



FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer: LG Electronics Inc.

**391-2, Gaeumjeong-dong, Changwon City,
Gyeongnam 641-711, Korea**

Attn: Mr. Kwang-Mu Son / Chief Research Engineer

Date of Issue: February 19, 2013

Order Number: GETEC-C1-13-029

Test Report Number: GETEC-E3-13-009

Test Site: GUMI COLLEGE EMC CENTER

FCC Registration Number: (100749, 443957)

FCC ID. : BEJ-LGHAWWW1301

Applicant : LG Electronics Inc.

Rule Part(s)	: FCC Part 15 Subpart C-Intentional Radiator § 15.247
Test Method	: ANSI C63.10 (2009)
Equipment Class	: Digital Transmission System(DTS)
EUT Type	: WLAN module
Type of Authority	: Certification
Model Name	: LGHA-WWW1301
Trade Name	: LG

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4 (2009)

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Reviewed by,


**Seung-Chul Lee, Associate Engineer
GUMI COLLEGE EMC CENTER**


**Jae-Hoon Jeong, Technical Manager
GUMI COLLEGE EMC CENTER**





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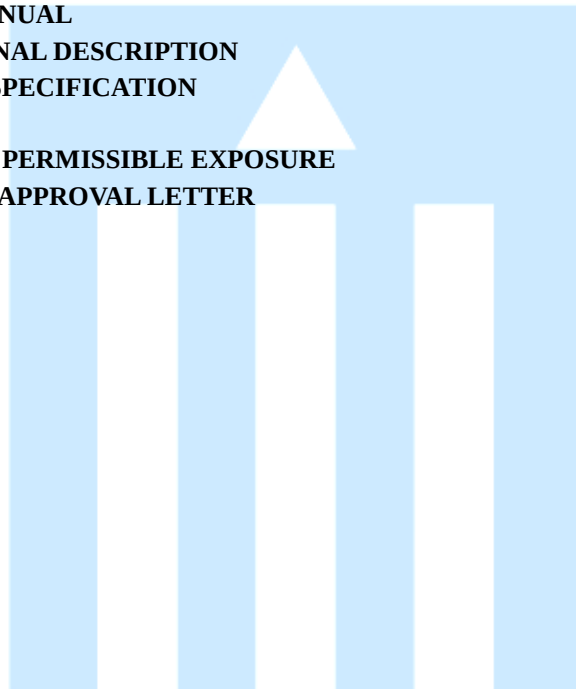
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Scope: Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

1. General Information

Applicant: LG Electronics Inc.

Applicant Address: 391-2, Gaeumjeong-dong, Changwon City, Gyeongnam 641-711, Korea

Manufacturer: LG Electronics Inc.

Manufacturer Address: 391-2, Gaeumjeong-dong, Changwon City, Gyeongnam 641-711, Korea

Contact Person: Mr. Kwang-Mu Son / Chief Research Engineer

Telephone Number: +82-55-260-3966

- **FCC ID.** BEJ-LGHAWWW1301
- **Equipment Class** Digital Transmission System (DTS)
- **EUT Type** WLAN module
- **Model Name** LGHA-WWW1301
- **Rule Part(s)** FCC Part 15 Subpart C-Intentional Radiator § 15.247
- **Test Method** ANSI C63.10 (2009)
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2009)
- **Dates of Test** January 10 ~ February 18, 2013
- **Place of Test** GUMI COLLEGE EMC CENTER (FCC Registration No.: 100749, 443957)
37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Korea
- **Test Report Number** GETEC-E3-13-009
- **Dates of Issue** February 19, 2013





2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009) was used in determining radiated and conducted emissions emanating from **LG Electronics Inc. WLAN module (Model name: LGHA-WWW1301)**

These measurement tests were conducted at **GUMI COLLEGE EMC CENTER**.

The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Gyeongnam 641-713, Korea

This test site is one of the highest point of Gumi 1 college at about 200 kilometers away from Seoul city and 40 kilometers away from Daejeon city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 (2009)

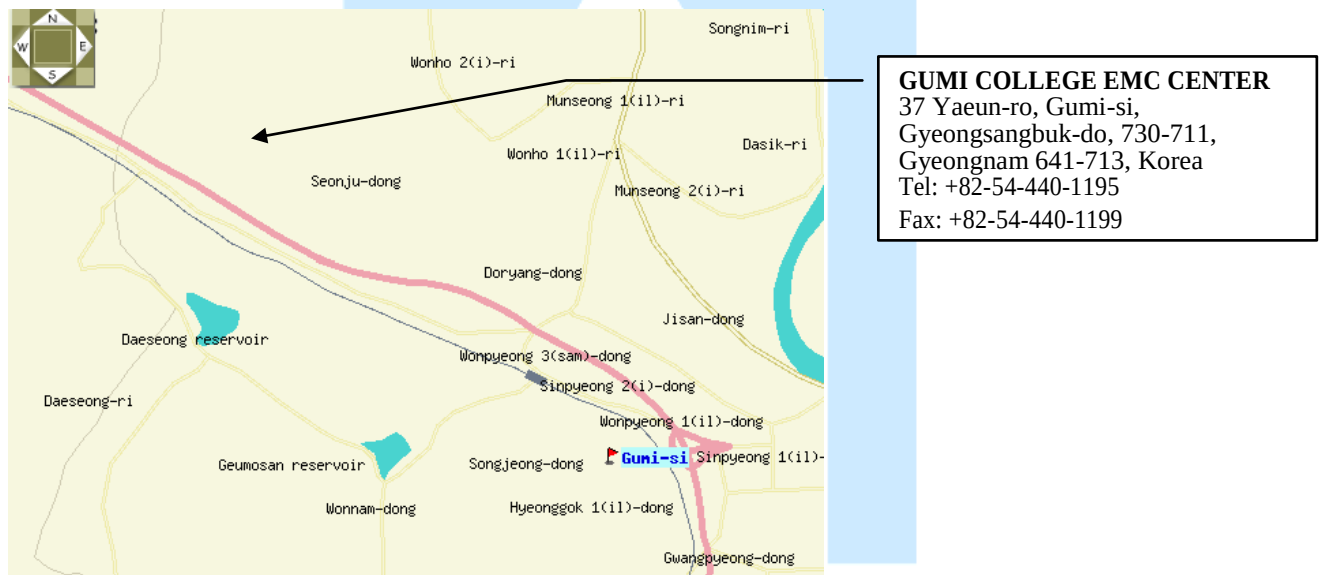


Fig 1. The map above shows the Gumi College in vicinity area.





3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **LG Electronics Inc. WLAN module**
(Model Name: LGHA-WWW1301) FCC ID.: BEJ-LGHAWWW1301

- 2.4GHz IEEE 802.11b/g/n Radio Technology
- On-board Antenna
- Transmit power : +17dBm @ 11b/11Mbps
- Max Receive Sensitivity : -92dBm
- MURATA Module (RF chipset : BCM4319)
- USB2.0 A Type Interface
- Operating Temperature Range : -20°C to 70°C
- ROHS compliant

-. Crystal & Clock Frequency : 30MHz

3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Notebook PC	SAMSUNG	NT-Q45	S/N: ONBA4300168AI00683B7460 FCC ID.: N/A

See “Appendix E – Test Setup Photographs” for actual system test set-up

3.2.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
None.	-	-	S/N: - FCC ID.: -

3.2.3 Used Cable(s)

Cable Name	Condition	Description
USB cable	Connected to the EUT and notebook PC	0.50 m shielded

3.3 Modification Item(s)

-. None





4. Description of tests

4.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used. The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency: DC 5 V

- Test Mode(s):
Executed "DOS (Copyright by Microsoft)" to control EUT continuously transmit RF signal.

Mode	Test level (dbm)		
Frequency	2 412 MHz	2 442 MHz	2 462 MHz
IEEE 802.11 B	17	17	17
IEEE 802.11 G	14	14	14
IEEE 802.11 N	13	13	13

Mode	Available channel	Modulation Technology	Data rate (Mbps)
IEEE 802.11 B	1 to 11	DSSS	11
IEEE 802.11 G	1 to 11	OFDM	54
IEEE 802.11 N	1 to 11	OFDM	64

5. Antenna Requirement - §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

5.1 Description of Antenna

The **LG Electronics Inc.** comply with the requirement of §15.203 with a chip antenna permanently attached to the transmitter.





5.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (FCC Registration No.: 100749)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ESH2-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH3-Z5). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCS30).

Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and Average mode.

The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

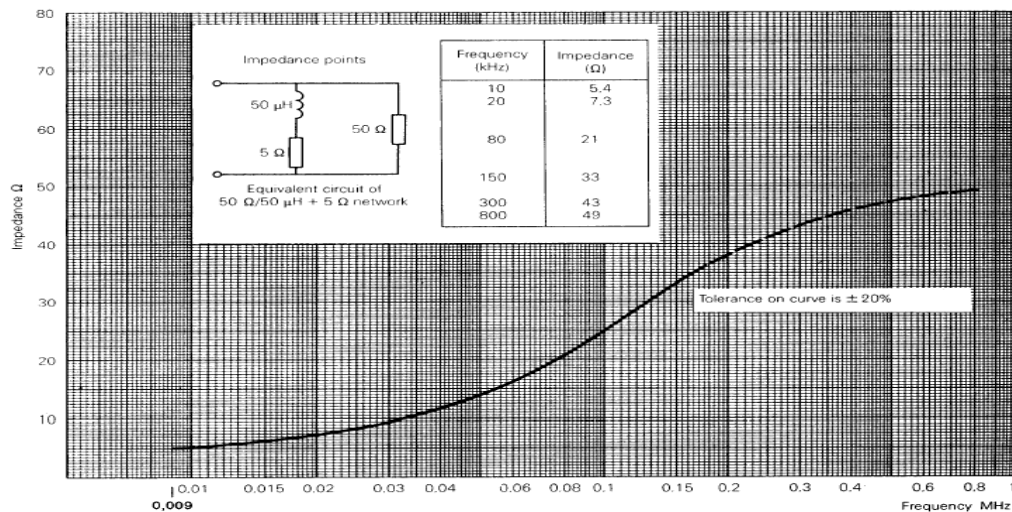


Fig 2. Impedance of LISN





5.3 Radiated Emission

Exploratory Radiated measurements were conducted at the 3m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements of below 1GHz were made at 3m Chamber (FCC Registration No.: 443957) or Open area test site (FCC Registration No.: 100749) that complies with CISPR 16/ANSI C63.4.

Above 1GHz final measurements were conducted at the 3m Chamber (FCC Registration No.: 443957) only.

For measurements above 1GHz, the bottom side of 3m chamber was installed with absorbers in order to meet SVSWR Limit.

Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1GHz) and Peak & Average mode (Above 1GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

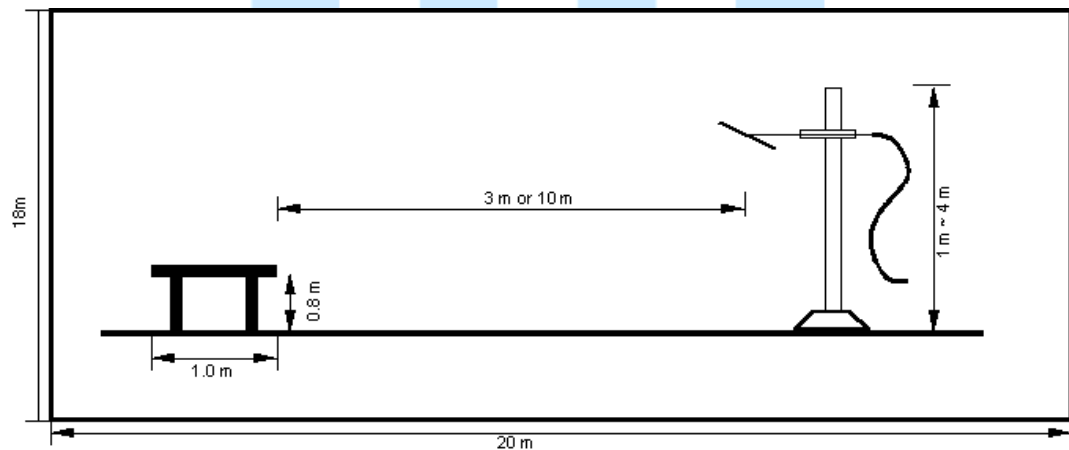


Fig 3. Dimensions of test site (Below 1GHz)

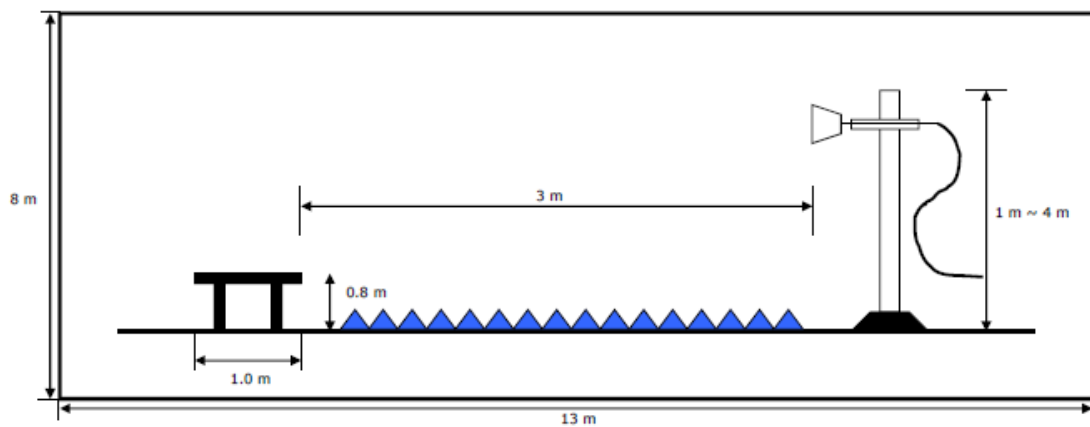


Fig 4. Dimensions of test site (Above 1GHz)





6. Conducted Emission

6.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 43.0 % R.H.

6.2 Test Set-up

The conducted emission measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.

AMN is bonded on horizontal reference ground plane.

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

6.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO "Guide to the expression of uncertainty in measurement."

The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	± 2.74 dB	Confidence level of approximately 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	± 4.25 dB	Confidence level of approximately 95 % ($k = 2$)





6.4 Limit

RFI Conducted	FCC Limit(dB μ V/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

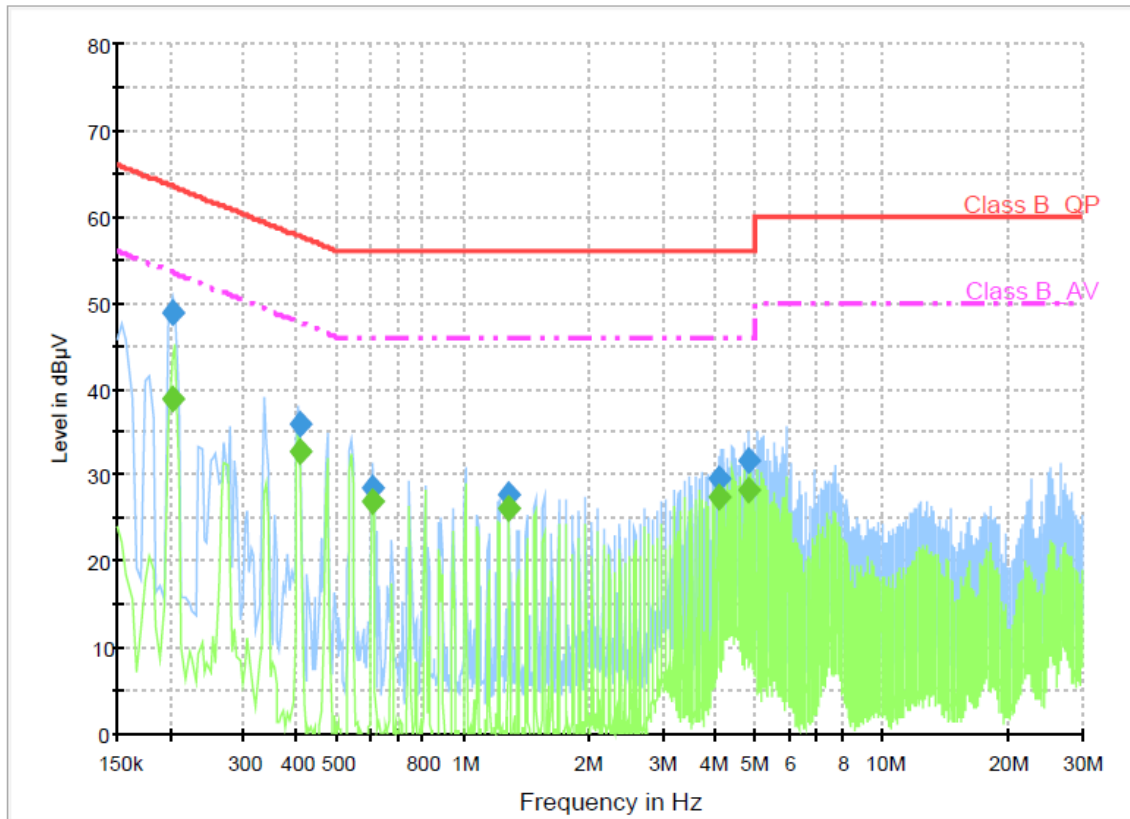
6.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI test receiver	839809/003	05. 22. 2013
□- ESH3-Z5	Rohde & Schwarz	LISN	838979/020	05. 23. 2013
■ - ESH2-Z5	Rohde & Schwarz	LISN	829991/009	05. 23. 2013
□ - ISN T8	TESEQ. GmbH	ISN	24568	07. 04. 2013

6.6 Test data for Conducted Emission

- Test Date : January 22, 2013
- Reference Standard : Part 15 Subpart C, Sec. 15.207
- Operating Condition (Worst Case) : RF transmitting mode (Low: 2 412 MHz)
- Frequency rage : 0.15MHz ~ 30 MHz





Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.204000	48.8	1000.0	9.000	GND	L1	10.1	14.7	63.4	
0.408000	35.9	1000.0	9.000	GND	L1	10.1	21.8	57.7	
0.612000	28.4	1000.0	9.000	GND	L1	10.1	27.6	56.0	
1.288000	27.7	1000.0	9.000	GND	L1	10.1	28.3	56.0	
4.060000	29.7	1000.0	9.000	GND	L1	10.1	26.3	56.0	
4.804000	31.7	1000.0	9.000	GND	L1	10.1	24.3	56.0	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.204000	38.9	1000.0	9.000	GND	L1	10.1	14.6	53.4	
0.408000	32.8	1000.0	9.000	GND	L1	10.1	14.9	47.7	
0.612000	26.8	1000.0	9.000	GND	L1	10.1	19.2	46.0	
1.288000	26.1	1000.0	9.000	GND	L1	10.1	19.9	46.0	
4.060000	27.4	1000.0	9.000	GND	L1	10.1	18.6	46.0	
4.804000	28.3	1000.0	9.000	GND	L1	10.1	17.7	46.0	

< Fig 5. Conducted emission result >



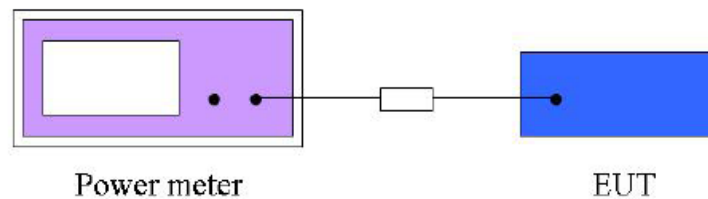


7. Maximum Peak Output Power Measurement

7.1 Operating environment

Temperature : 22.0 °C
Relative Humidity : 43.0 % R.H.

7.2 Test Set-up (Layout)



7.3 Limit

For systems using digital modulation in the (2 400~2 483.5) MHz, the limit for peak output power is 30 dBm. The limit has to be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

7.4 Test Equipment used

Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ - NRVD	Rohde & Schwarz	Power meter	837794/048	05. 23. 2013
■ - NRP-Z32	Rohde & Schwarz	Power sensor	100062	05. 24. 2013

7.5 Test Result

- Test Date : February 18, 2013
- Reference Standard : Part 15 Subpart C, Sec. 15.247(b)(3) / ANSI C63.10 Clause 6.10.2.1 (a)
- Operating Condition : RF transmitting mode (Low: 2 412 MHz, Middle: 2 442 MHz, High: 2 462 MHz)
- Power Source : DC 5 V





Configuration IEEE 802.11 B

Frequency (MHz)	Peak Conducted Power (dBm)	Peak Conducted Power (mW)	Max. Limit (dBm)	Result
2 412	19.07	80.72	30.00	Complies
2 442	18.15	65.31	30.00	Complies
2 462	17.45	55.59	30.00	Complies

Configuration IEEE 802.11 G

Frequency (MHz)	Peak Conducted Power (dBm)	Peak Conducted Power (mW)	Max. Limit (dBm)	Result
2 412	18.96	78.70	30.00	Complies
2 442	17.74	59.43	30.00	Complies
2 462	18.34	68.23	30.00	Complies

Configuration IEEE 802.11 N

Frequency (MHz)	Peak Conducted Power (dBm)	Peak Conducted Power (mW)	Max. Limit (dBm)	Result
2 412	16.50	44.67	30.00	Complies
2 442	17.34	54.20	30.00	Complies
2 462	16.70	46.77	30.00	Complies



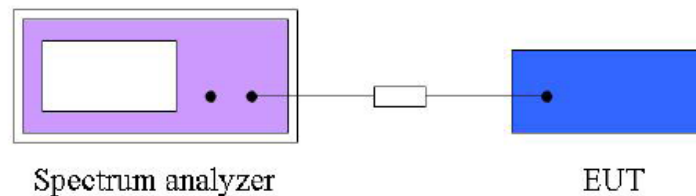


8. Power Spectral Density Measurement

8.1 Operating Environment

Temperature : 22.0 °C
Relative Humidity : 43.0 % R.H.

