Lab Code: 200167-0

FCC PART 15.247

TEST AND MEASUREMENT REPORT

For

U-IT Co., Ltd.

620, Byucksan Digital Valley 2Cha, 481-20,

Gasan-Dong, Geumcheon-gu, Seoul, Korea

FCC ID: X6FCCR-900
Model: CCR-900

Report Type:	**Product Type:**
Original Report	900 MHz RF Reader

Test Engineer:	Kevin Li
Report Number:	R1002034-247
Report Date:	2010-03-09
Reviewed By:	Boni Baniqued Sr. RF Engineer
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1002034-247	Original Report	2010-03-09

1 GENERAL INFORMATION

1.1 Product Description for Equipment under Test (EUT)

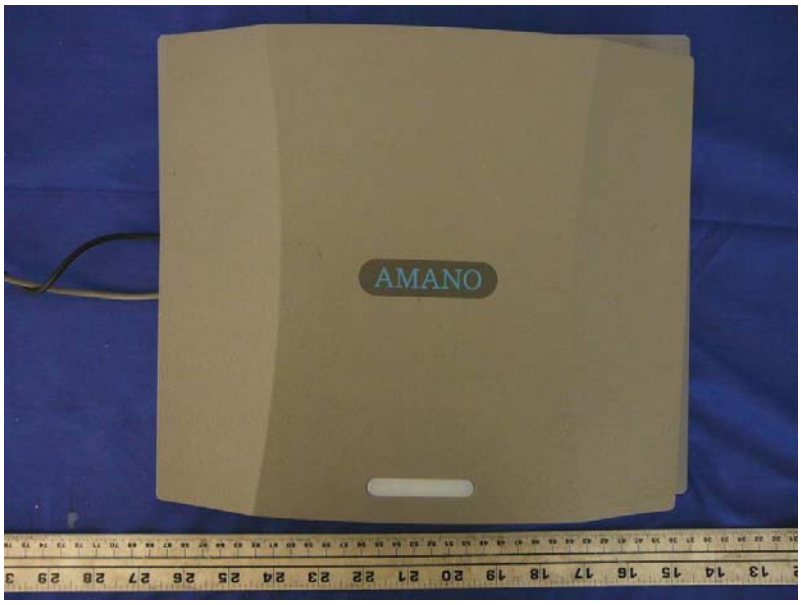
This test report was prepared on behalf of *U-IT Co., Ltd.* and their product model: CCR-900, FCC ID: X6FCCR-900 or the "EUT" as referred to in this report. The EUT is a RF Reader uses 900 MHz range of radio frequency to read the RFID tag attached to the car.

1.2 Mechanical Description of EUT

The *U-IT Co., Ltd.* product, *model: CCR-900* measures approximately 85.6 mm (L) x 53.98mm (W) x 3 mm (H) and weighs approximately 825 g.

** The test data gathered are from typical production sample, serial number: R1002034-1, assigned by BACL.*

1.3 EUT Photograph



Please refer to Exhibit C for more EUT photographs.

1.4 Objective

This type approval report is prepared on behalf of *U-IT Co., Ltd.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

1.5 Related Submittal(s)/Grant(s)

N/A

1.6 Test Methodology

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

1.7 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.

1.8 Test Facility

The semi-anechoic chambers used by BACL to collect radiated and conducted emissions measurement data is located in the building at it's facility in Sunnyvale, California, USA.

BACL's test sites 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 have 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 complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-2698 and R-2463. The test site has been approved by the FCC 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

2 SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in accordance with 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 is provided by customer. The EUT exercise program used during radiated testing was designed to exercise the system components.

Radio Mode	Low CH	Middle CH	High CH
FHSS	903.6	908.4	913.4

2.3 Special Equipment

No special equipment used during testing.

2.4 Equipment Modifications

No modifications were made to the EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
IBM	Laptop	T40	00045-494-924-841

2.6 EUT Internal Configuration Details

Manufacturer	Description	Model	Serial Number
UIT	Main Board	900M	080826

2.7 Interface Ports and Cabling

Cable Description	Length (m)	From	To
USB TO RS232	< 3 m	EUT	Laptop
RF Cable	< 3 m	EUT	PSA

3 SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§15.203	Antenna Requirements	Compliant
§15.207(a)	Conducted Emissions	Compliant
§15.205, §15.209 & §15.247(d)	Radiated Spurious Emissions	Compliant
§15.247(a) (1)	Channel Bandwidth	Compliant
§15.247(a) (1)	Hopping Channel Separation	Compliant
§15.247(a)(1)(iii)	Number of Hopping Frequencies Used	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(i) & §2.1093	RF Exposure	Compliant

4 FCC §15.247(i) & §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 §2.1093 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

Predication of MPE limit at a given distance, Equation from 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):	29.44
Maximum peak output power at antenna input terminal mW):	879
Prediction distance(cm):	20
Prediction frequency(MHz):	903.6
Antenna Gain (typical)(dBi):	2.5
Maximum Antenna Gain(numeric):	1.78
Power density at prediction frequency at 20 cm (mW/cm^2):	0.31
MPE limit for uncontrolled exposure at predication frequency(mW/cm^2):	0.6024

4.3 Test Result

The predicted power density level at 20 cm is 0.31 mW/cm^2, The EUT is used at least 20 cm away from user's body. It is determined as mobile equipment and complies with the MPE limit.

5 FCC §15.203 - ANTENNA REQUIREMENT

5.1 Applicable Standard

According to FCC §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.

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.

5.2 Antenna Connected Construction

The antenna of the EUT has a max gain of 2.5 dBi which fulfills the requirements of FCC rule 15.203, and the directional gain is less than 6 dBi thus not requiring reduction of the EUT output power.

☒ **Compliant** ☐ **N/A**

Antenna Photo

6 FCC §15.207 – 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 (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*

6.2 EUT Setup

The conducted emissions tests were performed in the 5-meter test chamber, using the setup in accordance with ANSI C63.4-2003 measurement procedures. The specifications used were in accordance with FCC Part 15.207 limits.

The adapter of EUT' was connected to a 120 V, 60 Hz AC mains power source.

6.3 Test Procedure

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

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

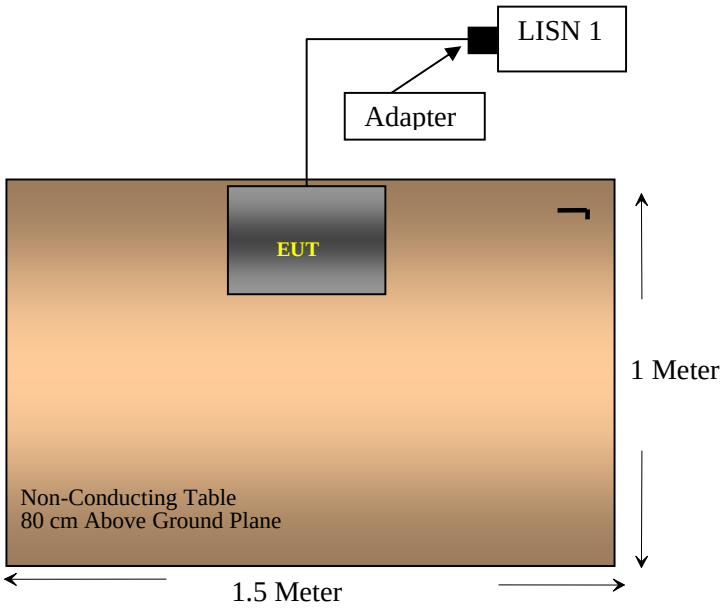
All data was recorded in the quasi-peak and average detection mode. Quasi-Peak readings are distinguished with a “QP”. Average readings are distinguished with an “Ave”.

6.4 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Solar Electronics	LISN	9252-R-24-BNC	511205	2009-06-09
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2009-04-29

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

6.5 Test Setup Block Diagram



6.6 Test Environmental Conditions

Temperature:	22 ºC
Relative Humidity:	44 %
ATM Pressure:	101.2kPa

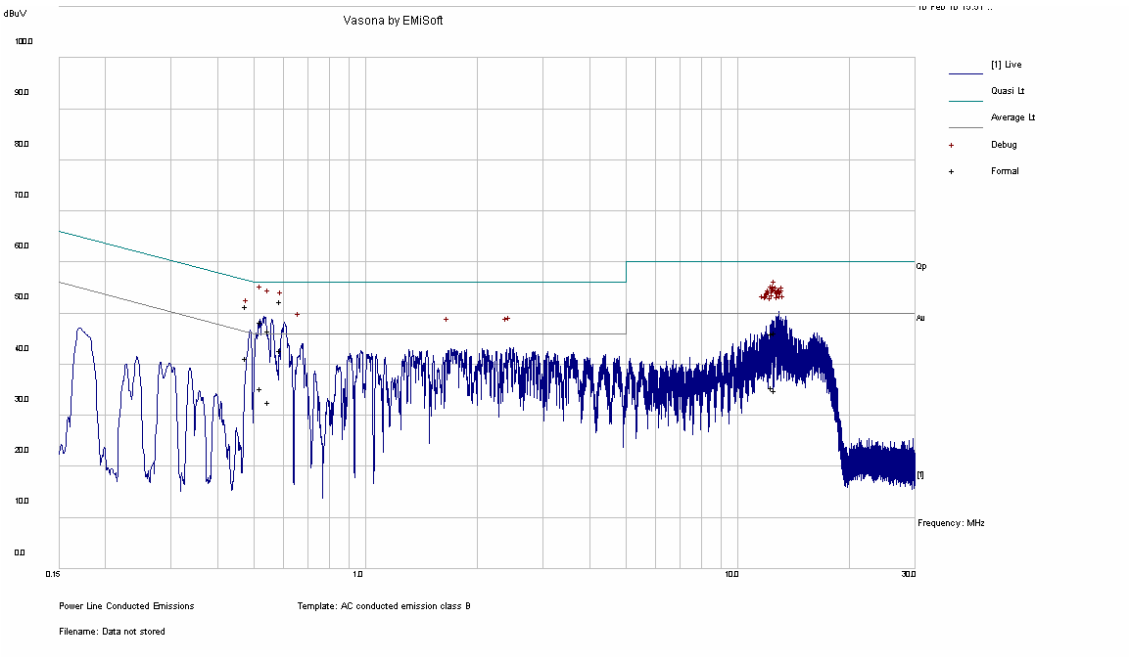
**Testing was performed by Kevin Li on 2010-02-10 in 5 meter Chamber 3.*

