

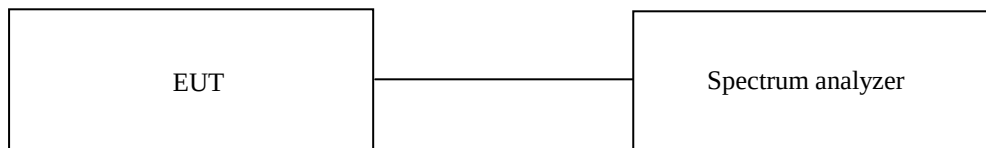
12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

12.1 Operating environment

Temperature : 25 °C
Relative humidity : 46 % R.H.

12.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution and video bandwidth is set to 100 kHz, and peak detection was used.



12.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

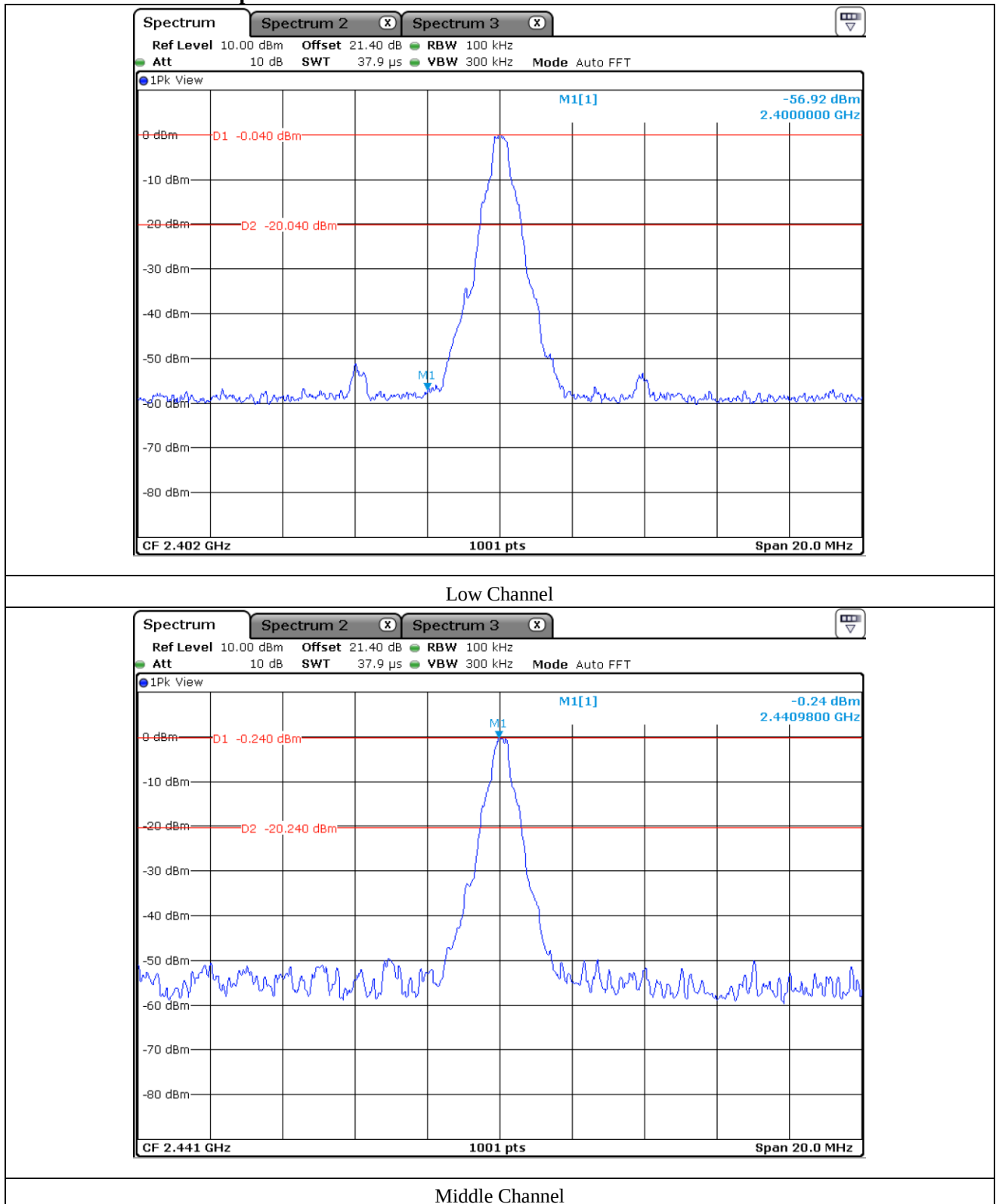
12.4 Test equipment used

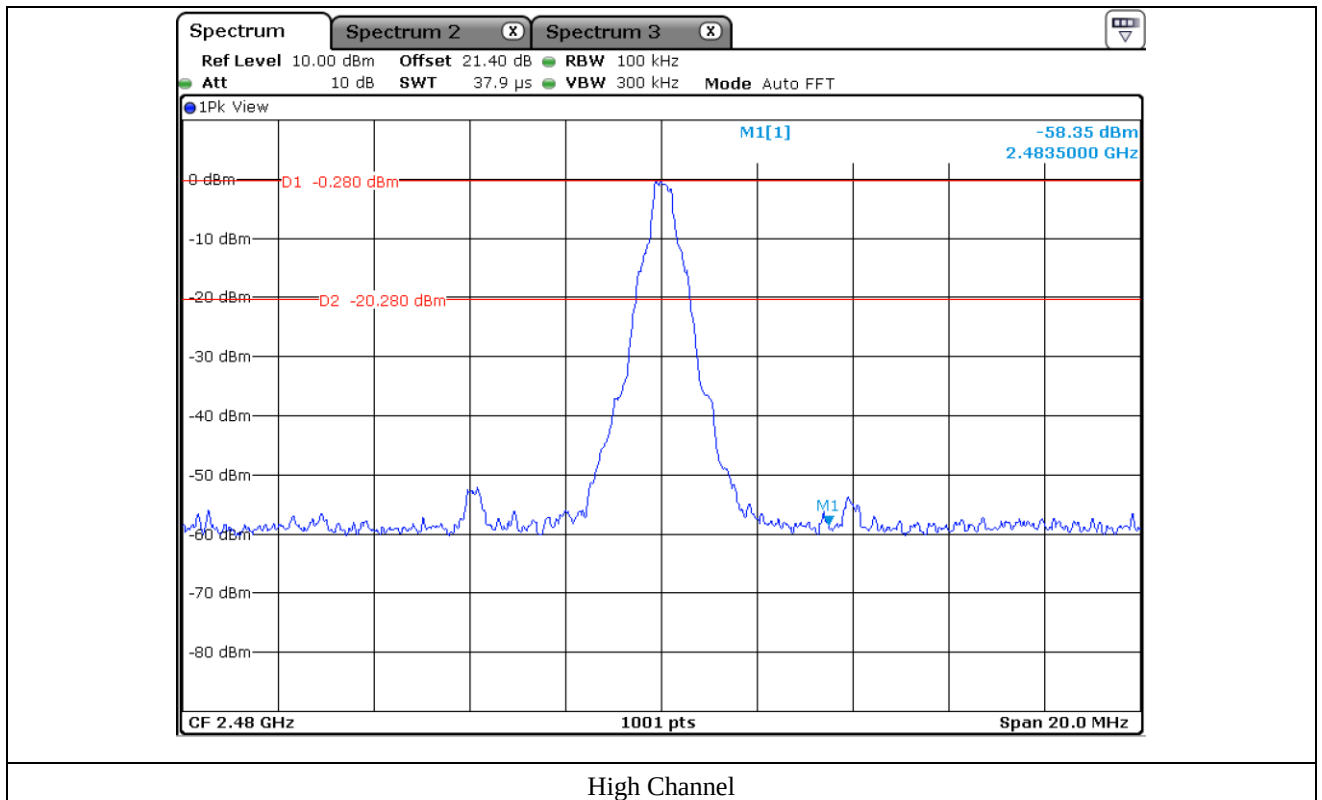
	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 28, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2019 (1Y)
■ -	BBV 9718B	Schwarzbeck	Amplifier	009	Mar. 20, 2019 (1Y)
■ -	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 11, 2019 (1Y)
■ -	DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
■ -	MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)

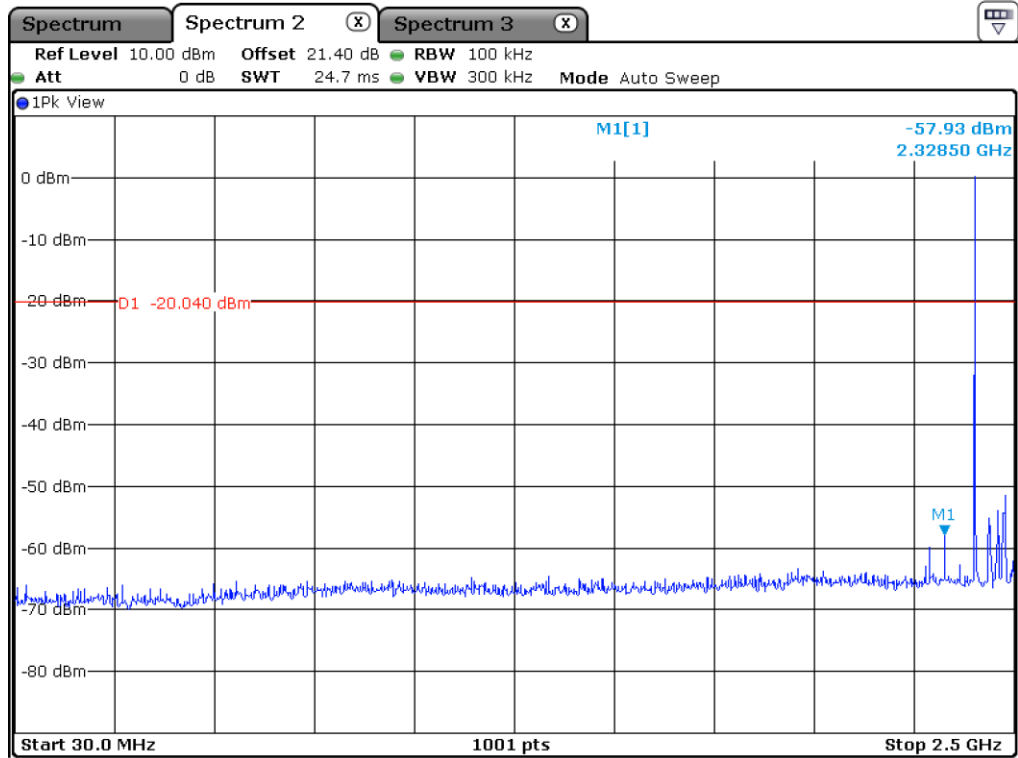
All test equipment used is calibrated on a regular basis.

