



Test Report: 6W70104.2 Issue 2

Applicant: BelAir Networks Inc.,
603 March Road,
Ottawa, ON
K2K 2M5

Apparatus: BRM 3 & ASM-E

FCC ID: RAR20005004

In Accordance With: FCC Part 15 Subpart C, 15.247
FHSS System and Digitally Modulated Radiators
902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz

Tested By: Nemko Canada Inc.
303 River Road
Ottawa, Ontario
K1V 1H2

Authorized By: 
Jason Nixon, Telecom Specialist

Date: January 2, 2007

Total Number of Pages: 35

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:	BRM 3 & ASM-E
Specification:	FCC Part 15.247, Subpart C
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Issue 2 – Updated FCC ID

Author: Xu Jin, Wireless 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.

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Section 1: Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows:
BRM 3 & ASM-E

1.2 Samples Submitted for Assessment

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

Sample No.	Description	Serial No.
1	SCM	K000625766
2	BRM3 North America	K001665360
3	ASM-E	K001252349
4	15dBi Belair Directional Antenna	203-B

The first samples were received on: July.11, 2006

1.3 Technical Specifications of the EUT

Manufacturer:	BelAir Networks Inc.
Frequency Band	5725MHz-5850MHz
Operation Frequency	5740MHz-5835MHz
Rated Output Power:	20dBm*
Emission Designator	16M4G1W
Modulation:	802.11 a
Antenna Data:	15dBi BelAir Directional Antenna
Antenna Connector:	SMA

* Manufacture's rated power is average power measured using a wide band power meter with a thermocouple detector.

Section 2 : Test Conditions

2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 15 Subpart C, 15.247

FHSS System and Digitally Modulated Radiators

902-928MHz, 2400 - 2483.5 MHz, 5725-5850MHz

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 °C
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.
Spectrum Analyzer	Rohde & Schwarz	FSU	FA001877	May 10/07
Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	May 16/07
Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	May 16/07
Biconical (1) Antenna	EMCO	3109	FA000805	May 03/07
Log Periodic Antenna #2	EMCO	3148	FA001355	May 16/07
Horn Antenna #2	EMCO	3115	FA000825	Dec. 16/06
18.0 – 40.0GHz Horn Antenna	EMCO	3116	FA001847	May 03/07
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 - 18GHz 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
Power Meter	HP	4418B	FA001678	May 16/07
Power Probe	HP	8487A	FA001741	May 22/07
LISN	EMCO	4825/2	FA001545	Jan 30/07
Transient Limiter	Hewlett-Packard	1194 7A	FA000975	May 18/07

* COU (Calibrate on Use)

Section 3: Observations

3.1 Modifications Performed During Assessment

In power line conducted emissions test, four ferrite cores (Steward 28H5776-OA2, HFA187102-OA2, HFA259137-OB2, 28A2093-OA2) have been added on the power supply cord in order that power conducted emissions did not exceed the limit.

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.

Section 4 : Results Summary

This section contains the following:

FCC Part 15.247, Subpart C: Test Result

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, 15.247: Test Results

Section	Clause	Test Description	Required	Result
1	15.207(a)	Power-line Conducted Emissions	Y	PASS
2	15.247(a)(2)	6dB Bandwidth	Y	PASS
3	15.247(b)(3)	Output Power	Y	PASS
4	15.247(c)	Spurious Emissions	Y	PASS
5	15.247(d)	Peak Power Spectral Density	Y	PASS
6	15.31(e)	Supply Voltage Variation	Y	PASS

Appendix A: Test Results

Section 1. Power Line Conducted Emissions

Criteria: Clause 15.207(a)

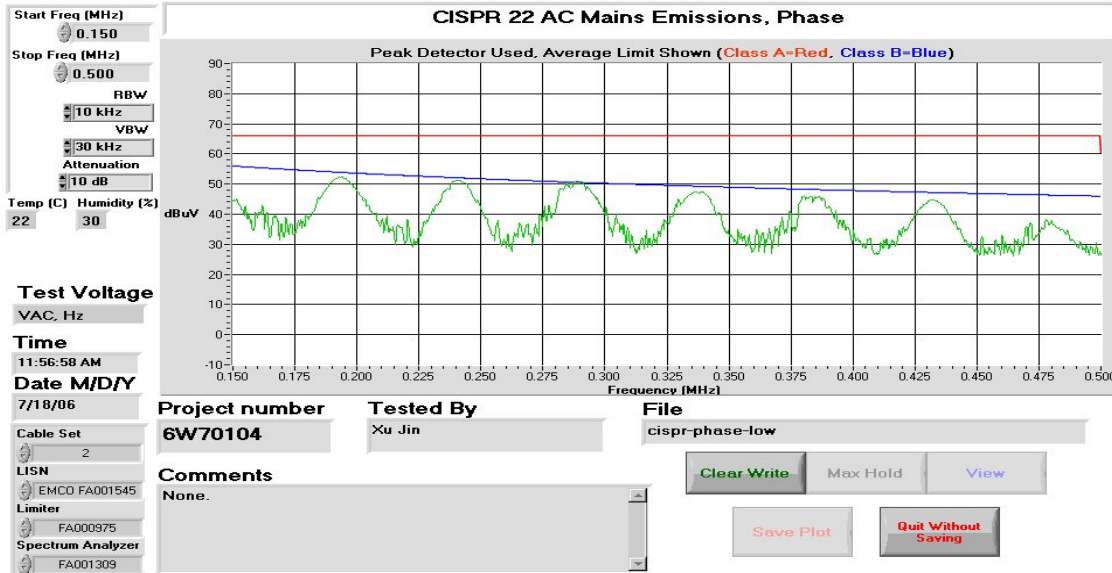
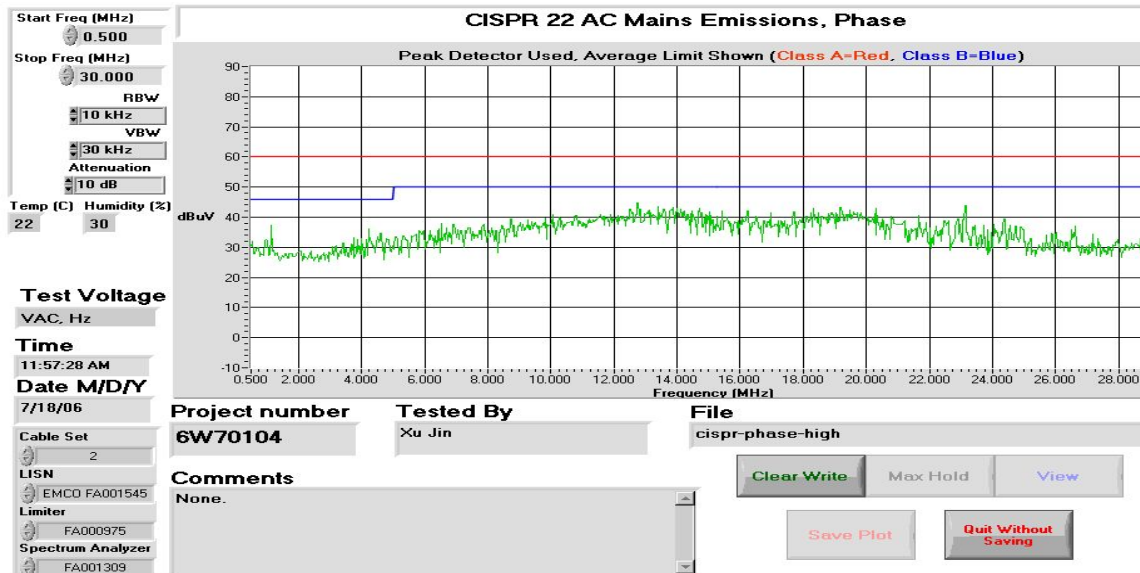
Frequency of Conducted limit (dB μ V)		
Emission (MHz)	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

