

## ***FCC EVALUATION REPORT FOR CERTIFICATION***

**Manufacturer : CMAX Wireless Co., Ltd.****Date of Issue : May 10, 2010****KT Bongduk B/D 9F, 627-15 Bongduk-dong****Order Number: GETEC-C1-09-246****Nam-gu, Daegu, 705-710, Korea****Test Report S/N : GETEC-E3-09-167****Attn : Mr. Donghun Chae/Deputy general manager****Test Site : Gumi College EMC Center****FCC Registration Number: (100749, 443957)****FCC ID.: YC9CWE-100SA****Applicant: CMAX Wireless Co., Ltd.**

<b>Rule Part(s)</b>	<b>: FCC Part 15 Subpart C-Intentional Radiator § 15.247</b>
<b>Test Method</b>	<b>: Public Notice FCC97-114</b> (Guidance on measurement for direct sequence spread spectrum systems)
<b>Equipment Class</b>	<b>: Digital Transmission System (DTS)</b>
<b>EUT Type</b>	<b>: WIFI module</b>
<b>Type of Authority</b>	<b>: Certification</b>
<b>Model Name</b>	<b>: CWE-100SA</b>
<b>Trade Name</b>	<b>: CMAX</b>

**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 C63.4-2003**

**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,**

**Soon-Hoon Jeong, 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: CMAX Wireless Co., Ltd.**

**Applicant Address: KT Bongduk B/D 9F, 627-15 Bongduk-dong, Nam-gu, Daegu, 705-710, Korea.**

**Manufacturer: CMAX Wireless Co., Ltd.**

**Manufacturer Address: KT Bongduk B/D 9F, 627-15 Bongduk-dong, Nam-gu, Daegu, 705-710, Korea.**

**Contact Person: Mr. Donghun Chae / Deputy general manager**

**Telephone Number: +82-53-659-2700      Fax Number: +82-53-793-1008**

- **FCC ID.** YC9CWE-100SA
- **Test Method** Public Notice FCC97-114  
(Guidance on measurement for direct sequence spread spectrum systems)
- **EUT Type** WIFI module
- **Model Name** CWE-100SA
- **Trade Name** CMAX
- **Serial Number** Prototype
- **Rule Part(s)** FCC Part 15, Subpart C-Intentional Radiator § 15.247
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** April 29 ~ May 7, 2009
- **Place of Test** **Gumi College EMC Center** ( FCC Registration Number: 100749, 443957)  
407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.
- **Test Report Number** GETEC-E3-09-167
- **Dates of Issue** May 10, 2010

**EUT Type: WIFI module**

**FCC ID.: YC9CWE-100SA**



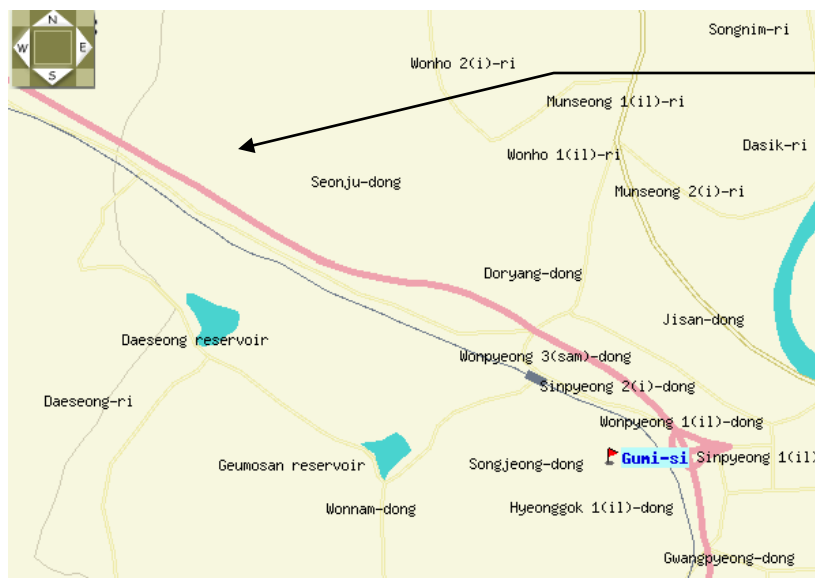
## 2. Introduction

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 (ASNI C63.4-2003) was used in determining radiated and conducted emissions emanating from **CMAX Wireless Co., Ltd. WIFI module (Model Name: CWE-100SA)**

These measurement tests were conducted at **Gumi College EMC Center**.

The site address is 407, Bugok-dong, Gumi-si, Gyeongbuk, Korea.

This test site is one of the highest point of Gumi 1 college at about 200 km away from Seoul city and 40 km away from Daegu 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 (2003)



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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 **CMAX Wireless Co., Ltd. WIFI module (Model Name: CWE-100SA)**  
**FCC ID.: YC9CWE-100SA**

ITEM	SPECIFICATIONS
<b>WIRELESS SPECIFICATION</b>	
Wireless Standard	IEEE802.11b, IEEE802.11g
Frequency Range	2.412~2.484GHz (USA version: 2.412 ~ 2.462 GHz)
Channels	1 ~ 14 Channels (USA version: 1 ~ 11 Channel)
Baseband Processing	OFDM, CCK and DSSS
Modulation	BPSK, QPSK, 16-QAM, 64-QAM
Range	Up to 100m free space (Outdoor)
Connection Modes	Infrastructure and Ad-hoc (IBSS)
<b>RF PERFORMANCE</b>	
Transmit Power (Conducted)	Max 15 dBm (802.11g), Max 18 dBm(802.11 b)
Receive sensitivity(802.11g)	Receive sensitivity(6Mbps) : -89dBm Receive sensitivity(54Mbps) : -72dBm
Antenna Gain	2dBi ± 0.5 dBi, (internal chip antenna)
Tx EVM	Min 25dB (54Mbps)
Tx Center Frequency Accuracy	20ppm
Tx Symbol Clock Frequency Tolerance	20ppm
Tx Spectrum Mask	-21dBr @ fc +/- 11MHz
	-29dBr @ fc +/- 20MHz
	-41dBr @ fc +/- 30MHz
Tx Spectral Flatness	2dB/ - 4dB
<b>UART INTERFACE</b>	
Baud Rate	115,200bps
Bits	8
Parity	None
Stop bits	1
Flow Control	CTS/RTS (Hardware)
<b>PROTOCOL</b>	
Internet	DHCP Client, HTTP, HTTPS, TELNET, FTP, ARP, ICMP, SNMP, IPv4, TCP, UDP
Security	Open Connection
	Shared Key (WEP encryption 64 and 128 bit options)
	WPA1/2-Personal (PSK)
	WPA1/2-Enterprise (EAP-TLS, EAP-TTLS, PEAP, LEAP, FAST)
	SSL2 / SSL3 / TLS1
<b>OTHERS</b>	
Management	Configuration Tool, HTTP, HTTPS, TELNET, FTP
Software Update	Firmware upgradeable via UART and Wireless LAN
<b>PHYSICAL DIMENSION</b>	
Power	80mA * 3.3V (Peak 90mA * 3.3V)
Dimensions	30mm × 40mm × 4.8mm
Weight	8g (Approx.)
Power Consumption	264mW (Peak 297mW)
MCU	200MHz ARM9 with SRAM 8M and Flash 8M
Environmental	-5°C ~ 55°C
	-20°C ~ 70°C
Humidity	Operation: 10% to 90%, Non-Condensing
	Storage: 5% to 90%, Non-Condensing

Frequency Band	Channel Number	Frequency	Channel Number	Frequency
2 400.0 MHz~2 483.5 MHz	1	2 412 MHz	7	2 442 MHz
	2	2 417 MHz	8	2 447 MHz
	3	2 422 MHz	9	2 452 MHz
	4	2 427 MHz	10	2 457 MHz
	5	2 432 MHz	11	2 462 MHz
	6	2 437 MHz		



### 3.2 Support Equipment / Cables used

#### 3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
PC	RIPPLE	BAREBONE	S/N: - FCC ID: DoC
USB mouse	Sunsonny Electronics	GM-3000C	S/N: - FCC ID: DoC
Keyboard	SNJ	SKG-210P	S/N: - FCC ID: DoC
Monitor	LG Electronics Inc.	L1740BU	S/N: 512KGPM08672 FCC ID: DoC

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	-	-	-

#### 3.2.3 Used Cable(s)

Cable Name	Condition	Description
SD cable	Connected to the EUT and PC	0.20 m unshielded

### 3.3 Modification Item(s)

-. None

## 4. 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.

### 4.1 Description of Antenna

The **CMAX WIRELESS CO., LTD. WIFI module** comply with the requirement of §15.203 with a built-in monopole antenna permanently attached to the transmitter.



## 5. Description of tests

### 5.1 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 (DC 3.3 V supplied from the host unit)
- Test Mode(s)

-. Executed “Atheros Radio Test (ART) 6000 (made by Atheros Communications, Inc.)” to control the EUT continuously transmit RF signal

Test Software Version	ART 6000		
Frequency	2 412 MHz	2 437 MHz	2 462 MHz
IEEE 802.11 B	12	12	12
IEEE 802.11 G	12	12	12





## 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

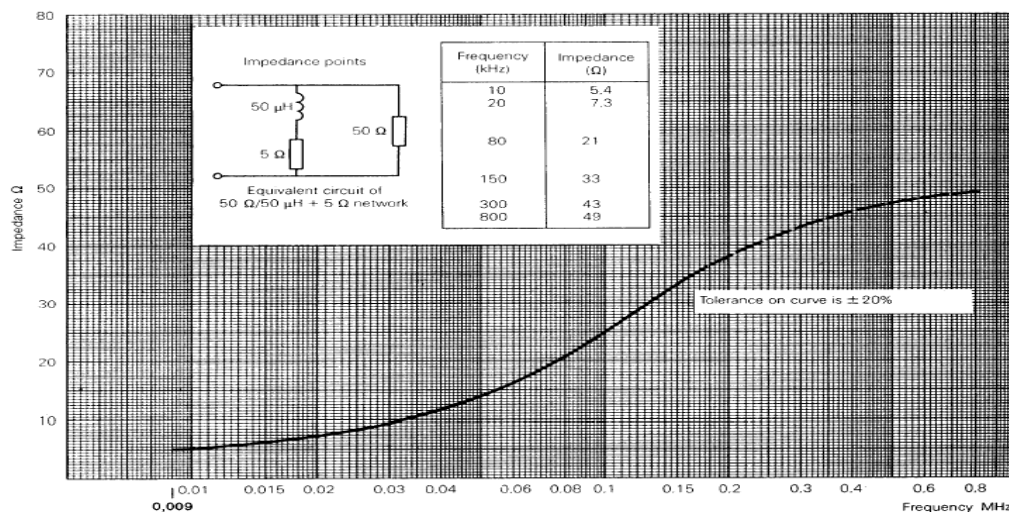


Fig 2. Impedance of LISN



### 5.3 Radiated Emission

Preliminary measurements were conducted 3 m semi anechoic chamber using broadband antennas to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The technology configuration, mode of operation and turntable azimuth with respect to antenna was note for each frequency found.

Final measurements were made 3 m chamber (FCC registration No.: 443957) and/or 10 m OATS (FCC registration No.: 100749).

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

Each frequency found during pre-scan measurements was re-examined and investigated using EMI test receiver. The detector function was set to CISPR quasi-peak mode average mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency or type of signal.

The EUT, support equipment and interconnecting cables were reconfigured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non-metallic 1.0 m × 1.5 m table.

The turntable containing the test sample was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission.

