12. 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

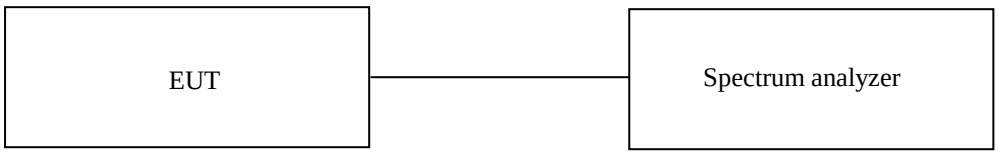
12.1 Operating environment

Temperature : 24.4 ℃

Relative humidity : 45 % 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, open-field test site. The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane.

The frequency spectrum from 30 kHz 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 ms 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. (Interval)
☐ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Nov. 03, 2014(1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 29, 2014(1Y)
☐ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 28, 2014(1Y)
☐ -	FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Oct. 08, 2014(1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Apr. 28, 2014(1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	Apr. 28, 2014(1Y)
■ -	SCU-18	Rohde & Schwarz	PRE-AMPLIFIER	10041	Jan. 20, 2014(1Y)
■ -	MA240	HD GmbH	Antenna Master	N/A	N/A
■ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DS420S	HD GmbH	Turn Table	N/A	N/A
■ -	HFH2-Z2	Rohde & Schwarz	Loop Antenna	879 285/26	Dec. 09, 2014(2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	May 02, 2014(2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 05, 2013(2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	N/A
■ -	83051A	Agilent	Microwave System Preamplifer	3950M00201	Apr. 30, 2014(1Y)

All test equipment used is calibrated on a regular basis.

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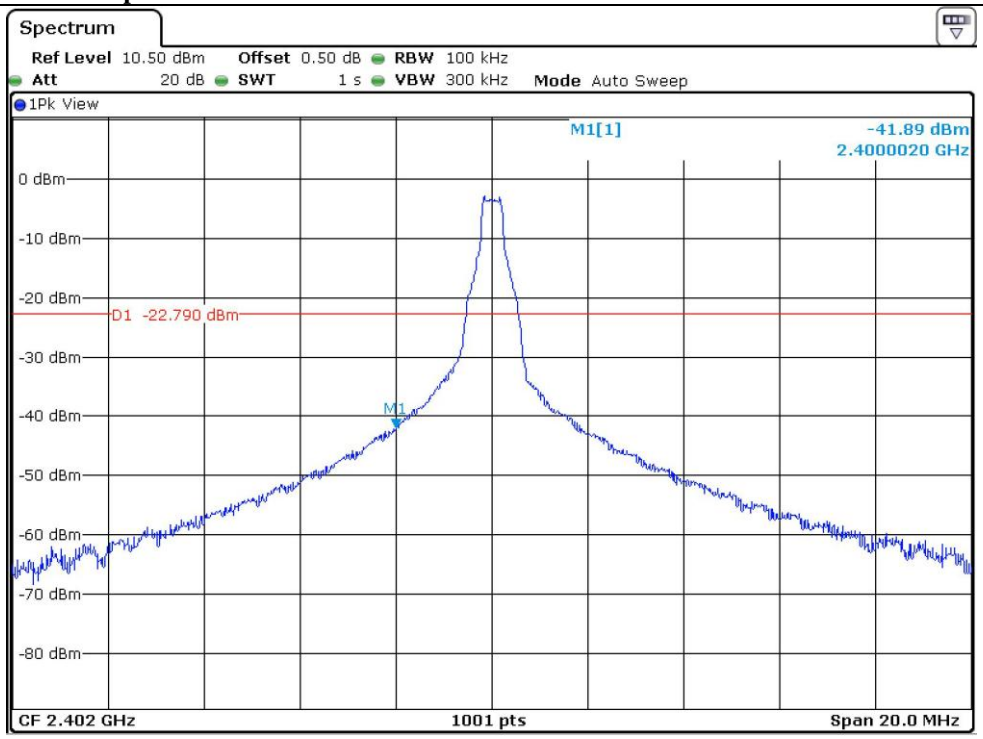
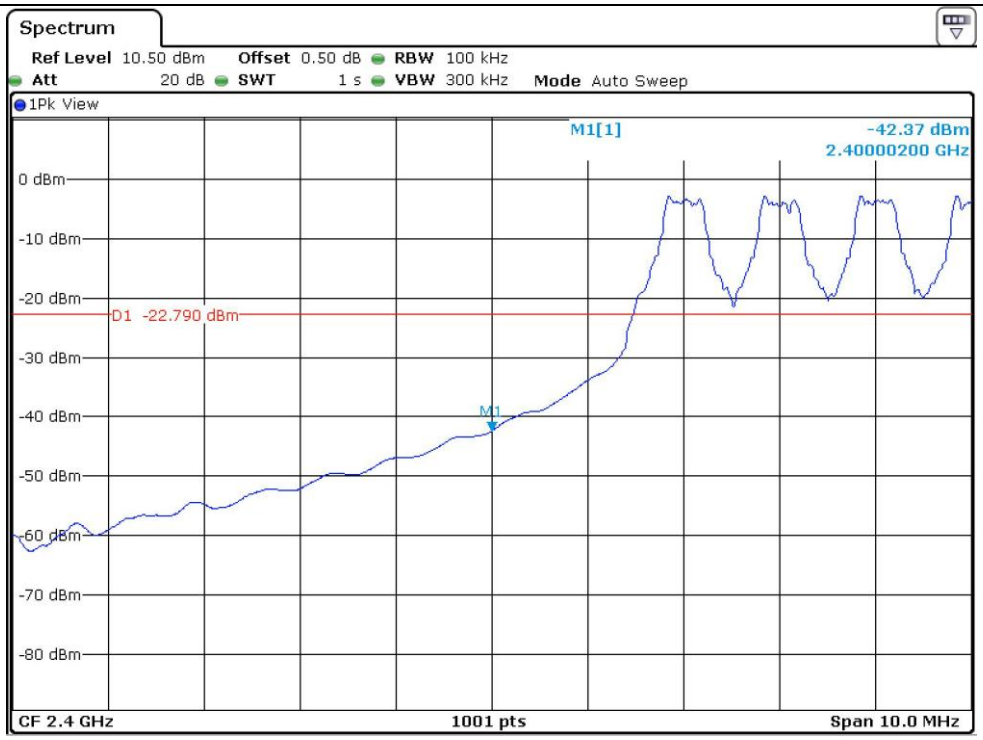
12.5 Test data for conducted emission

12.5.1 Test data for 1 Mbps



Low Channel



Low Channel

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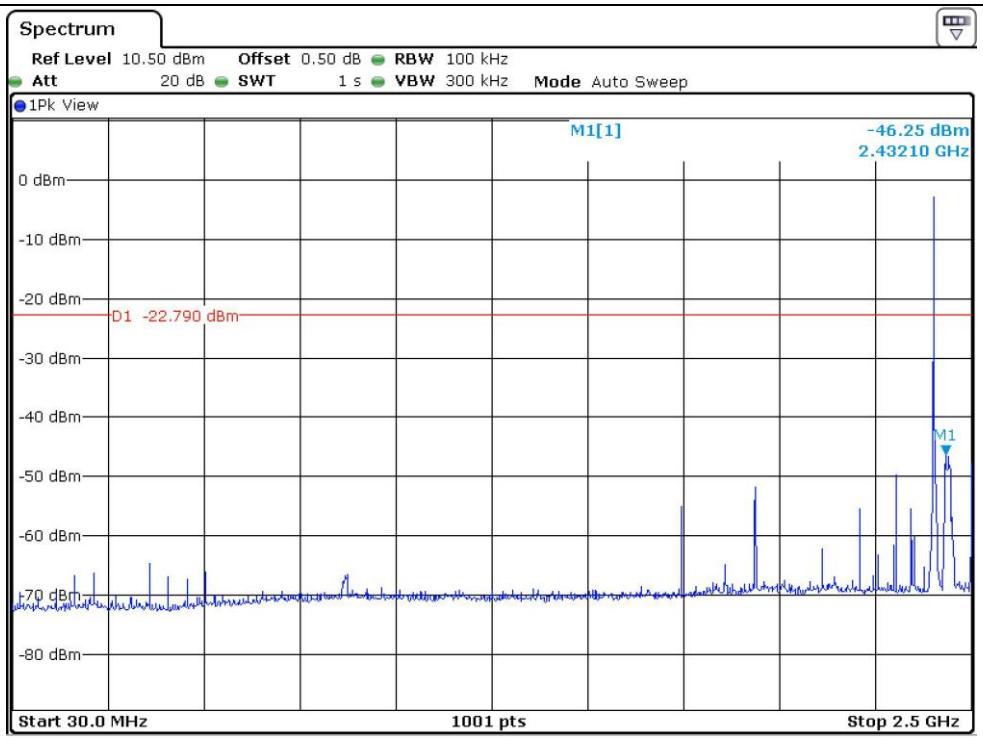

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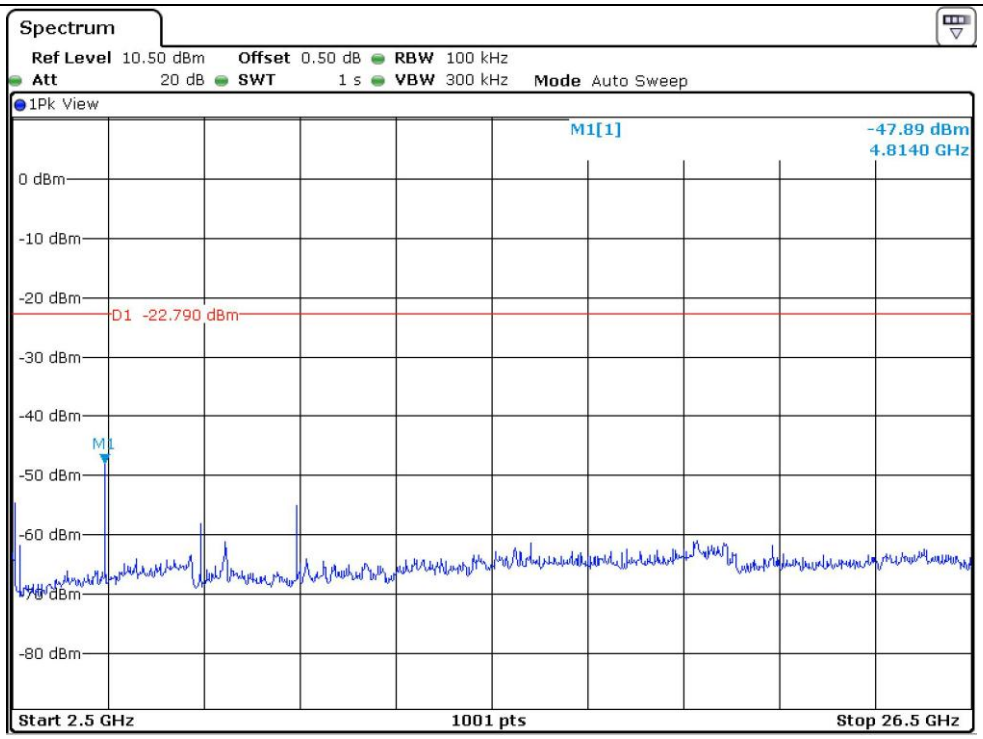

Low Channel

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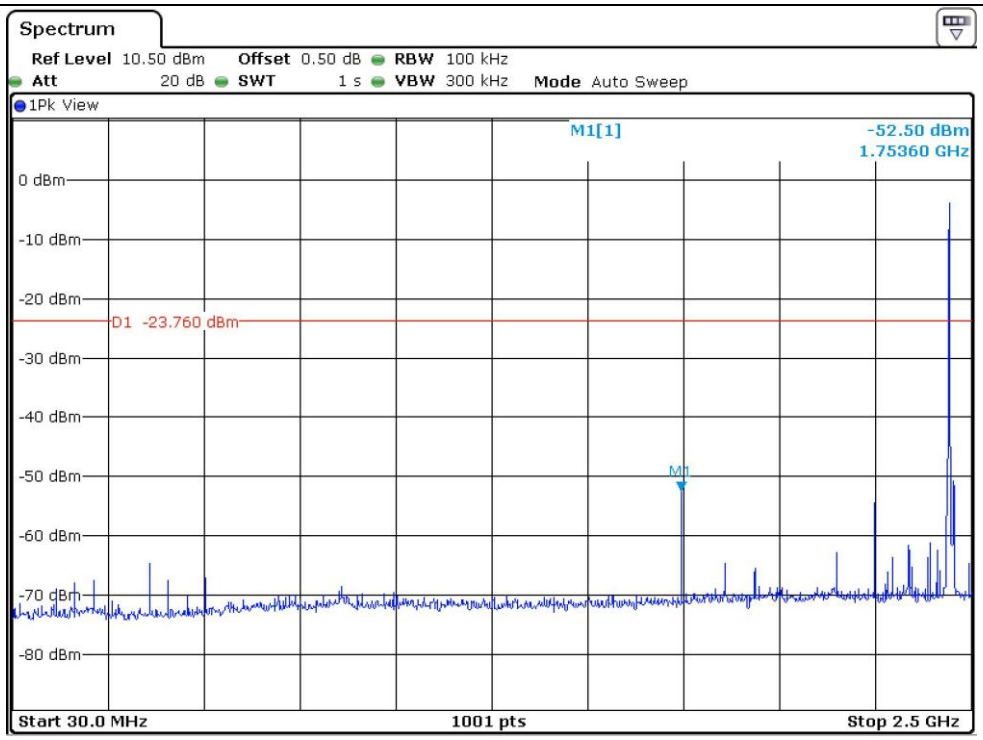
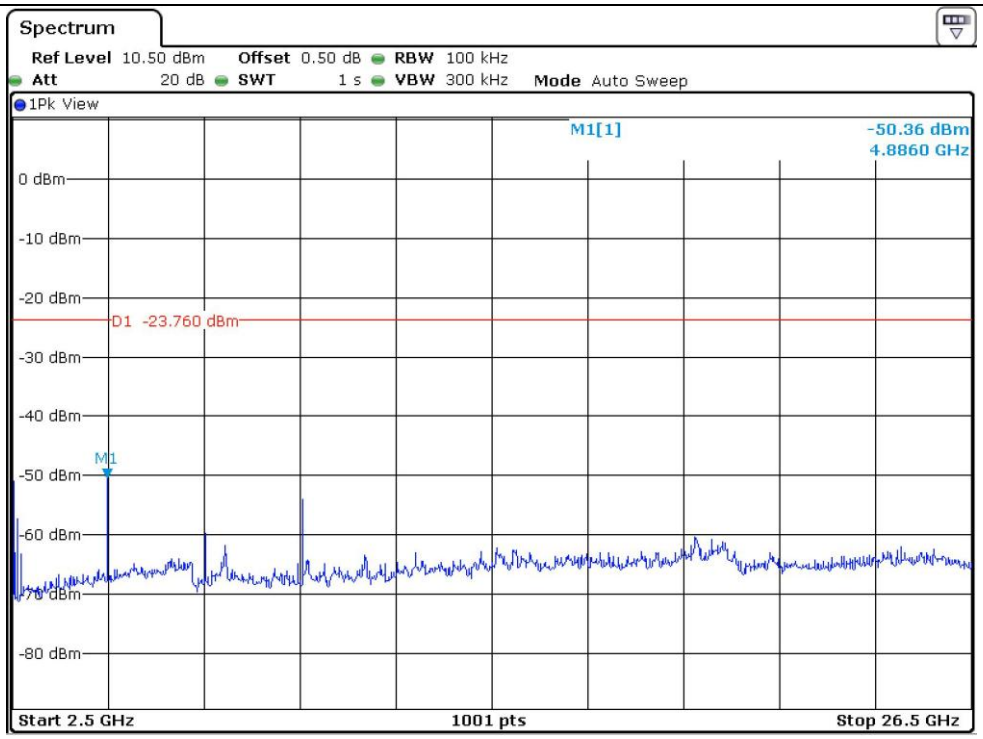


Middle Channel



Middle Channel

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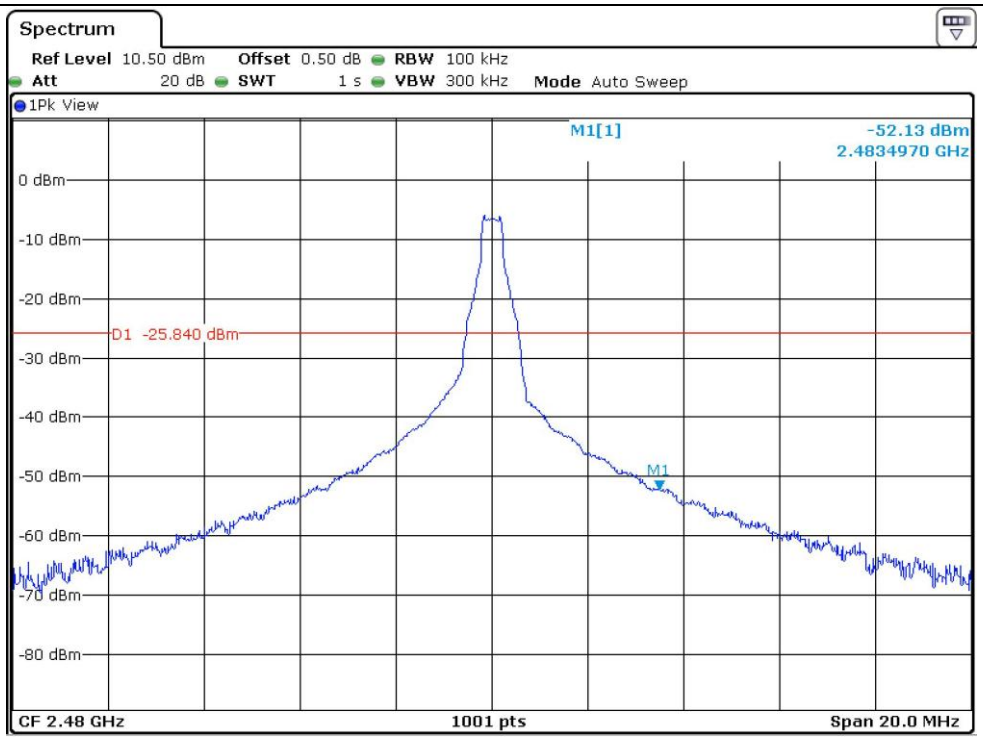
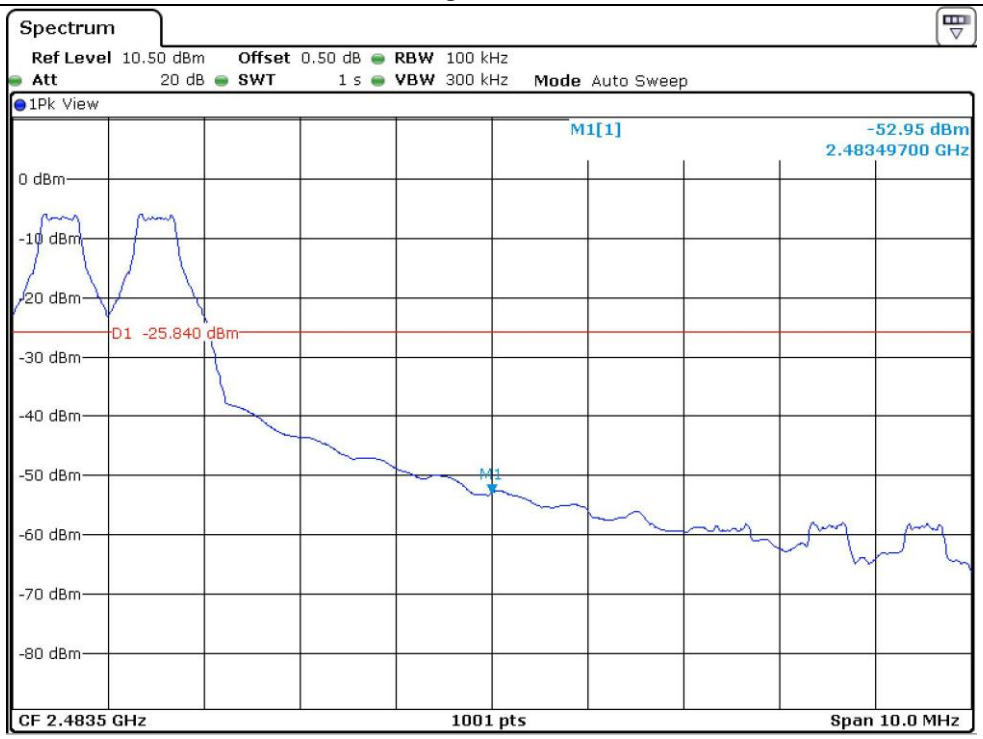


