Lab Code: 200167-0

FCC PART 15 SUBPART C

MEASUREMENT AND TEST REPORT

For

InnoSys, Inc. (KeySpan)

4118 Lakeside Drive
Richmond, CA 94806

FCC ID: JFVKYRF-TVUSB-A-1
Model Number: KYRF-TVUSB-A

This Report Concerns:	**Equipment Type:**
☒ Original Report	Remote Transceiver

Test Engineer:	Choon Sian Ooi
Report Number:	R0702071-247
Report Date:	2007-05-21
Reviewed By:	Daniel Deng, RF Engineering Lead
Prepared By: **(i0)**	Bay Area Compliance Laboratories Corp. (BACL) 1274 Anvilwood Ave. Sunnyvale, CA 94089 Tel: (408) 732-9162 Fax: (408) 732-9164

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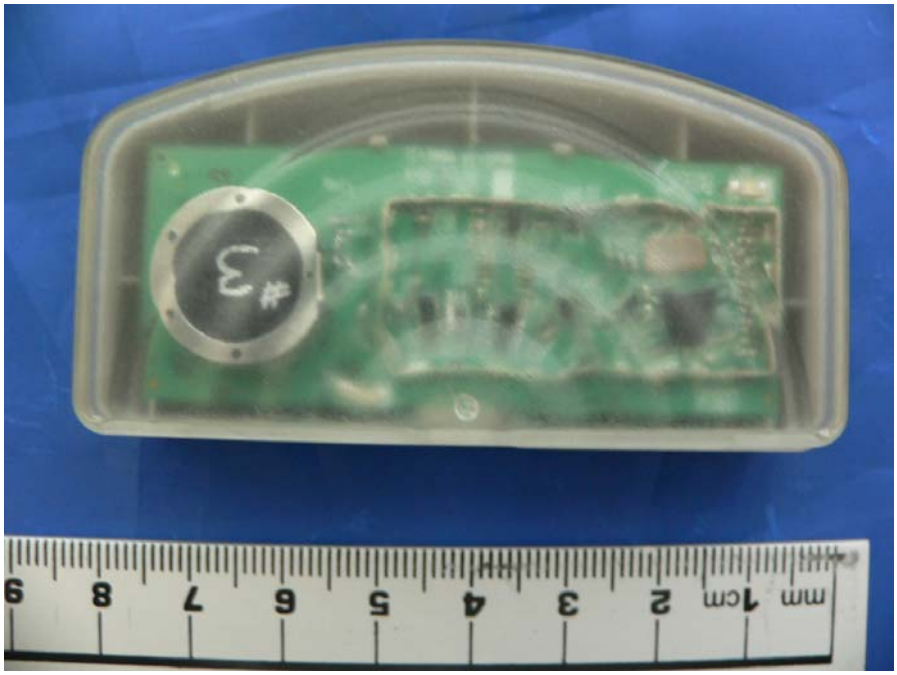
GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

This BACL measurement and test report has been complied on behalf of *InnoSys, Inc. (KeySpan)* and their product, model: *KYRF-TVUSB-A* Tune View USB or the "EUT" as referred to in this report. The EUT is a remote transceiver that consists of three major parts CPU, radio and power/data interface. For the CPU part, the STR751FR0T7 is an ARM7 processor with integrated RAM and Flash, contains a USB Serial Interface Engine and Transceiver, and General Purpose Interface logic. For radio part: the radio provides communication with the remote (model: KYRF-RMLN) in the 2.4 GHz ISM band. The radio uses GFSK modulation, and spread spectrum frequency hopping on channels 2 through 79. The radio communicates in ShockBurst mode, in which data sent from the CPU is collected at a relatively slow data rate, then transmitted at 256 Kbps (or 1 Mbps, depending on radio mode). In practice, this means the radio is typically transmitting for 1.1 ms and off for 1.7 ms (at 256 Kbps). ShockBurst mode has the advantage of decoupling the CPU and radio data rates, and reducing the power drawn by the radio and power amplifier. The radio operates in half duplex mode. For power part, power to drive the EUT circuitry is drawn from the USB power pin via one regulator and provides 3.3V to the circuitry on the EUT. The antenna utilized by this device is a integral PCB antenna with max gain of 5.0 dBi.

EUT Photo



Additional photos in exhibit C

EUT Mechanical Description

The EUT measures approximately 7 cm (L) x 3.2 cm(W) x 1.5 cm(H), weighs approximately 46.5 g and is of plastic construction.*

**All measurements and tests were performed on a manufacturer provided post production sample serial number: 26202*

Objective

This report has been prepared on behalf of *InnoSys, Inc.(KeySpan)* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

Related Submittal(s)/Grant(s)

There are no related submittals or grants.

Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003.

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values range from $\pm$2.0 for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL.

Detailed instrumentation measurement uncertainties can be found in BACL report QAP-018.

Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

Special Accessories

No special accessories were required during testing and all interface cables used for compliance testing were shielded.

Equipment Modifications

No modifications were made to the EUT.

Power Supply

NA, EUT was powered by direct connection with computer USB port

Interface Ports and Cabling

Cable Description	Length (M)	From	To
USB A to mini B	2	Computer	EUT

Local Support Equipment

Manufacturer	Description	Model	Serial Number
Sharp	Monitor	LL-T15G4-B	4 H005572
Dell	Computer	MMB	2KP2Q01

SUMMARY OF TEST RESULTS FOR FCC PART 15

FCC RULES	DESCRIPTION OF TEST	RESULT
§ 15.247 (e)(i) & §2.1091	RF Exposure	Compliant
§ 2.1051	Spurious Emissions at Antenna Port	Compliant
§15.203	Antenna Requirements	Compliant
§ 15.205	Restricted Bands	Compliant
§15.207 (a)	Conducted Emissions	Compliant
§15.209	Radiated Emissions	Compliant
§15.247 (a) (1)	Hopping Channel Separation	Compliant
§15.247 (a) (1)	Channel Bandwidth	Compliant
§15.247 (a) (1) (iii)	Dwell Time	Compliant
§15.247 (b) (1)	Maximum Peak Output Power	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant

§ 15.247 (e) (i) and § 2.1091 - RF EXPOSURE

According to §15.247(e)(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm):	10.83
Maximum peak output power at antenna input terminal (mW):	12.106
Prediction distance (cm):	20
Prediction frequency (MHz):	2440
Antenna Gain, typical (dBi):	5.0
Maximum Antenna Gain (numeric):	3.16
Power density at predication frequency at 20 cm (mW/cm^2):	0.00761
MPE limit for uncontrolled exposure at predication frequency (mW/cm^2):	1.0

Test Result

The EUT is a mobile device. The power density level at 20 cm is 0.00761 mW/cm^2, which is below the uncontrolled exposure limit of 1.0mW/cm^2 at 2440 MHz.

§2.1051 SPURIOUS EMISSIONS AT ANTENNA PORT

Applicable Standard

According to §15.209 (f) and §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.

2. Position the EUT on a bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.

3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.

4. Set the SA on View mode and then plot the result on SA screen.

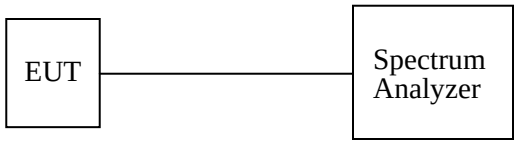
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



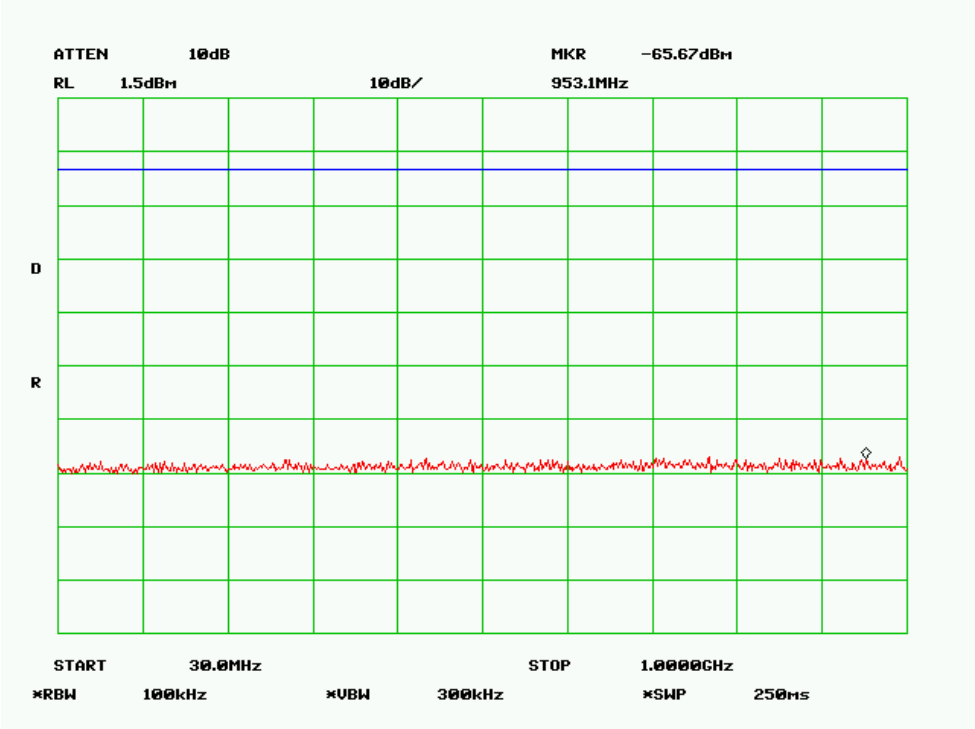
Environmental Conditions

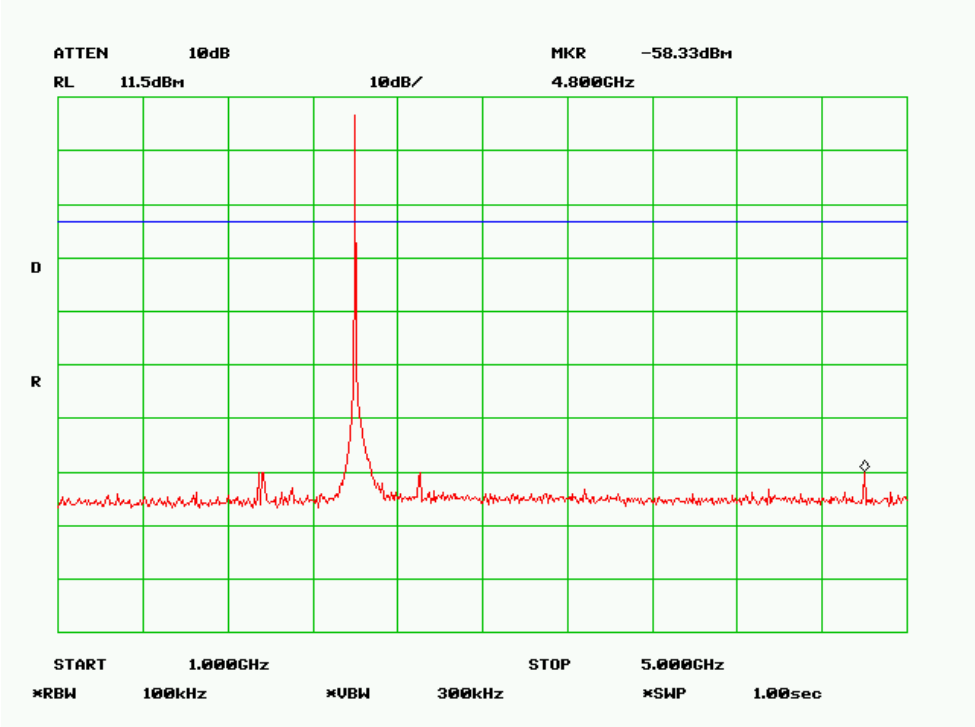
Temperature:	26 ° C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

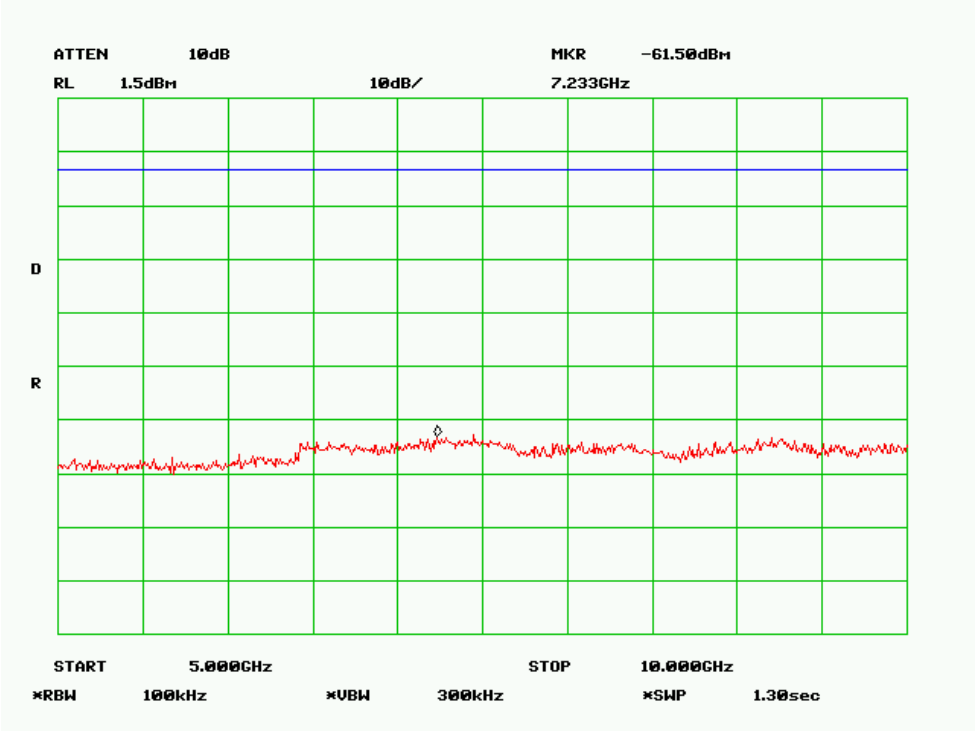
**The testing was performed by Choon Sian Ooi on 2007-02-13*

