



Nemko

Test Report: 5W54150

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

Apparatus: BRM 3

FCC ID: RAR20001003

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: 
Sim Jagpal, General Manager

Date: January 16, 2006

Total Number of Pages: 37

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
Specification:	FCC Part 15.247, Subpart C
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release

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

1.2 Samples Submitted for Assessment

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

Sample No.	Description	Serial No.
1	BRM3	K001362009
2	Digital board LMP	K001245162
3	H&S 23dBi Antenna	00445
4	15dBi Belair Patch Antenna	203-B
5	MaxRad omnidirectional Antenna 4dBi	MMO58004NF
6	MaxRad omnidirectional Antenna 10dBi	MMO58010NF

The first samples were received on: Oct.17, 2005

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	16M5G1W
Modulation:	802.11 a
Antenna Data:	(1).Maxrad 10dBi Antenna (2).Maxrad 4dBi Antenna (2) 15dBi BelAir Patch Antenna (3) H&S 23dBi Antenna
Antenna Connector:	MCX

* 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.	Last Cal.	Next Cal.
Spectrum Analyzer	Rohde & Schwarz	FSP	FA001920	March 22/05	March 22/06
Spectrum Analyzer	Rohde & Schwarz	FSU	FA001877	May 17/05	May 17/06
Spectrum Analyzer	Hewlett-Packard	8566B	FA001309	May 18/05	May 18/06
Spectrum Analyzer Display	Hewlett-Packard	85662A	FA001309	May 18/05	May 18/06
Biconical (1) Antenna	EMCO	3109	FA000805	April 22/05	April 22/06
Log Periodic Antenna #1	EMCO	LPA-25	FA000477	Aug. 29/05	Aug. 29/06
Horn Antenna #1	EMCO	3115	FA000649	Dec. 22/04	Dec. 22/05
18.0 – 40.0GHz Horn Antenna	EMCO	3116	FA001847	April 25/05	April 25/06
1.0 – 2.0 GHz Amplifier	JCA	12-400	FA001498	July 14/05	July 14/06
2.0 – 4.0 GHz Amplifier	JCA	24-600	FA001496	July 14/05	July 14/06
4.0 – 8.0 GHz Amplifier	JCA	48-600	FA001497	July 14/05	July 14/06
5.0 - 18GHz Amplifier	Narda	DWT-186N23U40	FA001409	COU	COU
18.0 – 26.0 GHz Amplifier	NARDA	BBS-1826N612	FA001550	COU	COU
26 – 40.0 GHz Amplifier	NARDA	DBL-2640N610	FA001556	COU	COU
Signal Generator	Rhode & Schwarz	SMR 40	FA001879	July 13/05	July 13/06
Power Meter	HP	4418B	FA001678	Mar 8/05	Mar 8/06
Power Probe	HP	8487A	FA001741	May 26/05	May 26/06
LISN	EMCO	4825/2	FA001545	Jan 13/05	Jan 13/06
Transient Limiter	Hewlett-Packard	1194 7A	FA000975	May 25/05	May 25/06

* COU (Calibrate on Use)

** NCR (No Calibration Required)

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.

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:

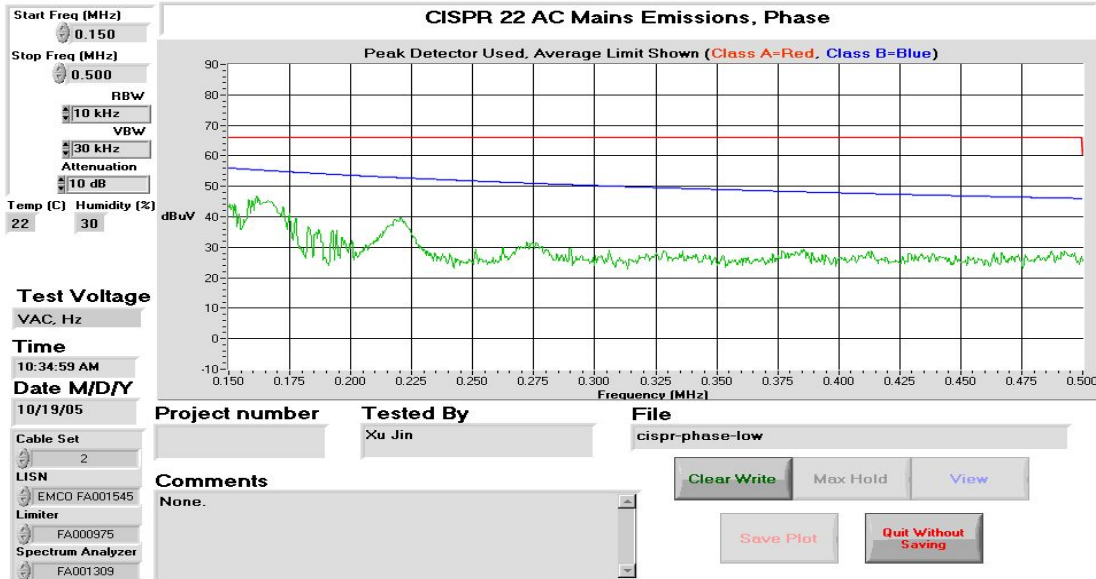
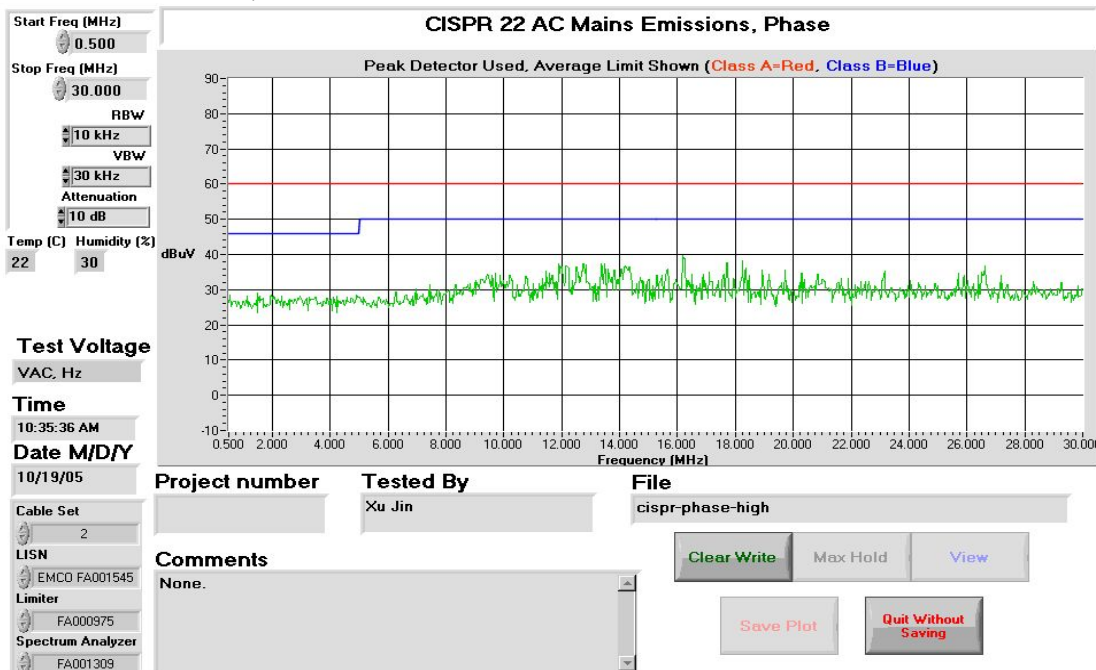
Sample Number:	1,2	Temperature:	22 °C
Date:	Oct.19, 2005	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

