TEST REPORT

Report Number: 3110296MIN-004O
Project Number: 3110296

Evaluation of the
Omni Key Reader

FCC ID:
OMNI5121

to
FCC Part 2
FCC Part 15, Subpart C, Section 15.225

For
Fargo Electronics Inc.

Test Performed by:	Test Authorized by:
Intertek	Fargo Electronics Inc.
7250 Hudson Blvd. Suite 100	6533 Flying Cloud Drive, Suite 1000
Oakdale, MN 55128	Eden Prairie, MN 55344-3307

Prepared by: _____ Date: December 21, 2006
Norman Shpilsher

Reviewed by: _____ Date: December 21, 2006
Uri Spector

CONTENTS

1.0 GENERAL DESCRIPTION

1.1 Related Submittals Grants

This is single application of the *Omni Key Reader* Transmitter for Certification under Part 15 Subpart C. There are no other simultaneous applications.

1.2 Product Description

The *Omni Key Reader* is a RFID transmitter operating at 13.56 MHz under **CFR 47:2005**, Section 15.225.
The *Omni Key Reader* Transmitter is incorporated in XXXXX Printers and XXXXX Media Programmer manufactured by Fargo Electronics Inc. The Transmitters are identical for both devices and located on the Main Boards with slight differences in components layout.
The intended use of the *Omni Key Reader* Transmitter is to generate and transmit a RF signal from the Antenna to the RFID Card (Mifare or I-Class); the same antenna is used to receive modified by the RFID Card signal (inductive coupling).
The *Omni Key Reader* Transmitter powered at 5VDC from the PC via an USB cable.

The *Omni Key Reader* Transmitter antenna is an integral antenna located on the PCB.

Sample Submitted: December 4, 2006
Test Work Started: December 4, 2006
Test Work Completed: December 8, 2006

1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2003. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on December 2005 submitted to FCC. Please reference the site registration number: 90706, dated December 6, 2005.

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

To demonstrate compliance with FCC requirements the *Omni Key Reader* transmitter was tested in both Milfare and I-Class modes.
Conducted Emissions test was not performed as a DC powered device.

2.2 EUT Setup

For simplicity of testing, the transmitter was set to transmit continuously.

2.3 EUT Exercising Software

Omni Key Test application Ver. 0.1.3.

2.4 Special Accessories

There are no special accessories necessary for compliance of these products.

2.5 Equipment Modification

No modifications were installed during the testing.

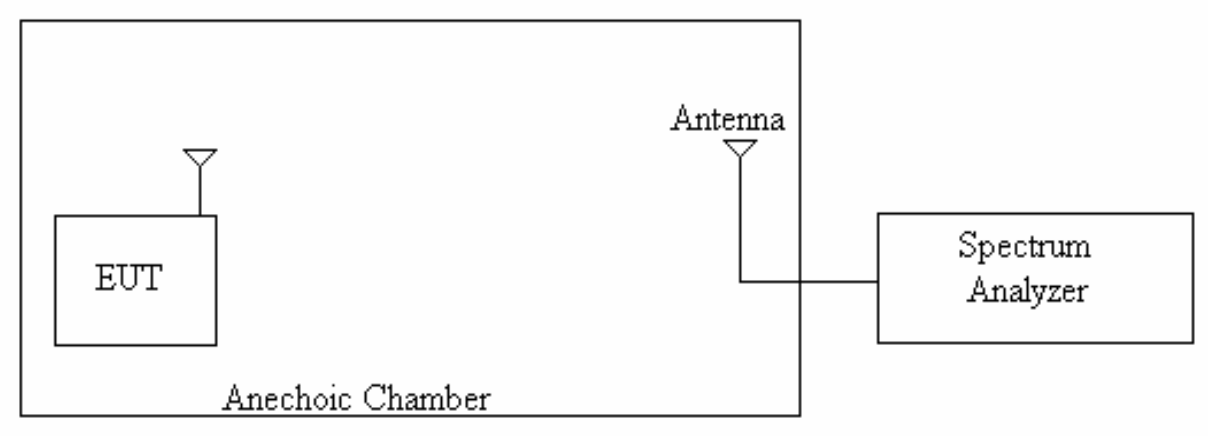
2.6 Support Equipment List and Description

Dell D610 Laptop PC, s/n CN-OC4708-48643-560-2551
Milfare and I-Class Cards

2.7 Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.
Measurements below 30MHz were performed at 10-m measurement distance with Loop Antenna.
Measurements from 30MHz to 1GHz were performed at 3-m measurement distance with Bicono-Log Antenna.
The EUT was powered at 5VDC from the PC via the USB cable

Field Strength Measurements



3.0 TEST RESULTS

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

47 CFR 15.225(a)(b)(c)	Field Strength of Fundamental
47 CFR 15.225(d), 15.209	Out of Band Spurious Emissions
47 CFR 15.225(d), 15.209	Field Strength of Spurious Emissions
47 CFR 15.225(e)	Frequency Tolerance
47 CFR 15.215	Bandwidth of the Emission

3.1 Field Strength of Radiated Emissions, FCC 15.225(a)(b)(c), 15.209

Field Strength of Fundamental and Harmonics Emissions measurements were made at Fundamental frequency of 13. 56 MHz.

FCC Part 15.225 limits at 30m are:

15848µV/m, or 84.0dBµV/m within the band 13.553-13567MHz
334µV/m, or 50.5dBµV/m within the bands 13.410-13.553MHz and 13.567-13.710MHz
106µV/m, or 40.5dBµV/m within the bands 13.110-13.410MHz and 13.710-14.010MHz

The maximum emissions were measured with margin 56.3dB below limits.

Table 3-1-1 and Graphs 3-1-1 and 3-1-2 below show the Field Strength of Fundamental Radiation.

Radiated Emissions at Fundamental **Date:** 12/4-6/2006

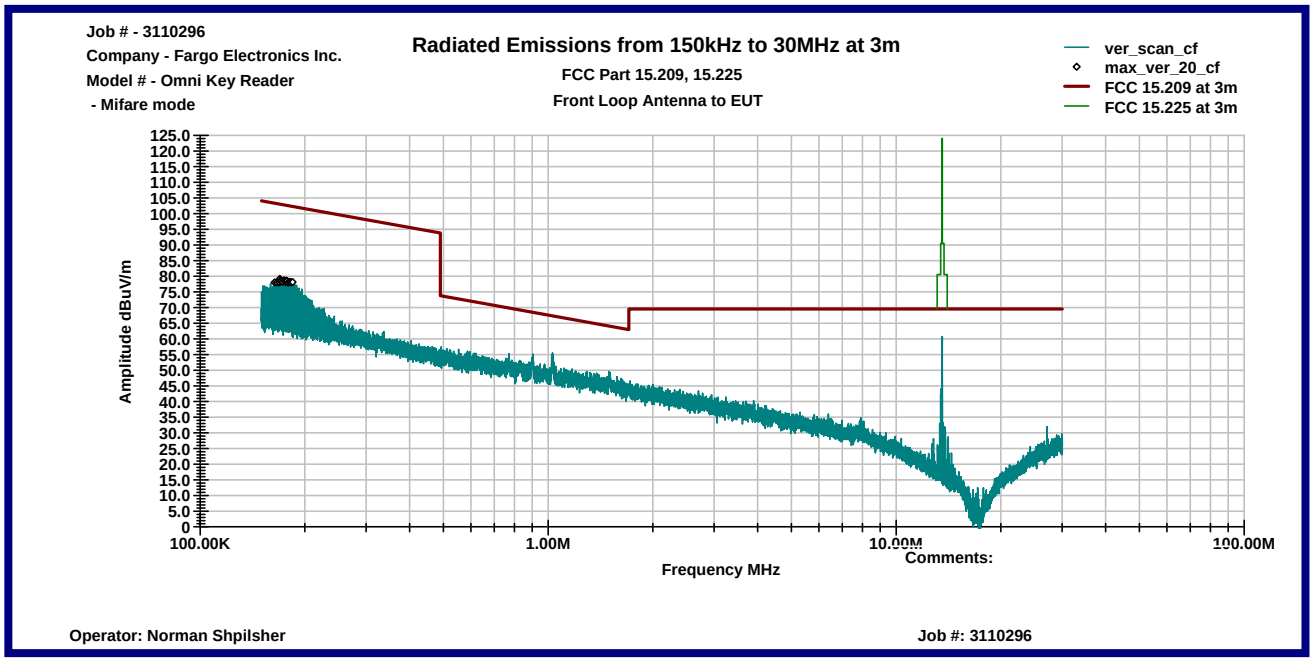
Company:	Fargo Electronics Inc.
Model:	Omni Key Reader
Test Engineer:	Norman Shpilsher
Special Info:	Continuous transmission
Standard:	FCC Part 15.225
Test Site:	Open Area Test Site, 10m measurement distance
Note:	Measurement distance 10m with Loop antenna SAS 200/562B Distance Factor is 40dB per decade from 490kHz to 30MHz.