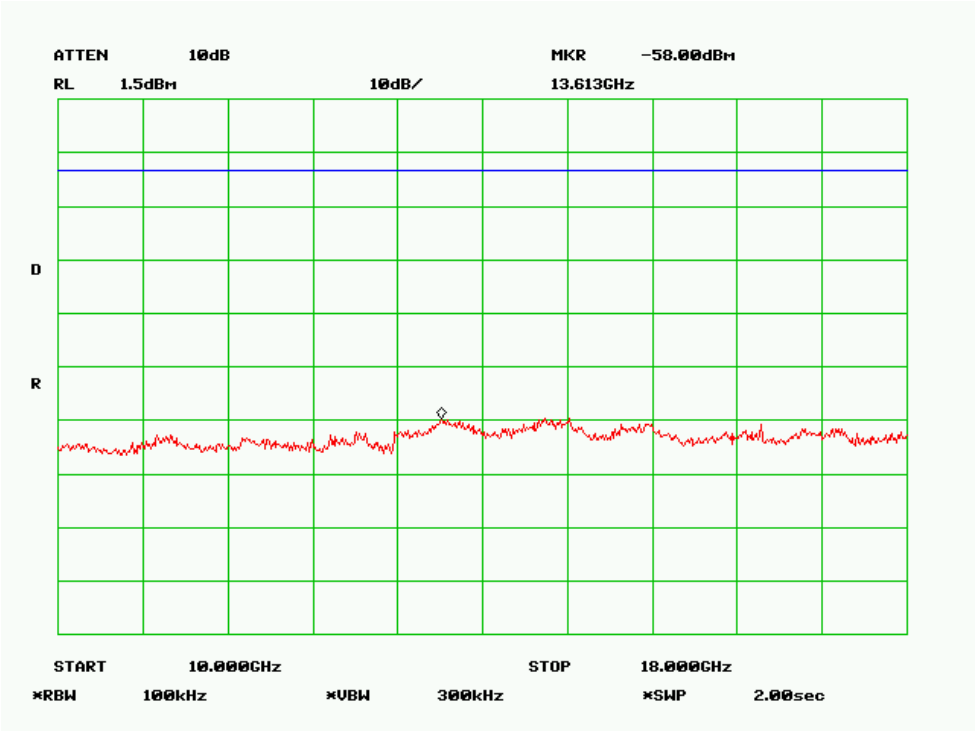
Please refer to the following plots for detailed test results

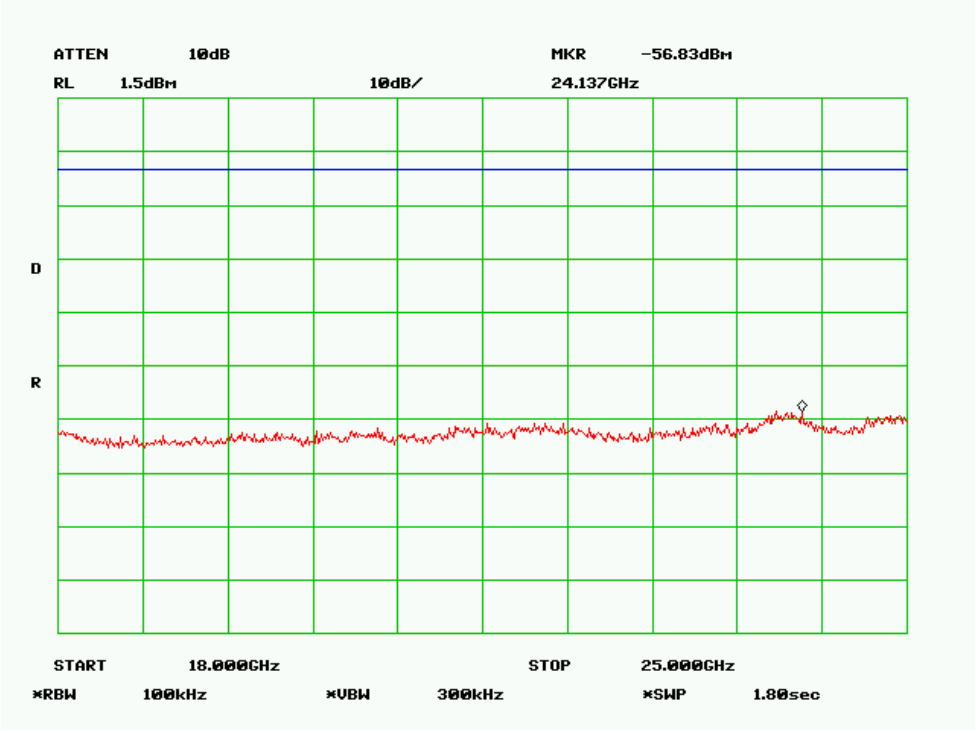
Low Channel


ATTEN 10dB
MKR -65.67dBm
RL 1.5dBm
10dB/
953.1MHz
D
R
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 250ms

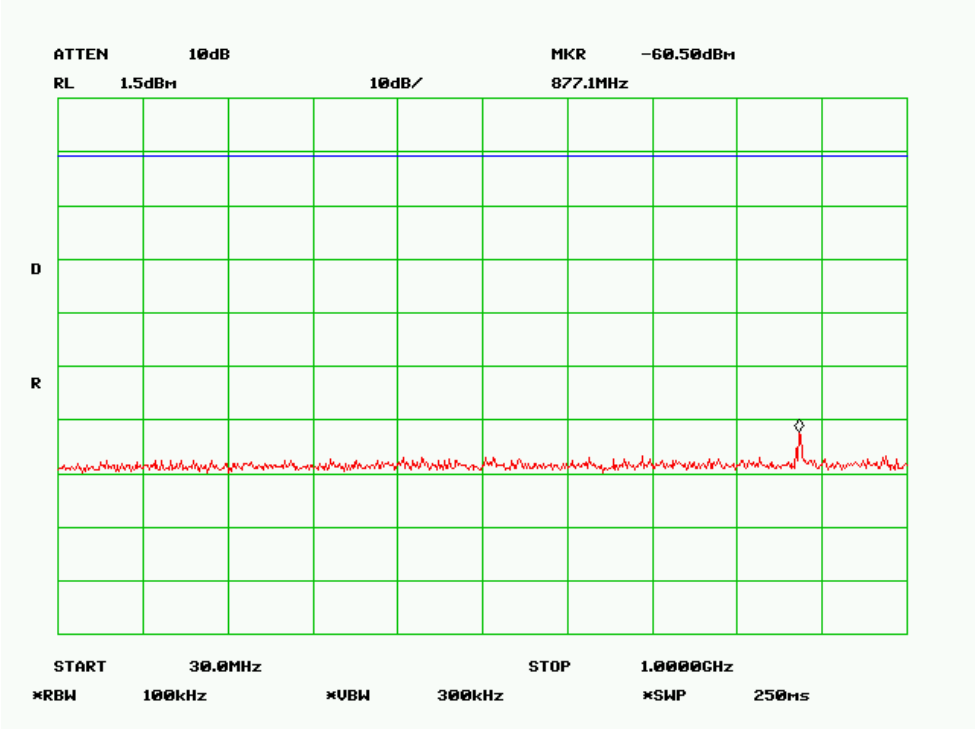

ATTEN 10dB
MKR -58.33dBm
RL 11.5dBm
10dB/
4.800GHz
D
R
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 1.00sec

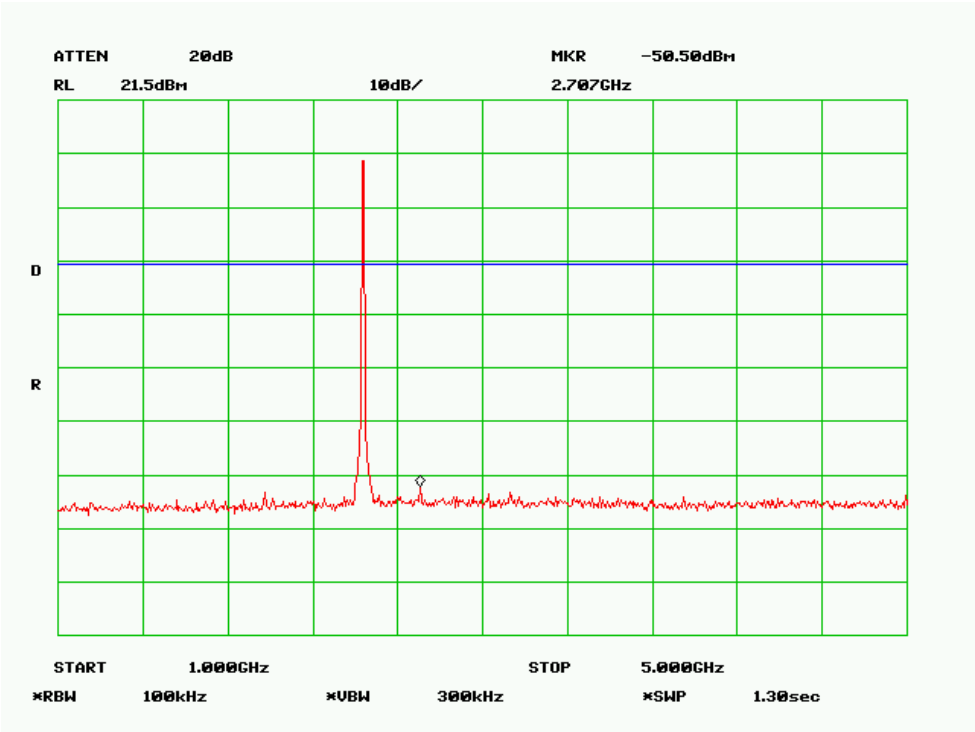

ATTEN 10dB
MKR -61.50dBm
RL 1.5dBm
10dB/
7.233GHz
D
R
START 5.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 1.30sec


ATTEN 10dB
MKR -58.00dBm
RL 1.5dBm
10dB/
13.613GHz
D
R
START 10.000GHz
STOP 18.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 2.00sec



Middle Channel

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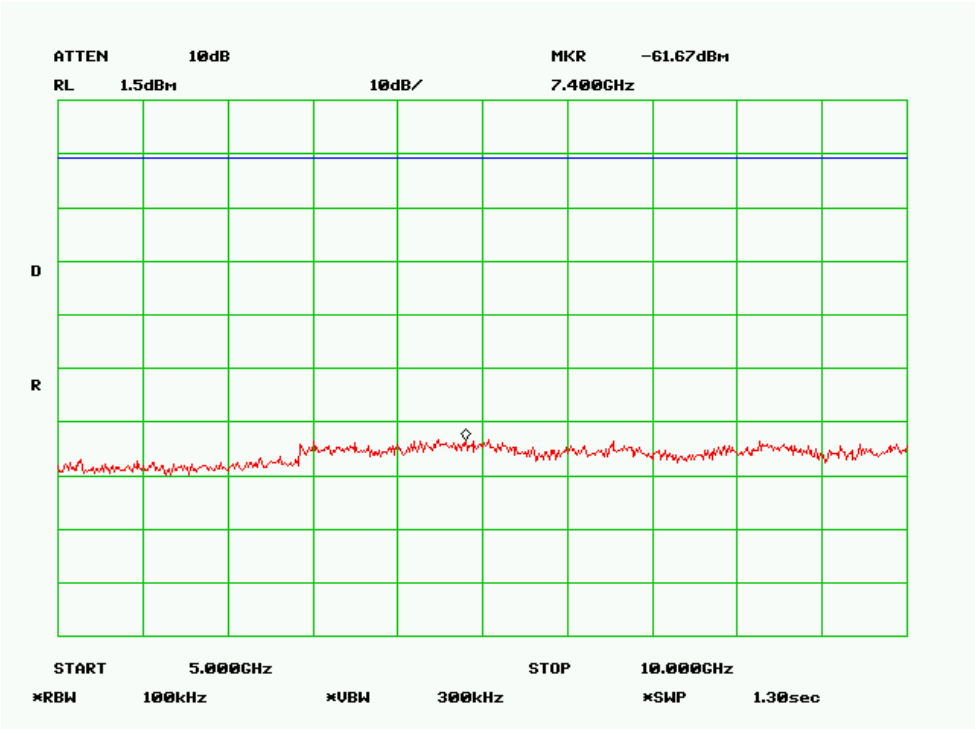
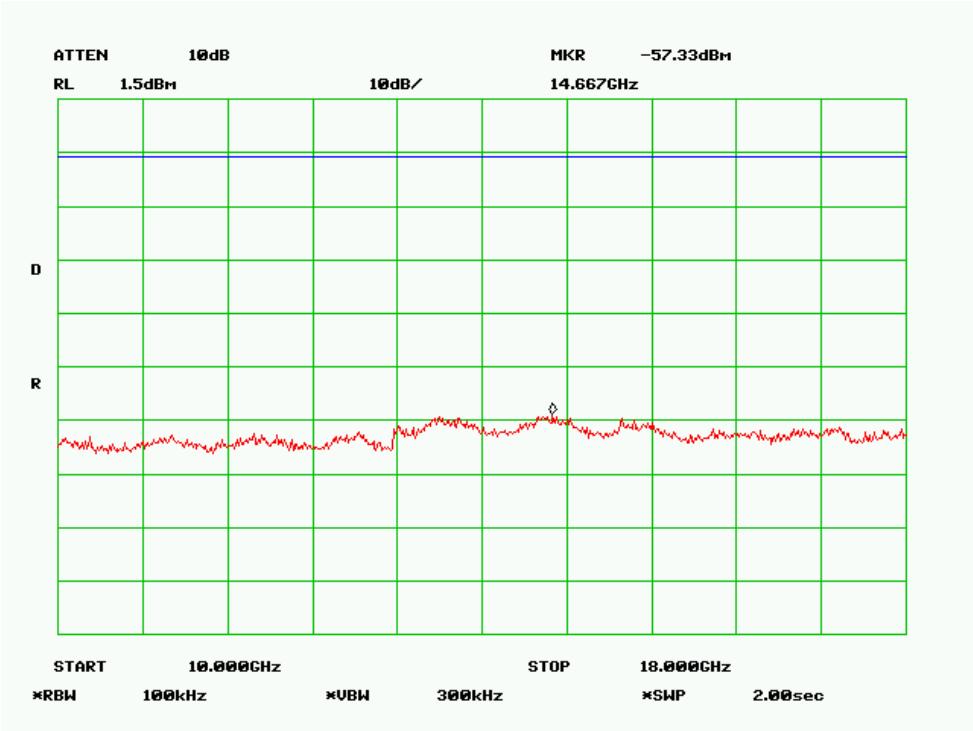
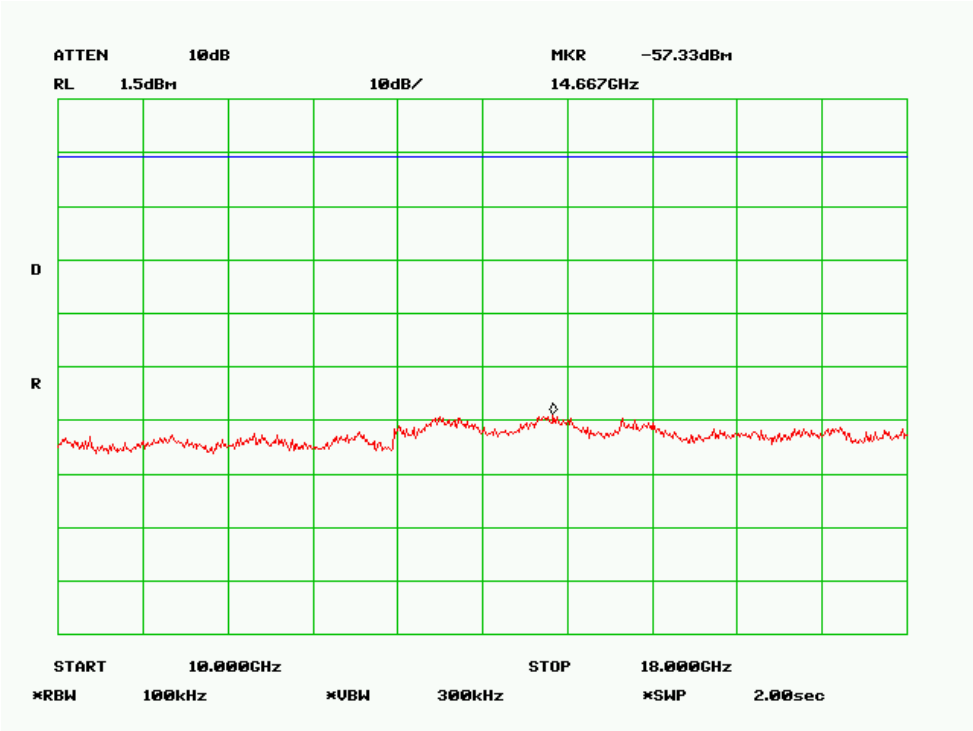
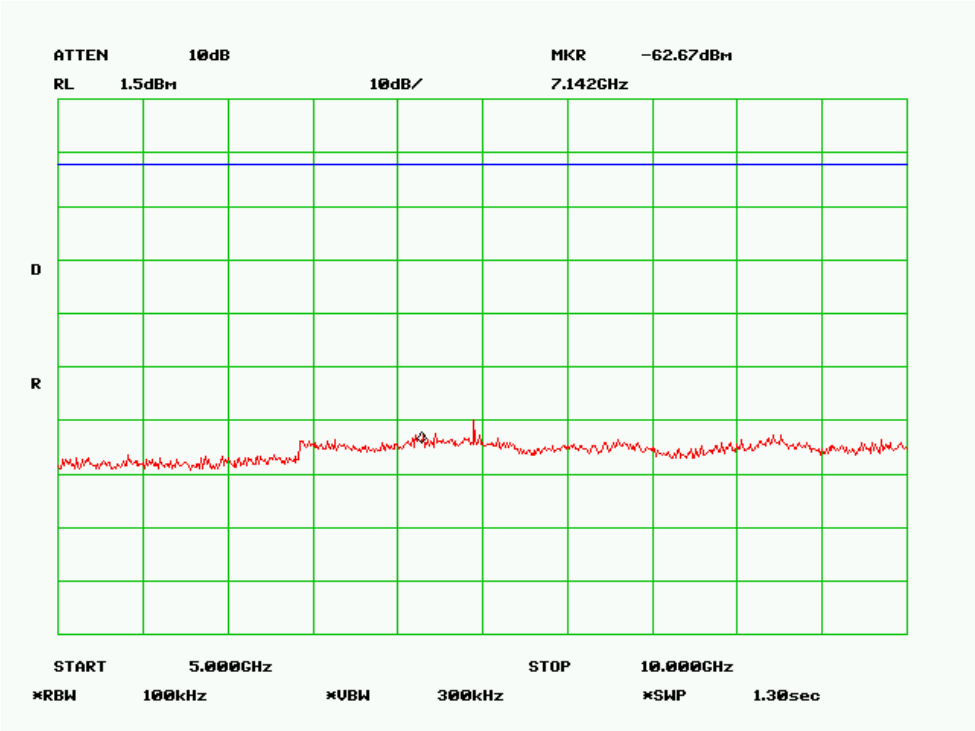
RL 21.5dBm
10dB/
2.707GHz
D
R
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 1.30sec

