Excellence in Compliance Testing

FCC Part 15.247
Transceiver Certification

Digital Transmission System with Frequency Hopping Spread Spectrum

Test Report

FCC ID: HSW-2492

FCC Rule Part: 15.247

ACS Report Number: 07-0052-15C

Manufacturer: Cirronet
Model: WIT2492

Test Begin Date: February 14, 2007
Test End Date: March 2, 2007

Report Issue Date: March 22, 2007

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612-0

This report is not be used to claim certification, approval, or endorsement by NVLAP, NIST or any government agency.

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This report contains 28 pages

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1.0 GENERAL

1.1 Purpose
The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

1.2.1 General
The WIT2492 radio transceiver provides reliable wireless connectivity for either point to point or multipoint applications. Frequency hopping spread spectrum technology ensures maximum resistance to noise and multipath fading and robustness in the presence of interfering signals, while operation in the 2.4GHz ISM band allows license free use and worldwide compliance. A simple serial interface supports asynchronous data up to 230400 bps. An on board 3 KB buffer and an error correcting over the air protocol provide smooth data flow and simplify the task of integration with existing applications.

Manufacturer Information:
Cirronet
3079 Premiere Parkway, Suite 140
Duluth, GA 30097

Detailed photographs of the EUT are filed separately with this filing.

1.2.2 Intended Use
The WIT2492 radio transceiver provides reliable wireless connectivity for either point to point or multipoint applications.

1.3 Test Methodology and Considerations
The Cirronet WIT2492 is a transmission systems that employs both frequency hopping (or channel changing) techniques using digitally modulated channels. Based on the FCC interpretation on devices which employ both techniques, the WIT2492 demonstrated compliance with the DTS standards of Part 15.247 only. According to the FCC interpretation, there is no need to demonstrate compliance with both the FHSS standards and the DTS standards.

Because the WIT2492 utilizes antennas of multiple types and gains, the highest gain antenna for each type was tested.

This device allows for the use of all antennas listed below without any reduction in output power as required by 15.247(b)(4).

1.4 Antenna List

Description	Gain	Part Number	Coupling
15dB Yagi Directional*	15dBi	YAGI2415	N
14dB Corner Reflector*	14dBi	CORNER2414	N
9dB Omni-directional / Dipole*	9dBi	OMNI249	N
9dB Corner Reflector	9dBi	CORNER249	N
12dB Cironnet Patch*	12dBi	A-4201-0497	MMCX
6dB Cironnet Patch	6dBi	PA2400	MMCX
5dB Mobile Mount*	5dBi	MAG245	N
2dB Cirronet Patch	2dBi	PA2410	MMCX
2dB Rugged Mobile Mount	2dBi	RBM242	N
Dipole	2dBi	RWA249R	Reverse SMA

* Antennas of the highest gain of each type.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 89450
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612-0

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

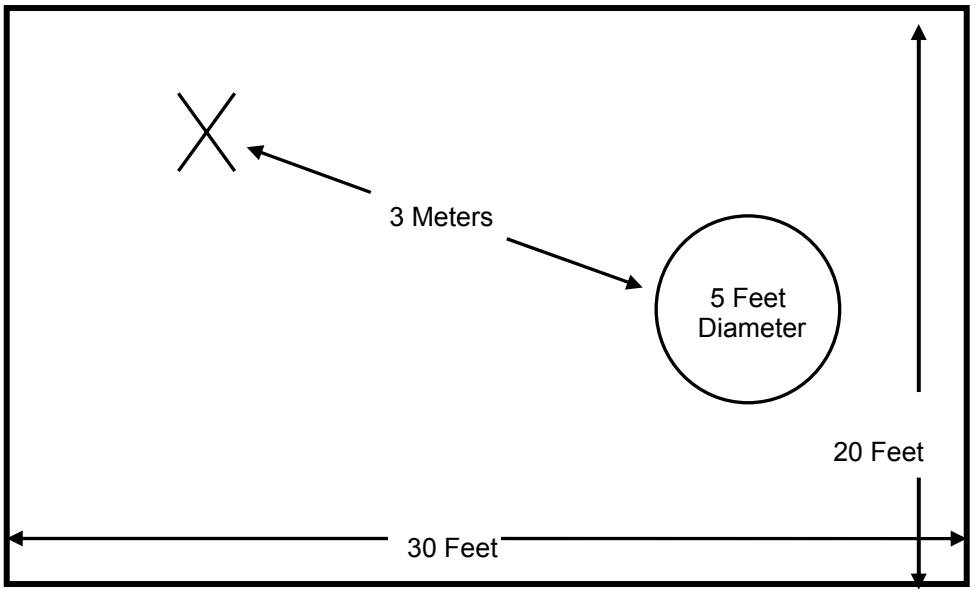

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

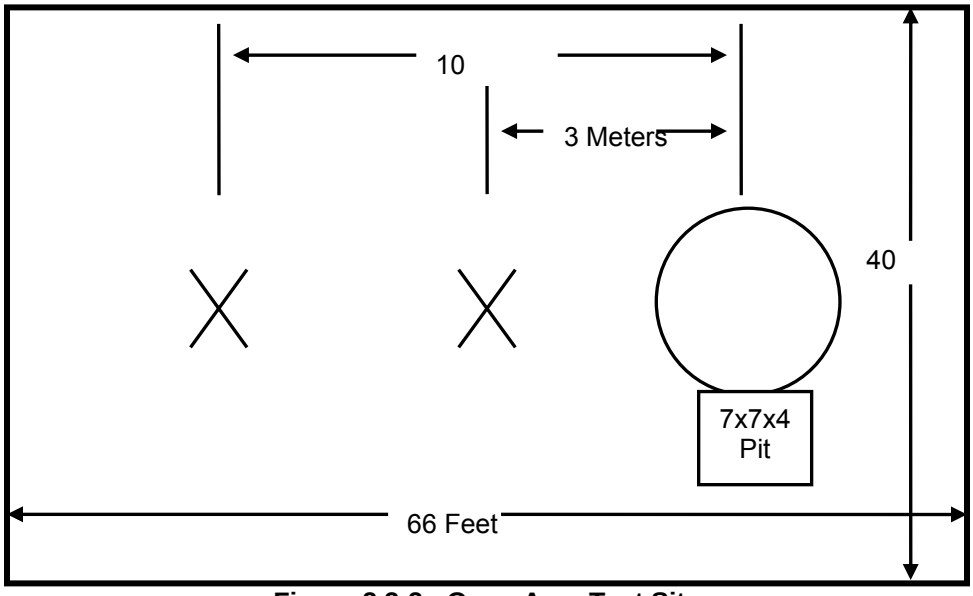

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal group reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 4.1.3-1:

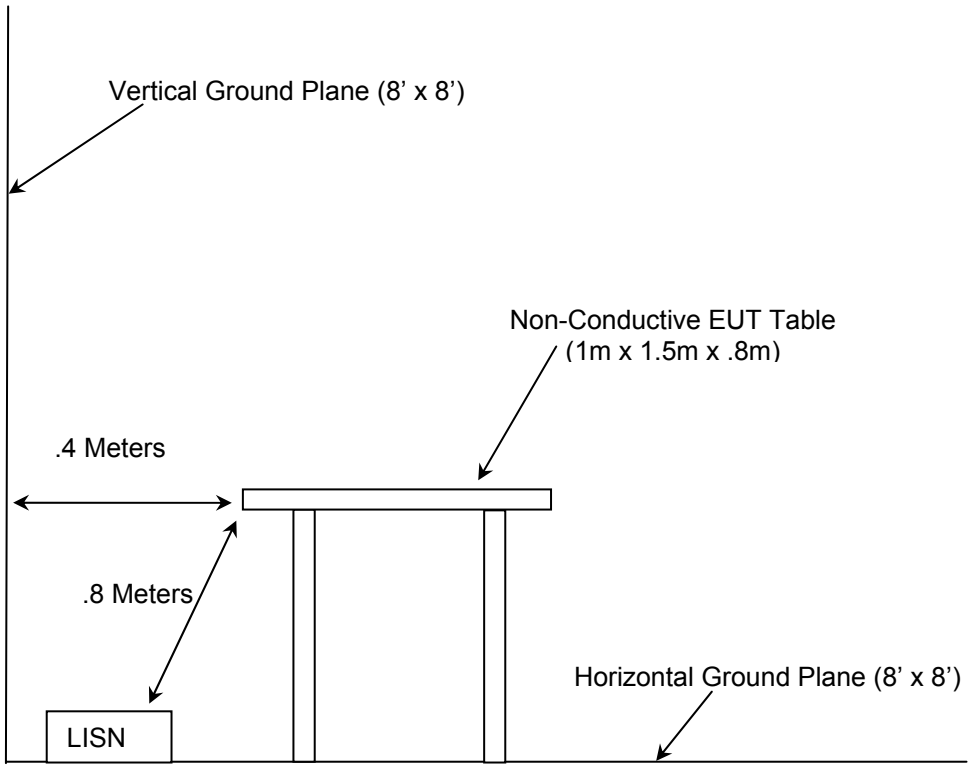

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2006
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2006
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, 2001
- FCC KDB Publication No. 558074 - Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), March 2005
- FCC Public Notice DA 00-705 - Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems, March 30, 2000