Table # 3-1-1

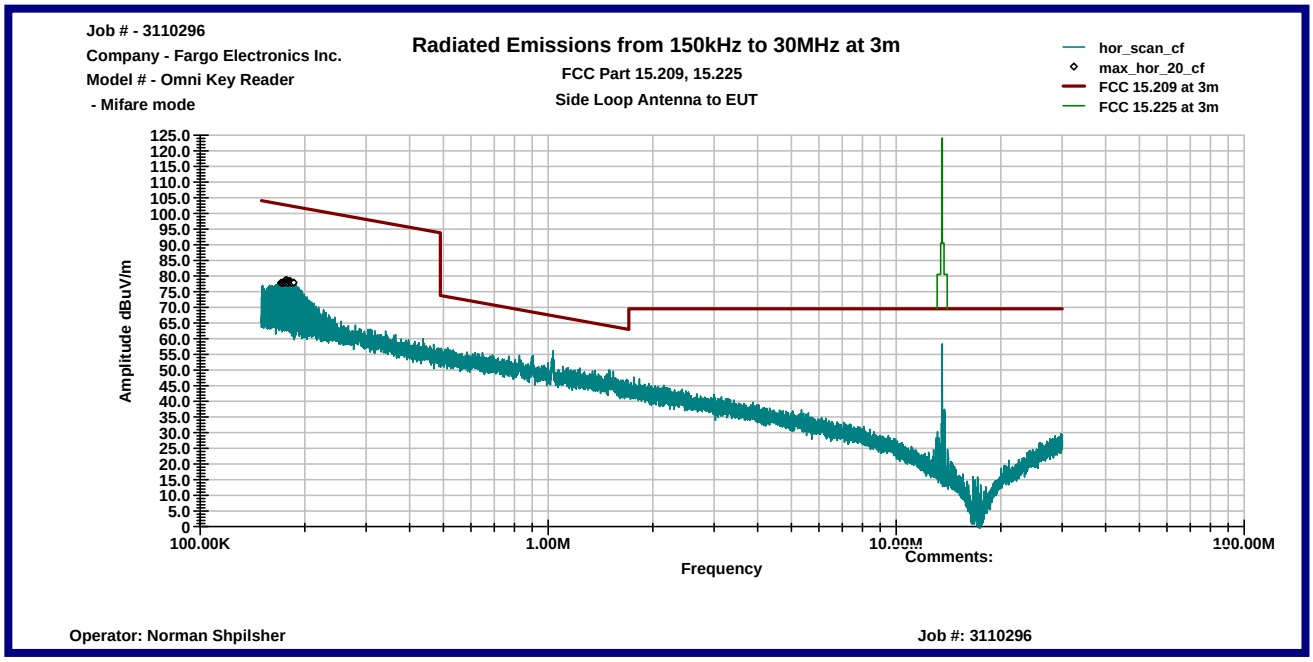
Frequency MHz	Reading dBµV	E Antenna Factor dB/m	Pre-Amp Gain (dB)	Net at 10m. dBµA/m	Distance Factor (dB)	Limit dBµV/m	Margin dB	Antenna pos.
			Mifare mode					
13.560	68.4	6.9	28.5	46.8	19.1	84.0	-56.3	Front
13.560	68.3	6.9	28.5	46.7	19.1	84.0	-56.4	Side
			I-Class mode					
13.560	63.6	6.9	28.5	42.0	19.1	84.0	-61.1	Front
13.560	64.6	6.9	28.5	43.0	19.1	84.0	-60.1	Side

Graph # 3-1-1
Radiated Emissions below 30MHz, Milfare Mode

Vertical Antenna Polarization

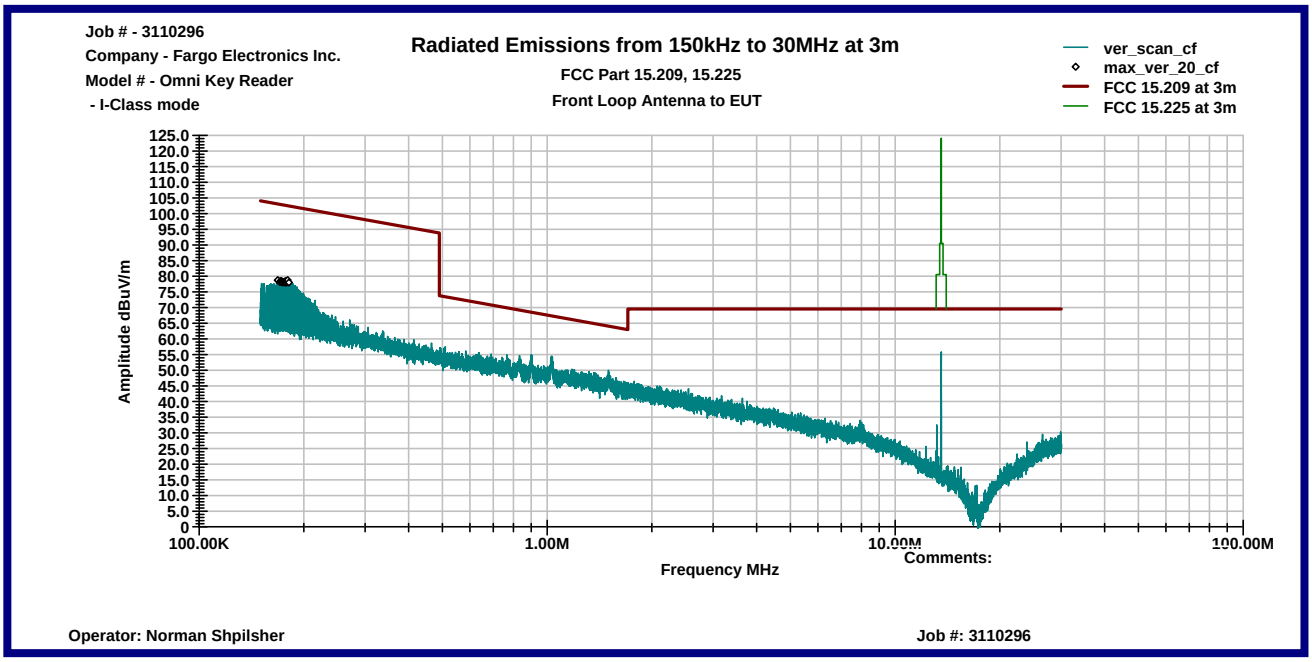


Horizontal Antenna Polarization

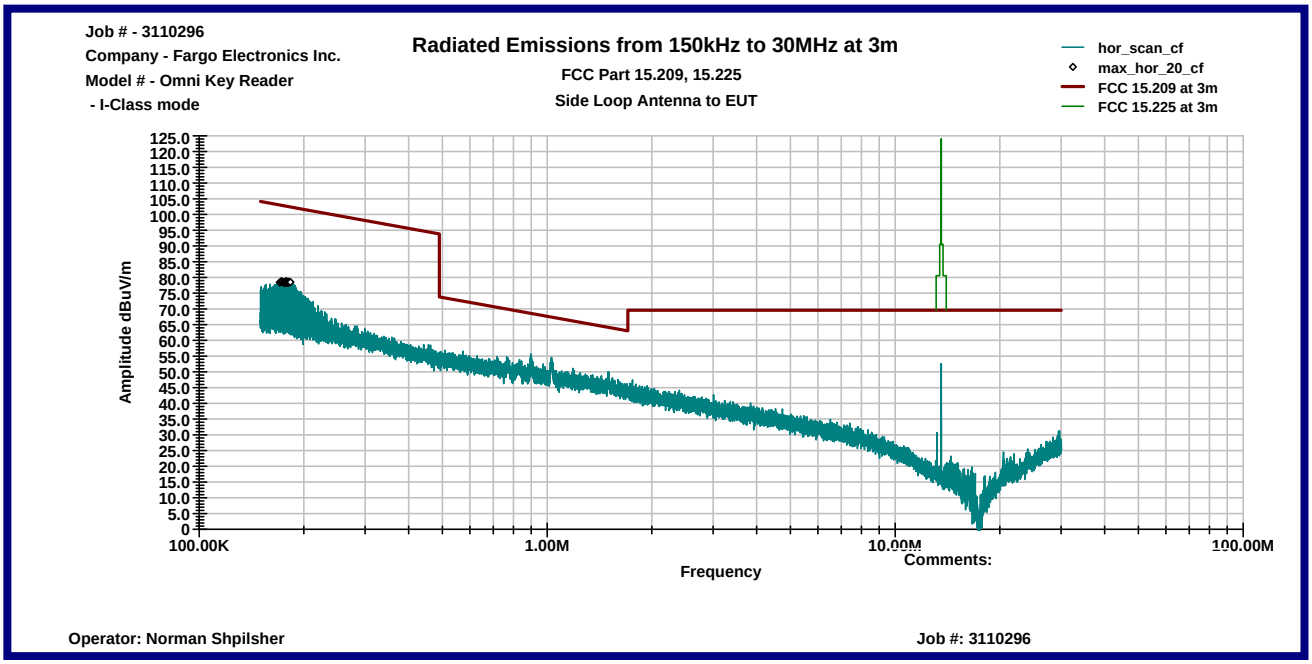


Graph # 3-1-2
Radiated Emissions below 30MHz, I-Class Mode

Vertical Antenna Polarization



Horizontal Antenna Polarization



3.2 Out of Band Spurious Emissions, FCC 15.225(d), 15.209

To demonstrate the EUT compliance with the Out of band spurious emissions, measurements were made for frequencies 15.553 and 15.567MHz and the general limits FCC Part 15.209 were applied.