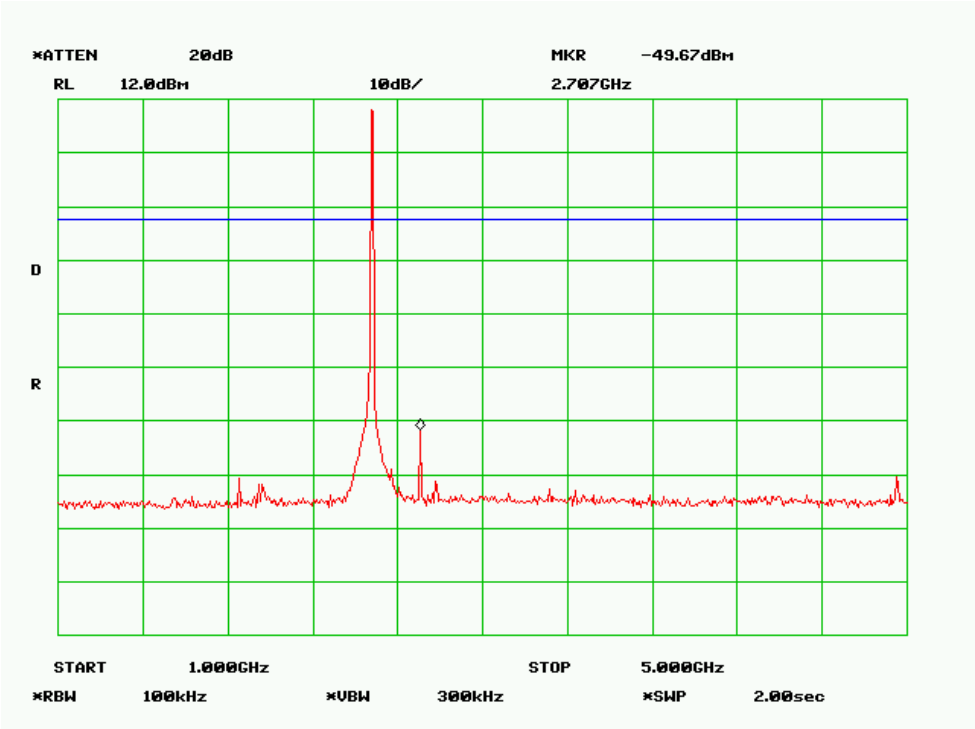

ATTEN 10dB
MKR -61.67dBm
RL 1.5dBm
10dB/
7.400GHz
D
R
START 5.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 1.30sec

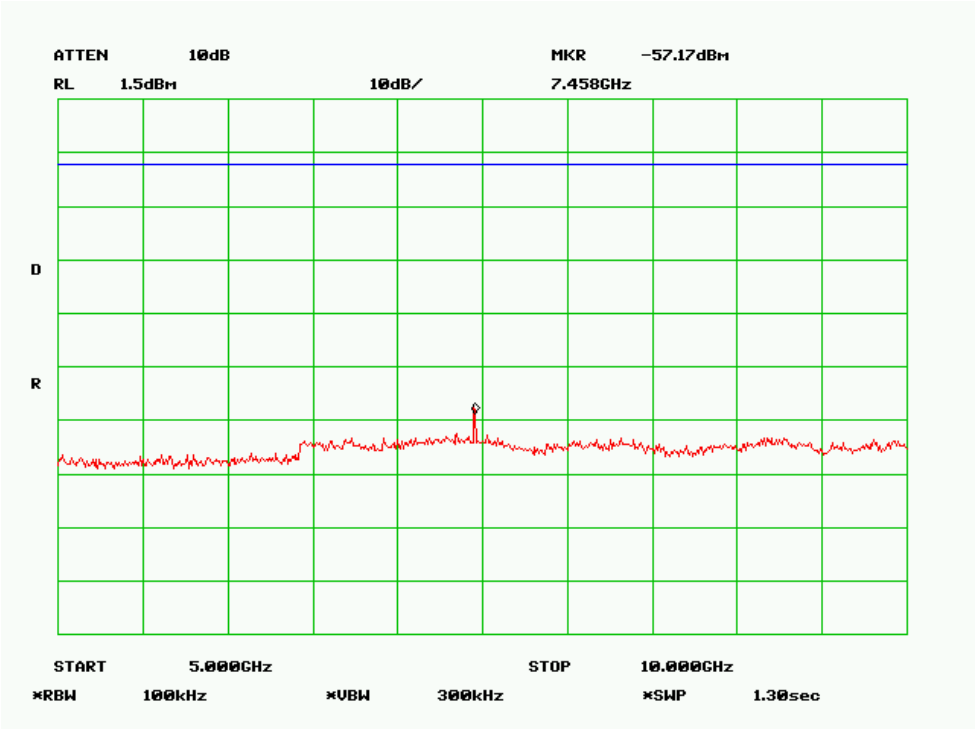

ATTEN 10dB
MKR -57.33dBm
RL 1.5dBm
10dB/
14.667GHz
D
R
START 10.000GHz
STOP 18.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 2.00sec


ATTEN 10dB
MKR -57.33dBm
RL 1.5dBm
10dB/
14.667GHz
D
R
START 10.000GHz
STOP 18.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 2.00sec

High Channel



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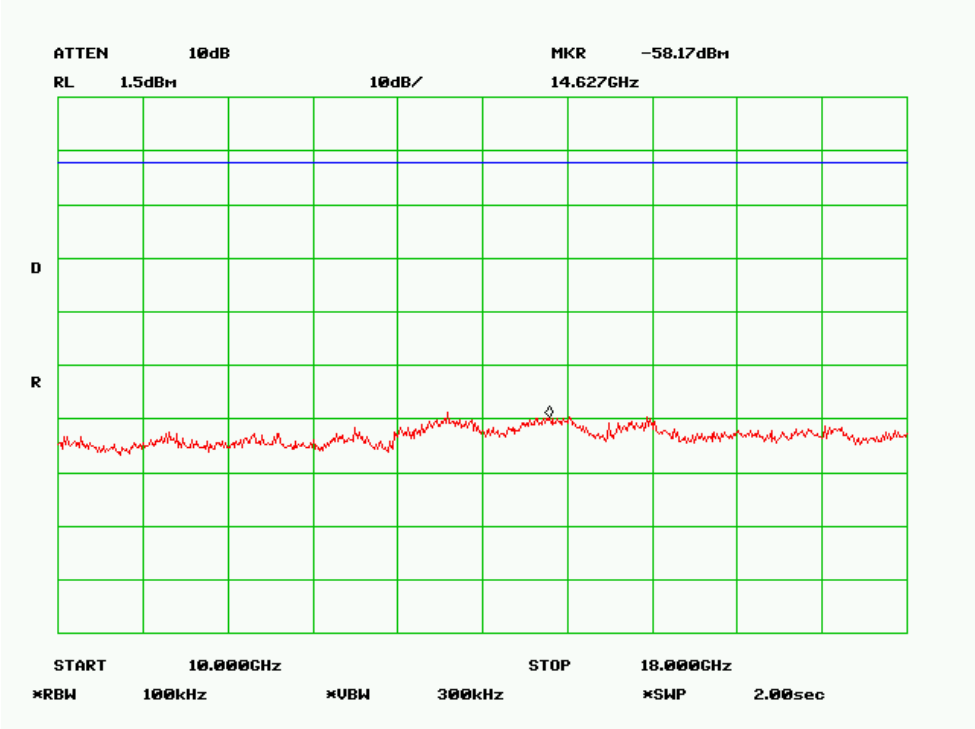
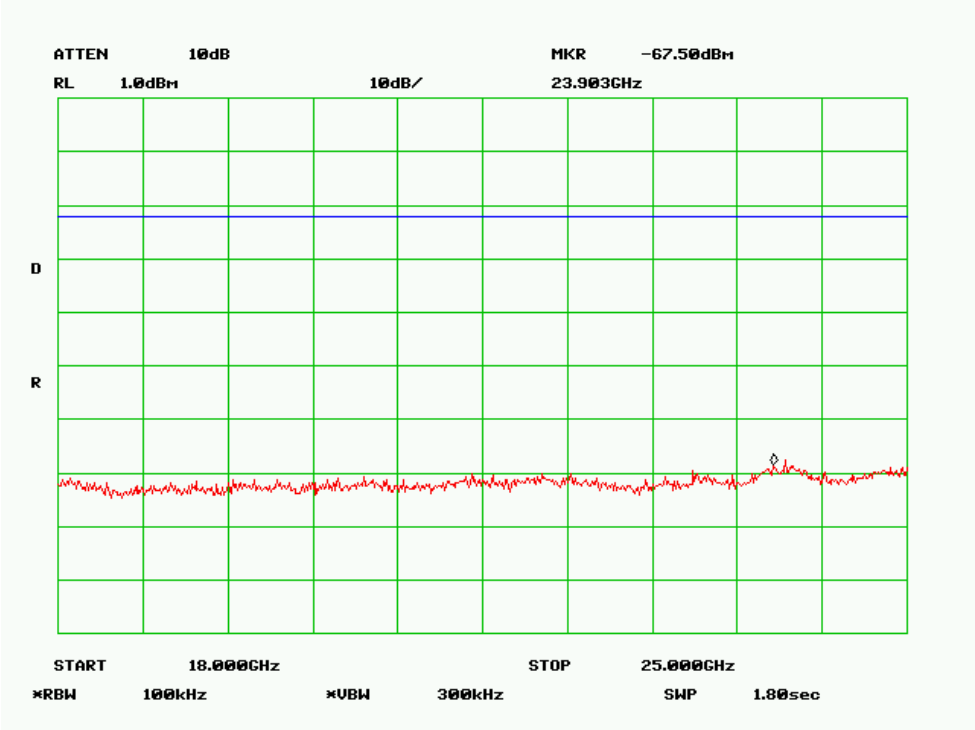
MKR -57.17dBm
RL 1.5dBm
10dB/
7.458GHz
D
R
START 5.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 1.30sec


ATTEN 10dB
MKR -58.17dBm
RL 1.5dBm
10dB/
14.627GHz
D
R
START 10.000GHz
STOP 18.000GHz
*RBW 100kHz
*VBW 300kHz
*SWP 2.00sec


ATTEN 10dB
MKR -67.50dBm
RL 1.0dBm
10dB/
23.903GHz
D
R
START 18.000GHz
STOP 25.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 1.80sec

§15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Antenna Connected Construction

The antenna for this device is integrated into the construction of the main PCB and is an antenna that the end user cannot access. It is fully enclosed by the EUT chassis and removal/modification would result in irreparable damage to the device.

