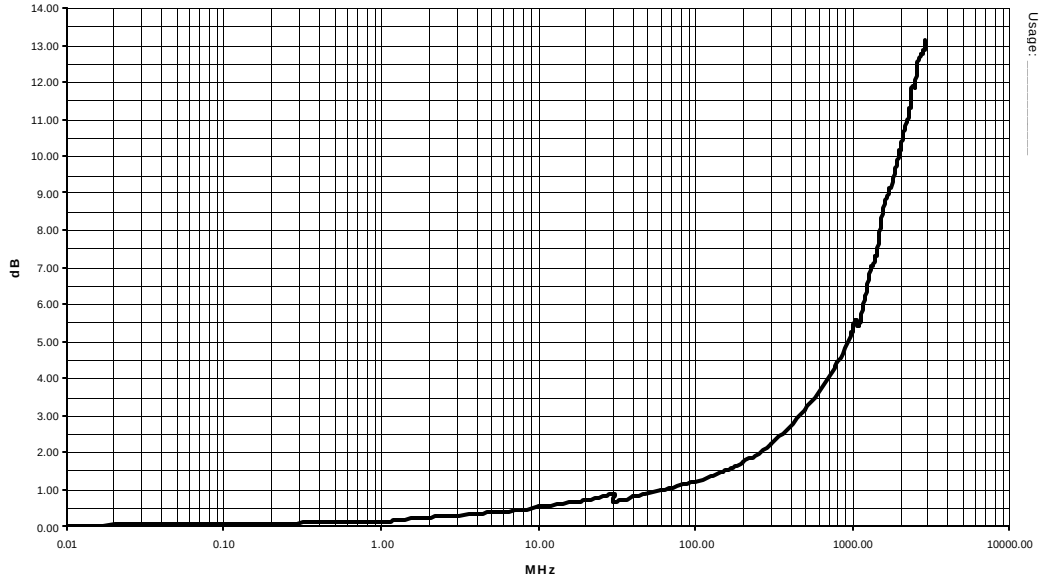
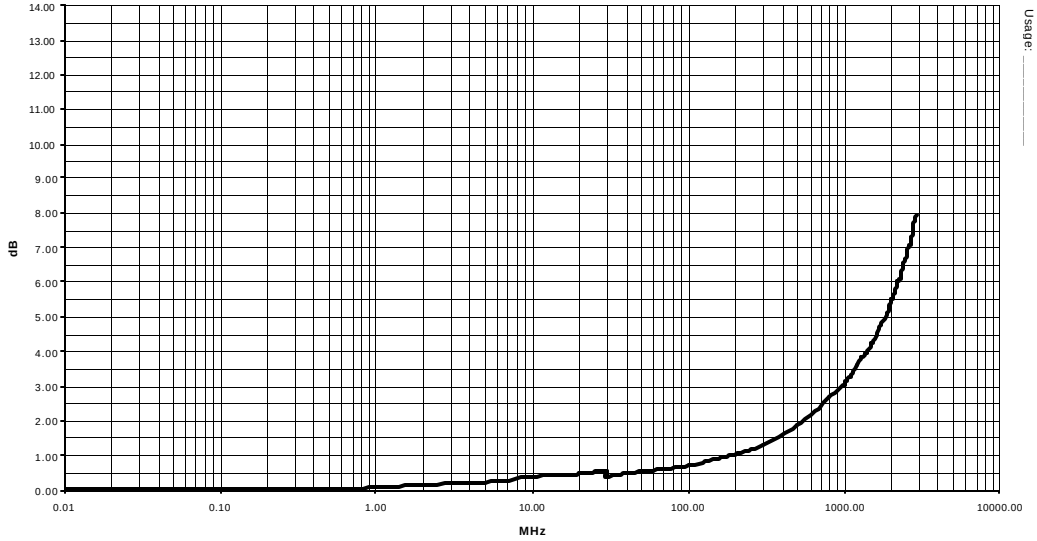
Cable loss plots

Line Conducted 150KHz through 30MHz, Coax #920809
Last Calibration date: February 23, 2007

