

# TEST REPORT

of

FCC Part 15 Subpart B&C §15.247/RSS-210 Issue 7, RSS-Gen Issue 2

FCC ID/IC Certification: LW5SP5700/3114-SP5700

Equipment Under Test : Industrial Mobile Computer  
Model Name : OptimusPDA SP5700 Series  
Serial No. : N/A  
Applicant : Metrologic Instruments, Inc.  
Manufacturer : InnoTeletek, Inc.  
Date of Test(s) : 2007-11- 20~ 2008-01-10  
Date of Issue : 2008-02-04

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Date

2008-02-04

Feel Jeong

Approved By



Date

2008-02-04

Denny Ham

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## **Appendix A-1. Photo of Spurious Emission Test**

## **Appendix A -2. Photos of Conducted Power Line Test**

## **Appendix A -3. Photo of RF Conducted Measurement setup**

## **Appendix B. Photos of the EUT**

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## 1. General Information

### 1.1. Testing Laboratory

SGS Testing Korea Co., Ltd.

- 705, Dongchun-Dong Sooji-Gu, Yongin-Shi, Kyungki-Do, South Korea.

[www.electrolab.kr.sgs.com](http://www.electrolab.kr.sgs.com)

Telephone : +82 +31 428 5700

FAX : +82 +31 427 2371

### 1.2. Details of Applicant

Applicant : Metrologic Instruments, Inc.  
Address : P.O. Box 307, Bellmawr, New Jersey, USA 08099-0307  
Contact Person : Sandeep Unni  
Phone No. : +1 856 228 8100  
Fax No. : +1 856 228 6673

### 1.3. Description of EUT

<b>Kind of Product</b>	Industrial Mobile Computer
<b>Model Name</b>	OptimusPDA SP5700 Series
<b>Serial Number</b>	N/A
<b>Power Supply</b>	DC 3.7 V
<b>Frequency Range</b>	2412 MHz ~ 2462 MHz(11b/g), 2402 MHz ~ 2480 MHz(Bluetooth) 824.2 MHz ~ 848.8 MHz(GSM 850), 1850.2 MHz ~ 1909.8 MHz(GSM 1900)
<b>Modulation Technique</b>	DSSS(11b), OFDM(11g), FHSS(Bluetooth), GMSK, 8-PSK
<b>Number of Channels</b>	11 CH(11b/g), 79 CH(Bluetooth), 300(GSM 1900), 125(GSM 850)
<b>Operating Conditions</b>	-20 ~ 55
<b>Antenna Type</b>	Polded Type(GSM), Plate Type(W-LAN), Chip Type(BT)
<b>Antenna Gain</b>	-1.24 dBi(GSM 850), -0.38dBi(GSM 1900), 1.86 dBi(BT), -2.47 dBi(W-LAN)

\* This sample uses one of each Symbol laser scan engine (Model: SE-955), HHP scan engine (Model: 5000 LED Aimer), and VuQuest scan engine (Model: IS4910). These 3 kind of scan engine doesn't give any effect on radio characteristics, so we evaluated EMI test only for these 3 kind of scan engines.

### 1.4. Details of modification

-N/A

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### 1.5. Test Equipment List

EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Signal Generator	Agilent	E4438C	May 2008
Spectrum Analyzer	R&S	FPS40	Dec. 2008
Highpass Filter	Wainwright	WHK3.0/18G-10SS	Dec.2008
Pre-amplifier	Agilent	8449B	May 2008
Amplifier	HP	8447F	Sep. 2008
Attenuator	Agilent	8494B	May 2008
Two-Line V-Network	Rohde & Schwarz	ENV216	Jan. 2009
Test Receiver	Rohde & Schwarz	ESVS10	Apr. 2008
Test Receiver	Rohde & Schwarz	ESHS10	Sep. 2008
Ultra-Broadband Antenna	Rohde & Schwarz	HL562	Oct. 2009
Horn Antenna	Electro-Metrics	RGA-60	Jul. 2008
Anechoic Chamber	SY Corporation	L 6.5 W 3.5 H 3.5	Aug. 2008

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## 1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

<b>APPLIED STANDARD:FCC Part15, RSS-210,RSS-Gen</b>			
<b>Section in FCC 15</b>	<b>Section in RSS-210 RSS-Gen</b>	<b>Test Item</b>	<b>Result</b>
15.207	RSS-Gen 7.2.2	Transmitter AC Power Line Conducted Emission	Complied
15.107	RSS-Gen 7.2.2	Receiver AC Power Line Conducted Emission	Complied
15.205(a) 15.209(a) 15.247(d)	RSS-210 A8.5	Transmitter Radiated Spurious Emissions Conducted Spurious Emission	Complied
15.109(a)	RSS-Gen 7.2.3.2	Receiver Radiated Spurious Emission	complied
15.247(a)(2)	RSS-210 A8.2(1)	6 dB Bandwidth and 99% BW	complied
15.247(b)(3)	RSS-210 A8.4(4)	Maximum Peak Output Power	Complied
15.247(e)	RSS-210 A8.2(2)	Power Spectral Density	Complied

## 1.7. Conclusion of worst-case and operation mode

The EUT has three type of Scan Engine (Symbol laser, hhp scanner, VuQuest scanner).

The test was tested to the worst case of three type of Scan Engine (Symbol laser, hhp scanner, VuQuest scanner).

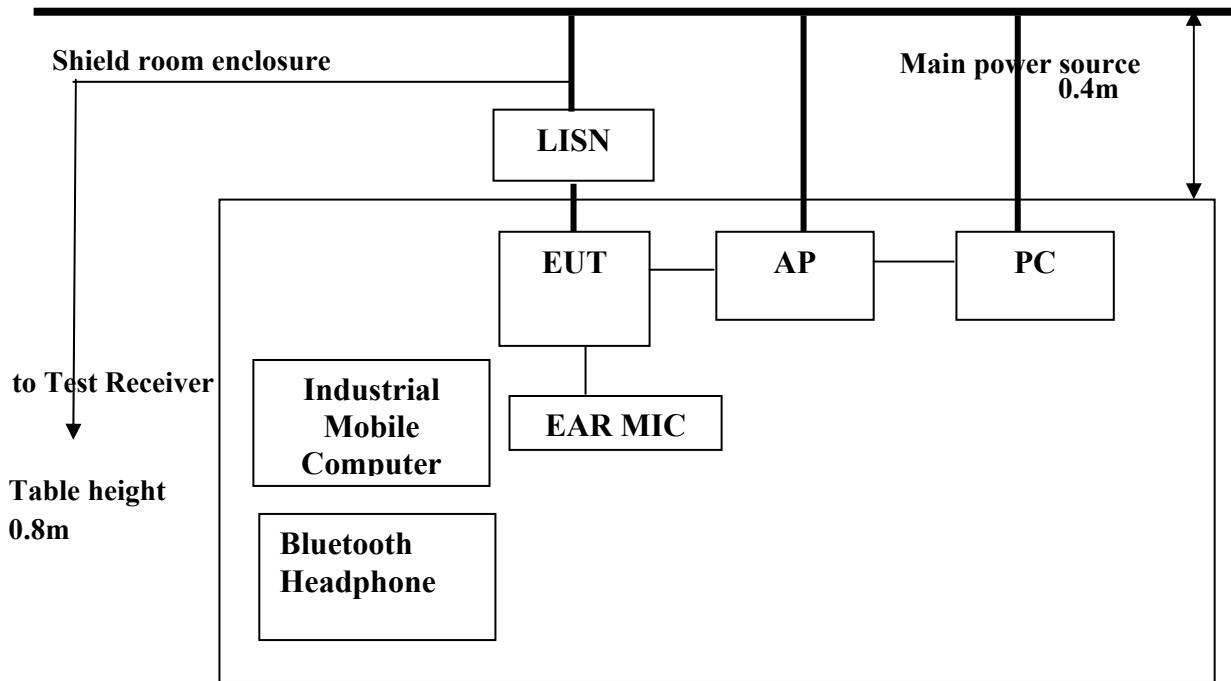
The field strength of spurious emission was measured in three orthogonal EUT positions(X-axis, Y-axis and Z-axis).

The highest emission of EUT position is Z-axis.

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## 2. Transmitter AC Power Line Conducted Emission

### 2.1. Test Setup



### 2.2. Limit

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 uH/50 ohm line impedance stabilization network(LISN).

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

Frequency of Emission (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

\* Decreases with the logarithm of the frequency.

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### 2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5m × 3.6m × 3.6m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0m(W)× 1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

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## 2.4. Test Results( Worst case)

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line;

Ambient temperature : 22 Relative humidity : 43 %

Frequency range : 0.15 MHz – 30 MHz

Measured Bandwidth : 9 kHz

FREQ. (MHz)	LEVEL(dBuV)		LINE	LIMIT(dBuV)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.20	47.50	31.00	N	63.61	53.61	16.11	22.61
0.47	17.60	15.60	N	56.60	46.60	39.00	31.00
4.19	14.00	12.30	N	56.00	46.00	42.00	33.70
4.99	14.00	12.30	N	56.00	46.00	42.00	33.70
19.06	16.10	13.80	N	60.00	50.00	43.90	36.20
24.75	34.70	29.70	N	60.00	50.00	25.30	20.30
0.20	48.90	32.40	H	63.61	53.61	14.71	21.21
0.47	19.30	16.90	H	56.60	46.60	37.30	29.70
4.19	14.60	12.60	H	56.00	46.00	41.40	33.40
4.99	14.20	12.30	H	56.00	46.00	41.80	33.70
19.06	19.40	15.30	H	60.00	50.00	40.60	34.70
24.75	20.60	16.20	H	60.00	50.00	39.40	33.80

Note ;