8.2 Test Set-up (Layout)



8.3 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

8.4 Test Equipment used

Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSP	Rohde & Schwarz	Spectrum Analyzer	101431	04. 26. 2013

7.5 Test Result

- Test Date : February 18, 2013
- Reference Standard : Part 15 Subpart C, Sec. 15.247(e)
- Operating Condition : RF transmitting mode (Low: 2 412 MHz, Middle: 2 442 MHz, High: 2 462 MHz)
- Power Source : DC 5 V

Spectrum Parameter

- Resolution bandwidth : 3 kHz
- Video bandwidth : 30 kHz
- Sweep time : Auto
- Span frequency : 1.5 times the DTS bandwidth
- Detector : Peak
- Trace mode : Max. Hold





Configuration IEEE 802.11 B

Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
2 412 MHz	- 5.09	8.00	Complies
2 442 MHz	- 3.63	8.00	Complies
2 462 MHz	- 6.77	8.00	Complies

Configuration IEEE 802.11 G

Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
2 412 MHz	- 13.06	8.00	Complies
2 442 MHz	- 13.30	8.00	Complies
2 462 MHz	- 12.01	8.00	Complies

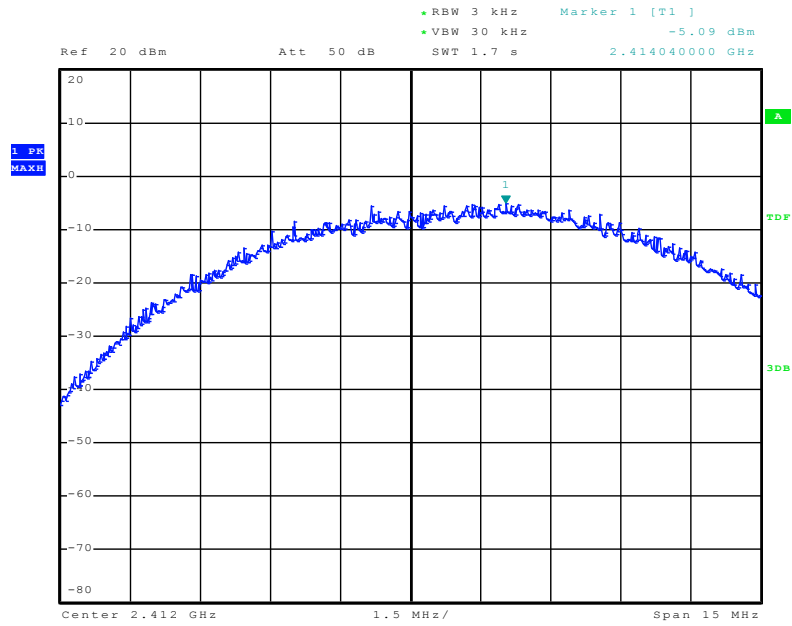
Configuration IEEE 802.11 N

Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
2 412 MHz	- 14.34	8.00	Complies
2 442 MHz	- 15.86	8.00	Complies
2 462 MHz	- 14.65	8.00	Complies



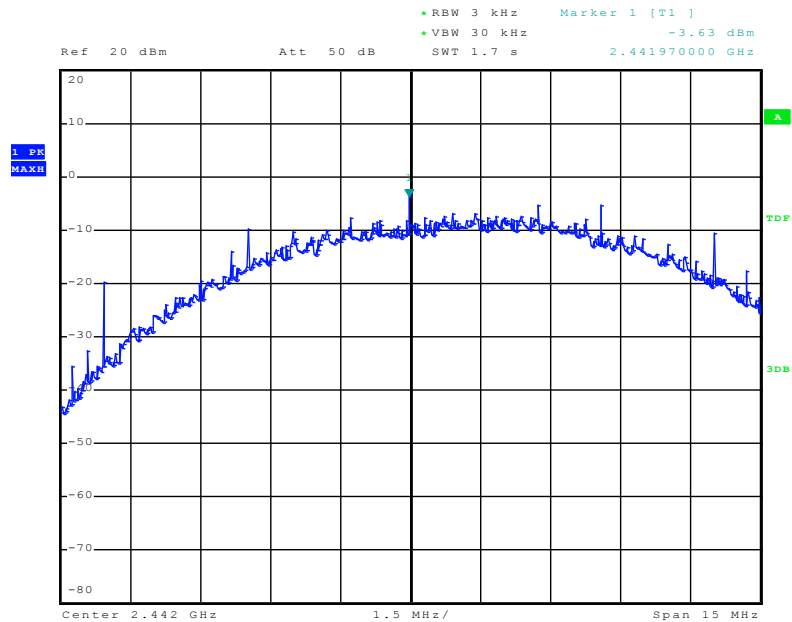


Power Density Plot on configuration IEEE 802.11 B / 2 412 MHz



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Power Density Plot on configuration IEEE 802.11 B / 2 442 MHz

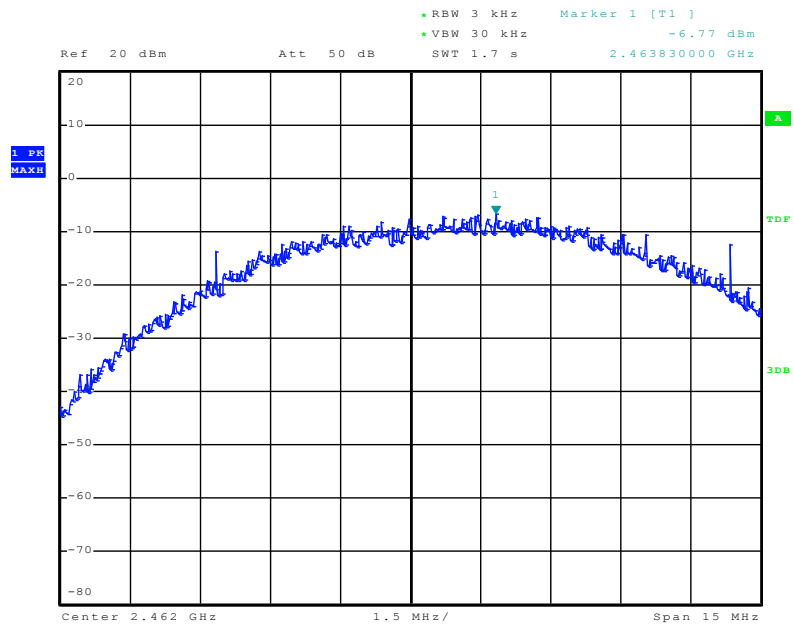


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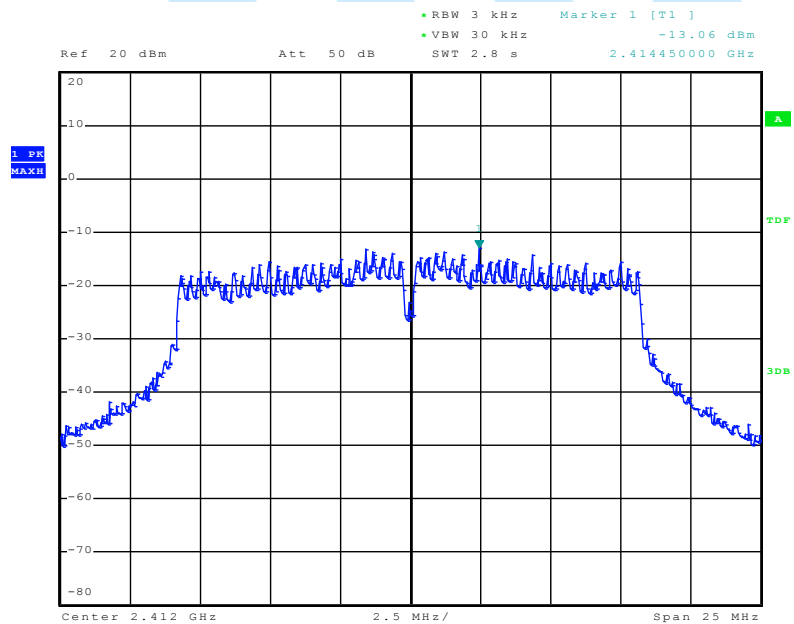


Power Density Plot on configuration IEEE 802.11 B / 2 462 MHz



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Power Density Plot on configuration IEEE 802.11 G / 2 412 MHz

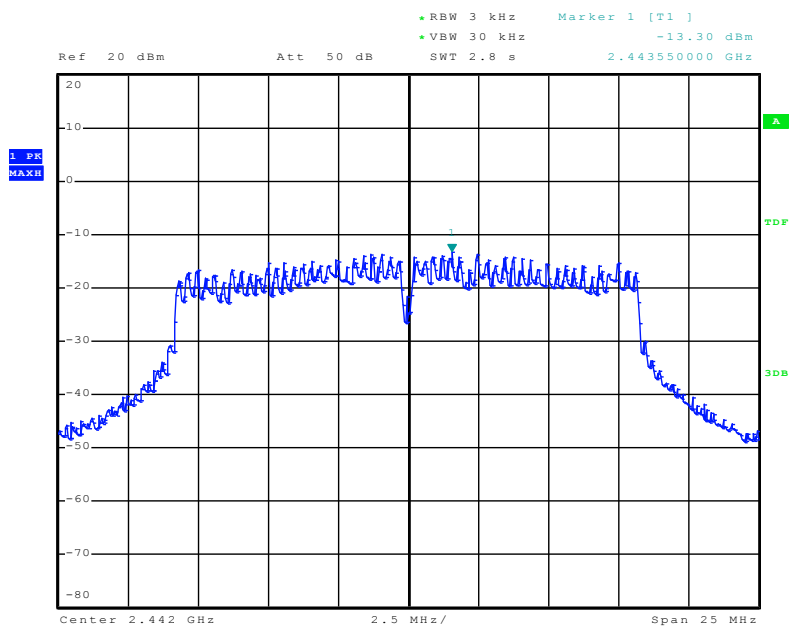


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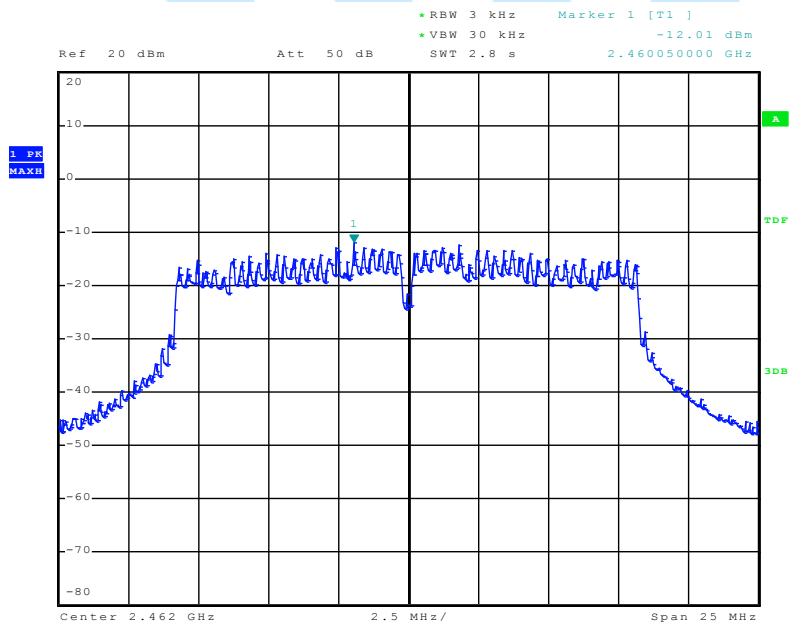


Power Density Plot on configuration IEEE 802.11 G / 2 442 MHz



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Power Density Plot on configuration IEEE 802.11.G / 2 462 MHz

