Lab Code: 200167-0

FCC PART 15.247

MEASUREMENT AND TEST REPORT

For

Dust Networks, Inc.

30695 Huntwood Ave.
Hayward, CA 94544

FCC ID: SJC-M1310
Model: M1310

This Report Concerns: ☒ Original Report	**Equipment Type:** 900 MHz Mote Frequency Hopping System Module
Test Engineer:	Choon Sian Ooi
Report Number:	R0702152-247
Report Date:	2007-03-29
Reviewed By:	VP of Engineering: Hans Mellberg
Prepared By: (12)	Bay Area Compliance Laboratories Corp. (BACL) 1274 Anvilwood Ave. Sunnyvale, CA 94089 Tel: (408) 732-9162 Fax: (408) 732-9164

Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP or any agency of the U.S. Governmen

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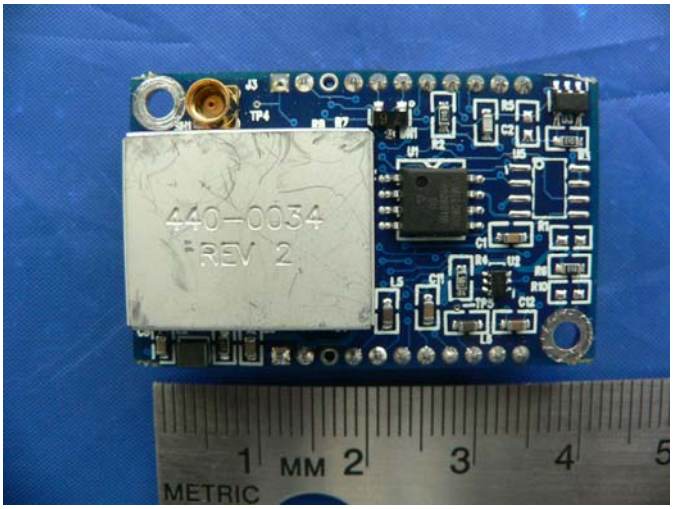
GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

This BACL measurement and test report has been complied on behalf of DUST Inc and their product, FCC ID: *SJC-M1310*, model: *M1310* or the "EUT" as referred to in this report. The EUT is a *900 MHz transceiver module* mounted on a through hole or surface mount compatible card also consisting of a DUST Networks Gold9b integrated microcontroller and a 900MHz radio with external Atmel AT45DB0111. The EUT provides radio communications and interface with digital I/O and analog inputs. An Amale MMCX antenna connector is provided for external antenna connection. There is no onboard antenna.

** The test data gathered are from a production sample, P/N: 800-0114 Rev.1, provided by the manufacturer.*

EUT Photo



EUT (FCC ID: SJC-M1310)

Additional photos in exhibit C

EUT Mechanical Description

The EUT measures approximately 39 mmL x 24 mmW x 12 mmH and weighs approximately 6.5 g

Objective

This type approval report is prepared on behalf of *Dust 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 in accordance with ANSI C63.4-2003.

Measurement Uncertainty

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

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

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

Test Facility

The 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 Number: 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.

Special Accessories

Dust Model: D1310, SN: 805 0023 rev. 1 evaluation device.

Equipment Modifications

No modifications were made to the EUT.

Power Supply

Manufacturer	Description	Model	Serial Number
Tadiran	2/3AA style Lithium Ion Batteries x 2	TLH-5955	NA

Interface Ports and Cabling

Cable Description	Length (M)	From	To
Serial Cable RS-232	2	Laptop	EUT

Local Support Equipment

Manufacturer	Description	Model	Serial Number
Dell	Laptop	Sync Master 940MW	D019HCGL805457

SUMMARY OF TEST RESULTS FOR FCC PART 15

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirements	Compliant
§ 15.205	Restricted Bands	Compliant
§15.207 (a)	Conducted Emissions	N/A *
§15.209	Radiated Emissions	Compliant
§15.247 (a) (1) (i)	Hopping Channel Separation	Compliant
§15.247 (a) (1) (i)	20 dB Channel Bandwidth	Compliant
§15.247 (a) (1) (i)	Dwell Time	Compliant
§15.247 (b) (2)	Maximum Peak Output Power	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§ 15.247 (e)(i) & §2.1091	RF Exposure	Compliant
§ 15.247 (d)	Spurious Emissions at Antenna Port	Compliant

Note: * Battery operation.

§15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Refer to statement below for compliance.

“The antenna for this device is an integral antenna that the end user cannot access. Furthermore the device is for indoor/outdoor use as detailed in the Users Manual and Operational Description”.

Antenna Connected Construction

The antenna port is a unique MMCX-compatible male connector and designed to be plugged into the OEM provided antenna. Testing was performed with an antenna designed to represent worst case results with a maximum gain of 6 dBi. Product will require retesting by OEM when integrated in their product to ensure continued compliance.

☒ **Compliant** ☐ **N/A**

§15.205 §15.209 & §15.247 - RADIATED EMISSIONS

Applicable Standard: FCC §15.205 Restricted bands of operation

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

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

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

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

☒ **Compliant** ☐ **N/A**

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

(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (Microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

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

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

☒ **Compliant** ☐ **N/A**

Applicable Standard: FCC §15.247 Radiated emission limits.

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)).

Test Setup

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

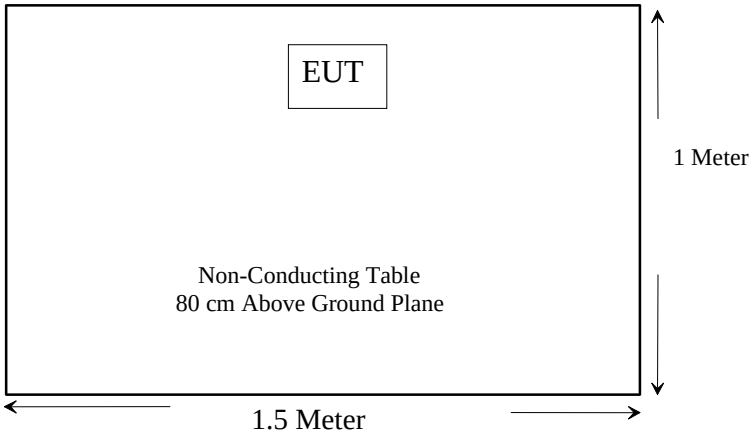
Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Sonoma	Amplifier, Pre	317	260408	2006-02-03*
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24
HP	Amiplifier, Pre	8449B	3147A00400	2006-08-21
Sunol Sciences	Antenna	JB3	A020106-3/S006628	2006-03-14
A.R.A	Antenna, Horn, DRG	DRG-118/A	1132	2006-08-17

**Two year calibration cycle*

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

Test Setup Diagram



Environmental Conditions

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

**The testing was performed by Choon Sian Ooi on 2007-02-15.*

Test Procedure

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

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

Corrected Amplitude & Margin Calculation

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

Cord. Amp. = 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 = Cord. Amp. - 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 standard's radiated emissions limits for class B devices, and had the worst margin of:

-9.6 dB at **3612 MHz** in the **Vertical** polarization at **Low** Channel

-6.0 dB at **3663.98 MHz** in the **Horizontal** polarization at **Middle** Channel

-5.0dB at **3707 MHz** in the **Horizontal** polarization at **High** Channel

Please refer to the following tables for full test results

Radiated Emissions Test Result Data: Measured at 3 meter

Run # 1: Low CH = 903.005 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Pola. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Amplifier Gain (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
903.005	114	187	1.6	V	23.6	0.7	37.4	100.9			Fund/Peak
903.005	106	50	1.5	H	23.6	0.7	37.4	92.9			Fund/Peak
903.005	84.2	187	1.6	V	23.6	0.7	37.4	71.1			Fund/QP
903.005	77.9	50	1.5	H	23.6	0.7	37.4	64.8			Fund/QP
3612	48.5	329	1.6	V	30	0.8	34.9	44.4	54	-9.6	Ave
1806	43.8	260	1.3	H	24.8	1.5	35.9	34.2	44.8	-10.6	Ave
3612	45.2	90	1.6	H	30	0.8	34.9	41.1	54	-12.9	Ave
1806	46.9	220	1.3	V	24.8	1.5	35.9	37.3	51.1	-13.8	Ave
2709	43.2	173	1.4	H	28.9	1.5	35.1	38.5	54	-15.5	Ave
1806	65.9	260	1.3	H	24.8	1.5	35.9	56.3	72.9	-16.6	Peak
2709	42.1	210	1	V	28.9	1.5	35.1	37.4	54	-16.6	Ave
3612	59.3	329	1.6	V	30	0.8	34.9	55.2	74	-18.8	Peak
2709	59.2	173	1.5	H	28.9	1.5	35.1	54.5	74	-19.5	Peak
2709	57.6	351	1.5	V	28.9	1.5	35.1	52.9	74	-21.1	Peak
3612	54.2	90	1.6	H	30	0.8	34.9	50.1	74	-23.9	Peak
1806	64.8	220	1.3	V	24.8	1.5	35.9	55.2	80.9	-25.7	Peak

Run # 2: Mid CH = 915.97 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Pola. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Amplifier Gain (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
915.97	116	242	1	V	23.2	0.7	37	102.9			Fund/Peak
915.97	108	202	1.1	H	23.2	0.7	37	94.9			Fund/Peak
915.97	85.5	242	1	V	23.2	0.7	37	72.4			Fund/QP
915.97	78.1	202	1.2	H	23.2	0.7	37	65			Fund/QP
3663.38	43.1	134	1.3	H	30	0.8	34.9	39	45	-6	Ave
3663.38	45.6	321	1.2	V	30	0.8	34.9	41.5	52.4	-10.9	Ave
2747.91	46.8	156	1.2	V	28.9	1.5	35.1	42.1	54	-11.9	Ave
1832	42.6	162	1.4	H	24.8	1.5	35.9	33	45	-12	Ave
2747.91	45.6	82	1.7	H	28.9	1.5	35.1	40.9	54	-13.1	Ave
1832	45.6	166	1.3	V	24.8	1.5	35.9	36	52.4	-16.4	Ave
2747.91	57.6	156	1.2	V	28.9	1.5	35.1	52.9	74	-21.1	Peak
1832	63.2	162	1.4	H	24.8	1.5	35.9	53.6	74.9	-21.3	Peak
2747.91	56.5	82	1.7	H	28.9	1.5	35.1	51.8	74	-22.2	Peak
3663.38	54.5	134	1.3	H	30	0.8	34.9	50.4	74.9	-24.5	Peak
1832	64.1	166	1.3	V	24.8	1.5	35.9	54.5	82.9	-28.4	Peak
3663.38	58.1	321	1.2	V	30	0.8	34.9	54	82.9	-28.9	Peak

Run # 3: High CH = 926.73 MHz

Frequency (MHz)	Reading (dBµV)	Azimuth Degrees	Height (m)	Pola. H / V	Antenna Factor (dB/m)	Cable Loss (dB)	Amplifier Gain (dB)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Comments
926.73	111.9	291	1.5	V	23.4	0.7	37.2	98.8			Fund/Peak
926.73	103.6	180	1.4	H	23.4	0.7	37.2	90.5			Fund/Peak
926.73	83.6	291	1.5	V	23.4	0.7	37.2	70.5			Fund/QP
926.73	77.5	180	1.4	H	23.4	0.7	37.2	64.4			Fund/QP
3707	43.5	264	1.3	H	30	0.8	34.8	39.4	44.4	-5	Ave
3707	47.2	205	1.3	V	30	0.8	34.8	43.1	50.5	-7.4	Ave
1854	44.2	253	1.9	H	24.8	1.5	36.3	34.1	44.4	-10.3	Ave
2780.2	47.2	194	1.7	V	28.9	1.5	35.5	42.1	54	-11.9	Ave
2780.2	46.3	202	1.5	H	28.9	1.5	35.5	41.2	54	-12.8	Ave
1854	45.8	235	1.5	V	24.8	1.5	36.3	35.7	50.5	-14.8	Ave
1854	64.7	243	2	H	24.8	1.5	36.3	54.6	70.5	-15.9	Peak
3707	55.1	264	1.5	H	30	0.8	34.8	51	70.5	-19.5	Peak
2780.2	56.1	194	1.7	V	28.9	1.5	35.5	51	74	-23	Peak
2780.2	55.9	202	1.5	H	28.9	1.5	35.5	50.8	74	-23.2	Peak
1854	65.1	314	1.1	V	24.8	1.5	36.3	55.1	78.8	-23.7	Peak
3707	59.2	205	1.3	V	30	0.8	34.8	55.1	78.8	-23.7	Peak

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

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

Measurement Procedure

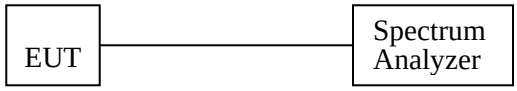
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient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