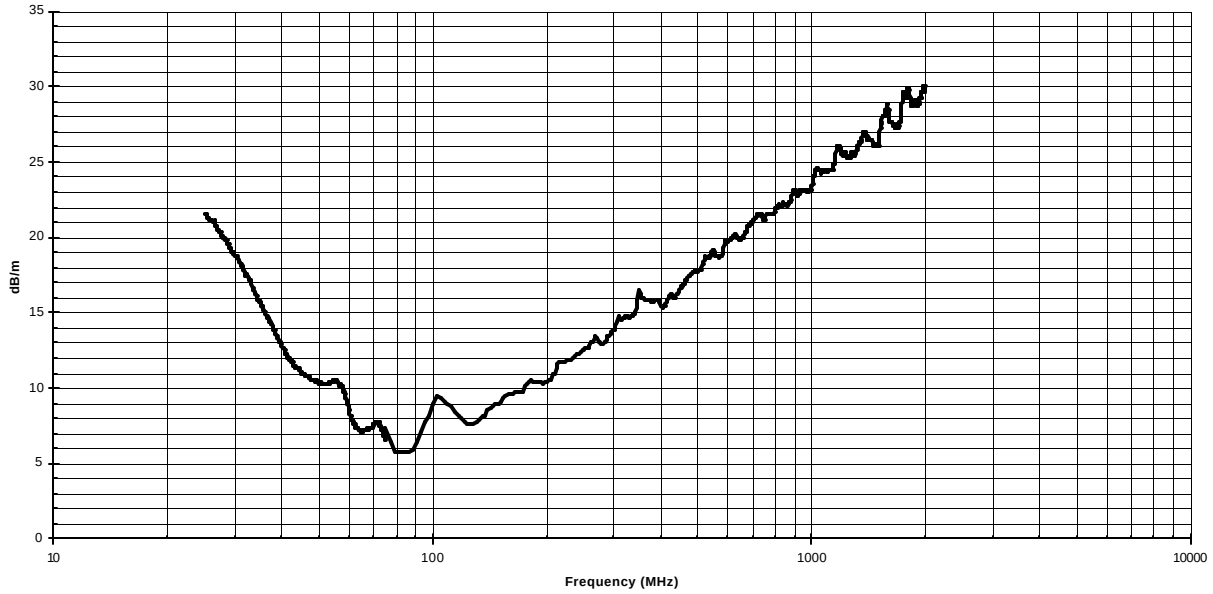


Radiated at 3 meters; 30MHz through 3000MHz, Coax #9812_11
Last Calibration date: May 8, 2007

