



Nemko

Test Report:

3W07702

Applicant:

BelAir Networks
603 March Road,
Ottawa Ont.
K2K 2M5

**Equipment Under Test:
(EUT)**

BA200 Wireless LAN Access Radio Module
BEL20001, 5GHz Band

FCC ID:

RAR20001001

In Accordance With:

FCC Part 15.401, Subpart E

Tested By:

Nemko Canada Inc.
303 River Road, R.R. 5
Ottawa, Ontario K1V 1H2

Authorized By:

Kevin Carr, EMC Specialist

Date:

14 January 2004

Total Number of Pages:

41

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EQUIPMENT: BEL20001

Section 1. Summary of Test Results

General

All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart E. Radiated tests were conducted in accordance with ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See " Summary of Test Data".



TESTED BY: _____
Glen Westwell, Wireless Technologist

DATE: 14 January 2003

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This report applies only to the items tested.

EQUIPMENT: BEL20001

Summary Of Test Data

Name Of Test	Para. No.	Result
Powerline Conducted Emissions	15.207(a)	Complies
Emission Bandwidth	15.403(c)	Complies
Peak Conducted Transmit Power	15.407(a)(3)	Complies
Peak Power Spectral Density	15.407(a)(3)	Complies
Peak Excursion Measurement	15.407(a)(6)	Complies
Undesirable Emissions	15.407(b)(3)(5)	Complies

Product Modifications:

To achieve compliance the following change(s) were made during compliance testing:

A clamp on ferrite bead (Steward P/N 28A2029-0A2) was added to the AC power cable.

Test Conditions:

Indoor Temperature: 23°C
 Humidity: 12%

Outdoor Temperature: -20°C
 Humidity: 10%

Section 3. RF Exposure Evaluation

- (1) This U-NII Band radio module will be integrated into an enclosure with FCC approved access radio module FCC ID# RAR20000001. Co-location compliance for multiple frequency exposure criteria to the power density exposure limit is detailed in the table below.
- (2) The antenna(s) used with this device are integral and will be installed to provide a minimum separation distance of 25cm from all persons and will not be co-located or operated in conjunction with any other antenna or transmitter not described in this application.
- (3) This integrated modular transmitter will only be operated according to the exposure conditions described in this application. End users and installers will be provided with antenna installation and transmitting operating conditions for satisfying RF exposure compliance.

Power Ratio Summation for Integrated Co-located Radios at 25cm.						
802.11b FCC I.D.# RAR20000001 (mW/cm ²)	802.11a FCC I.D.# RAR20001001 (mW/cm ²)	802.11a FCC I.D.# RAR20001001 (mW/cm ²)	802.11a FCC I.D.# RAR20001001 (mW/cm ²)	Sum of Worst Case Power Density at 25cm (mW/cm ²)	General Exposure Limit (mW/cm ²)	
Radio 1	Radio 2	Radio 3	Radio 4			
0.452	0.101	-----	-----	0.553	1.0	PASS
0.452	0.101	0.101	-----	0.645	1.0	PASS
0.452	0.101	0.101	0.101	0.755	1.0	PASS

802.11b Radio

Maximum conducted power = 27dBm, antenna gain = 8.5dBi, therefore the power density at 25cm = 0.451762mW/cm².

802.11a Radio

Maximum conducted power = 14dBm, antenna gain = 15dBi, therefore the power density at 25cm = 0.101137mW/cm².

EQUIPMENT: BEL20001

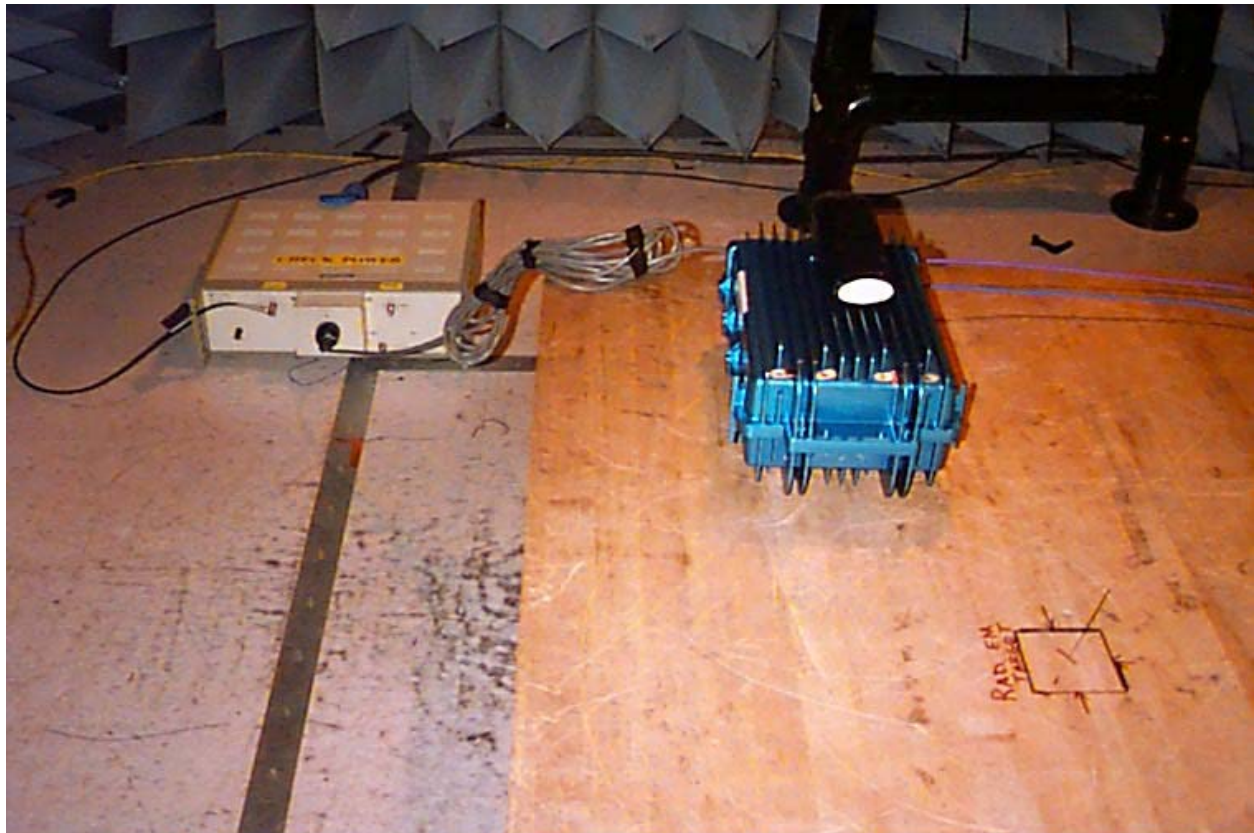
Section 4. Powerline Conducted Emissions

Para. No.: 15.207(a)

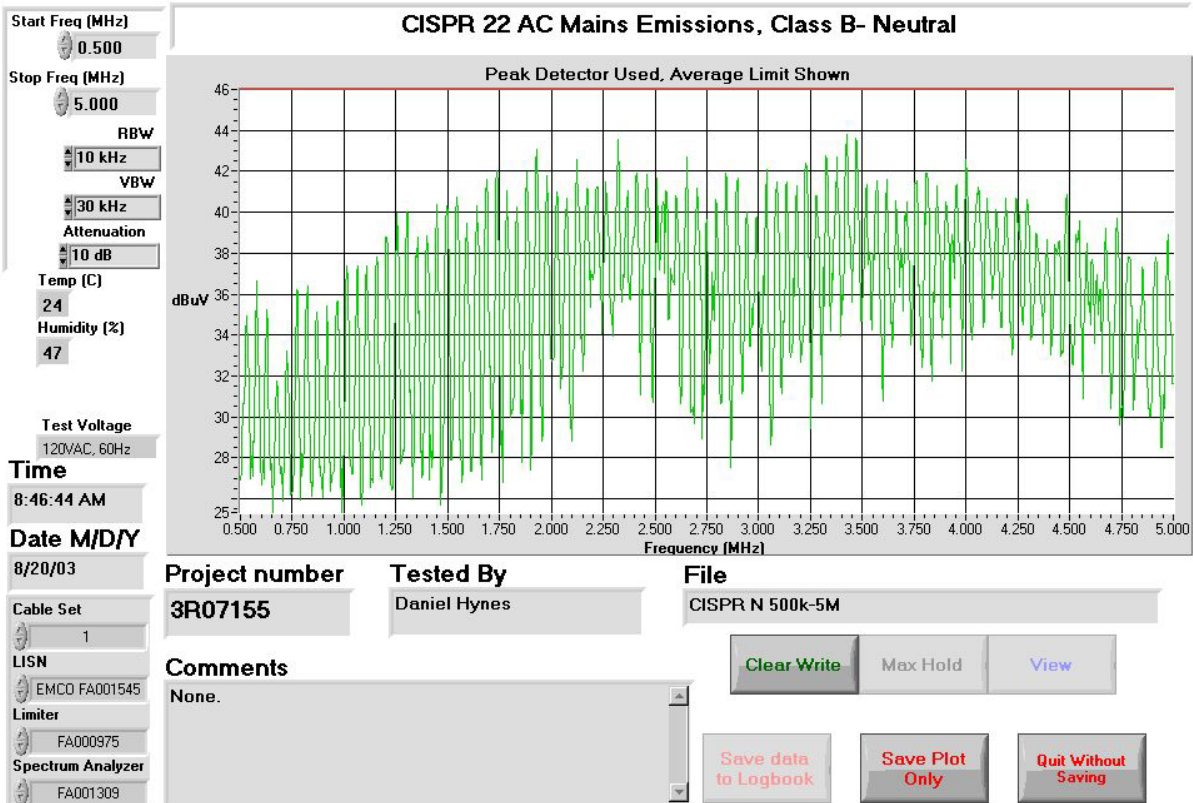
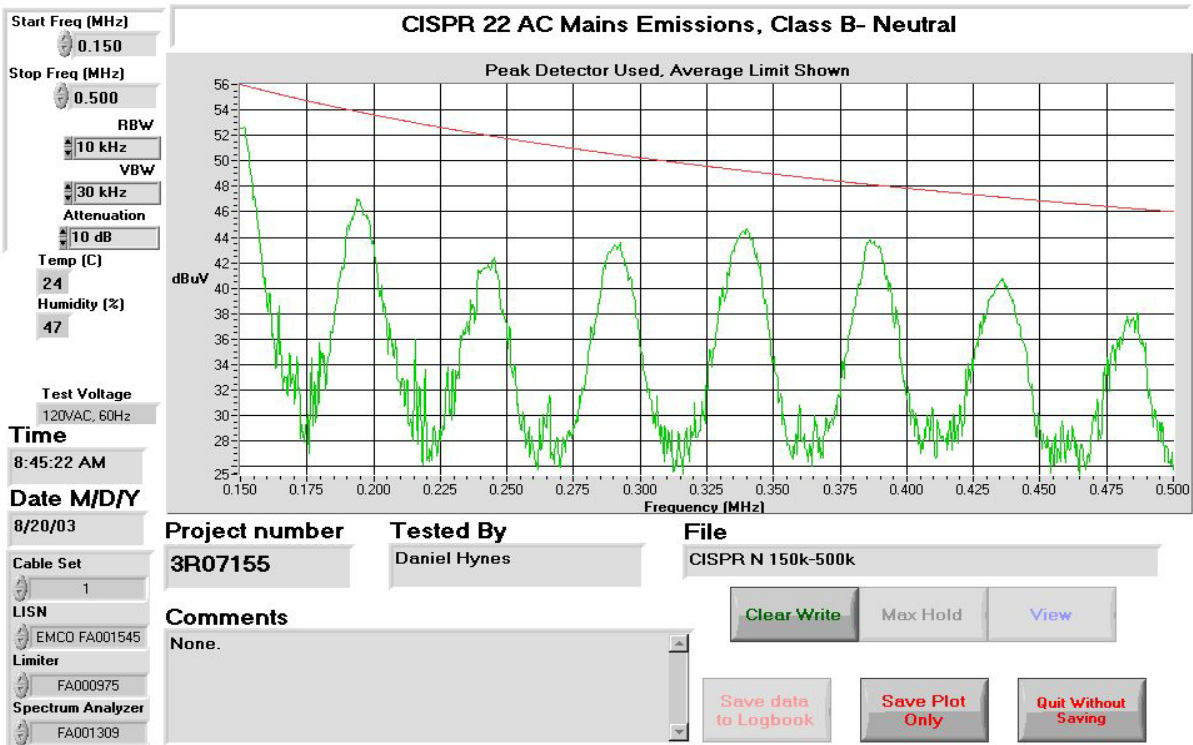
Test Performed By: Daniel Hynes	Date of Test: 20 Aug. 2003
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Test Results: Comply.

