

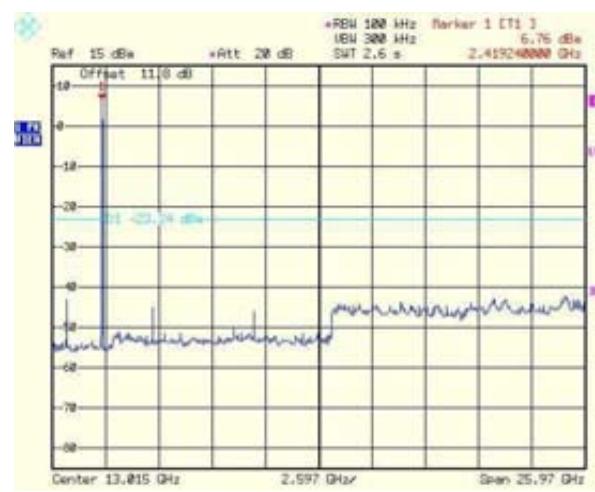
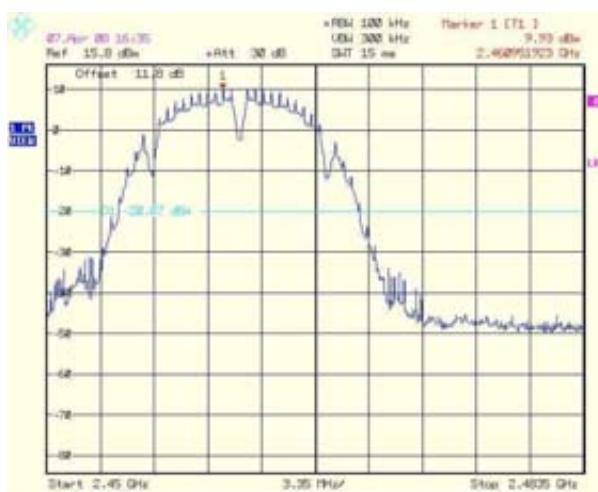
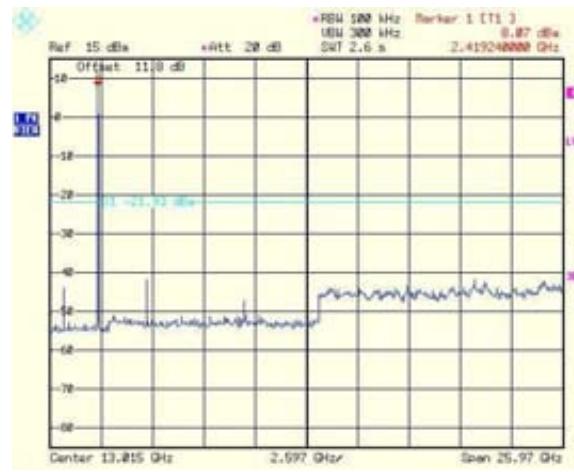
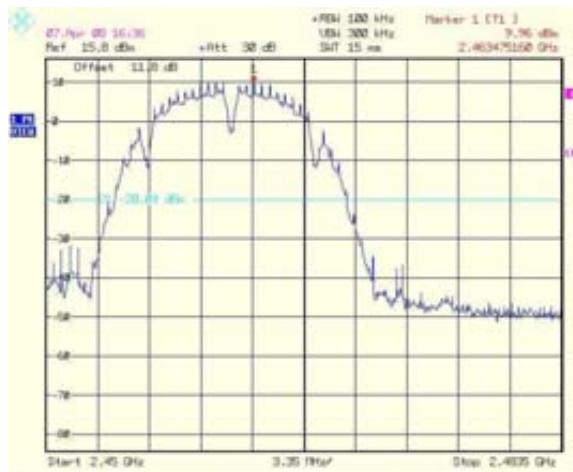
Test Report No.: 8812328348

Page 37 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

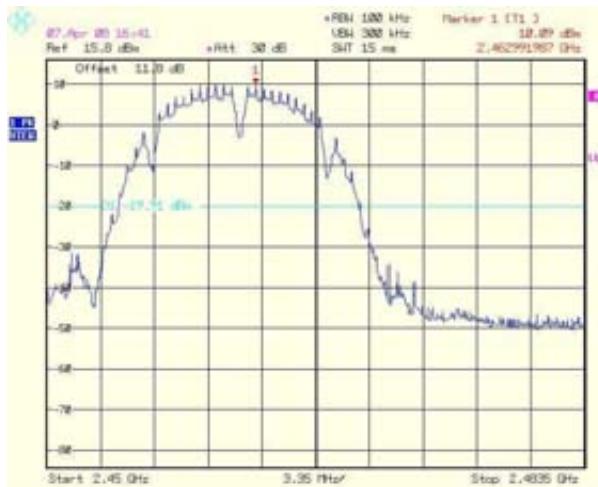
Model: WBS-2400

FCC ID: UGM-WBS2400-1

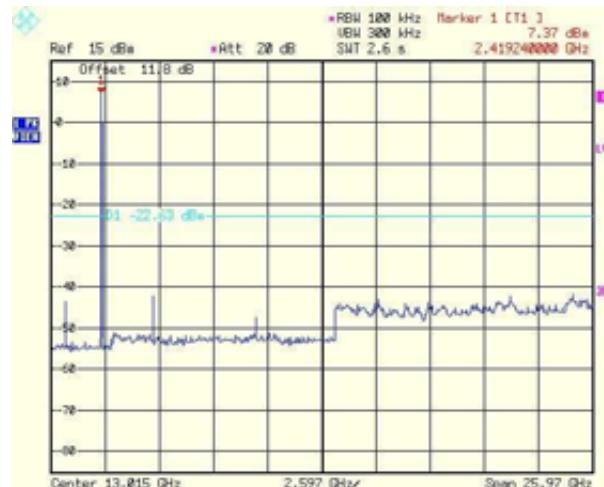


Test Report No.: 8812328348

Page 38 of 105 Pages

 Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station  
 Model: WBS-2400 FCC ID: UGM-WBS2400-1


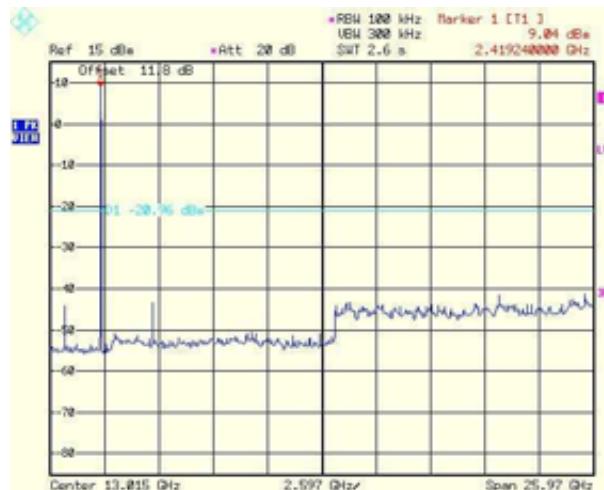
Plot # 85.

 Output 3. High frequency bandedge.  
 802.11b mode.


Plot # 86.

 Output 3. High frequency spurious.  
 802.11b mode.


Plot # 87.

 Output 4. High frequency bandedge.  
 802.11b mode.


Plot # 88.

 Output 4. High frequency spurious.  
 802.11b mode.

