



## EMC Test Data

Client:	Bitrage	Job Number:	J42216
Model:	5.3 & 5.8 GHz UNII	T-Log Number:	T42491
Contact:	Chet Ferry	Proj Eng:	Mark Briggs
Emissions Spec:	15.407	Class:	N/A
Immunity Spec:	-	Environment:	-

## EMC Test Data

For The

### Bitrage

Model

**5.3 & 5.8 GHz UNII**



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## EUT INFORMATION

### General Description

The EUT is a UNII radio which is designed to operate in fixed link, point-to-point applications in the 5.25-5.35 and 5.725-5.825 GHz bands. Normally, the EUT would be mounted to a pole during operation. During radiated emissions testing the EUT was mounted on a pole such that it was at a height of 1m above the ground. The EUT was connected to a 2' or 6' dish antenna as appropriate for the frequency band being tested.

The EUT is powered from a dual voltage dc supply. During testing a bench power supply was used. When installed the end-user is responsible for providing dc power from a distributed dc power network or other dc power source.

### Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
BitRage	CR45-A-58	5.8GHz UNII Transceiver	N/A	PGK-CR45-A-58
BitRage	CR45-A-53	5.3GHz UNII Transceiver	N/A	PGK-CR45-A-53
RadioWave	SP2-5.2NS	2' Dish antenna (28dBi)	297	N/A
RadioWave	SP6-5.2	6' Dish antenna (37 dBi)	N/A	N/A
RadioWave	SP3-5.2	3' Dish antenna (31 dBi)	N/A	N/A

### Other EUT Details

The EUT operates at T3 data rates (44.736 Mb/s). One side of the link transmits in the 5.25 - 5.35 GHz band using a 2' diameter dish antenna with a gain of 28dBi. The other side of the link transmits in the 5.725 - 5.825 GHz band at two different power levels. The low power level can utilize dish antennas up to a maximum diameter of 6' (gain = 37dBi). The higher power level can utilize a dish of up to 3' in diameter (31dBi gain).



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### EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 10 cm wide by 10 cm deep by 25 cm high.

### Modification History

Mod. #	Test	Date	Modificaiton
1			



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### Test Configuration #1

#### Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Tenma	72-6615	DC Power supply	9912036	N/A

#### Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Sunrise Telecom	Sunset T3	T3 BER tester	9027	DoC

#### EUT Interface Ports

EUT Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
DC Power	DC Power meter	Alpha 3223 SL005	Shielded	30
T3 Rx/Tx	BER Tester	75 ohm coaxial (x2)	Shielded	15
Antenna	Antenna (note 1,2)	50 ohm coaxial (Belden 9913 or equivalent)	Shielded	1

Note 1: The antenna port was connected to the spectrum analyzer or power meter for measurements made directly on the antenna port. The antenna port was connected to an antenna for radiated spurious emissions.

The 5.3 GHz radio was connected to the 2' diameter dish, which represents the highest gain antenna that is intended to be used with the 5.3GHz radio. The 5.8 GHz radio was connected to a 6' dish and operated at full power. The high power setting is intended to be used with antennas up to 3' in diameter and the 6' dish is only intended to be used with the low power setting. For testing the purposes the combination of high power setting and high gain antenna were used since this configuration would represent the worst case configuration with respect to radiated spurious emissions.

#### EUT Operation During Emissions

The EUT was configured to constantly transmit a pseudo random data sequence generated by the BER tester at the output power detailed for each test.



## *EMC Test Data*

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Spec:	15.407	Class:	N/A

## FCC Part 15 Subpart E Tests - 5.3GHz Radio

## Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 3/14/2001 Config. Used: #1  
Test Engineer: J Martinez, M Briggs Config Change: N/A  
Test Location: Chamber #2, SV #3 EUT Voltage: DC

## General Test Configuration

The EUT was located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 15 meters from the EUT with all I/O connections running on top of the groundplane.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT unless stated otherwise.