☒ **Compliant** ☐ **N/A**

§15.207 – CONDUCTED EMISSIONS

Applicable Standard

According to FCC §15.207 (a) 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 μH/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 frequencies ranges.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	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 Setup

The measurement was performed at shield room, using the setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The host computer was connected to LISN-1 (set to 120 V/ 60 Hz ac) and provided 3.3 VDC power via USB connection to the EUT.

Test Equipment List and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	2006-07-07
Rohde & Schwarz	EMI Test Receiver	ESCS30	100137	2007-03-08

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

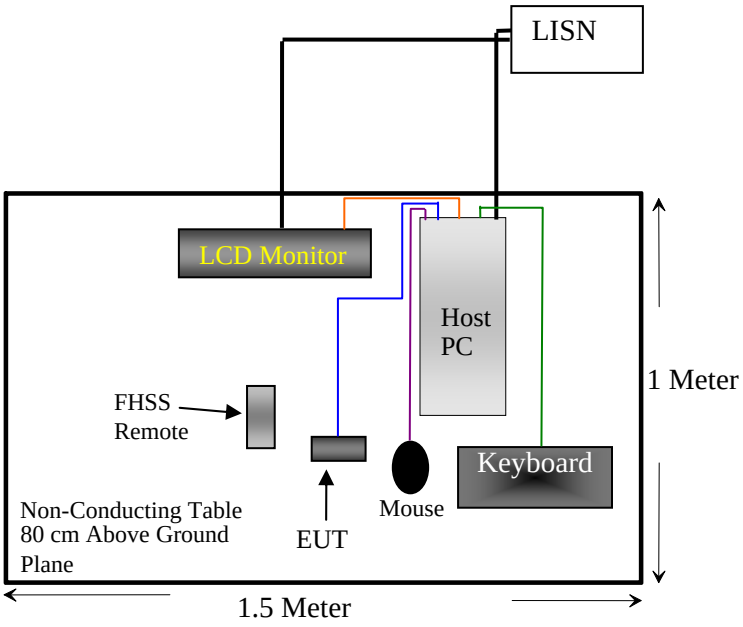
Test Procedure

During the conducted emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a "QP". Average readings are distinguished with an "Ave".

Test Setup Diagram



Environmental Conditions

Temperature:	24 °C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

**The testing was performed by Choon Sian Ooi on 2007-02-13*

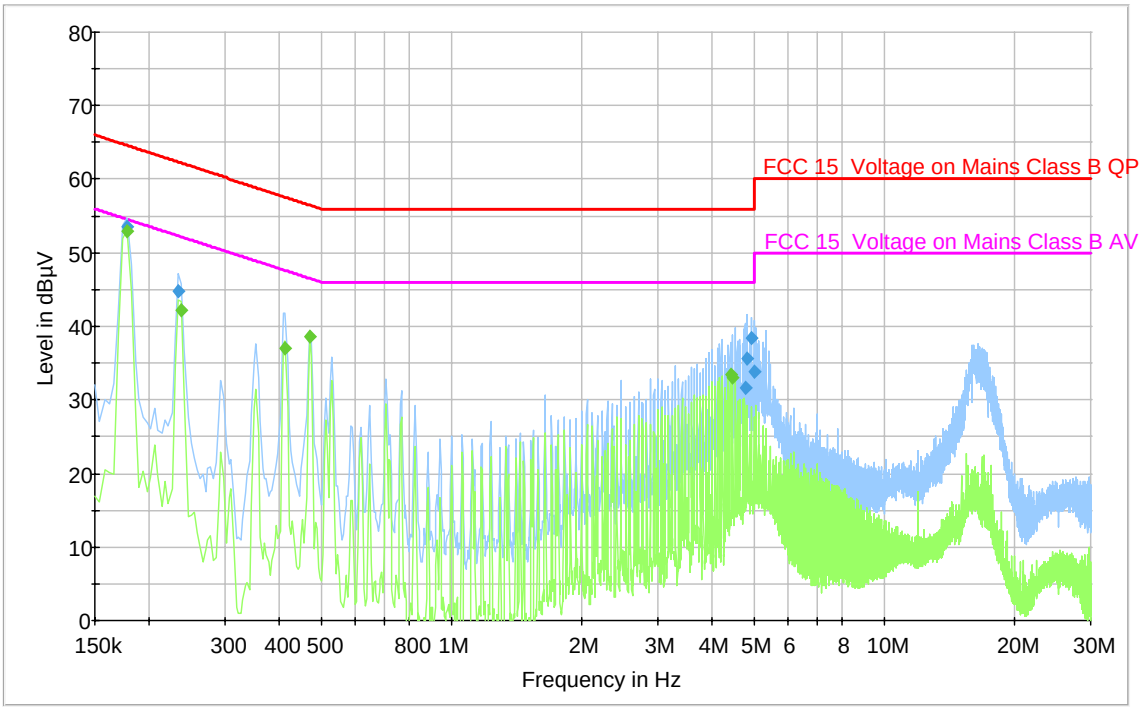
Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC standard's conducted emissions limits for Class B devices, with the *worst* margin reading of:

-0.9 dB at **0.178000 MHz** in the **Neutral** Conductor mode

Conducted Emissions Test plot & data

Hot



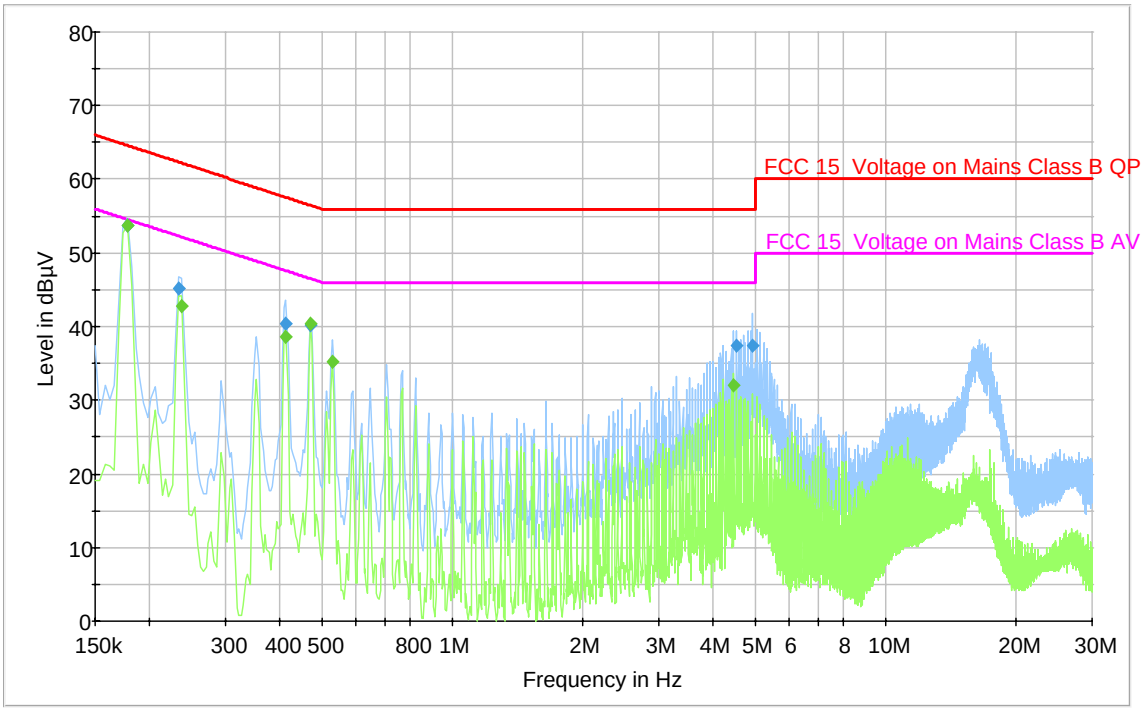
QP Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Hot/ Neutral)	Limit (dBµV)	Margin (dB)
0.178000	53.5	Hot	64.6	-11.1
0.234000	44.8	Hot	62.3	-17.5
4.938000	38.5	Hot	56.0	-17.5
4.822000	35.6	Hot	56.0	-20.4
4.998000	33.8	Hot	56.0	-22.2
4.766000	31.6	Hot	56.0	-24.4

Average Measurements

Frequency (MHz)	Average (dBµV)	Conductor (Hot/ Neutral)	Limit (dBµV)	Margin (dB)
0.178000	53.0	Hot	54.6	-1.6
0.470000	38.7	Hot	46.5	-7.8
0.238000	42.1	Hot	52.2	-10.0
0.414000	37.0	Hot	47.6	-10.6
4.410000	33.4	Hot	46.0	-12.6
4.466000	32.9	Hot	46.0	-13.1

Neutral



QP Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (Hot/ Neutral)	Limit (dBµV)	Margin (dB)
0.174000	53.7	Neutral	64.6	-10.9
0.237000	40.3	Neutral	56.5	-16.3
0.409000	45.1	Neutral	62.3	-17.2
0.469000	40.3	Neutral	57.6	-17.2
4.933000	37.4	Neutral	56.0	-18.6
4.729000	37.4	Neutral	56.0	-18.6

Average Measurements

Frequency (MHz)	Average (dBµV)	Conductor (Hot/ Neutral)	Limit (dBµV)	Margin (dB)
0.178000	53.7	Neutral	54.6	-0.9
0.470000	40.4	Neutral	46.5	-6.1
0.414000	38.6	Neutral	47.6	-9.0
0.238000	42.8	Neutral	52.2	-9.4
0.530000	35.2	Neutral	46.0	-10.8
4.470000	31.9	Neutral	46.0	-14.1

§15.205, §15.209 & §15.247 - RADIATED EMISSIONS

Applicable Standard: FCC §15.205 Restricted bands of operation

(a) Except as shown in 15.205 paragraphs (d), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.090 – 0.110	8.291 – 8.294	16.69475 – 16.69525	156.7 – 156.9	1435 – 1626.5	3.332 – 3.339	10.6 – 12.7
0.495 – 0.505	8.362 – 8.366	25.5 – 25.67	162.0125 –167.17	1645.5 – 1646.5	3.3458 – 3.358	13.25 – 13.4
2.1735 – 2.1905	8.37625 – 8.38675	37.5 – 38.25	167.72 – 173.2	1660 – 1710	3.600 – 4.400	14.47 – 14.5
4.125 – 4.128	8.41425 – 8.41475	73 – 74.6	240 – 285	1718.8 – 1722.2	4.5 – 5.15	15.35 – 16.2
4.17725 – 4.17775	12.29 – 12.293	74.8 – 75.2	322 – 335.4	2200 – 2300	5.35 – 5.46	17.7 – 21.4
4.20725 – 4.20775	12.51975 – 12.52025	108 – 121.94	399.9 – 410	2310 – 2390	7.25 – 7.75	22.01 – 23.12
6.215 – 6.218	12.57675 – 12.57725	123 – 138	608 – 614	2483.5 – 2500	8.025 – 8.5	23.6 – 24.0
6.26775 – 6.26825	13.36 – 13.41	149.9 – 150.05	960 – 1240	2690 – 2900	9.0 – 9.2	31.2 – 31.8
6.31175 – 6.31225	16.42 – 16.423	156.52475 – 156.52525	1300 – 1427	3260 – 3267	9.3 – 9.5	36.43 – 36.5
						Above 38.6

(b) Except as provided in 15.205 paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e), regardless of the field strength limits specified elsewhere in this Subpart, the provisions of this Section apply to emissions from any intentional radiator.

☒ **Compliant** ☐ **N/A**

Applicable Standard: FCC §15.209 Radiated emission limits, general requirements.

(a) 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

*** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

(b) In the emission table above, the tighter limit applies at the band edges.

☒ **Compliant** ☐ **N/A**

Applicable Standard: FCC §15.247(d)

§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)).

