Engineering and Testing for EMC and Safety Compliance

Certification Application Report
FCC Part 15.247

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 Web: www.rheintech.com Herndon, VA 20170 E-Mail: ATCBINFO@rheintech.com	Investigation Total Ware, S.A.U. (ITOWA, SAU) c/Faraday, 159 Phone: 34937339850 08224 Terrassa Fax: 34937891351 Spain E-Mail: rfaure@itowa.com Contact: Ramon Faure

FCC ID:	UIWICFM01ITW	**Test Report Date:**	August 30, 2006
Platform:	N/A	**RTL Work Order Number:**	2006097
Model Name / Model Number:	ICFM	**RTL Quote Number:**	QRTL06-305

American National Standard Institute:	ANSI C63.4-2003: Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
FCC Classification:	DSS – Part 15 Spread Spectrum Transmitter
FCC Rule Part(s):	FCC Rules Part 15.247 (10-01-05): Operation within the bands 920-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System
FCC Guidance:	DA 00-705, AD 00-1407
Digital Interface Information	Digital Interface was found to be compliant

Frequency Range (MHz)	Output Power (W)	Frequency Tolerance	Emission Designator
902.225 – 914.975	0.054	N/A	16K1F7D
915.000 – 927.750	0.052	N/A	16K3F7D

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, FCC 97-114, ANSI C63.4.

Signature: _____ Date: August 30, 2006

Typed/Printed Name: Desmond A. Fraser Position: President

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The test results relate only to the item(s) tested.

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1 General Information

1.1 Scope

Applicable Standards and Guidance:

- FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
- DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

1.2 Description of EUT

Equipment Under Test	RF Module
Model Name	ICFM
Modulation Type	FHSS
Frequency Range	902 - 928 MHz
Antenna Types	Internal flexible PCB dipole or ½ wave whip

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.4 Related Submittal(s)/Grant(s)

This is an original application for **LIMITED MODULAR APPROVAL** certification for Model ICFM, FCC ID: UIWICFM01ITW.

1.5 Modifications

No modifications were required for compliance.

2 Test Information

2.1 Description of Test Modes

Intentional radiator testing was done with the module in a stand-alone configuration. Because this is a **LIMITED MODULAR APPROVAL**, additional radiated spurious testing was done with the module in a host. Additionally, Part 15B unintentional emissions were tested in three typical hosts. This data is in an FCC verification test report and is available upon request.

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested:

Table 2-1: Channels Tested – Low Band

Channel	Frequency
Low	902.225
Middle	908.475
High	914.975

Table 2-2: Channels Tested – High Band

Channel	Frequency
Low	915.000
Middle	921.250
High	927.750

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-3: Test Result Summary – FCC Part 15, Subpart C (Section 15.247)

Standard	Test	Pass/Fail or N/A
FCC 15.207	AC Power Conducted Emissions	Pass
FCC 15.209	Radiated Emissions	Pass
FCC 15.247(b)	Maximum Peak Power Output	Pass
FCC 15.247(d)	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	Band Edge Measurement	Pass
FCC 15.247(a)(1)	Carrier Frequency Separation	Pass
FCC 15.247(a)(1)(ii)	20 dB Bandwidth	Pass
FCC 15.247(a)(1)(iii)	Hopping Characteristics	Pass
FCC 15.247(a)(1)(iii)	Average Time of Occupancy	Pass

2.4 Test System Details

The test sample was received on July 11, 2006. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

Table 2-4: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
Module	Itowa	ICFM	N/A	UIWICFM01ITW	28 and 10 cm unshielded I/O; 23 cm and 13 cm 1shielded antenna I/O	17450

2.5 Configuration of Tested System

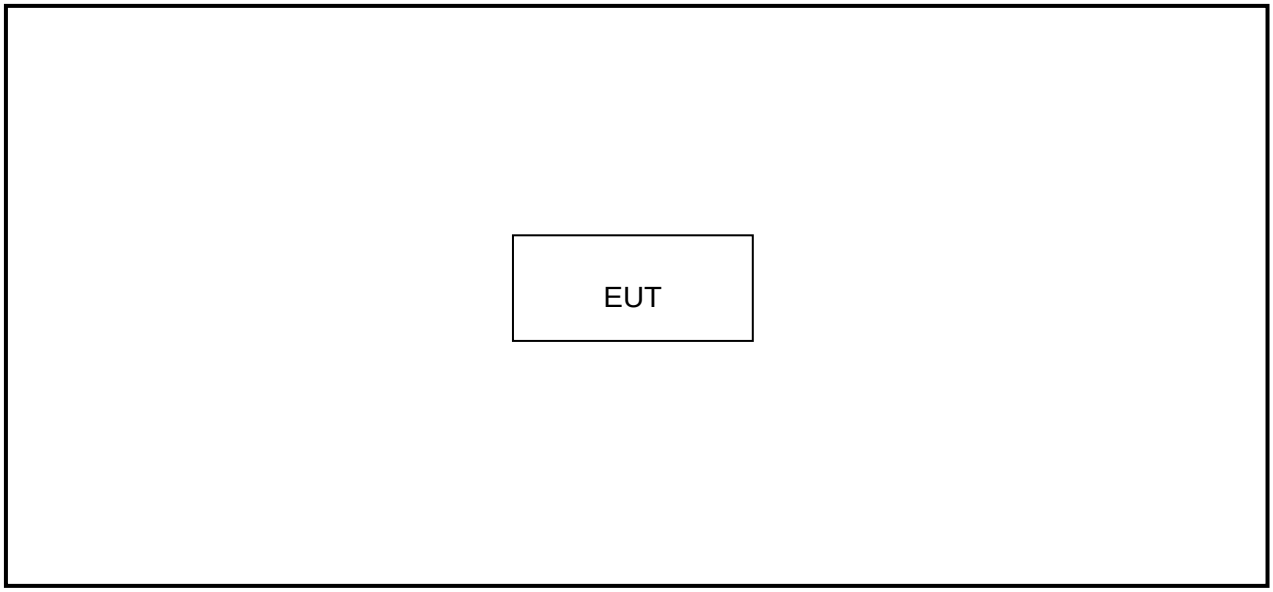


Figure 1: Configuration of System Under Test

3 Peak Output Power - §15.247(b)(1)

3.1 Power Output Test Procedure

A conducted power measurement of the EUT was taken using an Agilent 4416A EPM-P Series Power Meter with an E9323A Peak and Average Power Sensor.

Table 3-1: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	9/21/06
901356	Agilent	E9323A	Power Sensor	31764-264	9/21/06

3.2 Power Output Test Data

Table 3-2: Power Output Test Data – Low Band

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
Low	902.225	16.1
Mid	908.475	16.7
High	914.975	17.3

Table 3-3: Power Output Test Data – High Band

Channel	Frequency (MHz)	Peak Power Conducted Output (dBm)
Low	915.000	17.2
Mid	921.250	16.8
High	927.750	16.8

Test Personnel:

Richard B. McMurray	Richard B. McMurray	August 3, 2006
EMC Test Engineer	Signature	Date of Test

4 Compliance with the Band Edge – FCC §15.247(d)

4.1 Band Edge Test Procedure

The transmitter output was connected to its appropriate antenna. Peak (1 MHz RBW/VBW) and average (1 MHz RBW/10 Hz VBW) radiated measurements were taken with a suitable span to encompass the peak of the fundamental. A delta measurement was performed from the highest peak in the restricted band to the peak of the fundamental, and subtracted from the field strength; the result was compared to the limit (20 dBc)

Table 4-1: Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901231	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901232	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901235	IW Microwave Products	KPS-1503-360-KPS	High frequency RF cables	36"	9/1/06
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
901053	Schaffner Chase	CBL6112B	Bi-Log Antenna (20 MHz - 2 GHz)	2648	11/1/06
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

