

## FCC 15.247 2.4 GHz Report for

**Fortress Auto Int'l Ltd**

**No.3, Ln. 190, Danyan Rd., Yangmei Dist.,  
Taoyuan City 32661, Taiwan**

**Product Name : The Multi-Angle Digital  
Wireless Parking Camera**  
**Brand : N/A**  
**Model Name : WB060**  
**FCC ID : 2AJNIWB060**

**Prepared by: : AUDIX Technology Corporation,  
EMC Department**



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APPENDIX A TEST PHOTOGRAPHS  
APPENDIX B TEST PLOTS

## TEST REPORT CERTIFICATION

Applicant : Fortress Auto Int'l Ltd  
Product Name : The Multi-Angle Digital Wireless Parking Camera  
Model No. : WB060  
Serial No. : N/A  
Brand Name : N/A

Applicable Standards:

47 CFR FCC Part 15 Subpart C: 2015  
ANSI C63.10:2013  
KDB 558074 D01 DTS Meas Guidance v03r05

**AUDIX Technology Corp.** tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report. **AUDIX Technology Corp.** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Test: 2016. 09. 21 ~ 10. 12

Date of Report: 2016. 10. 17

Producer: Sabrina Wang  
(Sabrina Wang/Administrator)

Signatory: Ben Cheng  
(Ben Cheng/Manager)

## 1. REPORT HISTORY

Revision	Date	Revision Summary	Report Number
0	2016. 10. 17	Original Report.	EM-F160619

## 2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	N/A, Note
15.247(d)/15.205	Radiated Band Edge and Radiated Spurious Emission	PASS
15.247(a)(2)	6dB Bandwidth	PASS
15.247(b)(3)	Maximum Peak Output	PASS
15.247(d)	Conducted Band Edges and Conducted Spurious Emission	PASS
15.247 (e)	Peak Power Spectral Density	PASS
15.203	Antenna Requirement	PASS
Note: The EUT only employs battery power for operation, so it is unnecessary to test.		

### 3. GENERAL INFORMATION

#### 3.1. Description of EUT

Product	The Multi-Angle Digital Wireless Parking Camera		
Model Number	WB060		
Serial Number	N/A		
Brand	N/A		
Applicant	Fortress Auto Int'l Ltd No.3, Ln. 190, Dianyan Rd., Yangmei Dist., Taoyuan City 32661, Taiwan		
RF Features	802.11 b/g		
Transmit Type	802.11b	1T1R	
	802.11g	1T1R	
Power Wire	Unshielded, Undetachable, 2.0m		
Date of Receipt of Sample	2016. 08. 28		

#### 3.2. Antenna Information

Antenna Part Number	Brand	Antenna Type	Frequency	Max Gain
RA16LMSA00RA045S	RIFO	PIFA Antenna	2400-2500MHz	3.76dBi

### 3.3. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
802.11b	2412-2462	11	DSSS (DBPSK/DQPSK/CCK)	Up to 11
802.11g		11	OFDM (BPSK/QPSK/16QAM/64QAM)	Up to 54

Channel List	
802.11 b/g	
Channel Number	Frequency (MHz)
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462



### 3.4. Data Rate Relative to Output Power

802.11b			
Channel	Modulation	Date Rate (Mbps)	Power (dBm)
1	DBPSK	1	<b>15.86</b>
1	DQPSK	2	<b>15.83</b>
1	CCK	5.5	<b>15.77</b>
1	CCK	11	<b>15.71</b>
802.11g			
Channel	Modulation	Date Rate (Mbps)	Power (dBm)
1	BPSK	6	<b>13.82</b>
1	BPSK	9	<b>13.79</b>
1	QPSK	12	<b>13.77</b>
1	QPSK	18	<b>13.72</b>
1	16-QAM	24	<b>13.65</b>
1	16-QAM	36	<b>13.59</b>
1	64-QAM	48	<b>13.53</b>
1	64-QAM	54	<b>13.48</b>

Note: Above results are assessed in Average power.

### 3.5. Test Configuration

Mode	Duty Cycle (x)	T (ms)	Duty Cycle Factor (dB)
802.11b	1.0	N/A	N/A
802.11g	1.0	N/A	N/A

Note: When duty cycle is less than 98% (0.98) that duty cycle factor  $10\log(1/x)$  is needed to add in conducted test items measured in average detector.

Item		Mode	Data Rate	Test Channel
Radiated Test Case	Radiated Band Edge <small>Note1</small>	802.11b	1Mbps	1/11
		802.11g	6Mbps	1/6/11
	Radiated Spurious Emission <small>Note1 &amp; 2</small>	802.11b	1Mbps	1/6/11
		802.11g	6Mbps	1/6/11
Conducted Test Case	6dB Bandwidth	802.11b	1Mbps	1/6/11
		802.11g	6Mbps	1/6/11
	Peak Power Spectral Density	802.11b	1Mbps	1/6/11
		802.11g	6Mbps	1/6/11
	Peak Output Power	802.11b	1Mbps	1/6/11
		802.11g	6Mbps	1/2/10/11
	Band Edge	802.11b	1Mbps	1/11
		802.11g	6Mbps	1/11
	Spurious Emission	802.11b	1Mbps	1/6/11
		802.11g	6Mbps	1/6/11

Note 1:

☒ Mobile Device

☐ Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow:

- ☐ Lie
- ☐ Side
- ☐ Stand

Note 2: Low, mid, and high channels were measured, only the worst channel of each modulation was presented in this report.

### 3.6. Tested Supporting System List

#### 3.6.1. Support Peripheral Unit

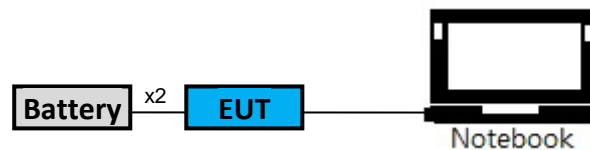
No.	Product	Brand	Model No.	Serial No.	FCC ID
1.	Battery (DC 12V)	N/A	N/A	N/A	N/A
2.	Notebook PC	ASUS	X5502E	N/A	PPD-AAR5B225

#### 3.6.2. Cable Lists

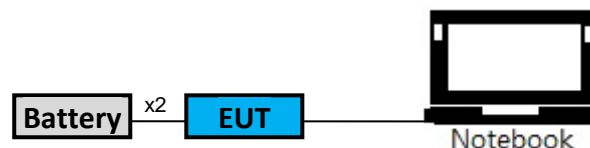
No.	Cable Description Of The Above Support Units
1.	Power Wire x2: Unshielded, Detachable, 0.2m
2.	USB Cable: Unshielded, Detachable, 1.0m Adapter: Enerironix, M/N M/N EXA1208UH, DC Power Cord: Unshielded, Detachable, 1.8m AC Power Cord: Shielded, Undetachable, 1.8m, Bonded a ferrite core

### 3.7. Setup Configuration

#### 3.7.1. EUT Configuration for Radiated Emission



#### 3.7.2. EUT Configuration for Conducted Test Items



### 3.8. Operating Condition of EUT

Test program “MTT601” is used for enabling EUT WLAN function under continues transmitting and choosing data rate/ channel.

### 3.9. Description of Test Facility

Test Firm Name	:	<b>AUDIX Technology Corporation</b> <b>EMC Department</b> No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
Test Location & Facility	:	<b>Semi-Anechoic Chamber</b> <b>Fully Anechoic Chamber</b> No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan
NVLAP Lab. Code	:	200077-0
TAF Accreditation No	:	1724
FCC OET Designation	:	TW1004 & TW1090

### 3.10. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 3.68dB
	Above 1GHz	± 5.82dB

Remark : Uncertainty =  $k_{uc}(y)$

Test Item	Uncertainty
6dB Bandwidth	± 0.05kHz
Maximum peak output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 0.13dB

## 4. MEASUREMENT EQUIPMENT LIST

### 4.1. Radiated Emission Measurement

#### 4.1.1. Frequency Range 9kHz~1000MHz (Semi-Anechoic Chamber)

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2016. 09. 19	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2016. 06. 22	1 Year
3.	Amplifier	HP	8447D	2944A06305	2016. 02. 23	1 Year
4.	Bilog Antenna	CHASE	CBL6112D	33821	2016. 01. 30	1 Year
5.	Loop Antenna	R&S	HFH2-Z2	891847/27	2015. 12. 24	1 Year
6.	Test Software	Audix	e3	V.6.110601	N.C.R.	N.C.R.

#### 4.1.2. Frequency Range Above 1GHz (Fully Anechoic Chamber)

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	2016. 08. 19	1 Year
2.	Amplifier	Sonoma	310N	187161	2016. 06. 14	1 Year
3.	2.4GHz Notch Filter	K&L	7NSL10-2441. 5E130.5-00	1	2016. 07. 28	1 Year
4.	Horn Antenna	ETS-Lindgren	3117	00135902	2016. 03. 05	1 Year
5.	Horn Antenna	EMCO	3116	2653	2015. 10. 20	1 Year
6.	Test Software	Audix	e3	V.6.110601	N.C.R.	N.C.R.

### 4.2. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-507	MY52220264	2016. 08. 09	1 Year
2.	Power Meter	Anritsu	ML2495A	1145008	2015. 10. 23	1 Year
3.	Power Sensor	Anritsu	MA2411B	1126096	2015. 10. 23	1 Year

## **5. CONDUCTED EMISSION MEASUREMENT**

【The EUT only employs battery power for operation, no conductive emission limits are required according to FCC Part 15 Section §15.207】

