1.0 PURPOSE

This test report applies to the American Innovations, Ltd. (AI) Wireless Optical Pulse Initiator (WOPI) (see Fig. 1). This is a reliable low-cost device that converts electric meter disk rotations into count output. The WOPI uses optical sensing to detect a non-reflective stripe on the meter disk and provides an RF transmission of counts for each for each rotation. The device is powered from the utility side of the meter.

The unit is designed to fit into most single-phase electromechanical watt-hour power meters manufactured in the last 25 years.

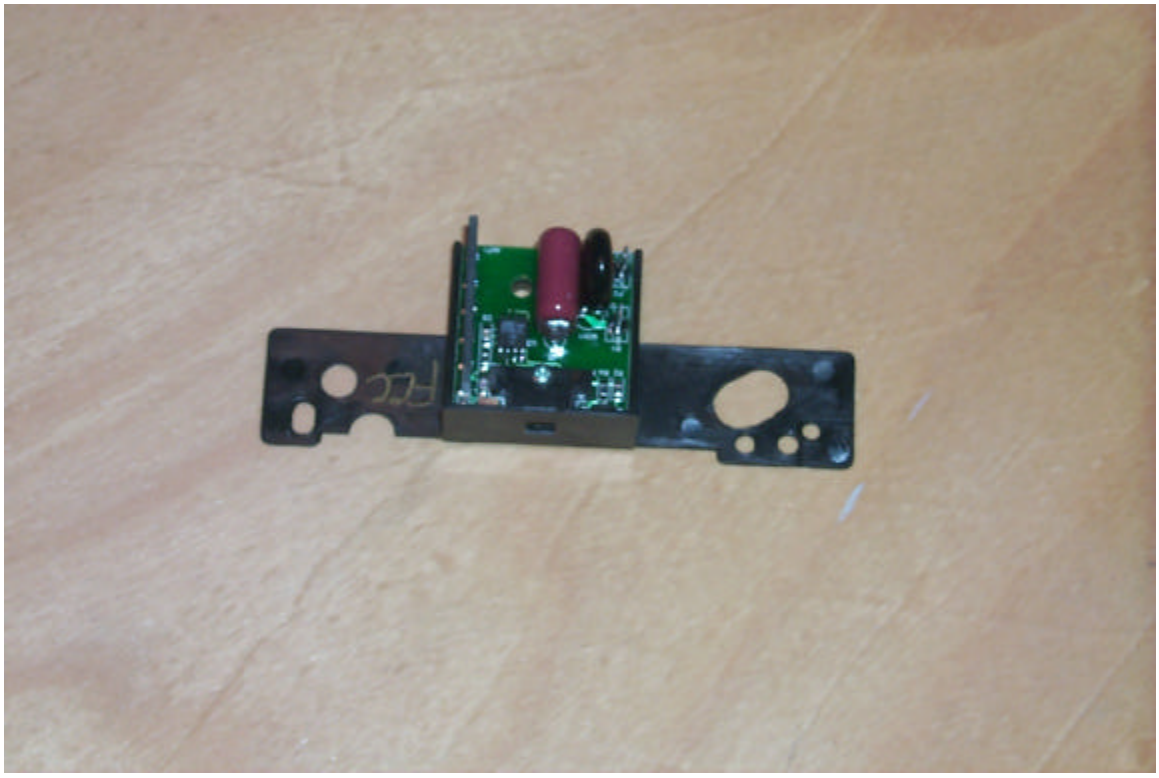

Figure 1

The purpose of this electromagnetic compatibility (EMC) Test Report is to give the FCC information on the radiated emission profile of the WOPI as required for *47 CFR 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 heart of this device is a RFM TX6000 Hybrid Transmitter. The operating frequency is 916.50MHz. It s designed for modulation types on-off keyed (OOK) and amplitude-shift keyed (ASK) modulation. It's maximum output power is 0.75mW. Therefore it is a CFR47, Part 15.249 device.

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. The target emissions levels are set using criterion set in FCC Part 15.

Since the WOPI is powered by the AC-line voltage, conducted emissions were necessary as well as the radiated measurements.

