Test Report:	79546-1TRFWL
Applicant:	ShieldTech Systems, LLC 823 Hollywood Blvd Crownsville, Maryland 21032 USA
Apparatus:	SnapLink (M/N: SL-24-U)
FCC ID:	U4Z-SL24U
In Accordance With:	FCC Part 15 Subpart C, 15.249 Operation in the 902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz and 24.0-24.25 GHz
Tested By:	Nemko Canada Inc. 303 River Road Ottawa, Ontario K1V 1H2
Authorized By:	 Sim Jagpal, Resource Manager
Date:	May 28, 2007
Total Number of Pages:	23

Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed: SnapLink (M/N: SL-24-U)

Specification: FCC Part 15 Subpart C, 15.249

Compliance Status: Complies

Exclusions: None

Non-compliances: None

Report Release History: Original Release

Author: Jason Nixon, Telecom Specialist

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

TABLE OF CONTENTS

Section 1 : Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows:

SnapLink (M/N: SL-24-U)

1.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No.	Description	Serial No.
1	SnapLink poit-to-point radio	None
7	Switching AC Adaptor (M/N: PSA31U-480)	C22500162A2

The first samples were received on: January 11, 2007

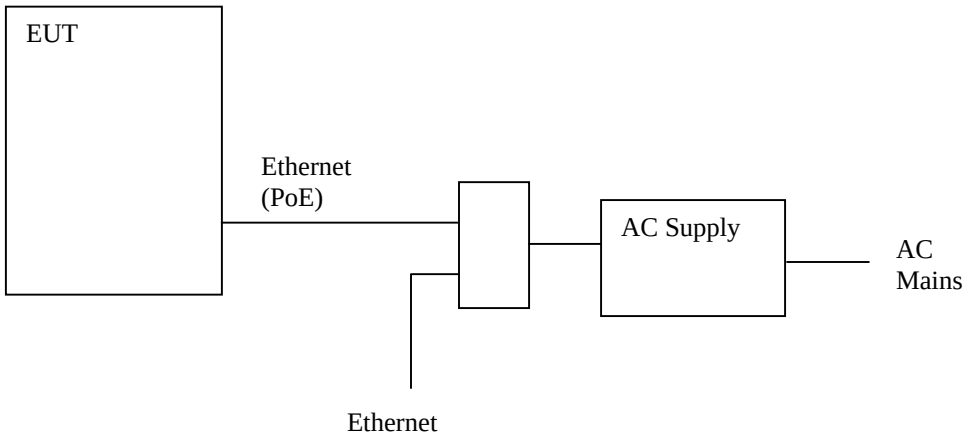
1.3 Theory of Operation

The EUT is a 24GHz point-to-point radio that uses 802.11 modulations.

1.4 Technical Specifications of the EUT

Operating Frequency:	24112 to 24162MHz
Emission Designator	G1D, W7D
Modulation:	802.11b/g
Antenna Data:	34dBi integral antenna
Power Source:	48VDC, power of ethernet

1.5 Block Diagram of the EUT



Section 2 : Test Conditions

2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.249
Operation in the 902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz and 24.0-24.25 GHz bands

2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

2.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15 – 30 ºC
Humidity range	:	20 - 75 %
Pressure range	:	86 - 106 kPa
Power supply range	:	+/- 5% of rated voltages

