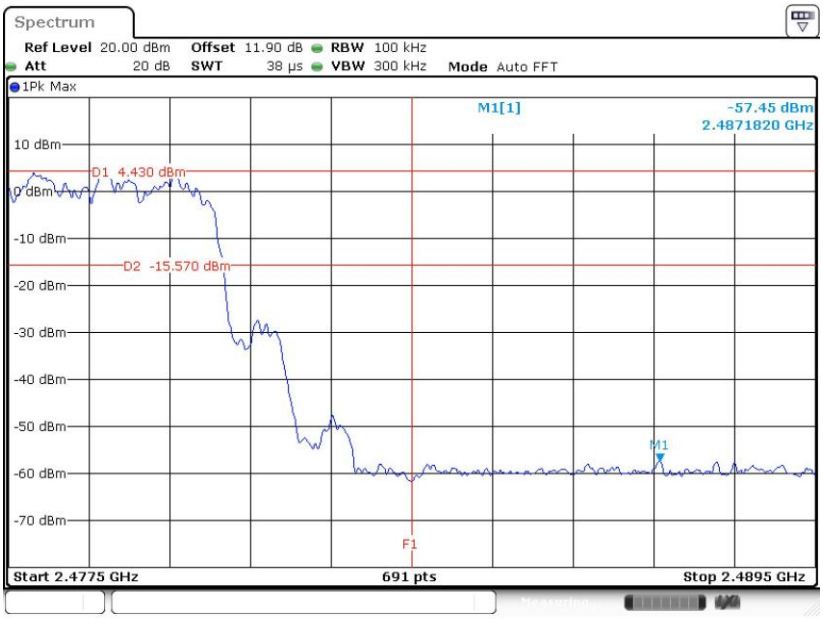

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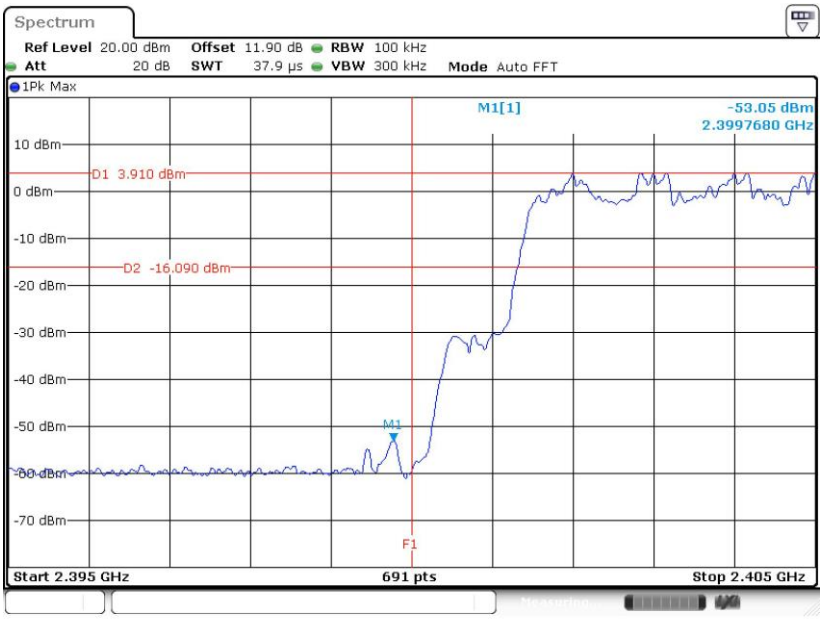

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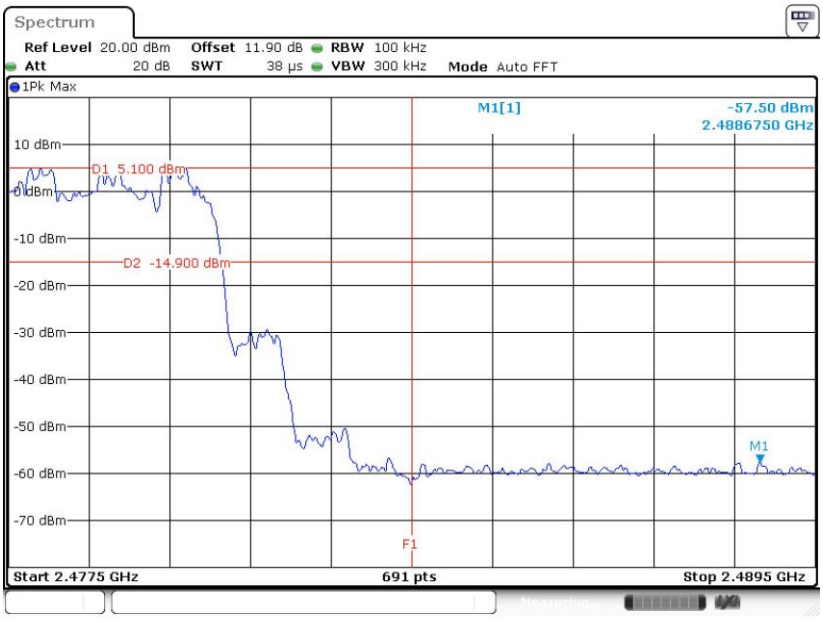

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3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

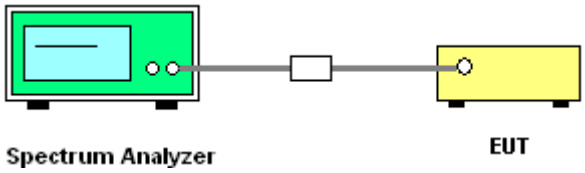
3.7.2 Measuring Instruments

See list of measuring equipment of this test report.

3.7.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.7.4 Test Setup



3.7.5 Test Result of Conducted Spurious Emission

<Main Antenna>

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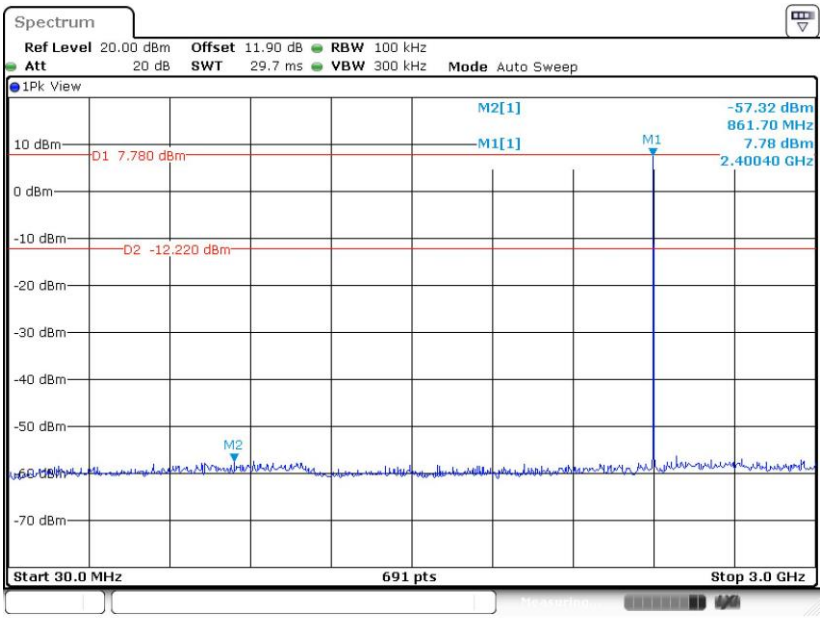
CSE Plot on Ch 00 between 30MHz ~ 3 GHz



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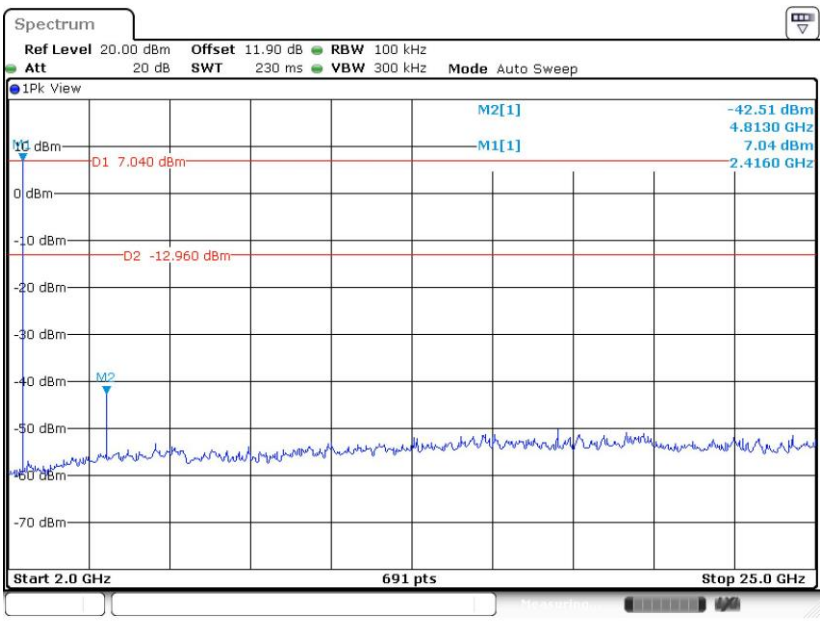
1Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



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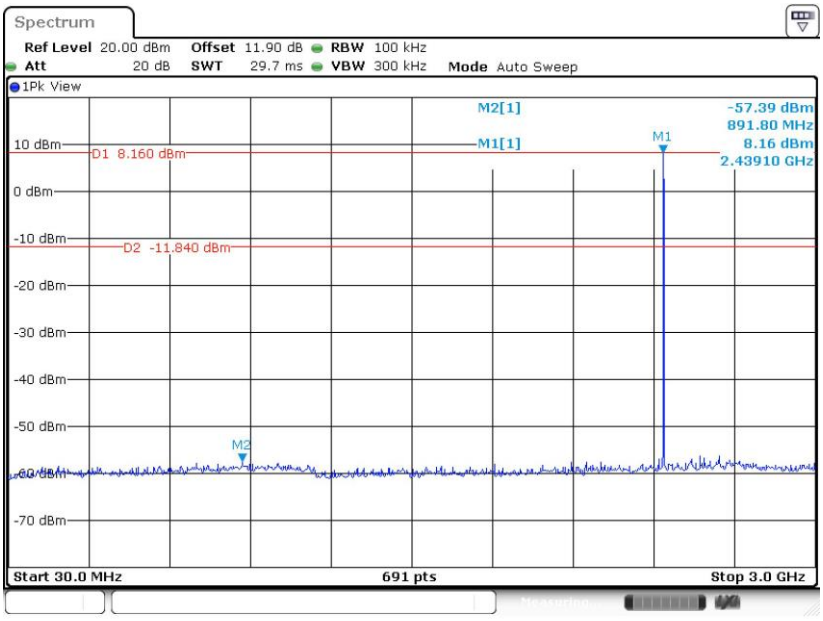
CSE Plot on Ch 39 between 30MHz ~ 3 GHz



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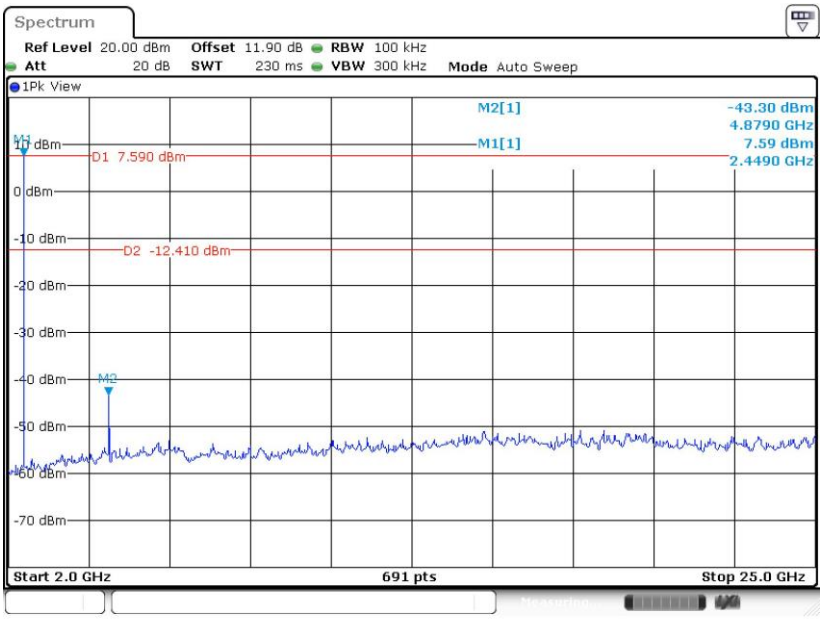
CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



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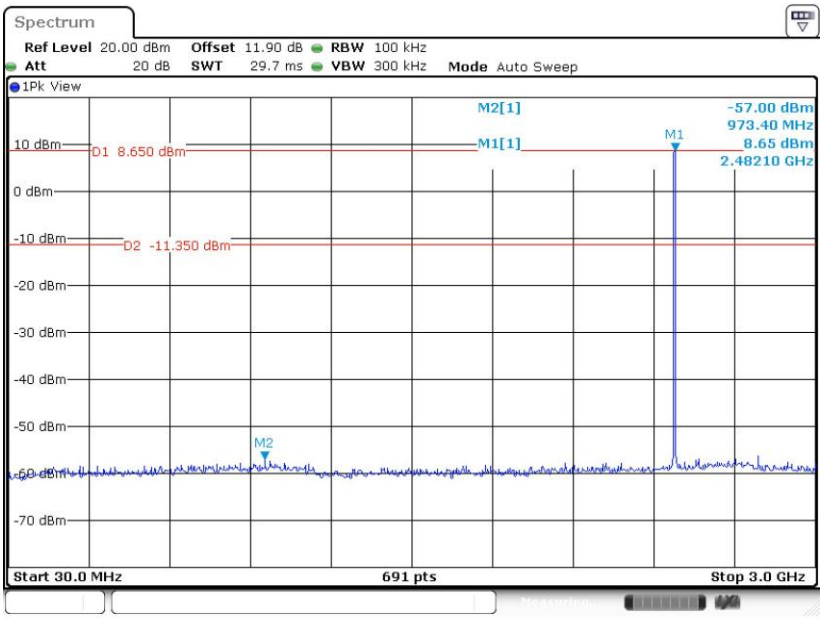
CSE Plot on Ch 78 between 30MHz ~ 3 GHz



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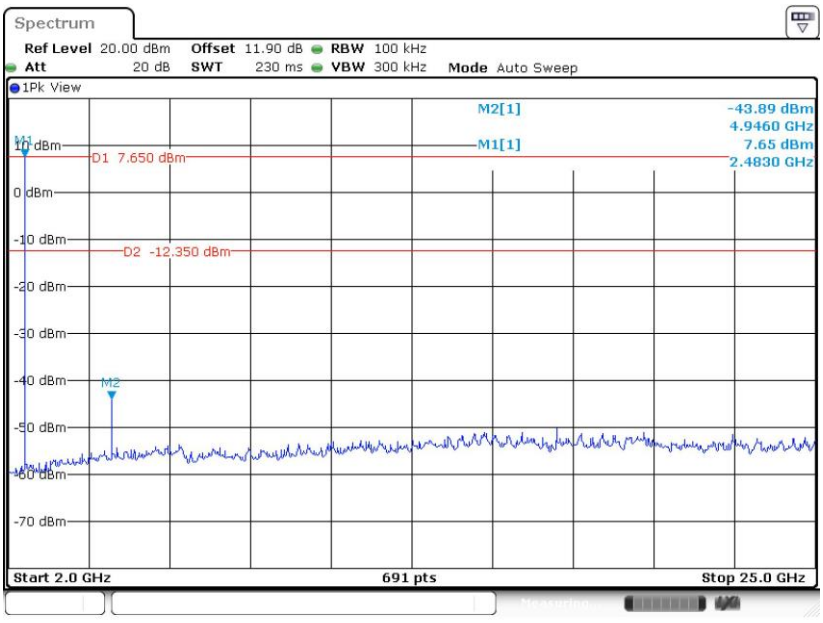
CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



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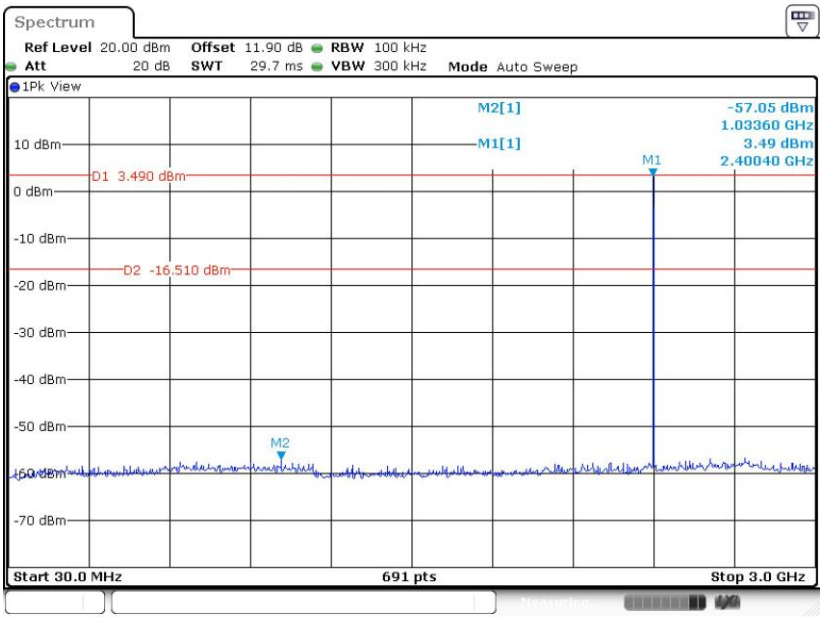
CSE Plot on Ch 00 between 30MHz ~ 3 GHz



