

11 - ANTENNA REQUIREMENT

11.1 Standard Applicable

For intentional device, according to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to § 15.247 (1), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to § 15.407 (d), any U-NII device shall use a transmitting antenna that is an integral part of the device.

Refer to statement below for compliance.

“The antenna for the device is an integral antenna that the end user cannot access. Further the device is for outdoor use as detailed in the Users Manual and Operational Description, which are included in this application.”

11.2 Antenna Connected Construction

The antenna connector is designed with permanent attachment and no consideration of replacement.

12 - SPURIOUS RADIATED EMISSION

12.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ± 4.0 dB.

According to §15.205, except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
¹ 0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2655 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.57725	240 – 285	3345.8 – 3358	36.43 – 36.5
13.36 – 13.41	322 – 335.4	3600 – 4400	(²)

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510MHz

² Above 38.6

Except as provided in paragraph (d) and (e), the filed strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

According to §15.209, the device shall meet radiated emission general requirements.

Except for Class A device, the filed strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission (MHz)	Field Strength (Microvolts/meter)	dB (dB μ V/meter)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

12.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4-2001. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The host PC system was connected with 120Vac/60Hz power source.

12.3 Spectrum Analyzer Setup

According to FCC CFR 47, Section 15.31, the EUT was tested to 50GHz. During the radiated emission test, the spectrum analyzer was set with the following configurations:

Start Frequency	30 MHz
Stop Frequency	50GHz
Sweep Speed	Auto
IF Bandwidth	1 MHz
Video Bandwidth	1 MHz
Quasi-Peak Adapter Bandwidth.....	120 kHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth.....	1MHz

12.4 Test Procedure

For the radiated emissions test, the Host PC system power cord was connected to the AC floor outlet since the power supply used in the EUT did not provide an accessory power outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB μ V of specification limits), and are distinguished with a "Qp" in the data table.

12.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB μ V means the emission is 7dB μ V below the maximum limit for Subpart C. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Subpart C Limit}$$

12.6 Summary of Test Results

According to the data in section 12.7, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207 and 15.247, and had the worst margin of:

Test Data for 802.11b, 15.247

- 12.0 dB at 7236.00 MHz in the **Vertical** polarization, Low Channel
- 12.1 dB at 7311.00 MHz in the **Vertical** polarization, Middle Channel
- 12.3 dB at 7386.60 MHz in the **Vertical** polarization, High Channel
- 2.8 dB at 482.70 MHz in the **Vertical** polarization, Unwanted Emission

Test Data for 802.11g, 15.247

- 12.1 dB at 7236.00 MHz in the **Horizontal** polarization, Low Channel
- 12.1 dB at 7311.00 MHz in the **Vertical** polarization, Middle Channel
- 12.0 dB at 7386.00 MHz in the **Vertical** polarization, High Channel
- 7.2 dB at 416.00 MHz in the **Vertical** polarization, Unintentional Emission

Test Data for 802.11a, 15.407

- 9.4 dB at 15495.00 MHz in the **Vertical** polarization, Low Band, Low Channel
- 9.3 dB at 15600.00 MHz in the **Vertical** polarization, Low Band, Mid Channel
- 9.3 dB at 15750.00 MHz in the **Vertical** polarization, Low Band, High Channel
- 5.8 dB at 10530.00 MHz in the **Vertical** polarization, Mid Band, Low Channel
- 7.8 dB at 10600.00 MHz in the **Vertical** polarization, Mid Band, Mid Channel
- 6.6 dB at 10660.00 MHz in the **Vertical** polarization, Mid Band, High Channel
- 10.9 dB at 17220.00 MHz in the **Vertical** polarization, High Band, Low Channel
- 10.5 dB at 11540.00 MHz in the **Vertical** polarization, High Band, Mid Channel
- 11.3 dB at 17430.00 MHz in the **Vertical** polarization, High Band, High Channel
- 10.6 dB at 33.20 MHz in the **Vertical** polarization, Unwanted Emission

