



1.0 PURPOSE

This test report applies to the Securiton GCS GmbH (GCS) PROXI ESCORTE Data Acquisition Unit (DAU) and its Transmission Data Unit (TDU). (See Fig. 1.) The device has a wide range of applications but is initially intended to replace the mechanical clock/key system currently used by security guards on their rounds. Rather than a bulky heavy clock, the guard would pass the battery-operated DAU across an encoded ferro-magnetic data strip or a transponder TAG. The code number on the strip and the time would be loaded into the DAU. Once the guard has completed making rounds the DAU memory can be downloaded into a computer via the line-powered TDU.

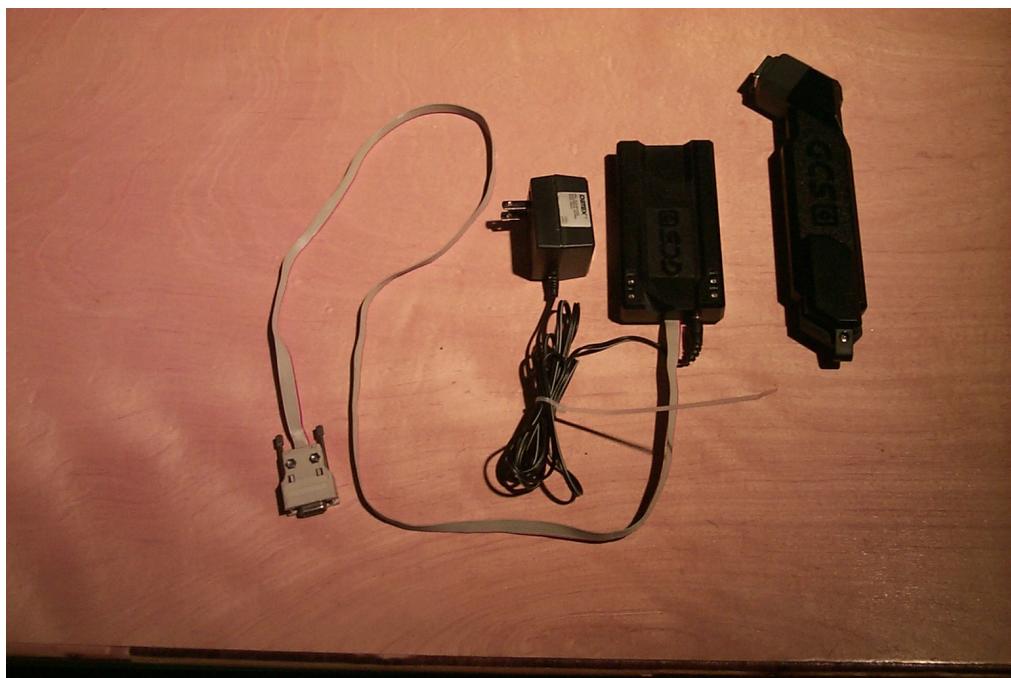


Figure 1

The purpose of this electromagnetic compatibility (EMC) Test Report is to give the FCC information on the radiated emission profile of the data acquisition unit as required for *47 CFR Ch. I (10-1-97 Edition) Part 15-Radio Frequency Devices, Subpart C-Intentional Radiators and Subpart B-Unintentional Radiators*. For sake of brevity, this standard will be referred to as FCC Part 15.

The data acquisition unit is an intentional radiator designed to operate at 125KHz. It emits a weak RF field to activate the transponder. Obviously, it is a Subpart C device. Since the TDU/data acquisition units contain microprocessors (operating at 6MHz) and the TDU can be part of a distributed network, it is a computer peripheral and is subject to Subpart B levels also.

FCC Part 15 testing is performed using the techniques and practices described in the *"American National Standard for Methods of Measurement of Radio Noise Emission from Low-Voltage*



Electrical and Electronic Equipment in the Range of 9KHz to 40GHZ, ANSIC63.4-1992. The target emissions levels are set using criterion set in FCC Part 15.