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4.0-1: Test Equipment

AssetID	Manufacturer	ModelNumber	SerialNumber	Equipment Type	Cal Due
1	Rohde & Schwarz	ESMI - Display	833771/007	Spectrum Analyzers	03/05/08
2	Rohde & Schwarz	ESMI-Receiver	839587/003	Spectrum Analyzers	03/05/08
22	Agilent	8449B	3008A00526	Amplifiers	04/07/07
25	Chase	CBL6111	1043	Antennas	05/30/07
30	Spectrum Technologies	DRH-0118	970102	Antennas	05/09/07
73	Agilent	8447D	2727A05624	Amplifiers	05/10/07
152	EMCO	3825/2	9111-1905	LISN	02/20/08
167	ACS	Chamber EMI Cable Set	167	Cables	01/05/08
267	Agilent	N1911A	MY45100129	Meters	10/26/07
268	Agilent	N1921A	MY45240184	Sensors	10/26/07
282	Microwave Circuits	H2G020G4	74541	Filters	03/10/07
283	Rohde & Schwarz	FSP40	1000033	Spectrum Analyzers	03/24/07
290	Florida RF Cables	SMSE-200-72.0-SMRE	None	Cables	05/03/07
291	Florida RF Cables	SMRE-200W-12.0-SMRE	None	Cables	05/03/07
292	Florida RF Cables	SMR-290AW-480.0-SMR	None	Cables	05/24/07
329	A.H.Systems	SAS-571	721	Antennas	08/24/07
333	Rohde&Schwarz	3160-09	00049404	Antennas	09/11/07
335	Suhner	SF-102A	882/2A	Cables	08/29/07
338	Hewlett Packard	8449B	3008A01111	Amplifiers	09/26/07
345	Suhner Sucoflex	102A	1077/2A	Cables	12/19/07

5.0 SUPPORT EQUIPMENT

Table 5-3: Support Equipment

Item	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	Volgen	Power Supply	NP12-US0520	NA	NA
2	Cirronet	Interface PCB	HN-550	NA	NA

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

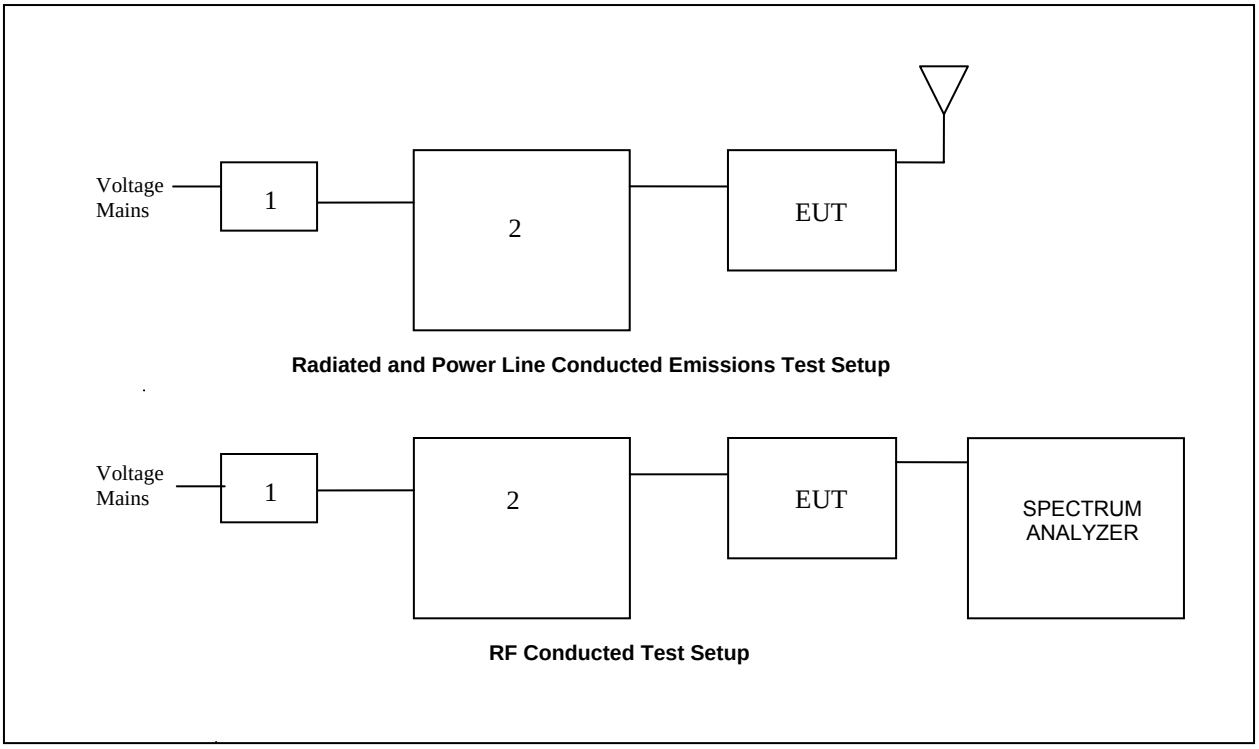

Figure 6-1: EUT Test Setup

*See Test Setup photographs for additional detail.

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement - FCC Section 15.203

The WIT2492 utilizes a MMCX antenna connector thus satisfying the Part 15.203 requirement for a unique antenna connector.

7.2 Power Line Conducted Emissions - FCC Section 15.207

7.2.1 Test Methodology

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

Power Line Conducted Emissions were performed with multiple antennas and worst case data reported.

7.2.2 Test Results

Results of the test are shown below in and Table 7.2-1.

Table 7.2-1: Conducted EMI Results

Frequency (MHz)	Uncorrected Reading (dBuV)		Total Correction Factor (dB)	Corrected Level (dBuV)		Limit (dBuV)		Margin (dB)	
	Quasi-Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.15	39	18.7	9.80	48.80	28.50	66.00	56.00	17.2	27.5
0.17	34.7	11.9	9.80	44.50	21.70	64.96	54.96	20.5	33.3
0.26	42.6	38.9	9.80	52.40	48.70	61.43	51.43	9.0	2.7
0.39	35.3	29	9.80	45.10	38.80	58.06	48.06	13.0	9.3
0.9	34.9	28.2	9.80	44.70	38.00	56.00	46.00	11.3	8.0
1.544	32.8	24.6	9.80	42.60	34.40	56.00	46.00	13.4	11.6
Line 2									
0.2	32.4	10	9.80	42.20	19.80	63.61	53.61	21.4	33.8
0.26	44.9	34.3	9.80	54.70	44.10	61.43	51.43	6.7	7.3
0.52	36.1	24.4	9.80	45.90	34.20	56.00	46.00	10.1	11.8
0.65	26.1	17	9.80	35.90	26.80	56.00	46.00	20.1	19.2
0.79	33.3	16.2	9.80	43.10	26.00	56.00	46.00	12.9	20.0
0.91	32.2	21.2	9.80	42.00	31.00	56.00	46.00	14.0	15.0

7.3 Radiated Emissions - FCC Section 15.109 (Unintentional/Receiver Radiation)

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 1 GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz for measurements above 30MHz. Average measurements are taken with the RBW and VBW were set to 1MHz and 10 Hz respectively for measurements above 1000MHz.

Radiated emissions were performed with multiple antennas and worst case data reported.

7.3.2 Test Results

Results of the test are given in Table 7.3-1 below:

Table 7.3-1: Radiated Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg	(H/V)	(dB)	pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
30.02	---------	28.79	V	-8.51	---------	20.28	--------	40.0	---------	19.72
57.54	---------	39.87	V	-19.36	---------	20.51	--------	40.0	---------	19.49
88.14	---------	38.32	V	-16.65	---------	21.67	--------	43.5	---------	21.83
108.12	---------	43.42	V	-13.70	---------	29.72	--------	43.5	---------	13.78
140.07	---------	41.02	V	-12.80	---------	28.22	--------	43.5	---------	15.28
154.8	---------	39.26	V	-13.88	---------	25.38	--------	43.5	---------	18.12
213.79	---------	36.03	H	-13.84	---------	22.19	--------	43.5	---------	21.31
591.22	---------	34.21	V	-3.95	---------	30.26	--------	46.0	---------	15.74
810.96	---------	37.33	H	-0.06	---------	37.27	--------	46.0	---------	8.73
840.45	---------	33.92	H	0.70	---------	34.62	--------	46.0	---------	11.38

* Note: Emissions above 840.45 MHz were attenuated below the noise floor of the measurement system.

7.4 6dB Bandwidth – FCC Section 15.247(a)

7.4.1 Test Methodology

The 6dB bandwidth was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the entire emissions and >> RBW.

7.4.2 Test Results

Results are shown below in table 7.4.2-1 and figure 7.4.2-1 to 7.4.2-3:

Table 7.4.2-1: 6dB Bandwidth

Frequency [MHz]	Bandwidth [kHz]	Limit	Result
2402.6	952	≥500kHz	Pass
2441.3	912	≥500kHz	Pass
2480.0	872	≥500kHz	Pass