12.6.1 Final test data for 802.11b (15.247)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency	Ampl.	Comments	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m		Degree	Meter	H/V	dBμV/m	DB	DB	dBμV/m	dBμV/m	dB
Low Channel, 1-25GHz											
2412.00	104.8	FUND/PEAK	250	2.5	V	28.1	3.4	35.2	101.1		
2412.00	90.5	FUND/PEAK	150	1.0	H	28.1	3.4	35.2	86.8		
2412.00	101.3	FUND/AVE	250	2.5	V	28.1	3.4	35.2	97.6		
2412.00	86.5	FUND/AVE	150	1.0	H	28.1	3.4	35.2	82.8		
7236.00	34.8	AVE	270	1.4	V	35.1	5.6	33.5	42.0	54	-12.0
7236.00	34.7	AVE	30	1.5	H	35.1	5.6	33.5	41.9	54	-12.1
4824.00	31.7	AVE	250	1.8	V	32.5	4.9	33.0	36.1	54	-17.9
4824.00	31.7	AVE	100	1.4	H	32.5	4.9	33.0	36.1	54	-17.9
7236.00	45.7	PEAK	270	1.4	V	35.1	5.6	33.5	52.9	74	-21.1
7236.00	45.2	PEAK	30	1.5	H	35.1	5.6	33.5	52.4	74	-21.6
4824.00	44.5	PEAK	250	1.8	V	32.5	4.9	33.0	48.9	74	-25.1
4824.00	44.0	PEAK	100	1.4	H	32.5	4.9	33.0	48.4	74	-25.6
Middle Channel, 1-25GHz											
2437.00	105.0	FUND/PEAK	270	1.6	V	28.1	3.4	35.2	101.3		
2437.00	92.7	FUND/PEAK	250	1.0	H	28.1	3.4	35.2	89.0		
2437.00	100.7	FUND/AVE	270	1.6	V	28.1	3.4	35.2	97.0		
2437.00	87.7	FUND/AVE	250	1.0	H	28.1	3.4	35.2	84.0		
7311.00	34.7	AVE	270	1.8	V	35.1	5.6	33.5	41.9	54	-12.1
7311.00	34.5	AVE	0	1.2	H	35.1	5.6	33.5	41.7	54	-12.3
4874.00	31.8	AVE	90	1.5	V	32.5	4.9	33.0	36.2	54	-17.8
4874.00	31.5	AVE	270	1.2	H	32.5	4.9	33.0	35.9	54	-18.1
7311.00	46.3	PEAK	270	1.8	V	35.1	5.6	33.5	53.5	74	-20.5
7311.00	45.7	PEAK	0	1.2	H	35.1	5.6	33.5	52.9	74	-21.1
4874.00	45.1	PEAK	90	1.5	V	32.5	4.9	33.0	49.5	74	-24.5
4874.00	44.3	PEAK	270	1.2	H	32.5	4.9	33.0	48.7	74	-25.3

12.6.1 Final test data for 802.11b (15.247, Continued)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dB μ V /m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dB μ V/m	Cable DB	Amp. DB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
High Channel, 1-25GHz											
2462.00	104.2	FUND/PEAK	180	1.0	V	28.1	3.4	35.2	100.5		
2462.00	92.3	FUND/PEAK	180	1.7	H	28.1	3.4	35.2	88.6		
2462.00	99.7	FUND/AVE	180	1.0	V	28.1	3.4	35.2	96.0		
2462.00	88.0	FUND/AVE	180	1.7	H	28.1	3.4	35.2	84.3		
7386.00	34.5	AVE	150	1.4	V	35.1	5.6	33.5	41.7	54	-12.3
7386.00	34.3	AVE	180	1.6	H	35.1	5.6	33.5	41.5	54	-12.5
4924.00	31.6	AVE	30	1.2	V	32.5	4.9	33.0	36.0	54	-18.0
4924.00	31.3	AVE	0	1.8	H	32.5	4.9	33.0	35.7	54	-18.3
7386.00	46.2	PEAK	150	1.4	V	35.1	5.6	33.5	53.4	74	-20.6
7386.00	45.3	PEAK	180	1.6	H	35.1	5.6	33.5	52.5	74	-21.5
4924.00	44.3	PEAK	30	1.2	V	32.5	4.9	33.0	48.7	74	-25.3
4924.00	43.8	PEAK	0	1.8	H	32.5	4.9	33.0	48.2	74	-25.8

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart B	
Frequency MHz	Ampl. dB μ V/m	Direction Degree	Height Meter	Polar H/V	Antenna dB μ V/m	Cable Loss dB μ V/m	Amp. dB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
482.70	46.8	200	1.4	V	18.3	3.1	25.0	43.2	46	-2.8
440.67	45.5	90	2.0	H	16.9	2.9	25.0	40.3	43.5	-3.2
311.02	46.2	0	1.8	V	15.1	2.3	25.0	38.6	43.5	-4.9
519.92	37.8	180	1.5	V	18.4	3.1	25.0	34.3	46	-11.7
73.70	39.5	270	1.6	H	9.2	1.2	25.0	24.9	43.5	-18.6
146.40	35.2	30	1.2	H	12.6	1.7	25.0	24.4	43.5	-19.1

Note:

FUND = Fundamental

AVG = average

12.6.2 Final test data for 802.11g (15.247)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency	Ampl.	Comments	Angle	Height	Polar	Antenna	Cable	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m		Degree	Meter	H/V	dBμV/m	DB	DB	dBμV/m	dBμV/m	dB
Low Channel, 1-25GHz											
2412.00	104.8	FUND/PEAK	300	2.0	V	28.1	3.4	35.2	101.1		
2412.00	95.5	FUND/PEAK	30	1.0	H	28.1	3.4	35.2	91.8		
2412.00	93.8	FUND/AVE	300	2.0	V	28.1	3.4	35.2	90.1		
2412.00	85.5	FUND/AVE	30	1.0	H	28.1	3.4	35.2	81.8		
7236.00	34.7	AVE	300	1.0	V	35.1	5.6	33.5	41.9	54	-12.1
7236.00	34.7	AVE	270	1.4	H	35.1	5.6	33.5	41.9	54	-12.1
4824.00	32.0	AVE	150	1.6	V	32.5	4.9	33.0	36.4	54	-17.6
4824.00	31.8	AVE	60	1.2	H	32.5	4.9	33.0	36.2	54	-17.8
7236.00	46.3	PEAK	300	1.0	V	35.1	5.6	33.5	53.5	74	-20.5
7236.00	46.2	PEAK	270	1.4	H	35.1	5.6	33.5	53.4	74	-20.6
4824.00	44.5	PEAK	150	1.6	V	32.5	4.9	33.0	48.9	74	-25.1
4824.00	44.0	PEAK	60	1.2	H	32.5	4.9	33.0	48.4	74	-25.6
Middle Channel, 1-25GHz											
2437.00	103.8	FUND/PEAK	0	1.0	V	28.1	3.4	35.2	100.1		
2437.00	91.3	FUND/PEAK	0	1.6	H	28.1	3.4	35.2	87.6		
2437.00	93.2	FUND/AVE	0	1.0	V	28.1	3.4	35.2	89.5		
2437.00	80.2	FUND/AVE	0	1.6	H	28.1	3.4	35.2	76.5		
7311.00	34.7	AVE	0	1.2	V	35.1	5.6	33.5	41.9	54	-12.1
7311.00	34.5	AVE	150	2.0	H	35.1	5.6	33.5	41.7	54	-12.3
4874.00	32.3	AVE	270	1.4	V	32.5	4.9	33.0	36.7	54	-17.3
4874.00	32.2	AVE	60	1.8	H	32.5	4.9	33.0	36.6	54	-17.4
7311.00	46.5	PEAK	150	2.0	H	35.1	5.6	33.5	53.7	74	-20.3
7311.00	46.2	PEAK	0	1.2	V	35.1	5.6	33.5	53.4	74	-20.6
4874.00	45.7	PEAK	270	1.4	V	32.5	4.9	33.0	50.1	74	-23.9
4874.00	44.3	PEAK	60	1.8	H	32.5	4.9	33.0	48.7	74	-25.3

12.6.2 Final test data for 802.11g (15.247, Continued)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV /m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
High Channel, 1-25GHz											
2462.00	106.0	FUND/PEAK	90	1.2	V	28.1	3.4	35.2	102.3		
2462.00	93.8	FUND/PEAK	100	1.0	H	28.1	3.4	35.2	90.1		
2462.00	94.5	FUND/AVE	90	1.2	V	28.1	3.4	35.2	90.8		
2462.00	82.0	FUND/AVE	100	1.0	H	28.1	3.4	35.2	78.3		
7386.00	34.8	AVE	90	1.2	V	35.1	5.6	33.5	42.0	54	-12.0
7386.00	34.6	AVE	330	1.0	H	35.1	5.6	33.5	41.8	54	-12.2
4924.00	31.9	AVE	270	1.5	V	32.5	4.9	33.0	36.3	54	-17.7
4924.00	31.7	AVE	60	1.5	H	32.5	4.9	33.0	36.1	54	-17.9
7386.00	46.8	PEAK	90	1.2	V	35.1	5.6	33.5	54.0	74	-20.0
7386.00	45.9	PEAK	330	1.0	H	35.1	5.6	33.5	53.1	74	-20.9
4924.00	45.1	PEAK	270	1.5	V	32.5	4.9	33.0	49.5	74	-24.5
4924.00	44.6	PEAK	60	1.5	H	32.5	4.9	33.0	49.0	74	-25.0

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart B	
Frequency MHz	Ampl. dBμV/m	Direction Degree	Height Meter	Polar H/V	Antenna dBμV/m	Cable Loss dBμV/m	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB
416.00	44.8	150	1.8	V	16.4	2.6	25.0	38.8	46	-7.2
479.40	39.3	30	1.5	V	17.8	3.1	25.0	35.2	46	-10.8
214.78	42.7	180	2.2	H	11.9	2.2	25.0	31.8	43.5	-11.7
558.83	34.2	45	1.0	V	19.3	2.8	25.0	31.3	46	-14.7
275.79	37.5	100	1.0	V	13.3	2.2	25.0	28.0	43.5	-15.5
57.50	38.5	0	1.2	H	9.8	1.7	25.0	25.0	43.5	-18.5

Note:

FUND = Fundamental

AVG = average

12.6.3 Final test data for 802.11a (15.407)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dB μ V/ m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dB μ V/m	Cable DB	Amp. DB	Corr. Ampl. dB μ V/m	Limit dB μ V/ m	Margin dB
Low Band, Low Channel, 1-50GHz, Normal Mode											
5165.00	92.0	FUND/PEAK	330	1.8	V	33.9	5.2	33.0	98.1		
5165.00	83.7	FUND/PEAK	150	2.5	H	33.9	5.2	33.0	89.8		
5165.00	80.8	FUND/AVE	330	1.8	V	33.9	5.2	33.0	86.9		
5165.00	73.3	FUND/AVE	150	2.5	H	33.9	5.2	33.0	79.4		
15495.00	37.2	AVE	30	1.4	V	35.1	5.6	33.3	44.6	54	-9.4
15495.00	37.0	AVE	60	1.5	H	35.1	5.6	33.3	44.4	54	-9.6
10330.00	34.3	AVE	30	1.5	V	35.1	5.6	34.5	40.5	54	-13.5
10330.00	33.7	AVE	120	1.6	H	35.1	5.6	34.5	39.9	54	-14.1
15495.00	48.2	PEAK	30	1.4	V	35.1	5.6	33.3	55.6	74	-18.4
15495.00	47.2	PEAK	60	1.5	H	35.1	5.6	33.3	54.6	74	-19.4
10330.00	47.7	PEAK	30	1.5	V	35.1	5.6	34.5	53.9	74	-20.1
10330.00	46.0	PEAK	120	1.6	H	35.1	5.6	34.5	52.2	74	-21.8
Low Band, Middle Channel, 1-50GHz, Turbo Mode											
5200.00	90.3	FUND/PEAK	180	1.6	V	33.9	5.2	33.0	96.4		
5200.00	80.0	FUND/PEAK	150	1.8	H	33.9	5.2	33.0	86.1		
5200.00	79.3	FUND/AVE	180	1.6	V	33.9	5.2	33.0	85.4		
5200.00	69.2	FUND/AVE	150	1.8	H	33.9	5.2	33.0	75.3		
15600.00	37.3	AVE	0	1.5	V	35.1	5.6	33.3	44.7	54	-9.3
15600.00	36.8	AVE	90	1.8	H	35.1	5.6	33.3	44.2	54	-9.8
10400.00	34.5	AVE	0	1.2	V	35.1	5.6	34.5	40.7	54	-13.3
10400.00	34.0	AVE	220	1.4	H	35.1	5.6	34.5	40.2	54	-13.8
15600.00	48.3	PEAK	0	1.5	V	35.1	5.6	33.3	55.7	74	-18.3
15600.00	48.0	PEAK	90	1.8	H	35.1	5.6	33.3	55.4	74	-18.6
10400.00	45.4	PEAK	0	1.2	V	35.1	5.6	34.5	51.6	74	-22.4
10400.00	45.0	PEAK	220	1.4	H	35.1	5.6	34.5	51.2	74	-22.8

12.6.3 Final test data for 802.11a (15.407, Continued)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/ m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/ m	Margin dB
Low Band, High Channel, 1-50GHz, Normal Mode											
5250.00	93.2	FUND/PEAK	0	1.6	V	33.9	5.2	33.0	99.3		
5250.00	84.5	FUND/PEAK	180	2.0	H	33.9	5.2	33.0	90.6		
5250.00	82.8	FUND/AVE	0	1.6	V	33.9	5.2	33.0	88.9		
5250.00	73.5	FUND/AVE	180	2.0	H	33.9	5.2	33.0	79.6		
15750.00	37.3	AVE	180	1.4	V	35.1	5.6	33.3	44.7	54	-9.3
15750.00	37.1	AVE	30	1.6	H	35.1	5.6	33.3	44.5	54	-9.5
10500.00	34.2	AVE	1.5	1.5	V	35.1	5.6	34.5	40.4	54	-13.6
10500.00	33.8	AVE	150	1.5	H	35.1	5.6	34.5	40.0	54	-14.0
15750.00	48.5	PEAK	180	1.4	V	35.1	5.6	33.3	55.9	74	-18.1
15750.00	47.7	PEAK	30	1.6	H	35.1	5.6	33.3	55.1	74	-18.9
10500.00	47.5	PEAK	0	1.5	V	35.1	5.6	34.5	53.7	74	-20.3
10500.00	46.2	PEAK	150	1.5	H	35.1	5.6	34.5	52.4	74	-21.6