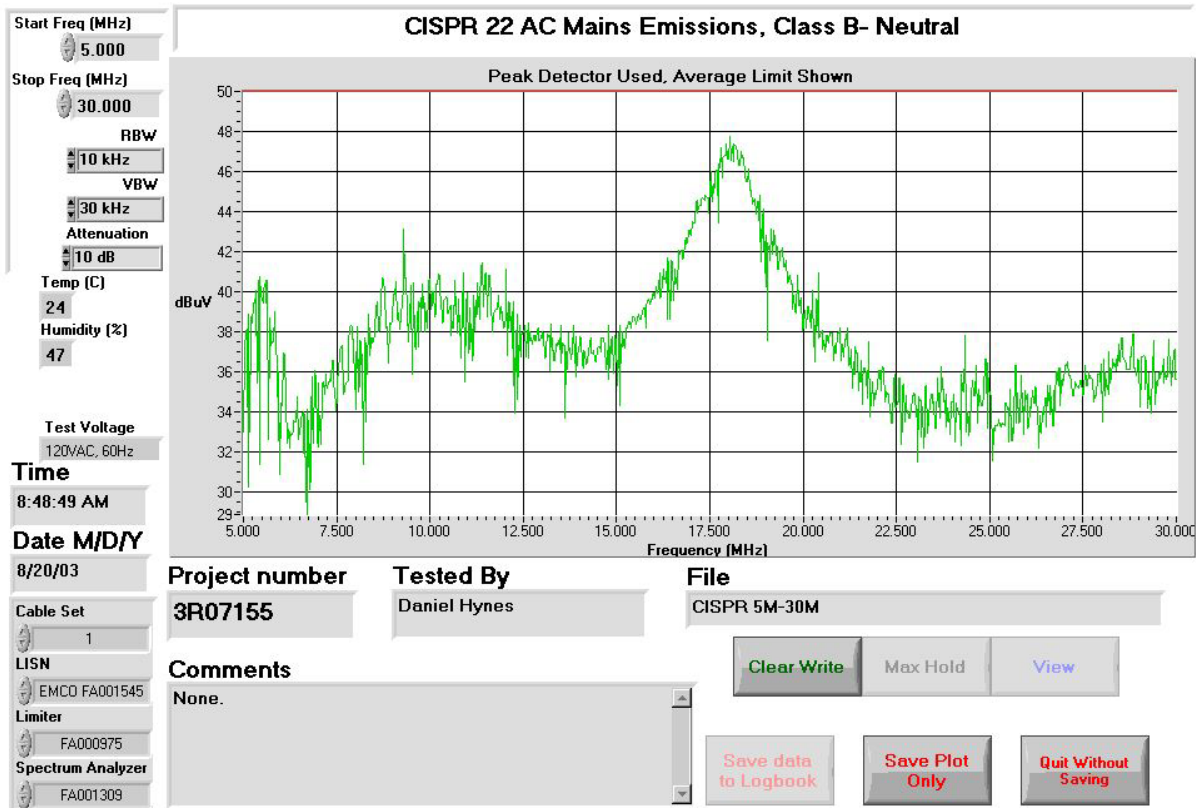
Measurement Data: See Attached Graphs.



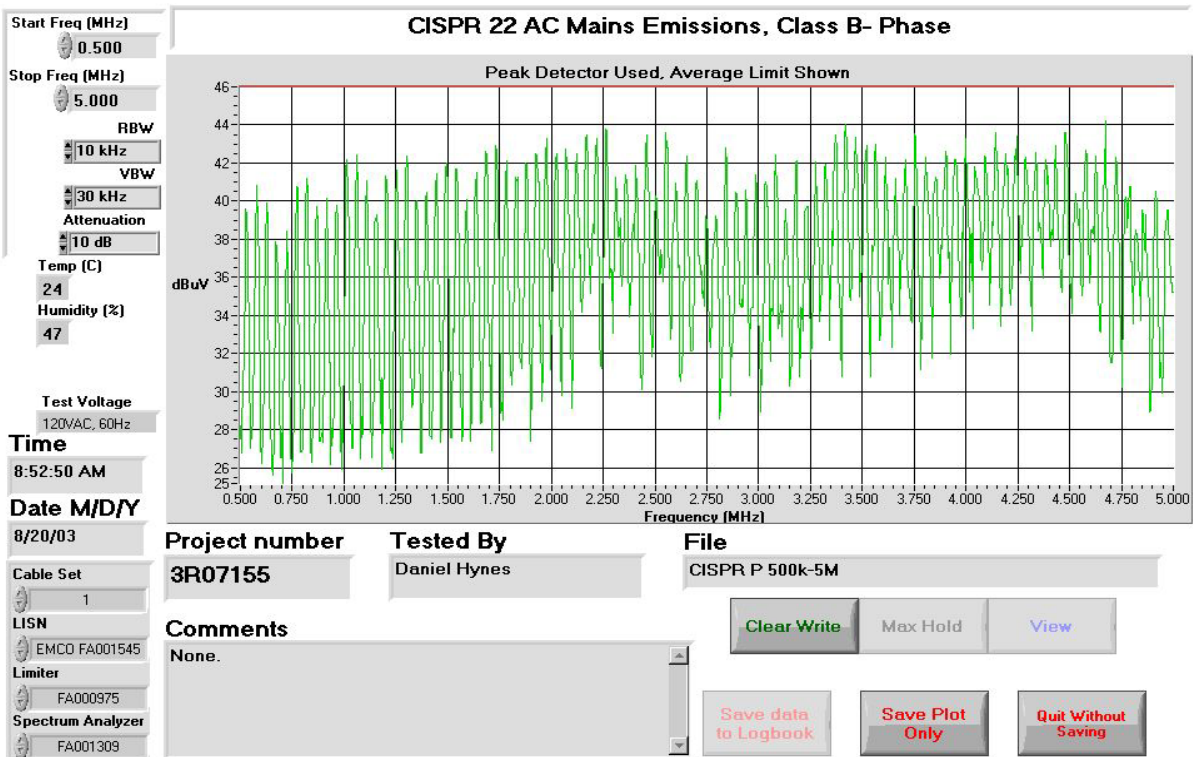
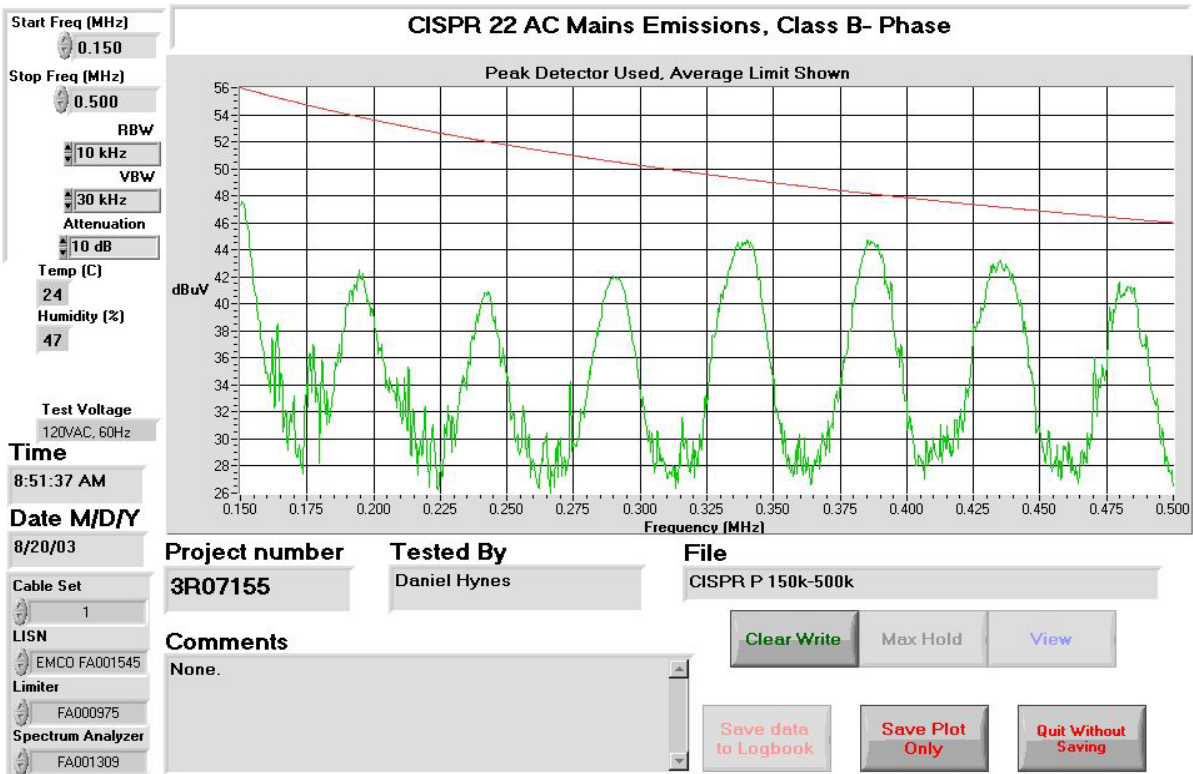
EQUIPMENT: BEL20001



