

**2.9 Average Spurious Emission in the Frequency Range 30 - 25000 MHz (FCC 15.247(c))****Section**

The EUT was placed into a continuous transmit mode of operation. A preliminary scan was performed on the EUT to determine frequencies that were caused by the transmitter portion of the product. Significant emissions that fell within restricted bands were then measured on an OAT's site. Radiated measurements below 1 GHz were tested with a RBW = 120 kHz. Radiated measurements above 1 GHz were measured using a RBW = VBW = 1 MHz. The results of average radiated spurious emissions falling within restricted bands are given in Tables 5a – 5c.

Average values were calculated using the following duty cycle correction.

### **Worst Case Transmit Duty Cycle for RFM 1.0**

The duty cycle de-rating factor used in the calculation of average radiated limits (per 15.249) is described below. This factor was calculated by first determining the worst case scenario for system operation. The worst case operating scenario is as follows:

Maximum transmit time/on equals 19.77 ms over a 100 msec period.

The transmission duty cycle correction factor is then calculated as:

$$20 * \log_{10} (19.77\text{ms}/100 \text{ ms}) = -14.079 \text{ dB}$$

This value was subtracted from the peak data listed in Section 2.8 and compared to the average limits in tables 3e and 3f.

On Time

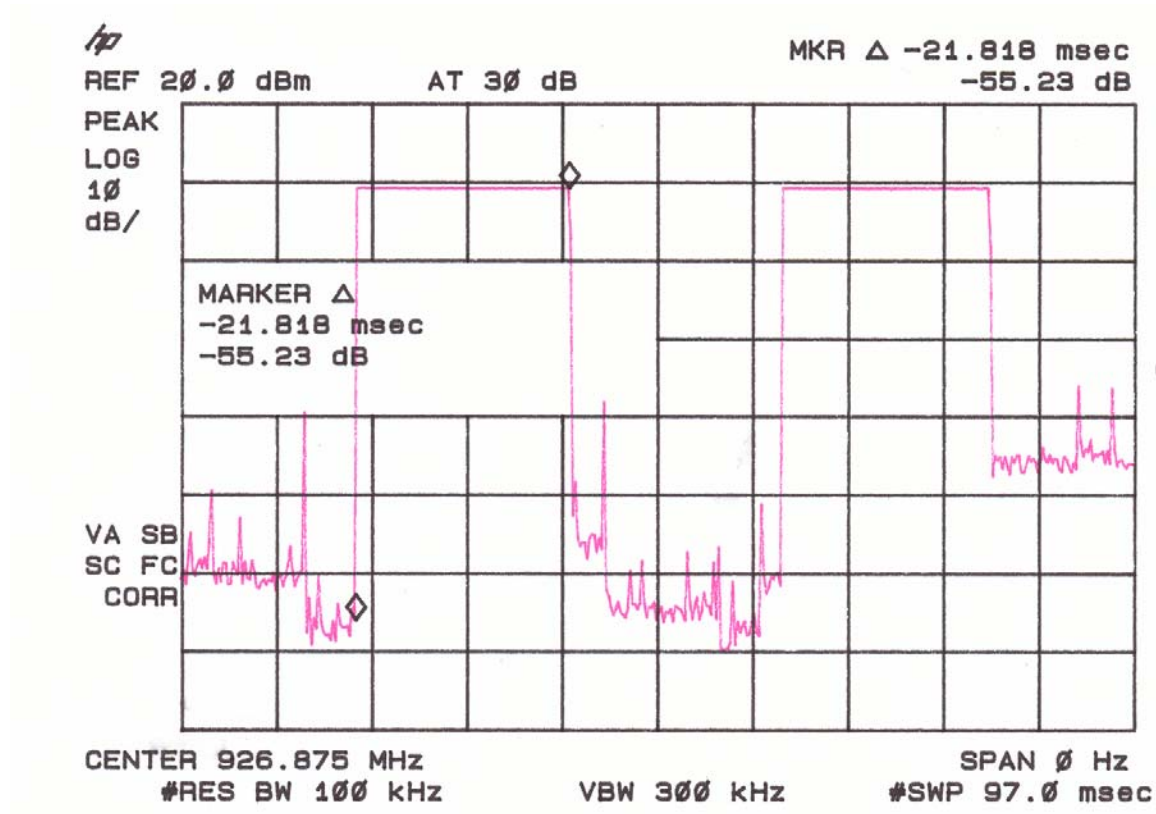


Table 5a. AVERAGE RADIATED SPURIOUS EMISSIONS Low Channel


Radiated Emissions									
Test By:	Test:	FCC Part 15 - AVG Harmonics (Low - 6dB)				Client:	Ferguson Manufacturing Company, Inc.		
A.T.	Project:	06-0198		Class:	B	Model:	RFM10		
Frequency	Test Data	AF	Test Data	AF+CA-AMP	Results	Limits	Distance /	Margin	PK = n
(MHz)	(dBm)	Table	(dBuV)	(dB)	(uV/m)	(uV/m)	Polarity	(dB)	/ QP
904.00	-38.9	1HN3mV	68.1	24.8	44396.5		3m./VERT		AVG
1807.88	-70.6	1HN3mV	36.4	-4.8	38.3	4439.7	3m./VERT	41.3	AVG
2712.05	-68.3	1HN3mV	38.7	-1.7	71.0	500.0	3m./VERT	17.0	AVG
3616.13	-78.4	1HN3mV	28.6	2.2	34.5	500.0	3m./VERT	23.2	AVG
4519.93	-68.3	1HN3mV	38.7	4.2	138.5	500.0	3m./VERT	11.1	AVG
5424.03	-75.1	1HN3mV	31.9	6.8	85.8	500.0	3m./VERT	15.3	AVG
6327.9	-59.1	1HN3mV	47.9	8.0	624.9	4439.7	3m./VERT	17.0	AVG
7231.78	-74.6	1HN3mV	32.4	9.6	126.2	4439.7	3m./VERT	30.9	AVG
8135.9	-79.6	1HN3mH	27.4	11.4	86.4	500.0	3m./HORZ	15.2	AVG
9039.85	-78.9	1HN3mV	28.1	12.0	101.7	500.0	3m./VERT	13.8	AVG
9944	-78.6	1HN3mV	28.4	13.3	122.5	4439.7	3m./VERT	31.2	AVG