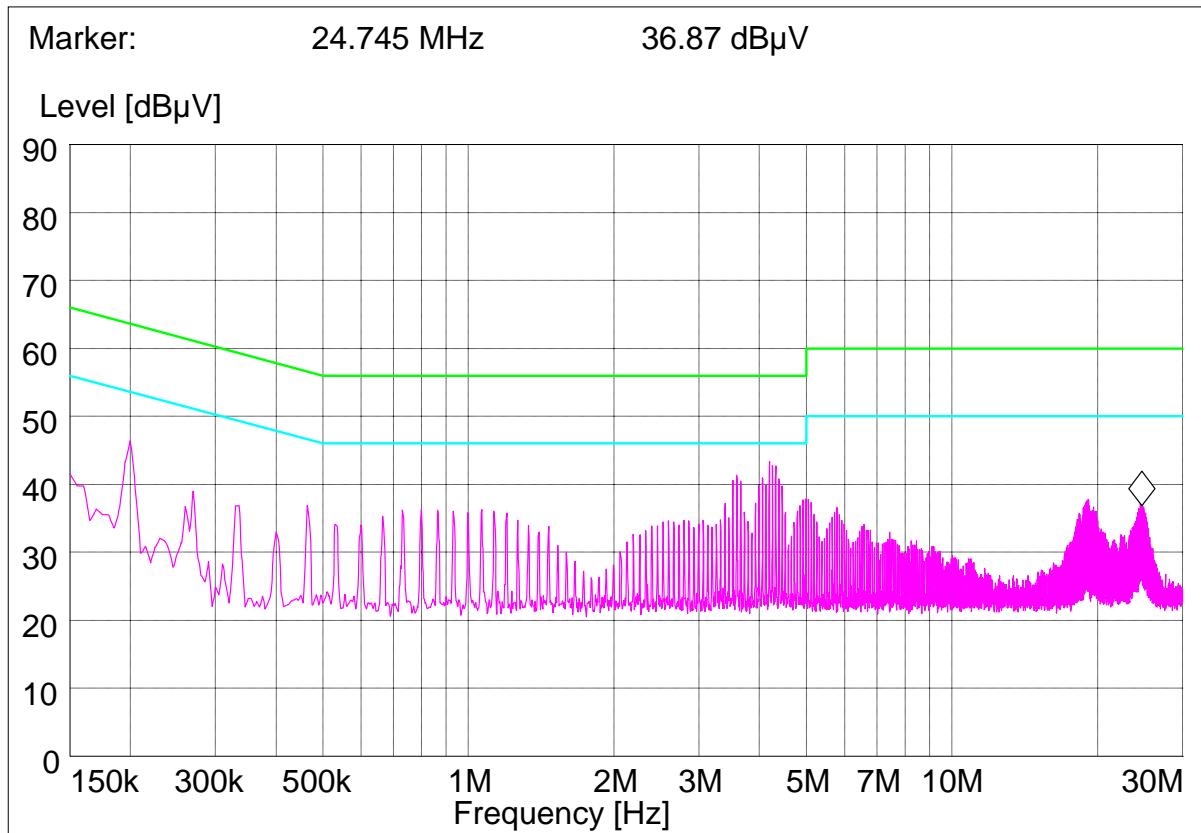
Line ( H ) : Hot

Line ( N ) : Neutral

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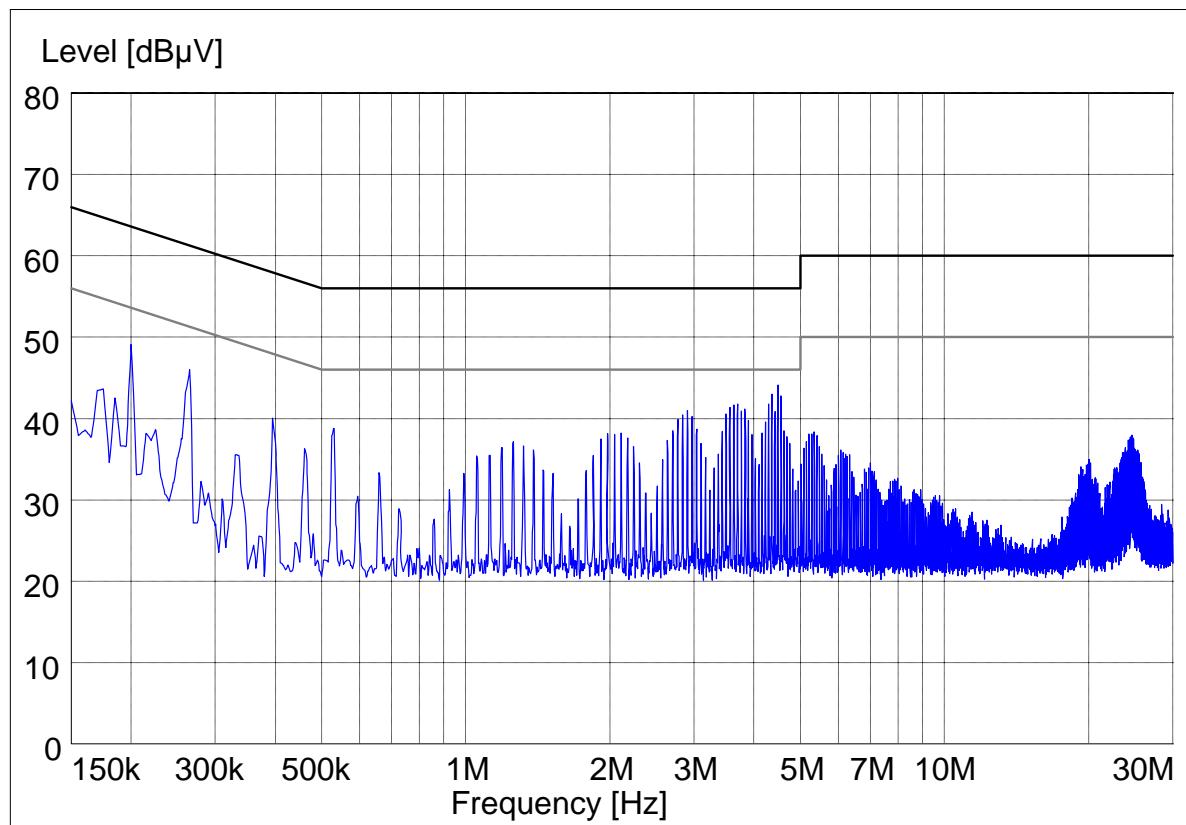
### Plot of Conducted Power line

Test mode : (Hot)



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Test mode : (Neutral)



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### 3. Receiver AC Power Line Conducted Emission

#### 3.1. Test Setup- Same as clause 2.1.

#### 3.2. Limit

According to §15.107(a) Except for Class A digital devices, for equipment 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  $\mu$ H/50 ohms 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 band edges.

Frequency of Emission (MHz)	Conducted limit (dB $\mu$ V)	
	Qausi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

\* Decreases with the logarithm of the frequency.

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### 3.3. Test Procedures- Same as clause 2.3.

### 3.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line;

Ambient temperature : 22 Relative humidity : 43 %

Frequency range : 0.15 MHz – 30 MHz

Measured Bandwidth : 9 kHz

FREQ. (MHz)	LEVEL(dBuV)		LINE	LIMIT(dBuV)		MARGIN(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.19	46.30	36.20	N	64.04	54.04	17.74	17.84
0.33	34.10	25.40	N	59.45	49.45	25.35	24.05
1.79	30.20	24.10	N	56.00	46.00	25.80	21.90
1.98	31.20	26.20	N	56.00	46.00	24.80	19.80
14.15	41.20	37.10	N	60.00	50.00	18.80	12.90
14.51	38.90	33.50	N	60.00	50.00	21.10	16.50
0.19	49.30	37.80	H	64.04	54.04	14.74	16.24
0.33	33.70	24.50	H	59.45	49.45	25.75	24.95
1.79	29.80	25.40	H	56.00	46.00	26.20	20.60
1.98	30.10	25.60	H	56.00	46.00	25.90	20.40
14.15	39.20	37.80	H	60.00	50.00	20.80	12.20
14.51	37.00	34.10	H	60.00	50.00	23.00	15.90

Note ;

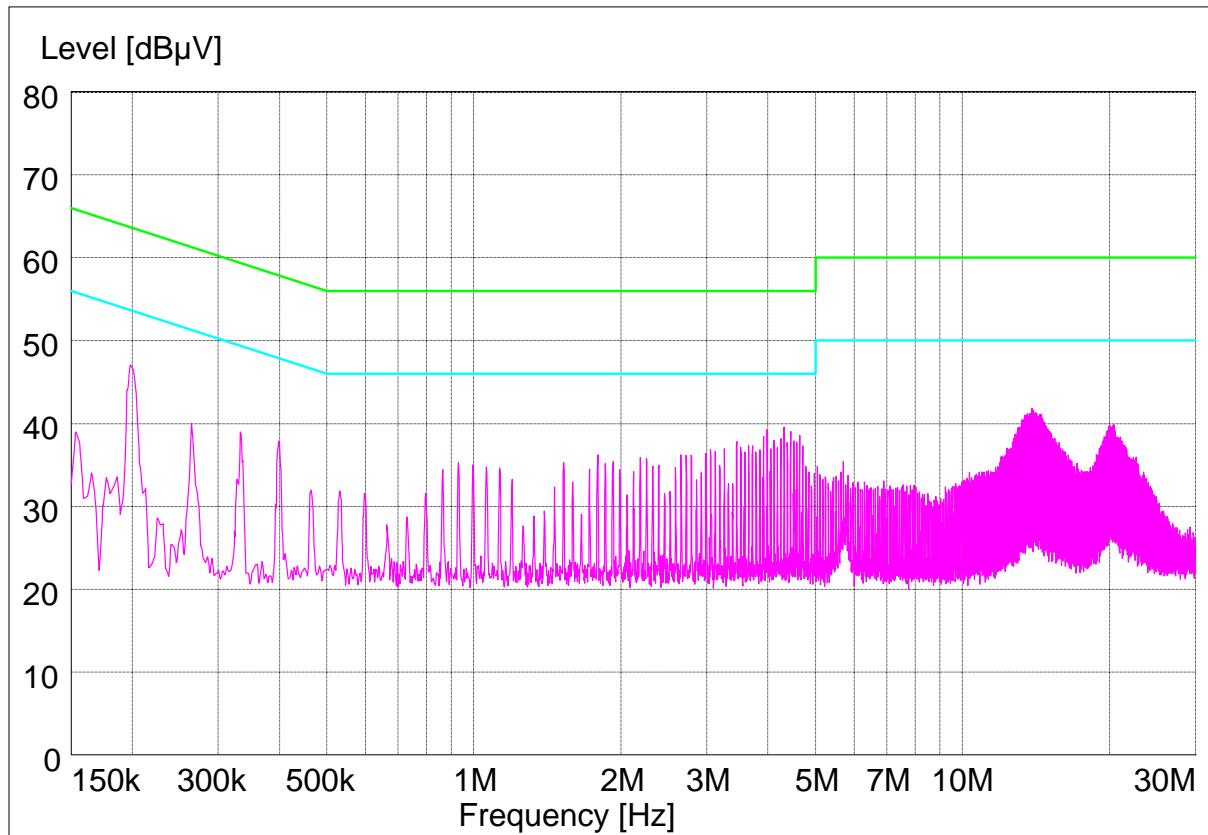
Line ( H ) : Hot

Line ( N ) : Neutral

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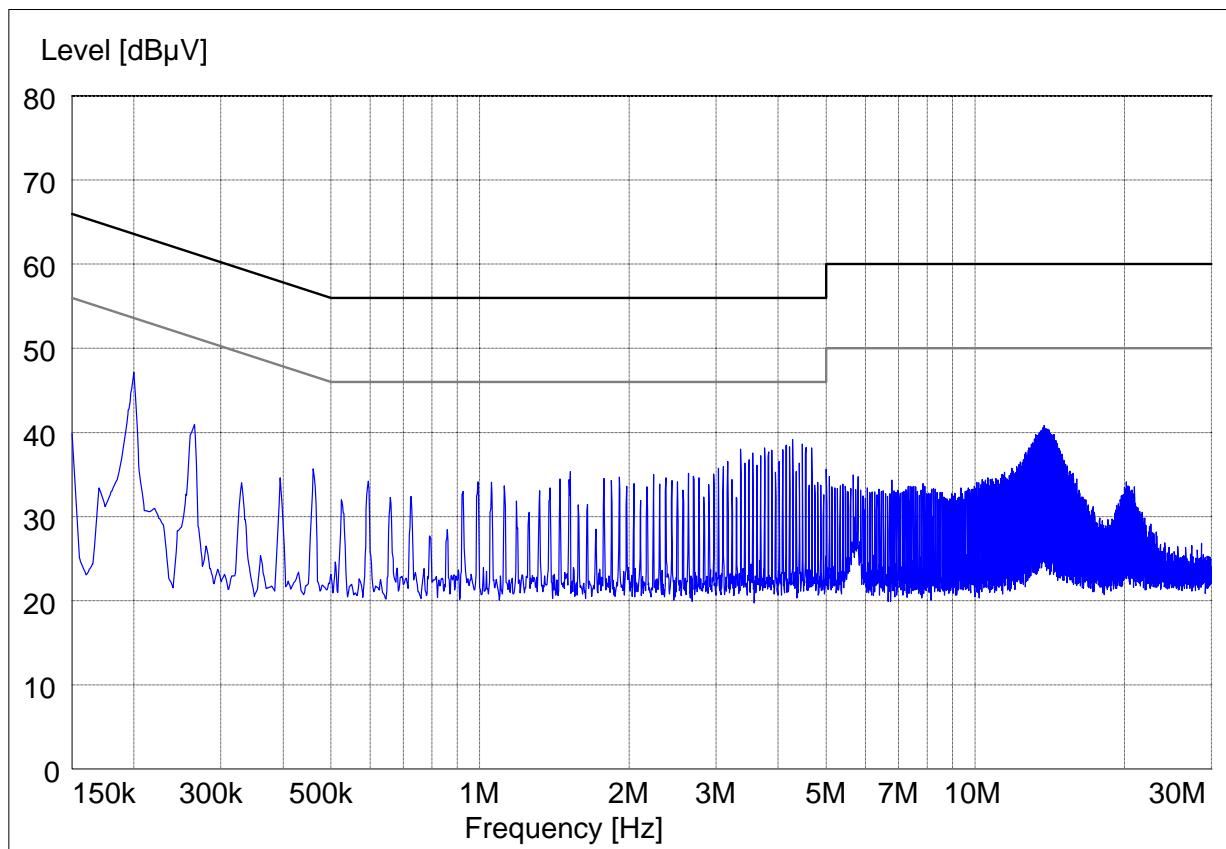
### Plot of Conducted Power line

Test mode : (Hot)



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Test mode : (Neutral)



