
FCC TEST REPORT



UCS Co., Ltd.

#702, Megavalley, 799 Kwanyang-dong, Dongan-gu, Anyang-city, Kyunggi-do, 431-767, Korea
Tel : 82-31-420-5680/Fax :82-31-420-5685, Open Site : 82-31-355-2666

FCC Test Report

Report Number	UCSFR-1203-001							
Applicant	Company Name	WIZNET Co.,LTD.						
	Address	4F Humax Village, 11-4, Sunae-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea						
Product	Product Name	WiFi Module						
	Model Name	WIZ630wi	Manufacturer	WIZNET Co.,LTD.				
	Multiple Model Name	WizFi630	Country of origin	Korea				
Other	Receipt Date	2012-03-19	Receipt Number	UCS-R-2012-139				
	Issued Date	2012-03-30	Tested Date	2012/03/26 ~ 2012/03/29				
Test Result	Pass							
Standard	FCC CFR 47 Part 15.247 Subpart C							
Test Method	ANSI C63.4:2003							
Tested by	Y. R. JO							
Approved by	K. T. Kim							
UCS Co., Ltd.								
#702, Megavalley, 799 Kwanyang-dong, Dongan-gu, Anyang-city, Kyunggi-do, 431-767, Korea Tel : 82-31-420-5680/Fax : 82-31-420-5685, Open Site : 82-31-355-2666								
o This is certified that the above mentioned products have been tested for the sample provided by client.								
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1. Applicant Information

Applicant Name : WIZNET Co.,LTD.
Address : 4F Humax Village, 11-4, Sunae-dong, Bundang-gu, Seongnam-si,
 Gyeonggi-do, South Korea
Manufacturer : WIZNET Co.,LTD.
Country of Origin : Korea

2. Test Result Certification

2.1 Applicable standards

Standard	Test Item	CFR 47 Section	Result
FCC CFR 47 Part 15.247 Subpart C	Antenna Requirement	15.203, 15.247(b)(4)	PASS
	6dB Bandwidth	15.247(a)(2)	PASS
	Maximum Peak Output Power	15.247(b)(1)	PASS
	Peak Power Spectral Density	15.247(a)(1)	PASS
	Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.209	PASS
	AC Power Line Conducted Emissions	15.207	PASS
	Receiver Spurious Emissions	-	PASS

3. EUT Information

3.1 RF specification

Product name	WiFi Module	
Model name	WIZ630wi	
Power source	DC 5.0 V	
Output Power	MAX 0.0097 W	
Ferquency range	802.11 b/g/n(HT20) : 2412 MHz ~ 2472 MHz 802.11 n(HT40) : 2422 MHz ~ 2452 MHz	
Number of channels	802.11 b/g/n(HT20) : 13 CH	
	802.11 n(HT40) : 7 CH	
Modulation Technique	DSSS, OFDM	
Antenna specification	Dipole	2.5 dBi gain (Max)
	Monopole	4.0 dBi gain (Max)
	Internal	2.5 dBi gain (Max)
Weight	43(L)mm X 33(W)mm X 4.5(H)mm	
Dimension	6 g	

4. Laboratory Information

4.1. General

UCS Co., Ltd. established 1999 as the International agreed upon laboratory(CBTL, KOLAS) for Standard. Internally, UCS Co., Ltd. is the designated test laboratory from Radio Research Laboratory of Korea Communications Commission and Korea Food & Drug Administration.

Based on its extensive experience and expertise, UCS Co., Ltd. is the Global test laboratory that has best professionalism in this field.

4.2. Test Site

- UCS Co., Ltd. (Universal Certification Solution)
- FCC Registration Number : 803225
- This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

4.3 Location

UCS Co., Ltd.

- #702, Anyang Megavalley799, Gwanyang2-dong, Dongan-gu, Anyang-si, Gyeonggi-do, 431-767, Korea

ER Center

- #476-4, Hwalcho-dong, Hwaseong-si, Gyeonggi-do, 445-150, Korea

5. Measurement conditions

5.1 Scope

This test report certifies that the WIZNET Co.,LTD. WIZ630wi, as tested, meets the FCC Part 15.247, Subpart C requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

5.2 Measurement Procedure

- Test measurements were made in accordance FCC Part 15.247: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz. The test methods used to generate the data in this test report is in accordance with ANSI C63.4: 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 26.5 GHz and FCC Publication KDB 558074: Measurement of Digital Transmission Systems Operating under Section 15.247 March 23, 2005.

5.3 Choice of Equipment for Test Suits

5.3.1 Choice of Model

- This test report is based on the test samples supplied by the manufacturer and are reported by the manufacturer to be equivalent to the production units.

5.3.2 Presentation

- This test sample was tested complete with all required ancillary equipment.

5.3.3 Choice of Operating Frequencies

- The WIZ630wi operates on a total of 13 channels, from channel 1 to channel 13.
- In accordance with ANSI C63.4-2009, section 13.2.1, the choice of operating frequencies selected for the testing detailed in this report was based on the lowest, middle and highest operating frequencies. The frequencies selected were 802.11b/g/n(HT20) : 2412 MHz (Channel 1), 2442 MHz(Channel 7) and 2472 MHz (Channel 13), 802.11n(HT40) : 2422 MHz (Channel 3), 2442 MHz(Channel 7) and 2452 MHz (Channel 9)

5.3.4 Channel Table

Ch.	Frequency	Ch.	Frequency
1	2412 MHz	8	2447 MHz
2	2417 MHz	9	2452 MHz
3	2422 MHz	10	2457 MHz
4	2427 MHz	11	2462 MHz
5	2432 MHz	12	2467 MHz
6	2437 MHz	13	2472 MHz
7	2442 MHz		

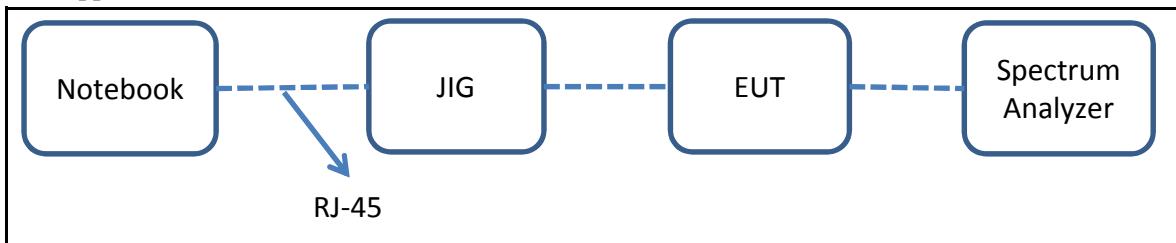
5.4 Description of test modes

- The EUT had been tested under the operating condition.
- There are three channels have been tested as following:
- Channel Low and Channel High with higher data rate were chosen for full testing.

Channel	TX Frequency (MHz)		RX Frequency (MHz)	
	802.11 b/g/n (HT20)	802.11 n (HT40)	802.11 b/g/n (HT20)	n (HT40)
LOW	2412	2422	2412	2422
MIDDLE	2442	2442	2442	2442
HIGH	2472	2452	2472	2452

5.5 Description of test configuration

- The measurements were taken in continuous transmitting mode using the TEST MODE. For controlling the EUT as TEST MODE, the test program and the cable assembly were provided by the applicant.



[System Block Diagram of Test Configuration]

5.6 Setup of equipment under test

5.3.1 Description of support units

- The EUT has been tested as an independent unit along with the following necessary accessories or support units, which are adopted to form a representative test configuration.

No	Equipment	Manufacturer	Model	S/N
1	Notebook**	HP	PSMDCK-06L001	-
-	TEST JIG**	WIZNET Co.,LTD.	-	-

Notes:

** For control of the RF module via RJ-45 interface in the EUT. For radiated spurious emission measurements, The test was conducted, JIG mounted on.

5.3.2 Type of Used Cables

No	START		END		CABLE	
	NAME	I/O PORT	NAME	I/O PORT	LENGTH(m)	SHIELDED
1	Notebook	RJ-45	TEST JIG	RJ-45	1.0	Shielded
-	-	-	-	-	-	-

6. Limite And Result

6.1 Antenna requirement

6.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.1.2 Result : PASS

- Provides three types of antennas.
 1. Dipole antenna. The directional gain of the antenna is 2.5 dBi.
 - The antenna connector is the reverse thread (left hand twist) SMA connector.
 2. Monopole antenna. The directional gain of the antenna is 4.0 dBi.
 3. Internal antenna. The directional gain of the antenna is 2.5 dBi.

6.2 6 dB BANDWIDTH MEASUREMENT

6.2.1 Regulation

According to §15.247(a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.2.2 Test Condition

- Set RBW of Spectrum analyzer to 100 kHz, Span=50MHz, Sweep=auto
- The 6dB bandwidth is defined as the frequency range where the power is higher than the peak power minus 6 dB

6.2.3 Test result : PASS

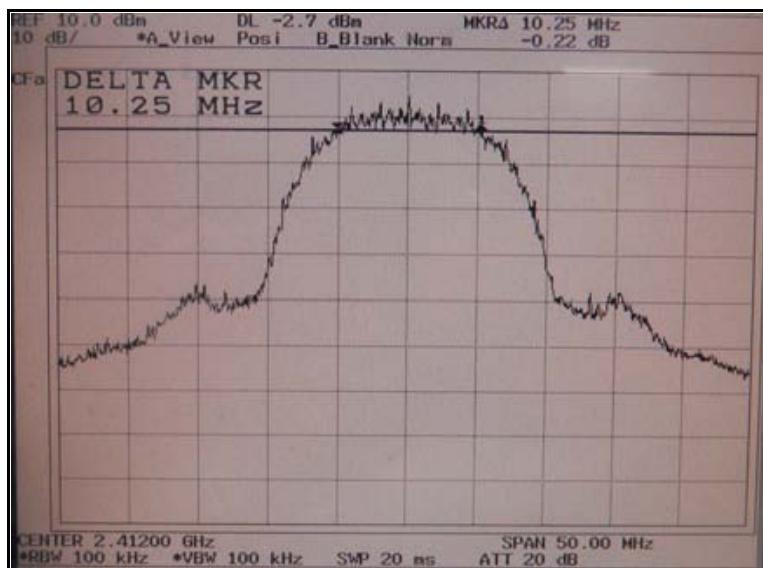
Table 1 : Measured values of the 6 dB Bandwidth

Mode	Frequency (MHz)	Result (MHz)	Limit (kHz)	Verdict
802.11b	2412	10.25	> 500	PASS
	2442	10.15		PASS
	2472	10.20		PASS
802.11g	2412	16.50	> 500	PASS
	2442	16.50		PASS
	2472	16.55		PASS
802.11n (HT20)	2412	17.70	> 500	PASS
	2442	17.65		PASS
	2472	17.65		PASS
802.11n (HT40)	2422	36.10	> 500	PASS
	2442	36.15		PASS
	2452	36.30		PASS

