FCC CFR47 Part 15 Subpart C Certification Test Report

For the

Product	**: S-DAQ(WLAN)**
Model	**: SRC-BAMVC2**
FCC ID	**: A3LSRC-BAMVC2**
Applicant	**: Samsung Electronics Co., Ltd.**
FCC Rule	**: CFR 47 Part 15 Subpart C**

We hereby certify that the above product has been tested by us with the listed rules and found in compliance with the regulation. The test data and results are issued on the test report no. **TR-W1511-009**

Signature

Park, Young-cheol / Technical Manager

Date: 2015-11-10

Test Laboratory: ENG Co., Ltd.

It shall not be reproduced except in full, without the written approval of the ENG Co., Ltd. This document may be altered or revised by the ENG Co., Ltd. personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample.

FCC CERTIFICATION TEST REPORT

Project Number	**: EA1506Q-002**
Test Report Number	**: TR-W1511-009**
Type of Equipment	**: S-DAQ (WLAN)**
Model Name	**: SRC-BAMVC2**
Multiple Model Name	**: N/A**
Applicant	**: Samsung Electronics Co., Ltd.**
Address	**: (Maetan dong)129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyenggi-do, 443-742, Korea**
Manufacturer	**: Samsung Electronics**
Address	**: (Maetan dong)129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyenggi-do, 443-742, Korea**
Regulation	**: FCC Part 15 Subpart C 15.247**
Total page of Report	**: 1 Pages**
Date of Receipt	**: 2015-09-08**
Date of Issue	**: 2015-11-12**
Test Result	**: PASS**

This test report only contains the result of a single test of the sample supplied for the examination.
It is not a generally valid assessment of the features of the respective products of the mass-production.

Prepared by	Jang, Seung-man / Project Engineer		2015-11-12 Date
Reviewed by	Park, Young-cheol / Technical Manager	Signature	2015-11-12 Date

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

CONTENTS

Page

1. TEST SUMMARY 3
2. EUT (EQUIPMENT UNDER TEST).....5
3. TEST CONDITION.....6
4. ANTENNA REQUIREMENT 8
4.1 ANTENNA DESCRIPTION 8
4.2 CONCLUSION.....8
5. TEST RESULT 9
5.1 6 DB BANDWIDTH.....9
5.2 99 % BANDWIDTH.....11
5.3 MAXIMUM PEAK OUTPUT POWER.....13
5.4 PEAK POWER SPECTRAL DENSITY 14
5.5 OUT OF BAND EMISSION.....16
5.6 RADIATED EMISSION 24
5.7 AC POWER LINE CONDUCTED EMISSION 36
APPENDIX I- TEST INSTRUMENTATION 39

Release Control Record

Issue Report No.	Issued Date	Revisions	Effect Section
TR-W1511-009	2015-11-10	Initial Release	All

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942

TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

1. TEST SUMMARY

1.1 Regulations and results

The sample submitted for evaluation(Referred to below as the EUT) has been tested in accordance with the following regulations or standards.

FCC Reference Section	Description	P (Pass)	F (Fail)	N.T. (Not Tested)	Note
15.203	Antenna Requirement	P			
15.205, 15.209	Radiated Spurious Emissions	P			
15.207	AC Power-line Conducted Emissions	P			
15.247 (a)(2)	6 dB Occupied Bandwidth	P			
15.247 (b)(3)	RF Output Power	P			
2.1051, 15.247 (d)	Band Edge / Conducted Spurious Emissions	P			
15.247 (e)	Power Spectral Density	P			

1.2 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC Part 15 Subpart C Section 15.247.

1.3 Test Methodology

The tests mentioned in clause 1.1 in this test report were performed according to FCC CFR 47 Part 2, CFR 47 Part 15 and ANSI C63.10-2013.

KDB 558074 D01DTS Meas Guidance v03r03: Measurement Procedure PK is used for power and PKPSD is used for power spectral density..

1.4 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

1.5 Test Facility

Site Qualification	Registration on IC effective through February 09, 2015 IC Registration No.: 12721A-1 Registration on FCC effective through February 24, 2015 FCC Registration No.: 955964 Appointed Laboratory acc. to ISO/IEC 17025 by TUV Rheinland on June 22, 2015 Appointment No: UA 50314109-0001 Designated Laboratory acc. to ISO/IEC 17025 by Radio Research Agency in Korea on October 20, 2015 Designated No: KR0160
Test Site	ENG Co., Ltd.
Site Location	135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea.

2. EUT (Equipment Under Test)

2.1 General Description

The EUT is a device for transferring voltage signal and equipment information to an agent PC through wired/wireless communication. For wireless communication, the EUT has WLAN module has function for 802.11a/b/g, so this report covers 802.11 b/g only and another report covers function for 802.11a.

Description of equipment	S-DAQ (WLAN)
Model Name	SRC-BAMVC2
Serial Number	N/A
Operating Frequency	2 412 ~ 2 462 MHz, 5 180 MHz ~ 5 240 MHz, 5 745 ~ 5 805 MHz
Max. RF Output Power	20.01 dBm (802.11g)
Modulation Types	CCK(802.11 b), OFDM(802,11 a/g)
Number of Channels	2 412 ~ 2 462 MHz : 11 CH (802.11 b/g) 5 180 ~ 5 240 MHz : 4 CH (802.11 a) 5 745 ~ 5 805 MHz: 4 CH (802.11 a)
Channel Bandwidth	5 MHz
Generated or used Freq. in EUT	32.768 kHz, 12 MHz, 24 MHz, 25 MHz, 33 MHz, 37.4 MHz
Type of Antenna	☐ Integrated Type (PCB Type) ■ Dedicated Type
Antenna Gain	2.4 GHz Band : 4.16 dBi 5 GHz Band : 3.92 dBi
Operating Temperature	0 ℃ ~ 50 ℃
Normal Test Voltage	DC 24 V
Electrical Rating	DC 21.6 V ~ DC 26.4 V

Note:.

2.2 Available channel number and frequency

Operating Mode: 802.11 b/g, 5 MHz Channel Bandwidth					
Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2412	2	2417	3	2422
4	2427	5	2432	6	2437
7	2442	8	2447	9	2452
10	2457	11	2462		

2.3 Additional Model

None

3. TEST CONDITION

3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description	Model No.	Serial No.	Manufacturer.
S-DAQ (EUT)	SRC-BAMVC2	N/A	Samsung Electronics
Notebook PC	LG15U34	411NZJV003852	LG Electronics Nanjing Display Co., Ltd.

3.2 Mode of operation during the test

For finding worse case configuration and operating mode, preliminary testing was performed and radiated emission and conducted emission were performed with the EUT set to transmit at the channel with the highest output power as worse case scenario.

Based on preliminary testing following operating modes were selected for the final test as listed below.

3.2.1 Radiated Emission Test Mode Above 1 GHz

All data rates have been investigated and the worst one was set for final test as following table.

Operating Mode	Channel	Frequency (MHz)	Data rate (Mbps)	Output Power (dBm)
802.11b	Low	2412	11	16.34
	Middle	2437	11	16.30
	High	2462	11	16.21
802.11g	Low	2412	6	20.01
	Middle	2437	6	19.74
	High	2462	6	19.53

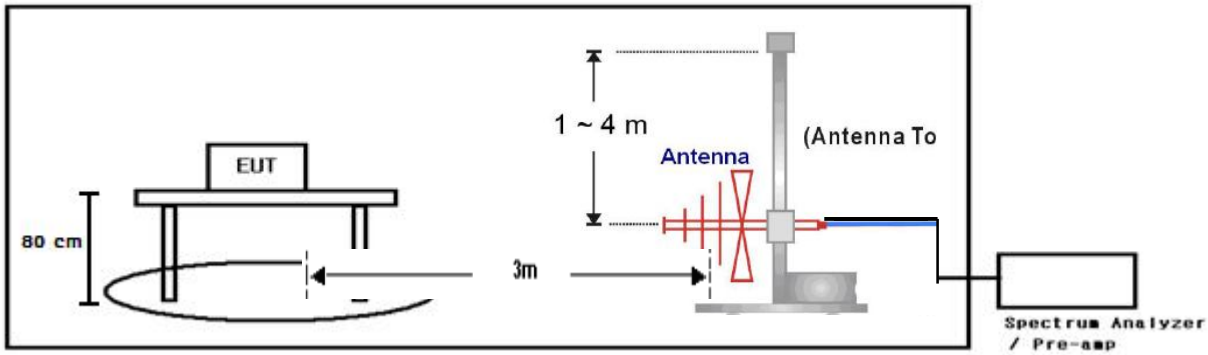
3.2.1 Radiated Emission Test Mode below 1 GHz and AC Power Line Conducted Emission

Operating Mode	Tested Channel	Data rate (Mbps)	Output Power (mW)
802.11g	Low	6	20.01

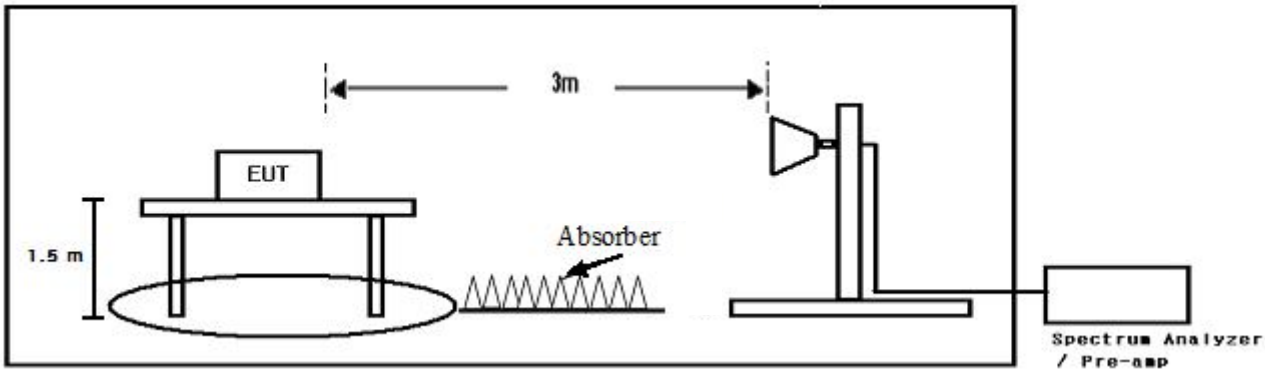
ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

3.3 Test Setup Drawing

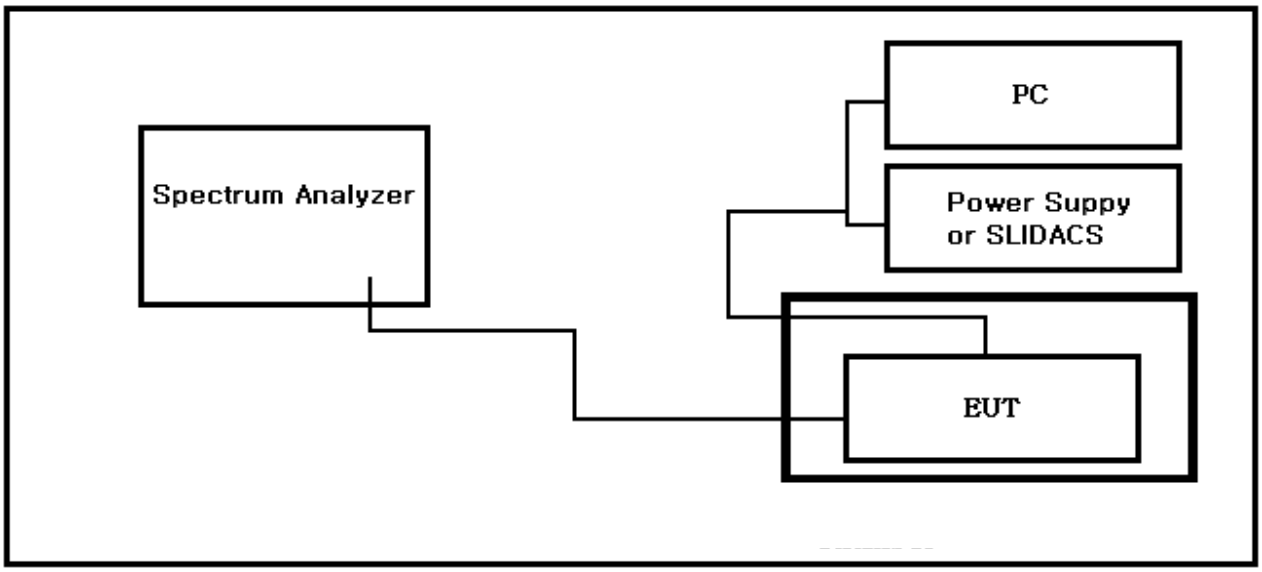
(Radiated Test Below 1 GHz)



(Radiated Test Above 1 GHz)



(Conducted Test)



3.4 EUT Modifications

Following modifications were implemented on the EUT for fixing the problem caused by EMC testing and the product will have all of the modifications incorporated into the product when manufactured and placed on the market.

- None.