The EUT operating frequency is 13.560MHz

FCC Part 15.209 limits at 30m is 30µV/m, or 29.5dBµV/m

The maximum emissions were measured with margin 17.8dB below the FCC Part 15.209 limits.

The Table 3-2-1 below shows the Out of Band Spurious Emissions.

Out of Band Spurious Radiated Emissions **Date:** 12/4-6/2006

Company:	Fargo Electronics Inc.
Model:	Omni Key Reader
Test Engineer:	Norman Shpilsher
Special Info:	Continuous transmission Fundamental Opearting Frequency 13.56MHz
Standard:	FCC Part 15.209
Test Site:	Open Area Test Site, 10m measurement distance
Note:	Measurement distance 10m with Loop antenna SAS 200/562B Distance Factor is 40dB per decade from 490kHz to 30MHz.

Table # 3-2-1

Frequency MHz	Reading dBµV	E Antenna Factor dB/m	Pre-Amp Gain (dB)	Net at 10m. dBµA/m	Distance Factor (dB)	Limit dBµV/m	Margin dB	Antenna pos.
			Mifare mode					
13.553	52.1	7.0	28.4	30.7	19.1	29.5	-17.9	Front
13.567	50.9	6.9	28.4	29.4	19.1	29.5	-19.2	Front
13.553	52.0	7.0	28.4	30.6	19.1	29.5	-18.0	Side
13.567	52.3	6.9	28.4	30.8	19.1	29.5	-17.8	Side
			I-Class mode					
13.553	49.3	7.0	28.4	27.9	19.1	29.5	-20.7	Front
13.567	48.8	6.9	28.4	27.3	19.1	29.5	-21.3	Front
13.553	49.5	7.0	28.4	28.1	19.1	29.5	-20.5	Side
13.567	49.4	6.9	28.4	27.9	19.1	29.5	-20.7	Side

3.3 Field Strength of Spurious Emissions, FCC 15.205, 15.209

Field Strength of Spurious Emissions measurements were made in frequency range from the EUT operating frequency of 13.560MHz up to 1000MHz.

FCC Part 15.209 limits are:

1.705-30MHz at 30m is 30µV/m, or 29.5dBµV/m
30-88MHz at 3m is 100µV/m, or 40.0dBµV/m
88-216MHz at 3m is 150µV/m, or 43.5dBµV/m
216-960MHz at 3m is 200µV/m, or 46.0dBµV/m
above 960MHz at 3m is 500µV/m, or 54.0dBµV/m

The maximum peak emissions were measured with margin 1.1dB below Quasi-peak limits.

The Tables 3-3-1 to 3-3-3 and Graph 3-3-1 to 3-3-4 show the Spurious Emissions

Spurious Radiated Emissions below 30MHz **Date:** 12/4-6/2006

Company:	Fargo Electronics Inc.
Model:	Omni Key Reader
Test Engineer:	Norman Shpilsher
Special Info:	Continuous transmission Fundamental Opearting Frequency 13.56MHz
Standard:	FCC Part 15.209
Test Site:	Open Area Test Site, 10m measurement distance
Note:	Measurement distance 10m with Loop antenna SAS 200/562B Distance Factor is 40dB per decade from 490kHz to 30MHz.

Table # 3-3-1

Frequency MHz	Reading dBµV	E Antenna Factor dB/m	Pre-Amp Gain (dB)	Net at 10m. dBµA/m	Distance Factor (dB)	Limit dBµV/m	Margin dB	Antenna pos.
			Mifare mode					
27.119	46.1	14.7	28.4	32.4	19.1	29.5	-16.2	Front
27.129	49.9	14.7	28.4	36.2	19.1	29.5	-12.4	Side
			I-Class mode					
27.104	41.2	14.7	28.4	27.5	19.1	29.5	-21.1	Front
27.106	42.2	14.7	28.4	28.5	19.1	29.5	-20.1	Side

Spurious Radiated Emissions from 30MHz to 1GHz **Date:** 12/4-6/2006

Company: Fargo Electronics Inc.
Model: Omni Key Reader, Milfare Mode
Test Engineer: Norman Shpilsher
Special Info: Continuous transmission
Fundamental Opearting Frequency 13.56MHz
Standard: FCC Part 15.209
Test Site: 3m Anechoic Chamber, 3m measurement distance
Note: The table shows the worst case radiated emissions
All measurements were taken using a Peak detector

Table # 3-3-2

Frequency	Ant. Polarity	Reading dBµV	Ant. Factor dB1/m	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
30.208 MHz	V	20.0	18.9	38.9	40.0	-1.1
54.243 MHz	V	23.3	7.9	31.2	40.0	-8.8
60.061 MHz	V	25.4	7.1	32.4	40.0	-7.6
65.976 MHz	V	20.8	7.0	27.9	40.0	-12.1
132.08 MHz	V	17.5	13.3	30.8	43.5	-12.7
155.97 MHz	V	20.5	12.0	32.6	43.5	-11.0
167.86 MHz	V	19.6	11.5	31.1	43.5	-12.4
191.97 MHz	V	19.4	11.3	30.7	43.5	-12.9
383.81 MHz	V	20.5	18.3	38.8	46.0	-7.2
948.36 MHz	V	15.8	25.6	41.4	46.0	-4.7
30.277 MHz	H	19.5	18.8	38.3	40.0	-1.7
149.86 MHz	H	20.7	12.4	33.1	43.5	-10.4
167.86 MHz	H	20.5	11.5	32.0	43.5	-11.5
191.97 MHz	H	21.8	11.3	33.1	43.5	-10.4
203.87 MHz	H	18.3	12.2	30.5	43.5	-13.1
230.55 MHz	H	20.9	13.0	33.9	46.0	-12.1
240.2 MHz	H	19.6	14.0	33.5	46.0	-12.5
257.56 MHz	H	18.6	15.4	34.0	46.0	-12.0
284.89 MHz	H	19.1	15.5	34.6	46.0	-11.5
352.64 MHz	H	20.7	17.5	38.2	46.0	-7.8
379.66 MHz	H	22.4	18.1	40.5	46.0	-5.6
383.81 MHz	H	20.7	18.3	39.0	46.0	-7.0
969.58 MHz	H	15.3	26.0	41.3	54.0	-12.7

Spurious Radiated Emissions from 30MHz to 1GHz **Date:** 12/4-6/2006

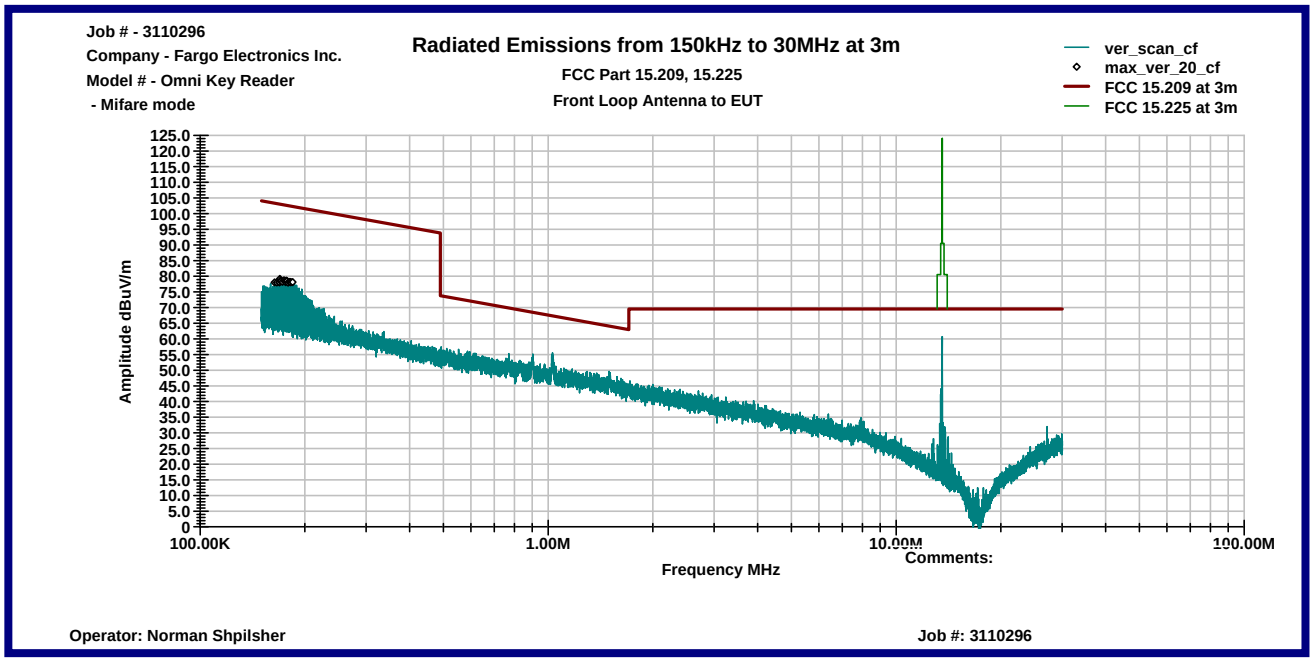
Company: Fargo Electronics Inc.
Model: Omni Key Reader, I-Class Mode
Test Engineer: Norman Shpilsher
Special Info: Continuous transmission
Fundamental Opearting Frequency 13.56MHz
Standard: FCC Part 15.209
Test Site: 3m Anechoic Chamber, 3m measurement distance
Note: The table shows the worst case radiated emissions
All measurements were taken using a Peak detector