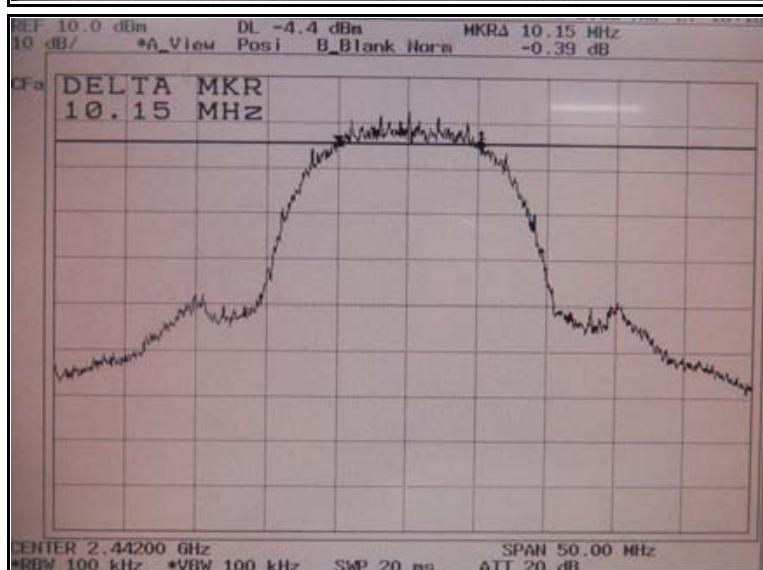
6.2.4 Plot of the 6dB Channel Bandwidth

802.11 b Mode

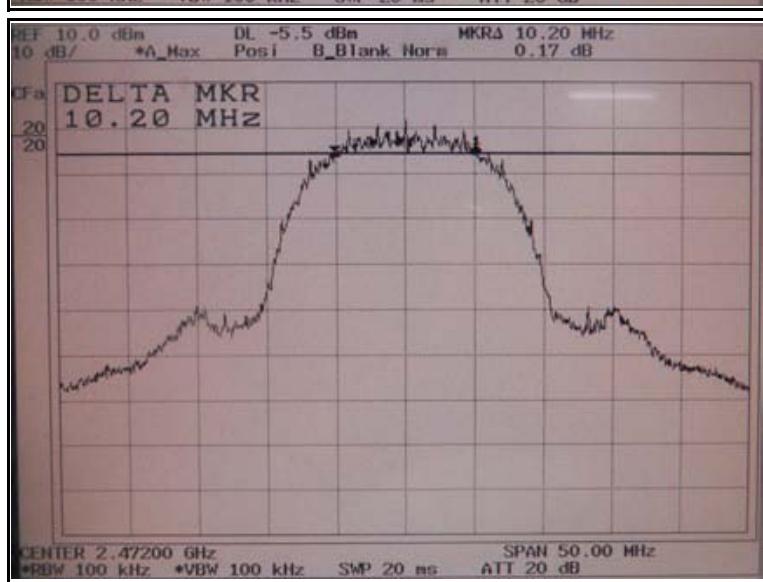
Lowest Channel



Middle Channel

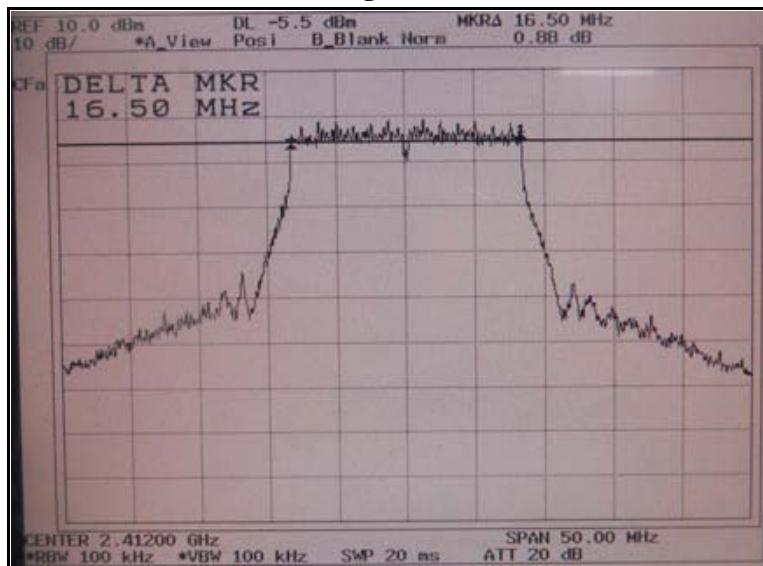


Highest Channel

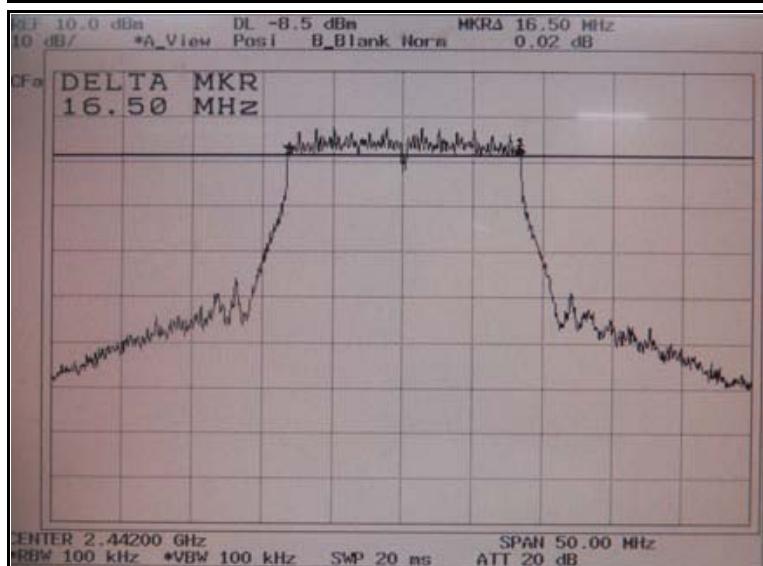


802.11 g Mode

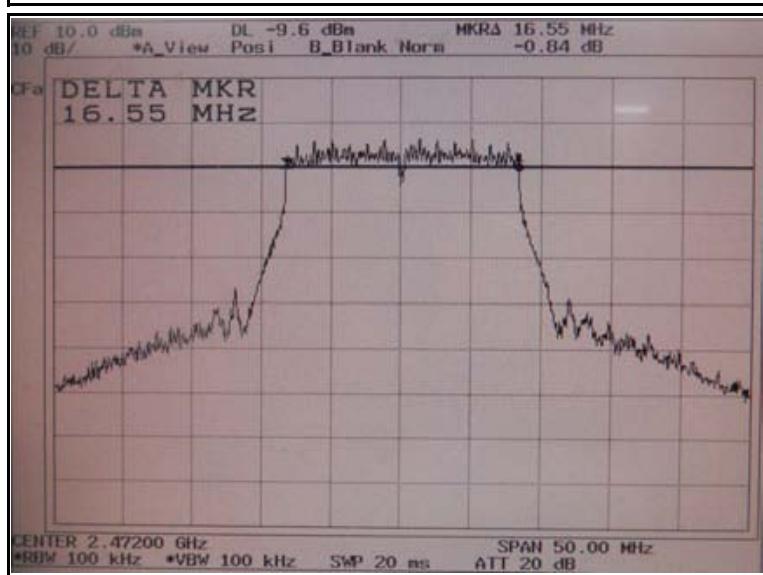
Lowest Channel



Middle Channel

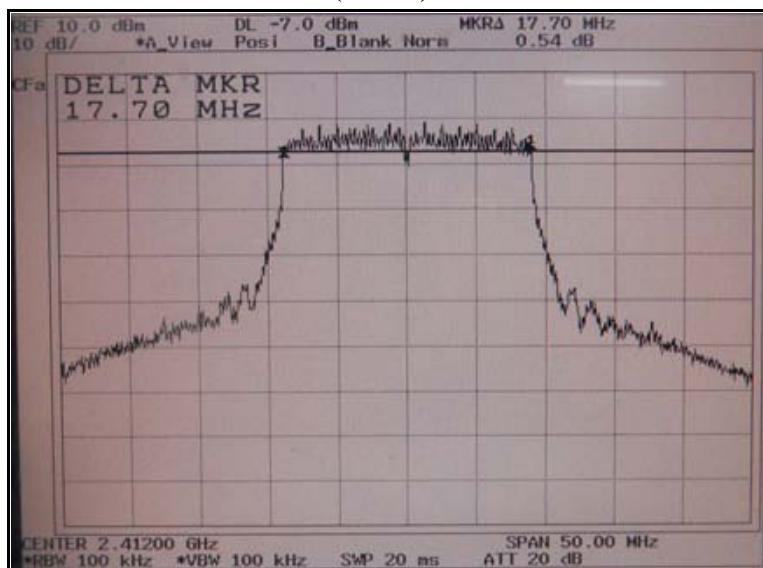


Highest Channel

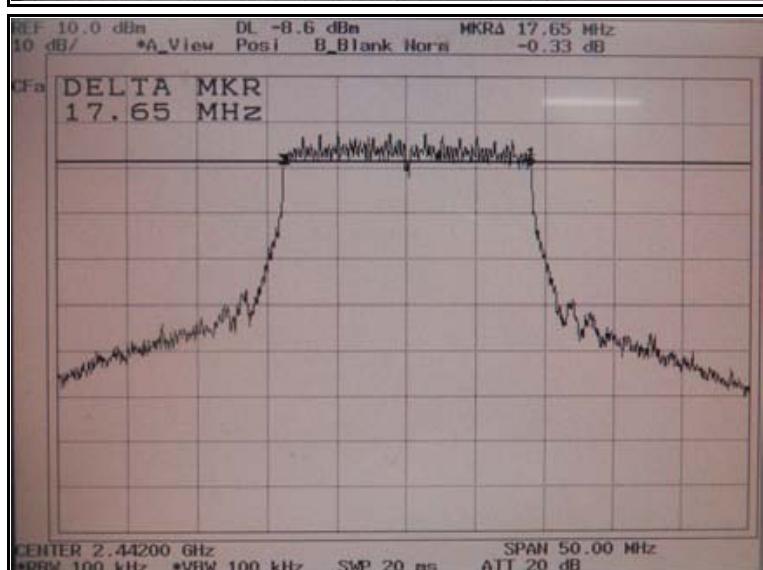


802.11 n (HT 20) Mode

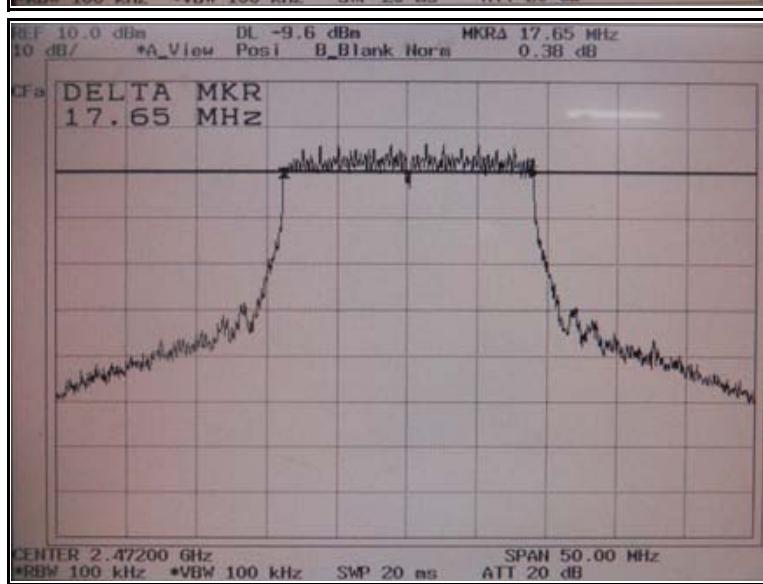
Lowest Channel



Middle Channel

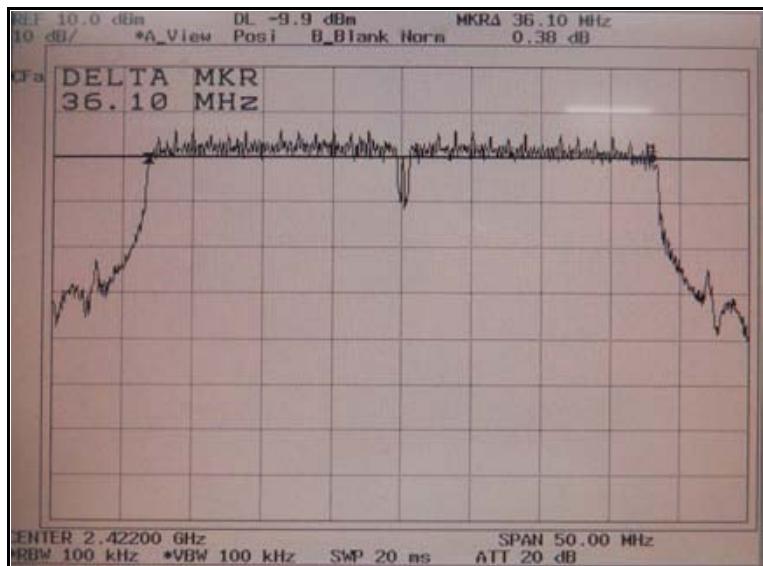


Highest Channel

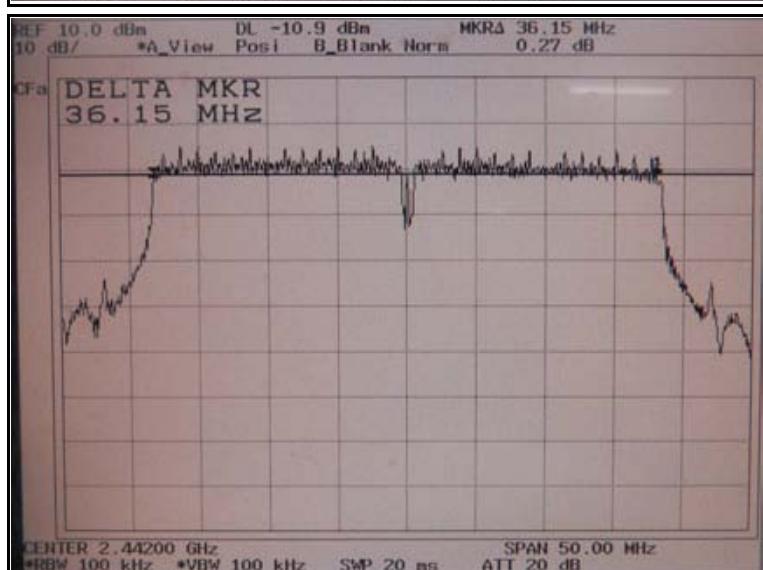


802.11 n (HT 40) Mode

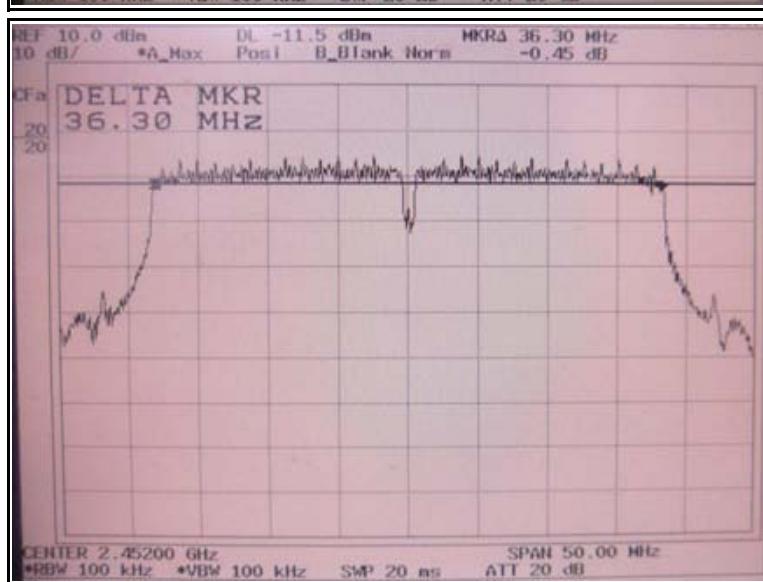
Lowest Channel



Middle Channel



Highest Channel



6.3 Maximum peak power

6.3.1 Regulation

According to §15.247(b), The maximum peak conducted output power of the intentional radiator shall not exceed the following:

§15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.3.2 Test Condition

- Set RBW of Spectrum analyzer to 1 MHz
- The Maximum Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

6.3.3 Test result : PASS

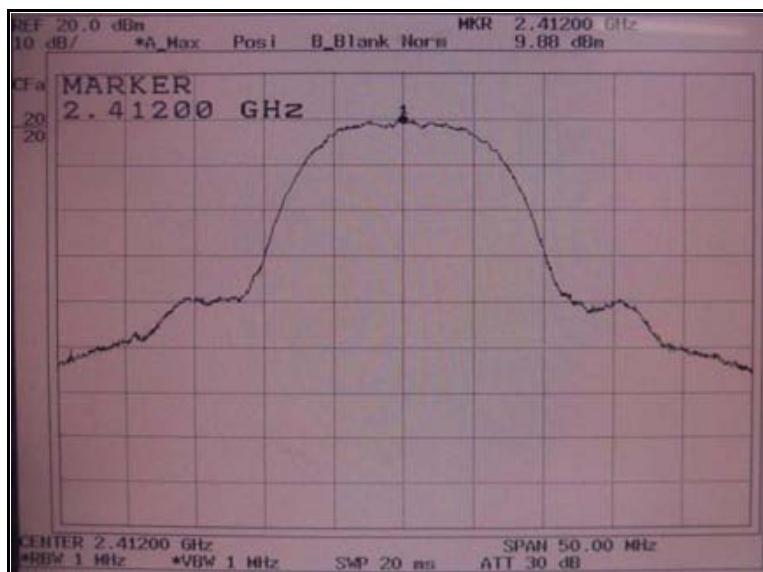
Table 2 : Measured values of the Maximum Peak Output Power(Conducted)

Mode	Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)	Verdict
802.11b	2412	9.88	0.0097	< 1	PASS
	2442	8.05	0.0064		PASS
	2472	6.75	0.0047		PASS
802.11g	2412	7.44	0.0056	< 1	PASS
	2442	6.51	0.0045		PASS
	2472	4.78	0.0030		PASS
802.11n (HT20)	2412	8.08	0.0064	< 1	PASS
	2442	5.89	0.0039		PASS
	2472	5.02	0.0032		PASS
802.11n (HT40)	2422	4.83	0.0030	< 1	PASS
	2442	3.65	0.0023		PASS
	2452	3.09	0.0020		PASS

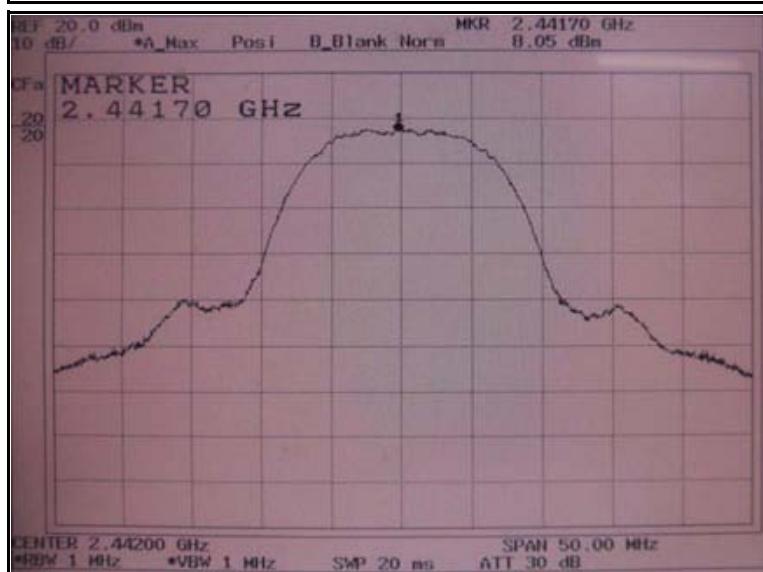
6.3.4 Plot of the Maximum Peak Output Power(Conducted)