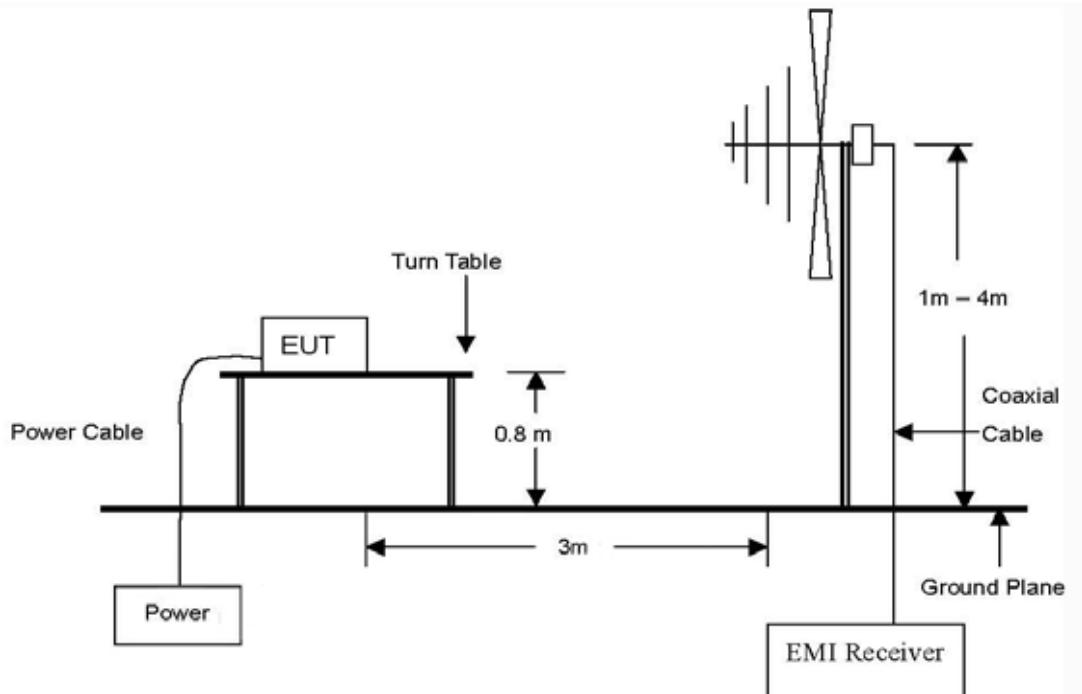
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## 4. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

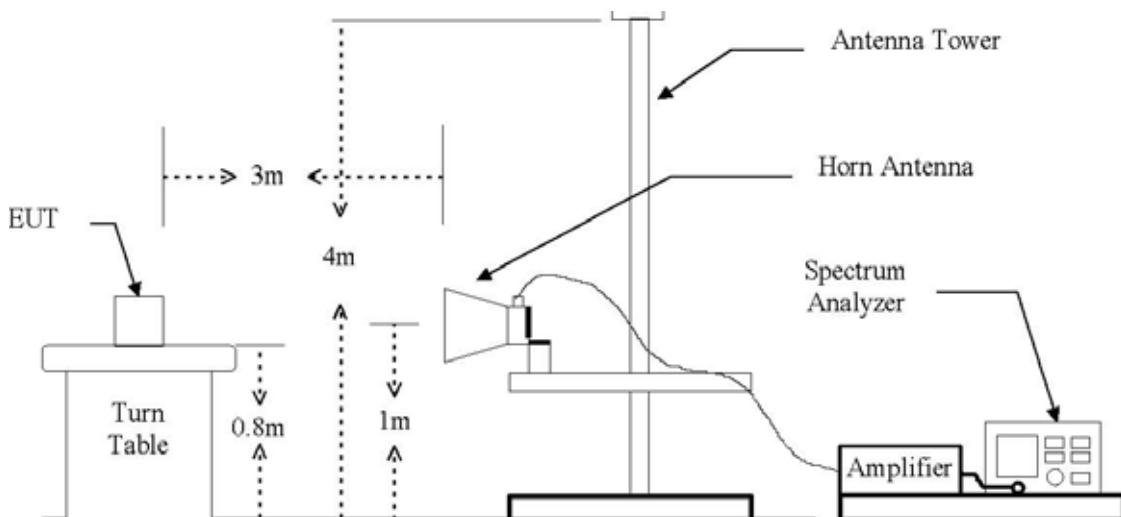
### 4.1. Test Setup

#### 4.1.1. Transmitter Radiated Spurious Emissions

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 24 GHz Emissions.



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#### 4.1.2. Conducted Spurious Emissions



#### 4.2. Limit

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

According to § 15.109(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
Above 960	3	54.0	500

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

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### 4.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

#### 4.3.1. Test Procedures for Radiated Spurious Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE :

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection and frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

#### 4.3.2. Test Procedures for Conducted Spurious Emissions

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 kHz, VBW=100 kHz.

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#### 4.4. Test Results

Ambient temperature : 20 Relative humidity : 45 %

##### 4.4.1. Spurious Radiated Emission ( Worst case )

The frequency spectrum from 30 MHz to 1000 MHz was investigated. All emissions are not reported much lower than the prescribed limits.

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
117.300	11.54	Q.P.	V	9.59	1.38	22.51	43.50	20.99
139.125	13.32	Q.P.	V	8.07	1.53	22.92	43.50	20.58
481.050	18.58	Q.P.	V	15.56	2.93	37.07	46.00	8.93
505.300	17.50	Q.P.	V	15.57	2.98	36.05	46.00	9.95
529.550	16.34	Q.P.	H	15.91	3.04	35.29	46.00	10.71
912.700	17.82	Q.P.	H	20.65	4.09	42.56	46.00	3.44
Above 920.000	Not Detected	-	-	-	-	-	-	-

##### Remark:

1. All spurious emission at channels are almost the same below 1 GHz, so that the channel was chosen at representative in final test.
2. “\*” means the restricted band.
3. Actual = Reading + AF + CL

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#### 4.4.2. Spurious Radiated Emission

The frequency spectrum above 1000 MHz was investigated. All emissions are not reported much lower than the prescribed limits.

##### 4.4.2.1. DSSS : 802.11b

###### A. Low Channel (2412 MHz)

Radiated Emissions			Ant	Antenna Factor	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	2Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2390.00*	47.26	P	H	28.06	-28.19	47.13	74.00	26.87
4824.00	35.21	P	H	32.91	-24.85	43.27	74.00	30.73
Above 5000.00	Not Detected	-	-	-	-	-	-	-

###### B. Middle Channel (2437 MHz)

Radiated Emissions			Ant	Antenna Factor	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4874.00	35.48	P	H	32.93	-25.04	43.37	74.00	30.63
Above 5000.00	Not Detected	-	-	-	-	-	-	-

###### C. High Channel (2462 MHz)

Radiated Emissions			Ant	Antenna Factor	Correction Factors	Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.50*	48.74	P	H	28.34	-28.14	48.94	74.00	25.06
4924.00	34.85	P	H	32.95	-25.06	42.74	74.00	31.26
Above 5000.00	Not Detected	-	-	-	-	-	-	-

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#### 4.4.2.2. OFDM : 802.11g

##### A. Low Channel (2412 MHz)

Radiated Emissions			Ant	Antenna Factor	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2390.00*	53.20	P	H	28.06	-28.19	53.08	74.00	20.93
4824.00	35.63	P	H	32.91	-24.85	43.69	74.00	30.31
Above 5000.00	Not Detected	-	-	-	-	-	-	-

##### B. Middle Channel (2437 MHz)

Radiated Emissions			Ant	Antenna Factor	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4874.00	35.19	P	H	32.93	-25.04	43.08	74.00	30.92
Above 5000.00	Not Detected	-	-	-	-	-	-	-

##### C. High Channel (2462 MHz)

Radiated Emissions			Ant	Antenna Factor	Correction Factors	Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2483.50*	53.99	P	H	28.34	-28.14	54.19	74.00	19.81
2483.50*	39.40	A	H	28.34	-28.14	39.60	54.00	14.40
4909.38	34.91	P	H	32.95	-25.06	42.80	74.00	31.20
Above 5000.00	Not Detected	-	-	-	-	-	-	-

Remarks :

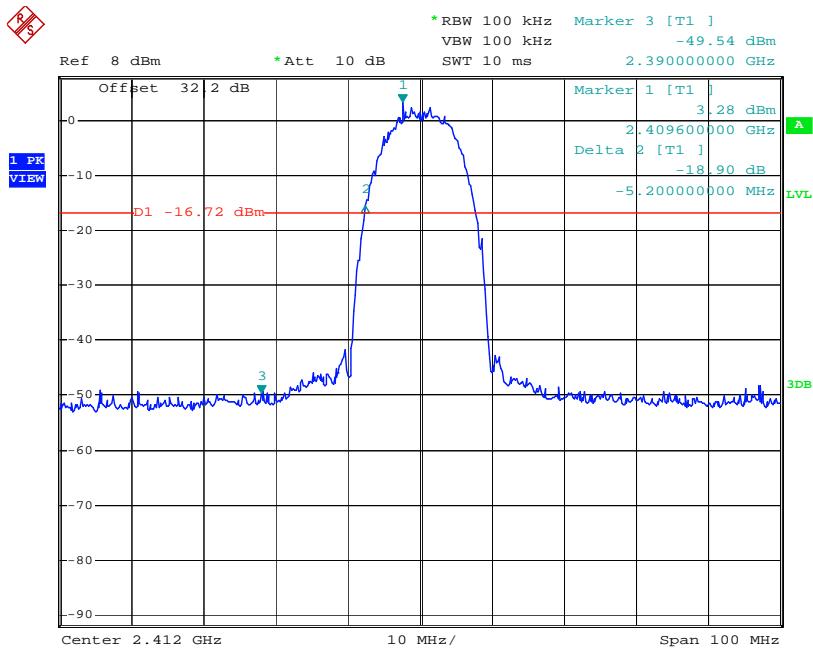
- “\*” means the restricted band.
- Measuring frequencies from 1 GHz to the 10<sup>th</sup> harmonic of highest fundamental Frequency.
- Radiated emissions measured in frequency above 1000 MHz were made with an instrument using peak/average detector mode.
- Average test would be performed if the peak result were greater than the average limit.
- Actual = Reading + AF + Amp Gain + CL

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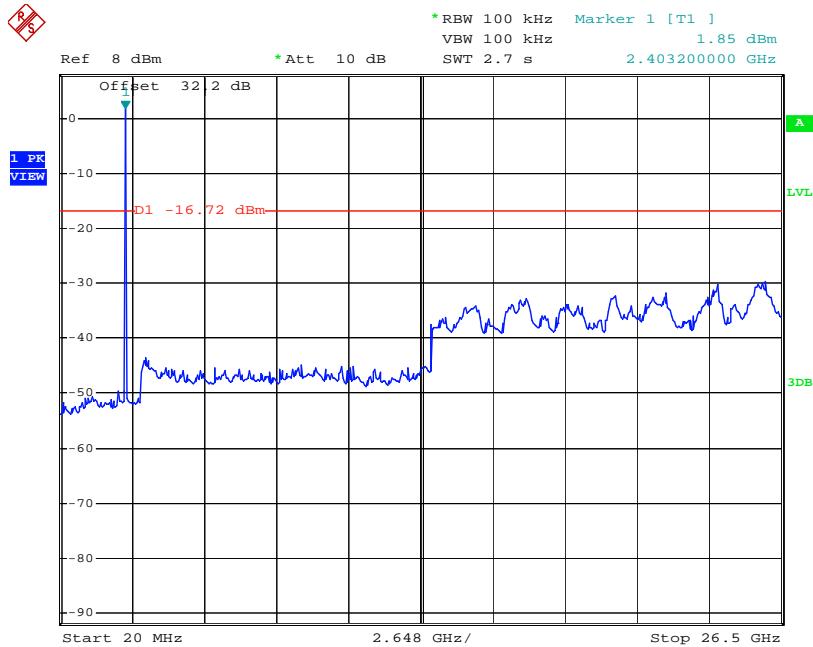
#### 4.4.3. Spurious RF Conducted Emissions: Plot of Spurious RF Conducted Emission

