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Job Number:	954504
Project Number	08CA15013
File Number:	MC15905
Date:	April 25, 2008
Model:	HUB

# Electromagnetic Compatibility Test Report

For

**Murphy Industries Inc.**

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to public safety and committed to  
quality service for over 100 years**

## Test Report Details

Tests Performed By: **Underwriters Laboratories Inc.**  
**333 Pfingsten Rd.**  
**Northbrook, IL 60062**

Tests Performed For: **Murphy Industries Inc.**  
5311 S. 122<sup>nd</sup> East Av  
Tulsa, OK 74146

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Test Report Date: **April 25, 2008**

Product Type: **900MHz Frequency Hopping Transmitter**

Product standards	47 CFR Part 15.247, Subpart C
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Model Number: **HUB**

EUT Category: **Low Power Transmitter**

Testing Start Date: **March 24, 2008**

Date Testing Complete: **March 27, 2008**

**Overall Results: Compliant**

Underwriters Laboratories Inc. reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. Underwriters Laboratories Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from Underwriters Laboratories Inc. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or endorsement by NVLAP, A2LA, or any agency of the US government.

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Report Revision History

Revision Date	Description	Revised By	Revision Reviewed By
none			

## 1.0 G E N E R A L - Product Description

### 1.1 Equipment Description

The *hub* is the central unit which talks to all remote sensor modules via a wireless link. The wireless topology used for this system is called a star topology. This means that there is a single hub, and numerous remote units. The remote unit's cannot talk to each other, only to the hub. The hub, in turn, communicates with an engine controller such as a Centurion, Millenium, etc. using the MODBUS protocol across an RS-485 physical layer. The hub is the central repository for all data; it also is the heartbeat timing scheduler. The hub never goes to sleep.

#### SYSTEM:

The M2Wireless system is designed to replace expensive wiring and conduit that is part of a natural gas compressor system. Typically, a natural gas compressor skid requires conduit or tubing between the sensor and the control panel which monitors the sensor. By using a low power wireless system, this conduit and wiring cost is significantly reduced or completely eliminated.

The M2Wireless will use a star type of wireless network topology as shown in Figure 1. This type of topology utilizes a single wireless master, denoted as the "Hub", and multiple slaves, denoted as "Remotes". This topology has been chosen because it meets the following requirements:

1. Extremely low power consumption.
2. Near real-time throughput of data from the sensor to the engine controller.

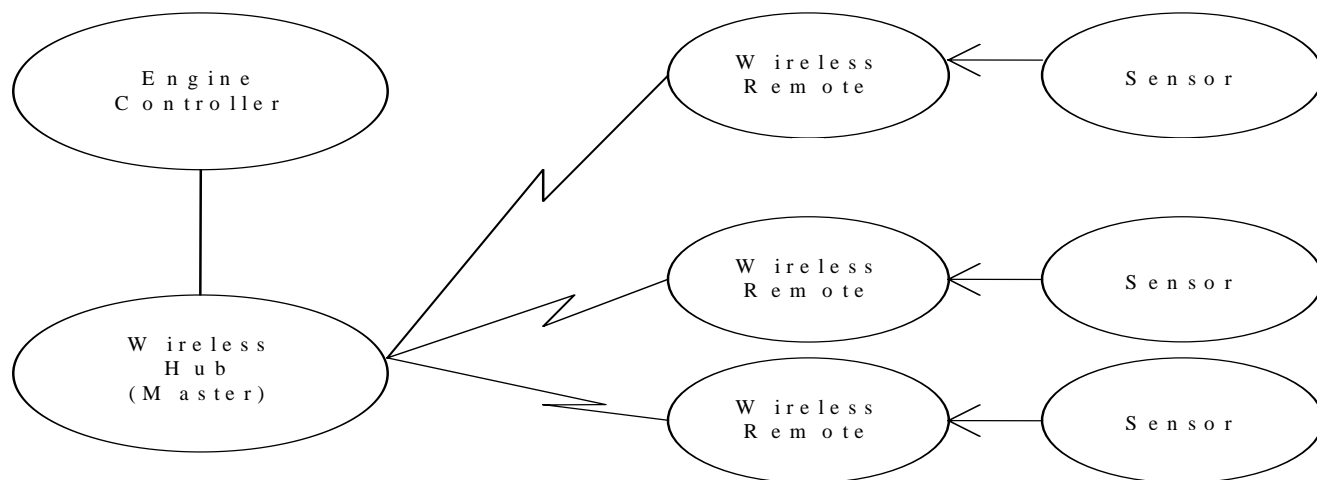


Figure 1. Wireless Star Architecture

## 1.2 Device Configuration During Test

### 1.2.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	HUB	Murphy Industries, Inc.	53-00-0002	None
AE	Antenna	Radiotronics	ANT-915-09A	Available from Mouser

Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)

### 1.2.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None
1	Mains	DC	N	N	8-32Vdc input
2	RS-485	TP	N	N	None
3	Digital Input	I/O	N	N	Pulled up on Hub
4	Form C	I/O	N	N	SPDT relay output
5	FET Output	I/O	N	N	8ea open drain outputs
6	RF	I/O	Y	N	Cable for RF antenna

Note:  
 AC = AC Power Port      DC = DC Power Port      N/E = Non-Electrical  
 I/O = Signal Input or Output Port (Not Involved in Process Control)  
 TP = Telecommunication Ports

### 1.2.3 Power Interface:

Mode # /Rated	Voltage (V)	Frequency (DC/AC-Hz)	Phases (#)	Comments
HUB 1	12	DC	-	Used to power the Hub

## 1.3 EUT Configurations

Mode #	Description
1	Configured in Semi-Anechoic chamber on 80cm non-conductive support. Hub antenna mounted on a ground plane representative of the type that will be supplied with the installation kit. Cable from Hub to ground plane is typical of cable that will be supplied with the installation kit.
2	Configured on test bench connected to S/A thru coaxial cable

#### 1.4    EUT Operation Modes

Mode #	Description
1	Transmitting
2	Receiving

## 2.0    Summary

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by Underwriters Laboratories Inc. in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

#### 2.1    Deviations from standard test methods

None
------

#### 2.2    Device Modifications Necessary for Compliance

None
------

### 2.3      Reference Standards

Standard Number	Standard Name	Standard Date
FCC Part 15, Subpart C	Code of Federal Regulations, Part 15, Radio Frequency Devices	2007
RSS-210, Issue 7	Low-Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment	June 2007
RSS-Gen, Issue 2	General Requirements and Information for the Certification of Radiocommunication Equipment	June 2007

\*In addition to the above standards, FCC DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems was used.

### 2.4      Results Summary

Requirement – Test	Requirement – Test	Result (Compliant / Non-Compliant)*
Conducted Emissions	47 CFR Part 15.207 RSS-Gen 7.2.2	Compliant
Carrier Frequency Separation	47 CFR Part 15.247(a)(1) RSS-210 A8.1(b)	Compliant
20dB Bandwidth	47 CFR Part 15.247(a)(1)(i) RSS-210 A8.1(c)	Compliant
Number of Hopping Frequency	47 CFR Part 15.247(a)(1)(i) RSS-210 A8.1(c)	Compliant
Dwell Time	47 CFR Part 15.247(a)(1)(i) RSS-210 A8.1(c)	Compliant
Maximum Peak Output Power	47 CFR Part 15.247(b)(2) RSS-210 A8.4(1)	Compliant
Band Edge Compliance	47 CFR Part 15.247(d) RSS-210 A8.5	Compliant
Spurious Emissions	47 CFR Part 15.247(d) RSS-210 A8.5 RSS-Gen 7.2.1 and 7.2.3	Compliant
99% Occupied Bandwidth	RSS-Gen 4.6.1	Compliant

Test Engineer:

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 Conformity Assessment Services-

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 Conformity Assessment Services

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### 3.0    Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

### 4.0    EMISSIONS TEST RESULTS

The emissions tests were performed according to following regulations:

----- United States -----

Code of Federal Regulations Title 47	Part 15, Subpart C, Radio Frequency Devices
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----- Canada -----

Spectrum Management and Telecommunications - Radio Standards Specification	RSS-210, Issue 7: Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
Spectrum Management and Telecommunications - Radio Standards Specification	RSS-Gen, Issue 2: General Requirements and Information for the Certification of Radiocommunication Equipment

Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

Ambient Temperature, °C	22.5 ± 2.5	Relative Humidity, %	45 ± 15	Barometric Pressure, mBar	950 ± 150
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#### 4.1 Test Conditions and Results – MAINS TERMINAL – CONDUCTED EMISSIONS

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.	
Basic Standard	FCC Part 15, Subpart C, 15.207 RSS-Gen 7.2.2	
UL LPG	80-EM-S0026	
	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150kHz to 30MHz	Mains
<b>Limits - Class B</b>		
Frequency (MHz)	Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50
Supplementary information: None		

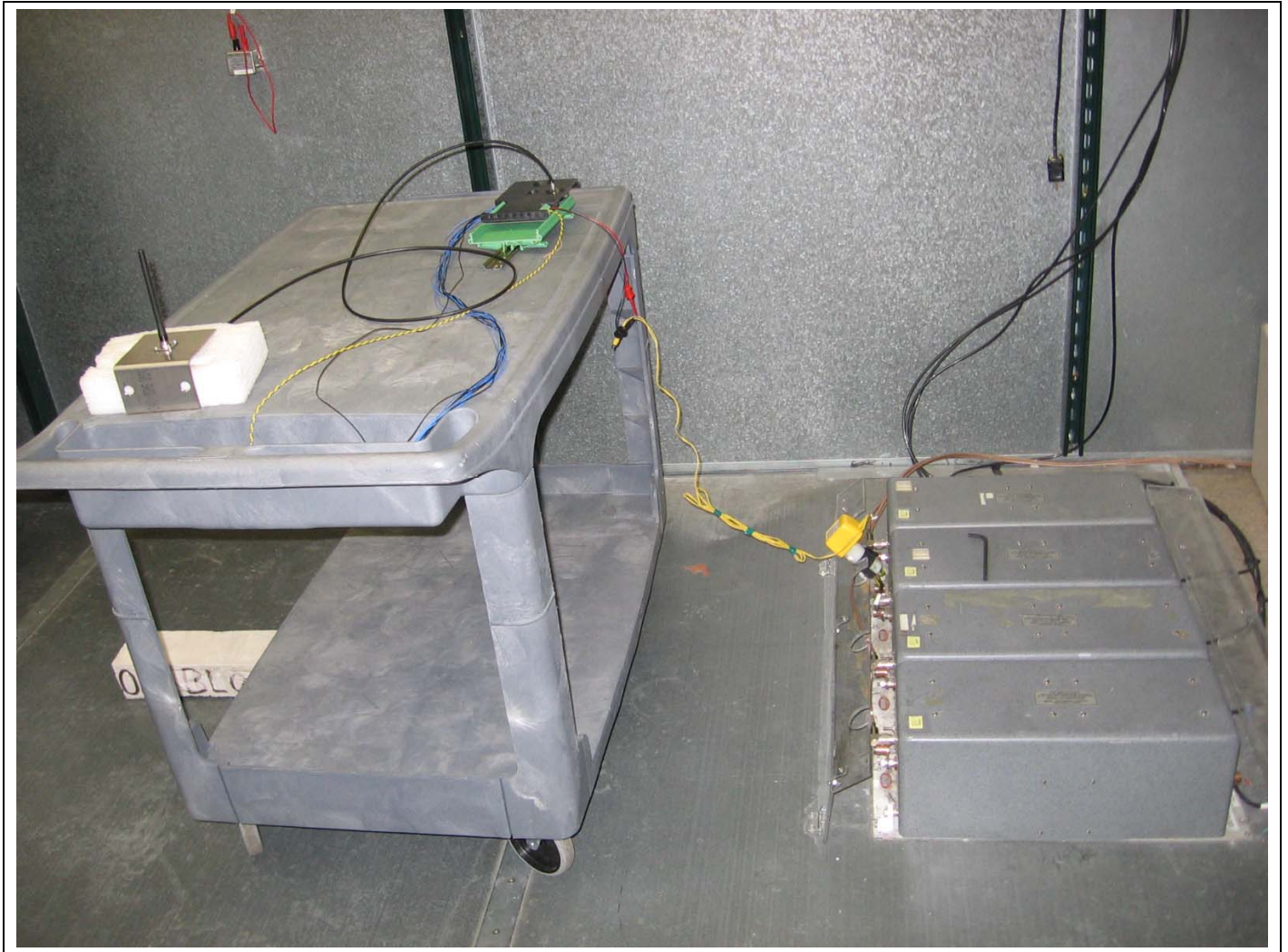
**Table 1 Conducted Emissions EUT Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1 and 2
Supplementary information: Testing was conducted with non-filtered power supply.		

**Table 2 Conducted Emissions Test Equipment**

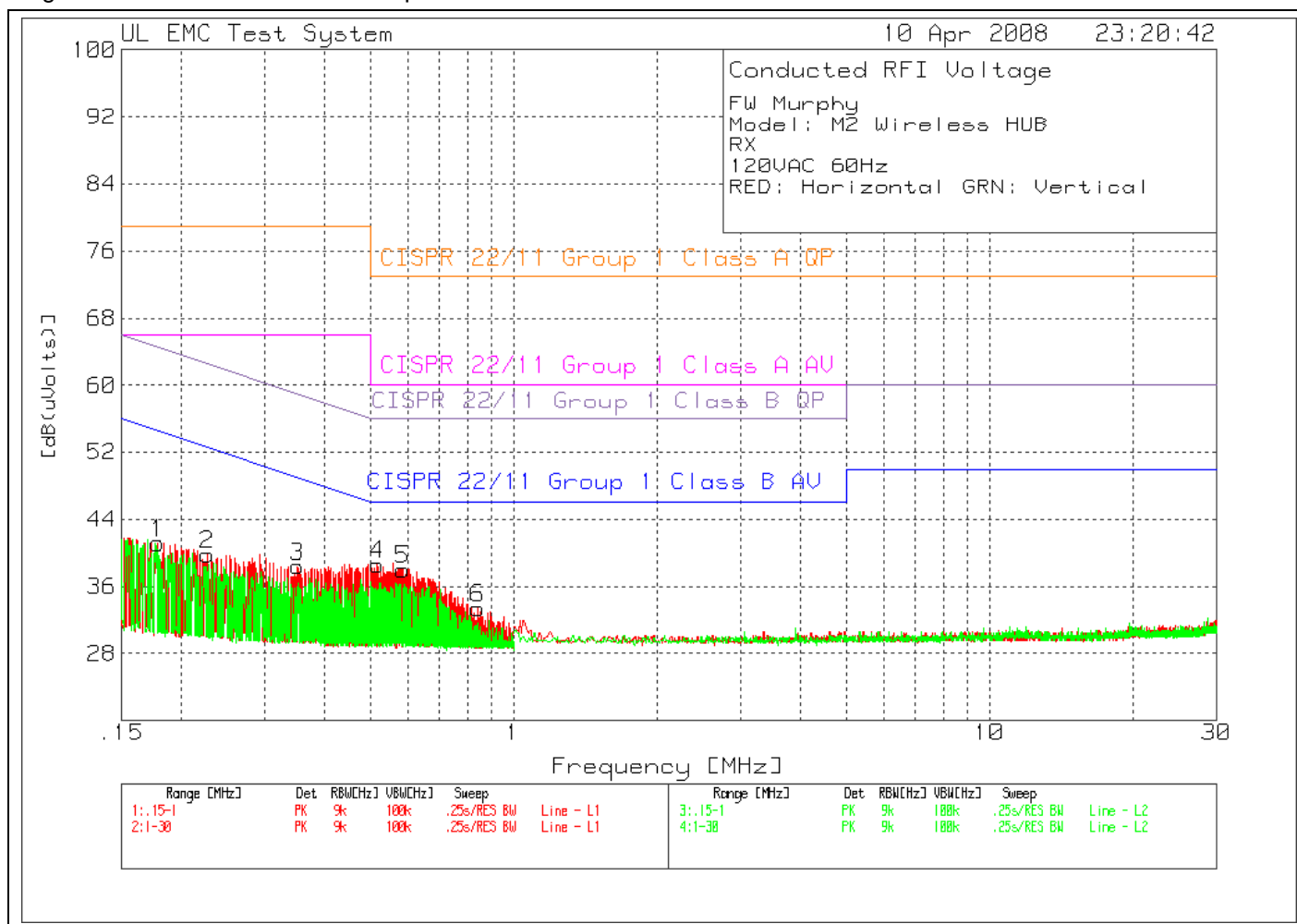
Description	Manufacturer	Model	Identifier
Spectrum Analyzer / Preselector	Advantest	R3361D / R3551	EMC4259
Transient Limiter	Electro-Metrics	EM7600-2	EMC4224
LISN - L1	Solar	8602-50-TS-50-N	EMC4052
LISN - L2	Solar	8602-50-TS-50-N	EMC4064

**Figure 2 Test Setup for Conducted Emissions**



#### 4.2.1 Conducted Emissions – Receive Mode

Figure 3 Conducted Emissions Graph



### Table 3 Conducted Emissions Data Points

FW Murphy  
 Model: M2 Wireless HUB  
 RX  
 120VAC 60Hz  
 RED: Horizontal GRN: Vertical