12.6.3 Final test data for 802.11a (15.407, Continued)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/ m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/ m	Margin dB
Mid Band, Low Channel, 1-50GHz , Normal Mode											
5265.00	97.5	FUND/PEAK	330	2.0	V	33.9	5.2	33.0	103.6		
5265.00	90.2	FUND/PEAK	150	2.2	H	33.9	5.2	33.0	96.3		
5265.00	86.7	FUND/AVE	330	2.0	V	33.9	5.2	33.0	92.8		
5265.00	79.5	FUND/AVE	150	2.2	H	33.9	5.2	33.0	85.6		
10530.00	42.0	AVE	330	1.2	V	35.1	5.6	34.5	48.2	54	-5.8
10530.00	39.8	AVE	300	1.0	H	35.1	5.6	34.5	46.0	54	-8.0
15795.00	34.7	AVE	0	1.6	V	35.1	5.6	33.3	42.1	54	-11.9
15795.00	34.5	AVE	30	1.2	H	35.1	5.6	33.3	41.9	54	-12.1
10530.00	54.2	PEAK	330	1.2	V	35.1	5.6	34.5	60.4	74	-13.6
10530.00	51.7	PEAK	300	1.0	H	35.1	5.6	34.5	57.9	74	-16.1
15795.00	46.8	PEAK	0	1.6	V	35.1	5.6	33.3	54.2	74	-19.8
15795.00	46.5	PEAK	30	1.2	H	35.1	5.6	33.3	53.9	74	-20.1
Mid Band, Middle Channel, 1-50GHz, Turbo Mode											
5300.00	97.7	FUND/PEAK	200	1.4	V	33.9	5.2	33.0	103.8		
5300.00	89.8	FUND/PEAK	180	1.4	H	33.9	5.2	33.0	95.9		
5300.00	86.0	FUND/AVE	200	1.4	V	33.9	5.2	33.0	92.1		
5300.00	79.0	FUND/AVE	0	2.0	H	33.9	5.2	33.0	85.1		
10600.00	40.0	AVE	0	1.6	V	35.1	5.6	34.5	46.2	54	-7.8
10600.00	38.8	AVE	220	1.4	H	35.1	5.6	34.5	45.0	54	-9.0
15900.00	34.7	AVE	220	1.0	V	35.1	5.6	33.3	42.1	54	-11.9
15900.00	34.7	AVE	150	1.2	H	35.1	5.6	33.3	42.1	54	-11.9
10600.00	53.0	PEAK	0	1.6	V	35.1	5.6	34.5	59.2	74	-14.8
10600.00	52.8	PEAK	220	1.4	H	35.1	5.6	34.5	59.0	74	-15.0
15900.00	46.2	PEAK	220	1.0	V	35.1	5.6	33.3	53.6	74	-20.4
15900.00	46.0	PEAK	150	1.2	H	35.1	5.6	33.3	53.4	74	-20.6

12.6.3 Final test data for 802.11a (15.407, Continued)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/ m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/ m	Margin dB
Mid Band, High Channel, 1-50GHz, Normal Mode											
5330.00	96.7	FUND/PEAK	200	1.8	V	33.9	5.2	33.0	102.8		
5330.00	88.7	FUND/PEAK	150	2.2	H	33.9	5.2	33.0	94.8		
5330.00	85.3	FUND/AVE	200	1.8	V	33.9	5.2	33.0	91.4		
5330.00	78.7	FUND/AVE	150	2.2	H	33.9	5.2	33.0	84.8		
10660.00	41.2	AVE	1.2	1.6	V	35.1	5.6	34.5	47.4	54	-6.6
10660.00	39.5	AVE	0	1.2	H	35.1	5.6	34.5	45.7	54	-8.3
15990.00	34.6	AVE	30	1.5	V	35.1	5.6	33.3	42.0	54	-12.0
15990.00	34.5	AVE	200	1.6	H	35.1	5.6	33.3	41.9	54	-12.1
10660.00	52.5	PEAK	180	1.6	V	35.1	5.6	34.5	58.7	74	-15.3
10660.00	52.0	PEAK	0	1.2	H	35.1	5.6	34.5	58.2	74	-15.8
15990.00	46.6	PEAK	30	1.5	V	35.1	5.6	33.3	54.0	74	-20.0
15990.00	46.3	PEAK	200	1.6	H	35.1	5.6	33.3	53.7	74	-20.3

12.6.3 Final test data for 802.11a (15.407, Continued)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBμV/ m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dBμV/m	Cable DB	Amp. DB	Corr. Ampl. dBμV/m	Limit dBμV/ m	Margin dB
High Band, Low Channel, 1-50GHz, Normal Mode											
5740.00	94.8	FUND/PEAK	30	1.2	V	34.1	5.4	33.0	101.3		
5740.00	86.3	FUND/PEAK	180	2.2	H	34.1	5.4	33.0	92.8		
5740.00	84.8	FUND/AVE	30	1.2	V	34.1	5.4	33.0	91.3		
5740.00	75.5	FUND/AVE	180	2.2	H	34.1	5.4	33.0	82.0		
17220.00	35.7	AVE	90	1.5	V	35.1	5.6	33.3	43.1	54	-10.9
17220.00	35.0	AVE	60	1.8	H	35.1	5.6	33.3	42.4	54	-11.6
11480.00	35.8	AVE	330	1.2	V	35.1	5.6	34.5	42.0	54	-12.0
11480.00	34.3	AVE	0	1.4	H	35.1	5.6	34.5	40.5	54	-13.5
17220.00	47.2	PEAK	90	1.5	V	35.1	5.6	33.3	54.6	74	-19.4
11480.00	48.3	PEAK	330	1.2	V	35.1	5.6	34.5	54.5	74	-19.5
17220.00	46.8	PEAK	60	1.8	H	35.1	5.6	33.3	54.2	74	-19.8
11480.00	47.0	PEAK	0	1.4	H	35.1	5.6	34.5	53.2	74	-20.8
High Band, Middle Channel, 1-50GHz, Turbo Mode											
5770.00	91.3	FUND/PEAK	180	1.5	V	34.1	5.4	33.0	97.8		
5770.00	82.0	FUND/PEAK	300	1.5	H	34.1	5.4	33.0	88.5		
5770.00	80.7	FUND/AVE	180	1.5	V	34.1	5.4	33.0	87.2		
5770.00	71.8	FUND/AVE	300	1.5	H	34.1	5.4	33.0	78.3		
11540.00	37.3	AVE	150	1.8	V	35.1	5.6	34.5	43.5	54	-10.5
17310.00	35.6	AVE	270	1.6	V	35.1	5.6	33.3	43.0	54	-11.0
17310.00	35.3	AVE	200	1.8	H	35.1	5.6	33.3	42.7	54	-11.3
11540.00	35.8	AVE	0	1.4	H	35.1	5.6	34.5	42.0	54	-12.0
11540.00	49.5	PEAK	150	1.8	V	35.1	5.6	34.5	55.7	74	-18.3
17310.00	47.6	PEAK	270	1.6	V	35.1	5.6	33.3	55.0	74	-19.0
11540.00	48.2	PEAK	0	1.4	H	35.1	5.6	34.5	54.4	74	-19.6
17310.00	47.0	PEAK	200	1.8	H	35.1	5.6	33.3	54.4	74	-19.6