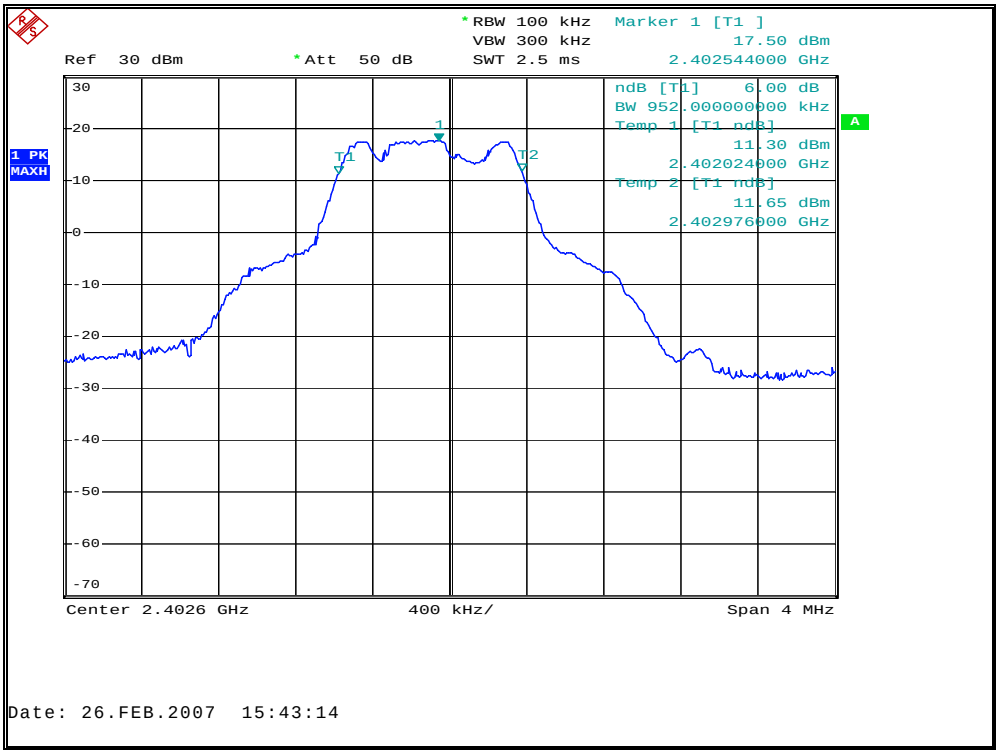

Figure 7.4.2-1: 6dB Bandwidth Plot – Low Channel

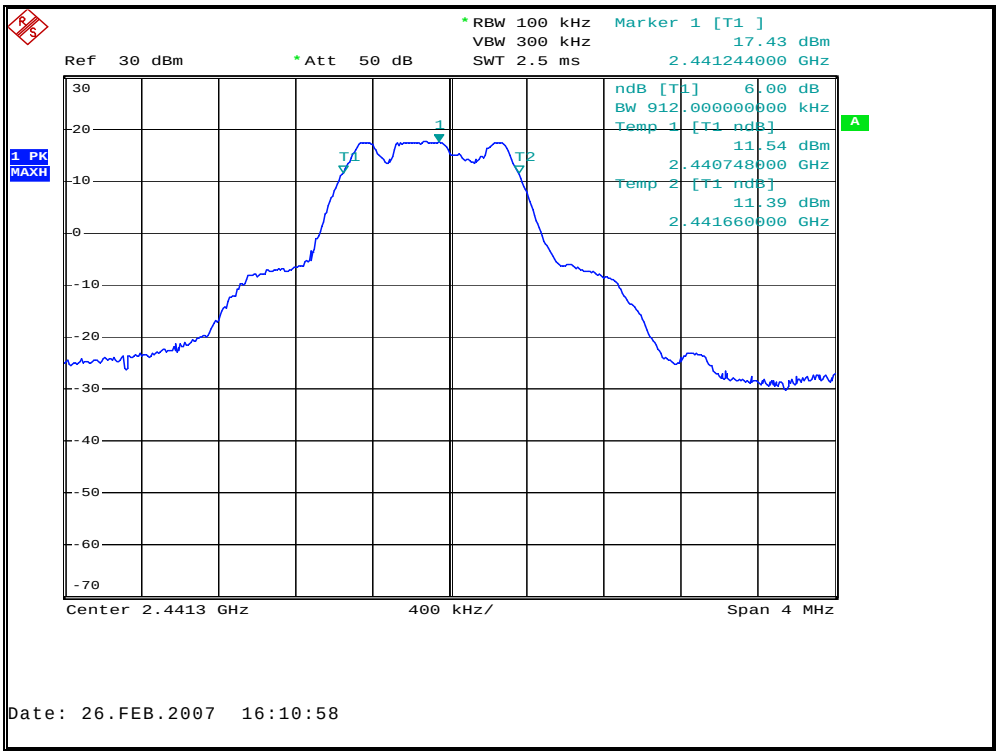

Figure 7.4.2-2: 6dB Bandwidth Plot – Mid Channel

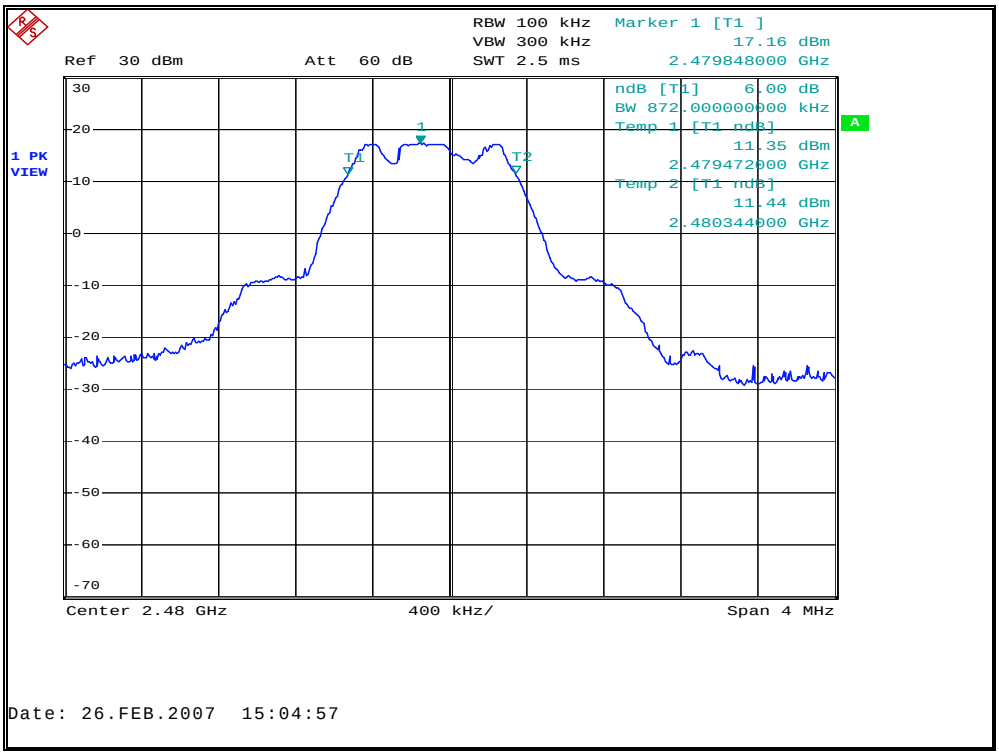

Figure 7.4.2-3: 6dB Bandwidth Plot – High Channel

7.5 Peak Output Power Requirement - FCC Section 15.247(b)

7.5.1 Test Methodology

The Peak Output Power was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)" Power Option 1. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer. The RBW was set to greater than 6 dB bandwidth of the emission.

Data was collected with the EUT operating at maximum power.

7.5.2 Test Results

Results are shown below in Table 7.5.2-1 and Figures 7.5.2-1 to 7.5.2-3.