4.2 Band Edge Test Results

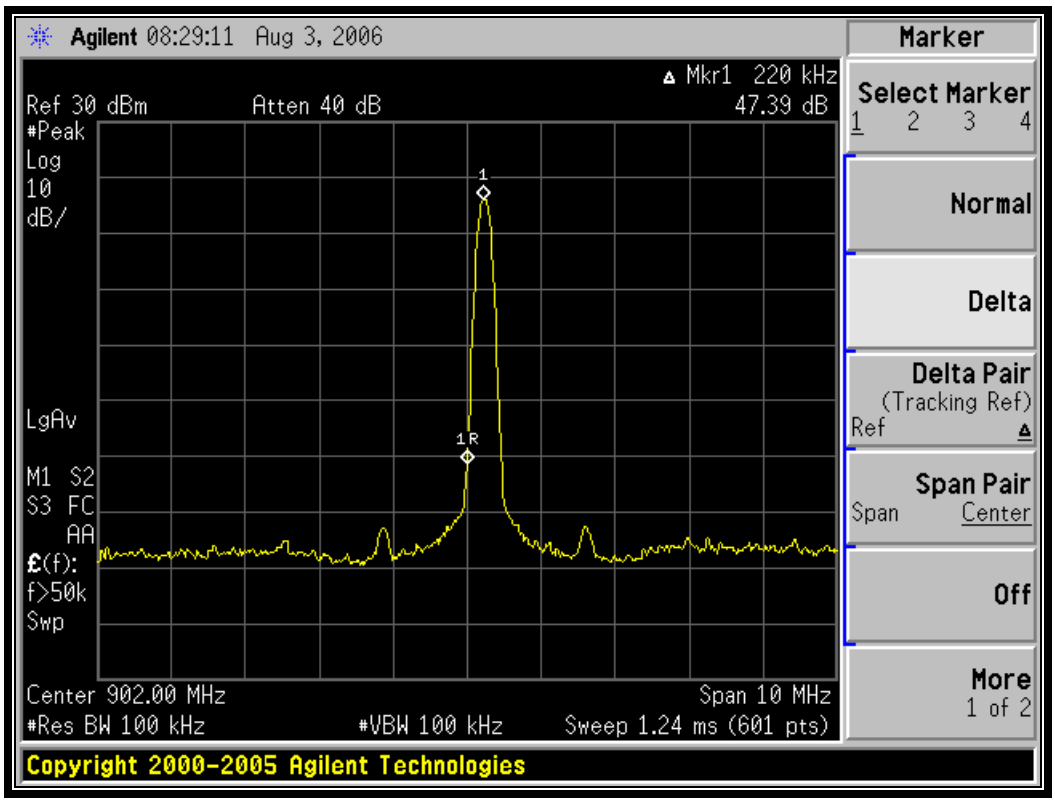
4.2.1 Calculation of Lower Band Edge

114.9 dBuV/m is the field strength measurement, from which the delta measurement of 39.4 dB is subtracted (reference plots), resulting in a level of 75.5 dB. This level has a margin of 19.4 dB below the limit of 94.9 dBuV/m.

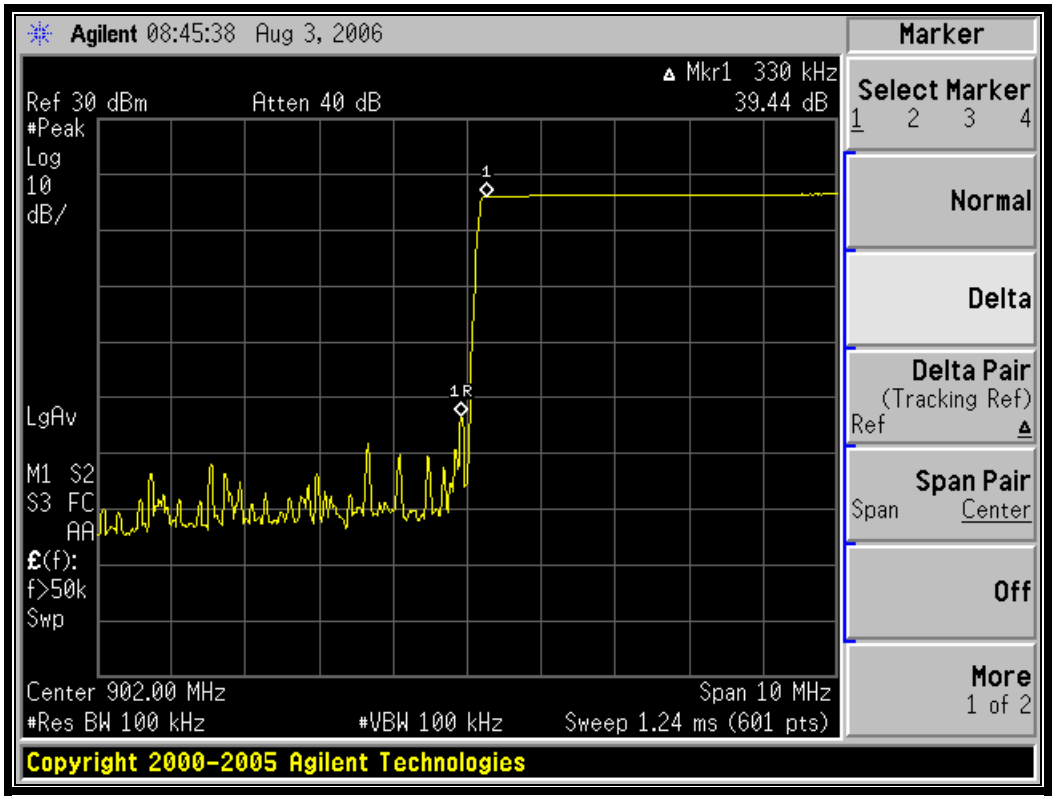
Calculation: 114.9 dBuV/m – 39.4 dB – 94.9 dBuV/m = -19.4 dB

Peak Field Strength of Lower Band Edge (1 MHz RBW/1 MHz VBW) = 114.9 dBuV/m
Quasi-Peak Field Strength of Lower Band Edge (1 MHz RBW/10 Hz VBW) = 114.9 dBuV/m
Delta measurement = 39.4 dB

Plot 4-1: Lower Band Edge: Low Channel (TX Frequency: 902 MHz) – Not Hopping



Plot 4-2: Lower Band Edge: Low Channel (TX Frequency: 902 MHz) – Hopping Mode



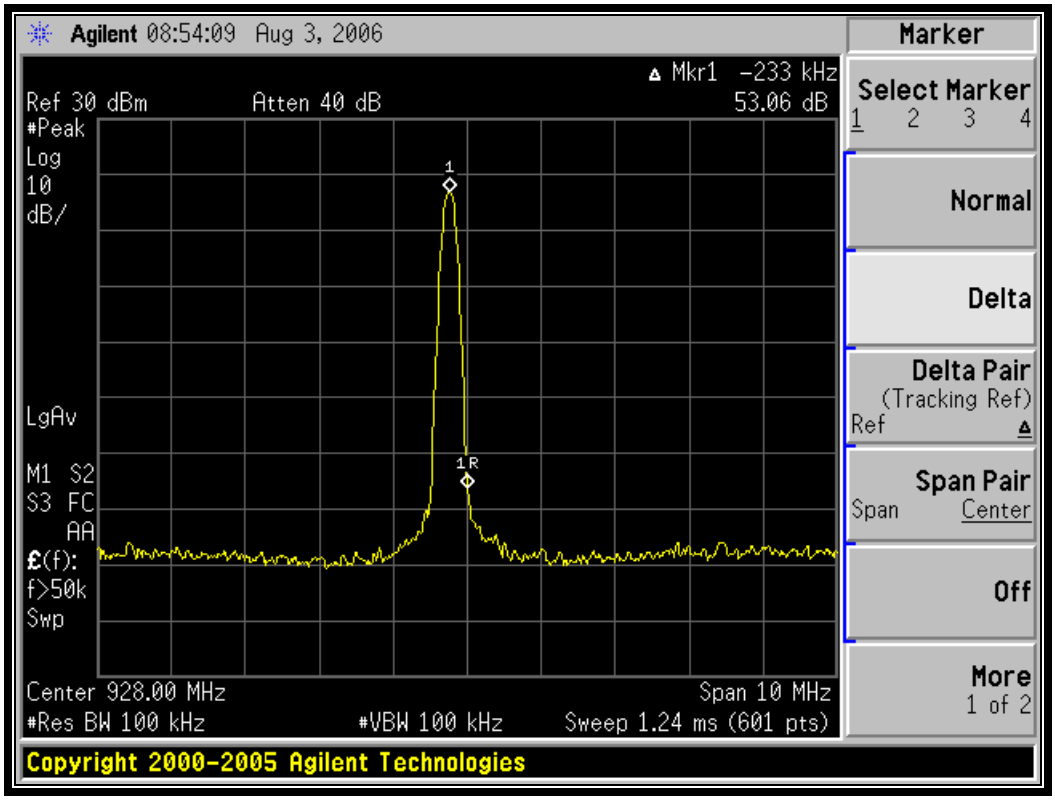
4.2.2 Calculation of Upper Band Edge

111.6 dBuV/m is the field strength measurement, from which the delta measurement of 29.9 dB is subtracted (reference plots), resulting in a level of 81.7 dB. This level has a margin of 9.9 dB below the limit of 91.6 dBuV/m.