##### 4.4.3.1 DSSS : 802.11b

Low Channel



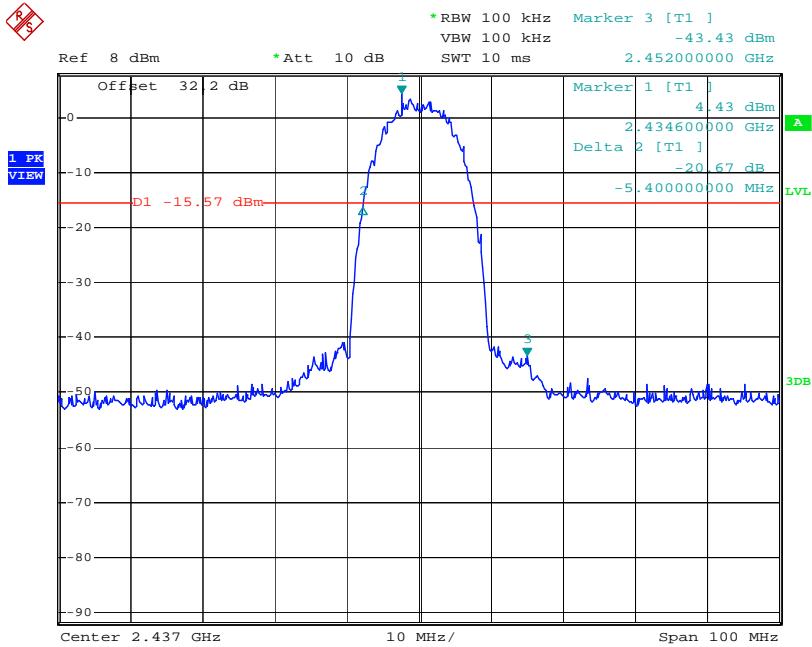
Date: 22.NOV.2007 16:26:39



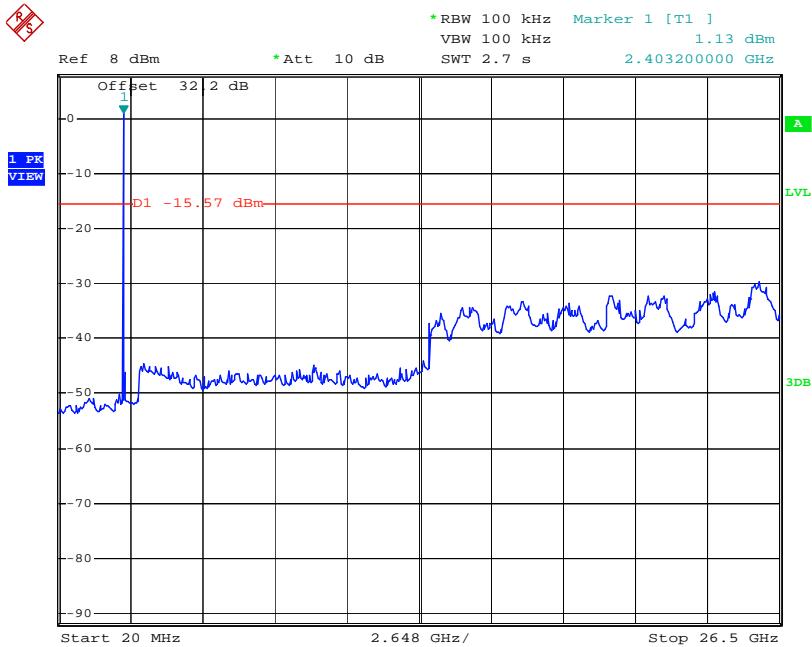
Date: 22.NOV.2007 16:27:57

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Middle Channel



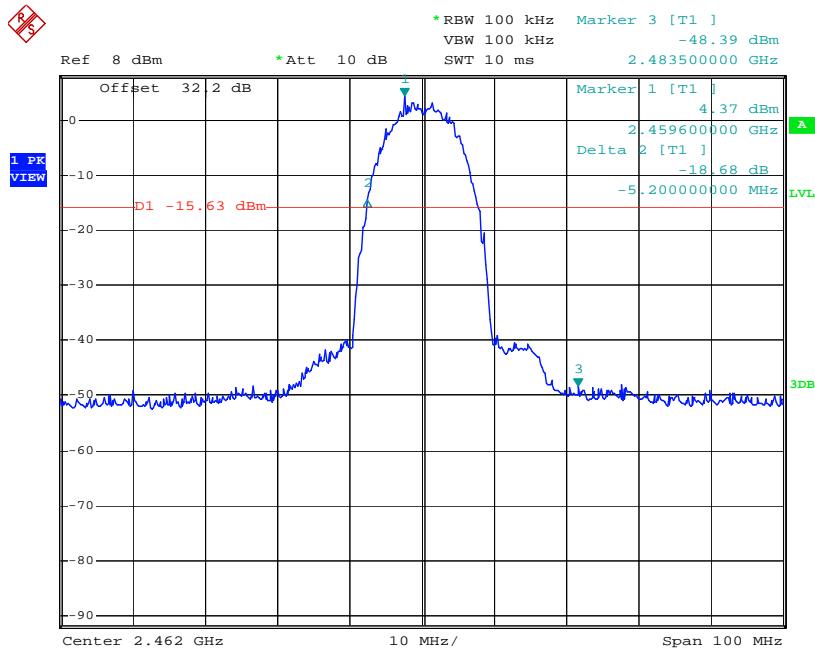
Date: 22.NOV.2007 16:30:18



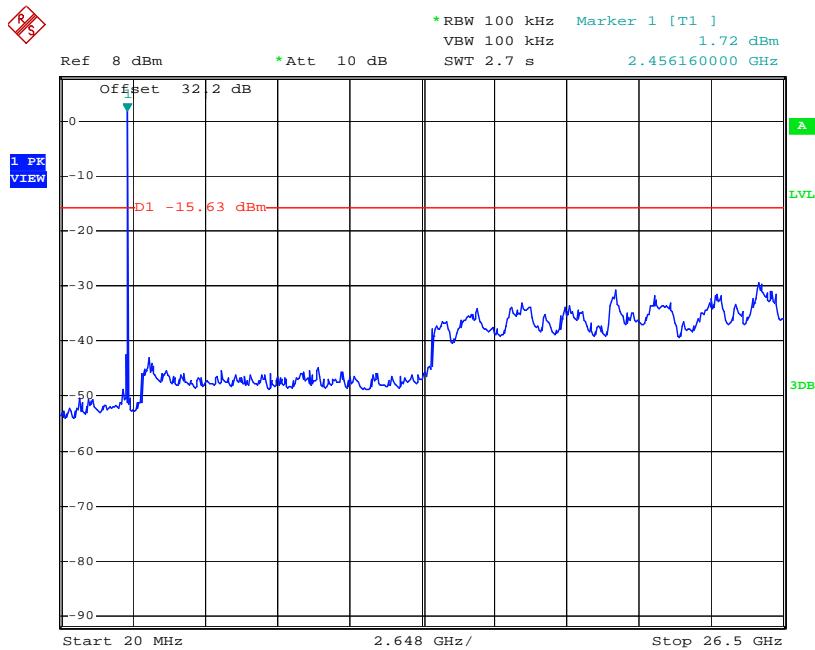
Date: 22.NOV.2007 16:31:25

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High Channel



Date: 22.NOV.2007 16:33:34

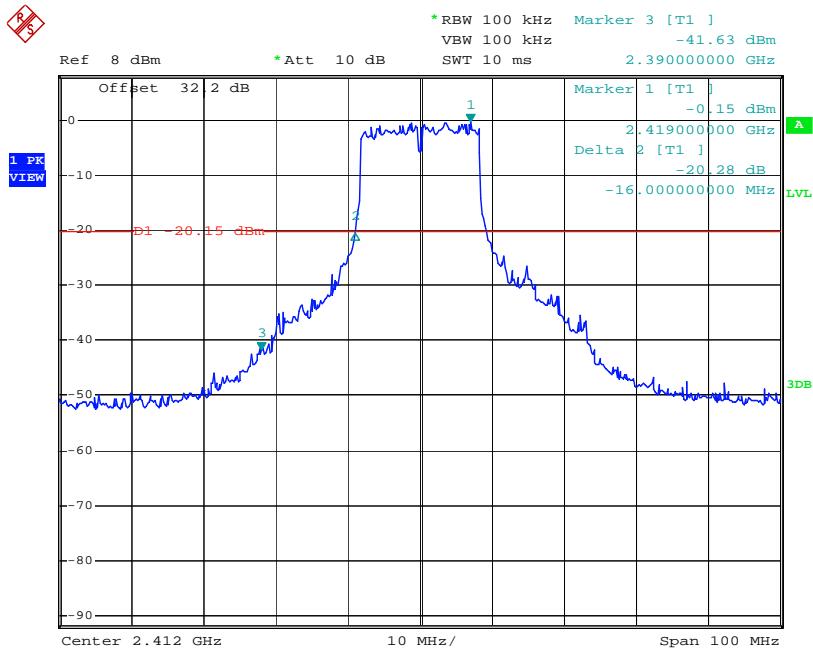


Date: 22.NOV.2007 16:34:34

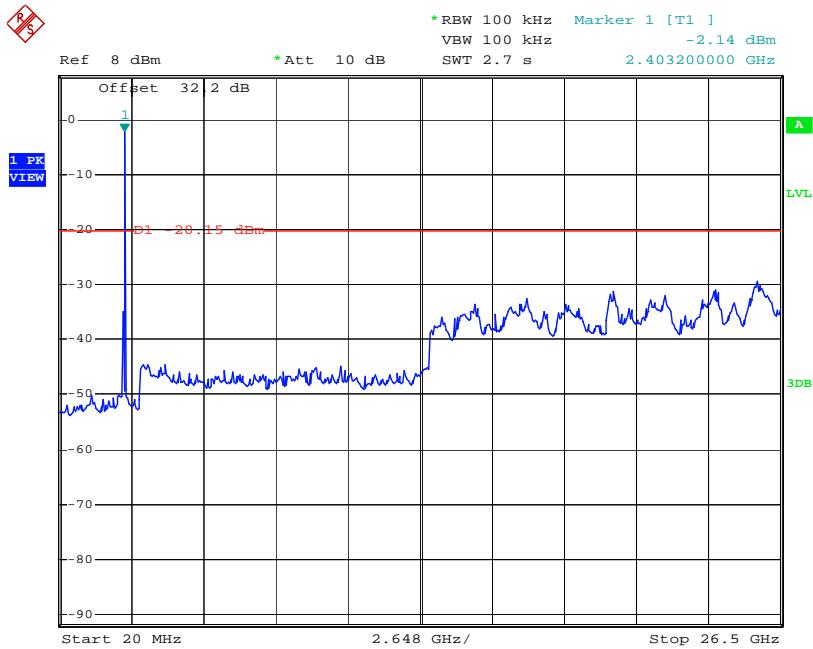
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

