Washington Laboratories, Ltd.

FCC Certification Test Report
for the
MEI
PayPass Credit Card Bezel

FCC ID: QP8MEICARD

WLL JOB# **9720**
May 9, 2007

Prepared for:

MEI
1301 Wilson Drive
West Chester, PA 19380

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

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Prepared by:

James Ritter
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Reviewed by:

Steven D. Koster
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Abstract

This report has been prepared on behalf of MEI to support the attached Application for Equipment Authorization. The test report and application are submitted for an Intentional Radiator under Part 15.225 of the FCC Rules and Regulations. This Certification Test Report documents the test configuration and test results for a MEI PayPass Credit Card Bezel.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The MEI PayPass Credit Card Bezel complies with the limits for an Intentional Radiator device under FCC Part 15.225.

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1 Introduction

1.1 Compliance Statement

The MEI PayPass Credit Card Bezel complies with the limits for an Intentional Radiator device under FCC Part 15.225.

1.2 Test Scope

Tests for radiated and conducted emissions were performed. All measurements were performed in accordance with the 2003 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	MEI 1301 Wilson Drive West Chester, PA 19380
Purchase Order Number:	4500050088
Quotation Number:	63473

1.4 Test Dates

Testing was performed on the following date(s):	April 19 and April 20, 2007

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	Bob Carney

1.6 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**eres
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**C**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**decibel**
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**M**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

2.1 EUT Identification & Description

The MEI PayPass Credit Card Bezel is a POS transaction bezel that is mounted within an end use vending machine or similar application. It incorporates a conventional credit card magnetic stripe reader (swipe) and PayPass enabled reader hardware that allows consumers to tap their PayPass card or device on the bezel for credit. The PayPass reader communicates with a PayPass Credit card in it's field when a card is presented (tapped). The card consist of a embedded chip and antenna. The field emitted by the reader (13.56 MHz) provides power for the chip to operate.

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Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	MEI
FCC ID:	QP8MEICARD
Model:	PayPass Credit Card Bezel
FCC Rule Parts:	§15.225
Frequency Range:	13.56MHz
Maximum Output Power:	1068.5 uV/m at 10 meters
Modulation:	None
Occupied Bandwidth:	1.949 kHz
Type of Information:	Data
Number of Channels:	1
Power Output Level	Fixed
Antenna Type	Internal PCB
Frequency Tolerance:	>±0.01% (±100 ppm)
Interface Cables:	Power, I/O
Power Source & Voltage:	5Vdc from Host device

2.2 Test Configuration

The PayPass Credit Card Bezel was configured for testing as indicated in the figure below. Power from a support AC115 to 5VDC power adaptor (EUT normally receives 5VDC from host unit) was provided to EUT. In addition a RS232 (DB9) line was connected between the EUT and a support laptop. No other connections were necessary.

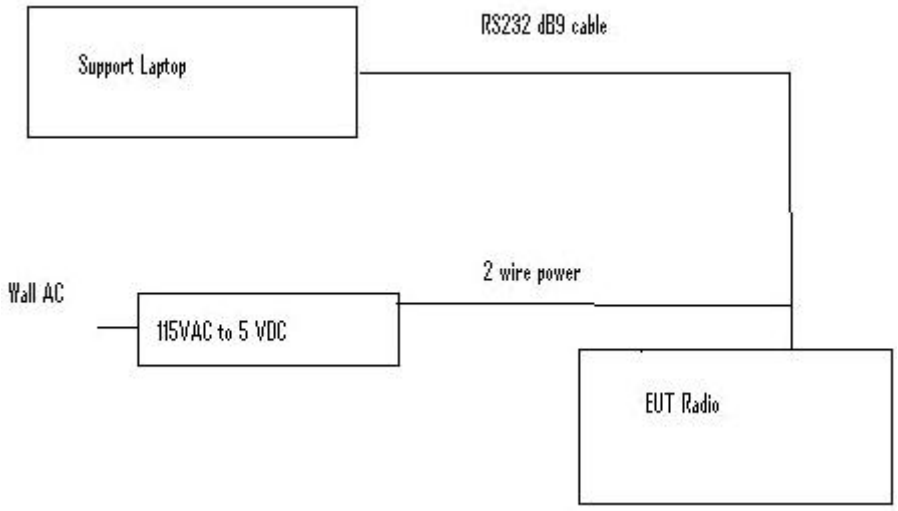

Figure 1: Test Configuration

2.3 Testing Algorithm

The Reader operates at a fixed frequency of 13.56MHz. A support laptop sent commands via RS232 to continuously transmit characters using "MEIVendiPayFCCTest.exe" test utility program.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-93)

