

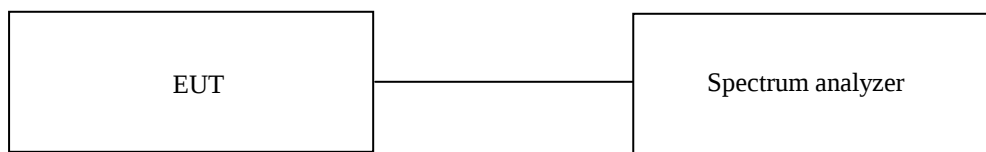
9. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

9.1 Operating environment

Temperature : 24.3 °C
Relative humidity : 43.9 % R.H.

9.2 Test set-up for conducted measurement

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, the video bandwidth is set to 3 times the resolution bandwidth and peak detection was used.



9.3 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.

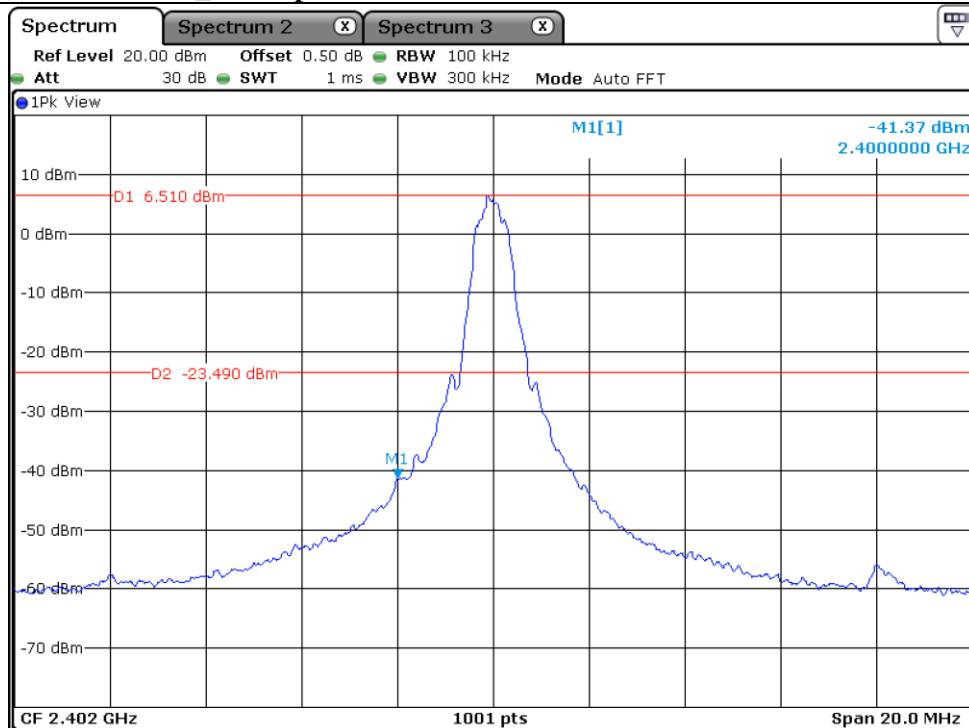
9.4 Test equipment used

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	312545	Mar. 18, 2019 (1Y)
■ - BBV9718	Schwarzbeck	Amplifier	310	Mar. 28, 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)
■ - BBHA 9120D	Schwarzbeck	Horn Antenna	9120D-1366	Aug. 02, 2017 (2Y)
■ - BBHA 9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)

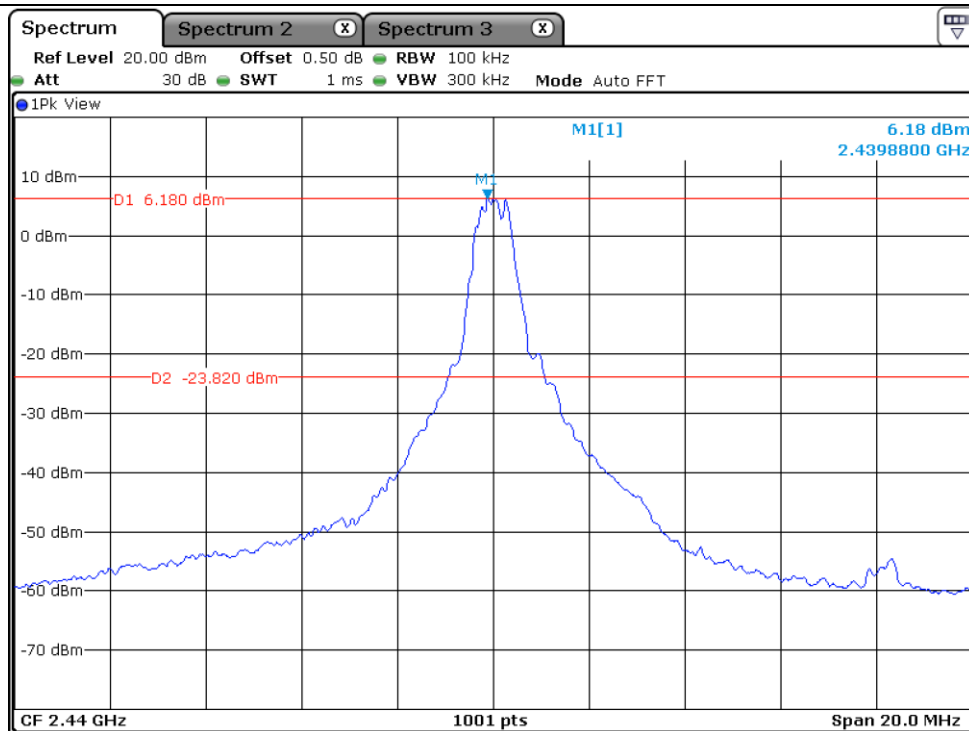
All test equipment used is calibrated on a regular basis.