Table # 3-3-3

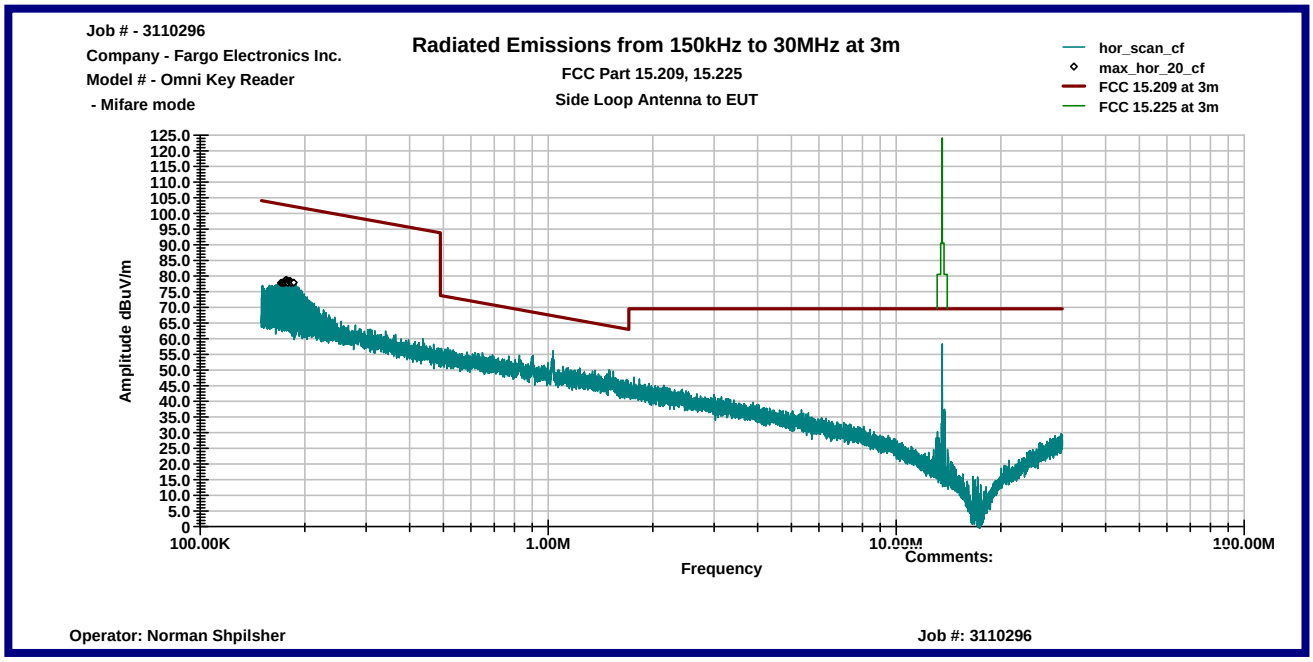
Frequency	Ant. Polarity	Reading dBµV	Ant. Factor dB1/m	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
30.623 MHz	V	18.1	18.6	36.7	40.0	-3.3
40.667 MHz	V	20.8	12.8	33.7	40.0	-6.4
54.243 MHz	V	23.0	7.9	30.9	40.0	-9.1
59.992 MHz	V	20.2	7.1	27.2	40.0	-12.8
65.976 MHz	V	21.5	7.0	28.5	40.0	-11.5
67.767 MHz	V	23.4	7.1	30.5	40.0	-9.5
81.347 MHz	V	19.4	8.5	27.9	40.0	-12.1
143.75 MHz	V	17.8	12.8	30.6	43.5	-13.0
191.97 MHz	V	18.8	11.3	30.1	43.5	-13.4
216.09 MHz	V	18.8	12.0	30.7	46.0	-15.3
913.0 MHz	V	16.1	25.4	41.5	46.0	-4.5
30.554 MHz	H	19.4	18.7	38.1	40.0	-1.9
143.75 MHz	H	19.4	12.8	32.1	43.5	-11.4
167.86 MHz	H	19.9	11.5	31.4	43.5	-12.1
191.97 MHz	H	22.8	11.3	34.0	43.5	-9.5
230.55 MHz	H	20.8	13.0	33.8	46.0	-12.3
257.56 MHz	H	20.7	15.4	36.0	46.0	-10.0
284.89 MHz	H	19.5	15.5	35.0	46.0	-11.1
311.78 MHz	H	19.6	16.1	35.7	46.0	-10.3
352.64 MHz	H	19.1	17.5	36.6	46.0	-9.4
379.66 MHz	H	21.1	18.1	39.2	46.0	-6.9
383.81 MHz	H	20.8	18.3	39.1	46.0	-7.0
461.39 MHz	H	19.6	19.9	39.6	46.0	-6.5
977.37 MHz	H	15.3	26.0	41.4	54.0	-12.6