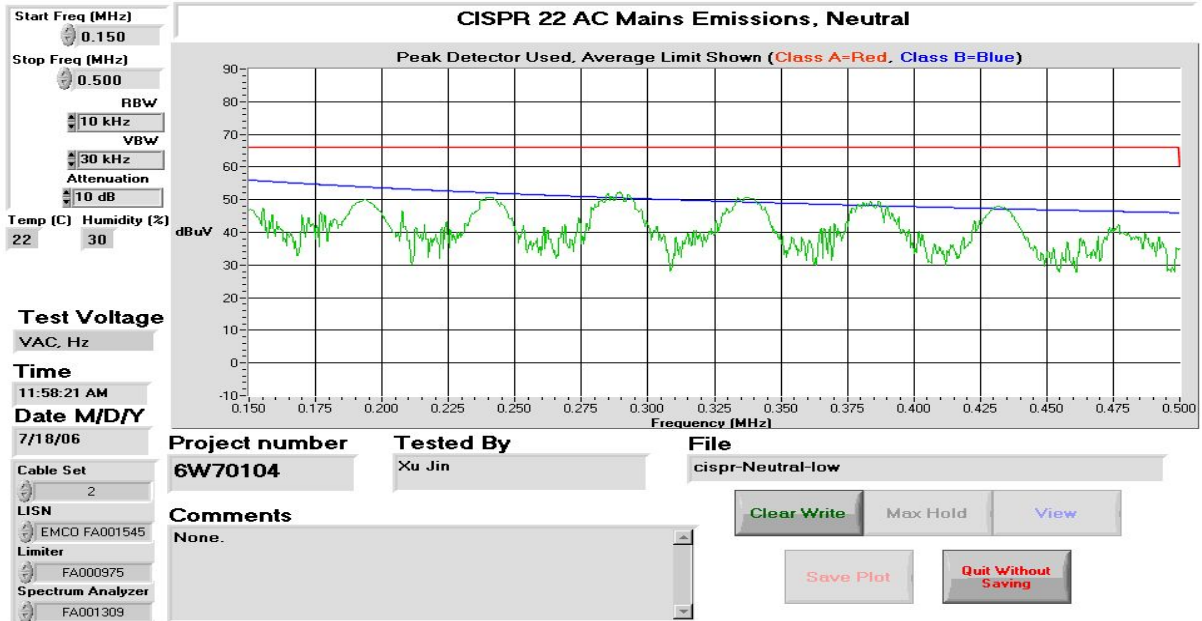
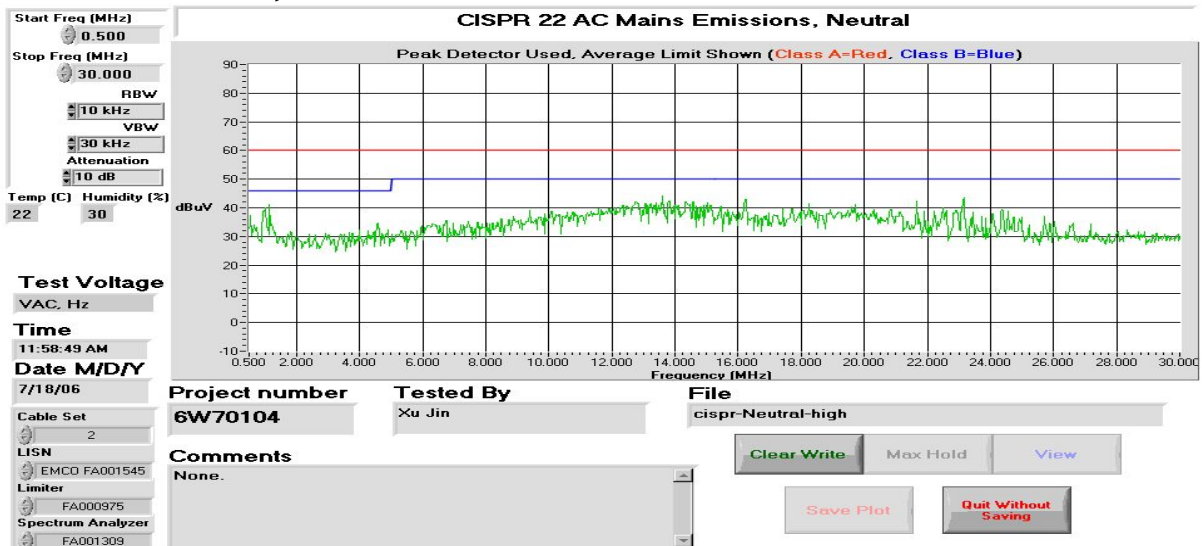
Test Conditions:

Sample Number:	1,2,3	Temperature:	22 °C
Date:	July.18, 2006	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Results: Complies

Test Data: See Attached Plots and Tables.

Conducted Disturbance at Mains, Plots**Phase, 0.150 – 0.500 MHz****Phase, 0.500 – 30 MHz**

Conducted Disturbance at Mains Plots, continued**Neutral, 0.150 – 0.500 MHz****Neutral, 0.500 – 30 MHz**

Test Date: July. 18, 2006								
Engineer's Name: Xu Jin								
Tested as per: Table Top								
Mains Input Voltage: 120VAC					Mains Input Frequency: 60Hz			
Port Investigation Data								
Port under test: AC Mains Input								
Conductor	Frequency (MHz)	Detector	Emission Level (dBuV)	LISN Loss (dB)	Cable Loss (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
Phase	0.1931	Quasi Peak	50.7	0.00	0.19	50.89	63.9	13.0
		Average	45.2	0.00	0.19	45.39	53.9	8.5
	0.2410	Quasi Peak	48.8	0.00	0.20	49.00	62.1	13.1
		Average	42.8	0.00	0.20	43.00	52.1	9.1
	0.2886	Quasi Peak	48.8	0.00	0.20	49.00	60.6	11.6
		Average	45.0	0.00	0.20	45.20	50.6	5.4
Neutral	0.2400	Quasi Peak	48.4	0.00	0.20	48.60	62.1	13.5
		Average	41.9	0.00	0.20	42.10	52.1	10.0
	0.2858	Quasi Peak	49.7	0.00	0.20	49.90	60.6	10.7
		Average	46.4	0.00	0.20	46.60	50.6	4.0
	0.3390	Quasi Peak	46.0	0.00	0.20	46.20	59.2	13.0
		Average	43.4	0.00	0.20	43.60	49.2	5.6
	0.3831	Quasi Peak	45.9	0.00	0.20	46.10	58.2	12.1
		Average	36.9	0.00	0.20	37.10	48.2	11.1
0.4321	Quasi Peak	46.6	0.00	0.20	46.80	57.2	10.4	
	Average	46.0	0.00	0.20	46.20	47.2	1.0	
Notes								
None								
Test Result								
Final Test Result: Pass								

Section 2. 6dB Bandwidth**Criteria: Clause 15.247(a)**

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Conditions:

Sample Number:	1,2, 3	Temperature:	22 °C
Date:	Aug. 30, 2006	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

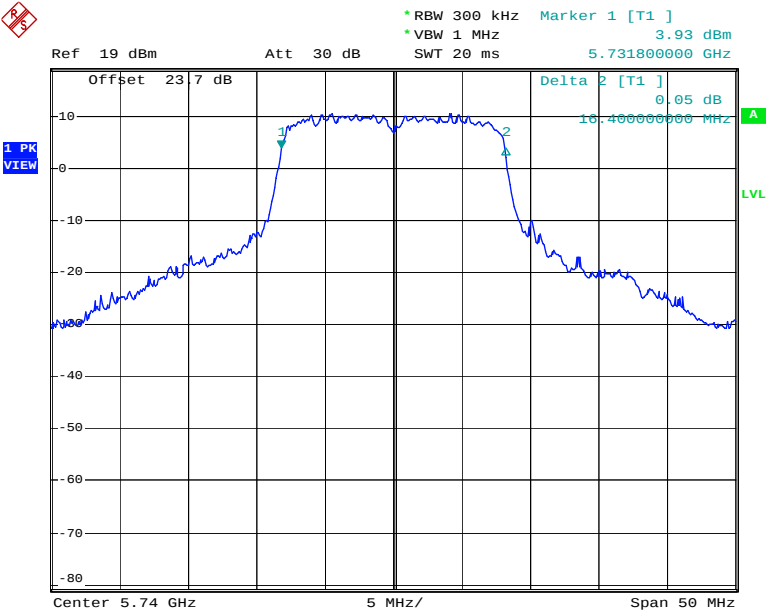
Test Results: Complies

Test Data: See attached table and graphics

6dB Occupied Bandwidth (MHz)