Test Equipment

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

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

Test Setup Diagram



Environmental Conditions

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

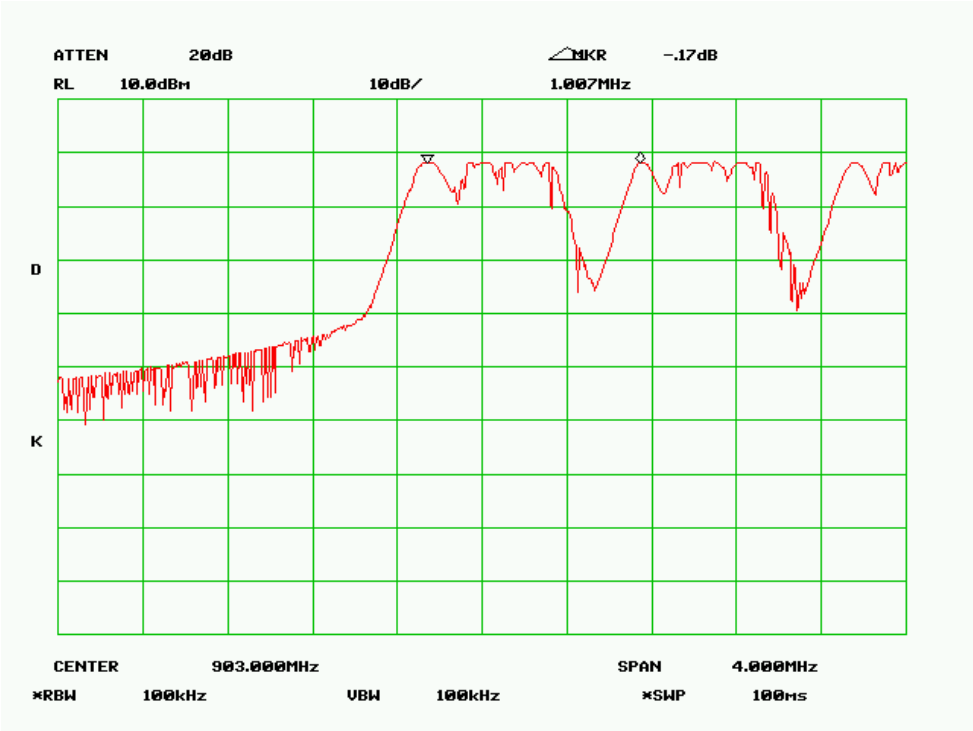
**The testing was performed by Choon Sian Ooi on 2007-02-15.*

Measurement Results

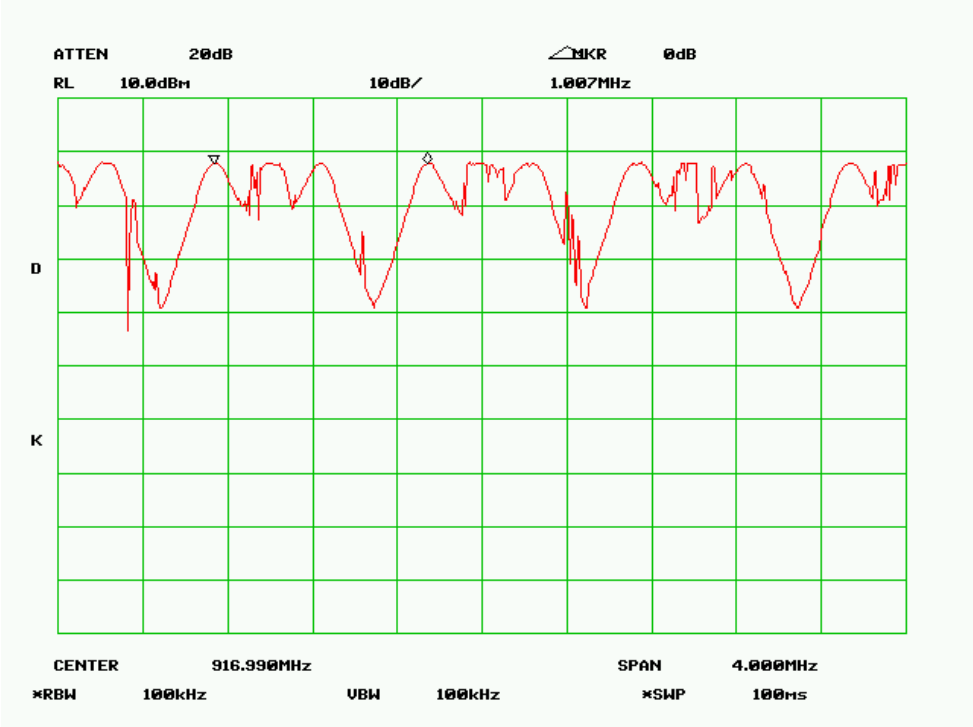
Channel	Frequency (MHz)	Channel Separation (MHz)	Limit >(KHz)
Low	902.99	1.007	670
Mid	915.9	1.007	633
High	926.9	1.000	697

Please refer to the following plots.

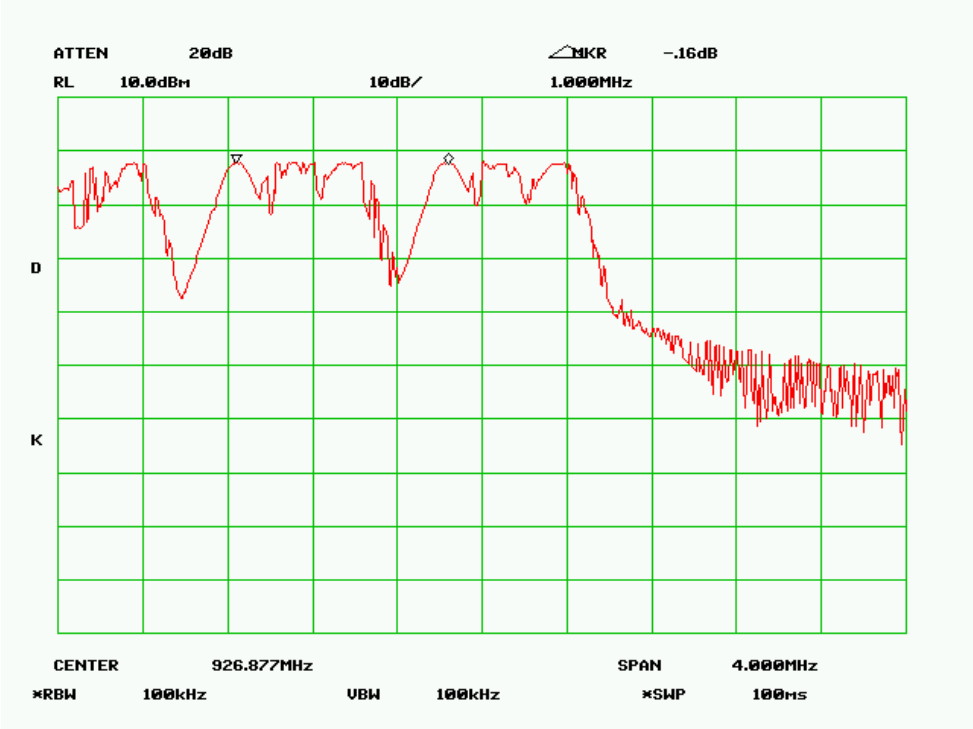
Low Channel



Middle Channel



High Channel



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

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

Measurement Procedure

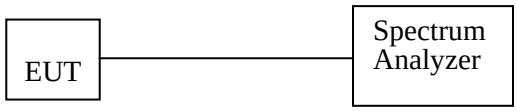
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency 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 emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment

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

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

Test Setup Diagram



Environmental Conditions

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

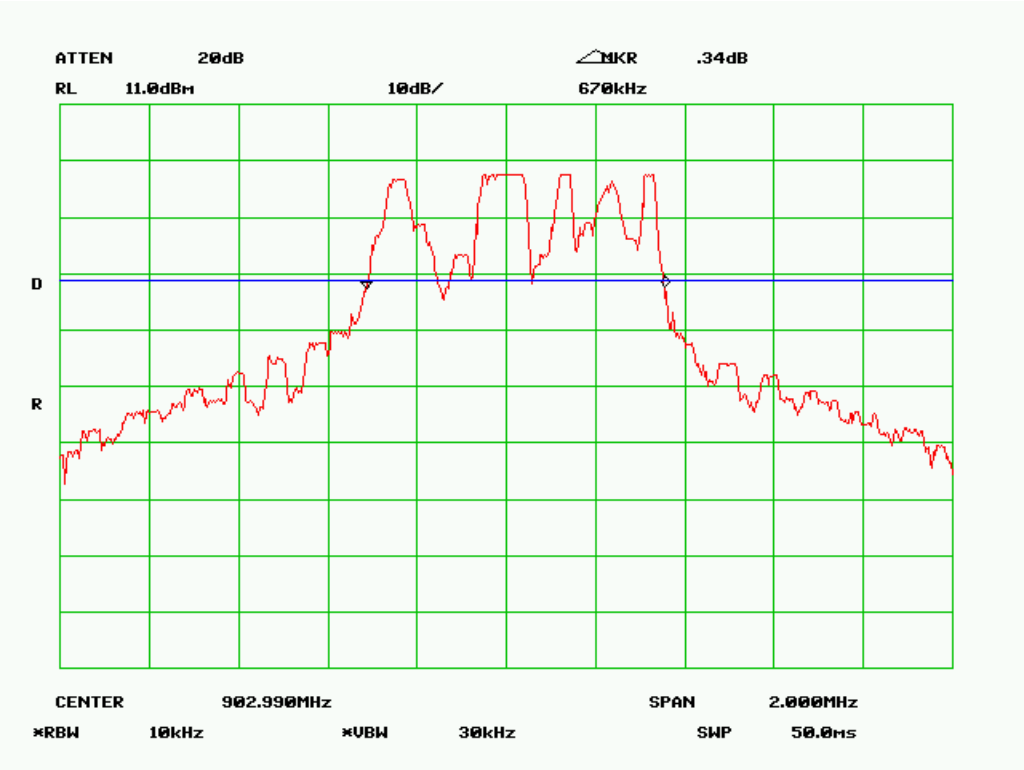
**The testing was performed by Choon Sian Ooi on 2007-02-15.*

Measurement Results

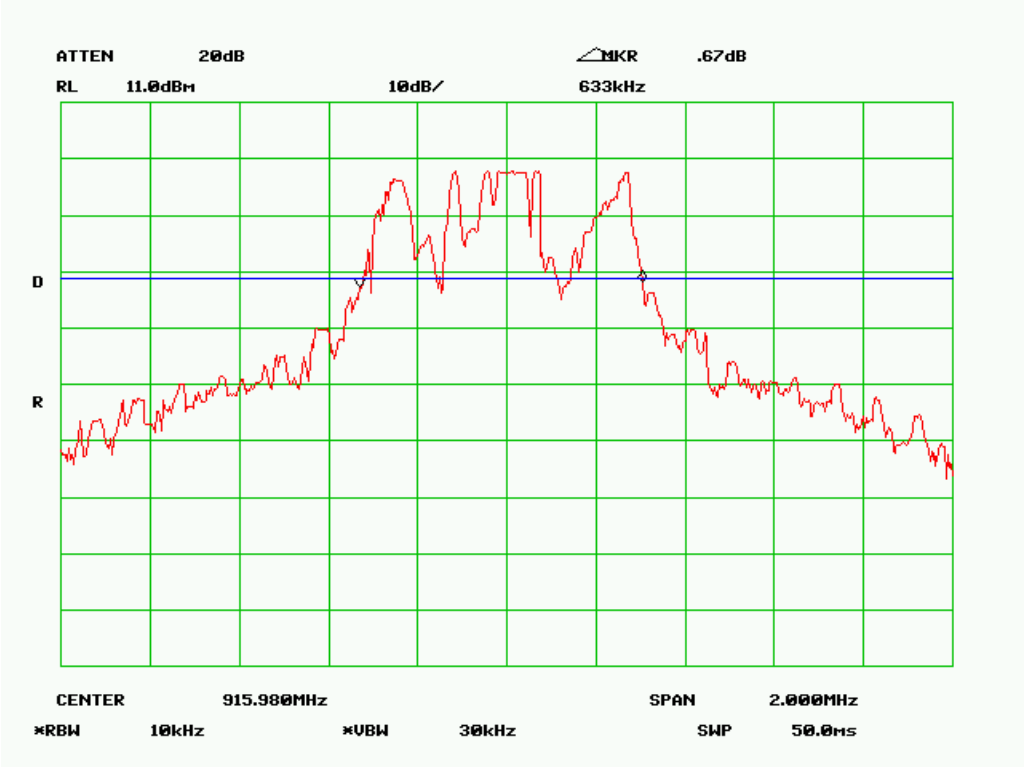
Channel	Frequency (MHz)	20 dB Channel Bandwidth (KHz)
Low	902.99	670
Mid	915.9	633
High	926.9	697

Please refer to the following plots.