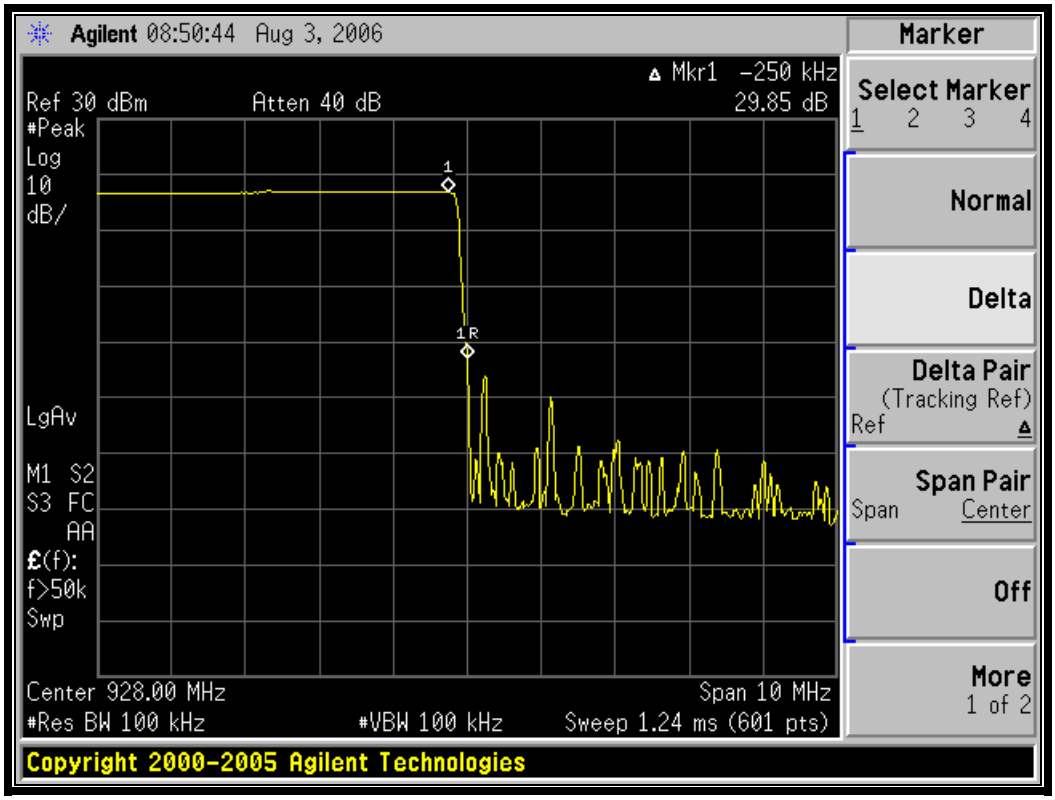
Calculation: 111.6 dBuV/m – 29.9 dB – 91.6 dBuV/m = -9.9 dB

Peak Field Strength of Lower Band Edge (1 MHz RBW/1 MHz VBW) = 111.6 dBuV/m
Quasi-Peak Field Strength of Lower Band Edge (1 MHz RBW/10 Hz VBW) = 111.6 dBuV/m
Delta measurement = 29.9dB

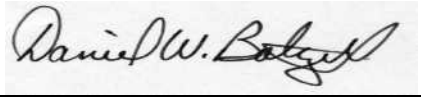
Plot 4-3: Upper Band Edge: Upper Channel (TX Frequency: 927 MHz) – Not Hopping



Plot 4-4: Upper Band Edge: Upper Channel (TX Frequency: 927 MHz) – Hopping Mode



Test Personnel:

Daniel W. Baltzell		August 3, 2006
Test Engineer	Signature	Dates of Test

5 Antenna Conducted Spurious Emissions - §15.247(d)

5.1 Antenna Conducted Spurious Emissions Test Procedures

Antenna spurious emissions per FCC 15.247(d) were measured from the EUT antenna port using a 50 ohm spectrum analyzer with the resolution and video bandwidth set at 100 kHz. The modulated carrier was investigated at the following frequencies: 902 MHz, 915 MHz and 928 MHz. Hopping mode was also investigated.

Note: No harmonics or spurs were found within 20 dB of the limit from the lowest frequency generated in the EUT to the 10th harmonic of the carrier frequency (note that we are reporting power as peak). Per FCC 15.31(o), no data is being reported.

Table 5-1: Antenna Conducted Spurious Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

Test Personnel:

Richard B. McMurray	Richard B. McMurray	August 3, 2006
EMC Test Engineer	Signature	Date of Test

6 20 dB Bandwidth – FCC §15.247(a)(1)(i)

6.1 20 dB Bandwidth Test Procedure

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.

The minimum 20 dB bandwidths were measured using a 50 ohm spectrum analyzer. The carrier was adjusted on the analyzer so that it was displayed entirely on the spectrum analyzer. The sweep time was set to auto and allowed through several sweeps with the max hold function used in peak detector mode. The resolution bandwidth was set to 1 kHz, and the video bandwidth set at 1 kHz. The minimum 20 dB bandwidths were measured using the spectrum analyzer delta marker set 20 dB down from the peak of the carrier and with a modulated signal. The data table below contains the bandwidth measurement results.

Table 6-1: 20 dB Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

6.2 20 dB Modulated Bandwidth Test Data

Table 6-2: 20 dB Modulated Bandwidth Test Data – Minimum 20 dB Bandwidths

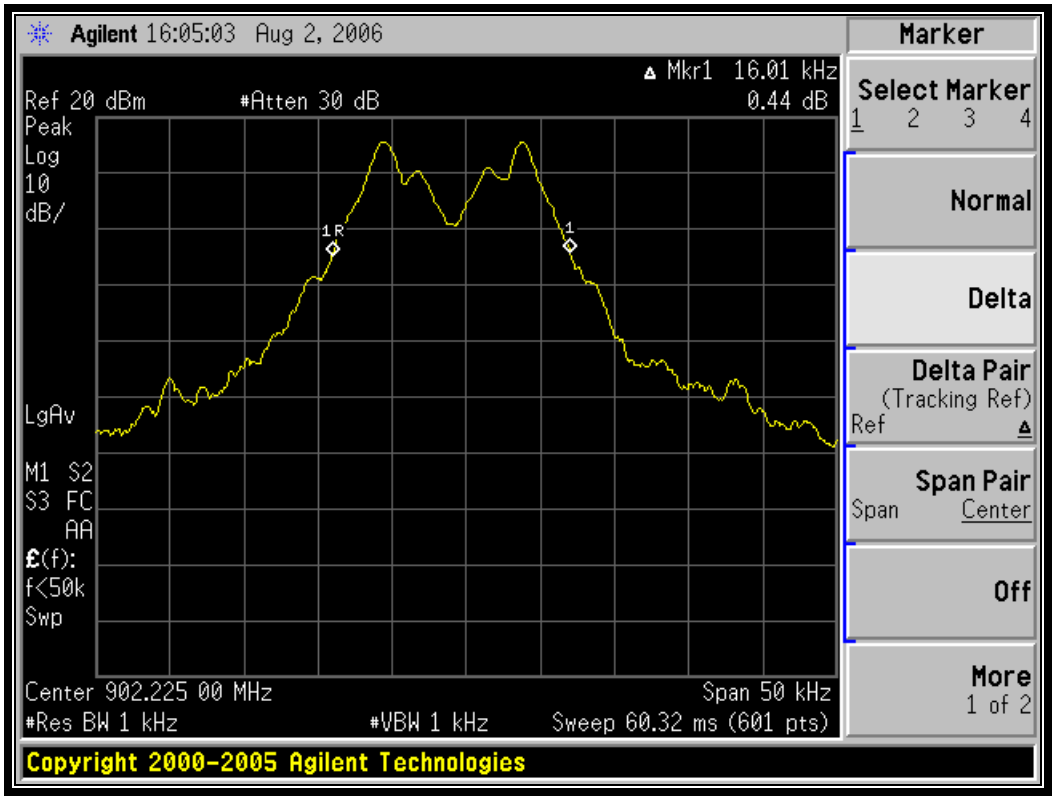
Channel / Frequency (MHz)	20 dB Bandwidth (kHz)
Low Band - Low / 902.225	16.01
Low Band - Mid / 908.475	16.09
Low Band - High / 914.975	16.09

Channel / Frequency (MHz)	20 dB Bandwidth (kHz)
High Band – Low / 915.000	16.09
High Band – Mid / 921.250	16.34
High Band – High / 927.750	16.10