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

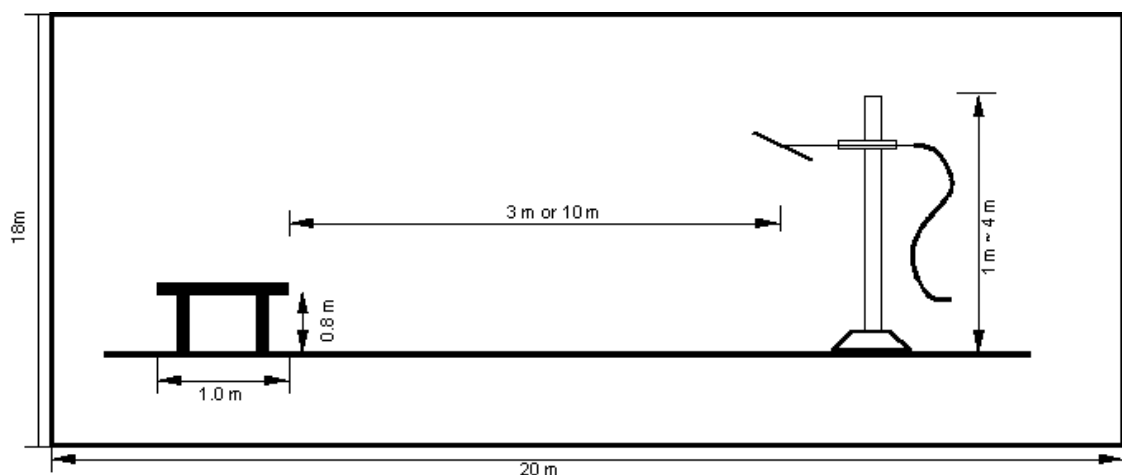


Fig 3. Dimensions of test site.



## 6. Conducted Emission

### 6.1 Operating Environment

Temperature : 23 °C  
Relative Humidity : 36 % 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.

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)	$\pm 2.69$ dB	Confidence levels of 95 % ( $k = 2$ )
Conducted emission (150 kHz ~ 30 MHz)	$\pm 4.16$ dB	Confidence levels of 95 % ( $k = 2$ )



#### 6.4 Limit

RFI Conducted	FCC Limit(dB $\mu$ 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

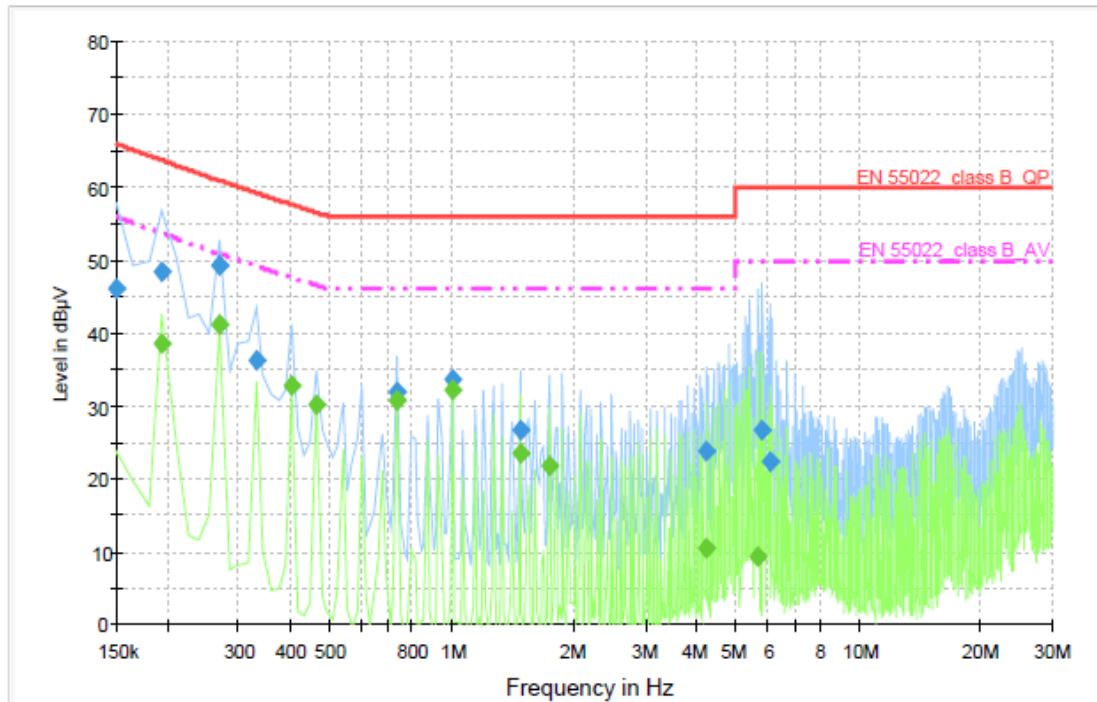
Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI Test Receiver	839809/003	12. 10. 2010
■ - ESH3-Z5	Rohde & Schwarz	LISN	838979/020	12. 10. 2010
■ - ESH2-Z5	Rohde & Schwarz	LISN	829991/009	12. 10. 2010
□ - ISN T8	TESEQ. GmbH	Impedance Network	24568	10. 16. 2010

#### 6.6 Test data for Conducted Emission

- Test Date	: May 7, 2010
- Reference standard	: Part 15 Subpart C, Sec. 15.207
- Channel	: 802.11b, 1ch
- Operating condition	: Wi-Fi RF transmitting mode
- Resolution bandwidth	: 9 kHz
- Frequency range	: 0.15 MHz ~ 30 MHz



## Voltage with 4-Line-LISN\_L1



## Final Measurement Detector 1

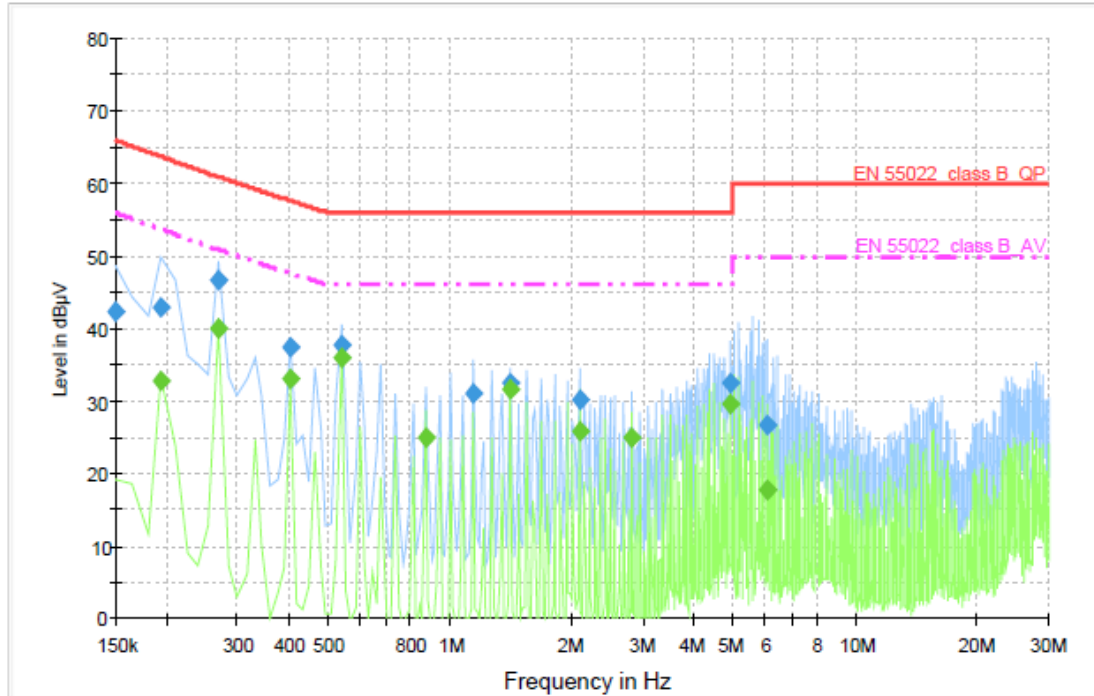
Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	46.1	1000.000	9.000	GND	L1	10.0	19.9	66.0	
0.195000	48.5	1000.000	9.000	GND	L1	10.0	15.2	63.7	
0.270000	49.4	1000.000	9.000	GND	L1	10.0	11.5	60.9	
0.330000	36.2	1000.000	9.000	GND	L1	10.0	23.1	59.3	
0.735000	31.9	1000.000	9.000	GND	L1	10.0	24.1	56.0	
1.005000	33.7	1000.000	9.000	GND	L1	10.0	22.3	56.0	
1.470000	26.6	1000.000	9.000	GND	L1	10.1	29.4	56.0	
4.215000	23.8	1000.000	9.000	GND	L1	10.2	32.2	56.0	
5.820000	26.6	1000.000	9.000	GND	L1	10.2	33.4	60.0	
6.090000	22.5	1000.000	9.000	GND	L1	10.2	37.5	60.0	

## Final Measurement Detector 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.195000	38.6	1000.000	9.000	GND	L1	10.0	15.1	53.7	
0.270000	41.2	1000.000	9.000	GND	L1	10.0	9.7	50.9	
0.405000	32.9	1000.000	9.000	GND	L1	10.0	14.7	47.6	
0.465000	30.2	1000.000	9.000	GND	L1	10.0	16.3	46.5	
0.735000	30.7	1000.000	9.000	GND	L1	10.0	15.3	46.0	
1.005000	32.3	1000.000	9.000	GND	L1	10.0	13.7	46.0	
1.470000	23.5	1000.000	9.000	GND	L1	10.1	22.5	46.0	
1.740000	21.9	1000.000	9.000	GND	L1	10.1	24.1	46.0	
4.215000	10.5	1000.000	9.000	GND	L1	10.2	35.5	46.0	
5.685000	9.2	1000.000	9.000	GND	L1	10.2	40.8	50.0	



## Voltage with 4-Line-LISN\_N



### Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.150000	42.3	1000.000	9.000	GND	N	10.0	23.7	66.0	
0.195000	42.9	1000.000	9.000	GND	N	10.0	20.8	63.7	
0.270000	46.7	1000.000	9.000	GND	N	10.0	14.2	60.9	
0.405000	37.3	1000.000	9.000	GND	N	10.0	20.3	57.6	
0.540000	37.6	1000.000	9.000	GND	N	10.0	18.4	56.0	
1.140000	31.0	1000.000	9.000	GND	N	10.1	25.0	56.0	
1.410000	32.6	1000.000	9.000	GND	N	10.1	23.4	56.0	
2.085000	30.3	1000.000	9.000	GND	N	10.1	25.7	56.0	
4.905000	32.4	1000.000	9.000	GND	N	10.2	23.6	56.0	
6.045000	26.8	1000.000	9.000	GND	N	10.2	33.2	60.0	

### Final Measurement Detector 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.195000	32.7	1000.000	9.000	GND	N	10.0	21.0	53.7	
0.270000	40.1	1000.000	9.000	GND	N	10.0	10.8	50.9	
0.405000	33.1	1000.000	9.000	GND	N	10.0	14.5	47.6	
0.540000	35.8	1000.000	9.000	GND	N	10.0	10.2	46.0	
0.870000	24.9	1000.000	9.000	GND	N	10.0	21.1	46.0	
1.410000	31.5	1000.000	9.000	GND	N	10.1	14.6	46.0	
2.085000	25.7	1000.000	9.000	GND	N	10.1	20.3	46.0	
2.820000	25.0	1000.000	9.000	GND	N	10.1	21.0	46.0	
4.905000	29.4	1000.000	9.000	GND	N	10.2	16.6	46.0	
6.045000	17.7	1000.000	9.000	GND	N	10.2	32.3	50.0	