802.11 b Mode

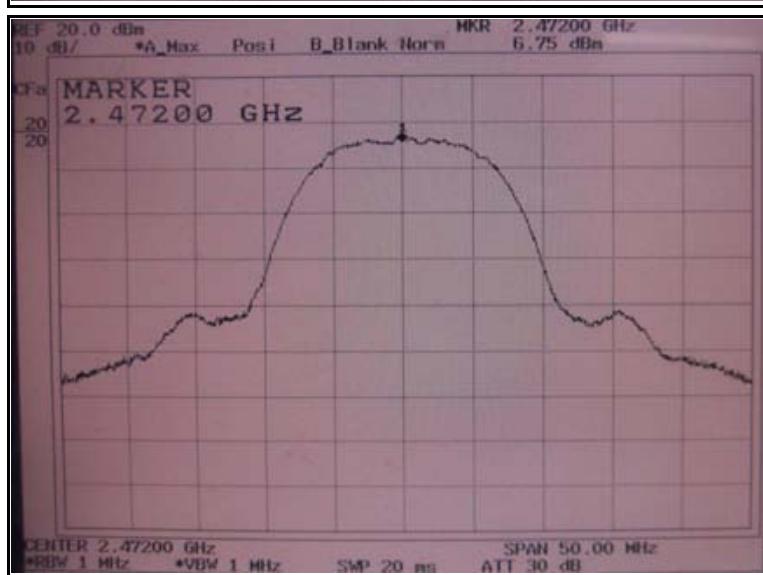
Lowest Channel



Middle Channel

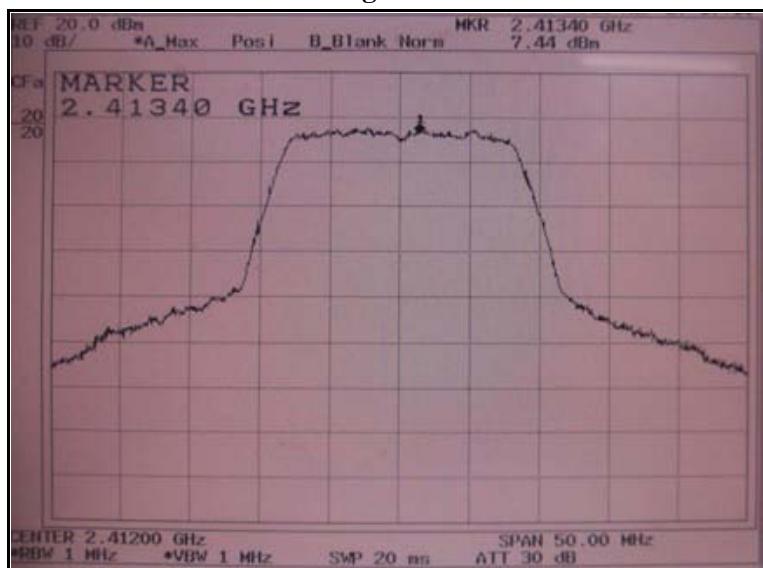


Highest Channel

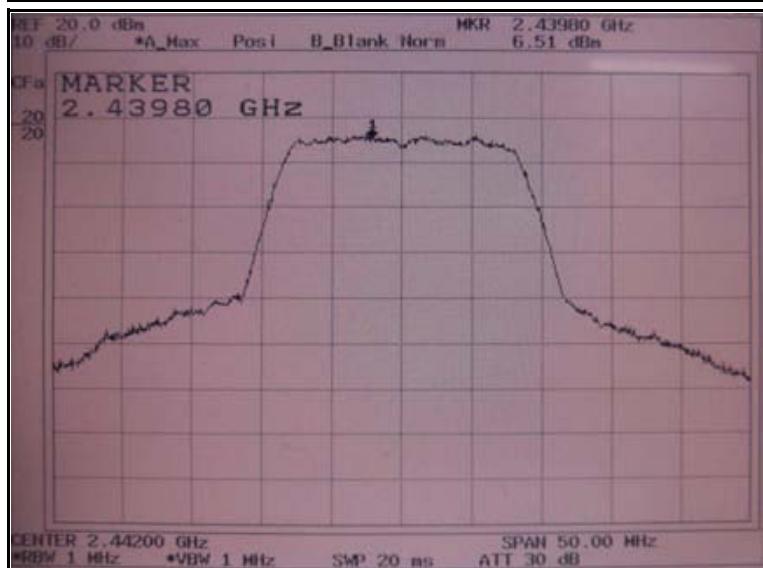


802.11 g Mode

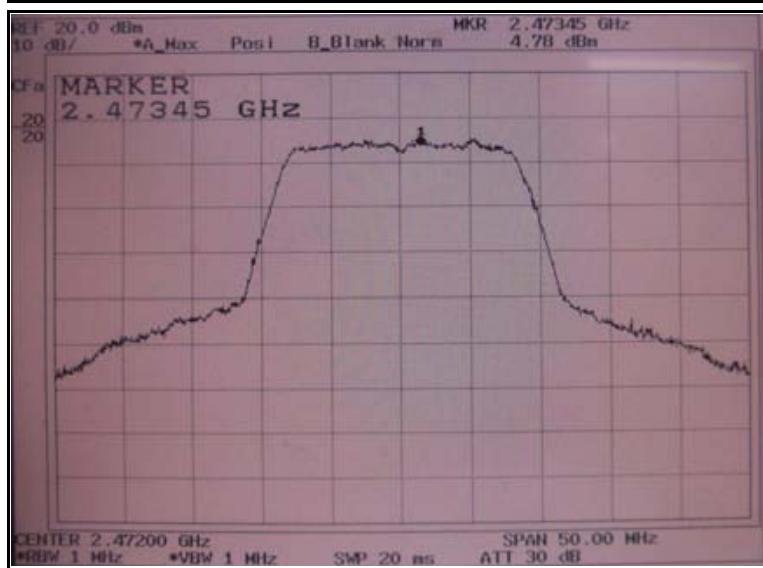
Lowest Channel



Middle Channel

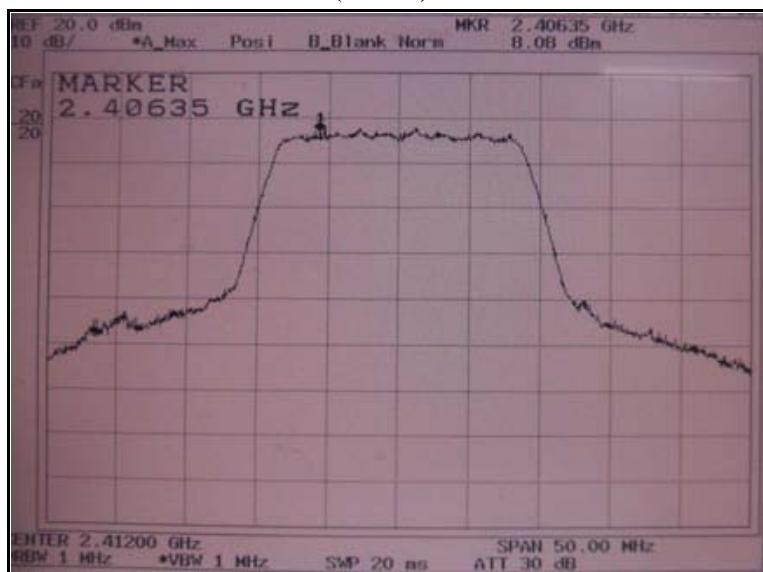


Highest Channel

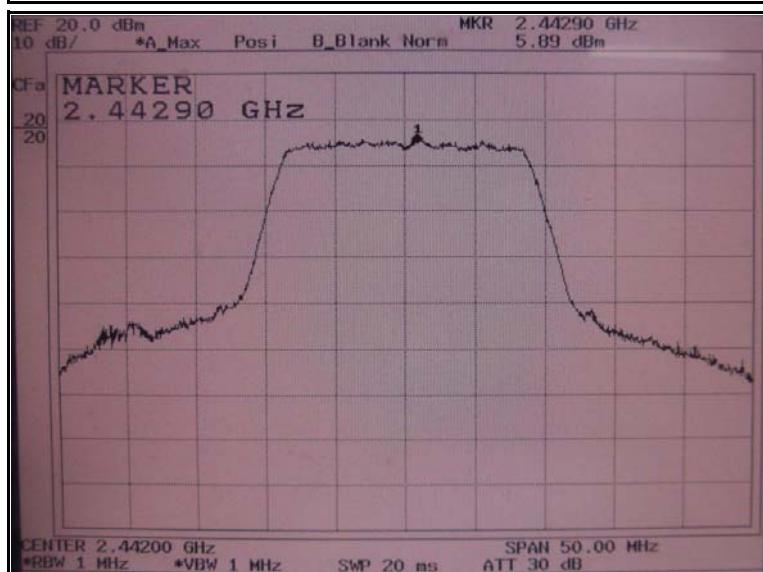


802.11 n (HT 20) Mode

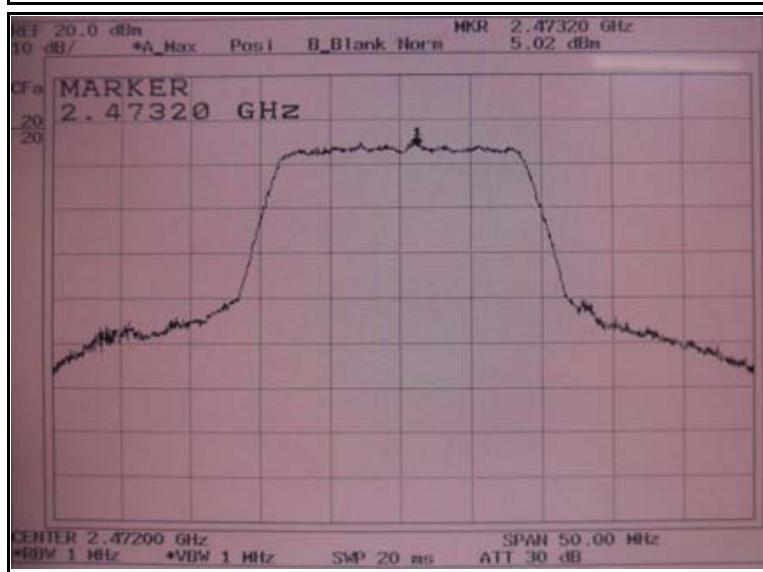
Lowest Channel



Middle Channel

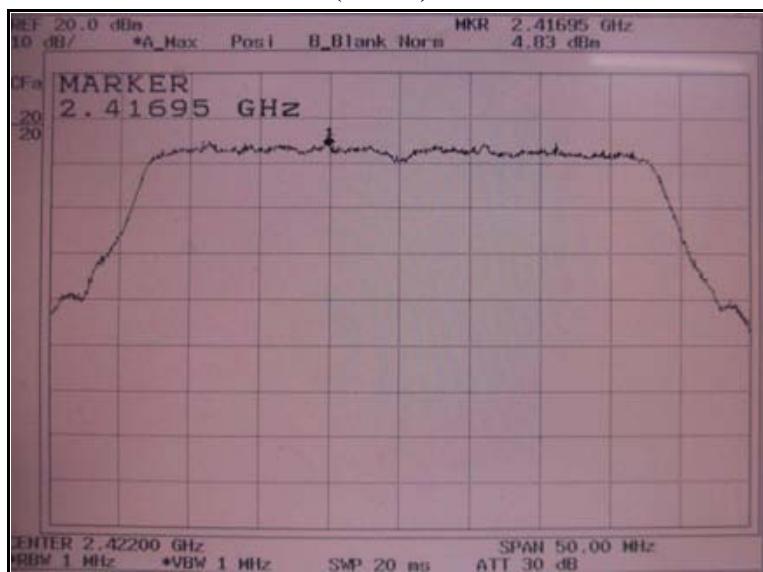


Highest Channel

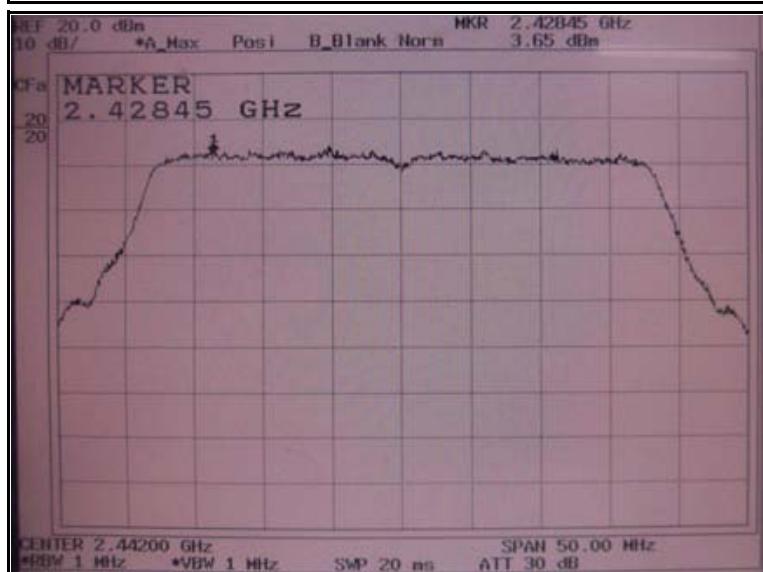


802.11 n (HT 40) Mode

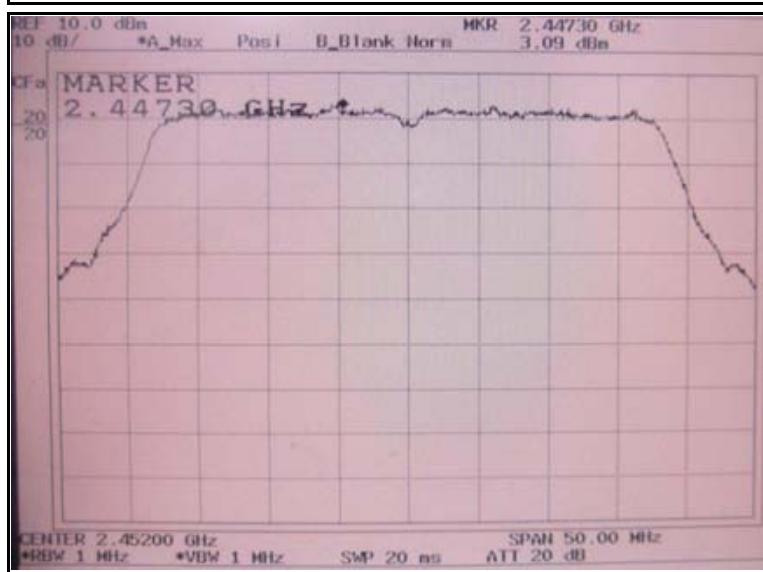
Lowest Channel



Middle Channel



Highest Channel



6.4 PEAK POWER SPECTRAL DENSITY

6.4.1 Regulation

According to §15.247(e), 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

6.4.2 Test Condition

- Set RBW of Spectrum analyzer to 3 kHz, Span=1MHz, Sweep=Auto
- The transmitter output was connected to a spectrum analyzer and the maximum level in a 3kHz bandwidth was measured. A peak value was found over the full emission bandwidth and the frequency span reduced to obtain enhanced resolution. Sweep time \geq span / 3kHz with video averaging turned off. The Peak Power Spectral Density is the highest level found across the emission in a 3kHz resolution bandwidth.

6.4.3 Test result : PASS

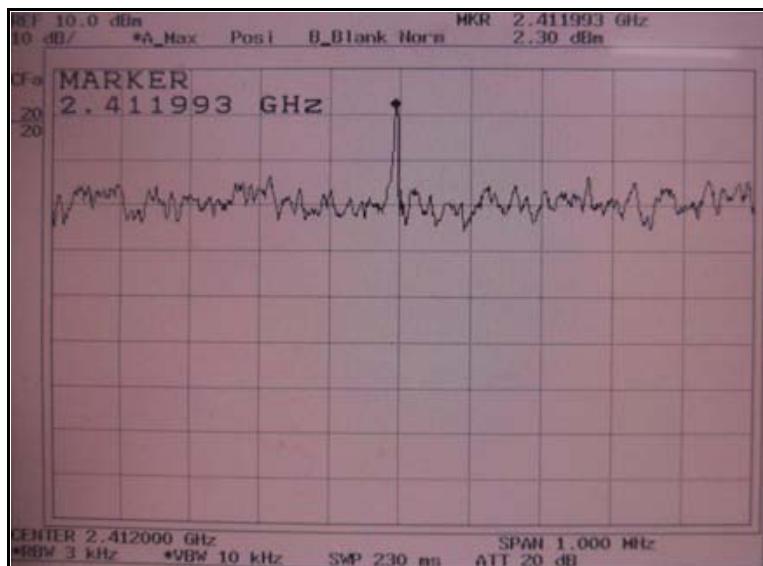
Table 3 : Measured values of the Peak power spectral density

Mode	Frequency (MHz)	Peak frequency (MHz)	Peak power Spectral Density (dBm)	Limit (dBm)	Verdict
802.11b	2412	2411.993	2.30	< 8	PASS
	2442	2441.993	1.53		PASS
	2472	2471.993	1.56		PASS
802.11g	2412	2411.711	-18.13	< 8	PASS
	2442	2441.710	-18.16		PASS
	2472	2471.709	-18.86		PASS
802.11n (HT20)	2412	2411.669	-18.14	< 8	PASS
	2442	2441.667	-19.13		PASS
	2472	2471.668	-19.20		PASS
802.11n (HT40)	2422	2421.993	-29.12	< 8	PASS
	2442	2441.992	-29.52		PASS
	2452	2451.981	-29.72		PASS

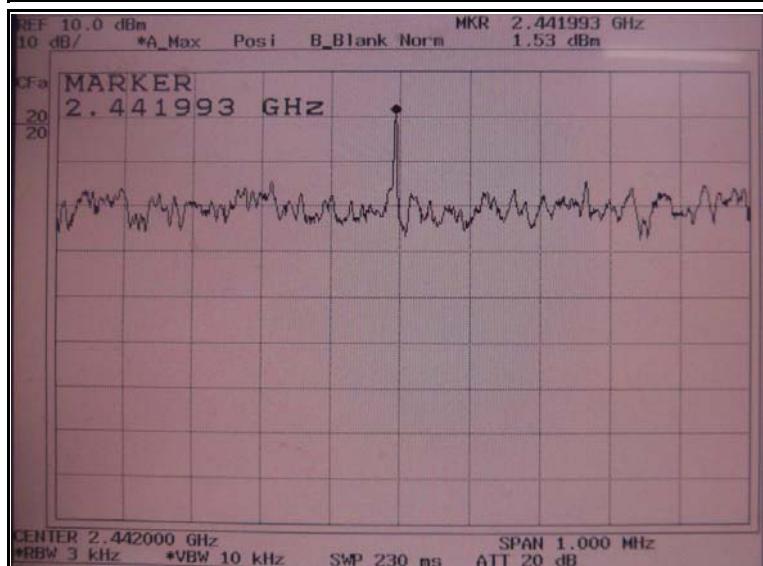
6.4.4 Plot of the Peak power spectral density