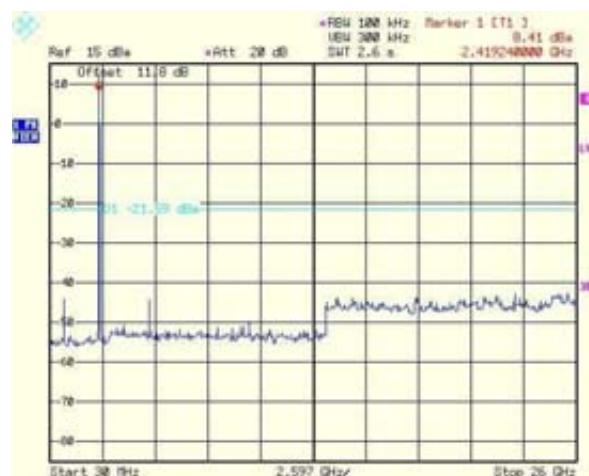
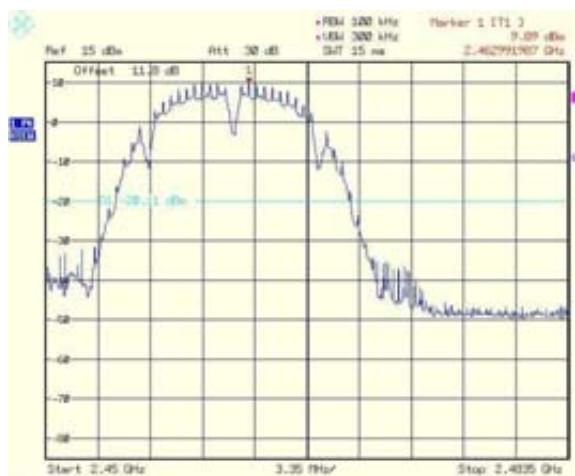
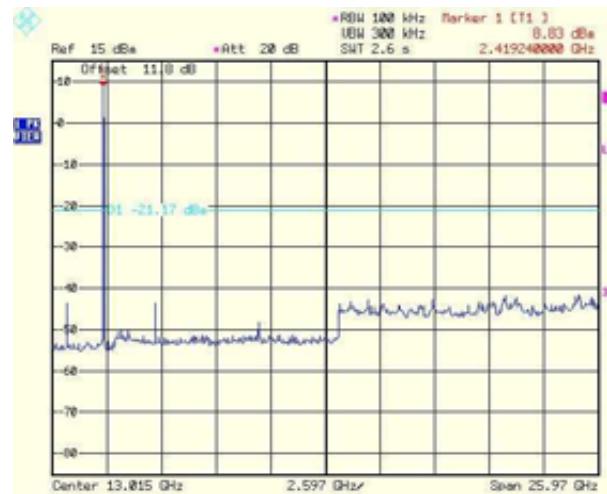
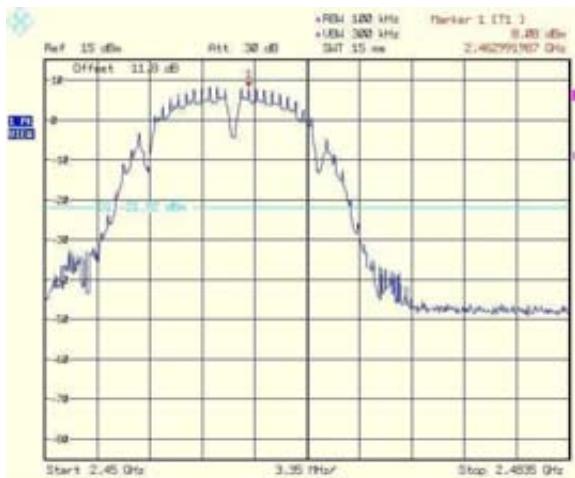
Test Report No.: 8812328348

Page 39 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1



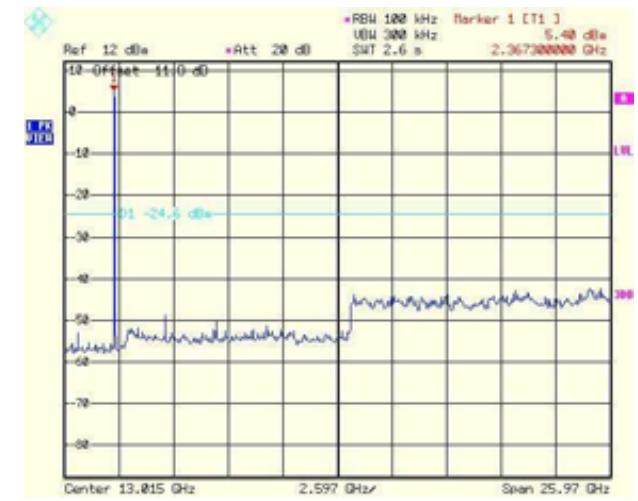
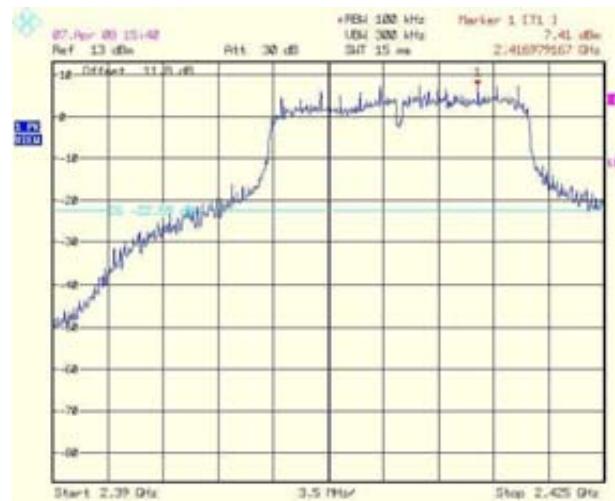
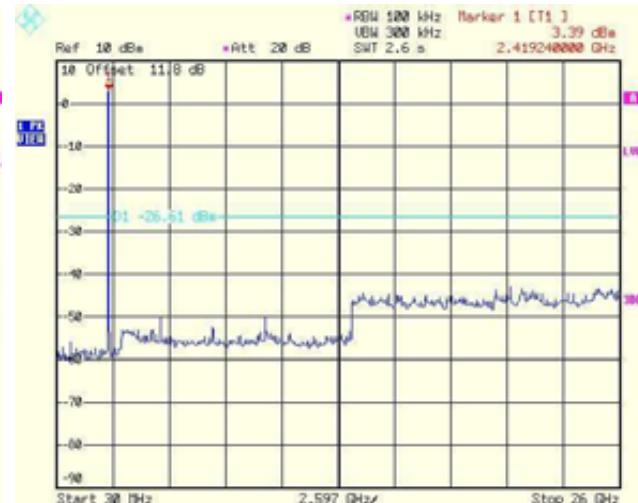
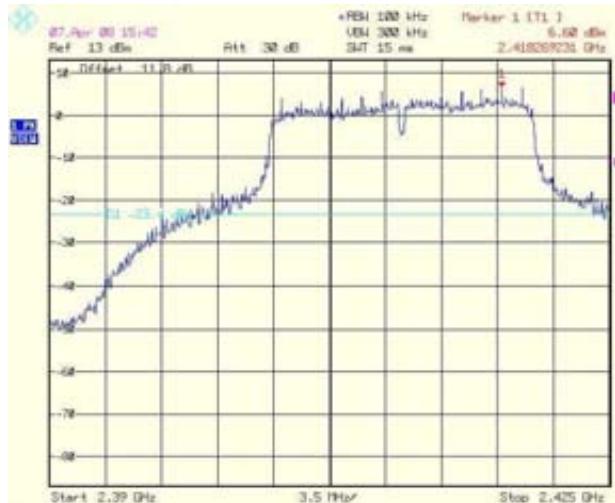
Test Report No.: 8812328348

Page 40 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1



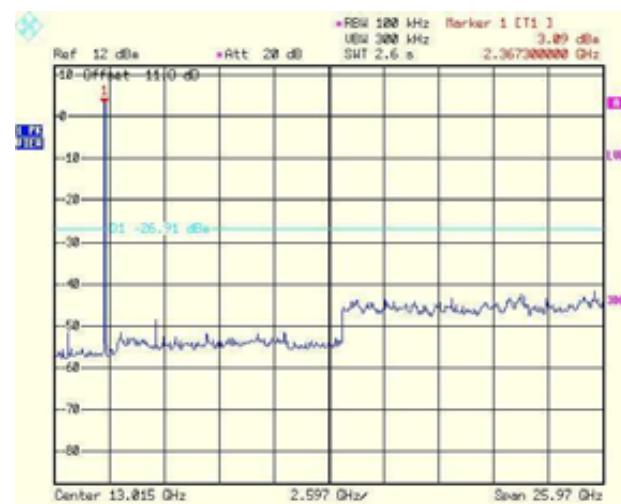
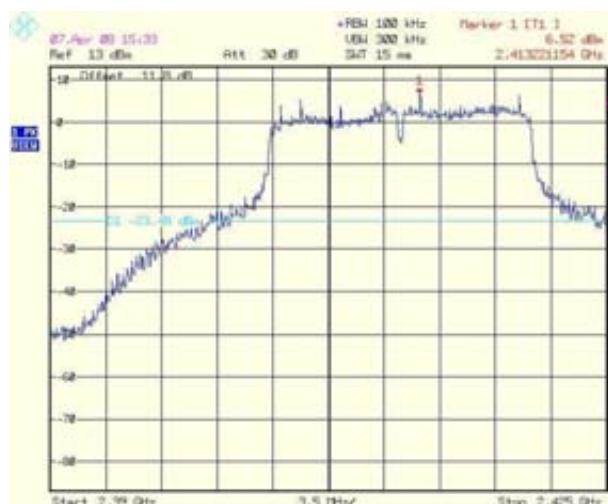
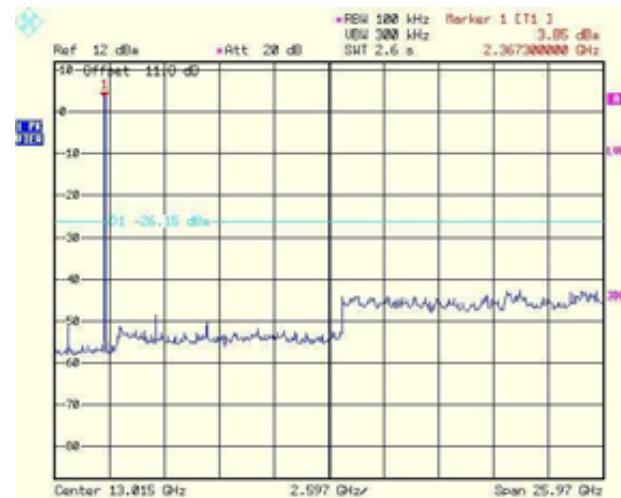
Test Report No.: 8812328348

