

7.3.7.3 Test data for 802.11n_HT20 Mode

- Test Date : January 28, 2014
- Resolution bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and Average Mode
- Video bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (GHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
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Test Data for Low Channel

2 412.00	98.12	Peak	H	27.10	7.90	43.00	90.12	113.98	23.86
	89.36	Average	H				81.36	93.98	12.62
	96.12	Peak	V				88.12	113.98	25.86
	87.32	Average	V				79.32	93.98	14.66
4 824.00	48.25	Peak	H	30.70	11.90	42.50	48.35	73.98	25.63
	37.01	Average	H				37.11	53.98	16.87
	46.25	Peak	V				46.35	73.98	27.63
	32.42	Average	V				32.52	53.98	21.46

Test Data for Middle Channel

2 442.00	98.98	Peak	H	27.20	7.90	43.00	91.08	113.98	22.90
	90.74	Average	H				82.84	93.98	11.14
	97.04	Peak	V				89.14	113.98	24.84
	88.21	Average	V				80.31	93.98	13.67
4 884.00	48.36	Peak	H	30.70	12.00	42.40	48.66	73.98	25.32
	37.63	Average	H				37.93	53.98	16.05
	46.93	Peak	V				47.23	73.98	26.75
	33.21	Average	V				33.51	53.98	20.47

Test Data for High Channel									
2 462.00	99.26	Peak	H	27.30	8.00	43.00	91.56	113.98	22.42
	90.57	Average	H				82.87	93.98	11.11
	97.11	Peak	V				89.41	113.98	24.57
	88.80	Average	V				81.10	93.98	12.88
4 924.00	48.96	Peak	H	30.80	12.00	42.30	49.46	73.98	24.52
	38.04	Average	H				38.54	53.98	15.44
	47.94	Peak	V				48.44	73.98	25.54
	33.84	Average	V				34.34	53.98	19.64

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dB μ V/m) - Total Level (dB μ V/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Project Engineer

7.3.7.4 Test data for 802.11n_HT40 Mode

- Test Date : January 28, 2014
- Resolution bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and Average Mode
- Video bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (GHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
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Test Data for Low Channel

2 422.00	99.03	Peak	H	27.10	7.90	43.00	91.03	113.98	22.95
	90.21	Average	H				82.21	93.98	11.77
	96.87	Peak	V				88.87	113.98	25.11
	87.04	Average	V				79.04	93.98	14.94
4 844.00	48.87	Peak	H	30.70	12.00	42.40	49.17	73.98	24.81
	37.74	Average	H				38.04	53.98	15.94
	47.14	Peak	V				47.44	73.98	26.54
	32.64	Average	V				32.94	53.98	21.04

Test Data for Middle Channel

2 442.00	99.97	Peak	H	27.20	7.90	43.00	92.07	113.98	21.91
	91.63	Average	H				83.73	93.98	10.25
	97.92	Peak	V				90.02	113.98	23.96
	89.12	Average	V				81.22	93.98	12.76
4 884.00	48.83	Peak	H	30.70	12.00	42.40	49.13	73.98	24.85
	38.11	Average	H				38.41	53.98	15.57
	47.48	Peak	V				47.78	73.98	26.20
	33.79	Average	V				34.09	53.98	19.89

Test Data for High Channel									
2 452.00	100.12	Peak	H	27.50	8.10	43.00	92.72	113.98	21.26
	90.86	Average	H				83.46	93.98	10.52
	97.42	Peak	V				90.02	113.98	23.96
	89.14	Average	V				81.74	93.98	12.24
4 904.00	49.42	Peak	H	30.80	12.00	42.30	49.92	73.98	24.06
	38.63	Average	H				39.13	53.98	14.85
	48.42	Peak	V				48.92	73.98	25.06
	34.38	Average	V				34.88	53.98	19.10

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dB μ V/m) - Total Level (dB μ V/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Project Engineer

7.4 PEAK POWER SPECTRUL DENSITY

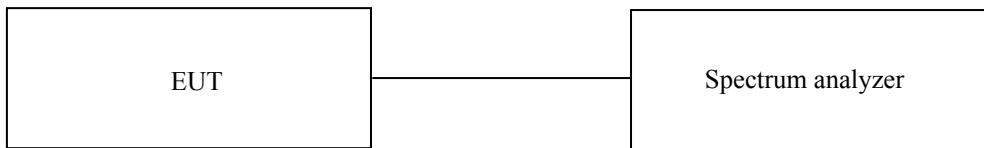
7.4.1 Operating environment

Temperature : 20 °C

Relative humidity : 40 % R.H.

7.4.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 3 kHz, the video bandwidth is set to 3 times the resolution bandwidth. The maximum level form the EUT in 100 kHz bandwidth was measured with above condition.



7.4.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	R/S	Spectrum Analyzer	101372	May 20, 2013

All test equipment used is calibrated on a regular basis.

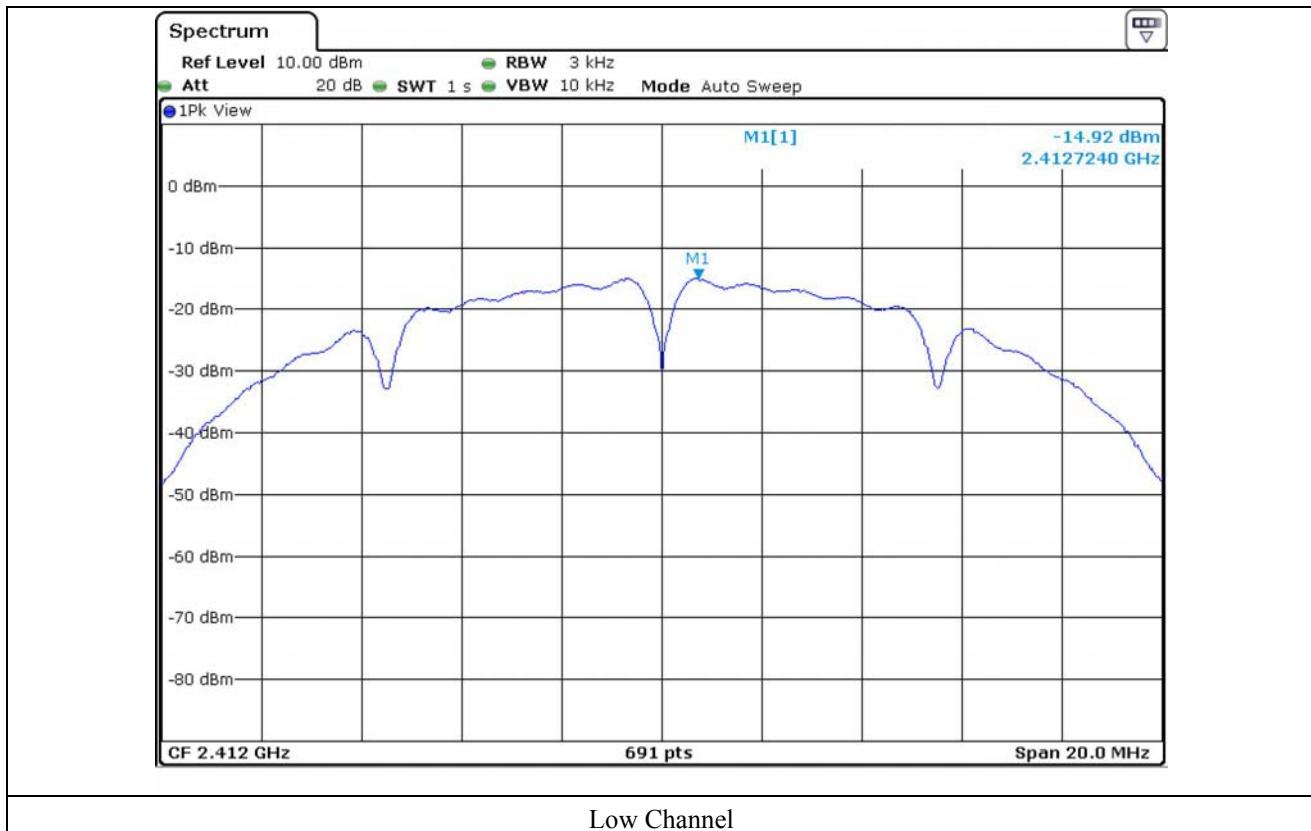
7.4.4 Test data for 802.11b Mode

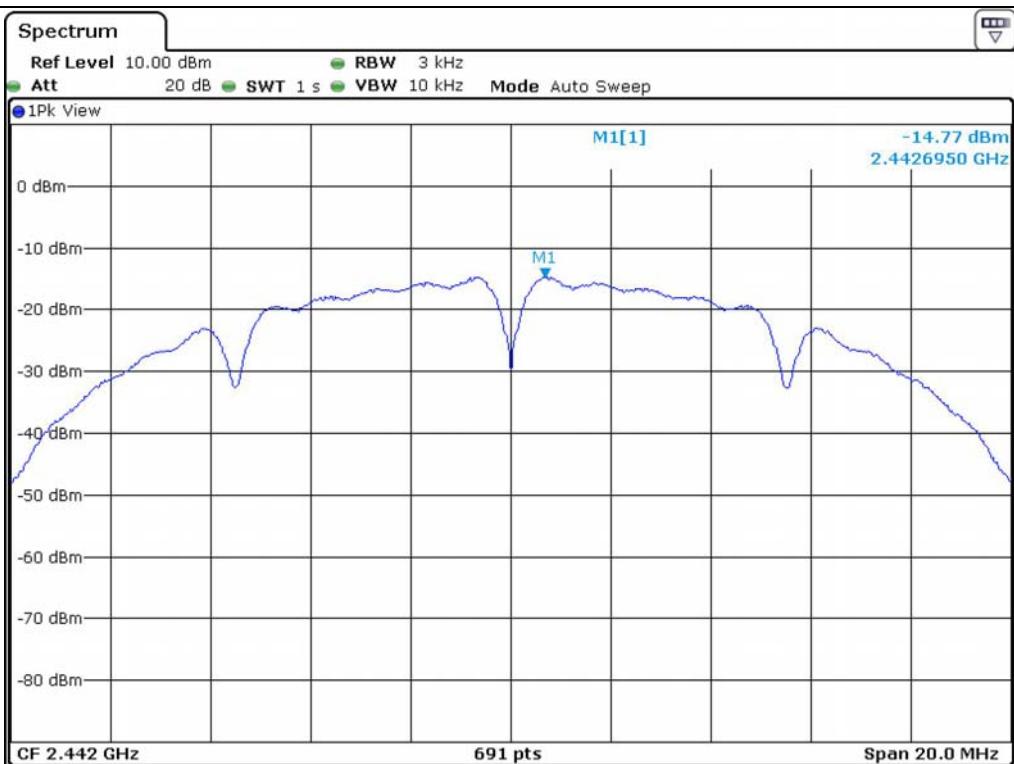
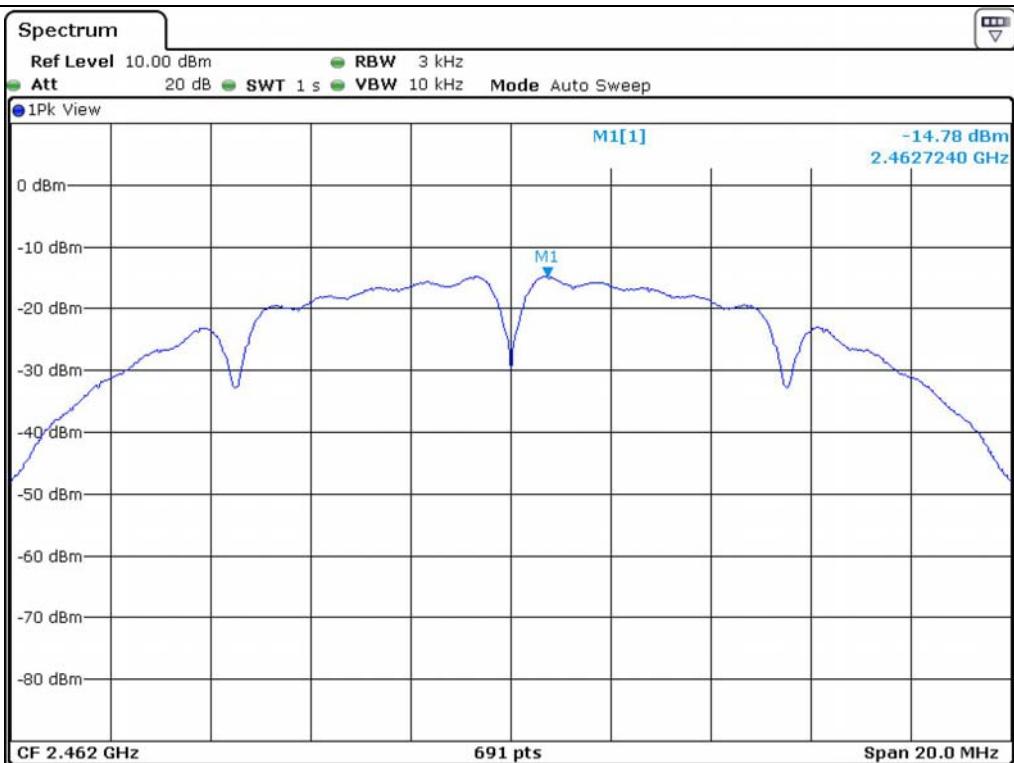
- Test Date : January 28, 2014
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412	-14.92	8.00	22.92
Middle	2 442	-14.77	8.00	22.77
High	2 462	-14.78	8.00	22.78

Remark. Margin = Limit – Measured value

Tested by: Tae-Ho, Kim / Project Engineer



**Middle Channel****High Channel**

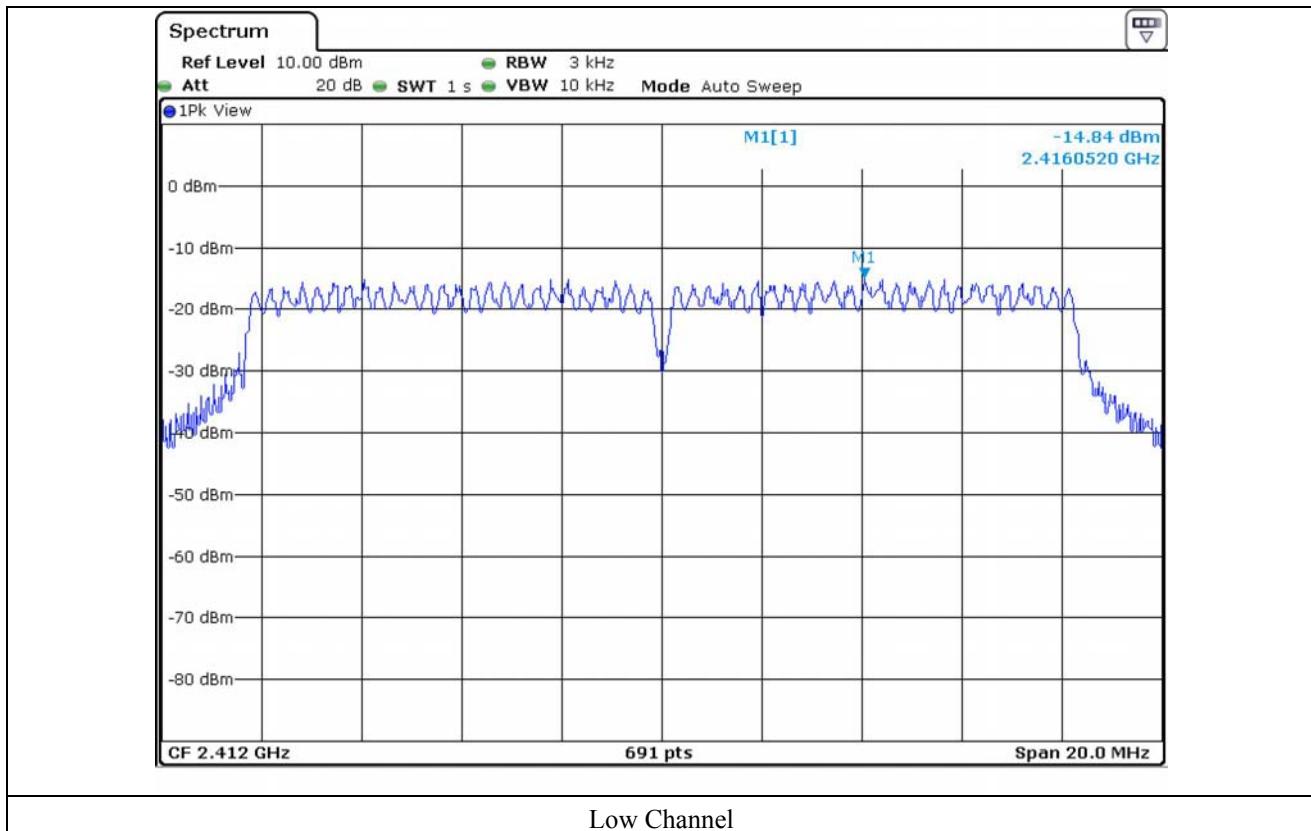
7.4.5 Test data for 802.11g Mode

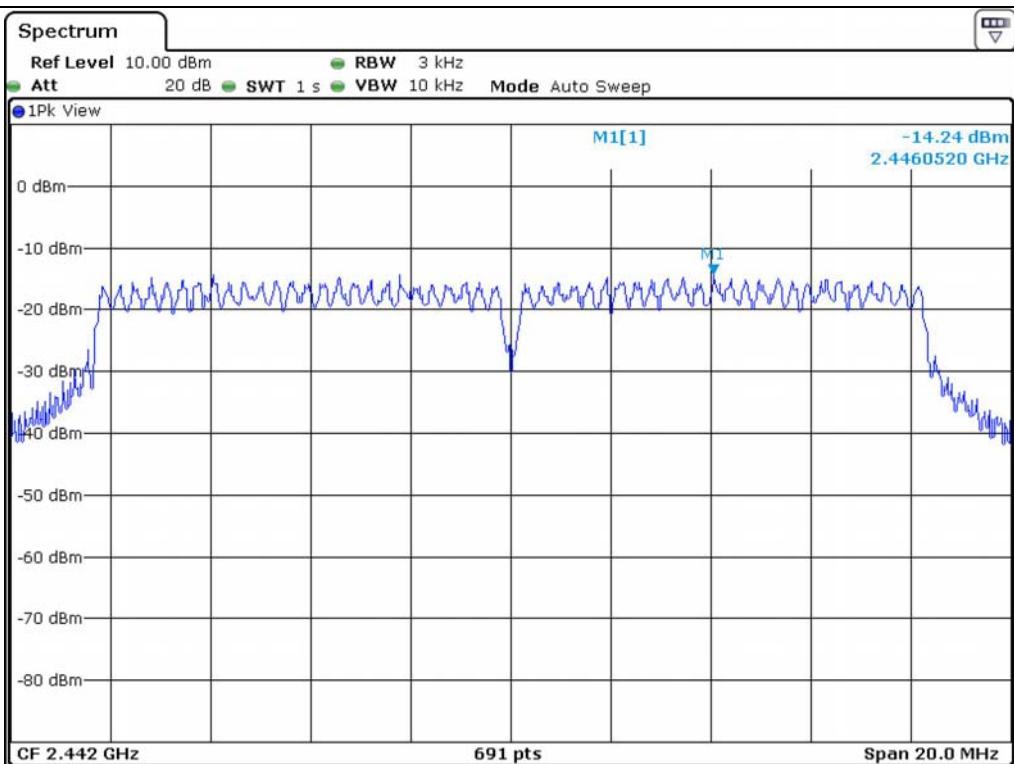
- Test Date : January 28, 2014
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412	-14.84	8.00	22.84
Middle	2 442	-14.24	8.00	22.24
High	2 462	-14.30	8.00	22.30

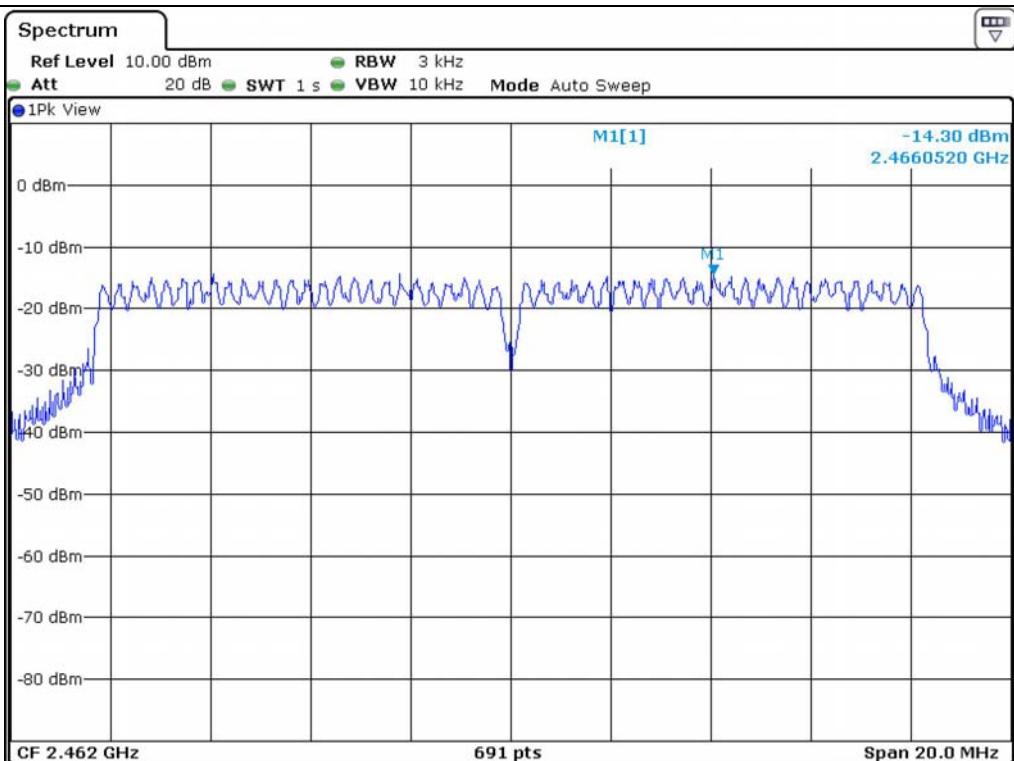
Remark. Margin = Limit – Measured value

Tested by: Tae-Ho, Kim / Project Engineer





Middle Channel



High Channel

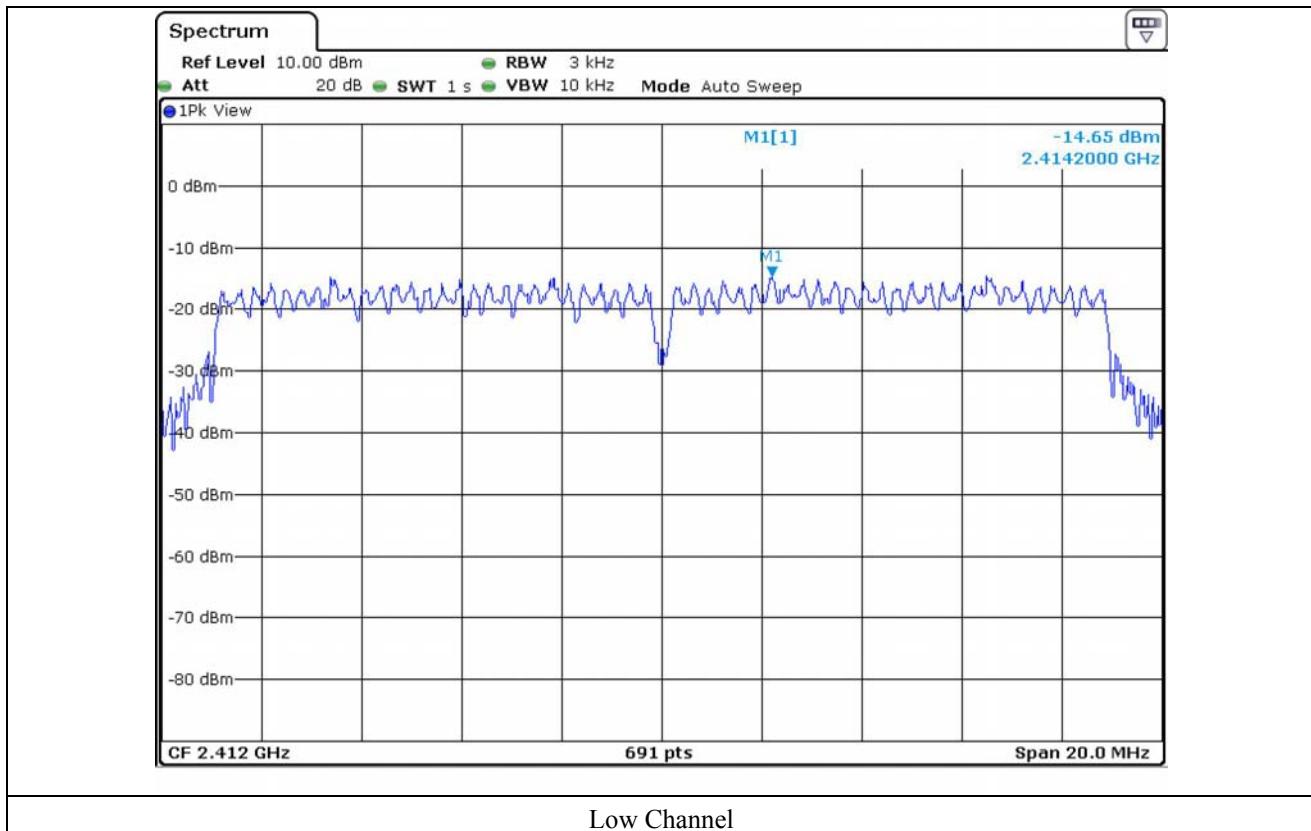
7.4.6 Test data for 802.11n_HT20 Mode

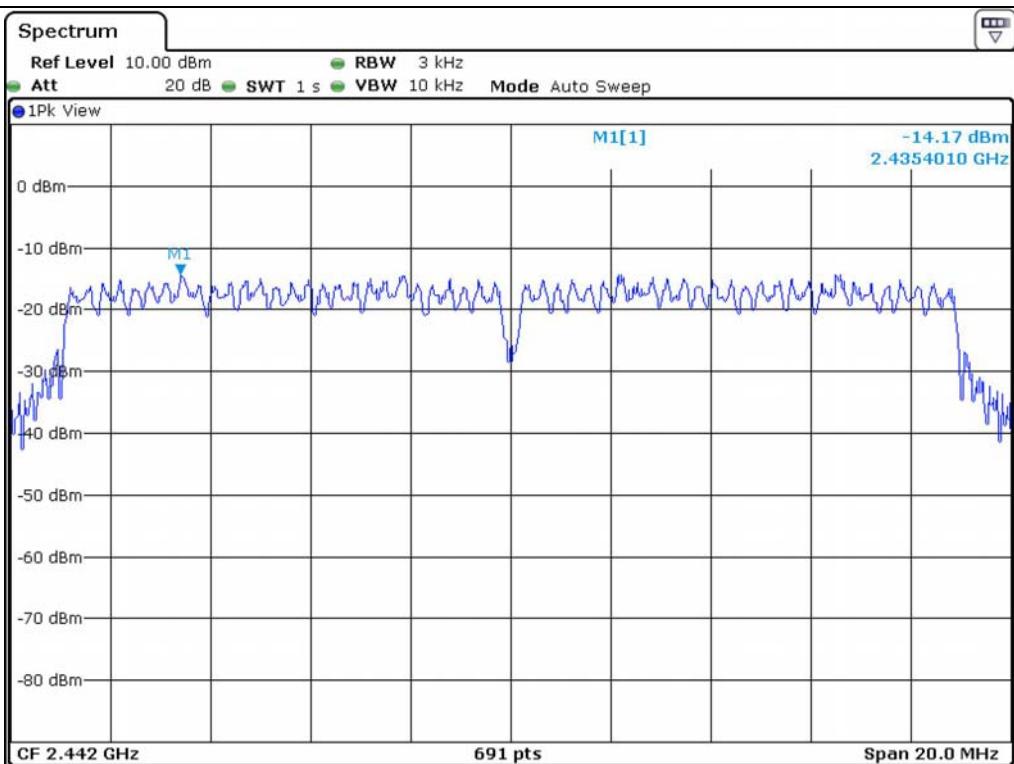
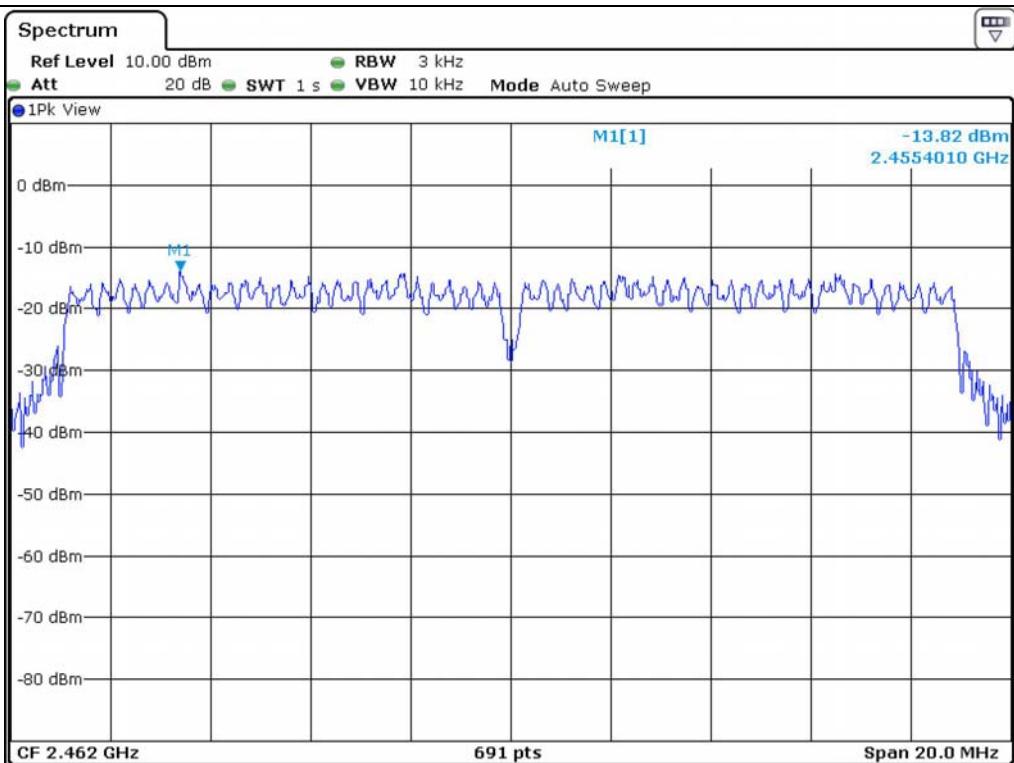
- Test Date : January 28, 2014
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 412	-14.65	8.00	22.65
Middle	2 442	-14.17	8.00	22.17
High	2 462	-13.82	8.00	21.82