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

**Ambient Conditions:** Temperature: 25°C  
Rel. Humidity: 51%

## Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Output Power	15.407(a) (2)	Pass	
2	Power Spectral Density (PSD)	15.407(a) (2)	Pass	
3	26dB Bandwidth	15.407	N/A	
4	Peak Excursion Envelope	15.407(a) (6)	Pass	
5	Antenna Conducted - Out of Band Spurious	15.407(b)	Pass	
6	RE, 1000 - 40000 MHz - Spurious Emissions	15.407(b)(6)	Pass	-10.5dB @ 21200MHz

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Spec:	15.407	Class:	N/A

**Modifications Made During Testing:**

No modifications were made to the EUT during testing

**Deviations From The Standard**

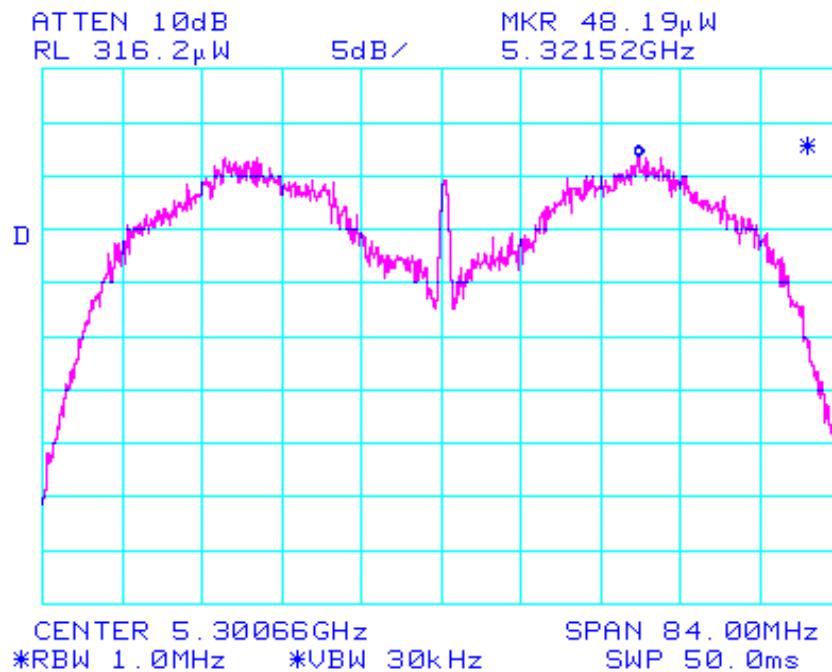
No deviations were made from the requirements of the standard.

**Run #1: Output Power**

The maximum antenna gain that can be used with the 5.3 GHz radio is 28dBi. The maximum power output is, therefore, 24 - (28-6) dBm, which is 2dBm.

Channel	Frequency (MHz)	Res BW	Output Power	Graph reference #
Low	5300	N/A	1.3 dBm	Power Meter
Low	5301	N/A	0.9 dBm	Note 1

Note 1: Measured using spectrum analyzer (RBW = 1MHz, VBW = 30kHz) and summing the power in each 1MHz band across the entire emission bandwidth. Data is attached under "Output Power"