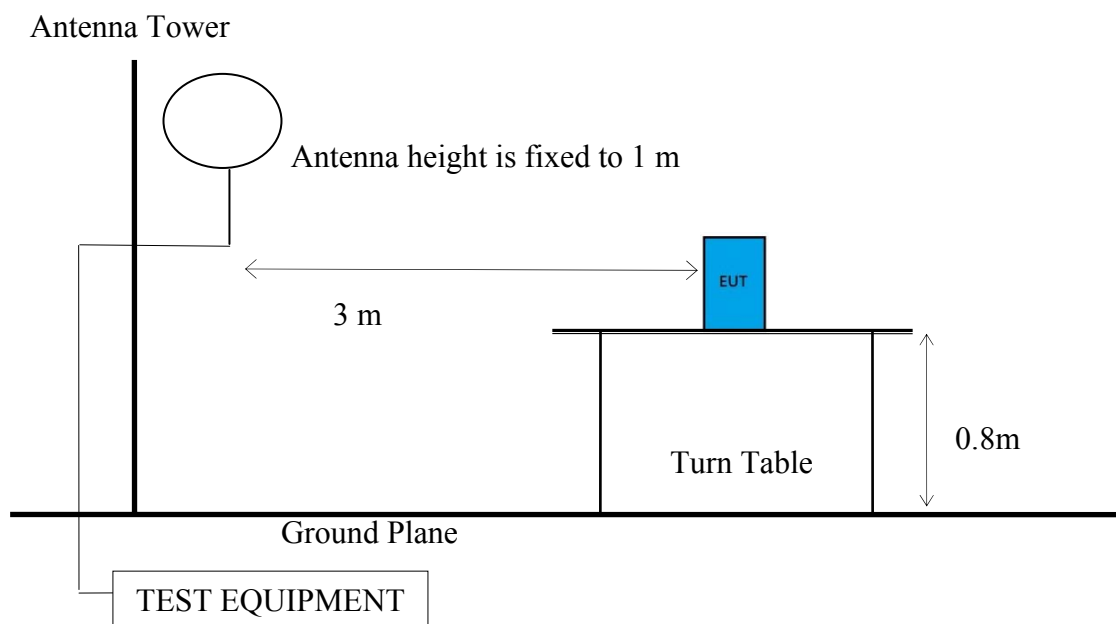
## 6. RADIATED EMISSION MEASUREMENT

### 6.1. Block Diagram of Test Setup

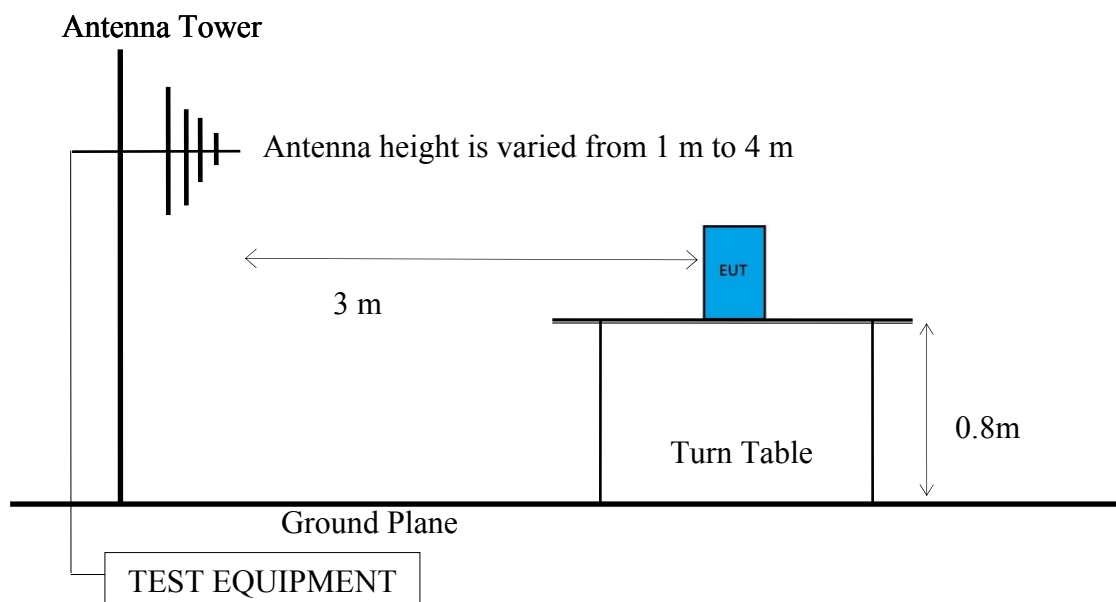
#### 6.1.1. Block Diagram of connection between EUT and simulators

Indicated as section 3.7

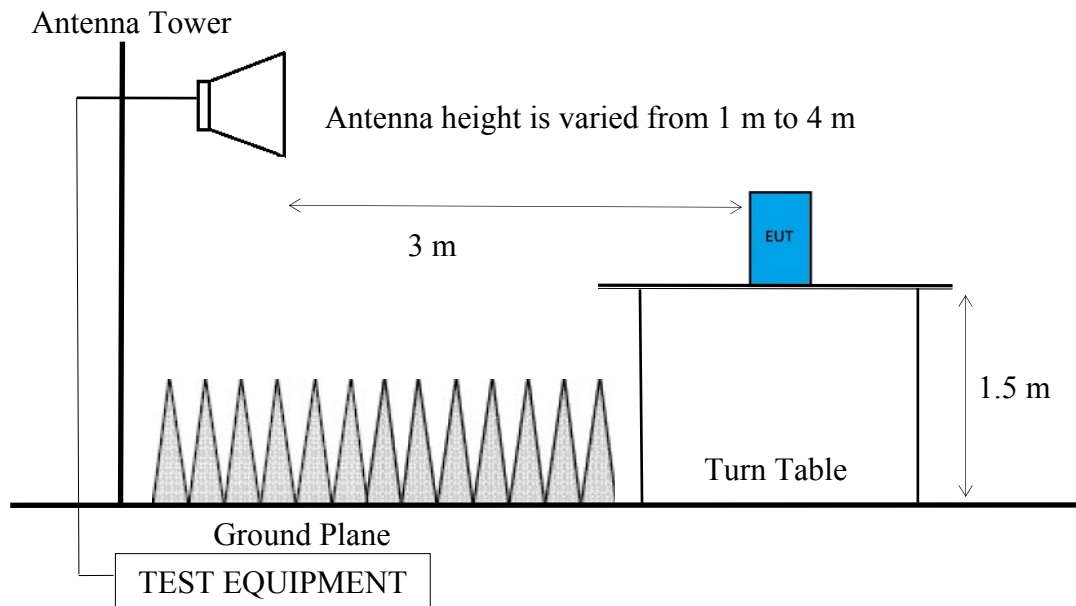
#### 6.1.2. Semi Anechoic Chamber (3m) Setup Diagram for 9kHz-30MHz



#### 6.1.3. Semi Anechoic Chamber (3m) Setup Diagram for 30-1000 MHz



#### 6.1.4. Fully Anechoic Chamber (3m) Setup Diagram for above 1GHz



## 6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Limits	
		dB $\mu$ V/m	$\mu$ V/m
0.009 - 0.490	300	67.6	2400/kHz
0.490 - 1.705	30	87.6	24000/kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dB $\mu$ V/m (Peak) 54.0 dB $\mu$ V/m (Average)	

Remark : (1) dB $\mu$ V/m = 20 log ( $\mu$ V/m)

- (2) The tighter limit applies to the edge between two frequency bands.
- (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
- (4) Fundamental and emission fall within operation band are exempted from this section.
- (5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.



### 6.3. Test Procedure

#### **Frequency Range 9kHz~30MHz:**

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

- (1) RBW = 9kHz with peak and average detector.
- (2) Detector: average and peak (9kHz-490kHz)  
Q.P. (490kHz-30MHz)

#### **Frequency Range 30MHz ~ 40GHz:**

The EUT setup on the turn find table which has 80 cm (for 30-1000 MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

#### **Frequency below 1 GHz:**

Spectrum Analyzer is used for pre-testing with following setting:

- (1) RBW = 120KHz
- (2) VBW  $\geq 3 \times$  RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the Q.P. detector is not required. Otherwise using Q.P. for finally measurement.

**Frequency above 1GHz to 10th harmonic:****Peak Detector:**

- (1) RBW = 1MHz
- (2) VBW  $\geq 3 \times$  RBW.
- (3) Detector = Peak.
- (4) Sweep time = auto.
- (5) Trace mode = max hold.
- (6) Allow sweeps to continue until the trace stabilizes.
- (7) When peak-detected value is lower than limit that the measurement using the average detector is not required. Otherwise using average for finally measurement.

**Average Detector:****■ Option 1:**

- (1) RBW = 1MHz
- (2) VBW  $\geq 1/T$ .

Modulation Type	T (ms)	1/ T (kHz)	VBW Setting(kHz)
802.11b	1	N/A	N/A
802.11g	1	N/A	N/A

N/A: 1/ T is not implemented when duty cycle presented in section 3.5 is  $\geq 98\%$ .

- (1) Detector = Peak.
- (2) Sweep time = auto.
- (3) Trace mode = max hold.
- (4) Allow sweeps to continue until the trace stabilizes.

**□ Option 2:**

Average Emission Level= Peak Emission Level+ D.C.C.F.

**6.4. Measurement Result Explanation**

- Peak Emission Level=Antenna Factor + Cable Loss + Meter Reading
- Average Emission Level=Antenna Factor + Cable Loss + Meter Reading
- Average Emission Level= Peak Emission Level+ DCCF  
Duty Cycle Correction Factor (DCCF)=  $20\log(TX_{on}/TX_{on+off})$  presented in section 3.5
- EPR= Peak Emission Level-95.2dB-2.14dB

**6.5. Test Results****PASSED.**

Test Date	2016/10/12	Temp./Hum.	23°C/53%
Test Voltage	DC 12V (Via Battery)		

### 6.5.1. Emissions within Restricted Frequency Bands

#### 6.5.1.1. Frequency 9kHz~30MHz

**The emissions (9kHz~30MHz) not reported for there is no emission be found.**

#### 6.5.1.2. Frequency Below 1 GHz

Mode	802.11b	Frequency	TX 2437MHz
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#### Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
86.26	10.16	2.09	12.50	24.75	40.00	15.25	Peak
248.25	12.65	3.80	19.10	35.55	46.00	10.45	Peak
433.52	16.38	5.87	12.92	35.17	46.00	10.83	Peak
702.21	18.54	7.09	9.89	35.52	46.00	10.48	Peak

#### Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
88.20	10.43	2.12	17.96	30.51	43.50	12.99	Peak
240.49	12.19	3.73	15.65	31.57	46.00	14.43	Peak
397.63	15.90	5.53	9.62	31.05	46.00	14.95	Peak
647.89	18.46	6.91	11.74	37.11	46.00	8.89	Peak

Mode	802.11g	Frequency	TX 2437MHz
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**Antenna at Horizontal Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
86.26	10.16	2.09	12.23	24.48	40.00	15.52	Peak
241.46	12.24	3.74	17.74	33.72	46.00	12.28	Peak
433.52	16.38	5.87	13.68	35.93	46.00	10.07	Peak
702.21	18.54	7.09	9.55	35.18	46.00	10.82	Peak

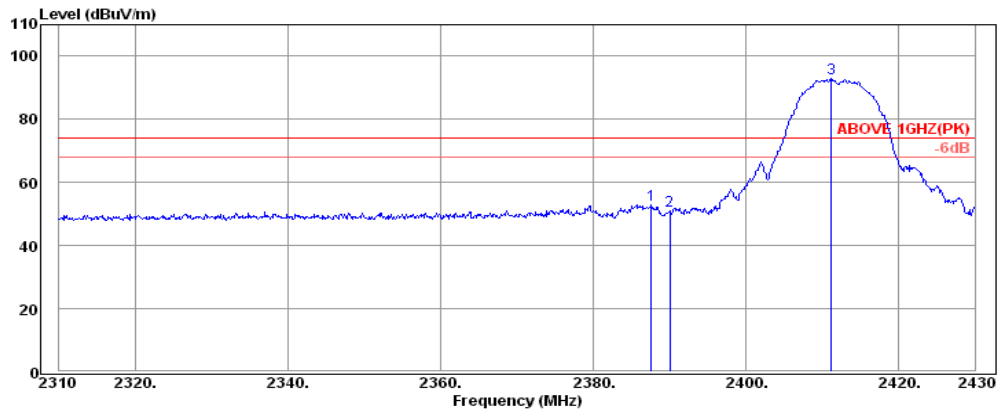
**Antenna at Vertical Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
86.26	10.16	2.09	18.99	31.24	40.00	8.76	Peak
242.43	12.29	3.74	14.43	30.46	46.00	15.54	Peak
499.48	17.13	6.42	9.36	32.91	46.00	13.09	Peak
647.89	18.46	6.91	11.60	36.97	46.00	9.03	Peak

## 6.5.2. Frequency Above 1 GHz to 10<sup>th</sup> harmonics

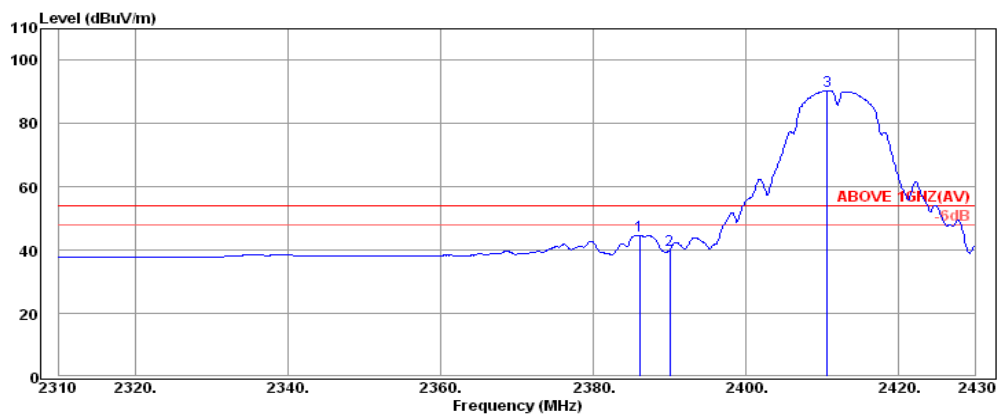
### Band Edge:

Mode	802.11b	Frequency	TX 2412MHz
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### Antenna at Horizontal Polarization

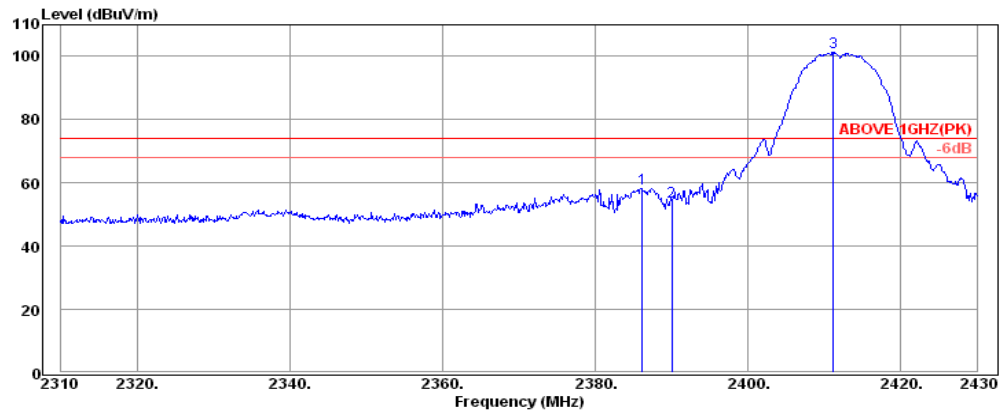
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2387.64	32.16	6.08	14.80	53.04	74.00	20.96	Peak
2390.04	32.16	6.08	12.82	51.06	74.00	22.94	Peak
2411.16	32.18	6.11	54.63	92.92	---	---	Peak



### Antenna at Horizontal Polarization

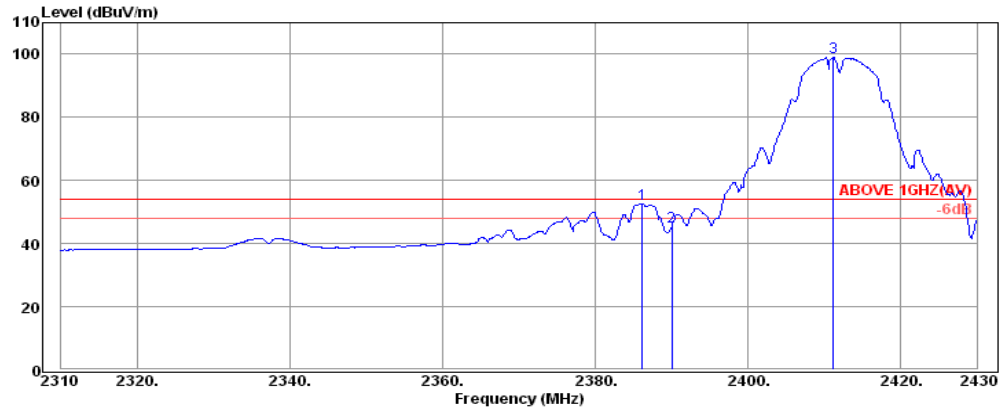
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2386.08	32.16	6.07	6.50	44.73	54.00	9.27	Average
2390.04	32.16	6.08	1.87	40.11	54.00	13.89	Average
2410.68	32.18	6.10	52.23	90.51	---	---	Average

Mode	802.11b	Frequency	TX 2412MHz
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#### Antenna at Vertical Polarization

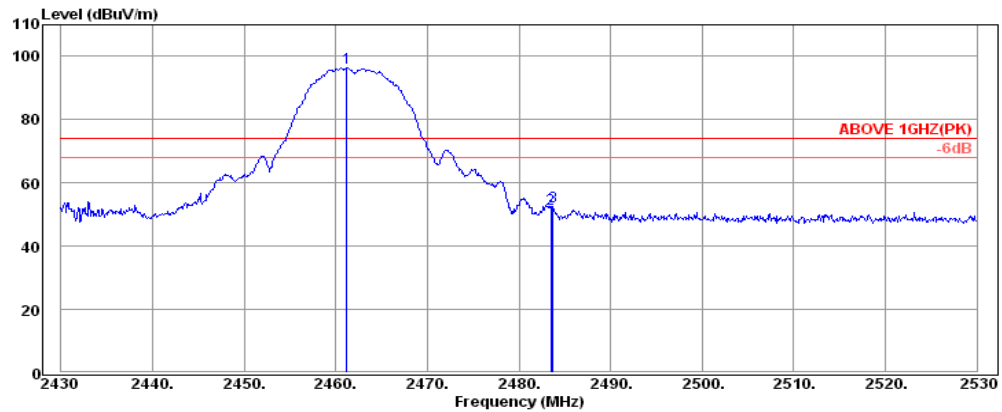
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2386.20	32.16	6.07	20.14	58.37	74.00	15.63	Peak
2390.04	32.16	6.08	15.73	53.97	74.00	20.03	Peak
2411.16	32.18	6.11	62.93	101.22	---	---	Peak



#### Antenna at Vertical Polarization

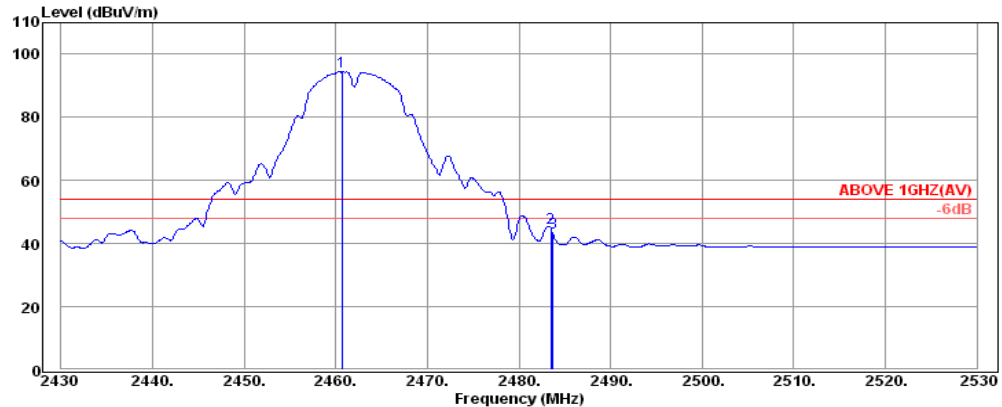
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2386.20	32.16	6.07	14.25	52.48	54.00	1.52	Average
2390.04	32.16	6.08	7.09	45.33	54.00	8.67	Average
2411.16	32.18	6.11	60.61	98.90	---	---	Average

Mode	802.11b	Frequency	TX 2462MHz
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#### Antenna at Horizontal Polarization

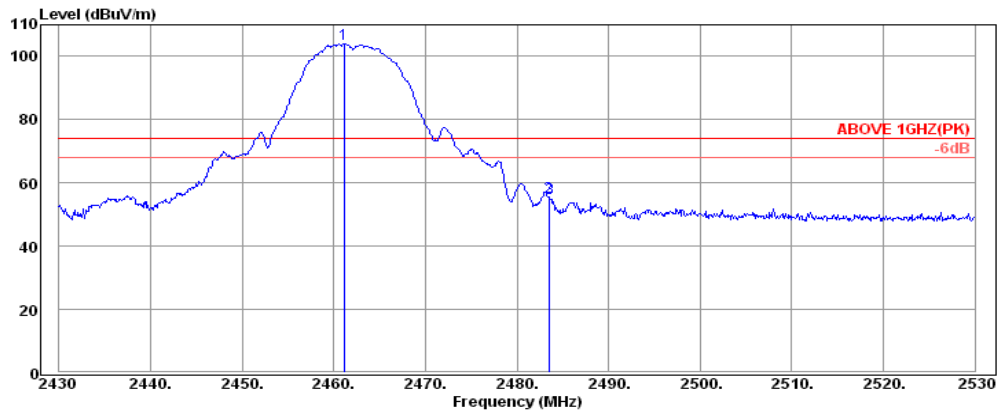
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2461.20	32.25	6.16	58.15	96.56	---	---	Peak
2483.50	32.28	6.19	13.25	51.72	74.00	22.28	Peak
2483.70	32.28	6.19	14.21	52.68	74.00	21.32	Peak



#### Antenna at Horizontal Polarization

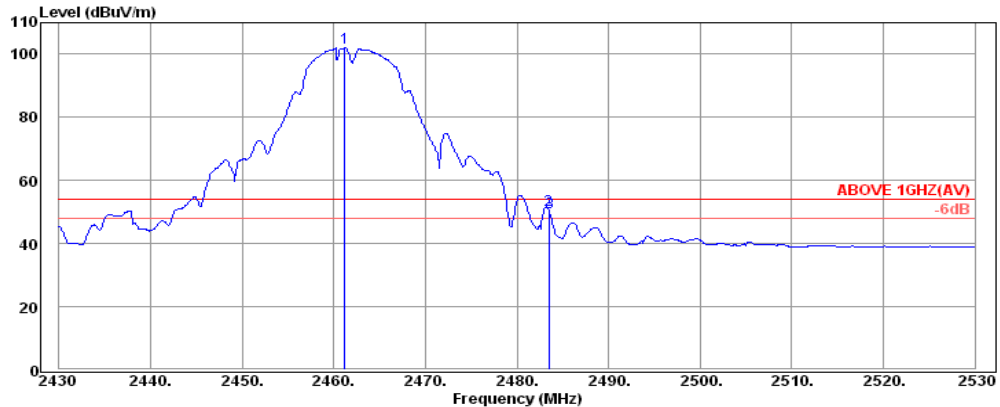
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2460.70	32.25	6.16	55.99	94.40	---	---	Average
2483.50	32.28	6.19	6.41	44.88	54.00	9.12	Average
2483.70	32.28	6.19	5.08	43.55	54.00	10.45	Average

Mode	802.11b	Frequency	TX 2462MHz
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#### Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2461.10	32.25	6.16	65.70	104.11	---	---	Peak
2483.50	32.28	6.19	16.95	55.42	74.00	18.58	Peak
2483.60	32.28	6.19	16.75	55.22	74.00	18.78	Peak

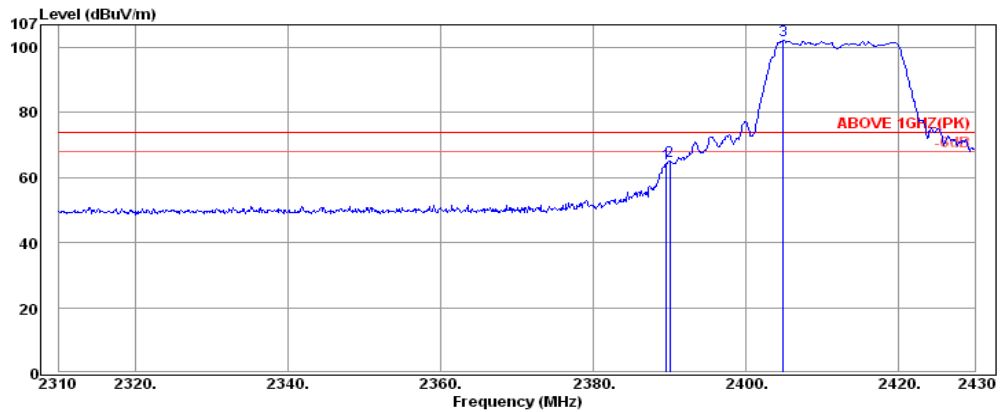


#### Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2461.20	32.25	6.16	63.54	101.95	---	---	Average
2483.50	32.28	6.19	12.17	50.64	54.00	3.36	Average
2483.60	32.28	6.19	11.43	49.90	54.00	4.10	Average