2.0 EQUIPMENT

2.1 AI 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	Serial Number
Wireless Optical Pulse Intiator	N/A
Landis & Gyr /Duncan, single-phase electromechanical watt-hour meter	N/A
Landis & Gyr power meter housing with load and 110/220 transformer	N/A

2.2 EMCA Test Equipment

Name and Model Number	Serial Number	Calibrated	Next Calibration
Hewlett-Packard HP8546A Receiver	3520A00237 3448A00238	11 Nov. 2000	11 Nov. 2001
EMCO Biconilog 3142 Antenna 30MHz-1GHz	9803-1251	15 Aug. 2000	15 Aug.2001
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 2075 Minimast (chamber)	9707-2061	N/A	N/A
EMCO 2090 Multi-Device Controller(chamber)	9704-1231	N/A	N/A
Pentium-based PC system	N/A	N/A	N/A
EMCA Emissions S/W Ver. 8.45	N/A	N/A	N/A

Shield Room	N/A	N/A	N/A
EMCO 3816/2 LISN	1115	11/2000	11/2001
EMCO 3816/2 LISN	9702-1283	11/2000	11/2001
Agilent E7405A EMC Analyzer	US40240226	11/2000	11/2001

3.0 PROCEDURE and RESULTS

3.1 Equipment Configuration

The dates of the testing were April 30th and May 11th,2001. Testing was done in the semi-anechoic chamber and the Shield Room. At both sites, the WOPI was installed in an electric power meter placed on a wooden (non-conductive) table, 80cm high. The table was placed on a turntable inside the chamber for radiated emissions.

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

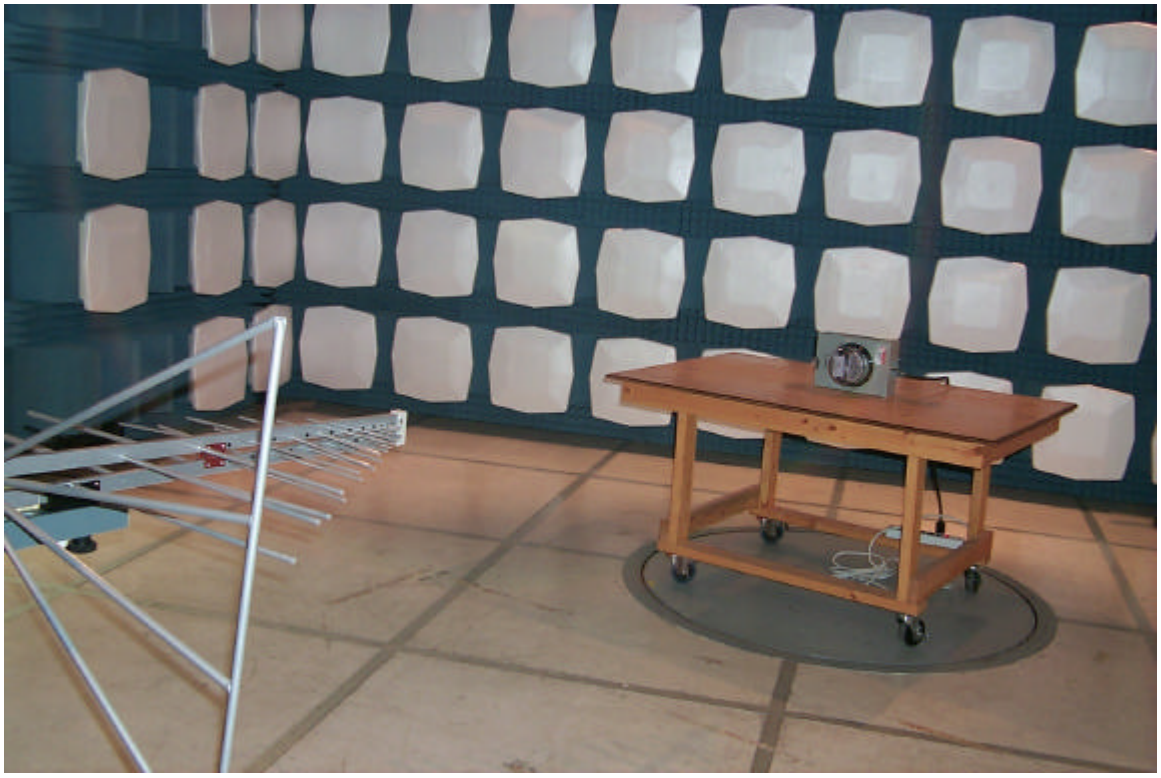

Figure 2

Figure 2 shows the test setup. When actual testing began, the power cable was wrapped non-inductively not coiled as seen in the photograph. Figure 3 shows the

WOPI installed in the meter. The WOPI was modified to allow continuous broadcasting. This was necessary because a continuous signal was necessary for emissions profile measurement.