2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next Cal.
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU	FA002043	Oct. 24/07
LISN	Rohde & Schwarz	ENV216	FA002023	Aug. 28/07
International Power Supply	California Inst.	3001i	FA001021	Jan. 09/08
Spectrum Analyzer	Rohde & Schwarz	FSP	FA001920	March 17/07
Spectrum Analyzer	Hewlett-Packard	8565E	FA000981	Oct. 06/07
Horn Antenna #1	EMCO	3115	FA000649	Jan. 12/07
18.0 – 40.0GHz Horn Antenna	EMCO	3116	FA001847	May 3/07
1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	Aug. 02/07
2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	Aug. 02/07
4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	Aug. 02/07
5.0 – 18.0 GHz Amplifier	NARDA	DWT-186N23U40	FA001409	COU
18.0 – 26.0 GHz Amplifier	NARDA	BBS-1826N612	FA001550	COU
26 – 40.0 GHz Amplifier	NARDA	DBL-2640N610	FA001556	COU
Biconical (1) Antenna	EMCO	3109	FA000805	May 03/07
Log Periodic Antenna #1	EMCO	LPA-25	FA000477	Sept. 12/07
Temperature Chamber	Thermotron	SM-16C	FA001030	NCR
Fluke	Multimeter	16	FA001831	Jan 10/08
Fluke	Air probe	None	FA001248	NCR
Mixer/Antenna (40-60GHz)	Olsen	M19HWA	FA001523	VOU
Mixer/Antenna (60-90GHz)	Olsen	M12HWA	FA001524	VOU
Mixer/Antenna (90-140GHz)	Olsen	M08HWA	FA001296	VOU

COU – Calibrate on Use
NCR – No Calibration Required
VOU – Verified on Use

Section 3 : Observations

3.1 Modifications Performed During Assessment

No modifications were performed during assessment.

3.2 Record Of Technical Judgements

No technical judgements were made during the assessment.

3.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

3.4 Test Deleted

No Tests were deleted from this assessment.

3.5 Additional Observations

There were no additional observations made during this assessment.

Section 4 : Results Summary

This section contains the following:

FCC Part 15 Subpart C : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N	No : not applicable / not relevant.
Y	Yes : Mandatory i.e. the apparatus shall conform to these tests.
N/T	Not Tested, mandatory but not assessed. (See section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

4.1 FCC Part 15 Subpart C : Test Results

Part 15	Test Description	Required	Result
15.31(e)	Variation of power supply	Y	PASS
15.207(a)	Powerline Conducted Emissions	Y	PASS
15.209(a)	Radiated Emissions within Restricted Bands	Y	PASS
15.215(c)	20dB Bandwidth	Y	PASS
15.249(a)	Radiated emissions not in Restricted Bands	Y	PASS
15.249(b)	Fixed Point-to-Point operation in the 24.0-24.25 GHz Band	Y	PASS
15.249(d)	Spurious emissions (except Harmonics)	Y	PASS

Notes:

Appendix A : Test Results

Clause 15.207(a) Conducted Emissions

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBµV) Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Conditions:

Sample Number:	1	**Temperature (°C):**	23
Date:	May 1, 2007	**Humidity (%):**	21
Modification State:	0	**Tester:**	Jason Nixon
		Laboratory:	Shielded Room

Test Results: See Attached Plots and Table.

Additional Observations:

All Plots were taken with a 9kHz RBW and have been corrected with the cable and LISN losses to show compliance.

