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Test Report:	83533-7TRFWL
Applicant:	Ingrid Inc. 920 Cassatt Rd. Suite 220 Berwyn, PA 19312 USA
Apparatus:	HSC1000
FCC ID:	S9PHSC1000
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:	July 27, 2007
Total Number of Pages:	31

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: HSC1000

Specification: FCC Part 15 Subpart C, 15.247

Compliance Status: Complies

Exclusions: None

Non-compliances: None

Report Release History: Original Release

Author: Heng Lin EMC / 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:

HSC1000

1.2 Samples Submitted for Assessment

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

Sample No.	Description	Serial No.
9	CHC1000	None
11	HSC1000	None
12	HSC1000	None
21	Switching mode power supply	None

The first samples were received on: March 30, 2007

1.3 Technical Specifications of the EUT

Manufacturer: Ingrid Inc.

Operating Frequency: 2401.056 – 2482.272 MHz

Peak Output Power: 22.93 dBm (Conducted Output Power)

Emission Designator F1D

Modulation: GFSK

Antenna Data: Integrated PCB Antenna, 3 dBi

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 ^{o}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.
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU	FA002043	Oct. 24/07
LISN	Rohde & Schwarz	ENV216	FA002023	Aug. 28/07
Spectrum Analyzer	Rohde & Schwarz	FSU	FA001877	Jan. 16/08
Receiver	Rohde & Schwarz	ESVS-30	FA001445	July 14/07
Biconical (2) Antenna	EMCO	3109	FA000904	Sept. 12/07
Log Periodic Antenna #2	EMCO	3148	FA001355	May 16/07
Horn Antenna #1	EMCO	3115	FA000649	Feb. 26/08
Horn Antenna #2	EMCO	3115	FA000825	Jan. 30/08
Horn 18 – 26.5 GHz	Electro-Metrics	SH-50/60-1	FA000479	COU
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

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.

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
15.247(a)(1)	Frequency hopping systems	Y	PASS
15.247(a)(1)(i)	Frequency hopping systems operating in the 902-928 MHz band	N	
15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725-5850 MHz band	N	
15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400-2483.5 MHz band	Y	PASS
15.247(a)(2)	Systems using digital modulation techniques	N	
15.247(b)(1)	Maximum peak output power of Frequency hopping systems operating in the 2400-2483.5 MHz band and 5725-5850 MHz band	Y	PASS
15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902-928 MHz band	N	
15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands	N	
15.247(b)(4)	Maximum peak output power	Y	PASS
15.247(c)(1)	Fixed point-to-point Operation with directional antenna gains greater than 6 dBi	N	
15.247(c)(2)	Transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams	N	
15.247(d)	Radiated Emissions Not in Restricted Bands	Y	PASS
15.247(e)	Power Spectral Density for Digitally Modulated Devices	N	
15.247(f)	Time of Occupancy for Hybrid Systems	N	

Notes:

Appendix A : Test Results

Clause 15.207(a) Powerline Conducted Emissions

Frequency of Conducted limit (dBuV)

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:

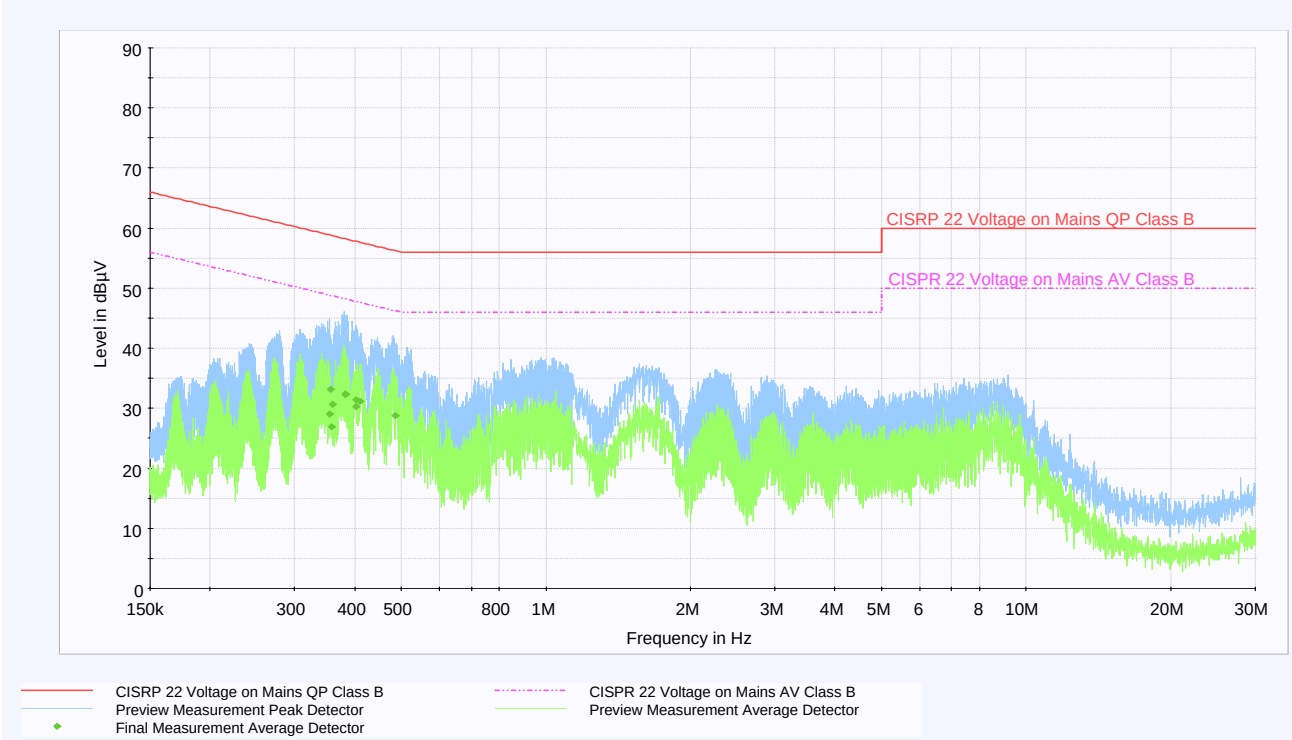
Sample Number:	9, 11, 21	**Temperature:**	22
Date:	April 16, 2007	**Humidity:**	45
Modification State:	0	**Tester:**	Heng Lin
		Laboratory:	Ottawa

Test Results: See Attached Plots.