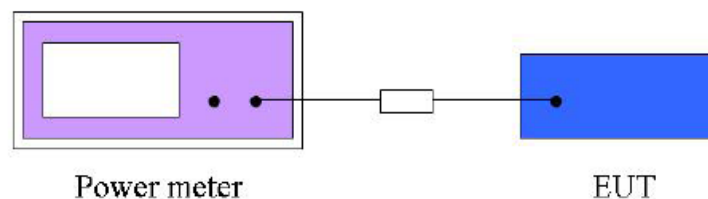


## 7. Maximum Peak Output Power Measurement

### 7.1 Operating environment

Temperature : 24.0 °C  
Relative humidity : 41.0 % 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 Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	NRVD	Rohde & Schwarz	Power meter	837794/048	12.11. 2010
■ -	NRV-Z32	Rohde & Schwarz	Power sensor	100062	10.15. 2010

### 7.5 Test result of Maximum Peak Output Power

- Test Date : April 29, 2010  
- Reference standard : Part 15 Subpart C, Sec. 15.247(b)(3)  
- Channel : 802.11b(1ch / 6ch / 11ch) ; 802.11g(1ch / 6ch / 11ch)  
- Operating condition : Wi-Fi RF transmitting mode  
- Power Source : DC 3.3 V supplied from the host unit

#### Parameter

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



**Configuration IEEE 802.11b**

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
1	2 412 MHz	17.99	30.00	Complies
6	2 437 MHz	18.36	30.00	Complies
11	2 462 MHz	18.41	30.00	Complies

**Configuration IEEE 802.11g**

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
1	2 412 MHz	15.20	30.00	Complies
6	2 437 MHz	15.81	30.00	Complies
11	2 462 MHz	15.87	30.00	Complies



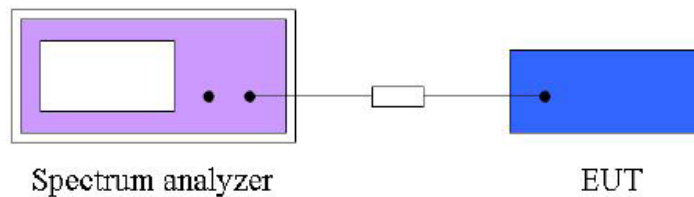


## 8. Power Spectral Density Measurement

### 8.1 Operating environment

Temperature : 24.0 °C  
Relative humidity : 41.0 % 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	12. 11. 2010

### 8.5 Test result of Maximum Peak Output Power

- Test Date : April 29, 2010  
- Reference standard : Part 15 Subpart C, Sec. 15.247(e)  
- Channel : 802.11b(1ch / 6ch / 11ch) ; 802.11g(1ch / 6ch / 11ch)  
- Operating condition : Wi-Fi RF transmitting mode  
- Power Source : DC 3.3 V supplied from the host unit

#### Spectrum Parameter

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



**Configuration IEEE 802.11b**

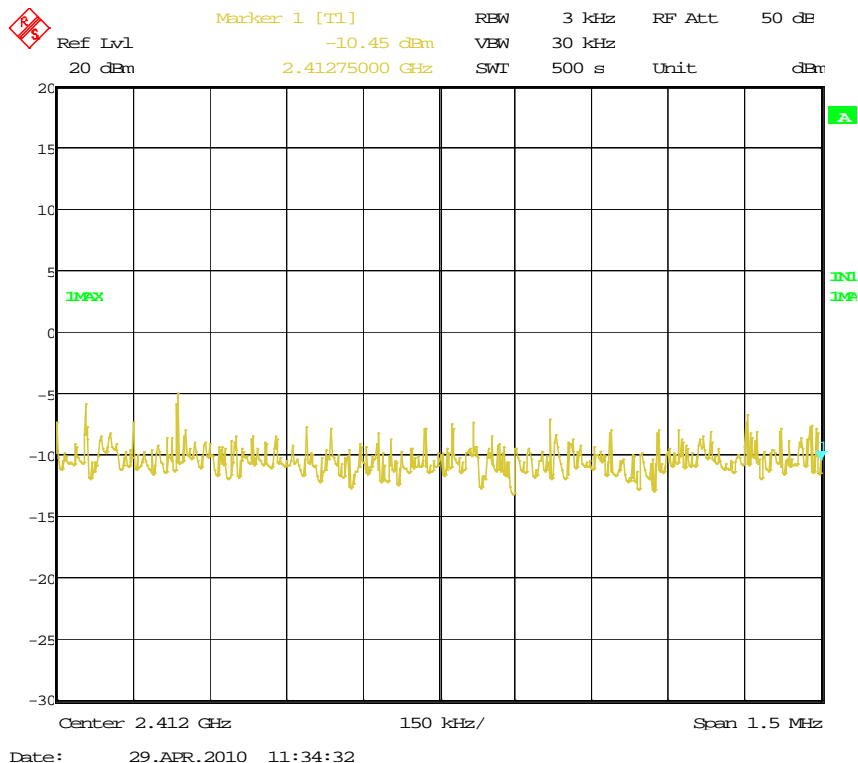
Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
1	2 412 MHz	-5.01	8.00	Complies
6	2 437 MHz	-3.30	8.00	Complies
11	2 462 MHz	-3.86	8.00	Complies

**Configuration IEEE 802.11g**

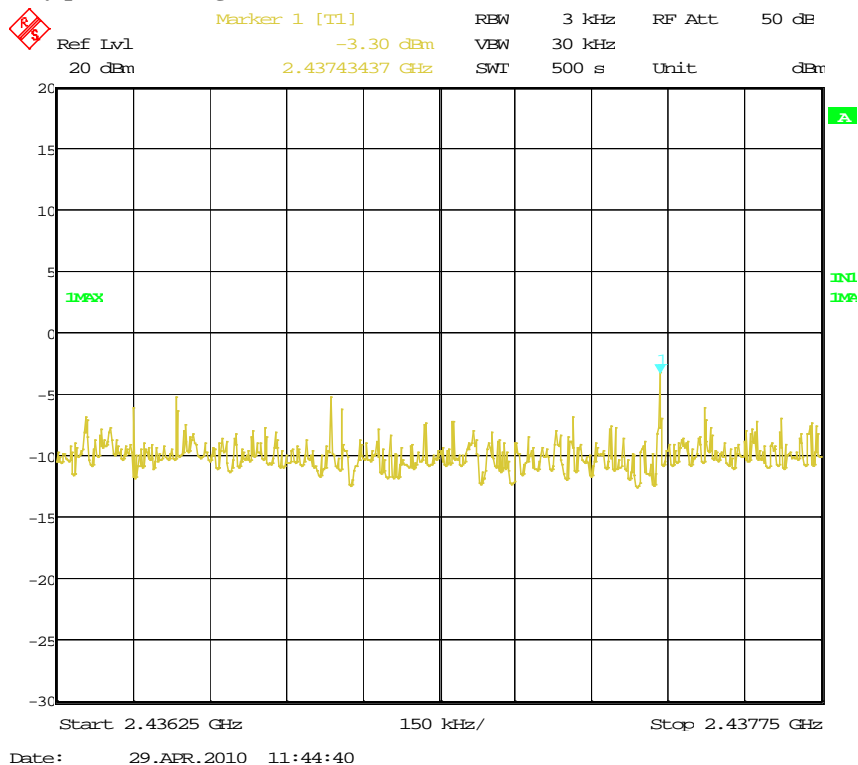
Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
1	2 412 MHz	-16.15	8.00	Complies
6	2 437 MHz	-15.64	8.00	Complies
11	2 462 MHz	-15.59	8.00	Complies