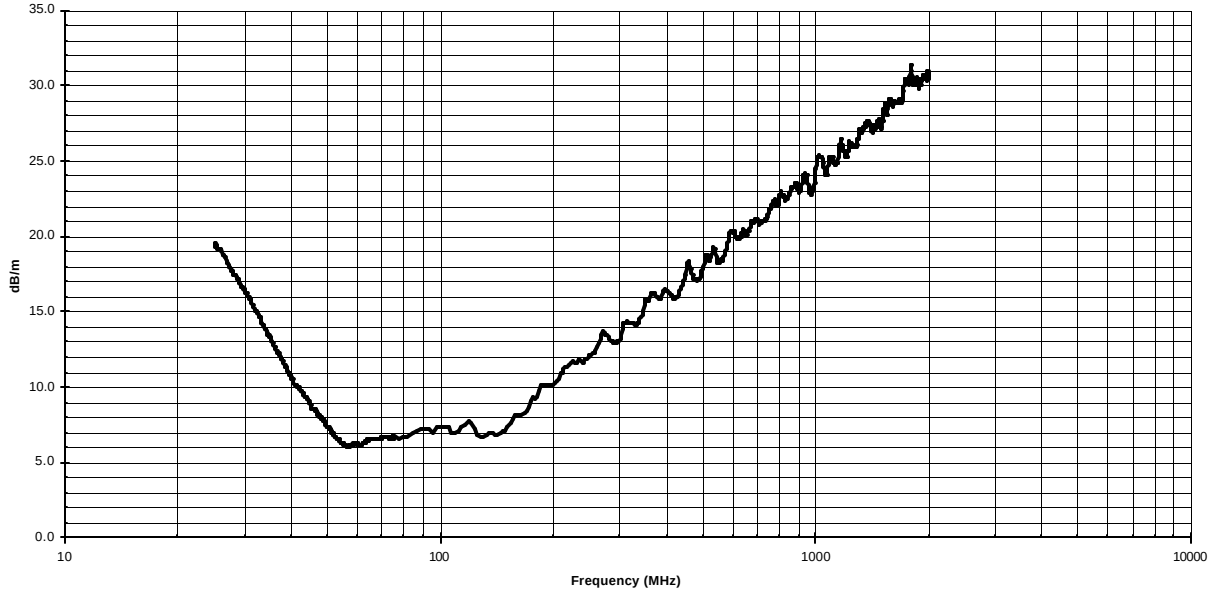


Antenna Factors

EMCO Model 3142 Antenna #1069
Last Calibration Date; August 30, 2007
3 Meter Distance Factors



10 Meter Distance Factors



5. UNITS OF MEASUREMENT

Measurement dimensions are according to ANSI C63.4-2003. However, an explanation of the units used for radiated emissions measurements at < 30 MHz is in order.

All radiated measurements below 30 MHz were taken with a loop antenna per ANSI C63.4 section 8.2.1. While 47 CFR Part 15 references ANSI C63.4 – 2003 for measurement methods, it does not stipulate explicitly which of the two antennas (dipole or loop) is to be used. Meaurements with a loop antenna are preferred, but 47 CFR Part 15.209 states the limits in units of dBuV/m.

For testing against emission limits, dBuA / m units of the loop antenna are translated into dBuV/m using calibrated transfer impedance values that are programmed into the spectrum analyzer.

Bandwidth and frequency stability measurements were done using units of dBuA / m.

6. LOCATION OF TEST FACILITY

All tests were completed at the facility for which NVLAP accreditation was attained. See appendix for accreditation document.

7. MEASUREMENT PROCEDURES

The setup pictures or descriptions in this report indicate the configurations for maximum emissions.

Line Conducted testing, performed in a shielded enclosure, and radiated testing, performed at the applicable distance of the 10 meter and 3 meter open field test sites, were both completed according to the procedures in FCC Part 15 with supporting instructions from ANSI C63.4 (2003).

The ITE host system included in the test was positioned per ANSI C63.4.

The EUT's antenna is a foil trace on a PCB that is arranged in a rectangular spiral pattern.

The EUT was setup up, via the PC software, for maximum output and, for the test, to transmit continuously. Upon detecting a badge placed nearby, a communication link was established which, via the serial I/O port, was displayed and continually updated on the CRT monitor.

The measurements of the fundamental, harmonics, and other spurious emissions were compared to the Quasi-Peak limit of section 47 CFR 15.209.

Mains Conducted Emission

This evaluation was completed before radiated emissions commenced.

The system was placed upon a 1 x 1.5 meter non-metallic table 80cm from the ground floor and 40cm from the vertical conducting plane in the prescribed setup per ANSI C63.4-2003, Figure 10(a). This table is housed in a shielded enclosure that contains filtered mains outlets, blocking conducted ambient emissions.

The mains power is nominally 120VAC, 60Hz.

Power to the EUT is supplied through the USB connection rather than a separate power supply or battery: it can only operate if connected to a PC with a USB port. Therefore, the PC (host unit) was connected to the LISN being monitored by the EMI Receiver. The monitor was connected to one of the filtered mains outlets in the shielded room.

The EUT was continuously exercised by software supplied by the manufacturer.

While monitoring the display of the EMI Receiver, via remote video monitor, the cables were manipulated to determine a position that maximized the emissions on the phase line and neutral line.

The configuration that created an emission closest to the limit was used during the course of taking final measurements. Pictures of this final configuration are recorded in this report.

Informative Annex H [(Section H.1 (b)] of C63.4-2003, suggests conducted emissions also be done on intentional radiators with detachable antennas removed and replaced by 50? dummy loads. This was completed and the data is provided in this report.