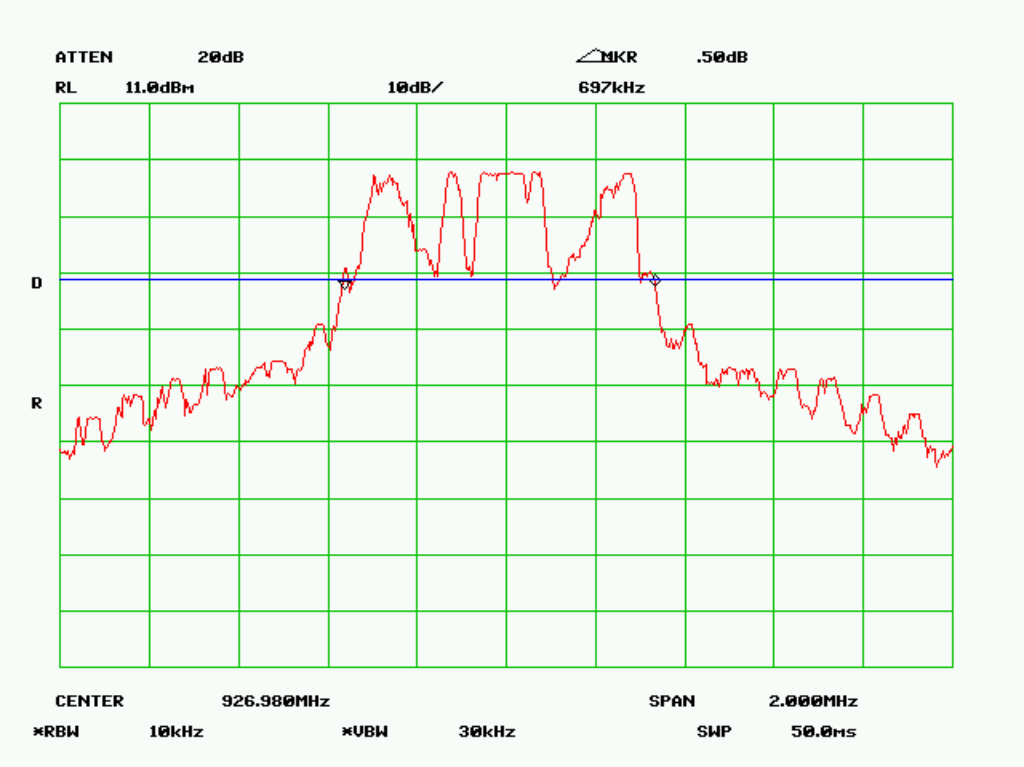
Low Channel



Middle Channel



High Channel



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

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

Measurement Procedure

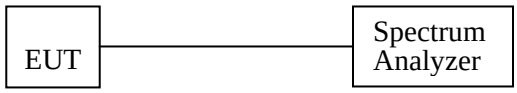
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low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

Test Equipment

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

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

Test Setup Diagram



Environmental Conditions

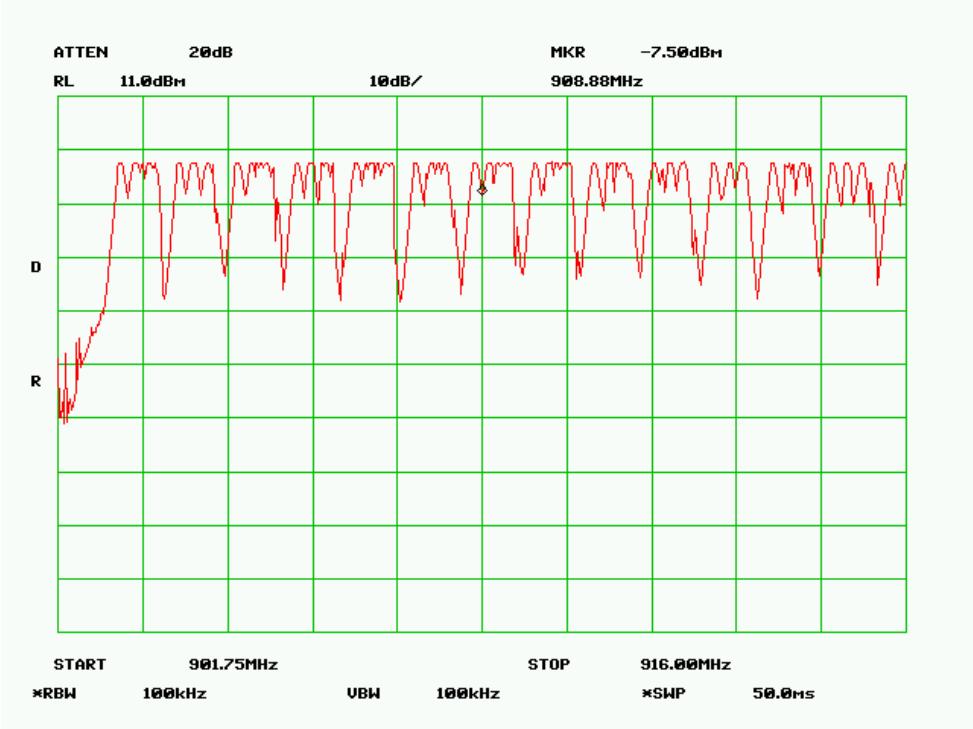
Temperature:	24 ° C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

**The testing was performed by Choon Sian Ooi on 2007-02-15.*

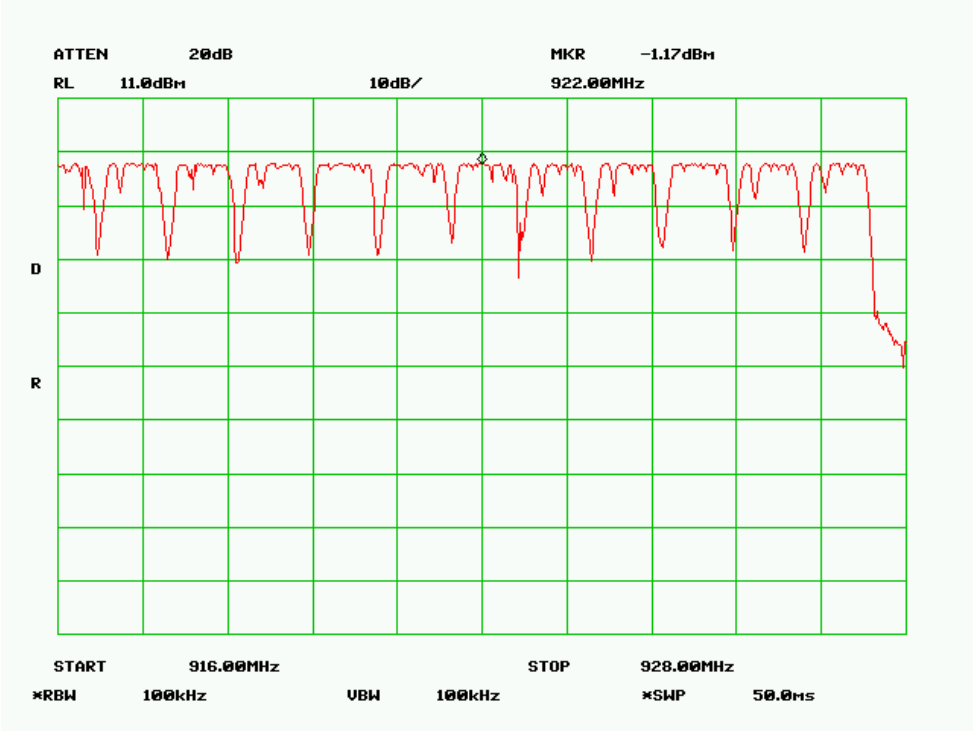
Measurement Result: 25 channels

Please refer to the following plots:

Number of Channels 901.75 – 916.00 MHz: 14 Channels



Number of Channels 916.00 – 928.00 MHz: 11 Channels



§15.247(a) (1) (i) - DWELL TIME

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.

Measurement Procedure

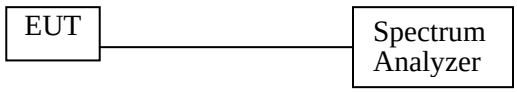
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. 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 Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2007-01-24

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

Test Setup Diagram



Environmental Conditions

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

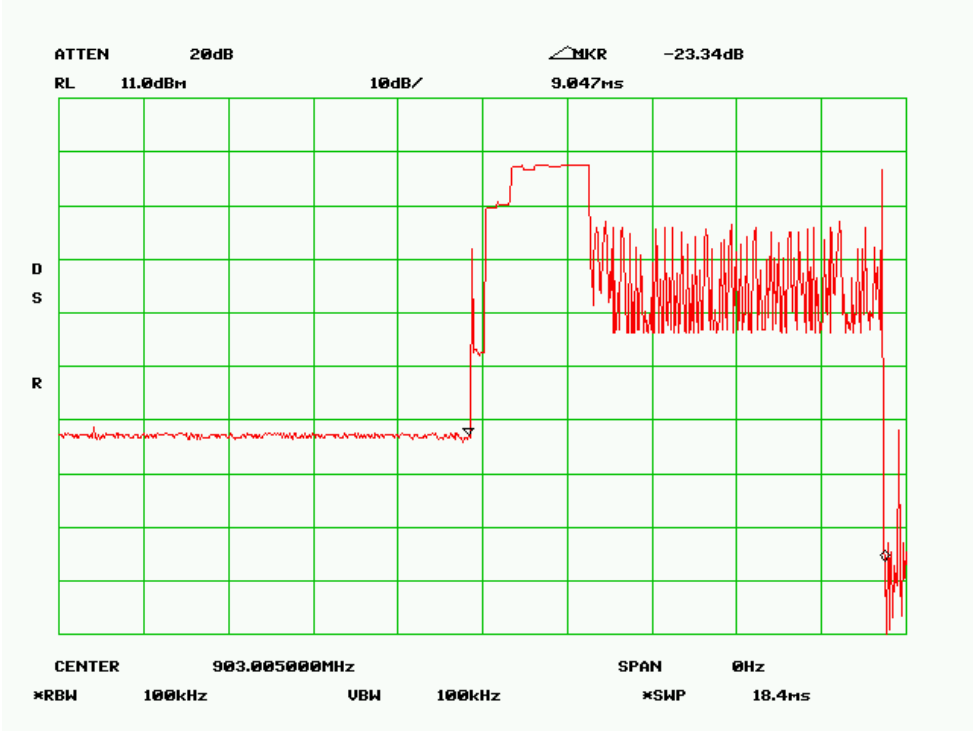
**The testing was performed by Choon Sian Ooi on 2007-02-15.*

Measurement Results:

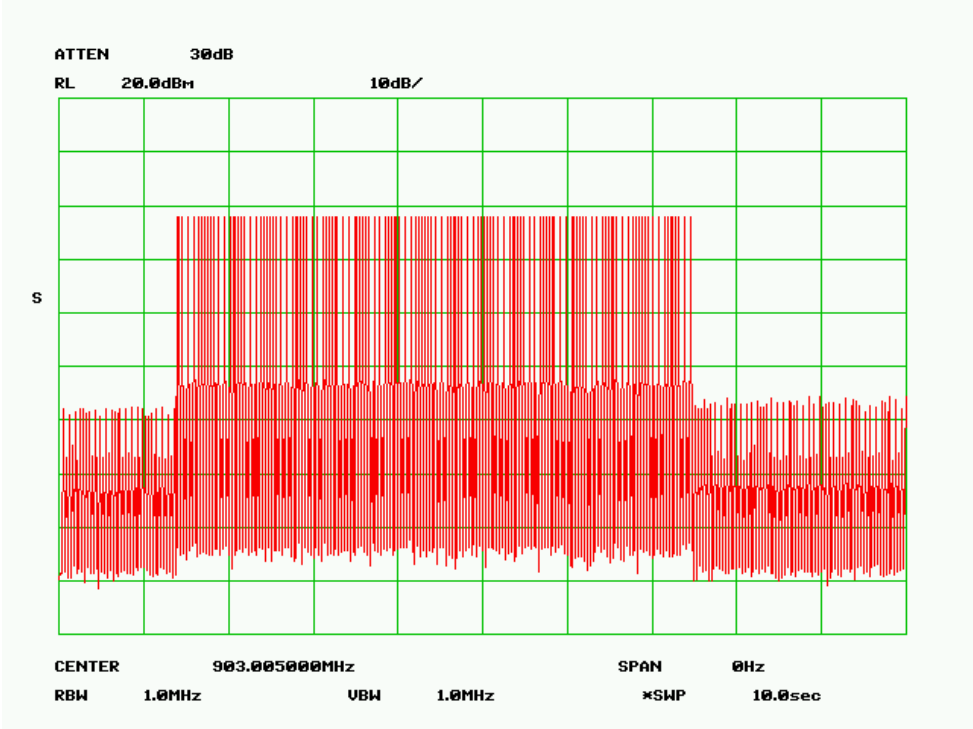
Channel	Frequency (MHz)	Pulse Width (ms)	Dwell Time (sec.)	Limit (sec.)	Result
Low	903.005	9.047	0.11	0.4	Pass
Mid	916	9.000	0.21	0.4	Pass
High	926.7	9.019	0.21	0.4	Pass

Please refer the following plots.