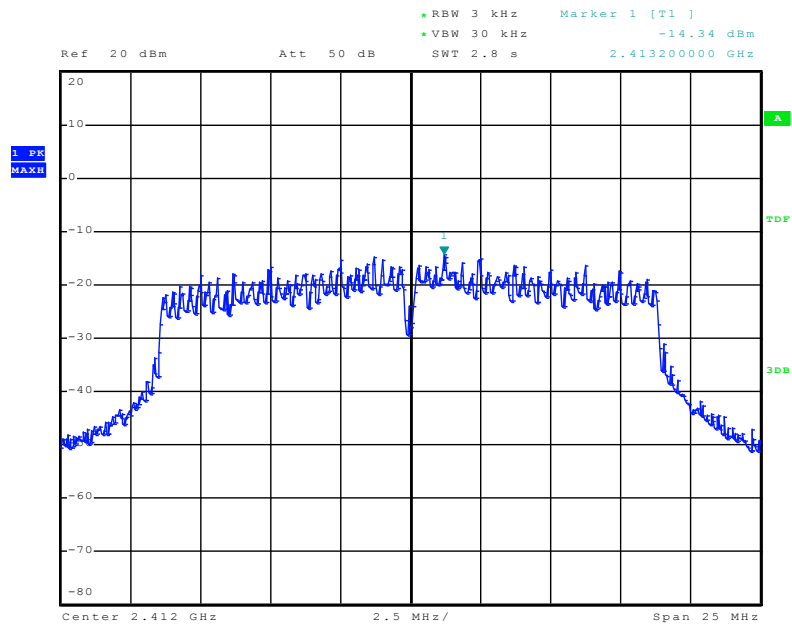


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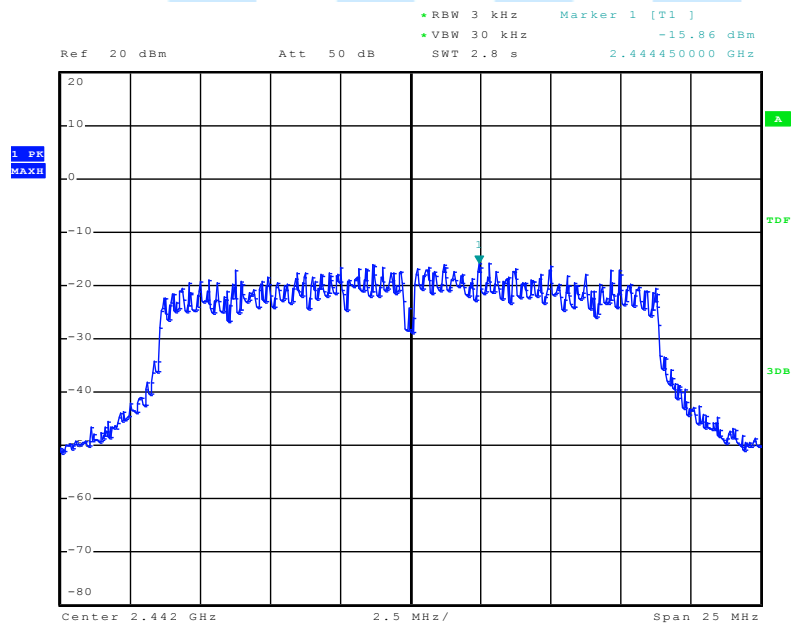


Power Density Plot on configuration IEEE 802.11.N / 2 412 MHz



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Power Density Plot on configuration IEEE 802.11.N / 2 442 MHz

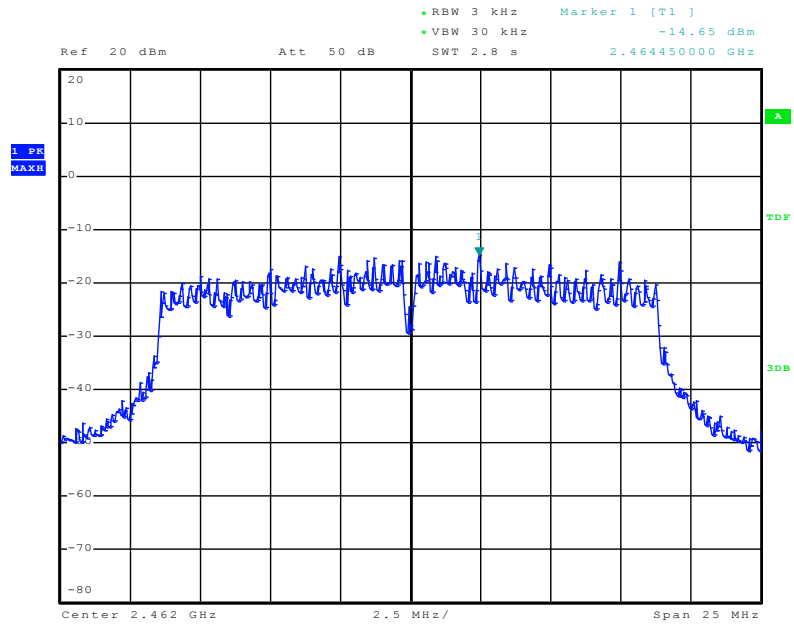


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Power Density Plot on configuration IEEE 802.11.N / 2 462 MHz



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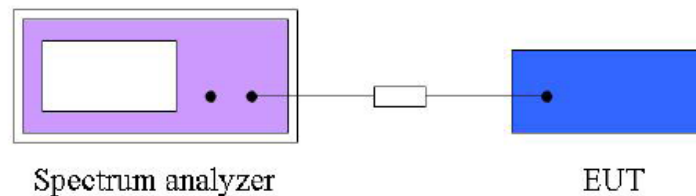


9. 6 dB Spectrum bandwidth Measurement

9.1 Operating environment

Temperature : 22.0 °C
Relative Humidity : 43.0 % R.H.

9.2 Test Set-up (Layout)



9.3 Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

9.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSP	Rohde & Schwarz	Spectrum Analyzer	101431	04. 26. 2013

9.5 Test result

- Test Date : February 18, 2013
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(2)
- Operating Condition : RF transmitting mode (Low: 2 412 MHz, Middle: 2 442 MHz, High: 2 462 MHz)
- Power Source : DC 5 V

Spectrum Parameter

- Resolution bandwidth : 100 kHz
- Video bandwidth : 300 kHz
- Sweep time : Auto
- Span frequency : 30 MHz
- Detector : Peak
- Trace mode : Max. Hold





Configuration IEEE 802.11 B

Frequency (MHz)	6 dB Bandwidth (MHz)	99 % Occupied bandwidth (MHz)	Min. Limit (kHz)	Result
2 412	7.06	11.64	500	Complies
2 442	7.44	11.70	500	Complies
2 462	7.62	11.76	500	Complies

Configuration IEEE 802.11 G

Frequency (MHz)	6 dB Bandwidth (MHz)	99 % Occupied bandwidth (MHz)	Min. Limit (kHz)	Result
2 412	15.76	16.44	500	Complies
2 442	15.96	16.44	500	Complies
2 462	15.72	16.44	500	Complies

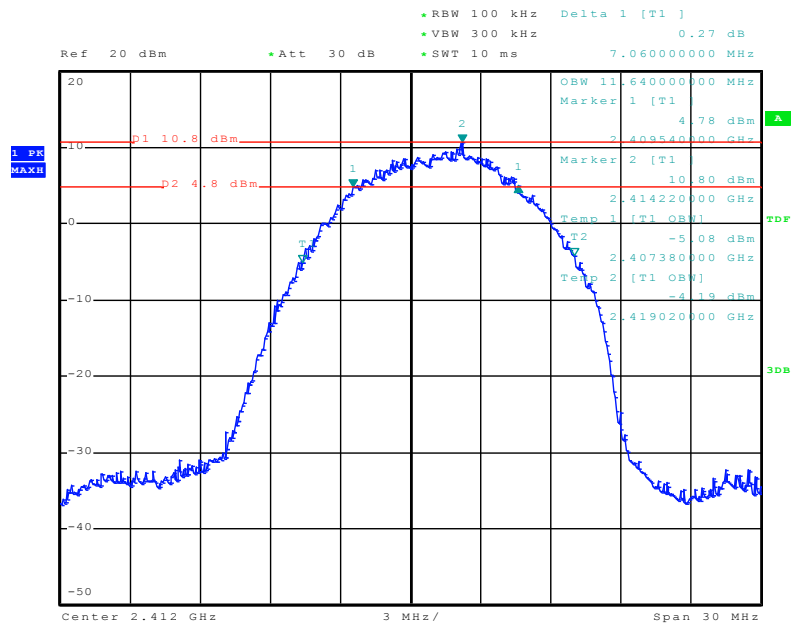
Configuration IEEE 802.11 N

Frequency (MHz)	6 dB Bandwidth (MHz)	99 % Occupied bandwidth (MHz)	Min. Limit (kHz)	Result
2 412	15.70	17.64	500	Complies
2 442	15.72	17.58	500	Complies
2 462	15.70	17.58	500	Complies