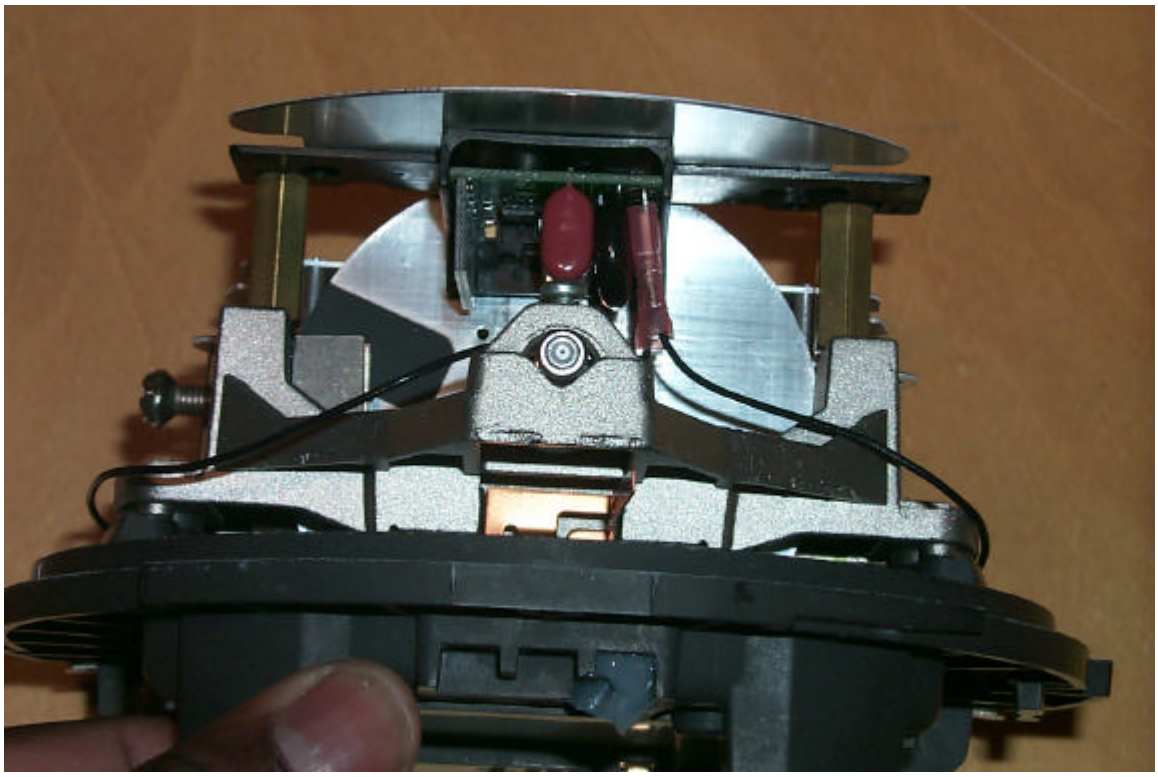

Figure 3

3.2 Environment

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

Temperature	20°C
Humidity	30%

3.3 Radiated Emissions

3.3.1 Preliminary Scan

During testing, the limit line was adjusted. All data was taken at a 3m distance in the semianechoic chamber.

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 3 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.

All 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. Radiated emissions measurements from 30-2000MHz, emissions measurements were made with the bilog antenna (EMCO 3142). Above 2000MHz, The EMCO 3115 horn antenna was used.

The first scan covered a frequency range of 30MHz to 2000MHz. This data was taken with the biconilog antenna in both vertical and horizontal polarities.

Figure 5 shows the horizontal/vertical peak data. Please note all emissions (measured in peak mode) from 30MHz–2000MHz, are below the Quasi-Peak limit line.