High Channel



High Channel

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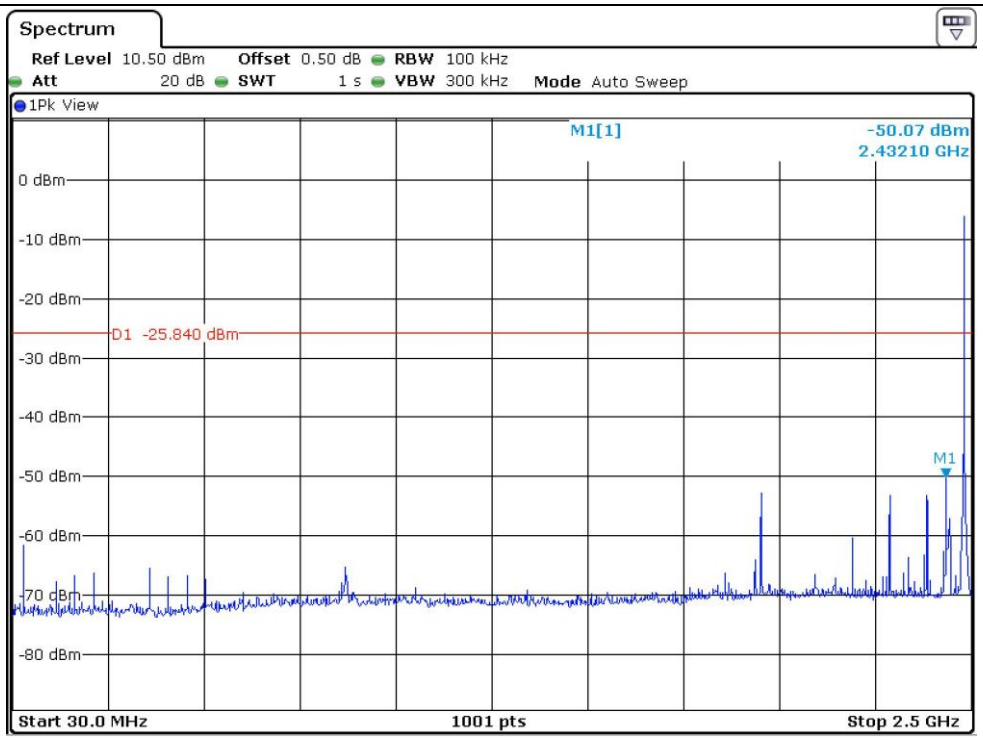

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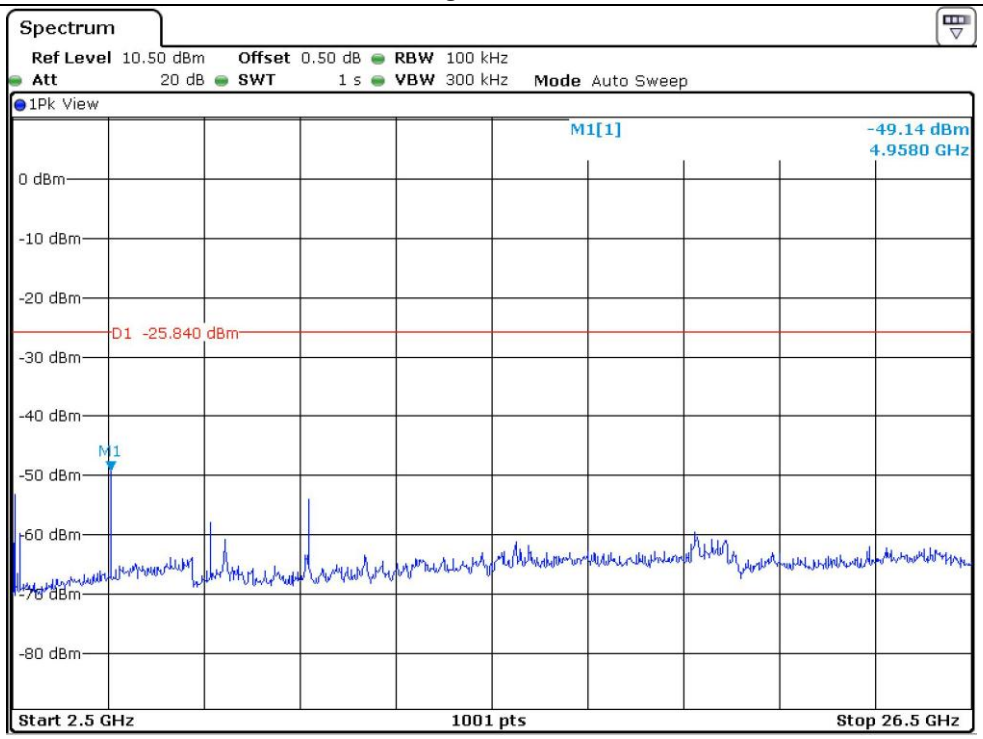

High Channel

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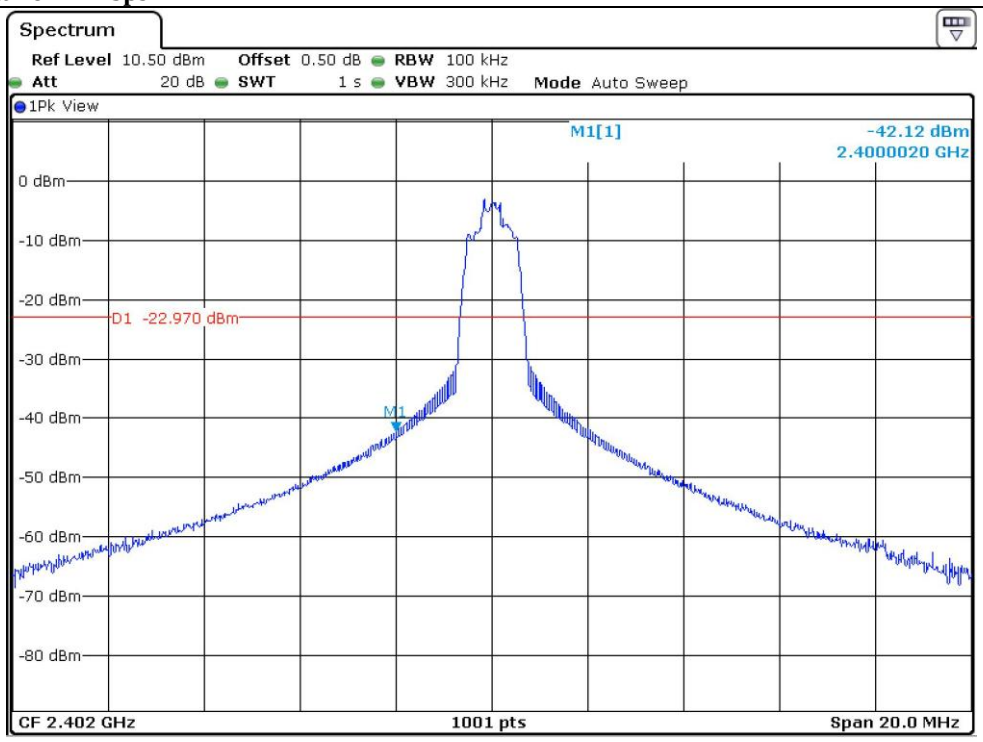
12.5.2 Test data for 2 Mbps



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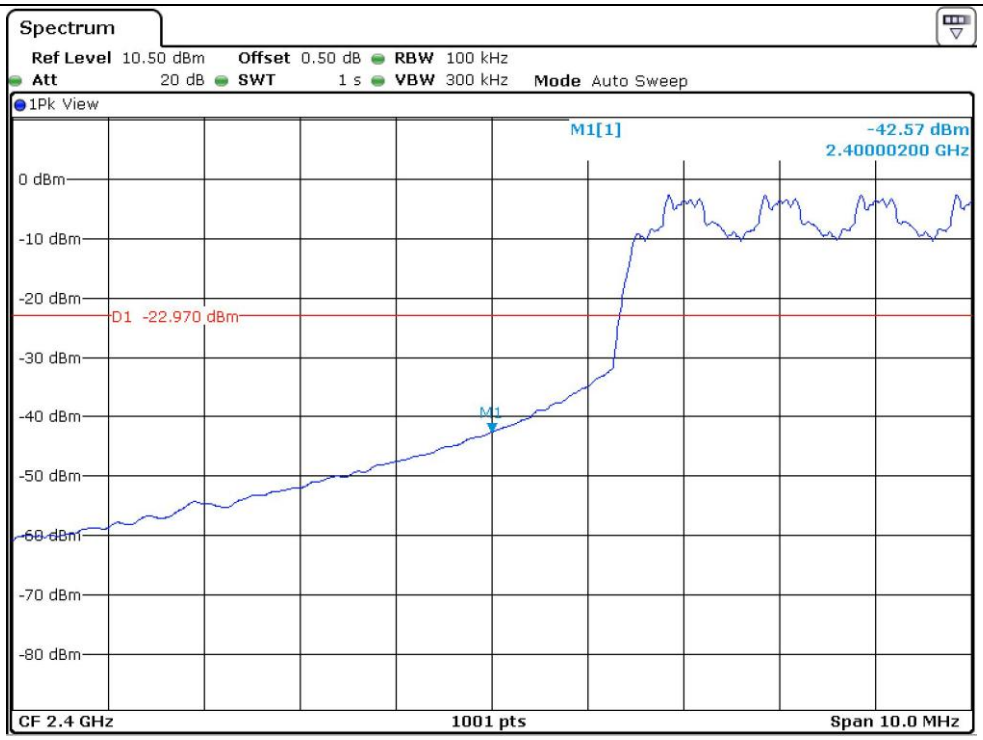

Low Channel

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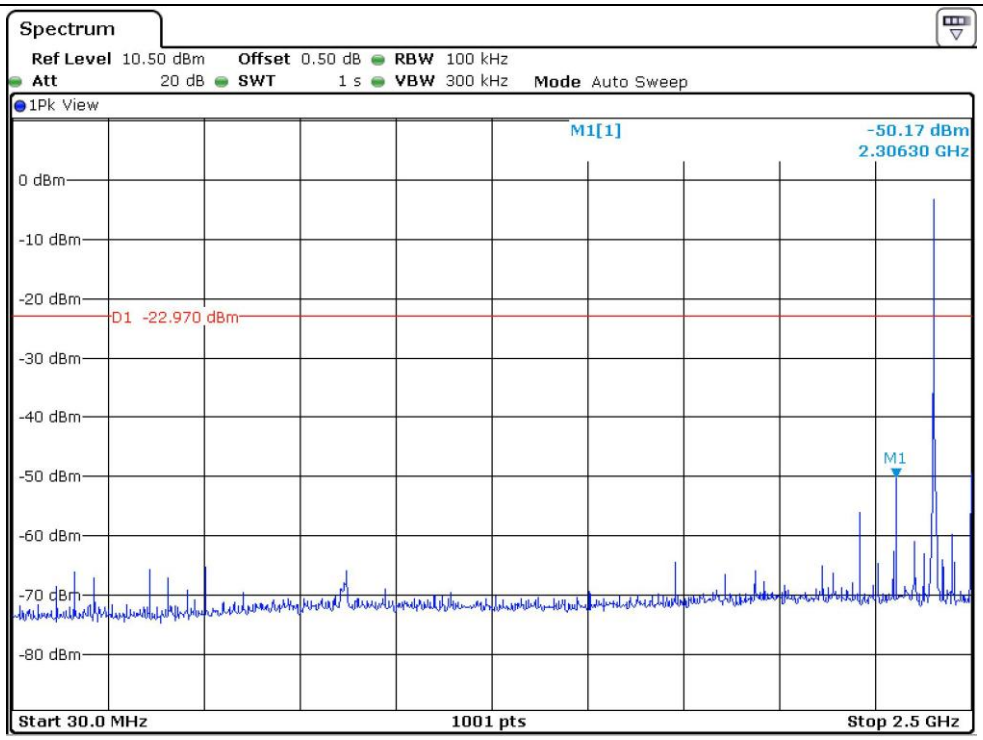

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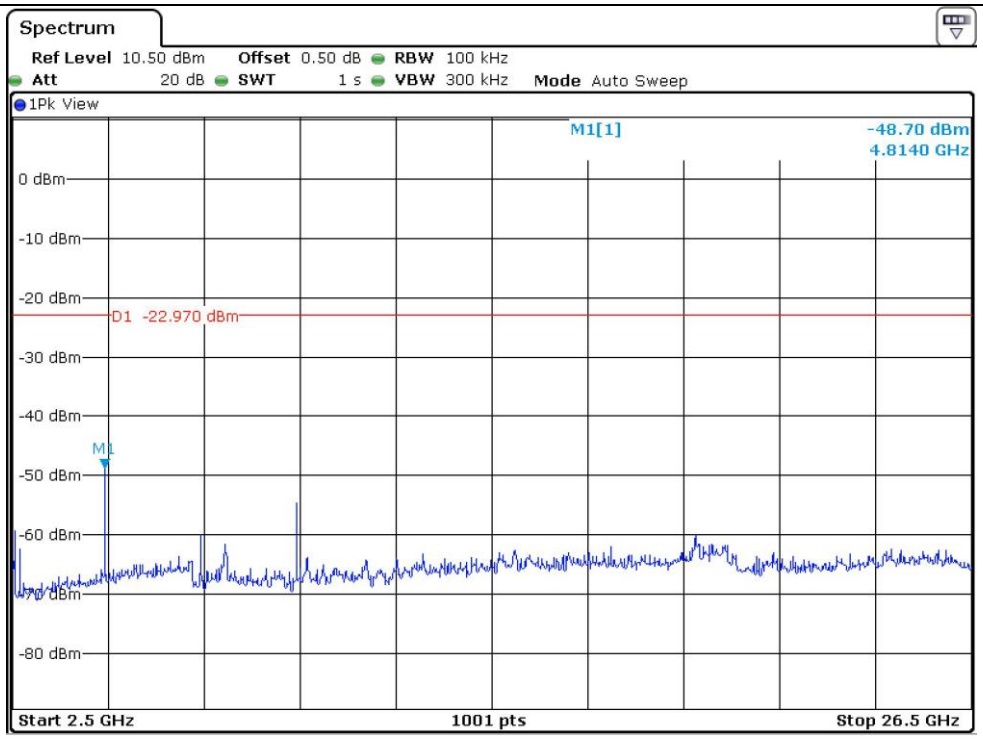

Low Channel

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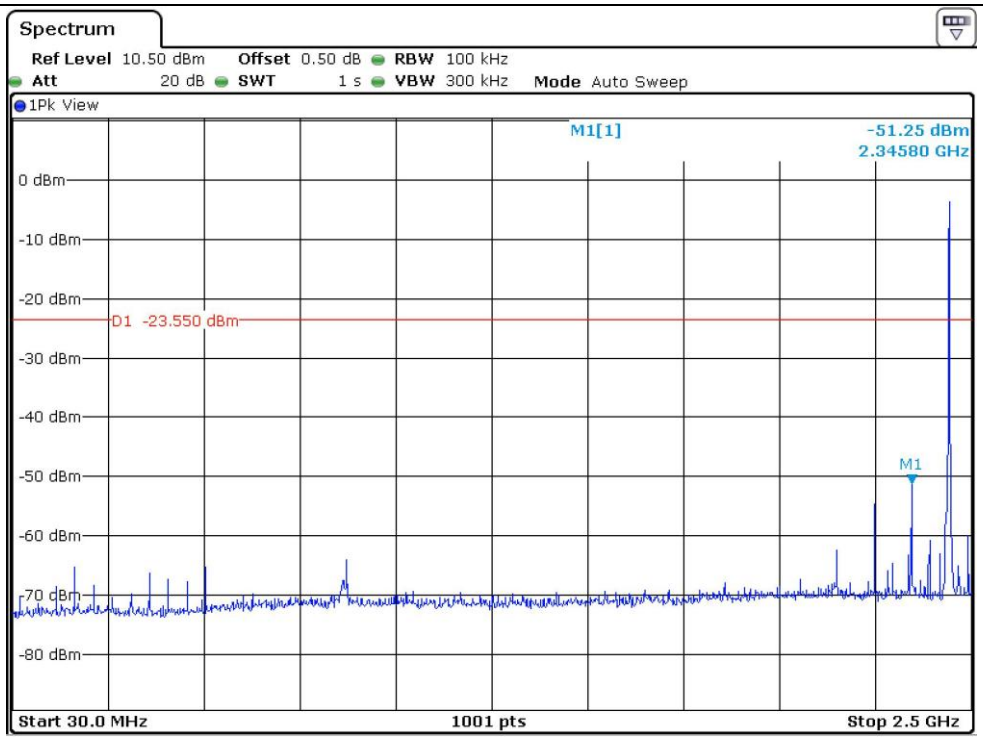
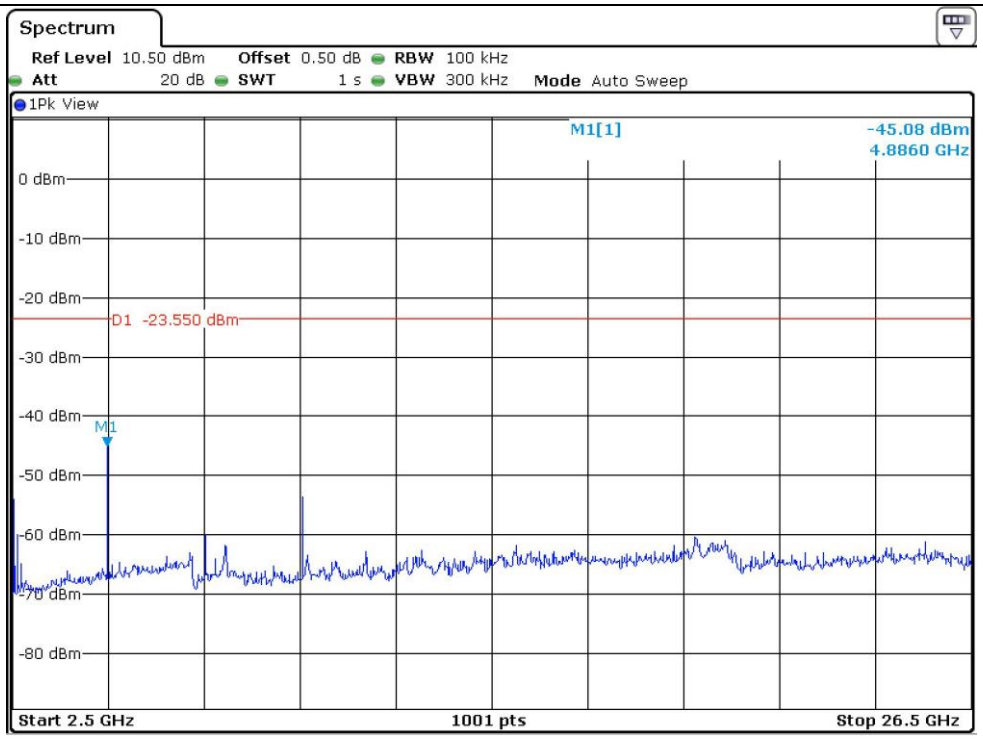


