FCC CFR47 Part 15 Subpart C Certification Test Report

For the

Product	**: S-DAQ**
Model	**: SRC-BAMVC2**
FCC ID	**: 2AN5BSRC-BAMVC2**
Applicant	**: SEMES 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-W1712-001**

Signature

Choi, Yeong-min / Technical Manager

Date: 2017-12-01

Test Laboratory: ENG Co., Ltd.

FCC CERTIFICATION
TEST REPORT

Project Number	**: EA1710C-008**
Test Report Number	**: TR-W1712-001**
Type of Equipment	**: S-DAQ**
Model Name	**: SRC-BAMVC2**
FCC ID	**: 2AN5BSRC-BAMVC2**
Multiple Model Name	**: SRC-BAMVE2**
Applicant	**: SEMES CO., LTD.**
Address	**: 77, 4sandan 5-gil, Jiksan-eup Seobuk-gu, Cheonan-si, Chungcheongnam-do, Korea**
Manufacturer	**: SEMES CO., LTD.**
Address	**: 77, 4sandan 5-gil, Jiksan-eup Seobuk-gu, Cheonan-si, Chungcheongnam-do, Korea**
Regulation	**: FCC Part 15 Subpart C Section 15.247**
Total page of Report	**: 48 Pages**
Date of Receipt	**: 2017-10-13**
Date of Issue	**: 2017-12-01**
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 Song, In-young / Senior Engineer _____ (Signature) 2017-12-01 (Date)

Reviewed by Choi, Yeong-min / Technical Manager _____ (Signature) 2017-12-01 (Date)

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

Issue Report No.	Issued Date	Revisions	Effect Section
TR-W1712-001	2017-12-01	Initial Release	All

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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 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, ANSI C63.10-2013 and KDB 558074 D01DTS Meas Guidance v04

1.4 Additions, deviations, exclusions from standards

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

1.4 Test Facility

The measurement facilities are located at 135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do 12813, Korea. Description details of test facilities were submitted to the FCC and IC, designated by the RRA (Radio Research Agency), and accredited by Korea and accredited by KOLAS (Korea Laboratory Accreditation Scheme) in Korea according to the requirement of ISO 17025.

Agency Name	Registration No.	Mark
FCC	KR0160	
Industry Canada (IC)	IC 12721A-1	
RRA	KR0160	
Korean Agency for Technology and Standards	KT733	

2. EUT (Equipment Under Test) INFORMATION

2.1 General Description

The SEMES CO., LTD., Model SRC-BAMVC2 (referred to as the EUT in this report) is a S-DAQ. 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.

The product specification described herein was obtained from product data sheet or user's manual.

Operating Frequency	2 412 ~ 2 462 MHz
Max. RF Output Power	19.11 dBm (Measured)
Modulation Types	CCK(802.11 b), OFDM(802,11 g)
Number of Channels	2 412 ~ 2 462 MHz : 11 CH (802.11 b/g)
Channel Bandwidth	20 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 ■ Dedicated Type
Antenna Gain	4.16 dBi
Operating Temperature	+5 °C ~ + 50 °C
Normal Test Voltage	DC 24 V
Electrical Rating	DC 21.6 V - DC 26.4 V
Test SW Version	Tera Term ver.4.91
RF power setting in TEST SW	802.11b: 67, 802.11g: 63

2.2 Available channel number and frequency

Operating Mode: 802.11 b/g, 5 MHz Channel Spacing					
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

Model Name	Model Difference
SRC-BAMVC2	Basic Model
SRC-BAMVE2	SRC-BAMVE2 is identical to basic model except for model designation and RS232 board is deleted and other electrical circuitry is same with basic model.
NOTE: The Manufacturer has declared to all the additional model names into basic model name without any further evaluation by ENG Co., Ltd.	

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	SEMES CO., LTD.
Notebook PC	LGR48	MEZ62016801	LG Electronics
Adapter for Notebook PC	PA-1900-08	0Y00719207	Dongguang Lite Power 2nd Plant

3.2 Mode of operation during the test

For finding worst 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 worst case scenario. All spurious emission tests were performed in X, Y and Z axis direction. And only the worst X-axis test condition was recorded in this test report.

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

3.2.1 Conducted Emission Test Mode

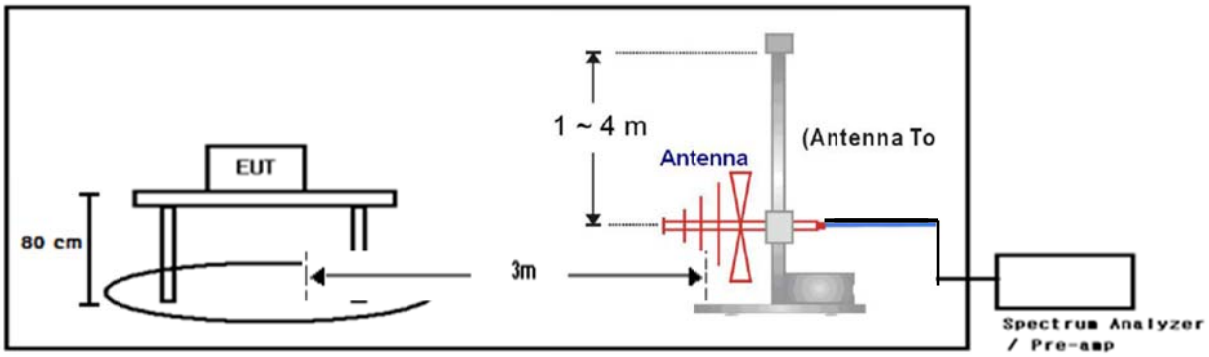
Operating Mode	Channel	Frequency (MHz)	Data rate(Mbps)	Output Power(dBm)
802.11b	1	2 412	11	16.30
	6	2 437	11	16.42
	11	2 462	11	16.38
802.11g	1	2 412	54	18.96
	6	2 437	54	18.92
	11	2 462	54	19.11

3.2.2 Radiated Emission & AC Power Line Conducted Emission Test Mode

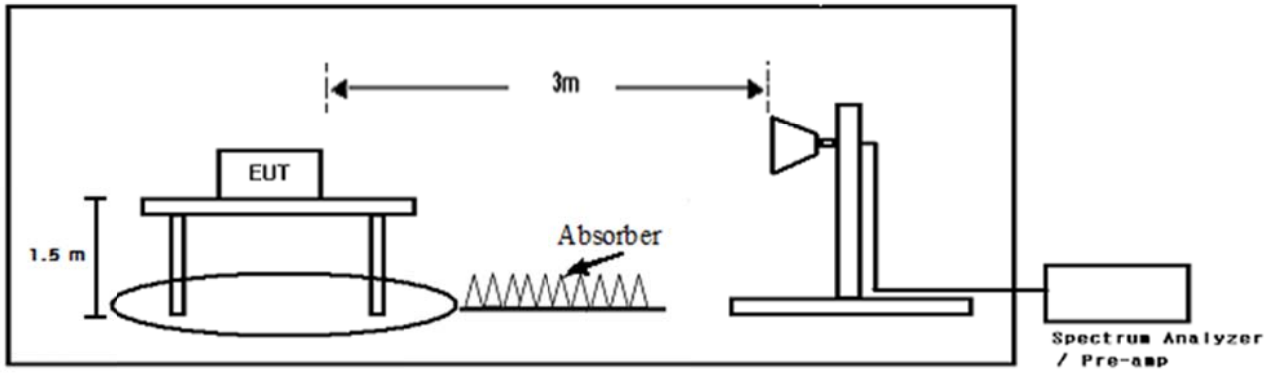
Operating Mode	Tested Channel	Data rate(Mbps)	Output Power(dBm)
802.11g	11	54	19.11

3.3 Test Setup Drawing

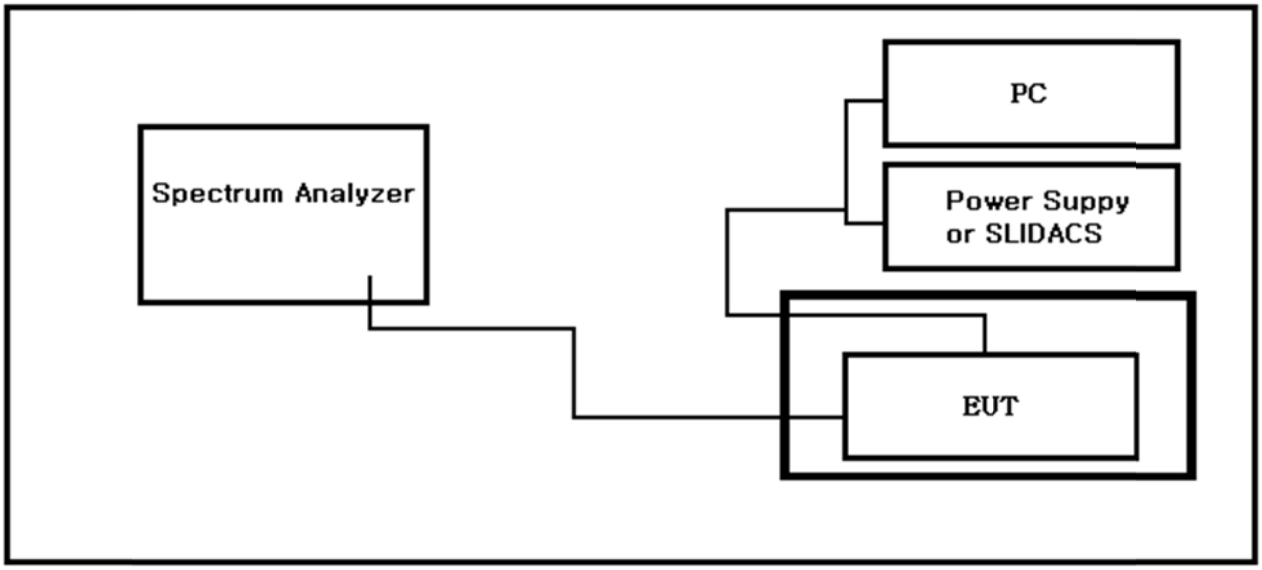
(Radiated Test below 1 GHz)



(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

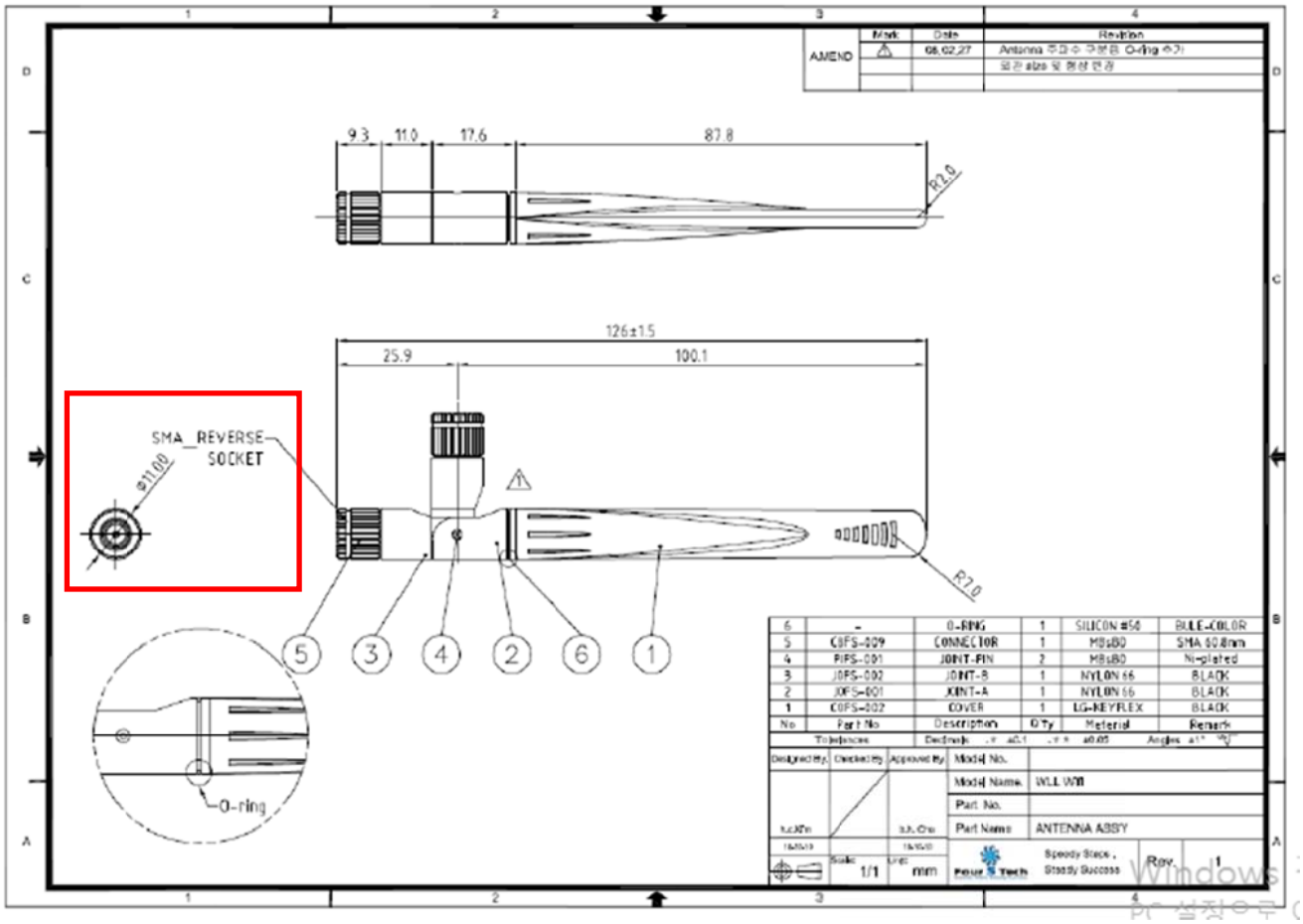
According to FCC CFR 47 Part 15 section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional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

4.1 Antenna Description

Frequency Band (GHz)	Antenna Type	Max Peak Gain (dBi)	Connector Type
2.4	Dipole Antenna	4.16	Reverse polarity SMA
5	Dipole Antenna	3.92	Reverse polarity SMA

4.2 Conclusion

The antenna connector type of the EUT is reverse polarity 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 v04: 8.1 Option 1

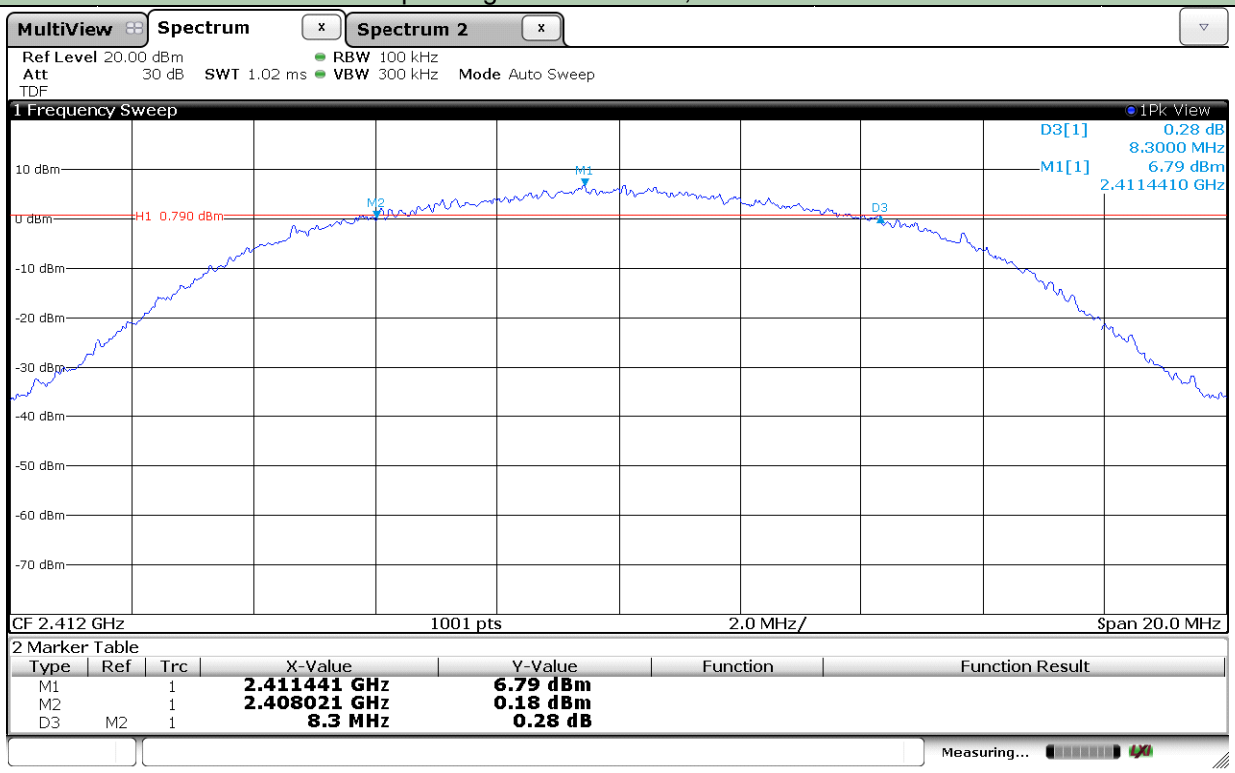
The transmitter output is connected to a spectrum analyzer with the RBW set to 100 kHz, VBW ≥ 3 X RBW, peak detector and max hold.