9.5 Test data for conducted emission

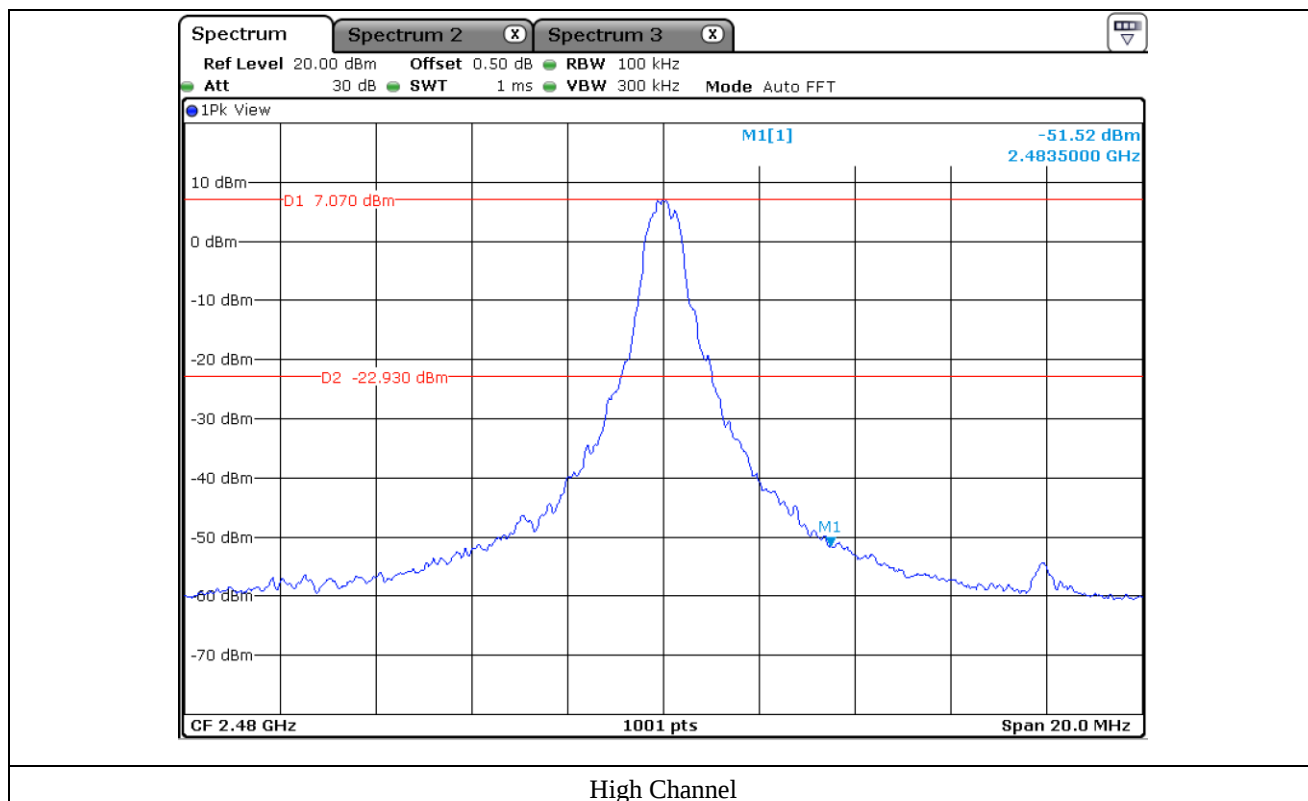
9.6.1 Test data for LE Coded_125 kbps

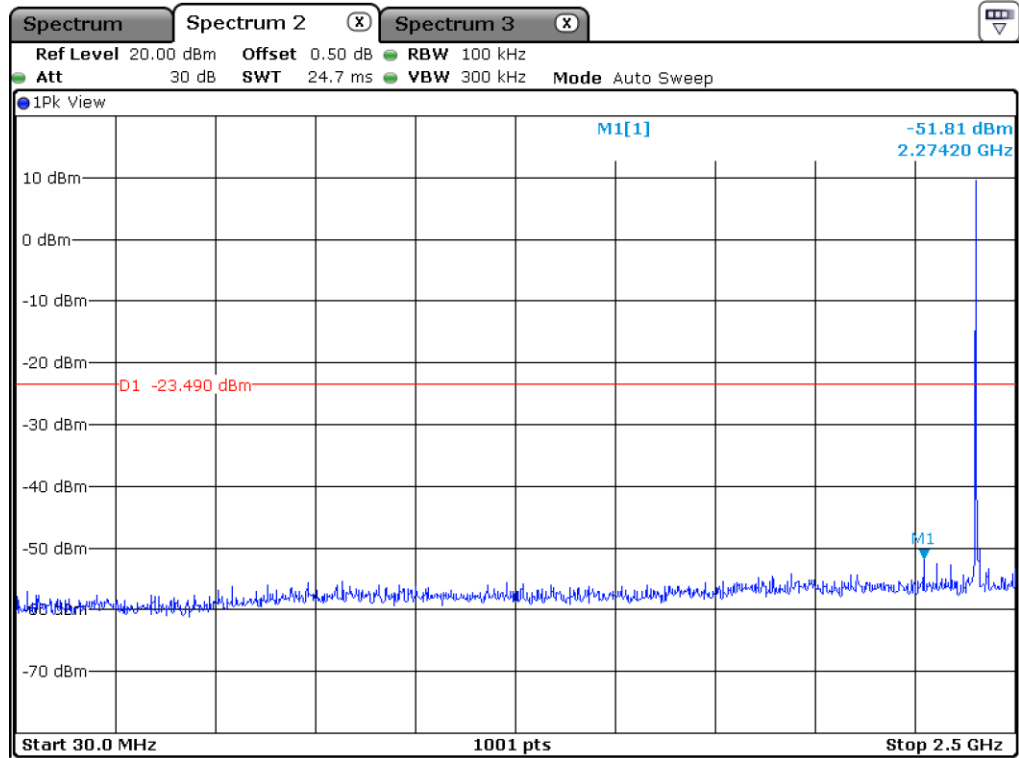


Low Channel

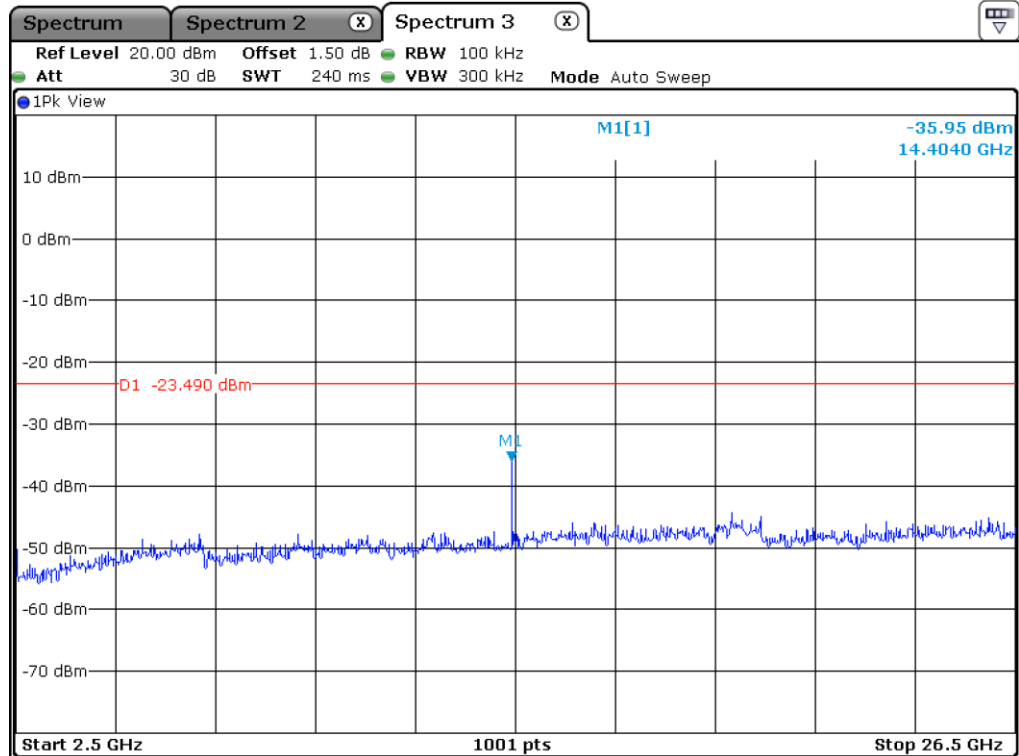


Middle Channel

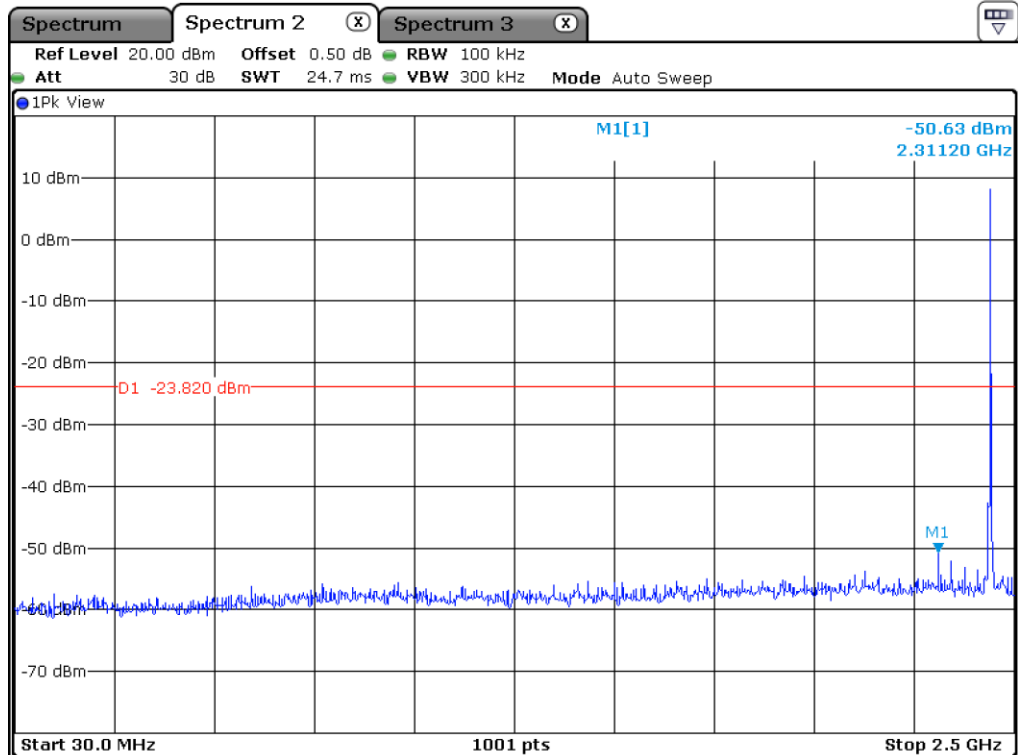




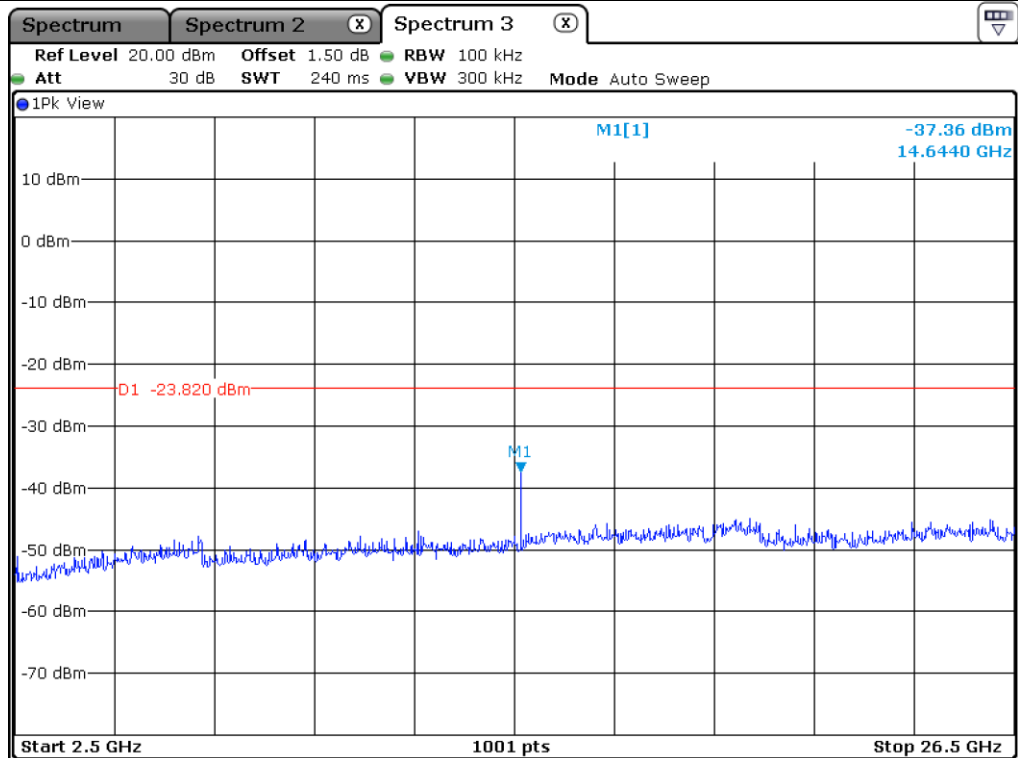
Low Channel



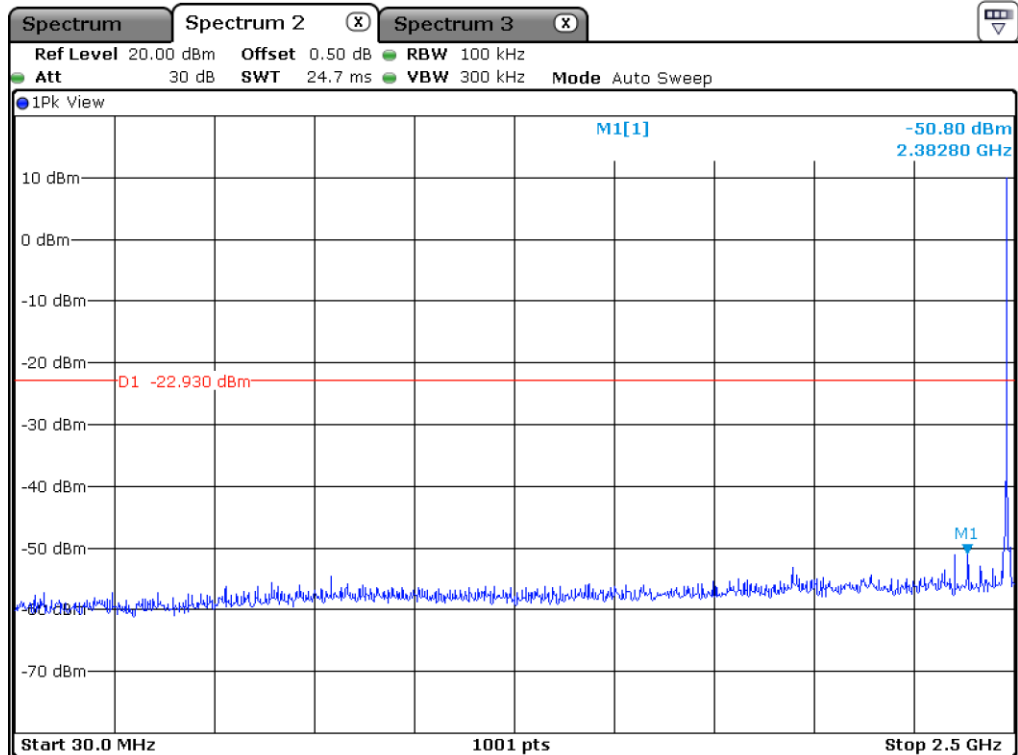
Low Channel



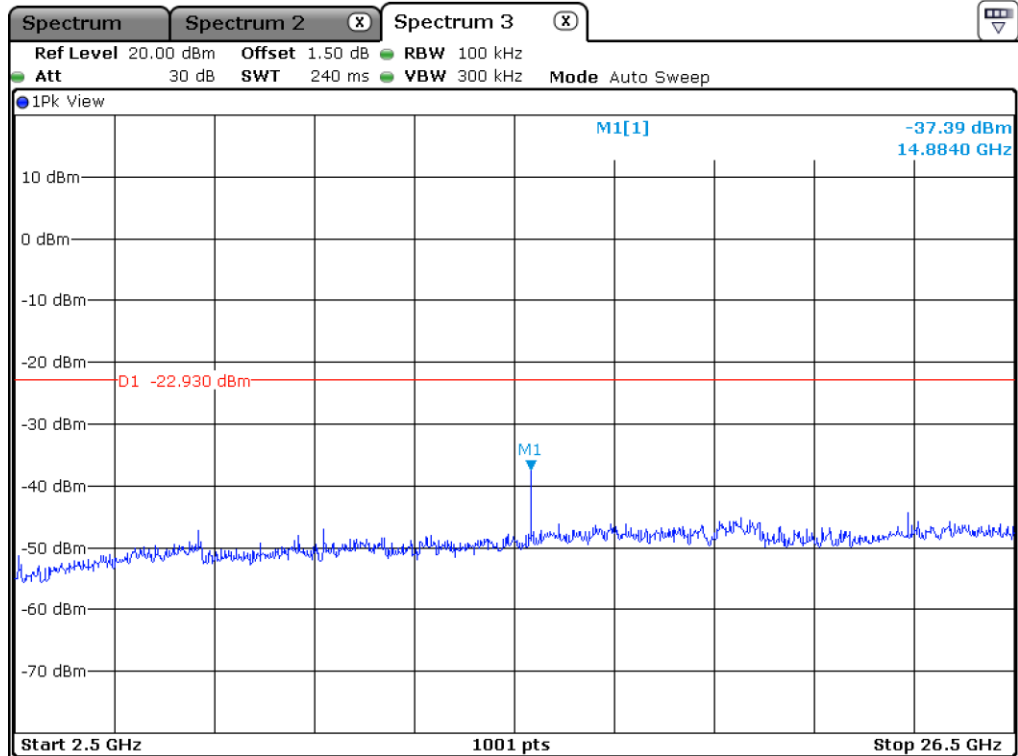
Middle Channel



Middle Channel

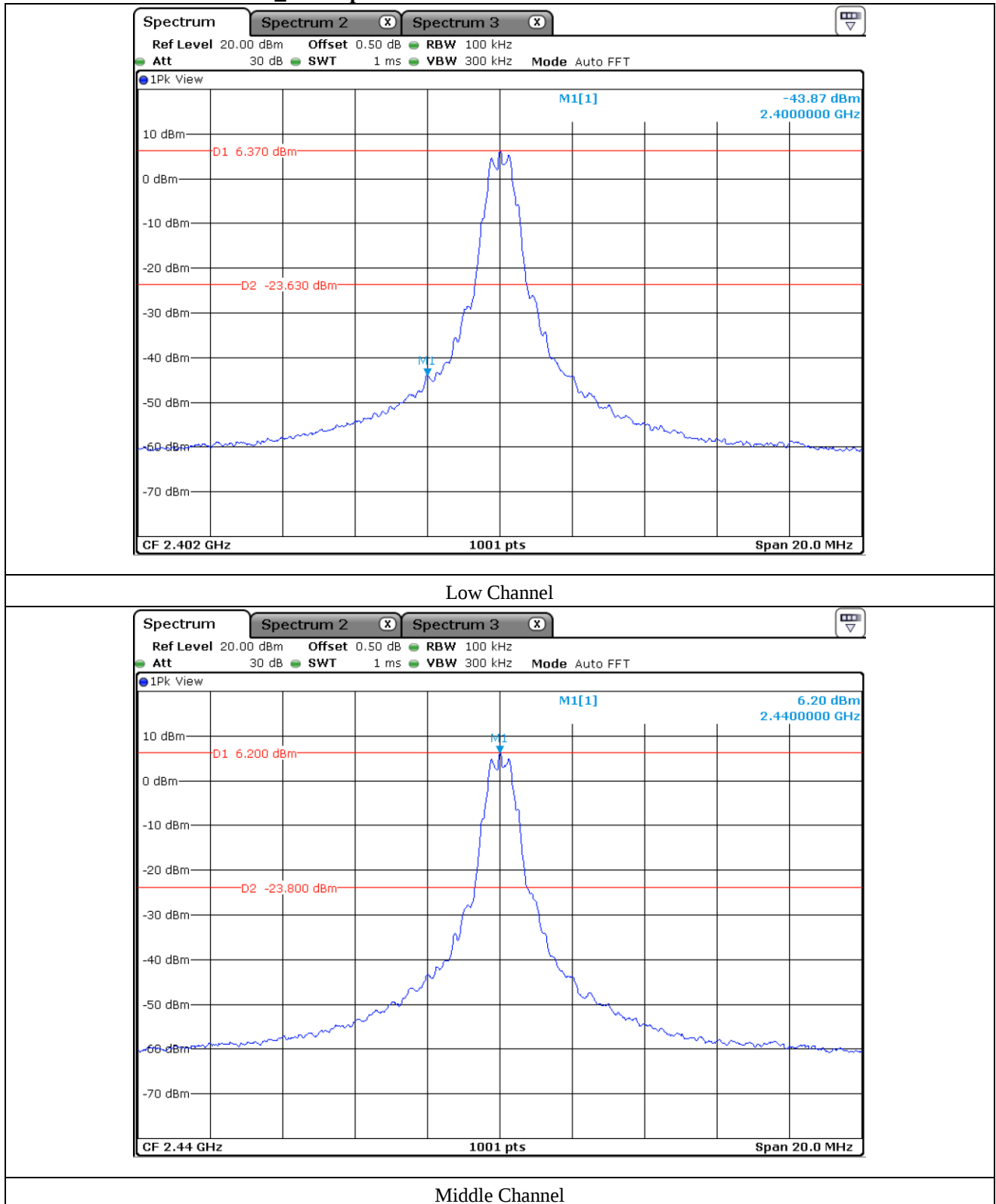


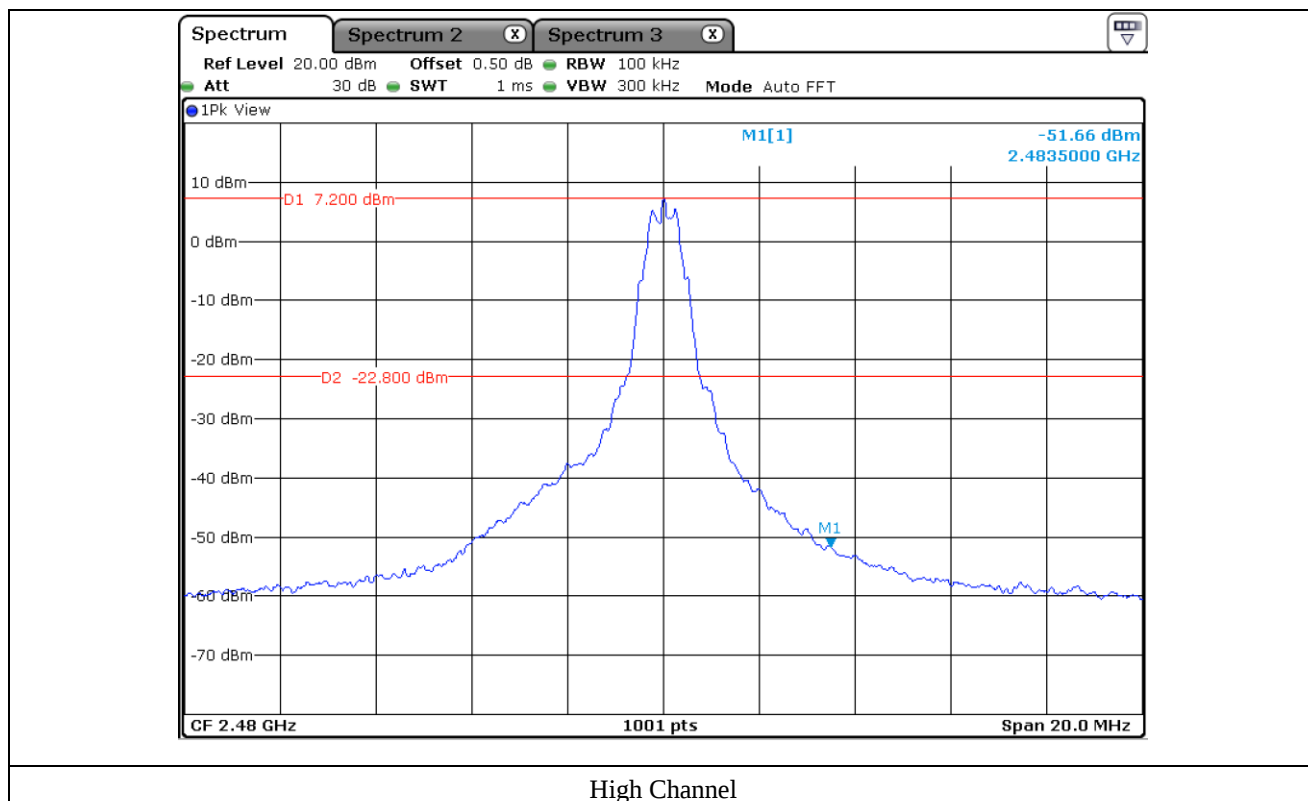
High Channel

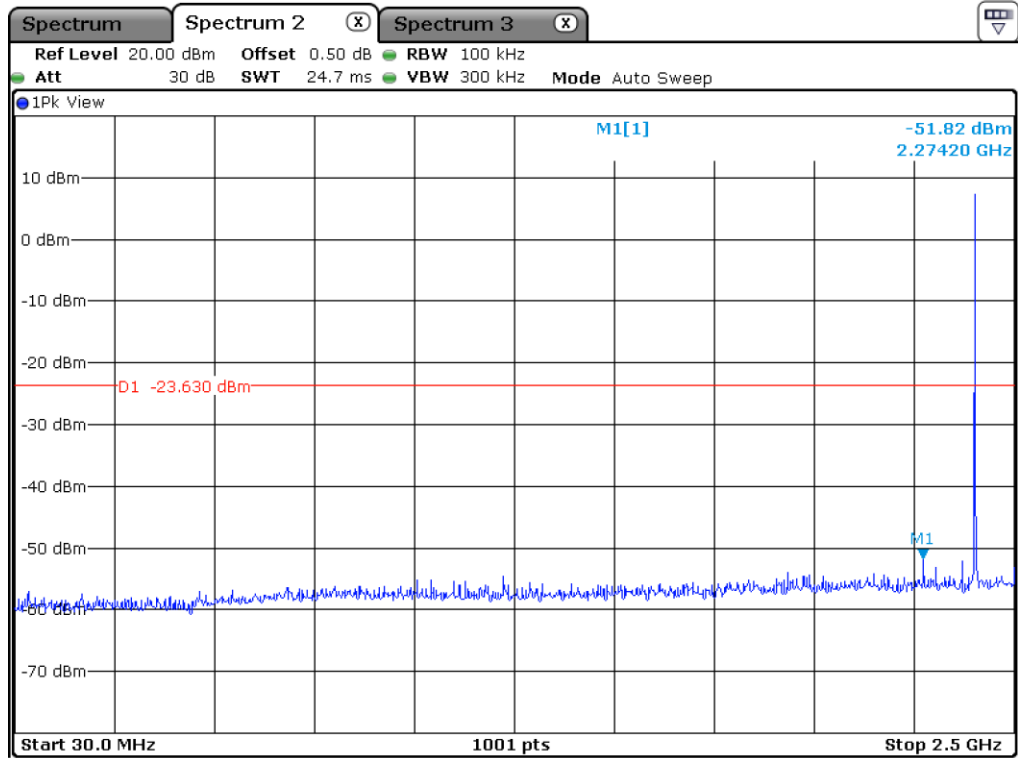


High Channel

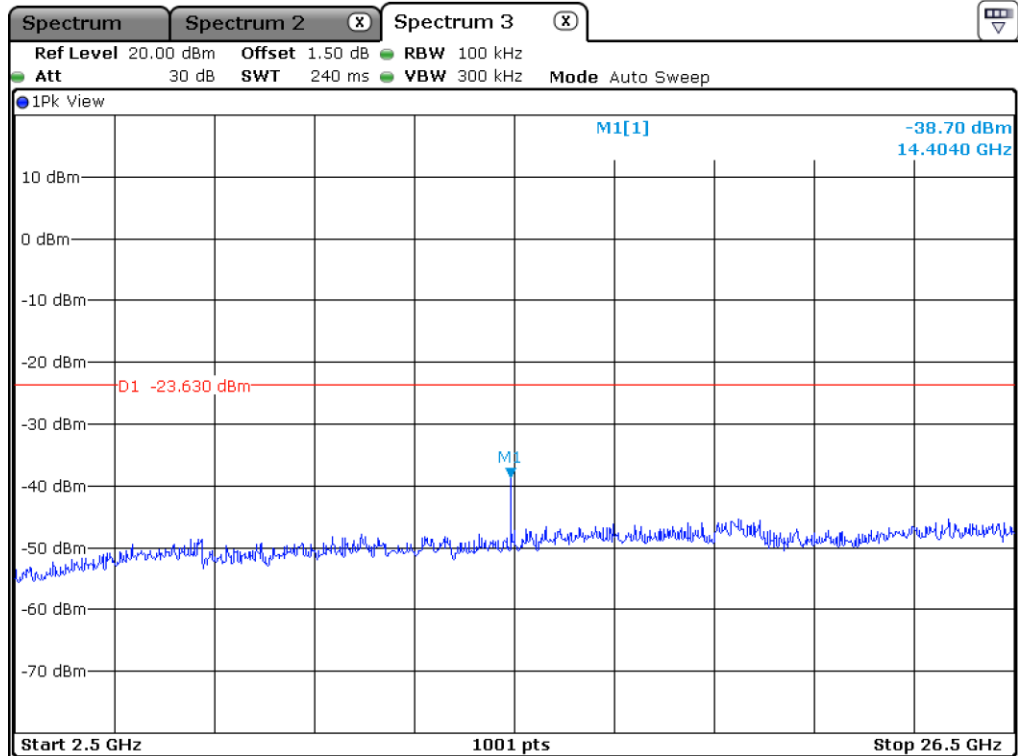
9.6.2 Test data for LE Coded_500 kbps



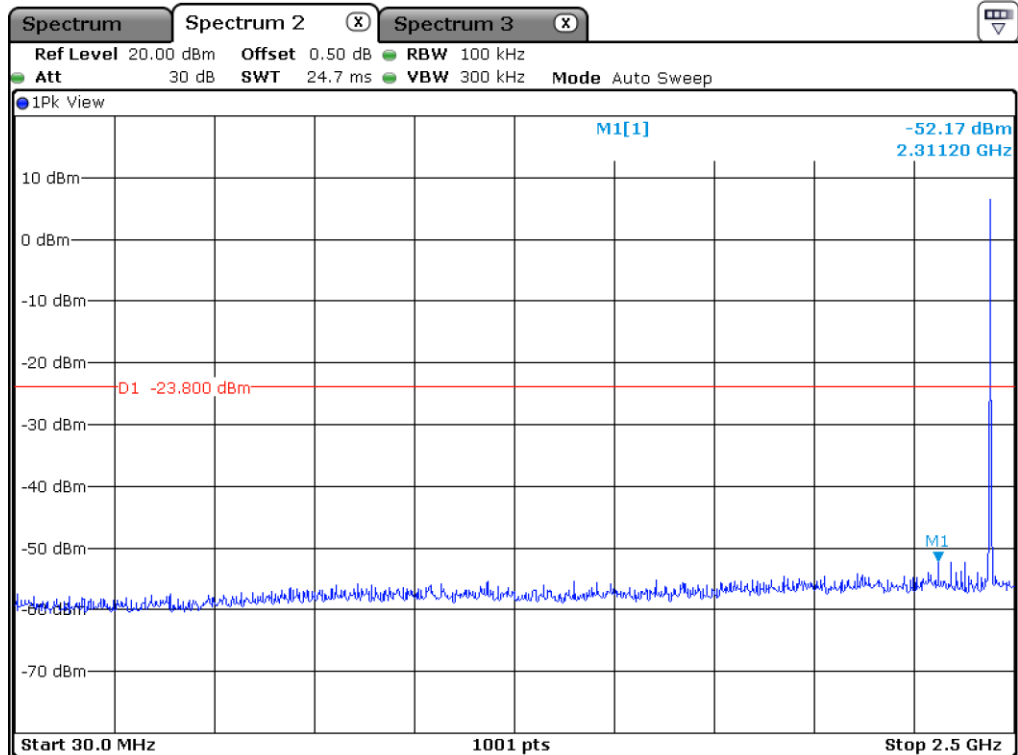




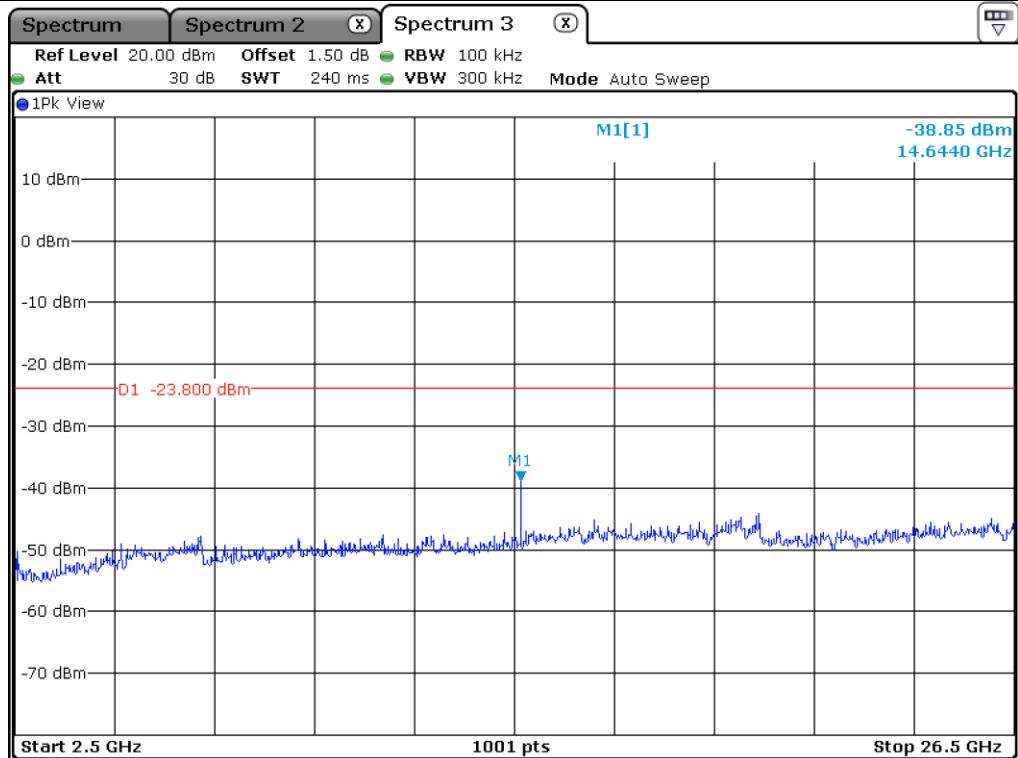
Low Channel



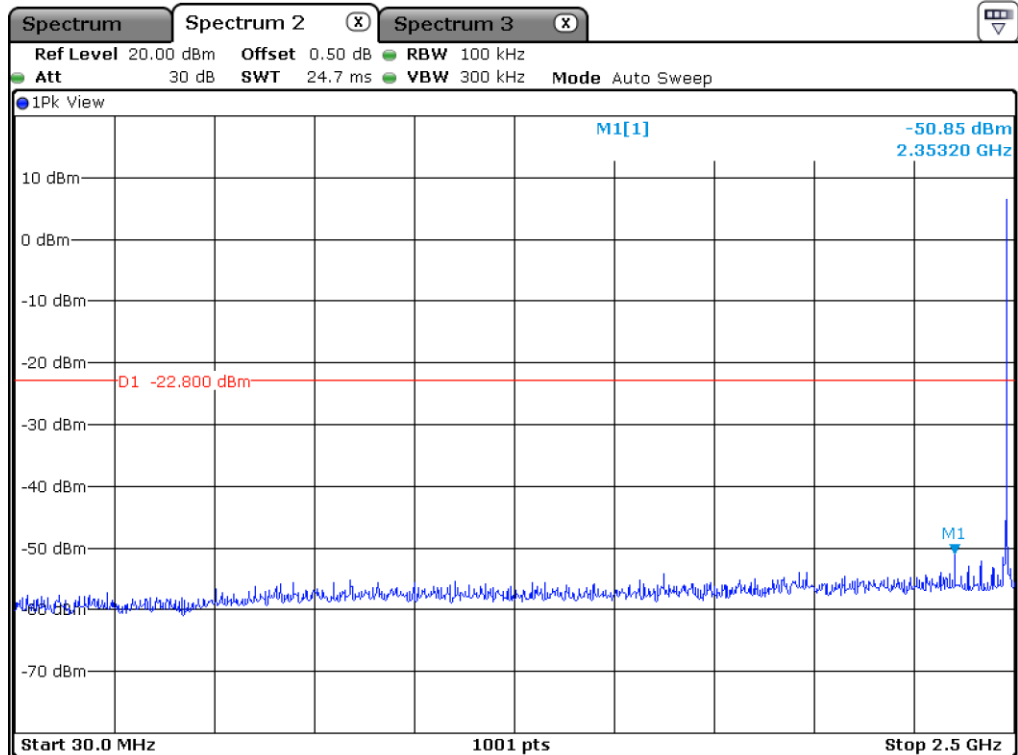
Low Channel



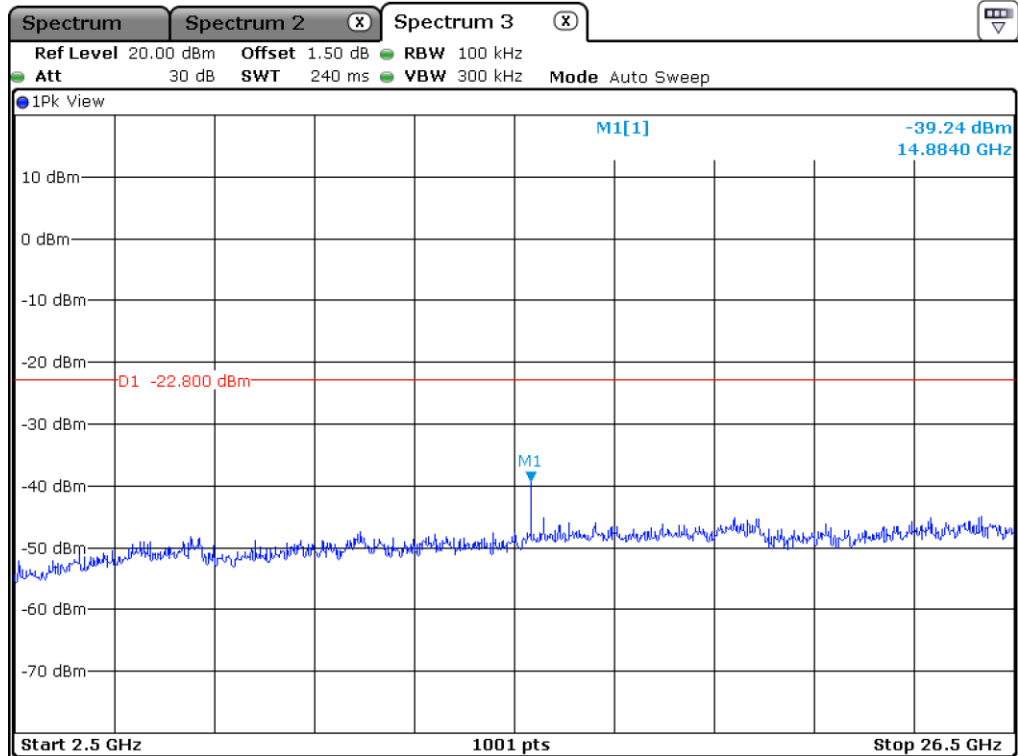
Middle Channel



Middle Channel

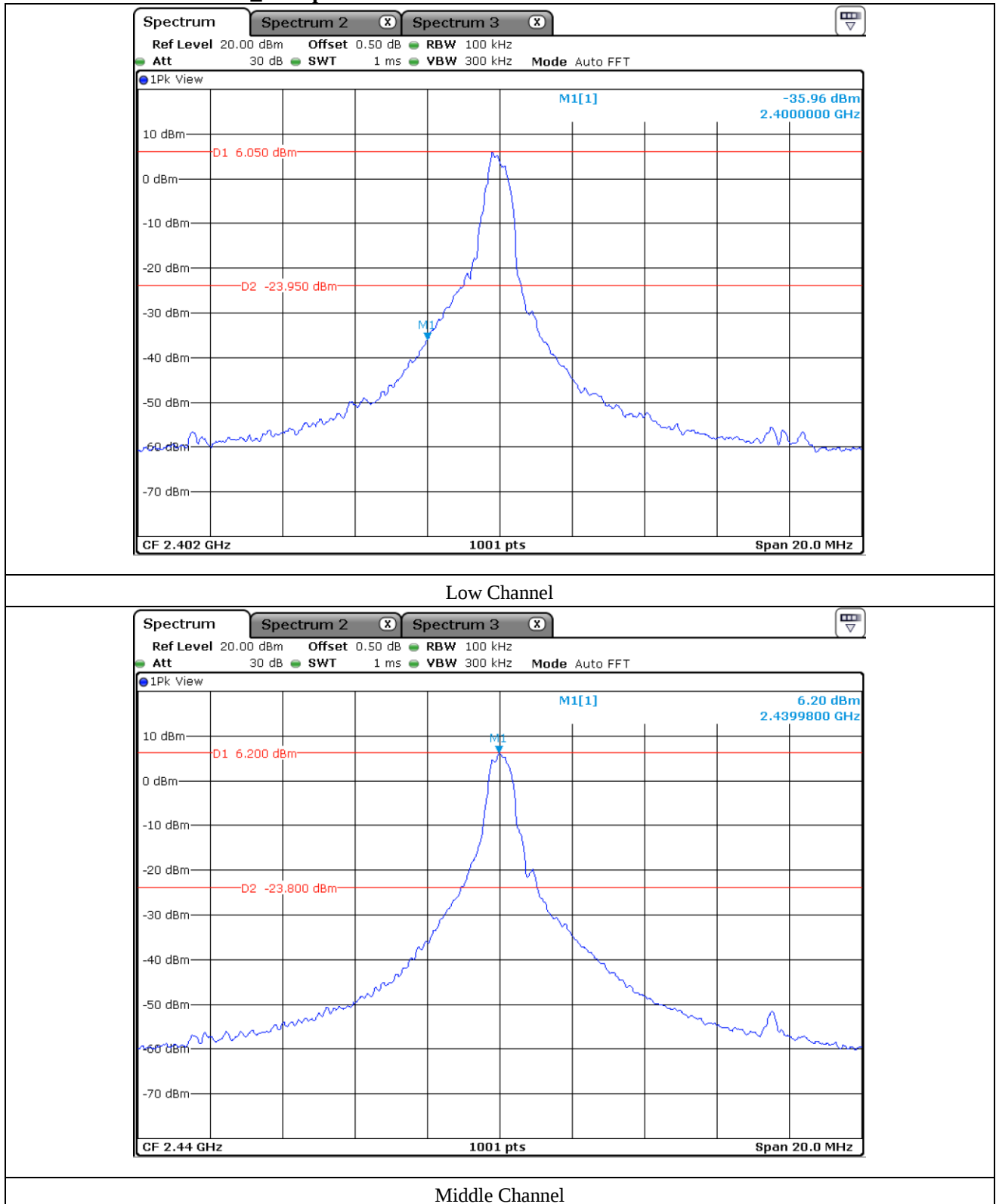


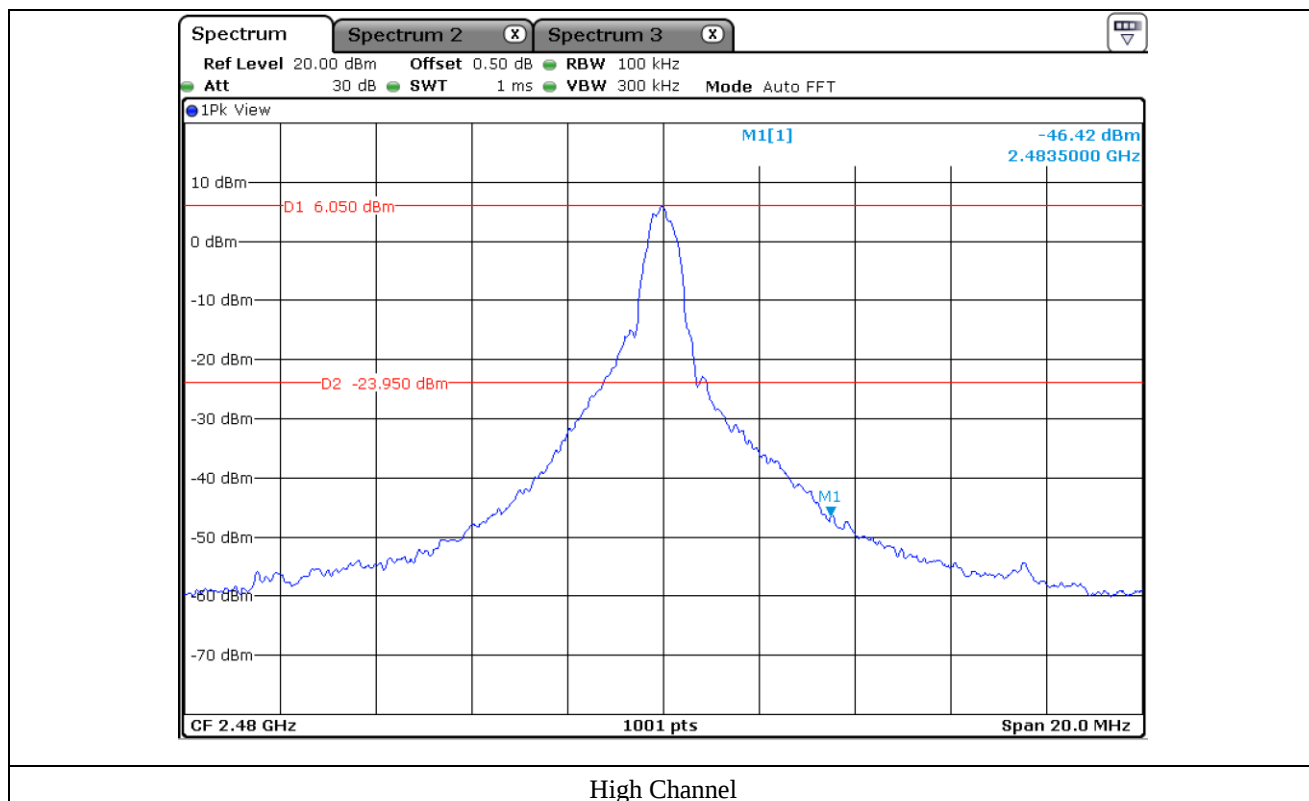
High Channel

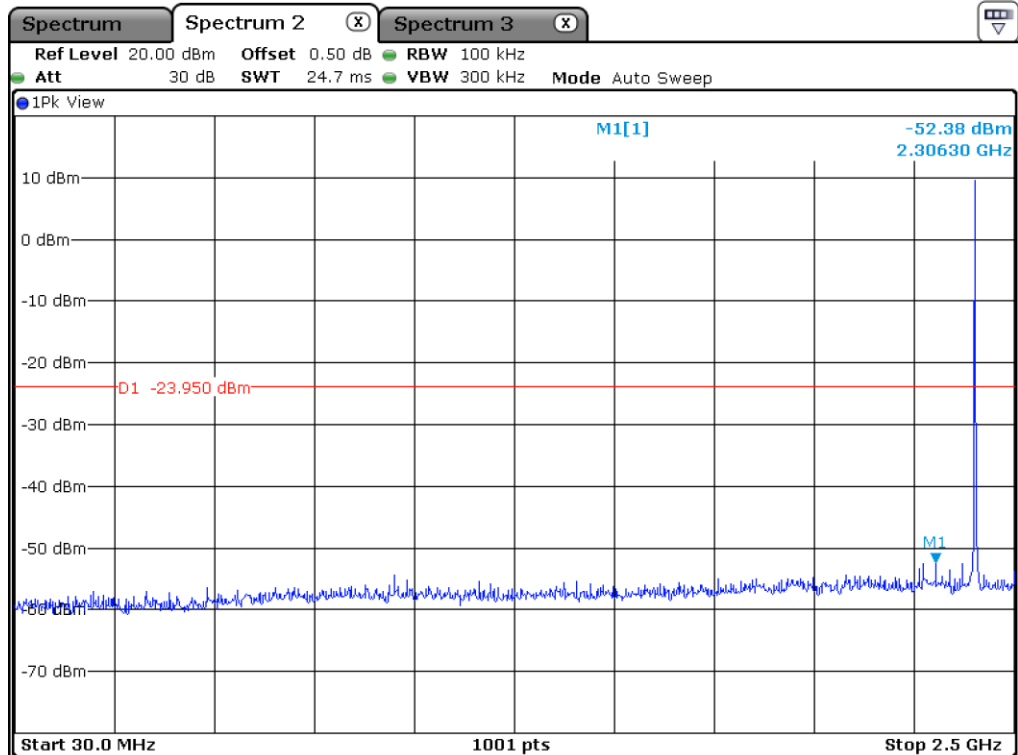


High Channel

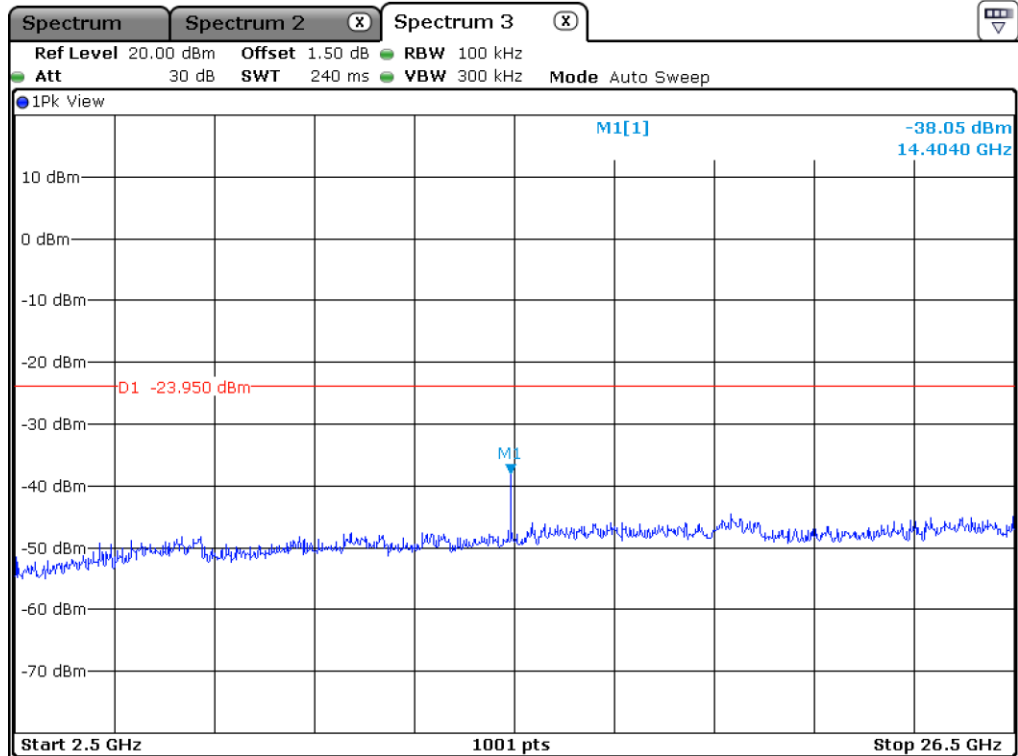
9.6.3 Test data for LE 1 M_1 Mbps



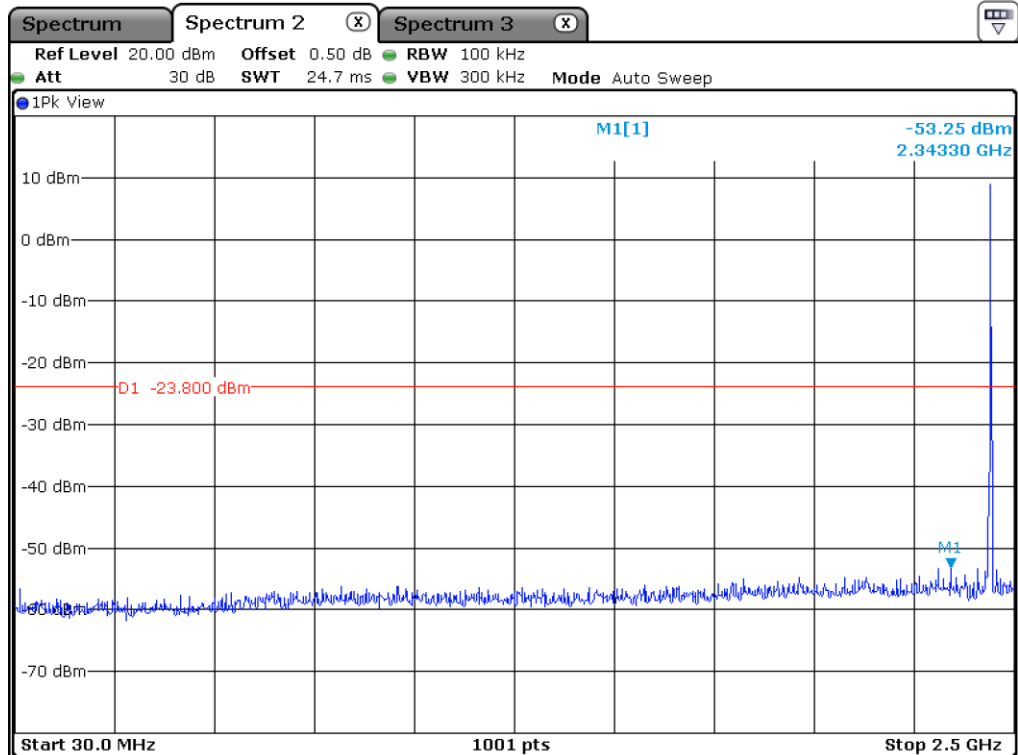




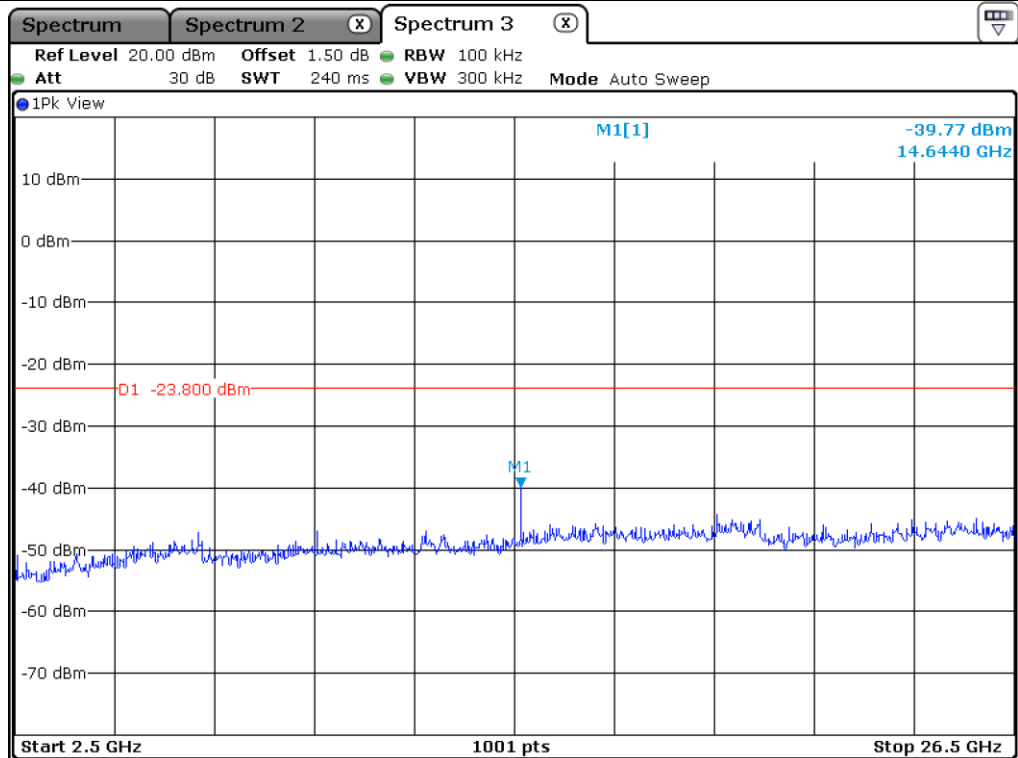
Low Channel



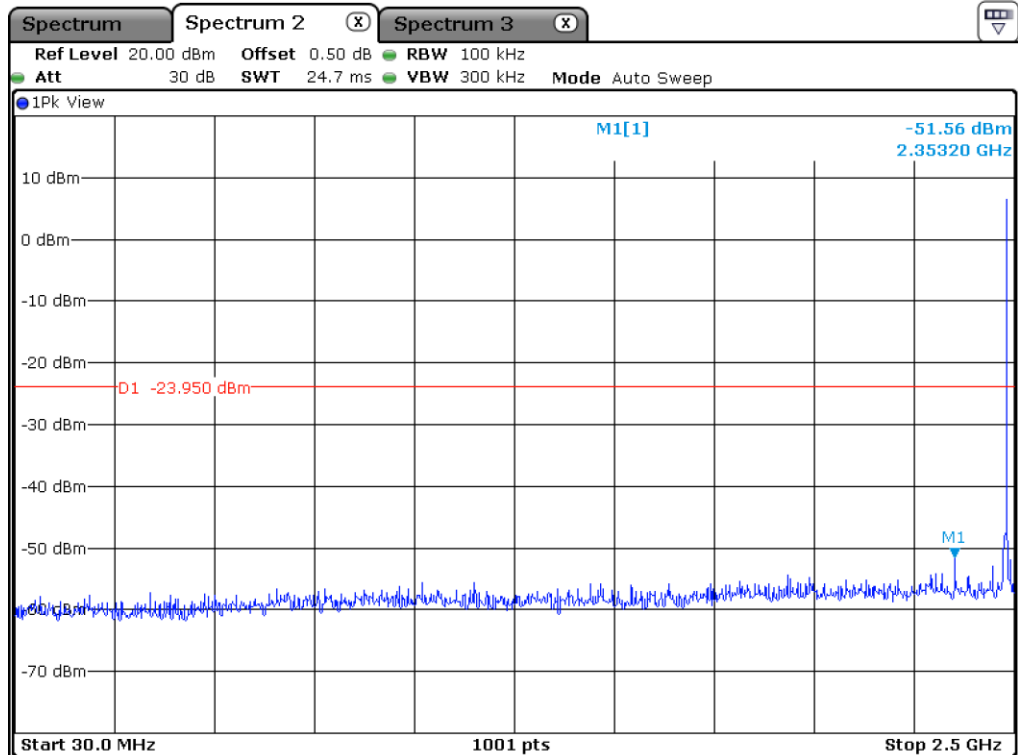
Low Channel



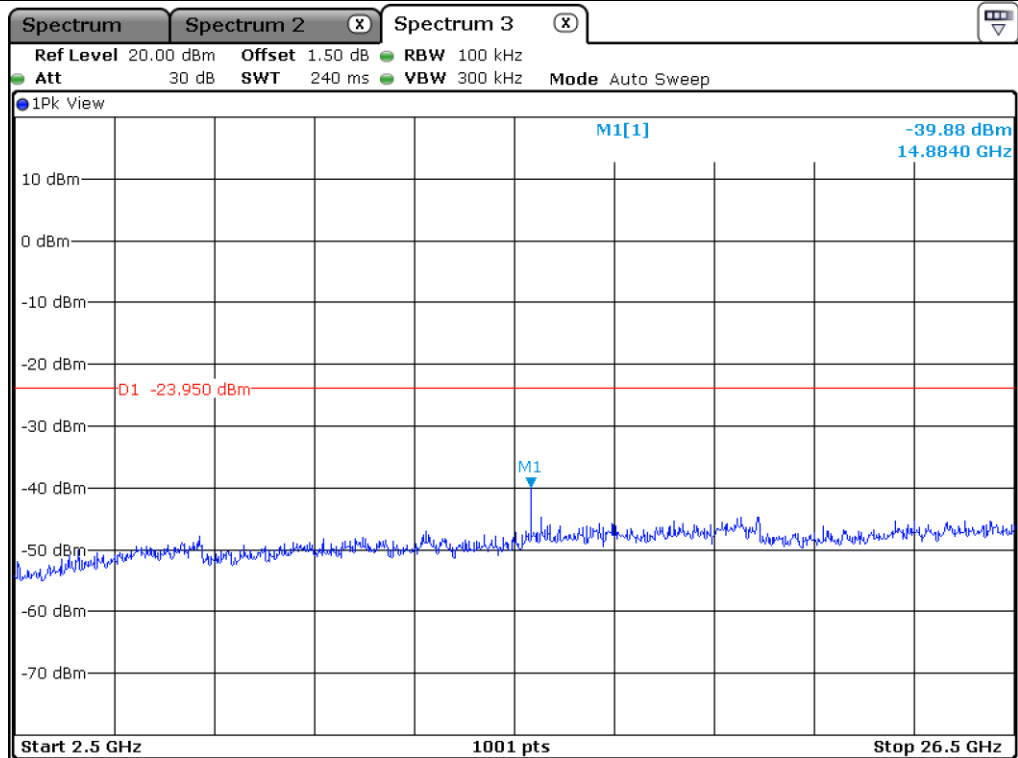
Middle Channel



Middle Channel

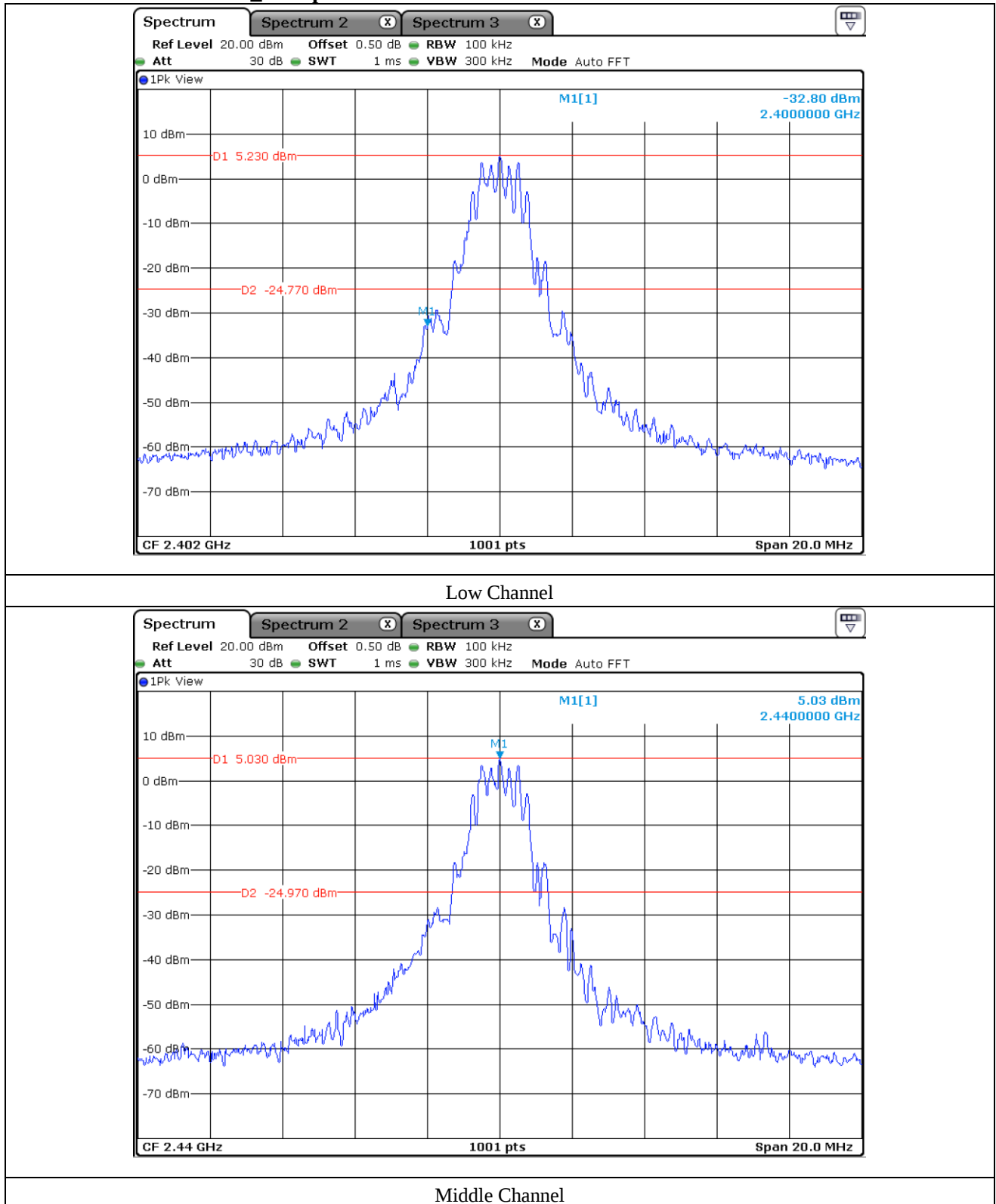


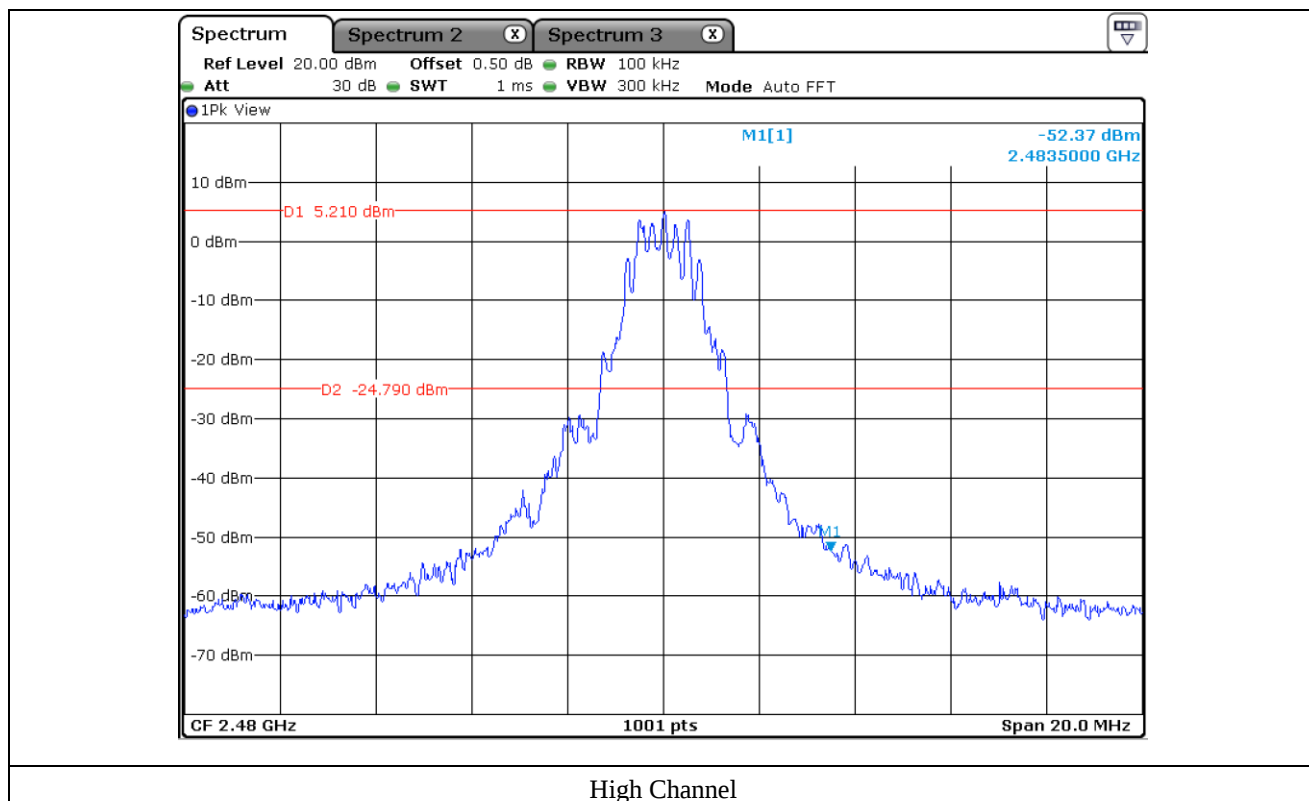
High Channel

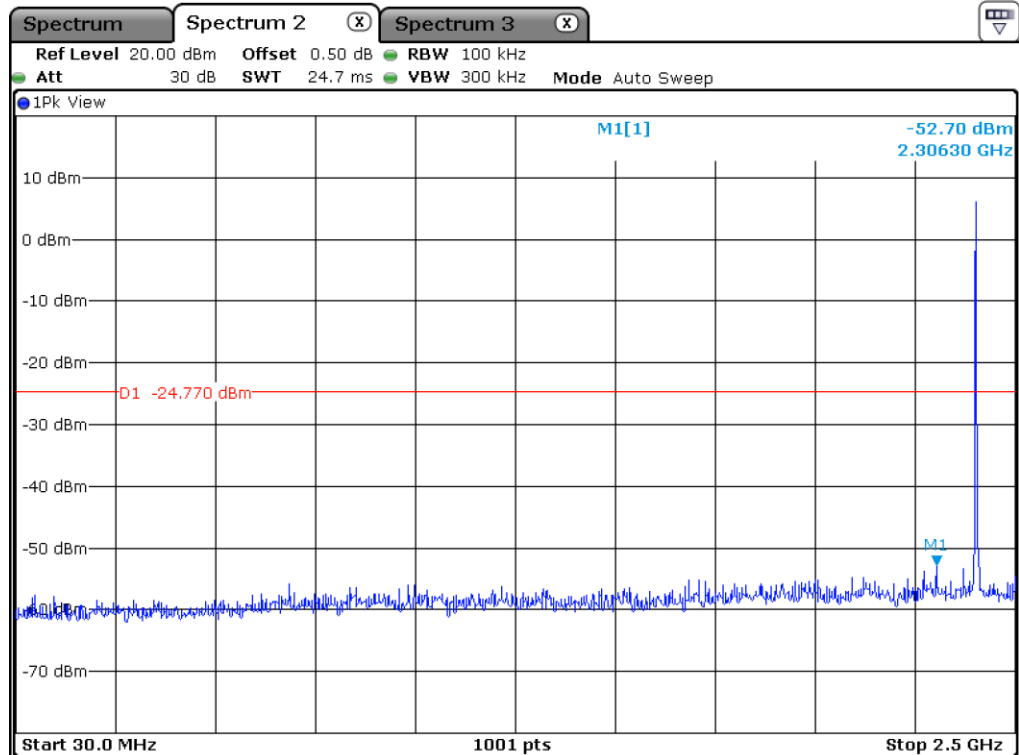


High Channel

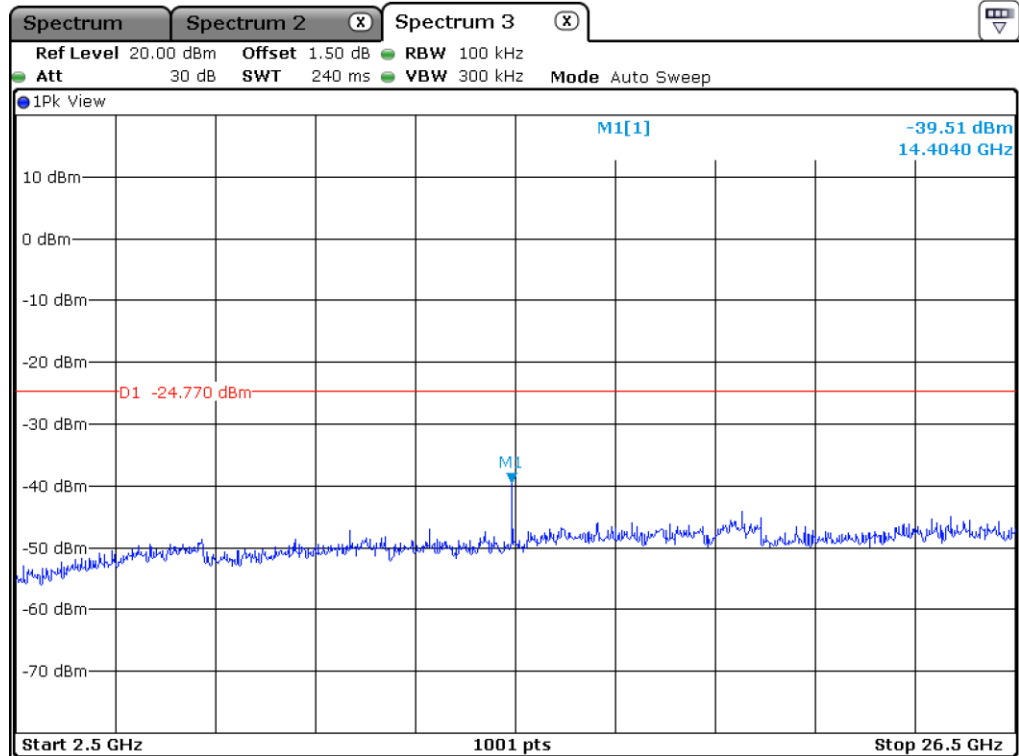
9.6.4 Test data for LE 2 M_2 Mbps



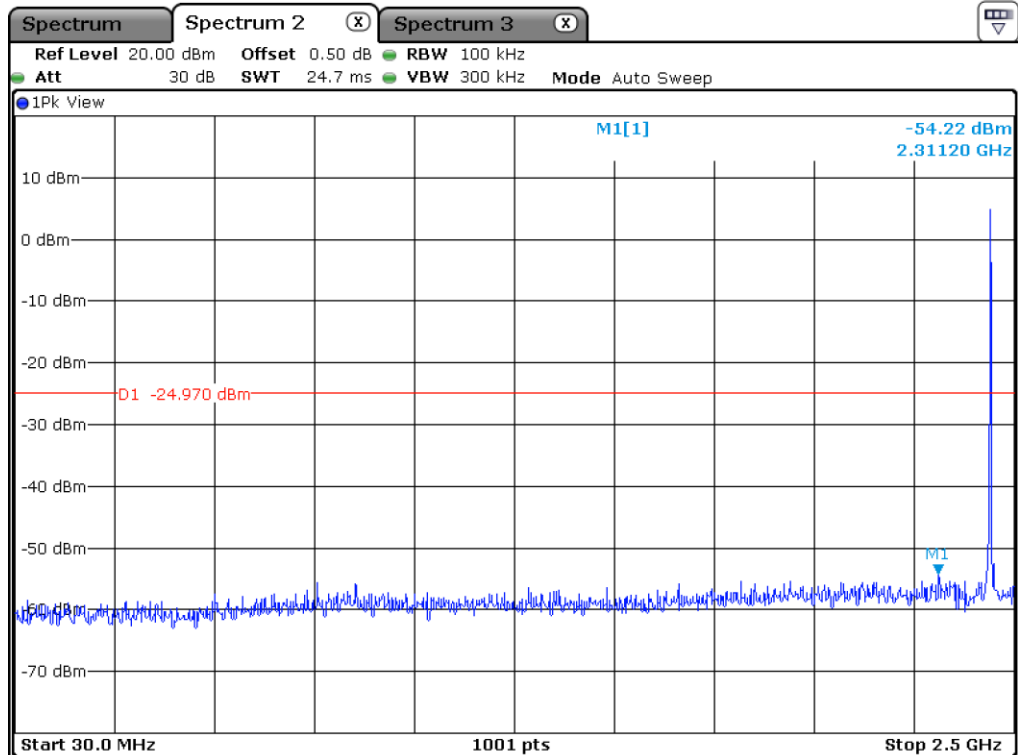




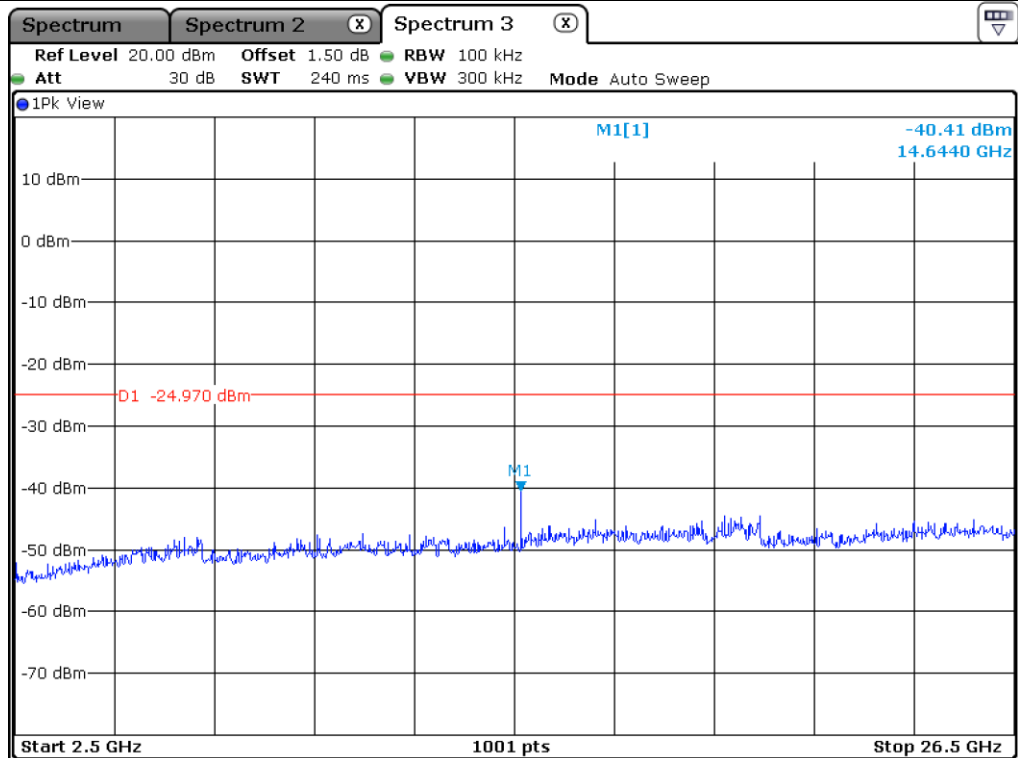
Low Channel



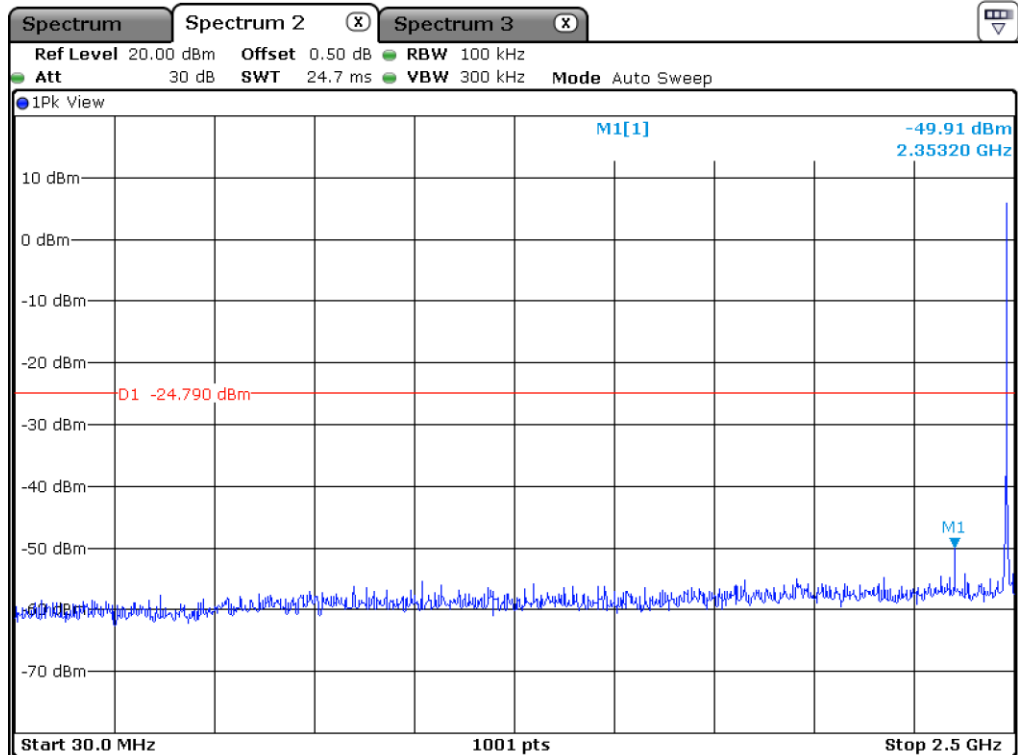
Low Channel



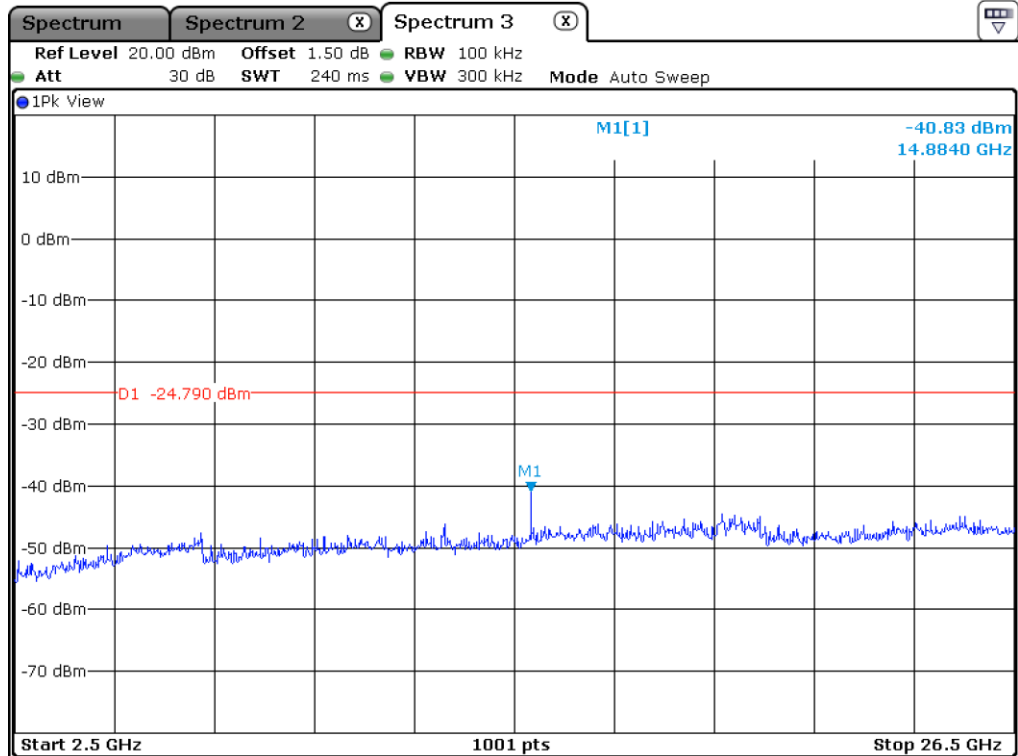
Middle Channel



Middle Channel



High Channel



High Channel

9.6 Test data for radiated emission

9.6.1 Radiated Emission which fall in the Restricted Band

9.6.1.1 Test data for LE Coded_125 kbps

-. Test Date : June 05, 2019 ~ June 11, 2019