Middle Channel



Middle Channel

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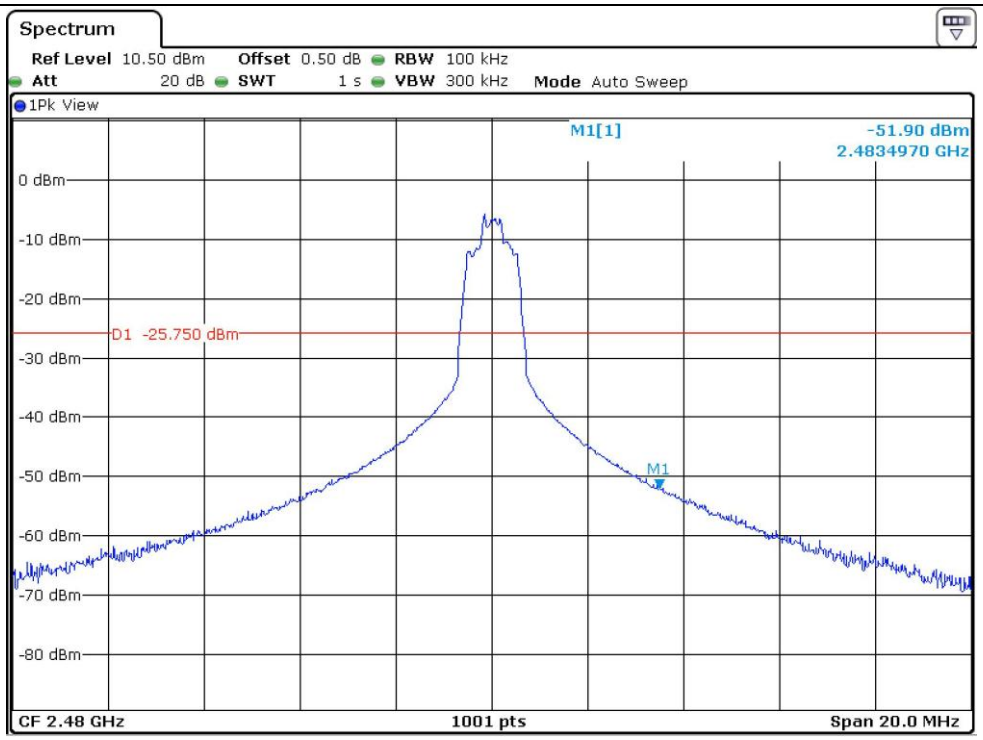
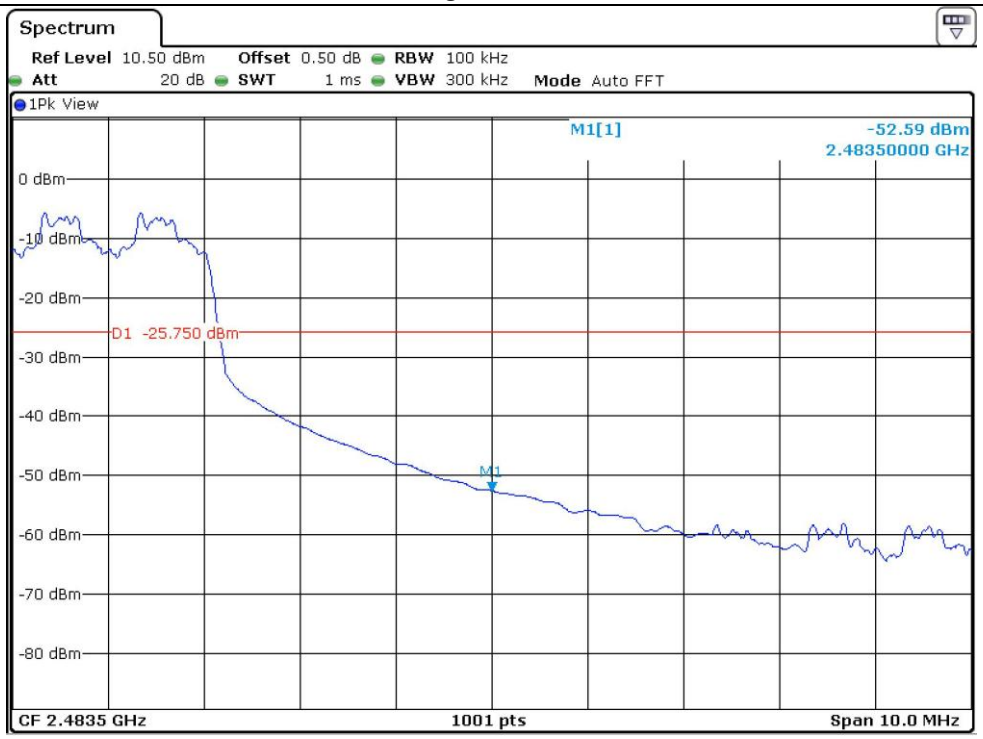


High Channel



High Channel

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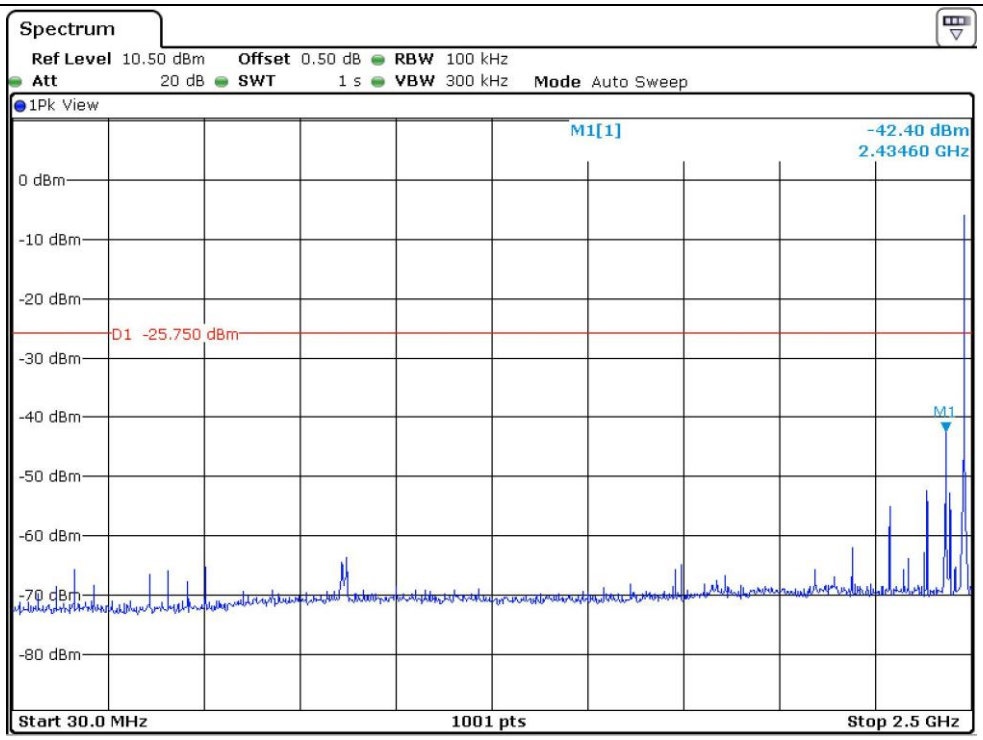

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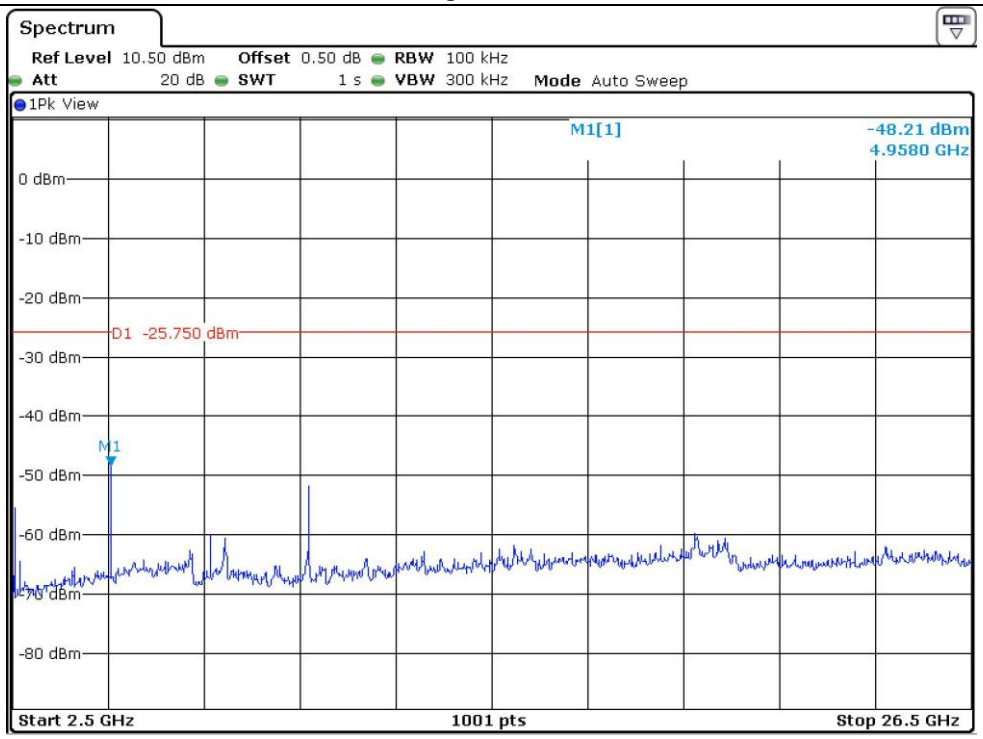

High Channel

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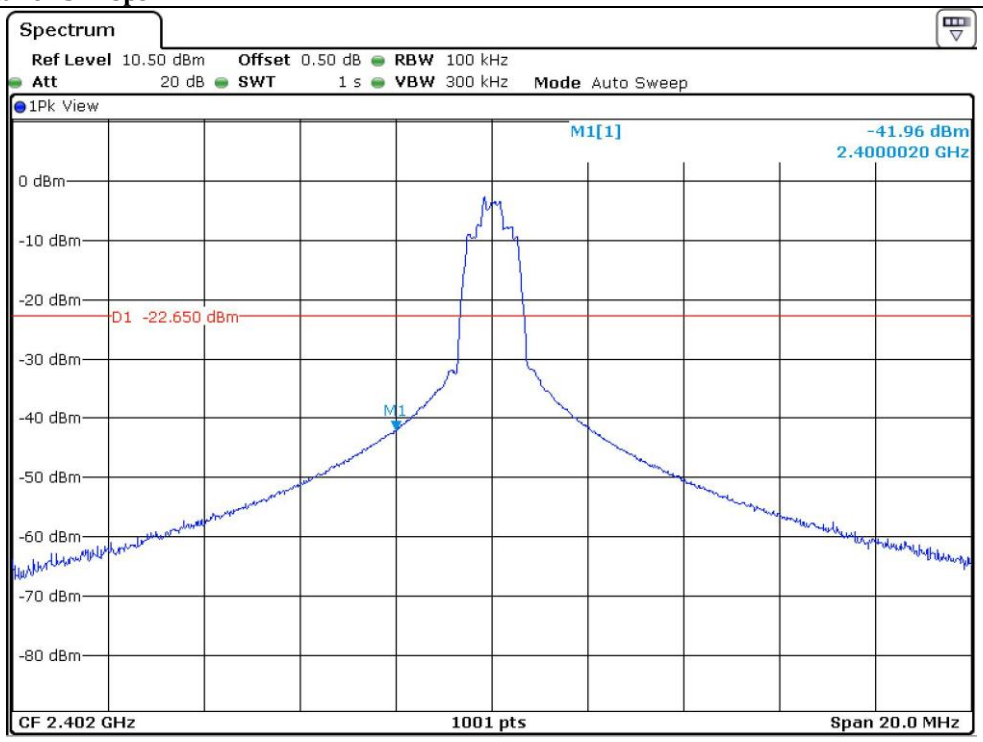
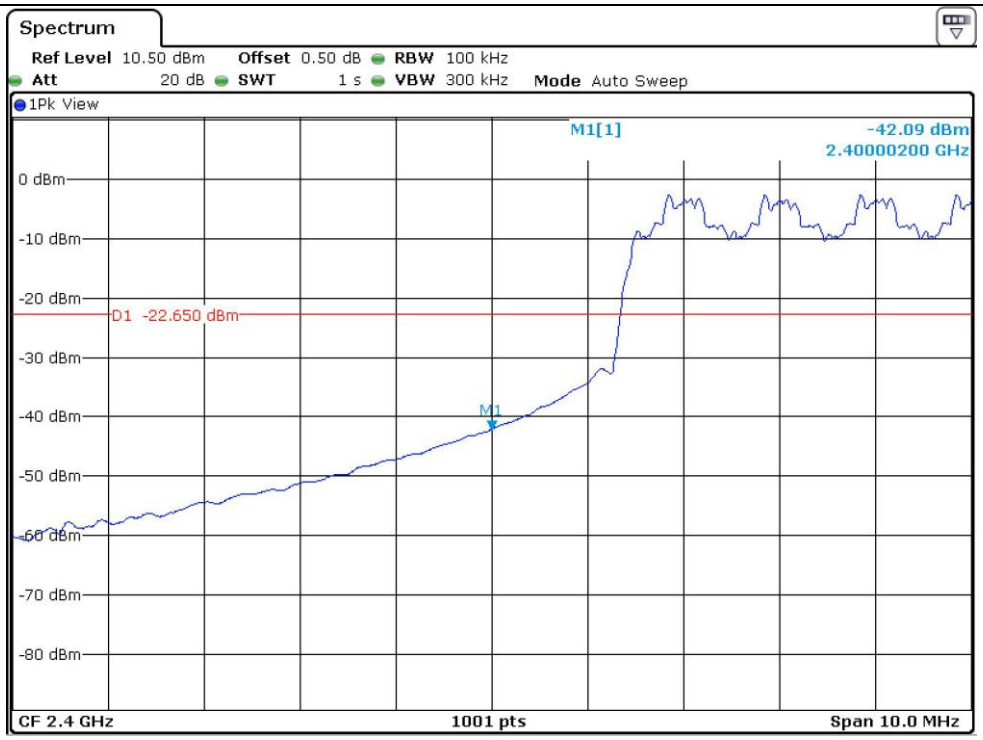
12.5.3 Test data for 3 Mbps



Low Channel



Low Channel

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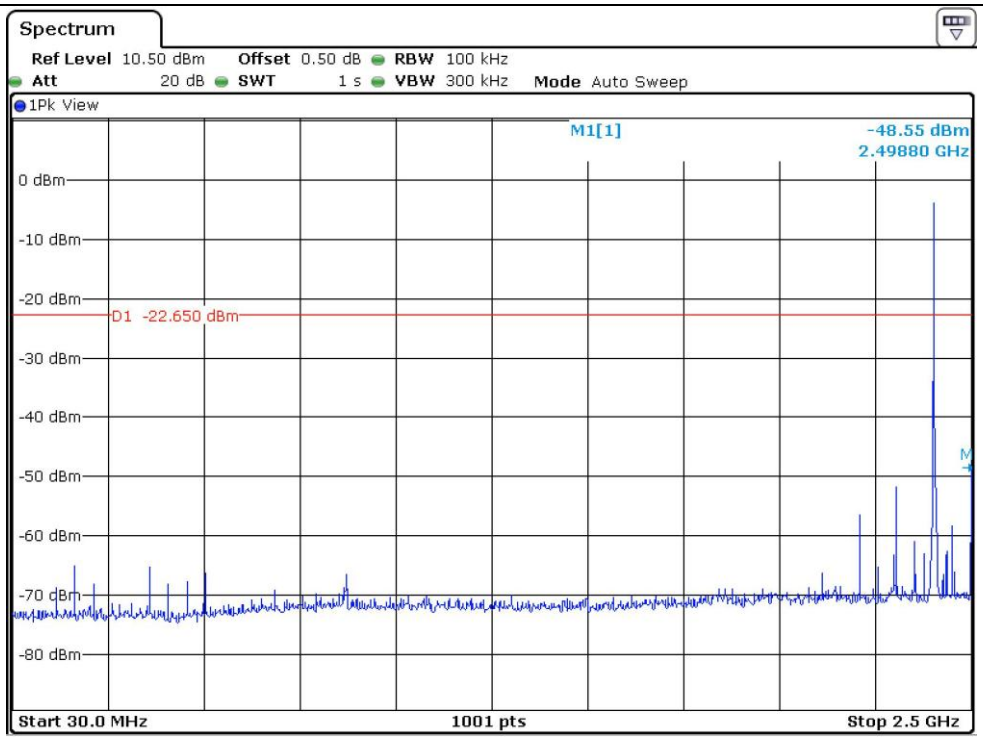

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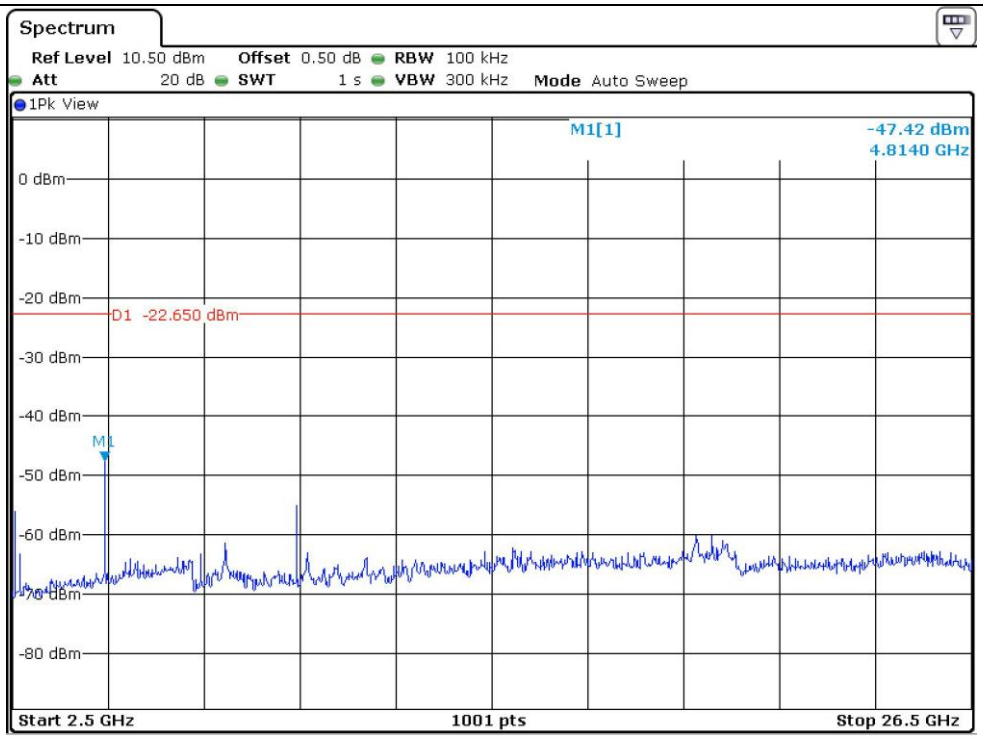

Low Channel

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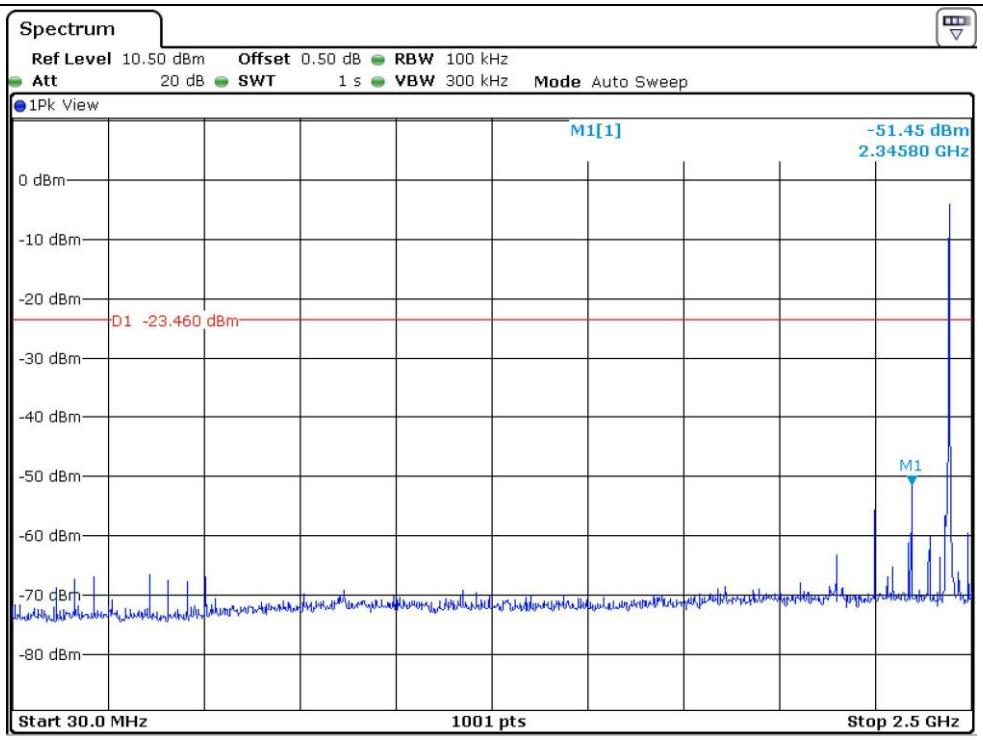
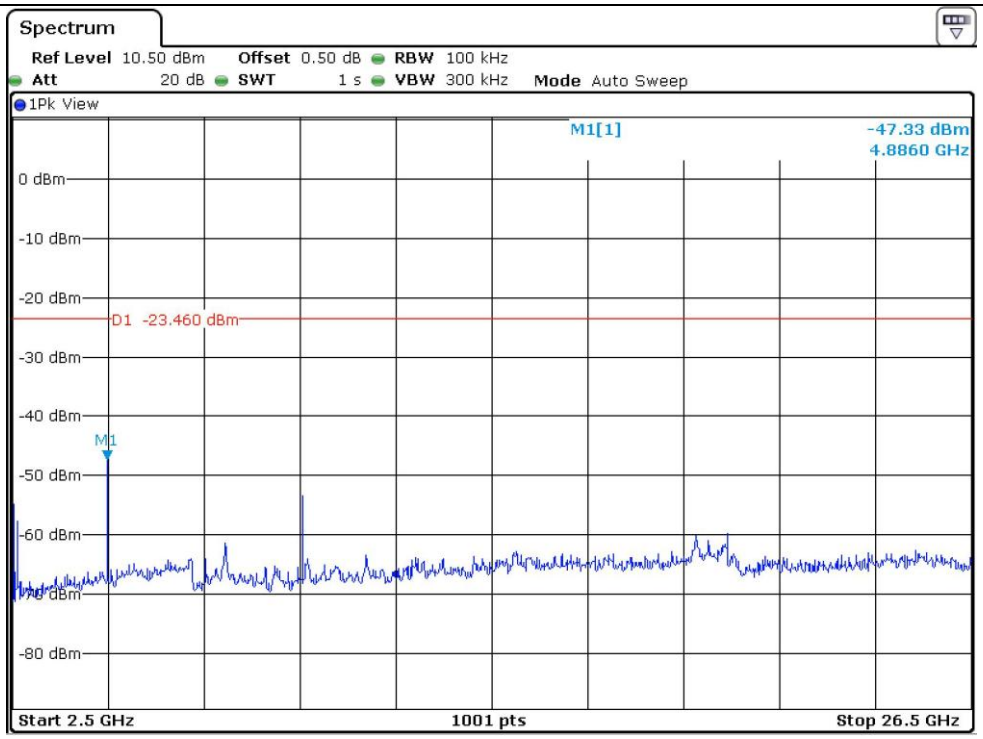