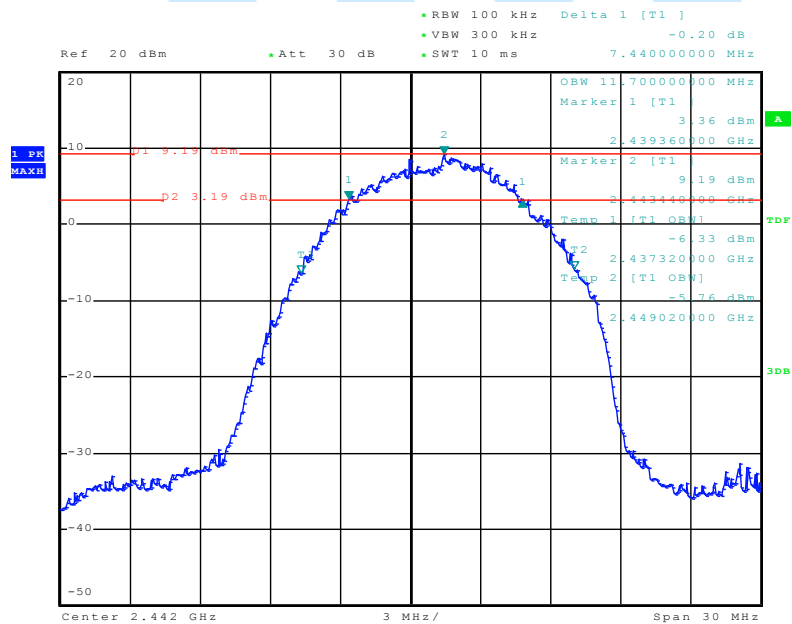


6 dB Bandwidth Plot on Configuration IEEE 802.11 B / 2 412 MHz



Date: 18.FEB.2013 10:40:24

6 dB Bandwidth Plot on Configuration IEEE 802.11 B / 2 442 MHz

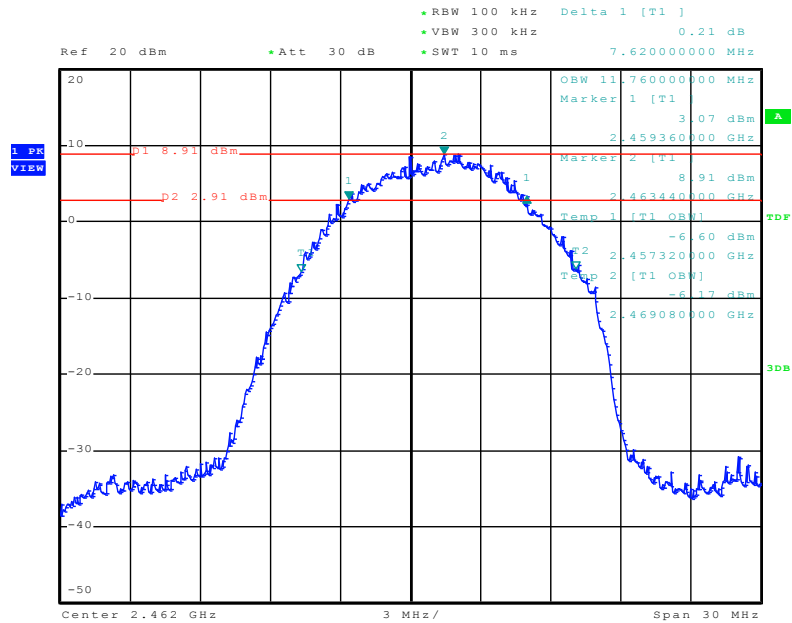


Date: 18.FEB.2013 11:51:49



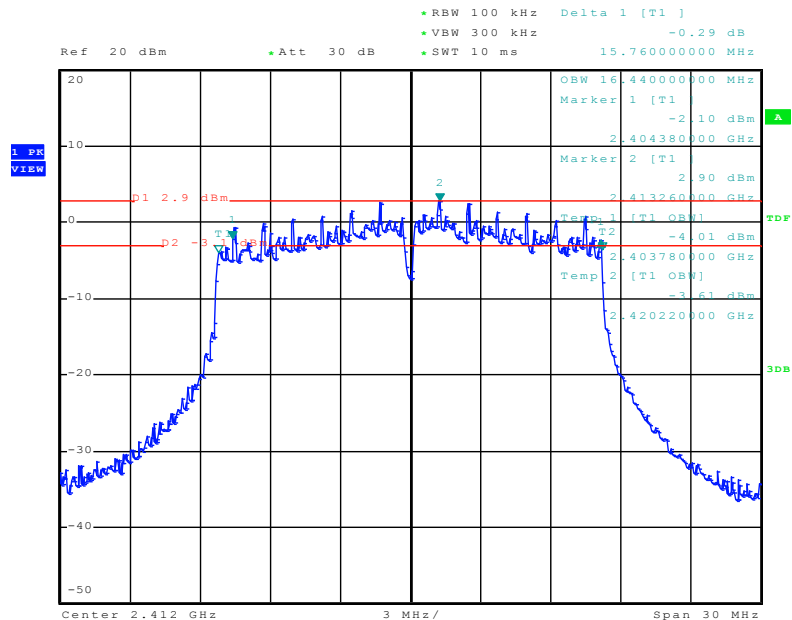


6 dB Bandwidth Plot on Configuration IEEE 802.11 B / 2 462 MHz



Date: 18.FEB.2013 11:59:29

6 dB Bandwidth Plot on Configuration IEEE 802.11 G / 2 412 MHz

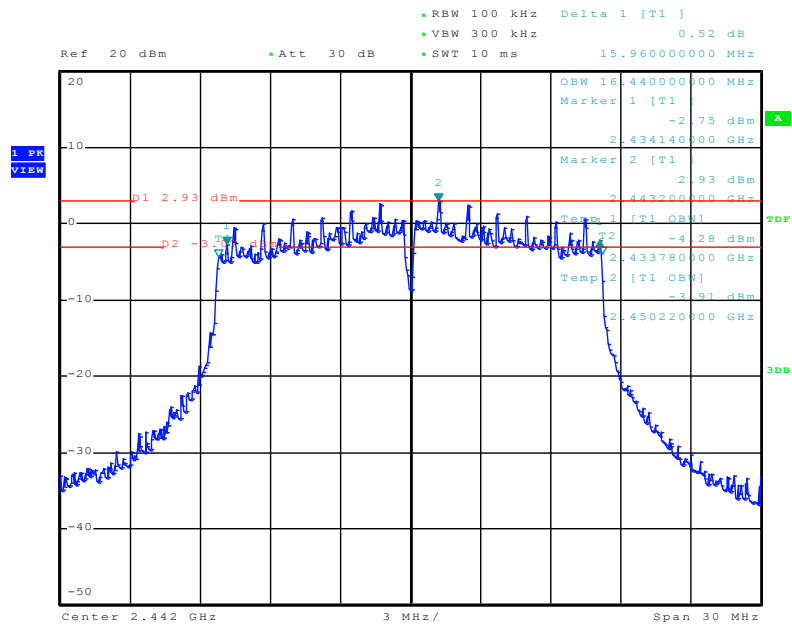


Date: 18.FEB.2013 12:22:17



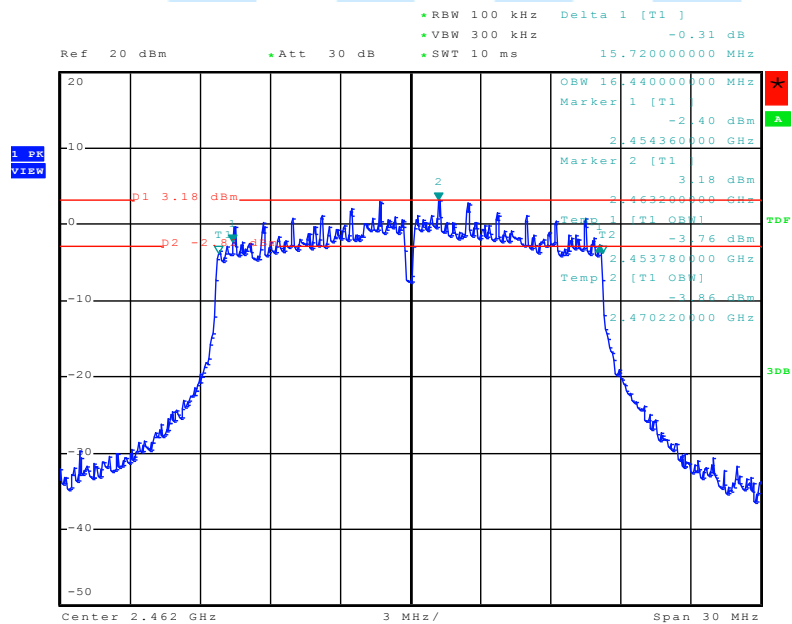


6 dB Bandwidth Plot on Configuration IEEE 802.11 G / 2 442 MHz



Date: 18.FEB.2013 12:31:26

6 dB Bandwidth Plot on Configuration IEEE 802.11 G / 2 462 MHz

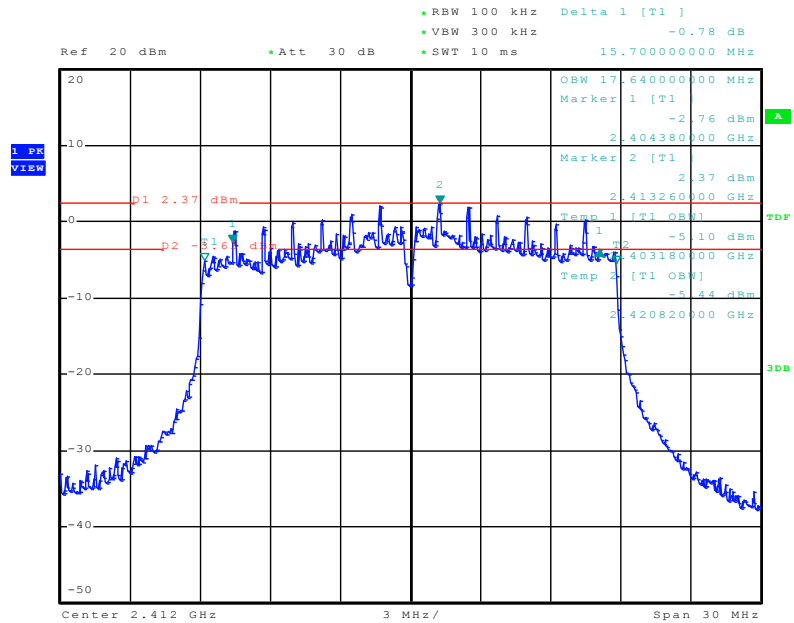


Date: 18.FEB.2013 12:34:36



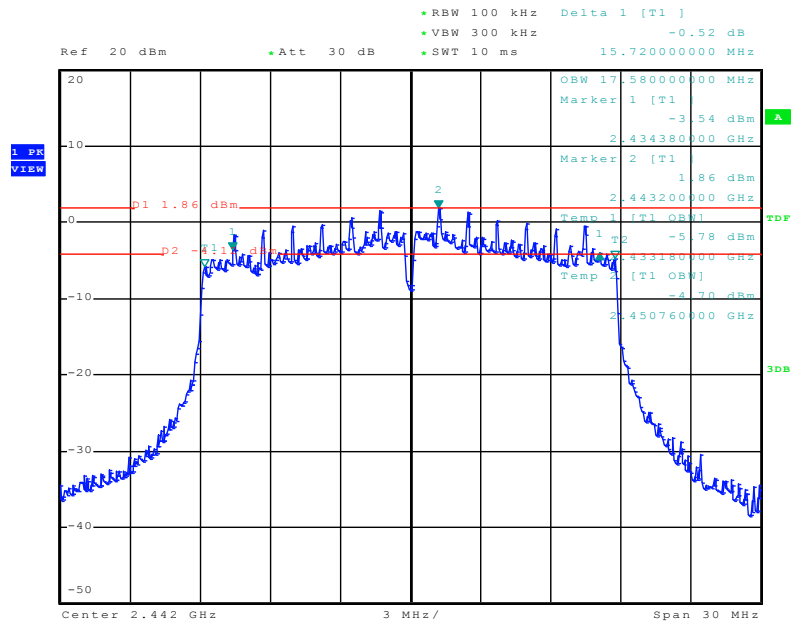


6 dB Bandwidth Plot on Configuration IEEE 802.11 N / 2 412 MHz



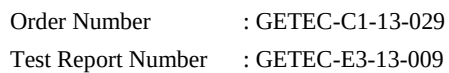
Date: 18.FEB.2013 12:57:54

6 dB Bandwidth Plot on Configuration IEEE 802.11 N / 2 442 MHz

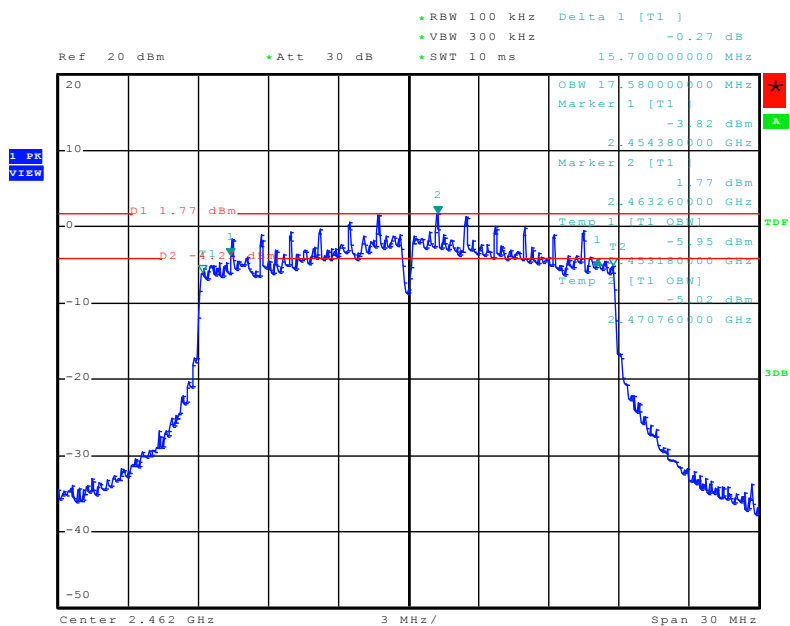


Date: 18.FEB.2013 13:04:18





6 dB Bandwidth Plot on Configuration IEEE 802.11 N / 2 462 MHz



Date: 18.FEB.2013 13:07:25



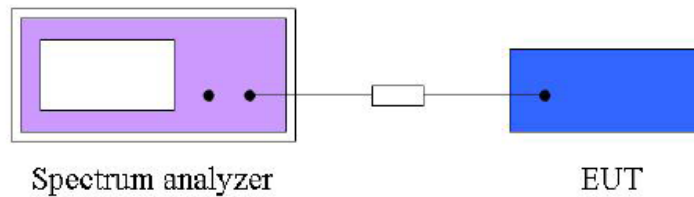


10. Band Edge Measurement

10.1 Operating environment

Temperature : 23.0 °C
Relative Humidity : 43.0 % R.H.