5.1.3 Test Data

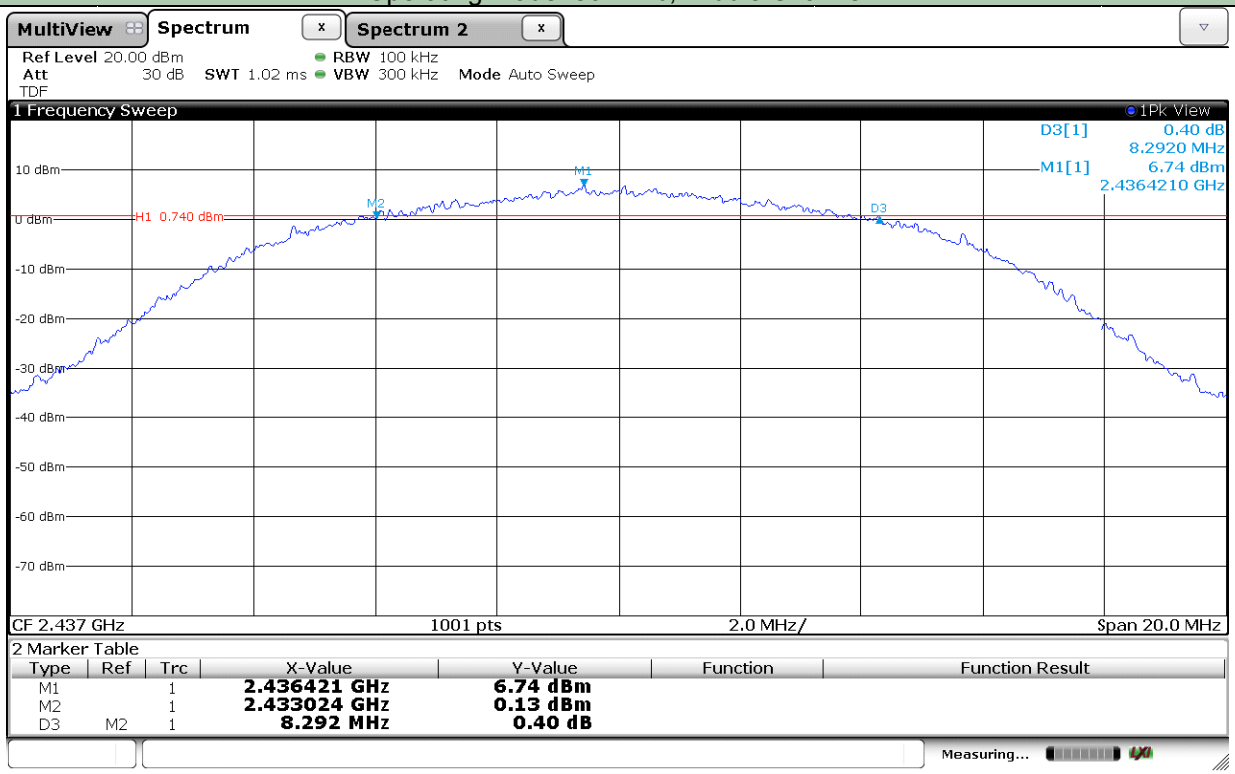
Date of Test	2017-11-06	Temperature	(26 ± 1) °C
		Relative humidity	(43 ± 3) % R.H.
Test Result	***PASS***	Tested by	In-yong Song
Operating Mode: 802.11b			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 412	8.30	0.5
Middle	2 437	8.29	
High	2 462	8.29	
Operating Mode: 802.11g			
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2 412	16.58	0.5
Middle	2 437	16.56	
High	2 462	16.58	

5.1.4 Test Plots

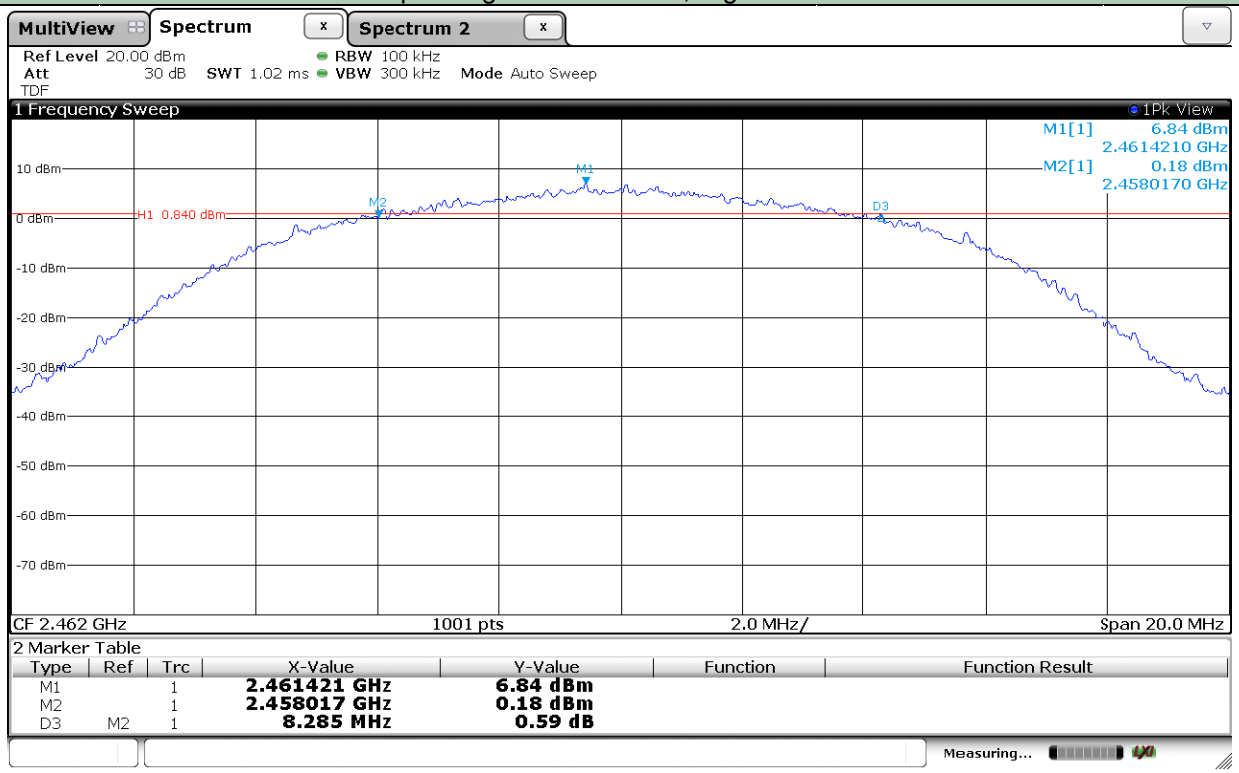
Operating Mode: 802.11b, Low Channel



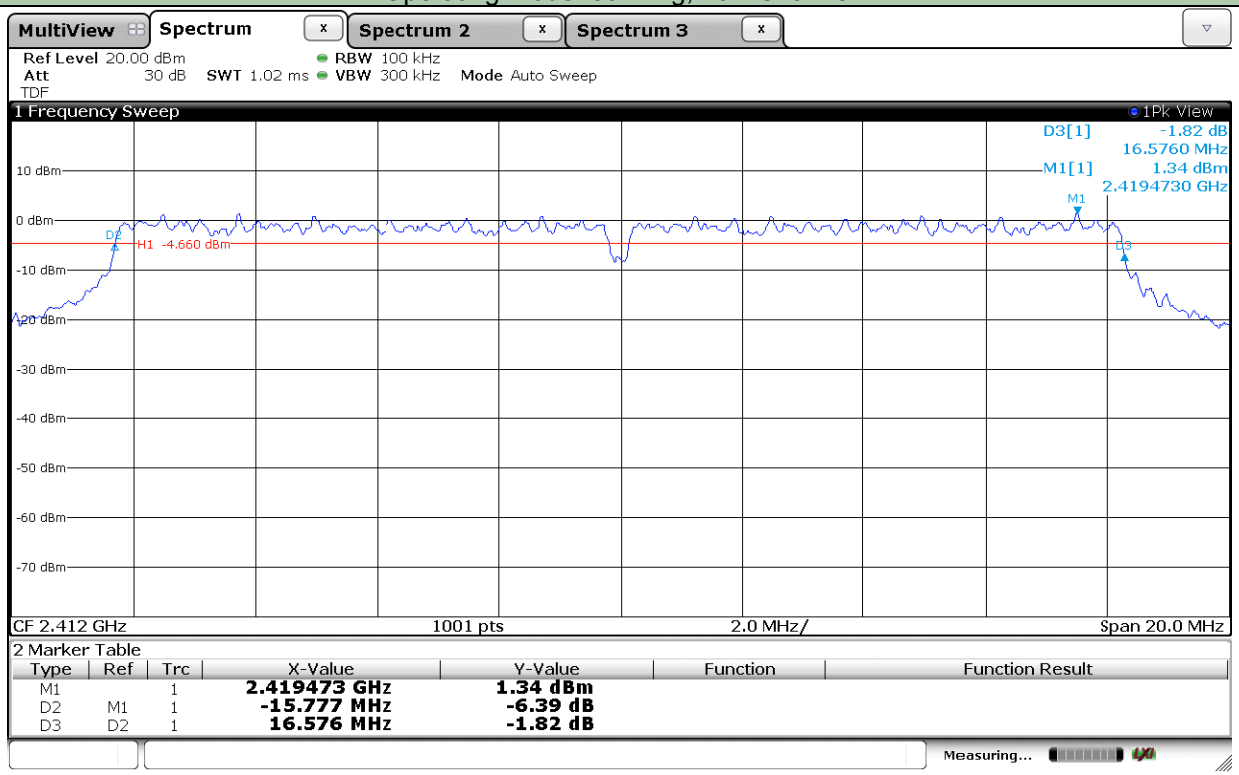
Operating Mode: 802.11b, Middle Channel



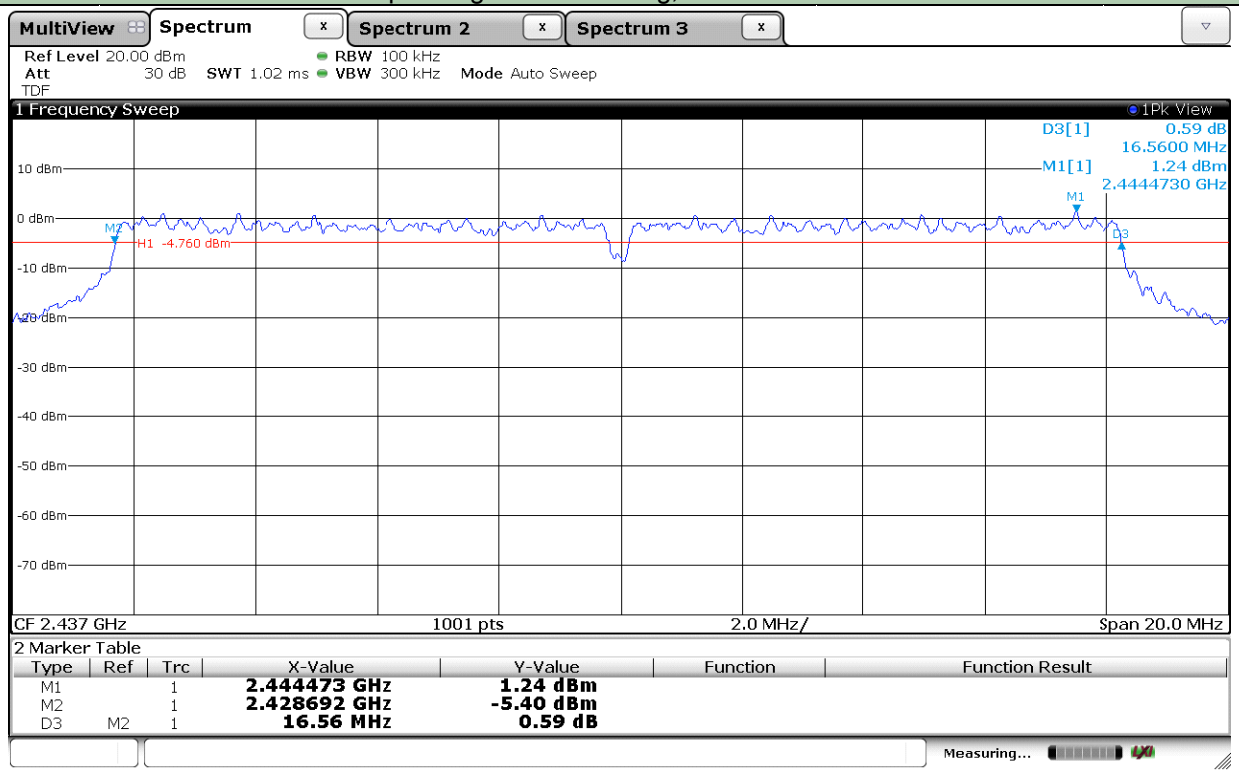
Operating Mode: 802.11b, High Channel



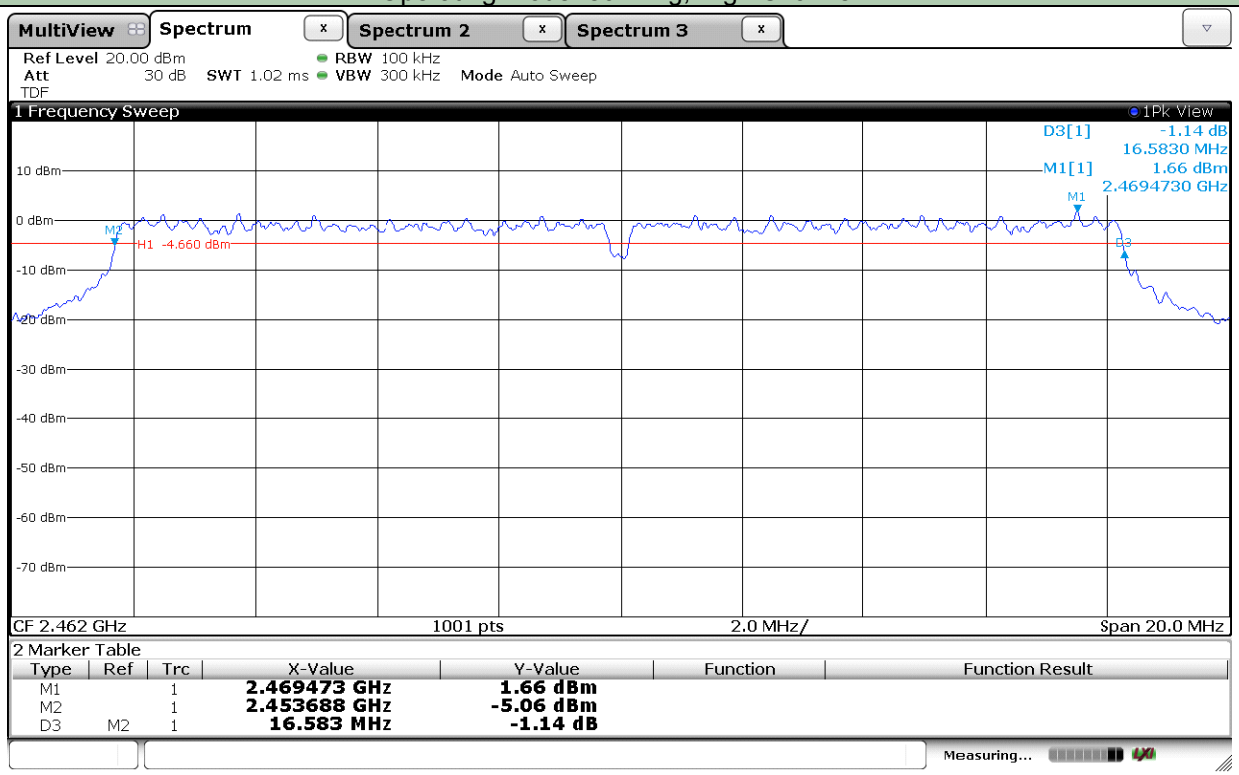
Operating Mode: 802.11g, Low Channel



Operating Mode: 802.11g, Middle Channel



Operating Mode: 802.11g, High 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 5 % of the OBW.

The span is set to capture all products of the modulation process, including the emission skirts.

The VBW is set to 3 times the RBW. The sweep time is coupled and peak detection and max hold mode is used. The spectrum analyzer internal 99% bandwidth function is utilized.

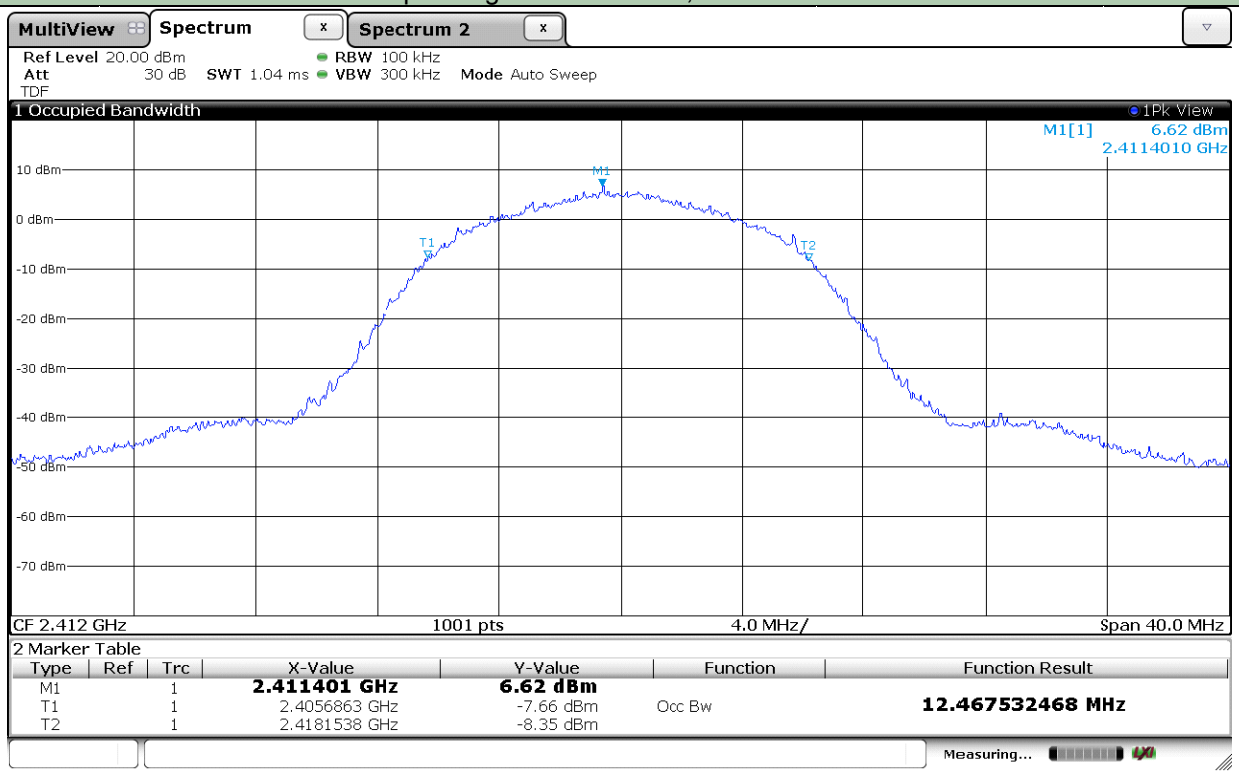
5.2.3 Test Data

Date of Test	2017-11-06	Temperature	(26 ± 1) °C
		Relative humidity	(43 ± 3) % R.H.
Test Result	***PASS***	Tested by	In-yong Song