802.11 b Mode

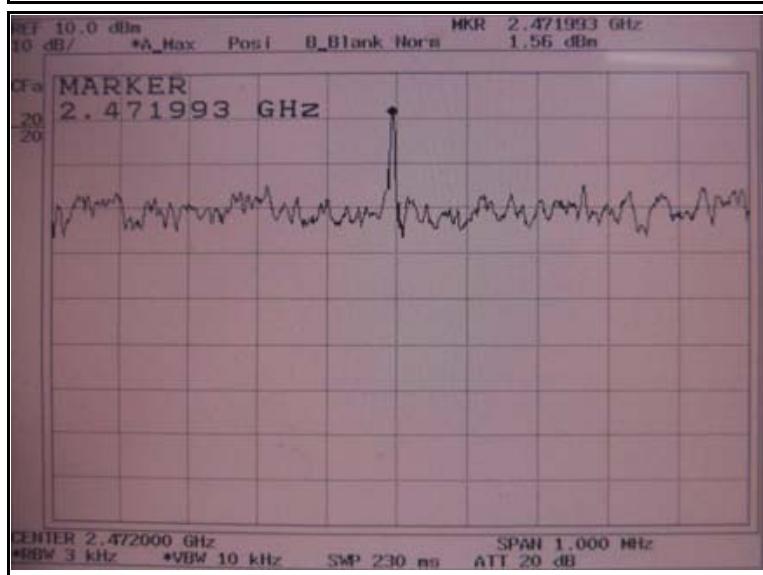
Lowest Channel



Middle Channel

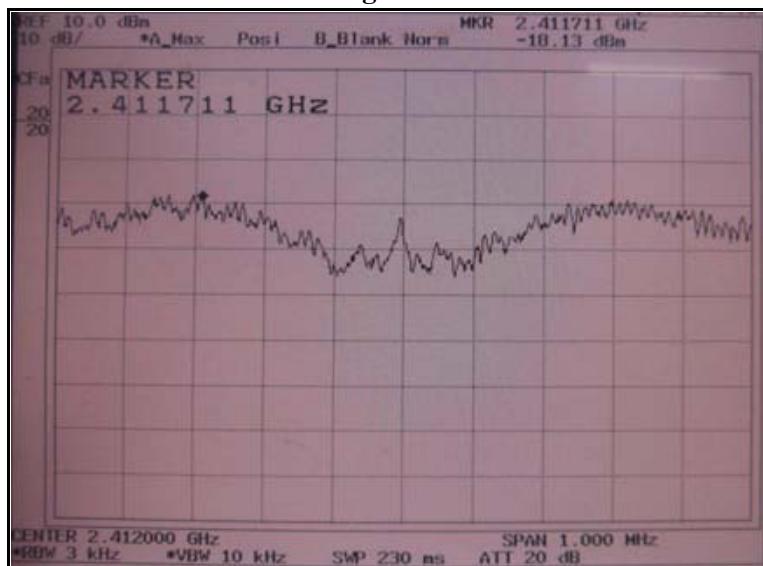


Highest Channel

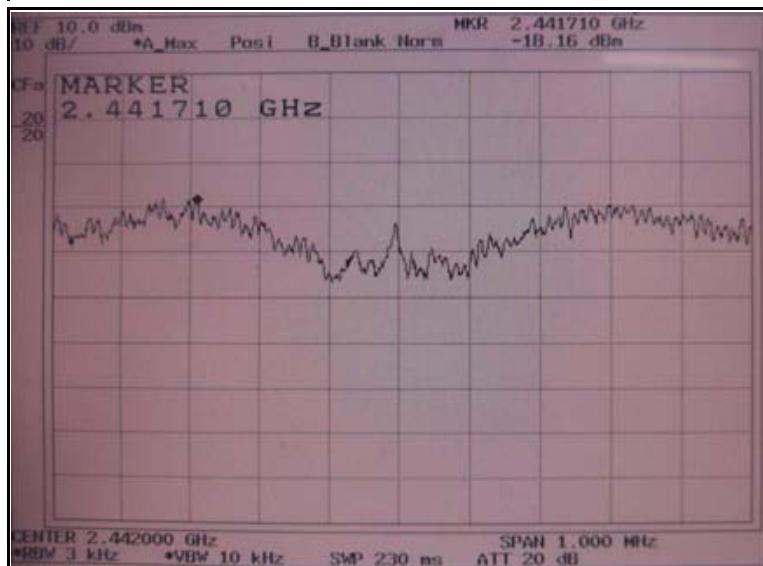


802.11 g Mode

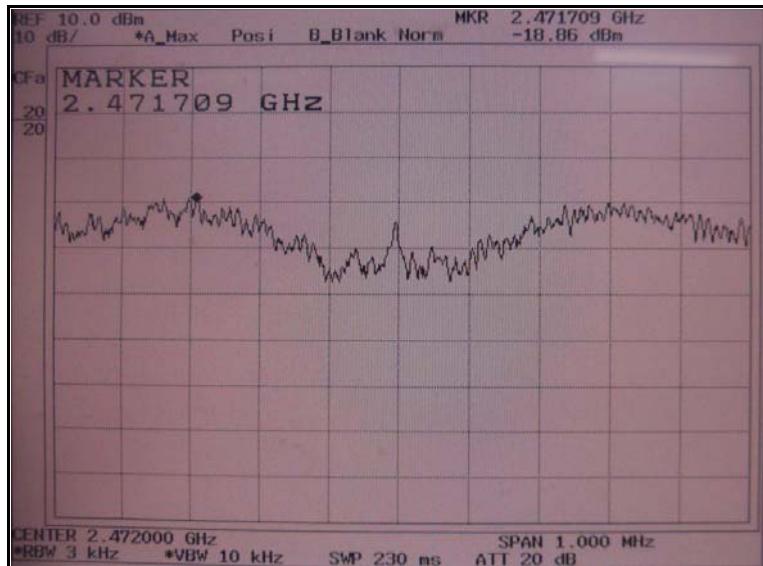
Lowest Channel



Middle Channel

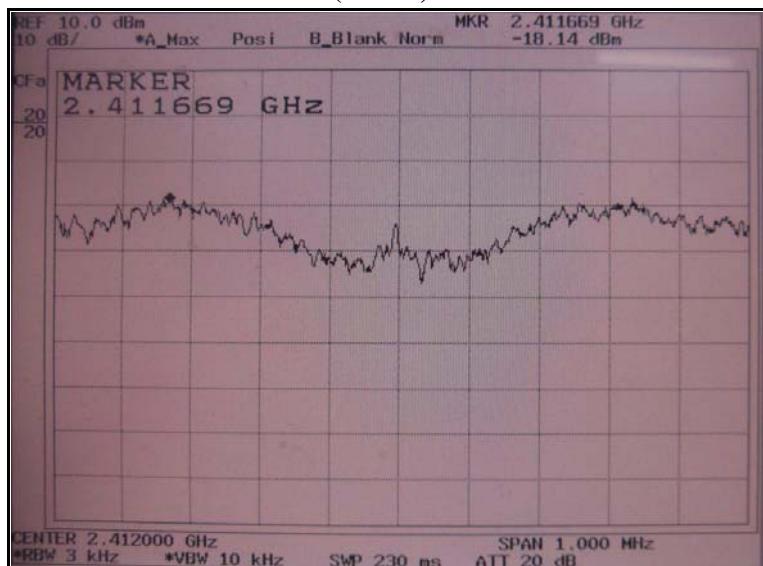


Highest Channel

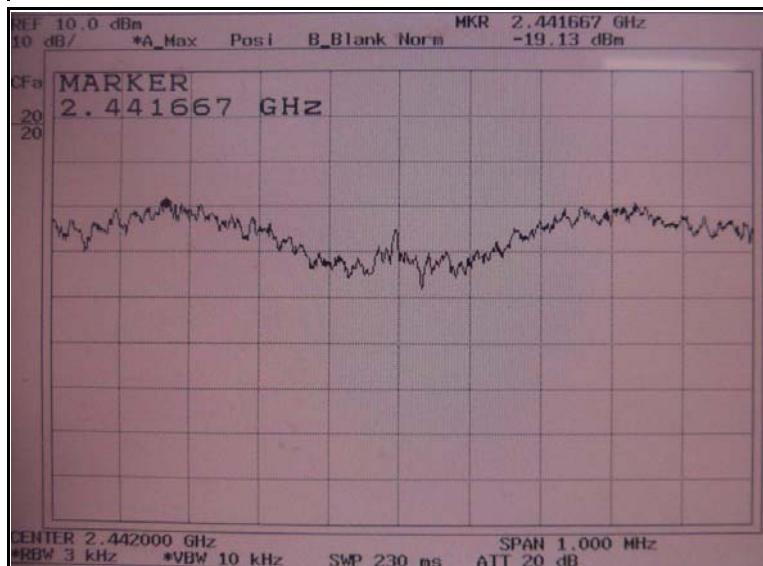


802.11 n (HT 20) Mode

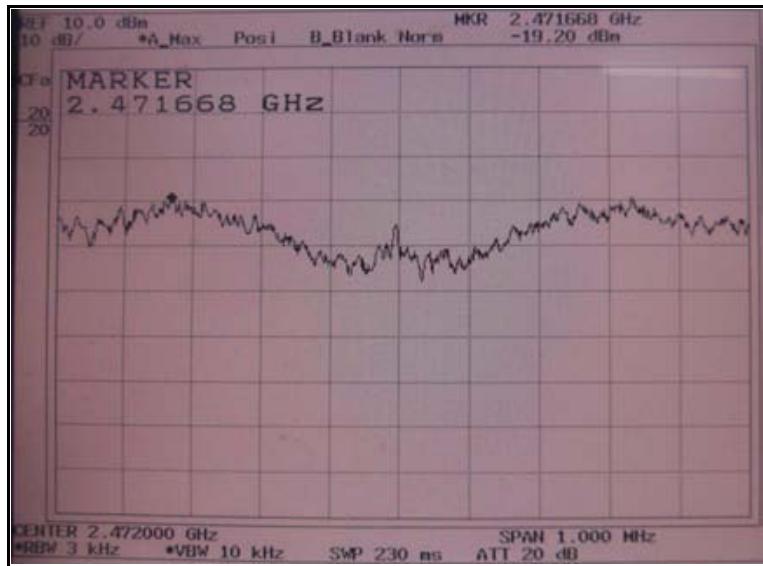
Lowest Channel



Middle Channel

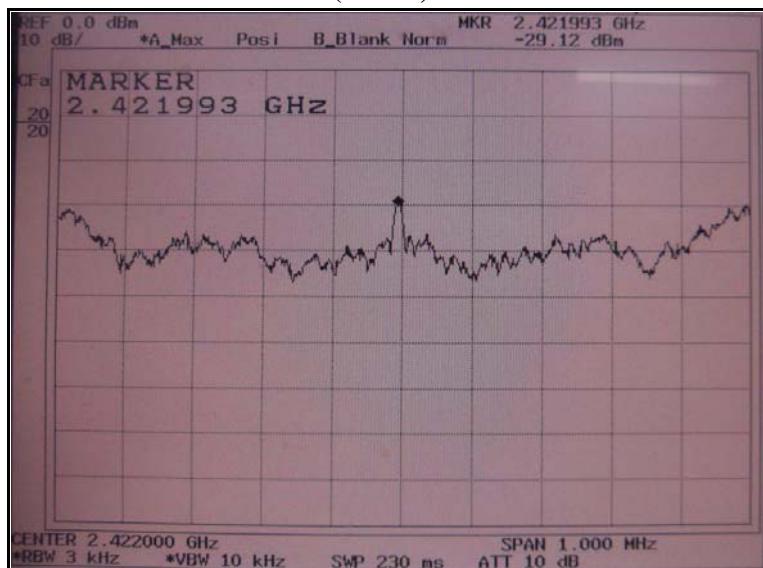


Highest Channel

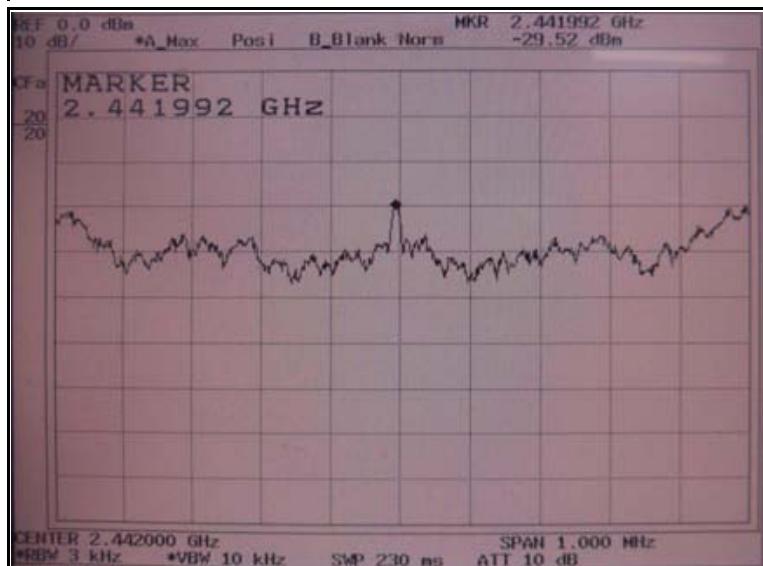


802.11 n (HT 40) Mode

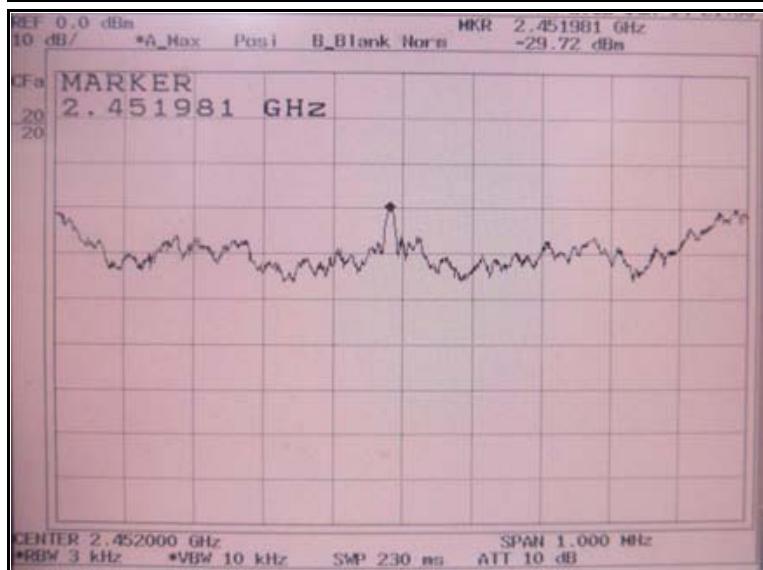
Lowest Channel



Middle Channel



Highest Channel



6.5 Spurious emissions, Band edge, and Restricted bands

6.5.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

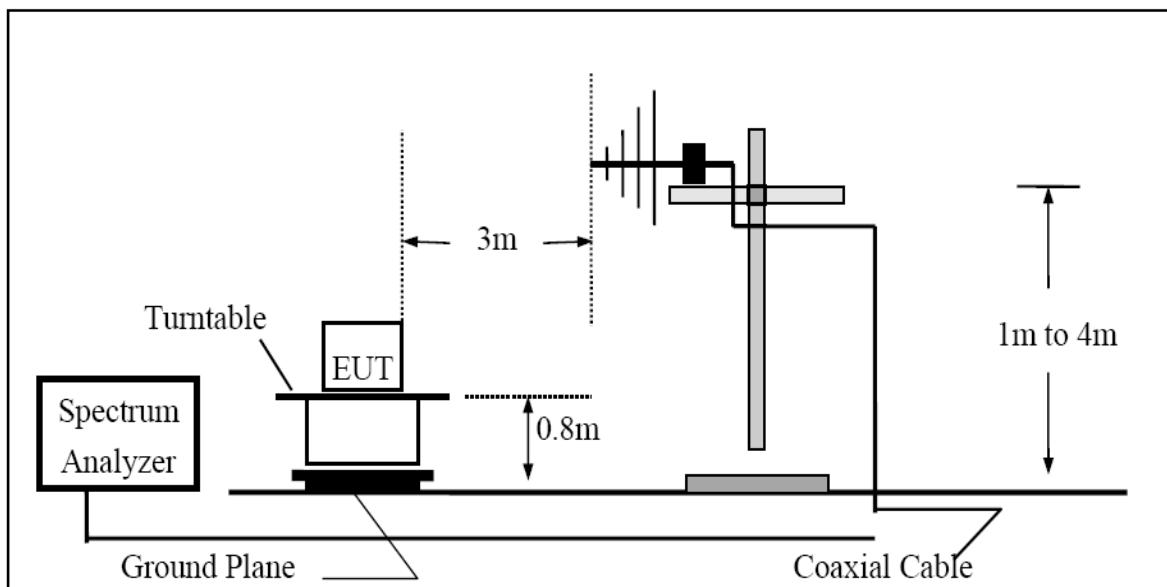
Frequency (MHz)	Field strength (μ V/m)	Field strength (dB μ V/m)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	29.5	30
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

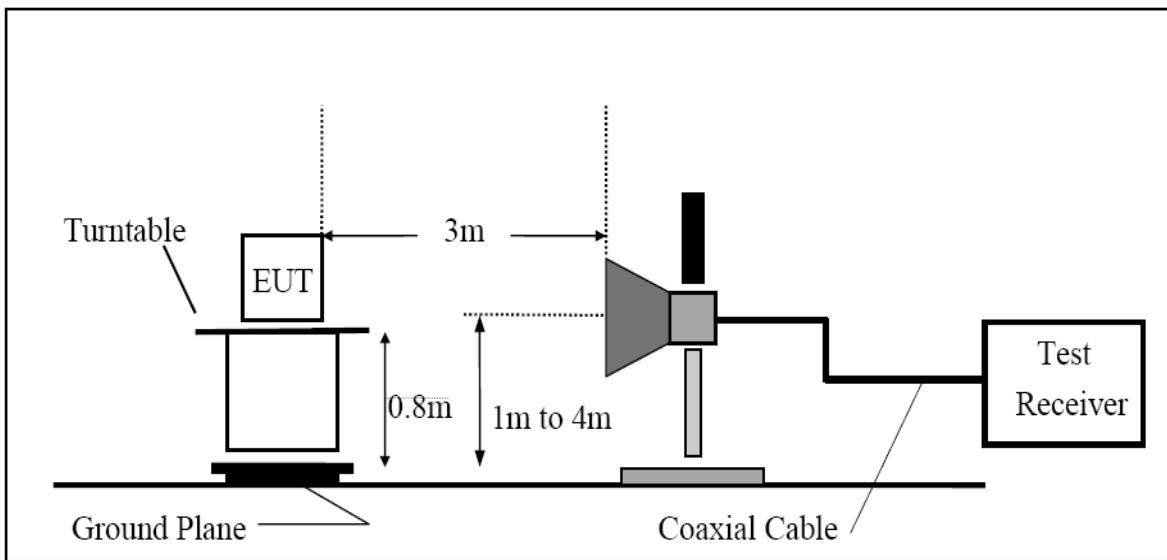
** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

6.5.2 Test Setup Layout

6.5.2.1 Radiated Emission Test Set-Up, Frequency Below 1000MHz



6.5.2.2 Radiated Emission Test Set-UP Frequency Over 1000MHz



6.5.3 Test Procedure

1) Band-edge Compliance of RF Conducted Emissions

1. Set the spectrum analyzer as follows:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation

RBW \geq 1% of the span

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.

3. Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

2) Spurious RF Conducted Emissions:

1. Set the spectrum analyzer as follows:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

3) Spurious Radiated Emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter distance for below 30 MHz.

2. The EUT was placed on the top of the 0.8-meter height, 1 \times 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.