Test Result: According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15C section 15.207 standard's Conducted emissions limits and had the worst margin of:

-3.05 dB at 0.602553 MHz in the Neutral conductor, 120V/60Hz

6.7 Conducted Emissions Test Data

Line:



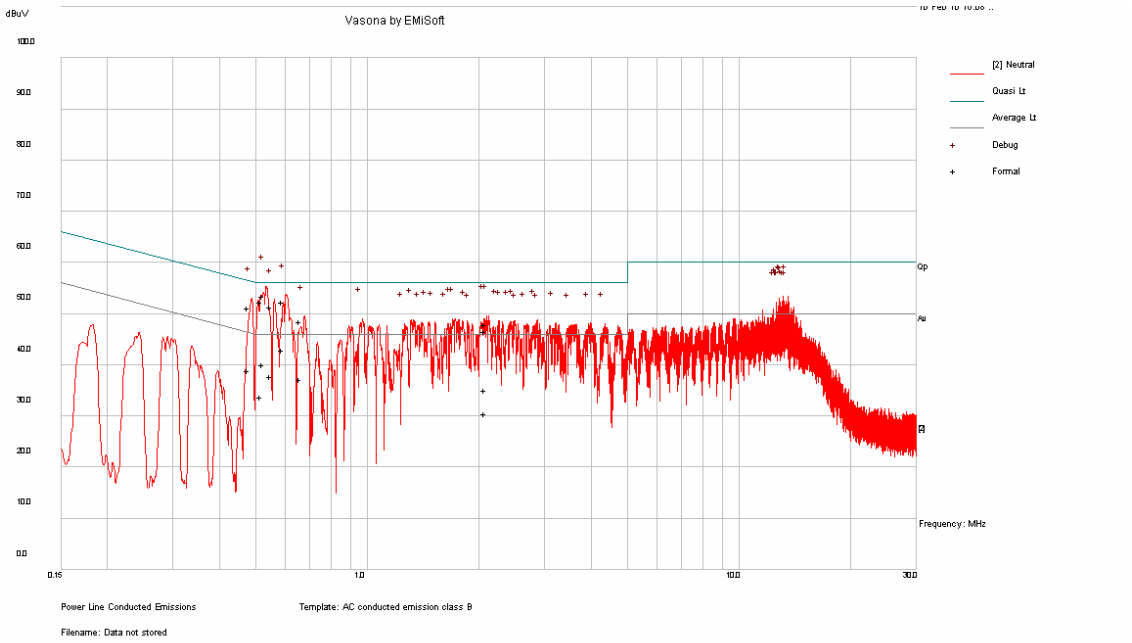
Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (L/N)	Limit (dBµV)	Margin (dB)
0.602877	52.24	L	56.00	-3.76
0.487056	51.40	L	56.22	-4.82
0.533895	48.22	L	56.00	-7.78
0.559860	46.53	L	56.00	-9.47
12.85196	46.25	L	60.00	-13.75
12.63700	46.02	L	60.00	-13.98

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (L/N)	Limit (dBµV)	Margin (dB)
0.602877	42.72	L	46.00	-3.28
0.487056	41.21	L	46.22	-5.01
0.533895	35.18	L	46.00	-10.82
0.559860	32.69	L	46.00	-13.31
12.63700	35.53	L	50.00	-14.47
12.85196	34.83	L	50.00	-15.17

Neutral:



Quasi-Peak Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (L/N)	Limit (dBµV)	Margin (dB)
0.602553	52.24	N	56.0	-3.76
0.560697	51.30	N	56.0	-4.70
0.488337	51.09	N	56.2	-5.11
0.673128	48.40	N	56.0	-7.60
2.115901	47.91	N	56.0	-8.09
2.107488	46.48	N	56.0	-9.52

Average Measurements

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (L/N)	Limit (dBµV)	Margin (dB)
0.602553	42.95	N	46.0	-3.05
0.488337	38.81	N	46.2	-7.38
0.560697	37.73	N	46.0	-8.27
0.673128	37.16	N	46.0	-8.84
2.115901	34.99	N	46.0	-11.01
2.107488	30.50	N	46.0	-15.50

7 FCC §15.205, §15.209 & 15.247(D) - RADIATED EMISSIONS

7.1 Applicable Standard:

As per 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.

As per 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.*

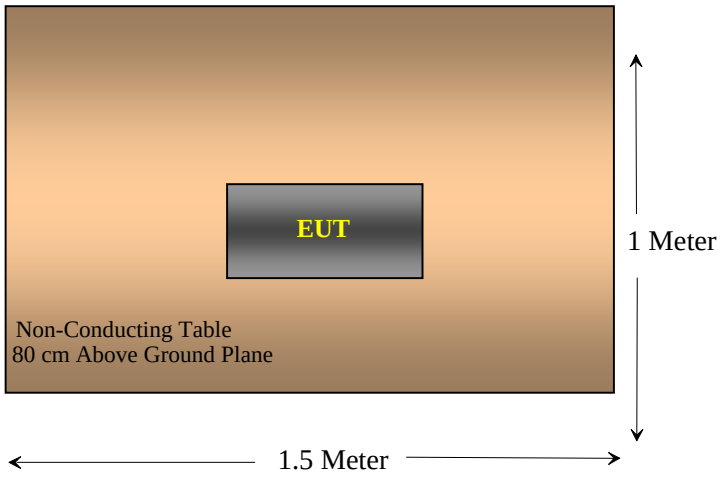
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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)).

IC RSS-Gen §4.9 the measurement method shall be described in the test report. The same parameter, peak power or average power, used for the transmitter output power measurement shall be used for unwanted emission measurements. The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate or carrier frequency), or from 30 MHz, whichever is the lower, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

7.2 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.

7.3 Test Setup Diagram



7.4 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 meter away from the testing antenna, which is varied from 1-4 mete, 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 1000 MHz:

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

Above 1000 MHz:

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

7.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Cable Loss, and Attenuator Factor adding to the Indicated Reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Cable Loss + Attenuator Factor

For example, a Corrected Amplitude of 34.08 dBuV/m = Indicated Reading (23.85 dBuV) + Cable Factor (0.22 dB) + Attenuator Factor (10dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit.

7.6 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
HP	Pre amplifier	8449B	3147A00400	2010-02-01
Sunol Science Corp	Combination Antenna	JB1 Antenna	A020106-1	2009-04-17
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27
A.R.A.	Antenna, Horn	DRG-118/A	1132	2009-10-27

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

7.7 Test Environmental Conditions

Temperature:	22.3 ºC
Relative Humidity:	43 %
ATM Pressure:	101.7kPa

**Testing was performed by Kevin Li on 2010-02-12 in 5 meter Chamber #2.*

7.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247 standard's radiated emissions limits, and had the worst margin of:

30-1000 MHz:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-2.95	129.0758	Vertical	Low, 30-1000 MHz

Above 1 GHz:

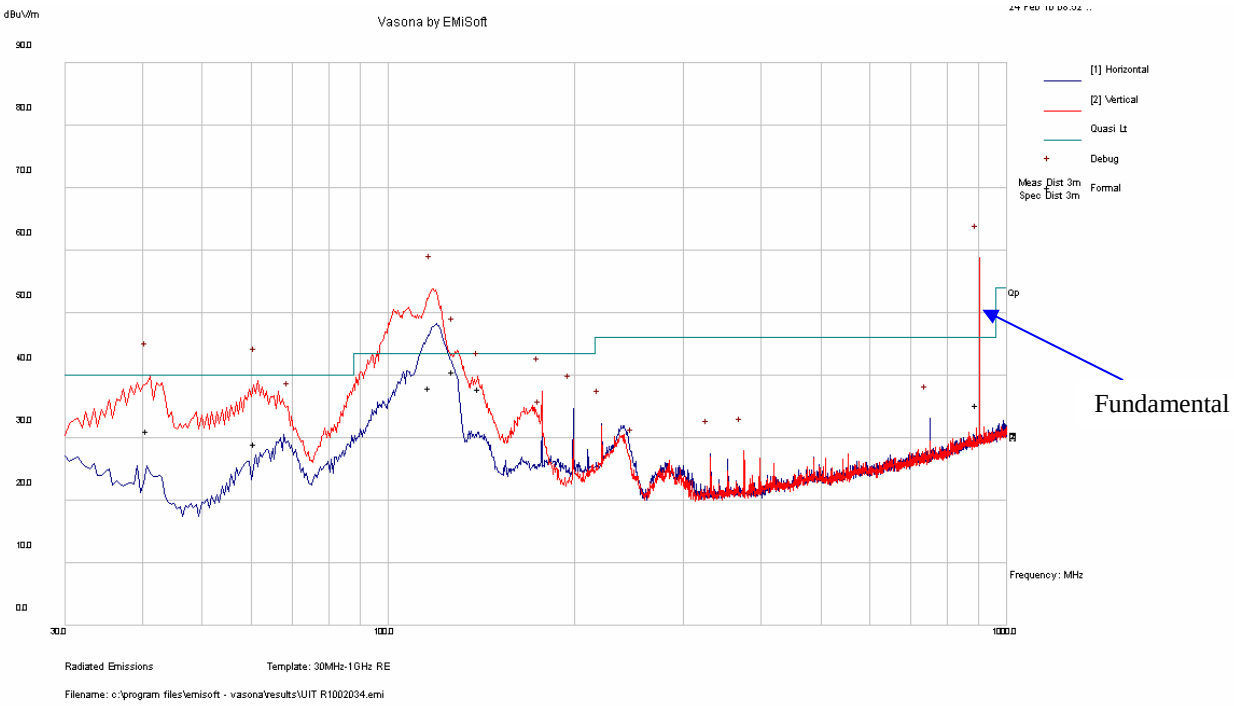
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel, Range**
-0.808	1807.2	Vertical	Low, 1-12.75 GHz
-0.278	1816.8	Vertical	Mid, 1-12.75 GHz
-0.098	1826.8	Vertical	High, 1-12.75 GHz