10.2 Test set-up (Lay-out)



10.3 Limit

Below -20 dB of the highest emission level of operating band (in 100 kHz resolution band width)

10.4 Test equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSP	Rohde & Schwarz	Spectrum Analyzer	101431	04. 26. 2013

10.5 Test Result

- Test Date : January 22, 2013
- Reference standard : Part 15 Subpart C, Sec. 15.247(d)
- Operating condition : RF transmitting mode (Low: 2 412 MHz, High: 2 462 MHz)
- Power Source : DC 5 V

The spectrum plots are attached on the following 8 images, D1 line indicates the highest level, D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement in part 15.247(d)

Spectrum Parameter

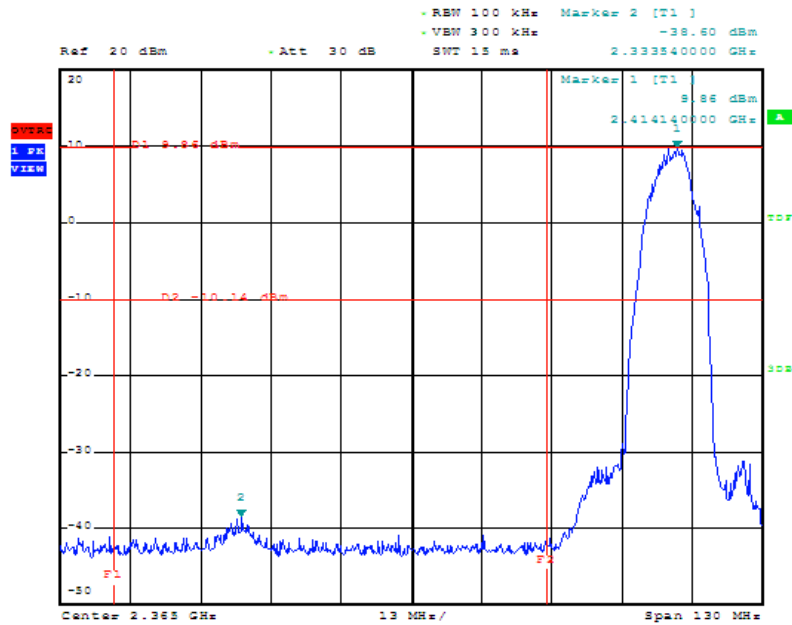
- Resolution bandwidth : 100 kHz
- Video bandwidth : 300 kHz
- Sweep time : Auto
- Detector : Peak
- Trace mode : Max. Hold