Data corrected by 0.1 dB for loss of high pass filter, except to fundamental

\*\* Conversion from 1 meter to 3 meters = -9.54 dB

SAMPLE CALCULATION:RESULTS (uV/m @ 3m) = Antilog  $((-70.6 + -4.8 + 107)/20)$  = 38.3  
 CONVERSION FROM dBm TO dBuV = 107 dB

Tester

Signature: 

Name: Austin Thompson

Table 5b. AVERAGE RADIATED SPURIOUS EMISSIONS Mid Channel

Radiated Emissions									
<b>Test By:</b>	<b>Test:</b>	FCC Part 15 - AVG Harmonic (Mid - 6dB)				<b>Client:</b>	Ferguson Manufacturing Company, Inc.		
A.T.	<b>Project:</b>	06-0198		<b>Class:</b>	B	<b>Model:</b>	RFM10		
<b>Frequency</b>	<b>Test Data</b>	<b>AF</b>	<b>Test Data</b>	<b>AF+CA-AMP</b>	<b>Results</b>	<b>Limits</b>	<b>Distance /</b>	<b>Margin</b>	<b>PK = n</b>
<b>(MHz)</b>	<b>(dBm)</b>	<b>Table</b>	<b>(dBuV)</b>	<b>(dB)</b>	<b>(uV/m)</b>	<b>(uV/m)</b>	<b>Polarity</b>	<b>(dB)</b>	<b>/ QP</b>
915.32	-37.2	1HN3mV	69.8	24.9	54202.0		3m./VERT		AVG
1830.5	-66.4	1HN3mV	40.6	-4.6	62.7	5420.2	3m./VERT	38.7	AVG
2745.83	-64.7	1HN3mV	42.3	-1.5	108.8	500.0	3m./VERT	13.2	AVG
3660.93	-75.7	1HN3mV	31.3	2.4	48.6	500.0	3m./VERT	20.3	AVG
4576.28	-66.4	1HN3mV	40.6	4.3	177.2	500.0	3m./VERT	9.0	AVG
5491.28	-72.1	1HN3mV	34.9	6.9	123.1	5420.2	3m./VERT	32.9	AVG
6406.35	-54.9	1HN3mV	52.1	8.0	1014.2	5420.2	3m./VERT	14.6	AVG
7321.45	-69.7	1HN3mV	37.3	9.8	228.2	500.0	3m./VERT	6.8	AVG
8237.1	-76.7	1HN3mH	30.4	11.5	123.4	500.0	3m./HORZ	12.2	AVG
9151.98	-76.4	1HN3mV	30.6	12.2	138.7	500.0	3m./VERT	11.1	AVG
10066.9	-76.3	1HN3mV	30.7	13.5	163.6	5420.2	3m./VERT	30.4	AVG

Data corrected by 0.1 dB for loss of high pass filter, except to fundamental

\*\* Conversion from 1 meter to 3 meters = -9.54 dB

SAMPLE CALCULATION: RESULTS (uV/m @ 3m) = Antilog ((-66.4 + -4.6 + 107)/20) = 62.7  
 CONVERSION FROM dBm TO dBuV = 107 dB

Tester

Signature: \_\_\_\_\_



Name: Austin Thompson

Table 5c. AVERAGE RADIATED SPURIOUS EMISSIONS High Channel

Radiated Emissions									
Test By:	Test:	FCC Part 15 - AVG Harmonics (High - 6dB)			Client:	Ferguson Manufacturing Company, Inc.			
A.T.	Project:	06-0198		Class:	B	Model:	RFM10		
Frequency	Test Data	AF	Test Data	AF+CA-AMP	Results	Limits	Distance /	Margin	PK = n
(MHz)	(dBm)	Table	(dBuV)	(dB)	(uV/m)	(uV/m)	Polarity	(dB)	/ QP
926.80	-38.3	1HN3mV	68.7	25.0	48275.4		3m./VERT		AVG
1853.6	-67.2	1HN3mV	39.9	-4.5	58.5	4827.5	3m./VERT	38.3	AVG
2780.35	-68.3	1HN3mV	38.7	-1.4	73.5	500.0	3m./VERT	16.7	AVG
3707.25	-77.6	1HN3mV	29.4	2.6	40.0	500.0	3m./VERT	21.9	AVG
4633.87	-69.3	1HN3mV	37.7	4.5	129.6	500.0	3m./VERT	11.7	AVG
5560.67	-72.0	1HN3mV	35.0	7.1	126.8	4827.5	3m./VERT	31.6	AVG
6487.4	-60.2	1HN3mV	46.8	8.0	552.6	4827.5	3m./VERT	18.8	AVG
7414.5	-71.5	1HN3mV	35.5	10.1	191.5	500.0	3m./VERT	8.3	AVG
8341.25	-76.6	1HN3mV	30.5	11.4	123.3	500.0	3m./VERT	12.2	AVG
9268.12	-77.6	1HN3mH	29.4	12.6	125.8	4827.5	3m./HORZ	31.7	AVG
10194.57	-79.7	1HN3mV	27.3	13.8	112.7	4827.5	3m./VERT	32.6	AVG

Data corrected by 0.1 dB for loss of high pass filter, except to fundamental

\*\* Conversion from 1 meter to 3 meters = -9.54 dB

SAMPLE CALCULATION:RESULTS (uV/m @ 3m) = Antilog ((-67.2 + -4.5 + 107)/20) = 58.5  
CONVERSION FROM dBm TO dBuV = 107 dB

Tester

Signature: \_\_\_\_\_



Name: Austin Thompson

## 2.10 Band Edge Measurements

Band Edge measurements were made at a Low Channel and High Channel peak at highest EUT related emission outside the occupied bandwidth. A peak measurement was made of the fundamental, and the emission was measured using a peak setting. A Resolution Bandwidth of  $> 1\%$  of the emission bandwidth was used. This procedure was repeated for the high channel.