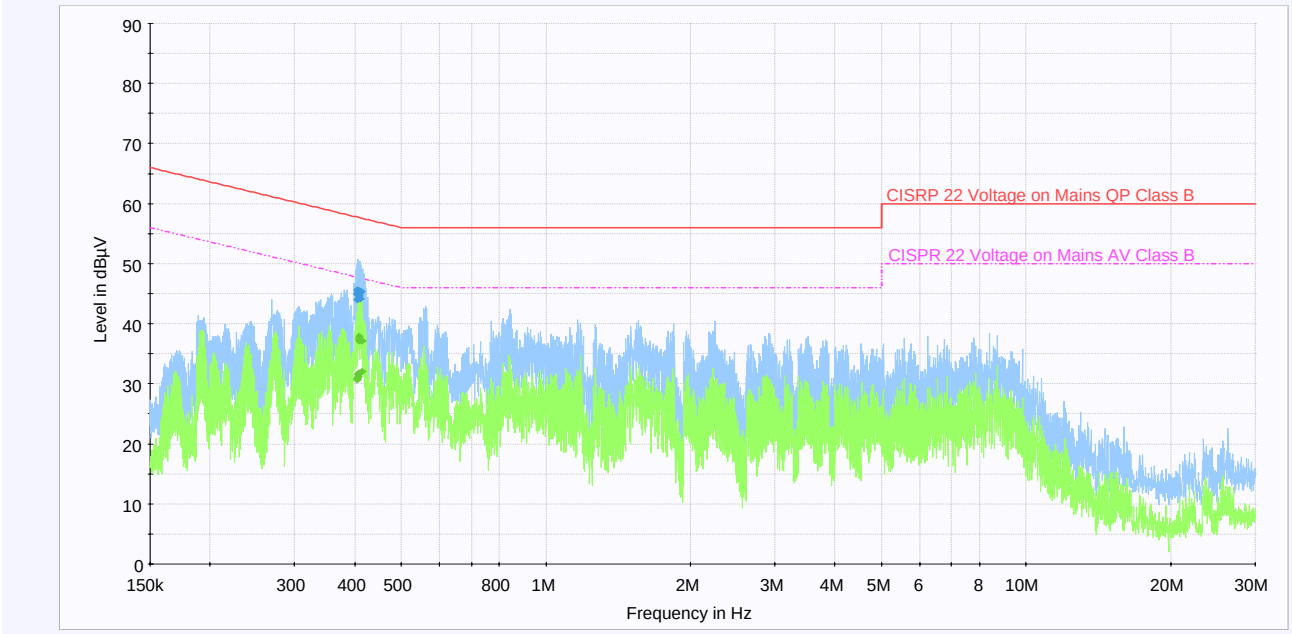
Additional Observations:

All measurements for conducted emissions were performed using a Peak detector, Average detector and Quasi-Peak detector with 9 kHz RBW.

AC Mains Phase Line - 120VAC, 60Hz



AC Mains Neutral Line - 120VAC, 60Hz



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 (microvolts/meter)	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:	11	**Temperature:**	22
Date:	May 04, 2007	**Humidity:**	45
Modification State:	0	**Tester:**	Heng Lin
		Laboratory:	Ottawa

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.

The EUT was measured on three orthogonal axes.

The test was performed with a fresh battery.

All measurements were performed using a Peak Detector with 100kHz / 300kHz RBW / VBW below 1GHz and a 1MHz / 3MHz RBW / VBW above 1GHz at a distance of 3 meters.

Only emission within 20 dB below the limit line in the restricted bands were reported.

Below 1GHz:

Freq. (MHz)	Ant	Pol. V/H	RCVD Signal (dBμV)	Ant. Factor/Cable Loss (dB)	Amp. Gain (dB)	Cable Loss (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)
114.0484	BC2	V	19.3	11.5	NA	1.1	31.9	43.5	11.6
134.7841	BC2	V	17.8	13.8	NA	1.3	32.9	43.5	10.6

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

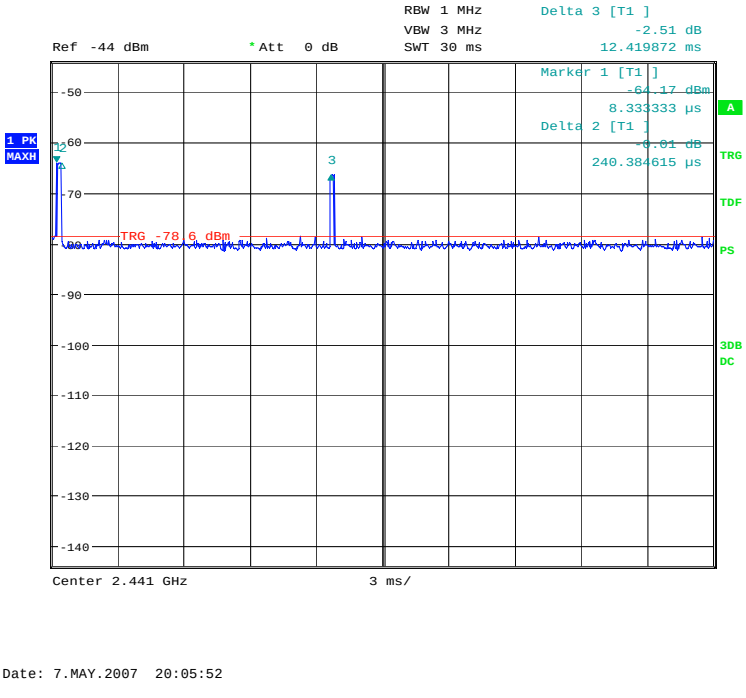
Above 1 GHz:

	Frequency (MHz)	**Ant.**	**Polarity**	**RCVD Signal (dBuV)**	**Ant. Factor (dB)**	**Amp. Gain (dB)**	**Duty Cycle Corr.**	**Cable Loss (dB)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Detector**
1	7446.8400	Horn2	V	61.6	36.4	55.7	-34.24	12.3	54.6	74.0	19.4	Peak
									20.36	54.0	33.64	Average
2	7446.8400	Horn2	H	64.4	36.3	55.7	-34.24	12.3	57.3	74.0	16.7	Peak
									23.06	54.0	30.94	Average

Note:

Antenna Legend: BC = Biconical, BL = Bilog, LP = Log Periodic, Horn = Horn, ED = EMCO Dipole
Detector Legend: Below 1GHz, Peak detector with 100 KHz RBW
Above 1GHz, Peak detector with 1MHz RBW
The spectrum was investigated for radiated emissions from 30 MHz to 10th Harmonic.

Duty Cycle Correction Factor:



T_{ON} : 240.384615 µs

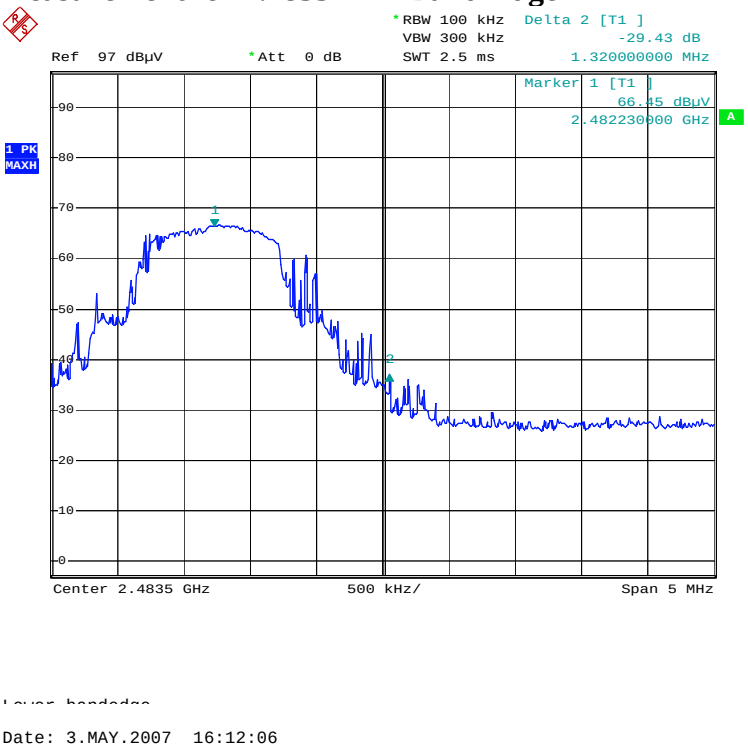
$T_{ON} + T_{OFF}$: 12.419872 ms

Duty Cycle = $T_{ON} / (T_{ON} + T_{OFF}) \times 100\% = 0.240384615 / 12.419872 \times 100\% = 1.94\%$