#### 4.4.3.2 OFDM : 802.11g

Low Channel



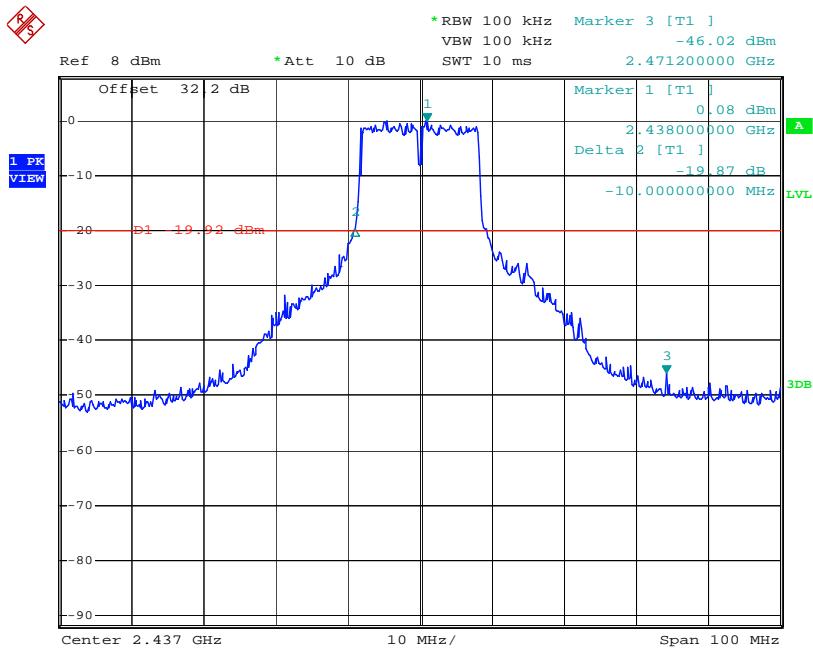
Date: 22.NOV.2007 16:37:57



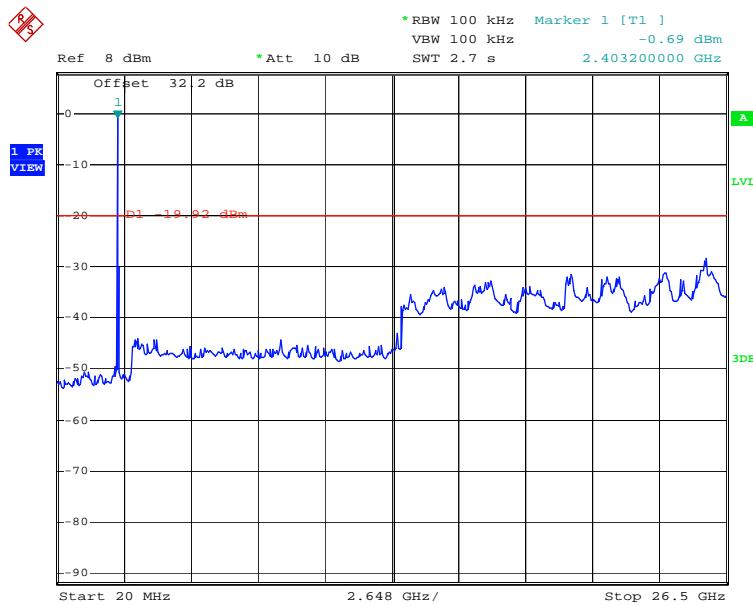
Date: 22.NOV.2007 16:39:05

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Middle Channel



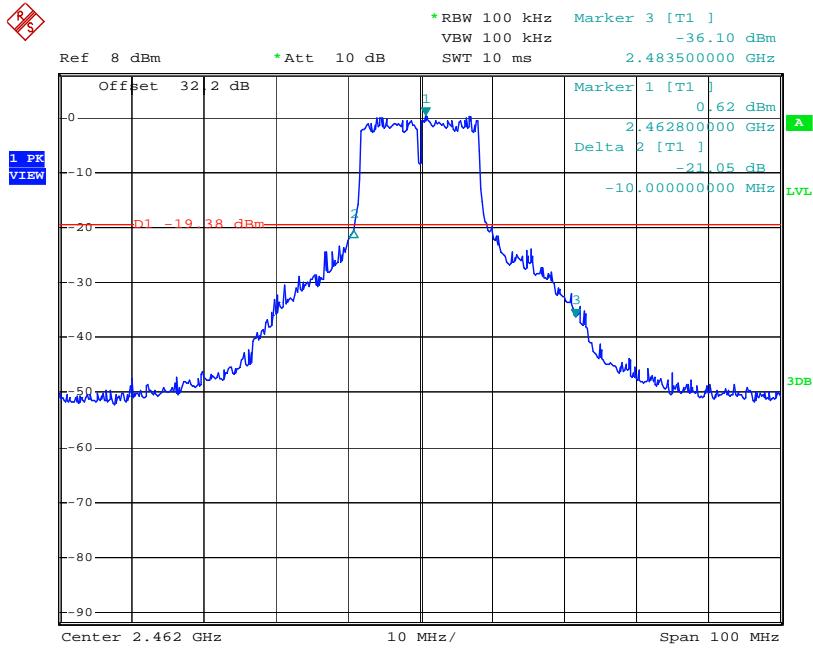
Date: 22.NOV.2007 16:41:01



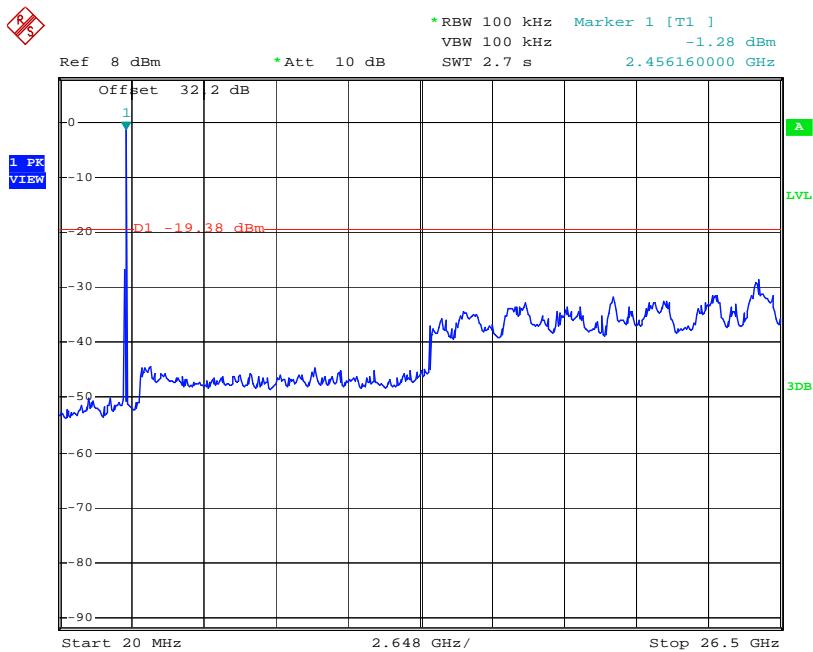
Date: 22.NOV.2007 16:42:20

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

High Channel



Date: 22.NOV.2007 16:44:10



Date: 22.NOV.2007 16:45:18

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

## 5. Receiver Radiated spurious emissions

### 5.1. Test setup – Same as clause 4.1.

#### 5.1.1. Receiver Radiated Spurious Emissions – Same as clause 4.1.1.

### 5.2. Limit

According to §15.109(a), Except for Class A digital devices, the field strength of radiated emission from unintentional radiator at a distance of 3 m shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
30 – 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

### 5.3. Test Procedures – Same as clause 4.3.

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

#### 5.3.1. Test Procedures for Radiated Spurious Emissions- Same as clause 4.3.1.

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## 5.4. Test Results

Ambient temperature : 20 Relative humidity : 45 %

### 5.4.1. Spurious Radiated Emission (Worst case)

All emissions are not reported much lower than the prescribed limits. All reading values are quasi-peak values.

Radiated Emissions			Ant	Antenna Factor	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
35.63	16.30	Q.P.	V	16.75	0.77	33.82	40.00	6.18
82.39	12.40	Q.P.	H	8.08	1.15	21.63	40.00	18.37
116.52	18.70	Q.P.	V	9.78	1.38	29.86	43.50	13.64
179.65	21.10	Q.P.	H	7.92	1.72	30.74	43.50	12.76
405.00	18.70	Q.P.	H	13.52	2.70	34.92	46.00	11.08
668.74	19.60	Q.P.	H	18.12	3.45	41.17	46.00	4.83
Above 670.00	Not Detected	-	-	-	-	-	-	-

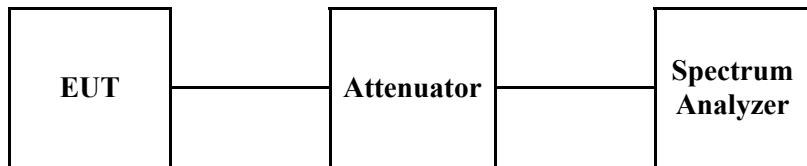
#### Remark:

1. All spurious emission at channels are almost the same below 1 GHz, so that the channel was chosen at representative in final test.
2. “\*” means the restricted band.
3. Actual = Reading + AF + Amp Gain + CL

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## 6. 6 dB Bandwidth Measurement and 99% BW

### 6.1. Test Setup



### 6.2. Limit

#### 6.2.1. 6 dB Bandwidth

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 ~928 MHz, 2400 ~ 2483.5 MHz, and 5725 ~ 5825 MHz bands. The minimum of 6dB Bandwidth shall be at least 500 kHz

#### 6.2.2. 99% BW

Not Applicable

### 6.3. Test Procedure

1. The 6 dB band width was measured with a spectrum analyzer connected to RF antenna connector(conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer. Display Line and Marker Delta functions, the 6 dB band width of the emission was determined.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 kHz, VBW=100 kHz, Span=50 MHz.

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#### 6.4. Test Results

Ambient temperature : 20 Relative humidity : 45 %

Operation Mode	Channel	Channel Frequency (MHz)	6 dB Bandwidth (MHz)	Minimun Limit (MHz)
DSSS (802.11b)	Low	2412	9.60	0.5
	Middle	2437	9.60	
	High	2462	9.50	
OFDM (802.11g)	Low	2412	16.70	
	Middle	2437	16.60	
	High	2462	16.70	

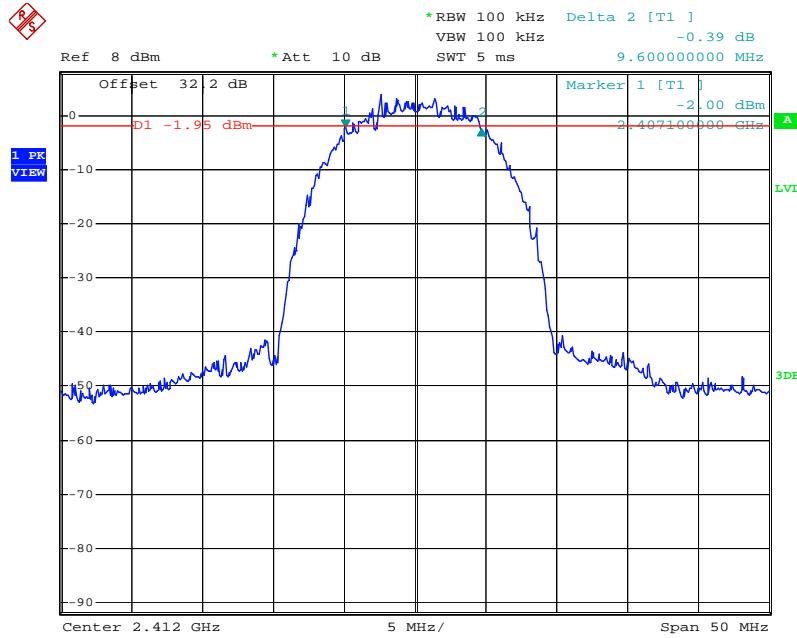
Operation Mode	Channel	Channel Frequency (MHz)	99 % Bandwidth (MHz)	Limit
DSSS (802.11b)	Low	2412	13.50	Not Applicable
	Middle	2437	13.50	
	High	2462	13.50	
OFDM (802.11g)	Low	2412	16.52	
	Middle	2437	16.52	
	High	2462	16.52	

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## 6 dB Bandwidth

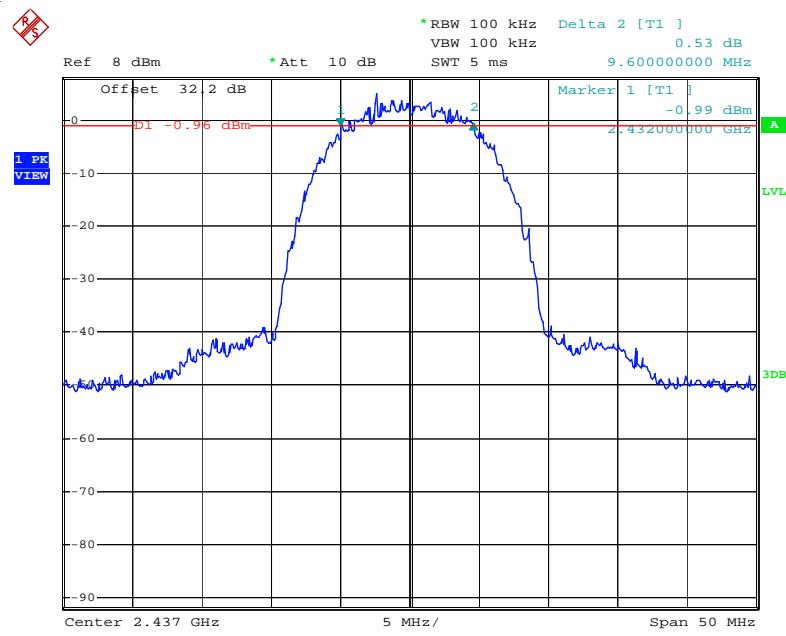
## DSSS : 802.11b

## Low Channel



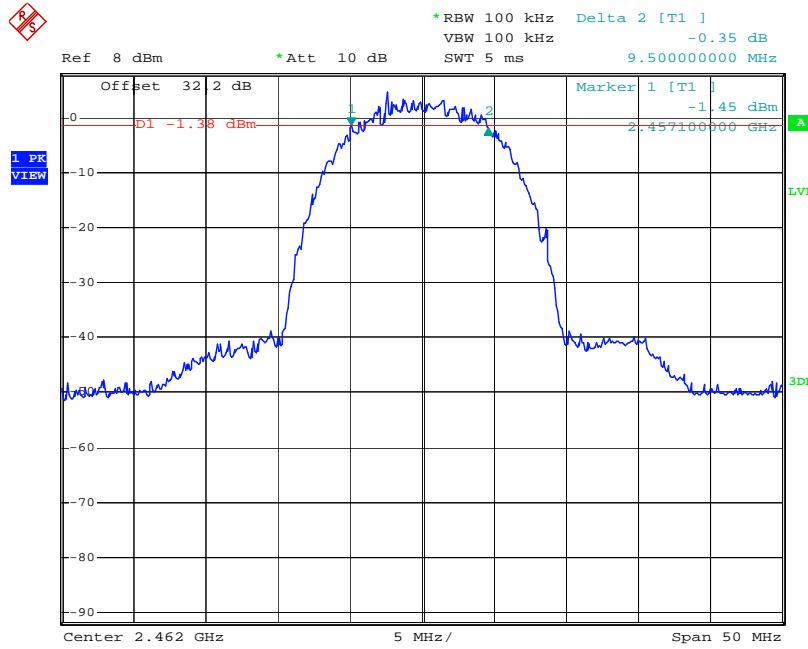
Date: 22.NOV.2007 16:57:12

## Middle Channel



Date: 22.NOV.2007 17:05:01

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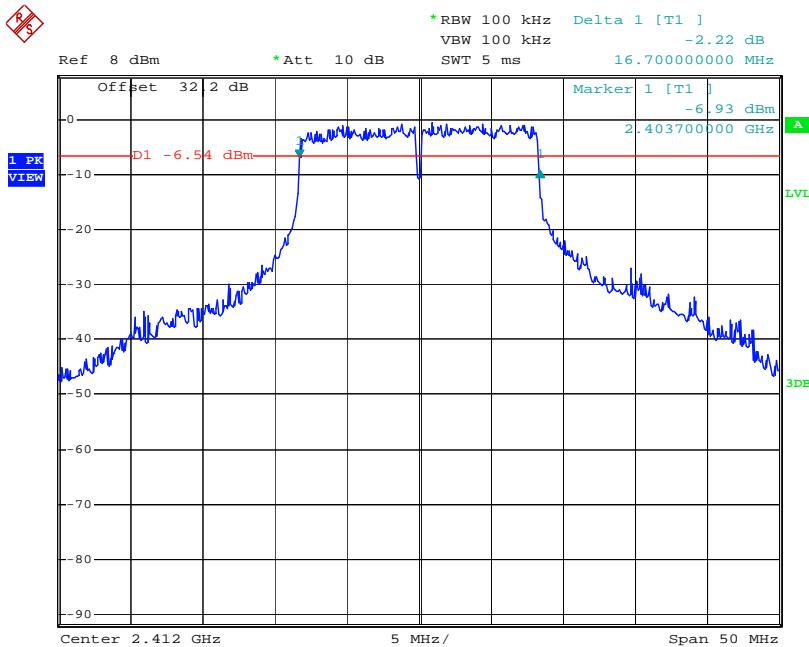
**High Channel**