6.3 20 dB Bandwidth Plots

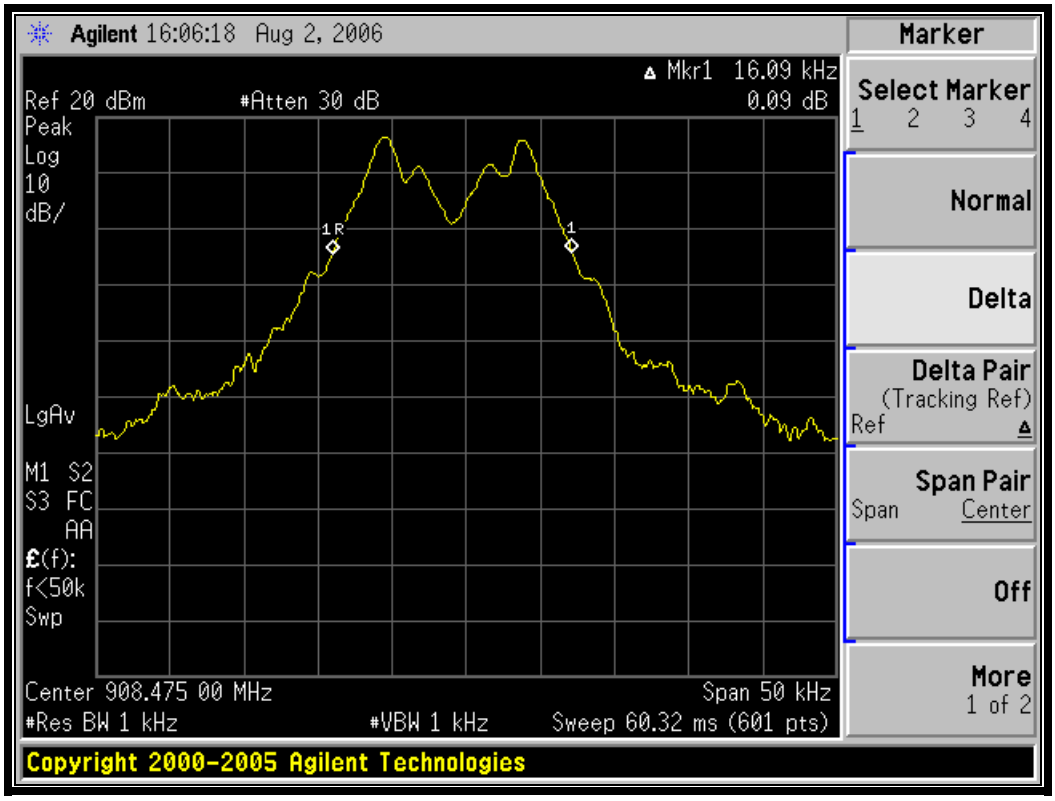
Channel:	Low Band - Low
Channel Frequency (MHz):	902.225
Resolution Bandwidth (kHz):	1
Video Bandwidth (kHz):	1
Span (MHz):	0.05

Plot 6-1: 20 dB Bandwidth Low Band Low Channel



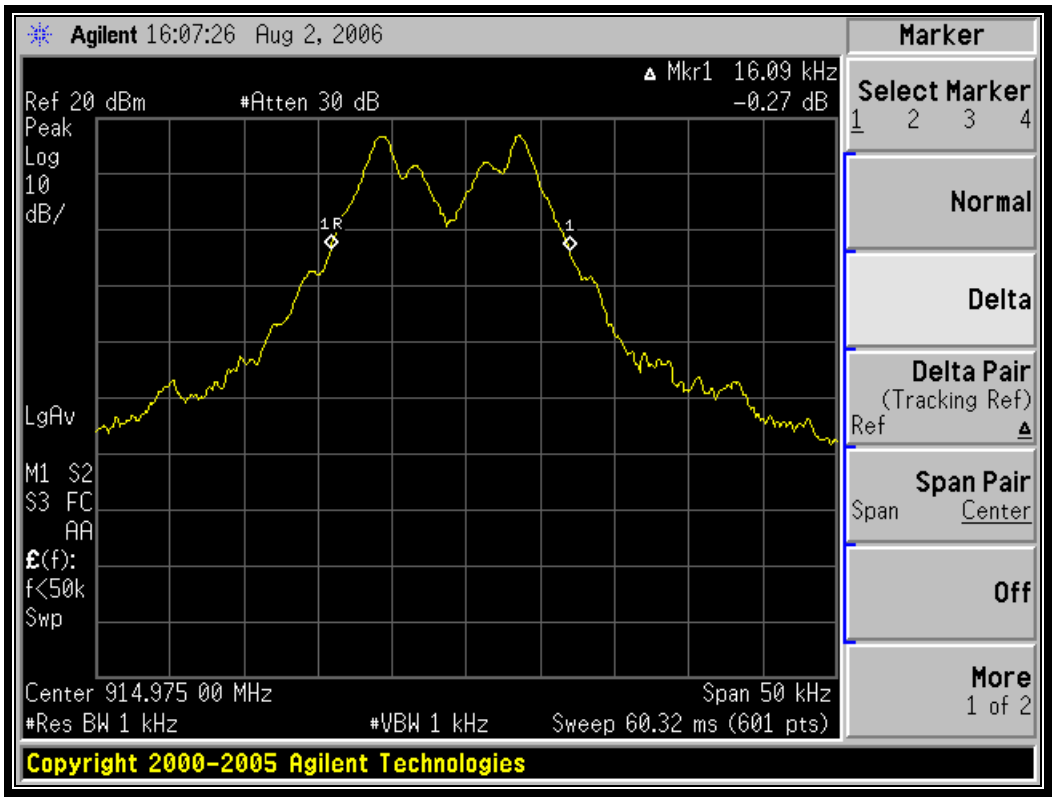
Channel: Low Band - Mid
Channel Frequency (MHz): 908.475
Resolution Bandwidth (kHz): 1
Video Bandwidth (kHz): 1
Span (MHz): 0.05

Plot 6-2: 20 dB Bandwidth Low Band Mid Channel



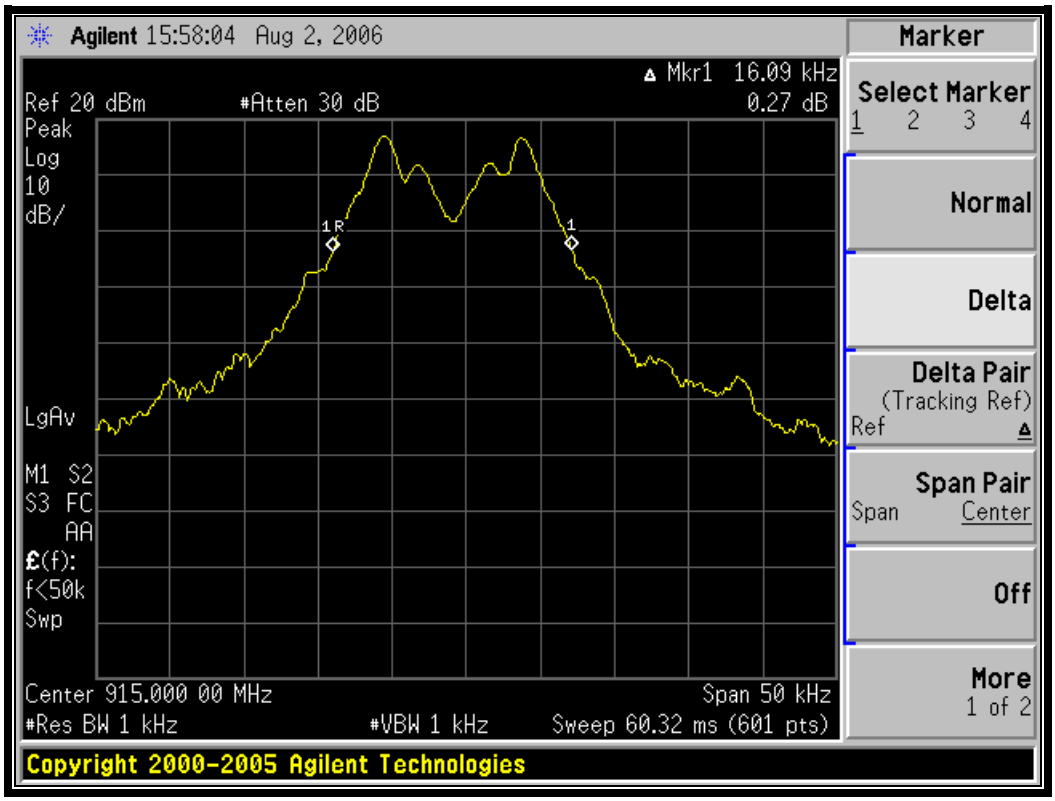
Channel: Low Band - High
Channel Frequency (MHz): 914.975
Resolution Bandwidth (kHz): 1
Video Bandwidth (kHz): 1
Span (MHz): 0.05