Table 7.5.2-1: Peak Output Power

Frequency (MHz)	Output Power (dBm)
2402.6	17.75
2441.3	17.73
2480.0	17.36

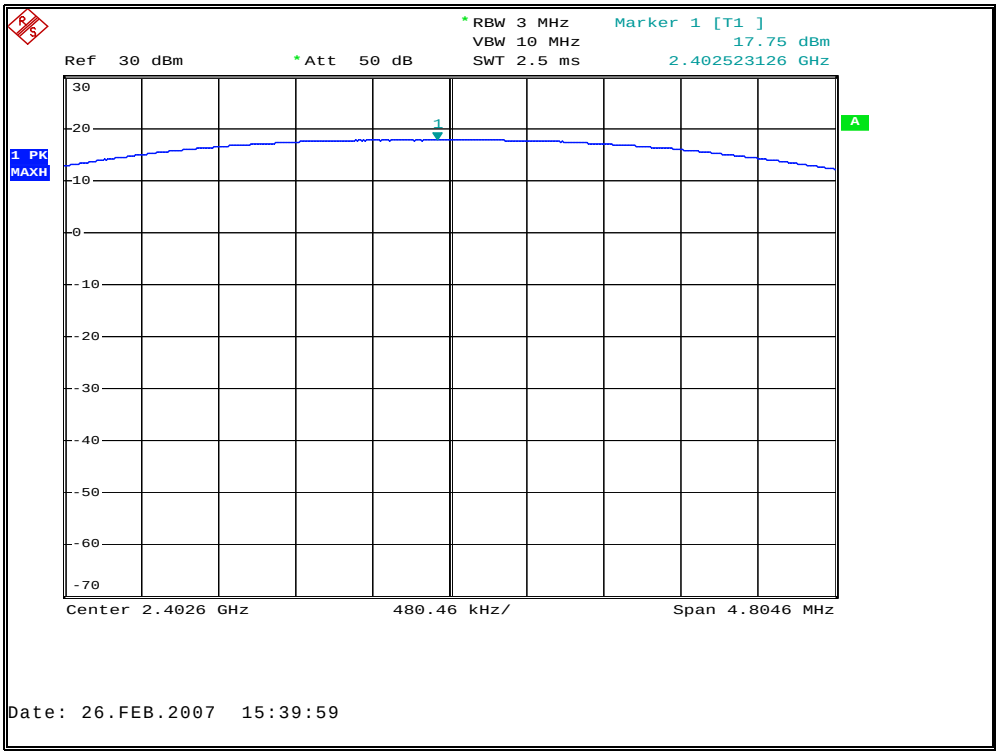

Figure 7.5.2-1: Output power – Low Channel

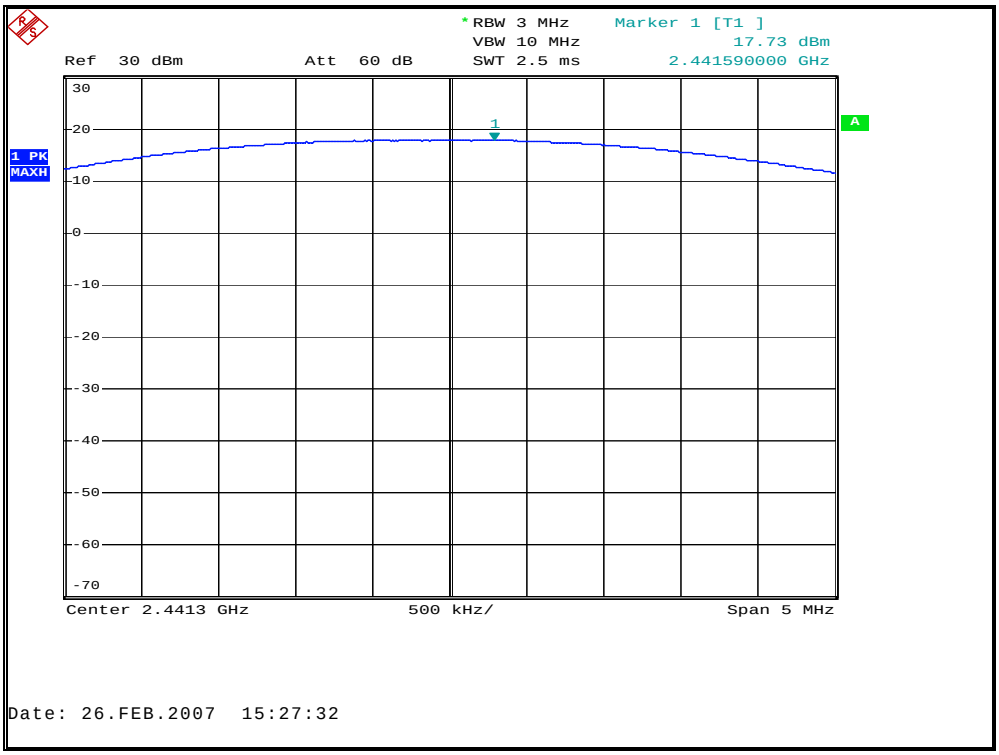

Figure 7.5.2-2: Output power – Mid Channel

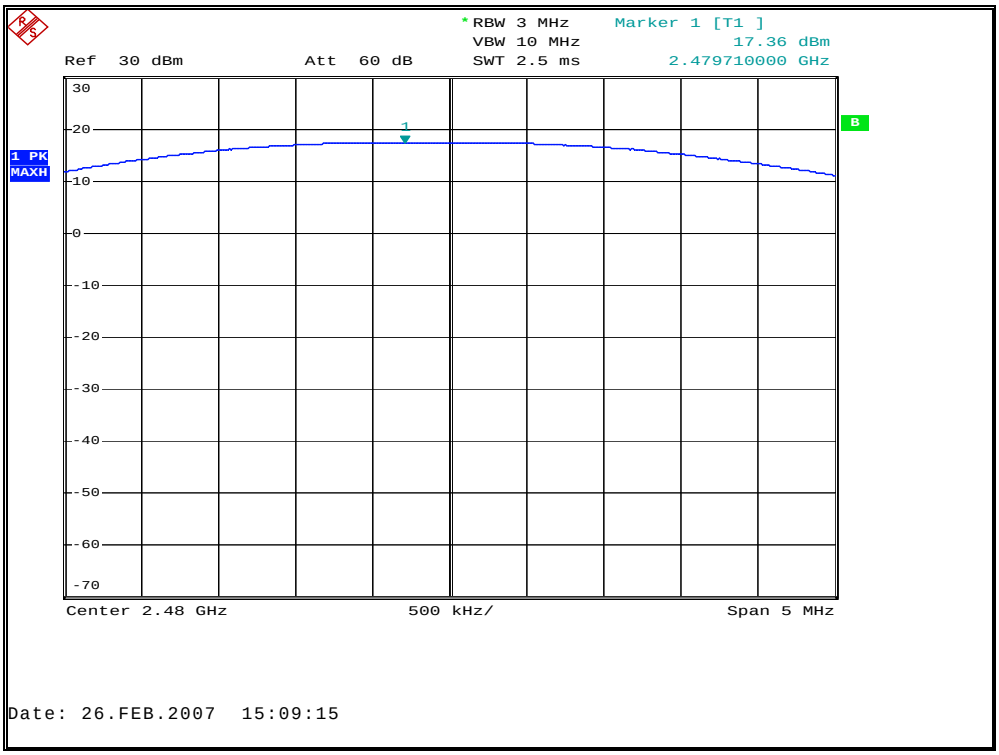

Figure 7.5.2-3: Output power – High Channel

7.6 Band-Edge Compliance and Spurious Emissions - FCC Section 15.247(d)

7.6.1 Band-Edge Compliance of RF Emissions

7.6.1.1 Test Methodology

The EUT was investigated at the low and high channels of operation to determine band-edge compliance. All antenna types were evaluated. Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method as outlined in FCC DA 00-705. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions.

The lower band-edge compliance was determined using the marker-delta method in which the radio frequency power that is produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. The lower band-edge was measured at the antenna output port of the EUT via direct connection to a spectrum analyzer.

The EUT test mode allowed for a duty cycle of ~93% therefore average measurements using a VBW of 10Hz were not performed. The peak emission levels were corrected for the actual duty cycle during normal operation and compared to the average limits. The duty cycle correction factor of 50.93dB is further explained in section 7.6.3.2.

7.6.1.2 Test Results

Band-edge compliance is displayed in Table 7.6.1.2-1 and Figure 7.6.1.2-1 – 7.6.1.2-2.

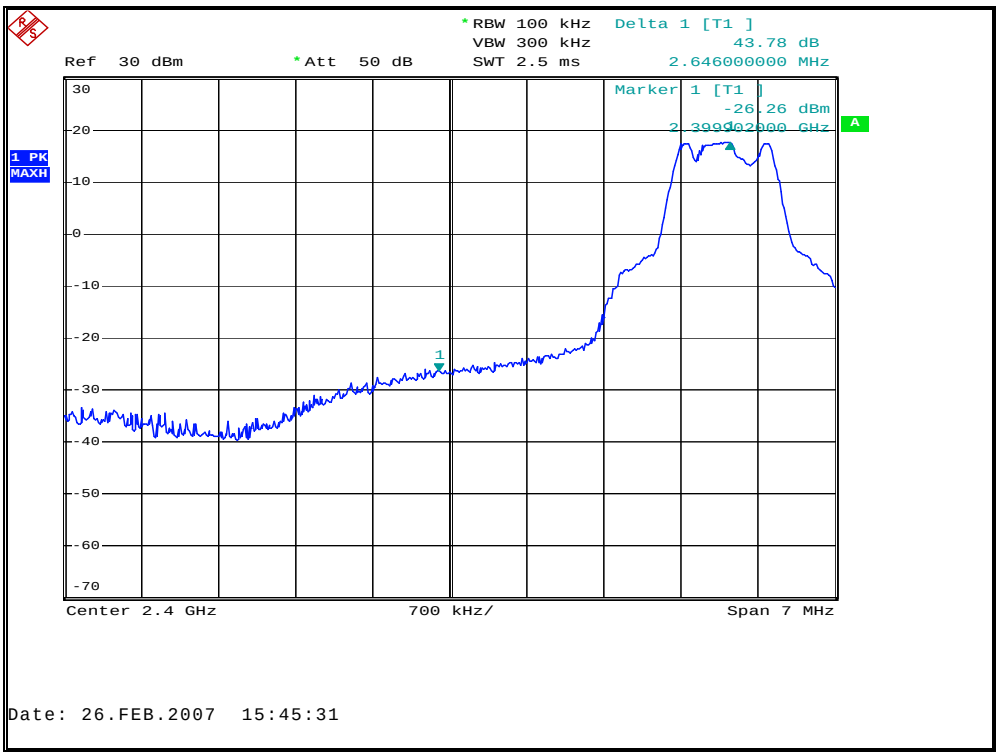

Figure 7.6.1.2-1: Lower Band-edge (Conducted)

Table 7.6.1.2-1: Upper Band-edge Marker Delta Method - 15dB Yagi Direction Antenna

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74 / 54	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2480	125.93	125.99	V	0.75	126.68	75.75	53.44	73.24	22.31	0.76	31.69

Table 7.6.1.2-2: Upper Band-edge Marker Delta Method - 14dB Corner Reflector

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74 / 54	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2480	123.58	123.58	V	0.75	124.33	73.40	53.42	70.91	19.98	3.09	34.02

Table 7.6.1.2-3: Upper Band-edge Marker Delta Method - 9dB Omni-directional / Dipole

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74 / 54	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2480	120.13	120.13	V	0.75	120.88	69.95	52.64	68.24	17.31	5.76	36.69

Table 7.6.1.2-4: Upper Band-edge Marker Delta Method - 12dB Cironnet Patch

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74 / 54	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2480	123.19	123.19	V	0.75	123.94	73.01	53.68	70.26	19.33	3.74	34.67

Table 7.6.1.2-5: Upper Band-edge Marker Delta Method - 5dB Mobile Mount

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Fundamental Field Strength (dBuV/m)		Delta-Marker (dB)	Band-edge Field Strength (dBuV/m)		Margin to Limit (dBuV/m) 74 / 54	
	pk	avg	(H/V)	(dB)	pk	avg		pk	avg	pk	avg
Fundamental Frequency											
2480	112.36	112.36	V	0.75	113.11	62.18	50.79	62.32	11.39	11.68	42.61