### Power Density Plot on configuration IEEE 802.11b / 2 412 MHz

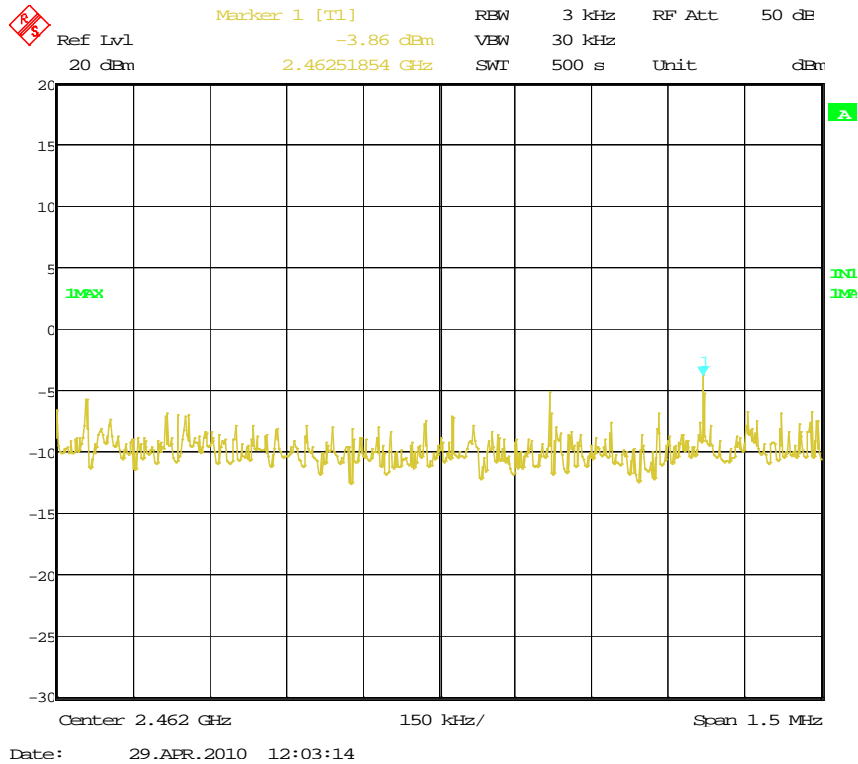


### Power Density plot on Configuration IEEE 802.11b / 2 437 MHz

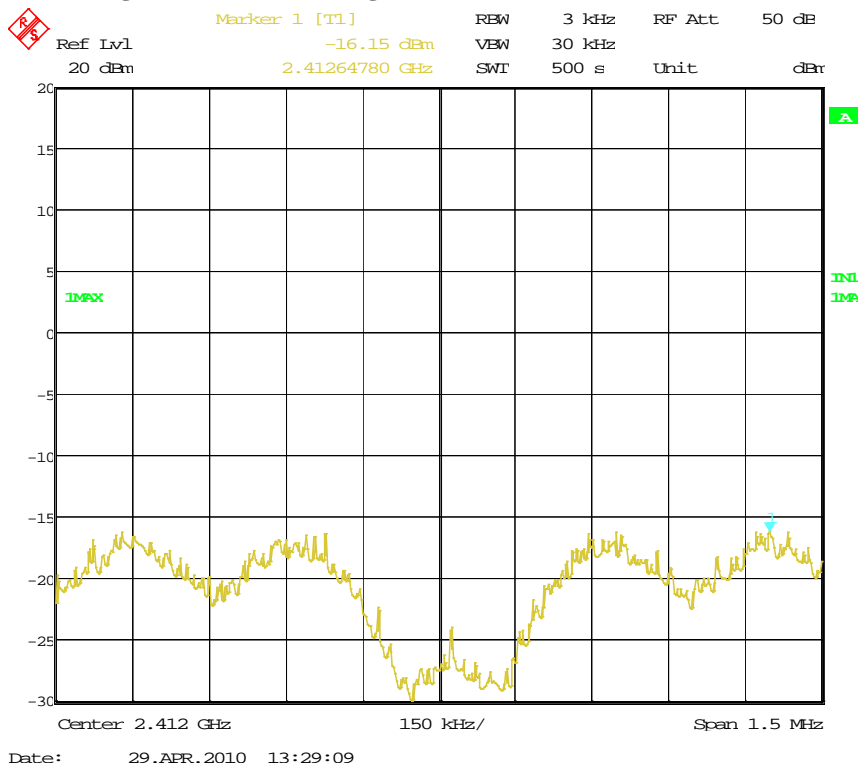




### Power Density Plot on Configuration IEEE 802.11b / 2 462 MHz

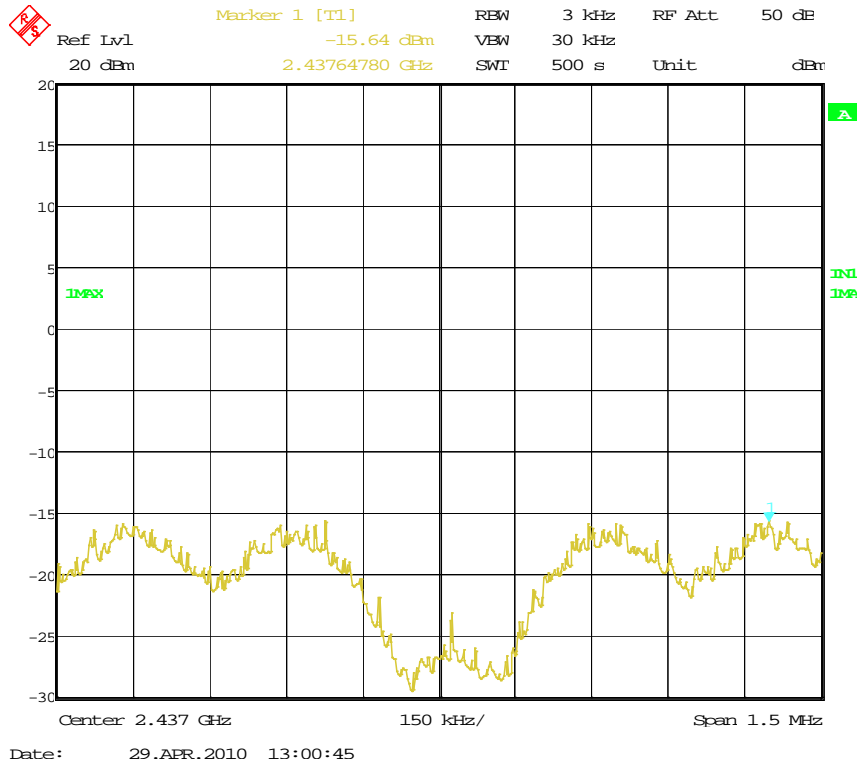


### Power Density Plot on Configuration IEEE 802.11g / 2 412 MHz

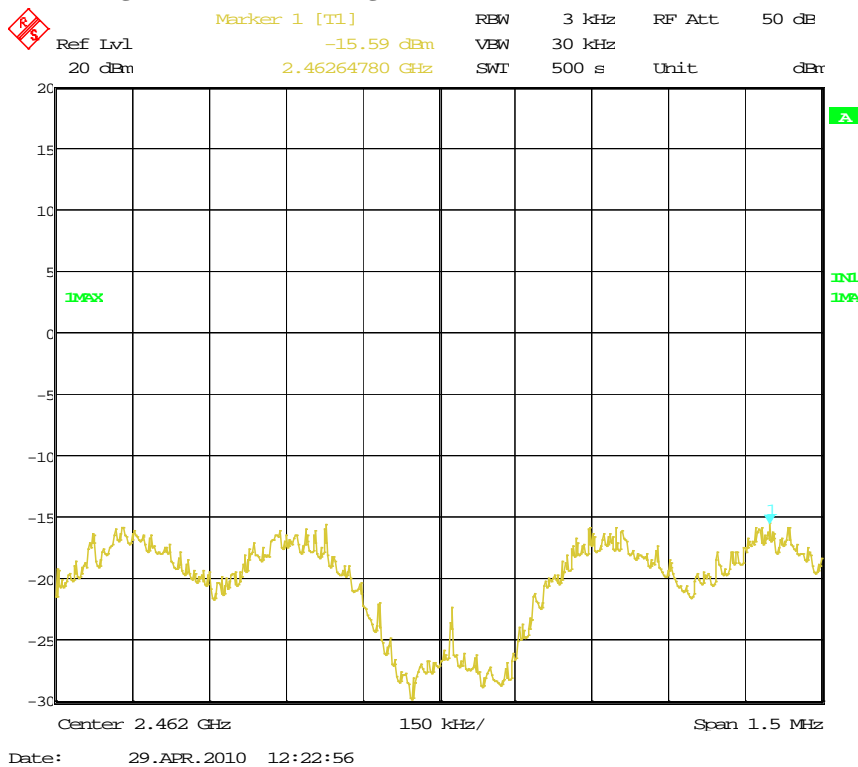




### Power Density Plot on Configuration IEEE 802.11g / 2 437 MHz



### Power Density Plot on Configuration IEEE 802.11g / 2 462 MHz



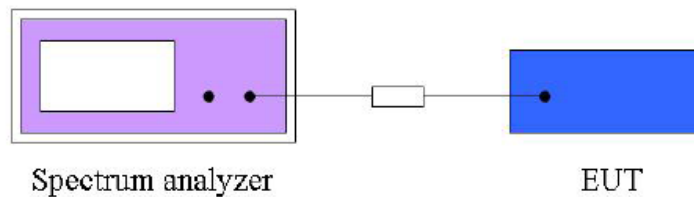


## 9. 6 dB Spectrum bandwidth Measurement

### 9.1 Operating environment

Temperature : 24.0 °C  
Relative humidity : 41.0 % 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 Number	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI test receiver	830482/010	12. 11. 2010

### 9.5 Test result of Maximum Peak Output Power

- Test Date : April 29, 2010  
- Reference standard : Part 15 Subpart C, Sec. 15.247(a)(2)  
- Channel : 802.11b(1ch / 6ch / 11ch) ; 802.11g(1ch / 6ch / 11ch)  
- Operating condition : Wi-Fi RF transmitting mode  
- Power Source : DC 3.3 V supplied from the host unit

#### Spectrum Parameter

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



**Configuration IEEE 802.11b**

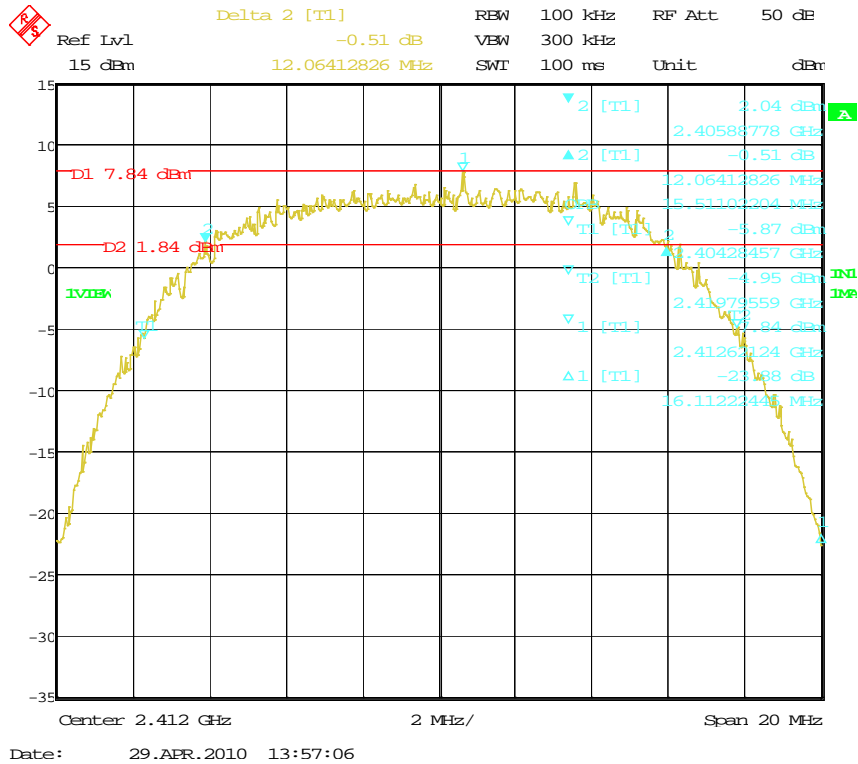
Channel	Frequency	6 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Min. Limit (kHz)	Result
1	2 412 MHz	12.06	15.51	500	Complies
6	2 437 MHz	12.14	15.51	500	Complies
11	2 462 MHz	12.02	15.55	500	Complies

**Configuration IEEE 802.11g**

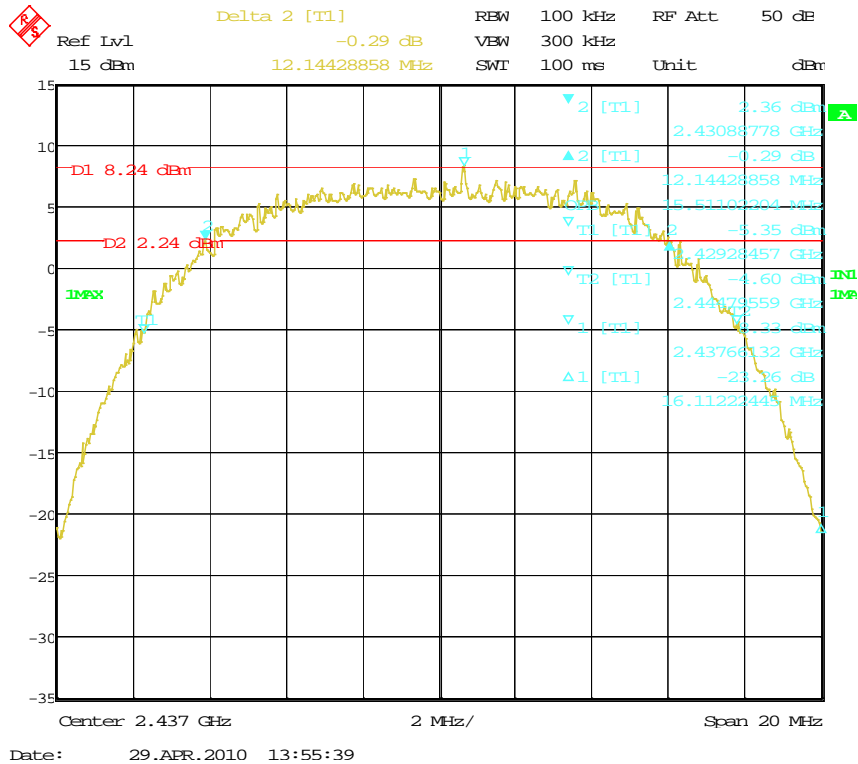
Channel	Frequency	6 dB Bandwidth (MHz)	99 % Occupied Bandwidth (MHz)	Min. Limit (kHz)	Result
1	2 412 MHz	16.63	16.55	500	Complies
6	2 437 MHz	16.59	16.55	500	Complies
11	2 462 MHz	16.63	16.55	500	Complies