Transmission-on-time within 100 milliseconds period: T = 1.94 ms

Duty Cycle Correction = $20 \log_{10}(T / 100ms) = 20 \log_{10}(1.94 \text{ ms} / 100 \text{ ms}) = -34.24$ dB

Delta Marker Measurement for 2.4835MHz Band Edge



Measured Field Strength for High Channel in 1MHz RBW = 100.6 dBµV/m

Delta Marker = -29.43 dB

Therefore, Peak Field Strength = 100.6 dBµV/m – 29.43 dB = 71.17 dBµV/m
Limit = 74 dBµV/m
Average Field Strength = 71.17 dBµV/m – 34.24dB(Duty Cycle) = 36.93 dBµV/m
Limit = 54 dBµV/m

Clause 15.247(a)(1) Frequency hopping systems

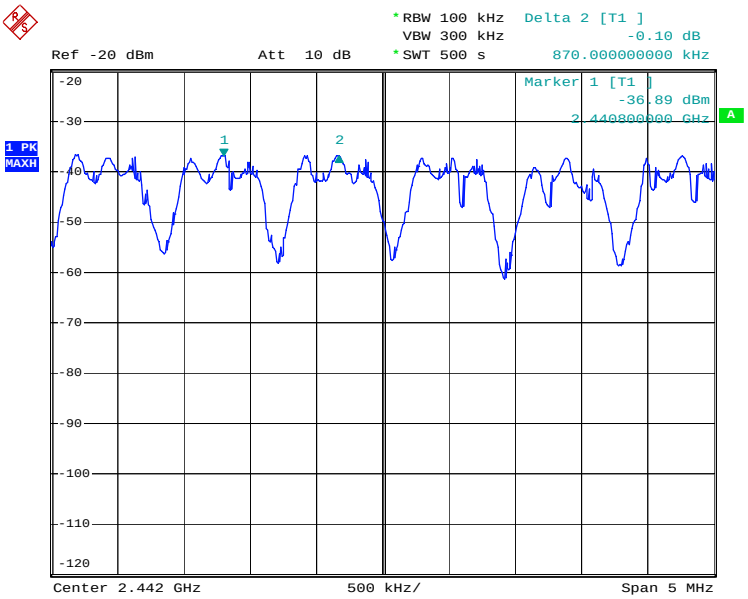
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Test Conditions:

Sample Number:	12	**Temperature:**	22
Date:	May 01, 2007	**Humidity:**	45
Modification State:	0	**Tester:**	Heng Lin
		Laboratory:	Ottawa

Test Results:

Channel Spacing:



Date: 1.MAY.2007 15:54:30

Clause 15.247(a)(1)(iii) Frequency hopping systems operating in the 2400-2483.5 MHz band

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used

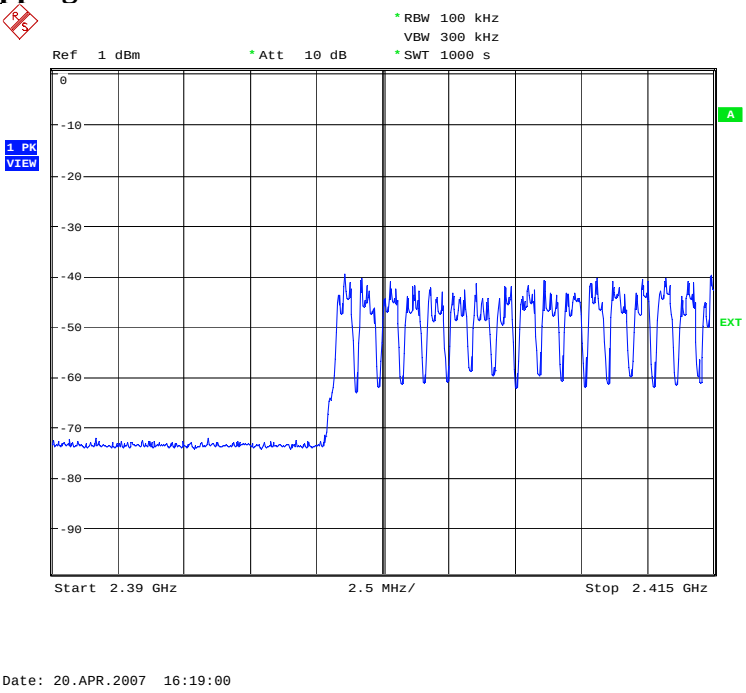
Test Conditions:

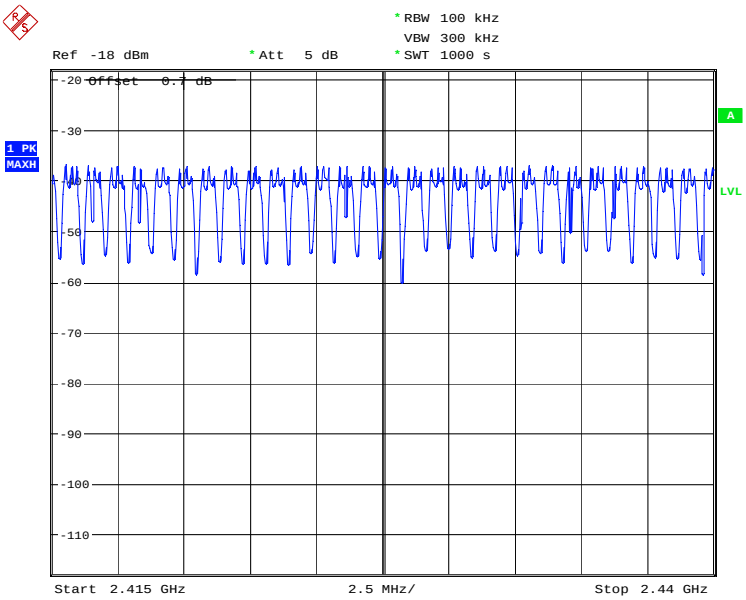
Sample Number:	12	**Temperature:**	22
Date:	April 20, 2007	**Humidity:**	45
Modification State:	0	**Tester:**	Heng Lin
		Laboratory:	Ottawa

Test Results:

Number of Hopping channel = 95 Channels
Maximum 20dB Bandwidth = 720 kHz
Time of Occupancy = 8.91 msec in 38 seconds

Number of Hopping Channels:





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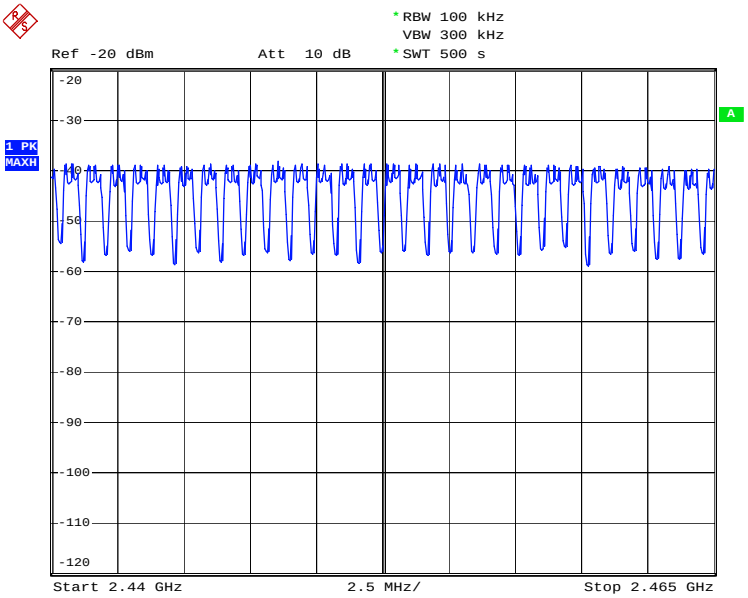

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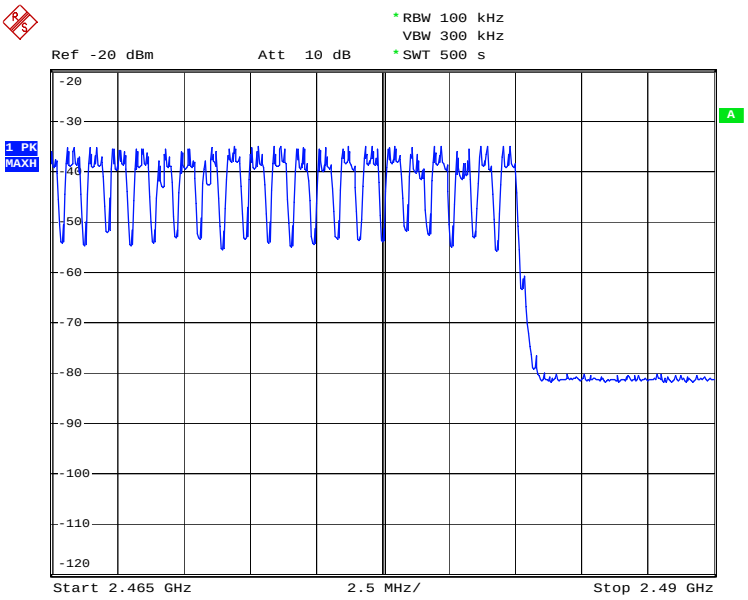

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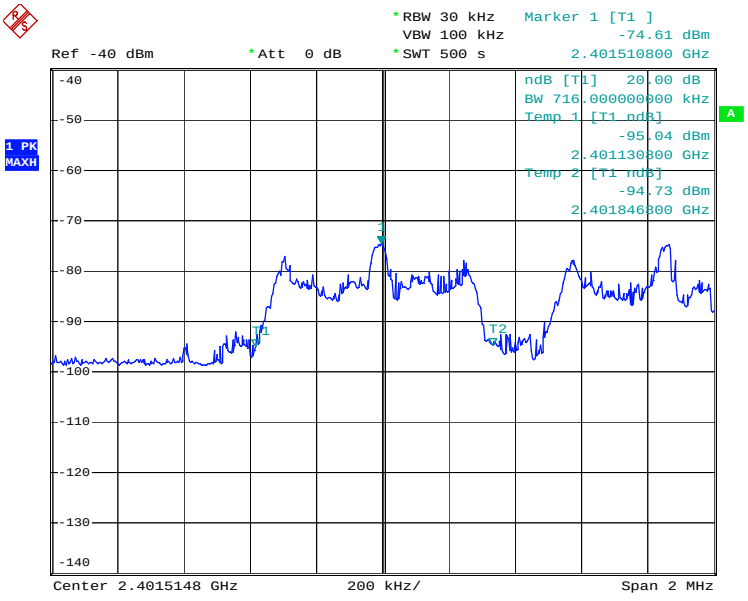
20dB Bandwidth:
Low Channel



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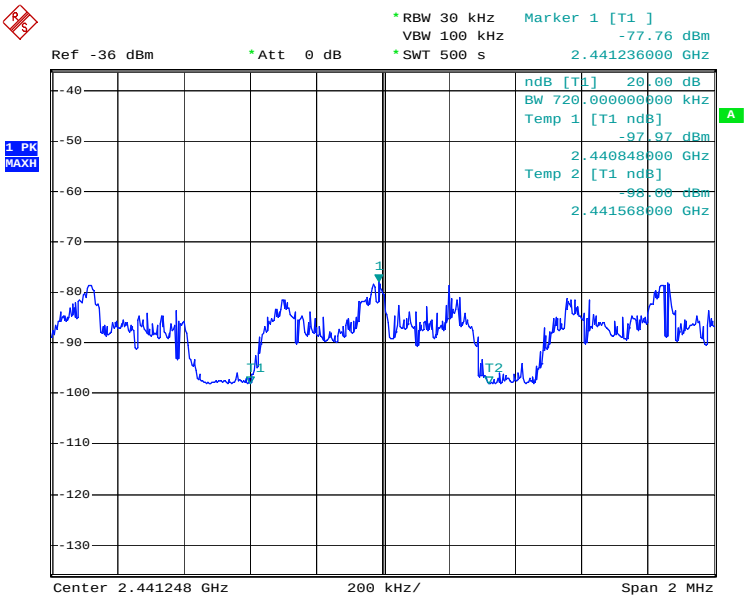
Mid Channel