Graph # 3-3-1
Radiated Emissions below 30MHz, Milfare Mode

Vertical Antenna Polarization

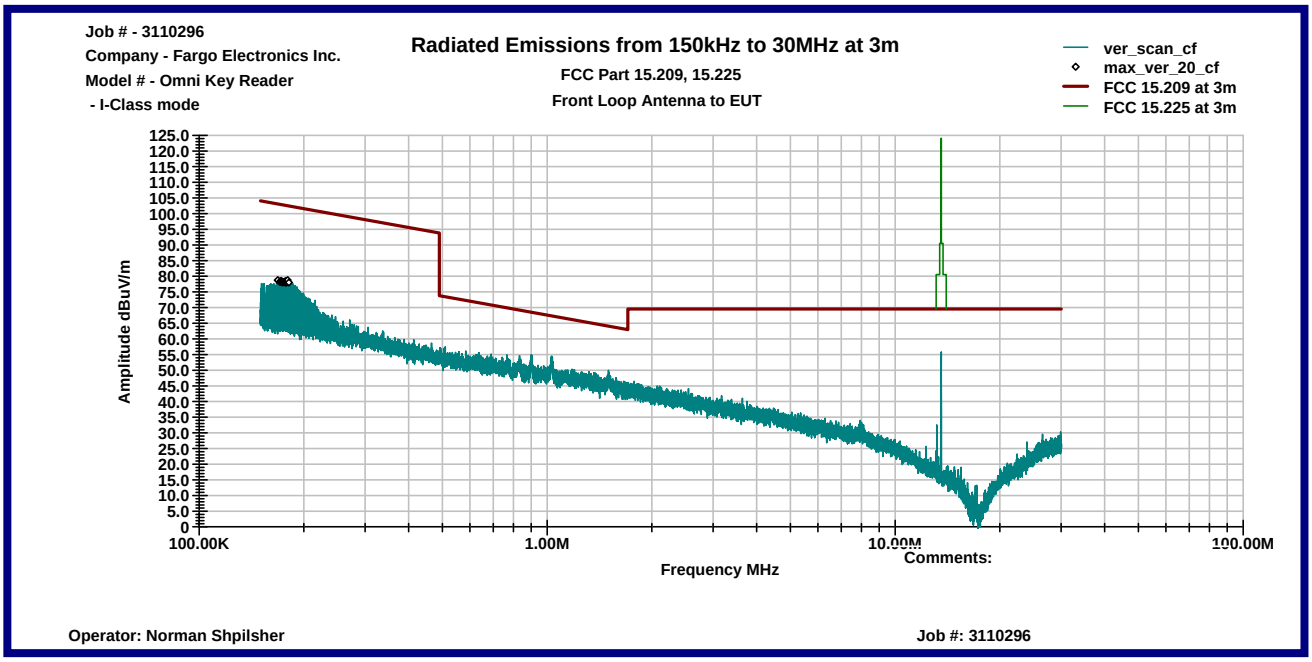


Horizontal Antenna Polarization

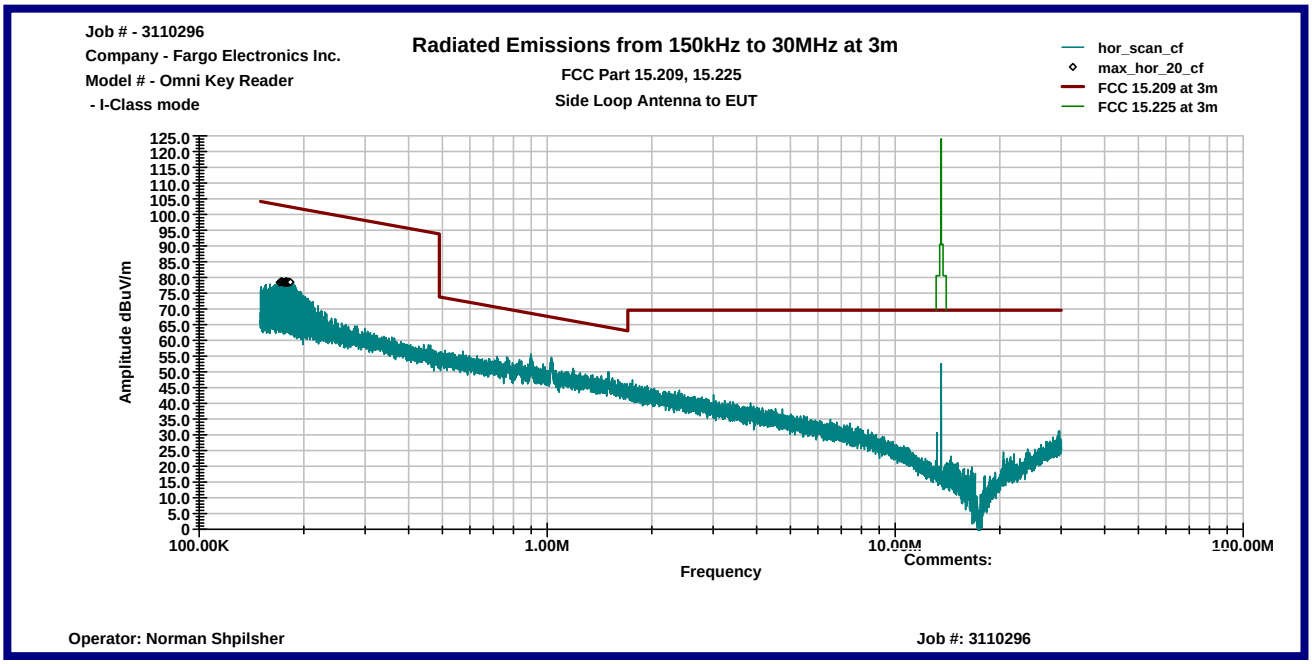


Graph # 3-3-2
Radiated Emissions below 30MHz, I-Class Mode

Vertical Antenna Polarization

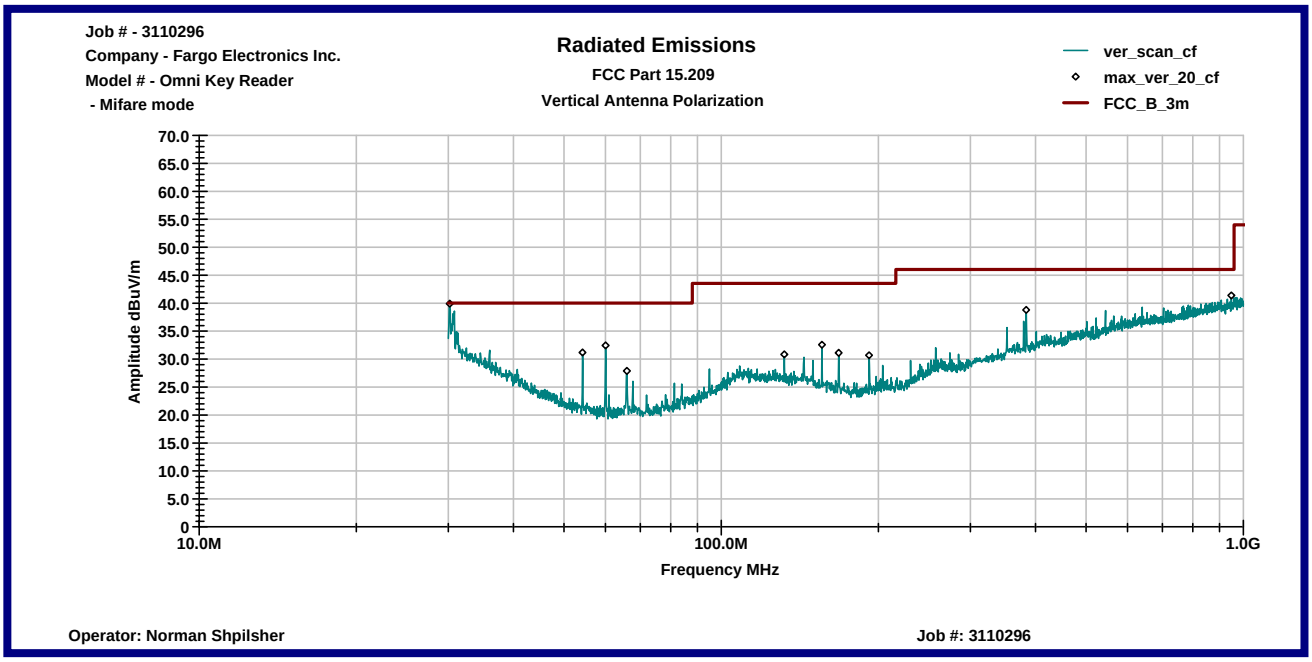


Horizontal Antenna Polarization

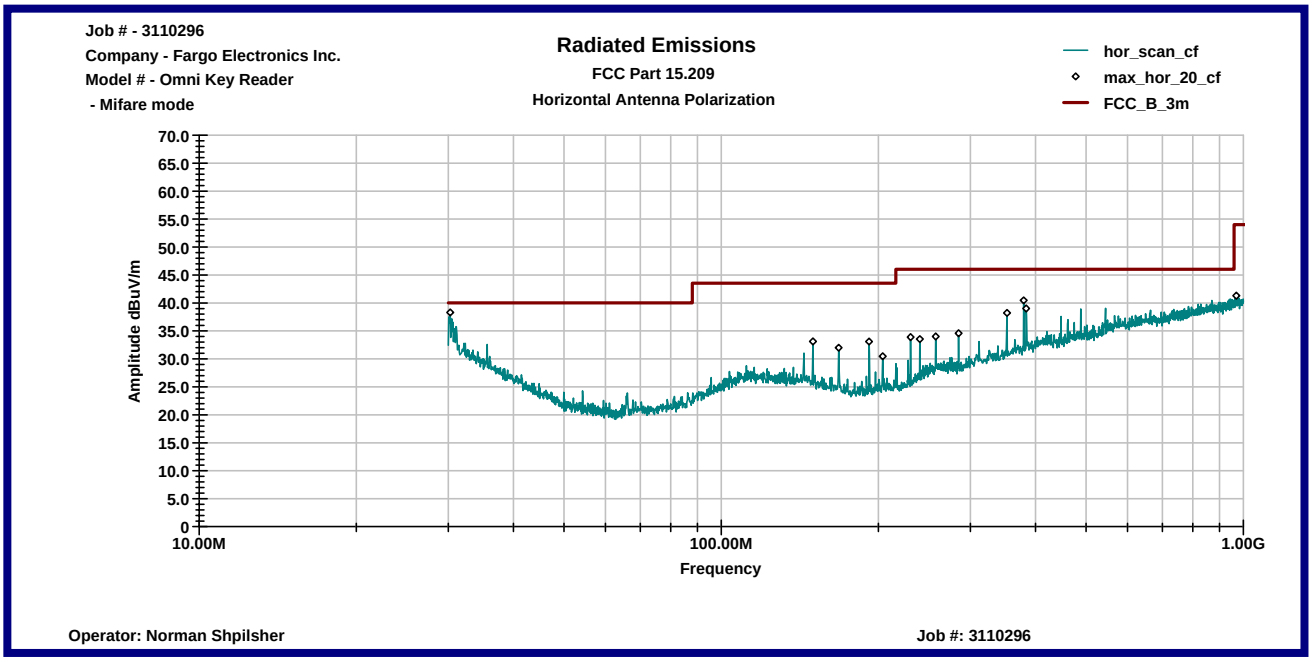


Graph # 3-3-3
Spurious Radiated Emissions from 30MHz to 1GHz, Milfare Mode

Vertical Antenna Polarization

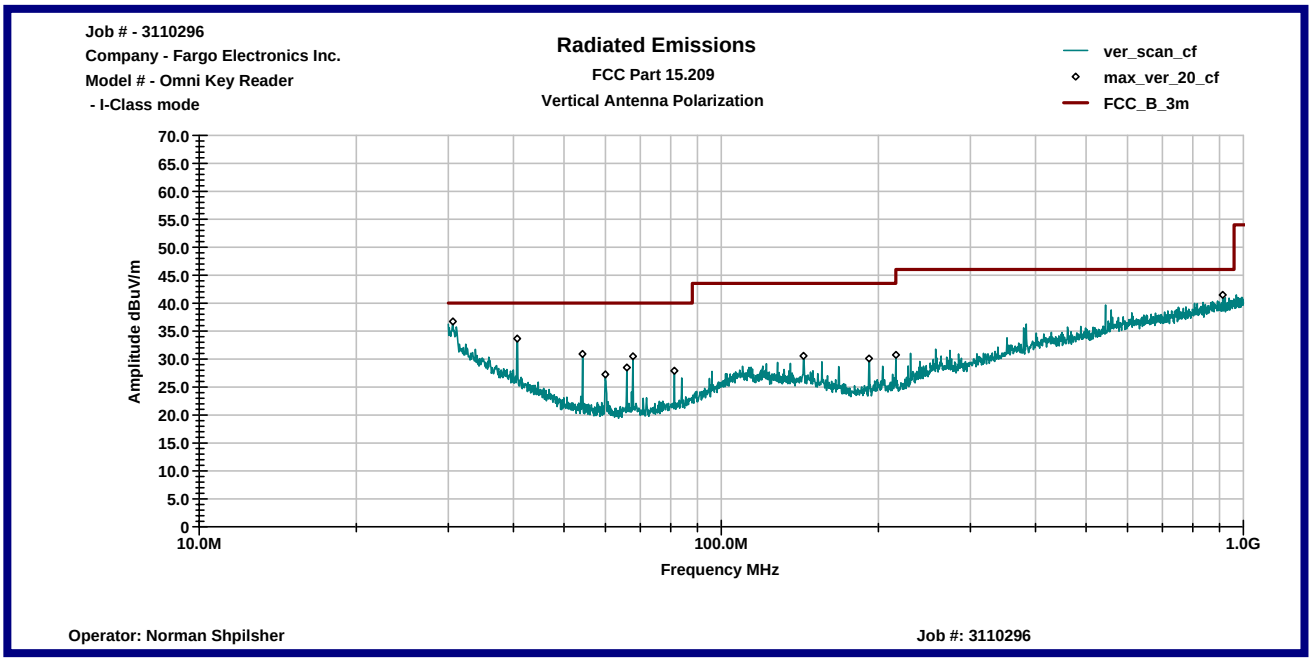


Horizontal Antenna Polarization

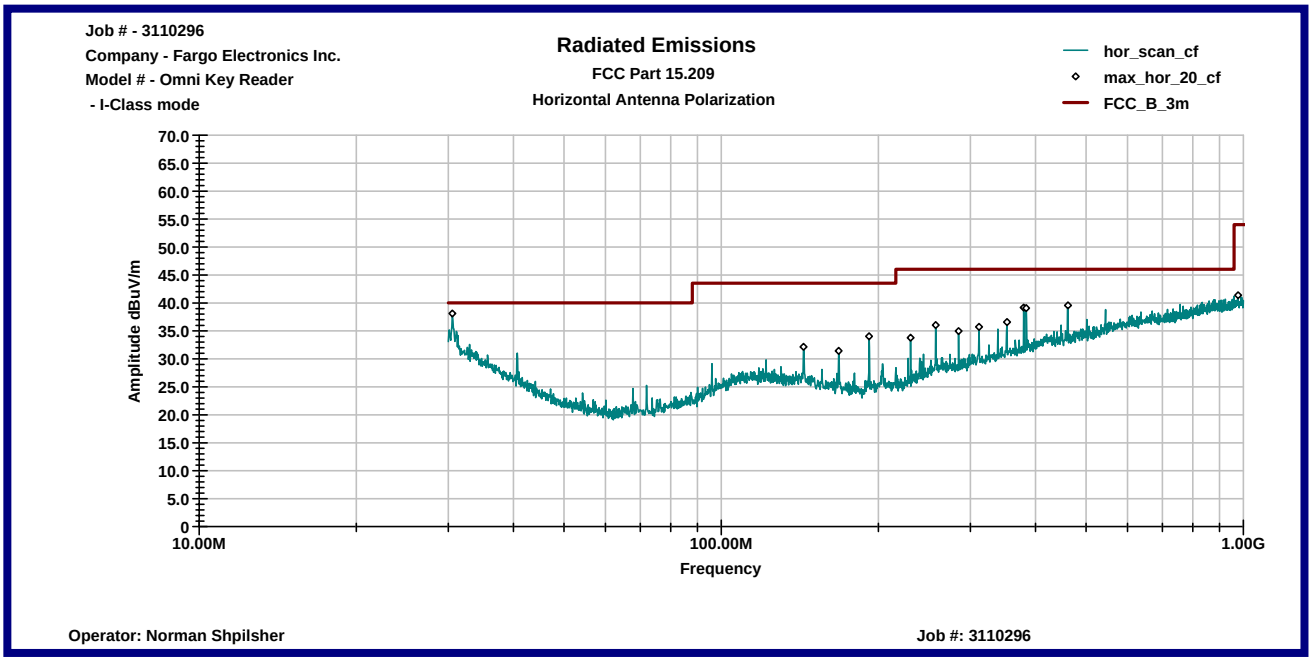


Graph # 3-3-4
Spurious Radiated Emissions from 30MHz to 1GHz, I-Class Mode

Vertical Antenna Polarization



Horizontal Antenna Polarization



3.4 Frequency Tolerance, FCC 15.225(e)

Frequency Stability with variation of ambient temperature was measured from –20 degrees C to +50 degrees C at frequency 13.56 MHz and rated power input 120VAC/60Hz.

Frequency Stability with variation of primary supply voltage was measured at 85% (102V) and 115% (138V) of rated AC Power Supply input voltage of 120V at frequency 13.56 MHz.