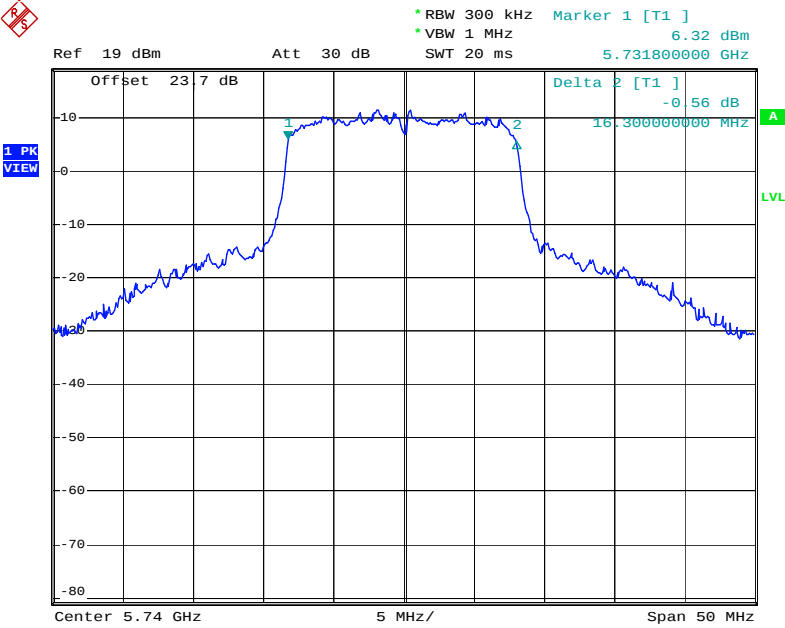
Frequency (MHz)	6 Mb/s	54 Mb/s
5740	16.4	16.3
5790	16.4	16.4
5835	16.3	16.4