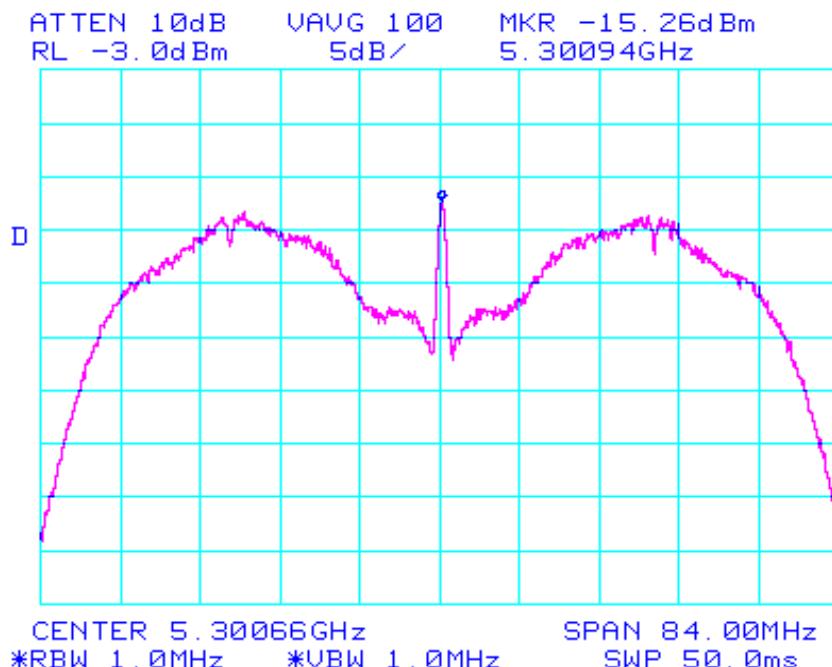


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Spec:	15.407	Class:	N/A

**Run #2: Power Spectral Density**

The maximum antenna gain that can be used with the 5.3 GHz radio is 28dBi. The maximum power spectral density permitted is, therefore, 11 - (28-6) dBm, which is -11dBm/MHz.

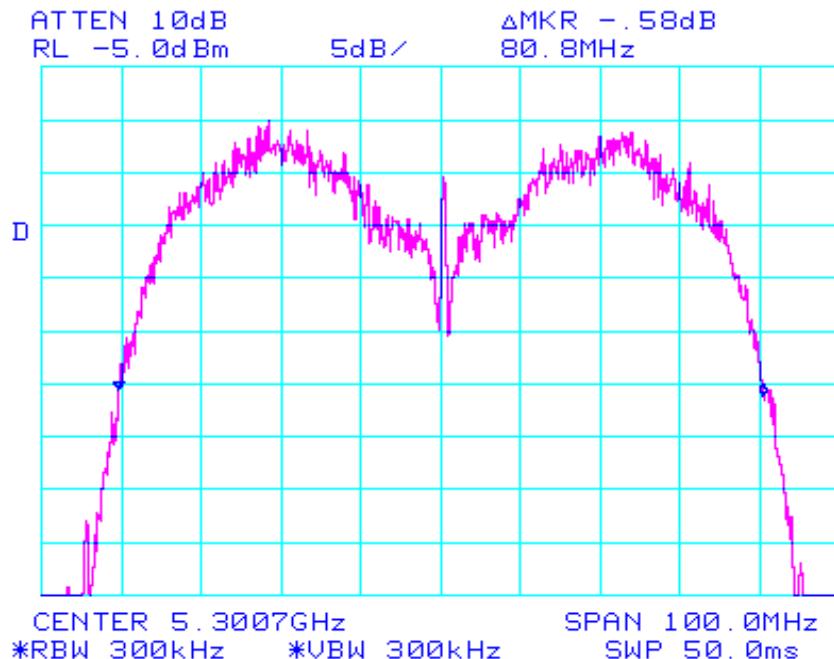
Channel	Frequency (MHz)	Res BW	P.S.D. in 1MHz, Video averaging of 100 samples.	Graph reference #
Low	5300	1 MHz	-19.5 dBm	None



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**Run #3: Signal Bandwidth**

Channel	Frequency (MHz)	Resolution Bandwidth	26dB Signal Bandwidth	Graph reference #
NA	5301	300 kHz	80.8 MHz	None