Page 41 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1



Test Report No.: 8812328348

Page 42 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

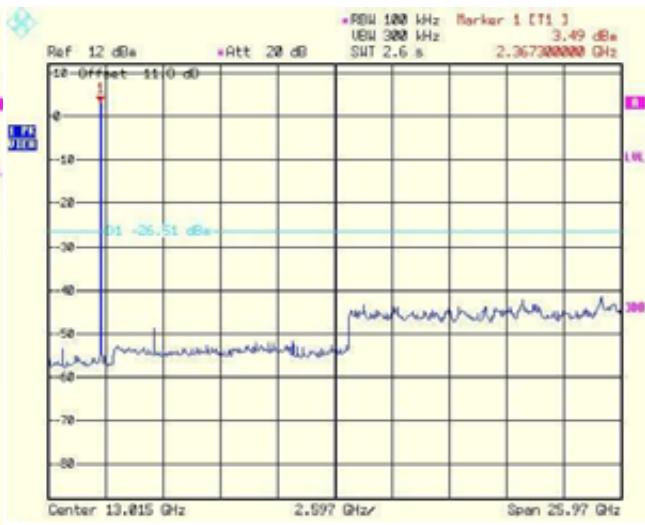
Model: WBS-2400

FCC ID: UGM-WBS2400-1



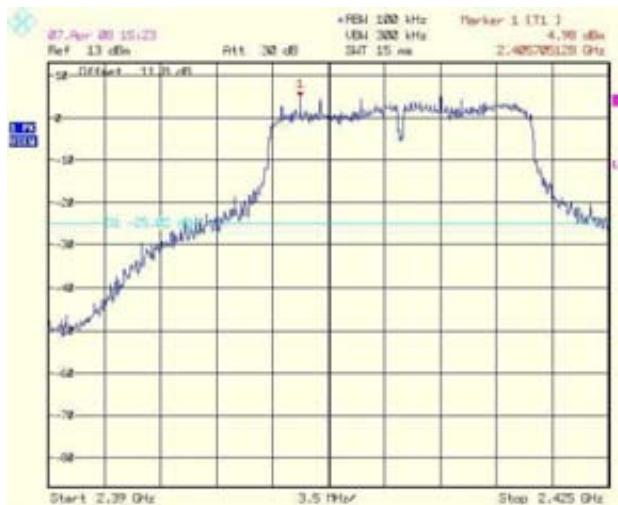
Plot # 101.

**Output 5. Low frequency bandedge.  
802.11g mode.**



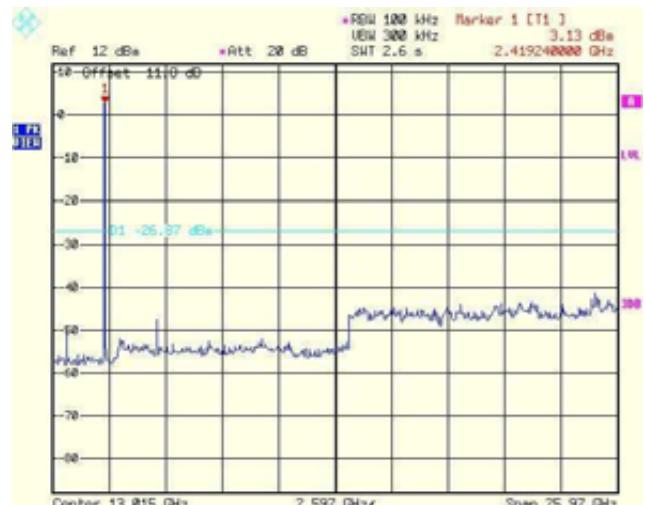
Plot # 102.

**Output 5. Low frequency spurious.  
802.11g mode.**



Plot # 103.

**Output 6. Low frequency bandedge.  
802.11g mode.**



Plot # 104.

**Output 6. Low frequency spurious.  
802.11g mode.**

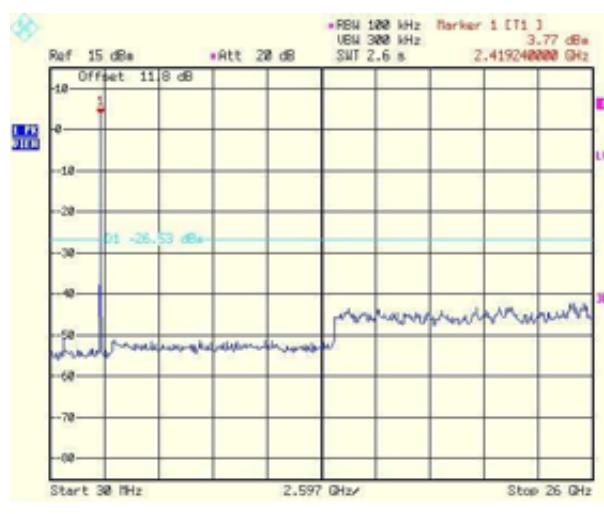
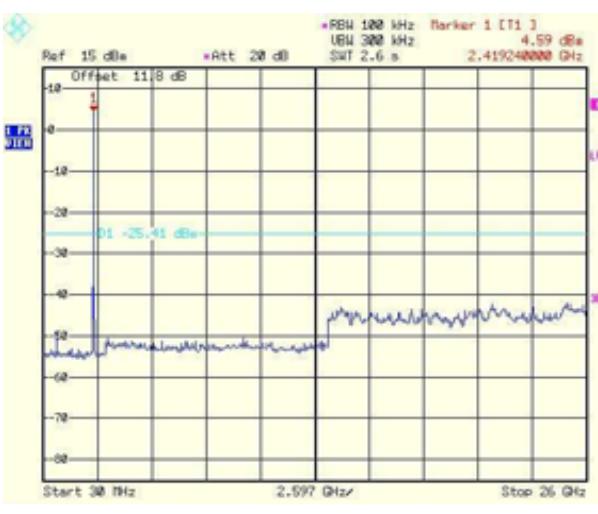
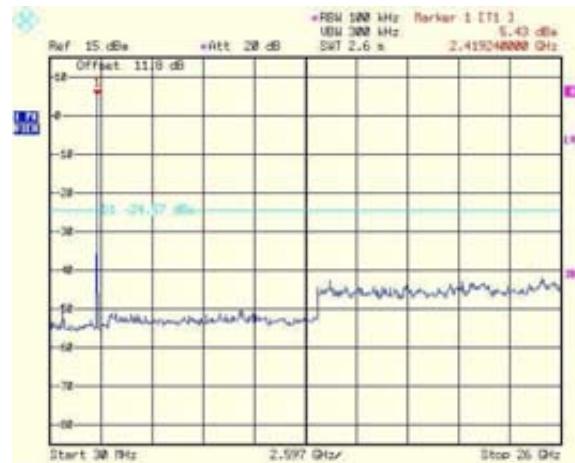
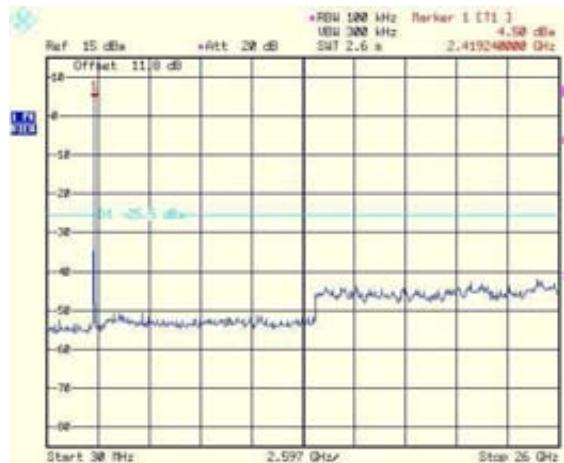
Test Report No.: 8812328348