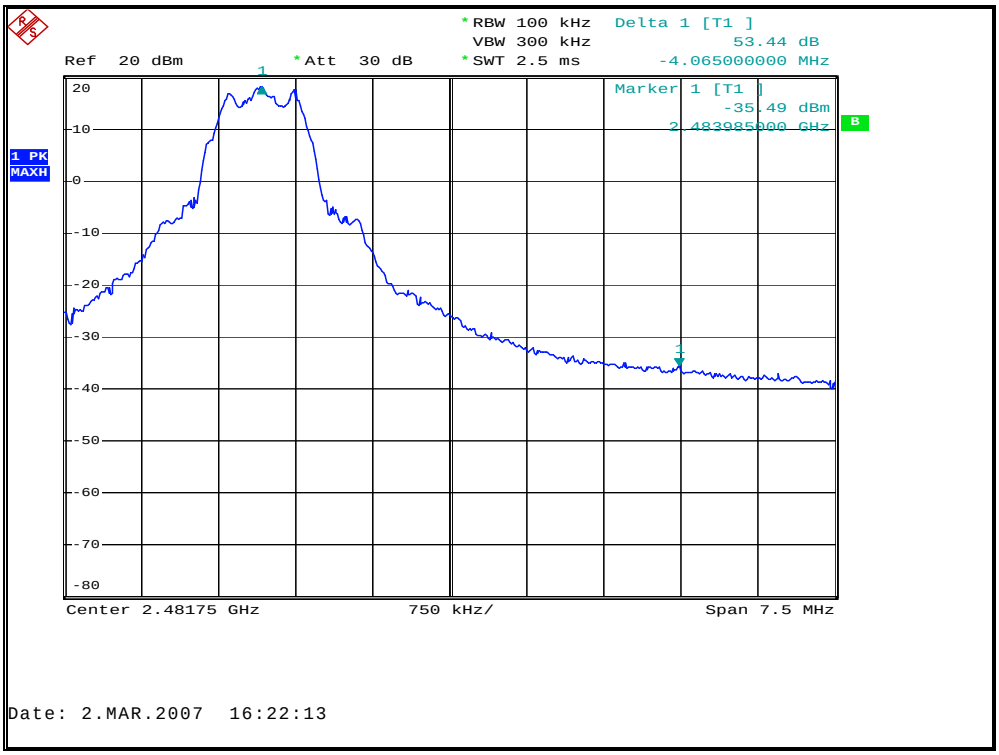

Figure 7.6.1.2-2: Upper Band-edge (Radiated) - 15dB Yagi Direction Antenna

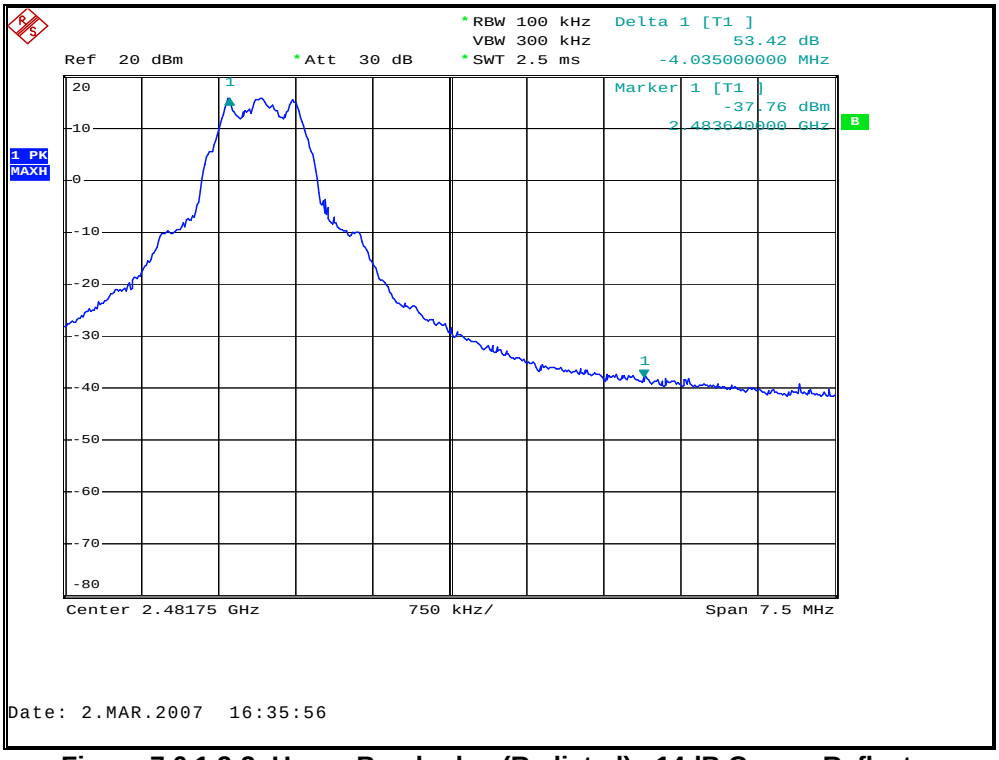

Figure 7.6.1.2-3: Upper Band-edge (Radiated) - 14dB Corner Reflector

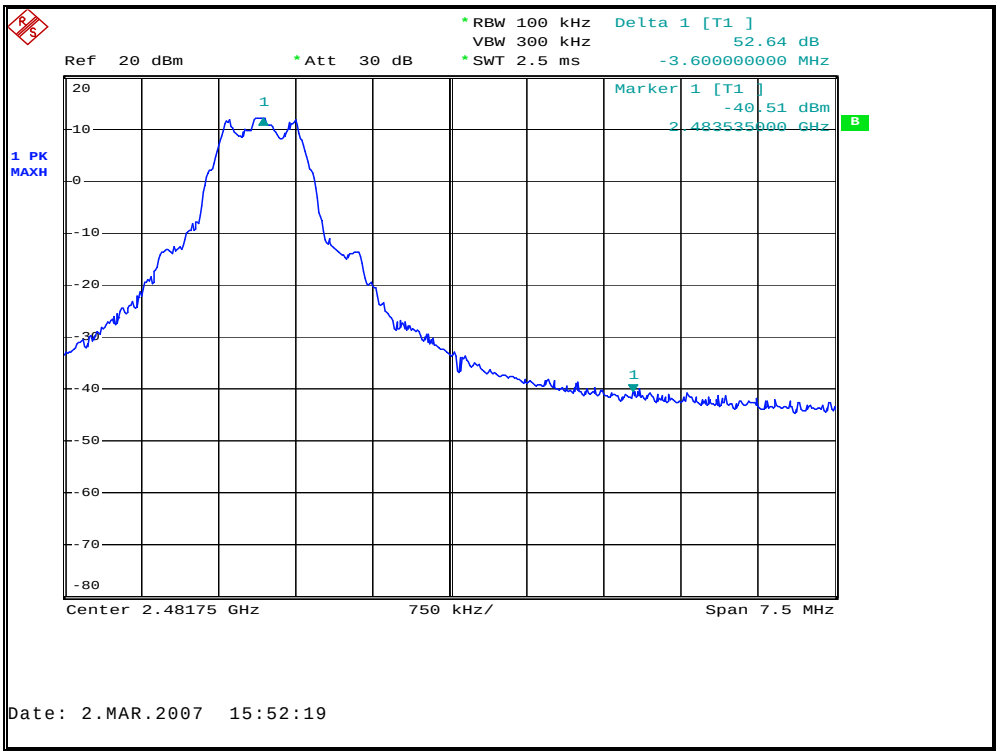

Figure 7.6.1.2-4: Upper Band-edge (Radiated) - 9dB Omni-directional / Dipole

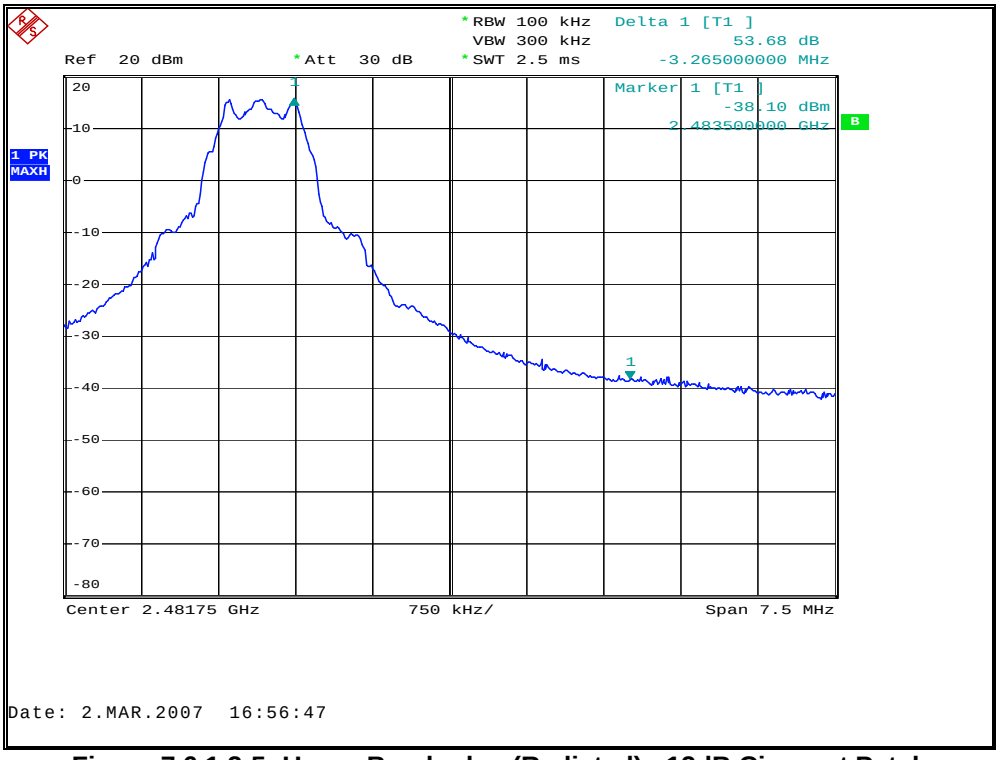

Figure 7.6.1.2-5: Upper Band-edge (Radiated) - 12dB Cironnet Patch

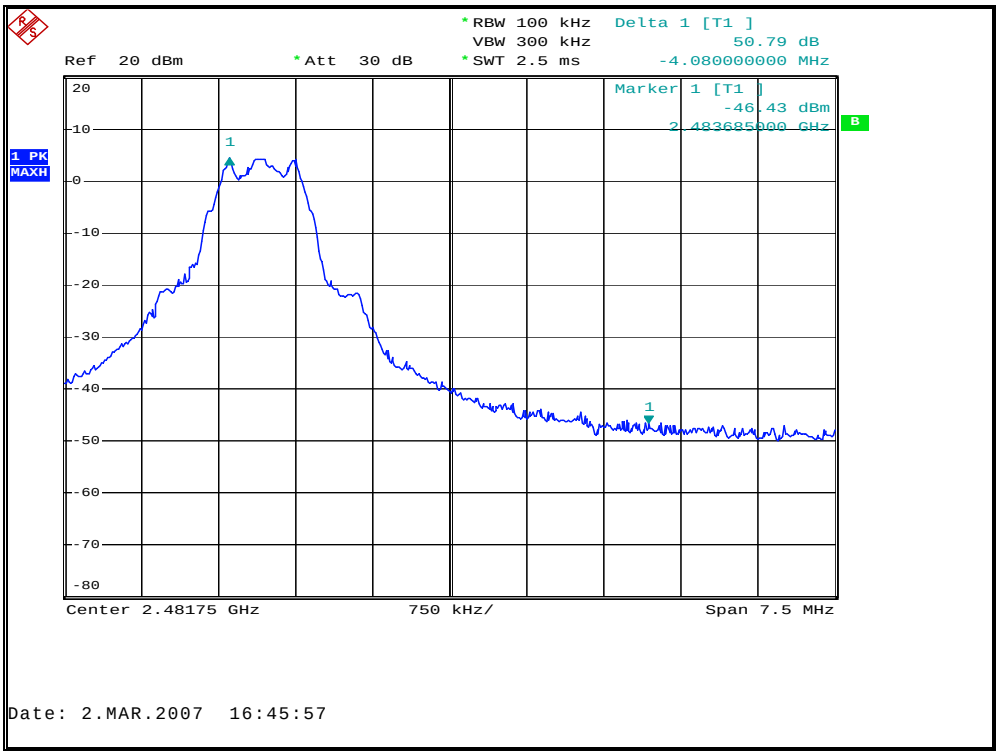

Figure 7.6.1.2-6: Upper Band-edge (Radiated) - 5dB Mobile Mount

7.6.2 RF Conducted Spurious Emissions

The RF Conducted Spurious Emissions were measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer. The EUT was investigated for conducted spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency. For each measurement, the spectrum analyzer's RBW was set to 100 kHz and the VBW was set to 300 kHz. The peak detector and Max Hold function of the analyzer were utilized.

7.6.2.2 Test Results

In a 100 kHz bandwidth, the radio frequency power that was produced by the EUT emissions is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. RF Conducted Emissions are displayed in Figures 7.6.2.2-1 through 7.6.2.2-6.