12.5 Test data for conducted emission

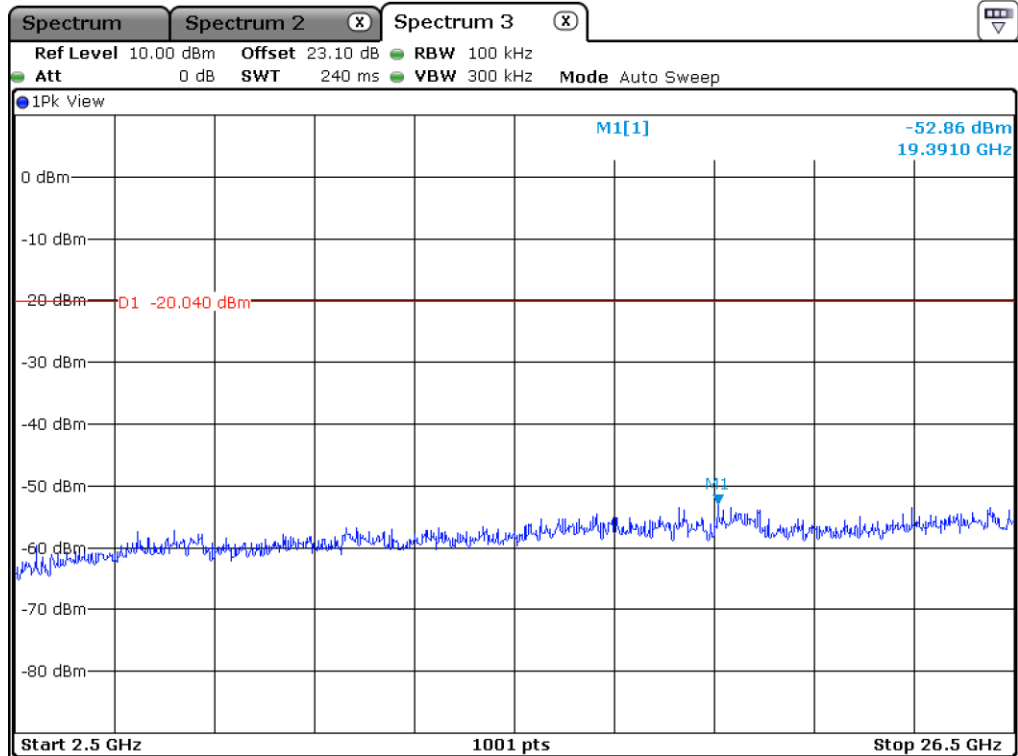
12.5.1 Test data for 1 Mbps



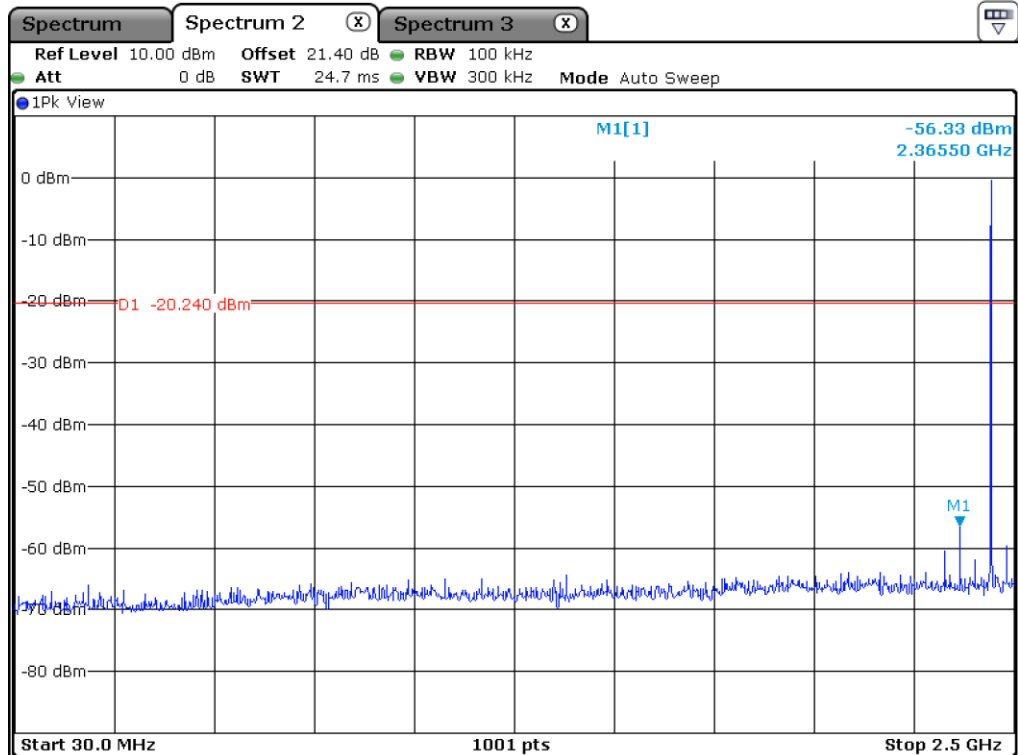




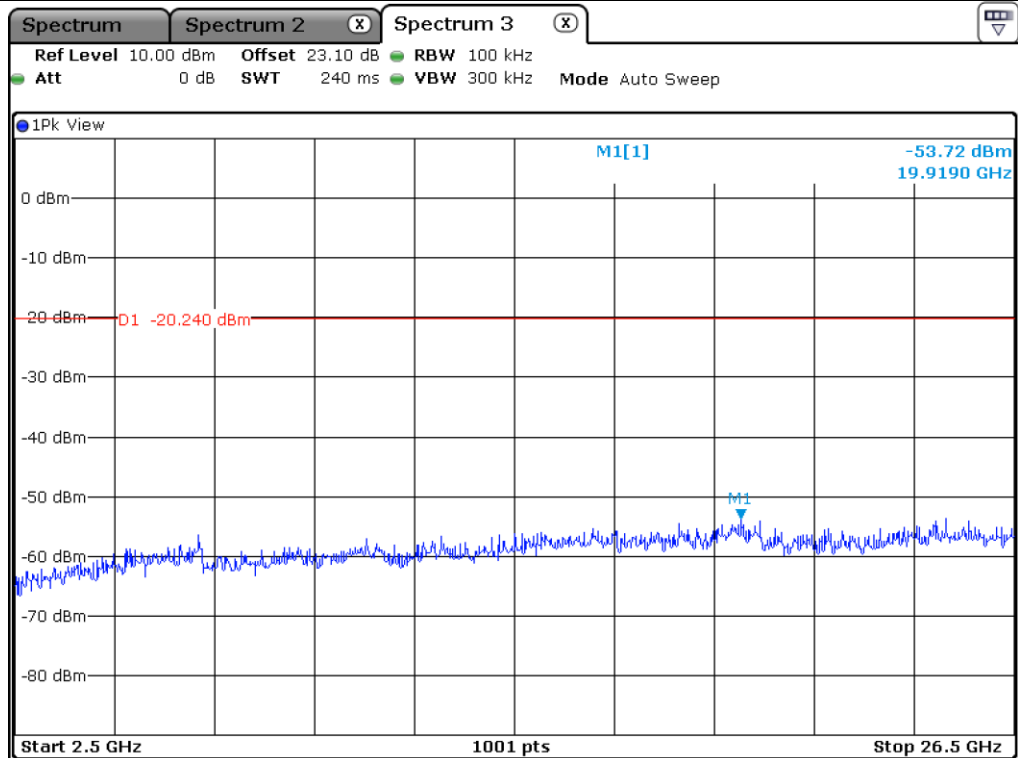
Low Channel



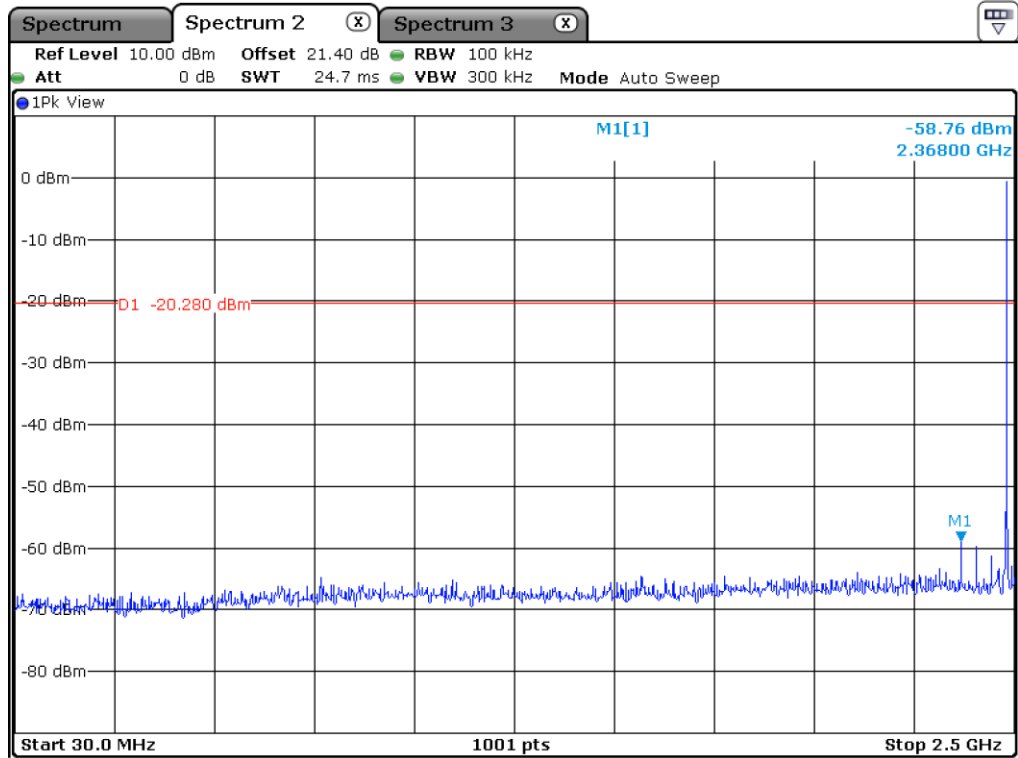
Low Channel



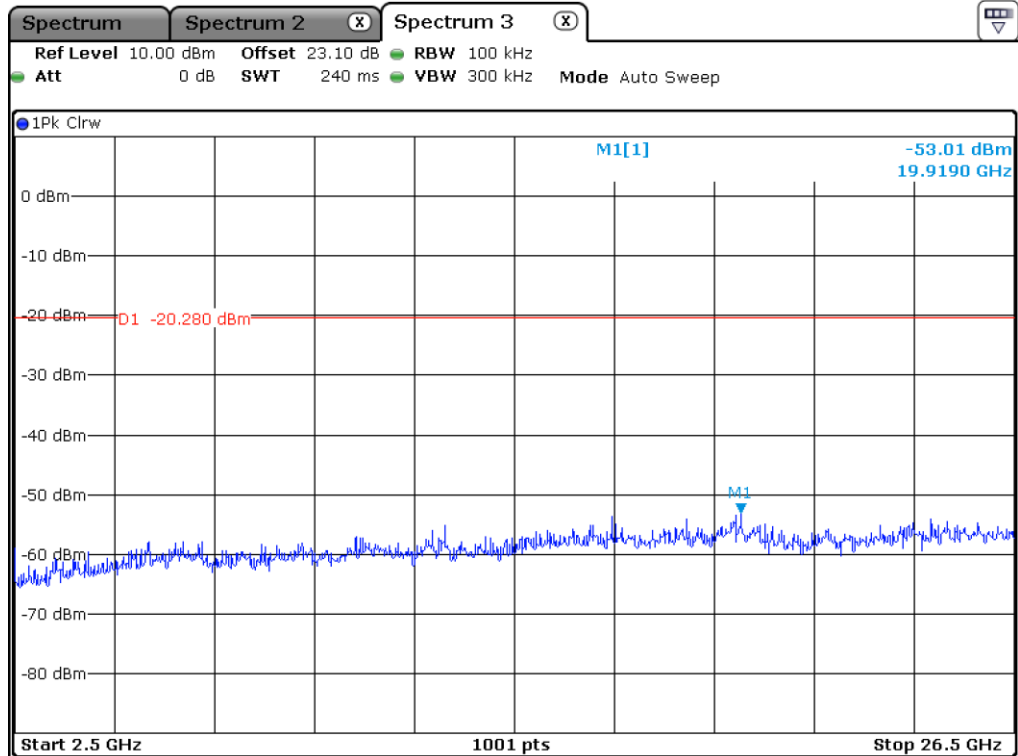
Middle Channel



Middle Channel

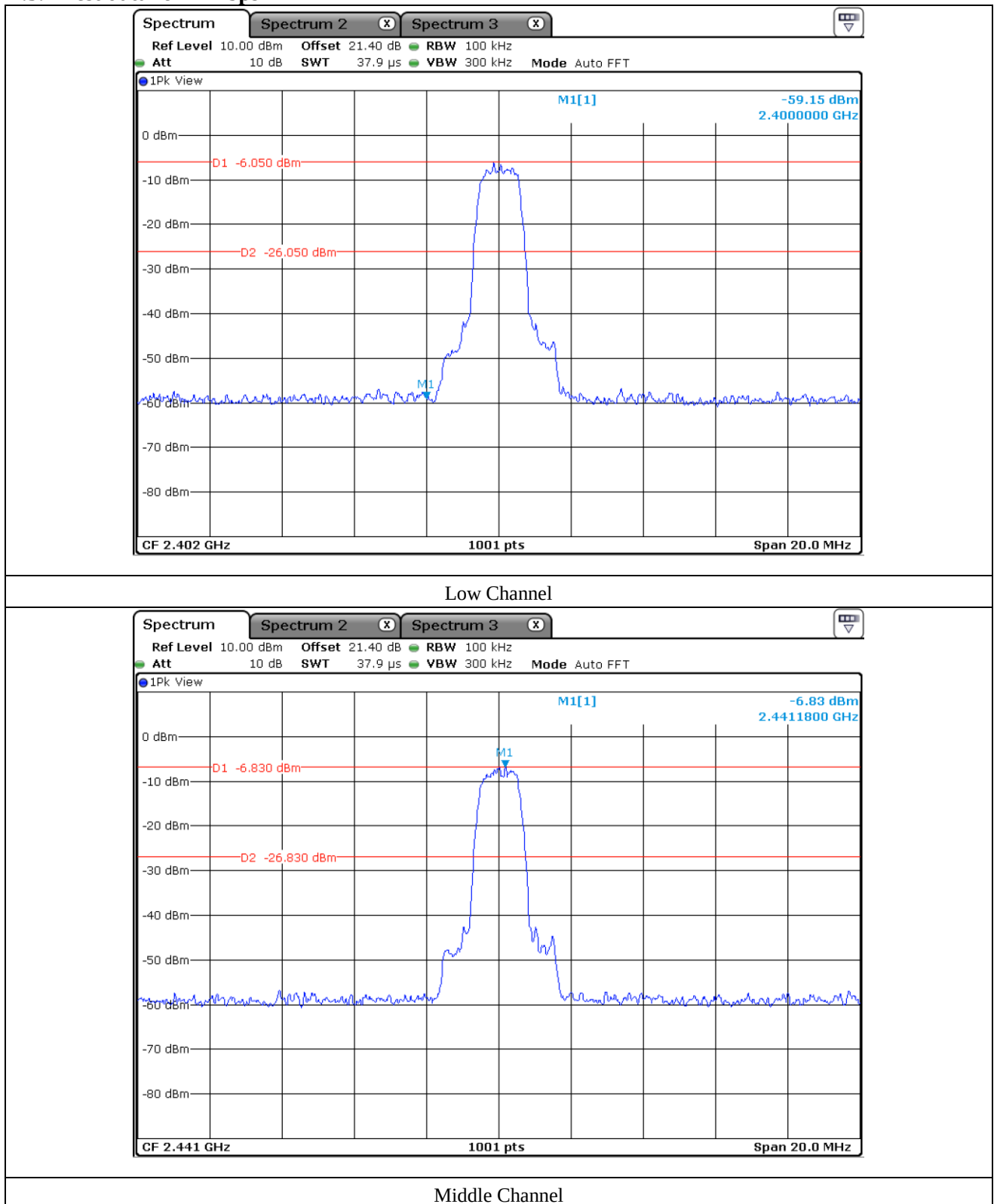


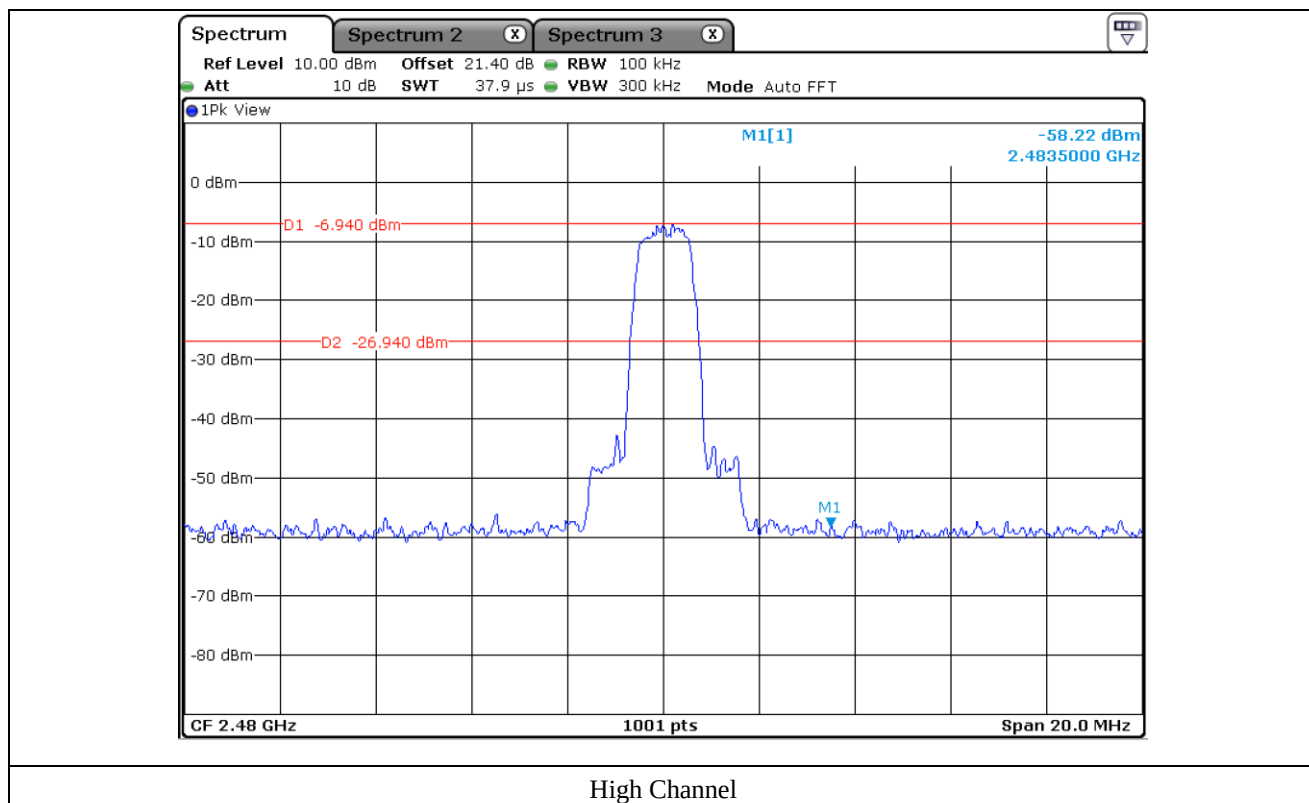
High Channel

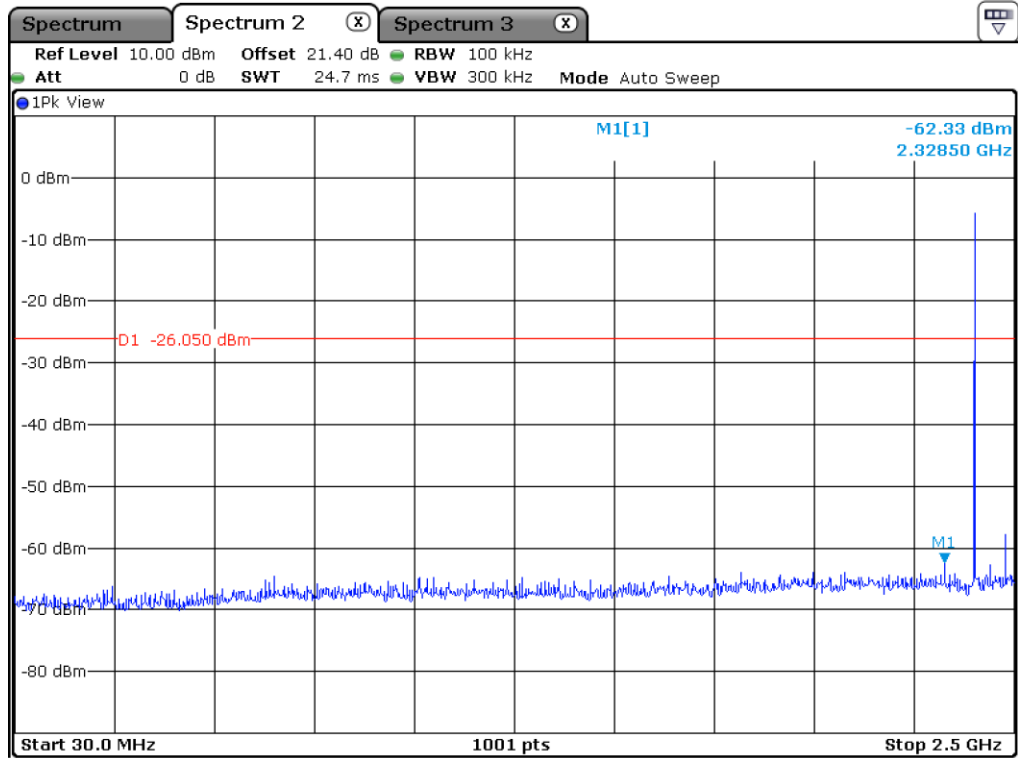


High Channel

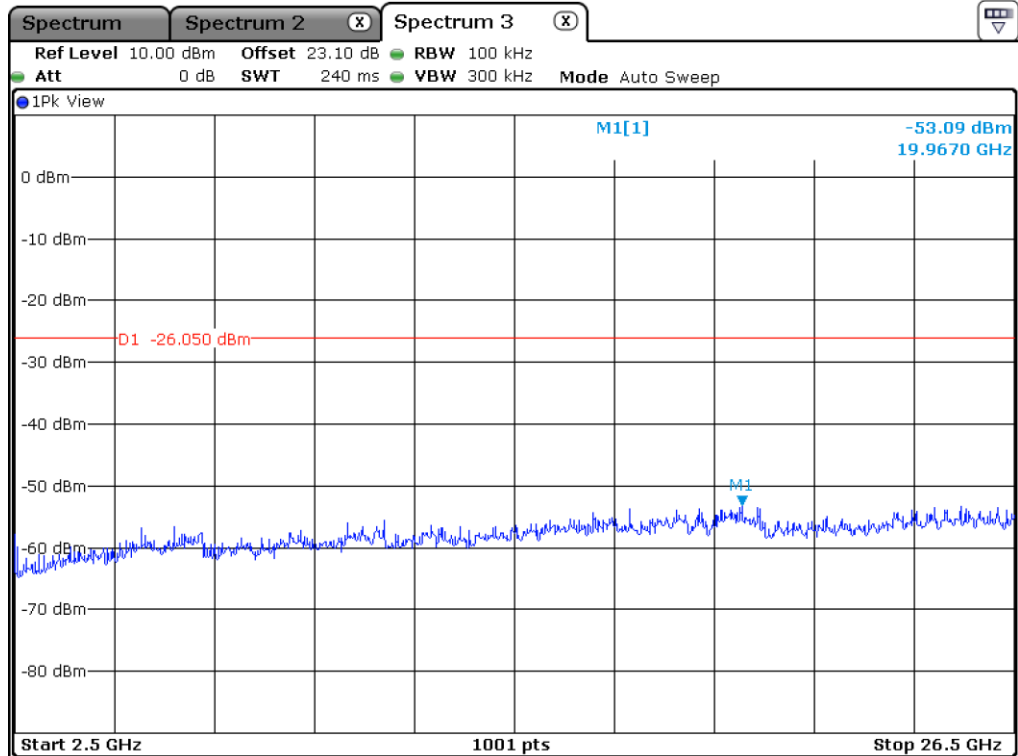
12.5.2 Test data for 2 Mbps



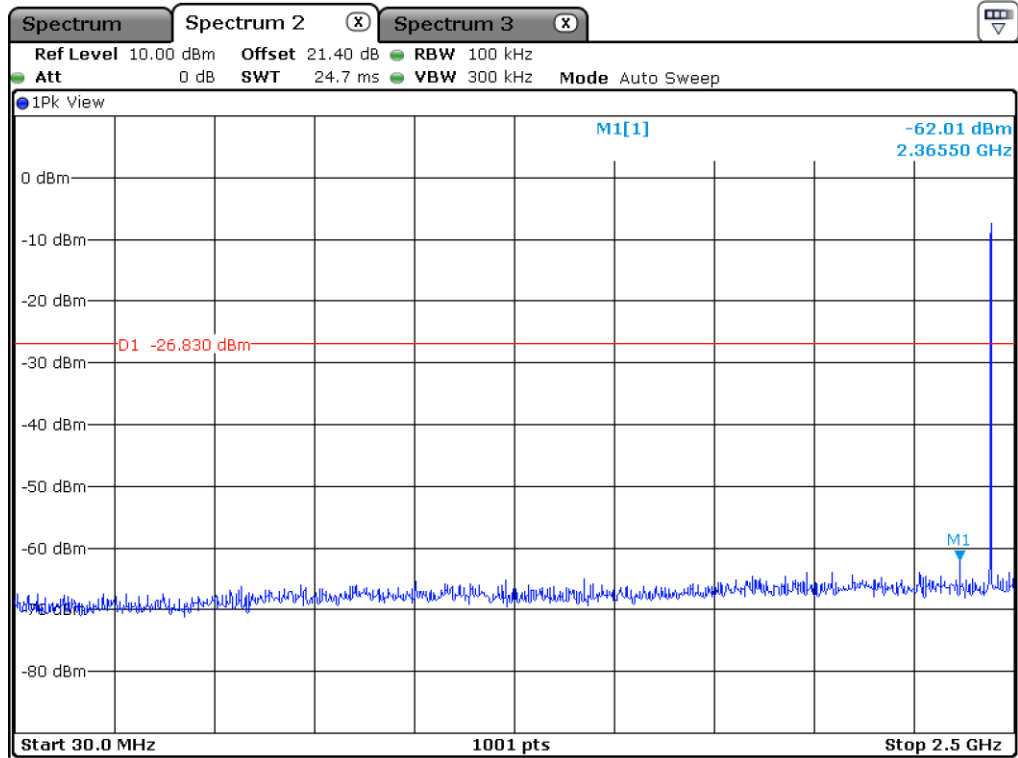




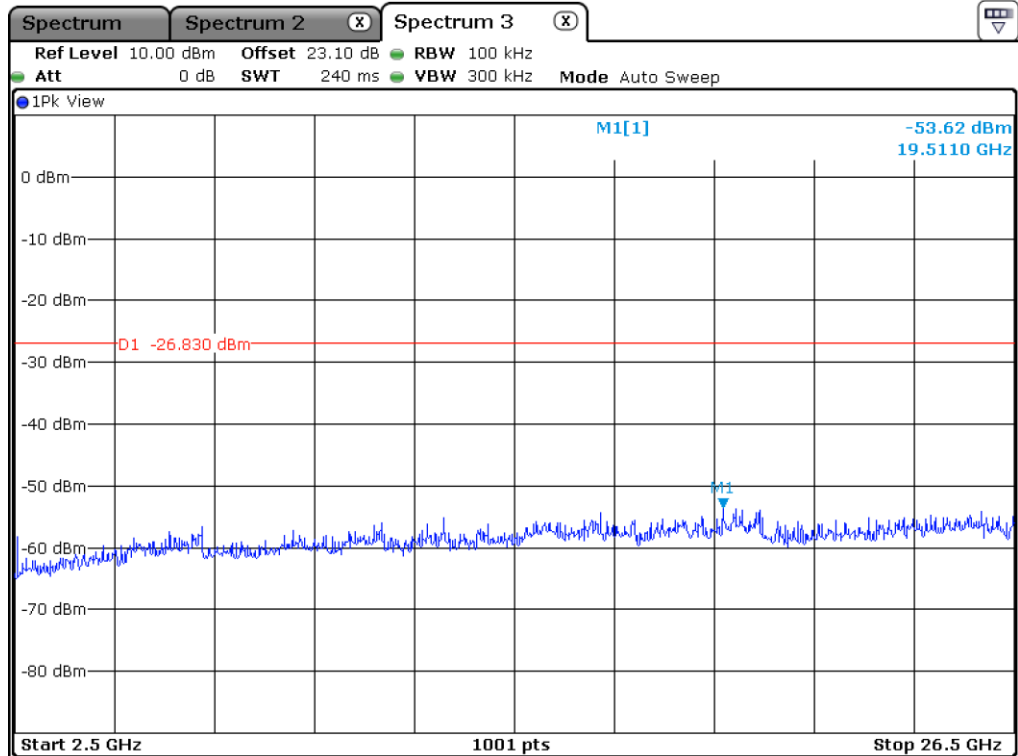
Low Channel



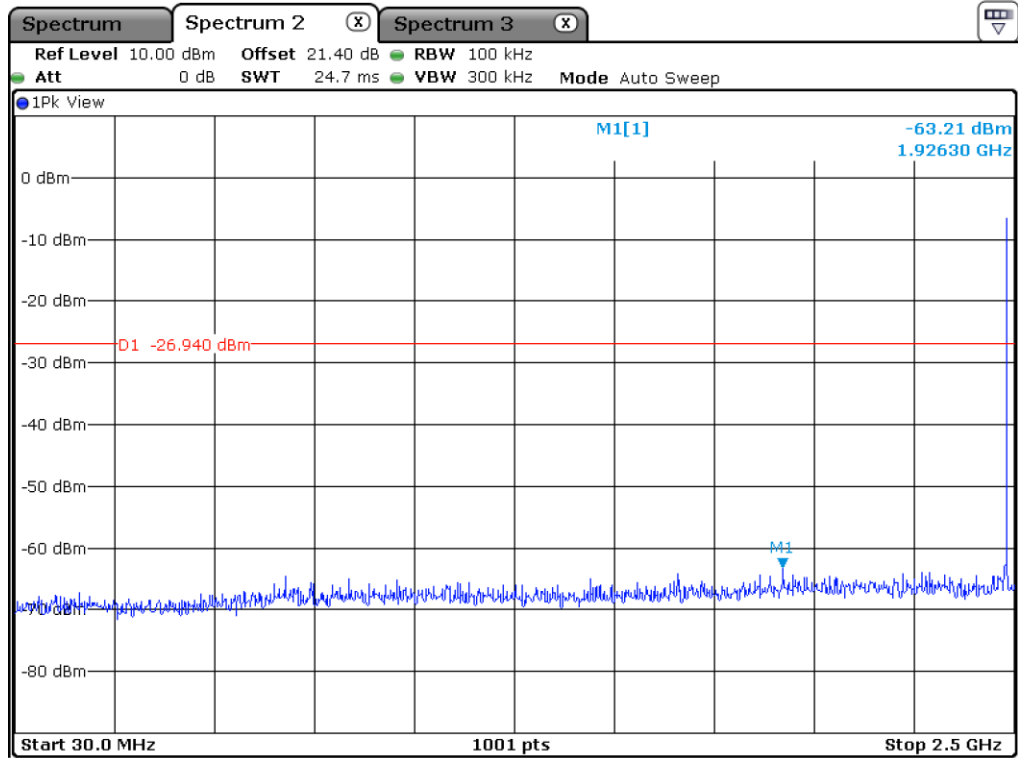
Low Channel



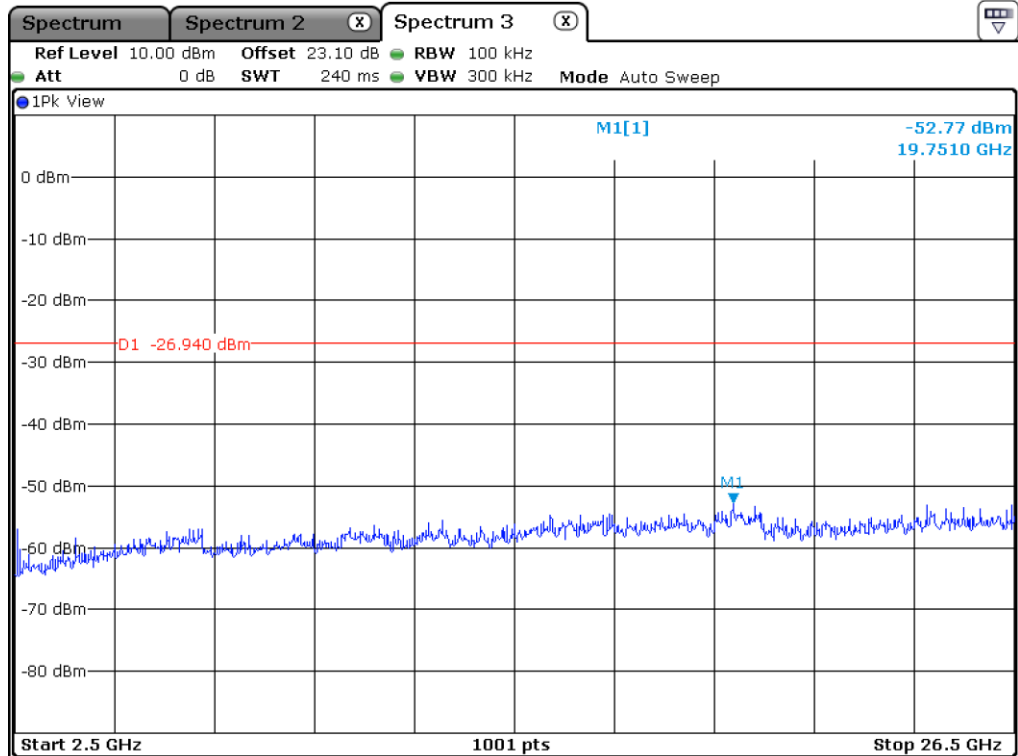
Middle Channel



Middle Channel

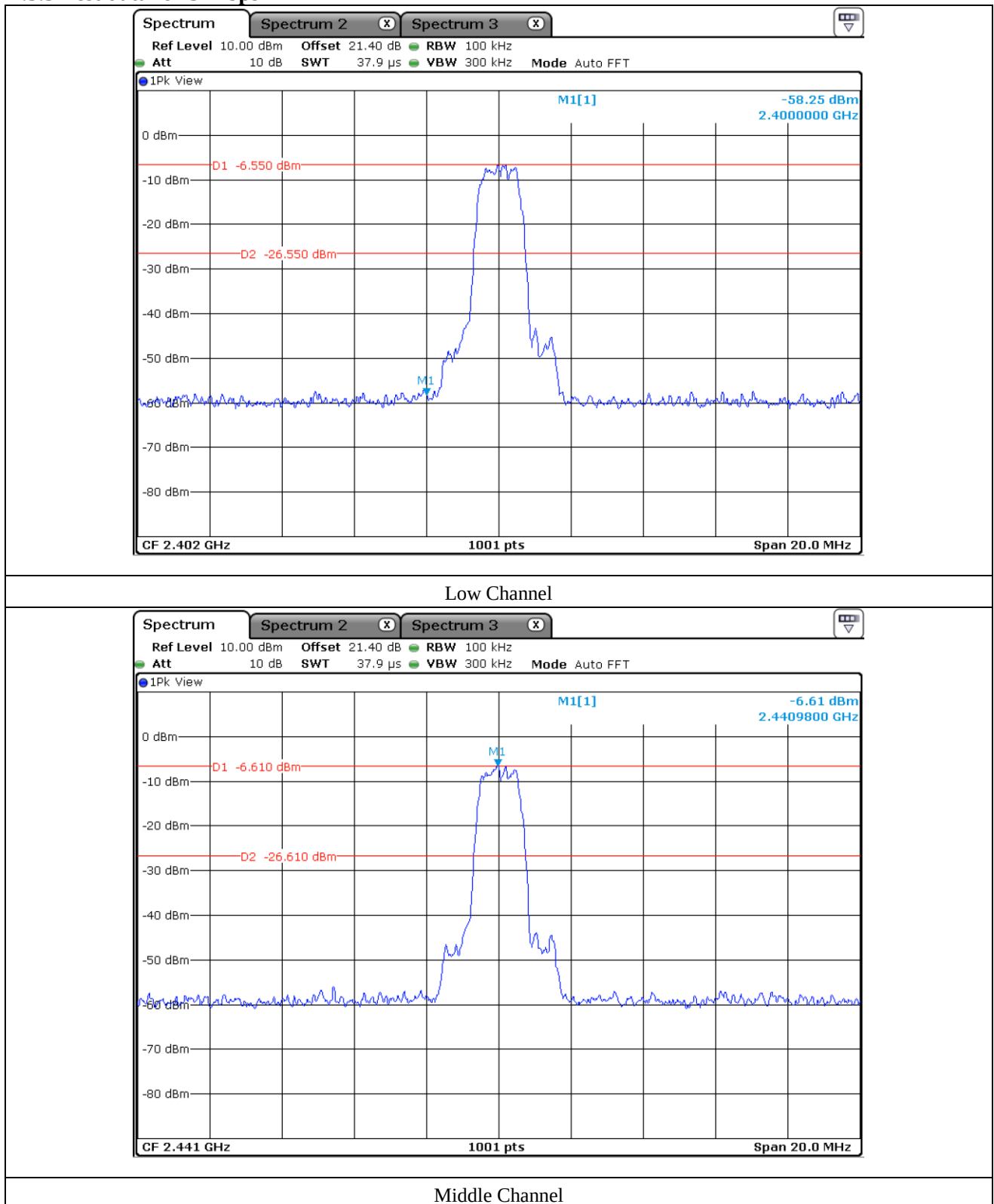