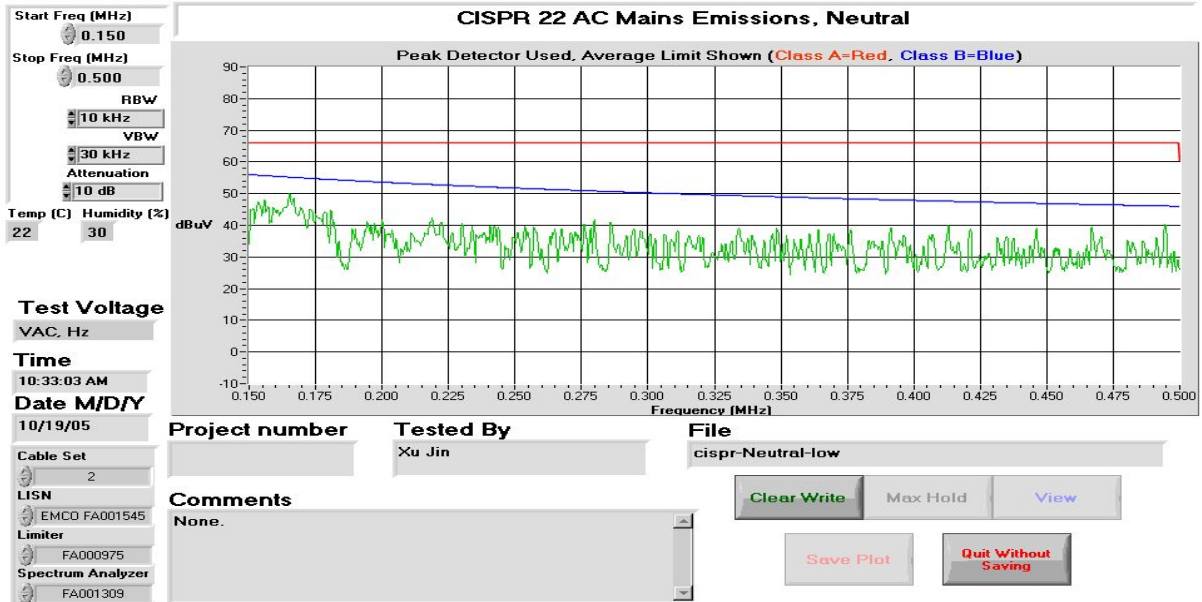
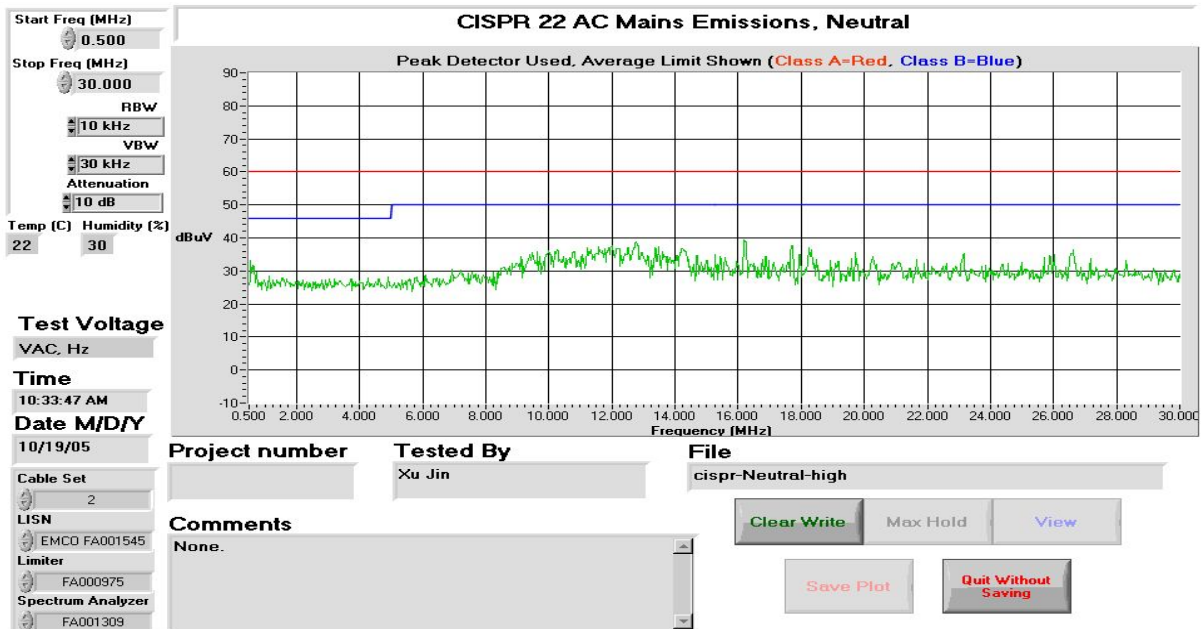
Test Results: Complies

Test Data: See Attached Plots and Tables.

Conducted Disturbance at Mains, Setup Photos



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**

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	Temperature:	22 °C
Date:	Oct.17, 2005	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

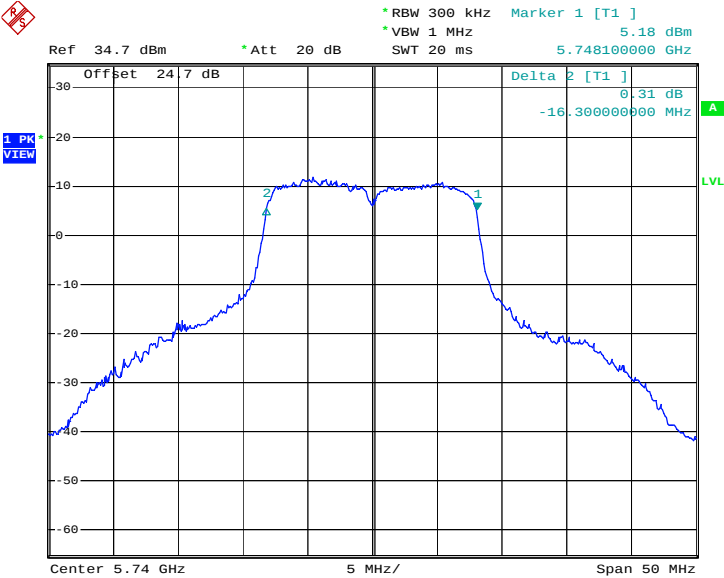
Test Results: Complies

Test Data: See attached table and graphics

6dB Occupied Bandwidth (MHz)

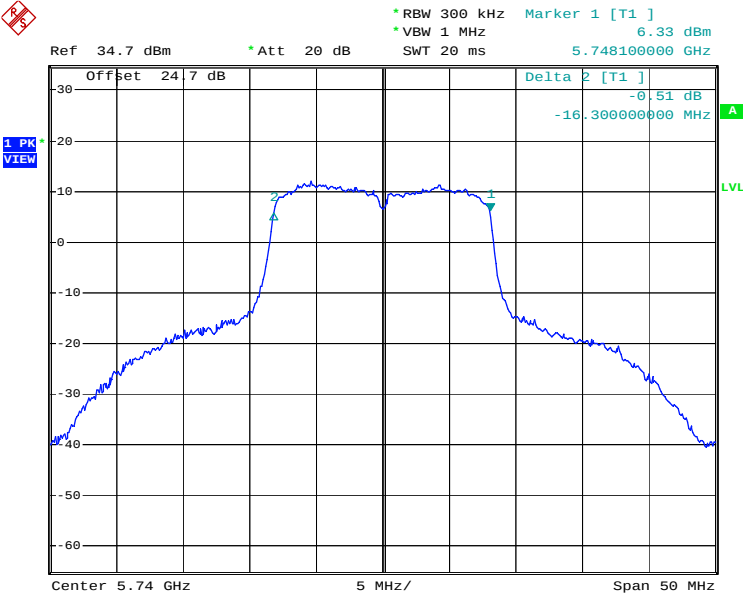
Frequency (MHz)	6 Mb/s	54 Mb/s
5740	16.3	16.3
5790	16.5	16.3
5835	16.3	16.3

5740MHz-6Mb/s



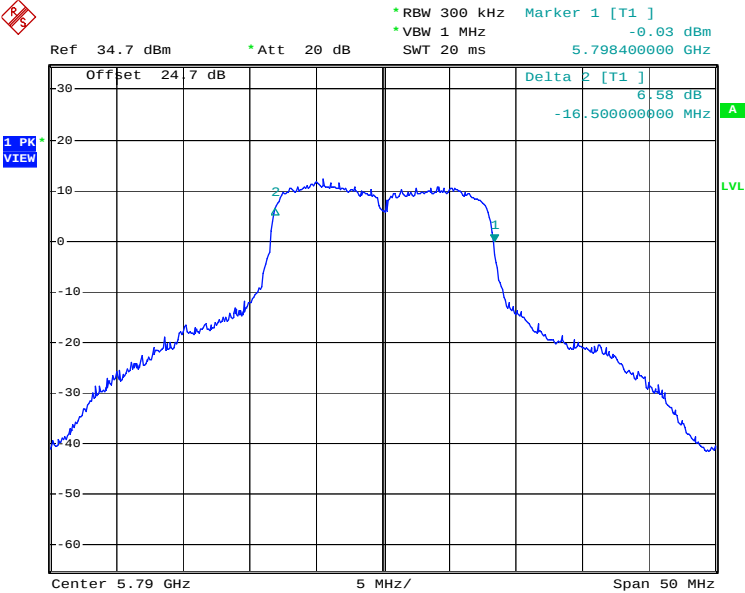
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5740MHz-54Mb/s