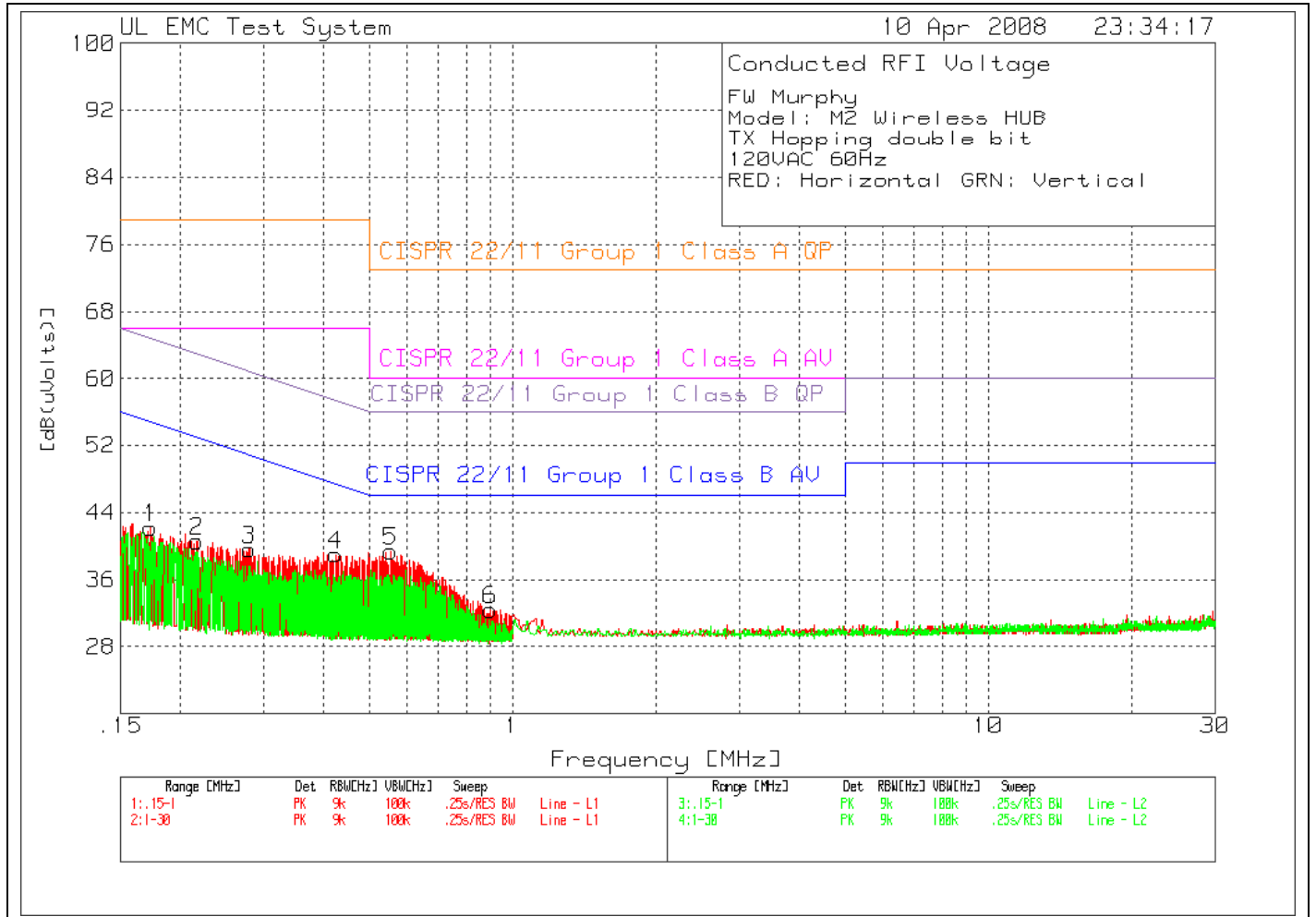
Test No. Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2	3	4	5	6
=====										
Line										
1 .17896	29.8 pk	10.1	1.3	41.2	79	66	64.5	54.5	-	-
			Margin [dB]		-37.8	-24.8	-23.3	-13.3	-	-
2 .22763	28.8 pk	10.1	.9	39.8	79	66	62.5	52.5	-	-
			Margin [dB]		-39.2	-26.2	-22.7	-12.7	-	-
3 .35196	27.8 pk	10.1	.5	38.4	79	66	58.9	48.9	-	-
			Margin [dB]		-40.6	-27.6	-20.5	-10.5	-	-
4 .51769	28.2 pk	10.1	.3	38.6	73	60	56	46	-	-
			Margin [dB]		-34.4	-21.4	-17.4	-7.4	-	-
5 .58531	27.6 pk	10.1	.3	38	73	60	56	46	-	-
			Margin [dB]		-35	-22	-18	-8	-	-
6 .84262	23.1 pk	10.1	.2	33.4	73	60	56	46	-	-
			Margin [dB]		-39.6	-26.6	-22.6	-12.6	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP  
 LIMIT 2: CISPR 22/11 Group 1 Class A AV  
 LIMIT 3: CISPR 22/11 Group 1 Class B QP  
 LIMIT 4: CISPR 22/11 Group 1 Class B AV

pk - Peak detector  
 qp - Quasi-Peak detector

#### 4.2.2 Conducted Emissions – Transmit Mode, Double Bit, Hopping

Figure 4 Conducted Emissions Graph



Job #: 954504    Project #: 08CA15013    File #: MC15905  
 Model Number:    HUB  
 Client Name:      Murphy Industries Inc.

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#### Table 4 Conducted Emissions Data Points

FW Murphy  
 Model: M2 Wireless HUB  
 TX Hopping double bit  
 120VAC 60Hz  
 RED: Horizontal GRN: Vertical

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1	2	3	4	5	6
=====											
Line											
1	.17365	30.7 pk	10.1	1.4	42.2	79	66	64.8	54.8	-	-
				Margin [dB]		-36.8	-23.8	-22.6	-12.6	-	-
2	.21747	29.5 pk	10.1	1	40.6	79	66	62.9	52.9	-	-
				Margin [dB]		-38.4	-25.4	-22.3	-12.3	-	-
3	.28024	28.8 pk	10.1	.7	39.6	79	66	60.8	50.8	-	-
				Margin [dB]		-39.4	-26.4	-21.2	-11.2	-	-
4	.42535	28.5 pk	10.1	.4	39	79	66	57.3	47.3	-	-
				Margin [dB]		-40	-27	-18.3	-8.3	-	-
5	.55499	29 pk	10.1	.3	39.4	73	60	56	46	-	-
				Margin [dB]		-33.6	-20.6	-16.6	-6.6	-	-
6	.89872	22.1 pk	10.1	.2	32.4	73	60	56	46	-	-
				Margin [dB]		-40.6	-27.6	-23.6	-13.6	-	-

LIMIT 1: CISPR 22/11 Group 1 Class A QP  
 LIMIT 2: CISPR 22/11 Group 1 Class A AV  
 LIMIT 3: CISPR 22/11 Group 1 Class B QP  
 LIMIT 4: CISPR 22/11 Group 1 Class B AV

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector

**4.2    Test Conditions and Results – Carrier Frequency Separation**

Test Description	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.
Basic Standard	47 CFR Part 15.247(a)(1) RSS-210, A8.1(b)

**Table 5 Carrier Frequency Separation Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: Separation frequencies were measured for each channel and then averaged.		

**Table 6 Carrier Frequency Separation Test Equipment**

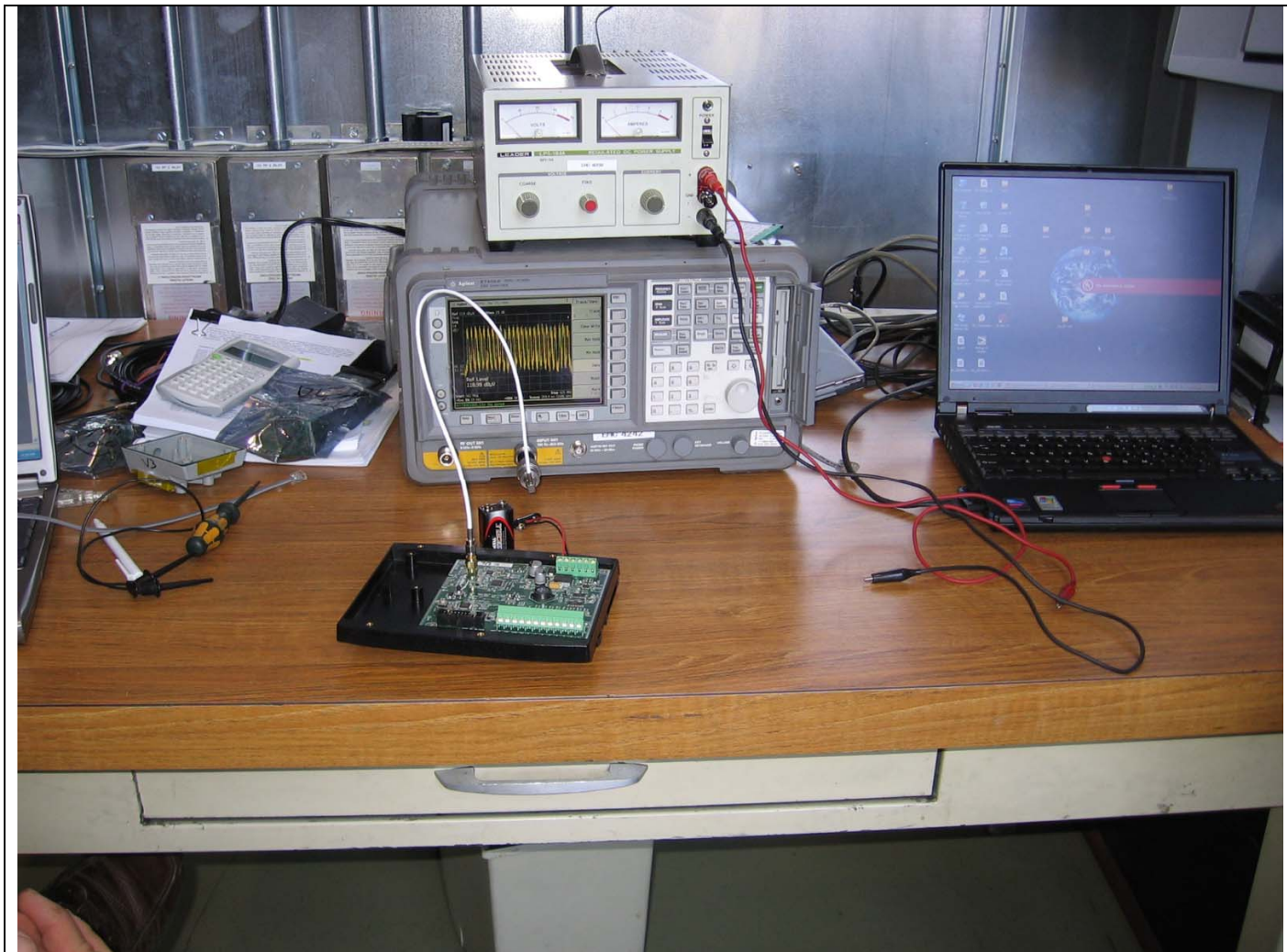
Test Equipment Used			
Description	Manufacturer	Model	Identifier
Spectrum Analyzer	Agilent	E7405A	US41160342
Attenuator	Pasternek	10dB	None

**Table 7 Carrier Frequency Separation Results**

Mode	Channel	Carrier Frequency Separation Limit	Average Separation
4 Data Bytes, Two Bursts	All	> 25kHz	0.999 MHz
4 Data Bytes, Single Burst	All	> 25kHz	1.000 MHz



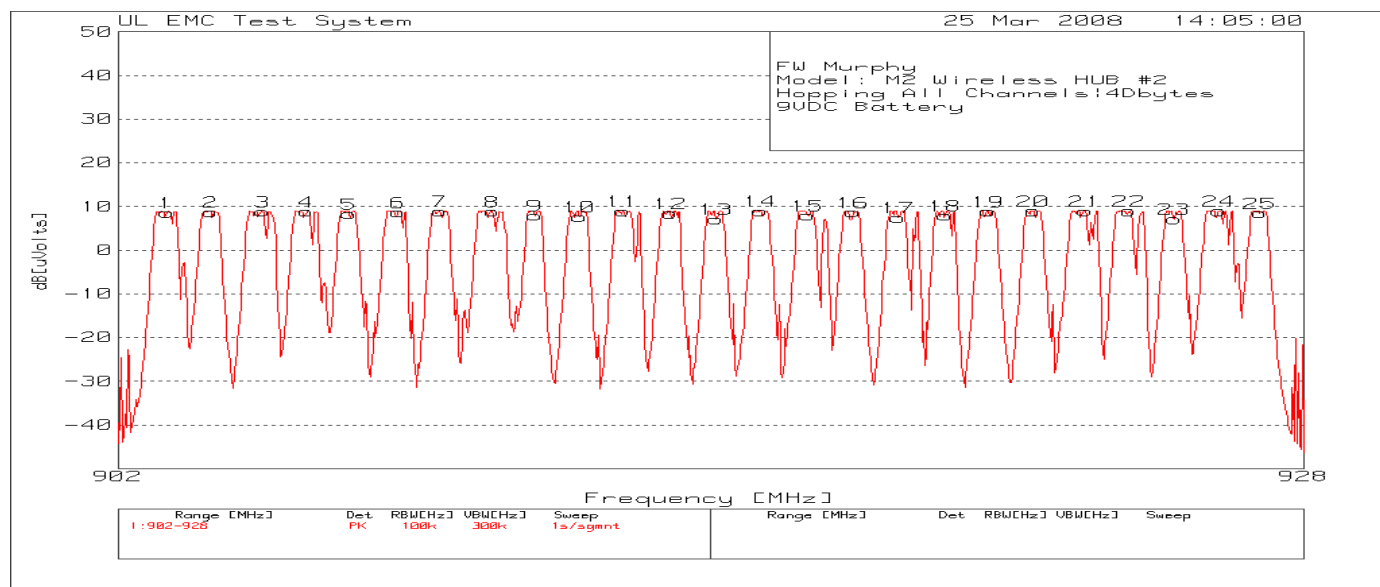
**Figure 5 Test Setup for Carrier Frequency Separation**



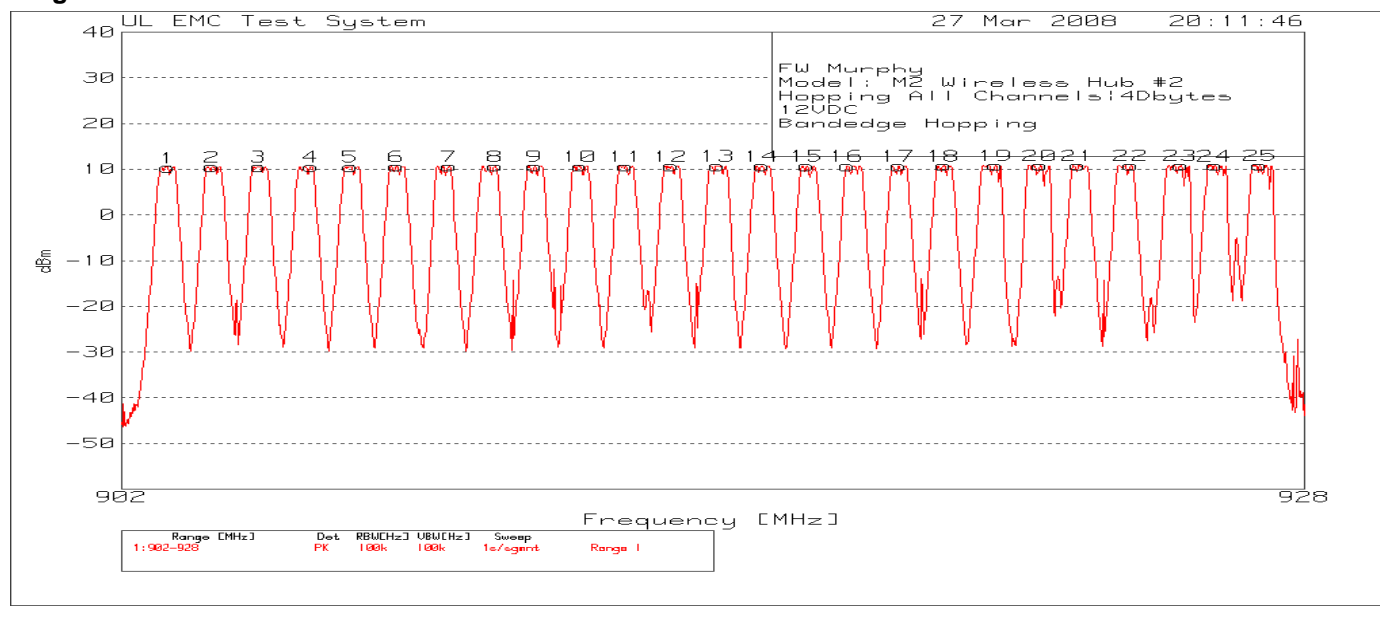


**Figure 6 Carrier Frequency Separation Graphs**

**Double Burst**



**Single Burst**



#### 4.3 Test Conditions and Results – 20dB Bandwidth

Test Description	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.	
Basic Standard	47 CFR Part 15.247(a)(1)(i) RSS-210, A8.1(c)	

