110 Nortech Parkway
San Jose, California, 95134

FCC Part 15.247 Certification Application

EMI Test Report
and
Technical Documentation
on
Airespace Access Point.
Model: 1200

FCC ID: QTZAMAP1200AB

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General Information

Unit(s) Under Test: (UUT) Airespace Access Point (AP)

Model: AS1200

Product Description: IEEE 802.11 A/B Access point

FCC ID: **QTZAMAP1200AB**

Tested For: Airespace
110 Nortech Parkway
San Jose, Ca. 95134

Tested At: Elliott Laboratories
684 West Maude Ave
Sunnyvale, CA 94086

Tested By: Juan Martinez, Sr. Test Engineer, Elliott Laboratories
Trinh Waitt, (Independent Consultant)

Test Specifications: FCC CFR 47, Part 15.247, 2.4 GHz DSSS

Test Date: Aug 11 – 14, 2003

Requested Certification: Part 15.247 / Part 15 Subpart E Certification

Detailed Product Information

The Airespace access point radio is an IEEE 802.11 A/B Access point (AP) intended to be professionally installed and configured in corporate and industrial environments.

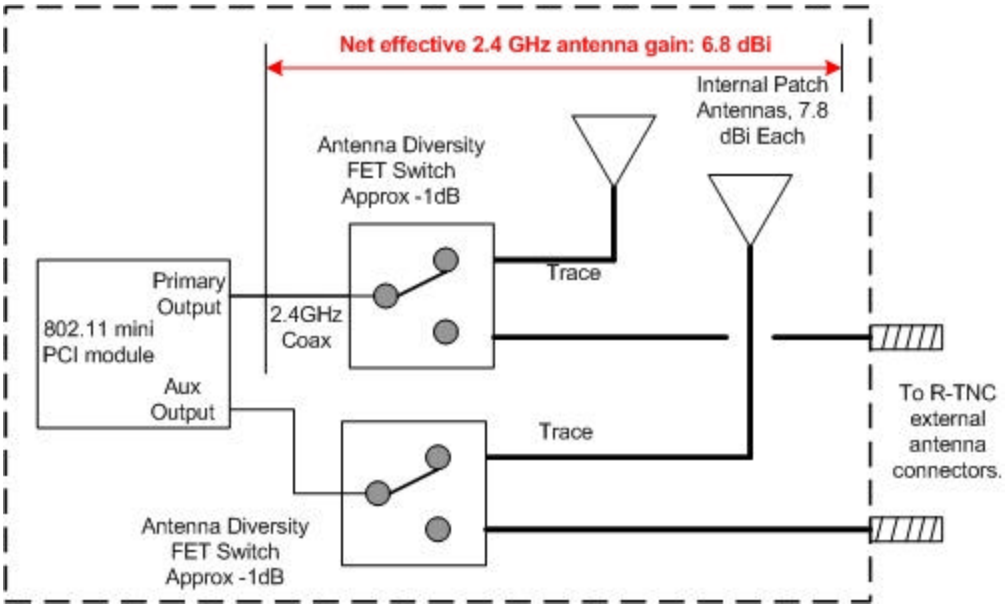
The device utilizes a mini PCI module manufactured by an outside vendor. At the time of this certification the module had received FCC modular approval, however with an antenna of significantly lower gain. For this reason, Airespace is pursuing its own certification.

This product is similar in may respect to previous Airespace products (FCC ID:QTZWNAP1200AB) the only significant difference is that this unit incorporates mini PCI IEEE802.11 modules from a different supplier than the previous product(s)

The AP utilizes integral antennas on the 802.11 A and B band. The AP effectively includes only a single 2.4GHz patch antenna. However, physically there are two 2.4 GHz antennas. The AP switches rapidly between them and when a signal is detected, the AP uses the antenna offering the best connection. At any one time, there is only one antenna connected to the internal PCI module.

There are two “back to back” internal 5 GHz antennas that are used together to provides a somewhat omni-directional pattern

The effective gain of the 2.4 GHz internal antenna path (the antenna switch and the antenna itself) is 6.8dBi. The diagrams below outline the RF path from the output of the mini PCI module within the AP to the integral antennas within the AP . (Note that only the Part 15.247, 2.4 GHz portion of the AP is covered by this particular report)



Test Results Summary

This report presents the results of the tests that verify compliance with FCC Part 15.247..

A brief results summary of all the in this report is below.

Part 15 Paragraph	RSS-210 Paragraph	Test	Results
15.247(b)	6.2.2(o)(a) 3	Maximum Power Output at Antenna Terminal	15.94 dBm Max
15.247(a)(2)	6.2.2(o)(e1)	6dB Bandwidth	12.27 MHz Min
15.247(d)	6.2.2(o)(d1)	Power Spectral Density	-9.5dBm/3kHz Max
15.247(c)	6.2.2(o)(a) 4	Out of Band Spurious Emissions	-40 dBc Max
15.205	6.3(c)	Radiated Emissions in Restricted bands	.7 dB in spec min @6336.042MHz

Test Facilities

The certification tests were performed at:

Elliott Labs
684 West Maude Ave
Sunnyvale, CA 94086

General:

Final radiated test measurements were taken in March 2003 at the Elliott Laboratories Open Area Test Site #4.

The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

OATS:

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated emissions are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 Guidelines.

Antenna, Antenna Mast and Turntable

The Horn antennas that are use to measure radiated emissions above 1000MHz are amounted on a non-conductive antenna mast equipped with a motor drive to vary the antenna height.

ANSI C63.4 specifies that the test height above the ground plane shall be 80cm unless the equipment is intended to be floor mounted. During the radiated emissions tests the equipment is positioned on a motorized turntable in conformance with the ANSI requirement.

Equipment Lists

Instrument Calibration

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

The following test equipment was used to perform the testing

Elliott Test Equipment

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	868	12	3/14/2003	3/14/2004
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz), system 2	84125C	1410	12	4/2/2003	4/2/2004
Miteq	Preamplifier, 1-18GHz	AFS44	1346	12	1/6/2003	1/6/2004
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1534	12	3/20/2003	3/20/2004
Rohde & Schwarz	Power Sensor, 1uW-100mW, DC-18 GHz, 50ohm	NRV-Z51	1070	12	3/25/2003	3/25/2004
Rohde & Schwarz	Power Sensor 100uW - 10 Watts	NRV-Z53	1236	12	8/15/2002	8/15/2003

Test Methods

The tests are performed at a low, middle and high channel of the applicable band. The typical frequencies used for the Part 15.247 , 2.4 GHz tests are listed below. Unless otherwise noted, all testing was performed on these channels / frequencies

ISM 802.11 B	
2400 – 2483.5 MHz	
Channel	Freq(MHz)
Low CH 1	2412
Mid CH 6	2437
High Ch 11	2462

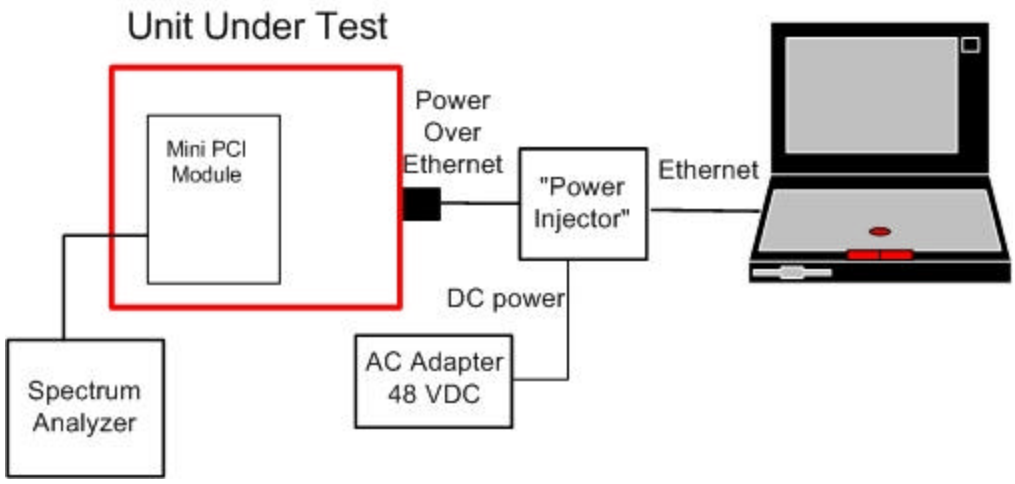
In order to comply with the “radiated emissions in restricted bands” requirements the transmit power had to be lowered on some of the channels at the edges of the operating band. The maximum power setting that allowed compliance with the radiated emissions requirements will be programmed into the configuration firmware of the access point ensuring that maximum possible power setting will be correct for each channel. Given that the access point will normally be operated at these power settings, these same settings were also used during the “bench top” conducted RF tests (Spectral density, bandwidth etc).

The transmit power setting for the 2.4 GHz ISM band 802.11 B channels used in the testing is shown in the table below. The power setting was +14 dBm on channels 1 and 11 to improve restricted band emissions at the band edges. All channels (in the 2.4 GHz band) other than 1 and 11 will be configured for +17 dBm power out.