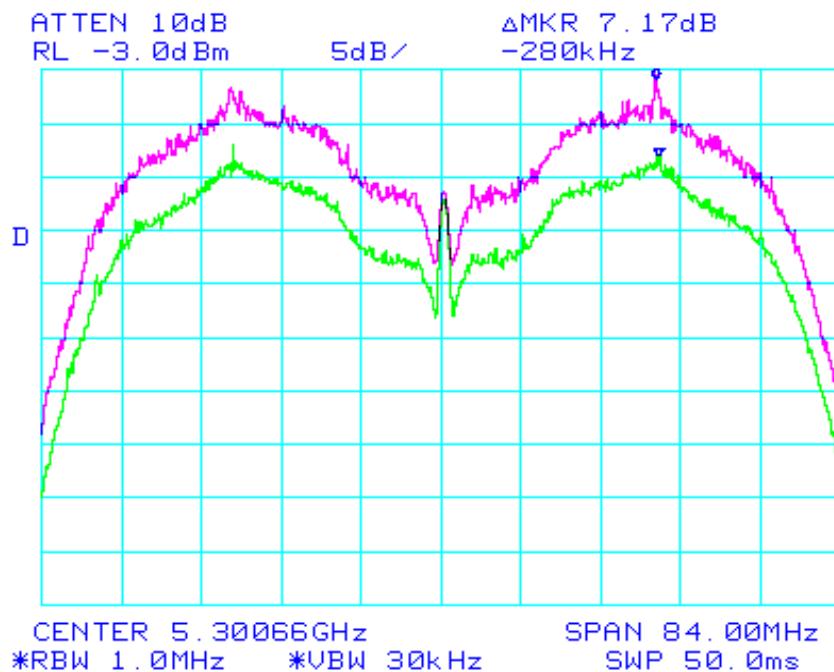


Client: Bitrage  
 Model: 5.3 & 5.8 GHz UNII  
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 Spec: 15.407

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 Class: N/A

**Run #4: Peak Excursion Measurement**

The plot shows that the peak excursion was less than 13dB (approximately 7.2dB worst case)