 -. Resolution bandwidth : 1 MHz for Peak and Average Mode
 -. Video bandwidth : 3 MHz for Peak and Average Mode
 -. Measurement distance : 3 m
 -. Duty Cycle : 67.20 %
 -. 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									
2 389.954	20.78	Peak	H	26.94	4.75	-	52.47	74.00	21.53
2 382.273	12.31	Average	H	26.94	4.75	1.73	45.73	54.00	8.27
2 343.926	17.02	Peak	V	26.94	4.75	-	48.71	74.00	25.29
2 345.840	7.36	Average	V	26.94	4.75	1.73	40.78	54.00	13.22
Test Data for High Channel									
2 483.510	24.47	Peak	H	27.47	4.39	-	54.00	15.00	4.39
2 483.510	10.05	Average	H	27.47	4.39	1.73	54.00	15.00	4.39
2 484.870	18.73	Peak	V	27.47	4.39	-	54.00	15.00	4.39
2 484.264	5.41	Average	V	27.47	4.39	1.73	54.00	15.00	4.39

Tabulated test data for Restricted Band

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

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

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor



Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.1.2 Test data for LE Coded_500 kbps

-. Test Date : June 05, 2019 ~ June 11, 2019
 -. Resolution bandwidth : 1 MHz for Peak and Average Mode
 -. Video bandwidth : 3 MHz for Peak and Average Mode
 -. Measurement distance : 3 m
 -. Duty Cycle : 86.70 %
 -. 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									
2 389.950	20.44	Peak	H	26.94	4.75	-	52.13	74.00	21.87
2 382.277	11.40	Average	H	26.94	4.75	0.62	43.71	54.00	10.29
2 343.920	16.94	Peak	V	26.94	4.75	-	48.63	74.00	25.37
2 345.841	6.33	Average	V	26.94	4.75	0.62	38.64	54.00	15.36
Test Data for High Channel									
2 483.510	23.84	Peak	H	27.47	4.39	-	55.70	74.00	18.30
2 483.510	10.43	Average	H	27.47	4.39	0.62	42.91	54.00	11.09
2 484.878	18.79	Peak	V	27.47	4.39	-	50.65	74.00	23.35
2 484.300	6.07	Average	V	27.47	4.39	0.62	38.55	54.00	15.45

Tabulated test data for Restricted Band

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

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

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor



Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.1.3 Test data for LE 1 M_1 Mbps