The data acquisition unit is powered by batteries therefore no conducted emissions testing was necessary for the unit itself. However the TDU is a line-powered device designed to operate only in conjunction with the DAU. Conducted emissions testing in this configuration was necessary.

2.0 EQUIPMENT

2.1 GCS Supplied Equipment

All tests described below were carried out on a system comprised of standard production units. The equipment defined below was available solely for the purposes of EMC testing during the test program.

Description
ProxiEscorte Data Acquisition Unit,
TAGS transponders
Transmission Data Unit

In addition to the above, Securiton supplied software and a notebook computer that continually exercised the hardware via a fiber-optic link in order to maximize emissions. They also supplied an unpotted version of the device allowing disassembly. Photos of this particular unit are to be included with the FCC Form 731 submittal.

**2.2 EMCA Test Equipment**

Name and Model Number	Serial Number	Calibrated	Next Calibration
Hewlett-Packard HP8546A Receiver	3520A00237 3448A00238	13 Oct. 1998	13 Oct. 1999
EMCO 3810/2 EMCO Passive Monopole 3303 Antenna 10KHz-30MHz	9903-304	22 Mar. 1999	22 Mar. 2000
EMCO Biconilog 3142 Antenna 30MHz-1GHz	9706-1104	17 Feb. 1999	17 Feb. 2000
Transformer/Adapter U.S. 110Vac to European 220Vac	N/A	N/A	N/A
3M Semi-anechoic Chamber and Associated H/W (turntable, antenna mast, etc.)	N/A	N/A	N/A
EMCO 3810/2 Line Impedance Stabilization Network	1823	May 25, 1999	May 25, 2000
EMCO 2075 Minimast	9707-2061	N/A	N/A



EMCO 2090 Multi-Device Controller	9704-1231	N/A	N/A
Pentium-based PC system	N/A	N/A	N/A
EMCA Radiated Emissions S/W Ver. 7.33	N/A	N/A	N/A

3.0 PROCEDURE and RESULTS

3.1 Equipment Configuration

The dates of the testing were June 1 & 2, 1999. Testing was done in the semi-anechoic chamber, the shield room and the 10m Open Area Test Site (OATS). At all sites, the data acquisition unit was placed on a wooden (non-conductive) table, 80cm high. On the emissions sites, the table was placed on a turntable.

The equipment was arranged in the manner recommended in Fig 9(c) *Test Configuration Tabletop Equipment Radiated Emissions* of ANSI C63.4-1992.



Figure 2

Figure 2 shows the test setup. The DAU only fits one way on TDU. The transmit data unit was connected via an orange fiber-optic line to a computer located outside the semianechoic chamber.

Figure 3 shows the data acquisition unit when it was tested by itself in TAG mode. The antenna is a biconilog good for the range 26MHz-2000MHz. The DAU head was held less than 1" from the TAG and the button depressed. The TAG was removed but device continued to transmit as evidenced by a "ticking" sound and flashing LEDs. A signal could be seen at the display by holding the data acquisition unit close (<2 ft.) to the monopole antenna.



Figure 3

3.2 Environment

The temperature/humidity in the semianechoic chamber and the shield room was as follows:

Temperature	20°C
Humidity	30%

The temperature/humidity on the OATS was as follows:

Temperature	24°C
Relative Humidity	54

3.3 Radiated Emissions

3.3.1 Preliminary Scan

Figure 4 shows the frequency range and the limit line determined from the device transmitting and clock frequencies as determined by review of Part 15.

The limits were set for 3m. The test was computer driven/monitored. For prescans, the antenna was set at 1m, the turn table was rotated in 90° increments. The antenna was then raised to a height of 2m and the turntable was rotated in 90° increments. This was repeated for 3m and 4m. Initial sweeps were done with the antenna in vertical then horizontal



polarity. The maximum peak value for each frequency was stored in computer memory and graphed.