Date: 22.NOV.2007 17:06:43

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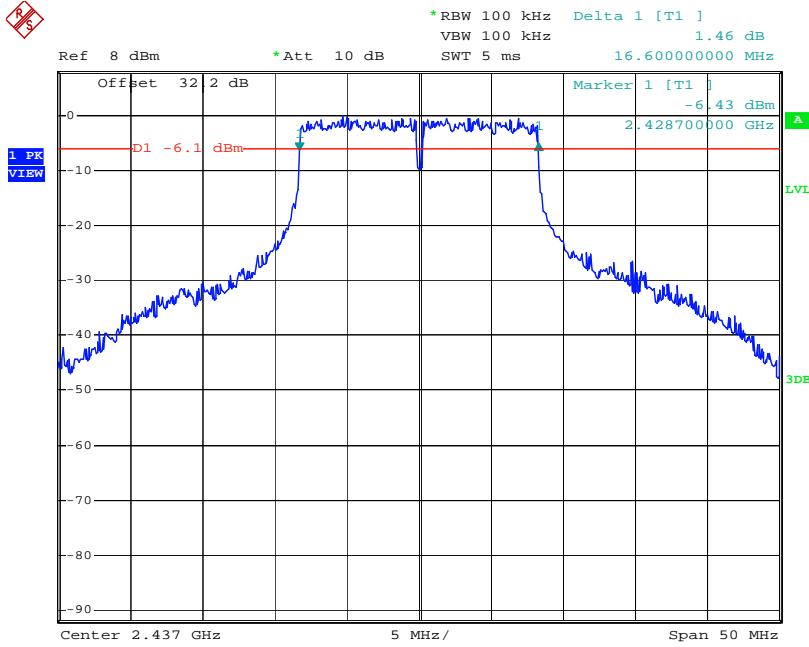
## OFDM : 802.11g

### Low Channel



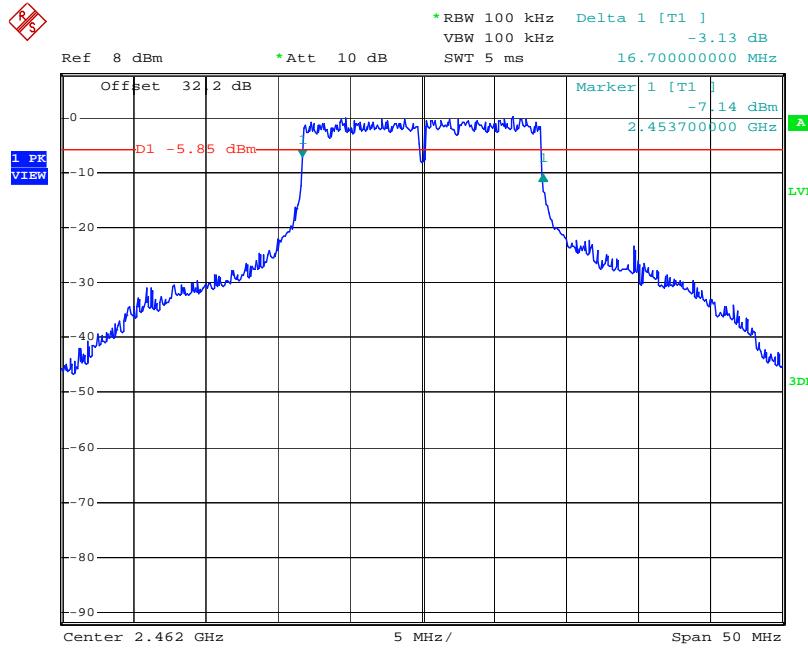
Date: 22.NOV.2007 17:09:41

### Middle Channel



Date: 22.NOV.2007 17:11:24

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**High Channel**

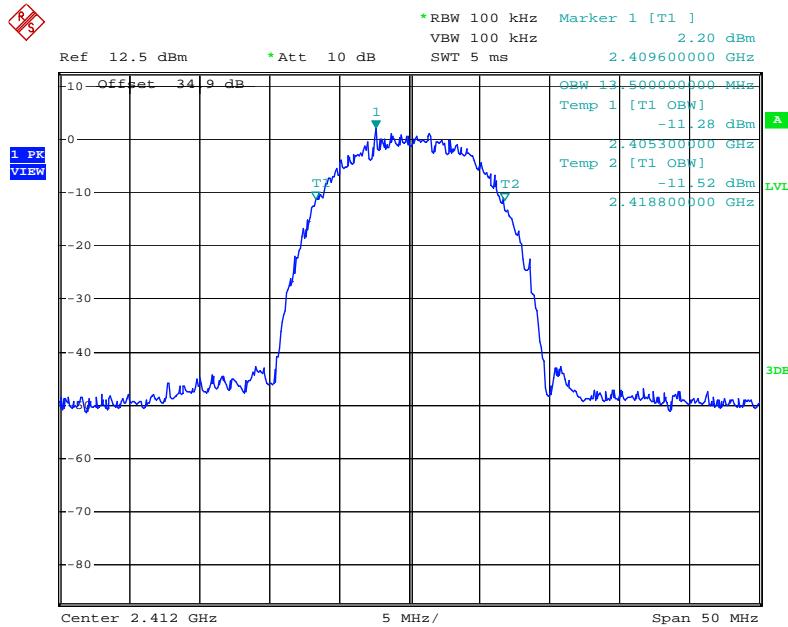
Date: 22.NOV.2007 17:13:02

*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

## 99% Bandwidth

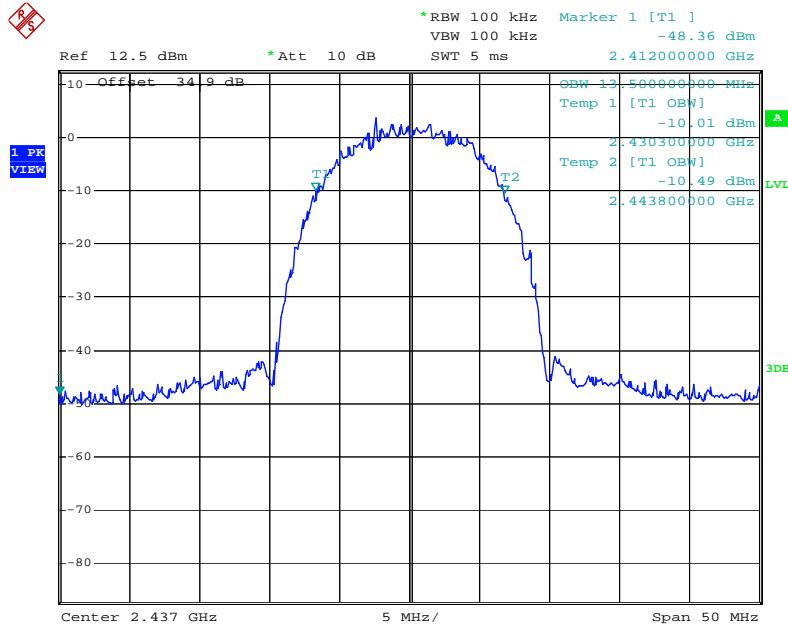
DSSS : 802.11b

Low Channel



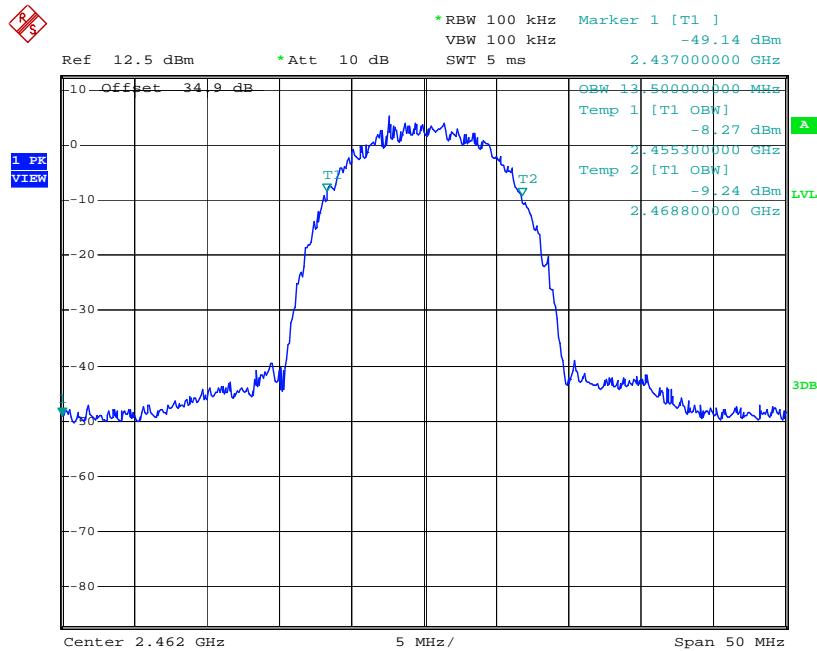
Date: 8.JAN.2008 17:11:03

Middle Channel



Date: 8.JAN.2008 18:09:47

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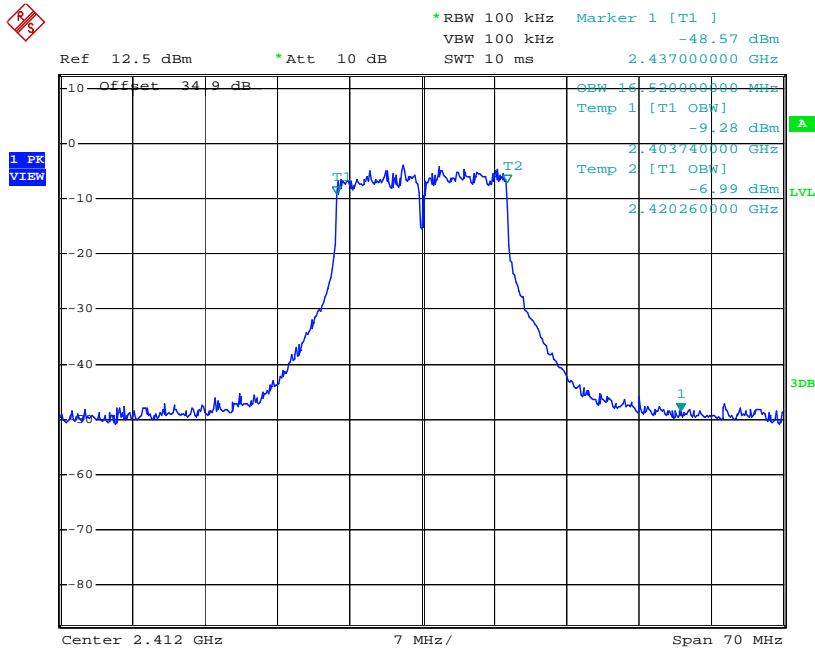
**High Channel**

