SMITH ELECTRONICS, INC.
ELECTROMAGNETIC COMPATIBILITY LABORATORIES

RADIO-FREQUENCY EMISSIONS TEST REPORT

FOR

HEXAGRAM, INC.

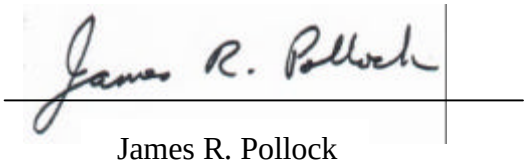
S-4
METER TRANSMITTING UNIT (MTU)

(DIGITAL DEVICE)

Model 9845
FCC ID: LLB9845

April 21, 2006

Prepared by:



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TEST REPORT

INTRODUCTION

The Hexagram Model 9845 transceiver is a designed to provide remote meter reading capability with the Landis & Gyr "S-4" 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 a 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 - 3. Both sides of the AC line were examined and are shown on each sweep along with the limits for Class B devices. The limits shown are for acceptable CISPR 22 requirements. The device also meets the FCC requirements of 48 dBu/V.

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

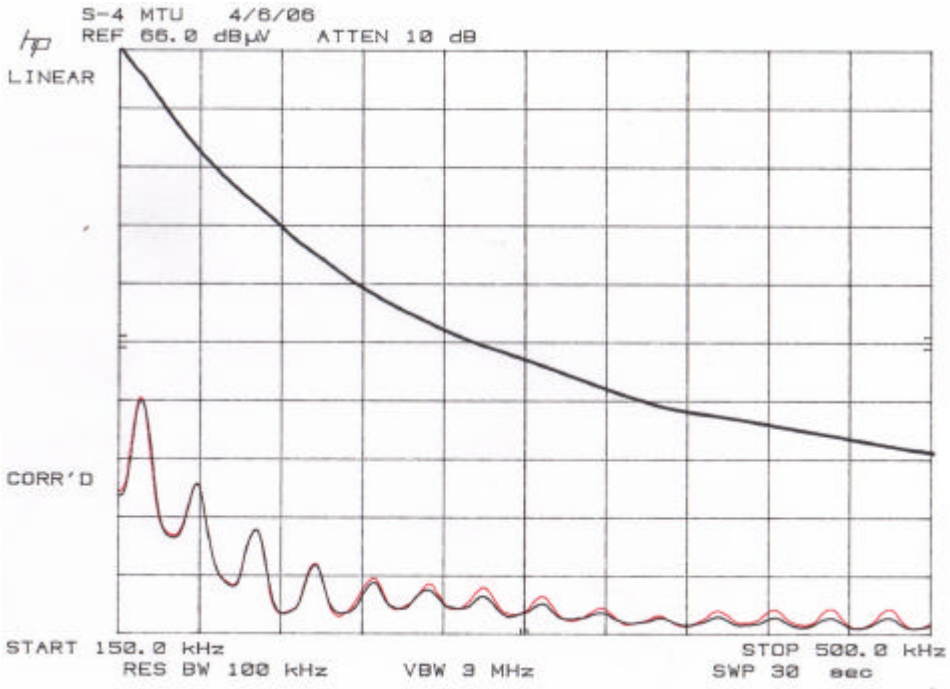
setup permits observation of any significant signals. The results of the frequency scans are seen in Figs. 4 & 5. Each plot shows the results of both horizontal and vertical polarized measurement antennas as well as the limits for digital devices as modified for gains and losses of the system. The upper scans of Figs. 4 & 5 were made with the entire meter assembly powered. The lower set of scans in Figs. 4& 5 were made with only the transceiver being powered from its battery. It is obvious the emissions seen in the upper plots are entirely produced by the meter circuit and not the transceiver circuit. As can be seen from the plots for the transceiver only, no significant emissions above the ambient are observable. 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^{th} 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.