Pout settings Vs. Channel	802.11a/b Channel	Frequency (MHz)	Tx Pout Set Point (dBm)
2.4 GHz ISM	1	2412.00	+14.00
	6	2437.00	+17.00
	11	2462.00	+14.00

The tests listed below are performed using the basic “conducted” test setup shown below unless otherwise noted. In most cases, the UUT was running special diagnostic software to allow it to transmit random data on a particular channel indefinitely.

Part 15	Test
15.247(a)(1)	6dB Bandwidth
15.247(c)	Out of Band Conducted Emissions
15.247(a)(1)(i)	Power Spectral Density



Basic Conducted RF Bench Test Setup

Unless otherwise noted, the support equipment for the bench tests is listed below.

Support Equipment				
Description	**Model number**	**FCC ID or SN**	**Manufacturer**	**Power Cable**
Laptop	Armada E 500	P31000T4X20DC12N2	Compaq	Laptop PS
Test Software	Atheros Radio Test		Atheros	
48VDC AC adapter	Generic		Generic	Standard Twin lead DC wire

NOTE: The “Power Injector” is simply a connector attached to wires “broken out” of the Ethernet cable. It is not really a “piece of equipment”.

Test Results

Detailed test procedures and test results are contained in the following sections. In cases where the test setup differs from the Conducted RF test setup shown earlier, the test setup is also presented.

Test Conditions			
Temperature	Approx 23C	**Humidity:**	Approx 51%
ATM pressure	Approx 1005 mBar	**Grounding:**	None
Tested By	Trinh Waitt , Juan Martinez	**Date of Test:**	August 11-14 2003
Test Reference	Refer to individual test results		
Tested Range	Test Dependent		
Test Voltage	48 VDC to the AP		
Modifications	No modifications were made to the unit during the tests		

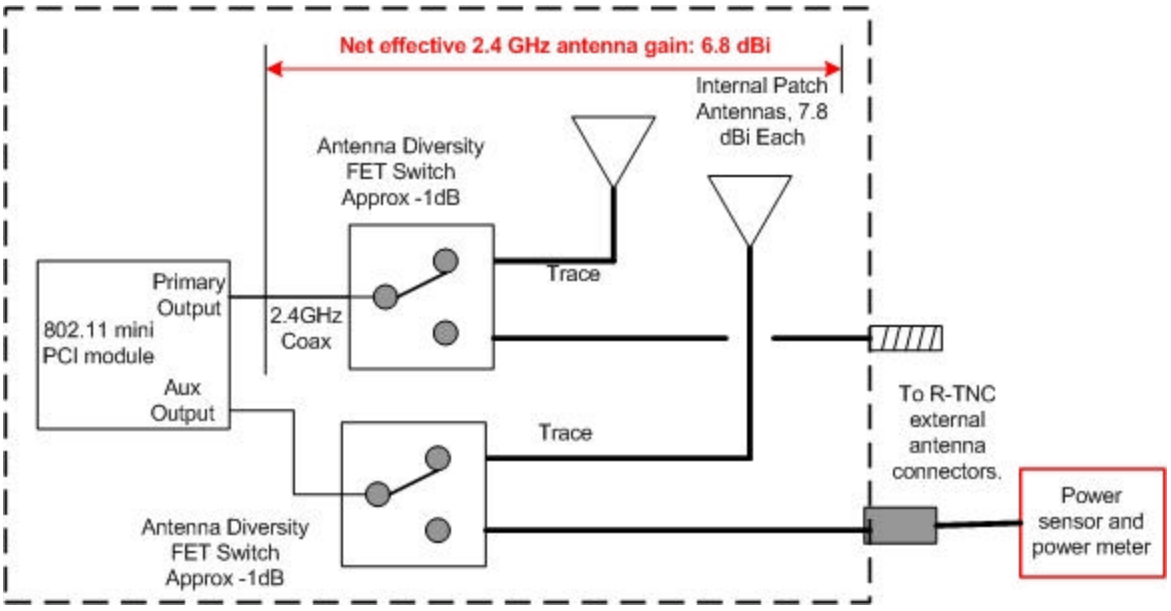
802.11 B Maximum RF Power Output at Antenna Terminals

Specifications:

FCC Specification: Paragraph: 15.247(b)

Procedure:

The test was configured as shown in the conducted RF test setup. The unit was tuned to the test channels and configured to transmit random data packets.



Because the unit will be operated at different power levels depending on the channel being used, the RF power out was measured at the appropriate power level for the given test channel (see table above). The level used for each channel is indicated in the results table below.

RF Transmit Power Result:

The following power levels were measured on low, mid and high channels of the ISM bands. Given the power measured above, the EIRP of the AP, for each channel tested, is listed below.

Pout settings Vs. Channel	802.11a/b Channel	Frequency (MHz)	Spec (dBm)	Msrd Pout (Pk, dBm)	Msrd Pout (Pk , Watts)	Ant Gain MAX (dBi)	Msrd EIRP MAX (dBm)
2.4 GHz ISM	1	2412.00	30	**13.1**	.02041	7.8	20.9
	6	2437.00	30	**15.94**	.03926	7.8	23.74
	11	2462.00	30	**13.5**	.02238	7.8	21.3

ISM 6 dB bandwidth

Specifications

FCC Specification: Paragraph 15.247(a)(2)

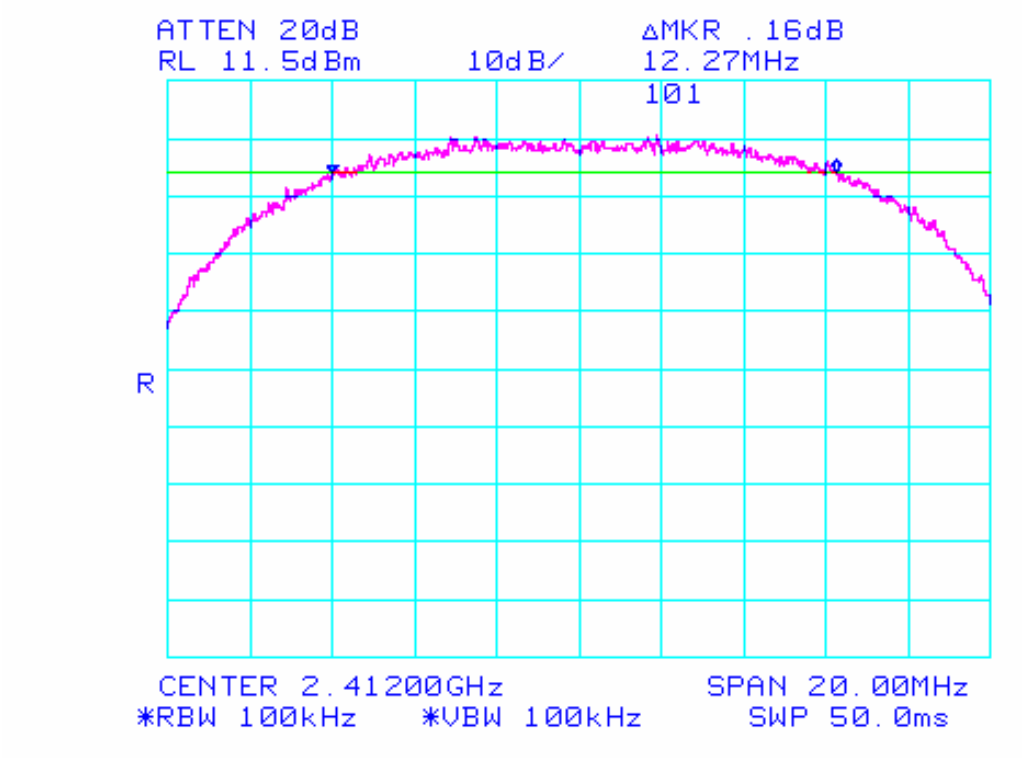
Procedure:

The Airespace AP access point operates on the standard IEEE 802.11 A / B channels. The 6dB bandwidth was measured on the low, middle and high channel of the 2.4 GHz ISM band using the bench conducted RF test setup. The spectrum analyzer was configured for MAX HOLD and the trace allowed to stabilize. A peak search was performed and the then delta-marker used to locate the point –6dB below the peak.