Please refer to the following table and plots for specific test result details

7.9 Radiated Emissions Test Result Data:

Below 1 GHz:

Measured at 3 meter, Low Channel (903.6 MHz, worst case)



Frequency (MHz)	Corrected Amplitude (dB)	Antenna Height (cm)	Antenna Polarity (H/V)	Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)
129.0758	40.55	103	V	360	43.5	-2.95
118.1085	38.00	97	V	167	43.5	-5.50
141.5805	37.82	101	V	354	43.5	-5.68
41.21236	31.10	134	V	62	40.0	-8.90
176.9456	32.74	107	V	317	43.5	-10.76
61.57588	29.08	130	V	346	40.0	-10.92

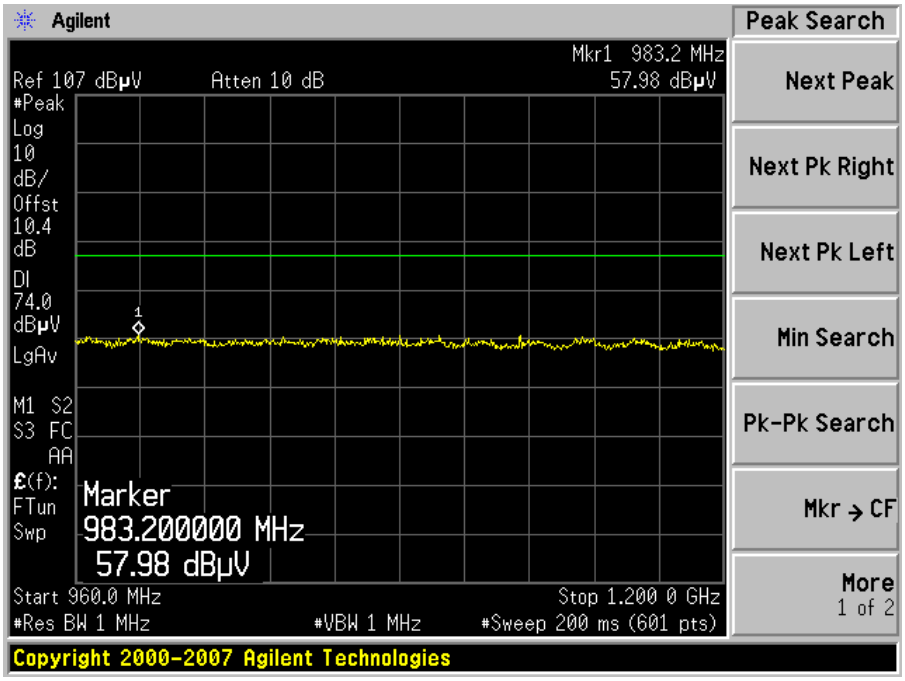
Above 1 GHz:

Measured at 3 meters

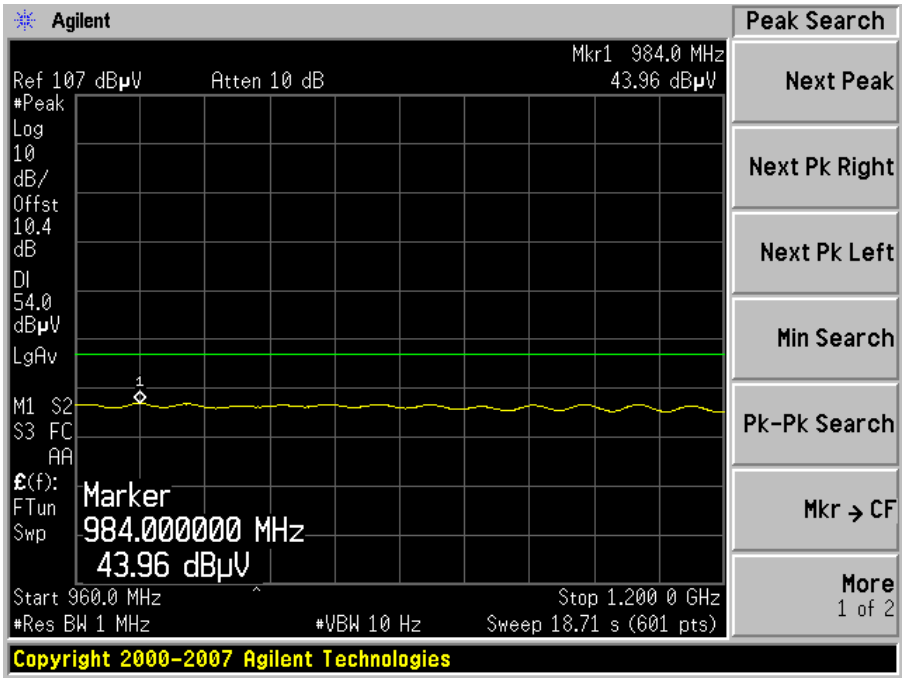
Frequency (MHz)	S.A. Reading (dBµV)	Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	Part 15C		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 903.6 MHz											
1807.2	79.2	195	100	V	25.722	4.54	36.37	73.092	74	-0.908	peak
1807.2	77.79	55	100	H	25.722	4.54	36.37	71.682	74	-2.318	peak
1807.2	59.3	195	100	V	25.722	4.54	36.37	53.192	54	-0.808	Ave
1807.2	58.49	55	100	H	25.722	4.54	36.37	52.382	54	-1.618	Ave
2710.8	62.03	285	100	V	29.555	5.66	35.96	61.285	74	-12.715	peak
2710.8	58.4	248	100	H	29.555	5.66	35.96	57.655	74	-16.345	peak
2710.8	48.42	285	100	V	29.555	5.66	35.96	47.675	54	-6.325	Ave
2710.8	44.93	248	100	H	29.555	5.66	35.96	44.185	54	-9.815	Ave
3614.4	63.05	211	100	V	31.244	6.74	35.77	65.264	74	-8.736	peak
3614.4	55.58	171	100	H	31.244	6.74	35.77	57.794	74	-16.206	peak
3614.4	48.79	211	100	V	31.244	6.74	35.77	51.004	54	-2.996	Ave
3614.4	43.61	171	100	H	31.244	6.74	35.77	45.824	54	-8.176	Ave
Middle Channel 908.4 MHz											
1816.8	79.29	146	100	V	25.722	4.54	36.37	73.182	74	-0.818	peak
1816.8	78.17	212	100	H	25.722	4.54	36.37	72.062	74	-1.938	peak
1816.8	59.83	146	100	V	25.722	4.54	36.37	53.722	54	-0.278	Ave
1816.8	55.12	212	100	H	25.722	4.54	36.37	49.012	54	-4.988	Ave
3633.6	59.97	313	100	V	29.555	5.66	35.96	59.225	74	-14.775	peak
3633.6	55.09	83	100	H	29.555	5.66	35.96	54.345	74	-19.655	peak
3633.6	46.71	313	100	V	29.555	5.66	35.96	45.965	54	-8.035	Ave
3633.6	41.59	83	100	H	29.555	5.66	35.96	40.845	54	-13.155	Ave
6358.8	56.25	64	100	V	31.244	6.74	35.77	58.464	74	-15.536	peak
6358.8	55.2	259	100	H	31.244	6.74	35.77	57.414	74	-16.586	peak
6358.8	41.76	64	100	V	31.244	6.74	35.77	43.974	54	-10.026	Ave
6358.8	40.16	259	100	H	31.244	6.74	35.77	42.374	54	-11.626	Ave
High Channel 913.4 MHz											
1826.8	79.98	314	100	V	25.722	4.54	36.37	73.872	74	-0.128	peak
1826.8	78.53	148	100	H	25.722	4.54	36.37	72.422	74	-1.578	peak
1826.8	59.98	314	100	V	25.722	4.54	36.37	53.872	54	-0.128	Ave
1826.8	60.01	148	100	H	25.722	4.54	36.37	53.902	54	-0.098	Ave
2740.2	60.55	165	100	V	29.555	5.66	35.96	59.805	74	-14.195	peak
2740.2	59.63	288	100	H	29.555	5.66	35.96	58.885	74	-15.115	peak
2740.2	47.71	165	100	V	29.555	5.66	35.96	46.965	54	-7.035	Ave
2740.2	46.09	288	100	H	29.555	5.66	35.96	45.345	54	-8.655	Ave
6393.8	57.18	157	100	V	31.244	6.74	35.77	59.394	74	-14.606	peak
6393.8	55.67	268	100	H	31.244	6.74	35.77	57.884	74	-16.116	peak
6393.8	43.4	157	100	V	31.244	6.74	35.77	45.614	54	-8.386	Ave
6393.8	42.46	268	100	H	31.244	6.74	35.77	44.674	54	-9.326	Ave

Restricted Band:

