Lab Code: 200167-0

FCC PART 15.247

MEASUREMENT AND TEST REPORT

For

Trimble Navigation Limited

935 Stewart Drive
Sunnyvale, CA 94085

Model: SPSx81
FCC ID: JUP-6248192-B1

Report Type: ☒ Original Report	**Product Type:** GPS Receiver with Integrated Bluetooth and 900 MHz FHSS Radio Transceiver
Test Engineer(s):	Choon Sian Ooi
Report Number:	R0711021-247
Test Date(s)	2007-11-05, 2007-11-20, 2007-11-28
Report Date:	2007-12-20
Reviewed By:	Hans Mellberg, VP of Engineering
Prepared By: **(24)**	Bay Area Compliance Laboratories Corp. (BACL) 1274 Anvilwood Ave. Sunnyvale, CA 94089, USA Tel: (408) 732-9162 Fax: (408) 732-9164

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1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

This measurement and test report has been compiled on behalf of the company *Trimble Navigation Limited* and their product, model number: SPSx81 which will be henceforth in this report referred to as the EUT (Equipment Under Test). The EUT is a GPS Receiver containing a Bluetooth receiver module; it is designed for grade checkers and site engineers on site development or highway projects that require precise site measurement and stakeout capability. The EUT can operate with both a 5 dBi Whip and a 2.5 dBi Dipole antenna. The Bluetooth Module from Infineon installed in the EUT has been certified under FCC ID: Q2331308. The EUT is composed of: SPSx81 receiver (host unit), P/N 59355-91, SN 4718131622; 900 MHz FHHSS Radio Transceiver Module, P/N 62481-92, SN 8978 Rev B; and Infineon PBA31308 Bluetooth Module.

1.2 Mechanical Description of EUT

The *Trimble Navigation Limited* model*: SPSx81 is* a GPS Receiver with Bluetooth receiver module and measures approximately 19 cm **(W)** x 11.2 cm **(H)**, weighing approximately *1.37 kg*.

**The data gathered are from a sample provided by the manufacturer, serial number 4718131622.*

1.3 EUT Photo

Please refer to Exhibit C for addition EUT photographs.

1.4 Antennae Descriptions

Item Number	Model/Type	
External Antenna 1	Part number:	32316
	Antenna Manufacturer:	Trimble Navigation
	Frequency :	890-960 MHz
	Maximum Gain	5 dBi
	Antenna Type/ Pattern:	Whip/ Omni-Directional
	Terminations:	Reverse Polarity TNC Connector
	Measurement:	Length: 78.7 cm (L) x 4 cm (W)
External Antenna 2	Part number:	32318
	Antenna Manufacturer:	Trimble Navigation
	Frequency :	890-960 MHz
	Maximum Gain	3 dBi
	Antenna Type/ Pattern:	Whip/ Omni-Directional
	Terminations:	Reverse Polarity TNC Connector
	Measurement:	Length: 56 cm (L) x 4 cm (W)
External Antenna 3	Part number:	32317
	Antenna Manufacturer:	Trimble Navigation
	Frequency :	890-960 MHz
	Maximum Gain	0 dBi
	Antenna Type/ Pattern:	Whip/ Omni-Directional
	Terminations:	Reverse Polarity TNC Connector
	Measurement:	Length: 33 cm (L) x 4 cm (W)
External Antenna 4	Part number:	EXE902TNSP
	Antenna Manufacturer:	Centurion Wireless Technologies, Inc.
	Frequency :	896-940 MHz
	Maximum Gain	2.5 dBi
	Antenna Type/ Pattern:	Dipole/ Omni-Directional
	Terminations:	Reverse Polarity TNC Connector
	Measurement:	Length: 17.8 cm (L) x 1.5 cm (W)

1.5 Objective

This report is prepared on behalf of *Trimble Navigation Limited.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules and limits for the EUT including:

- RF Exposure
- Antenna Requirement
- Conducted Emissions
- Spurious Emissions at Antenna Port
- Radiated Spurious Emissions
- Restricted Band
- Receiver Spurious Emissions
- Hopping Channel Separation
- 20 dB Bandwidth
- Number of Hopping Frequencies Used
- Dwell Time of Each Frequency
- Maximum Peak Output Power
- 100 kHz Bandwidth of Frequency Band Edge

1.6 Related Submittal(s)/Grant(s)

No related submittals.

1.7 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.8 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 +2.0 for Conducted Emissions tests and +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.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.9 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/Standards/scopes/2001670.htm

2 SYSTEM TEST CONFIGURATION

2.1 Justification

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

The EUT was tested in the testing mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The software to exercise the EUT is provided by the manufacturer

2.3 Special Accessories

There were no special accessories were required, included, or intended for use with EUT during these tests.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment List and Details

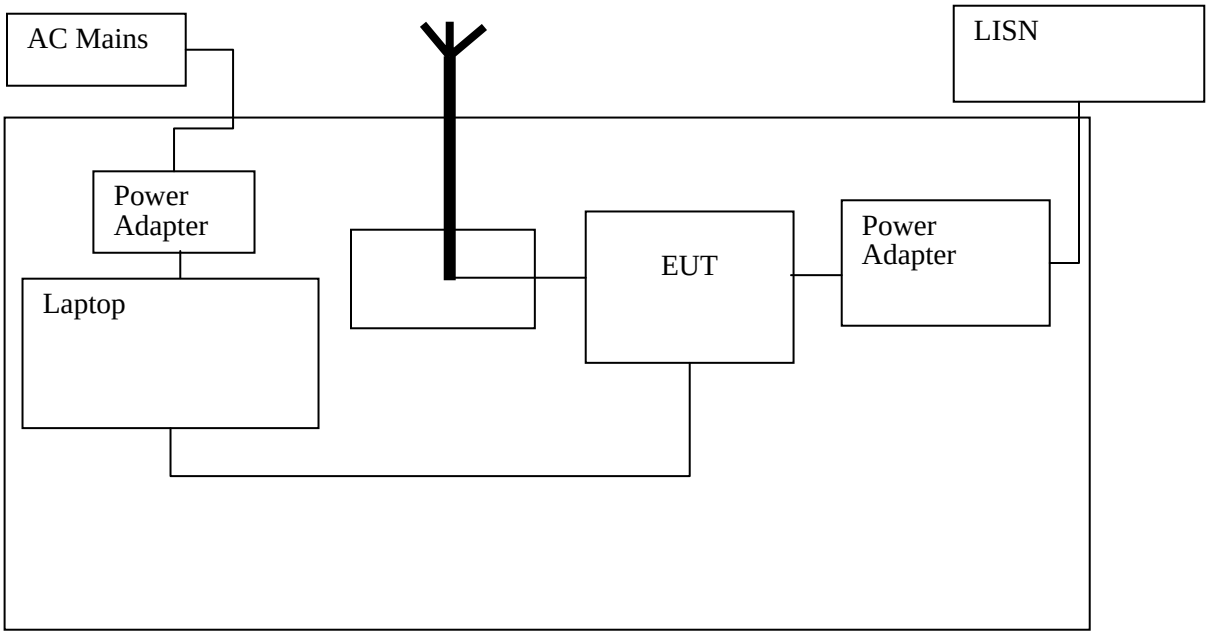
Manufacturer	Description	Model	Serial Number
Dell	Laptop	D610	-

2.6 Power Supply Information

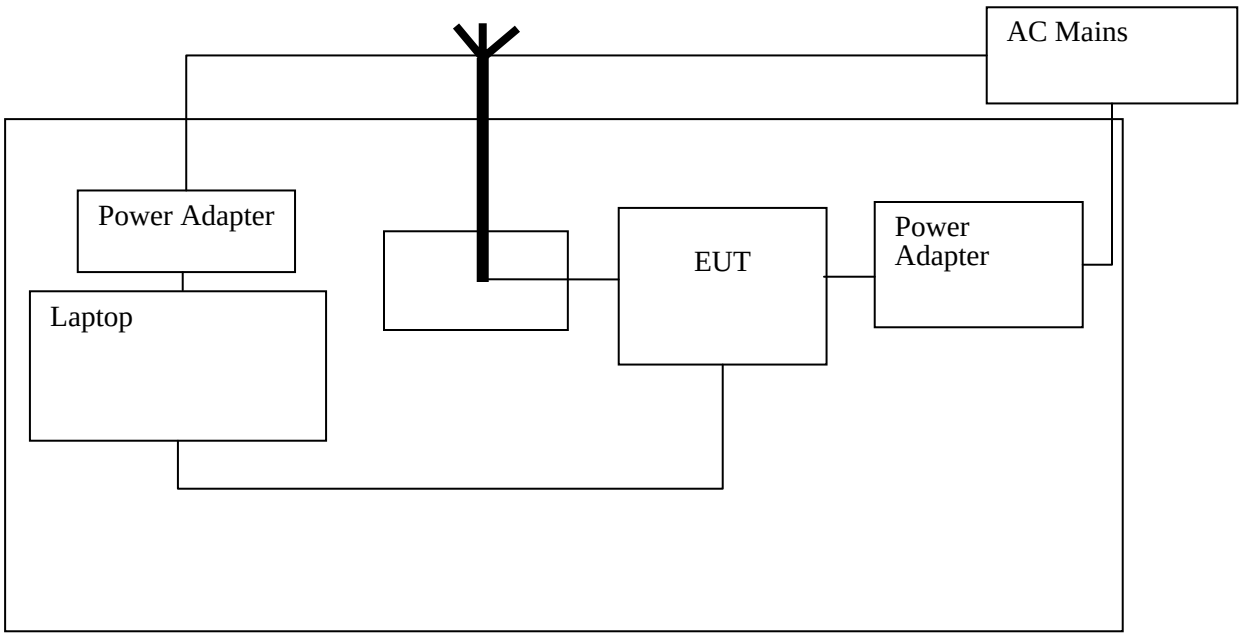
Manufacturer	Description	Model/ Rev. #	Serial Number
AULT Korea Corp.	ITE Power Supply	PW174KA1802FXX	82-31-299-1234

2.7 Test Setup Block Diagrams

Conducted Emissions



Radiated Emissions



3 SUMMARY OF TEST RESULTS

Results reported relate only to the product tested.

900 MHz FHSS Transceiver:

FCC Part 15C Rules	Description of Test	Result	Note
FCC §15.247 (i)	RF Exposure	Compliant	-
FCC §15.203	Antenna Requirement	Compliant	-
FCC §15.207 (a)	Conducted Emissions	Compliant	-
FCC §15.247(d)	Spurious Emissions at Antenna Port	Compliant	-
FCC §15.205, §15.209	Radiated Spurious Emissions	Compliant	-
FCC §15.205	Restricted Band	Compliant	-
§15.109 (a)	Receiver Spurious Emissions	Compliant	-
§15.247 (a)(1)	20 dB Bandwidth	Compliant	-
§15.247 (a)(1)	Hopping Channel Separation	Compliant	-
§15.247 (a)(1)(iii)	Number of Hopping Frequencies Channel Used	Compliant	-
§15.247 (a)(1)(iii)	Dwell Time	Compliant	-
§15.247 (b)(3)	Maximum Peak Output Power	Compliant	-
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant	-

Bluetooth:

FCC Part 15C Rules	Description of Test	Result	Note
FCC §15.247 (i)	RF Exposure	Compliant*	-
FCC §15.203	Antenna Requirement	Compliant*	-
FCC §15.207 (a)	Conducted Emissions	Compliant*	-
FCC §15.247(d)	Spurious Emissions at Antenna Port	Compliant *	-
FCC §15.205, §15.209	Radiated Spurious Emissions	Compliant	-
FCC §15.205	Restricted Band	Compliant*	-
§15.109 (a)	Receiver Spurious Emissions	Compliant*	-
§15.247 (a)(1)	20 dB Bandwidth	Compliant*	-
§15.247 (a)(1)	Hopping Channel Separation	Compliant *	-
§15.247 (a)(1)(iii)	Number of Hopping Frequencies Channel Used	Compliant*	-
§15.247 (a)(1)(iii)	Dwell Time	Compliant*	-
§15.247 (b)(3)	Maximum Peak Output Power	Compliant*	-
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant*	-

* The Bluetooth Module from Infineon installed in the EUT has been certified under FCC ID: Q2331308, please refer to said FCC ID for the relevant test results.

4 FCC §15.247 (i) and §2.1091 - RF Exposure

4.1 Applicable Standard

According to §15.247(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

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
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

4.2 MPE Prediction

Prediction 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): 29.66
Maximum peak output power at antenna input terminal (mW): 924.698
Prediction distance (cm): 20
Prediction frequency (MHz): 928
Maximum Antenna Gain, typical (dBi): 5
Maximum Antenna Gain (numeric): 3.16
Power density of prediction frequency at 20.0 cm (mW/cm^2): 0.581
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2): 0.619

4.3 Test Result

The power density level at 20 cm is 0.581 mW/cm^2, which is below the uncontrolled exposure limit of 0.619 mW/cm^2 at 928 MHz.

5 FCC §15.203 – Antenna Requirement

5.1 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.

And according to § 15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The antennas for the EUT are three whip antennas which connect to the EUT via a RF cable and one dipole antenna which connects directly to the EUT. The gain of the whip antennas used for transmitting are: 5dBi, 3 dBi and 0 dBi. The dipole antenna is 2 dBi. Please see the photos below for details.

5.2 Result

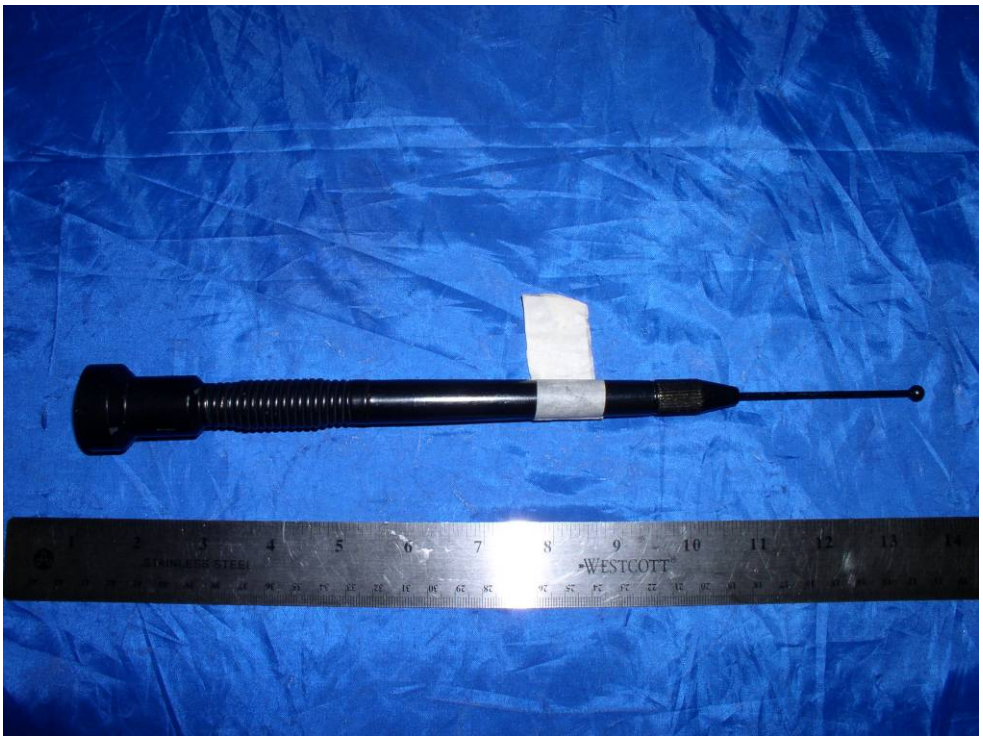
The Antennae used are: three whip antennas with gains of: 5 dBi, 3 dBi, and 0 dBi, and a dipole antenna with a gain of: 2 dBi all using reverse polarity TNC connectors therefore complying with the unique connector requirement.

Item Number	Model/Type	
External Antenna 1	Part number:	32316
	Antenna Manufacturer:	Trimble Navigation
	Frequency :	890-960 MHz
	Maximum Gain	5 dBi
	Antenna Type/ Pattern:	Whip/ Omni-Directional
	Terminations:	Reverse Polarity TNC
	Measurement:	Length: 78.7 cm (L) x 4 cm (W)
External Antenna 2	Model number:	32318
	Antenna Manufacturer:	Trimble Navigation
	Frequency :	890-960 MHz
	Maximum Gain	3 dBi
	Antenna Type/ Pattern:	Whip/ Omni-Directional
	Terminations:	Reverse Polarity TNC
	Measurement:	Length: 56 cm (L) x 4 cm (W)
External Antenna 3	Model number:	32317
	Antenna Manufacturer:	Trimble Navigation
	Frequency :	890-960 MHz
	Maximum Gain	0 dBi
	Antenna Type/ Pattern:	Whip/ Omni-Directional
	Terminations:	Reverse Polarity TNC
	Measurement:	Length: 33 cm (L) x 4 cm (W)
External Antenna 4	Model number:	EXE902TNSP
	Antenna Manufacturer:	Centurion Wireless Technologies, Inc.
	Frequency :	896-940 MHz
	Maximum Gain	2.5 dBi
	Antenna Type/ Pattern:	Dipole/ Omni-Directional
	Terminations:	Reverse Polarity TNC Connector
	Measurement:	Length: 17.8 cm (L) x 1.5 cm (W)

External Antenna 1:

External Antenna 2:

External Antenna 3:



External Antenna 4:

☒ **Compliant** ☐ **N/A**

6 FCC §15.207 (a) - Conducted Emissions

6.1 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 (dBµV)	
	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*

6.2 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 bundled when necessary.

The EUT was connected with LISN-1.

6.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100044	2007-02-19
Solar Electronics CO	Artificial-Mains Network	9252-50-R-24-N	0511213	2007-07-30

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

6.4 Test Procedure

During the conducted emissions test, the power cord of the EUT was connected to an AC/DC Adapter which then 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".