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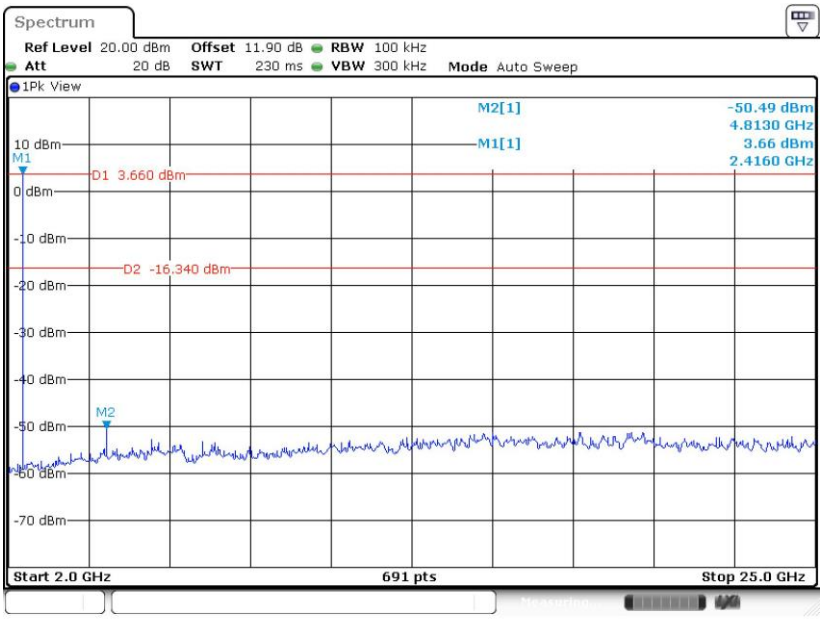
CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



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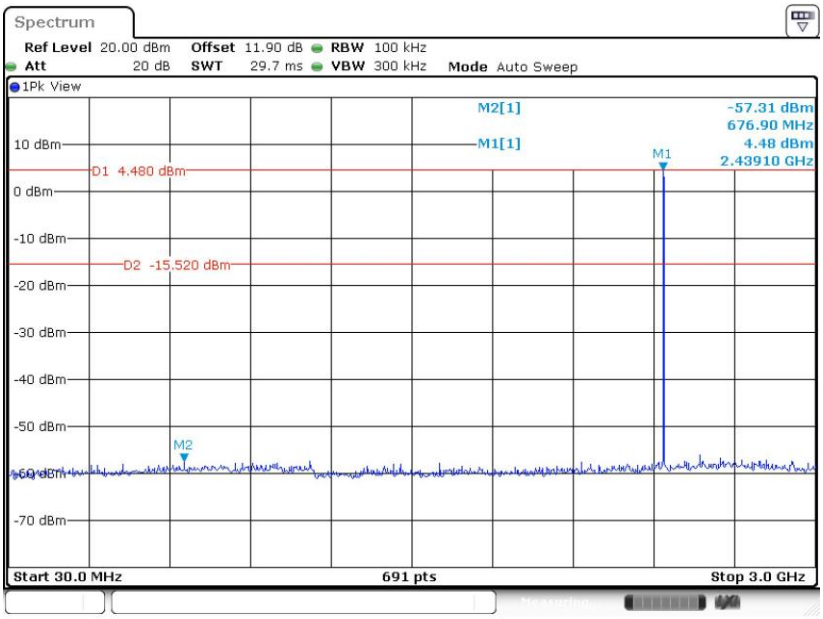

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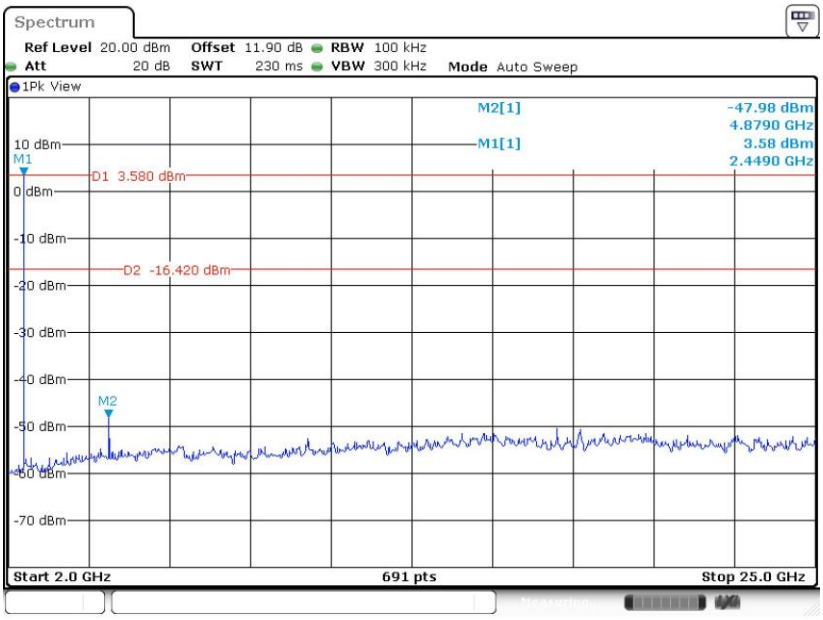

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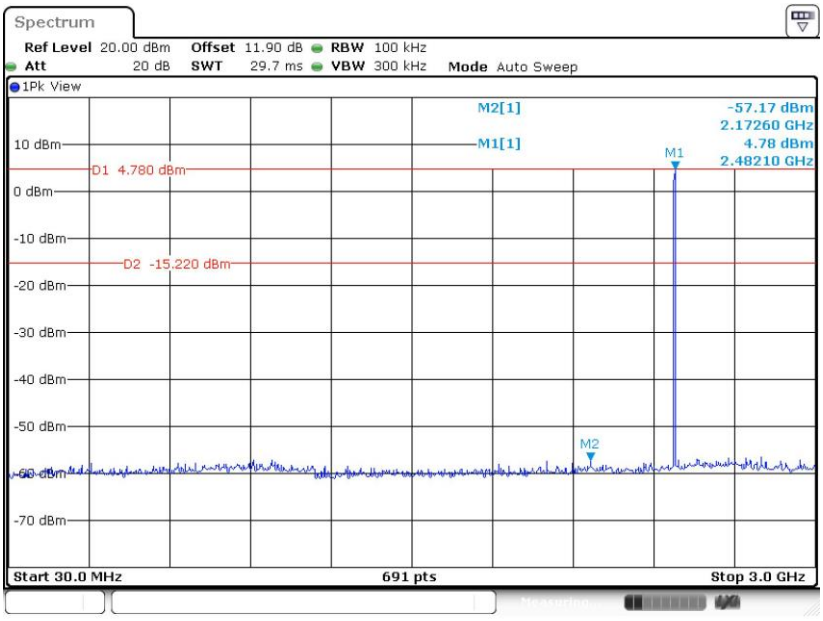
CSE Plot on Ch 78 between 30MHz ~ 3 GHz



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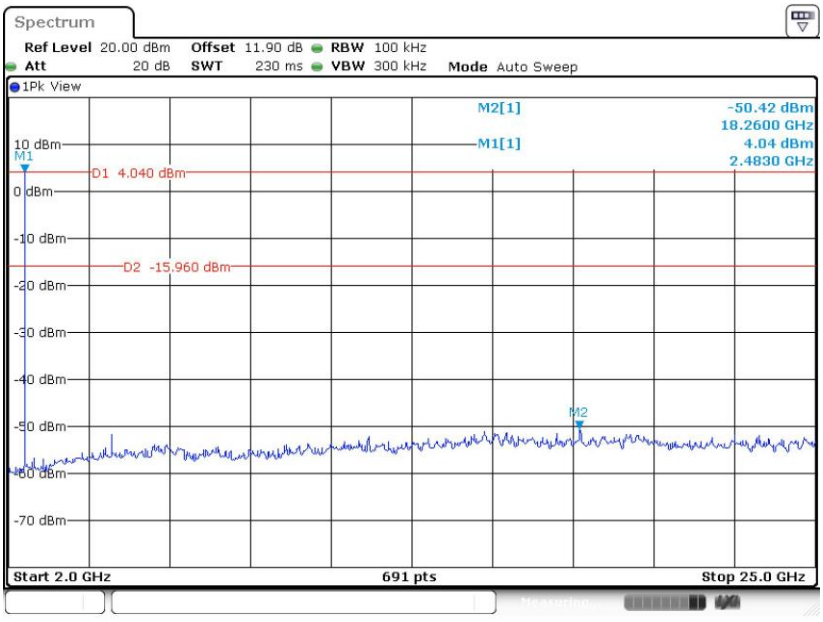

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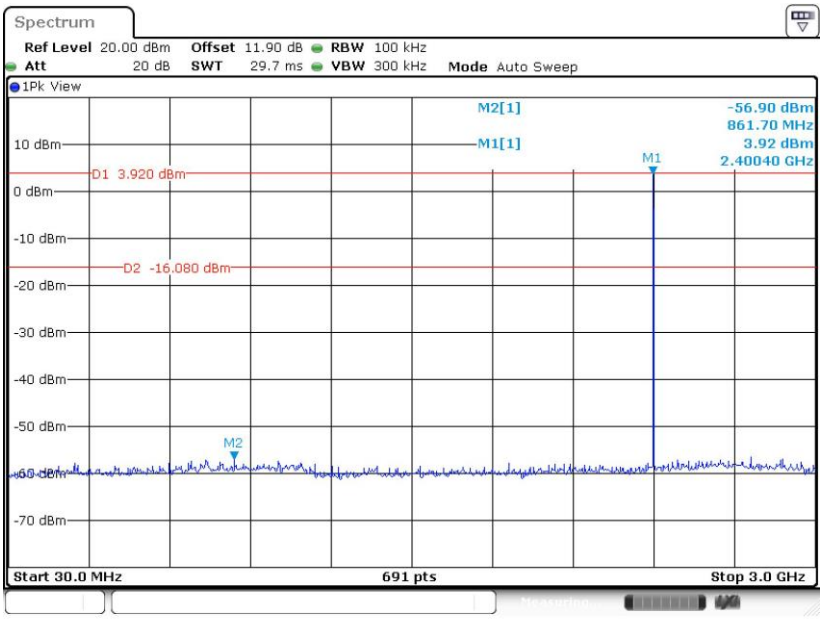
CSE Plot on Ch 00 between 30MHz ~ 3 GHz



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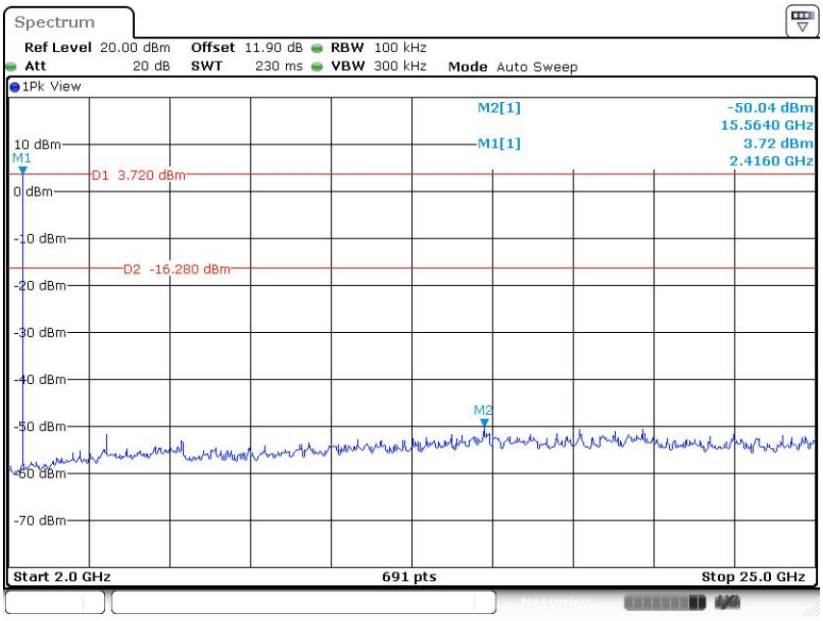

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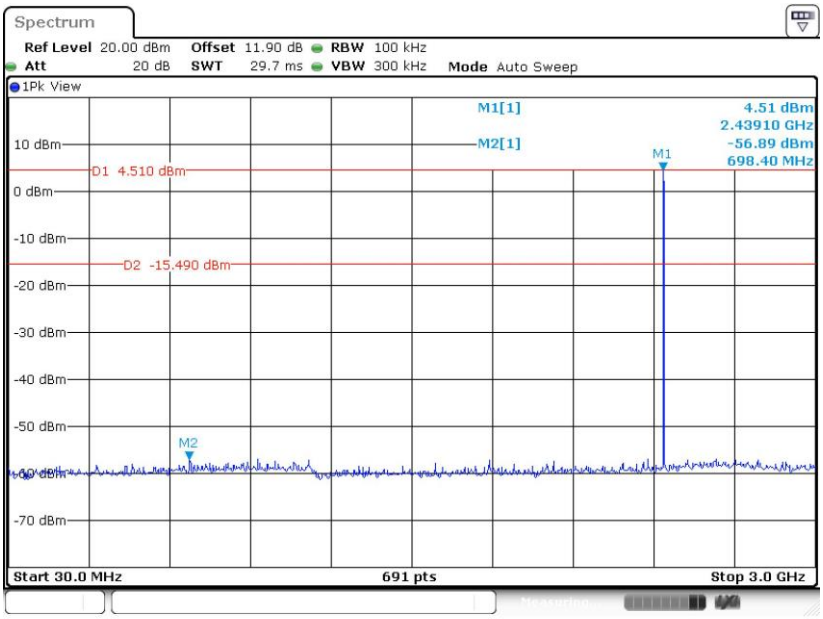
CSE Plot on Ch 39 between 30MHz ~ 3 GHz



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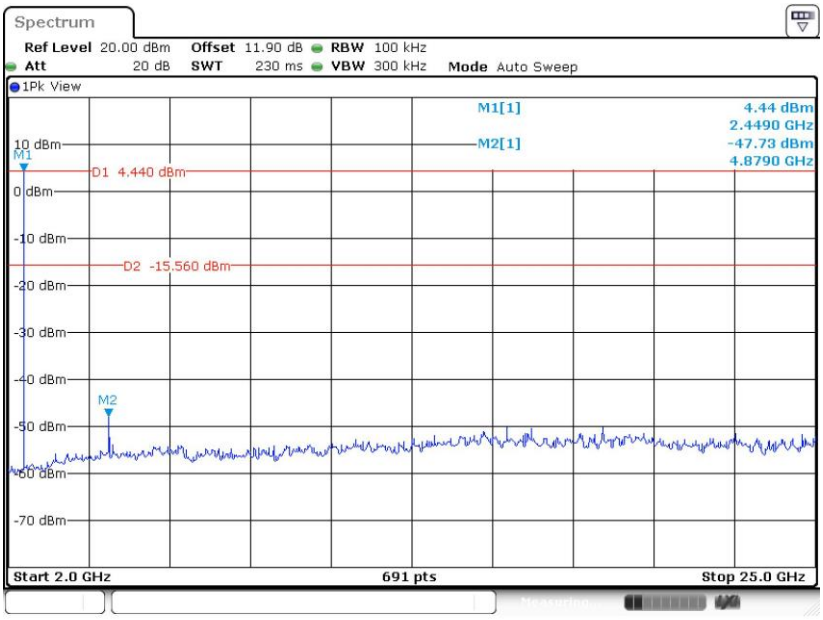

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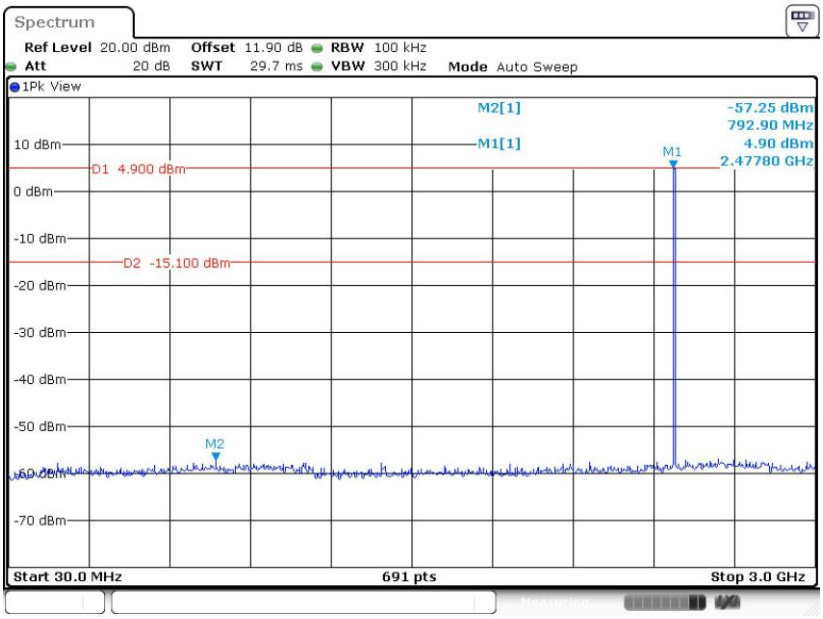