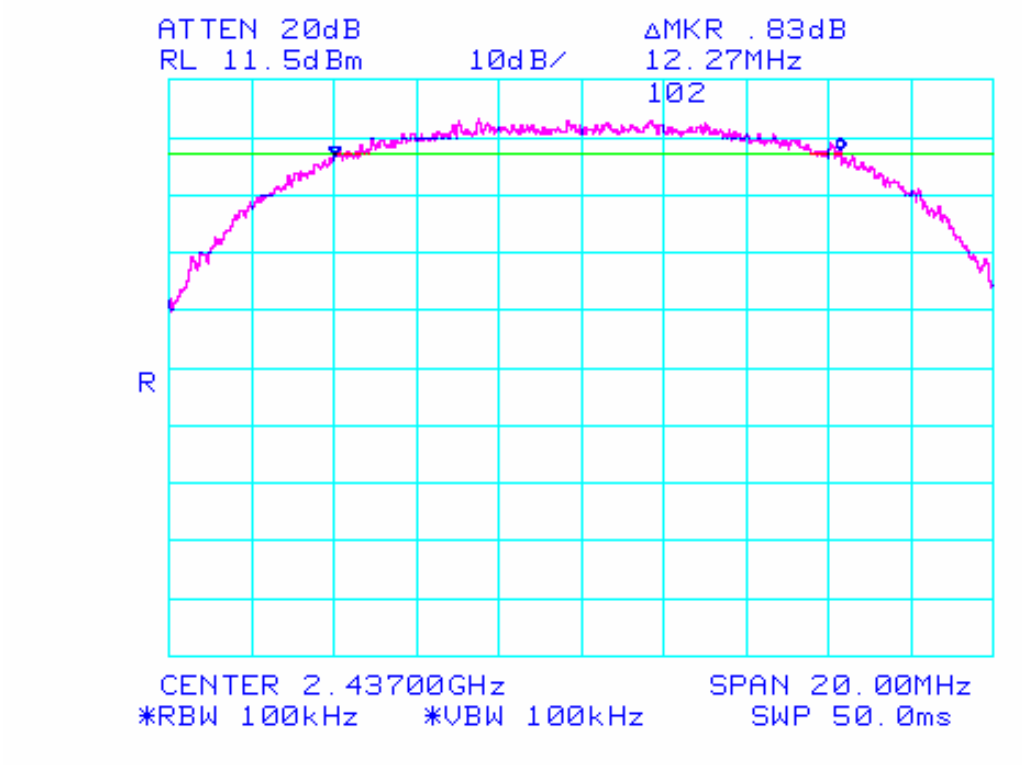
Once this was complete, the point was used as a reference and another delta measurement was performed and an attempt made to make the two markers "level" (0dB difference). The delta frequency between the two markers was measured as the 6 dB BW of the signal. The bandwidth test was performed at the power settings that will be used in the final system configuration.

Results:

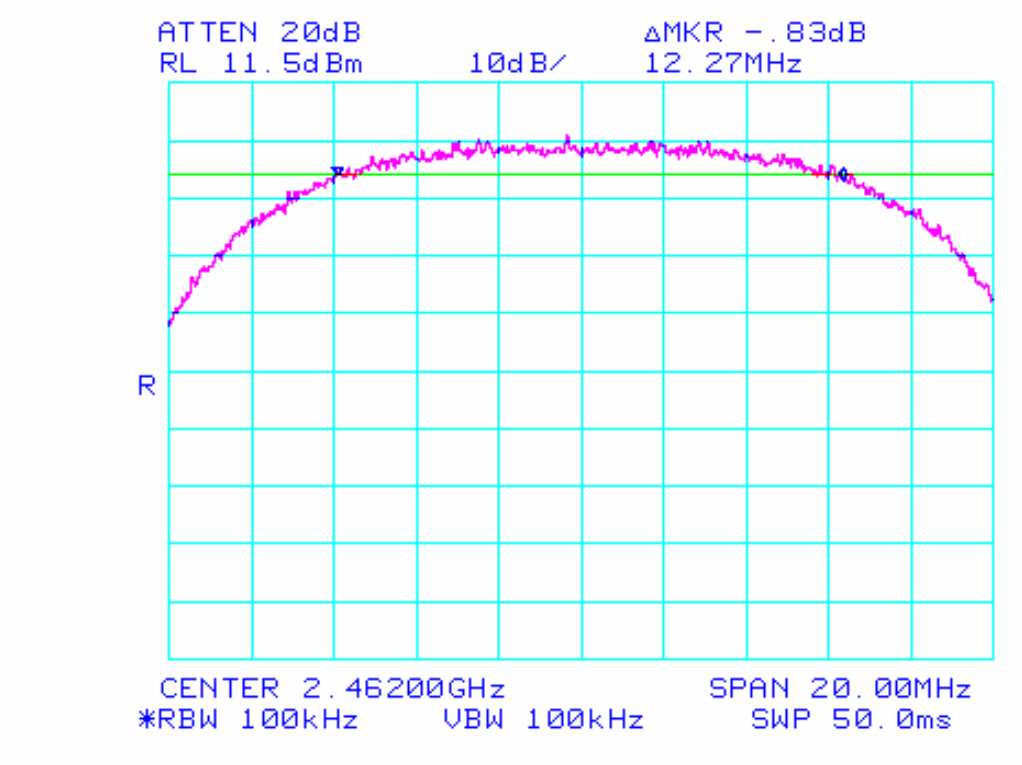
Band	802.11a/b Channel	Frequency (MHz)	Measured BW (MHz)
2.4 GHz ISM 6 dB BW	1	2412.00	**12.27**
	6	2437.00	**12.27**
	11	2462.00	**12.27**



6 dB BW, Channel 1, 2412 MHz



6 dB BW, Channel 6 , 2437 MHz



6 dB BW, Channel 11, 2462 MHz

ISM Power Spectral Density

FCC Specification: Paragraph: 15.247(4)(d)

Procedure

The test setup was configured as shown in the bench conducted RF test setup. The UUT was configured to continuously transmit random data packets.

Procedure(2.4 GHz):

Initially the bandwidth of the entire channel was examined. Using MAX HOLD, the trace was allowed to stabilize. Once the trace was stable, a peak search was performed and the frequency with the maximum power was determined.

The measurement span was then narrowed to 300kHz and centered on the “MAX power” frequency, the RBW set to 3 kHz and the sweep time set to 100 sec. This method averages the data for 1 second for every 3 kHz BW.

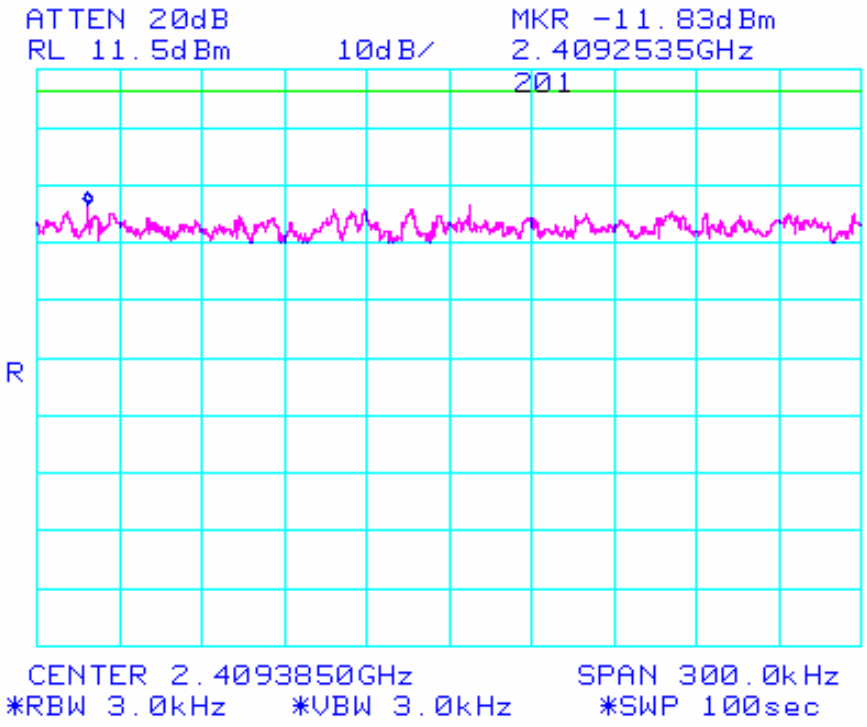
he analyzer was then set to MAX HOLD and a display line placed at +8dBm.

