ITS Intertek Testing Services

**Fargo Electronics Inc.**

Application
For Certification
RF ID Card Transmitter

**(FCC ID: JZ2X001200)**

August 23, 2002

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## TABLE OF CONTENTS


**1.0 General Description** ..... 1
- 1.1 Related Submittal(s) Grants ..... 1
- 1.2 Product Description ..... 1
- 1.3 Test Methodology ..... 1
- 1.4 Test Facility ..... 1

**2.0 System Test Configuration** ..... 2
- 2.1 Justification ..... 2
- 2.2 EUT Exercising Software ..... 2
- 2.3 Special Accessories ..... 2
- 2.4 Equipment Modification ..... 2
- 2.5 Support Equipment List and Description ..... 2
- 2.6 Test Configuration Block Diagram ..... 3

**3.0 Test Results** ..... 4
- 3.1 Field Strength of Radiated Emissions, FCC 15.225(a), 15.225(b), 15.209 ..... 5
- 3.2 Out of Band Spurious Emissions, FCC 15.225(b), 15.209 ..... 8
- 3.3 Frequency Tolerance, FCC 15.225(c) ..... 10
- 3.4 Conducted Emissions, FCC 15.207 ..... 12
- 3.5 Test Procedure ..... 15
- 3.6 Field Strength Calculation ..... 16

**4.0 Test Equipment** ..... 17

**EXHIBIT I**
Test Set Up Photographs ..... 18

**EXHIBIT II**
FCC ID Label Location ..... 23

**EXHIBIT III**
External Photographs ..... 25

**EXHIBIT IV**
Internal Photographs ..... 28

**EXHIBIT V**
Electrical Schematics and Block Diagram ..... 31

**EXHIBIT VI**
User Manual and Operational Description ..... 32

# 1.0 GENERAL DESCRIPTION

## 1.1 Related Submittals Grants

This is single application of the *RF ID Card Transmitter;* for Certification under Part 15 Subpart C. There are no other simultaneous applications.

## 1.2 Product Description

The *RF ID Card Transmitter* is operating at 13.56 MHz. The intended use of the *RF ID Card Transmitter* is to generate and transmit a RF signal to the ID card printer module.
The *RF ID Card Transmitter* powered at 120 VAC, 60 Hz.
The *RF ID Card Transmitter* antenna is an integrated antenna.

## 1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-1992. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E 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 January 2000 submitted to your office. Please reference the site registration number: 90706, dated May 19, 2000.

## 2.0 SYSTEM TEST CONFIGURATION

### 2.1 Justification

N/A

### 2.2 EUT Exercising Software

USB Spooler Ver. 1.0 software over Windows 2000.

### 2.3 Special Accessories

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

### 2.4 Equipment Modification

No modifications were installed during the testing.

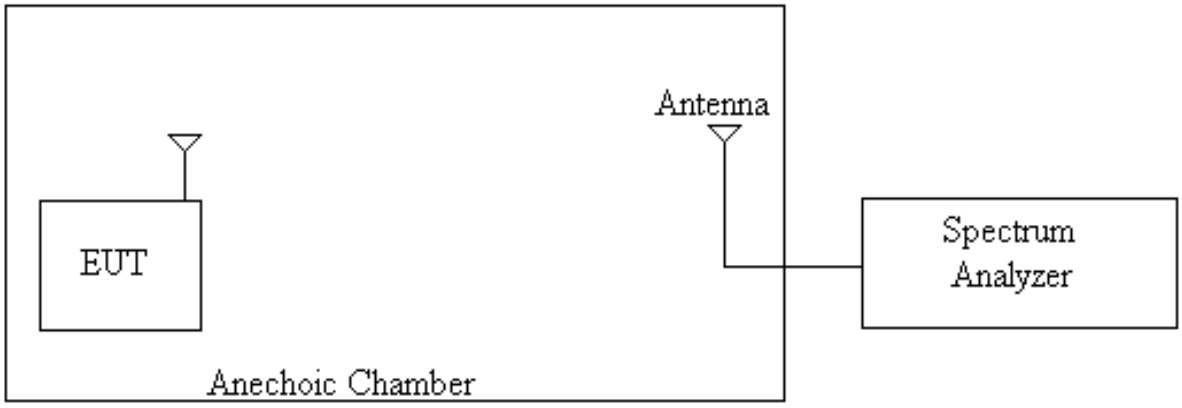
### 2.5 Support Equipment List and Description

A30 IBM ThinkPad Laptop PC, s/n 79-GNH59

## 2.6 Test Setup and Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.
The EUT was powered at 120 VAC, 60 Hz.
The Support Equipment was connected to the EUT to set a transmitting mode. During testing the Support Equipment was disconnected from the EUT.