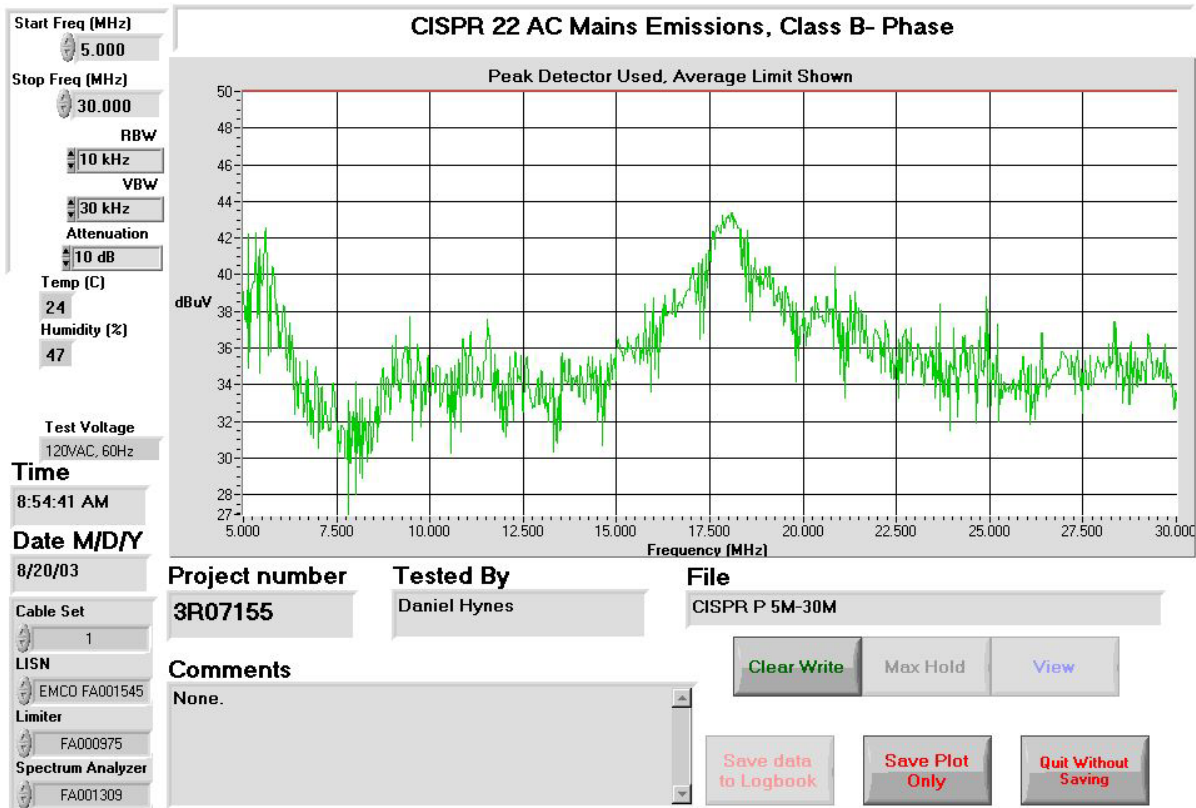
EQUIPMENT: BEL20001



EQUIPMENT: BEL20001



EQUIPMENT: BEL20001



EQUIPMENT: BEL20001



EQUIPMENT: BEL20001

Section 5. Emission Bandwidth

Para. No.: 15.403(c)

Test Performed By: Glen Westwell	Date of Test: 24 Dec. 2003
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Test Results: Complies

Measurement Data: See Attached Plots.

Emission Bandwidth (EBW)			
Frequency (U-NII 2)	5265MHz	5300MHz	5335MHz
	18.3MHz	17.8MHz	19.6MHz
Frequency (U-NII 3)	5740MHz	5775MHz	5810MHz
	18.6MHz	19.1MHz	18.6MHz

EQUIPMENT: BEL20001

Section 6. Peak Conducted Transmit Power

Para. No.: 15.407(a)(2)(3)

Test Performed By: Glen Westwell	Date of Test: 24 Dec. 2003
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Test Results: Complies.

Measurement Data: See Attached Data
Worst case data has been presented for maximum power vs data rate.

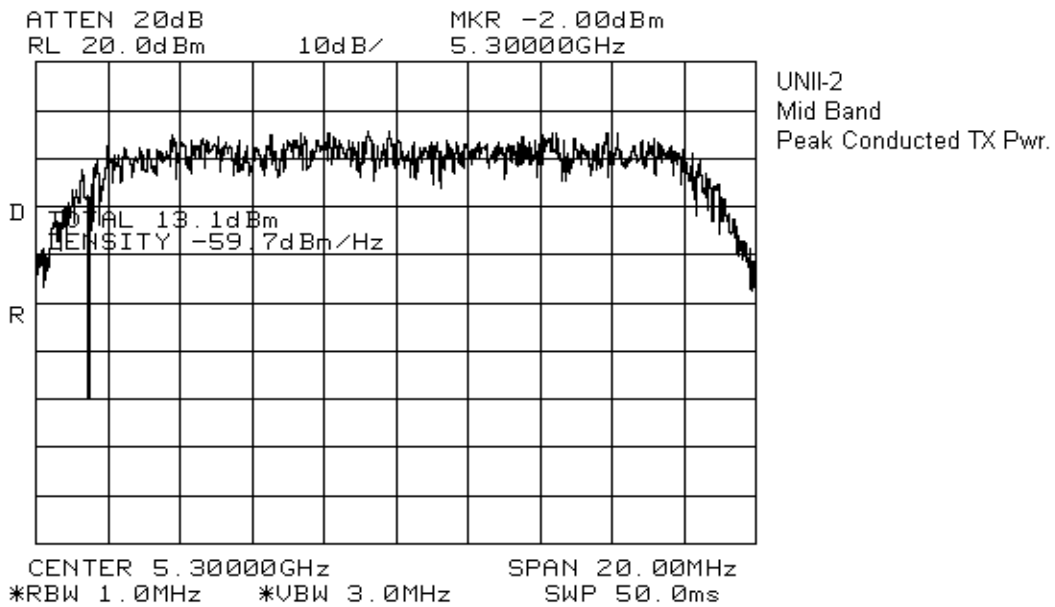
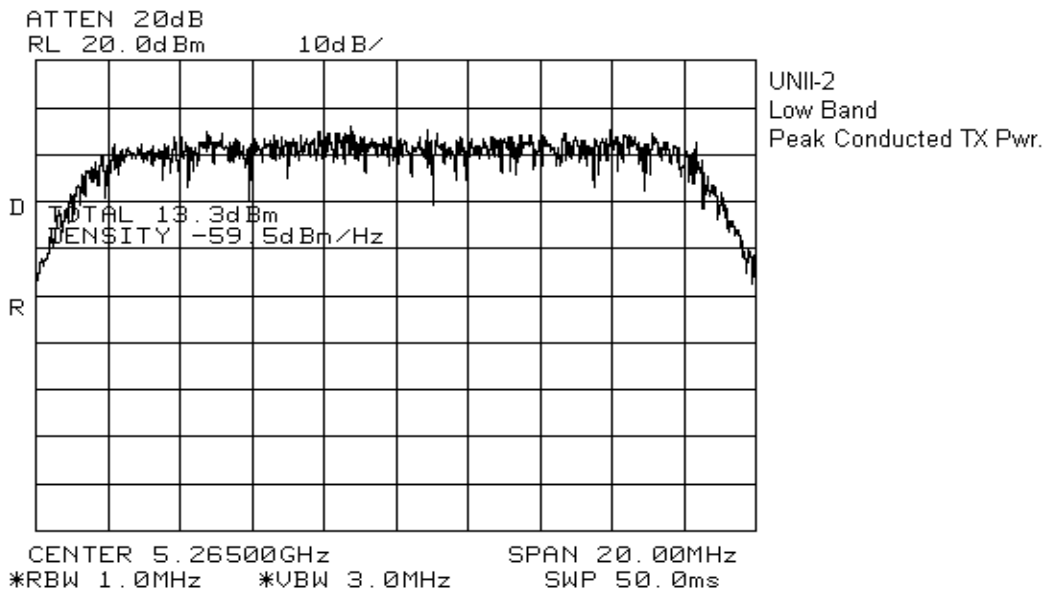
The power was measured using a wide band power meter and a thermocouple detector power head.