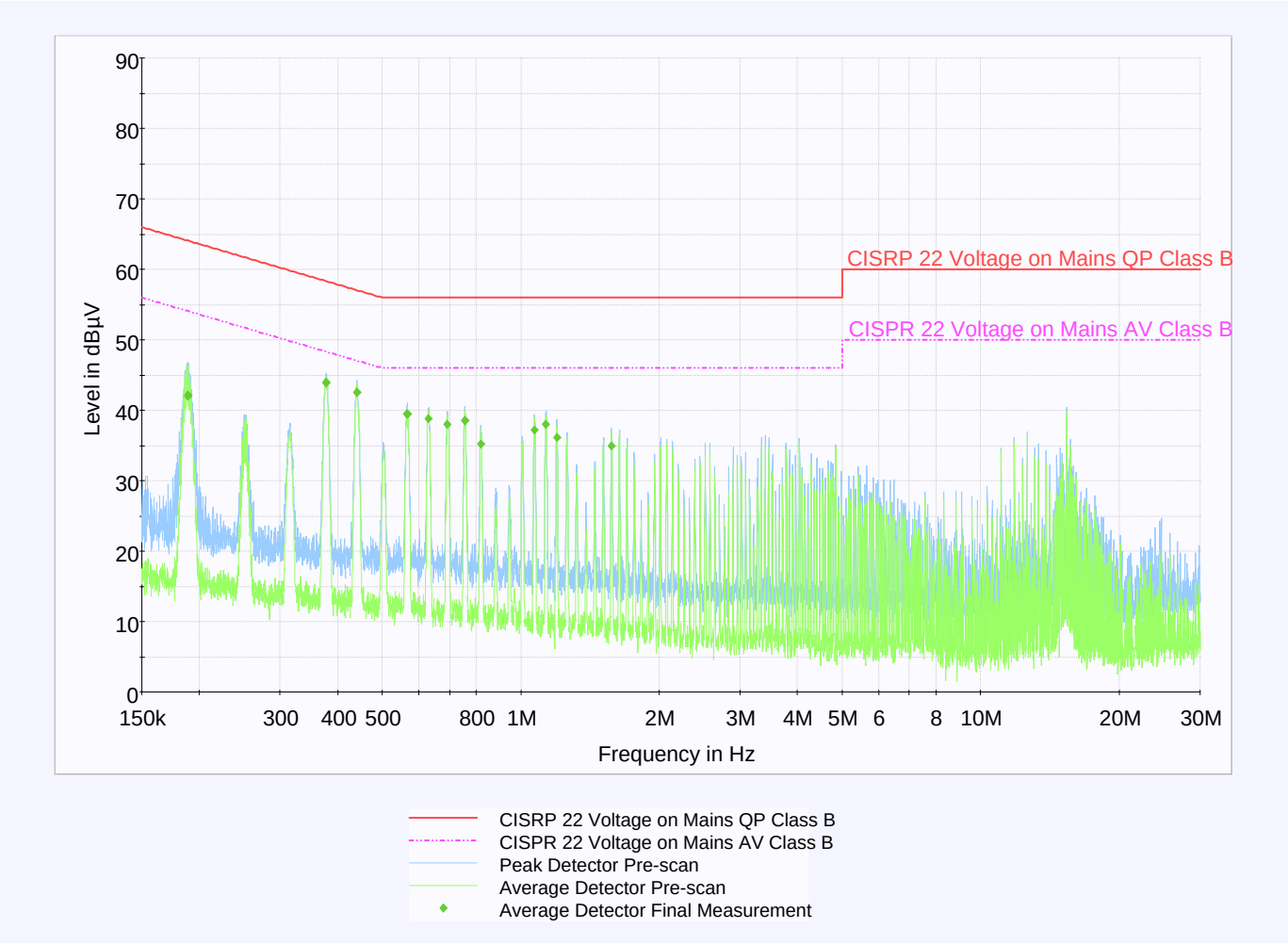
Average Detector Final Measurements

Frequency (MHz)	Line	Cable/LISN Loss (dB)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)
0.188548	N	10.06	41.26	54.10	12.80
0.188755	N	10.06	41.31	54.09	12.80
0.188772	N	10.06	41.29	54.09	12.80
0.188938	N	10.06	41.25	54.08	12.80
0.377560	N	9.87	43.09	48.33	5.20
0.378033	N	9.87	42.92	48.32	5.40
0.440598	N	9.90	42.44	47.05	4.70
0.440851	N	9.90	42.34	47.05	4.70
0.565915	N	9.93	38.61	46.00	7.40
0.566930	N	9.93	38.51	46.00	7.50
0.629304	N	9.93	37.96	46.00	8.00
0.691486	N	9.93	37.09	46.00	8.90
0.754197	N	9.99	37.57	46.00	8.40
0.754858	N	9.99	37.74	46.00	8.30
0.818084	N	10.01	34.31	46.00	11.70
1.068980	N	9.88	36.33	46.00	9.70
1.132992	N	9.88	36.91	46.00	9.10
0.188841	L1	10.08	42.07	54.09	12.00
0.188858	L1	10.08	42.08	54.09	12.00
0.189063	L1	10.08	42.04	54.08	12.10
0.377158	L1	9.89	43.90	48.34	4.40
0.377278	L1	9.89	43.98	48.34	4.30
0.440826	L1	9.91	42.54	47.05	4.50
0.441039	L1	9.91	42.51	47.04	4.50
0.565915	L1	9.93	39.45	46.00	6.60
0.566363	L1	9.93	39.44	46.00	6.60
0.628605	L1	9.93	38.76	46.00	7.20
0.691486	L1	9.93	38.00	46.00	8.00
0.754858	L1	9.99	38.56	46.00	7.40
0.755683	L1	9.99	38.47	46.00	7.50
0.818060	L1	10.01	35.25	46.00	10.70
1.068957	L1	9.90	37.17	46.00	8.80
1.132968	L1	9.90	37.99	46.00	8.00
1.197069	L1	9.90	36.10	46.00	9.90
1.571948	L1	9.90	34.94	46.00	11.10