3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 to 1000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4×4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative "marker-delta" method may be employed.

4) Marker-Delta Method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the above Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two "standard" bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

6.5.4 Test Results:

Band-edge compliance of RF conducted/radiated emissions was shown in the 6.5.5 and 6.5.6.

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Spurious RF conducted emissions were shown in the 6.5.7.

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Table 4-1 : Measured values of the Field strength of spurious emission (Transmit mode)

Frequency (MHz)	Detect Mode	Polarization (V/H)	Emission Level (dB μ N/m)	Limit (dB μ N/m)	Margin (dB)
802.11 b Mode					
2412	126.3	Quasi-peak	H	18.69	43.50
	321.7	Quasi-peak	V	20.38	46.00
	533.4	Quasi-peak	V	25.76	46.00
	747.6	Quasi-peak	V	25.59	46.00
	852.3	Quasi-peak	H	25.34	46.00
	1063	Peak	H	43.81	74.00
	1063	Average	H	35.26	54.00
	4820	Peak	V	52.44	74.00
	4820	Average	V	38.68	54.00
2442	144.4	Quasi-peak	H	15.38	43.50
	341	Quasi-peak	V	19.26	46.00
	549.6	Quasi-peak	V	24.63	46.00
	768.7	Quasi-peak	V	25.38	46.00
	866.7	Quasi-peak	H	24.89	46.00
	1063	Peak	H	42.39	74.00
	1063	Average	H	34.29	54.00
	7580	Peak	V	53.40	74.00
	7580	Average	V	38.69	54.00
2472	155.7	Quasi-peak	H	14.88	43.50
	355.6	Quasi-peak	V	19.05	46.00
	559.8	Quasi-peak	V	24.52	46.00
	780.1	Quasi-peak	V	25.12	46.00
	879.3	Quasi-peak	H	24.35	46.00
	1063	Peak	H	41.00	74.00
	1063	Average	H	33.64	54.00
	7512	Peak	V	54.08	74.00
	7512	Average	V	38.83	54.00

Note.

1. Margin (dB) = Limit – Emission Level
2. H = Horizontal, V = Vertical Polarization

Table 4-2 : Measured values of the Field strength of spurious emission (Transmit mode)

Frequency (MHz)	Detect Mode	Polarization (V/H)	Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
802.11 g Mode					
2412	125.4	Quasi-peak	H	14.31	43.50
	323.6	Quasi-peak	V	16.76	46.00
	531.9	Quasi-peak	V	28.35	46.00
	744.2	Quasi-peak	V	22.72	46.00
	850.9	Quasi-peak	H	28.89	46.00
	1063	Peak	H	44.07	74.00
	1063	Average	H	35.49	54.00
	7076	Peak	V	53.07	74.00
	7076	Average	V	38.33	54.00
2442	135.5	Quasi-peak	H	17.07	43.50
	336.1	Quasi-peak	V	15.11	46.00
	546.2	Quasi-peak	V	20.69	46.00
	757.4	Quasi-peak	V	21.21	46.00
	863.5	Quasi-peak	H	20.20	46.00
	1063	Peak	H	43.51	74.00
	1063	Average	H	33.60	54.00
	7428	Peak	V	53.57	74.00
	7428	Average	V	38.28	54.00
2472	145	Quasi-peak	H	9.66	43.50
	346.5	Quasi-peak	V	16.69	46.00
	557.1	Quasi-peak	V	20.57	46.00
	769.8	Quasi-peak	V	22.74	46.00
	876.6	Quasi-peak	H	22.11	46.00
	1864	Peak	H	50.26	74.00
	1864	Average	H	33.31	54.00
	7672	Peak	V	55.08	74.00
	7672	Average	V	38.55	54.00

Note.

1. Margin (dB) = Limit – Emission Level
2. H = Horizontal, V = Vertical Polarization

Table 4-3 : Measured values of the Field strength of spurious emission (Transmit mode)

Frequency (MHz)	Detect Mode	Polarization (V/H)	Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
802.11 n (HT 20) Mode					
2412	128.6	Quasi-peak	H	10.69	43.50
	324.8	Quasi-peak	V	14.65	46.00
	534.7	Quasi-peak	V	25.39	46.00
	745.9	Quasi-peak	V	19.53	46.00
	853.1	Quasi-peak	H	26.48	46.00
	1866	Peak	H	50.60	74.00
	1866	Average	H	35.18	54.00
	7632	Peak	V	54.27	74.00
	7632	Average	V	37.99	54.00
2442	140.7	Quasi-peak	H	14.74	43.50
	337.1	Quasi-peak	V	11.70	46.00
	545.1	Quasi-peak	V	17.82	46.00
	757.5	Quasi-peak	V	18.52	46.00
	864.3	Quasi-peak	H	17.14	46.00
	1935	Peak	H	53.52	74.00
	1935	Average	H	33.29	54.00
	7817	Peak	V	55.25	74.00
	7817	Average	V	38.07	54.00
2472	153.2	Quasi-peak	H	6.80	43.50
	348.4	Quasi-peak	V	13.62	46.00
	556.2	Quasi-peak	V	17.91	46.00
	769.5	Quasi-peak	V	20.76	46.00
	875.8	Quasi-peak	H	19.97	46.00
	1063	Peak	H	43.15	74.00
	1063	Average	H	32.84	54.00
	7900	Peak	V	54.01	74.00
	7900	Average	V	38.10	54.00

Note.

1. Margin (dB) = Limit – Emission Level
2. H = Horizontal, V = Vertical Polarization

Table 4-4 : Measured values of the Field strength of spurious emission (Transmit mode)

Frequency (MHz)	Detect Mode	Polarization (V/H)	Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
802.11 n (HT 40) Mode					
2422	122.3	Quasi-peak	H	10.06	43.50
	326.7	Quasi-peak	V	13.62	46.00
	530.8	Quasi-peak	V	24.28	46.00
	748.1	Quasi-peak	V	19.51	46.00
	855.8	Quasi-peak	H	27.54	46.00
	1063	Peak	H	45.97	74.00
	1063	Average	H	35.35	54.00
	7634	Peak	V	53.69	74.00
	7634	Average	V	38.31	54.00
2442	224.3	Quasi-peak	H	14.41	43.50
	338.8	Quasi-peak	V	11.14	46.00
	542.5	Quasi-peak	V	16.81	46.00
	760.5	Quasi-peak	V	18.20	46.00
	867.4	Quasi-peak	H	17.28	46.00
	1063	Peak	H	45.89	74.00
	1063	Average	H	32.93	54.00
	7809	Peak	V	54.67	74.00
	7809	Average	V	38.53	54.00
2452	237.1	Quasi-peak	H	6.47	43.50
	351.1	Quasi-peak	V	13.37	46.00
	553.9	Quasi-peak	V	16.88	46.00
	771.4	Quasi-peak	V	20.90	46.00
	878.5	Quasi-peak	H	19.56	46.00
	1063	Peak	H	43.22	74.00
	1063	Average	H	32.16	54.00
	7908	Peak	V	54.46	74.00
	7908	Average	V	38.49	54.00

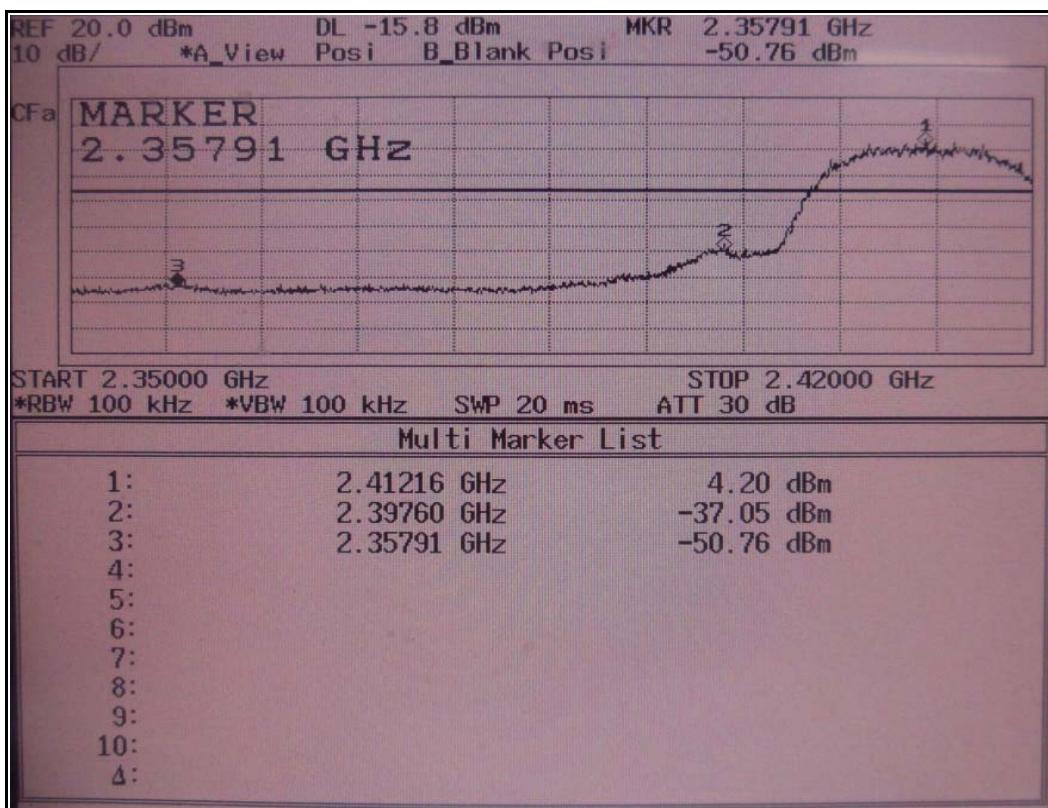
Note.

1. Margin (dB) = Limit – Emission Level
2. H = Horizontal, V = Vertical Polarization

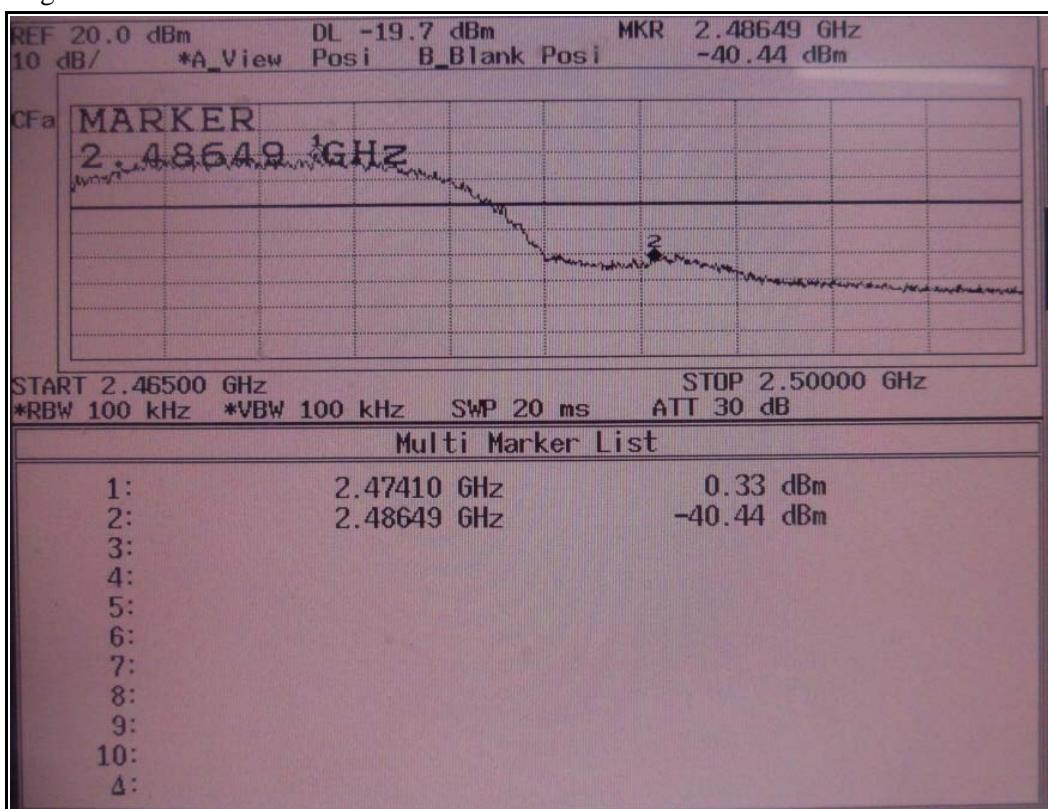
6.5.5 Plot of the Band Edge (Conducted)