-. Test Date : June 05, 2019 ~ June 11, 2019
 -. Resolution bandwidth : 1 MHz for Peak and Average Mode
 -. Video bandwidth : 3 MHz for Peak and Average Mode
 -. Measurement distance : 3 m
 -. Duty Cycle : 68.42 %
 -. 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									
2 389.960	20.42	Peak	H	26.94	4.75	-	52.11	74.00	21.89
2 382.287	11.57	Average	H	26.94	4.75	1.65	44.91	54.00	9.09
2 343.925	16.97	Peak	V	26.94	4.75	-	48.66	74.00	25.34
2 345.847	6.45	Average	V	26.94	4.75	1.65	39.79	54.00	14.21
Test Data for High Channel									
2 483.508	23.94	Peak	H	27.47	4.39	-	55.80	74.00	18.20
2 483.508	11.08	Average	H	27.47	4.39	1.65	44.59	54.00	9.41
2 484.876	19.07	Peak	V	27.47	4.39	-	50.93	74.00	23.07
2 484.270	5.24	Average	V	27.47	4.39	1.65	38.75	54.00	15.25

Tabulated test data for Restricted Band

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

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

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor



Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.1.4 Test data for LE 2 M_2 Mbps

-. Test Date : June 05, 2019 ~ June 11, 2019
 -. Resolution bandwidth : 1 MHz for Peak and Average Mode
 -. Video bandwidth : 3 MHz for Peak and Average Mode
 -. Measurement distance : 3 m
 -. Duty Cycle : 38.92 %
 -. 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									
2 389.960	20.95	Peak	H	26.94	4.75	-	52.64	74.00	21.36
2 382.288	11.87	Average	H	26.94	4.75	4.10	47.66	54.00	6.34
2 343.926	17.89	Peak	V	26.94	4.75	-	49.58	74.00	24.42
2 345.844	7.12	Average	V	26.94	4.75	4.10	42.91	54.00	11.09
Test Data for High Channel									
2 483.508	24.18	Peak	H	27.47	4.39	-	56.04	74.00	17.96
2 483.508	10.08	Average	H	27.47	4.39	4.10	46.04	54.00	7.96
2 484.876	18.07	Peak	V	27.47	4.39	-	49.93	74.00	24.07
2 484.266	6.08	Average	V	27.47	4.39	4.10	42.04	54.00	11.96

Tabulated test data for Restricted Band

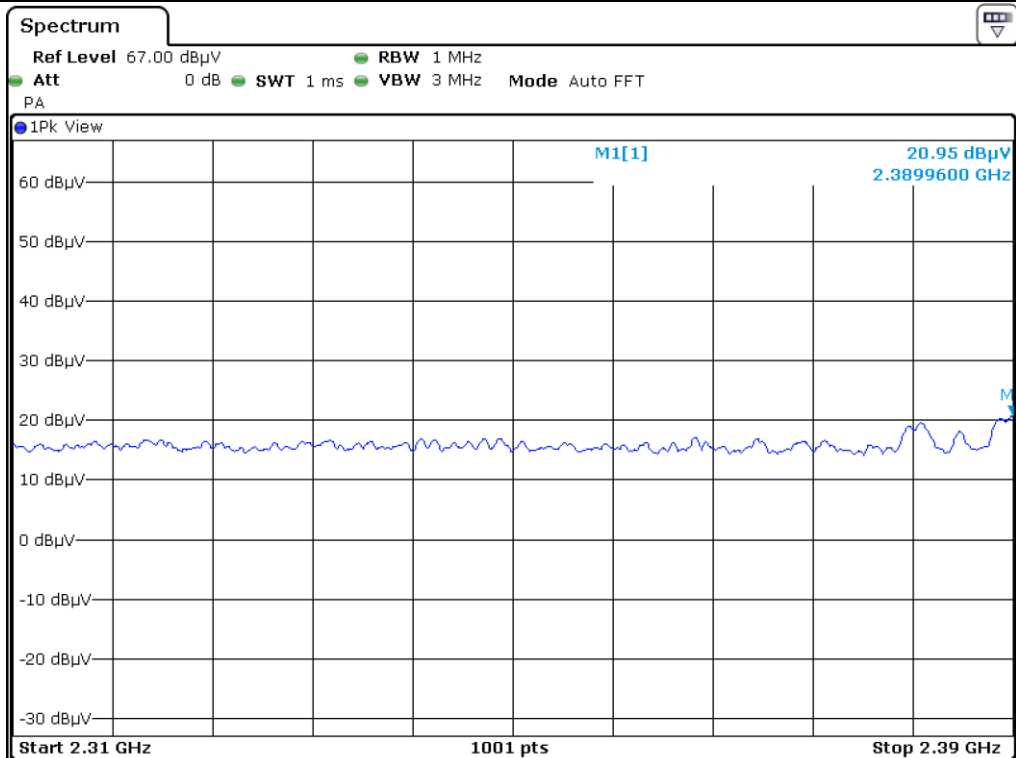
Remark: "H": Horizontal, "V": Vertical

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

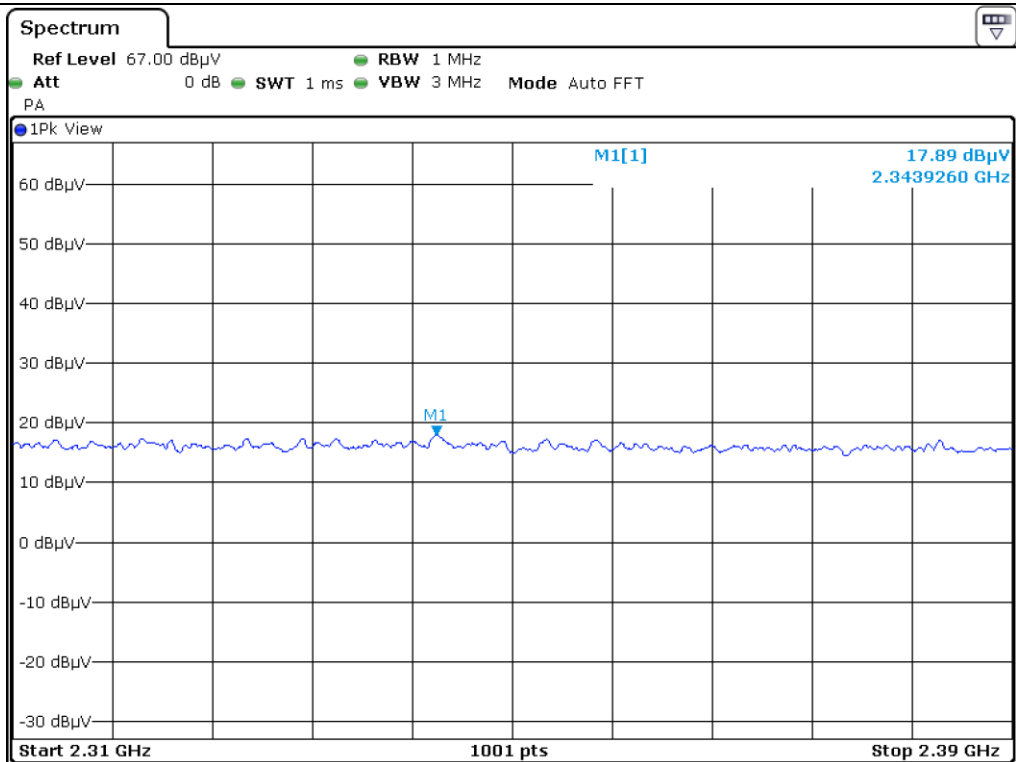
Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor



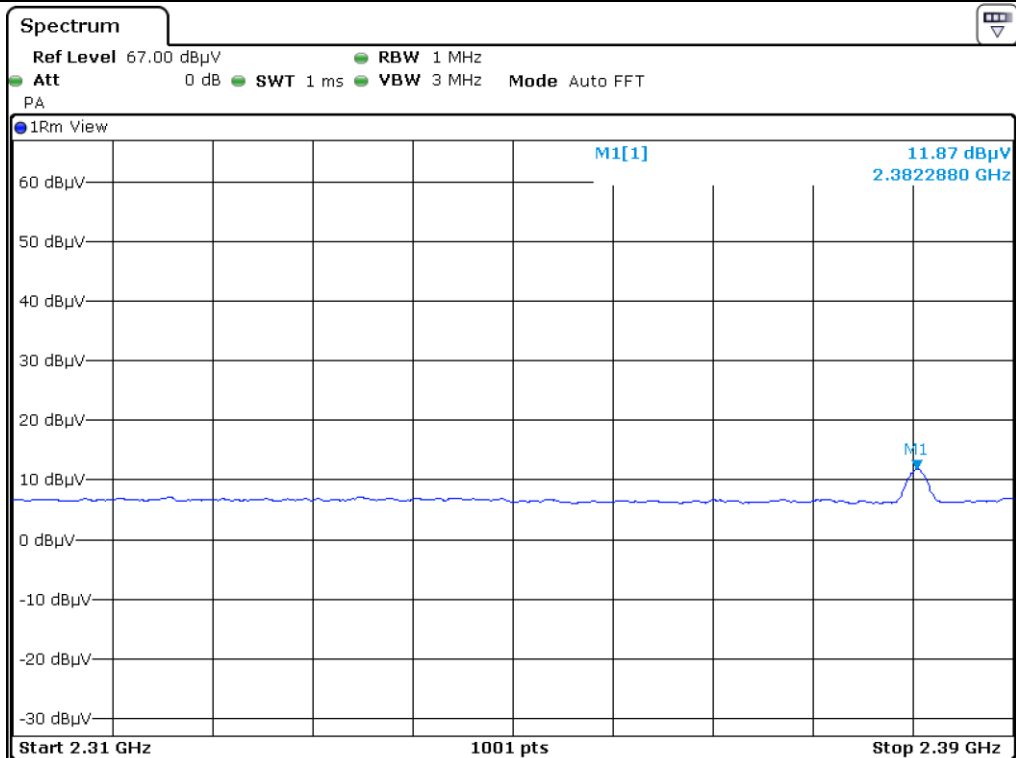
Tested by: Hyung-Kwon, Oh / Assistant Manager



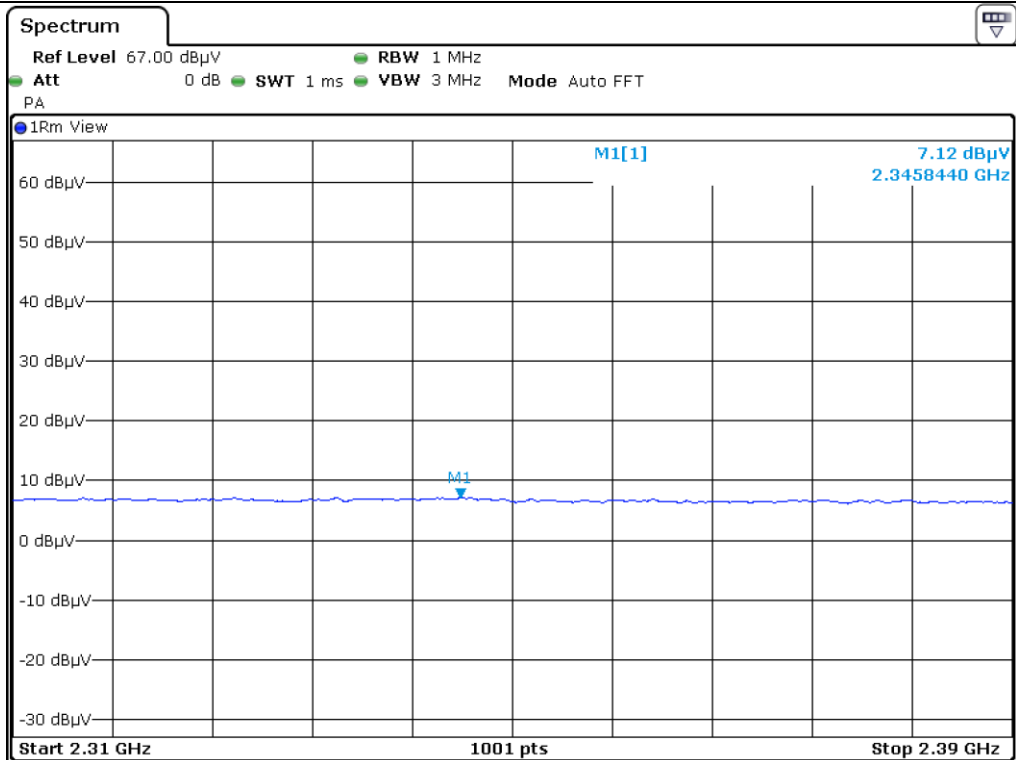
Low Channel_Peak_H



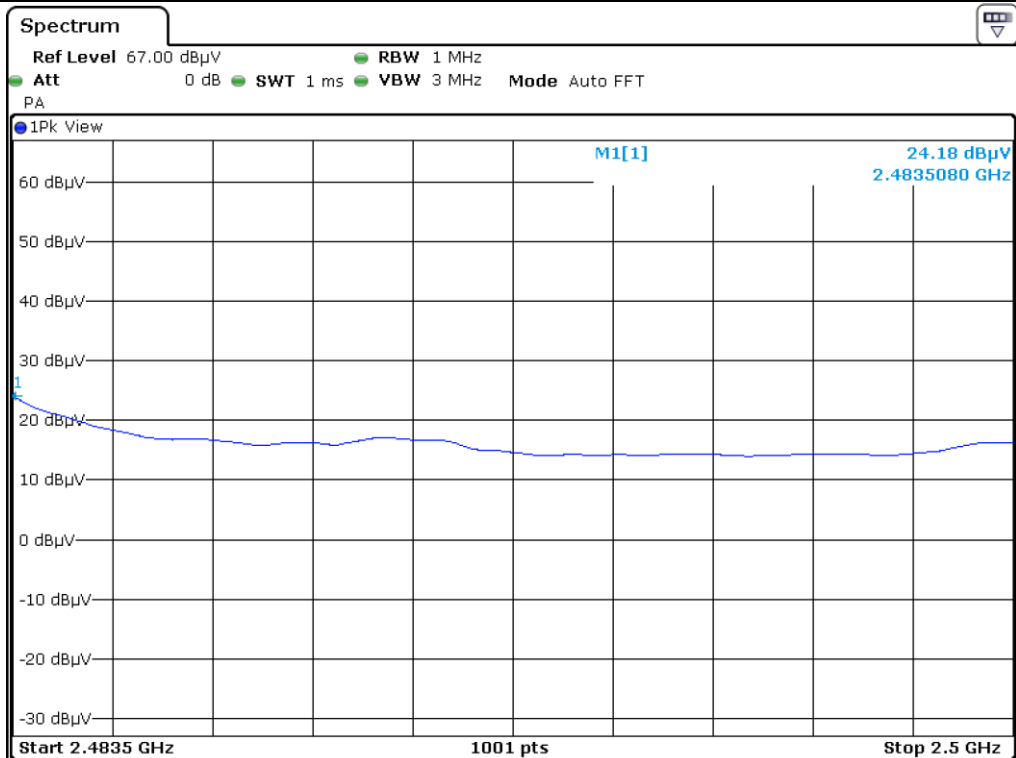
Low Channel_Peak_V



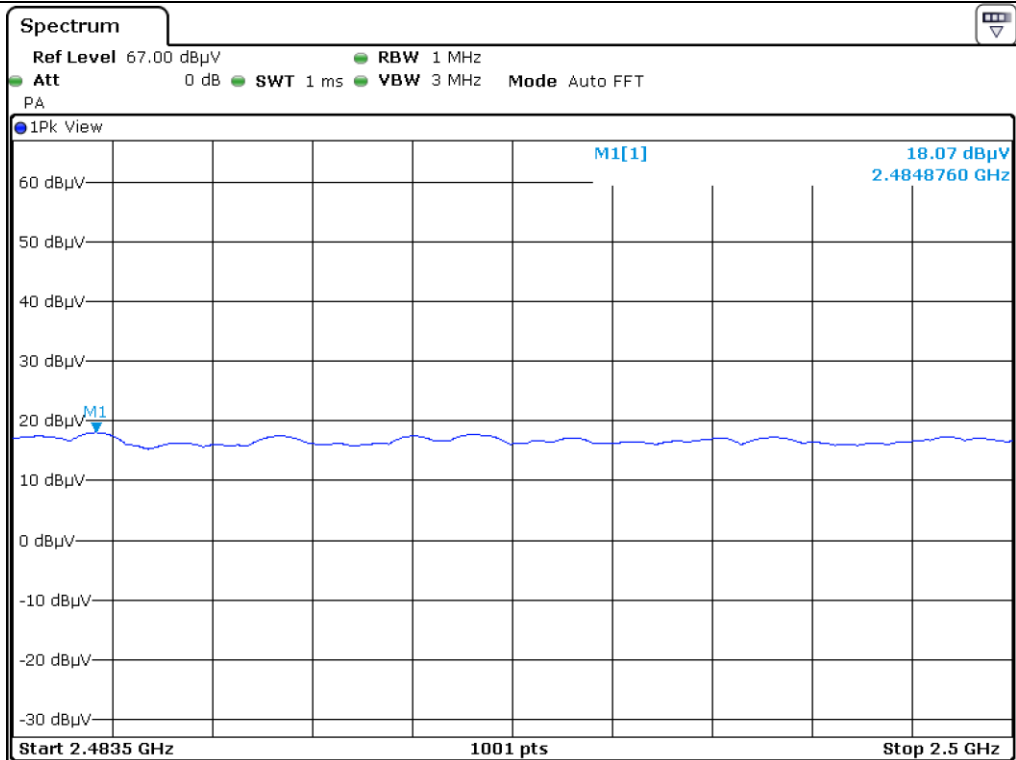
Low Channel_ Average_H



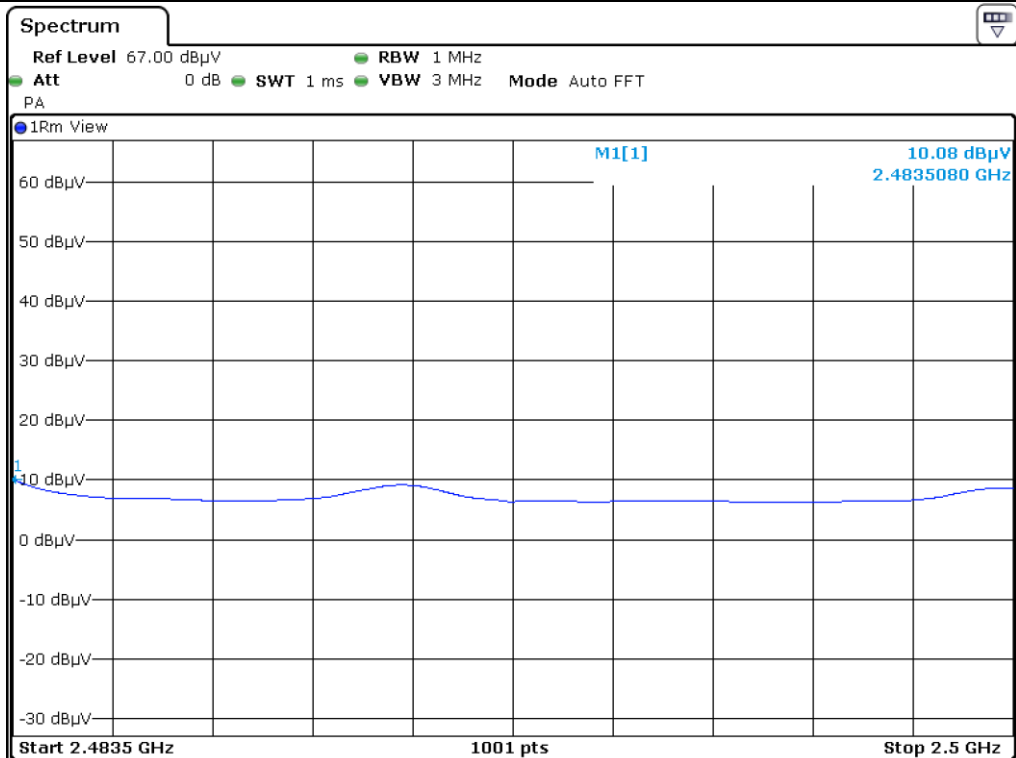
Low Channel_ Average_V



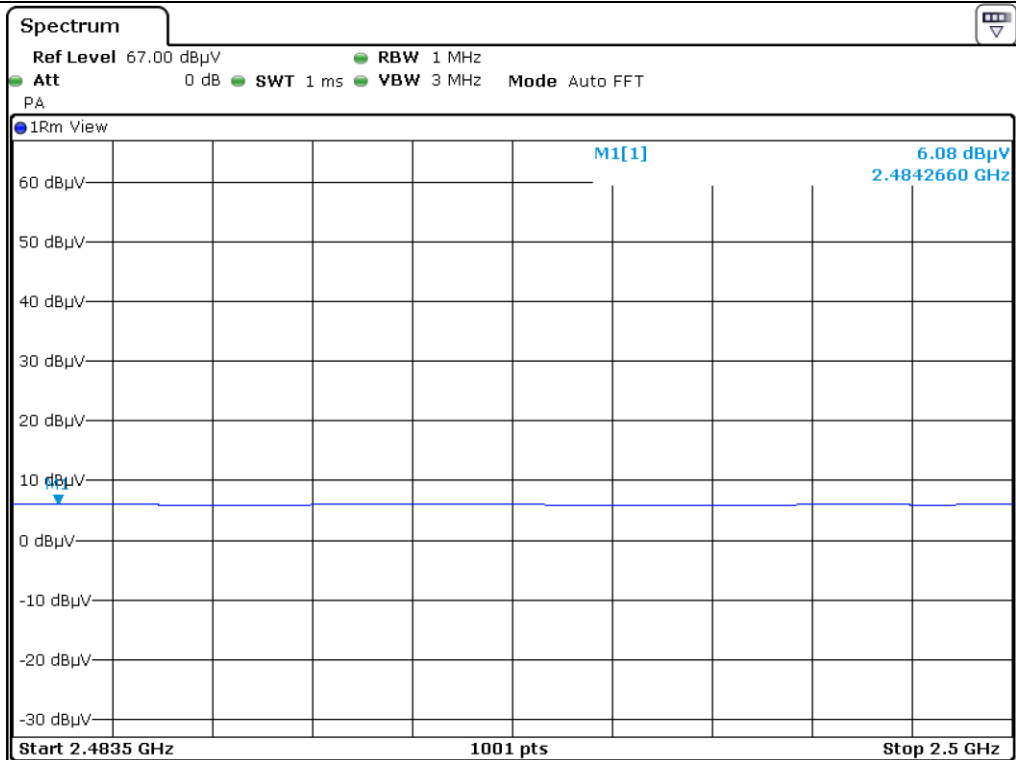
High Channel_Peak_H



High Channel_Peak_V



High Channel_Average_H



High Channel_Average_V

9.6.2 Spurious & Harmonic Radiated Emission

9.6.2.1 Test data for LE Coded_125 kbps

- . Test Date : June 05, 2019 ~ June 11, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
1 MHz 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 : 67.20 %
- . 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	18.15	Peak	H	30.84	7.28	-	56.27	74.00	17.73
4 804.000	9.21	Average	H	30.84	7.28	1.73	49.06	54.00	4.94
4 804.000	16.70	Peak	V	30.84	7.28	-	54.82	74.00	19.18
4 804.000	9.82	Average	V	30.84	7.28	1.73	49.67	54.00	4.33
Test Data for Middle Channel									
4 880.000	16.46	Peak	H	30.01	7.42	-	53.89	74.00	20.11
4 880.000	7.98	Average	H	30.01	7.42	1.73	47.14	54.00	6.86
4 880.000	16.75	Peak	V	30.01	7.42	-	54.18	74.00	19.82
4 880.000	8.72	Average	V	30.01	7.42	1.73	47.88	54.00	6.12
Test Data for High Channel									
4 960.000	17.62	Peak	H	31.15	7.40	-	56.17	74.00	17.83
4 960.000	9.07	Average	H	31.15	7.40	1.73	49.35	54.00	4.65
4 960.000	16.96	Peak	V	31.15	7.40	-	55.51	74.00	18.49
4 960.000	8.45	Average	V	31.15	7.40	1.73	48.73	54.00	5.27

Tabulated test data for Restricted Band

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

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

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor


Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.2.2 Test data for LE Coded_500 kbps

- Test Date : June 05, 2019 ~ June 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
1 MHz 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 : 86.70 %
- 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	18.73	Peak	H	30.84	7.28	-	56.85	74.00	17.15
4 804.000	9.48	Average	H	30.84	7.28	0.62	48.22	54.00	5.78
4 804.000	18.43	Peak	V	30.84	7.28	-	56.55	74.00	17.45
4 804.000	8.34	Average	V	30.84	7.28	0.62	47.08	54.00	6.92
Test Data for Middle Channel									
4 880.000	17.93	Peak	H	30.01	7.42	-	55.36	74.00	18.64
4 880.000	7.78	Average	H	30.01	7.42	0.62	45.83	54.00	8.17
4 880.000	17.94	Peak	V	30.01	7.42	-	55.37	74.00	18.63
4 880.000	8.48	Average	V	30.01	7.42	0.62	46.53	54.00	7.47
Test Data for High Channel									
4 960.000	17.55	Peak	H	31.15	7.40	-	56.10	74.00	17.90
4 960.000	8.95	Average	H	31.15	7.40	0.62	48.12	54.00	5.88
4 960.000	18.10	Peak	V	31.15	7.40	-	56.65	74.00	17.35
4 960.000	8.39	Average	V	31.15	7.40	0.62	47.56	54.00	6.44

Tabulated test data for Restricted Band

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

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

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor


Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.2.3 Test data for LE 1 M_1 Mbps

- . Test Date : June 05, 2019 ~ June 11, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
1 MHz 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 : 68.42 %
- . 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	18.36	Peak	H	30.84	7.28	-	56.48	74.00	17.52
4 804.000	9.19	Average	H	30.84	7.28	1.65	48.96	54.00	5.04
4 804.000	17.85	Peak	V	30.84	7.28	-	55.97	74.00	18.03
4 804.000	8.12	Average	V	30.84	7.28	1.65	47.89	54.00	6.11
Test Data for Middle Channel									
4 880.000	17.97	Peak	H	30.01	7.42	-	55.40	74.00	18.60
4 880.000	9.37	Average	H	30.01	7.42	1.65	48.45	54.00	5.55
4 880.000	16.76	Peak	V	30.01	7.42	-	54.19	74.00	19.81
4 880.000	9.27	Average	V	30.01	7.42	1.65	48.35	54.00	5.65
Test Data for High Channel									
4 960.000	17.01	Peak	H	31.15	7.40	-	55.56	74.00	18.44
4 960.000	7.95	Average	H	31.15	7.40	1.65	48.15	54.00	5.85
4 960.000	16.65	Peak	V	31.15	7.40	-	55.20	74.00	18.80
4 960.000	8.61	Average	V	31.15	7.40	1.65	48.81	54.00	5.19

Tabulated test data for Restricted Band

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

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

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor


Tested by: Hyung-Kwon, Oh / Assistant Manager

9.6.2.4 Test data for LE 2 M_2 Mbps

- Test Date : June 05, 2019 ~ June 11, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
1 MHz 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 : 38.92 %
- 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	17.77	Peak	H	30.84	7.28	-	55.89	74.00	18.11
4 804.000	8.89	Average	H	30.84	7.28	4.10	51.11	54.00	2.89
4 804.000	17.64	Peak	V	30.84	7.28	-	55.76	74.00	18.24
4 804.000	8.85	Average	V	30.84	7.28	4.10	51.07	54.00	2.93
Test Data for Middle Channel									
4 880.000	17.33	Peak	H	30.01	7.42	-	54.76	74.00	19.24
4 880.000	8.70	Average	H	30.01	7.42	4.10	50.23	54.00	3.77
4 880.000	17.16	Peak	V	30.01	7.42	-	54.59	74.00	19.41
4 880.000	8.60	Average	V	30.01	7.42	4.10	50.13	54.00	3.87
Test Data for High Channel									
4 960.000	17.68	Peak	H	31.15	7.40	-	56.23	74.00	17.77
4 960.000	8.50	Average	H	31.15	7.40	4.10	51.15	54.00	2.85
4 960.000	17.45	Peak	V	31.15	7.40	-	56.00	74.00	18.00
4 960.000	8.60	Average	V	31.15	7.40	4.10	51.25	54.00	2.75

Tabulated test data for Restricted Band

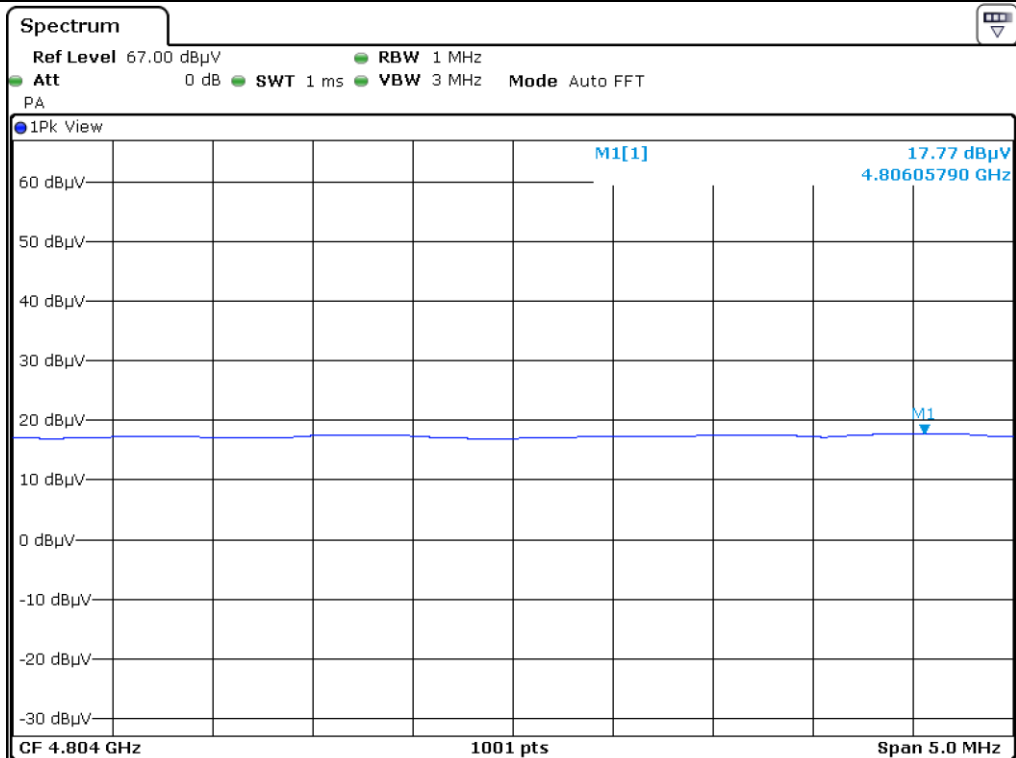
Remark: "H": Horizontal, "V": Vertical

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

Total Level = Reading + Antenna Factor + Cable Loss + Correction Factor



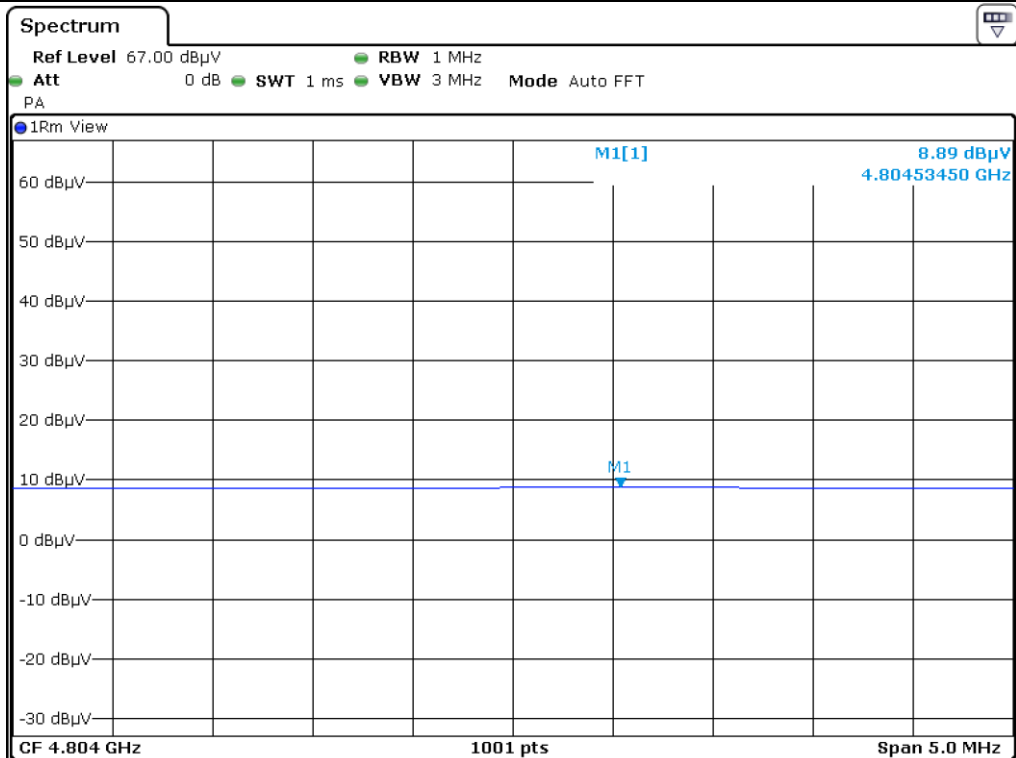
Tested by: Hyung-Kwon, Oh / Assistant Manager