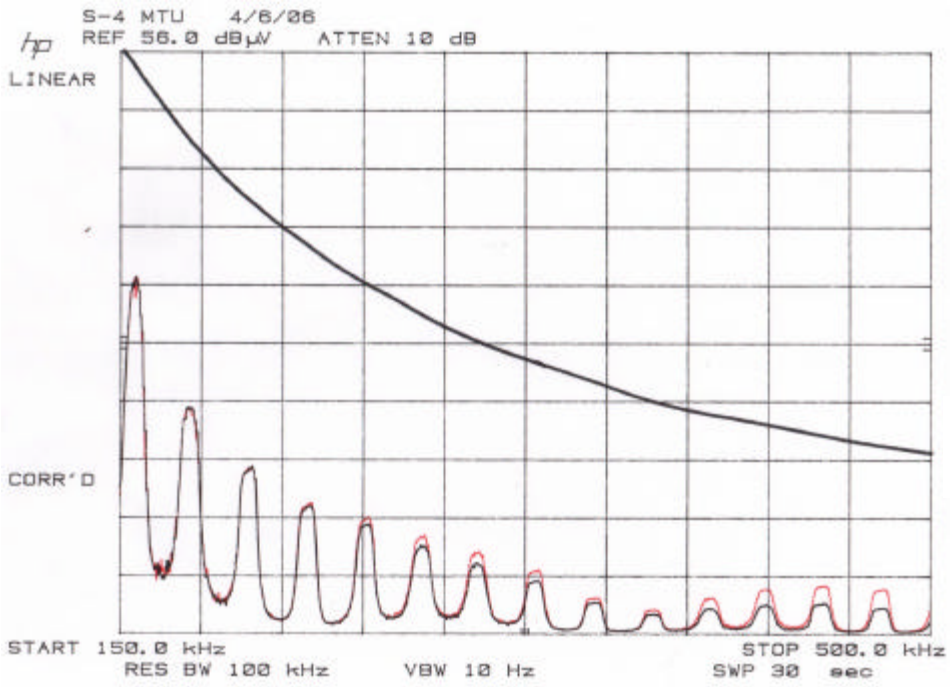
CONCLUSION

Based on the emissions observed and described in this report, the digital and receiver portions of the Model 9845 transceiver are within the emissions limits of the FCC as found in section 15.107 and 15.109 of the Rules and Regulations, as well as the requirements of CISPR22.