5740MHz-6Mb/s



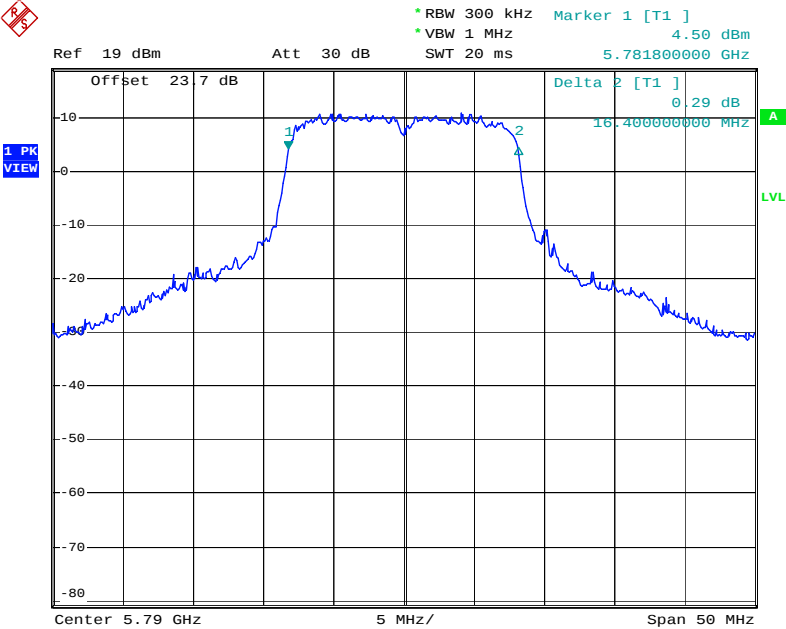
Date: 30.AUG.2006 23:00:37

5740MHz-54Mb/s



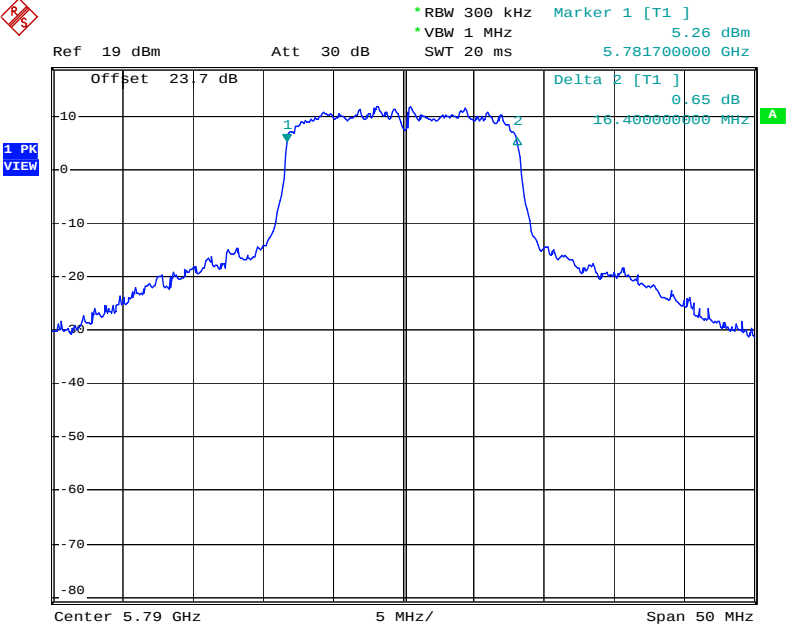
Date: 30.AUG.2006 23:01:30

5790MHz-6Mb/s



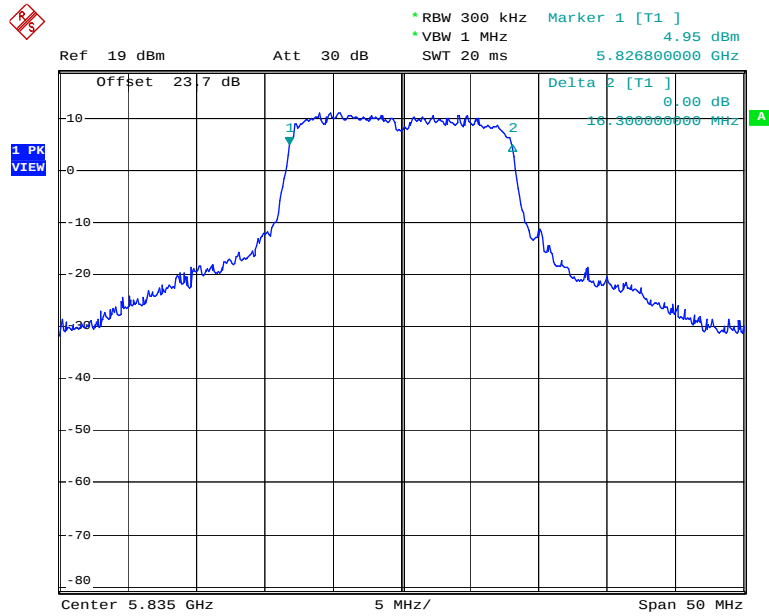
Date: 30.AUG.2006 23:03:12

5790MHz-54Mb/s



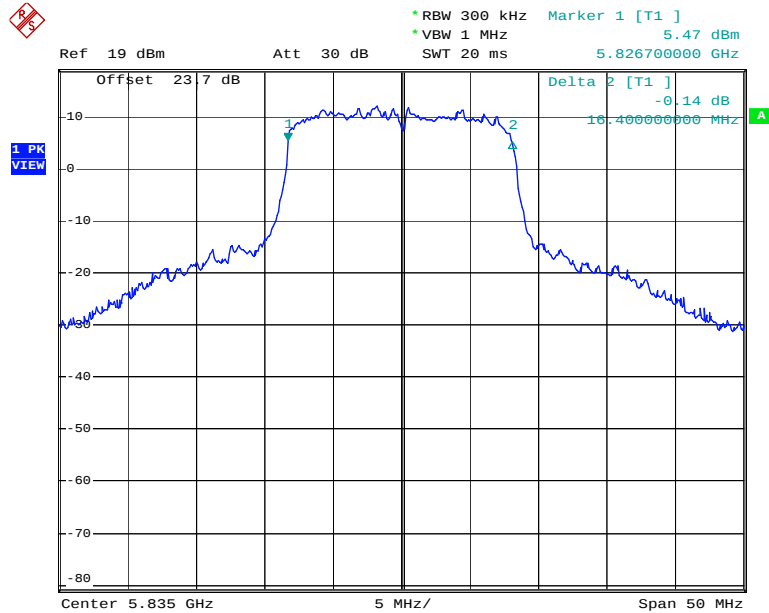
Date: 30.AUG.2006 23:10:54

5835MHz-6Mb/s



Date: 30.AUG.2006 23:11:59

5835MHz-54Mb/s



Date: 30.AUG.2006 23:13:03

Section 3. Output Power

Criteria: Clause 15.247(b)(3)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

Test Conditions:

Sample Number:	1,2, 3	Temperature:	22 °C
Date:	Aug 30, 2006	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Method: Output power was measured using sample detector on the spectrum analyzer according to FCC guidance on measurements for DTS and the documentation of FCC Public Notice: DA 02-2138.

Test Results: Complies

Test Data: See attached table and graphics

Conducted Output Power Test Data (dBm)

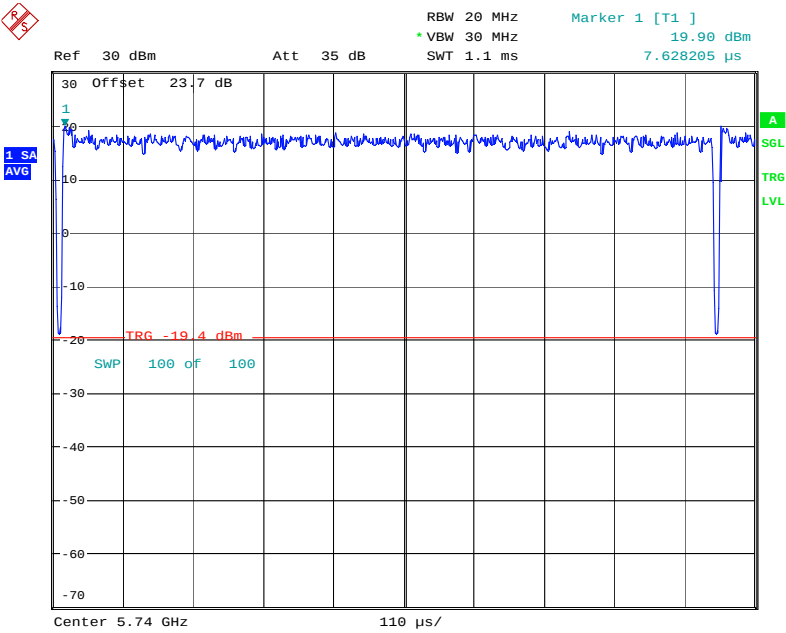
Frequency (MHz)	6 Mb/s	54 Mb/s
5740	19.90	19.67
5790	19.68	19.45
5835	19.46	19.58

The max. output power measured therefore
=19.90dBm

For Point to Point Operation:

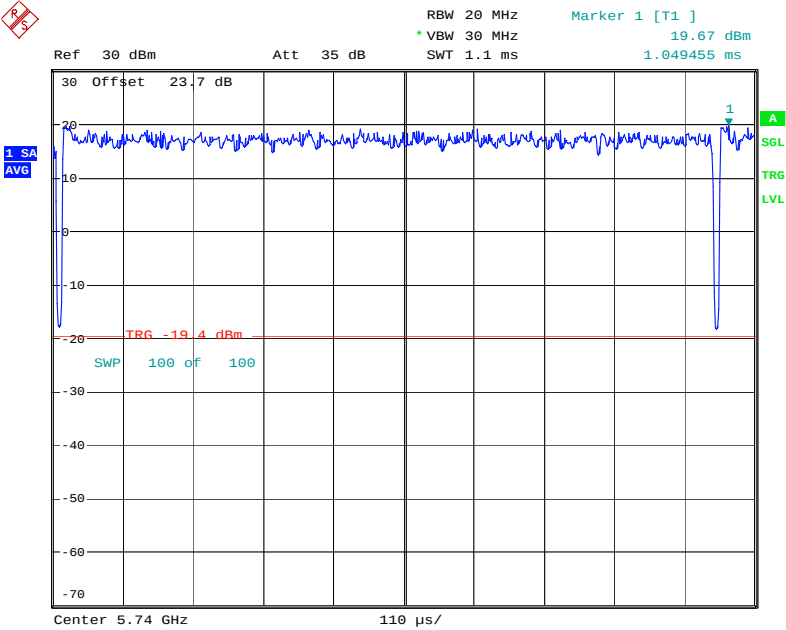
Limit: P-P operation =30dBm+ Antenna gain