Composite Limit for Intentional Radiator with Integrated Class A Digital Controller
(FCC Part 15 Subpart C, 15.209; Subpart B, 15.109, Subpart A, 15.33)

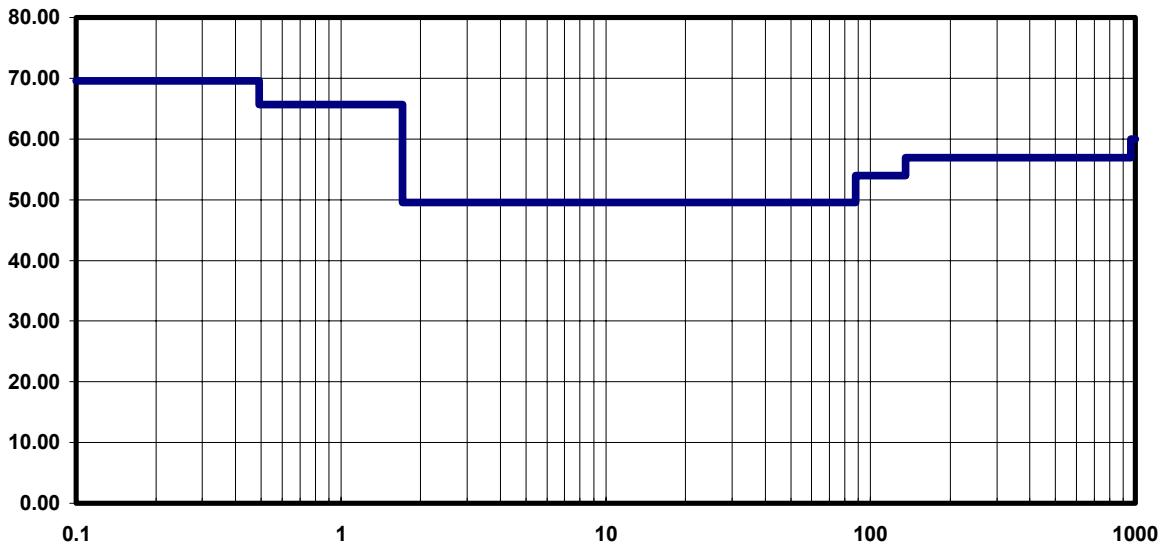


Figure 4

All initial scanning was done in the semi-anechoic chamber. During the initial scans, the exact frequencies emitted by the EUT were identified. Initial scans used the Peak Detector. Any frequencies within 10dBuV of the limit line were identified. All radiated emissions measurements below 30MHz were made with a calibrated monopole (rod) antenna (EMCO 3303). Above 30MHz, emissions measurements were made with the bilog antenna (EMCO 3142).

Figure 5 shows the initial scan made with the TDU and DAU working together. Both antenna horizontal and vertical polarities were included in the same graph. The scan was paused at 30MHz while the antennas were swapped. It is understood the FCC **does not** recognize semi-anechoic data below 30MHz. However, in order to distinguish between ambient noise at the OATS and the emissions from the EUT, this step was necessary.

Note the radiated emissions of the unit transmissions were well within the limits below 30MHz. This bode well for the quasi-peak measurements made on the OATS.