Quasi-Peak

CISPR 22 QP
Class B Limit

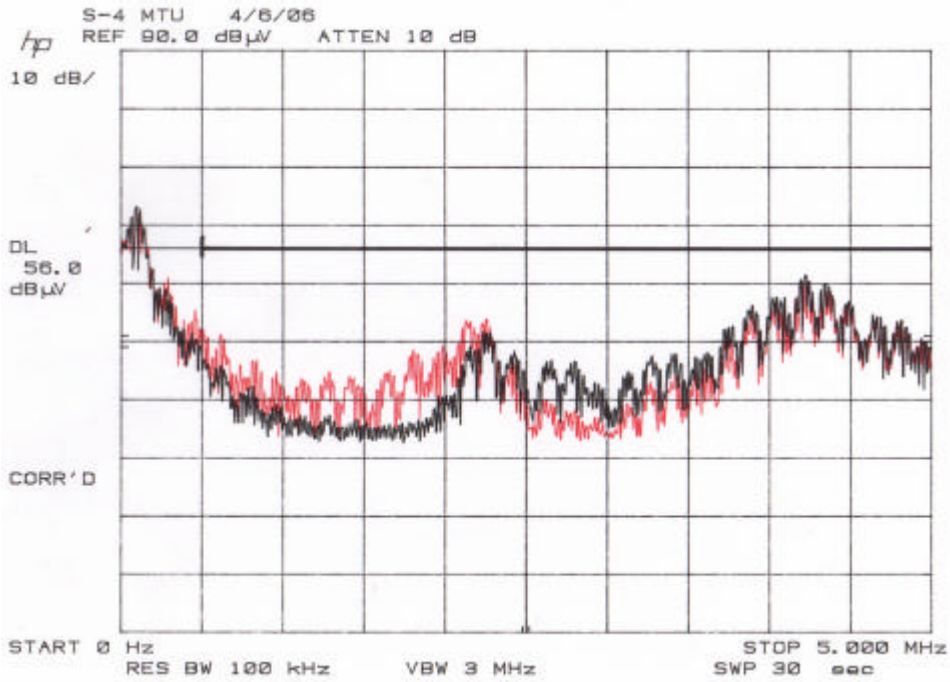


Average

CISPR22 Avg,
Class B Limit

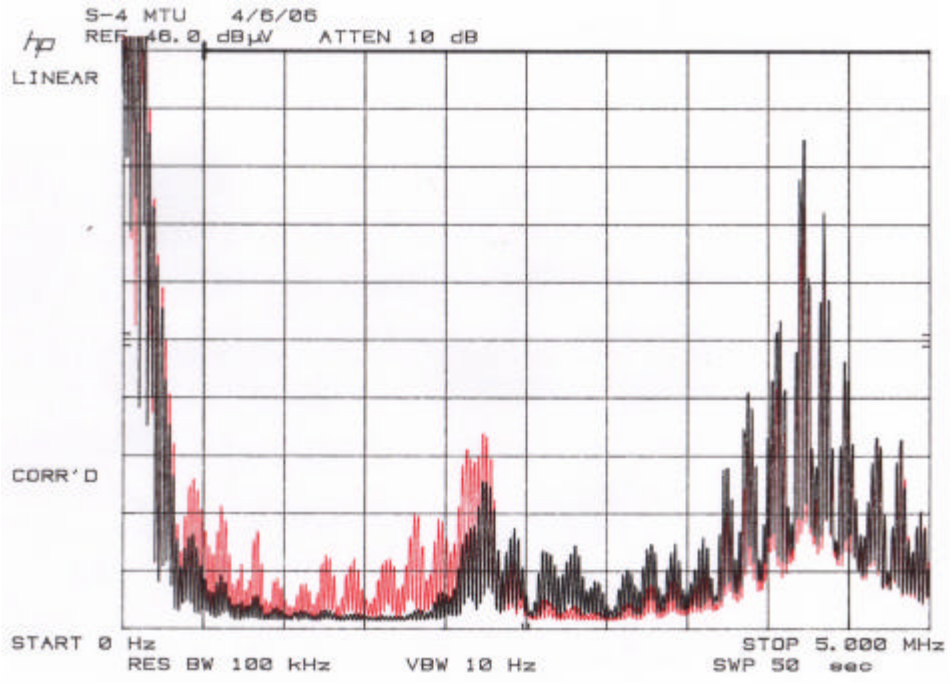
Black = Hot Line
Red = Neutral Line

Fig. 1
MODEL 9845 CONDUCTED EMISSIONS
150 kHz – 500 kHz



Peak

CISPR22 QP
Class B Limit

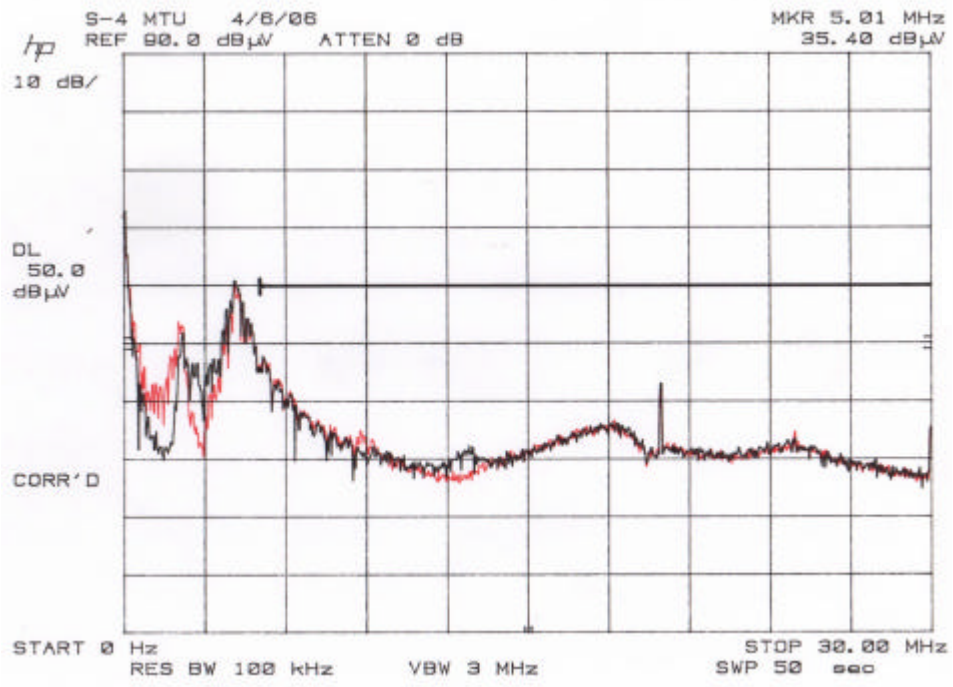


CISPR22 Avg.
Class B Limit

Average

Black = Hot Line
Red = Neutral Line

Fig. 2
MODEL 9845 CONDUCTED EMISSIONS