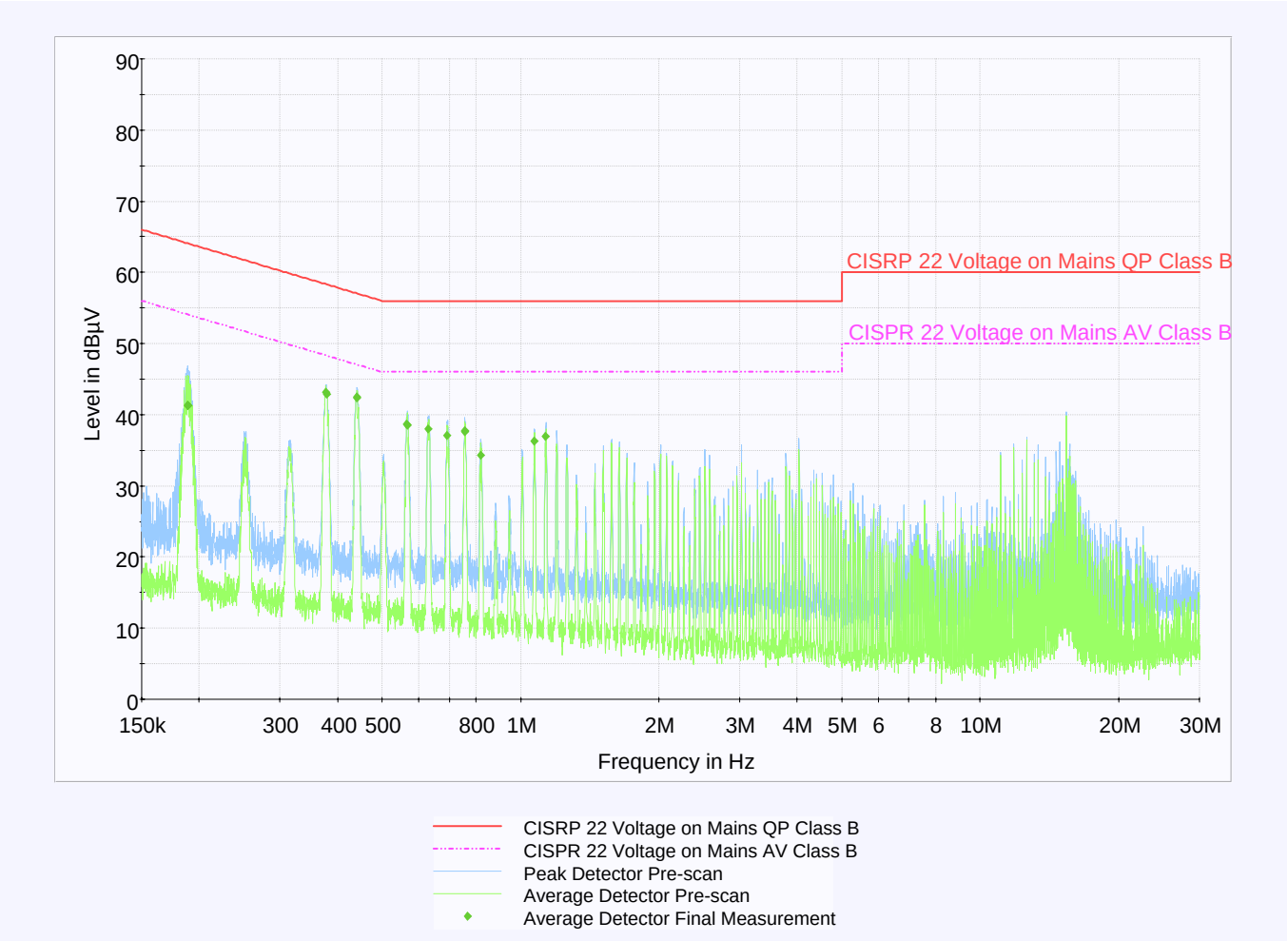
Note:

Emission level includes cable/LISN losses.