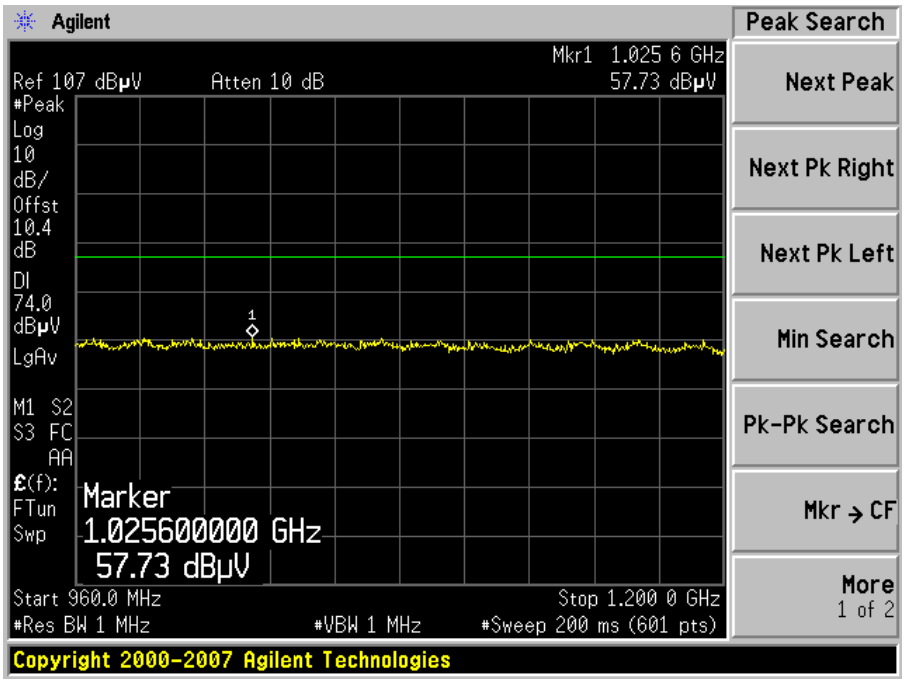
Highest Channel at Horizontal, Peak



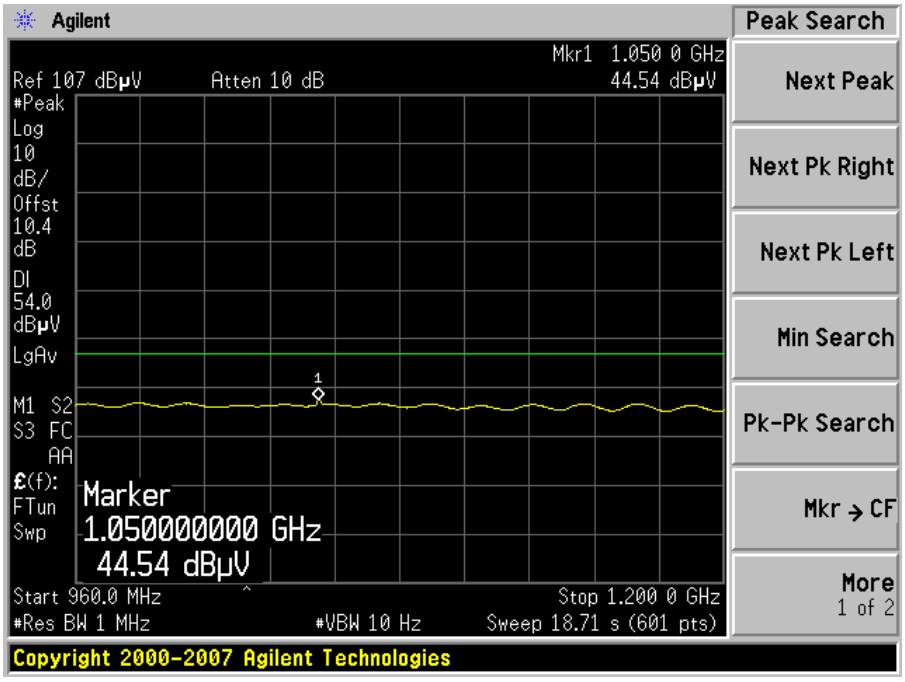
Highest Channel at Horizontal, Average



Highest Channel at Vertical, Peak



Highest Channel at Vertical, Average



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

8.1 Applicable Standard

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. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

8.2 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 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.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

8.4 Test Environmental Conditions

Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

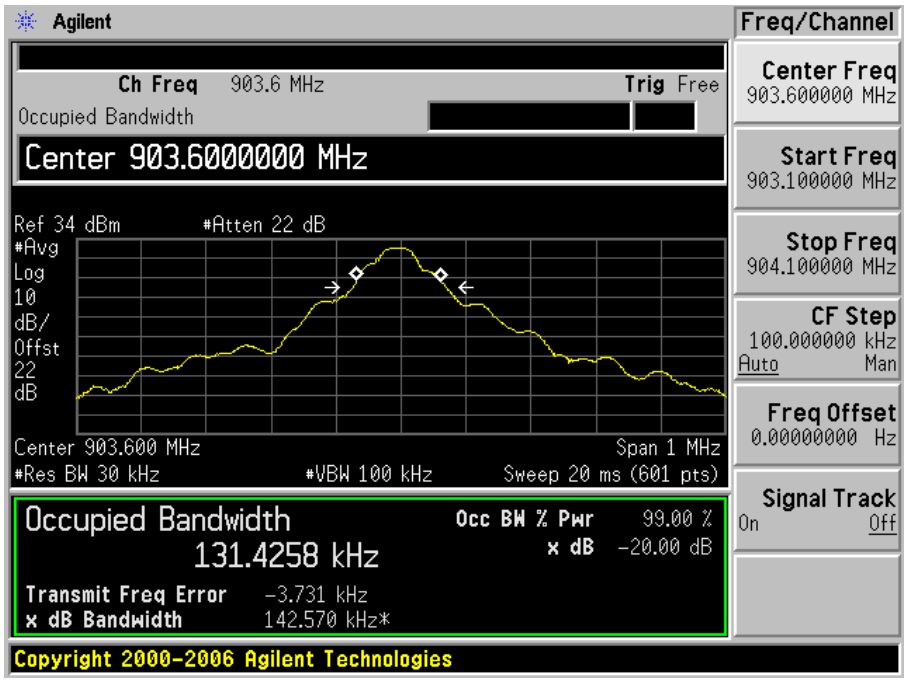
** Testing was performed by Kevin Li on 2020-02-10 in RF Site.*

8.5 Measurement Results

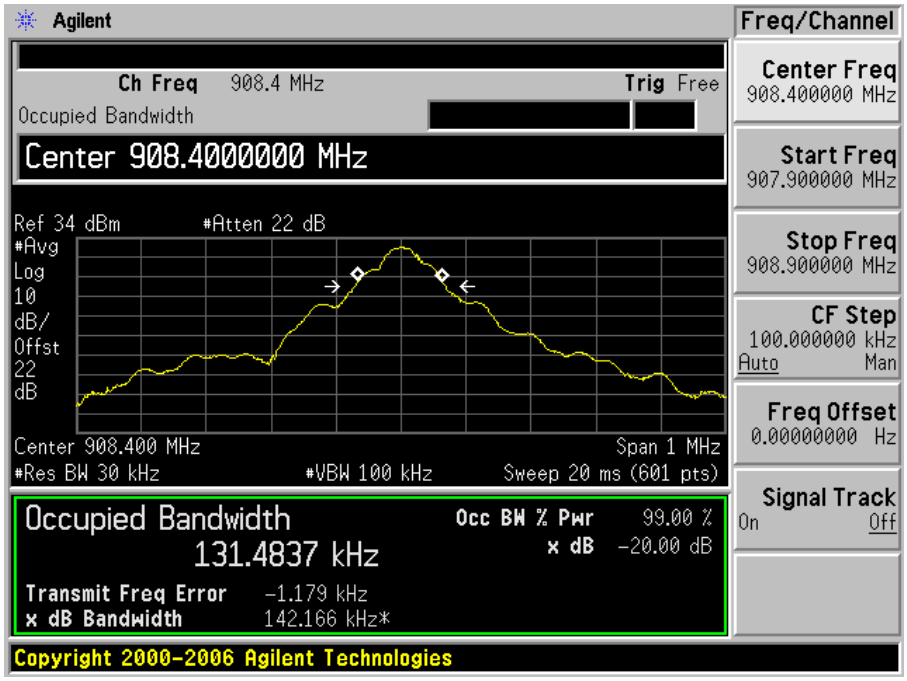
Channel	Frequency (MHz)	20 dB Channel Bandwidth (kHz)
Low	903.6	142.570
Middle	908.4	142.166
High	913.4	135.987

Please refer to the following plots.

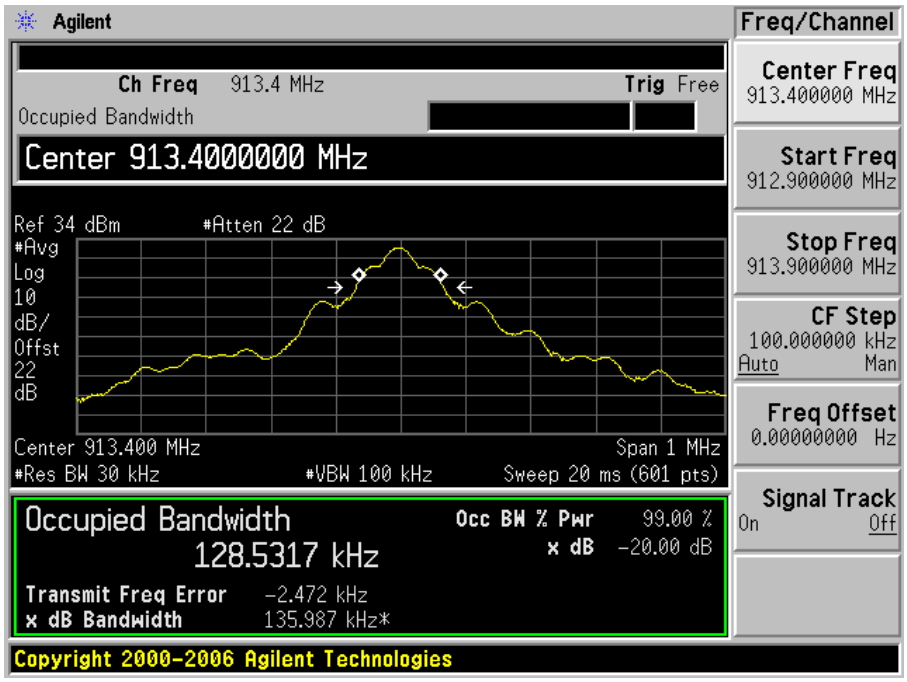
Low Channel



Middle Channel



High Channel



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

9.1 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. 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.

