FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT

For

Dust Networks, Inc.

30695 Huntwood Ave. Hayward, CA 94544

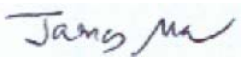
FCC ID: SJCM1030

This Report Concerns:	**Equipment Type:**
☒ Original Report	SmartMesh M1030 Mote Module

Test Engineer: Snell Leong

Report No.: R0601231

Report Date: 2006-1-25



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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Dust Networks, Inc,* FCC ID: *SJCM1030* or the "EUT" as referred to in this report is a SmartMesh M1030 Mote module, which measures approximately 44mmL x 25mm W x 1mm H. The EUT is a frequency-hopping device, which operates at the frequency range of 902.49– 927.48MHz, with the maximum conducted output power of 5.39dBm (3.46mW) and emission designator 180KF1D.

** The test data gathered are from a production sample, S/N: 181, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Dust Networks, Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

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

Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA with registration number: 90464.

Test site at BACL has 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 and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. 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

SYSTEM TEST CONFIGURATION

Justification

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

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

EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the system components.

Once loaded, set the Tx channel to low, mid and high for testing.

Special Accessories

As shown in following test block diagram, all interface cables used for compliance testing are shielded.

Schematics / Block Diagram

Please refer to Appendix A.

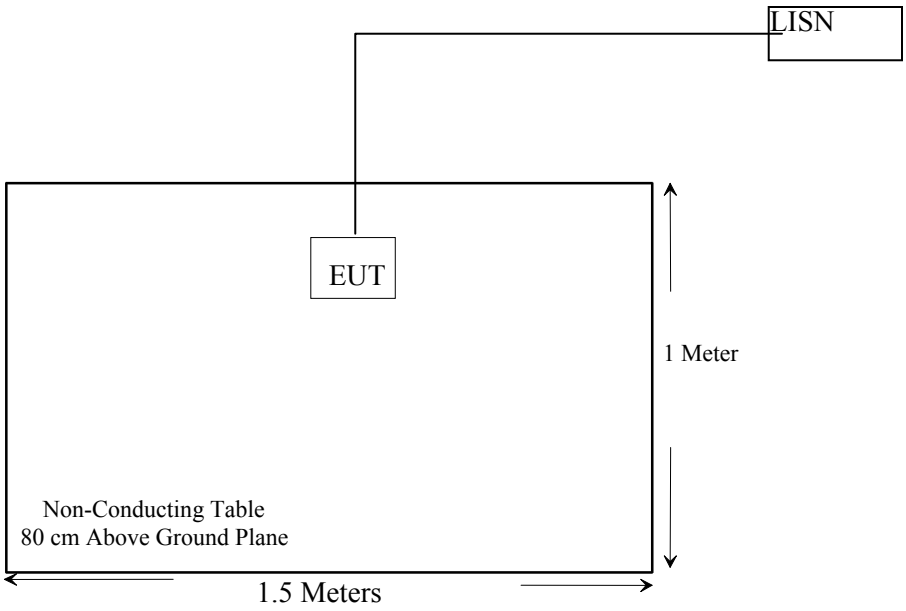
Equipment Modifications

No modifications were made to the EUT.

Configuration of Test System

EUT

Test Setup Block Diagram



SUMMARY OF TEST RESULTS FOR FCC PART 15

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§ 15.205	Restricted Bands	Compliant
§15.207 (a)	Conducted Emission	Compliant
§15.209	Radiated Emission	Compliant
§15.247 (a) (1)	Hopping Channel Separation	Compliant
§15.247 (a) (1)	Channel Bandwidth	Compliant
§15.247 (a) (1) (i)	Number of Hopping Frequencies Used	Compliant
§15.247 (a) (1) (i)	Dwell Time of Each Frequency	Compliant
§15.247 (b) (2)	Maximum Peak Output Power	Compliant
§2.1091& §2.1093	RF Safety Requirements	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§ 2.1051	Spurious Emission at Antenna Port	Compliant

§ 15.247 (b) (5) and § 2.1093 - RF EXPOSURE

According to §15.247(b)(5) 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.

Exposure category	low threshold	high threshold
general population	$(60/f_{GHz})$ mW, $d < 2.5$ cm $(120/f_{GHz})$ mW, $d \geq 2.5$ cm	$(900/f_{GHz})$ mW, $d < 20$ cm
occupational	$(375/f_{GHz})$ mW, $d < 2.5$ cm $(900/f_{GHz})$ mW, $d \geq 2.5$ cm	$(2250/f_{GHz})$ mW, $d < 20$ cm

Result:
Since the Power density of EUT is less than low threshold, therefore Routine SAR evaluation is not required

ANTENNA REQUIREMENT

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 antenna for the EUT is an integral antenna. The gain of antenna used for transmitting is 2dBi peak.

Please see EUT photo for details.

§15.207 (a) - CONDUCTED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are receiver, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is $\pm$2.4 dB.

Test Setup

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

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

The EUT was connected with LISN-1.

Receiver Setup

The EMI receiver was set to investigate the spectrum from 150 kHz to 30MHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
R&S	Receiver, EMI Test	ESCS30	100176	2005-09-15
R&S	Artificial Mains Network	ESH2-Z5	871884/039	2005-08-16

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

Test Procedure

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

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

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

**The testing was performed by Snell Leong on 2006-1-23.*

Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Conducted limit for a Class B device, with the *worst* margin reading of:

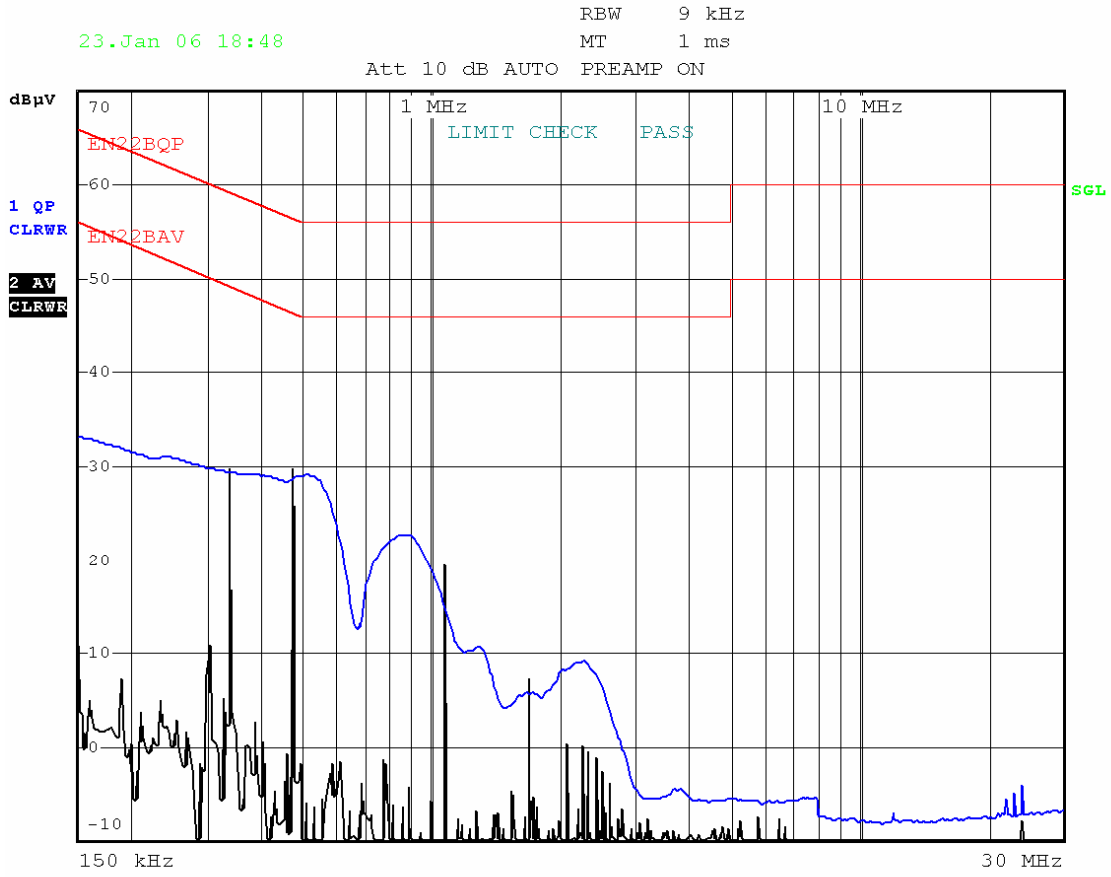
-15.9 dB at **0.689 MHz** in the **Line** conductor

Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.689	30.1	Ave	Line	46.00	-15.9
0.460	29.5	Ave	Line	46.69	-17.2
0.812	19.3	Ave	Line	46.00	-26.7
1.050	18.9	Ave	Neutral	46.00	-27.1
0.460	29.5	QP	Line	56.69	-27.2
0.689	28.3	QP	Line	56.00	-27.7
0.330	18.1	Ave	Neutral	49.45	-31.4
0.475	13.5	Ave	Neutral	46.43	-32.9
0.330	21.4	QP	Neutral	59.45	-38.1
0.812	15.2	QP	Line	56.00	-40.8
0.475	14.7	QP	Neutral	56.43	-41.7
1.050	14.0	QP	Neutral	56.00	-42.0

Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented in the following page as reference.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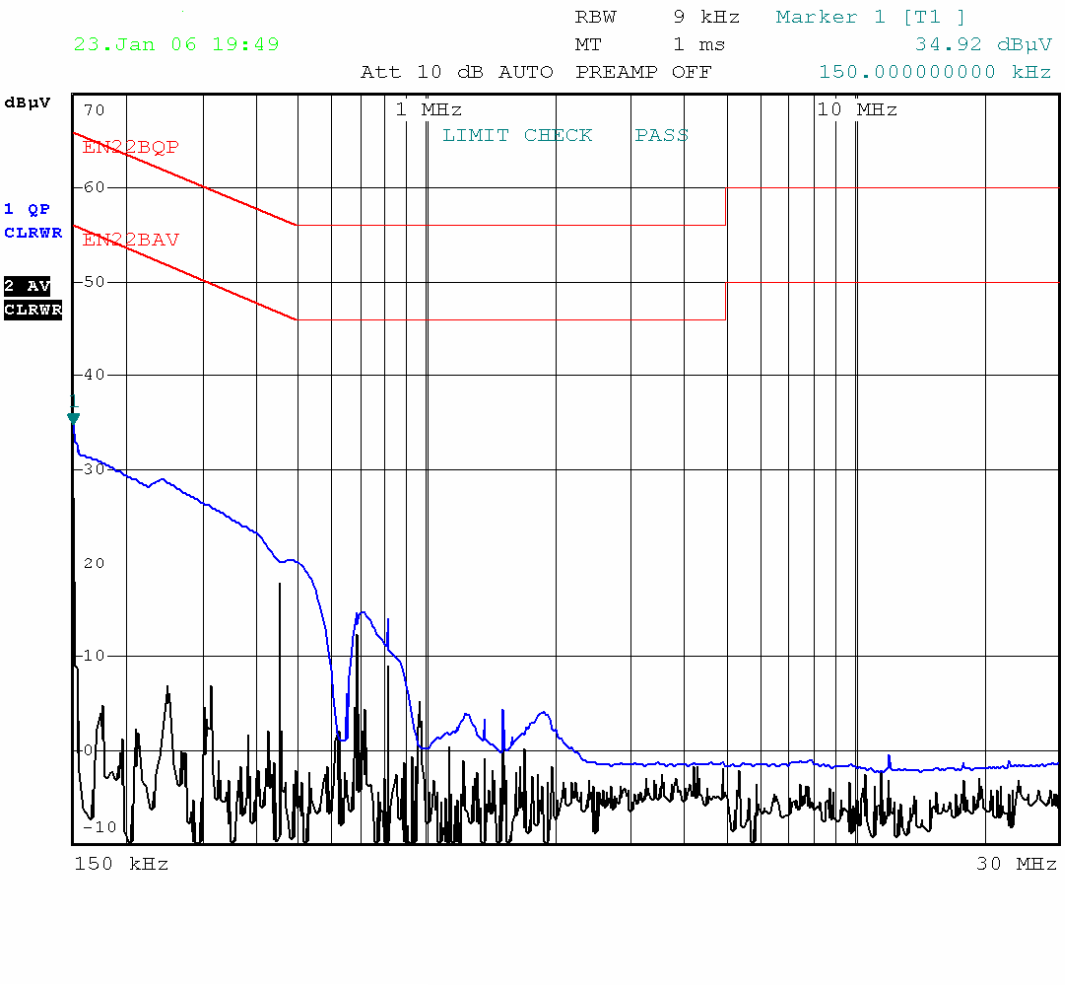
MT 1 ms
23.Jan 06 18:48
Att 10 dB AUTO PREAMP ON
dBµV
70
1 MHz
10 MHz
LIMIT CHECK PASS
EN22BQP
SGL
1 QP
CLRWR
EN22BAV
2 AV
CLRWR
60
50
40
30
20
10
0
-10
150 kHz
30 MHz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MT 1 ms
34.92 dBµV
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150.000000000 kHz
dBµV
70
1 MHz
LIMIT CHECK PASS
10 MHz
EN22BQP
60
1 QP
CLRWR
EN22BAV
2 AV
CLRWR
50
40
30
20
10
0
-10
150 kHz
30 MHz

§15.205, §15.209 & §15.247© - RADIATED EMISSION

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 best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

Test Setup

The radiated emission 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.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 10GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Amplifier, Pre (.1 ~1300MHz)	8447D	2944A10198	2005-08-20
Agilent	Analyzer, Spectrum	E4446A	US44300386	2005-11-10
HP	Pre, Amplifier (1 ~ 26.5 GHz)	8449B	3147A00400	2005-05-10
EMCO	Antenna, Log-Periodic	3148	4-1155	2005-12-14
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	2005-04-20
EMCO	Antenna, Biconical	3110B	9603-2315	2005-12-14

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

**The testing was performed by Snell Leong on 2006-1-23.*

Test Procedure

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

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

Corrected Amplitude & Margin Calculation

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

Corr. Ampl. = 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 for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. - Class B Limit

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, and had the worst margin of:

For Half Pole Antenna 2 dBi

-21.6 dB at **1804.9828 MHz** in the **Vertical** polarization, Low Channel, 3 meters

-22.6 dB at **1829.2076 MHz** in the **Vertical** polarization, Middle Channel, 3 meters

-22.0 dB at **1854.9646 MHz** in the **Vertical** polarization, High Channel, 3 meters

For Short Pole Antenna 2 dBi

-22.2 dB at **1804.9828 MHz** in the **Vertical** polarization, Low Channel, 3 meters

-23.1 dB at **1829.2076 MHz** in the **Vertical** polarization, Middle Channel, 3 meters

-22.5 dB at **1854.9646 MHz** in the **Vertical** polarization, High Channel, 3 meters

-23.0 dB at **120.20 MHz** in the **Horizontal** polarization, Unintentional Emission, 3 meters

Radiated Emission Test Data @ 3 meter

Half Pole Antenna 2 dBi

Indicated			Antenna	Antenna		Correction Factor			FCC 15.247		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB	
Low Channel											
1804.9828	42.0	270	2.4	v	24.8	1.9	36.3	32.4	54	-21.6	Ave
2707.4742	31.1	180	2.0	v	28.9	2.4	35.5	27.0	54	-27.0	Ave
2707.4742	30.8	90	2.0	h	28.9	2.4	35.5	26.6	54	-27.4	Ave
1804.9828	55.1	270	2.4	v	24.8	1.9	36.3	45.4	74	-28.6	Peak
1804.9828	33.9	180	2.3	h	24.8	1.9	36.3	24.2	54	-29.8	Ave
2707.4742	41.4	90	2.0	v	28.9	2.4	35.5	37.2	74	-36.8	Peak
2707.4742	41.0	180	2.0	h	28.9	2.4	35.5	36.8	74	-37.2	Peak
1804.9828	44.8	180	2.3	h	24.8	1.9	36.3	35.1	74	-38.9	Peak
Middle Channel											
1829.2076	41.1	270	2.4	v	24.8	1.9	36.3	31.4	54	-22.6	Ave
1829.2076	37.8	180	2.2	h	24.8	1.9	36.3	28.1	54	-25.9	Ave
2743.8114	32.3	270	2.4	v	28.9	2.4	35.5	28.1	54	-25.9	Ave
2743.8114	30.0	180	2.1	h	28.9	2.4	35.5	25.8	54	-28.2	Ave
1829.2076	53.8	270	2.4	v	24.8	1.9	36.3	44.1	74	-29.9	Peak
1829.2076	49.8	180	2.2	h	24.8	1.9	36.3	40.1	74	-33.9	Peak
2743.8114	42.9	270	2.4	v	28.9	2.4	35.5	38.7	74	-35.3	Peak
2743.8114	40.0	180	2.3	h	28.9	2.4	35.5	35.8	74	-38.2	Peak
High Channel											
1854.9646	41.7	270	2.4	v	24.8	1.9	36.3	32.0	54	-22.0	Ave
1854.9646	38.4	90	2.1	h	24.8	1.9	36.3	28.7	54	-25.3	Ave
2782.4469	32.1	270	2.4	v	28.9	2.4	35.5	27.9	54	-26.1	Ave
2782.4469	29.8	90	2.1	h	28.9	2.4	35.5	25.6	54	-28.4	Ave
1854.9646	54.6	270	2.4	v	24.8	1.9	36.3	44.9	74	-29.1	Peak
1854.9646	50.5	90	2.1	h	24.8	1.9	36.3	40.8	74	-33.2	Peak
2782.4469	42.7	270	2.4	v	28.9	2.4	35.5	38.5	74	-35.5	Peak
2782.4469	39.8	90	2.1	h	28.9	2.4	35.5	35.6	74	-38.4	Peak

Short Pole Antenna 2 dBi

Indicated			Antenna	Antenna		Correction Factor			FCC 15.247		
Freqency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB	
Low Channel											
1804.9828	41.5	270	2.4	v	24.8	1.9	36.3	31.8	54	-22.2	Ave
2707.4742	30.8	180	2.0	v	28.9	2.4	35.5	26.6	54	-27.4	Ave
2707.4742	30.5	90	2.0	h	28.9	2.4	35.5	26.3	54	-27.7	Ave
1804.9828	54.3	270	2.4	v	24.8	1.9	36.3	44.6	74	-29.4	Peak
1804.9828	33.5	180	2.3	h	24.8	1.9	36.3	23.8	54	-30.2	Ave
2707.4742	40.9	90	2.0	v	28.9	2.4	35.5	36.7	74	-37.3	Peak
2707.4742	40.5	180	2.0	h	28.9	2.4	35.5	36.3	74	-37.7	Peak
1804.9828	44.2	180	2.3	h	24.8	1.9	36.3	34.5	74	-39.5	Peak
Middle Channel											
1829.2076	40.5	270	2.4	v	24.8	1.9	36.3	30.9	54	-23.1	Ave
2743.8114	32.0	270	2.4	v	28.9	2.4	35.5	27.8	54	-26.2	Ave
1829.2076	37.4	180	2.2	h	24.8	1.9	36.3	27.7	54	-26.3	Ave
2743.8114	29.7	180	2.1	h	28.9	2.4	35.5	25.5	54	-28.5	Ave
1829.2076	53.1	270	2.4	v	24.8	1.9	36.3	43.4	74	-30.6	Peak
1829.2076	49.1	180	2.2	h	24.8	1.9	36.3	39.4	74	-34.6	Peak
2743.8114	42.3	270	2.4	v	28.9	2.4	35.5	38.1	74	-35.9	Peak
2743.8114	39.5	180	2.3	h	28.9	2.4	35.5	35.3	74	-38.7	Peak
High Channel											
1854.9646	41.2	270	2.4	v	24.8	1.9	36.3	31.5	54	-22.5	Ave
1854.9646	37.9	90	2.1	h	24.8	1.9	36.3	28.2	54	-25.8	Ave
2782.4469	31.8	270	2.4	v	28.9	2.4	35.5	27.6	54	-26.4	Ave
2782.4469	29.5	90	2.1	h	28.9	2.4	35.5	25.3	54	-28.7	Ave
1854.9646	53.8	270	2.4	v	24.8	1.9	36.3	44.1	74	-29.9	Peak
1854.9646	49.7	90	2.1	h	24.8	1.9	36.3	40.1	74	-33.9	Peak
2782.4469	42.1	270	2.4	v	28.9	2.4	35.5	37.9	74	-36.1	Peak
2782.4469	39.3	90	2.1	h	28.9	2.4	35.5	35.1	74	-38.9	Peak

Note:

FUND: Fundamental
AVG: Average

Unintentional Emission @ 3 meter

Indicated			Antenna	Antenna		Correction Factor			FCC 15.109	
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB
120.20	32.3	280	2.8	H	14.0	2.4	28.2	20.5	43.5	-23.0
121.00	30.1	270	2.1	H	14.0	2.4	28.2	18.3	43.5	-25.2
120.20	29.7	250	1.0	V	14.0	2.4	28.2	17.9	43.5	-25.6
121.00	28.6	330	1.2	V	14.0	2.4	28.2	16.8	43.5	-26.7
359.20	26.5	270	3.2	H	14.5	4.2	27.7	17.5	46	-28.5
359.20	22.1	75	1.8	V	14.5	4.2	27.7	13.1	46	-32.9

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

Standard Applicable

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.