The plots shown were verified using a Log Periodic Antenna. No preamp was used.

The limits were derived as follows:

High Bandedge

$$5000 \text{ uV/m} = -33.02 \text{ dBm}$$

$$-33.02 \text{ dBm} - 25.0 \text{ dB (antenna factor and cable loss)} = -58.02 \text{ dBm limit}$$

Fundamental measured at High Channel from Table 4c: -24.3 dBm

Delta from conducted measurement of band edge from fundamental peak to highest spur 10 MHz outside band edge: -61.12

$$-24.3 - 61.12 = -85.42$$

Low Bandedge

$$-33.02 \text{ dBm} - 24.8 \text{ dB (antenna factor and cable loss)} = -57.82 \text{ dBm limit}$$

Fundamental measured at Low Channel from Table 4a: -24.9 dBm

Delta from conducted measurement of band edge from fundamental peak to highest spur 10 MHz outside band edge: -61.77

$$-24.9 - 57.82 = -82.72$$

Figure 6a. Band Edge Compliance  
Antenna Conducted, High Channel

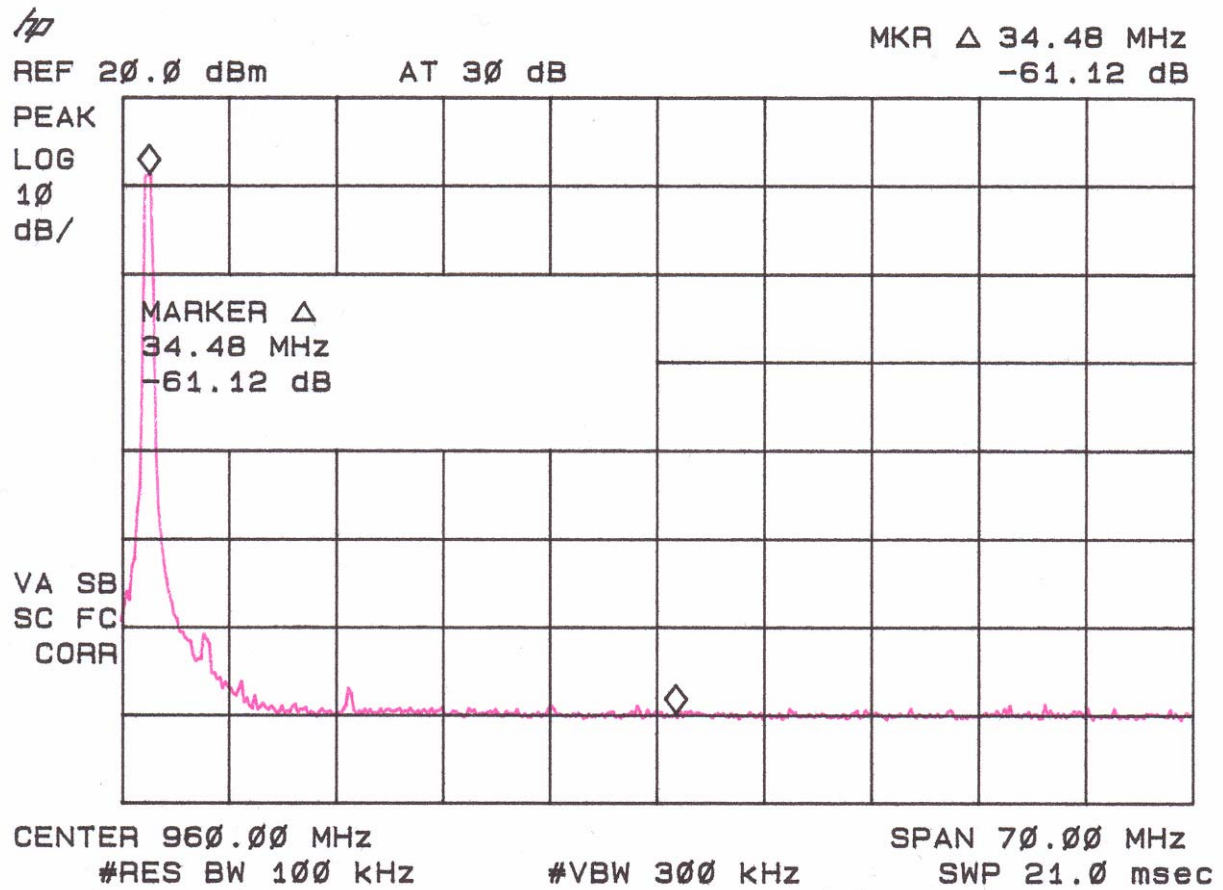
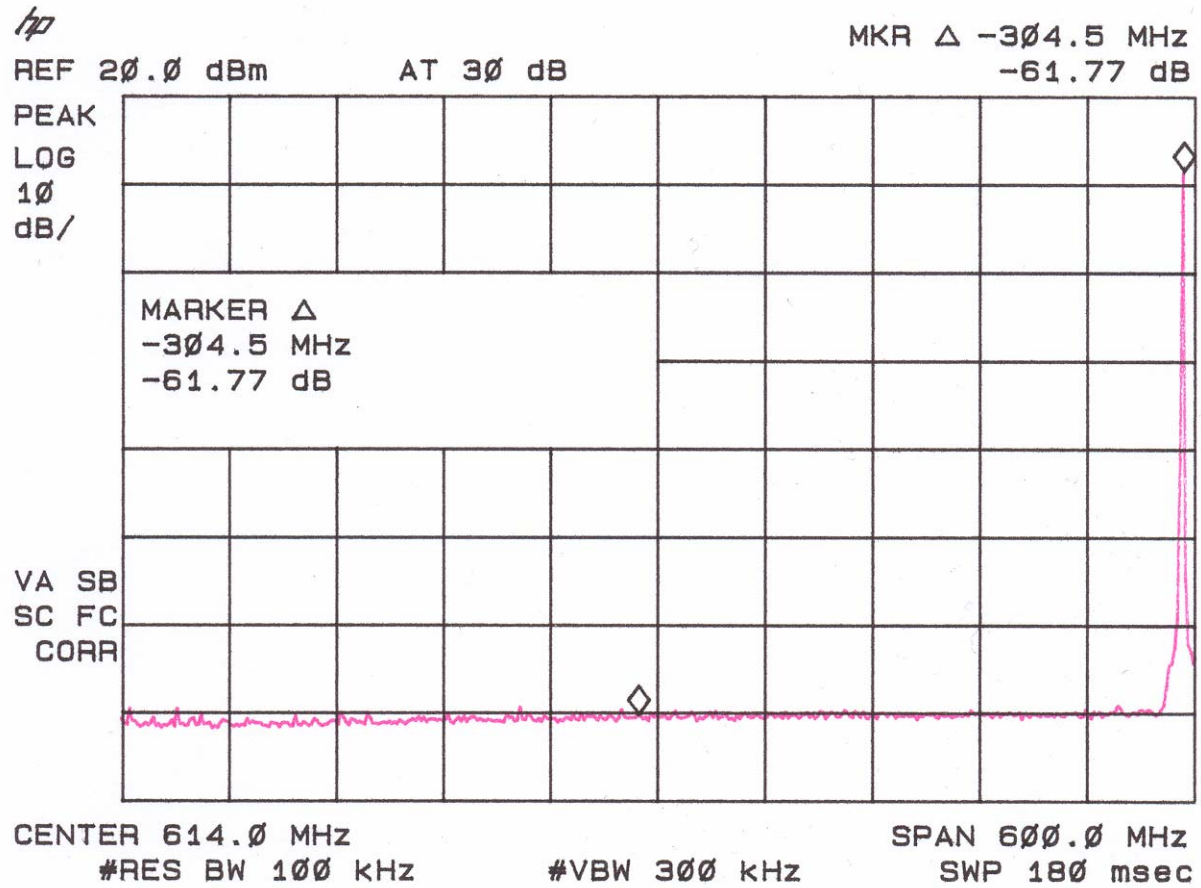