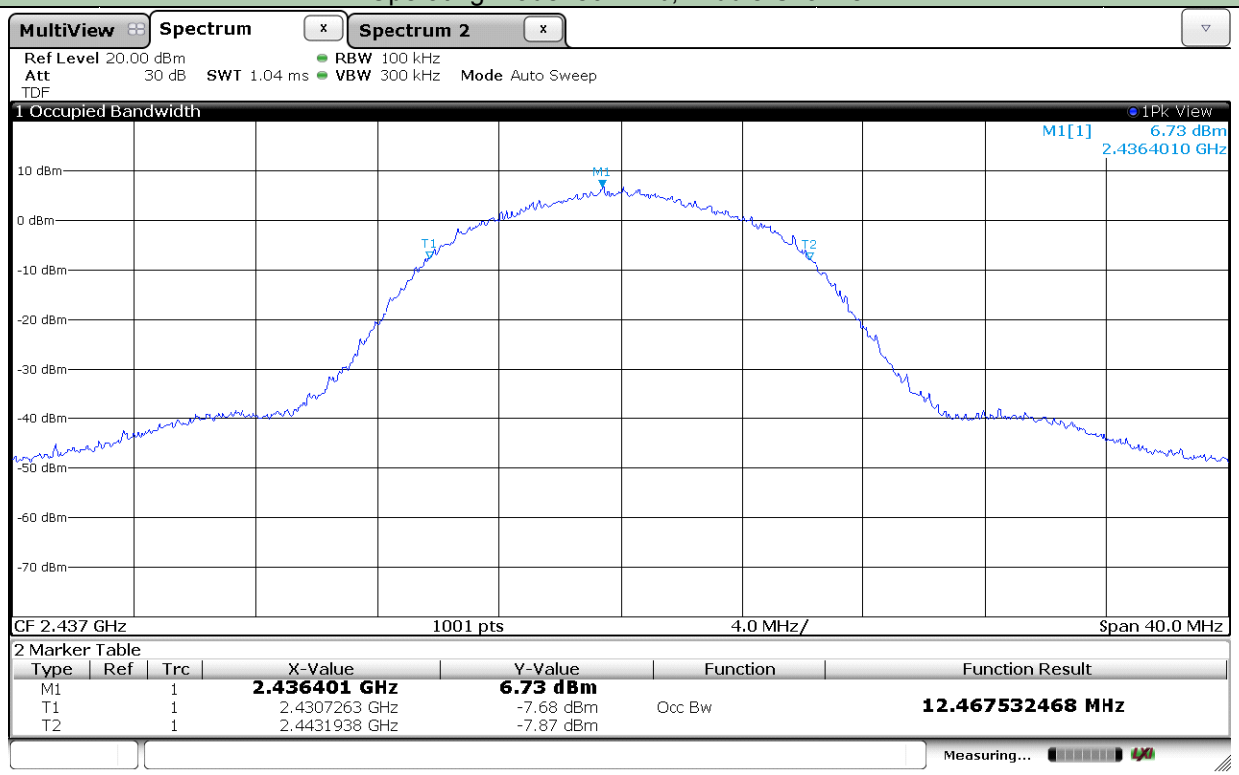
Operational Mode: 802.11b		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 412	12.47
Middle	2 437	12.47
High	2 462	12.47
Operational Mode: 802.11g		
Channel	Frequency (MHz)	99 % Bandwidth (MHz)
Low	2 412	16.70
Middle	2 437	16.74
High	2 462	16.74

5.2.4 Test Plots

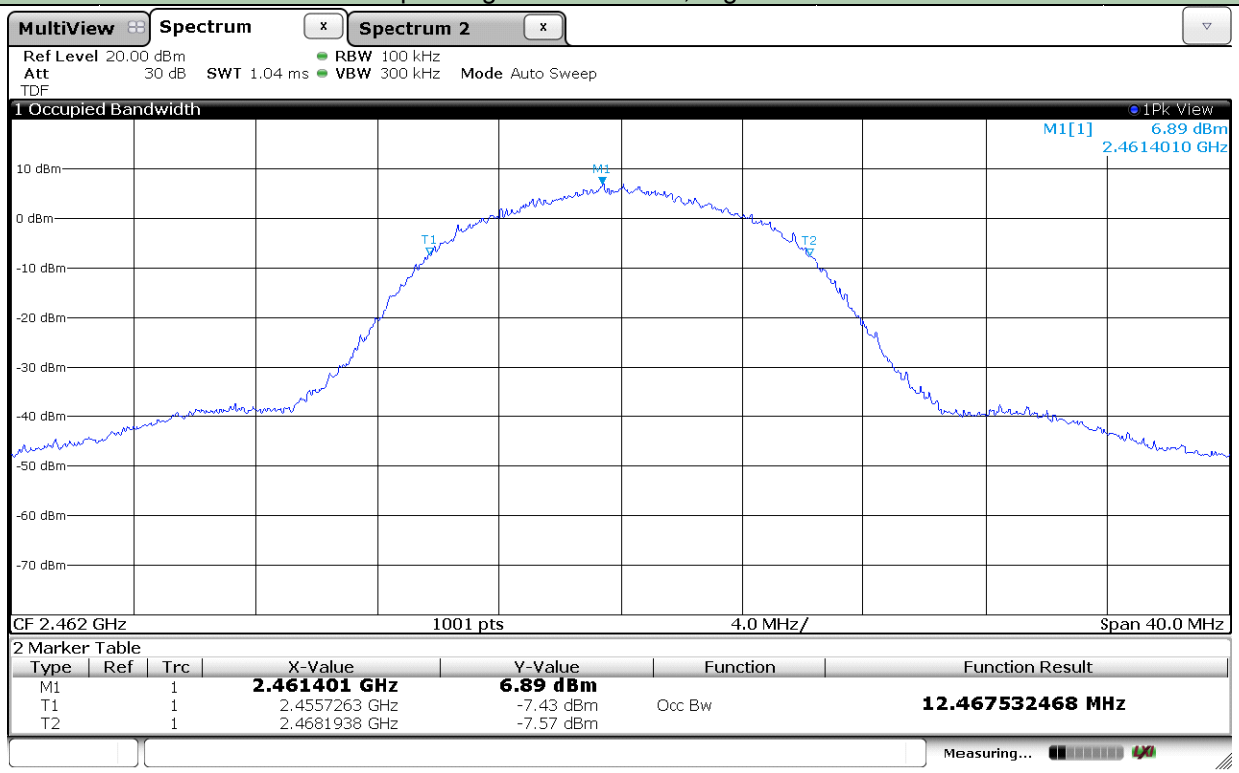
Operating Mode: 802.11b, Low Channel



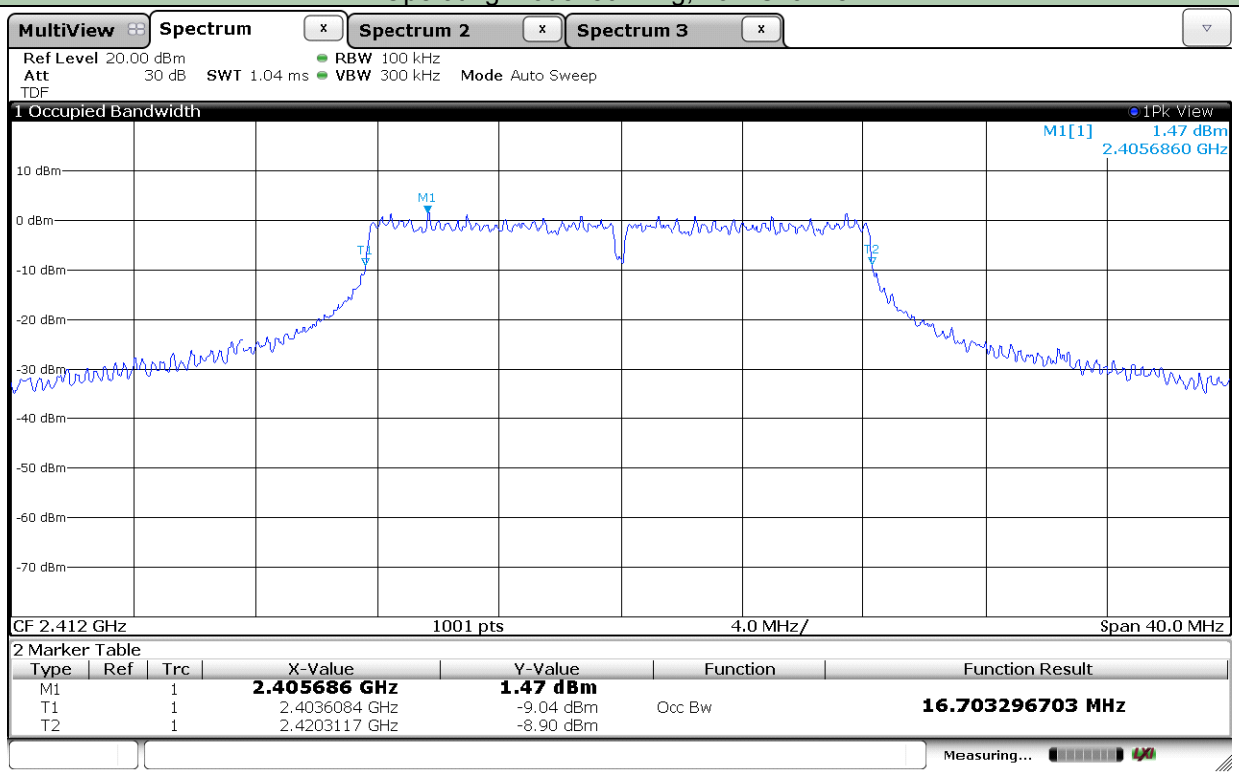
Operating Mode: 802.11b, Middle Channel



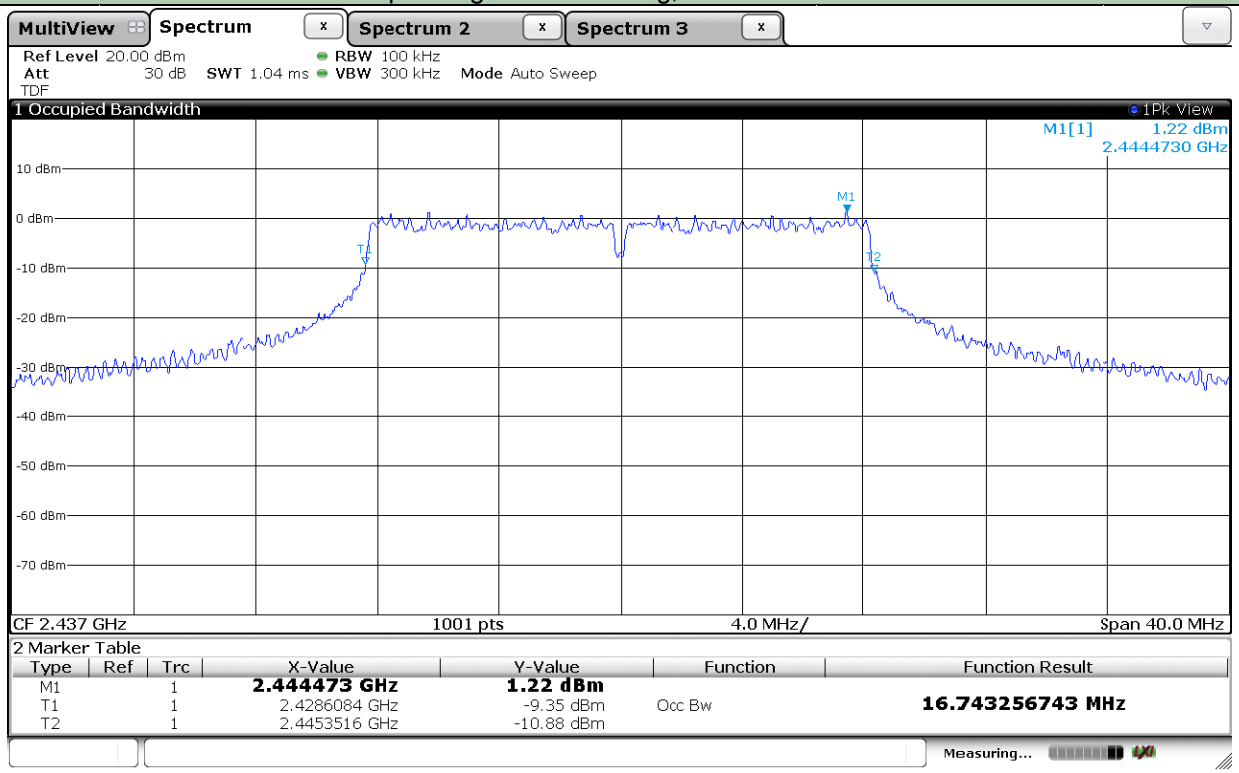
Operating Mode: 802.11b, High Channel



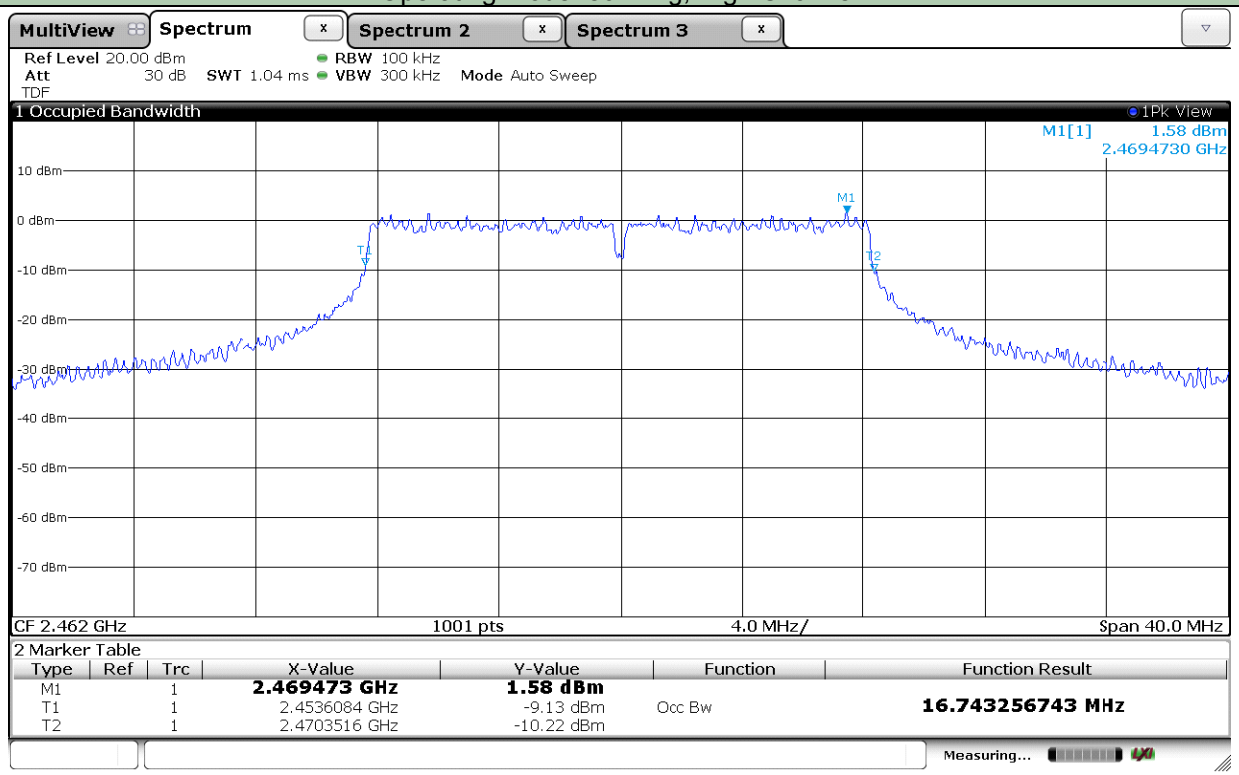
Operating Mode: 802.11g, Low Channel



Operating Mode: 802.11g, Middle Channel



Operating Mode: 802.11g, High Channel



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 v04: 9.1.3 PKPM1 Peak-reading power meter method.

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

The cable assembly insertion loss was entered as an offset in the spectrum analyzer to allow for direct reading of power.

5.3.3 Test Data for Output Power

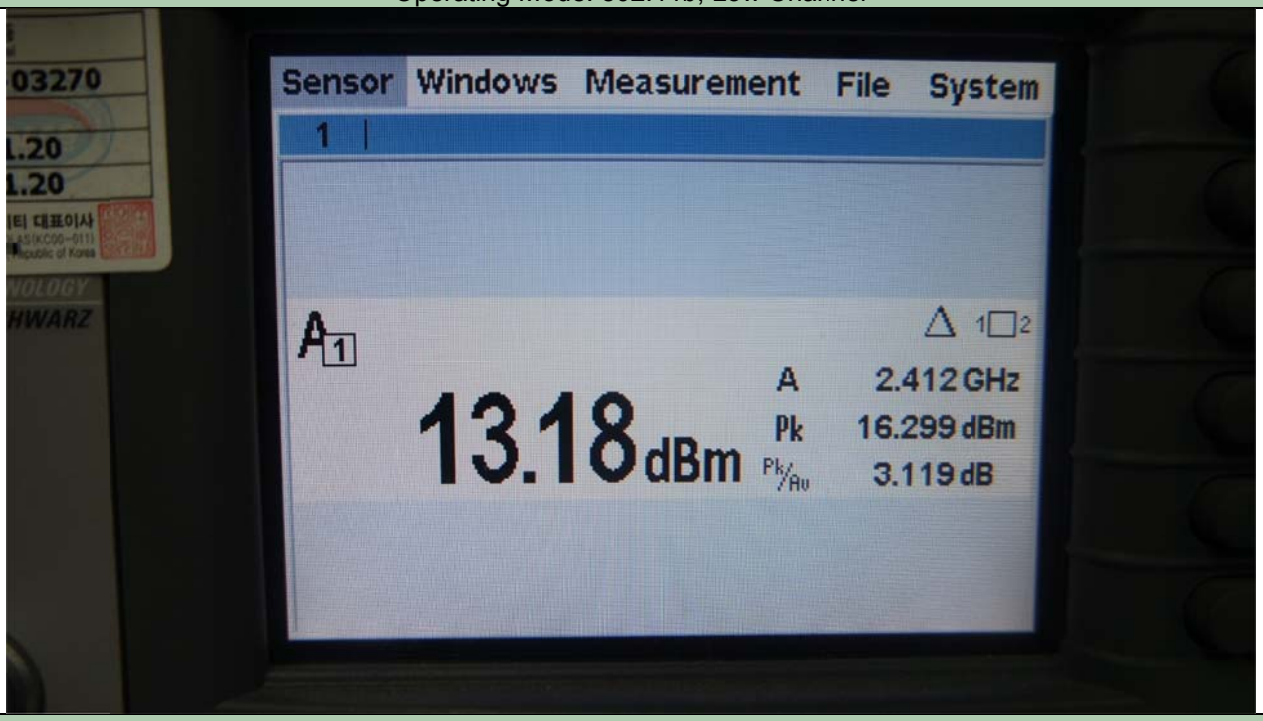
Date of Test	2017-11-06	Temperature	(26 ± 1) °C
		Relative humidity	(43 ± 3) % R.H.
Test Result	***PASS***	Tested by	In-yong Song

Operating Mode: 802.11b				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	16.30	30	13.70
Middle	2 437	16.42		13.58
High	2 462	16.38		13.62