Low Channel



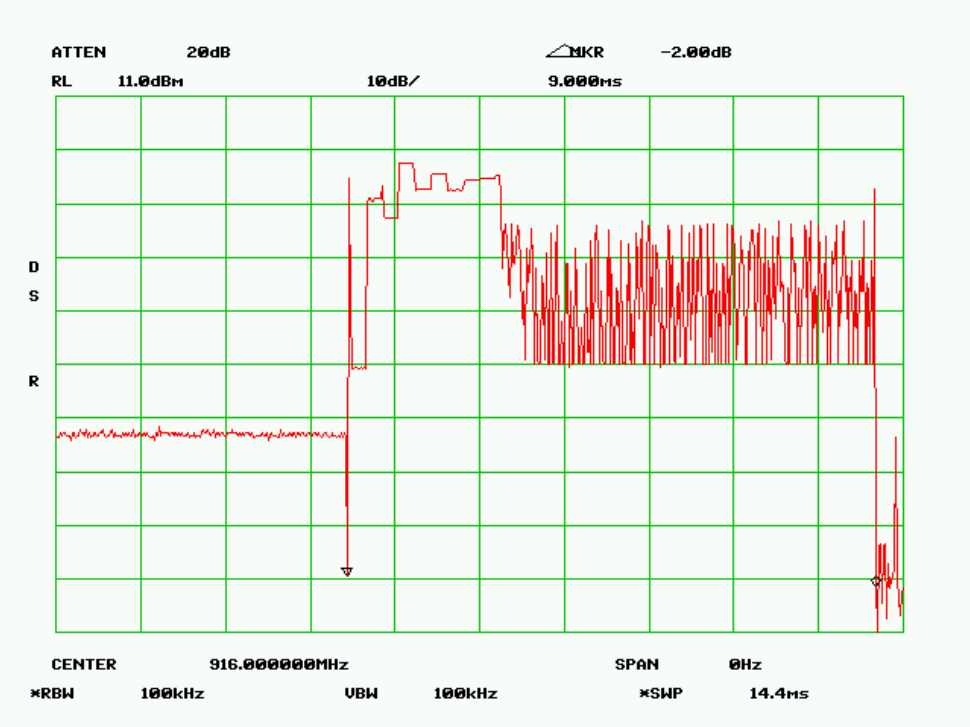
The Pulse Width measured in 18.4 s sweep time



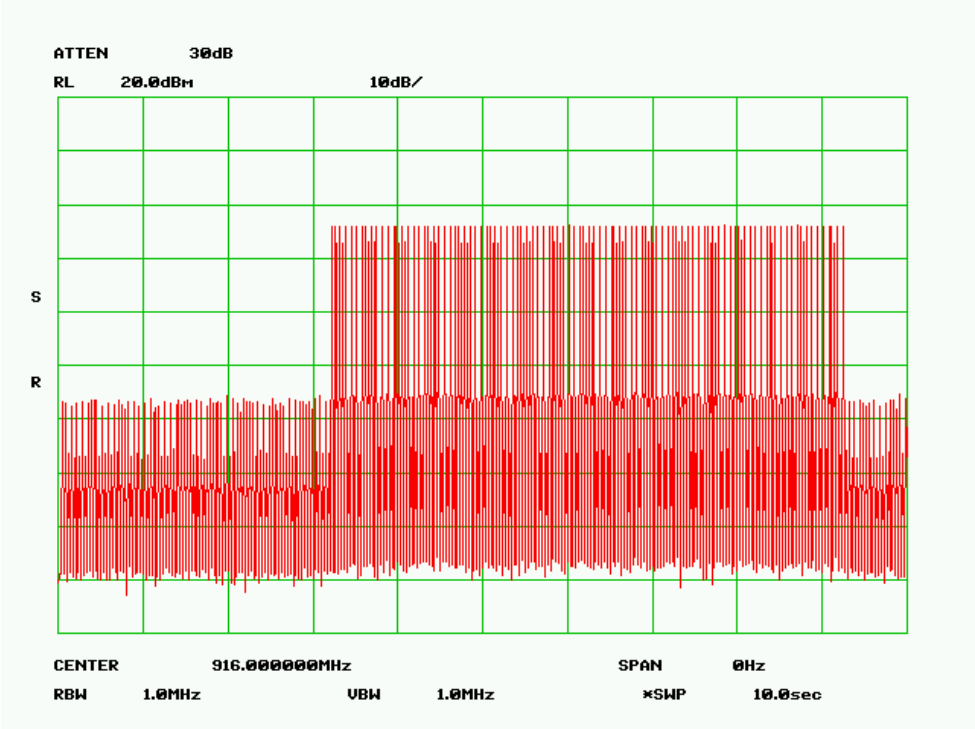
The total on time in 10 s sweep time
n =116

The total on time in 100 s sweep time
m =1

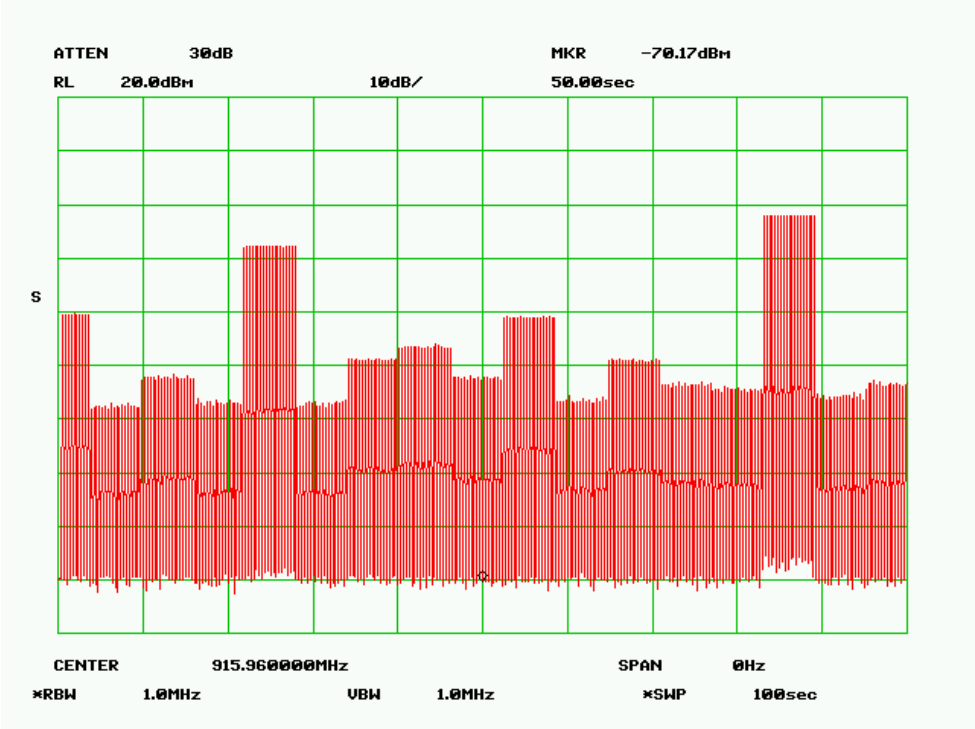
Mid Channel



The Pulse width in 14.4 ms sweep time

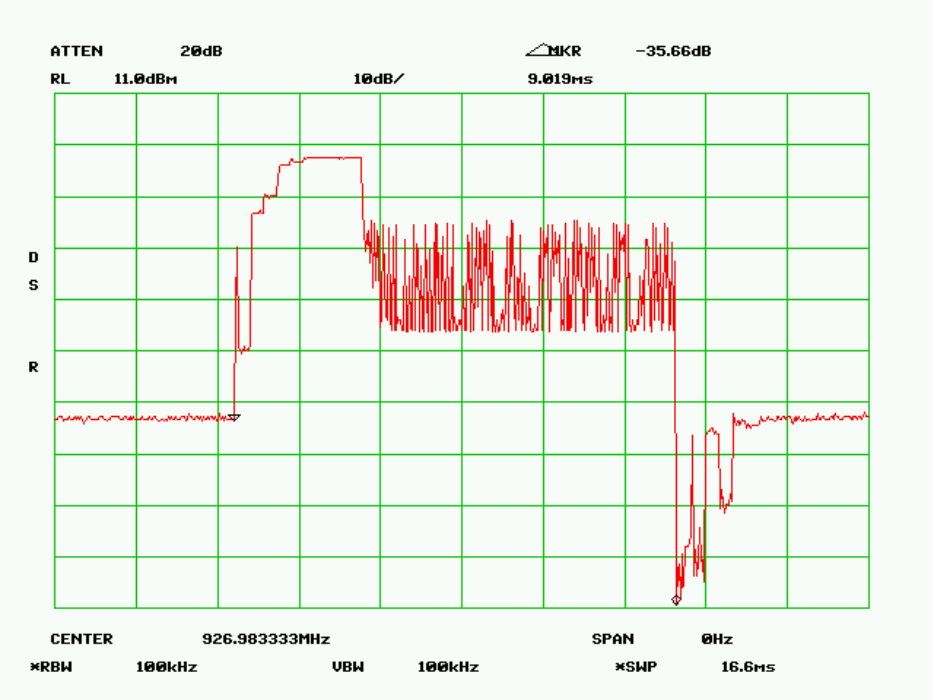


The total on time in 10 s sweep time
n =100

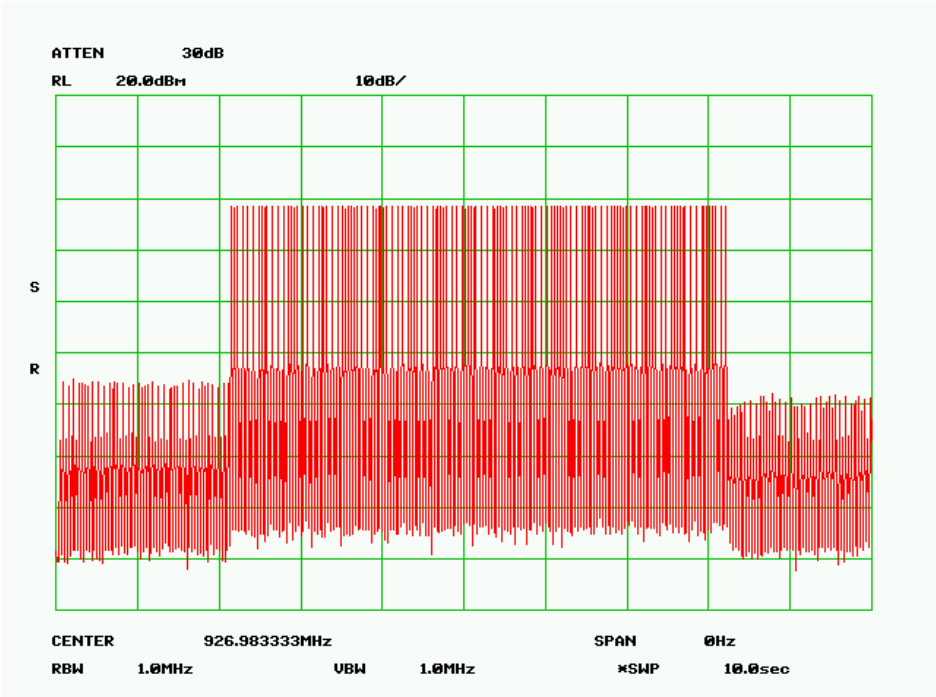


The total on time in 100 s sweep time
m =2

High Channel



The Pulse width in 16.6 ms sweep time



The total on time in 10 s sweep time
n =116

The total on time in 100 s sweep time
m =2

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

Applicable Standard

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

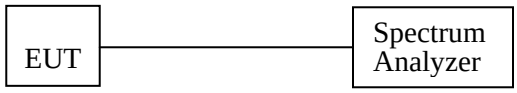
1. Place the EUT on the turntable and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Test Equipment