Page 43 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1



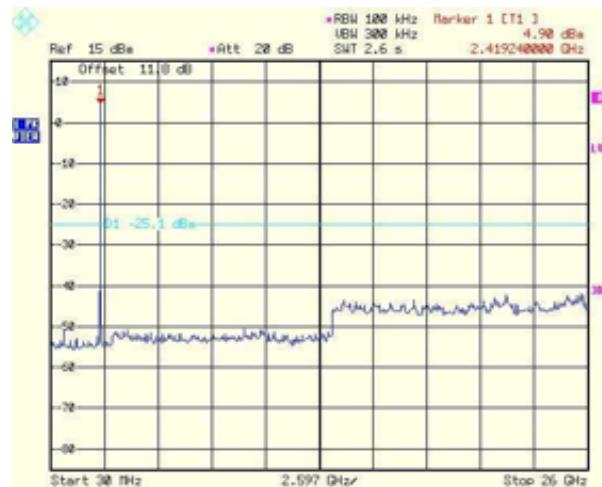
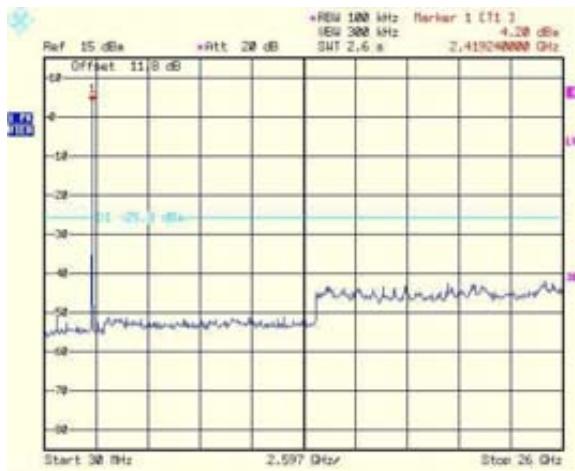
Test Report No.: 8812328348

Page 44 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

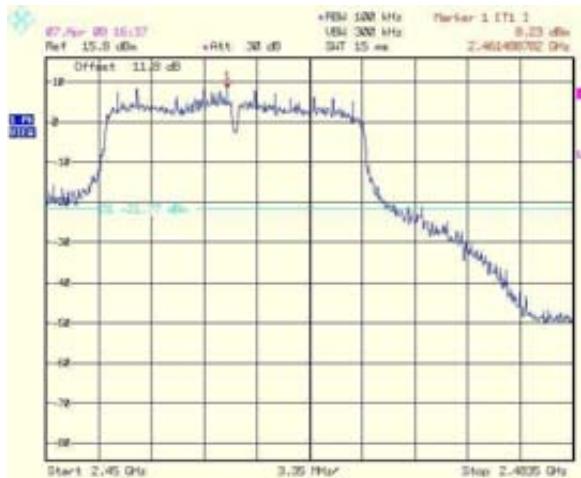
Model: WBS-2400

FCC ID: UGM-WBS2400-1



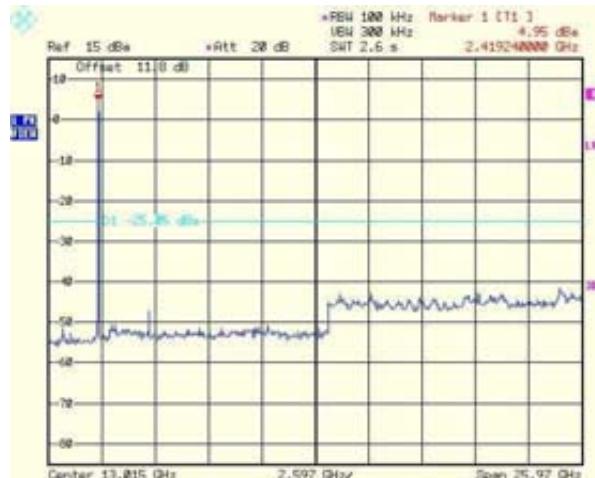
Test Report No.: 8812328348

Page 45 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station  
Model: WBS-2400 FCC ID: UGM-WBS2400-1

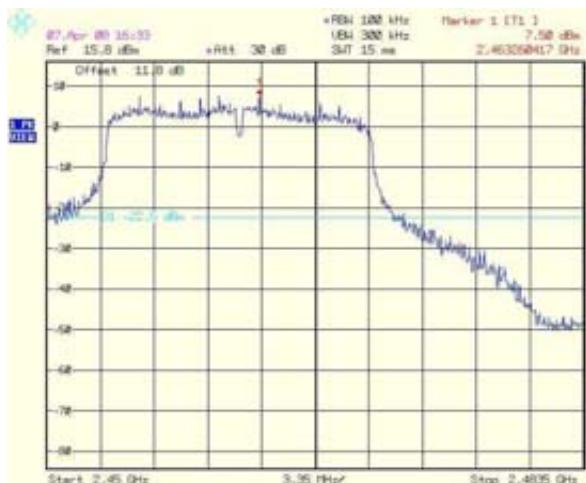
Plot # 111.

**Output 1. High frequency bandedge.  
802.11g mode.**



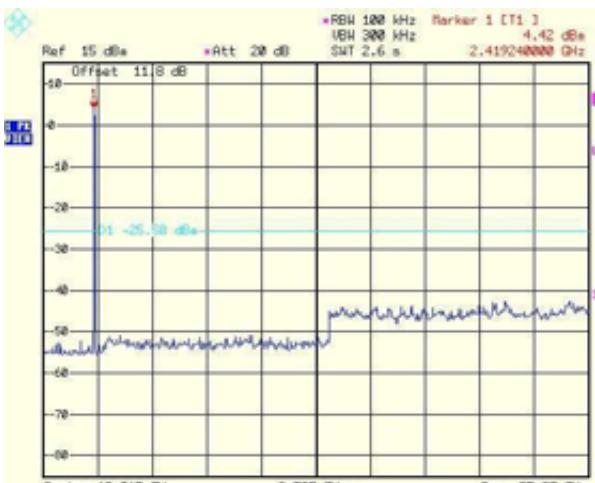
Plot # 112.

**Output 1. High frequency spurious.  
802.11g mode.**



Plot # 113.

**Output 2. High frequency bandedge.  
802.11g mode.**



Plot # 114.