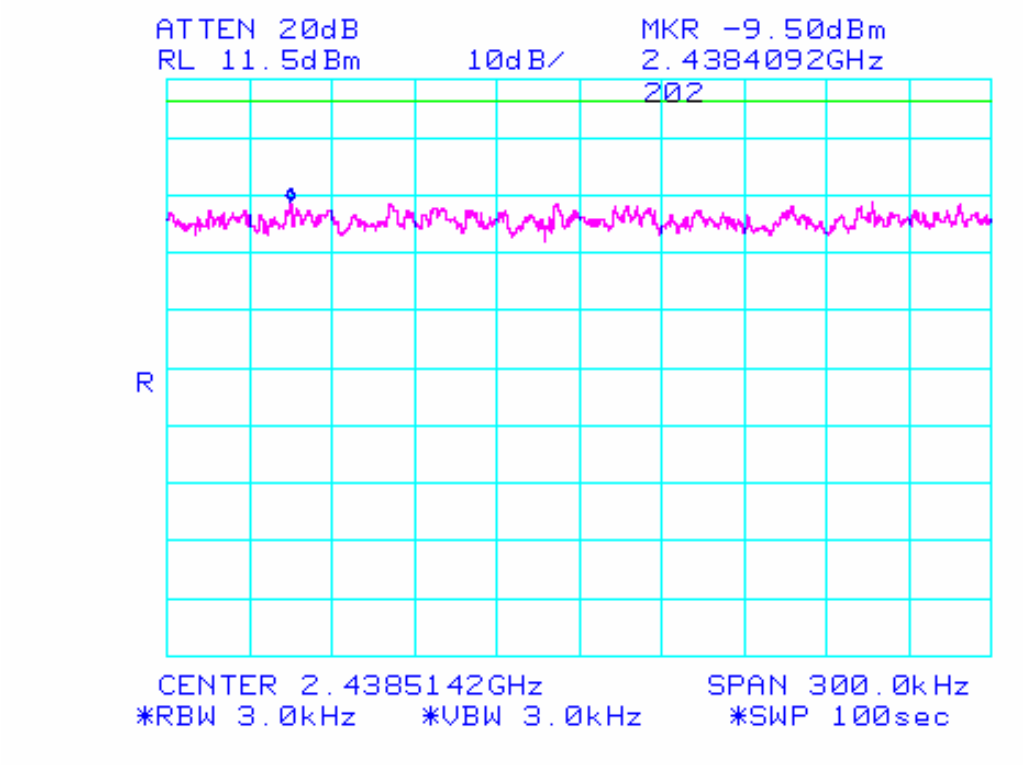
The power spectral density was measured at the low, middle and high-test channels with the appropriate power setting for the given test channel.

Results:

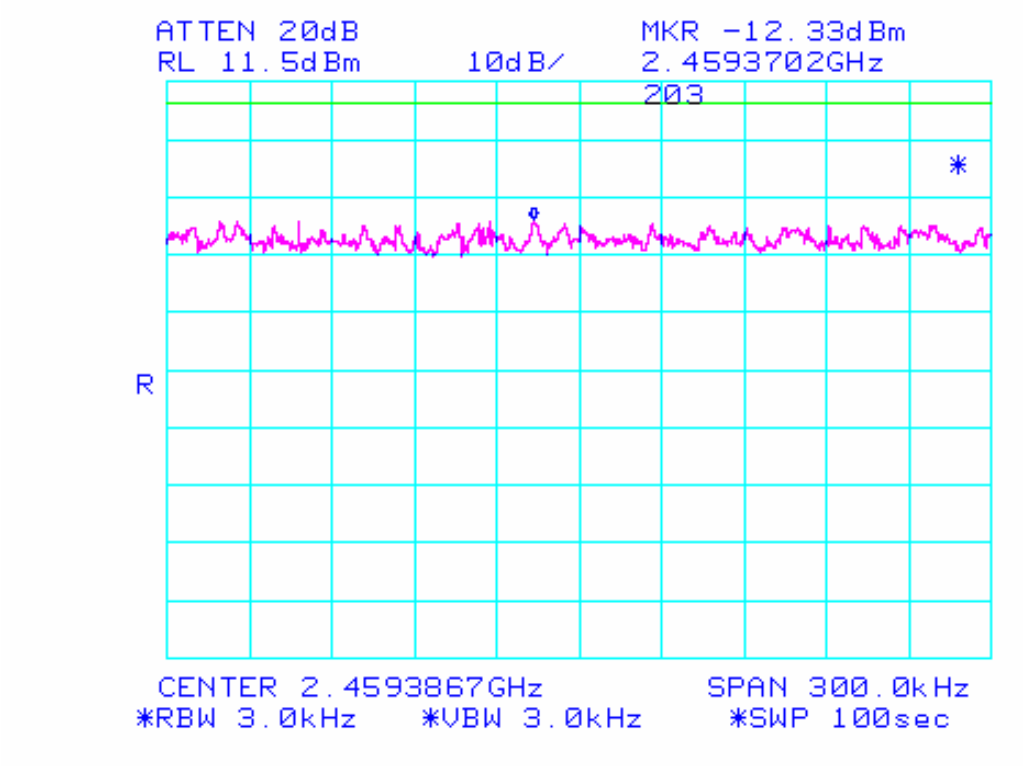
Band	802.11a/b Channel	Frequency (MHz)	Specification dBm /	Measured PSD (dBm)
2.4 GHz ISM PSD	1	2412.00	8dBm/3kHz	**-11.83**
	6	2437.00	8dBm/3kHz	**-9.50**
	11	2462.00	8dBm/3kHz	**-12.33**

Power Spectral Density, LOW Channel, 2412MHz





Power Spectral Density, MID Channel, 2437MHz



Power Spectral Density, HIGH Channel, 2462MHz

ISM Out of Band Emissions

Specifications:

FCC Part 15 Paragraph 15.247(c)

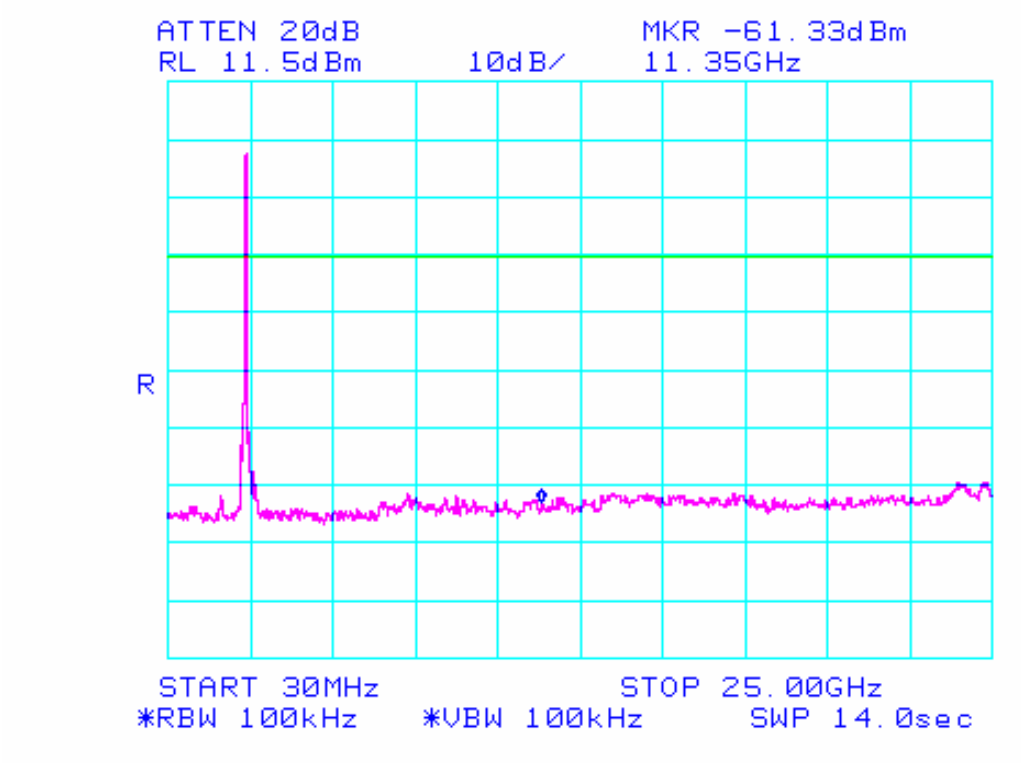
Procedure:

The test was configured as shown in the bench conducted RF test setup. The UUT was configured to transmit random data packets. The band from 1 GHz to 25GHz was examined for spurious emissions. This test was conducted the low middle and high channels. The UUT was configured to transmit +14 dBm for channels 1 and 11 and + 17 dBm for channel 6.

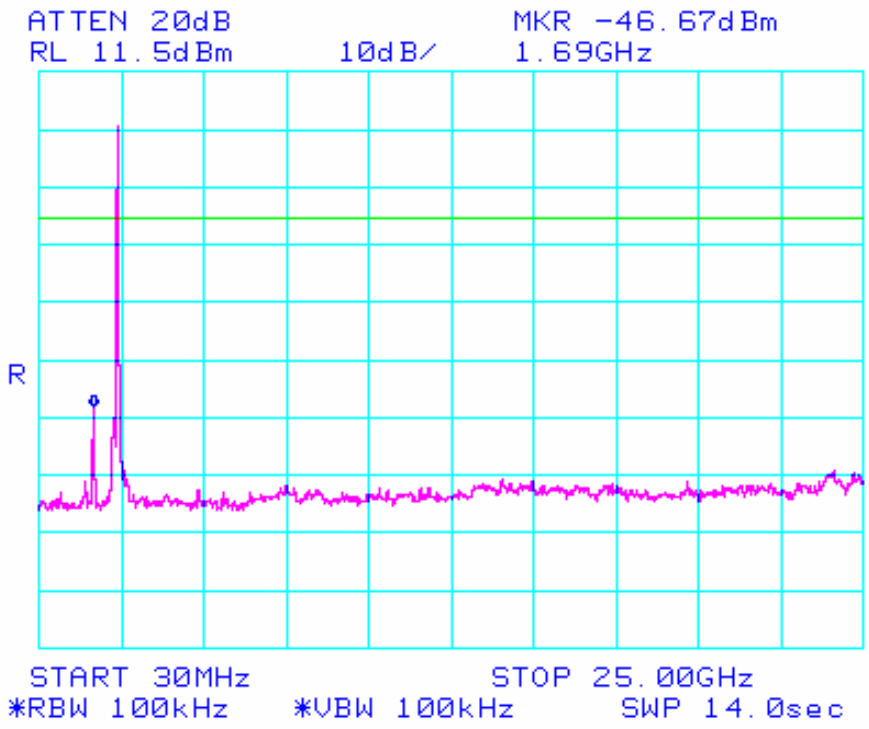
Results:

The entire band of interest was examined at one time to clearly demonstrate compliance. There were no spurious emissions above the limit (-20dBc)

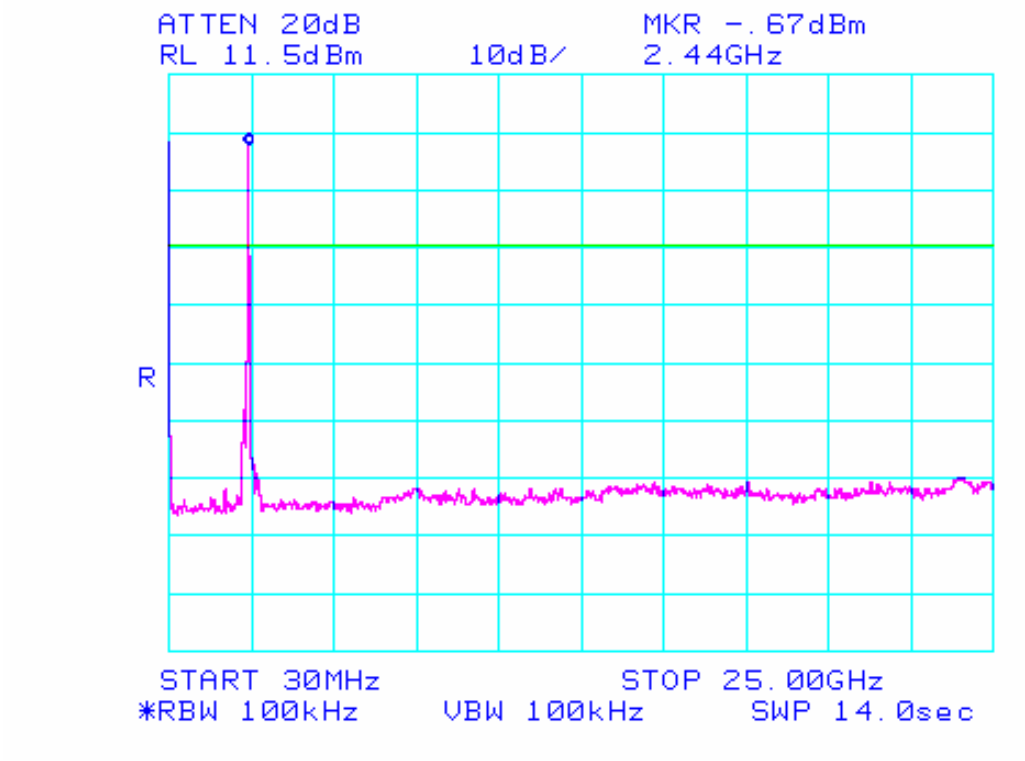
Out of Band Emissions Plots



OOB Emissions, Transmit on Channel 1 (2412MHz)



OOB Emissions, Transmit on Channel 6 (2437MHz)



OOB Emissions,, Transmit on Channel 11 (2462MHz)

ISM Radiated Emissions in Restricted bands

Specifications:

FCC Part 15 Paragraph 15.247(c)

Procedure:

This test was conducted on a 5-meter anechoic chamber at Elliott Laboratories Fremont ,California facility The unit was placed on a rotating wooden table 80cm above the ground plane. A Horn antenna was secured to a mast 3 meters away. The unit was tested for restricted band emissions at the Low, Mid and High test channels. The UUT was running in the diagnostic mode and set to transmit CW at maximum power on each of the channels. The test equipment was configured as shown below.

The harmonics of the fundamental that fell within restricted bands (up to the tenth) were measured (See table 1 below). A high pass filter prior to the pre-amplifier was required to prevent the large signal level of the fundamental frequency from overloading the front end of the spectrum analyzer and creating harmonics within the analyzer.

The EUT was rotated 360 degrees and the height of the antenna adjusted from 1 to 4 meters above the ground plane to determine the maximum level of the emission. The level of the harmonic emission was measured in two modes, “Peak” and “Average” using the following measurement bandwidths

```
Restricted Band Peak Measurements: RBW & VBW: 1 MHz
Restricted Band Average Measurements: RBW:1MHz & VBW:10 Hz.
All other measurements, RBW = 1MHz & VBW = 3MHz
   video averaging on (100 samples).
```

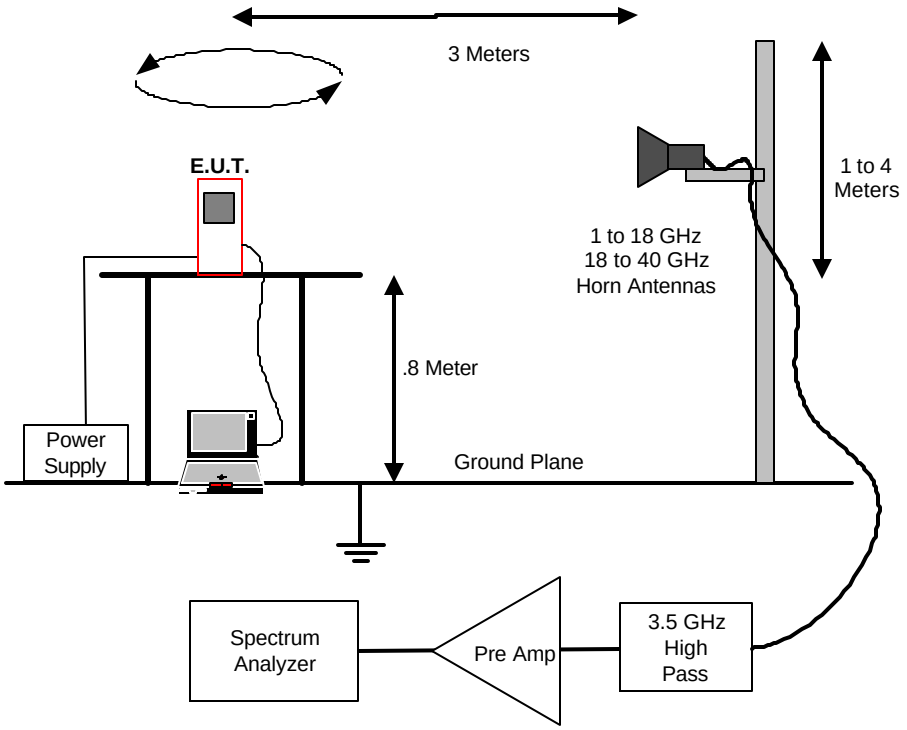
The spectrum analyzer reading was entered into a spreadsheet where correction factors (antenna factor, cable loss, pre-amplifier gain, HPF loss...) were then applied by Elliott Lab’s Software to obtain a final corrected measurement.

This procedure was repeated for the low, mid and high test channels within the 2400-2485.5MHz band. The table below indicates the harmonics that fall within restricted bands.

FUND	Harmonic (MHz)								
	2	3	4	5	6	7	8	9	10
2412	**4824**	**7236**	9648	**12060**	**14472**	16884	**19296**	21708	24120
2437	**4874**	**7311**	9748	**12185**	14622	17059	**19496**	21933	24370
2462	**4924**	**7386**	9848	**12310**	14772	17234	**19696**	**22158**	24620

15.205 Harmonic test tables

*NOTE: **RED** indicates a harmonic that falls within a restricted band and is subject to 15.205. The harmonics in **black** are NOT in restricted bands and are subject to 15.209*