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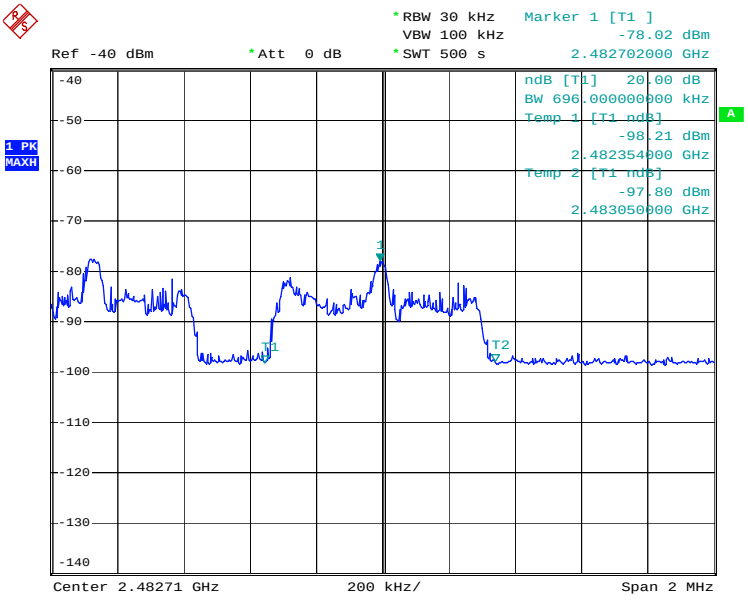
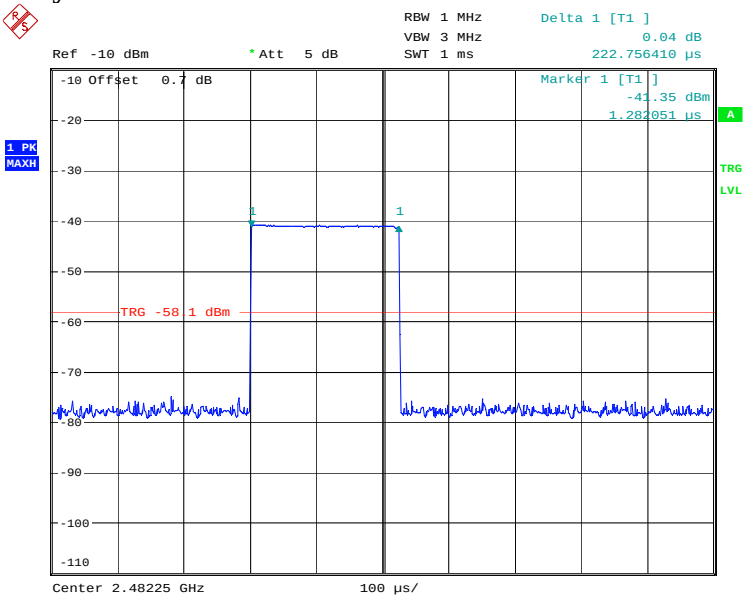
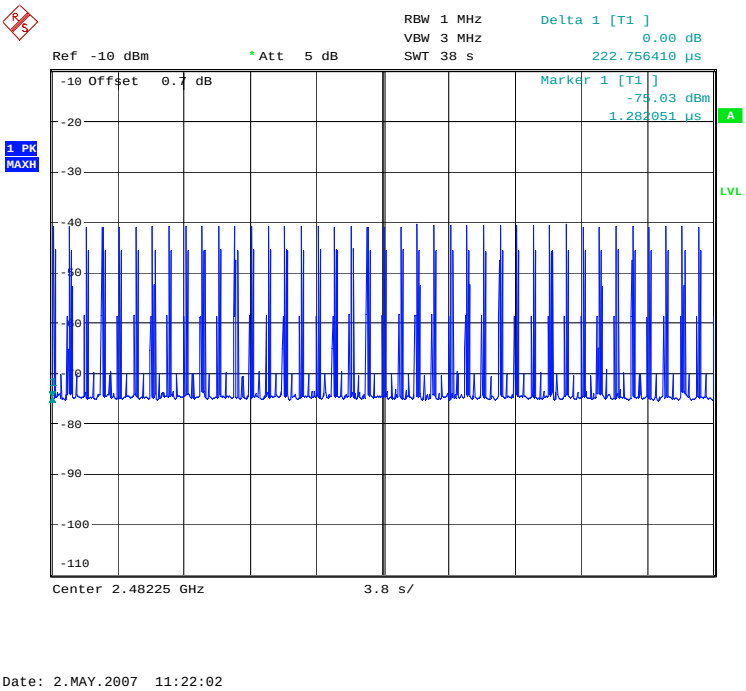
High Channel



Date: 9.MAY.2007 11:46:59

Time of Occupancy:





Required Reference Time Frame: T_{Ref} = 0.4 s × 95 = 38 s

Number of Hits in 38 seconds: 40 hits

Time of occupancy Within 38 seconds Frame: 222.756410 µs × 40 hits = 8.91 ms

Clause 15.247(b)(1) Maximum peak output power of Frequency hopping systems operating in the 2400-2483.5 MHz band and 5725-5850 MHz band

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Test Conditions:

Sample Number:	12	**Temperature:**	22
Date:	May 01, 2007	**Humidity:**	45
Modification State:	0	**Tester:**	Heng Lin
		Laboratory:	Ottawa

Test Results:

Conducted Output Power:

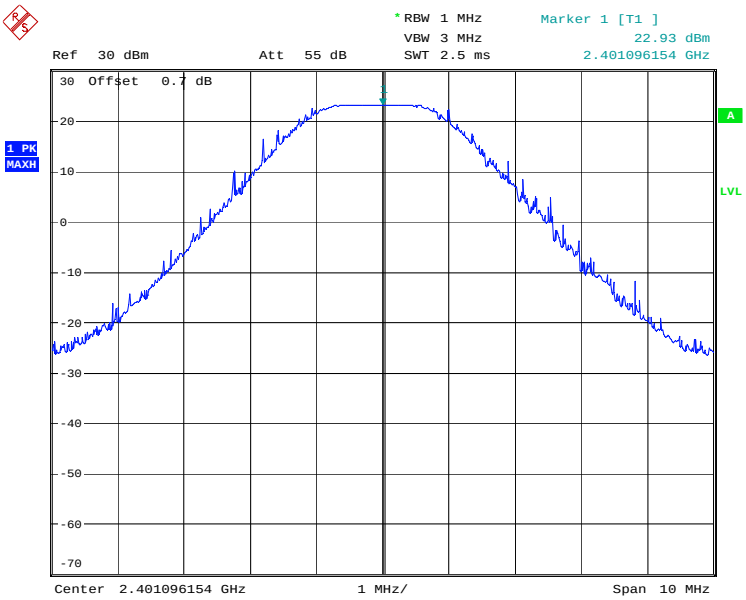
Measured output power = 22.93 dBm
Maximum output power = 22.93 dBm + 3 dBi = 25.93 dBm EIRP
Limit = 36 dBm EIRP

The test was performed with a fresh battery.

Note: The EUT was modified by the manufacturer to perform conducted measurements.

Channel Range	Measured Output Power	
Low	22.93 dBm	196.34 mW
Mid	22.54 dBm	179.47 mW
High	18.27 dBm	67.14 mW

Low Channel:



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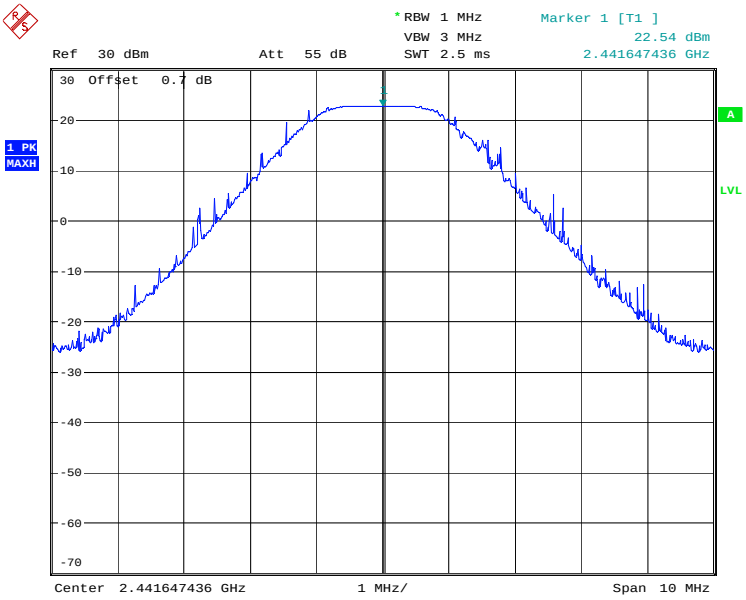
Mid Channel:



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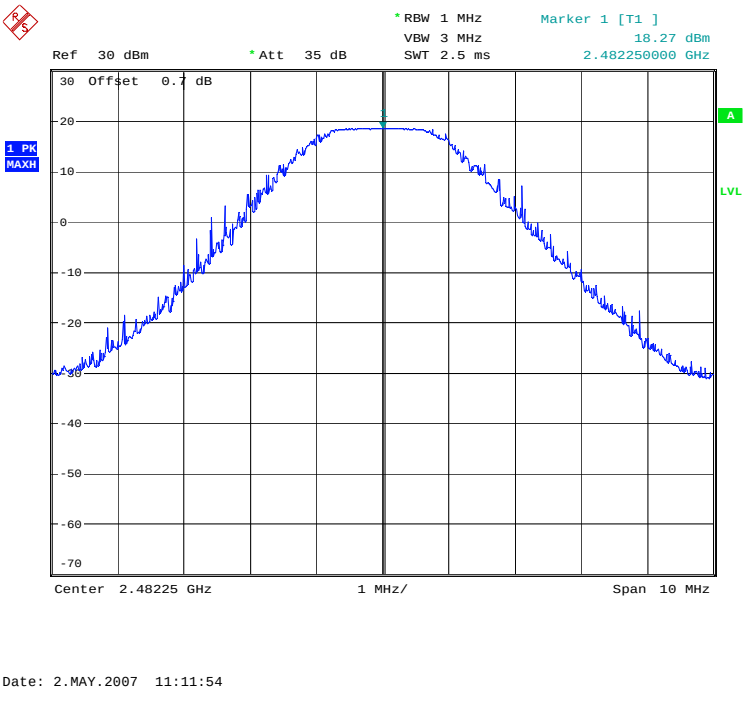
High Channel:



Clause 15.247(d) Radiated Emissions Not in Restricted Bands

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)).

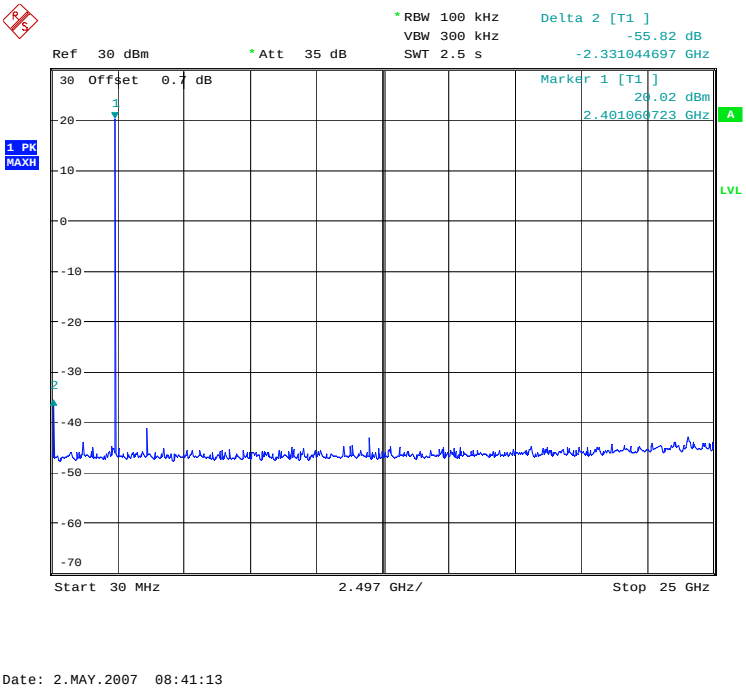
Test Conditions:

Sample Number:	12	**Temperature:**	22
Date:	May 01, 2007	**Humidity:**	45
Modification State:	0	**Tester:**	Heng Lin
		Laboratory:	Ottawa

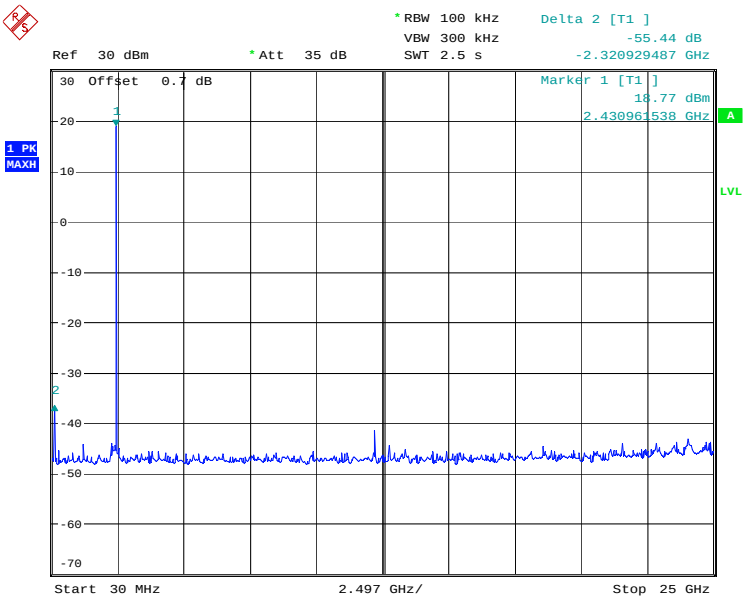
Test Results:

See Attached Table and Plots.

Conducted Emission
Low Channel



Mid Channel



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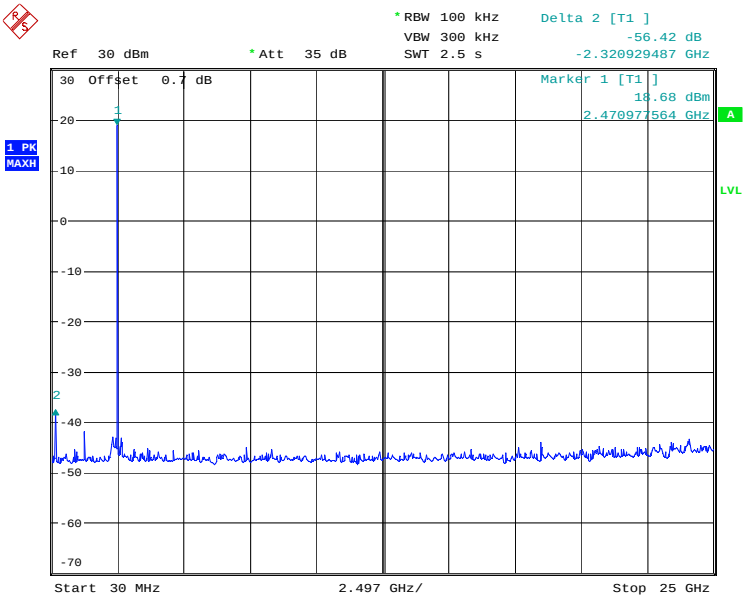
High Channel



