



TEST REPORT

Report Number: 3155476MPK-001

Project Number: 3155476

July 31, 2008

Testing performed on the

RF Hub

Model number: K200i-HB

FCC ID: WKGK200HB

IC: 7858A-K200HB

to

FCC Part 15.249, RSS-210 Annex 2

For

Saunatec Inc.



A2LA Certificate Number: 1755-01

Test Performed by:

Intertek Testing Services NA, Inc
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Menlo Park, CA 94025

Test Authorized by:

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Woodinville, Washington 98011

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Date: July 31, 2008

Reviewed by:

Ollie Moyrong

Ollie Moyrong, Operations Manager

Date: July 31, 2008

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1.0 Summary of Tests

TEST	REFERENCE FCC Rule	REFERENCE RSS-210/RSS-GEN	RESULT
Field Strength of Fundamental	15.249a	A2.9(a)	Complies
Field Strength of Harmonics	15.249a	A2.9(a)	Complies
Radiated Emissions outside the band	15.249c	A2.9(b)	Complies
Line Conducted Emissions	15.207	RSS-GEN 7.2.2	Complies
Radiated Emissions from digital part and receiver	15.109	RSS-GEN, ICES-003	Complies

2.0 General Description

2.1 Product Description

The RF Hub is one of the components of the Amerec K200i Control System (K200i). The K200i is a remotely operated steam bath controller designed and marketed by Saunatec, Inc. K200i is designed to be professionally installed in a residential steam room environment. In addition to regulating steam, K200i also controls a matrix of multi-coloured light-emitting diodes (LED), a fragrance injector pump and a variable speed fan. The end user uses the K200i system for therapy and overall wellness treatment in the home.

The K200i System contains three radios operating in the 2.4GHz ISM band: RF Hub, Remote Control and Remote Control Dock. In normal operation RF Hub is communicating with Remote Control and with Remote Control Dock. There is no wireless communication between the Remote Control and Remote Control Dock at any time. The Charging Station only charges the battery of the Remote Control and does not communicate with any component in the K200i system. It should be noted that the Remote Control does not transmit when it is placed in the Charging Station.

Overview of the EUT

Applicant name & address	Saunatec Inc. 17683 128th Place NE, Bldg C Woodinville, Washington 98011
Manufacturer name & address	Schippers & Crew, Inc. 5309 Shilshole Ave, NW #100 Seattle WA 98107, tel: 206-782-2325, fax: 877-263-4879
Trade Name & Model No.	K200i-HB
Rated RF Output Power	-7.3 dBm
Frequency Range	2425.75 – 2477.9 MHz
Number of Channel(s)	4 Ch 0: 2425.749695MHz Ch 1: 2450.743591MHz Ch 2: 2475.487549MHz Ch 3: 2477.986938MHz
Type of Modulation	2FSK, 38 kHz peak deviation
Data Rate	4.8 Kbps
Duty Cycle	20.5% maximum
Antenna(s) & Gain	Surface-mount disk, installed on PCB, +4.0 dBi gain

A prototype version of the EUT was received on July 22, 2008 in good operating condition. As declared by the Applicant, it is identical to production units.

2.2 Related Submittal(s) Grants

This report is for use with an application for certification of a low power transmitter.

2.3 Test Methodology

Radiated emissions measurements were performed according to the procedures in ANSI C63.4 (2003). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

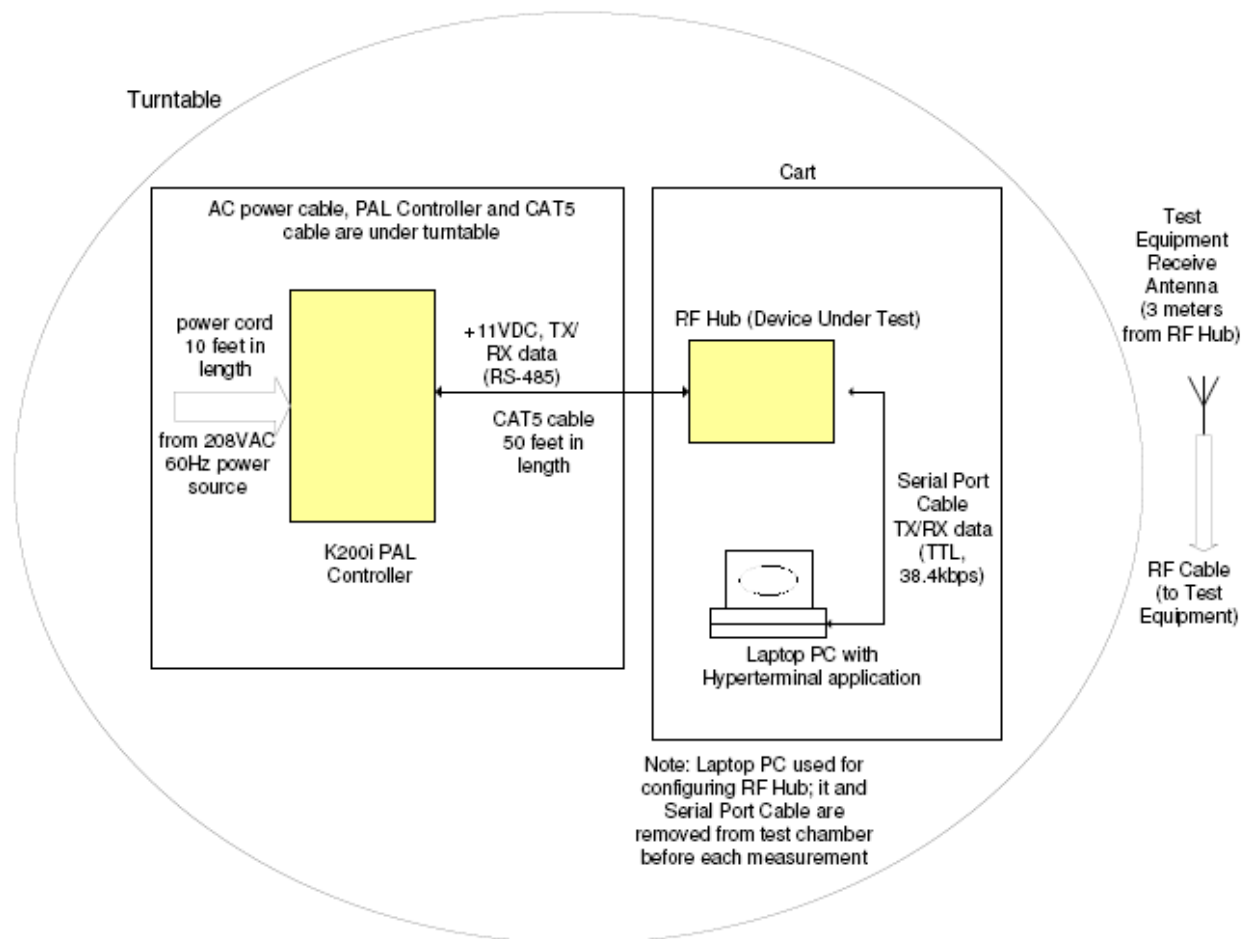
The 10m anechoic chamber and conducted measurement facility used to collect the radiated data is site #1. This test facility and site measurement data have been fully placed on file with the FCC and A2LA accredited.

