

FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer: OHSUNG ELECTRONICS CO., LTD.

Date of Issue: August 10, 2012

#181 Gongdan-dong, Gumi-si, Gyeongbuk,

Order Number: GETEC-C1-12-197

Republic of Korea

Test Report Number: GETEC-E3-12-065

Attn: Mr. Hak-Ki Kim / General Manager

Test Site: GUMI COLLEGE EMC CENTER

FCC Registration Number: (100749, 443957)

FCC ID. : OZ5URCMRX4IR

Applicant : OHSUNG ELECTRONICS CO., LTD.

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	: BASE STATION
Type of Authority	: Certification
Model Name	: MRX-4IR
Trade Name	: UNIVERSAL Remote Control

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

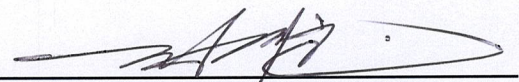
I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking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

Tested by,

Reviewed by,



Seung-Chul Lee, Associate Engineer
GUMI COLLEGE EMC CENTER



Jae-Hoon Jeong, Senior Engineer
GUMI COLLEGE EMC CENTER



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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: OHSUNG ELECTRONICS CO., LTD.

Applicant Address: #181 Gongdan-dong, Gumi-si, Gyeongbuk, Republic of Korea

Manufacturer: OHSUNG ELECTRONICS CO., LTD.

Manufacturer Address: #181 Gongdan-dong, Gumi-si, Gyeongbuk, Republic of Korea

Contact Person: Mr. Hak-Ki Kim / General Manager

Tel. Number: +82-54-468- 0831 Fax Number: +82-54- 461- 8368

- **FCC ID.** OZ5URCMRX4IR
- **Equipment Class** Digital Transmission System (DTS)
- **EUT Type** BASE STATION
(Wi-Fi module built in BASE STATION)
- **Model Name** MRX-4IR
- **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** July 10 ~ August 9, 2012
- **Place of Test** **GUMI COLLEGE EMC CENTER** (FCC Registration No.: 100749, 443957)
407, Bugok-Dong, Gumi-City, Gyungbok, 730-711, Republic of Korea
- **Test Report Number** GETEC-E3-12-065
- **Dates of Issue** August 10, 2012

EUT Type: BASE STATION

FCC ID.: OZ5URCMRX4IR



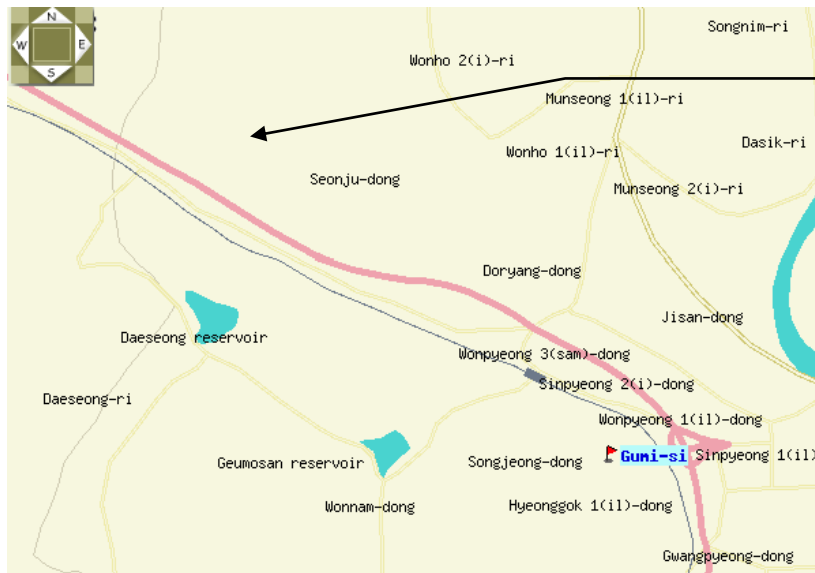
2. Introduction

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 **OHSUNG ELECTRONICS CO., LTD. BASE STATION (Model name: MRX-4IR)**

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

The site address is 407, Bugok-Dong, Gumi-City, Gyungbok, 730-711, Republic of 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 Daeje 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)



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Gyungbok, 730-711, Republic of Korea
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Fax: +82-54-440-1199

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 **OHSUNG ELECTRONICS CO., LTD. BASE STATION (Model Name: MRX-4IR) FCC ID.: OZ5URCMRX4IR**

CPU : ARM 32-bit Cortex-M3(120MHz)

Memory : 128Kbyte SRAM, 768Kbyte Flash

Macro Capability : Up to 255 steps each

IR Range(Line of Sight via Infrared) : 30 to 50 feet, depending on the environment

RF Range(radio frequency) : 50 to 100 feet, depending upon the environment

Wi-Fi : IEEE 802.11 b/g/n

Weight : 3.0 oz

Size : 3.74" X 2.7" X 1.1"

Power : 12V DC 1A

- I/O Port : Stereo Jack 4 EA, RJ45 1 EA
- RF Frequency : 2.412 GHz ~ 2.462 GHz
- Crystal & Clock Frequency : Wi-Fi board: 26 MHz, 27 MHz
Main board: 32.768 kHz, 25 MHz, 50 MHz
CPU: 120 MHz



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

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

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.
AC/DC adapter ¹⁾	HONKWANG ELECTRIC CO., LTD.	HK-X212-A12	S/N: None. FCC ID.: N/A

1) Input ratings: AC (120 – 240) V~, (50 – 60) Hz / Output ratings: DC 12 V, 1 A

3.2.3 Used Cable(s)

Cable Name	Condition	Description
Adapter cable	Connected to the EUT and adapter	1.80 m unshielded
IR emitter cable	Connected to the EUT and IR sensor	3.00 m unshielded
LAN cable	Connected to the EUT and Network	10.00 m unshielded

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: AC 120 V / 60 Hz
- Test Mode(s):

Executed “Tera term (Copyright by T.Teranishi)” to control the EUT continuously transmit RF signal

Test Software Version	Tera term (Ver 4.64)		
Frequency	2 412 MHz	2 437 MHz	2 462 MHz
IEEE 802.11 B	10	10	10
IEEE 802.11 G	10	10	10
IEEE 802.11 N	10	10	10

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	3
IEEE 802.11 N	1 to 11	OFDM	19

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 **OHSUNG ELECTRONICS CO., LTD. RF Transmitter Universal Remote Control** comply with the requirement of §15.203 with a PCB pattern 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).

The EMI test receiver was scanned from 150 kHz to 30 MHz with 20 ms sweep time to determine the frequency producing the maximum EME from the EUT. The frequency producing the maximum level was re-examined using Quasi-Peak mode of the EMI test receiver.

The bandwidth of Quasi-peak mode was set to 9 kHz. Each emission was maximized consistent with typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum diagram emission. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

Each EME reported was calibrated using the R/S signal generator

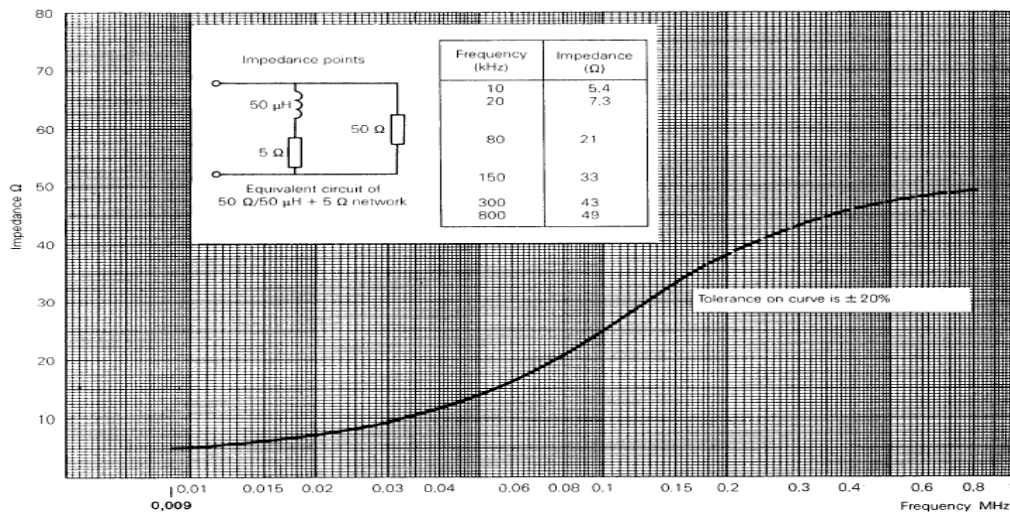


Fig 2. Impedance of LISN



5.3 Radiated Emission

Measurements (below 1 GHz) were made at Open area test site that complies to CISPR 16/ANSI C63.4/ANSI C63.10. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10 m. The EUT was rotated 360° about its azimuth with the receive antenna located at 1, 2, 3 and 4 meter heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then 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, where applicable.

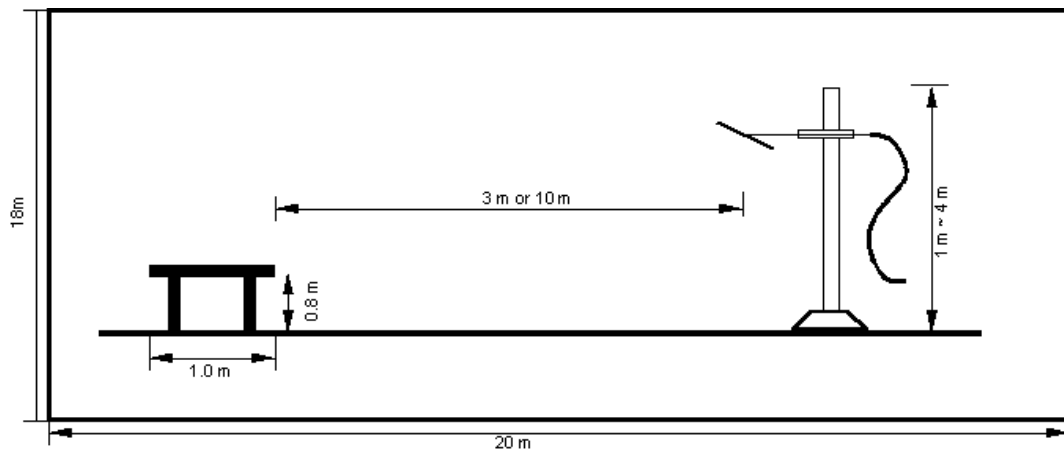


Fig 3. Dimensions of test site

The measurements (above 1 GHz) were made 3 m distance test site that complies to CISPR 16-1-4 (2007). In order to meet SVSWR Limit (Within 6 dB), the bottom side of test site was installed with absorbers. 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. The measurements were conducted with Average and Peak value.