4. ANTENNA REQUIREMENT

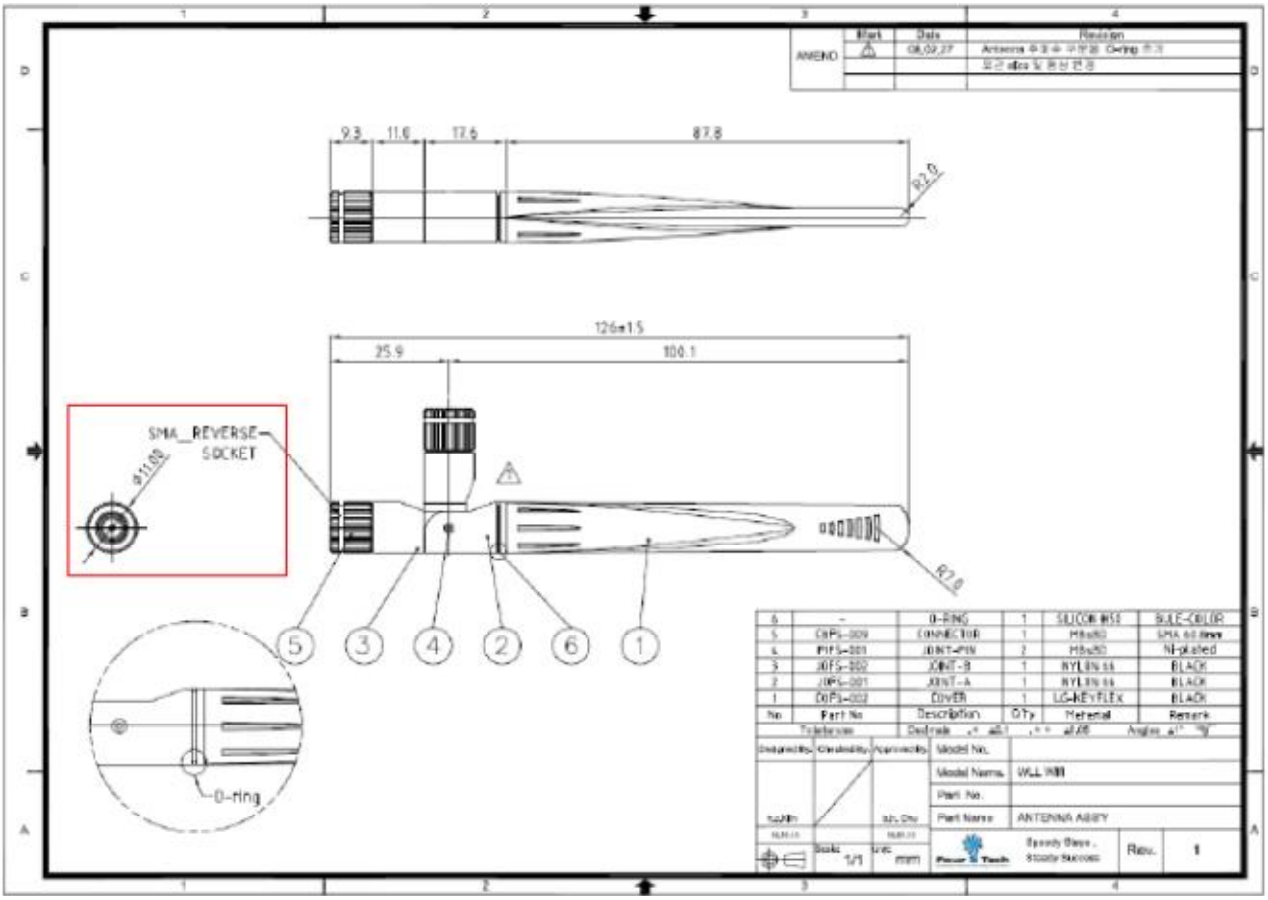
According to FCC CFR 47 Part 15 section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provision of this section.

4.1 Antenna Description

Frequency Band (GHz)	Antenna Type	Tx Parh	Max Peak Gain (dBi)	Connector Type
2.4	Dipole Antenna	1	4.16	Reversed SMA
5	Dipole Antenna	1	3.92	Reversed SMA

4.2 Conclusion

The antenna connector type of the EUT is Reversed SMA, so the EUT met the requirement.



5. TEST RESULT

5.1 6 dB Bandwidth

5.1.1 Limit

The minimum 6 dB bandwidth shall be at least 500 kHz acc to Section 15.247 (a) (2)

5.1.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r03: 8.1 Option 1

The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, VBW ≥ 3 X RBW, peak detector and max hold.

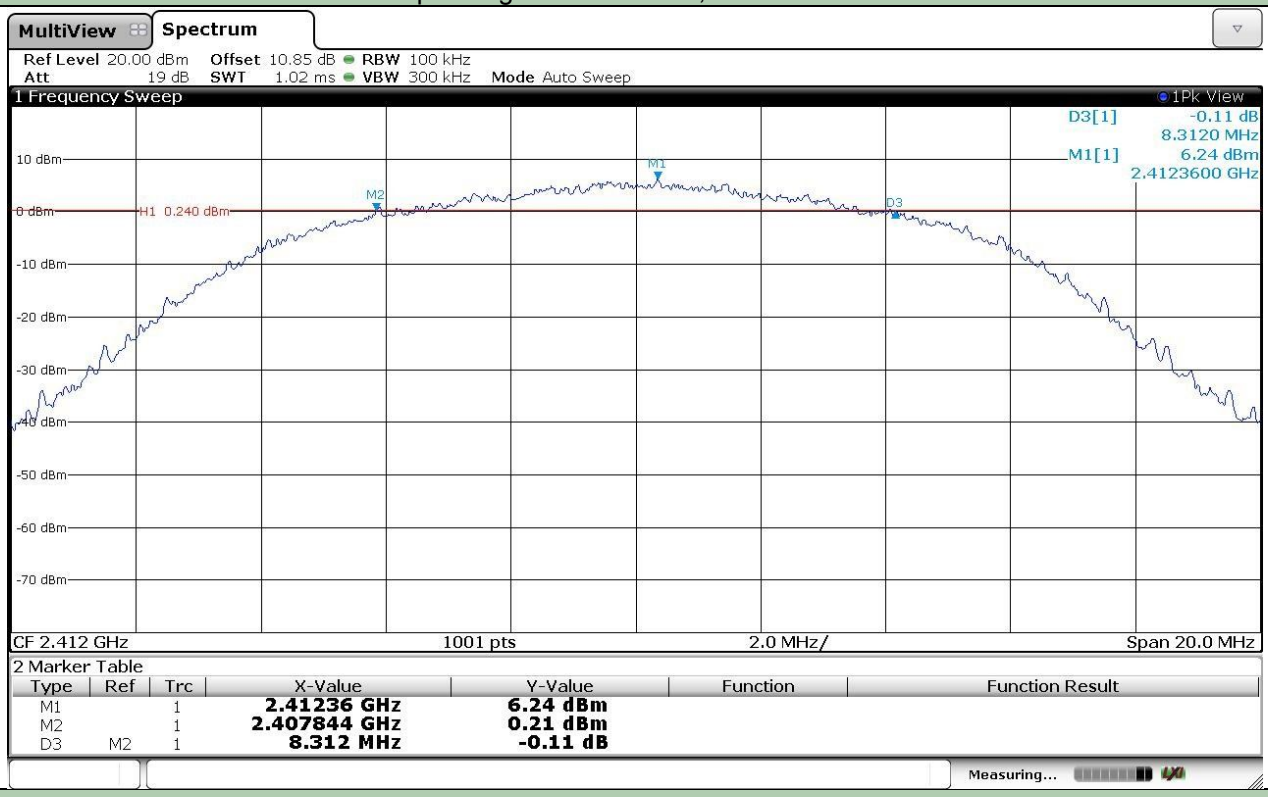
5.1.3 Test Data

Test Date: Oct. 20, 2015		Tested by: S. M. Jang	
Operating Mode: 802.11b			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 412	8.31	0.5
Middle	2 437	8.21	
High	2 462	8.15	
Operating Mode: 802.11g			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 412	16.52	0.5
Middle	2 437	16.54	
High	2 462	16.52	

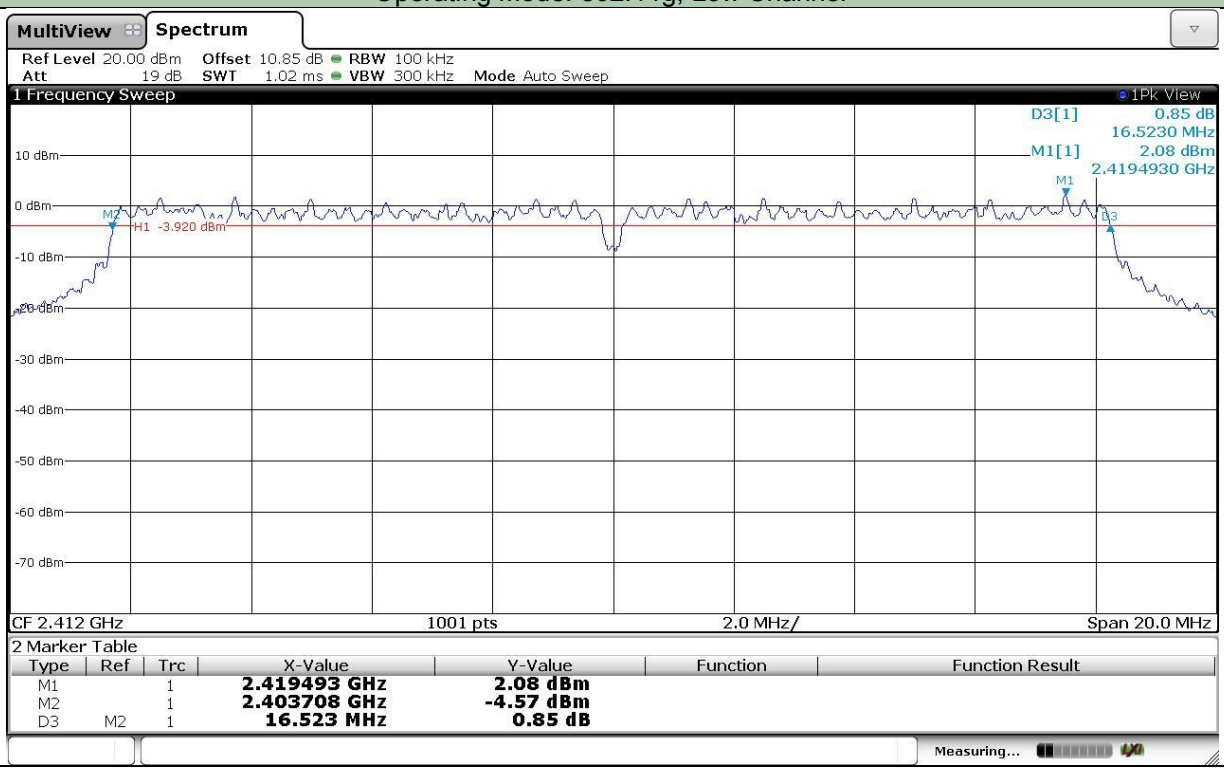
ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.1.4 Test Plots

Operating Mode: 802.11b, Low Channel



Operating Mode: 802.11g, Low Channel



5.2 99 % Bandwidth

5.2.1 Limit

Not applicable. For reporting purpose only.

5.2.2 Method of Measurement

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1 % to 3 % of the Span.

The VBW is set to 3 times the RBW. The sweep time is coupled.

The spectrum analyzer internal 99% bandwidth function is utilized.

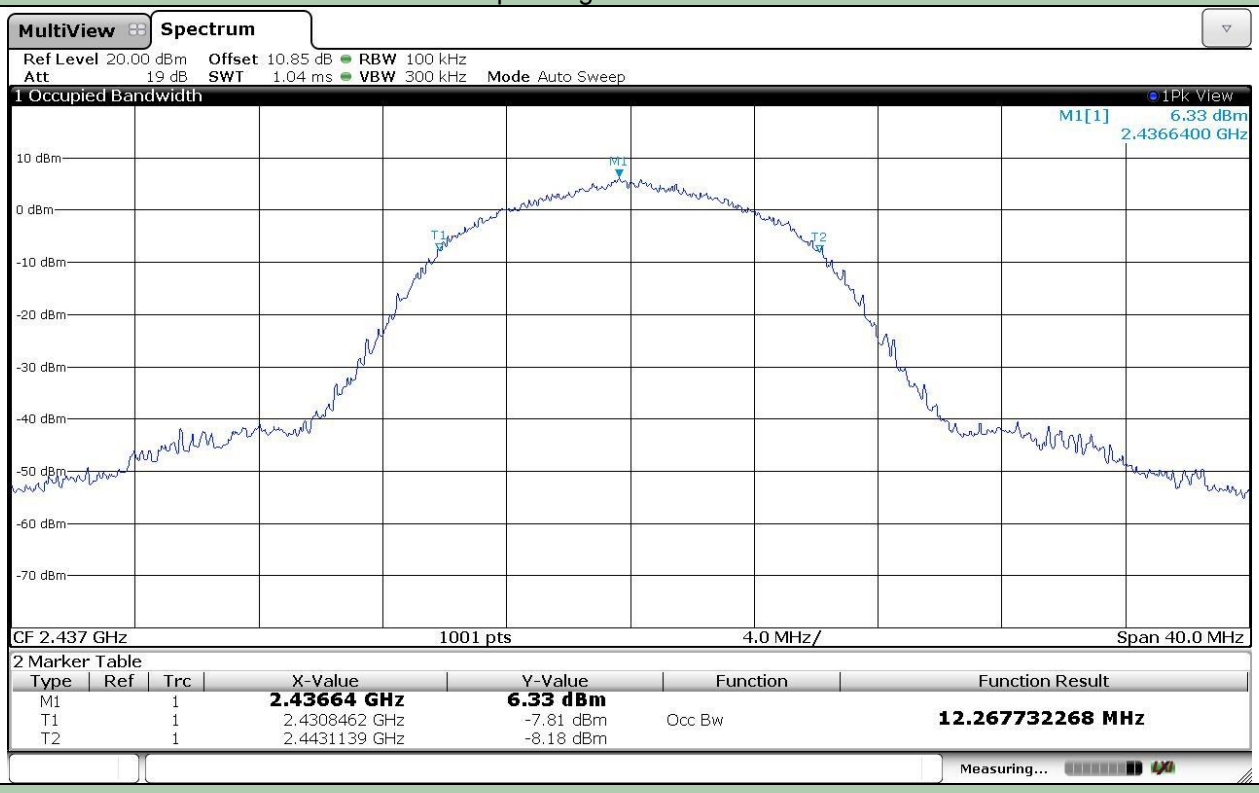
5.2.3 Test Data

Test Date: Oct. 20, 2015		Tested by: S. M. Jang
Operating Mode: 802.11b		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 412	12.27
Middle	2 437	12.27
High	2 462	12.27
Operating Mode: 802.11g		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 412	16.62
Middle	2 437	16.66
High	2 462	16.66