**Table 8 20dB Bandwidth Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: None		

**Table 9 20dB Bandwidth Test Equipment**

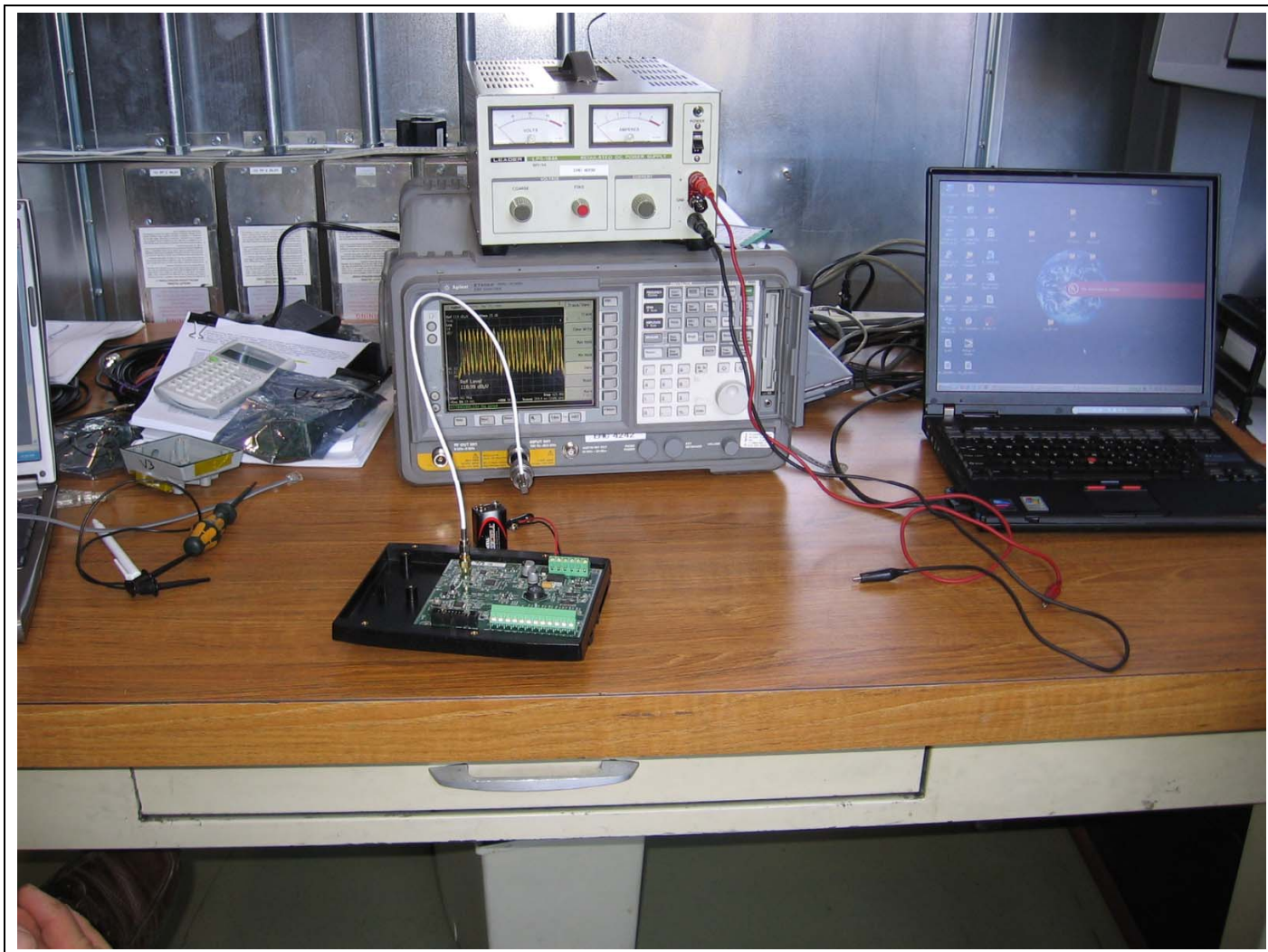
Description	Manufacturer	Model	Identifier
Spectrum Analyzer	Agilent	E7405A	US41160342
Attenuator	Pasternek	10dB	None

**Table 10 20dB Bandwidth Results**

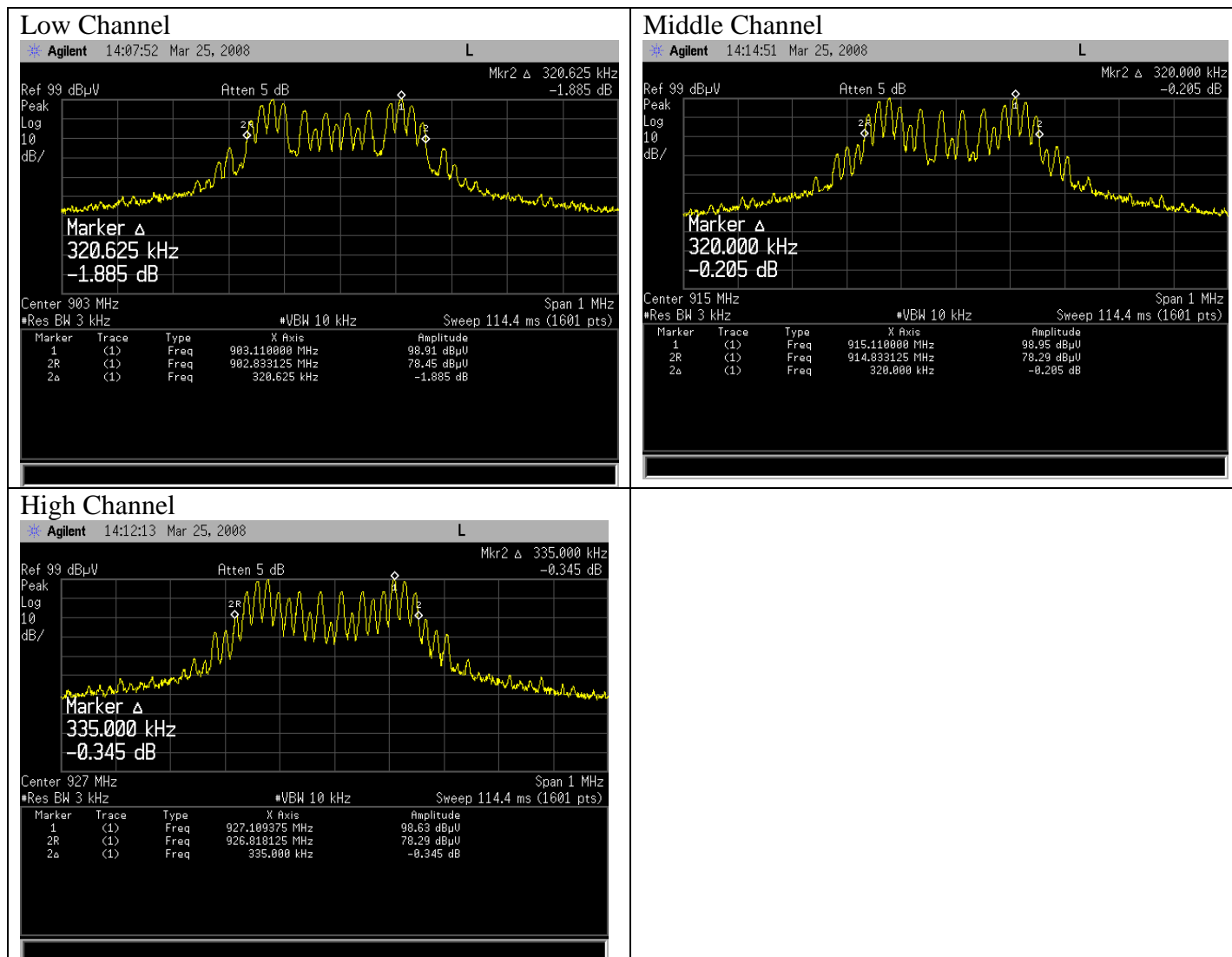
Mode	Channel	20dB Bandwidth
4 Data Bytes, Two Bursts	903 MHz – Low	320.625 kHz
	915 MHz – Middle	320.000 kHz
	927 MHz – High	335.000 kHz

Number of Bursts does not effect the 20dB Bandwidth Measurement.

**Figure 7 Test Setup for 20dB Bandwidth**



**Figure 8 20dB Bandwidth Graphs**



#### 4.4    Test Conditions and Results – Number of Hopping Frequencies

Test Description	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.	
Basic Standard	47 CFR Part 15.247(a)(1)(i) RSS-210, A8.1(c)	

**Table 11 Number of Hopping Frequencies Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: None		

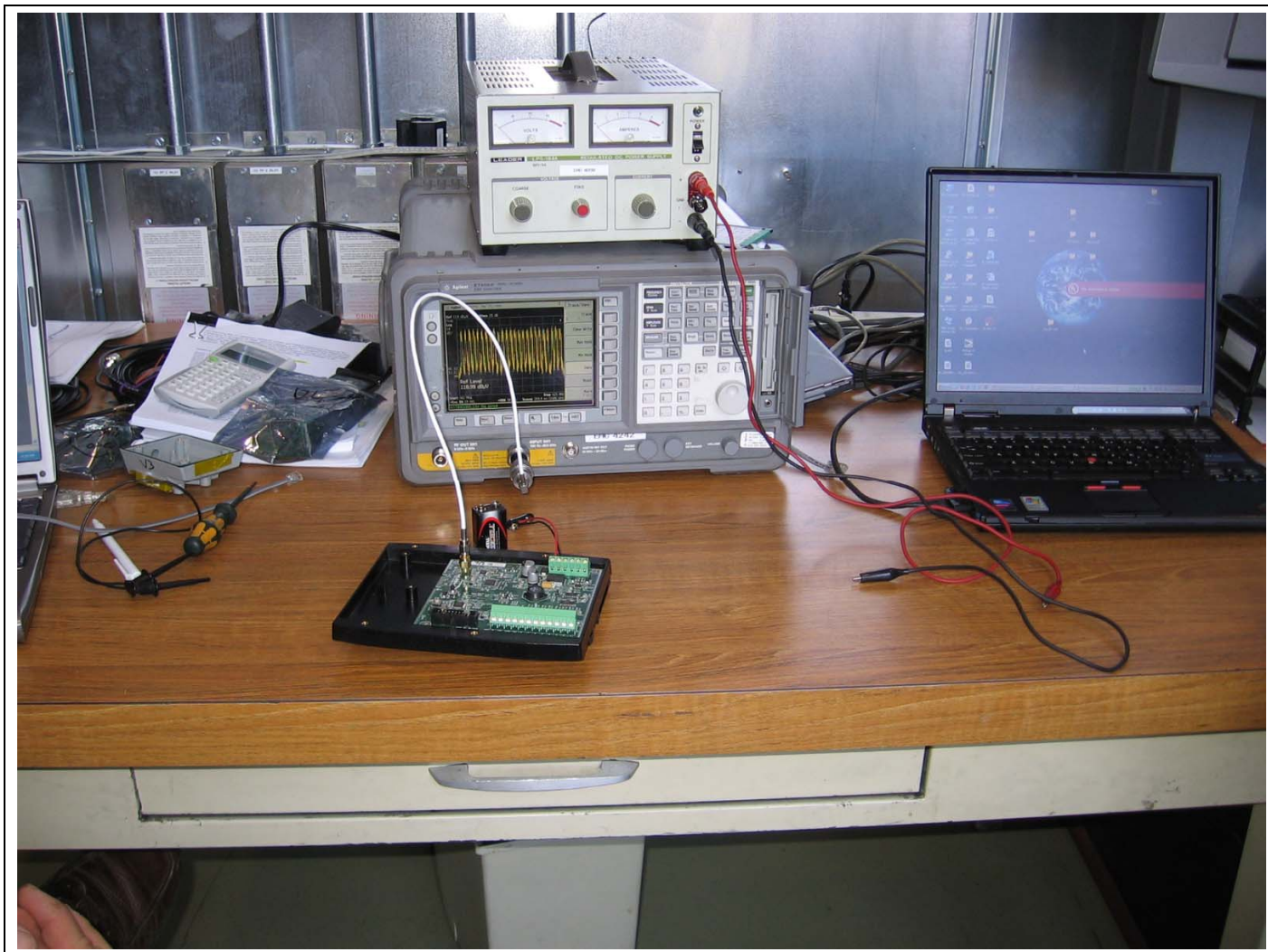
**Table 12 Number of Hopping Frequencies Test Equipment**

Test Equipment Used			
Description	Manufacturer	Model	Identifier
Spectrum Analyzer	Agilent	E7405A	US41160342
Attenuator	Pasternek	10dB	None

**Table 13 Number of Hopping Frequencies Results**

Mode	Number of Channels	Minimum Number Required
4 Data Bytes, Two Bursts	25	25

**Figure 9 Test Setup for Number of Hopping Frequencies**





**Figure 10 Number of Hopping Frequencies Graphs**



#### 4.5 Test Conditions and Results – Dwell Time

Test Description	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.
Basic Standard	47 CFR Part 15.247(a)(1)(i) RSS-210, A8.1(c)

**Table 14 Dwell Time Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: Duty cycle also measured/calculated for use in radiated spurious measurements		

**Table 15 Dwell Time Test Equipment**

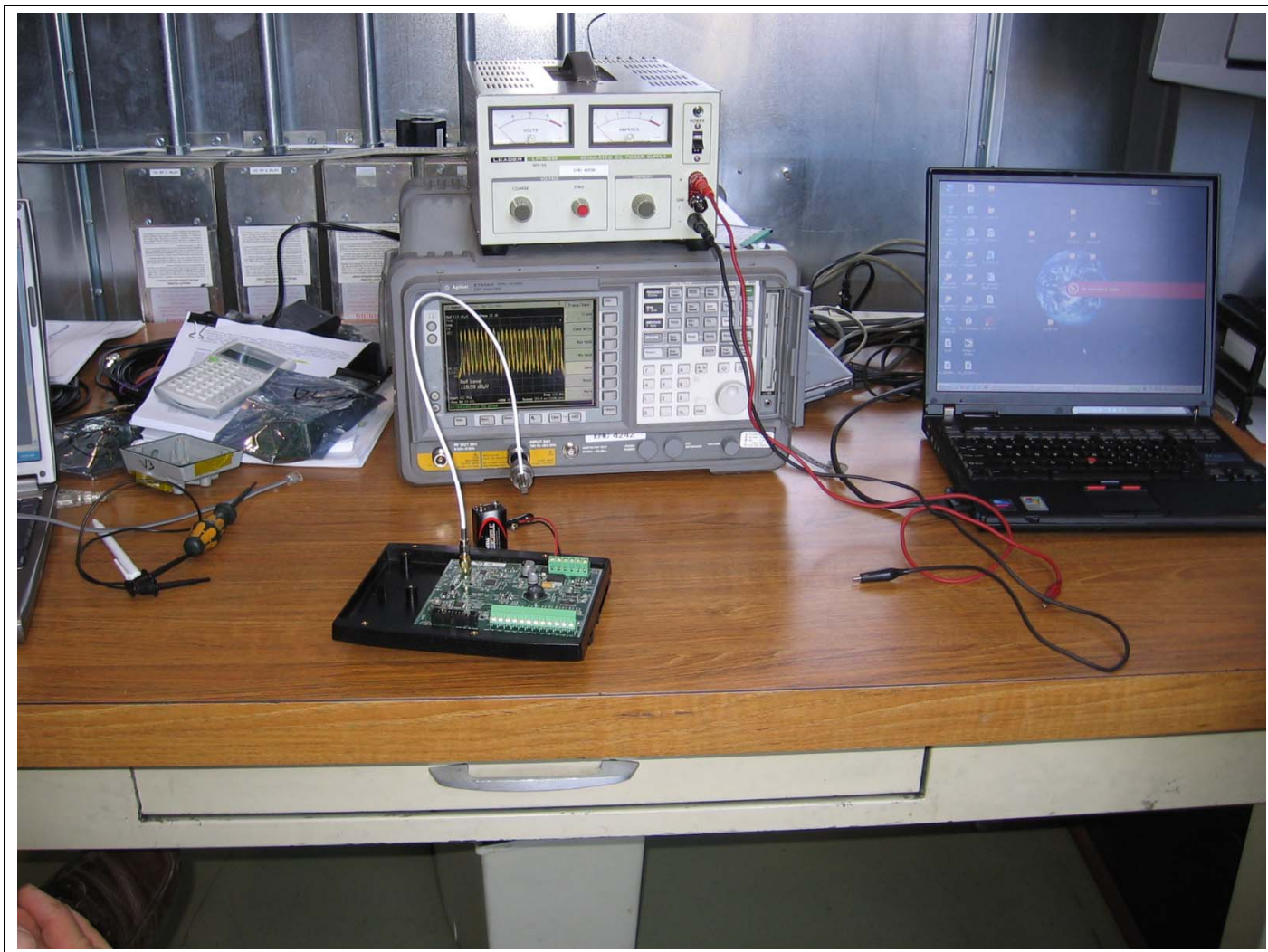
Test Equipment Used			
Description	Manufacturer	Model	Identifier
Spectrum Analyzer	Agilent	E7405A	US41160342
Attenuator	Pasternek	10dB	None

**Table 16 Dwell Time Results**

Mode	Number of Channels	Maximum Time Allowed	Measured Dwell Time	Measured TX Time in 100ms	Duty Cycle Factor $20 \cdot \log(t_1/t_2)$
4 Data Bytes, Two Bursts	25	0.4s in 10s	0.249s in 10s	20.75mS	-13.66dB
4 Data Bytes, Single Burst	25	0.4s in 10s	0.2415s in 10s	10.5mS	-19.58dB



**Figure 11 Test Setup for Dwell Time**



**Figure 12 Dwell Time Graphs**

Double Burst



#### 4.6 Test Conditions and Results – Maximum Peak Output Power

Test Description	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.	
Basic Standard	47 CFR Part 15.247(b)(2) RSS-210, A8.4(1)	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	902 MHz – 928MHz	Antenna Conducted
Limits		
Frequency (MHz)	Limit mW	
	Peak	
902 - 928	250 (24dBm)	
Supplementary information: None		