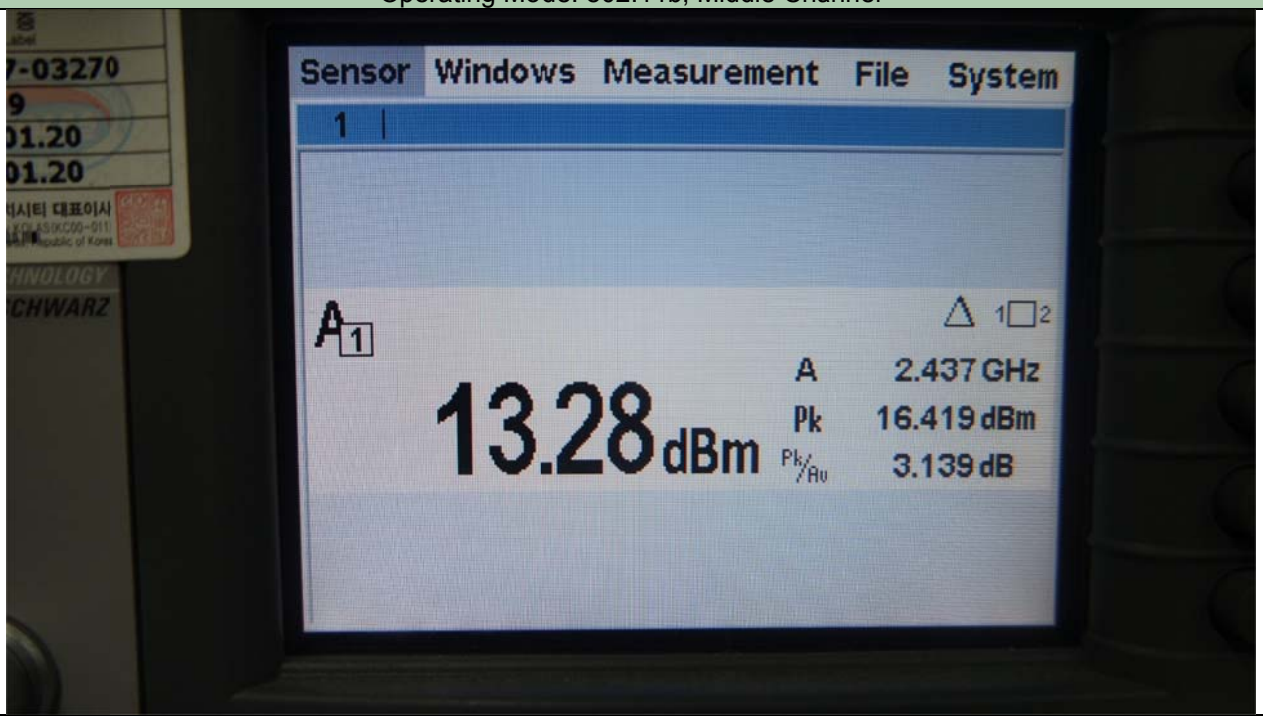
Operating Mode: 802.11g				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	18.96	30	11.04
Middle	2 437	18.92		11.08
High	2 462	19.11		10.89

5.3.4 Test Plots

Operating Mode: 802.11b, Low Channel



Operating Mode: 802.11b, Middle Channel

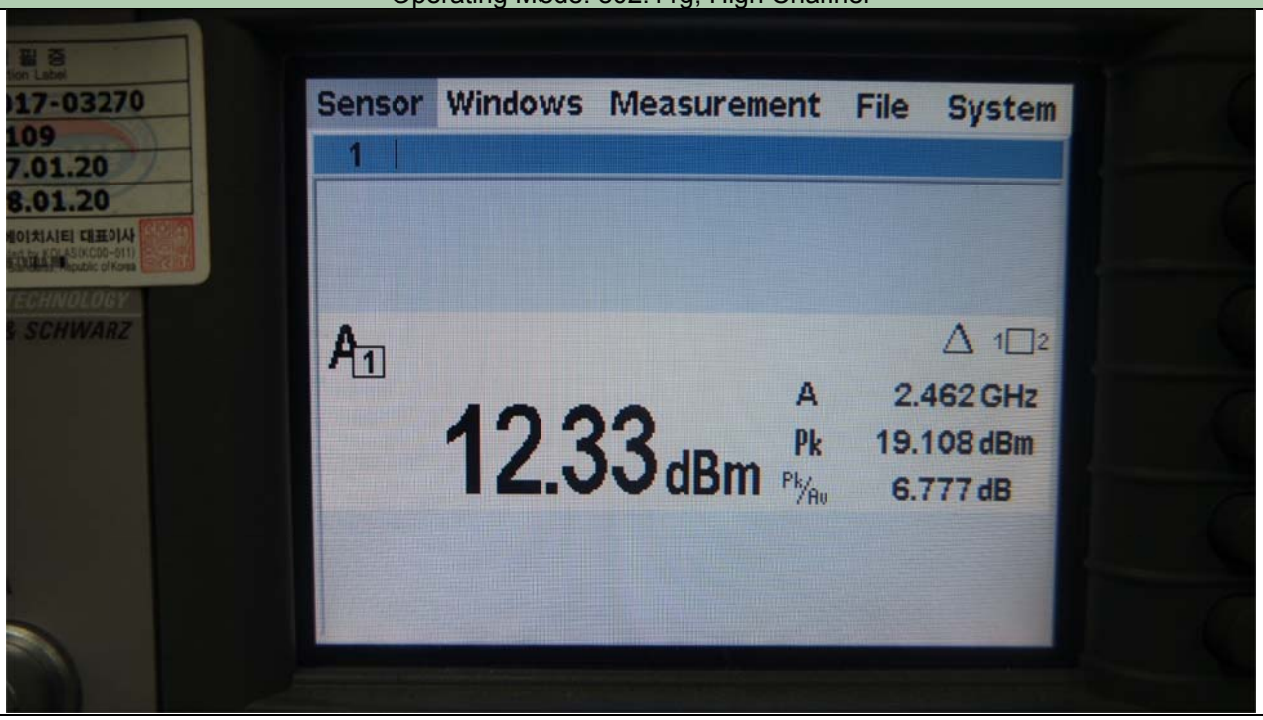


Operating Mode: 802.11b, High Channel

Operating Mode: 802.11g, Low Channel

Operating Mode: 802.11g, Middle Channel

Operating Mode: 802.11g, High Channel



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 v04: 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

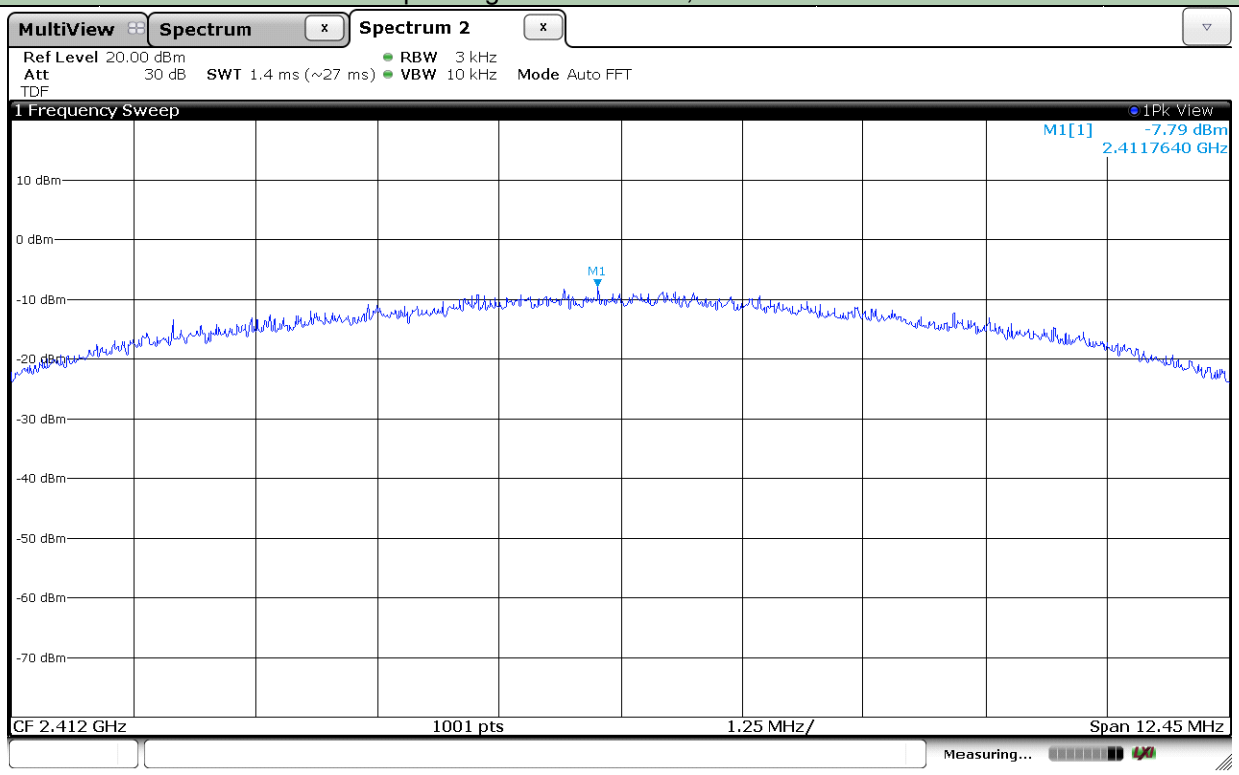
Date of Test	2017-11-06	Temperature	(26 ± 1) °C
		Relative humidity	(43 ± 3) % R.H.
Test Result	***PASS***	Tested by	In-yong Song

Operating Mode: 802.11b				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	-7.79	8	15.79
Middle	2 437	-7.89		15.89
High	2 462	-7.80		15.80
Operating Mode: 802.11g				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
Low	2 412	-12.73	8	20.73
Middle	2 437	-12.87		20.87
High	2 462	-12.73		20.73