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

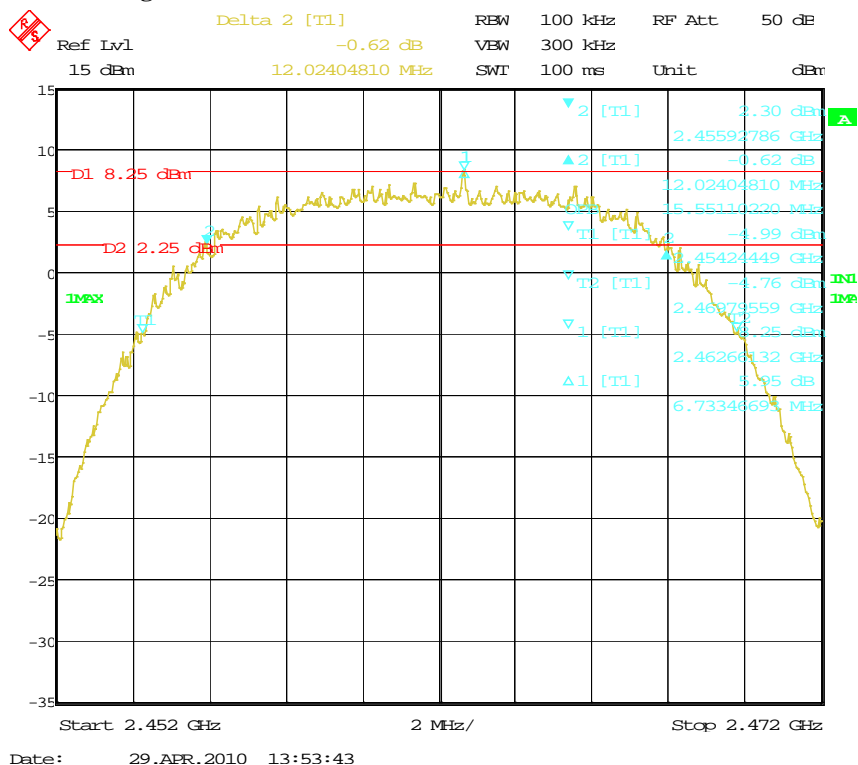


### 6 dB Bandwidth Plot on Configuration IEEE 802.11b / 2 437 MHz

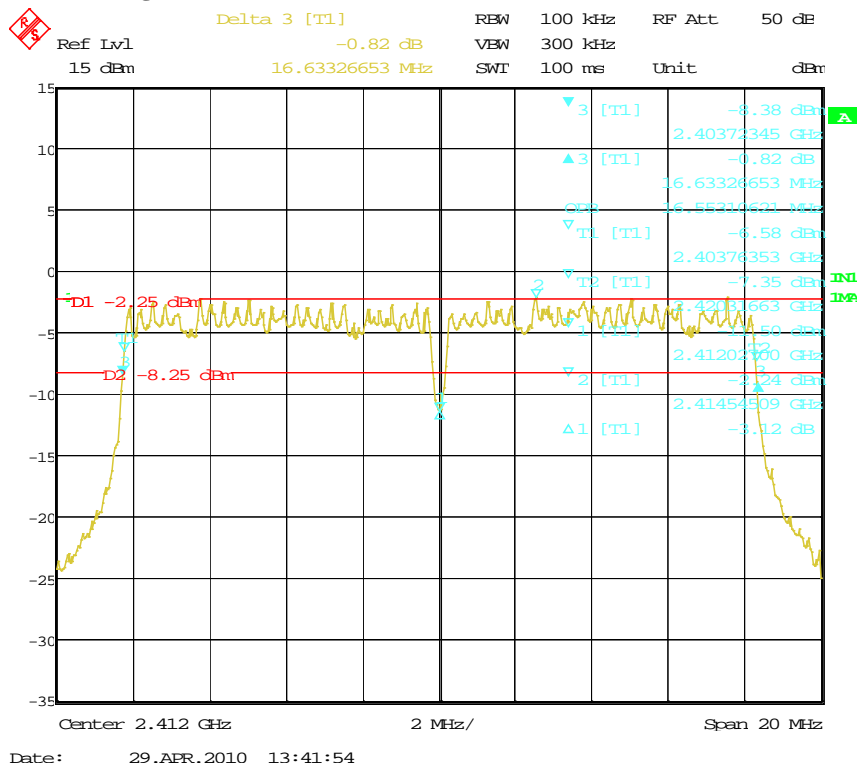




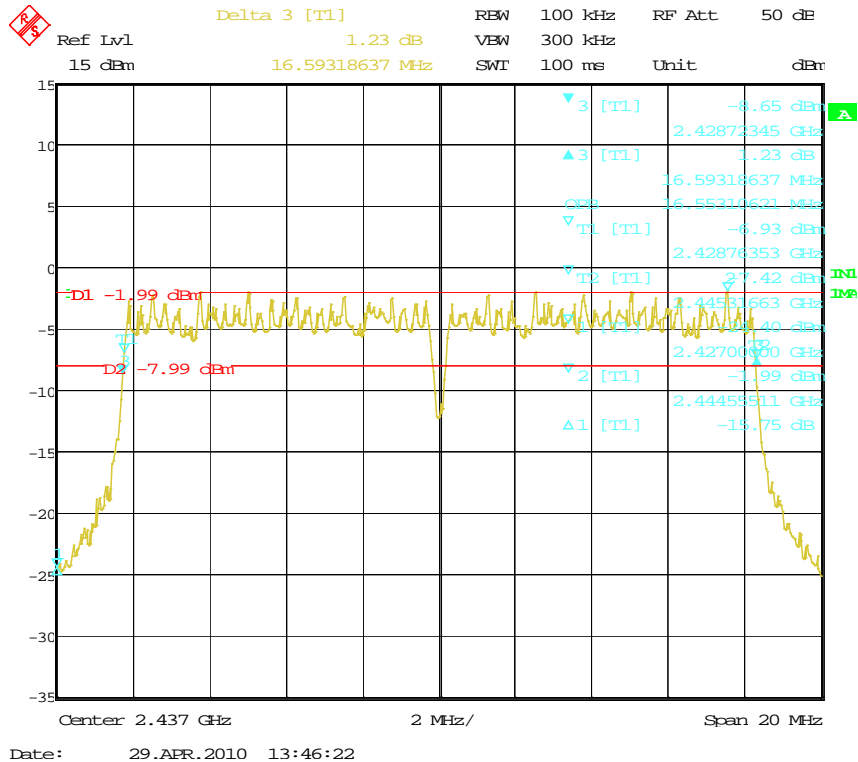
### 6 dB Bandwidth Plot on Configuration IEEE 802.11b / 2 462 MHz



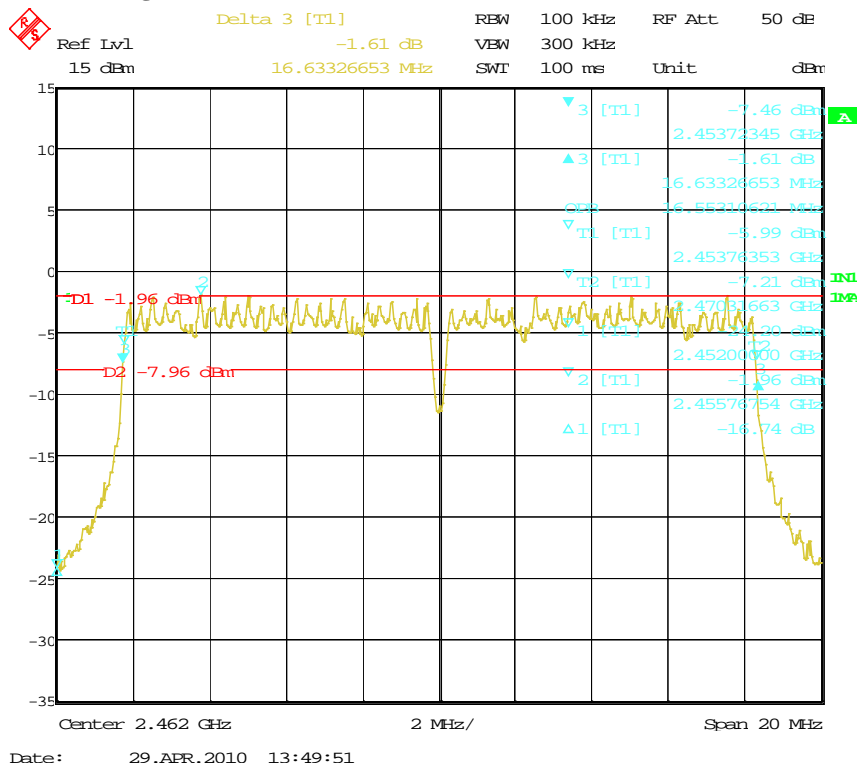
### 6 dB Bandwidth Plot on Configuration IEEE 802.11b / 2 412 MHz



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



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



**EUT Type: WIFI module**

**FCC ID.: YC9CWE-100SA**



## 10. Radiated Emission

### 10.1 Operating environment

Temperature : 24.0 °C  
Relative humidity : 39.0 % R.H.

### 10.2 Test set-up

The EUT was placed on a non-conductive turntable approximately 0.8 meters above the ground plane. The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 and 4.0 meters in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

### 10.3 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 (Chamber)	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	± 4.32 dB	Confidence levels of 95 % ( $k = 2$ )
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	± 4.21 dB	Confidence levels of 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	± 3.96 dB	Confidence levels of 95 % ( $k = 2$ )
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	± 3.97 dB	Confidence levels of 95 % ( $k = 2$ )



#### 10.4 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	2 400/F (kHz)	300
0.490~1.705	2 400/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

#### 10.5 Test equipment used

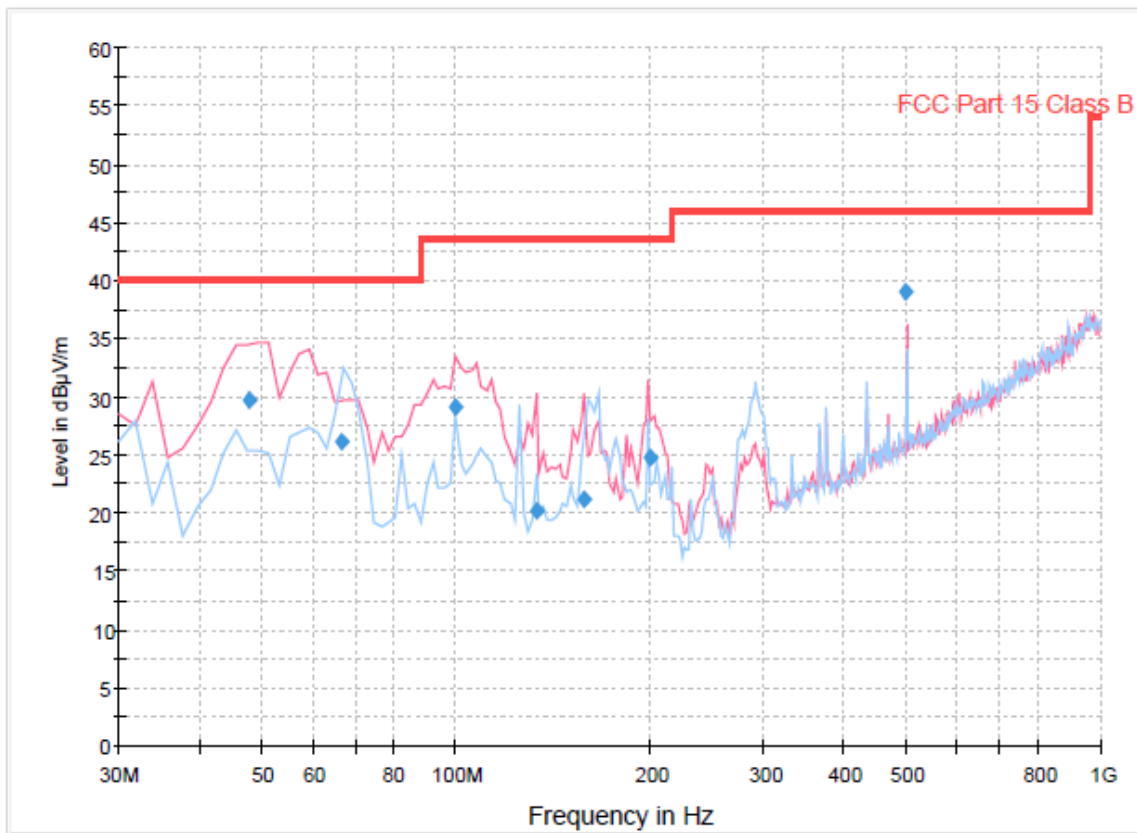
Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI test receiver	830482/010	12. 11. 2010
■ - VULB3193	Schwarzbeck	Bi-log antenna	3193	03. 15. 2012
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - AM4.0	maturo GmbH	Antenna Mast	1390308	N/A
■ - BBHA9120D	Schwarzbeck	Horn antenna	207	12. 22. 2011
■ - 3160-09	EMCO	Horn antenna	Lm3423	04. 06. 2011
■ - AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258943	11.12. 2010