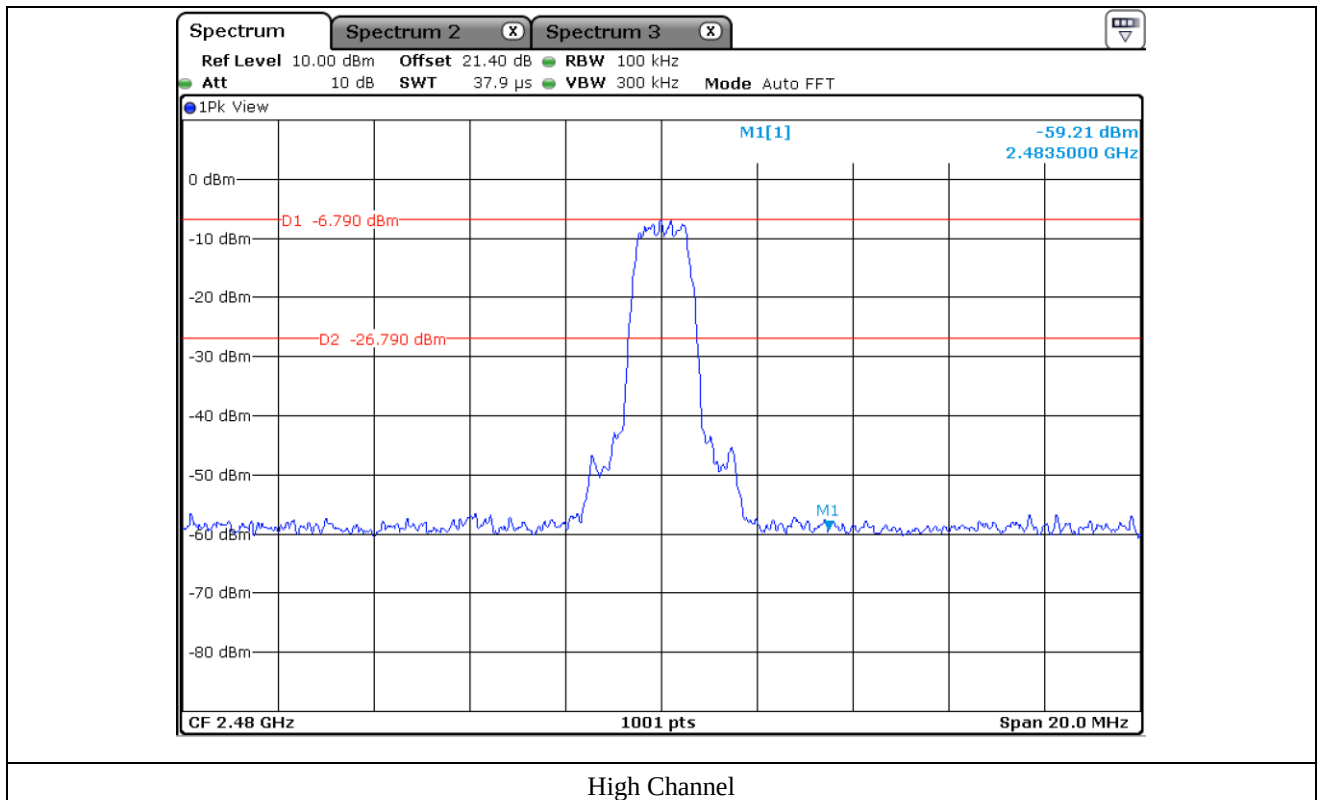
High Channel



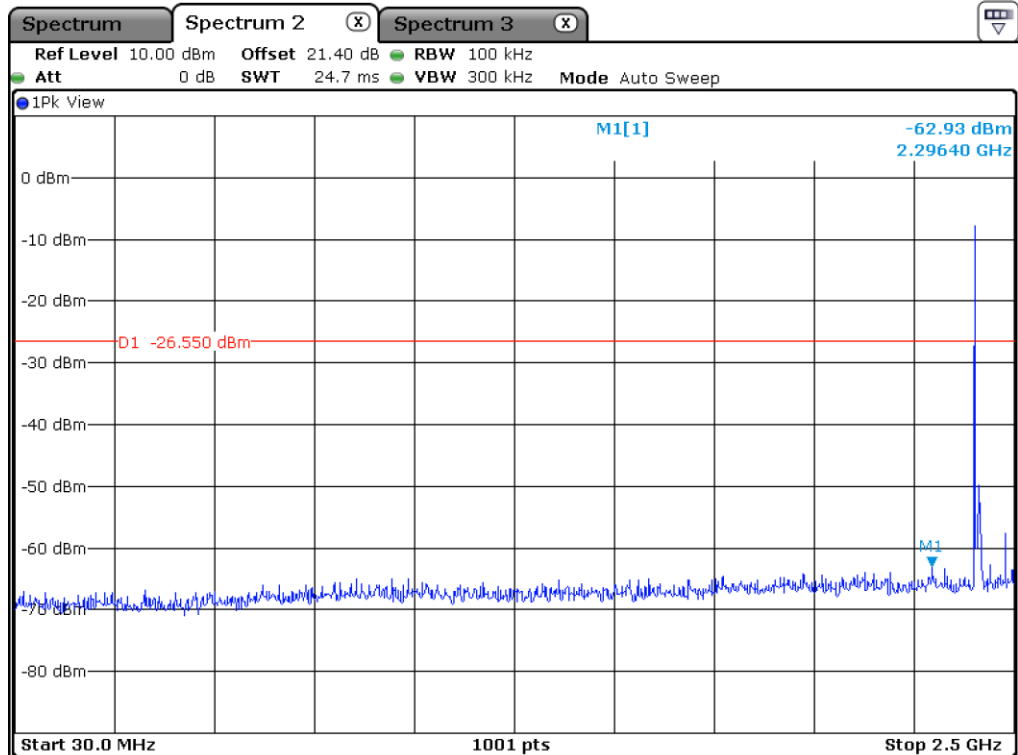
High Channel

12.5.3 Test data for 3 Mbps

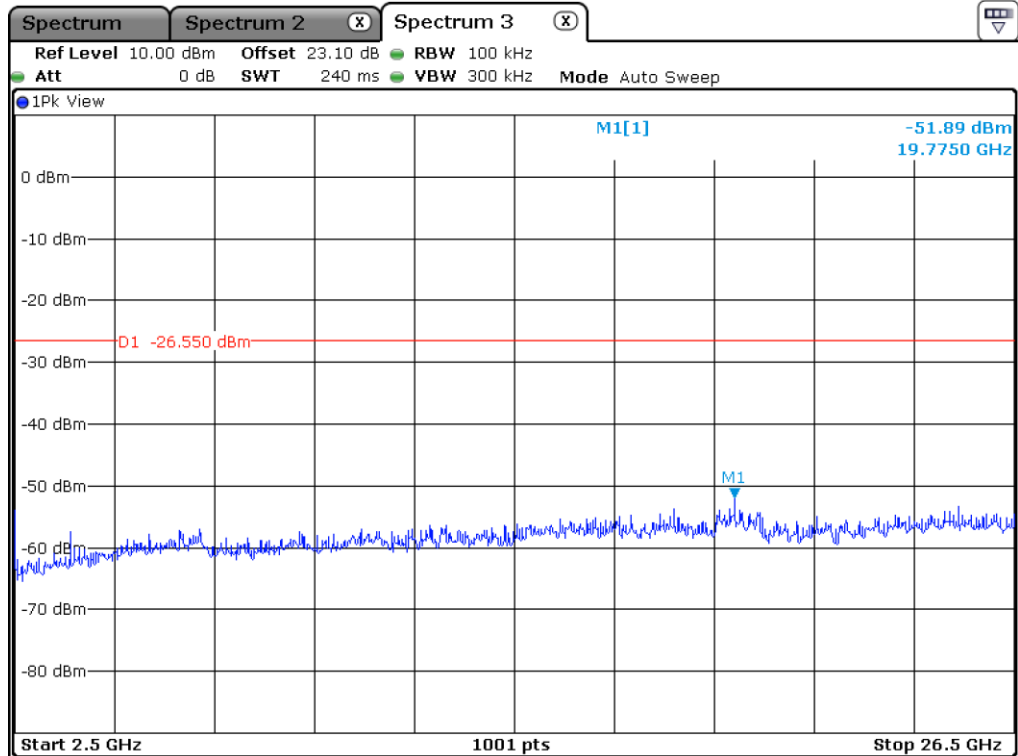




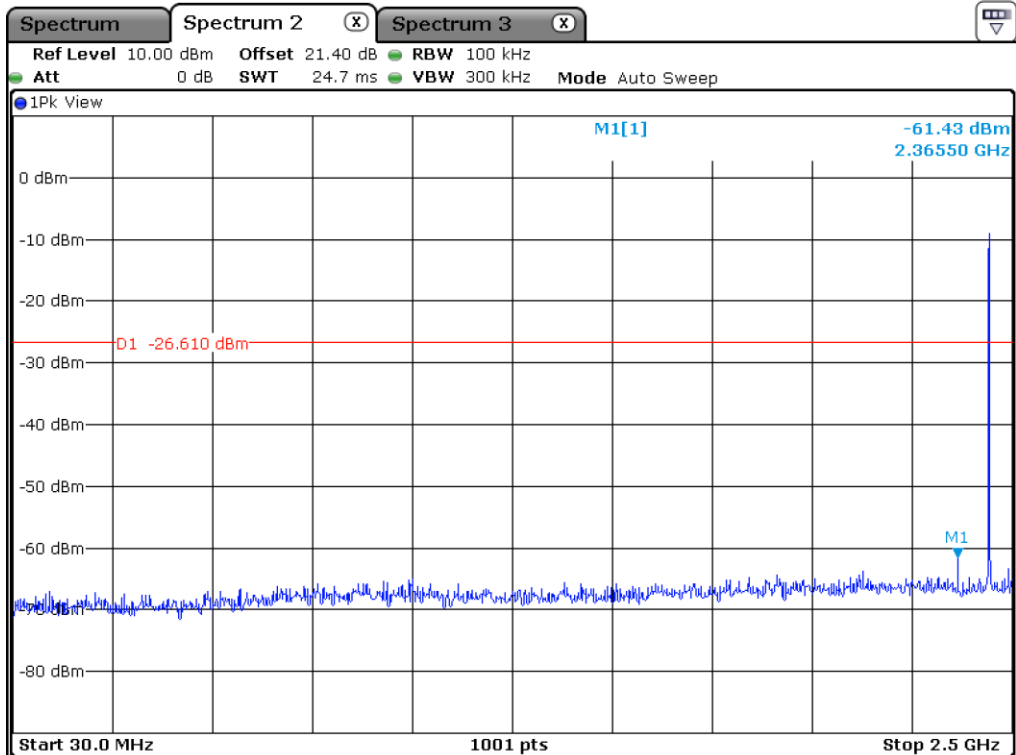
High Channel



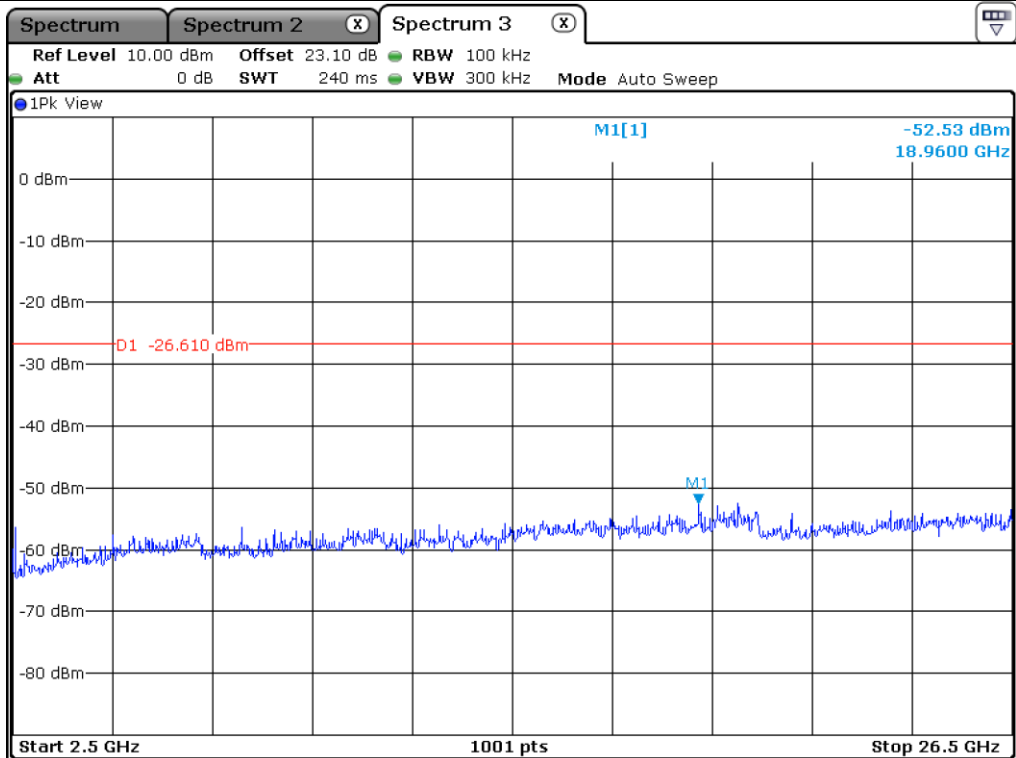
Low Channel



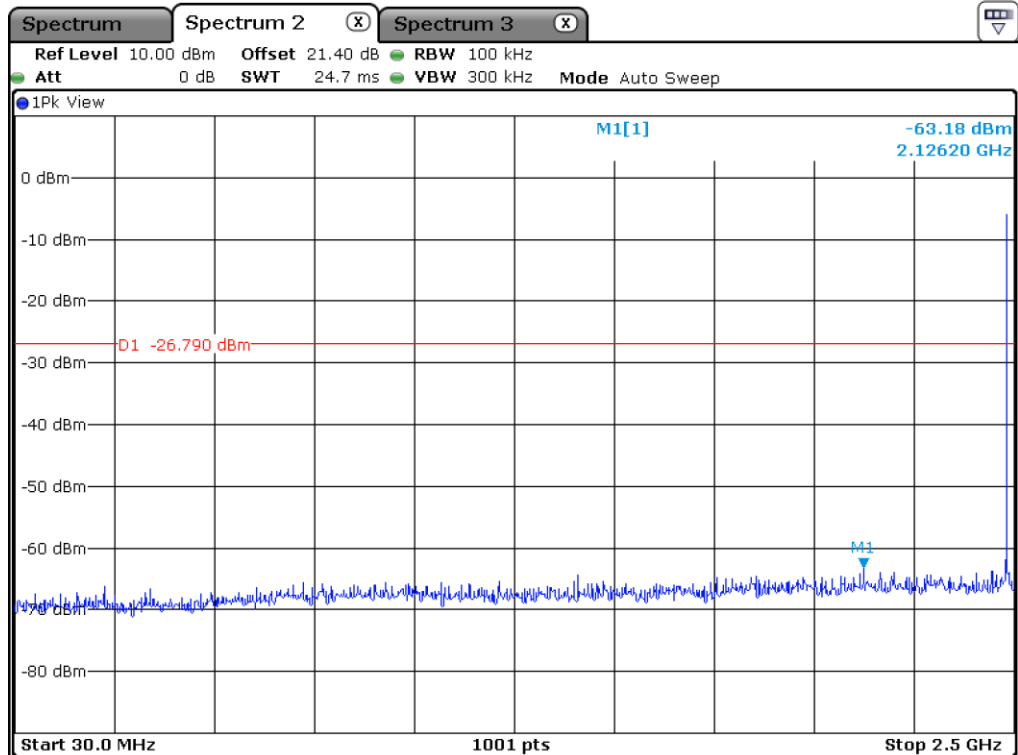
Low Channel



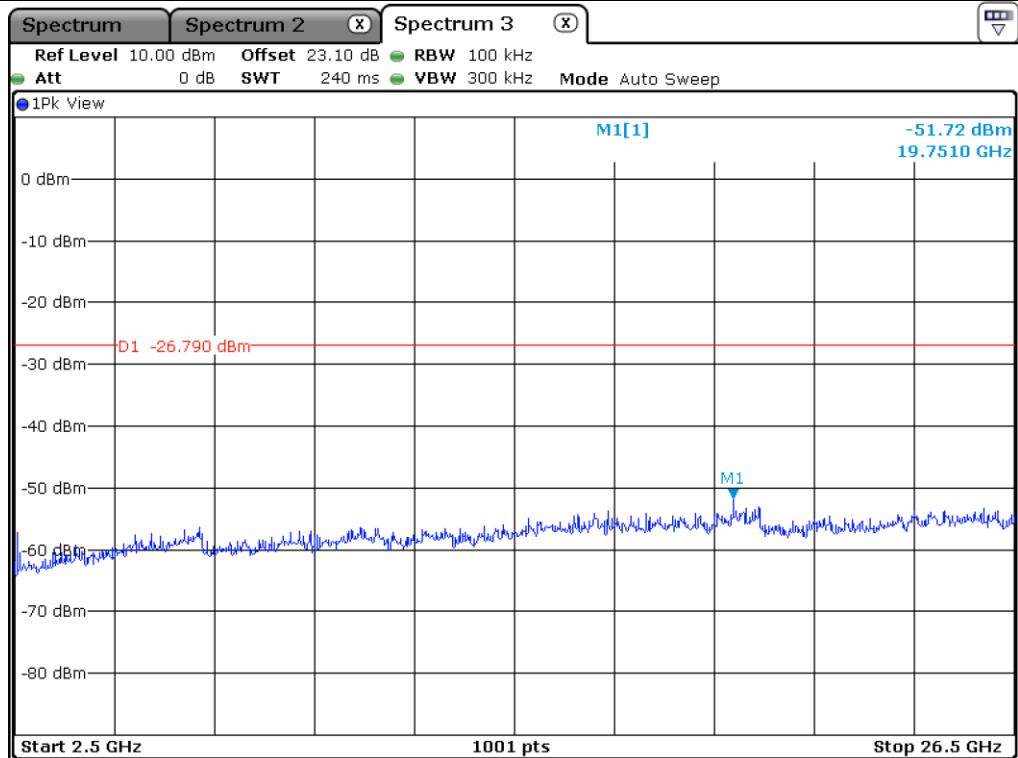
Middle Channel



Middle Channel



High Channel



High Channel

12.6 Test data for Transmitting mode radiated emission

12.6.1 Radiated Emission which fall in the Restricted Band

12.6.1.1 Test data for 1 Mbps

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Duty Cycle : 46.33 %
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 328.541	16.15	Peak	H	25.94	2.75	-	44.84	74.00	29.16
2 339.790	4.32	Average	H	25.94	2.75	3.34	36.35	54.00	17.65