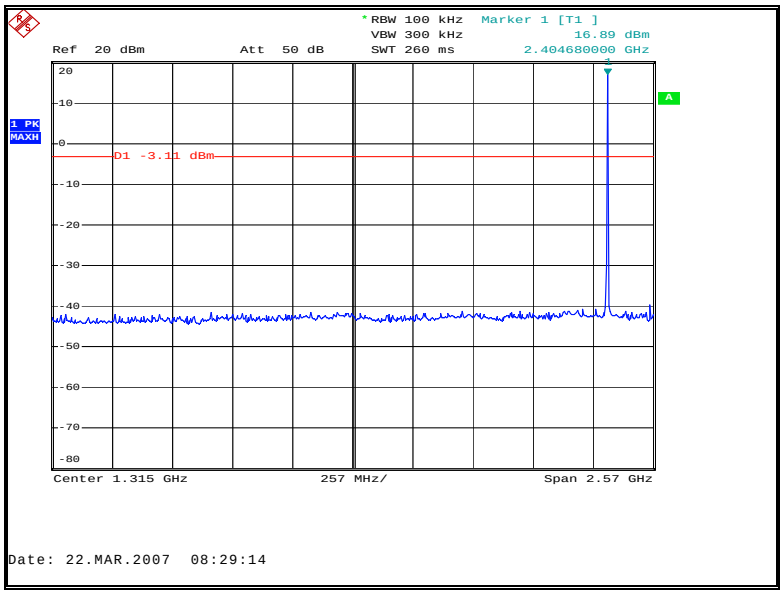

Figure 7.6.2.2-1: 30 MHz – 2.6 GHz – Low Channel

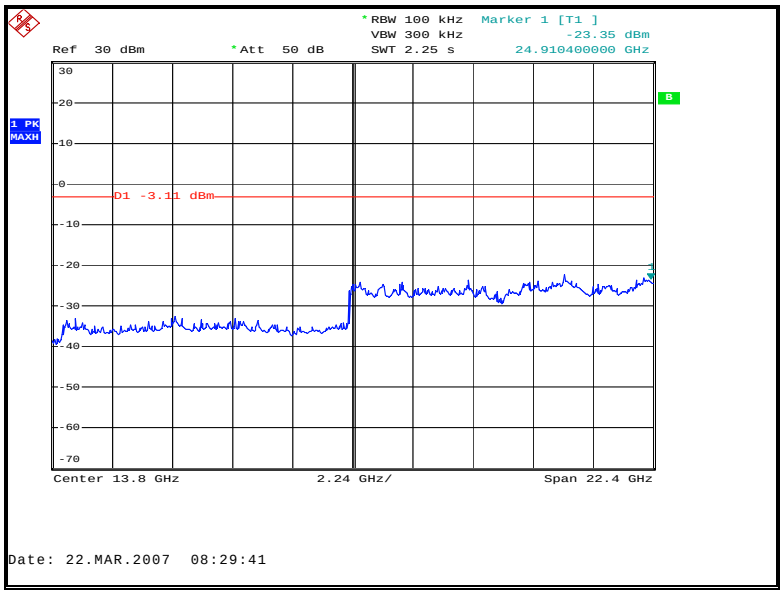

Figure 7.6.2.2-2: 2.6 GHz – 25 GHz – Low Channel

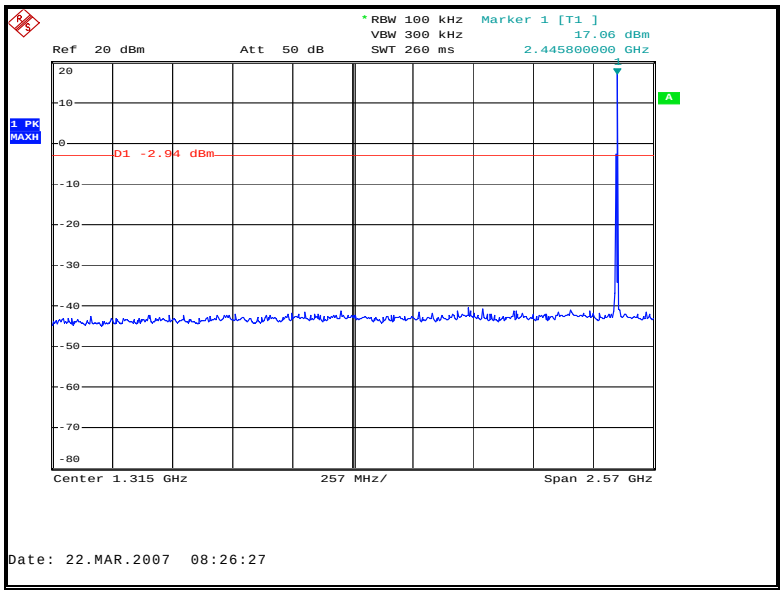

Figure 7.6.2.2-3: 30 MHz – 2.6 GHz –Mid Channel

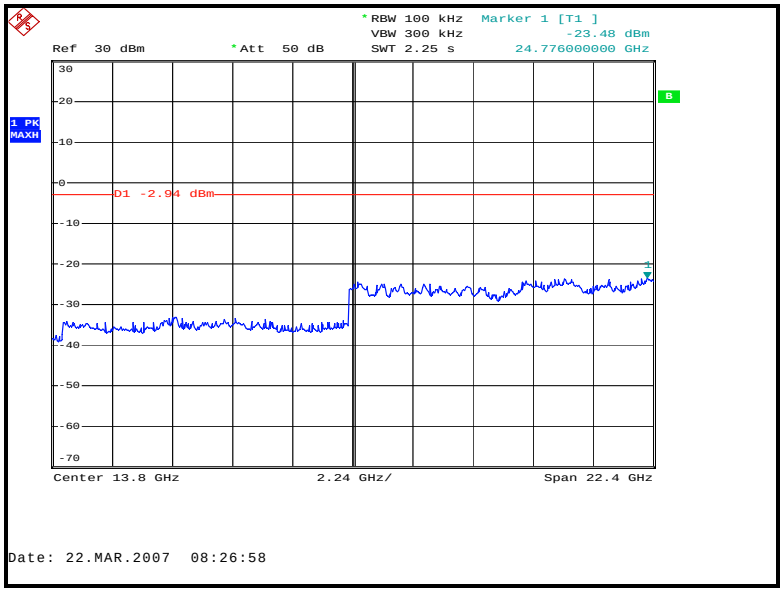

Figure 7.6.2.2-4: 2.6 GHz – 25 GHz – Mid Channel

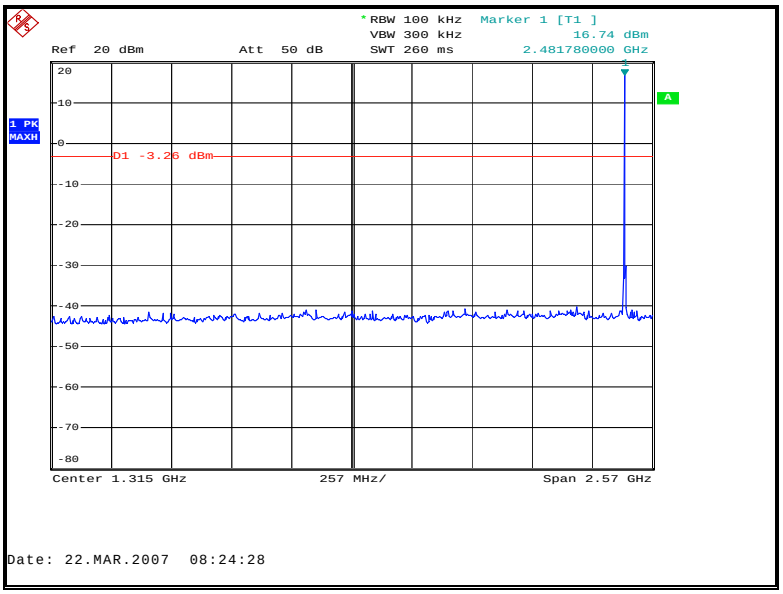

Figure 7.6.2.2-5: 30 MHz – 2.6 GHz – High Channel

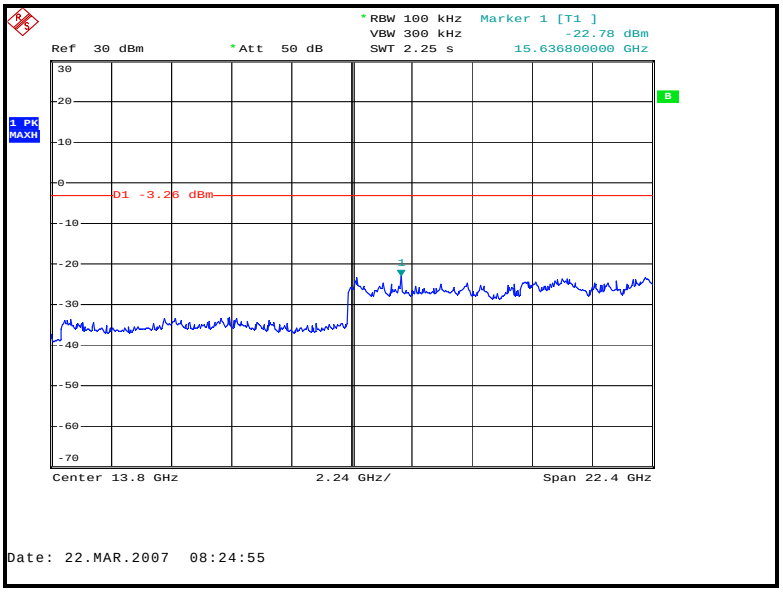

Figure 7.6.2.2-6: 2.6 GHz – 25 GHz –High Channel

7.6.3 Radiated Spurious Emissions (Restricted Bands) - FCC Section 15.205

7.6.3.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 25GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak measurements made with RBW and VBW of 1 MHz.

The EUT test mode allowed for a duty cycle of ~93% therefore average measurements using a VBW of 10Hz were not performed. The peak emission levels were corrected for the actual duty cycle during normal operation and compared to the average limits.

7.6.3.2 Duty Cycle Correction

For average radiated measurements, the peak measured level was reduced by a factor -50.93dB to account for the duty cycle of the EUT. The packet transmissions length is 0.284ms. The duty cycle correction factor is determined using the formula: 20log (0.284/100) = -50.93dB. Further justification for the duty cycle is provided in the Theory of Operation.

7.6.3.3 Test Results

Using the procedures set forth in the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)", radiated spurious emissions found in the band of 30MHz to 25GHz are reported in Table 7.6.3.3-1 to 7.6.3.3-5. Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits as defined in section 15.209.

Table 7.6.3.3-1: Radiated Spurious Emissions - 15dBi Yagi Direction Antenna

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Spurious Emissions - Low Channel										
4805.2	53.05	53.05	H	6.80	59.85	8.92	74.0	54.0	14.15	45.08
4805.2	54.45	54.45	V	7.10	61.55	10.62	74.0	54.0	12.45	43.38
Spurious Emissions - Mid Channel										
4882.6	48.66	48.66	H	7.16	55.82	4.89	74.0	54.0	18.18	49.11
4882.6	48.76	48.76	V	7.46	56.22	5.29	74.0	54.0	17.78	48.71
7323.9	52.67	52.67	H	12.22	64.89	13.96	74.0	54.0	9.11	40.04
7323.9	54.14	54.14	V	12.09	66.23	15.29	74.0	54.0	7.77	38.71
Spurious Emissions - High Channel										
4960	49.80	49.80	H	7.53	57.33	6.39	74.0	54.0	16.67	47.61
4960	49.85	49.85	V	7.83	57.68	6.74	74.0	54.0	16.32	47.26