#### 10.6 Radiated emission test data

- Test Date	: May 3, 2010
- Reference standard	: Part 15 Subpart C, Sec. 15.247(d)
- Channel	: 802.11b(1ch / 6ch / 11ch) ; 802.11g(1ch / 6ch / 11ch)
- Operating condition	: Wi-Fi RF transmitting mode
- Measuring distance	: 3 m
- Spectrum resolution bandwidth(6dB)	: 120 kHz / 1 MHz
- Detector mode	: Peak detector mode / Quasi Peak detector mode / Average detector mode
- Power Source	: DC 3.3 V supplied from the host unit
- Note	: Through three orthogonal axes were investigated and the worst case is report



### 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)
47.978878	29.7	1000.0	120.000	100.0	V	216.0	13.5	10.3	40.0
66.673868	26.1	1000.0	120.000	100.0	H	319.0	12.2	13.9	40.0
99.999960	29.2	1000.0	120.000	100.0	V	128.0	11.1	14.3	43.5
133.326052	20.2	1000.0	120.000	121.0	V	41.0	14.2	23.3	43.5
157.716593	21.2	1000.0	120.000	139.0	V	323.0	15.0	22.3	43.5
199.978236	24.7	1000.0	120.000	100.0	V	172.0	11.7	18.8	43.5
500.040842	38.9	1000.0	120.000	100.0	V	110.0	21.4	7.1	46.0

Note:

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

Red trace: Vertical polarization

Blue trace: Horizontal polarization

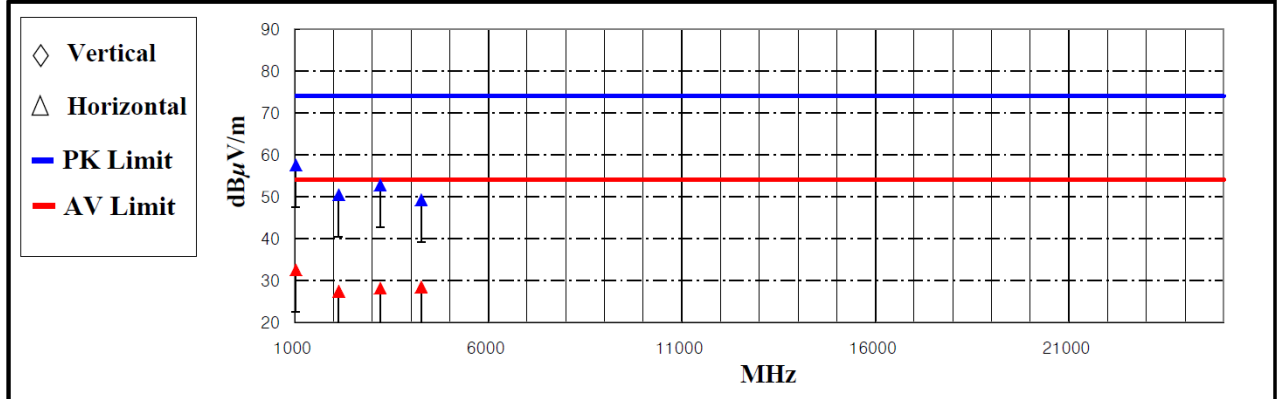
Emission level (dBμV/m) = 20 log Emission level (μV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read value = Test result



### Result of radiated emission (1 GHz to 25 GHz spurious)

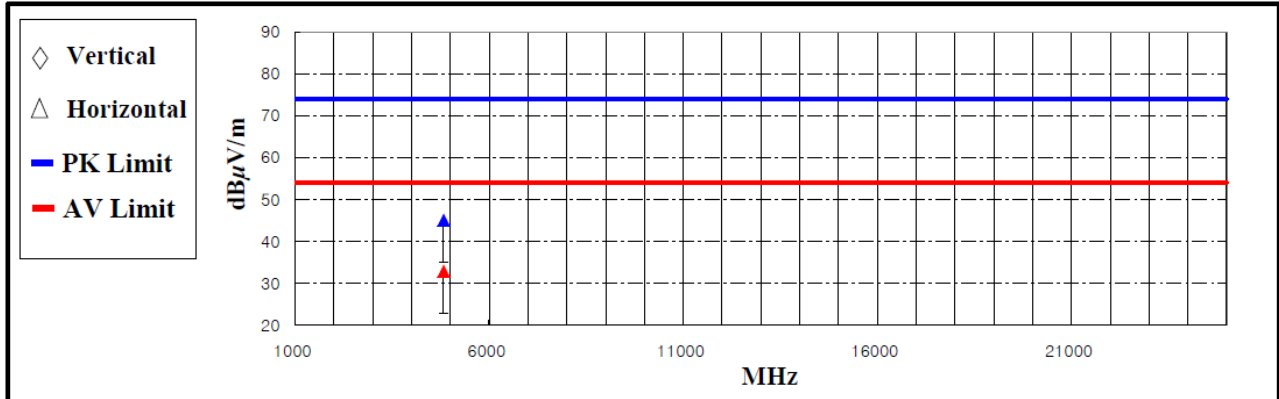
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
1019.88	77.24	52.20	25.02	-44.66	57.60	32.56	74.00	54.00	16.40	21.44	H	100	237
2129.26	68.58	45.61	26.27	-44.35	50.50	27.53	74.00	54.00	23.50	26.47	H	100	148
3202.96	67.57	43.01	28.82	-43.59	52.80	28.24	74.00	54.00	21.20	25.76	H	156	20
4262.60	62.20	41.44	30.25	-43.15	49.30	28.54	74.00	54.00	24.70	25.46	H	113	20



### Result of radiated emission (1 GHz to 10<sup>th</sup> harmonics)

(802.11 B, 1 CH.)

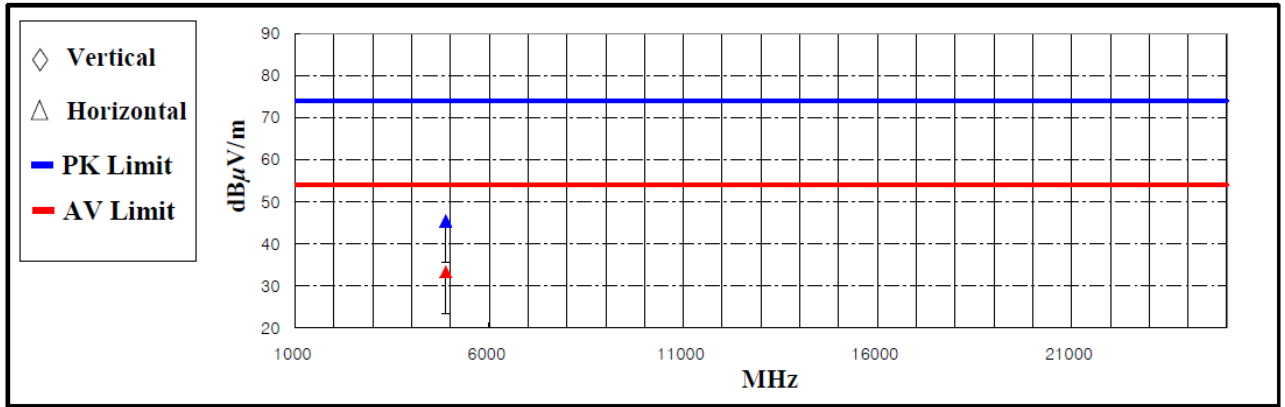
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4824.00	57.15	45.00	31.24	-43.29	45.10	32.95	74.00	54.00	28.90	21.05	H	150	322





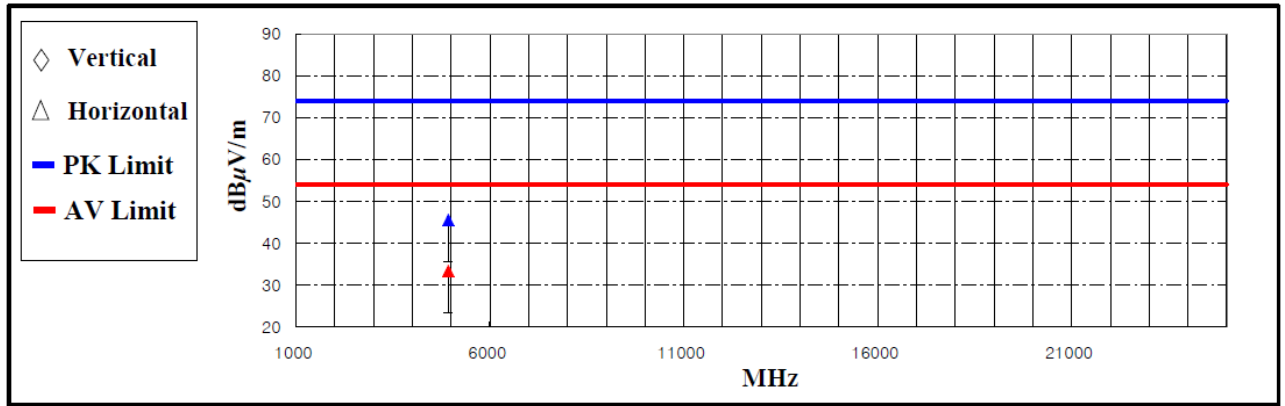
(802.11 B, 6 CH.)

Frequency (MHz)	Measurement Level						Limit (dB $\mu$ V/m)		Margin (dB)		Positioning System		
	Reading Value (dB $\mu$ V/m)		AF	AMP / CL	Test Result (dB $\mu$ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
	4874.00	57.24	45.09	31.32	-43.09	45.47	33.32	74.00	54.00	28.53	20.68	H	154



(802.11 B, 11 CH.)

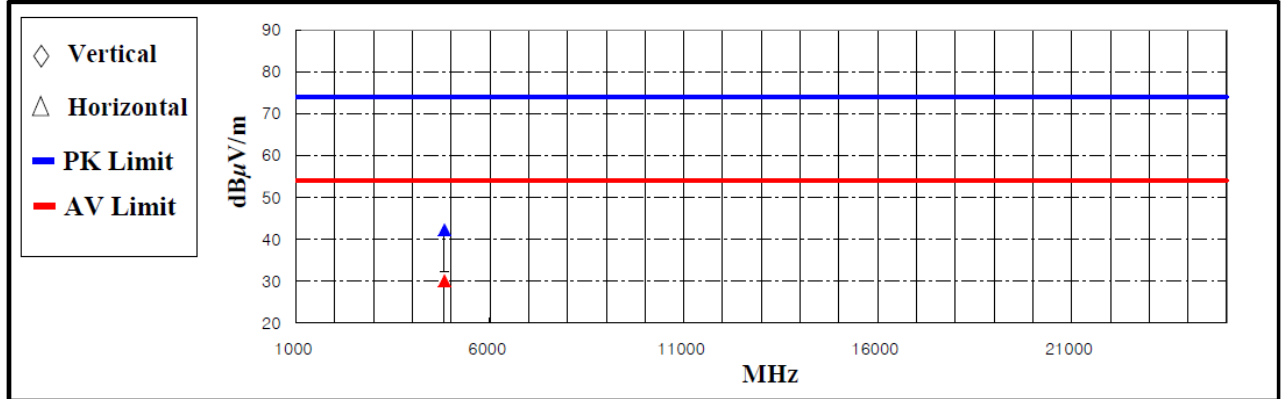
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	(H/V)	(cm)	(°)		
	4924.00	57.10	44.95	31.41	-42.99	45.52	33.37	74.00	54.00	28.48	20.63	H	148