Measurement Procedure

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

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

**The testing was performed by Snell Leong on 2006-1-23.*

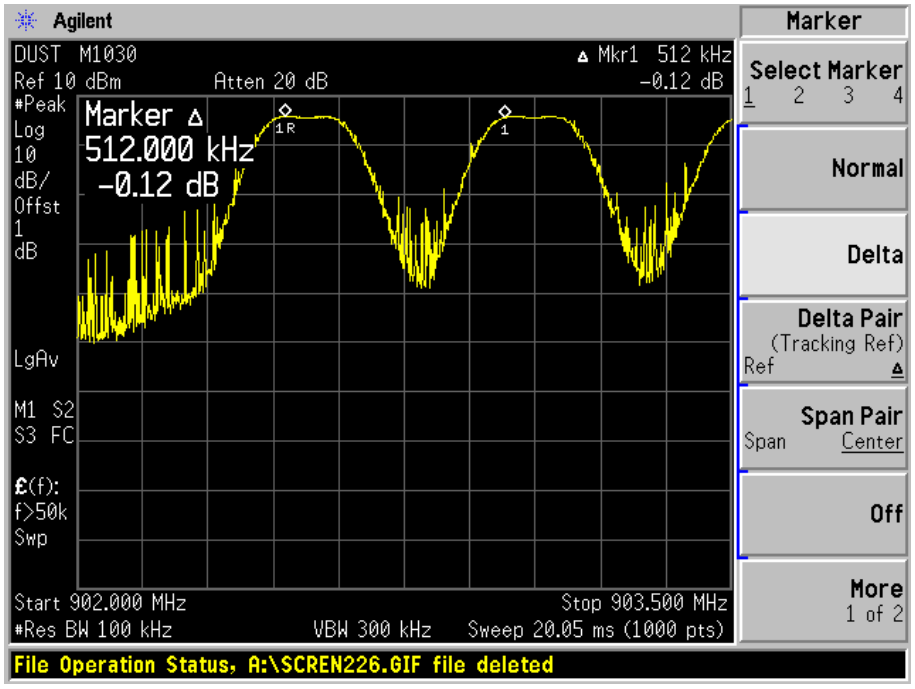
Measurement Results

Channel	Frequency MHz	Channel Separation (KHz)
Low	902.491	512
Mid	914.604	398
High	927.482	492

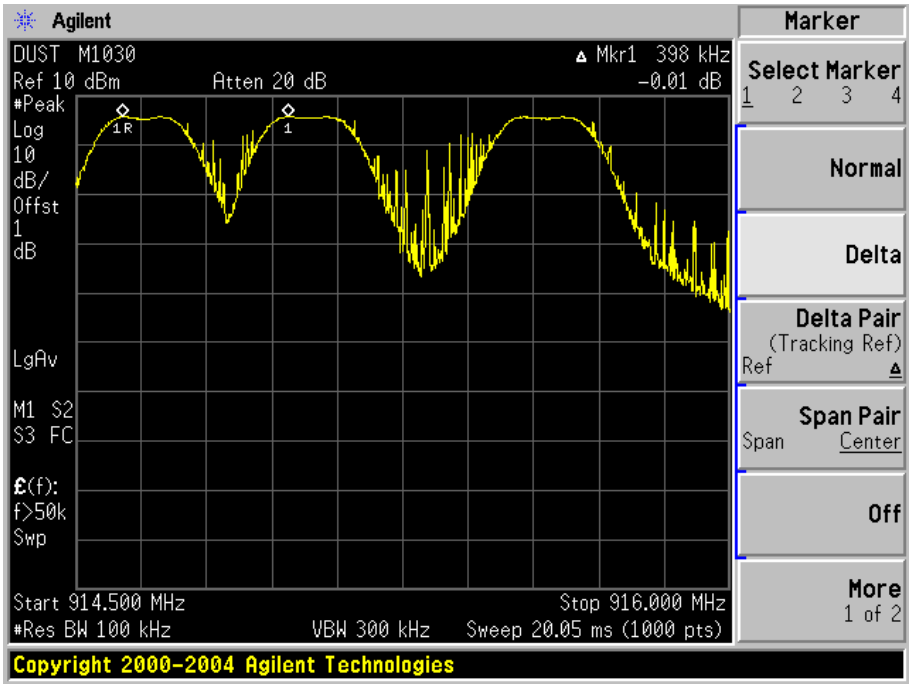
Plots of Hopping Channel Separation

Please refer to the following plots.

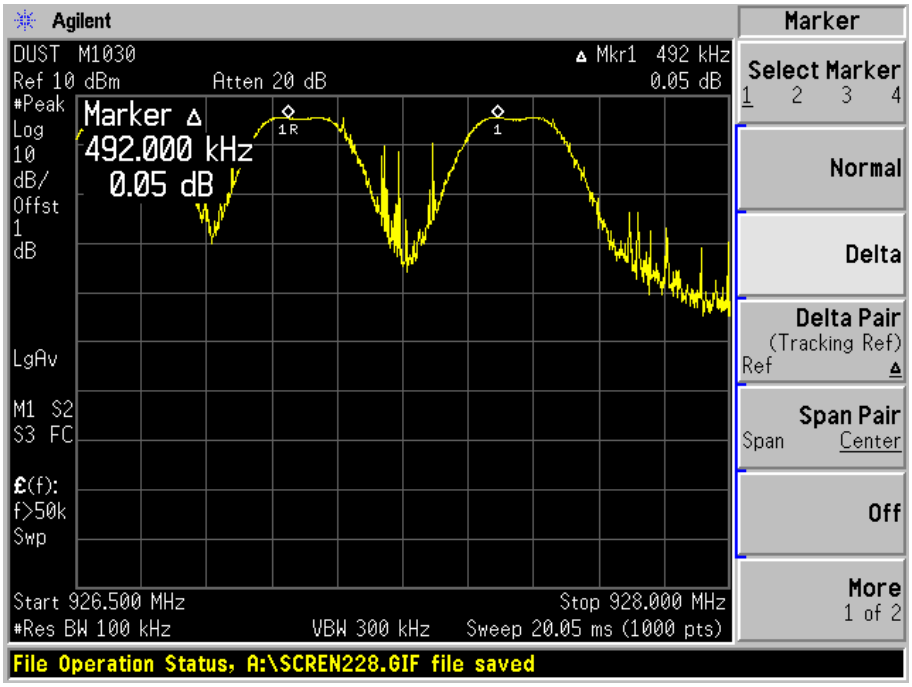
Low Channel



Middle Channel



High Channel



§15.247 (a) (1) - CHANNEL BANDWIDTH

Standard Applicable

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

Measurement Procedure

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

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

**The testing was performed by Snell Leong on 2006-1-23.*

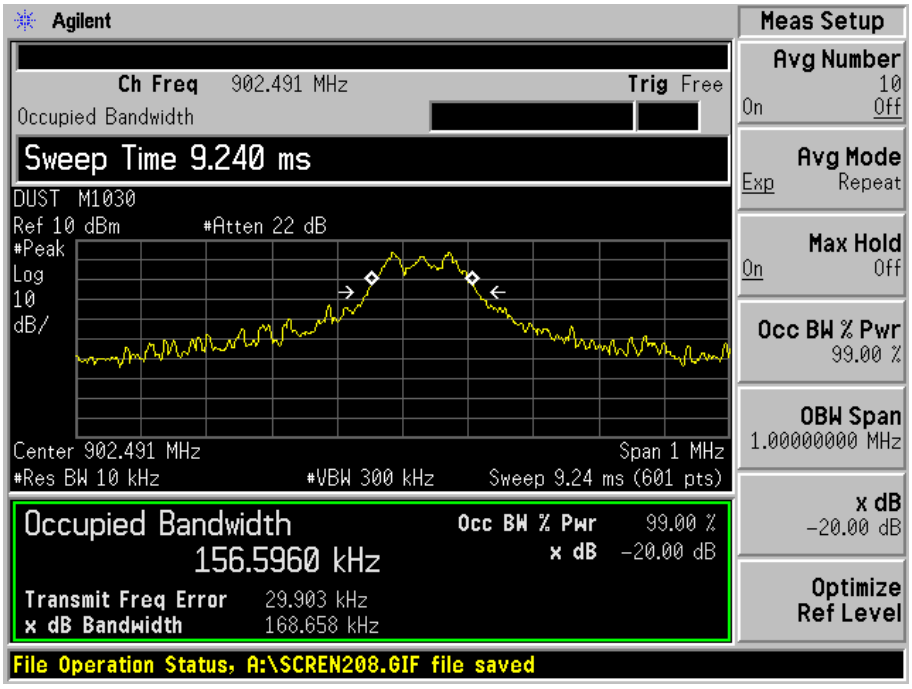
Measurement Result

Channel	Frequency MHz	Channel Bandwidth (KHz)	Limit KHz
Low	902.491	168.66	<500
Mid	914.604	167.31	<500
High	927.482	177.12	<500