Environmental Conditions

Temperature:	24 ° C
Relative Humidity:	65 %
ATM Pressure:	1020 mbar

**The testing was performed by Choon Sian Ooi on 2007-11-20.*

6.5 Summary of Test Results

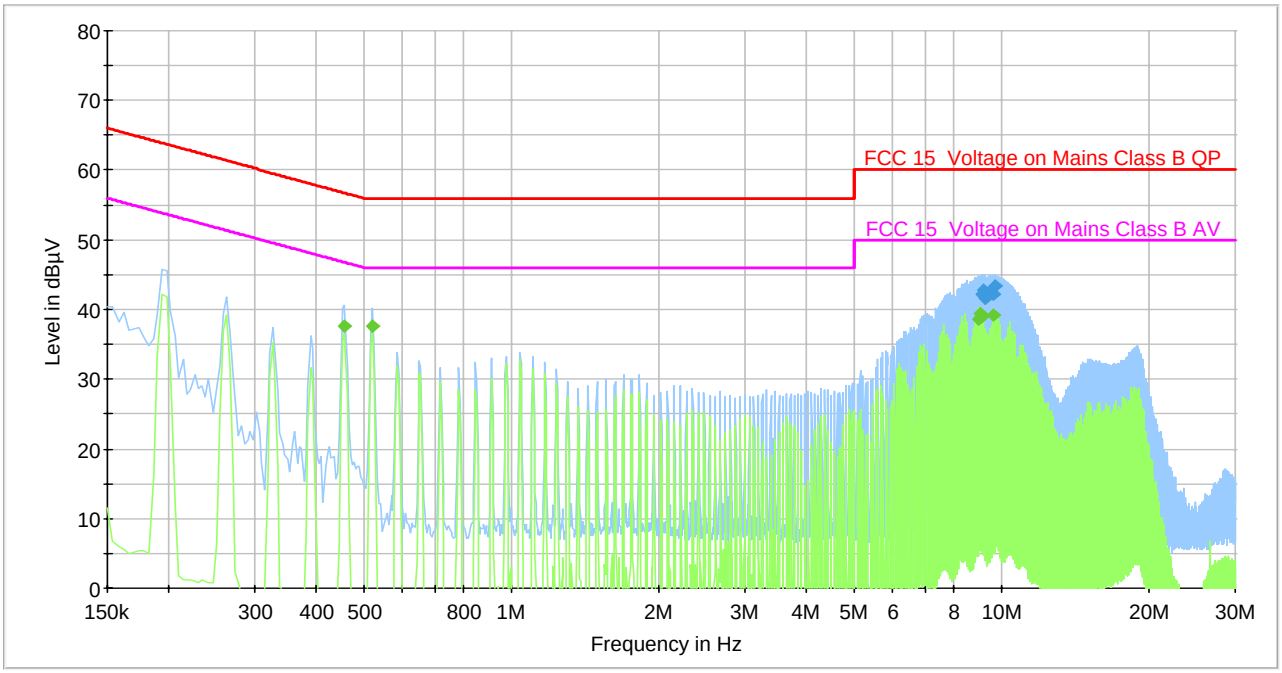
According to the recorded data in following table, the EUT complied with the applicable FCC Rules, conducted emissions limits for Class B devices, with the *worst* margin reading of:

Mode: 120V/ 60 Hz			
Margin (dB)	**Frequency (MHz)**	**Conductor (Hot/Neutral)**	**Range (MHz)**
-8.4	0.521000	Hot	0.15 to 30

Please refer to the following plots and tables for complete test results

Conducted Emissions Test plot & data

Hot Conductor Mode



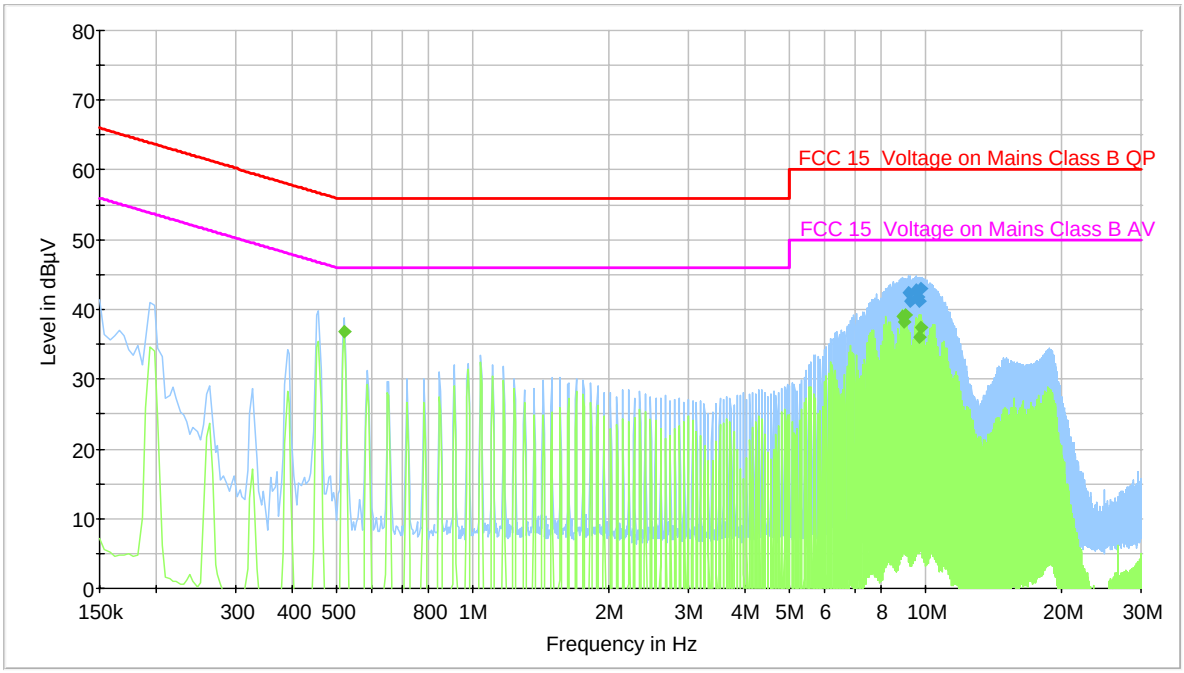
QP Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (H/N)	Corrected Reading (dB)	Limit (dBµV)	Margin (dB)
9.709000	43.4	H	12.4	56.0	-16.6
9.189000	42.8	H	12.4	62.3	-17.2
9.513000	42.6	H	12.4	56.0	-17.4
9.121000	42.2	H	12.4	64.8	-17.8
9.645000	42.2	H	12.4	56.0	-17.9
9.253000	41.6	H	12.4	57.6	-18.4

Average Measurements

Frequency (MHz)	Average (dBµV)	Conductor (H/N)	Corrected Reading (dB)	Limit (dBµV)	Margin (dB)
0.521000	37.6	H	12.3	46.0	-8.4
0.457000	37.5	H	12.3	46.7	-9.2
9.057000	39.4	H	12.4	50.0	-10.6
9.641000	39.1	H	12.4	50.0	-10.9
9.121000	39.0	H	12.4	50.0	-11.0
8.993000	38.6	H	12.4	50.0	-11.4

Neutral Conductor Mode



QP Measurements

Frequency (MHz)	Quasi-Peak (dBµV)	Conductor (H/N)	Corrected Reading (dB)	Limit (dBµV)	Margin (dB)
9.774000	43.0	N	12.4	60.0	-17.0
9.578000	42.8	N	12.4	60.0	-17.2
9.190000	42.5	N	12.4	60.0	-17.5
9.642000	41.9	N	12.4	60.0	-18.1
9.254000	41.2	N	12.4	60.0	-18.8
9.706000	41.2	N	12.4	60.0	-18.8

Average Measurements

Frequency (MHz)	Average (dBµV)	Line (H/N)	Corrected Reading (dB)	Limit (dBµV)	Margin (dB)
0.522000	36.8	N	12.3	46.0	-9.2
9.058000	39.2	N	12.4	50.0	-10.8
8.926000	38.9	N	12.4	50.0	-11.1
8.990000	38.2	N	12.4	50.0	-11.8
9.774000	37.3	N	12.4	50.0	-12.7
9.706000	35.9	N	12.4	50.0	-14.1

7 FCC §15.247(d) - Spurious Emissions at Antenna Terminals

7.1 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)).

7.2 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.

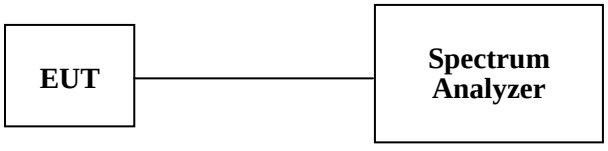
5. Repeat above procedures until all frequencies measured were complete.

7.3 Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

7.4 Test Setup Diagram



7.5 Environmental Conditions

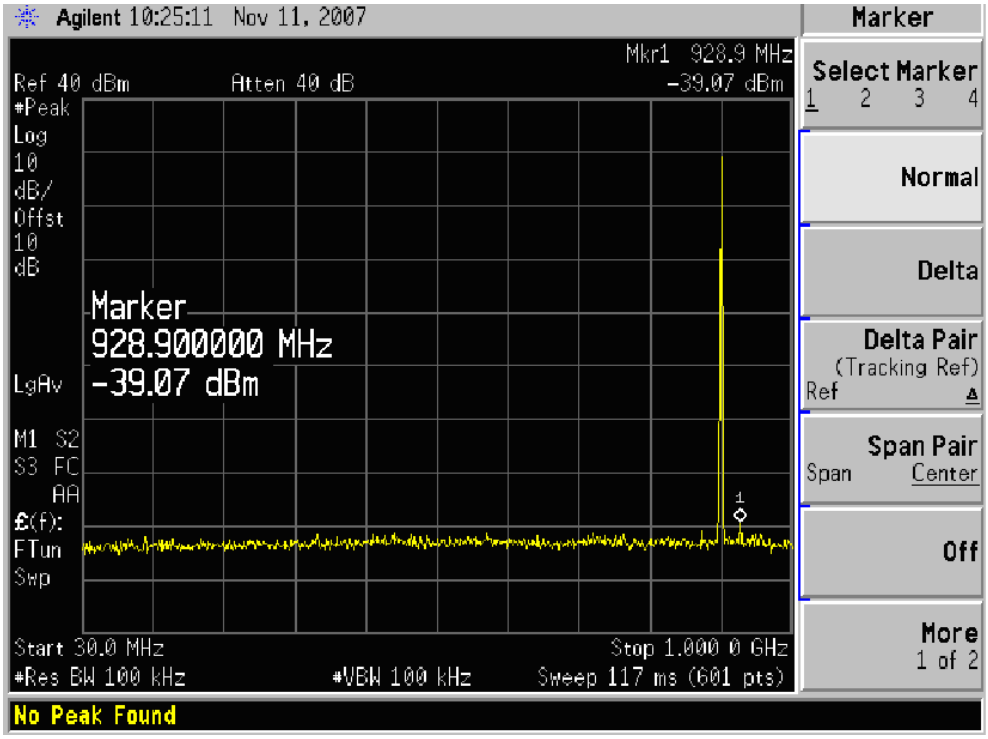
Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

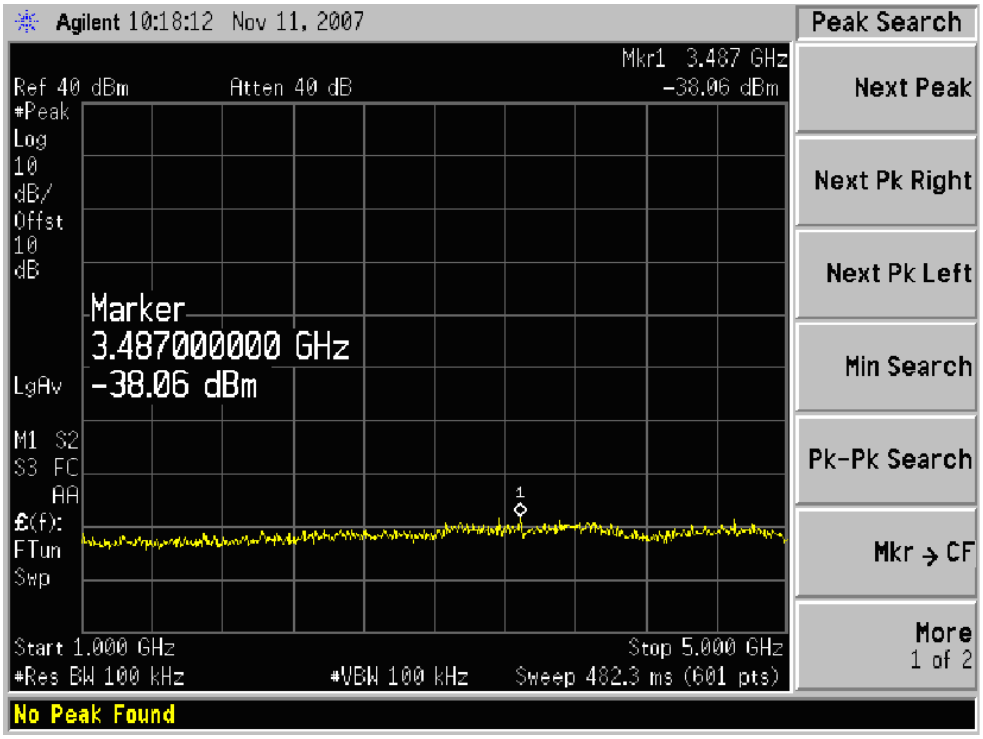
**The testing was performed by Choon Sian Ooi on 2007-11-28*

Please refer to the following plots.

7.6 Measurement Results

Low Channel

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Mkr1 3.487 GHz
Ref 40 dBm
Atten 40 dB
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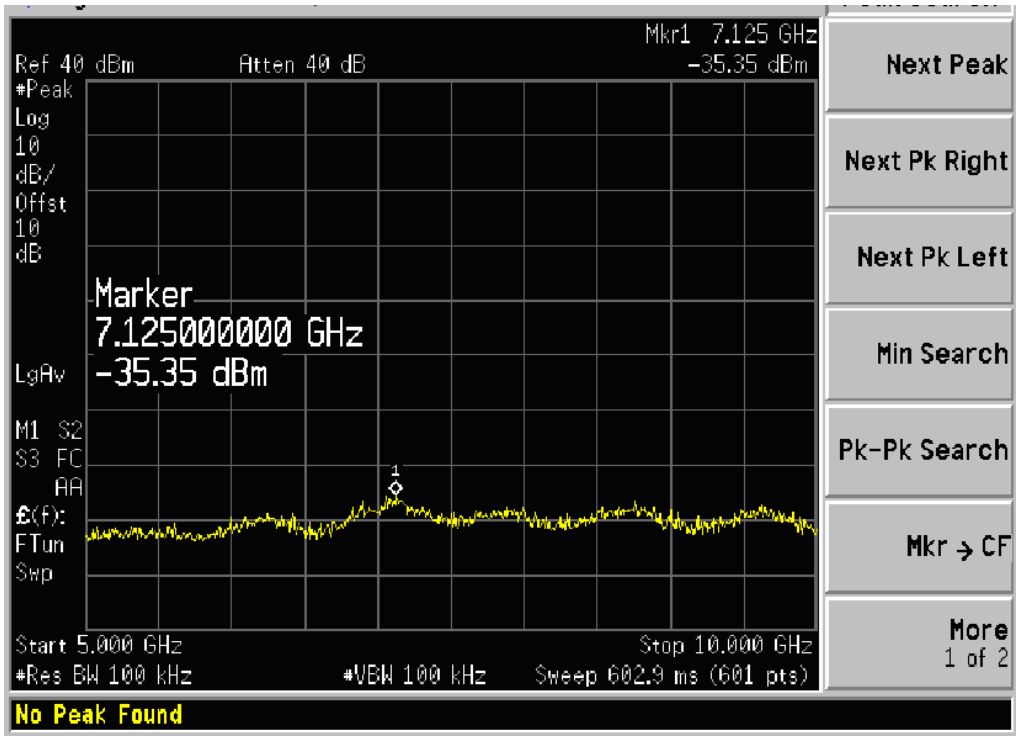
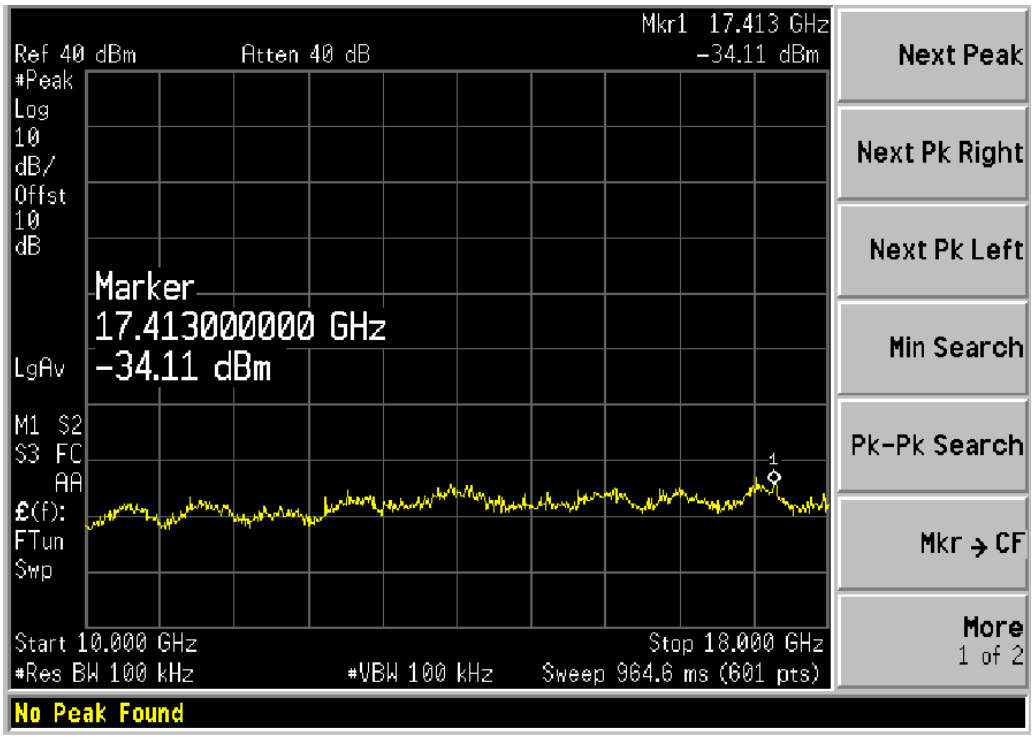
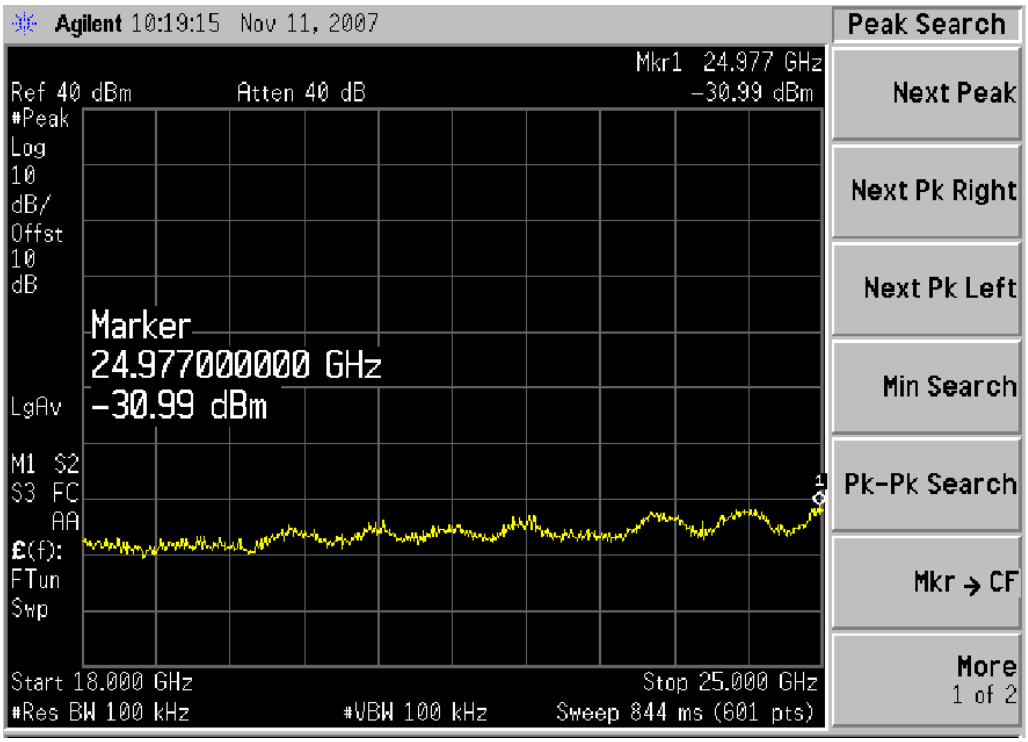
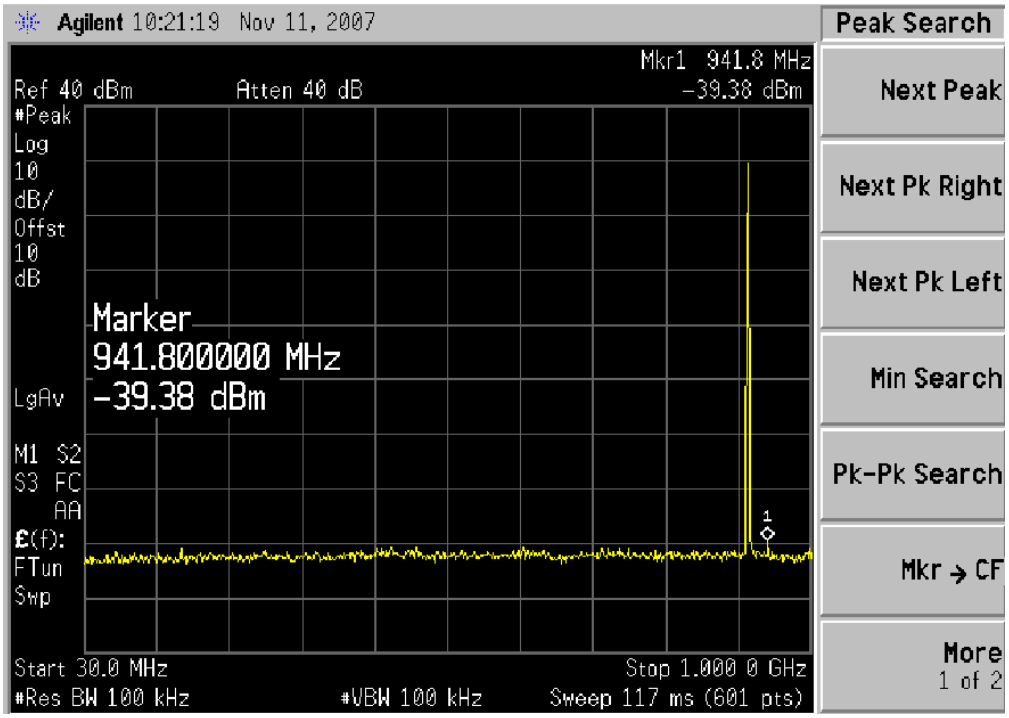
Log
10
dB/
Offst
10
dB
Marker
3.487000000 GHz
-38.06 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 1.000 GHz
Stop 5.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 482.3 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
No Peak Found