Middle Channel



Middle Channel

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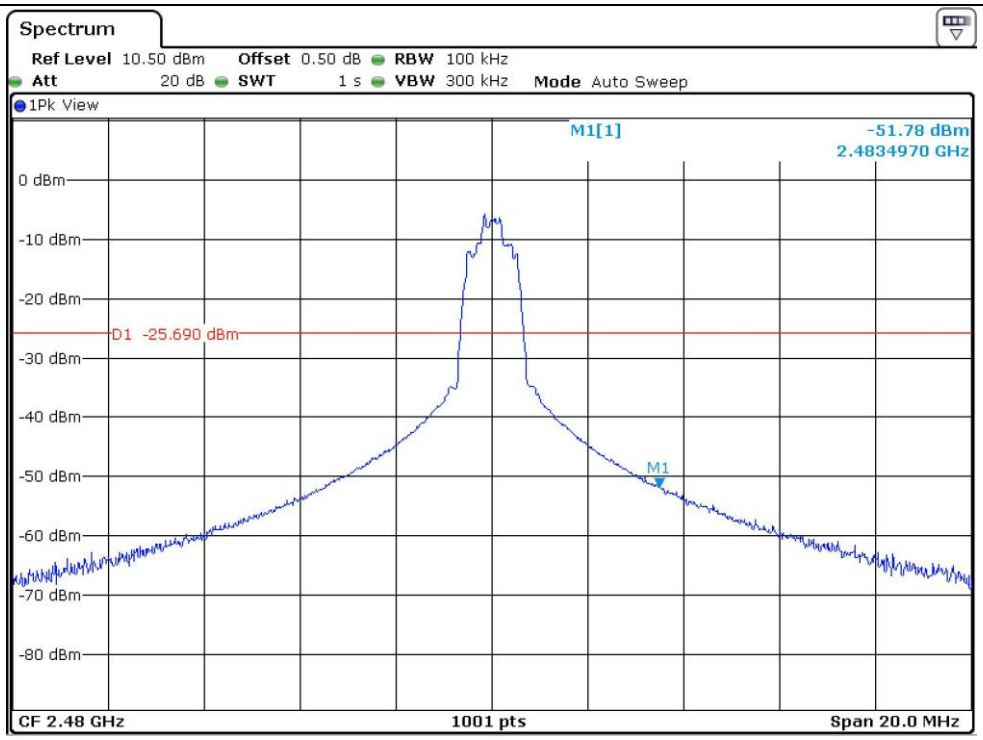
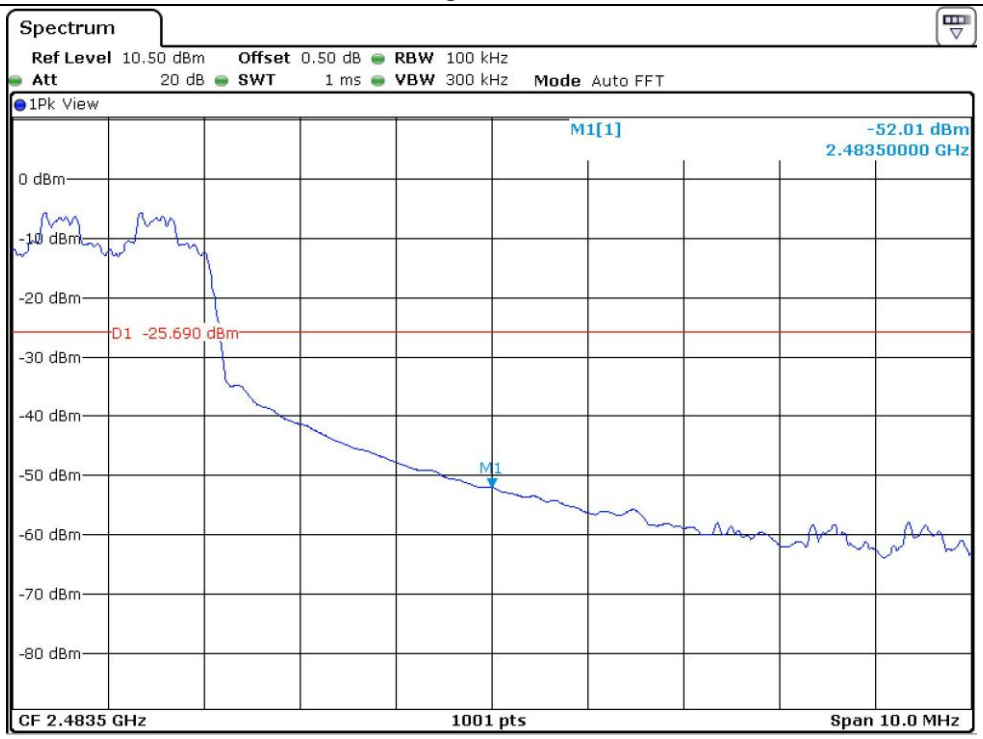


High Channel



High Channel

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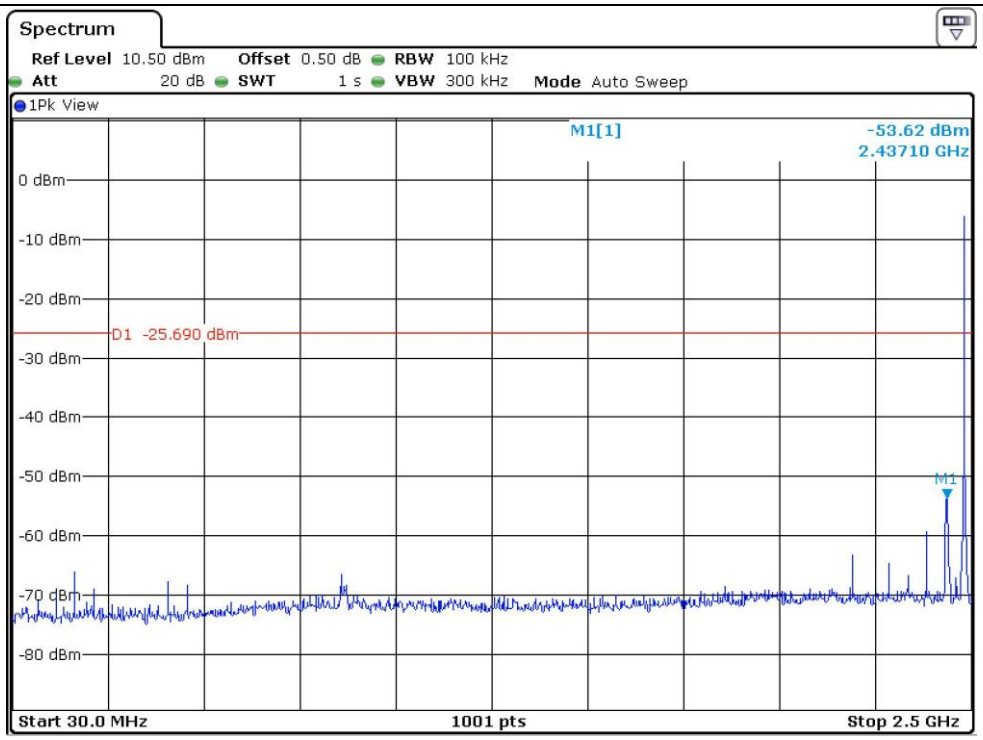

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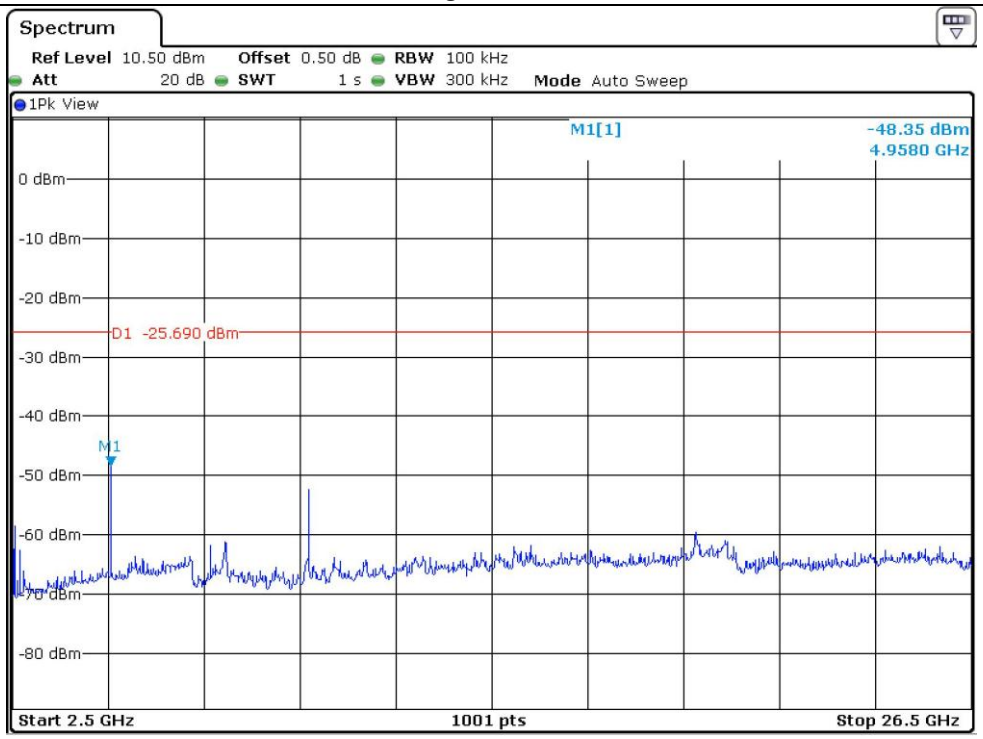

High Channel

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12.6 Test data for radiated emission

12.6.1 Radiated Emission which fall in the Restricted Band

12.6.1.1 Test data for 1 Mbps

-. Test Date : December 22, 2014

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Measurement distance : 3 m

-. Operating Condition : Highest Output Power Transmitting Mode(Low Channel and High Channel)

-. Result : PASSED

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 389.48	48.56	Peak	H	27.10	7.50	43.00	40.16	74.00	33.84
	36.84	Average	H				28.44	54.00	25.56
2 388.15	48.97	Peak	V				40.57	74.00	33.43
	36.85	Average	V				28.45	54.00	25.55
Test Data for High Channel									
2 483.50	44.86	Peak	H	27.10	7.50	43.00	36.46	74.00	37.54
	33.58	Average	H				25.18	54.00	28.82
2 484.15	43.98	Peak	V				35.58	74.00	38.42
	32.74	Average	V				24.34	54.00	29.66

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.1.2 Test data for 2 Mbps

-. Test Date : December 22, 2014

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Measurement distance : 3 m

-. Operating Condition : Highest Output Power Transmitting Mode(Low Channel and High Channel)

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
2 385.45	47.88	Peak	H	27.10	7.50	43.00	39.48	74.00	34.52
	34.96	Average	H				26.56	54.00	27.44
2 389.89	46.95	Peak	V				38.55	74.00	35.45
	33.21	Average	V				24.81	54.00	29.19
Test Data for High Channel									
2 483.94	42.88	Peak	H	27.10	7.50	43.00	34.48	74.00	39.52
	31.97	Average	H				23.57	54.00	30.43
2 483.84	42.85	Peak	V				34.45	74.00	39.55
	32.08	Average	V				23.68	54.00	30.32

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.1.3 Test data for 3 Mbps

-. Test Date : December 22, 2014

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Measurement distance : 3 m

-. Operating Condition : Highest Output Power Transmitting Mode(Low Channel and High Channel)

-. Result : PASSED

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
2 389.85	47.23	Peak	H	27.10	7.50	43.00	38.83	74.00	35.17
	33.57	Average	H				25.17	54.00	28.83
2 389.63	46.15	Peak	V				37.75	74.00	36.25
	33.84	Average	V				25.44	54.00	28.56
Test Data for High Channel									
2 483.66	42.95	Peak	H	27.10	7.50	43.00	34.55	74.00	39.45
	31.28	Average	H				22.88	54.00	31.12
2 484.14	42.17	Peak	V				33.77	74.00	40.23
	31.34	Average	V				22.94	54.00	31.06

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.2 Spurious & Harmonic Radiated Emission above 1 GHz

12.6.2.1 Test data for 1 Mbps

-. Test Date : December 22, 2014

-. Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Operating Condition : Highest Output Power Transmitting Mode

-. Result : PASSED

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Test Data for Low Channel									
2 402.00	92.51	Peak	H	27.00	7.50	42.80	84.21	-	84.21
	92.14	Peak	V				83.84	-	83.84
4 804.00	50.76	Peak	H	30.60	11.10	42.50	49.96	74.00	24.04
	41.15	Average	H				40.35	54.00	13.65
	51.16	Peak	V				50.36	74.00	23.64
	41.78	Average	V				50.98	54.00	3.02
Test Data for Middle Channel									
2 441.00	91.04	Peak	H	27.20	7.60	42.80	83.04	-	83.04
	91.21	Peak	V				83.21	-	83.21
4 882.00	49.31	Peak	H	30.70	11.20	42.50	48.71	74.00	25.29
	40.86	Average	H				40.26	54.00	13.74
	49.59	Peak	V				48.99	74.00	25.01
	40.77	Average	V				40.17	54.00	13.83

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Test Data for High Channel									
2 480.00	90.11	Peak	H	27.40	7.70	42.90	82.31	-	82.31
	89.94	Peak	V				82.14	-	82.14
4 960.00	49.04	Peak	H	30.80	11.30	42.50	48.64	74.00	25.36
	48.86	Average	H				48.46	54.00	5.54
	40.26	Peak	V				39.86	74.00	34.14
	40.18	Average	V				39.78	54.00	14.22

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical, “*” Frequency fall in restricted band

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.2.2 Test data for 2 Mbps

-. Test Date : December 22, 2014

-. Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Operating Condition : Highest Output Power Transmitting Mode

-. Result : PASSED

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 402.00	90.14	Peak	H	27.00	7.50	42.80	81.84	-	81.84
	90.22	Peak	V				81.92	-	81.92
4 804.00	47.99	Peak	H	30.60	11.10	42.50	47.19	74.00	26.81
	39.56	Average	H				38.76	54.00	15.24
	47.85	Peak	V				47.05	74.00	26.95
	39.21	Average	V				38.41	54.00	15.59
Test Data for Middle Channel									
2 441.00	89.74	Peak	H	27.20	7.60	42.80	81.74	-	81.74
	89.88	Peak	V				81.88	-	81.88
4 882.00	47.21	Peak	H	30.70	11.20	42.50	46.61	74.00	27.39
	38.51	Average	H				37.91	54.00	16.09
	47.02	Peak	V				46.42	74.00	27.58
	38.26	Average	V				37.66	54.00	16.34

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Test Data for High Channel									
2 480.00	88.11	Peak	H	27.40	7.70	42.90	80.31	-	80.31
	88.06	Peak	V				80.26	-	80.26
4 960.00	46.55	Peak	H	30.80	11.30	42.50	46.15	74.00	27.85
	37.89	Average	H				37.49	54.00	16.51
	46.24	Peak	V				45.84	74.00	28.16
	37.73	Average	V				37.33	54.00	16.67

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical, “*” Frequency fall in restricted band

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.2.3 Test data for 3 Mbps

-. Test Date : December 22, 2014

-. Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band

-. Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode

-. Frequency range : 1 GHz ~ 26.5 GHz

-. Measurement distance : 3 m

-. Operating Condition : Highest Output Power Transmitting Mode

-. Result : PASSED

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Test Data for Low Channel									
2 402.00	90.34	Peak	H	27.00	7.50	42.80	82.04	-	82.04
	90.05	Peak	V				81.75	-	81.75
4 804.00	47.25	Peak	H	30.60	11.10	42.50	46.45	74.00	27.55
	38.45	Average	H				37.65	54.00	16.35
	47.17	Peak	V				46.37	74.00	27.63
	37.89	Average	V				37.09	54.00	16.91
Test Data for Middle Channel									
2 441.00	90.07	Peak	H	27.20	7.60	42.80	82.07	-	82.07
	89.94	Peak	V				81.94	-	81.94
4 882.00	46.88	Peak	H	30.70	11.20	42.50	46.28	74.00	27.72
	37.94	Average	H				37.34	54.00	16.66
	46.58	Peak	V				45.98	74.00	28.02
	36.94	Average	V				36.34	54.00	17.66

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Test Data for High Channel									
2 480.00	88.19	Peak	H	27.40	7.70	42.90	80.39	-	80.39
	88.24	Peak	V				80.44	-	80.44
4 960.00	46.28	Peak	H	30.80	11.30	42.50	45.88	74.00	28.12
	36.84	Average	H				36.44	54.00	17.56
	46.11	Peak	V				45.71	74.00	28.29
	36.54	Average	V				36.14	54.00	17.86

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical, “*” Frequency fall in restricted band

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.3 Spurious Radiated Emission

12.6.3.1 Test Data for 1 Mbps

12.6.3.1.1 Test Data for 30 MHz ~ 1 000 MHz

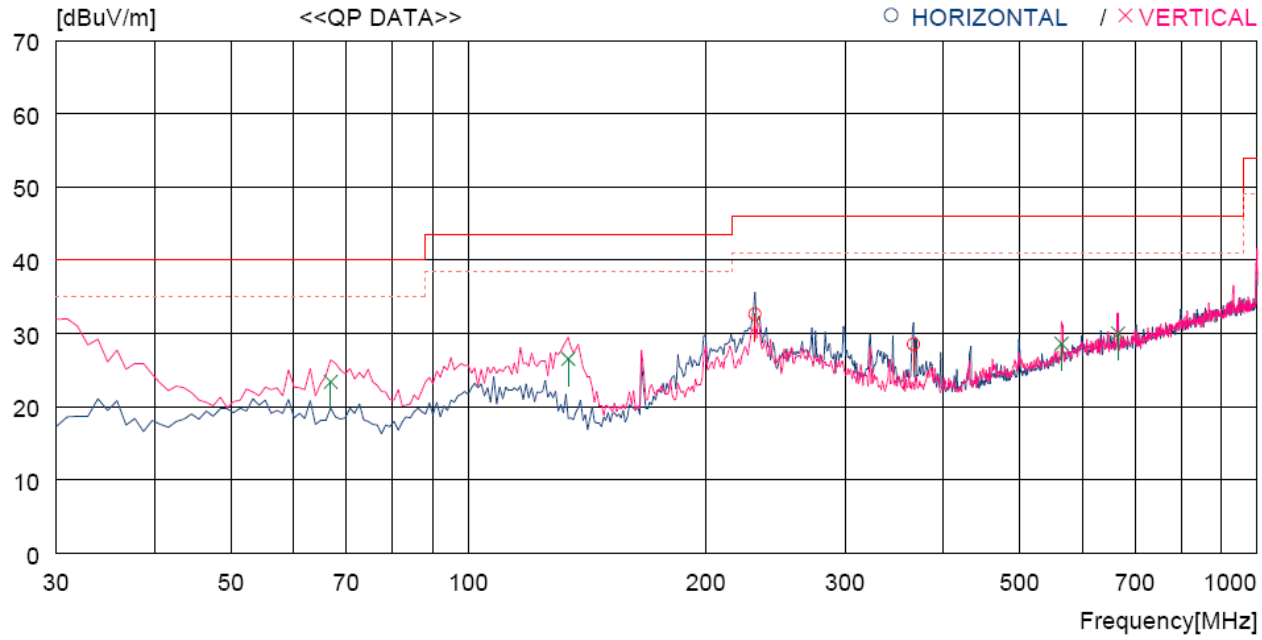
Humidity Level : (45 ~ 46) % R.H. Temperature: (24 ~ 25) ℃