7440	53.33	53.33	H	12.21	65.54	14.61	74.0	54.0	8.46	39.39
7440	50.89	50.89	V	12.10	62.99	12.05	74.0	54.0	11.01	41.95

Table 7.6.3.3-2: Radiated Spurious Emissions - 14dBi Corner Reflector

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Spurious Emissions - Low Channel										
4805.2	49.72	49.72	H	6.80	56.52	5.59	74.0	54.0	17.48	48.41
4805.2	51.17	51.17	V	7.10	58.27	7.34	74.0	54.0	15.73	46.66
Spurious Emissions - Mid Channel										
4882.6	46.40	46.40	H	7.16	53.56	2.63	74.0	54.0	20.44	51.37
4882.6	46.83	46.83	V	7.46	54.29	3.36	74.0	54.0	19.71	50.64
7323.9	51.12	51.12	H	12.22	63.34	12.41	74.0	54.0	10.66	41.59
7323.9	50.76	50.76	V	12.09	62.85	11.91	74.0	54.0	11.15	42.09
Spurious Emissions - High Channel										
4960	48.30	48.30	V	7.83	56.13	5.19	74.0	54.0	17.87	48.81
7440	50.89	50.89	H	12.21	63.10	12.17	74.0	54.0	10.90	41.83
7440	50.76	50.76	V	12.10	62.86	11.92	74.0	54.0	11.14	42.08

Table 7.6.3.3-3: Radiated Spurious Emissions - 9dBi Omni-directional / Dipole

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Spurious Emissions - Low Channel										
4805.2	49.98	49.98	H	6.80	56.78	5.85	74.0	54.0	17.22	48.15
4805.2	51.17	51.17	V	7.10	58.27	7.34	74.0	54.0	15.73	46.66
Spurious Emissions - Mid Channel										
4882.6	48.53	48.53	H	7.16	55.69	4.76	74.0	54.0	18.31	49.24
4882.6	48.50	48.50	V	7.46	55.96	5.03	74.0	54.0	18.04	48.97
7323.9	52.26	52.26	H	12.22	64.48	13.55	74.0	54.0	9.52	40.45
7323.9	51.80	51.80	V	12.09	63.89	12.95	74.0	54.0	10.11	41.05
Spurious Emissions - High Channel										
4960	46.32	46.32	V	7.83	54.15	3.21	74.0	54.0	19.85	50.79
7440	51.09	51.09	H	12.21	63.30	12.37	74.0	54.0	10.70	41.63
7440	50.86	50.86	V	12.10	62.96	12.02	74.0	54.0	11.04	41.98

Table 7.6.3.3-4: Radiated Spurious Emissions - 12dBi Cironnet Patch

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Spurious Emissions - Low Channel										
4805.2	58.15	58.15	H	6.80	64.95	14.02	74.0	54.0	9.05	39.98
4805.2	53.43	53.43	V	7.10	60.53	9.60	74.0	54.0	13.47	44.40
Spurious Emissions - Mid Channel										
4882.6	50.36	50.36	H	7.16	57.52	6.59	74.0	54.0	16.48	47.41
4882.6	47.64	47.64	V	7.46	55.10	4.17	74.0	54.0	18.90	49.83
7323.9	54.27	54.27	H	12.22	66.49	15.56	74.0	54.0	7.51	38.44
7323.9	52.44	52.44	V	12.09	64.53	13.59	74.0	54.0	9.47	40.41
Spurious Emissions - High Channel										
7440	53.73	53.73	H	12.21	65.94	15.01	74.0	54.0	8.06	38.99
7440	52.03	52.03	V	12.10	64.13	13.19	74.0	54.0	9.87	40.81