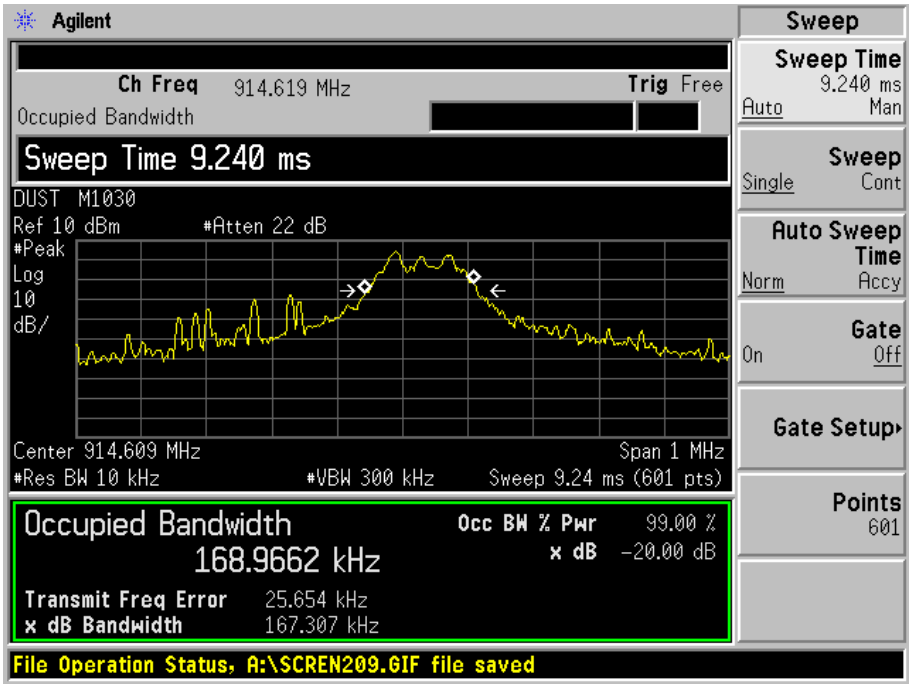
Plot of Channel Bandwidth

Please see the following plots

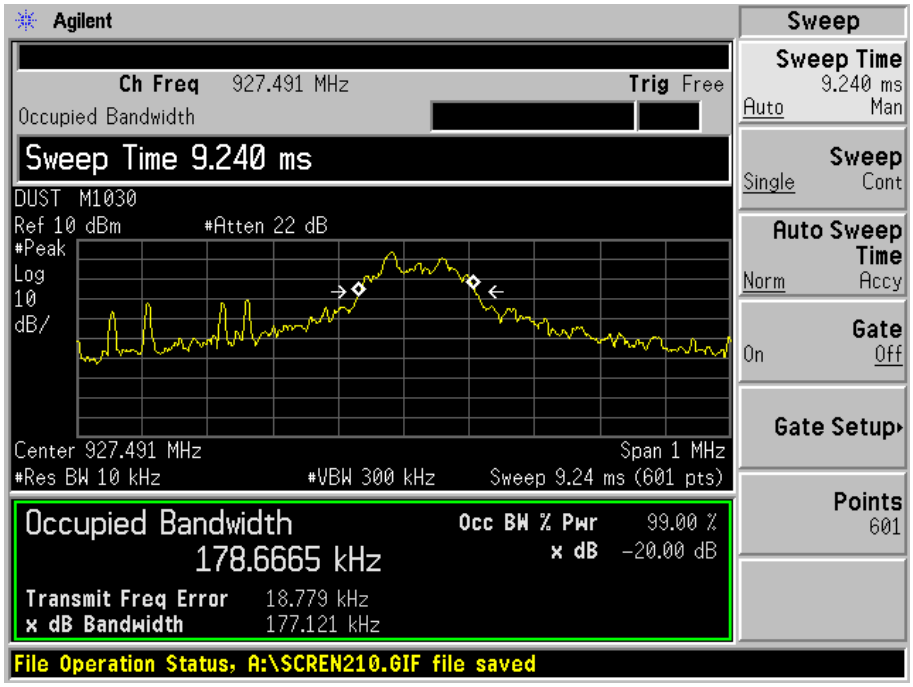
Low Channel



Middle Channel



High Channel



§15.247 (a) (1) (i) - NUMBER OF HOPPING FREQUENCY USED

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.

Measurement Procedure

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

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

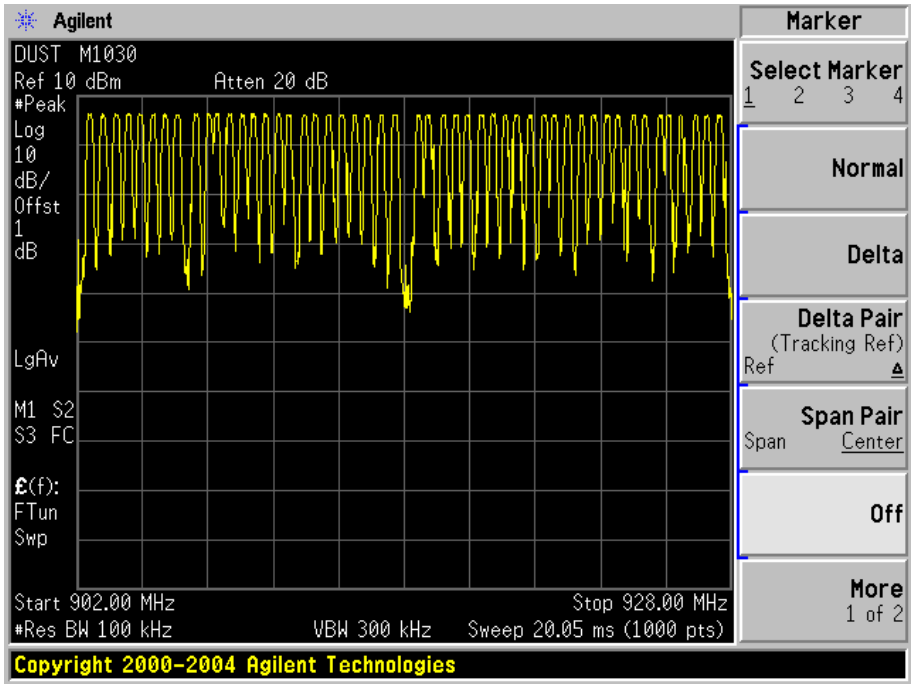
**The testing was performed by Snell Leong on 2006-1-23.*

Measurement Results

Measurement	Standard	Result
50	≥25	Compliant

Plots of Number of Hopping Frequency

Please refer to the attached plots.



§15.247(a)(1)(i) - DWELL TIME

Standard Applicable

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.

Measurement Procedure

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

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

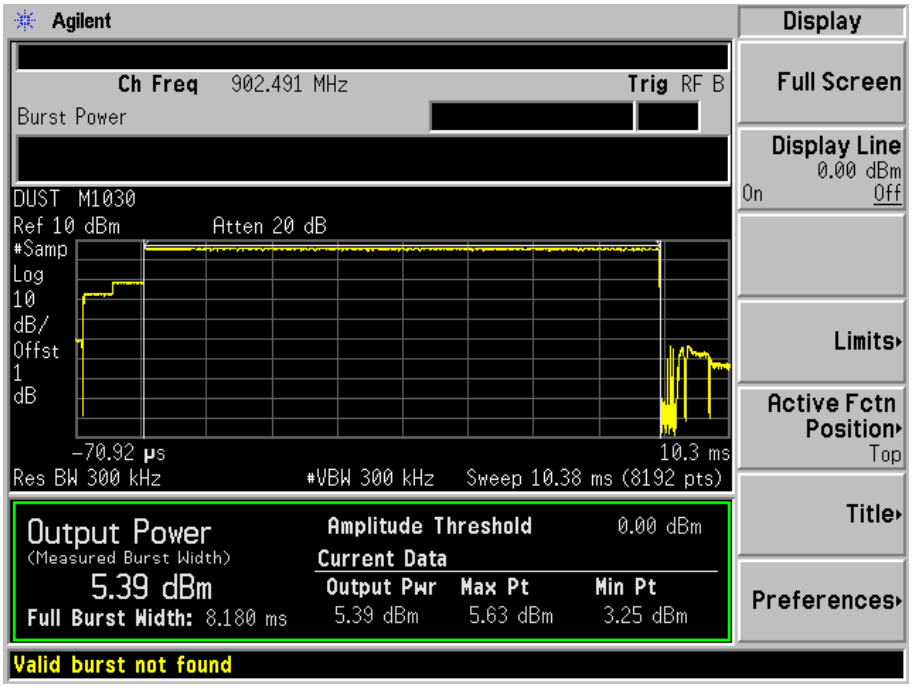
**The testing was performed by Snell Leong on 2006-1-23.*

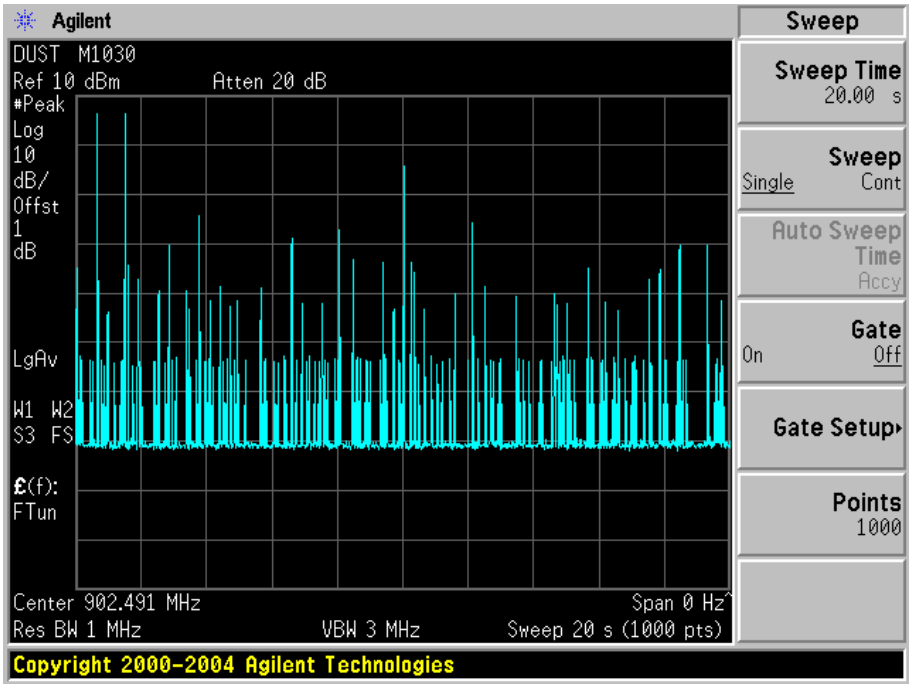
Measurement Results

Channel	Frequency MHz	Pulse Width uSec	Occupied time Per 20 Sec	Dwell Time Sec	Limit Sec
Low	902.491	8180	2	0.016	0.4
Mid	914.604	8168	2	0.016	0.4
High	927.482	8179	1	0.008	0.4

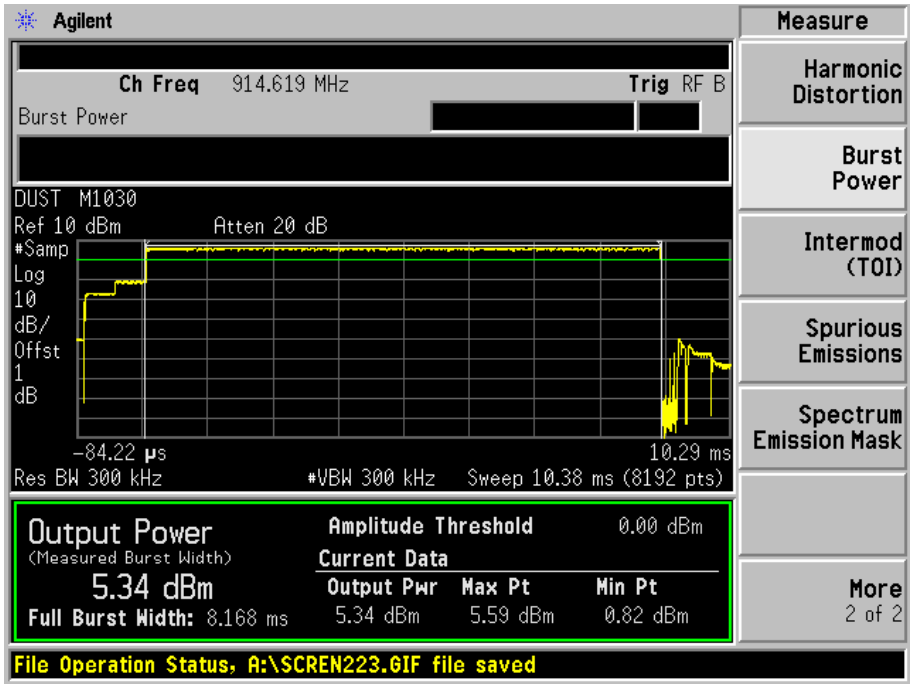
Plots of Dwell Time
Please refer the following plots.