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

Result : PASSED

EUT : Bluetooth Speaker Date: December 22, 2014

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



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	230.790	43.4	13.1	9.1	33.0	32.6	46.0	13.4	100	81
2	366.590	35.5	16.2	9.8	33.0	28.5	46.0	17.5	100	2
----- Vertical ------										
3	66.860	37.5	11.4	7.6	33.1	23.4	40.0	16.6	100	187
4	133.790	41.5	9.9	8.2	33.1	26.5	43.5	17.0	100	47
5	564.469	31.2	19.7	10.9	33.2	28.6	46.0	17.4	100	0
6	666.316	31.3	20.6	11.4	33.3	30.0	46.0	16.0	100	0

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.3.1.2 Test Data for Below 30 MHz

-. Test Date : December 22, 2014

-. 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 Condition : Highest Output Power Transmitting Mode

-. Result : PASSED

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

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.3.2 Test Data for 2 Mbps

12.6.3.2.1 Test Data for 30 MHz ~ 1 000 MHz

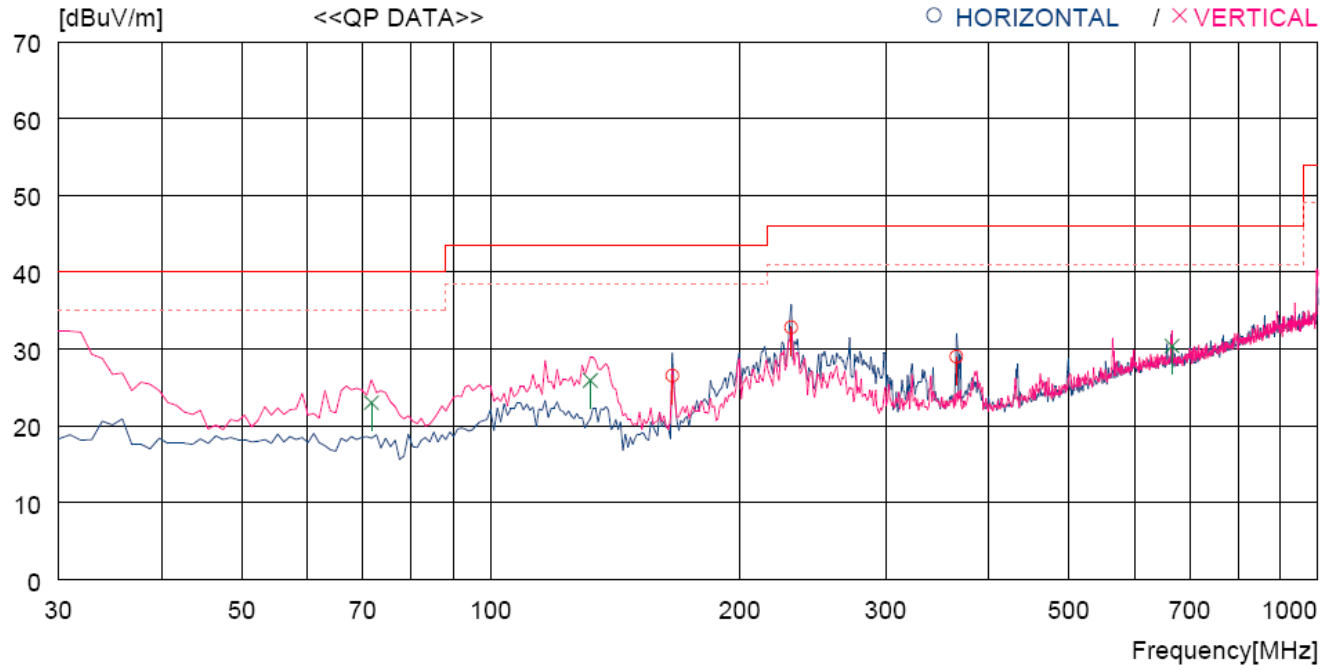
Humidity Level : (45 ~ 46) % R.H. Temperature: (24 ~ 25) ℃

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

Result : PASSED

EUT : Bluetooth Speaker Date: December 22, 2014

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



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	165.800	41.4	9.5	8.6	33.0	26.5	43.5	17.0	200	75
2	230.790	43.6	13.1	9.1	33.0	32.8	46.0	13.2	100	359
3	365.620	36.0	16.2	9.8	33.0	29.0	46.0	17.0	100	319
----- Vertical ------										
4	71.710	38.6	9.9	7.6	33.1	23.0	40.0	17.0	100	0
5	131.850	40.7	10.1	8.2	33.1	25.9	43.5	17.6	100	0
6	666.316	31.7	20.6	11.4	33.3	30.4	46.0	15.6	100	271

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.3.2.2 Test Data for Below 30 MHz

-. Test Date : December 22, 2014

-. 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 Condition : Highest Output Power Transmitting Mode

-. Result : PASSED

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

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.3.3 Test Data for 3 Mbps

12.6.3.3.1 Test Data for 30 MHz ~ 1 000 MHz

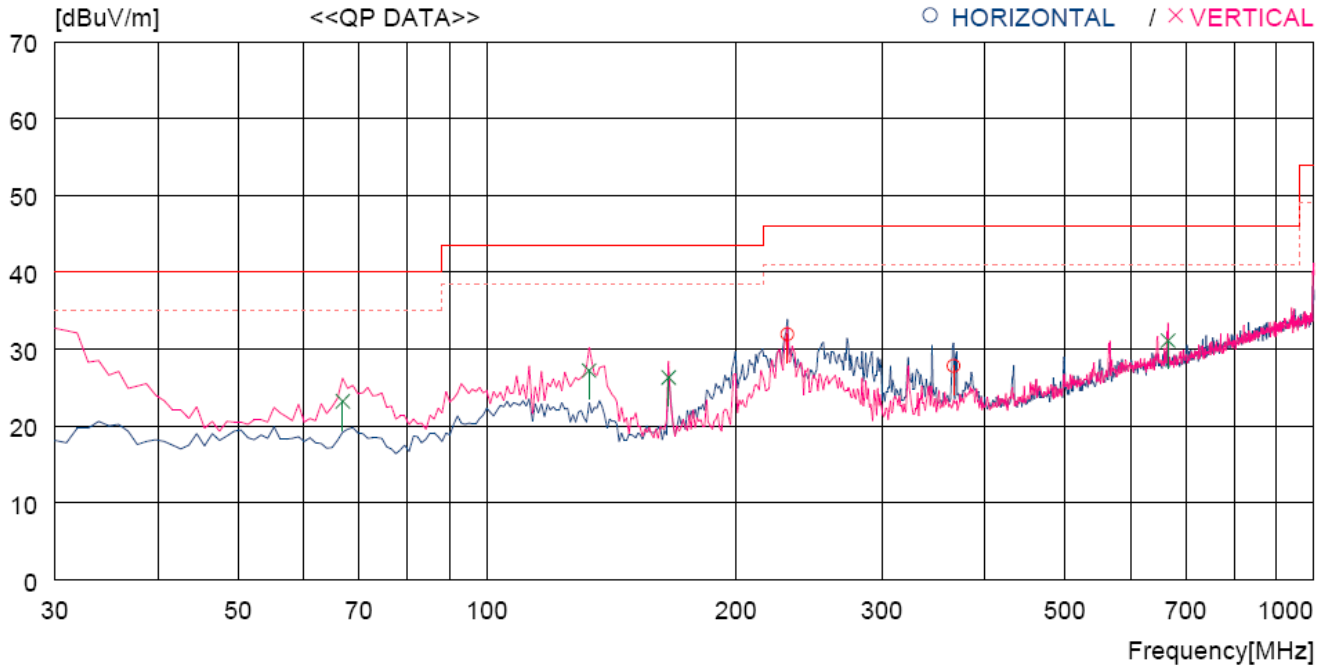
Humidity Level : (45 ~ 46) % R.H. Temperature: (24 ~ 25) ℃

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

Result : PASSED

EUT : Bluetooth Speaker Date: December 22, 2014

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



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	230.790	42.7	13.1	9.1	33.0	31.9	46.0	14.1	200	0
2	366.590	34.8	16.2	9.8	33.0	27.8	46.0	18.2	100	359
----- Vertical ------										
3	66.860	37.3	11.4	7.6	33.1	23.2	40.0	16.8	100	243
4	132.820	42.1	10.0	8.2	33.1	27.2	43.5	16.3	100	25
5	165.800	41.2	9.5	8.6	33.0	26.3	43.5	17.2	100	0
6	666.316	32.4	20.6	11.4	33.3	31.1	46.0	14.9	100	0

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.3.3.2 Test Data for Below 30 MHz

-. Test Date : December 22, 2014

-. 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 Condition : Highest Output Power Transmitting Mode

-. Result : PASSED

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

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.3.4 Test Data for Charging Mode

12.6.3.4.1 Test Data for 30 MHz ~ 1 000 MHz

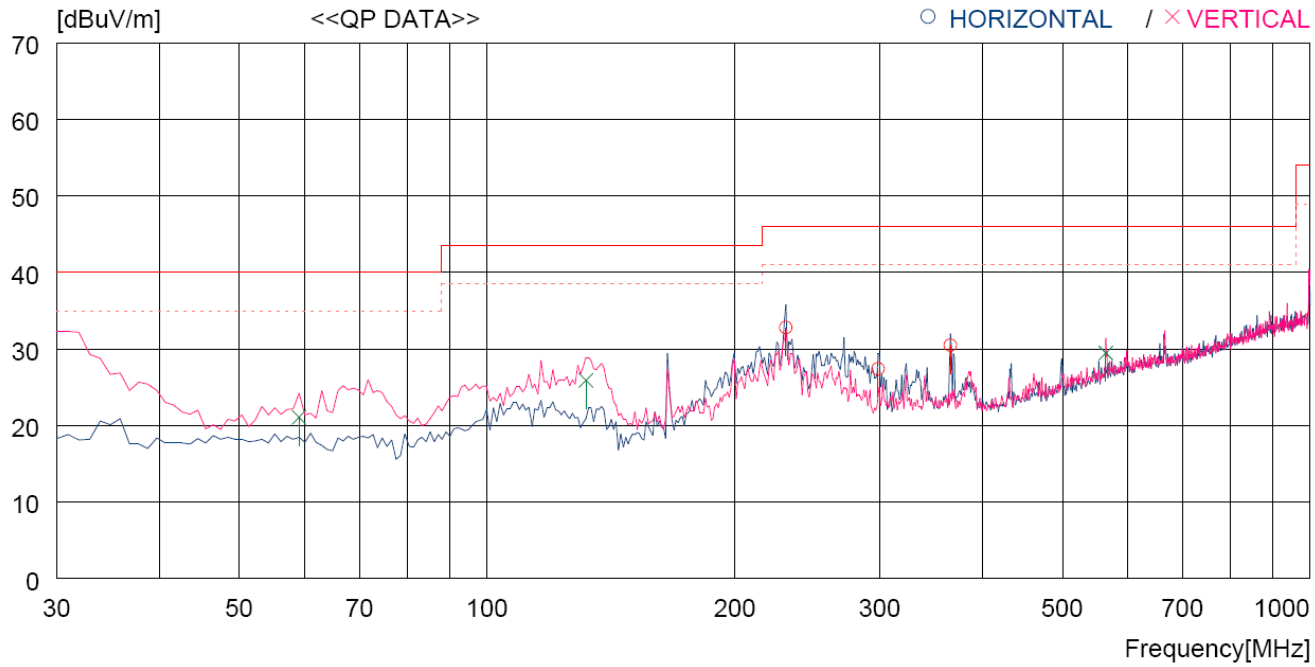
Humidity Level : (45 ~ 46) % R.H. Temperature: (24 ~ 25) ℃

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

Result : PASSED

EUT : Bluetooth Speaker Date: December 22, 2014

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



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	230.790	43.6	13.1	9.1	33.0	32.8	46.0	13.2	100	359
2	298.690	36.2	14.7	9.5	33.0	27.4	46.0	18.6	100	359
3	365.620	37.5	16.2	9.8	33.0	30.5	46.0	15.5	100	319
----- Vertical ------										
4	59.100	32.5	14.2	7.5	33.1	21.1	40.0	18.9	100	214
5	131.850	40.7	10.1	8.2	33.1	25.9	43.5	17.6	100	0
6	564.469	32.1	19.7	10.9	33.2	29.5	46.0	16.5	100	0

Tested by: Tae-Ho, Kim / Project Engineer

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12.6.3.4.2 Test Data for Below 30 MHz

-. Test Date : December 22, 2014

-. 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 Condition : Highest Output Power Transmitting Mode

-. Result : PASSED

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

Tested by: Tae-Ho, Kim / Project Engineer

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13. SPURIOUS EMISSION - RECEIVER

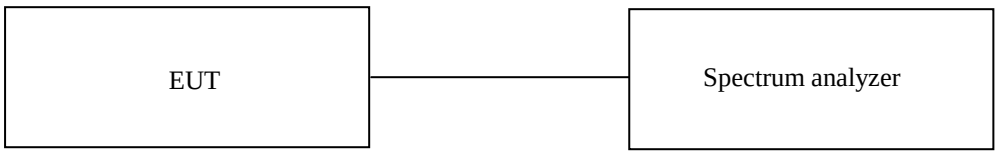
13.1 Operating environment

Temperature : 21.4 ℃

Relative humidity : 45 % R.H.

13.2 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.



13.3 Test set-up for radiated measurement

The radiated emissions measurements were performed on the 3 m, open-field test site. The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane. The frequency spectrum from 30 MHz to 40 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.

13.4 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	8564E	HP	Spectrum Analyzer	3650A00756	Apr. 28, 2014(1Y)
■ -	ESU	Rohde & Schwarz	EMI Test Receiver	100261	Apr. 29, 2014(1Y)
■-	310N	Sonoma Instrument	AMPLIFIER	312544	Apr. 28, 2014(1Y)
■ -	83051A	Agilent	Microwave System Preamplifer	3950M00201	Apr. 30, 2014(1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101372	May 20, 2013(1Y)
■ -	SCU-18	Rohde & Schwarz	PRE-AMPLIFIER	10041	Apr. 28, 2014(1Y)
■ -	MA220	HD	Turn Table	N/A	N/A
■ -	HD240	HD	Antenna Mast	N/A	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	May 02, 2014(2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Sep. 05, 2013(2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	N/A

All test equipment used is calibrated on a regular basis.

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13.5 Test data for 1 Mbps

13.5.1 Test data – Conducted

-. Test Date : December 22, 2014

-. Resolution bandwidth : 120 kHz / 1 MHz

-. Frequency range : 30 MHz ~ 26.5 GHz

-. Test Result : Pass

Frequency (MHz)	Spectrum Reading (dBm)	Cable Loss (dB)	Total (dBm)	Limits (dBμV/m)
Test result for Low Channel				
47.50	-76.62	0.08	-76.54	-57.0
9 617.00	-56.72	0.60	-56.10	-53.0
Test result for Middle Channel				
47.50	-76.81	0.08	-76.73	-57.0
9 764.00	-58.69	0.60	-58.09	-53.0
Test result for High Channel				
47.50	-78.54	0.08	-78.46	-57.0
9 912.00	-56.03	0.60	-55.43	-53.0

Tested by: Tae-Ho, Kim / Project Engineer

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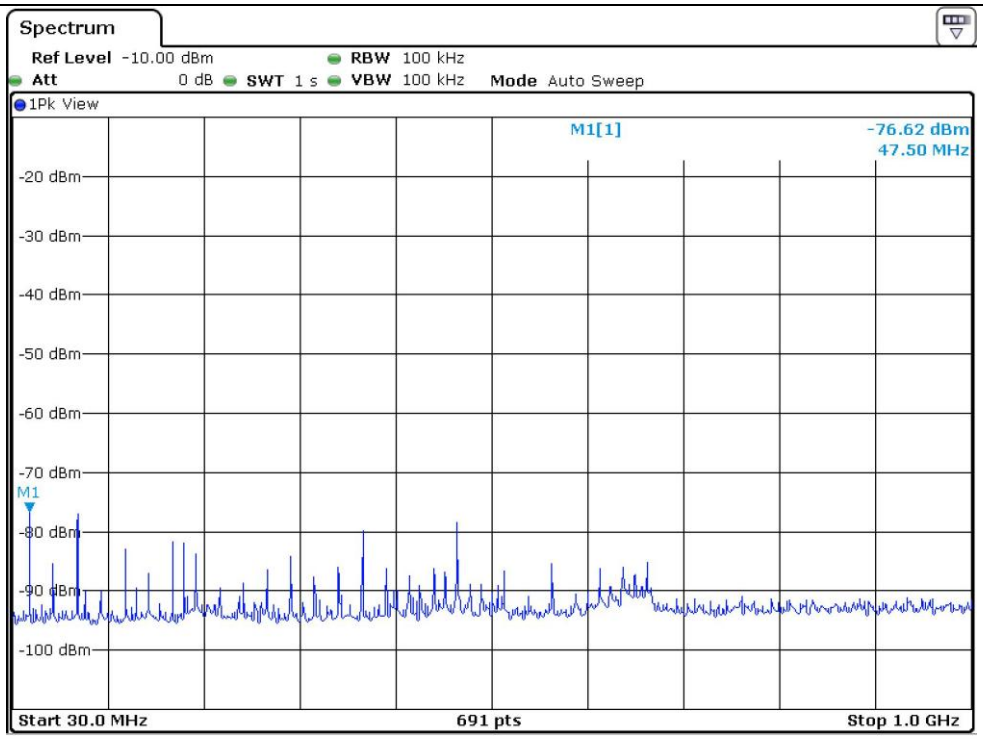
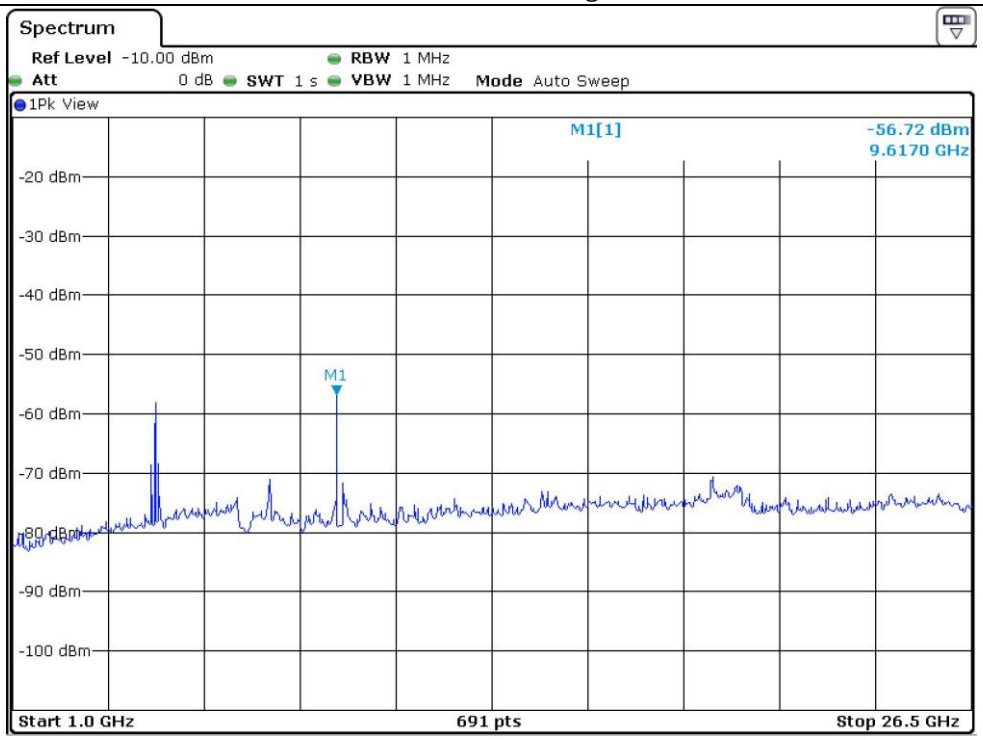