Remark. Margin = Limit – Measured value

Tested by: Tae-Ho, Kim / Project Engineer



**Middle Channel****High Channel**

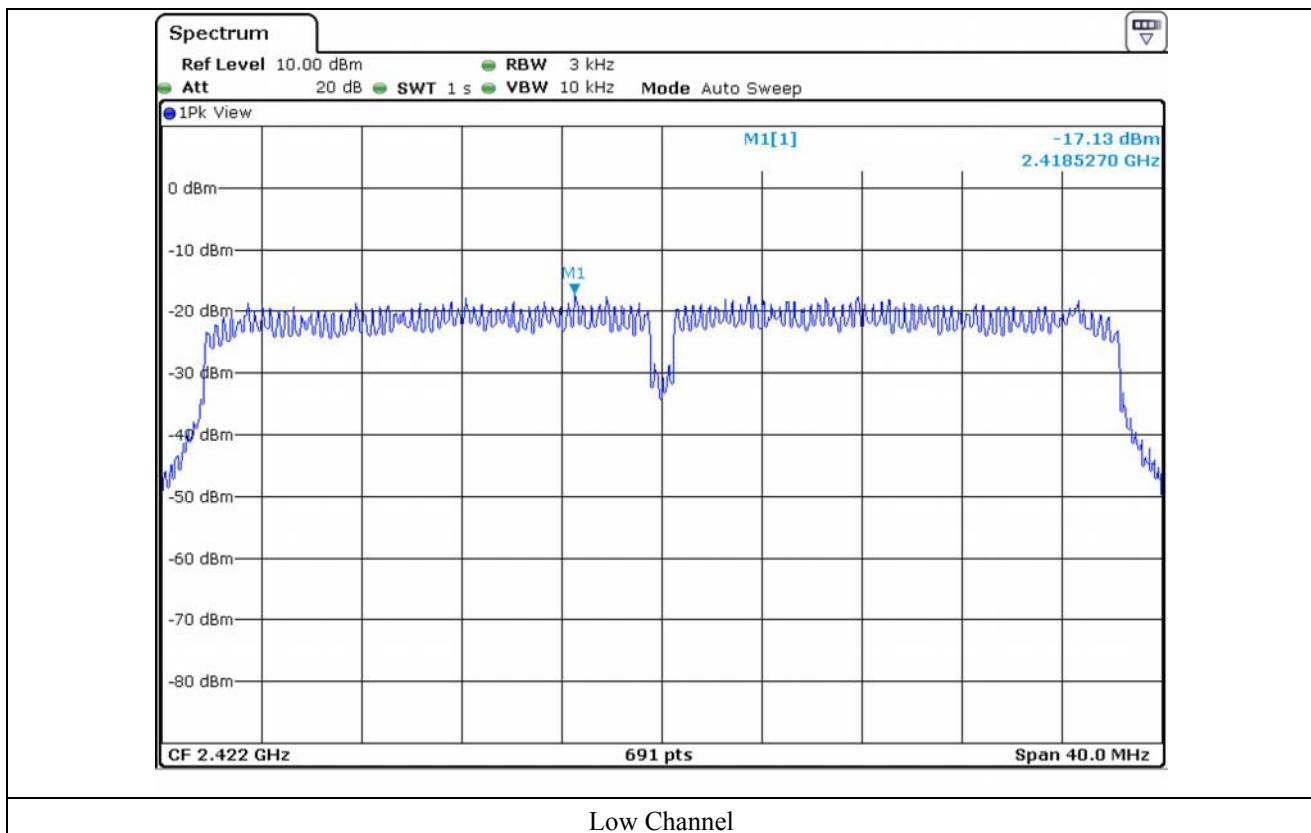
7.4.7 Test data for 802.11n_HT40 Mode

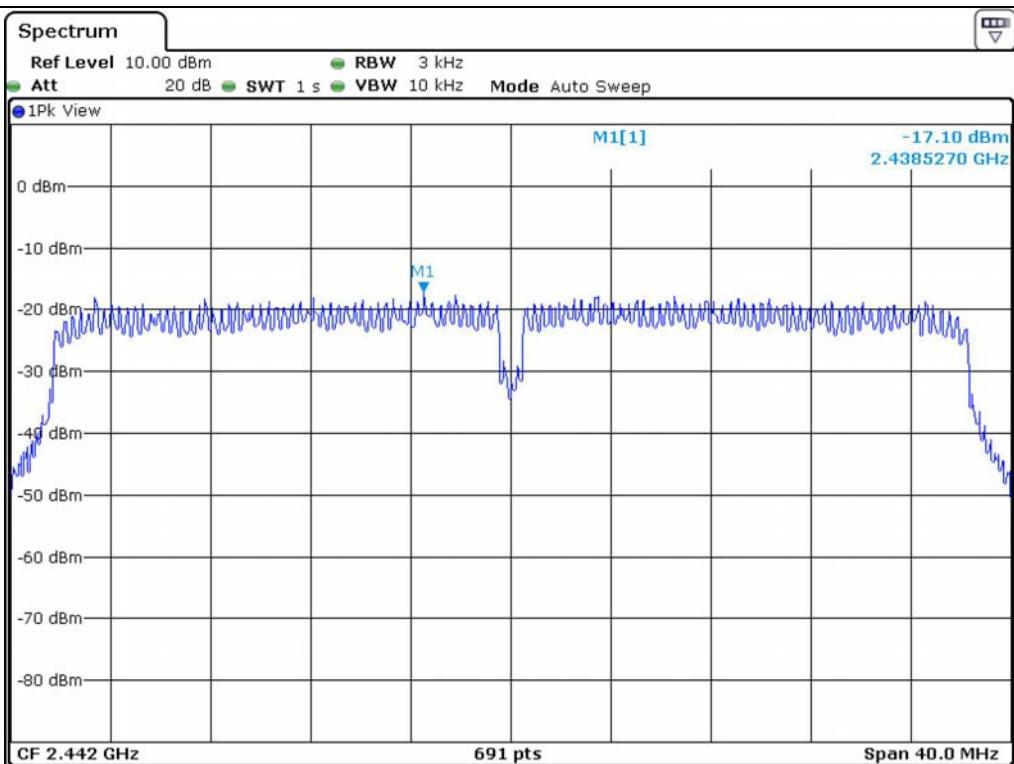
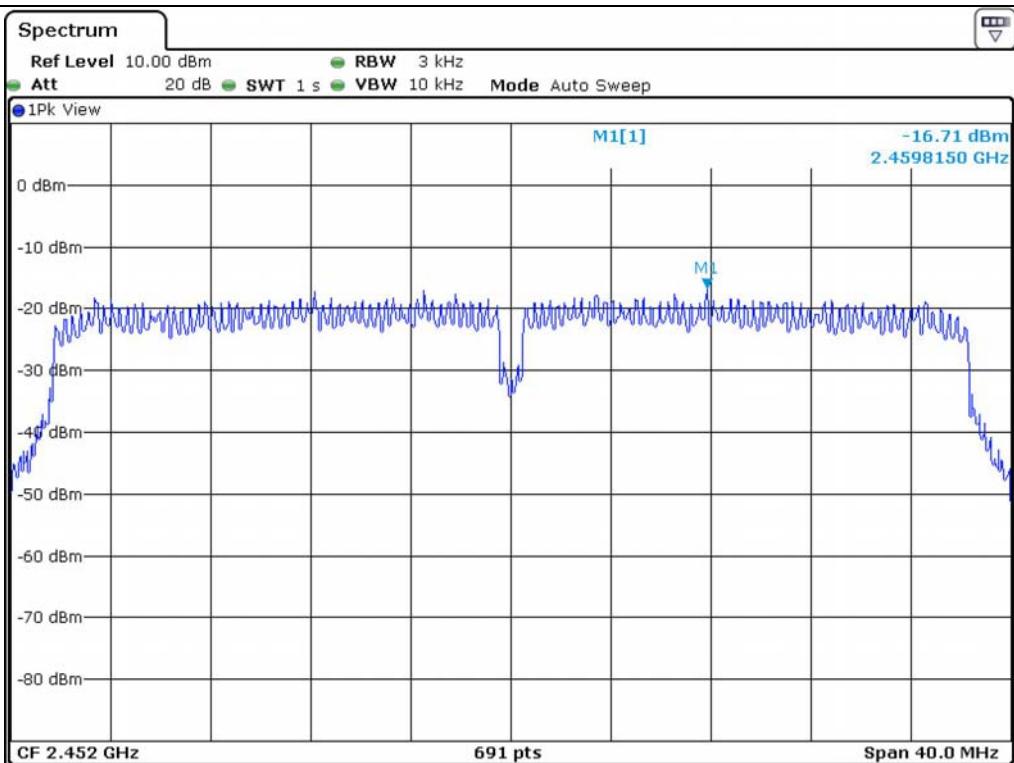
- Test Date : January 28, 2014
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 422	-17.13	8.00	25.13
Middle	2 442	-17.10	8.00	25.10
High	2 452	-16.71	8.00	24.71

Remark. Margin = Limit – Measured value

Tested by: Tae-Ho, Kim / Project Engineer



**Middle Channel****High Channel**

7.5 RADIATED EMISSION TEST

7.5.1 Operating environment

Temperature : (21 ~ 22) °C

Relative humidity : (43 ~ 44) % R.H.

7.5.2 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 up to 25 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.

7.5.3 Measurement uncertainty

Radiated emission electric field intensity, 0.15 MHz ~ 30 MHz : ± 2.61 dB

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Radiated emission electric field intensity, 1 000 MHz ~ 3 000 MHz: ± 4.40 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

7.5.4 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
□ - ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Nov. 18, 2013(1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	May 27, 2013(1Y)
□ - 8564E	HP	Spectrum Analyzer	3650A00756	May 03, 2013(1Y)
□ - FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Nov. 05, 2013(1Y)
■ - 310N	Sonoma Instrument	AMPLIFIER	312544	May 21, 2013(1Y)
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101372	May 20, 2013(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. 11, 2012(2Y)
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	Apr. 24, 2012(2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 05, 2013(2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jun. 17, 2013(2Y)
■ - 83051A	Agilent	Microwave System Preamplifier	3950M00201	May 22, 2013(1Y)

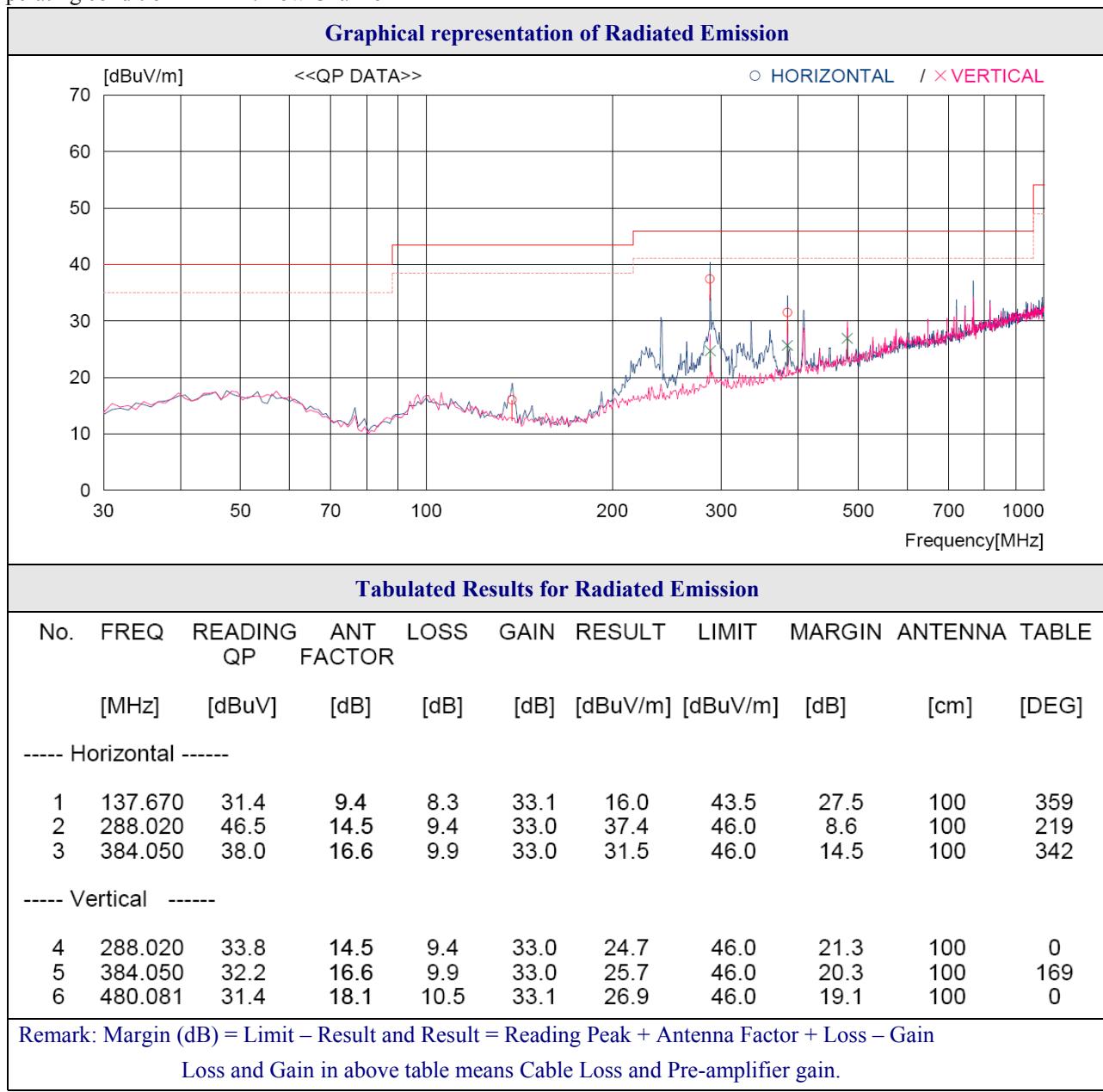
All test equipment used is calibrated on a regular basis.

7.5.5 Test data for 802.11b Mode**7.5.5.1 Test data for 30 MHz ~ 1 000 MHz**

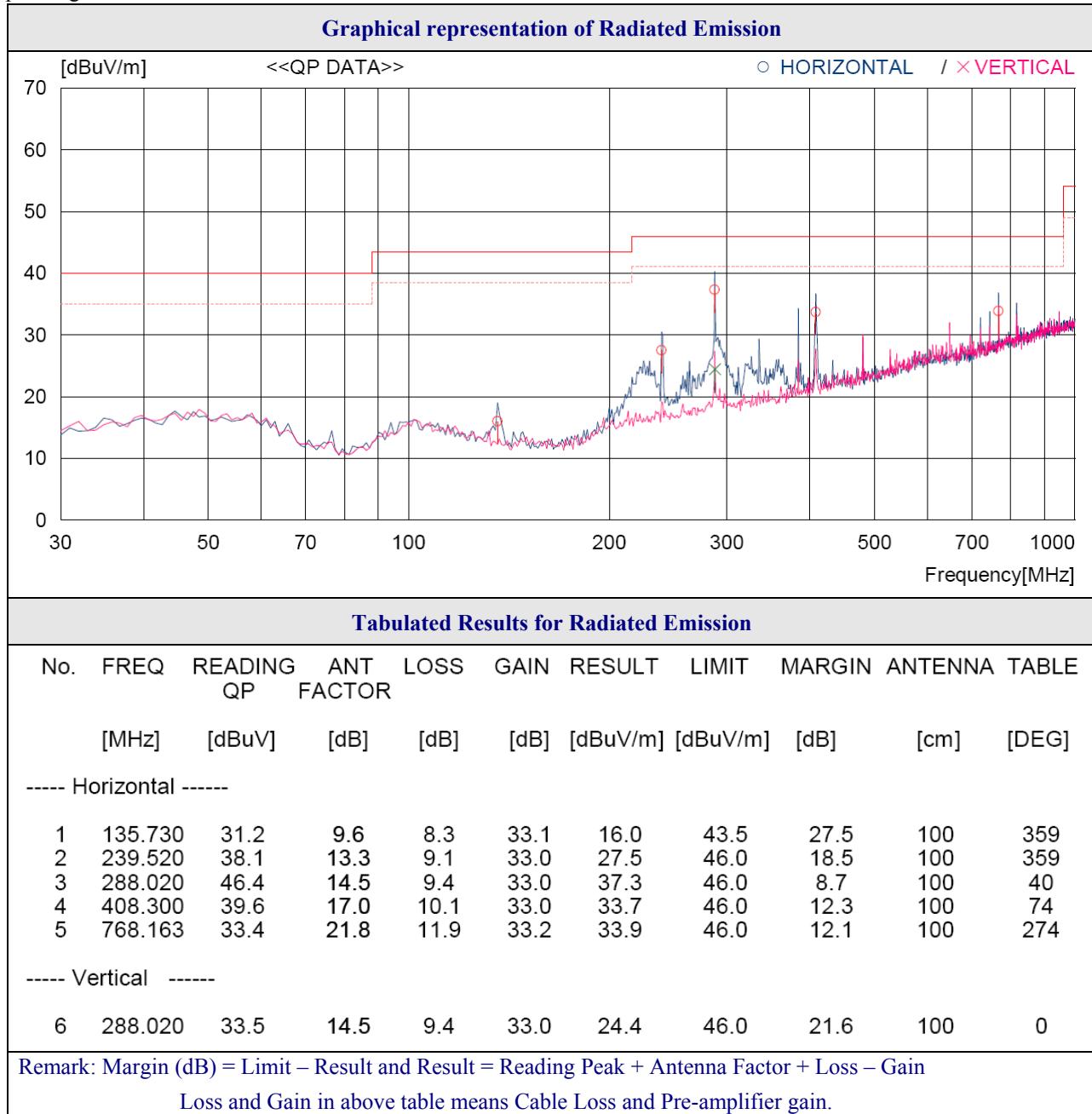
Humidity Level : (43 ~ 44) % R.H. Temperature: (21 ~ 22) °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : Remote Control Date: January 27, 2014
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

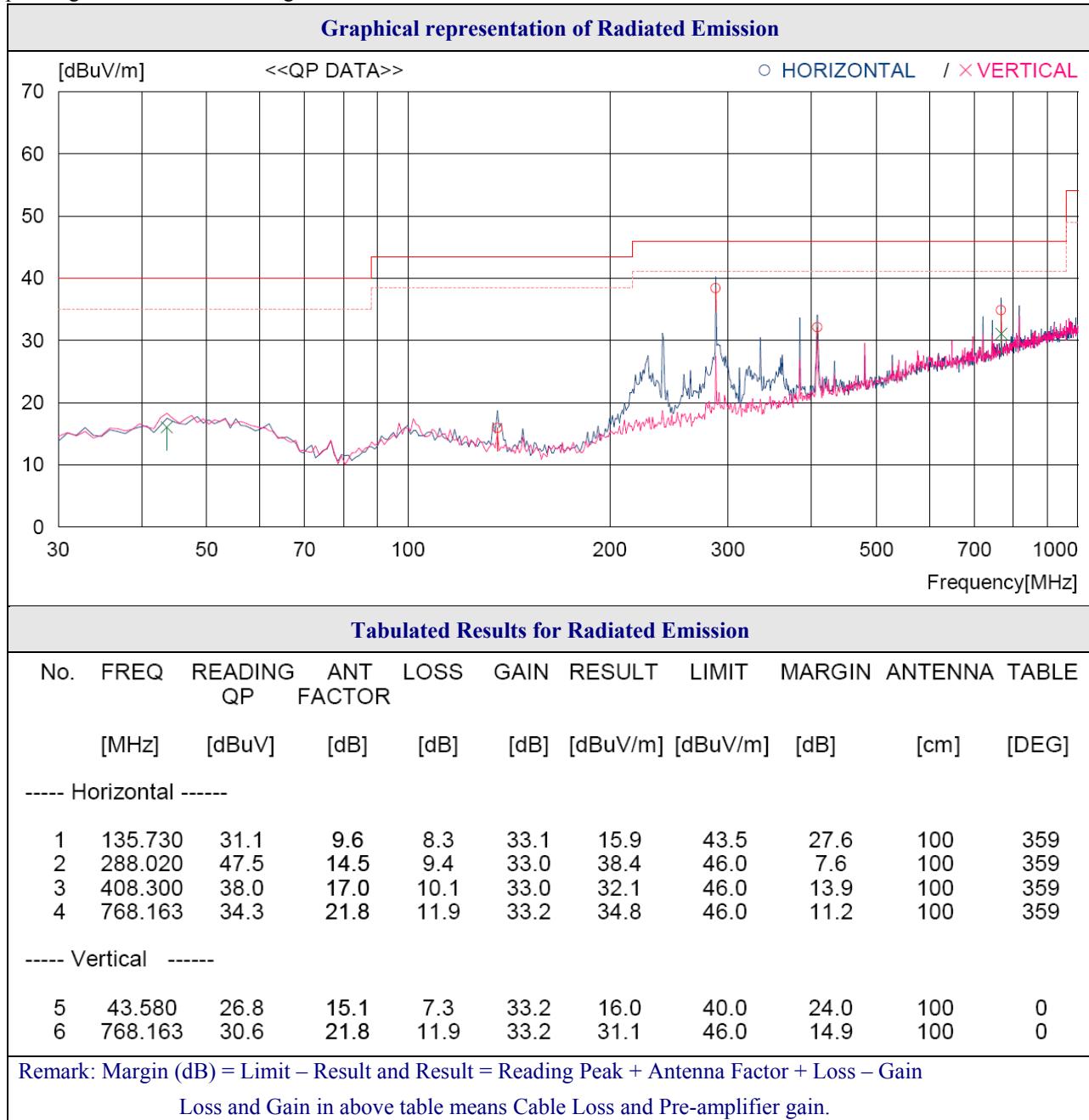
Operating condition : Low Channel



Operating condition : Middle Channel



Operating condition : High Channel



Tested by: Tae-Ho, Kim / Project Engineer

7.5.5.2 Test data for Below 30 MHz

- . Test Date : January 27, 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 (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.									

7.5.5.3 Test data for above 1 GHz

- . Test Date : January 27, 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 (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.									