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

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

Test Setup Diagram



Environmental Conditions

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

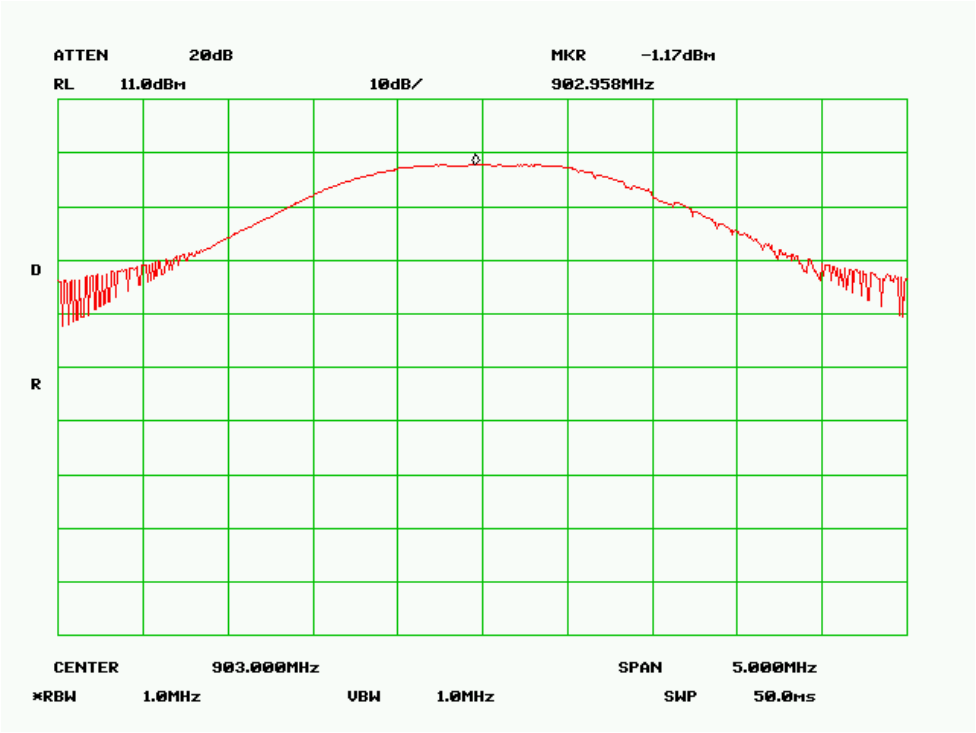
**The testing was performed by Choon Sian Ooi on 2007-02-15.*

Measurement Result

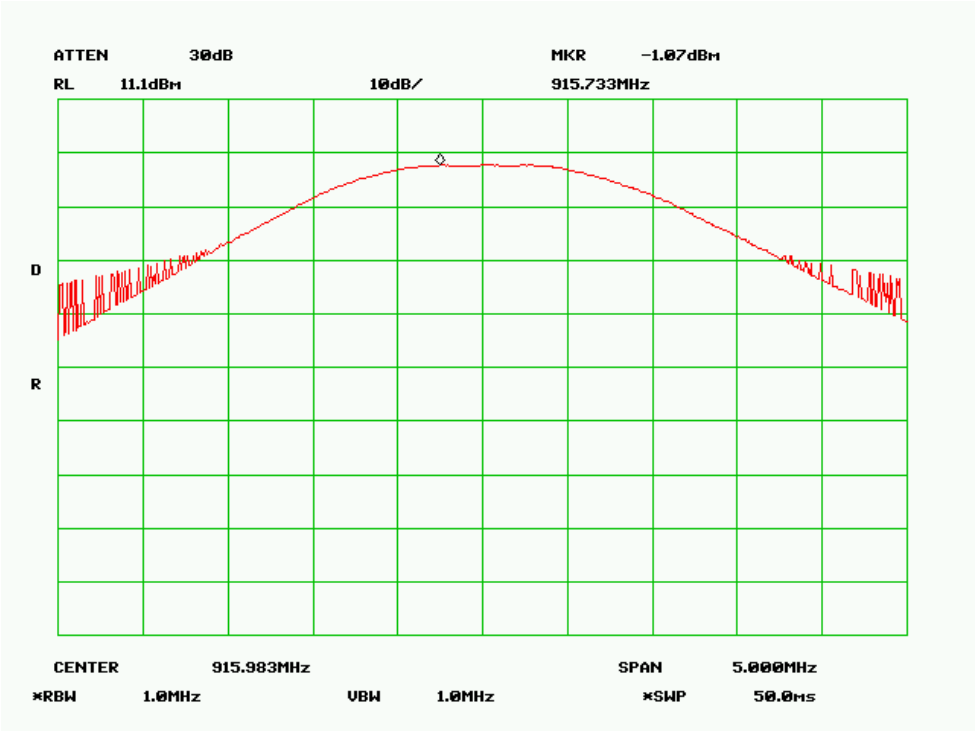
Channel	Frequency (MHz)	Max Peak Output Power		Limit (mW)	Result
		(dBm)	(mw)		
Low	903.005	-1.17	0.7638	250	compliant
Mid	916	-108	0.7620	250	compliant
High	926.7	-1.17	0.7628	250	compliant

Plots of Maximum Peak Output Power

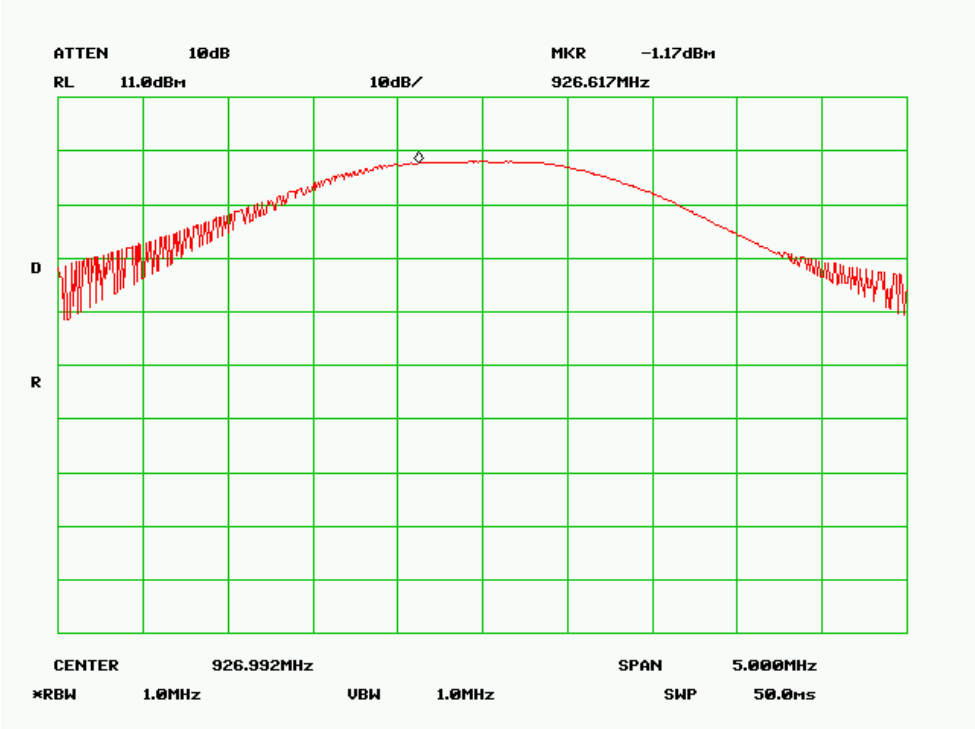
Low Channel



Middle Channel



High Channel



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

Applicable Standard

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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

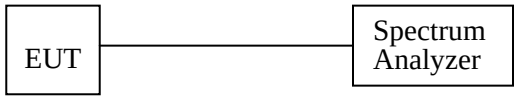
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then 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 Number	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	8565EC	3946A00131	2006-01-24

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

Test Setup Diagram



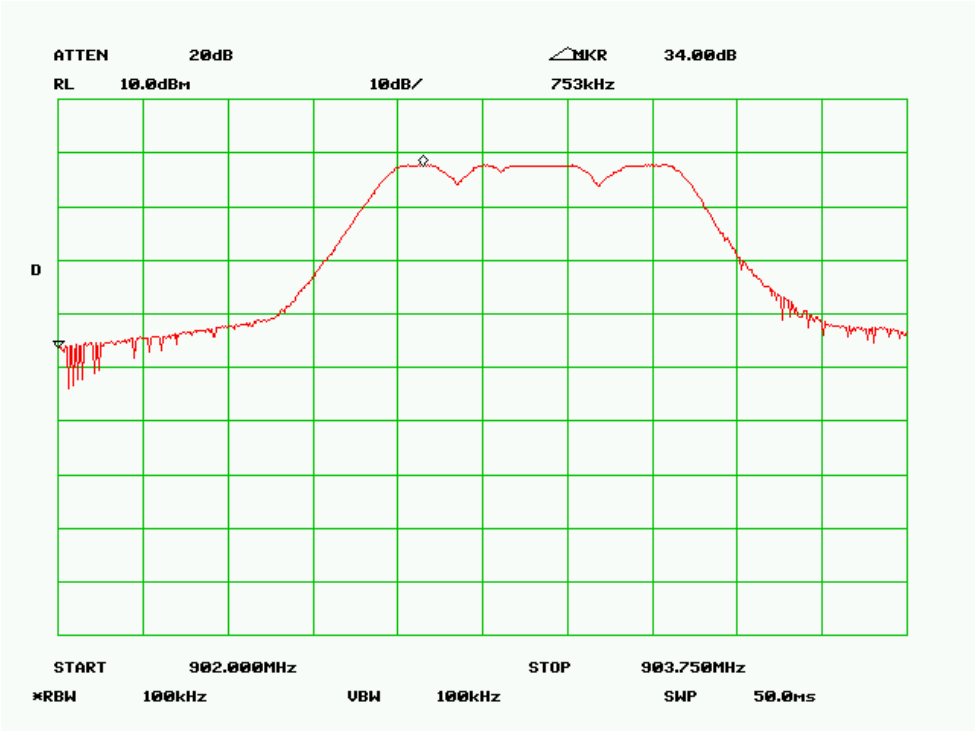
Environmental Conditions

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

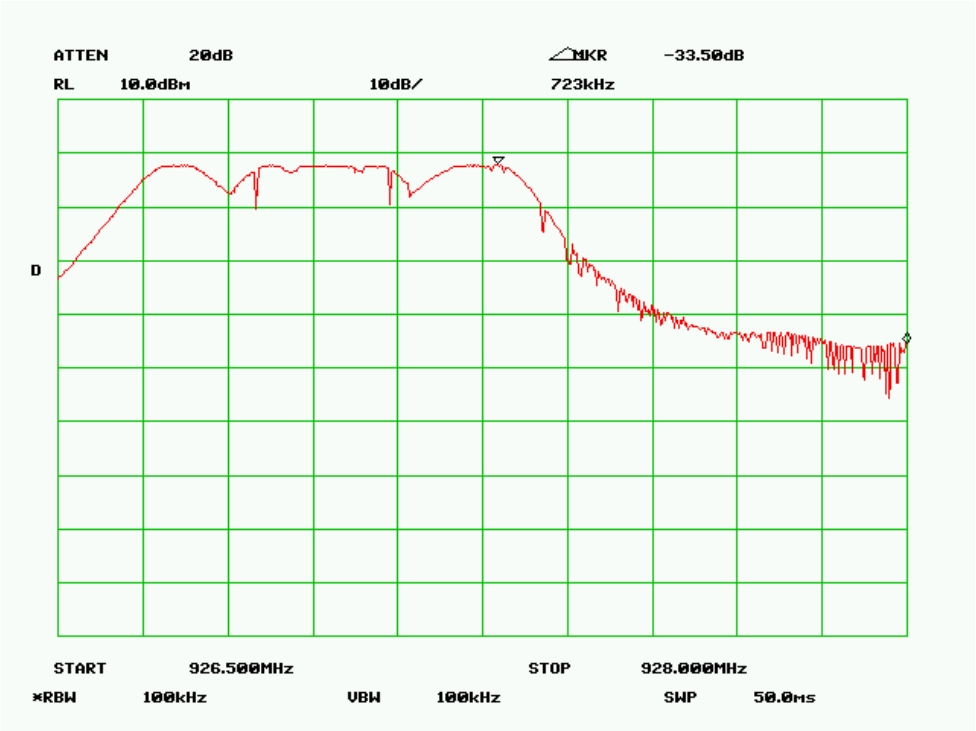
**The testing was performed by Choon Sian Ooi on 2007-02-15*

Hopping Mode:

Low Channel



High Channel



§15.247(d) SPURIOUS EMISSIONS AT ANTENNA PORT

Applicable Standard

As per 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Measurement Procedure

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

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

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

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

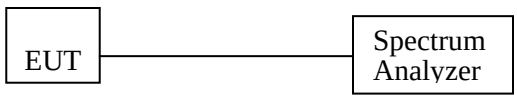
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

