

**SMITH ELECTRONICS, INC.  
ELECTROMAGNETIC COMPATIBILITY LABORATORIES**

RADIO-FREQUENCY EMISSIONS TEST REPORT

FOR

HEXAGRAM, INC.

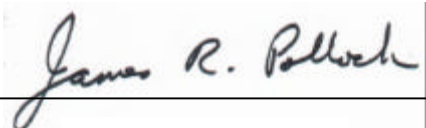
FOCUS  
METER TRANSMITTING UNIT (MTU)

(DIGITAL DEVICE)

Model 10152  
FCC ID: LLB10152

April 24, 2006

Prepared by:



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Prepared for:

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# **TEST REPORT**

## **INTRODUCTION**

The Hexagram Model 10152 transceiver is designed to provide remote meter reading capability with the Landis & Gyr “FOCUS” family of electric meters. The transceiver is connected to the meter circuitry and mounts within the meter enclosure. An on-board battery provides power when AC power is not available. The transmitter provides a very short, intermittent radio frequency transmission to provide a remote reading of the meter. A microprocessor provides timing, control and data processing functions. The built in antenna is inaccessible to the user and no provision is made for an external antenna. The receiver can be used to request a meter reading or other options available in the system. This report describes the tests performed on the digital device and receiver portions as support for verification of compliance to the FCC Rules.

## **MEASUREMENTS PERFORMED**

The transceiver under test was examined for emissions from the microprocessor and receiver portions of the system with the transmitter portion inactive as it would be between transmissions. Radiated and conducted emissions were examined, as the unit receives power from the AC line under normal conditions. The circuitry uses a 10 MHz crystal in transceiver circuitry to generate the LO signal. The digital circuitry uses 4 MHz and a 32 kHz crystal for its operation. Measurements were performed under the basic procedures of (ANSI) C63.4-1992.

## **CONDUCTED EMISSIONS**

The electric meter assembly housing the transmitter was placed on a non-conducting table and positioned 40 cm from the shielded room wall with all other conducting surface at least 80 cm away. The AC power was provided through an LISN, which provides the standardized impedance required. This test was performed at 115 VAC although other voltages may be used to power the system. The frequency range of 150 kHz – 30 MHz was covered in three sweeps of the spectrum analyzer. The first was 0 – 500 kHz, the second was 0 – 5 MHz and the third was 0 – 30 MHz. The results of the sweeps are shown in Figs. 1 & 2. Both sides of the AC line were examined and are shown on each sweep along with the limits for Class B devices.

## **RADIATED EMISSIONS**

The meter assembly with the transceiver attached was set upright on a non-conducting table in the shielded room. With the system powered but not transmitting, scans were made of the radiated emissions between 30 and 1000 MHz. Using broadband antennas at a 1 m test distance, the required spectrum was scanned using two spans. The first, 0 – 200 MHz was for the 30 – 200 MHz range while the second, 0 – 1000 MHz was for the 200 – 1000 MHz range. Although the test sample was not rotated, the higher sensitivity capability of the test setup permits observation of any significant signals. The results of the frequency scans are