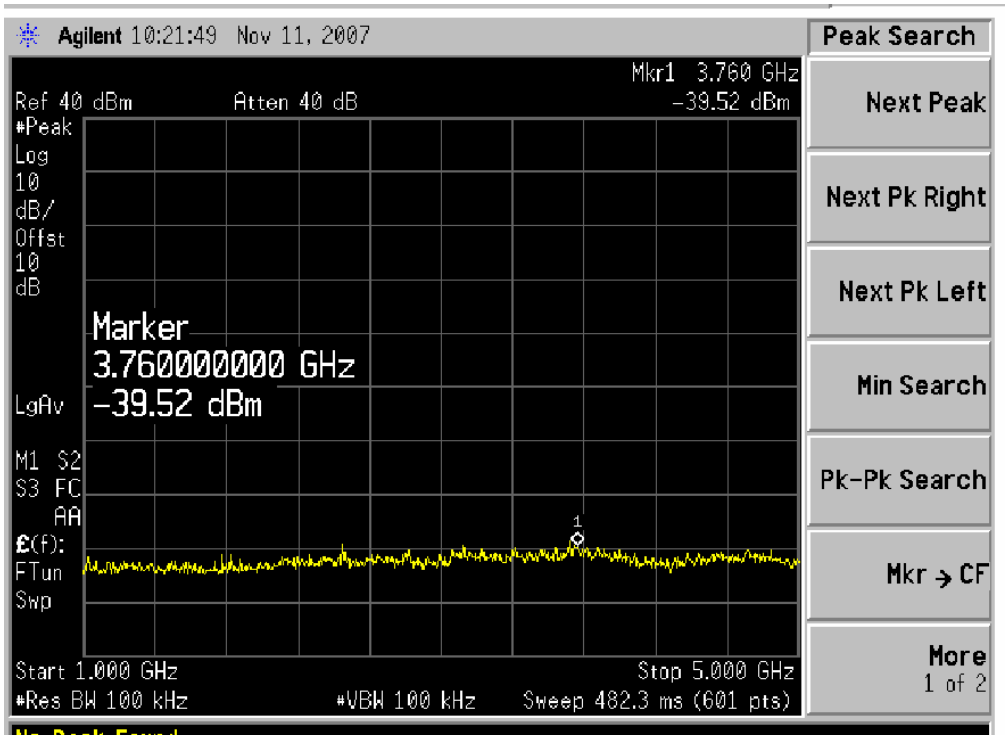

Mkr1 7.125 GHz
Ref 40 dBm
Atten 40 dB
-35.35 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
7.125000000 GHz
-35.35 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 5.000 GHz
Stop 10.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 602.9 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
No Peak Found

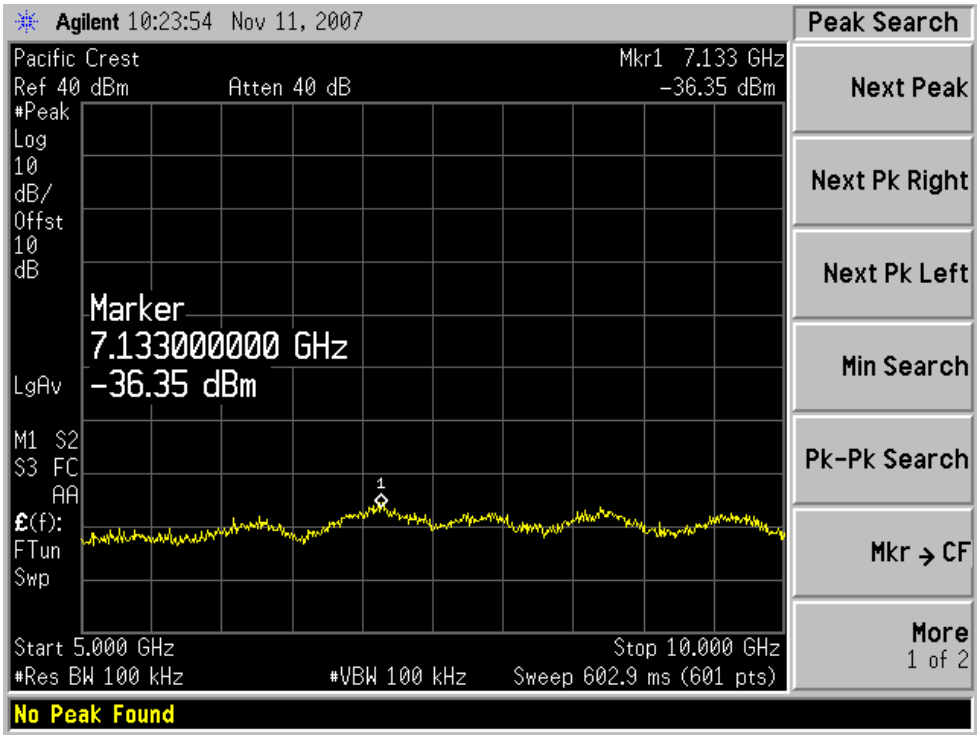

Mkr1 17.413 GHz
Ref 40 dBm
Atten 40 dB
-34.11 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
17.413000000 GHz
-34.11 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 10.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 18.000 GHz
Sweep 964.6 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
No Peak Found

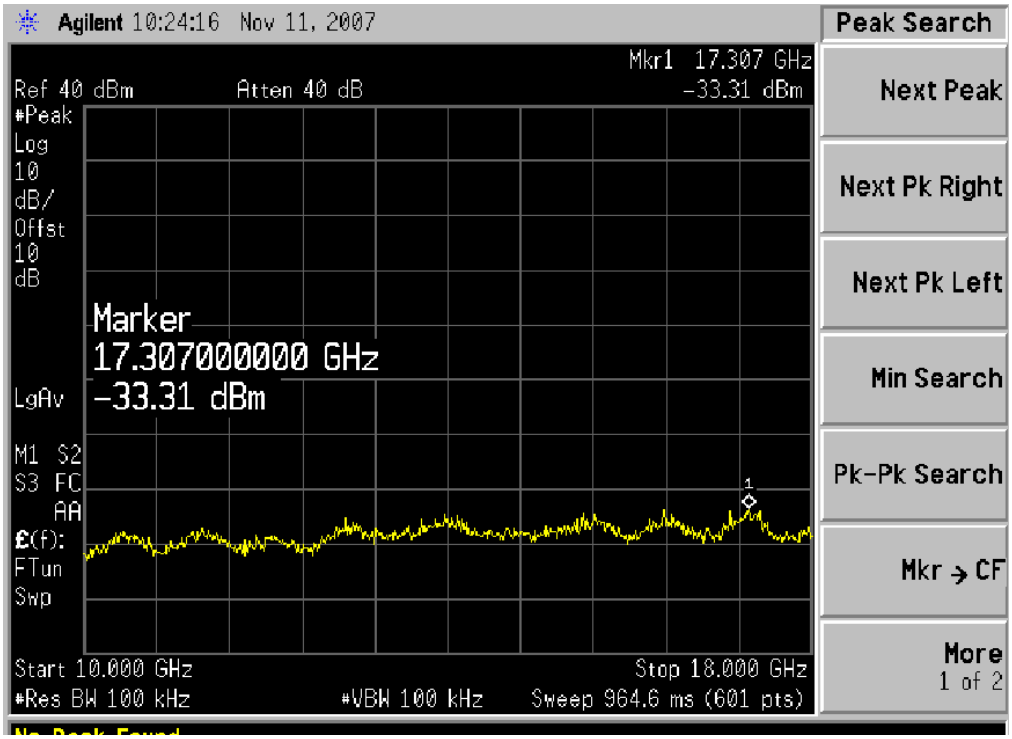

Agilent 10:19:15 Nov 11, 2007
Peak Search
Mkr1 24.977 GHz
Ref 40 dBm
Atten 40 dB
-30.99 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
24.977000000 GHz
-30.99 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 18.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 25.000 GHz
Sweep 844 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2

Middle Channel

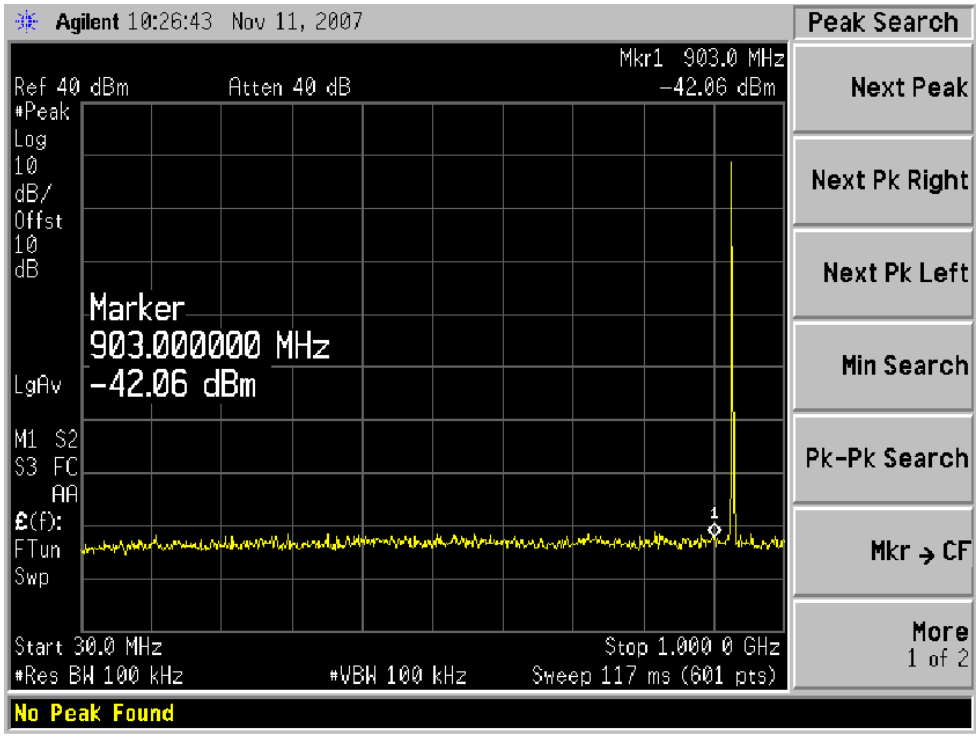


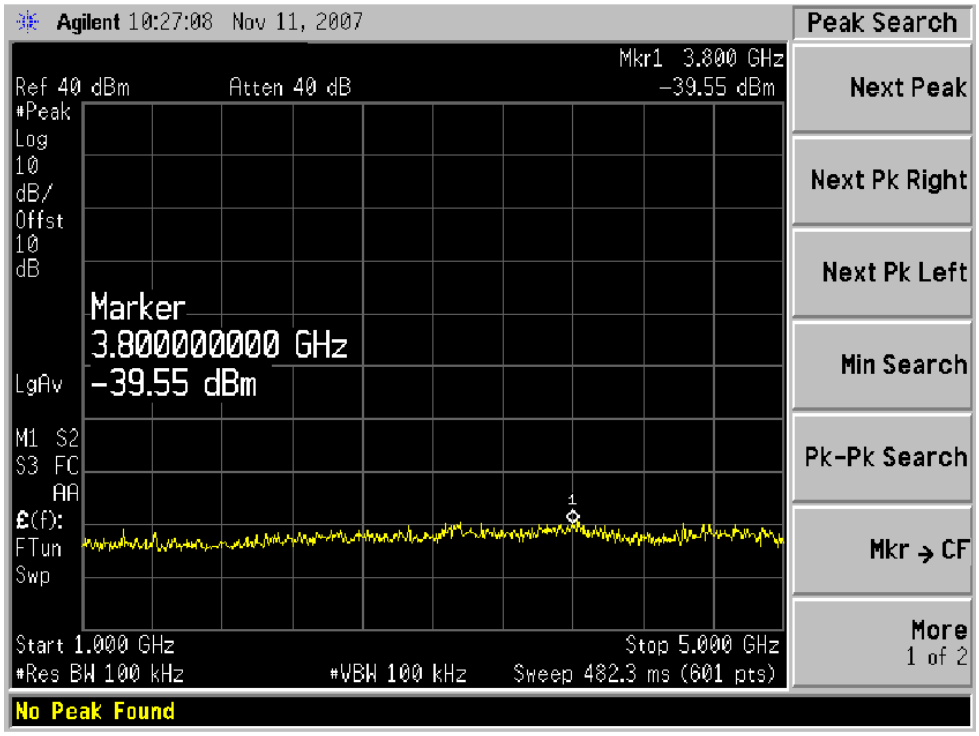


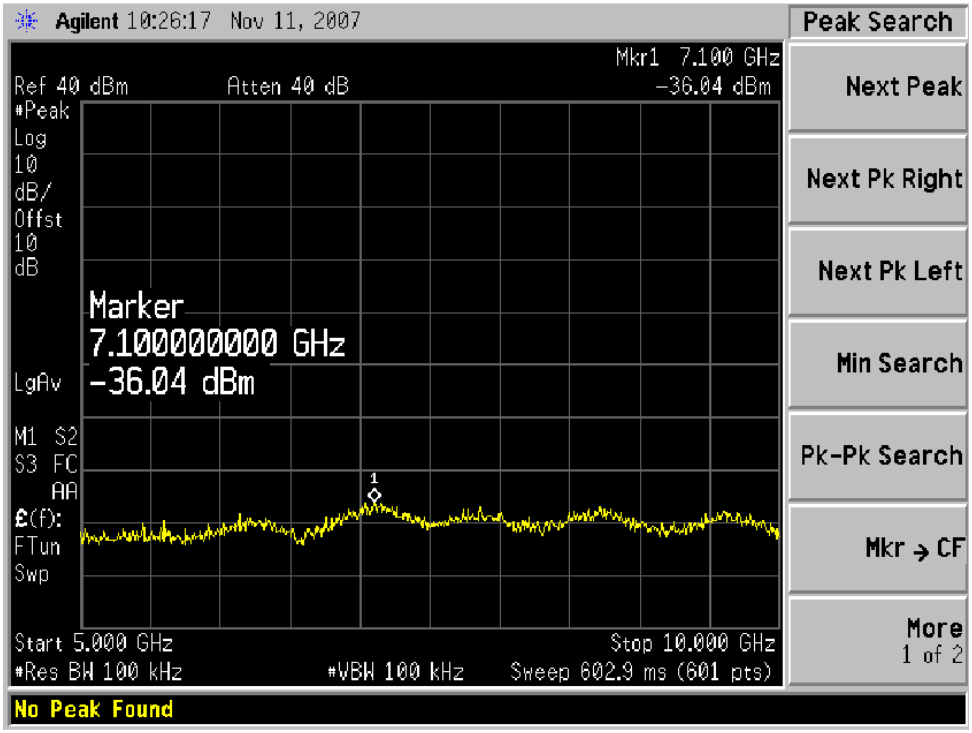

Agilent 10:23:54 Nov 11, 2007
Peak Search
Pacific Crest
Ref 40 dBm
Atten 40 dB
Mkr1 7.133 GHz
-36.35 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
7.133000000 GHz
-36.35 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 5.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 10.000 GHz
Sweep 602.9 ms (601 pts)
No Peak Found