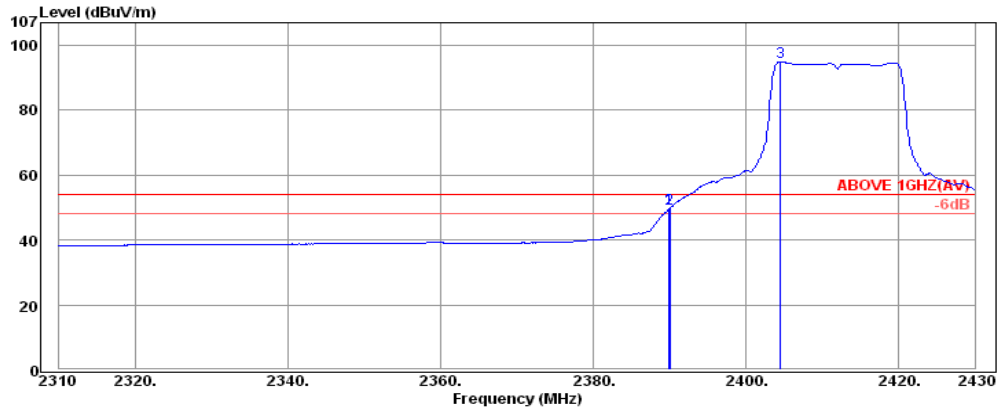


Mode	802.11g	Frequency	TX 2412MHz
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#### Antenna at Horizontal Polarization

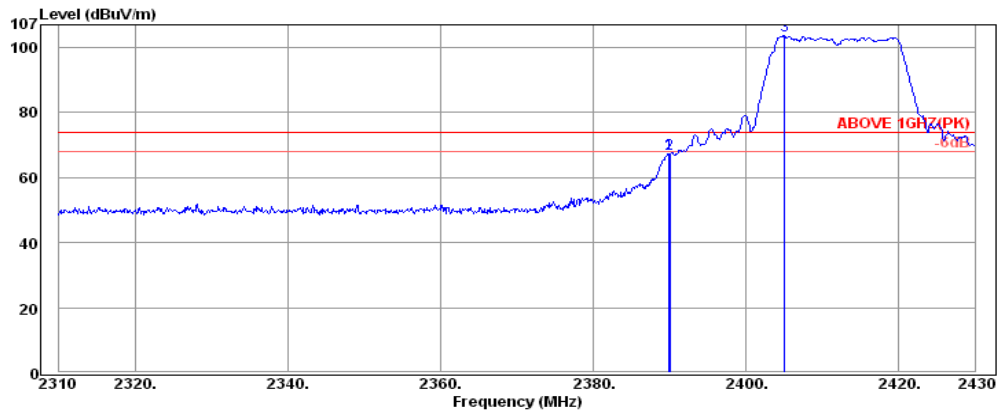
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2389.56	32.16	6.08	26.13	64.37	74.00	9.63	Peak
2390.04	32.16	6.08	26.80	65.04	74.00	8.96	Peak
2404.92	32.18	6.10	63.79	102.07	---	---	Peak



#### Antenna at Horizontal Polarization

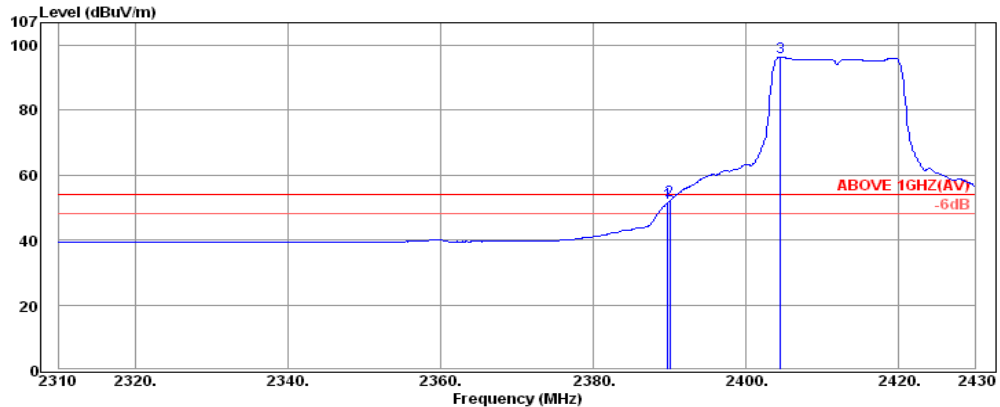
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2389.92	32.16	6.08	11.33	49.57	54.00	4.43	Average
2390.04	32.16	6.08	11.57	49.81	54.00	4.19	Average
2404.56	32.18	6.10	56.64	94.92	---	---	Average

Mode	802.11g	Frequency	TX 2412MHz
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### Antenna at Vertical Polarization

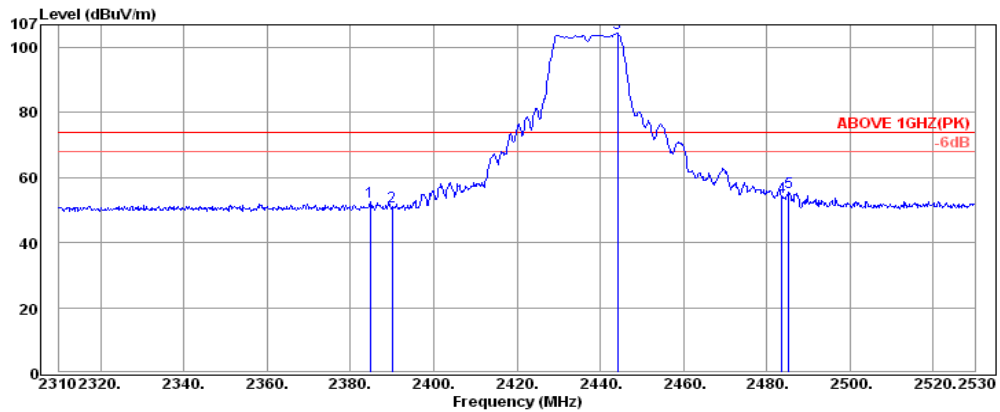
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2389.92	32.16	6.08	28.91	67.15	74.00	6.85	Peak
2390.04	32.16	6.08	28.91	67.15	74.00	6.85	Peak
2405.04	32.18	6.10	65.26	103.54	---	---	Peak



### Antenna at Vertical Polarization

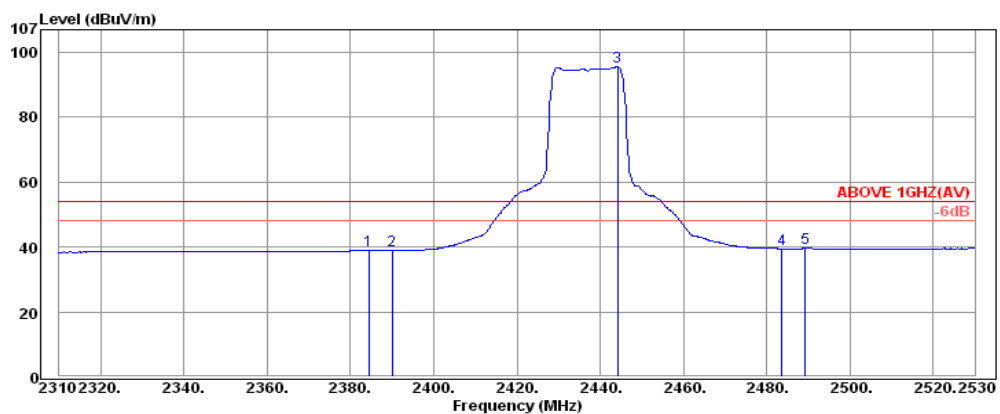
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2389.80	32.16	6.08	13.37	51.61	54.00	2.39	Average
2390.04	32.16	6.08	13.86	52.10	54.00	1.90	Average
2404.56	32.18	6.10	58.13	96.41	---	---	Average

Mode	802.11g	Frequency	TX 2437MHz
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### Antenna at Horizontal Polarization

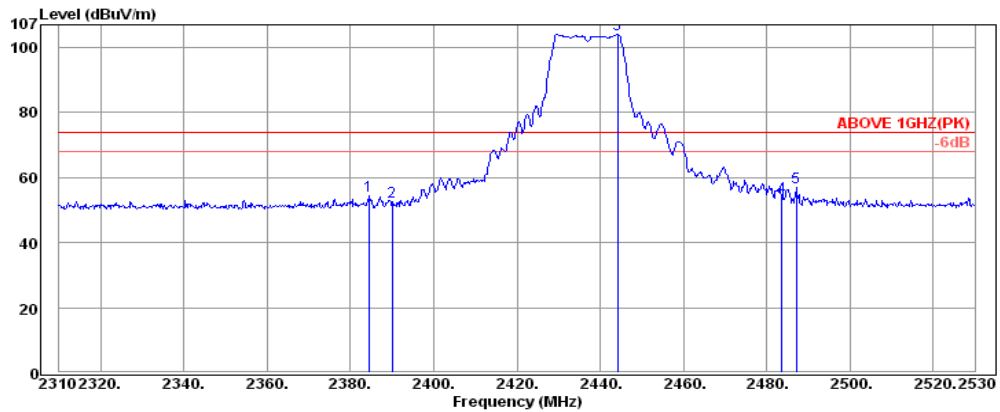
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2384.80	32.13	6.07	14.35	52.55	74.00	21.45	Peak
2390.08	32.16	6.08	12.90	51.14	74.00	22.86	Peak
2444.20	32.23	6.14	66.02	104.39	74.00	---	Peak
2483.58	32.28	6.19	15.70	54.17	74.00	19.83	Peak
2485.34	32.28	6.19	16.90	55.37	74.00	18.63	Peak



### Antenna at Horizontal Polarization

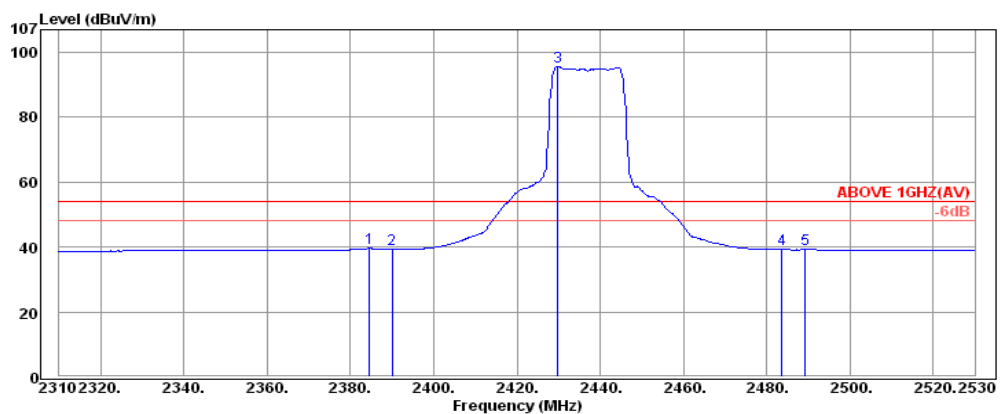
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2384.36	32.13	6.07	0.92	39.12	54.00	14.88	Average
2390.08	32.16	6.08	0.61	38.85	54.00	15.15	Average
2444.20	32.23	6.14	57.12	95.49	---	---	Average
2483.58	32.28	6.19	1.05	39.52	54.00	14.48	Average
2489.30	32.30	6.19	1.19	39.68	54.00	14.32	Average

Mode	802.11g	Frequency	TX 2437MHz
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### Antenna at Vertical Polarization