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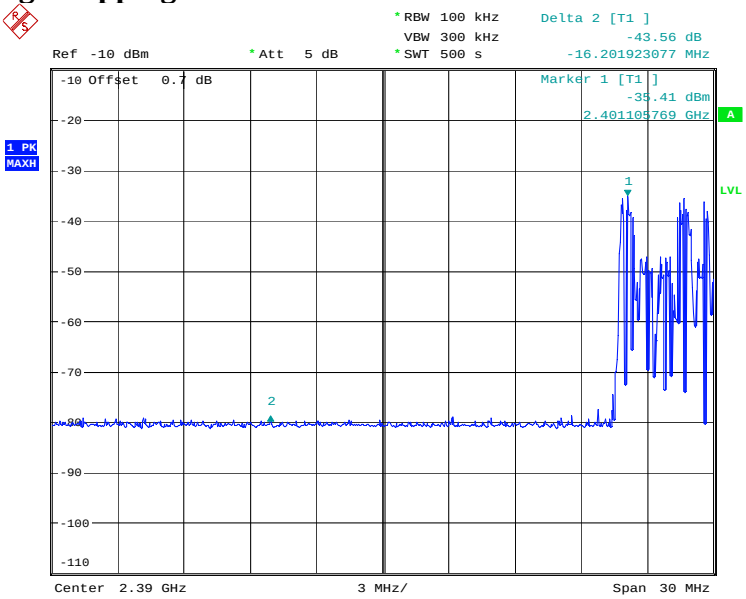
Lower Band Edge Hopping On:



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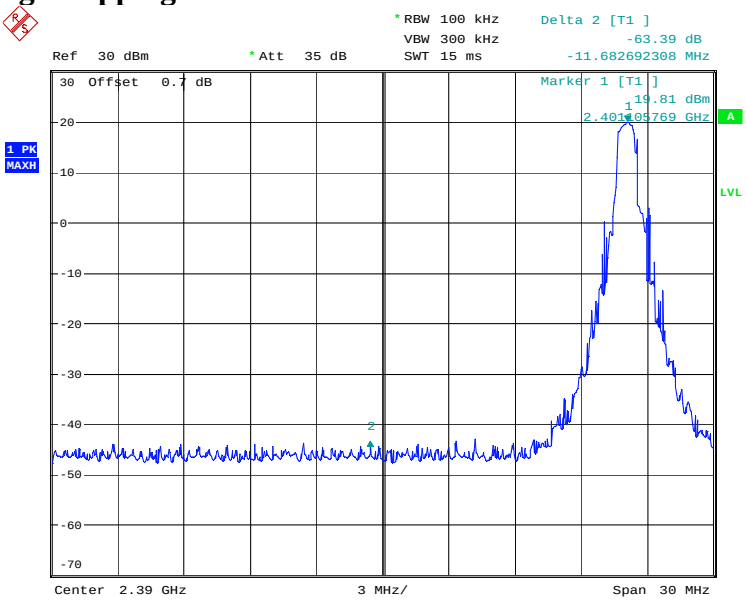
Lower Band Edge Hopping Off:



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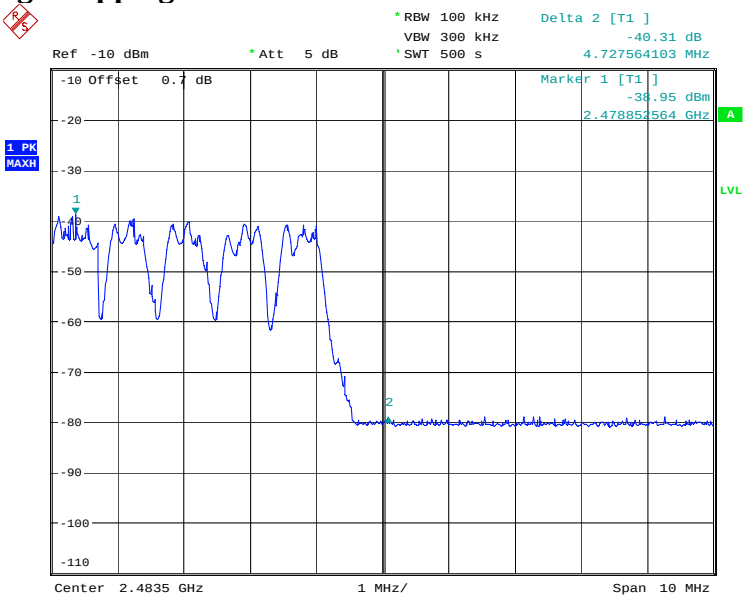
Upper Band Edge Hopping On:



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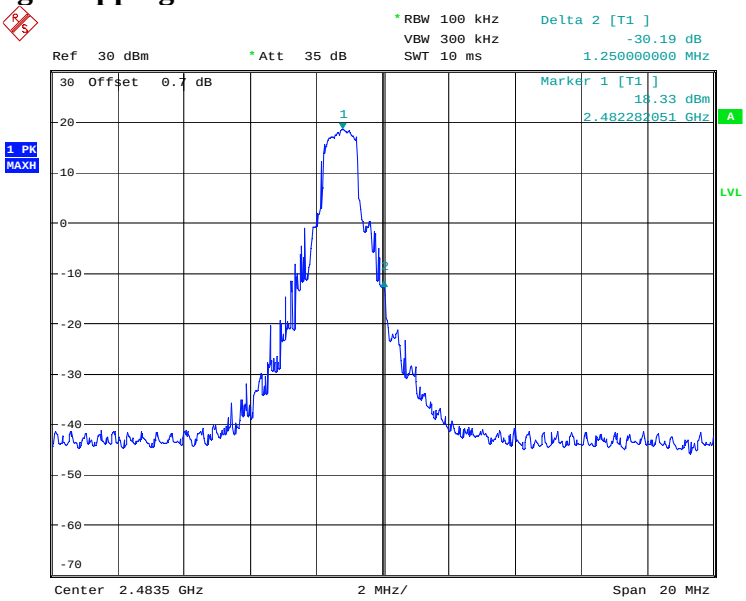