3.0 System Test Configuration

3.1 Support Equipment and description

Item #	Description	Model No.	Serial No.
1	K200i PAL Controller	K200i-PAL	P1-01
2	Compaq Laptop PC	1262	1V95CFKD32GP

3.2 Block Diagram of Test Setup



3.3 Justification

For emission testing, the test procedures, as described in American National Standards Institute C63.4-1992 (2003), were employed. The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it).

During testing, all cables were manipulated to produce worst case emissions.

If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT was wired to transmit full power. Care was taken to ensure proper power supply voltages during testing.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

3.5 Mode of operation during test

During the test the EUT was setup to transmit continuously a modulated signal.

3.6 Modifications required for Compliance

No modifications were installed by Intertek Testing Services during compliance testing in order to bring the product into compliance (Please note that this does not include changes made specifically by Saunatec Inc. prior to compliance testing).

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Transmitter Radiated Emissions

FCC Rules: 15.249, 15.209.

Requirements

The Field Strength of emissions shall not exceed the following levels:

94 dB(μ V/m) for fundamental frequency,

54 dB(μ V/m) for harmonics.

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

Procedure

For radiated emission measurements, the EUT is placed on the non-conductive turntable. The signal is maximized through rotation and placement in the three orthogonal axes.

During the test the EUT is rotated and the antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

Radiated emission measurements were performed from 30 MHz to 25 GHz.

Analyzer resolution is:

100 kHz or greater - for frequencies 1000 MHz and below,

1 MHz - for frequencies above 1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength in dB (μ V/m)

RA = Receiver Amplitude (including preamplifier) in dB (μ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB(1/m)

AG = Amplifier Gain in dB

Test Result

Results	Complies by 1.3 dB
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The data below shows the significant emission frequencies, the limit and the margin of compliance.

Radiated emissions at fundamental frequency

Channel number	Frequency MHz	RA dB(uV)	Detector Peak/Ave	AF dB(1/m)	CF dB	FS at 3m dB(uV/m)	FS Limit dB(uV/m)	Margin dB
0	2425.7	58.4	Average	28.9	5.1	92.7	94	-1.3
1	2450.7	57.5	Average	29.1	5.1	91.8	94	-2.2
3	2477.99	58	Average	29.2	5.1	92.3	94	-1.7

Notes:

- 1) The peak-to-average ratio is less than 10 dB, therefore the peak Field Strength complies with the Limit of 114 dB(uV/m).
- 2) EUT passed without duty cycle correction.

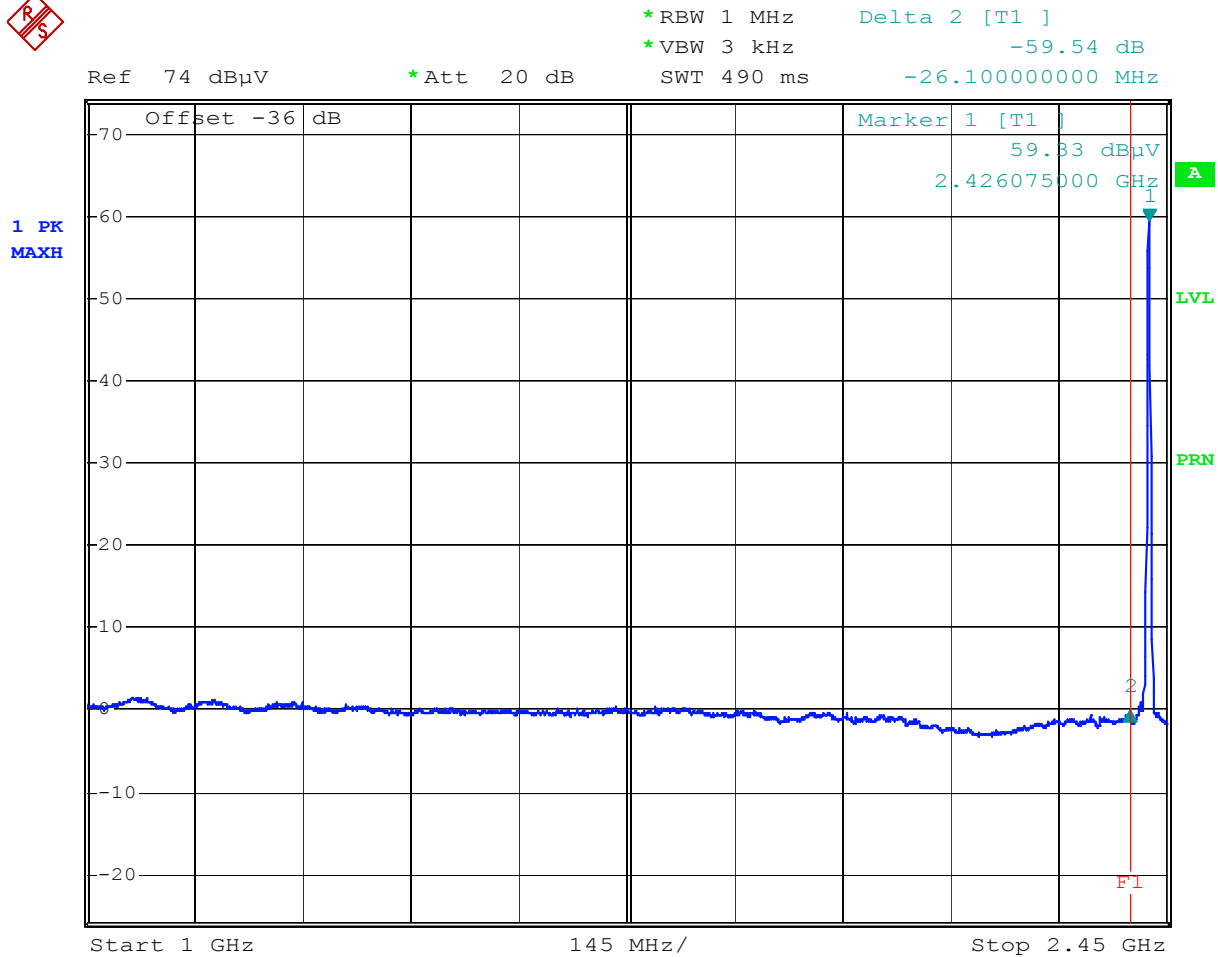
Radiated emissions at harmonic frequencies