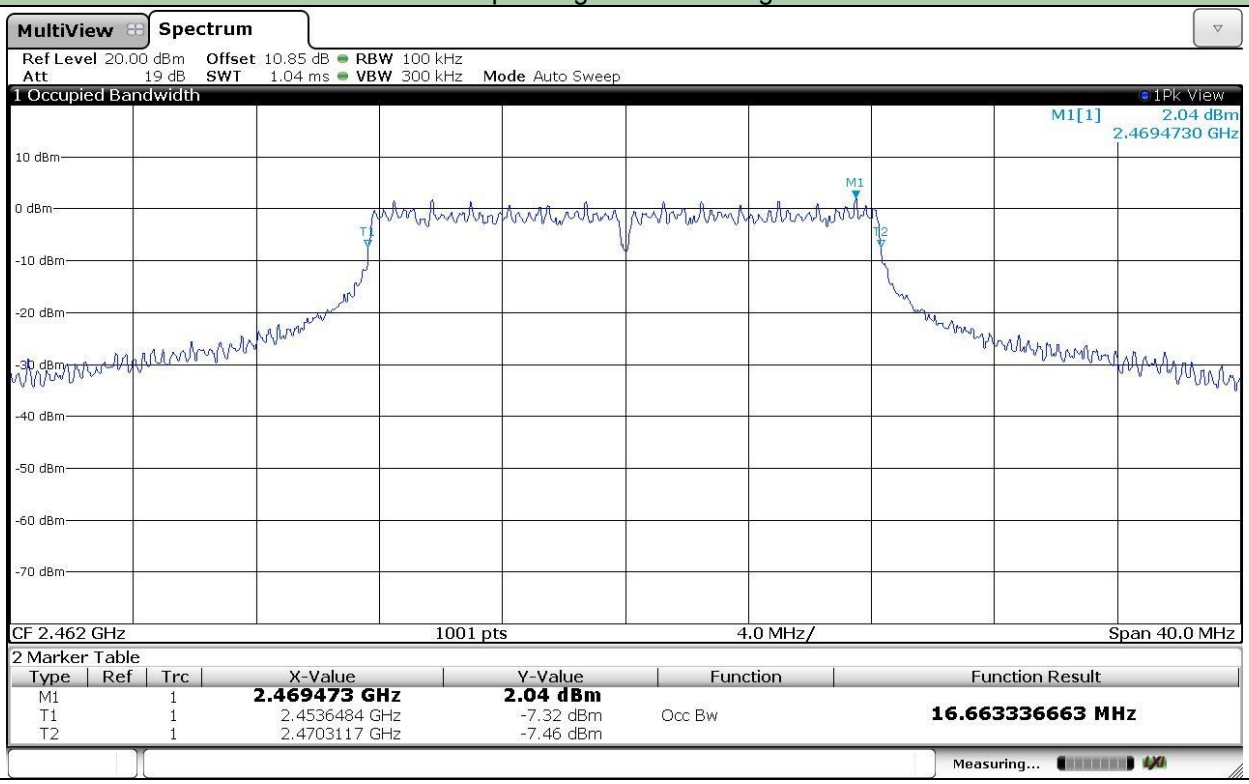
ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.2.4 Test Plots

Operating Mode: 802.11b



Operating Mode: 802.11g



5.3 Maximum Peak Output Power

5.3.1 Limit

Acc. to section 15.247, For system using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r03: 9.1.2 PKPM1 Peak power meter method.

The Antenna output of the EUT was connected to a peak power meter directly.

The cable assembly insertion loss of 10.85 dB(including 10 dB attenuator and 0.85 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

5.3.3 Test Data for Output Power

Test Date: Oct. 20, 2015			Tested by: S. M. Jang	
Operating Mode: 802.11b				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2412	16.34	30	13.66
Middle	2437	16.30		13.70
High	2462	16.21		13.79
Operating Mode: 802.11g				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2412	20.01	30	9.99
Middle	2437	19.74		10.26
High	2462	19.53		10.47

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.4 Peak Power Spectral Density

5.4.1 Limit

Acc. to section 15.247, the power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.4.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r03: 10.2 Method PKPSD (peak PSD).

The transmitter output is connected to a spectrum analyzer with the RBW set from 3 kHz to 100 kHz, VBW ≥ 3 X RBW, peak detector and max hold.

5.4.3 Test Data

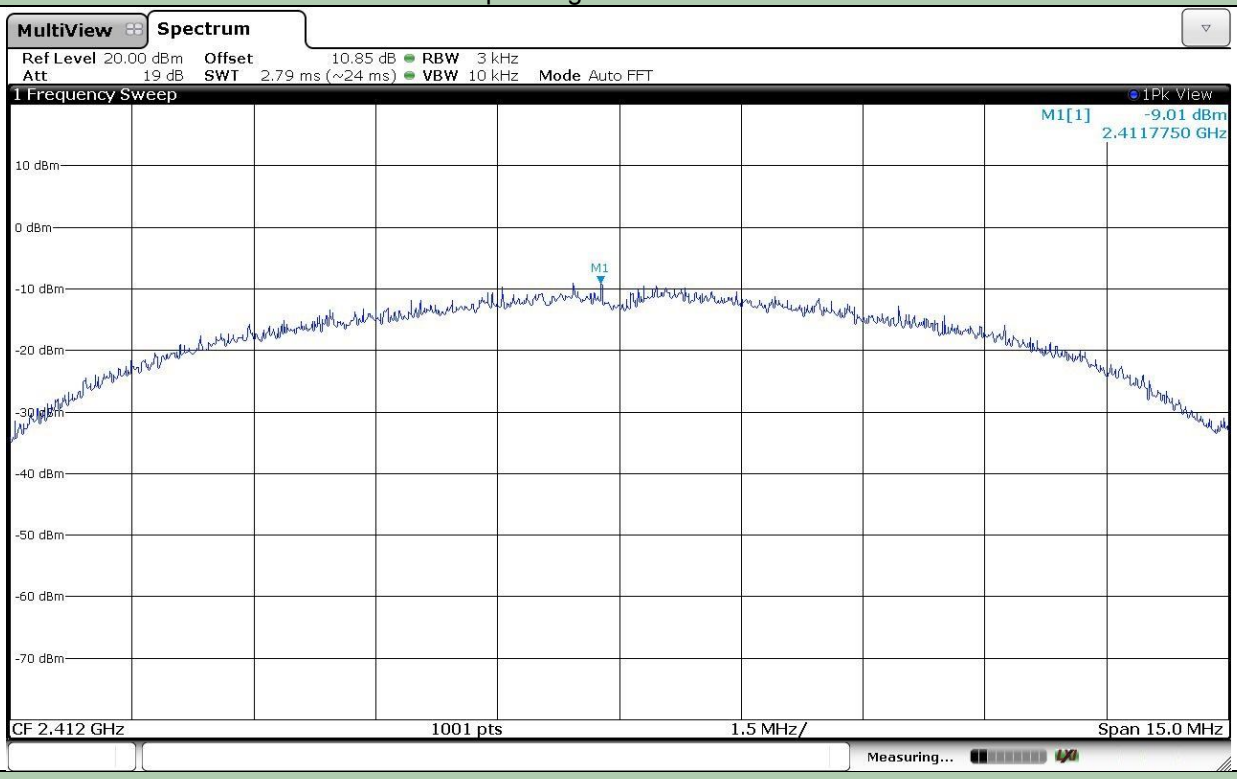
Test Date: Oct. 20, 2015			Tested by: S. M. Jang	
Operating Mode: 802.11b				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-9.01	8	17.01
Middle	2437	-8.46		16.46
High	2462	-8.54		16.54
Operating Mode: 802.11g				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-12.94	8	20.94
Middle	2437	-12.76		20.76
High	2462	-13.11		21.11

Remark. Margin = Limit – Measured Value

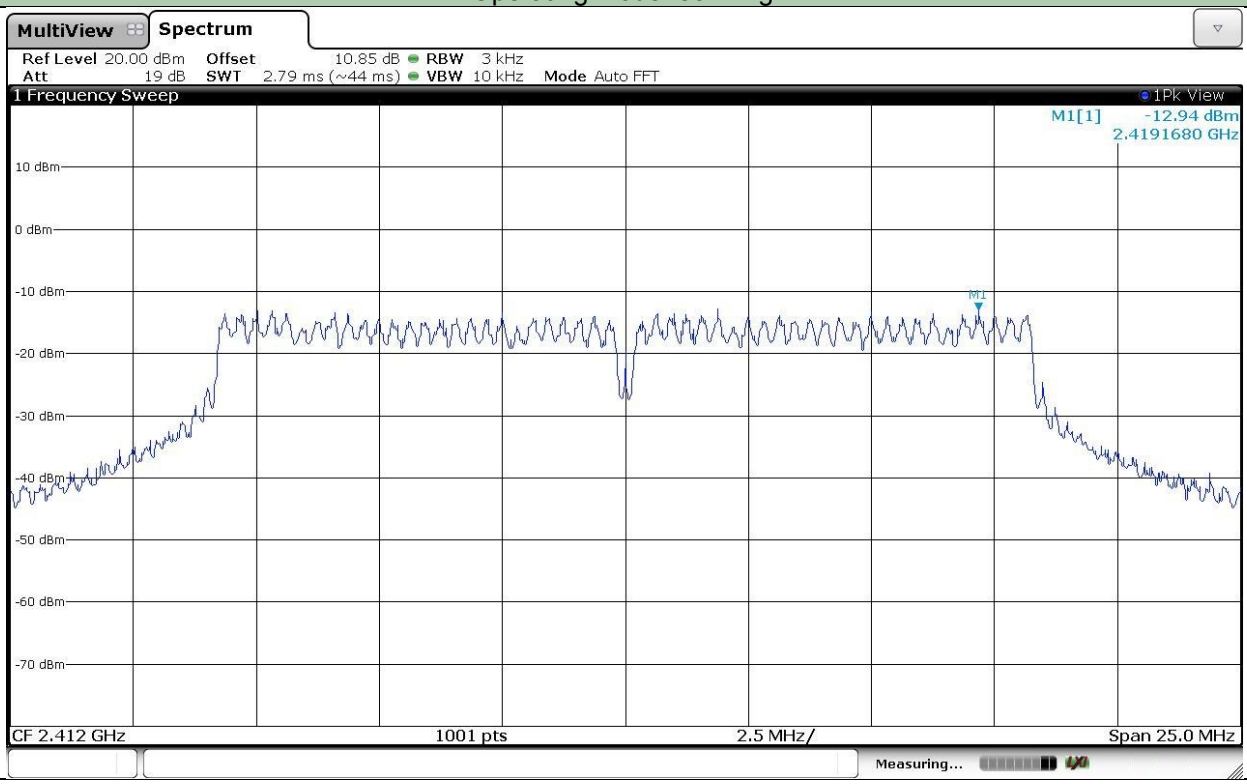
ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.4.4 Test Plots

Operating Mode: 802.11b



Operating Mode: 802.11g



5.5 Out of Band Emission

5.5.1 Limit

Acc. to section 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in 15.209(a) is not required.

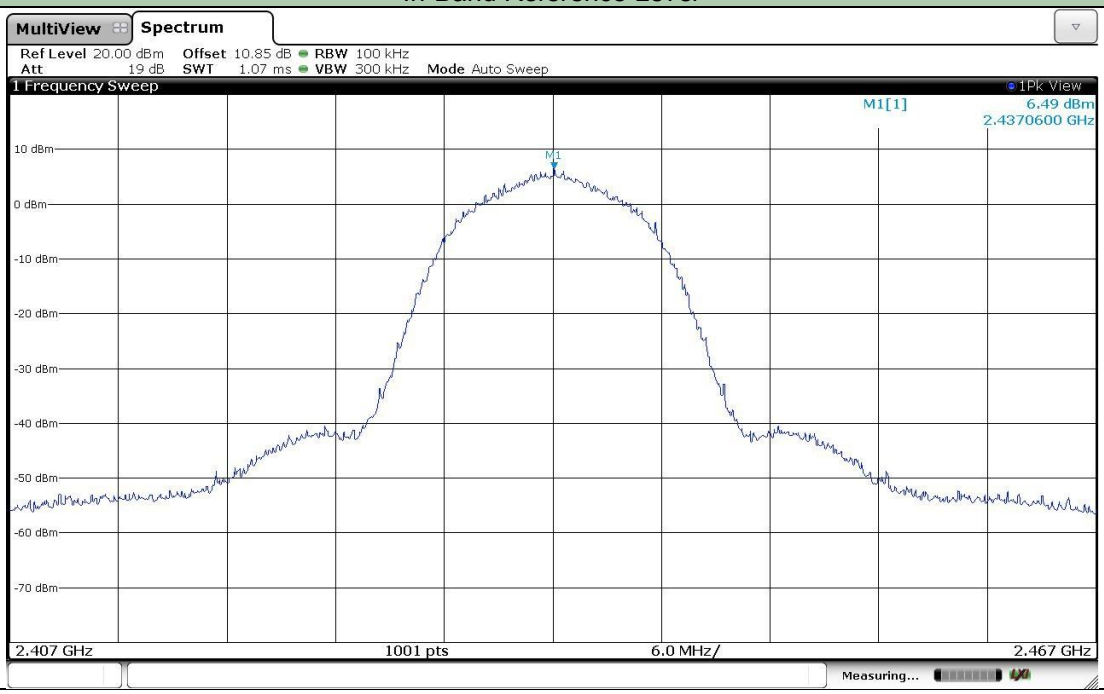
5.5.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r03: 11.0 Emissions in non-restricted frequency bands. The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, VBW ≥ 3 X RBW, peak detector and max hold. Measurements utilizing these settings are made of the in-band reference level, bandedge (where measurements to the general radiated limits will not be made) and out-of-band emissions.