802.11 b Mode

Lowest Channel

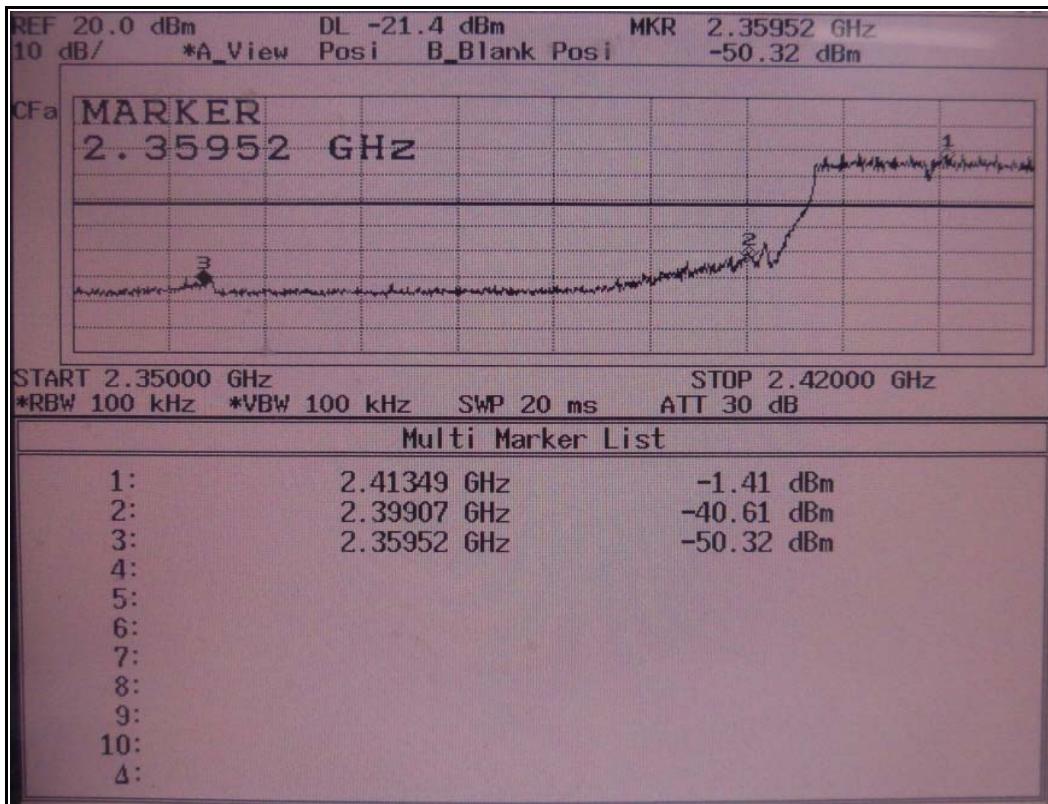


Highest Channel

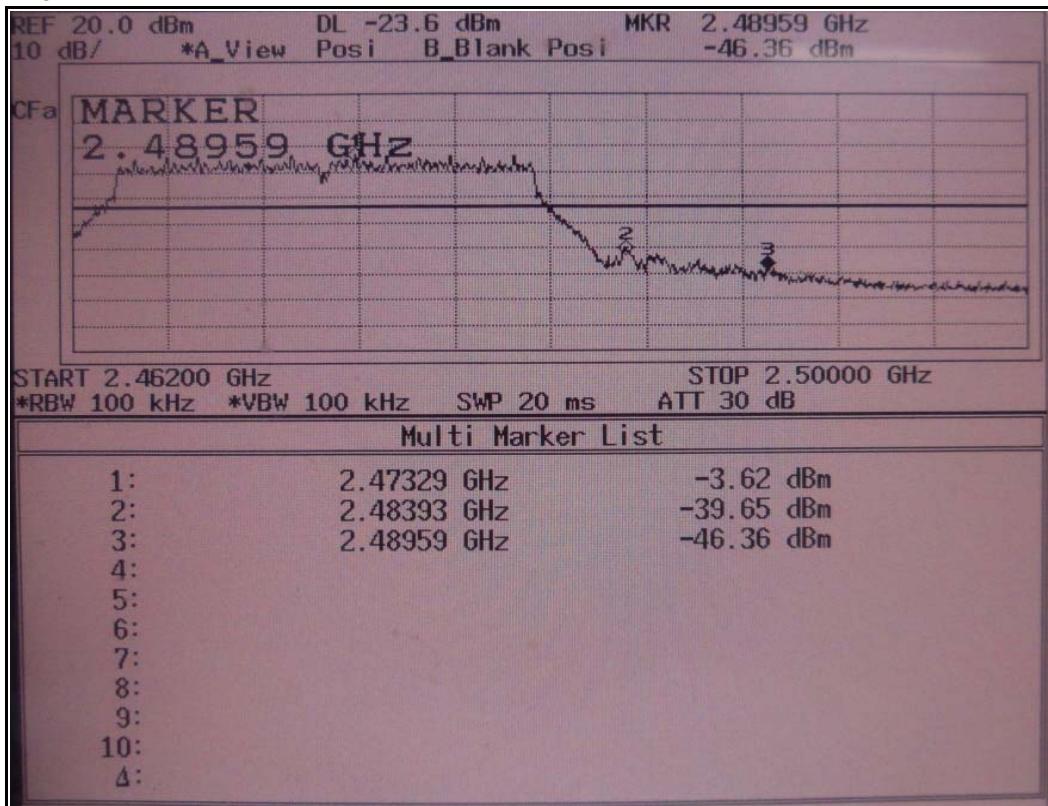


802.11 g Mode

Lowest Channel

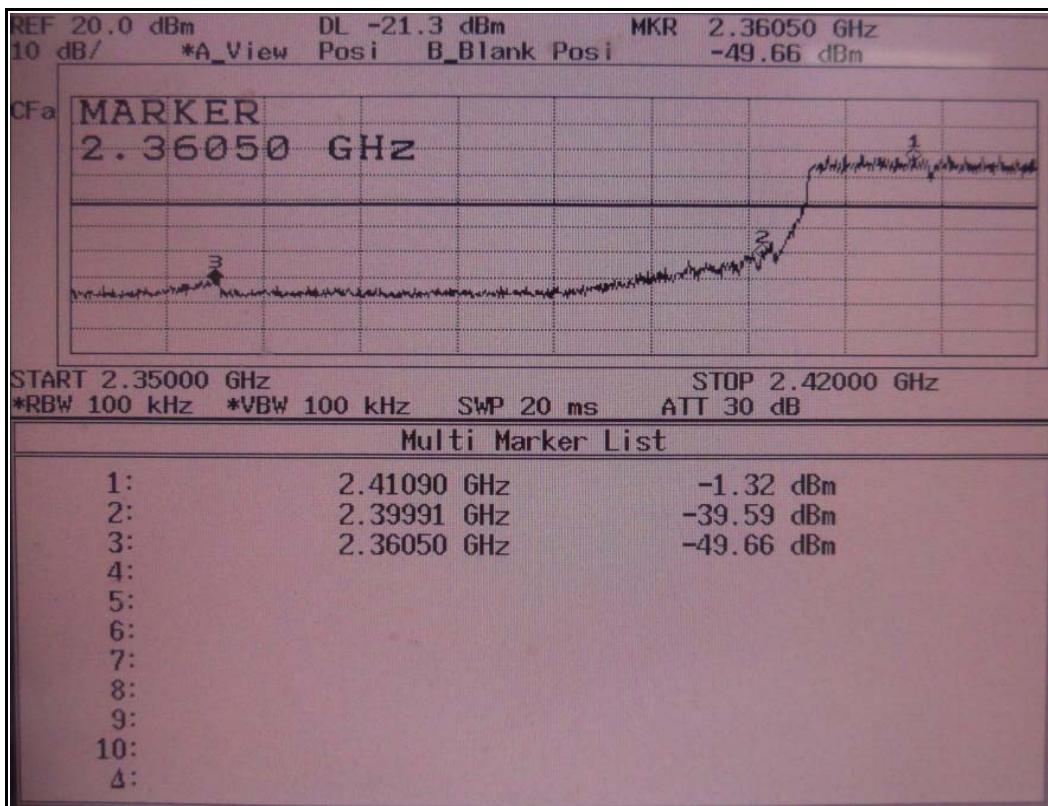


Highest Channel

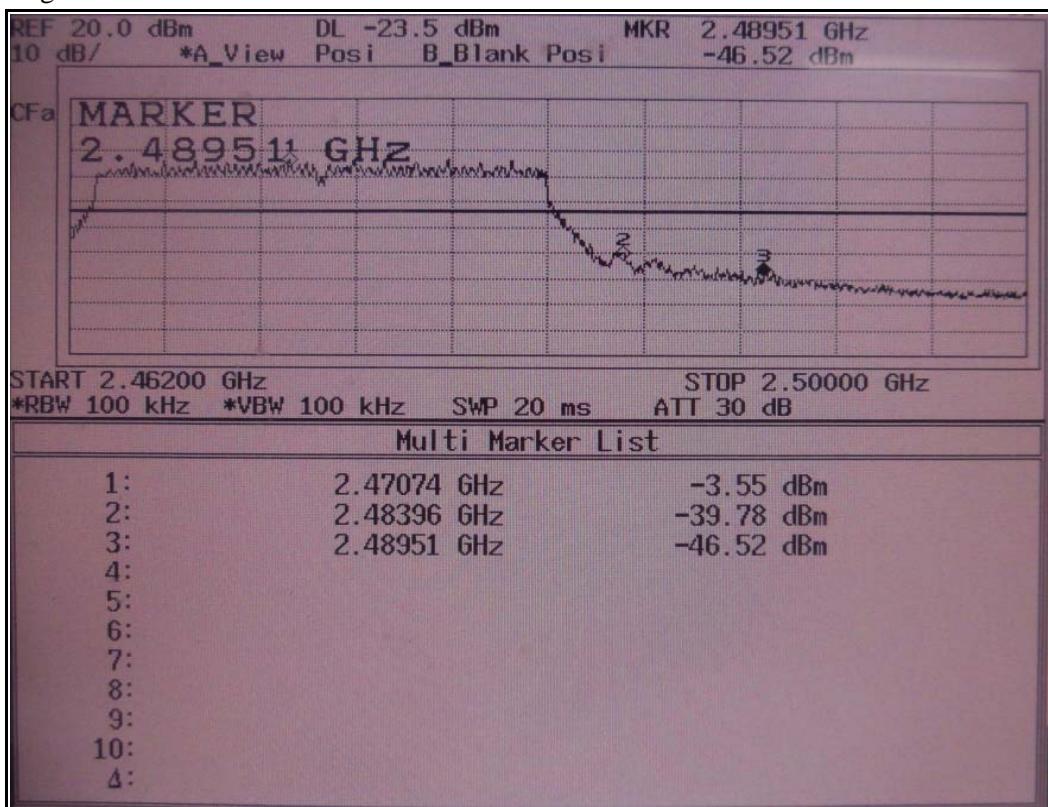


802.11 n (HT 20) Mode

Lowest Channel

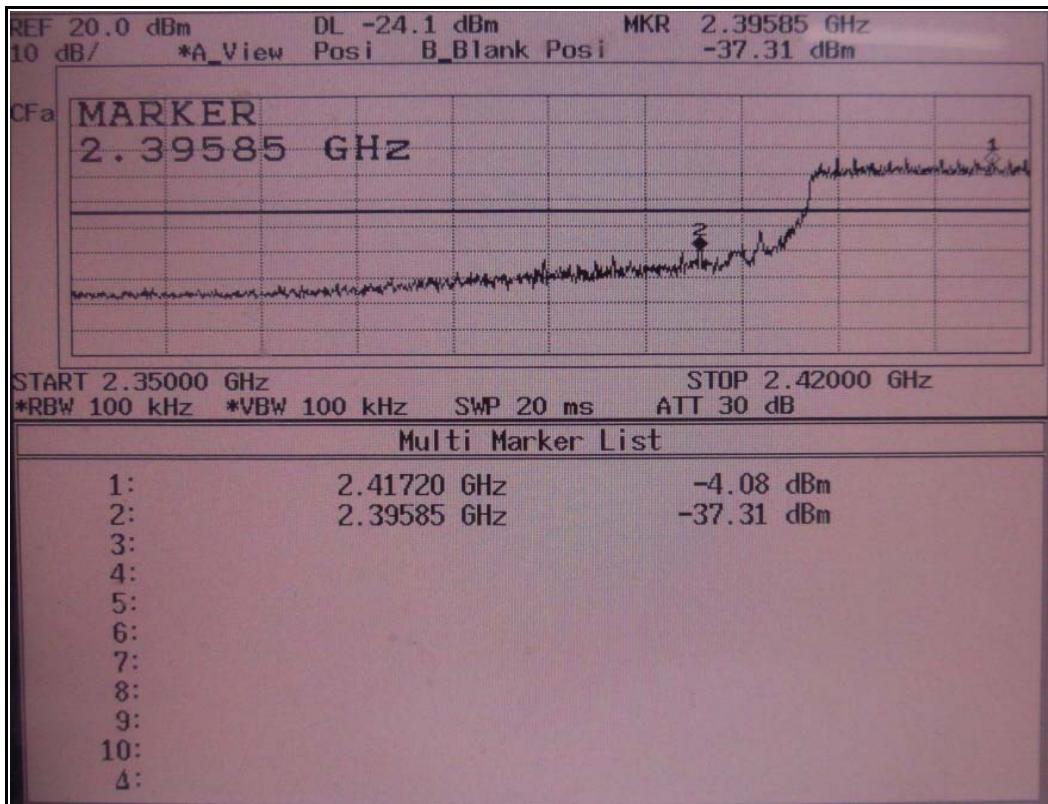


Highest Channel

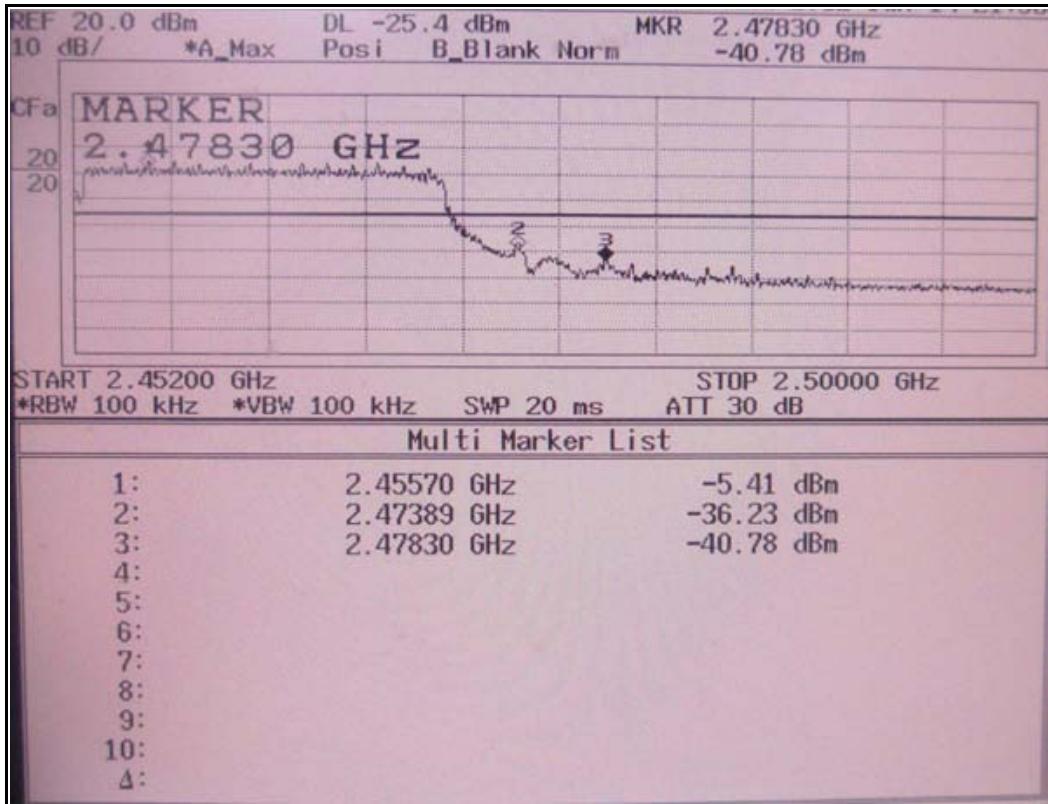


802.11 n (HT 40) Mode

Lowest Channel



Highest Channel



6.5.6 Plot of the Band Edge (Radiated)

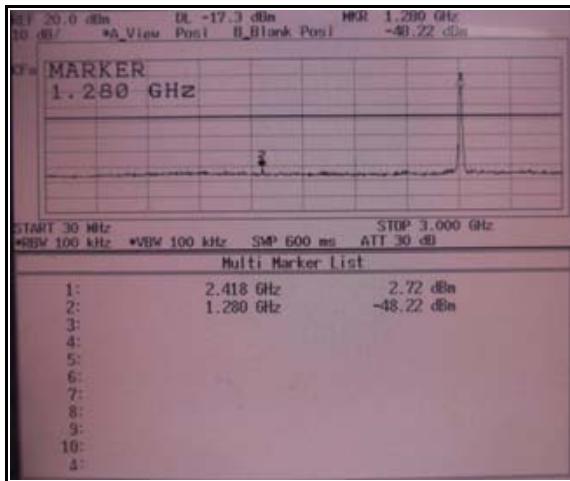
Table 5 : Measured values of the Band Edge(Radiated)

Mode	Frequency (MHz)		Detect Mode	Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
802.11b	2412	2396.80	Peak	47.25	74	26.75
		2396.80	Average	35.18	54	18.82
	2472	2489.47	Peak	48.04	74	25.96
		2489.47	Average	35.69	54	18.31
802.11g	2412	2398.76	Peak	47.16	74	26.84
		2398.76	Average	35.41	54	18.59
	2472	2485.07	Peak	47.84	74	26.16
		2485.07	Average	35.39	54	18.61
802.11n (HT20)	2412	2399.26	Peak	46.88	74	27.12
		2399.26	Average	35.18	54	18.82
	2472	2484.65	Peak	47.55	74	26.45
		2484.65	Average	35.42	54	18.58
802.11n (HT40)	2422	2396.33	Peak	47.22	74	26.78
		2396.33	Average	35.13	54	18.87
	2452	2484.68	Peak	47.51	74	26.49
		2484.68	Average	35.26	54	18.74

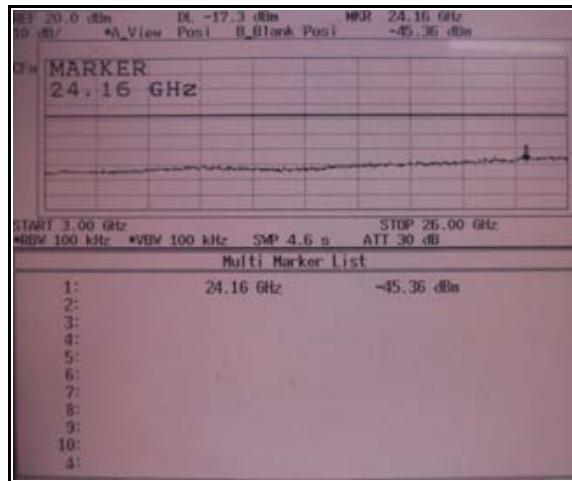
6.5.7 Plot of the Spurious RF conducted emissions