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

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

Test Setup Diagram



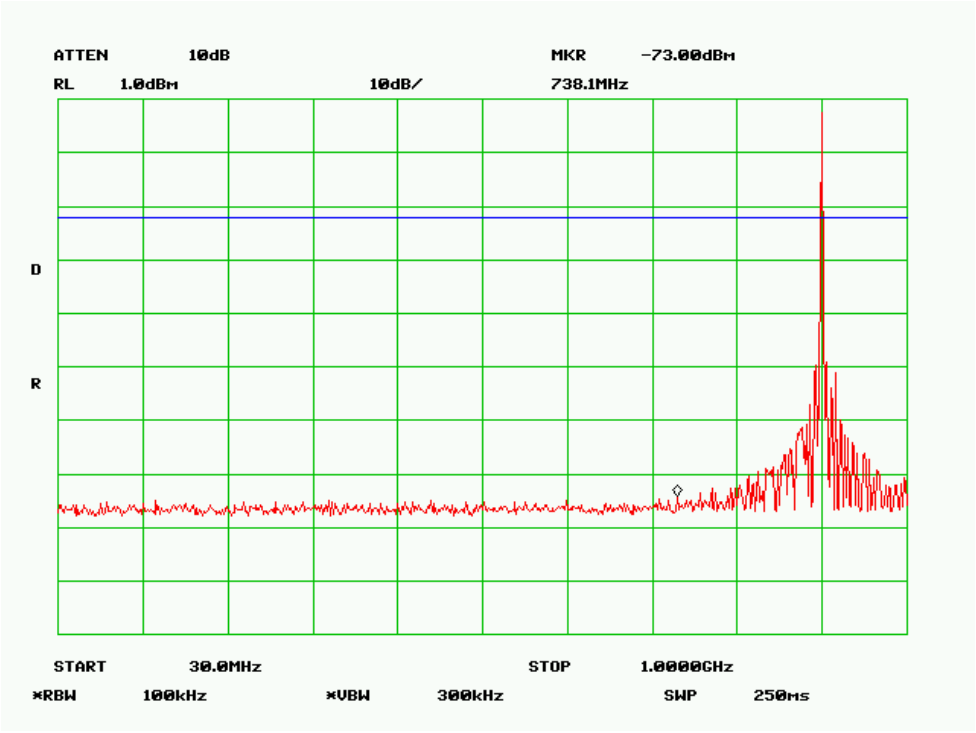
Environmental Conditions

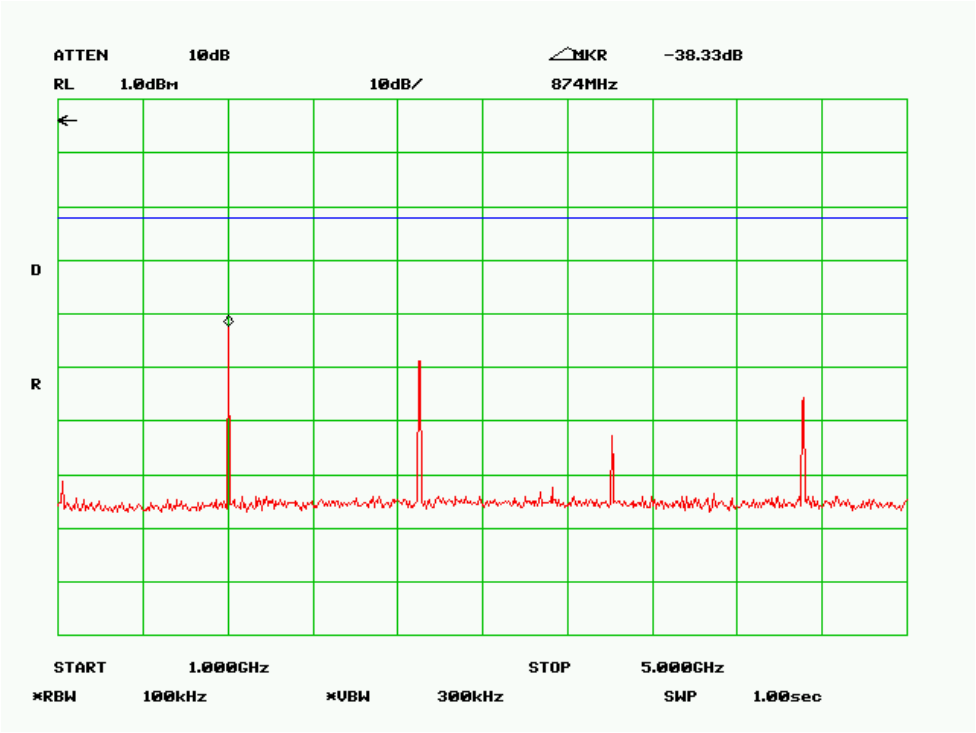
Temperature:	26 °C
Relative Humidity:	65 %
ATM Pressure:	102.0 kPa

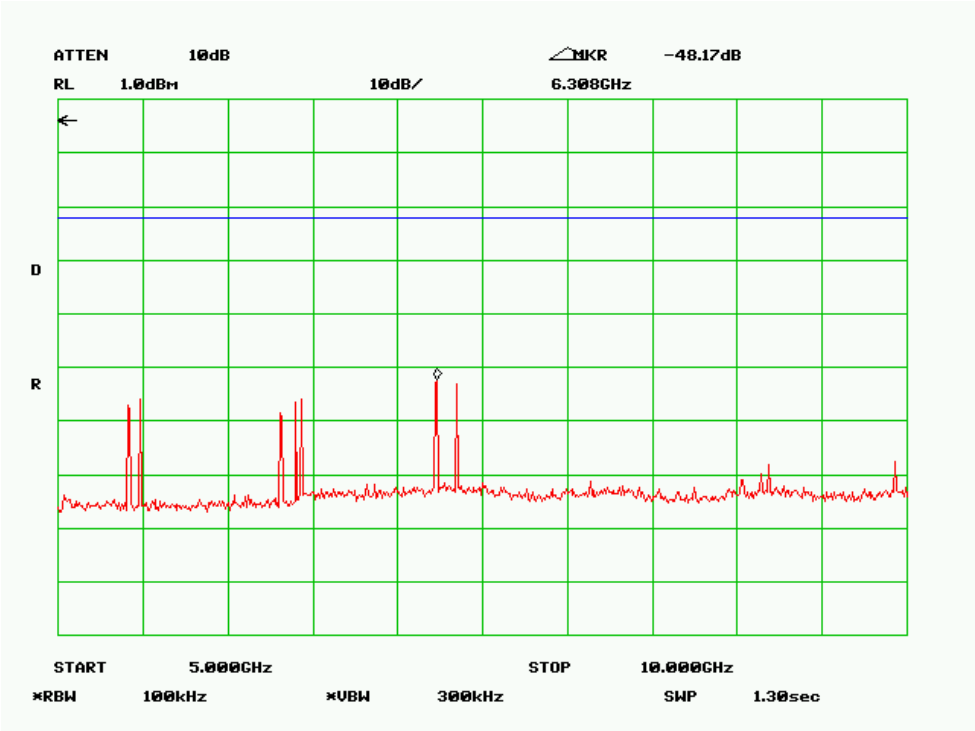
**The testing was performed by Choon Sian Ooi on 2007-02-15*