5.5.3 Test Data

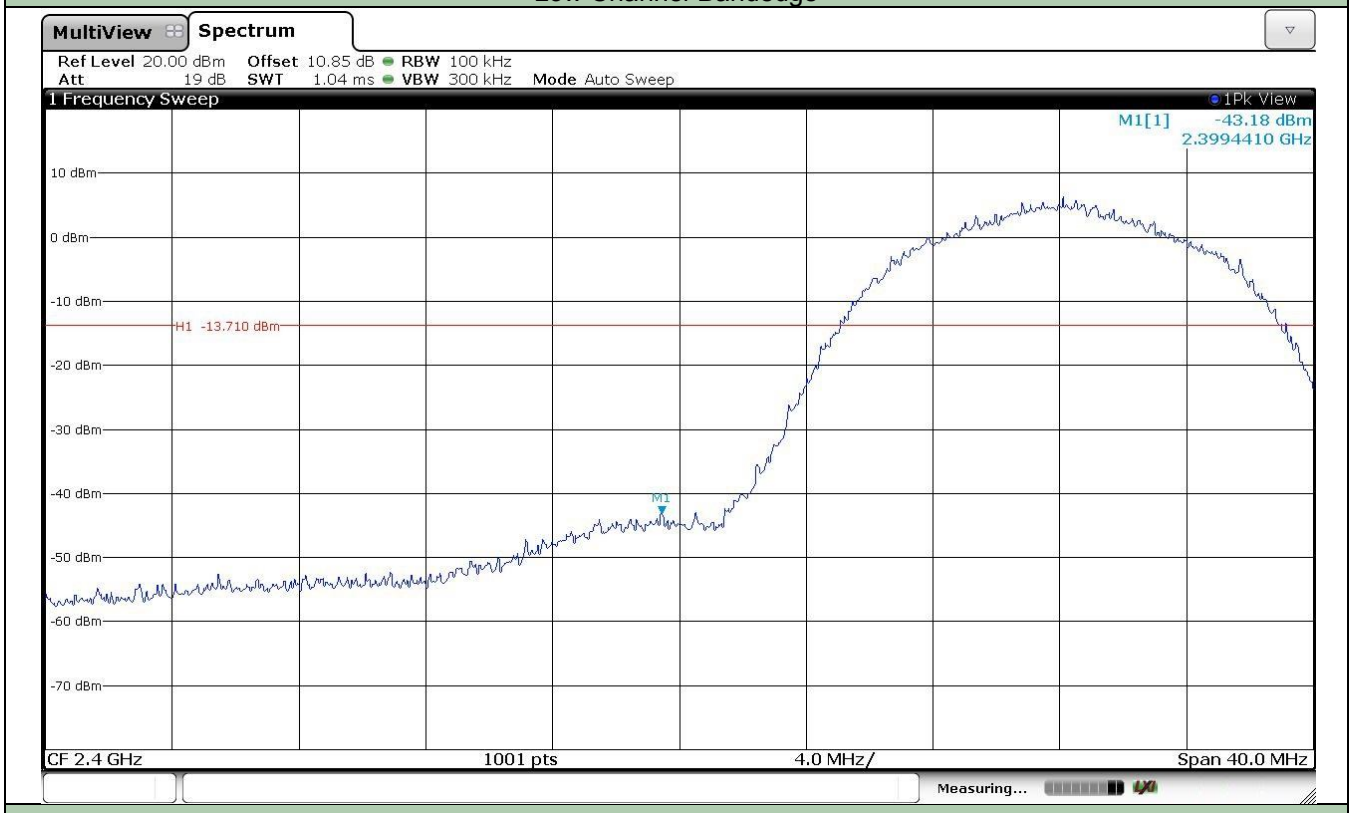
5.5.3.1 Operating Mode: 802.11b

Test Date: Oct. 20, 2015	Tested by: S. M. Jang
In-Band Reference Level	

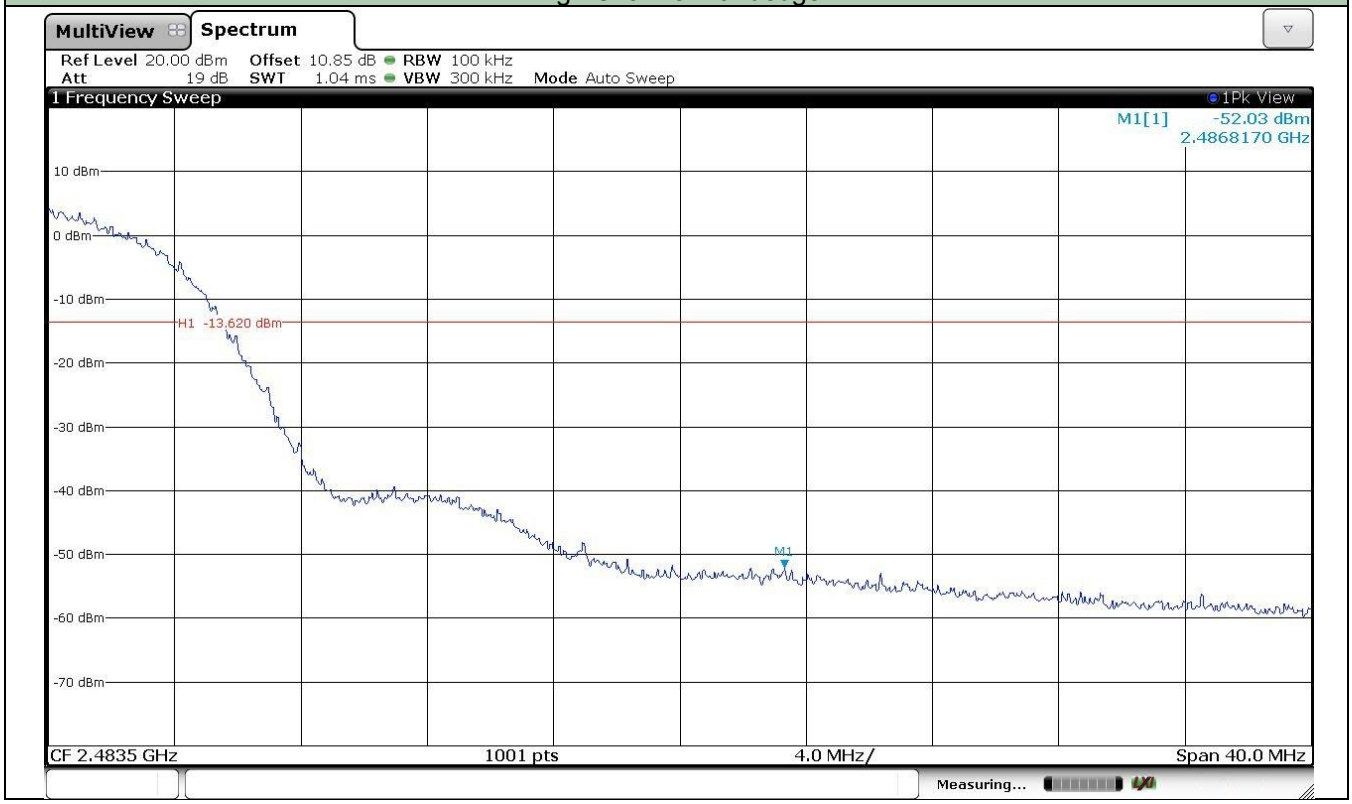


ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

Low Channel Bandedge

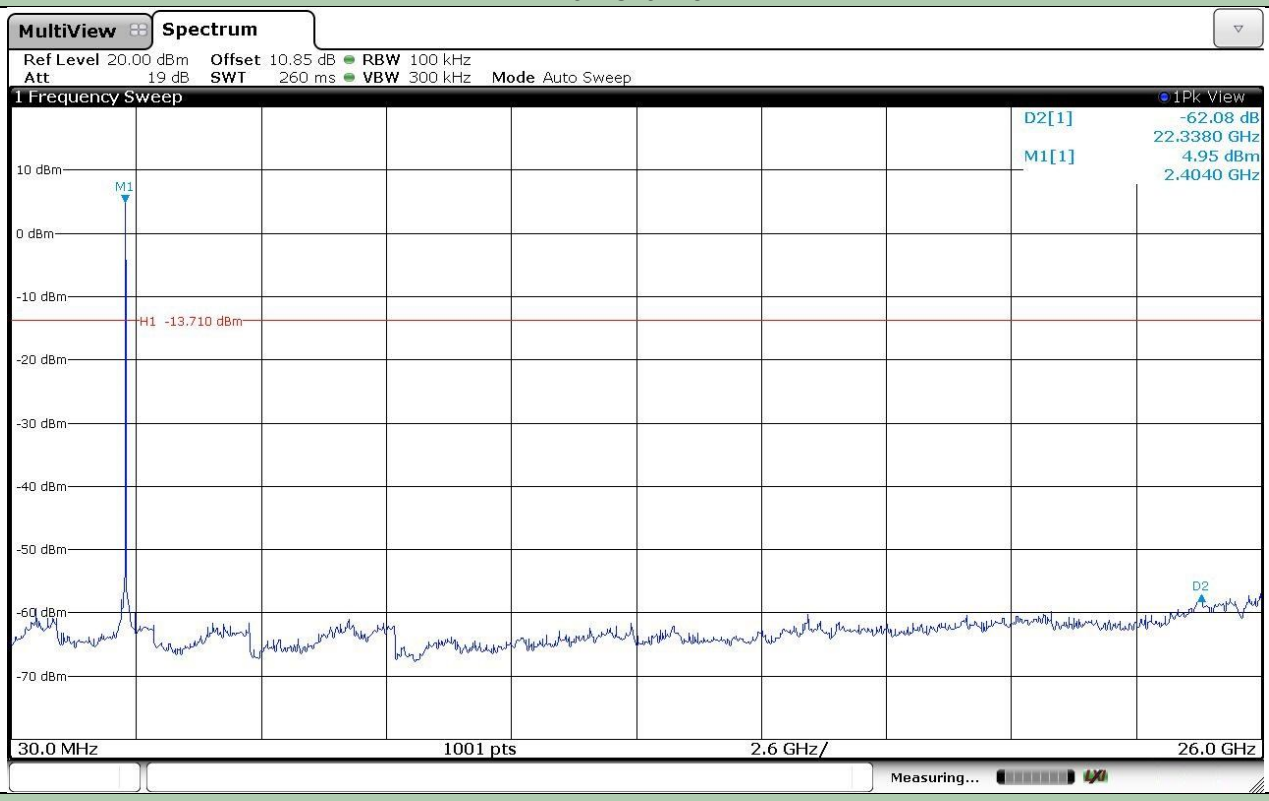


High Channel Bandedge

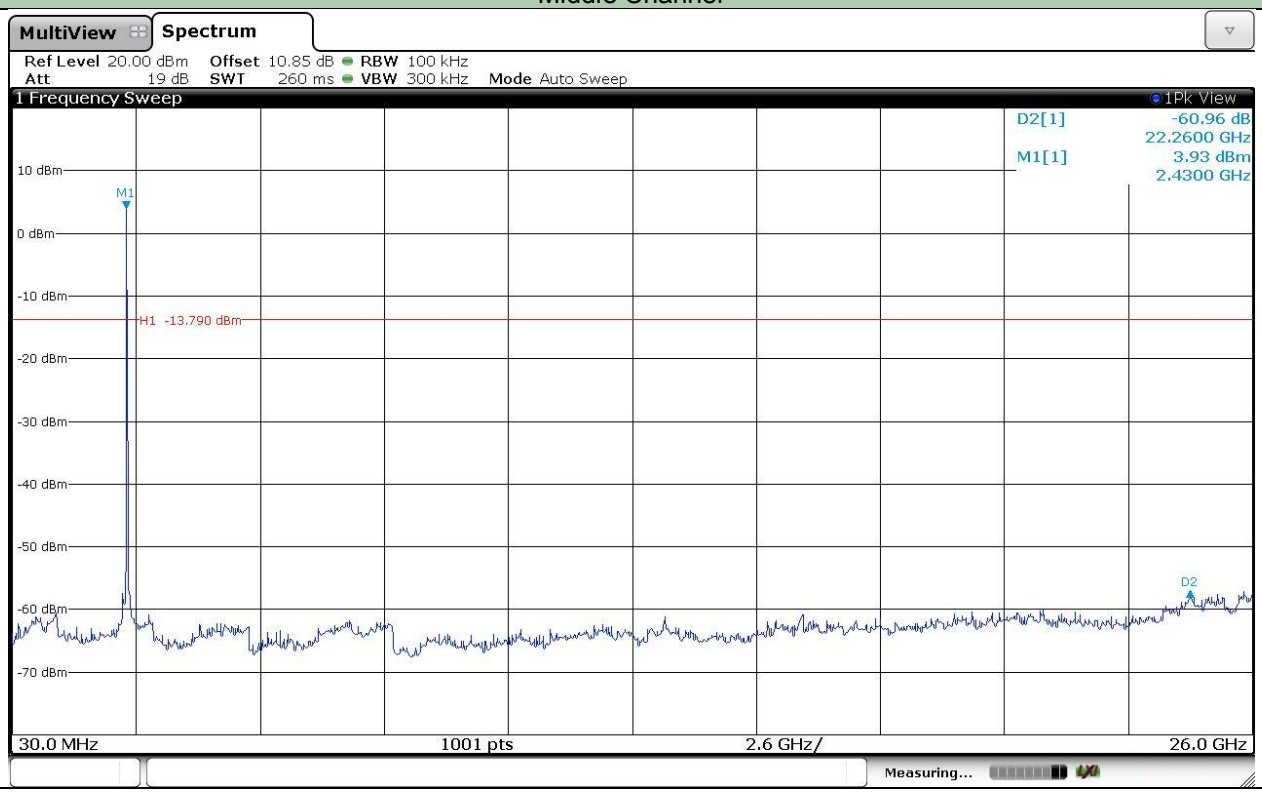


Out of Band Emission

Low Channel

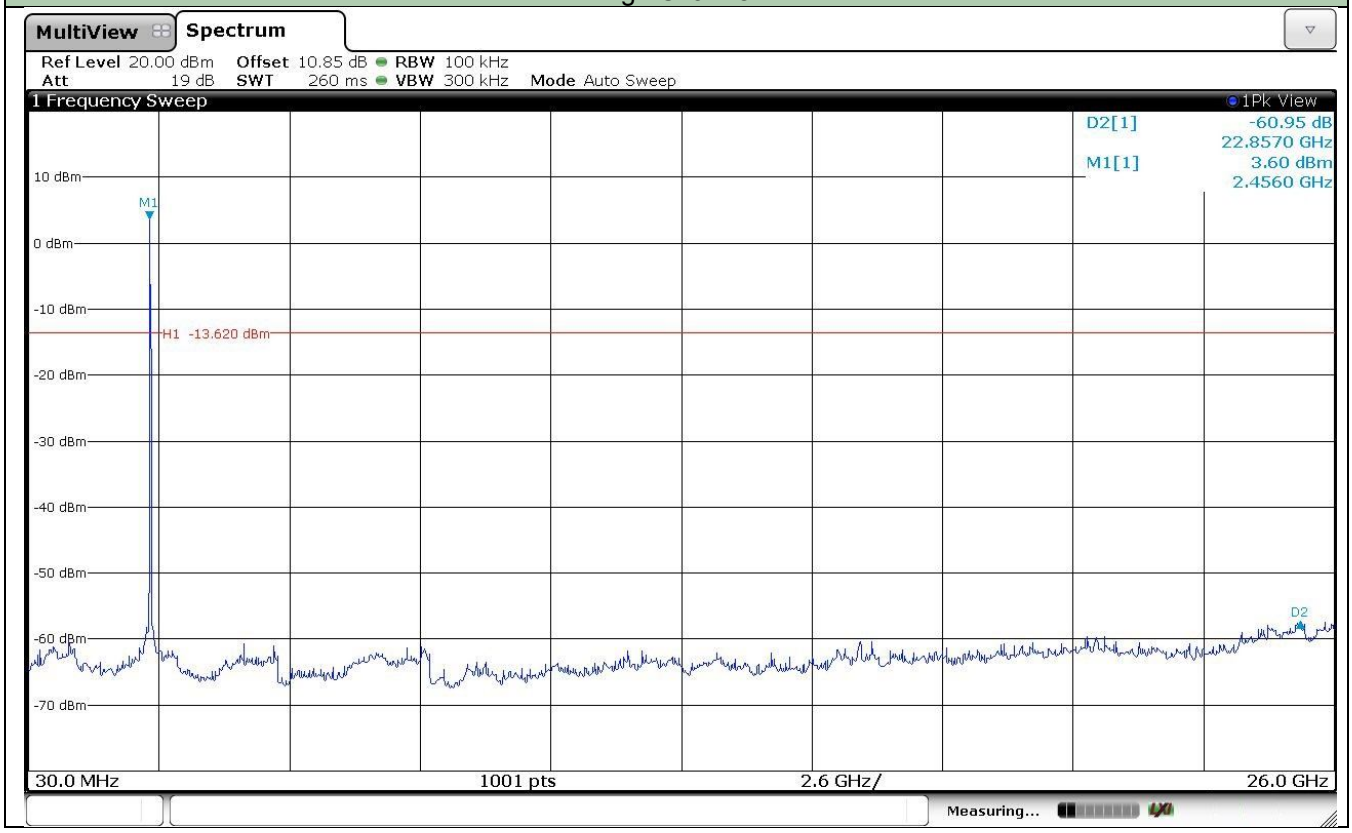


Middle Channel



Out of Band Emission

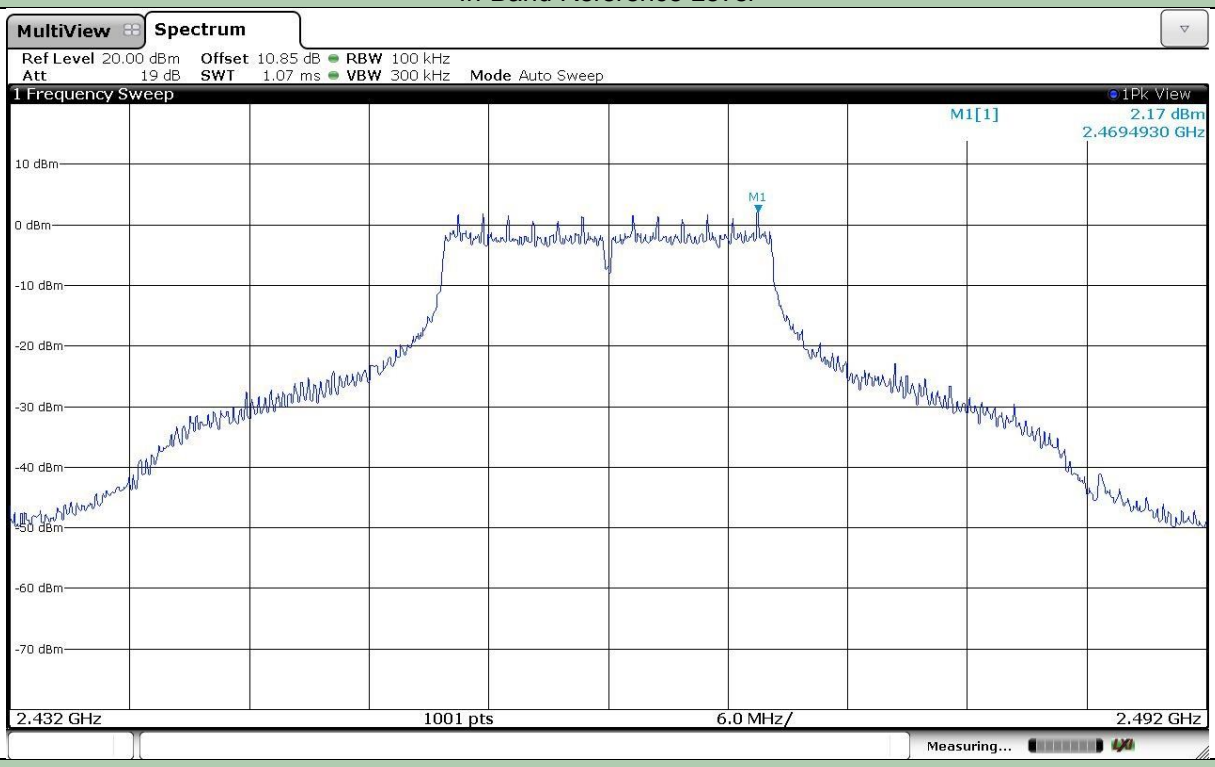
High Channel



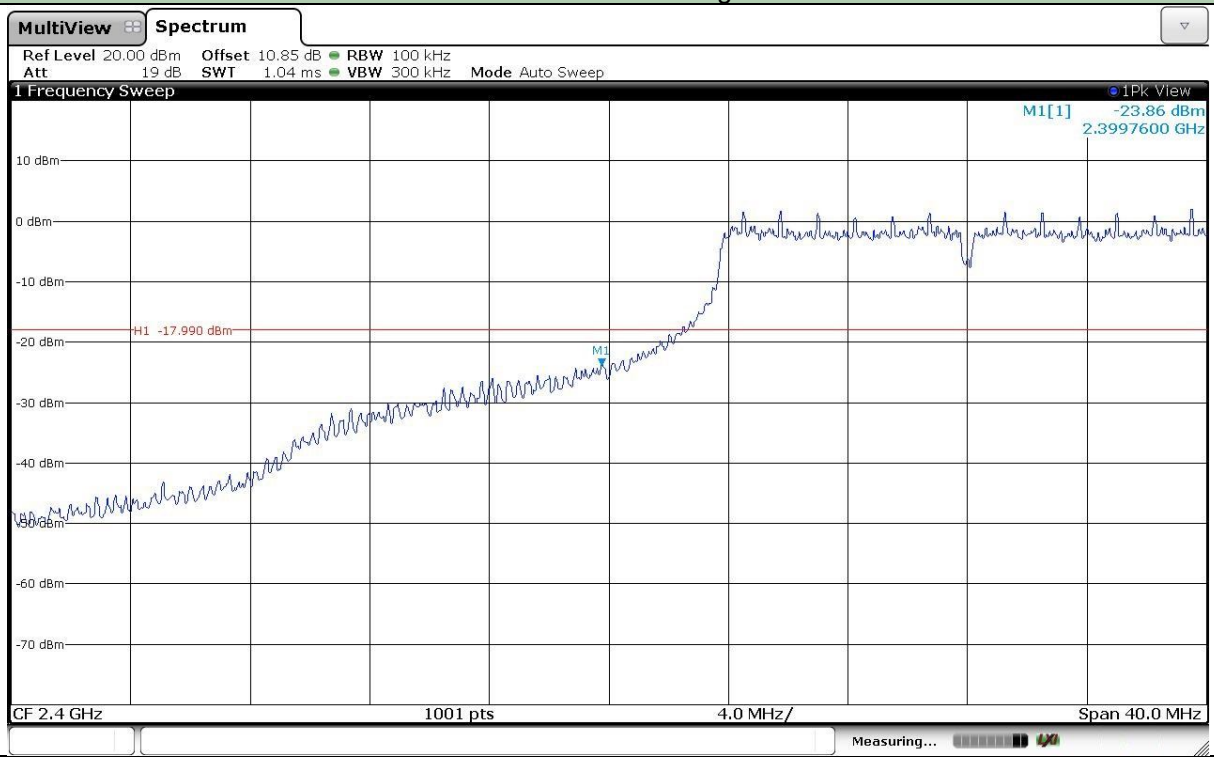
5.5.3.2 Operating Mode: 802.11g

Test Date: Oct. 20, 2015	Tested by: S. M. Jang

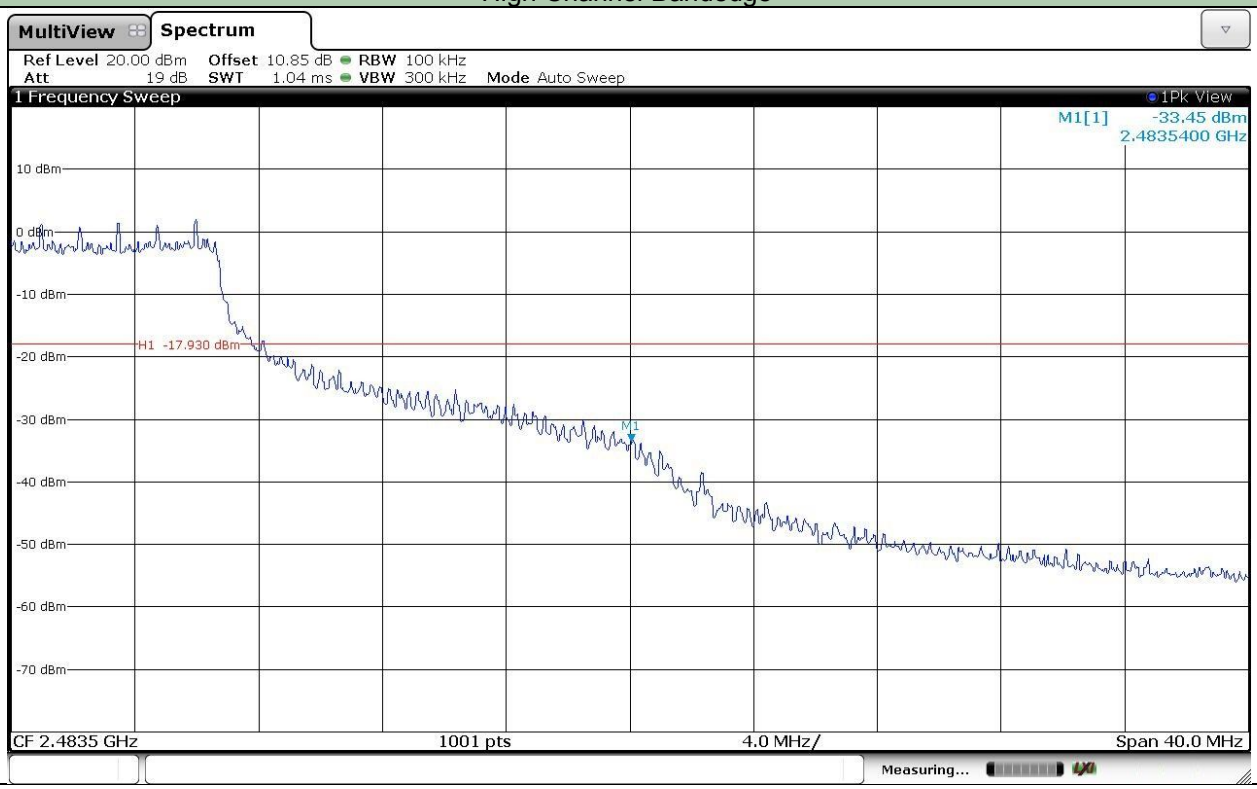
In-Band Reference Level



Low Channel Bandedge

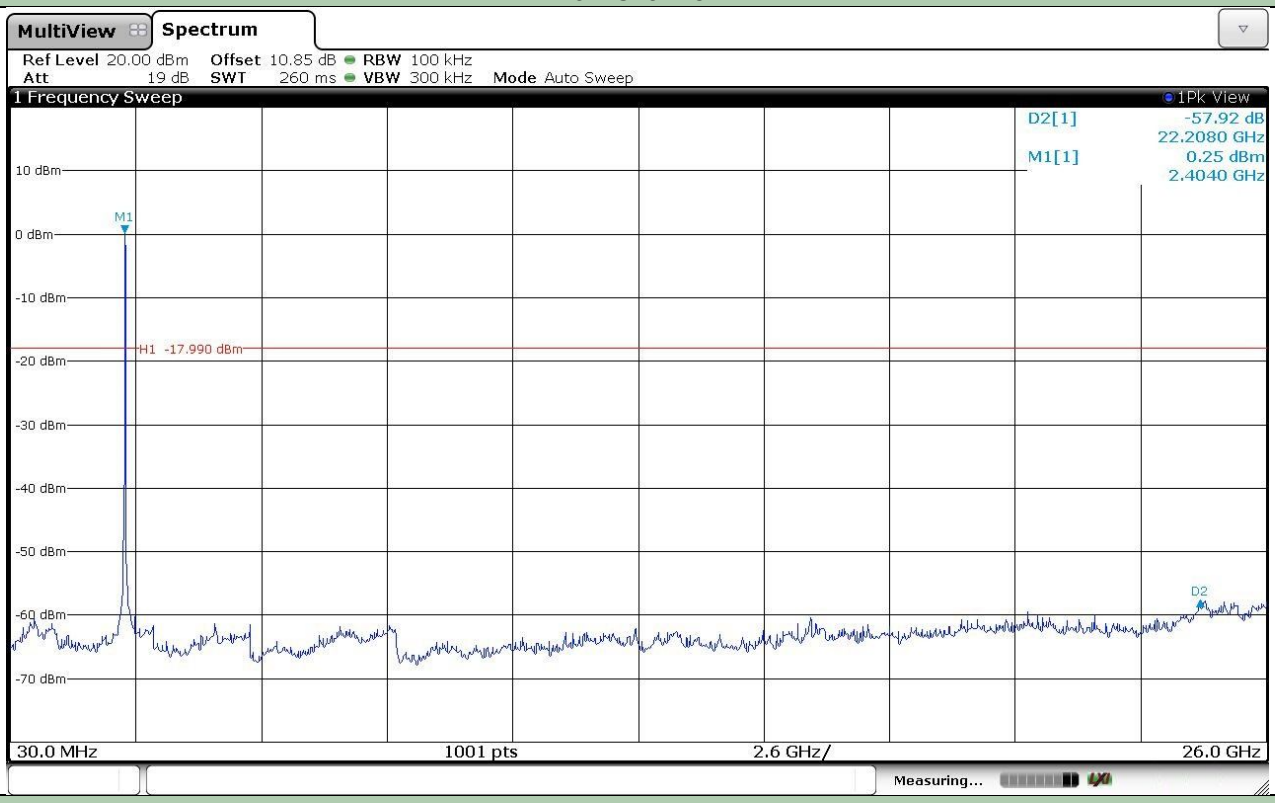


High Channel Bandedge

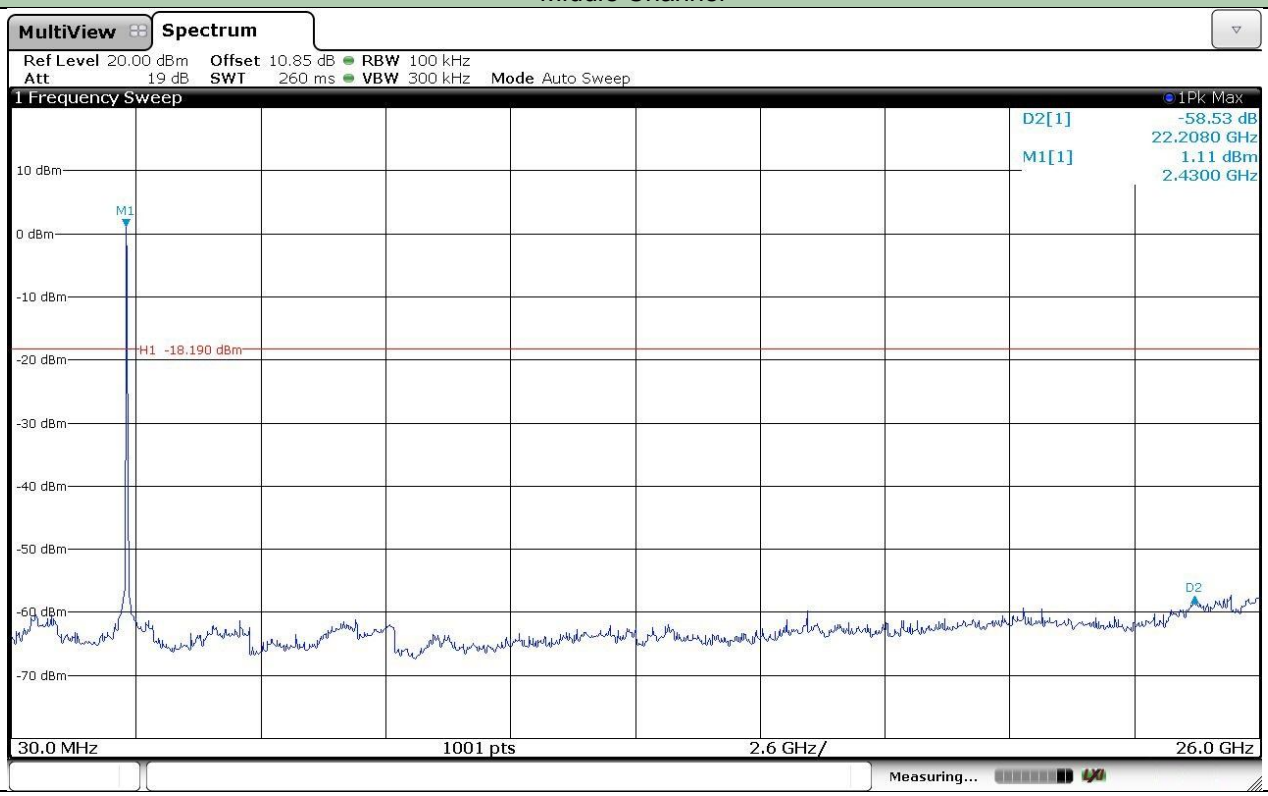


Out of Band Emission

Low Channel

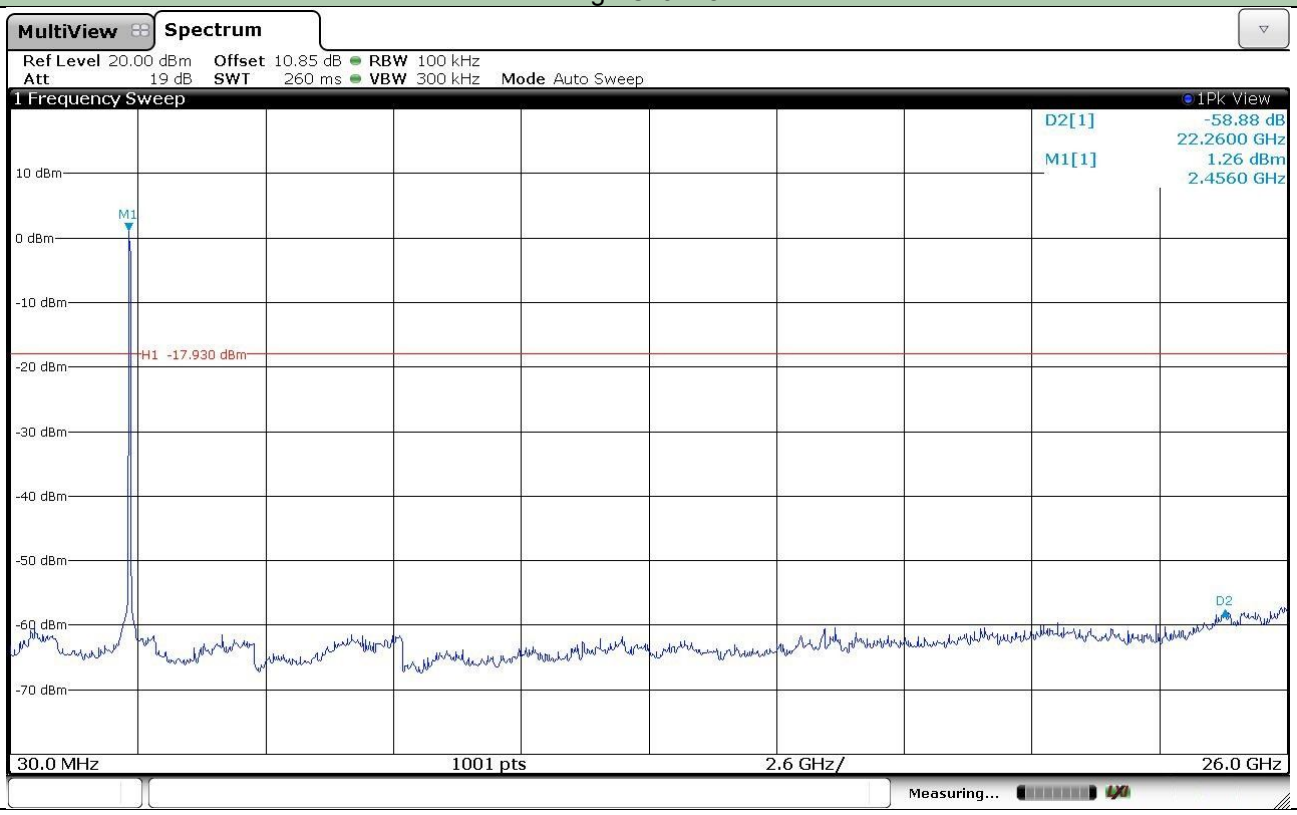


Middle Channel



Out of Band Emission

High Channel



ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942

TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.6 Radiated Emission