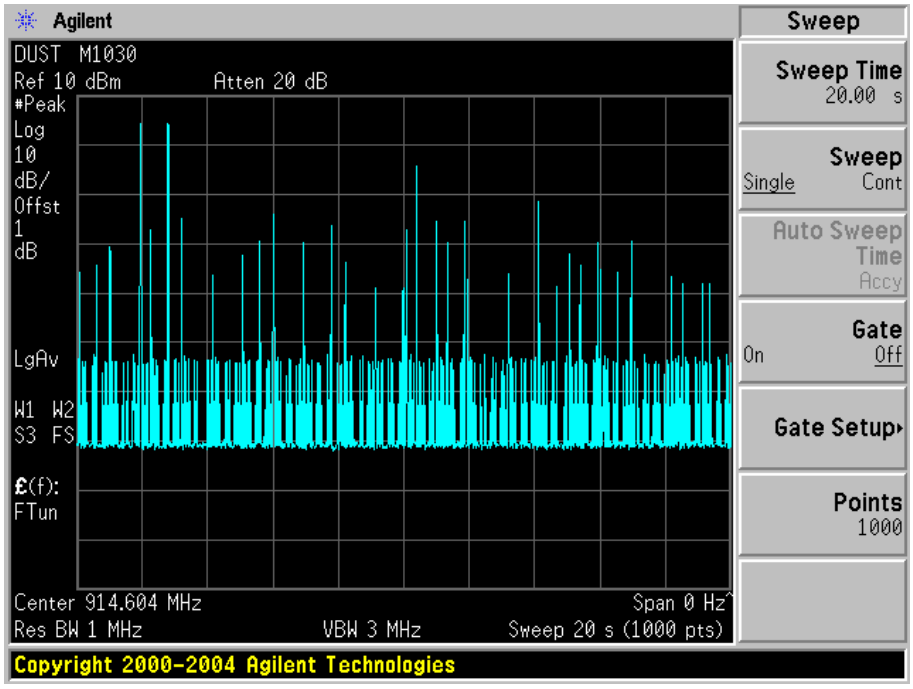
Low Channel


Agilent
Display
Ch Freq 902.491 MHz
Trig RF B
Burst Power
DUST M1030
Ref 10 dBm
Atten 20 dB
#Samp
Log
10
dB/
Offst
1
dB
-70.92 µs
10.3 ms
Res BW 300 kHz
#VBW 300 kHz
Sweep 10.38 ms (8192 pts)
Output Power
(Measured Burst Width)
5.39 dBm
Full Burst Width: 8.180 ms
Amplitude Threshold
0.00 dBm
Current Data
Output Pwr
Max Pt
Min Pt
5.39 dBm
5.63 dBm
3.25 dBm
Valid burst not found
Full Screen
Display Line
0.00 dBm
On
Off
Limits
Active Fctn
Position
Top
Title
Preferences

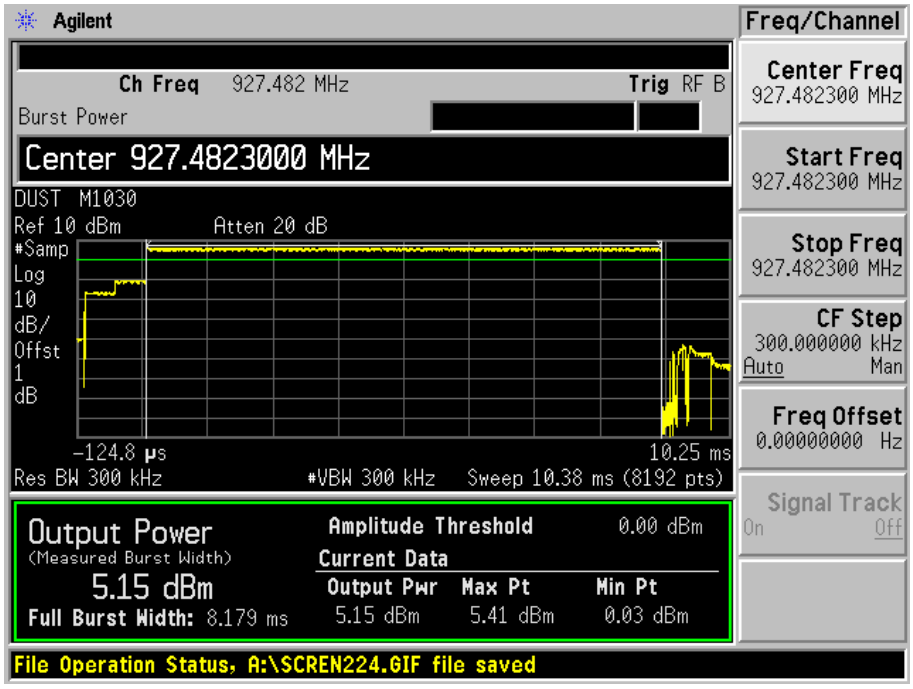

Agilent
Sweep
DUST M1030
Ref 10 dBm
Atten 20 dB
#Peak
Log
10
dB/
Offst
1
dB
LgAv
W1 W2
S3 FS
£(f):
FTun
Center 902.491 MHz
Span 0 Hz
Res BW 1 MHz
VBW 3 MHz
Sweep 20 s (1000 pts)
Copyright 2000-2004 Agilent Technologies
Sweep Time
20.00 s
Sweep
Single
Cont
Auto Sweep
Time
Accy
Gate
On
Off
Gate Setup
Points
1000

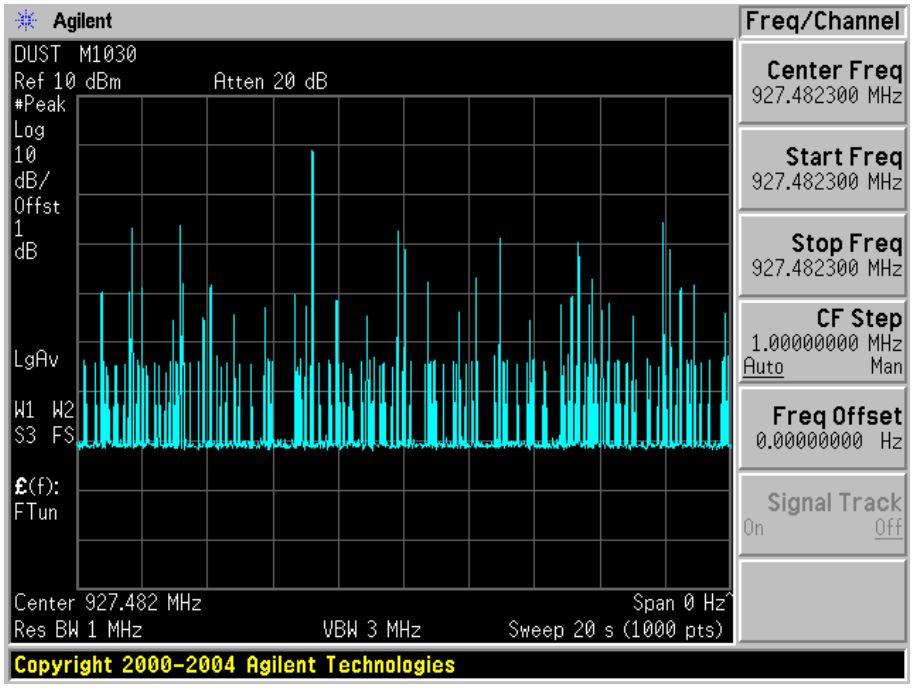
Middle Channel





High Channel





§15.247(b)(2) - MAXIMUM PEAK OUTPUT POWER

Standard Applicable

According to §15.247(b) (2), 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.

Measurement Procedure

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

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

Environmental Conditions

Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1020 mbar

**The testing was performed by Snell Leong on 2006-1-23.*

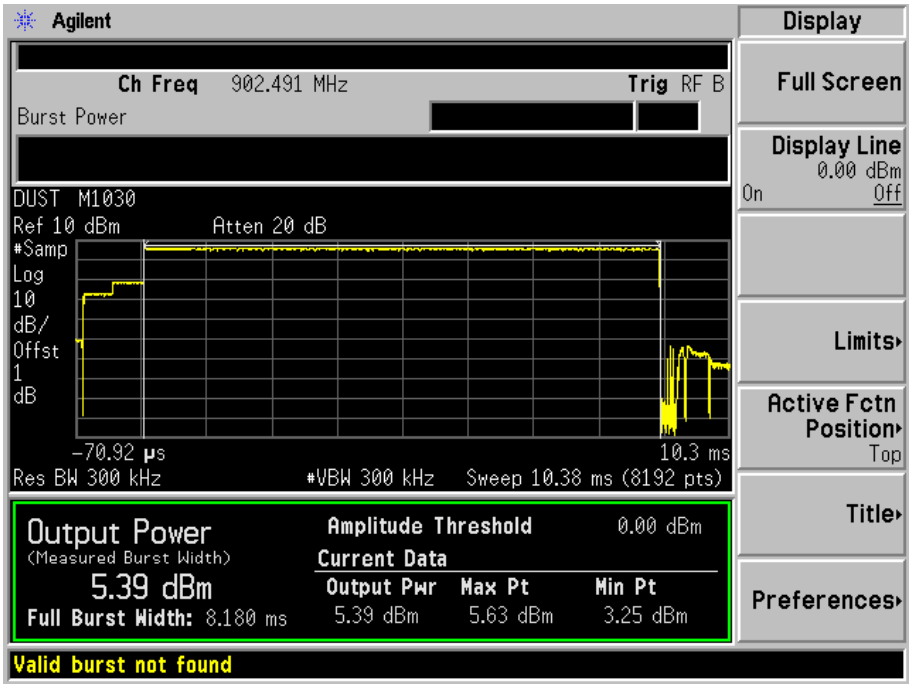
Measurement Result

Channel	Frequency	Max Peak Output Power		Limit	Result
	MHz	(dBm)	(m Watt)	(m Watt)	
Low	902.491	5.39	3.46	1000	Pass
Mid	914.619	5.34	3.42	1000	Pass
High	927.482	5.15	3.27	1000	Pass