Plot 6-3: 20 dB Bandwidth Low Band High Channel



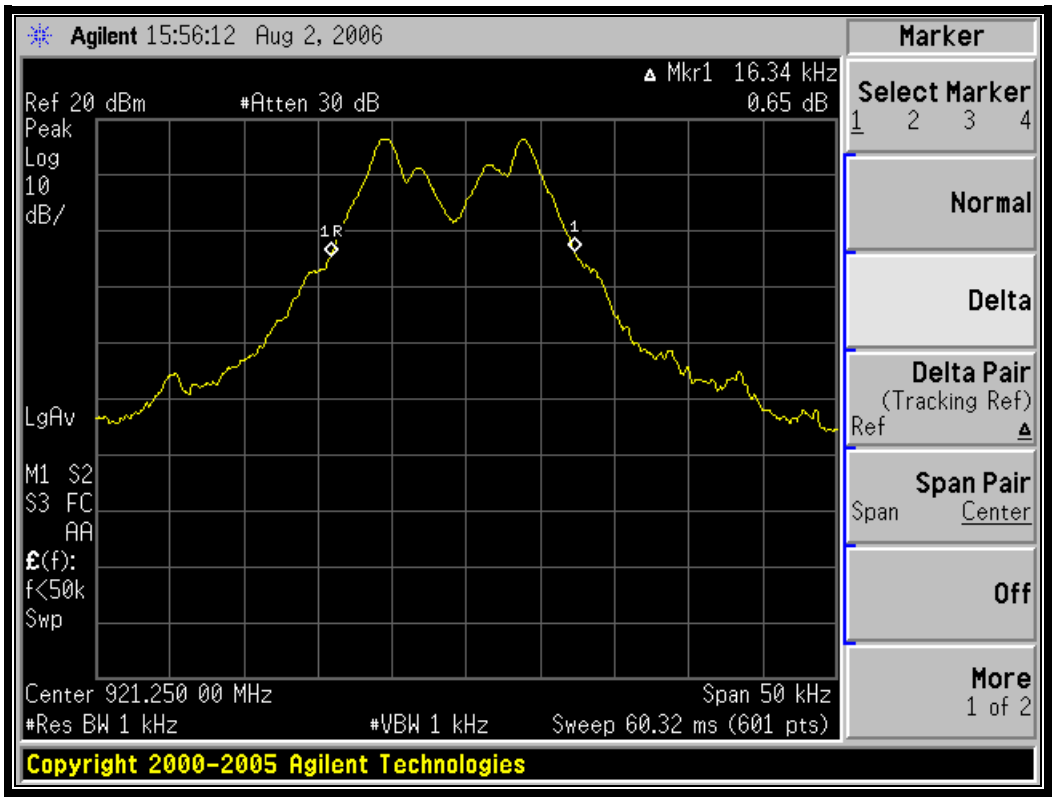
Channel: High Band - Low
Channel Frequency (MHz): 915.000
Resolution Bandwidth (kHz): 1
Video Bandwidth (kHz): 1
Span (MHz): 0.05

Plot 6-4: 20 dB Bandwidth High Band Low Channel



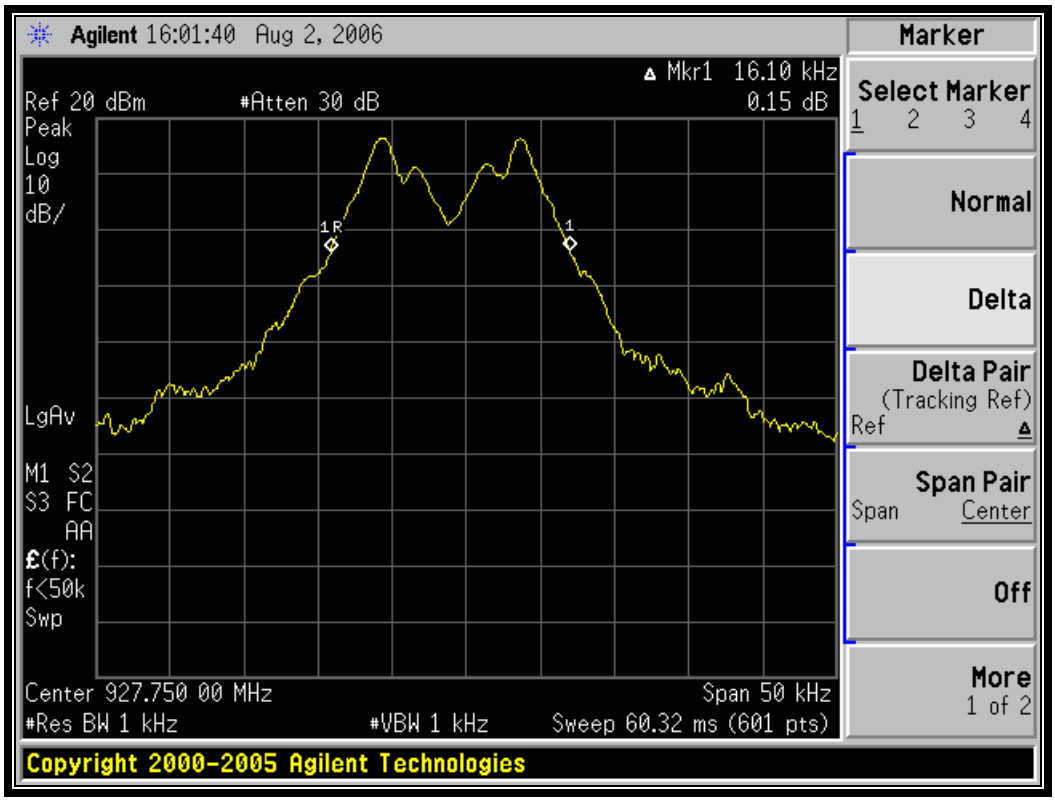
Channel: High Band - Mid
Channel Frequency (MHz): 921.250
Resolution Bandwidth (kHz): 1
Video Bandwidth (kHz): 1
Span (MHz): 0.05

Plot 6-5: 20 dB Bandwidth High Band Mid Channel



Channel: High Band - High
Channel Frequency (MHz): 927.750
Resolution Bandwidth (kHz): 1
Video Bandwidth (kHz): 1
Span (MHz): 0.05

Plot 6-6: 20 dB Bandwidth High Band High Channel



Test Personnel:

Richard B. McMurray	Richard B. McMurray	August 2, 2006
EMC Test Engineer	Signature	Date of Test

7 Carrier Frequency Separation - §15.247(a)(1)

7.1 Carrier Frequency Separation Test Procedure

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.

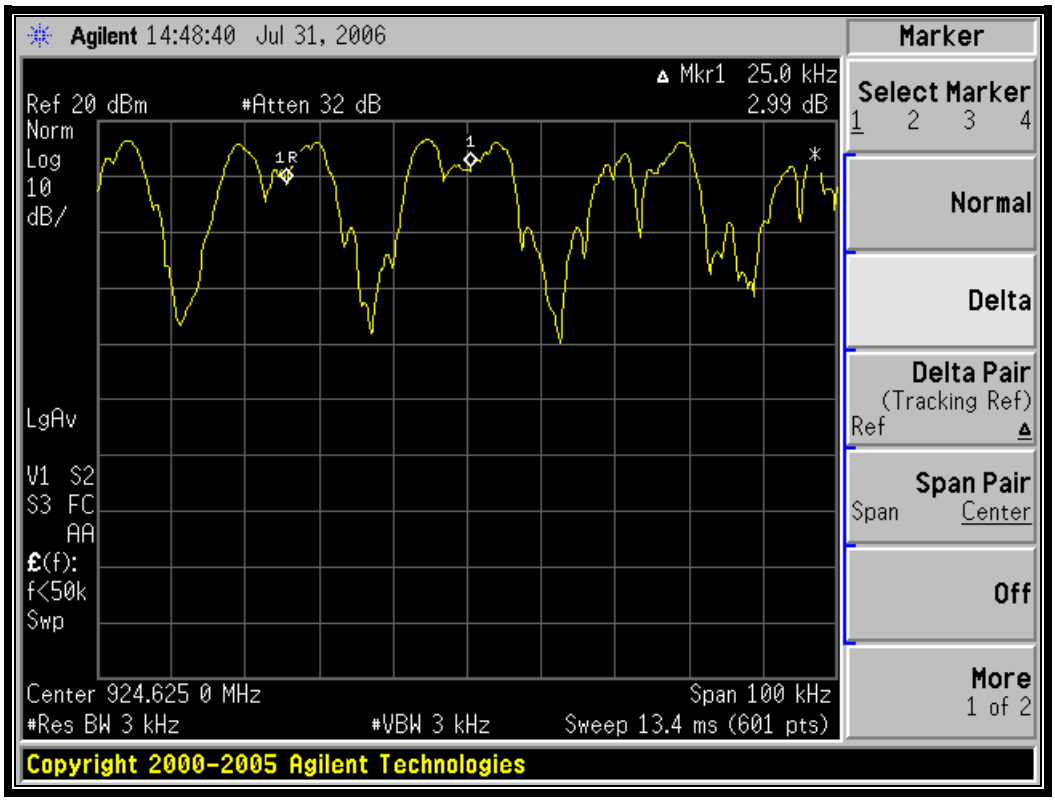
Measured frequency separation = 25 kHz

Table 7-1: Carrier Frequency Separation Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