Low Channel - Receiving Mode



Low Channel - Receiving Mode

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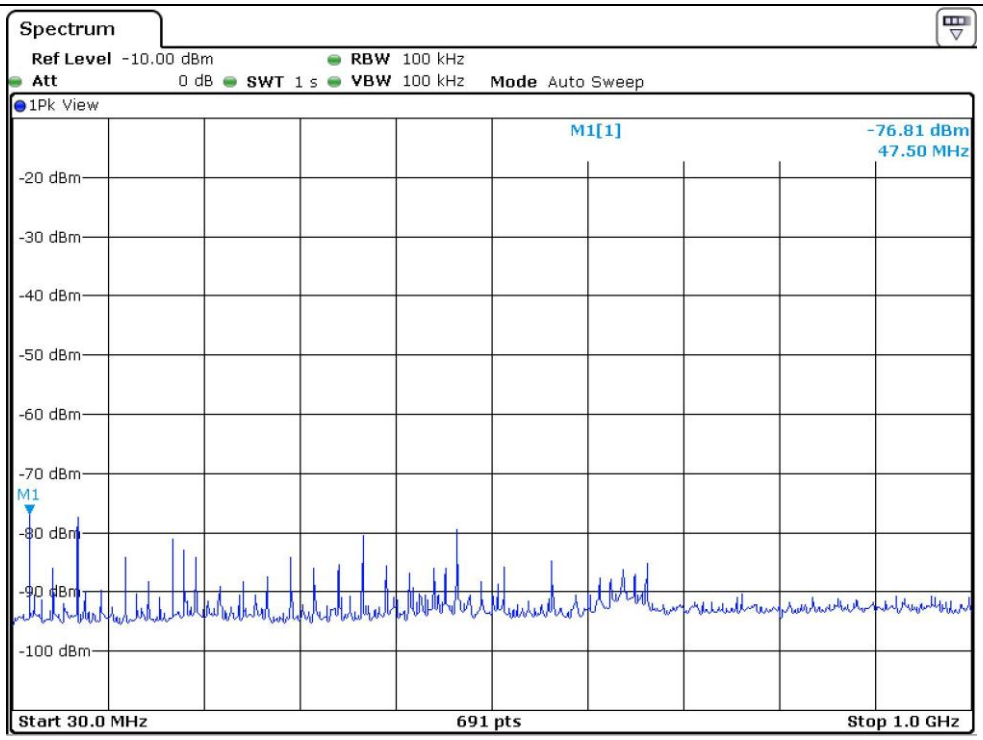
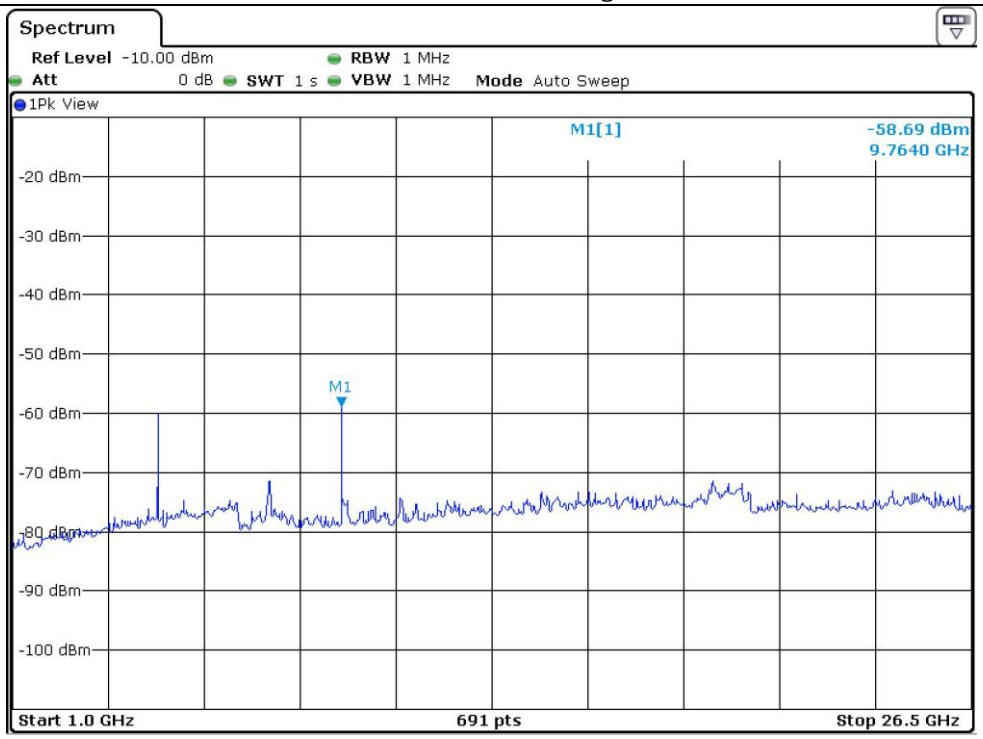


Middle Channel - Receiving Mode



Middle Channel - Receiving Mode

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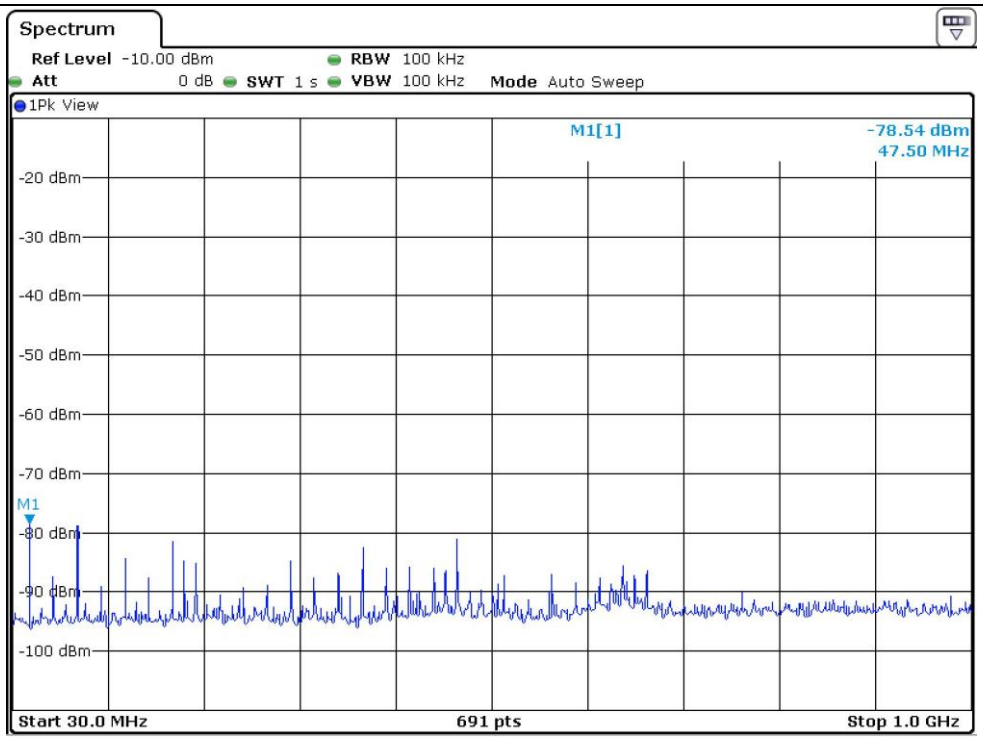
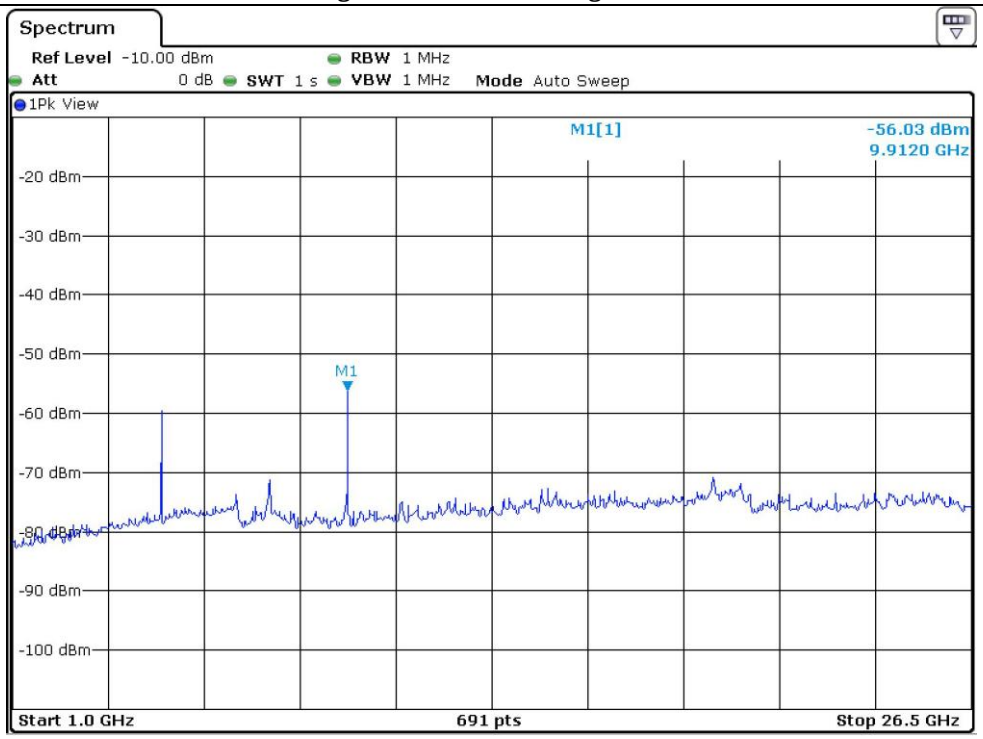


High Channel - Receiving Mode



High Channel - Receiving Mode

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13.5.2 Test data - Radiated

13.5.2.1 Test data for Below 30 MHz

-. Test Date : December 22, 2014

-. 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

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

Tested by: Tae-Ho, Kim / Project Engineer

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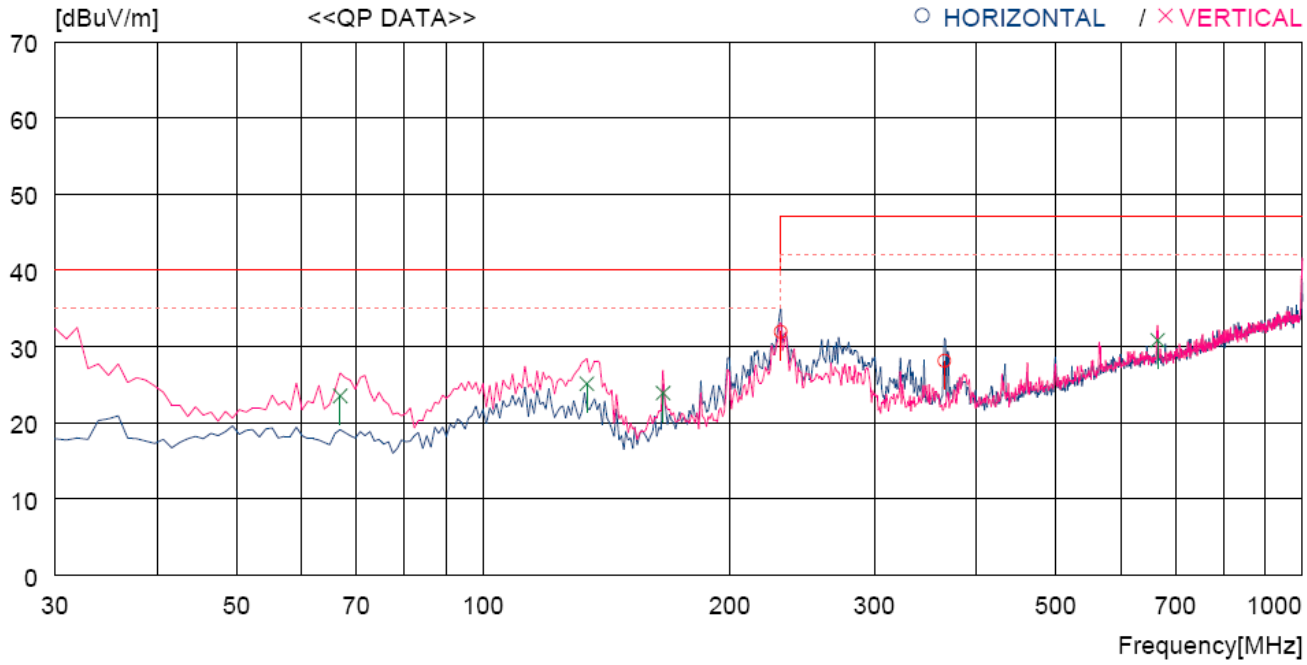
13.5.2.2 Test data for 30 MHz ~ 1 000 MHz

-. Test Date : December 22, 2014

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

-. Measurement distance : 3 m



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	230.790	42.7	13.1	9.1	33.0	31.9	47.0	15.1	100	359
2	365.620	35.1	16.2	9.8	33.0	28.1	47.0	18.9	100	359
----- Vertical ------										
3	66.860	37.6	11.4	7.6	33.1	23.5	40.0	16.5	100	242
4	133.790	40.1	9.9	8.2	33.1	25.1	40.0	14.9	100	47
5	165.800	38.8	9.5	8.6	33.0	23.9	40.0	16.1	100	306
6	665.346	32.1	20.6	11.4	33.3	30.8	47.0	16.2	100	0

Tested by: Tae-Ho, Kim / Project Engineer

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13.5.2.3 Test data for above 1 GHz

-. Test Date : December 22, 2014

-. 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

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

Tested by: Tae-Ho, Kim / Project Engineer

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13.6 Test data for 2 Mbps

13.6.1 Test data – Conducted

-. Test Date : December 22, 2014

-. Resolution bandwidth : 120 kHz / 1 MHz

-. Frequency range : 30 MHz ~ 26.5 GHz

-. Test Result : Pass

Frequency (MHz)	Spectrum Reading (dBm)	Cable Loss (dB)	Total (dBm)	Limits (dBμV/m)
Test result for Low Channel				
47.50	-75.87	0.08	-75.79	-57.0
9 617.00	-59.20	0.60	-58.60	-53.0
Test result for Middle Channel				
47.50	-77.21	0.08	-77.13	-57.0
9 764.00	-58.30	0.60	-57.70	-53.0
Test result for High Channel				
96.70	-77.14	0.08	-77.06	-57.0
9 912.00	-57.22	0.60	-56.60	-53.0

Tested by: Tae-Ho, Kim / Project Engineer

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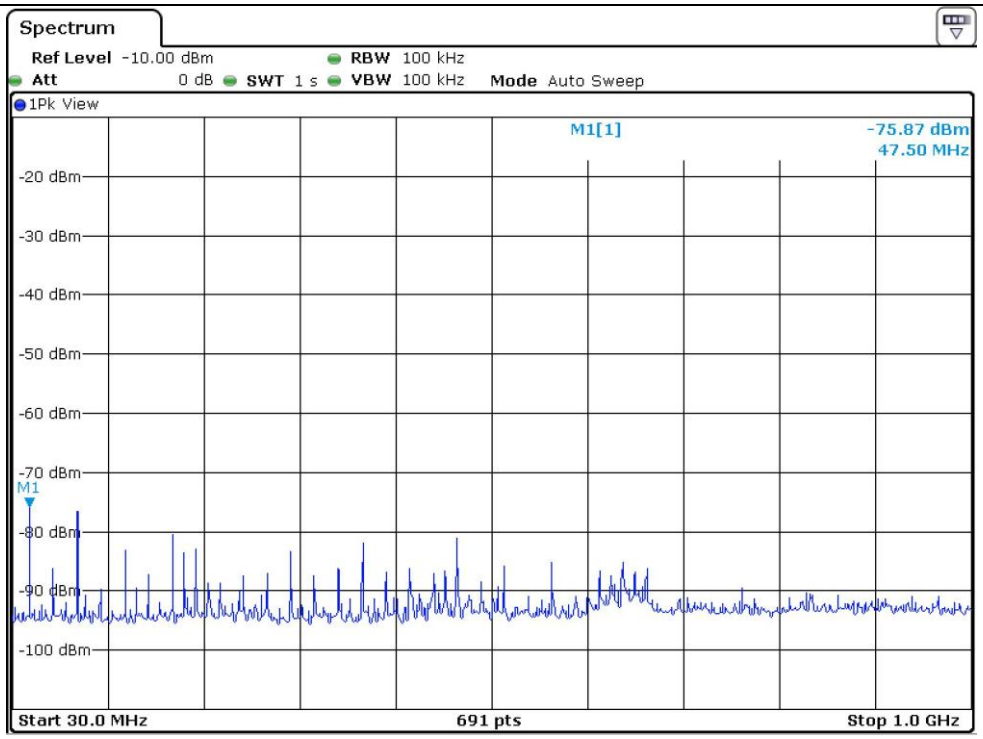
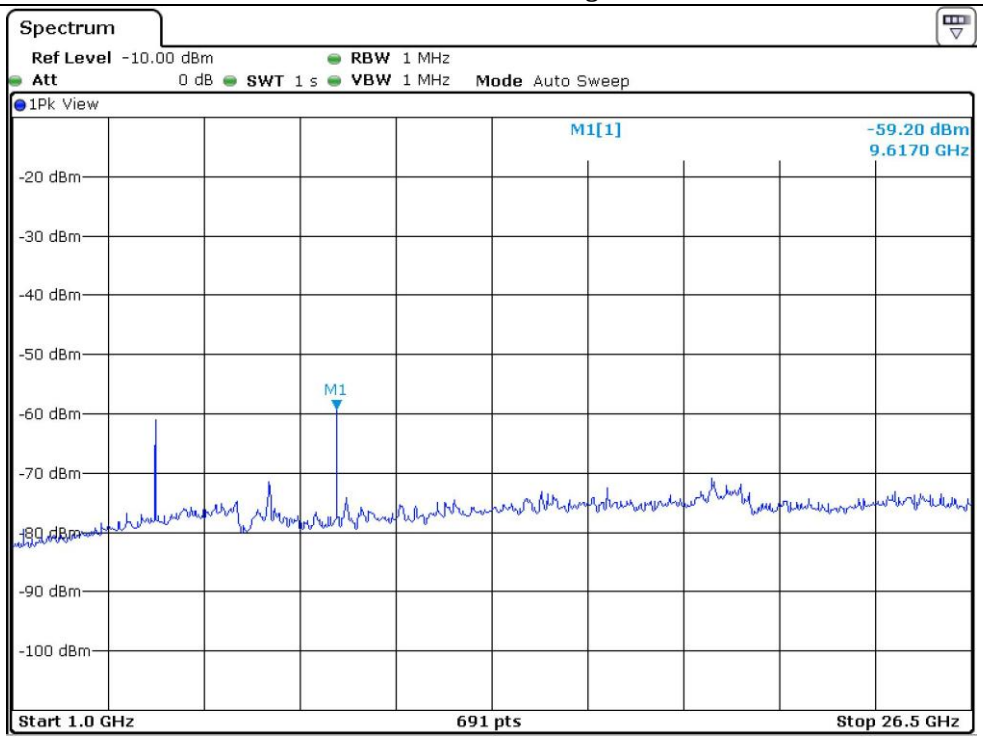