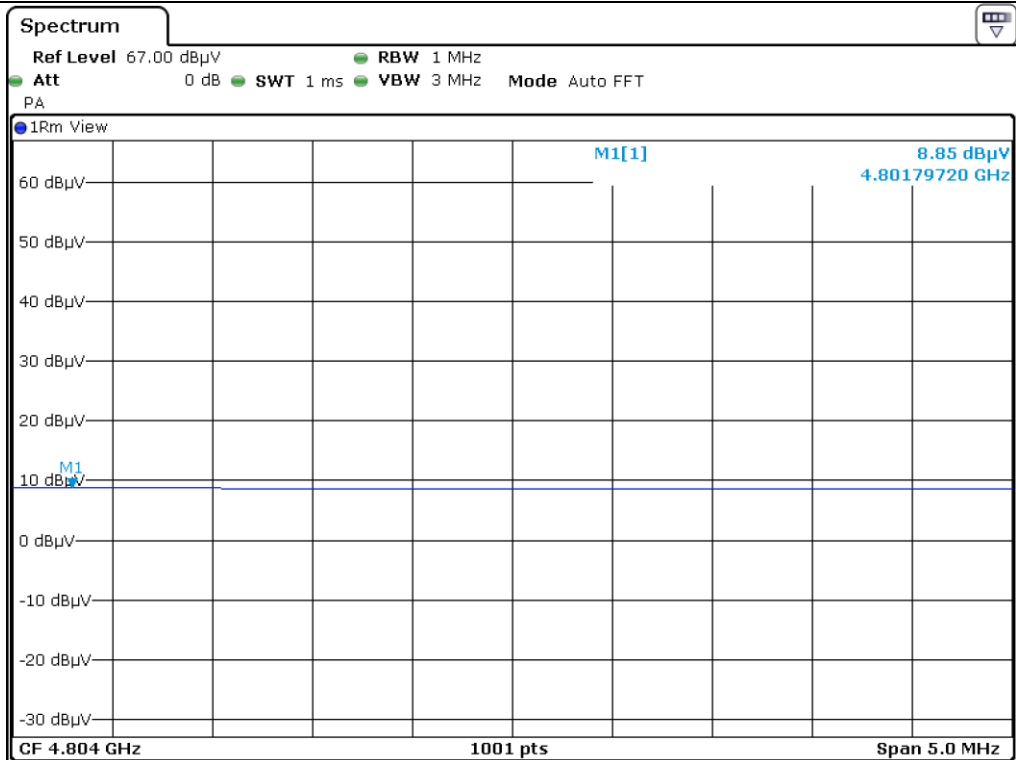
Low Channel_Peak_H



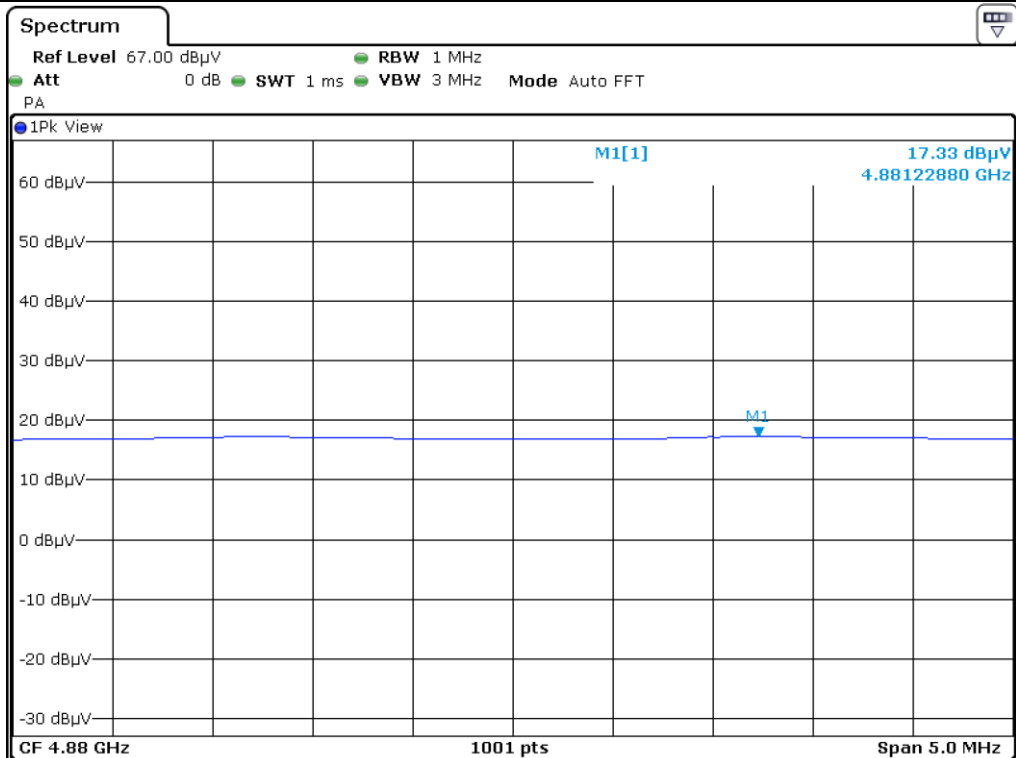
Low Channel_Peak_V



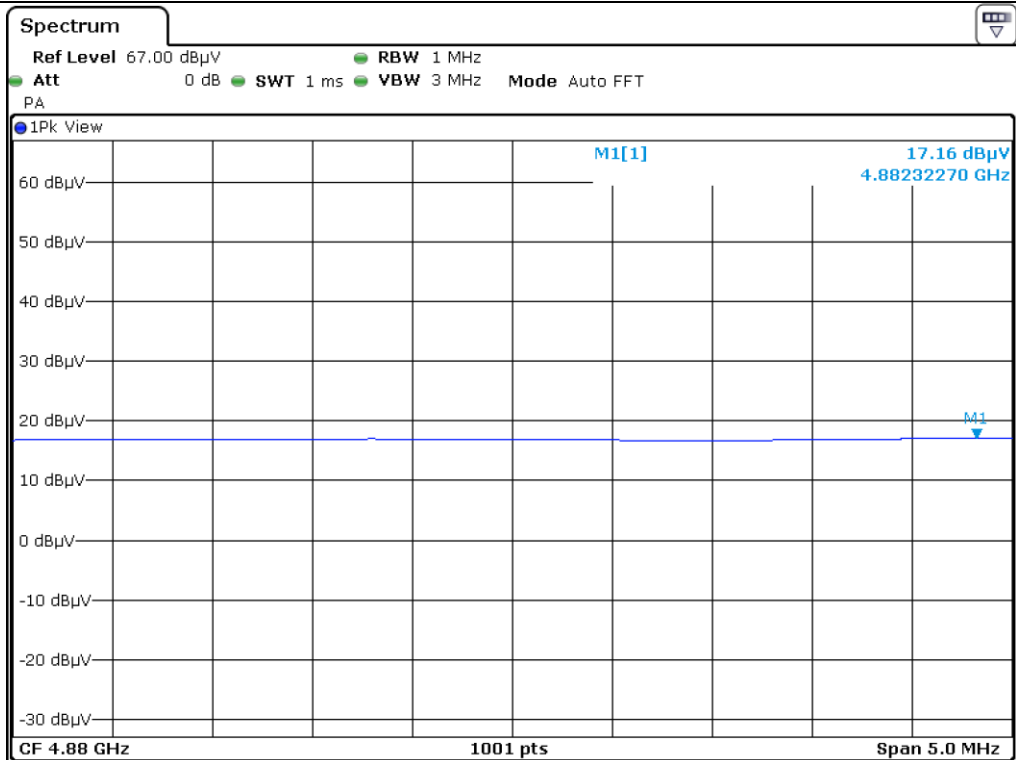
Low Channel_ Average_H



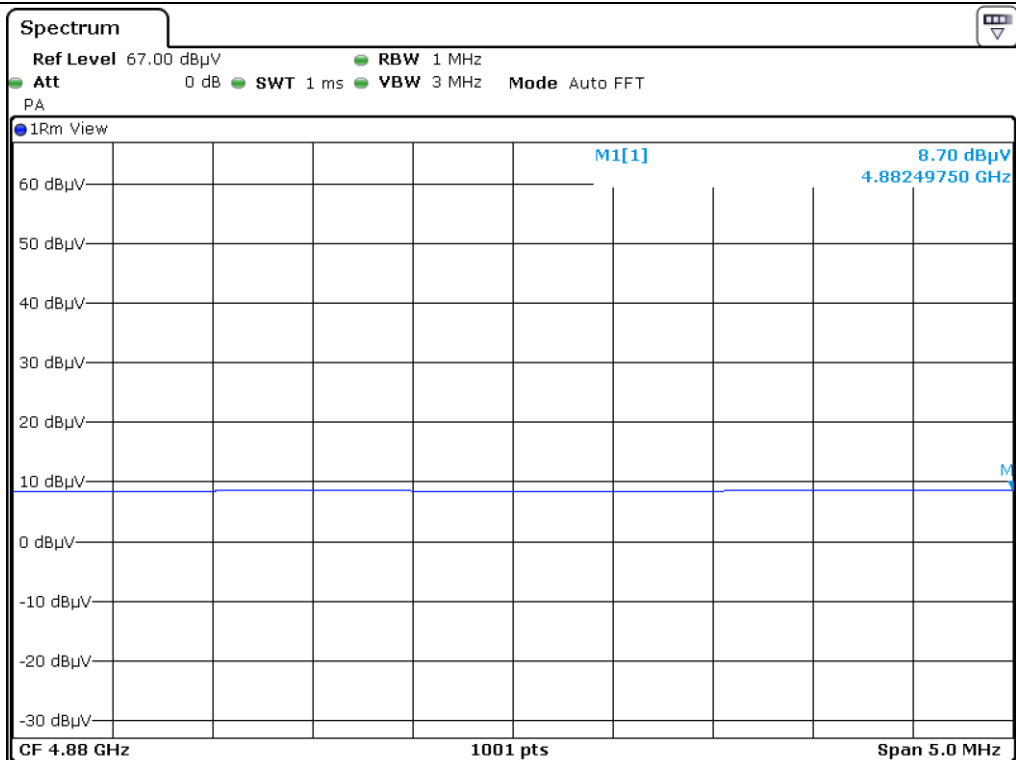
Low Channel_ Average_V



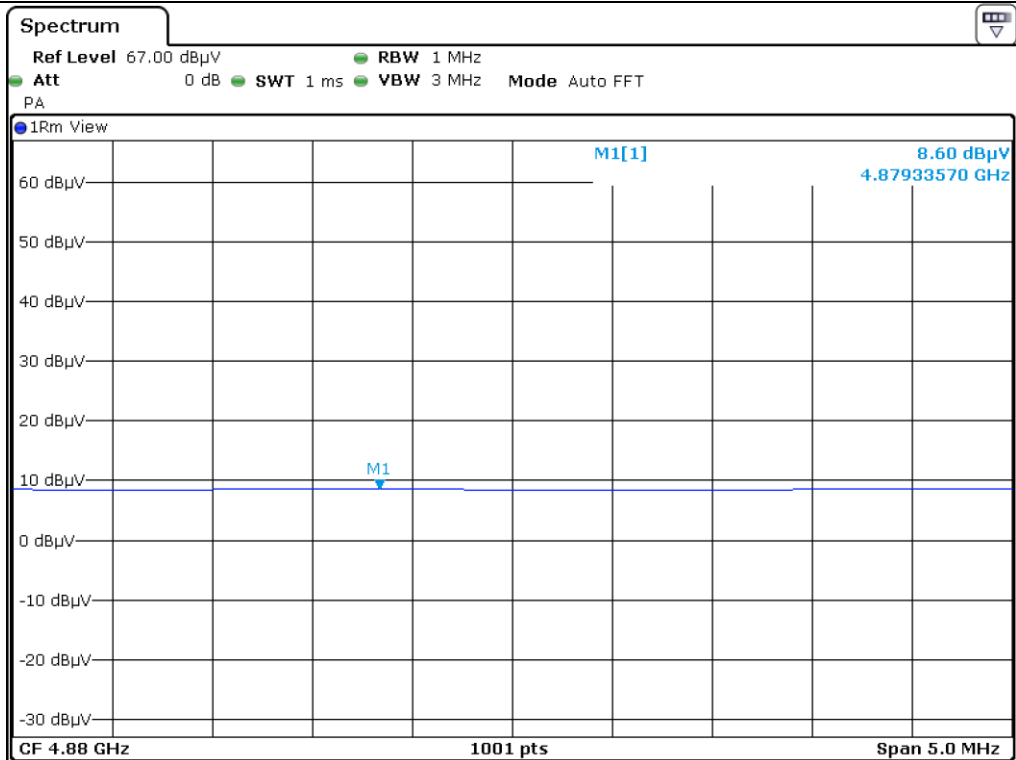
Middle Channel_Peak_H



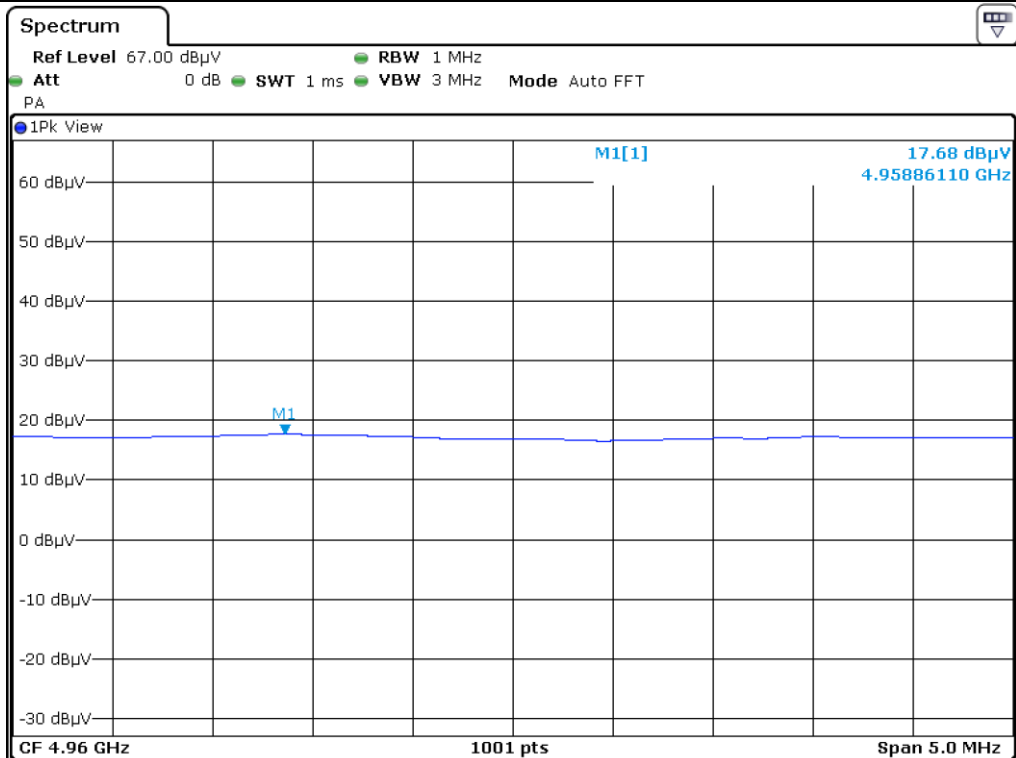
Middle Channel_Peak_V



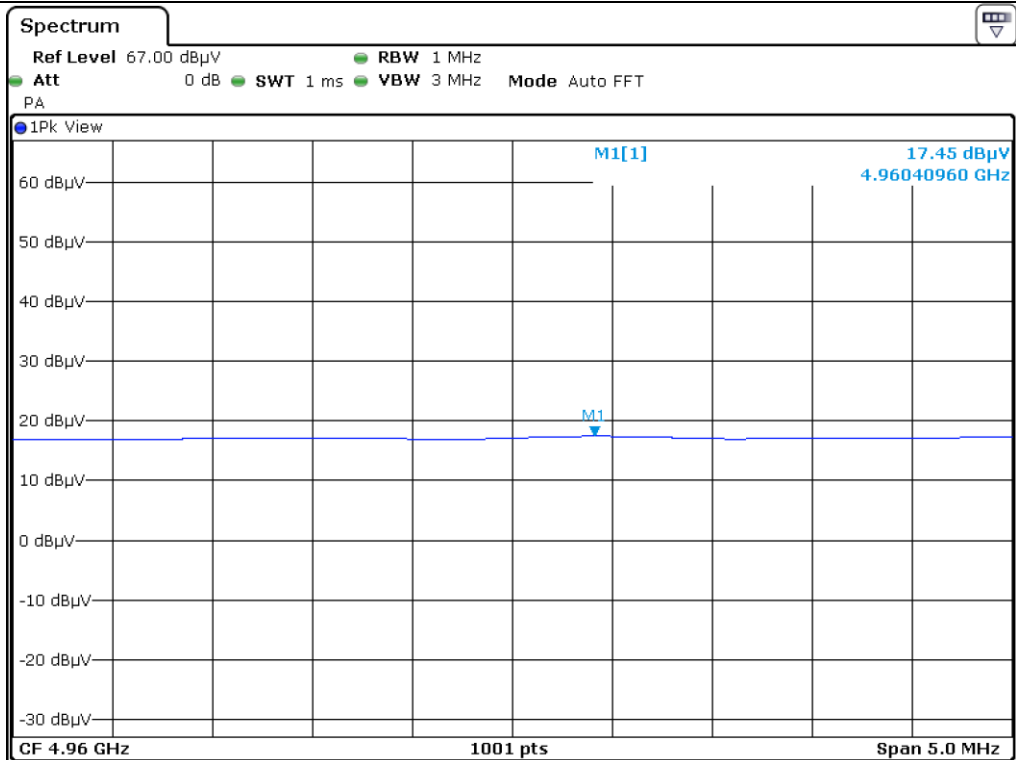
Middle Channel_Average_H



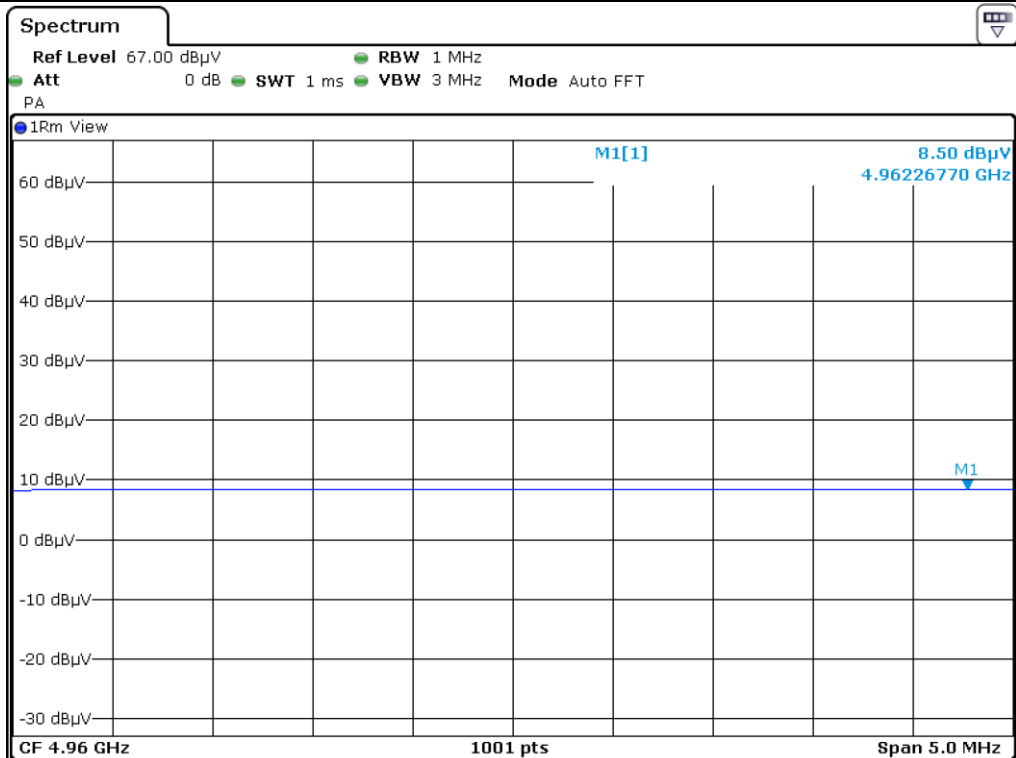
Middle Channel_Average_V



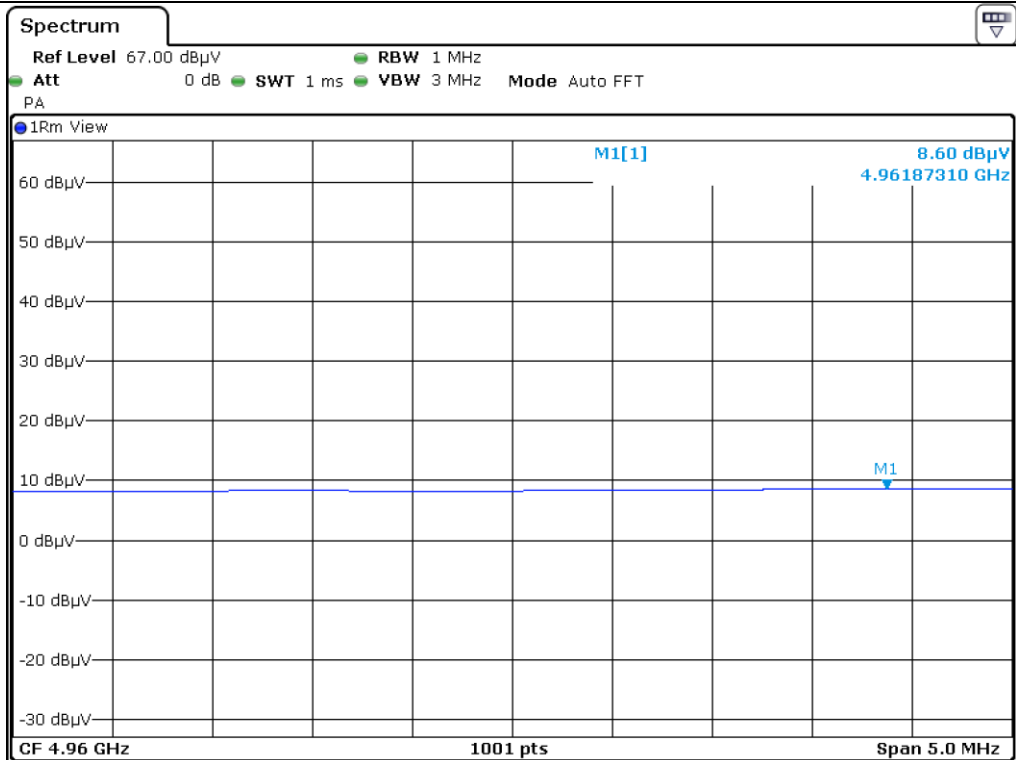
High Channel_Peak_H



High Channel_Peak_V



High Channel_Average_H



High Channel_Average_V

10. PEAK POWER SPECTRAL DENSITY

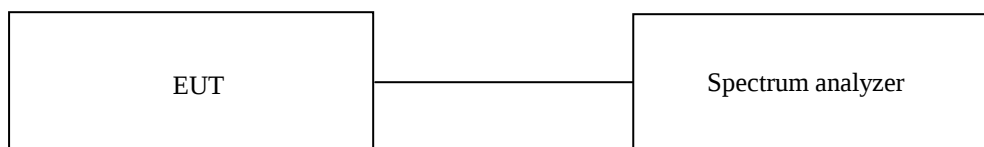
10.1 Operating environment

Temperature : 24.3 °C
Relative humidity : 43.9 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer.