**Table 17 Maximum Peak Output Power EUT Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: None		

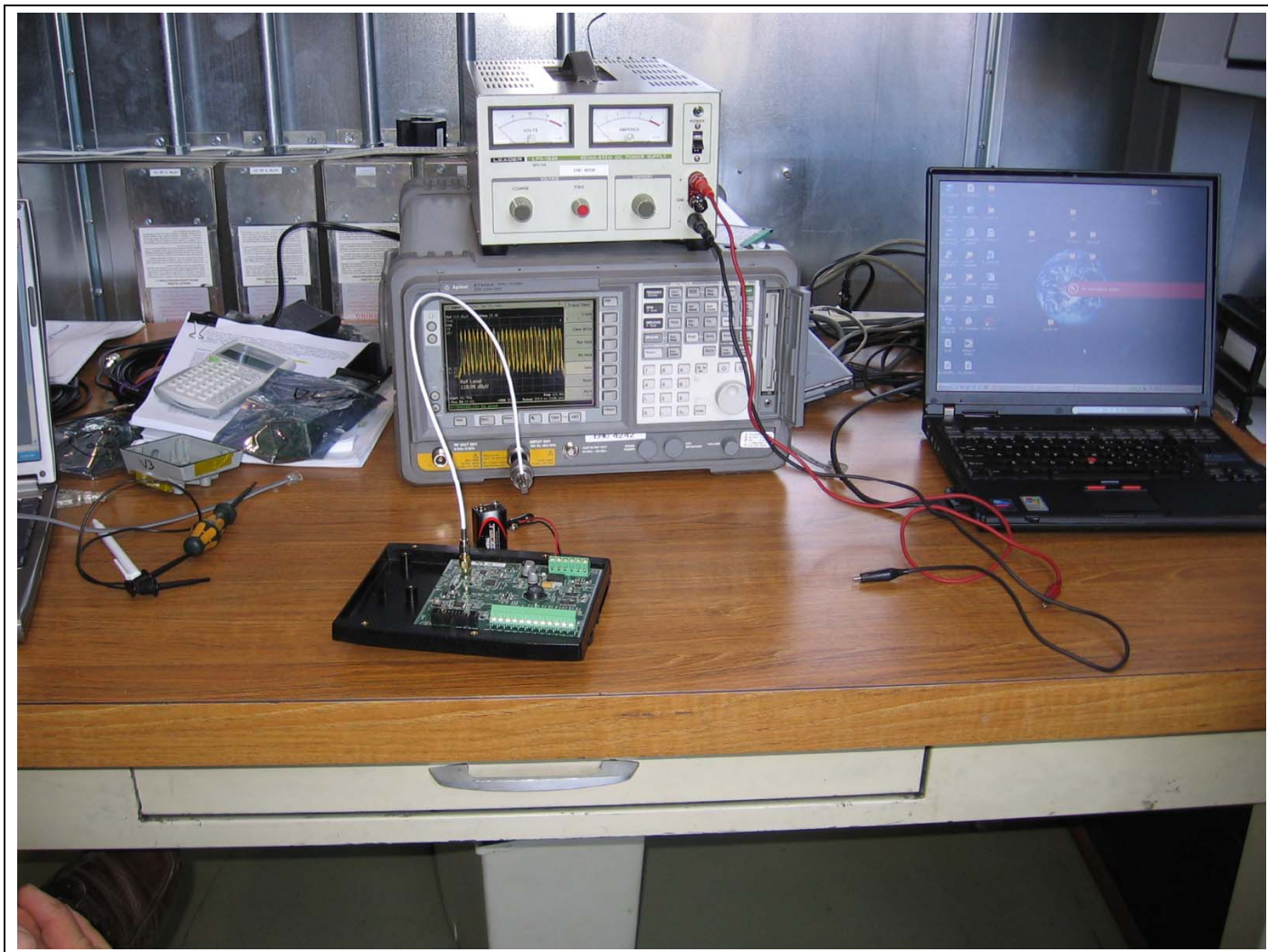
**Table 18 Maximum Peak Output Power Test Equipment**

Description	Manufacturer	Model	Identifier
Spectrum Analyzer	Agilent	E7405A	US41160342
Attenuator	Pasternek	10dB	None

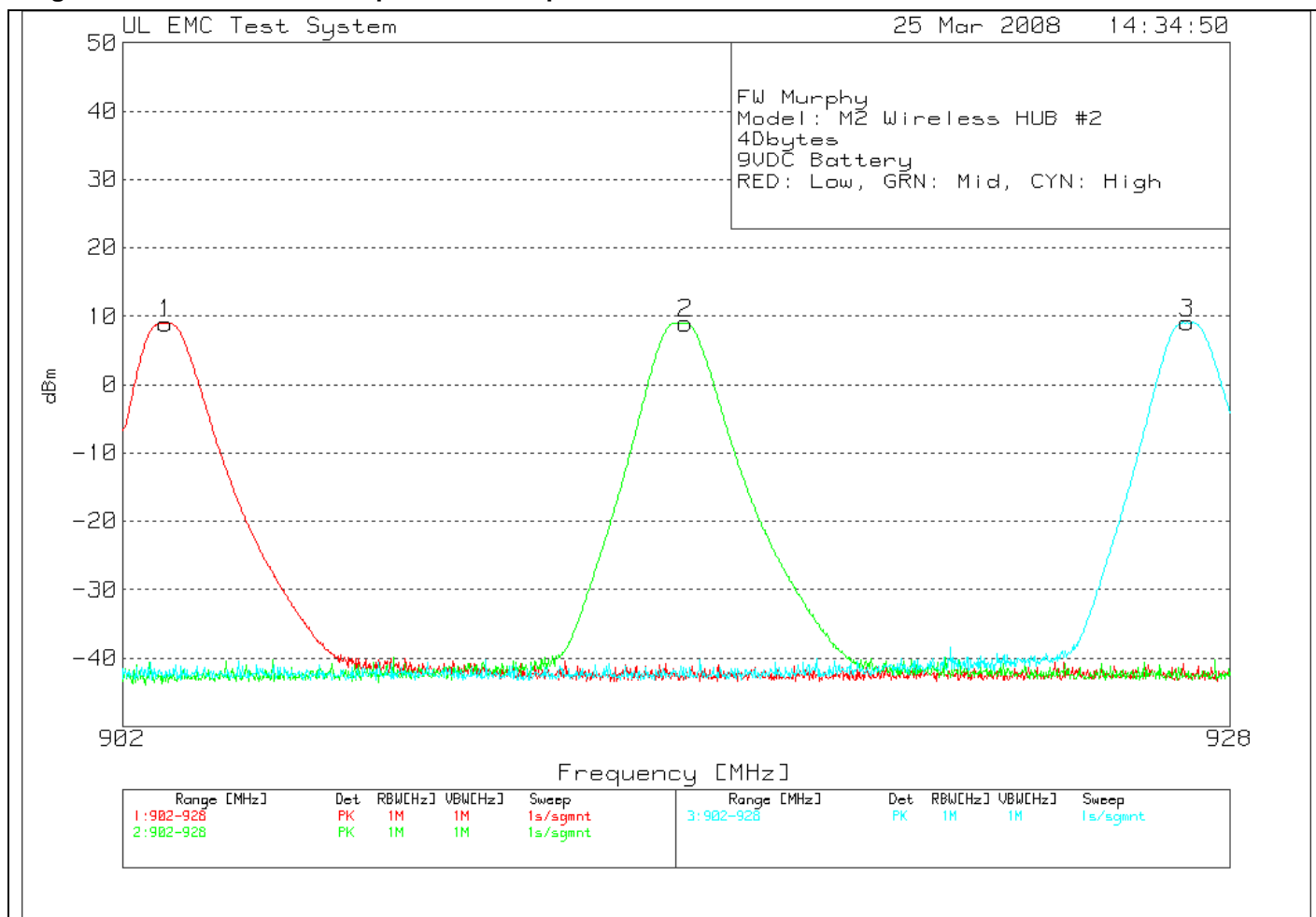
**Table 19 Maximum Peak Output Power Results**

Channel	Power dBm	Power W
Low Channel 903MHz	8.9	0.00776
Middle Channel 915MHz	8.98	0.00791
High Channel 927MHz	9.04	0.00802

**Figure 13 Test setup for Maximum Peak Output Power**



**Figure 14 Maximum Peak Output Power Graph**



**Table 20 Maximum Peak Output Power Emissions Data Points**

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dBm	Limit:1	2	3	4	5	6
Low Channel											
1	903.0058	105.6 pk	10.3	-107	8.9	-	-	-	-	-	-
				Margin [dB]		-	-	-	-	-	-
Middle Channel											
2	915.1298	105.68 pk	10.3	-107	8.98	-	-	-	-	-	-
				Margin [dB]		-	-	-	-	-	-
High Channel											
3	926.9834	105.74 pk	10.3	-107	9.04	-	-	-	-	-	-
				Margin [dB]		-	-	-	-	-	-



#### 4.7      Test Conditions and Results – Band Edge Compliance

Test Description	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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).	
Basic Standard	47 CFR Part 15.247(d) RSS-210, A8.5	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	852MHz – 978MHz	Antenna Conducted
	N/A – No restricted bands near used frequency range.	3 meter measurement distance
<b>Limits</b>		
Frequency (MHz)	Limits	
	Antenna Conducted – 20dB below the fundamental	Radiated – Peak 20dB below the fundamental and Average must meet the general limit in restricted bands.
Below 902MHz and Above 928MHz	Aprox. -10dBm (See Data Table Below)	54dBuV/m
Supplementary information: Spurious limits are only applied against products of the transmitter. All other emissions must meet the general limits. Portable transmitters are to be checked in 3 orthogonal axis.		

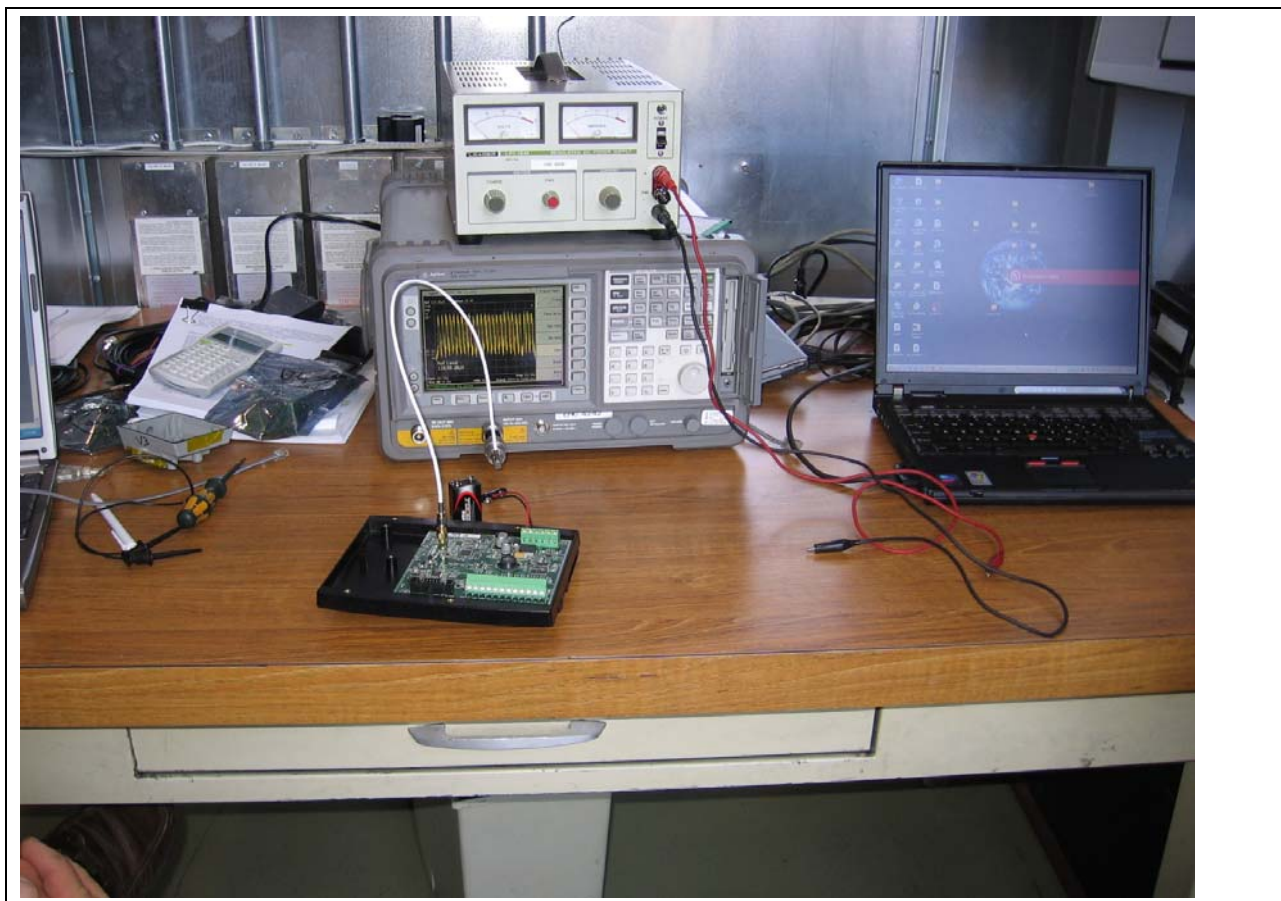
**Table 21 Band Edge Compliance EUT Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1, 2	1
Supplementary information: None		

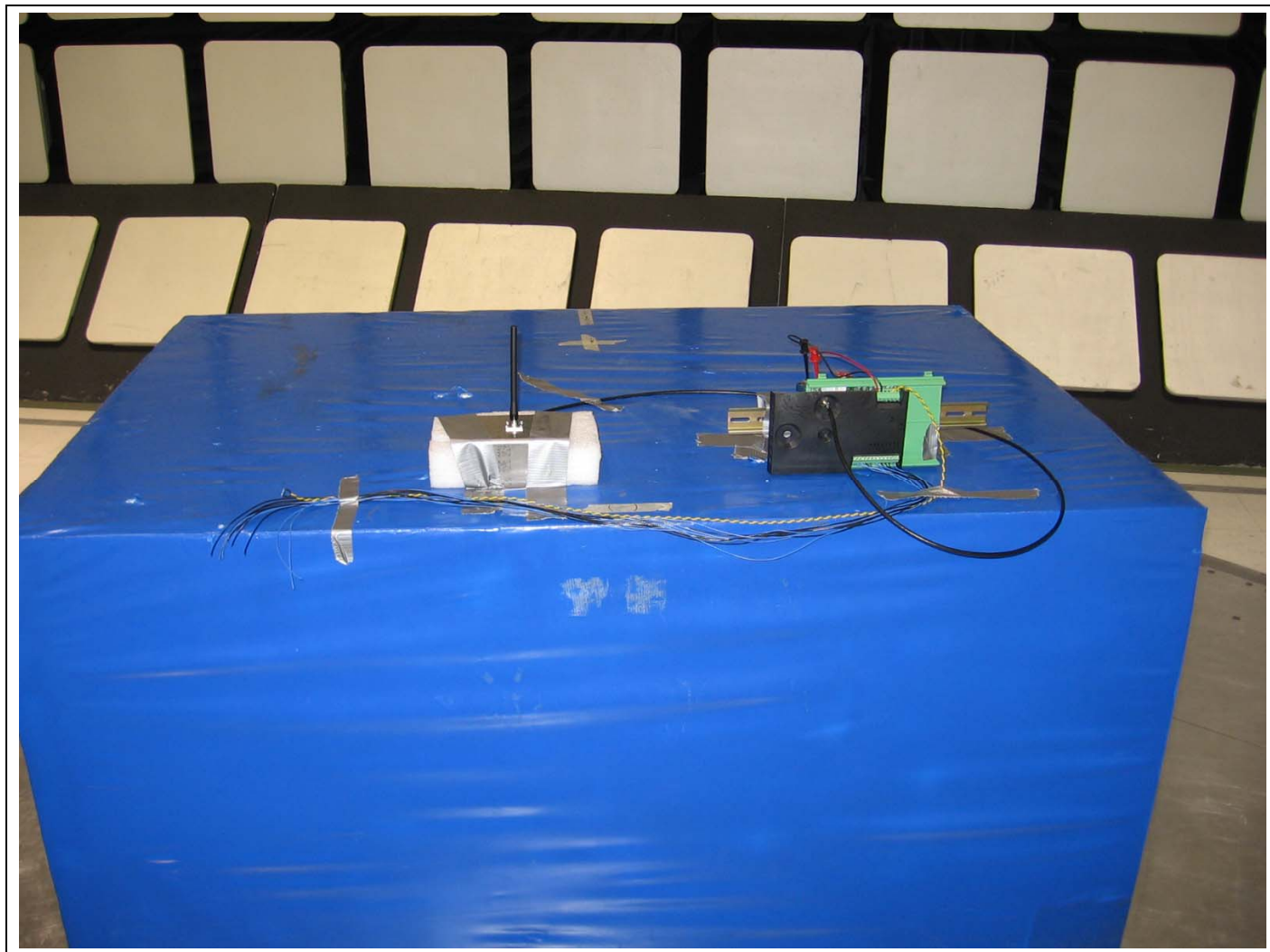
**Table 22 Band Edge Compliance Test Equipment**

Description	Manufacturer	Model	Identifier
Spectrum Analyzer	Rhode & Schwartz	FSEK	EMC4182
Antenna Array	UL	BOMS	EMC4276
Spectrum Analyzer	Agilent	E7405A	US41160342
Attenuator	Pasternek	10dB	None