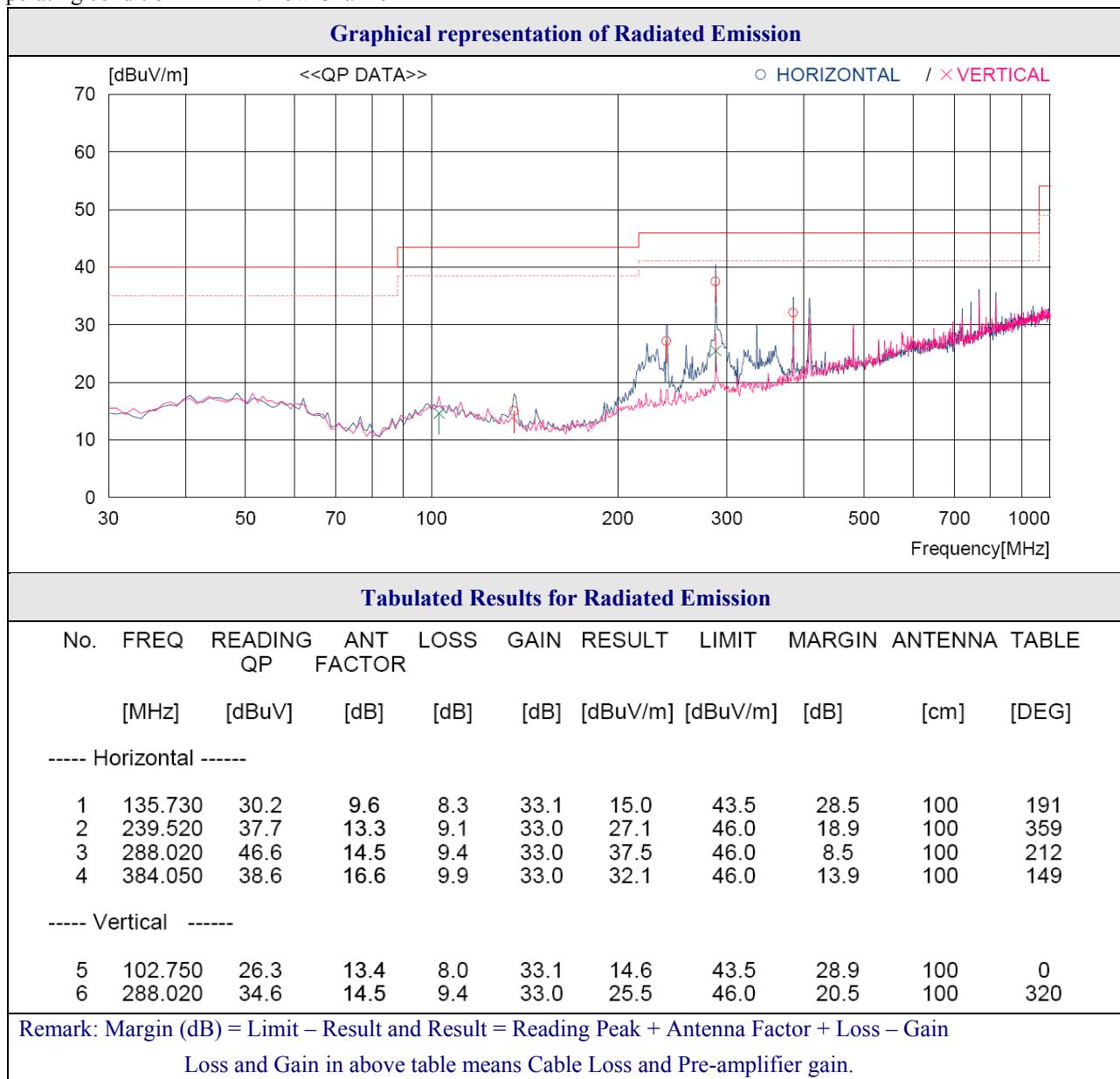
Tested by: Tae-Ho, Kim / Project Engineer

7.5.6 Test data for 802.11g Mode**7.5.6.1 Test data for 30 MHz ~ 1 000 MHz**

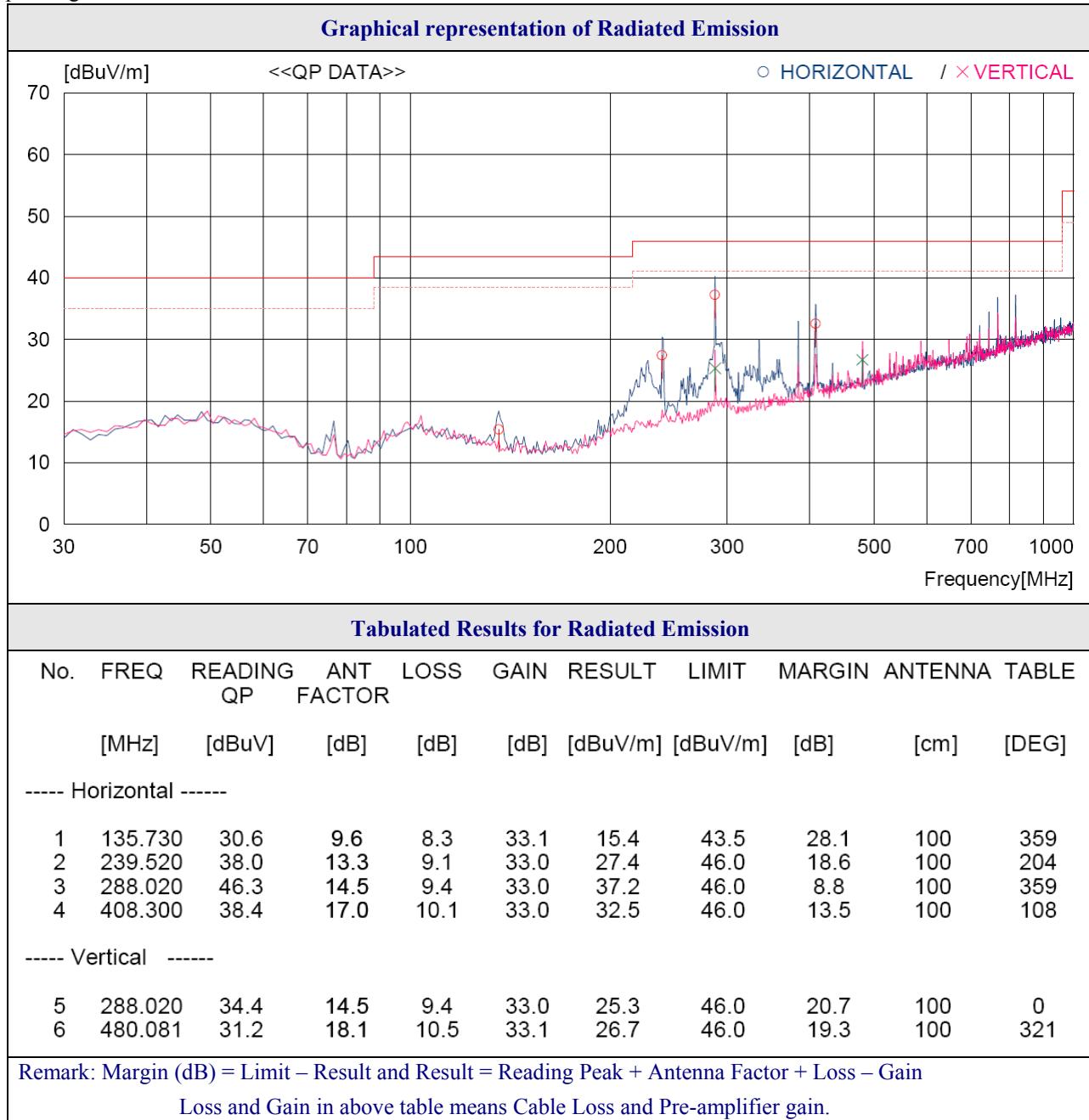
Humidity Level : (43 ~ 44) % R.H. Temperature: (21 ~ 22) °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : Remote Control Date: January 27, 2014
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

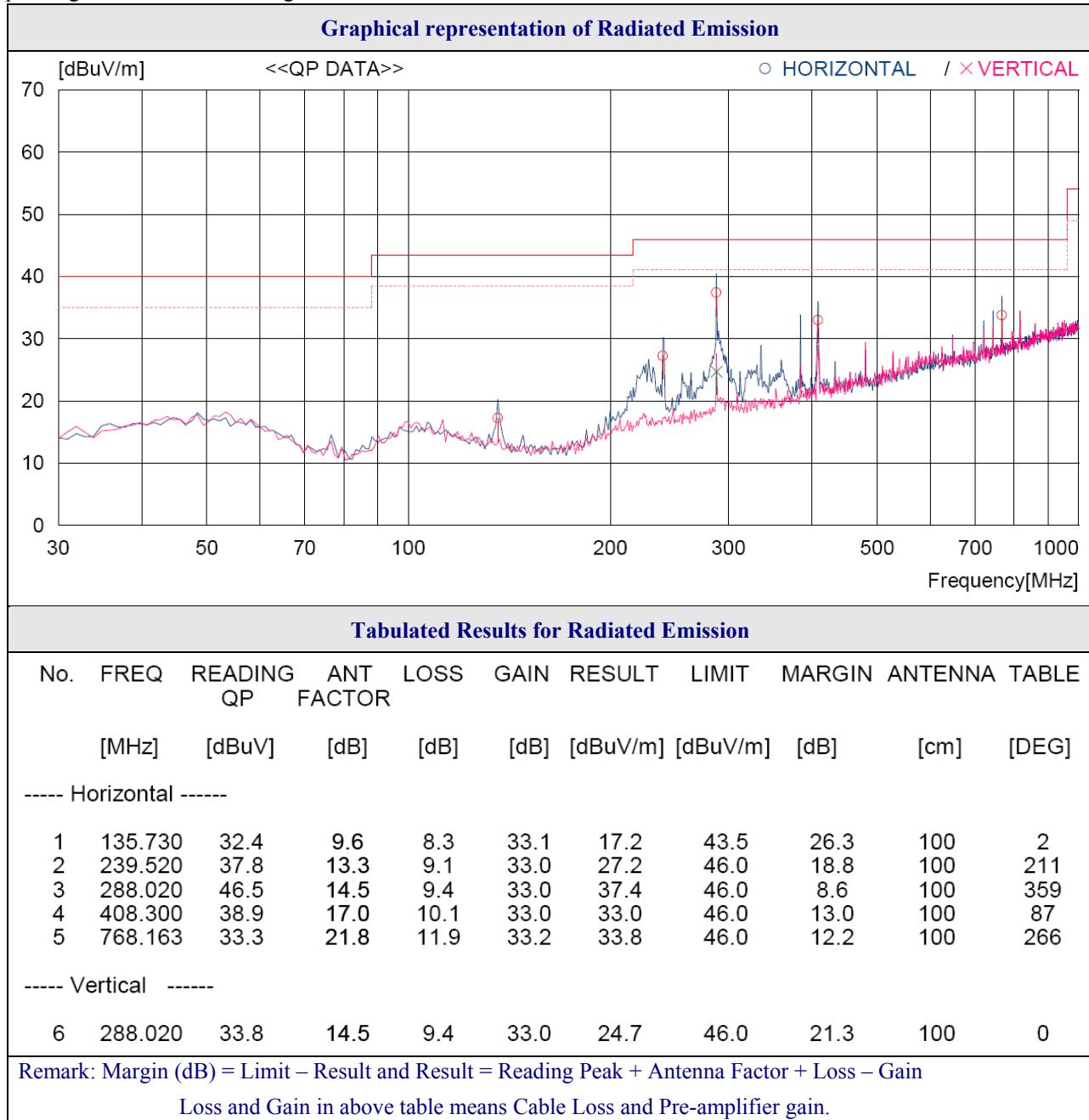
Operating condition : Low Channel



Operating condition : Middle Channel



Operating condition : High Channel



Tested by: Tae-Ho, Kim / Project Engineer

7.5.6.2 Test data for Below 30 MHz

- Test Date : January 27, 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 (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.									

7.5.6.3 Test data for above 1 GHz

- Test Date : January 27, 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 (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: Tae-Ho, Kim / Project Engineer

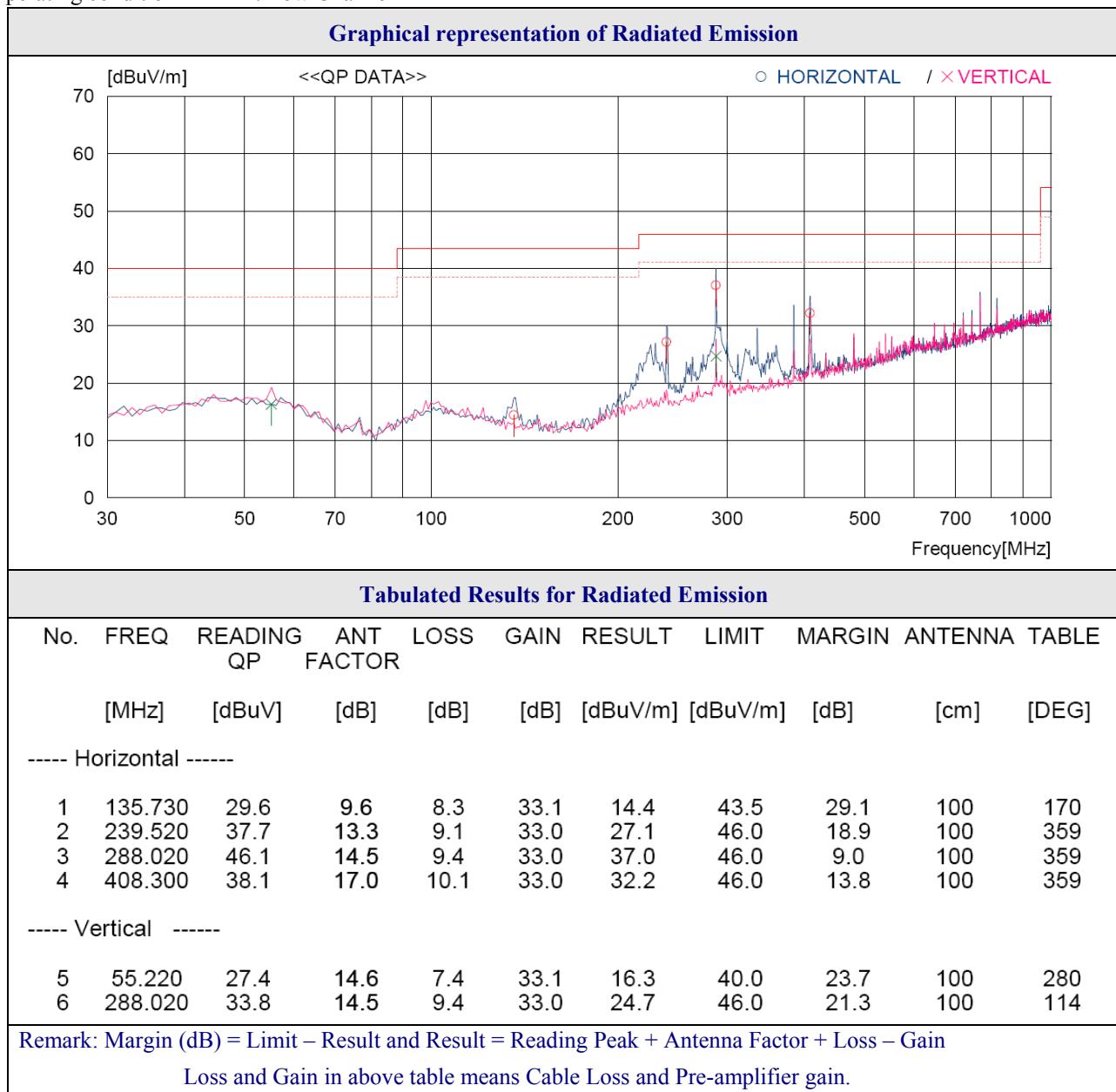
7.5.7 Test data for 802.11n_HT20 Mode

7.5.7.1 Test data for 30 MHz ~ 1 000 MHz

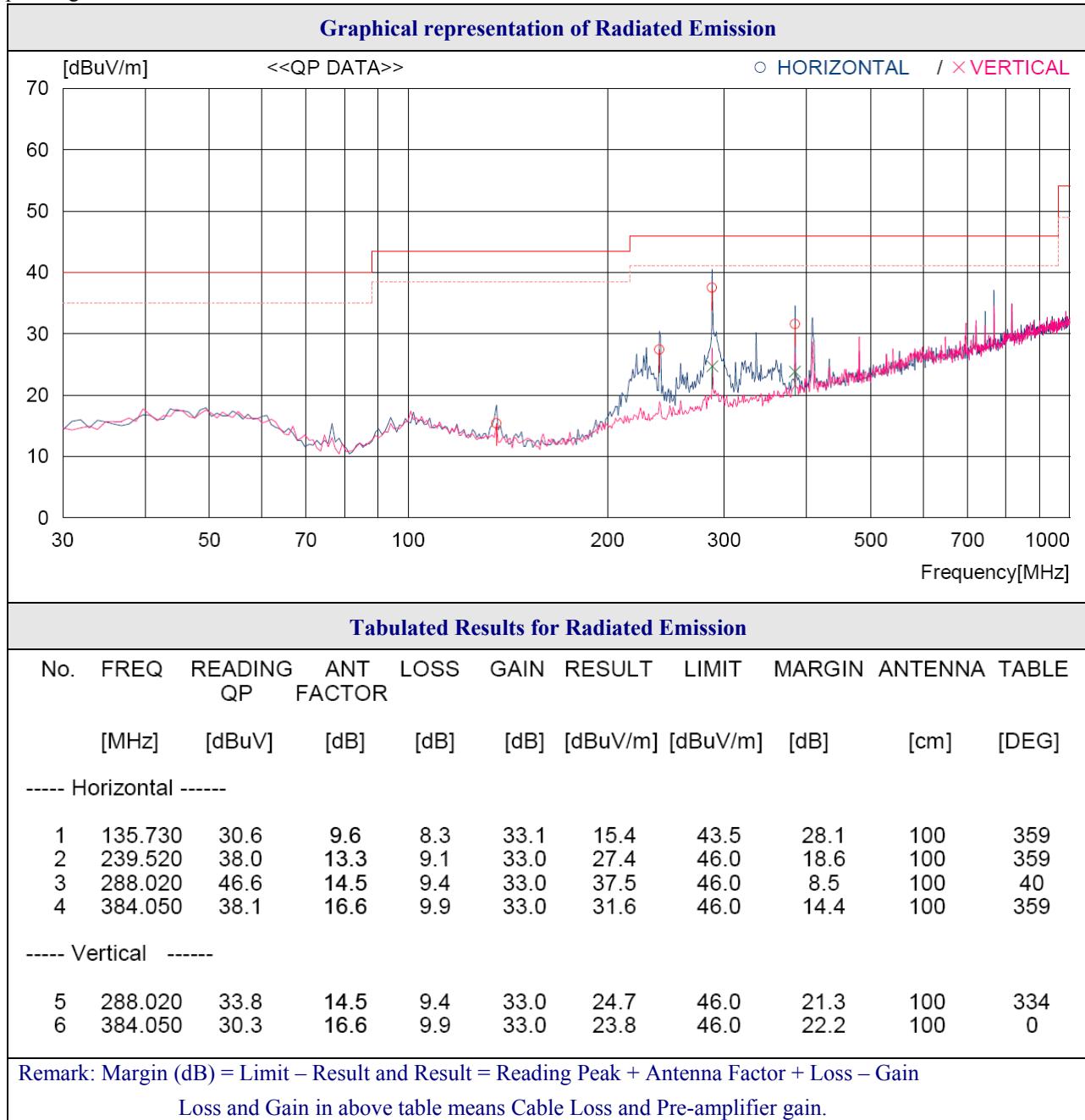
Humidity Level : (43 ~ 44) % R.H. Temperature: (21 ~ 22) °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : Remote Control Date: January 27, 2014
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

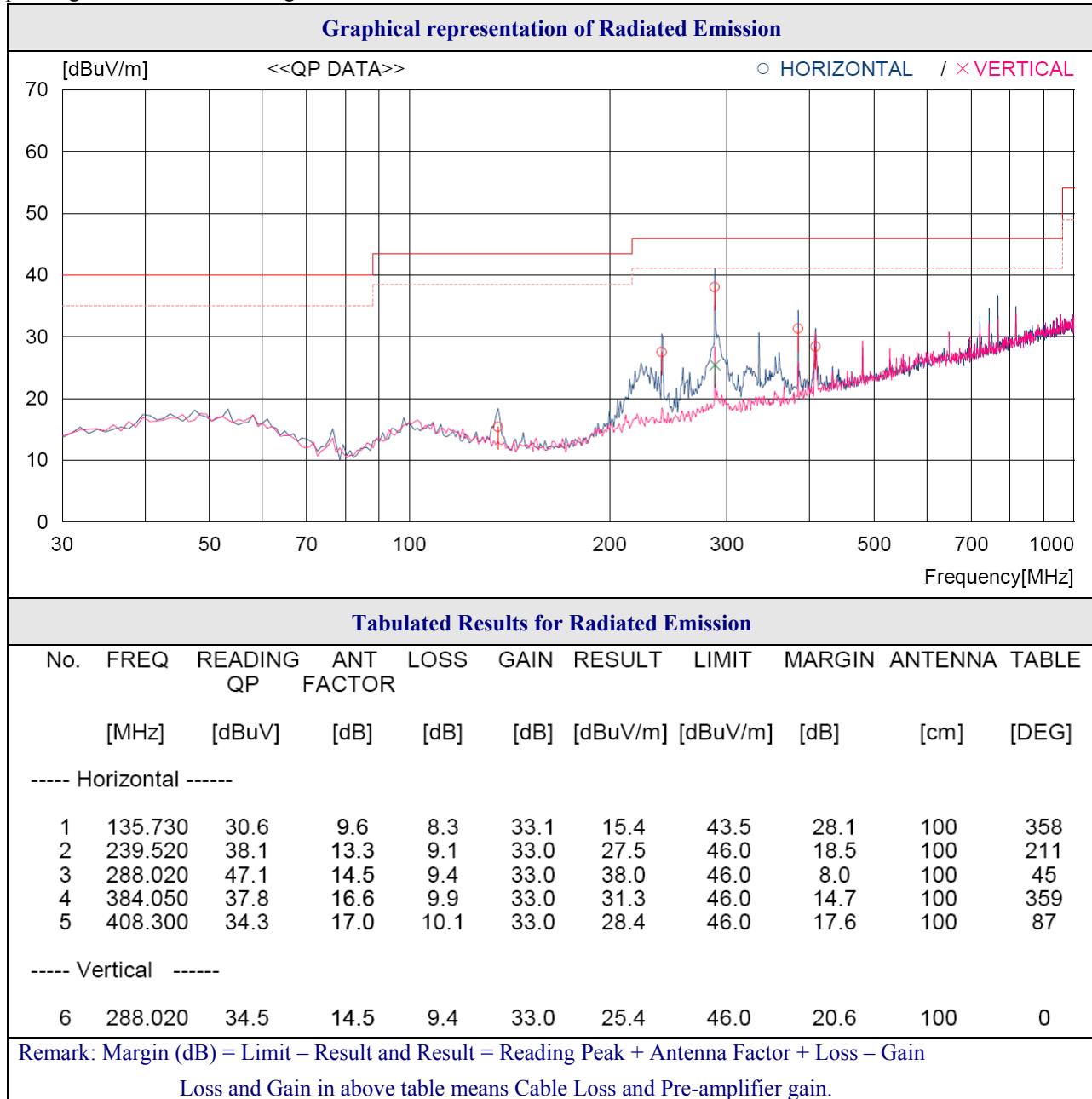
Operating condition : Low Channel



Operating condition : Middle Channel



Operating condition : High Channel



Tested by: Tae-Ho, Kim / Project Engineer

7.5.7.2 Test data for Below 30 MHz

- . Test Date : January 27, 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 (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.									

7.5.7.3 Test data for above 1 GHz

- . Test Date : January 27, 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 (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.									



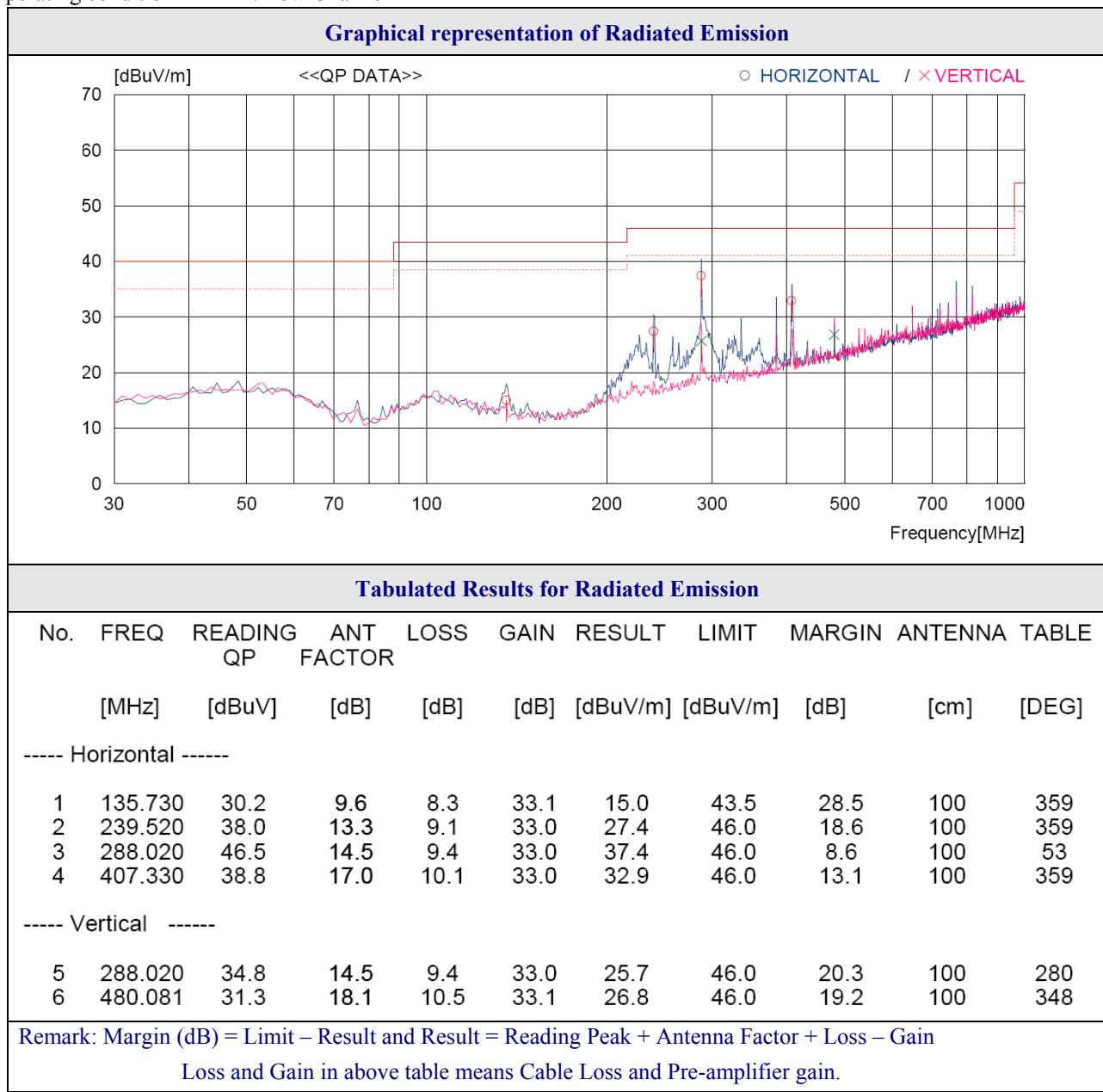
Tested by: Tae-Ho, Kim / Project Engineer

7.5.8 Test data for 802.11n_HT40 Mode**7.5.8.1 Test data for 30 MHz ~ 1 000 MHz**

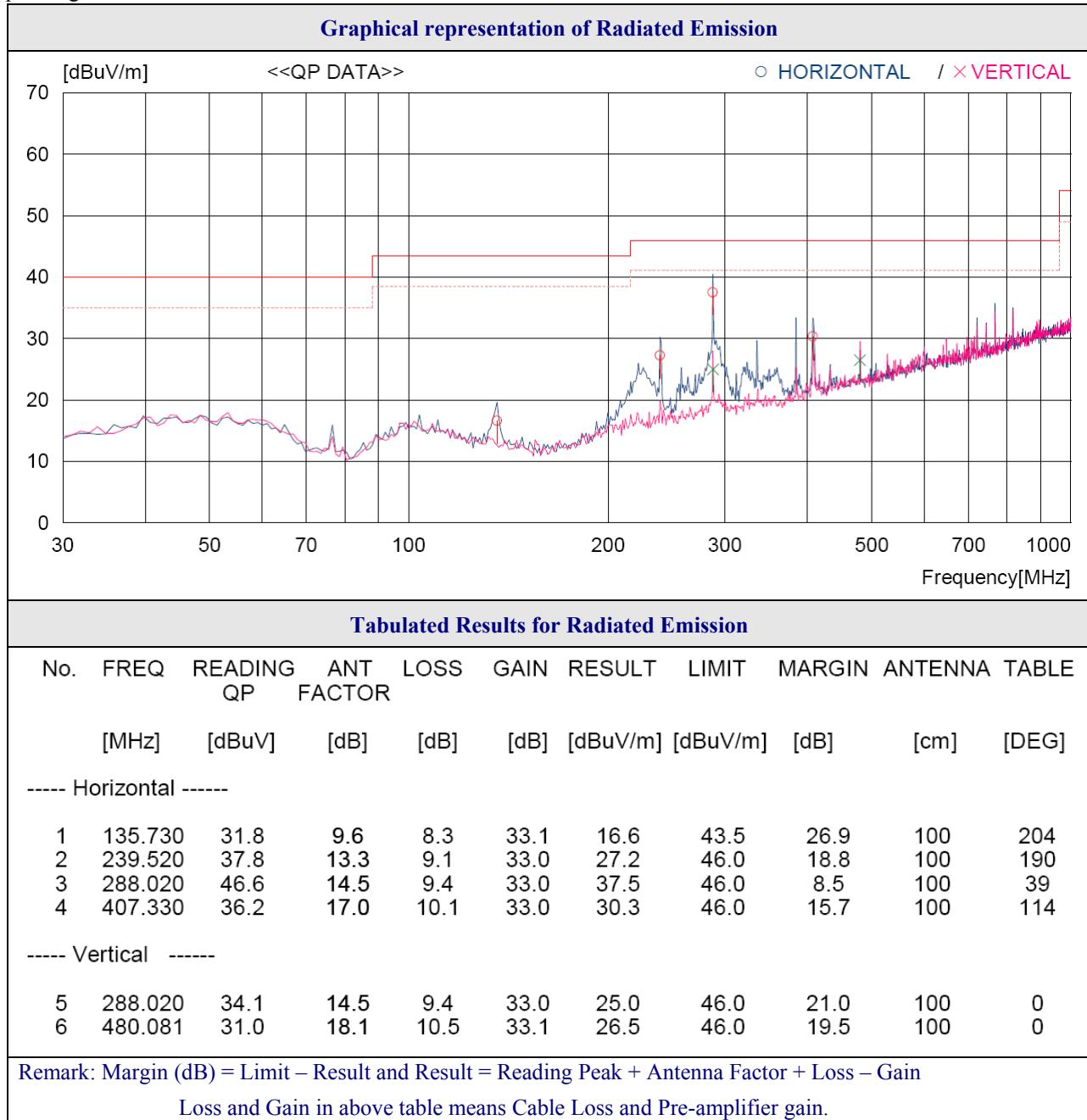
Humidity Level : (43 ~ 44) % R.H. Temperature: (21 ~ 22) °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : Remote Control Date: January 27, 2014
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

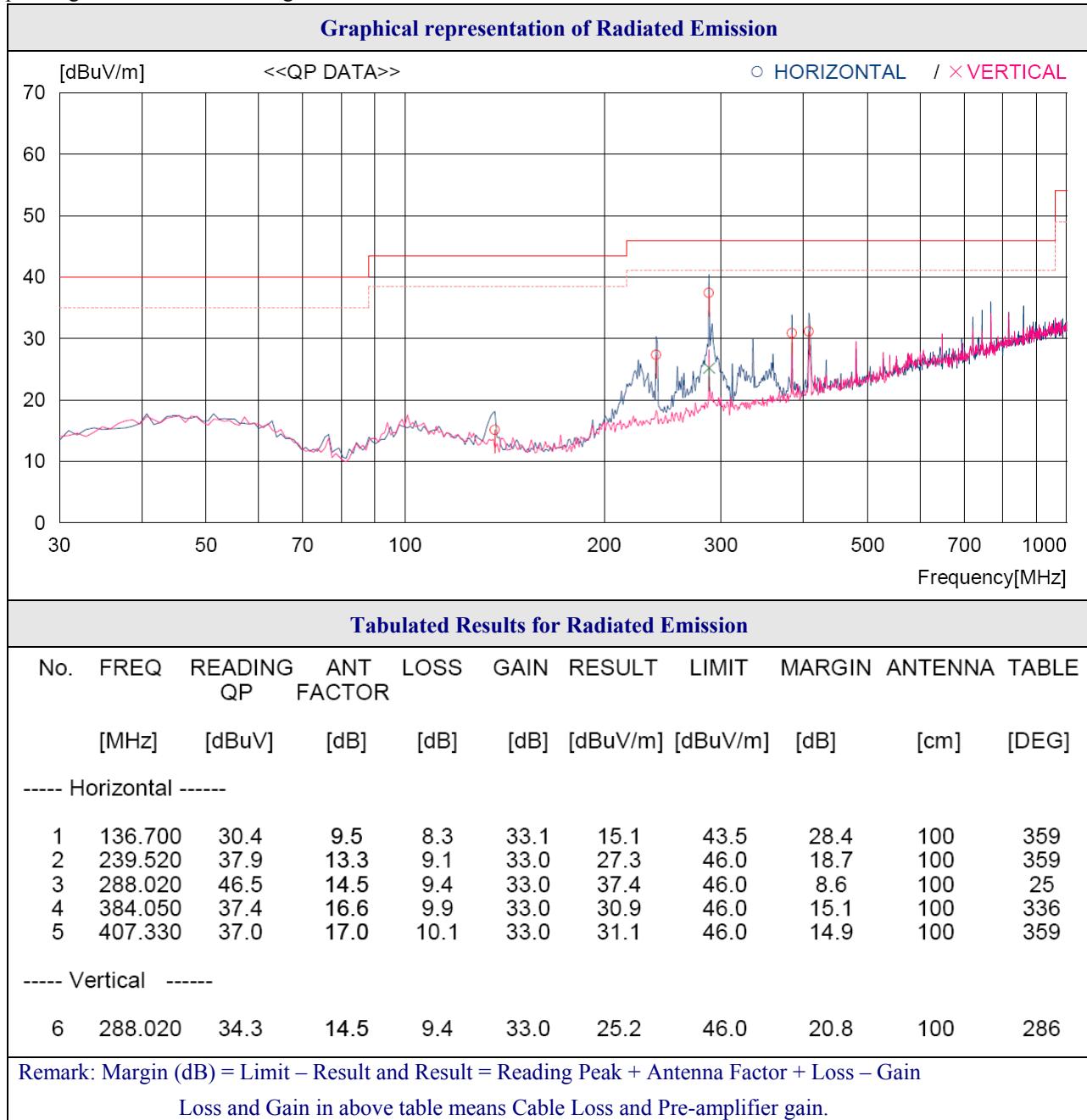
Operating condition : Low Channel



Operating condition : Middle Channel



Operating condition : High Channel



Tested by: Tae-Ho, Kim / Project Engineer

7.5.8.2 Test data for Below 30 MHz

- Test Date : January 27, 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 (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.									