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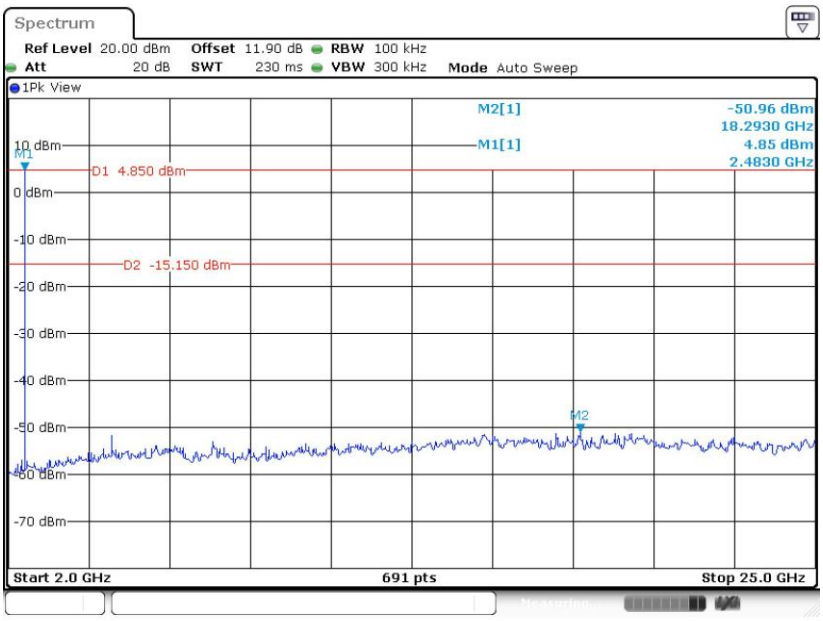

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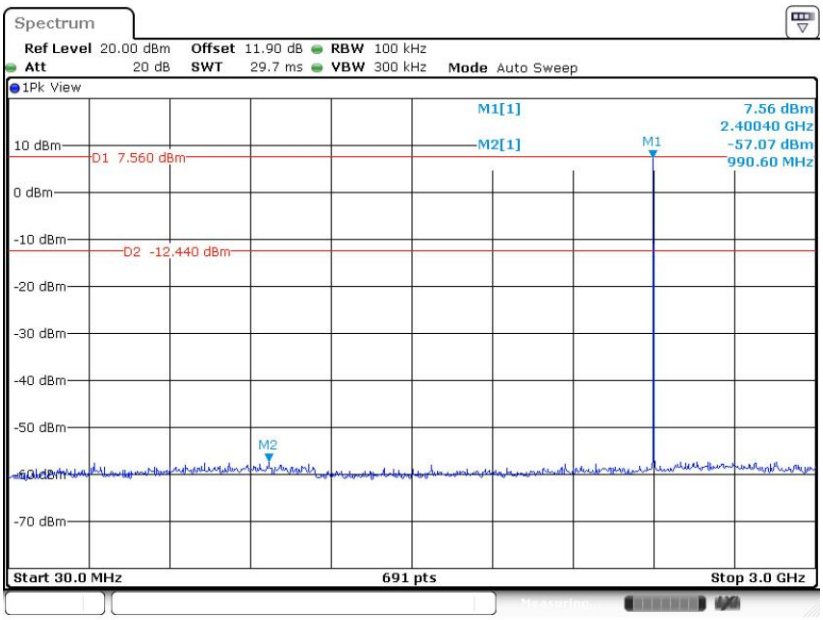
CSE Plot on Ch 00 between 30MHz ~ 3 GHz



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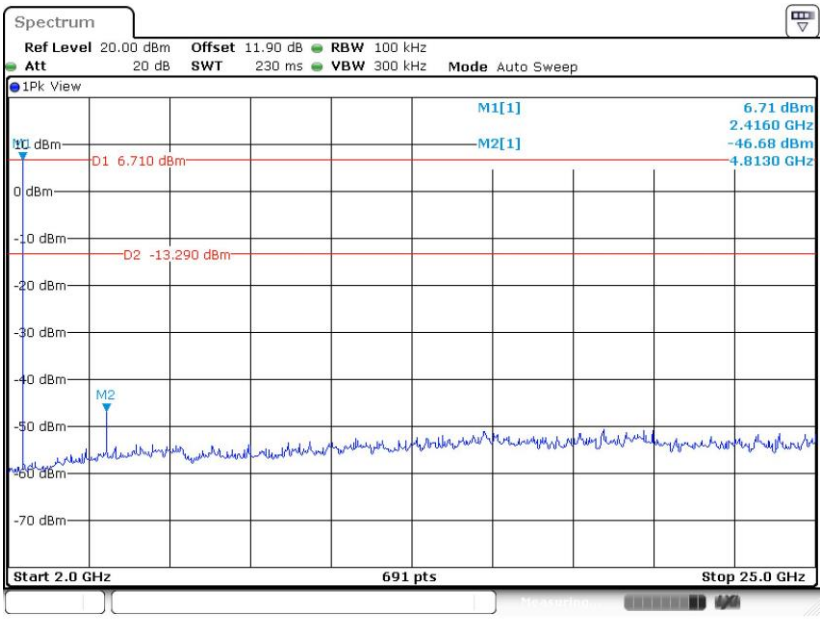
1Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



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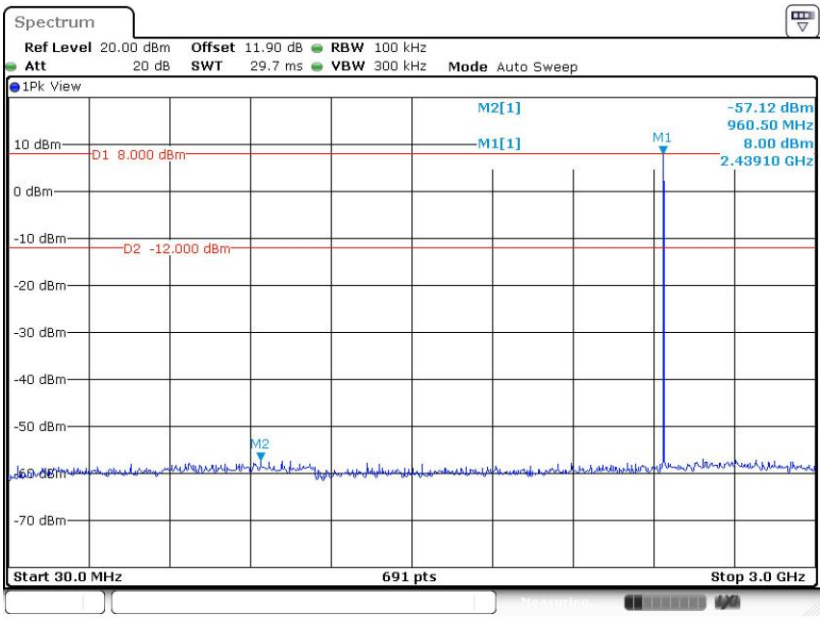
CSE Plot on Ch 39 between 30MHz ~ 3 GHz



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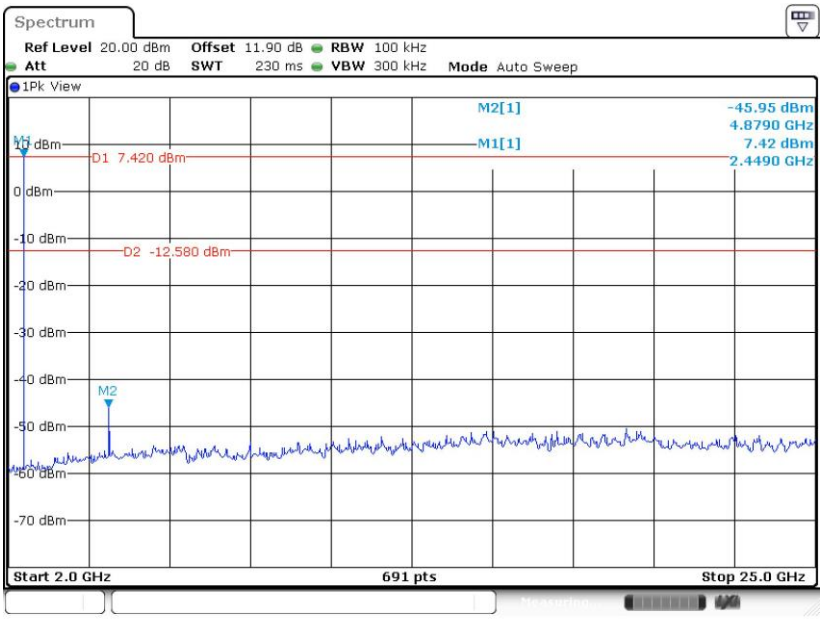
CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



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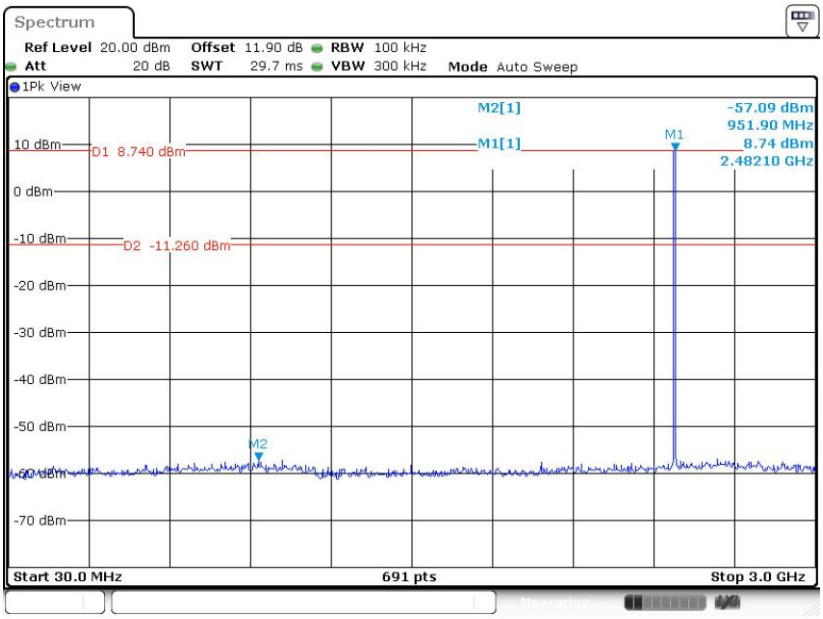

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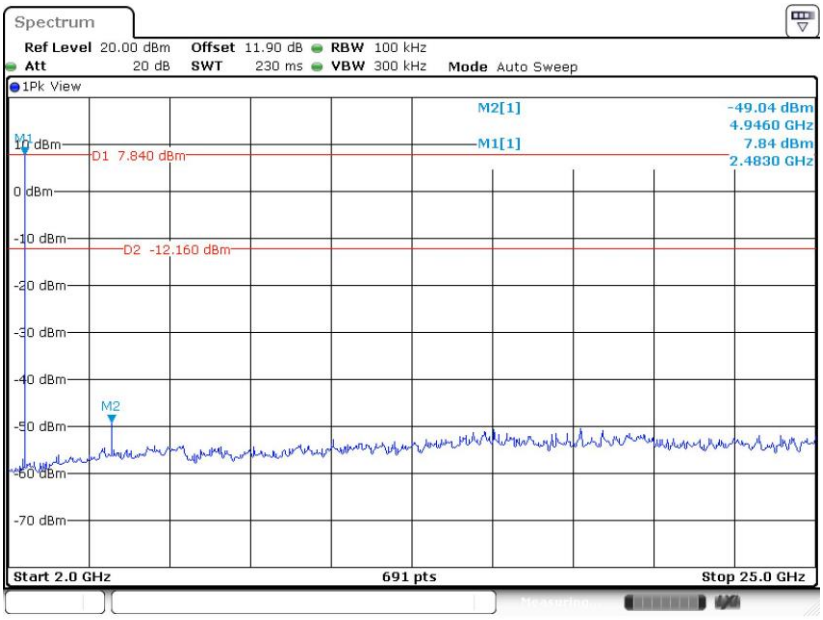

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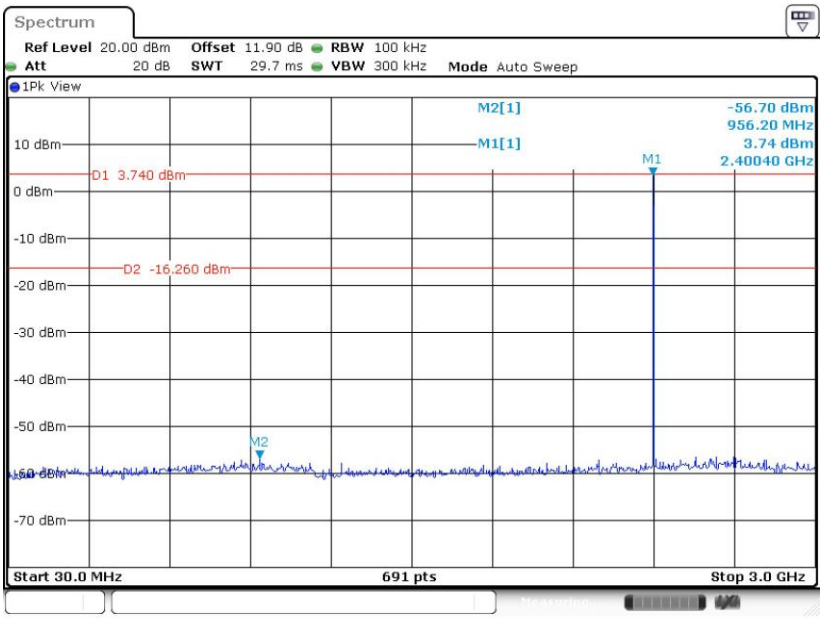
CSE Plot on Ch 00 between 30MHz ~ 3 GHz



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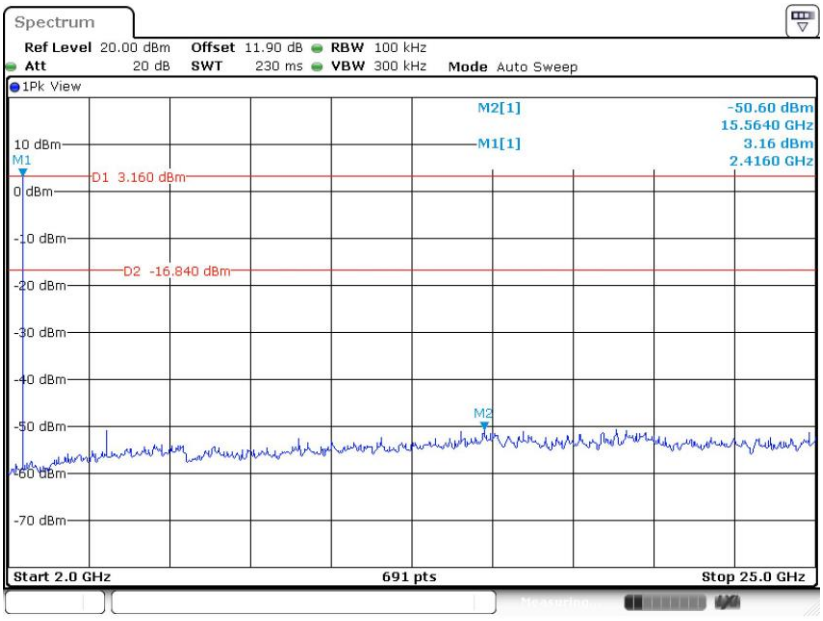
CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



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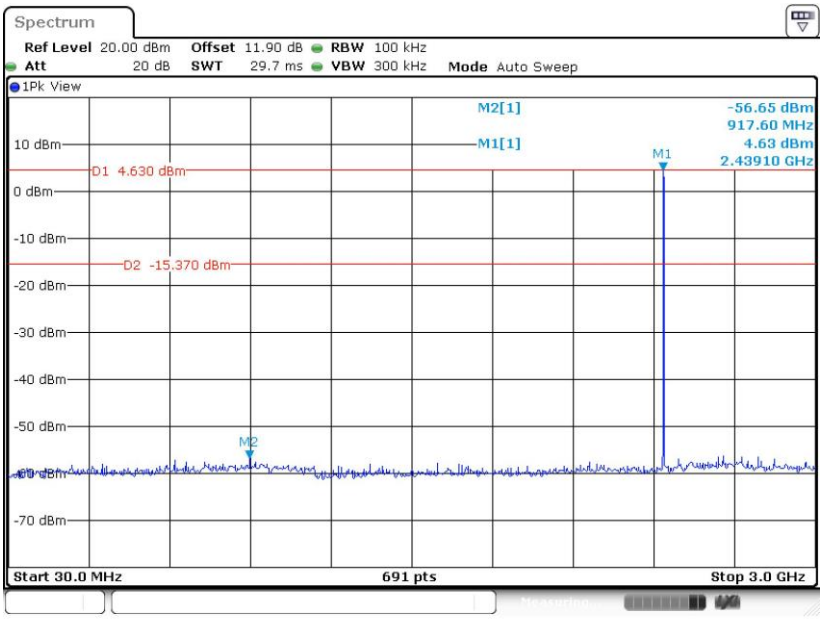

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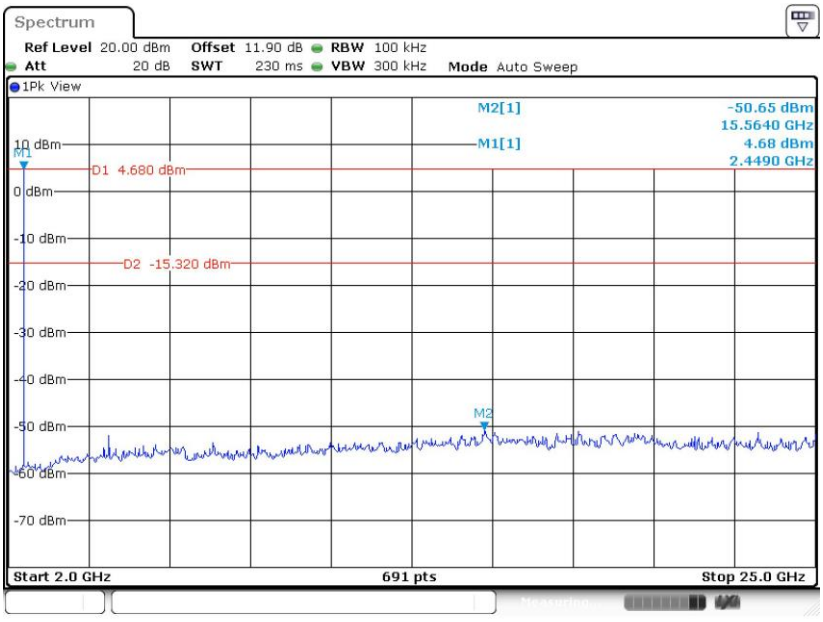
CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