The resolution bandwidth is set to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$, the video bandwidth is set to 3 times the resolution bandwidth.



10.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

10.4 Test data for LE Coded_125 kbps

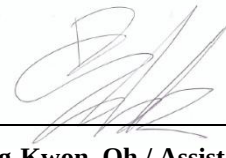
-. Test Date : June 05, 2019 ~ June 11, 2019

-. Test Result : Pass

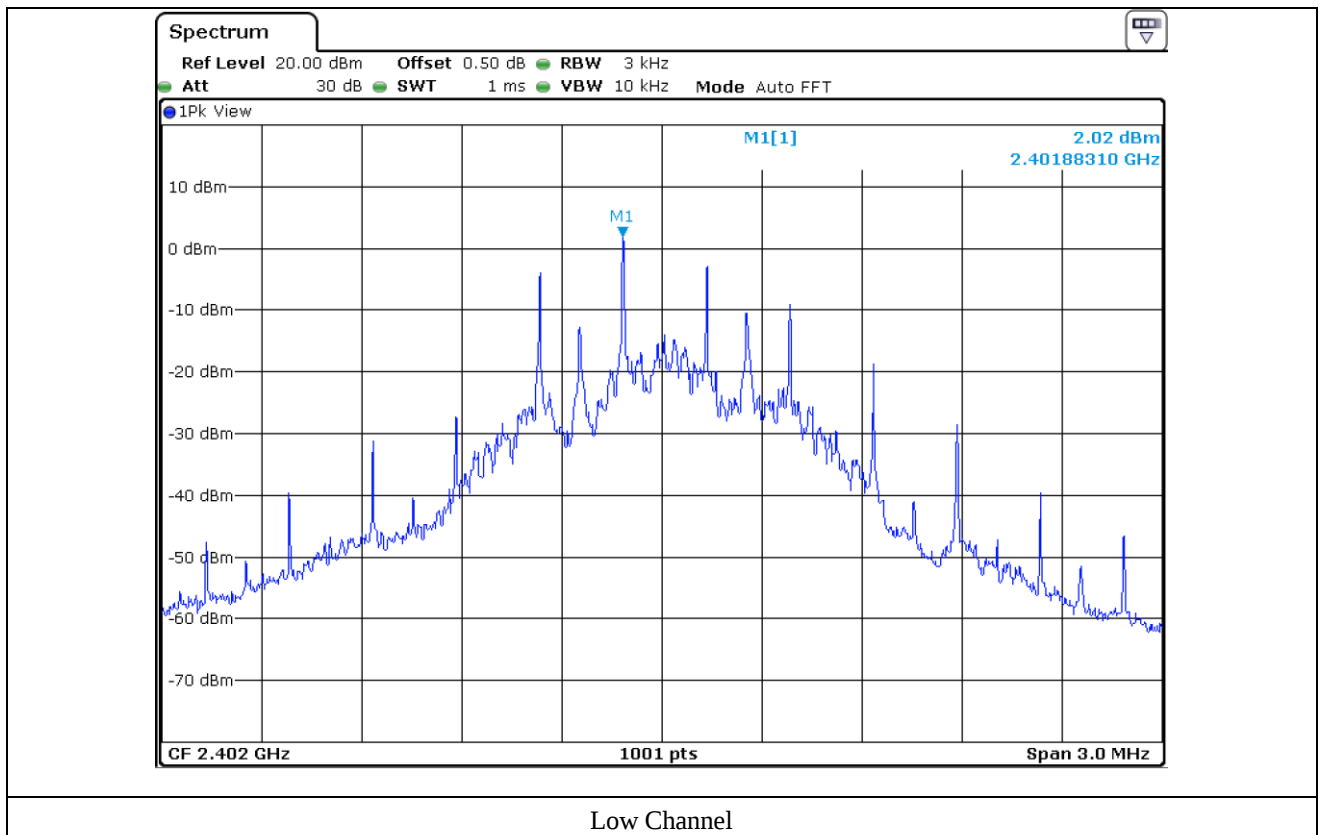
-. Operating Condition : Continuous transmitting mode

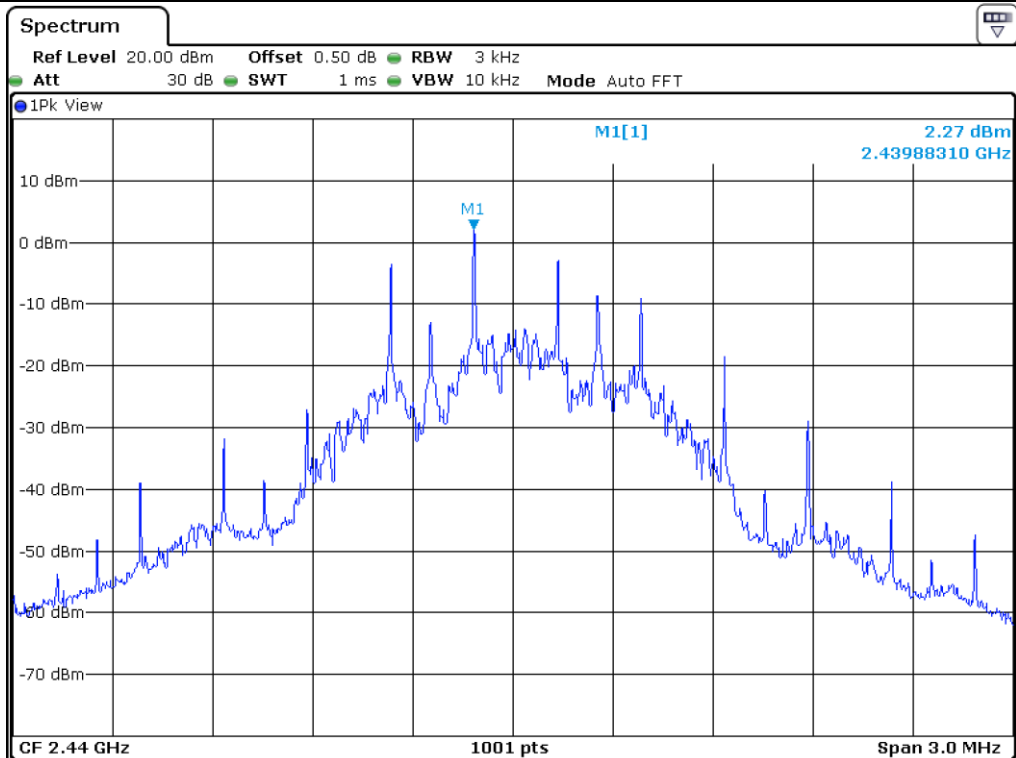
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	2.02	8.00	5.98
Middle	2 440.00	2.27	8.00	5.73
High	2 480.00	1.80	8.00	6.20

Remark. Margin = Limit – Measured value

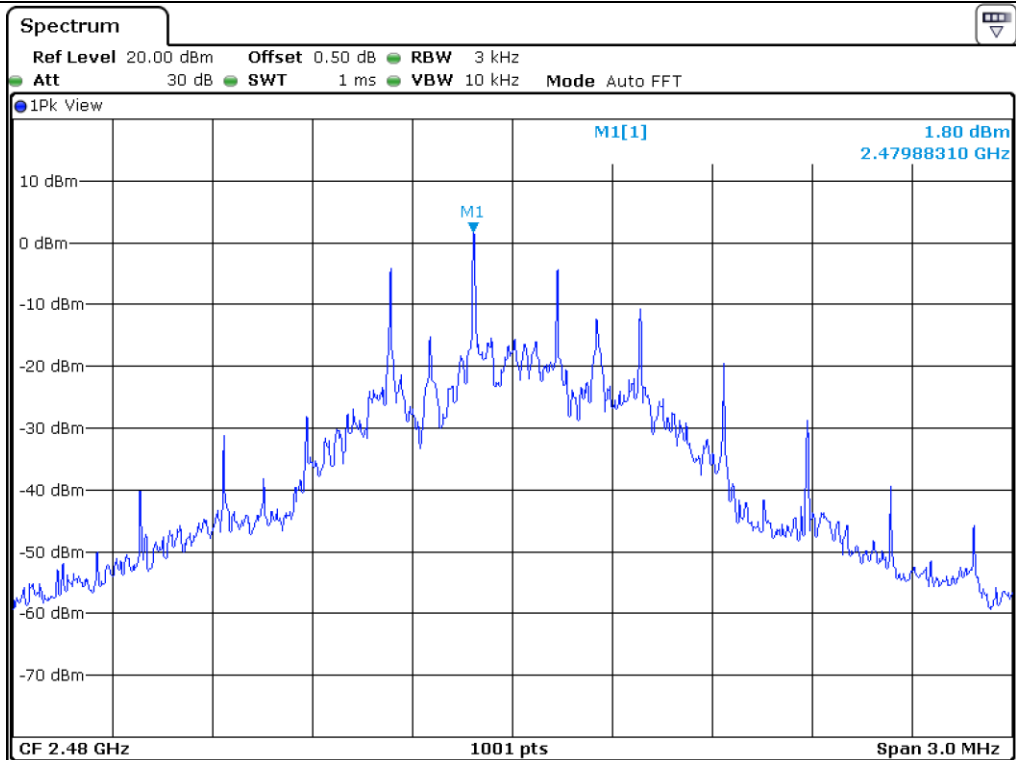


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

10.5 Test data for LE Coded_500 kbps

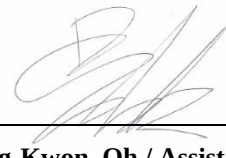
-. Test Date : June 05, 2019 ~ June 11, 2019

-. Test Result : Pass

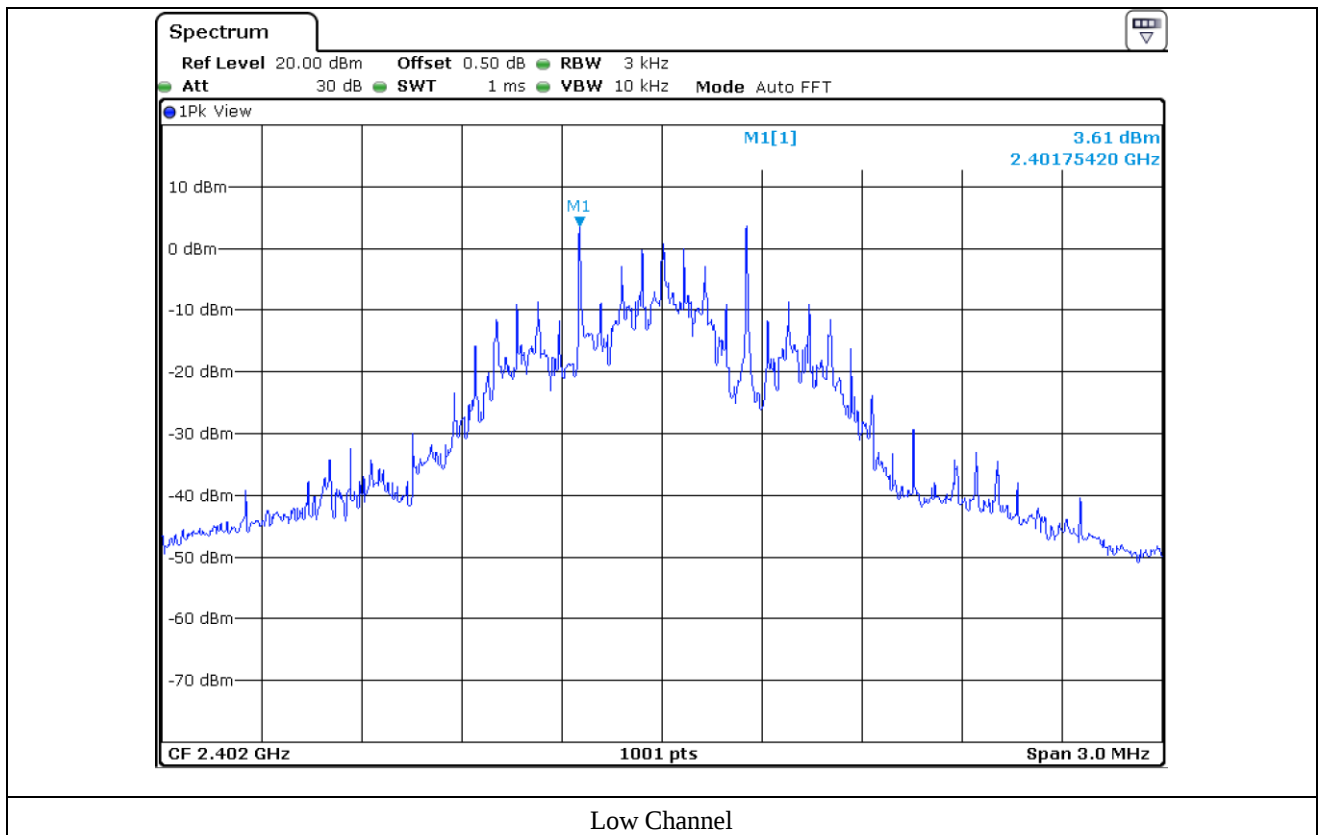
-. Operating Condition : Continuous transmitting mode

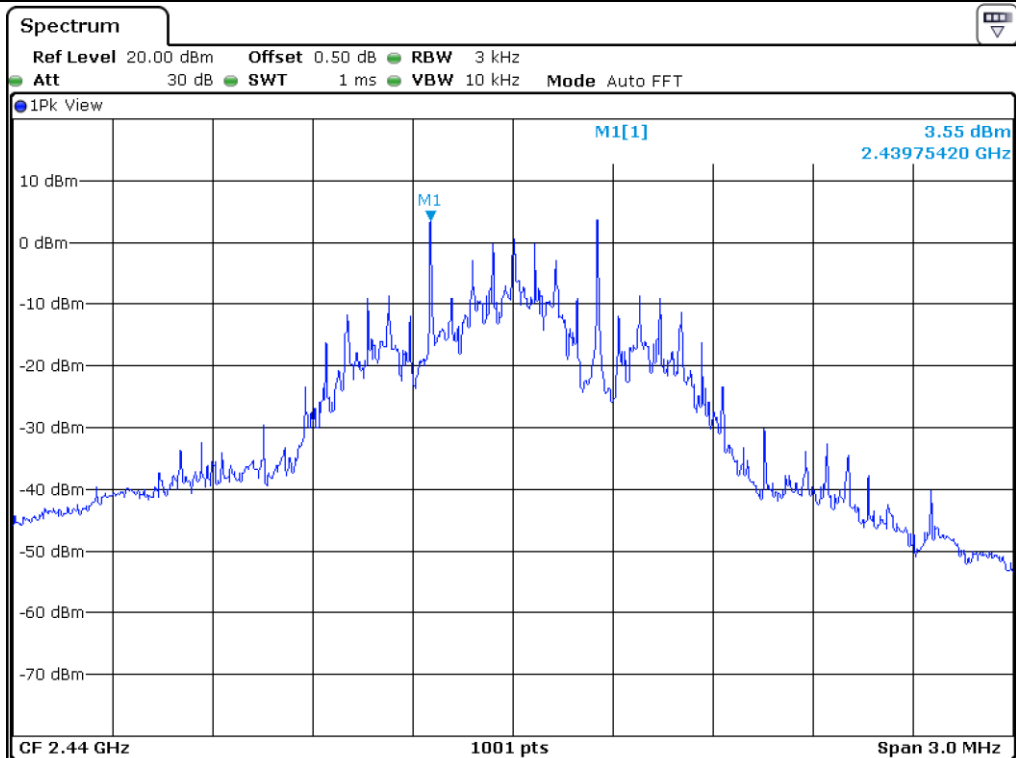
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	3.61	8.00	4.39
Middle	2 440.00	3.55	8.00	4.45
High	2 480.00	3.72	8.00	4.28

Remark. Margin = Limit – Measured value

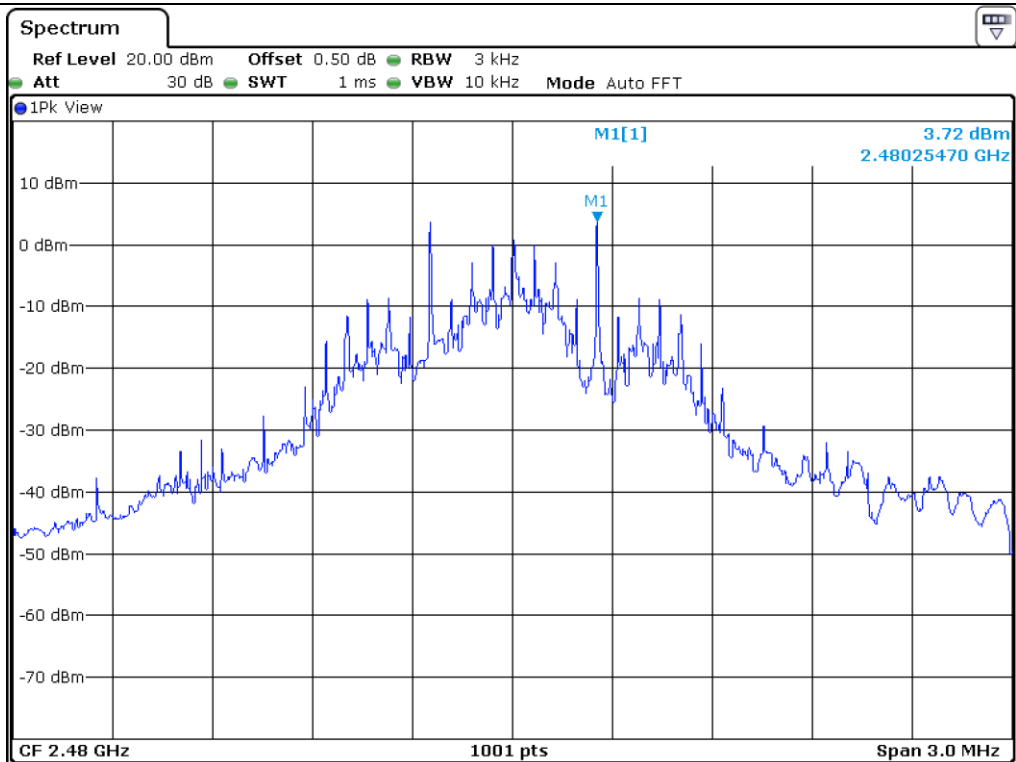


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

10.6 Test data for LE 1 M_1 Mbps

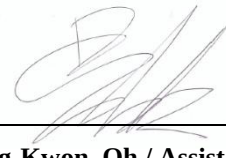
-. Test Date : June 05, 2019 ~ June 11, 2019

-. Test Result : Pass

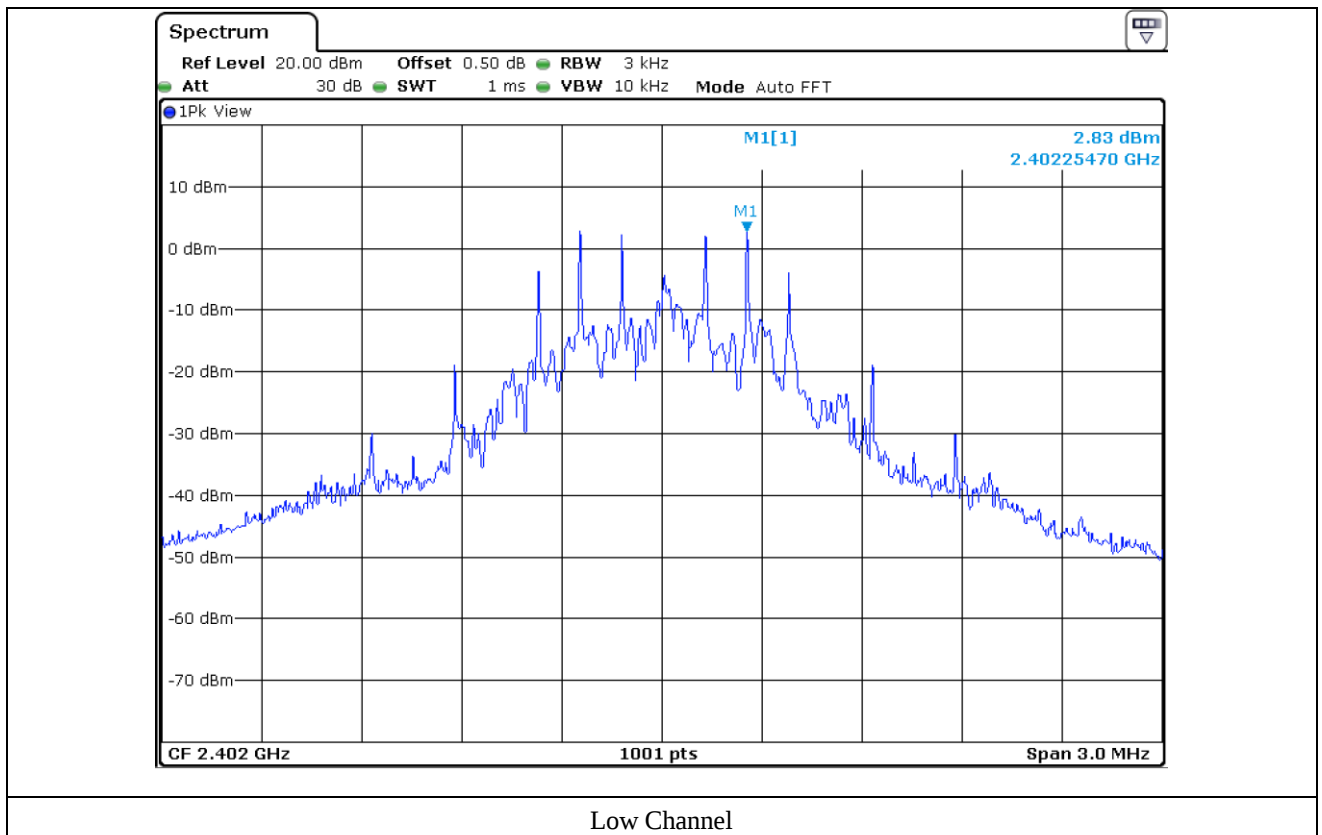
-. Operating Condition : Continuous transmitting mode

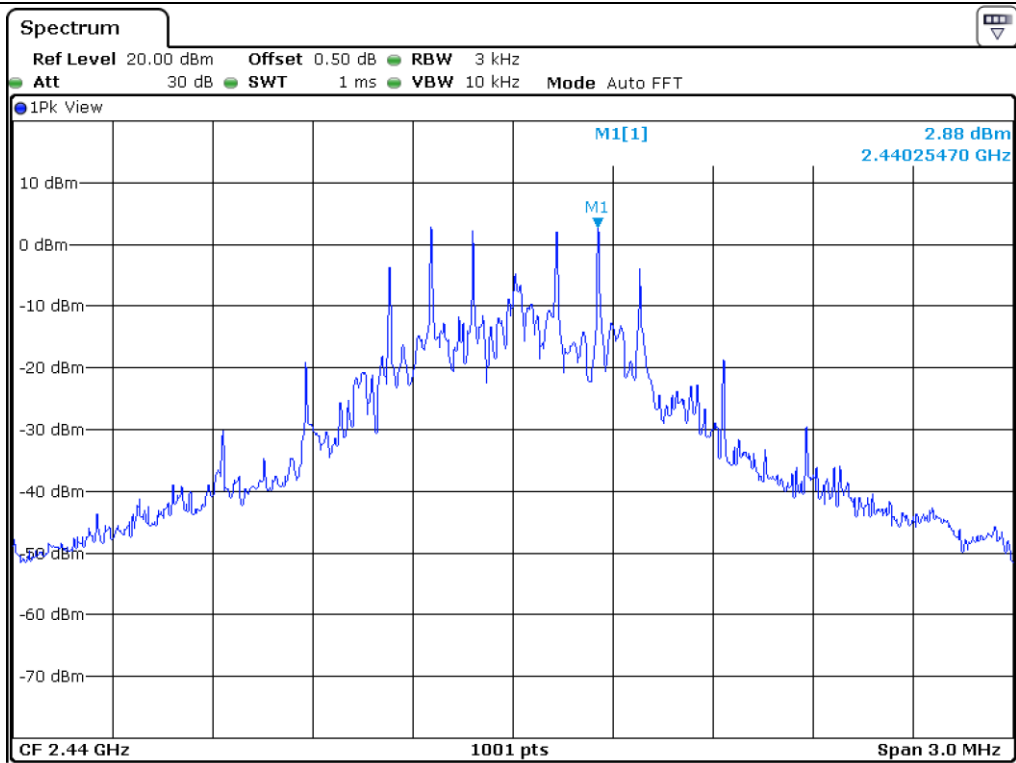
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	2.83	8.00	5.17
Middle	2 440.00	2.88	8.00	5.12
High	2 480.00	2.96	8.00	5.04