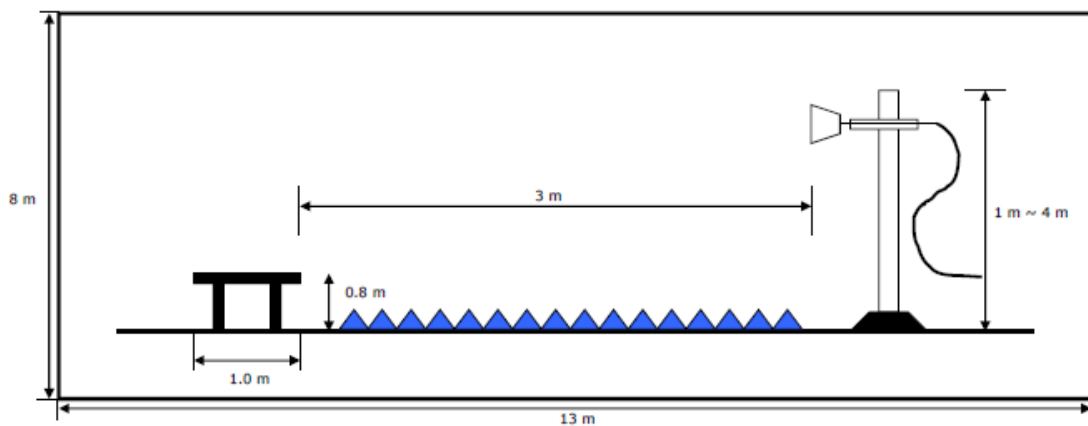


Fig 4. Dimensions of test site



6. Conducted Emission

6.1 Operating Environment

Temperature : 25.0 °C
Relative Humidity : 42.0 % 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)	± 2.71 dB	Confidence levels of 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	± 3.34 dB	Confidence levels of 95 % ($k = 2$)



6.4 Limit

RFI Conducted	FCC Limit(dB μ V/m) Class B	
	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

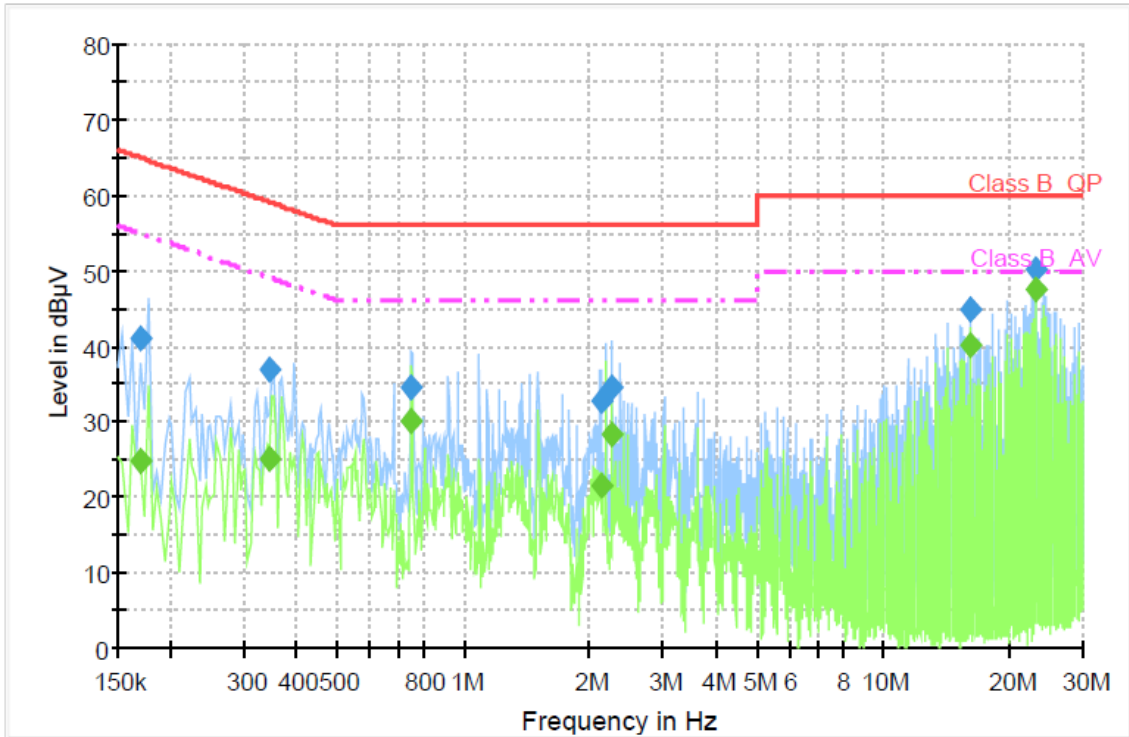
*Limits decreases linearly with the logarithm of frequency.

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 : July 19, 2012
- Reference Standard : Part 15 Subpart C, Sec. 15.207
- Channel (Worst Case) : 802.11 B (Low: 2 412 MHz)
- Operating Condition : RF transmitting mode
- 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
0.170000	40.9	1000.0	9.000	GND	N	10.1	24.0	65.0	
0.344000	37.0	1000.0	9.000	GND	N	10.1	22.1	59.1	
0.752000	34.5	1000.0	9.000	GND	N	10.1	21.5	56.0	
2.128000	32.7	1000.0	9.000	GND	N	10.2	23.3	56.0	
2.260000	34.4	1000.0	9.000	GND	L1	10.2	21.6	56.0	
16.228000	44.7	1000.0	9.000	GND	L1	10.3	15.3	60.0	
23.128000	50.2	1000.0	9.000	GND	L1	10.4	9.8	60.0	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.170000	24.8	1000.0	9.000	GND	N	10.1	30.1	55.0	
0.344000	25.2	1000.0	9.000	GND	N	10.1	24.0	49.1	
0.752000	30.1	1000.0	9.000	GND	N	10.1	15.9	46.0	
2.128000	21.7	1000.0	9.000	GND	N	10.2	24.3	46.0	
2.260000	28.3	1000.0	9.000	GND	L1	10.2	17.7	46.0	
16.228000	40.3	1000.0	9.000	GND	L1	10.3	9.7	50.0	
23.128000	47.6	1000.0	9.000	GND	L1	10.4	2.4	50.0	

< Fig 5. Conducted emission result >

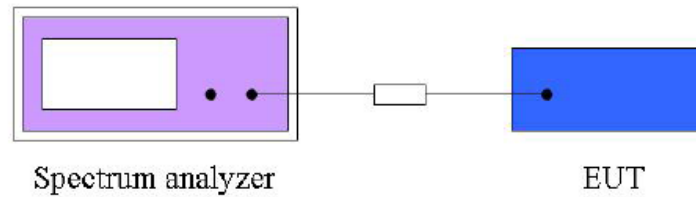


7. Maximum Peak Output Power Measurement

7.1 Operating environment

Temperature : 25.0 °C
Relative Humidity : 42.0 % 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
■ - FSP	Rohde & Schwarz	Spectrum Analyzer	101431	04. 26. 2013

7.5 Test Result

- Test Date : July 18 ~ August 9, 2012
- Reference Standard : Part 15 Subpart C, Sec. 15.247(b)(3) / ANSI C63.10 Clause 6.10.2.1 (a)
- Channel : 802.11 B/G/N (Low: 2 412 MHz, Middle: 2 437 MHz, High: 2 462 MHz)
- Operating Condition : RF transmitting mode
- Power Source : AC 120 V / 60 Hz

Parameter

- Filter no: Auto
- Measurement time: 0.135 s ~ 26 s



Configuration IEEE 802.11 B

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (mW)	Max. Limit (dBm)	Result
2 412	10.40	10.96	30.00	Complies
2 437	10.18	10.42	30.00	Complies
2 462	10.90	12.30	30.00	Complies

Configuration IEEE 802.11 G

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (mW)	Max. Limit (dBm)	Result
2 412	15.43	34.91	30.00	Complies
2 437	15.45	35.08	30.00	Complies
2 462	15.81	38.11	30.00	Complies

Configuration IEEE 802.11 N

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (mW)	Max. Limit (dBm)	Result
2 412	14.77	29.99	30.00	Complies
2 437	15.34	34.20	30.00	Complies
2 462	15.36	34.36	30.00	Complies

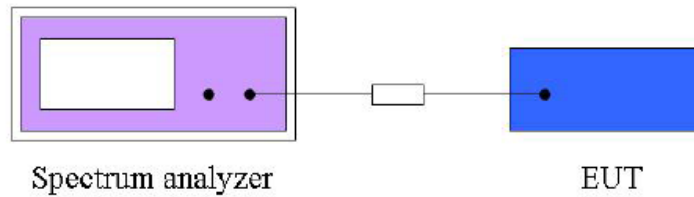


8. Power Spectral Density Measurement

8.1 Operating Environment

Temperature : 25.0 °C
Relative Humidity : 42.0 % 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
■ - ESIB26	Rohde & Schwarz	EMI test receiver	830482/010	05. 23. 2013

7.5 Test Result

- Test Date : July 18 ~ August 9, 2012
- Reference Standard : Part 15 Subpart C, Sec. 15.247(e)
- Channel : 802.11 B/G/N (Low: 2 412 MHz, Middle: 2 437 MHz, High: 2 462 MHz)
- Operating Condition : RF transmitting mode
- Power Source : AC 120 V / 60 Hz

Spectrum Parameter

- Attenuation : Auto
- Span frequency : 1.5 MHz
- Resolution band width : 3 kHz
- Video band with : 30 kHz
- Sweep time : 500 s



Configuration IEEE 802.11 B

Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
2 412 MHz	- 17.78	8.00	Complies
2 437 MHz	- 17.47	8.00	Complies
2 462 MHz	- 16.52	8.00	Complies

Configuration IEEE 802.11 G

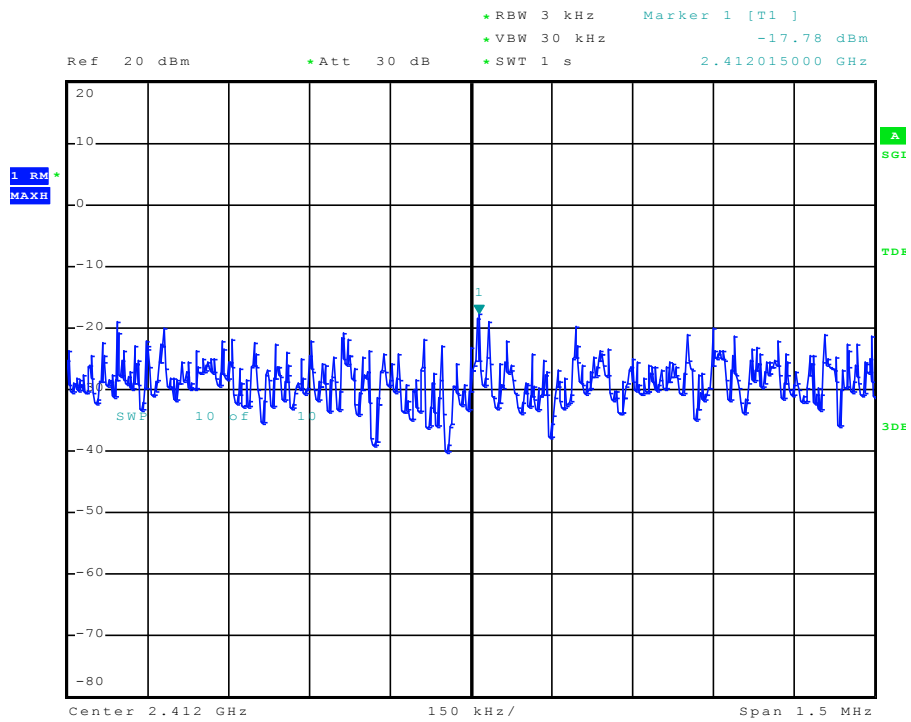
Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
2 412 MHz	- 17.45	8.00	Complies
2 437 MHz	- 15.81	8.00	Complies
2 462 MHz	- 17.08	8.00	Complies