The principal settings of the EMI Receiver for line conducted testing include:

- ? Bandwidth = 9KHz
- ? Detector Function: scanning and signal search = Peak Detection Mode
  measurements = Quasi Peak Detection and Average Detection

Radiated Emissions

The system was placed upon a 1 x 1.5 meter non-metallic table 80cm above the open field site ground plane in the prescribed setup per ANSI C63.4, Figure 11a.

The table sits upon a remote controlled turntable. The receiving antenna, located at the appropriate standards distance of 3 or 10 meters from the table center, is also remote controlled.

The principle settings of the EMI Receiver for radiated testing include:

IF Bandwidth: 9KHz for frequencies less than 30MHz.
120KHz for frequencies less than 1GHz.
1 MHz for frequencies greater than 1GHz.
Detector Function: Quasi-Peak

Table 3. Antenna types used

Freq. = 30 MHz	Broadband loop antenna.
30 MHz = freq. = 1000 MHz	BiconiLog broadband antenna

During the evaluation the EUT was transmitting and receiving continuously.

The loop antenna was positioned 3 meters from the turntable and 1 meter above the Open Area Test Site ground plane. The turntable was rotated 360 degrees for three different orientations of the EUT while the loop receiving antenna remained fixed.

Above 30MHz, the USB cable, turntable angle move through 360 deg., and the biconical receiving antenna height was varied from 1 to 4 meters to uncover the highest emissions. The procedure was repeated for vertical and horizontal receive antenna polarizations.

8. MEASUREMENT DATA

A.C. Mains Conducted Emissions data

The test conditions required and executed in this evaluation are listed below.

Through "incorporation by reference", CFR 47 Part 15.31 (Measurement Standards) invokes ANSI C63.4-2003 in several instances.

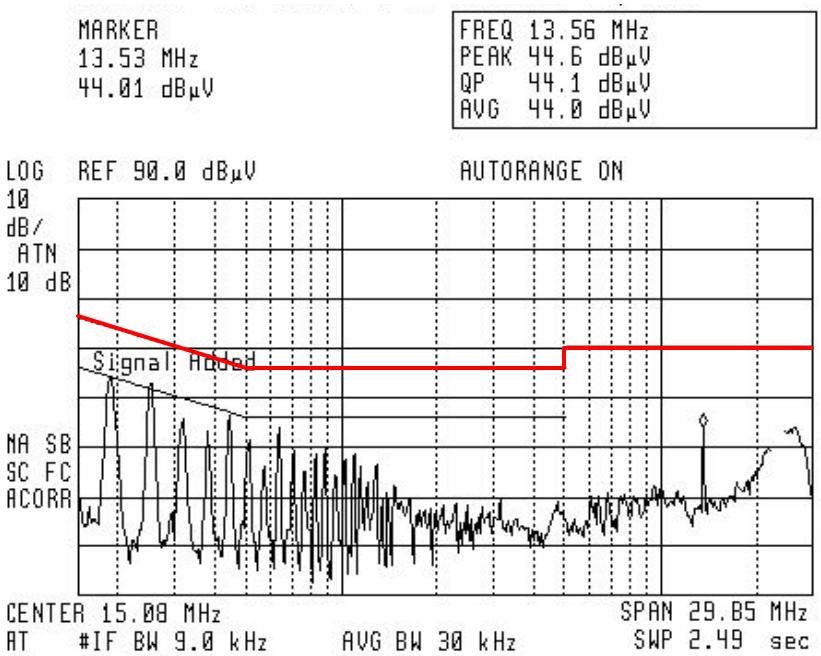
Measurement standards used

Table 4. Referenced standard by condition

Condition	Reference to standard
Full power, phase and neutral with detachable antenna replaced with a dummy load (exploratory scan)	CFR 47 Part 15.207 ANSI C63.4, Section 13.1.3.1
Full power, phase and neutral, antenna attached.	CFR 47 Part 15.207 ANSI C63.4, Section 13.1.3.2