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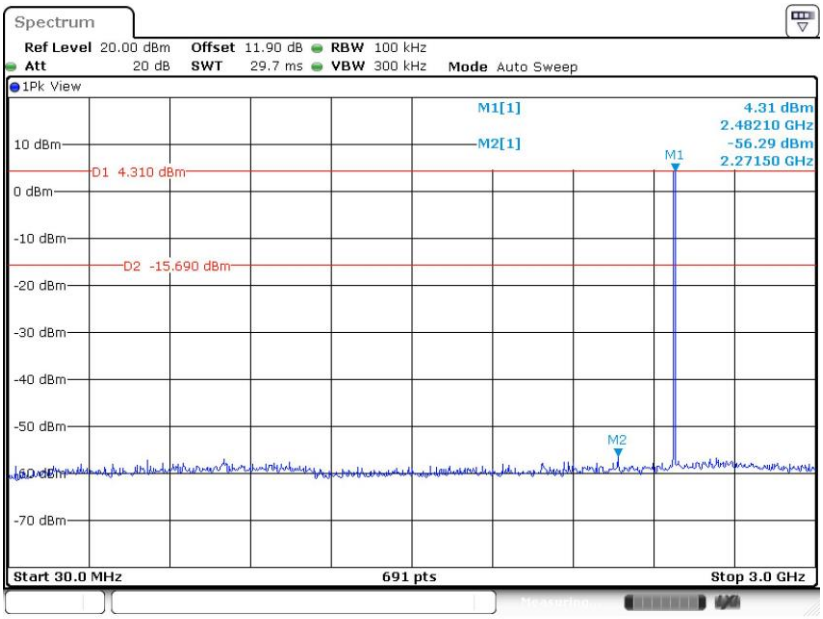
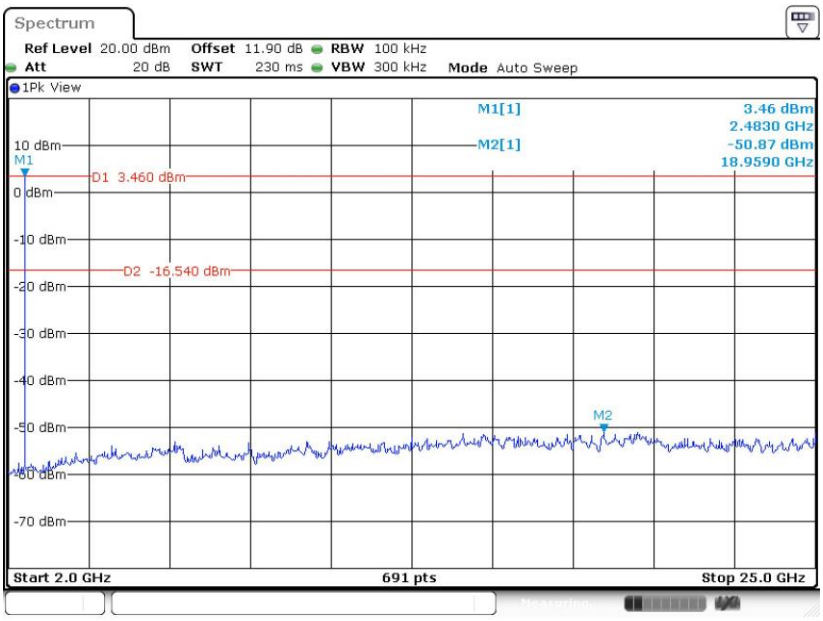


Date: 16.NOV.2020 19:34:00

CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



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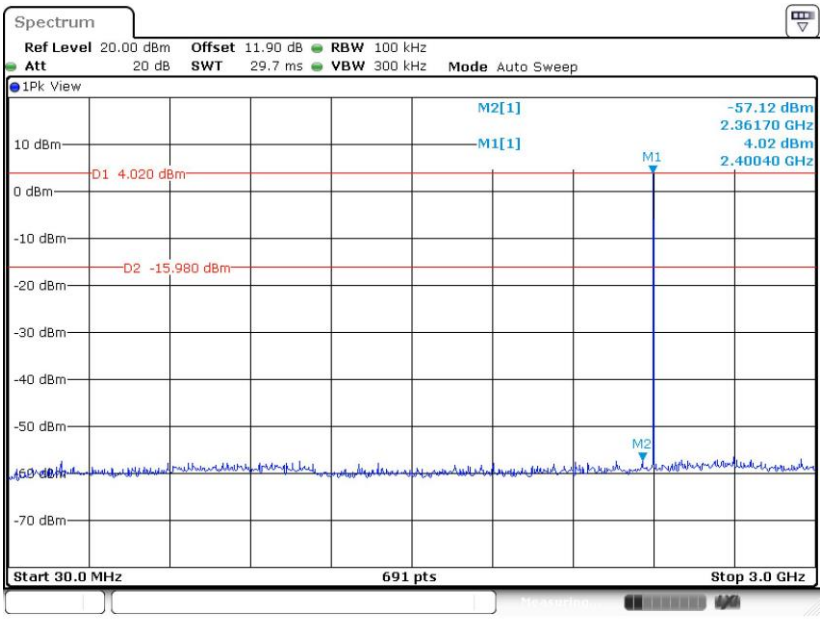
<3Mbps>

CSE Plot on Ch 00 between 30MHz ~ 3 GHz



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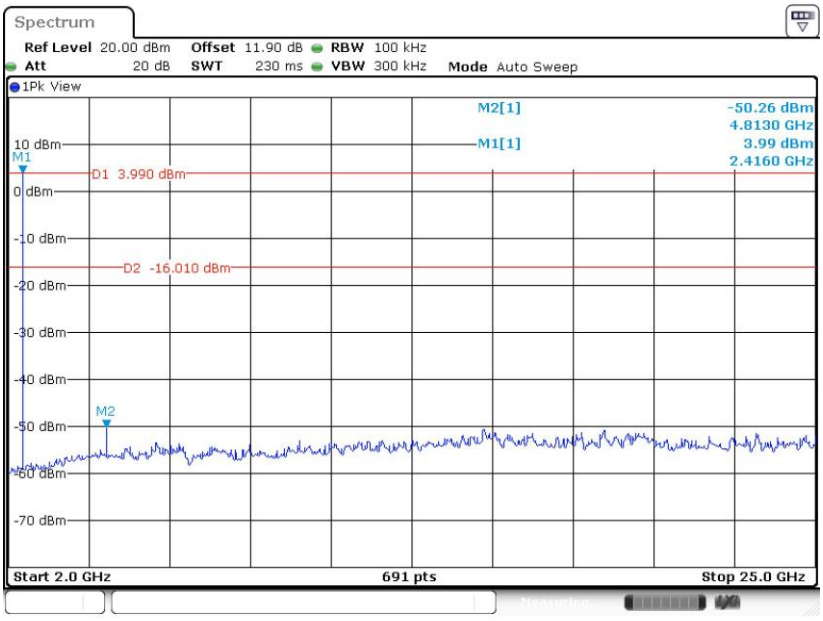
CSE Plot on Ch 00 between 2 GHz ~ 25 GHz



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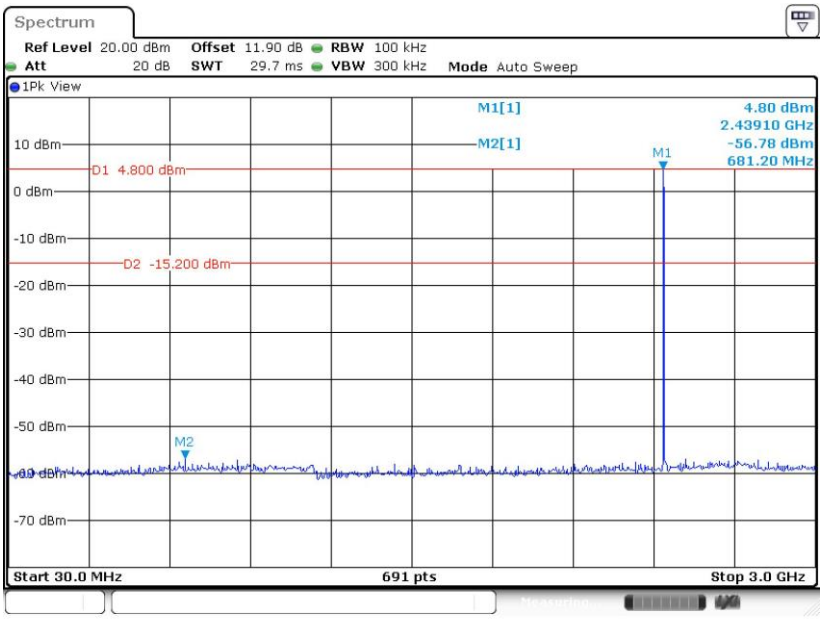
CSE Plot on Ch 39 between 30MHz ~ 3 GHz



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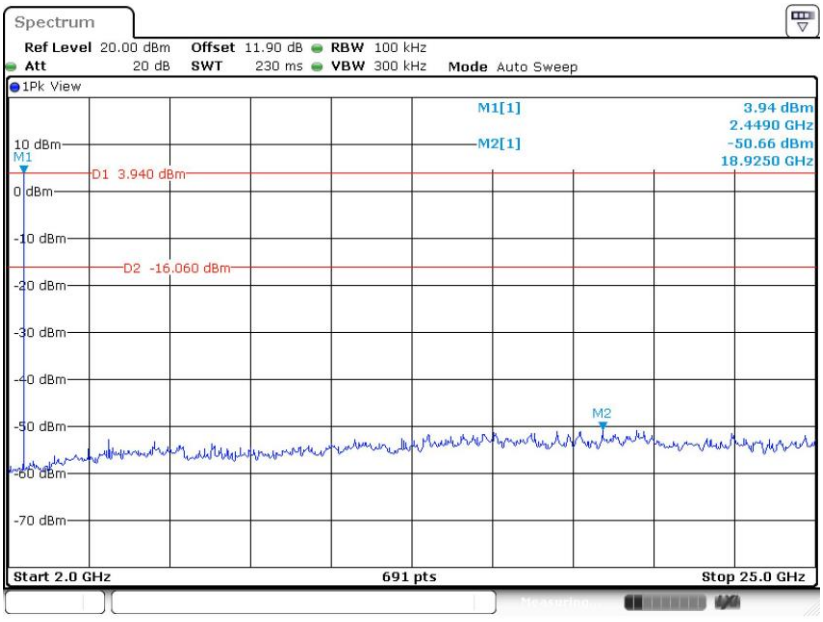
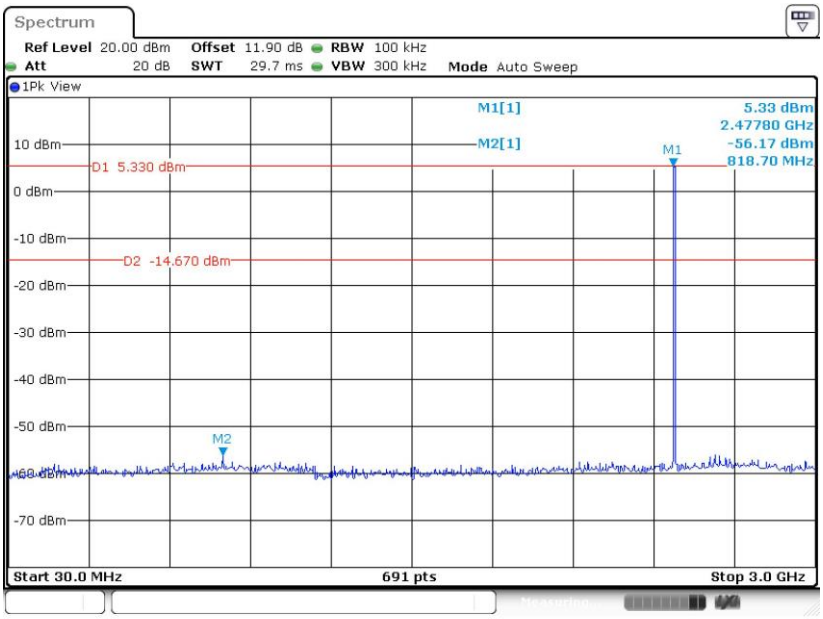


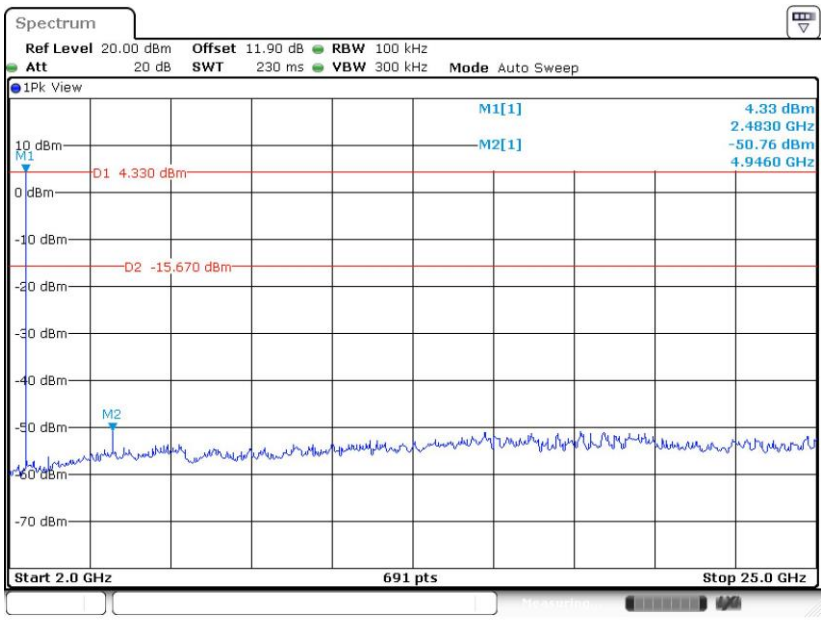
Date: 16.NOV.2020 19:53:39

CSE Plot on Ch 78 between 30MHz ~ 3 GHz



Date: 16.NOV.2020 20:12:13

CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



Date: 16.NOV.2020 20:12:51

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.8.2 Measuring Instruments

See list of measuring equipment of this test report.

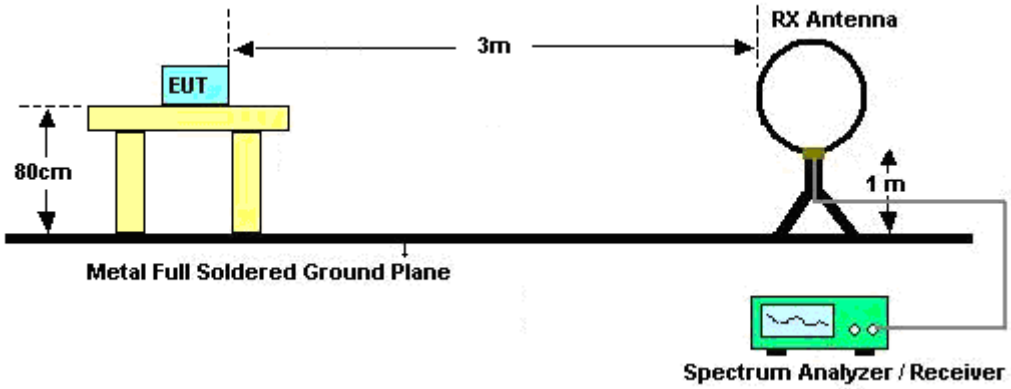
3.8.3 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log(Duty cycle)
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

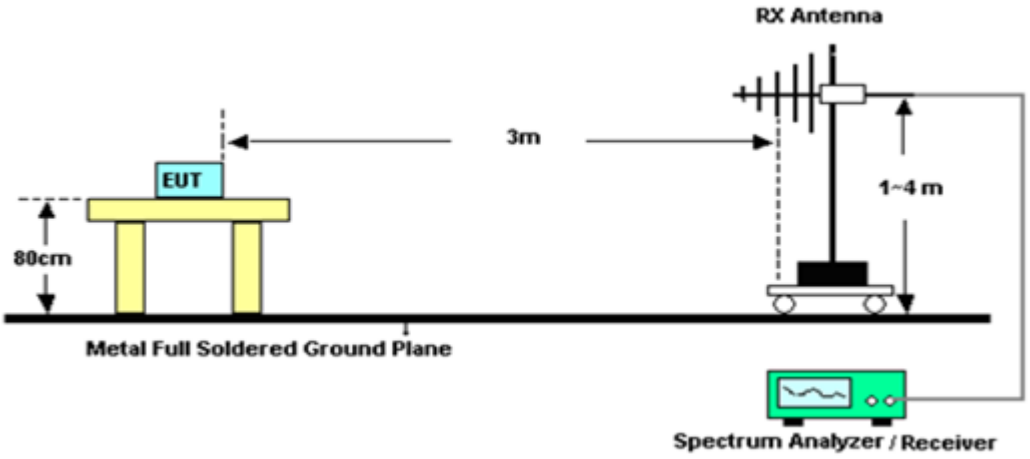
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.77dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.8.4 Test Setup