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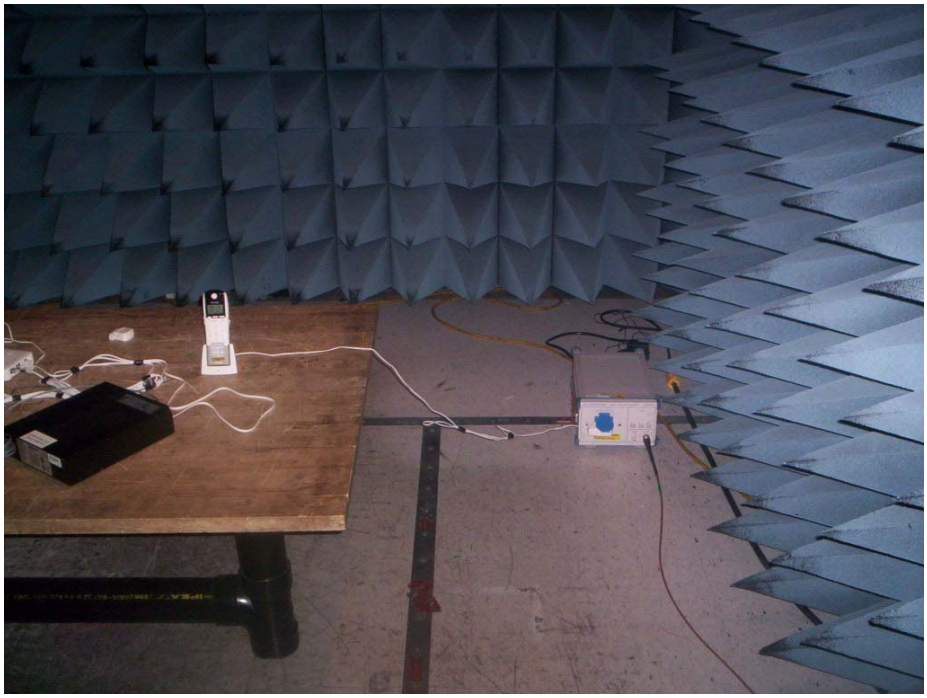
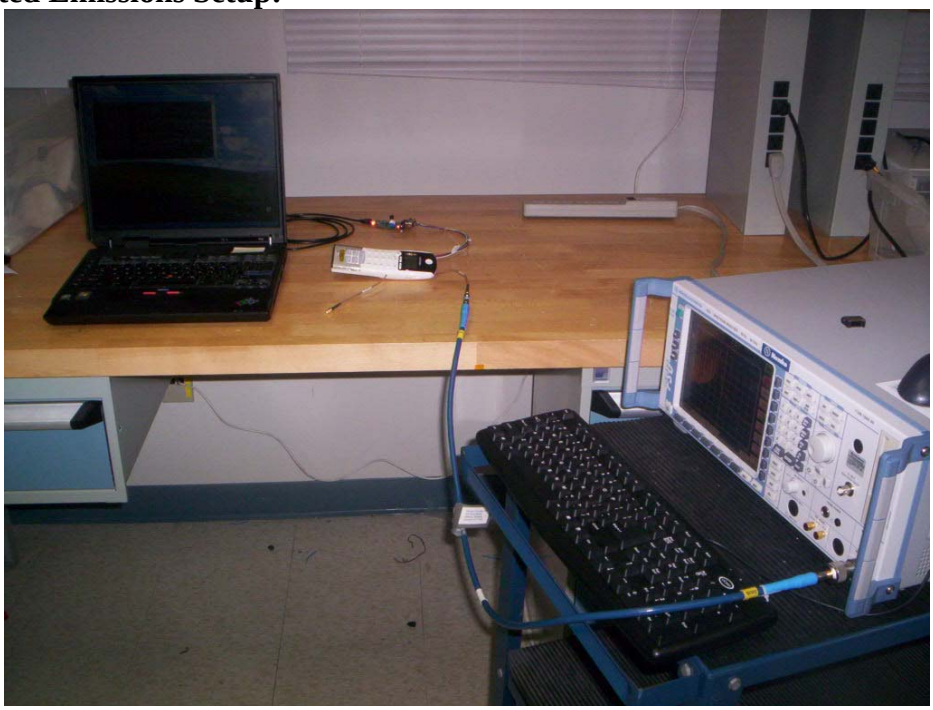
Appendix B : Setup Photographs

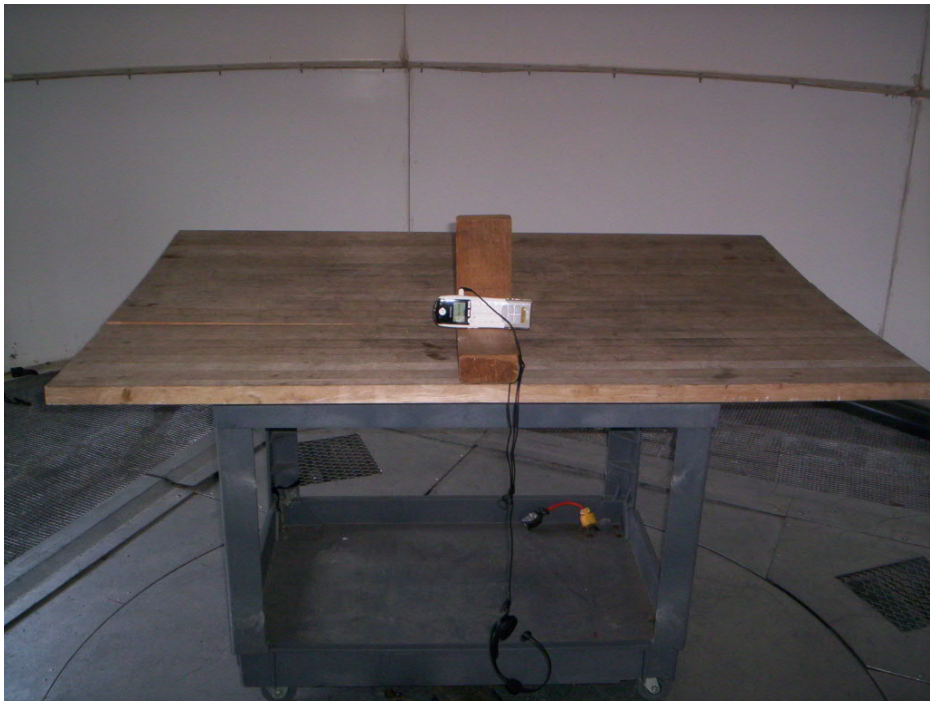
Conducted Emission at Mains Port



Conducted Emissions Setup:

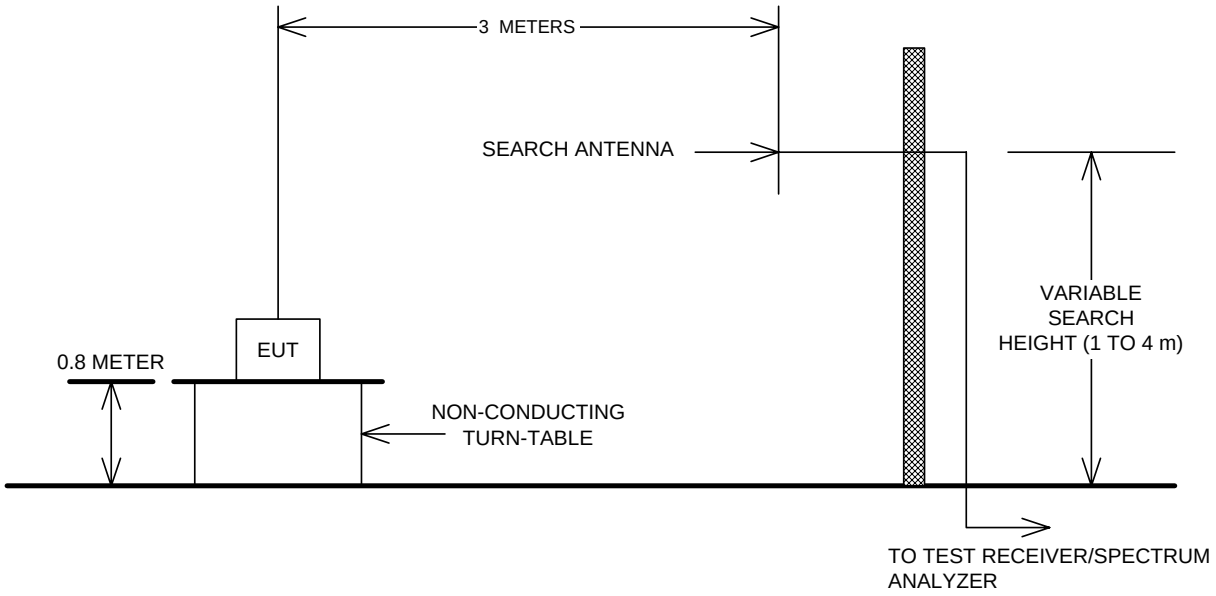


Spurious Emissions Setup:



Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Emissions