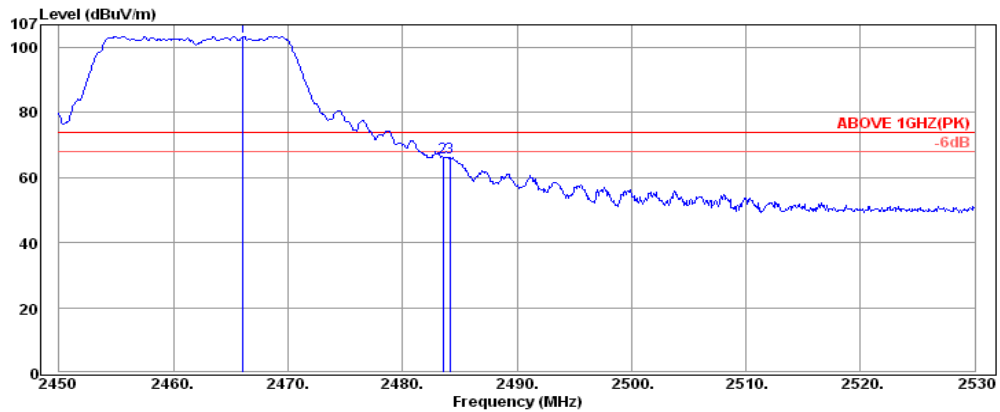
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2384.36	32.13	6.07	16.10	54.30	74.00	19.70	Peak
2390.08	32.16	6.08	14.23	52.47	74.00	21.53	Peak
2444.20	32.23	6.14	65.71	104.08	---	---	Peak
2483.58	32.28	6.19	15.70	54.17	74.00	19.83	Peak
2487.10	32.28	6.19	18.47	56.94	74.00	17.06	Peak



### Antenna at Vertical Polarization

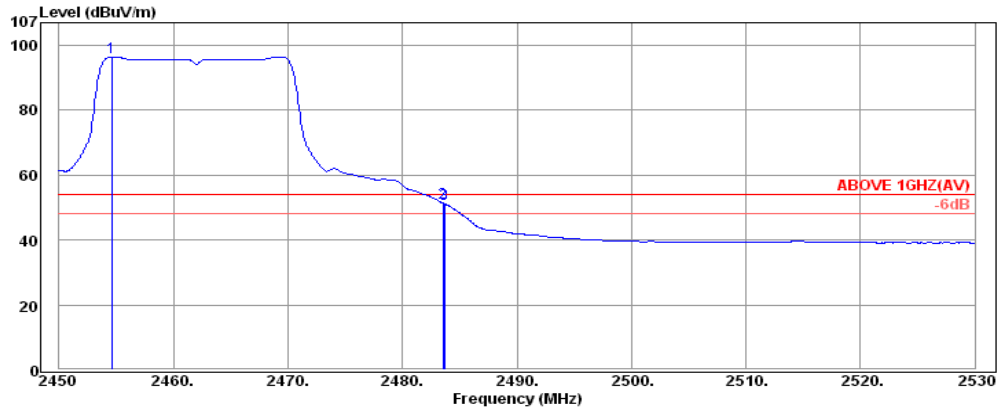
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2384.58	32.13	6.07	1.39	39.59	54.00	14.41	Average
2390.08	32.16	6.08	1.03	39.27	54.00	14.73	Average
2429.90	32.20	6.13	57.36	95.69	---	---	Average
2483.58	32.28	6.19	0.72	39.19	54.00	14.81	Average
2489.30	32.30	6.19	0.85	39.34	54.00	14.66	Average

Mode	802.11g	Frequency	TX 2462MHz
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#### Antenna at Horizontal Polarization

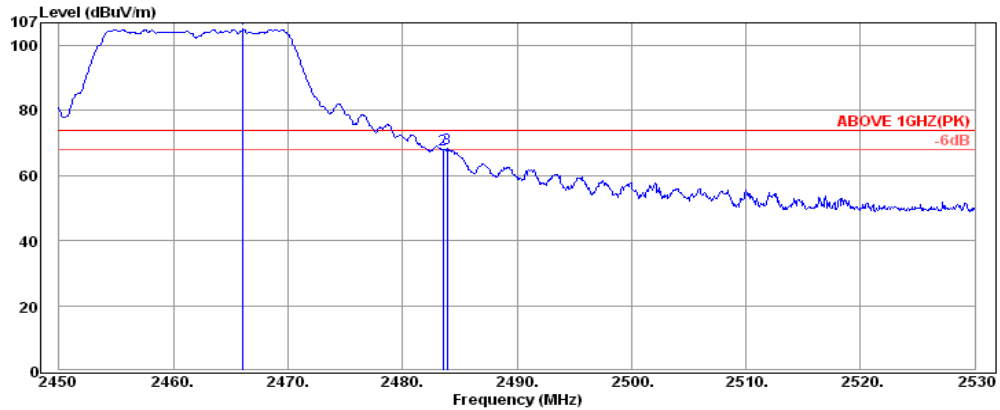
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2466.08	32.25	6.16	65.07	103.48	---	---	Peak
2483.52	32.28	6.19	27.81	66.28	74.00	7.72	Peak
2484.16	32.28	6.19	27.85	66.32	74.00	7.68	Peak



#### Antenna at Horizontal Polarization

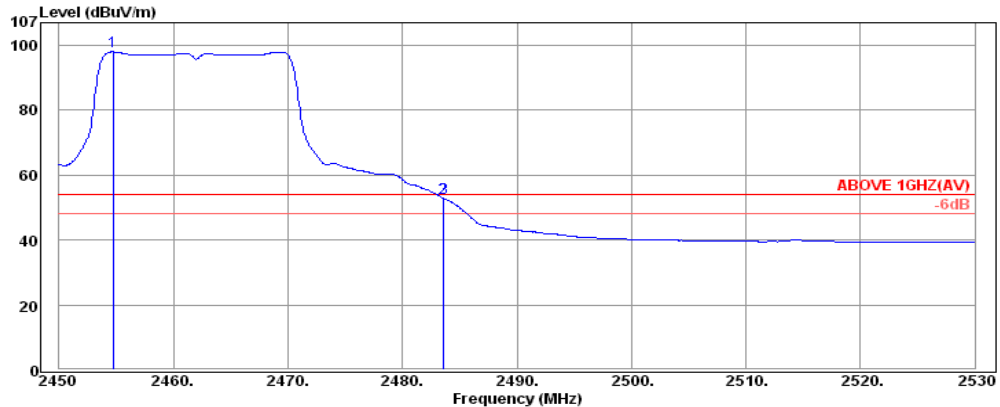
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2454.64	32.25	6.15	58.08	96.48	---	---	Average
2483.52	32.28	6.19	12.89	51.36	54.00	2.64	Average
2483.68	32.28	6.19	12.64	51.11	54.00	2.89	Average

Mode	802.11g	Frequency	TX 2462MHz
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### Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2466.08	32.25	6.16	66.58	104.99	---	---	Peak
2483.52	32.28	6.19	29.61	68.08	74.00	5.92	Peak
2483.92	32.28	6.19	29.89	68.36	74.00	5.64	Peak



### Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2454.72	32.25	6.15	59.61	98.01	---	---	Average
2483.52	32.28	6.19	14.52	52.99	54.00	1.01	Average
2483.60	32.28	6.19	14.39	52.86	54.00	1.14	Average

**6.5.3. Emissions outside the frequency band:**

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	802.11b	Frequency	TX 2437MHz
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**Antenna at Horizontal Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4875.00	34.25	8.35	4.93	47.53	54.00	6.47	Peak
7310.00	35.80	9.82	-2.82	42.80	54.00	11.20	Peak

**Antenna at Vertical Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4875.00	34.25	8.35	4.11	46.71	54.00	7.29	Peak
7310.00	35.80	9.82	-2.18	43.44	54.00	10.56	Peak

Mode	802.11g	Frequency	TX 2437MHz
------	---------	-----------	------------

**Antenna at Horizontal Polarization**

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4875.00	34.25	9.09	-1.54	41.80	54.00	12.20	Peak
7310.00	35.80	11.80	-2.99	44.61	54.00	9.39	Peak

**Antenna at Vertical Polarization**

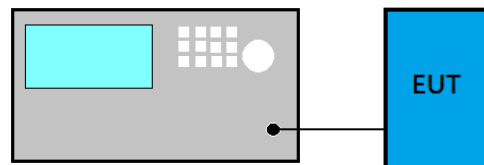
Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4875.00	34.25	9.09	-0.76	42.58	54.00	11.42	Peak
7310.00	35.80	11.80	-4.14	43.46	54.00	10.54	Peak

**6.5.4. Emissions in Non-restricted Frequency Bands**

Pursuant to KDB 558074 D01 v03r05 that emission levels below the 15.209 Section 8.9 table 4 general radiated emissions limits is not required.

## 7. 6dB BANDWIDTH MEASUREMENT

### 7.1. Block Diagram of Test Setup



### 7.2. Specification Limits

The minimum 6dB bandwidth shall be at least 500kHz.

### 7.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r05:

■ Option 2

- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- (3) Detector = Peak.
- (4) Trace mode = max hold.
- (5) Sweep = auto couple.
- (6) Allow the trace to stabilize.
- (7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

### 7.4. Test Results

Please refer to Appendix A



## 8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

### 8.1. Block Diagram of Test Setup



### 8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm)

### 8.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r05:

#### ☒ PKPM1 Peak power meter method:

EUT is connected to power sensor and record the maximum output power.

#### ☐ Method AVGPM (Measurement using an RF average power meter):

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.5 is < 98%.

#### ☐ Method AVGSA-2 (Spectrum channel power)

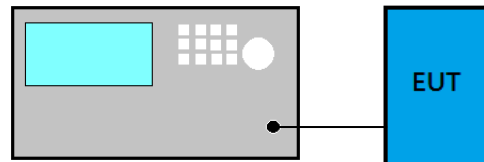
- (1) Set span to at least 1.5 times the OBW
- (2) Set RBW = 1 -5% of OBW
- (3) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- (4) Detector = RMS.
- (5) Trace mode = trace average at least 100 traces
- (6) Sweep = auto couple.
- (7) Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges.
- (8) Duty cycle factor is added when duty cycle presented in section 3.5 is < 98%.

### 8.4. Test Results

Please refer to Appendix A

## 9. EMISSION LIMITATIONS MEASUREMENT

### 9.1. Block Diagram of Test Setup



### 9.2. Specification Limits

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) Section 8.9 table 4 is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a) Section 8.10 table 6, must also comply with the radiated emission limits specified in Section 15.209(a) Section 8.9 table 4 (See Section 15.205(c)).

### 9.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r05:

#### ■ Reference Level

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW  $\geq 3 \times$  RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max PSD as reference level.

#### ■ Emission Level Measurement

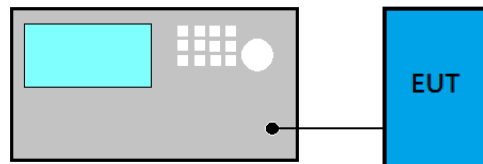
- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to: 100 kHz.
- (4) Set the VBW  $\geq 3 \times$  RBW.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize to find the max level.