Phase conductor



Neutral conductor



Clause 15.209(a) Radiated Emissions within Restricted Bands

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvoltsmeter)	Measurement Distance (meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Conditions:

Sample Number:	1	**Temperature (°C):**	23
Date:	May 28, 2007	**Humidity (%):**	42
Modification State:	0	**Tester:**	Jason Nixon
		Laboratory:	Wireless

Test Results:

See Attached Table for Results

Additional Observations:

The Spectrum was searched from 30MHz to the 10th Harmonic.

These results apply to emissions found in the Restricted bands defined in FCC Part 15 Subpart C, 15.205.

Measurements were performed at 3m with a peak detector using an RBW/VBW of 1MHz**.**

Freq. (MHz)	Ant	Pol. V/H	RCVD Signal (dBµV)	Ant. Factor (dB)	Amp. Gain/Cable Loss (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)
10850.000	Horn1	H	49.3	38.7	35.0	53.0	54	1.0

Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole
Note 2: Positive Peak detector used

Clause 15.215(c) 20dB Bandwidth

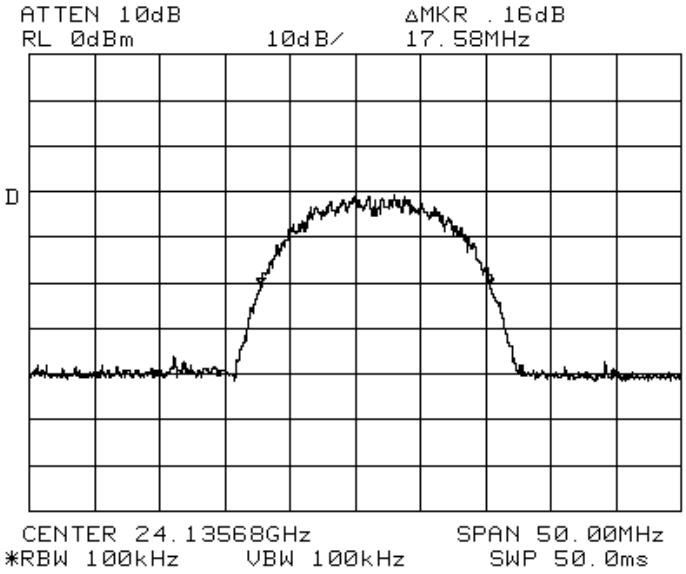
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Conditions:

Sample Number:	1	**Temperature (°C):**	24
Date:	January 18, 2007	**Humidity (%):**	13
Modification State:	0	**Tester:**	Jason Nixon
		Laboratory:	Wireless

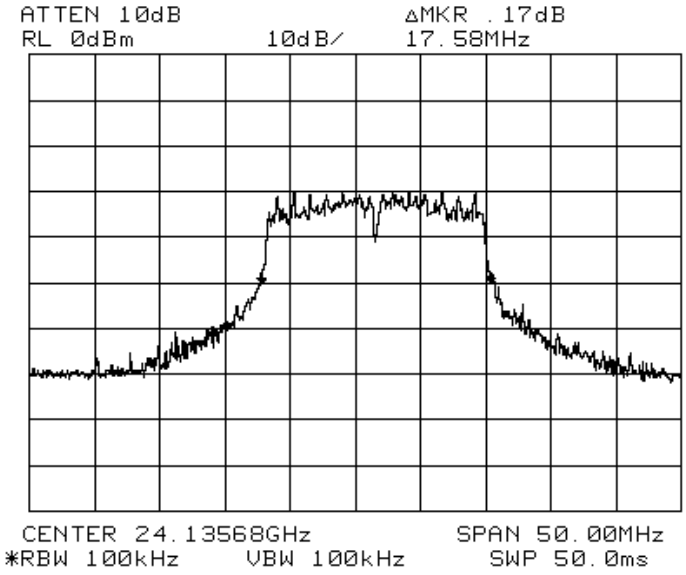
Test Results: See Attached Plots.