Date: 8.JAN.2008 18:10:43

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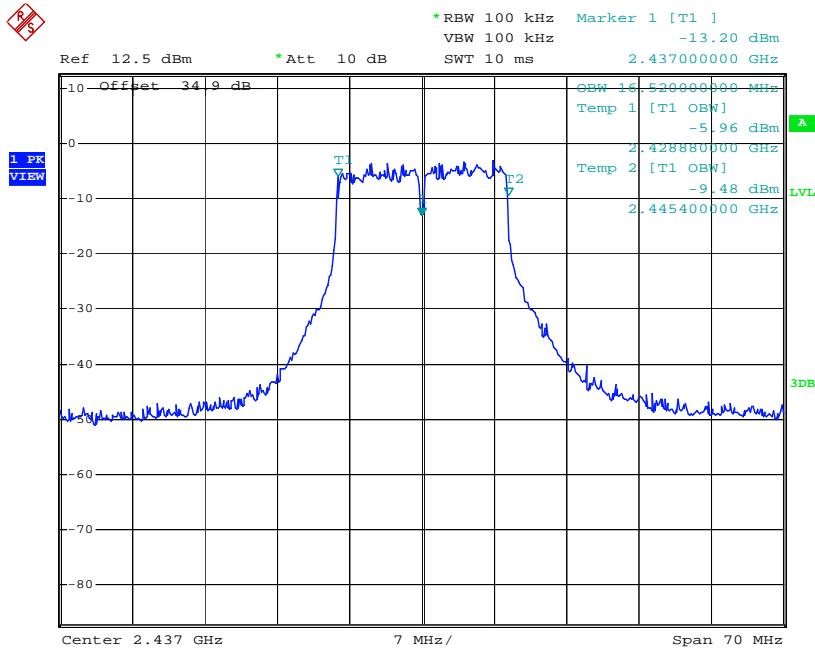
## OFDM : 802.11g

### Low Channel



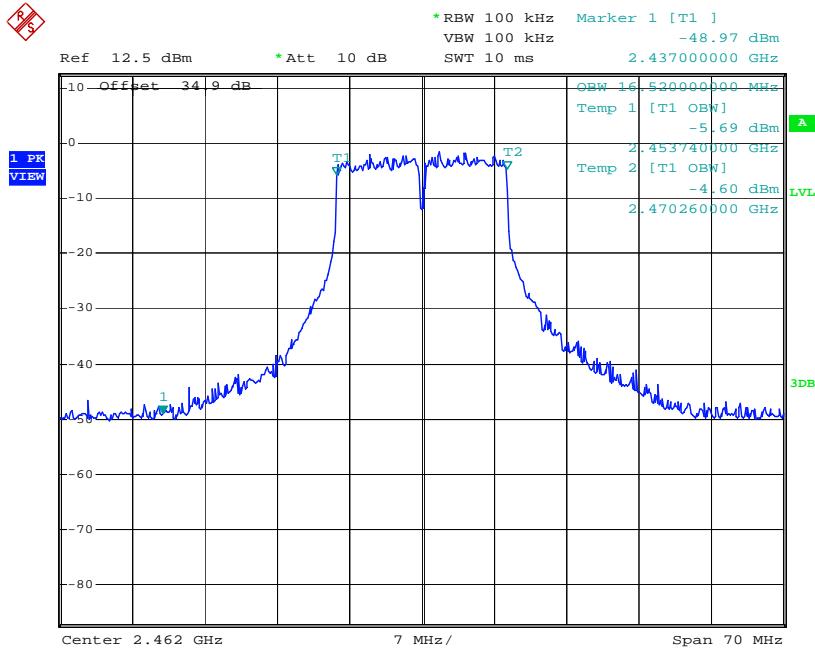
Date: 8.JAN.2008 18:11:45

### Middle Channel



Date: 8.JAN.2008 18:12:46

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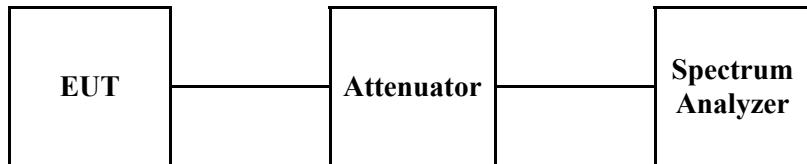
**High Channel**

Date: 8.JAN.2008 18:13:25

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## 7. Maximum Peak Output Power Measurement

### 7.1. Test Setup



### 5.2. Limit

According to §15.247(b)(3), for systems using digital modulation in the 902 ~ 928 MHz, 2400 ~2483.5 MHz, and 5725 ~ 5850 MHz band: 1 Watt. As an alternative to a peak power measurement, compliance with the one watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted output 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. Power must be summed across all antenna elements. The average must not include any intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4), the conducted output power limit specified in paragraph(b) of this section is based on the use of antenna with directional gains that do not exceed 6 dBi. Except as shown in paragraph(c) of this section, if transmitting antenna 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 paragraph (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 6dBi.

### 5.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the Spectrum analyzer as RBW = 1 MHz, VBW = 3 MHz, Span = Auto, Channel BW = 99% BW.

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## 7.4. Test Results

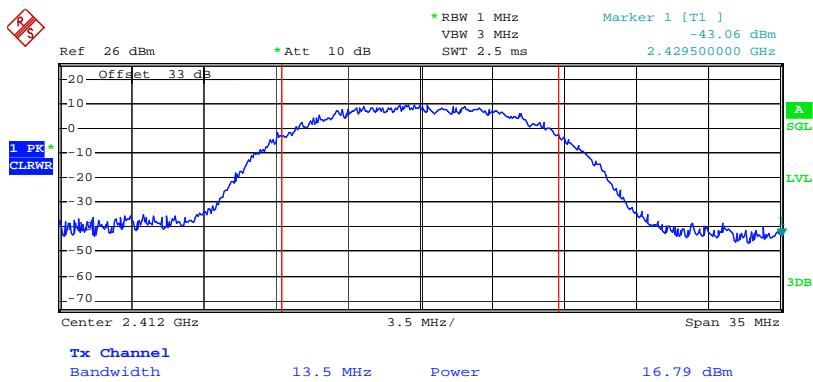
Ambient temperature : 20 Relative humidity : 45 %

Operation Mode	Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)
DSSS (802.11b)	Low	2412	16.79	30
	Middle	2437	16.75	30
	High	2462	16.92	30
OFDM (802.11g)	Low	2412	14.38	30
	Middle	2437	13.95	30
	High	2462	14.04	30

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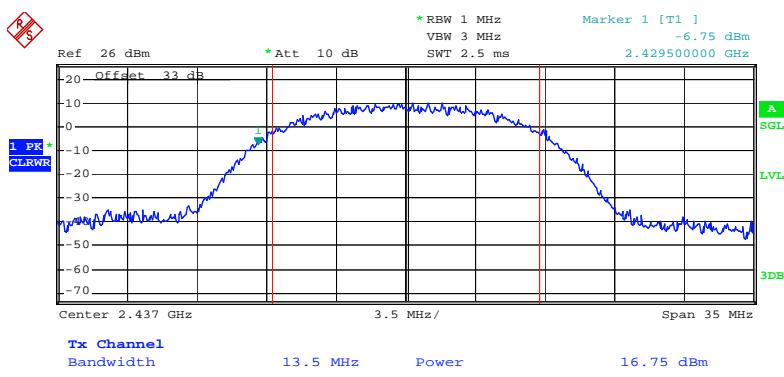
**DSSS : 802.11b**

## Low Channel



Date: 8.JAN.2008 20:14:04

## Middle Channel



Date: 8.JAN.2008 20:14:36

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**High Channel**

Date: 8.JAN.2008 20:15:16

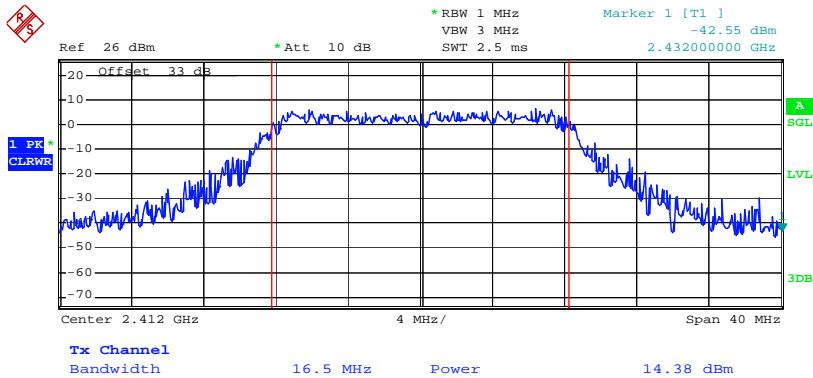
*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

SGS Testing Korea Co., Ltd.

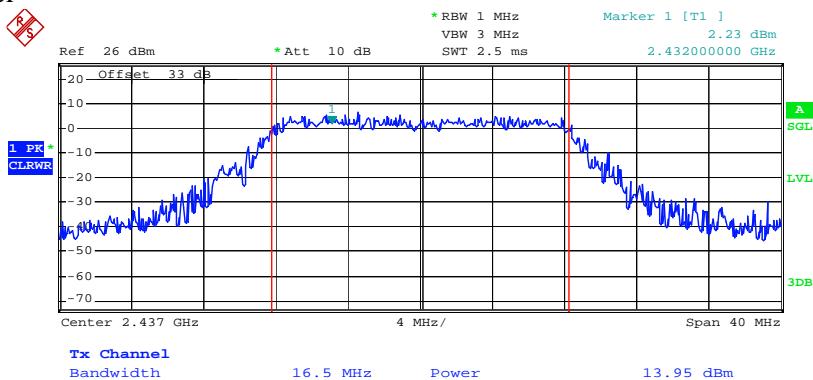
705, Dongchun-Dong Sooji-Gu, Yongin-Shi, Kyungki-Do, South Korea.

Tel. +82 31 428 5700 / Fax. +82 31 427 2371

[www.electrolab.kr.sgs.com](http://www.electrolab.kr.sgs.com)

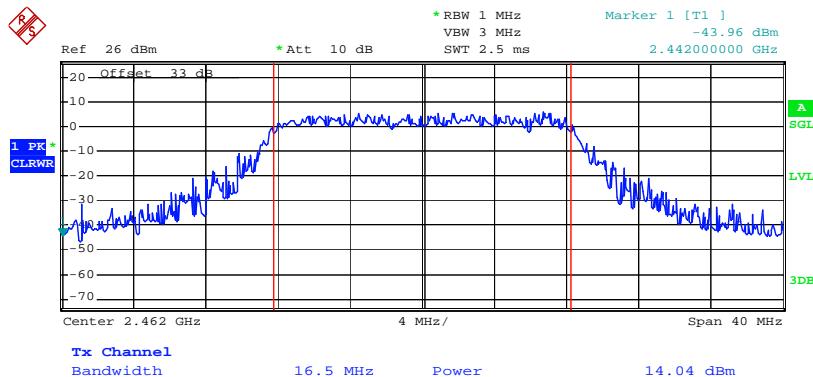
**OFDM : 802.11g****Low Channel**

Date: 8.JAN.2008 20:16:18

**Middle Channel**

Date: 8.JAN.2008 20:16:46

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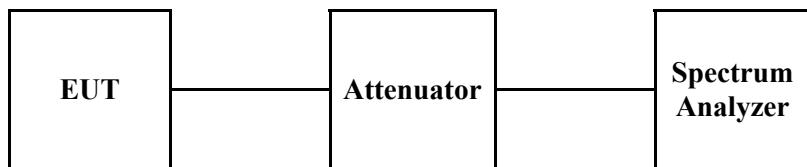
**High Channel**

Date: 8.JAN.2008 20:17:15

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## 8. POWER SPECTRAL DENSITY MEASUREMENT

### 8.1. Test Setup



### 8.2. Limit

§15.247(e) For digitally modulated system, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band 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.

### 8.3. Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the Max Hold function record the separation of adjacent channels.
4. Repeat above procedures until all frequencies measured were complete.
5. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using ;  
RBW=3 kHz, VBW=10 kHz, Span=300 kHz and Sweep=100 s.