☒ **Compliant** ☐ **N/A**

Test Setup

The radiated emissions tests were performed in the 3-meter semi-anechoic chamber test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

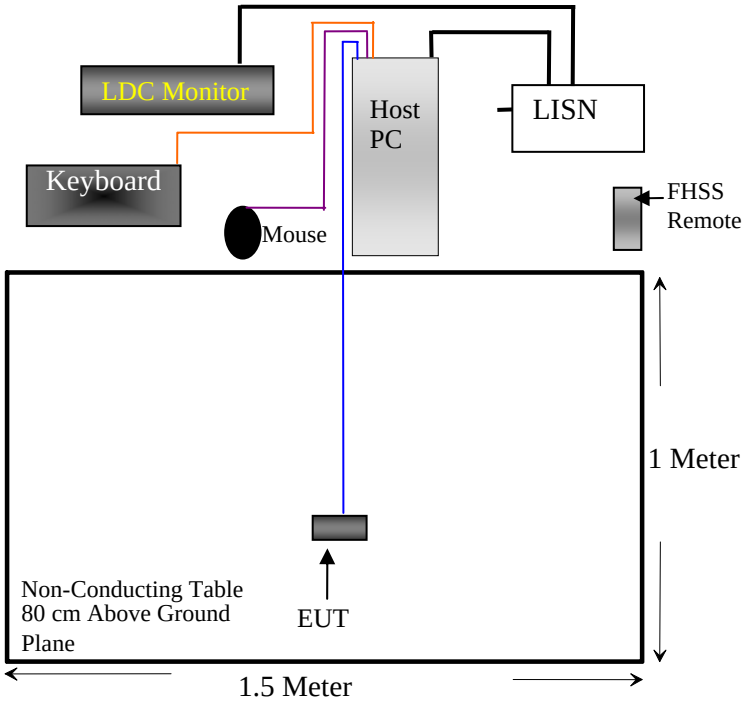
Test Equipment List and Details

Manufacturer	Description	Model Number	Serial Number	Cal. Date
Sonoma	Amplifier, Pre	317	260407	2007-04-26
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24
HP	Pre, Amplifier (1 ~ 26.5 GHz)	8449B	3147A00400	2005-08-10*
Sunol Sciences	Antenna	JB3	A020106-3/S006628	2006-03-14*
A. R.A	Horn Antenna	DRG-118/A	1132	2005-08-17*

**Two year calibration cycle*

Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

Temperature:	24 ° C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

**The testing was performed by Choon Sian Ooi on 2007-02-13*

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC rules, Part 15, Subpart C, sections 15.205, 15.209 and 15.247 radiated emissions limits, with the following closest margins below the limits:

-7.0 dB at **9607.0 MHz** in the **Vertical** polarization at **Low** Channel

-9.4 dB at **9759.0 MHz** in the **Horizontal** polarization at **Middle** Channel

-6.5 dB at **9916.0 MHz** in the **Horizontal** polarization at **High** Channel

Please refer to the following result tables

Radiated Emissions Test Result Data: Measured at 3 meter - With Notch filter
Measured at 3 meter - With Notch filter, 1GHz – 25GHz

Run # 1: Low CH = 2402.0 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polarization (H / V)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
2402.0000	104.8	260	1.0	V	28.7	1.5	37.4	97.6			Fund/Peak
2402.0000	101.0	131.9	1.3	H	28.7	1.5	37.4	93.8			Fund/Peak
2402.0000	80.7	260	1.1	V	28.7	1.5	37.4	73.4			Ave
2402.0000	78.8	131.9	1.3	H	28.7	1.5	37.4	71.6			Ave
9607.0000	41.5	352	1.3	V	38.1	3.7	36.9	46.4	53.4	-7.0	Ave
9607.0000	38.2	203	1.1	H	38.1	3.7	36.9	43.1	51.6	-8.5	Ave
7205.0000	34.3	163	1.3	H	36.7	4.2	34.9	40.3	51.6	-11.3	Ave
7205.0000	35.8	26	1.1	V	36.7	4.2	34.9	41.8	53.4	-11.6	Ave
4803.9000	42.2	107	1.0	V	32.5	1.9	34.8	41.8	54	-12.2	Ave
4803.9000	39.2	255	1.4	H	32.5	1.9	34.8	38.8	54	-15.2	Ave
9607.0000	57.2	352	1.1	V	38.1	3.7	36.9	62.1	77.6	-15.5	Peak
9607.0000	52.3	203	1.6	H	38.1	3.7	36.9	57.2	73.8	-16.6	Peak
7205.0000	48.8	140	1.0	H	36.7	4.2	34.9	54.8	73.8	-19.0	Peak
4803.9000	52.0	255	1.4	V	32.5	1.9	34.8	51.6	74	-22.4	Peak
7205.0000	48.8	220	1.1	V	36.7	4.2	34.9	54.8	77.6	-22.8	Peak
4803.9000	50.8	163	1.4	H	32.5	1.9	34.8	50.4	74	-23.6	Peak

Run # 2: Mid CH = 2442.0 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polarization (H / V)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
2439.9000	112.7	260	1.0	V	28.7	1.5	37.0	105.8			Fund/Peak
2439.9000	101.8	338	1.0	H	28.7	1.5	37.0	95.0			Fund/Peak
2439.9000	85.3	260	1.0	V	28.7	1.5	37.0	78.5			Ave
2439.9000	79.2	202	1.2	H	28.7	1.5	37.0	72.3			Ave
9759.8000	37.8	141	1.7	H	38.1	3.7	36.7	42.9	52.3	-9.4	Ave
7319.8000	38.7	117.5	1.2	V	36.7	4.2	35.1	44.5	54	-9.5	Ave
4879.9000	43.0	295	1.2	V	32.5	1.9	34.8	42.6	54	-11.4	Ave
9759.8000	40.0	171.9	1.7	V	38.1	3.7	36.7	45.1	58.5	-13.4	Ave
7319.8000	34.5	275	1.2	H	36.7	4.2	35.1	40.3	54	-13.7	Ave
4879.9000	39.3	134	1.2	H	32.5	1.9	34.8	38.9	54	-15.1	Ave
4879.9000	57.0	295	1.2	V	32.5	1.9	34.8	56.6	74	-17.4	Peak
7319.8000	50.2	117.5	1.2	V	36.7	4.2	35.1	56.0	74	-18.0	Peak
9759.8000	51.2	141	1.7	H	38.1	3.7	36.7	56.3	75	-18.7	Peak
7319.8000	47.7	275	1.3	H	36.7	4.2	35.1	53.5	74	-20.5	Peak
4879.9000	52.5	134	1.2	H	32.5	1.9	34.8	52.1	74	-21.9	Peak
9759.8000	53.0	171.9	1.7	V	38.1	3.7	36.7	58.1	85.8	-27.7	Peak

Run # 3: High CH = 2479 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Polarization (H / V)	Antenna Factor (dB/m)	Cable Loss (dB)	Pre-Amplifier Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
2479.0000	110.7	292	1.0	V	28.7	1.5	37.2	103.6			Fund/Peak
2479.0000	94.8	0	1.3	H	28.7	1.5	37.2	87.8			Fund/Peak
2479.0000	84.2	180	1.1	V	28.7	1.5	37.2	77.1			Ave
2479.0000	75.0	0	1.3	H	28.7	1.5	37.2	68.0			Ave
9916.0000	33.9	156	1.1	H	38.1	3.7	34.2	41.5	48	-6.5	Ave
4958.0000	45.5	179	1.0	V	32.5	1.9	34.8	45.1	54	-8.9	Ave
7437.0000	36.7	139	1.1	V	36.7	4.2	34.7	42.9	54	-11.1	Ave
9916.0000	48.8	156	1.6	H	38.1	3.7	34.2	56.5	67.8	-11.3	Peak
7437.0000	35.5	113.1	1.3	H	36.7	4.2	34.7	41.7	54	-12.3	Ave
7437.0000	55.3	139	1.1	V	36.7	4.2	34.7	61.5	74	-12.5	Peak
4958.0000	41.3	133.1	1.4	H	32.5	1.9	34.8	40.9	54	-13.1	Ave
4958.0000	59.8	179	1.4	V	32.5	1.9	34.8	59.4	74	-14.6	Peak
4958.0000	56.8	133.1	1.4	H	32.5	1.9	34.8	56.5	74	-17.5	Peak
7437.0000	48.3	113.1	1.0	H	36.7	4.2	34.7	54.6	74	-19.4	Peak
9916.0000	53.9	256	1.1	V	38.1	3.7	34.2	61.5	83.6	-22.1	Peak
9916.0000	36.8	256	1.3	V	38.1	3.7	34.2	44.4	571	-526.6	Ave

§15.247 (a) (1) - HOPPING CHANNEL SEPARATION

Applicable Standard

According to §15.247(a)(1): 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.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the Max-Hold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function, and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram

Environmental Conditions

Temperature:	24 °C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

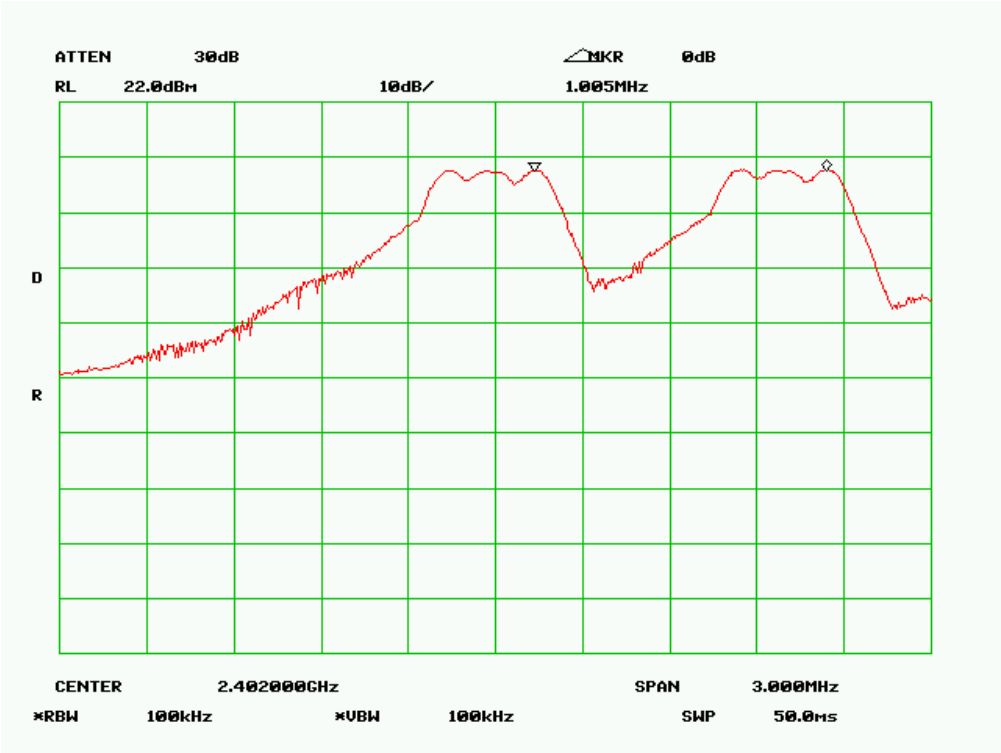
**The testing was performed by Choon Sian Ooi on 2007-02-13*

Measurement Results

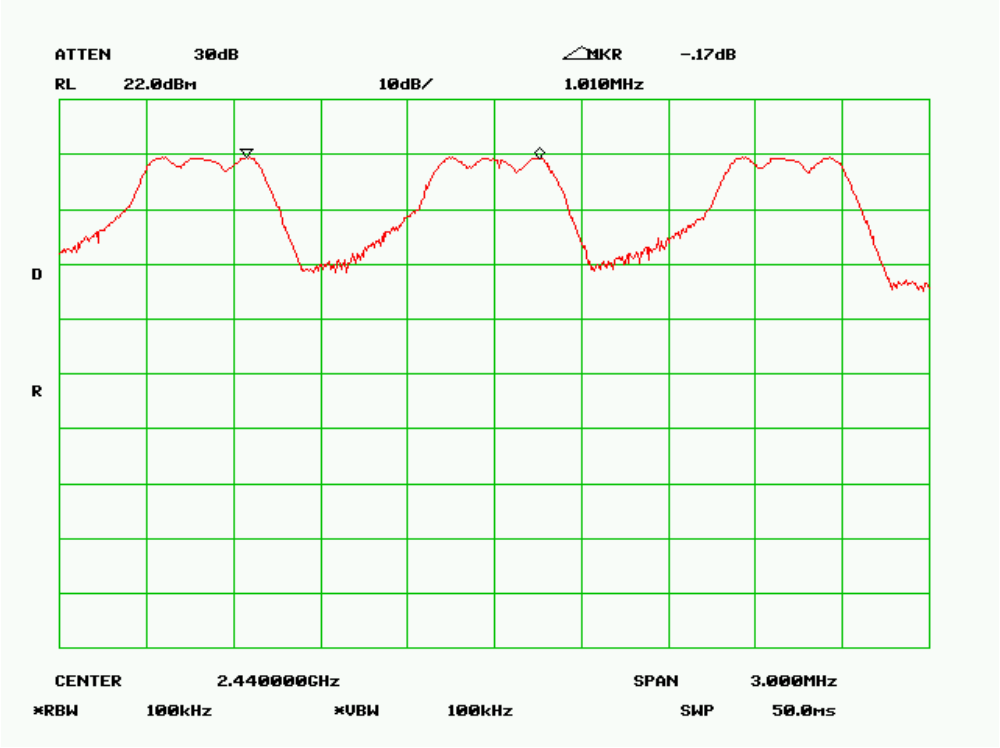
Channel	Frequency (MHz)	Channel Separation (kHz)	Limit >(kHz)
Low	2402.0	1005	345.3
Mid	2440.0	1010	344.7
High	2479.0	1003	348.7

Please refer to the following plots.

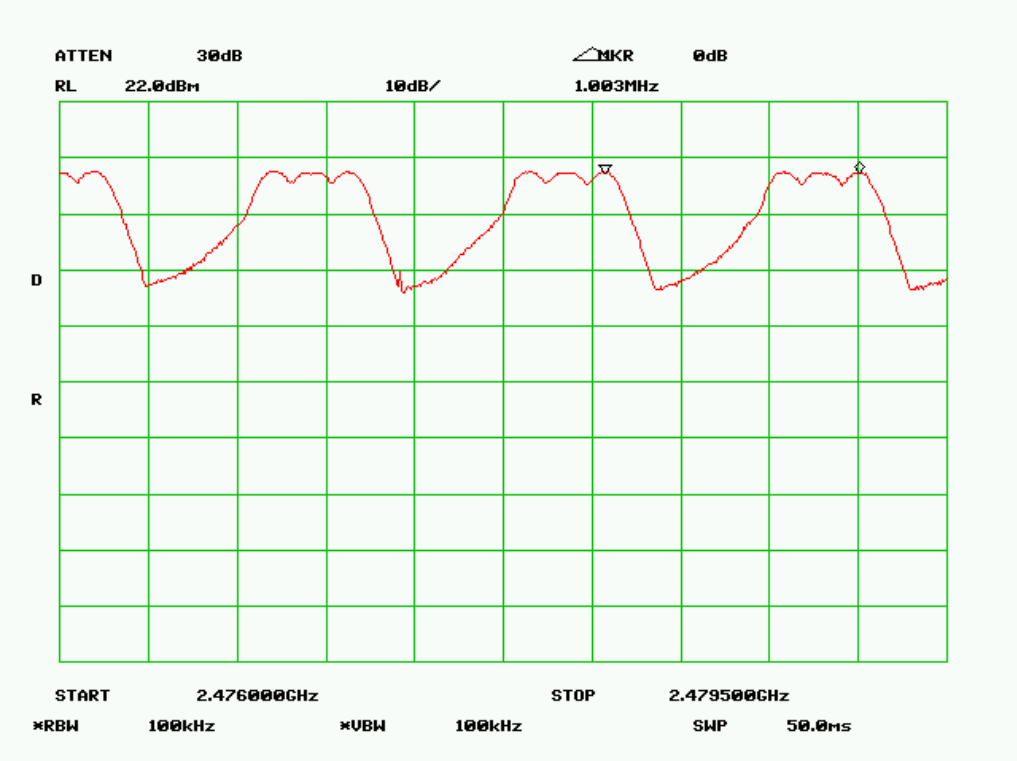
Low Channel



Middle Channel



High Channel



§15.247 (a) (1) – HOPPING CHANNEL BANDWIDTH

Applicable Standard

According to §15.247 (a)(1): 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.

