

ATMI Packaging Inc.

Application
For Certification
4 Channel RFID PCI Reader Board

(FCC ID: Q25NOWTrakI)

June 16, 2003



CERT NO: 1427.01

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1.0 GENERAL DESCRIPTION

1.1 Related Submittals Grants

This is single application of the *4 Channel RFID PCI Reader Board*; for Certification under Part 15 Subpart C.

There are no other simultaneous applications.

1.2 Product Description

The *4 Channel RFID PCI Reader Board* is operating at 13.56 MHz. The intended use of the *4 Channel RFID PCI Reader Board* is to generate and transmit a RF signal to Read RFID TAG.

The *4 Channel RFID PCI Reader Board* powered via host computer. The host computer operated at 120 VAC, 60 Hz.

The *4 Channel RFID PCI Reader Board* has four antenna RF ports.

1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-1992. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on March 2003 submitted to FCC. Please reference the site registration number: 90706, dated April 18, 2003.

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

N/A

2.2 EUT Exercising Software

Power PC Firmware over Windows 2000.

2.3 Special Accessories

There are no special accessories necessary for compliance of these products.

2.4 Equipment Modification

No modifications were installed during the testing.

2.5 Support Equipment List and Description

1x14.1 TFT Monitor

COMPAQ Mouse, P/N: 141189-401

Keytronic Keyboard, s/n: CO13900062

Advantech Host Computer, Model: IPC-610BP-00

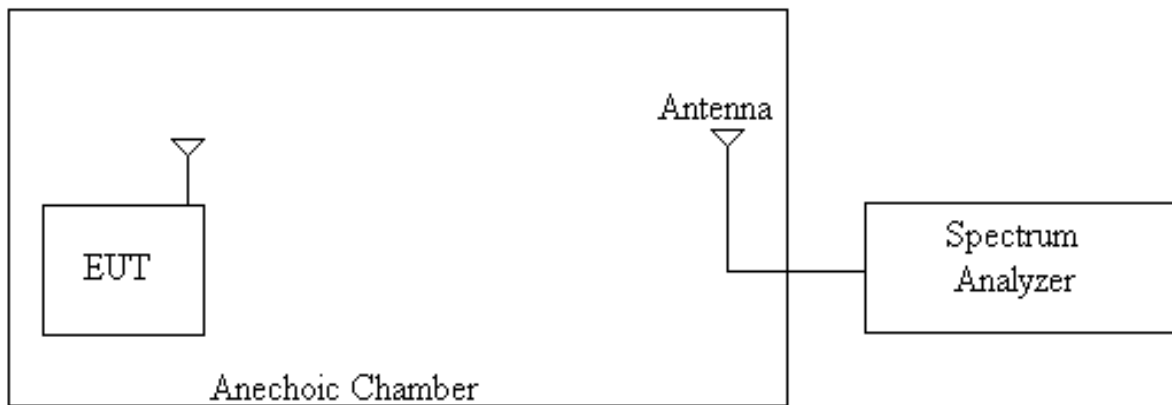
2.6 Test Setup and Test Configuration Block Diagrams

The 4 Channel RFID PCI Reader Board was installed into PCI slot of the host support computer. The computer was setup as tabletop equipment.

The 4 Channel RFID PCI Reader Board was powered via host support computer. Computer was powered at 120 VAC, 60 Hz.

The host computer activated the 4 Channel RFID PCI Reader Board to set a transmitting mode.

Field Strength Measurements



3.0 TEST RESULTS

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

Testing was completed by September 30, 2002.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

47 CFR 15.225(a)	Field Strength of Fundamental
47 CFR 15.225(b), 15.209	Field Strength of Spurious Emissions
47 CFR 15.225(b), 15.209	Out of Band Spurious Emissions
47 CFR 15.225(c)	Frequency Tolerance
47 CFR 15.207	Conducted Emissions

3.1 Field Strength of Radiated Emissions, FCC Part 15.225(a)(b), 15.209

Field Strength of Fundamental and Harmonics Emissions measurements were made with Fundamental frequency at 13.56 MHz. The Harmonics emissions were tested up to 1000MHz.

The Tables ## 3.1.1 and 3.1.2 below show the Field Strength of Fundamental Radiation and Harmonics Emissions.