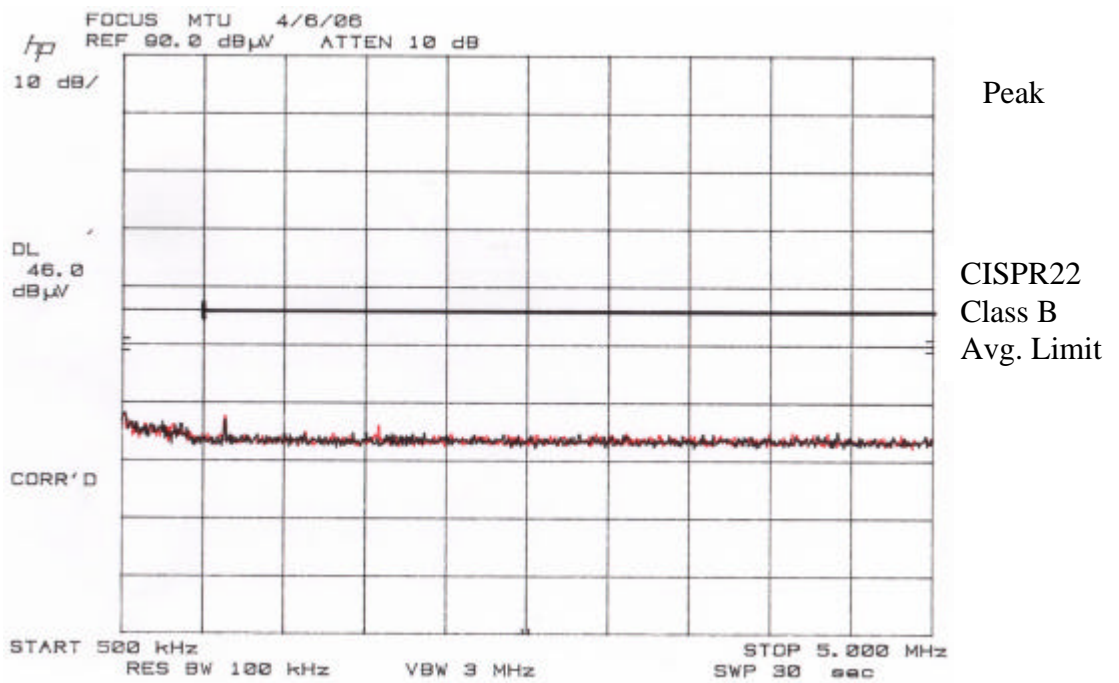
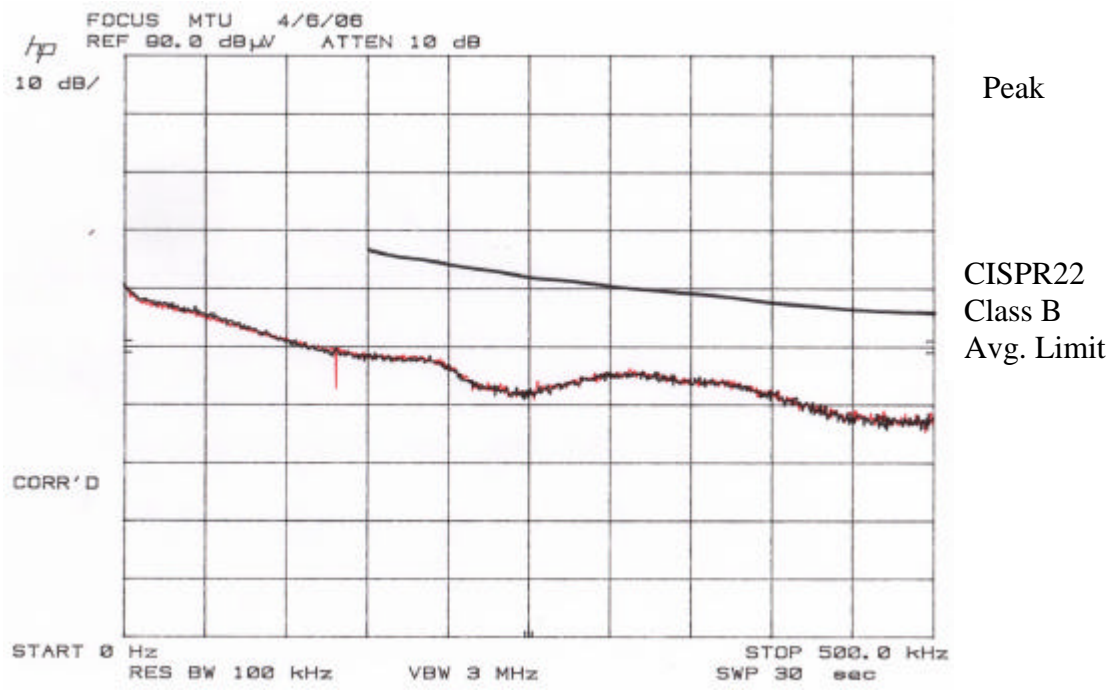
seen in Fig. 3 & 4. Each plot shows the results of both horizontal and vertical polarized measurement antennas as well as the limits for Class B digital devices as modified for gains and losses of the system. The upper plots of Figs. 3 & 4 were made with the transceiver and meter circuitry powered. The lower scans of the two figures were made with only the transceiver being powered. As can be seen from the plots, no significant emissions above the ambient are observable with the transceiver only. In view of the very low emissions level, no open field measurements were performed.