Data Rate (Mbps)	Rated Power	Measured Power (dBm)		
		5265MHz	5300MHz	5335MHz
54	+14dBm	13.8	13.7	14.0
6	+14dBm	14.2	13.9	14.2
Data Rate (Mbps)	Rated Power	Measured Power (dBm)		
		5740MHz	5775MHz	5810MHz
54	+14dBm	13.6	13.5	13.5
6	+14dBm	13.5	13.7	13.6

15.407 General Technical Requirements – Peak Transmit Power		
U-NII Band 2 (MHz)	Measured Across EBW (dBm)	Limit (dBm)
5265	13.3	24
5300	13.1	24
5335	13.9	24
U-NII Band 3 (MHz)	Measured Across EBW (dBm)	Limit (dBm)
5740	12.4	30
5775	12.0	30
5810	12.0	30

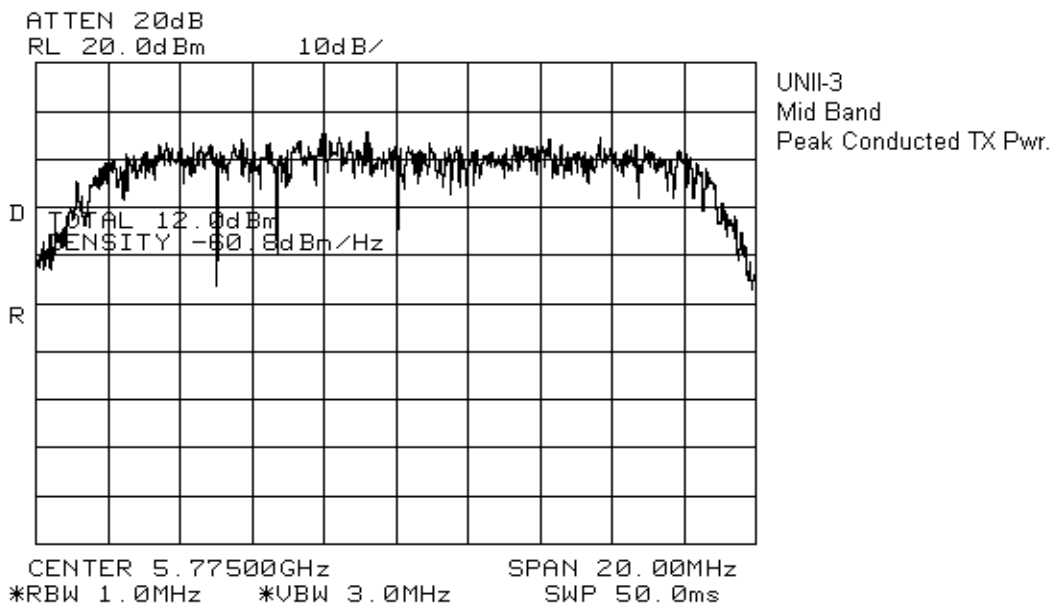
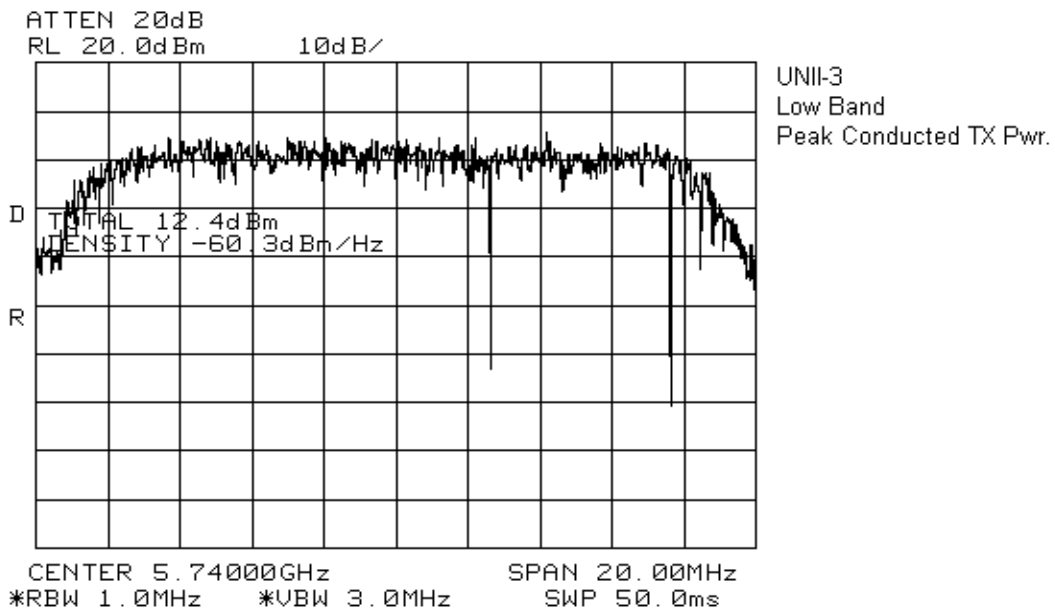
EQUIPMENT: BEL20001

U-NII 2

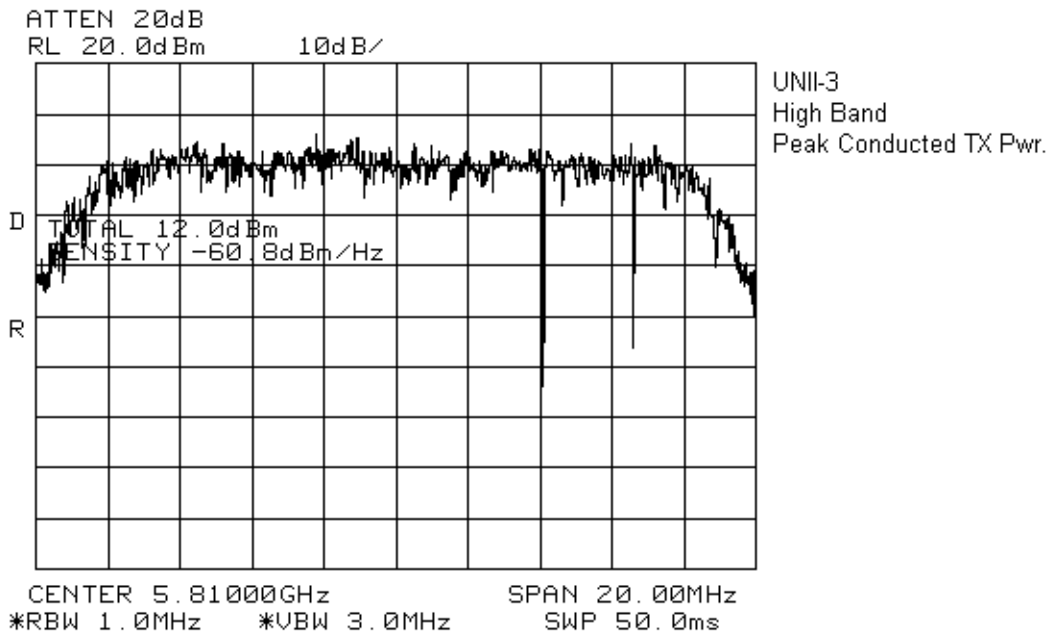


EQUIPMENT: BEL20001

U-NII 3



EQUIPMENT: BEL20001



EQUIPMENT: BEL20001

Section 7. Peak Power spectral density

Para. No.: 15.407(a)(2)(3)

Test Performed By: Glen Westwell	Date of Test: 23 Dec. 2003
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Limit: 5.25-5.35GHz, U-NII 2 = +11dBm/MHz
5.725-5.825GHz, U-NII 3 = +17dBm/MHz

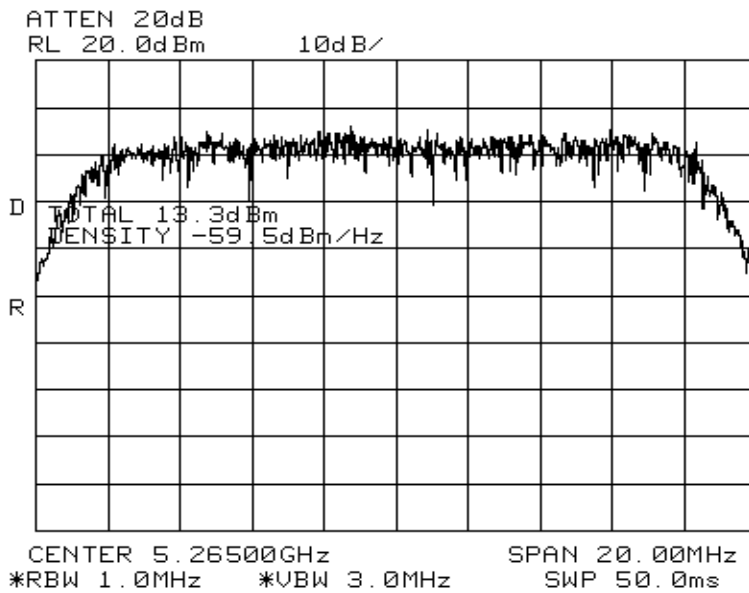
Test Results: Complies.

Measurement Data: See attached plots.

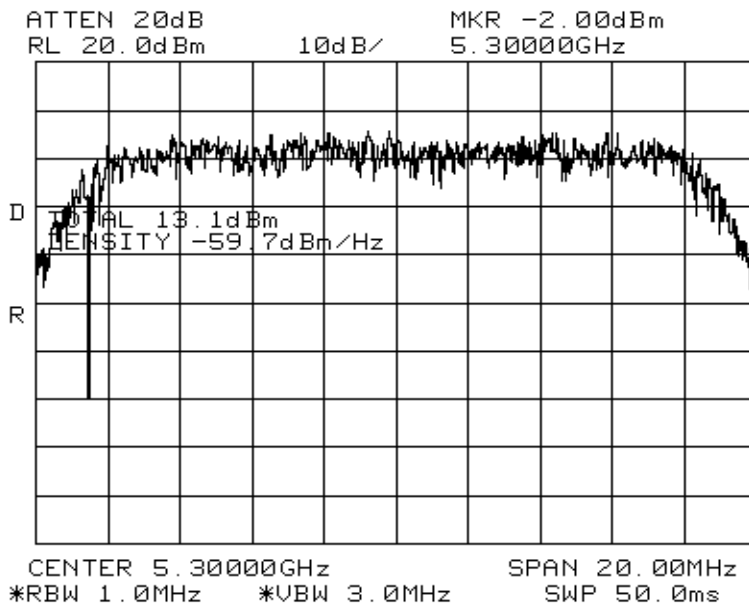
PPSD Measurements	
Frequency (MHz)	Density (dBm/MHz)
5265	0.5
5300	0.3
5335	1.1
5740	-0.3
5775	-0.8
5810	-0.8