Table 7.6.3.3-5: Radiated Spurious Emissions - 5dBi Mobile Mount

Frequency (MHz)	Level (dBuV)		Antenna Polarity	Correction Factors	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Avg	(H/V)	(dB)	pk	Avg	pk	Avg	pk	Avg
Spurious Emissions - Low Channel										
4805.2	49.90	49.90	H	6.80	56.70	5.77	74.0	54.0	17.30	48.23
4805.2	52.47	52.47	V	7.10	59.57	8.64	74.0	54.0	14.43	45.36
Spurious Emissions - Mid Channel										
4882.6	50.03	50.03	H	7.16	57.19	6.26	74.0	54.0	16.81	47.74
4882.6	51.50	51.50	V	7.46	58.96	8.03	74.0	54.0	15.04	45.97
7323.9	45.89	45.89	H	12.22	58.11	7.18	74.0	54.0	15.89	46.82
7323.9	49.19	49.19	V	12.09	61.28	10.34	74.0	54.0	12.72	43.66
Spurious Emissions - High Channel										
4960	54.14	54.14	H	7.53	61.67	10.73	74.0	54.0	12.33	43.27
4960	53.94	53.94	V	7.83	61.77	10.83	74.0	54.0	12.23	43.17
7440	48.05	48.05	H	12.21	60.26	9.33	74.0	54.0	13.74	44.67
7440	51.40	51.40	V	12.10	63.50	12.56	74.0	54.0	10.50	41.44

7.6.3.4 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T = Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U = Uncorrected Reading
R_C = Corrected Level
AF = Antenna Factor
CA = Cable Attenuation
AG = Amplifier Gain
DC = Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: 49.90+ 6.80= 56.70dBuV/m
Margin: 74dBuV/m – 56.70dBuV/m = 17.30dB

Example Calculation: Average

Corrected Level: 49.90+ 6.80 - 50.9= 5.77dBuV
Margin: 54dBuV – 5.77dBuV = 48.23dB

7.7 Peak Power Spectral Density- FCC Section 15.247(e)

7.7.1 Test Methodology

The power spectral density was measured in accordance with the FCC KDB Publication No. 558074 "Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)". The emission peaks within the pass band were located and zoomed in on. The spectrum analyzer RBW was set to 3 kHz and VBW 10 kHz. Span was adjusted to 500 kHz and the sweep time was calculated to be 170s (Span/3 kHz).

7.7.2 Test Results

Results are shown below in table 7.7.2-1 and figures 7.7.2-1 – 7.7.2-3:

Table 7.7.2-1: Peak Power Spectral Density

Frequency [MHz]	Level [dBm]	Limit [dBm]	Result
2402.6	4.28	8	Pass
2441.3	3.56	8	Pass
2480.0	2.80	8	Pass

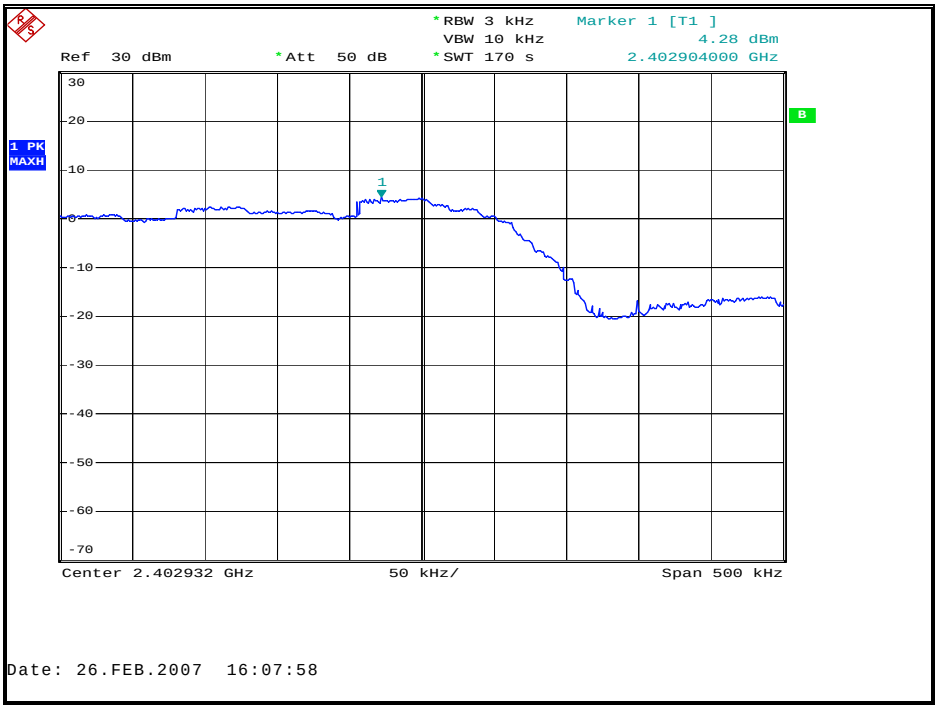

Figure 7.7.2-1: Power Spectral Density Plot – Low Channel

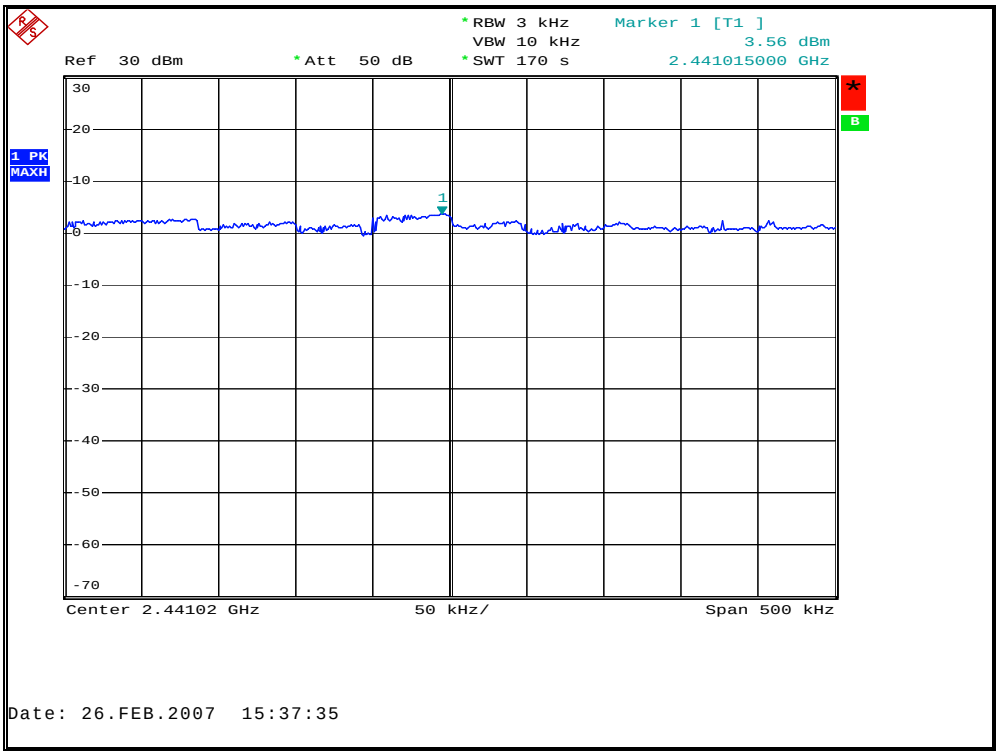

Figure 7.7.2-2: Power Spectral Density Plot – Mid Channel

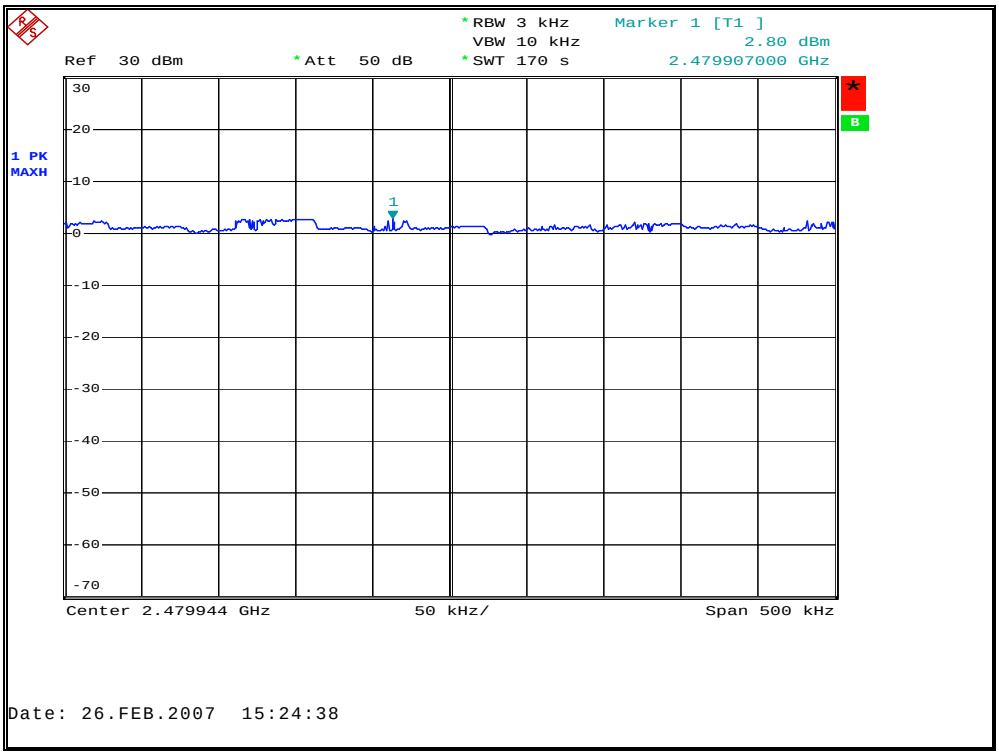

Figure 7.7.2-3: Power Spectral Density Plot – High Channel

8.0 CONCLUSION

In the opinion of ACS, Inc. the WIT2492, manufactured by Cirronet meets the requirements of FCC Part 15 subpart C.

END REPORT