9.2 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 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.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

9.4 Test Environmental Conditions

Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

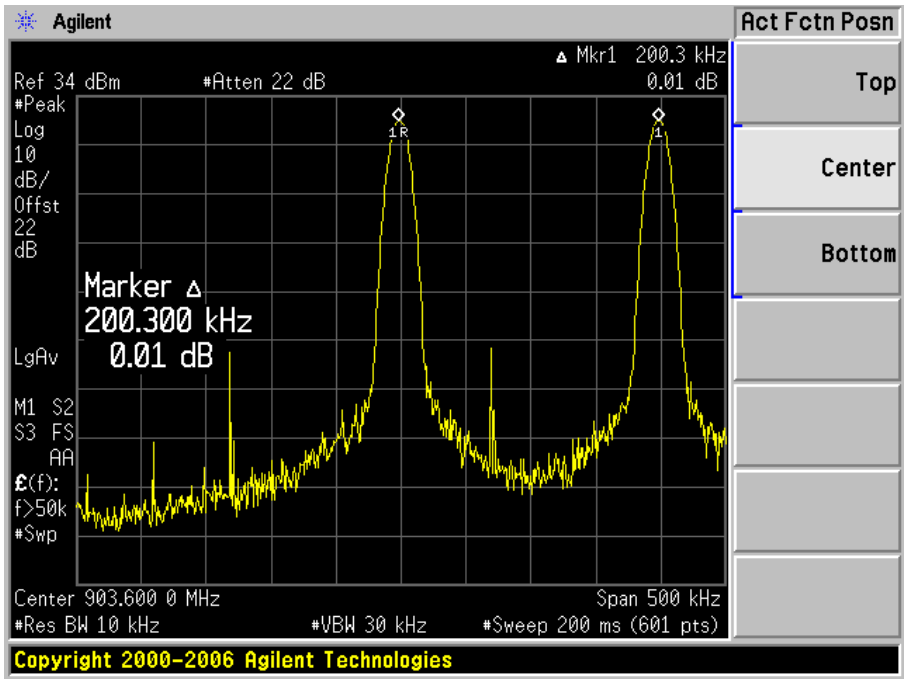
** Testing was performed by Kevin Li on 2010-02-10 .in RF Site.*

9.5 Measurement Results

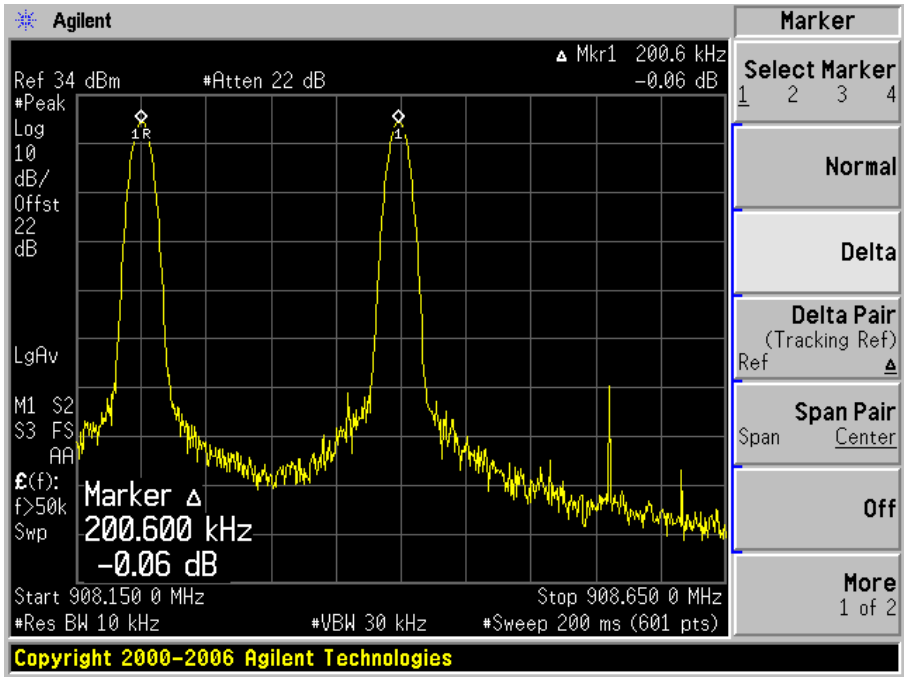
Channel	Frequency (MHz)	Measured Channel Separation (kHz)	Limit > 20 dB BW (kHz)
Low	903.6	200.3	142.57
Mid	908.4	200.6	142.166
High	913.4	199.967	135.987

Please refer to the following plots.

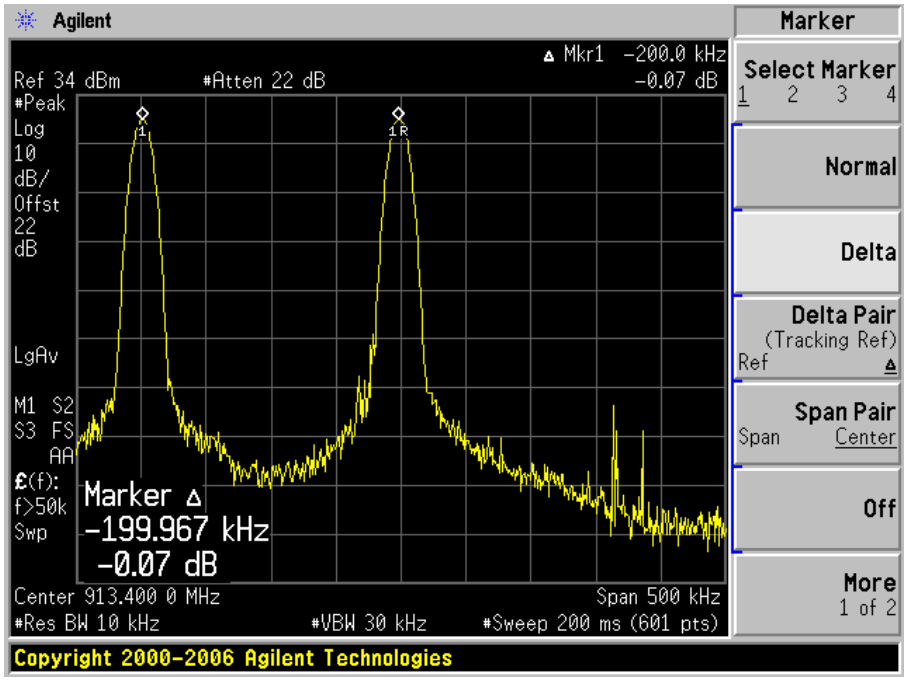
Low Channel



Middle Channel



High Channel



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

10.1 Applicable Standard

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. The maximum allowed 20 dB bandwidth of the hopping channel is 500 k

10.2 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 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.

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

10.4 Test Environmental Conditions

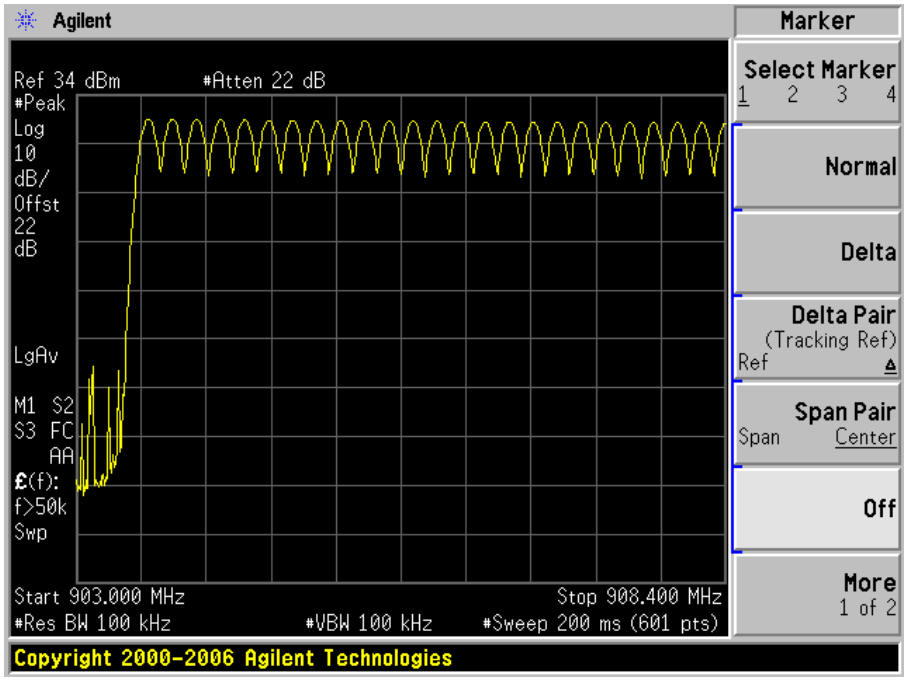
Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

** Testing was performed by Kevin Li on 2010-02-10 in RF Site.*

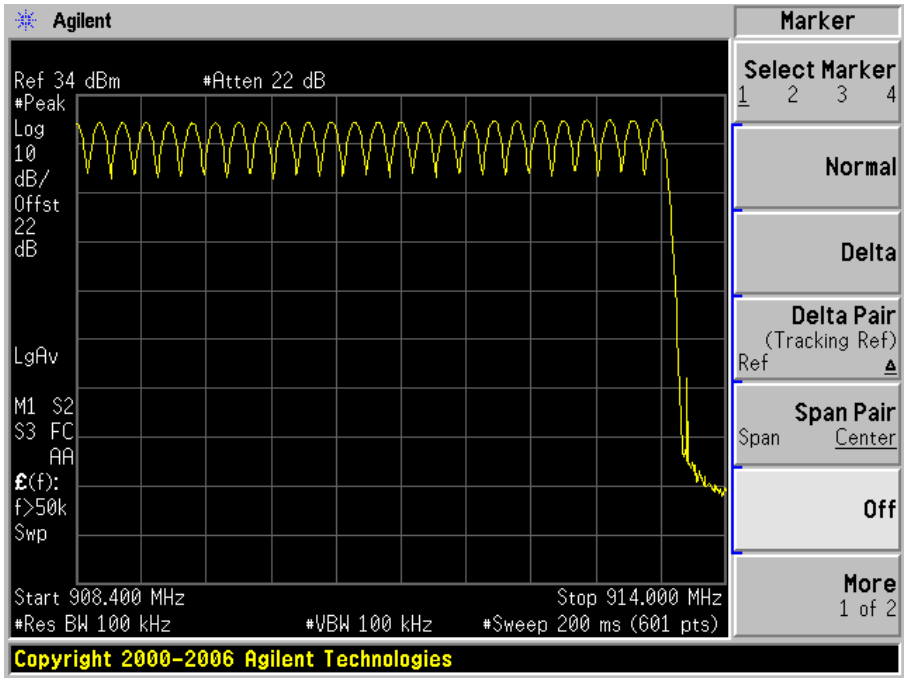
10.5 Measurement Results

50 channels; please refer to the following plots.