### 9.4. Test Results

Please refer to Appendix A

## 10. POWER SPECTRAL DENSITY

### 10.1. Block Diagram of Test Setup



### 10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

### 10.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 DTS Meas Guidance v03r05:

#### ■ Method PKPSD (peak PSD)

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth.
- (3) Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- (4) Set the VBW  $\geq 3 \times \text{RBW}$ .
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Allow trace to fully stabilize.
- (9) Use the peak marker function to determine the maximum amplitude level.
- (10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

#### □ Method AVGPSD-2

- (1) Using peak PSD procedure step 1 to step 4.
- (2) Detector = RMS detector
- (3) Sweep time = auto couple
- (4) Trace mode = trace averaging over a minimum of 100 traces
- (5) Use the peak marker function to determine the maximum amplitude level.
- (6) Duty cycle factor is added when duty cycle presented in section 3.5  $< 98\%$ .
- (7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 10.4. Test Results

Please refer to Appendix A

## **11.DEVIATION TO TEST SPECIFICATIONS**

**【NONE】**



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**APPENDIX A**

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# APPENDIX A

## TEST PLOTS

(Model: WB060)

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## A.1 6dB BANDWIDTH MEASUREMENT

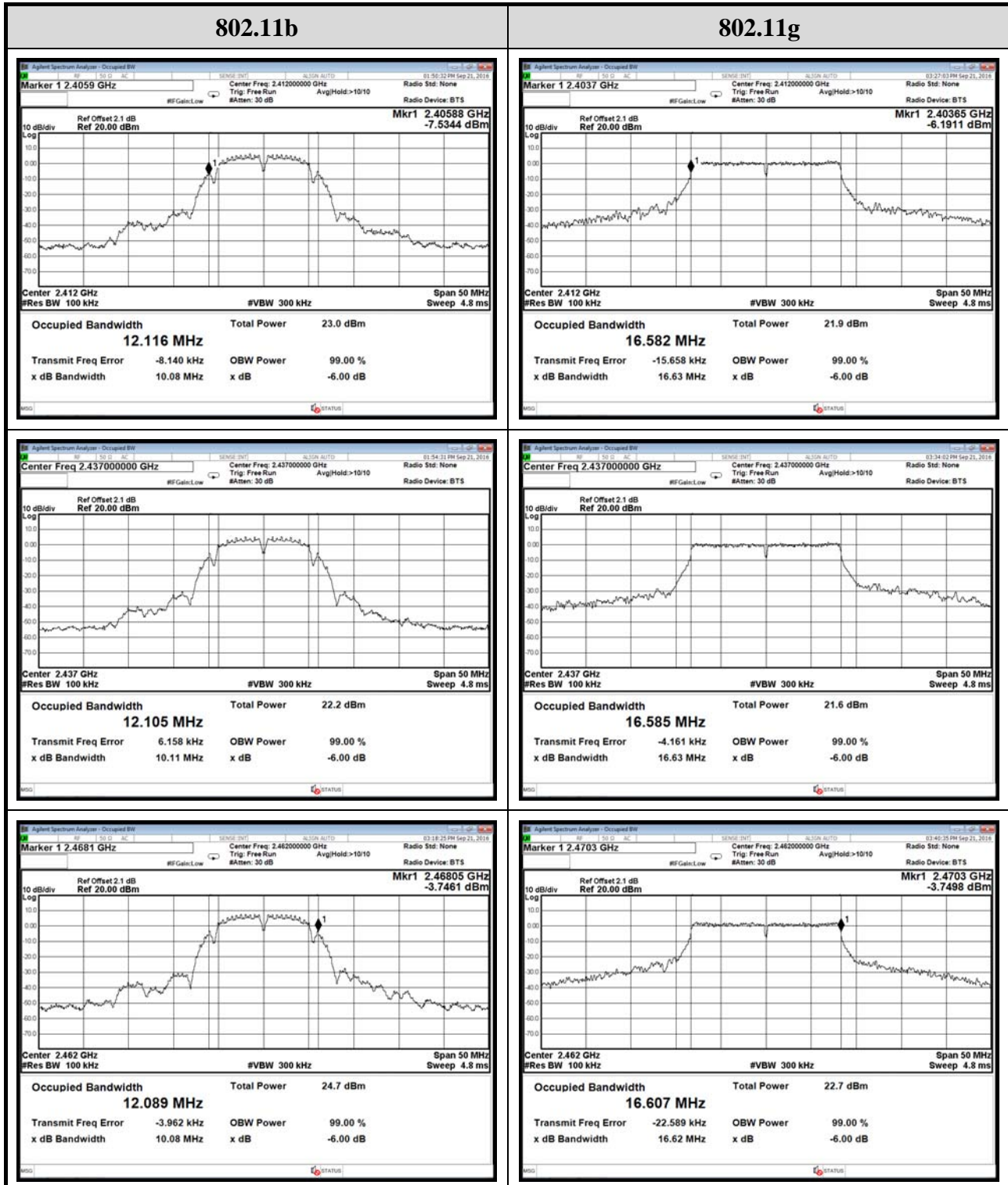
Test Date	2016/09/21	Temp./Hum.	26°C/58%
Cable Loss	---	Test Voltage	DC 12V (Via Battery)

### A.1.1 6dB Bandwidth Result

Modulation Type	Centre Frequency (MHz)	6 dB Bandwidth (MHz)	Limit
802.11b	2412	<b>10.08</b>	>500kHz
	2437	<b>10.11</b>	
	2462	<b>10.08</b>	
802.11g	2412	<b>16.63</b>	
	2437	<b>16.63</b>	
	2462	<b>16.62</b>	



## A.1.2 Measurement Plots



## A.2 MAXIMUM PEAK OUTPUT POWER MEASUREMENT

Test Date	2016/09/21	Temp./Hum.	26°C/58%
Cable Loss	---	Test Voltage	DC 12V (Via Battery)

### A.2.1 Peak Output Power

Modulation Type	Centre Frequency (MHz)	Maximum Output Power		Limit
		(dBm)	(W)	
802.11b	2412	19.12	0.081658	< 30dBm (1W)
	2437	19.26	0.084333	
	2462	19.18	0.082794	
802.11g	2412	20.75	0.118850	
	2417	20.69	0.117220	
	2437	21.83	0.152405	
	2457	21.10	0.128825	
	2462	21.18	0.131220	

Note: The results have been included cable loss.

### A.2.2 Average Output Power (Reporting only)

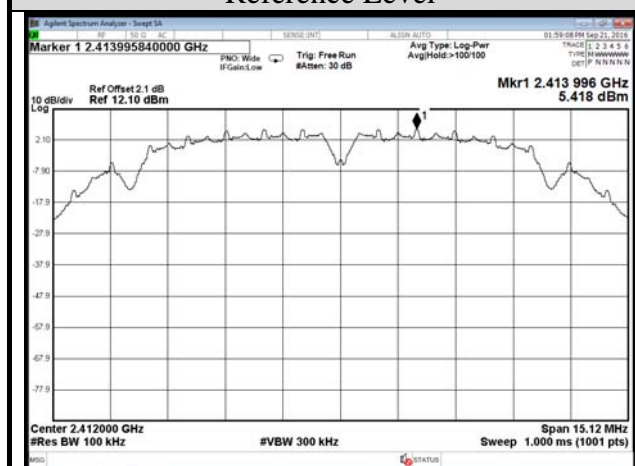
Modulation Type	Centre Frequency (MHz)	Maximum Output Power		Limit
		(dBm)	(W)	
802.11b	2412	15.86	0.038548	< 30dBm (1W)
	2437	16.01	0.039902	
	2462	15.92	0.039084	
802.11g	2412	13.82	0.024099	
	2417	13.74	0.023659	
	2437	15.17	0.032885	
	2457	14.22	0.026424	
	2462	14.31	0.026977	

Note: The results have been included cable loss.

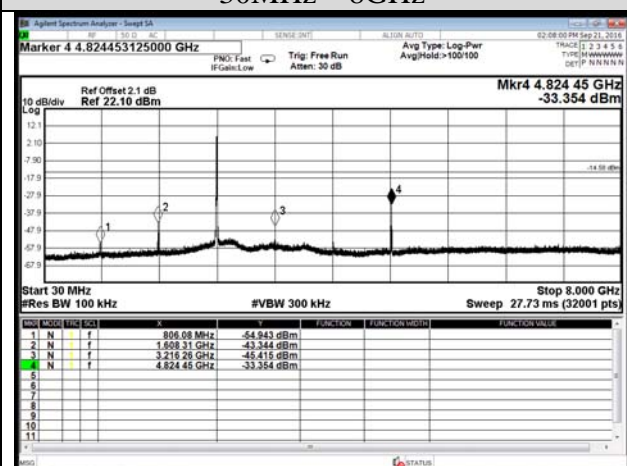
## A.3 EMISSION LIMITATIONS MEASUREMENT

Test Date	2016/07/11	Temp./Hum.	26°C/58%
Cable Loss	2.1dB	Test Voltage	DC 12V (Via Battery)
Mode	802.11b	Frequency	TX 2412MHz
Simultaneous Factor10 log(n) (Note: "n" is antenna number)	N/A		