Radiated Emissions in Restricted Bands Test Setup

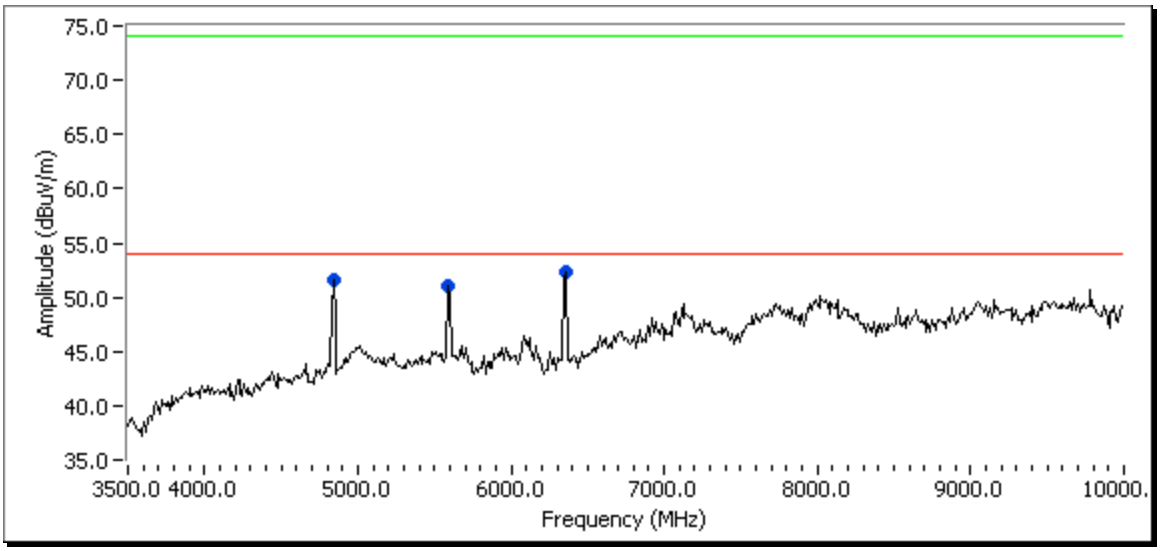
Support Equipment				
Description	**Model number**	**FCC ID or SN**	**Mfg**	**Power Cable**
Laptop	Armada E 500	P31000T4X20DC12N2	Compaq	Laptop PS
Test Software	Atheros Radio Test		Atheros	
48VDC AC adapter	Generic		Generic	Std Twin lead DC wire

Test Conditions			
Temperature	Approx 23 C	**Humidity:**	Approx 51%
ATM pressure	Approx 1005 mBar	**Grounding:**	None
Tested By	Trinh Waitt, Juan Martinez	**Date of Test:**	Aug 11-14 2003
Test Reference	FCC Part 15.205 IC Paragraph RSS210, 6.2.3 (c)		
Setup Method	ANSI C63.4		
Tested Range	1 GHz to 24 GHz		
Test Voltage	120 VAC / 60 Hz		
Modifications	No modifications were made to the unit		

***NOTES**: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental. No emission detected above 15GHz.*

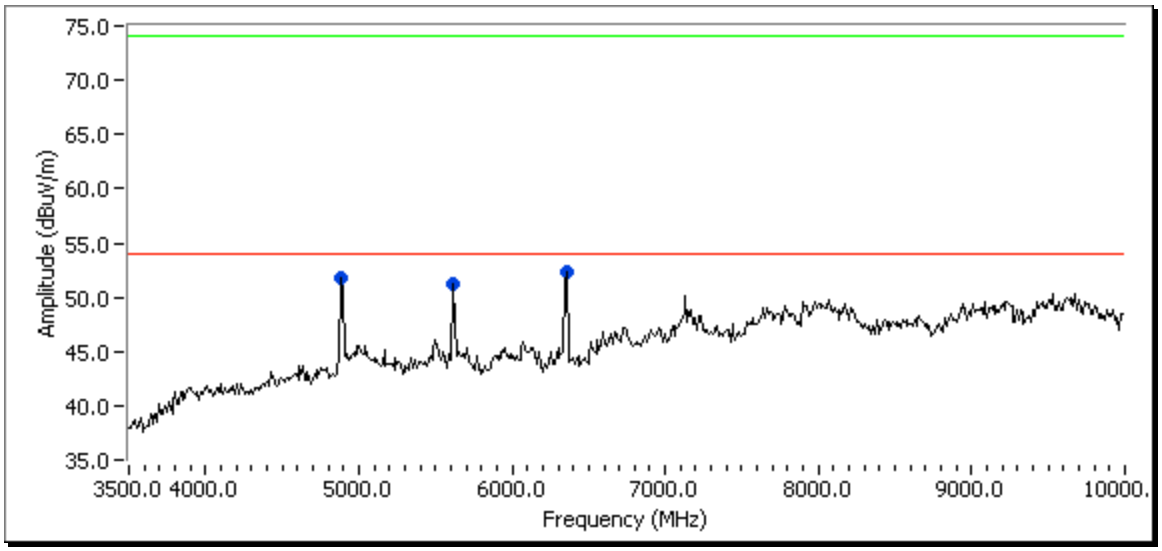
Results:

UUT Transmitting on low Channel: 2412 MHz



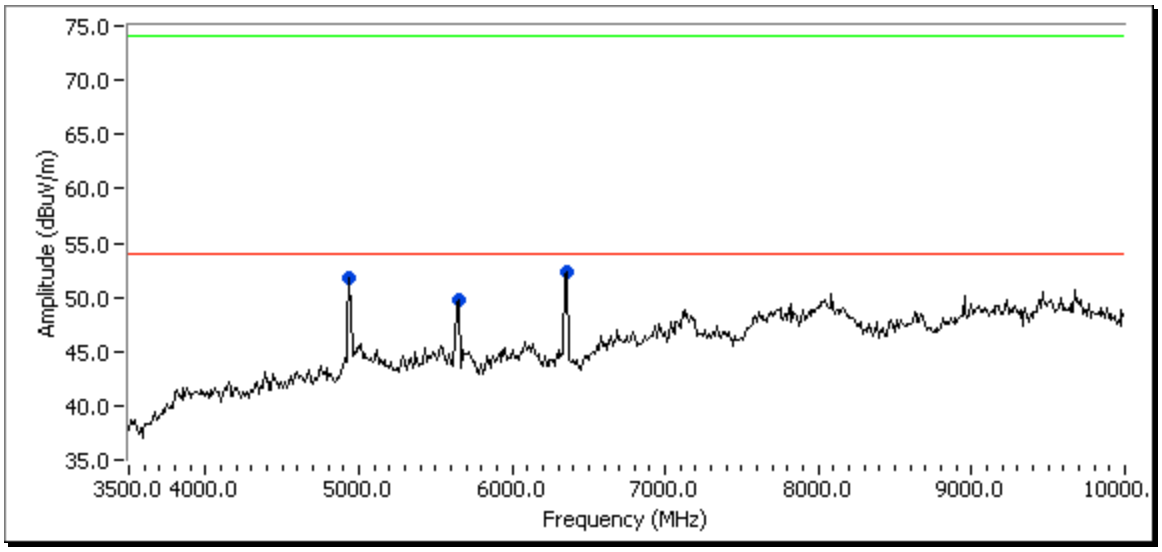
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters
4824.102	40.5	V	54.0	-13.5	AVG	12	2.0
4824.102	52.6	V	74.0	-1.5	PK	12	2.0
5579.410	43.5	H	54.0	-10.5	AVG	120	1.5
5579.410	52.3	H	74.0	-1.7	PK	120	1.5
6336.042	50.5	H	54.0	-3.5	AVG	160	1.0
6336.042	53.3	H	74.0	-0.7	PK	160	1.0

UUT Transmitting on mid Channel: 2437 MHz



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters
4873.884	41.5	V	54.0	-12.5	AVG	359	1.5
4873.884	53.7	V	74.0	-20.3	PK	359	1.5
5605.804	44.9	H	54.0	-9.2	AVG	182	1.5
5605.804	53.1	H	74.0	-20.9	PK	182	1.5
6336.122	49.8	H	54.0	-4.2	AVG	150	1.0
6336.122	53.0	H	74.0	-21.0	PK	150	1.0

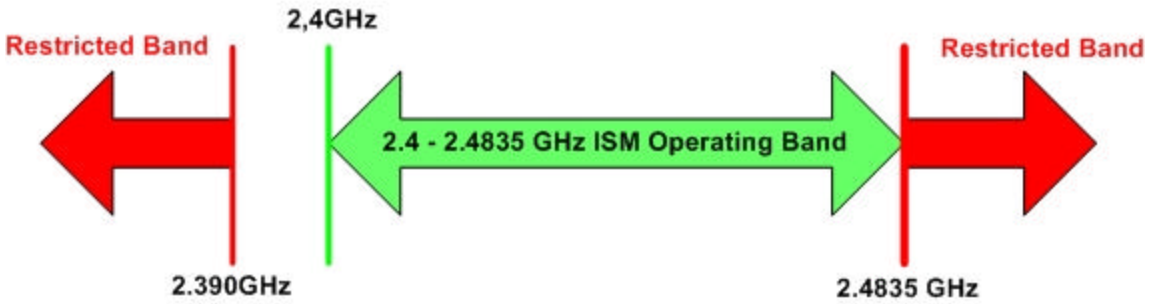
UUT Transmitting on high Channel: 2462 MHz



Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters
4924.043	41.6	H	54.0	-12.4	AVG	314	1.0
4924.043	53.7	H	74.0	-20.3	PK	314	1.0
5630.087	42.9	V	54.0	-11.1	AVG	3	1.0
5630.087	51.7	V	74.0	-22.3	PK	3	1.0
6335.937	50.2	V	54.0	-3.8	AVG	179	1.5
6335.937	53.0	V	74.0	-21.1	PK	179	1.5

Radiated emissions in the restricted bands near the operating band edge

Since this is an 802.11 B product, there is a restricted band that begins immediately at the high end of the operating band and another that begins 10 MHz below the low end of the operating band.