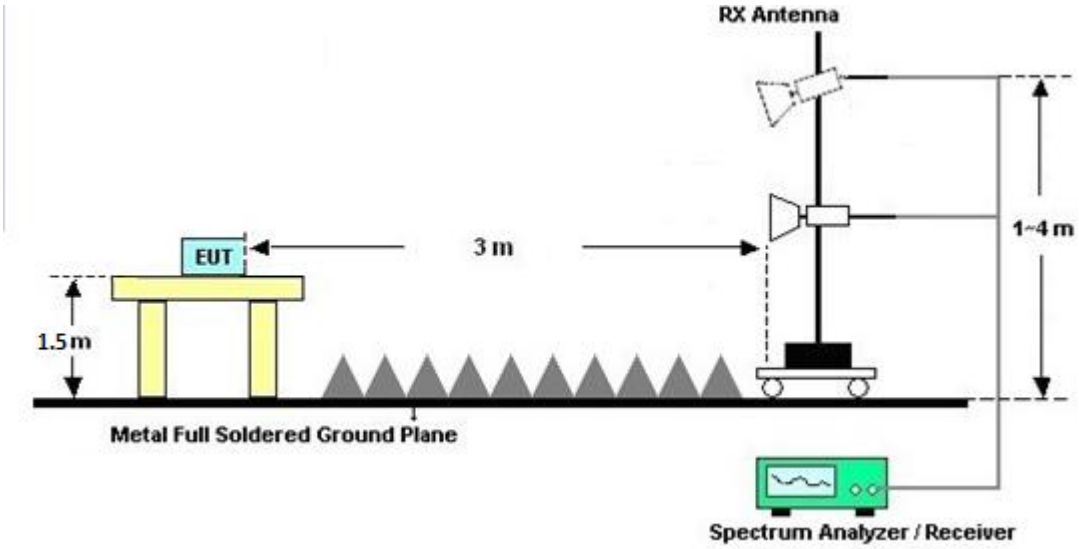
For radiated test below 30MHz



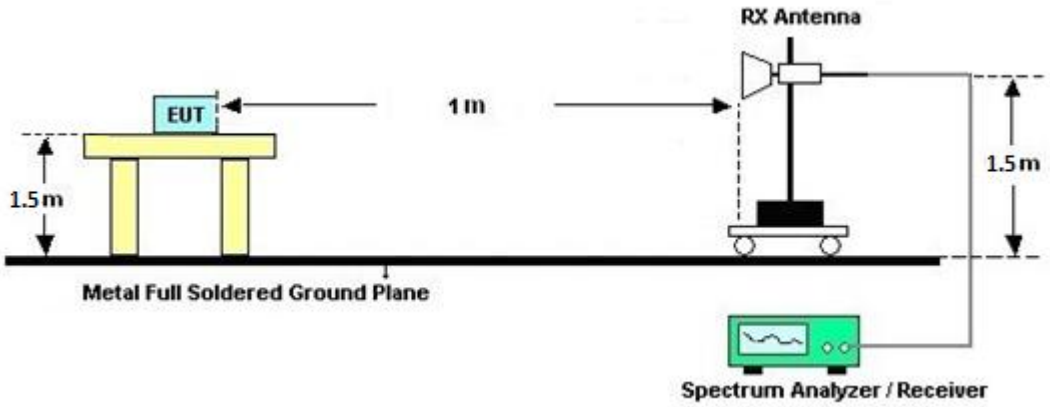
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

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

There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges and Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Radiated Spurious Emission

<Main Antenna for Sample 1>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH00 2402MHz		2373.53	48.35	-25.65	74	44.68	27.66	7.4	31.39	145	180	P	H
		2373.53	23.56	-30.41	54	-	-	-	-	-	-	A	H
	*	2402	105.67	-	-	101.98	27.61	7.44	31.36	145	180	P	H
	*	2402	80.9	-	-	-	-	-	-	-	-	A	H
		2342.97	47.96	-26.04	74	44.21	27.81	7.35	31.41	120	159	P	V
		2342.97	23.19	-30.8	54	-	-	-	-	-	-	A	V
	*	2402	100.31	-	-	96.66	27.57	7.44	31.36	120	159	P	V
	*	2402	75.54	-	-	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		2326.8	46.22	-27.78	74	42.5	27.82	7.32	31.42	400	178	P	H
		2326.8	21.45	-32.54	54	-	-	-	-	-	-	A	H
	*	2441	103.65	-	-	99.92	27.59	7.5	31.36	400	178	P	H
	*	2441	78.88	-	-	-	-	-	-	-	-	A	H
		2485.51	46.61	-27.39	74	42.83	27.56	7.57	31.35	400	178	P	H
		2485.51	21.84	-32.15	54	-	-	-	-	-	-	A	H
		2357.6	46.44	-27.56	74	42.7	27.77	7.37	31.4	108	164	P	V
		2357.6	21.67	-32.32	54	-	-	-	-	-	-	A	V
	*	2441	98.93	-	-	95.34	27.45	7.5	31.36	108	164	P	V
	*	2441	74.16	-	-	-	-	-	-	-	-	A	V
		2485.3	46.37	-27.63	74	42.76	27.39	7.57	31.35	108	164	P	V
		2485.3	21.6	-32.39	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz	*	2480	104.25	-	-	100.47	27.57	7.56	31.35	400	158	P	H
	*	2480	79.48	-	-	-	-	-	-	-	-	A	H
		2483.6	60.87	-13.13	74	57.08	27.57	7.57	31.35	400	158	P	H
		2483.6	36.1	-17.89	54	-	-	-	-	-	-	A	H
	*	2480	100.05	-	-	96.44	27.4	7.56	31.35	100	159	P	V
	*	2480	75.28	-	-	-	-	-	-	-	-	A	V
		2483.52	59.03	-14.97	74	55.42	27.39	7.57	31.35	100	159	P	V
		2483.52	34.26	-19.73	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH 00 2402MHz		4804	44.47	-29.53	74	68.1	31.38	11.28	66.29	100	0	P	H
		4804	19.7	-34.29	54	-	-	-	-	-	-	A	H
		4804	41.72	-32.28	74	65.34	31.39	11.28	66.29	100	0	P	V
		4804	16.95	-37.04	54	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		4880	45.95	-28.05	74	69.31	31.35	11.43	66.14	100	0	P	H
		4880	21.18	-32.81	54	-	-	-	-	-	-	A	H
		7323	45.44	-28.56	74	61.04	36.37	13.89	65.86	100	0	P	H
		7323	20.67	-33.32	54	-	-	-	-	-	-	A	H
		4880	42.67	-31.33	74	66.1	31.28	11.43	66.14	100	0	P	V
		4880	17.9	-36.09	54	-	-	-	-	-	-	A	V
		7323	46.04	-27.96	74	61.57	36.44	13.89	65.86	100	0	P	V
		7323	21.27	-32.72	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		4960	47.08	-26.92	74	70	32.22	10.84	65.98	100	0	P	H
		4960	22.31	-31.68	54	-	-	-	-	-	-	A	H
		7440	45.76	-28.24	74	61.11	37.08	13.46	65.89	100	0	P	H
		7440	20.99	-33.	54	-	-	-	-	-	-	A	H
		4960	43.06	-30.94	74	66.03	32.17	10.84	65.98	100	0	P	V
		4960	18.29	-35.7	54	-	-	-	-	-	-	A	V
		7440	45.63	-28.37	74	61.01	37.05	13.46	65.89	100	0	P	V
		7440	20.86	-33.13	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BT LF		74.62	24.59	-15.41	40	42.62	12.86	1.54	32.43	-	-	P	H
		173.56	29.53	-13.97	43.5	44.36	15.44	2.14	32.41	-	-	P	H
		263.77	32.49	-13.51	46	41.94	20.32	2.64	32.41	-	-	P	H
		307.42	40.29	-5.71	46	50.58	19.3	2.84	32.43	100	0	P	H
		374.35	32.78	-13.22	46	41.1	20.9	3.26	32.48	-	-	P	H
		967.99	34.5	-19.5	54	29.36	30.98	5.24	31.08	-	-	P	H
		43.58	28.33	-11.67	40	41.82	17.85	1.1	32.44	-	-	P	V
		118.27	32.03	-11.47	43.5	45.21	17.5	1.73	32.41	-	-	P	V
		307.42	35.39	-10.61	46	45.68	19.3	2.84	32.43	100	0	P	V
		385.99	34.59	-11.41	46	42.41	21.3	3.37	32.49	-	-	P	V
		561.56	32.36	-13.64	46	34.94	26.17	3.87	32.62	-	-	P	V
		745.86	33.45	-12.55	46	33.29	28	4.6	32.44	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

<Aux. Antenna for Sample 1>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH00 2402MHz		2366.7	48.88	-25.12	74	45.2	27.68	7.39	31.39	140	5	P	H
		2366.7	24.14	-29.86	54	-	-	-	-	-	-	A	H
	*	2402	97.27	-	-	93.58	27.61	7.44	31.36	140	5	P	H
	*	2402	72.53	-	-	-	-	-	-	-	-	A	H
		2331.53	48.01	-25.99	74	44.28	27.82	7.33	31.42	199	15	P	V
		2331.53	23.27	-30.73	54	-	-	-	-	-	-	A	V
	*	2402	97.38	-	-	93.73	27.57	7.44	31.36	199	15	P	V
	*	2402	72.64	-	-	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		2334.08	47.62	-26.38	74	43.92	27.79	7.33	31.42	400	338	P	H
		2334.08	22.88	-31.12	54	-	-	-	-	-	-	A	H
	*	2441	97.08	-	-	93.35	27.59	7.5	31.36	400	338	P	H
	*	2441	72.34	-	-	-	-	-	-	-	-	A	H
		2493.21	47.68	-26.32	74	43.88	27.56	7.58	31.34	400	338	P	H
		2493.21	22.94	-31.06	54	-	-	-	-	-	-	A	H
		2382.24	47.94	-26.06	74	44.25	27.66	7.41	31.38	186	16	P	V
		2382.24	23.2	-30.80	54	-	-	-	-	-	-	A	V
	*	2441	99.12	-	-	95.53	27.45	7.5	31.36	186	16	P	V
	*	2441	74.38	-	-	-	-	-	-	-	-	A	V
		2495.45	47.15	-26.85	74	43.51	27.39	7.59	31.34	186	16	P	V
		2495.45	22.41	-31.59	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz	*	2480	97.86	-	-	94.08	27.57	7.56	31.35	400	336	P	H
	*	2480	73.12	-	-	-	-	-	-	-	-	P	H
		2483.52	57.74	-16.26	74	53.95	27.57	7.57	31.35	400	336	P	H
		2483.52	32.2	-21.00	54	-	-	-	-	-	-	A	H
	*	2480	101.82	-	-	98.21	27.4	7.56	31.35	199	12	P	V
	*	2480	77.08	-	-	-	-	-	-	-	-	A	V
		2483.52	61.21	-12.79	74	57.6	27.39	7.57	31.35	199	12	P	V
		2483.52	36.47	-17.53	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH 00 2402MHz		4804	44.42	-29.58	74	68.05	31.38	11.28	66.29	100	0	P	H
		4804	19.68	-34.32	54	-	-	-	-	-	-	A	H
		4804	43.82	-30.18	74	67.44	31.39	11.28	66.29	100	0	A	V
		4804	19.08	-34.92	54	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		4882	45.02	-28.98	74	68.38	31.35	11.43	66.14	100	0	P	H
		4882	20.28	-33.72	54	-	-	-	-	-	-	A	H
		7323	45.25	-28.75	74	60.85	36.37	13.89	65.86	100	0	P	H
		7323	20.51	-33.49	54	-	-	-	-	-	-	A	H
		4882	44.58	-29.42	74	68.01	31.28	11.43	66.14	100	0	P	V
		4882	19.84	-34.16	54	-	-	-	-	-	-	A	V
		7323	45.57	-28.43	74	61.1	36.44	13.89	65.86	100	0	P	V
		7323	20.83	-33.17	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		4960	45.6	-28.4	74	68.52	31.47	11.59	65.98	100	0	P	H
		4960	20.86	-33.14	54	-	-	-	-	-	-	A	H
		7440	46.35	-27.65	74	61.7	36.51	14.03	65.89	100	0	P	H
		7440	21.61	-32.39	54	-	-	-	-	-	-	A	H
		4960	45.3	-28.7	74	68.27	31.42	11.59	65.98	100	0	P	V
		4960	20.56	-33.44	54	-	-	-	-	-	-	A	V
		7440	45.66	-28.34	74	61.04	36.48	14.03	65.89	100	0	P	V
		7440	20.92	-33.08	54	36.3	36.48	14.03	65.89	100	0	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BT LF		88.2	23.2	-20.3	43.5	39.29	14.62	1.67	32.38	-	-	P	H
		173.56	30.3	-13.2	43.5	45.1	15.44	2.14	32.38	-	-	P	H
		307.42	36.2	-9.8	46	46.53	19.3	2.84	32.47	100	0	P	H
		385.99	35.37	-10.63	46	43.25	21.3	3.37	32.55	-	-	P	H
		746.83	32.32	-13.68	46	32.39	28	4.6	32.67	-	-	P	H
		967.02	33.21	-20.79	54	28.22	31.02	5.23	31.26	-	-	P	H
		36.79	25.98	-14.02	40	35.81	21.55	1.01	32.39	-	-	P	V
		111.48	31.66	-11.84	43.5	45.27	17.05	1.72	32.38	-	-	P	V
		301.6	34.85	-11.15	46	45.2	19.3	2.82	32.47	-	-	P	V
		385.99	32.15	-13.85	46	40.03	21.3	3.37	32.55	-	-	P	V
		746.83	35.4	-10.6	46	35.47	28	4.6	32.67	100	0	P	V
		965.08	33.29	-20.71	54	28.24	31.1	5.23	31.28	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

<Main Antenna for Sample 2>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH 78 2480MHz	*	2480	106.77	-	-	102.99	27.57	7.56	31.35	313	176	P	H
	*	2480	82	-	-	-	-	-	-	-	-	A	H
		2483.56	65.12	-8.88	74	61.33	27.57	7.57	31.35	313	176	P	H
		2483.56	40.35	-13.64	54	-	-	-	-	-	-	A	H
	*	2480	96.72	-	-	93.11	27.4	7.56	31.35	109	134	P	V
	*	2480	71.95	-	-	-	-	-	-	-	-	A	V
		2483.52	56.62	-17.38	74	53.01	27.39	7.57	31.35	109	134	P	V
		2483.52	31.85	-22.14	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH 78 2480MHz		4960	45.27	-28.73	74	68.19	31.47	11.59	65.98	100	0	P	H
		4960	20.5	-33.49	54	-	-	-	-	-	-	A	H
		7440	45.82	-28.18	74	61.17	36.51	14.03	65.89	100	0	P	H
		7440	21.05	-32.94	54	-	-	-	-	-	-	A	H
		4960	41.82	-32.18	74	64.79	31.42	11.59	65.98	100	0	P	V
		4960	17.05	-36.94	54	-	-	-	-	-	-	A	V
		7440	46.04	-27.96	74	61.42	36.48	14.03	65.89	100	0	P	V
		7440	21.27	-32.72	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

<Aux. Antenna for Sample 2>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH00 2402MHz		2340.345	48.54	-25.46	74	44.85	27.76	7.34	31.41	371	337	P	H
		2340.345	23.77	-30.22	54	-	-	-	-	-	-	A	H
	*	2402	96.62	-	-	92.93	27.61	7.44	31.36	371	337	P	H
	*	2402	71.85	-	-	-	-	-	-	-	-	A	H
		2379.72	47.78	-26.22	74	44.08	27.67	7.41	31.38	100	183	P	V
		2379.72	23.01	-30.98	54	-	-	-	-	-	-	A	V
	*	2402	103.58	-	-	99.93	27.57	7.44	31.36	100	183	P	V
	*	2402	78.81	-	-	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		2344.58	48.16	-25.84	74	44.48	27.74	7.35	31.41	396	334	P	H
		2344.58	23.39	-30.6	54	-	-	-	-	-	-	A	H
	*	2441	98.67	-	-	94.94	27.59	7.5	31.36	396	334	P	H
	*	2441	73.9	-	-	-	-	-	-	-	-	A	H
		2491.67	47.7	-26.3	74	43.9	27.56	7.58	31.34	396	334	P	H
		2491.67	22.93	-31.06	54	-	-	-	-	-	-	A	H
		2369.64	47.33	-26.67	74	43.61	27.72	7.39	31.39	100	182	P	V
		2369.64	22.56	-31.43	54	-	-	-	-	-	-	A	V
	*	2441	105.8	-	-	102.21	27.45	7.5	31.36	100	182	P	V
	*	2441	81.03	-	-	-	-	-	-	-	-	A	V
		2496.43	48.2	-25.8	74	44.56	27.39	7.59	31.34	100	182	P	V
		2496.43	23.43	-30.56	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz	*	2480	96.87	-	-	93.09	27.57	7.56	31.35	311	128	P	H
	*	2480	72.1	-	-	-	-	-	-	-	-	A	H
		2483.52	48.92	-25.08	74	45.13	27.57	7.57	31.35	311	128	P	H
		2483.52	24.15	-29.84	54	-	-	-	-	-	-	A	H
	*	2480	106.4	-	-	102.79	27.4	7.56	31.35	100	28	P	V
	*	2480	81.63	-	-	-	-	-	-	-	-	A	V
		2483.52	56.99	-17.01	74	53.38	27.39	7.57	31.35	100	28	P	V
		2483.52	32.22	-21.77	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH 00 2402MHz		4804	53.94	-20.06	74	77.57	31.38	11.28	66.29	262	62	P	H
		4804	29.17	-24.82	54	-	-	-	-	-	-	A	H
		4804	56.13	-17.87	74	79.75	31.39	11.28	66.29	291	96	P	V
		4804	31.36	-22.63	54	-	-	-	-	-	-	A	V
BT CH 39 2441MHz		4882	50.64	-23.36	74	74	31.35	11.43	66.14	334	105	P	H
		4882	25.87	-28.12	54	-	-	-	-	-	-	A	H
		7323	45.78	-28.22	74	61.38	36.37	13.89	65.86	100	0	P	H
		7323	21.01	-32.98	54	-	-	-	-	-	-	A	H
		4882	53.92	-20.08	74	77.35	31.28	11.43	66.14	303	94	P	V
		4882	29.15	-24.84	54	-	-	-	-	-	-	A	V
		7323	45.5	-28.5	74	61.03	36.44	13.89	65.86	100	0	P	V
		7323	20.73	-33.26	54	-	-	-	-	-	-	A	V
BT CH 78 2480MHz		4960	52.66	-21.34	74	75.58	31.47	11.59	65.98	260	64	P	H
		4960	27.89	-26.1	54	-	-	-	-	-	-	A	H
		7440	45.62	-28.38	74	60.97	36.51	14.03	65.89	100	0	P	H
		7440	20.85	-33.14	54	-	-	-	-	-	-	A	H
		4960	53.31	-20.69	74	76.28	31.42	11.59	65.98	101	128	P	V
		4960	28.54	-25.45	54	-	-	-	-	-	-	A	V
		7440	45.43	-28.57	74	60.81	36.48	14.03	65.89	100	0	P	V
		7440	20.66	-33.33	54	-	-	-	-	-	-	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