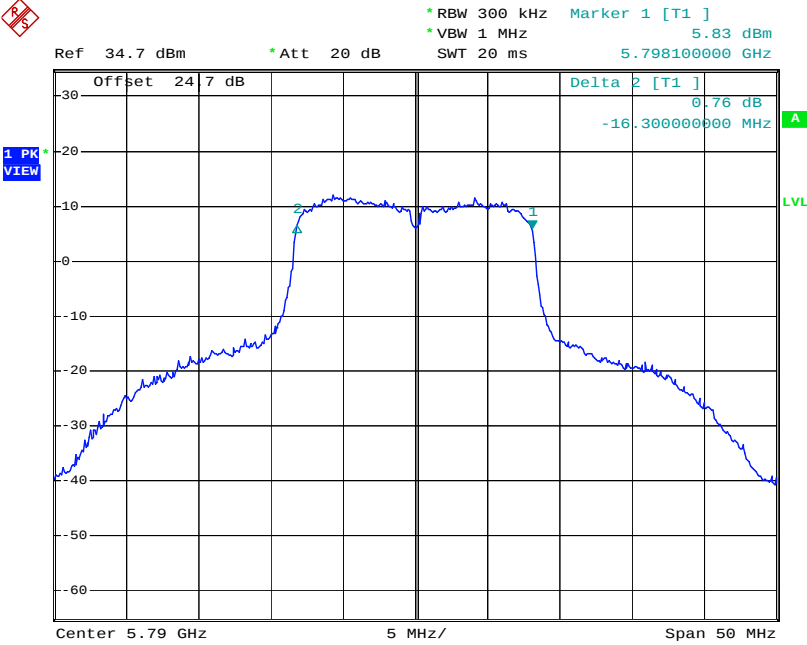
Date: 17.OCT.2005 22:05:28

5790MHz-6Mb/s



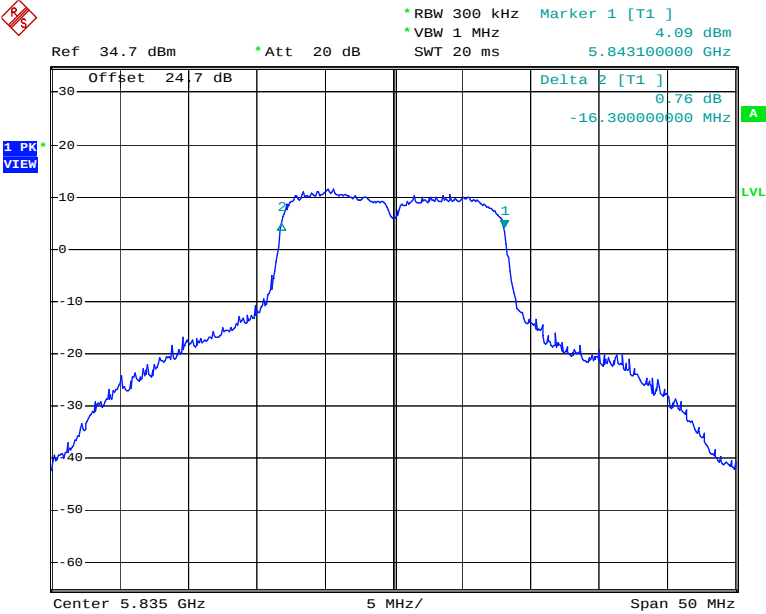
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5790MHz-54Mb/s



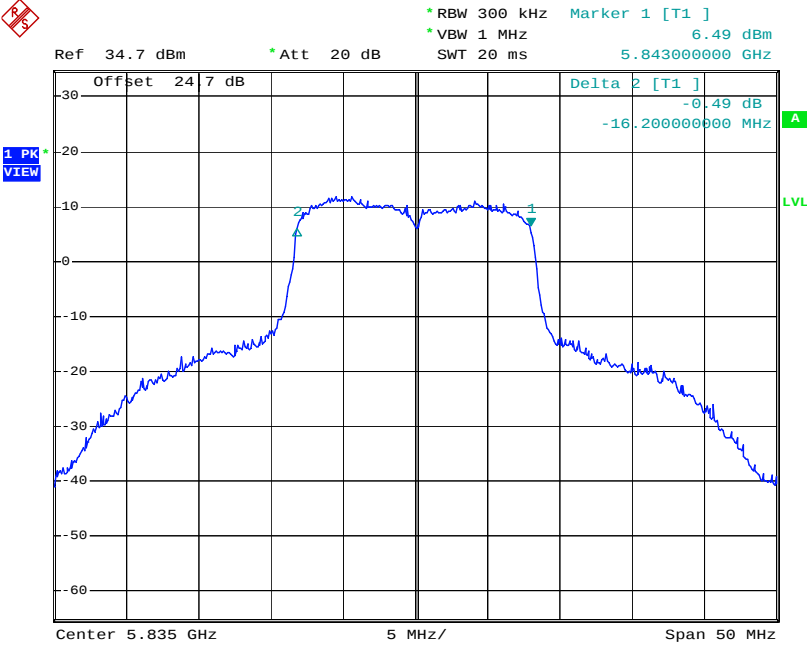
Date: 17.OCT.2005 22:09:34

5835MHz-6Mb/s



Date: 17.OCT.2005 22:15:05

5835MHz-54Mb/s



Date: 17.OCT.2005 22:18:52

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	Temperature:	22 °C
Date:	Oct.18, 2005	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	21.34	21.85
5790	21.08	21.70
5835	21.05	21.82

Manufacturer has declared there is 1dB cable loss between the radio module and antenna connector.

The max. output power measured therefore
 $=21.85\text{dBm}-1\text{dB}=20.85\text{dBm}$

For Point to Point Operation:

Limit: P-P operation $=30\text{dBm} + \text{Antenna gain}$

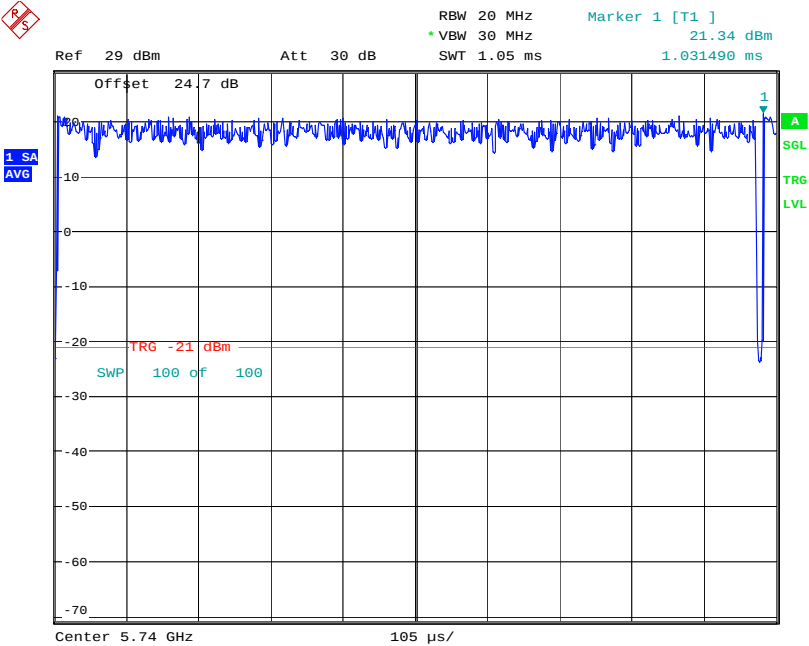
No	Antenna Type	Limit (Conducted)	Max. Conducted Power Measured	Max. E.R.I.P
1	Maxrad 10dBi	30dBm	$21.85\text{dBm}-1\text{dB}=20.85\text{dBm}$	$20.85\text{dBm}+10\text{dBi}=30.85\text{dBm}$
2	Maxrad 4dBi	30dBm	$21.85\text{dBm}-1\text{dB}=20.85\text{dBm}$	$20.85\text{dBm}+4\text{dBi}=24.85\text{dBm}$
3	15dBi BelAir Patch Antenna	30dBm	$21.85\text{dBm}-1\text{dB}=20.85\text{dBm}$	$20.85\text{dBm}+15\text{dBi}=35.85\text{dBm}$
4	H&S 23dBi	30dBm	$21.85\text{dBm}-1\text{dB}=20.85\text{dBm}$	$20.85\text{dBm}+23\text{dBi}=43.85\text{dBm}$