Radiated Emissions at Fundamental and 2-nd Harmonic Date: 09-26-2002

Company: ATMI Packaging
Model: 4Channel RFID Reader Board
Test Engineer: Uri Spector
Special Config. Info: Anechoic Chamber, 3m measurement Distance
Standard: FCC Part 15.225 and 15.209
Note: Measurement distance 3m with Loop antenna SAS 200/562B
 All measurements were taken using a CISPR Quasi-Peak detector with RBW 10kHz.

Table # 3.1.1

Frequency MHz	QP Reading dBμV	Antenna Factor dB/m	Net at 3m. dBμV/m	Limit at 3m dBμV/m	Margin dB	Comments
13.560	48.50	9.24	57.74	120.00	-62.26	Fund.
27.120	8.60	12.49	21.09	69.50	-48.41	2-nd Harm.

Spurious Radiated Emissions
Date: 9/26/2002

Company: ATMI Packaging

Model: 4Channel RFID Reader Board

Test Engineer: Uri Spector

Standard: FCC Part 15.225, 15.209

Test Site: 3m Anechoic Chamber, 3m measurement distance

Note: The table shows the worst case radiated emissions
All measurements were taken using a CISPR Quasi-peak detector

Table # 3.1.2

Frequency MHz	Antenna			Total QP dBμV/m	QP Limit dBμV/m	Margin dB	Comments
	Polarity	Hts(cm)	Factor(dB1/m)				
40.68	V	100	14.5	39.3	40.0	-0.7	
54.24	V	100	8.8	34.0	40.0	-6.0	
67.80	V	154	7.2	23.4	40.0	-16.6	
81.36	V	103	8.5	24.2	40.0	-15.8	
94.92	V	113	10.7	24.1	44.0	-19.9	
108.48	V	107	12.6	23.1	44.0	-20.9	
122.04	V	102	13.7	22.1	44.0	-21.9	

3.2 Out of Band Spurious Emissions, FCC Part 15.225(b), 15.209

The EUT operates at frequency of 13.560MHz within the band 13.553-13.567MHz according to FCC Part 15.225, and out-of-band measurements were made at the edges of this band.

The Table # 3-2-1 and Graphs ## 3-2-1 and 3-2-2 show the Out of Band Spurious Emissions.

Note: Emission level shown in the Graphs does not include the Antenna and Cable correction factors.