2 324.515	15.78	Peak	V	25.94	2.75	-	44.47	74.00	29.53
2 385.054	4.40	Average	V	25.94	2.75	3.34	36.43	54.00	17.57
Test Data for High Channel									
2 488.382	16.96	Peak	H	26.47	2.39	-	45.82	74.00	28.18
2 497.873	4.37	Average	H	26.47	2.39	3.34	36.57	54.00	17.43
2 488.664	15.10	Peak	V	26.47	2.39	-	43.96	74.00	30.04
2 494.911	4.34	Average	V	26.47	2.39	3.34	36.54	54.00	17.46

Tabulated test data for Restricted Band

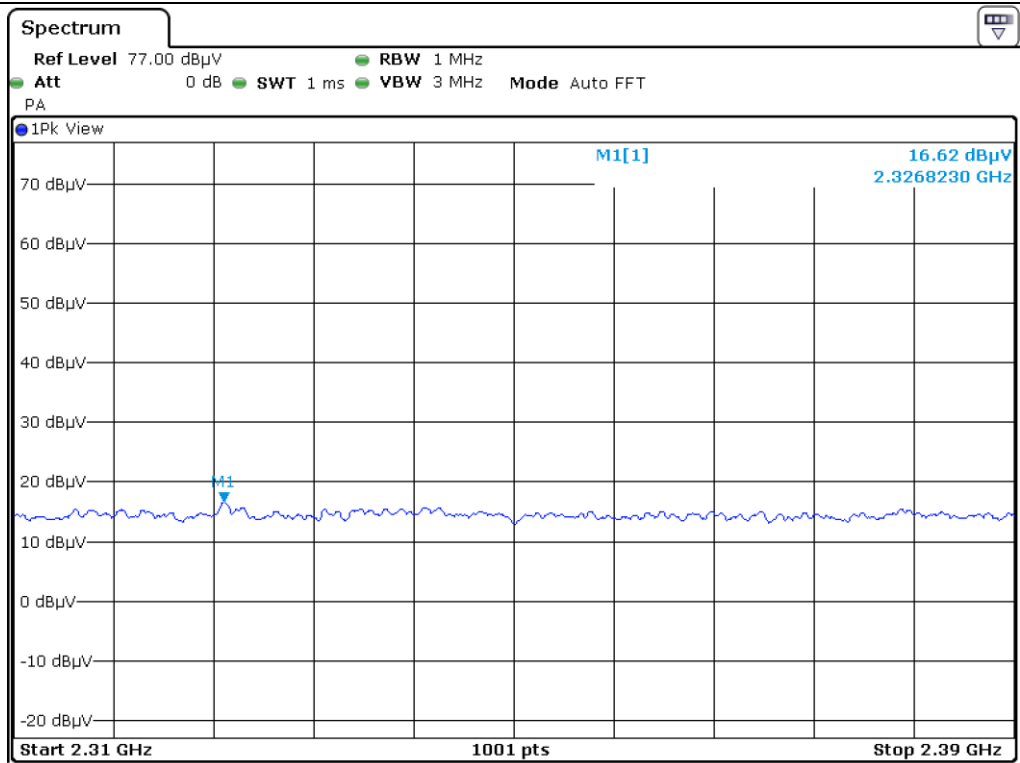
Remark: "H": Horizontal, "V": Vertical

$$\text{Margin(dB)} = \text{Limits(dB}\mu\text{V/m)} - \text{Total Level(dB}\mu\text{V/m)}$$

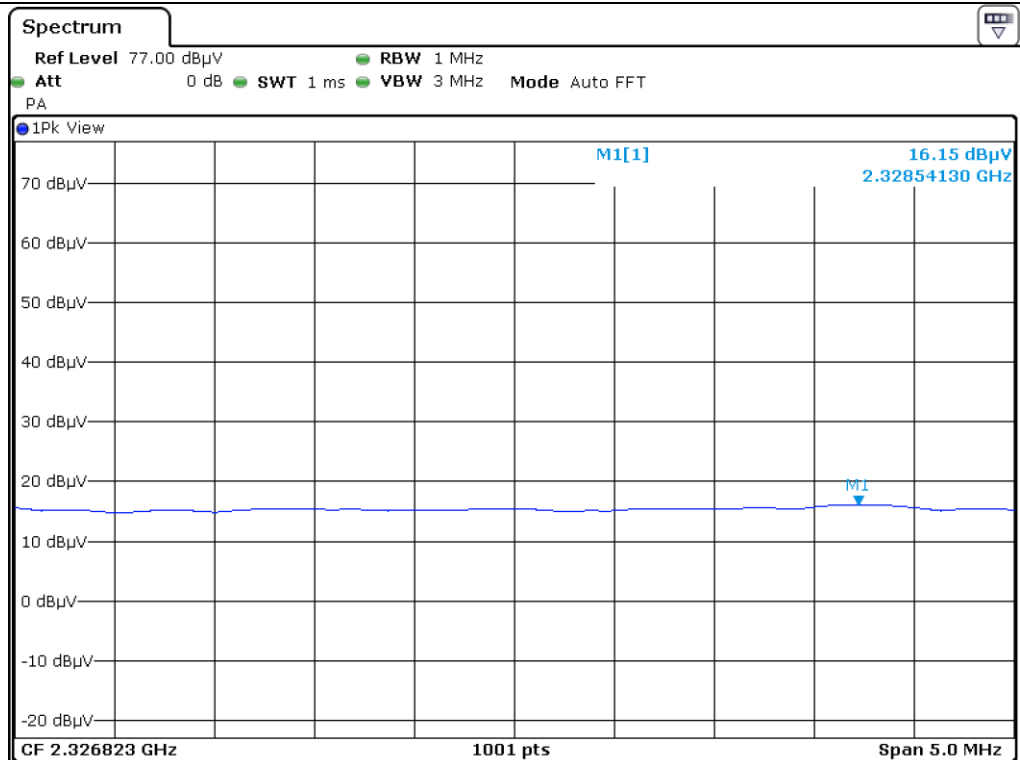
$$\text{Total Level} = \text{Reading} + \text{Ant. Factor} + \text{Cable Loss} + \text{Correction Factor}$$



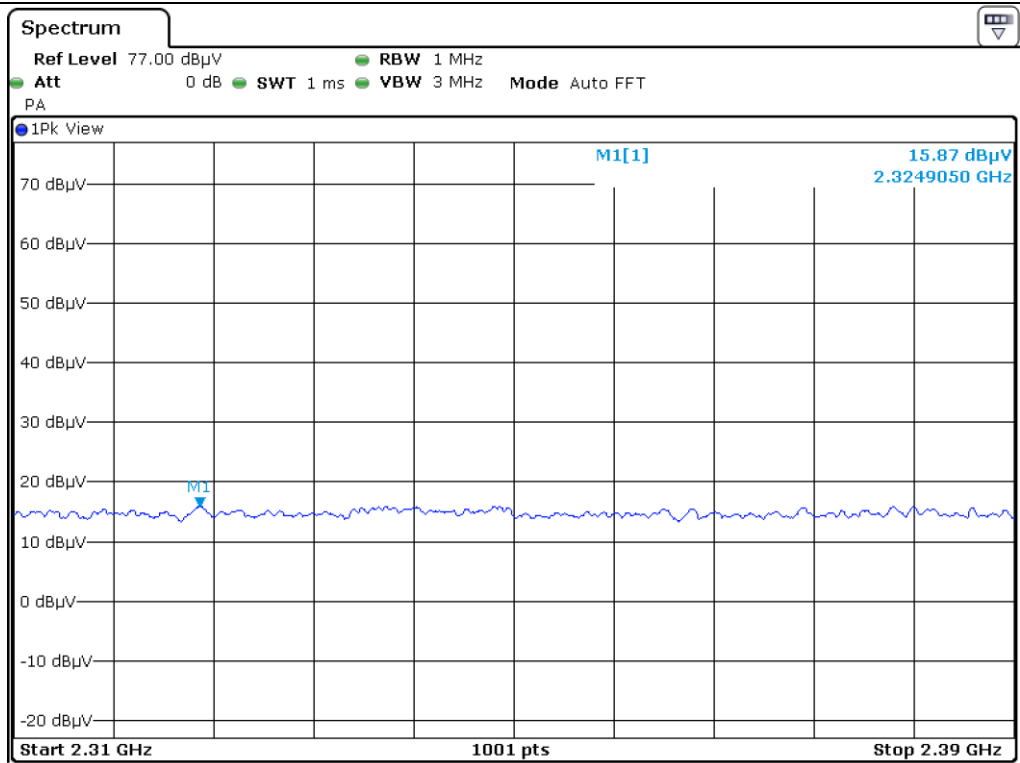
Tested by: Hyung-Kwon, Oh / Assistant Manager