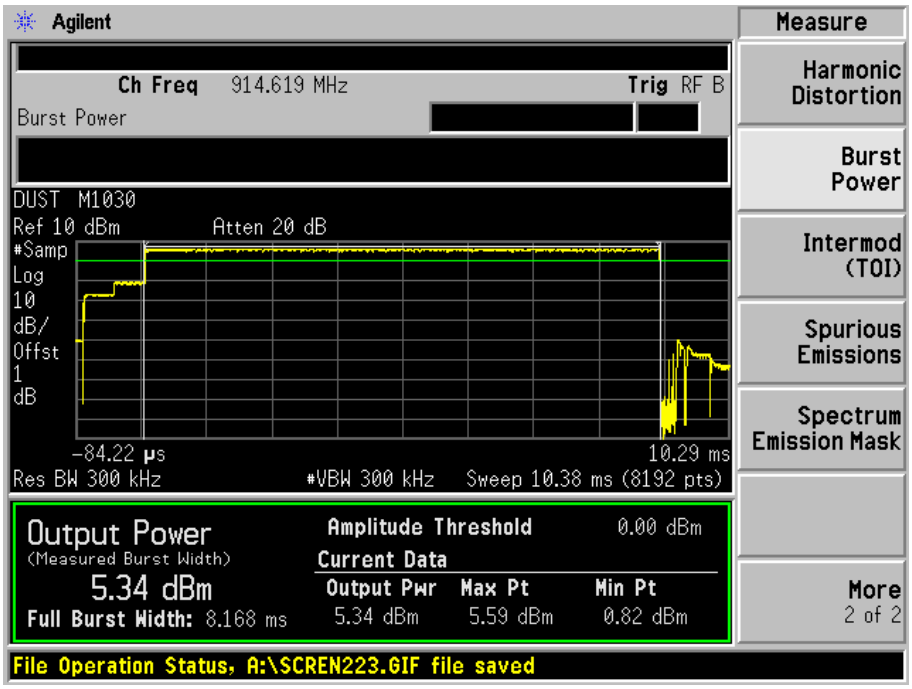
Plots of Maximum Peak Output Power

Please see the following plots

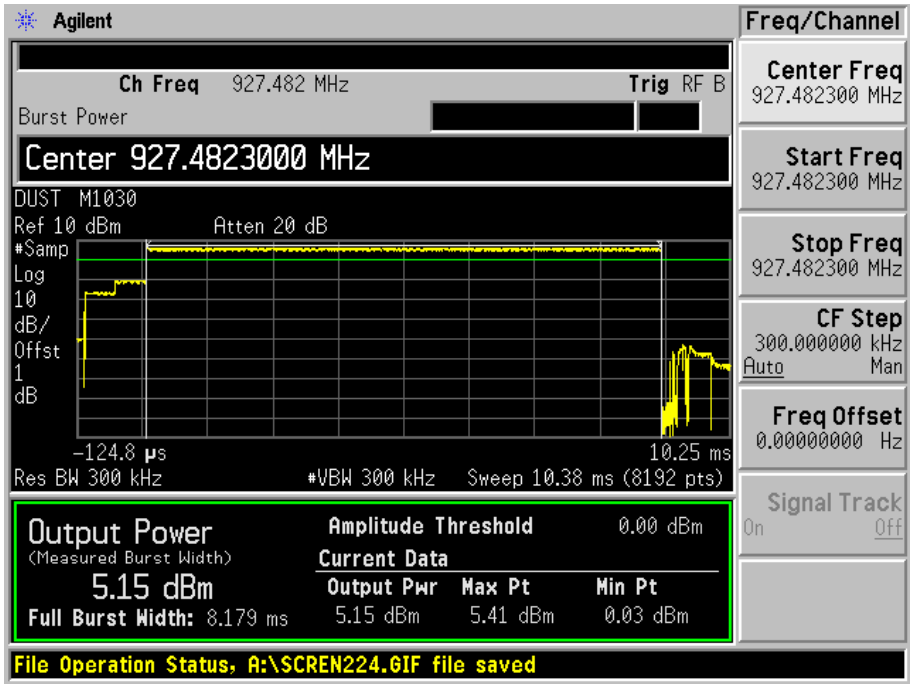
Low Channel



Middle Channel



High Channel



§15.247 (c) - 100 KHZ BANDWIDTH OF BAND EDGES

Standard Applicable

According to §15.247(c), 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.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

Environmental Conditions

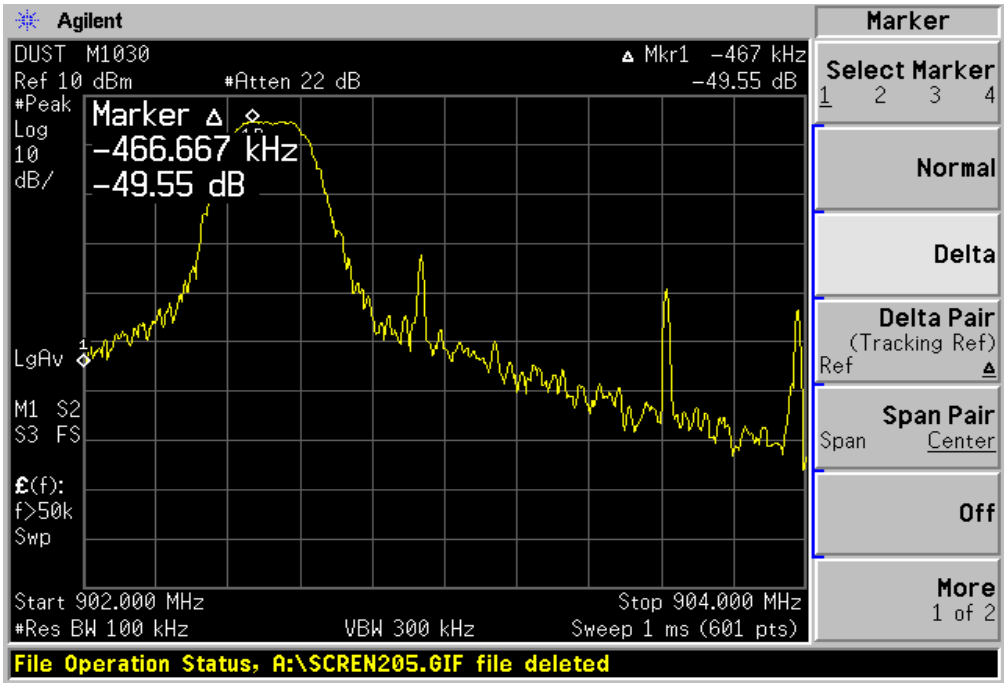
Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

**The testing was performed by Snell Leong on 2006-1-23.*

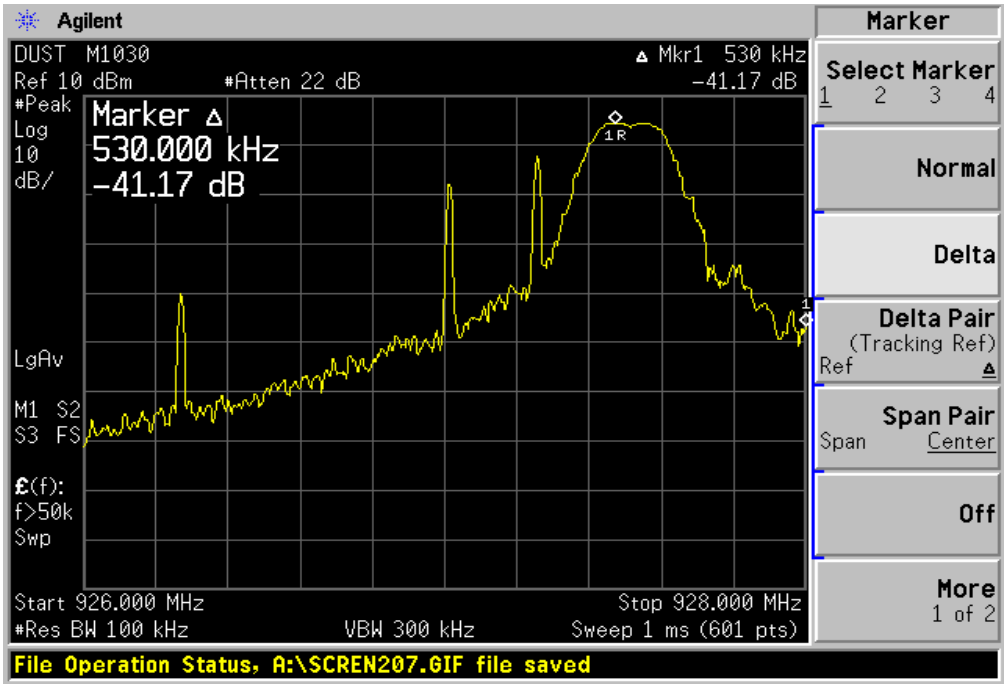
Plots of 100kHz Bandwidth of Band Edge

Please refer the following plots.