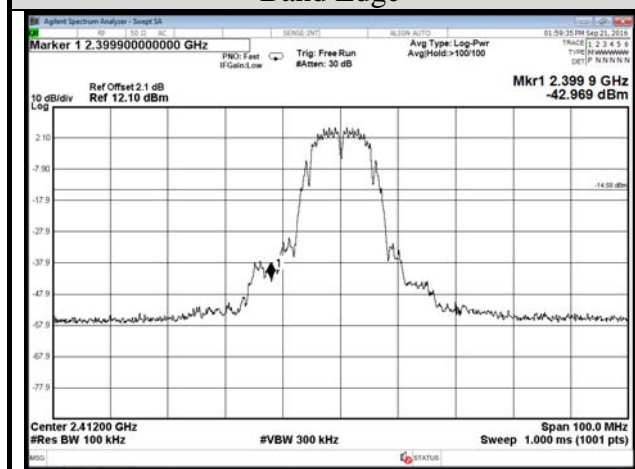
Reference Level



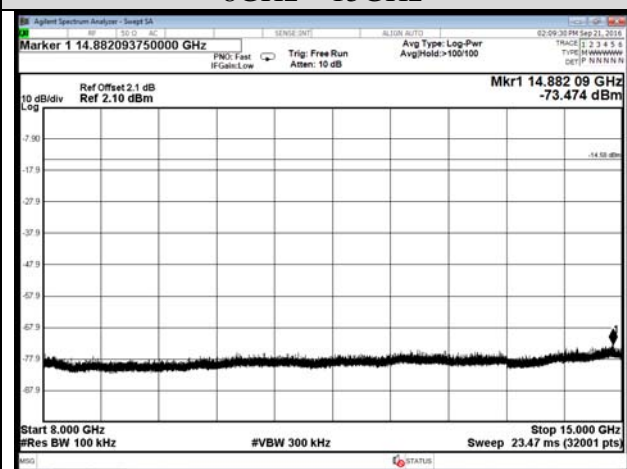
30MHz – 8GHz



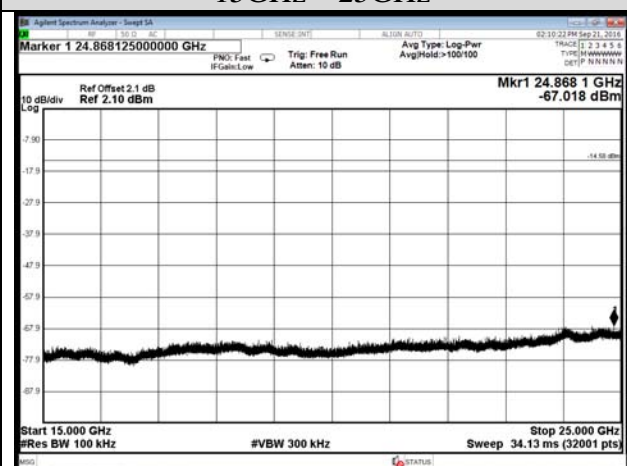
Band Edge



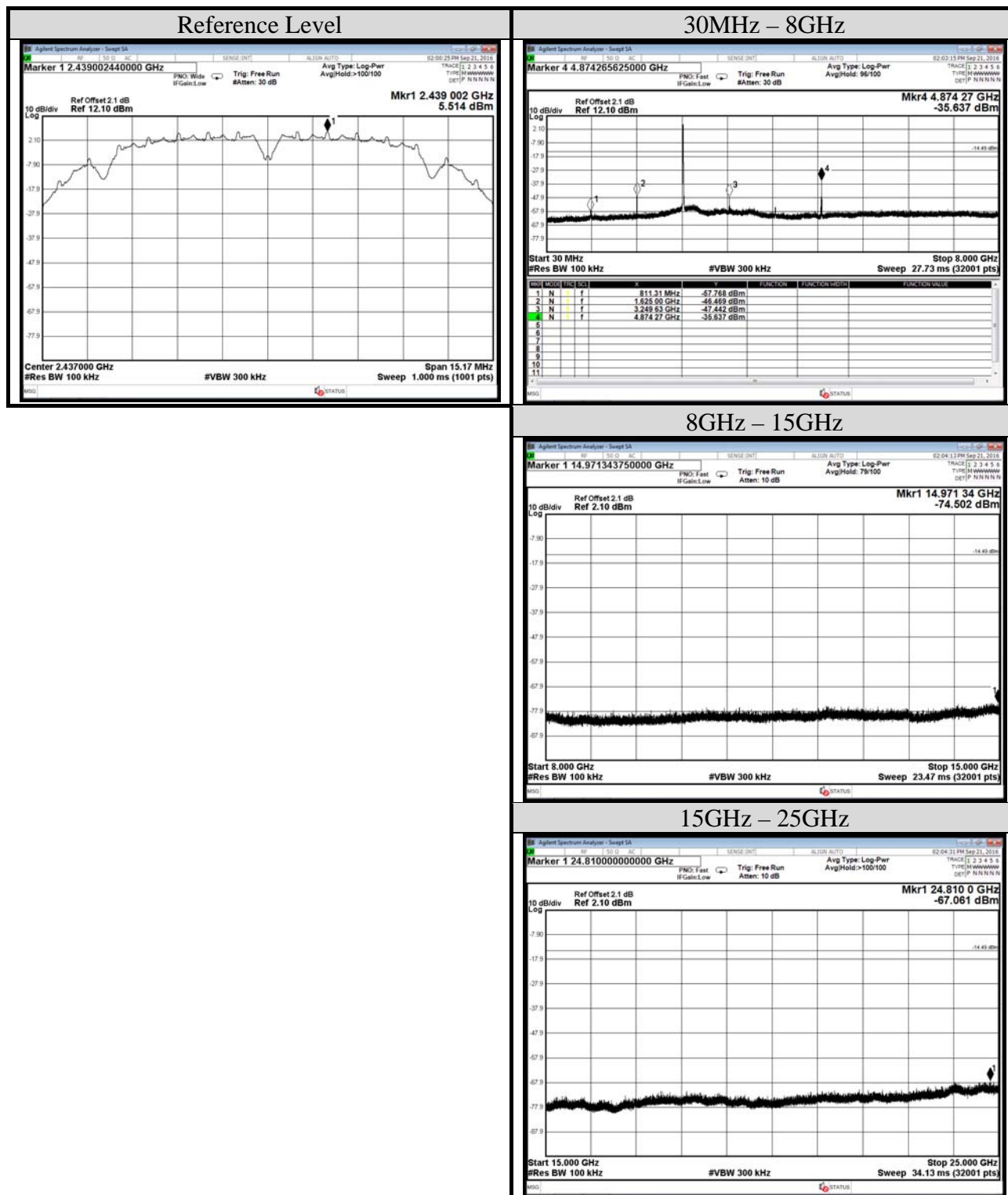
8GHz – 15GHz



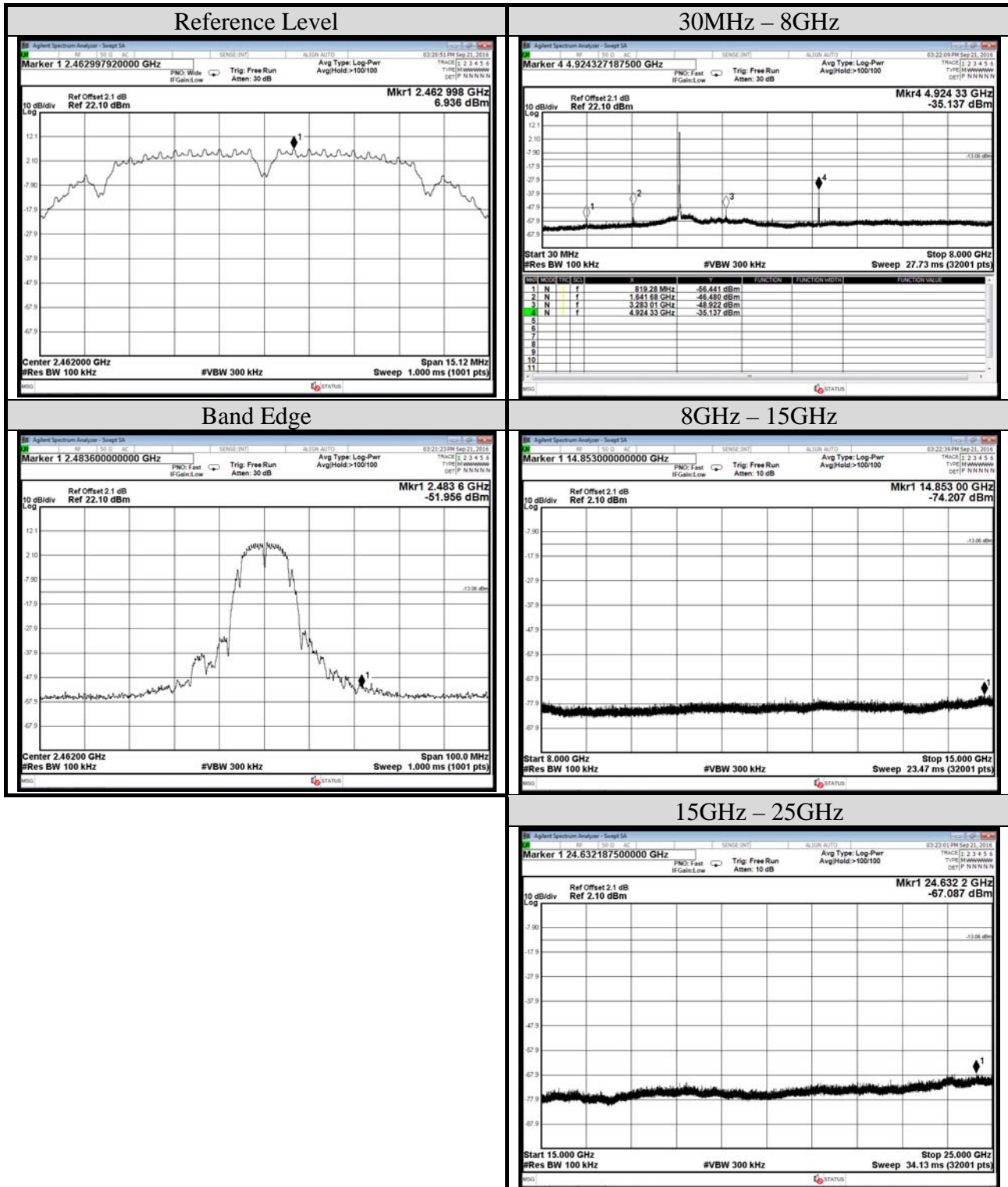
15GHz – 25GHz



Test Date	2016/07/11	Temp./Hum.	26°C/58%
Cable Loss	2.1dB	Test Voltage	DC 12V (Via Battery)
Mode	802.11b	Frequency	TX 2437MHz
Simultaneous Factor	10 log(n) (Note: "n" is antenna number)		N/A

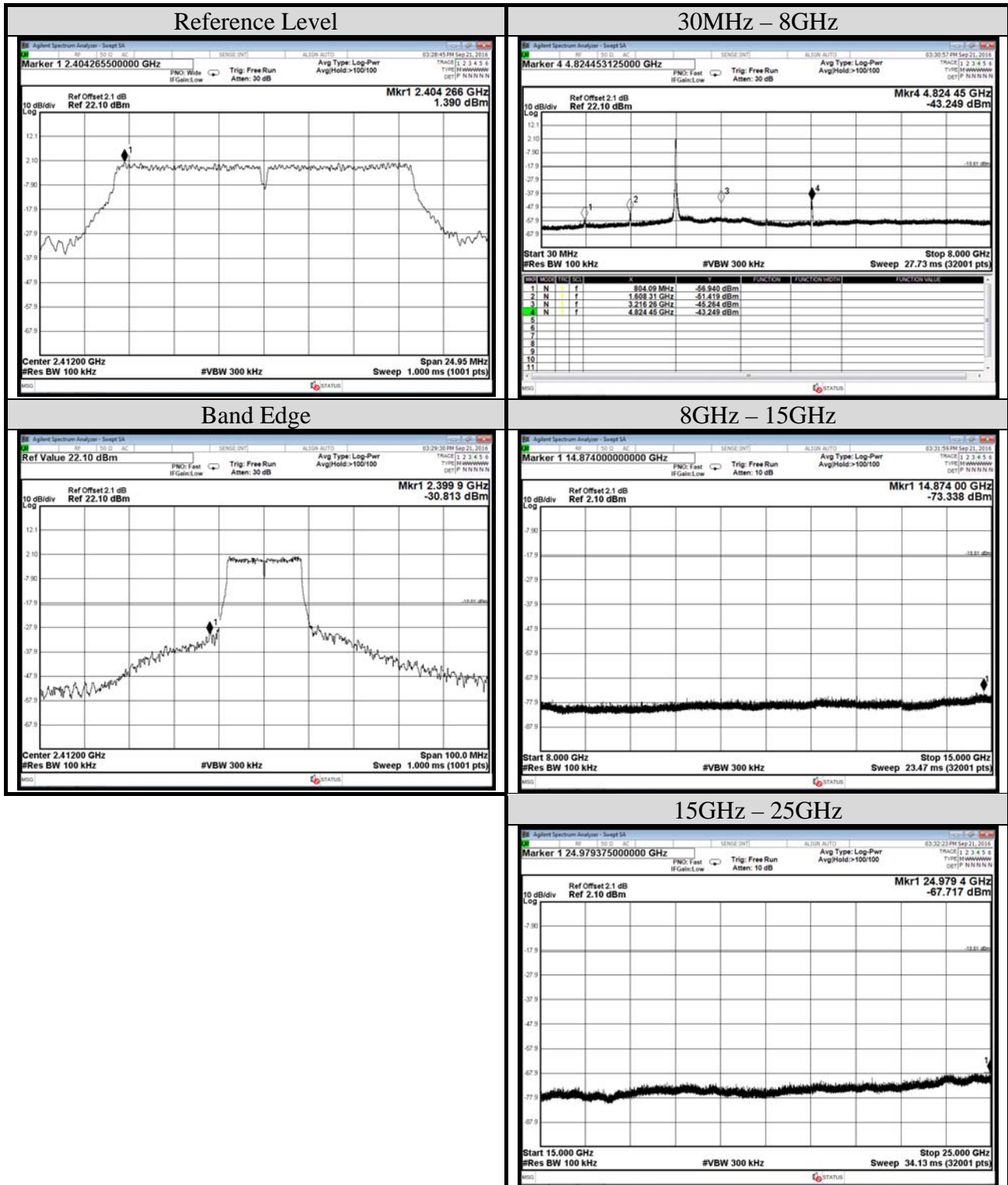


Test Date	2016/07/11	Temp./Hum.	26°C/58%
Cable Loss	2.1dB	Test Voltage	DC 12V (Via Battery)
Mode	802.11b	Frequency	TX 2462MHz
Simultaneous Factor	10 log(n) (Note: "n" is antenna number)		N/A