7.5.8.3 Test data for above 1 GHz

- Test Date : January 27, 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 (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: Tae-Ho, Kim / Project Engineer

8. Test Data for Zigbee

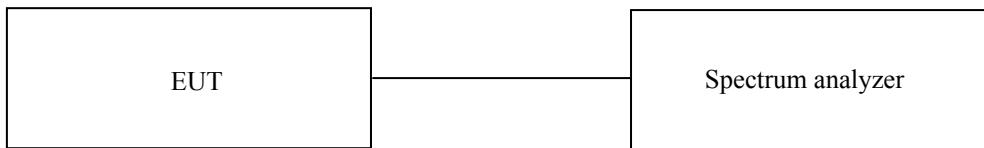
8.1 MIMIMUM 6 dB BANDWIDTH

8.1.1 Operating environment

Temperature : 21 °C
Relative humidity : 42 % R.H.

8.1.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.



8.1.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	R/S	Spectrum Analyzer	101372	May 20, 2013

All test equipment used is calibrated on a regular basis.

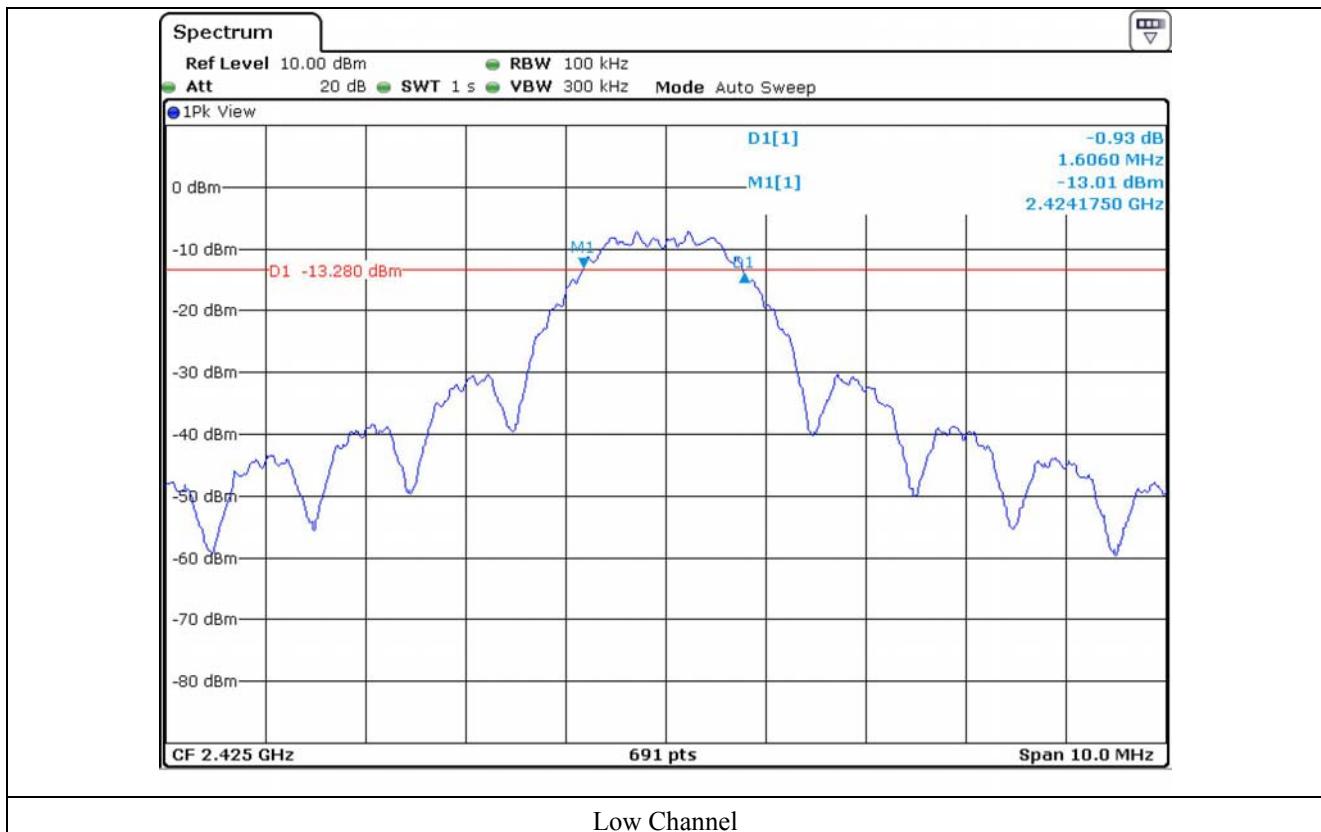
8.1.4 Test data for Antenna 0

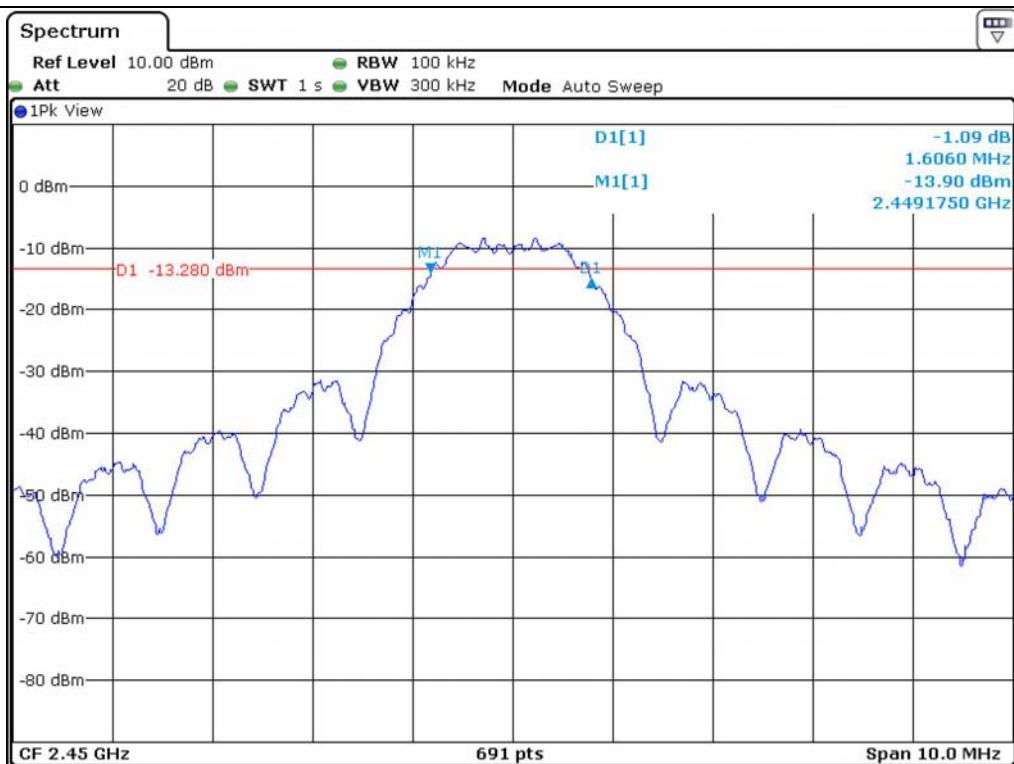
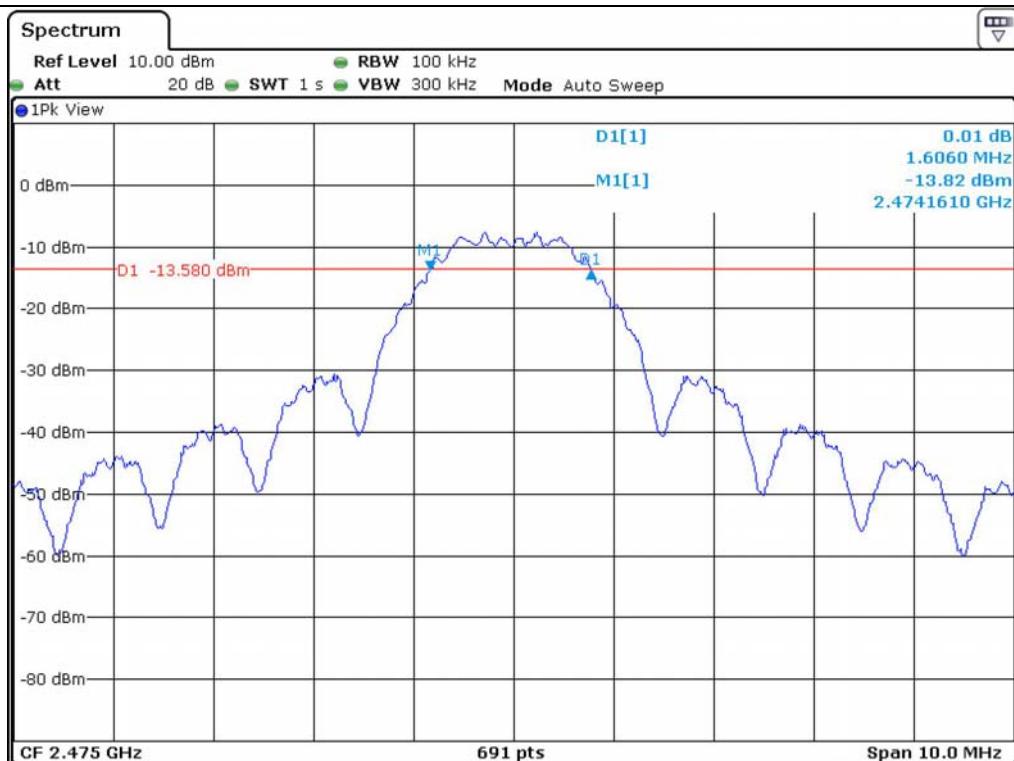
- Test Date : January 24, 2014
- Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)	LIMIT (MHz)	MARGIN (MHz)
Low	2 425	1.60	0.5	1.10
Middle	2 450	1.60	0.5	1.10
High	2 475	1.60	0.5	1.10

Remark. Margin = Measured Value - Limit

Tested by: Tae-Ho, Kim / Project Engineer



**Middle Channel****High Channel**

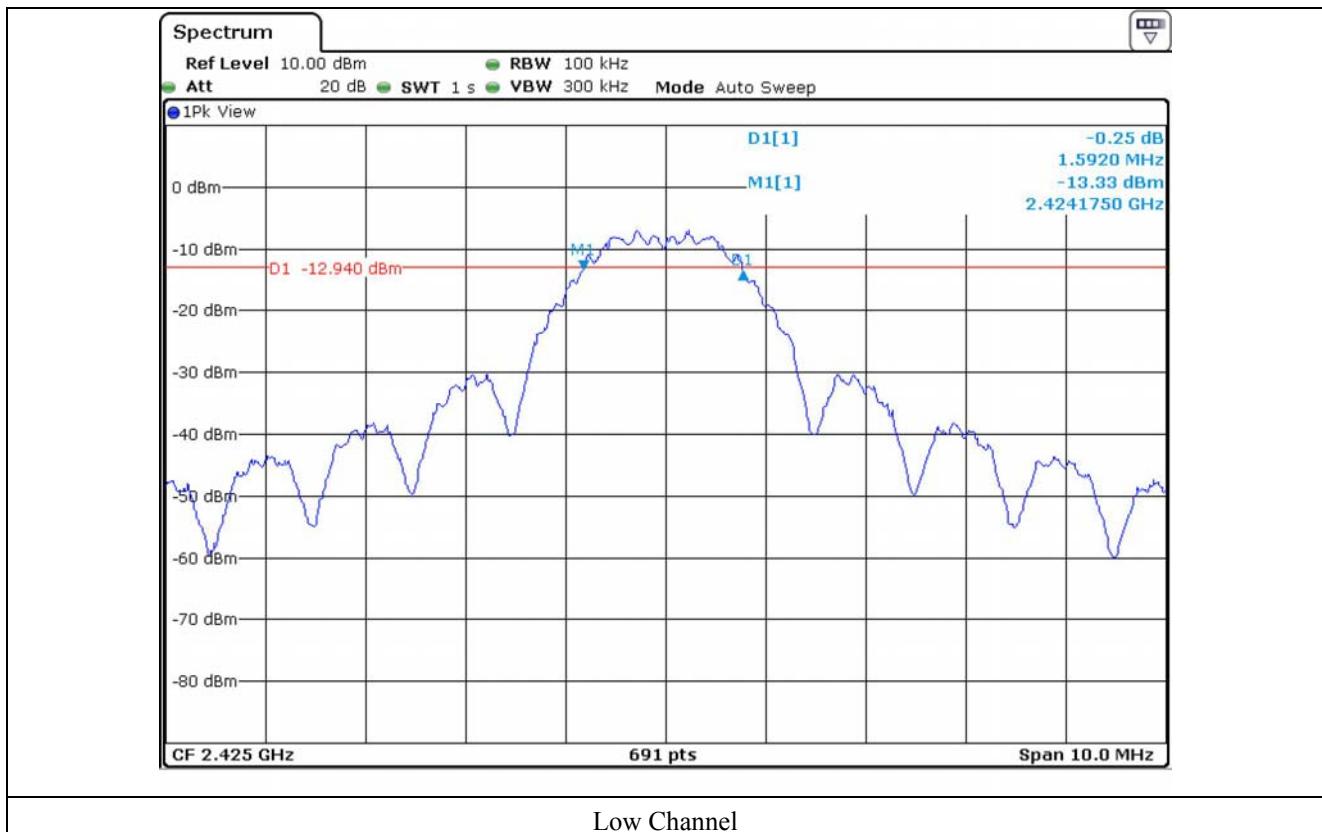
8.1.5 Test data for Antenna 1

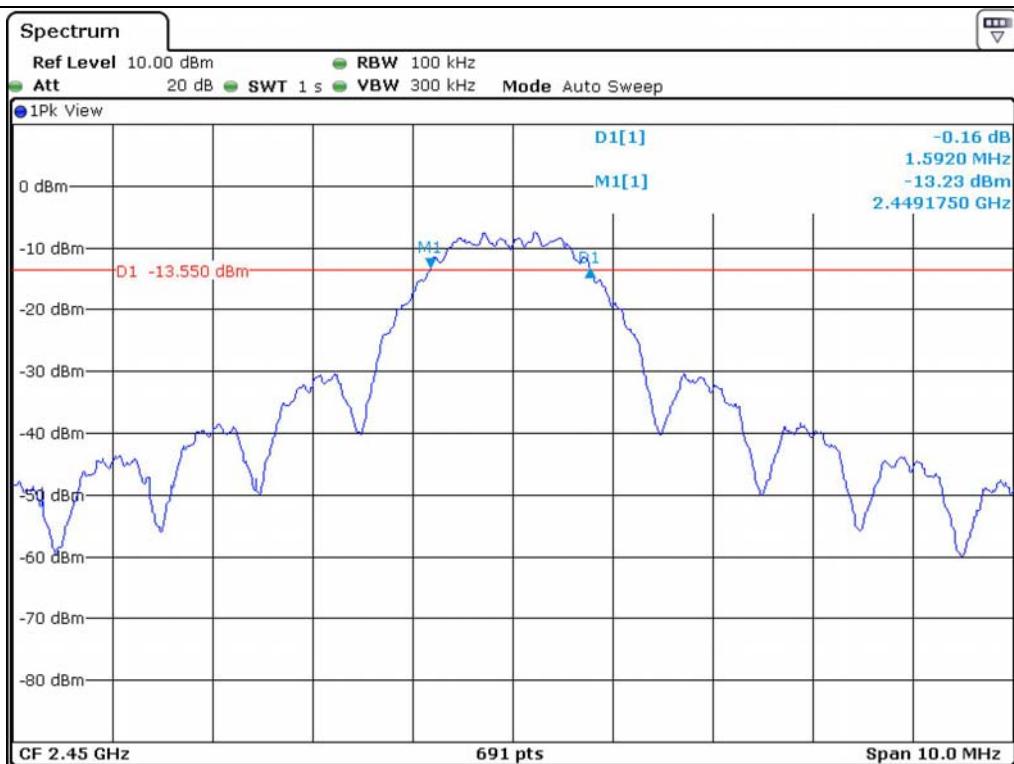
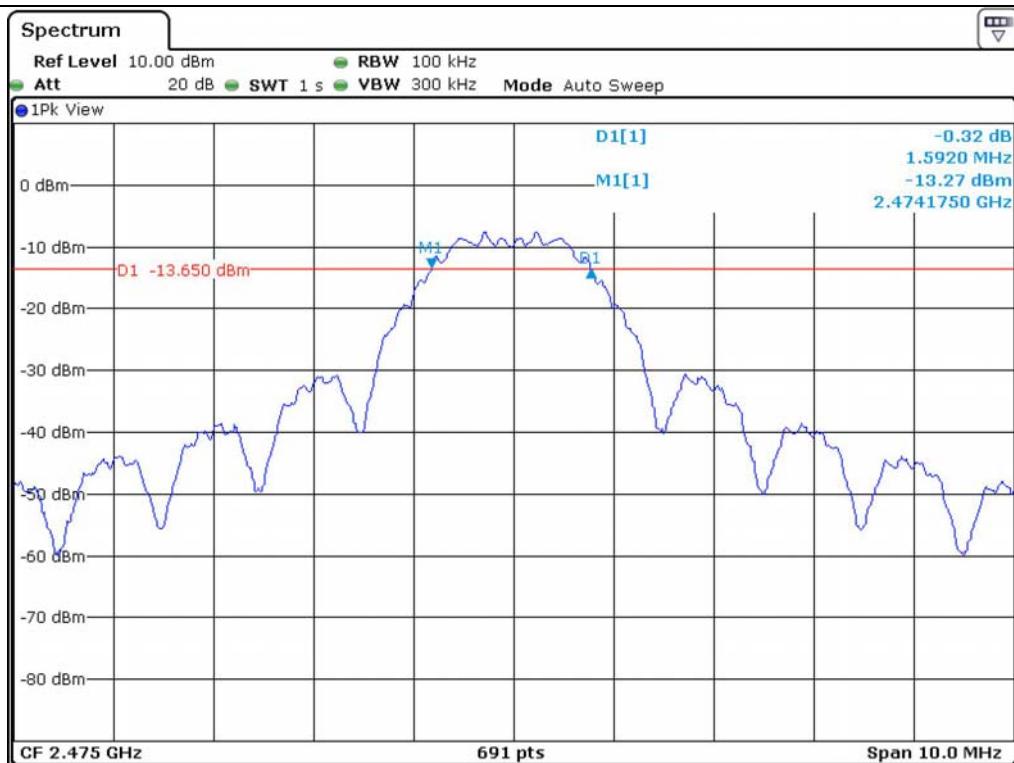
- Test Date : January 24, 2014
- Test Result : Pass

CHANNEL	FREQUENCY(MHz)	MEASURED VALUE (MHz)	LIMIT (MHz)	MARGIN (MHz)
Low	2 425	1.59	0.5	1.09
Middle	2 450	1.59	0.5	1.09
High	2 475	1.59	0.5	1.09

Remark. Margin = Measured Value - Limit

Tested by: Tae-Ho, Kim / Project Engineer



**Middle Channel****High Channel**

8.2 MAXIMUM PEAK OUTPUT POWER

8.2.1 Operating environment

Temperature : 21 °C

Relative humidity : 42 % R.H.

8.2.2 Test set-up

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT.

The EUT was operating in transmit mode at the appropriate center frequency.



8.2.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	R/S	Spectrum Analyzer	101372	May 30, 2013

All test equipment used is calibrated on a regular basis.

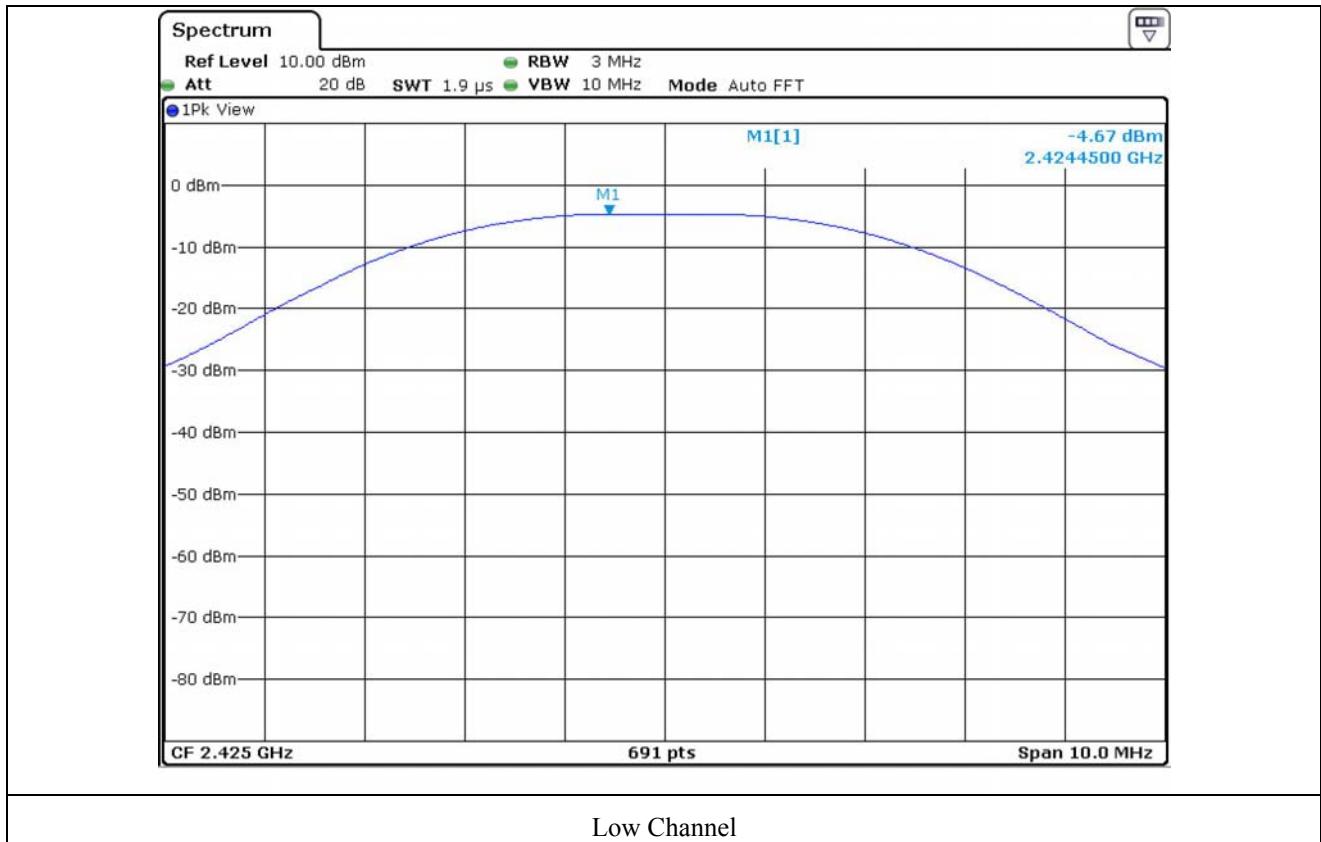
8.2.4 Test data for Antenna 0

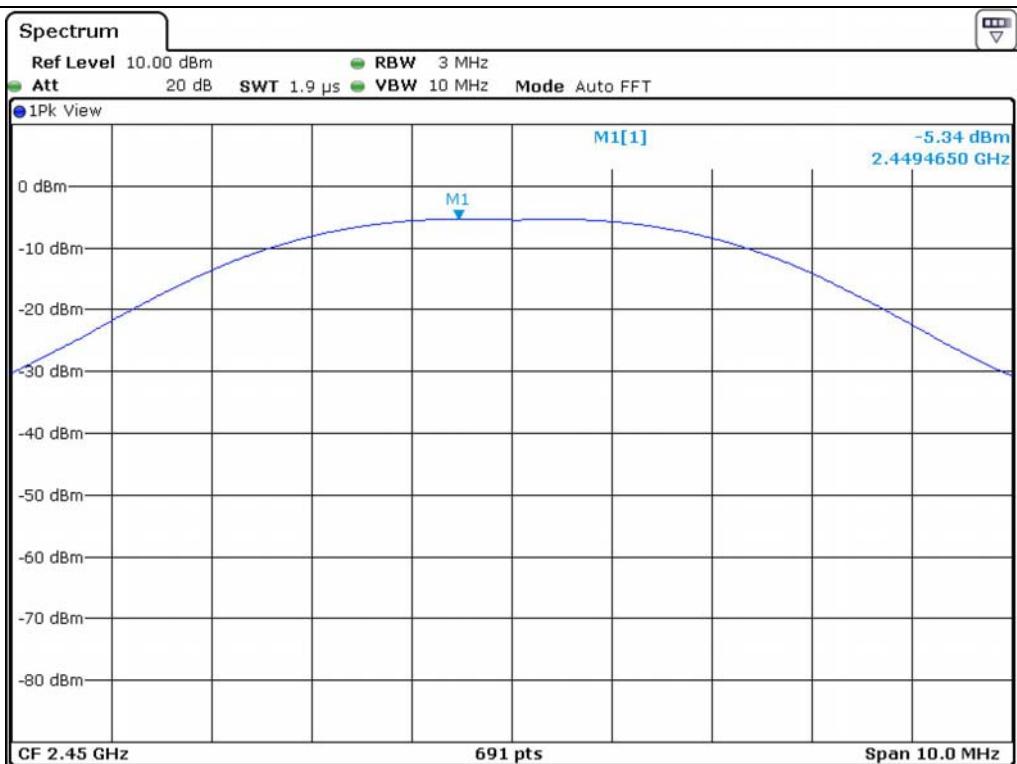
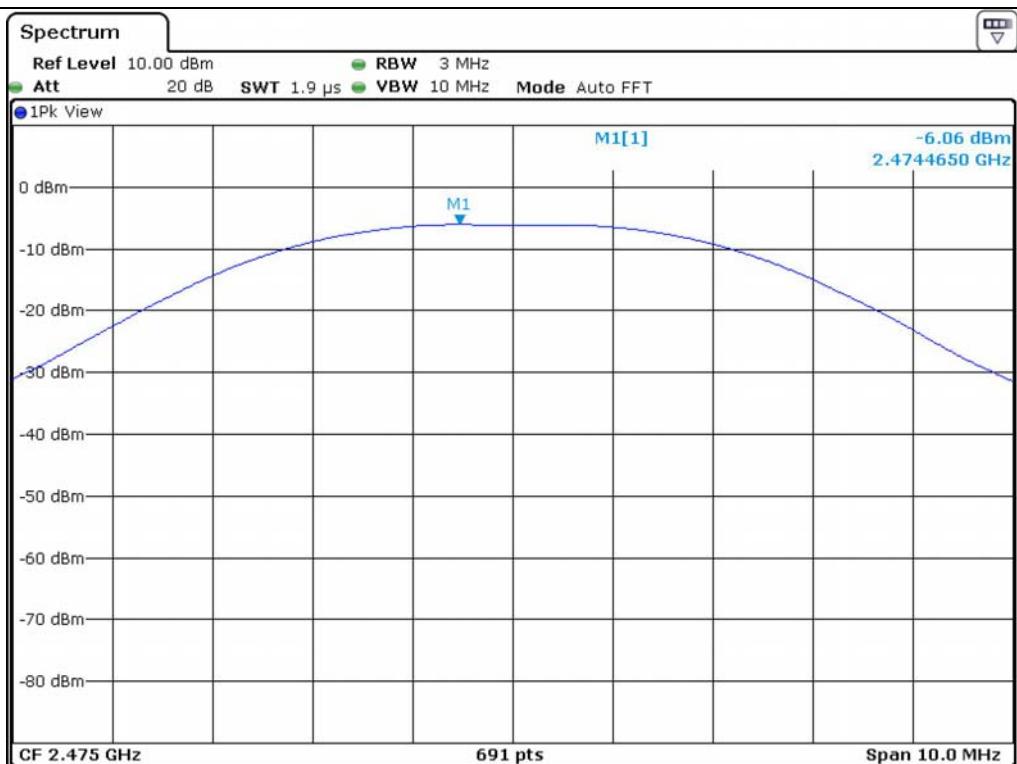
- Test Date : January 24, 2014
- Test Result : Pass