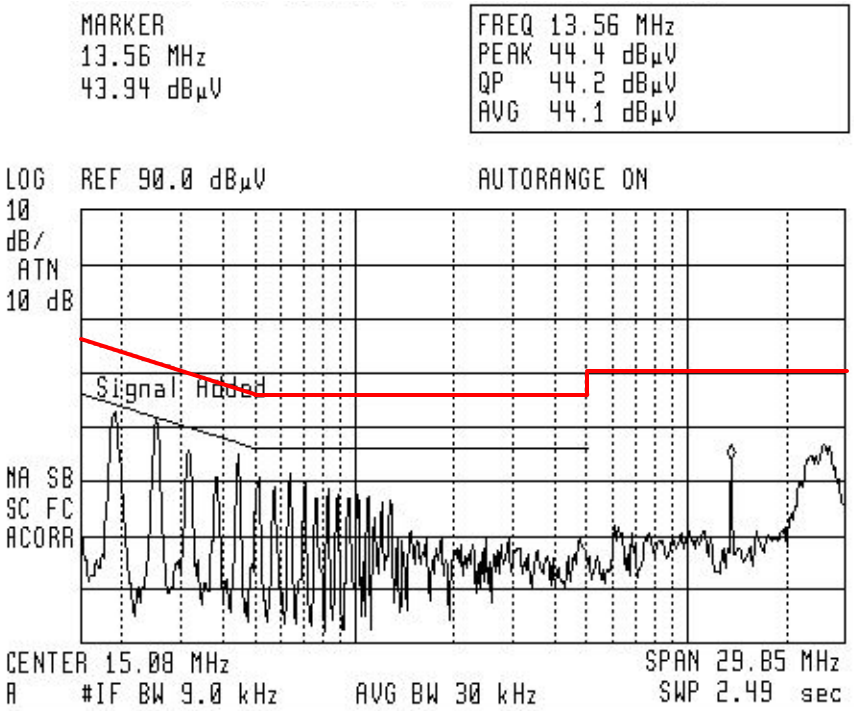
Tables and plots

Phase-to-Ground Measurement
Peak Value Plot at Full Power
Antenna replaced with 50? "dummy load"
(Limit lines represent quasi-peak values)



Frequency	dBuV Reading		FCC Subpart C Limit (Intentional radiators)		dB Margin	
MHz	QP	Avg	QP	Avg	QP	Avg
13.56	44.1	44	60.0	50.00	-15.9	-6

Neutral-to-Ground Measurement
Peak Value Plot at Full Power
Antenna replaced with 50? "dummy load"
(Limit lines represent quasi-peak values)



Frequency	dBuV Reading		FCC Subpart C Limit (Intentional radiators) dBuV		dB Margin	
MHz	QP	Avg	QP	Avg	QP	Avg
13.56	44.2	44.1	60.0	50.00	-15.8	-5.9

Phase-to-Ground Measurement
Peak Value Plot at Full Power
Detachable antenna installed
(Limit lines represent quasi-peak values)