**Figure 15 Test setup for Band Edge Compliance – Conducted**

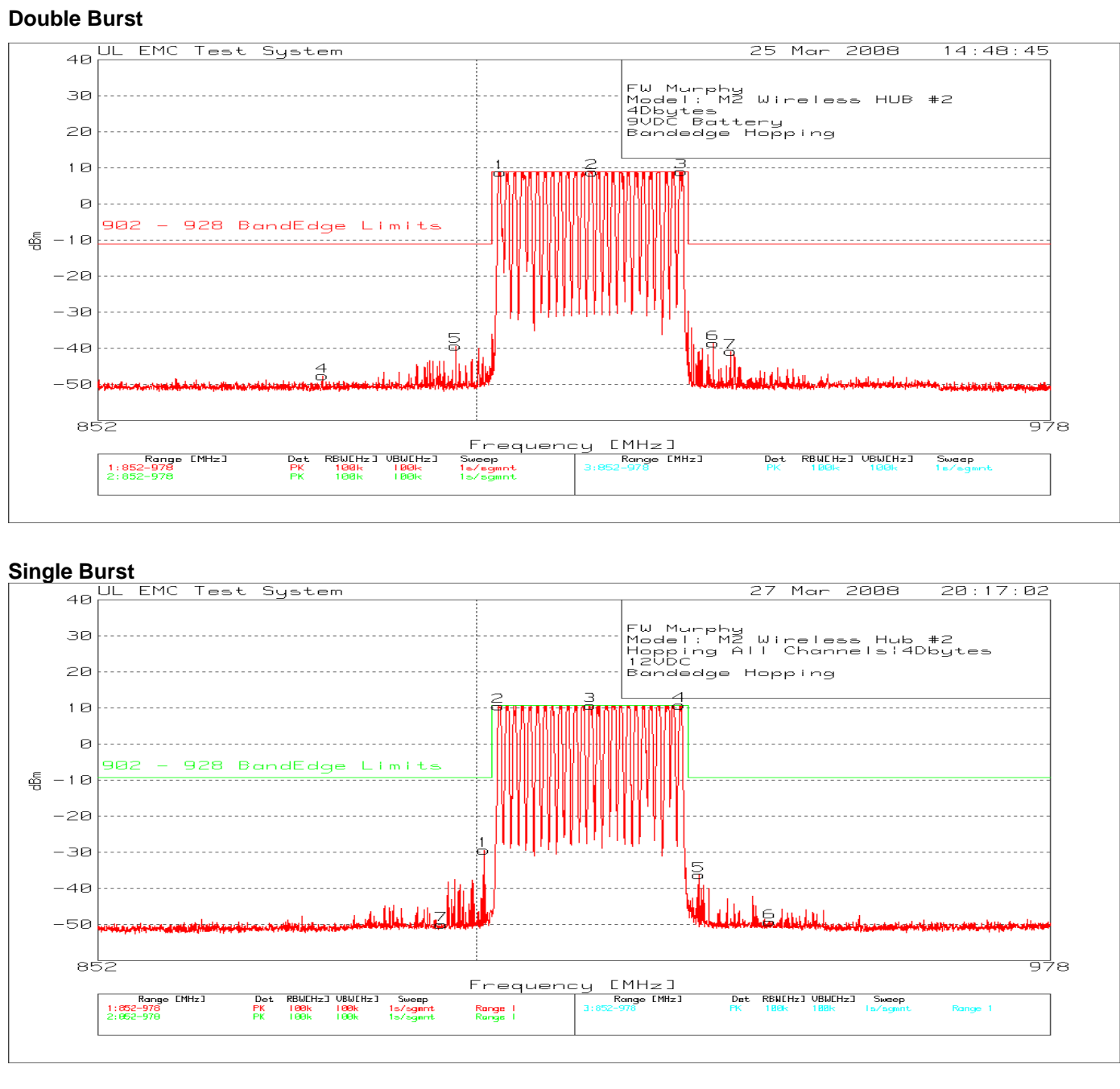


**Figure 16 Test setup for Band Edge Compliance – Radiated**





**Figure 17 Conducted Band Edge Compliance Graph**



**Table 23 Band Edge Compliance Data Points**

FW Murphy  
 Model: M2 Wireless HUB #2  
 4Dbytes, Double Burst  
 9VDC Battery  
 Bandedge Hopping

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dBm	Limit:1	2	3	4	5	6
1	903.1151	105.47 pk	10.3	-107	8.77	0	-	-	-	-	-
				Margin [dB]		8.77	-	-	-	-	-
2	915.2161	105.51 pk	10.3	-107	8.81	0	-	-	-	-	-
				Margin [dB]		8.81	-	-	-	-	-
3	927.1207	105.67 pk	10.3	-107	8.97	0	-	-	-	-	-
				Margin [dB]		8.97	-	-	-	-	-
4	880.131	49.19 pk	10.2	-107	-47.61	-11	-	-	-	-	-
				Margin [dB]		-36.61	-	-	-	-	-
5	897.3003	57.32 pk	10.3	-107	-39.38	-11	-	-	-	-	-
				Margin [dB]		-28.38	-	-	-	-	-
6	931.4032	58.13 pk	10.3	-107	-38.57	-11	-	-	-	-	-
				Margin [dB]		-27.57	-	-	-	-	-
7	933.7605	55.88 pk	10.3	-107	-40.82	-11	-	-	-	-	-
				Margin [dB]		-29.82	-	-	-	-	-

LIMIT 1: 902 - 928 BandEdge Limits  
 pk - Peak detector

FW Murphy  
 Model: M2 Wireless Hub #2  
 Hopping All Channels|4Dbytes - Single Burst  
 12VDC  
 Bandedge Hopping

Test No.	Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dBm	Limit:1	2	3	4	5	6
1	900.9542	67.32 pk	10.3	-107	-29.38	-9.2	-	-	-	-	-
				Margin [dB]		-20.18	-	-	-	-	-
2	902.8793	107.19 pk	10.3	-107	10.49	10.8	-	-	-	-	-
				Margin [dB]		-.31	-	-	-	-	-
3	914.9804	107.36 pk	10.3	-107	10.66	10.8	-	-	-	-	-
				Margin [dB]		-.14	-	-	-	-	-
4	926.8457	107.52 pk	10.3	-107	10.82	10.8	-	-	-	-	-
				Margin [dB]		.02	-	-	-	-	-
5	929.4387	60.41 pk	10.3	-107	-36.29	-9.2	-	-	-	-	-
				Margin [dB]		-27.09	-	-	-	-	-
6	939.0645	47.47 pk	10.3	-107	-49.23	-9.2	-	-	-	-	-
				Margin [dB]		-40.03	-	-	-	-	-
7	895.4537	46.73 pk	10.3	-107	-49.97	-9.2	-	-	-	-	-
				Margin [dB]		-40.77	-	-	-	-	-

LIMIT 1: 902 - 928 BandEdge Limits  
 pk - Peak detector

Test Description	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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).				
Basic Standard	47 CFR Part 15.247(d) RSS-210, A8.5 RSS-Gen 7.2.1 and 7.2.3				
	Frequency range	Measurement Point			
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	(10 meter measurement distance)			
Fully configured sample scanned over the following frequency range	1GHz – 10GHz	(3 meter measurement distance)			
<b>Limits</b>					
Frequency (MHz)	Limit (dBµV/m)				
	Quasi-Peak	Average			
	General Emissions	Fundamental	Spurious		
30 – 88	29.54	-	-		
88 – 216	33.06	-	-		
216-960	35.56	-	-		
960-1000	43.52	-	-		
1,000-25,000	-	-	54		
Supplementary information: Spurious limits are only applied against products of the transmitter. All other emissions must meet the general limits. Since EUT is a fixed mounted and antenna is attached thru coaxial cable, antenna position was tested in two axis (X-axis Vertical and Y-Axis Horizontal)					

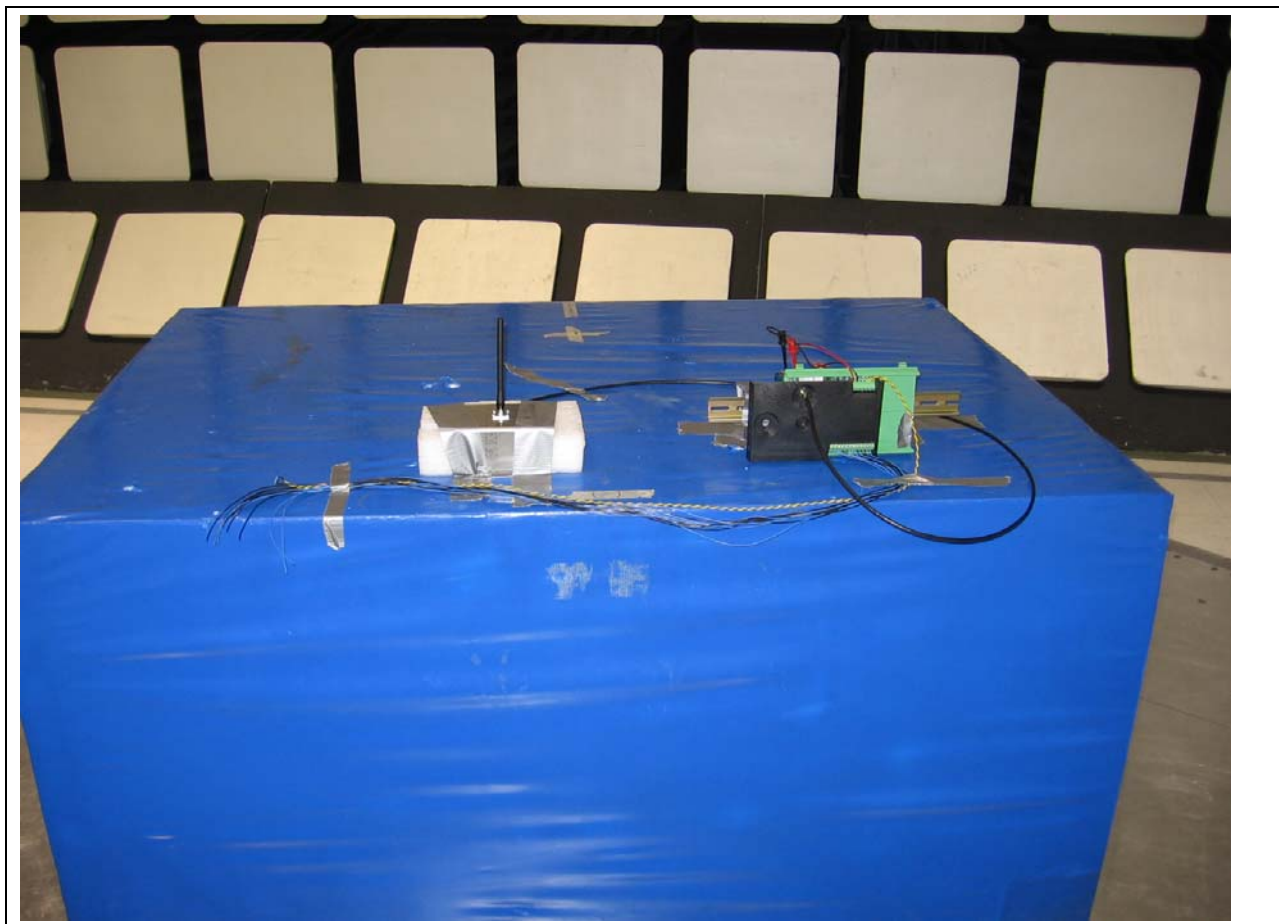
**Table 24 SPURIOUS EMISSIONS EUT Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

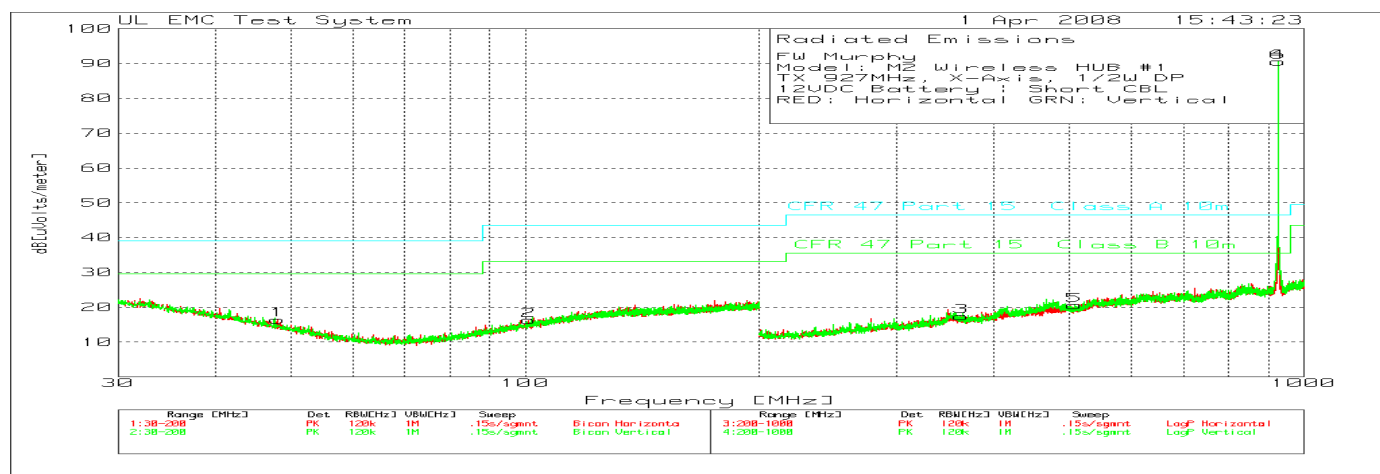
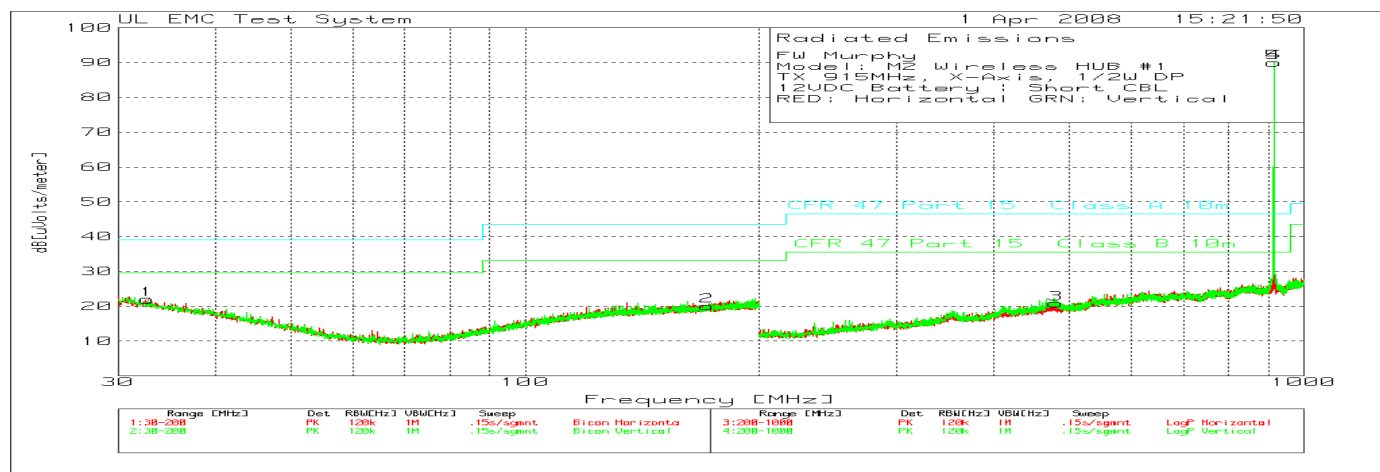
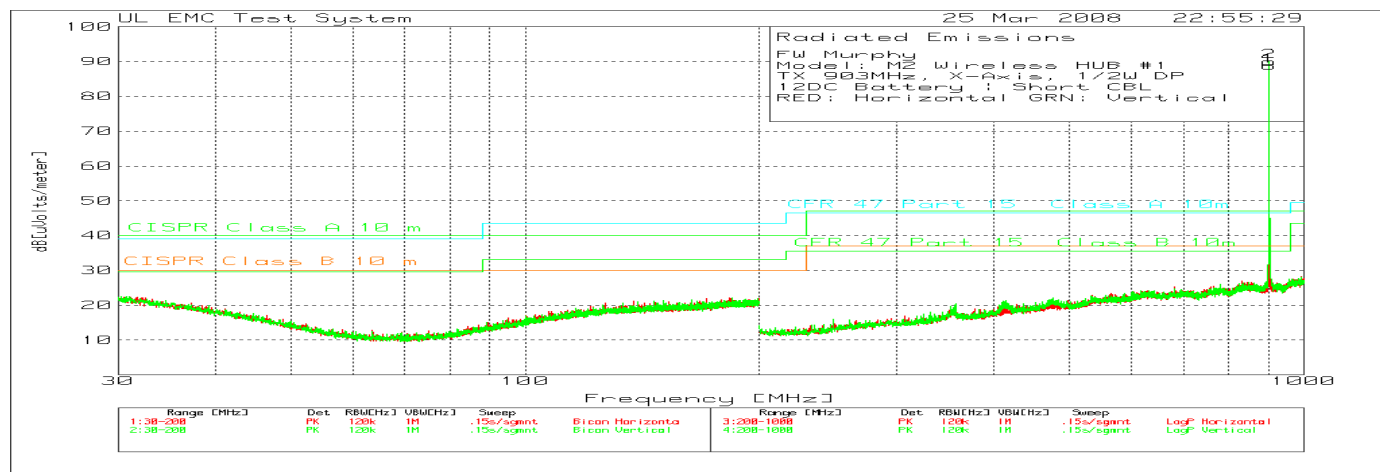
**Table 25 SPURIOUS EMISSIONS Test Equipment**

Description	Manufacturer	Model	Identifier
Spectrum Analyzer	Rhode & Schwartz	FSEK	EMC4182
Antenna Array	UL	BOMS	EMC4276
Spectrum Analyzer	Agilent	E7405A	US41160342
Attenuator	Pasternek	10dB	None