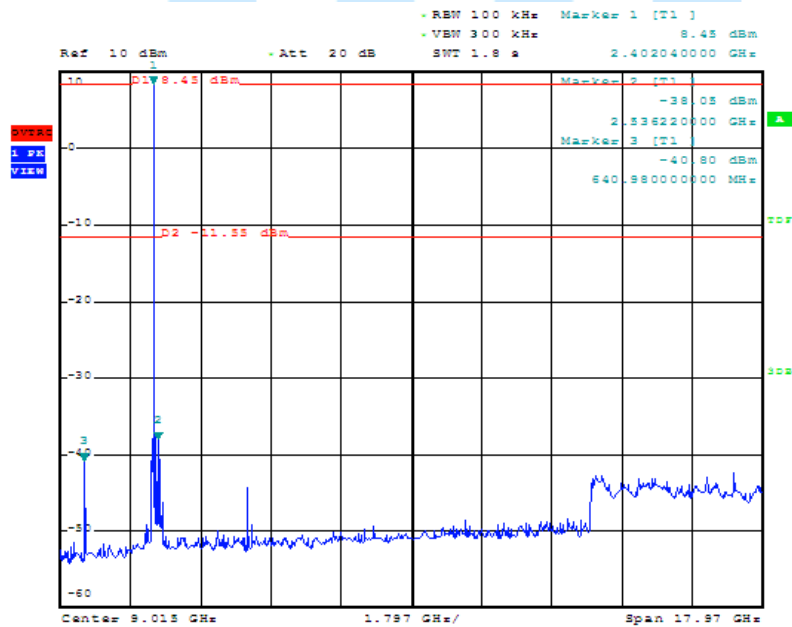
For Emission not in Restricted Band

Low Band Edge Plot on Configuration IEEE 802.11 B / 2 412 MHz



Date: 22.JAN.2013 03:27:15

High Band Edge Plot on Configuration IEEE 802.11 B / 2 412 MHz



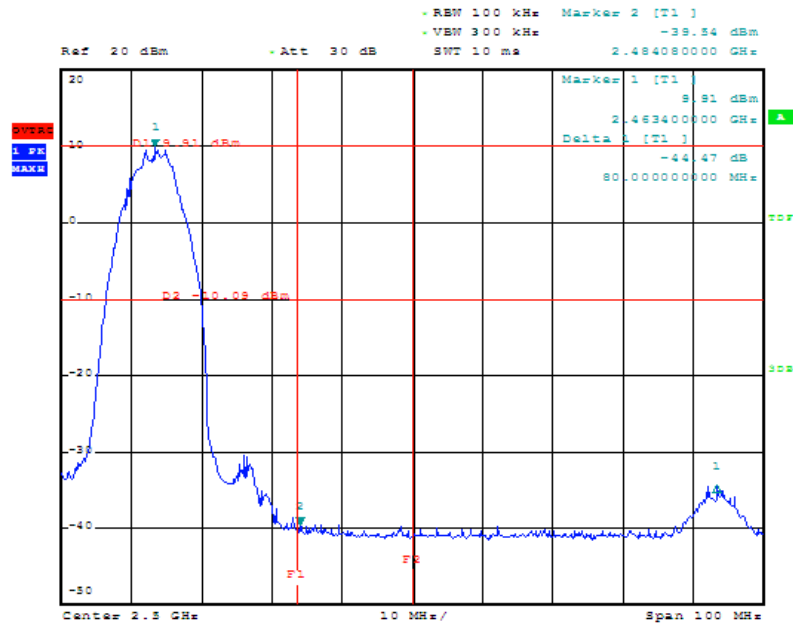
Date: 22.JAN.2013 03:25:24





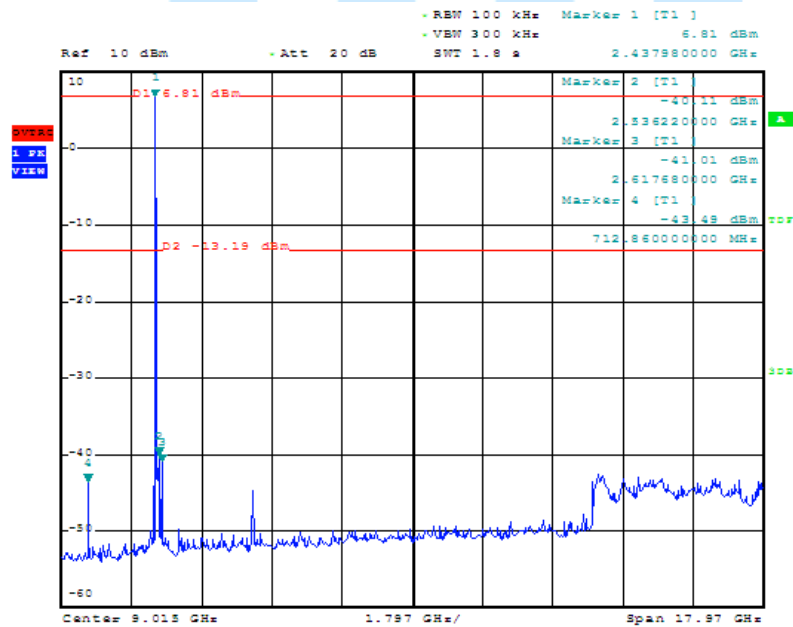
For Emission not in Restricted Band

Low Band Edge Plot on Configuration IEEE 802.11 B / 2 462 MHz



Date: 22.JAN.2013 07:08:21

High Band Edge Plot on Configuration IEEE 802.11 B / 2 462 MHz



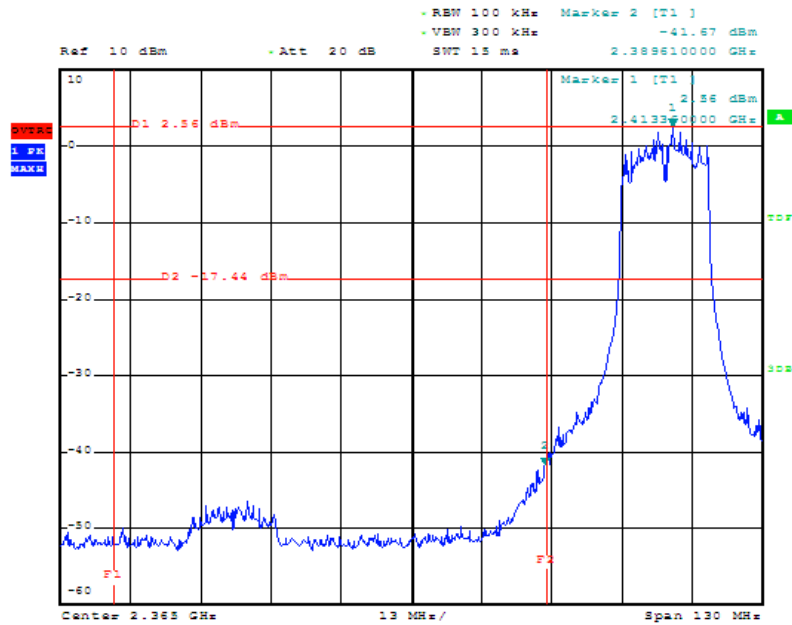
Date: 22.JAN.2013 07:10:28





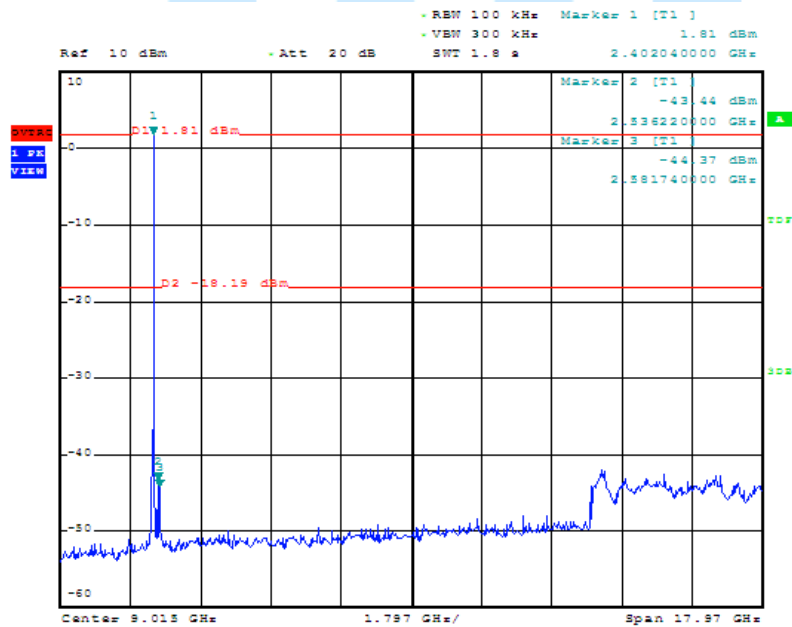
For Emission not in Restricted Band

Low Band Edge Plot on Configuration IEEE 802.11 G / 2 412 MHz



Date: 22.JAN.2013 07:18:24

High Band Edge Plot on Configuration IEEE 802.11 G / 2 412 MHz



Date: 22.JAN.2013 07:14:31





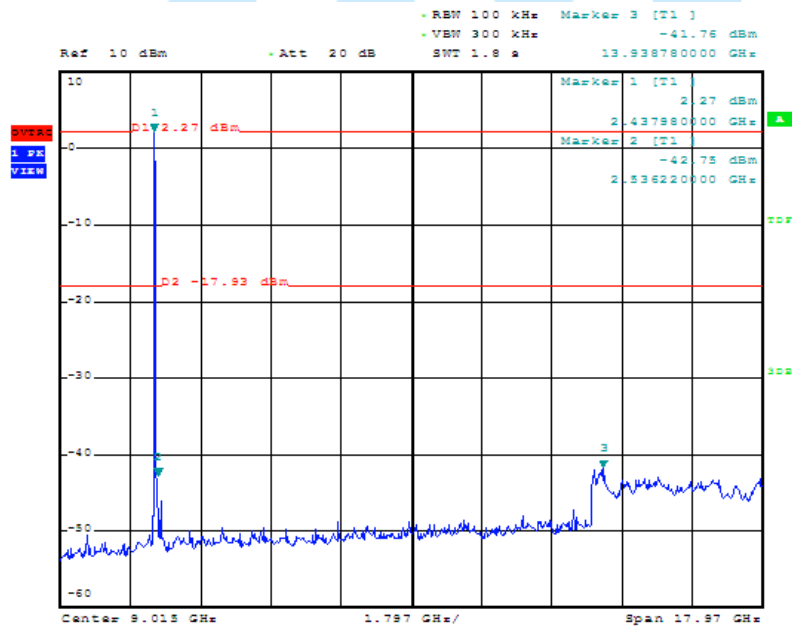
For Emission not in Restricted Band

Low Band Edge Plot on Configuration IEEE 802.11 G / 2 462 MHz



Date: 22.JAN.2013 08:15:07

High Band Edge Plot on Configuration IEEE 802.11 G / 2 462 MHz



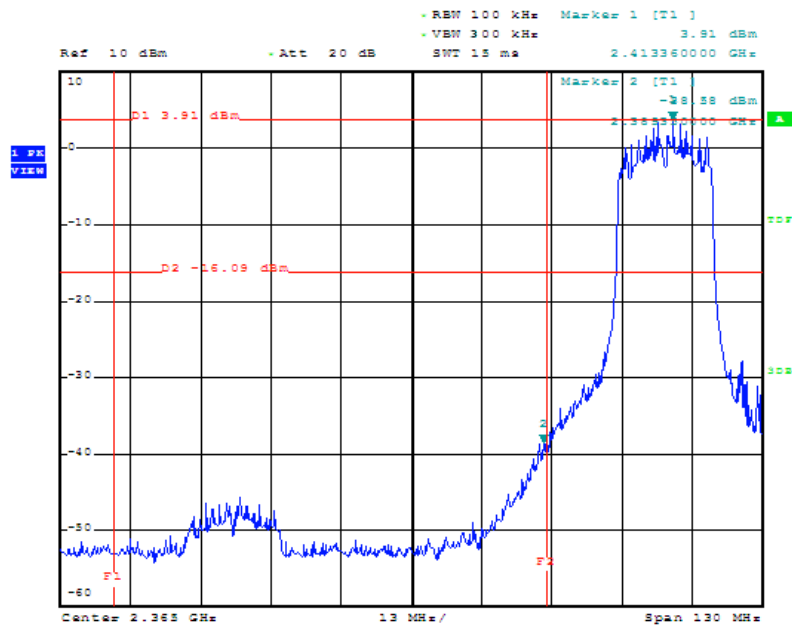
Date: 22.JAN.2013 08:13:43





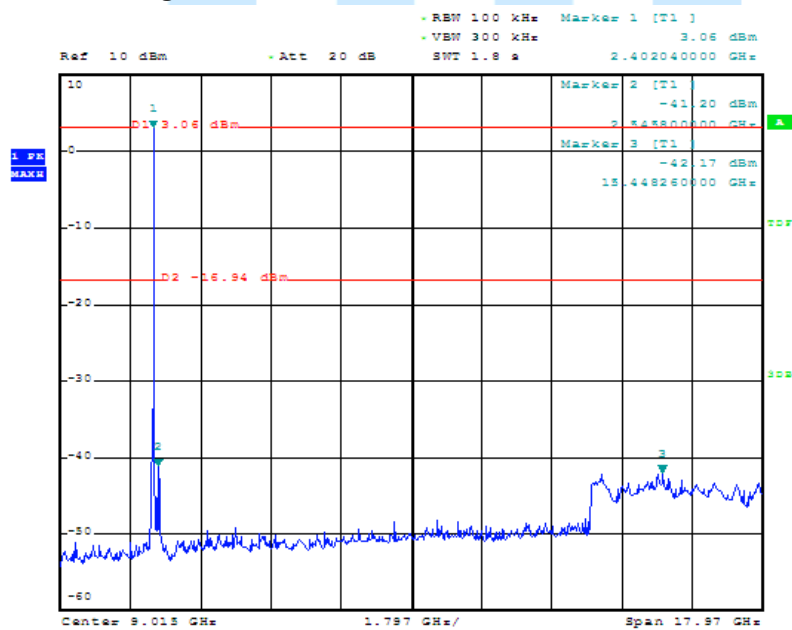
For Emission not in Restricted Band

Low Band Edge Plot on Configuration IEEE 802.11 N / 2 412 MHz



Date: 22.JAN.2013 12:18:53

High Band Edge Plot on Configuration IEEE 802.11 N / 2 412 MHz



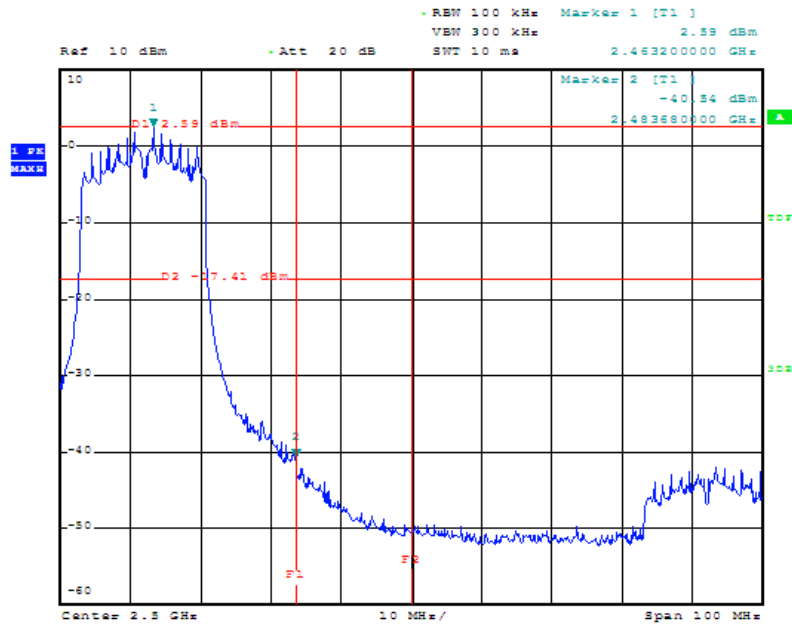
Date: 22.JAN.2013 12:17:39





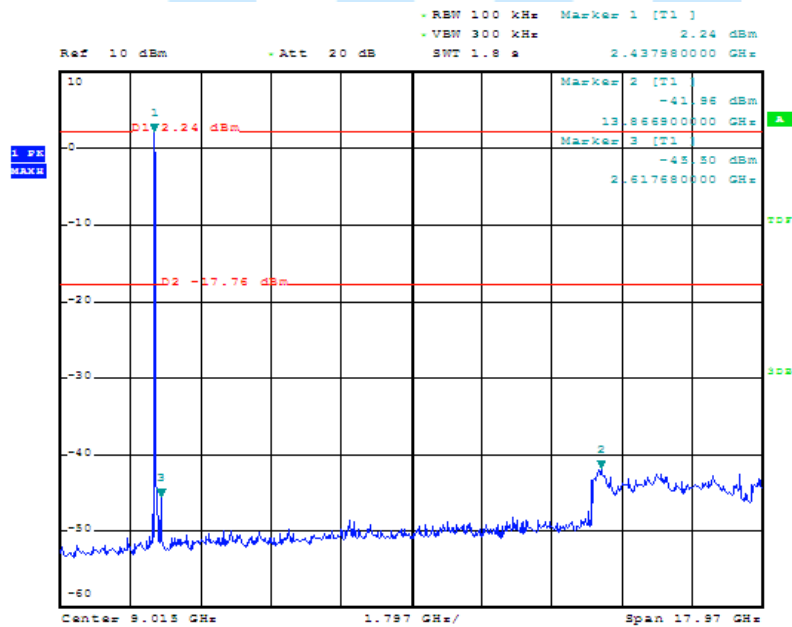
For Emission not in Restricted Band

Low Band Edge Plot on Configuration IEEE 802.11 N / 2 462 MHz



Date: 22.JAN.2013 12:50:56

High Band Edge Plot on Configuration IEEE 802.11 N / 2 462 MHz



Date: 22.JAN.2013 12:47:44





11. Radiated Emission

11.1 Operating Environment

Temperature : 22.0 °C
Relative Humidity : 40.0 % R.H.

11.2 Test set-up

The formal radiated emission was measured at 3 m distance anechoic chamber.

The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

11.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95 %.

Test Items (Semi anechoic chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	± 4.35 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	± 4.29 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	± 4.43 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	± 4.21 dB	Confidence level of approximately 95 % ($k = 2$)

11.4 Limit

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1.705	2400/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

[Limit at 3 m] = [Limit at 300 m] -40 × log (3 [m] / 300 [m])

[Limit at 3 m] = [Limit at 30 m] -40 × log (3 [m] / 30 [m])





11.5 Test equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	05. 23. 2013
■ - FSP	Rohde & Schwarz	Spectrum Analyzer	101431	04. 26. 2013
■ - VULB9160	Schwarzbeck	Broadband test antenna	3099	08. 07. 2013
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - AM4.0	maturo GmbH	Antenna Mast	1390308	N/A
■ - BBHA9120D	Schwarzbeck	Horn antenna	207	01. 29. 2014
■ - 3160-09	ETS LINDGREN	Horn antenna	LM3423	11. 14. 2013
■ - AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258942	11. 12. 2013
■ - AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258943	11. 12. 2013

11.6 Radiated emission test data

- Test Date : January 10 ~ 16, 2013
- Reference standard : Part 15 Subpart C, Sec. 15.247(d) / ANSI C63.10
- Operating condition : RF transmitting mode (Low: 2 412 MHz, Middle: 2 437 MHz, High: 2 462 MHz)
- Measuring distance : 3 m
- Power Source : DC 5 V
- Note : None.
- Measurement

Frequency range	9 kHz ~ 90 kHz, 110 kHz ~ 150 kHz	90 kHz ~ 110 kHz	150 kHz ~ 490 kHz	490 kHz ~ 30 MHz	30 MHz ~ 1 GHz	Above 1 GHz
Detector type	Peak / Average	Quasi peak	Peak / Average	Quasi peak	Quasi peak	Peak / Average
IF bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz	1 MHz