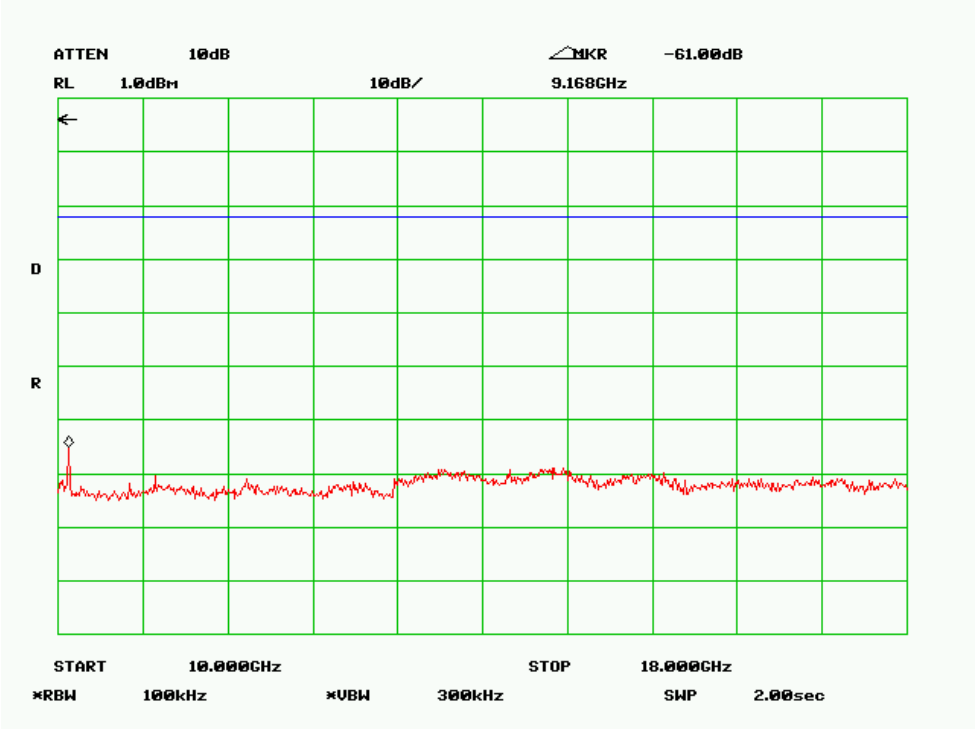
Measurement Results

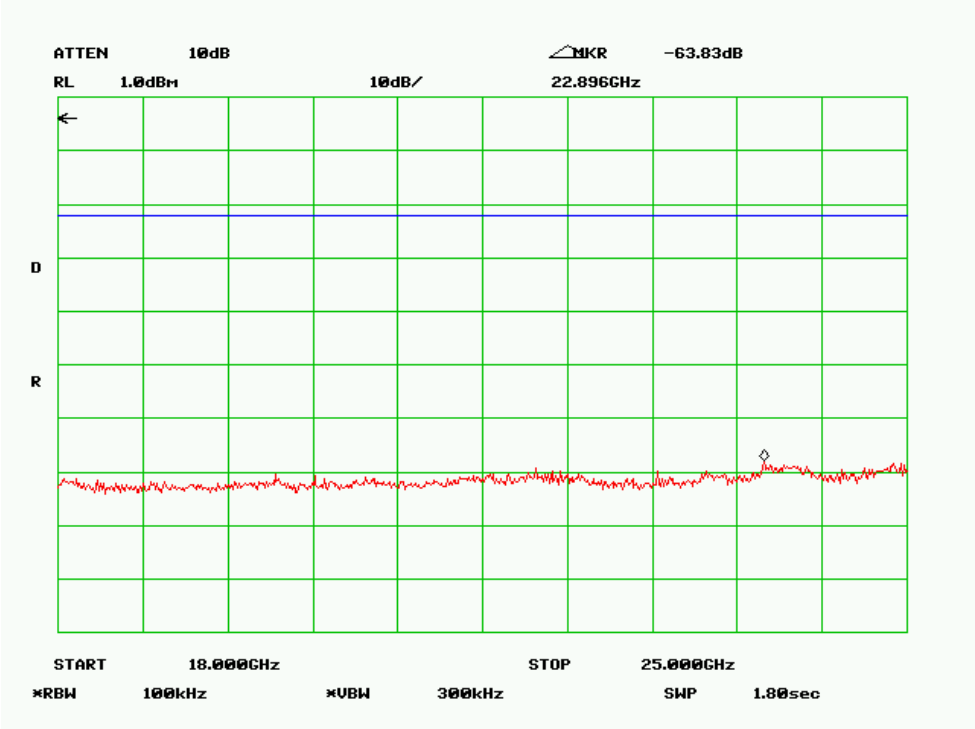
Low Channel



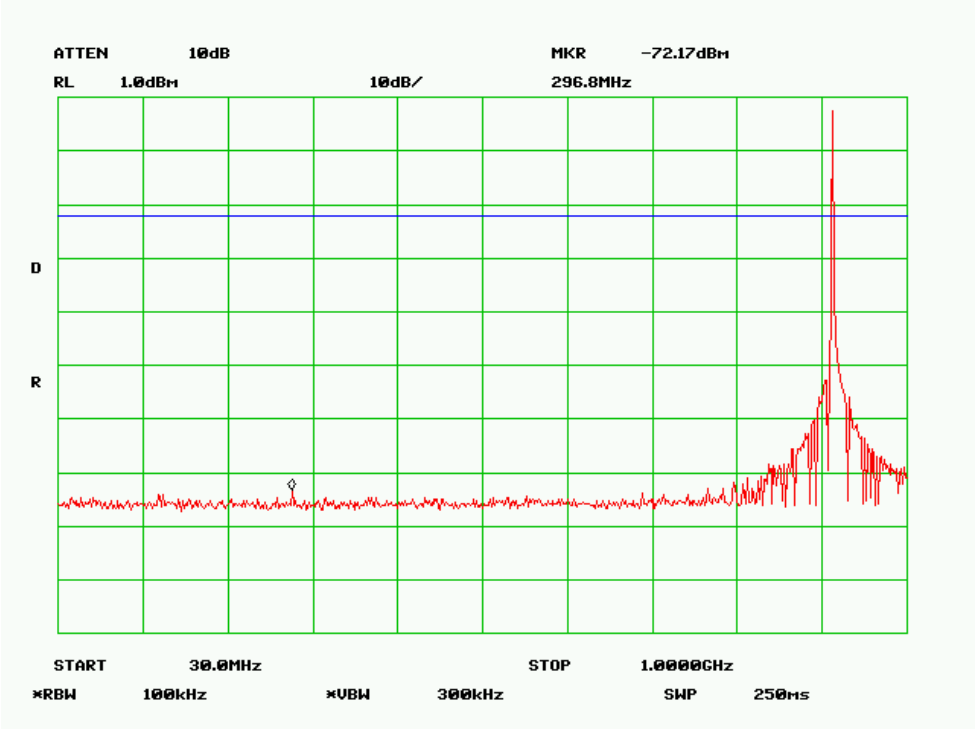


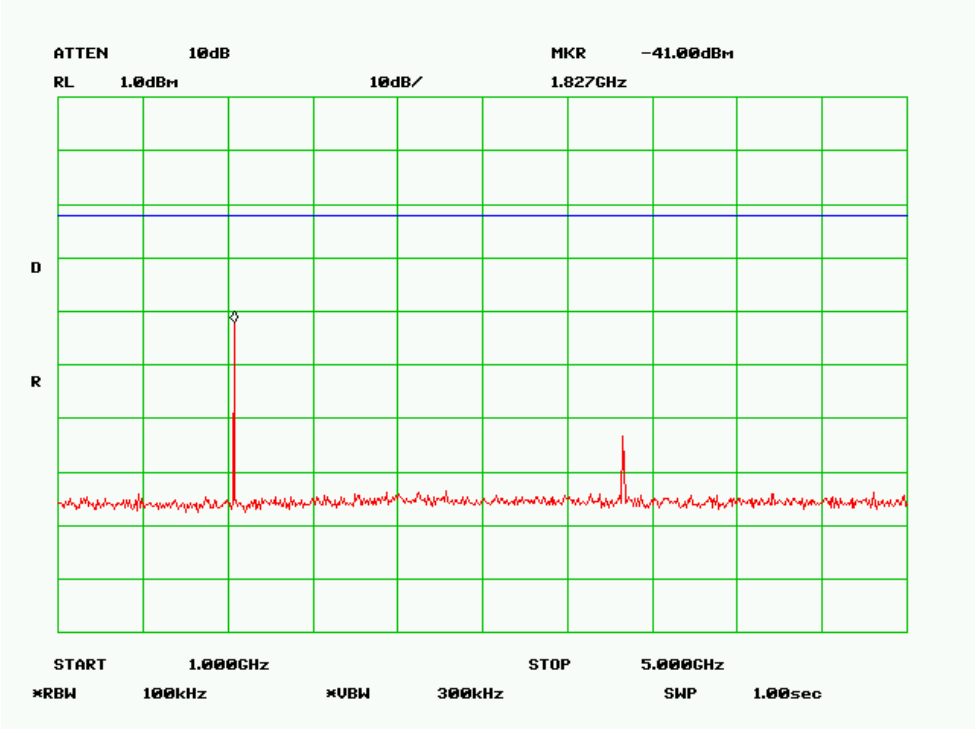

ATTEN 10dB
MKR -48.17dB
RL 1.0dBm
10dB/
6.308GHz
D
R
START 5.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 1.30sec

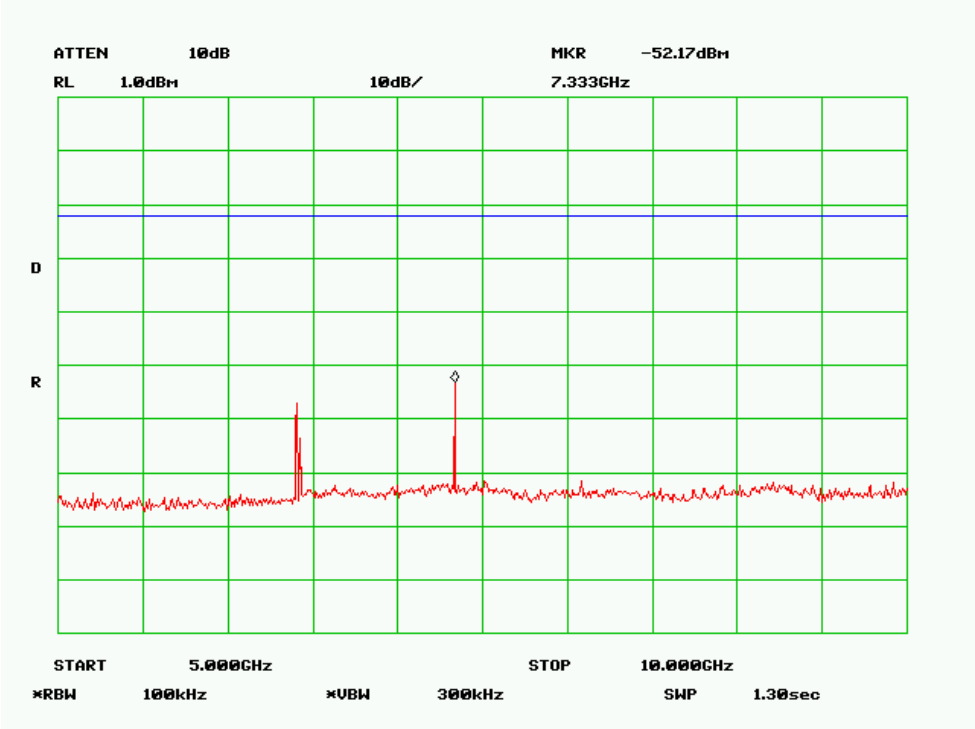

ATTEN 10dB
MKR -61.00dB
RL 1.0dBm
10dB/
9.168GHz
D
R
START 10.000GHz
STOP 18.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 2.00sec

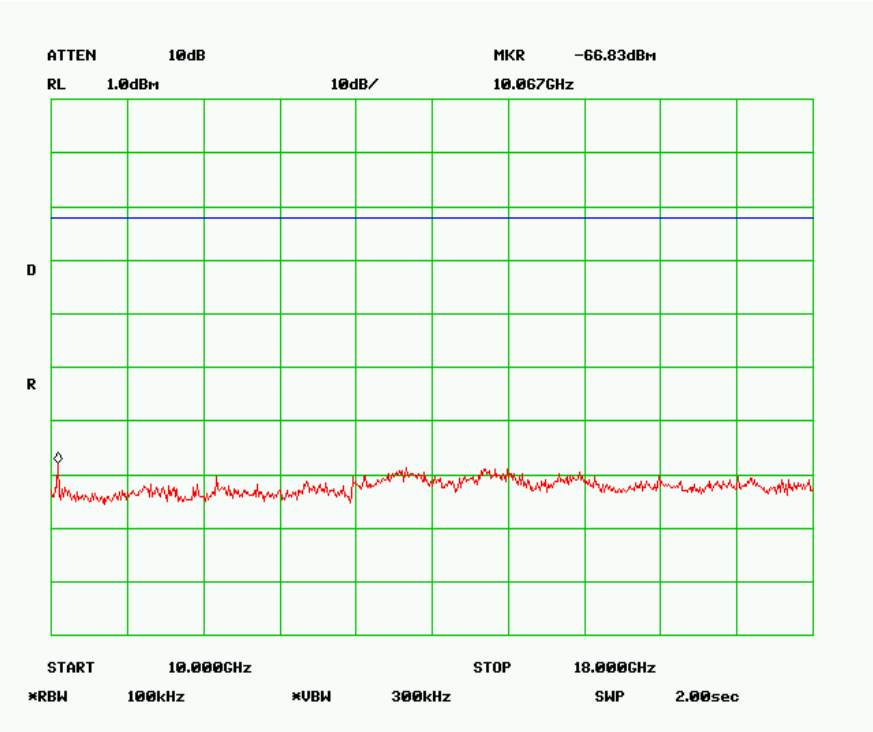

ATTEN 10dB
MKR -63.83dB
RL 1.0dBm
10dB/
22.896GHz
D
R
START 18.000GHz
STOP 25.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 1.80sec

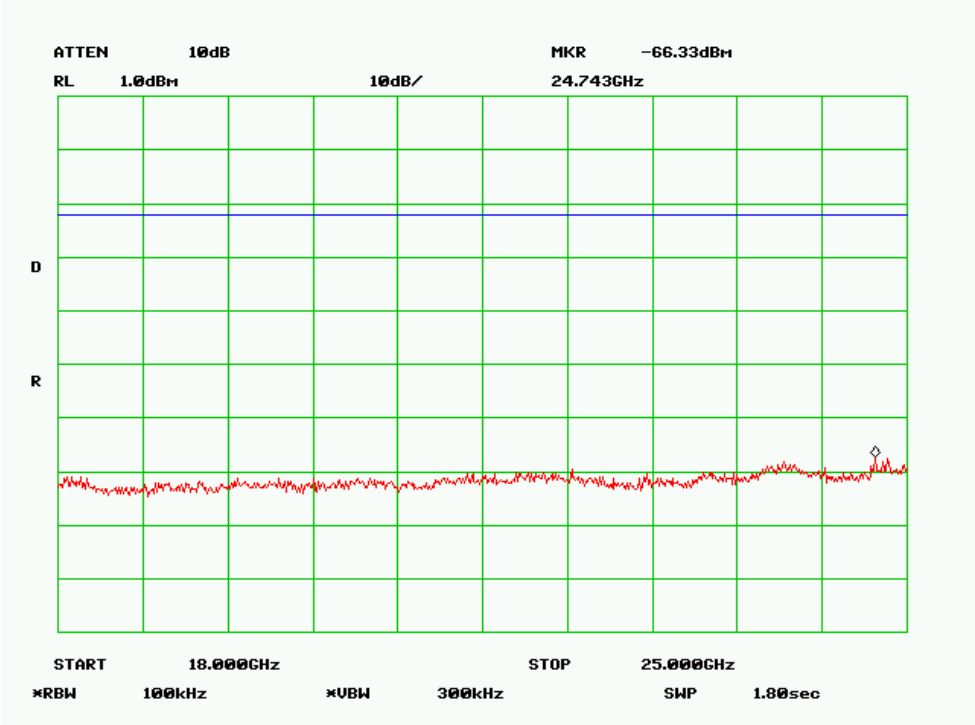
Mid Channel


ATTEN 10dB
MKR -72.17dBm
RL 1.0dBm
10dB/
296.8MHz
D
R
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
*VBW 300kHz
SWP 250ms

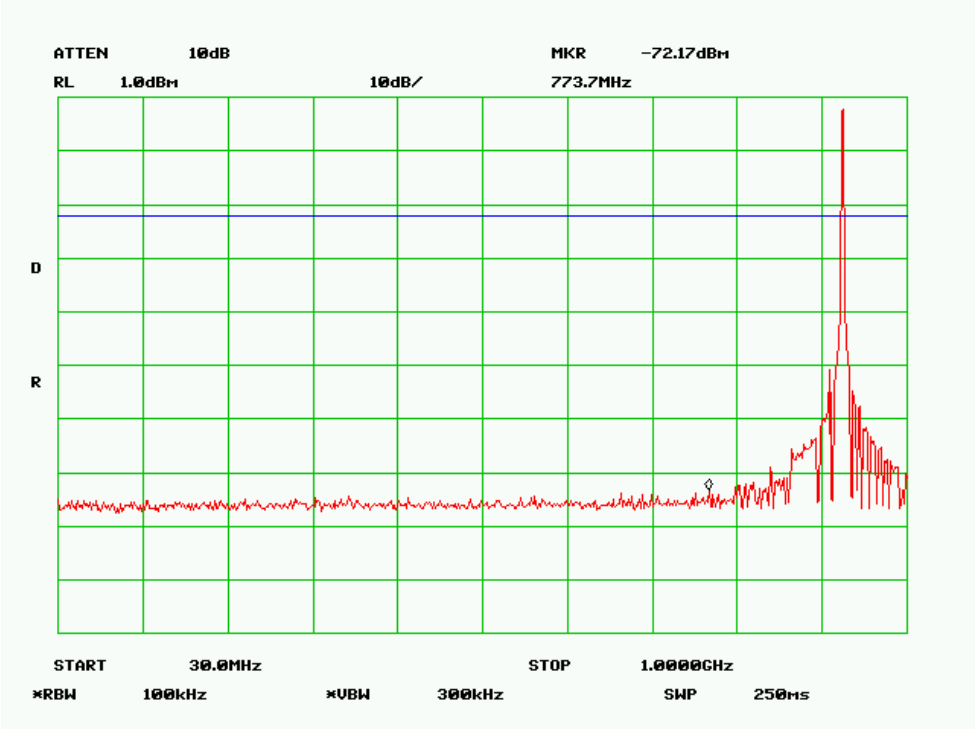

ATTEN 10dB
MKR -41.00dBm
RL 1.0dBm
10dB/
1.827GHz
D
R
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 1.00sec