Out of Band Spurious Emissions

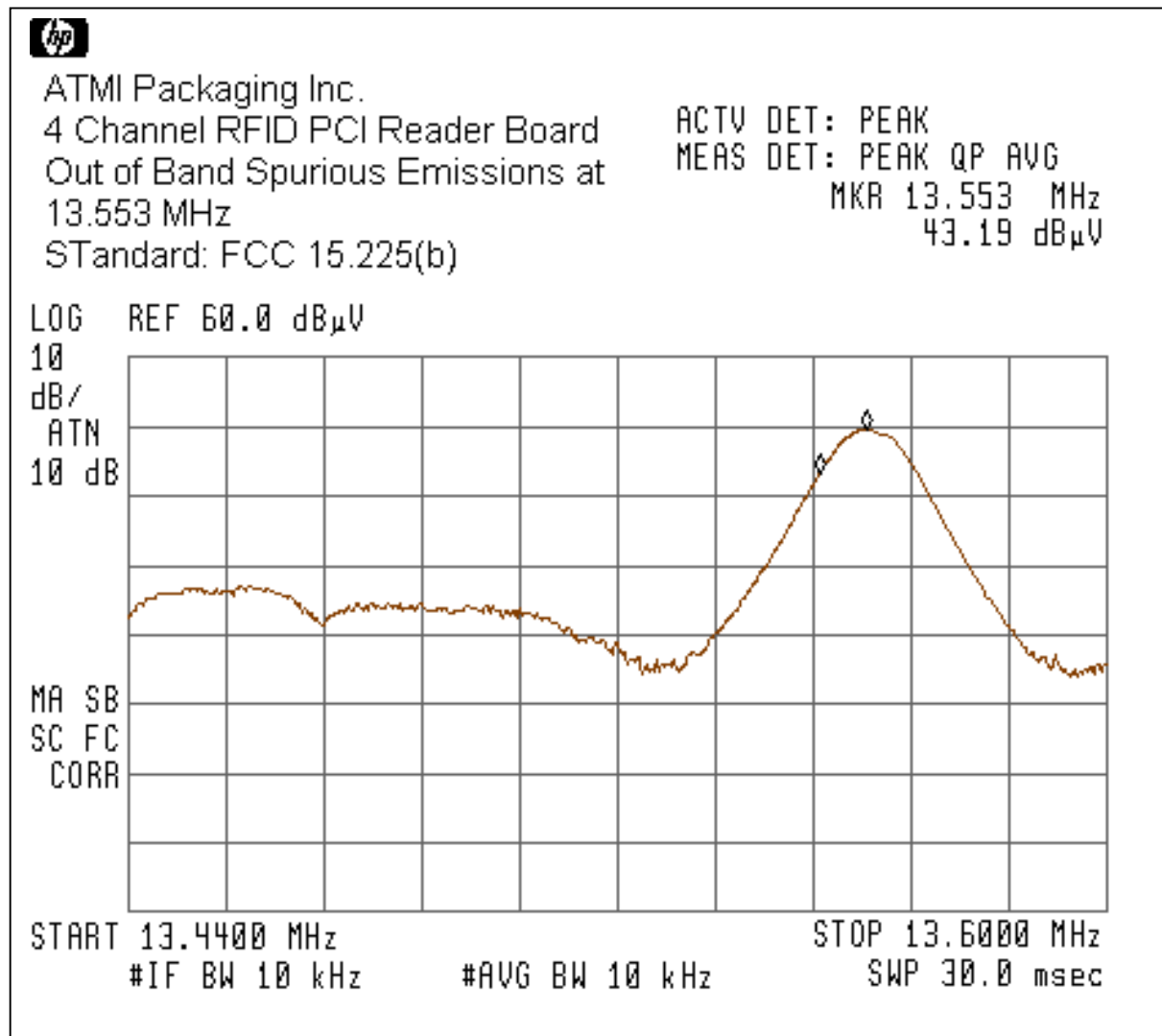
Date: 09-26-2002

Company: 4Channel RFID Reader Board
Model: Uri Spector
Test Engineer: FCC Part 15.225, 15.209
Special Config. Info: Anechoic chamber 3m measurement Distance
Standard: FCC Part 15.225 and 15.209
Note: Measurement distance 3m with Loop antenna SAS 200/562B
 All measurements were taken using a Peak detector
 with RBW 10 kHz.