20dB Bandwidth 802.11b Mode:



20dB Bandwidth
802.11b mode

20dB Bandwidth 802.11g Mode:



20dB Bandwidth
802.11g mode

Clause 15.249(b) Fixed Point-to-Point operation in the 24.0-24.25 GHz Band

Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.

(2) The frequency tolerance of the carrier signal shall be maintained within +/- 0.001% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(3) Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

Test Conditions:

Sample Number:	1	**Temperature (°C):**	24
Date:	January 11, 2007	**Humidity (%):**	11
Modification State:	0	**Tester:**	Jason Nixon
		Laboratory:	Wireless

Test Results:

Field Strength

Freq. (MHz)	Ant	Pol. V/H	RCVD Signal (dBµV)	Ant. Factor (dB)	Amp Gain (dB)	Cable Loss (dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
24112.000	18-40GHz Horn	V	58.3	46.1	0.0	4.5	109.0	128.0	19.0
24112.000	18-40GHz Horn	H	69.7	45.1	0.0	4.5	119.3	128.0	8.7
24140.000	18-40GHz Horn	V	60.3	46.2	0.0	4.5	111.0	128.0	17.0
24140.000	18-40GHz Horn	H	72.0	45.2	0.0	4.5	121.7	128.0	6.3
24162.000	18-40GHz Horn	V	59.7	46.2	0.0	4.5	110.3	128.0	17.7
24162.000	18-40GHz Horn	H	72.0	45.2	0.0	4.5	121.7	128.0	6.3

Note 1: Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole
Note 2: Positive Peak detector used

Level = RCVD Signal + Ant Factor – Amp Gain + Cable loss

Additional Observations:

Measurements were performed at 3m with a peak detector using an RBW/VBW of 1MHz**.**

The spectrum was searched from 30MHz to 100GHz and no harmonic emissions were found within 20dB below the limit.

Frequency tolerance

Condition	Frequency (Hz)	Offset (ppm)
+50°C, Nominal	24133748313	0.02
+40°C, Nominal	24133746500	-0.05
+30°C, Nominal	24133744813	-0.12
+20°C, +15%	24133746313	-0.06
+20°C, Nominal	24133747813	———
+20°C, -15%	24133745687	-0.09
+10°C, Nominal	24133743187	-0.19
0°C, Nominal	24133751625	0.16
-10°C, Nominal	24133709750	-1.58
-20°C, Nominal	24133734687	-0.54

Condition: Temperature, Supply voltage

The nominal supply voltage is –48VDC.

Clause 15.249(d) Spurious emissions (except Harmonics)

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

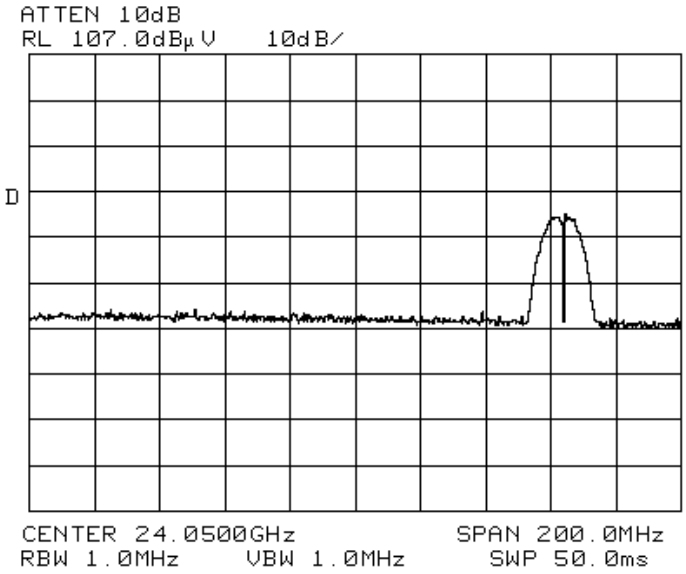
Test Conditions:

Sample Number:	1	**Temperature (°C):**	24
Date:	January 11, 2007	**Humidity (%):**	13
Modification State:	0	**Tester:**	Jason Nixon
		Laboratory:	Wireless

Test Results: See attached plots

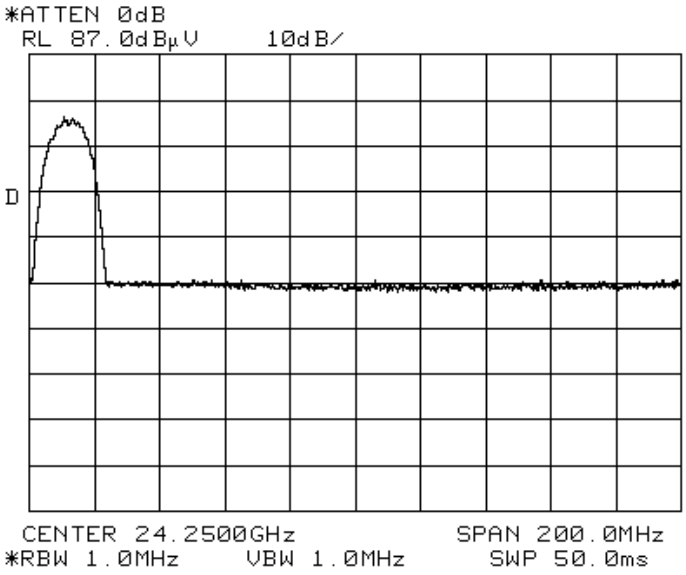
No emissions were detected within 20dB below the limit.