Frequency MHz	SA reading dB(uV)	RBW/VBW	Pre Amp dB	Cable Loss dB	Antenna Factor dB(1/m)	FS dB(uV/m)	FS Limit dB(uV/m)	Margin dB
Tx @ 2425.7 MHz								
4851.4	43.2	1MHz/100 Hz	35.1	7.2	33.2	48.5	54.0	-5.5
7277.1	28.8	1MHz/100 Hz	35.4	9.7	36.2	39.3	54.0	-14.7
9702.8	27.3 *	1MHz/100 Hz	35.0	10.6	38.3	41.2	54.0	-12.8
Tx @ 2450.7 MHz								
4901.4	44.0	1MHz/100 Hz	35.1	7.2	33.2	49.3	54.0	-4.7
7352.1	29.2	1MHz/100 Hz	35.3	9.8	36.3	40.0	54.0	-14.0
9802.8	27.3 *	1MHz/100 Hz	34.9	10.8	38.5	41.7	54.0	-12.3
Tx @ 2477.99 MHz								
4956.0	41.0	1MHz/100 Hz	35.2	7.4	33.4	46.6	54.0	-7.4
7434.0	28.3	1MHz/100 Hz	35.1	9.9	36.4	39.5	54.0	-14.5
9912.0	27.4 *	1MHz/100 Hz	34.7	10.9	38.7	42.3	54.0	-11.7

* Noise floor

- Notes:
- 1) The peak-to-average ratio is less than 10 dB, therefore the peak Field Strength complies with The Limit of 74 dB(uV/m).
 - 2) EUT passed without duty cycle correction.
 - 3) All other emissions not reported are noise floor which is at least 10 dB below the limit.

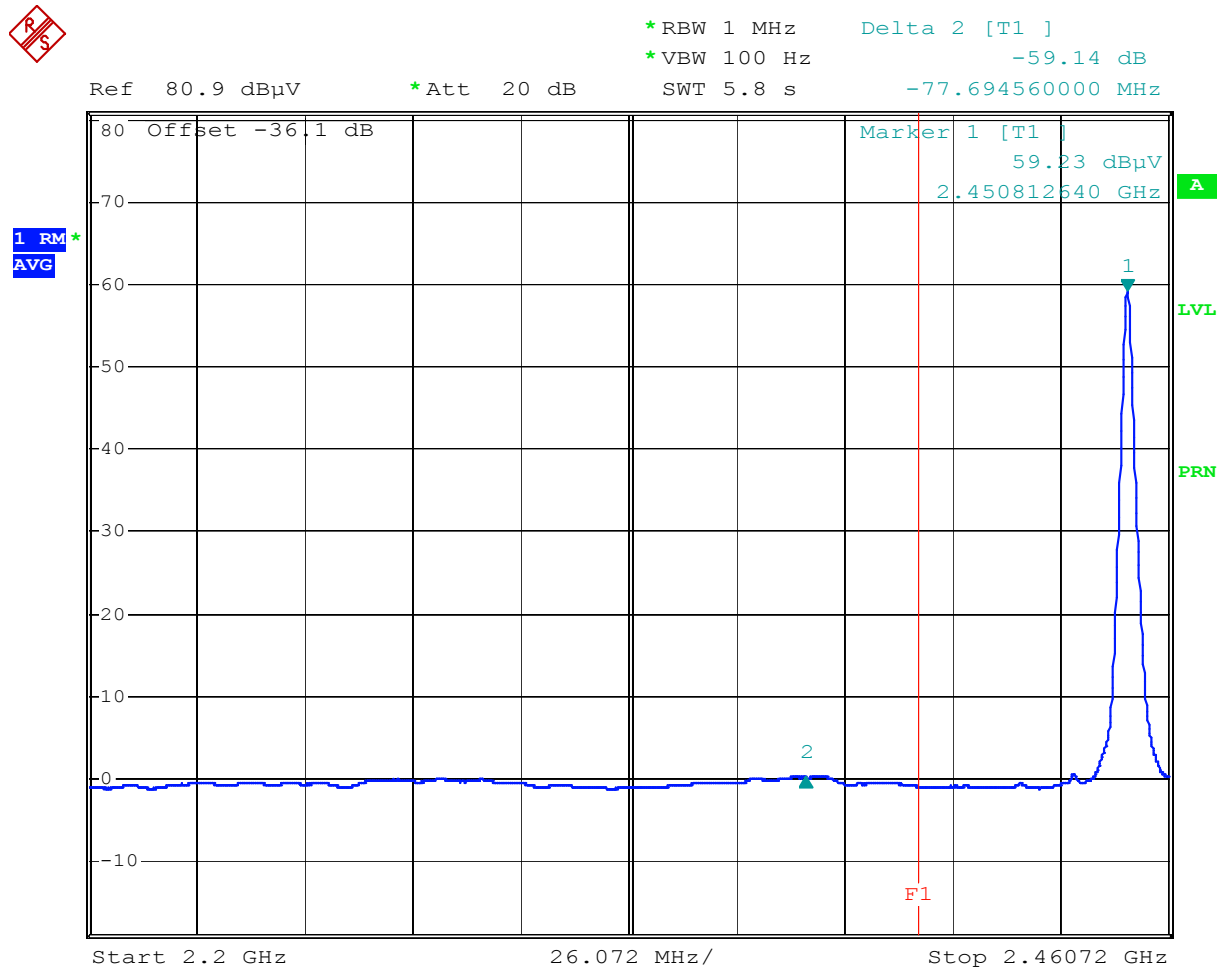
Radiated Emissions outside the operating band except harmonics