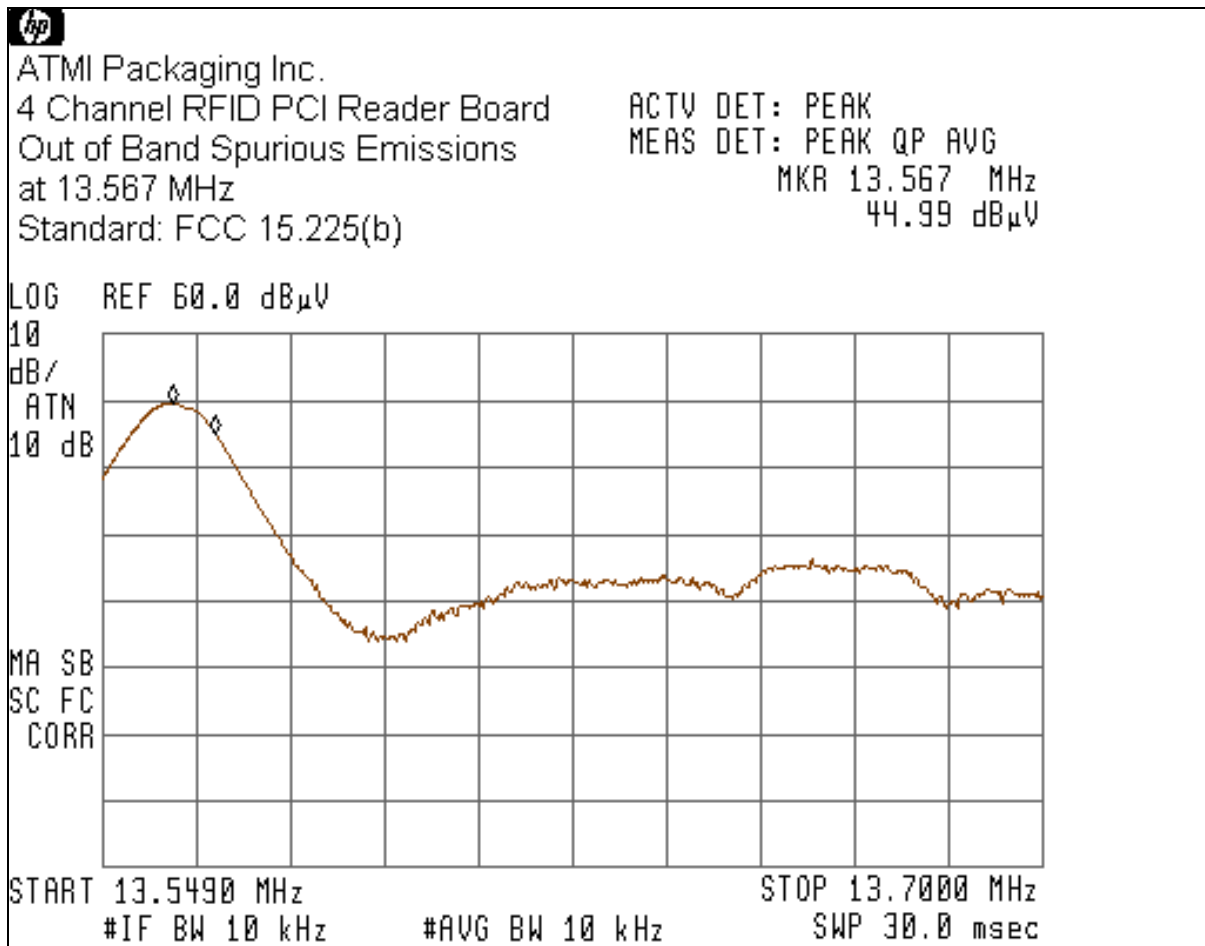
Table # 3.2.1

Frequency MHz	Reading dBμV	Antenna Factor dB/m	Pre-amp. Gain (dB)	Net at 3m. dBμV/m	Limit at 3m dBμV/m	Margin dB	Comments
13.553	43.19	9.25	0.00	52.44	69.50	-17.06	Pass
13.567	44.99	9.22	0.00	54.21	69.50	-15.29	Pass

Graph # 3-2-1



Graph # 3-2-2



3.3 Frequency Tolerance, FCC Part 15.225(c)

Frequency Stability with variation of ambient temperature was measured from –20 degrees C to +50 degrees C at frequency 13.56 MHz and rated power input 120VAC/60Hz.

Frequency Stability with variation of primary supply voltage was measured at 85% (102V) and 115% (138V) of rated AC Power Supply input voltage of 120V at frequency 13.56 MHz.

Table below shows the frequency stability vs. temperature ambient and supply voltage.

Frequency Stability **Date:** 09-27-2002
Company: ATMI Packaging
Model: 4Channel RFID Reader Board
Special Info: Enviromental Chamber (Frequency Stability testing)
Test Engineer: Uri Spector
Standard: FCC 15.225(c)

Table # 3-3-1

Temperature Degree C	Output Frequency MHz	Frequency Stability Hz	Freq. Tolerance +/- 0.01 % Hz	Test Result
-20	13.56	0	1356	Pass
-10	13.56	0	1356	Pass
0	13.56	0	1356	Pass
10	13.56	0	1356	Pass
20	13.56	0	1356	Pass
30	13.56	0	1356	Pass
40	13.56	0	1356	Pass
50	13.56	0	1356	Pass
55	13.56	0	1356	Pass
Input Power AC Voltage V	Output Frequency MHz	Frequency Stability Hz	Freq. Tolerance +/- 0.01 % Hz	Test Result
102	13.56	0.0	1356	Pass
110	13.56	0.0	1356	Pass
120	13.56	0.0	1356	Pass
130	13.56	0.0	1356	Pass
138	13.56	0.0	1356	Pass

3.4 Conducted Emissions, FCC Part 15.207

Conducted Emissions testing was performed in frequency range from 150kHz to 30MHz. Emissions at the Transmitter operating frequency of 13.566MHz were excluded from the test result.

The Table # 3-4-1 and Graph # 3-4-1 shows the Conducted Emissions.