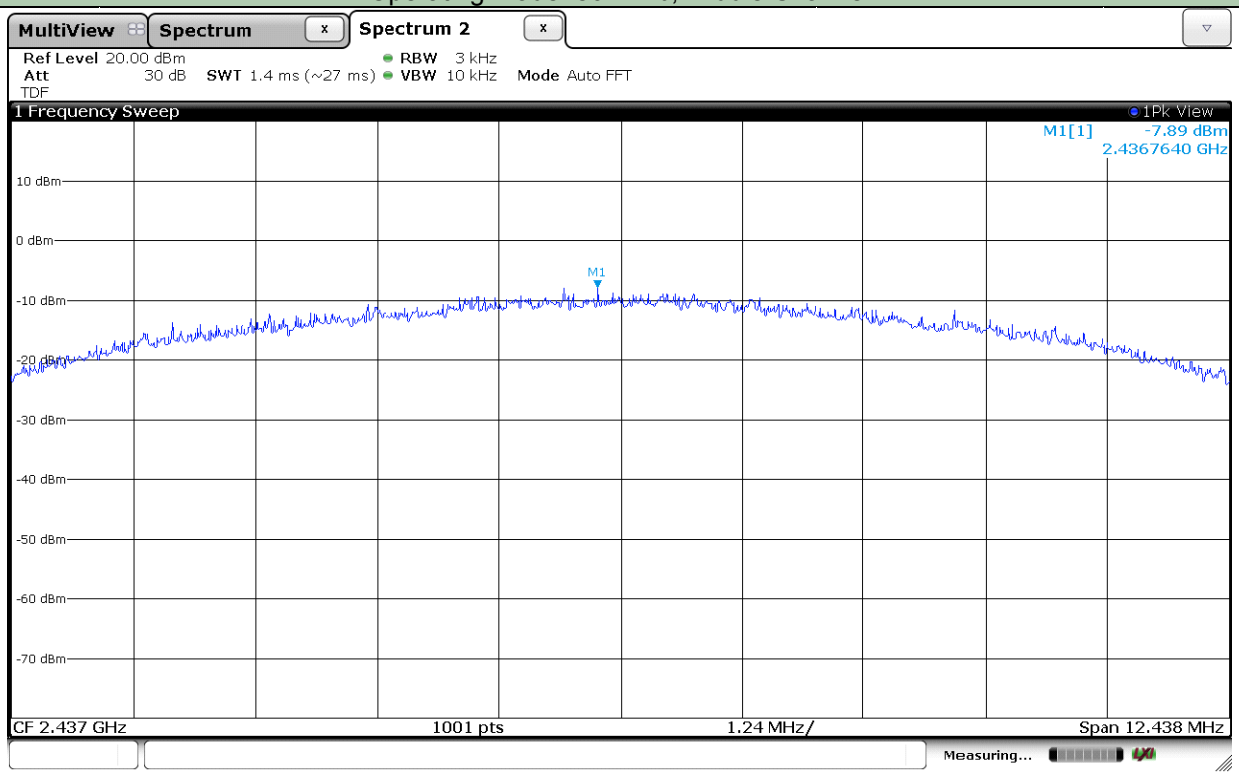
Remark. Margin = Limit – Measured Value

5.4.4 Test Plots

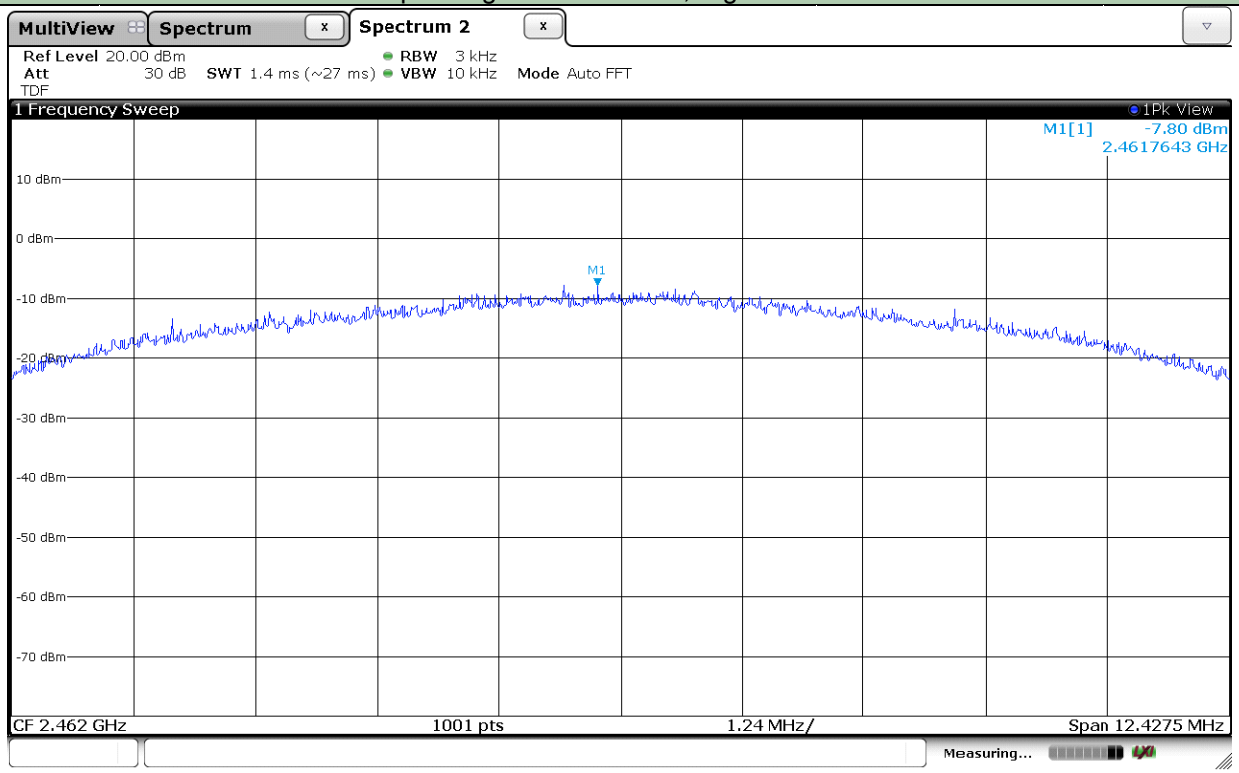
Operating Mode: 802.11b, Low Channel



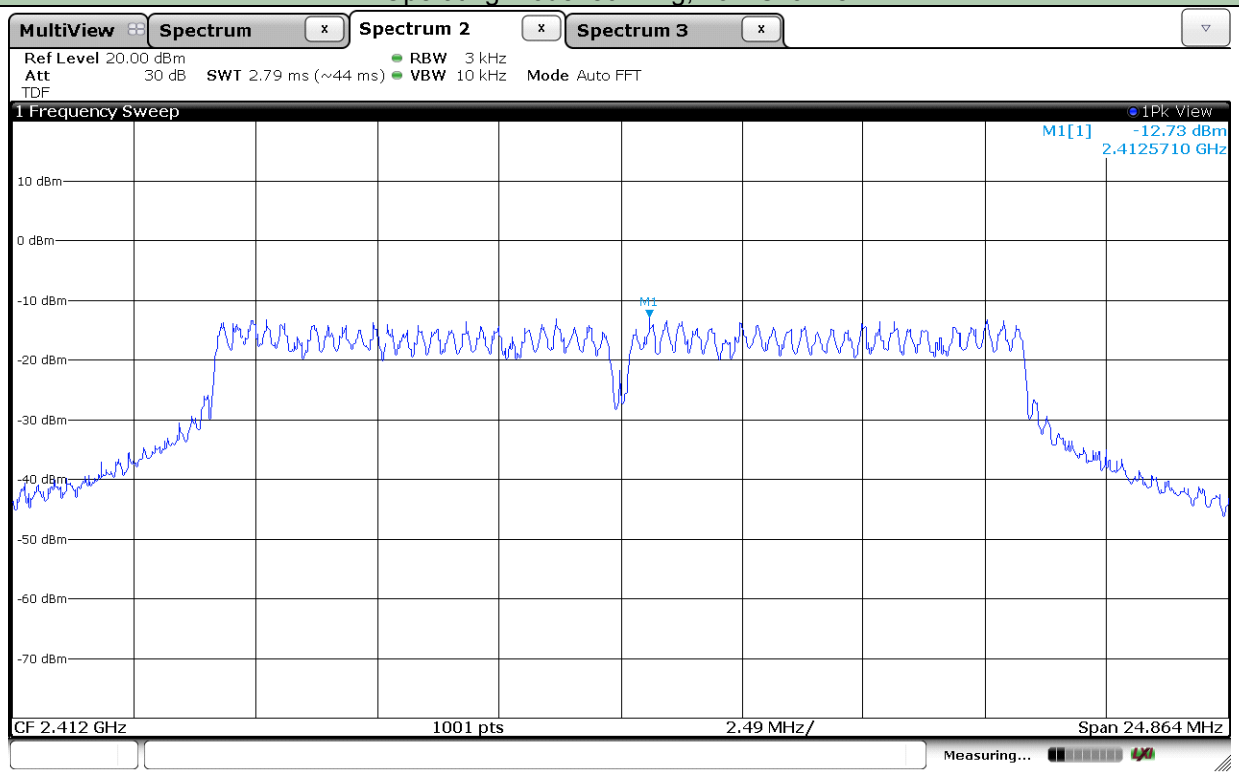
Operating Mode: 802.11b, Middle Channel



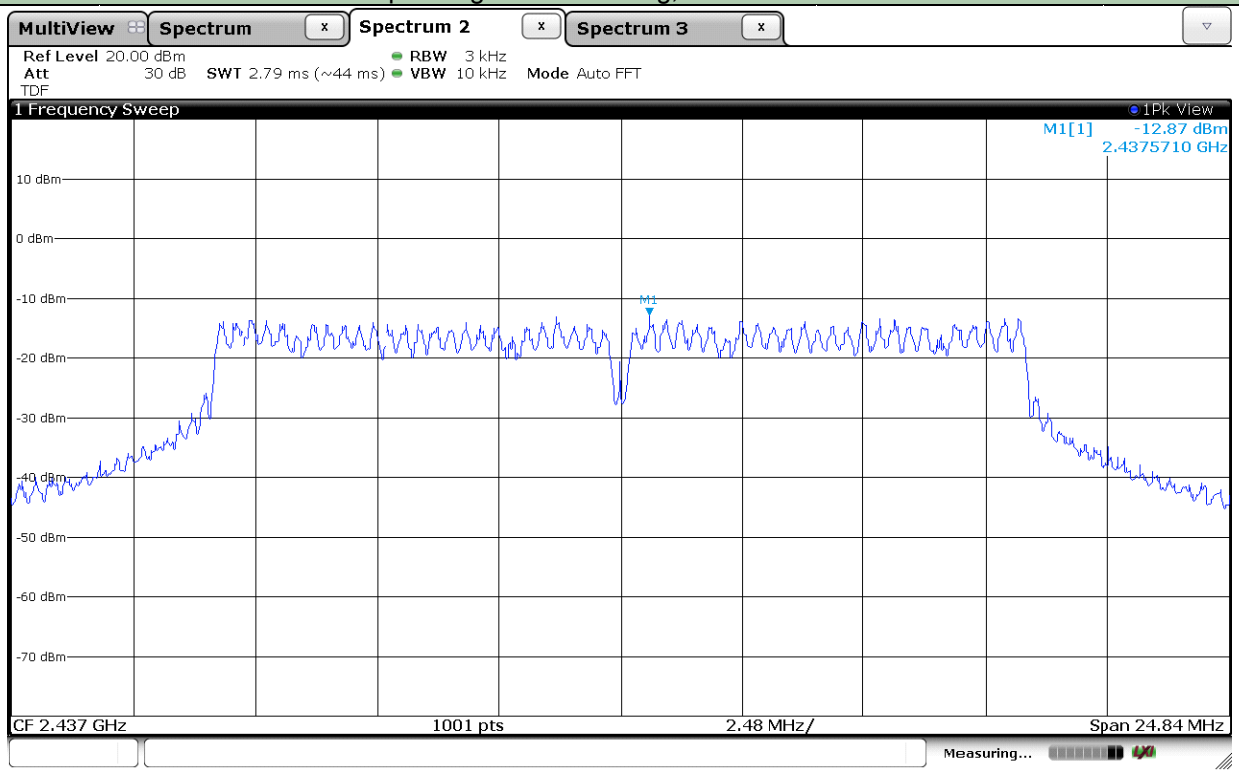
Operating Mode: 802.11b, High Channel



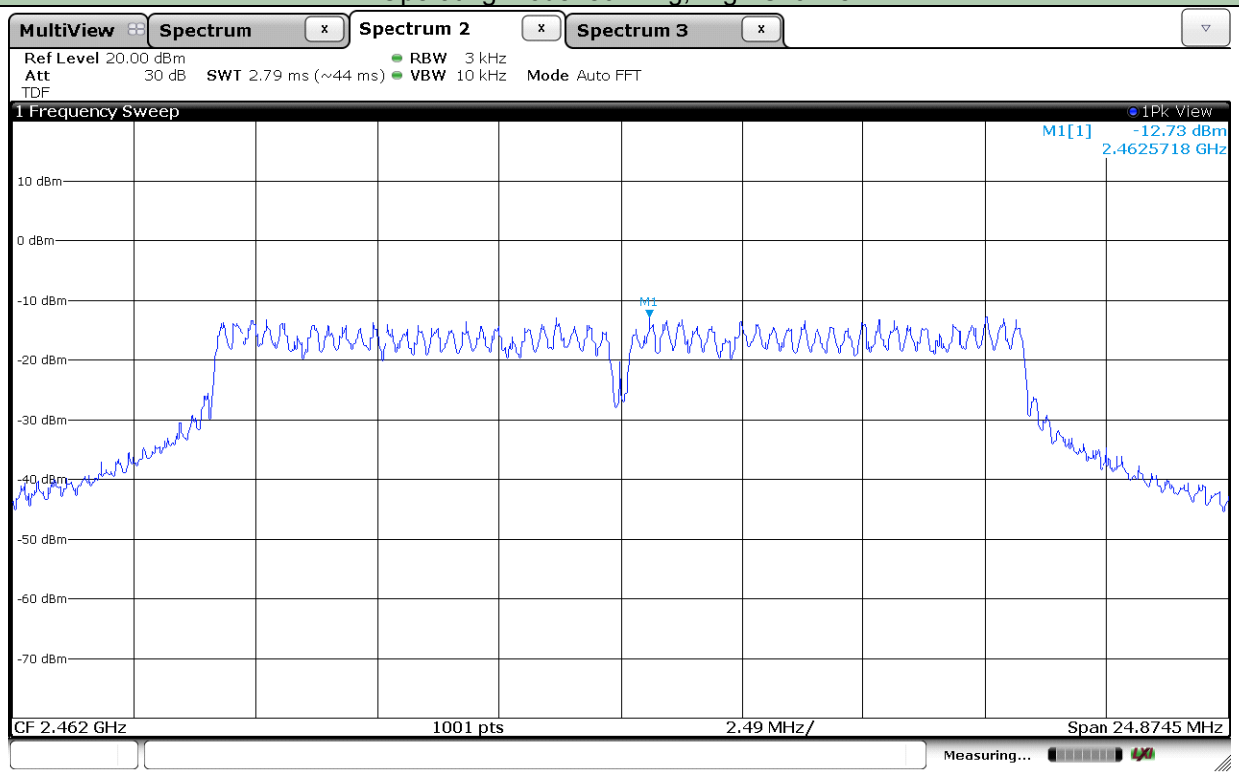
Operating Mode: 802.11g, Low Channel



Operating Mode: 802.11g, Middle Channel



Operating Mode: 802.11g, High Channel



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. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

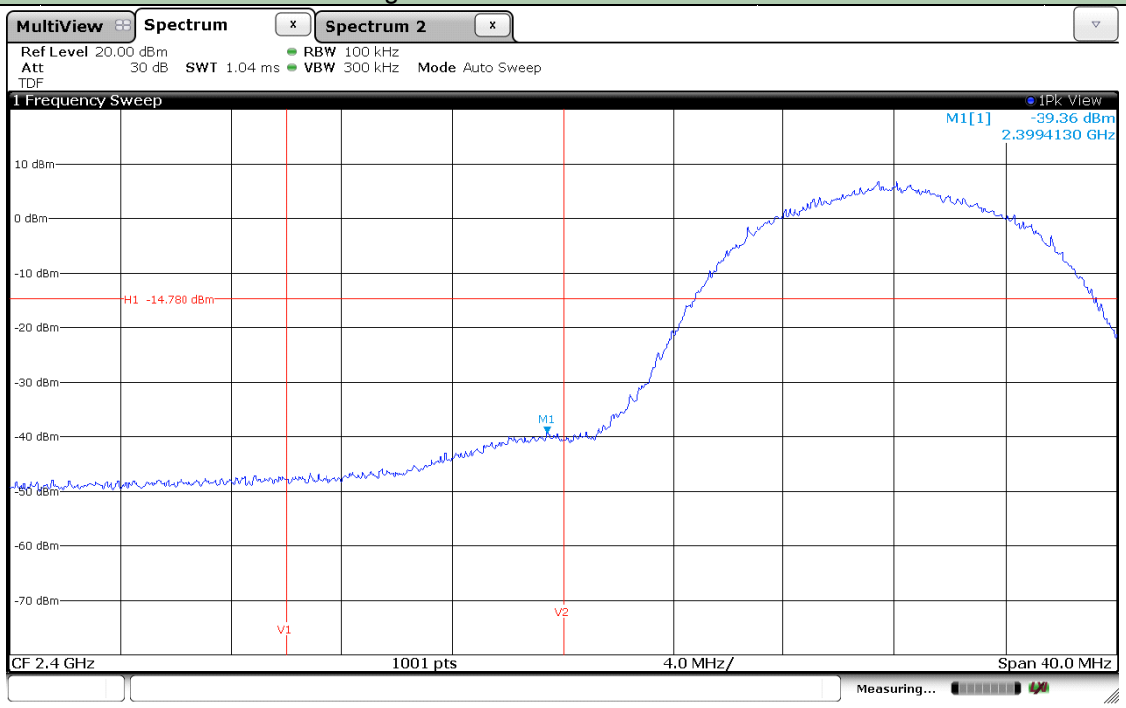
5.5.2 Method of Measurement

Reference to KDB 558074 D01 DTS Meas Guidance v04: 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.

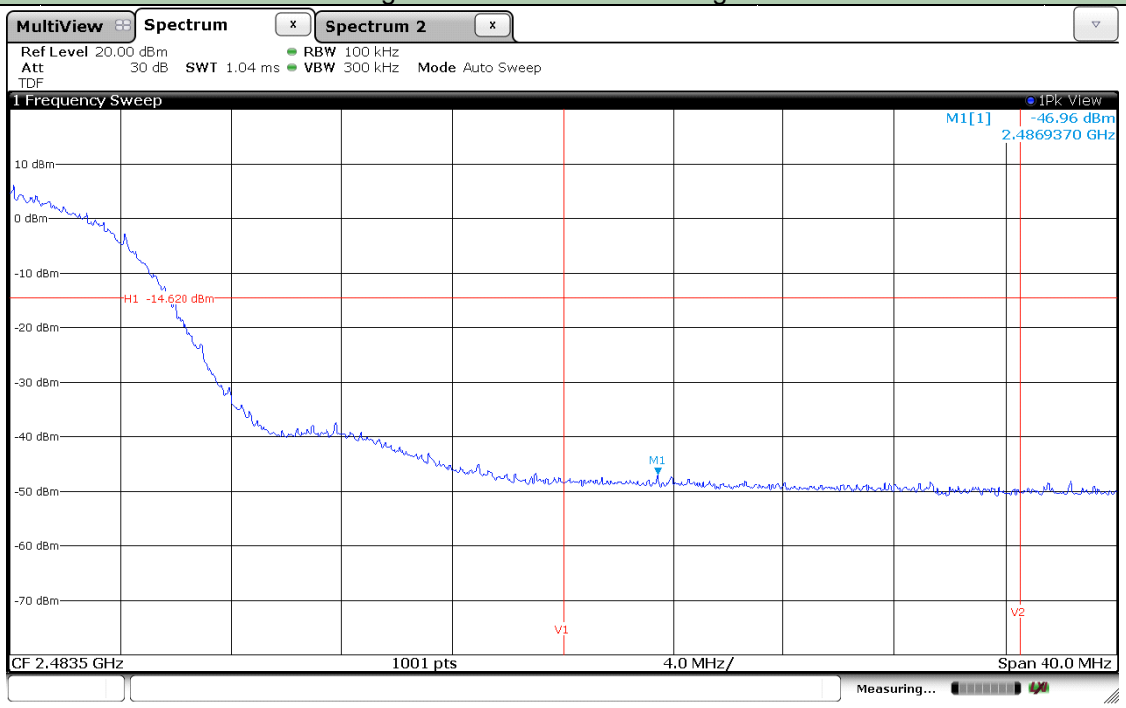
5.5.3 Test Data for Operating mode: 802.11b

Date of Test	2017-11-06	Temperature	(26 ± 1) °C
		Relative humidity	(43 ± 3) % R.H.
Test Result	***PASS***	Tested by	In-yong Song

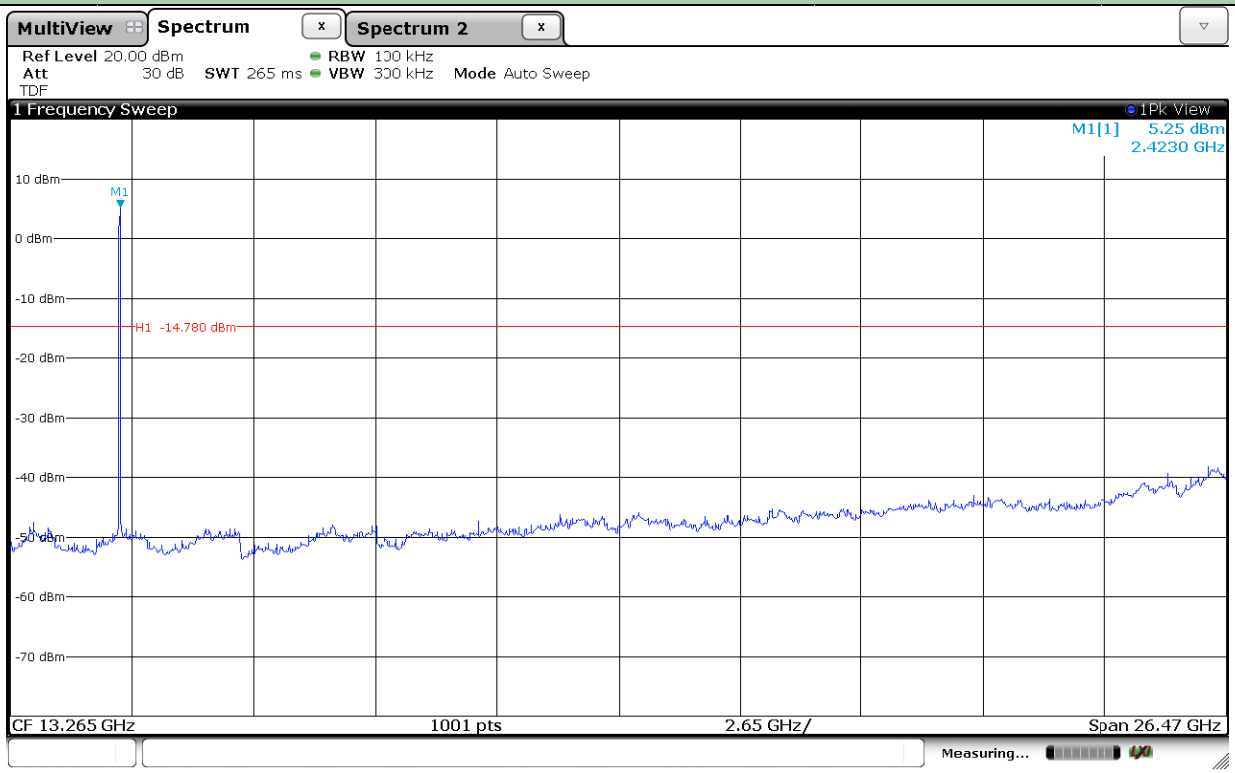
Band-edge and Restricted band – Low channel



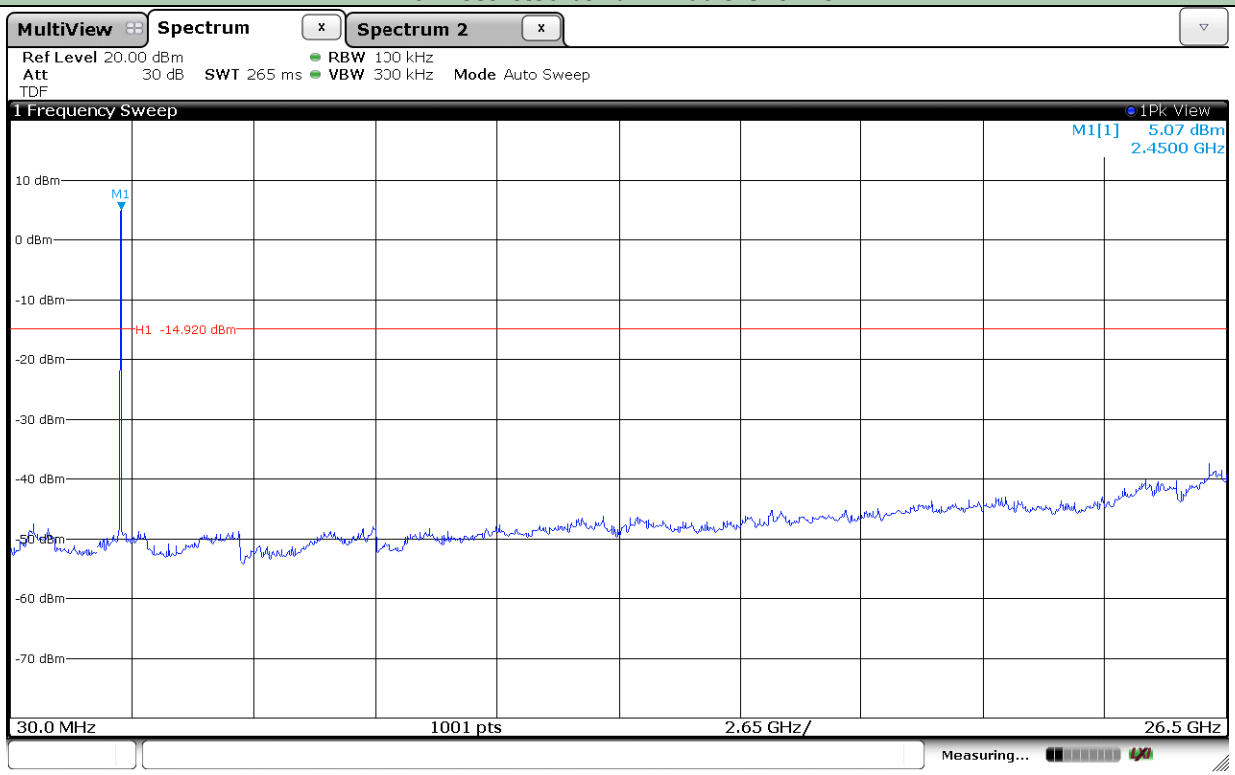
Band-edge and Restricted band – High channel