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 Date: 23.JUL.2008 15:15:20

Reference level OFFCET is the amplifier gain

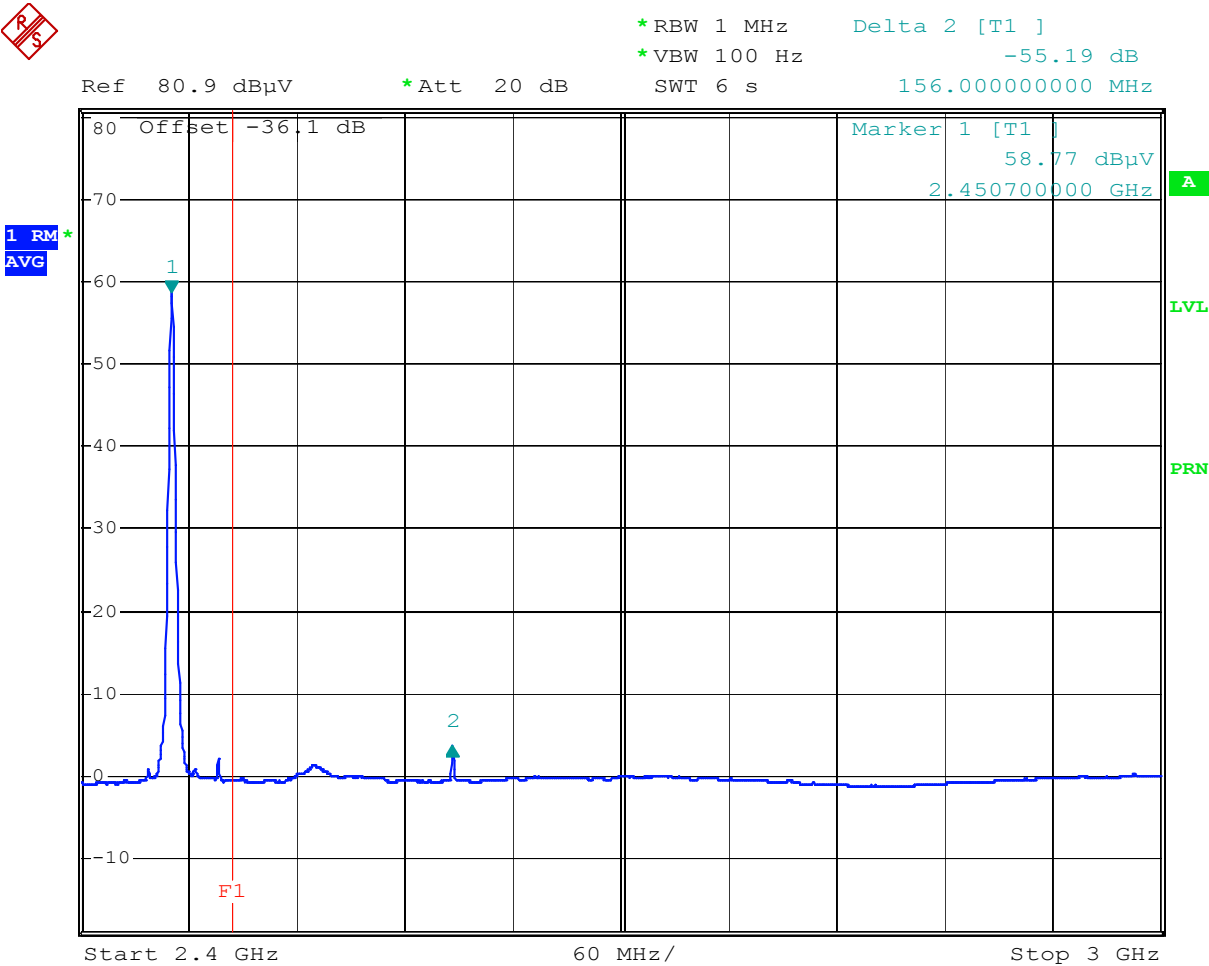
Radiated Emissions outside the operating band except harmonics



Comment: Out-of-band emissions, Ch 1
Date: 22.JUL.2008 21:56:27

Reference level OFFCET is the amplifier gain

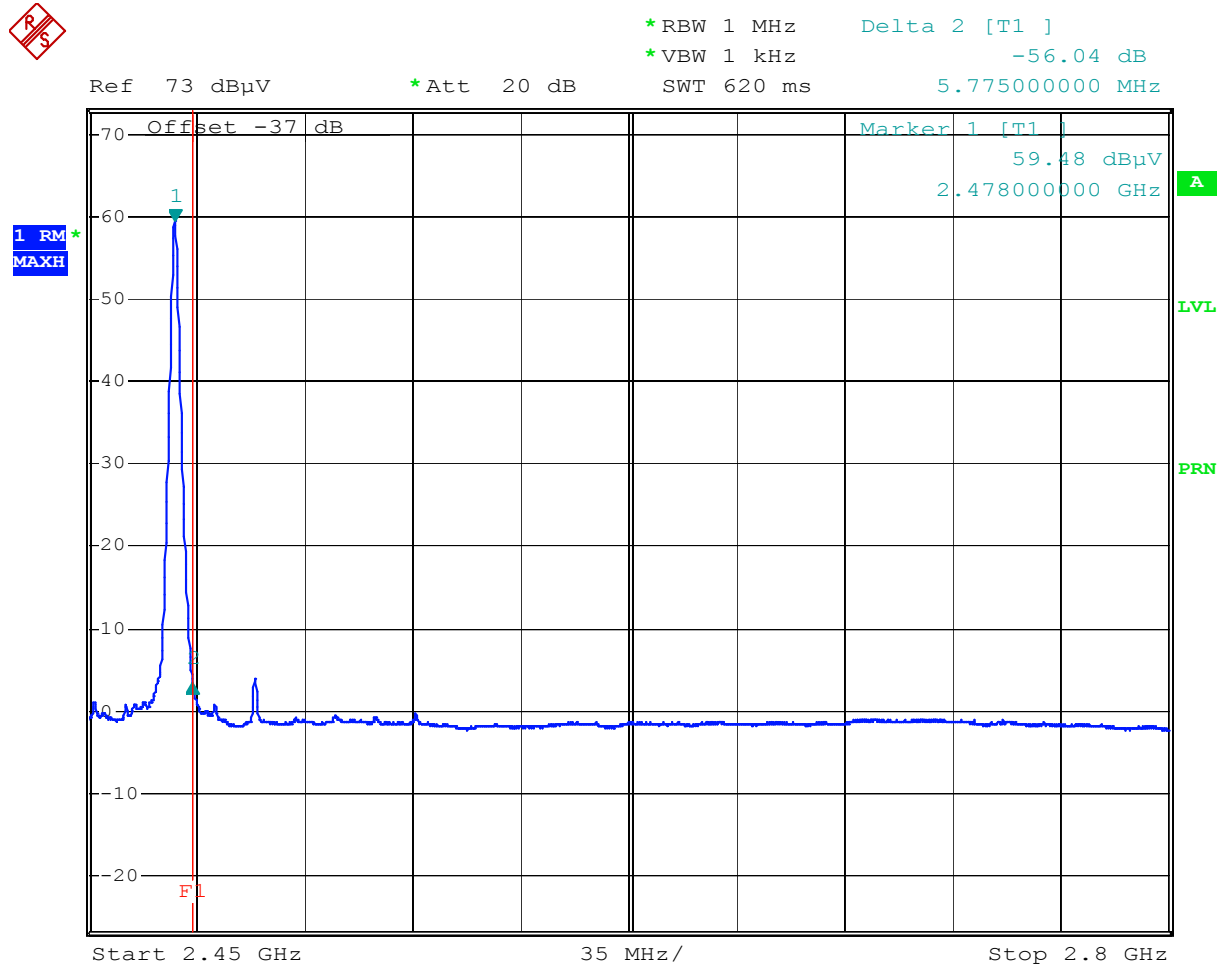
Radiated Emissions outside the operating band except harmonics