## **RECEIVER LO EMISSIONS**

The receiver LO varies between about 1800 MHz and 1880 MHz for the frequency range of the system. The LO is generated on the transceiver chip and is divided by 4 to obtain the mixing signal that is 307.2 kHz below the tuned frequency. With a receiver tuned to 458 MHz, the LO was determined to be about 1803.69 MHz. This frequency and its harmonics up to the 5<sup>th</sup> were examined in the shielded room, using the same general set-up as for the digital radiated emissions. Due to the high frequency and relatively low level of the signal, the antennas were placed at a distance of 0.25 meters. The meter assembly was rotated in an attempt to obtain the highest reading. Using a log-periodic antenna, the sub-harmonics of the LO were also looked for. At the same distance, the signals at about 458 and 916 MHz were not detected. Measurements were made with the antennas positioned both vertically and horizontally. The maximum level at each frequency is reported in Table 1. The appropriate coax and antenna factors are also shown as well as the limits for receiver emissions.

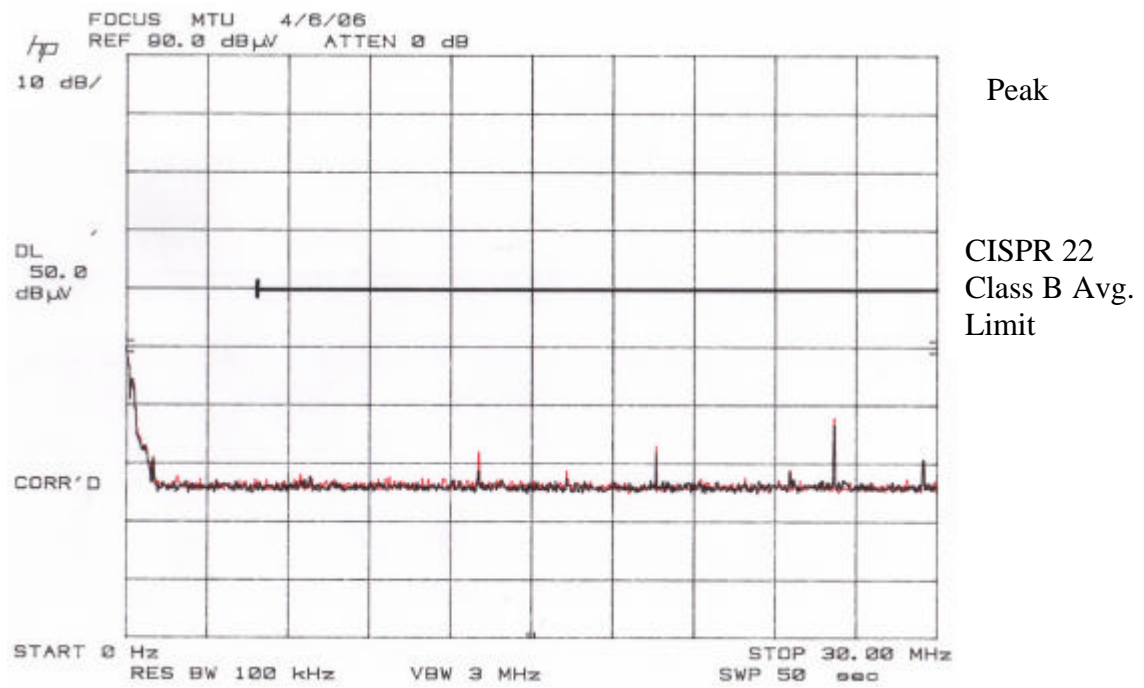
## **CONCLUSION**

Based on the emissions observed and described in this report, the digital and receiver portions of the Model 10152 transceiver are within the emissions limits of the FCC as found in section 15.107 and 15.109 of the Rules and Regulations.