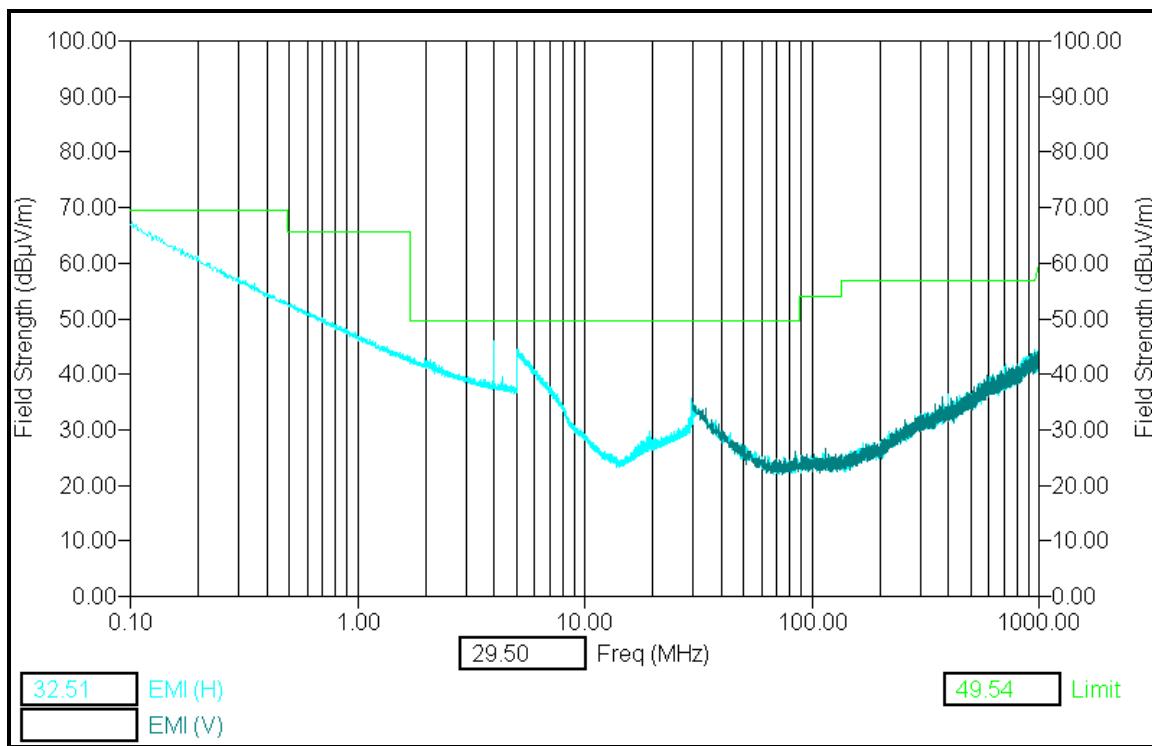


Figure 5

The next scan was made with the DAU *only* operating in the TAG mode. Figure 6 shows the horizontal/vertical peak data. Please note there is no difference between the two scans.