Restricted Bands close to the ISM operating band

Procedure

There are three steps to performing this test. The first involves making a radiated measurement of the fundamental signal with the UUT on the operating channel closest to the edge of the band. This measurement is made using the peak and average RBW and VBW of 1MHz/1MHz and 1MHz/10Hz. This measured radiated level is then used as a “fundamental reference” level

Then, a second measurement (conducted) is made using narrower bandwidths (100 kHz) to determine a –dBc (delta dB) level between the peak of the fundamental level (measured in a 100 kHz BW) and the highest level within the restricted band near the operating band.

A third and final measurement (conducted) is made to determine the apparent drop in fundamental carrier power when the RBW is narrowed from 1MHz (in the reference measurement) to 100kHz (for the delta dB measurement). This is referred to below as the “BW Delta”.

The level of the emission in the restricted band is then calculated using the formulas below

Restricted band level (AVG) = AVG reference level - delta dB - BW Delta dB
Restricted band level (Peak) = Peak reference level - delta dB - BW Delta dB

2.400 ISM Band Edge (Restricted band @ 2.390GHz)

Pol	Fundemental Ref Msmt		dBc Msmt	RBW Delta msmt	Radiated Level at Band Edge		Specification		Delta (dB below Limit)	
	Peak dbuv/m	Avg dbuv/m	dBc	dB	Peak dBuv/m	Avg dBuv/m	Peak dBuv/m	Avg dBuv/m	Peak dBuv/m	Avg dBuv/m
Vert	113.4	106.2	50	9.5	53.9	46.7	74	54	20.1	7.3
Horz	102.6	95.4	50	9.5	43.1	35.9	74	54	30.9	18.1

2.400 ISM Band Edge (Restricted band @ 2.4835GHz)

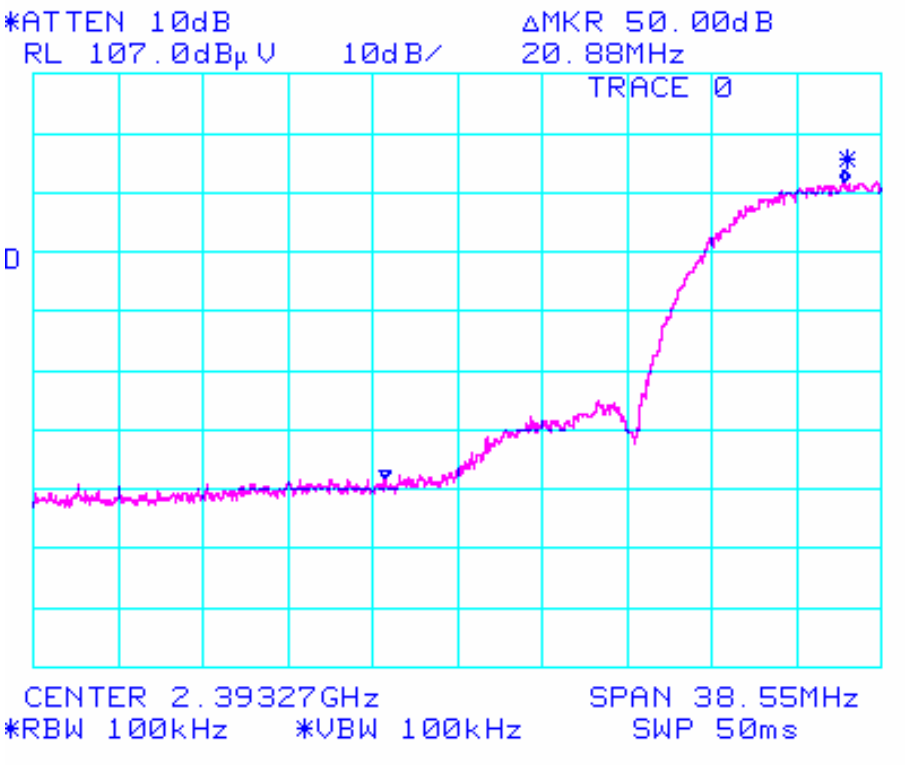
Pol	Fundemental Ref Msmt		dBc Msmt	RBW Delta msmt	Radiated Level at Band Edge		Specification		Delta (dB below Limit)	
	Peak dbuv/m	Avg dbuv/m	dBc	dB	Peak dBuv/m	Avg dBuv/m	Peak dBuv/m	Avg dBuv/m	Peak dBuv/m	Avg dBuv/m
Vert	112.4	105.7	46.71	7.8	57.89	51.19	74	54	16.1	2.81
Horz	103.7	96.4	46.71	7.8	49.19	41.89	74	54	24.8	12.1

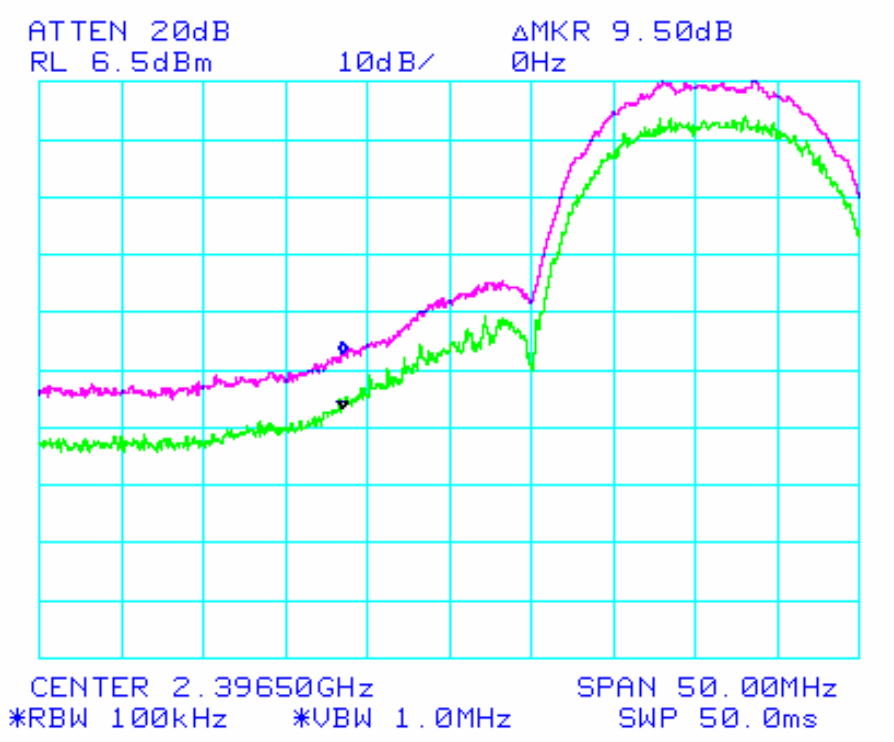
Radiated emissions at band edge sample calculation:

Emission Level = Fund Ref Msmt – Delta msmt – RBW Delta Msmt

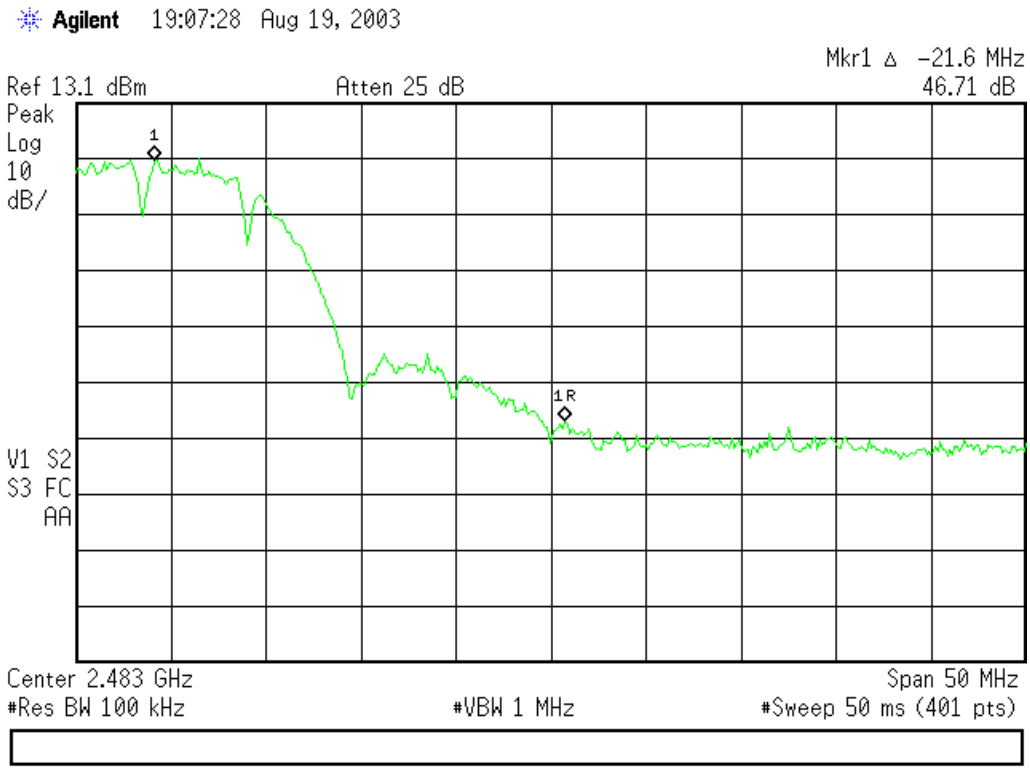
Example: 105.7dBuV/m – 46.71dBc – 7.8dB = 51.19dBuv/m
54 dBuv/m - 51.19dBuv/m = 2.81dB margin