For None Point to Point Operation

Limit: None P-P operation $=30\text{dBm}+6\text{dBi antenna (EIRP)}$

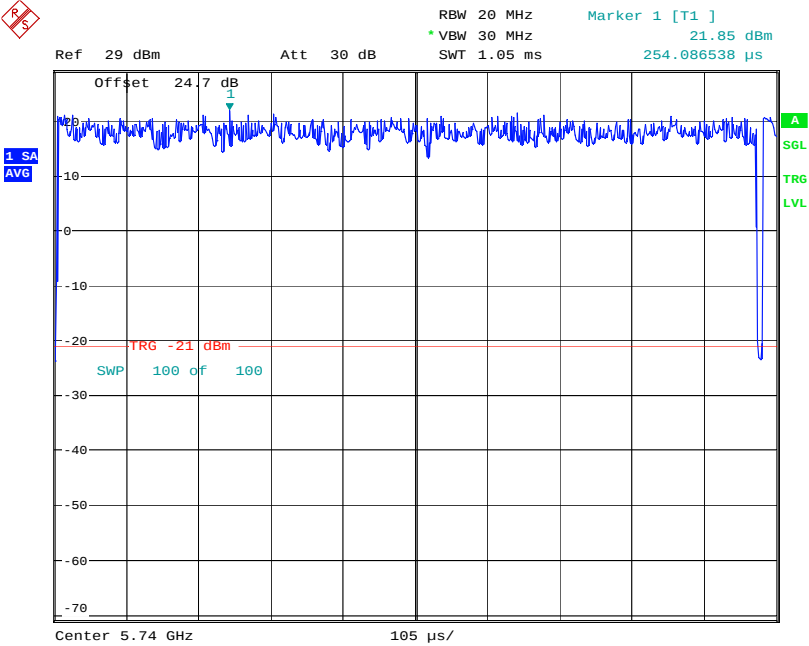
No	Antenna Type	Limit (Conducted)	Max. Conducted Power Measured	Max. E.R.I.P
1	Maxrad 10dBi	$30\text{dBm}-(10\text{dBi}-6\text{dBi})=26\text{dBm}$	$21.85\text{dBm}-1\text{dB}=20.85\text{dBm}$	$20.85\text{dBm}+10\text{dBi}=30.85\text{dBm}$
2	Maxrad 4dBi	30dBm	$21.85\text{dBm}-1\text{dB}=20.85\text{dBm}$	$20.85\text{dBm}+4\text{dBi}=24.85\text{dBm}$
3	15dBi BelAir Patch Antenna	$30\text{dBm}-(15\text{dBi}-6\text{dBi})=21\text{dBm}$	$21.85\text{dBm}-1\text{dB}=20.85\text{dBm}$	$20.85\text{dBm}+15\text{dBi}=35.85\text{dBm}$

5740MHz-6Mb/s



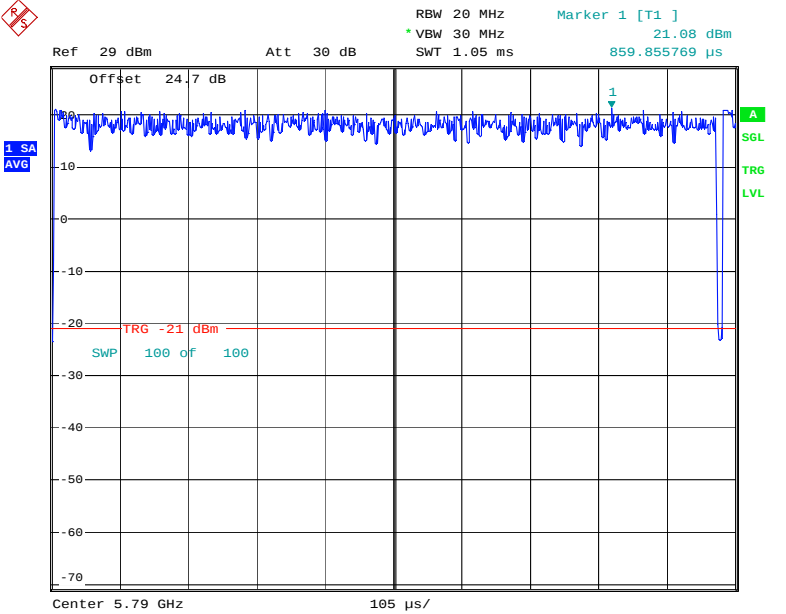
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5740MHz-54Mb/s



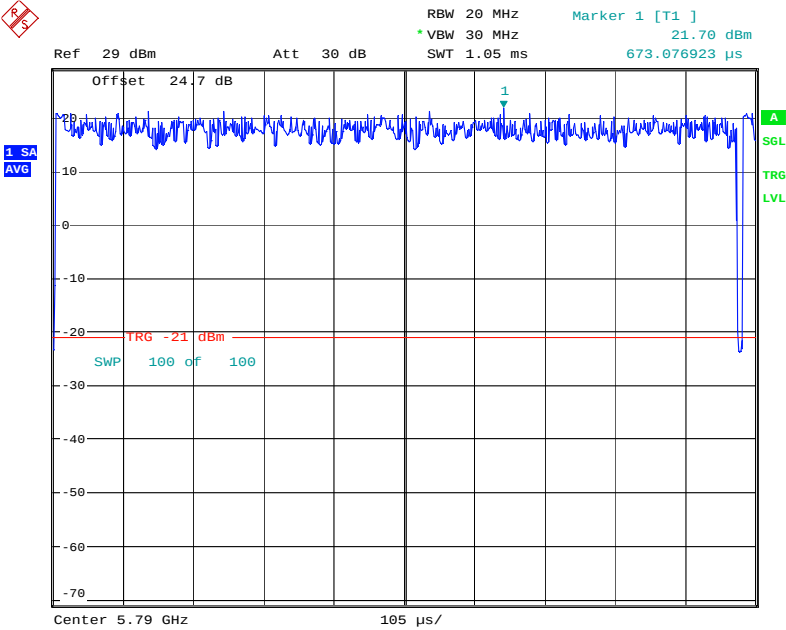
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5790MHz-6Mb/s



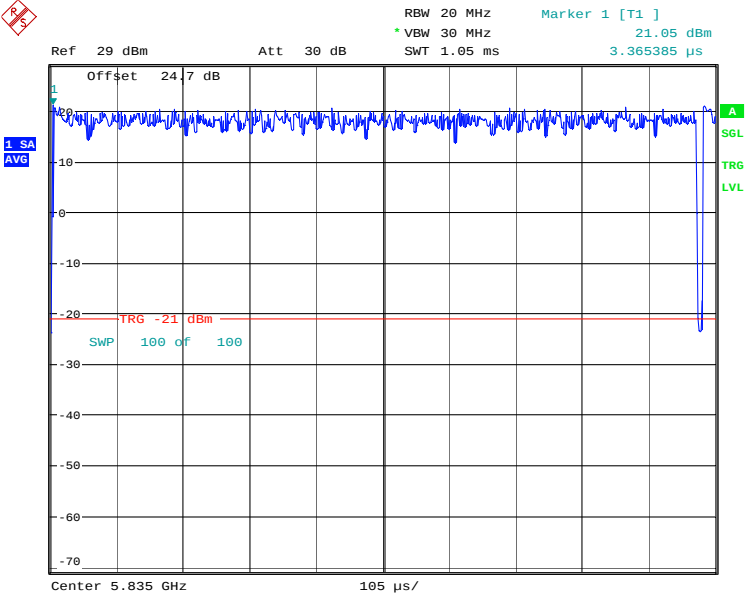
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5790MHz-54Mb/s



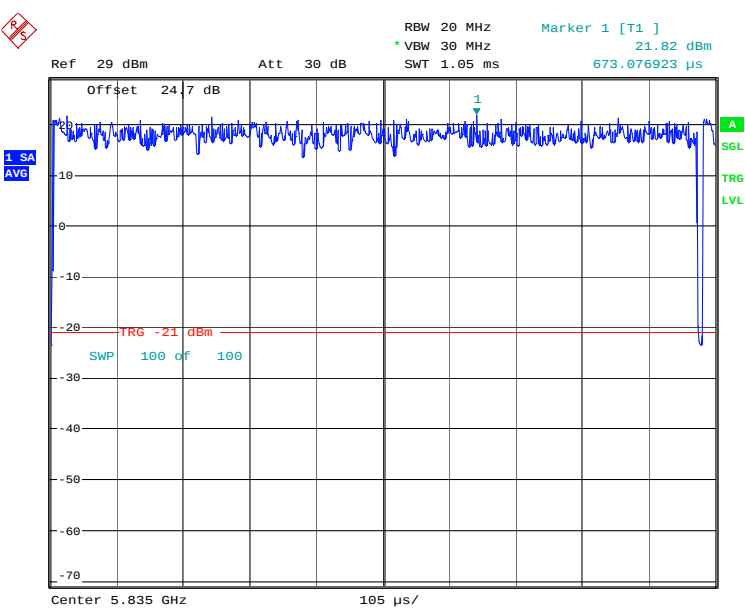
Date: 18.OCT.2005 10:54:57

5835MHz-6Mb/s



Date: 18.OCT.2005 10:56:02

5835MHz-54Mb/s



Date: 18.OCT.2005 10:56:54

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:	1,2,3,4,5,6	Temperature:	22 °C
Date:	Oct.18, 2005	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