12.6.3 Final test data for 802.11a (15.407, Continued)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dB μ V/ m	Comments	Angle Degree	Height Meter	Polar H/ V	Antenna dB μ V/m	Cable DB	Amp. DB	Corr. Ampl. dB μ V/m	Limit dB μ V/ m	Margin dB
High Band, High Channel, 1-50GHz, Normal Mode											
5810.00	92.7	FUND/PEAK	0	2.0	V	34.1	5.4	33.0	99.2		
5810.00	82.5	FUND/PEAK	250	1.4	H	34.1	5.4	33.0	89.0		
5810.00	81.0	FUND/AVE	0	2.0	V	34.1	5.4	33.0	87.5		
5810.00	72.2	FUND/AVE	250	1.4	H	34.1	5.4	33.0	78.7		
17430.00	35.3	AVE	0	2.0	V	35.1	5.6	33.3	42.7	54	-11.3
17430.00	35.3	AVE	180	1.6	H	35.1	5.6	33.3	42.7	54	-11.3
11620.00	34.5	AVE	1.5	1.8	V	35.1	5.6	34.5	40.7	54	-13.3
11620.00	34.3	AVE	270	1.5	H	35.1	5.6	34.5	40.5	54	-13.5
17430.00	47.5	PEAK	0	2.0	V	35.1	5.6	33.3	54.9	74	-19.1
17430.00	47.1	PEAK	180	1.6	H	35.1	5.6	33.3	54.5	74	-19.5
11620.00	47.0	PEAK	30	1.8	V	35.1	5.6	34.5	53.2	74	-20.8
11620.00	46.8	PEAK	270	1.5	H	35.1	5.6	34.5	53.0	74	-21.0

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart B	
Frequency MHz	Ampl. dB μ V/m	Direction Degree	Height Meter	Polar H/V	Antenna dB μ V/m	Cable Loss dB μ V/m	Amp. dB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
33.20	38.7	90	1.2	V	14.9	0.8	25.0	29.4	40	-10.6
104.40	40.3	0	1.5	H	10.7	1.5	25.0	27.5	43.5	-16.0
114.10	37.5	30	1.6	V	11.3	1.5	25.0	25.3	43.5	-18.2
253.10	43.2	250	2.0	H	13.3	2.2	25.0	33.7	46	-12.3
279.00	36.5	150	1.8	V	13.3	2.2	25.0	27.0	46	-19.0
437.40	38.2	90	1.4	V	16.9	2.8	25.0	32.9	46	-13.1
715.50	34.1	0	1.8	H	21.7	3.8	25.0	34.6	46	-11.4
815.70	36.7	90	1.6	V	22.2	3.7	25.0	37.6	46	-8.4

Note:

FUND = Fundamental

AVG = average

13 - CONDUCTED EMISSIONS

13.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ± 2.4 dB.

13.2 EUT Setup

The measurement was performed in the shield room, using the same setup per ANSI C63.4-2001 measurement procedure. The specification used was FCC 15 Subpart B limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The host system was connected with 120Vac/60Hz power source.

13.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conduction test:

Start Frequency.....	150 kHz
Stop Frequency.....	30 MHz
Sweep Speed.....	Auto
IF Bandwidth.....	10 kHz
Video Bandwidth.....	10 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode.....	Normal

13.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dB μ V of specification limits). Quasi-peak readings are distinguished with a "Qp".

13.4 Equipment Lists

Manufacturer	Model No.	Description	Calibration Due Date
Rohde&Schwarz	ESC530	EMI Test Receiver	2003-12-03

13.5 Summary of Test Results

According to the data in section 13.6, the EUT complies with the FCC Conducted margin for a Class B device, with the *worst* margin reading of:

-9.7 μ V at 13.00 in the Neutral mode

13.6 Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC PART 15 CLASS B	
Frequency MHz	Amplitude dB μ V	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dB μ V	Margin dB
13.000	40.3	AVG	Neutral	50	-9.7
1.500	34.2	AVG	Line	46	-11.8
1.500	33.7	AVG	Neutral	46	-12.3
11.000	33.9	AVG	Line	50	-16.1
0.195	36.6	AVG	Neutral	53	-16.4
11.000	42.0	QP	Line	60	-18.0
13.000	40.8	QP	Neutral	60	-19.2
1.500	36.7	QP	Line	56	-19.3
0.195	43.2	QP	Neutral	63	-19.8
1.500	36.2	QP	Neutral	56	-19.8
0.195	41.6	QP	Line	64	-22.4
0.195	30.8	AVG	Line	54	-23.2

13.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented hereinafter as reference.