EQUIPMENT: BEL20001

U-NII 2



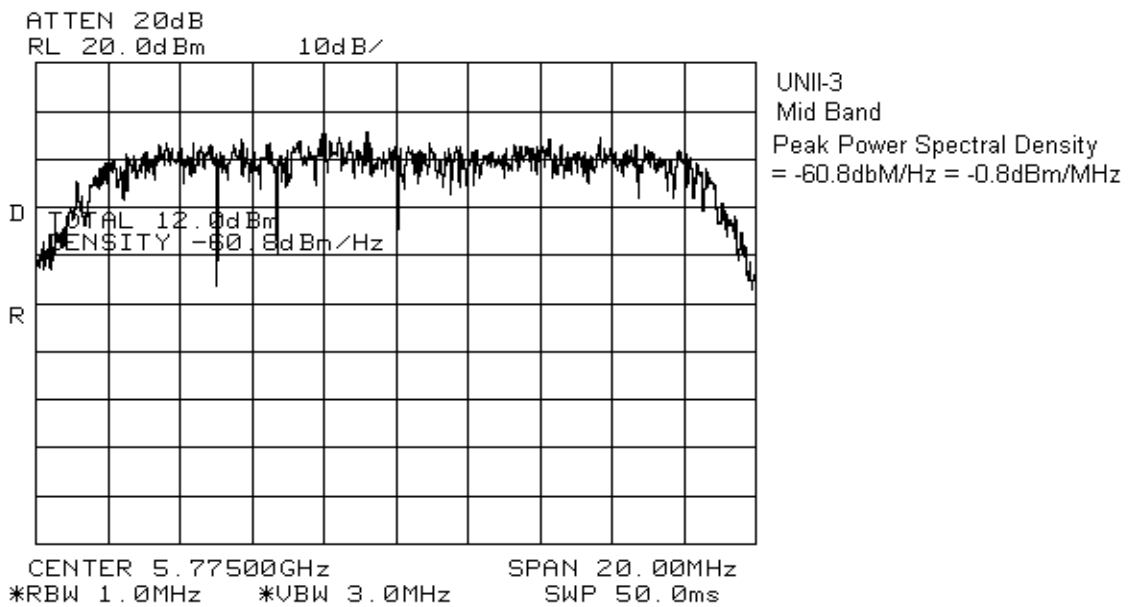
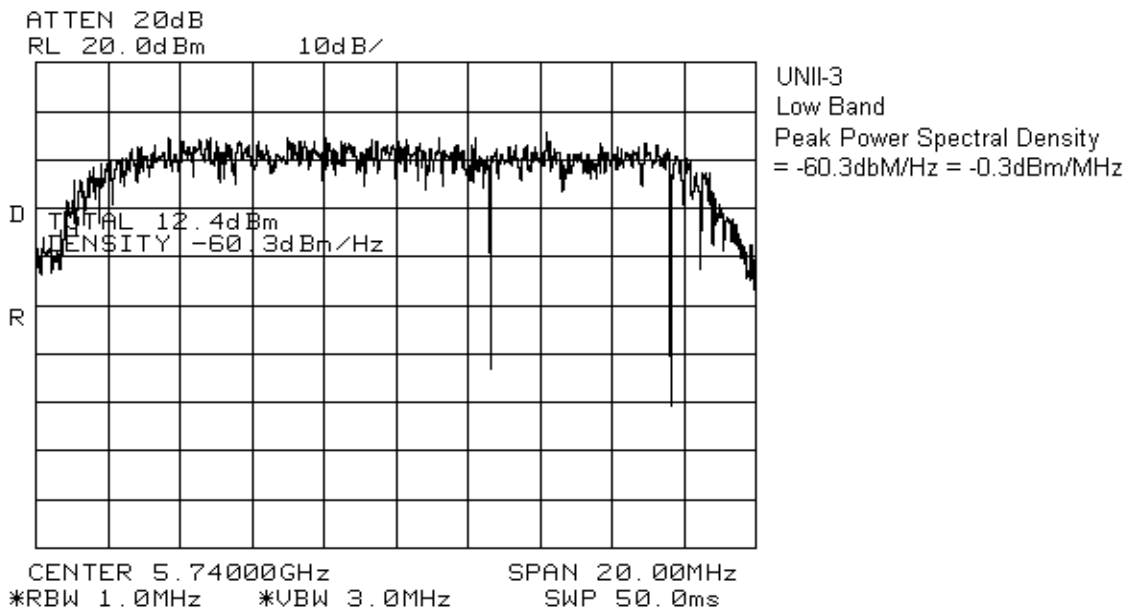
UNII-2
Low Band
Peak Power Spectral Density
= -59.5dBm/Hz = 0.5dBm/MHz



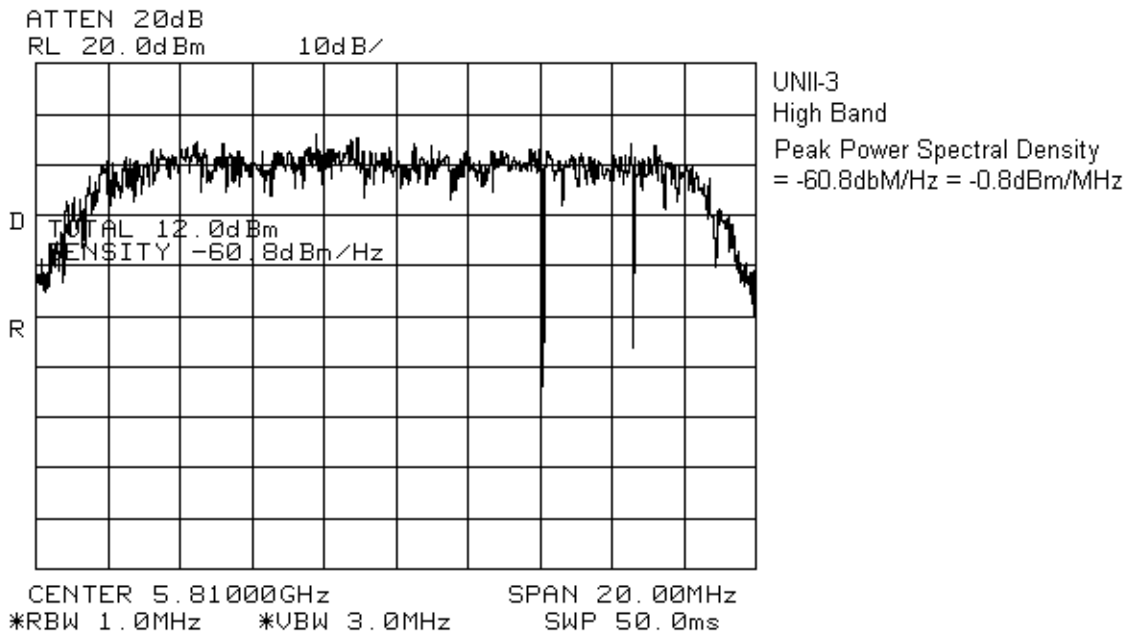
UNII-2
Mid Band
Peak Power Spectral Density
= -59.7dBm/Hz = 0.3dBm/MHz

EQUIPMENT: BEL20001

U-NII 3



EQUIPMENT: BEL20001



EQUIPMENT: BEL20001

Section 8. Peak Excursion Measurement

Para. No.: 15.407(a)(6)

Test Performed By: Glen Westwell	Date of Test: 23 Dec. 2003
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Limit: $\leq +13\text{dB}$

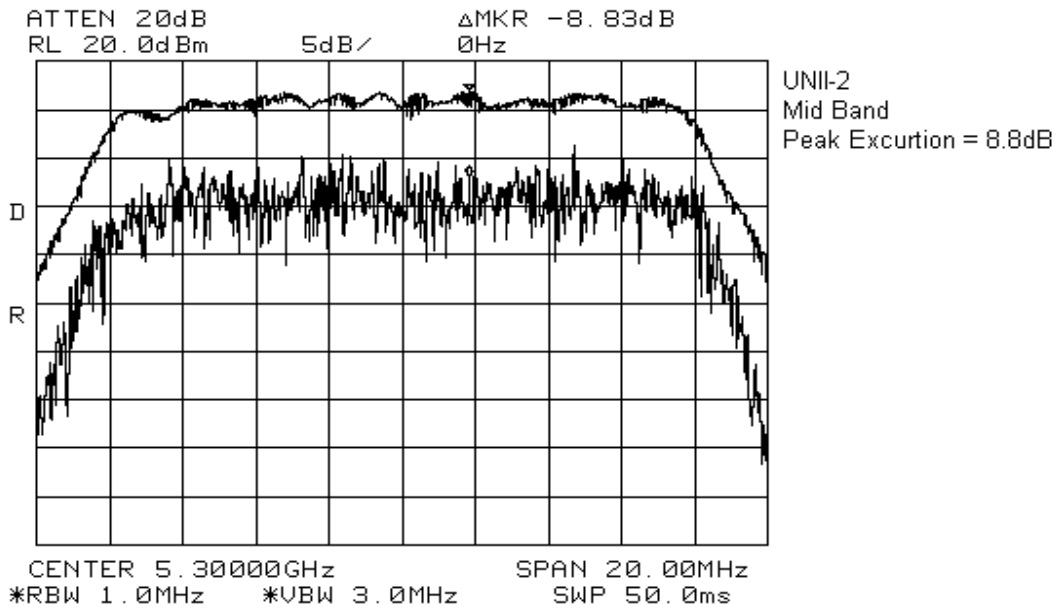
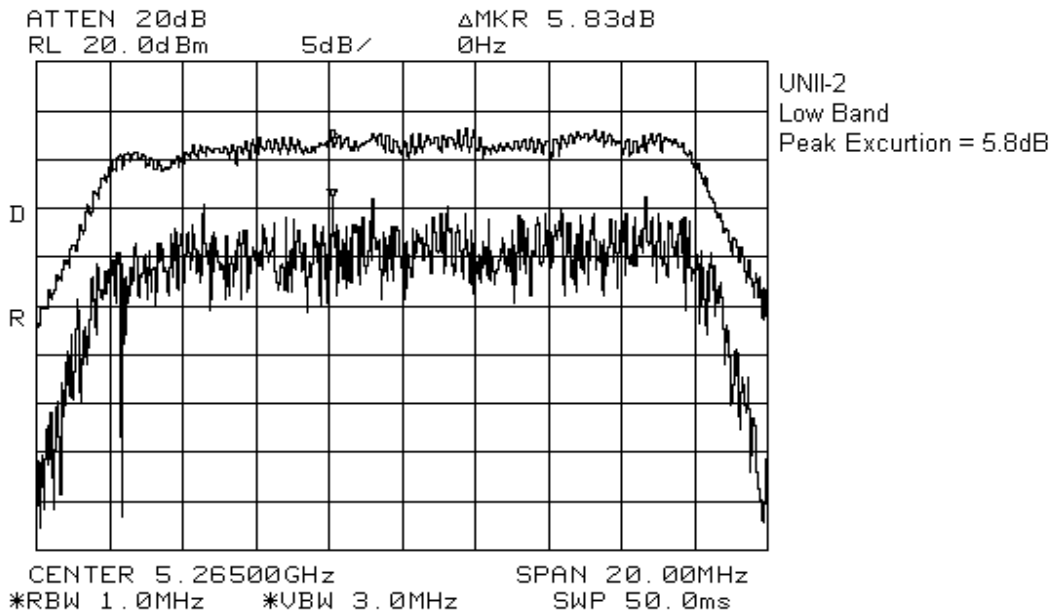
Test Results: Complies

Measurement Data: See attached plots.