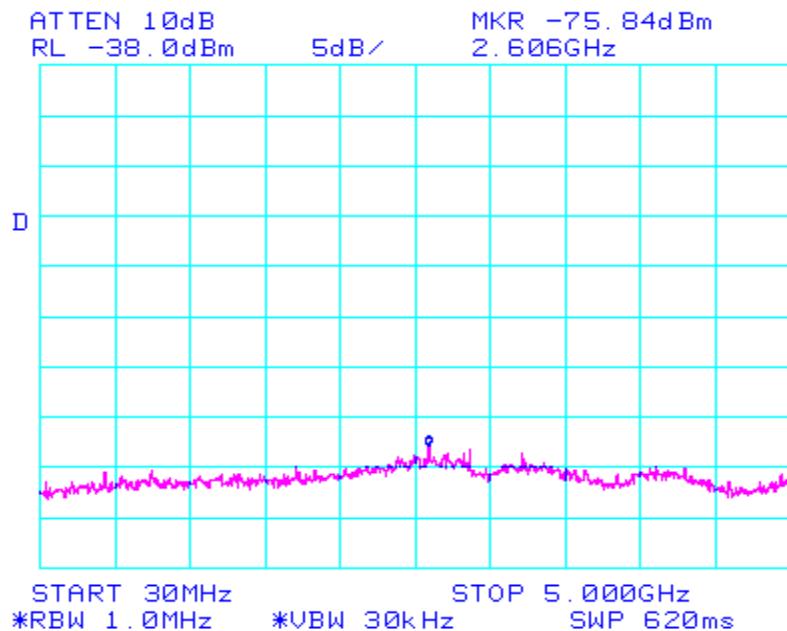


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Spec:	15.407	Class:	N/A

**Run #5: Out Of Band Spurious Emissions - Antenna Conducted**

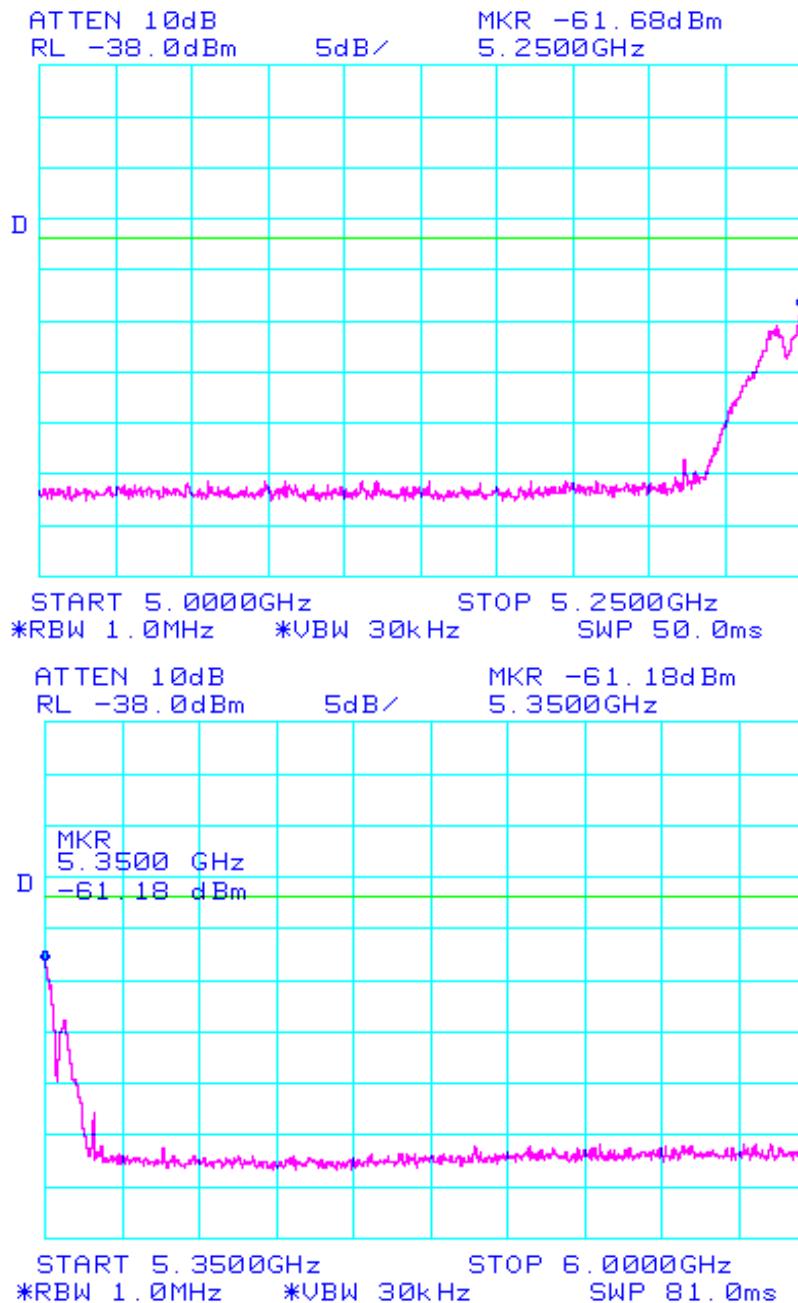
The maximum antenna gain that can be used with the 5.3 GHz radio is 28dBi. The EIRP limit is -27dBm/MHz. For signals close to the band edge a limit of -55dBm was used (assuming that the antenna gain at the band edges is the same as the in-band antenna gain). For signals removed from the band edge, radiated measurements were made (refer to run #6)

The highest signal in the upper band-edge was -61.2dBm. The highest signal in the lower band edge was -61.7dBm. There were no other signals above the instrumentation noise floor.