**Figure 18 Test setup for SPURIOUS EMISSIONS**

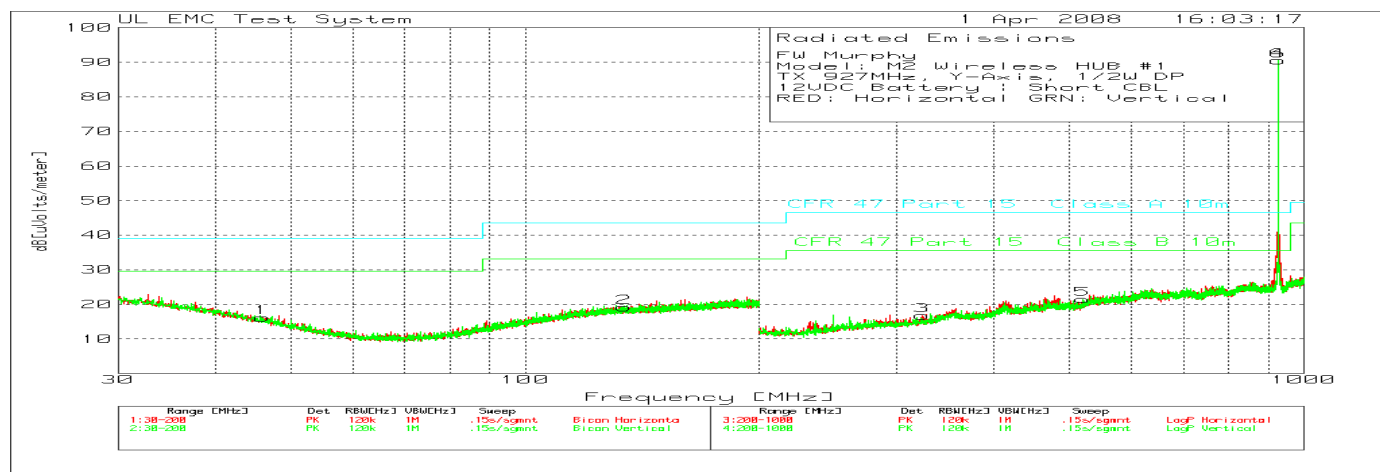
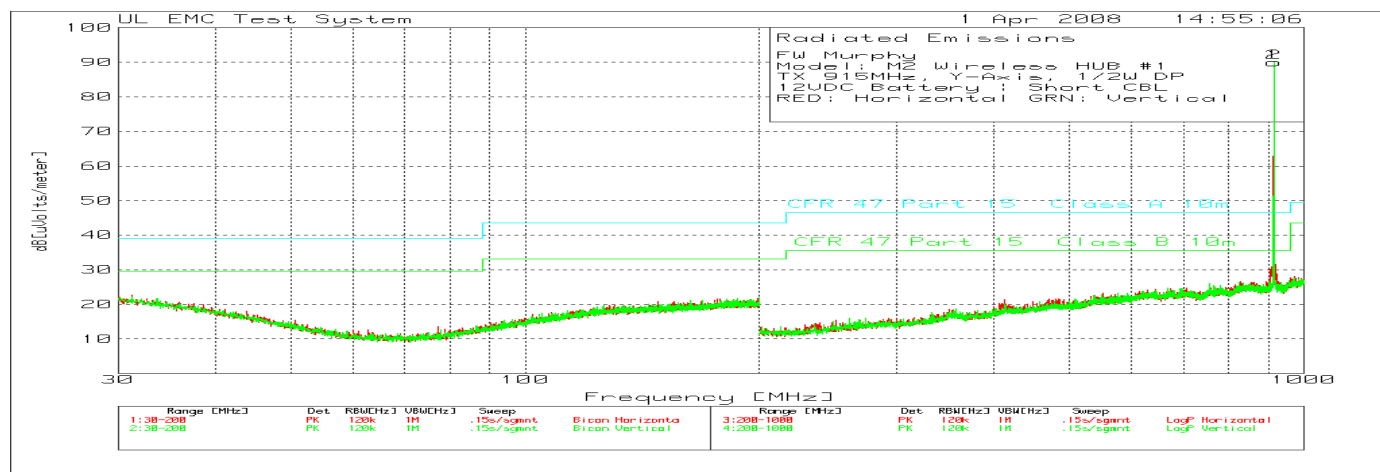
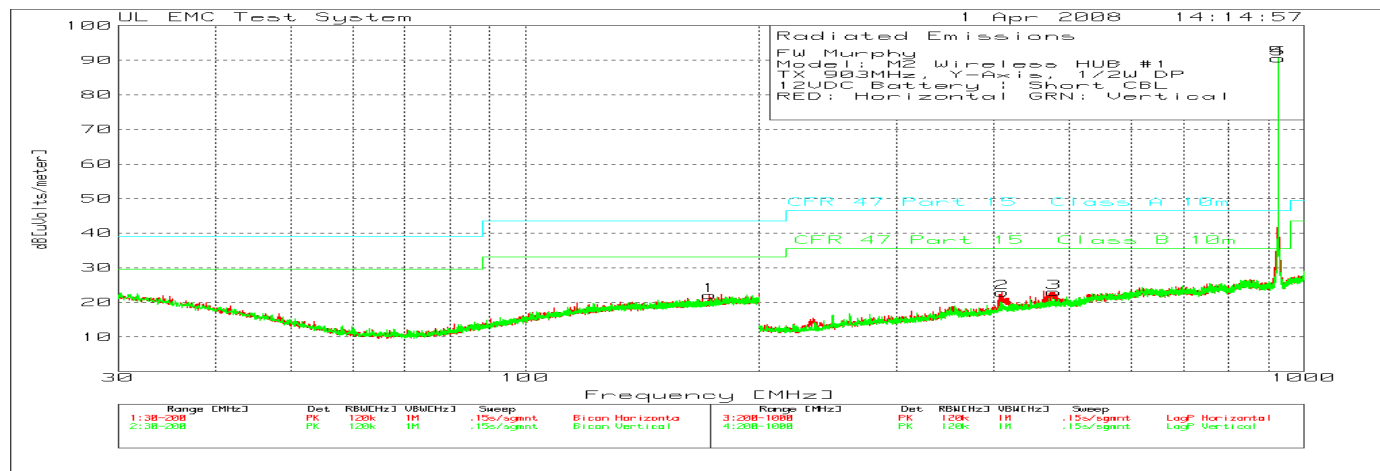


**Figure 19 Radiated Emissions Graph, 30MHz – 1GHz, X-Axis, Low, Mid and High Channels**



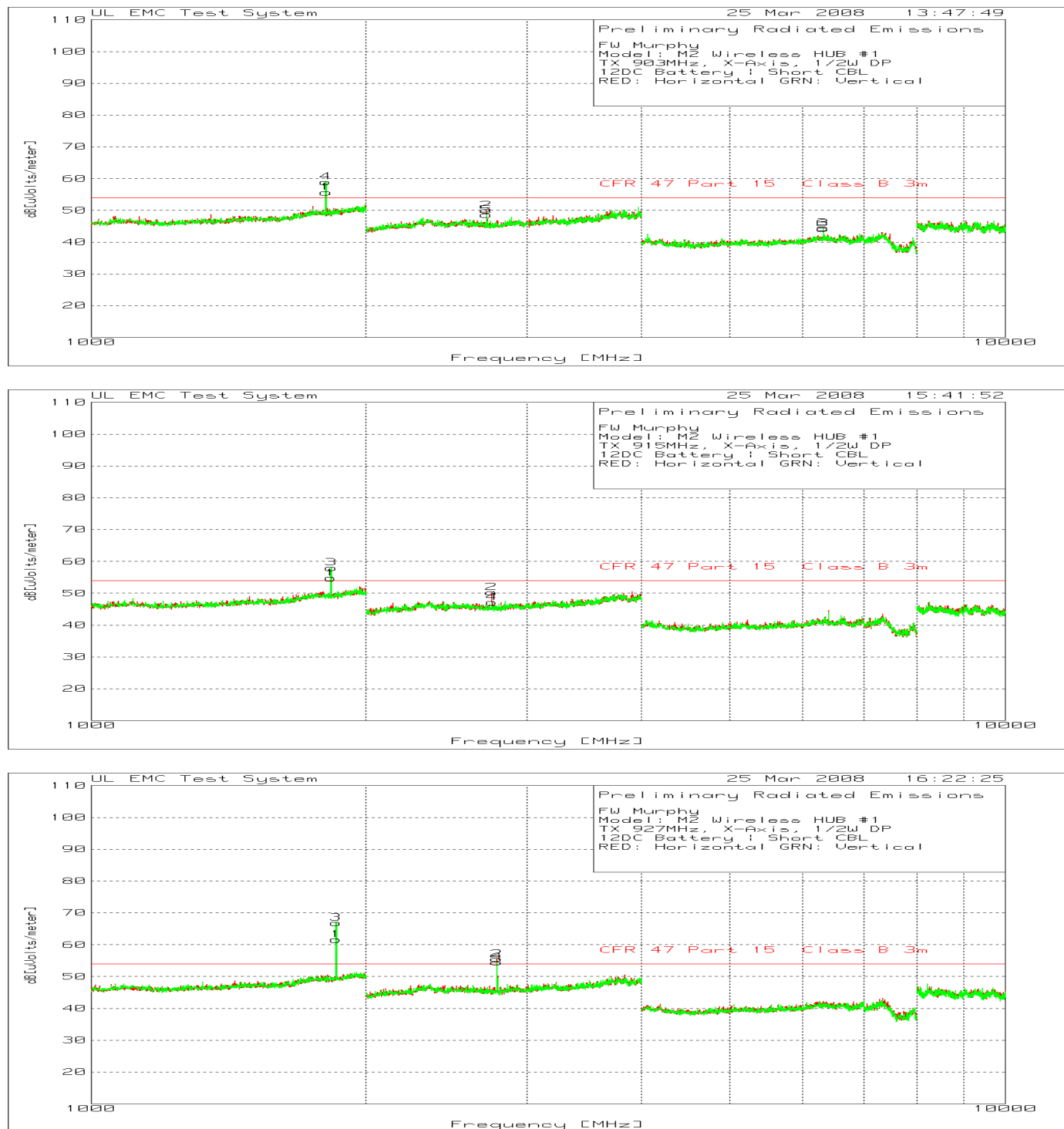
No emissions other the fundamental frequency detected. Measurements Not Required.

**Figure 20 Radiated Emissions Graph, 30MHz – 1GHz, Y-Axis, Low, Mid and High Channels**



No emissions other the fundamental frequency detected. Measurements Not Required.

**Figure 21 SPURIOUS EMISSIONS Preliminary Scan Data, X-Axis, Low, Middle and High Channels**



**Table 26 X-Axis Peak Scan Data**

Preliminary Peak Scan Data

FW Murphy  
Model: M2 Wireless HUB #1  
TX 903MHz, X-Axis, ½W DP  
12DC Battery | Short CBL  
RED: Horizontal GRN: Vertical

Marker Number	Test Frequency [MHz]	Restricted	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1 [dB]	Height [cm]	Polarity
1	1806.807	N	25.33	pk	3.59	26.7	55.62	54	1.62	150	Horz
2	2708.472	Y	23.71	pk	4.14	22.1	49.95	54	-4.05	100	Horz
3	6318.879	N	63.25	pk	-48.01	29.2	44.44	54	-9.56	100	Horz
4	1805.806	N	28.63	pk	3.59	26.7	58.92	54	4.92	150	Vert
5	2708.472	Y	22.34	pk	4.14	22.1	48.58	54	-5.42	150	Vert
6	6321.548	N	63	pk	-47.97	29.2	44.23	54	-9.77	100	Vert

FW Murphy  
Model: M2 Wireless HUB #1  
TX 915MHz, X-Axis, ½W DP  
12DC Battery | Short CBL  
RED: Horizontal GRN: Vertical

Marker Number	Test Frequency [MHz]	Restricted	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1 [dB]	Height [cm]	Polarity
1	1829.83	N	24.35	pk	3.59	26.8	54.74	54	.74	100	Horz
2	2744.496	Y	24.12	pk	4.04	22.1	50.26	54	-3.74	100	Horz
3	1830.831	N	27.56	pk	3.6	26.8	57.96	54	3.96	150	Vert
4	2745.831	Y	21.01	pk	4.03	22.1	47.14	54	-6.86	150	Vert

FW Murphy  
Model: M2 Wireless HUB #1  
TX 927MHz, X-Axis, ½W DP  
12DC Battery | Short CBL  
RED: Horizontal GRN: Vertical

Marker Number	Test Frequency [MHz]	Restricted	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1 [dB]	Height [cm]	Polarity
1	1853.854	N	30.99	pk	3.74	26.9	61.63	54	7.63	101	Horz
2	2780.52	Y	29.05	pk	4.25	22.2	55.5	54	1.5	101	Horz
3	1854.354	N	36.21	pk	3.73	26.9	66.84	54	12.84	150	Vert
4	2780.52	Y	28.03	pk	4.25	22.2	54.48	54	.48	150	Vert

LIMIT 1: CFR 47 Part 15 Class B 3m

pk - Peak detector

qp - Quasi-Peak detector

av - Average detector

If spurious emission frequency falls in non-restricted band, only 74dBuV/m peak limit applies.



**Table 27 X-Axis Maximized Worst Case Peak and Average Measurement (Restricted Band Only)**

FW Murphy  
 Model: M2 Wireless HUB #1  
 TX 927MHz, X-Axis, ½W DP  
 12DC Battery | Short CBL  
 RED: Horizontal GRN: Vertical

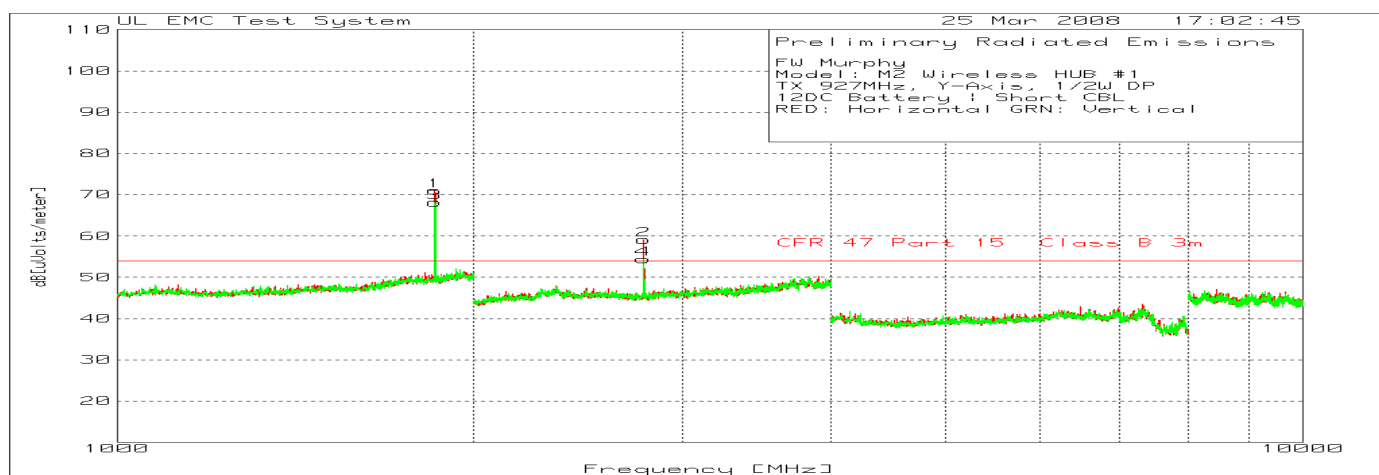
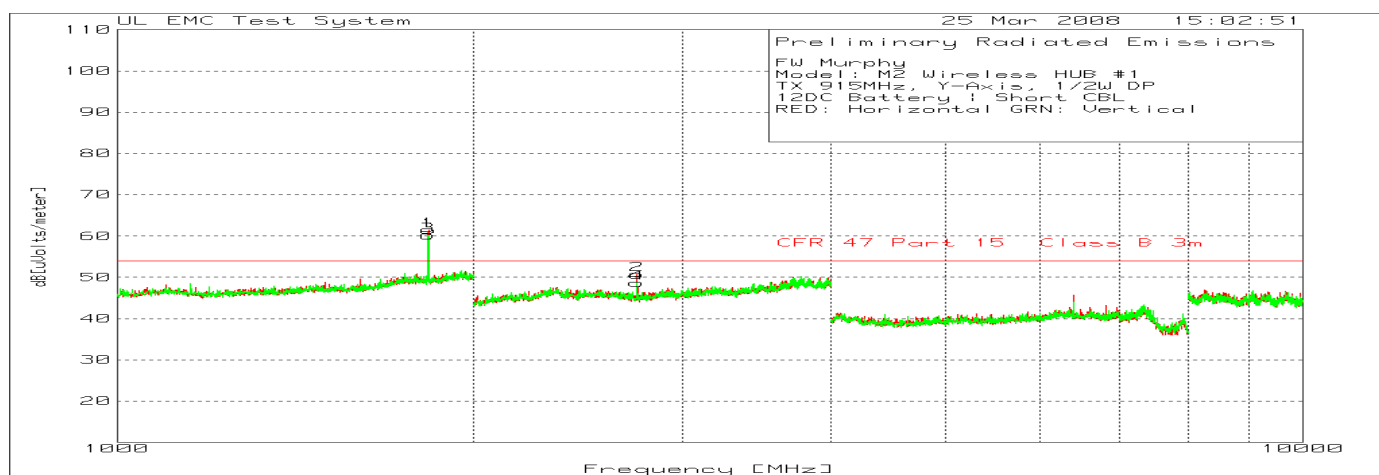
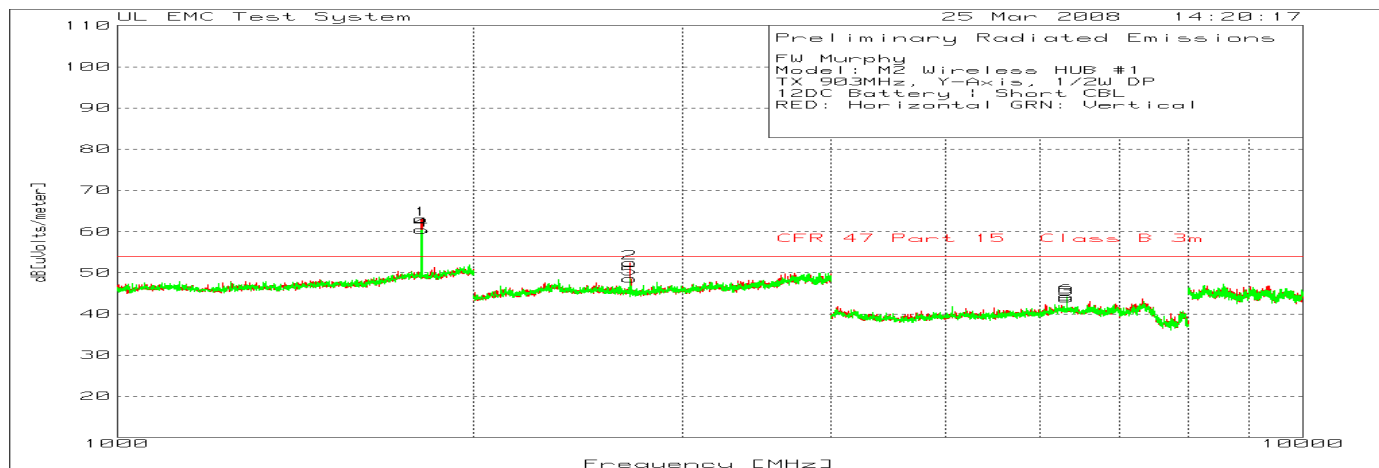
Frequencies only in restricted bands need to be measured.