2.4GHz BT (LF)

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
2.4GHz BT LF		72.68	24.2	-15.8	40	42.4	12.67	1.51	32.38	-	-	P	H
		174.53	30.47	-13.03	43.5	45.35	15.35	2.15	32.38	-	-	P	H
		213.33	38.9	-4.6	43.5	54	14.9	2.4	32.4	100	0	P	H
		311.3	38.43	-7.57	46	48.63	19.4	2.87	32.47	-	-	P	H
		746.83	31.57	-14.43	46	31.64	28	4.6	32.67	-	-	P	H
		982.54	33.86	-20.14	54	28.93	30.75	5.28	31.1	-	-	P	H
		35.82	27.93	-12.07	40	37.16	22.17	0.99	32.39	-	-	P	V
		111.48	34.51	-8.99	43.5	48.12	17.05	1.72	32.38	-	-	P	V
		213.33	37.18	-6.32	43.5	52.28	14.9	2.4	32.4	100	0	P	V
		295.78	33.44	-12.56	46	43.91	19.2	2.79	32.46	-	-	P	V
		746.83	33.56	-12.44	46	33.63	28	4.6	32.67	-	-	P	V
		986.42	33.58	-20.42	54	28.72	30.64	5.29	31.07	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

BT	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
BT CH 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBµV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

3. Over Limit(dB) = Level(dBµV/m) – Limit Line(dBµV/m)

For Peak Limit @ 2390MHz:

1. Level(dBµV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBµV) – 35.86 (dB)

= 55.45 (dBµV/m)

2. Over Limit(dB)

= Level(dBµV/m) – Limit Line(dBµV/m)

= 55.45(dBµV/m) – 74(dBµV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBµV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBµV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBµV) – 35.86 (dB)

= 43.54 (dBµV/m)

2. Over Limit(dB)

= Level(dBµV/m) – Limit Line(dBµV/m)

= 43.54(dBµV/m) – 54(dBµV/m)

= -10.46(dB)

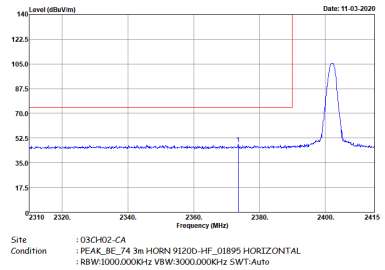
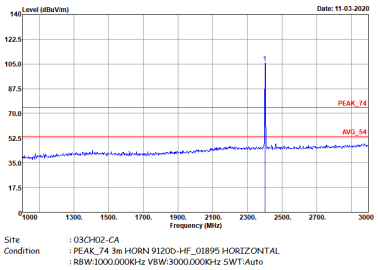
Both peak and average measured complies with the limit line, so test result is “PASS”.

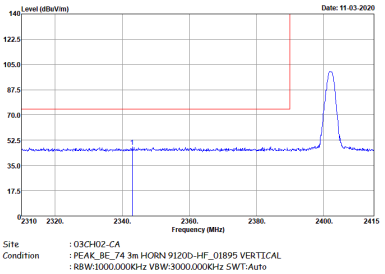
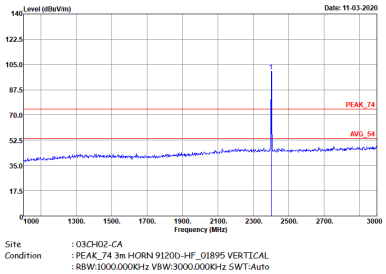
Radiated Spurious Emission Plots

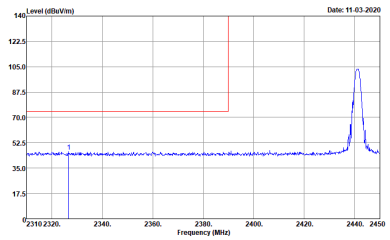
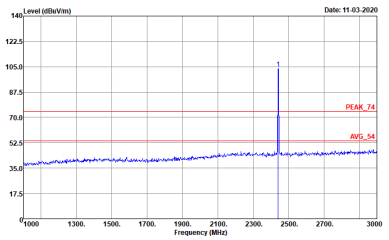
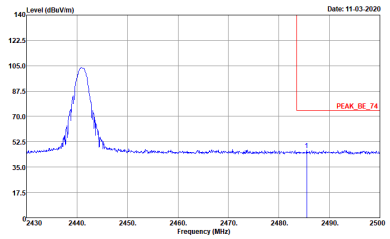
<Main Antenna for Sample 1>

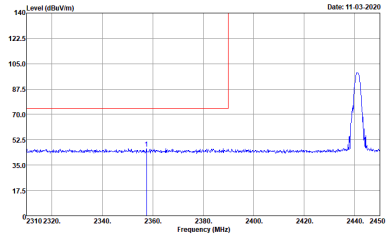
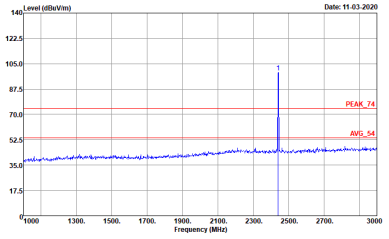
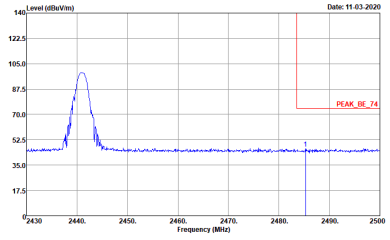
2.4GHz 2400~2483.5MHz

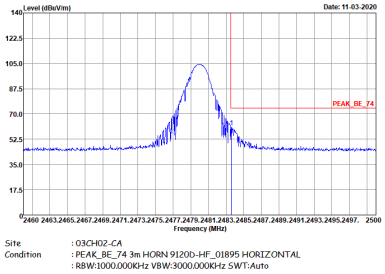
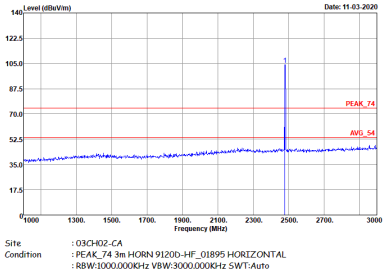
BT (Band Edge @ 3m)

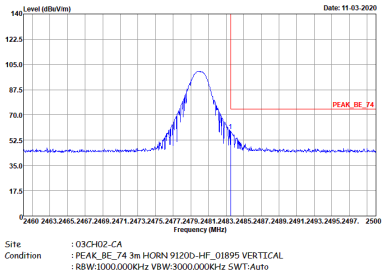
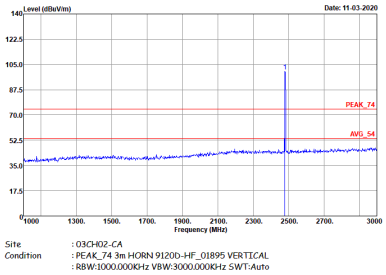
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Vertical	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

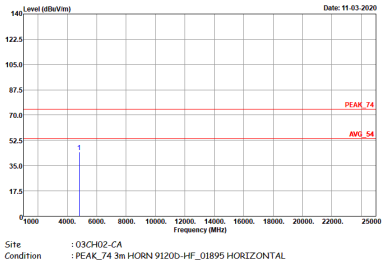
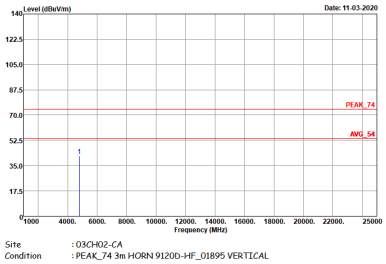
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

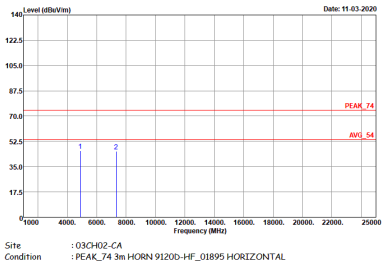
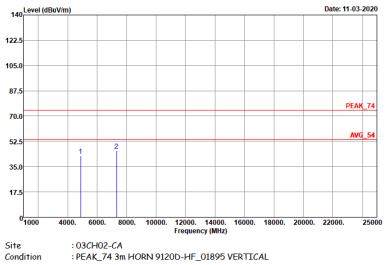
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

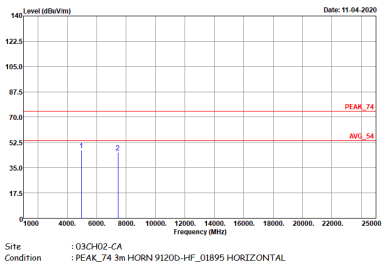
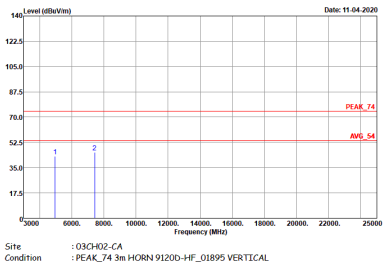
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

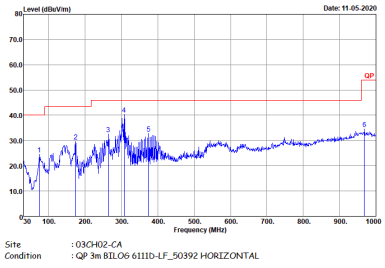
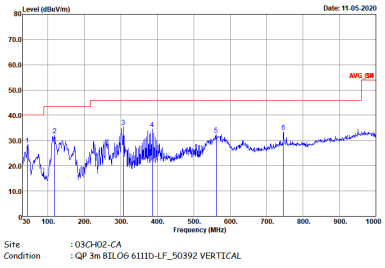
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH39 2441MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

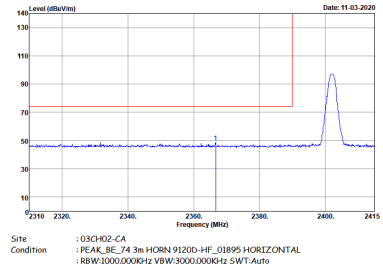
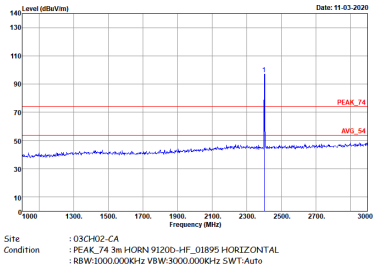
2.4GHz BT (LF)

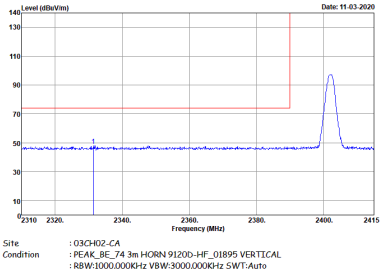
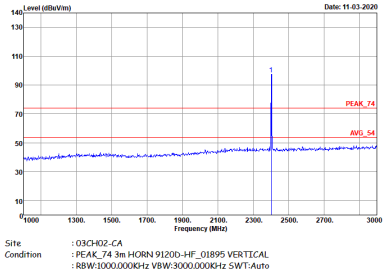
BT	2.4GHz 2400~2483.5MHz	
	BT LF	
	Horizontal	Vertical
QP / Peak		

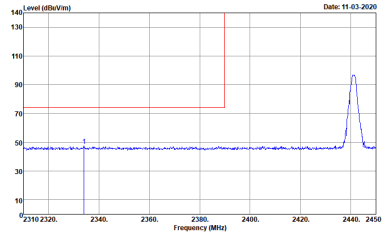
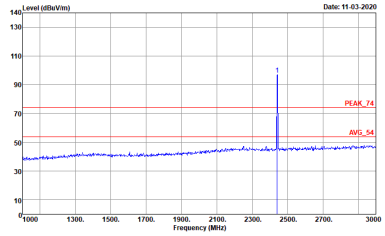
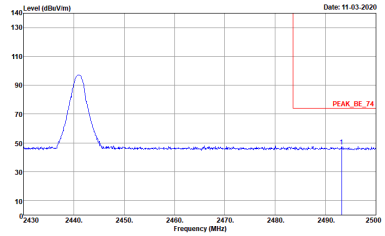
<Aux. Antenna for Sample 1>

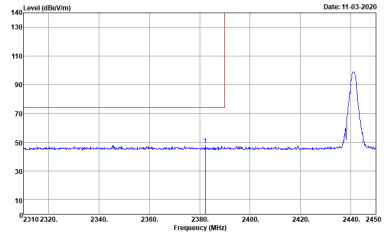
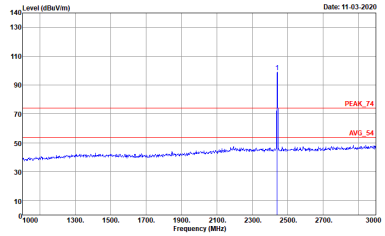
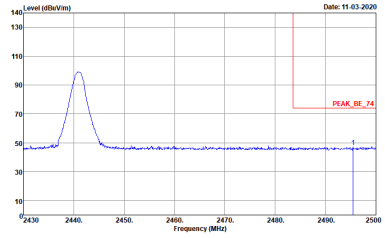
2.4GHz 2400~2483.5MHz

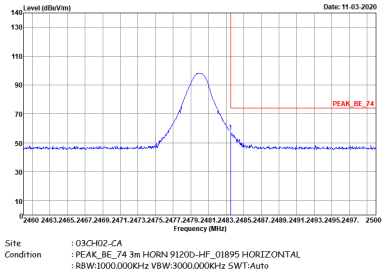
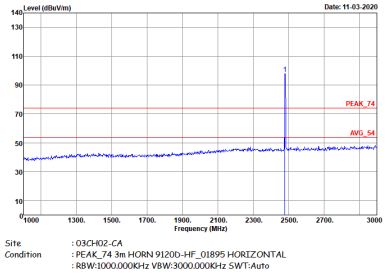
BT (Band Edge @ 3m)

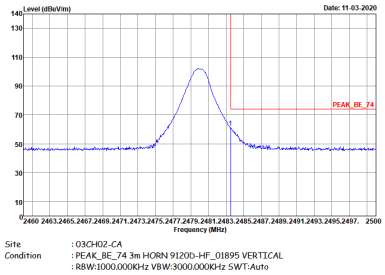
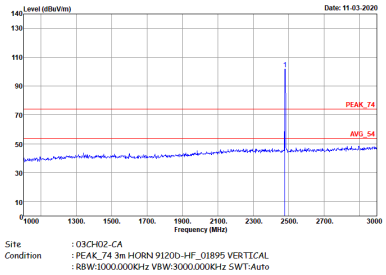
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Vertical	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

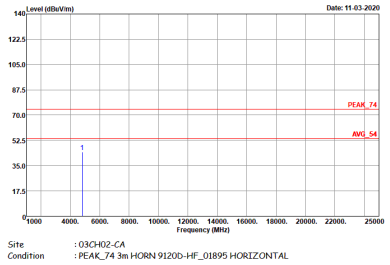
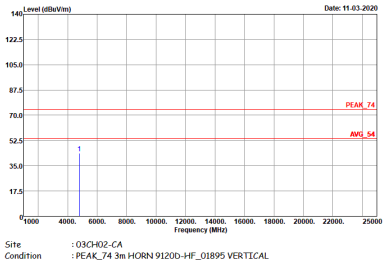
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

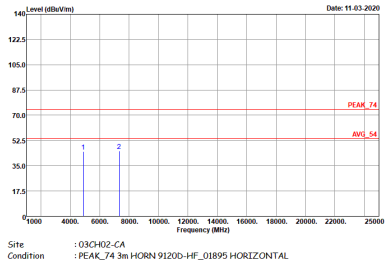
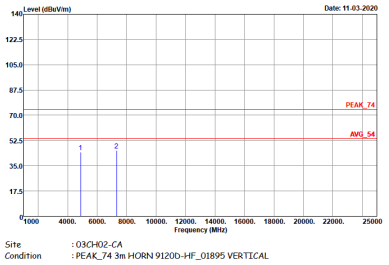
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

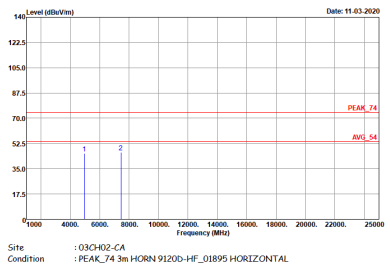
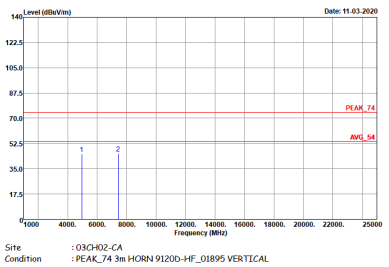
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