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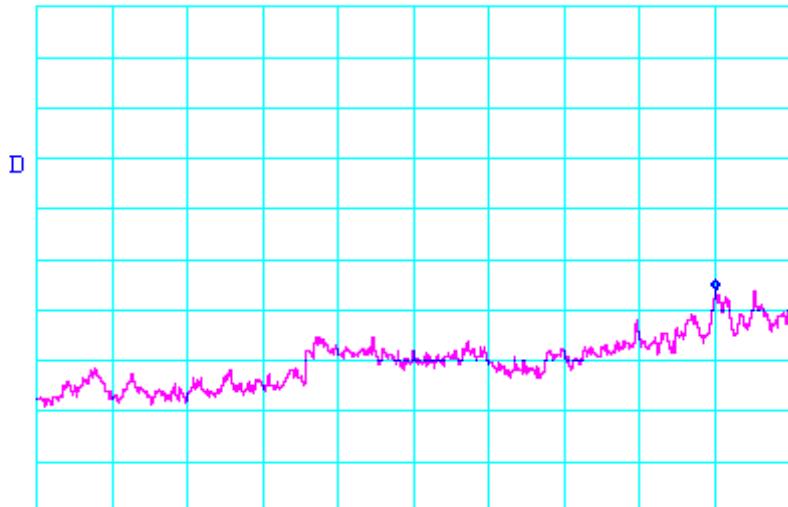
Contact: Chet Ferry

Proj Eng: Mark Briggs

Spec: 15.407

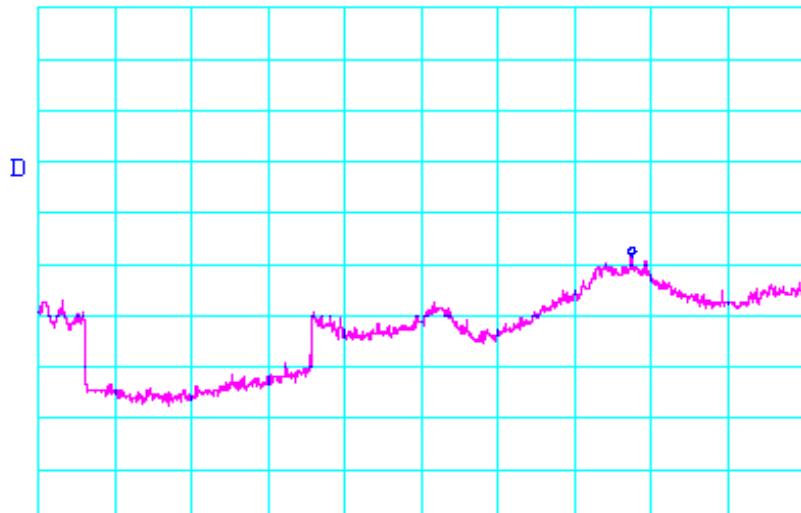
Class: N/A

ATTEN 10dB  
RL -38.0dBm 5dB/  
MKR -66.01dBm  
24.03GHz



START 6.00GHz STOP 26.00GHz  
\*RBW 1.0MHz \*VBW 30kHz SWP 2.50sec

ATTEN 10dB  
RL -38.0dBm 5dB/  
MKR -62.26dBm  
36.85GHz



START 26.00GHz STOP 40.00GHz  
\*RBW 1.0MHz \*VBW 30kHz SWP 1.80sec



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Contact:	Chet Ferry		
Spec:	15.407	Class:	N/A

### Run #6: Radiated Spurious Emissions, 1000 - 40000 MHz

Spurious emissions from 30 - 1000 MHz were measured while performing emissions measurements of the digital device. The emissions were below the FCC Class B limit (refer to T42466).

Limit for emissions in restricted bands:	54dBuV/m (Average)
Limit for emissions outside of restricted bands:	EIRP < -27dBm/MHz