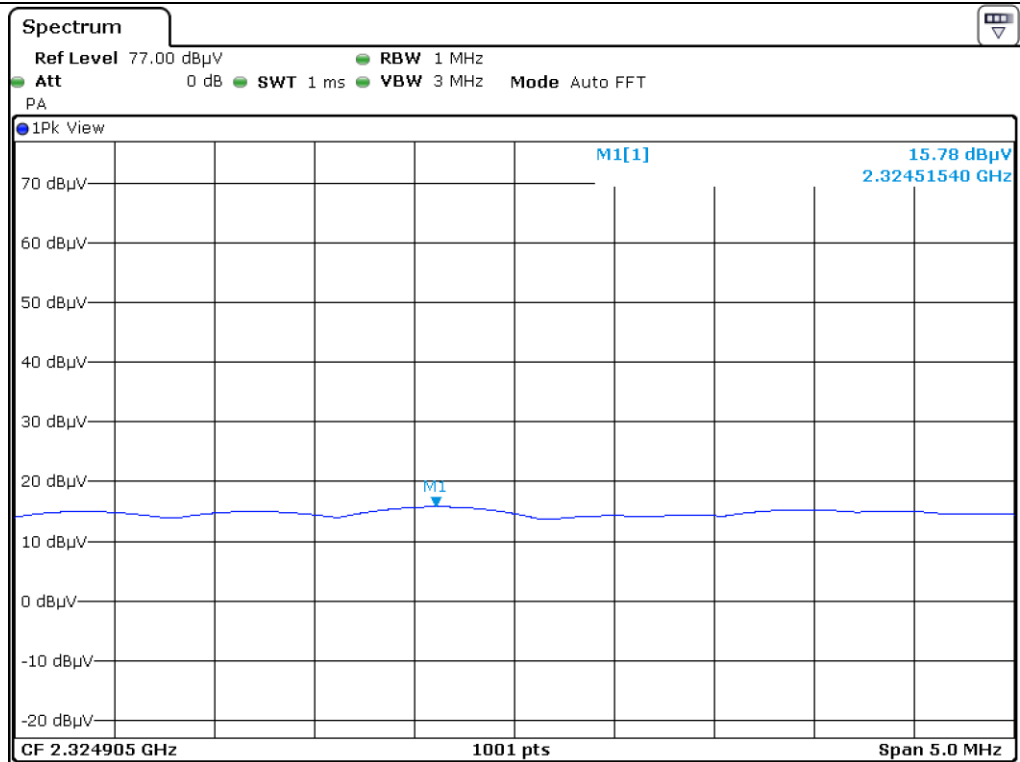
Low Channel_H_Peak



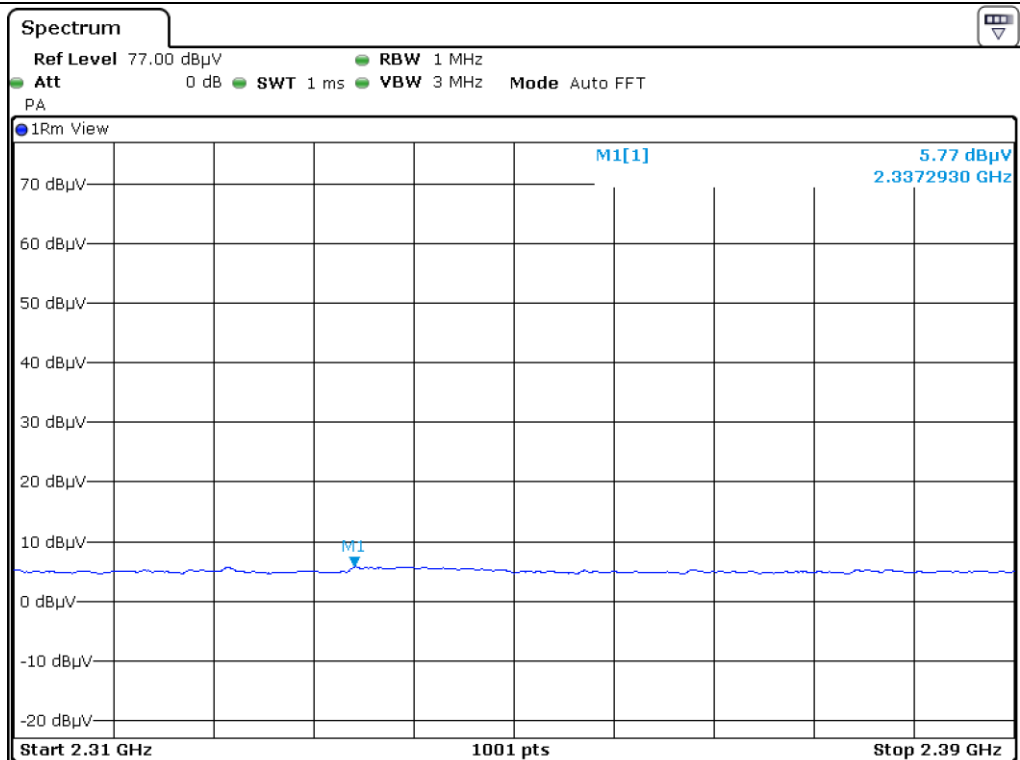
Low Channel_H_Peak_Focus



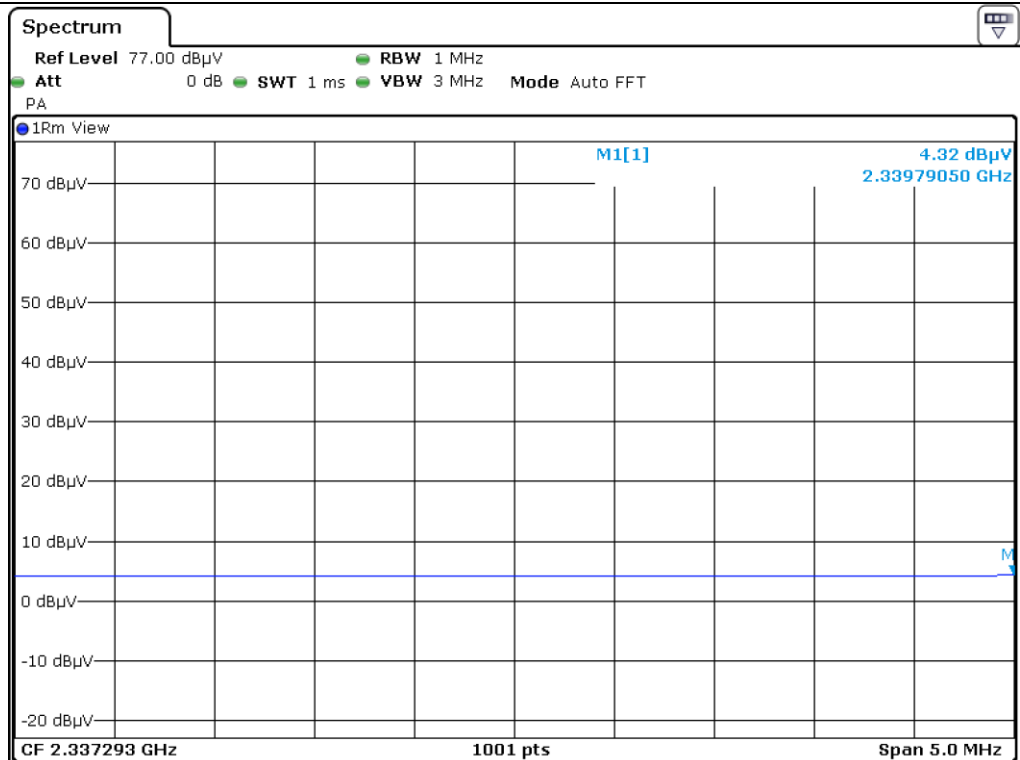
Low Channel_V_Peak



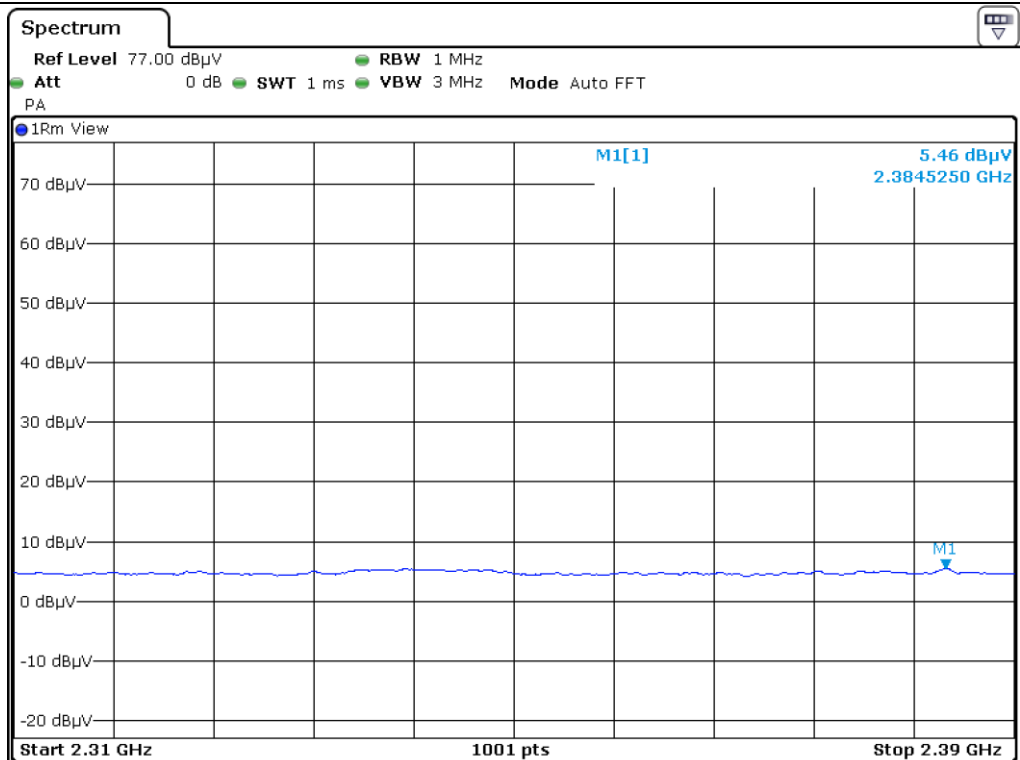
Low Channel_V_Peak_Focus



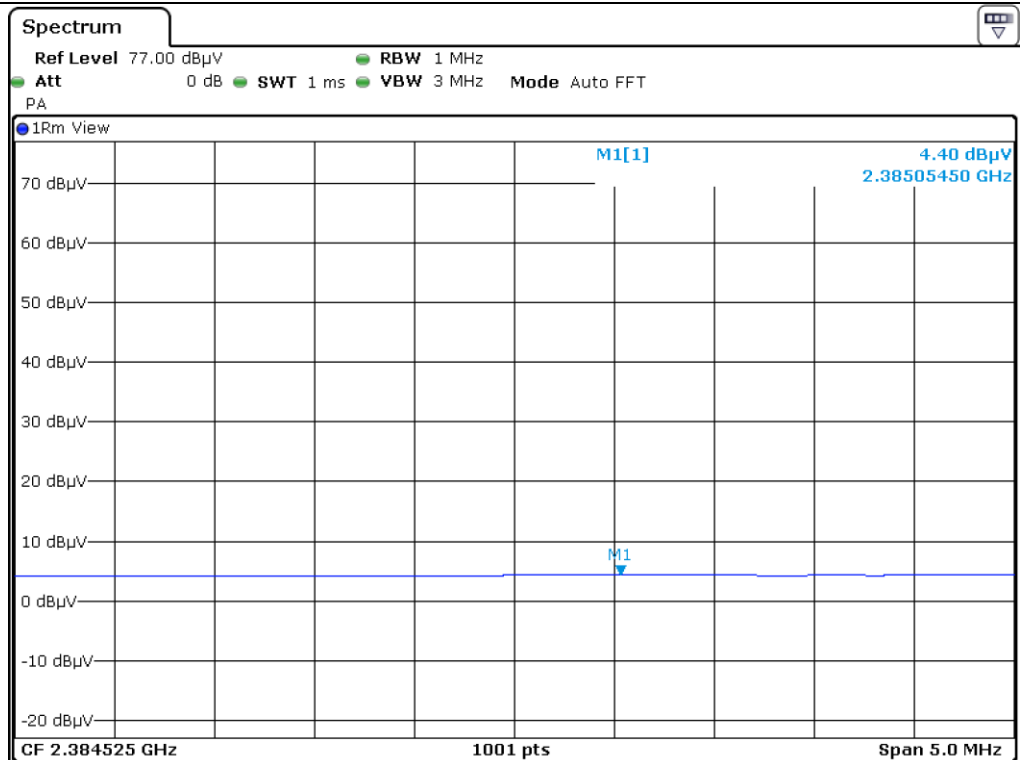
Low Channel_H_Average



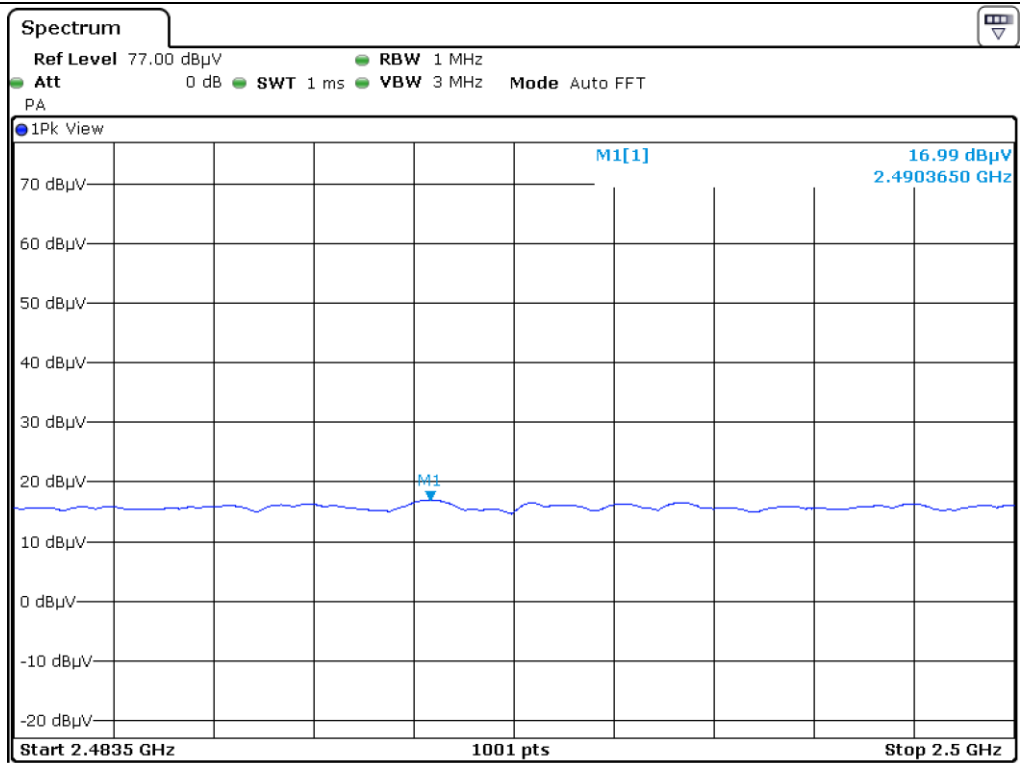
Low Channel_H_Average_Focus



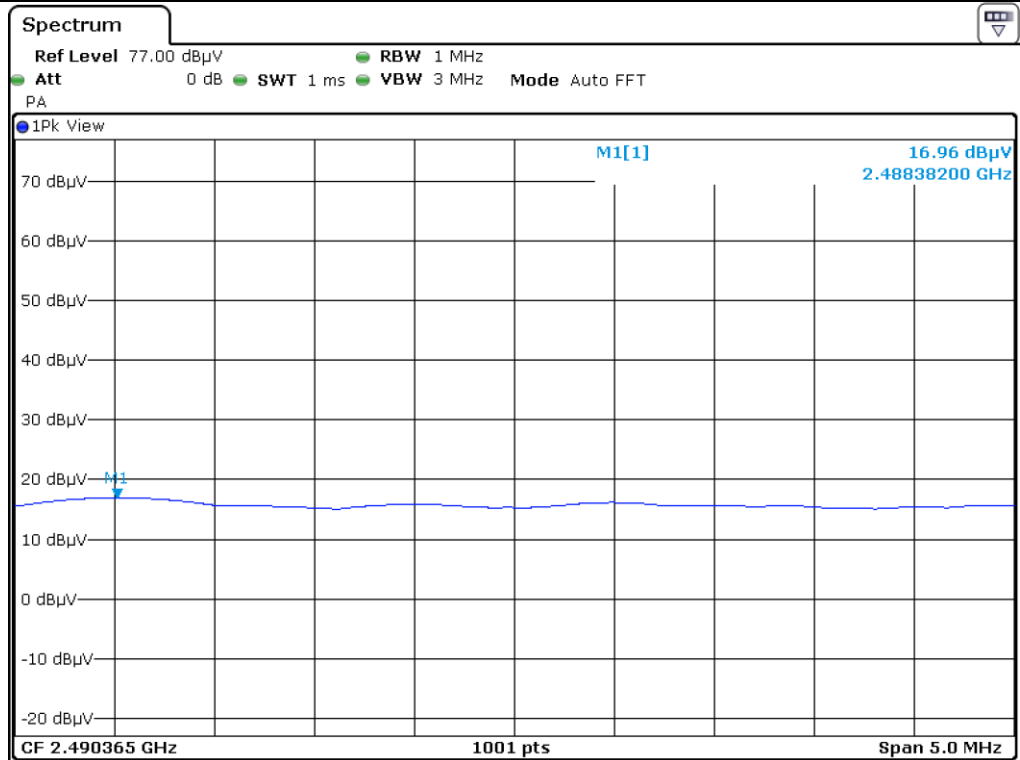
Low Channel_V_Average



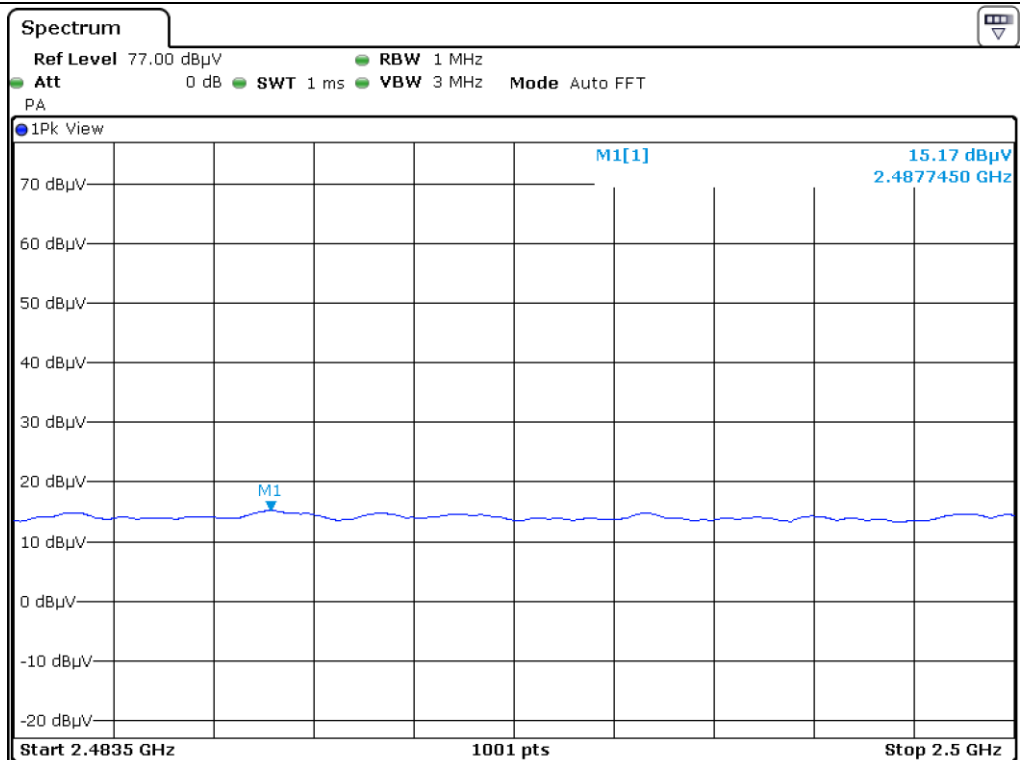
Low Channel_V_Average_Focus



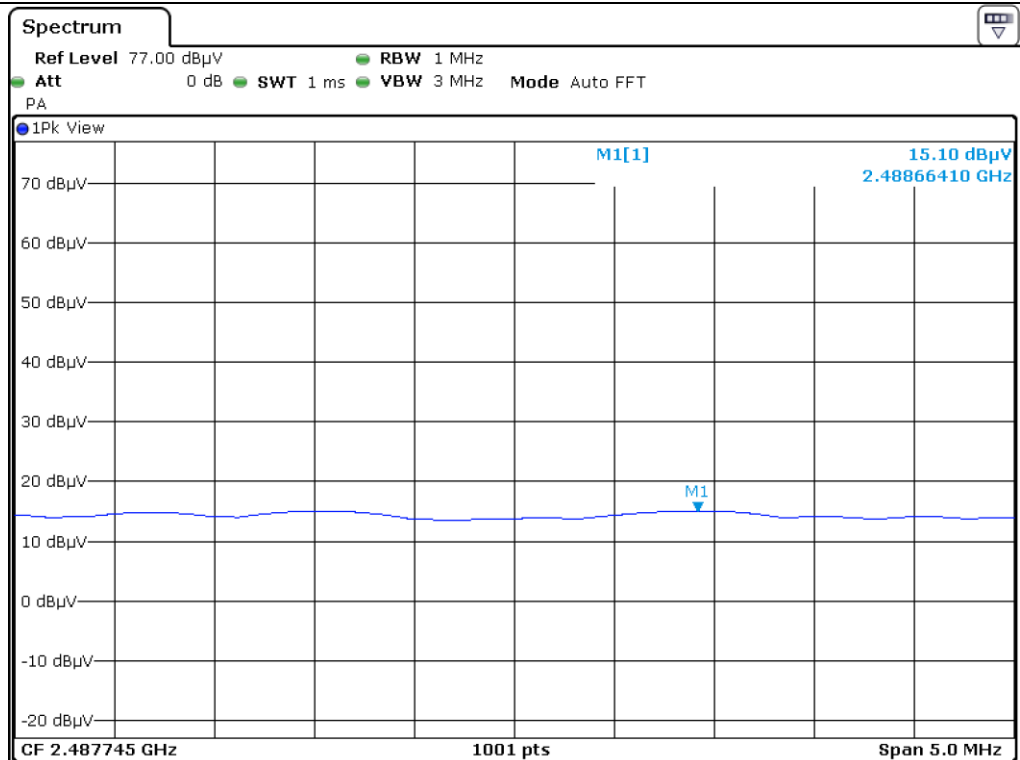
High Channel_H_Peak



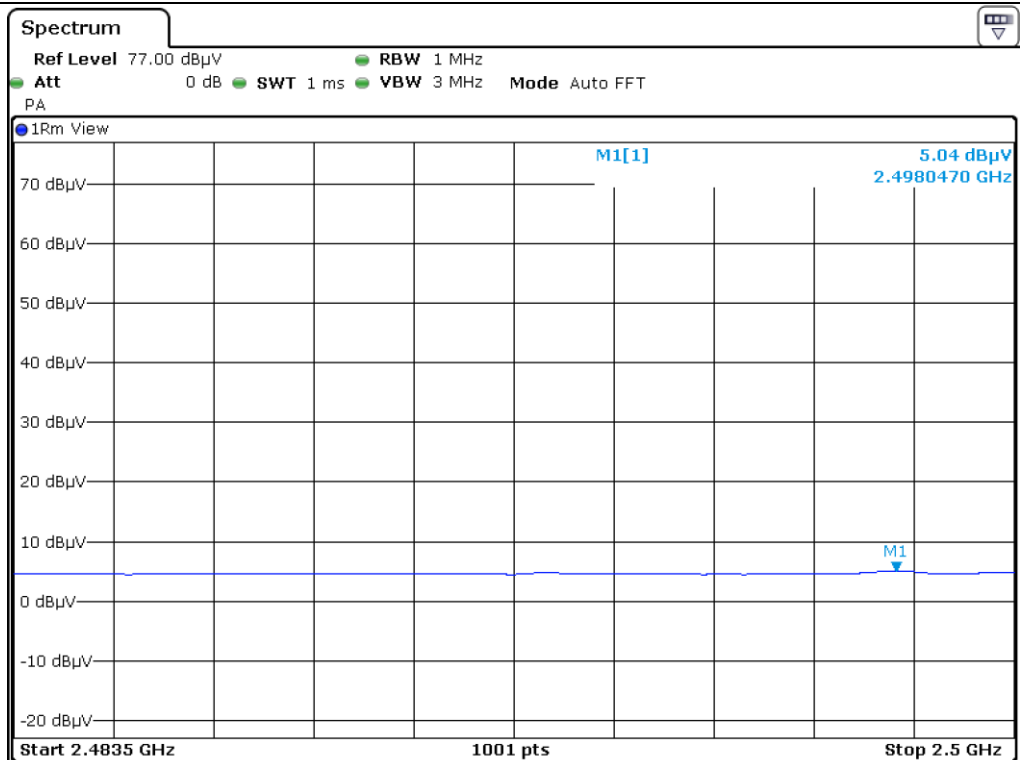
High Channel_H_Peak_Focus



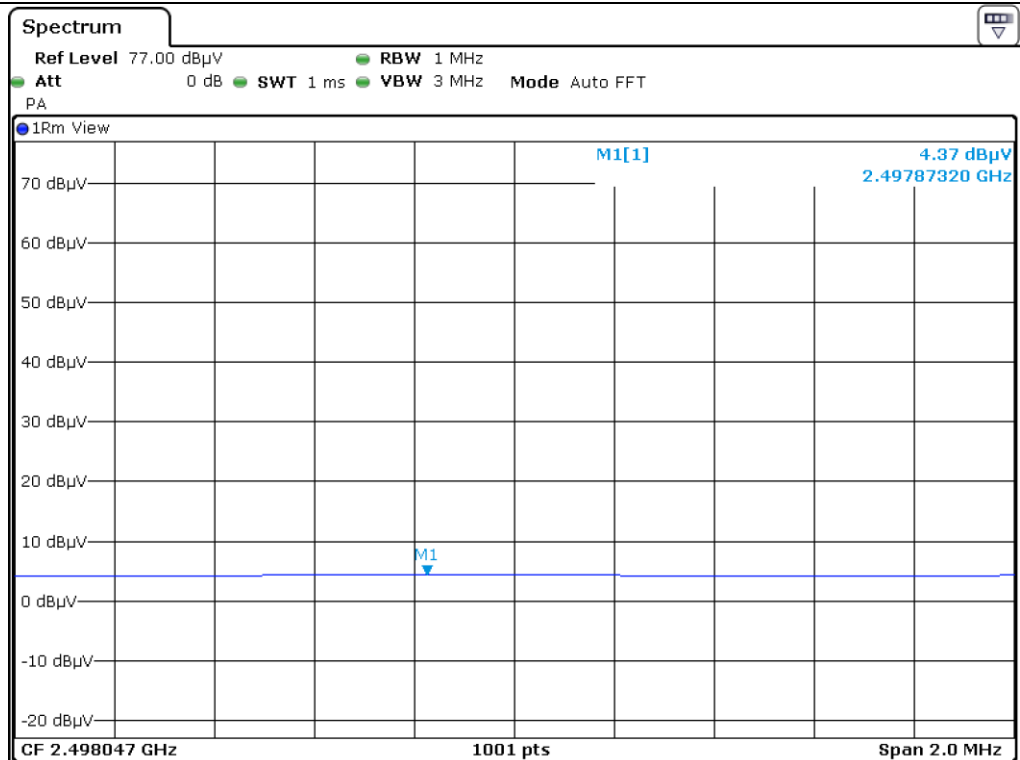
High Channel_V_Peak



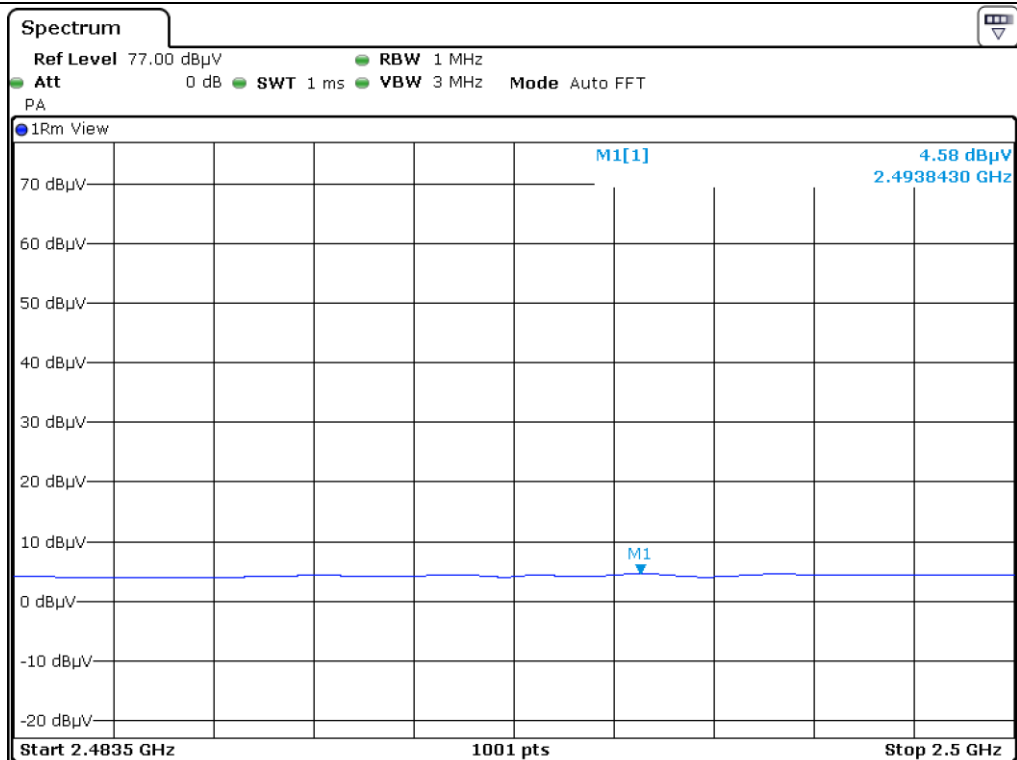
High Channel_V_Peak_Focus



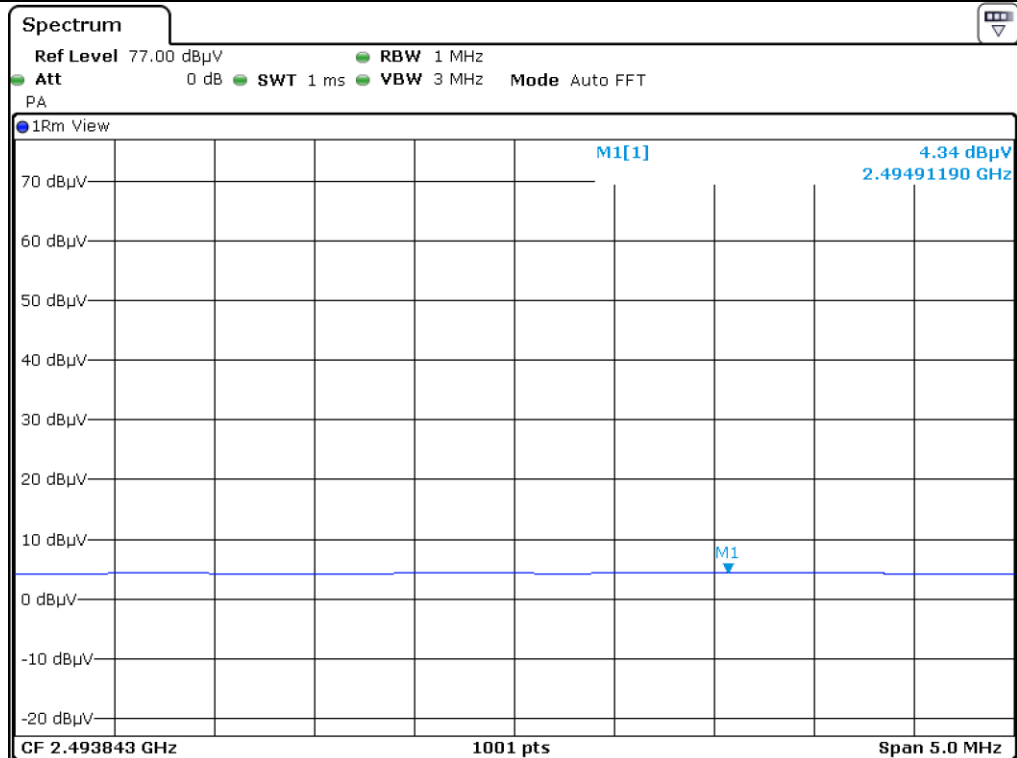
High Channel_H_Average



High Channel_H_Average_Focus



High Channel_V_Average



High Channel_V_Average_Focus

12.6.1.2 Test data for 2 Mbps

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Duty Cycle : 46.01 %
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 328.544	15.64	Peak	H	25.94	2.75	-	44.33	74.00	29.67
2 339.682	3.34	Average	H	25.94	2.75	3.37	35.40	54.00	18.60
2 324.531	15.67	Peak	V	25.94	2.75	-	44.36	74.00	29.64
2 385.045	4.18	Average	V	25.94	2.75	3.37	36.24	54.00	17.76
Test Data for High Channel									
2 488.377	16.27	Peak	H	26.47	2.39	-	45.13	74.00	28.87
2 497.853	3.52	Average	H	26.47	2.39	3.37	35.75	54.00	18.25
2 488.531	14.16	Peak	V	26.47	2.39	-	43.02	74.00	30.98
2 494.911	4.11	Average	V	26.47	2.39	3.37	36.34	54.00	17.66

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Margin(dB) = Limits(dBμV/m) – Total Level(dBμV/m)

Total Level = Reading + Ant. Factor + Cable Loss + Correction Factor



Tested by: Hyung-Kwon, Oh / Assistant Manager

12.6.1.3 Test data for 3 Mbps

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode
1 MHz and RMS Detector for Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Measurement distance : 3 m
- . Duty Cycle : 46.33 %