CHANNEL	FREQUENCY (MHz)	Emission Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 425	1.60	-4.67	30.00	34.67
MIDDLE	2 450	1.60	-5.34	30.00	35.34
HIGH	2 475	1.60	-6.06	30.00	36.06

Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Tae-Ho, Kim / Project Engineer



**Middle Channel****High Channel**

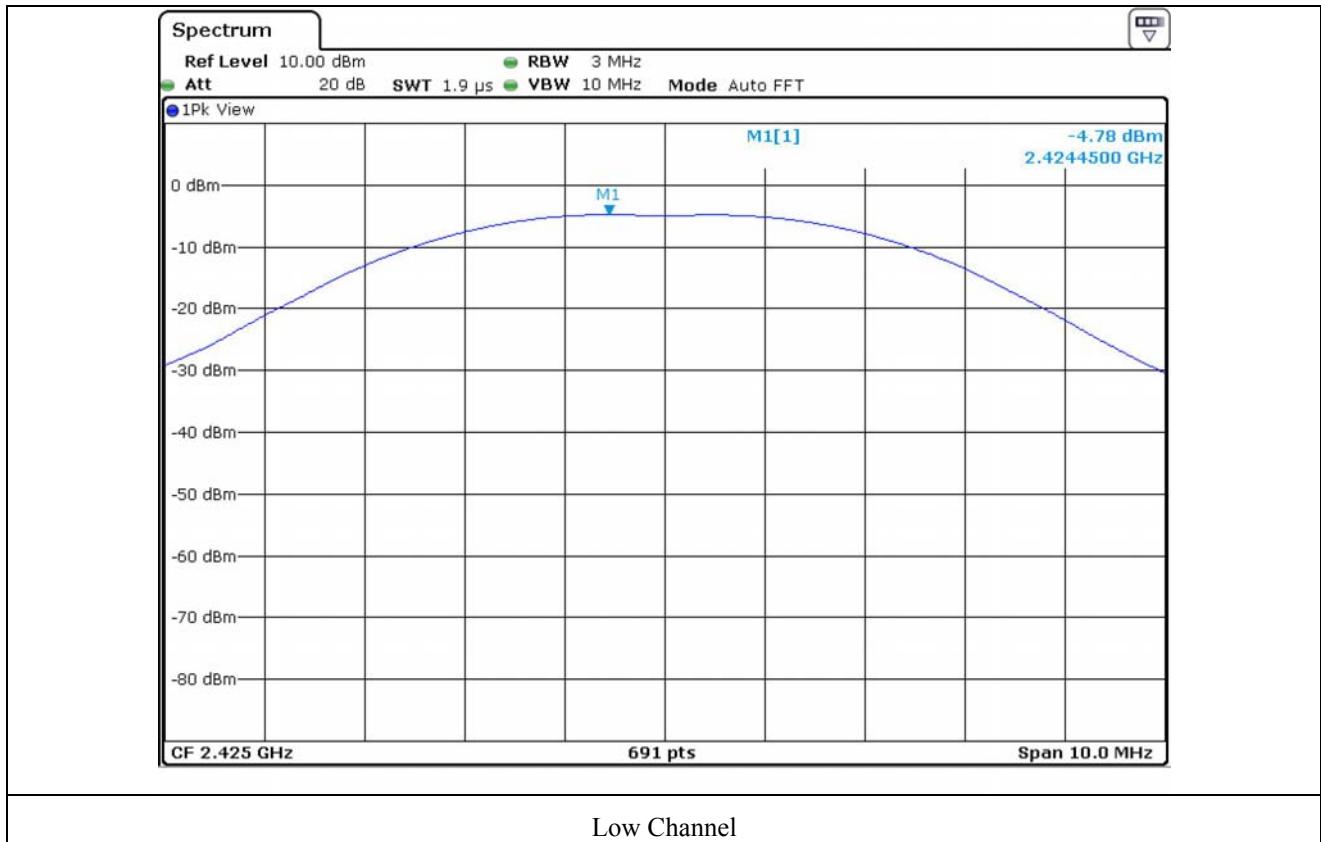
8.2.5 Test data for Antenna 1

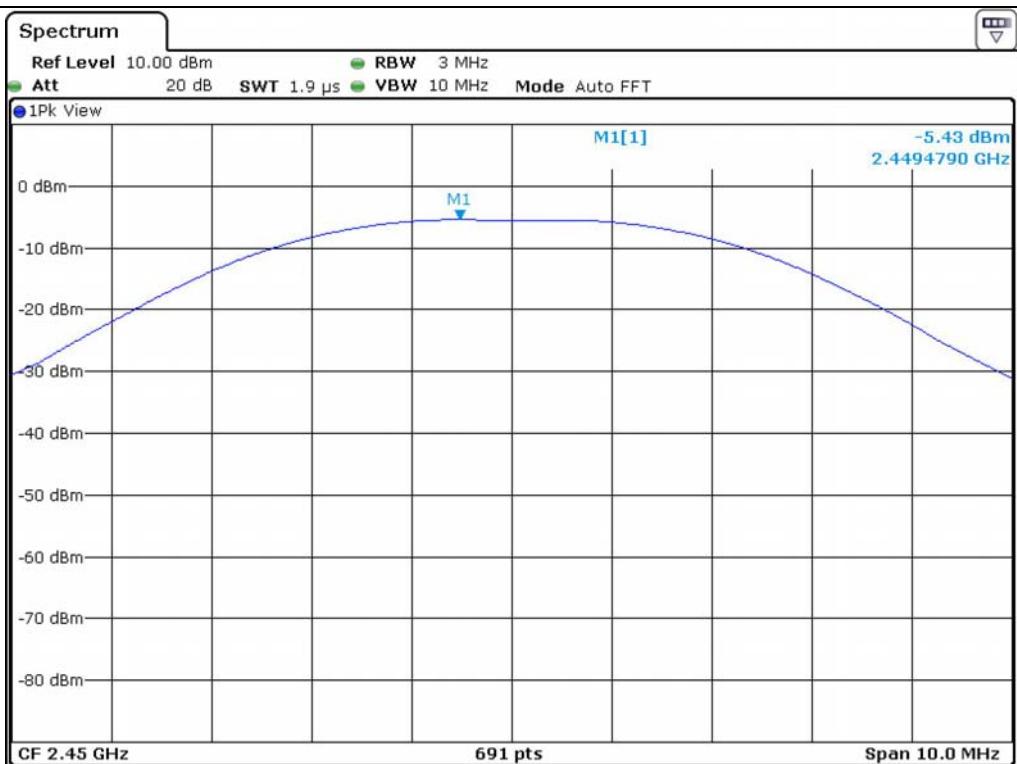
- Test Date : January 24, 2014
- Test Result : Pass

CHANNEL	FREQUENCY (MHz)	Emission Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
LOW	2 425	1.59	-4.78	30.00	34.78
MIDDLE	2 450	1.59	-5.43	30.00	35.43
HIGH	2 475	1.59	-6.16	30.00	36.16

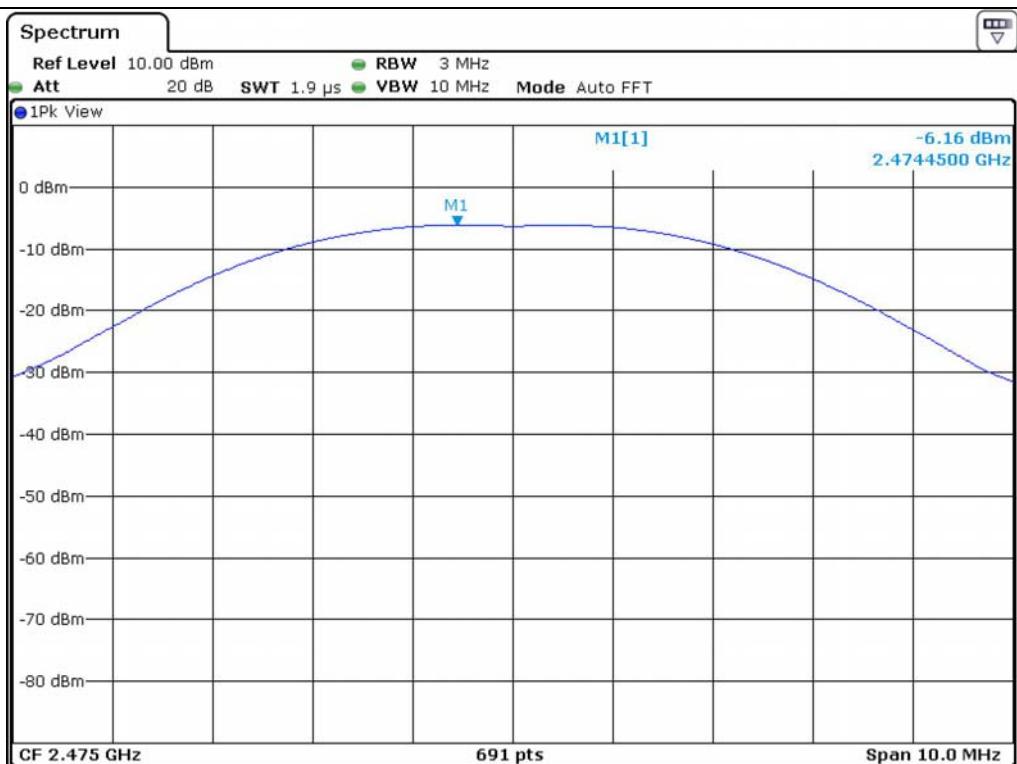
Remark. Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Tested by: Tae-Ho, Kim / Project Engineer





Middle Channel



High Channel

8.3 100 kHz BANDWIDTH OUTSIDE THE FREQUENCY BAND

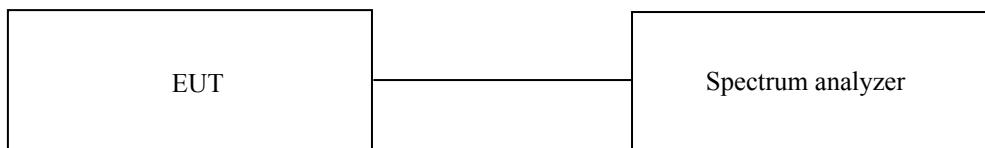
8.3.1 Operating environment

Temperature : 28 °C

Relative humidity : 45 % R.H.

8.3.2 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.



8.3.3 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 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.

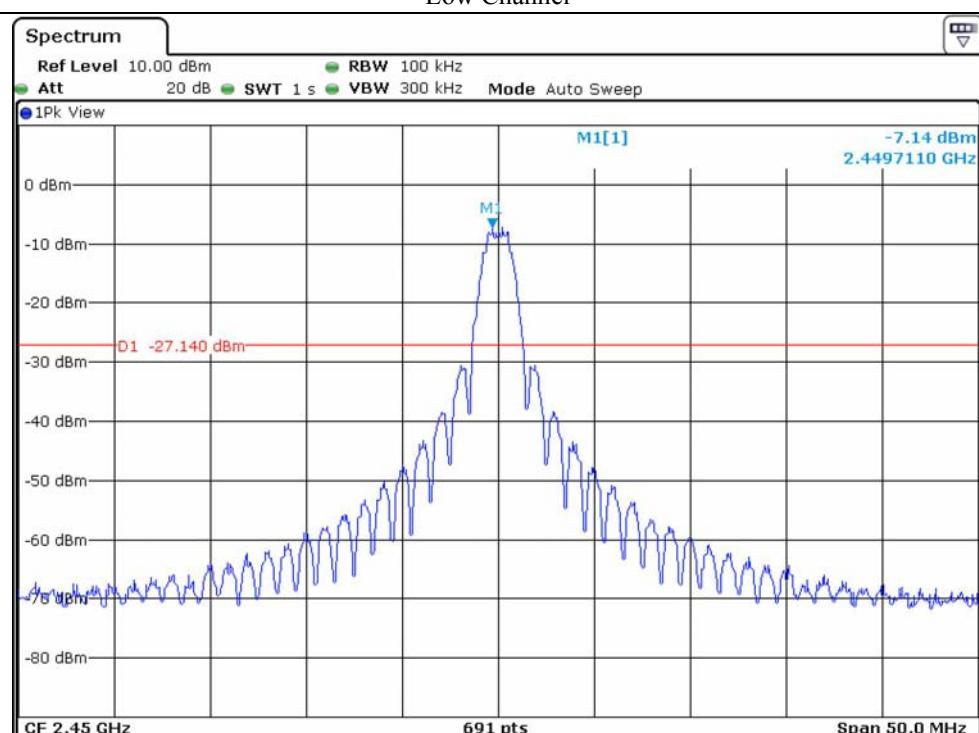
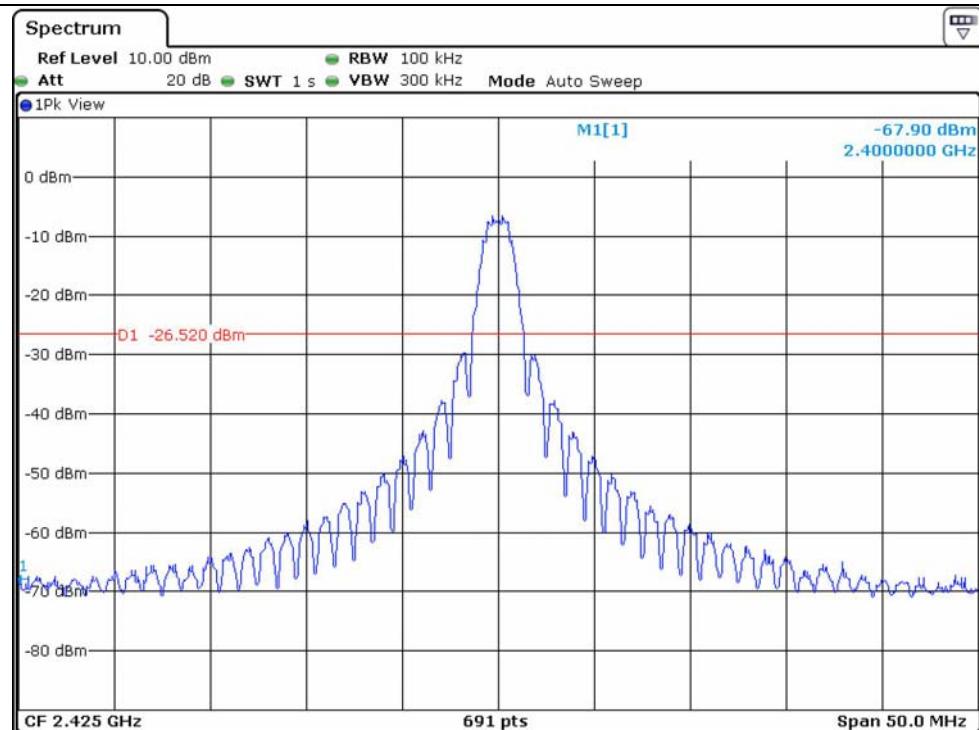
8.3.4 Test equipment used

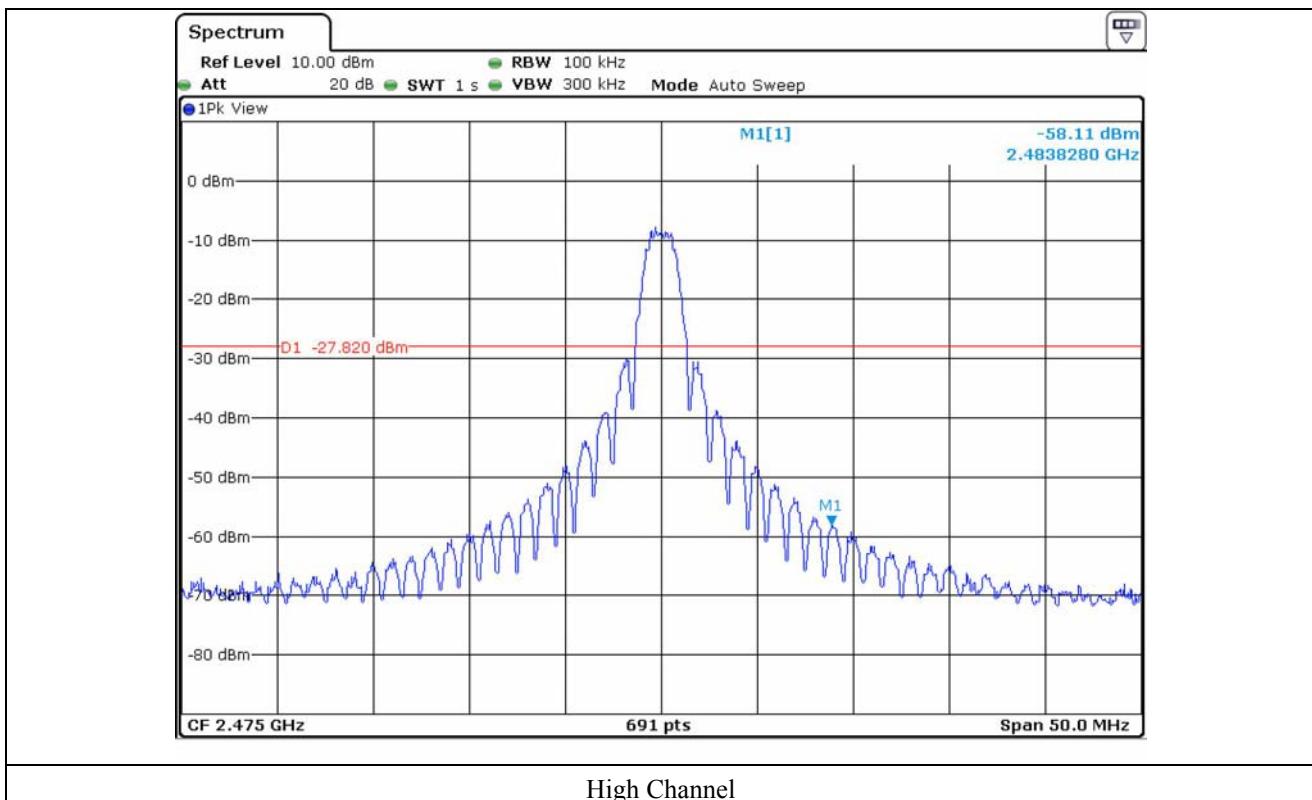
Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ - 8564E	HP	Spectrum Analyzer	3650A00756	May 03, 2013(1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	May 27, 2013(1Y)
■ - 310N	Sonoma Instrument	AMPLIFIER	312544	May 21, 2013(1Y)
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101372	May 20, 2013(1Y)
■ - SCU-18	Rohde & Schwarz	PRE-AMPLIFIER	10041	Jan. 25, 2013(1Y)
■ - MA220	HD	Turn Table	N/A	N/A
■ - HD240	HD	Antenna Mast	N/A	N/A
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	VULB9163-255	Apr. 24, 2012(2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Jun. 17, 2013 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jun. 17, 2013 (2Y)
■ - 83051A	Agilent	Microwave System Preamplifier	3950M00201	May 22, 2013(1Y)

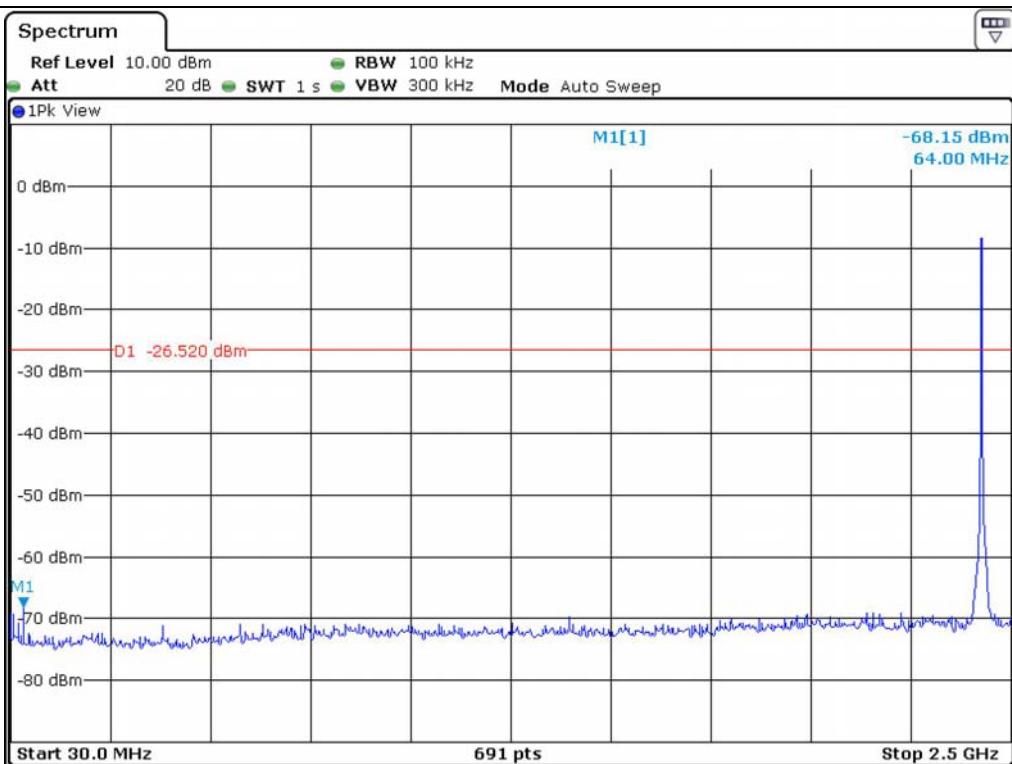
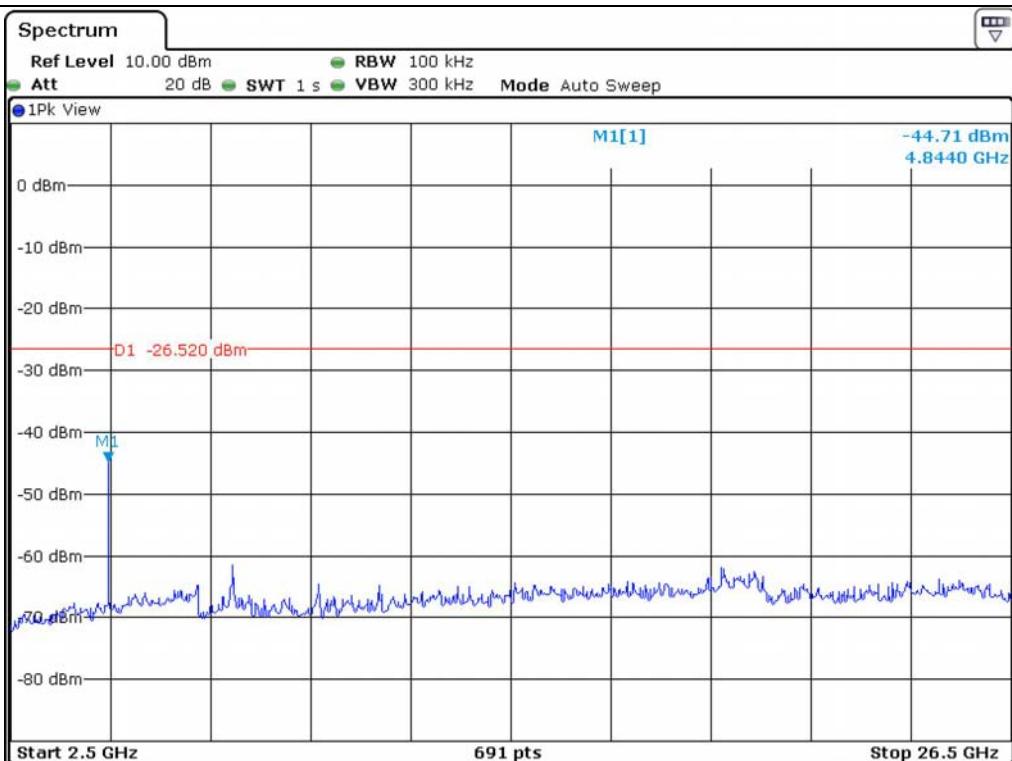
All test equipment used is calibrated on a regular basis.