Figure 6b. Band Edge Compliance  
Antenna Conducted, Low Channel





### **2.11 20 dB Bandwidth per FCC Section 15.247(a)(1)(ii)**

The antenna port was connected to a spectrum analyzer that was set for a 50  $\Omega$  impedance with the RBW = approximately 1/100 of the manufacturers claimed RBW & VBW > RBW. The results of this test are given in Table 6 and Figure 7.

**TABLE 6**  
**20 dB Bandwidth**

Test Date: October 30, 2006  
UST Project: 06-0198  
Customer: Ferguson Manufacturing Company, Inc.

**Model:** ***RFM10***

Frequency (MHz)	20 dB Bandwidth (MHz)	MAXIMUM FCC LIMIT (MHz)
904.01	0.475	1.0
926.77	0.450	1.0

Tester  
Signature: \_\_\_\_\_



Name: Austin Thompson

Figure 7a.  
20 dB Bandwidth per FCC Section 15.247(a)(1)(ii) Low

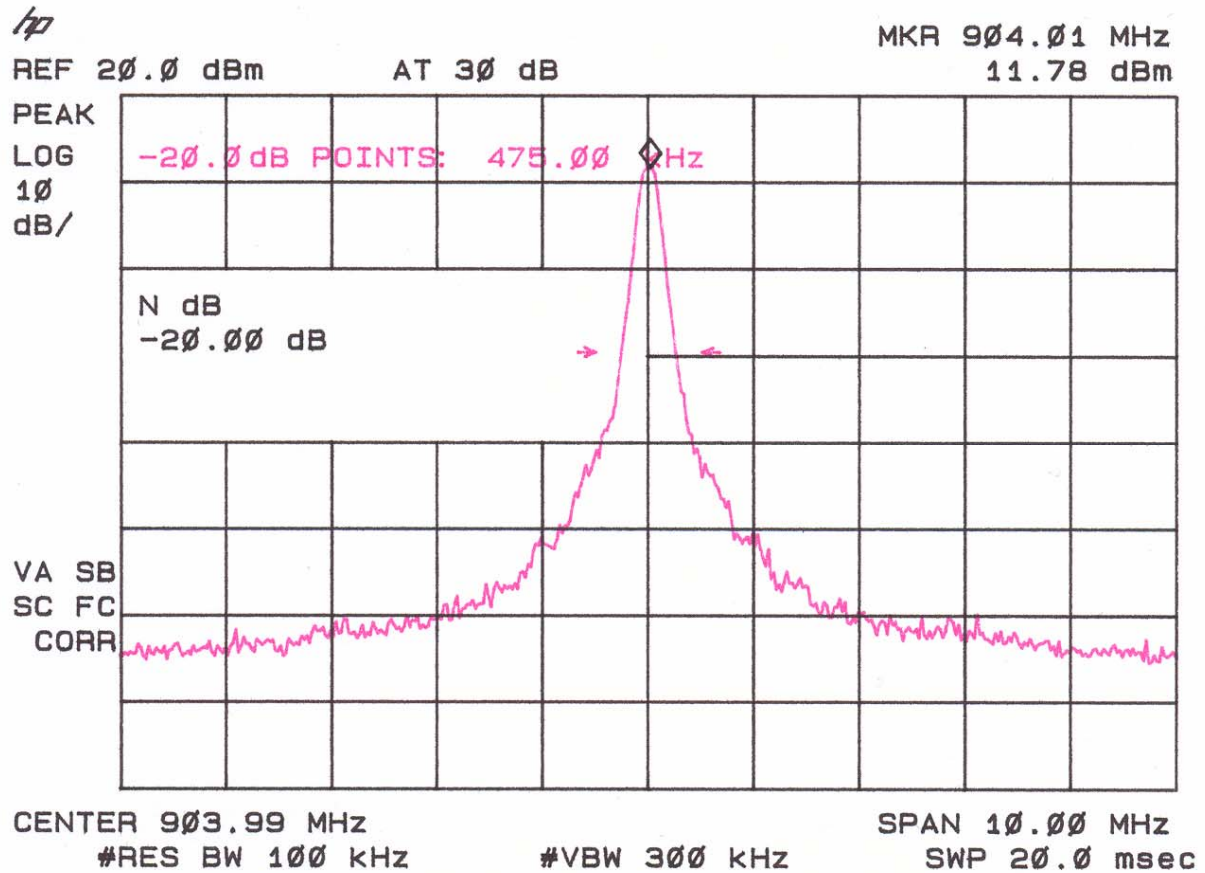
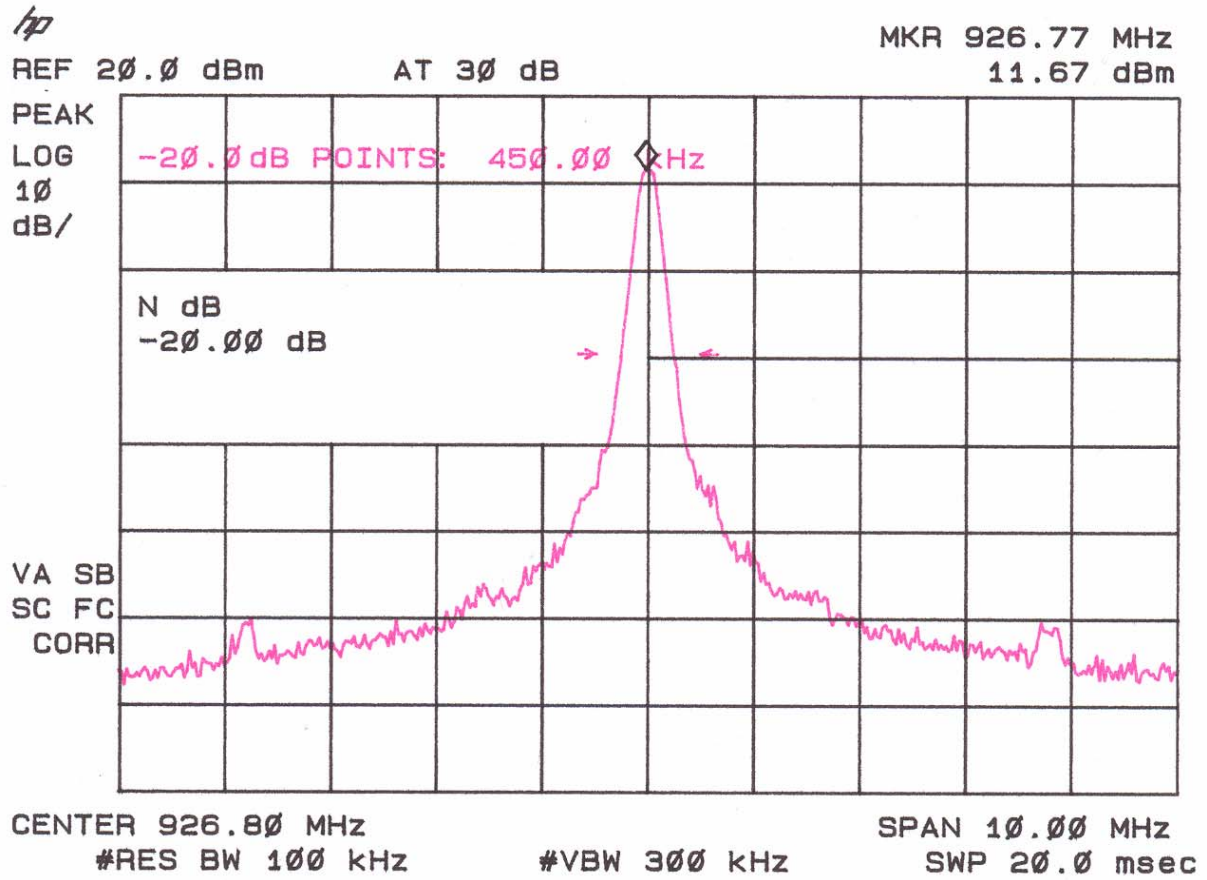


Figure 7c.  
20 dB Bandwidth per FCC Section 15.247(a)(1)(ii) High



## **2.12 Number of Hopping Channels FCC Section 15.247(a)(1)(ii)**

The transmitter was placed into a typical frequency hopping mode of operation. The 2400 – 2483.5 MHz band was centered on the screen and the RBW and VBW chosen such that the individual channels could be discerned. The trace capture time was a minimum of 5 minutes.

The results of this test are given in Table 7 and Figures 8a through 8b.