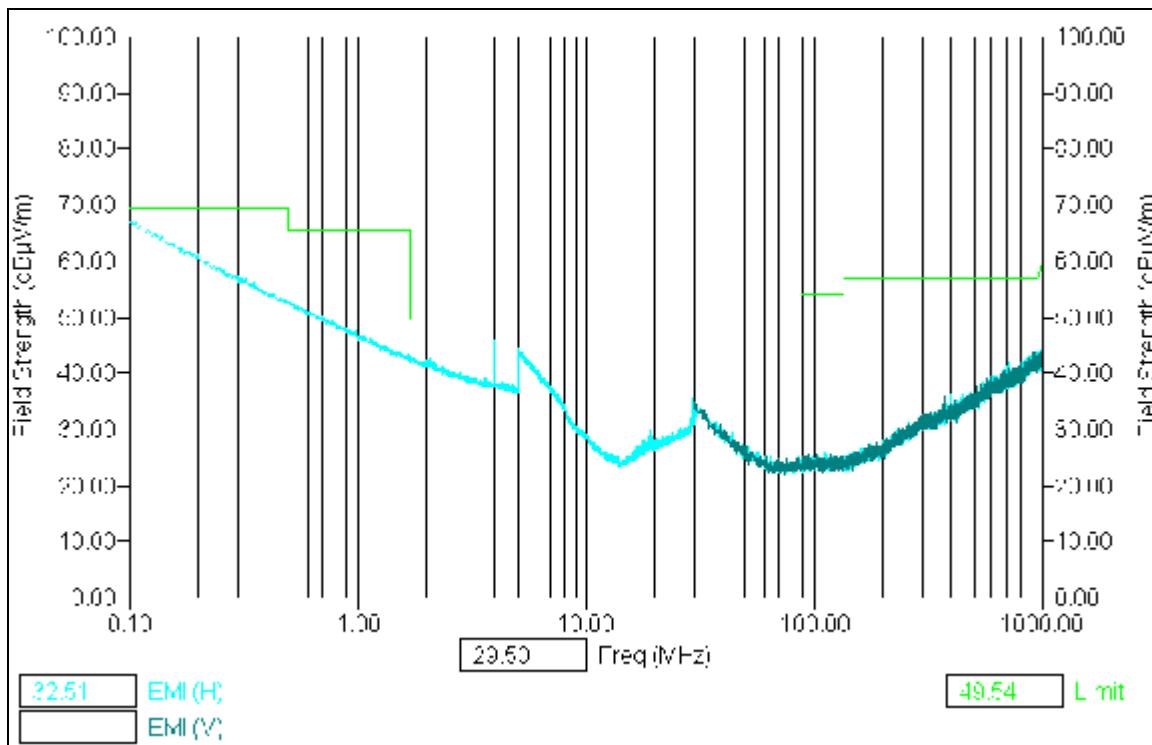


Figure 6

3.3.2 Final Radiated Emissions Scan

Final scans were run differently from the prescans. These are the frequencies to be investigated using the quasi-peak detector.

Once a frequency has been identified, testing begins. The antenna is set initially at a height of 2m. The operating EUT is rotated/scanned continuously for 360°. The turntable rotates back to the angular position of maximum emissions. The antenna was lowered to 1m then raised to a height of 4m. Scanning continued while the antenna height was adjusted. Once the scan was complete, the antenna was returned to the height of maximum emissions and the quasi-peak measurement completed.

For the frequency range of 30MHz-1000MHz, no quasi-peak data collected. The emissions were significantly below the limit line. However further testing was necessary on the Open Area Test Site (OATS).

The hardware was moved outside for OATS testing. Figure 7 shows the test setup. Data was taken in both modes of operation. The antenna was set at a distance of 3m from the EUT.

The results for both runs is shown:



Freq (MHz)	Freq (Max) (MHz)	(QP) Trace (dB μ V)	(QP) EMI (dB μ V/m)	Limit (dB μ V/m)	(QP) Margin (dB)
4.00	4.00	16.33	41.92	49.54	-7.62
5.00	5.00	-7.48	17.51	49.54	-32.03
5.00	5.00	-7.55	34.44	49.54	-15.10

Q.P. data was taken twice because of the range switch on the monopole. The first range went from 0.001-5MHz and the second range went from 5-30MHz.

The radiated emissions measured were well within the established limits.



Figure 7

3.3.3 Harmonics

Specific measurements were also taken of key operating frequencies and their harmonics. They are as follows:

80C154 Clock Frequency: 6MHz
Carrier Frequency of DAU: 125KHz
DAU-DTU: 600KHz
DTU-DAU: 800KHz

First the clock frequency:



Frequency [kHz]	EMI Horizontal [dBuV/m]	EMI Vertical [dBuV/m]	EMI Limit [dBuV/m]	Horizontal Margin [dBuV/m]	Vertical Margin [dBuV/m]
6.00	40.16	*	49.54	-9.38	*
12.00	25.47	*	49.54	-24.07	*
18.00	26.33	*	49.54	-23.21	*
24.00	28.61	*	49.54	-20.93	*
30.00	33.44	33.58	49.54	-16.10	-15.96
36.00	29.41	29.81	49.54	-20.13	-19.73
42.00	28.20	27.76	49.54	-21.34	-21.78
48.00	25.21	25.92	49.54	-24.33	-23.62
54.00	25.43	26.03	49.54	-24.11	-23.51
60.00	23.90	23.83	49.54	-25.64	-25.71
66.00	22.67	23.25	49.54	-26.87	-26.29

* monopole only has one polarity

Next the intentional radiating frequency of 125KHz and it's harmonics:

Frequency [kHz]	EMI Horizontal [dBuV/m]	EMI Vertical [dBuV/m]	EMI Limit [dBuV/m]	Horizontal Margin [dBuV/m]	Vertical Margin [dBuV/m]
125.00	64.20	*	69.54	-5.34	*
250.00	58.09	*	69.54	-11.45	*
375.00	54.67	*	69.54	-14.87	*
500.00	52.13	*	65.66	-13.53	*
625.00	50.75	*	65.66	-14.91	*
750.00	48.82	*	65.66	-16.84	*
875.00	47.88	*	65.66	-17.78	*
1000.00	46.85	*	65.66	-18.81	*
1125.00	45.67	*	65.66	-19.99	*
1250.00	44.51	*	65.66	-21.15	*
1375.00	44.00	*	65.66	-21.66	*

* monopole only has one polarity



For the DAU-DTU frequency of 600KHz and it's harmonics:

Frequency [kHz]	EMI Horizontal [dBuV/m]	EMI Vertical [dBuV/m]	EMI Limit [dBuV/m]	Horizontal Margin [dBuV/m]	Vertical Margin [dBuV/m]
600.00	50.62	*	65.66	-15.04	*
1200.00	44.82	*	65.66	-20.84	*
1800.00	42.17	*	49.54	-7.37	*
2400.00	40.47	*	49.54	-9.07	*
3000.00	38.70	*	49.54	-10.84	*
3600.00	37.94	*	49.54	-11.60	*
4200.00	37.16	*	49.54	-12.38	*
4800.00	36.83	*	49.54	-12.71	*
5400.00	42.52	*	49.54	-7.02	*
6000.00	40.16	*	49.54	-9.38	*
6600.00	38.25	*	49.54	-11.29	*

Finally the DTU-DAU frequency of 800KHz and it's harmonics:

Frequency [kHz]	EMI Horizontal [dBuV/m]	EMI Vertical [dBuV/m]	EMI Limit [dBuV/m]	Horizontal Margin [dBuV/m]	Vertical Margin [dBuV/m]
800.00	48.57	*	65.66	-17.09	*
1600.00	43.03	*	65.66	-22.63	*
2400.00	40.47	*	49.54	-9.07	*
3200.00	38.60	*	49.54	-10.94	*
4000.00	41.69	*	49.54	-7.85	*
4800.00	36.83	*	49.54	-12.71	*
5600.00	41.53	*	49.54	-8.01	*
6400.00	38.73	*	49.54	-10.81	*
7200.00	36.88	*	49.54	-12.66	*
8000.00	33.91	*	49.54	-15.63	*
8800.00	29.98	*	49.54	-19.56	*

* There is only one possible orientation for a monopole antenna

All peak data measurements of the harmonics were well below the quasi-peak limits.

3.4 Conducted Emissions (CFR47, Part 15.107(b))

It was necessary that conducted emissions be performed on the Transmit Data Unit (TDU). The unit only operates if a Data Acquisition Unit (DAU) is installed. Testing was performed in the shield room (see Fig.8).