The Table 3-4-1 below shows the frequency stability vs. temperature ambient and supply voltage.

Frequency Stability **Date:** 12-08-2006

Company: Fargo Electronics Inc.
Model: Omni Key Reader
Special Info: Enviromental Chamber (Frequency Stability testing)
Test Engineer: Norman Shpilsher
Standard: FCC 15.225(e)
Note: Voltage deviations applied to the PC connected to the EUT USB port

Table # 3-4-1

Temperature Degree C	Output Frequency MHz	Frequency Deviation Hz	Max. Deviation + /- 0.01% Hz	Test Result
-20	13.56	92	1356	Pass
-10	13.56	61	1356	Pass
0	13.56	31	1356	Pass
10	13.56	13	1356	Pass
20	13.56	0	1356	Pass
30	13.56	8	1356	Pass
40	13.56	16	1356	Pass
50	13.56	23	1356	Pass
55	13.56	29	1356	Pass
Input Power AC Voltage V	Output Frequency MHz	Frequency Deviation Hz	Freq. Tolerance + /- 0.01% Hz	Test Result
102	13.56	0	1356	Pass
110	13.56	0	1356	Pass
120	13.56	0	1356	Pass
130	13.56	0	1356	Pass
138	13.56	0	1356	Pass

3.5 Bandwidth of Emissions, FCC 15.215

Bandwidth of Emissions measurements was made for the Fundamental frequency of 13.56MHz.