Frequency (MHz)	Modulation Envelope Peak Excursion Ratio (dB)	Limit (dB)
5265	5.8	13
5300	8.8	13
5335	5.1	13
5740	4.5	13
5775	4.9	13
5810	5.8	13

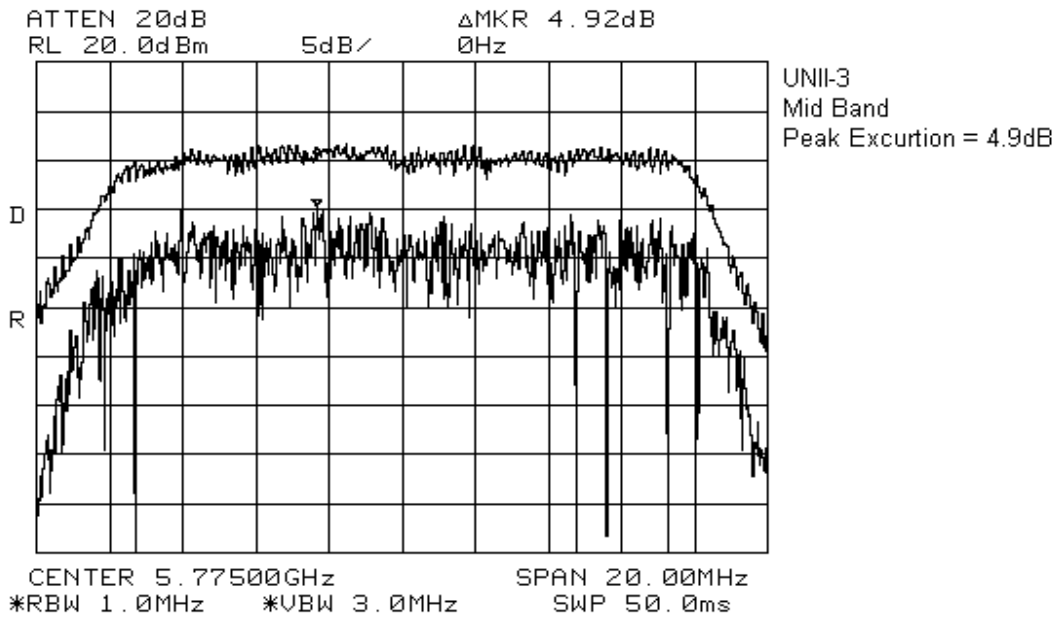
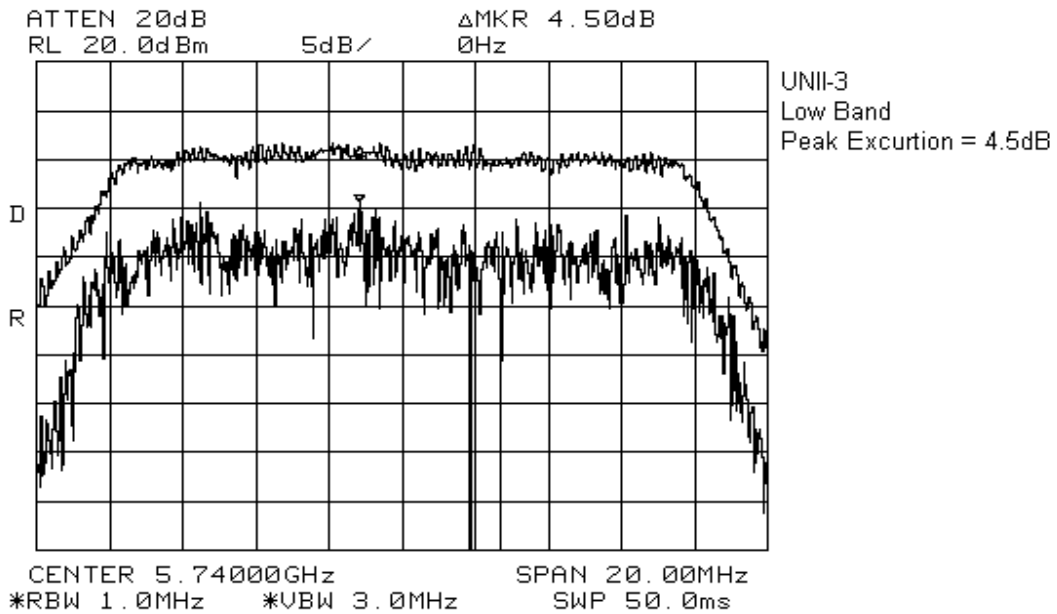
EQUIPMENT: BEL20001

U-NII 2



EQUIPMENT: BEL20001

U-NII 3



EQUIPMENT: BEL20001

Section 9. Undesirable Emissions

Para. No.: 15.407(b)(2)

Test Performed By: Glen Westwell	Date of Test: 22 Dec. 2003
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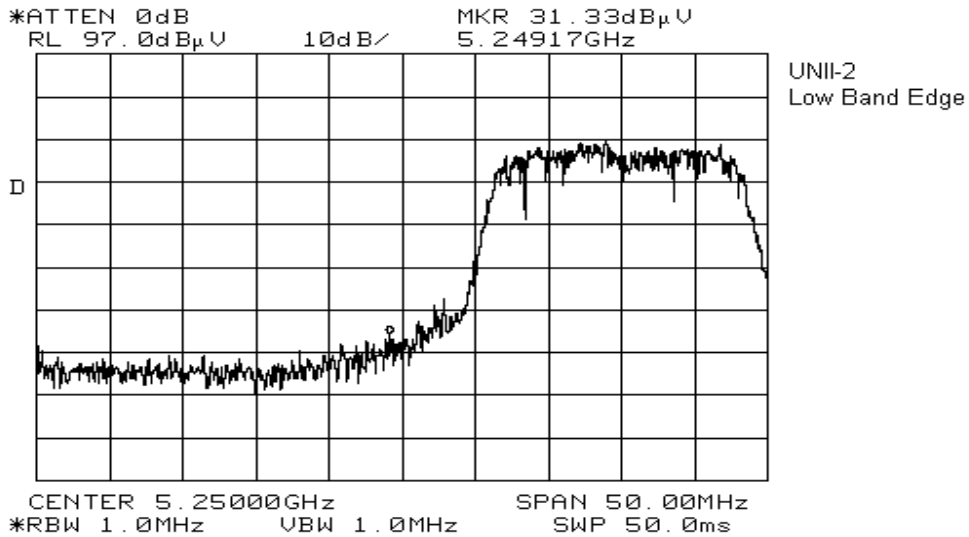
Test Results: Complies

Measurement Data: See attached plots and table.

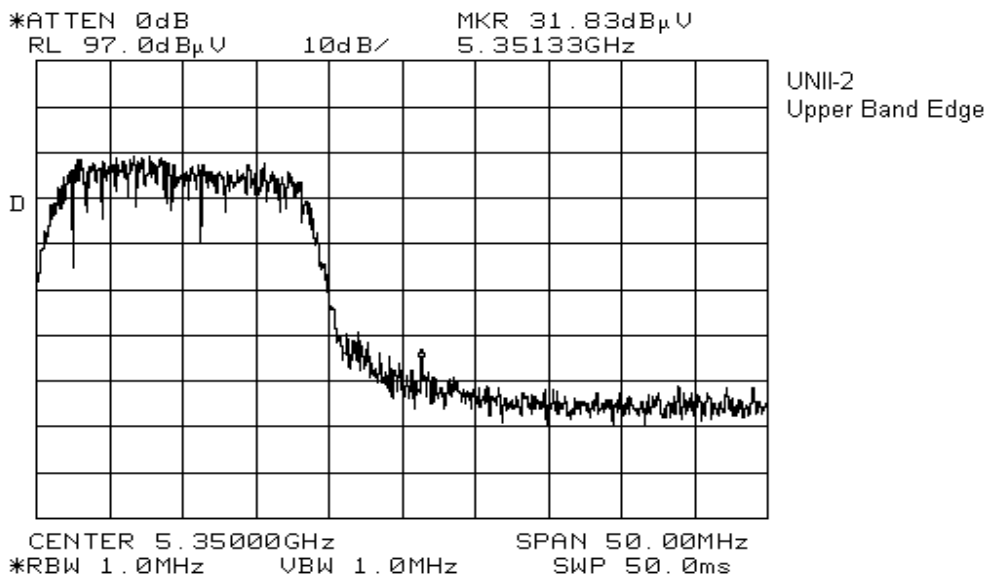
- Emissions were searched for all possible configurations. Worst case data has been presented.
- The DUT was searched from 30MHz to the 10th harmonic. Only those emissions within 20dB of the limit were reported.
- Bandedge emissions were measured at the lowest and highest operating frequencies.
- The power supply source was varied +/-15% to verify worst case emissions.
- Where necessary radiated emissions search were performed at 1 meter to achieve receiver sensitivity.