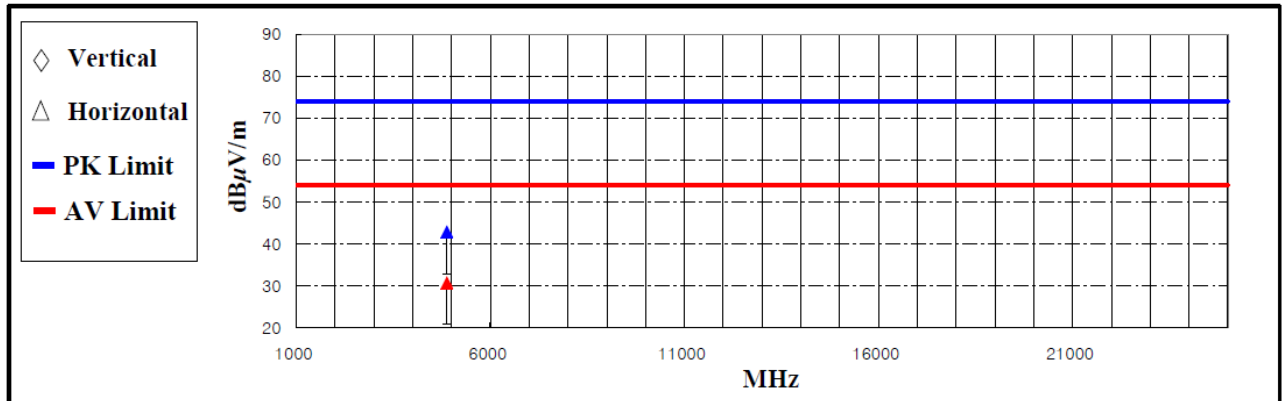
(802.11 G, 1 CH.)

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)	(°)
	4824.00	54.36	42.21	31.24	-43.29	42.31	30.16	74.00	54.00	31.69	23.84	H	145



(802.11 G, 6 CH.)

Frequency (MHz)	Measurement Level						Limit (dB $\mu$ V/m)		Margin (dB)		Positioning System		
	Reading Value (dB $\mu$ V/m)		AF	AMP / CL	Test Result (dB $\mu$ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	(H/V)	(cm)	(°)		
	4874.00	54.69	42.54	31.32	-43.09	42.92	30.77	74.00	54.00	31.08	23.23	H	153

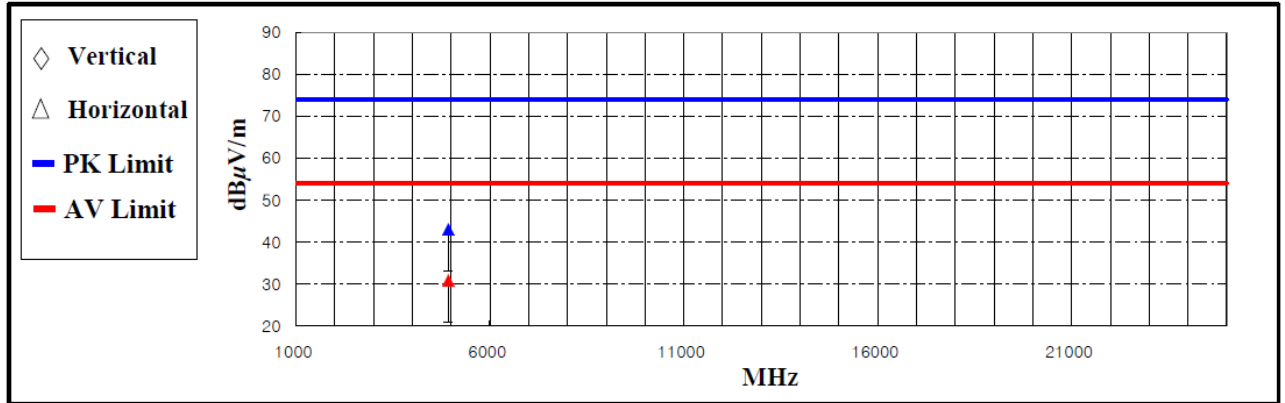






(802.11 G, 11 CH.)

Frequency (MHz)	Measurement Level						Limit (dB $\mu$ V/m)		Margin (dB)		Positioning System		
	Reading Value (dB $\mu$ V/m)		AF	AMP / CL	Test Result (dB $\mu$ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4924.00	54.56	42.41	31.41	-42.99	42.98	30.83	74.00	54.00	31.02	23.17	H	143	298



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 (dB $\mu$  V/m) = 20 log Emission level( $\mu$  V/m).

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

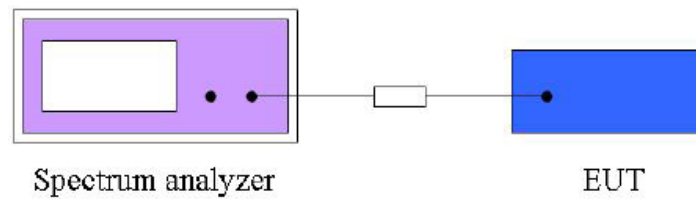


## 11. Band Edge Measurement

### 11.1 Operating environment

Temperature : 24.0 °C  
Relative humidity : 41.0 % R.H.

### 11.2 Test set-up (Layout)



### 11.3 Limit

> 20 dBc

### 11.4 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI test receiver	830482/010	12. 11. 2010

### 11.5 Test result of Band Edge

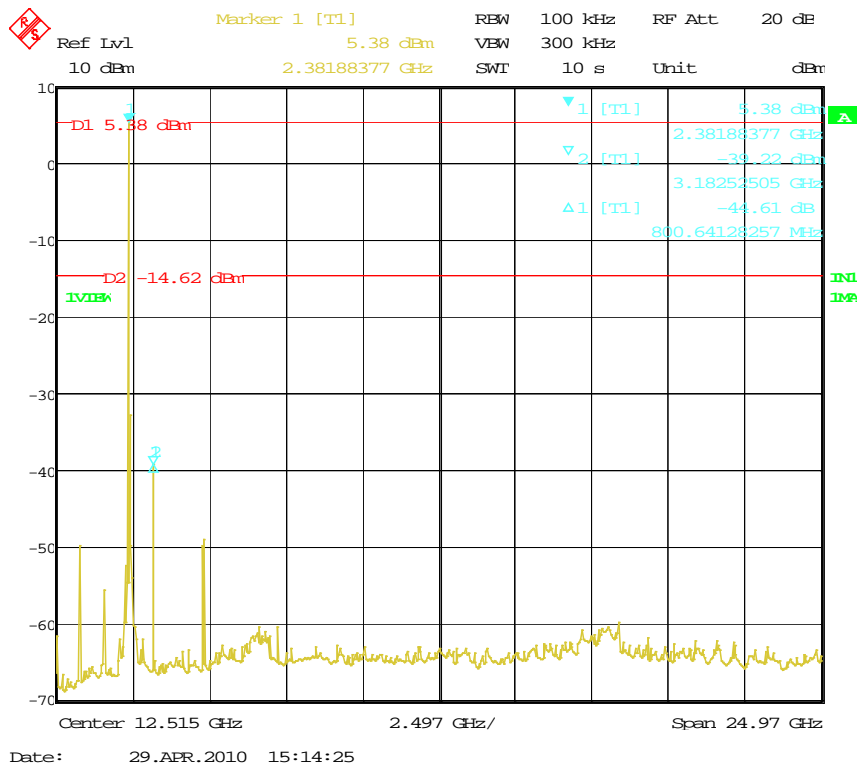
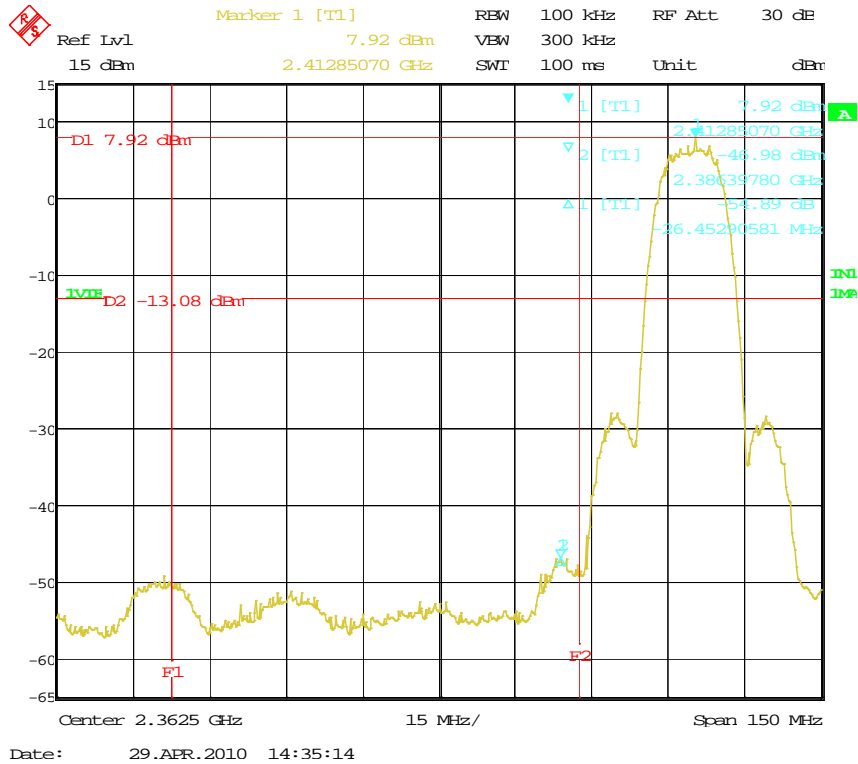
- Test Date : April 29, 2010  
- Reference standard : Part 15 Subpart C, Sec. 15.247(d)  
- Channel : 802.11b(1ch / 6ch / 11ch) ; 802.11g(1ch / 6ch / 11ch)  
- Operating condition : Wi-Fi RF transmitting mode  
- Power Source : DC 3.3 V supplied from the host unit