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 328.577	16.97	Peak	H	25.94	2.75	-	45.66	74.00	28.34
2 399.682	5.03	Average	H	25.94	2.75	3.34	37.06	54.00	16.94
2 324.631	16.09	Peak	V	25.94	2.75	-	44.78	74.00	29.22
2 385.077	3.89	Average	V	25.94	2.75	3.34	35.92	54.00	18.08
Test Data for High Channel									
2 488.352	16.16	Peak	H	26.47	2.39	-	45.02	74.00	28.98
2 497.853	3.85	Average	H	26.47	2.39	3.34	36.05	54.00	17.95
2 488.557	15.33	Peak	V	26.47	2.39	-	44.19	74.00	29.81
2 494.904	4.07	Average	V	26.47	2.39	3.34	36.27	54.00	17.73

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Margin(dB) = Limits(dBμV/m) – Total Level(dBμV/m)

Total Level = Reading + Ant. Factor + Cable Loss + Correction Factor



Tested by: Hyung-Kwon, Oh / Assistant Manager

12.6.2 Spurious & Harmonic Radiated Emission above 1 GHz

12.6.2.1 Test data for 1 Mbps

- Test Date : June 20, 2019 ~ June 26, 2019
- Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 3 MHz for Peak and Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Duty Cycle : 46.33 %
- Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
4 804.000	17.27	Peak	H	27.84	5.28	-	50.39	74.00	23.61
4 804.000	6.17	Average	H	27.84	5.28	3.34	42.63	54.00	11.37
4 804.000	17.12	Peak	V	27.84	5.28	-	50.24	74.00	23.76
4 804.000	6.21	Average	V	24.84	5.28	3.34	39.67	54.00	14.33
Test Data for Middle Channel									
4 882.000	17.05	Peak	H	27.01	5.42	-	49.48	74.00	24.52
4 882.000	6.19	Average	H	27.01	5.42	3.34	41.96	54.00	12.04
4 882.000	16.79	Peak	V	27.01	5.42	-	49.22	74.00	24.78
4 882.000	6.22	Average	V	27.01	5.42	3.34	41.99	54.00	12.01
Test Data for High Channel									
4 960.000	17.37	Peak	H	28.15	5.40	-	50.92	74.00	23.08
4 960.000	6.47	Average	H	28.15	5.40	3.34	43.36	54.00	10.64
4 960.000	17.25	Peak	V	28.15	5.40	-	50.80	74.00	23.20
4 960.000	6.54	Average	V	28.15	5.40	3.34	43.43	54.00	10.57

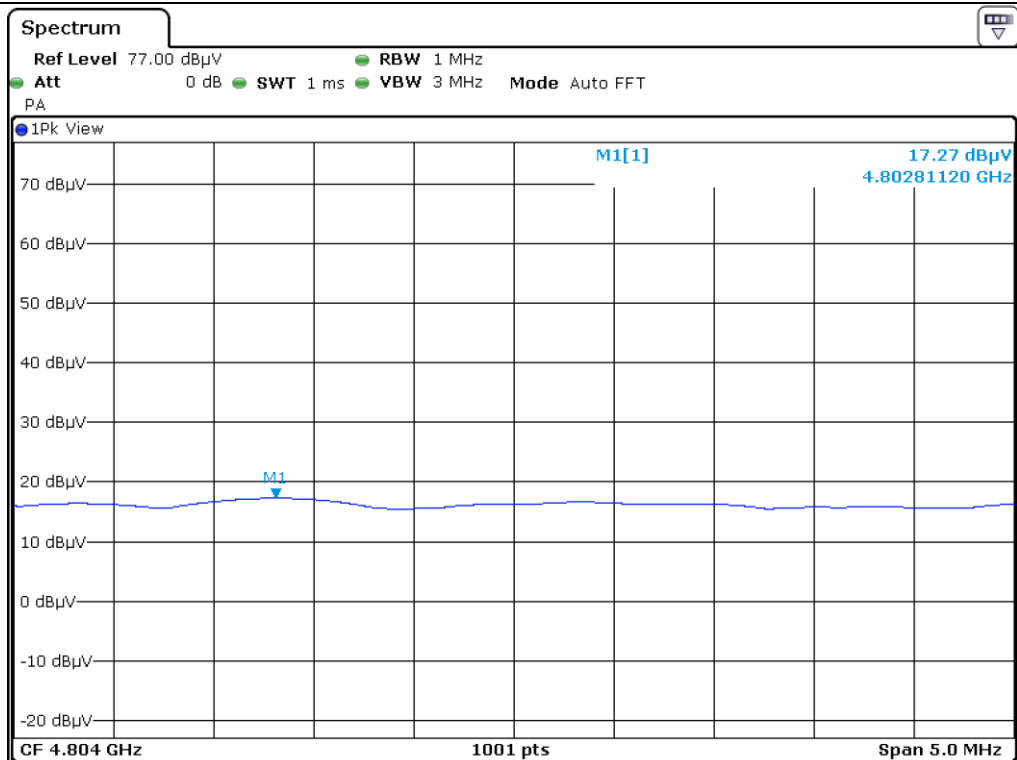
Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

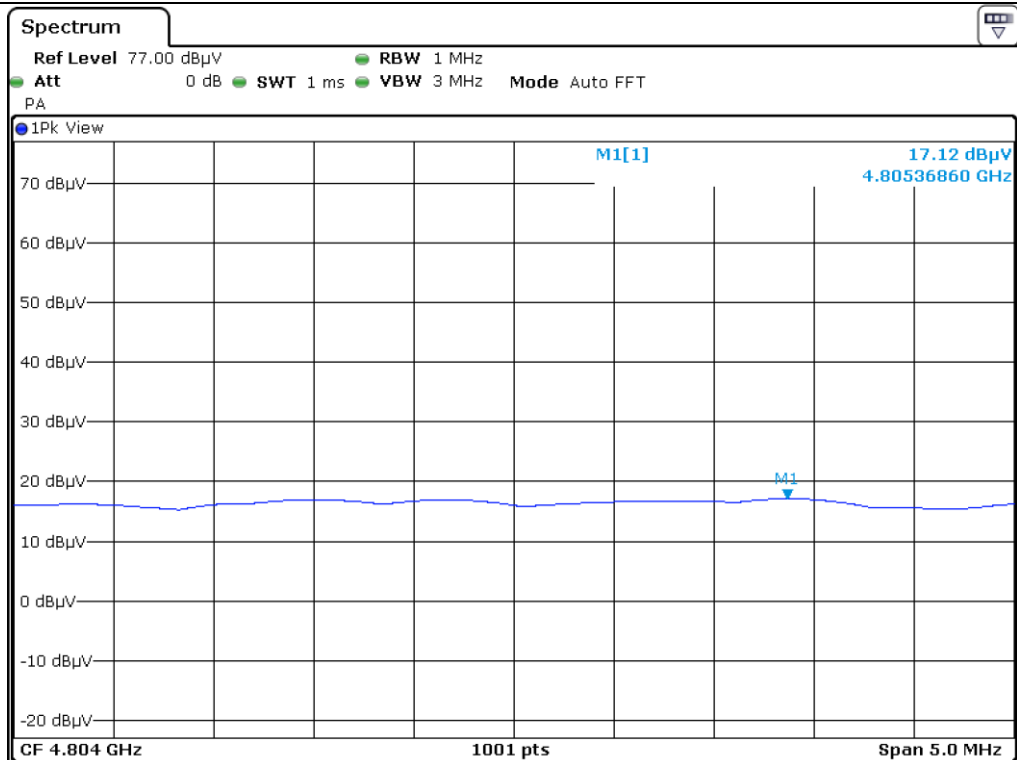
Margin(dB) = Limits(dBμV/m) – Total Level(dBμV/m)