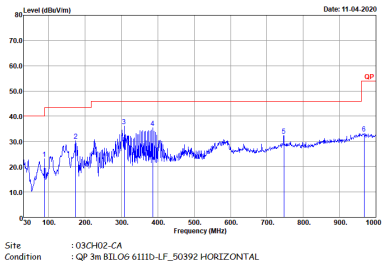
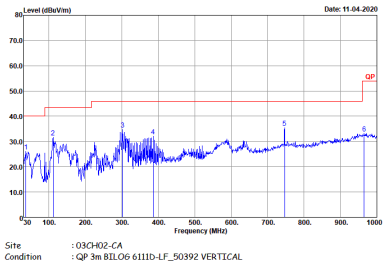
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH39 2441MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

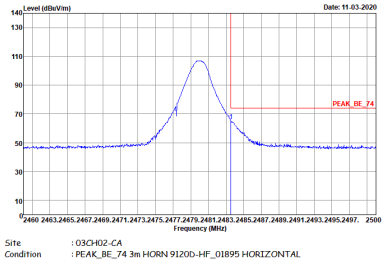
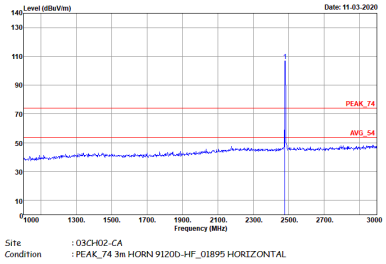
2.4GHz BT (LF)

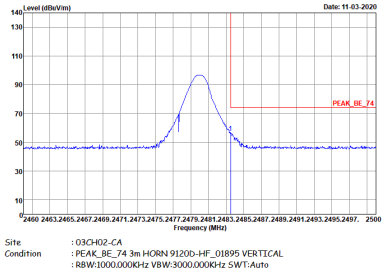
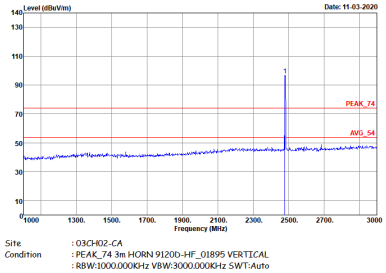
BT	2.4GHz 2400~2483.5MHz	
	BT LF	
	Horizontal	Vertical
QP / Peak		

<Main Antenna for Sample 2>

2.4GHz 2400~2483.5MHz

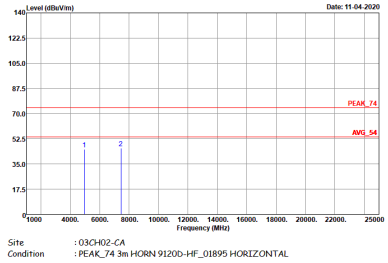
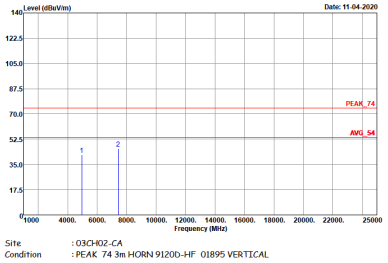
BT (Band Edge @ 3m)

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

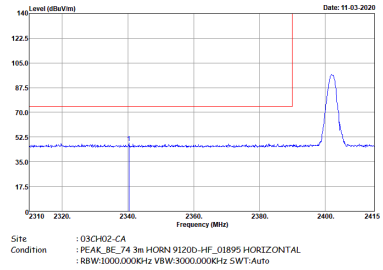
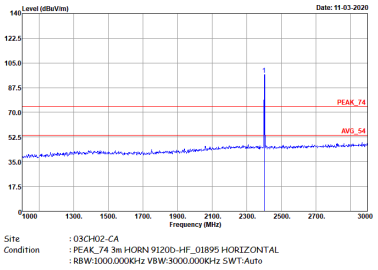
BT (Harmonic @ 3m)

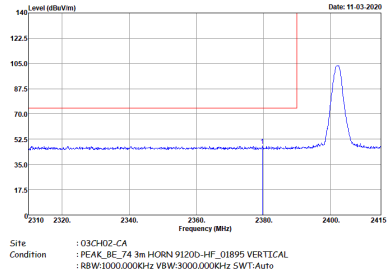
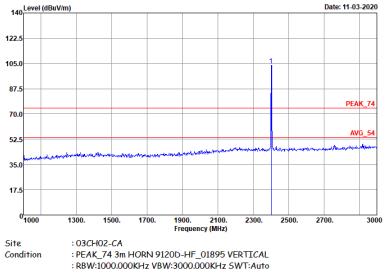
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

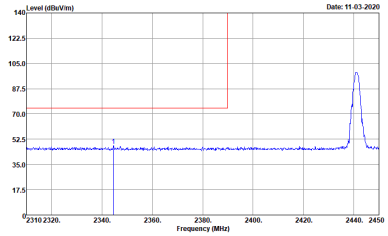
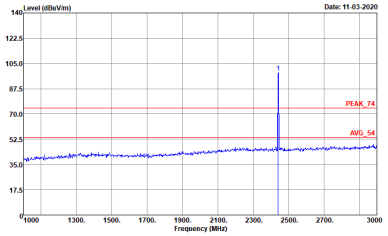
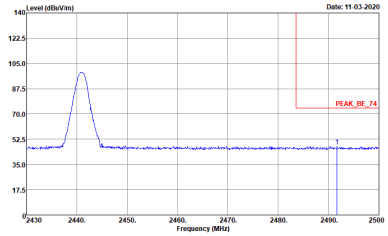
<Aux. Antenna for Sample 2>

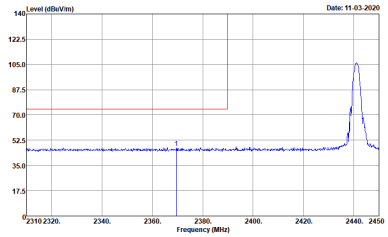
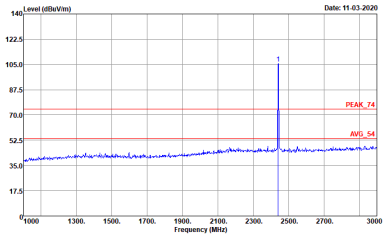
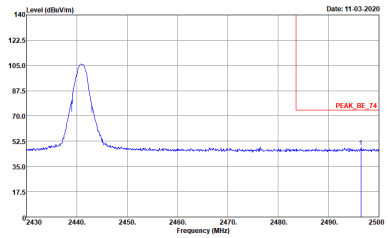
2.4GHz 2400~2483.5MHz

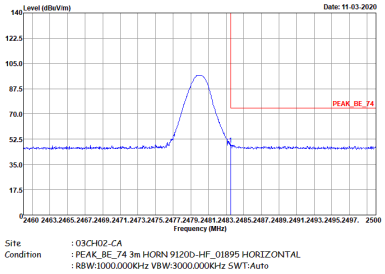
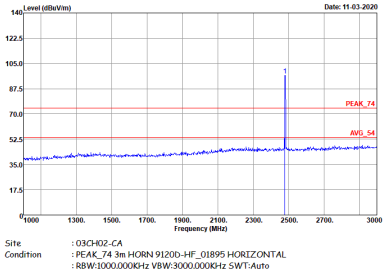
BT (Band Edge @ 3m)

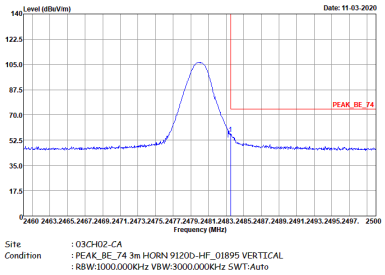
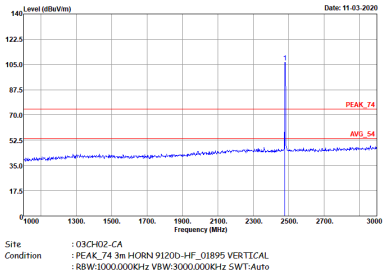
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH00 2402MHz	
	Vertical	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Horizontal	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

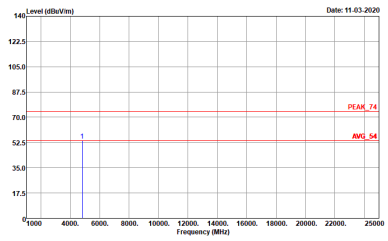
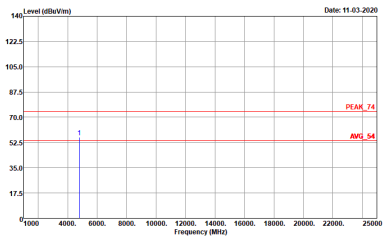
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH39 2441MHz	
	Vertical	Fundamental
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	 Site : 03CH02-CA Condition : PEAK_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto
Peak	 Site : 03CH02-CA Condition : PEAK_BE_74 3m HORN 9120D-HF_01895 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto	Left blank

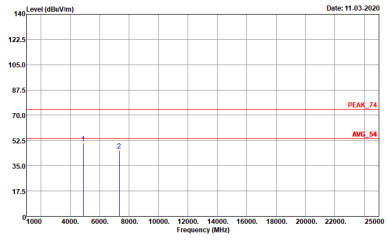
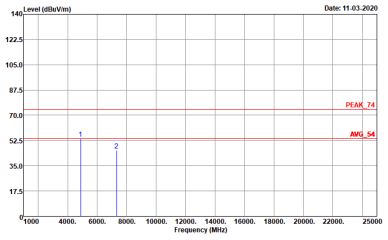
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Horizontal	Fundamental
Peak		

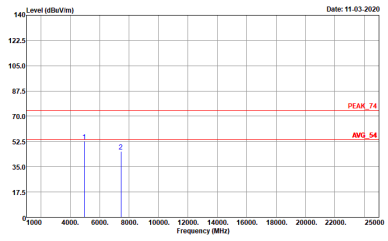
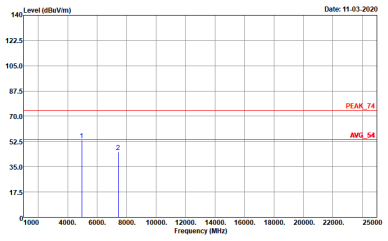
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
	BT CH78 2480MHz	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)

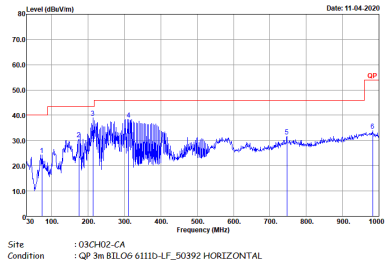
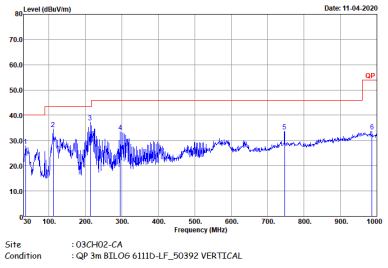
BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH00 2402MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH39 2441MHz	
	Horizontal	Vertical
Peak Avg.		

BT	2.4GHz 2400~2483.5MHz Harmonic @ 3m	
	BT CH78 2480MHz	
	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

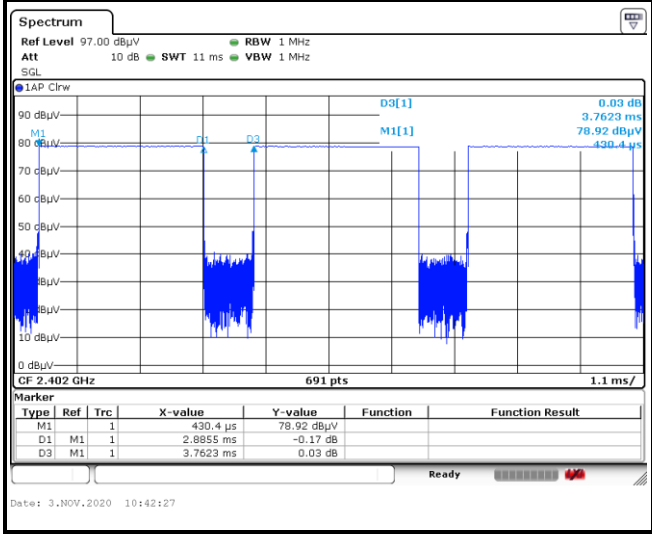
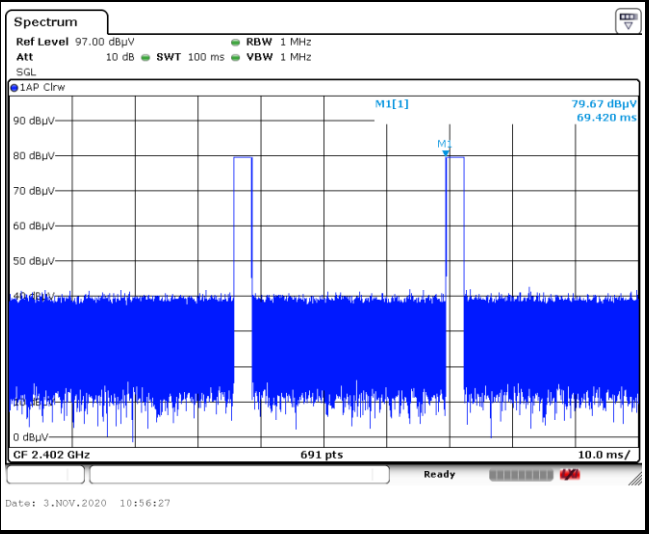
2.4GHz BT (LF)

BT	2.4GHz 2400~2483.5MHz	
	BT LF	
	Horizontal	Vertical
QP / Peak		

3.8.7 Duty Cycle

<Sample 1>

<Main Antenna>

DH5 on time (One Pulse) Plot on Channel 39	on time (Count Pulses) Plot on Channel 39
	

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.885 / 100 = 5.77 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.77 dB
3. DH5 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

2.885 ms x 20 channels = 57.7 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.7 ms] = 2 hops

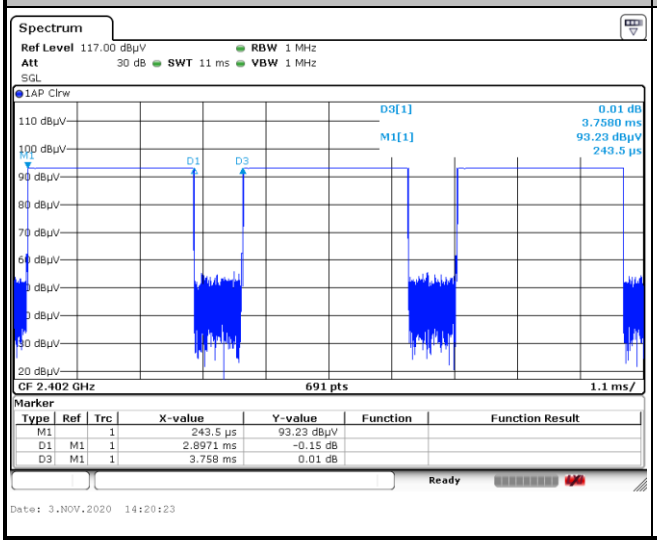
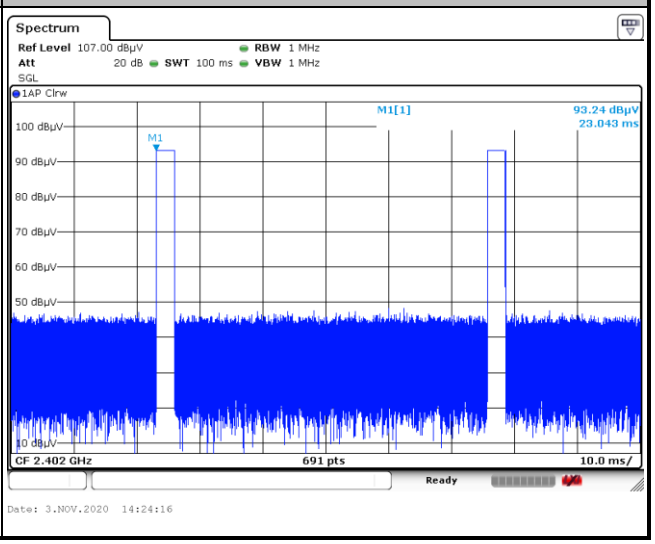
Thus, the maximum possible ON time:

2.885 ms x 2 = 5.77 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

20 x log(5.77 ms/100 ms) = -24.77 dB

<Aux. Antenna>

DH5 on time (One Pulse) Plot on Channel 39	on time (Count Pulses) Plot on Channel 39
	

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.897 / 100 = 5.79 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.74 dB
3. DH5 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

2.897 ms x 20 channels = 57.9 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.9 ms] = 2 hops

Thus, the maximum possible ON time:

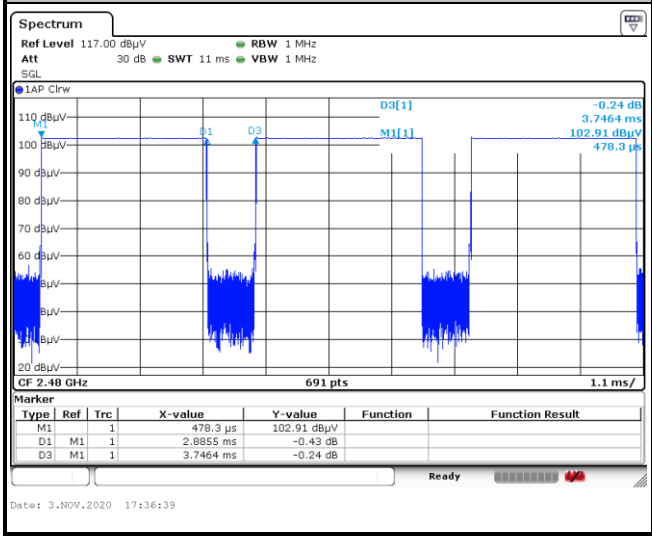
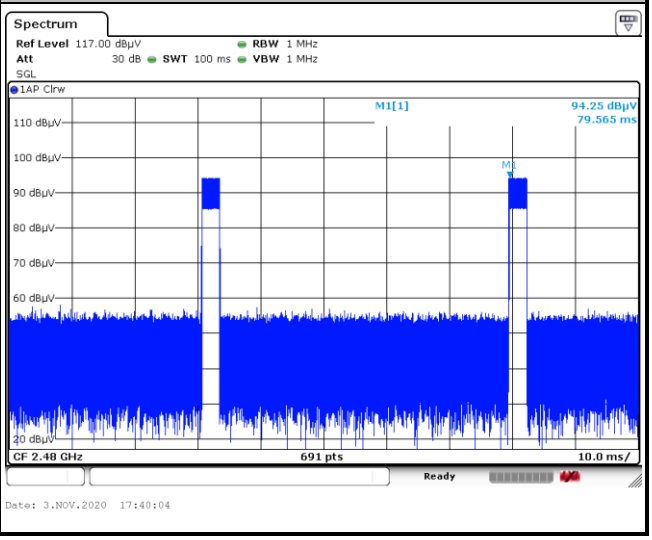
2.897 ms x 2 = 5.79 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

20 x log(5.79 ms/100 ms) = -24.74 dB

<Sample 2>

<Main Antenna>

DH5 on time (One Pulse) Plot on Channel 39	on time (Count Pulses) Plot on Channel 39
	

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.885 / 100 = 5.77 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.77 dB
3. DH5 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the period to have DH5 packet completing one hopping sequence is

2.885 ms x 20 channels = 57.7 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.7 ms] = 2 hops

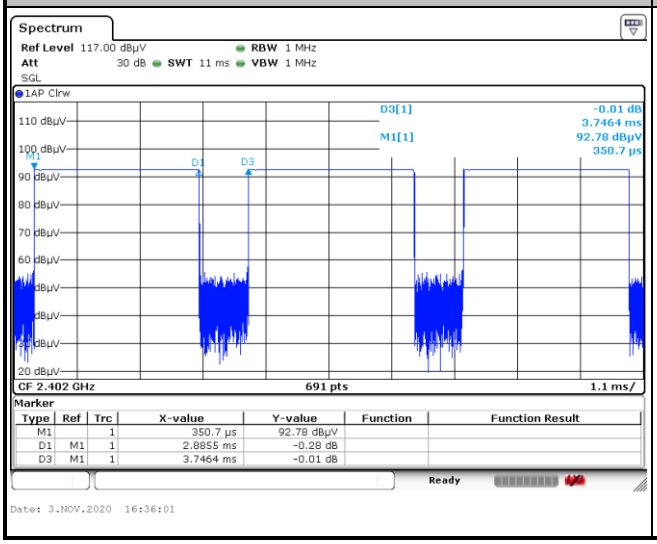
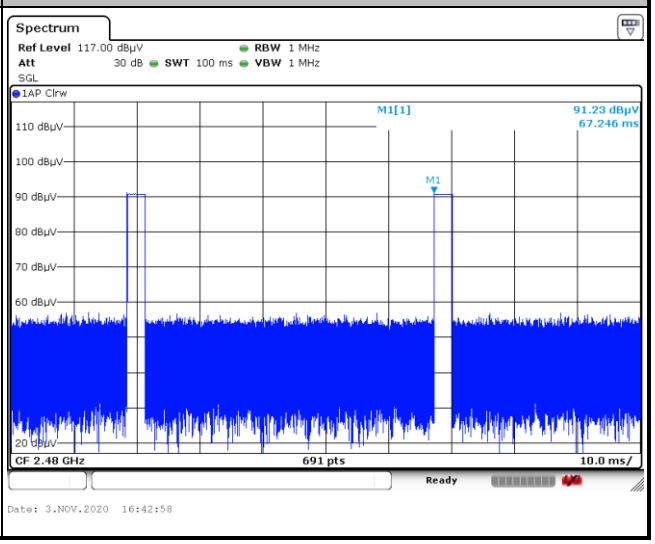
Thus, the maximum possible ON time:

2.885 ms x 2 = 5.77 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

20 x log(5.77 ms/100 ms) = -24.77 dB

<Aux. Antenna>

DH5 on time (One Pulse) Plot on Channel 39	on time (Count Pulses) Plot on Channel 39
	

Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.885 / 100 = 5.77 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.77 dB
3. DH5 has the highest duty cycle worst case and is reported.

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

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2.885 ms x 20 channels = 57.7 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.7 ms] = 2 hops

Thus, the maximum possible ON time:

2.885 ms x 2 = 5.77 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

20 x log(57.7 ms/100 ms) = -24.77 dB

3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

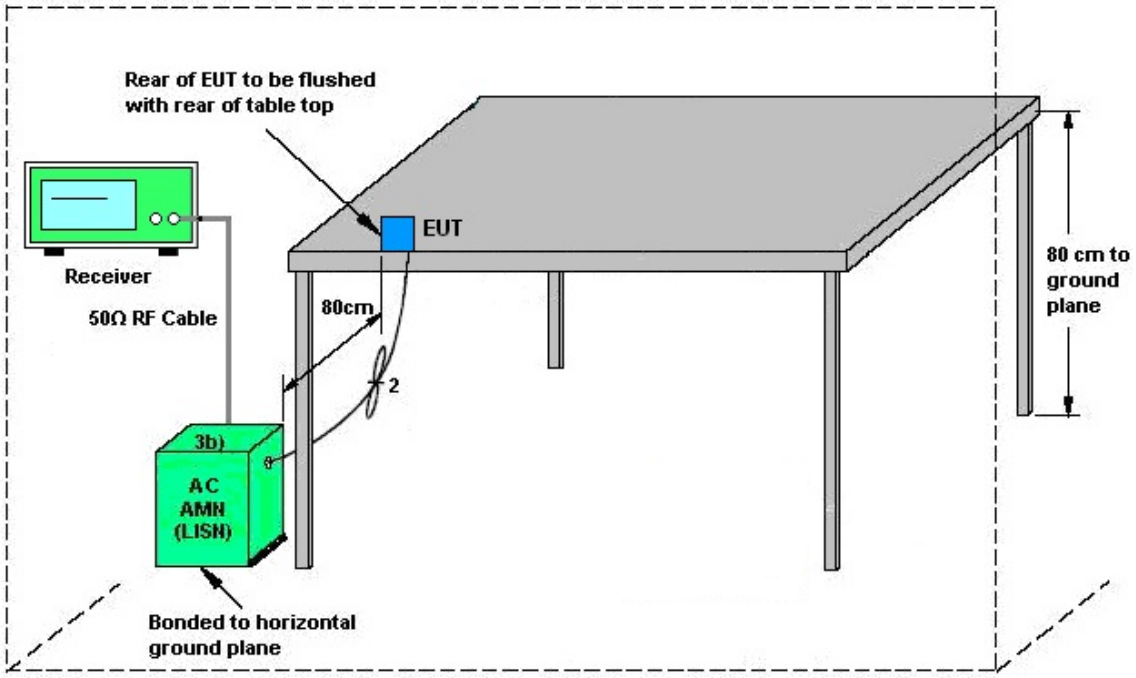
3.9.2 Measuring Instruments

See list of measuring equipment of this test report.

3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test Setup



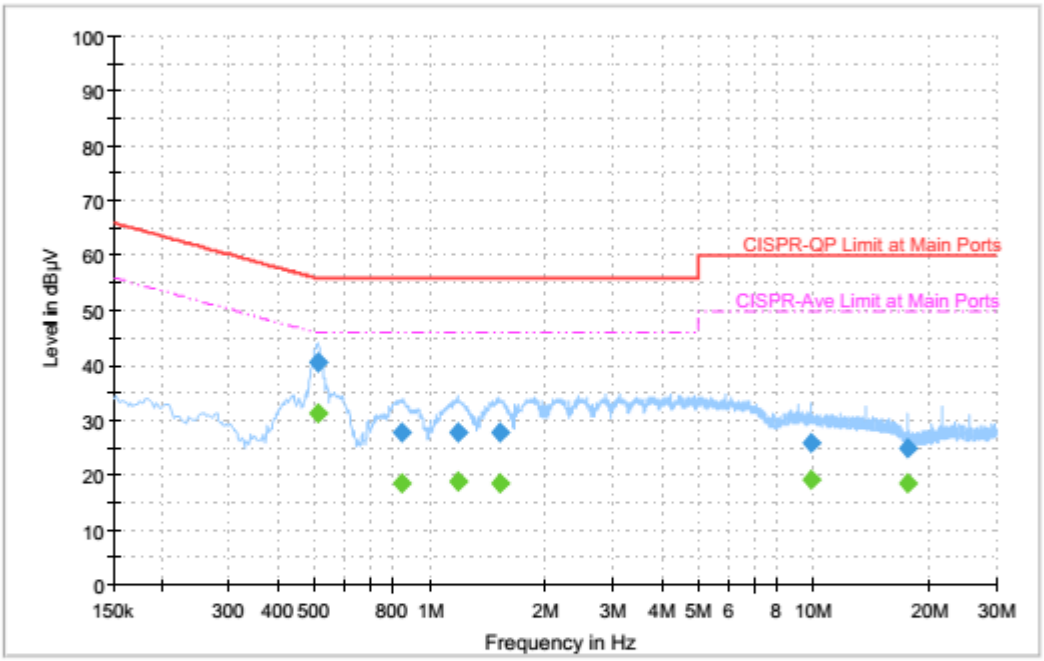
AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.9.5 Test Result of AC Conducted Emission

EUT Information

Test Site :	CO01-CA
Mode	2
Test Voltage:	120Vac/60Hz
Project	Cypress
	Line
	200819001
Config	3
	WIFI idle + BT link

Full Spectrum



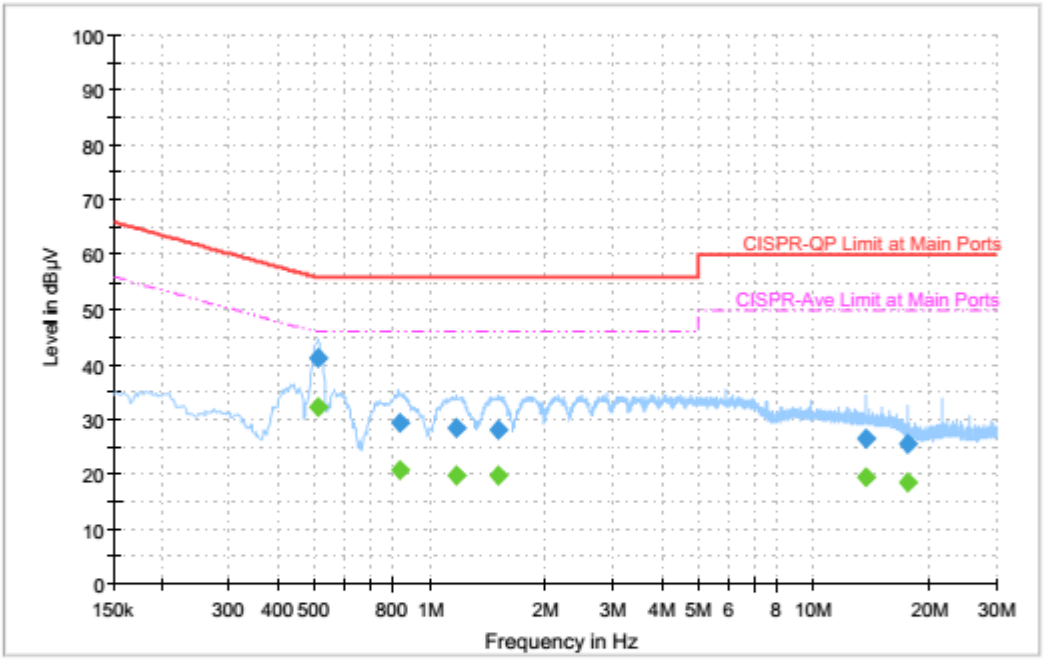
Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.510450	---	31.33	46.00	14.67	L1	OFF	20.0
0.510450	40.72	---	56.00	15.28	L1	OFF	20.0
0.843000	---	18.52	46.00	27.48	L1	OFF	20.0
0.843000	27.74	---	56.00	28.26	L1	OFF	20.0
1.178250	---	18.87	46.00	27.13	L1	OFF	20.0
1.178250	27.78	---	56.00	28.22	L1	OFF	20.0
1.518000	---	18.66	46.00	27.34	L1	OFF	20.0
1.518000	27.80	---	56.00	28.20	L1	OFF	20.0
9.804030	---	19.19	50.00	30.81	L1	OFF	20.2
9.804030	25.90	---	60.00	34.10	L1	OFF	20.2
17.647170	---	18.47	50.00	31.53	L1	OFF	20.4
17.647170	24.96	---	60.00	35.04	L1	OFF	20.4

EUT Information

Test Voltage:	120Vac/60Hz
Config	3
Project	Cypress
Phase:	Neutral
Project#	200819001
Mode	2
	WIFI Idle +BT Link

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.510540	---	32.17	46.00	13.83	N	OFF	20.0
0.510540	41.34	---	56.00	14.66	N	OFF	20.0
0.831750	---	20.63	46.00	25.37	N	OFF	20.0
0.831750	29.40	---	56.00	26.60	N	OFF	20.0
1.174380	---	19.95	46.00	26.05	N	OFF	20.0
1.174380	28.44	---	56.00	27.56	N	OFF	20.0
1.501080	---	19.80	46.00	26.20	N	OFF	20.0
1.501080	28.20	---	56.00	27.80	N	OFF	20.0
13.725600	---	19.41	50.00	30.59	N	OFF	20.3
13.725600	26.36	---	60.00	33.64	N	OFF	20.3
17.647170	---	18.64	50.00	31.36	N	OFF	20.4
17.647170	25.52	---	60.00	34.48	N	OFF	20.4

3.10 Antenna Requirements

3.10.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 rule.

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	6111D	50392	30MHz~1GHz	Jul. 29, 2020	Oct. 28, 2020~ Dec. 08, 2020	Jul. 28, 2021	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	01895	1GHz~18GHz	Aug. 28, 2020	Oct. 28, 2020~ Dec. 08, 2020	Aug. 27, 2021	Radiation (03CH02-CA)
Amplifier	SONOMA	310N	372240	N/A	Aug. 12, 2020	Oct. 28, 2020~ Dec. 08, 2020	Aug. 11, 2021	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270321	1GHz~26.5GHz	Jul. 28, 2020	Oct. 28, 2020~ Dec. 08, 2020	Jul. 27, 2021	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900251	1GHz~18GHz	Nov. 26, 2019	Oct. 28, 2020~ Dec. 08, 2020	Nov. 25, 2021	Radiation (03CH02-CA)
Spectrum Analyzer	Keysight	N9010A	MY57420221	10Hz~44GHz	Sep. 11, 2020	Oct. 28, 2020~ Dec. 08, 2020	Sep. 10, 2021	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN2	1.2G Low Pass	Jul. 24, 2020	Oct. 28, 2020~ Dec. 08, 2020	Jul. 23, 2021	Radiation (03CH02-CA)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN10	3G Highpass	Jul. 24, 2020	Oct. 28, 2020~ Dec. 08, 2020	Jul. 23, 2021	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Aug. 05, 2020	Oct. 28, 2020~ Dec. 08, 2020	Aug. 04, 2021	Radiation (03CH02-CA)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Oct. 28, 2020~ Dec. 08, 2020	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Oct. 28, 2020~ Dec. 08, 2020	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Oct. 28, 2020~ Dec. 08, 2020	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	Oct. 28, 2020~ Dec. 08, 2020	N/A	Radiation (03CH02-CA)
Hygrometer	Testo	608-H1	45142595	N/A	Aug. 05, 2020	Oct. 22, 2020~ Dec. 16, 2020	Aug. 04, 2021	Conducted (TH01-CA)
Power meter	Anritsu	ML2495A	1804004	N/A	Aug. 10, 2020	Oct. 22, 2020~ Dec. 16, 2020	Aug. 09, 2021	Conducted (TH01-CA)
Power Sensor	Anritsu	MA2411B	1726149	300MHz-40GHz	Aug. 10, 2020	Oct. 22, 2020~ Dec. 16, 2020	Aug. 09, 2021	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz-40GHz	Sep. 14, 2020	Oct. 22, 2020~ Dec. 16, 2020	Sep. 13, 2021	Conducted (TH01-CA)
Coupler	WOKEN	20dB 30W Coupler	CAT7AKW1A1	0.5-18GHz	Calibration from System	Oct. 22, 2020~ Dec. 16, 2020	Calibration from System	Conducted (TH01-CA)
LISN	TESEQ	NNB51	47407	N/A	Jul. 06, 2020	Nov. 12, 2020	Jul. 05, 2021	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	9KHz~7GHz	Jul. 16, 2020	Nov. 12, 2020	Jul. 15, 2021	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	R&S	VTSD 9561-F N	9561-F-N00412	N/A	Jul. 08, 2020	Nov. 12, 2020	Jul. 07, 2021	Conduction (CO01-CA)
Test Software	R&S	EMC32 V10.30.0	N/A	N/A	N/A	Nov. 12, 2020	N/A	Conduction (CO01-CA)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.2**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.50**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.10**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.50**

————THE END————