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Reference level OFFCET is the amplifier gain

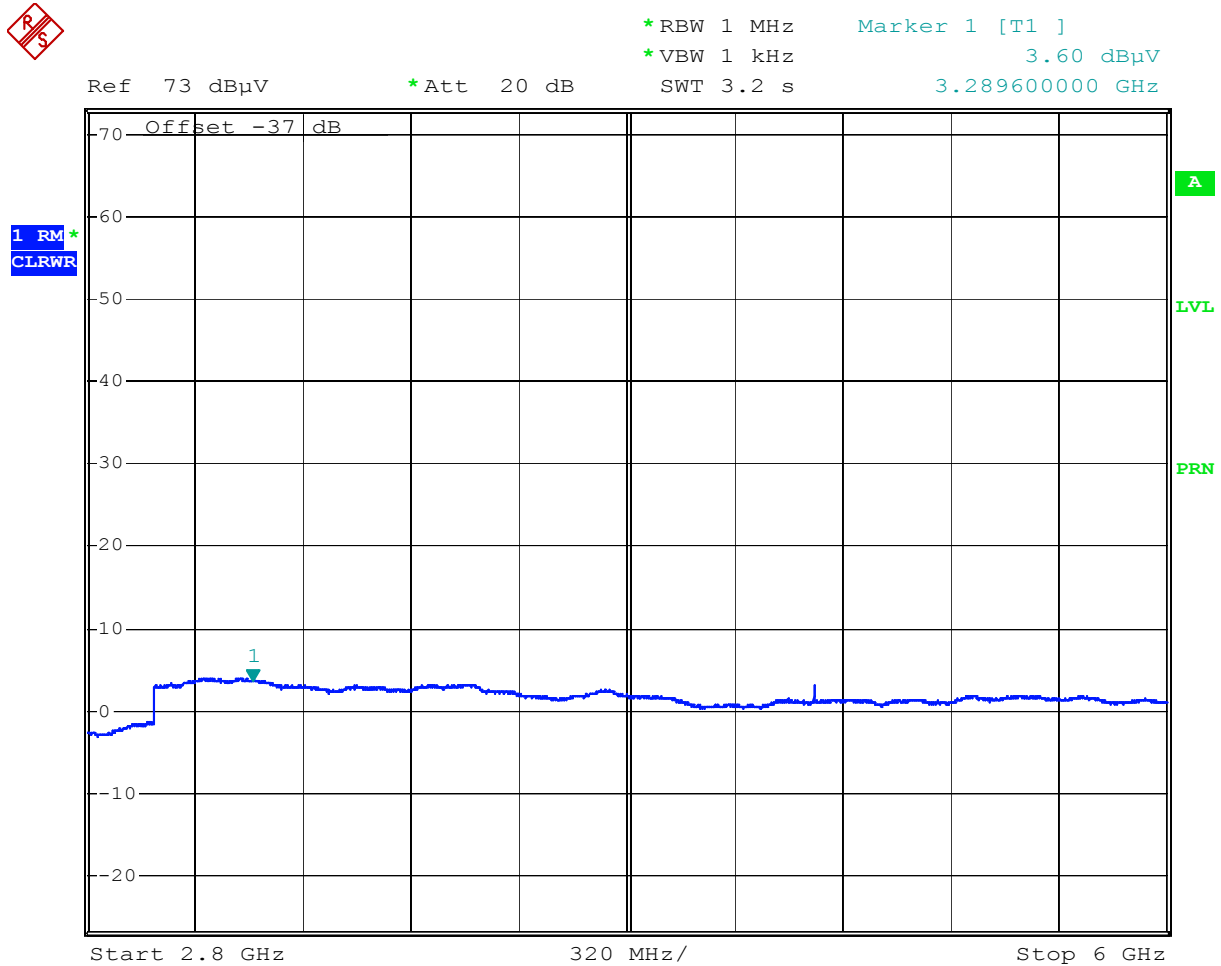
Radiated Emissions outside the operating band except harmonics



Comment: Out-of-band emissions, Ch 3
Date: 22.JUL.2008 22:25:49

Reference level OFFCET is the amplifier gain

Radiated Emissions outside the operating band except harmonics



Comment: Out-of-band emissions, Ch 3
Date: 22.JUL.2008 22:27:25

Reference level OFFCET is the amplifier gain

4.2 AC line conducted emissions

Test Limits

Table 5-1 FCC Part 15 / ICES-003 Limits for Conducted Emissions at the Mains Ports

Frequency Band MHz	Class B Limit dB (μV)	
	Quasi-Peak	Average
0.15-0.50	66 to 56 Decreases linearly with the logarithm of the frequency	56 to 46 Decreases linearly with the logarithm of the frequency
0.50-5.00	56	46
5.00-30.00	60	50

Note: At the transition frequency the lower limit applies.

Test Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. A LISN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An ISN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the LISN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