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) | Field Strength of Fundamental |
| 47 CFR 15.225(b), 15.209 | Field Strength of Spurious Emissions |
| 47 CFR 15.225(b), 15.209 | Out of Band Spurious Emissions |
| 47 CFR 15.225(c) | Frequency Tolerance |
| 47 CFR 15.207 | Conducted Emissions |

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

Field Strength of Fundamental and Harmonics Emissions measurements were made with Fundamental frequency at 13. 56 MHz. The Harmonics emissions were tested up to 1000MHz.

The Tables ## 3.1.1 and 3.1.2 and Graph 3.1.1 below show the Field Strength of Fundamental Radiation and Harmonics Emissions.

**Note:** Emission level shown in the Graphs does not include the Antenna, Cable and Pre-amplifier correction factors.

**Radiated Emissions at Fundamental and 2-nd Harmonic** **Date:** 08-19-2002

**Company:** Fargo Electronics Inc.
**Model:** RF ID Card Transmitter
**Test Engineer:** Norman Shpilsher
**Special Config. Info:** Open Area Test Site, 10m measurement Distance
**Standard:** FCC Part 15.225 and 15.209
**Note:** Measurement distance 10m with Loop antenna SAS 200/562B
All measurements were taken using a CISPR Quasi-Peak detector with RBW 10kHz.

**Table # 3.1.1**

| Frequency MHz | QP Reading dBµV | Antenna Factor dB/m | Pre-amp. Gain (dB) | Net at 10m. dBµV/m | Limit at 30m dBµV/m | Margin dB | Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 13.560 | 48.04 | 9.24 | 0.00 | 57.28 | 80.00 | -22.72 | Fund. |
| | | | | | | | |
| 27.120 | 34.20 | 12.49 | 28.35 | 18.34 | 29.50 | -11.16 | 2-nd Harm. |
| | | | | | | | |