Low Channel - Receiving Mode



Low Channel - Receiving Mode

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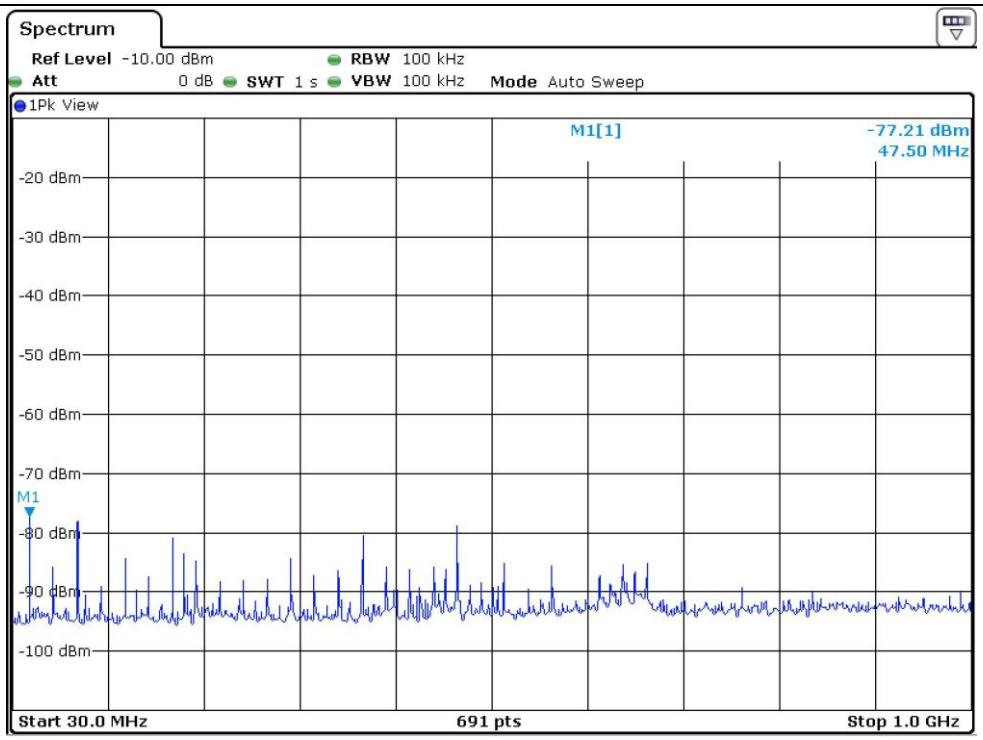
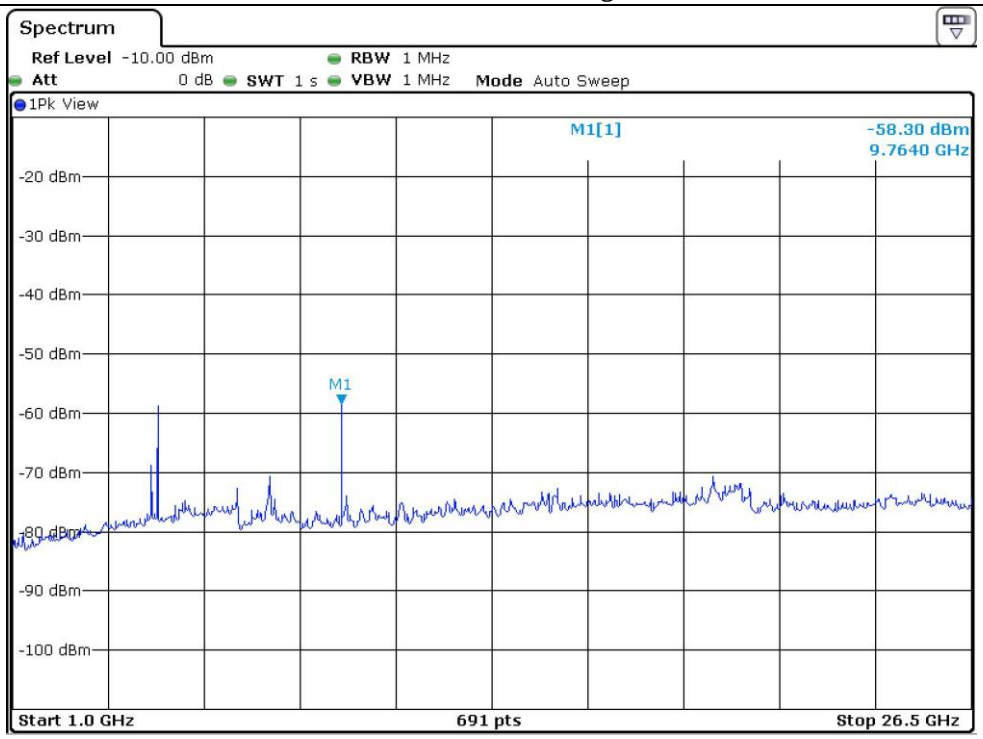


Middle Channel - Receiving Mode



Middle Channel - Receiving Mode

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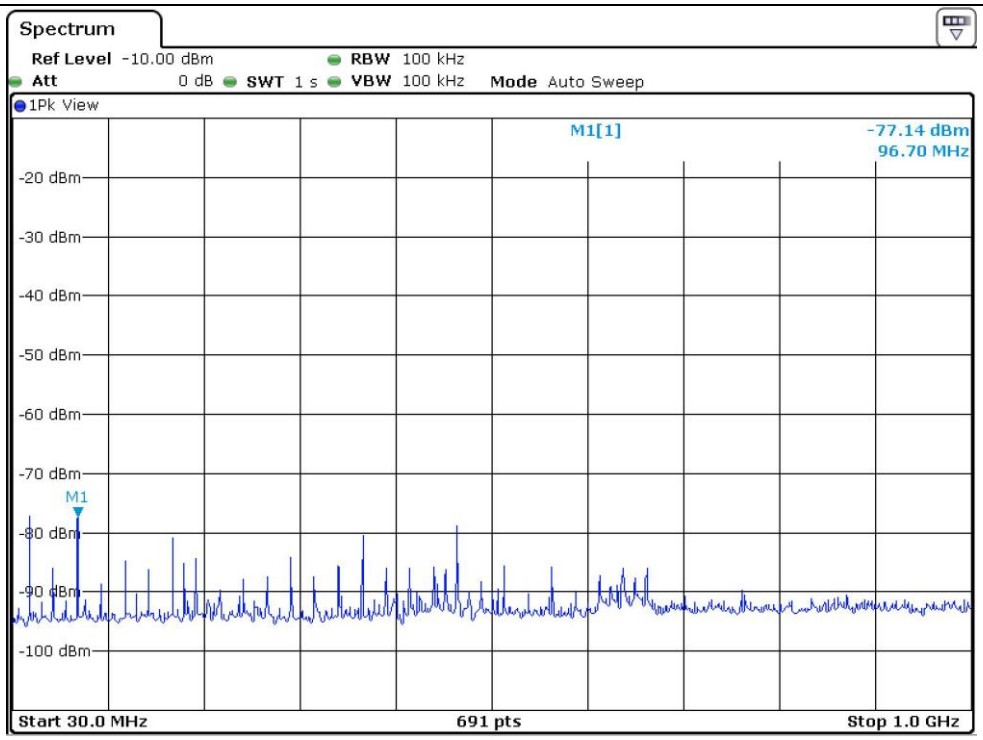
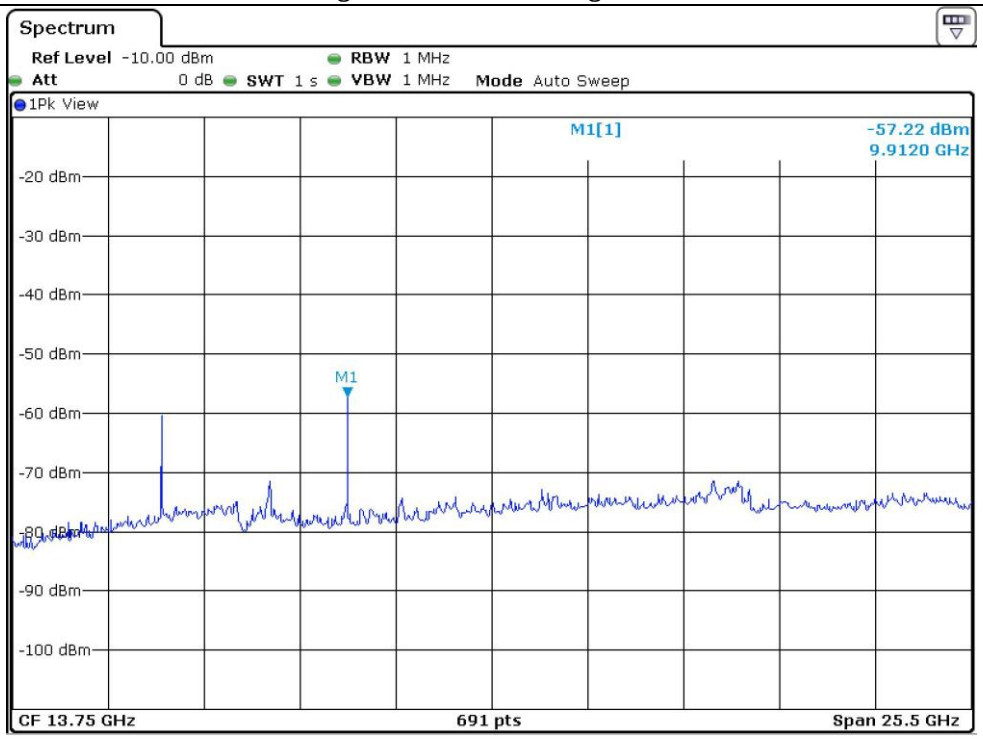


High Channel - Receiving Mode



High Channel - Receiving Mode

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13.6.2 Test data - Radiated

13.6.2.1 Test data for Below 30 MHz

-. Test Date : December 22, 2014

-. 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

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

Tested by: Tae-Ho, Kim / Project Engineer

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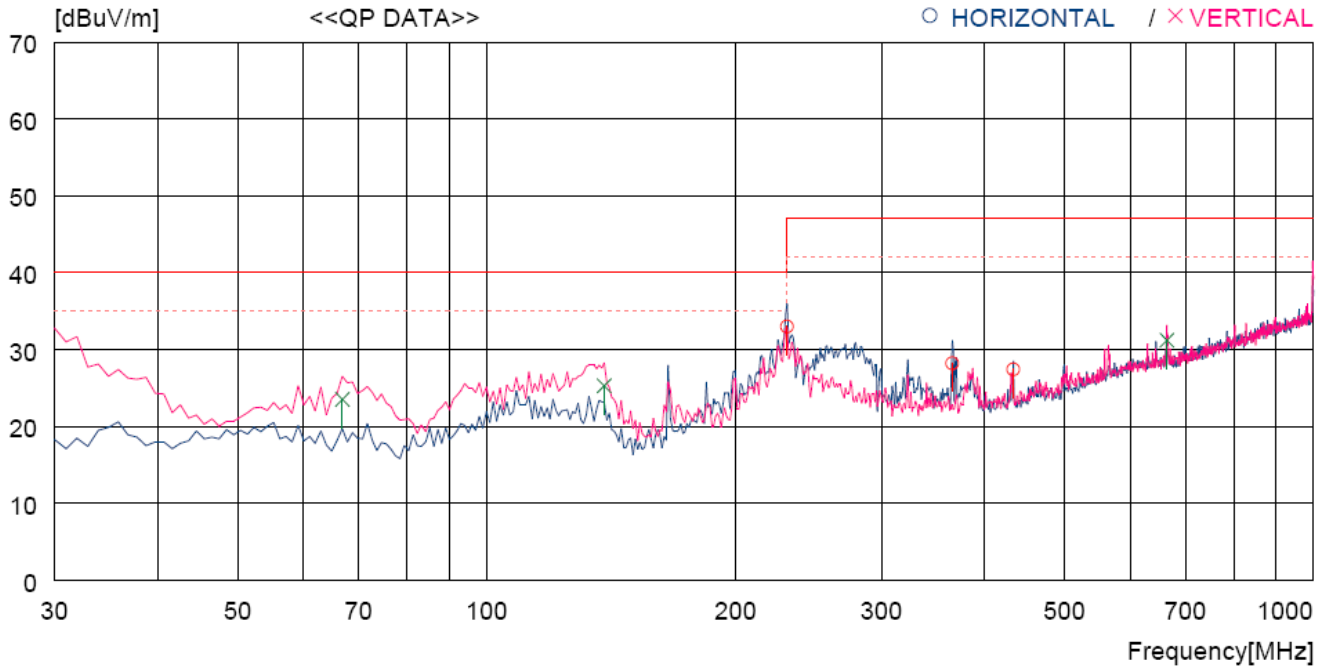
13.6.2.2 Test data for 30 MHz ~ 1 000 MHz

-. Test Date : December 22, 2014

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

-. Measurement distance : 3 m



No.	FREQ	READING QP	ANT FACTOR	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal ------										
1	230.790	44.1	11.9	9.9	32.9	33.0	47.0	14.0	100	110
2	365.620	35.3	14.8	11.1	33.0	28.2	47.0	18.8	100	359
3	433.521	32.7	16.1	11.7	33.1	27.4	47.0	19.6	100	327
----- Vertical ------										
4	66.860	38.3	10.6	7.6	33.0	23.5	40.0	16.5	100	0
5	138.640	41.4	8.1	8.8	33.0	25.3	40.0	14.7	100	0
6	664.376	31.6	19.3	13.6	33.3	31.2	47.0	15.8	100	0

Tested by: Tae-Ho, Kim / Project Engineer

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13.6.2.3 Test data for above 1 GHz

-. Test Date : December 22, 2014

-. 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

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

Tested by: Tae-Ho, Kim / Project Engineer

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13.7 Test data for 3 Mbps

13.7.1 Test data – Conducted

-. Test Date : December 22, 2014

-. Resolution bandwidth : 120 kHz / 1 MHz

-. Frequency range : 30 MHz ~ 26.5 GHz

-. Test Result : Pass

Frequency (MHz)	Spectrum Reading (dBm)	Cable Loss (dB)	Total (dBm)	Limits (dBμV/m)
Test result for Low Channel				
96.70	-76.88	0.08	-76.80	-57.0
9 617.00	-59.18	0.60	-58.58	-53.0
Test result for Middle Channel				
47.50	-77.23	0.08	-77.15	-57.0
9 764.00	-58.43	0.60	-57.83	-53.0
Test result for High Channel				
47.50	-77.20	0.08	-77.12	-57.0
9 912.00	-57.43	0.60	-56.83	-53.0

Tested by: Tae-Ho, Kim / Project Engineer

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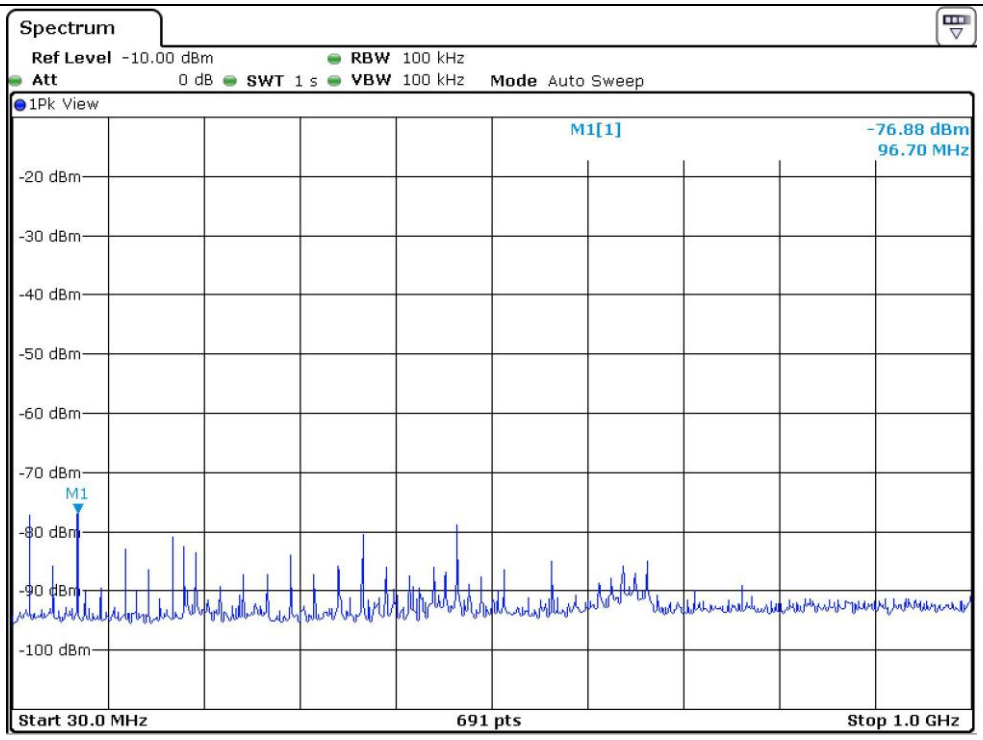
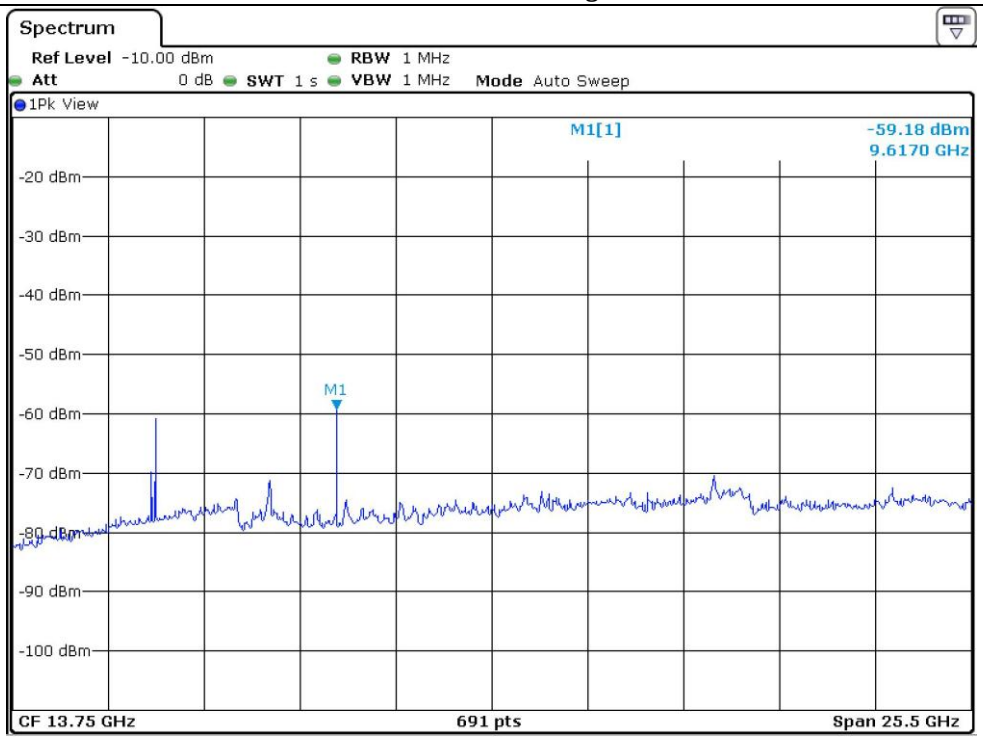