Measurement Procedure

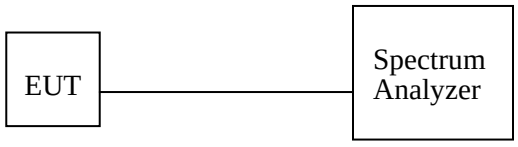
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

Temperature:	24 °C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

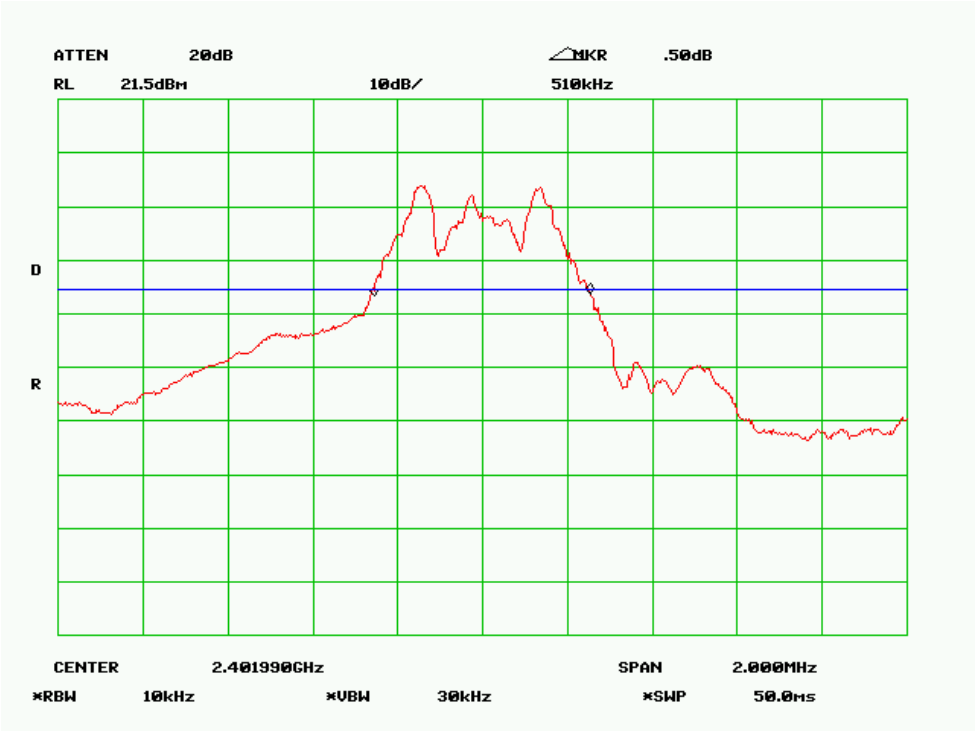
**The testing was performed by Choon Sian Ooi on 2007-02-13*

Measurement Results

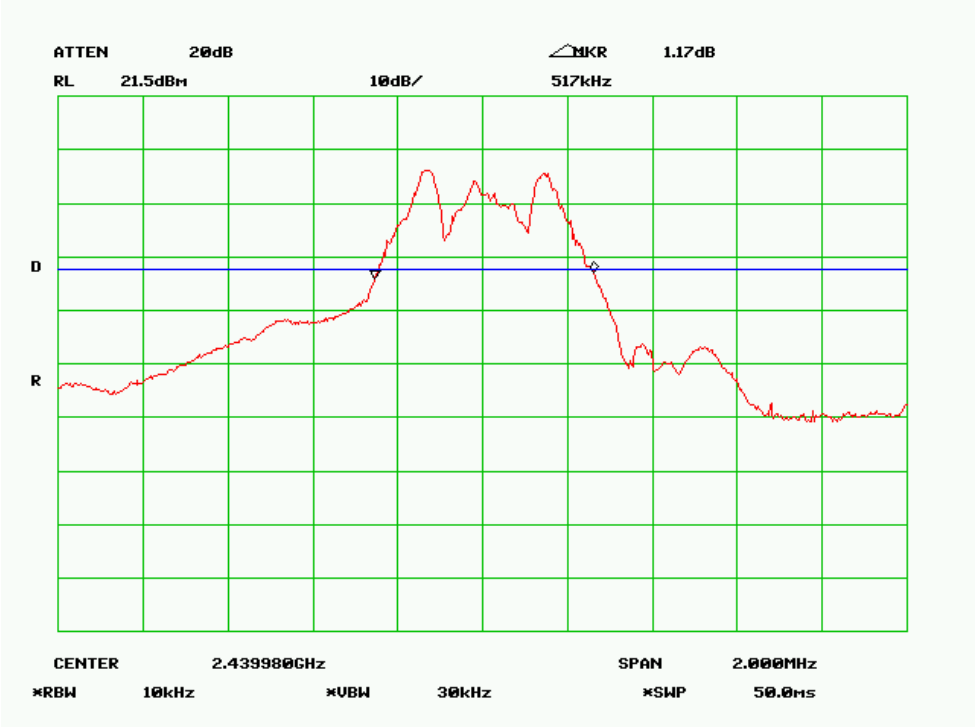
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402.0	518
Mid	2440.0	517
High	2479.0	523

Please refer to the following plots.

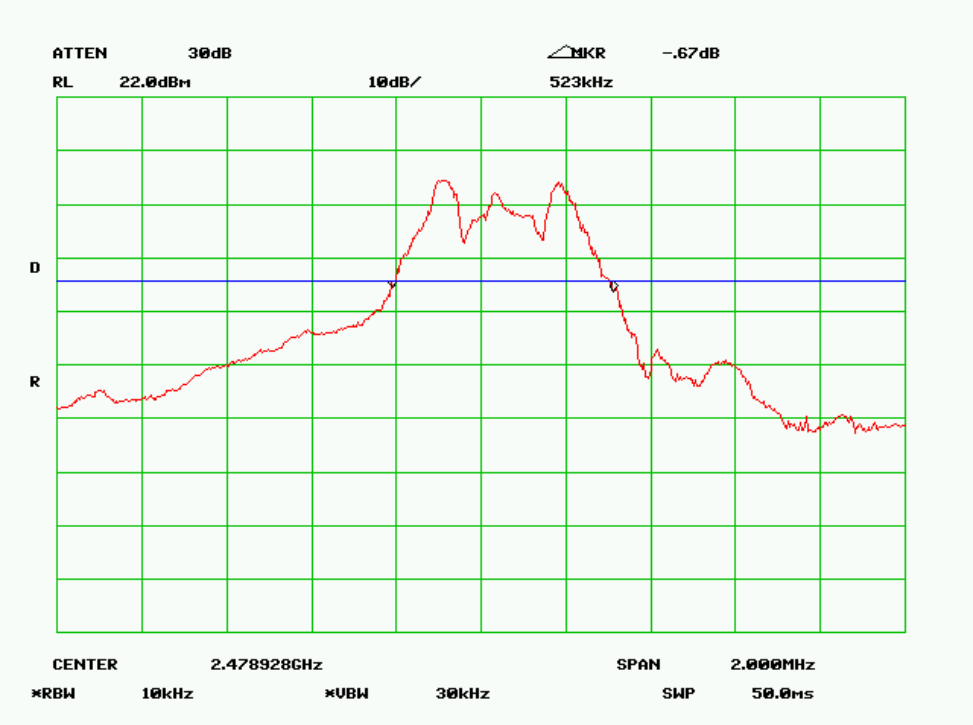
Low Channel



Middle Channel



High Channel



§15.247 (a) (1) (iii) - NUMBER OF HOPPING FREQUENCIES USED

Applicable Standard

According to §15.247 (a)(1)(iii) 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.

Measurement Procedure

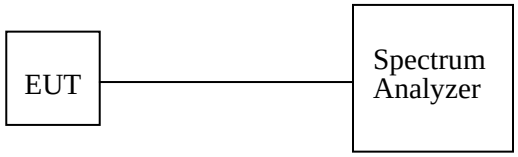
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

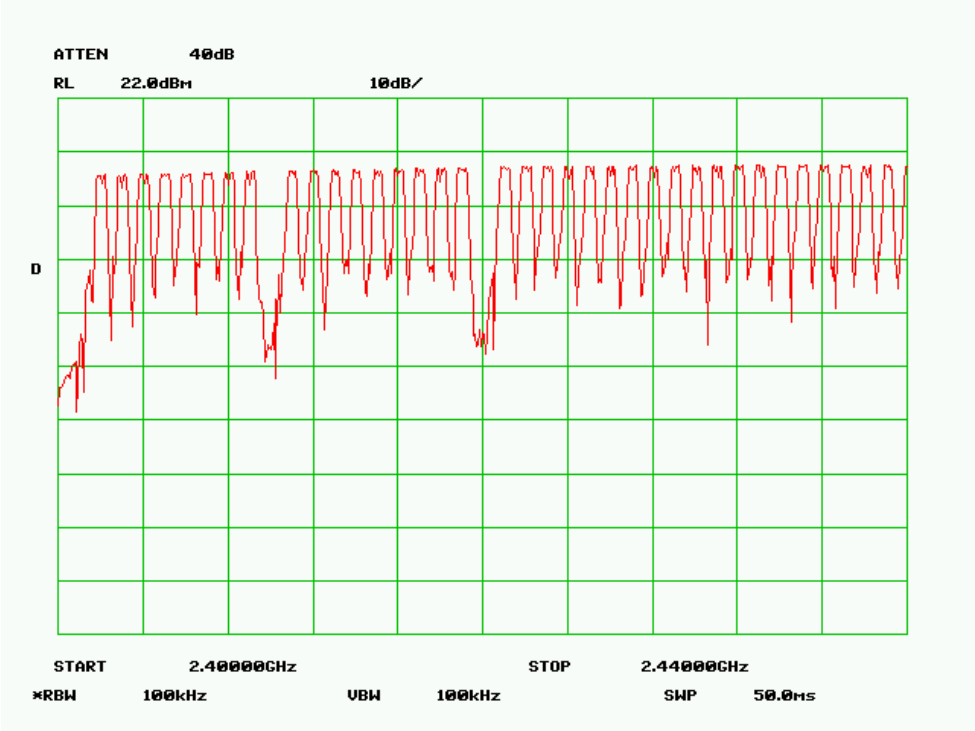
Temperature:	24 °C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

**The testing was performed by Choon Sian Ooi on 2007-02-13*

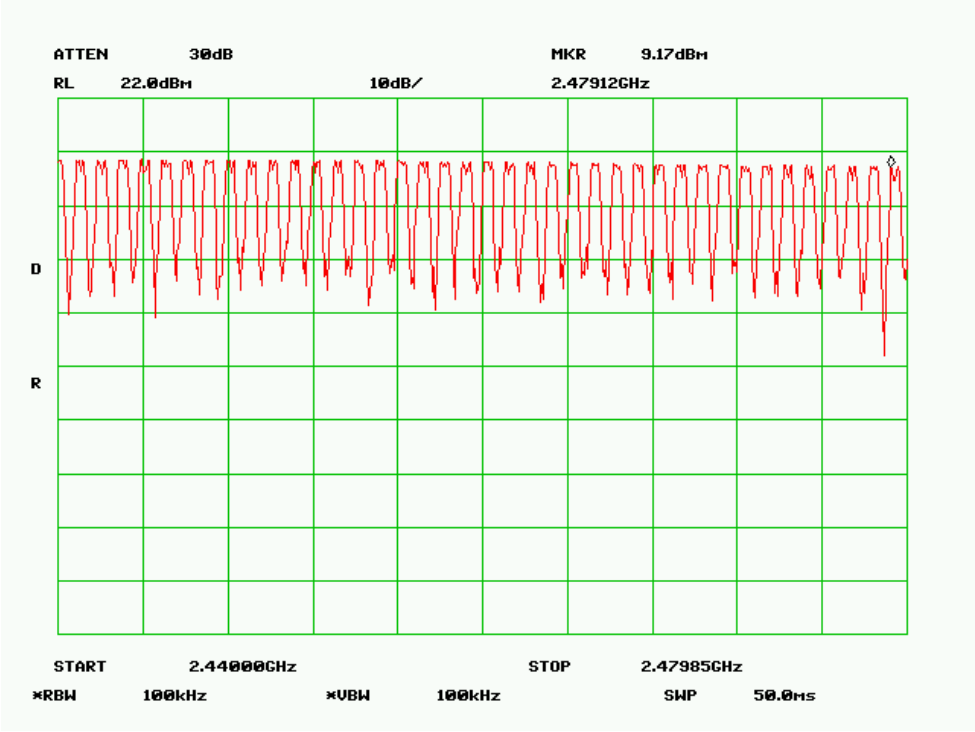
Measurement Result: 76 channels

Please refer to the following plots:

First plot is 36 channels



Second plot is 40 channels



§15.247(a) (1) (iii) - DWELL TIME

Applicable Standard

According to §15.247 (a) (1) (iii), 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.