5.6.1 Limit

Acc. to section 15.205 and 15.209, following table shall be applied.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	24

5.6.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v03r03: 12.1 Radiated emission measurements.
The radiated emissions measurements were on 3 m, semi-anechoic chamber. The EUT and other support equipment were placed on a non-conductive table 80 cm above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.
The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

For measurement below 1 GHz, the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For peak emission measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz and for average measurement, resolution bandwidth is set to 1 MHz; and the video bandwidth is set to 10 Hz, when duty cycle is more than 98 %. If duty cycle is less than 98 %, the video bandwidth is set to ≥ 1/T, where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

5.6.3 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus. The measurement uncertainties are given with at least 95 % confidence.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 30 MHz	± 3.2 dB	30 MHz ~ 1 GHz	± 3.8 dB
1 GHz ~ 18 GHz	± 4.9 dB	18 GHz ~ 40 GHz	± 5.1 dB

5.6.4 Test Data above 1 GHz

Test Date: Oct. 20, 2015	Tested by: S. M. Jang

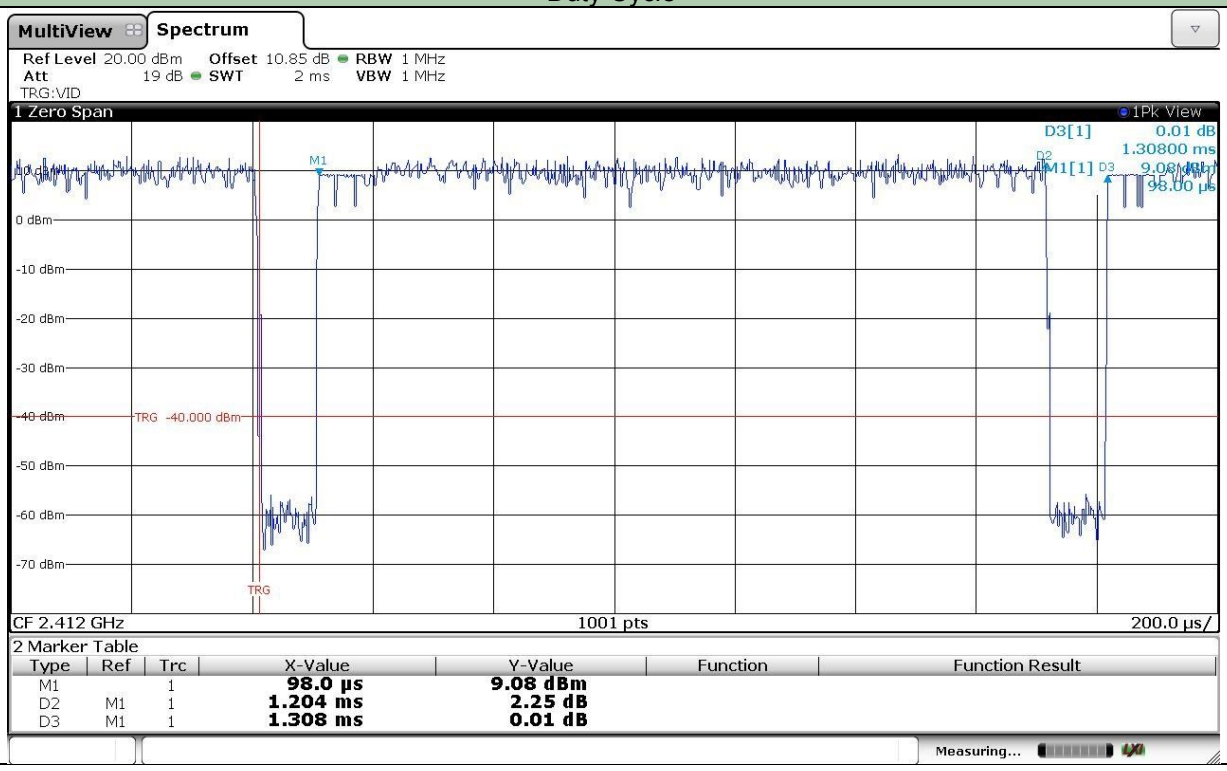
5.6.4.1 Operating Mode: 802.11b

5.6.4.1.1 Duty Cycle

Operating Mode	On Time (ms)	On + Off Time (ms)	Duty Cycle (%)	Duty Factor
802.11b	1.204	1.308	92	0.36
T (ms)	1/T(kHz)	VBW Setting		
1.204	0.830 56	1 kHz		

5.6.4.1.1.1 Test Plot for Duty Cycle

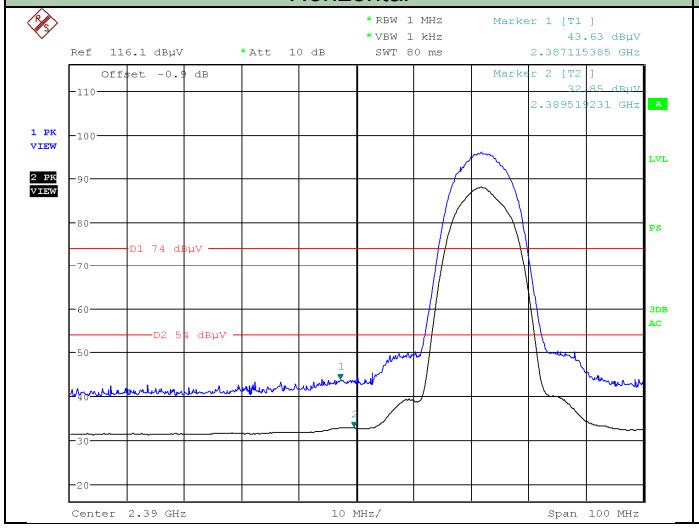
Duty Cycle



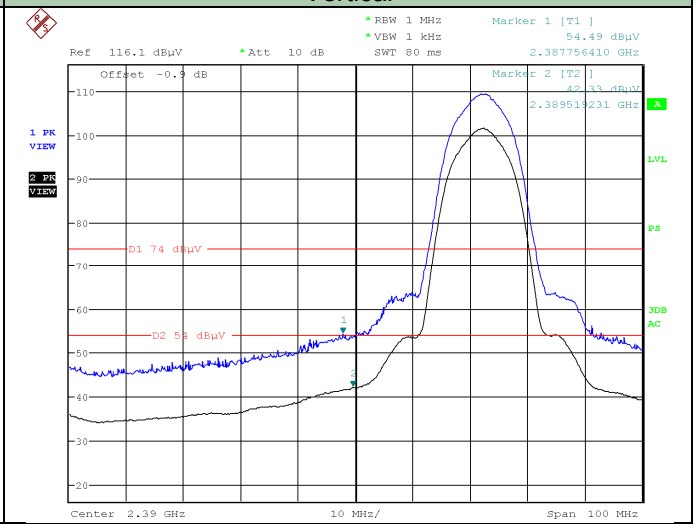
5.6.4.1.2 Test Data for Band edge(Restricted band) @ 3 m

Graphical Test Data _ Low Channel

Horizontal



Vertical



Tabulated Test Data

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
2 387.1	44.43	Peak	H	28.8	29.6	43.63	74	30.4	150	260
2 389.5	33.65	Average	H	28.8	29.6	32.85	54	21.2	150	260
2 387.7	55.29	Peak	V	28.8	29.6	54.49	74	19.5	150	310
2 389.5	43.13	Average	V	28.8	29.6	42.33	54	11.7	150	310

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

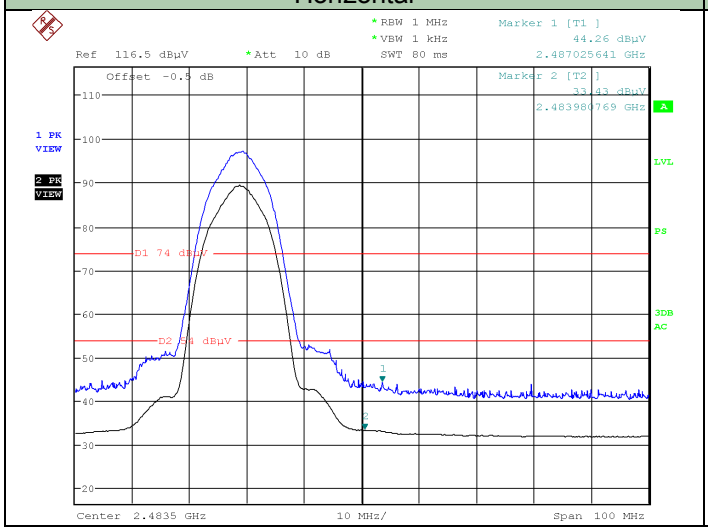
Margin = Limit - Result

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)