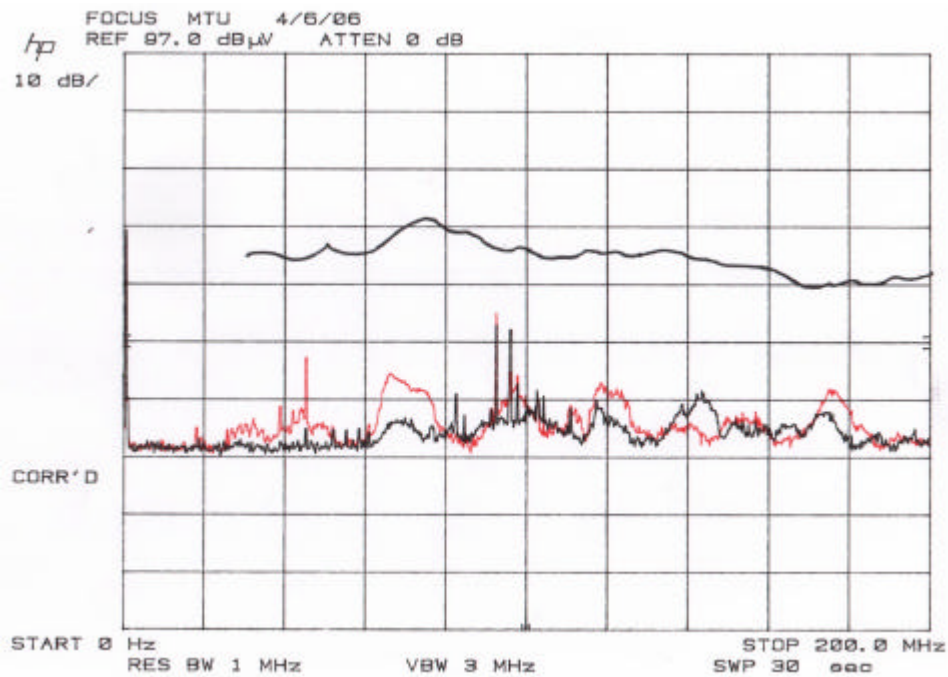
Black = Hot Lead  
 Red = Neutral Lead

Fig. 1  
 10152 CONDUCTED EMISSIONS  
 150 kHz – 5.0 MHz

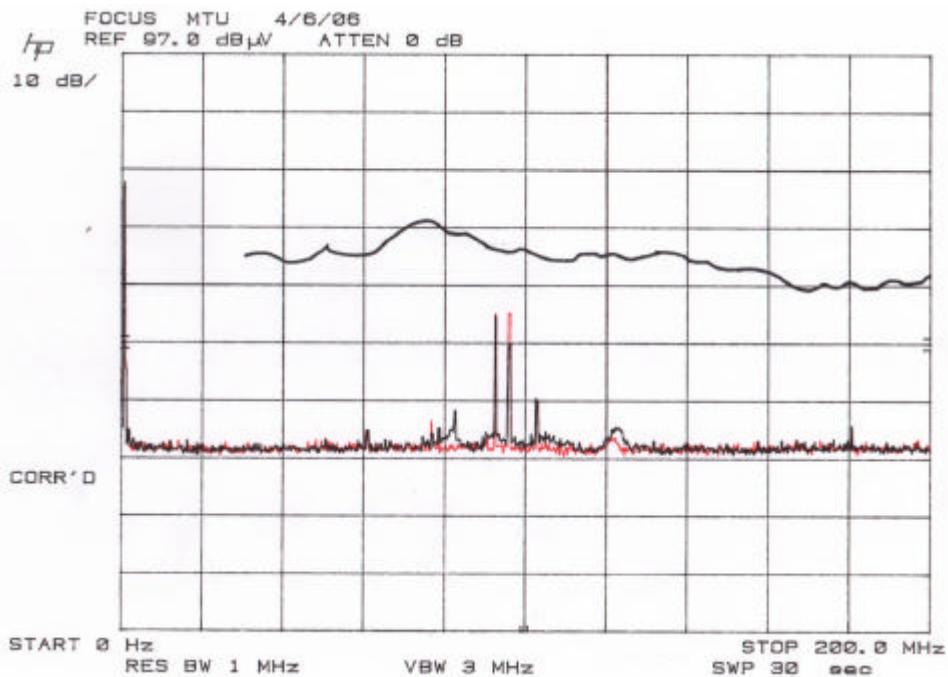


Black = Hot Lead  
 Red = Neutral Lead

Fig. 2  
 10152 CONDUCTED EMISSIONS  
 5.0 MHz – 30 MHz



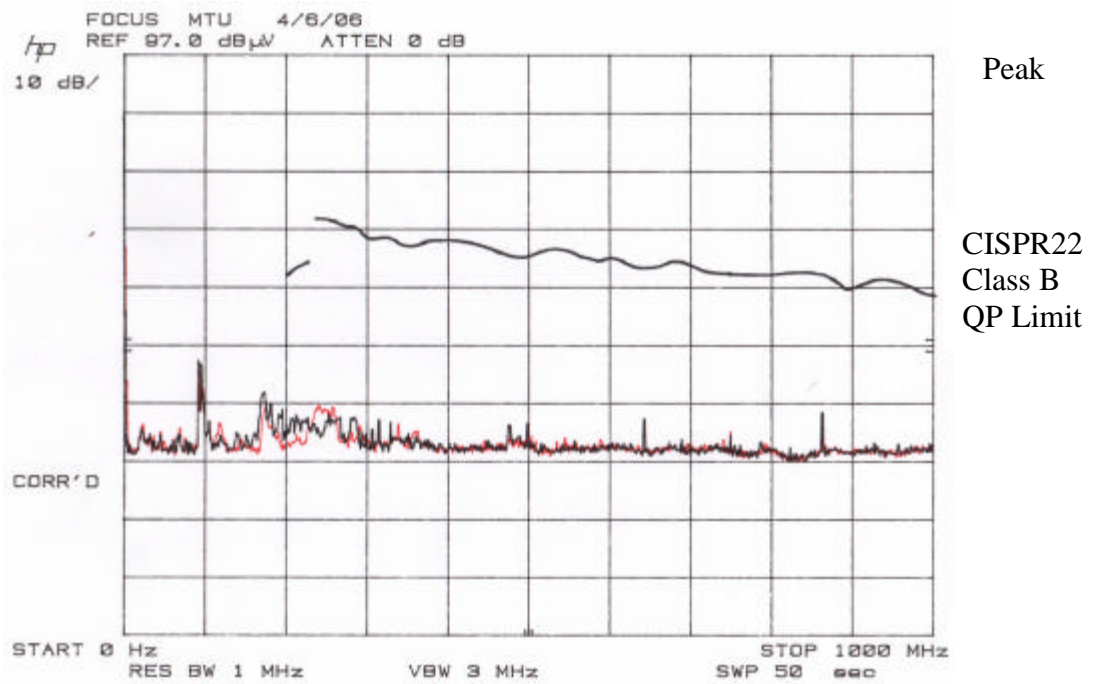
Transceiver with Meter Circuits Powered



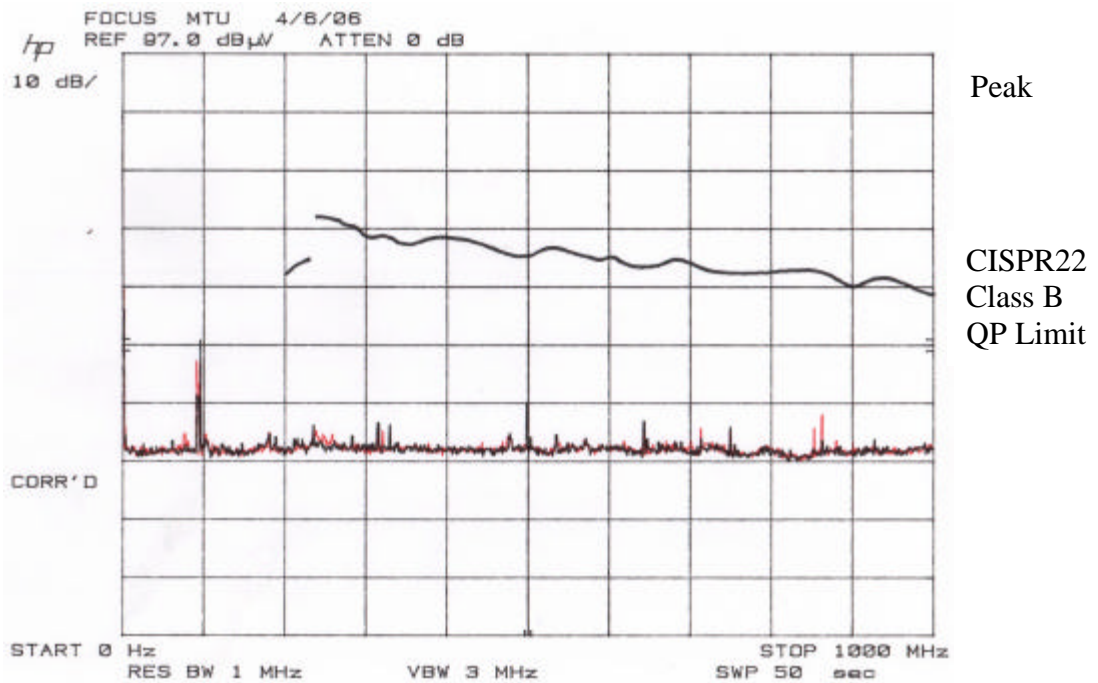
Transceiver Only

Black = Horizontal  
Red = Vertical

Fig. 3  
10152 RADIATED EMISSIONS  
30 MHz – 200 MHz



Transceiver with Meter Circuits Powered



Transceiver Only

Black = Horizontal  
Red = Vertical

Fig. 4  
10152 RADIATED EMISSIONS  
200 MHz – 1000 MHz

**TABLE 1**  
**MODEL 10152 RECEIVER EMISSIONS**

<b>Freq. GHz</b>	<b>Measured Value dBuV</b>	<b>AF dB</b>	<b>Coax dB</b>	<b>Field Strength @0.25 m dBuV</b>	<b>Field Strength @0.25 m uV</b>	<b>FS @ 3m uV</b>	<b>Limit @ 3m uV</b>
.457693	≤13.2	17.1	1.1	≤31.4	≤37	≤3	200
.915386	≤10.6	23.1	3.5	≤37.2	≤72	≤6	200