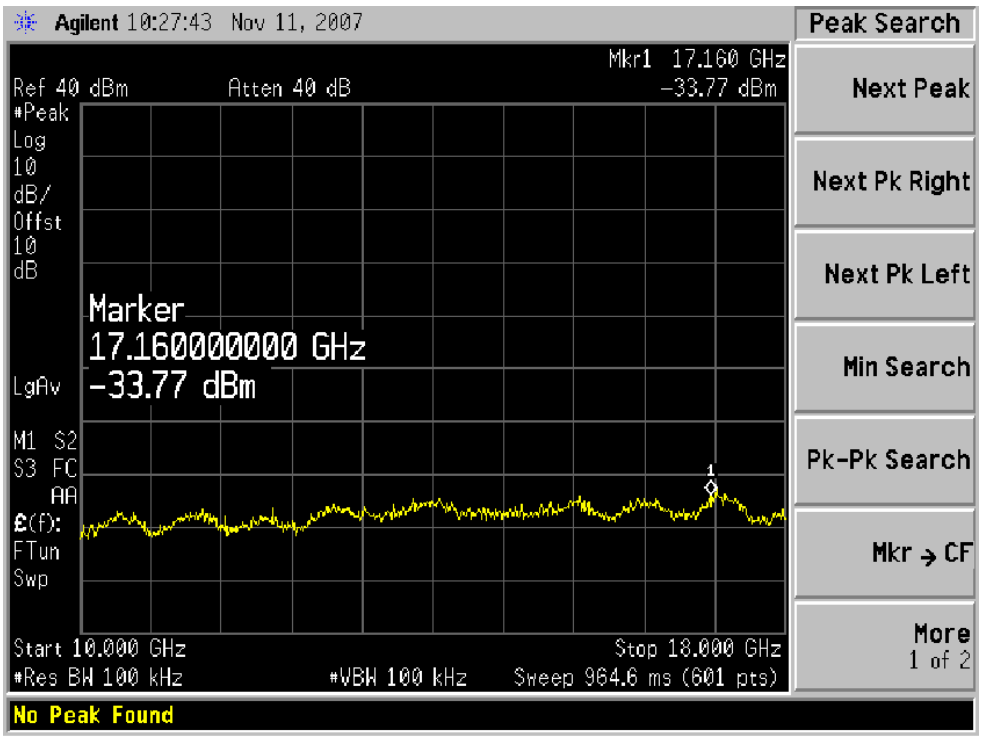

Agilent 10:24:16 Nov 11, 2007
Peak Search
Mkr1 17.307 GHz
Ref 40 dBm
Atten 40 dB
-33.31 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
17.307000000 GHz
-33.31 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 10.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Stop 18.000 GHz
Sweep 964.6 ms (601 pts)

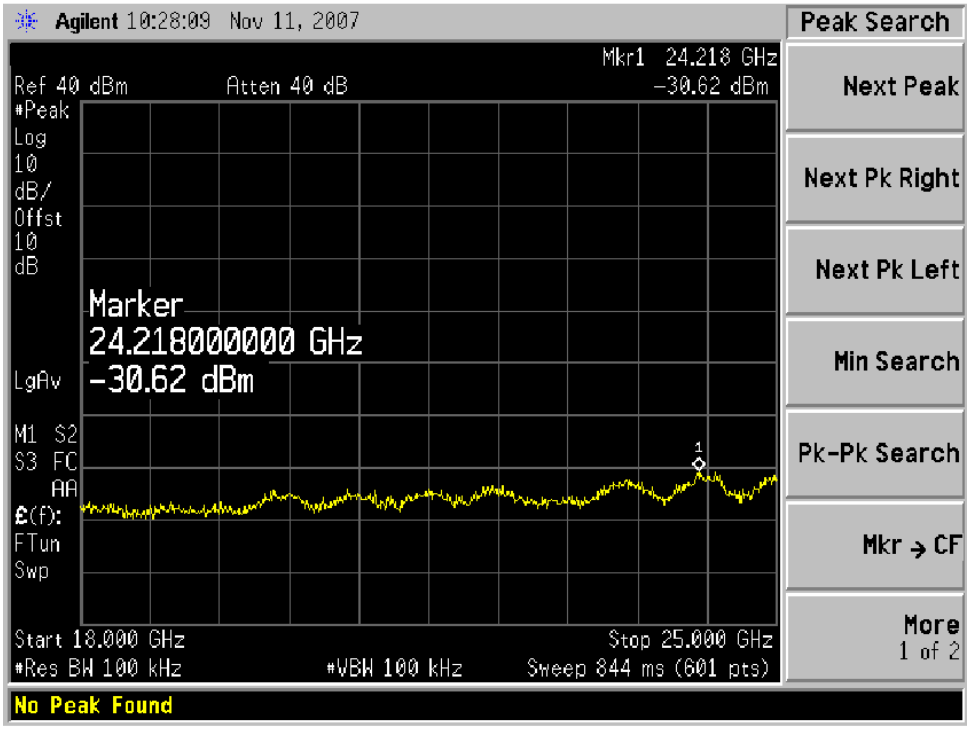
High Channel




Agilent 10:27:08 Nov 11, 2007
Peak Search
Mkr1 3.800 GHz
Ref 40 dBm
Atten 40 dB
-39.55 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
3.800000000 GHz
-39.55 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 1.000 GHz
Stop 5.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 482.3 ms (601 pts)
No Peak Found


Agilent 10:26:17 Nov 11, 2007
Peak Search
Mkr1 7.100 GHz
Ref 40 dBm
Atten 40 dB
-36.04 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
7.100000000 GHz
-36.04 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Start 5.000 GHz
Stop 10.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 602.9 ms (601 pts)
No Peak Found


Agilent 10:27:43 Nov 11, 2007
Peak Search
Mkr1 17.160 GHz
Ref 40 dBm
Atten 40 dB
-33.77 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
17.160000000 GHz
-33.77 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 10.000 GHz
Stop 18.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 964.6 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
No Peak Found


Agilent 10:28:09 Nov 11, 2007
Peak Search
Mkr1 24.218 GHz
Ref 40 dBm
Atten 40 dB
-30.62 dBm
#Peak
Log
10
dB/
Offst
10
dB
Marker
24.218000000 GHz
-30.62 dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Start 18.000 GHz
Stop 25.000 GHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 844 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
No Peak Found

8 FCC §15.205, §15.209 & §15.247(c) - Spurious Radiated Emissions

8.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As per FCC §15.209(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 (micro volts/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.

As per FCC §15.247(c)(1)(i): Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §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)).

8.2 Test Setup

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

8.3 EUT Setup

The radiated emissions tests were performed using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC 15C limits.

The spacing between the peripherals was 10 centimeters.

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

8.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26
Sonoma Instruments	Pre amplifier	317	260407	2007-04-26
HP	Pre amplifier	8449B	3147A00400	2006-08-21
Sunol Science Corp	Combination Antenna	JB3 Antenna	A020106-3	2007-03-05
A.R.A	Antenna Horn	DRG-118/A	1132	2007-06-18

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

8.5 Test Procedure

For the radiated emissions test, the EUT, and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meters away from the testing antenna, which is varied from 1-4 meters, and the EUT is placed on a turntable, which is 0.8 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

8.6 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

8.7 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

**The testing was performed by Choon Sian Ooi on 2007-11-20.*

8.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Rules, and had the worst margin readings of:

900 MHz FHSS Transceiver Module

Low Channel:

Mode: Data Transmit			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-2.8	956.108750	Vertical	30 to 1000
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-21.96	1000	Vertical	1000 to 1500
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-4.72	2800.124	Vertical	1500 to 10000

Middle Channel:

Mode: Data Transmit			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-2.9	861.836250	Vertical	30 to 1000
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-23.22	1022.711	Vertical	1000 to 1500
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-5.74	2847.862	Vertical	1500 to 10000

High Channel:

Mode: Data Transmit			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-6.4	874.082500	Vertical	30 to 1000
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-24.77	1047.179	Vertical	1000 to 1500
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-4.6	2799.931	Vertical	1500 to 10000

BLUETOOTH

Low Channel:

Mode: Data Transmit			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-23.7	4804	Vertical	1000 to 25000

Middle Channel:

Mode: Data Transmit			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-23.4	4884	Vertical	1000 to 25000

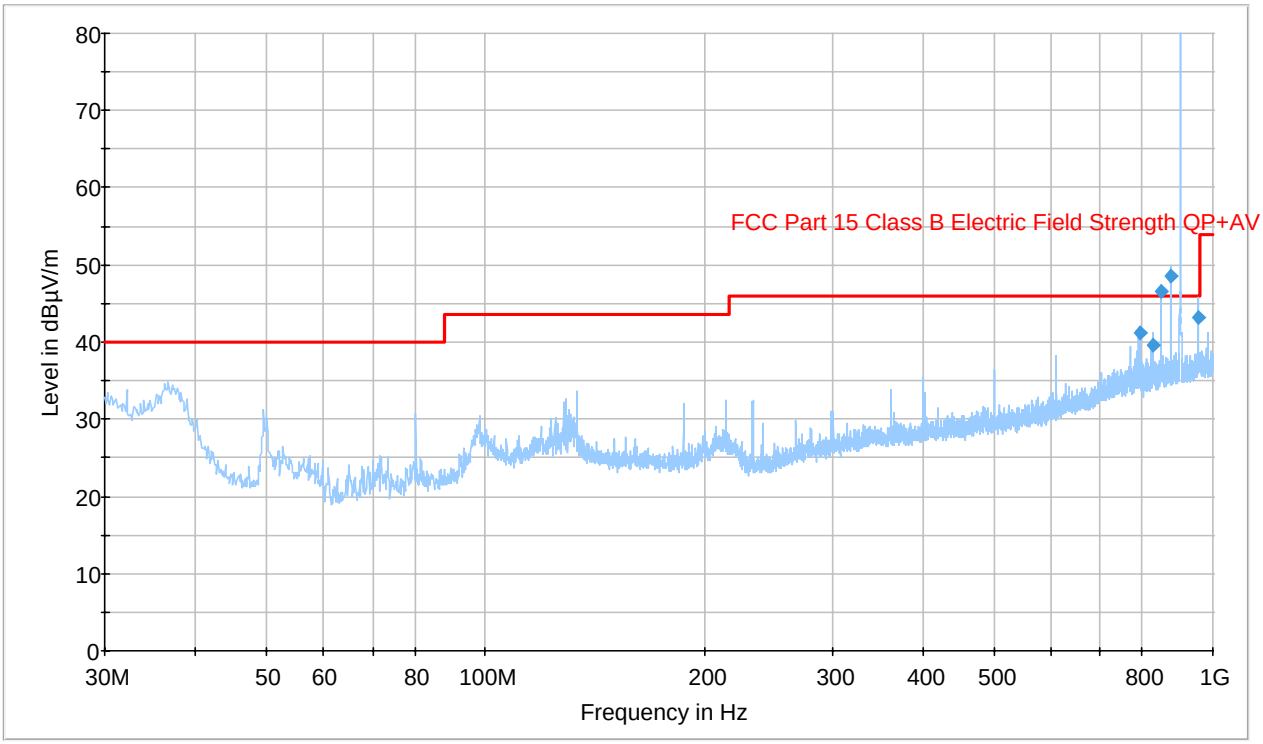
High Channel:

Mode: Data Transmit			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Range (MHz)**
-22.3	4960	Vertical	1000 to 25000

8.9 Radiated Spurious Emissions Test Data

Low channel

30 to 1000 MHz

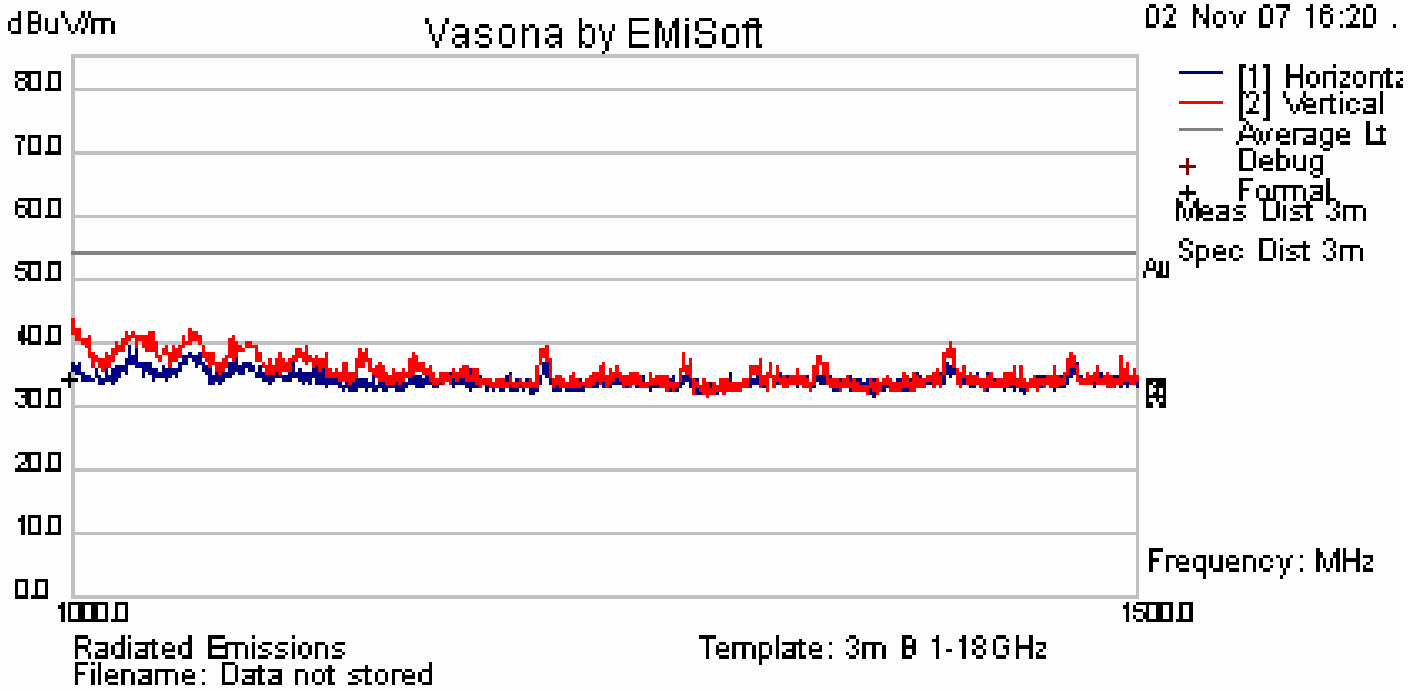


Quasi-Peak Measurements

Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Limit (dBµV/m)	Margin (dB)
956.108750	43.2	100.8	V	169.0	46.0	-2.8
795.633750	41.2	100.8	V	307.0	46.0	-4.8
829.281250	39.5	101.0	V	342.0	46.0	-6.5
*875.841250	48.5	100.8	V	6.0	97.15	-48.65
*849.105000	46.6	100.9	V	350.0	97.15	-50.55

*97.15 dBuV/m limit is the corrected field strength using the -30 dBc allowance for peak emissions.

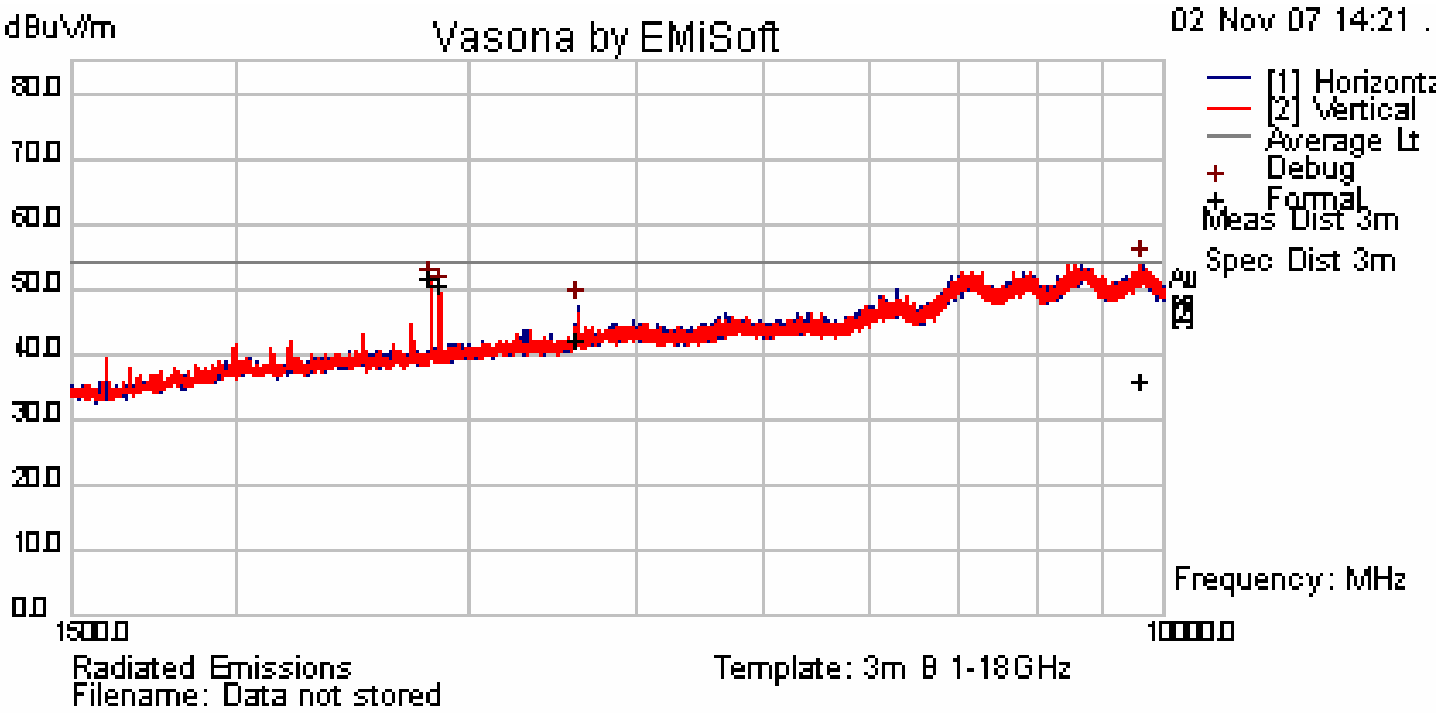
1000 to 1500 MHz



Average Measurements

Frequency (MHz)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Meas. Type	Pol. (H/V)	Ant. Height (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)
1000	1.49	-14.06	32.04	Average Max	V	98	29	54	-21.96