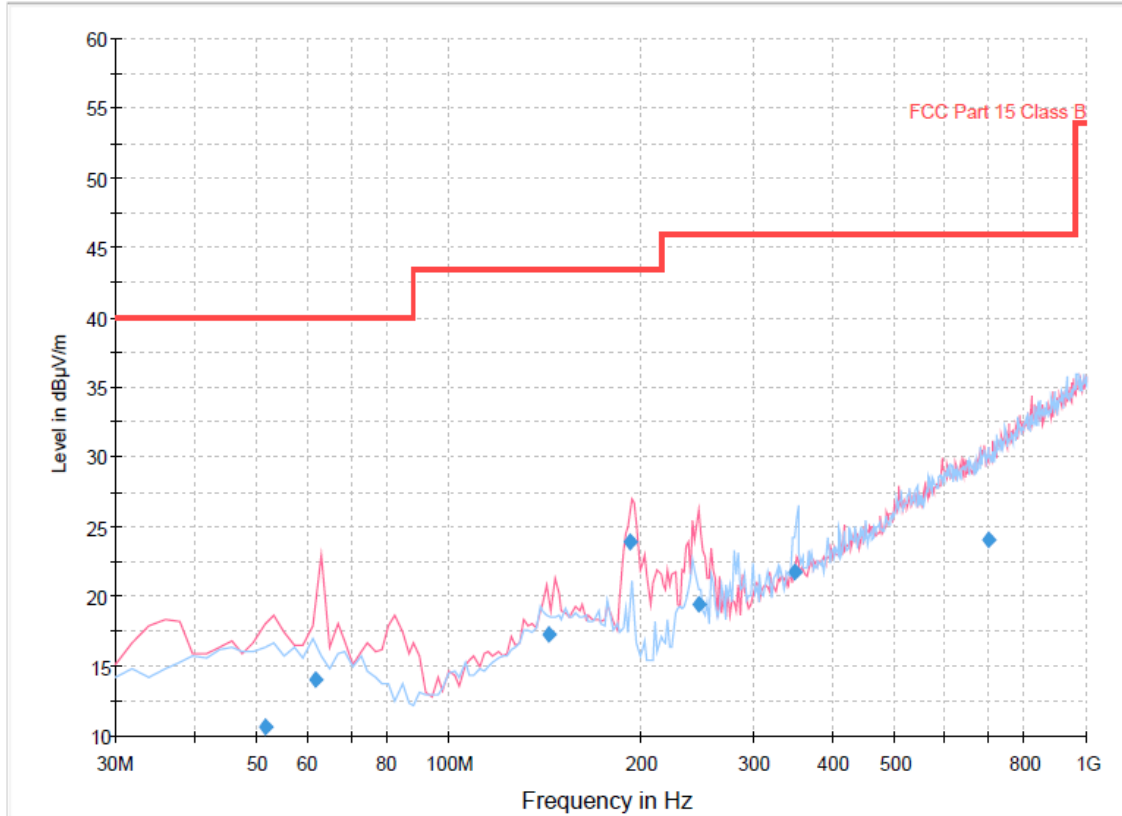




Result of radiated emission (9 kHz to 30 MHz)

No emission found between lowest internal used/generated frequency to 30 MHz.

Result of radiated emission (30 MHz to 1 000 MHz)



Final Result 1

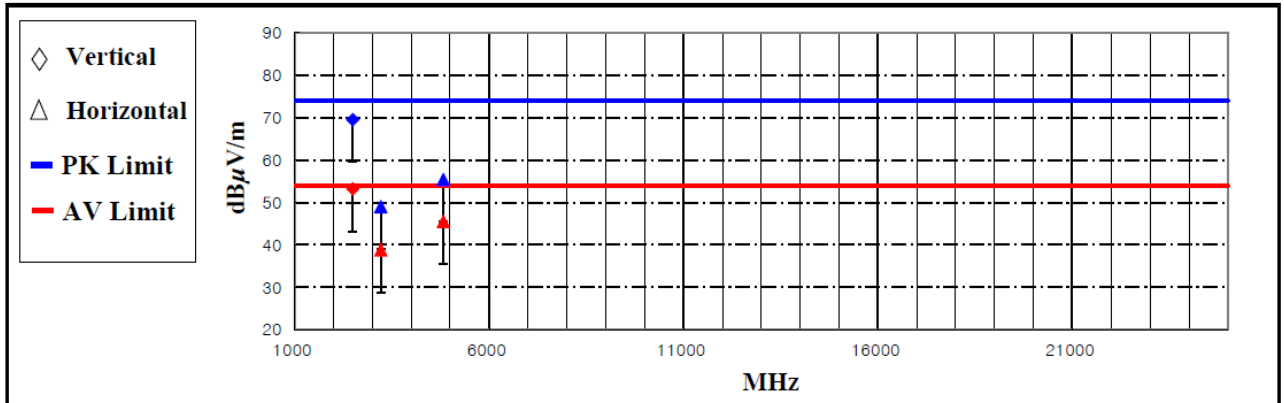
Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
36.278163	9.8	1000.0	120.000	100.0	V	329.0	11.5	30.2	40.0
51.433653	10.6	1000.0	120.000	145.0	V	273.0	12.7	29.4	40.0
61.764092	14.1	1000.0	120.000	138.0	V	0.0	12.0	29.4	43.5
143.767767	17.2	1000.0	120.000	100.0	V	119.0	14.4	26.3	43.5
192.915073	23.8	1000.0	120.000	100.0	V	136.0	12.0	22.2	46.0
246.726931	19.4	1000.0	120.000	100.0	V	183.0	14.0	26.6	46.0
347.537871	21.8	1000.0	120.000	100.0	H	265.0	17.6	24.2	46.0
703.551231	24.0	1000.0	120.000	150.0	V	12.0	25.5	22.0	46.0





Worst case result of radiated emission (1 GHz to 25 GHz)

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
2494.99	79.02	62.72	27.24	-36.76	69.50	53.20	74.00	54.00	4.50	0.80	V	100	290
3215.82	55.57	45.37	28.84	-35.41	49.00	38.80	74.00	54.00	25.00	15.20	H	100	274
4823.81	56.99	47.09	31.23	-32.82	55.40	45.50	74.00	54.00	18.60	8.50	H	100	288



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

Result of radiated emission (Band Edge)

802.11 B, 2 412 MHz

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	(H/V)	(cm)	(°)		
2390.00	69.27	55.57	26.96	-36.93	59.30	45.60	74.00	54.00	14.70	8.40	H	100	344

802.11 B, 2 462 MHz

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
2483.50	73.47	62.27	27.21	-36.78	63.90	52.70	74.00	54.00	10.10	1.30	V	100	299

Note:

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Emission level (dBμ V/m) = 20 log Emission level (μV/m).

Corrected reading: Antenna factor + Cable loss + Preamplifier gain + Read value = Test result

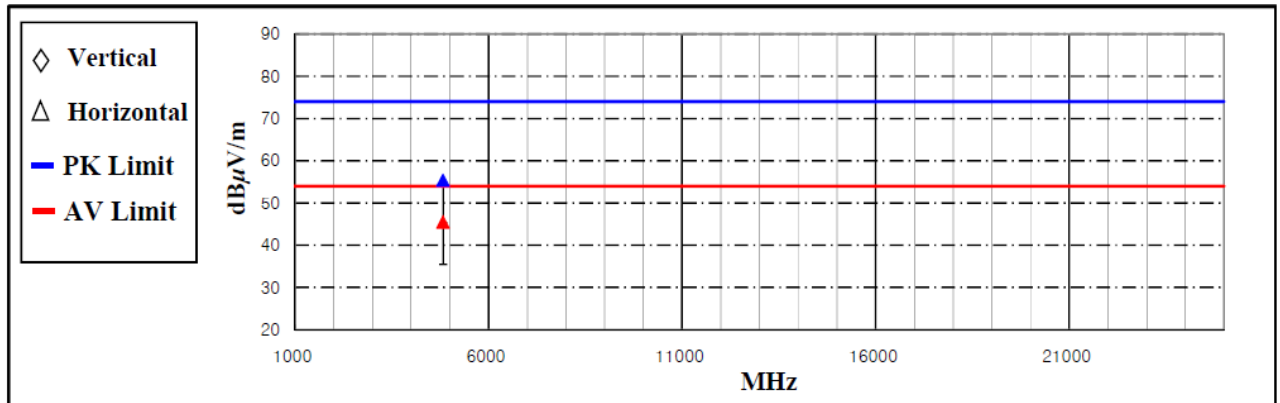




Result of radiated emission (1 GHz to 10th harmonics)

(802.11 B, 2 412 MHz)

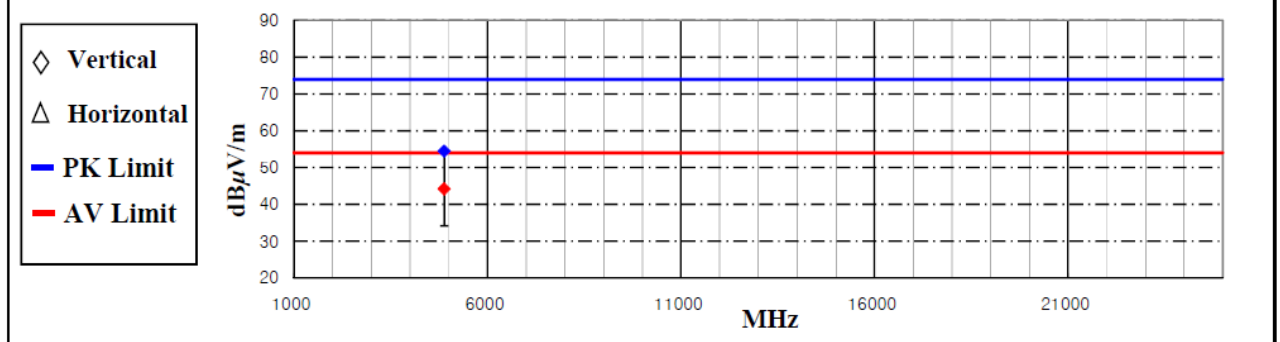
Frequency (MHz)	Measurement Level						Limit (dB μ V/m)		Margin (dB)		Positioning System		
	Reading Value (dB μ V/m)		AF	AMP / CL	Test Result (dB μ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4823.81	56.99	47.09	31.23	-32.82	55.40	45.50	74.00	54.00	18.60	8.50	H	100	288



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(802.11 B, 2 442 MHz)

Frequency (MHz)	Measurement Level					Limit (dBμ V/m)		Margin (dB)		Positioning System			
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)					Pol.	Height	Angle	
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	(H/V)	(cm)	(°)		
4883.93	55.93	45.63	31.34	-32.77	54.50	44.20	74.00	54.00	19.50	9.80	V	100	284

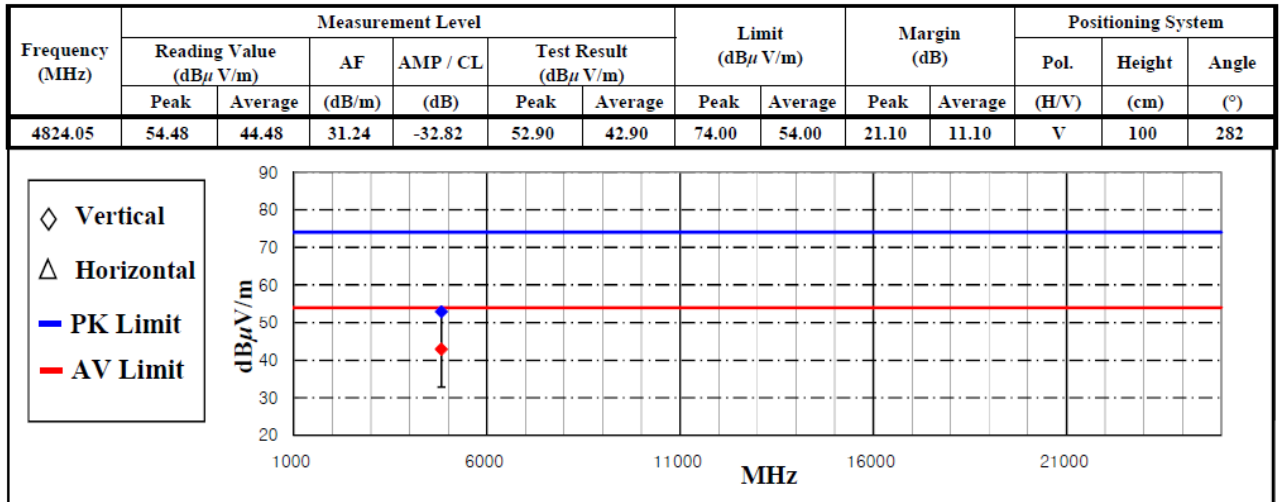


*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)





(802.11 B, 2 462 MHz)



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Reading value + AF (Antenna Factor) + AMP/CL (Cable Loss + Preamp factor) = Test result

- The end -