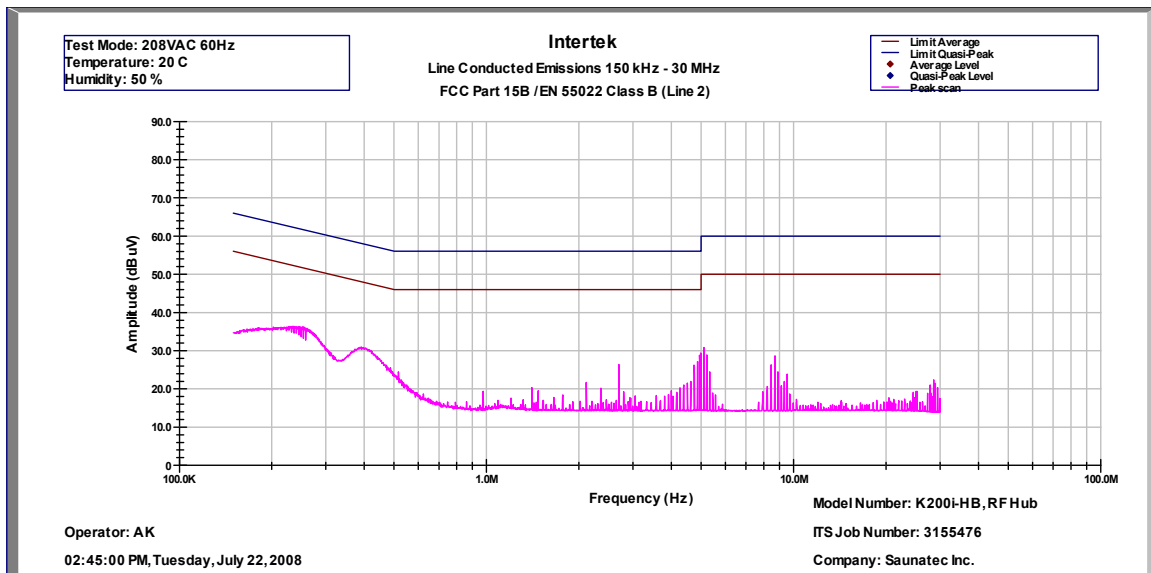
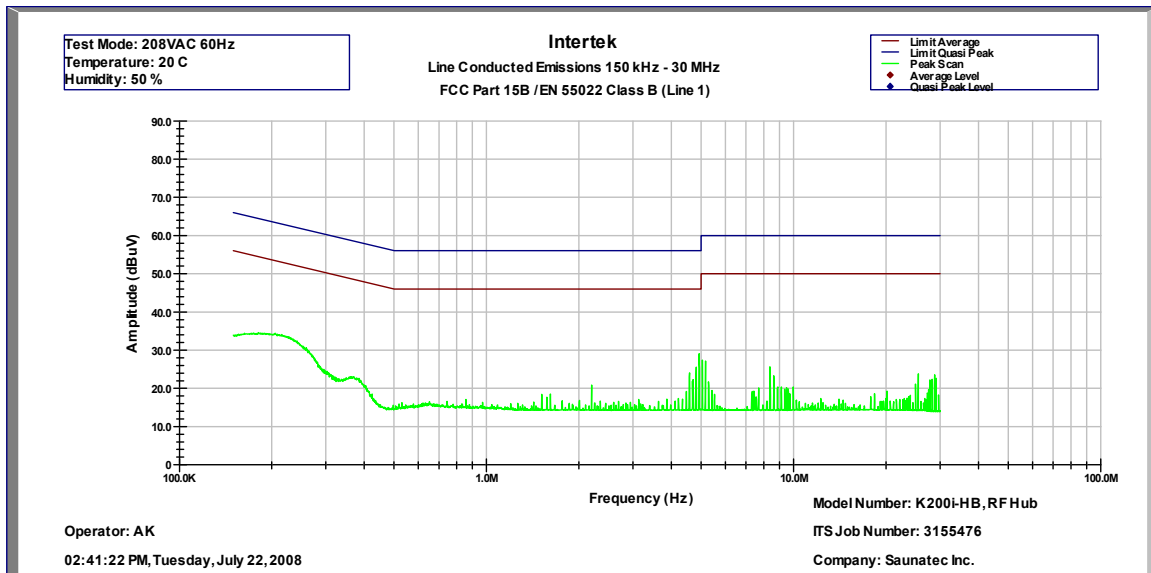
The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but July be extended for larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Test Results



Result: Complies by more than 10 dB

4.3 Radiated emissions from digital part and receiver

Test Limit

*Limits for Electromagnetic Radiated Emissions, FCC Section 15.109(b) and ICES 003 **

Frequency (MHz)	Class A at 10m dB(μ V/m)	Class B at 3m dB(μ V/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

Test Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

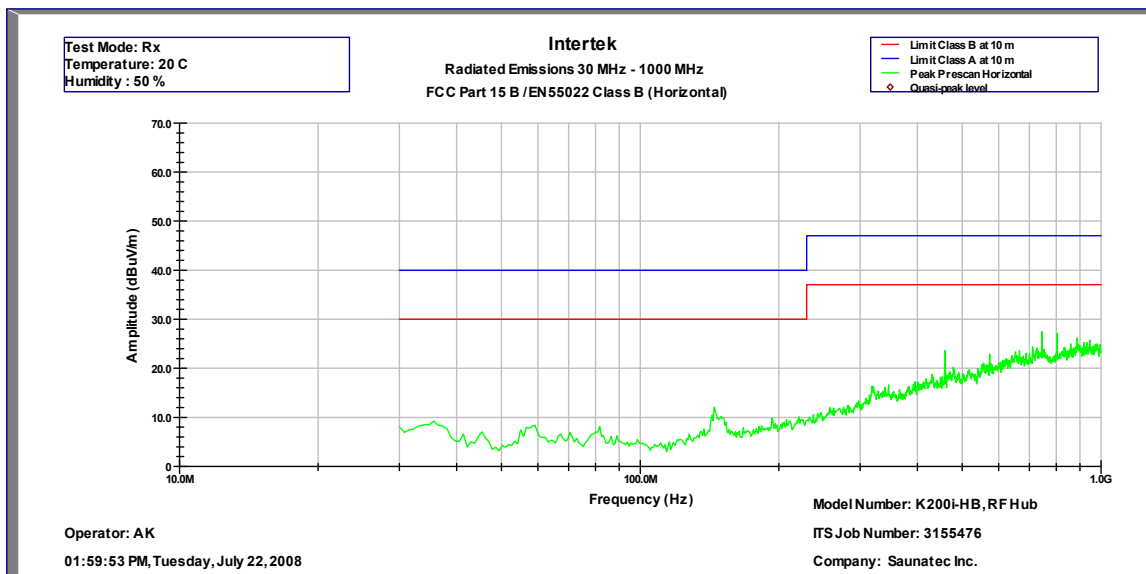
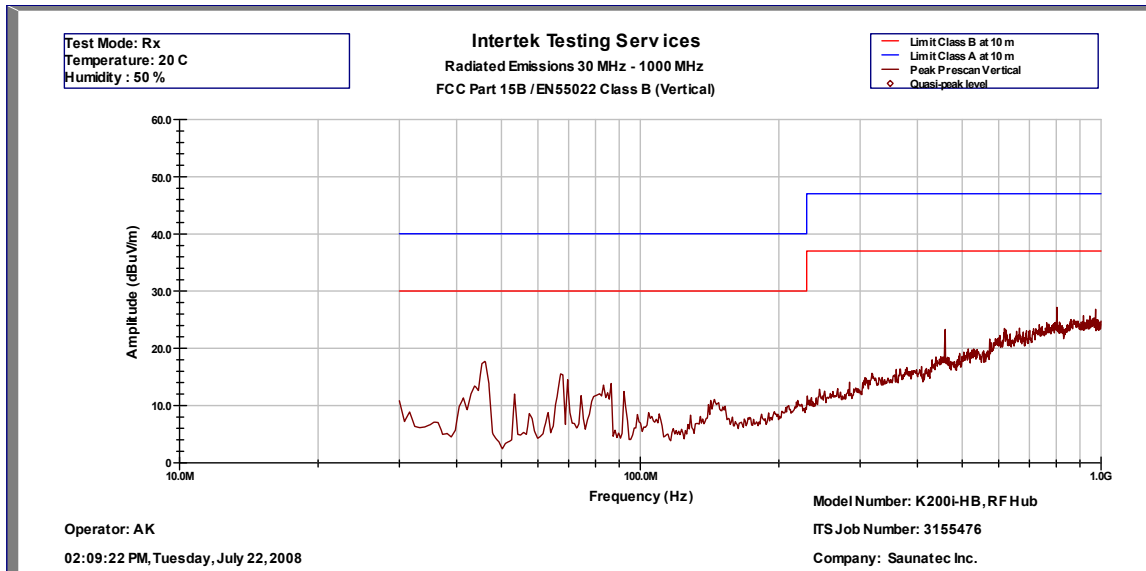
The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT. Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated emission test followed the guidelines of ANSI C63.4 (2003).