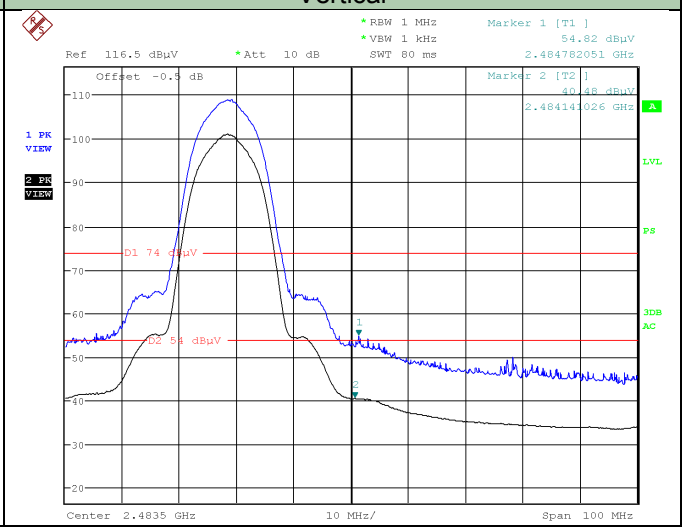
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

Graphical Test Data _ High Channel

Horizontal



Vertical



Tabulated Test Data

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
2 487.0	44.06	Peak	H	29.8	29.6	44.26	74	29.7	150	230
2 483.9	33.23	Average	H	29.8	29.6	33.43	54	20.6	150	230
2 484.7	54.62	Peak	V	29.8	29.6	54.82	74	19.2	150	310
2 484.1	40.28	Average	V	29.8	29.6	40.48	54	13.5	150	310

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942

TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.6.4.1.3 Test Data for Harmonic & Spurious emission

5.6.4.1.3.1 Low Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
*2 333.2	48.3	Peak	H	28.6	29.8	47.1	74	26.9	100	0
*2389.7	55.2	Peak	V	28.8	29.7	54.3	74	19.7	100	67
*2389.7	32.8	Ave.	V	28.8	29.7	31.9	54	22.1	100	67
3 754	43.6	Peak	H	32.8	28.6	47.8	74	26.2	100	0
4 162	42.7	Peak	V	33.5	28.3	47.9	74	26.1	100	0
Emission was scanned up to 26 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit										

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Band edge(Restricted band)

5.6.4.1.3.2 Middle Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
3 618	43.9	Peak	H	32.3	28.8	47.4	74	26.6	100	181
4 808	43.3	Peak	V	34.1	27.6	49.8	74	24.2	100	114
Emission was scanned up to 26 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit										

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Band edge(Restricted band).

5.6.4.1.3.3 High Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
*2 486.6	51.8	Peak	V	29.2	29.7	51.3	74	22.7	100	359
*2 486.6	29.3	Ave	V	29.2	29.7	28.8	54	25.2	100	359
*2 487.0	45.5	Peak	H	29.2	29.7	45.0	74	29.0	100	87
4 400	42.8	Peak	H	33.7	28.0	48.5	74	25.5	100	359
5 434	41.1	Peak	V	32.6	26.4	49.0	74	25.0	100	0
Emission was scanned up to 26 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit										

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Band edge(Restricted band).

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942

TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

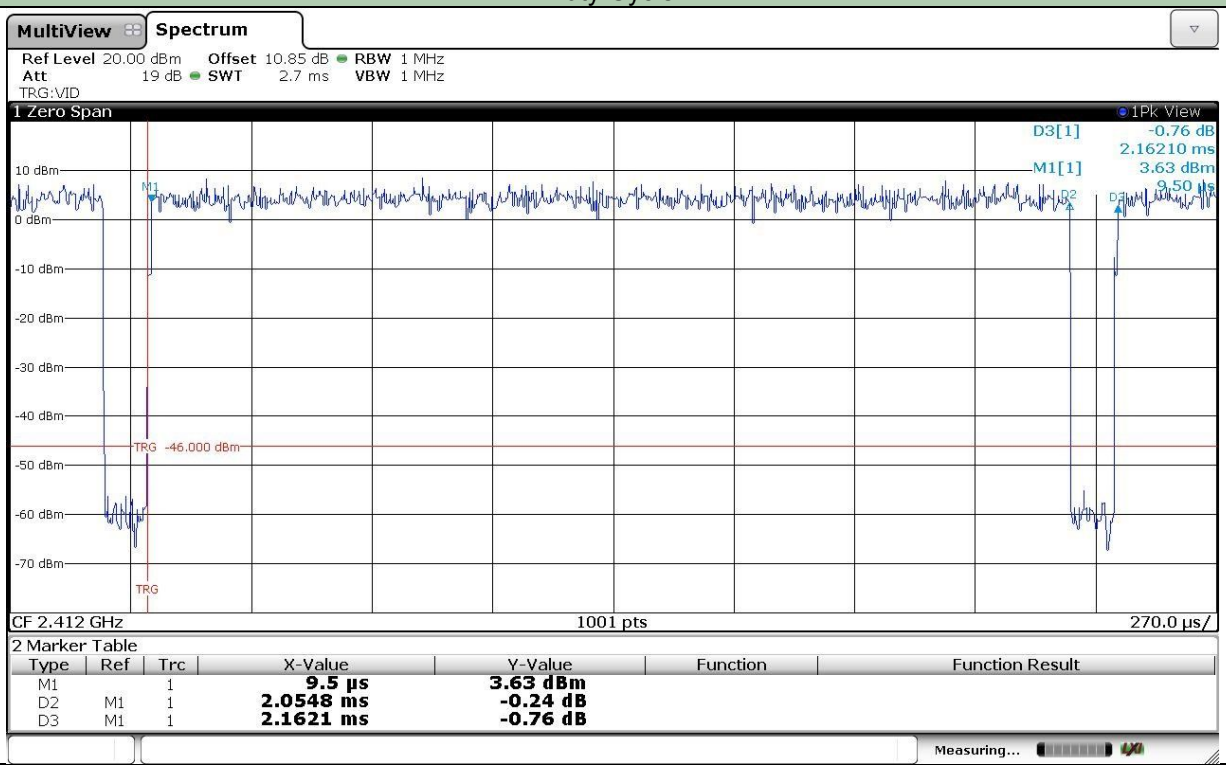
5.6.4.2 Operating Mode: 802.11g

5.6.4.2.1 Duty Cycle

Operating Mode	On Time (ms)	On + Off Time (ms)	Duty Cycle (%)	Duty Factor
802.11g	2.055	2.162	95	0.22
T (ms)	1/T(kHz)	VBW Setting		
2.055	0.486 61	1 kHz		

5.6.4.2.1.1 Test Plot for Duty Cycle

Duty Cycle

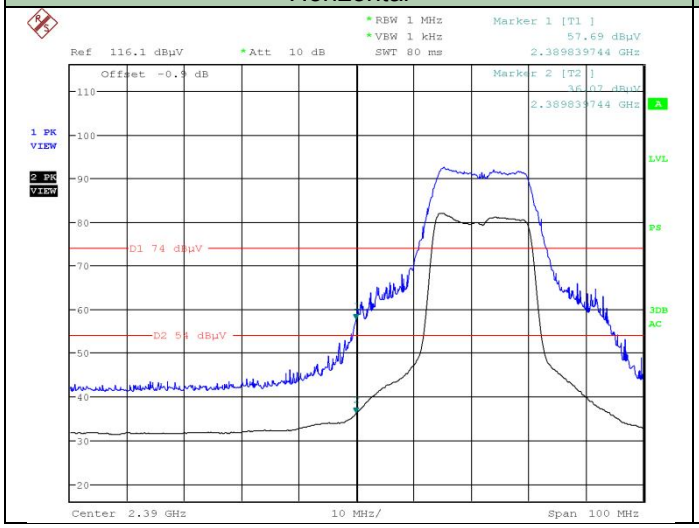


ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

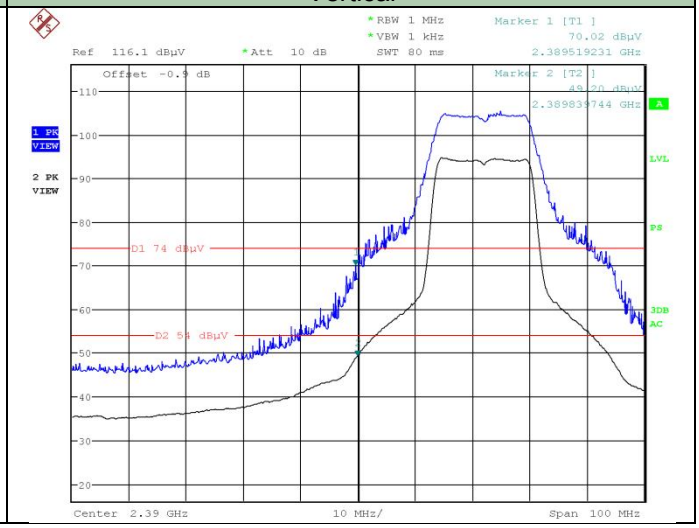
5.6.4.2.2 Test Data for Band edge(Restricted Band) @ 3 m

Graphical Test Data _ Low Channel

Horizontal



Vertical



Tabulated Test Data

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
2 389.8	58.49	Peak	H	28.8	29.6	57.69	74	16.3	150	260
2 389.8	36.87	Average	H	28.8	29.6	36.07	54	17.9	150	260
2 389.5	70.82	Peak	V	28.8	29.6	70.02	74	4.0	150	310
2 389.8	50.00	Average	V	28.8	29.6	49.20	54	4.8	150	310

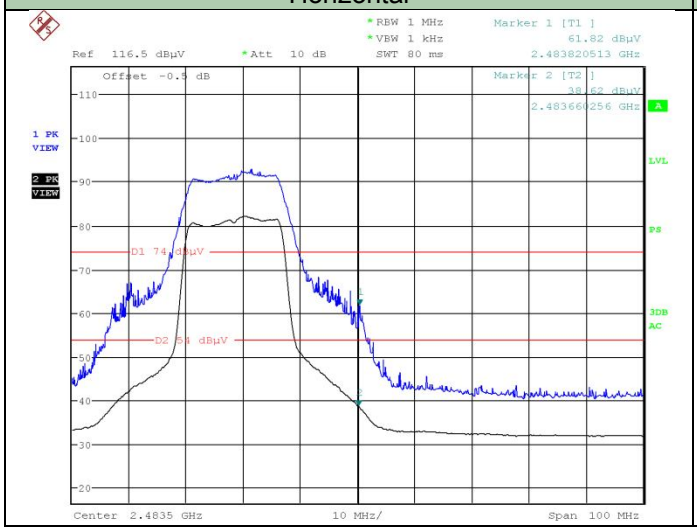
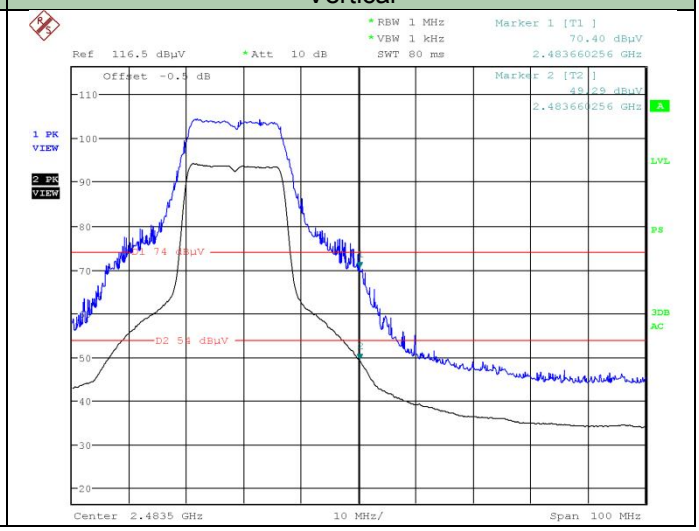
Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

Graphical Test Data _ High Channel

Horizontal	Vertical
	

Tabulated Test Data

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
2 483.8	61.62	Peak	H	29.8	29.6	61.82	74	12.2	150	260
2 483.6	38.42	Average	H	29.8	29.6	38.62	54	15.4	150	260
2 483.6	70.20	Peak	V	29.8	29.6	70.40	74	3.6	150	310
2 483.6	49.09	Average	V	29.8	29.6	49.29	54	4.7	150	310

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

5.6.4.2.3 Test Data for Harmonic & Spurious Emission

5.5.4.2.3.1 Low Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
*2 389.8	60.0	Peak	H	28.8	29.7	0	59.1	74	14.9	100	94
*2 389.8	35.2	Ave	H	28.8	29.7	0.22	34.52	54	19.48	100	94
*2 389.8	67.4	Peak	V	28.8	29.7	0	66.5	74	7.5	100	359
*2 389.8	40.5	Ave	V	28.8	29.7	0.22	39.82	54	14.18	100	359
4 400	43.1	Peak	H	32.7	28.0	0	48.8	74	25.2	100	0
6 253	41.9	Peak	V	34.8	25.8	0	50.9	74	23.1	100	0

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Band edge(Restricted band).

5.5.4.2.3.2 Middle Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
4 077	42.6	Peak	H	33.2	28.5	0	47.3	74	26.7	100	137
4 808	43.7	Peak	V	34.1	27.6	0	50.2	74	23.8	100	0
Emission was scanned up to 26 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit											

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Band edge(Restricted band).