7.2 Carrier Frequency Separation Test Data

Plot 7-1: Carrier Frequency Separation



Test Personnel:

Richard B. McMurray	Richard B. McMurray	July 31, 2006
EMC Test Engineer	Signature	Date of Test

8 Hopping Characteristics – FCC §15.247(a)(1)(i)

8.1 Hopping Characteristics Test Procedure

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. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

Table 8-1: Hopping Characteristics Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent	E4448A	Spectrum Analyzer (3 Hz – 50 GHz)	US440203416	11/02/06

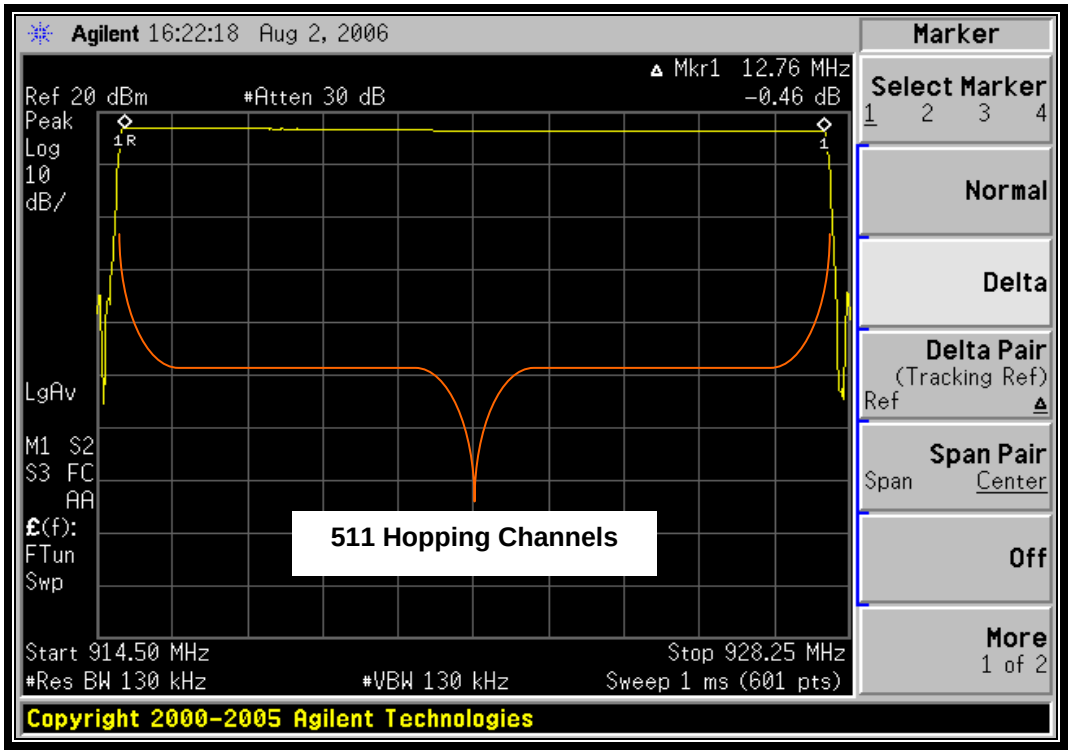
8.2 Number of Hopping Frequencies

Based on the theory of operation, 511 hopping frequencies are used in each band. The low band operates between 902.225 and 914.975 MHz and the high band between 915.000 and 927.750 MHz. The following confirm the actual bands above are used. The plot on the previous page shows channel spacing to be 25 kHz.

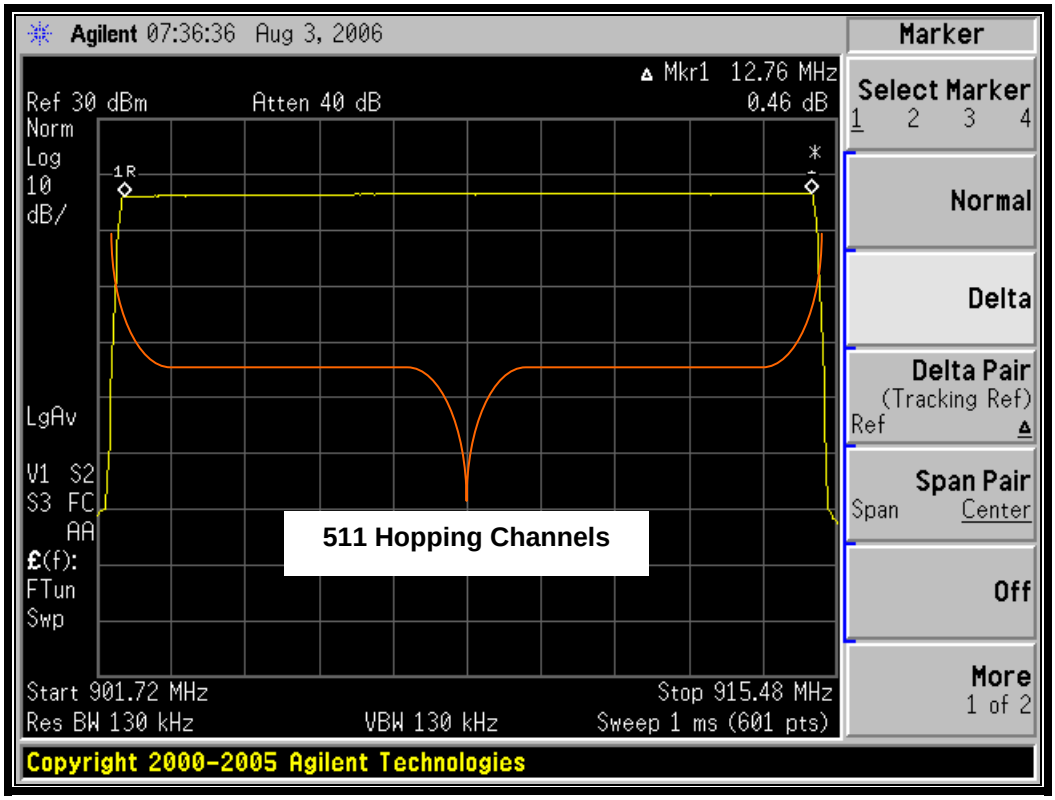
To confirm:
Low band: (914.975 – 902.225 + 0.025)/0.025 = 511 hopping frequencies
High band: (927.750 – 915.000 + 0.025)/0.025 = 511 hopping frequencies

Number of hopping frequencies in each band = 511

Plot 8-1: Number of Hopping Frequencies – High Band



Plot 8-2: Number of Hopping Frequencies – High Band



Test Personnel:

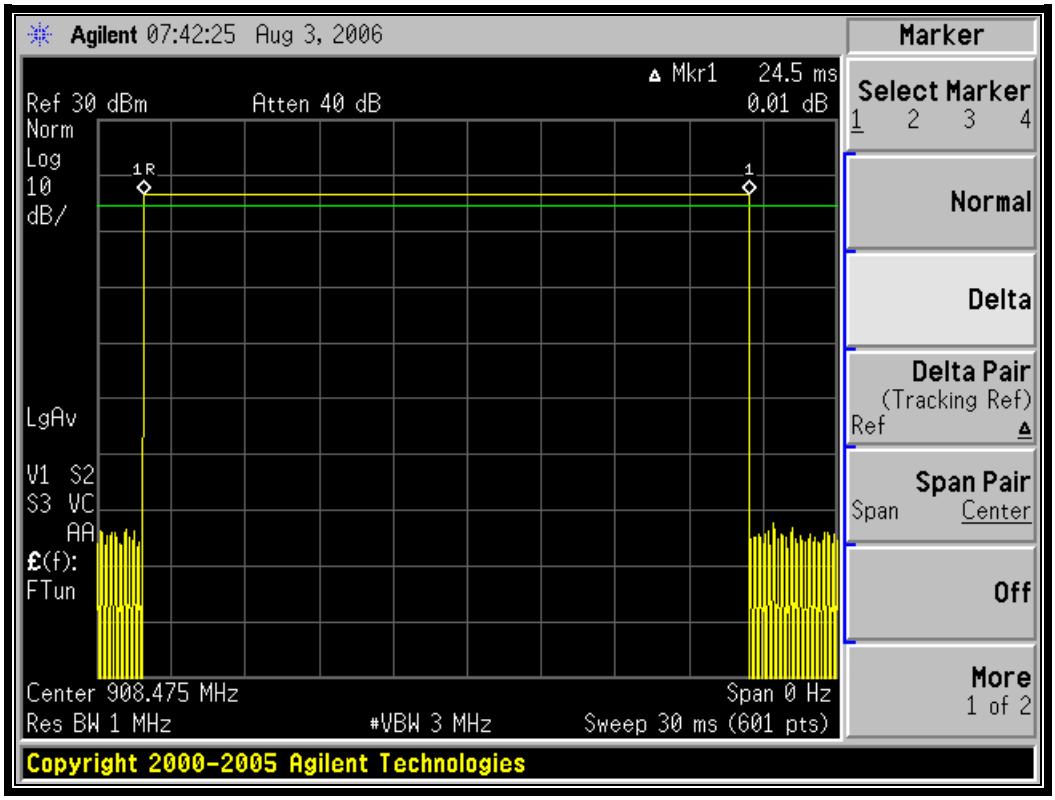
Richard B. McMurray	Richard B. McMurray	August 3, 2006
EMC Test Engineer	Signature	Date of Test

8.3 Average Time of Occupancy

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period. The spectrum analyzer sweep was set to 30 ms, with a zero span and max hold, until a pulse from the device under test was captured.