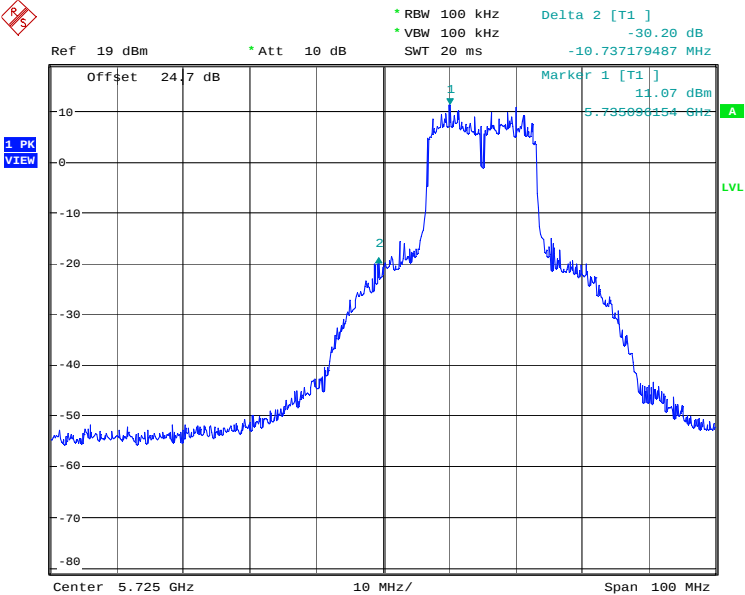
Test Results: Complies

Test Data: See attached table and graphics

Emissions were searched for all possible antenna configurations

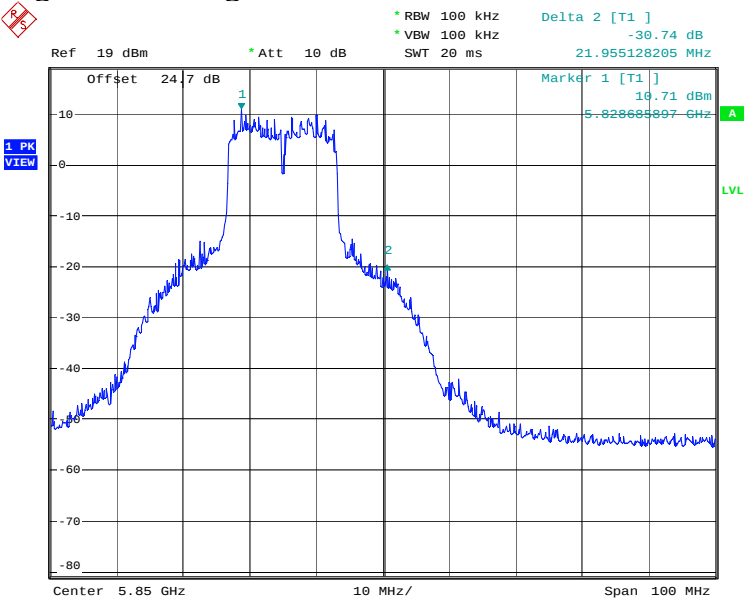
The DUT was searched to from 30MHz to 10th harmonic of the EUT, and for low, medium and high frequencies. Only worst case was reported.