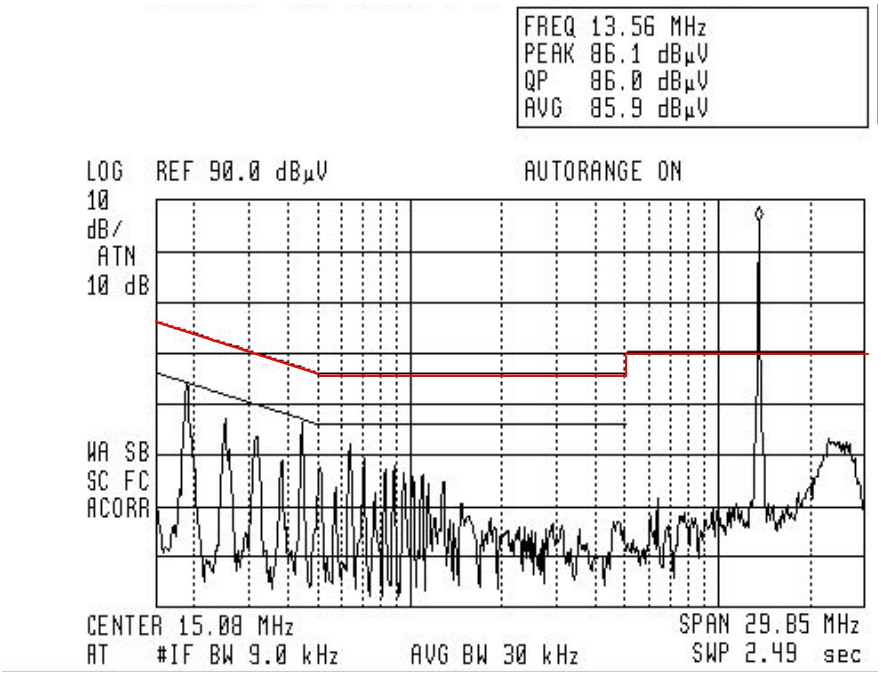


Table 5. Quasi-peak/average measurements: phase

Frequency	dBuV Reading		FCC Subpart C Limit (Intentional radiators) dBuV		dB Margin	
MHz	QP	Avg	QP	Avg	QP	Avg
13.56	86.0	85.9	60.0	50.00	See Fundamental frequency limits	
0.19	52.9	48.5	64.32	54.32	-11.4	-5.8
0.25	51.0	46.0	62.02	52.02	-11.0	-6.0
0.32	45.0	41.0	59.88	49.88	-14.9	-8.9
0.45	45.0	42.0	56.92	46.92	-11.9	-4.9
23.7	40.8	30.8	60.00	50.00	-19.2	-19.2

Only five spurious emissions were found to be within 20 dB of the limit on the mains phase input.

Neutral-to-Ground Measurement
Peak Value Plot at Full Power
Detachable antenna installed
(Limit lines represent quasi-peak values)

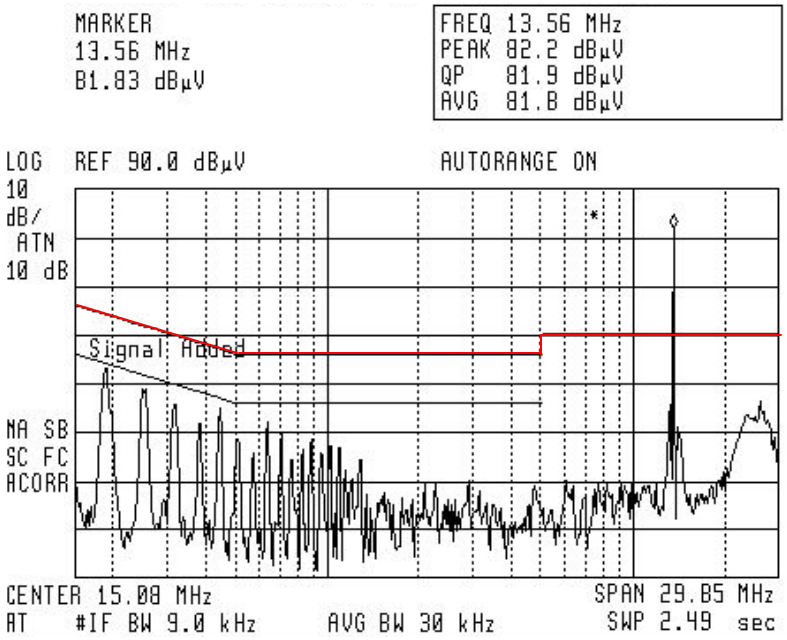


Table 6. Quasi-peak/average measurements: neutral

Frequency	dBuV Reading		FCC Subpart C Limit (Intentional radiators) dBuV		dB Margin	
MHz	QP	Avg	QP	Avg	QP	Avg
13.56	81.9	81.8	60.0	50.00	See Fundamental frequency limits	
0.19	52.3	47.6	64.32	54.32	-12.0	-6.7
0.25	51.2	46.0	62.02	52.02	-10.8	-6.0
0.30	44.0	40.0	60.43	50.43	-16.4	-10.4
0.40	44.0	42.0	57.94	47.94	-13.9	-5.9
26.5	43.0	33.0	60.00	50.00	-17.0	-17.0

Only five frequencies were found to be within 20 dB of the limit for the neutral**.**

Outside of the fundamental, the conducted emissions are contributed primarily by the host computer. See Appendix A for copies of the plots of the host system used.