Configuration IEEE 802.11 N

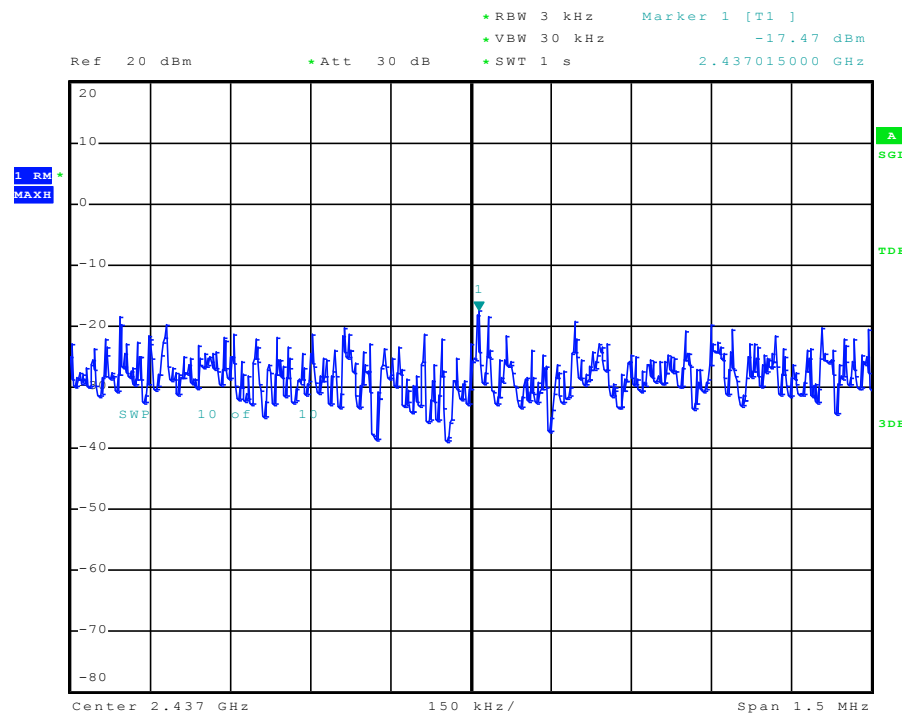
Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
2 412 MHz	- 24.68	8.00	Complies
2 437 MHz	- 20.47	8.00	Complies
2 462 MHz	- 18.59	8.00	Complies