5740MHz-6Mb/s



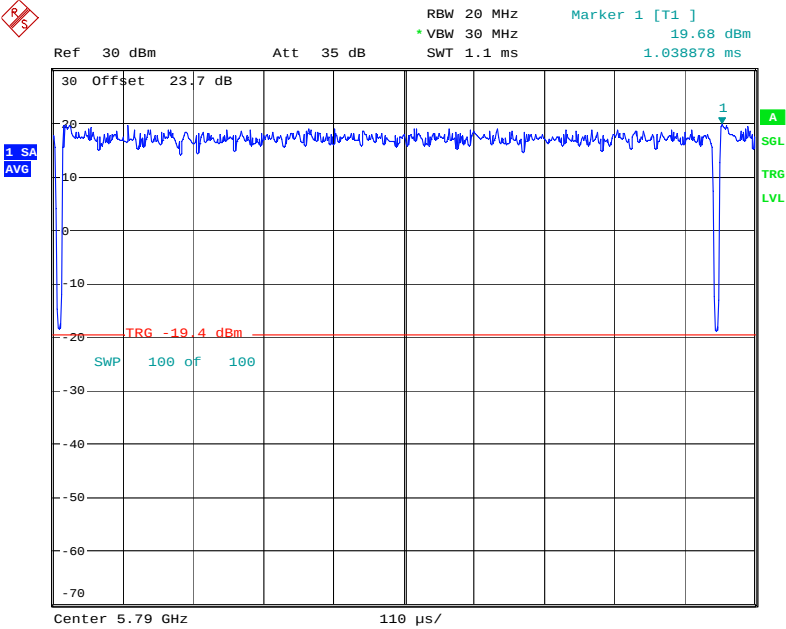
Date: 30.AUG.2006 10:48:46

5740MHz-54Mb/s



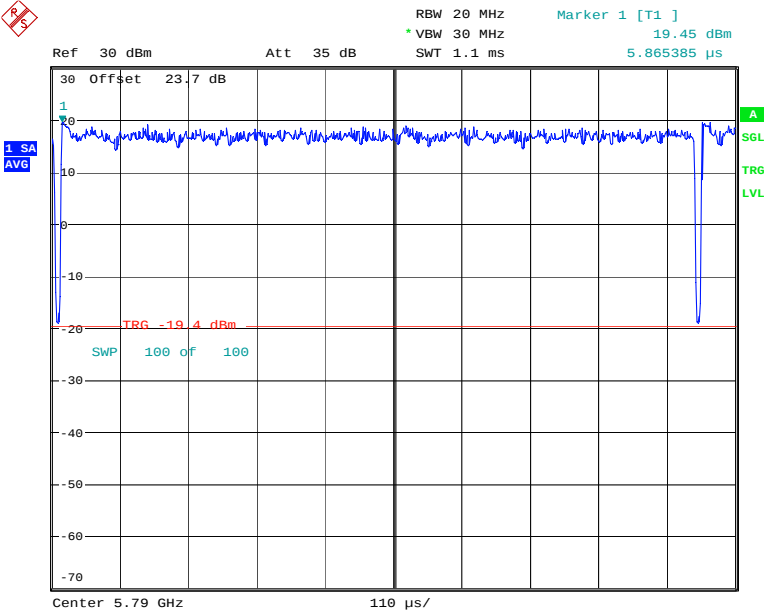
Date: 30.AUG.2006 10:49:47

5790MHz-6Mb/s



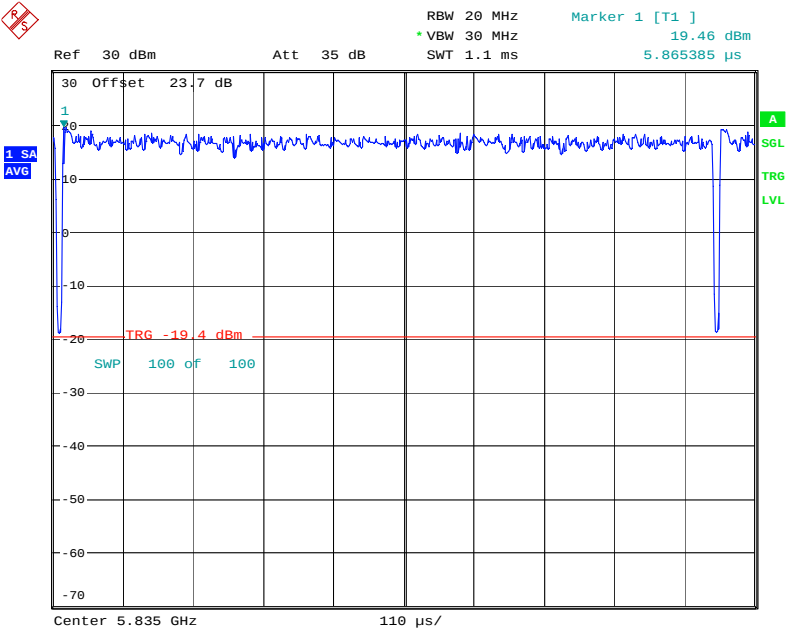
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5790MHz-54Mb/s



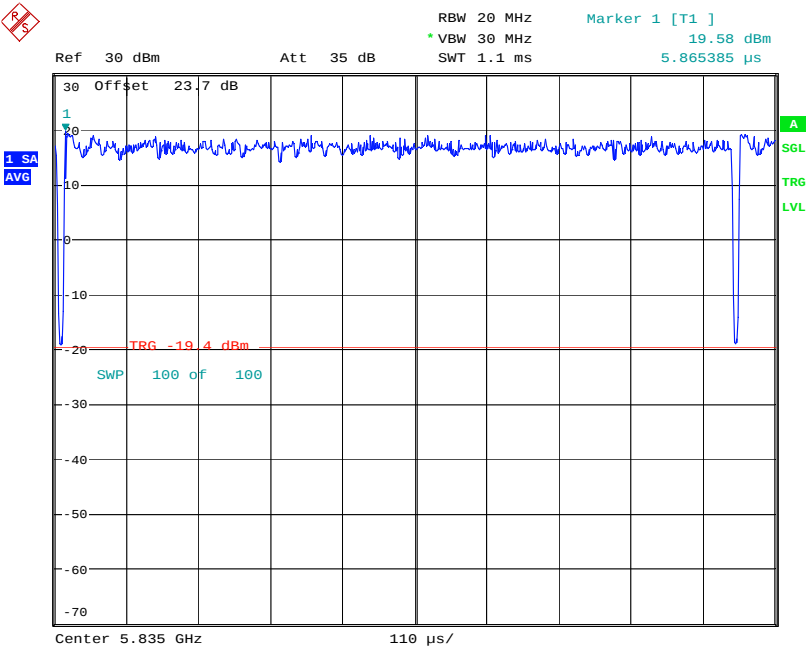
Date: 30.AUG.2006 10:52:06

5835MHz-6Mb/s



Date: 30.AUG.2006 10:45:05

5835MHz-54Mb/s



Date: 30.AUG.2006 10:46:25

Section 4. Spurious Emissions

Criteria: Clause 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Test Conditions:

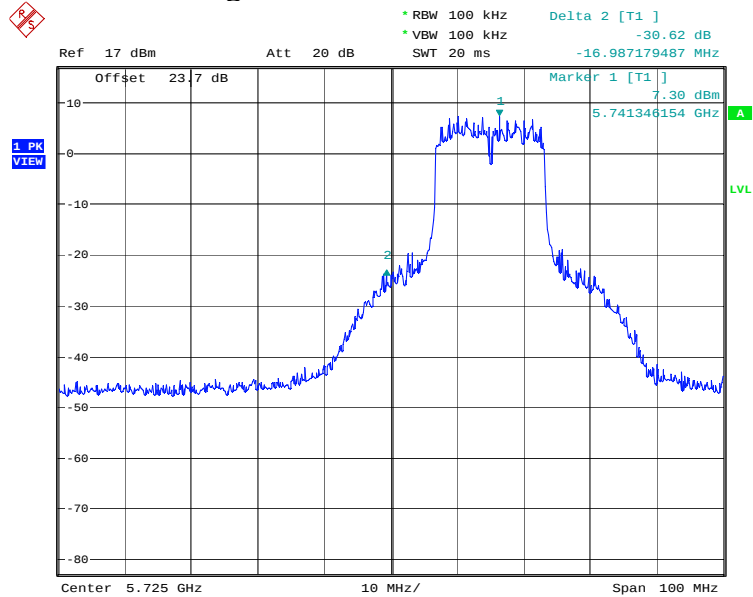
Sample Number:	1,2,3	Temperature:	22 °C
Date:	Aug 30, 2006	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Results: Complies

Test Data: See attached table and graphics

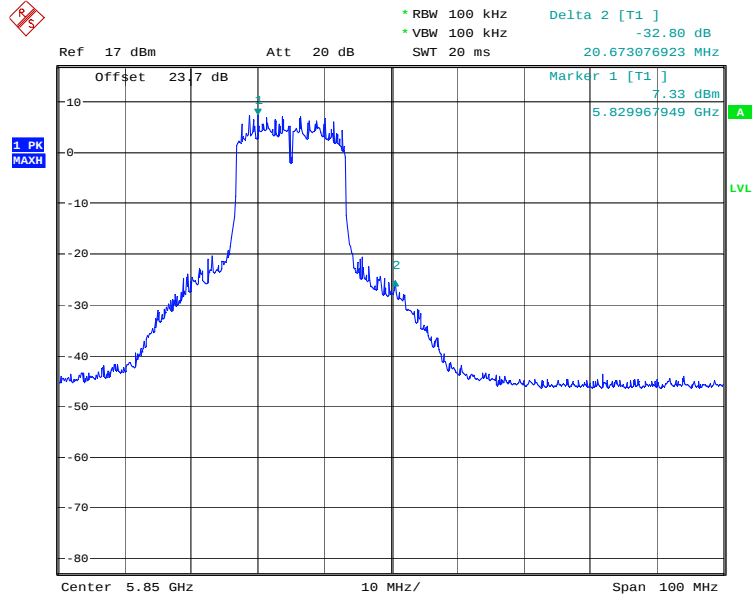
The DUT was searched to from 30MHz to 40GHz, and for low, medium and high frequencies. Only worst case was reported.