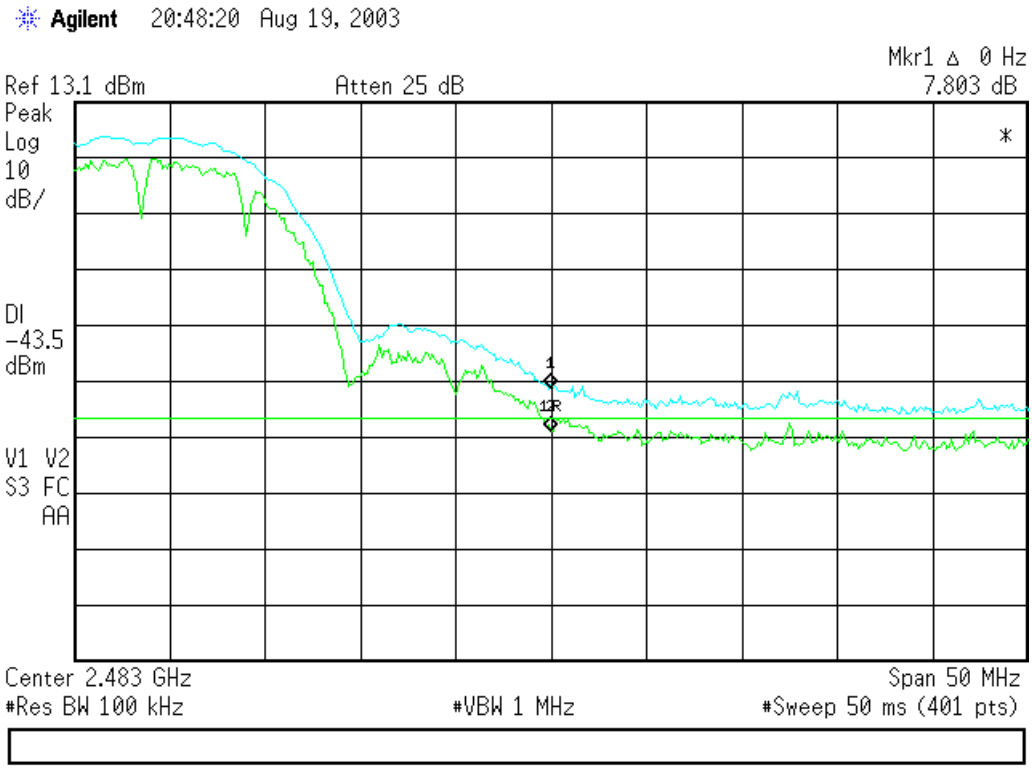
Radiated Emissions in Restricted bands
-dBc and BW Delta measurement for the low band edge restricted band @ 2390.0 MHz





Radiated Emissions in Restricted bands
-dBc and BW Delta measurement for the high band edge restricted band @ 2483.5 MHz





Radiated Emissions Sample Calculations

Receiver readings are compared directly to the specification limit. The receiver internally corrects for cable loss, preamp gain and antenna factor. The calculations are in reverse from the signal flow, meaning that cable loss is actually added to the reading and amplification is subtracted. Antenna factor is a measure of the conversion of the voltage at the coaxial connector to the field strength at the antenna elements. A distance factor, for the electric field is calculated using the following formula

$$F_d = 20 \text{ Log}_{10} (D_m/D_s)$$

Where:
F_d = Distance Factor
D_m = Measurement distance in meters
D_s = specification distance in meters

Measurement distance is the distance at which the measurements were taken and the specification distance is the distance at which the specification limit is based.

The margin of a given emissions peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

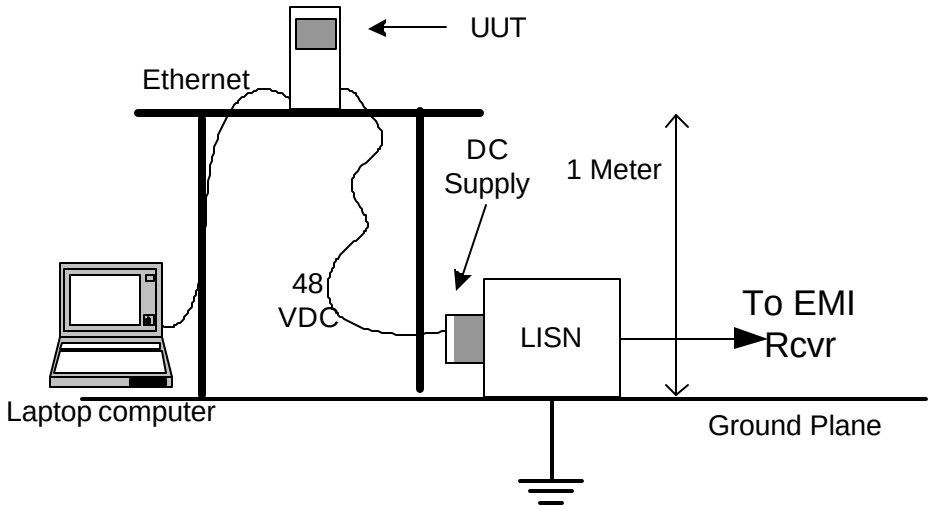
Where :
R_r = Relative reading in dBuV/m
F_d = Distance Factor
R_c = Corrected reading in dBuV/m
L_s = specification Limit in dBuV/m
M = Margin in dB relative to the spec.

AC Line Conducted Emissions

Specification:
FCC Specification: CISPR 22

Procedure:
The test was set up according to the guidelines set forth in EN55022:1998 and FCC Part 2 for AC Line Conducted Emissions. The measurement used a LISN line on each AC line and an EMI receiver. A peak scan was made over the measurement frequency range (150 kHz to 30 MHz). The highest peaks were then marked and re-measured and quasi-peaked and averaged. The unit was configured to transmit packets at the max data rate.

The test was configured as shown below. The product was tested while running on 120 VAC @ 60 Hz .



Test Results:

The AC Line conducted Emissions test results, relative to the Class B limits, are shown below.

Quasi Peak Test Results, CISPR 22 Class B limits

Freq (MHz)	Line	QP Level	Class B QP Limit	Delta	Freq (MHz)	Line	Class B QP Limit	Spec	Delta
	Neutral	(dBuV)	(dBuV)	(dB)		Neutral	(dBuV)	(dBuV)	(dB)
25.83	Line	40.97	60	19.03	25.65.	Neutral	40.05	60	19.95
26.35	Line	47.89	60	12.11	26.35	Neutral	43.48	60	16.52
26.62	Line	41.25	60	18.75	26.62	Neutral	42.53	60	17.47
26.85	Line	46.92	60	13.08	26.84	Neutral	46.86	60	13.14
27.1	Line	46.91	60	13.09	27.1	Neutral	43.35	60	16.65
27.29	Line	58.75	60	1.25	27.59	Neutral	48.14	60	11.86
27.6	Line	46.98	60	13.02	27.86	Neutral	41.28	60	18.72
27.83	Line	48.61	60	11.39	28/09	Neutral	46.23	60	13.77
28.12	Line	41.46	60	18.54	28.32	Neutral	48.92	60	11.08
29.58	Line	45.29	60	14.71	28.57	Neutral	45.2	60	14.8

AVG Test Results, CISPR 22, Class B limits

Freq (MHz)	Line	AVG Level	Class B AVG limit	Delta	Freq (MHz)	Line	AVG Level	Class B AVG limit	Delta
	Neutral	(dBuV)	(dBuV)	(dB)		Neutral	(dBuV)	(dBuV)	(dB)
25.83	Line	25.475	50	24.53	25.65.	Neutral	30.7	50	19.3
26.35	Line	30.23	50	19.77	26.35	Neutral	30.35	50	19.65
26.62	Line	31.44	50	18.56	26.62	Neutral	33.05	50	16.95
26.85	Line	34.257	50	15.74	26.84	Neutral	32.17	50	17.83
27.1	Line	29.59	50	20.41	27.1	Neutral	30.37	50	19.63
27.29	Line	36.118	50	13.9	27.59	Neutral	27.96	50	22.04
27.6	Line	28.64	50	21.36	27.86	Neutral	31.04	50	18.96
27.83	Line	29.9	50	20.1	28/09	Neutral	31.55	50	18.45
28.12	Line	34.03	50	15.97	28.32	Neutral	35.91	50	14.09
29.58	Line	32.43	50	17.57	28.57	Neutral	28.19	50	21.81