802.11 b Mode

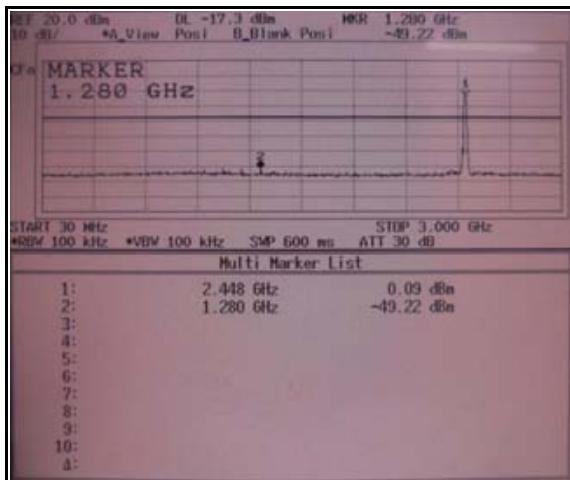
Lowest Channel : 30MHz ~ 3GHz



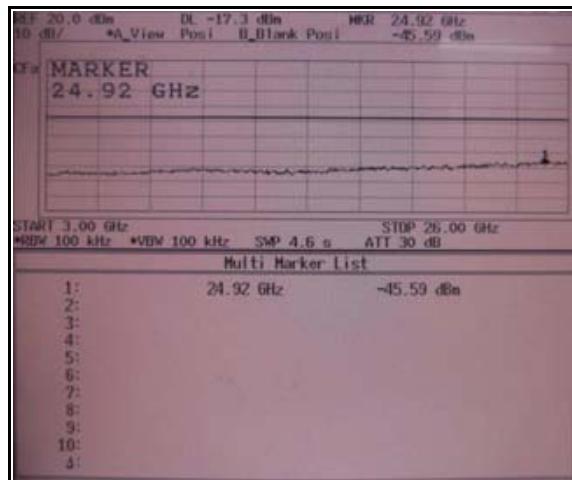
Lowest Channel : 3GHz ~ 26GHz



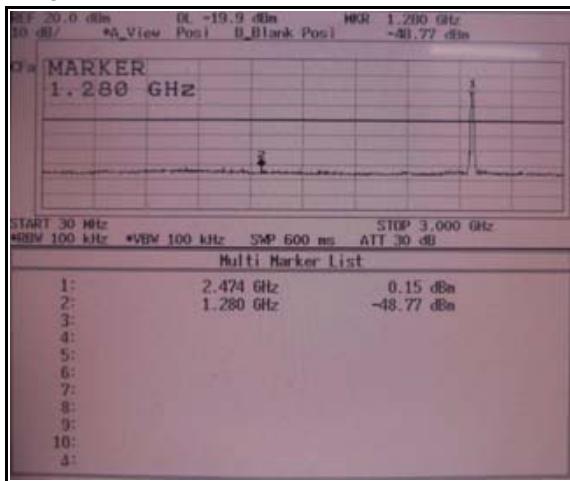
Middle Channel : 30MHz ~ 3GHz



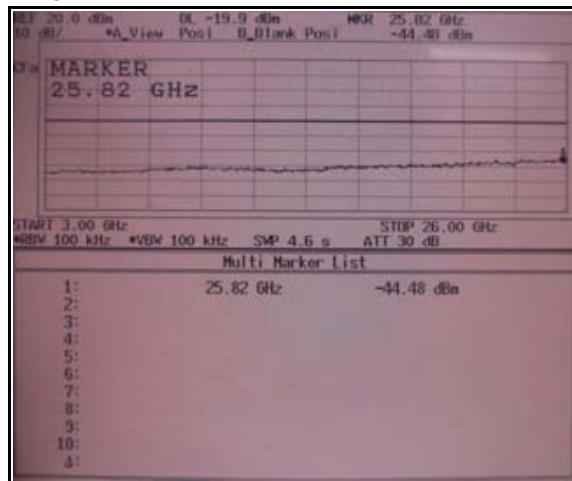
Middle Channel : 3GHz ~ 26GHz



Highest Channel : 30MHz ~ 3GHz

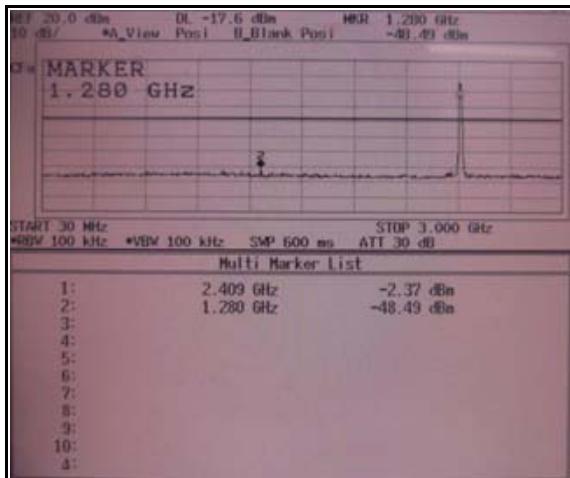


Highest Channel : 3GHz ~ 26GHz

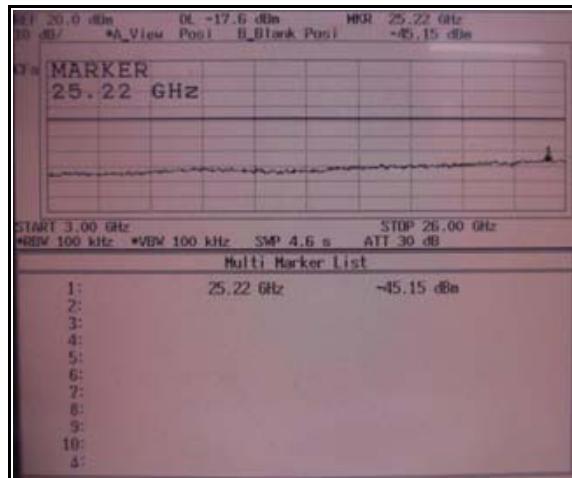


802.11 g Mode

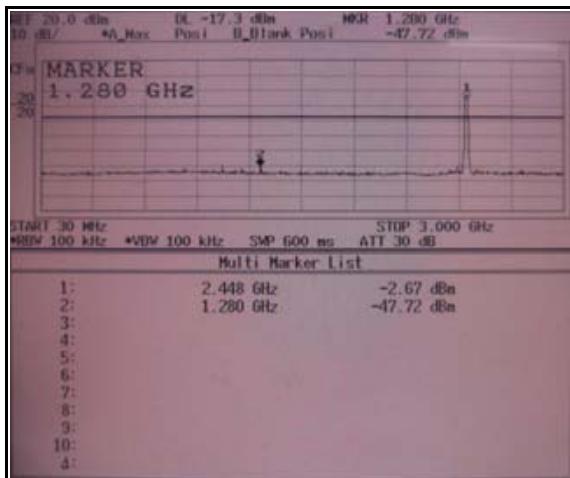
Lowest Channel : 30MHz ~ 3GHz



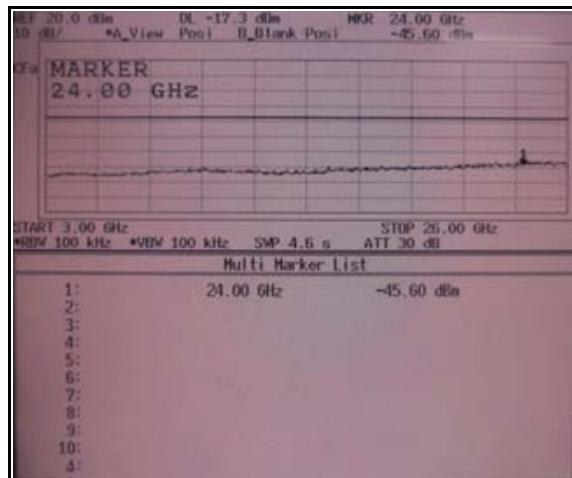
Lowest Channel : 3GHz ~ 26GHz



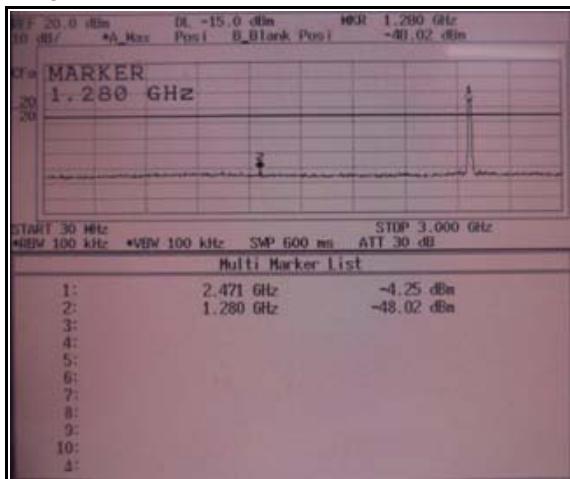
Middle Channel : 30MHz ~ 3GHz



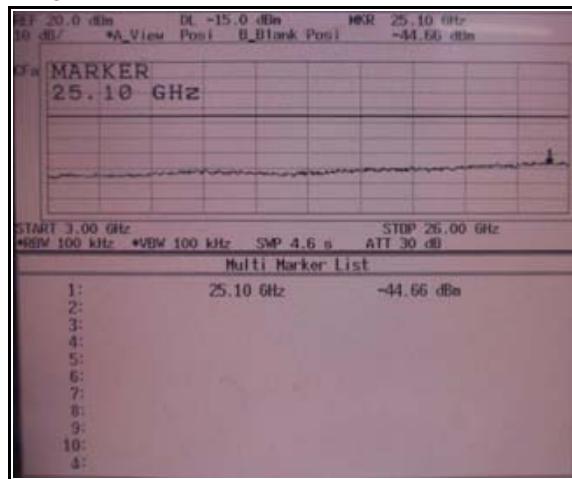
Middle Channel : 3GHz ~ 26GHz



Highest Channel : 30MHz ~ 3GHz

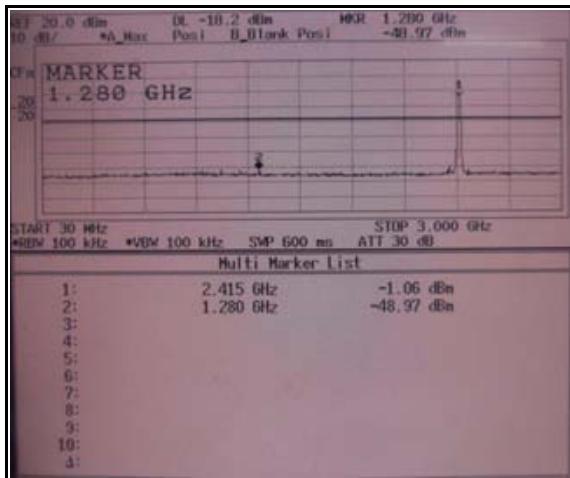


Highest Channel : 3GHz ~ 26GHz

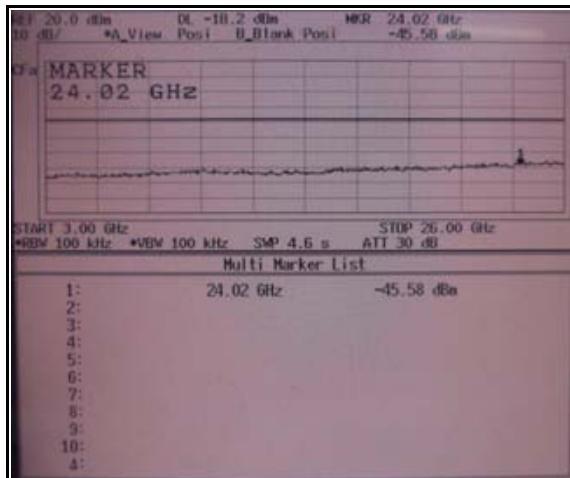


802.11 n (HT 20) Mode

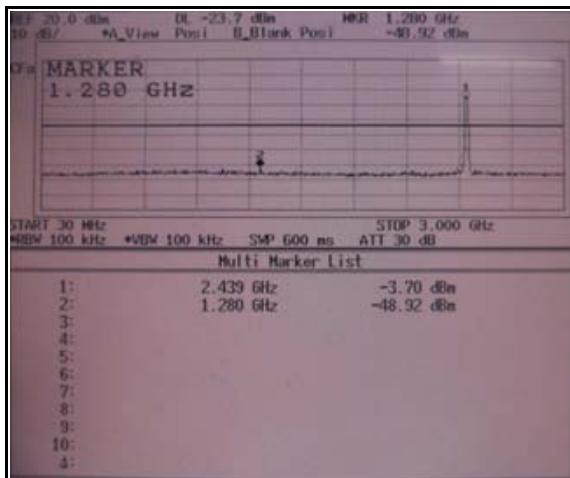
Lowest Channel : 30MHz ~ 3GHz



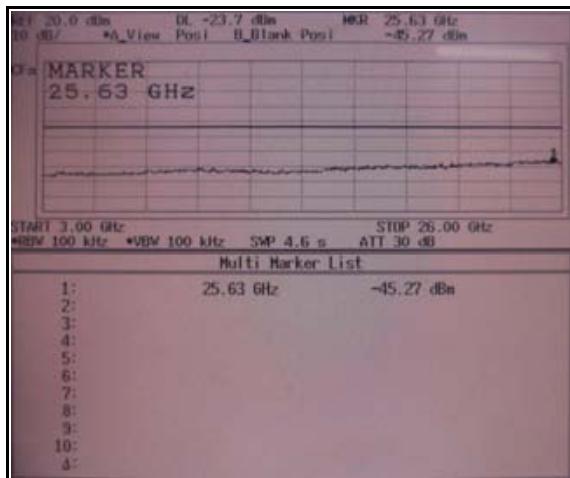
Lowest Channel : 3GHz ~ 26GHz



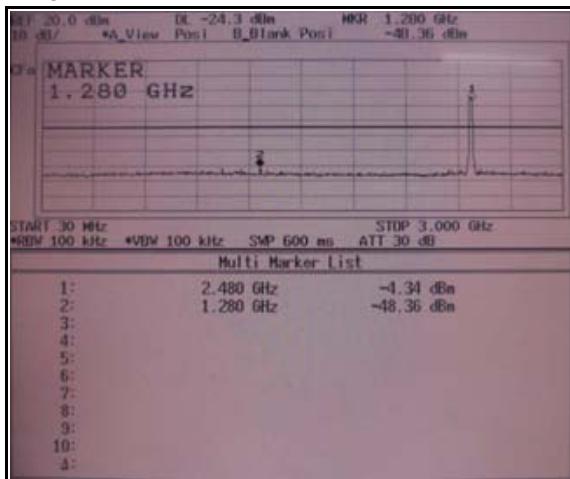
Middle Channel : 30MHz ~ 3GHz



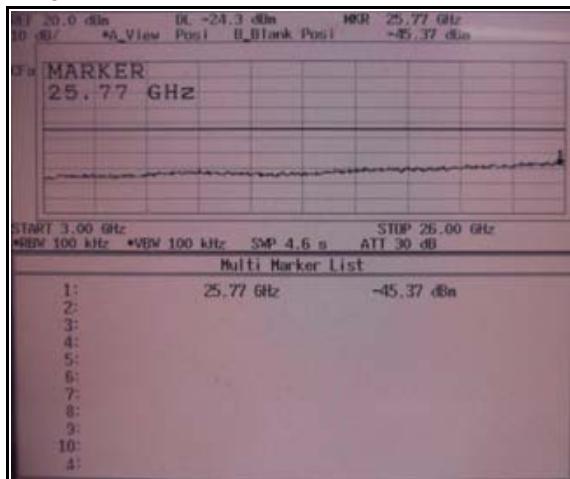
Middle Channel : 3GHz ~ 26GHz



Highest Channel : 30MHz ~ 3GHz

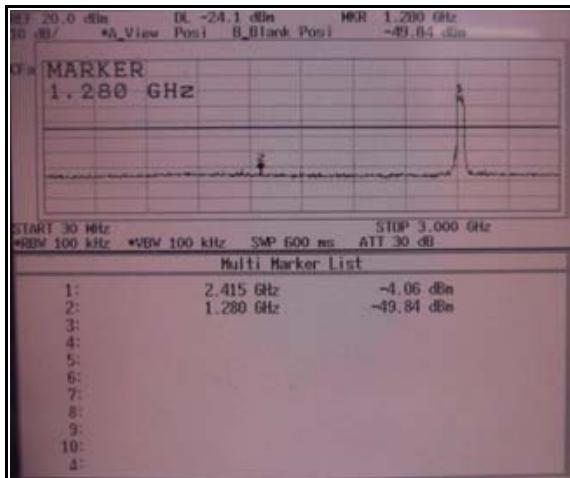


Highest Channel : 3GHz ~ 26GHz

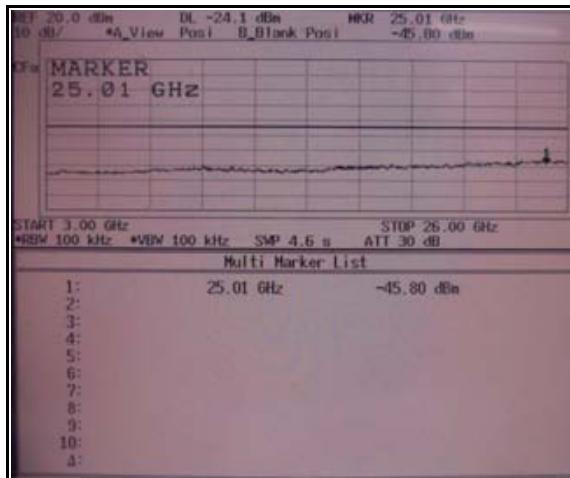


802.11 n (HT 40) Mode

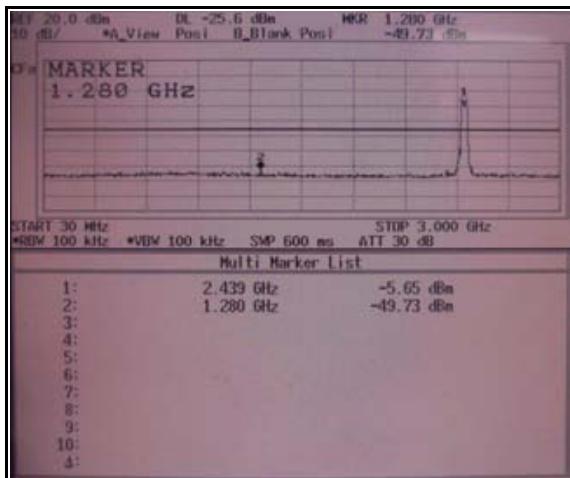
Lowest Channel : 30MHz ~ 3GHz



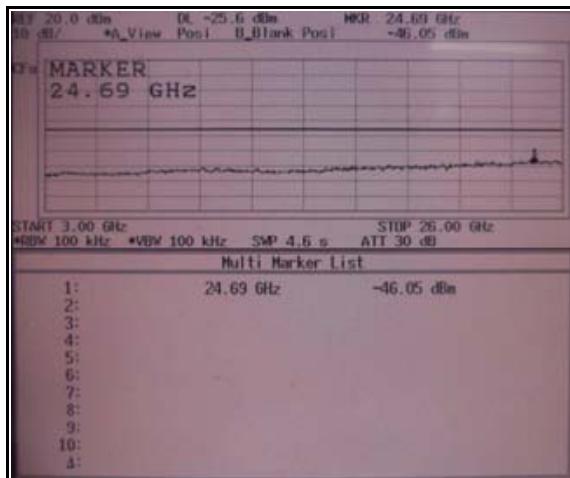
Lowest Channel : 3GHz ~ 26GHz



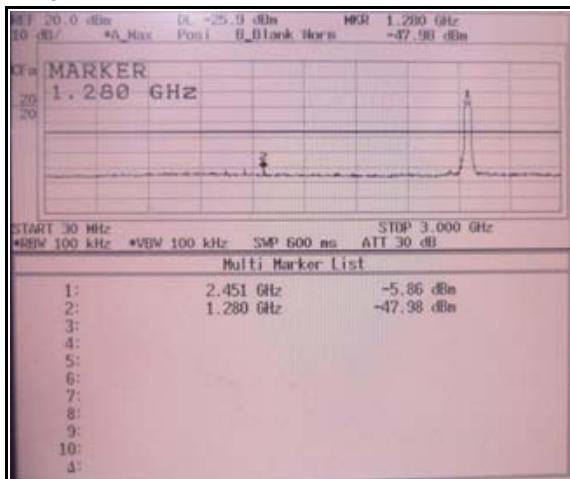
Middle Channel : 30MHz ~ 3GHz



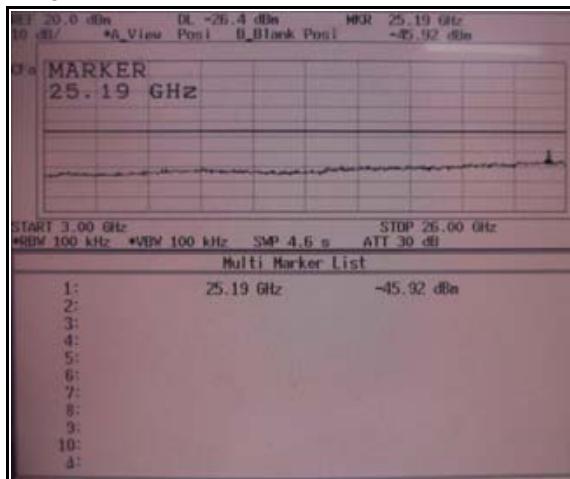
Middle Channel : 3GHz ~ 26GHz



Highest Channel : 30MHz ~ 3GHz



Highest Channel : 3GHz ~ 26GHz



6.6 AC Power Line Conducted Emissions

6.6.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

6.6.2 Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω /50 μ H LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