Total Level = Reading + Ant. Factor + Cable Loss + Correction Factor

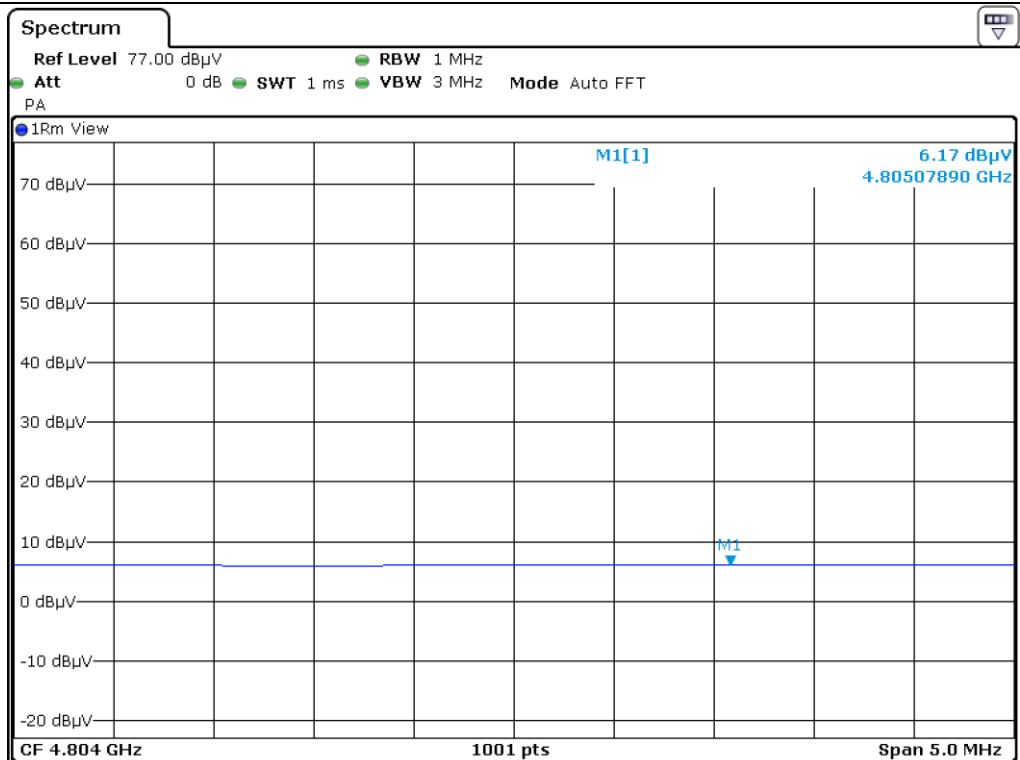

Tested by: Hyung-Kwon, Oh / Assistant Manager



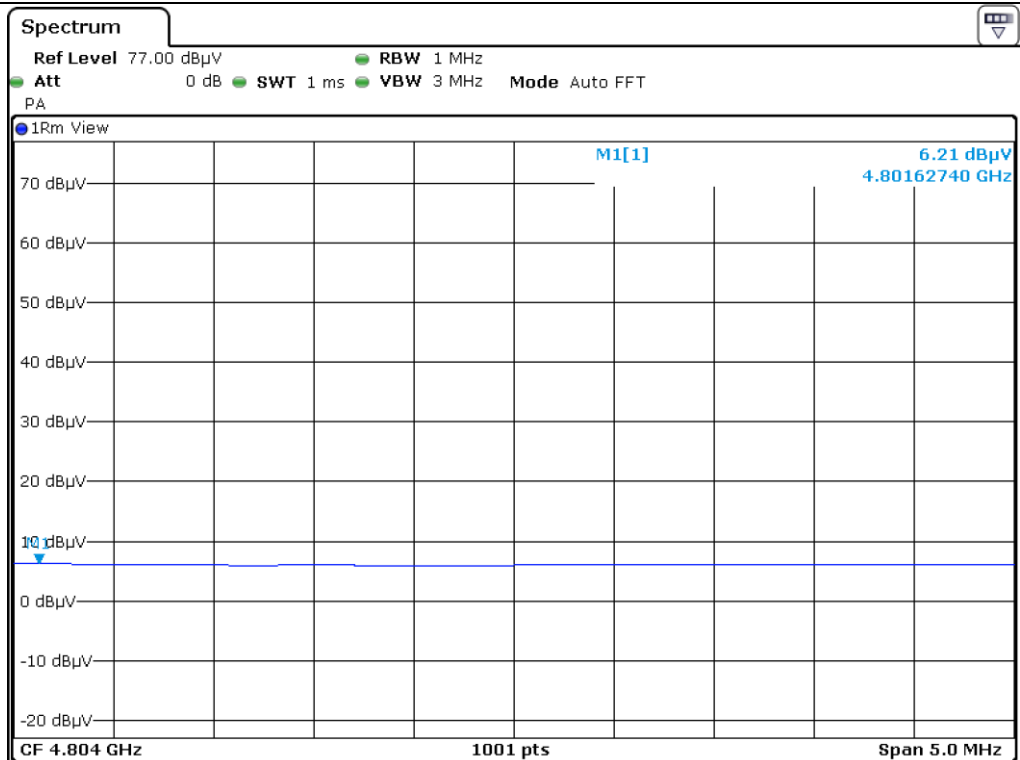
Low Channel_H_Peak



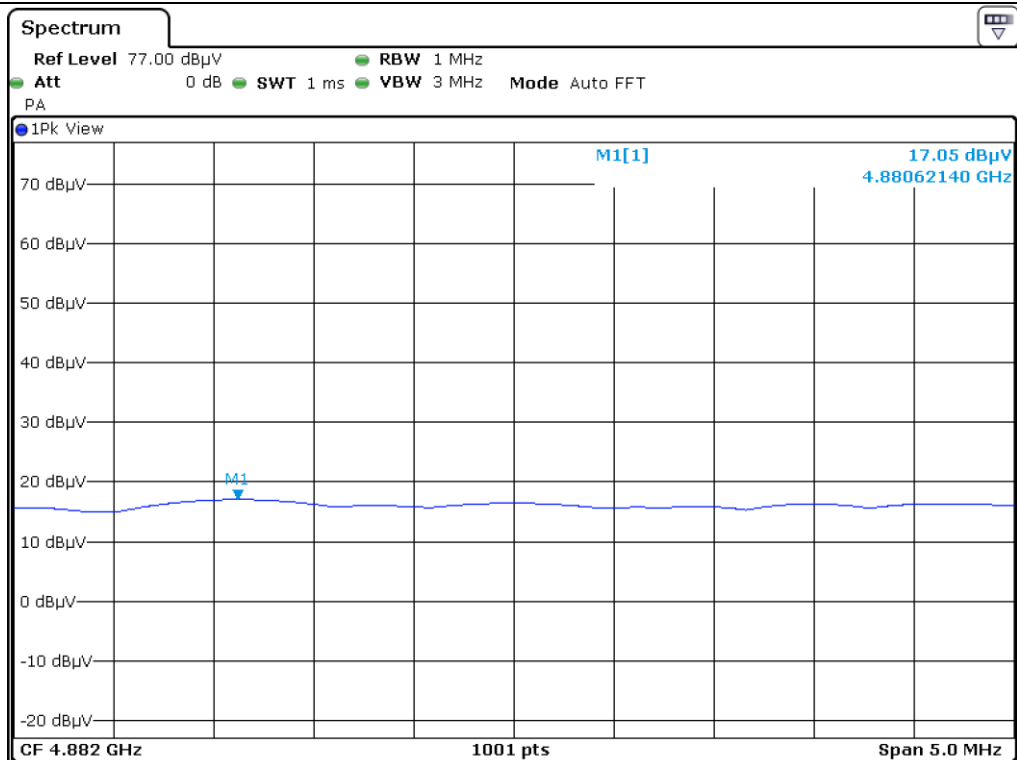
Low Channel_V_Peak



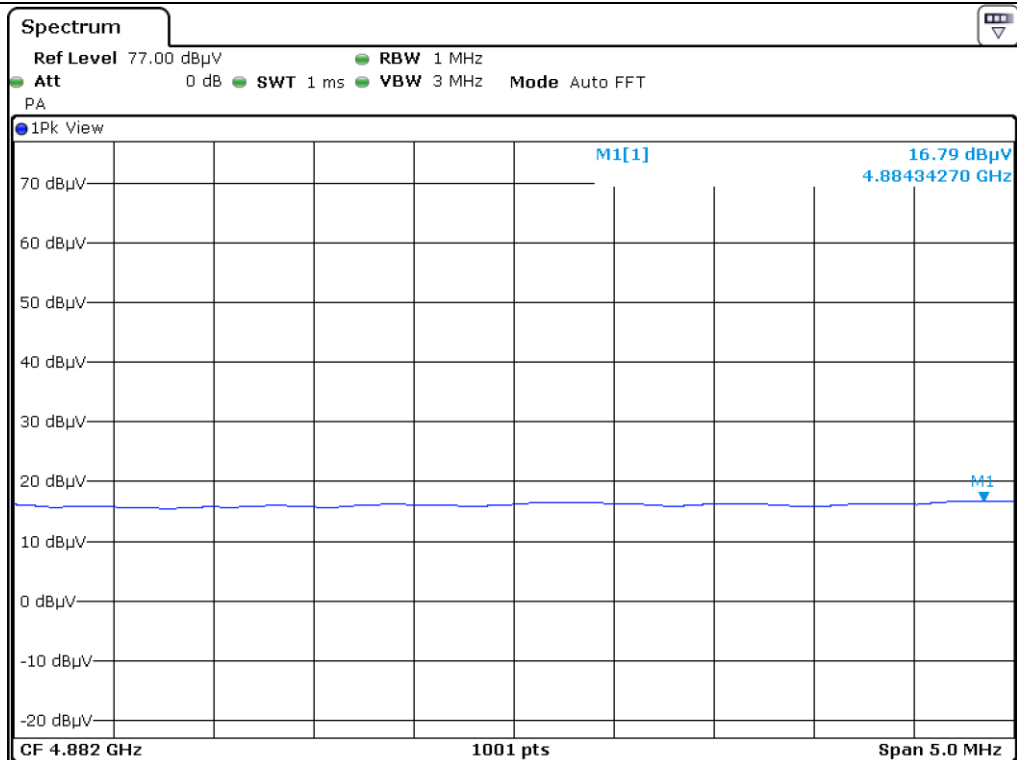
Low Channel_H_Average



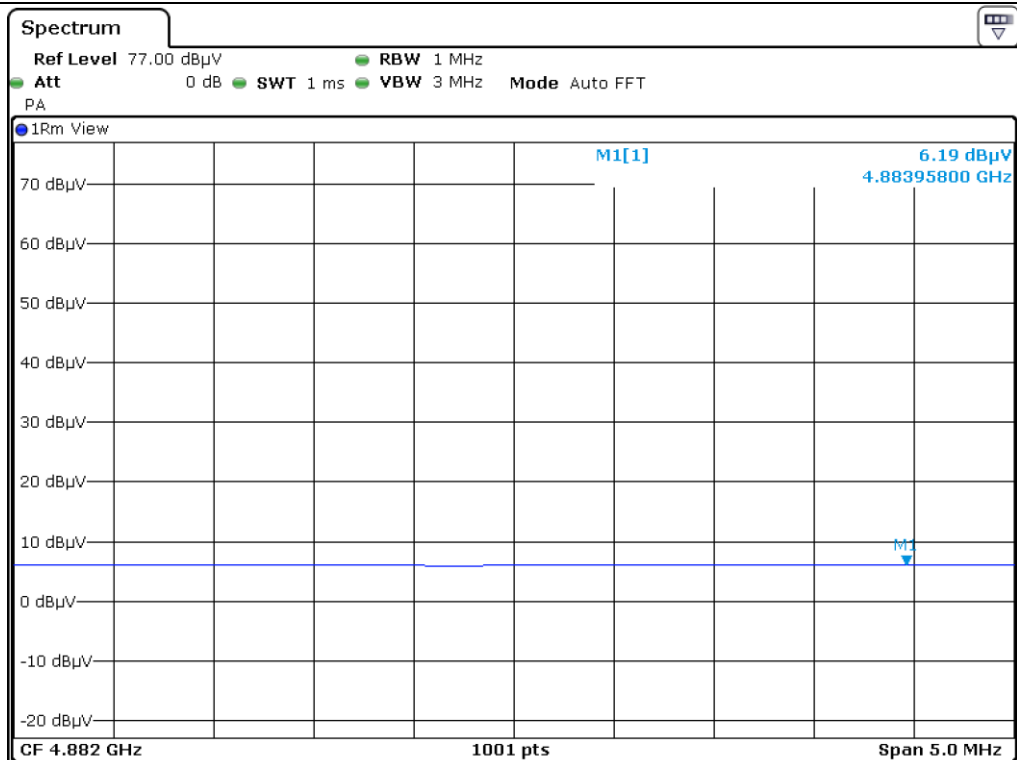
Low Channel_V_Average



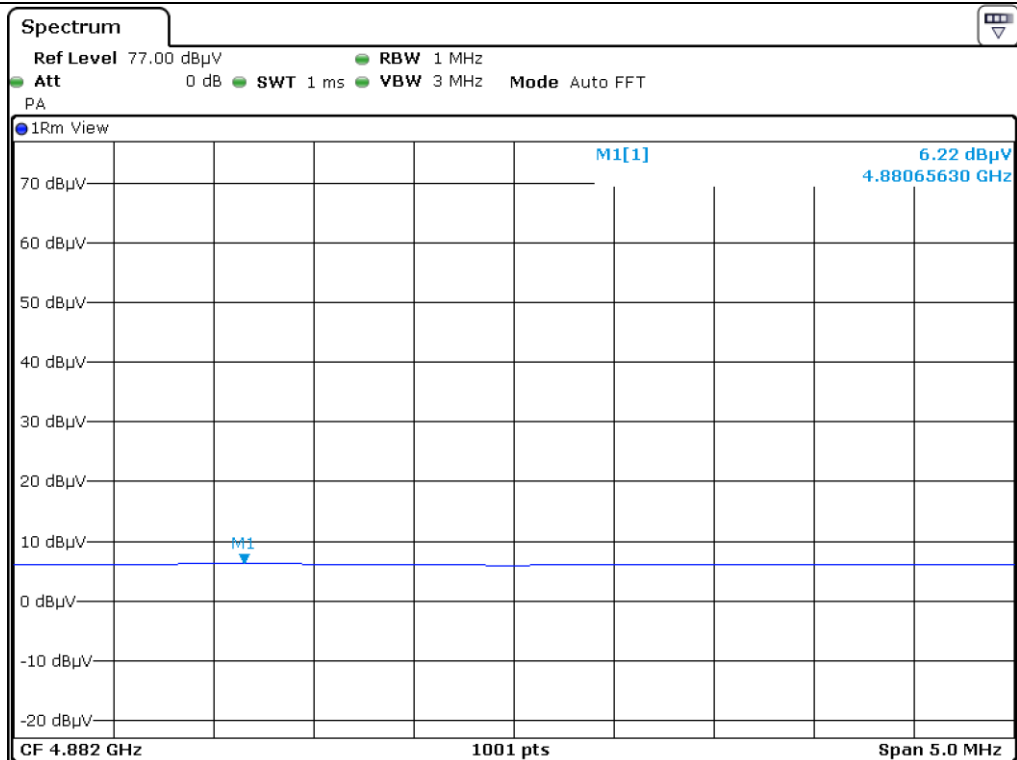
Middle Channel_H_Peak



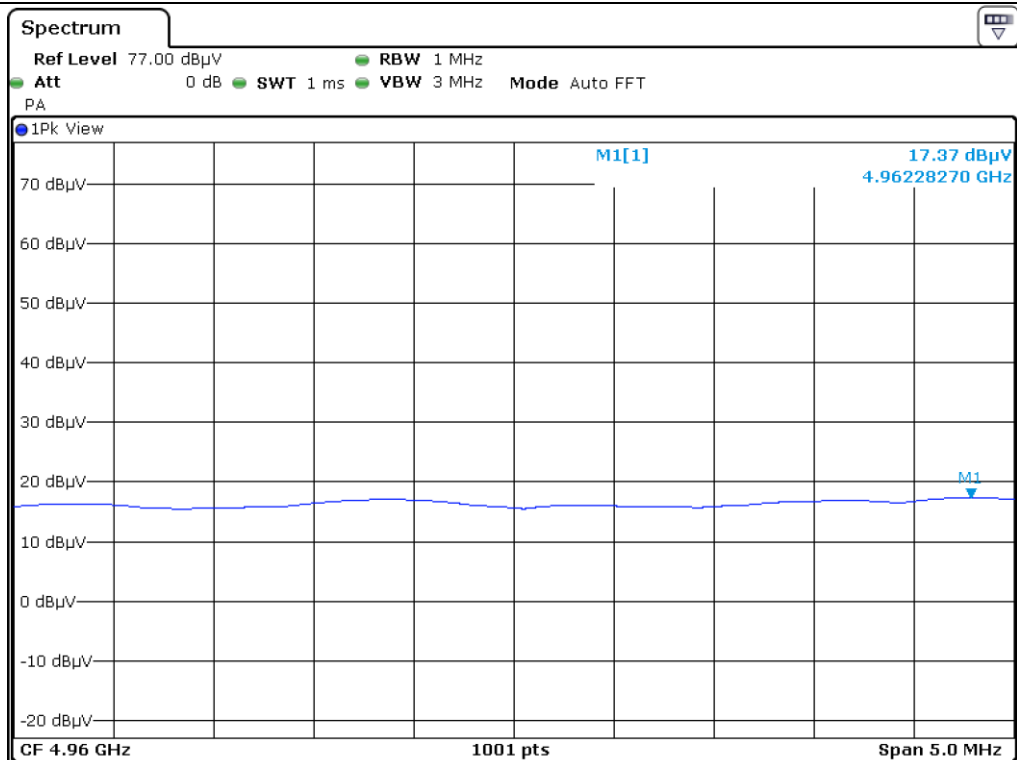
Middle Channel_V_Peak



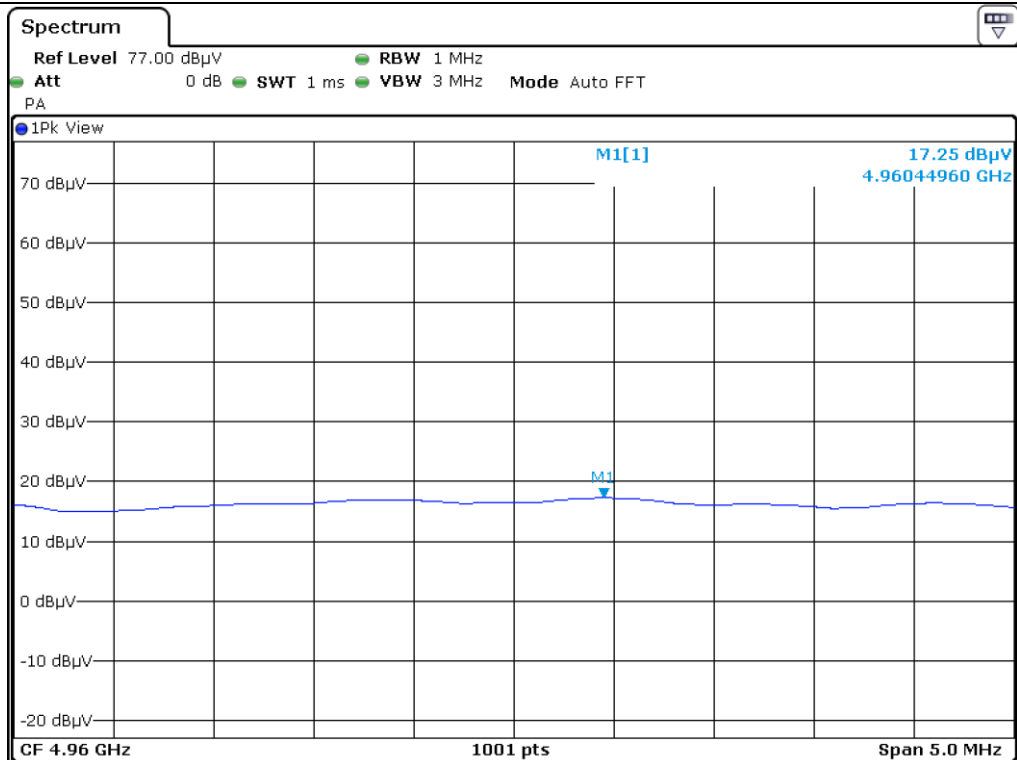
Middle Channel_H_Average



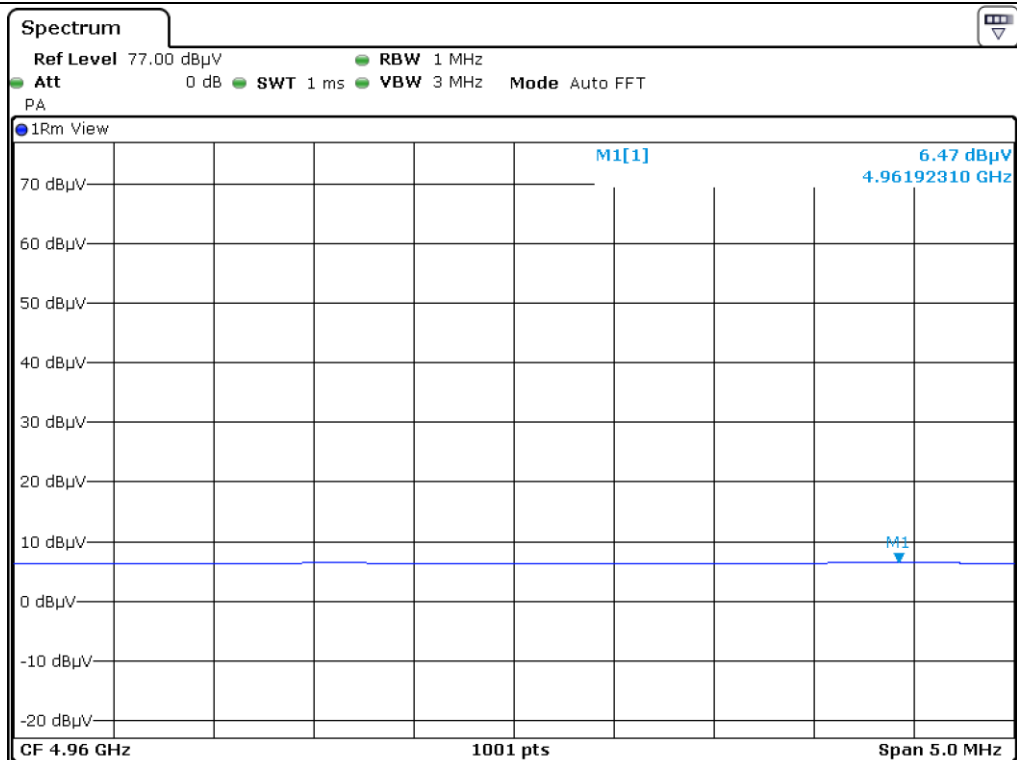
Middle Channel_V_Average



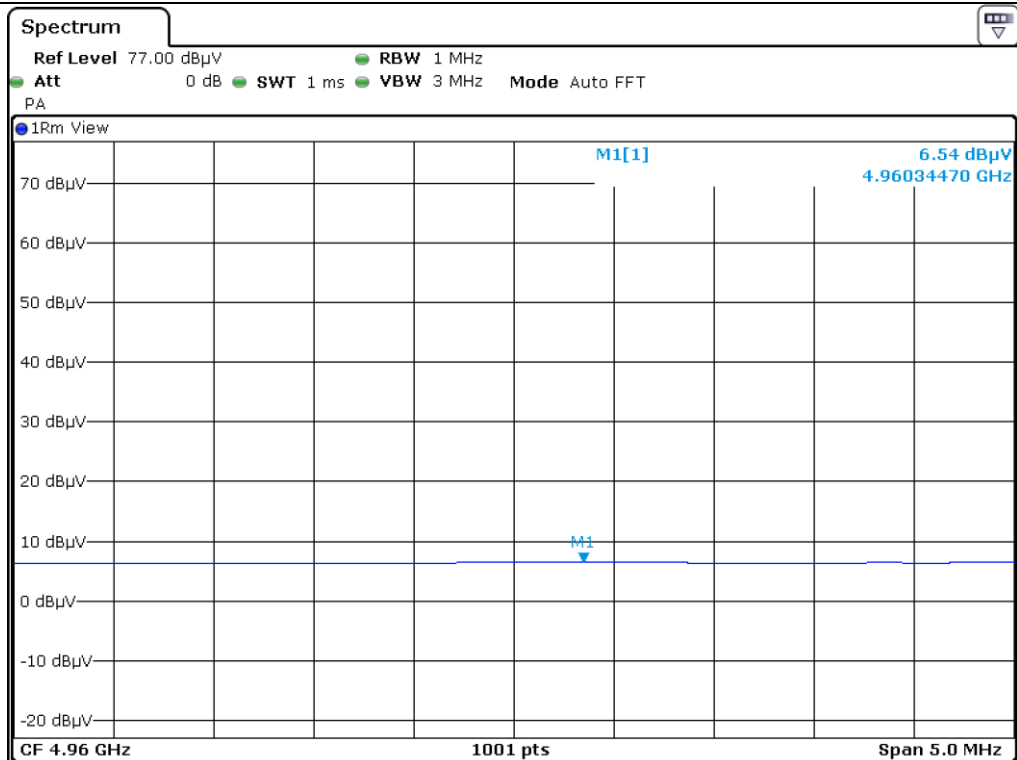
High Channel_H_Peak



High Channel_V_Peak



High Channel_H_Average



High Channel_V_Average

12.6.2.2 Test data for 2 Mbps

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Duty Cycle : 46.01 %
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
4 804.000	17.16	Peak	H	27.84	5.28	-	50.28	74.00	23.72
4 804.000	6.03	Average	H	27.84	5.28	3.37	42.52	54.00	11.48
4 804.000	17.36	Peak	V	27.84	5.28	-	50.48	74.00	23.52
4 804.000	5.95	Average	V	24.84	5.28	3.37	39.44	54.00	14.56
Test Data for Middle Channel									
4 882.000	16.20	Peak	H	27.01	5.42	-	48.63	74.00	25.37
4 882.000	5.33	Average	H	27.01	5.42	3.37	41.13	54.00	12.87
4 882.000	16.72	Peak	V	27.01	5.42	-	49.15	74.00	24.85
4 882.000	6.57	Average	V	27.01	5.42	3.37	42.37	54.00	11.63
Test Data for High Channel									
4 960.000	16.63	Peak	H	28.15	5.40	-	50.18	74.00	23.82
4 960.000	7.29	Average	H	28.15	5.40	3.37	44.21	54.00	9.79
4 960.000	16.54	Peak	V	28.15	5.40	-	50.09	74.00	23.91
4 960.000	6.36	Average	V	28.15	5.40	3.37	43.28	54.00	10.72

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Margin(dB) = Limits(dBμV/m) – Total Level(dBμV/m)

Total Level = Reading + Ant. Factor + Cable Loss + Correction Factor

Tested by: Hyung-Kwon, Oh / Assistant Manager

12.6.2.3 Test data for 3 Mbps

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 1 MHz and Peak Detector for Peak Mode for the emissions fall in restricted band,
1 MHz and RMS Detector for Average Mode for the emissions fall in restricted band
100 kHz for Peak Mode for the emissions outside restricted band
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Duty Cycle : 46.33 %
- . Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Correction Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
4 804.000	17.04	Peak	H	27.84	5.28	-	50.16	74.00	23.84
4 804.000	6.96	Average	H	27.84	5.28	3.34	43.42	54.00	10.58
4 804.000	17.56	Peak	V	27.84	5.28	-	50.68	74.00	23.32
4 804.000	6.01	Average	V	24.84	5.28	3.34	39.47	54.00	14.53
Test Data for Middle Channel									
4 882.000	17.06	Peak	H	27.01	5.42	-	49.49	74.00	24.51
4 882.000	6.98	Average	H	27.01	5.42	3.34	42.75	54.00	11.25
4 882.000	16.14	Peak	V	27.01	5.42	-	48.57	74.00	25.43
4 882.000	5.44	Average	V	27.01	5.42	3.34	41.21	54.00	12.79
Test Data for High Channel									
4 960.000	17.72	Peak	H	28.15	5.40	-	51.27	74.00	22.73
4 960.000	6.33	Average	H	28.15	5.40	3.34	43.22	54.00	10.78
4 960.000	17.60	Peak	V	28.15	5.40	-	51.15	74.00	22.85
4 960.000	6.18	Average	V	28.15	5.40	3.34	43.07	54.00	10.93

Tabulated test data for Restricted Band

Remark: "H": Horizontal, "V": Vertical

Margin(dB) = Limits(dBμV/m) – Total Level(dBμV/m)

Total Level = Reading + Ant. Factor + Cable Loss + Correction Factor


Tested by: Hyung-Kwon, Oh / Assistant Manager

13. RADIATED EMISSION TEST

13.1 Operating environment

Temperature : 25 °C
Relative humidity : 46 % R.H.