**Output 2. High frequency spurious.  
802.11g mode.**

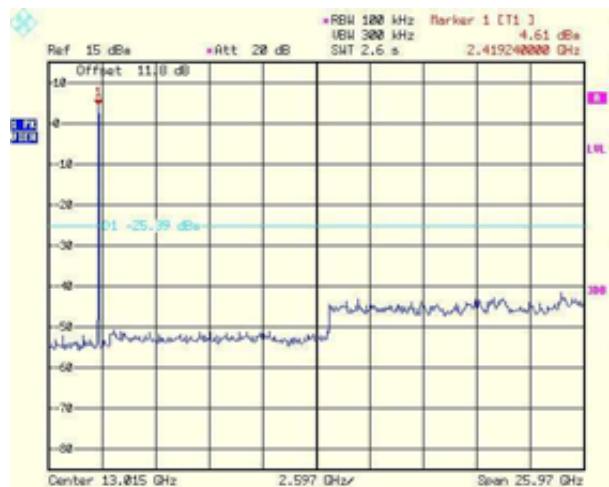
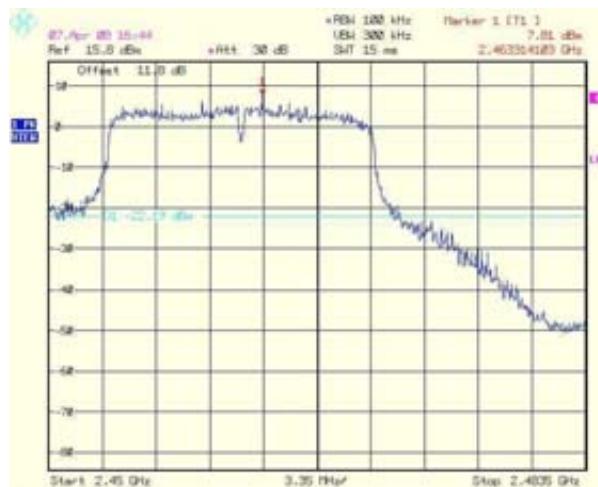
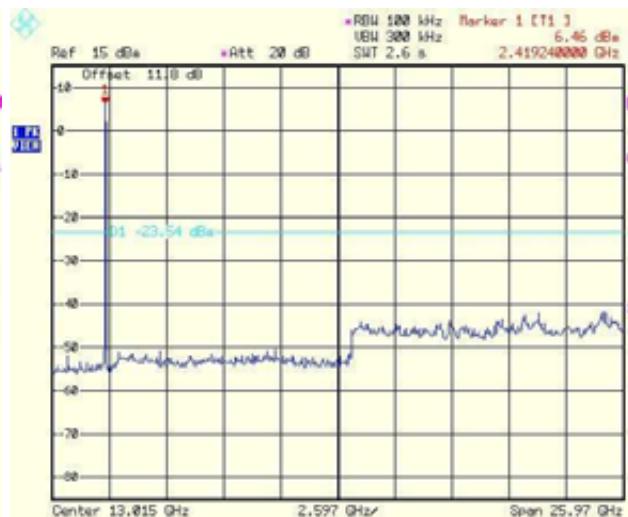
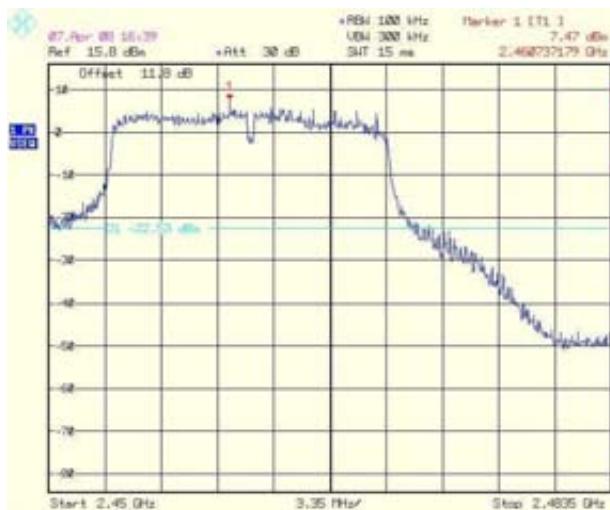
Test Report No.: 8812328348

Page 46 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1



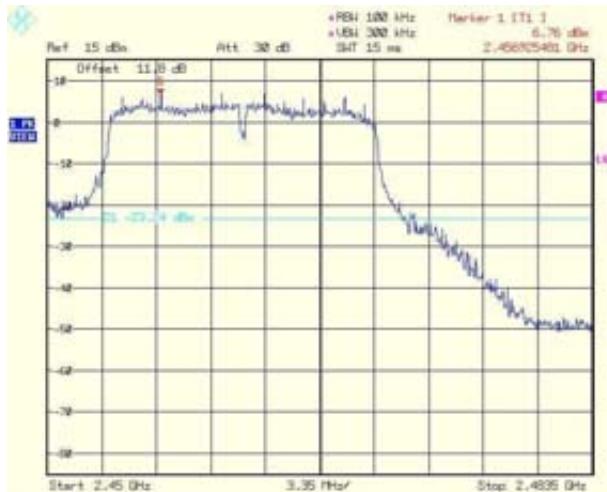
Test Report No.: 8812328348

Page 47 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

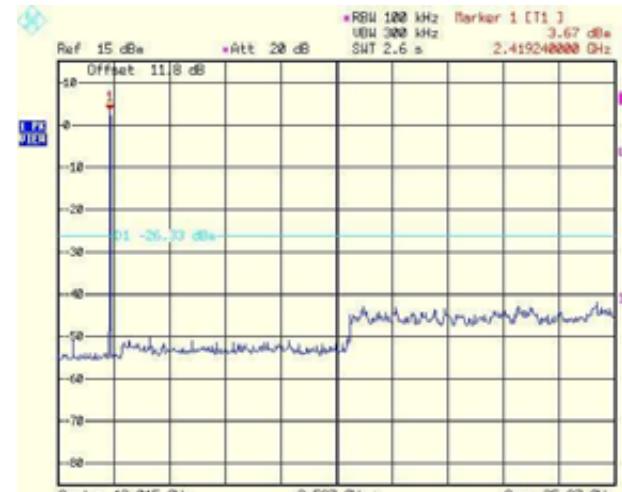
Model: WBS-2400

FCC ID: UGM-WBS2400-1



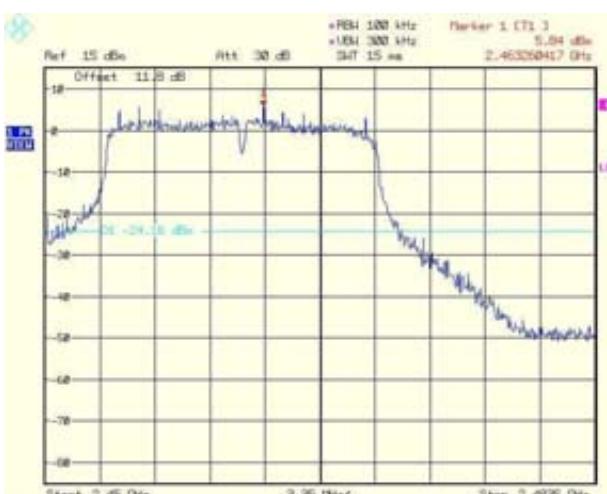
Plot # 119.

**Output 5. High frequency bandedge.  
802.11g mode.**



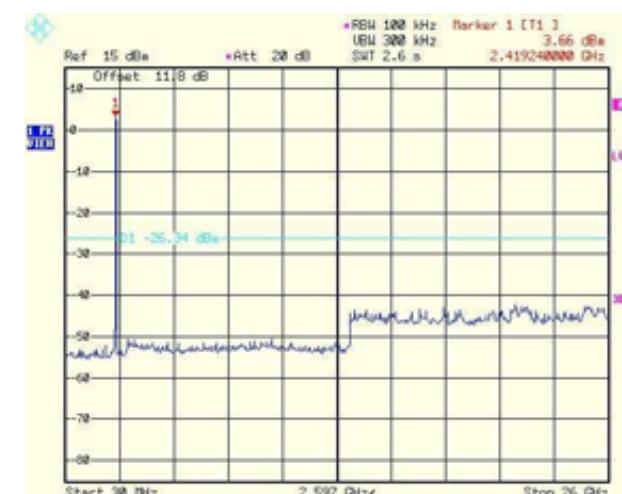
Plot # 120.

**Output 5. High frequency spurious.  
802.11g mode.**



Plot # 121.

**Output 6. High frequency bandedge.  
802.11g mode.**



Plot # 122.

**Output 6. High frequency spurious.  
802.11g mode.**



Test Report No.: 8812328348

Page 48 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1

## 7.6. Radiated emission test on Radio Unit – spurious (per Section 15.209):

### 7.6.1. Requirements:

The levels of any unwanted emission shall not exceed value required in section 15.209.

### 7.6.2. EUT configuration:

The tested configuration has been built with 6 Skyworks RF filters.

The radio unit was tested with Omni-directional antennas model MT-341017/N/A.

### 7.6.3. Test procedure:

The measurements were performed in the anechoic chamber.

The EUT was arranged on a non-metallic table 0.8 m placed on the turntable.

Measuring antennas used: Up to 18 GHz - Double Ridge EMCO model 3115.

Above 18 GHz - Antenna SHF-EHF Horn 15-40 GHz Schwarzbeck model BBHA 9170.

Cable loss (in dB) is included in SA measurement setup.

The emission levels of the EUT more than 20 dB lower than the specified limit were not recorded in the tables. For the test results refer to relevant Plots.

Test results found in 30 – 2000 MHz are brought in section 7.4 of this test report.

Antenna height = 1 m.

Polarization: Vertical/Horizontal

Measurement distance = 3m.

The frequency range was investigated up to 26 GHz.