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

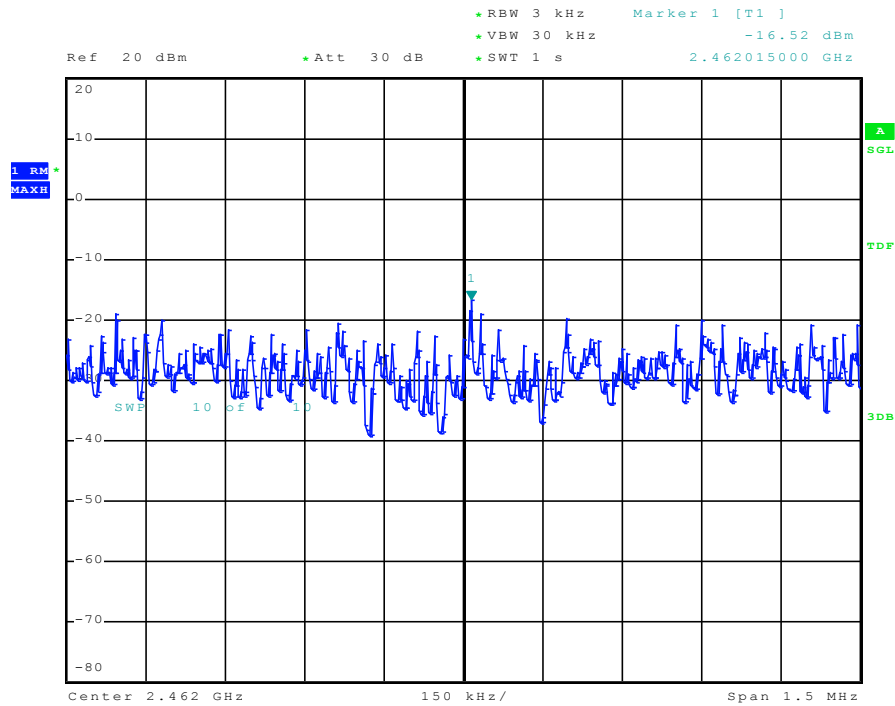


Power Density Plot on configuration IEEE 802.11 B / 2 437 MHz

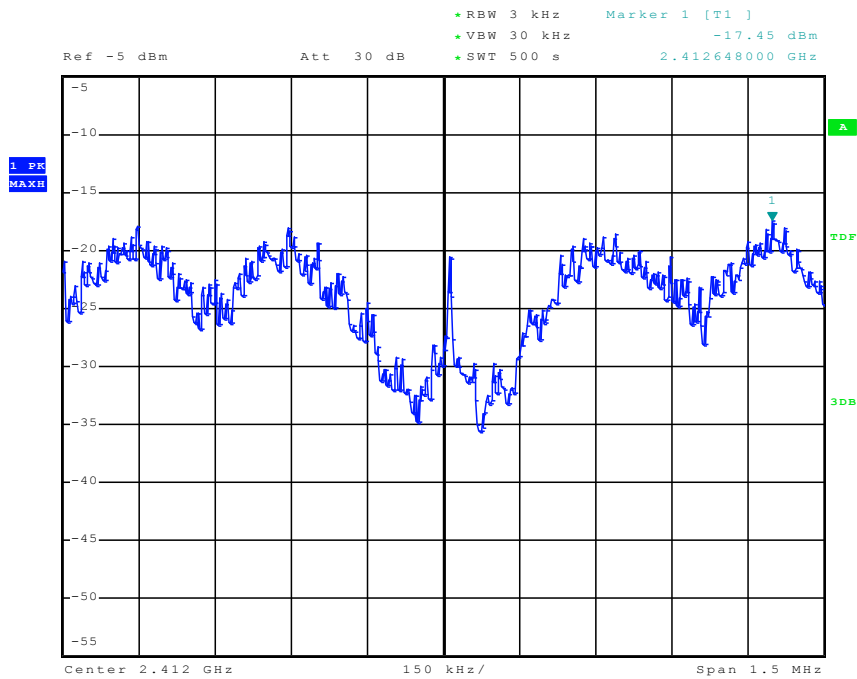




Power Density Plot on configuration IEEE 802.11 B / 2 462 MHz

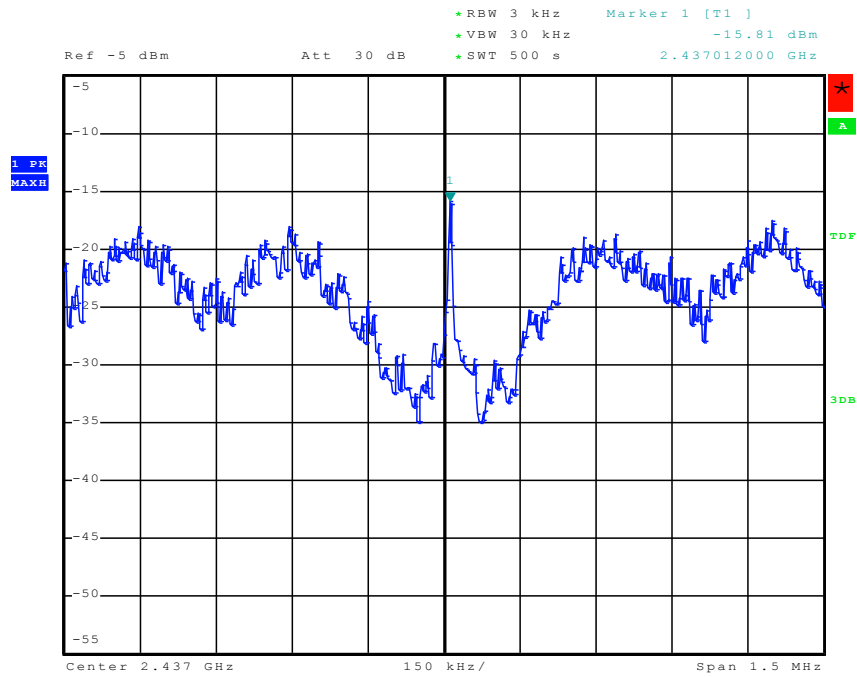


Power Density Plot on configuration IEEE 802.11 G / 2 412 MHz

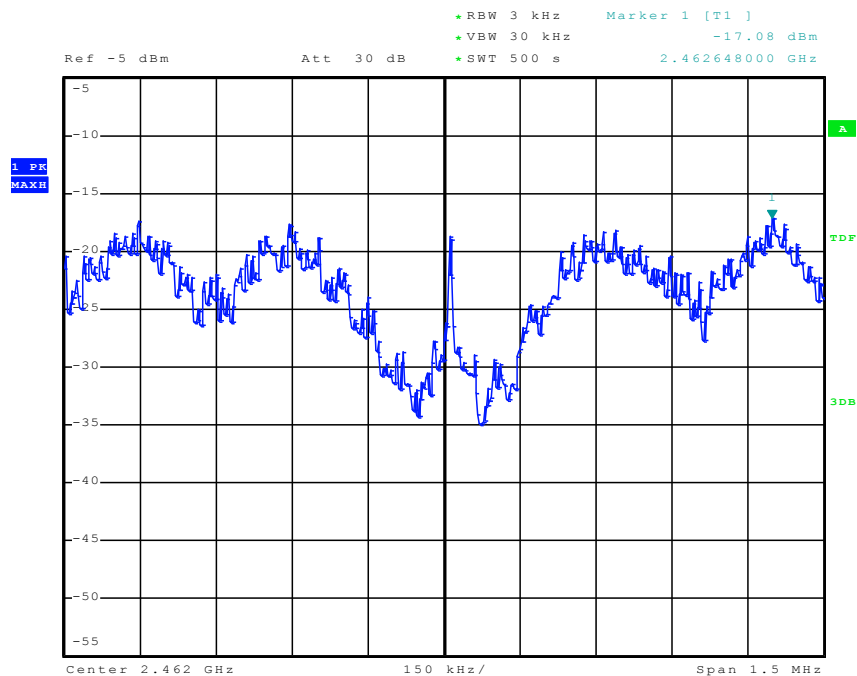




Power Density Plot on configuration IEEE 802.11 G / 2 437 MHz

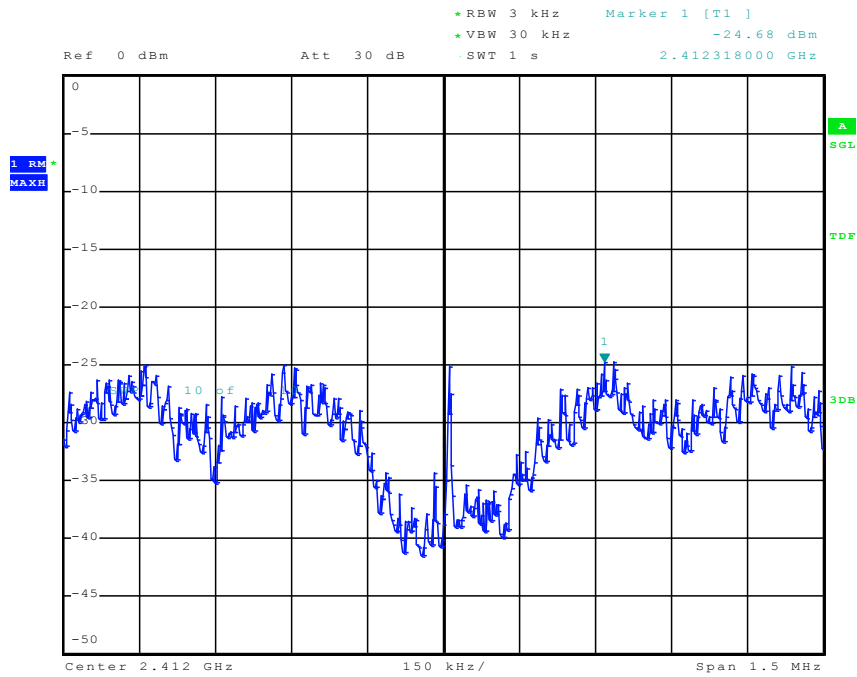


Power Density Plot on configuration IEEE 802.11 G / 2 462 MHz

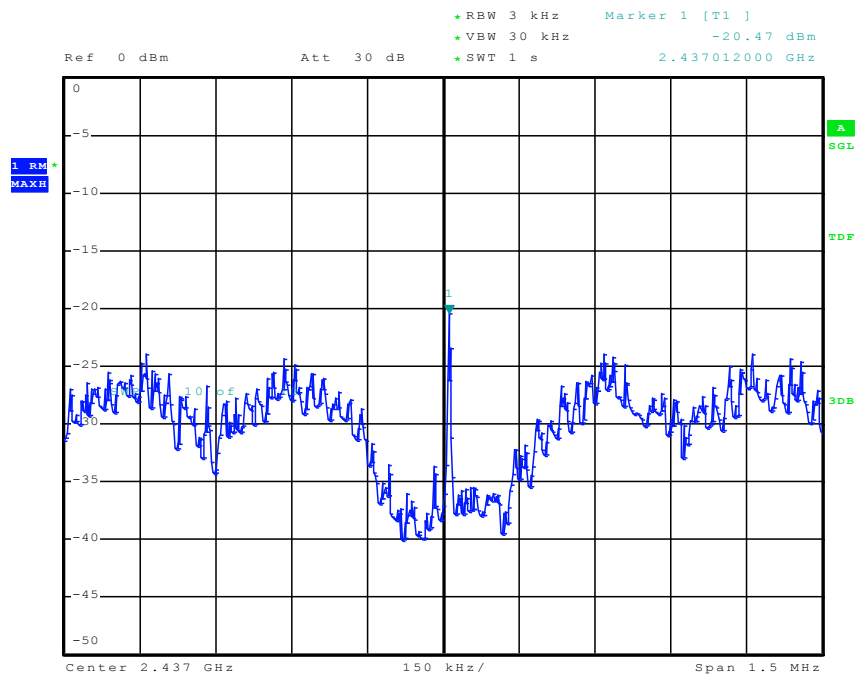




Power Density Plot on configuration IEEE 802.11 N / 2 412 MHz

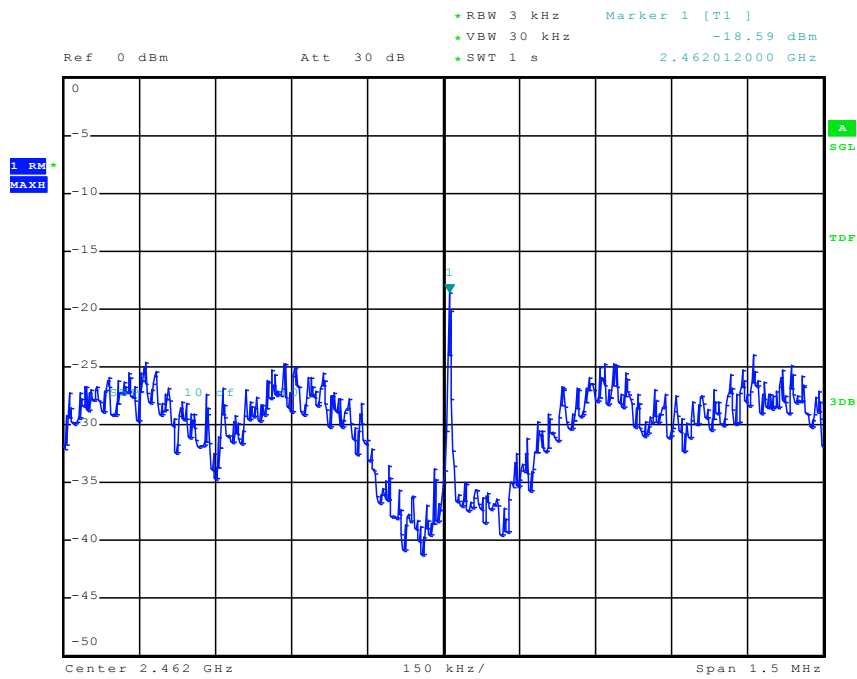


Power Density Plot on configuration IEEE 802.11 N / 2 437 MHz





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



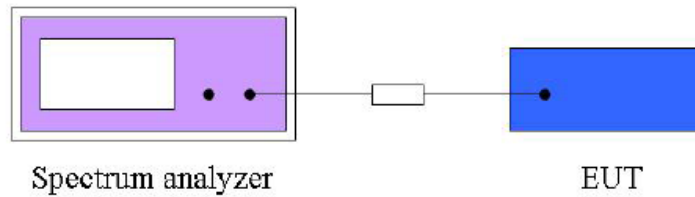


9. 6 dB Spectrum bandwidth Measurement

9.1 Operating environment

Temperature : 25.0 °C
 Relative Humidity : 42.0 % 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
■ - ESIB26	Rohde & Schwarz	EMI test receiver	830482/010	05. 23. 2013

9.5 Test result

- Test Date : July 18 ~ August 9, 2012
 - Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(2)
 - Channel : 802.11 B/G/N (Low: 2 412 MHz, Middle: 2 437 MHz, High: 2 462 MHz)
 - Operating Condition : RF transmitting mode
 - Power Source : AC 120 V / 60 Hz

Spectrum Parameter

- Attenuation : Auto
 - Span frequency : > 6 dB bandwidth
 - Resolution band width : 100 kHz
 - Video band with : 300 kHz
 - Detector : Peak
 - Trace : Maxhold
 - Sweep time : Auto



Configuration IEEE 802.11 B

Frequency (MHz)	6 dB Bandwidth (MHz)	99 % Occupied bandwidth (MHz)	Min. Limit (kHz)	Result
2 412	9.96	13.32	500	Complies
2 437	9.96	13.32	500	Complies
2 462	9.58	13.26	500	Complies

Configuration IEEE 802.11 G

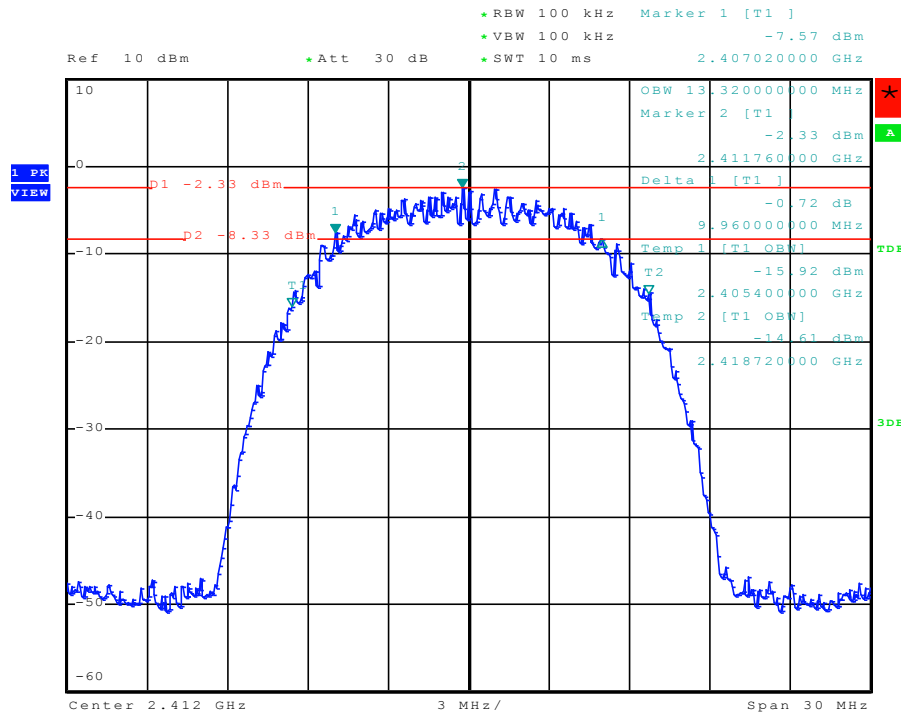
Frequency (MHz)	6 dB Bandwidth (MHz)	99 % Occupied bandwidth (MHz)	Min. Limit (kHz)	Result
2 412	16.50	16.50	500	Complies
2 437	16.50	16.50	500	Complies
2 462	16.50	16.50	500	Complies