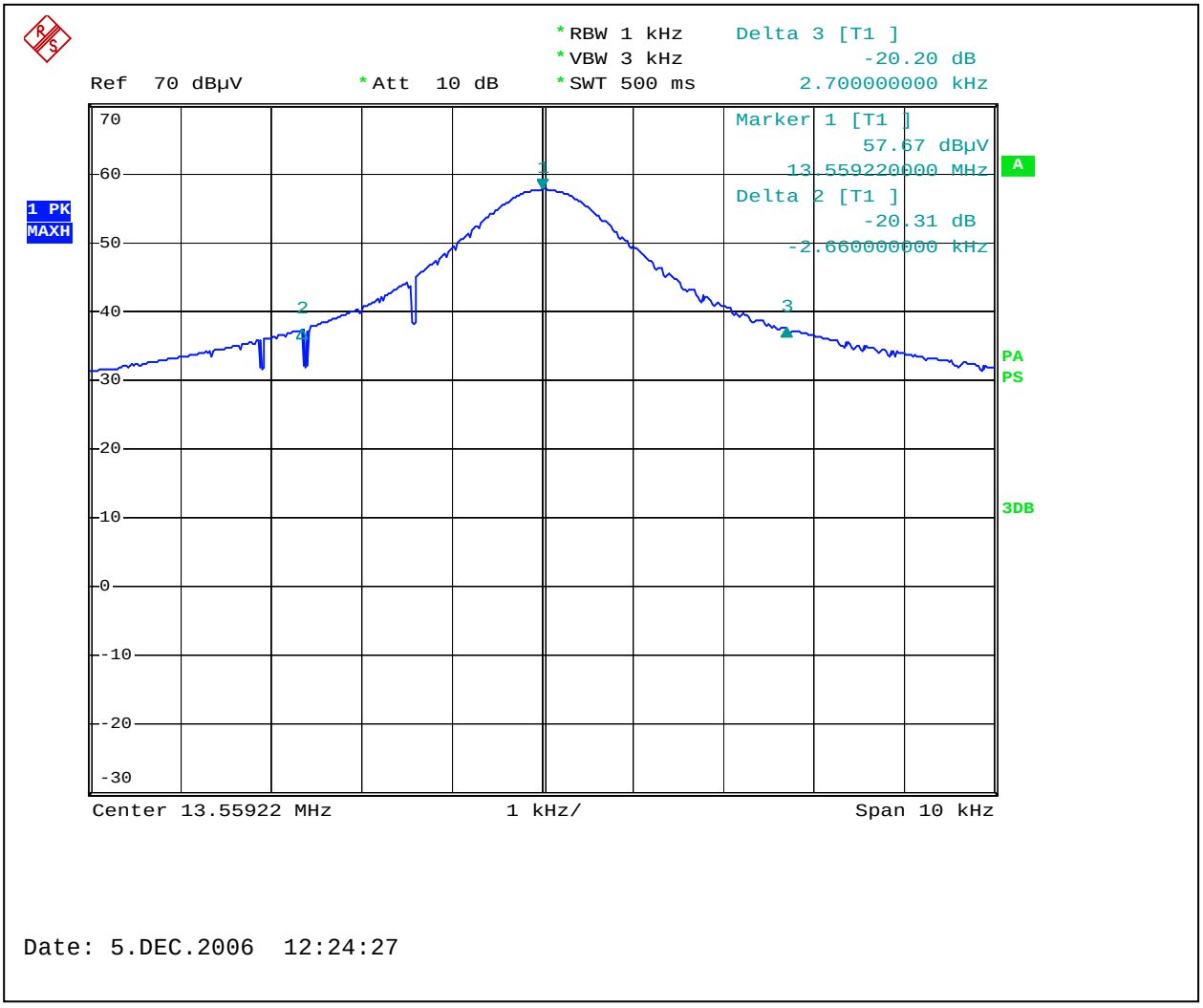
The Specified by FCC Part 15.225 frequency band is 13.553-13.567MHz, or 13560±7kHz.

The maximum 20dB Bandwidth of Emissions at fundamental frequency was measured at 5.36kHz.

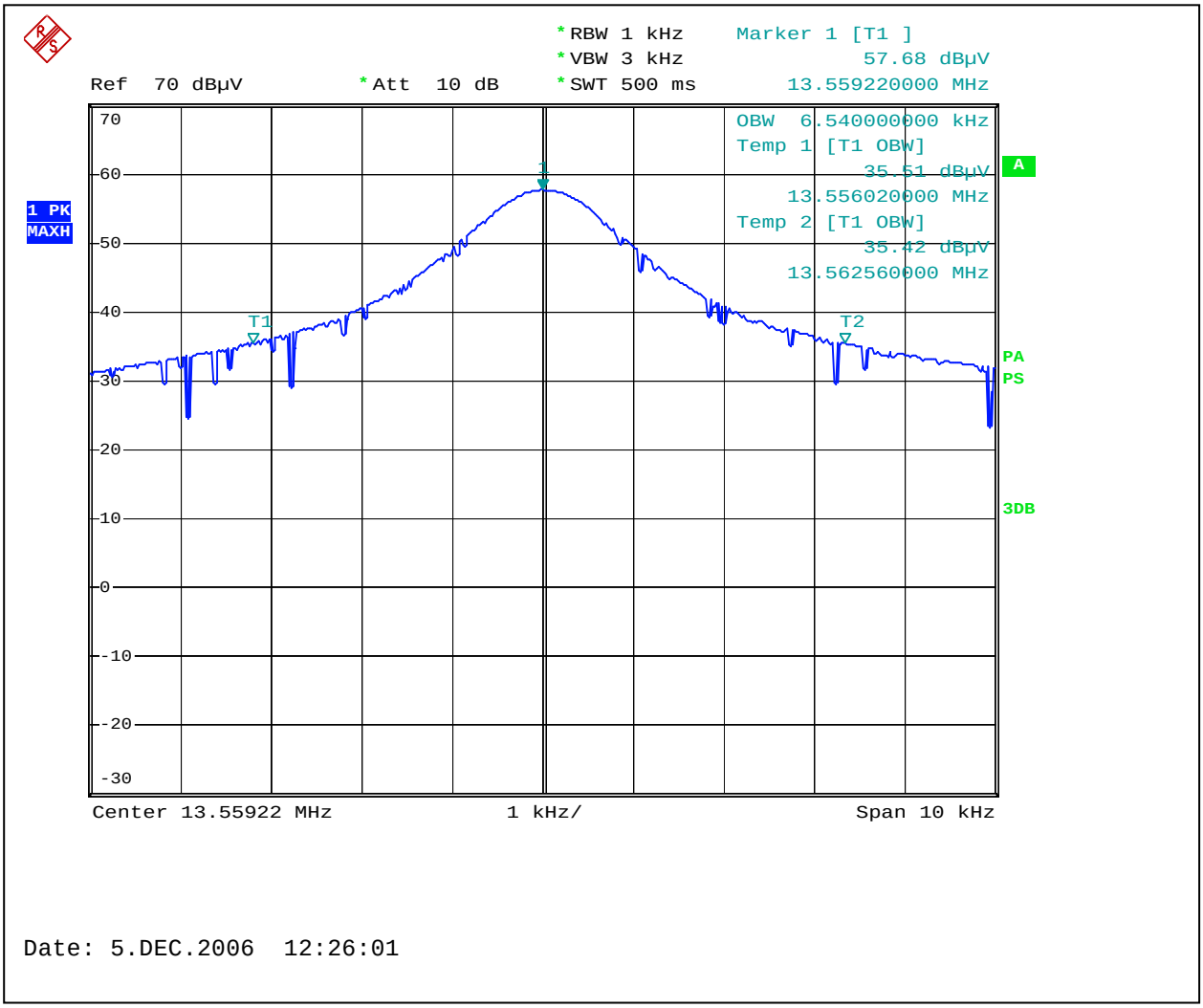
The maximum 99% Bandwidth of Emissions at fundamental frequency was measured at 6.54kHz.

The Graphs 3-5-1 to 3-5-4 show the Bandwidth of Emissions.

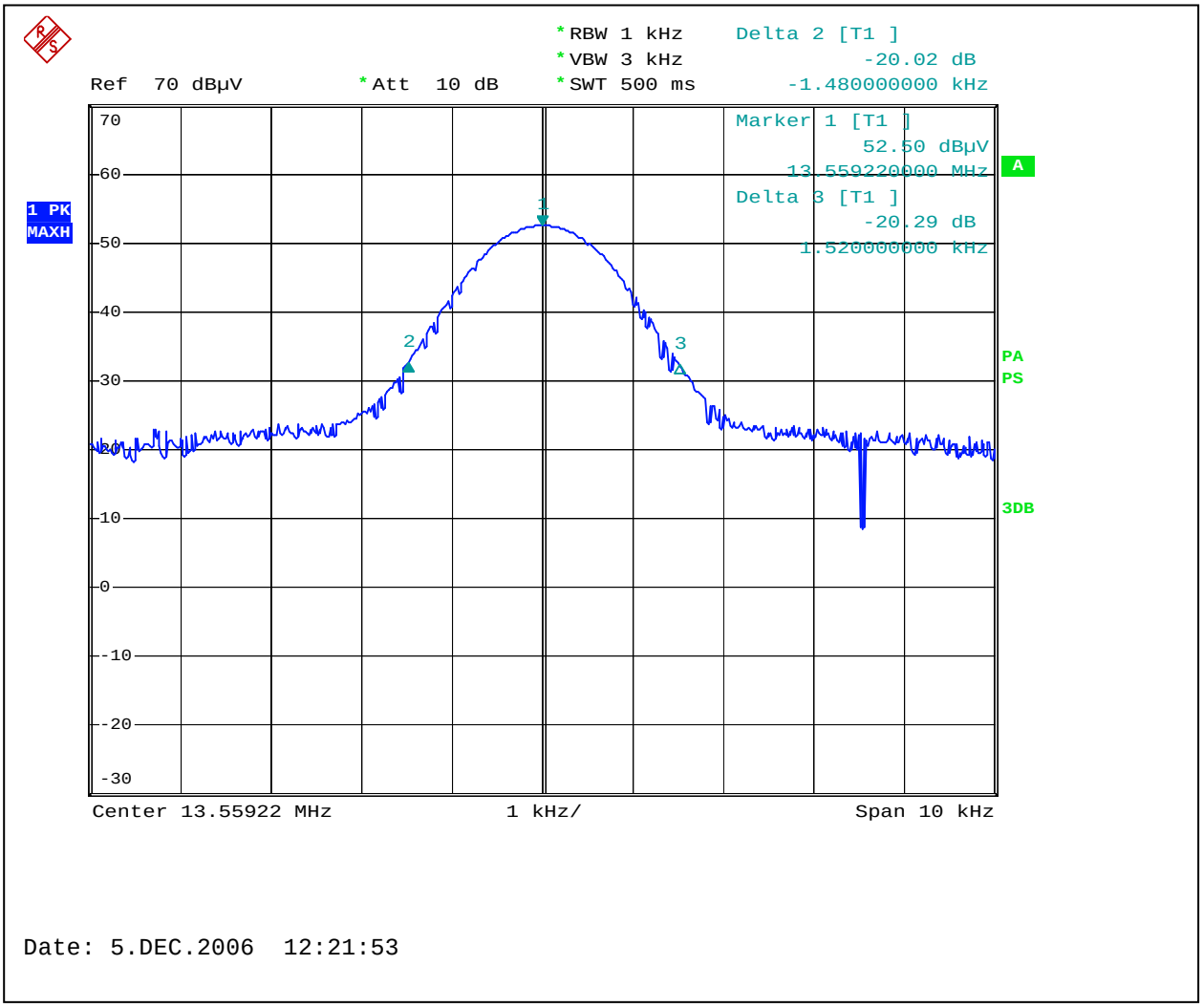
Graph # 3-5-1
20dB Bandwidth, Milfare Mode