Frequency	Level	Pol	15.209 / 15.407	Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters
21200.0	43.6	v	54.0	-10.4	Avg	71	1.5
31800.0	43.4	h	54.0	-10.6	Avg	80	1.6
31800.0	42.8	v	54.0	-11.2	Avg	76	1.5
26500.0	56.5	h	68.0	-11.5	Note 3	104	1.6
15900.0	42.5	v	54.0	-11.5	Avg	75	1.5
10600.0	41.8	v	54.0	-12.2	Avg	115	1.5
26500.0	55.8	v	68.0	-12.2	Note 3	100	1.5
15900.0	36.5	h	54.0	-17.5	Avg	110	1.6
10600.0	34.8	h	54.0	-19.2	Avg	120	1.6
31800.0	54.4	h	74.0	-19.6	Pk	80	1.6
21200.0	33.2	h	54.0	-20.8	Avg	105	1.6
31800.0	53.2	v	74.0	-20.8	Pk	76	1.5
15900.0	52.4	v	74.0	-21.6	Pk	75	1.5
10600.0	52.0	v	74.0	-22.0	Pk	115	1.5
21200.0	51.2	v	74.0	-22.8	Pk	71	1.5
37100.0	45.2	v	68.0	-22.8	Note 3	70	1.5
37100.0	44.9	h	68.0	-23.1	Note 3	100	1.6
15900.0	42.3	h	74.0	-31.7	Pk	110	1.6
21200.0	41.2	h	74.0	-32.8	Pk	105	1.6
10600.0	40.8	h	74.0	-33.2	Pk	120	1.6

Note 1: For emissions falling in the restricted bands detailed in 15.205 the general limits of 15.209 apply. For all other emissions the limit is EIRP < -27dBm (equivalent to a field strength at 3m of 68dBuV/m)

Note 2: Signal is in a restricted band

Note 3: Restricted Band Peak Measurements: Resolution and Video BW: 1 MHz, Restricted Band Average Measurements: Resolution Bw: 1MHz and Video Bw: 10 Hz. All other measurements, RBW = 1MHz and VBW = 30kHz.

**Output Power - 5.3GHz Radio:** Measured by summing the power measured on the analyzer (RBW=1MHz, VBW=30kHz) at 1MHz intervals

Frequency (MHz)	Power (mW)	Frequency (MHz)	Power (mW)
5258.7	0.0000	5299.8	0.0020
5259.6	0.0001	5300.8	0.0220
5260.6	0.0002	5301.8	0.0033
5261.6	0.0004	5302.8	0.0043
5262.6	0.0009	5303.7	0.0035
5263.6	0.0014	5304.7	0.0044
5264.5	0.0025	5305.7	0.0046
5265.5	0.0038	5306.7	0.0054
5266.5	0.0056	5307.7	0.0047
5267.5	0.0069	5308.6	0.0062
5268.5	0.0098	5309.6	0.0066
5269.4	0.0102	5310.6	0.0108
5270.4	0.0104	5311.6	0.0093
5271.4	0.0123	5312.6	0.0141
5272.4	0.0133	5313.5	0.0237
5273.4	0.0158	5314.5	0.0242
5274.3	0.0155	5315.5	0.0215
5275.3	0.0200	5316.5	0.0242
5276.3	0.0276	5317.5	0.0251
5277.3	0.0362	5318.4	0.0256
5278.3	0.0348	5319.4	0.0299
5279.2	0.0304	5320.4	0.0329
5280.2	0.0430	5321.4	0.0430
5281.2	0.0473	5322.4	0.0464
5282.2	0.0282	5323.3	0.0348
5283.2	0.0287	5324.3	0.0329
5284.1	0.0266	5325.3	0.0237
5285.1	0.0251	5326.3	0.0215
5286.1	0.0224	5327.3	0.0211
5287.1	0.0293	5328.2	0.0155
5288.1	0.0228	5329.2	0.0141
5289.0	0.0158	5330.2	0.0114
5290.0	0.0100	5331.2	0.0123
5291.0	0.0126	5332.2	0.0075
5292.0	0.0071	5333.1	0.0128
5293.0	0.0057	5334.1	0.0064
5293.9	0.0068	5335.1	0.0051
5294.9	0.0047	5336.1	0.0048
5295.9	0.0050	5337.1	0.0035
5296.9	0.0052	5338.0	0.0020
5297.9	0.0032	5339.0	0.0010
5298.8	0.0035	5340.0	0.0005

Total (mW) 1.240

Total (dBm) 0.9