Configuration IEEE 802.11 N

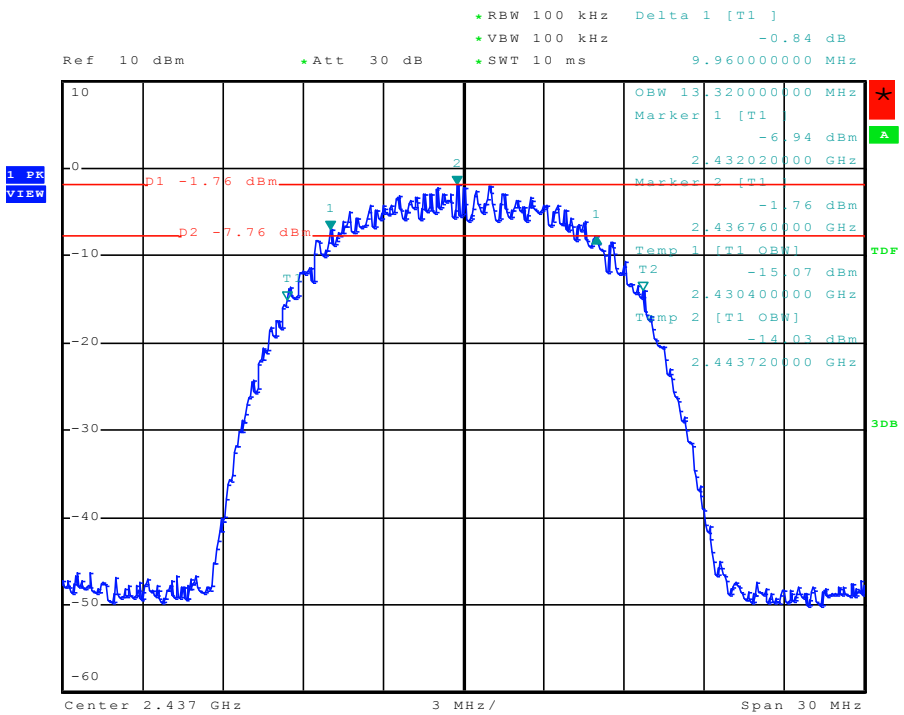
Frequency (MHz)	6 dB Bandwidth (MHz)	99 % Occupied bandwidth (MHz)	Min. Limit (kHz)	Result
2 412	17.70	17.70	500	Complies
2 437	17.70	17.70	500	Complies
2 462	17.70	17.70	500	Complies