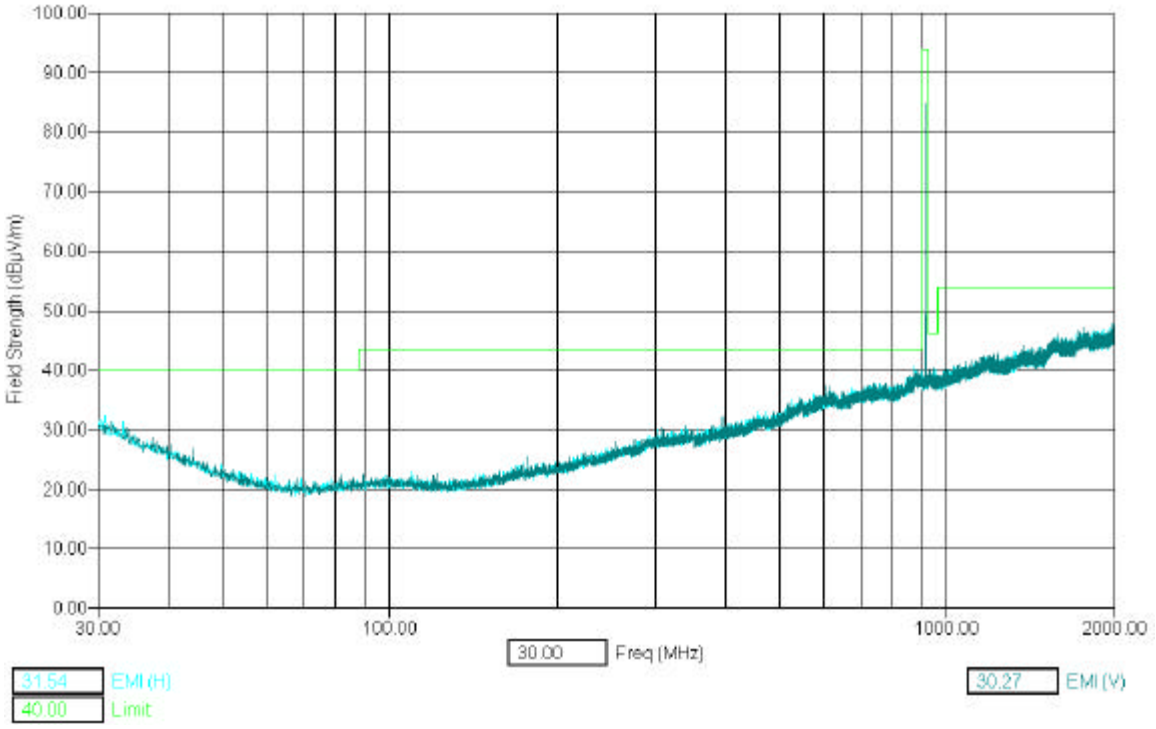

Figure 5

3.3.2 **Final Scan**

Final scans were run differently from the prescans. Peaks within 10dBuv of the limit were identified by the test S/W. 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 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.

Please note the preliminary scans indicated no points within 10dBuV of the limit. The emissions from 30MHz to 2000MHz are well within limits. No further effort in this frequency range was required.

3.3.3 **Harmonics**

Specific measurements were taken of the primary radiating frequency harmonics.

Next the intentional radiating frequency of 916.50MHz and it's harmonics:

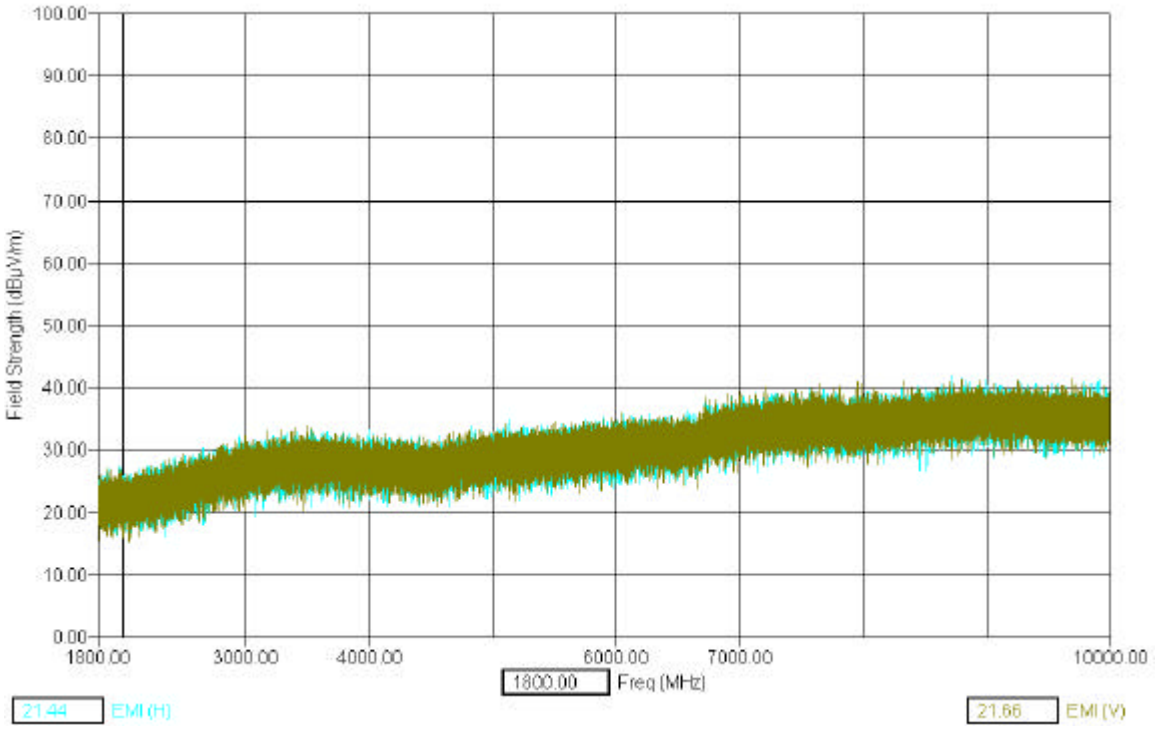

Figure 6

All peak data measurements of the harmonics were well below the quasi-peak limits. The limit for harmonics is 500 uV/m or 53.98 dBuV. We could detect no limits above the noise floor seen above.

3.3.4 Occupied Bandwidth

The WOPI is an OOP/ASK-modulated device operating at 916.50MHz. Occupied bandwidth measurements were made to demonstrate compliance with CFR47, Part 15.2249. This band is from 902-928MHz. The upper limit for this band is 50mV/m or 93dBuv/m. Outside of this band the limits are per CFR47, Part 15.209.