Lower Band Edge Check_Ch148, 5740MHz



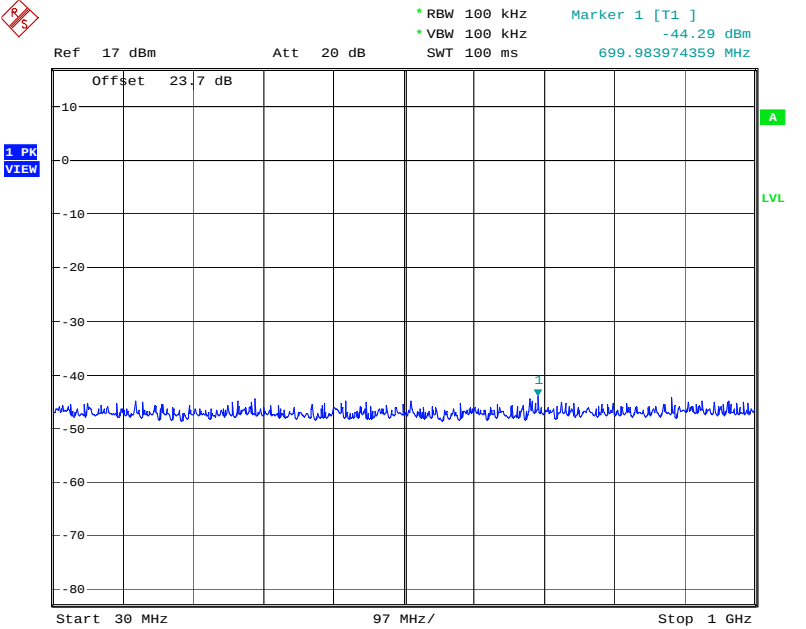
Date: 30.AUG.2006 11:02:33

Higher Band Edge Check_Ch167, 5835MHz

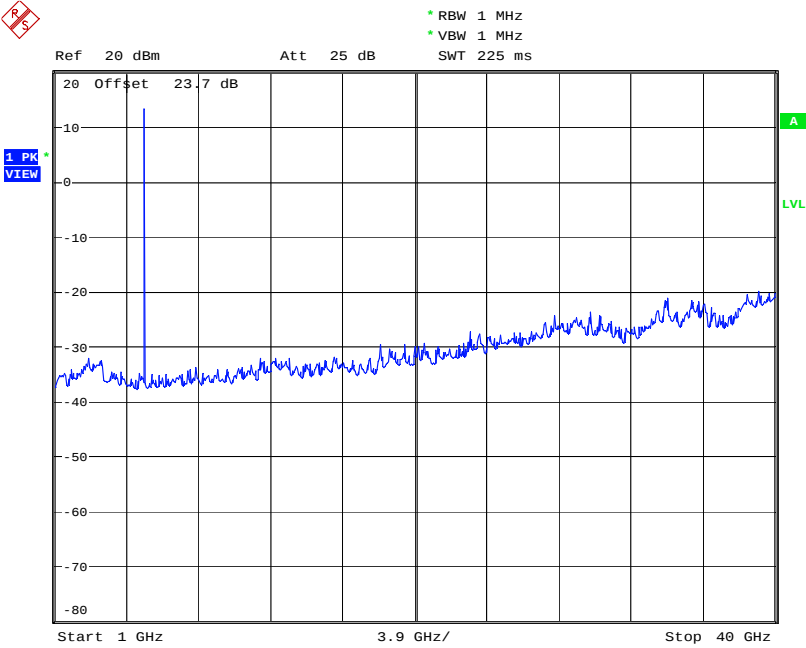


Date: 30.AUG.2006 11:05:06

Conducted Spurious Emissions



Date: 30.AUG.2006 11:10:24



Date: 30.AUG.2006 11:11:17

Radiated Emissions

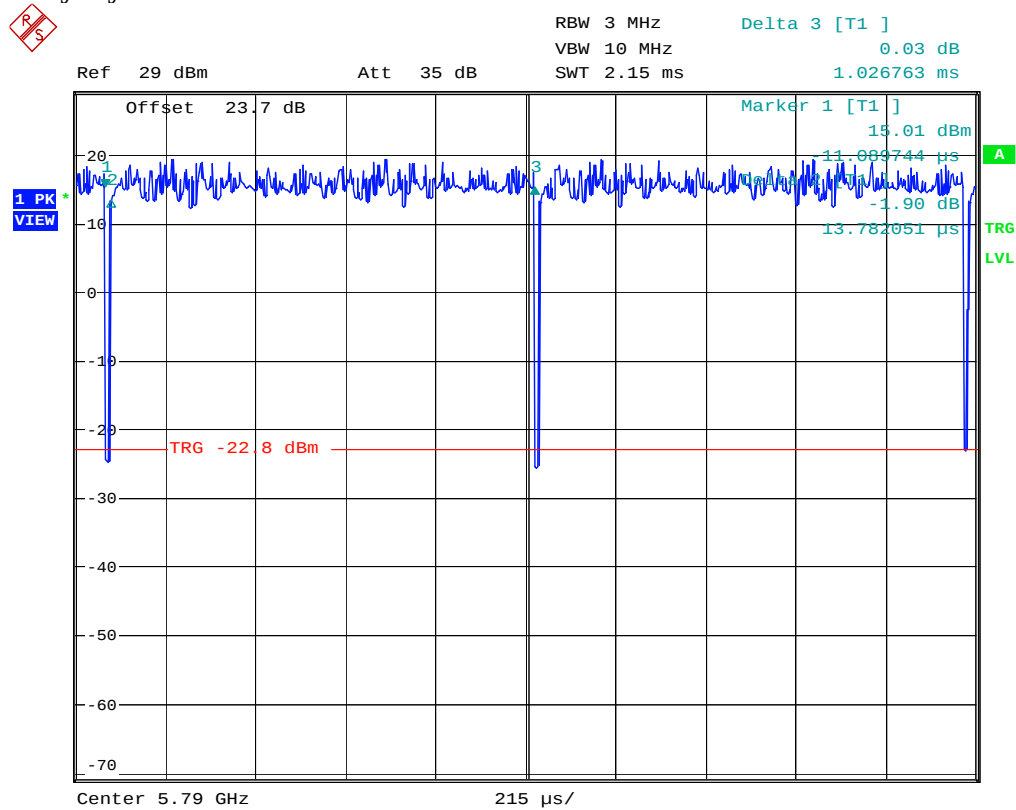
The DUT was searched from 30MHz to 40GHz, and for low, medium and high frequencies.

The spectrum analyzer was set to Qausi-Peak detector mode with RBW/VBW setting as 100KHz/100KHz below 1GHz, and peak detector mode with RBW/VBW settings as 1MHz/3MHz above 1GHz.

Only worst case was reported.

Test Date: Aug. 31, 2006										
Engineer's Name: Xu Jin										
Tested as per: Table Top										
Mains Input Voltage: 120VAC							Mains Input Frequency: 60Hz			
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
125.0000	BC1	H	21.3	12.3	N/A.	1.8	35.4	43.5	8.1	Q-Peak
125.0000	BC1	V	24.3	13.0	N/A.	1.8	39.1	43.5	4.4	Q-Peak
Legend:										
Antenna Legend: BC = Biconical, BL = Bilog, LP = Log-Periodic, Horn = Horn, ED = EMCO Dipole										
Detector Legend: Q-Peak = 120kHz RBW, Average = 1.0MHz RBW, 10Hz VBW, Peak=1.0MHz RBW, 1.0MHz VBW										

Duty Cycle



Date: 30.AUG.2006 13:41:33

$$\text{Duty Cycle} = (1 - 13.78 \mu\text{s} / 1027 \mu\text{s}) \times 100\% = 98.66\%$$

Section 5. Peak Power Spectrum Density**Criteria: Clause 15.247(e)**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Conditions:

Sample Number:	1,2,3	Temperature:	22 °C
Date:	Aug. 30, 2006	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Result: Complies