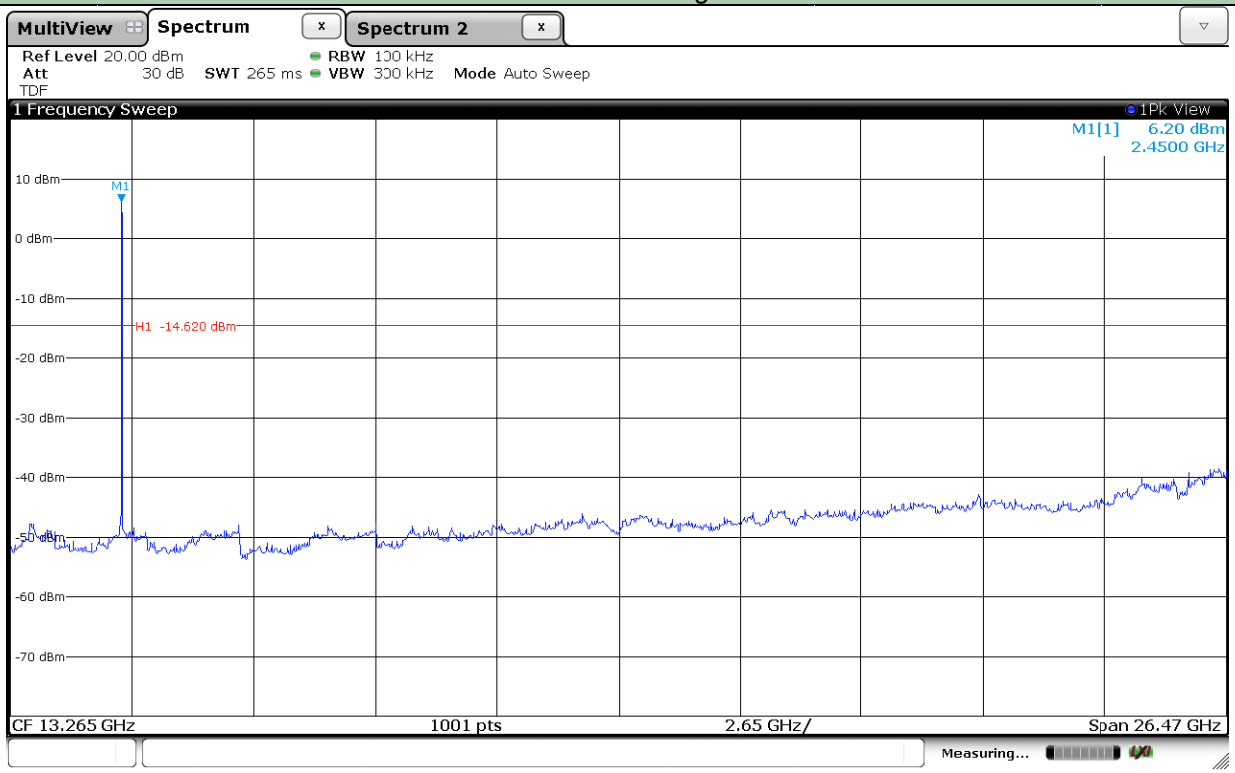
Non-restricted band – Low Channel



Non-restricted band – Middle Channel



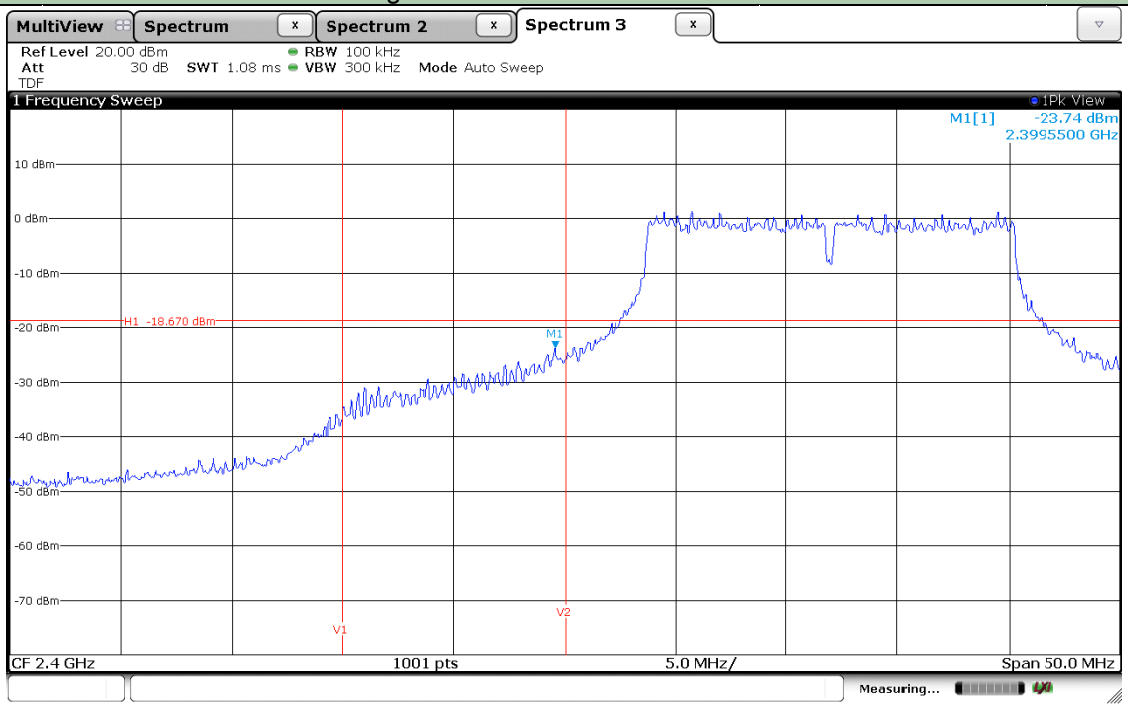
Non-restricted band – High Channel



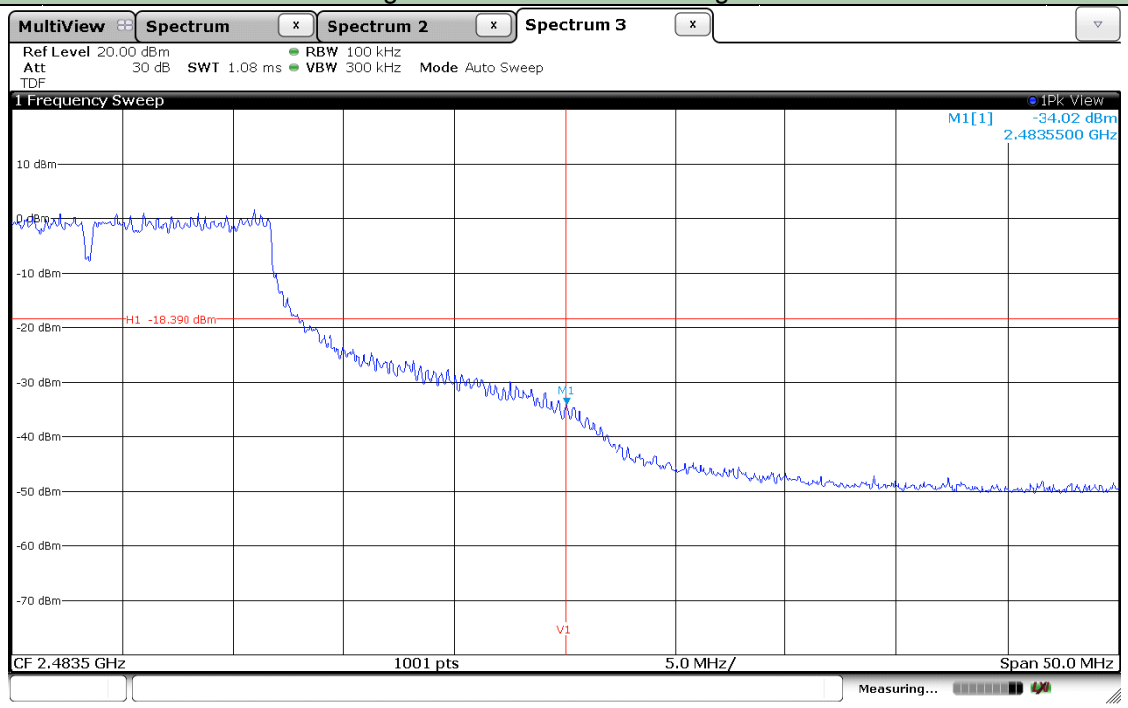
5.5.4 Test Data for Operating mode: 802.11g

Date of Test	2017-11-06	Temperature	(26 ± 1) °C
		Relative humidity	(43 ± 3) % R.H.
Test Result	***PASS***	Tested by	In-yong Song

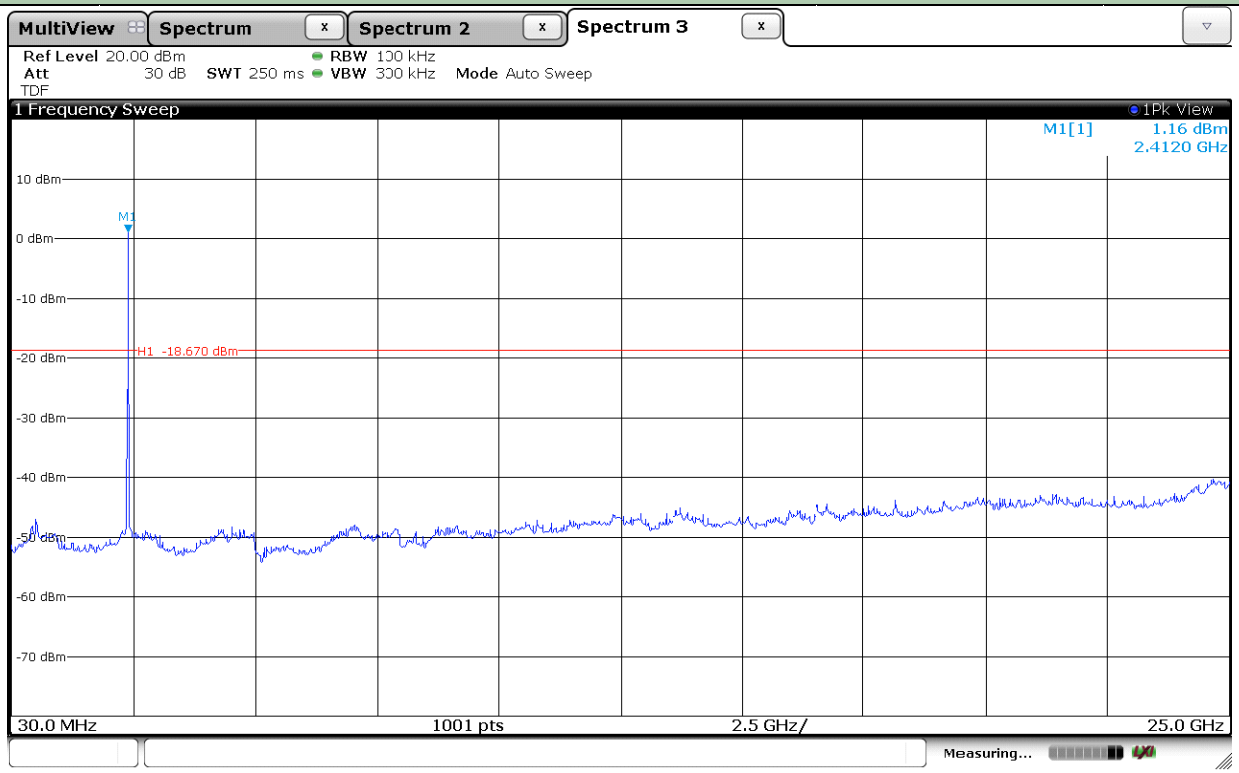
Band-edge and Restricted band – Low channel



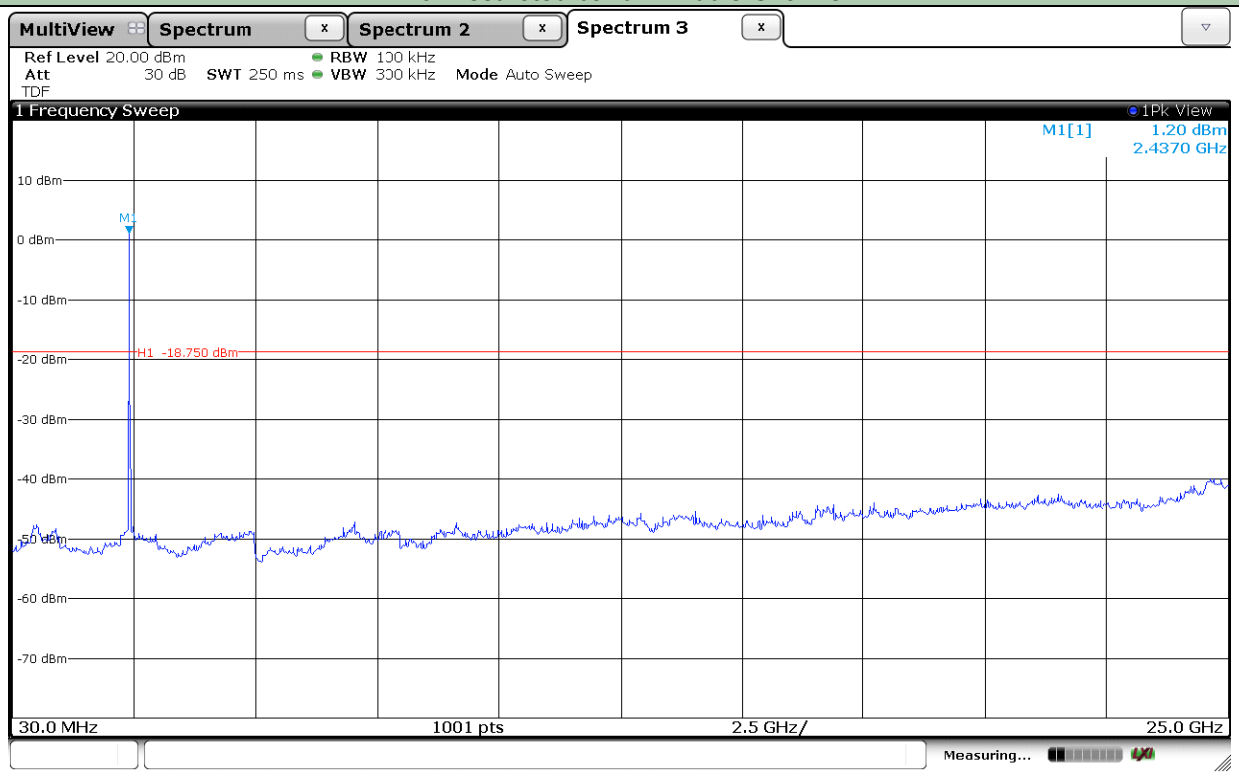
Band-edge and Restricted band – High channel



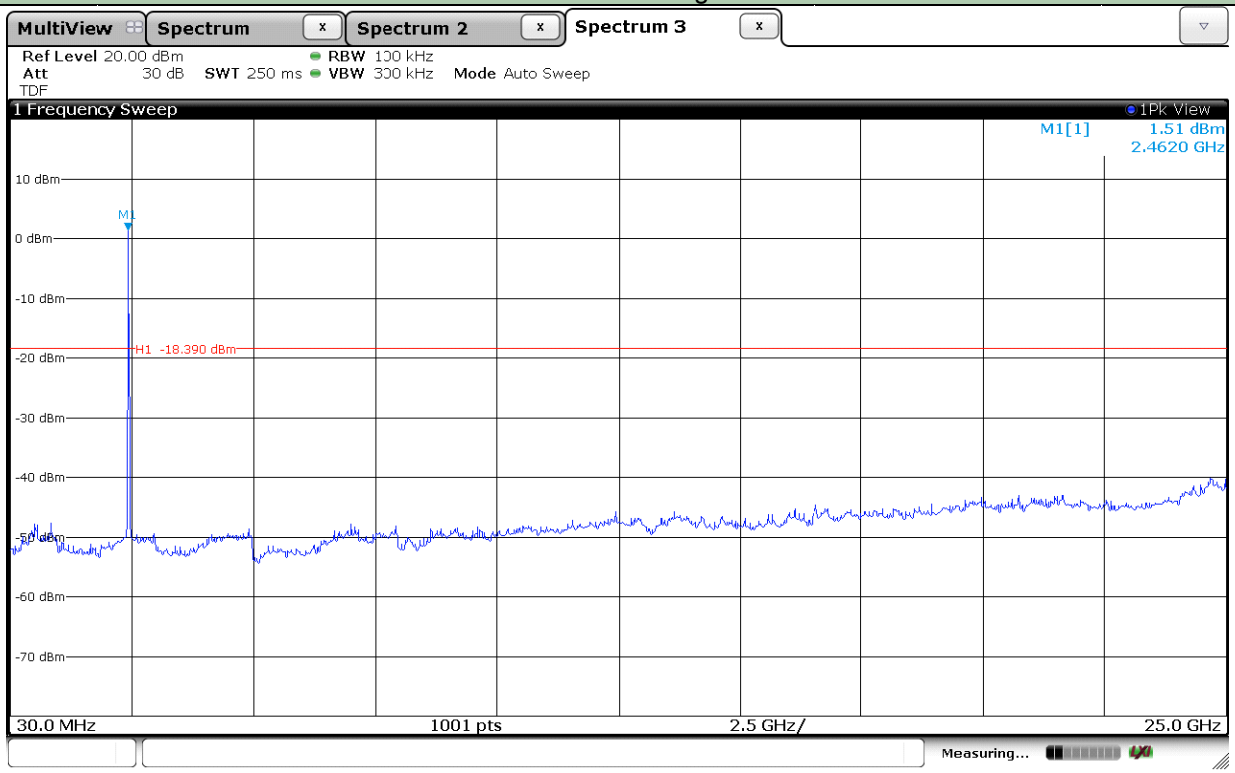
Non-restricted band – Low Channel



Non-restricted band – Middle Channel



Non-restricted band – High Channel



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 v04: 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 for below 1 GHz and 1.5 m for above 1 GHz 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.

For band edge measurement, a spectrum analyzer with the RBW set to 100 kHz, VBW ≥ 3 X RBW, RMS detector and power averaging. Perform a trace averaging of 100 traces and compute the power by integrating the spectrum power over 1MHz using the spectrum analyzer's band power measurement function within band limits set equal to the emissions frequency($f_{emissions}$ ±0.5 MHz) (Reference to KDB 558074 D01 DTS Meas

Guidance v04: 13.3.2 Trace averaging across on-and off-time of the EUT transmissions followed by duty cycle correction.)

5.6.3 Test Site Requirement for KDB 937606

Acc. to KDB 937606, Semi Anechoic Chamber (SAC) shall be verified test results below 30 MHz with Open Area Test Site (OATS), so we compared test results between the measurements from our SAC and an OATS and found test results almost same, so we declare test result for below 30 MHz from our SAC is valid and met the requirement acc. to KDB 937606.