13.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

13.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 28, 2019 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Mar. 18, 2019 (1Y)
■ -	BBV 9718B	Schwarzbeck	Amplifier	009	Mar. 20, 2019 (1Y)
■	SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Mar. 11, 2019 (1Y)
■ -	DT3000-3t	Innco System	Turn Table	DT3000/093	N/A
■ -	MA-4000XPET	Innco System	Antenna Master	MA4000/509	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Apr. 13, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

13.5 Test data for Bluetooth

13.5.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 44 % R.H.

Temperature: 25 °C

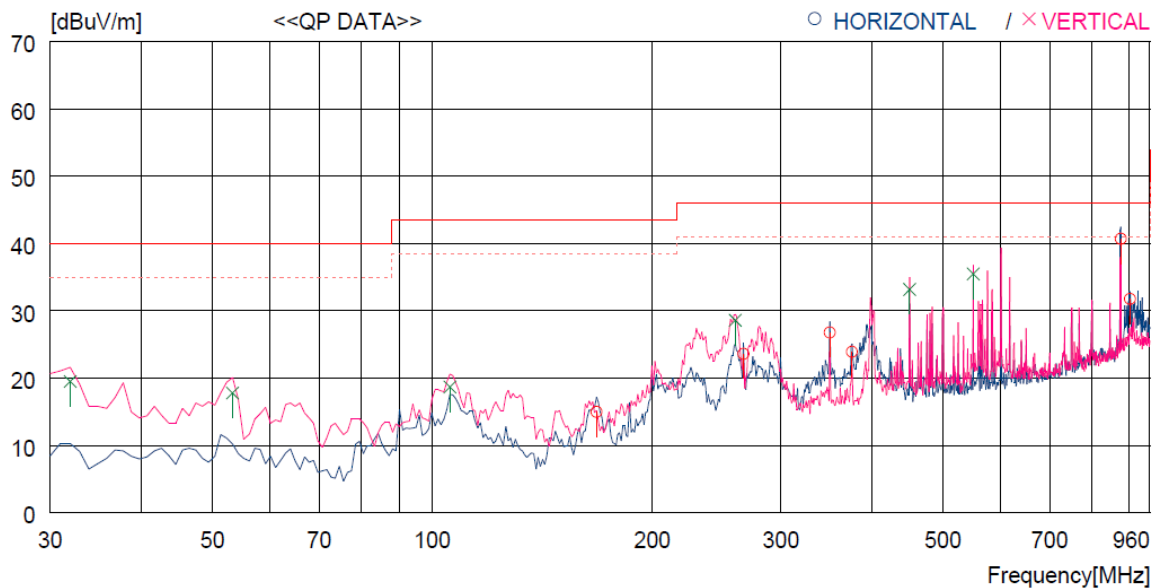
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT EUT : Wireless module

Date: June 20, 2019 ~ June 26, 2019

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QF	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	167.740	35.8	8.8	3.4	33.0	15.0	43.5	28.5	100	259
2	266.680	40.2	12.3	4.2	33.1	23.6	46.0	22.4	100	359
3	350.100	39.8	15.2	4.9	33.1	26.8	46.0	19.2	100	359
4	375.320	37.1	15.0	5.0	33.2	23.9	46.0	22.1	100	359
5	875.830	44.1	21.5	7.9	32.8	40.7	46.0	5.3	100	185
6	902.019	33.9	22.5	8.0	32.6	31.8	46.0	14.2	100	194
----- Vertical -----										
7	31.940	39.5	11.7	1.4	33.1	19.5	40.0	20.5	100	6
8	53.280	35.2	13.8	1.9	33.1	17.8	40.0	22.2	100	0
9	105.660	37.1	11.9	2.7	33.0	18.7	43.5	24.8	100	0
10	259.890	45.3	12.2	4.2	33.1	28.6	46.0	17.4	100	0
11	450.011	44.5	16.4	5.5	33.2	33.2	46.0	12.8	100	149
12	549.919	45.2	17.5	6.1	33.3	35.5	46.0	10.5	100	197

Tested by: Hyung-Kwon, Oh / Assistant Manager

13.5.2 Test data for Below 30 MHz

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

13.5.3 Test data for above 1 GHz

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Hyung-Kwon, Oh / Assistant Manager

13.6 Test data for WLAN 2.4 GHz + Bluetooth

13.6.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 44 % R.H.

Temperature: 25 °C

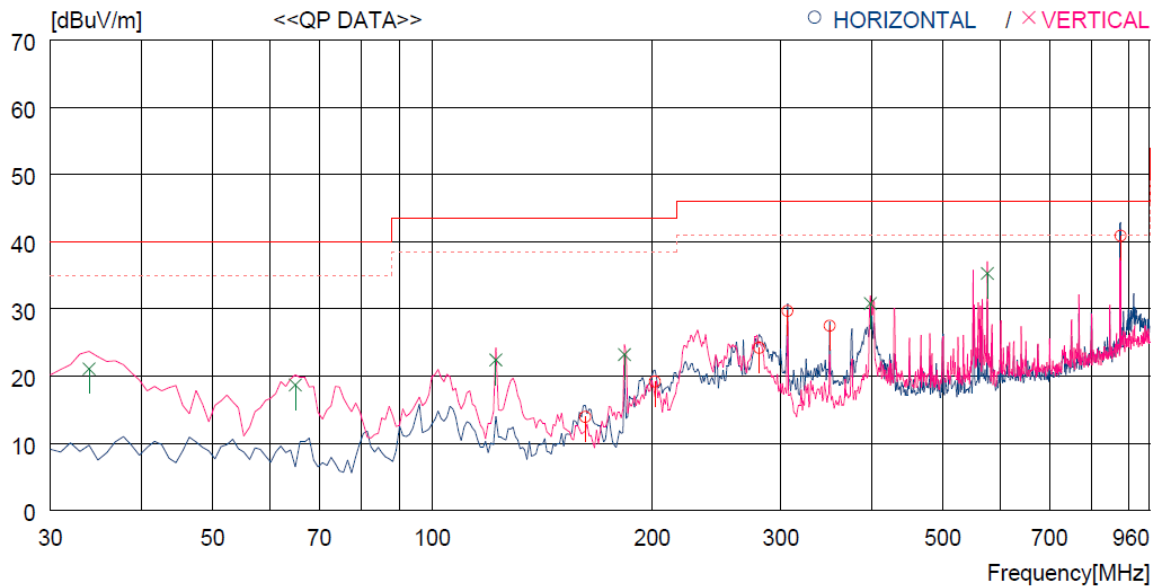
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT EUT : Wireless module

Date: June 20, 2019 ~ June 26, 2019

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	161.920	35.1	8.5	3.3	33.0	13.9	43.5	29.6	100	248
2	201.690	38.2	10.5	3.7	33.2	19.2	43.5	24.3	100	192
3	280.260	40.9	12.0	4.3	33.0	24.2	46.0	21.8	100	248
4	306.450	44.7	13.4	4.6	33.0	29.7	46.0	16.3	100	223
5	350.100	40.5	15.2	4.9	33.1	27.5	46.0	18.5	100	331
6	875.830	44.3	21.5	7.9	32.8	40.9	46.0	5.1	100	192
----- Vertical -----										
7	33.880	40.6	12.1	1.5	33.1	21.1	40.0	18.9	100	0
8	64.920	38.2	11.5	2.1	33.1	18.7	40.0	21.3	100	0
9	122.150	42.7	9.8	2.9	33.0	22.4	43.5	21.1	100	0
10	183.260	43.0	9.8	3.5	33.1	23.2	43.5	20.3	100	0
11	397.630	42.8	16.0	5.2	33.2	30.8	46.0	15.2	100	0
12	575.139	44.2	18.1	6.3	33.3	35.3	46.0	10.7	100	0

Tested by: Hyung-Kwon, Oh / Assistant Manager

13.6.2 Test data for Below 30 MHz

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									

13.6.3 Test data for above 1 GHz

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									


 Tested by: Hyung-Kwon, Oh / Assistant Manager

13.7 Test data for WLAN 5 GHz + Bluetooth

13.7.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 44 % R.H.

Temperature: 25 °C

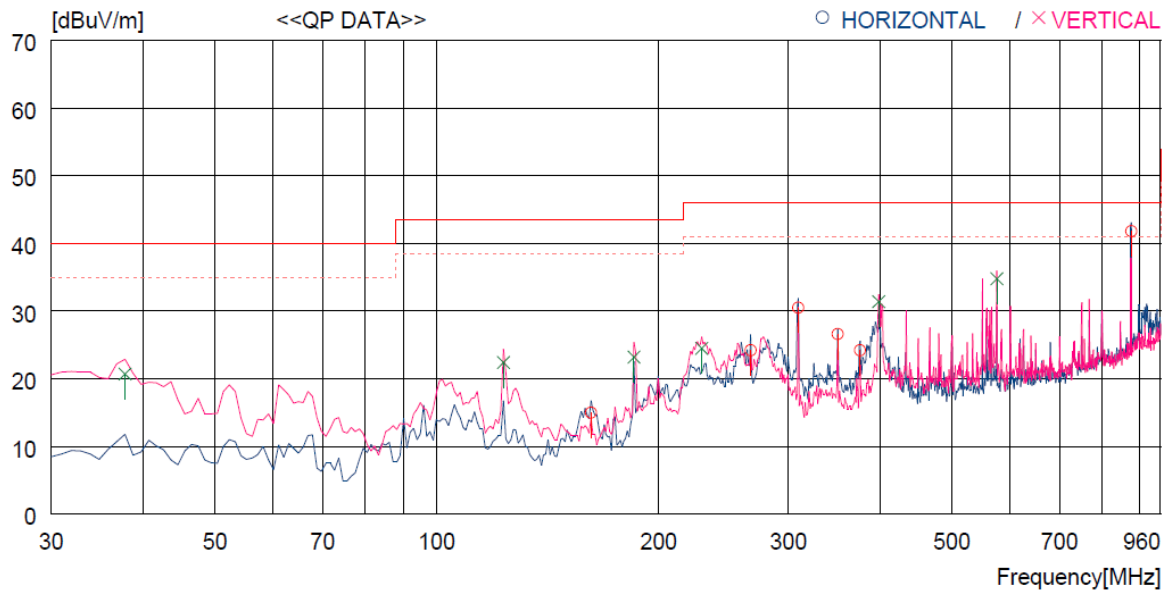
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT EUT : Wireless module

Date: June 20, 2019 ~ June 26, 2019

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QF	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	161.920	36.2	8.8	3.0	33.0	15.0	43.5	28.5	100	359
2	266.680	40.5	12.9	3.8	33.0	24.2	46.0	21.8	100	188
3	309.360	45.8	13.7	4.0	33.0	30.5	46.0	15.5	100	359
4	350.100	40.4	14.8	4.4	33.0	26.6	46.0	19.4	100	359
5	375.320	37.4	15.3	4.5	33.0	24.2	46.0	21.8	100	204
6	875.830	45.3	22.1	7.0	32.6	41.8	46.0	4.2	100	188
----- Vertical -----										
7	37.760	38.5	13.8	1.5	33.1	20.7	40.0	19.3	100	197
8	123.120	42.9	10.0	2.5	33.0	22.4	43.5	21.1	100	139
9	185.200	42.6	10.4	3.2	33.0	23.2	43.5	20.3	100	31
10	228.850	42.1	11.8	3.5	32.9	24.5	46.0	21.5	100	0
11	397.630	44.1	15.8	4.6	33.1	31.4	46.0	14.6	100	0
12	575.139	43.6	19.0	5.5	33.3	34.8	46.0	11.2	100	0

Tested by: Hyung-Kwon, Oh / Assistant Manager

13.7.2 Test data for Below 30 MHz

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

13.7.3 Test data for above 1 GHz

- . Test Date : June 20, 2019 ~ June 26, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Frequency range : 1 GHz ~ 26.5 GHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									



 Tested by: Hyung-Kwon, Oh / Assistant Manager

14. CONDUCTED EMISSION TEST

14.1 Operating environment

Temperature : 25 °C
Relative humidity : 44 % R.H.

14.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μ H + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

14.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Oct. 22, 2018 (1Y)
□ -	NSLK8128	Schwarzbeck	AMN	8128-216	Mar. 20, 2019 (1Y)
■ -	NSLK8126	Schwarzbeck	AMN	8126-404	Mar. 19, 2019 (1Y)
□ -	3825/2	EMCO	AMN	9109-1869	Mar. 19, 2019 (1Y)
■ -	3825/2	EMCO	AMN	9109-1867	Mar. 27, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

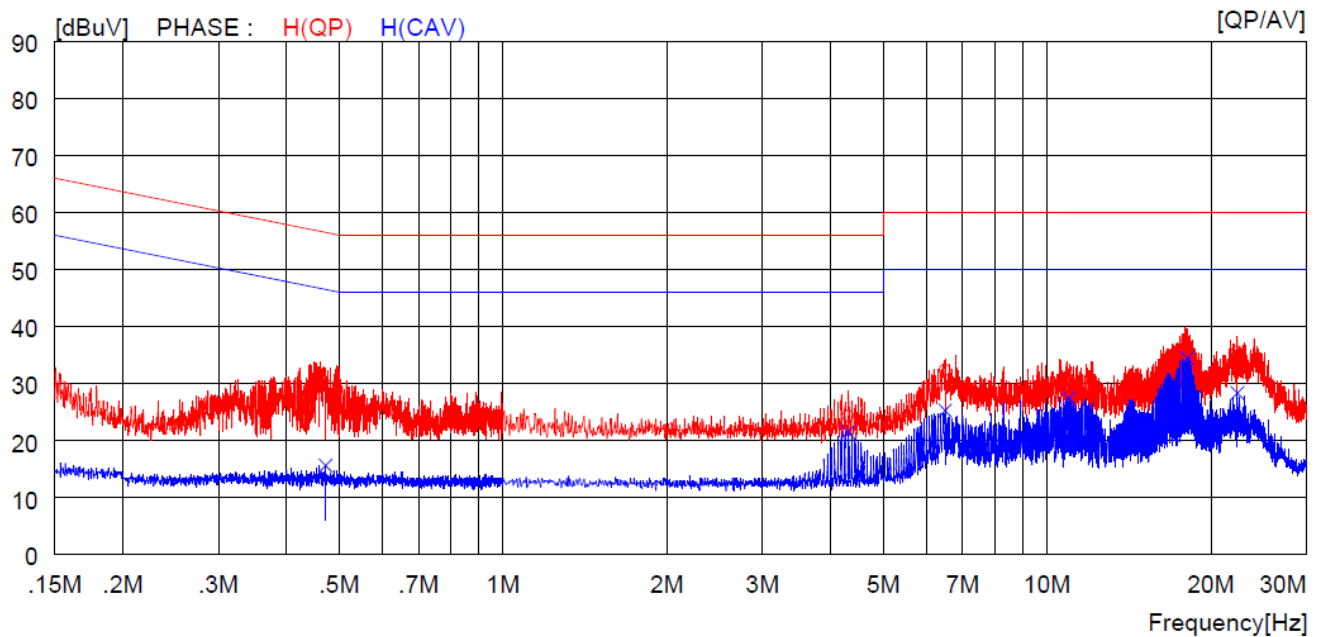
14.4 Test data

-. Test Date : June 20, 2019 ~ June 26, 2019

-. Resolution bandwidth : 9 kHz

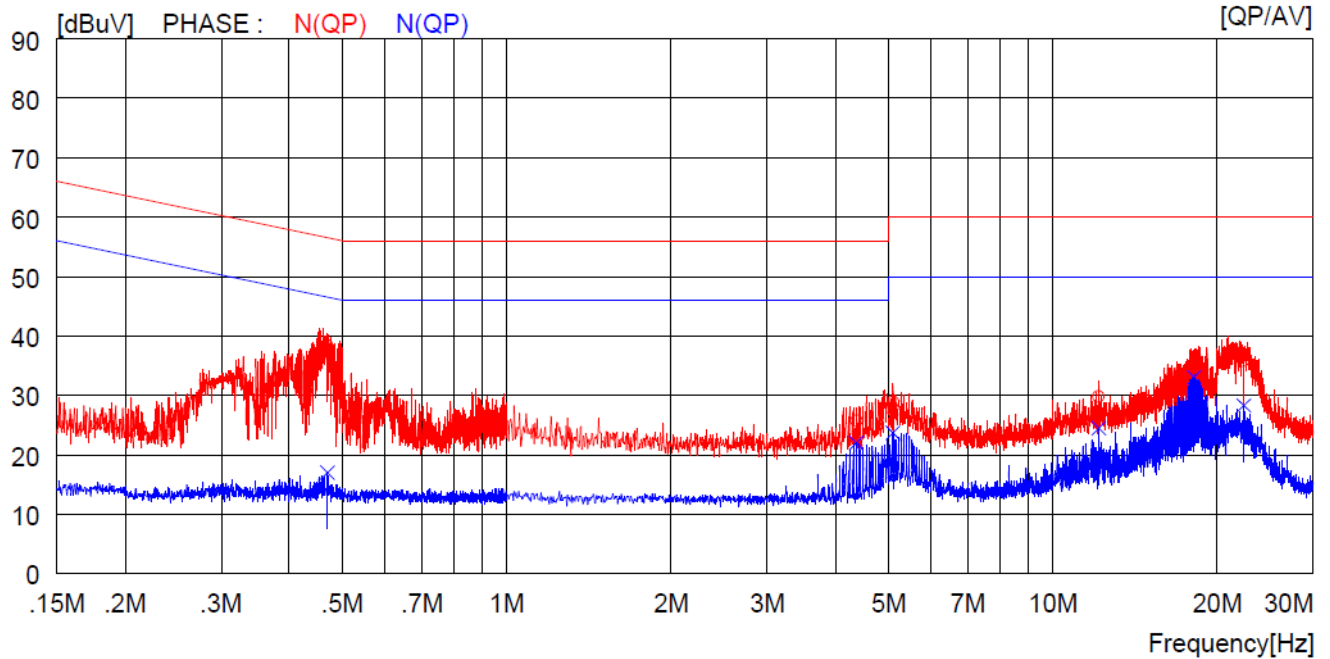
-. Frequency range : 0.15 MHz ~ 30 MHz

-. Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.47200	19.8	----	10.0	29.8	----	56.5	----	26.7	----	H (QP)
2	4.30800	14.2	----	10.1	24.3	----	56.0	----	31.7	----	H (QP)
3	6.49500	22.2	----	10.2	32.4	----	60.0	----	27.6	----	H (QP)
4	10.98000	20.0	----	10.4	30.4	----	60.0	----	29.6	----	H (QP)
5	18.09000	25.7	----	10.6	36.3	----	60.0	----	23.7	----	H (QP)
6	22.37000	24.9	----	10.7	35.6	----	60.0	----	24.4	----	H (QP)
7	0.47200	----	5.6	10.0	----	15.6	----	46.5	----	30.9	H (CAV)
8	4.30800	----	11.4	10.1	----	21.5	----	46.0	----	24.5	H (CAV)
9	6.49500	----	15.1	10.2	----	25.3	----	50.0	----	24.7	H (CAV)
10	10.98000	----	17.0	10.4	----	27.4	----	50.0	----	22.6	H (CAV)
11	18.09000	----	23.9	10.6	----	34.5	----	50.0	----	15.5	H (CAV)
12	22.37000	----	17.7	10.7	----	28.4	----	50.0	----	21.6	H (CAV)

-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C.FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.46900	28.4	----	10.0	38.4	----	56.5	----	18.1	----	N (QP)
2	4.37200	15.6	----	10.1	25.7	----	56.0	----	30.3	----	N (QP)
3	5.10000	18.7	----	10.2	28.9	----	60.0	----	31.1	----	N (QP)
4	12.14000	19.3	----	10.5	29.8	----	60.0	----	30.2	----	N (QP)
5	18.15000	23.5	----	10.6	34.1	----	60.0	----	25.9	----	N (QP)
6	22.37000	25.1	----	10.7	35.8	----	60.0	----	24.2	----	N (QP)
7	0.46900	----	7.0	10.0	----	17.0	----	46.5	----	29.5	N (CAV)
8	4.37200	----	11.9	10.1	----	22.0	----	46.0	----	24.0	N (CAV)
9	5.10000	----	13.5	10.2	----	23.7	----	50.0	----	26.3	N (CAV)
10	12.14000	----	14.0	10.5	----	24.5	----	50.0	----	25.5	N (CAV)
11	18.15000	----	22.4	10.6	----	33.0	----	50.0	----	17.0	N (CAV)
12	22.37000	----	17.6	10.7	----	28.3	----	50.0	----	21.7	N (CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.

Tested by: Hyung-Kwon, Oh / Assistant Manager