6.6.3 Test Results

Table 6 : Measured values of the AC Power Line Conducted Emissions

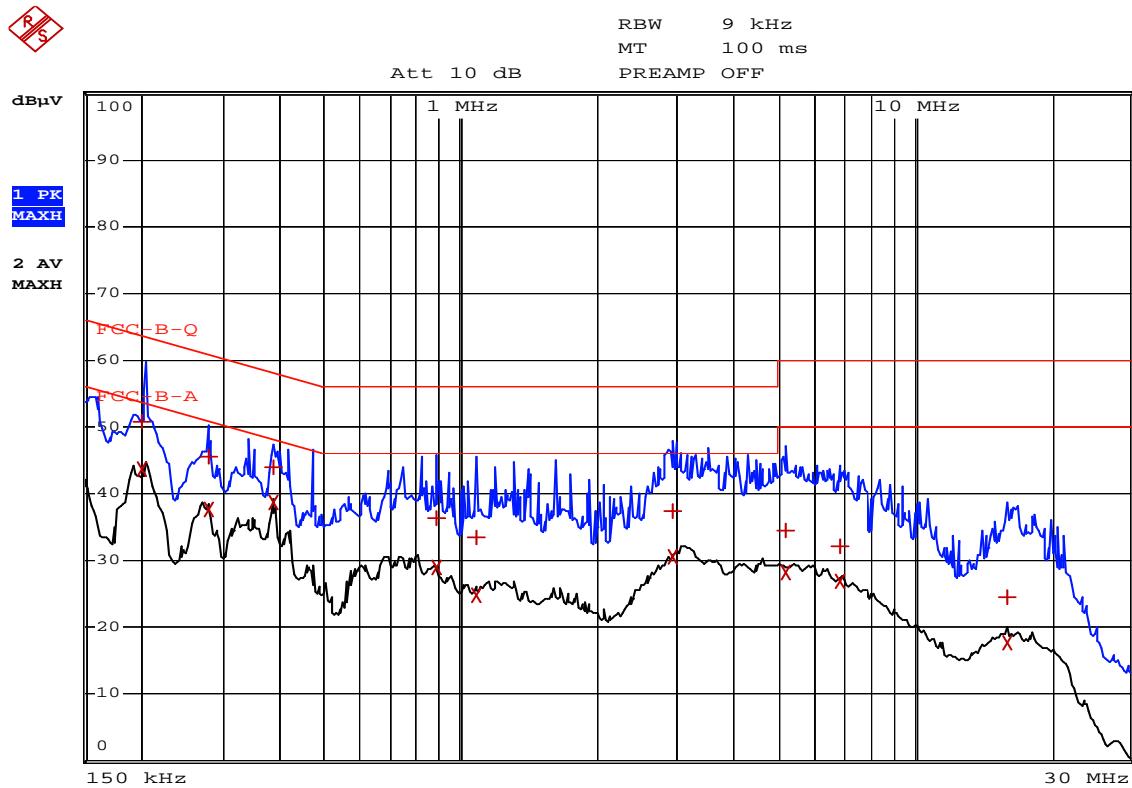
Frequency (MHz)	Mode	Hot/Neutral (H/N)	Measured Value (dB μ V)	Correction Factor (dB)	Cable Loss (dB)	Emission Level (dB μ V)	Limit (dB μ V)	Margin (dB)
0.20	Qausi-peak	H	50.82	0.05	0.04	50.91	63.61	12.70
	Average		43.69			43.78	53.61	9.83
0.21	Qausi-peak	N	43.67	0.03	0.04	43.74	63.21	19.47
	Average		36.85			36.92	53.21	16.29
0.28	Qausi-peak	H	45.50	0.05	0.05	45.60	60.82	15.22
	Average		27.76			27.86	50.82	22.96
0.39	Qausi-peak	H	43.88	0.04	0.00	43.92	58.06	14.14
	Average		38.82			38.86	48.06	9.20
0.89	Qausi-peak	H	36.41	0.04	0.09	36.54	56.00	19.46
	Average		-			-	-	-
1.08	Qausi-peak	H	33.48	0.04	0.10	33.62	56.00	22.38
	Average		-			-	-	-
1.32	Qausi-peak	N	38.31	0.04	0.12	38.47	56.00	17.53
	Average		30.57			30.73	46.00	15.27
1.75	Qausi-peak	N	38.43	0.05	0.14	38.62	56.00	17.38
	Average		-			-	-	-
2.95	Qausi-peak	H	37.48	0.07	0.20	37.75	56.00	18.25
	Average		30.61			30.88	46.00	15.12
2.97	Qausi-peak	N	41.55	0.06	0.20	41.81	56.00	14.19
	Average		-			-	-	-
5.20	Qausi-peak	H	34.47	0.09	0.31	34.87	60.00	25.13
	Average		-			-	-	-
5.69	Qausi-peak	N	29.51	0.10	0.32	29.93	60.00	30.07
	Average		-			-	-	-
6.88	Qausi-peak	H	32.22	0.12	0.37	32.71	60.00	27.29
	Average		-			-	-	-
7.60	Qausi-peak	N	29.15	0.12	0.38	29.65	60.00	30.35
	Average		-			-	-	-
16.10	Qausi-peak	H	24.49	0.22	0.56	25.27	60.00	34.73
	Average		17.74			18.52	50.00	31.48
18.17	Qausi-peak	N	20.79	0.24	0.59	21.62	60.00	38.38
	Average		14.82			15.65	50.00	34.35

1. Margin (dB) = Limit – Emission Level

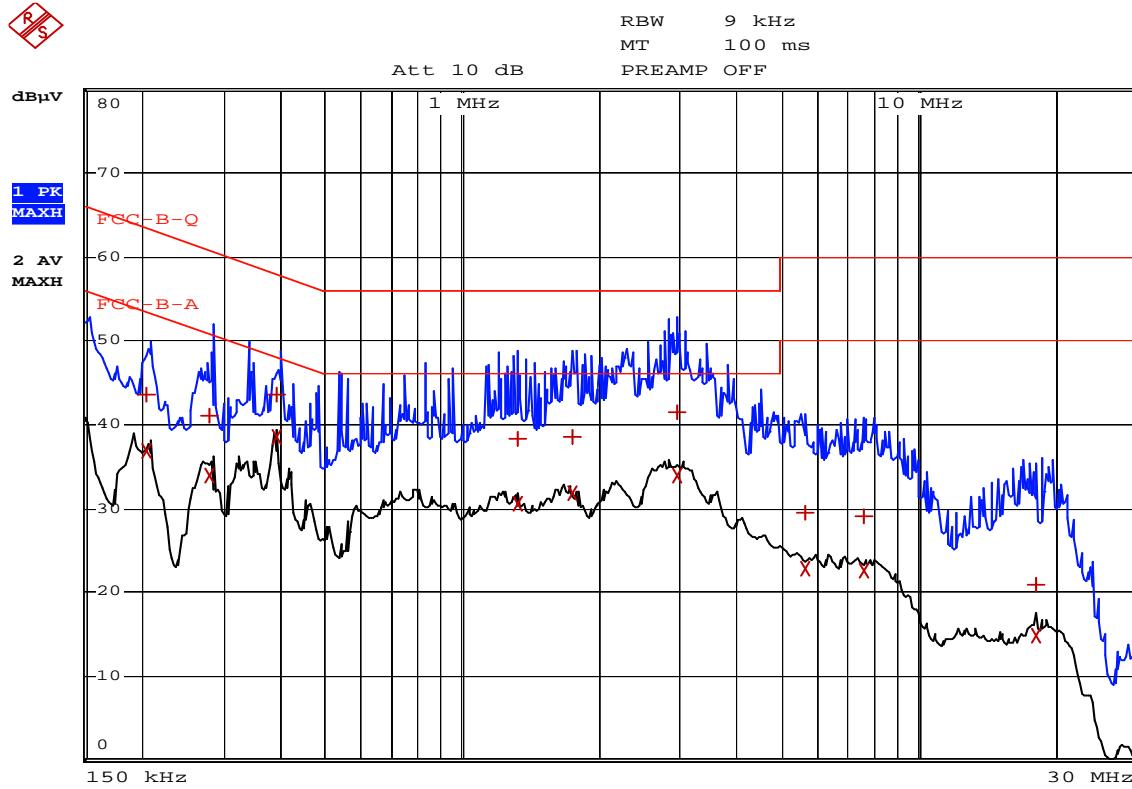
2. Emission Level = Measured Value + CF + CL

6.6.4 Plot of the AC Power Line Conducted Emissions

HOT LINE



NEUTRAL LINE



6.7 RECEIVER SPURIOUS EMISSIONS

6.7.1 Regulation

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (μ V/m @ 3m)	Field strength (dB μ V/m @ 3m)
30–88	100.0	40.0
88–216	150.0	43.5
216–960	200.0	46.0
Above 960	500.0	54.0

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

6.7.2 Test Condition

- Detector mode : CISPR Quasi - Peak mode (6dB Bandwidth : 120 kHz)
- The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

6.7.3 Test Results : PASS

Table 7 : Measured values of the Field strength of spurious emission (Receiver mode)

Frequency (MHz)	Detect Mode	Polarization (V/H)	Emission Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
Quasi-peak data, emissions below 1000 MHz					
All radiated results are exist under 20dB below than the limit					
Peak/Average data, emissions above 1000 MHz					
All radiated results are exist under 20dB below than the limit					

1. Margin (dB) = Limit – Emission Level

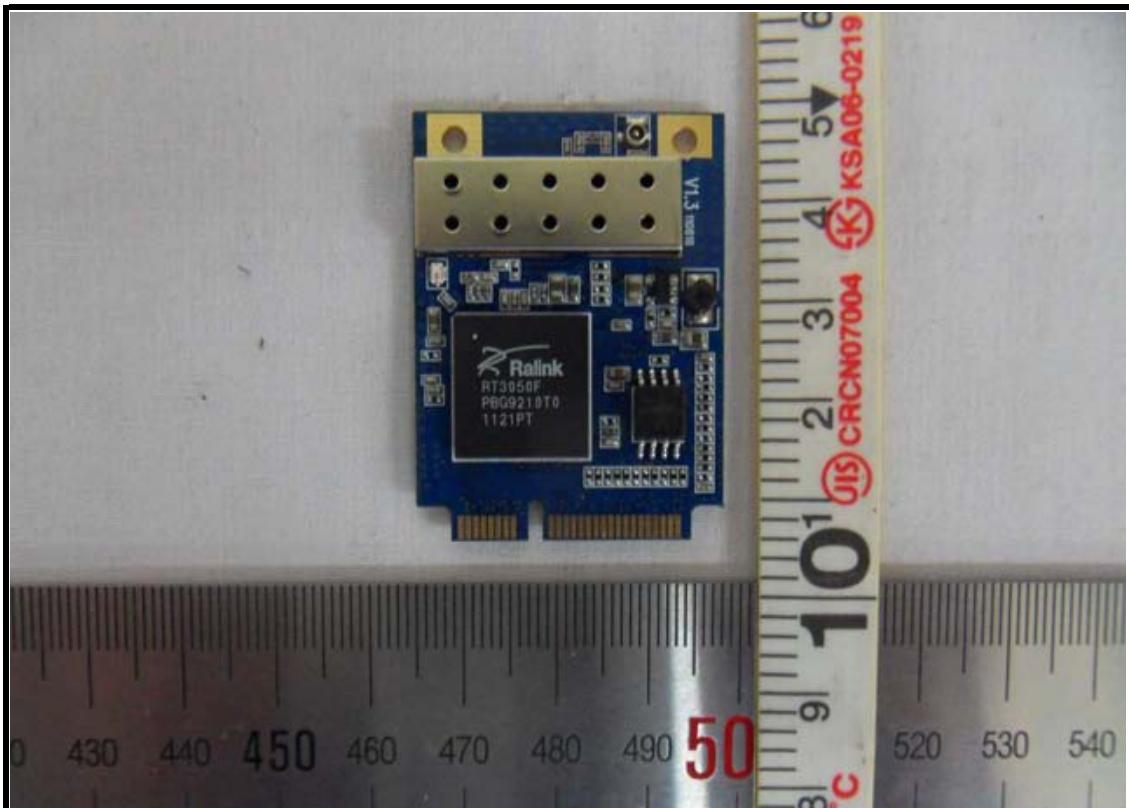
2. H = Horizontal, V = Vertical Polarization

7. Test Equipment Used For Test

Used equipment	Description	Manufacturer	Model Name	Serial Number	Specifications	Next Cal. Data
■	Spectrum Analyzer	ADVANTEST	R3273	101102518	100Hz ~ 26.5GHz	2012-10-13
□	MICROWAVE FREQUENCY COUNTER	ANRITSU	MF2414B	6200003197	10Hz ~ 26.5GHz	2012-10-04
□	EPM-P SERIES POWER METER	Agilent	E4416A	GB38272722	1CH 100-240VAC	2012-10-04
□	Power Sensor	Agilent	8481A	US41030240	MAX.23dBm AVG, 18GHz	2012-10-14
□	Signal Generator	ROHDE&SCHWARZ	SMIQ03B	832870/056	300kHz ~ 3.3GHz	2012-10-04
□	Signal Generator	AGILENT	83732B	US37101885	10MHz ~ 20GHz	2013-01-16
□	Modulation Analyzer	HP	8901B	3028A02980	150kHz-1.3GHz	2012-10-13
□	Audio Analyzer	HP	8903B	3729A17164	20Hz-100kHz	2012-10-04
□	Attenuator	Weinschel	41-6-12	21644	6dB, 10W	2012-10-13
□	Attenuator	Weinschel	41-10-12	13218	10dB, 10W	2012-10-13
□	Dual Directional Coupler	HP	778D	15923	20dB Coupler	2012-10-04
□	Dual Directional Coupler	AGILENT	11691D	1212A01281	18GHz 20dB	2013-02-29
□	BT SIMULATOR	TESCOM CO. LTD	TC-3000A	3000A4C0158	100-240VAC 50/60Hz 40W	2012-10-06
□	Power Divider	H.P	11636B	07317	DC-26.5GHz	2012-10-13
□	Power Divider	H.P	11636B	07412	DC-26.5GHz	2012-10-13
■	Test receiver	ROHDE&SCHWARZ	ESPI3	101171	9kHz~3GHz	2012-08-12
■	BI-LOG ANT	SCHWARZBECK	VULB9163	398	30MHz~1GHz	2013-10-03
□	Loop Antenna	EMCO	6502	9801-3191	9KHz~30MHz	2014-02-02
■	Horn antenna	Schwarzbeck	BBHA 9120D	769	1GHz ~ 18GHz	2013-03-22
■	Horn antenna	Schwarzbeck	BBHA 9120D	768	1GHz ~ 18GHz	2013-03-22
■	Spectrum Analyzer	ROHDE&SCHWARZ	FSPI3	100640	9kHz ~ 13.6GHz	2013-01-04
■	Amplifier	TESTEK	TS-PA2	120005	500MHz~18GHz	2013-03-01
□	DC Power Supply	ODA Tech	OPE-505S	oda-01-0923-03430	1CH 50V 5A	-
□	Slidacs	Daekwang	-	-	5KVA, OUTPUT:AC:0~300V	-
□	DC Power Supply	Maynuo	M8811	080010960011103046	30V 5A	2012-08-16
□	Digital Mutil Meter	UTI	DMSC 683A	06086830042	750V 10A	-
□	Digital Mutil Meter	FLUKE	8842A	5126272	1000V 2A	2012-08-11
□	Continuous operation tester	-	-	-	MAX 9990시간	2013-03-11
□	Vibration Tester	Gana	GNV-500	-	0~60Hz/50Kg	2012-10-04
□	HUMIDITY CHAMBER	BUM JIN Eng.	-	-	-40~120°C 95%	2012-09-16
□	Drop Tester	JUNG JIN Eng.	-	-	0-120Cm	-
■	Test Receiver	R&S	ESPI3	101171	9kHz ~ 1.3GHz	2012-08-12
■	ARTIFICIAL MAINS NETWORK	SCHWARZBECK	NSLK 8127	8127518	9kHz ~ 30MHz	2012-10-04

8. EUT Photographs

8.1 Front view



8.2 Back view