500 kHz – 5.0 MHz

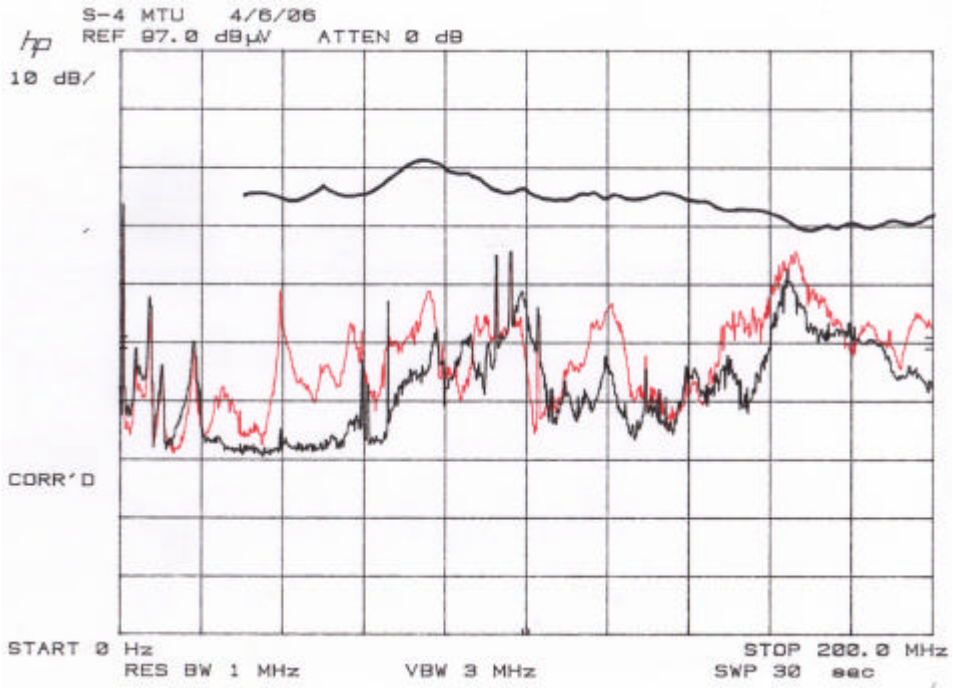


Peak

CISPR22 Avg.
Class B Limit

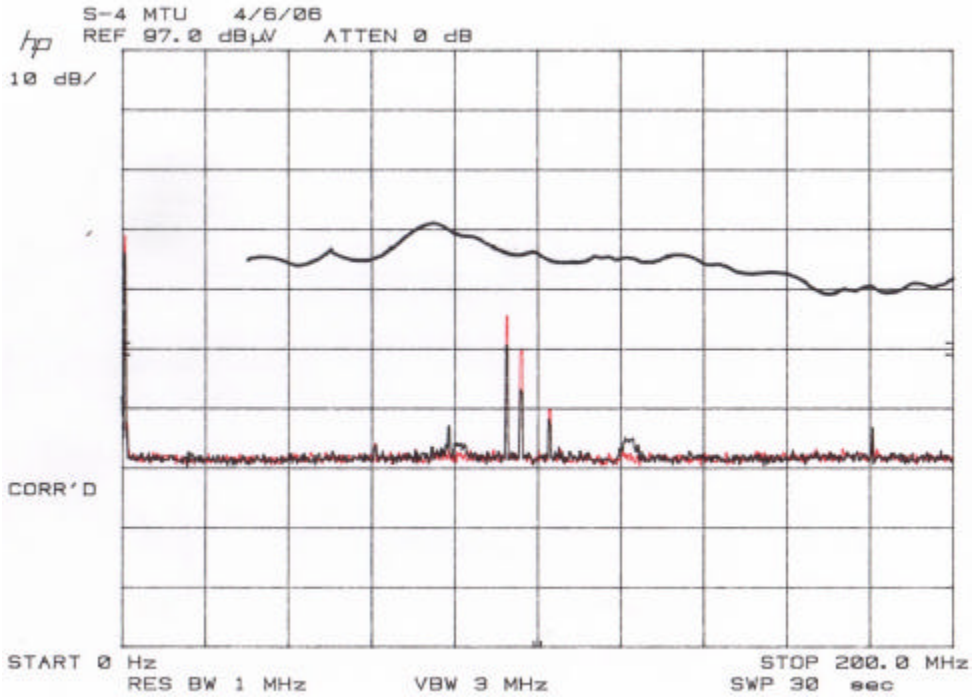
Black = Hot Line
Red = Neutral Line

Fig. 3
MODEL 9845 CONDUCTED EMISSIONS
5.0 MHz – 30 MHz



CISPR22
Class A Limit

Transceiver w/Meter Circuits Powered

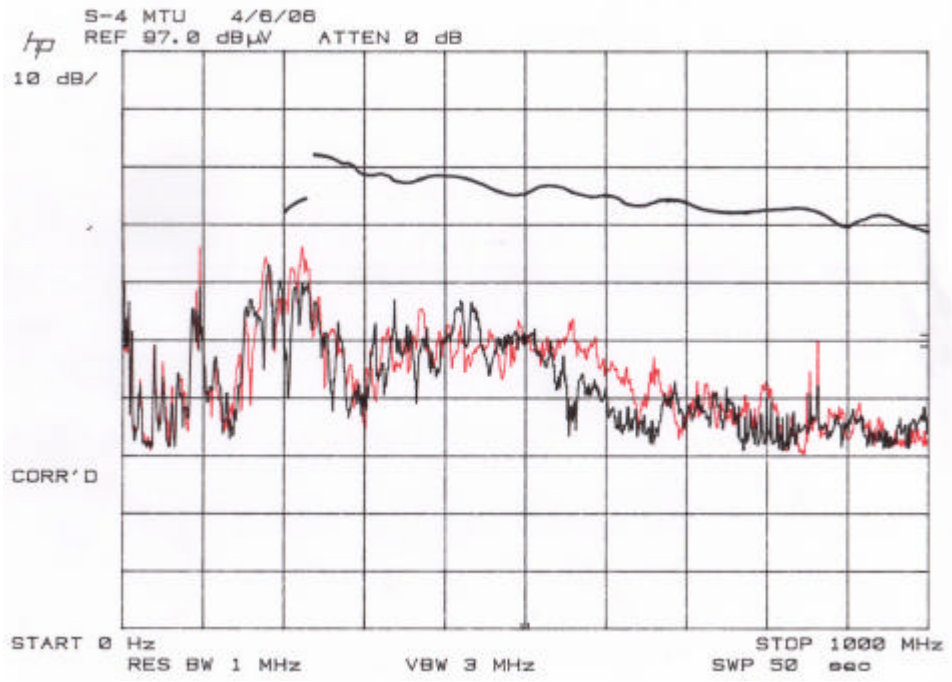


CISPR22
Class B Limit

Transceiver Only

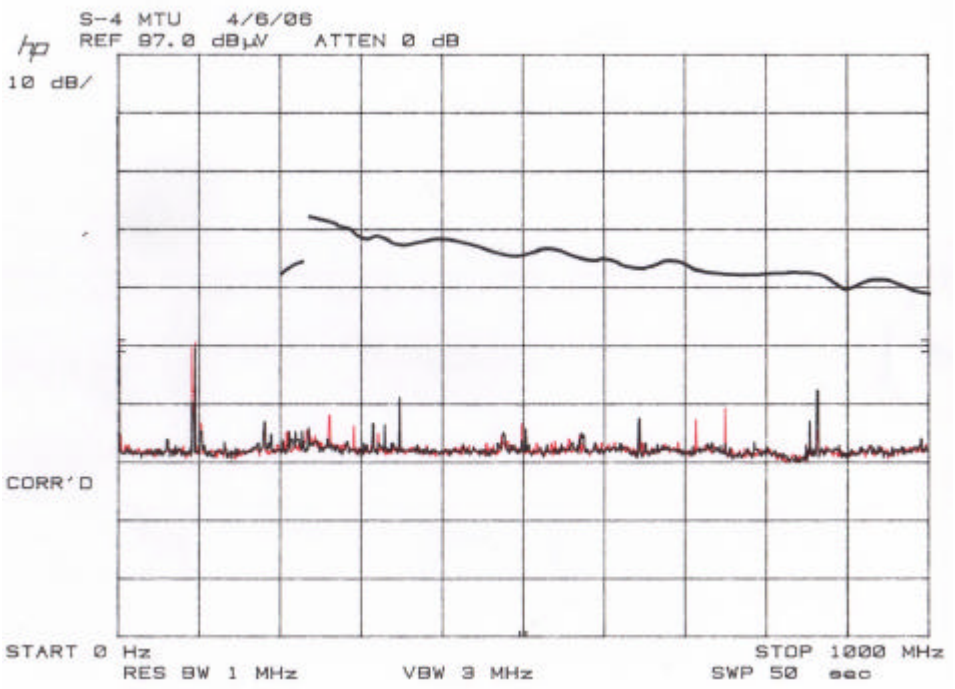
Black = Horizontal
Red = Vertical

Fig. 4
Model 9845 RADIATED EMISSIONS
30 MHz – 200 MHz



CISPR22
Class A Limit

Transceiver w/Meter Circuits Powered



CISPR22
Class B Limit

Transceiver Only

Black = Horizontal
Red = Vertical

Fig. 5
MODEL 9845 RADIATED EMISSIONS
200 MHz – 1000 MHz

TABLE 1
MODEL 9845 RECEIVER EMISSIONS

Freq. GHz	Measured Value dBuV	AF dB	Coax dB	Field Strength @0.25 m dBuV	Field Strength @0.25 m uV	FS @ 3m uV	Limit @ 3m uV
.457693	≤13.4	17.1	1.1	≤31.6	≤38	≤3	200
.915386	≤10.9	23.1	3.5	≤37.5	≤75	≤6	200
1.83077	26.3	27.5	1.1	54.9	556	46	500
3.66154	22.7	32.8	1.6	57.1	716	60	500
5.49233	≤13.2	36.2	2.1	≤51.5	≤375	≤31	500
7.32308	23.6	37.2	2.5	63.3	1462	122	500
9.15386	≤18.6	38.5	2.9	≤60.0	≤1000	≤83	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 9845 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 9845
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