Bay Area Compliance Laboratory Corp
CISPR CLASS B

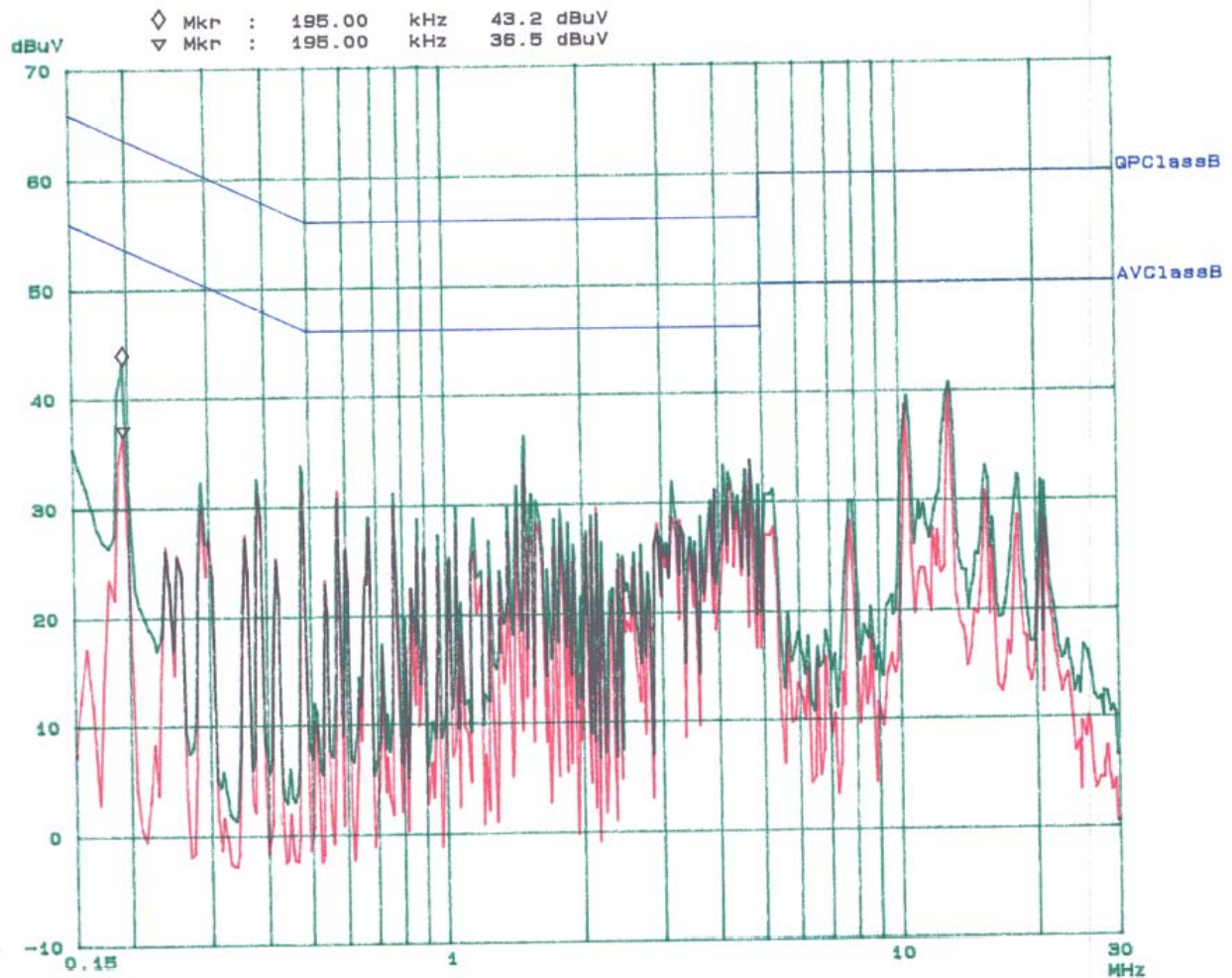
19. Sep 03 13:33

EUT: 802PAG
Manuf: ACTIONTEC
Op Cond: Normal
Operator: LINS
Comment: N

Scan Settings (3 Ranges)

Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dBLN	OFF
1M	5M	10k	9k	QP+AV	1ms	10dBLN	OFF
5M	30M	100k	9k	QP+AV	1ms	10dBLN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