Measurement Procedure

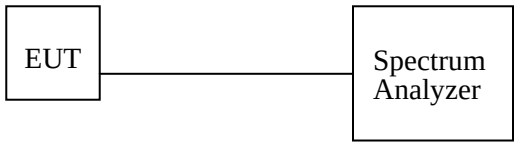
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

Temperature:	24 °C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

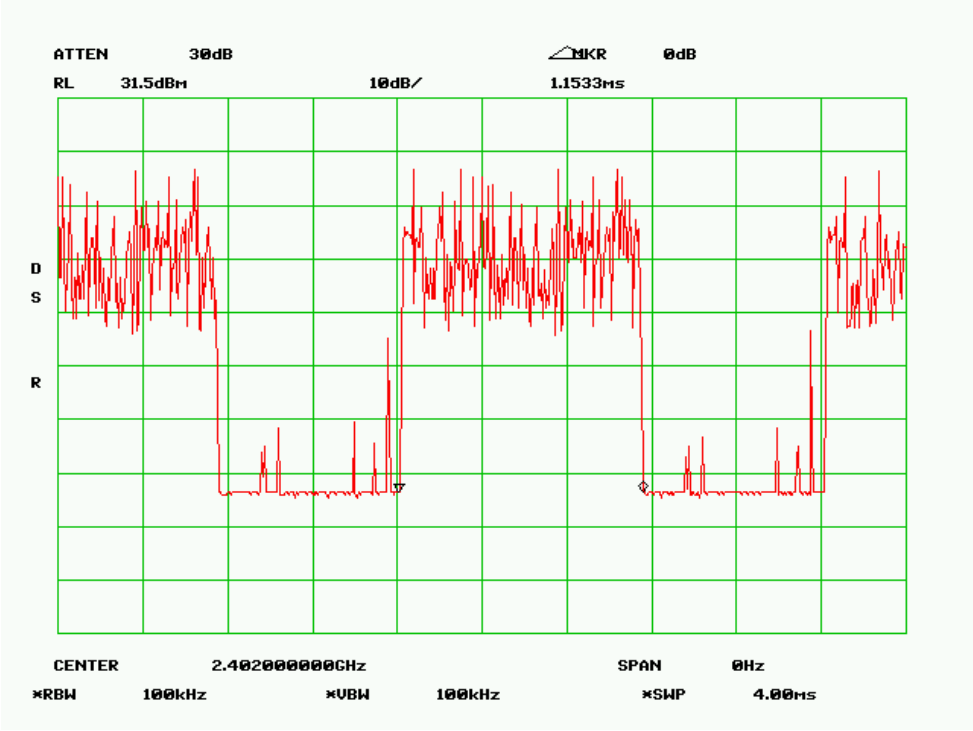
**The testing was performed by Choon Sian Ooi on 2007-02-13*

Measurement Results:

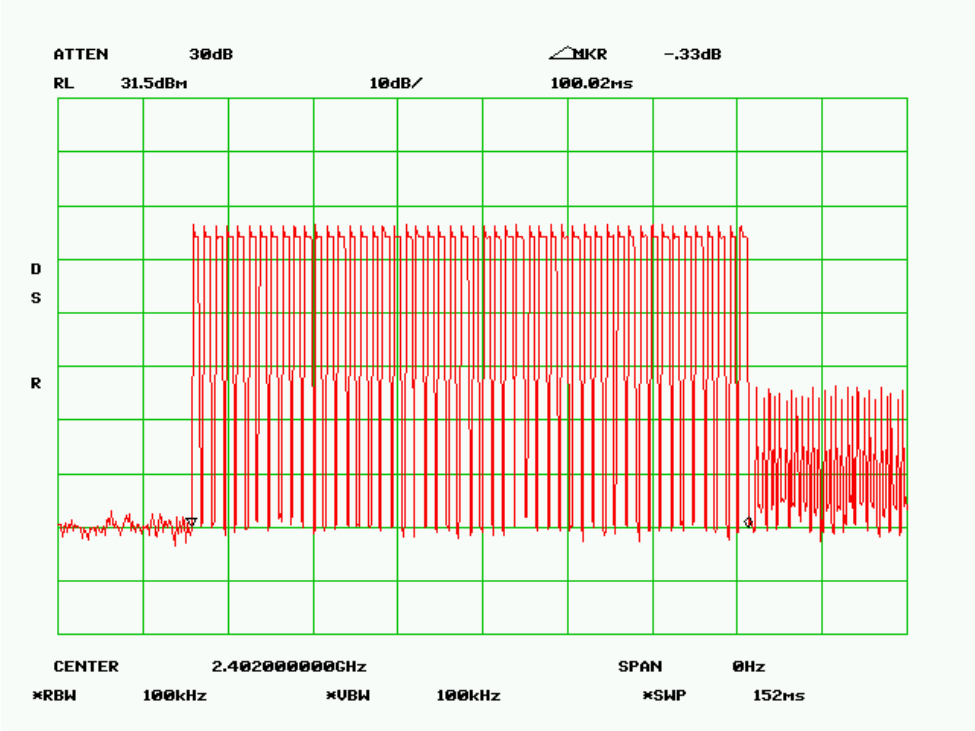
Channel	Frequency (MHz)	Pulse Width (ms)	Occupied Time	Dwell Time (sec.)	Limit	Result
Low	2402.0	1.1667	61	0.0712	0.4	Compliant
Mid	2442.0	1.1667	62	0.0723	0.4	Compliant
High	2479.0	1.1583	61	0.0707	0.4	Compliant