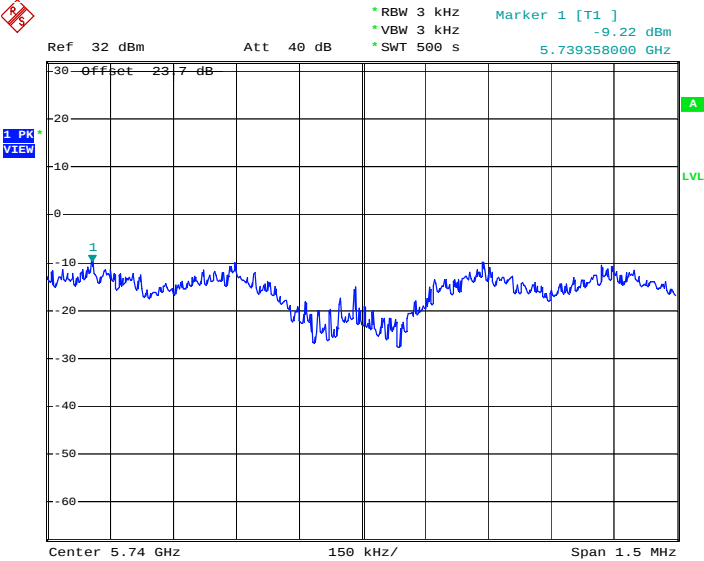
Test Data: See attached tables and graphics

Peak Power Spectrum Density Test Data(dBm/3KHz)

Frequency (MHz)	6 Mb/s	54 Mb/s
5740	-9.22	-7.69
5790	-8.81	-7.52
5835	-8.59	-7.34

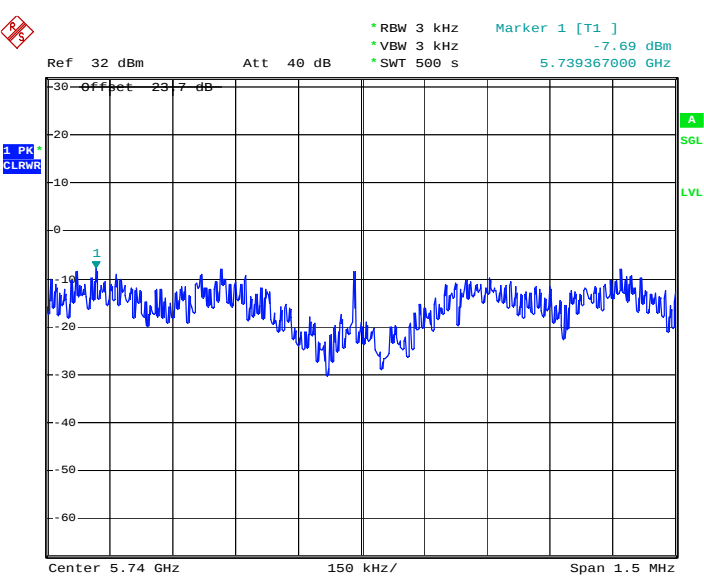
The Max. Peak Power Spectrum Density=-7.34dBm/3KHz

5740MHz _6Mb/s



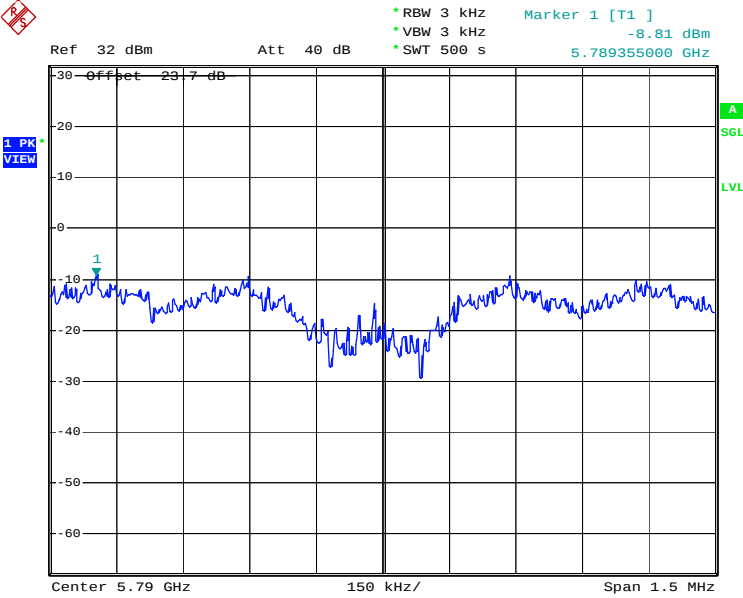
Date: 30.AUG.2006 21:07:34

5740MHz _54Mb/s



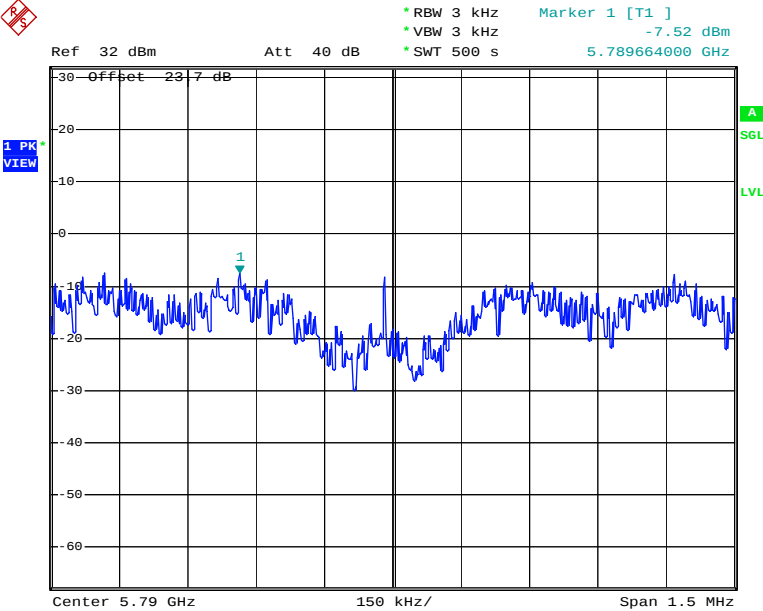
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5790MHz_6Mb/s