EQUIPMENT: BEL20001

Band Edge Level (dBuV)	Signal Substitution Level (dBm)	Antenna Gain (dBi)	Emission Power Level (dBm)	Limit (dBm)
31.3dBuV	-41.3	10.8	-30.5	-27.0

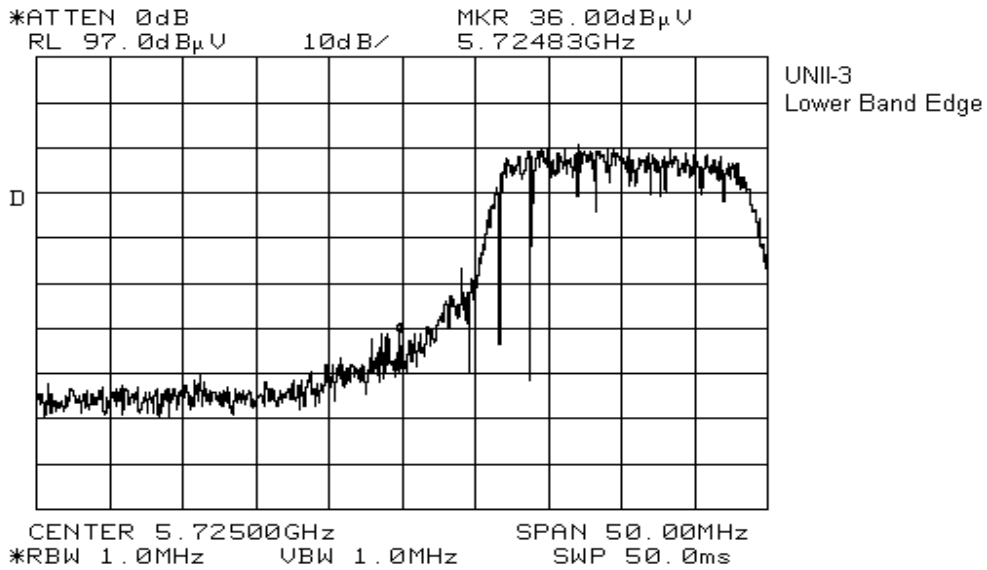


Band Edge Level (dBuV)	Signal Substitution Level (dBm)	Antenna Gain (dBi)	Emission Power Level (dBm)	Limit (dBm)
31.8dBuV	-41.8	10.8	-31.0	-27.0

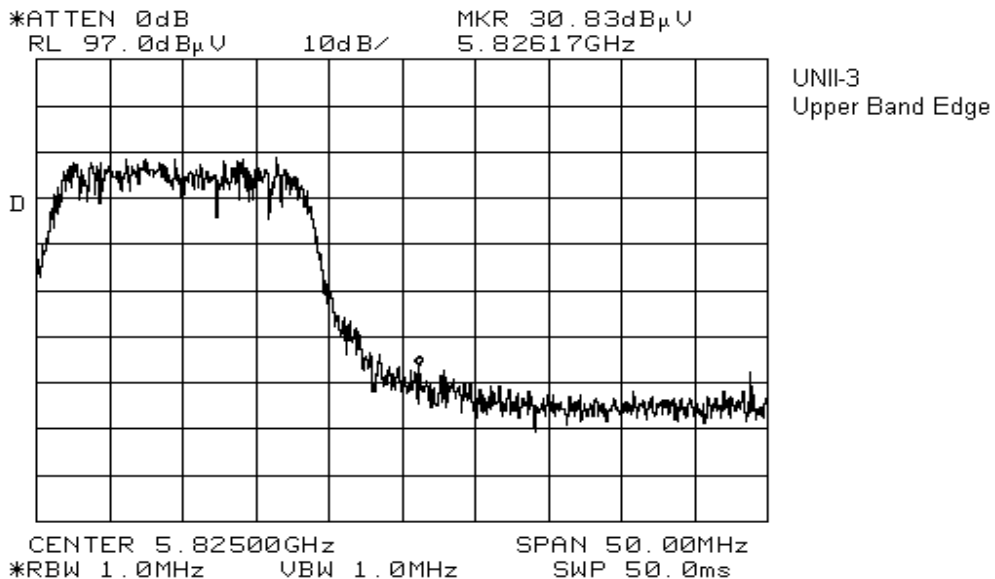


EQUIPMENT: BEL20001

Band Edge Level (dBuV)	Signal Substitution Level (dBm)	Antenna Gain (dBi)	Emission Power Level (dBm)	Limit (dBm)
36.0dBuV	-37.0	10.8	-26.2	-17.0



Band Edge Level (dBuV)	Signal Substitution Level (dBm)	Antenna Gain (dBi)	Emission Power Level (dBm)	Limit (dBm)
30.8dBuV	-41.0	10.8	-30.2	-17.0



EQUIPMENT: BEL20001

Radiated Disturbance Test Data:

Test Date: December 15, 2003 and December 22, 2003											
Engineer's Name: Andrew Roberts and David Duchesne											
Temperature (C°): -7						Humidity %: 86					
Tested as per: Table Top											
Test Distance (meters): 3						Dome: 1					
Freq. (MHz)	Ant.	Pol. V/H	RCVD Signal (dBµV)	Ant. Factor (dB)	Amp. Gain (dB)	Cable Loss (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Amp.
197.9968	BC1	V	7.8	14.2	N/A	1.7	23.7	43.5	19.8	Q-Peak	N/A
249.9956	BC1	V	10.6	16.7	N/A	2.0	29.3	46.0	16.7	Q-Peak	N/A
249.9956	BC1	H	14.1	15.7	N/A	2.0	31.8	46.0	14.2	Q-Peak	N/A
285.7097	BC1	H	12.7	17.4	N/A	2.1	32.3	46.0	13.8	Q-Peak	N/A
299.9956	BC1	H	15.3	18.2	N/A	2.3	35.8	46.0	10.2	Q-Peak	N/A
319.9974	LP1	V	10.9	14.8	N/A	2.3	28.0	46.0	18.0	Q-Peak	N/A
395.9935	LP1	V	12.8	16.1	N/A	2.6	31.5	46.0	14.5	Q-Peak	N/A
395.9935	LP1	H	17.9	16.2	N/A	2.6	36.7	46.0	9.3	Q-Peak	N/A
399.9912	LP1	V	21.5	16.3	N/A	2.6	40.4	46.0	5.6	Q-Peak	N/A
399.9912	LP1	H	19.5	16.3	N/A	2.6	38.4	46.0	7.6	Q-Peak	N/A
428.5644	LP1	V	17.8	16.4	N/A	2.7	36.9	46.0	9.1	Q-Peak	N/A
428.5644	LP1	H	12.4	16.5	N/A	2.7	31.6	46.0	14.4	Q-Peak	N/A
479.9974	LP1	V	14.8	17.8	N/A	2.8	35.4	46.0	10.6	Q-Peak	N/A
479.9974	LP1	H	15.5	18.1	N/A	2.8	36.4	46.0	9.6	Q-Peak	N/A
494.9923	LP1	V	11.3	18.0	N/A	2.9	32.2	46.0	13.9	Q-Peak	N/A
494.9923	LP1	H	10.6	19.0	N/A	2.9	32.5	46.0	13.5	Q-Peak	N/A
499.9916	LP1	V	17.7	17.9	N/A	2.9	38.5	46.0	7.5	Q-Peak	N/A
499.9916	LP1	H	16.3	19.0	N/A	2.9	38.2	46.0	7.8	Q-Peak	N/A
799.9841	LP1	V	16.4	21.8	N/A	3.7	41.9	46.0	4.1	Q-Peak	N/A
799.9841	LP1	H	15.9	22.5	N/A	3.7	42.1	46.0	3.9	Q-Peak	N/A
899.9841	LP1	V	10.0	22.8	N/A	4.0	36.8	46.0	9.2	Q-Peak	N/A
899.9841	LP1	H	9.5	23.6	N/A	4.0	37.1	46.0	8.9	Q-Peak	N/A
999.9799	LP1	V	15.2	24.4	N/A	4.2	43.8	54.0	10.2	Q-Peak	N/A
999.9799	LP1	H	14.0	25.9	N/A	4.2	44.1	54.0	9.9	Q-Peak	N/A
1000.0000	Horn2	V	57.0	25.0	45.7	2.9	39.2	54.0	14.7	Peak	1-2GHz
1000.0000	Horn2	H	59.0	25.0	45.7	2.9	41.2	54.0	12.7	Peak	1-2GHz
1040.0000	Horn2	V	60.0	25.2	46.0	3.0	42.1	54.0	11.8	Peak	1-2GHz
1040.0000	Horn2	H	60.0	25.2	46.0	3.0	42.1	54.0	11.8	Peak	1-2GHz
1100.0000	Horn2	V	53.0	25.4	46.5	3.1	35.0	54.0	19.0	Peak	1-2GHz
1100.0000	Horn2	H	59.0	25.4	46.5	3.1	41.0	54.0	13.0	Peak	1-2GHz
1200.0000	Horn2	V	52.0	25.8	46.5	3.1	34.4	54.0	19.6	Peak	1-2GHz
1200.0000	Horn2	H	57.0	25.8	46.5	3.1	39.4	54.0	14.6	Peak	1-2GHz
1280.0000	Horn2	V	45.0	26.1	46.5	3.2	27.8	54.0	26.2	Peak	1-2GHz
1280.0000	Horn2	H	43.0	26.1	46.5	3.2	25.8	54.0	28.2	Peak	1-2GHz
1360.0000	Horn2	V	48.0	26.4	46.6	3.3	31.1	54.0	22.9	Peak	1-2GHz
1360.0000	Horn2	H	46.0	26.4	46.6	3.3	29.1	54.0	24.9	Peak	1-2GHz
1520.0000	Horn2	V	48.0	27.0	45.9	3.3	32.4	54.0	21.6	Peak	1-2GHz
1520.0000	Horn2	H	46.0	27.0	45.9	3.3	30.4	54.0	23.6	Peak	1-2GHz
Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole											
Note 2: Detector Legend: Q-Peak = 120 kHz RBW, Average = 1.0 MHz RBW											
Notes:		None									

EQUIPMENT: BEL20001

Product Modifications:

To achieve compliance the following change(s) were made during compliance testing:

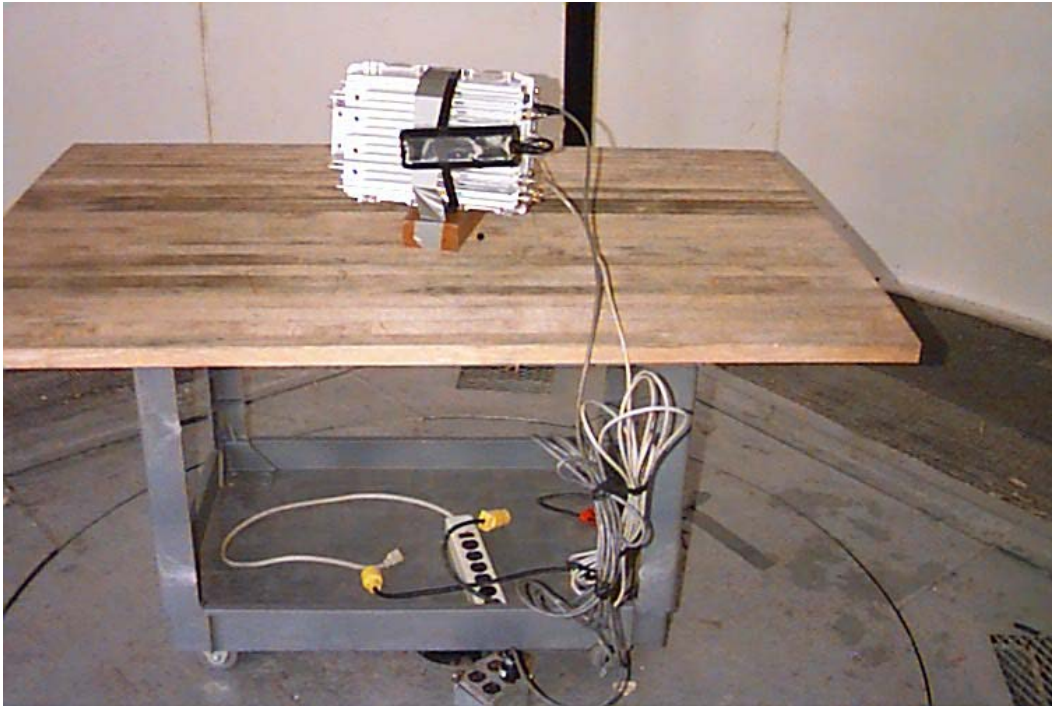
A clamp on ferrite bead (Steward P/N 28A2029-0A2) was added to the AC power cable.