Lower Band Edge Check_Ch148, 5740MHz



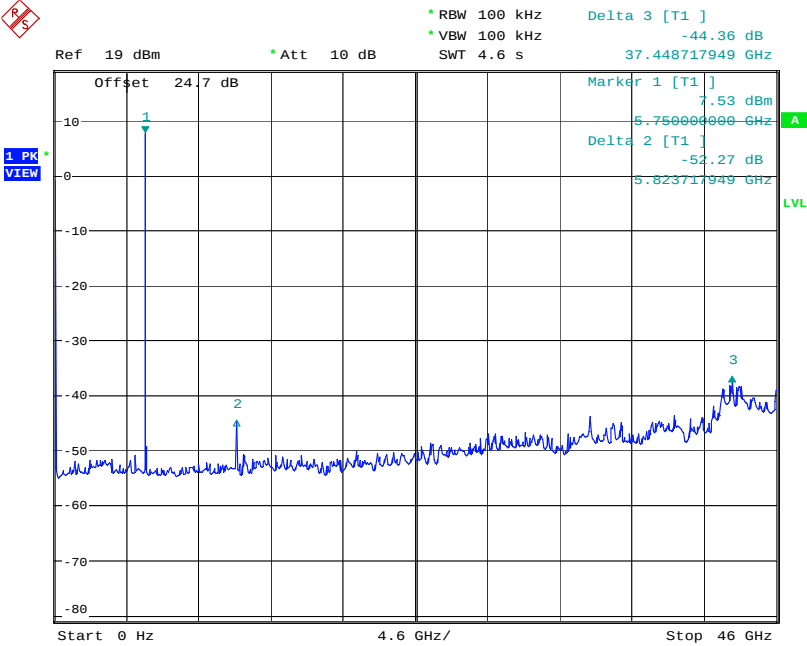
Date: 18.OCT.2005 13:57:31

Higher Band Edge Check_Ch167, 5835MHz



Date: 18.OCT.2005 13:59:45

Full Span

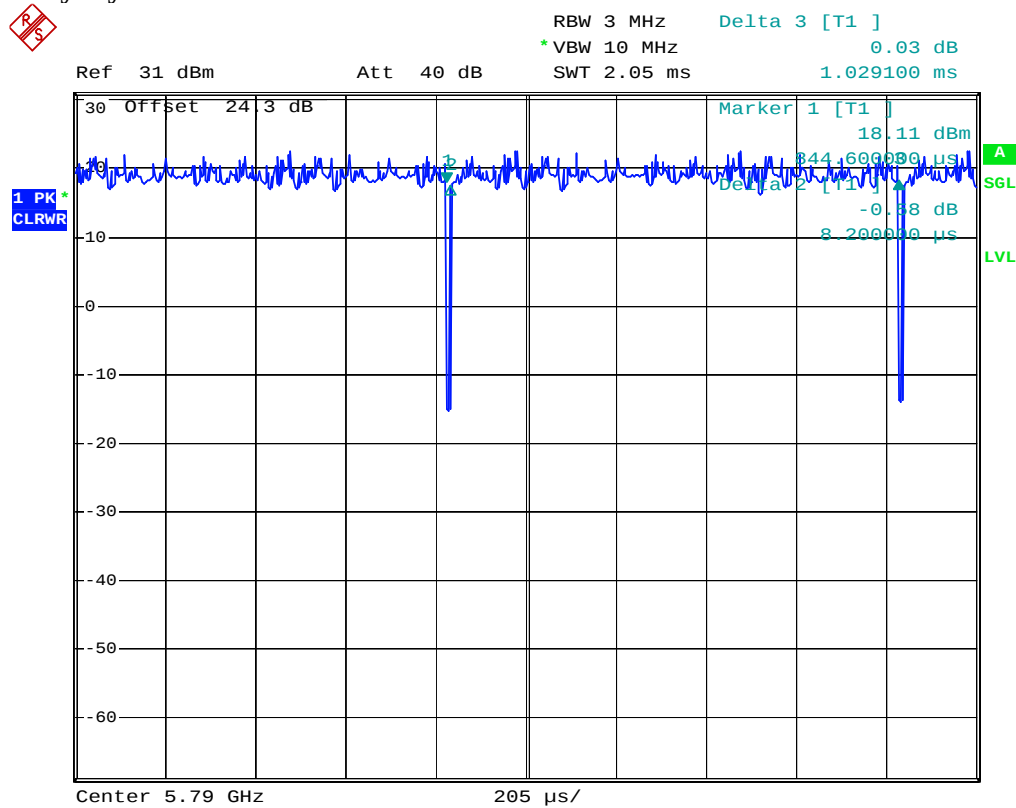


Date: 18.OCT.2005 13:48:05

Radiated Emissions Test Data

Test Date: Oct. 20, 2005										
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.	Po l. V/ H	RCVD Signal (dBμV)	Ant. Factor (dB)	Amp. Gain (dB)	Cable Loss (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
115.5016	BC1	H	6.5	11.6	N/A	1.8	19.9	43.5	23.6	Q-Peak
115.5016	BC1	V	12.2	12.0	N/A	1.8	26.0	43.5	17.5	Q-Peak
375.0200	LP1	H	17.2	15.7	N/A	2.9	35.7	46	10.3	Q-Peak
375.0200	LP1	V	19.2	15.5	N/A	2.9	37.5	46	8.5	Q-Peak
561.0000	LP1	V	15.8	19.0	N/A	3.3	38.1	46	7.9	Q-Peak
561.0000	LP1	H	16.2	19.7	N/A	3.3	39.2	46	6.8	Q-Peak
627.0000	LP1	V	18.3	19.7	N/A	3.5	41.5	46	4.5	Q-Peak
627.0000	LP1	H	21.5	19.9	N/A	3.5	44.9	46	1.1	Q-Peak
693.5000	LP1	H	15.7	21.2	N/A	3.8	40.7	46	5.3	Q-Peak
693.5000	LP1	V	12.3	20.9	N/A	3.8	37.0	46	9	Q-Peak
808.9000	LP1	H	10.9	22.1	N/A	4.3	37.3	46	8.7	Q-Peak
808.9000	LP1	V	10.8	21.5	N/A	4.3	36.6	46	9.4	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: 20.OCT.2005 21:37:20

Duty Cycle=(1-8.2μs/1029μs)×100%=99.2%

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	Temperature:	22 °C
Date:	Oct. 18, 2005	Humidity:	50 %
Modification State:	0	Tester:	Xu Jin
		Laboratory:	Ottawa

Test Result: Complies

Test Data: See attached tables and graphics

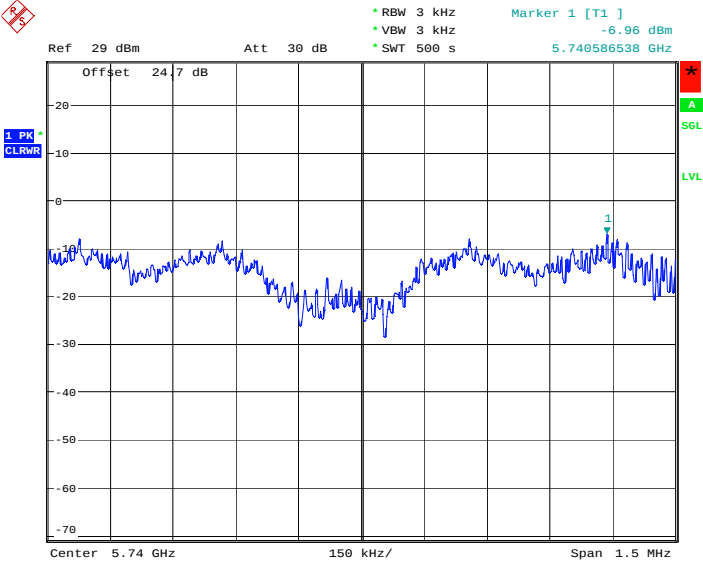
Peak Power Spectrum Density Test Data(dBm/3KHz)

Frequency (MHz)	6 Mb/s	54 Mb/s
5740	-6.96	-6.65
5790	-7.86	-6.65
5835	-6.69	-6.83

Manufacturer has declared there is 1dB cable loss between the radio module and antenna connector.

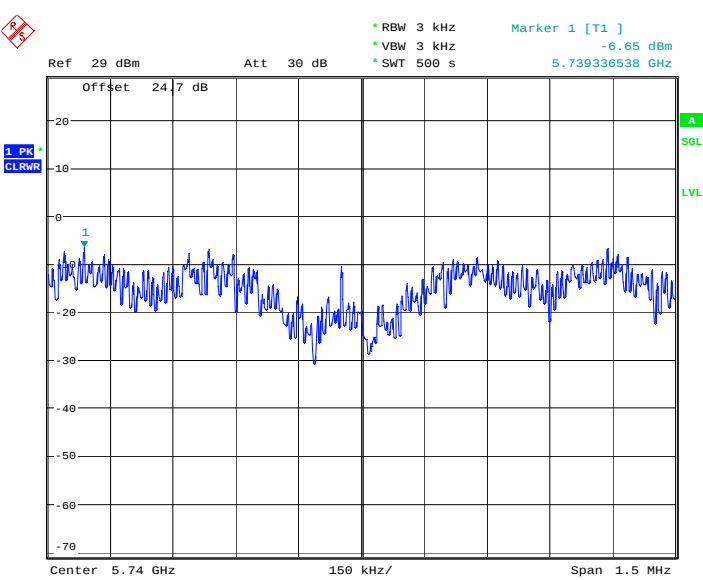
The Max. Peak Power Spectrum Density=-6.65dBm/3KHz-1dB=-7.63 dBm/3KHz

5740MHz _6Mb/s



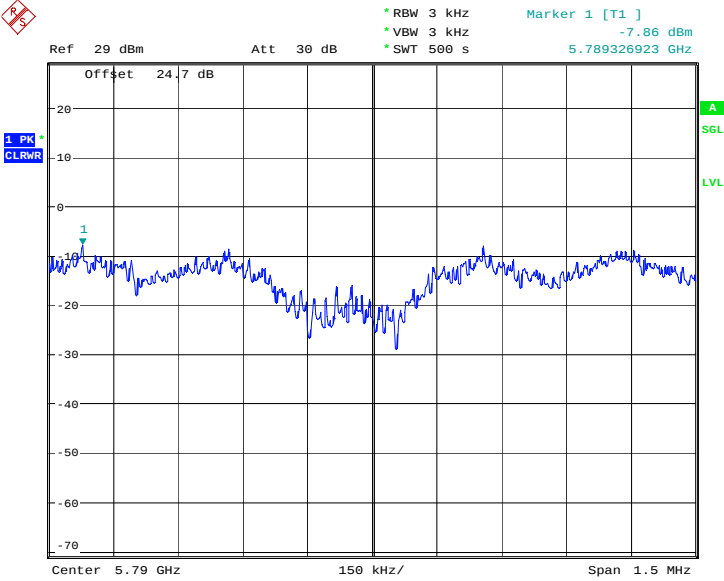
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5740MHz _54Mb/s



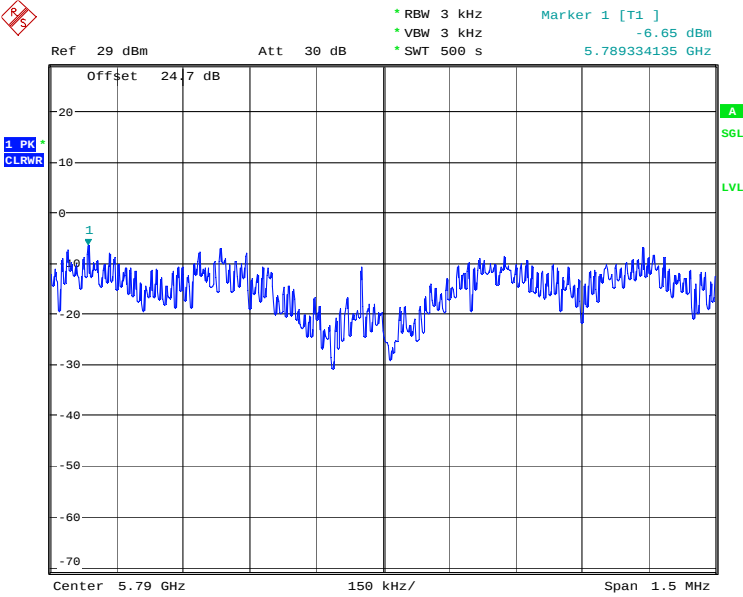
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5790MHz_6Mb/s