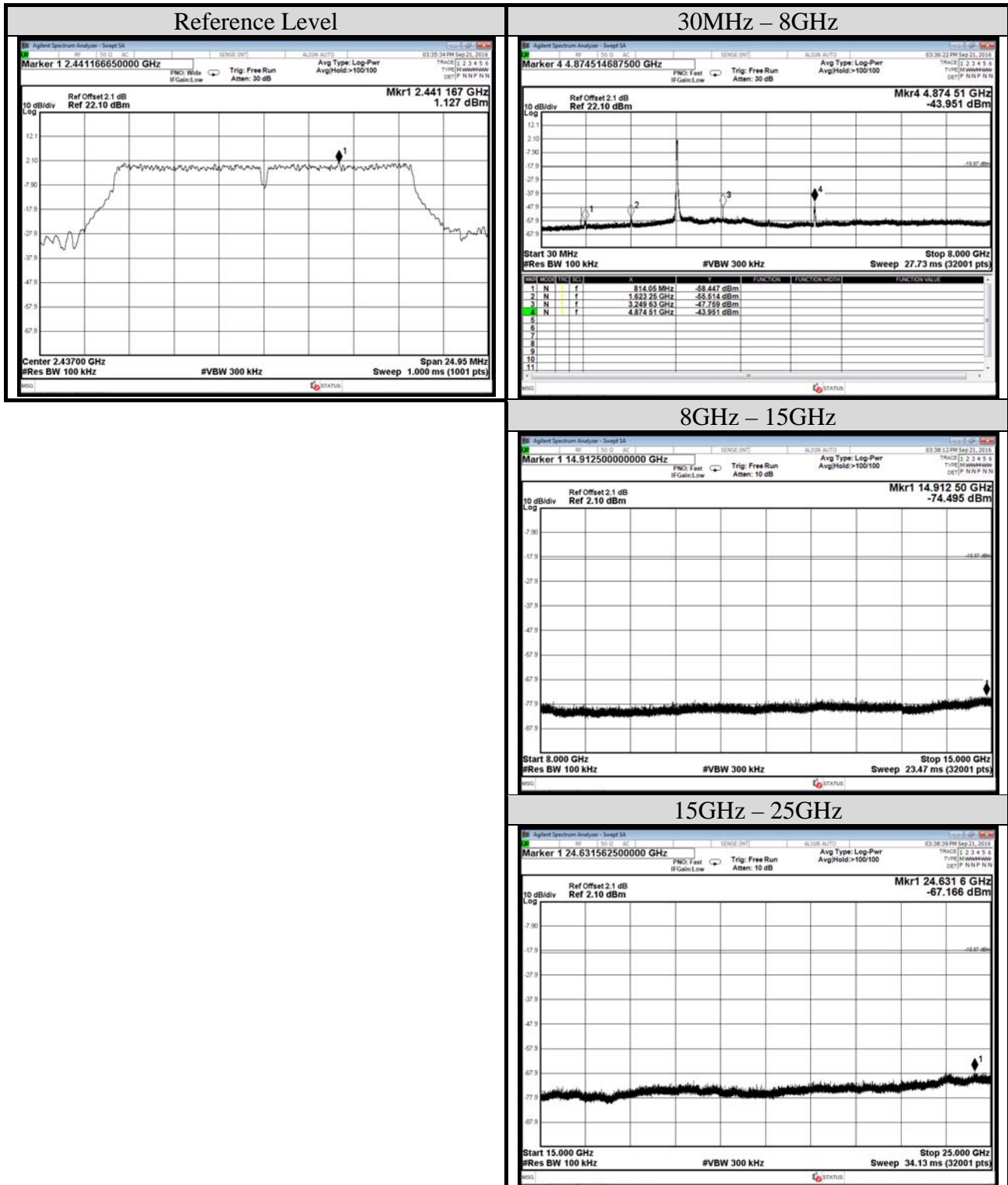
Test Date	2016/07/11	Temp./Hum.	26°C/58%
Cable Loss	2.1dB	Test Voltage	DC 12V (Via Battery)
Mode	802.11g	Frequency	TX 2412MHz
Simultaneous Factor	10 log(n) (Note: "n" is antenna number)		N/A



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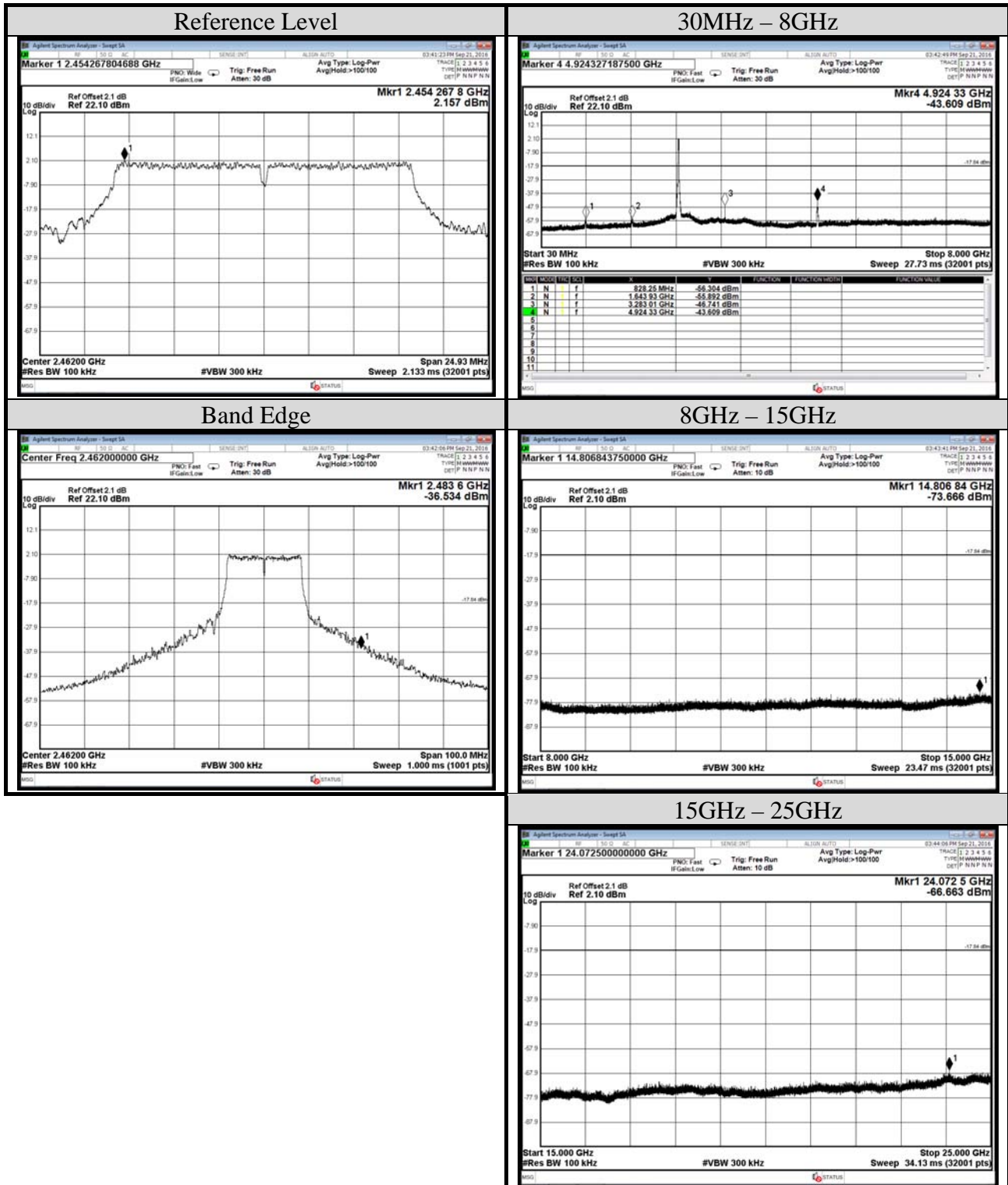
Test Date	2016/06/03	Temp./Hum.	26°C/58%
Cable Loss	2.1dB	Test Voltage	DC 12V (Via Battery)
Mode	802.11g	Frequency	TX 2437MHz
Simultaneous Factor	10 log(n) (Note: "n" is antenna number)		N/A



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Test Date	2016/07/11	Temp./Hum.	26°C/58%
Cable Loss	2.1dB	Test Voltage	DC 12V (Via Battery)
Mode	802.11g	Frequency	TX 2462MHz
Simultaneous Factor	10 log(n) (Note: "n" is antenna number)		N/A





## A.4 POWER SPECTRAL DENSITY

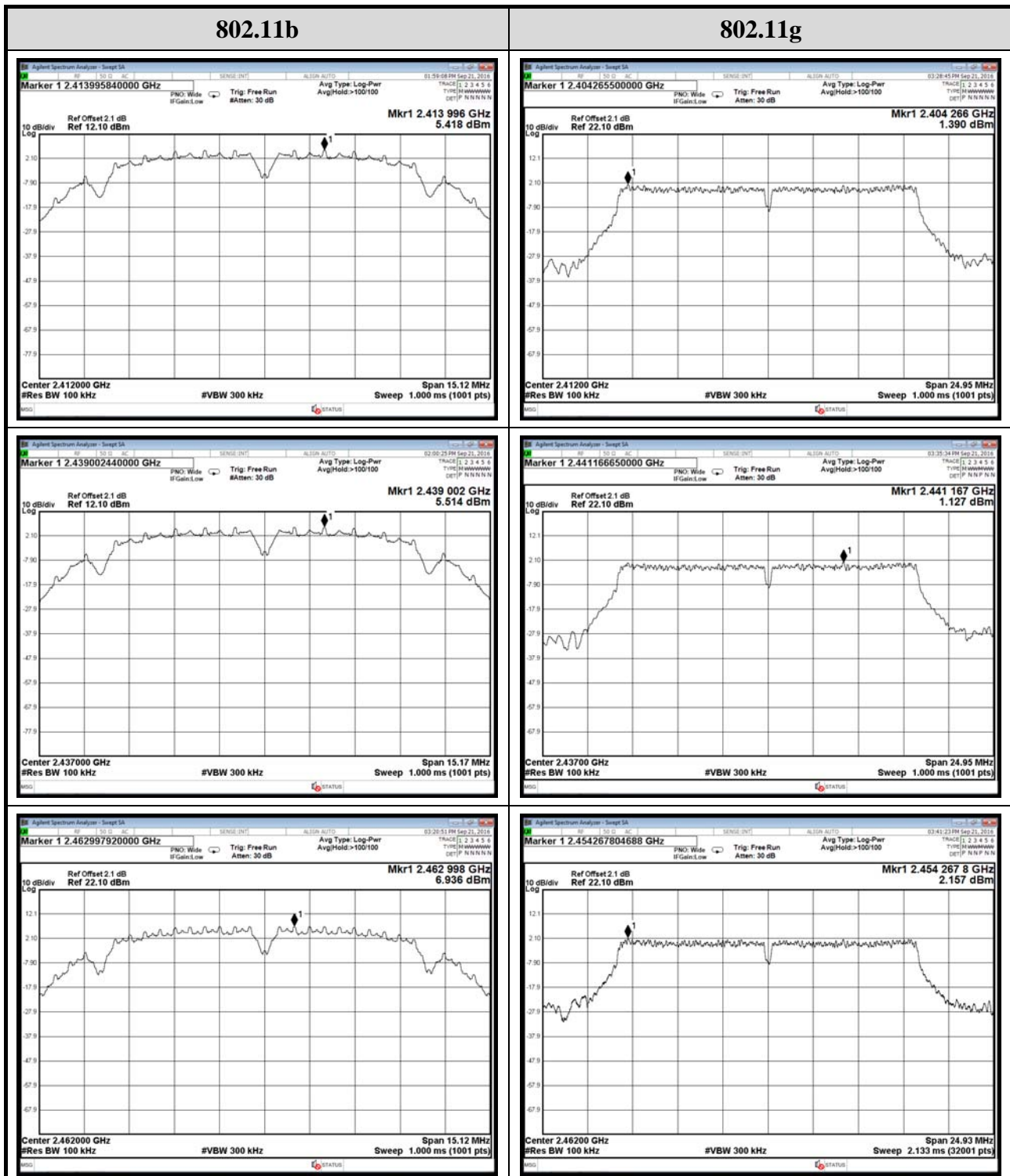
Test Date	2016/09/21	Temp./Hum.	26°C/58%
Cable Loss	2.1dB	Test Voltage	DC 12V (Via Battery)
Simultaneous Factor 10 log(n) (Note: "n" is antenna number)			N/A

### A.4.1 Power Spectral Density Result

Modulation Type	Centre Frequency (MHz)	Power Spectral Density (dBm)	Limit
802.11b	2412	<b>5.418</b>	< 8 dBm/3kHz
	2437	<b>5.514</b>	
	2462	<b>6.936</b>	
802.11g	2412	<b>1.390</b>	
	2437	<b>1.127</b>	
	2462	<b>2.157</b>	

Note: All results have been included cable loss and Simultaneous Factor.

## A.4.2 Measurement Plots



Note: All results have been included cable loss and Simultaneous Factor.