1500 to 10000 MHz

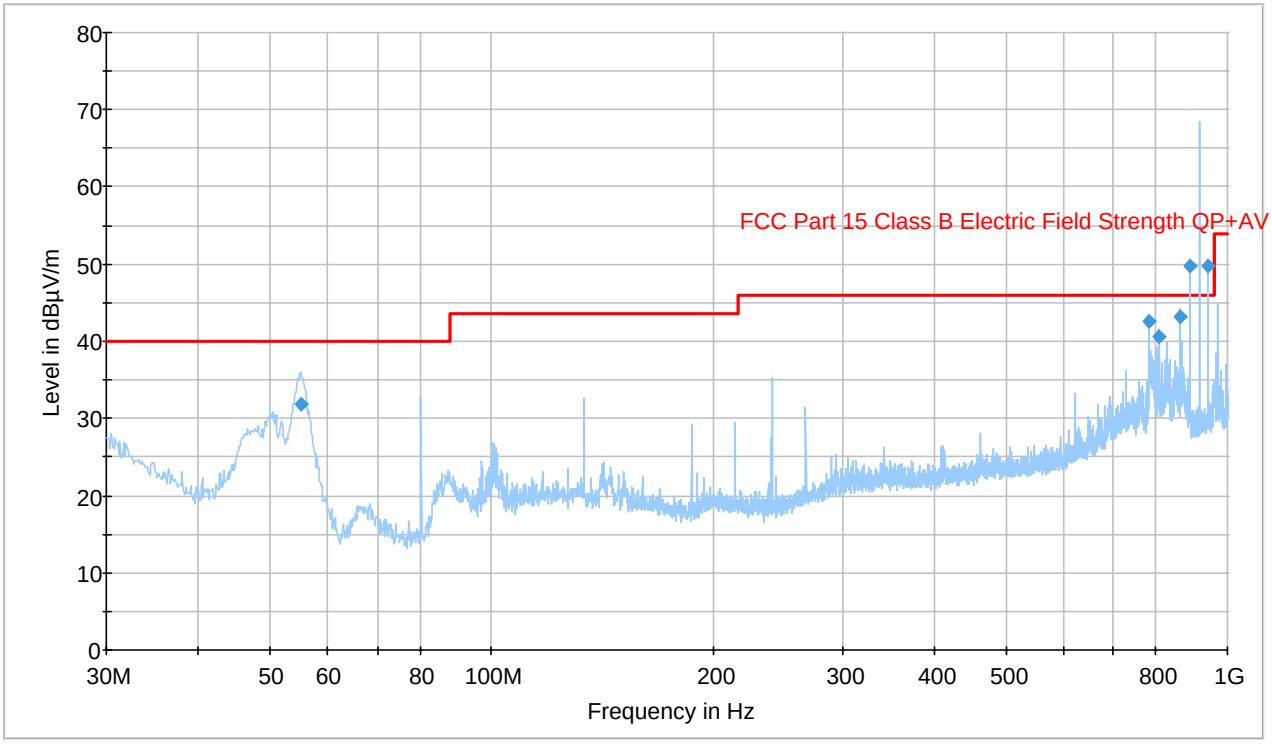


Average Measurements

Frequency (MHz)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Meas. Type	Pol . (H/V)	Ant. Height (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)
2800.124	2.4	-7.03	49.28	Average Max	V	98	33	54	-4.72
2847.797	2.42	-6.88	48.07	Average Max	V	114	36	54	-5.93
3610.444	2.73	-5.38	39.89	Average Max	H	116	281	54	-14.11
9632.762	4.68	1.74	33.4	Average Max	H	268	105	54	-20.6

Middle channel

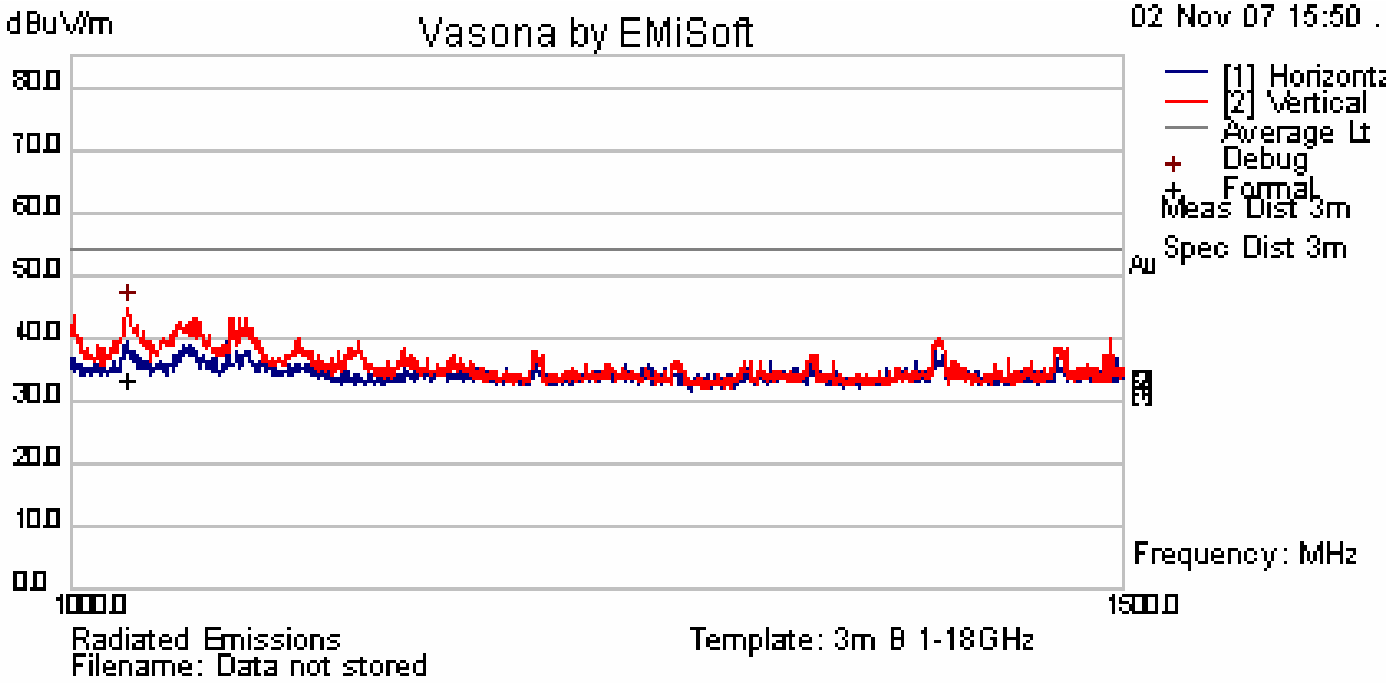
30 to 1000 MHz



Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (deg)	Limit (dBµV/m)	Margin (dB)
861.836250	43.1	100.2	V	339.0	46.0	-2.9
781.630000	42.6	100.8	V	288.0	46.0	-3.4
808.365000	40.6	98.2	V	4.0	46.0	-5.4
55.158750	31.9	100.9	V	322.0	40.0	-8.1
*888.632500	49.7	99.9	V	174.0	97.15	-47.45
*942.103750	49.7	142.8	V	24.0	97.15	-47.45

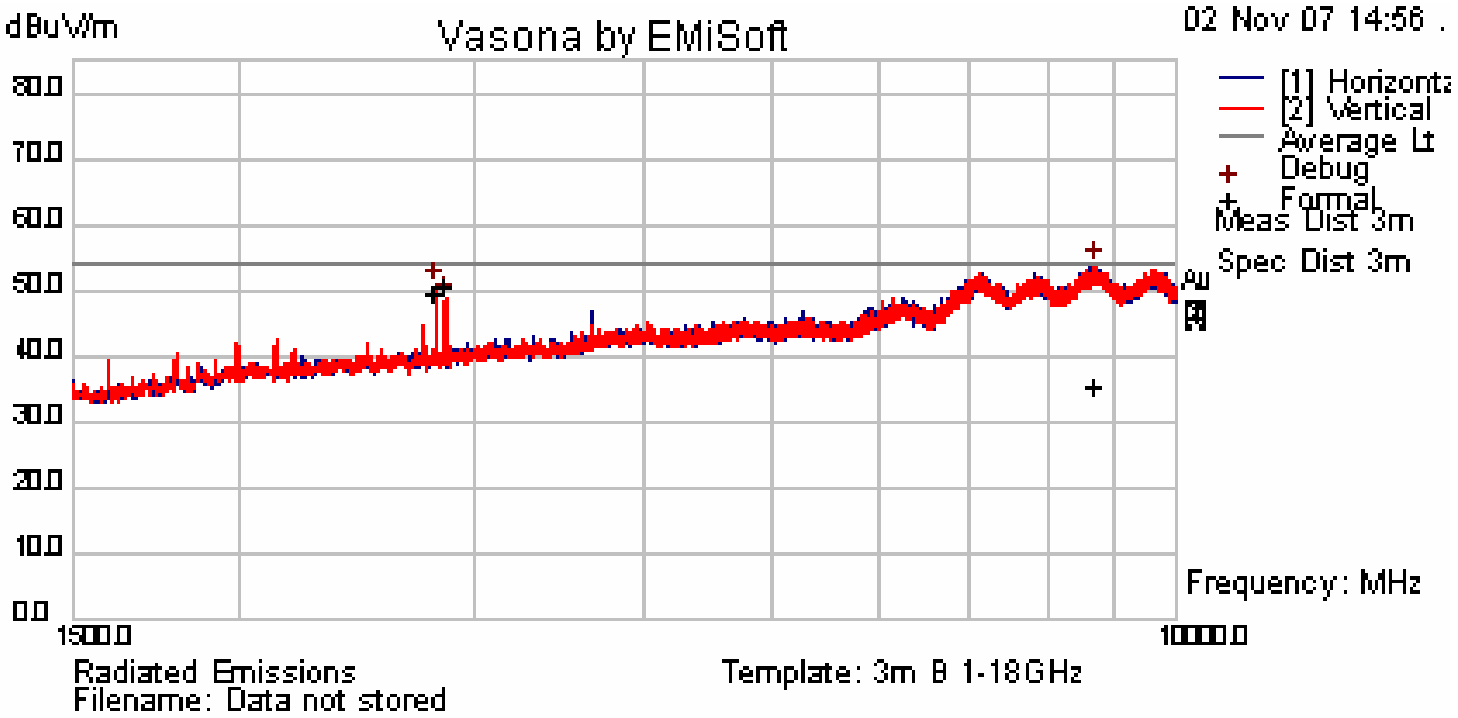
*97.15 dBuV/m limit is fundamental field strength 127.15 dBuV/m – 30dBc

1000 to 1500 MHz



Frequency (MHz)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Meas. Type	Pol. (H/V)	Ant. Height (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)
1022.711	1.5	-13.99	30.78	Average Max	V	100	12	54	-23.22

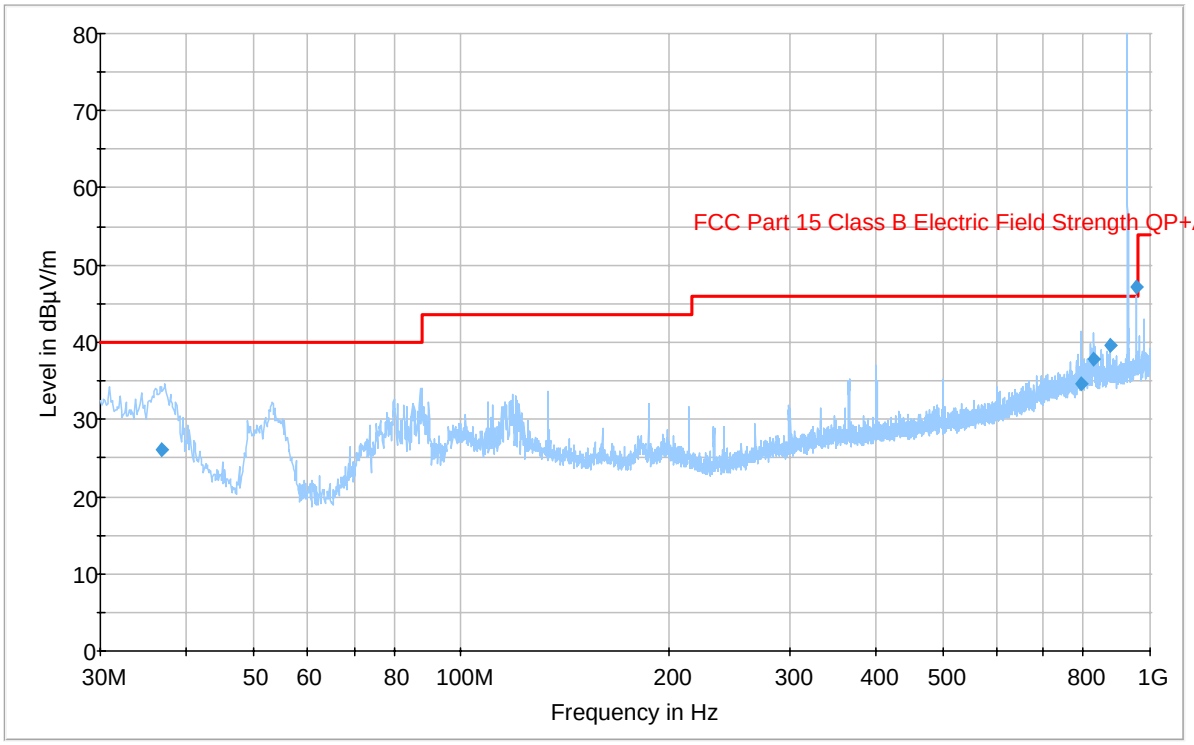
1500 to 10000 MHz



Frequency (MHz)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Meas. Type	Pol. (H/V)	Ant. Height (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)
2847.862	2.42	-6.88	48.26	Average Max	V	96	33	54	-5.74
2800.054	2.4	-7.03	47.2	Average Max	V	111	34	54	-6.8
8714.542	4.36	1.57	32.93	Average Max	V	134	263	54	-21.07

High channel

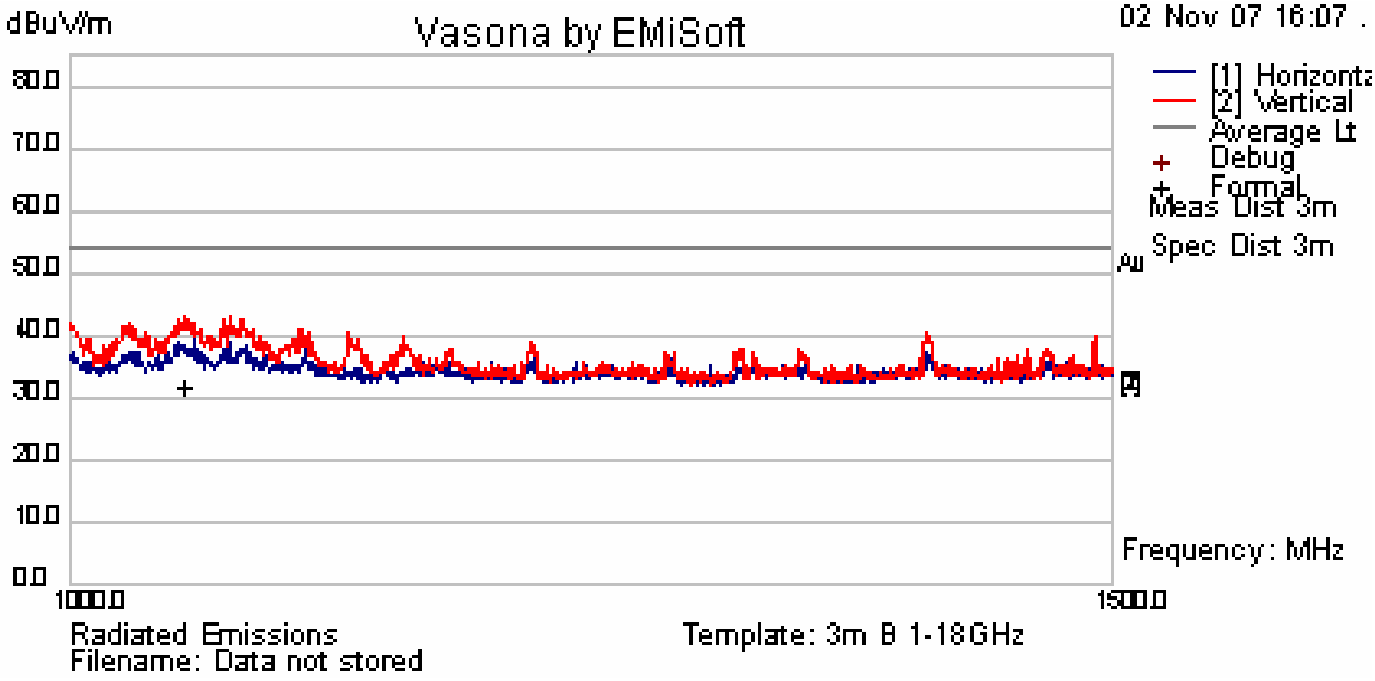
30 to 1000 MHz



Frequency (MHz)	QuasiPeak (dBµV/m)	Antenna height	Polarity	Turntable position	Limit (dBµV/m)	Margin (dB)
874.082500	39.6	100.8	V	28.0	46.0	-6.4
829.220000	37.9	101.0	V	339.0	46.0	-8.1
793.815000	34.6	100.8	V	6.0	46.0	-11.4
36.735000	26.0	118.0	V	350.0	40.0	-14.0
*954.350000	47.1	143.0	V	6.0	97.15	-50.05

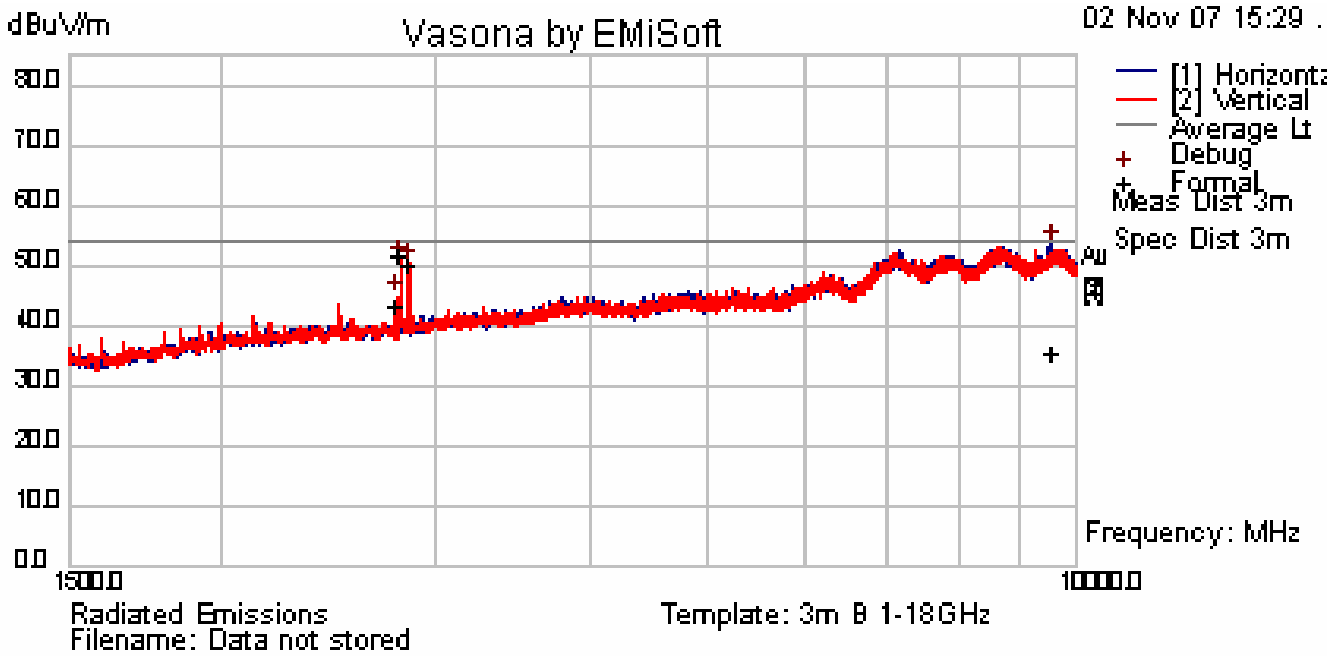
*97.15 dBuV/m limit is fundamental field strength 127.15 dBuV/m – 30dBc

1000 to 1500 MHz



Frequency (MHz)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Meas. Type	Pol. (H/V)	Ant. Height (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)
1047.179	1.51	-13.92	29.23	Average Max	V	103	170	54	-24.77