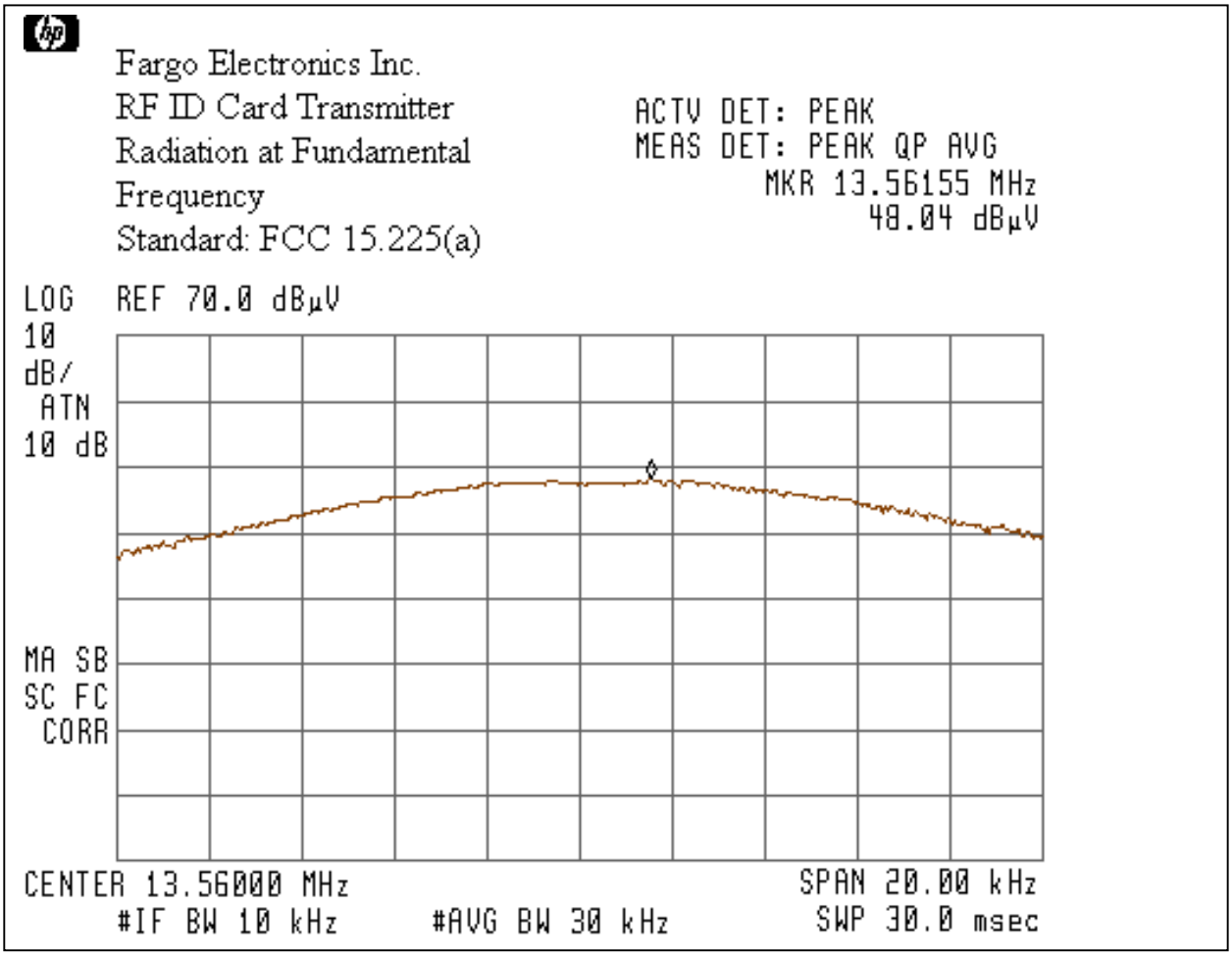
**Spurious Radiated Emissions** **Date:** 8/14/02

**Company:** Fargo Electronics Inc.
**Model:** RF ID Card Transmitter
**Test Engineer:** Uri Spector
**Standard:** FCC Part 15.225, 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 CISPR Quasi-peak detector

**Table # 3.1.2**

| Frequency | Antenna | | | Total QP | QP Limit | Margin | Comments |
|---|---|---|---|---|---|---|---|
| MHz | Polarity | Hts(cm) | Factor(dB1/m) | dBµV/m | dBµV/m | dB | |
| 162.72 | H | 187 | 11.8 | 34.0 | 44.0 | -10.0 | |
| 176.29 | H | 205 | 11.1 | 32.3 | 44.0 | -11.7 | |
| 203.40 | H | 135 | 11.6 | 41.6 | 44.0 | -2.4 | |
| 216.96 | H | 139 | 12.4 | 38.2 | 46.0 | -7.8 | |
| 230.52 | H | 113 | 13.2 | 38.8 | 46.0 | -7.2 | |
| 257.64 | H | 100 | 14.6 | 40.5 | 46.0 | -5.5 | |
| 336.07 | H | 100 | 16.8 | 36.6 | 46.0 | -9.4 | |
| 426.09 | H | 161 | 19.0 | 40.5 | 46.0 | -5.5 | |
| 432.09 | H | 186 | 19.2 | 40.0 | 46.0 | -6.0 | |
| 488.16 | H | 161 | 20.2 | 40.5 | 46.0 | -5.5 | |

**Graph # 3.1.1**


Fargo Electronics Inc.
RF ID Card Transmitter
Radiation at Fundamental
Frequency
Standard: FCC 15.225(a)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 13.56155 MHz
48.04 dBµV
LOG
10
dB/
ATN
10 dB
REF 70.0 dBµV
MA SB
SC FC
CORR
CENTER 13.56000 MHz
SPAN 20.00 kHz
#IF BW 10 kHz
#AVG BW 30 kHz
SWP 30.0 msec

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

Out-of-band measurements were made for frequencies:
- 15.553MHz
- 15.567MHz.

Output frequencies of the EUT was 13.560MHz

The Table # 3-2-1and Graph ## 3-2-1 show the Out of Band Spurious Emissions.