Based on the theory of operation, a complete hop sequence through all 511 frequencies takes longer than 20 seconds, therefore any one hopping channel occurs only once in any 20 second period and the average time of occupancy is equal to 24.5 ms, which meets the requirement.

Plot 8-3: Time of Occupancy (Dwell Time)



Test Personnel:

Richard B. McMurray	Richard B. McMurray	August 3, 2006
EMC Test Engineer	Signature	Date of Test

9 Conducted Emissions Measurement Limits – FCC §15.207

9.1 Limits of Conducted Emissions Measurements

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

9.2 Conducted Emissions Measurement Test Procedure

The conducted emissions measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 0.8 meters high. Power was fed to the EUT through a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an AC filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed AC power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 7 kHz high-pass filter. The filter was used to prevent overload of the spectrum analyzer from noise below 7 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or average mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements were performed in a linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The highest emissions amplitudes relative to the appropriate limits were measured and have been recorded in this report.

Table 9-1: Conducted Emissions Test Equipment

Part Type	Manufacturer	Model	Serial Number	Barcode	Cal Due Date
Spectrum Analyzer Display Section	Hewlett Packard	85662A	2816A16471	900896	3/28/2007
Spectrum Analyzer (10 kz-1.5 Hz)	Hewlett Packard	8567A	2727A00535	900897	3/28/2007
Quasi-Peak Adapter	Hewlett Packard	85650A	2412A00414	900969	8/3/2007
Filter	Solar	8130	947306	900729	N/A
16A LISN	AFJ International	LS16/110VAC	16010020082	901084	12/24/2006
16A LISN	AFJ International	LS16/110VAC	16010020080	901083	3/24/2007
RF Preselector for HP 8566B or 8568B (20Hz-2GHz)	Hewlett Packard	85685A	3146A01309	900889	3/10/2007
Emissions testing software	Rhein Tech Laboratories, Inc.	Automated Emission Tester	Rev. 14.0.2	N/A	N/A

9.3 Conducted Emissions Test Data

Table 9-2: Conducted Emissions (Neutral Side); Mode Digital-Receiver – 902 MHz

Temperature: 75°F Humidity: 45%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)	Pass/ Fail
0.156	Pk	40.9	0.2	41.1	65.7	-24.6	55.7	-14.6	Pass
0.182	Pk	32.3	0.2	32.5	64.4	-31.9	54.4	-21.9	Pass
0.377	Pk	17.5	0.3	17.8	58.3	-40.5	48.3	-30.5	Pass
1.210	Pk	18.6	0.5	19.1	56.0	-36.9	46.0	-26.9	Pass
13.300	Pk	18.4	2.1	20.5	60.0	-39.5	50.0	-29.5	Pass
24.100	Pk	20.3	2.8	23.1	60.0	-36.9	50.0	-26.9	Pass

Table 9-3: Conducted Emissions (Phase Side); Mode Digital-Receiver – 902 MHz

Temperature: 75°F Humidity: 45%									
Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Limit (dBuV)c	AV Margin (dBuV)	Pass/ Fail
0.151	Pk	43.2	0.2	43.4	65.9	-22.5	55.9	-12.5	Pass
0.160	Pk	39.0	0.2	39.2	65.5	-26.3	55.5	-16.3	Pass
0.319	Pk	20.6	0.3	20.9	59.7	-38.8	49.7	-28.8	Pass
1.860	Pk	20.8	0.8	21.6	56.0	-34.4	46.0	-24.4	Pass
11.740	Pk	20.1	2.1	22.2	60.0	-37.8	50.0	-27.8	Pass
24.420	Pk	21.9	2.8	24.7	60.0	-35.3	50.0	-25.3	Pass

Table 9-4: Conducted Emissions (Neutral Side); Mode Digital-Receiver – 915 MHz

Temperature: 75°F Humidity: 45%									
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**QP Limit (dBuV)**	**QP Margin (dBuV)**	**AV Limit (dBuV)**	**AV Margin (dBuV)**	**Pass/ Fail**
0.151	Pk	42.6	0.2	42.8	65.9	-23.1	55.9	-13.1	Pass
0.192	Pk	31.9	0.2	32.1	63.9	-31.8	53.9	-21.8	Pass
0.350	Pk	20.5	0.3	20.8	59.0	-38.2	49.0	-28.2	Pass
1.860	Pk	19.8	0.8	20.6	56.0	-35.4	46.0	-25.4	Pass
11.740	Pk	19.9	2.1	22.0	60.0	-38.0	50.0	-28.0	Pass
24.420	Pk	22.6	2.8	25.4	60.0	-34.6	50.0	-24.6	Pass

Table 9-5: Conducted Emissions (Phase Side); Mode: Digital-Receiver – 915 MHz

Temperature: 75°F Humidity: 45%									
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**QP Limit (dBuV)**	**QP Margin (dBuV)**	**AV Limit (dBuV)**	**AV Margin (dBuV)**	**Pass/ Fail**
0.150	Pk	43.5	0.2	43.7	66.0	-22.3	56.0	-12.3	Pass
0.160	Pk	39.7	0.2	39.9	65.5	-25.6	55.5	-15.6	Pass
0.243	Pk	22.3	0.2	22.5	62.0	-39.5	52.0	-29.5	Pass
0.417	Pk	16.5	0.2	16.7	57.5	-40.8	47.5	-30.8	Pass
1.860	Pk	19.7	0.8	20.5	56.0	-35.5	46.0	-25.5	Pass
11.770	Pk	19.8	2.1	21.9	60.0	-38.1	50.0	-28.1	Pass
14.900	Pk	19.1	2.3	21.4	60.0	-38.6	50.0	-28.6	Pass
24.420	Pk	20.0	2.8	22.8	60.0	-37.2	50.0	-27.2	Pass

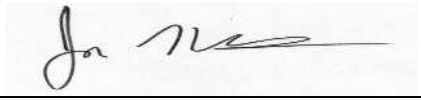
Table 9-6: Conducted Emissions (Neutral Side); Mode Digital-Receiver – 927 MHz

Temperature: 75°F Humidity: 45%									
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**QP Limit (dBuV)**	**QP Margin (dBuV)**	**AV Limit (dBuV)**	**AV Margin (dBuV)**	**Pass/ Fail**
0.150	Pk	43.5	0.2	43.7	66.0	-22.3	56.0	-12.3	Pass
0.170	Pk	36.4	0.2	36.6	65.0	-28.4	55.0	-18.4	Pass
0.343	Pk	18.7	0.3	19.0	59.1	-40.1	49.1	-30.1	Pass
1.860	Pk	20.9	0.8	21.7	56.0	-34.3	46.0	-24.3	Pass
11.740	Pk	19.5	2.1	21.6	60.0	-38.4	50.0	-28.4	Pass
24.100	Pk	21.2	2.8	24.0	60.0	-36.0	50.0	-26.0	Pass

Table 9-7: Conducted Emissions (Phase Side); Mode Digital-Receiver – 927 MHz

Temperature: 75°F Humidity: 45%									
Emission Frequency (MHz)	**Test Detector**	**Analyzer Reading (dBuV)**	**Site Correction Factor (dB)**	**Emission Level (dBuV)**	**QP Limit (dBuV)**	**QP Margin (dBuV)**	**AV Limit (dBuV)**	**AV Margin (dBuV)**	**Pass/ Fail**
0.150	Pk	43.6	0.2	43.8	66.0	-22.2	56.0	-12.2	Pass
0.228	Pk	25.2	0.2	25.4	62.5	-37.1	52.5	-27.1	Pass
0.282	Pk	22.1	0.3	22.4	60.8	-38.4	50.8	-28.4	Pass
0.426	Pk	18.4	0.2	18.6	57.3	-38.7	47.3	-28.7	Pass
1.860	Pk	19.8	0.8	20.6	56.0	-35.4	46.0	-25.4	Pass
11.420	Pk	20.3	2.0	22.3	60.0	-37.7	50.0	-27.7	Pass
24.130	Pk	20.0	2.8	22.8	60.0	-37.2	50.0	-27.2	Pass

TEST PERSONNEL:



John Wilson		August 3, 2006
EMC Test Engineer	Signature	Date Of Test

10 Radiated Emissions - §15.209

10.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/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

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

10.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency.