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

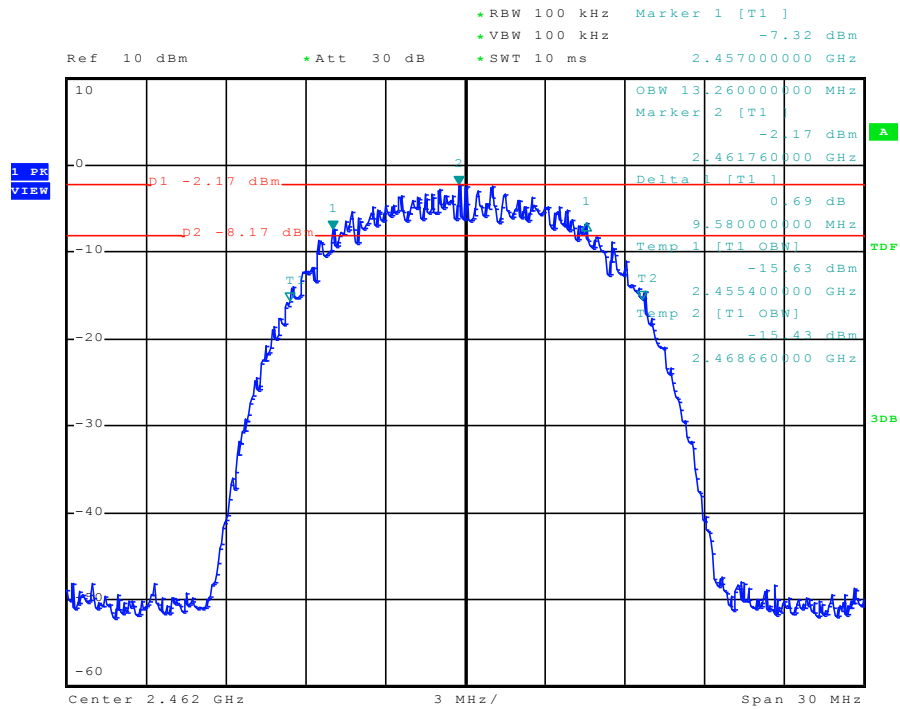


6 dB Bandwidth Plot on Configuration IEEE 802.11 B / 2 437 MHz

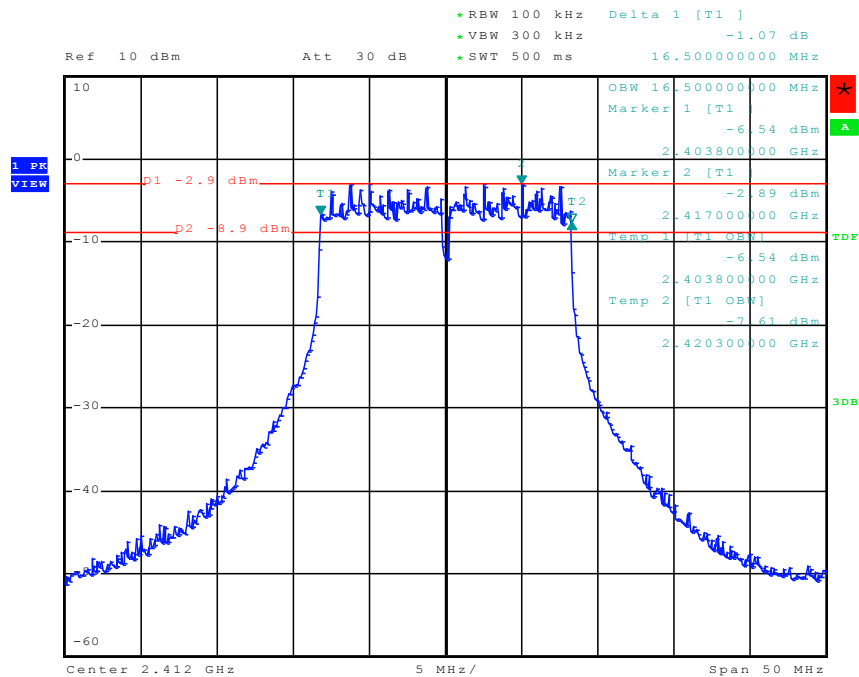




6 dB Bandwidth Plot on Configuration IEEE 802.11 B / 2 462 MHz

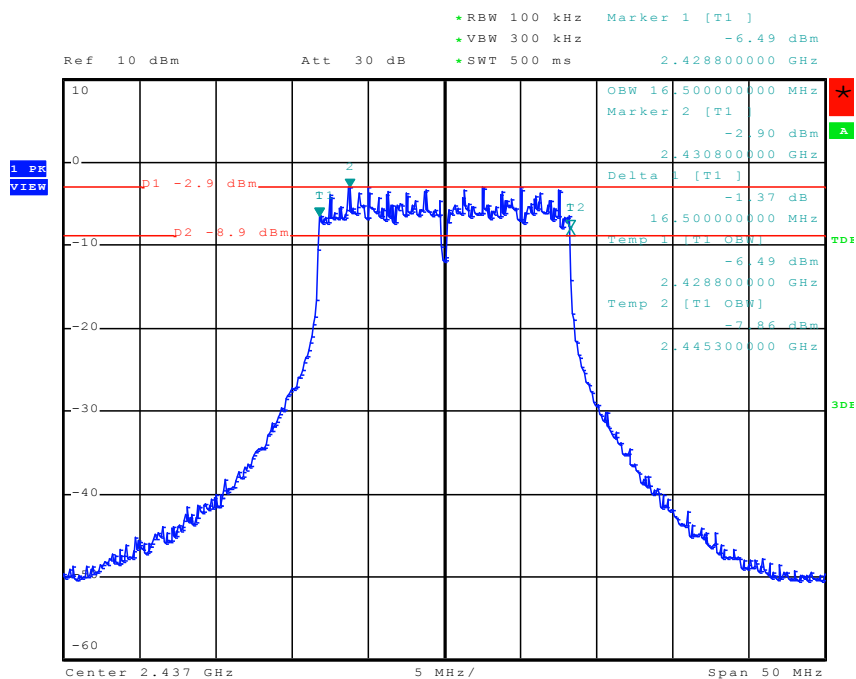


6 dB Bandwidth Plot on Configuration IEEE 802.11 G / 2 412 MHz

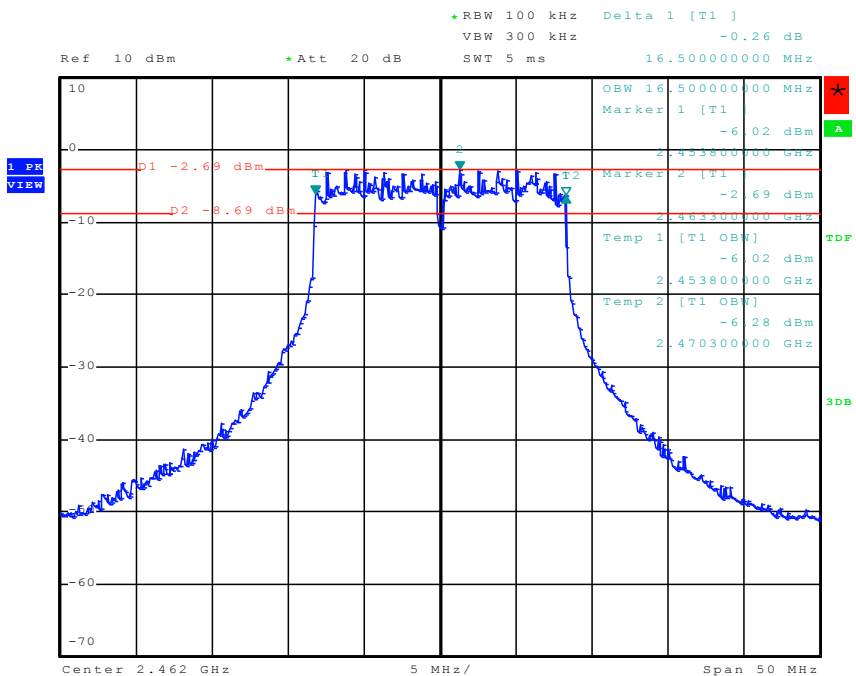




6 dB Bandwidth Plot on Configuration IEEE 802.11 G / 2 437 MHz

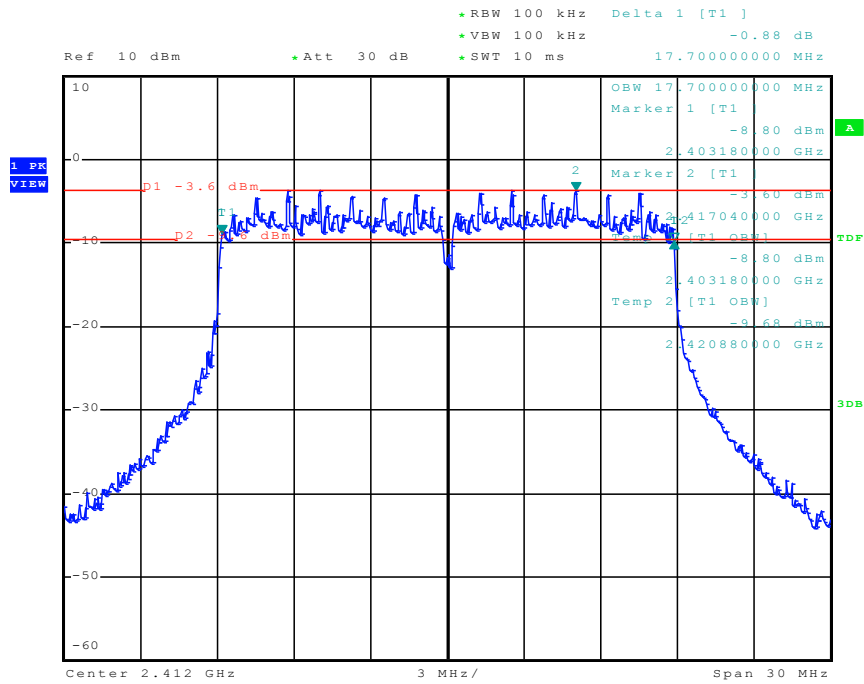


6 dB Bandwidth Plot on Configuration IEEE 802.11 G / 2 462 MHz

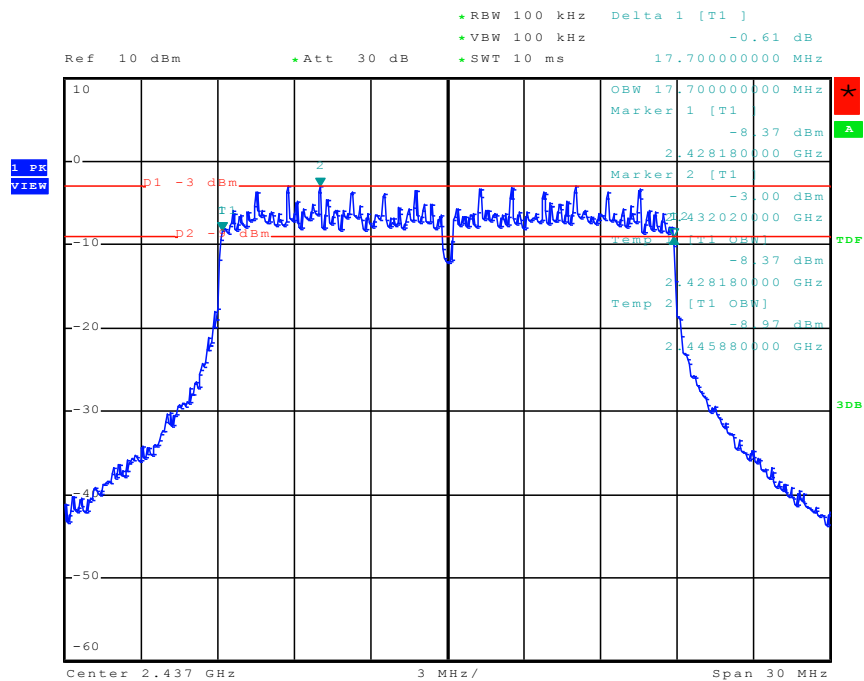




6 dB Bandwidth Plot on Configuration IEEE 802.11 N / 2 412 MHz

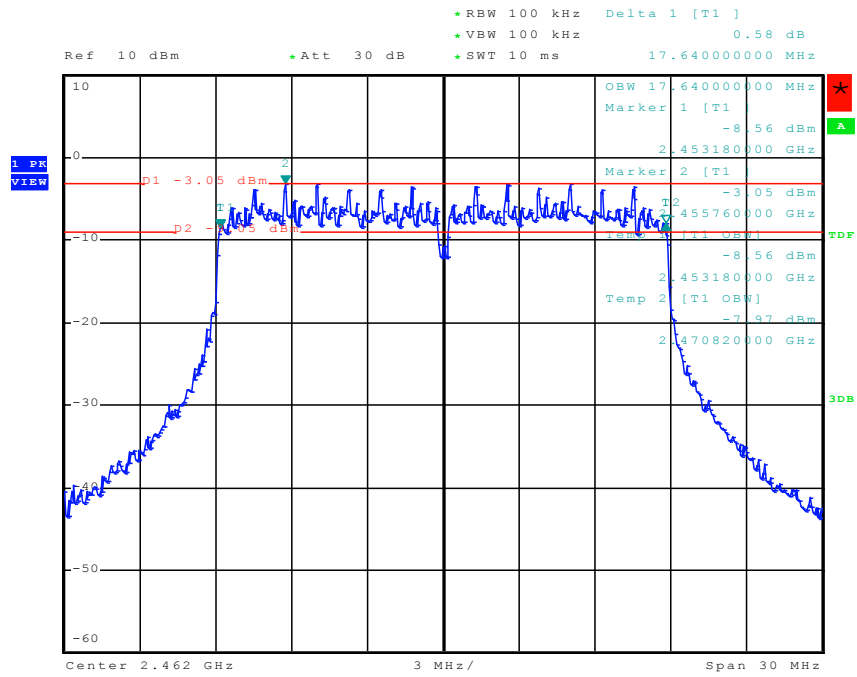


6 dB Bandwidth Plot on Configuration IEEE 802.11 N / 2 437 MHz





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



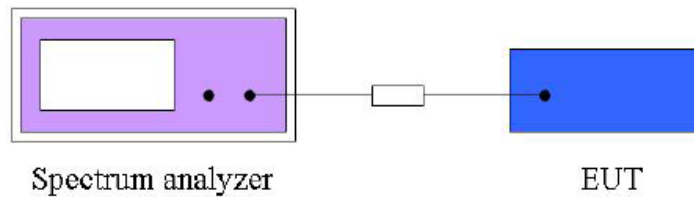


10. Band Edge Measurement

10.1 Operating environment

Temperature : 25.0 °C
 Relative Humidity : 42.0 % 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
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	05. 23. 2013

10.5 Test Result

- Test Date : July 18, 2012 ~ August 9, 2012
 - Reference standard : Part 15 Subpart C, Sec. 15.247(d)
 - Channel : 802.11 B/G/N (Low: 2 412 MHz, High: 2 462 MHz)
 - Operating condition : RF transmitting mode
 - Measuring distance : 3 m
 - Power Source : AC 120 V / 60 Hz

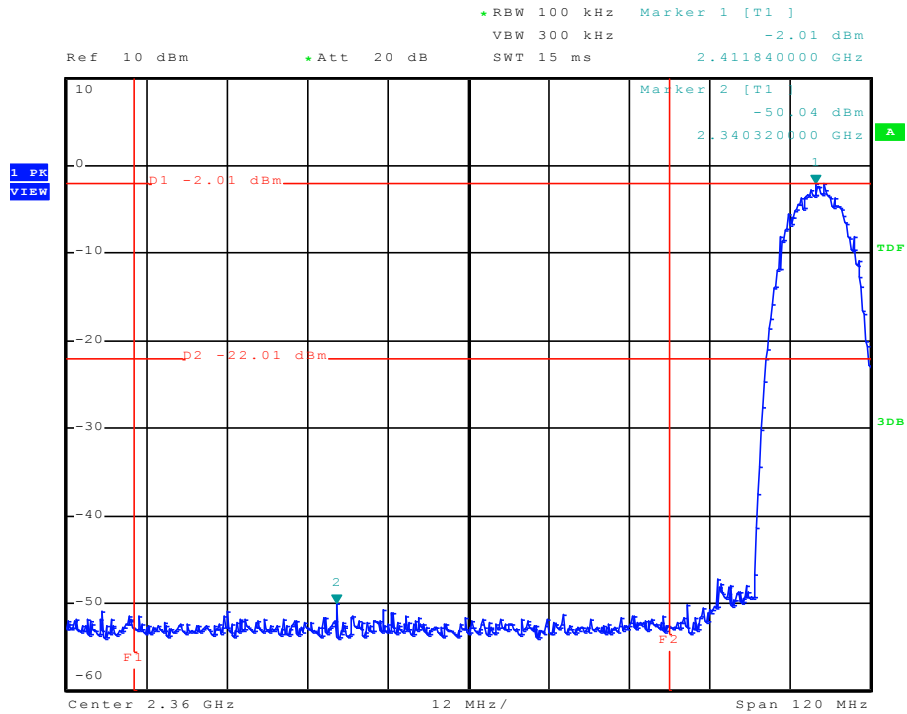
The spectrum plots are attached on the following 8 images, D1 line indicates the highest level, D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement in part 15.247(d)

Spectrum Parameter

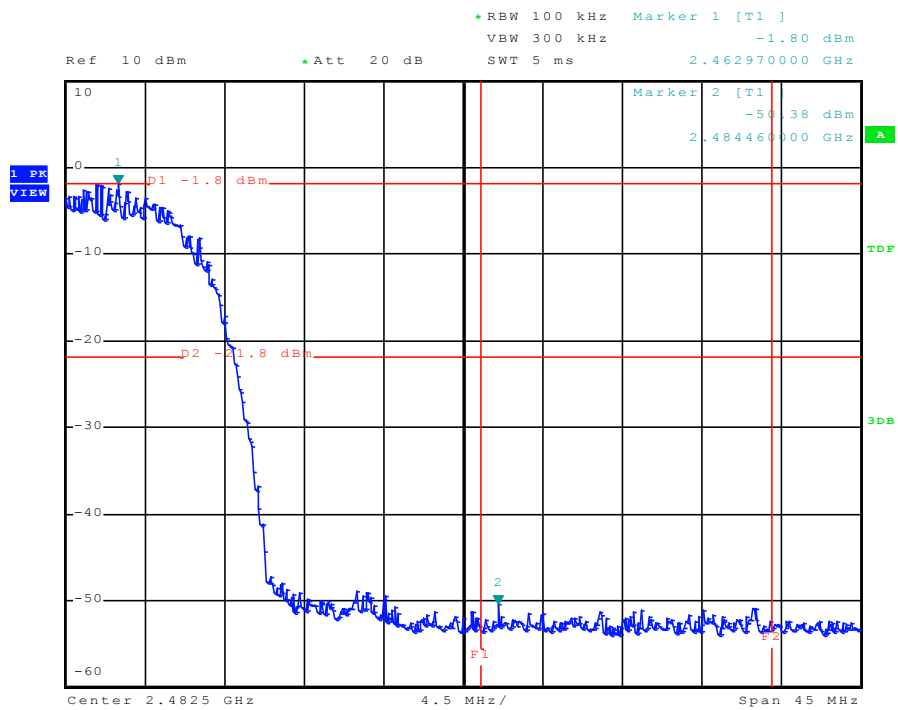
- Attenuation : Auto
 - Resolution bandwidth : 100 kHz
 - Video bandwidth : 100 kHz



For Emission not in Restricted Band
Low Band Edge Plot on Configuration IEEE 802.11 B / 2 412 MHz