**Note:** Emission level shown in the Graphs does not include the Antenna and Cable correction factors.

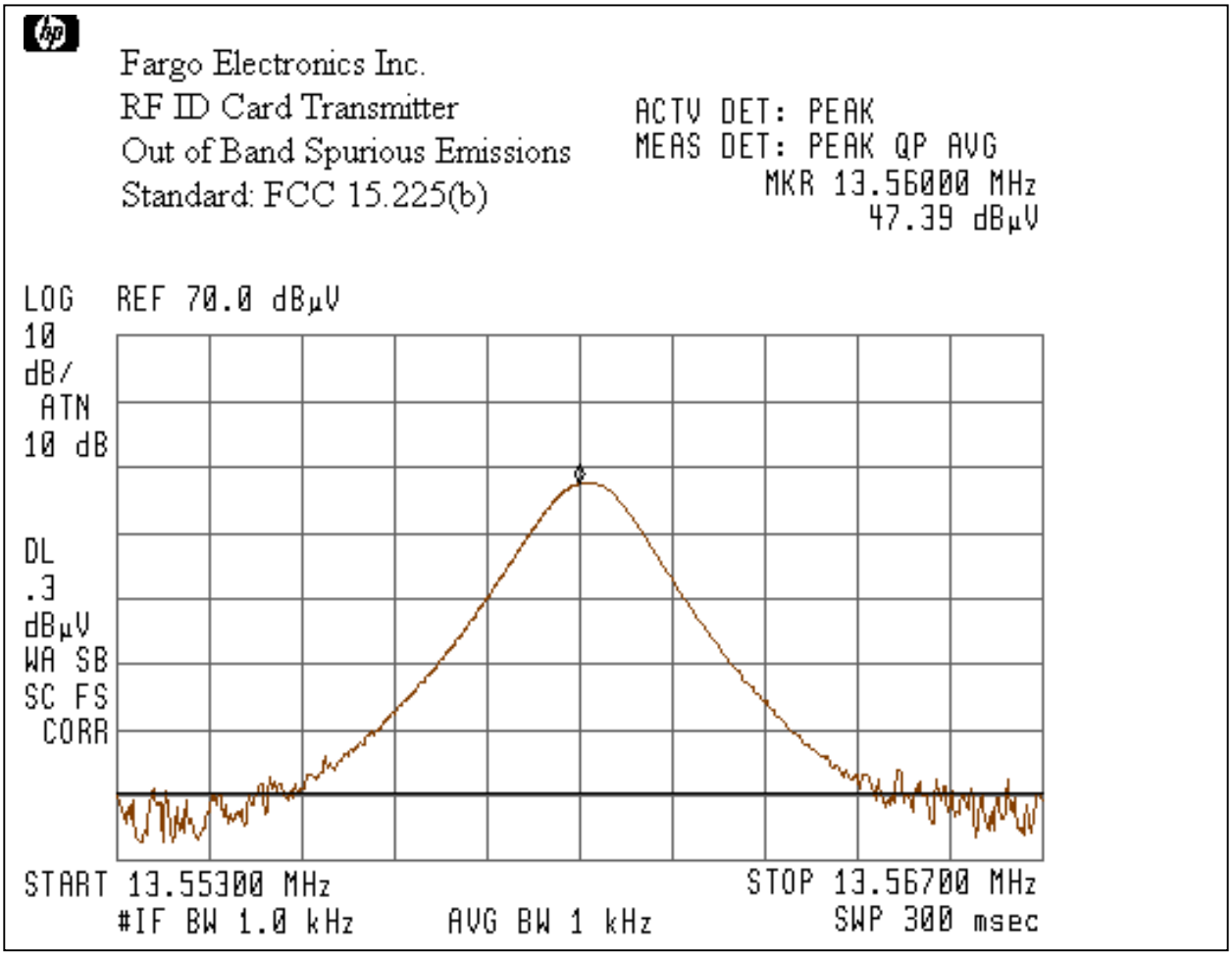
**Out of Band Spurious Emissions** **Date:** 08-19-2002

| | |
|---|---|
| **Company:** | Fargo Electronics Inc. |
| **Model:** | RF ID Card Transmitter |
| **Test Engineer:** | Norman Shpilsher |
| **Special Config. Info:** | Open Area Test Site, 10m measurement Distance |
| **Standard:** | FCC Part 15.225 and 15.209 |
| **Note:** | Measurement distance 10m with Loop antenna SAS 200/562B<br>All measurements were taken using a Peak detector<br>with RBW 1kHz. |