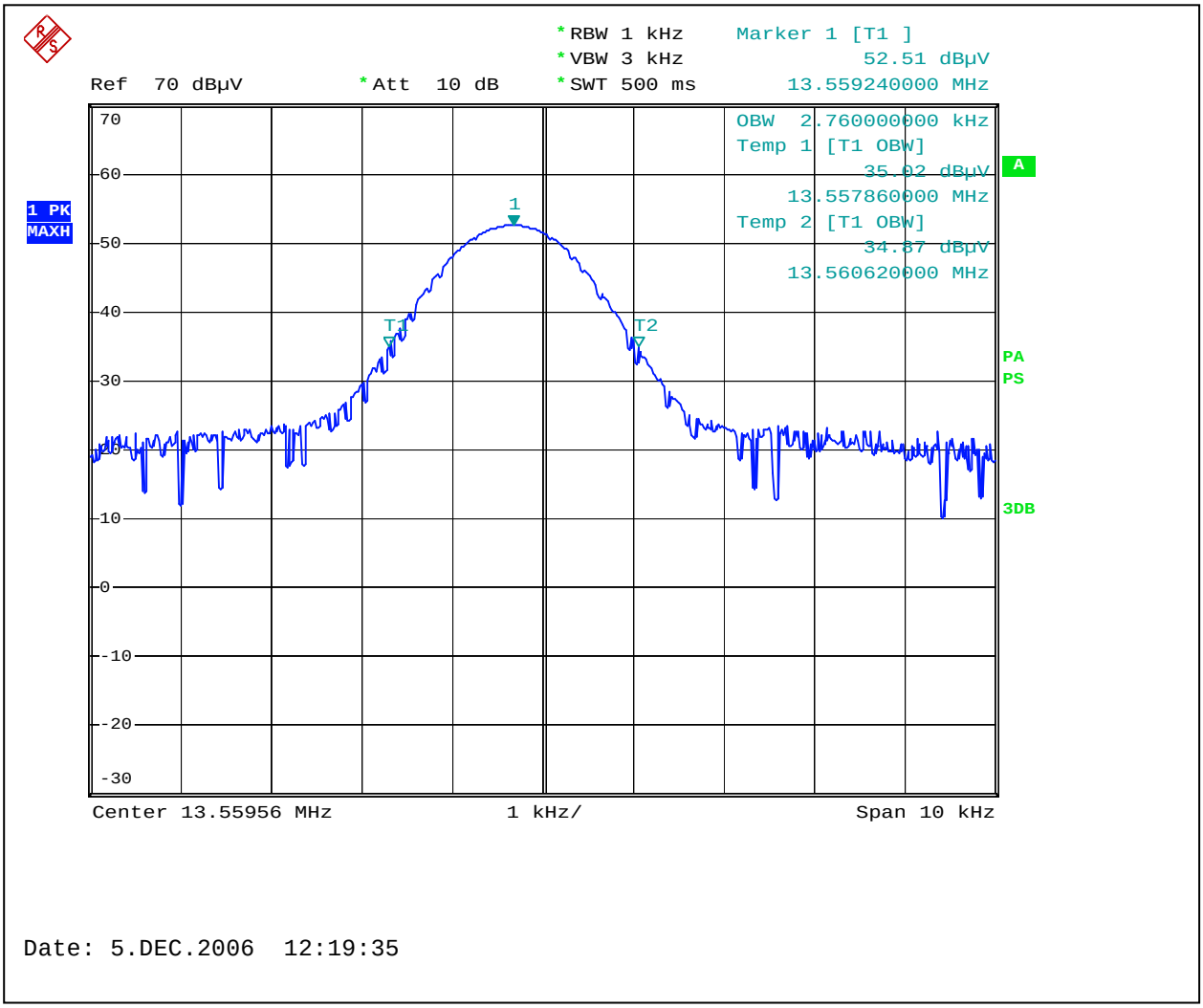
Graph # 3-5-2
99% Bandwidth, Milfare Mode



Graph # 3-5-3
20dB Bandwidth, I-Class Mode



Graph # 3-5-4
99% Bandwidth, I-Class Mode



3.6 Test Procedure

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m.
In frequency range below 30MHz the Loop antenna was used at 10m measurement distance with antenna heights of 1m and antenna loop and side faced to the EUT.
Method of the direct Field Strength Calculation is shown in Section 3.7.

Frequency Tolerance

The EUT was placed in an environmental test chamber and powered such that control element received normal voltage and the transmitter provided maximum RF output. The Chamber was programmed to cool from room temperature to minus 20 degrees C and then step in 10-degree increments to plus 55 degrees C. For Frequency Stability testing with variation of primary supply voltage the EUT power supply was powered at rated supply voltage at 120VAC/60Hz and then at 102VAC/60Hz and 138VAC/60Hz

Conducted Emissions

For conducted emissions testing, the equipment is moved to an insulating platform over the ground plane, and the EUT is powered from a LISN. Both sides of the AC line are measured and the results are compared to the applicable limits. Measurements are taken using CISPR quasi-peak and average detectors when the peak readings approach or exceed the average limit. Only quasi-peak readings are taken when the emissions from the EUT meet the average limit as measured with the quasi-peak detector. Only peak readings might be taken when the emissions from the EUT meet the average limit as measured with the peak detector.

3.7 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

In the tables the Cable correction factors are included to the Antenna Factors.

3.8 Measurement Uncertainty

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:
±4 dB at 10m ±5.4 dB at 3m

The expanded uncertainty (k = 2) for emissions from 150 kHz to 30 MHz has been determined to be:
±2.6 dB

Tested by:

Norman Shpilsher
EMC Staff Engineer
Intertek ETL SEMKO

Signature

Date: December 21, 2006

4.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers and Test Software

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
HP85462A Receiver RF Section	3325A00106	04/06	04/07	
HP85460A RF Filter Section	3330A00109	04/06	04/07	
HP85462A Receiver RF Section	3549A00306	02/06	02/07	X
HP85460A RF Filter Section	3448A00276	02/06	02/07	X
Rohde & Schwarz FSP 40 Spectrum Analyzer	100024	07/06	07/07	
Rohde & Schwarz ESCI Spectrum Analyzer	100358	04/06	04/07	X
Advantest R3271A Spectrum Analyzer	55050084	10/06	10/07	
Agilent E7402A Spectrum Analyzer	MY44212200	10/06	10/07	
TILE! Instrument Control System	Ver. 3.4 K.17	N/A	N/A	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Schaffner-Chase Bicono-Log Antenna	2468	01/06	01/07	X
Schaffner-Chase Bicono-Log Antenna	2630	08/06	08/07	
EMCO Horn Antenna 3115	9507-4513	01/06	01/07	
A.H. System Loop Antenna SAS-200/562	215	05/06	05/07	X
MITEQ AMF-5D Pre-Amplifier	1122951	02/06	02/07	
HP 8447F Pre-Amplifier	3113A04974	02/06	02/07	X

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
FCC LISN-2	316	05/06	05/07	
FCC-LISN-50-25-2	2014	09/05	10/07	

EXHIBIT 1
CONFIGURATION PHOTOS

Radiated Emissions Test Configuration

Radiated Emissions Test Configuration

Radiated Emissions Test Configuration