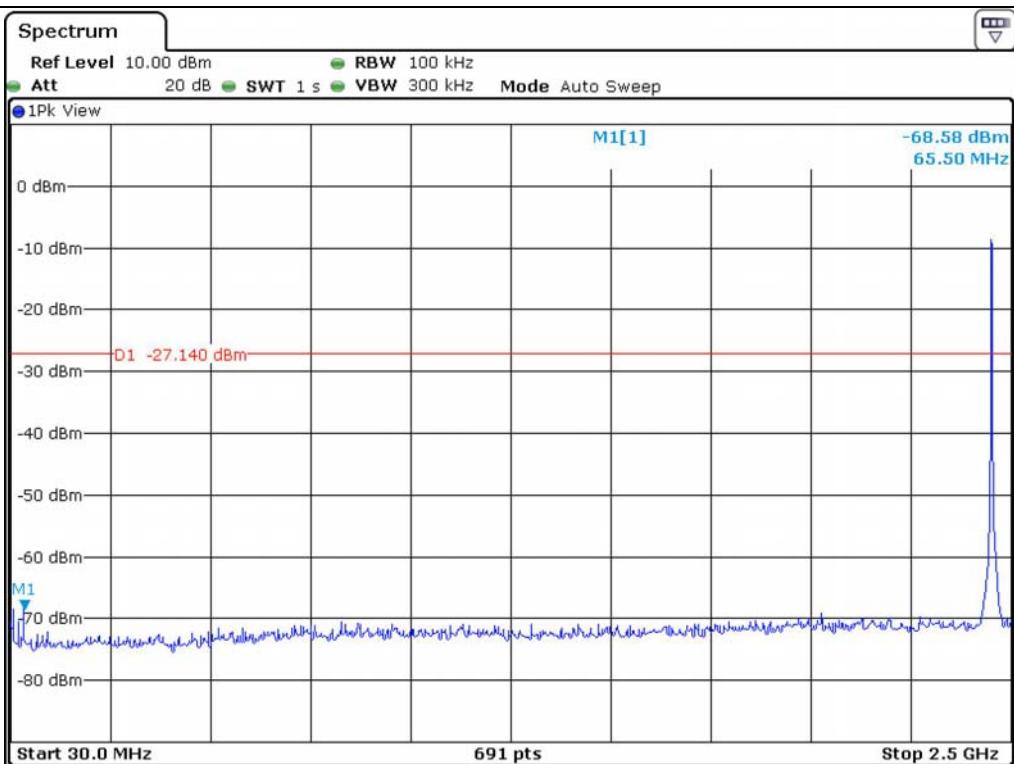
8.3.5 Test data for conducted emission

8.3.5.1 Test data for Antenna 0

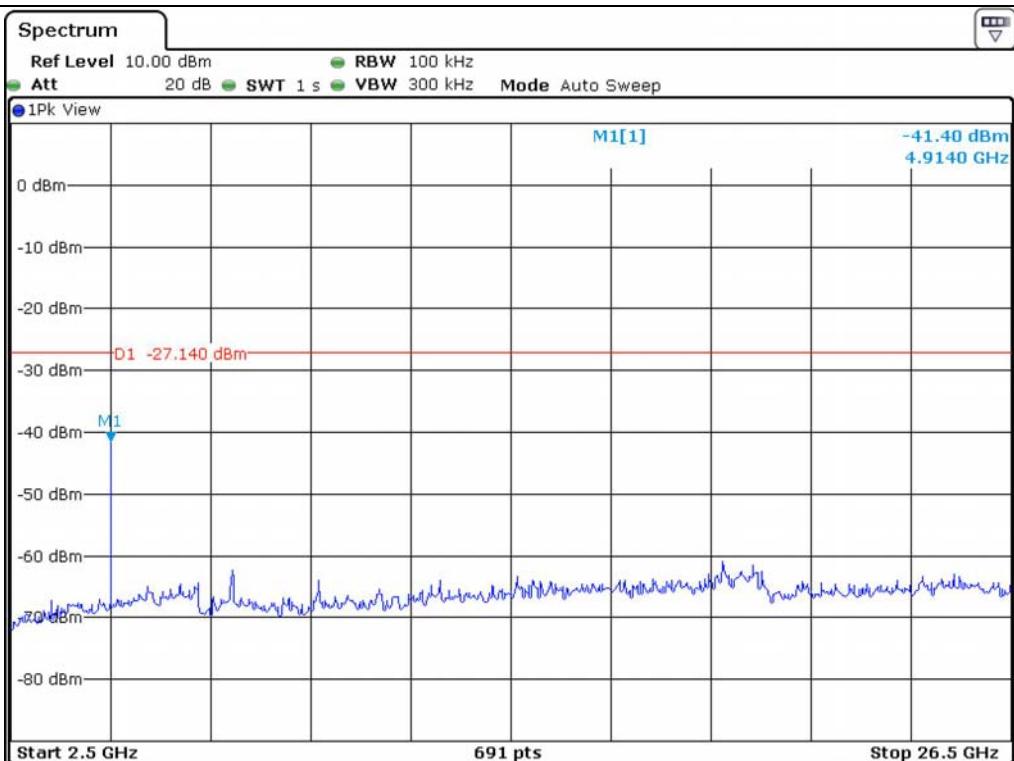




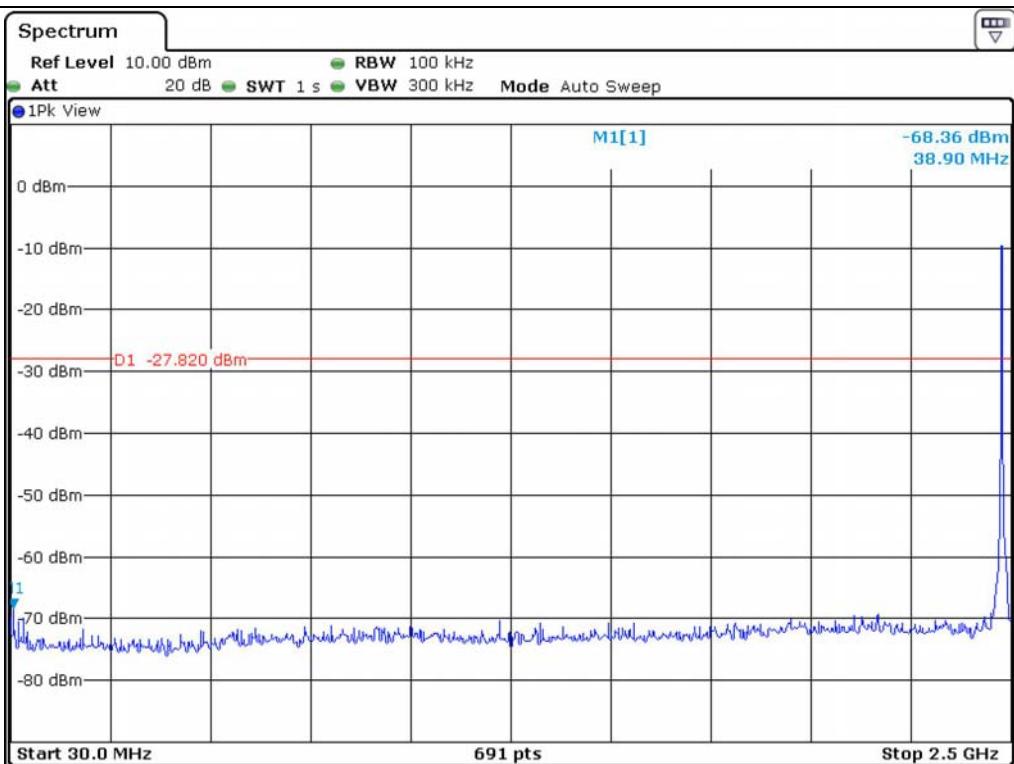
**Low Channel****Low Channel**



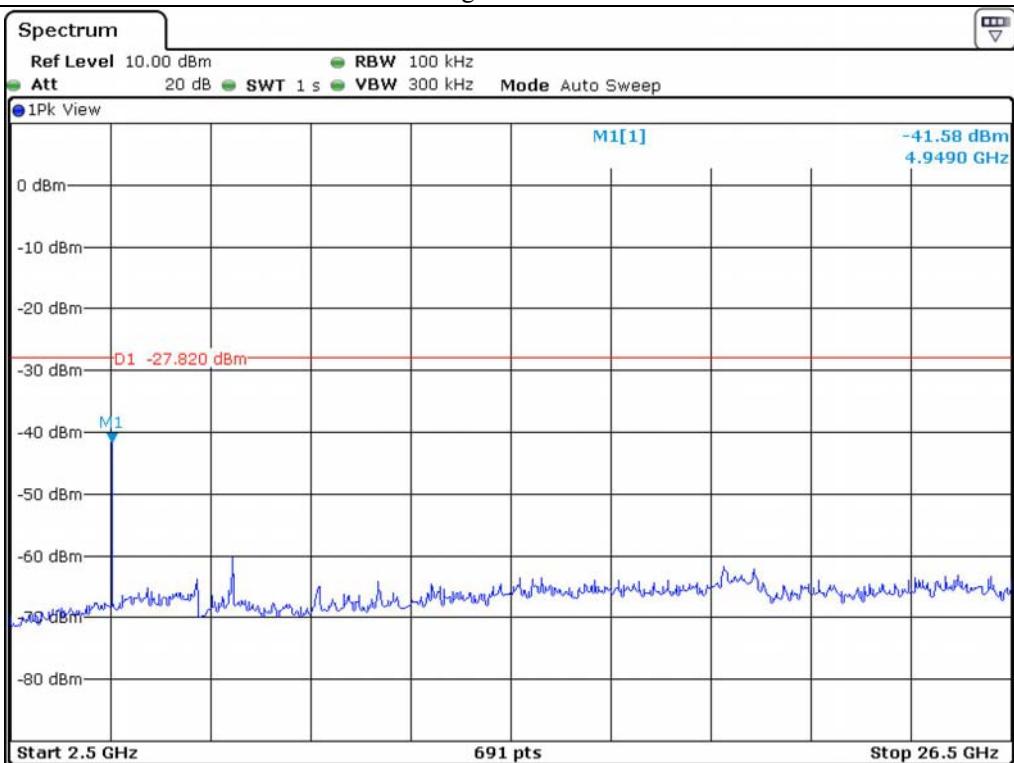
Middle Channel



Middle Channel

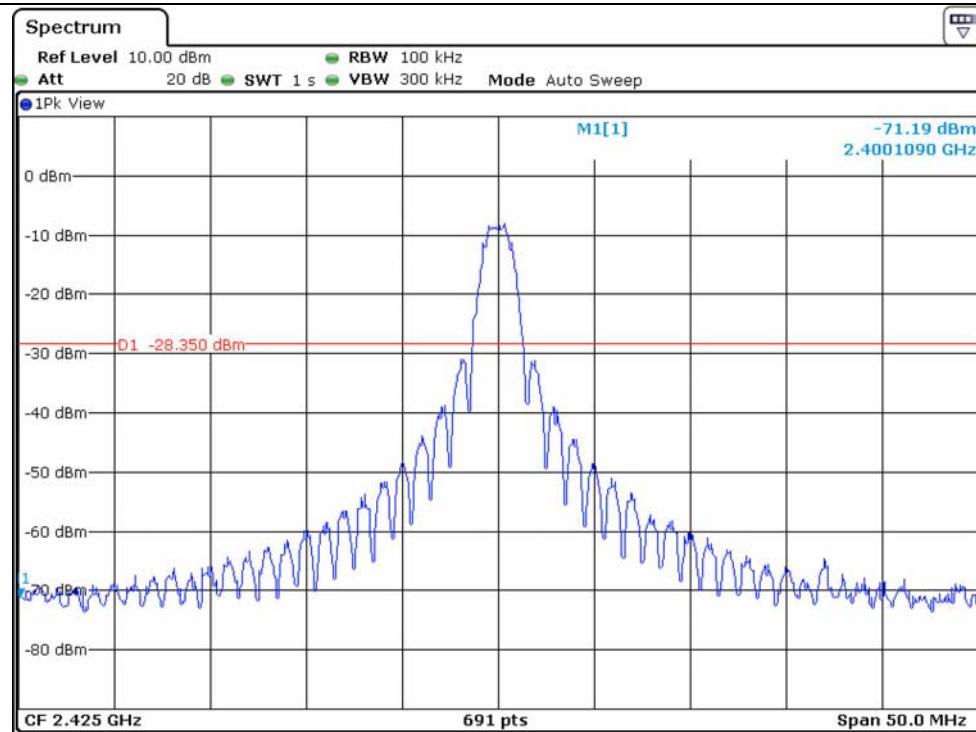


High Channel

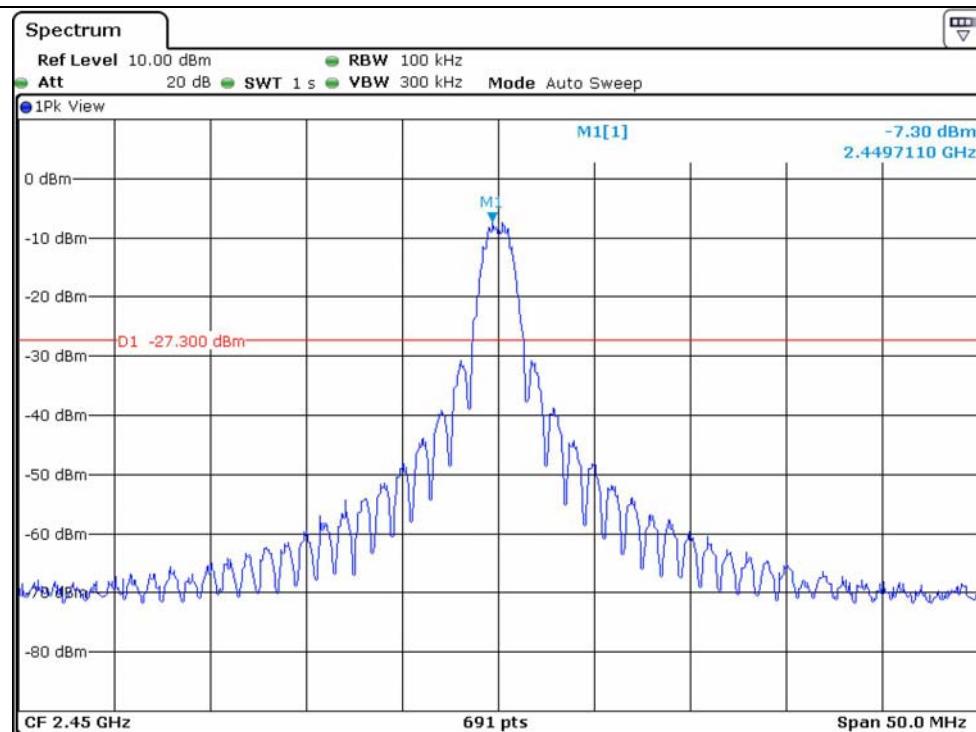


High Channel

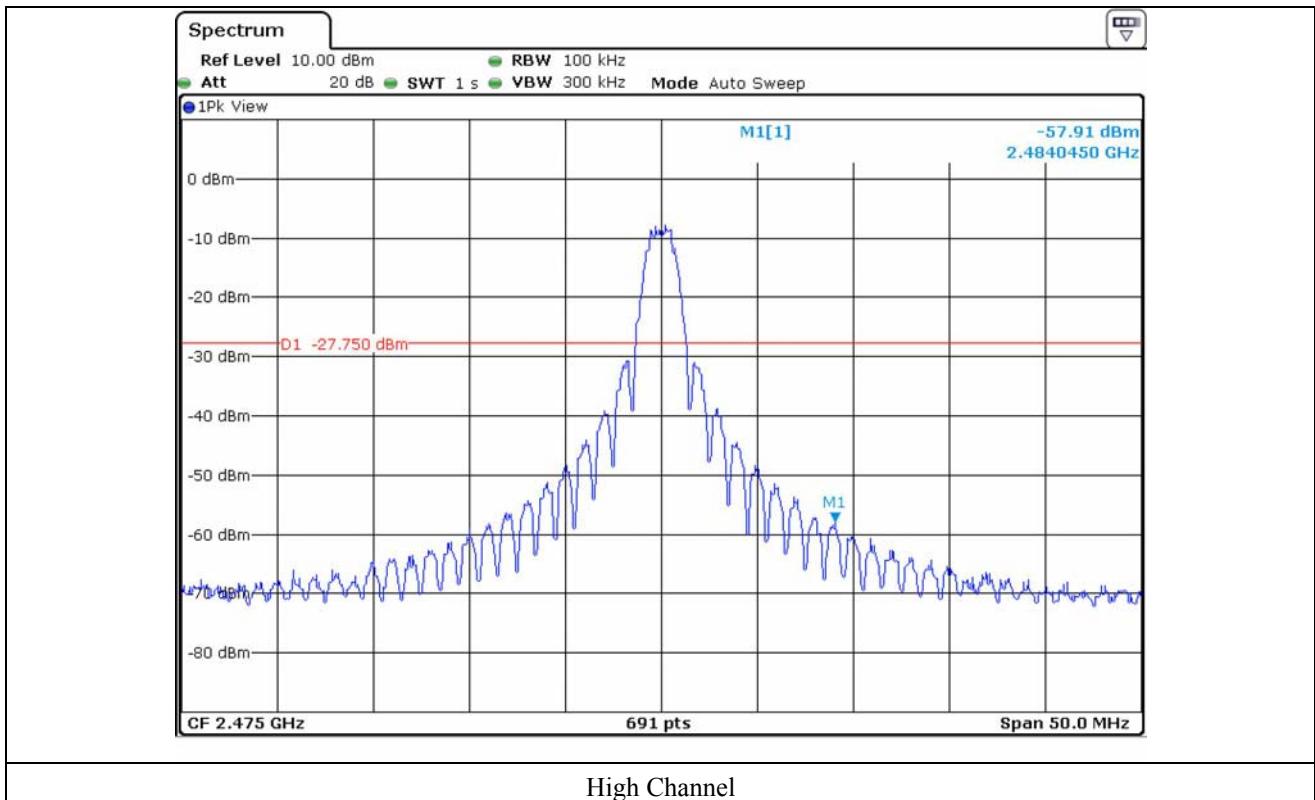
8.3.5.2 Test data for Antenna 1

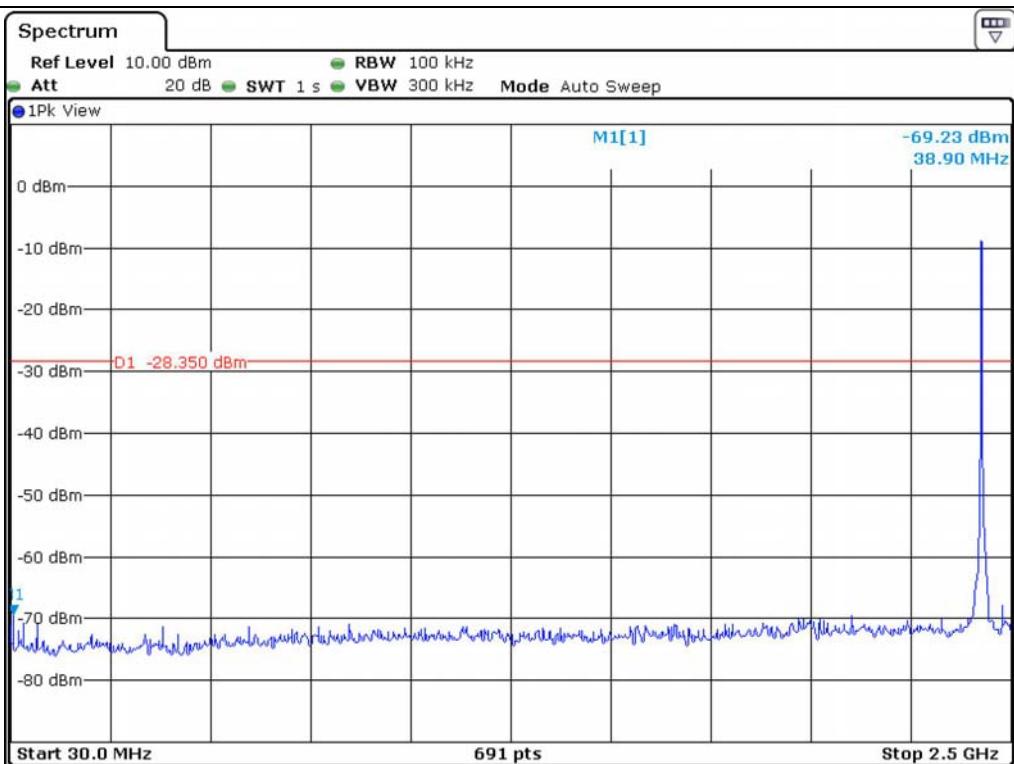
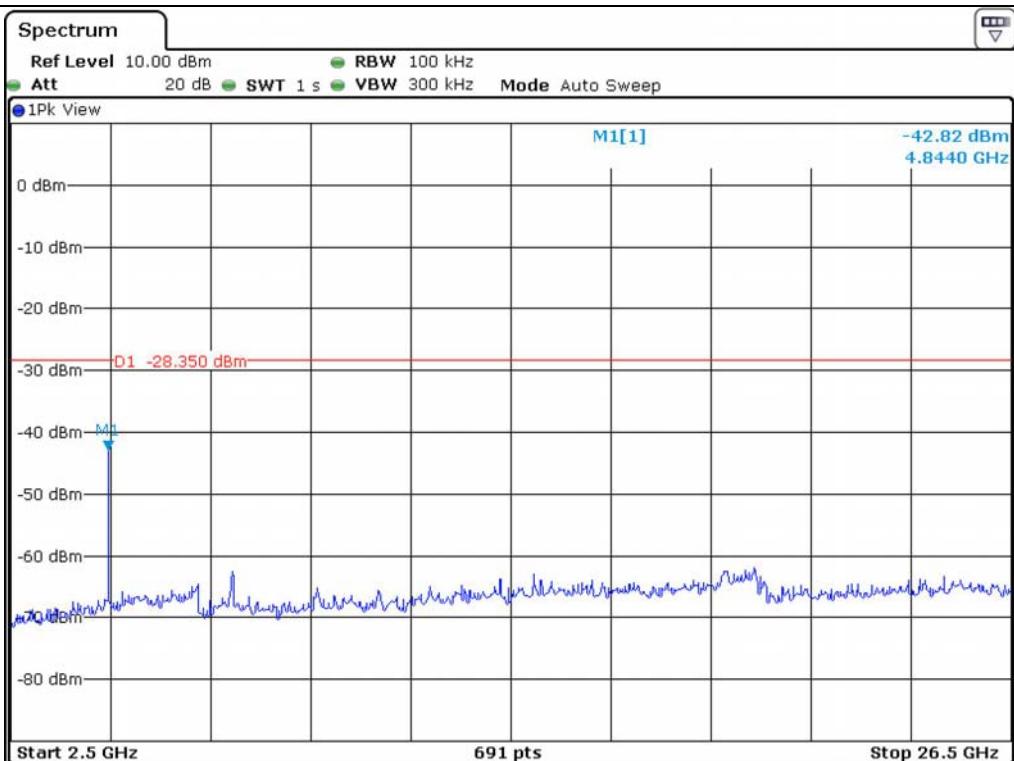