**Table # 3.2.1**

| Frequency MHz | QP Reading dBμV | Antenna Factor dB/m | Pre-amp. Gain (dB) | Net at 10m. dBμV/m | Limit at 30m dBμV/m | Margin dB | Comments |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 13.553 | 0.70 | 9.25 | 0.00 | 9.95 | 29.50 | -19.55 | |
| | | | | | | | |
| 13.567 | 0.70 | 9.22 | 0.00 | 9.92 | 29.50 | -19.58 | |
| | | | | | | | |

**Graph # 3-2-1**


Fargo Electronics Inc.
RF ID Card Transmitter
Out of Band Spurious Emissions
Standard: FCC 15.225(b)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 13.56000 MHz
47.39 dBµV
LOG
10
dB/
ATN
10 dB
REF 70.0 dBµV
DL
.3
dBµV
WA SB
SC FS
CORR
START 13.55300 MHz
#IF BW 1.0 kHz
AVG BW 1 kHz
STOP 13.56700 MHz
SWP 300 msec

## 3.3 Frequency Tolerance, FCC 15.225(c)

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.

Table below shows the frequency stability vs. temperature ambient and supply voltage.

**Frequency Stability** **Date:** 08-19-2002
**Company:** Fargo Electronics Inc.
**Model:** RF ID Card Transmitter
**Special Info:** Enviromental Chamber (Frequency Stability testing)
**Test Engineer:** Norman Shpilsher
**Standard:** FCC 15.225(c)

**Table # 3-3-1**

| Temperature Degree C | Output Frequency MHz | Frequency Stability Hz | Freq. Tolerance +/- 0.01% Hz | Test Result |
|---|---|---|---|---|
| -20 | 13.56 | 81 | 1356 | Pass |
| -10 | 13.56 | 65 | 1356 | Pass |
| 0 | 13.56 | 50 | 1356 | Pass |
| 10 | 13.56 | 21 | 1356 | Pass |
| 20 | 13.56 | 0 | 1356 | Pass |
| 30 | 13.56 | 10 | 1356 | Pass |
| 40 | 13.56 | 21 | 1356 | Pass |
| 50 | 13.56 | 40 | 1356 | Pass |
| 55 | 13.56 | 45 | 1356 | Pass |
| Input Power AC Voltage V | Output Frequency MHz | Frequency Stability Hz | Freq. Tolerance +/- 0.01% Hz | Test Result |
| 102 | 13.56 | 0.0 | 1356 | Pass |
| 110 | 13.56 | 0.0 | 1356 | Pass |
| 120 | 13.56 | 0.0 | 1356 | Pass |
| 130 | 13.56 | 0.0 | 1356 | Pass |
| 138 | 13.56 | 0.0 | 1356 | Pass |

## 3.4 Conducted Emissions, FCC 15.207

Conducted Emissions testing was performed in frequency range from 150kHz to 30MHz. Emissions at the Transmitter operating frequency of 13.566MHz were excluded from the test result.

The Table # 3-4-1and Graph # 3-4-1 shows the Conducted Emissions.

*TILE Instrument Control System EMI Measurement Software*

**Conducted Emissions** **Date:** 08-16-2002

**Company:** Fargo Electronics Inc.
**Model:** RF ID card Transmitter
**Test Engineer:** Norman Shpilsher
**Special Config. Info:** The Emissions at the Transmitter operating Frequency of 13.56MHz was excluded from the Table
**Standard:** FCC Part 15.207
**Note:** The table shows the worst case conducted emissions
All measurements were taken using a Peak detector