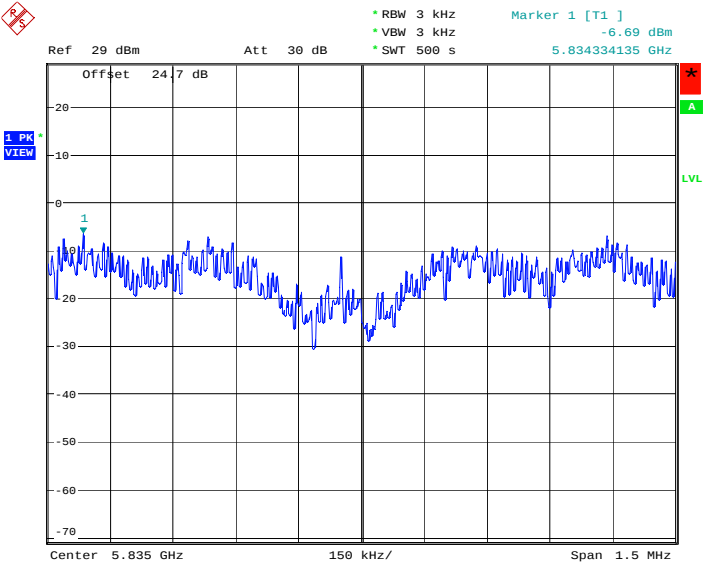
Date: 18.OCT.2005 13:14:48

5790MHz_54Mb/s



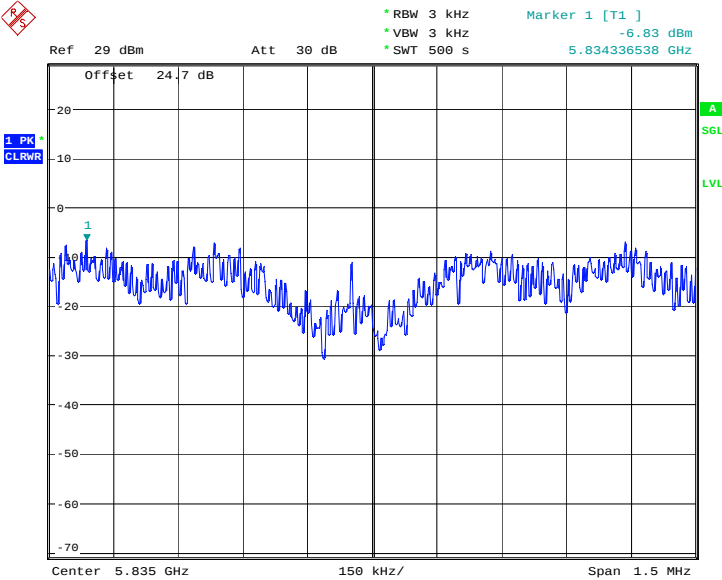
Date: 18.OCT.2005 13:24:33

5835MHz-6Mb/s



Date: 18.OCT.2005 11:25:06

5835MHz-54Mb/s



Date: 18.OCT.2005 11:44:44

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	Temperature:	22 °C
Date:	Oct. 19, 2005	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.

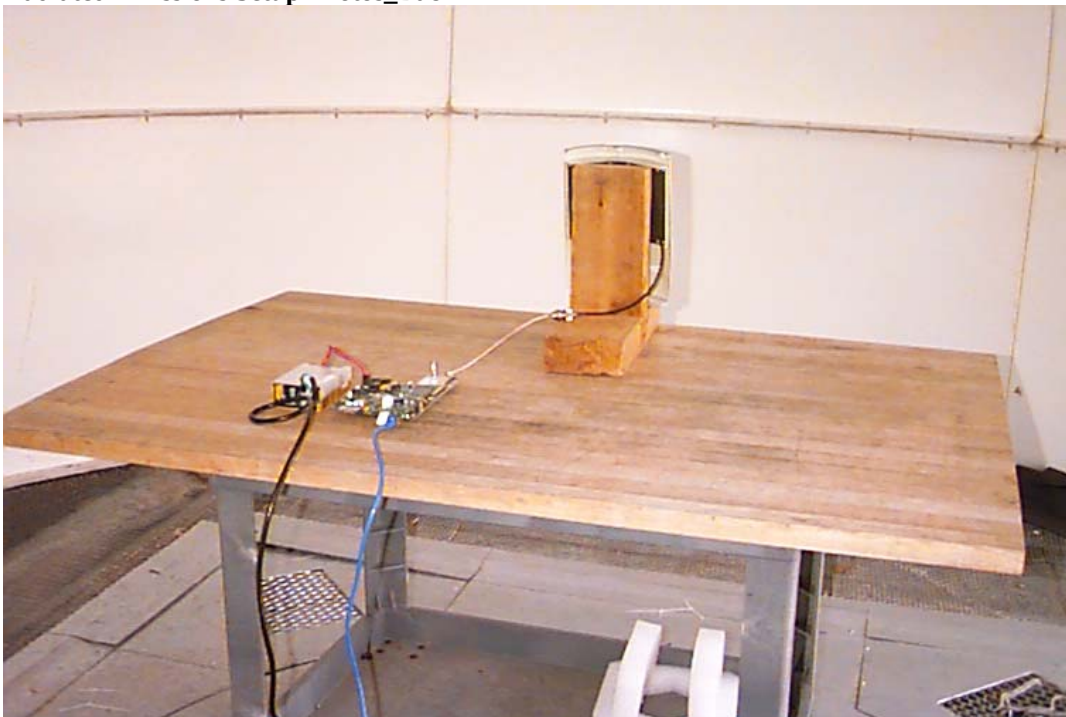
	120VAC	Low Voltage Extreme		High Voltage Extreme	
Frequency	Ave. Power	Ave. Power	Deviation	Ave. Power	Deviation
5790MHz	20.91	20.93	0.01%	20.94	0.01%