1500 to 10000 MHz



Frequency (MHz)	Cable Loss (dB)	AF (dB)	Level (dBuV/m)	Meas. Type	Pol. (H/V)	Ant. Height (cm)	Azt Deg	Limit (dBuV/m)	Margin (dB)
2799.931	2.4	-7.03	49.4	Average Max	V	98	39	54	-4.6
2848.124	2.42	-6.88	47.83	Average Max	V	98	35	54	-6.17
2782.656	2.39	-7.08	40.58	Average Max	V	116	-2	54	-13.42
9551.222	4.71	1.72	33.09	Average Max	H	382	210	54	-20.91

Bluetooth Radio

Murata Antenna

Run # 1- 1 : Final scan 1GHz -25GHz , (Lowest channel: 2402 MHz)

Frequency (MHz)	Reading (dBµV)	Azimuth (Degree)	Height (Meter)	Polar. (H / V)	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBµV/m)	15C Limit (dBµV/m)	15C Margin	Comments
2402.0000	90.8	220	1.4	V	28.7	2.7	35.8	86.3	-	-	Fund/Peak
2402.0000	86.0	40	1.4	H	28.7	2.7	35.8	81.5	-	-	Fund/Peak
2402.0000	90.6	220	1.4	V	28.7	2.7	35.8	86.1	-	-	Ave
2402.0000	85.9	40	1.4	H	28.7	2.7	35.8	81.4	-	-	Ave
4804.0000	28.8	220	1.3	V	32.5	3.8	34.8	30.3	54	-23.7	Ave
4804.0000	28.2	300	1.2	H	32.5	3.8	34.8	29.7	54	-24.3	Ave
4804.0000	41.5	220	1.3	V	32.5	3.8	34.8	43.0	74	-31.0	Peak
4804.0000	40.3	300	1.2	H	32.5	3.8	34.8	41.8	74	-32.2	Peak

Run # 1- 2 :Final scan 1GHz -25GHz, (Middle channel: 2441 MHz)

Frequency (MHz)	Reading (dBµV)	Azimuth (Degree)	Height (Meter)	Polar. (H / V)	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBµV/m)	15C Limit (dBµV/m)	15C Margin	Comments
2441.0000	90.5	220	1.2	V	28.7	2.7	35.8	86.0	-	-	Fund/Peak
2441.0000	87.4	270	1.3	H	28.7	2.7	35.8	82.9	-	-	Fund/Peak
2441.0000	90.3	220	1.2	V	28.7	2.7	35.8	85.8	-	-	Ave
2441.0000	87.3	270	1.3	H	28.7	2.7	35.8	82.8	-	-	Ave
4882.0000	29.0	210	1.0	V	32.5	3.9	34.8	30.6	54	-23.4	Ave
4882.0000	28.0	320	1.3	H	32.5	3.9	34.8	29.6	54	-24.4	Ave
4882.0000	41.3	210	1.0	V	32.5	3.9	34.8	42.9	74	-31.1	Peak
4882.0000	40.5	320	1.3	H	32.5	3.9	34.8	42.1	74	-31.9	Peak

Run # 1- 3 :Final scan 1GHz -25GHz , (Highest channel: 2480 MHz)

Frequency (MHz)	Reading (dBµV)	Azimuth (Degree)	Height (Meter)	Polar. (H / V)	Antenna Factor (dB/m)	Cable loss (dB)	Amplifier (dB)	Corrected Reading (dBµV/m)	15C Limit (dBµV/m)	15C Margin	Comments
2480.0000	88.5	300	1.2	V	28.7	2.7	35.8	84.0	-	-	Fund/Peak
2480.0000	88.3	220	1.0	H	28.7	2.7	35.8	83.8	-	-	Fund/Peak
2480.0000	88.4	300	1.2	V	28.7	2.7	35.8	83.9	-	-	Ave
2480.0000	88.1	220	1.0	H	28.7	2.7	35.8	83.6	-	-	Ave
4960.0000	30.3	55	1.2	V	32.5	3.9	35.0	31.7	54	-22.3	Ave
4960.0000	28.1	340	1.2	H	32.5	3.9	35.0	29.5	54	-24.5	Ave
4960.0000	42.3	55	1.2	V	32.5	3.9	35.0	43.7	74	-30.3	Peak
4960.0000	41.2	340	1.2	H	32.5	3.9	35.0	42.6	74	-31.4	Peak

9 § 15.109 (a) - Receiver Spurious Radiated Emissions

9.1 Test Setup

The radiated emissions tests were performed in the 3 meter chamber, using the setup in accordance with ANSI C63.4-2003.

9.2 Equipment Lists and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26
Sonoma Instrument	Amplifier Broadband (10 kHz - 2500 MHz)	317	260407	2007-04-26
Sunol Science Corp.	30MHz ~ 3 GHz Antenna	JB3	A020106-3/S006628	2007-03-05

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

9.3 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

**The testing was performed by Choon Sian Ooi on 2007-11-05*

9.4 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 emissions was found to be marginal (within -4 dB of specification limits), and are distinguished with a "**QP**" in the data table.

9.5 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 emissions are 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

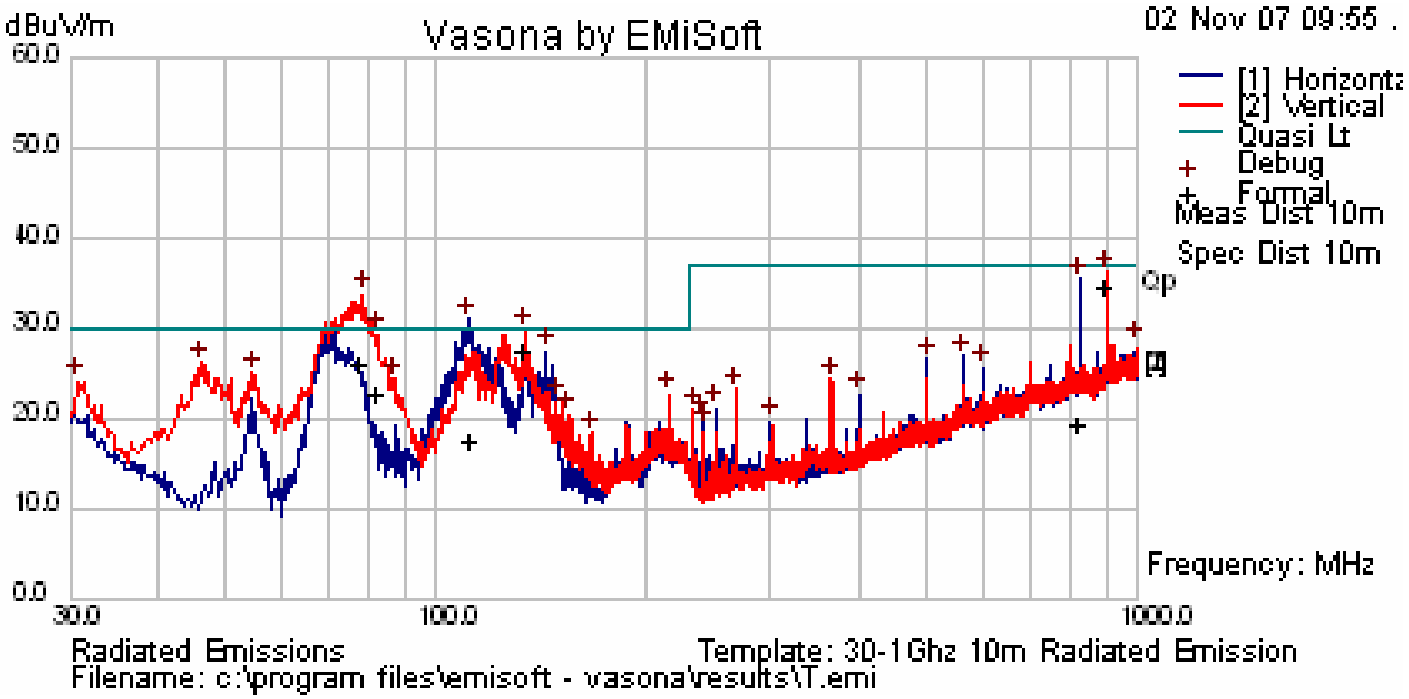
Margin = Corrected Amplitude - Class B Limit

9.6 Summary of Test Results

According to the test data,, the EUT complied with the with the FCC Rules, with the closest margins from the limit listed below:

Radiated Emissions Test Data @ 3meter

-4.12 dB at **133.77 MHz** in the **Horizontal** polarization



Quasi-Peak Measurements

Frequency (MHz)	Quasi-Peak (dBµV/m)	Antenna Height (cm)	Polarity (H/V)	Turntable Position (degrees)	Limit (dBµV/m)	Margin (dB)
133.77	25.88	359	H	275	30	-4.12
902.602	32.8	113	V	2	37	-4.2
78.078	24.21	380	V	25	30	-5.79
82.844	20.91	180	V	276	30	-9.09
111.647	15.91	180	H	278	30	-14.09
830.199	17.72	279	H	281	37	-19.28

10 FCC §15.247(a) (i) – 20 dB Bandwidth

10.1 Applicable Standard

According to §15.247(a)(l)(i), The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

10.2 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 6 dB from the reference level. Record the frequency difference as the emissions bandwidth. (6 dB bandwidth for DTS)
4. Repeat above procedures until all frequencies measured were complete.

10.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

10.4 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

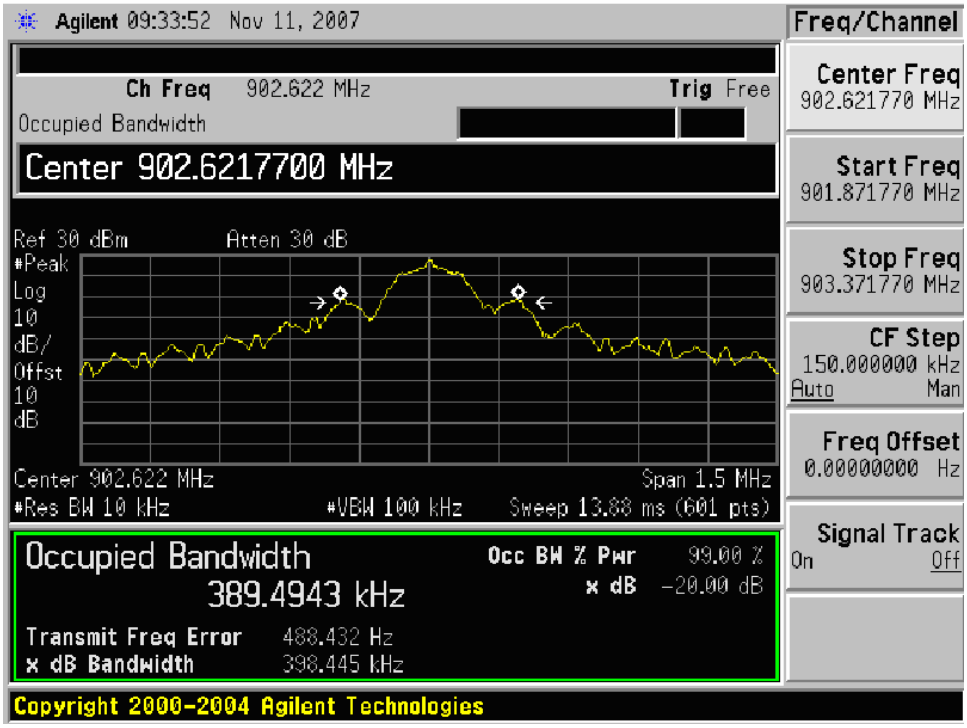
**The testing was performed by Choon Sian Ooi on 2007-11-28.*

10.5 Summary of Test Results

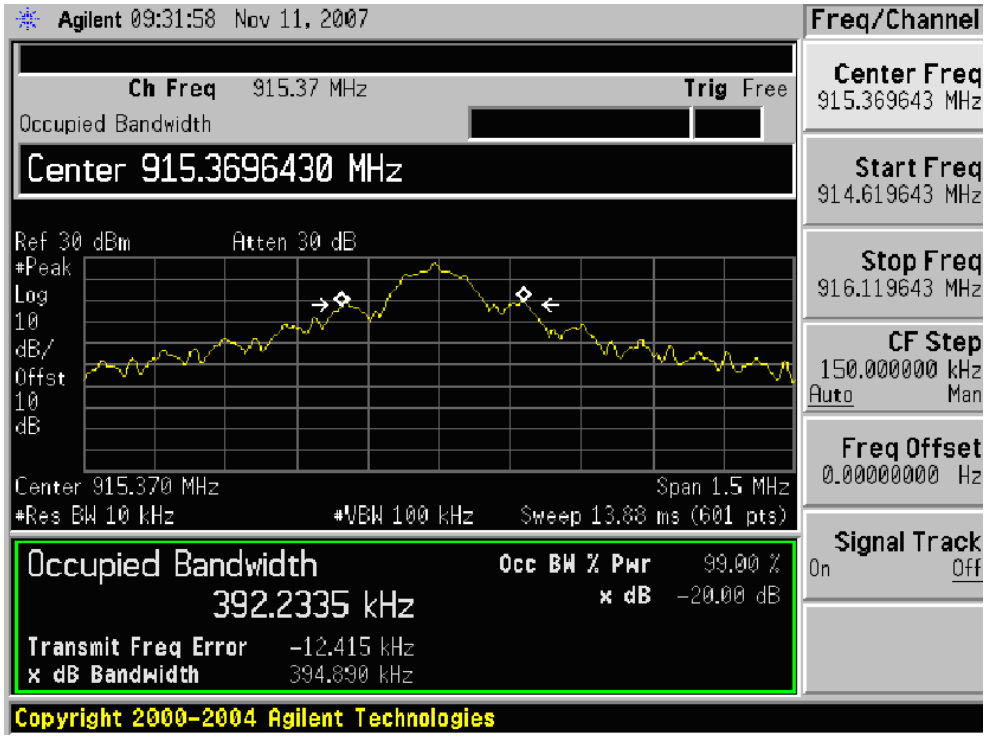
Channel	20 dB Channel Bandwidth (kHz)
Low	398.445
Middle	394.890
High	399.210

Please refer to the following plots for detailed test results

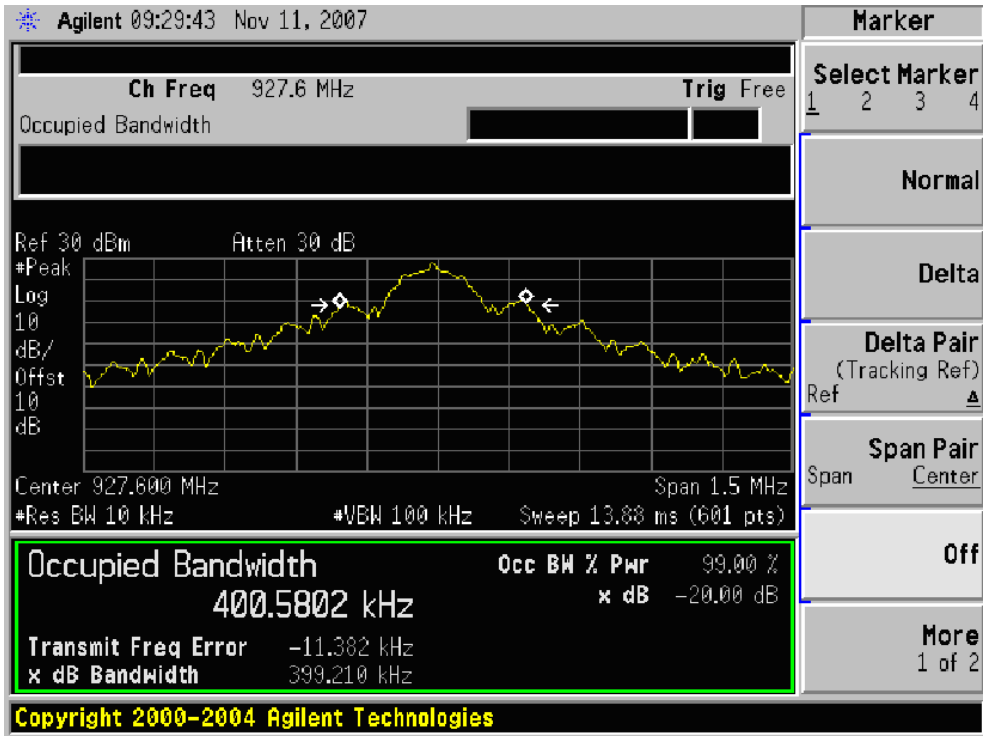
Low Channel



Middle Channel



High Channel



11 §15.247 (a) (1) – Hopping Channel Separation

11.1 Applicable Standard

According to §15.247(a)(1), frequency hopping system 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies.

11.2 Measurement Procedure

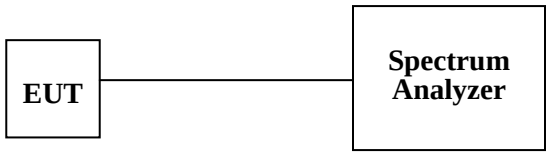
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient 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.