5.6.4 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	± 2.1 dB	30 MHz ~ 1 GHz	± 4.7 dB
1 GHz ~ 18 GHz	± 5.0 dB	18 GHz ~26.5 GHz	± 5.3 dB

5.6.5 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

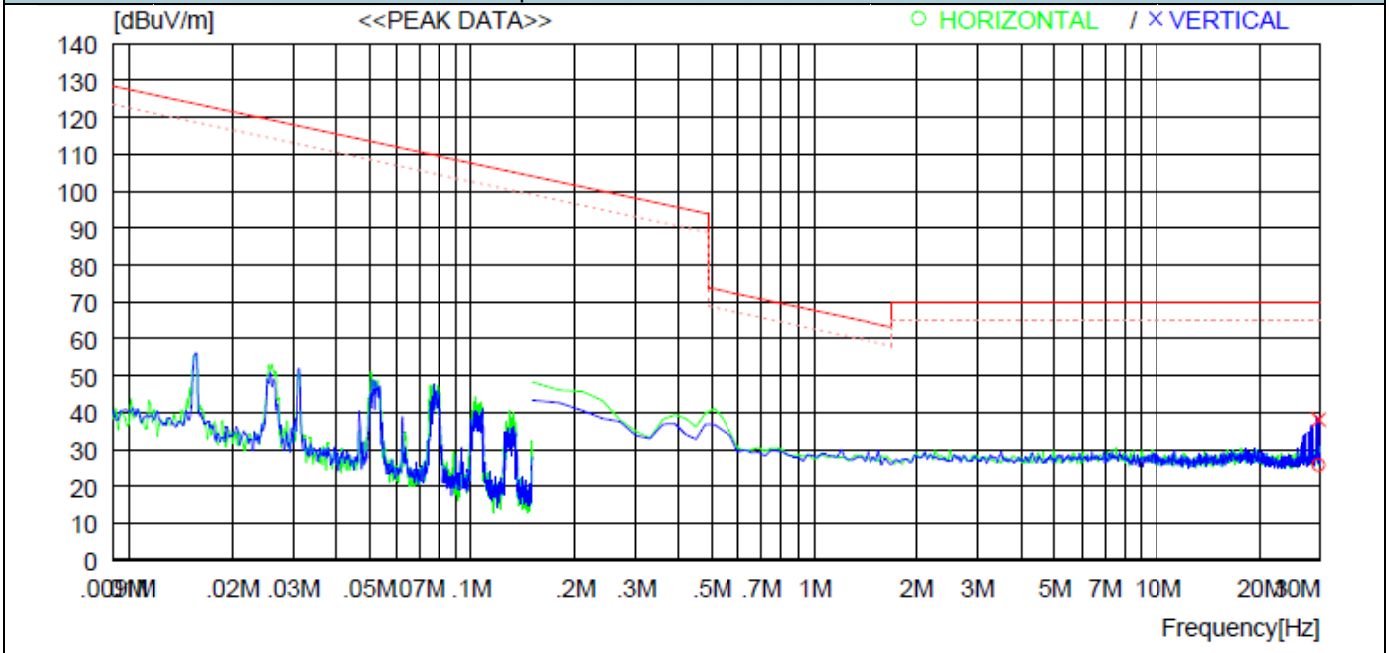
5.6.6 Test Data

Date of Test	2017-11-14 and 2017-11-16	Temperature	(21 ± 3) °C
		Relative humidity	(41 ± 6) % R.H.
Measurement Frequency Range		9 kHz ~ 26 GHz	
Test Result	***PASS***	Tested By	In-yong Song

Frequency range	Detector Mode	Resolution BW	Video BW	Video Filtering	Measurement distance
Below 30 MHz	Peak or Q.P.	9 kHz	100 kHz	-	3 m
30 MHz ~ 1 000 MHz	Peak or Q.P.	100 kHz	300 kHz	-	3 m

5.6.6.1 Test Data below 30 MHz

Graphical Test Data – Below 30 MHz



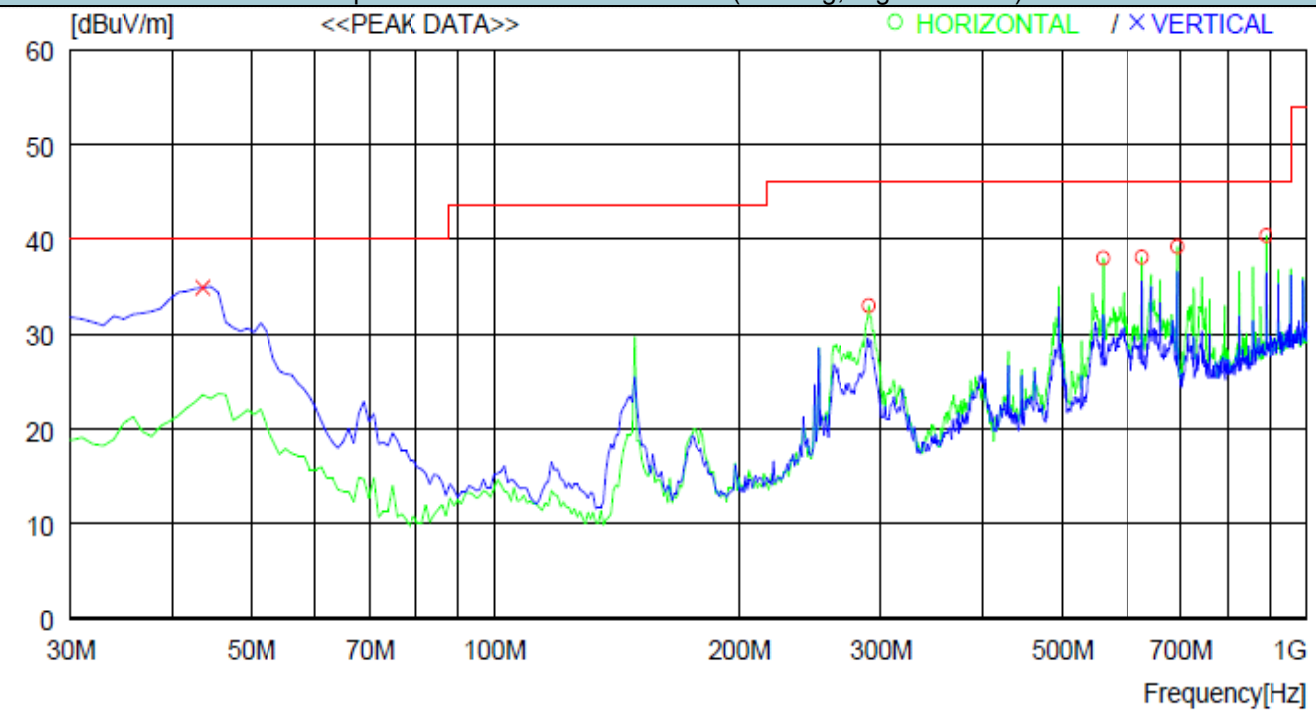
Tabulated Test Data – Low / Middle / High Channel

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)
* Spurious emissions that 20 dB below the limits didn't be recorded										

NOTE: The test results below 30 MHz in our SAC (Semi Anechoic Chamber) was compared with other OATS (Open Area Test Site) and found the result was almost same with OATS.

5.6.6.2 Test Data from 30 MHz to 1 GHz

Graphical Test Data – Below 1 GHz(802.11g, High Channel)

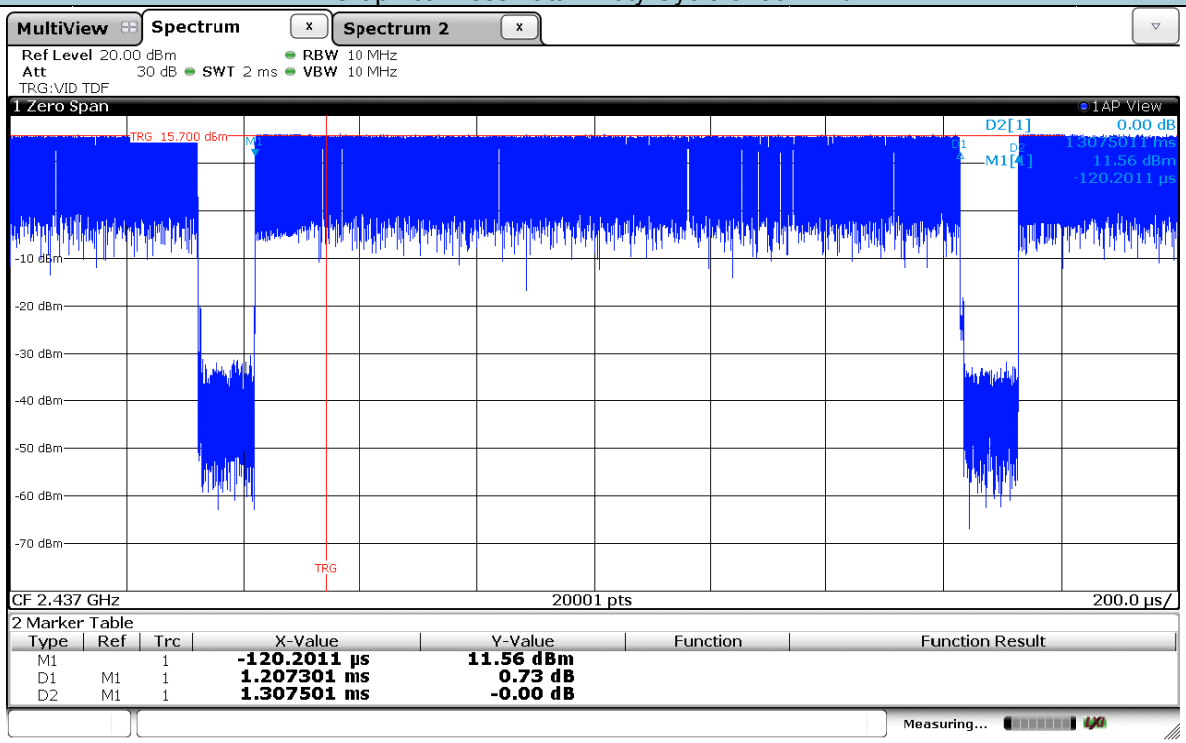


No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	289.960	42.9	13.3	9.5	32.7	33.0	46.0	13	100	275
2	560.589	41.3	18.8	10.9	33.0	38.0	46.0	8	150	322
3	627.517	40.1	19.8	11.3	33.1	38.1	46.0	7.9	150	113
4	693.475	40.6	20.0	11.7	33.1	39.2	46.0	6.8	100	168
5	891.349	37.7	22.8	12.4	32.5	40.4	46.0	5.6	100	0
----- Vertical ------										
6	43.580	47.0	13.4	7.2	32.7	34.9	40.0	5.1	100	359

5.6.6.3 Test Data above 1 GHz

5.6.6.3.1 Duty Cycle

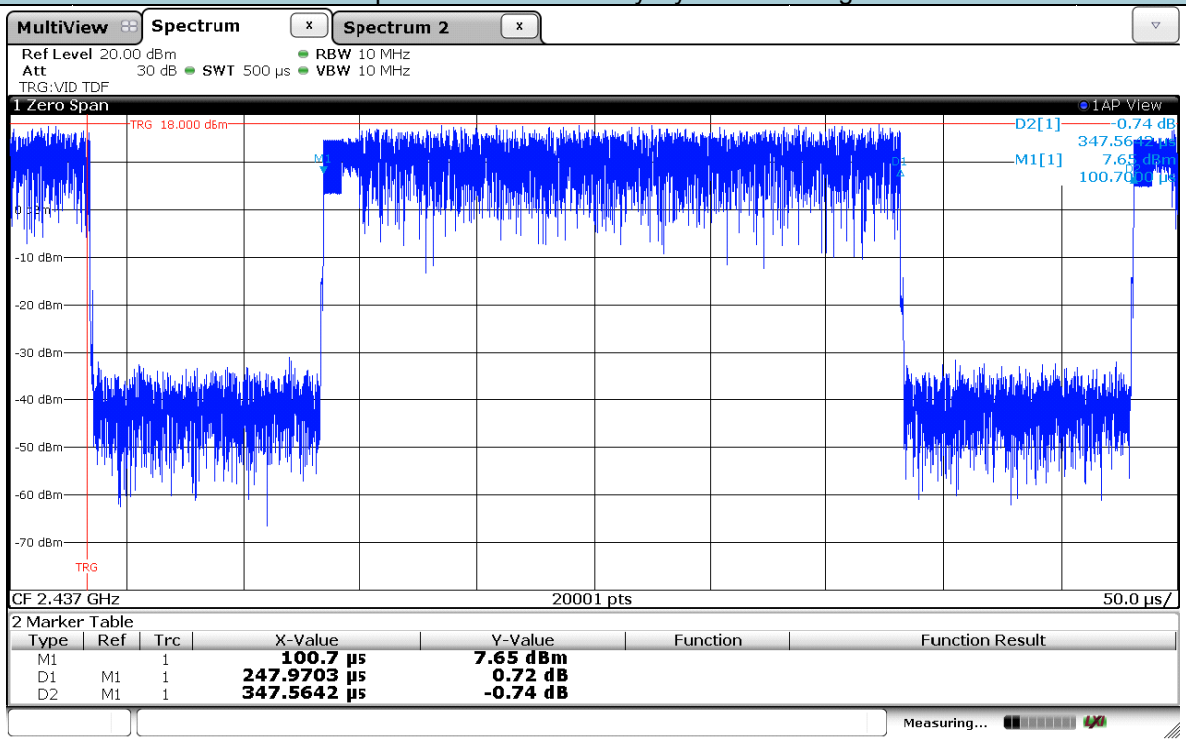
Graphical Test Data - Duty Cycle of 802.11b



Tabulated Test Data

Operating Mode	On Time (ms)	On + Off Time (ms)	Duty Cycle (%)	Duty Factor
802.11b	1.2073	1.3075	92.34	0.35

Graphical Test Data - Duty Cycle of 802.11g

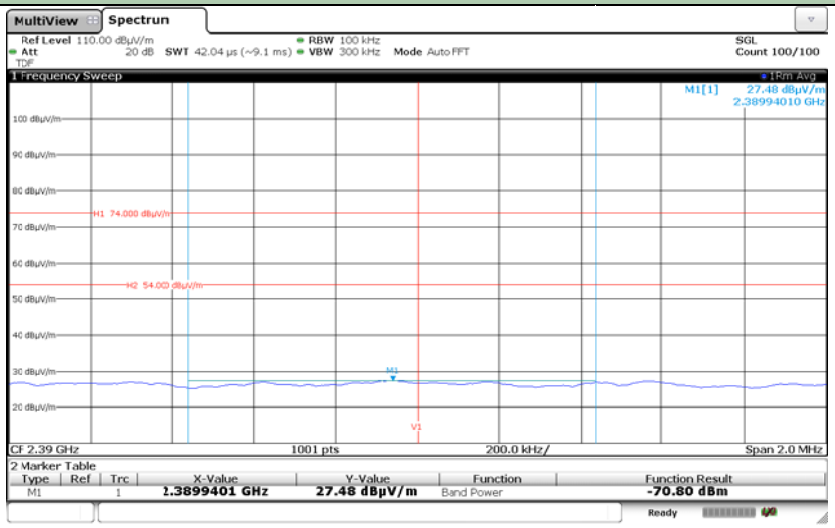


Tabulated Test Data

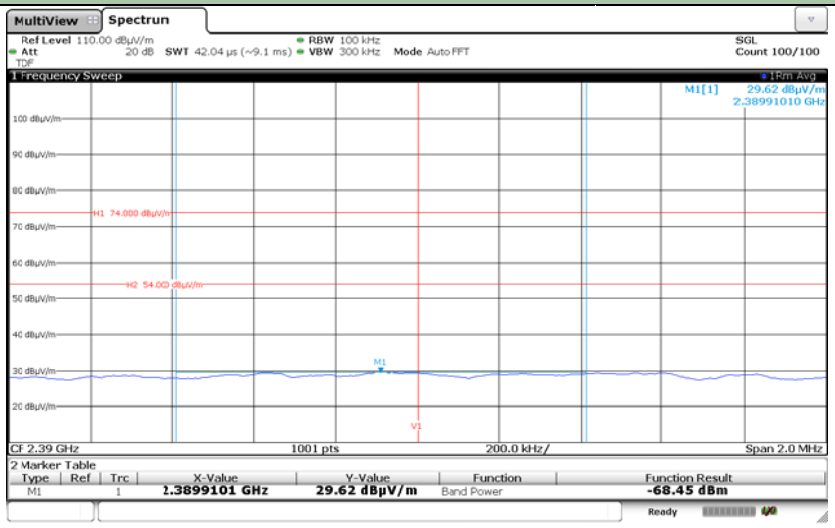
Operating Mode	On Time (ms)	On + Off Time (ms)	Duty Cycle (%)	Duty Factor
802.11g	0.248	0.348	71.35	1.47

5.6.6.3.2 Test Data for Band edge - 802.11b

Graphical Test Data – Low Channel
Horizontal



Vertical



Tabulated Test Data – Low Channel										
Freq. (MHz)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Measured (dBm)	Duty Factor (dB)	Result (dBm)	Height (cm)	Azimuth (Deg)	Limit (dBm)
2 389.940	RMS	H	28.8	38.5	-70.80	0.35	-70.45	150	170	-41.2
2 389.910	RMS	V	28.8	38.5	-68.45	0.35	-68.10	125	255	-41.2

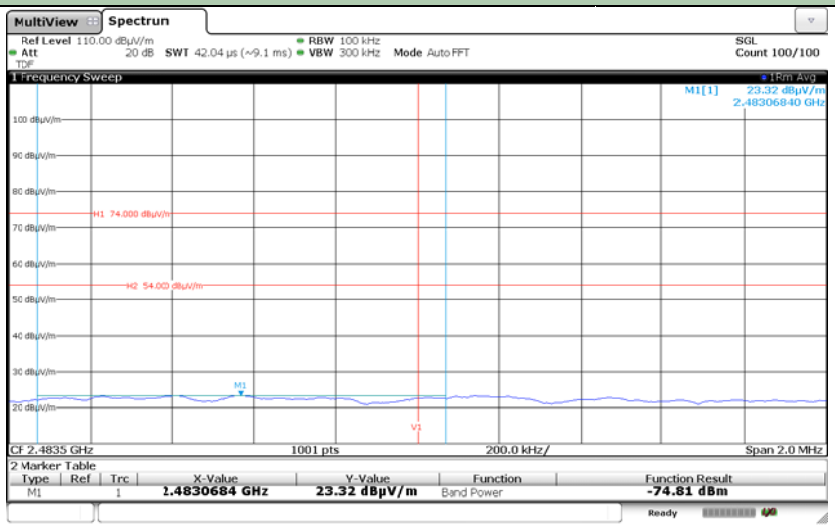
NOTE: "H" means Horizontal polarity, "V" means Vertical polarity.