#### Spectrum Parameter

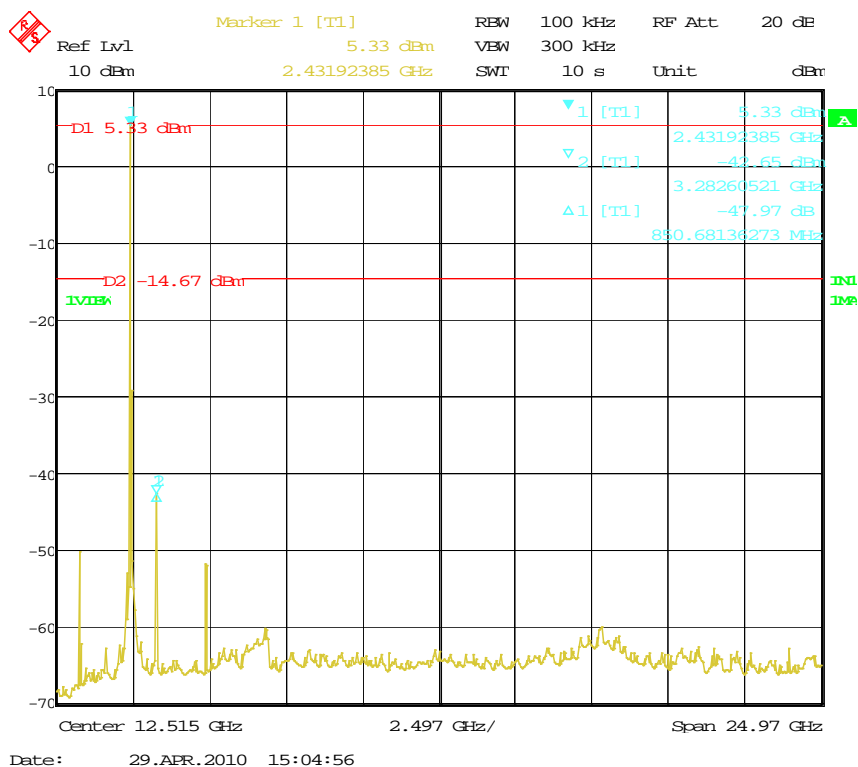
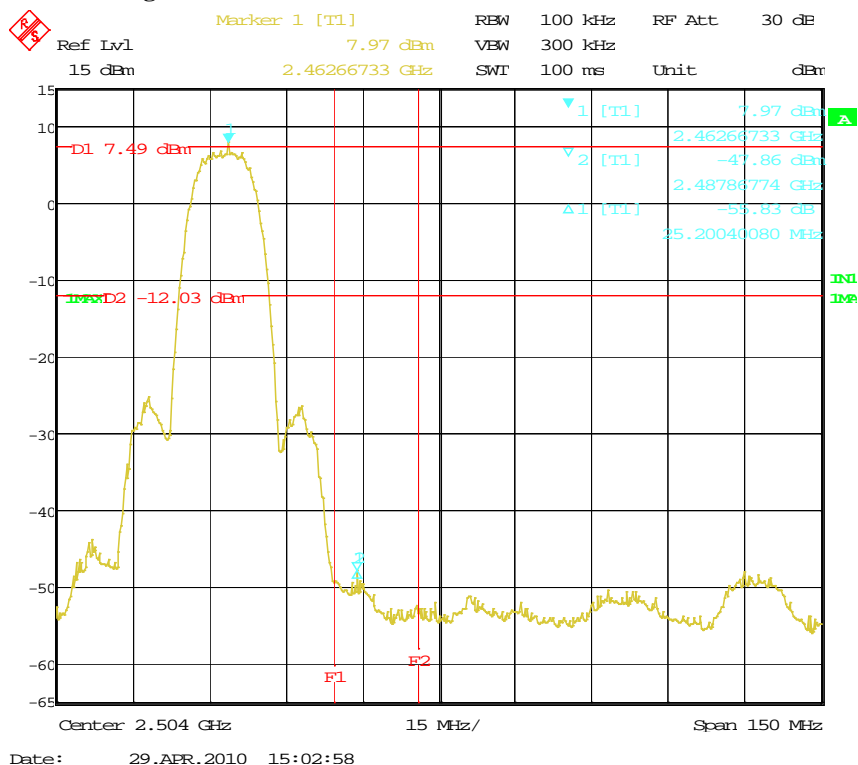
- Attenuation : Auto  
- Span frequency : 100 MHz  
- Resolution band width : 100 kHz  
- Video band with : 100 kHz  
- Detector : Peak  
- Trace : Maxhold  
- Sweep time : Auto



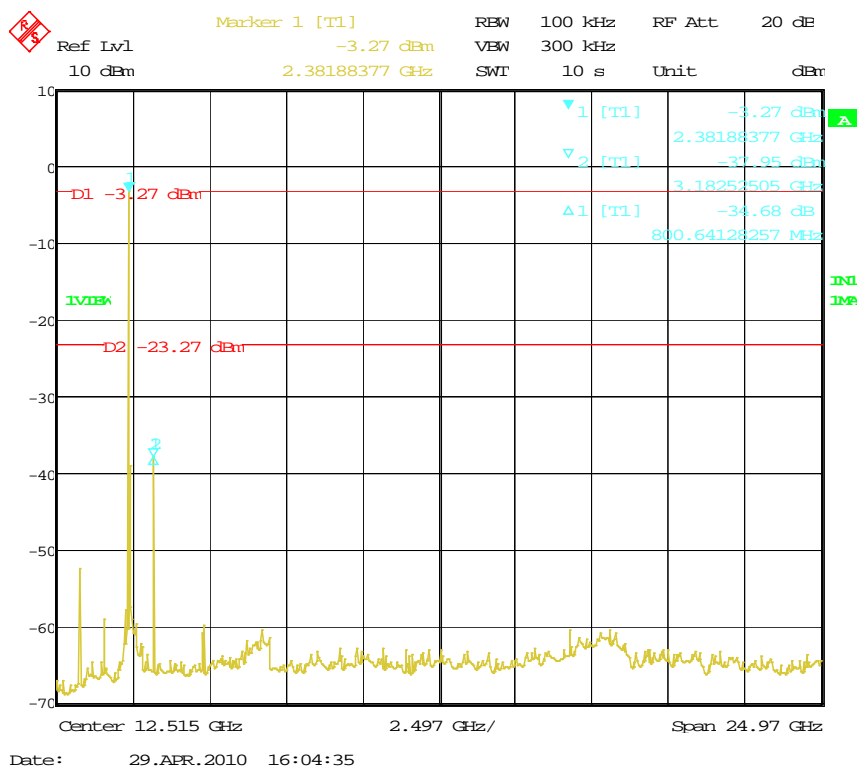
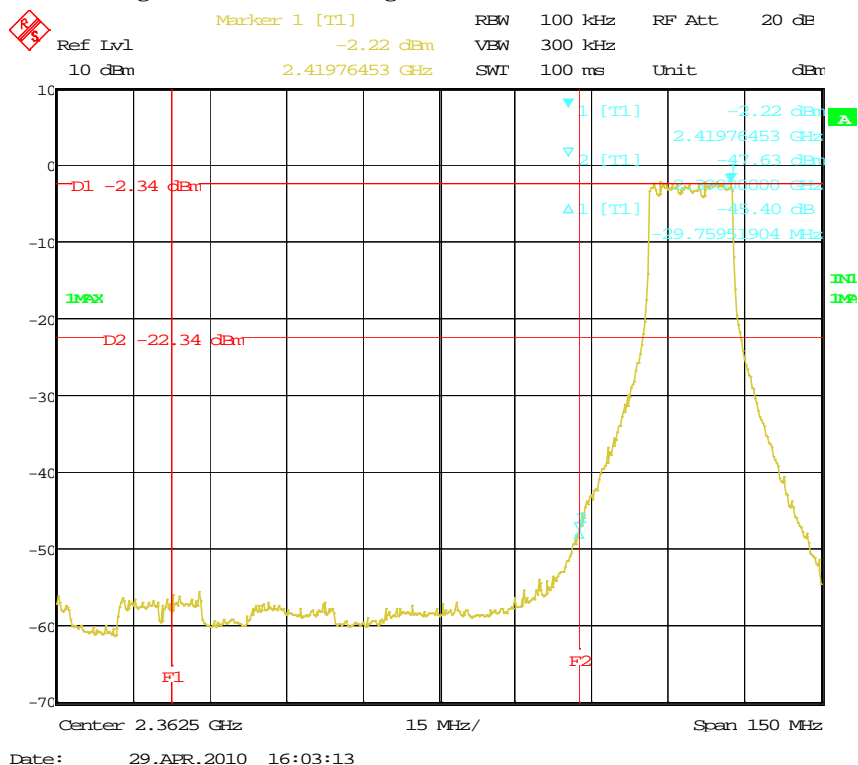
### Low Band Edge Plot on Configuration IEEE 802.11b / 2 412 MHz



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



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

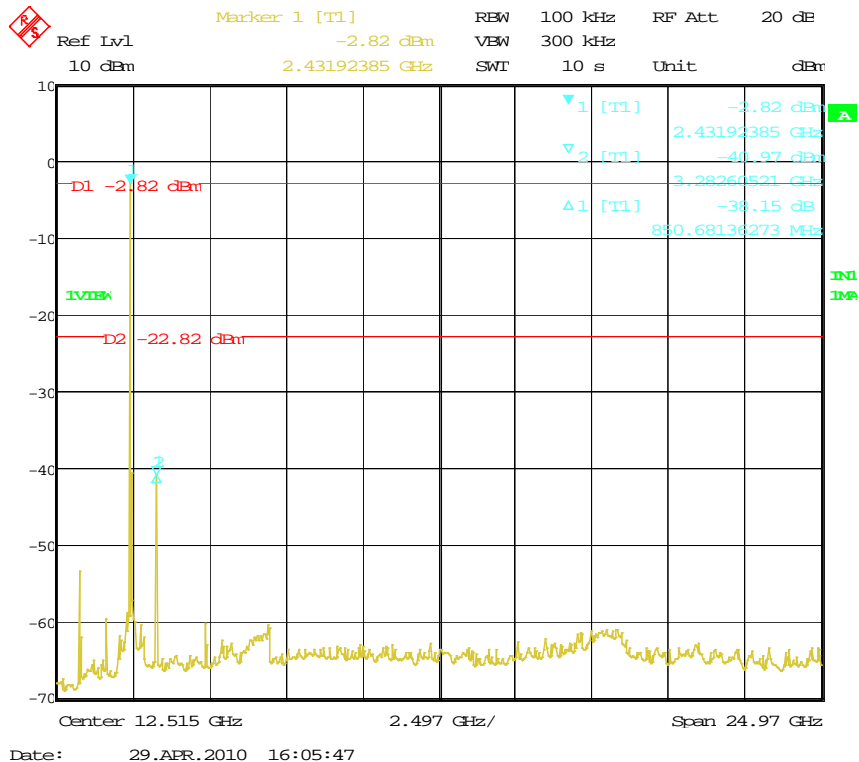
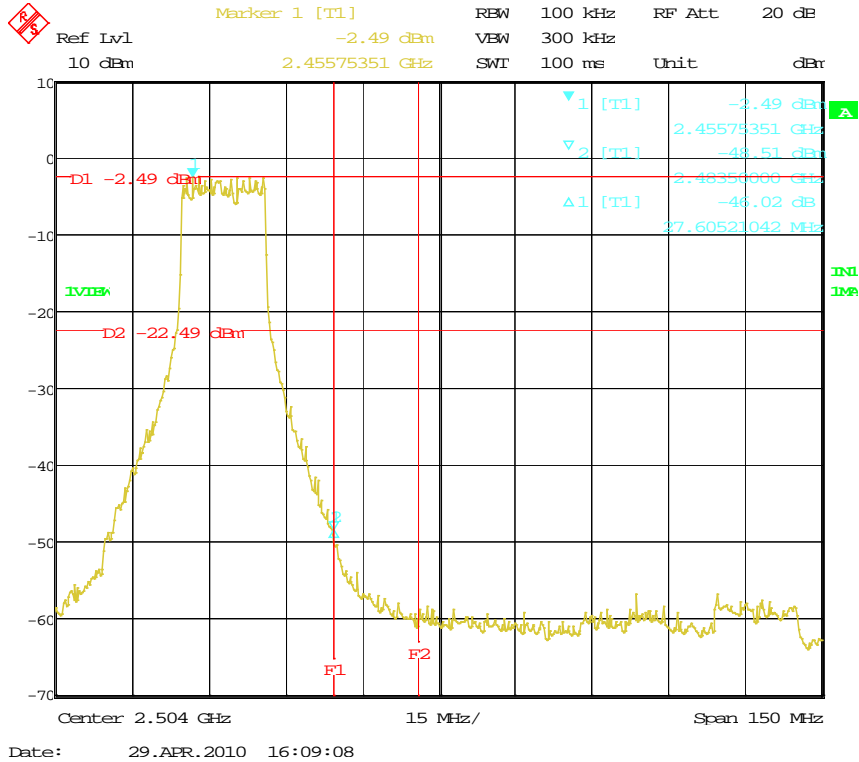


**EUT Type: WIFI module**

**FCC ID.: YC9CWE-100SA**



### High Band Edge Plot on Con figuration IEEE 802.11g / 2 462 MHz



EUT Type: WIFI module

FCC ID.: YC9CWE-100SA