Remark. Margin = Limit – Measured value

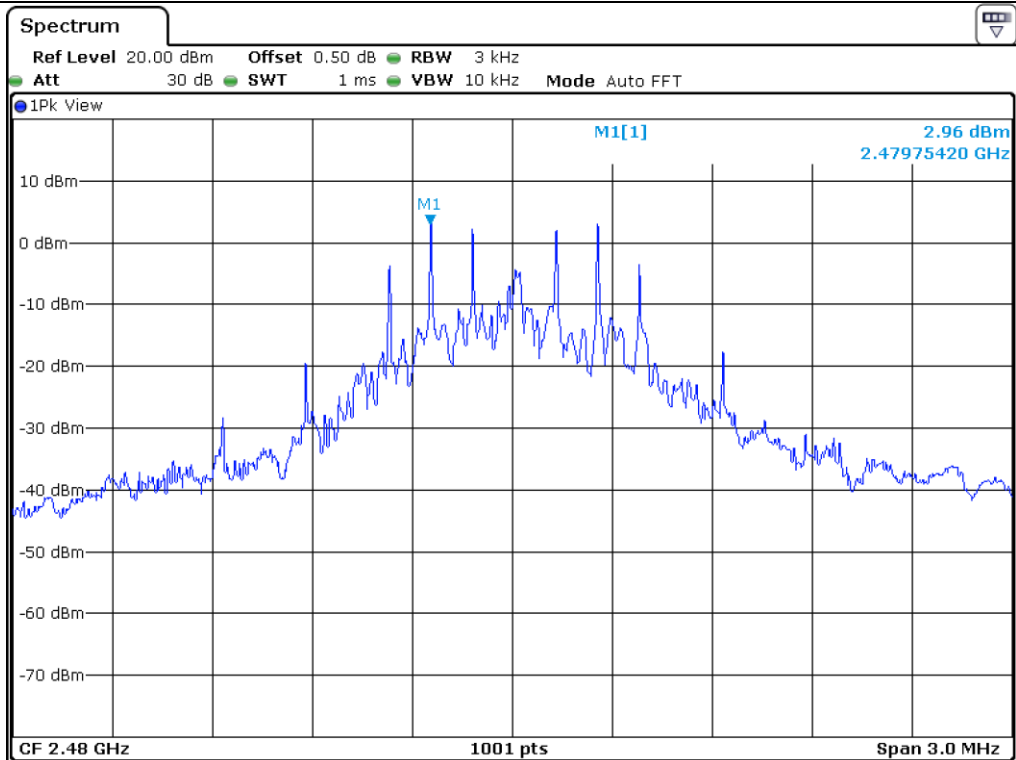


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

10.7 Test data for LE 2 M_2 Mbps

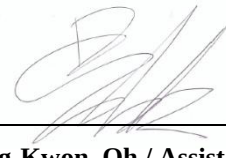
-. Test Date : June 05, 2019 ~ June 11, 2019

-. Test Result : Pass

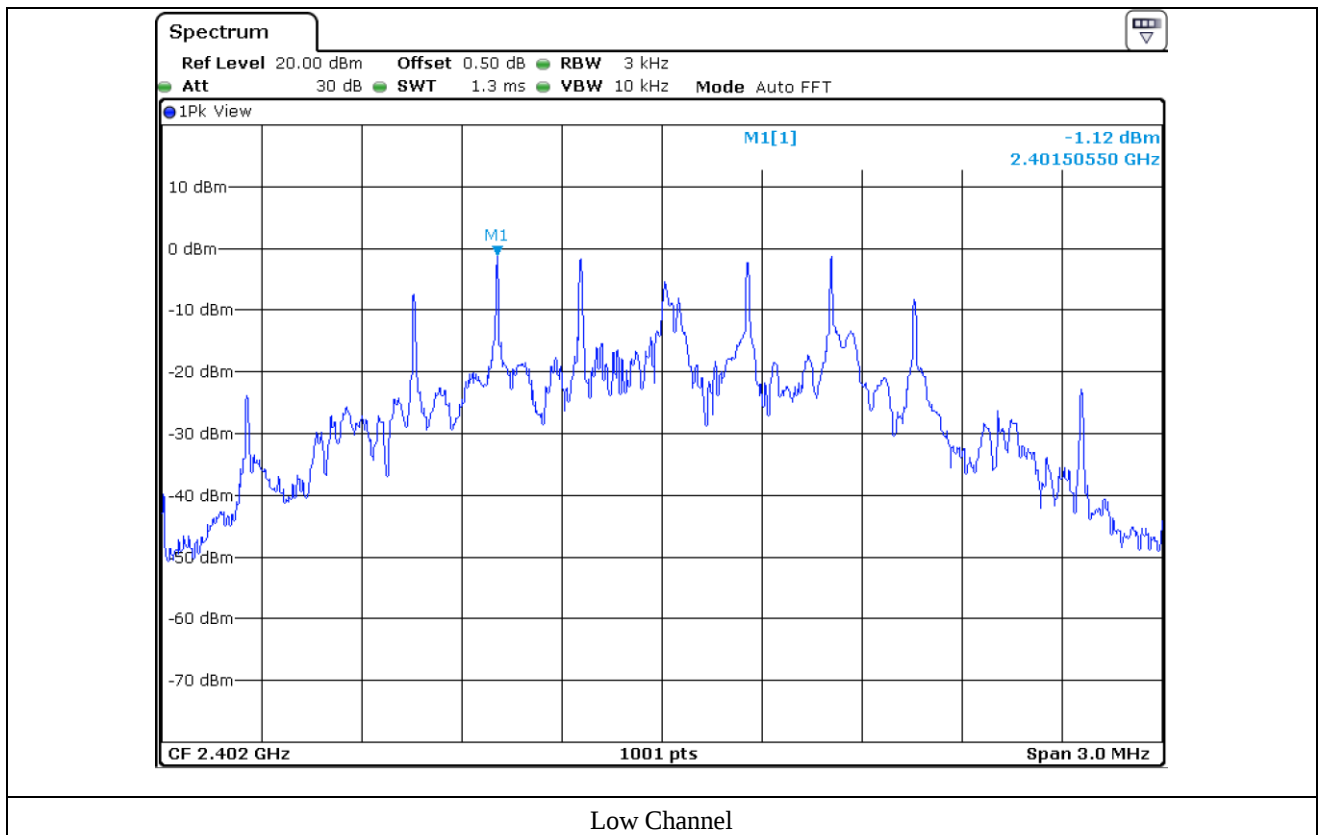
-. Operating Condition : Continuous transmitting mode

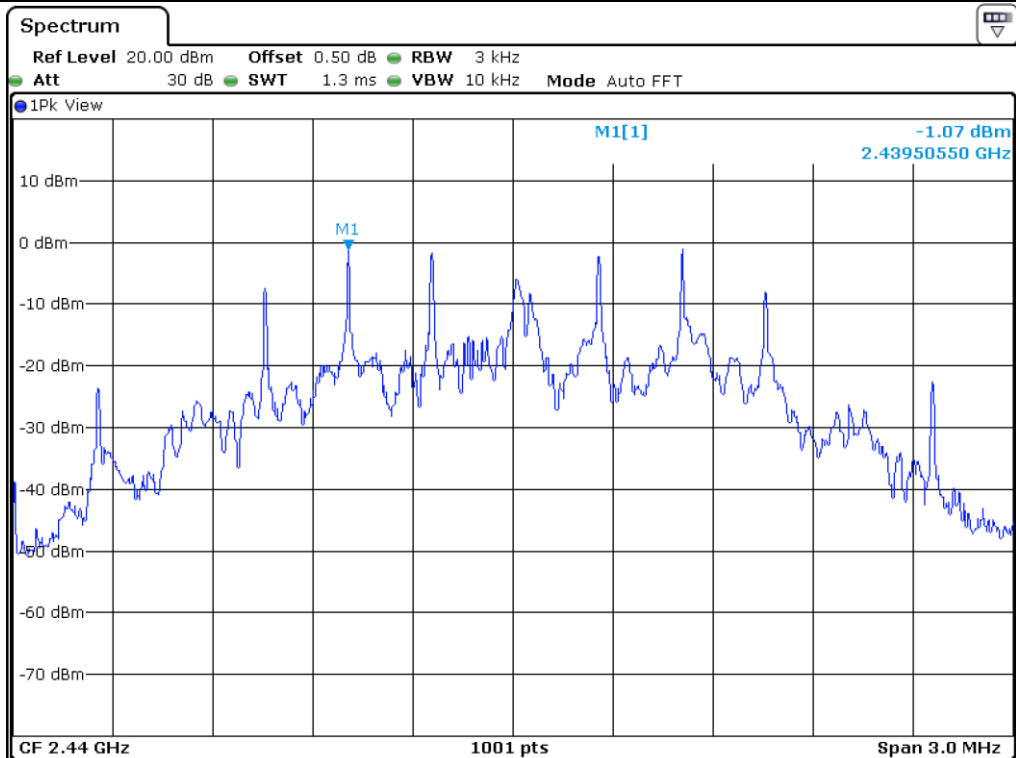
CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 402.00	-1.12	8.00	9.12
Middle	2 440.00	-1.07	8.00	9.07
High	2 480.00	-1.07	8.00	9.07

Remark. Margin = Limit – Measured value

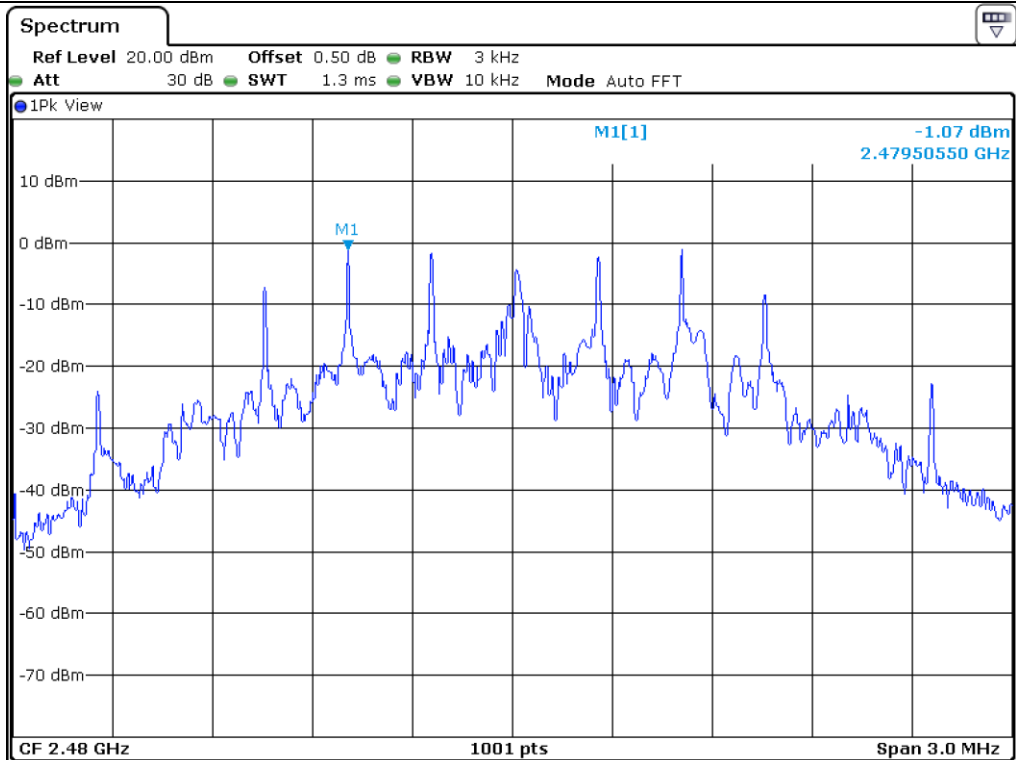


Tested by: Hyung-Kwon, Oh / Assistant Manager





Middle Channel



High Channel

11. RADIATED EMISSION TEST

11.1 Operating environment

Temperature : 24 °C
Relative humidity : 43 % R.H.

11.2 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.

11.3 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	312545	Mar. 18, 2019 (1Y)
■ - BBV9718	Schwarzbeck	Amplifier	310	Mar. 28, 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)
■ - BBHA 9120D	Schwarzbeck	Horn Antenna	9120D-1366	Aug. 02, 2017 (2Y)
■ - BBHA 9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 16, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test data

11.4.1 Test data for 30 MHz ~ 1 GHz

Humidity Level : 43 % R.H.

Temperature: 24 °C

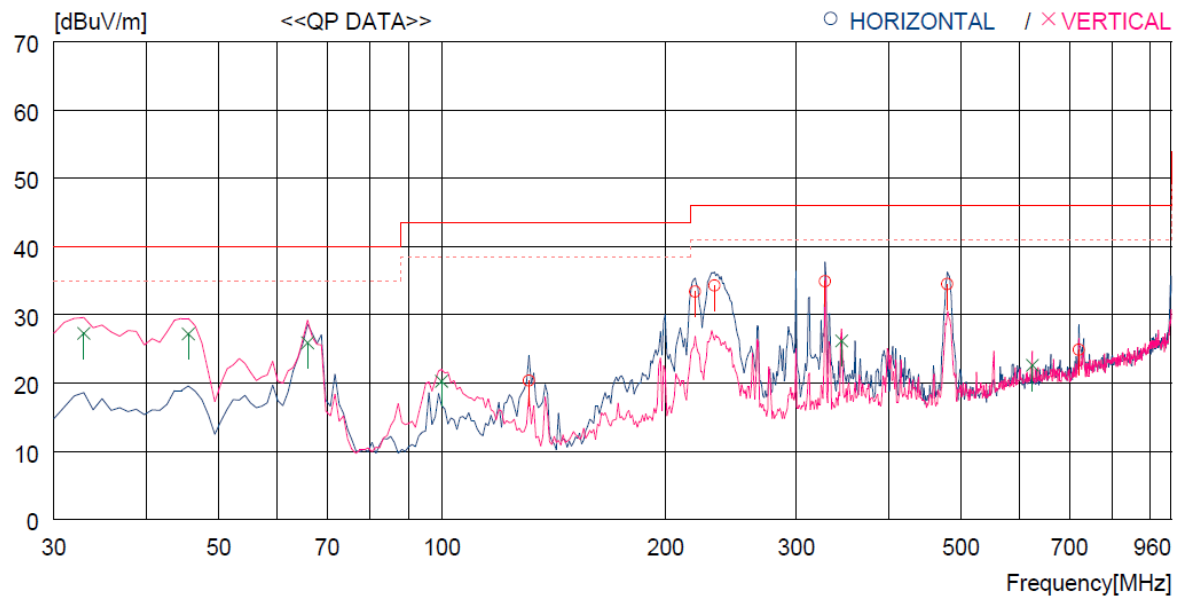
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247

Result : PASSED

EUT : IoT Module

Date: June 05, 2019 ~ June 11, 2019

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



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	130.880	41.8	9.0	2.6	33.0	20.4	43.5	23.1	300	263
2	219.150	51.4	11.5	3.4	32.9	33.4	46.0	12.6	200	234
3	232.730	51.7	11.7	4.0	33.1	34.3	46.0	11.7	200	209
4	479.111	45.3	16.8	5.7	33.3	34.5	46.0	11.5	100	359
5	720.634	31.8	19.5	7.1	33.5	24.9	46.0	21.1	300	255
6	327.790	49.3	14.0	4.7	33.1	34.9	46.0	11.1	100	359
----- Vertical -----										
7	32.910	46.1	12.9	1.4	33.1	27.3	40.0	12.7	100	0
8	45.520	44.3	14.5	1.5	33.1	27.2	40.0	12.8	100	0
9	65.890	46.2	10.9	1.9	33.1	25.9	40.0	14.1	100	0
10	99.840	38.5	12.5	2.3	33.0	20.3	43.5	23.2	100	0
11	345.250	39.5	15.0	4.8	33.1	26.2	46.0	19.8	200	201
12	623.637	30.1	19.4	6.5	33.4	22.6	46.0	23.4	100	0

Tested by: Hyung-Kwon, Oh / Assistant Manager

11.4.2 Test data for Below 30 MHz

- . Test Date : June 05, 2019 ~ June 11, 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.									

11.4.3 Test data for above 1 GHz

- . Test Date : June 05, 2019 ~ June 11, 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

12. CONDUCTED EMISSION TEST

12.1 Operating environment

Temperature : 24 °C
Relative humidity : 43 % R.H.

12.2 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.

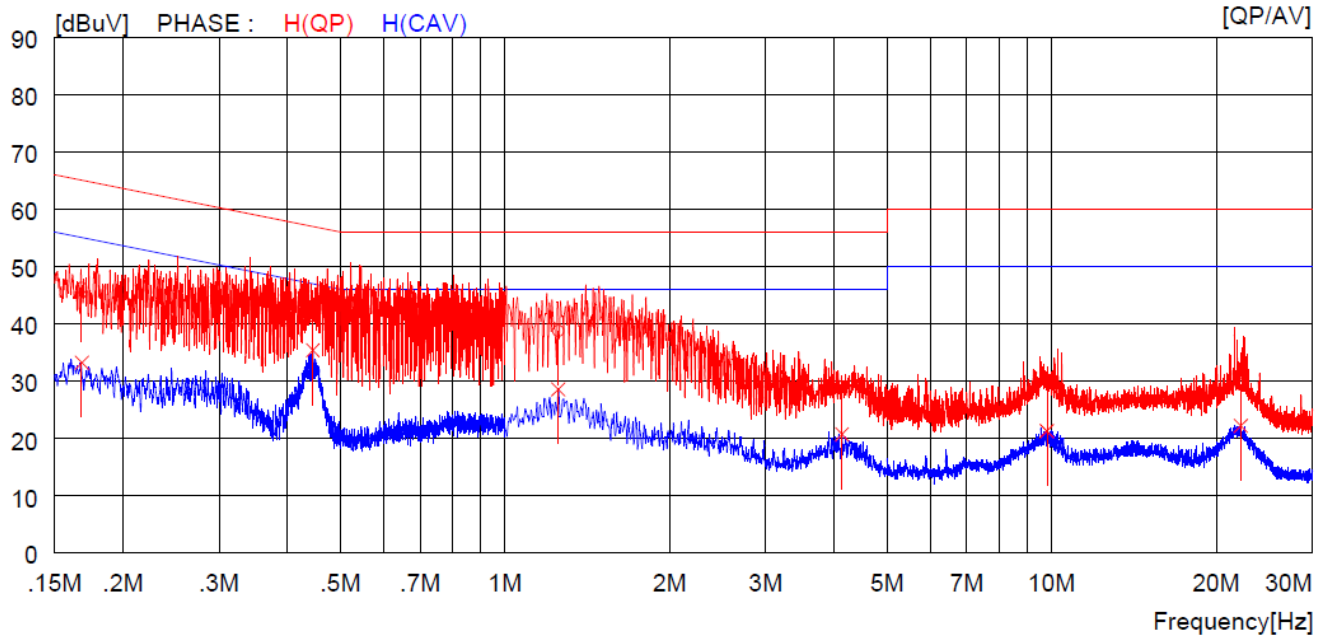
12.3 Test equipment used

	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.

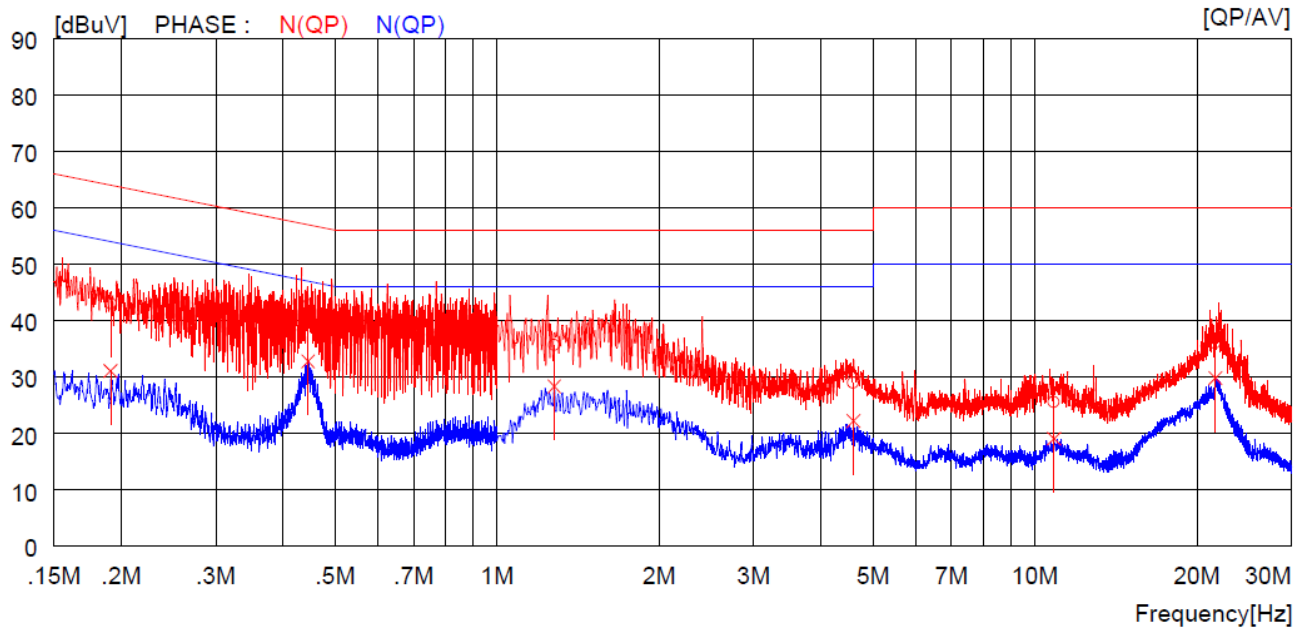
12.4 Test data

- Test Date : June 05, 2019 ~ June 11, 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	0.16800	36.3	----	10.0	46.3	----	65.1	----	18.8	----	H (QP)
2	0.44500	31.4	----	10.0	41.4	----	57.0	----	15.6	----	H (QP)
3	1.25200	28.7	----	10.1	38.8	----	56.0	----	17.2	----	H (QP)
4	4.13600	18.9	----	10.1	29.0	----	56.0	----	27.0	----	H (QP)
5	9.80500	19.9	----	10.3	30.2	----	60.0	----	29.8	----	H (QP)
6	22.17000	18.7	----	10.7	29.4	----	60.0	----	30.6	----	H (QP)
7	0.16800	----	23.2	10.0	----	33.2	----	55.1	----	21.9	H (CAV)
8	0.44500	----	25.4	10.0	----	35.4	----	47.0	----	11.6	H (CAV)
9	1.25200	----	18.5	10.1	----	28.6	----	46.0	----	17.4	H (CAV)
10	4.13600	----	10.6	10.1	----	20.7	----	46.0	----	25.3	H (CAV)
11	9.80500	----	11.0	10.3	----	21.3	----	50.0	----	28.7	H (CAV)
12	22.17000	----	11.5	10.7	----	22.2	----	50.0	----	27.8	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	0.19100	33.1	----	10.0	43.1	----	64.0	----	20.9	----	N (QP)
2	0.44500	32.7	----	10.0	42.7	----	57.0	----	14.3	----	N (QP)
3	1.27600	25.6	----	10.1	35.7	----	56.0	----	20.3	----	N (QP)
4	4.59600	18.9	----	10.1	29.0	----	56.0	----	27.0	----	N (QP)
5	10.85000	15.2	----	10.4	25.6	----	60.0	----	34.4	----	N (QP)
6	21.65000	25.3	----	10.7	36.0	----	60.0	----	24.0	----	N (QP)
7	0.19100	----	21.1	10.0	----	31.1	----	54.0	----	22.9	N (CAV)
8	0.44500	----	22.8	10.0	----	32.8	----	47.0	----	14.2	N (CAV)
9	1.27600	----	18.3	10.1	----	28.4	----	46.0	----	17.6	N (CAV)
10	4.59600	----	12.1	10.1	----	22.2	----	46.0	----	23.8	N (CAV)
11	10.85000	----	8.7	10.4	----	19.1	----	50.0	----	30.9	N (CAV)
12	21.65000	----	19.1	10.7	----	29.8	----	50.0	----	20.2	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.

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