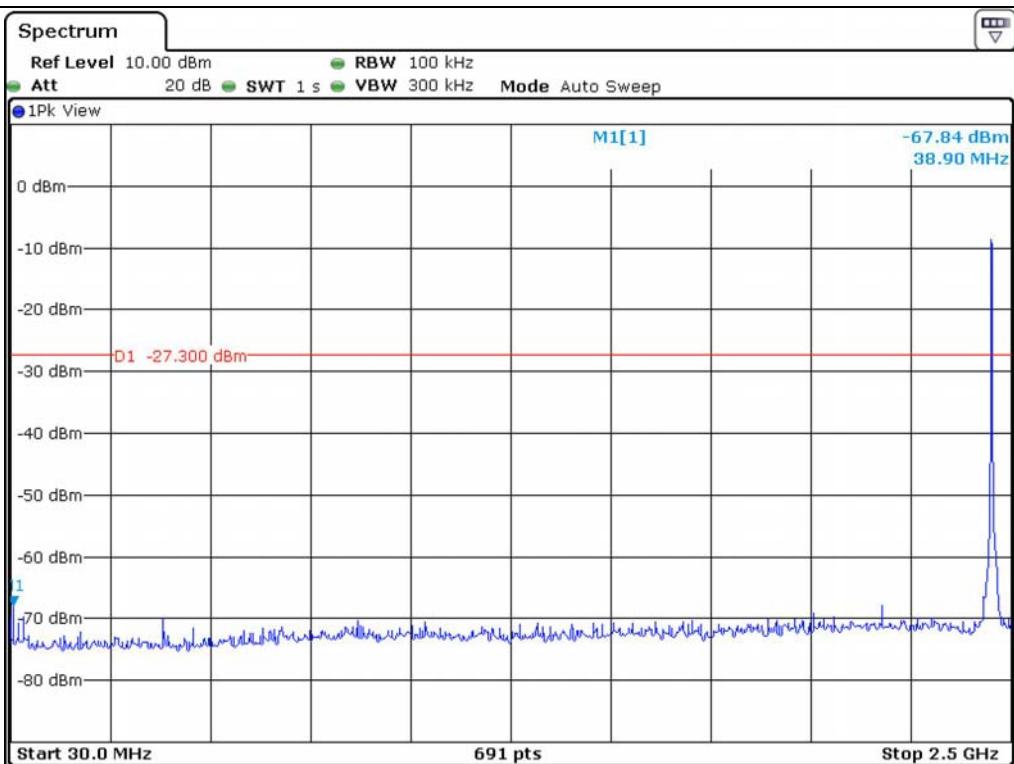
Low Channel



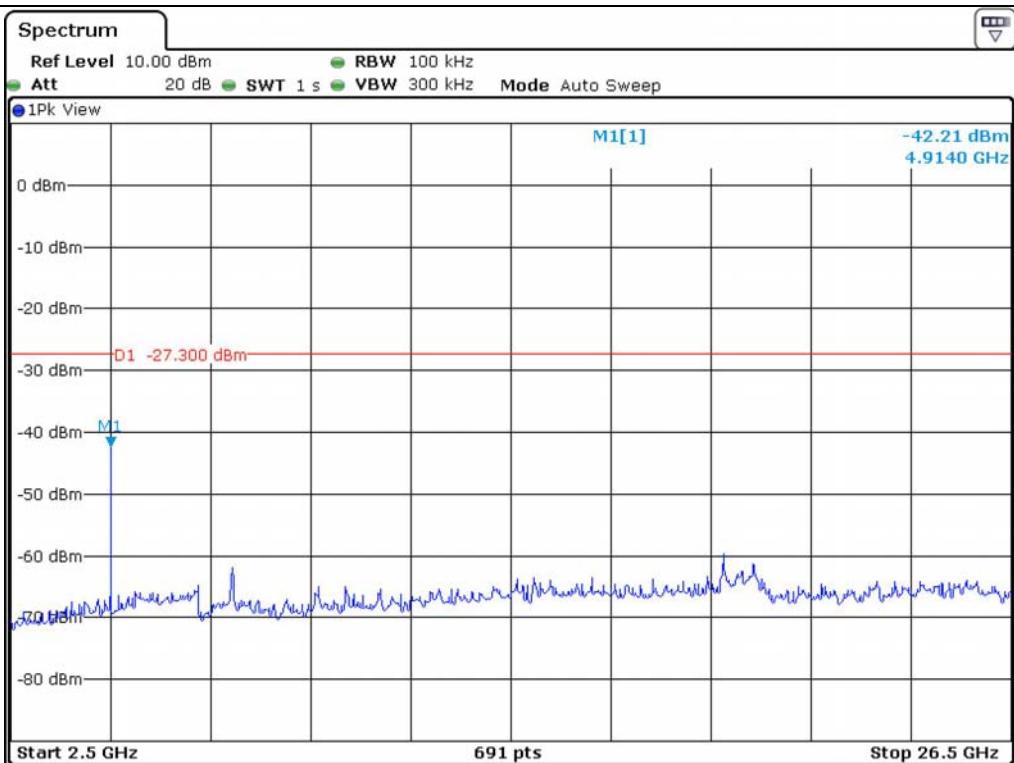
Middle Channel



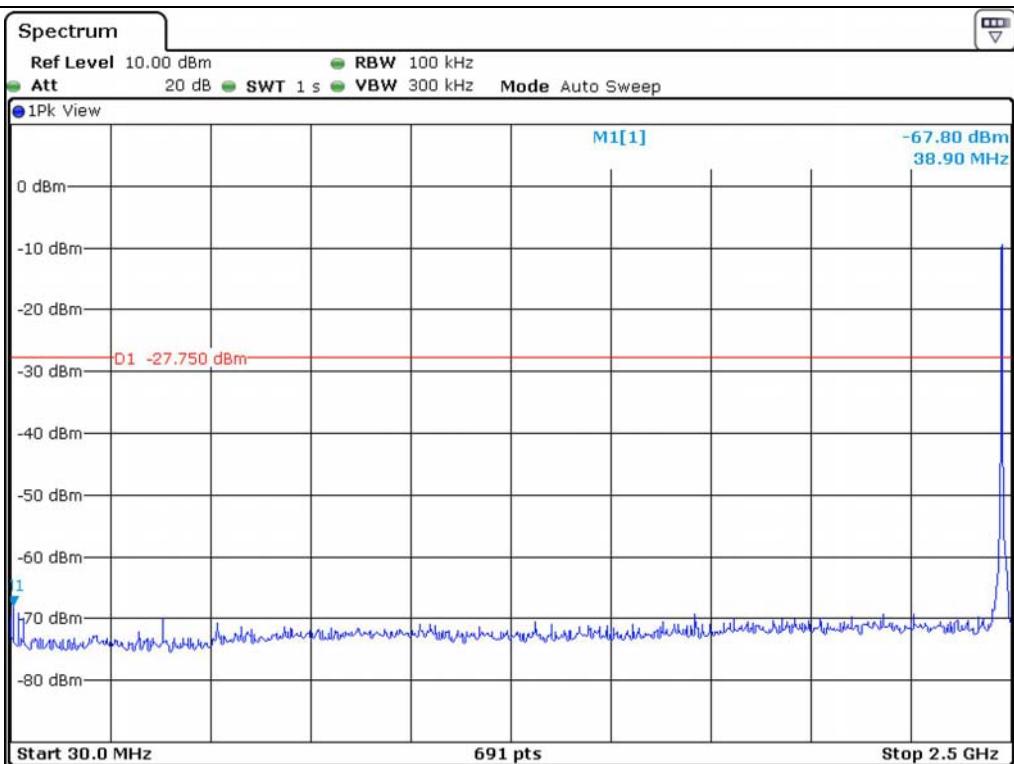
**Low Channel****Low Channel**



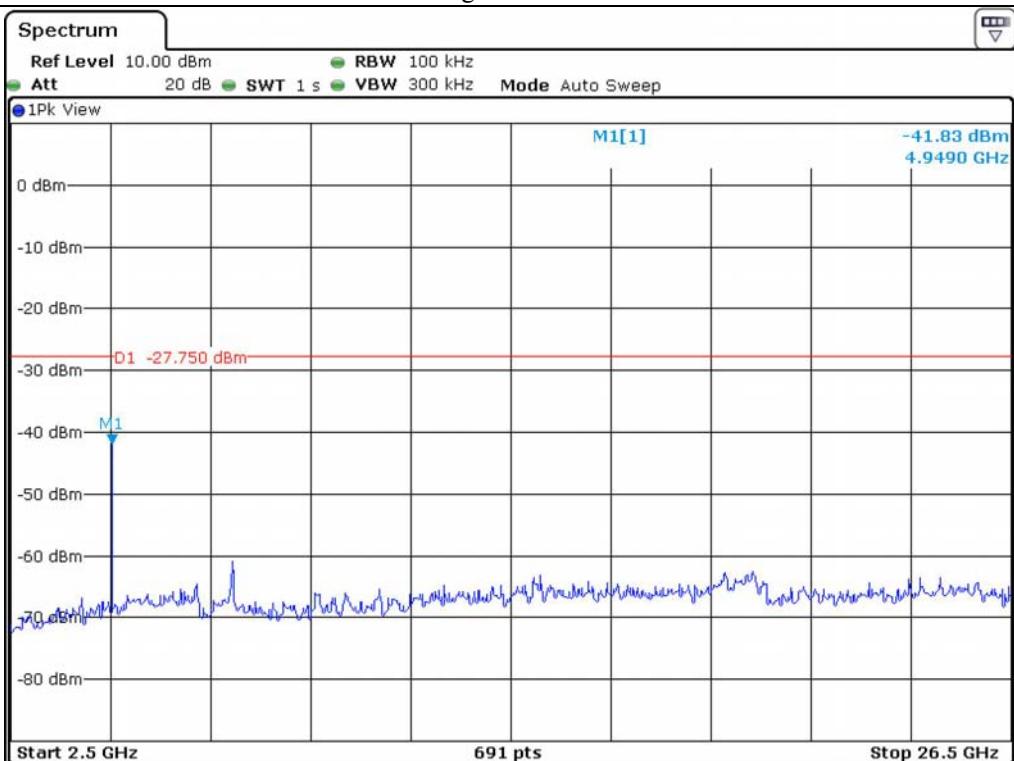
Middle Channel



Middle Channel



High Channel



High Channel

8.3.6 Test data for radiated emission

8.3.6.1 Radiated Emission which fall in the Restricted Band

8.3.6.1.1 Test data for Antenna 0

- Test Date : January 28, 2014
- Resolution bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and Average Mode
- Video bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and 10 Hz for Average Mode
- Frequency range : 30 MHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
2 390.00	51.33	Peak	H	27.00	7.80	43.00	43.13	74.00	30.87
	38.13	Average	H				29.93	54.00	24.07
	52.28	Peak	V				44.08	74.00	29.92
	39.32	Average	V				31.12	54.00	22.88
Test Data for High Channel									
2 483.50	51.47	Peak	H	27.40	8.00	43.00	43.87	74.00	30.13
	38.25	Average	H				30.65	54.00	23.35
	52.38	Peak	V				44.78	74.00	29.22
	39.14	Average	V				31.54	54.00	22.46

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dB μ V/m) - Total Level (dB μ V/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Project Engineer

8.3.6.1.2 Test data for Antenna 1

- Test Date : January 28, 2014
- Resolution bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and Average Mode
- Video bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and 10 Hz for Average Mode
- Frequency range : 30 MHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (MHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
2 390.00	51.01	Peak	H	27.00	7.80	43.00	42.81	74.00	31.19
	38.04	Average	H				29.84	54.00	24.16
	52.14	Peak	V				43.94	74.00	30.06
	39.25	Average	V				31.05	54.00	22.95
Test Data for High Channel									
2 483.50	51.21	Peak	H	27.40	8.00	43.00	43.61	74.00	30.39
	38.14	Average	H				30.54	54.00	23.46
	52.04	Peak	V				44.44	74.00	29.56
	39.09	Average	V				31.49	54.00	22.51

Tabulated test data for Restricted Band

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

 Margin (dB) = Limits (dB μ V/m) - Total Level (dB μ V/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Project Engineer

8.3.7 Spurious & Harmonic Radiated Emission

8.3.7.1 Test data for Antenna 0

- Test Date : January 28, 2014
- Resolution bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and Average Mode
- Video bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (GHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Test Data for Low Channel									
2 425.00	91.53	Peak	H	27.10	7.90	43.00	83.53	113.98	30.45
	87.25	Average	H				79.25	93.98	14.73
	87.79	Peak	V				79.79	113.98	34.19
	83.88	Average	V				75.88	93.98	18.10
4 850.00	56.94	Peak	H	30.70	12.00	42.40	57.24	73.98	16.74
	47.58	Average	H				47.88	53.98	6.10
	50.12	Peak	V				50.42	73.98	23.56
	39.28	Average	V				39.58	53.98	14.40
Test Data for Middle Channel									
2 450.00	91.83	Peak	H	27.20	7.90	43.00	83.93	113.98	30.05
	87.52	Average	H				79.62	93.98	14.36
	88.04	Peak	V				80.14	113.98	33.84
	84.31	Average	V				76.41	93.98	17.57
4 900.00	57.12	Peak	H	30.80	12.00	42.40	57.52	73.98	16.46
	47.74	Average	H				48.14	53.98	5.84
	50.38	Peak	V				50.78	73.98	23.20
	39.44	Average	V				39.84	53.98	14.14

Test Data for High Channel									
2 475.00	92.10	Peak	H	27.30	8.00	43.00	84.40	113.98	29.58
	87.86	Average	H				80.16	93.98	13.82
	87.42	Peak	V				79.72	113.98	34.26
	84.47	Average	V				76.77	93.98	17.21
4 950.00	56.70	Peak	H	30.80	12.10	42.30	57.30	73.98	16.68
	47.36	Average	H				47.96	53.98	6.02
	49.95	Peak	V				50.55	73.98	23.43
	39.01	Average	V				39.61	53.98	14.37

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dB μ V/m) - Total Level (dB μ V/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Project Engineer

8.3.7.2 Test data for Antenna 1

- Test Date : January 28, 2014
- Resolution bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and Average Mode
- Video bandwidth : 30 MHz~1 GHz 100 kHz for Peak and Average Mode
1 GHz above 1MHz for Peak and 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 26.5 GHz
- Measurement distance : 3 m
- Result : PASSED

Frequency (GHz)	Reading (dB μ V)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
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Test Data for Low Channel

2 425.00	91.06	Peak	H	27.10	7.90	43.00	83.06	113.98	30.92
	87.18	Average	H				79.18	93.98	14.80
	87.40	Peak	V				79.40	113.98	34.58
	82.96	Average	V				74.96	93.98	19.02
4 850.00	56.23	Peak	H	30.70	12.00	42.40	56.53	73.98	17.45
	46.78	Average	H				47.08	53.98	6.90
	49.97	Peak	V				50.27	73.98	23.71
	38.94	Average	V				39.24	53.98	14.74

Test Data for Middle Channel

2 450.00	91.43	Peak	H	27.20	7.90	43.00	83.53	113.98	30.45
	87.12	Average	H				79.22	93.98	14.76
	87.45	Peak	V				79.55	113.98	34.43
	83.69	Average	V				75.79	93.98	18.19
4 900.00	56.76	Peak	H	30.70	12.00	42.40	57.06	73.98	16.92
	47.23	Average	H				47.53	53.98	6.45
	50.04	Peak	V				50.34	73.98	23.64
	39.04	Average	V				39.34	53.98	14.64

Test Data for High Channel									
2 475.00	91.36	Peak	H	27.30	8.00	43.00	83.66	113.98	30.32
	87.16	Average	H				79.46	93.98	14.52
	86.51	Peak	V				78.81	113.98	35.17
	84.39	Average	V				76.69	93.98	17.29
4 950.00	56.02	Peak	H	30.80	12.10	42.30	56.62	73.98	17.36
	46.56	Average	H				47.16	53.98	6.82
	49.46	Peak	V				50.06	73.98	23.92
	38.12	Average	V				38.72	53.98	15.26

Tabulated test data for Restricted Band

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

Margin (dB) = Limits (dB μ V/m) - Total Level (dB μ V/m)

Total Level = Reading + Antenna Factor + Cable Loss – Pre-Amplifier Gain

Tested by: Tae-Ho, Kim / Project Engineer

8.4 PEAK POWER SPECTRUL DENSITY

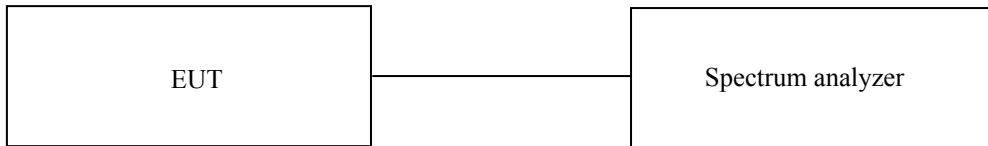
8.4.1 Operating environment

Temperature : 20 °C

Relative humidity : 40 % R.H.

8.4.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 3 kHz, the video bandwidth is set to 3 times the resolution bandwidth. The maximum level form the EUT in 100 kHz bandwidth was measured with above condition.



8.4.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	R/S	Spectrum Analyzer	101372	May 20, 2013

All test equipment used is calibrated on a regular basis.

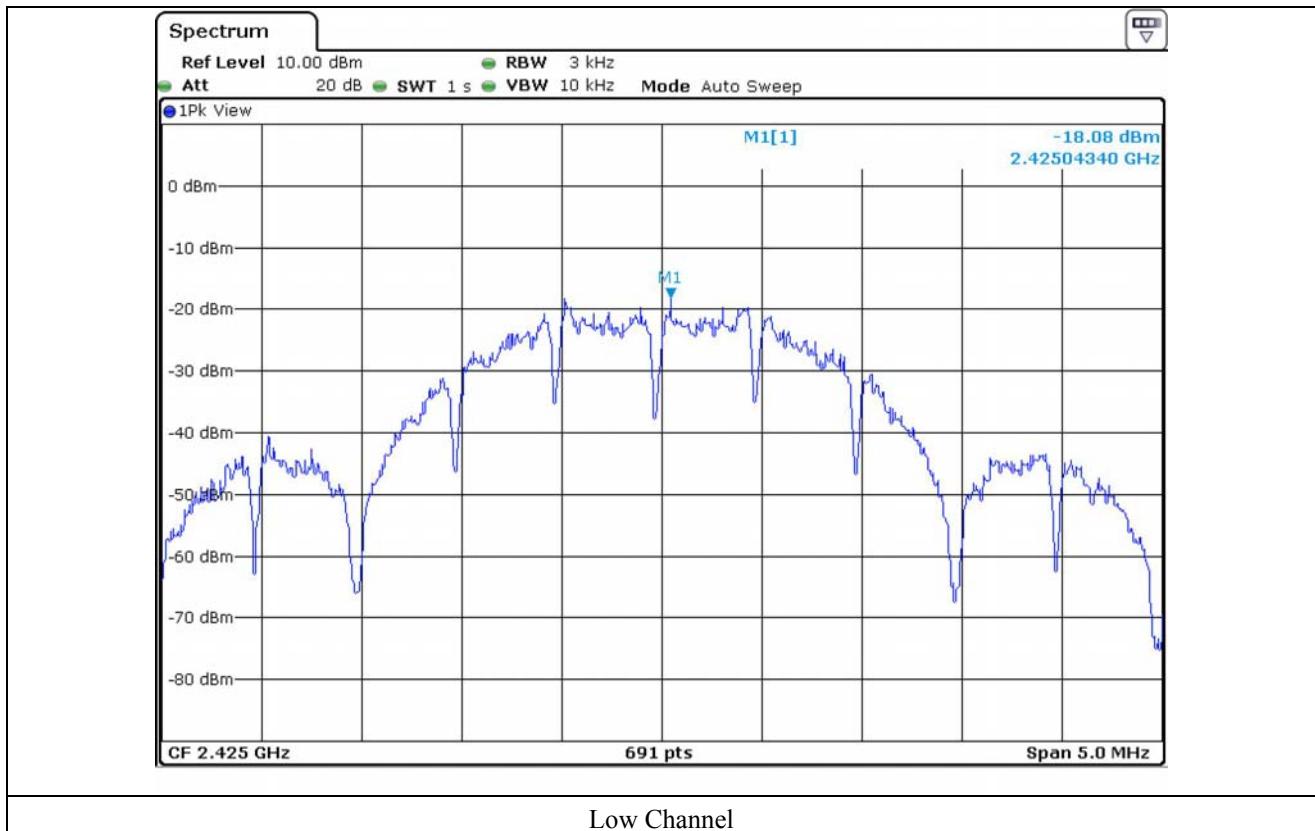
8.4.4 Test data for Antenna 0

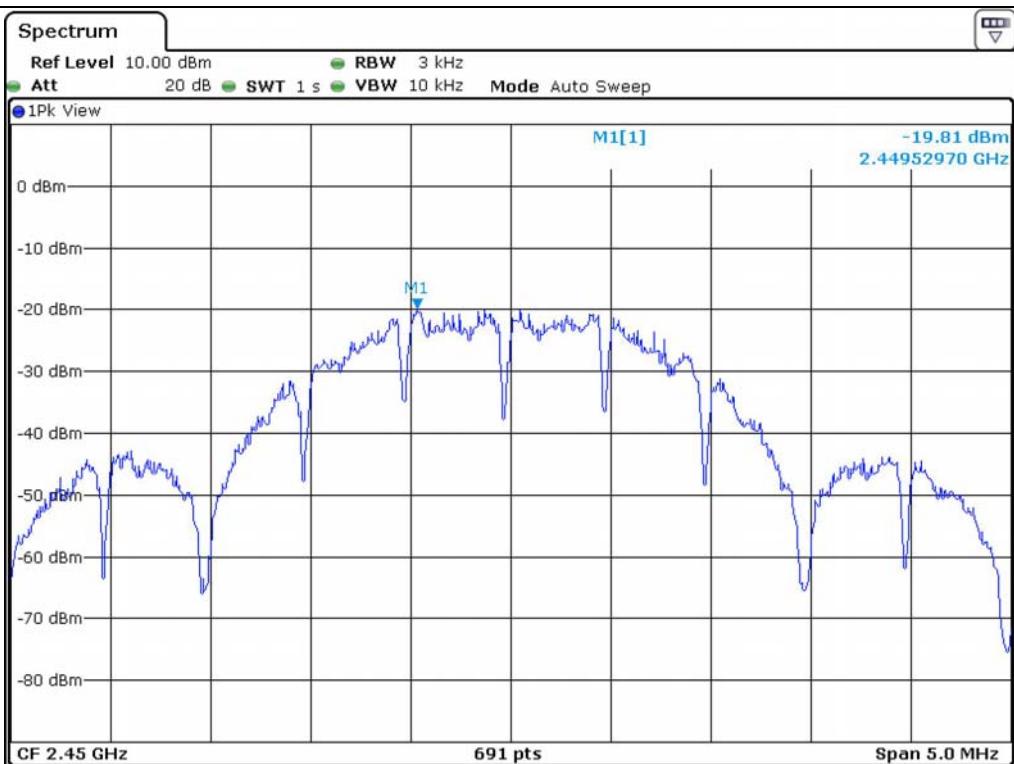
- Test Date : January 28, 2014
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 425	-18.08	8.00	26.08
Middle	2 450	-19.81	8.00	27.81
High	2 475	-20.37	8.00	28.37

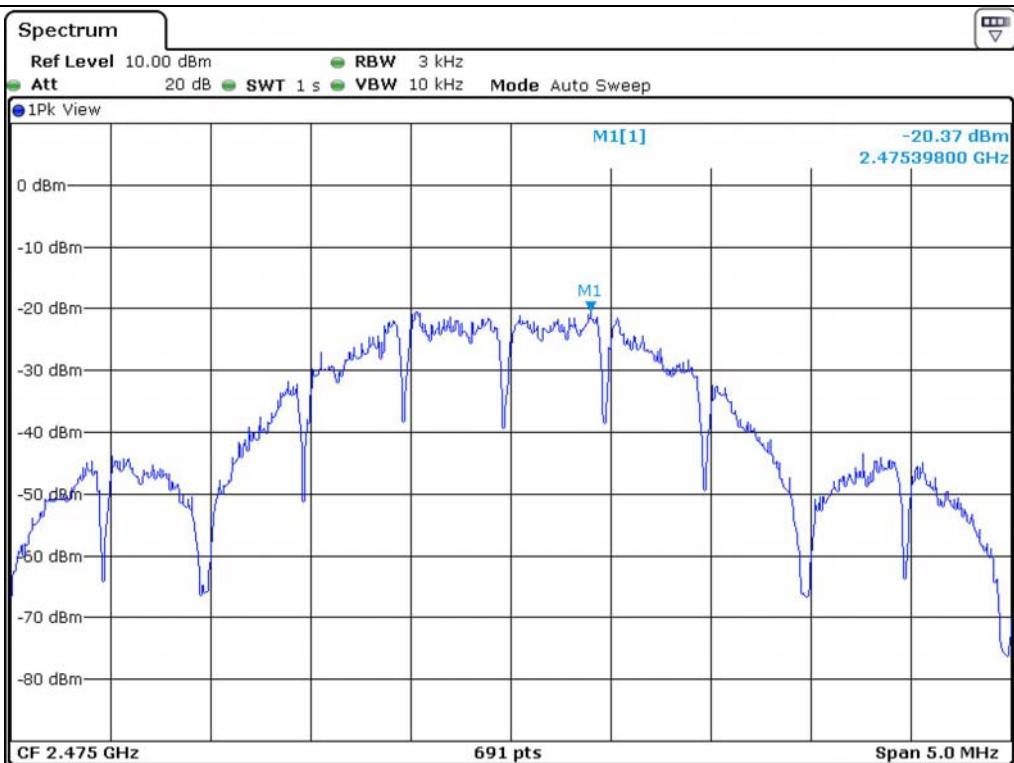
Remark. Margin = Limit – Measured value

Tested by: Tae-Ho, Kim / Project Engineer





Middle Channel



High Channel

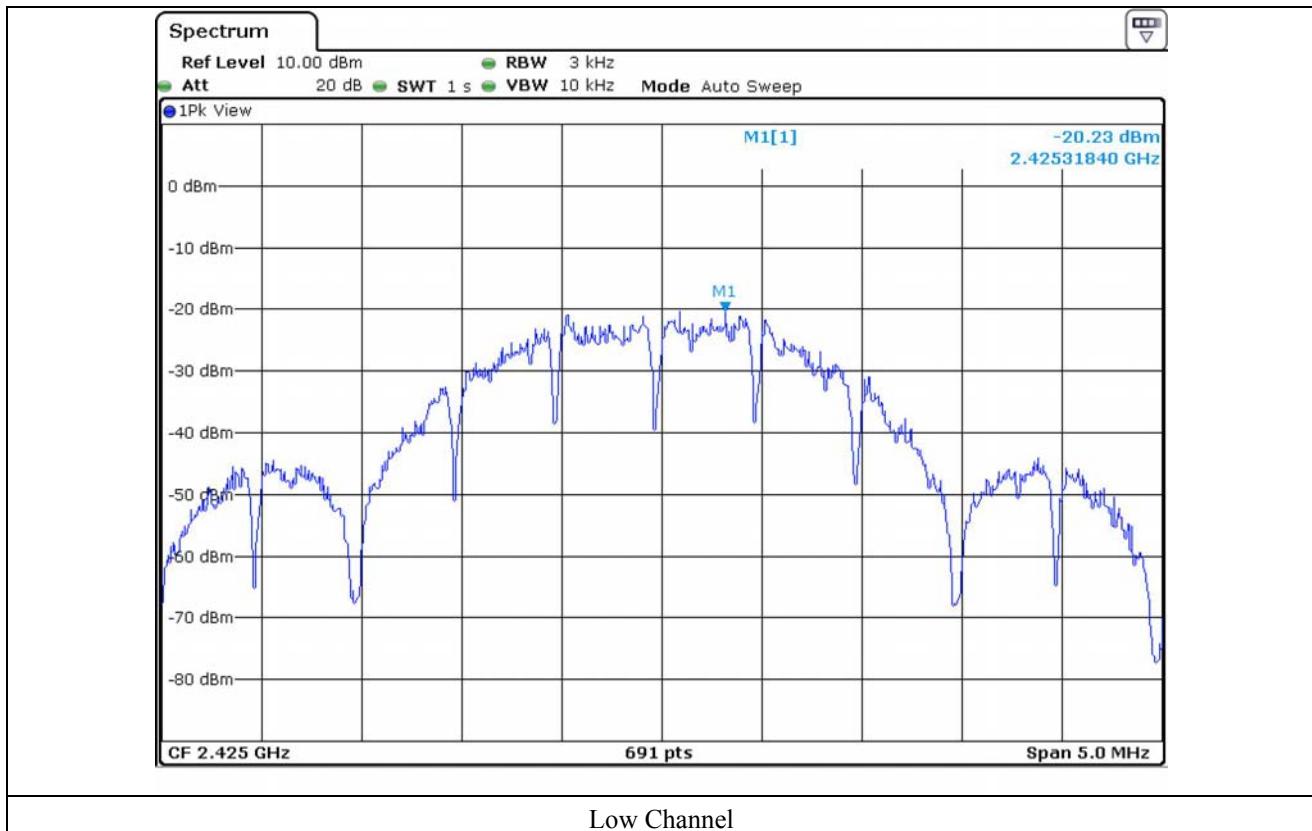
8.4.5 Test data for Antenna 1

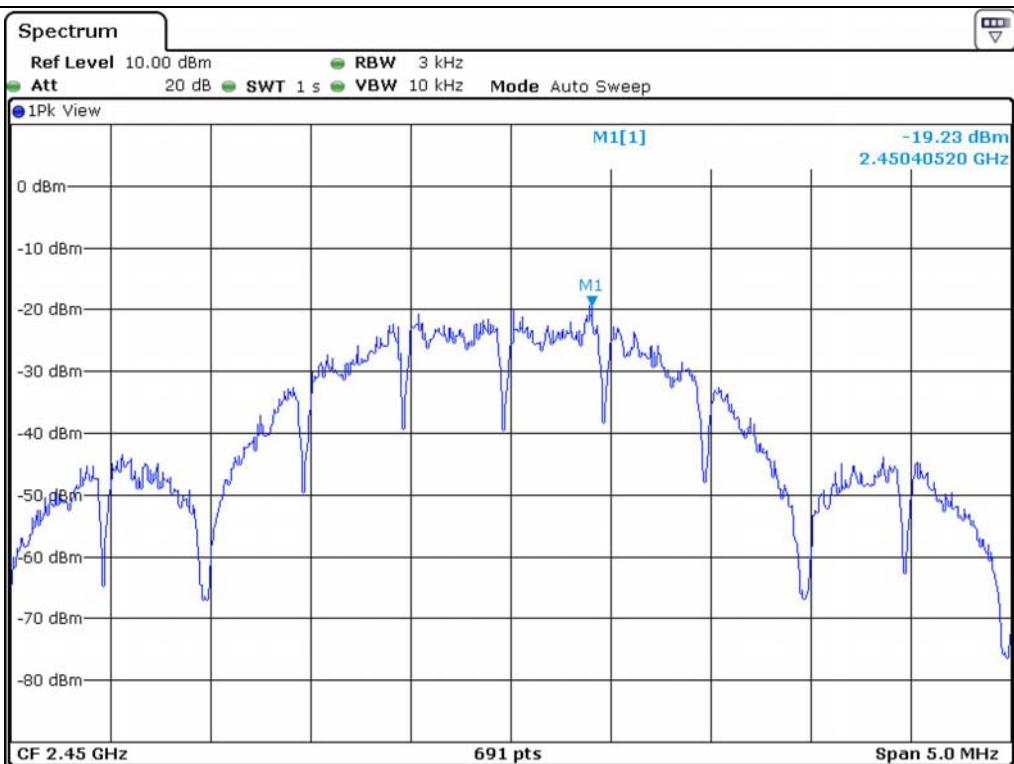
- Test Date : January 28, 2014
- Test Result : Pass
- Operating Condition : Continuous transmitting mode

CHANNEL	FREQUENCY(MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
Low	2 425	-20.23	8.00	28.23
Middle	2 450	-19.23	8.00	27.23
High	2 475	-20.26	8.00	28.26

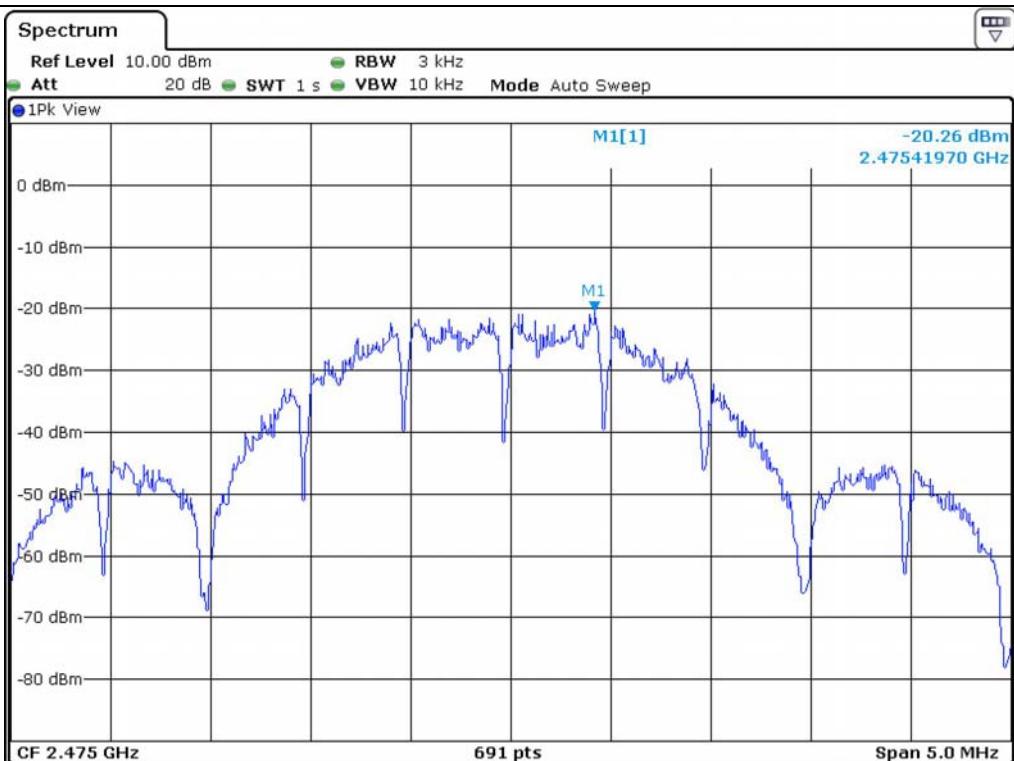
Remark. Margin = Limit – Measured value

Tested by: Tae-Ho, Kim / Project Engineer





Middle Channel



High Channel

8.5 RADIATED EMISSION TEST

8.5.1 Operating environment

Temperature : (21 ~ 22) °C

Relative humidity : (43 ~ 44) % R.H.