Hopping Channel Number



25 Channels between 903 to 908.4 MHz



25 Channels between 908.4 to 914 MHz

11 FCC §15.247(a)(1)(iii) - DWELL TIME

11.1 Applicable Standard

According to FCC §15.247(a)(1)(iii), 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.

11.2 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.

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

11.4 Test Environmental Conditions

Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

** Testing was performed by Kevin Li on 2010-02-10 .in RF Site.*

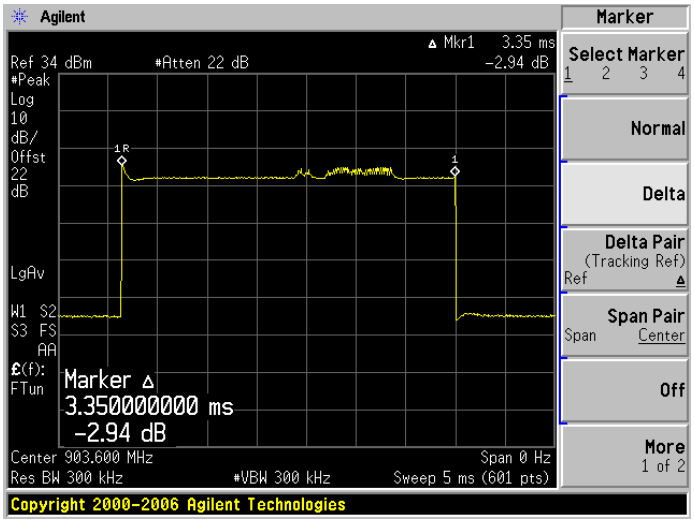
11.5 Measurement Results:

Channel	Frequency (MHz)	Pulse Width (ms)	Dwell Time (Sec.)	Limit (Sec.)	Results
Low	903.6	3.350	0.200	0.4	Compliant
Mid	908.4	3.367	0.203	0.4	Compliant
High	913.4	3.350	0.200	0.4	Compliant

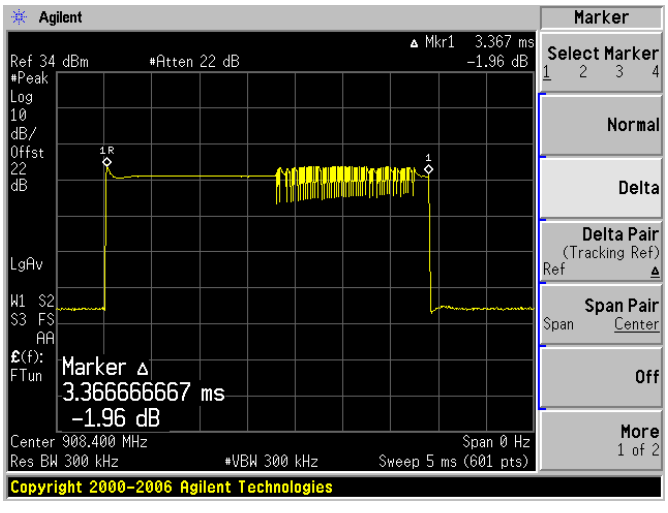
Note: Dwell time = Pulse time*(hop rate/2/number of channels)*20 sec
Hop Rate = 300; Number of Channels = 50
Dwell time = Pulse time*(300/2/50)*20 sec

Please refer the following plots.

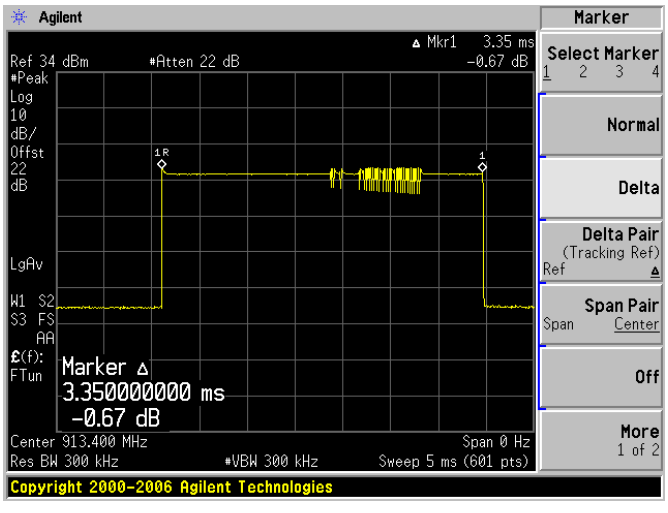
Low Channel



Middle Channel



High Channel



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

12.1 Applicable Standard

As per FCC §15.247(b)(1), for frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

12.2 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.

12.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

12.4 Test Environmental Conditions

Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

** Testing was performed by Kevin Li on 2010-02-10 .in RF Site.*

12.5 Measurement Results

Hopping Channels: 50; Power Limit: 1 Watt

Channel	Frequency (MHz)	Max Peak Output Power		Limit (mw)	Result
		(dBm)	(mw)		
Low	903.6	29.44	879.02	1000	Pass
Mid	908.4	28.83	763.84	1000	Pass
High	913.4	29.34	859.01	1000	Pass

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

13.1 Applicable Standard

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band 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. Attenuation below the general limits specified in §15.209(a) is not required.

13.2 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 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.

13.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

13.4 Test Environmental Conditions

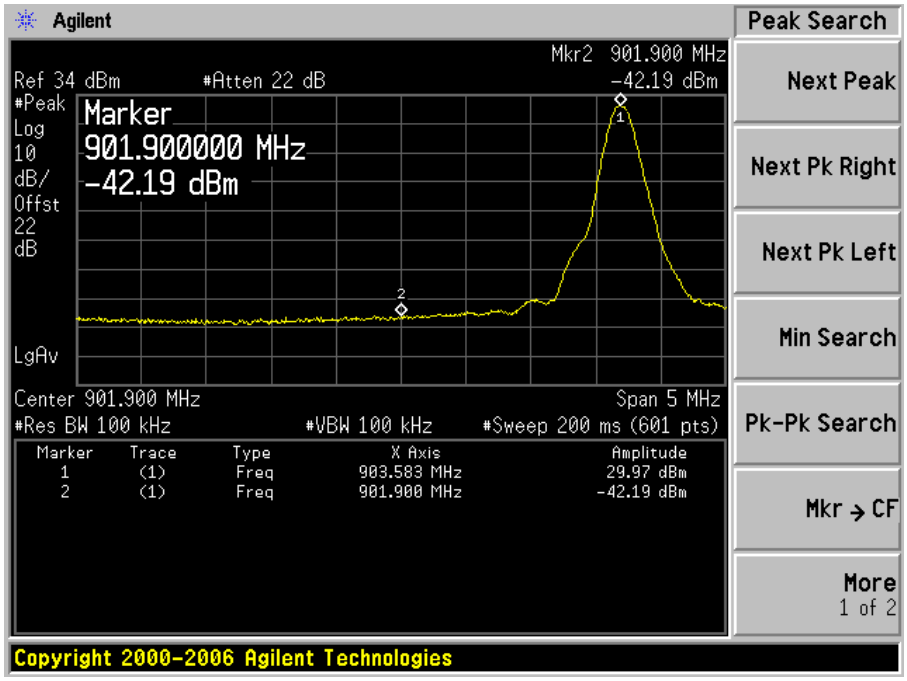
Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

** Testing was performed by Kevin Li on 2010-02-10 .in RF Site.*

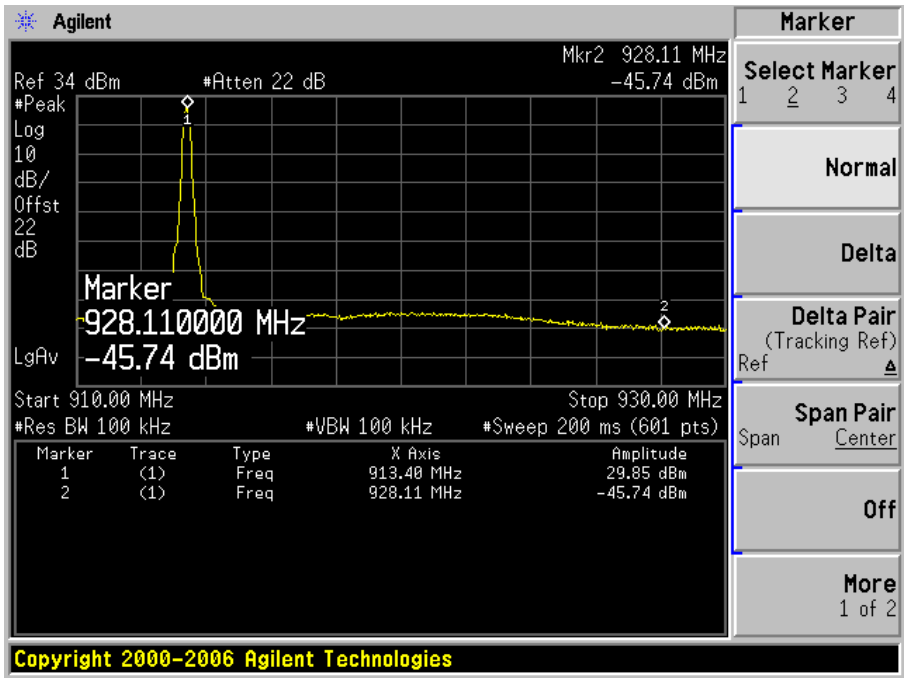
13.5 Measurement Results

Please refer to the following plots.

Band Edge: Lowest Channel



Band Edge: Highest Channel



14 FCC §2.1051 & §15.247(d) SPURIOUS EMISSIONS AT ANTENNA PORT

14.1 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

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band 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. Attenuation below the general limits specified in §15.209(a) is not required.

14.2 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.