The measurements were performed in vertical and horizontal polarization, the maximum reading recorded.

Measuring detector function and bandwidths:

Detector type	Peak
Resolution bandwidth	1MHz
Video bandwidth	1 MHz

Detector type	Average
Resolution bandwidth	1MHz
Video bandwidth	3 kHz

### 7.6.4. Radiated emission test results and calculation ratio:

The test results are shown in Table 6.

The emission level was calculated as:

E Reading (dB $\mu$ V) + measuring cable loss (dB) + measuring antenna factor (dB/m)

For measuring antenna factor refer to Appendix 2.



Test Report No.: 8812328348

Page 49 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1

Table 6. Spurious emissions test results

Antenna P/N: MT-341017/N/A

Frequency (GHz)	Emission Level (dB $\mu$ V/m)		Limit @ 3m (dB $\mu$ V/m)		Margin (dB)		Results
	Average	Peak	Average	Peak	Average	Peak	
<u>LOW 2.412 GHz</u>							
4.824	Noise floor	Noise floor	54	74	10 dB at least	10 dB at least	Complies
12.06	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
14.47	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
19.3	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
<u>MIDDLE 2.437 GHz</u>							
4.874	Noise floor	Noise floor	54	74	10 dB at least	10 dB at least	Complies
7.311	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
12.19	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
19.5	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
<u>HIGH 2.462 GHz</u>							
4.924	Noise floor	Noise floor	54	74	10 dB at least	10 dB at least	Complies
7.386	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
12.1	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
19.7	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies
22.16	Noise floor	Noise floor			10 dB at least	10 dB at least	Complies



Test Report No.: 8812328348

Page 50 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1

## 7.7. Radiated emission test on Radio Unit - restricted bands (per Section 15.205):

### 7.7.1. Requirements:

Radiated emission in restricted bands should meet the requirements sec. 15.205.

The following frequency bands should be measured:

Operating Frequency Range 2.412 – 2.462 GHz

### 7.7.2. EUT configuration:

The tested configuration has been built with 6 Skyworks RF filters.

The radio unit was tested with all six Omni-directional antennas (model MT-341017/N/A) connected to EUT, as it shown on the photo 3.

### 7.7.3. Test procedure:

The measurements were performed in the anechoic chamber.

The EUT was arranged on a non-metallic table 0.8 m placed on the turntable.

Measuring antennas used: Double Ridge EMC model 3115.

Cable loss (in dB) is included in SA measurement calculation.

First, initial scans were performed in normal (transmitting) mode of operation for carrier (channel) frequency at the low and the high of the 2412 - 2462 MHz frequency range under 2 data transfer bit rates. The Output Power (19dBm) was adjusted from the data and control transfer equipment with the system integrator access only (following to Important Safety Instruction of Installation Guide). The worst results from all measurements (Low band edge frequency-2390MHz frequency, and High band edge frequency-2483.5MHz) are presented in summary table of clause 7.7.4 and at the plots 123-138.

Antenna height = 1 m.

Measurement distance = 3m.

Measuring detector function and bandwidths:

Detector type	Peak	Average
RBW	1MHz	1MHz
VBW	1 MHz	30 Hz



Test Report No.: 8812328348

Page 51 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1

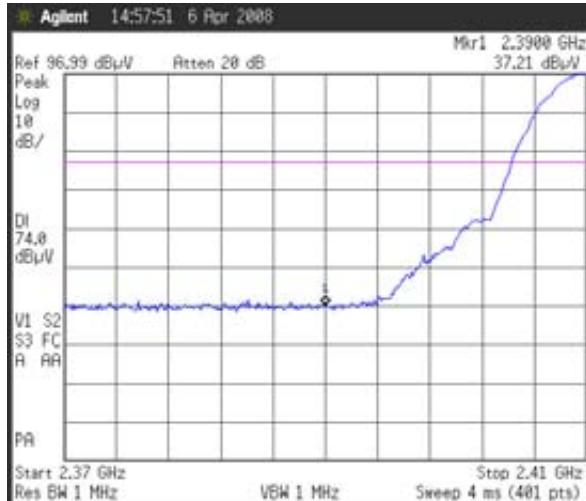
**7.7.4. Test results and calculation ratio:**

The test results are shown in Plots - as detailed in Table below:

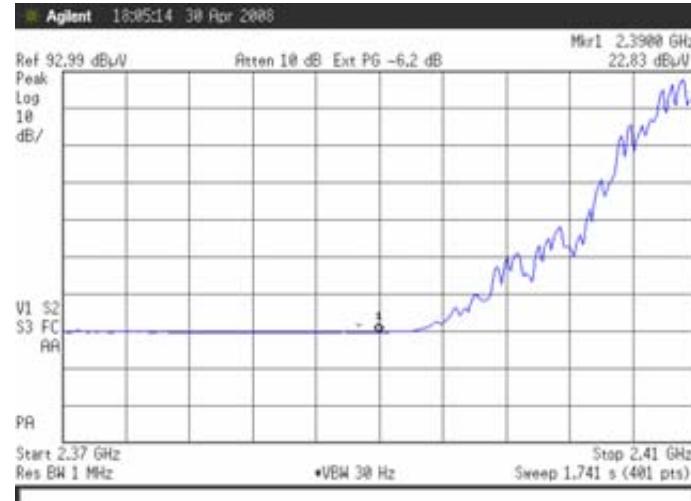
Band edge Freq. MHz	Pol V/H	Rate, Mbps	Read Pk, dB $\mu$ V	Read Avg, dB $\mu$ V	AF, dB	Peak, dB $\mu$ V/m	Avg, dB $\mu$ V/m	Peak Limit, dB( $\mu$ V/m)	Avg Limit, dB( $\mu$ V/m)	Peak Margin dB	Avg Margin dB	Verdict	Plot Number
<b>Transmitting on Low (2.412GHz) frequency.</b>													
2390	V	1	37.21	22.83	30	67.21	52.83	74	54	6.79	1.17	Pass	123,124
2390	H	1	21.31	12.06	30	51.31	42.06	74	54	22.69	11.94	Pass	125,126
2390	V	6	37.90	23.02	30	67.90	53.02	74	54	6.10	0.98	Pass	127,128
2390	H	6	22.08	10.18	30	52.08	40.18	74	54	21.92	13.82	Pass	129,130
<b>Transmitting on High (2.462GHz) frequency.</b>													
2483.5	V	1	30.87	19.37	30	60.87	49.37	74	54	13.13	4.63	Pass	131,132
2483.5	H	1	22.36	14.32	30	52.36	44.32	74	54	21.64	9.68	Pass	133,134
2483.5	V	6	29.63	19.76	30	59.63	49.76	74	54	14.37	4.24	Pass	135,136
2483.5	H	6	21.13	14.41	30	51.13	44.41	74	54	22.87	9.59	Pass	137,138

Test Report No.: 8812328348

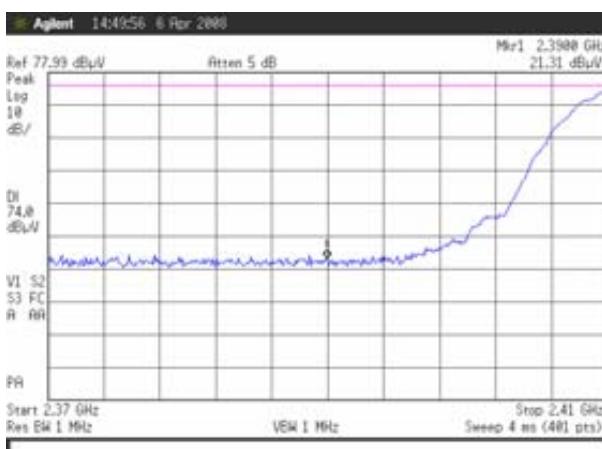
Page 52 of 105 Pages

 Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station  
 Model: WBS-2400 FCC ID: UGM-WBS2400-1


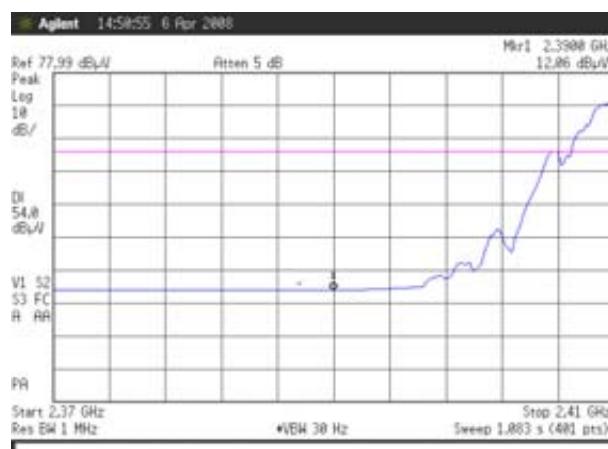
Plot # 123. Low frequency 1Mbps rate.  
802.11b;Peak;Vertical.