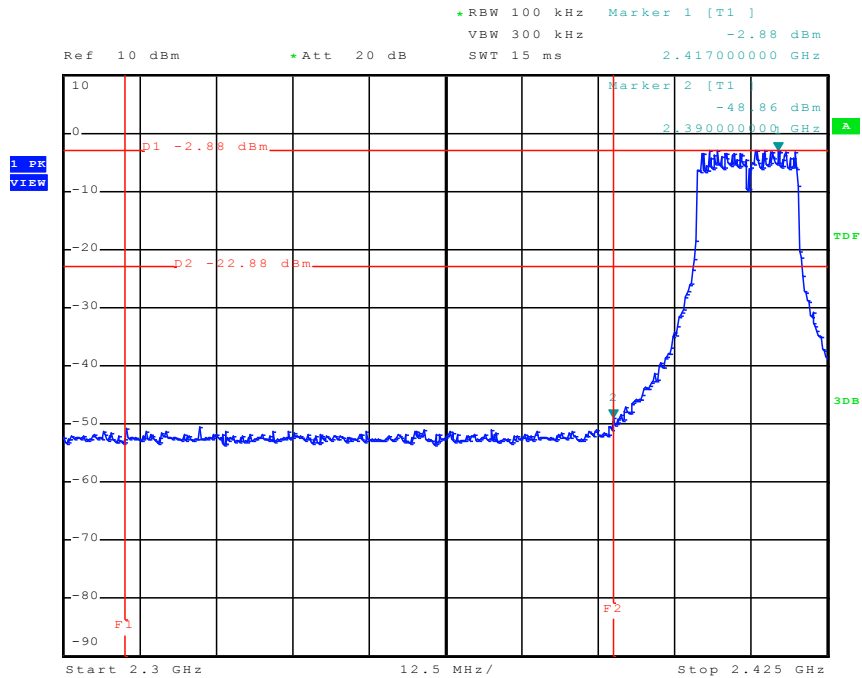


High Band Edge Plot on Configuration IEEE 802.11 B / 2 462 MHz

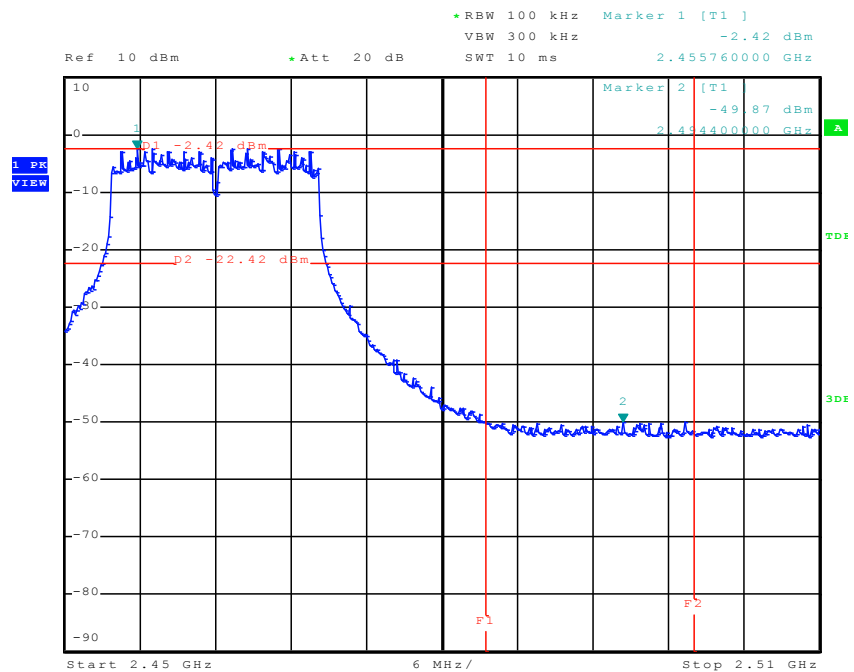




For Emission not in Restricted Band
Low Band Edge Plot on Configuration IEEE 802.11 G / 2 412 MHz

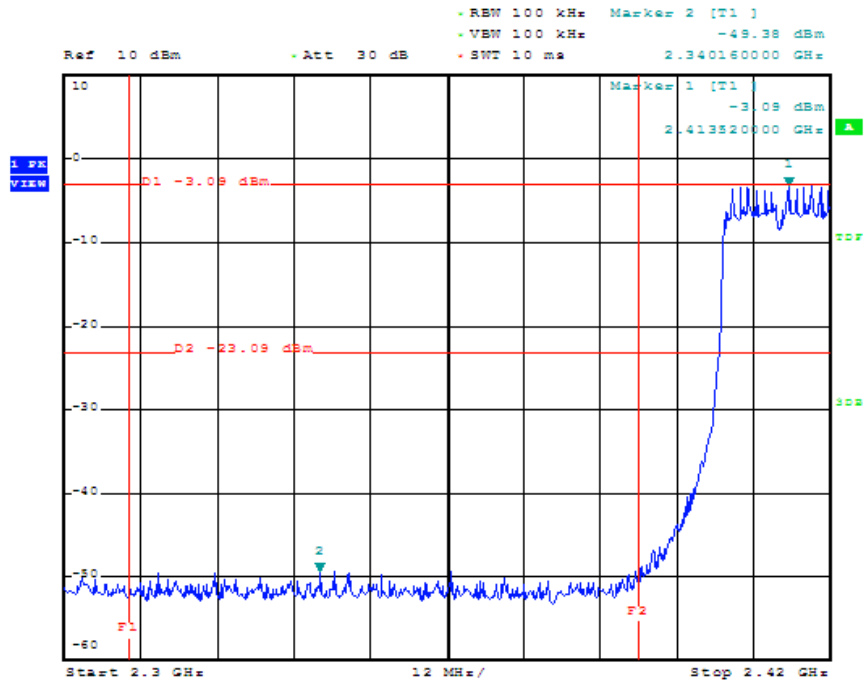


High Band Edge Plot on Configuration IEEE 802.11 G / 2 462 MHz

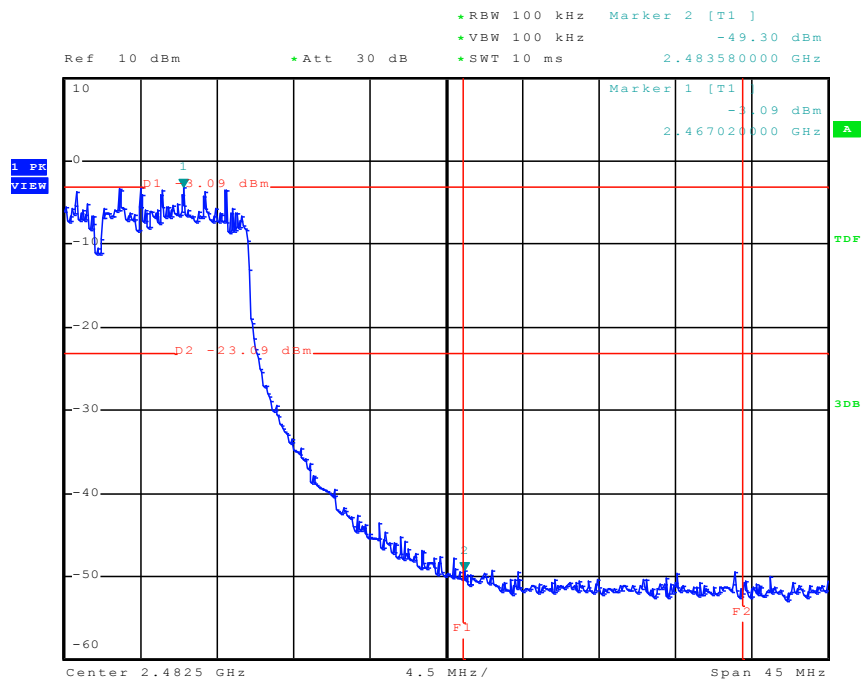




For Emission not in Restricted Band
Low Band Edge Plot on Configuration IEEE 802.11 N / 2 412 MHz



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





11. Radiated Emission

11.1 Operating Environment

Temperature : 24.0 °C
 Relative Humidity : 41.0 % 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



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
■ - VULB9160	Schwarzbeck	Broadband test antenna	3193	03. 14. 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	597	01. 23. 2013
■ - 3160-09	ETS LINDGREN	Horn antenna	LM3423	11. 14. 2013
■ - AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258942	11. 12. 2012
■ - AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258943	11. 12. 2012

11.6 Radiated emission test data

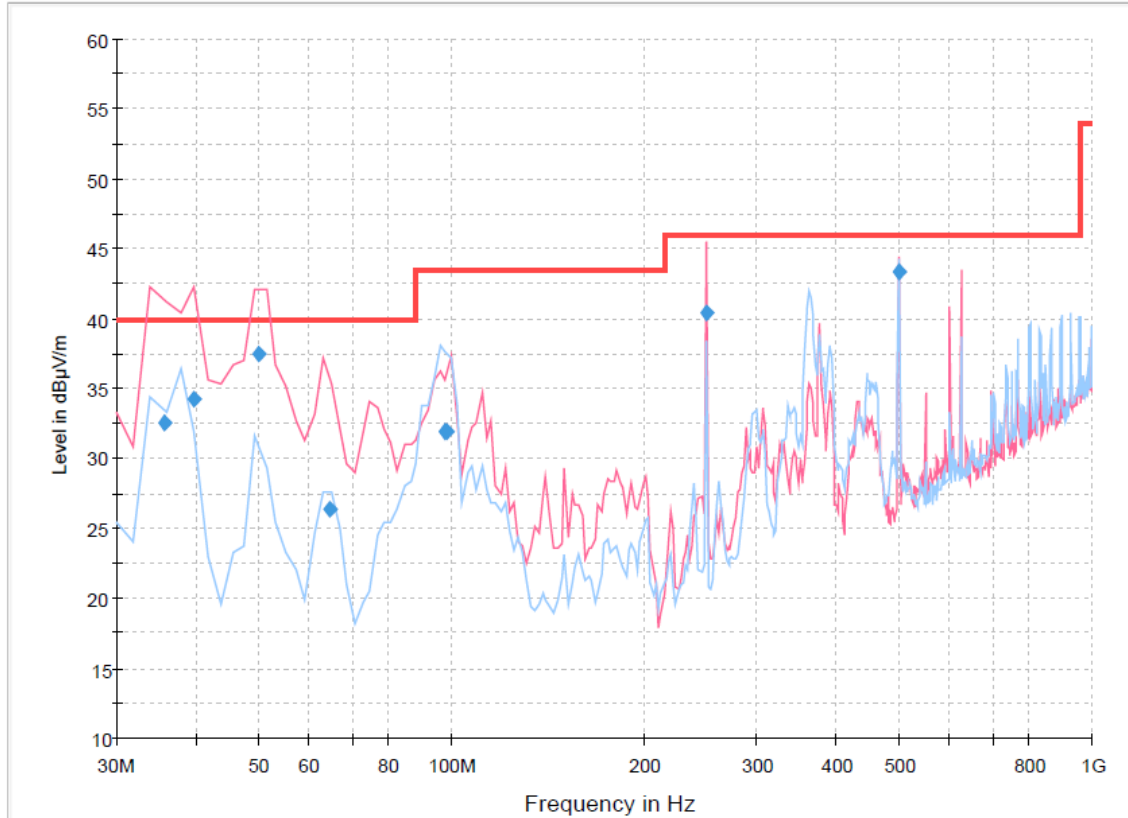
- Test Date : July 11 ~ 17, 2012
- Reference standard : Part 15 Subpart C, Sec. 15.247(d) / ANSI C63.10
- Channel (Worst Case) : 802.11 B (Low: 2 412 MHz, Middle: 2 437 MHz, High: 2 462 MHz)
- Operating condition : RF transmitting mode
- Measuring distance : 3 m
- Spectrum resolution bandwidth(6dB) : 120 kHz / 1 MHz / 10 Hz / 100 kHz
- Detector mode : Peak detector mode / Quasi Peak detector mode / Average detector mode
- Power Source : AC 120 V / 60 Hz
- Note : None.