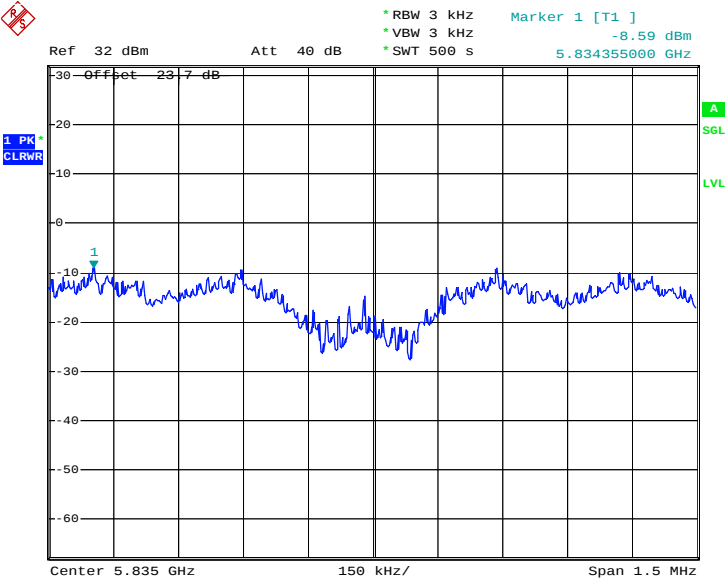
Date: 30.AUG.2006 21:34:43

5790MHz_54Mb/s



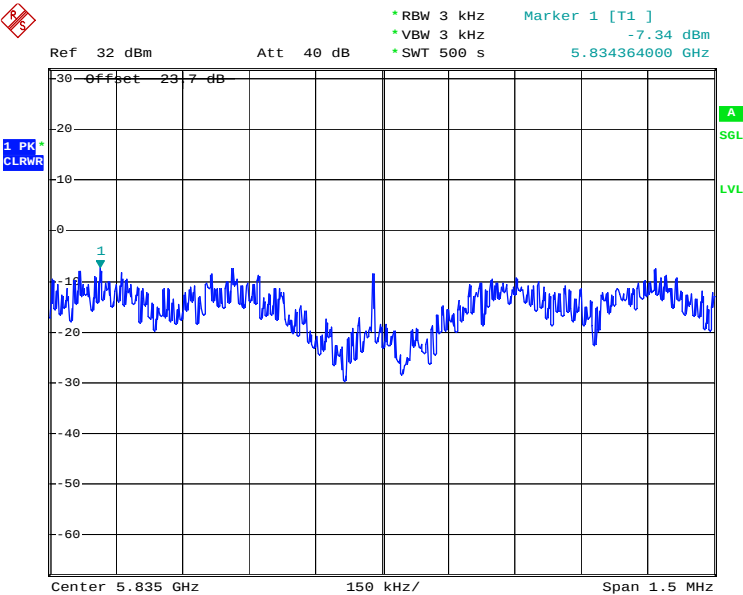
Date: 30.AUG.2006 21:44:20

5835MHz-6Mb/s



Date: 30.AUG.2006 22:05:27

5835MHz-54Mb/s



Date: 30.AUG.2006 22:34:07

Section 6. Supply Voltage Variation**Criteria: Clause 15.31**

§ 15.31 (e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.

Test Conditions:

Sample Number:	1,2, 3	Temperature:	22 °C
Date:	Aug. 30, 2006	Humidity:	50%
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Method:

Average power for selected channels was verified under voltage extreme conditions using a wideband power meter with thermocouple detector.

Extreme Voltage:

±15% of AC supply

Test Result:

No major changed was noticed during the test.
Refer to the attached tables.

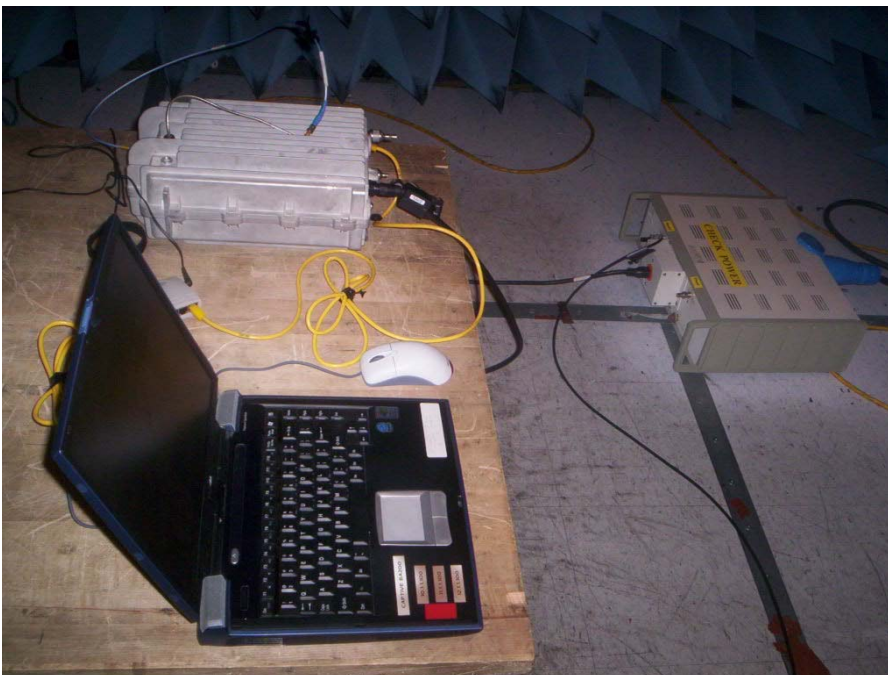
	120VAC	Low Voltage Extreme		High Voltage Extreme	
Frequency	Ave. Power	Ave. Power	Deviation	Ave. Power	Deviation
5790MHz	19.54	19.63	0.005%	19.58	0.002%

Appendix B : Setup Photographs

Radiated Emission Setup Photos

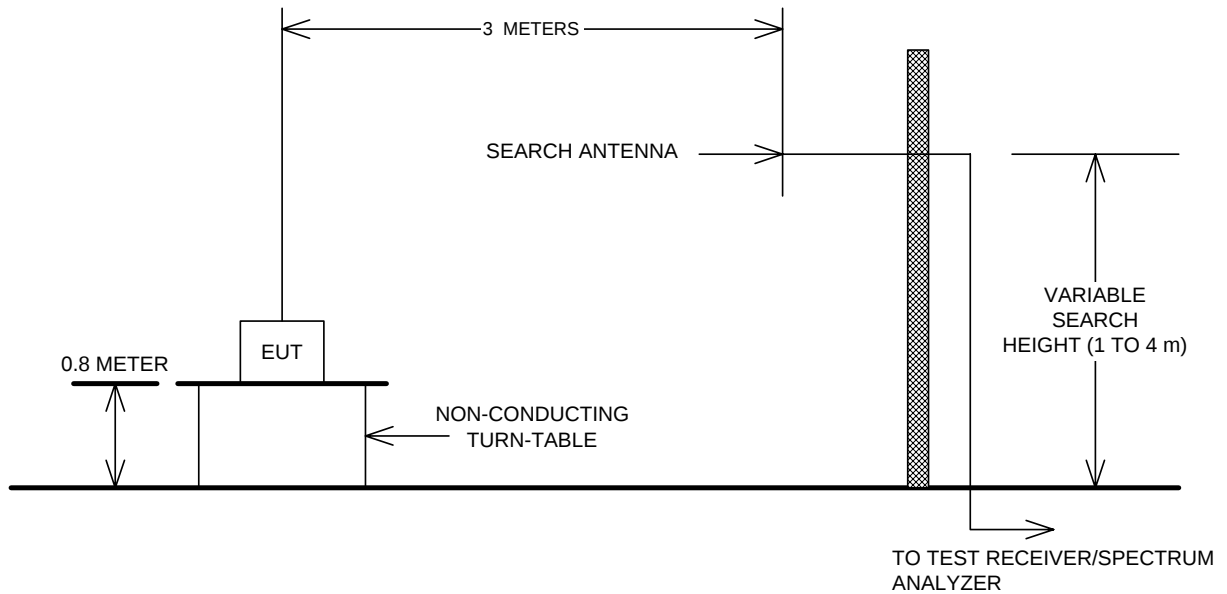


AC Power Line Conducted Emissions Setup Photos

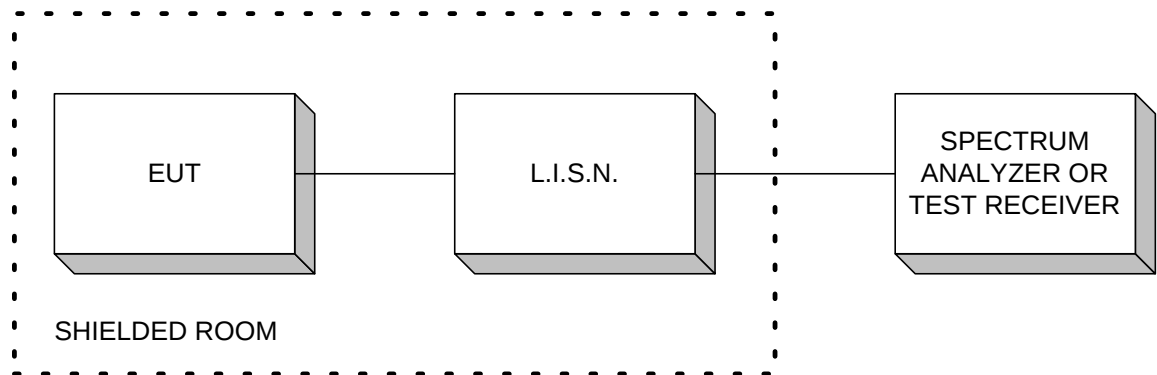


Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Emissions



Conducted Measurements