**Table # 3.4.1**

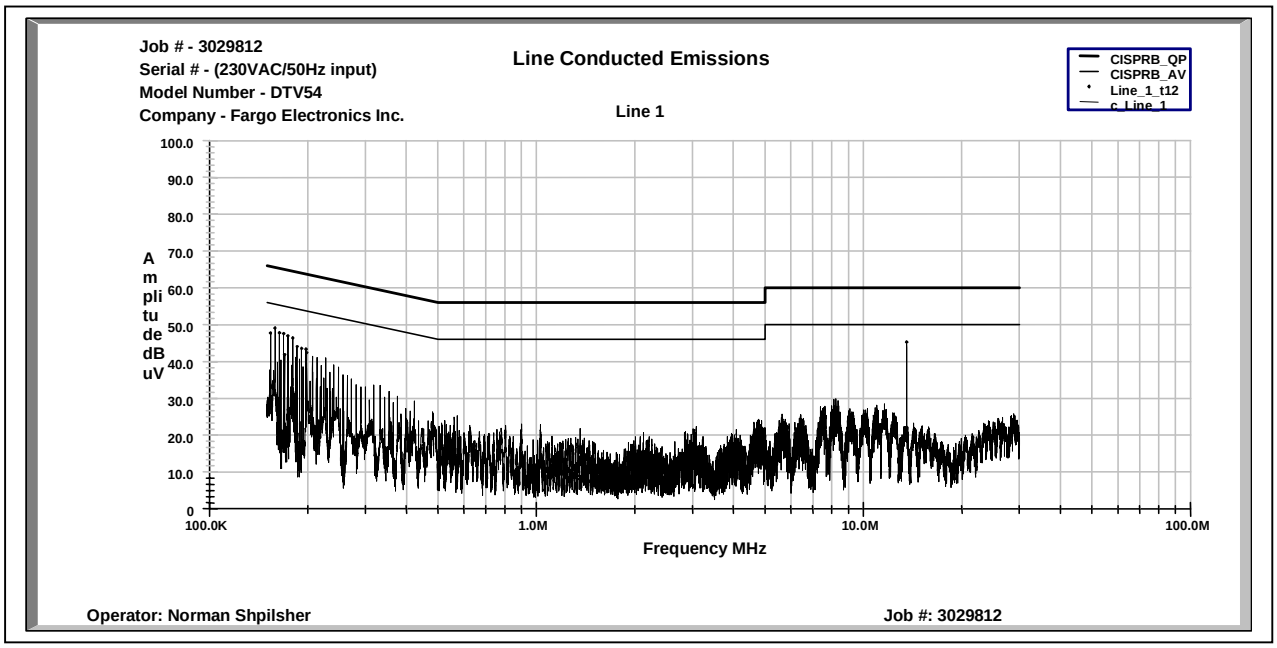
**Line 1**

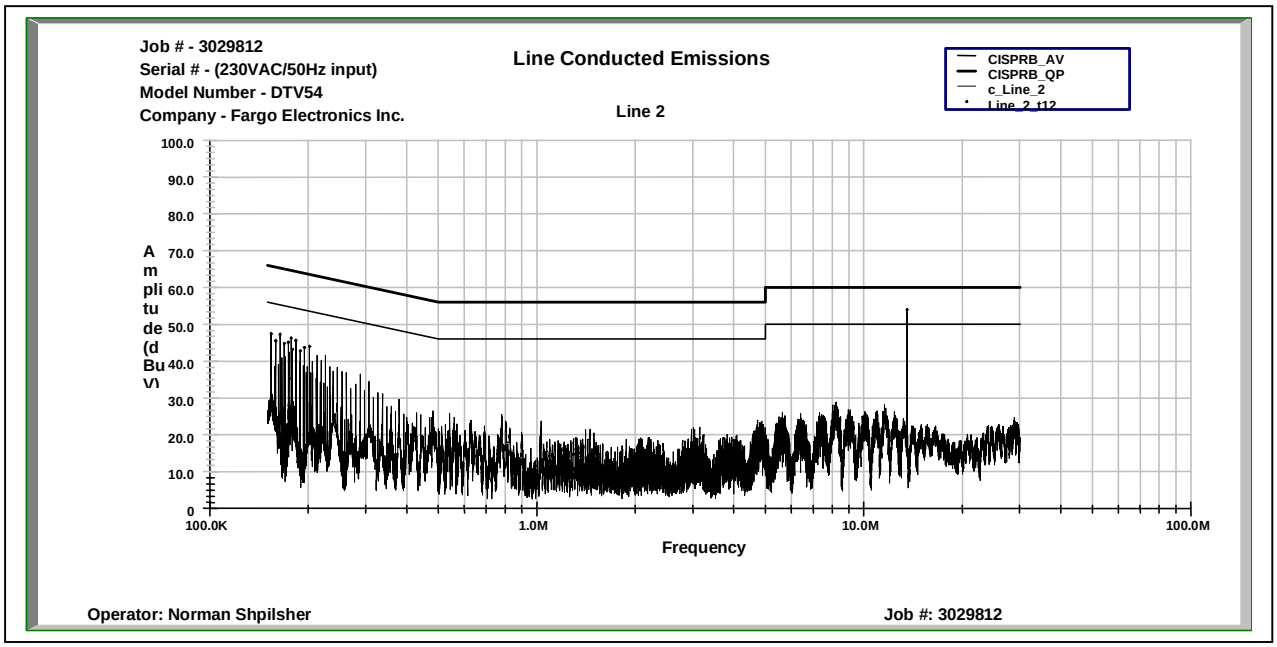
| Frequency MHz | Peak Reading dBµV | Class B QP Limits dBµV | Margin dB |
|---|---|---|---|
| 0.151 | 47.0 | 65.9 | -18.9 |
| 0.159 | 47.6 | 65.5 | -17.9 |
| 0.168 | 45.6 | 65.1 | -19.5 |
| 0.201 | 43.4 | 63.5 | -20.1 |
| 10.454 | 29.3 | 60.0 | -30.7 |
| 29.578 | 29.0 | 60.0 | -31.0 |