Low Channel



High Channel



SPURIOUS EMISSION AT ANTENNA PORT

Standard Applicable

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

Measurement Procedure

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

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

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

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

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

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2005

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

Environmental Conditions

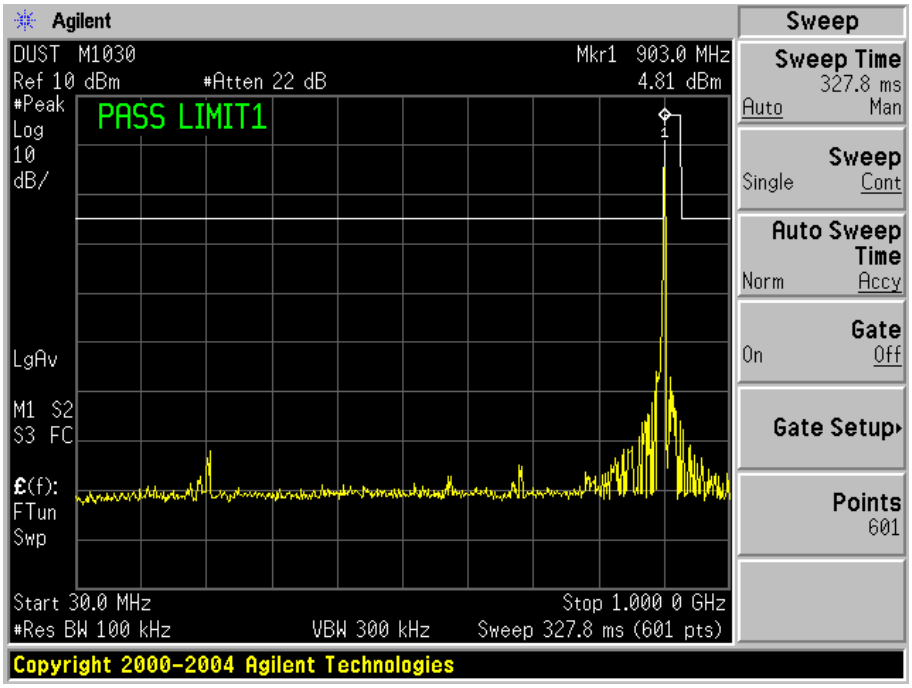
Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

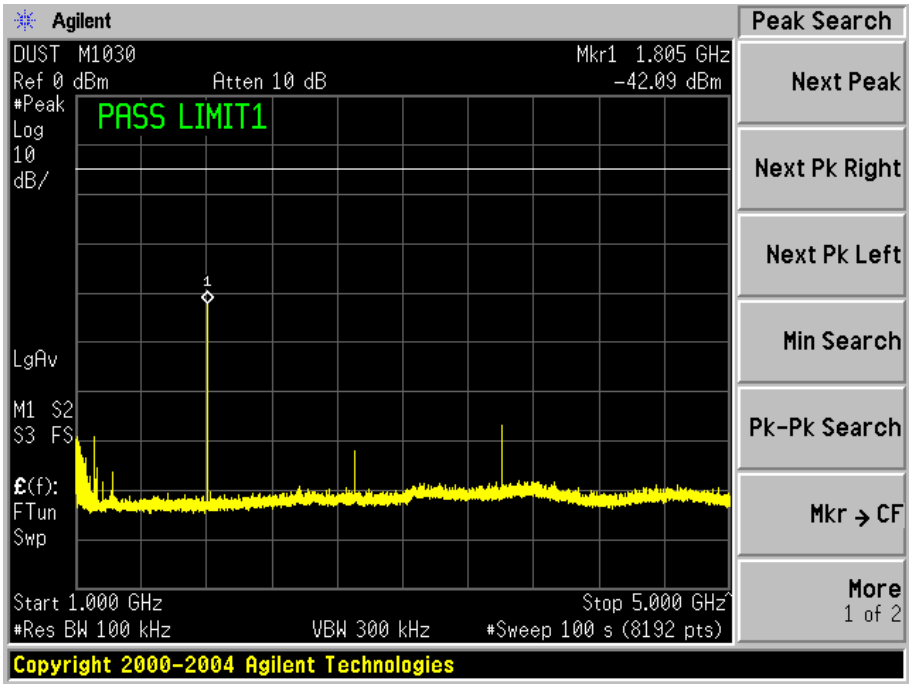
**The testing was performed by Snell Leong on 2006-1-23.*

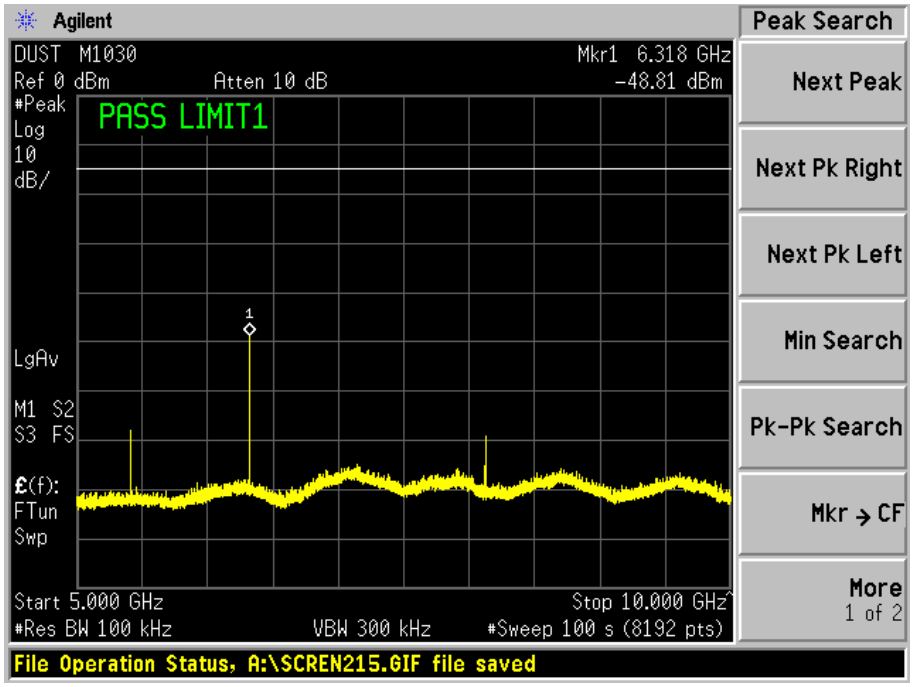
Measurement Results

Please refer to the following plots.

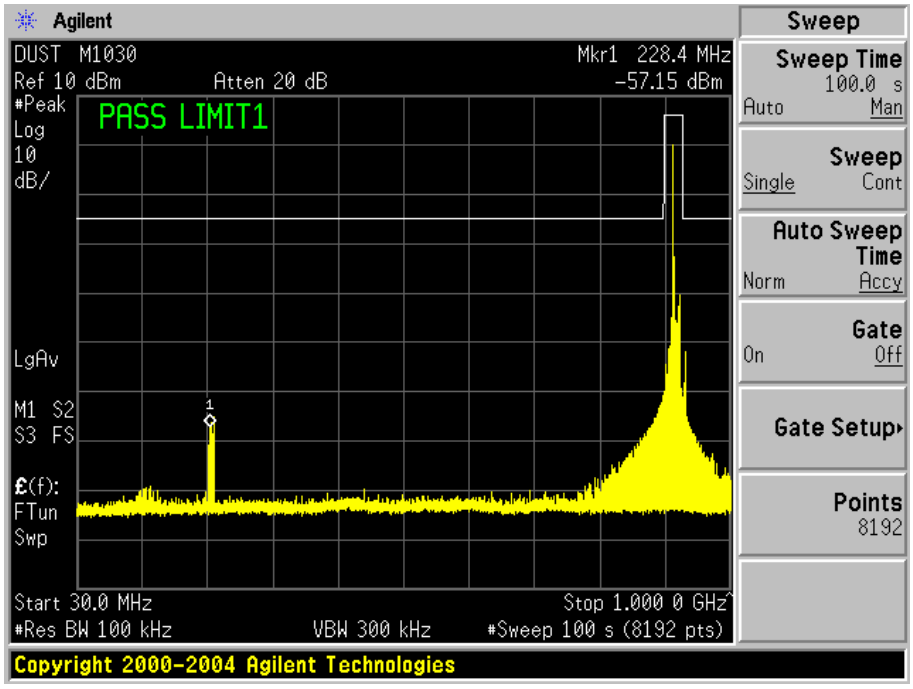
Low Channel

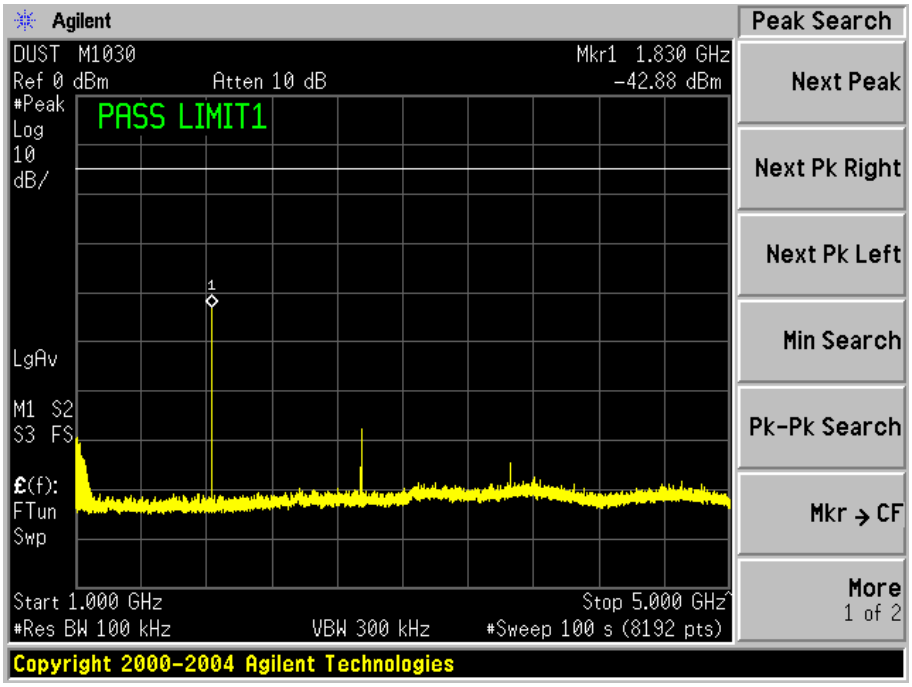

Agilent
Sweep
DUST M1030
Mkr1 903.0 MHz
Ref 10 dBm
#Atten 22 dB
4.81 dBm
#Peak
Log
10
dB/
PASS LIMIT1
1
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Start 30.0 MHz
Stop 1.000 0 GHz
#Res BW 100 kHz
VBW 300 kHz
Sweep 327.8 ms (601 pts)
Sweep Time
327.8 ms
Auto Man
Sweep
Single Cont
Auto Sweep Time
Norm Accy
Gate
On Off
Gate Setup
Points
601
Copyright 2000-2004 Agilent Technologies