11.3 Test Equipment

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

11.4 Test Setup Diagram



11.5 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

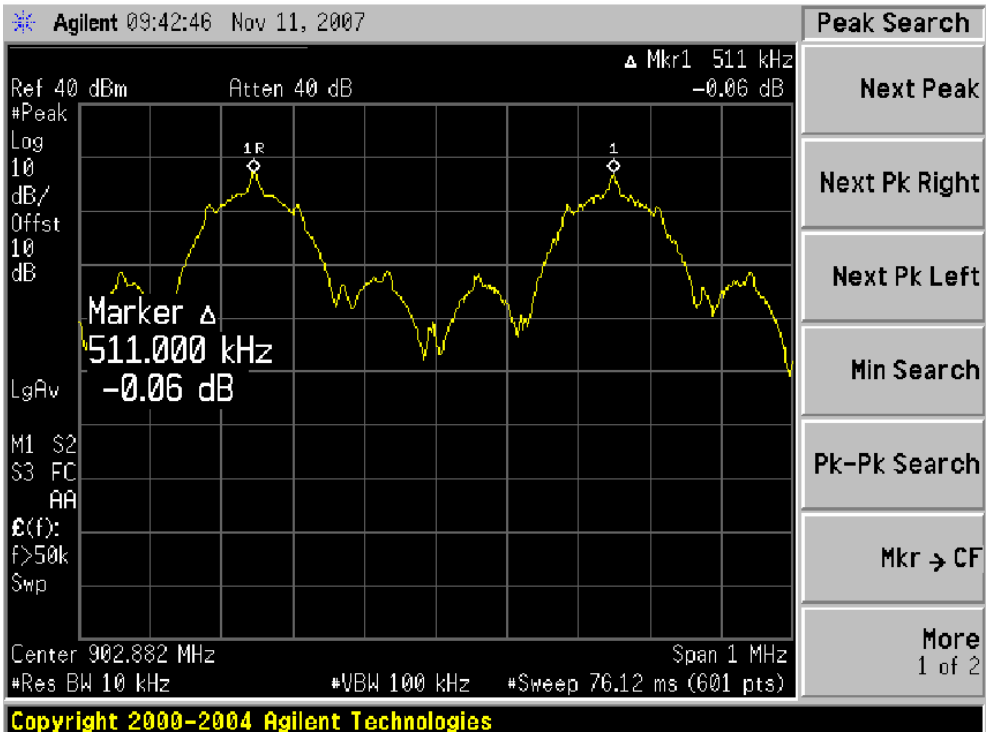
**The testing was performed by Choon Sian Ooi on 2007-11-28.*

11.6 Measurement Results

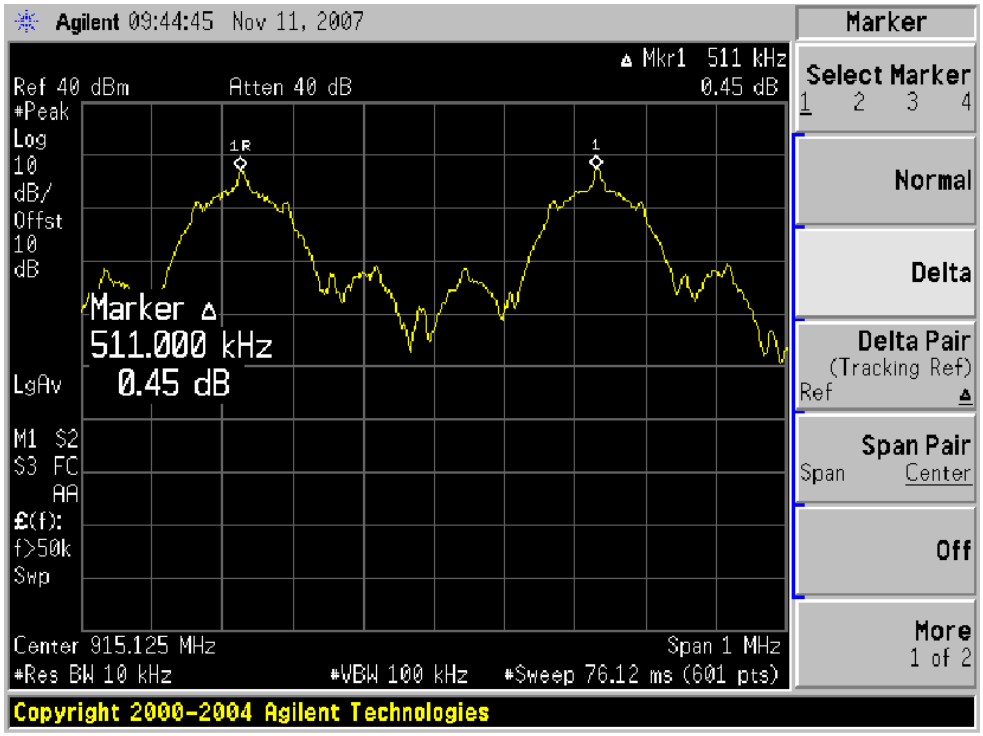
Channel	Channel Separation (kHz)	Limit > 20 dB BW >(kHz)	Result
Low	511	398.445	Compliant
Middle	511	394.890	Compliant
High	511	399.210	Compliant

Please refer to the following plots:

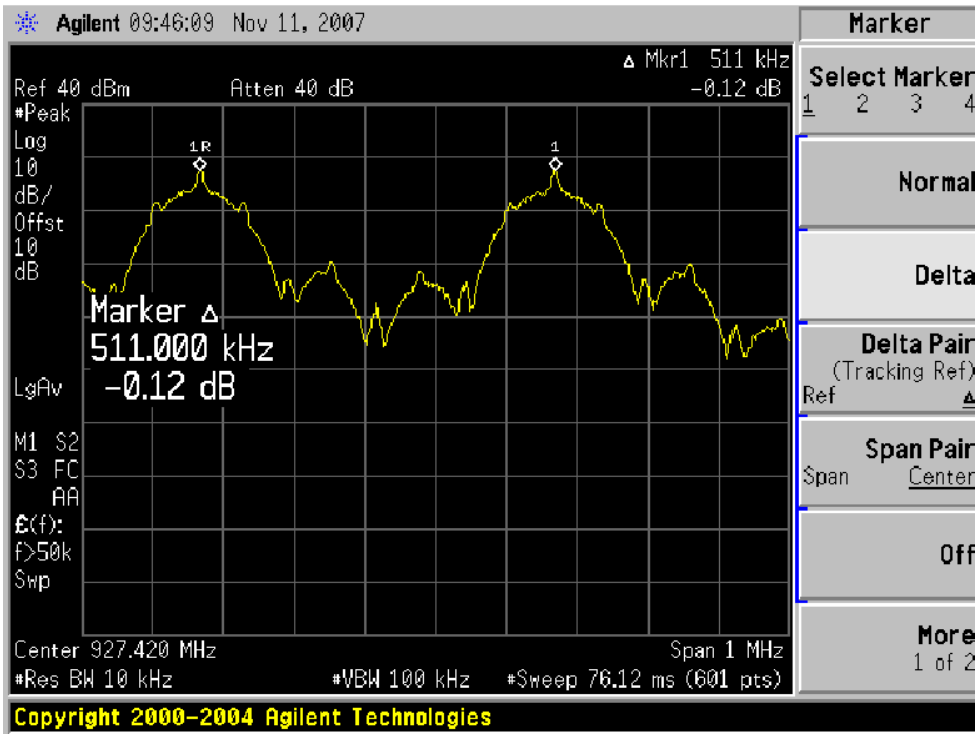
Low Channel



Middle Channel



High Channel



12 FCC §15.247(b) (3) - Peak Output Power Measurement

12.1 Applicable Standard

§15.247(b) the maximum peak output power of the intentional radiator shall not exceed the following:

§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.

§15.247(b) (4) (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

12.2 Measurement Procedure

1. Place the EUT on a bench 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 a spectrum analyzer.
3. Add a correction factor to the display.

4.Spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW > the 20 dB bandwidth of the emission being measured

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (see the NOTE above regarding external attenuation and cable loss). The limit is specified in one of the subparagraphs of this Section. Submit this plot. A peak responding power meter may be used instead of a spectrum analyzer.

12.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

12.4 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

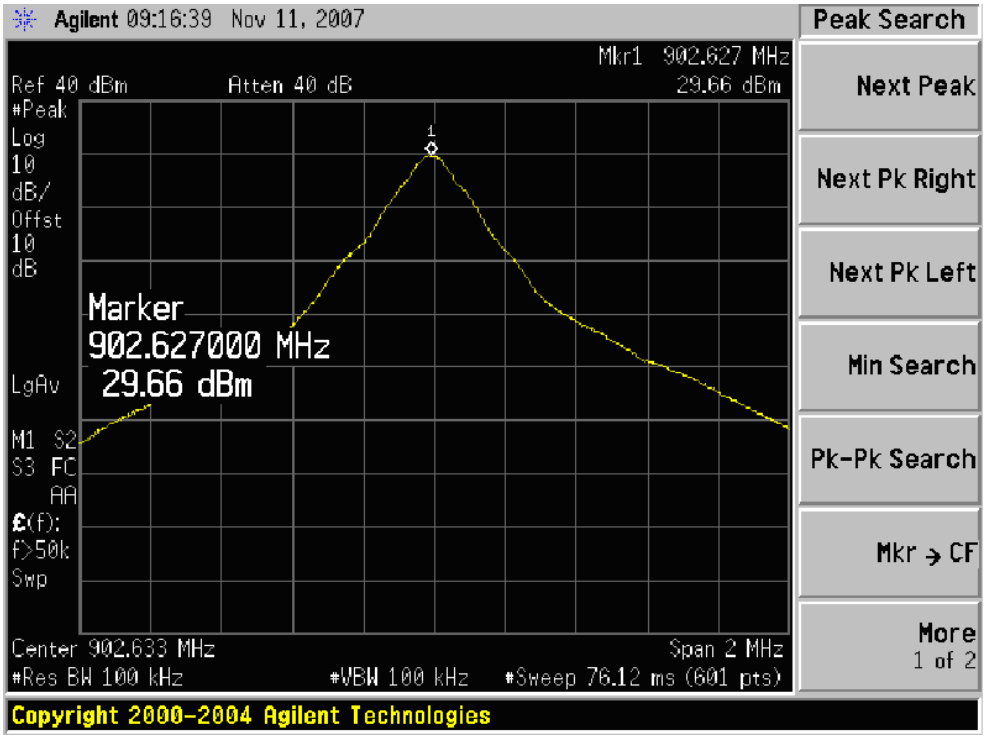
**The testing was performed by Choon Sian Ooi on 2007-11-28*

12.5 Measurement Result

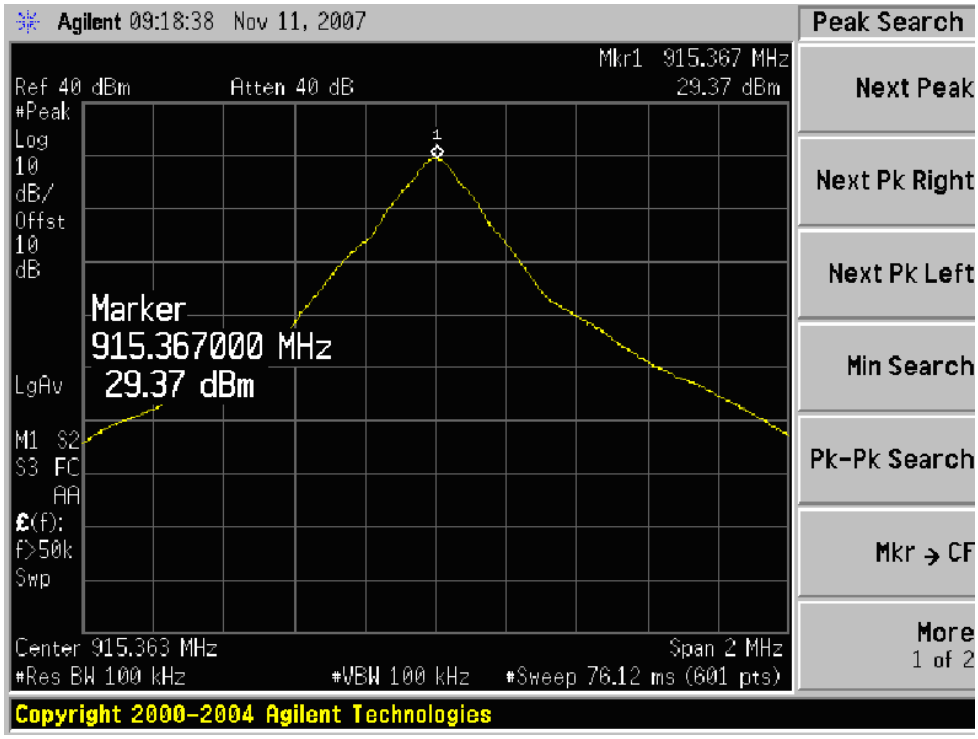
Channel	Max Peak Output Power		Limit (mW)	Result
	(dBm)	(mW)		
Low	29.66	924.698	1000	Compliant
Mid	29.37	864.967	1000	Compliant
High	28.81	760.326	1000	Compliant

Please see the following plots:

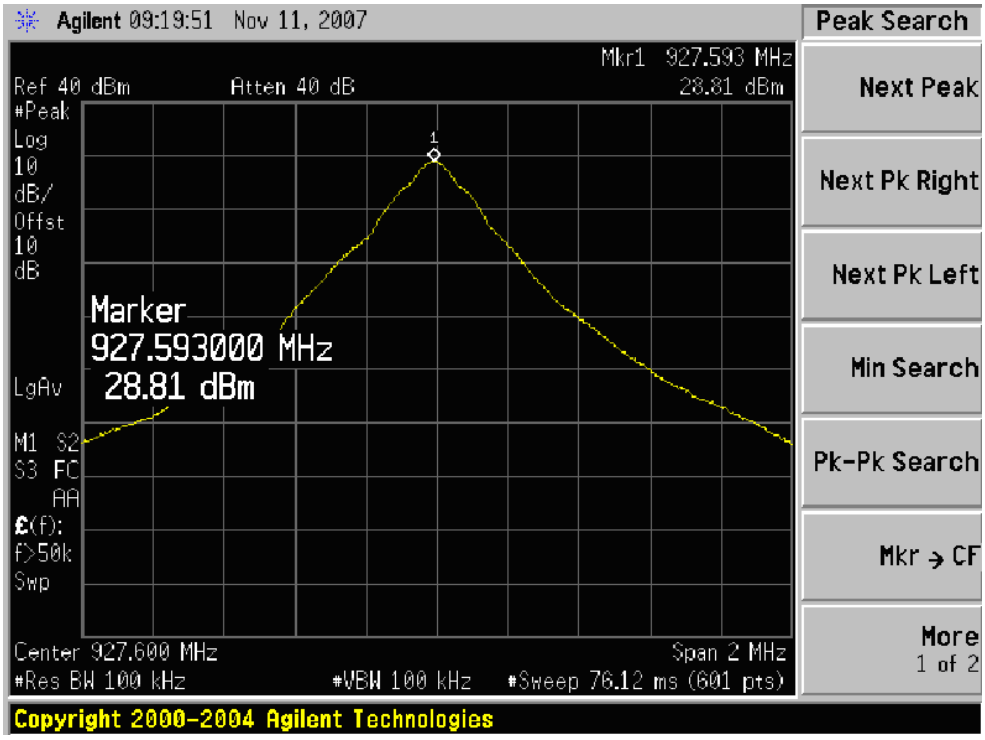
Low Channel



Middle Channel



High Channel



13 §15.247 (a) (1) (iii) - Number of Hopping Frequencies Used

13.1 Standard Applicable

According to §15.247(a)(1)(iii), For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

13.2 Measurement Procedure

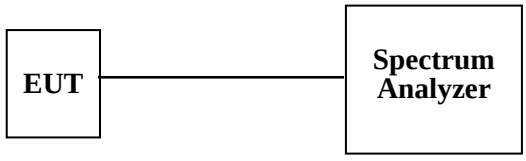
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low 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.

13.3 Test Equipment List and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

13.4 Test Setup Diagram



13.5 Environmental Conditions

Temperature:	28 °C
Relative Humidity:	42 %
ATM Pressure:	102.0 kPa

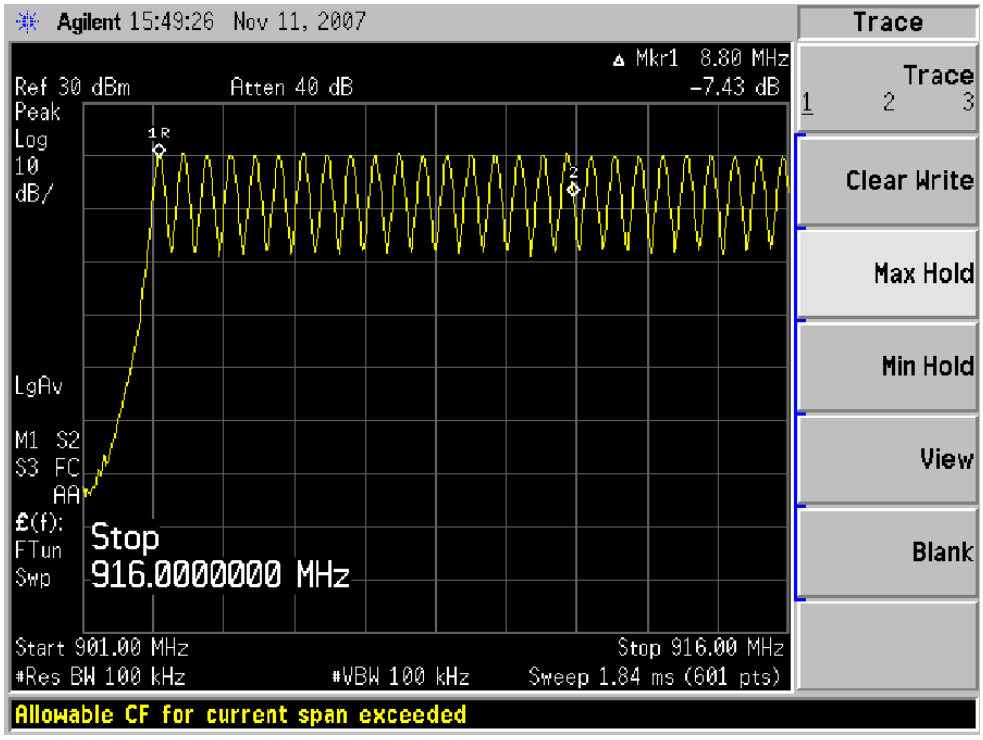
**The testing was performed by Choon Sian Ooi on 2007-11-28*

13.6 Measurement Result

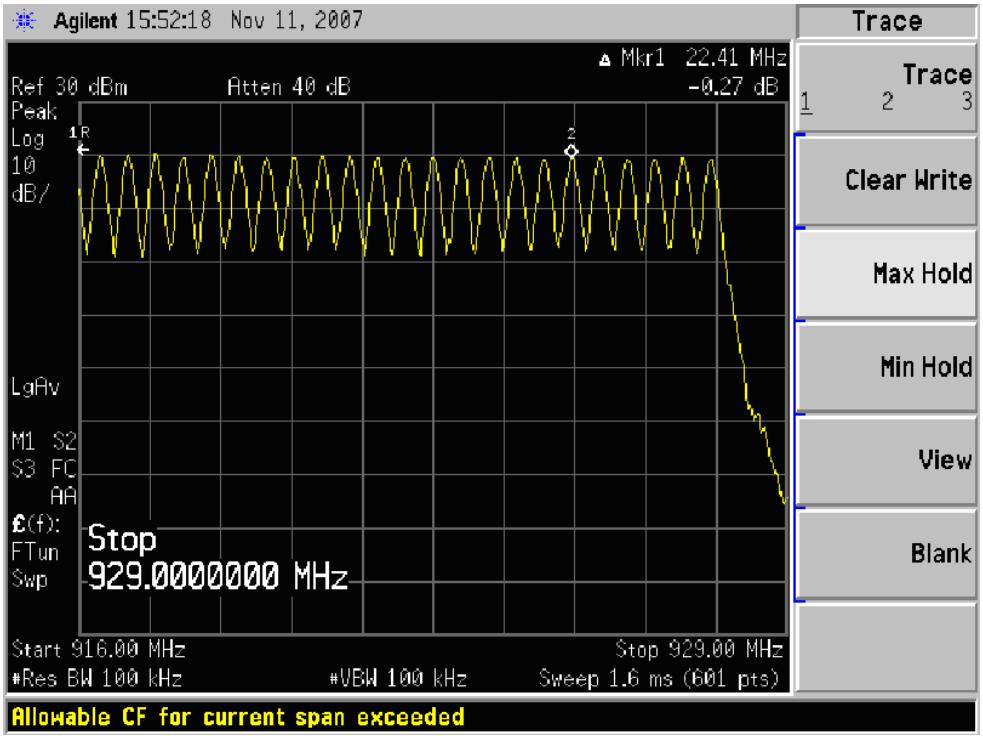
Frequency Range (MHz)	Number of Hopping Channels	Limit
902-908	50	>15

Please refer to the following plots:

Plot-1: Number of Channels: 27



Plot-2: Number of Channels: 23



14 §15.247(a) (1) (iii) - Dwell Time

14.1 Applicable Standard

According to §15.247 (a)(1)(i), For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

14.2 Measurement Procedure

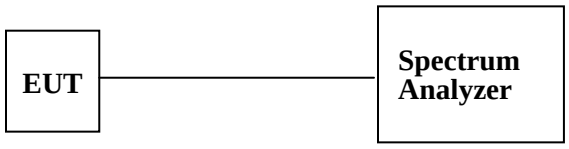
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. 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.