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)



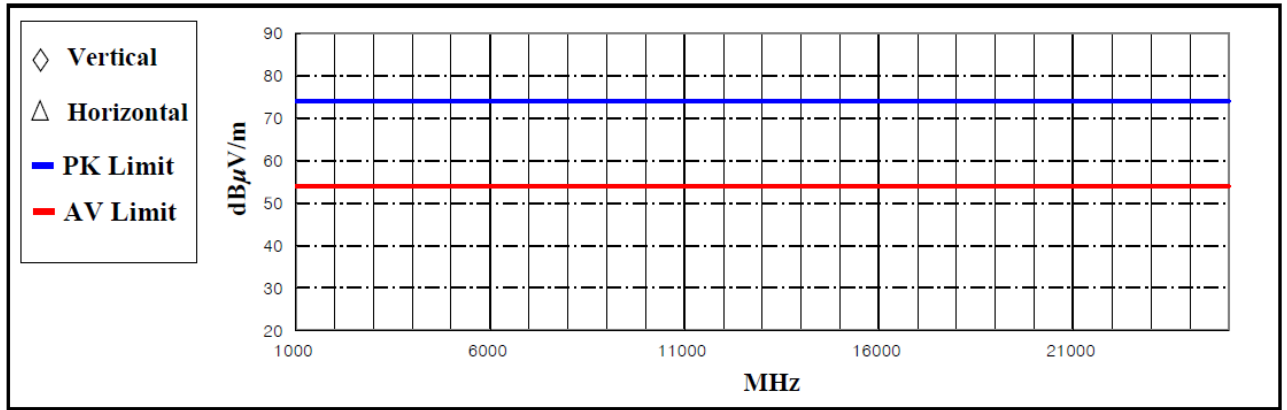
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
35.707776	32.6	1000.0	120.000	125.0	V	242.0	11.3	7.4	40.0
39.499439	34.2	1000.0	120.000	100.0	V	267.0	12.2	5.8	40.0
50.122766	37.5	1000.0	120.000	100.0	V	6.0	12.7	2.5	40.0
64.426092	26.4	1000.0	120.000	100.0	V	334.0	11.7	13.6	40.0
97.872184	31.9	1000.0	120.000	200.0	H	169.0	9.8	11.6	43.5
98.376072	31.8	1000.0	120.000	211.0	H	14.0	9.9	11.7	43.5
249.999319	40.4	1000.0	120.000	100.0	V	139.0	14.0	5.6	46.0
500.000842	43.3	1000.0	120.000	100.0	V	180.0	21.2	2.7	46.0



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

Frequency (MHz)	Measurement Level						Limit (dBμV/m)		Margin (dB)		Positioning System		
	Reading Value (dBμV/m)		AF	AMP / CL	Test Result (dBμV/m)		Peak	Average	Peak	Average	Pol. (H/V)	Height (cm)	Angle (°)
	Peak	Average	(dB/m)	(dB)	Peak	Average							
All frequency	<<	<<			<<	<<			<<	<<	-	-	-



*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 (dBμV/m)		Margin (dB)		Positioning System		
	Reading Value (dBμV)		AF	AMP / CL	Test Result (dBμV/m)		Peak	Average	Peak	Average	Pol. (H/V)	Height (cm)	Angle (°)
	Peak	Average	(dB/m)	(dB)	Peak	Average							
2390.00	79.17	61.27	26.96	-36.93	69.20	51.30	74.00	54.00	4.80	2.70	-	-	-

802.11 B, 2 462 MHz

Frequency (MHz)	Measurement Level						Limit (dBμV/m)		Margin (dB)		Positioning System		
	Reading Value (dBμV)		AF	AMP / CL	Test Result (dBμV/m)		Peak	Average	Peak	Average	Pol. (H/V)	Height (cm)	Angle (°)
	Peak	Average	(dB/m)	(dB)	Peak	Average							
2483.50	78.27	62.17	27.21	-36.78	68.70	52.60	74.00	54.00	-	-	-	-	-

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 (dBμV/m) = 20 log Emission level (μV/m).

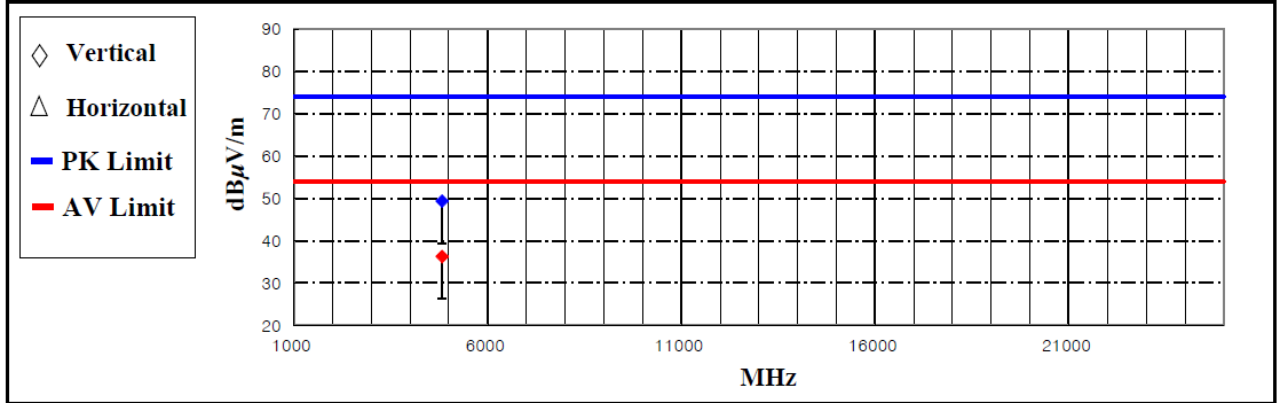
Corrected reading: Antenna factor + Cable loss + Pre-amplifier gain + Read value = Test result



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

(802.11 B, 2 412 MHz)

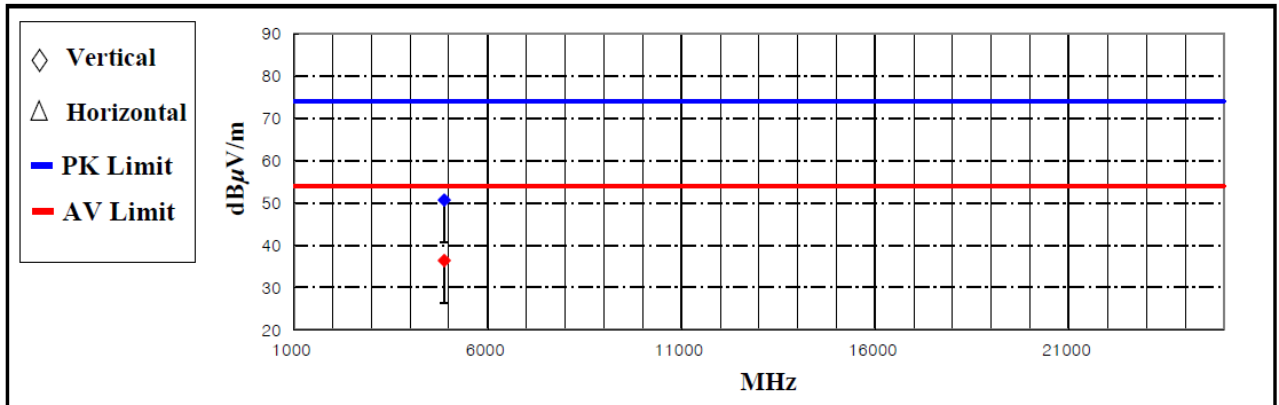
Frequency (MHz)	Measurement Level						Limit (dBμV/m)		Margin (dB)		Positioning System		
	Reading Value (dBμV/m)		AF	AMP / CL	Test Result (dBμV/m)		Peak	Average	Peak	Average	Pol. (H/V)	Height (cm)	Angle (°)
	Peak	Average	(dB/m)	(dB)	Peak	Average							
4825.00	50.97	37.87	31.24	-32.81	49.40	36.30	74.00	54.00	24.60	17.70	V	148	126



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

(802.11 B, 2 437 MHz)

Frequency (MHz)	Measurement Level						Limit (dBμV/m)		Margin (dB)		Positioning System		
	Reading Value (dBμV/m)		AF	AMP / CL	Test Result (dBμV/m)		Peak	Average	Peak	Average	Pol. (H/V)	Height (cm)	Angle (°)
	Peak	Average	(dB/m)	(dB)	Peak	Average							
4879.13	52.14	37.84	31.33	-32.77	50.70	36.40	74.00	54.00	23.30	17.60	V	149	129

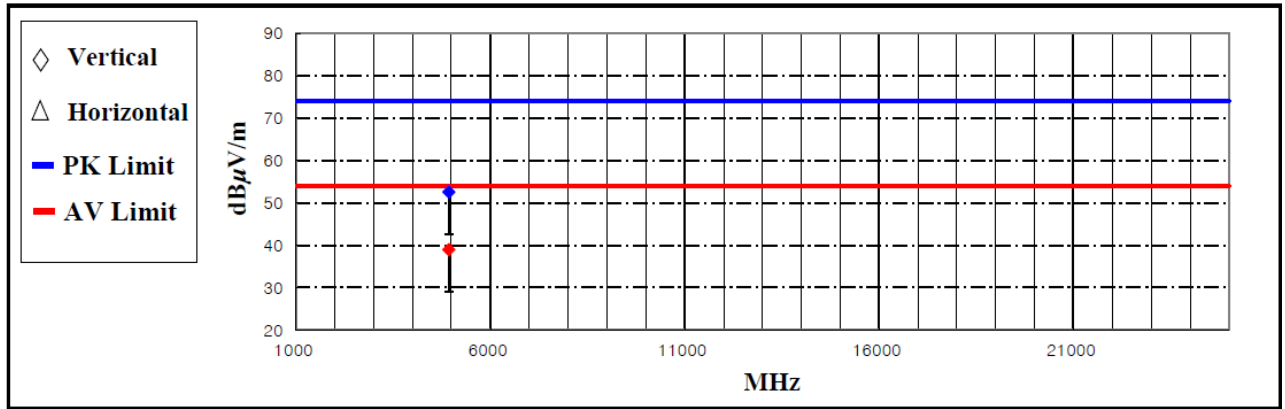


*Comment : AMP/CL_Cable loss value + AMP gain value
 AF : Antenna factor value
 Pol. : H(Horizontal), V(Vertical)



(802.11 B, 2 462 MHz)

Frequency (MHz)	Measurement Level						Limit (dBµV/m)		Margin (dB)		Positioning System		
	Reading Value (dBµV/m)		AF	AMP / CL	Test Result (dBµV/m)		Peak	Average	Peak	Average	Pol. (H/V)	Height (cm)	Angle (°)
	Peak	Average	(dB/m)	(dB)	Peak	Average							
4932.04	53.90	40.30	31.43	-32.73	52.60	39.00	74.00	54.00	21.40	15.00	V	100	139



*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 -