Plot # 124. Low frequency 1Mbps rate.  
802.11b;AVG;Vertical.



Plot # 125. Low frequency 1Mbps rate.  
802.11b;Peak; Horizontal.

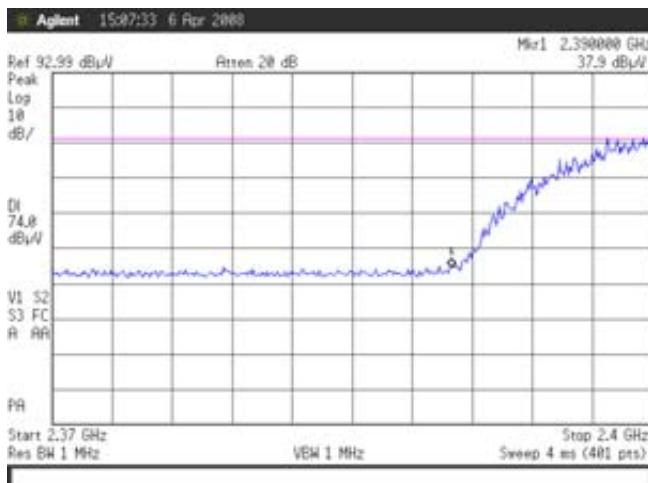
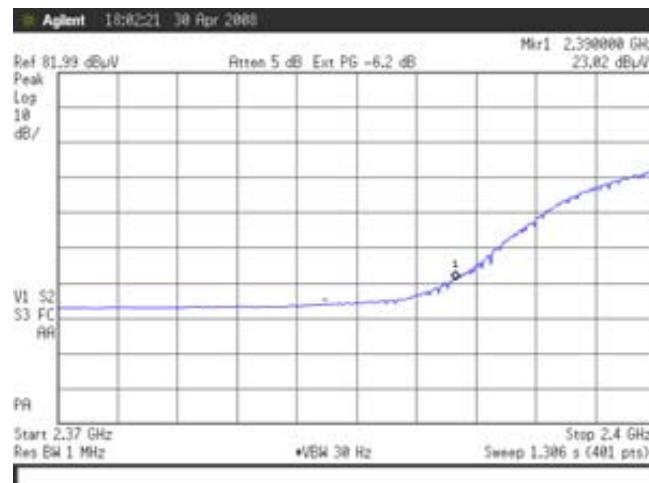
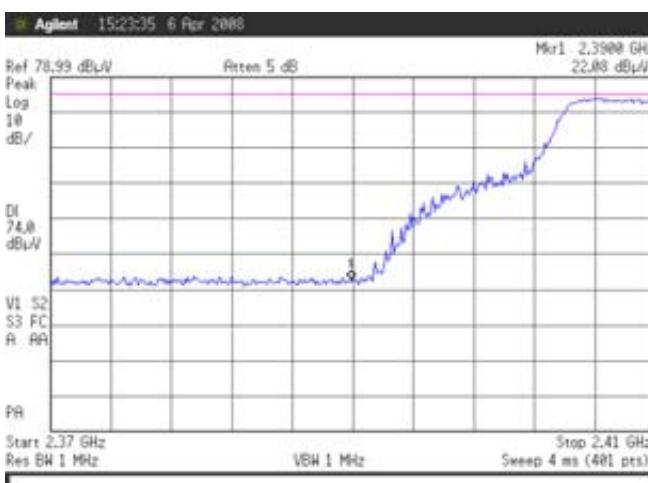
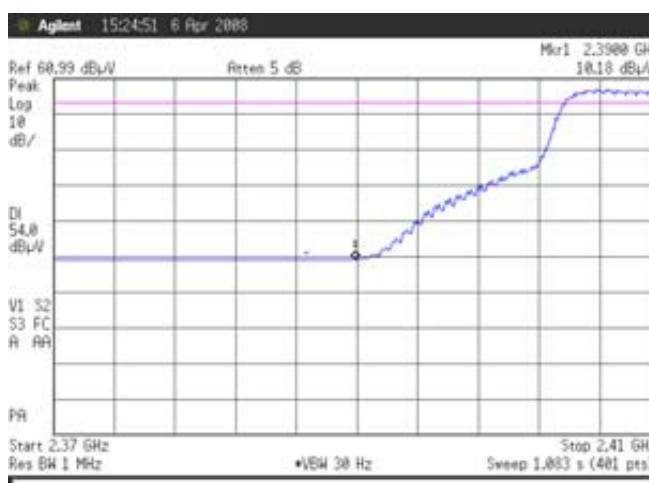


Plot # 126. Low frequency 1Mbps rate.  
802.11b;AVG; Horizontal.



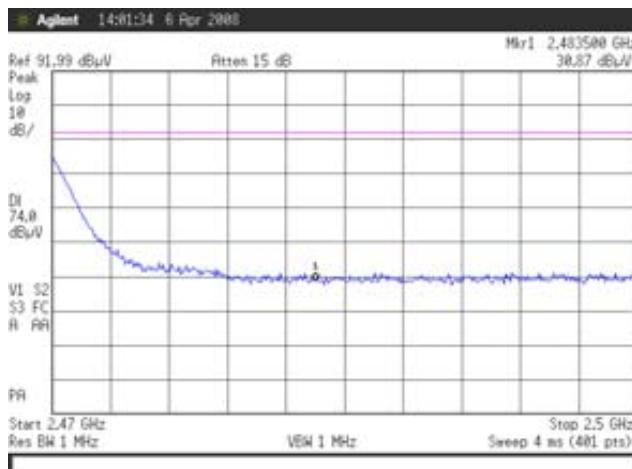
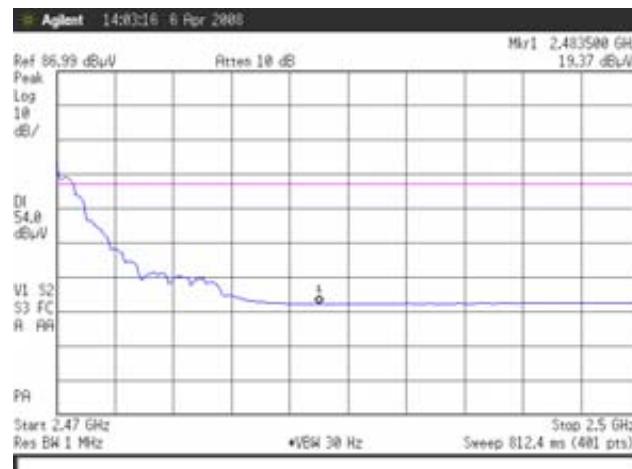
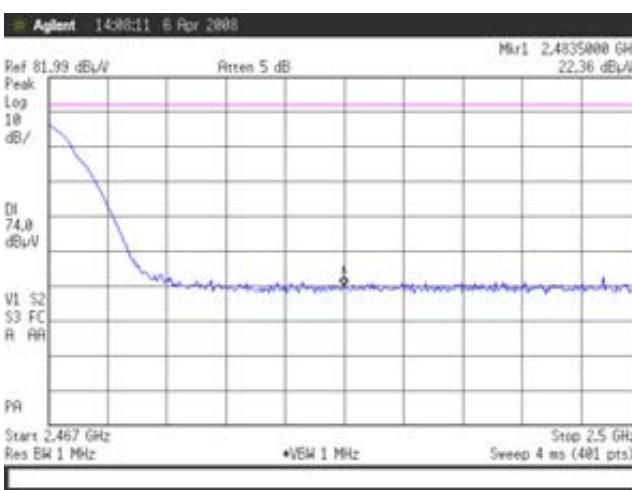
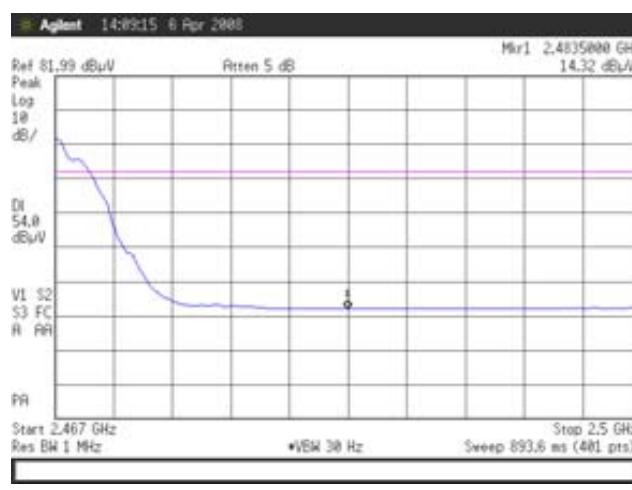
Test Report No.: 8812328348