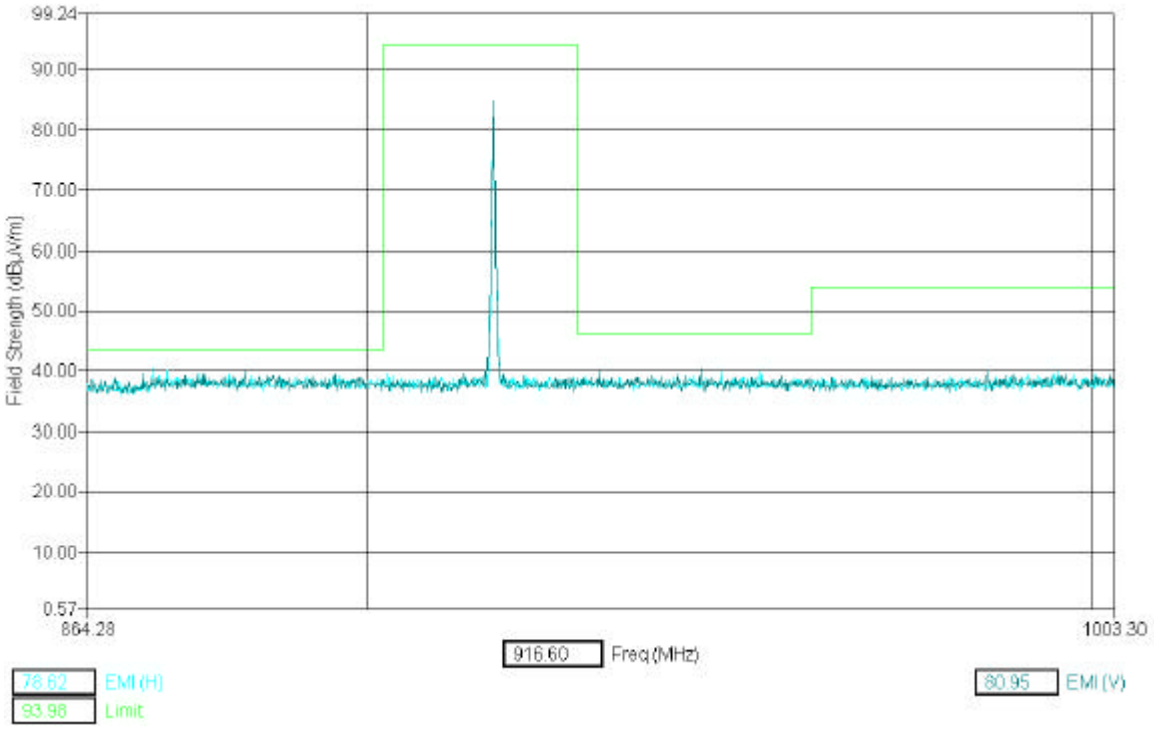

Figure 7

From Figure 7, it is obvious the signal fits neatly in the bandwidth in question.

3.4 Frequency Stability Data (CFR47 Part 15.249)

3.4.1 Power Variation

The base frequency of the badge reader was recorded as read off the receiver display. The supply voltage was 120Vac to the badge reader. The supply was raised to 138Vac or 115% of it's nominal value.

The transmit frequency of the badge reader was recorded:

Time	Frequency
Startup	916.60MHz
2 min.	916.60 MHz
5 min.	916.60 MHz
10 min.	916.60 MHz

The supply voltage was then turned down to 102Vac or 85% of it's value and the same data recorded:

Time	Frequency
Startup	916.60 MHz

2 min.	916.60 MHz
5 min.	916.60 MHz
10 min.	916.60 MHz

Varying the supply voltage had no effect.

3.4.2 Temperature

The EUT temperature was raised to 50°C and the transmit frequency recorded. The temperature of the badge reader was lowered to -20°C and the frequency recorded.

The first data set taken after the EUT temperature was raised to 50°C and maintained at that temperature for thirty minutes. At this time, data collection began.

Time	Frequency
Startup	916.60 MHz
2 min.	916.60 MHz
5 min.	916.60 MHz
10 min.	916.60 MHz

The EUT temperature was then lowered to -20°C and maintained at that frequency for thirty minutes. Data collection was repeated and is shown below:

Time	Frequency
Startup	916.60 MHz
2 min.	916.60 MHz
5 min.	916.60 MHz
10 min.	916.60 MHz

The base frequency was still at 916.60 MHz at both temperature extremes.

3.5 Conducted Emissions

Conducted emissions were performed in the Shield Room. The test setup was as shown in Figure 8. Before the actual test, the LISNs were moved behind the table per the ANSI standard.