**TABLE 7**  
**NUMBER OF HOPPING CHANNELS**

**Test Date:** October 30, 2006  
**UST Project:** 06-0198  
**Customer:** Ferguson Manufacturing Company, Inc.  
**Model:** RFM10

Number of Hopping Frequencies Measured	FCC Limit (Minimum Number of Channels)
56	25

Figure 8a  
Number of Hopping Channels FCC Section 15.247(a)(1)(ii)

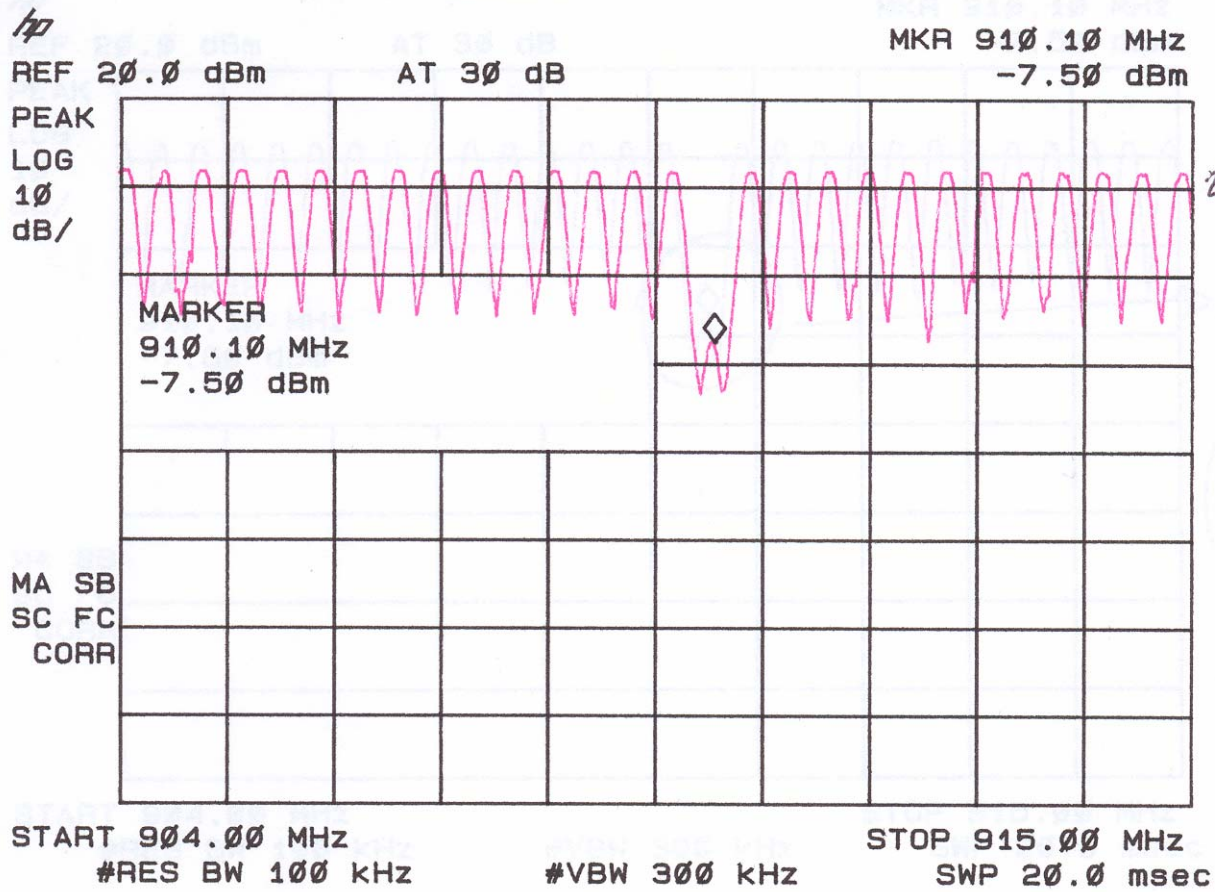
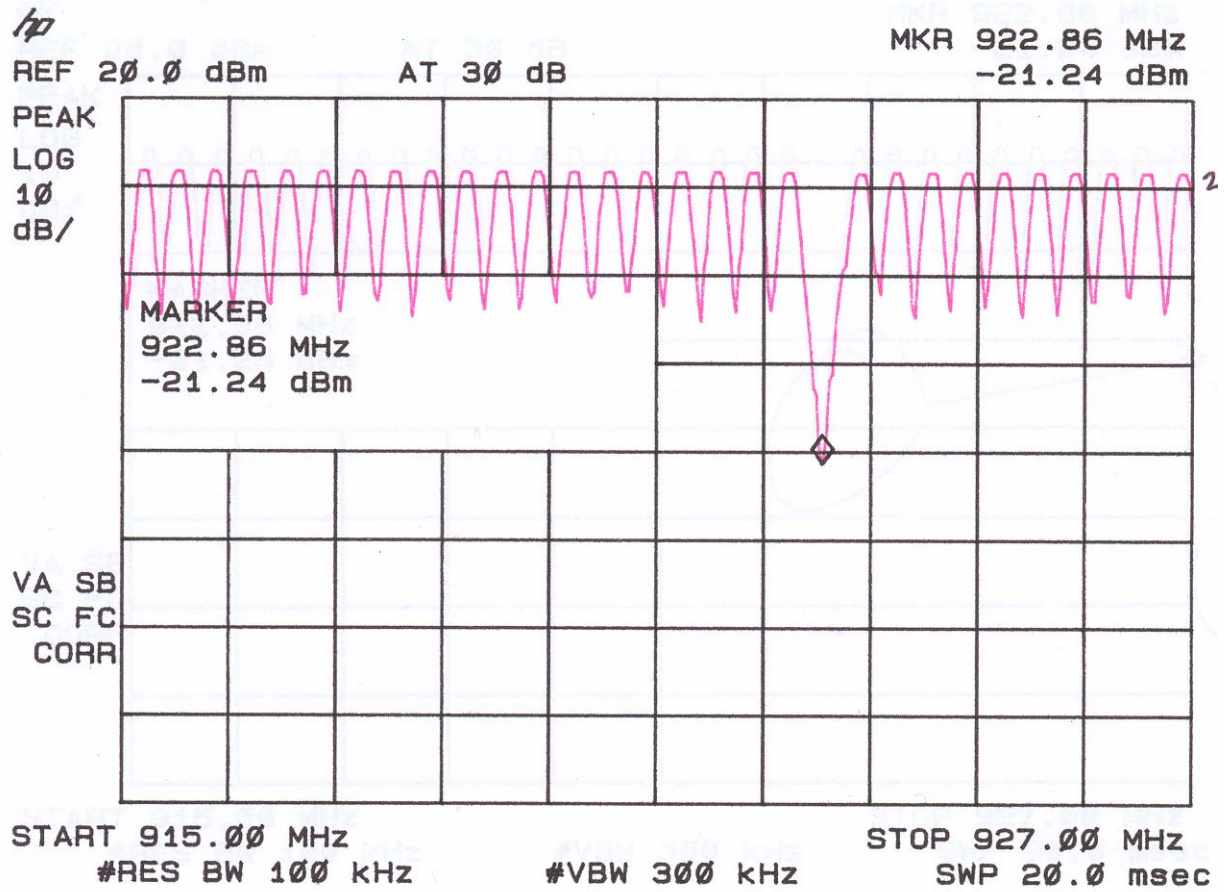