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.5.4.2.3.3 High Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
*2 483.8	63.4	Peak	H	29.2	29.7	0	62.9	74	11.1	100	95
*2 483.8	32.7	Ave	H	29.2	29.7	0.22	32.42	54	21.58	100	95
*2 483.6	68.4	Peak	V	29.2	29.7	0	68.12	74	6.1	100	359
*2 483.6	40.3	Ave	V	29.2	29.7	0.22	40.02	54	13.98	100	359
3 856	43.5	Peak	H	33.0	28.6	0	47.9	74	26.1	100	301
4 383	43.2	Peak	V	33.7	28.8	0	48.9	74	25.1	100	359
Emission was scanned up to 26 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit											

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

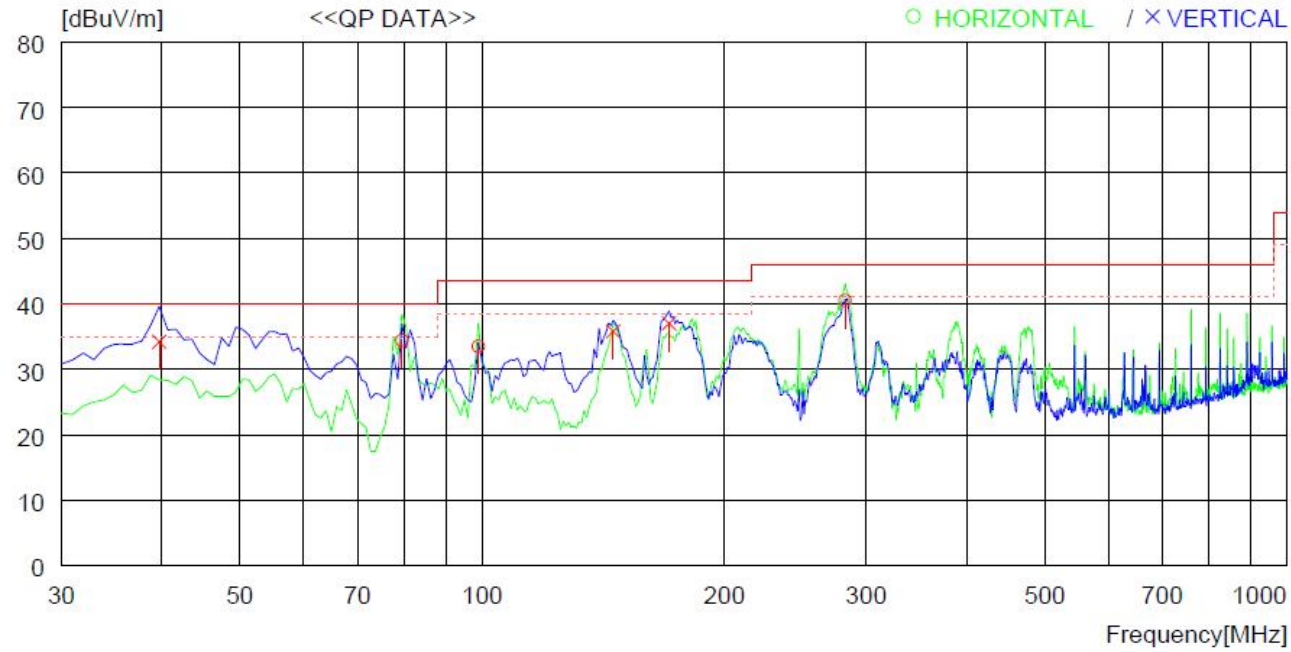
Margin = Limit - Result

"*" indicates frequency in Band edge(Restricted band).

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)

TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.6.4.3 Test Data below 1 GHz



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	79.470	51.1	8.4	7.6	32.7	34.4	40.0	5.6	200	206
2	98.870	46.3	12.1	7.8	32.7	33.5	43.5	10.0	300	0
3	282.200	50.7	12.8	9.5	32.5	40.5	46.0	5.5	100	245
----- Vertical ------										
4	39.700	46.3	13.4	7.2	32.7	34.2	40.0	5.8	100	137
5	145.430	51.7	8.4	8.4	32.7	35.8	43.5	7.7	100	0
6	170.650	51.9	9.2	8.5	32.6	37.0	43.5	6.5	100	261

5.6.4.3.1 Sample Calculated Example

At 80 MHz Limit = 40.0 dBuV/m

Result =Receiver reading value + Antenna Factor + Cable Loss - Pre-amplifier gain = 30 dBuV/m

Margin = Limit - Result = 40 - 30 = 10 so the EUT has 10.0 dB margin at 80 MHz

ENG Co., Ltd. 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea 464-942 Report Form_01 (Rev.0)
TEL: +82-31-727-8300 FAX: +82-31-746-0800 http://www.the-eng.co.kr

5.7 AC Power Line Conducted Emission

5.7.1 Limit

Acc. to section 15.207 (a), following table shall be applied.

Frequency Range (MHz)	Quasi-Peak (dBuV)	Average (dBuV)
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 -30	60	50

5.7.2 Method of Measurement

The EUT was placed on a wooden table, 0.8 m height above the horizontal ground plane and 40 cm from the vertical ground plane. 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.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

The test was performed for both Neutral and Hot lines.

5.7.3 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus. The measurement uncertainties are given with at least 95 % confidence.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 150 kHz	± 2.07 dB	150 kHz ~ 30 MHz	± 2.07 dB

5.7.4 Sample Calculated Example

At 5.31 MHz QP Limit = 60.0 dBuV

Correction Factor (C. Factor) of LISN, Pulse Limiter and cable loss at 5.31 MHz = 9.7 dB

Q.P Reading from the Test receiver = 20.8 dBuV

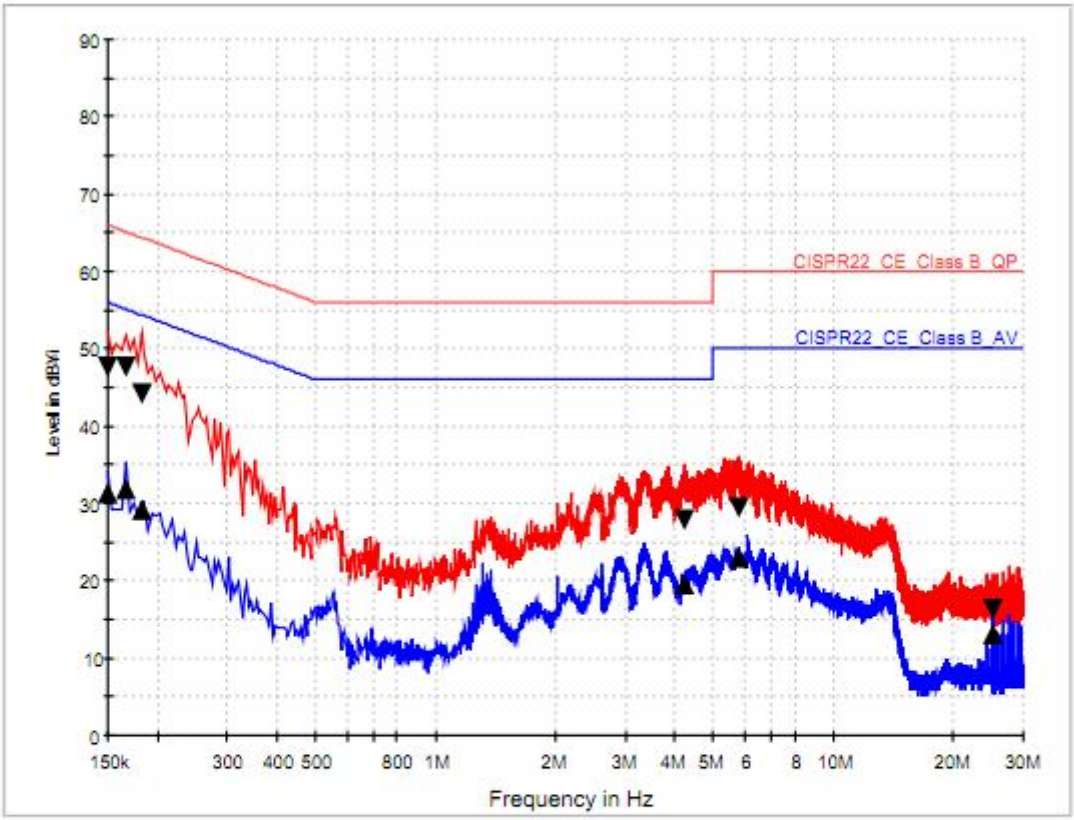
(Calculated value for system losses by software EMC32 manufactured by Rohde & Schwarz)

Therefore Q.P Margin = 60 - 20.8 = 39.2 so the EUT has 39.2 dB margin at 5.31 MHz

5.7.5 Worst Case Test Data

Test Date: Oct. 20, 2015	Tested by: S. M. Jang

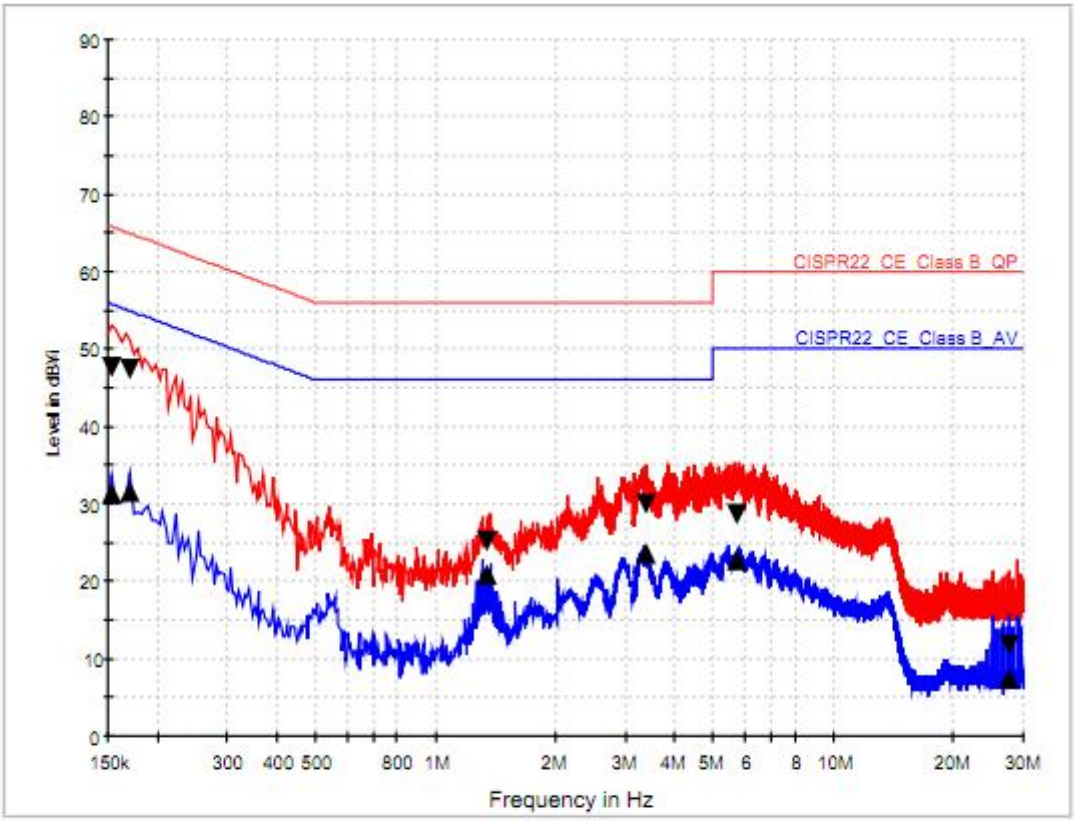
Hot Line



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBVi V)	CAverage (dBVi V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBVi V)	Margin - CAV (dB)	Limit - CAV (dBVi V)
0.150000	47.8	31.4	9.000	L1	9.6	18.2	66.0	24.6	56.0
0.166000	47.7	31.8	9.000	L1	9.6	17.4	65.2	23.3	55.2
0.182000	44.1	29.1	9.000	L1	9.6	20.3	64.4	25.3	54.4
4.218000	27.9	19.5	9.000	L1	9.7	28.1	56.0	26.5	46.0
5.758000	29.6	23.1	9.000	L1	9.7	30.4	60.0	26.9	50.0
25.062000	16.3	13.1	9.000	L1	10.0	43.7	60.0	36.9	50.0

Neutral Line



Limit and Margin1

Frequency (MHz)	QuasiPeak (dB¥i V)	CAverage (dB¥i V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dB¥i V)	Margin - CAV (dB)	Limit - CAV (dB¥i V)
0.154000	47.7	31.4	9.000	N	9.6	18.0	65.8	24.4	55.8
0.170000	47.5	31.7	9.000	N	9.6	17.5	65.0	23.3	55.0
1.342000	25.1	20.8	9.000	N	9.6	30.9	56.0	25.2	46.0
3.370000	30.0	23.7	9.000	N	9.7	26.0	56.0	22.3	46.0
5.722000	28.8	22.8	9.000	N	9.7	31.2	60.0	27.2	50.0
27.782000	11.8	7.5	9.000	N	10.1	48.2	60.0	42.5	50.0

Appendix I- Test Instrumentation

Description	Model No.	Serial No.	Manufacturer.	Due for Cal Date
TS8997 System				
Signal & Spectrum Analyzer	FSW 43	100578	Rohde & Schwarz	2016-05-06
Power Module	OSP 120	101389	Rohde & Schwarz	2016-05-06
Signal Generator	SMF100A	101441	Rohde & Schwarz	2016-05-06
Vector Signal Generator	SMBV100A	257560	Rohde & Schwarz	2016-05-06
DC Power Supply	E3610A	MY40005644	AGILENT	2016-05-06
Slidacs	DSD-1005	M06-117	Digitek Power	N/A
Attenuator	56-10	58769	WEINSCHEL	2016-05-06
Attenuator	10dB	N/A	Rohde & Schwarz	2016-05-06
Temperature & Humidity Chamber	PR-3KP	14004209	Espec	2016-08-14
Test Receiver	ESU 26	100303	Rohde & Schwarz	2016-02-27
Loop Antenna	HFH2-Z2	100341	Rohde & Schwarz	2017-06-03
TRILOG Broadband Antenna	VULB9163	9163.770	Schwarzbeck	2017-02-08
Dipole Antenna	UHA9105	N/A	S/B	2017-07-17
Horn Antenna	HF 907	102426	Rohde & Schwarz	2017-01-15
DOPPEL STEG Horn Antenna	HF 906	100332	Rohde & Schwarz	2017-01-22
Attenuator	6dB	272.4110.50	Rohde & Schwarz	2016-05-05
Pre-Amplifier	310N	344015	Sonoma Instrument	2016-05-05
Turn Table	DT3000-3t	1310814	INNCO SYSTEM	N/A
Antenna Master	MA4000-EP	4600814	INNCO SYSTEM	N/A
Camera Controller	HDCon4102	6531445048	PONTIS	N/A
CO3000 Controller	Co3000-4Port	CO3000/806/ 34130814/L	INNCO SYSTEM	N/A
EMI Test Receiver	ESCI 7	100722	Rohde & Schwarz	2016-06-02
LISN	ENV216	100110	Rohde & Schwarz	2015-12-17
LISN	LS16C	16011403310	AFJ	2016-09-08

The measuring equipment utilized to perform the tests documented in this test report has been calibrated in accordance with manufacturer's recommendations, and is traceable to recognized national standards.