TILE Instrument Control System EMI Measurement Software

Conducted Emissions **Date:** 09-25-2002
Company: ATMI Packaging
Model: 4 Channel RFID PCI Reader Board
Test Engineer: Uri Spector
Special Config. Info: Transmitting Frequency of 13.56 MHz was excluded from table
Standard: FCC Part 15.207
Note: The table shows the worst case conducted emissions
All measurements were taken using a CISPR Quasi-peak detector

Table # 3-4-1

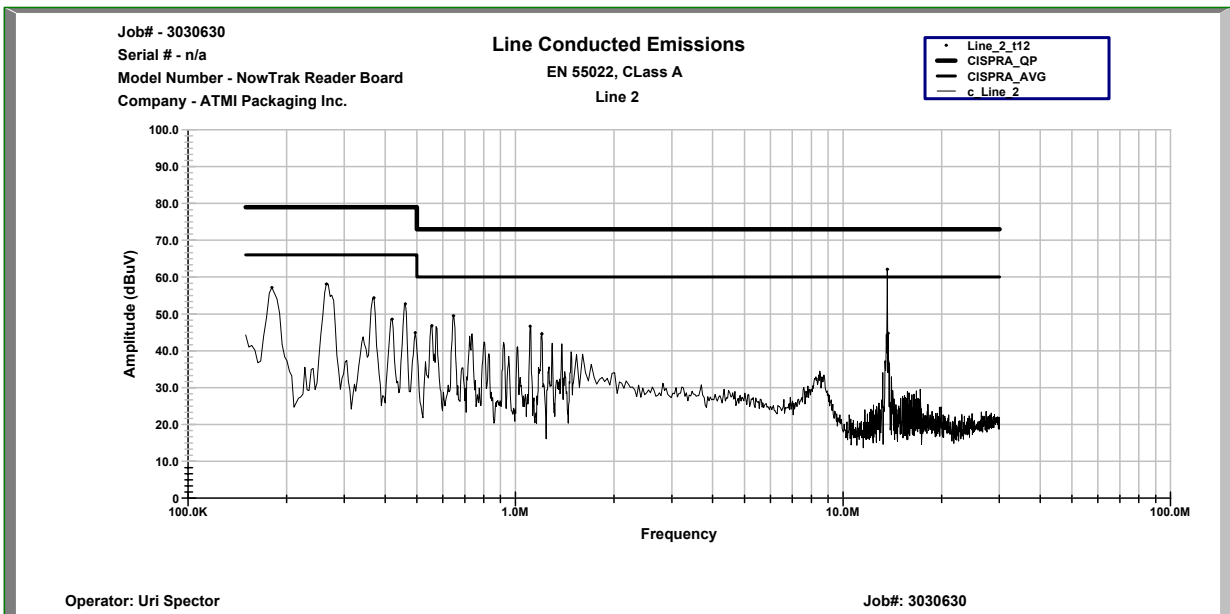
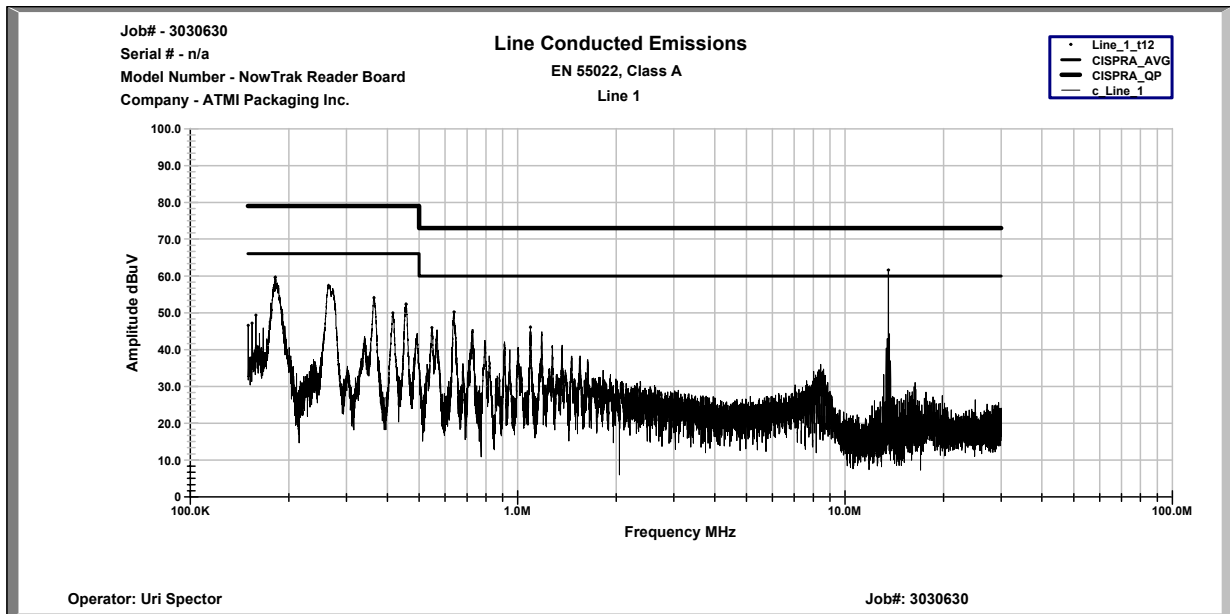
Line 1

Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
150.0 KHz	42.31	33.52	79	66	-36.69	-32.48
156.12 KHz	42.75	34.15	79	66	-36.25	-31.85
182.94 KHz	59.08	57.74	79	66	-19.92	-8.26
265.26 KHz	56.82	56.08	79	66	-22.18	-9.92
365.57 KHz	53.57	53.42	79	66	-25.43	-12.58
415.92 KHz	49.44	49.13	79	66	-29.56	-16.87
457.02 KHz	51.90	51.44	79	66	-27.10	-14.56
500.0 KHz	48.86	48.46	73	60	-24.14	-11.54
548.06 KHz	45.46	45.13	73	60	-27.54	-14.87
643.36 KHz	49.37	45.48	73	60	-23.63	-14.52
1.096 MHz	45.63	43.95	73	60	-27.37	-16.05

Line 2

Frequency	QP dBμV	AVG dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
152.13 KHz	45.30	42.77	79	66	-33.70	-23.23
152.44 KHz	44.80	42.71	79	66	-34.20	-23.29
160.28 KHz	43.81	36.50	79	66	-35.19	-29.50
183.72 KHz	57.34	55.27	79	66	-21.66	-10.73
264.44 KHz	57.80	57.27	79	66	-21.20	-8.73
366.12 KHz	53.92	53.72	79	66	-25.08	-12.28
415.47 KHz	50.13	49.81	79	66	-28.87	-16.19
457.93 KHz	52.26	51.88	79	66	-26.74	-14.12
500.0 KHz	49.27	48.76	73	60	-23.73	-11.24
550.47 KHz	45.69	45.01	73	60	-27.31	-14.99
644.14 KHz	49.63	45.72	73	60	-23.37	-14.28
1.099 MHz	44.97	42.93	73	60	-28.03	-17.07

Graph #3.4.1



3.5 Test Procedure

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Method of the direct Field Strength Calculation is shown in Section 3.4.

Frequency Tolerance

The EUT was placed in an environmental test chamber and powered such that control element received normal voltage and the transmitter provided maximum RF output. The Chamber was programmed to cool from room temperature to minus 20 degrees C and then step in 10-degree increments to plus 55 degrees C. For Frequency Stability testing with variation of primary supply voltage the EUT power supply was powered at rated supply voltage at 120VAC/60Hz and then at 102VAC/60Hz and 138VAC/60Hz

Conducted Emissions

For conducted emissions testing, the equipment is moved to an insulating platform over the ground plane, and the EUT is powered from a LISN. Both sides of the AC line are measured and the results are compared to the applicable limits. Measurements are taken using CISPR quasi-peak and average detectors when the peak readings approach or exceed the average limit. Only quasi-peak readings are taken when the emissions from the EUT meet the average limit as measured with the quasi-peak detector.

3.6 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength in dB(μ V/m)

RA = Receiver Amplitude in dB(μ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB(m^{-1})

AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(μ V) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(μ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RF + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/m)$$

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Uri Spector
EMC Project Engineer
Intertek Testing Services NA, Inc.

Signature 

Date: September 30, 2002

4.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
HP85462A Receiver RF Section	3549A00306	11/01	11/02	X
HP85460A RF Filter Section	3448A00276	11/01	11/02	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Schaffner-Chase Bicono-Log Antenna	2468	11/01	11/02	X
Schaffner-Chase Bicono-Log Antenna	2630	05/02	05/03	
SAS-200/5562B Loop Antenna	215	11/01	11/02	X

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
FCC LISN-2	316	01/02	01/03	X
FCC-LISN-50-25-2	2014	04/02	04/03	X