Figure 8b  
Number of Hopping Channels FCC Section 15.247(a)(1)(ii)



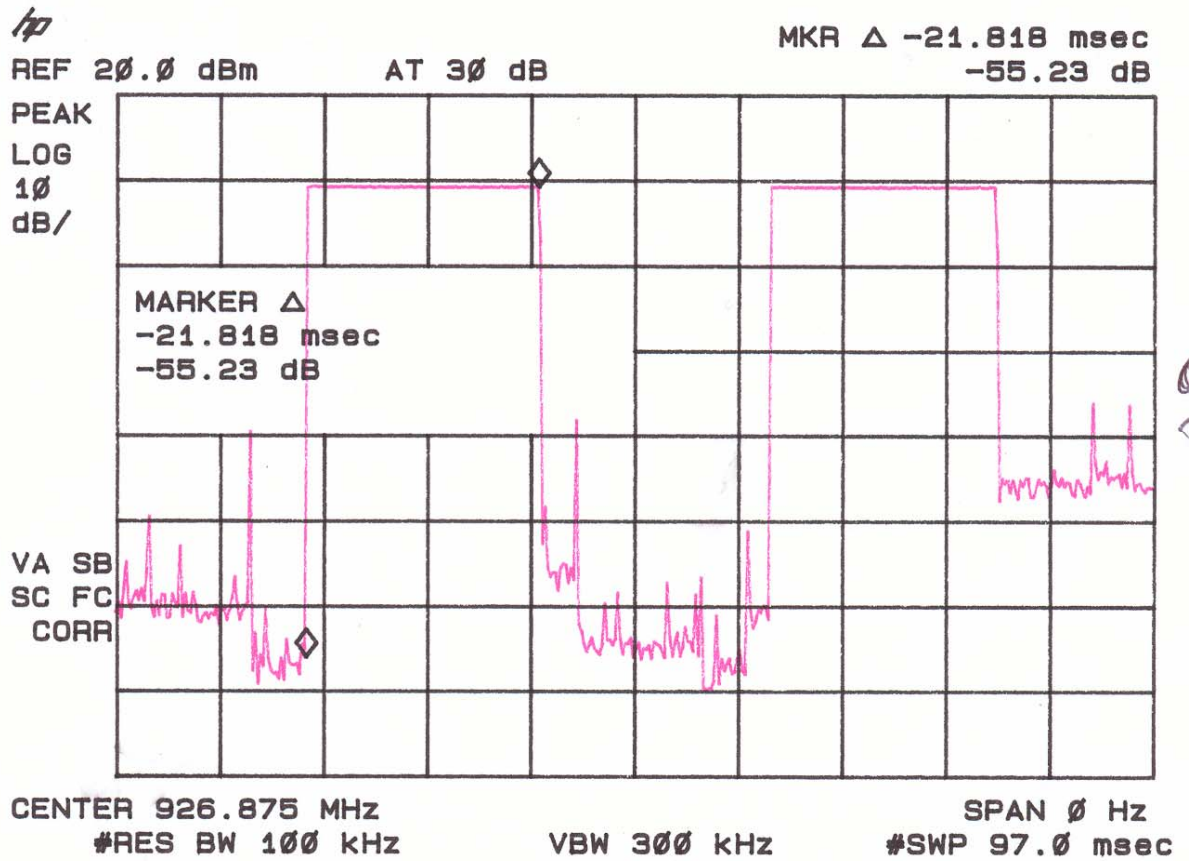


### **2.13 Average Time of Occupancy per Channel FCC Section 15.247(a)(1)(ii)**

Please refer to the Average Spurious Emissions portion of the report for details, and to Figure 9a-b.

Figure 9a

On Time



#### **2.14 Power Line Conducted Emissions for Transmitter FCC Section 15.207**

The conducted voltage measurements have been carried out in accordance with FCC Section 15.207, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmit. The results are given in Tables 8a-8b.

**TABLE 8. CONDUCTED EMISSIONS DATA*****CLASS B***

**Test Date:** September 28, 2006  
**UST Project:** 06-0198  
**Customer:** Ferguson Manufacturing Company, Inc.  
**Model:** RFM10

Conducted Emissions								
Test By:	Test:					Client:	Ferguson Manufacturing Company, Inc	
AT	Project:	06-0198		Class:	B	Model:	RFM10	
Frequency	Test Data	AF	Test Data	AF+CA-AMP	Results	Limits	Margin	PK = n
(MHz)	(dBm)	Table	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	/ QP
Not Applicable EUT is Battery Operated								

**Tester****Signature:** **Name:** Austin Thompson

## **2.15 Radiated Emissions for Digital Device & Receiver (47 CFR 15.109a)**

Radiated emissions were evaluated from 30 to 14500 MHz while the EUT was placed into a Receive mode of operation. Measurements were made with the analyzer's bandwidth set to 120 kHz measurements made less than 1 GHz and 1 MHz for measurements made greater than or equal to 1 GHz. The results for less than 1 GHz are shown in Table 9.