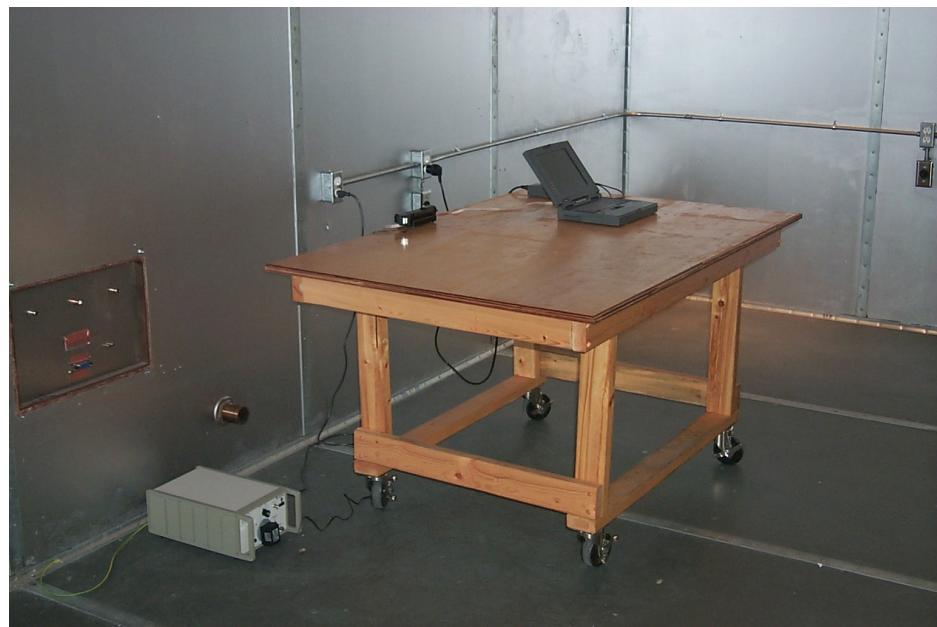


Figure 8

Per Part 15 requirements, testing was done from 450KHz to 30MHz. Data was taken on the voltage and neutral lines. The peak data is shown below in Figure 9. Please note the highest peak is 30dbuV below the limit line. No further testing was necessary.

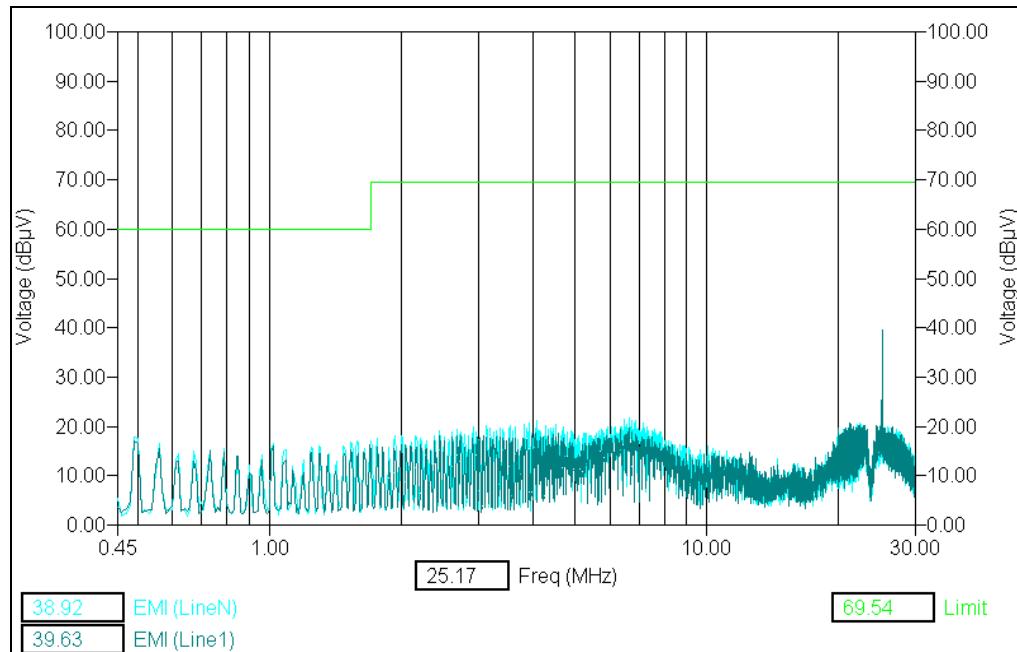


Figure 9

4.0 Conclusion

Based on the data obtained it is the opinion of this test facility the EUT tested is compliant to CFR47 Part 15. The test results should be submitted to the FCC for their review and opinion.

Test Performed By: _____

Orlando Perez
EMC Technician

Approved By: _____

Michael E. Hill
Manager Test Facility