**Line 2**

| Frequency MHz | Peak Reading dBµV | Class B QP Limits dBµV | Margin dB |
|---|---|---|---|
| 0.151 | 47.1 | 65.9 | -18.8 |
| 0.163 | 43.1 | 65.3 | -22.2 |
| 0.168 | 44.4 | 65.1 | -20.7 |
| 0.172 | 43.0 | 64.9 | -21.9 |
| 12.627 | 28.9 | 60.0 | -31.1 |
| 29.663 | 28.8 | 60.0 | -31.2 |

## Graph #3.4.1


Job # - 3029812
Serial # - (230VAC/50Hz input)
Model Number - DTV54
Company - Fargo Electronics Inc.
Line Conducted Emissions
Line 1
CISPRB_QP
CISPRB_AV
Line_1_t12
c_Line_1
Amplitude dB uV
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
100.0K
1.0M
10.0M
100.0M
Frequency MHz
Operator: Norman Shpilsher
Job #: 3029812


Job # - 3029812
Serial # - (230VAC/50Hz input)
Model Number - DTV54
Company - Fargo Electronics Inc.
Line Conducted Emissions
Line 2
CISPRB_AV
CISPRB_QP
c_Line_2
Line_2_t12
Amplitude (dBuV)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
100.0K
1.0M
10.0M
100.0M
Frequency
Operator: Norman Shpilsher
Job #: 3029812

## 3.5 Test Procedure

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. 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. Method of the direct Field Strength Calculation is shown in Section 3.4.

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.

### 3.6 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).

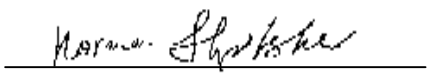
RA = 48.1 dB(μV)
AF = 7.4 dB($m^{-1}$)
CF = 1.6 dB
AG = 16.0 dB
FS = RF + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(μV/m)

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

Tested by:

Norman Shpilsher
EMC Project Engineer
Intertek Testing Services NA, Inc.

Signature



Signature

Date: August 23, 2002

## 4.0 TEST EQUIPMENT

**Receivers/Spectrum Analyzers**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| HP85462A Receiver RF Section | 3549A00306 | 11/01 | 11/02 | X |
| HP85460A RF Filter Section | 3448A00276 | 11/01 | 11/02 | X |

**Antennas**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| Schaffner-Chase Bicono-Log Antenna | 2468 | 11/01 | 11/02 | X |
| Schaffner-Chase Bicono-Log Antenna | 2630 | 05/02 | 05/03 | |
| EMCO Horn Antenna 3115 | 9507-4513 | 09/01 | 09/02 | |

**Artificial Mains Networks/Absorbing Clamps**

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|---|---|---|---|
| FCC LISN-2 | 316 | 01/02 | 01/03 | X |
| FCC-LISN-50-25-2 | 2014 | 04/02 | 04/03 | |