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

The data below represents worst case radiated emissions with the module tested stand alone. Radiated emissions were also investigated with the module within a typical host and found to be equal to or less than these levels.

Table 10-1: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900151	Rohde and Schwarz	HFH2-Z2	Loop Antenna (9 kHz - 30 MHz)	827525/019	8/25/06
901365	Miteq	JS4-00102600-41-5P	Amplifier, 15 V, 0.1-26 GHz, 28dB gain, power 5dB	1094152	3/24/07
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	9/14/06
901281	Rhein Tech Labs	PR-1040	Amplifier	1003	12/8/06
900878	Rhein Tech Labs	AM3-1197-0005	3 meter antenna mast, polarizing	Outdoor Range 1	Not Required
901231	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901232	IW Microwave Products	KPS-1503-2400-KPS	High frequency RF cables	240"	9/1/06
901235	IW Microwave Products	KPS-1503-360-KPS	High frequency RF cables	36"	9/1/06
901242	Rhein Tech Labs	WRT-000-0003	Wood rotating table	N/A	Not Required
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	5/20/07
900321	EMCO	3161-03	Horn Antennas (4 - 8,2GHz)	9508-1020	5/20/07
900323	EMCO	3160-7	Horn Antennas (8,2 - 12,4 GHz)	9605-1054	5/20/07
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	5/20/07
900325	EMCO	3160-9	Horn Antennas (18 - 26.5 GHz)	9605-1051	5/20/07
901218	EMCO	3301B	Horn Antenna (18 - 26.5 GHz)	960281-003	5/20/07
900392	Hewlett Packard	1197OK	Harmonic Mixer (18 – 26.5 GH)z	3525A00159	11/27/07
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/28/07
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	8/28/07
900889	Hewlett Packard	85685A	RF Preselector (20 Hz - 2 GHz)	3146A01309	4/12/07

10.3 Radiated Emissions Test Results

10.3.1 Radiated Emissions Digital/Receiver

Table 10-2: Digital/Receiver Radiated Emissions Test Results

Temperature: 37°F Humidity: 35%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pass/ Fail
38.568	Qp	H	270	1.5	29.4	-4.2	25.2	40.0	-14.8	Pass
83.528	Qp	H	0	1.0	34.9	-9.9	25.0	40.0	-15.0	Pass
104.014	Qp	H	0	2.0	48.5	-6.1	42.4	43.5	-1.1	Pass
108.015	Qp	H	180	2.0	33.8	-5.7	28.1	43.5	-15.4	Pass
110.593	Qp	H	180	1.8	37.4	-5.5	31.9	43.5	-11.6	Pass
112.015	Qp	H	180	2.0	32.1	-5.5	26.6	43.5	-16.9	Pass

10.3.2 Radiated Emissions Harmonics/Spurious - ½ Wave Whip Antenna

Table 10-3: Radiated Emissions Harmonics/Spurious Low Channel (TX Frequency: 902 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
902.0	74.7	74.6	38.8	113.4		Fundamental
1804.0	56.3	53.1	9.2	62.3	93.4	-31.1
2706.0	59.0	57.8	-5.2	52.6	54.0	-1.4
3608.0	54.1	53.6	-4.4	49.2	54.0	-4.8
4510.0	44.1	39.5	2.0	41.5	54.0	-12.5
5412.0	47.6	45.3	2.6	47.9	54.0	-6.1
6314.0	43.6	39.0	3.2	42.2	93.4	-51.2
7216.0	44.7	41.0	3.4	44.4	93.4	-49.0
8118.0	37.9	26.2	3.8	30.0	54.0	-24.0
9020.0	39.6	29.6	9.6	39.2	54.0	-14.8

Table 10-4: Radiated Emissions Harmonics/Spurious Mid channel (TX Frequency: 915 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
915.0	77.4	77.6	38.9	116.5		Fundamental
1830.0	53.1	48.4	9.6	58.0	96.5	-38.5
2745.0	55.9	55.2	-4.8	50.4	54.0	-3.6
3660.0	50.9	48.5	-4.2	44.3	54.0	-9.7
4575.0	48.2	45.7	1.6	47.3	54.0	-6.7
5490.0	54.6	53.0	2.8	55.8	96.5	-40.7
6405.0	43.9	39.8	3.4	43.2	96.5	-53.3
7320.0	44.5	41.1	3.3	44.4	54.0	-9.6
8235.0	40.5	30.7	9.5	40.2	54.0	-13.8
9150.0	38.9	27.6	10.0	37.6	54.0	-16.4

Table 10-5: Radiated Emissions Harmonics/Spurious High Channel (TX Frequency: 927 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
927.7	72.5	72.6	39.0	111.6		Fundamental
1855.4	50.1	44.9	10.0	54.9	91.6	-36.7
2783.2	53.4	52.4	-5.2	47.2	54.0	-6.8
3710.9	47.0	44.6	-4.2	40.4	54.0	-13.6
4638.6	32.2	20.8	32.1	52.9	54	-1.1
5566.3	41.1	33.8	2.8	36.6	91.6	-55.0
6494.0	39.7	29.3	3.7	33.0	54.0	-21.0
7421.8	45.3	40.9	4.0	44.9	54.0	-9.1
8349.5	39.0	29.3	9.0	38.3	54.0	-15.7
9277.2	37.1	25.2	9.8	35.0	91.6	-56.6

10.3.3 Radiated Emissions Harmonics/Spurious - Flexible Adhering PCB Dipole Antenna

Table 10-6: Radiated Emissions Harmonics/Spurious Low Channel (TX Frequency: 902 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
902.0	76.1	76.1	38.8	114.9		Fundamental
1804.0	54.4	50.8	9.2	60.0	94.9	-34.9
2706.0	55.1	54.1	-5.2	48.9	54.0	-5.1
3608.0	55.0	54.0	-4.4	49.6	54.0	-4.4
4510.0	47.5	45.6	2.0	47.6	54.0	-6.4
5412.0	41.0	34.2	2.6	36.8	54.0	-17.2
6314.0	44.9	41.1	3.2	44.3	94.9	-50.6
7216.0	43.6	37.0	3.4	40.4	94.9	-54.5
8118.0	36.7	26.5	3.8	30.3	54.0	-23.7
9020.0	36.2	25.1	9.6	34.7	54.0	-19.3

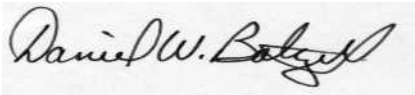
Table 10-7: Radiated Emissions Harmonics/Spurious Mid Channel (TX Frequency: 915 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW/VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
915.0	76.7	77.0	38.9	115.9		Fundamental
1830.0	49.7	37.5	9.6	47.1	95.9	-48.8
2745.0	56.8	56.2	-4.8	51.4	54.0	-2.6
3660.0	56.7	56.0	-4.2	51.8	54.0	-2.2
4575.0	48.2	45.8	1.6	47.4	54.0	-6.6
5490.0	52.8	51.0	2.8	53.8	95.9	-42.1
6405.0	44.9	41.5	3.4	44.9	95.9	-51.0
7320.0	43.9	38.5	3.3	41.8	54.0	-12.2
8235.0	43.5	38.7	9.5	48.2	54.0	-5.8
9150.0	37.2	28.8	10.0	38.8	54.0	-15.2

Table 10-8: Radiated Emissions Harmonics/Spurious High Channel (TX Frequency: 927 MHz)

Emission Frequency (MHz)	Peak Analyzer Reading (dBuV) (1 MHz RBW /VBW)	Average Analyzer Reading (dBuV) (1 MHz RBW/ 10 Hz VBW)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
927.7	72.6	72.6	39.0	111.6		Fundamental
1855.4	46.3	40.9	10.0	50.9	91.6	-40.7
2783.2	56.3	55.8	-5.2	50.6	54.0	-3.4
3710.9	51.2	50.0	-4.2	45.8	54.0	-8.2
4638.6	47.3	44.5	0.9	45.4	54.0	-8.6
5566.3	43.4	38.3	2.8	41.1	91.6	-50.5
6494.0	39.9	30.3	3.7	34.0	54.0	-20.0
7421.8	45.2	40.6	4.0	44.6	54.0	-9.4
8349.5	42.7	38.0	9.0	47.0	54.0	-7.0
9277.2	38.2	26.8	9.8	36.6	91.6	-55.0

Test Personnel:



Daniel W. Baltzell		August 6, 2006
EMC Test Engineer	Signature	Date of Test

11 Conclusion

The data in this measurement report shows that the EUT as tested, Model ICFM, FCC ID: UIWICFM01ITW, complies with all the applicable requirements of Parts 2 and 15 of the FCC Rules and Regulations.