Test Frequency [MHz]	Meter Reading [dB(uV) ]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	DC Correction	Limit 1	Margin 1[dB]	Azimuth [degs]	Height [cm]	Polarity
2781.481	33	pk	4.24	22.2	59.44	-	74	-14.56	39	100	Horz
2781.481	26.39	av	4.24	22.2	52.83	13.66	54	-14.83	39	100	Horz
2781.481	31.92	pk	4.24	22.2	58.36	-	74	-15.64	200	149	Vert
2781.481	24.51	av	4.24	22.2	50.95	13.66	54	-16.71	200	149	Vert

LIMIT 1: CFR 47 Part 15 Class B 3m

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector

**Table 28 SPURIOUS EMISSIONS Preliminary Scan Data, Y-Axis, Low, Middle and High Channels**



**Table 29 Y-Axis Peak Scan Data**

Preliminary Peak Scan Data

FW Murphy  
 Model: M2 Wireless HUB #1  
 TX 903MHz, Y-Axis, ½W DP  
 12DC Battery | Short CBL  
 RED: Horizontal GRN: Vertical

Marker Number	Test Frequency [MHz]	Restricted	Meter Reading [dB(µV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[µV/m]	Limit 1	Margin 1 [dB]	Height [cm]	Polarity
1	1805.806	N	32.76	pk	3.59	26.7	63.05	54	9.05	100	Horz
2	2708.472	Y	26.2	pk	4.14	22.1	52.44	54	-1.56	100	Horz
3	6321.548	N	62.53	pk	-47.97	29.2	43.76	54	-10.24	100	Horz
4	1806.807	N	30.11	pk	3.59	26.7	60.4	54	6.4	150	Vert
5	2708.472	Y	22.33	pk	4.14	22.1	48.57	54	-5.43	150	Vert
6	6321.548	N	62.96	pk	-47.97	29.2	44.19	54	-9.81	100	Vert

FW Murphy  
 Model: M2 Wireless HUB #1  
 TX 915MHz, Y-Axis, ½W DP  
 12DC Battery | Short CBL  
 RED: Horizontal GRN: Vertical

Marker Number	Test Frequency [MHz]	Restricted	Meter Reading [dB(µV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[µV/m]	Limit 1	Margin 1 [dB]	Height [cm]	Polarity
1	1830.831	N	31.1	pk	3.6	26.8	61.5	54	7.5	108	Horz
2	2745.831	Y	24.57	pk	4.03	22.1	50.7	54	-3.3	100	Horz
3	1829.83	N	29.81	pk	3.59	26.8	60.2	54	6.2	150	Vert
4	2744.496	Y	22.49	pk	4.04	22.1	48.63	54	-5.37	150	Vert

FW Murphy  
 Model: M2 Wireless HUB #1  
 TX 927MHz, Y-Axis, ½W DP  
 12DC Battery | Short CBL  
 RED: Horizontal GRN: Vertical

Marker Number	Test Frequency [MHz]	Restricted	Meter Reading [dB(µV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[µV/m]	Limit 1	Margin 1 [dB]	Height [cm]	Polarity
1	1853.854	N	40.36	pk	3.74	26.9	71	54	17	100	Horz
2	2781.855	Y	32.68	pk	4.24	22.2	59.12	54	5.12	100	Horz
3	1853.854	N	37.53	pk	3.74	26.9	68.17	54	14.17	150	Vert
4	2780.52	Y	27.97	pk	4.25	22.2	54.42	54	.42	150	Vert

LIMIT 1: CFR 47 Part 15 Class B 3m  
 pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector

If spurious emission frequency falls in non-restricted band, only 74dBuV/m peak limit applies.

**Table 30 Y-Axis Maximized Worst Case Peak and Average Measurement (Restricted Band Only)**

Only frequencies in restricted bands need to comply with spurious emissions average limits.

FW Murphy  
 Model: M2 Wireless HUB #1  
 TX 903MHz, Y-Axis, ½W DP  
 12DC Battery | Short CBL  
 RED: Horizontal GRN: Vertical

Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uV/m]	Duty Cycle Correction dB	Limit 1	Margin 1[dB]	Azimuth [deg]	Height [cm]	Polarity
2709.4349	32.66	pk	4.14	22.1	58.9	-	74	-15.1	43	108	Horz
2709.4349	25.35	av	4.14	22.1	51.59	13.66	54	-12.07	43	108	Horz

LIMIT 1: CFR 47 Part 15 Class B 3m

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector

FW Murphy  
 Model: M2 Wireless HUB #1  
 TX 927MHz, Y-Axis, ½W DP  
 12DC Battery | Short CBL  
 RED: Horizontal GRN: Vertical

Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uV/m]	Duty Cycle Correction dB	Limit 1	Margin 1[dB]	Azimuth [deg]	Height [cm]	Polarity
2780.6493	36.09	pk	4.25	22.2	62.54	-	74	-11.46	34	103	Horz
2780.6493	31.4	av	4.25	22.2	57.85	13.66	54	-9.81	34	103	Horz
2780.6493	33.16	pk	4.25	22.2	59.61	-	74	-14.39	4	183	Vert
2780.6493	26.62	av	4.25	22.2	53.07	13.66	54	-14.59	4	183	Vert

LIMIT 1: CFR 47 Part 15 Class B 3m

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector

#### 4.9    Test Conditions and Results – Radiated Emissions – Digital / Receiver

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10-meter below 1GHz and 3 meters above 1GHz. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15.209 RSS-Gen 7.2.1 and 7.2.3		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	(10 meter measurement distance)	
Fully configured sample scanned over the following frequency range	1GHz – 10GHz	(3 meter measurement distance)	
Limits			
Frequency (MHz)	Limit (dBµV/m)		
	Quasi-Peak	Average	
	General Emissions	Fundamental	Spurious
30 – 88	39.08	-	-
88 – 216	43.52	-	-
216-960	46.44	-	-
960 - 1000	49.54	-	-
1,000-25,000	-	-	54
Supplementary information: None			

**Table 31 SPURIOUS EMISSIONS EUT Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1, 2
Supplementary information: None		

**Table 32 SPURIOUS EMISSIONS Test Equipment**

Description	Manufacturer	Model	Identifier
Spectrum Analyzer	HP	8566B	EMC4085
Quasi-Peak Detector	HP	85650A	EMC4016
Bicon Antenna	Electro-Metrics	EM6912A	EMC4070
Log-P Antenna	Chase	UPA6109	EMC4258
Spectrum Analyzer	Rhode & Schwartz	FSEK	EMC4182
Antenna Array	UL	BOMS	EMC4276

**Figure 22 Test setup for SPURIOUS EMISSIONS**

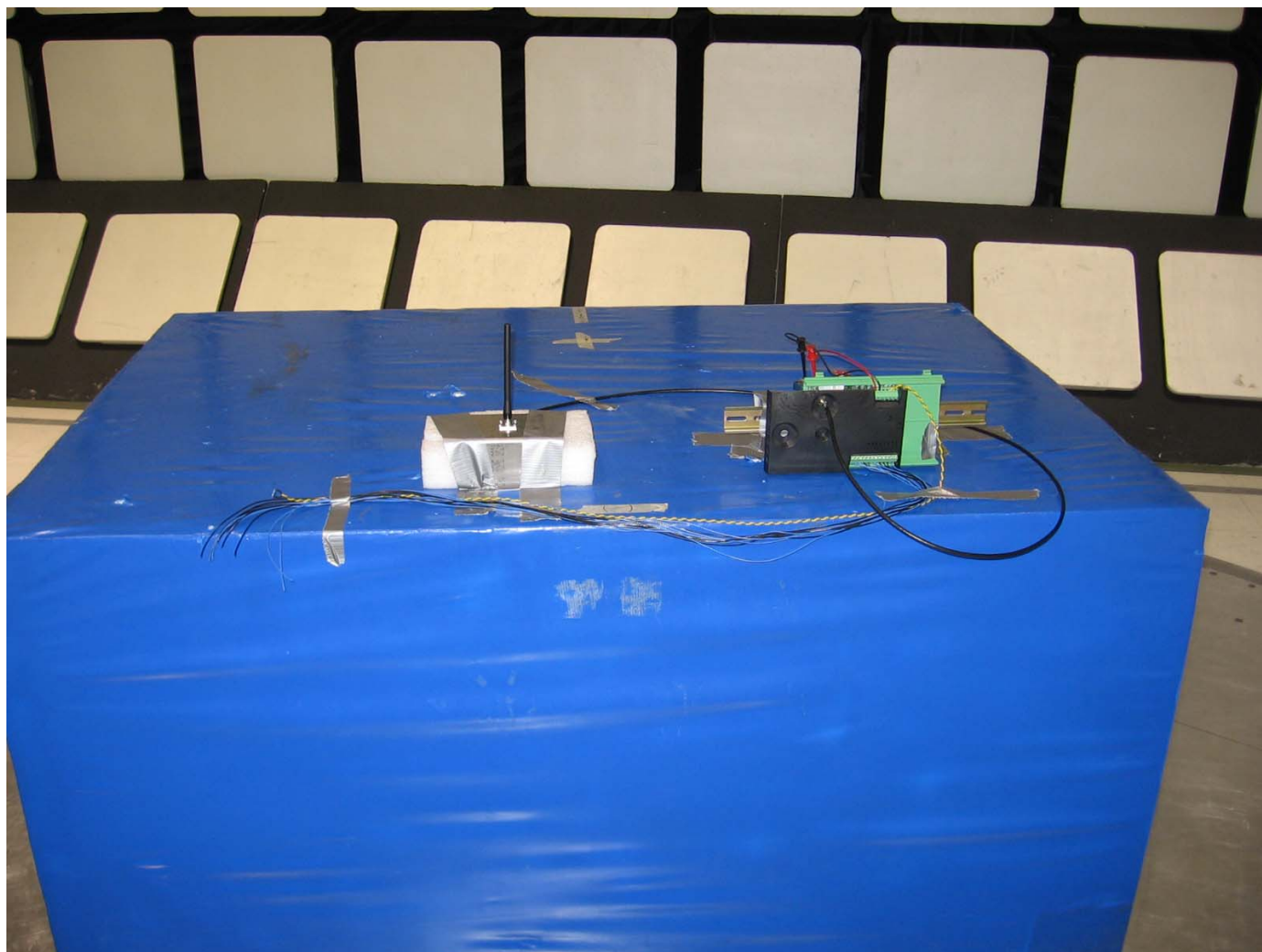
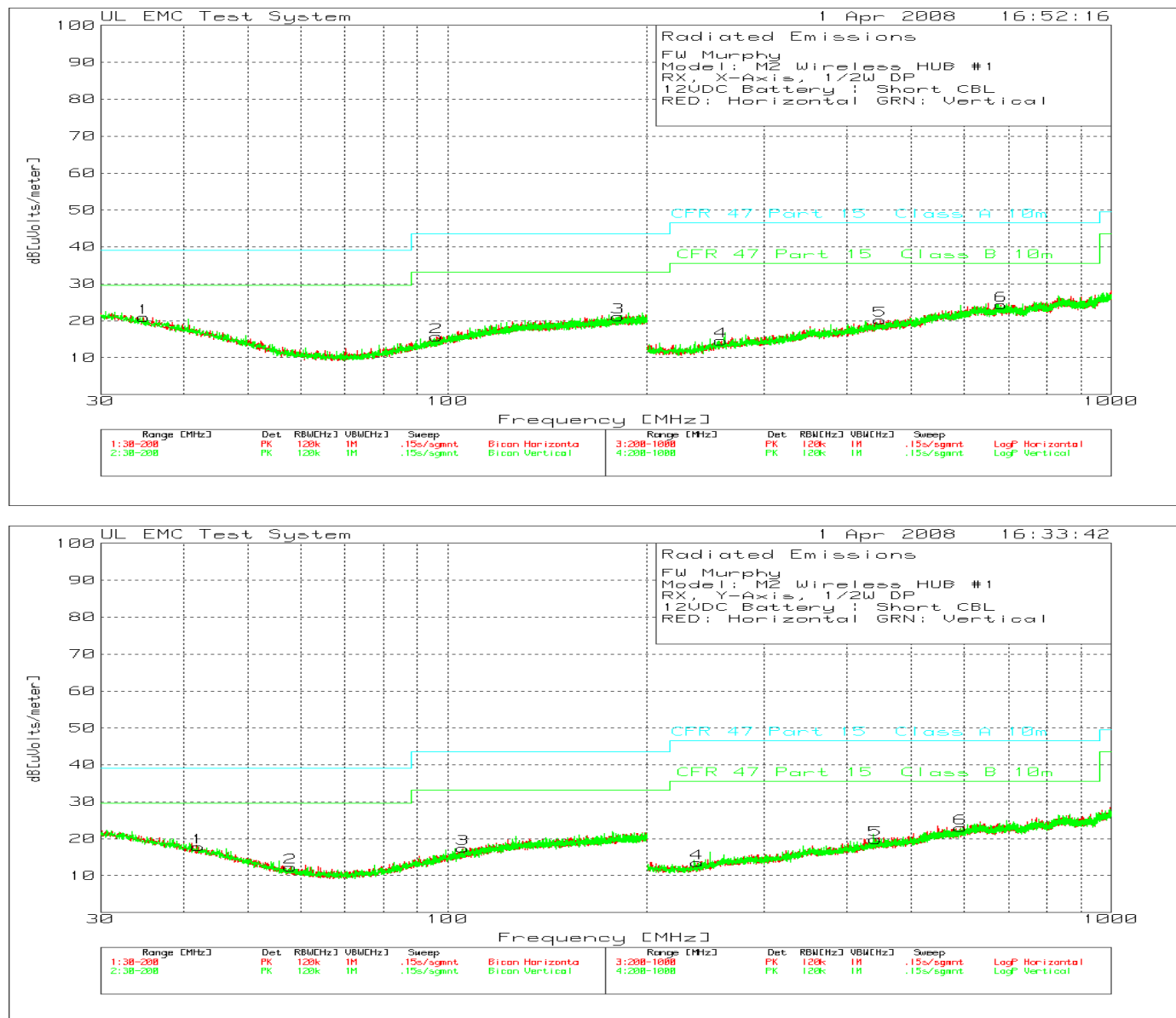


Figure 23 Radiated Emissions Graph 30MHz - 1GHz



**Table 33 SPURIOUS EMISSIONS Data Points**

FW Murphy  
 Model: M2 Wireless HUB #1  
 RX, X-Axis, 1/2W DP  
 12VDC Battery | Short CBL  
 RED: Horizontal GRN: Vertical

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3	4	5	6
1	34.8701	35.2 pk	-30.3	16	20.9	-	-	39.1	29.6	-	-
	Azimuth:241	Height:100	Horz	Margin [dB]		-	-	-18.2	-8.7	-	-
2	96.3125	35.8 pk	-30.1	10	15.7	-	-	43.5	33.1	-	-
	Azimuth:248	Height:300	Horz	Margin [dB]		-	-	-27.8	-17.4	-	-
3	180.8028	35.2 pk	-29.9	15.8	21.1	-	-	43.5	33.1	-	-
	Azimuth:218	Height:300	Horz	Margin [dB]		-	-	-22.4	-12	-	-
4	258.3562	35.3 pk	-33.2	12.5	14.6	-	-	46.4	35.6	-	-
	Azimuth:123	Height:300	Horz	Margin [dB]		-	-	-31.8	-21	-	-
5	448.4137	35.3 pk	-31.9	16.8	20.2	-	-	46.4	35.6	-	-
	Azimuth:194	Height:300	Horz	Margin [dB]		-	-	-26.2	-15.4	-	-
6	683.0377	35.1 pk	-31	20.2	24.3	-	-	46.4	35.6	-	-
	Azimuth:14	Height:100	Horz	Margin [dB]		-	-	-22.1	-11.3	-	-

LIMIT 3: CFR 47 Part 15 Class A 10m  
 LIMIT 4: CFR 47 Part 15 Class B 10m

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector

FW Murphy  
 Model: M2 Wireless HUB #1  
 RX, Y-Axis, 1/2W DP  
 12VDC Battery | Short CBL  
 RED: Horizontal GRN: Vertical

No.	Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3	4	5	6
1	42.1186	35 pk	-30.3	13.1	17.8	-	-	39.1	29.6	-	-
	Azimuth:100	Height:100	Horz	Margin [dB]		-	-	-21.3	-11.8	-	-
2	58.0313	35.4 pk	-30.2	7.1	12.3	-	-	39.1	29.6	-	-
	Azimuth:100	Height:100	Horz	Margin [dB]		-	-	-26.8	-17.3	-	-
3	105.4297	35.9 pk	-30	11.5	17.4	-	-	43.5	33.1	-	-
	Azimuth:96	Height:100	Horz	Margin [dB]		-	-	-26.1	-15.7	-	-
4	237.9715	35.6 pk	-33.2	11.1	13.5	-	-	46.4	35.6	-	-
	Azimuth:299	Height:102	Horz	Margin [dB]		-	-	-32.9	-22.1	-	-
5	442.0185	35.2 pk	-32.1	16.7	19.8	-	-	46.4	35.6	-	-
	Azimuth:26	Height:102	Horz	Margin [dB]		-	-	-26.6	-15.8	-	-
6	593.7047	35.1 pk	-31.4	19.3	23	-	-	46.4	35.6	-	-
	Azimuth:120	Height:301	Horz	Margin [dB]		-	-	-23.4	-12.6	-	-