14.3 Test Equipment List and Details

Manufacturer	Description	Model Number	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

14.4 Test Setup Diagram



14.5 Environmental Conditions

Temperature:	28.5 °C
Relative Humidity:	45 %
ATM Pressure:	102.7 kPa

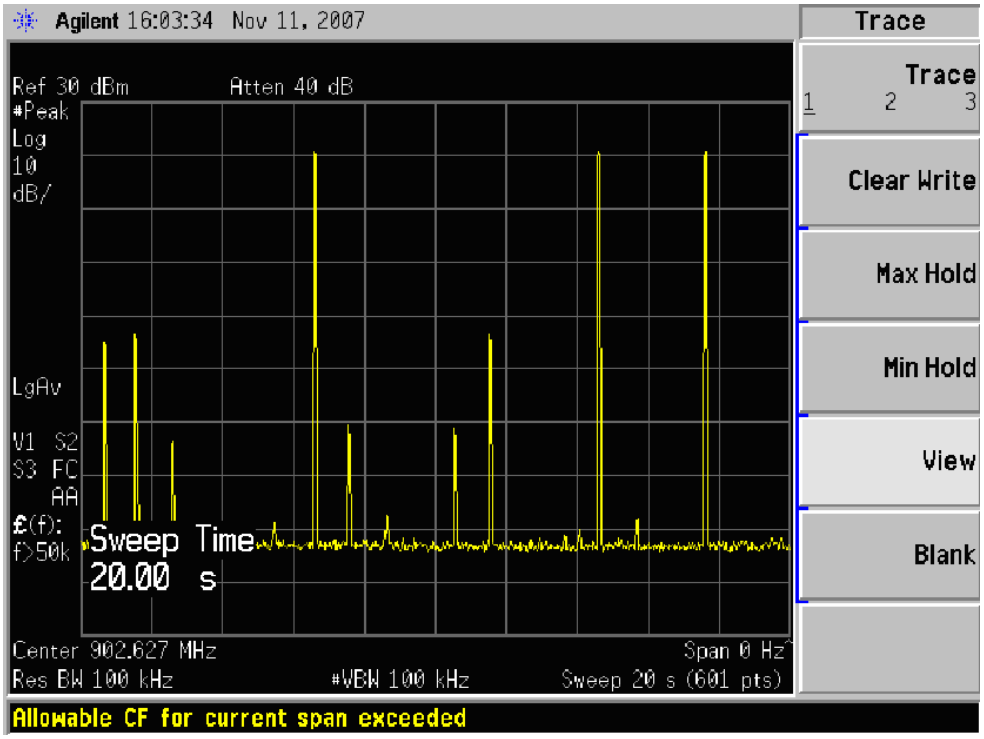
**The testing was performed by Choon Sian Ooi on 2007-11-28*

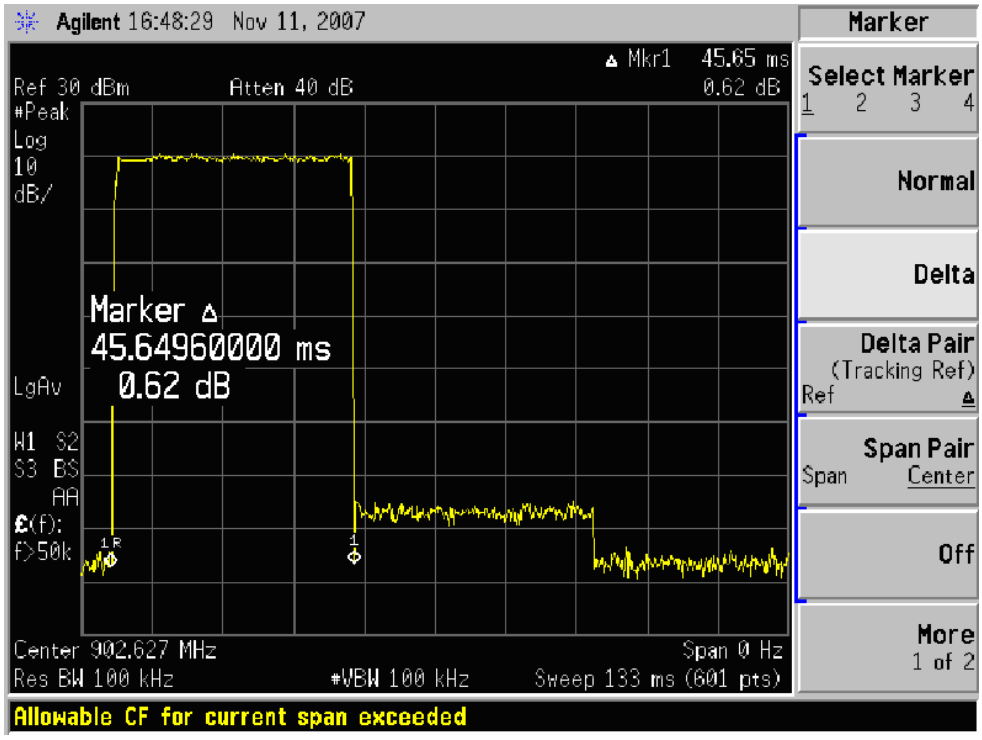
14.6 Measurement Results

Channel	Pulse Width (ms)	Pulse Quantity Per 20 Sec	Dwell Time (sec.)	Limit (Sec.)	Result
Low	45.6496	3	0.136949	0.4	Compliant
Mid	46.0928	3	0.138278	0.4	Compliant
High	45.428	2	0.090856	0.4	Compliant

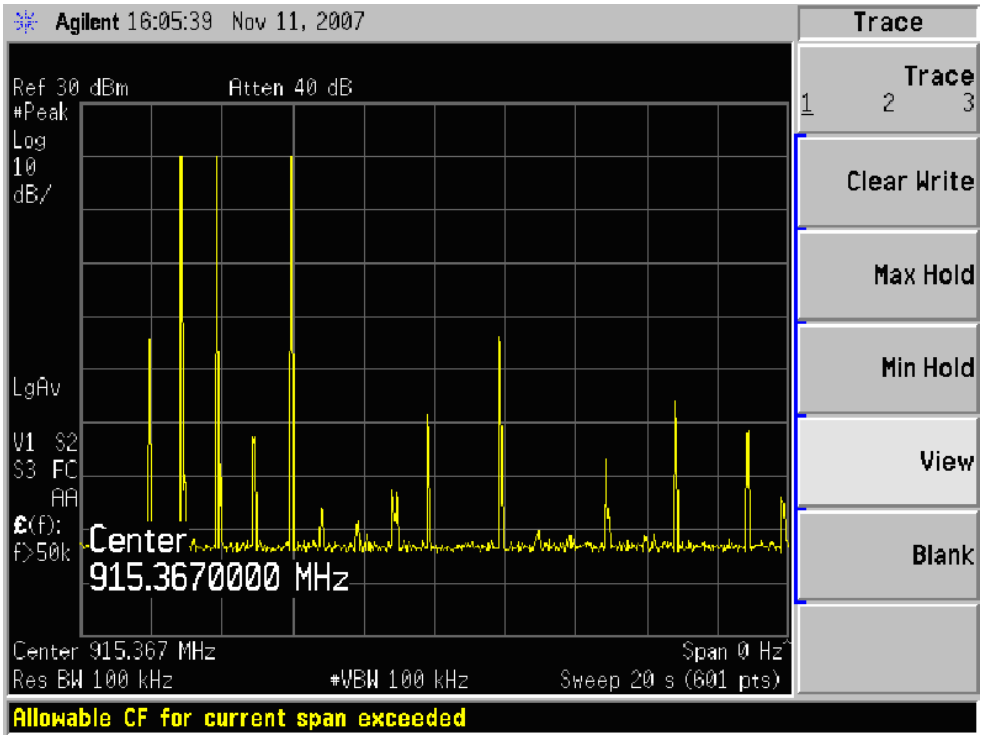
Please refer the following plots.

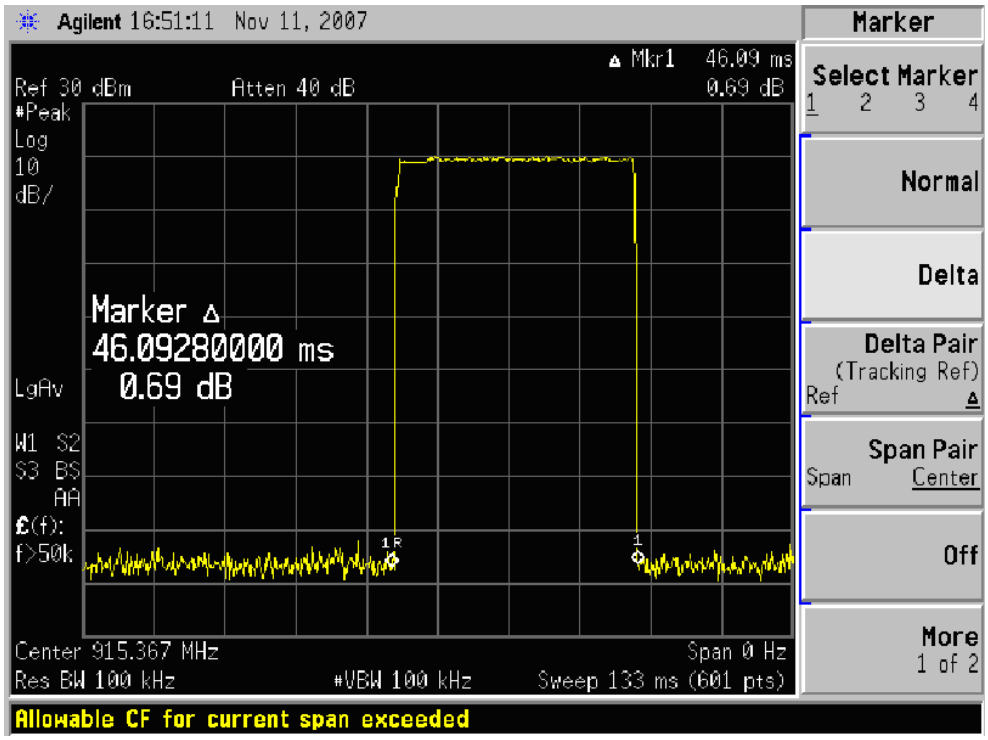
Low Channel


Agilent 16:03:34 Nov 11, 2007
Trace
Ref 30 dBm
Atten 40 dB
#Peak
Log
10
dB/
LgAv
V1 S2
S3 FC
AA
£(f):
f>50k
Sweep Time
20.00 s
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
Center 902.627 MHz
Span 0 Hz
Res BW 100 kHz
#VBW 100 kHz
Sweep 20 s (601 pts)
Allowable CF for current span exceeded

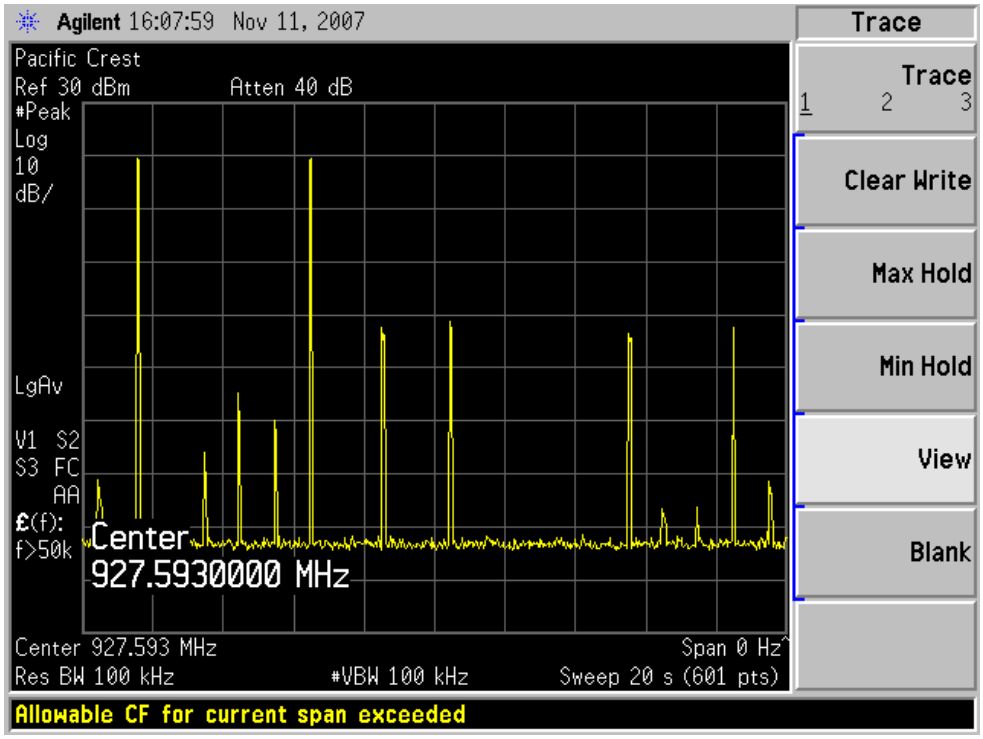

Agilent 16:48:29 Nov 11, 2007
Marker
Mkr1 45.65 ms
0.62 dB
Ref 30 dBm
Atten 40 dB
#Peak
Log
10
dB/
Marker Δ
45.64960000 ms
0.62 dB
LgAv
W1 S2
S3 BS
AA
£(f):
f>50k
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Δ
Span Pair
Span Center
Off
More
1 of 2
Center 902.627 MHz
Span 0 Hz
Res BW 100 kHz
#VBW 100 kHz
Sweep 133 ms (601 pts)
Allowable CF for current span exceeded

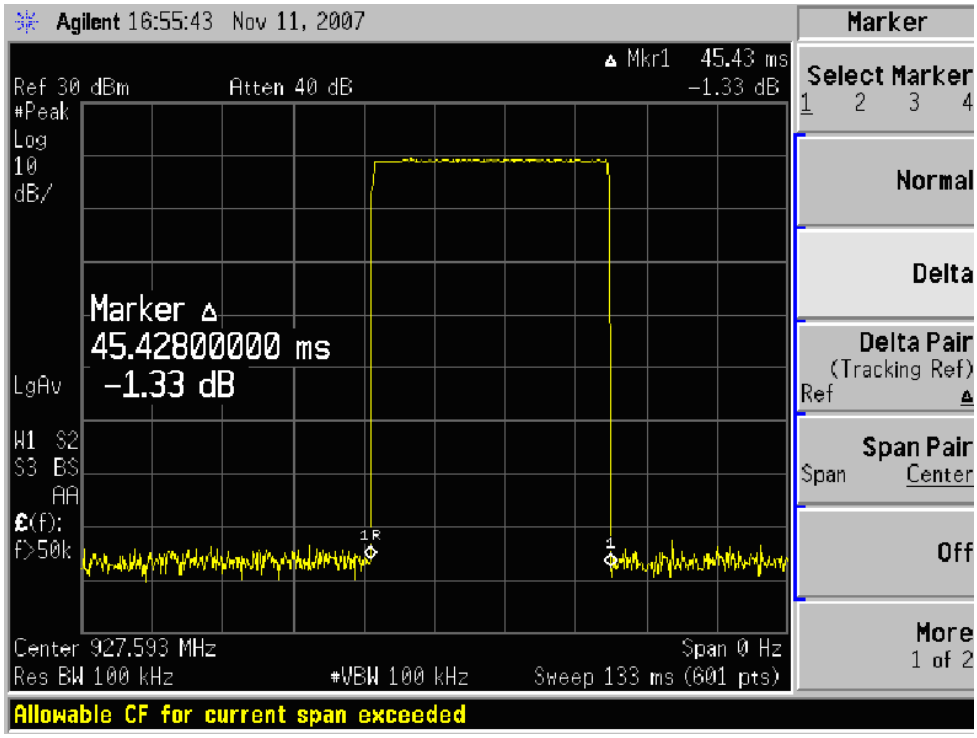
Middle Channel





High Channel





15 FCC §15.247(d) - 100 kHz Bandwidth of Band edges

15.1 Applicable Standard

According to §15.247(d), in *any* 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c)).

15.2 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 100 kHz 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.

15.3 Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2007-04-26

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

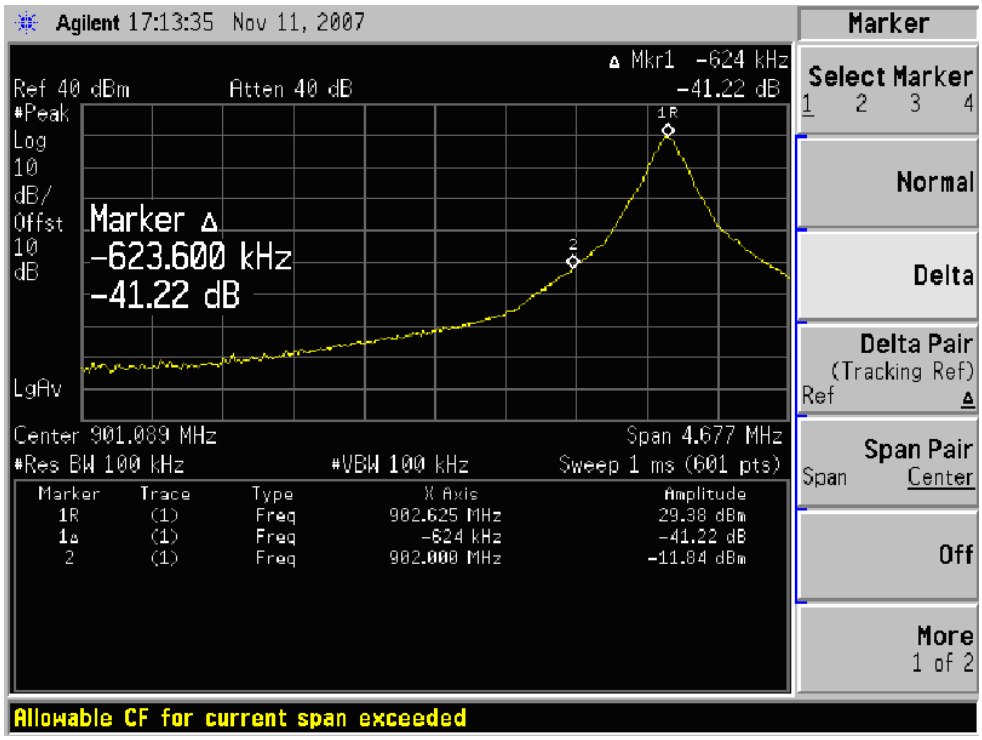
15.4 Environmental Conditions

Temperature:	26.5-28.5 °C
Relative Humidity:	42-45 %
ATM Pressure:	102.0-102.7 kPa

The testing was performed by Choon Sian Ooi on 2007-11-28

Please Refer to the Following Plots

Low Channel



High Channel