14.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4440A	MY44303352	2009-04-27

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

14.4 Test Environmental Conditions

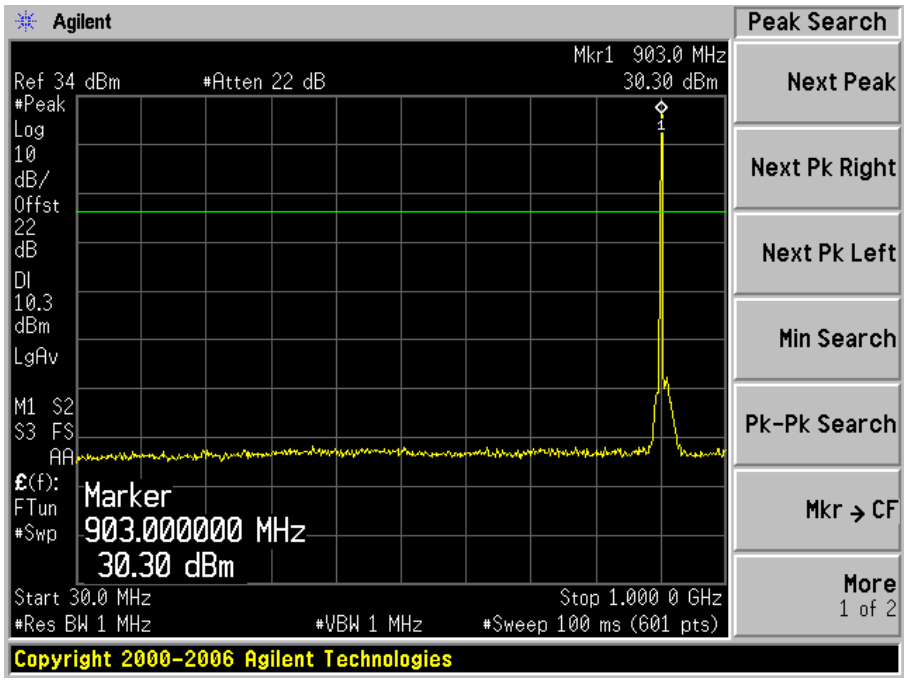
Temperature:	22.7 ºC
Relative Humidity:	42 %
ATM Pressure:	102.2kPa

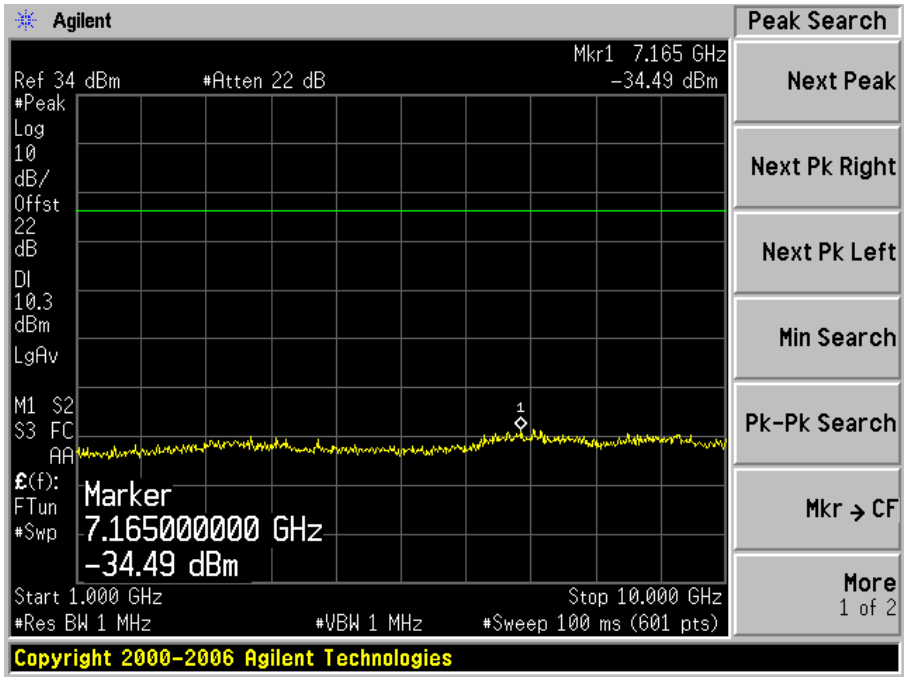
** Testing was performed by Kevin Li on 2010-02-10 in RF Site.*

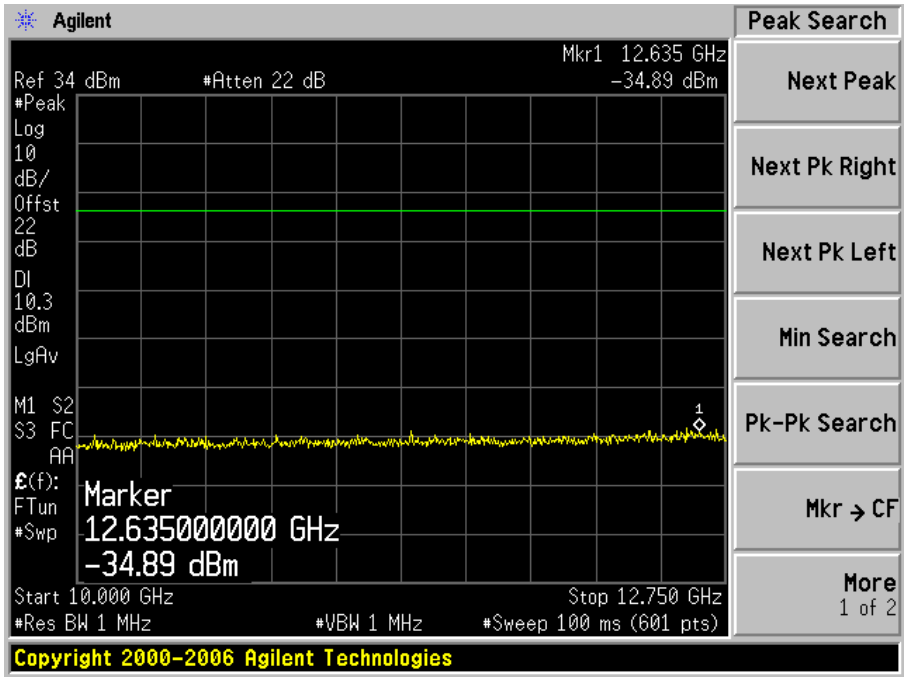
14.5 Measurement Results

Please refer to the following plots.