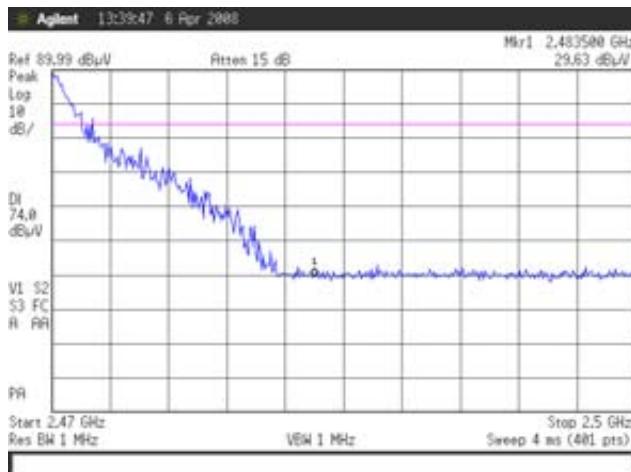
Page 53 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station  
Model: WBS-2400 FCC ID: UGM-WBS2400-1Plot # 127. Low frequency 6Mbps rate.  
802.11g; Peak; Vertical.Plot # 128. Low frequency 6Mbps rate.  
802.11g; AVG; Vertical.Plot # 129. Low frequency 6Mbps rate.  
802.11g; Peak; Horizontal.Plot # 130. Low frequency 6Mbps rate.  
802.11g; AVG; Horizontal.

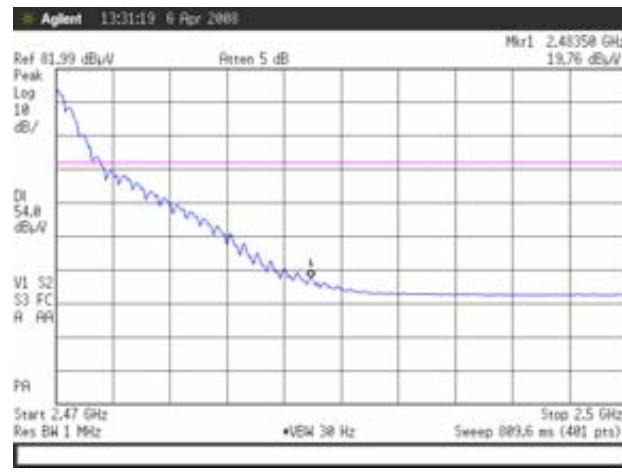
Test Report No.: 8812328348

Page 54 of 105 Pages

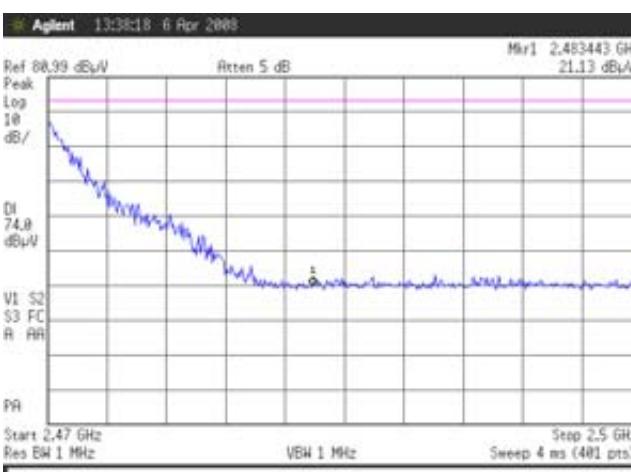
Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station  
Model: WBS-2400 FCC ID: UGM-WBS2400-1Plot # 131. High frequency 1Mbps rate.  
802.11b;Peak; Vertical.Plot # 132. High frequency 1Mbps rate.  
802.11b;AVG; Vertical.Plot # 133. High frequency 1Mbps rate.  
802.11b;Peak; Horizontal.Plot # 134. High frequency 1Mbps rate.  
802.11b;AVG; Horizontal.

**Test Report No.: 8812328348**
**Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station**
**Model: WBS-2400**
**Page 55 of 105 Pages**
**FCC ID: UGM-WBS2400-1**


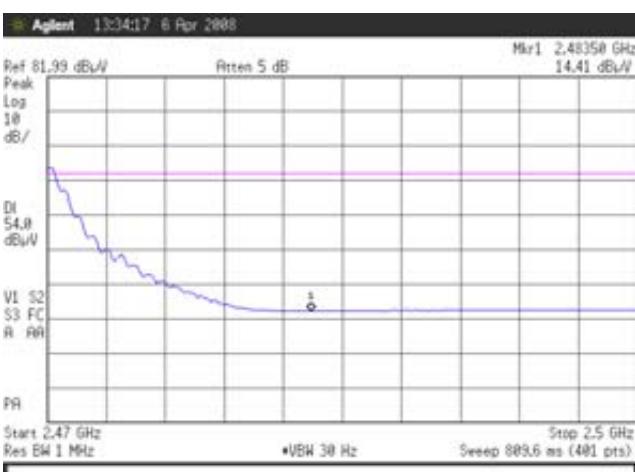
**Plot # 135. High frequency 6Mbps rate.  
802.11g; Peak; Vertical.**



**Plot # 136. High frequency 6Mbps rate.  
802.11g; AVG; Vertical.**



**Plot # 137. High frequency 6Mbps rate.  
802.11g; Peak; Horizontal.**



**Plot # 138. High frequency 6Mbps rate.  
802.11g; AVG; Horizontal.**



Test Report No.: 8812328348

Page 56 of 105 Pages

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

FCC ID: UGM-WBS2400-1

## 7.8. Minimum bandwidth

### 7.8.1. Requirements:

The minimum 6dB bandwidth shall be at least 500 KHz as required in sec. 15.247 (a)(2).

### 7.8.2. Pre-test scanning:

In order to find the “worst case” sample, which can represent all kinds of RF filters, each filter was pre-tested. The following filters were pre-tested: Murata, Comnav, Bitel, Skyworks. After all min. bandwidth tests the Skyworks models were chosen as the “worst case”, all final measurements were performed with 6 Skyworks filters.

### 7.8.3. Test procedure:

The measurements were performed in normal (transmitting) mode of operation for carrier (channel) frequency at low, middle and the high of the 2.412 - 2.462 GHz frequency range under 2 data transfer bit rates, that reflect to the worst test results. All final tests were performed on Output 4 that is the worst case between all outputs.

The EUT RF output was connected to the Spectrum Analyzer accounted with cable loss in SA settings.

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

### 7.8.4. Test results:

#### Pre-compliance measurements

The WBS-2400 configurations for preliminary tests was as following: 2 RF filters Skyworks, 1 RF filter Comnav, 2 RF filter Bitel, 1 RF filter Murata.

The summaries of preliminary minimum bandwidth measurements are shown in Table 7 and were found with large margin. The plots of pre-scan for each kind of 4 RF filters (outputs 1,3,5,6 accordantly) are presented on the plots 139-162.

			Output1	Output3	Output5	Output6
Freq.	Rate	Modulation	Skyworks	Comnav	Bitel	Murata
MHz	Mbps	mode	MHz	MHz	MHz	MHz
2412	1	802.11b	9.54	8.99	9.05	8.99
	6	802.11g	16.11	15.00	15.72	16.11
2437	1	802.11b	10.02	9.07	9.55	9.55
	6	802.11g	16.27	16.27	16.31	16.31
2462	1	802.11b	9.10	9.55	9.07	9.07
	6	802.11g	15.82	15.38	15.82	15.57

Table 7. 6dB bandwidth results

Test Report No.: 8812328348

Title: Test on 2.4 GHz Band Outdoor WiFi (802.11b/g) Wireless Base Station

Model: WBS-2400

Page 57 of 105 Pages

FCC ID: UGM-WBS2400-1