Low Channel - Receiving Mode



Low Channel - Receiving Mode

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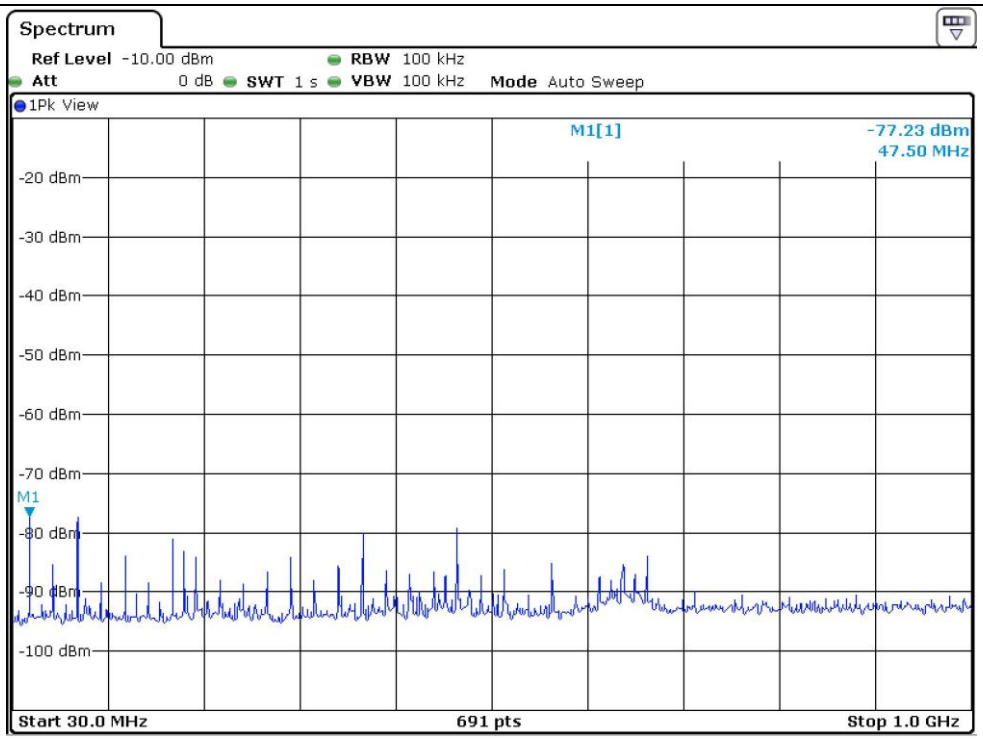
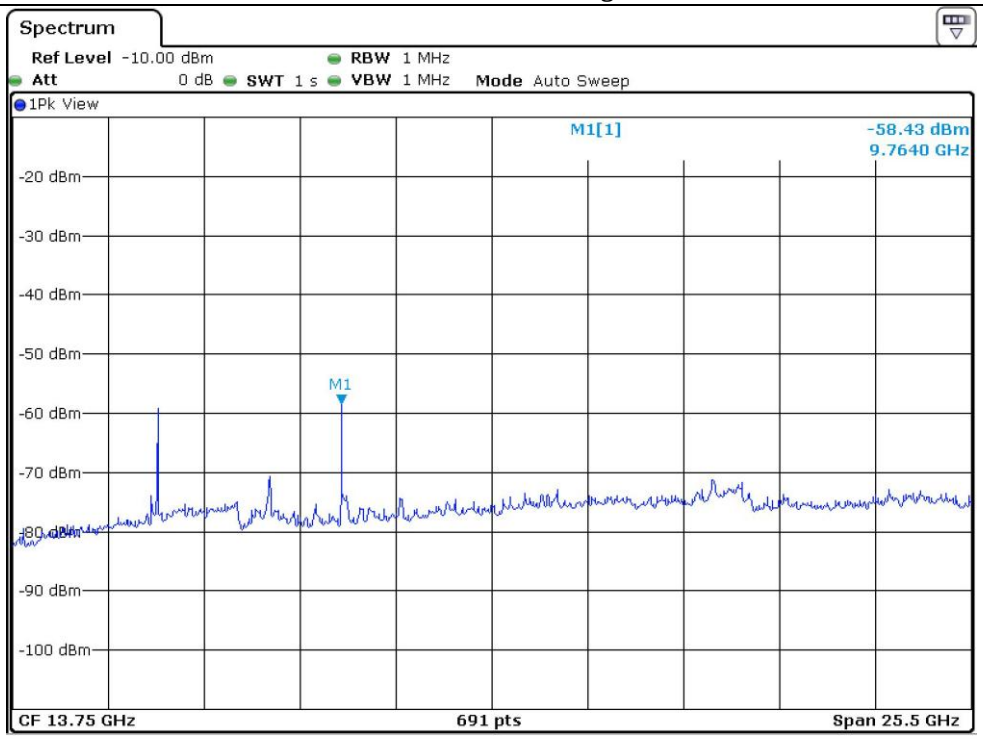


Middle Channel - Receiving Mode



Middle Channel - Receiving Mode

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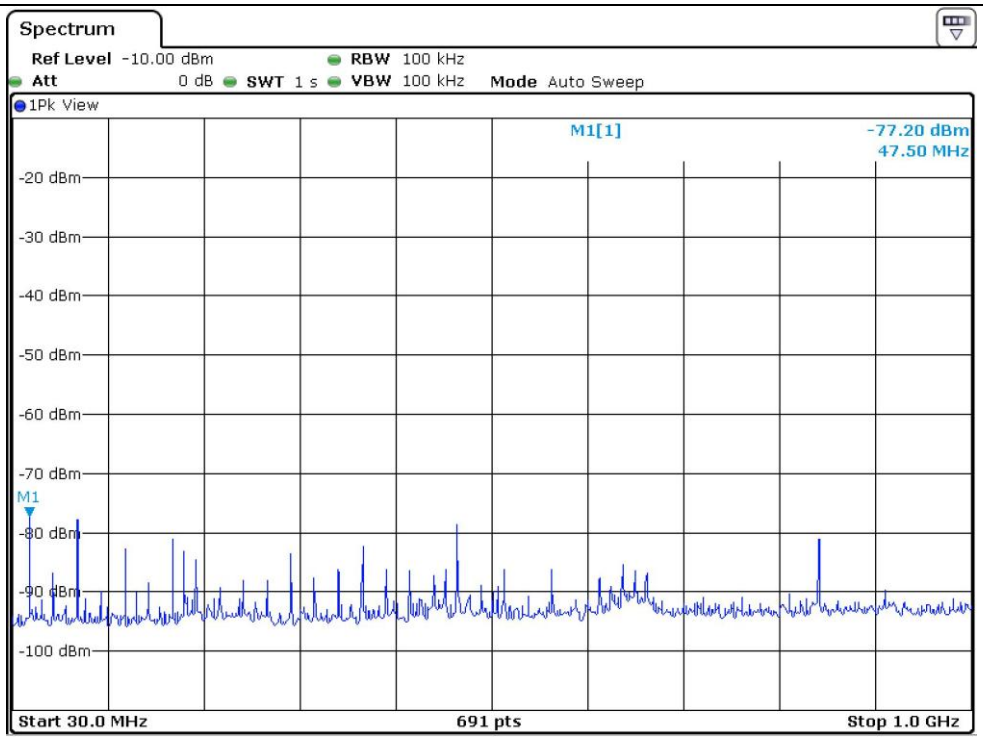
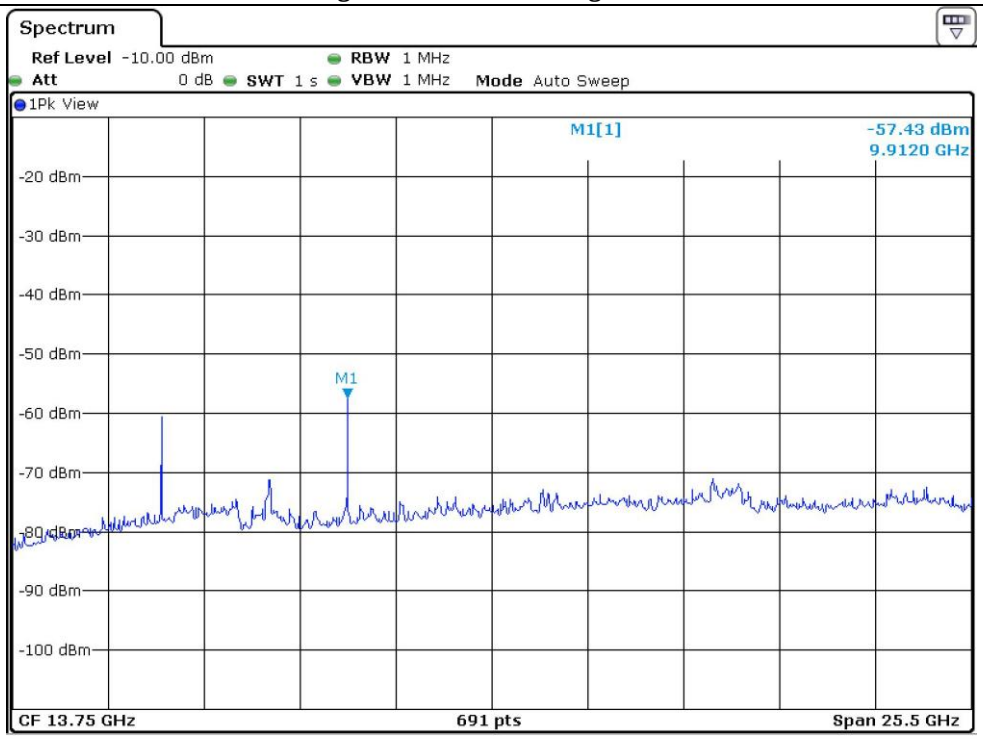


High Channel - Receiving Mode



High Channel - Receiving Mode

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13.7.2 Test data - Radiated

13.7.2.1 Test data for Below 30 MHz

-. Test Date : December 22, 2014

-. 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

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

Tested by: Tae-Ho, Kim / Project Engineer

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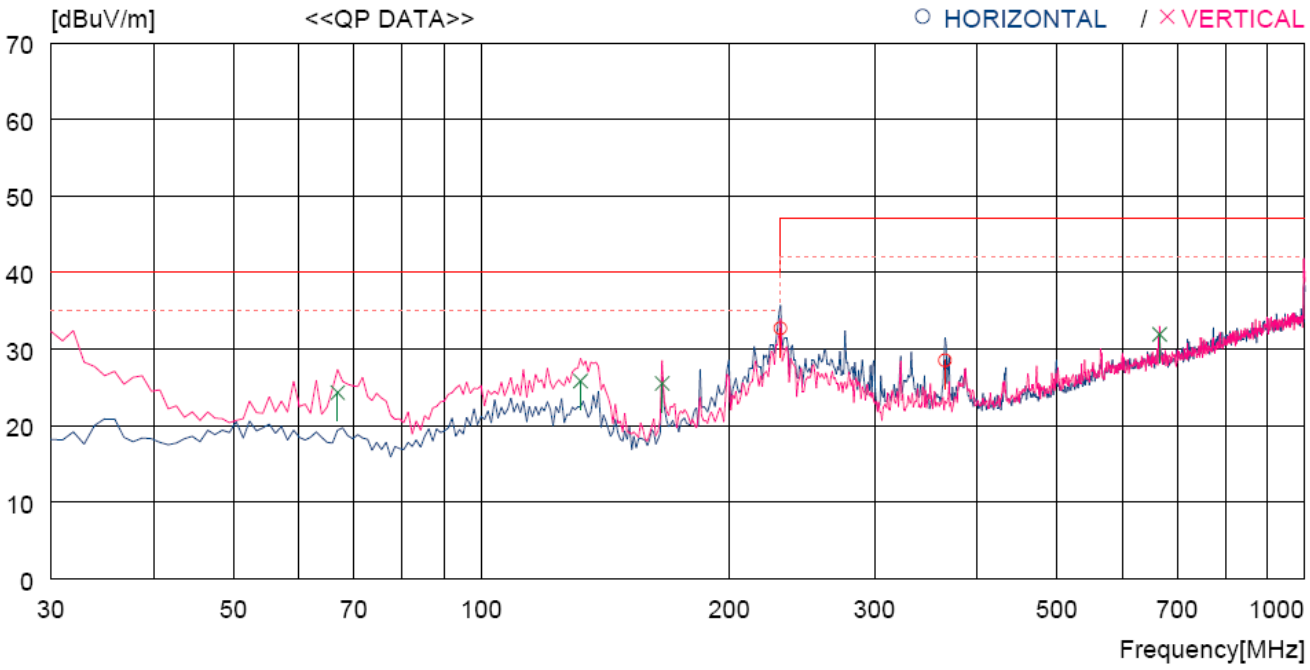
13.7.2.2 Test data for 30 MHz ~ 1 000 MHz

-. Test Date : December 22, 2014

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

-. Measurement distance : 3 m



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	230.790	43.8	11.9	9.9	32.9	32.7	47.0	14.3	200	0
2	365.620	35.6	14.8	11.1	33.0	28.5	47.0	18.5	100	359
----- Vertical ------										
3	66.860	39.1	10.6	7.6	33.0	24.3	40.0	15.7	100	215
4	131.850	41.3	8.8	8.7	33.0	25.8	40.0	14.2	100	25
5	165.800	40.6	8.8	9.1	33.0	25.5	40.0	14.5	100	0
6	666.316	32.3	19.3	13.6	33.3	31.9	47.0	15.1	100	0

Tested by: Tae-Ho, Kim / Project Engineer

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13.7.2.3 Test data for above 1 GHz

-. Test Date : December 22, 2014

-. 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

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

Tested by: Tae-Ho, Kim / Project Engineer

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14. CONDUCTED EMISSION TEST

14.1 Operating environment

Temperature : (24 ~ 25) ℃

Relative humidity : (45 ~ 46) % 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 μH + 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)
■ -	ESPI	Rohde & Schwarz	EMI Test Receiver	101278	Nov. 03, 2014 (1Y)
☐ -	ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	Jul. 15, 2014 (1Y)
☐	NSLK8128	Schwarzbeck	AMN	8128-216	Apr. 11, 2014 (1Y)
■ -	NSLK8126	Schwarzbeck	AMN	8126-404	Jul. 11, 2014 (1Y)
☐ -	3825/2	EMCO	AMN	9109-1869	Apr. 29, 2014 (1Y)
■ --	3825/2	EMCO	AMN	9109-1867	Apr. 29, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

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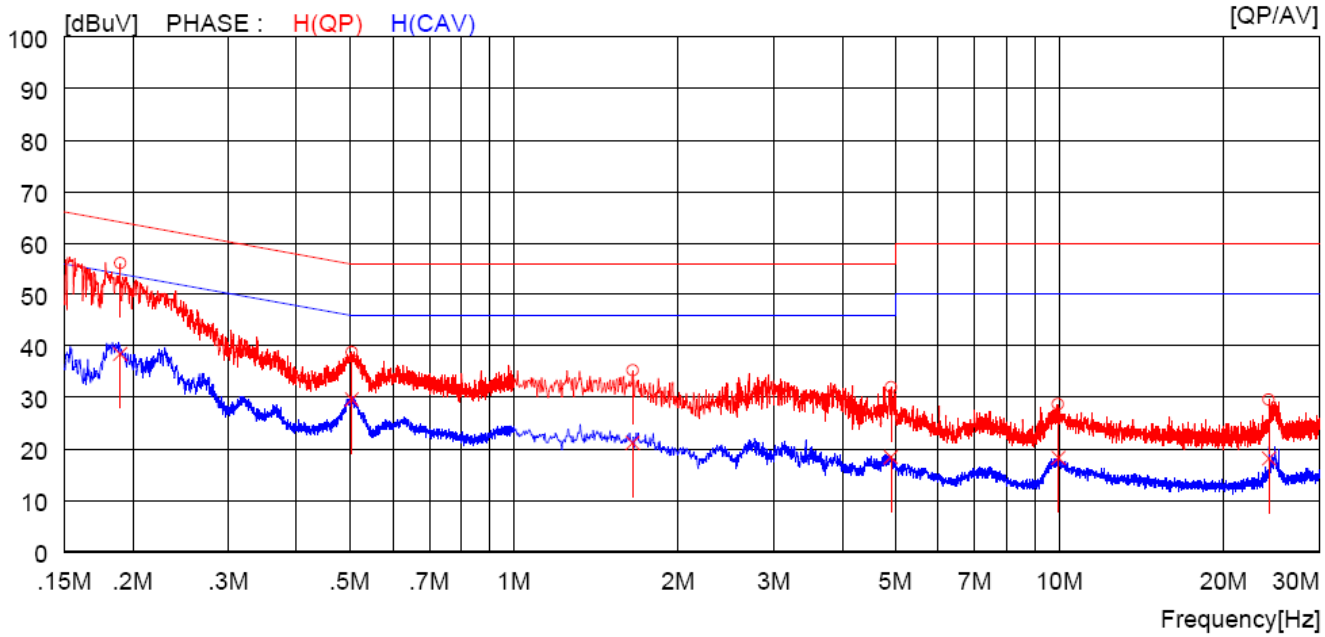
14.4 Test data for Charging mode

-. Test Date : December 22, 2014

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Tested Line : HOT LINE



NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.19000	46.1	----	10.0	56.1	----	64.0	----	7.9	----	H(QP)
2	0.50500	28.8	----	10.0	38.8	----	56.0	----	17.2	----	H(QP)
3	1.65200	25.3	----	10.0	35.3	----	56.0	----	20.7	----	H(QP)
4	4.91200	21.9	----	10.1	32.0	----	56.0	----	24.0	----	H(QP)
5	9.96000	18.4	----	10.2	28.6	----	60.0	----	31.4	----	H(QP)
6	24.22000	18.9	----	10.7	29.6	----	60.0	----	30.4	----	H(QP)
7	0.19000	----	28.5	10.0	----	38.5	----	54.0	----	15.5	H(CAV)
8	0.50500	----	19.6	10.0	----	29.6	----	46.0	----	16.4	H(CAV)
9	1.65200	----	11.1	10.0	----	21.1	----	46.0	----	24.9	H(CAV)
10	4.91200	----	8.3	10.1	----	18.4	----	46.0	----	27.6	H(CAV)
11	9.96000	----	8.1	10.2	----	18.3	----	50.0	----	31.7	H(CAV)
12	24.22000	----	7.4	10.7	----	18.1	----	50.0	----	31.9	H(CAV)

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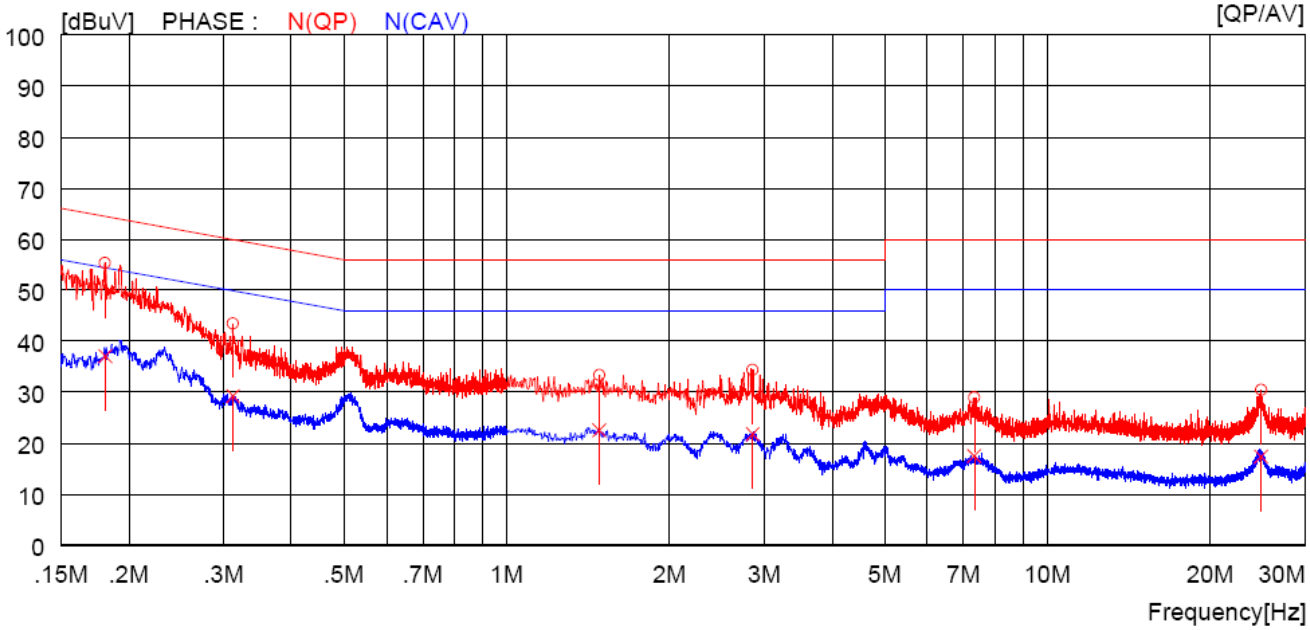
-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING QP [dBuV]	READING AV [dBuV]	C.FACTOR [dB]	RESULT QP [dBuV]	RESULT AV [dBuV]	LIMIT QP [dBuV]	LIMIT AV [dBuV]	MARGIN QP [dBuV]	MARGIN AV [dBuV]	PHASE
1	0.18100	45.3	----	10.0	55.3	----	64.4	----	9.1	----	N(QP)
2	0.31200	33.5	----	10.0	43.5	----	59.9	----	16.4	----	N(QP)
3	1.48400	23.4	----	10.0	33.4	----	56.0	----	22.6	----	N(QP)
4	2.85200	24.4	----	10.0	34.4	----	56.0	----	21.6	----	N(QP)
5	7.32000	18.7	----	10.2	28.9	----	60.0	----	31.1	----	N(QP)
6	24.86000	19.7	----	10.7	30.4	----	60.0	----	29.6	----	N(QP)
7	0.18100	----	27.1	10.0	----	37.1	----	54.4	----	17.3	N(CAV)
8	0.31200	----	19.2	10.0	----	29.2	----	49.9	----	20.7	N(CAV)
9	1.48400	----	12.5	10.0	----	22.5	----	46.0	----	23.5	N(CAV)
10	2.85200	----	11.8	10.0	----	21.8	----	46.0	----	24.2	N(CAV)
11	7.32000	----	7.3	10.2	----	17.5	----	50.0	----	32.5	N(CAV)
12	24.86000	----	6.7	10.7	----	17.4	----	50.0	----	32.6	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: Tae-Ho, Kim / Project Engineer

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