Test Result



Result: Complies by more than 10 dB

5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

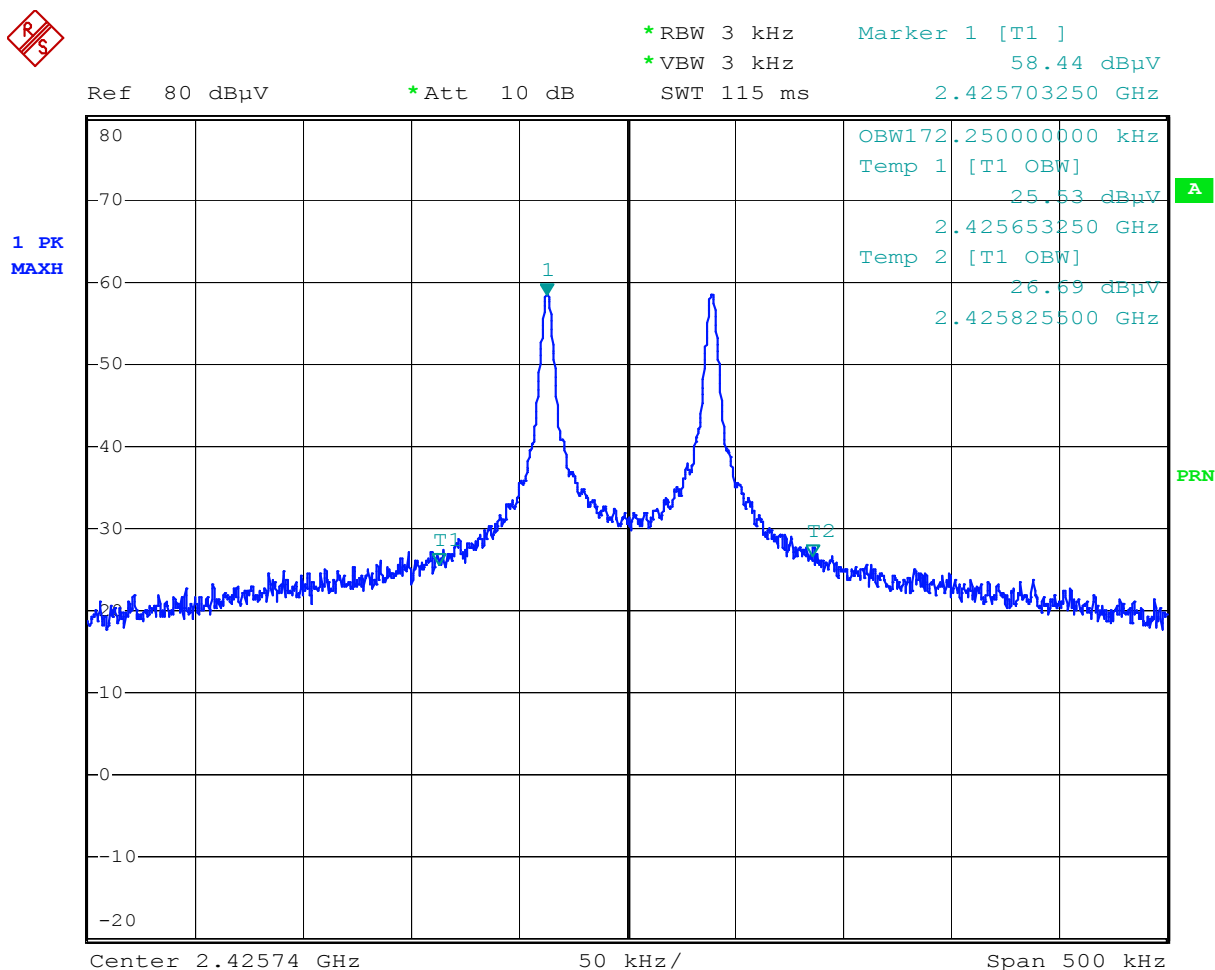
Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	10/02/08
Spectrum Analyzer	R & S	FSP40	036612004	12	10/01/08
BI-Log Antenna	EMCO	3143	9509-1160	12	09/05/08
Double-ridged Horn Antenna	EMCO	3115	9170-3712	12	10/26/08
Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Pre-Amplifier	Sonoma Inst.	310	185634	12	09/26/08
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	07/13/08
LISN	FCC	FCC-LISN-50-50-M-H	2012	12	08/02/08

No Calibration required

6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3155476	DC	July 31, 2008	Original document