1.83077	18.1	27.5	1.1	46.7	216	18	500
3.66154	19.2	32.8	1.6	53.6	479	40	500
5.49233	≤13.3	36.2	2.1	≤51.6	≤380	≤32	500
7.32308	18.2	37.2	2.5	57.9	785	65	500
9.15386	≤13.8	38.5	2.9	≤55.2	≤575	≤48	500

All measurements were made at a distance of 0,25 m. The antenna factor(AF) and coax factor were added to the measured value to obtain field strength at the measurement distance. To convert the field strength to the limit distance of 3 m, an inverse distance relationship was used. Because the difference between the 3 m limit distance and the 0.25 m measurement distance is a factor of 12, the field strength at the measurement distance is divided by 12 to obtain the field strength at the limit distance. All emissions are found to be well below the limits for unintentional radiators as found in Part 15.109 of the FCC Rules.



## **TEST INFORMATION**

### **SUMMARY**

The Hexagram MTU transmitter, Model 10152 has been shown to be capable of complying with those requirements of the Federal Communications Commission for a Class B digital device under Part 15.109.

### **EQUIPMENT UNDER TEST**

“MTU” Transmitter, Model 10152

### **MANUFACTURER**

Hexagram, Inc.  
23905 Mercantile  
Cleveland, OH 44122

### **TEST DATE**

April 6, 2006

### **TEST LABORATORY**

Smith Electronics, Inc.  
8200 Snowville Road  
Cleveland, OH 44141  
(440)526-4386

### **MEASUREMENT EQUIPMENT**

Hewlett-Packard Spectrum Analyzer  
Type 8568B with 8560A RF Section  
S/N 2216A02120  
85662A Display Section S/N 2152A03686  
85650A Quasi-Peak Adapter  
S/N 2043A00350 Calibrated 11/05

Hewlett-Packard Spectrum Analyzer  
Model 8563 S/N 3020A00248  
Calibrated 12/05

### **ANTENNAS**

EMCO Model 3104 BiConical  
Frequency Range 30 – 200 MHz

EMCO Model 3146 Log-Periodic  
Frequency Range 200 – 1000 MHz

EMCO Model 3115 Double-Ridged Guide  
Horn Frequency Range 1 – 18 GHz

### **PRE-AMPLIFIER**

Hewlett-Packard Model 8447D

### **MISCELLANEOUS**

12.2 m RG-214/U coaxial cable

2.4 m Belden 8267 coaxial cable