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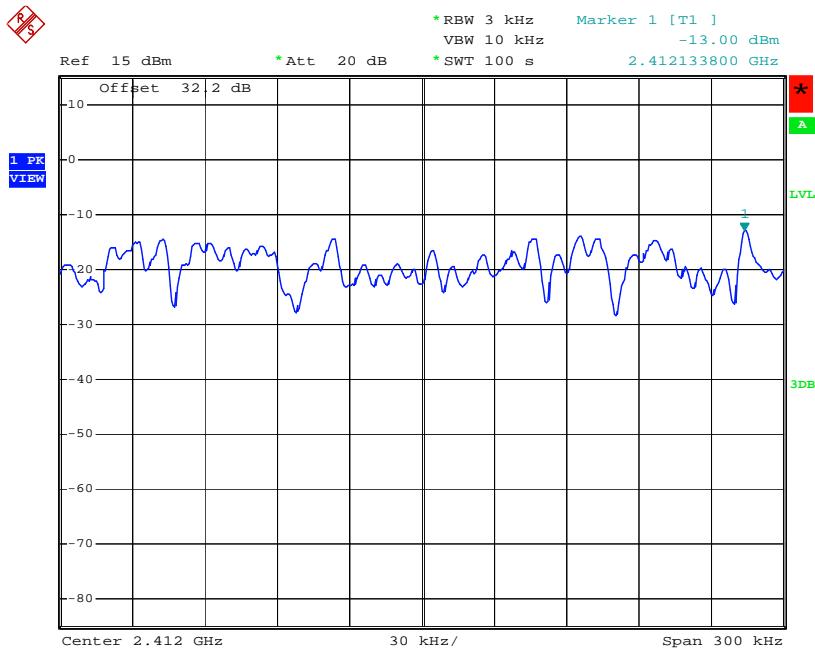
## 8.4. Test Results

Ambient temperature : 20 Relative humidity : 45 %

Operation Mode	Frequency	Final RF Power Level in 3 kHz BW (dBm)	Maximum Limit (dBm)
DSSS (802.11b)	2412 MHz	-13.00	8
	2437 MHz	-12.74	8
	2462 MHz	-13.42	8
OFDM (802.11g)	2412 MHz	-25.05	8
	2437 MHz	-25.52	8
	2462 MHz	-26.67	8

### DSSS : 802.11b

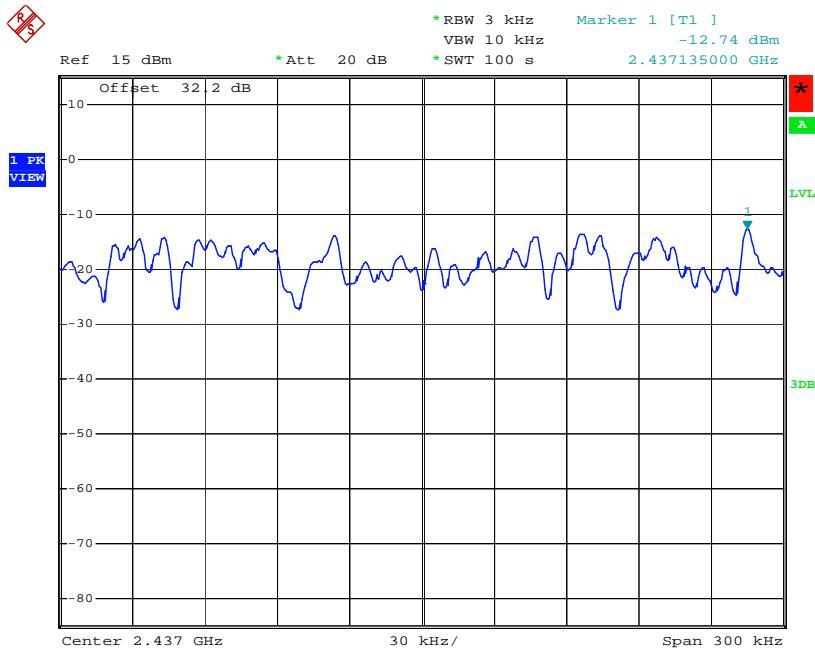
#### Low Channel



Date: 26.NOV.2007 17:45:47

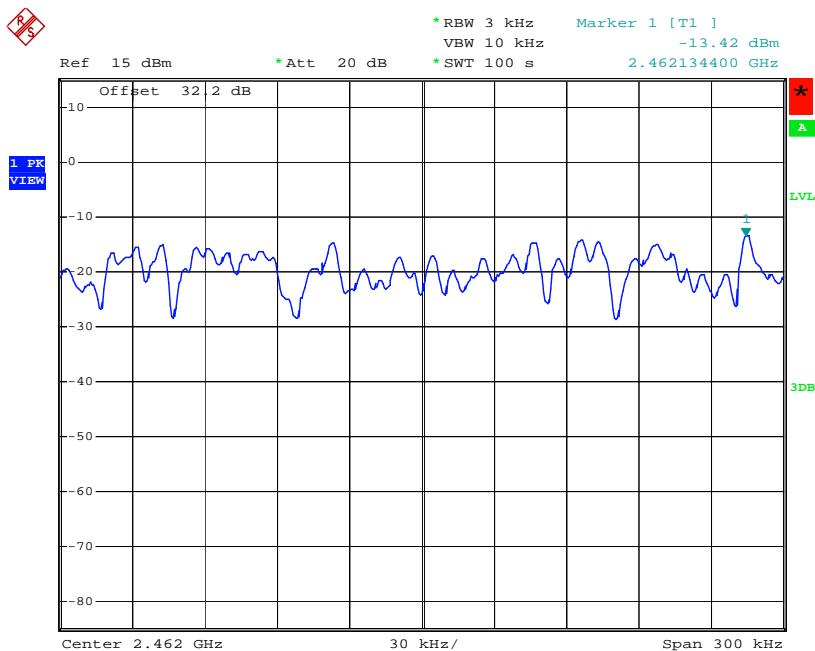
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

Middle Channel



Date: 26.NOV.2007 17:48:25

High Channel

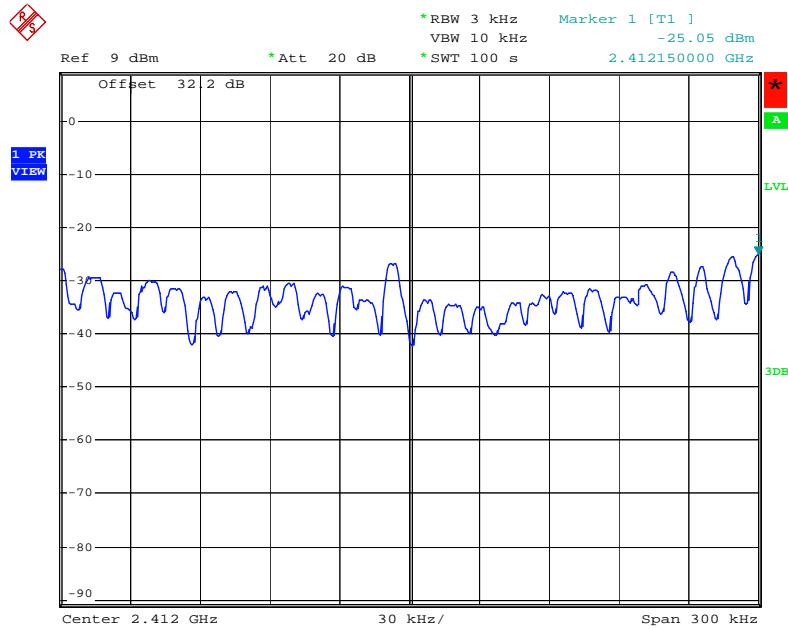


Date: 26.NOV.2007 17:51:07

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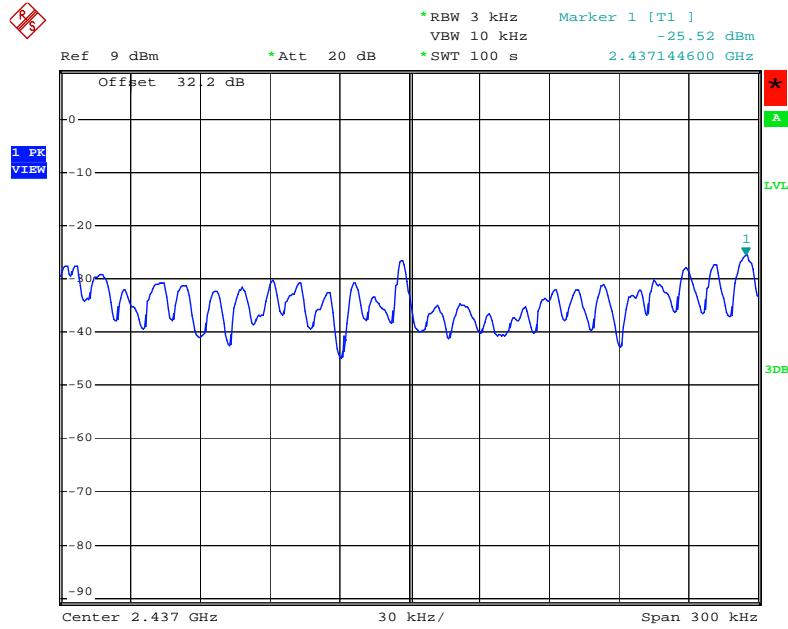
## OFDM : 802.11g

### Low Channel



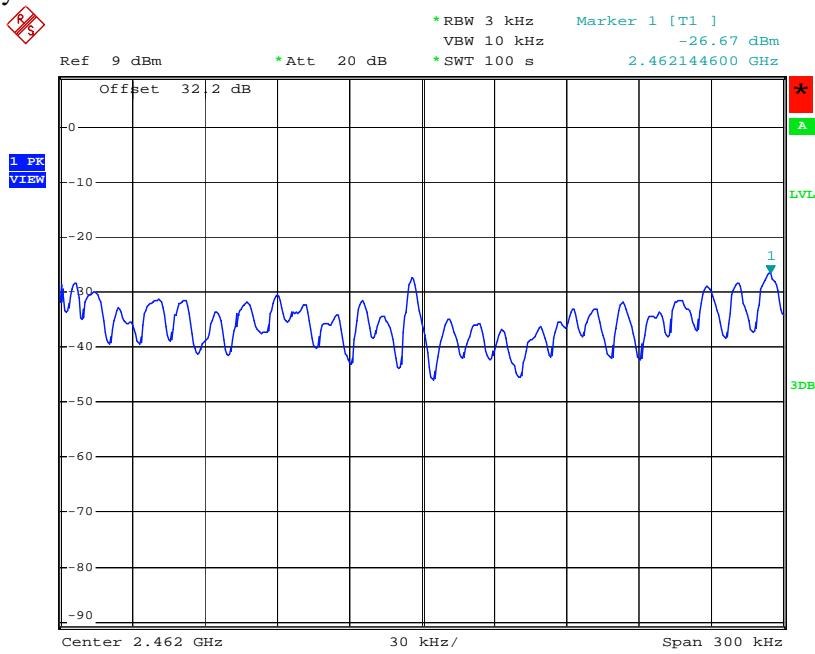
Date: 26.NOV.2007 17:58:34

### Middle Channel



Date: 26.NOV.2007 18:01:15

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**High Frequency**

Date: 26.NOV.2007 18:03:35

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## 9. ANTENNA REQUIREMENT

### 9.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.247 (b) if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6dBi.

### 9.2. Antenna Connected Construction

Antenna used in this product is plate type gain of -2.47dBi

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## Appendix A-1. Photo of Field Strength Test



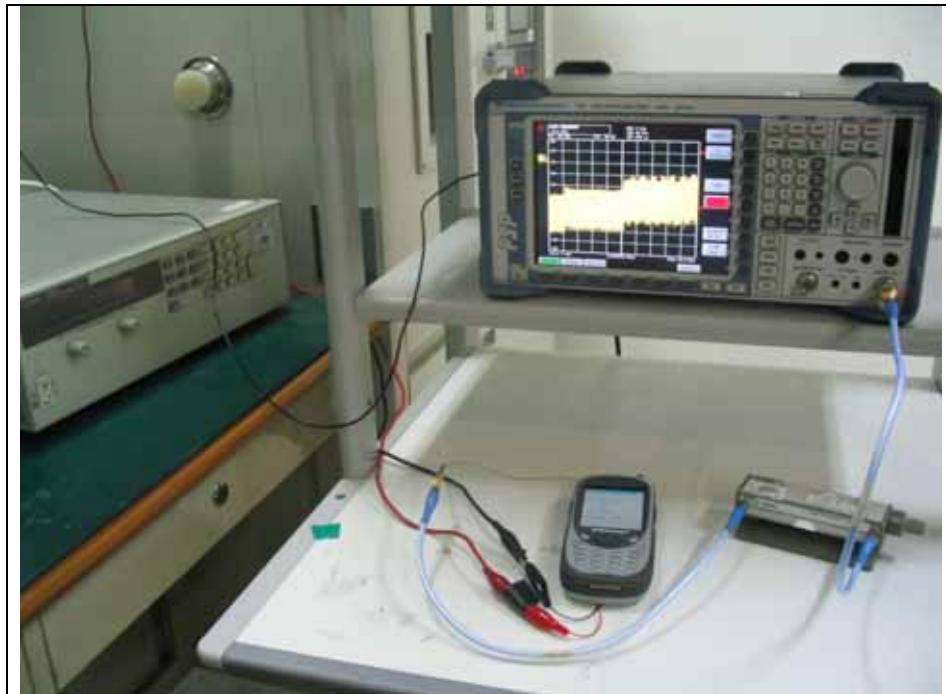
*The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.*

## Appendix A -2. Photos of Conducted Power Line Test



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### Appendix A -3. Photo of RF Conducted Measurement setup



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