Lower bandedge



Lower bandedge

Upper bandedge

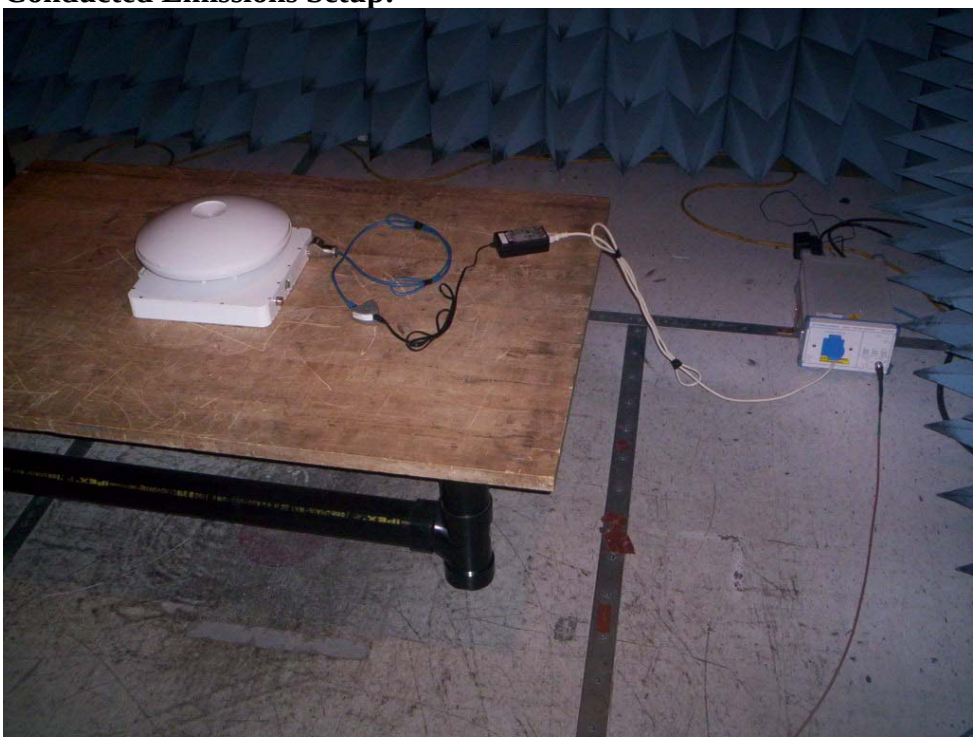


Upper Bandedge

Appendix B : Setup Photographs

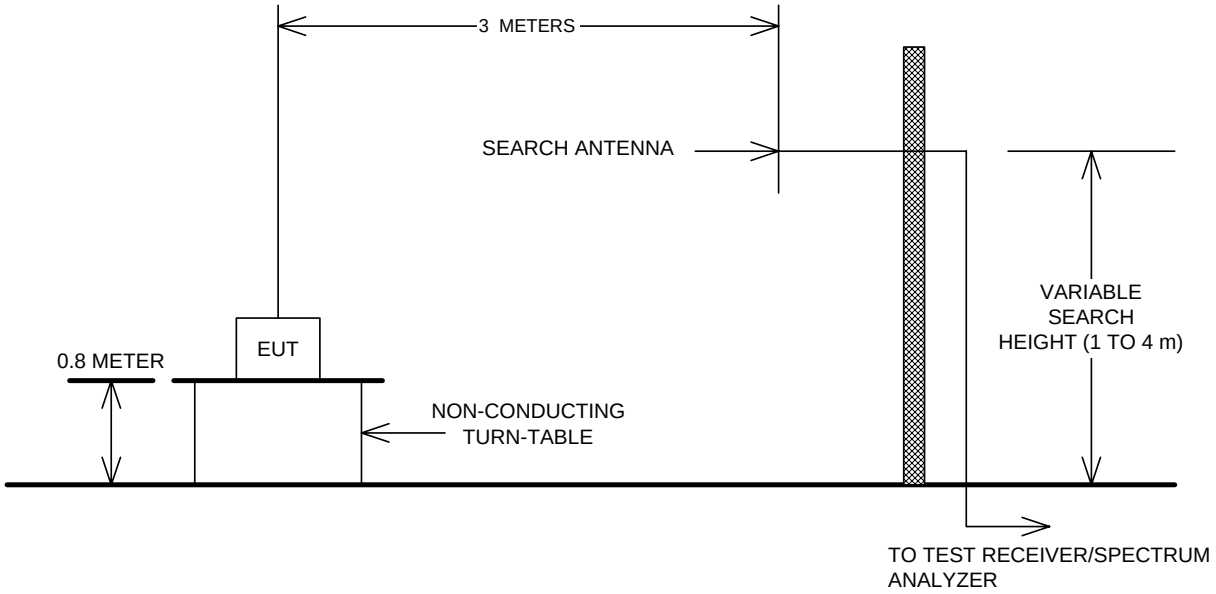
Spurious Emissions Setup:

Conducted Emissions Setup:

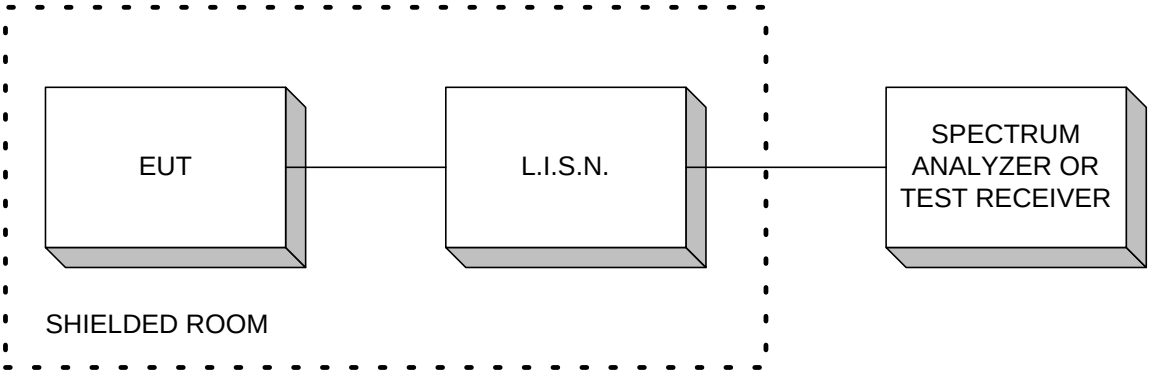


Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Emissions



Frequency stability