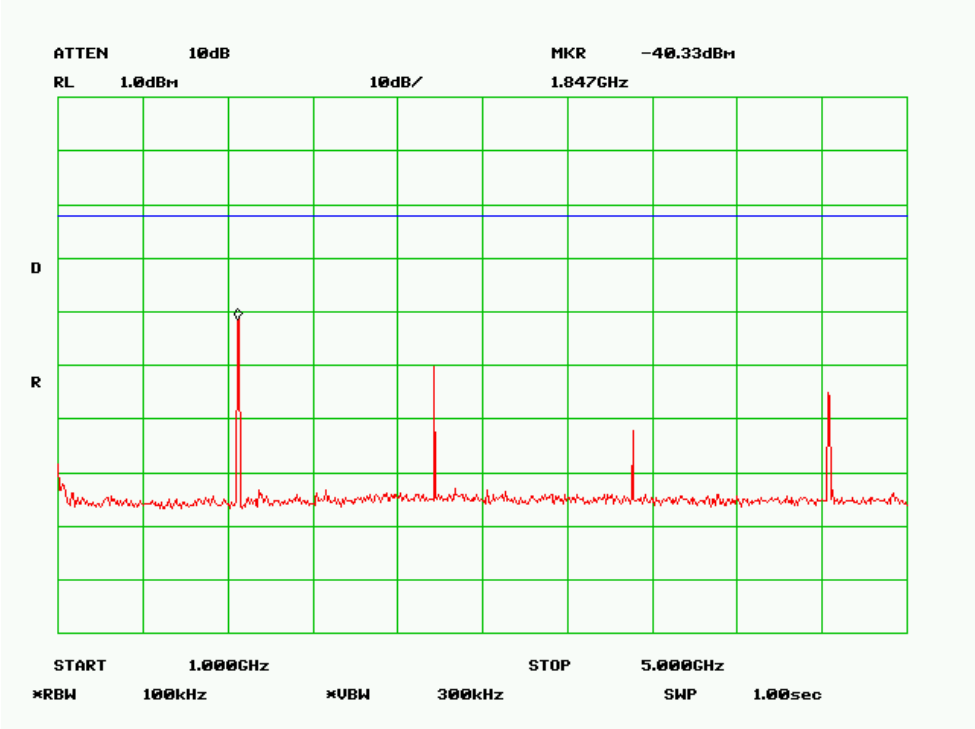

ATTEN 10dB
MKR -52.17dBm
RL 1.0dBm
10dB/
7.333GHz
D
R
START 5.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 1.30sec

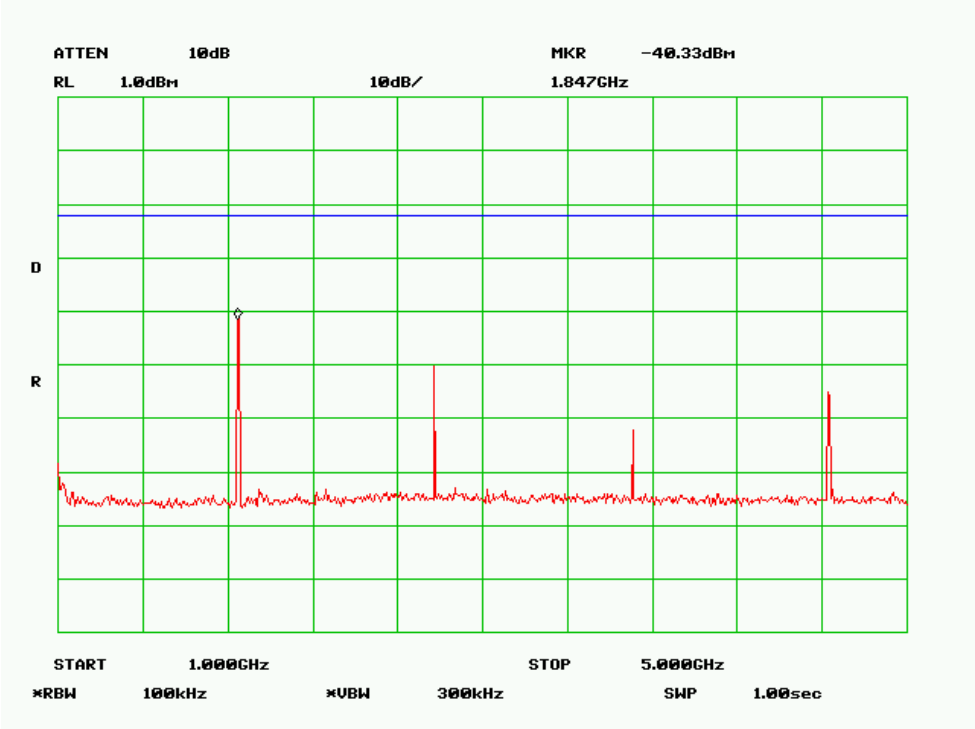

ATTEN 10dB
MKR -66.83dBm
RL 1.0dBm
10dB/
10.067GHz
D
R
START 10.000GHz
STOP 18.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 2.00sec

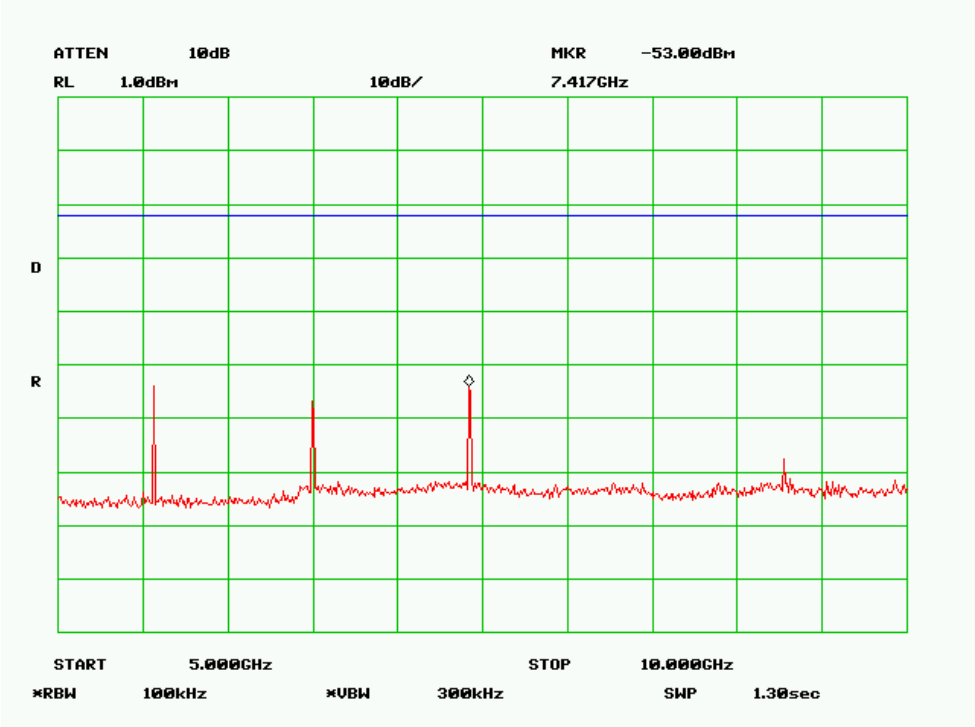

ATTEN 10dB
MKR -66.33dBm
RL 1.0dBm
10dB/
24.743GHz
D
R
START 18.000GHz
STOP 25.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 1.80sec

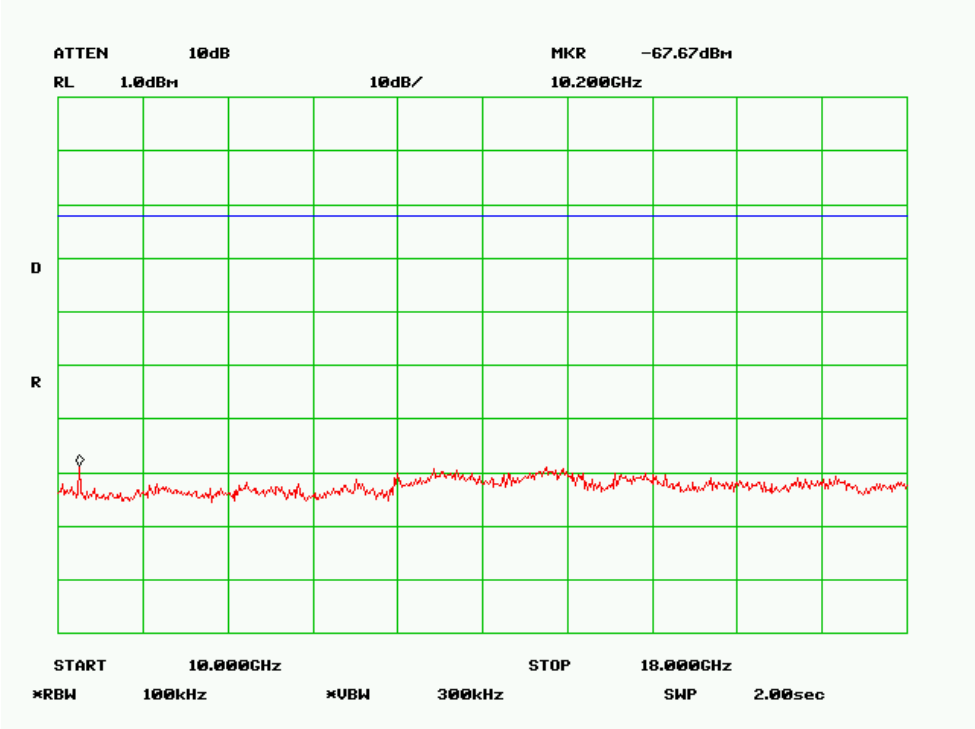
High Channel

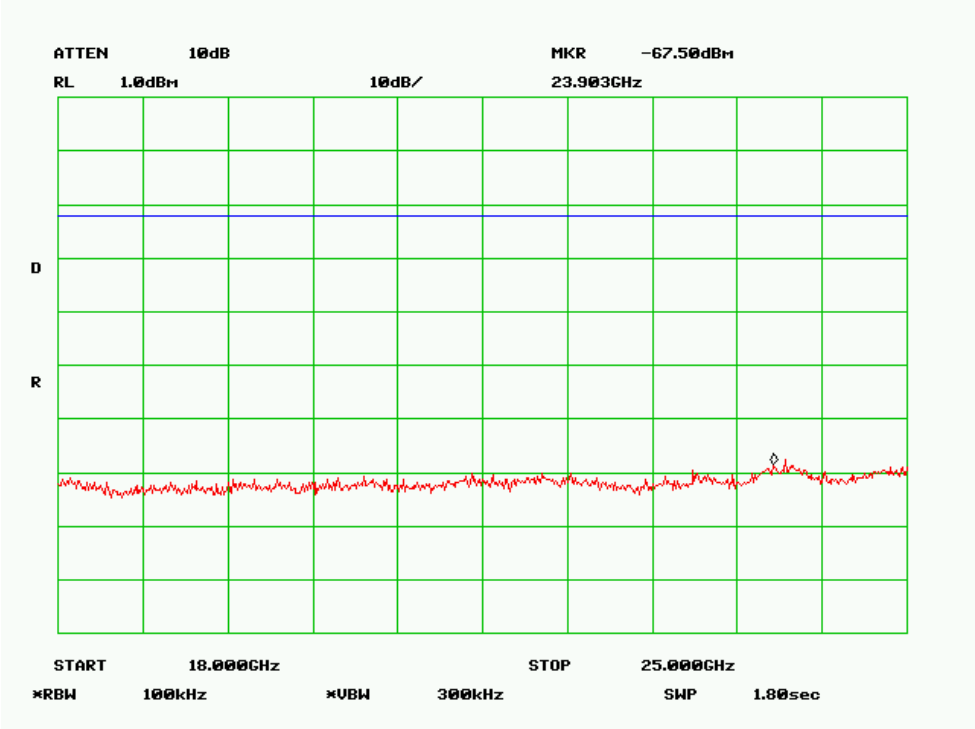





ATTEN 10dB
MKR -40.33dBm
RL 1.0dBm
10dB/
1.847GHz
D
R
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 1.00sec


ATTEN 10dB
MKR -53.00dBm
RL 1.0dBm
10dB/
7.417GHz
D
R
START 5.000GHz
STOP 10.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 1.30sec


ATTEN 10dB
MKR -67.67dBm
RL 1.0dBm
10dB/
10.200GHz
D
R
START 10.000GHz
STOP 18.000GHz
*RBW 100kHz
*VBW 300kHz
SWP 2.00sec


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

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

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

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

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

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

MPE Prediction

Predication of MPE limit at a given distance

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

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

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

Maximum peak output power at antenna input terminal:	-1.17(dBm)
Maximum peak output power at antenna input terminal:	0.7620 (mw)
Prediction distance:	20 (cm)
Predication frequency:	915 (MHz)
Antenna Gain (typical):	6 (dBi)
Antenna gain:	3.98 (numeric)
Power density at predication frequency at 20 cm:	0.0006(mW/cm^2)
MPE limit for uncontrolled exposure at prediction frequency:	0.61 (mW/cm^2)

Test Result

The EUT is a mobile device. The power density level at 20 cm is 0.0006mW/cm², which is below the uncontrolled exposure limit of 0.61mW/cm² at 915 MHz.