**TABLE 9. RADIATED EMISSIONS DATA**  
**(Digital Device & Receiver)**

**CLASS B**

**Test Date:** September 28, 2006  
**UST Project:** 06-0198  
**Customer:** Ferguson Manufacturing Company, Inc  
**Product:** RFM10

Radiated Emissions								
<b>Test By:</b>	<b>Test:</b>	FCC Part 15				<b>Client:</b>	Ferguson Manufacturing Company, Inc	
	<b>Project:</b>	06-0198		<b>Class:</b>	B	<b>Model:</b>	RFM10	
<b>Frequency</b>	<b>Test Data</b>	<b>AF</b>	<b>Test Data</b>	<b>AF+CA-AMP</b>	<b>Results</b>	<b>Limits</b>	<b>Margin</b>	<b>PK = n</b>
<b>(MHz)</b>	<b>(dBm)</b>	<b>Table</b>	<b>(dBuV)</b>	<b>(dB)</b>	<b>(uV/m)</b>	<b>(uV/m)</b>	<b>(dB)</b>	<b>/ QP</b>
No Emissions seen within 20 dB of the FCC Limit								

**Tester**  
**Signature:** \_\_\_\_\_



**Name:** Austin Thompson

**.2.16 Power Line Conducted Emissions for Digital Device and Receiver  
FCC Section 15.107**

The conducted voltage measurements have been carried out in accordance with FCC Section 15.107, with a spectrum analyzer connected to a LISN and the EUT placed into an idle condition or a continuous mode of receive. Similar results were seen as compared to the EUT in a transmit mode of operation.

**As stated in table 8a, not applicable. EUT is battery powered..**

### **2.17 Channel Separation (15.247(a)(1))**

The transmitter was placed into a typical frequency hopping mode of operation. The 2388 – 2488 MHz band was centered on the screen and the RBW and VBW chosen such that the individual channels could be discerned. The trace capture time was a minimum of 20msec.

Results are shown in Figure 10a and 10b.



Figure 10a

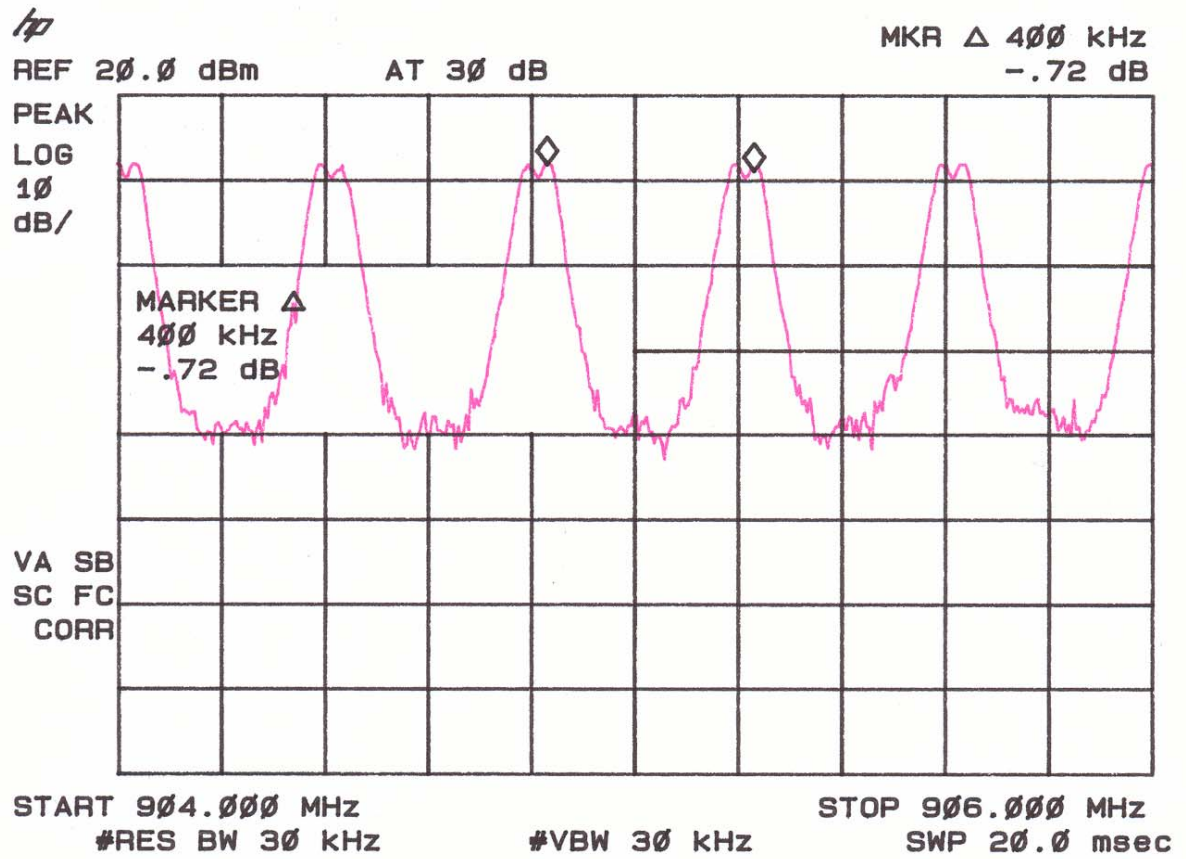


Figure 10b