Appendix B : Setup Photographs

Radiated Emission Setup Photos_Front



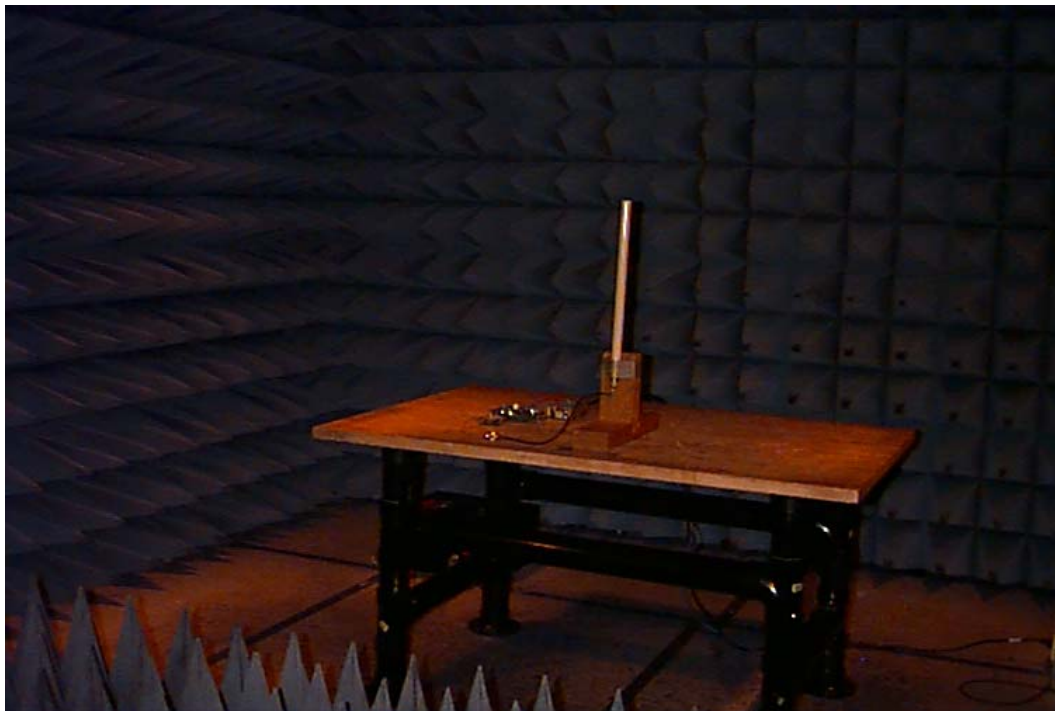
Radiated Emissions Setup Photos_Back



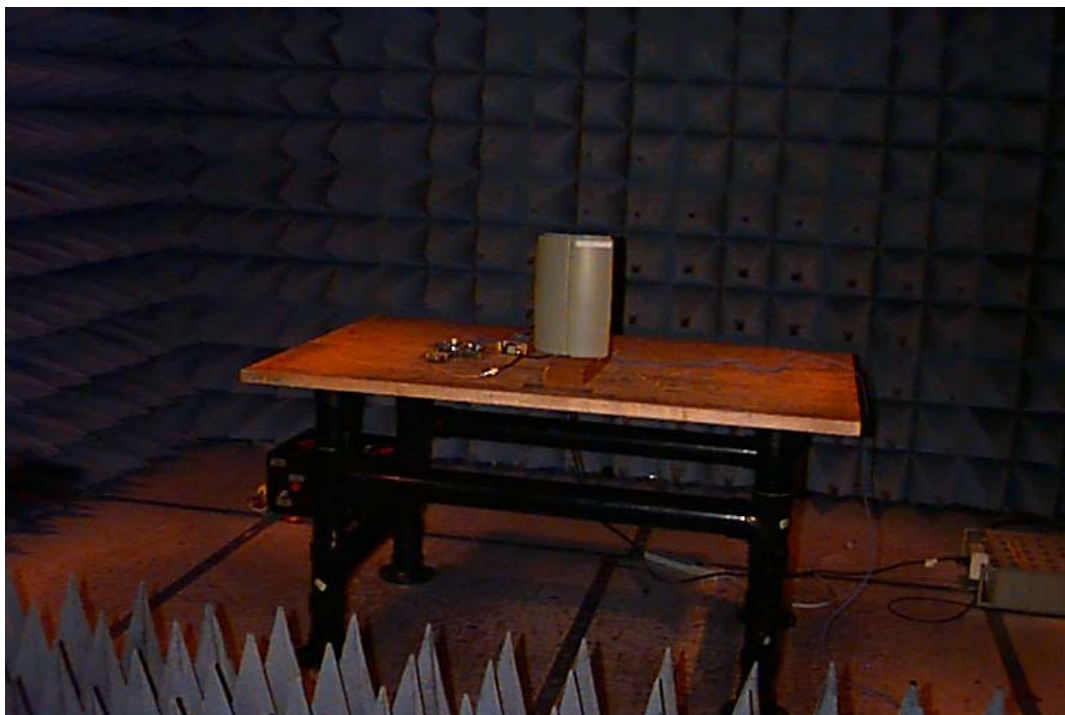
4dBi Maxrad Antenna



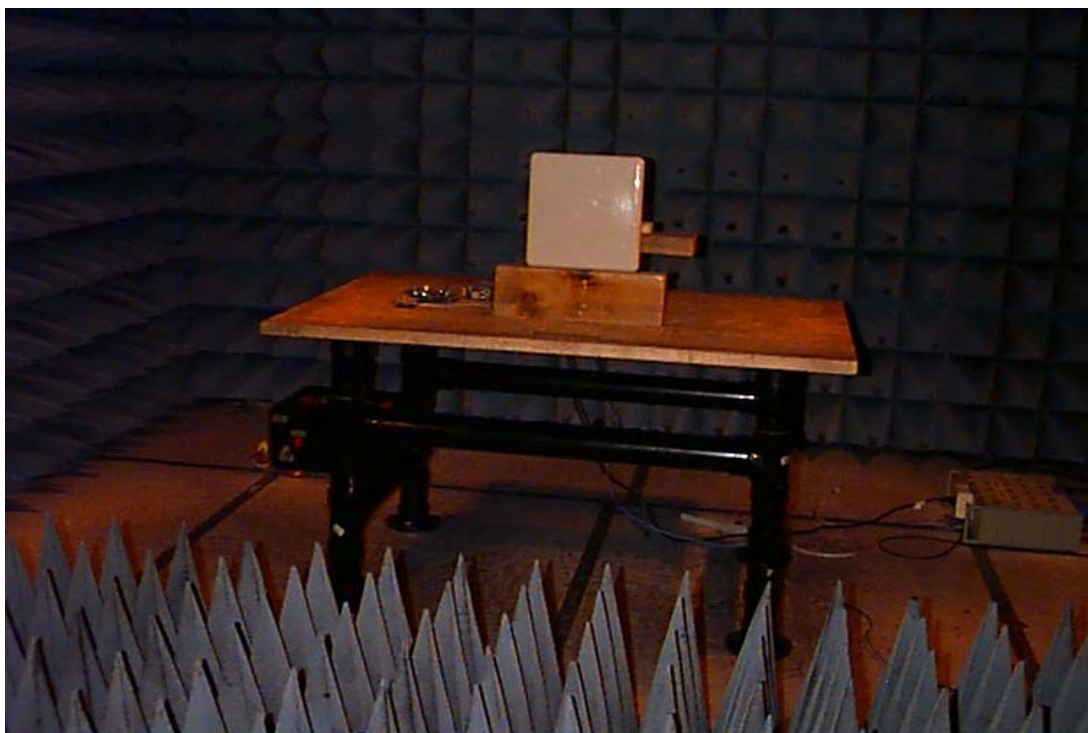
10dBi Maxrad Antenna



15dBi Belair Patch Antenna

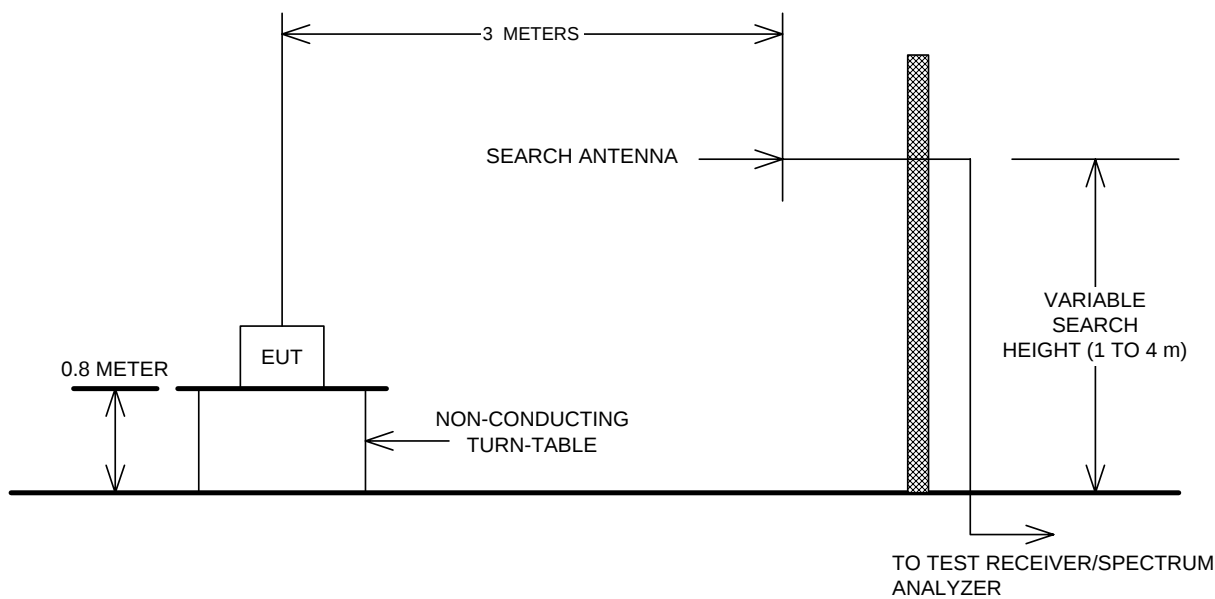


23dBi H&S Antenna

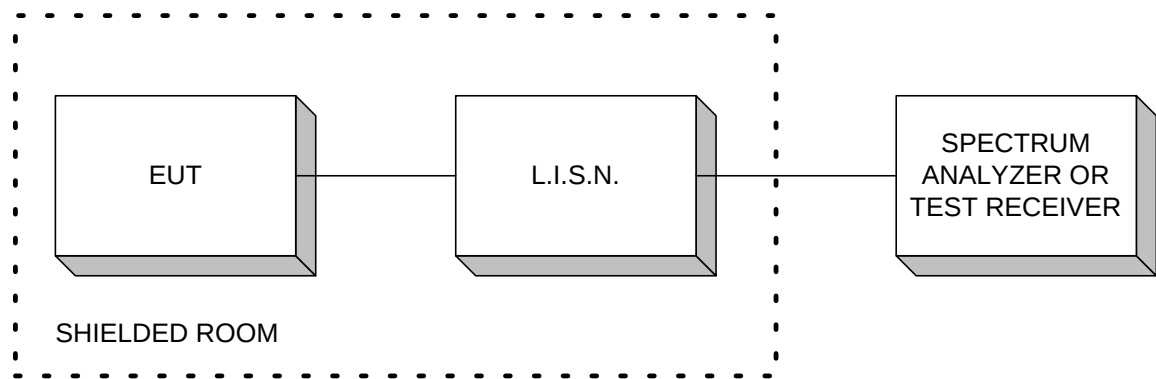


Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Emissions



Conducted Measurements