Radiated Disturbance Results:

Final Test Result:		<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail
Were there deviations from the standard test procedure?		<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
If yes, document:			
Has rented equipment been used?		<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
If yes, document:			
Exercise Program: The mode used to exercise the various system components in a manner similar to typical use.		A 4 MB/s wireless link was established between a laptop PC with a 802.11b PCMCIA module and the EUT's access radio. Four 1 MB/s links were set up between the access radio and the backhaul radios and the controller. The backhaul radios were in idle, operating in beacon mode.	

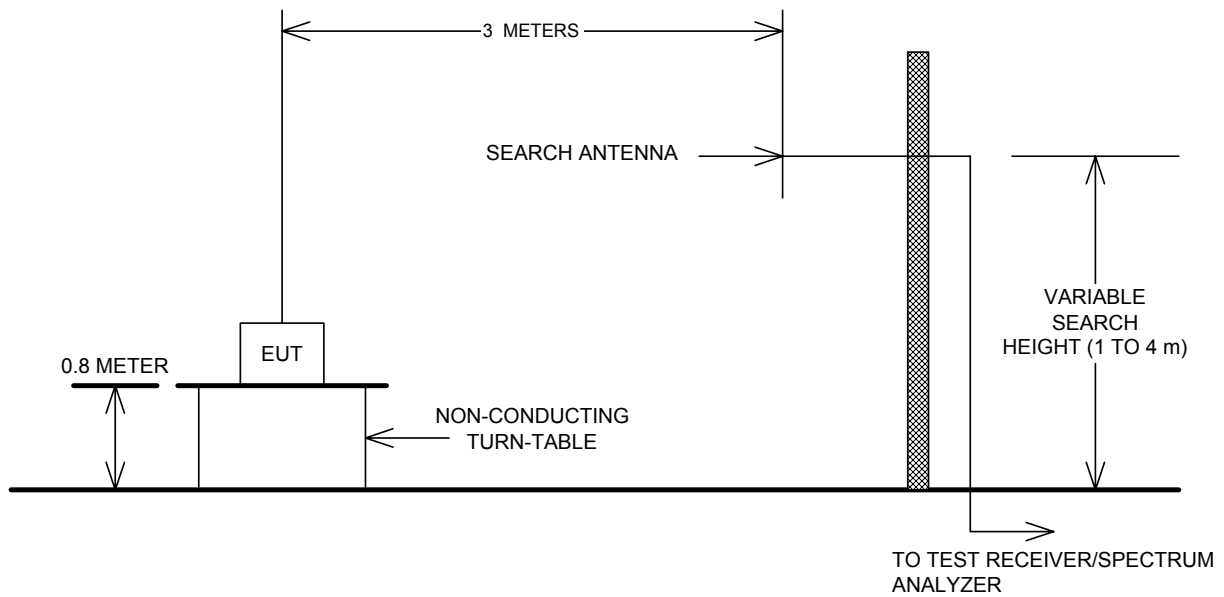
EQUIPMENT: BEL20001

Radiated Disturbance Detailed Setup Photos:

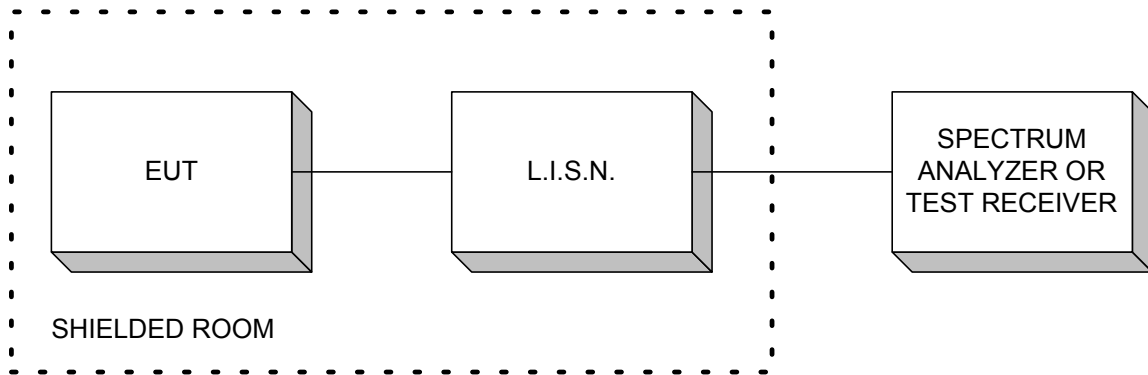


Section 10. Block Diagrams

Test Site For Radiated Emissions

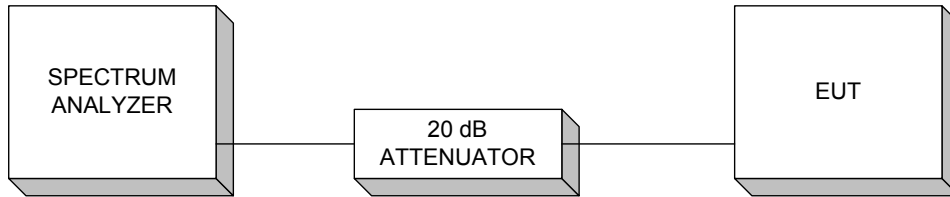


Conducted Emissions

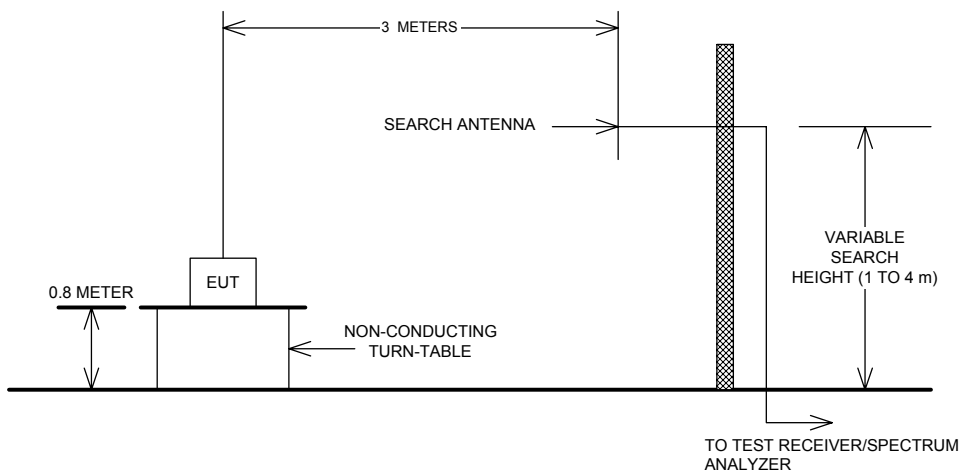


EQUIPMENT: BEL20001

Transmitter Power Density & Peak Power At Antenna Terminals Conducted Measurements



TIA/EIA 603, Signal Substitution Method



EQUIPMENT: BEL20001

Section 11. Test Equipment List

CAL Cycle	Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
1 Year	Spectrum Analyzer	Hewlett Packard	8564E	FA001367	13 May 03	13 May 04
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	03 Jul 03	03 Jul 04
3 Year	Signal Generator	Rhode & Schwarz	SMIQ03E	FA001269	06 Dec 02	06 Dec 05
1 Year	Power Meter	Hewlett Packard	E4418B	FA001413	08 May 03	08 May 04
1 Year	Power Sensor	Hewlett Packard	8487A	FA001419	15 May 03	15 May 04
1 Year	RF AMP	JCA	4-8 GHz	FA001497	18 June 03	18 June 04
1 Year	RF AMP	Narda	5 - 18GHz	FA001409	COU	COU
1 Year	Horn Antenna	EMCO #2	3115	FA000825	10 Dec 03	10 Dec 04
1 Year	Horn Antenna	EMCO #1	3115	FA000649	18 Dec 03	18 Dec 04
1 Year	Horn Antenna	EMCO #5	3116	FA001847	13 Feb 03	13 Feb 04
1 Year	Signal Generator	Hewlett Packard	8673B	FA001134	COU	COU
1 Year	High Pass Filter (9.6GHz)	Dorado	WR62	21-404	COU	COU
1 Year	Diplexer	Olsen - OML	DPL.26 (H.P)		COU	COU
1 Year	Mixer/Antenna 40-60Ghz	Olsen - OML	M19HWA (H.P.)		COU	COU

NA: Not Applicable
NCR: No Cal Required
COU: CAL On Use

Radiated Disturbance Test Equipment Used:

Equipment List - Radiated Emissions

CAL Cycle	Equipment	Manufacturer	Model No.	Asset/Serial No.	Last Cal.	Next Cal.
1 Year	Receiver	Rohde & Schwarz	ESVS-30	FA001437	July. 24/03	July. 24/04
1 Year	Spectrum Analyzer	Hewlett-Packard	8564E	FA001367	May. 13/03	May. 13/04
1 Year	Biconical (1) Antenna	EMCO	3109	FA000805	April. 15/03	April. 15/04
1 Year	Horn Antenna	EMCO #2	3115	FA000825	10 Dec 03	10 Dec 04
1 Year	Log Periodic Antenna #1	EMCO	LPA-25	FA000477	Sept. 02/03	Sept. 02/04
1 Year	1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	June. 18/03	June. 18/04
1 Year	2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	June. 18/03	June. 18/04
1 Year	4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	June. 18/03	June. 18/04

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use, OUT = Out For CAL/Repair