Please refer the following plots for detailed test results

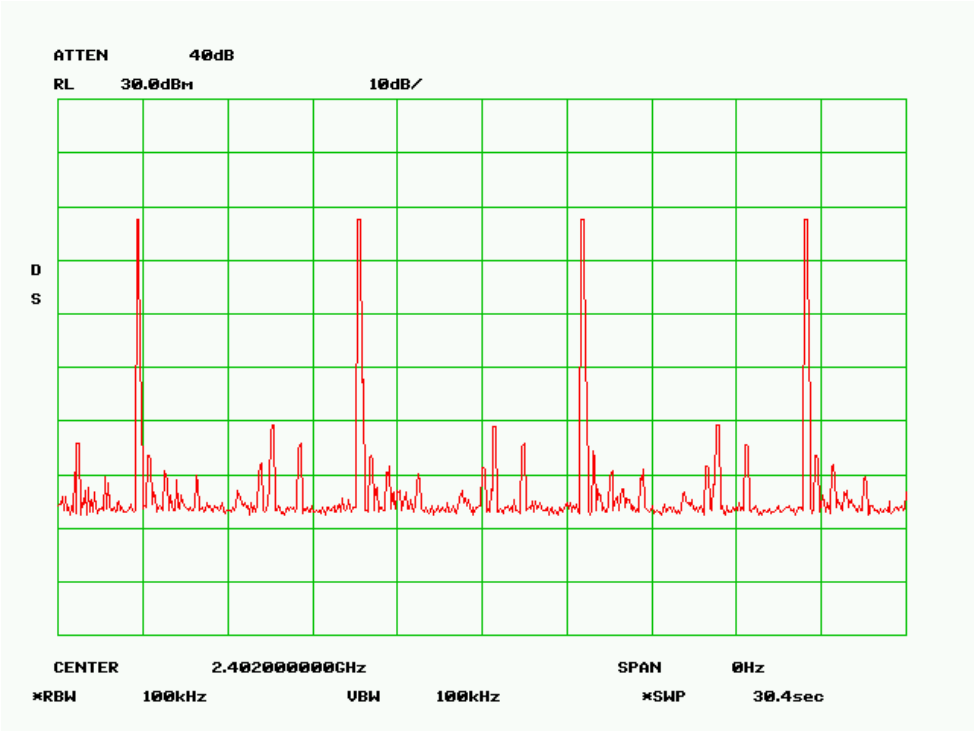
Low Channel



Pulse width, 4 ms span



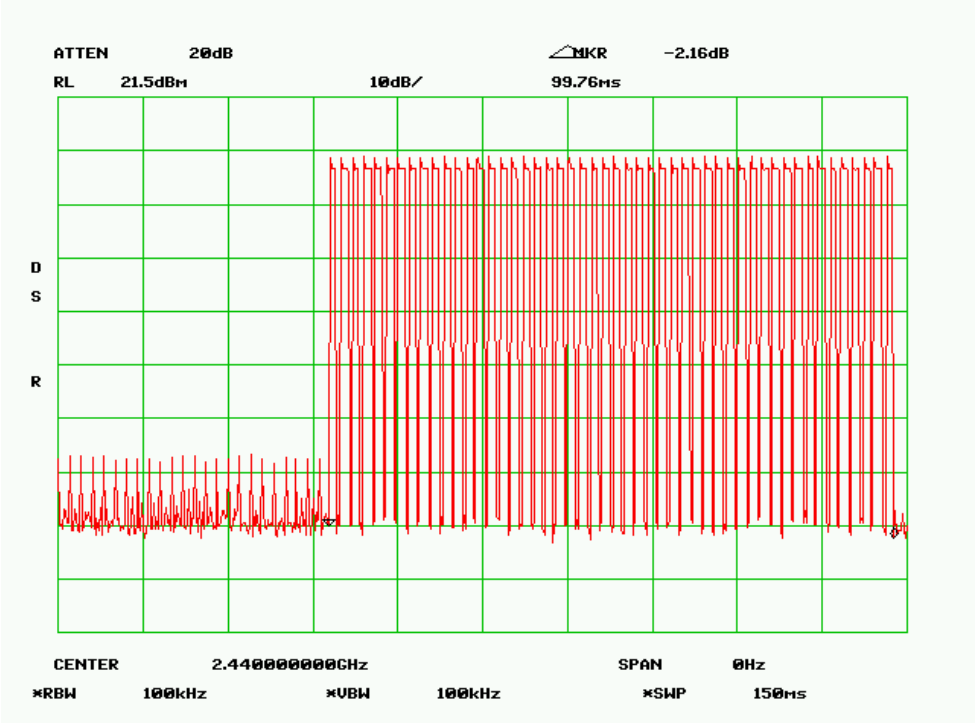
Occupied Time



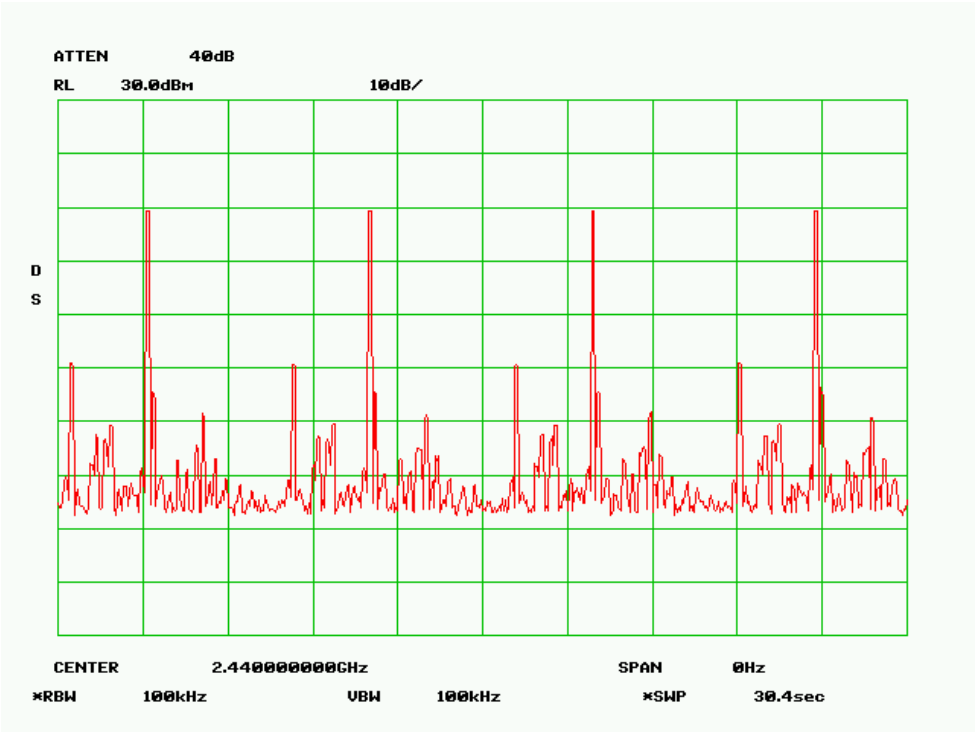
On time pattern in 30.4sec

Middle Channel

Pulse width in 4 ms

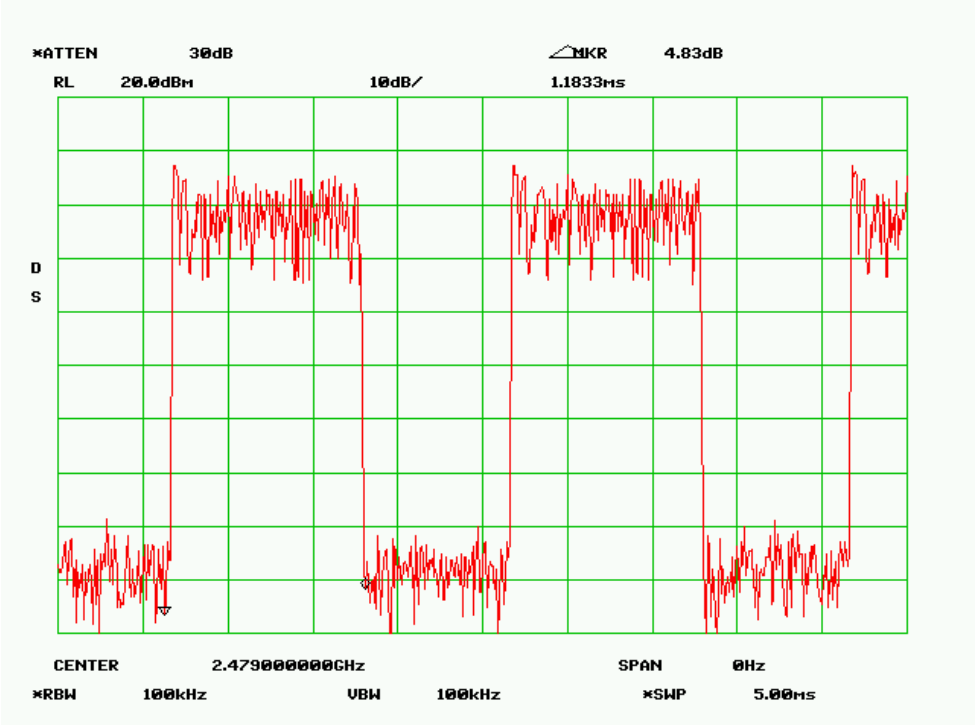


Occupied Time

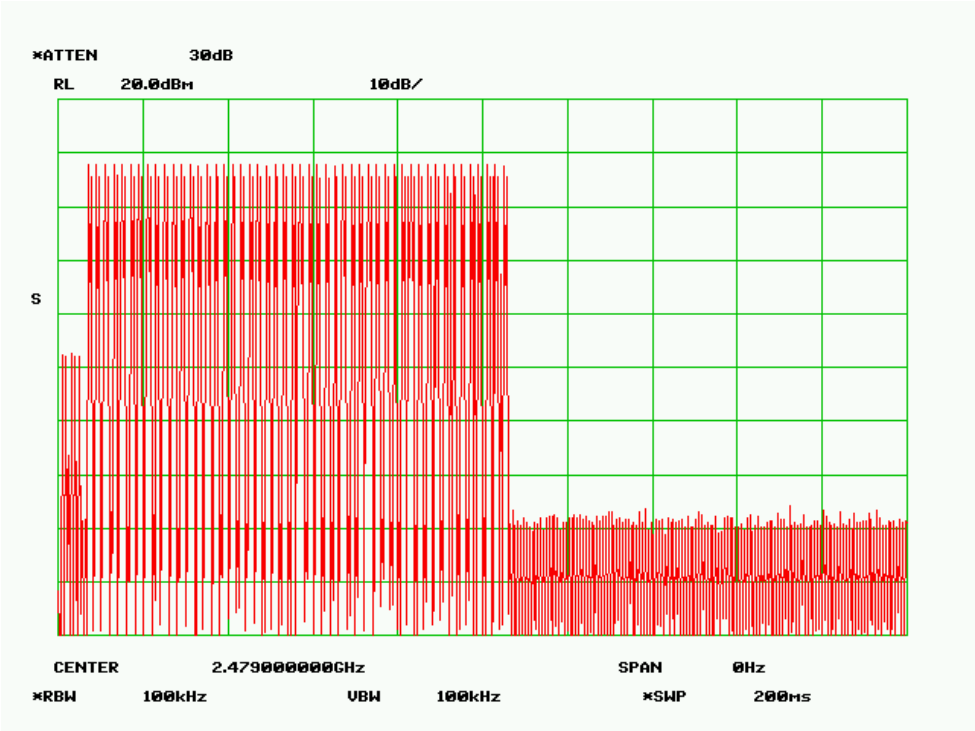


On time pattern in 30.4sec

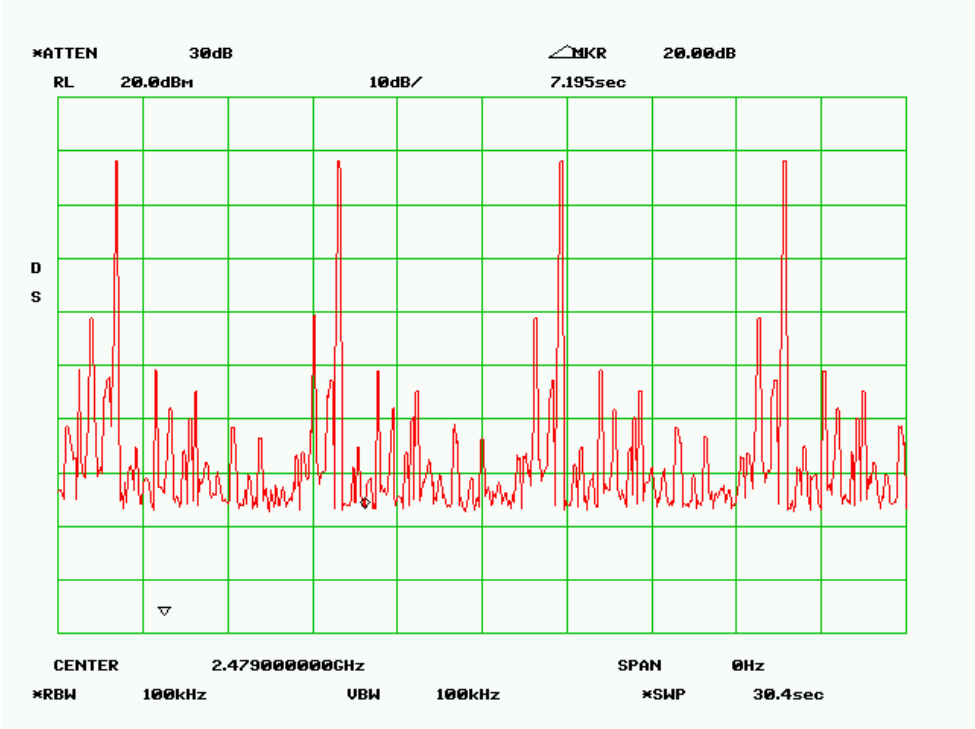
High Channel



Pulse width in 5ms



Occupied Time



On time pattern in 30.4 sec

§15.247(b) (1) - MAXIMUM PEAK OUTPUT POWER

Applicable Standard

According to §15.247(b) (1), 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.

Measurement Procedure

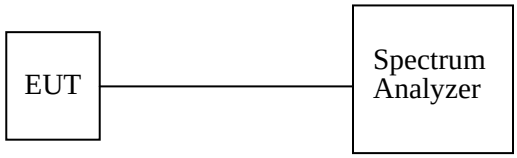
1. Place the EUT on the turntable and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

Temperature:	24 °C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

**The testing was performed by Choon Sian Ooi on 2007-02-13*

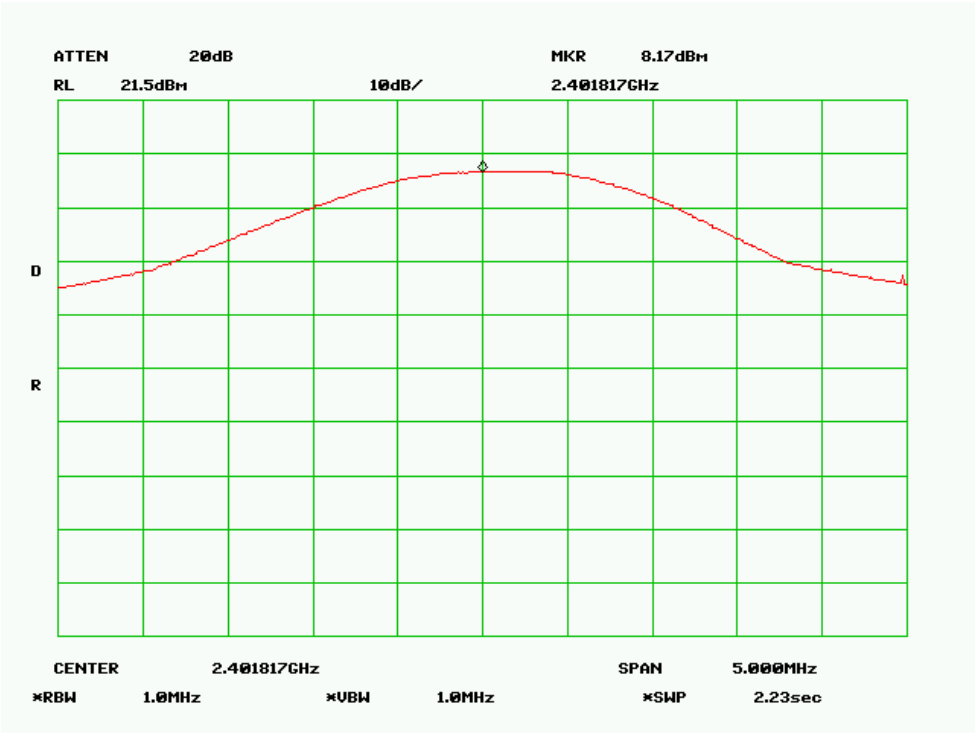
Measurement Result

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	2402.0	8.17	6.561	1000	Compliant
Mid	2442.0	10.83	12.106	1000	Compliant
High	24879.0	9.33	8.57	1000	Compliant

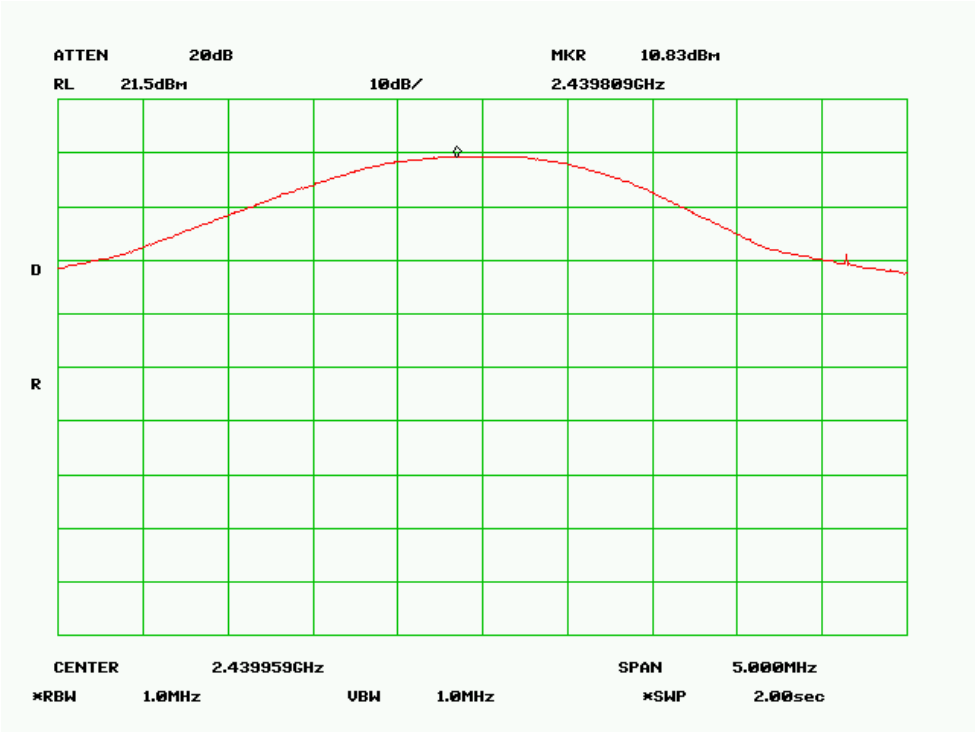
Please refer to the following plots for detailed test results

Plots of Maximum Peak Output Power

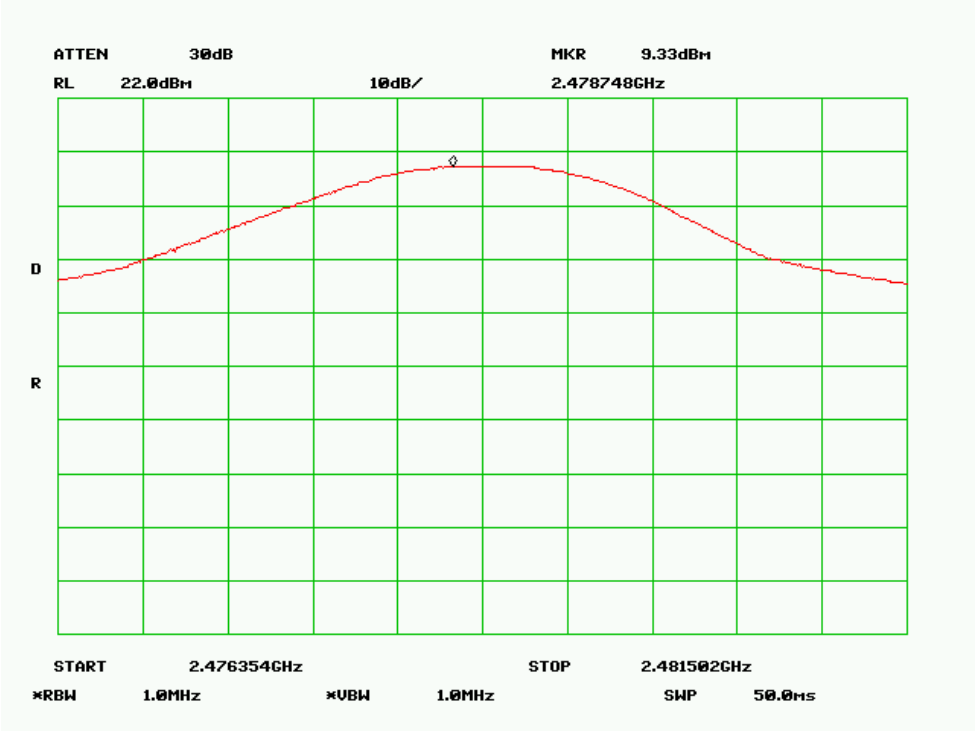
Low Channel



Middle Channel



High Channel



§15.247 (d) - 100 kHz BANDWIDTH OF BAND EDGES

Applicable Standard

According to §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)).

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.

4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

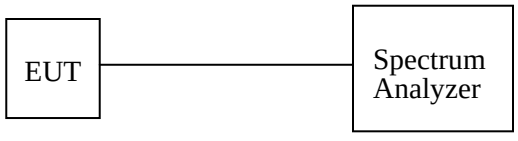
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Setup Diagram



Environmental Conditions

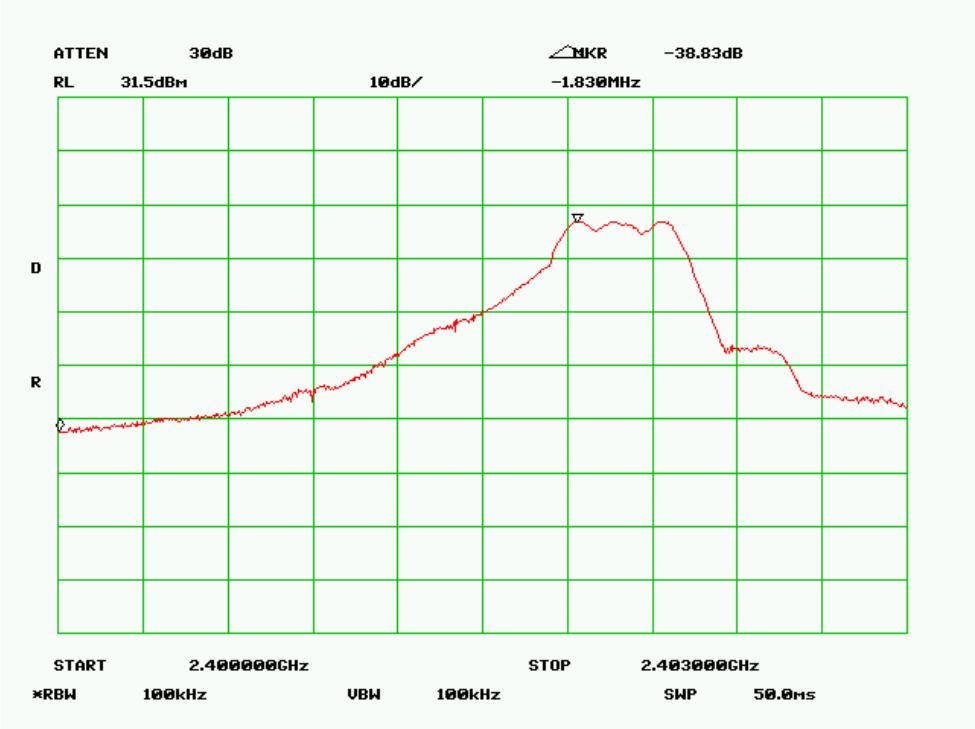
Temperature:	24 °C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

**The testing was performed by Choon Sian Ooi on 2007-02-13*

Please refer to the following plots for results.

Plots of 100 kHz Bandwidth of Band Edge

Low Channel



High Channel