Result = Measured Band-power + Duty factor

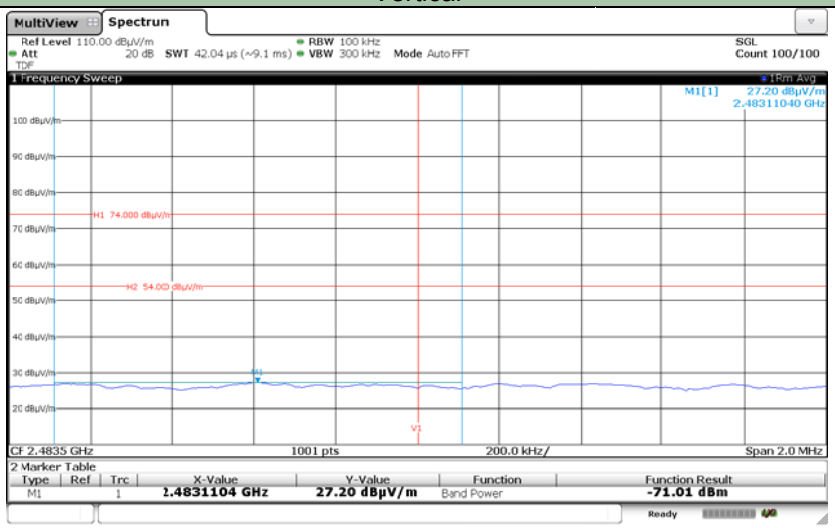
Limit (dBm) = 54 dBuV/m – 95.2 dB

Graphical Test Data – High Channel

Horizontal



Vertical



Tabulated Test Data – High Channel

Freq. (MHz)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Measured (dBm)	Duty Factor (dB)	Result (dBm)	Height (cm)	Azimuth (Deg)	Limit (dBm)
2 483.068	RMS	H	29.1	38.5	-74.81	0.35	-74.46	150	171	-41.2
2 483.110	RMS	V	29.1	38.5	-71.01	0.35	-70.66	125	255	-41.2

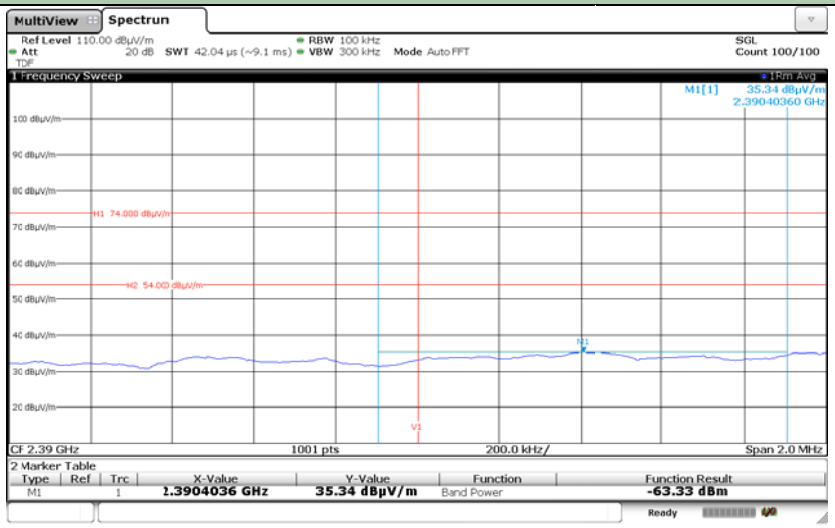
NOTE: "H" means Horizontal polarity, "V" means Vertical polarity.

Result = Measured Band-power + Duty factor

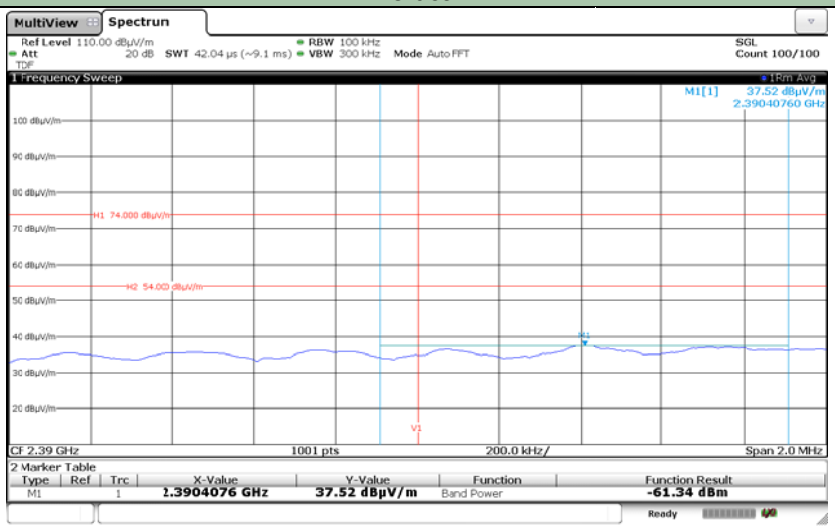
Limit (dBm) = 54 dBuV/m – 95.2 dB

5.6.6.3.3 Test Data for Band edge - 802.11g

Graphical Test Data – Low Channel
Horizontal



Vertical



Tabulated Test Data – Low Channel										
Freq. (MHz)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Measured (dBm)	Duty Factor (dB)	Result (dBm)	Height (cm)	Azimuth (Deg)	Limit (dBm)
2 390.404	RMS	H	28.9	38.6	-63.33	1.47	-61.86	150	170	-41.2
2 390.408	RMS	V	28.9	38.6	-61.34	1.47	-59.87	125	255	-41.2

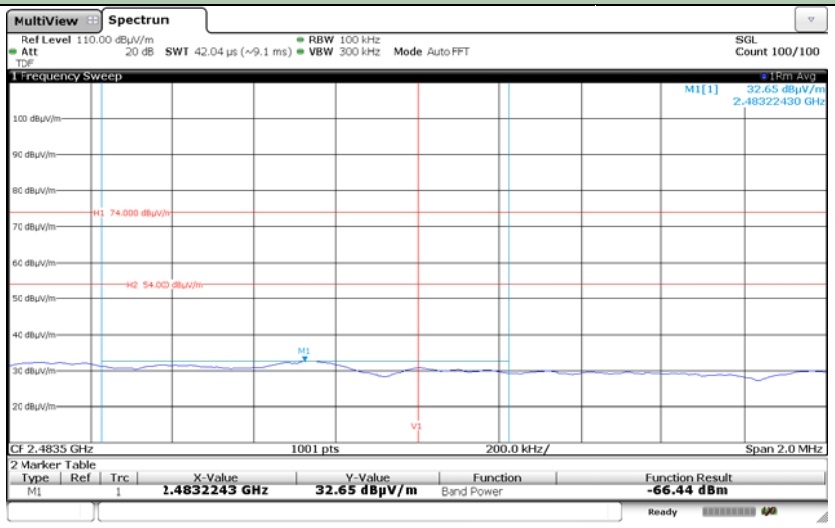
NOTE: "H" means Horizontal polarity, "V" means Vertical polarity.

Result = Measured Band-power + Duty factor

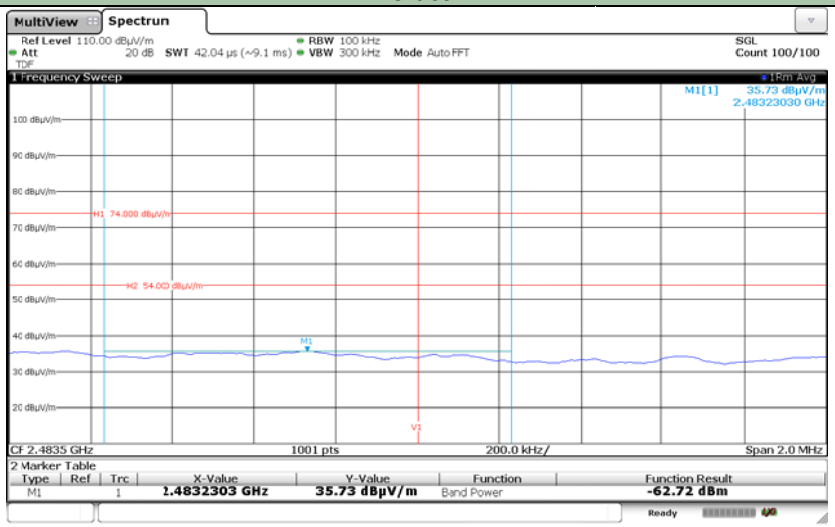
Limit (dBm) = 54 dBuV/m – 95.2 dB

Graphical Test Data – High Channel

Horizontal



Vertical



Tabulated Test Data – High Channel

Freq. (MHz)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Measured (dBm)	Duty Factor (dB)	Result (dBm)	Height (cm)	Azimuth (Deg)	Limit (dBm)
2 483.224	RMS	H	29.1	38.5	-66.44	1.47	-64.97	150	171	-41.2
2 483.230	RMS	V	29.1	38.5	-62.72	1.47	-61.25	125	255	-41.2

NOTE: "H" means Horizontal polarity, "V" means Vertical polarity.

Result = Measured Band-power + Duty factor

Limit (dBm) = 54 dBuV/m – 95.2 dB

5.6.6.4 Test Data for Harmonic & Spurious emission

5.6.6.4.1 Operating mode: 802.11b

Freq. (MHz)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Receiver Reading (dBuV/m)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Deg)
Low / Middle / High Channel											
* Spurious emissions that 20 dB below the limits didn't be recorded											

NOTE: Peak results are met average limit, so average measurement was not performed.

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 + Duty factor

Margin = Limit – Result

"*" indicates frequency in Restricted band.

5.6.6.4.2 Operating mode: 802.11g

Freq. (MHz)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor (dB)	Receiver Reading (dBuV/m)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Deg)
Low / Middle / High Channel											
* Spurious emissions that 20 dB below the limits didn't be recorded											

NOTE: Peak results are met average limit, so average measurement was not performed.

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 + Duty factor

Margin = Limit – Result

"*" indicates frequency in Restricted band.

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	± 2.00 dB	150 kHz ~ 30 MHz	± 2.00 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

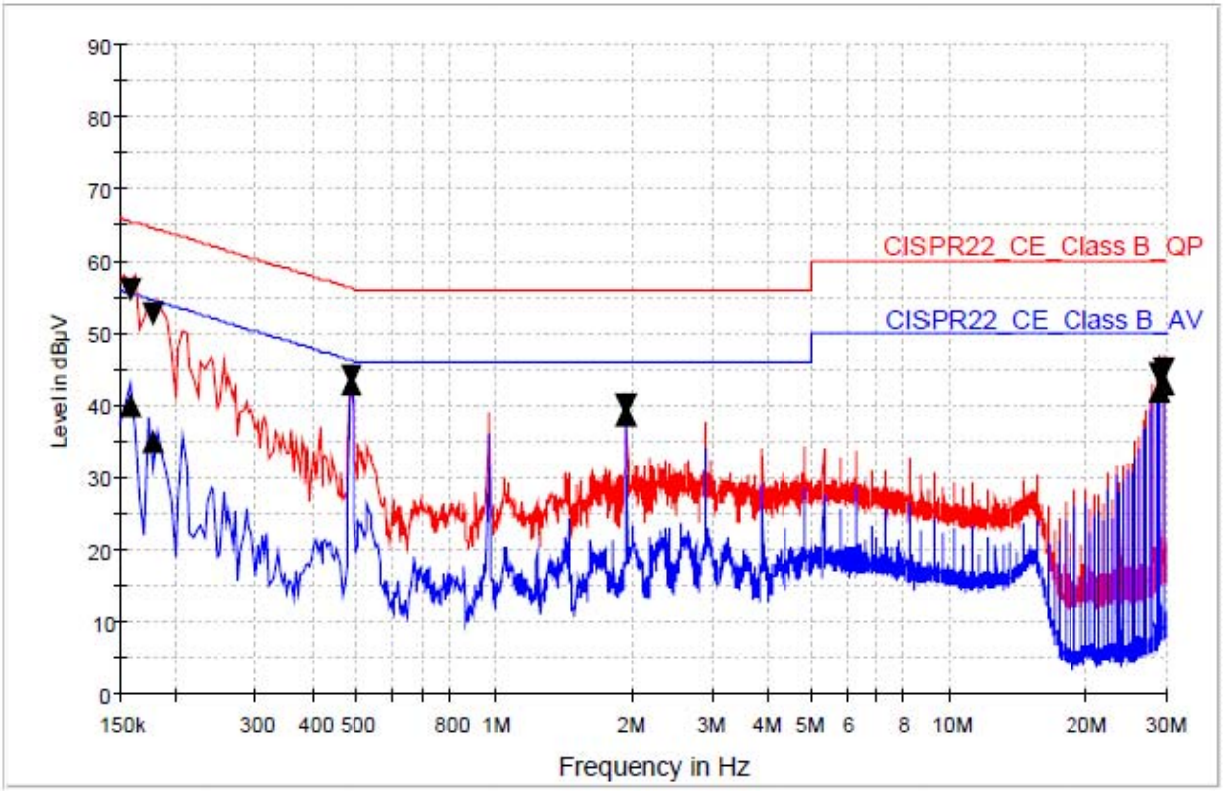
(Calculated value for system losses by software EMC32 manufactured by Rohde & Schwarz)

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

Date of Test	2017-11-08	Temperature	(23 ± 1) °C
		Relative humidity	(45 ± 2) % R.H.
Measurement Frequency Range		9 kHz ~ 30MHz	
Test Result	***PASS***	Tested By	In-yong Song

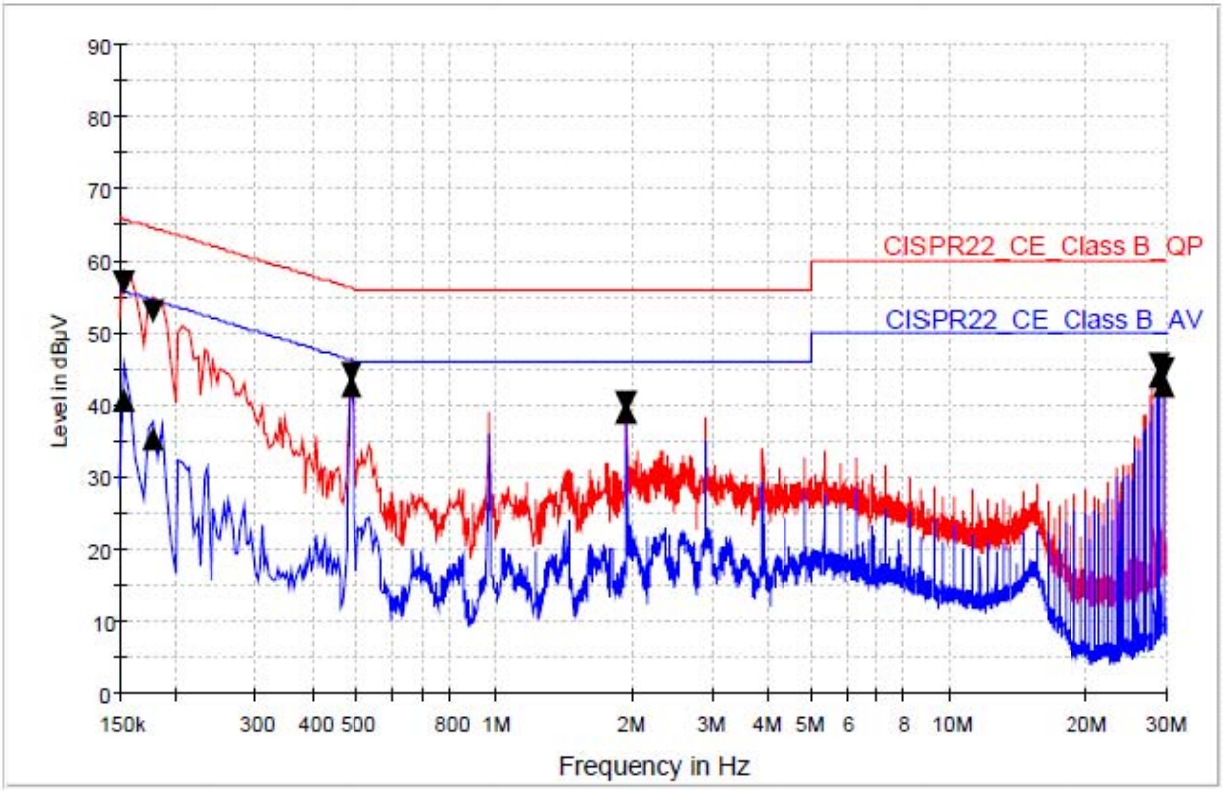
Hot Line



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.158000	56.0	40.1	9.000	L1	9.6	9.6	65.6	15.5	55.6
0.178000	52.6	34.9	9.000	L1	9.6	12.0	64.6	19.7	54.6
0.486000	44.1	42.9	9.000	L1	9.6	12.2	56.2	3.3	46.2
1.942000	40.0	38.8	9.000	L1	9.6	16.0	56.0	7.2	46.0
29.118000	44.3	41.9	9.000	L1	10.0	15.7	60.0	8.1	50.0
29.602000	45.1	43.0	9.000	L1	10.0	14.9	60.0	7.0	50.0

Neutral Line



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.154000	57.1	40.7	9.000	N	9.6	8.7	65.8	15.1	55.8
0.178000	53.1	35.2	9.000	N	9.6	11.4	64.6	19.4	54.6
0.486000	44.2	42.6	9.000	N	9.6	12.1	56.2	3.6	46.2
1.942000	40.3	39.1	9.000	N	9.6	15.7	56.0	6.9	46.0
29.130000	45.6	44.1	9.000	N	10.0	14.4	60.0	5.9	50.0
29.618000	45.0	42.7	9.000	N	10.0	15.0	60.0	7.3	50.0

Appendix I – Test Instrumentation

Description	Model No.	Serial No.	Manufacturer.	Due for Cal Date
Signal & Spectrum Analyzer	FSW 43	100578	Rohde & Schwarz	2018-05-04
Power Meter	NRP2	104109	Rohde & Schwarz	2018-01-19
Power Sensor	NRP-Z81	101507	Rohde & Schwarz	2018-07-28
DC Power Supply	U8001A	MY51080019	Agilent	2018-07-28
Attenuator	56-10	58769	WEINSCHEL	2018-01-19
Test Receiver	ESU 26	100303	Rohde & Schwarz	2018-01-19
Loop Antenna	HFH2-Z2	100341	Rohde & Schwarz	2019-06-05
TRILOG Broadband Antenna	VULB9163	9163.770	Schwarzbeck	2019-02-13
Notch Filter	BRM50702	G318	MICRO-TRONICS	2018-11-08
Horn Antenna	HF 907	102426	Rohde & Schwarz	2019-01-06
DOPPEL STEG Horn Antenna	HF 906	100332	Rohde & Schwarz	2019-02-13
Horn Antenna	BBHA 9170	783	Schwarzbeck	2019-11-28
Attenuator	6dB	272.4110.50	Rohde & Schwarz	2018-01-19
Pre-Amplifier	310N	344015	Sonoma Instrument	2018-01-19
Pre-Amplifier	SCU 18D	19006450	Rohde & Schwarz	2018-04-24
Pre-Amplifier	CBL18265035	28706	CERNEX	2018-03-29
Pre-Amplifier	CBL26405040	28707	CERNEX	2018-03-29
Turn Table	DT3000-3t	1310814	INNCO SYSTEM	N/A
Antenna Master	MA4000-EP	4600814	INNCO SYSTEM	N/A
Antenna Master	MA4000-XP-ET	-	INNCO SYSTEM	N/A
Camera Controller	HDCon4102	6531445048	PONTIS	N/A
CO3000 Controller	Co3000-4Port	CO3000/806/ 34130814/L	INNCO SYSTEM	N/A
CO3000 Controller	Co3000-4Port	CO3000/807/ 34130814/L	INNCO SYSTEM	N/A
EMI Test Receiver	ESCI 7	100722	Rohde & Schwarz	2018-01-19
LISN	ENV216	100110	Rohde & Schwarz	2018-07-28

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.