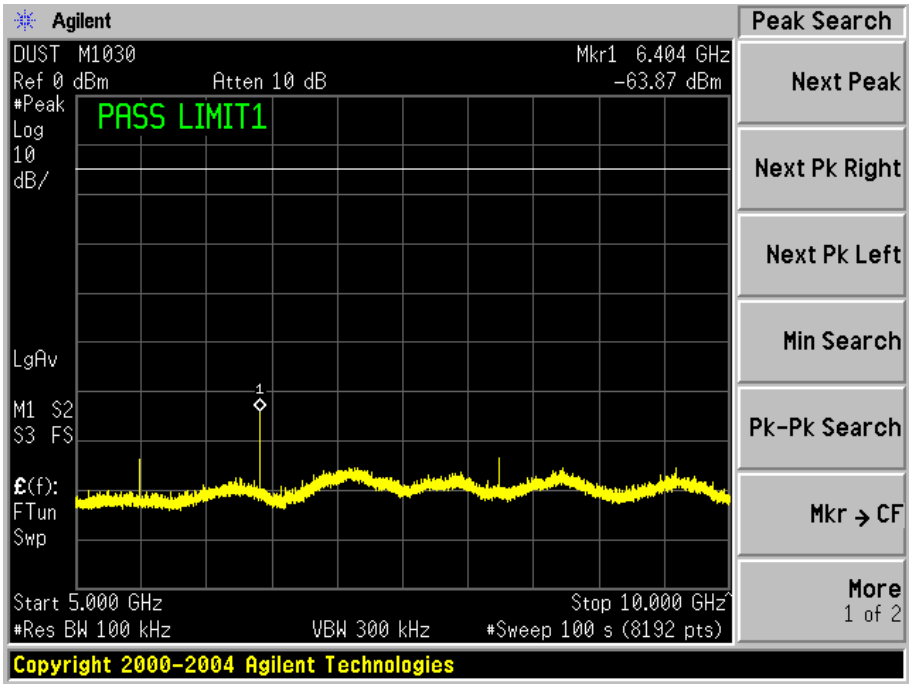

Agilent
Peak Search
DUST M1030
Mkr1 1.805 GHz
Ref 0 dBm
Atten 10 dB
-42.09 dBm
#Peak
Log
10
dB/
PASS LIMIT1
1
LgAv
M1 S2
S3 FS
£(f):
FTun
Swp
Start 1.000 GHz
Stop 5.000 GHz
#Res BW 100 kHz
VBW 300 kHz
#Sweep 100 s (8192 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Copyright 2000-2004 Agilent Technologies


Agilent
Peak Search
DUST M1030
Ref 0 dBm
Atten 10 dB
Mkr1 6.318 GHz
-48.81 dBm
#Peak
Log
10
dB/
PASS LIMIT1
LgAv
M1 S2
S3 FS
£(f):
FTun
Swp
Start 5.000 GHz
#Res BW 100 kHz
VBW 300 kHz
Stop 10.000 GHz
#Sweep 100 s (8192 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
File Operation Status, A:\SCREN215.GIF file saved

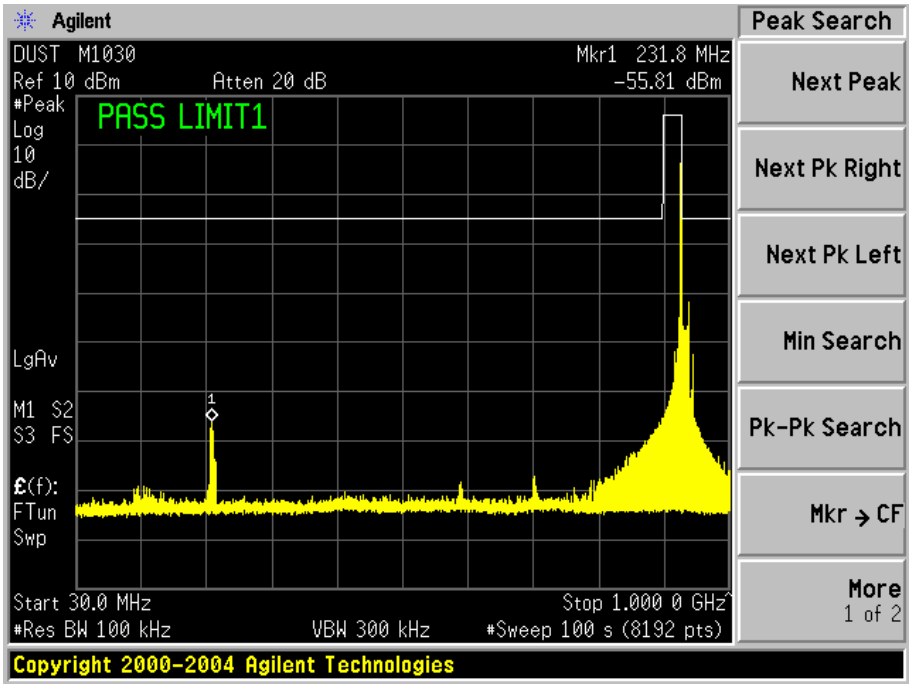
Mid Channel

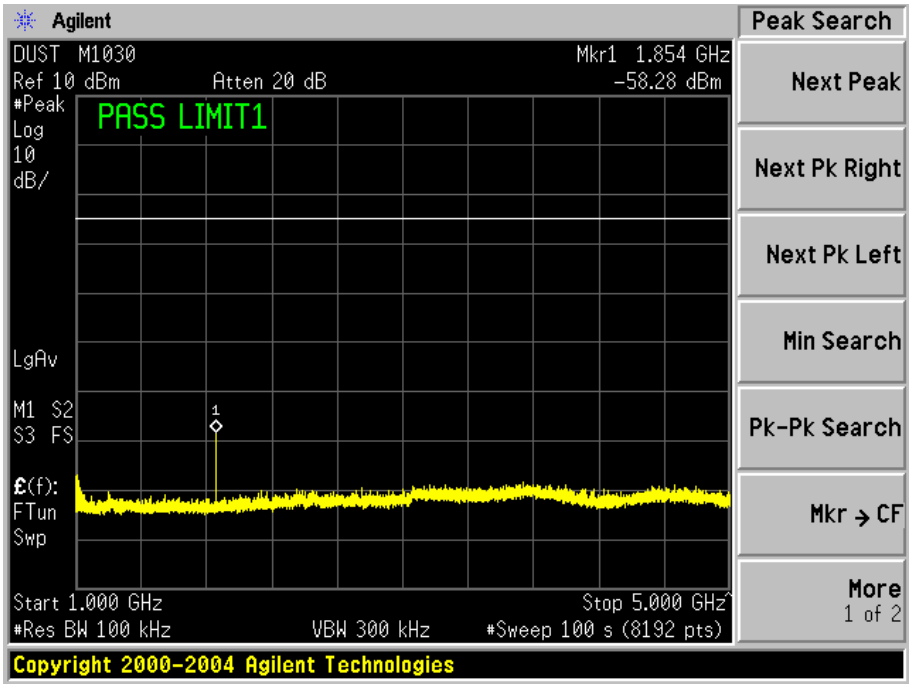

Agilent
Sweep
DUST M1030
Ref 10 dBm
Atten 20 dB
Mkr1 228.4 MHz
-57.15 dBm
#Peak
Log
10
dB/
PASS LIMIT1
LgAv
M1 S2
S3 FS
£(f):
FTun
Swp
Start 30.0 MHz
#Res BW 100 kHz
VBW 300 kHz
Stop 1.000 0 GHz
#Sweep 100 s (8192 pts)
Sweep Time
100.0 s
Auto Man
Sweep
Single Cont
Auto Sweep Time
Norm Accy
Gate
On Off
Gate Setup
Points
8192
Copyright 2000-2004 Agilent Technologies

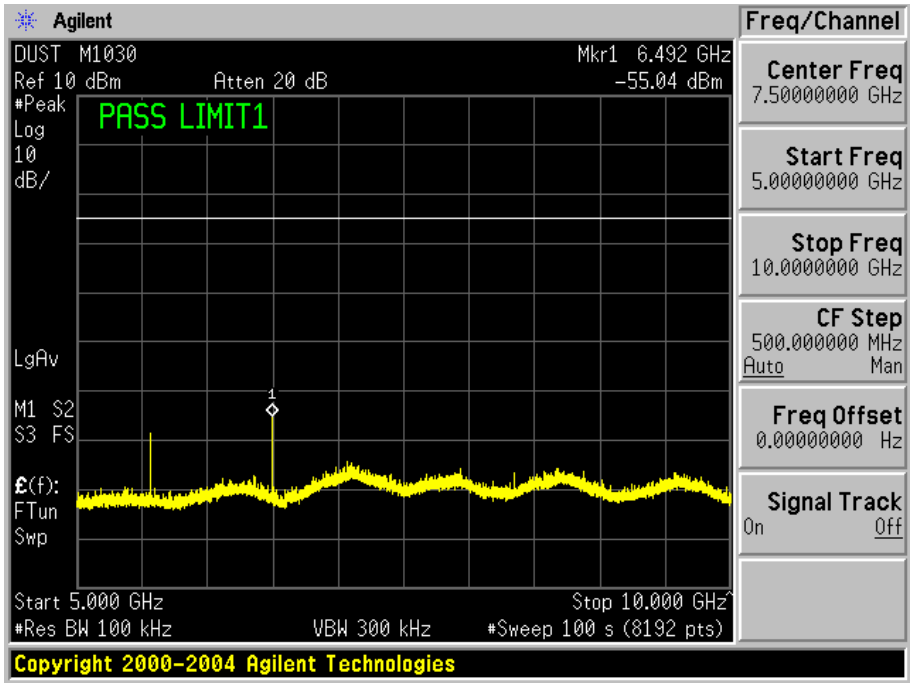

Agilent
Peak Search
DUST M1030
Ref 0 dBm
Atten 10 dB
Mkr1 1.830 GHz
-42.88 dBm
#Peak
Log
10
dB/
PASS LIMIT1
LgAv
M1 S2
S3 FS
£(f):
FTun
Swp
Start 1.000 GHz
#Res BW 100 kHz
VBW 300 kHz
Stop 5.000 GHz
#Sweep 100 s (8192 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Copyright 2000-2004 Agilent Technologies


Agilent
Peak Search
DUST M1030
Ref 0 dBm
Atten 10 dB
Mkr1 6.404 GHz
-63.87 dBm
#Peak
Log
10
dB/
PASS LIMIT1
LgAv
M1 S2
S3 FS
£(f):
FTun
Swp
Start 5.000 GHz
#Res BW 100 kHz
VBW 300 kHz
Stop 10.000 GHz
#Sweep 100 s (8192 pts)
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Copyright 2000-2004 Agilent Technologies

High Channel






Agilent
Freq/Channel
DUST M1030
Mkr1 6.492 GHz
Ref 10 dBm
Atten 20 dB
-55.04 dBm
#Peak
Log
10
dB/
PASS LIMIT1
LgAv
M1 S2
S3 FS
£(f):
FTun
Swp
Center Freq
7.50000000 GHz
Start Freq
5.00000000 GHz
Stop Freq
10.0000000 GHz
CF Step
500.000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Start 5.000 GHz
Stop 10.000 GHz
#Res BW 100 kHz
VBW 300 kHz
#Sweep 100 s (8192 pts)
Copyright 2000-2004 Agilent Technologies