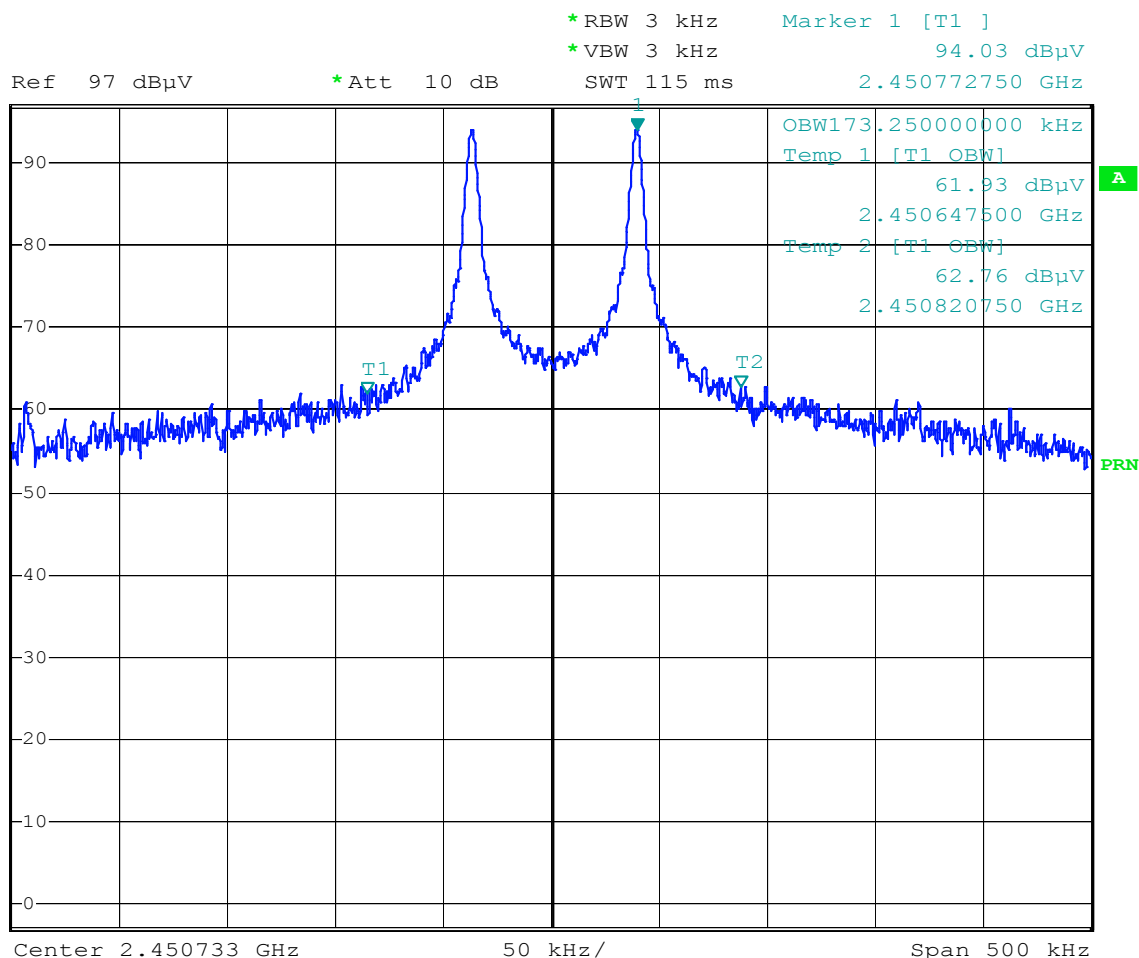
7.0 Appendix – Occupied Bandwidth



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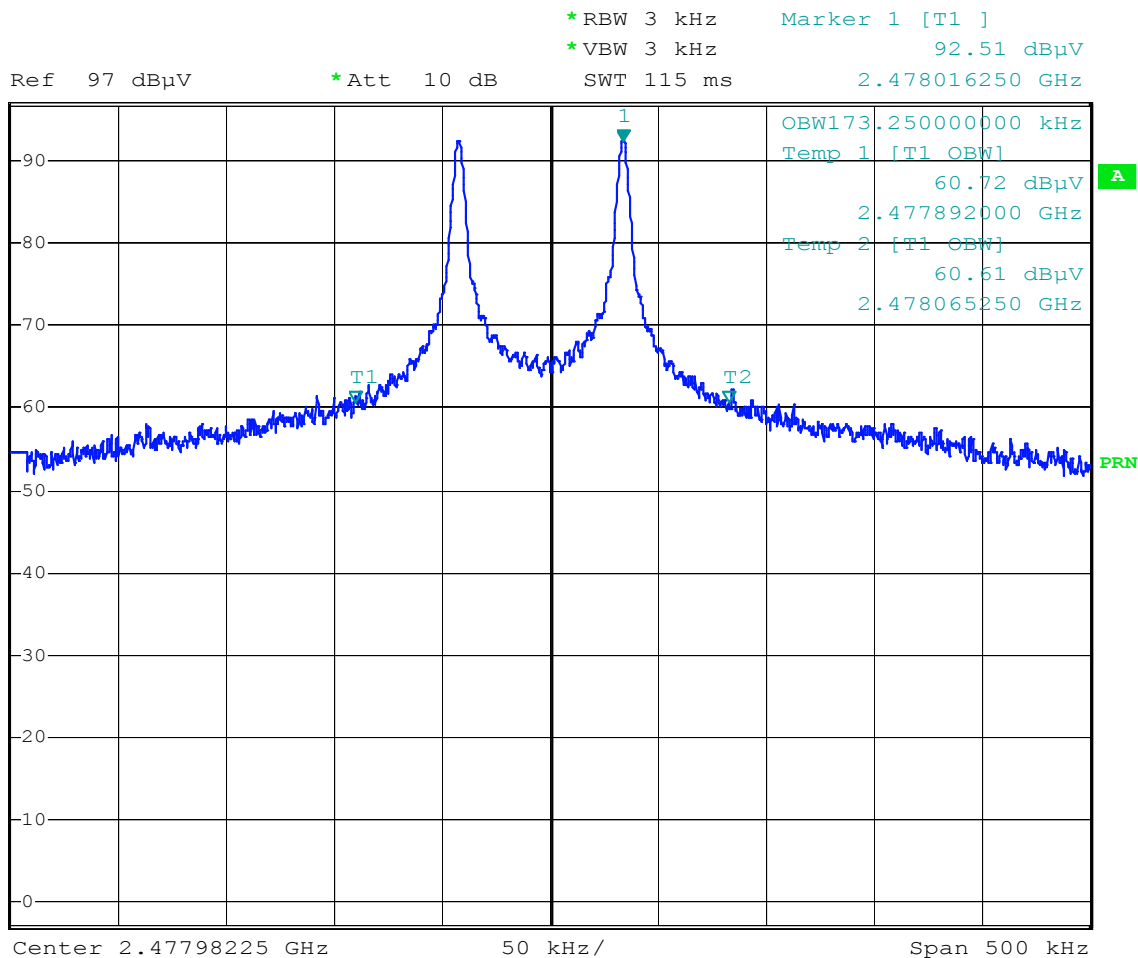
1 PK
VIEW



Comment: Occupied bandwidth, Ch 1
Date: 23.JUL.2008 20:39:53



1 PK
MAXH



Comment: Occupied bandwidth, Ch 3
 Date: 23.JUL.2008 20:44:24