2003-8-19

Bay Area Compliance Laboratory Corp
CISPR CLASS B

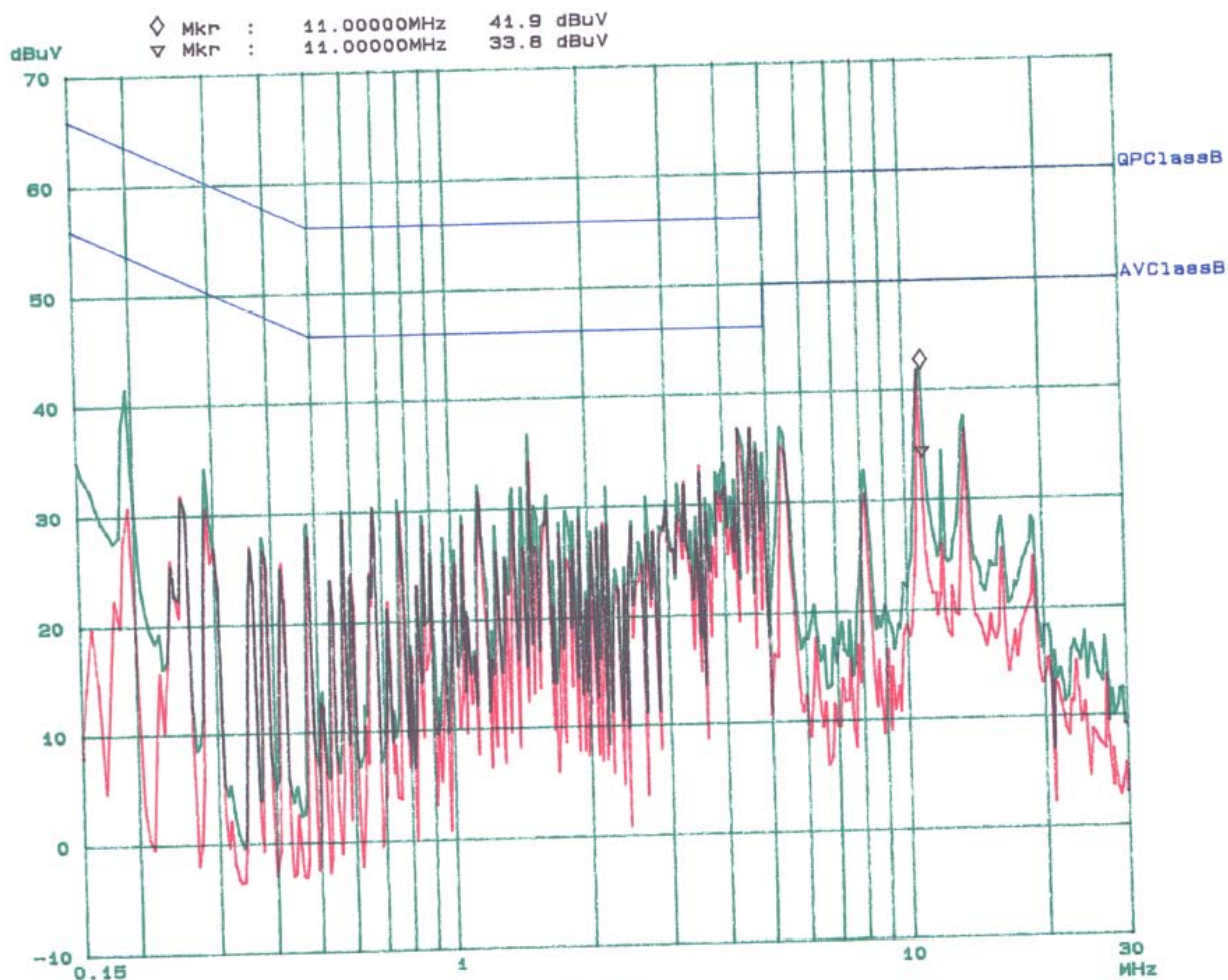
19. Sep 03 11:22

EUT: 802PAG
Manuf: ACTIONTEC
Op Cond: Normal
Operator: LING
Comment: L

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	10dBLN	OFF
1M	5M	10k	9k	QP+AV	1ms	10dBLN	OFF
5M	30M	100k	9k	QP+AV	1ms	10dBLN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



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14 - Discontinue Transmitting With Absence Of Data Or Operational Failure

According to § 15.407 (c), the device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application a description of how this requirement is met.

Please refer to respective technical description.

15 - Frequency Stability

15.1 Standard Applicable

According to §15.407 (g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation.

15.2 Measurement Result

Frequency Stability Versus Temperature

Carrier Center Frequencies (limit: 20 ppm)							
Temperation	Power Supplied (Vac)	5180MHz		5500MHz		5700MHz	
		Reading	ppm	Reading	ppm	Reading	ppm
55	207	5180.025	4.83	5500.0381	6.93	5700.0289	5.07
	253	5180.0332	6.41	5500.0267	4.85	5700.0278	4.88
20	230	5180.0145	2.80	5500.0122	2.22	5700.0076	1.33
-20	207	5180.0378	7.30	5500.0345	6.27	5700.0365	6.40
	253	5180.0324	6.25	5500.0311	5.65	5700.0402	7.05