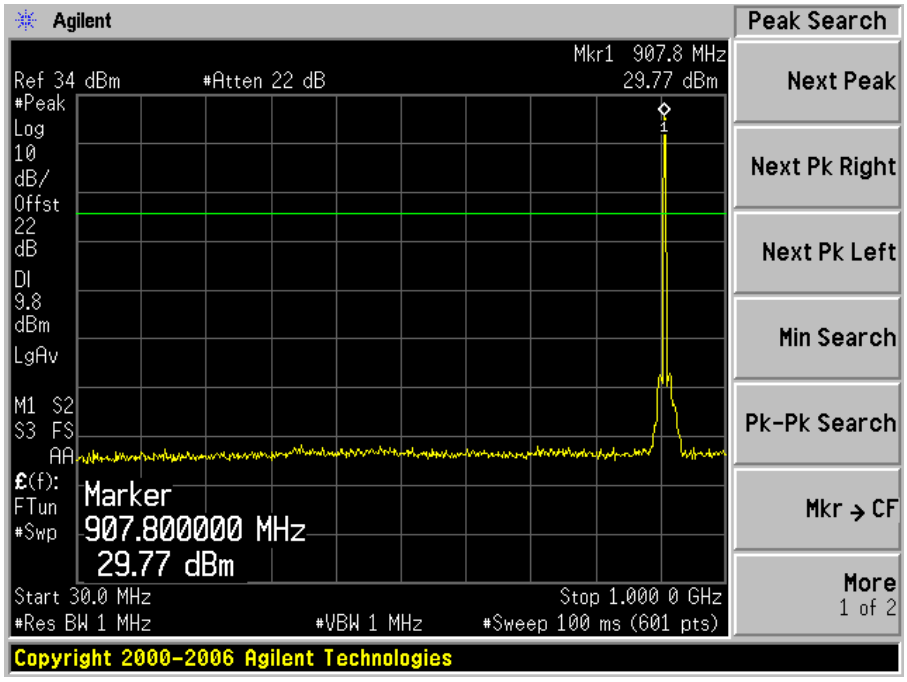
Low Channel

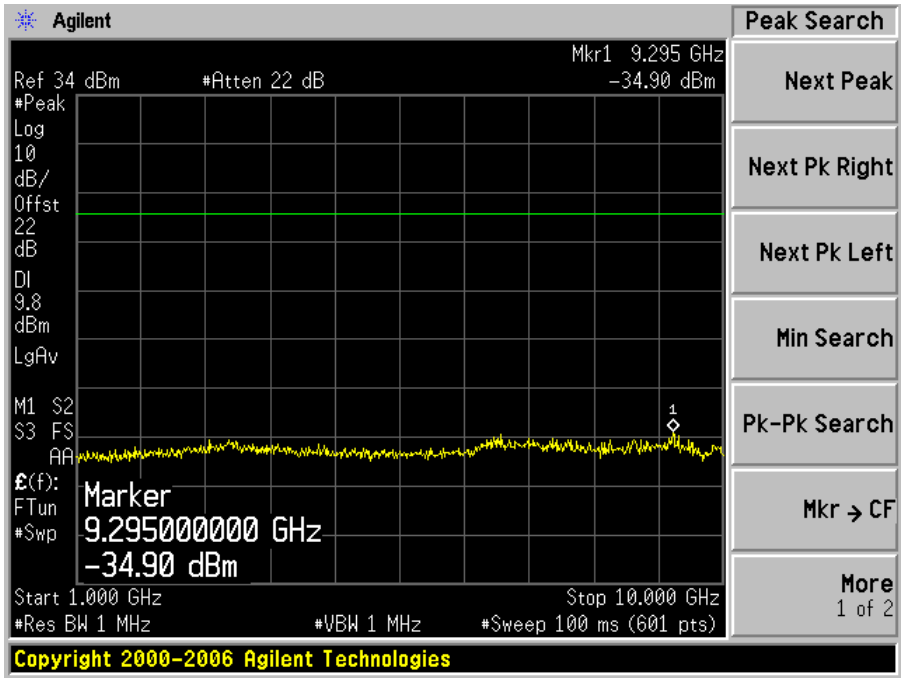


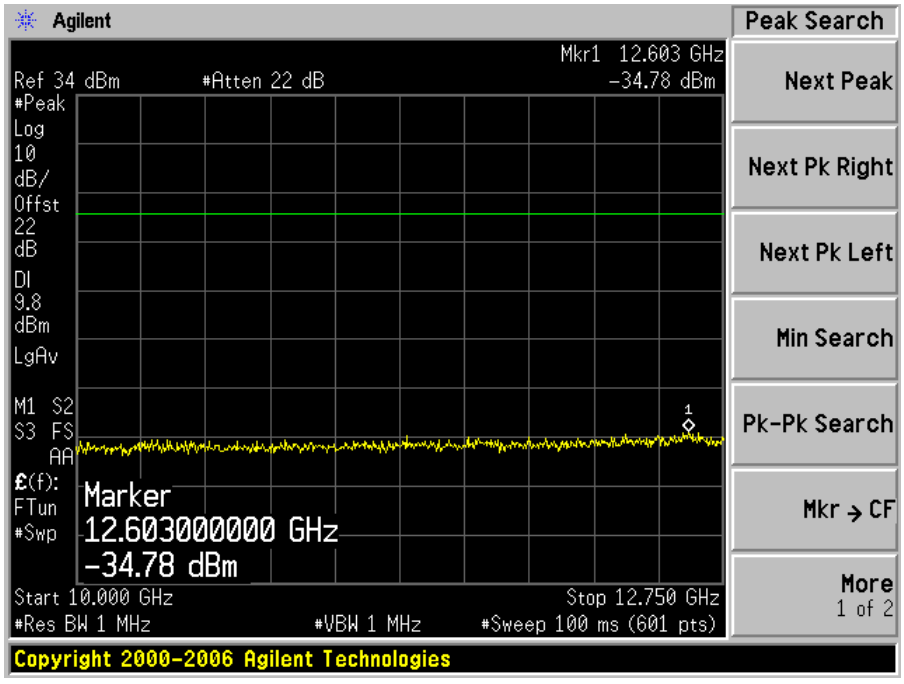




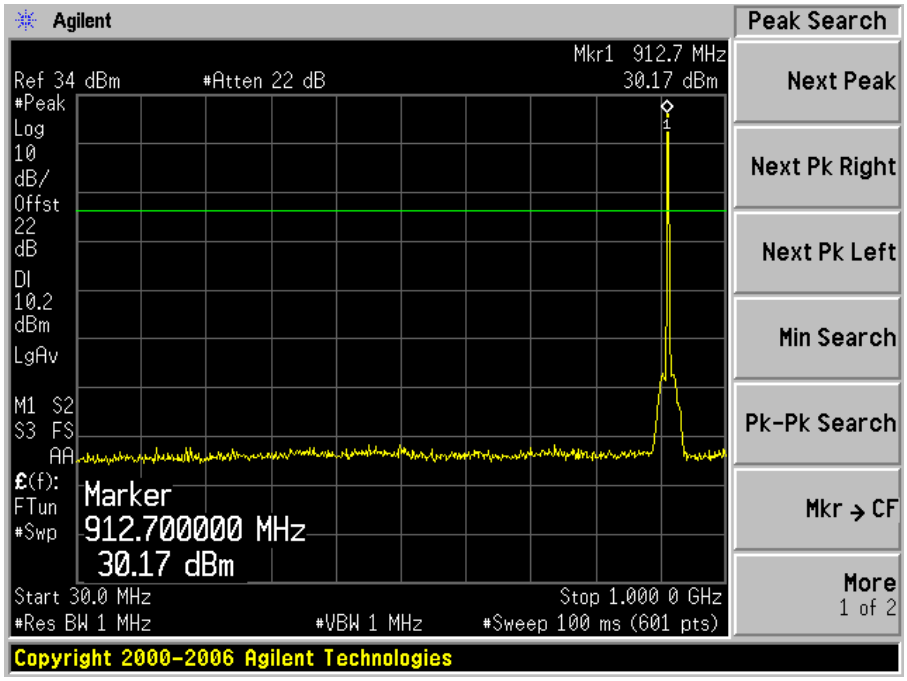
Middle Channel

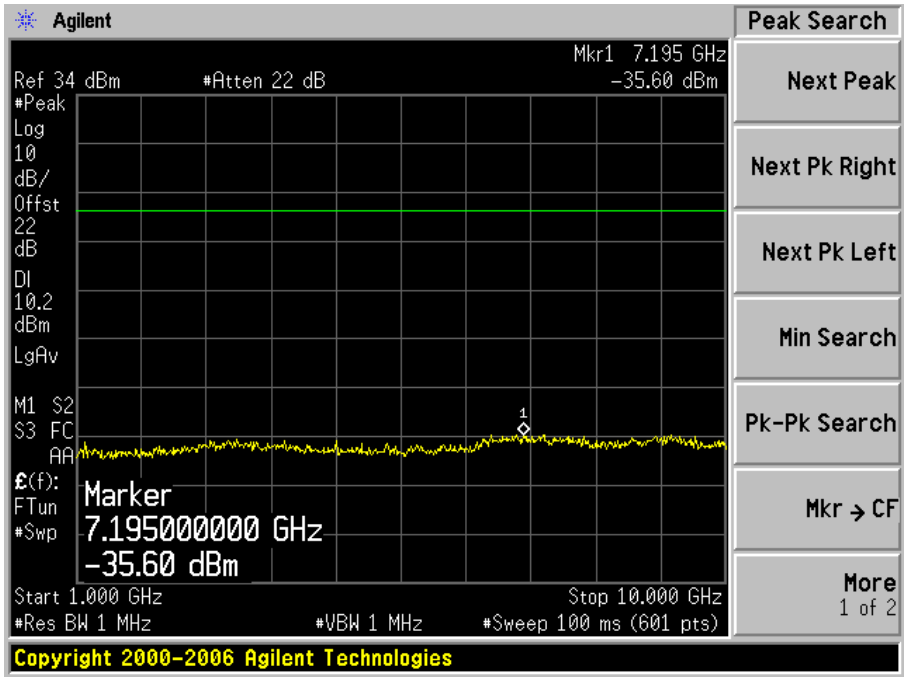


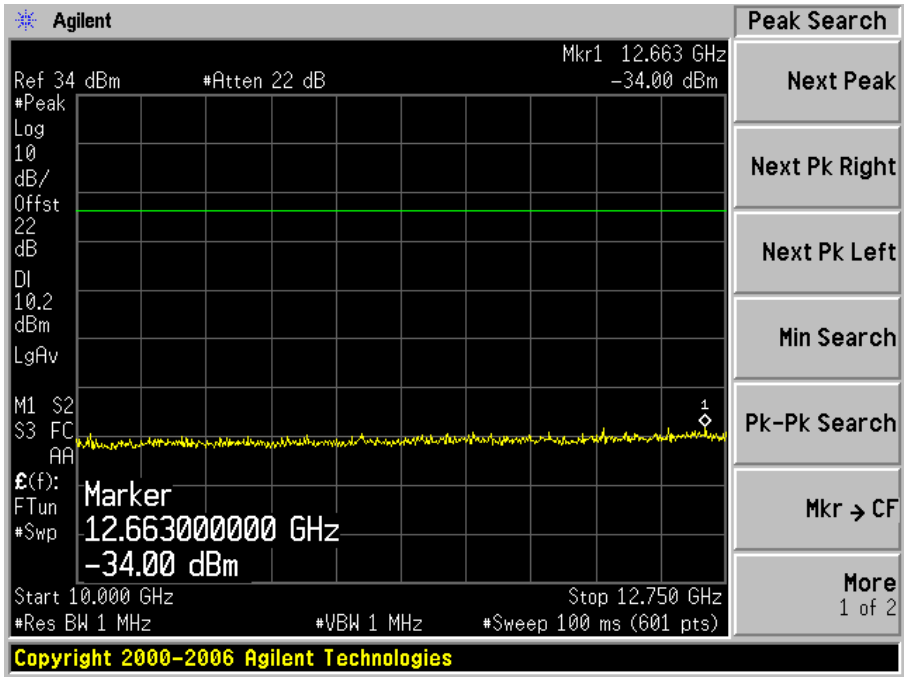

Agilent
Peak Search
Mkr1 9.295 GHz
Ref 34 dBm
#Atten 22 dB
-34.90 dBm
#Peak
Log
10
dB/
Offst
22
dB
Dl
9.8
dBm
LgAv
M1 S2
S3 FS
AA
£(f):
FTun
#Swp
Marker
9.295000000 GHz
-34.90 dBm
Start 1.000 GHz
Stop 10.000 GHz
#Res BW 1 MHz
#VBW 1 MHz
#Sweep 100 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Copyright 2000-2006 Agilent Technologies


Agilent
Peak Search
Mkr1 12.603 GHz
Ref 34 dBm
#Atten 22 dB
-34.78 dBm
#Peak
Log
10
dB/
Offst
22
dB
Dl
9.8
dBm
LgAv
M1 S2
S3 FS
AA
£(f):
FTun
#Swp
Marker
12.603000000 GHz
-34.78 dBm
Start 10.000 GHz
Stop 12.750 GHz
#Res BW 1 MHz
#VBW 1 MHz
#Sweep 100 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Copyright 2000-2006 Agilent Technologies

High Channel






Agilent
Peak Search
Mkr1 12.663 GHz
Ref 34 dBm
#Atten 22 dB
-34.00 dBm
#Peak
Log
10
dB/
Offst
22
dB
Dl
10.2
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
#Swp
Marker
12.663000000 GHz
-34.00 dBm
Start 10.000 GHz
#Res BW 1 MHz
#VBW 1 MHz
Stop 12.750 GHz
#Sweep 100 ms (601 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
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