8.5.2 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 up to 25 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.

8.5.3 Measurement uncertainty

Radiated emission electric field intensity, 0.15 MHz ~ 30 MHz : ± 2.61 dB

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Radiated emission electric field intensity, 1 000 MHz ~ 3 000 MHz: ± 4.40 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

8.5.4 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
□ - ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Nov. 18, 2013(1Y)
■ - ESU	Rohde & Schwarz	EMI Test Receiver	100261	May 27, 2013(1Y)
□ - 8564E	HP	Spectrum Analyzer	3650A00756	May 03, 2013(1Y)
□ - FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Nov. 05, 2013(1Y)
■ - 310N	Sonoma Instrument	AMPLIFIER	312544	May 21, 2013(1Y)
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101372	May 20, 2013(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. 11, 2012(2Y)
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-255	Apr. 24, 2012(2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Sep. 05, 2013(2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jun. 17, 2013(2Y)
■ - 83051A	Agilent	Microwave System Preamplifier	3950M00201	May 22, 2013(1Y)

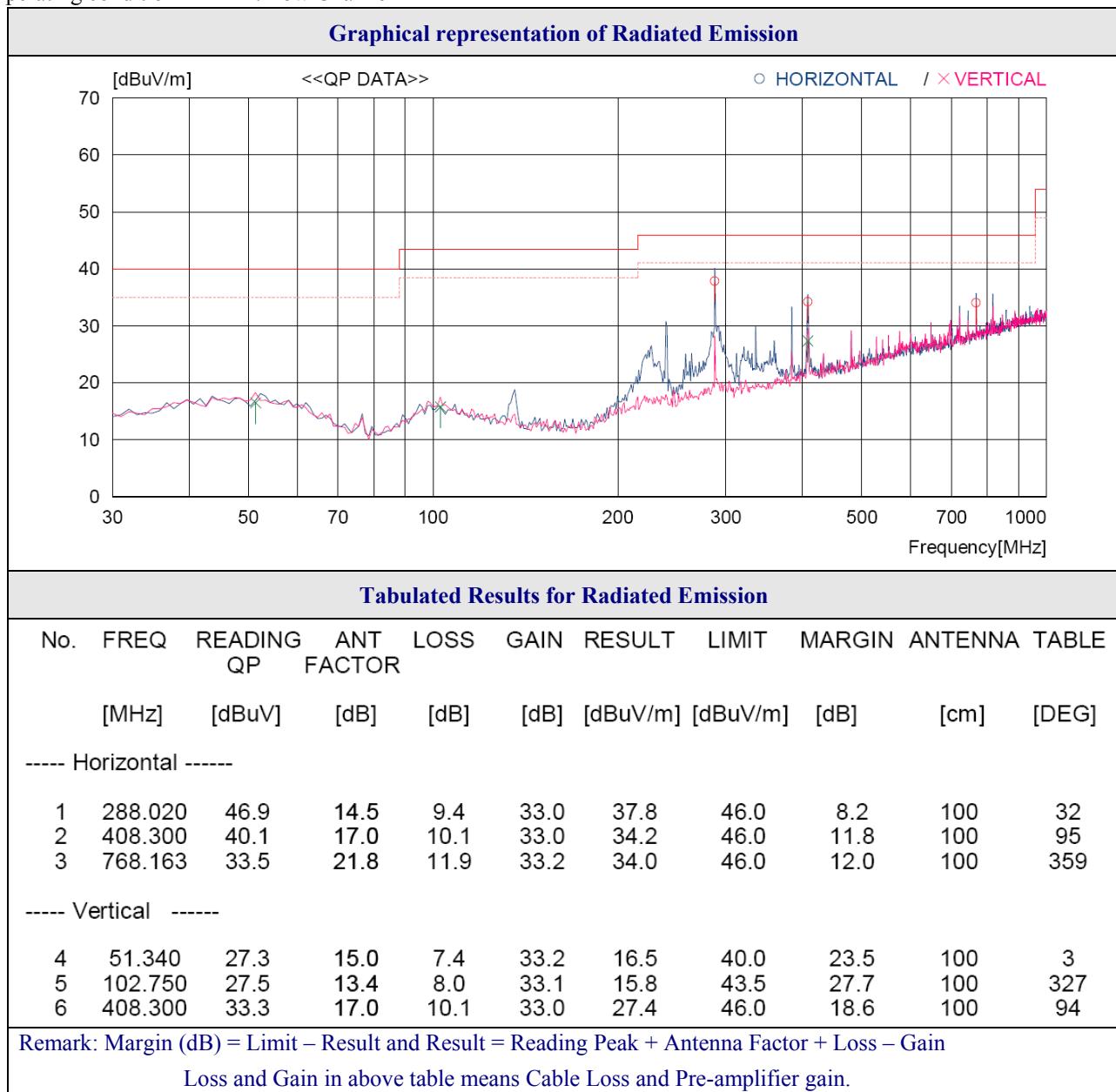
All test equipment used is calibrated on a regular basis.

8.5.4 Test data for Antenna 0**8.5.4.1 Test data for 30 MHz ~ 1 000 MHz**

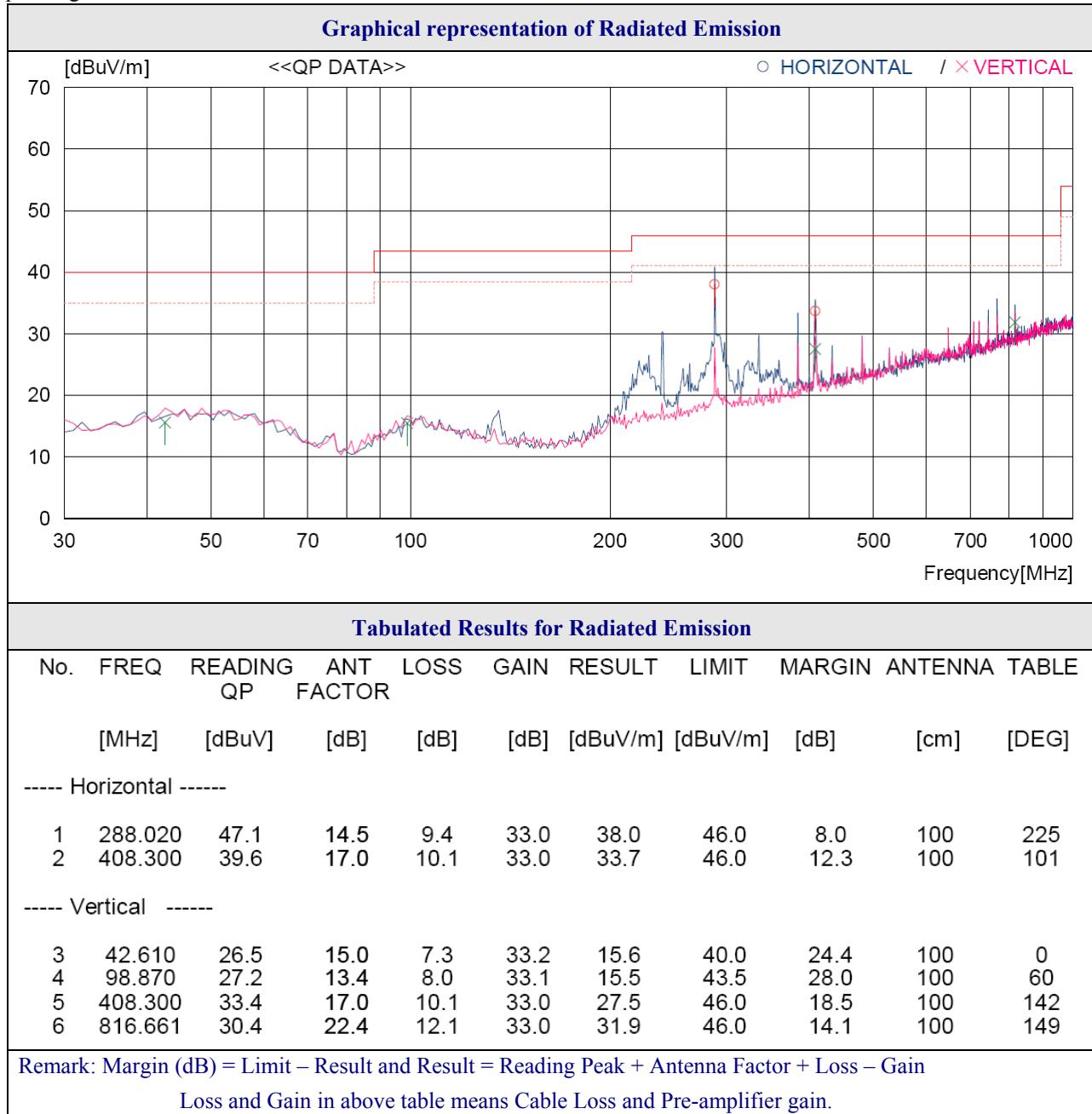
Humidity Level : (43 ~ 44) % R.H. Temperature: (21 ~ 22) °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)
 Result : PASSED

EUT : Remote Control Date: January 27, 2014
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

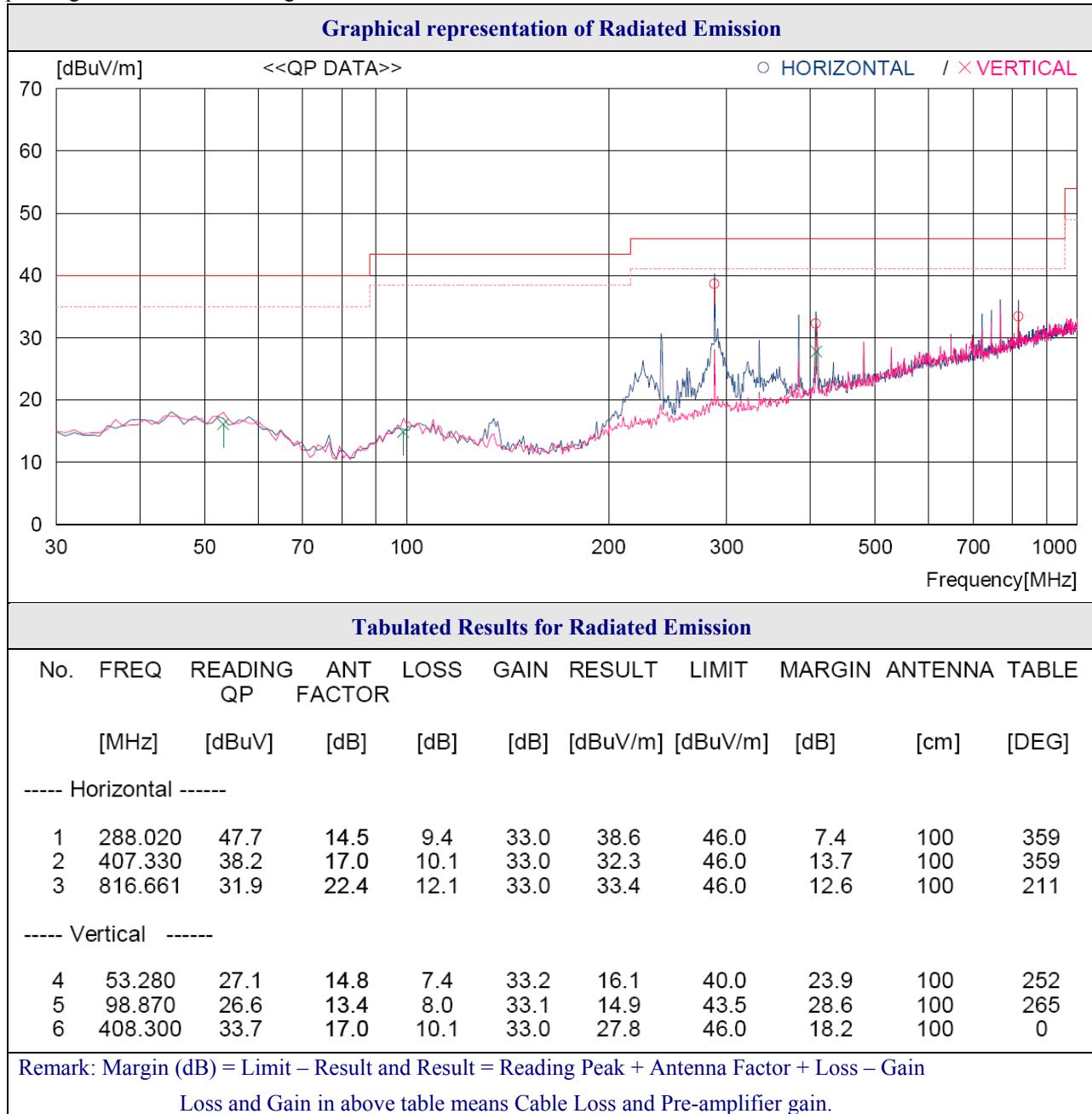
Operating condition : Low Channel



Operating condition : Middle Channel



Operating condition : High Channel



Tested by: Tae-Ho, Kim / Project Engineer

8.5.4.2 Test data for Below 30 MHz

- Test Date : January 27, 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 (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.									

8.5.4.3 Test data for above 1 GHz

- Test Date : January 27, 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 (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.									

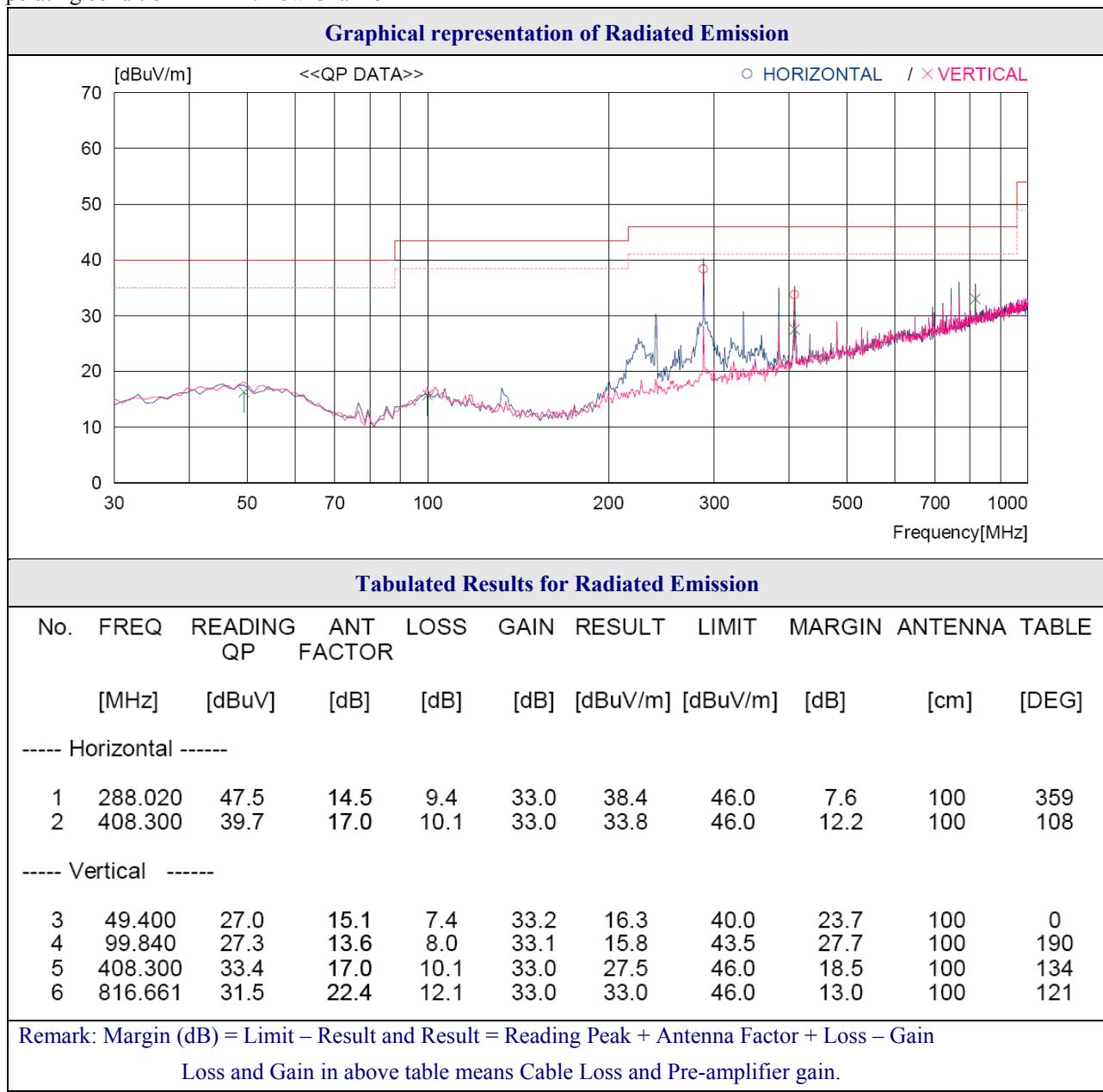
Tested by: Tae-Ho, Kim / Project Engineer

8.5.5 Test data for Antenna 1**8.5.5.1 Test data for 30 MHz ~ 1 000 MHz**

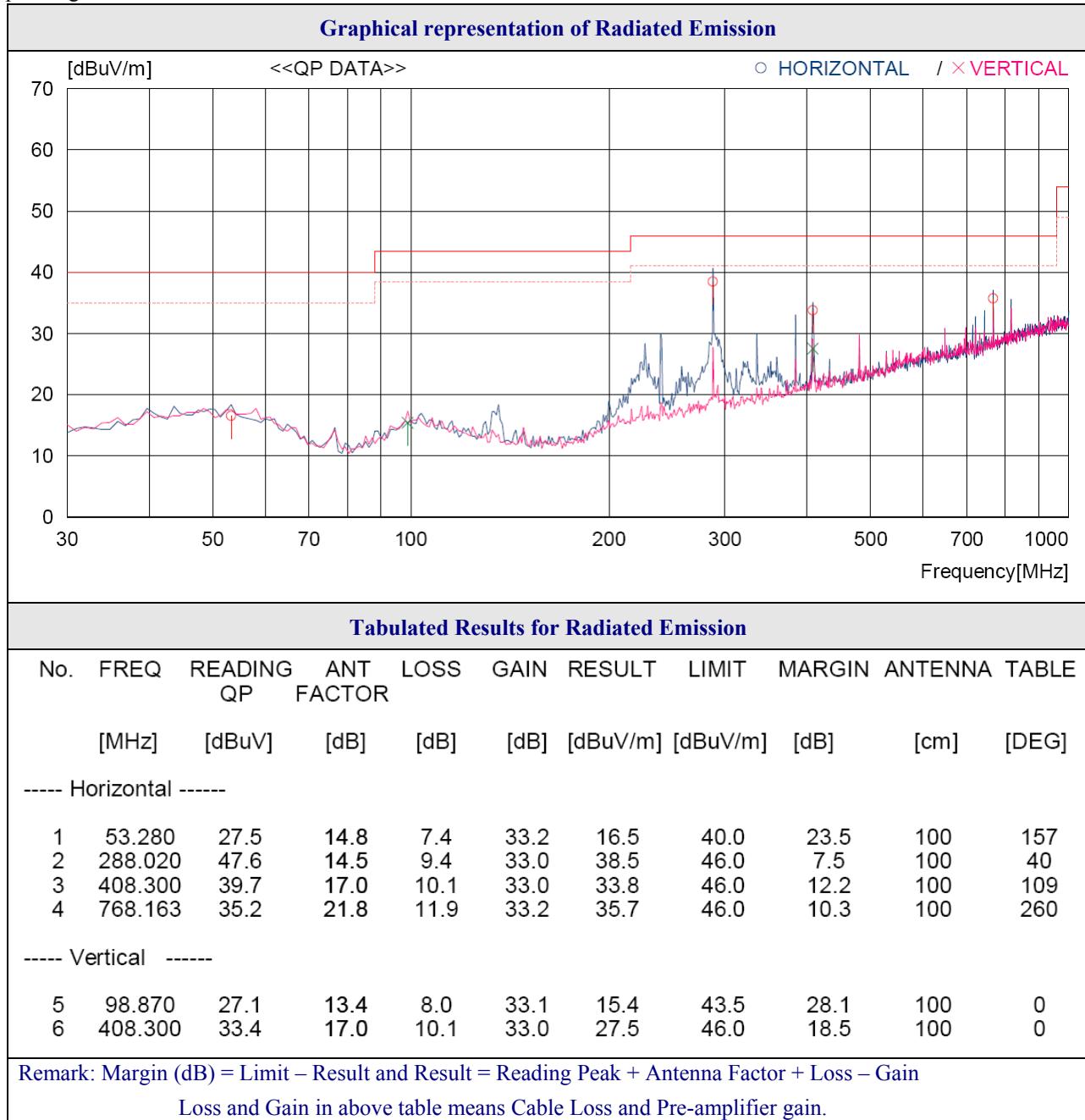
Humidity Level : (43 ~ 44) % R.H. Temperature: (21 ~ 22) °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.249 (d)
 Result : PASSED

EUT : Remote Control Date: January 27, 2014
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

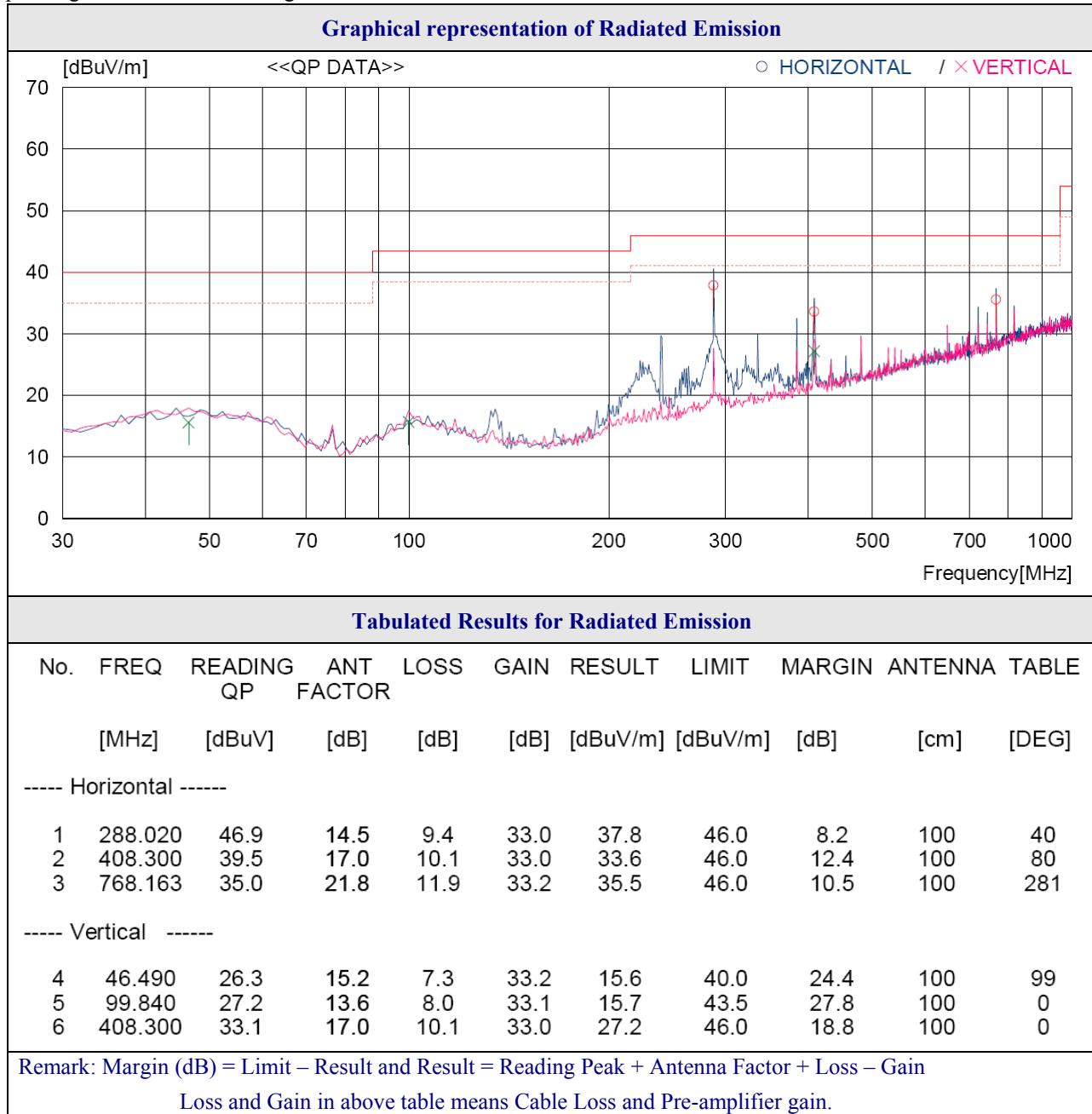
Operating condition : Low Channel



Operating condition : Middle Channel



Operating condition : High Channel



Tested by: Tae-Ho, Kim / Project Engineer

8.5.5.2 Test data for Below 30 MHz

- Test Date : January 27, 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 (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.									

8.5.5.3 Test data for above 1 GHz

- Test Date : January 27, 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 (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: Tae-Ho, Kim / Project Engineer

9. RADIO FREQUENCY EXPOSURE

9.1 RF Exposure Limit

According to the FCC rule §1.1310, the limit for General Population/Uncontrolled exposure is 1 mW/cm² for the device operating 1 500 ~ 100 000 MHz.

9.1 RF Exposure consideration

This equipment should be operated with a minimum distance of 2 cm between the radiator and front of face. This equipment should not be placed directly on the ear when the speaker is active

9.3 EUT Description

Kind of EUT	Remote Control		
Operating Frequency Band	<input type="checkbox"/> Wireless Microphone: 494.000 MHz ~ 501.000 MHz and 498.200 MHz ~ 505.200 MHz <input checked="" type="checkbox"/> WLAN(802.11b/g/n(HT20)): 2 412 MHz ~ 2 462 MHz <input checked="" type="checkbox"/> WLAN(802.11n(HT40)): 2 422 MHz ~ 2 452 MHz <input type="checkbox"/> WLAN: 5 180 MHz ~ 5 320 MHz / 5 500 MHz ~ 5 700 MHz <input type="checkbox"/> WLAN: 5 745 MHz ~ 5 825 MHz <input type="checkbox"/> Bluetooth: 2 402 MHz ~ 2 480 MHz <input checked="" type="checkbox"/> Zigbee: 2 425 MHz, 2 450 MHz, 2 475 MHz		
Device Category	<input type="checkbox"/> Portable (< 20 cm separation) <input type="checkbox"/> Mobile (> 20 cm separation) <input checked="" type="checkbox"/> Others		
Max. Output Power	WLAN	802.11b	14.80 dBm
		802.11g	13.97 dBm
		802.11n (HT20)	14.05 dBm
		802.11n (HT40)	13.39 dBm
	Zigbee	Antenna 0	-4.67 dBm
		Antenna 1	-4.78 dBm
Used Antenna	WLAN	Inserted into the main board (Chip Antenna)	
	Zigbee	Inserted into the main board (PCB Antenna)	
Used Antenna Gain	WLAN	3.3 dBi	
	Zigbee	Antenna0	-0.61 dBi
		Antenna1	1.73 dBi
Exposure Evaluation Applied	<input checked="" type="checkbox"/> MPE <input type="checkbox"/> SAR <input type="checkbox"/> N/A		

9.4 Test Result for WLAN

According to the procedure, KDB 447498 D01, the standalone SAR test exclusion threshold is
[(Max. Power of channel, including tune-up tolerance, mW)/(Mim. test separation distance, mm)] X [$\sqrt{f(\text{GHz})}$] < 3
= [30.2/20] X $\sqrt{2.462} = 2.37$

Conclusion: The SAR test exclusion threshold is less than 3, so the device meets the RF Exposure Requirement and excluded SAR Test.

9.5 Test Result for Zigbee

According to the procedure, KDB 447498 D01, the standalone SAR test exclusion threshold is
[(Max. Power of channel, including tune-up tolerance, mW)/(Mim. test separation distance, mm)] X [$\sqrt{f(\text{GHz})}$] < 3
= [0.34/20] X $\sqrt{2.425} = 0.026$

Conclusion: The SAR test exclusion threshold is less than 3, so the device meets the RF Exposure Requirement and excluded SAR Test.