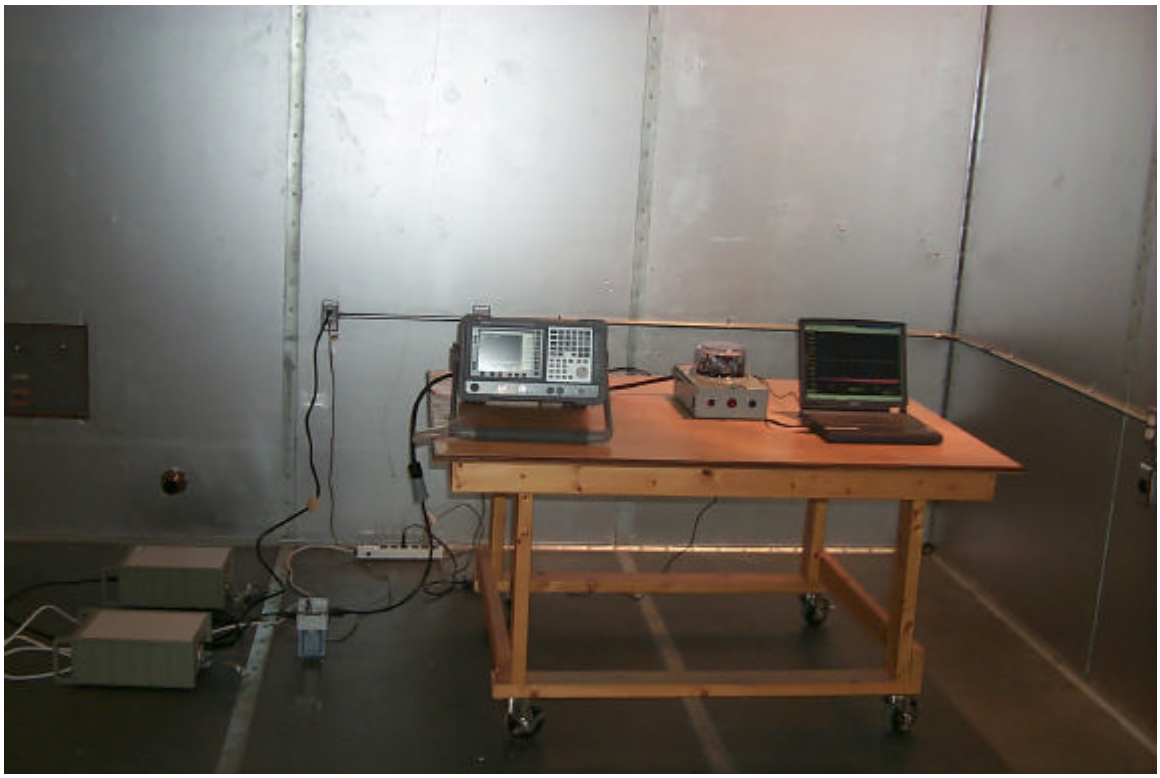

Figure 8

According to CFR47, Part 15.207, the conducted emissions shall be 250uV between 0.45-30MHz for an intentional radiator. Figure 9 shows the results of the conducted emissions test. 250 uV corresponds to a level of 47.95dBuV.

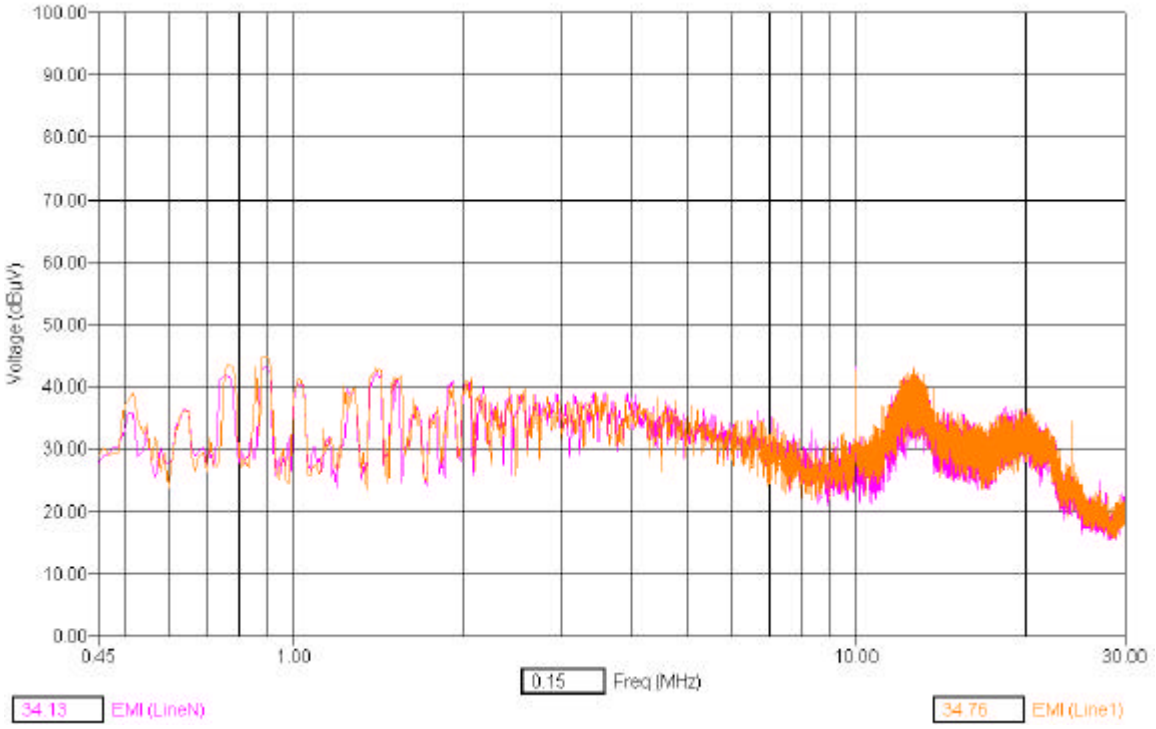

Figure 9

All conducted emissions were below the limits in this bandwidth. It was not necessary to use the quasi-peak detector.

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, NCE
Manager Test Facility