LIMIT 3: CFR 47 Part 15 Class A 10m  
 LIMIT 4: CFR 47 Part 15 Class B 10m

pk - Peak detector  
 qp - Quasi-Peak detector  
 av - Average detector



Figure 24 Radiated Emissions Graph 1GHz - 10GHz

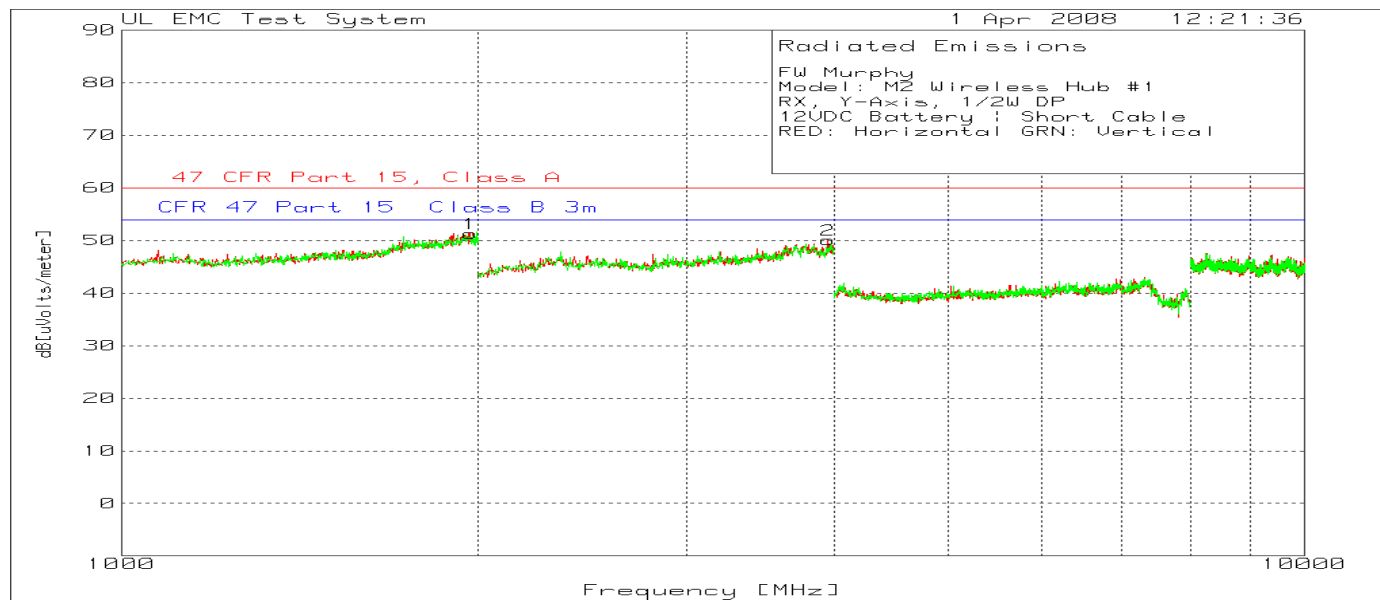
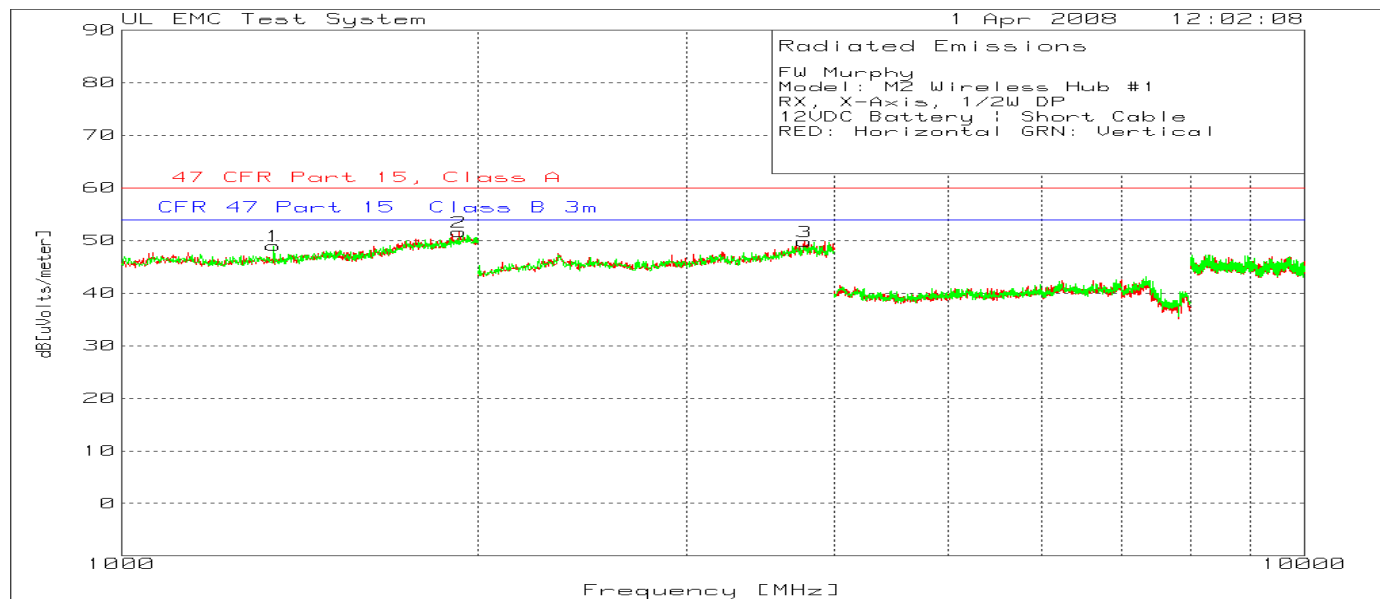


Table 34 SPURIOUS EMISSIONS Data Points

FW Murphy  
Model: M2 Wireless Hub #1  
RX, X-Axis, 1/2W DP  
12VDC Battery | Short Cable  
RED: Horizontal GRN: Vertical

Marker Number	Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]	Height [cm]	Polarity
2	1929.86	20.89	pk	3.55	27.2	51.64	60	-8.36	54	-2.36	101	Horz
3	3779.559	19.86	pk	5.91	24	49.77	60	-10.23	54	-4.23	100	Horz
1	1344.689	20.66	pk	3.32	25	48.98	60	-11.02	54	-5.02	150	Vert

LIMIT 1: 47 CFR Part 15, Class A  
LIMIT 2: CFR 47 Part 15 Class B 3m

pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector

FW Murphy  
Model: M2 Wireless Hub #1  
RX, Y-Axis, 1/2W DP  
12VDC Battery | Short Cable  
RED: Horizontal GRN: Vertical

Marker Number	Test Frequency [MHz]	Meter Reading [dB(uV)]	Detector Type	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit 1	Margin 1[dB]	Limit 2	Margin 2[dB]	Height [cm]	Polarity
1	1971.944	20.21	pk	3.68	27.4	51.29	60	-8.71	54	-2.71	100	Horz
2	3955.912	20.73	pk	5.23	24.1	50.06	60	-9.94	54	-3.94	100	Horz

LIMIT 1: 47 CFR Part 15, Class A  
LIMIT 2: CFR 47 Part 15 Class B 3m

pk - Peak detector  
qp - Quasi-Peak detector  
av - Average detector

#### 4.10 Test Conditions and Results – 99% Bandwidth

Test Description	When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.	
Basic Standard	RSS-Gen 4.6.1	
UL LPG	None	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	902 MHz – 928 MHz	Antenna Port Conducted
Supplementary information: None		

**Table 35 99% Bandwidth EUT Configuration Settings**

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	2	1
Supplementary information: None		

**Table 36 99% Bandwidth Test Equipment**

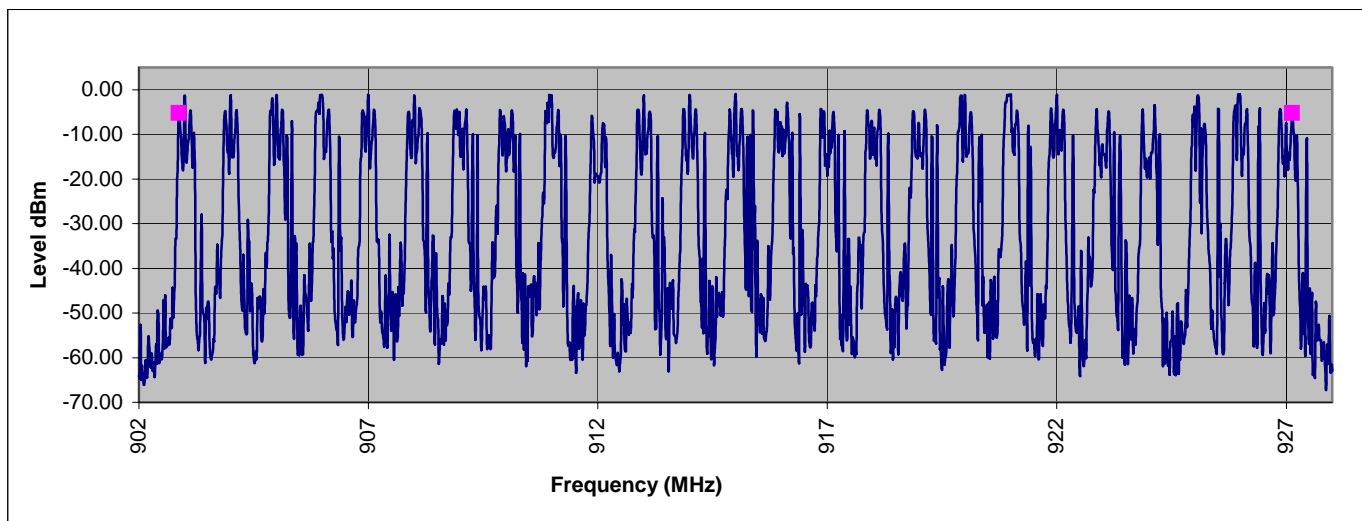
Description	Manufacturer	Model	Identifier
Spectrum Analyzer	Agilent	E7405A	US41160342
Attenuator	Pasternek	10dB	None

**Table 37 99% Bandwidth Results**

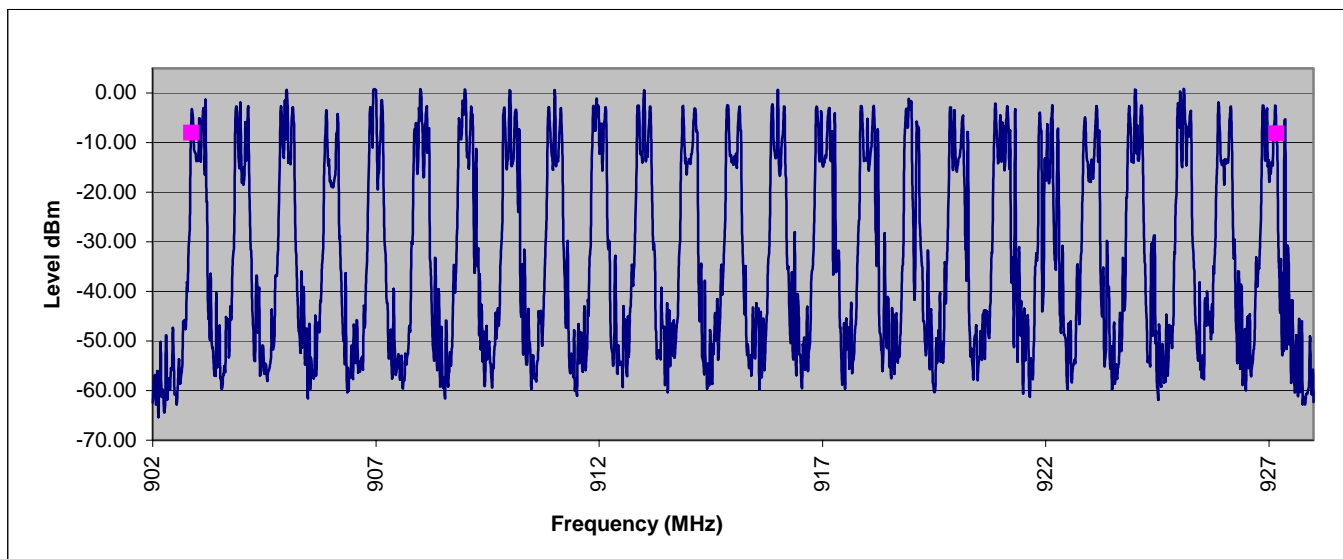
Modulation Mode	99% Bandwidth
Double Burst, All Channels	24,261.250 kHz
Single Burst, All Channels	24,310.000 kHz
Double Burst, Low Channel	316.250 kHz
Double Burst, Middle Channel	321.875 kHz
Double Burst, High Channel	328.125 kHz

**Figure 25 99% Band Width**

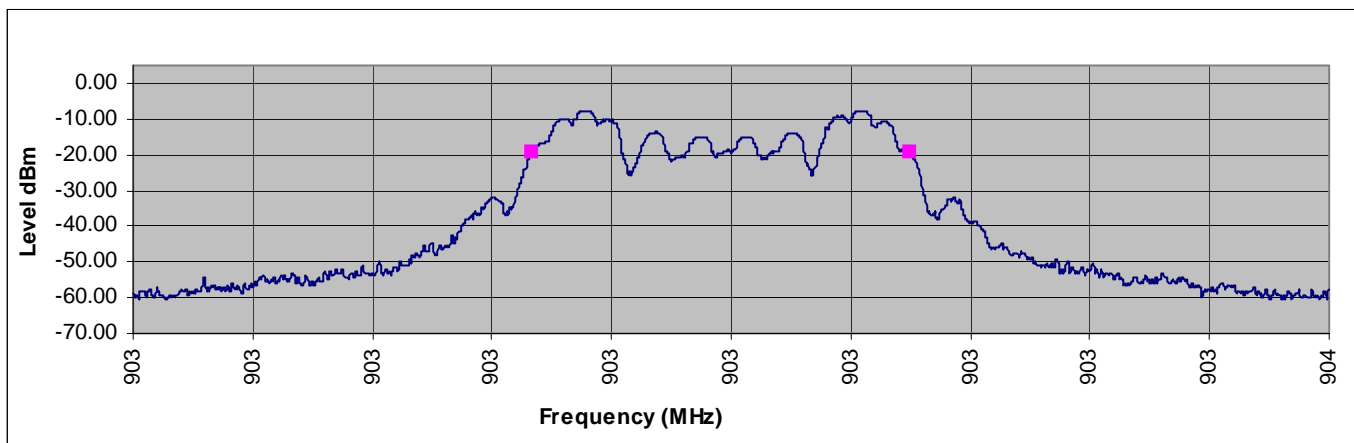
99%, All Channels, Double Burst



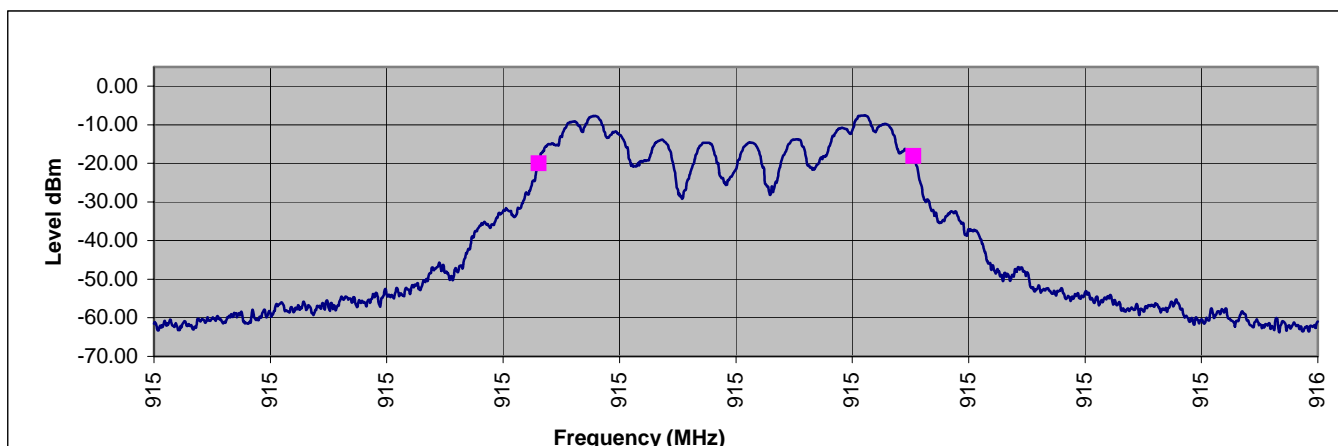
99%, All Channels, Single Burst



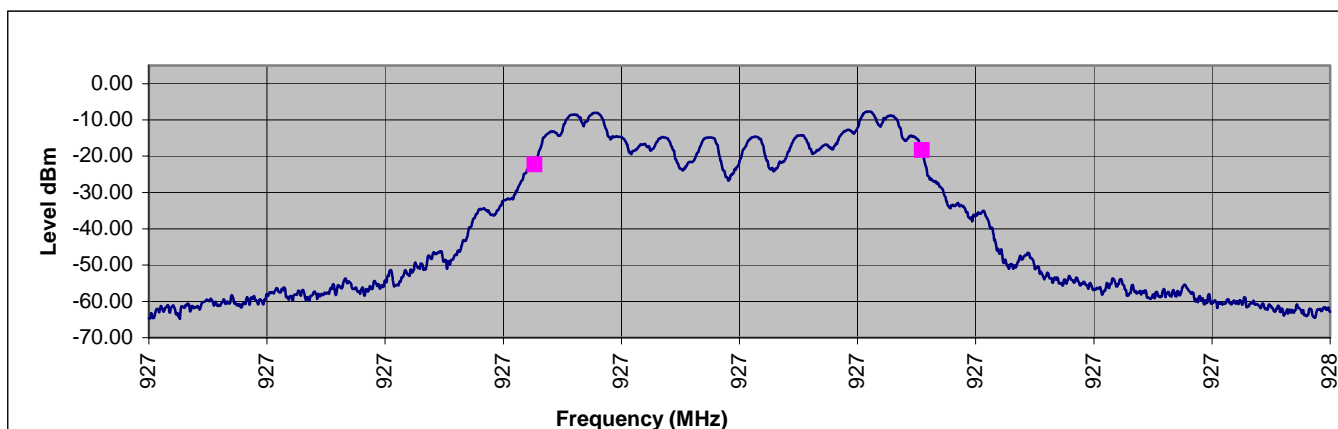
99% BW, Low Channel, Double Burst



99% BW, Middle Channel, Double Burst



99% BW, High Channel, Double Burst



## **5.0    IMMUNITY TEST RESULTS**

The immunity tests were not performed nor required:

## Appendix A

### Accreditations and Authorizations



NVLAP Lab code: 100414-0

NVLAP: Recognized under the National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC EN17025 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. For a full scope listing see <http://ts.nist.gov/ts/htdocs/210/214/scopes/1004140.htm>



FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91044).



Industry Canada    Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2180



VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: Radiated Emissions R-621, Conducted Emissions C-642.



ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).



NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 89/336/EEC, Article 10 (2). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.

NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).

NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6