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been

calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Asset #	Manufacturer/Model	Description	Cal. Due
0117	RACAL DANA	FREQUENCY COUNTER	5/4/2007
00125	SOLAR, 8028-50-TS-24-BNC	LISN	2/1/2008
00126	SOLAR, 8028-50-TS-24-BNC	LISN	2/1/2008
00071	HP, 85685A	PRESELECTOR, RF	6/26/2007
00073	HP, 8568B	ANALYZER, SPECTRUM	6/26/2007
00069	HP, 85650A	ADAPTER, QP	6/26/2007
00053	HP, 11947A	LIMITER, TRANSIENT	4/9/2008
00031	EMCO, 6502	ANTENNA, ACTIVE LOOP	2/12/2008
00026	EMCO, 3110B	ANTENNA, BICONICAL	12/19/2007
00029	EMCO, 3146A	ANTENNA, LOG PERIODIC	7/19/2008

4 Test Results

4.1 Occupied Bandwidth

Occupied bandwidth measurement was performed by coupling the output of the EUT to the input of a spectrum analyzer.

The occupied bandwidth was measured as shown:

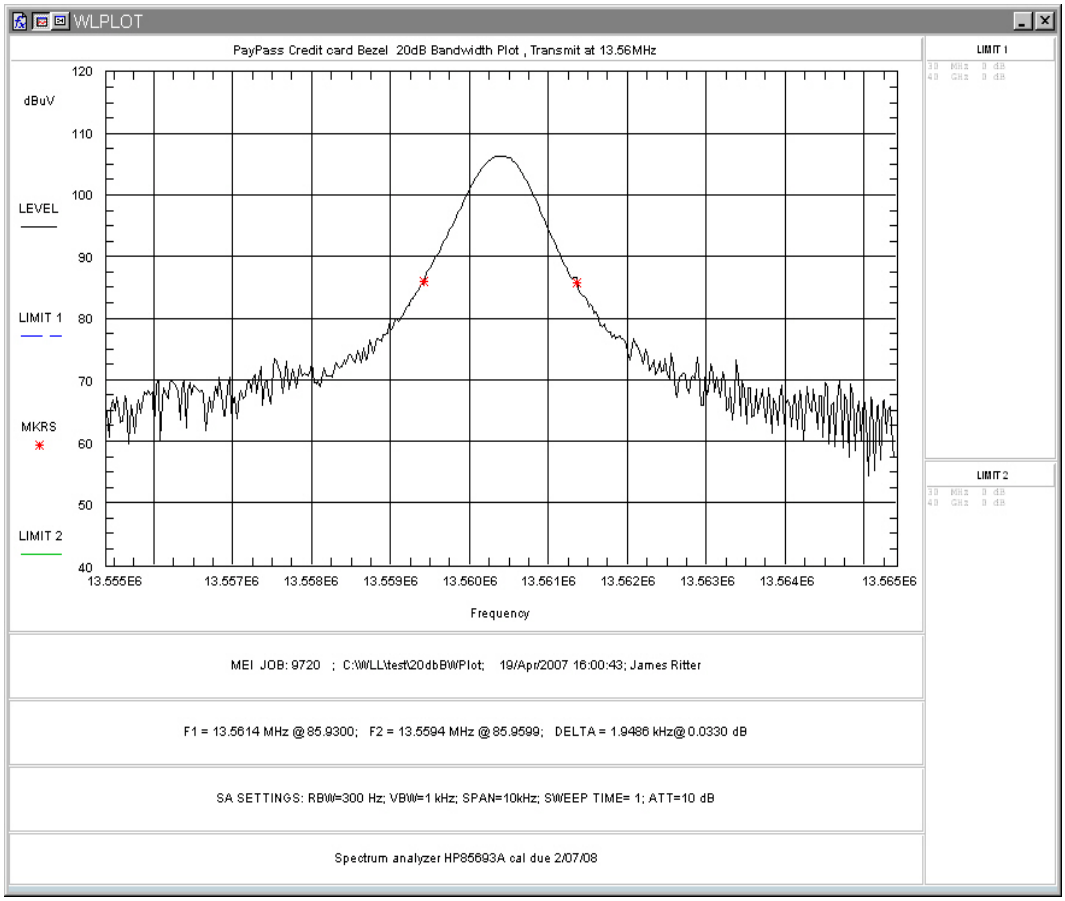

Figure 2. Occupied Bandwidth

Table 3 provides a summary of the Occupied Bandwidth Results.

Table 3: Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
13.560MHz	1.949 kHz	N/A	Pass

4.2 Radiated Spurious Emissions: §15.225, §15.209

Radiated emissions from the EUT must comply with the field strength limits as specified in FCC Part 15.225 and 15.209. The limits for the radiated emissions are as shown in the following table.

Table 4: Radiated Spurious Emissions Limits

Frequency (MHz)	Limit (µV/m)	Rule Part Reference
13.553 - 13.567	15,848 (@ 30m)	§15.225(a)
13.410 – 13.553	334 (@ 30m)	§15.225(b)
13.567 – 13.710	334 (@ 30m)	§15.225(b)
13.110 – 13.410	106 (@ 30m)	§15.225(c)
13.710 – 14.010	106 (@ 30m)	§15.225(c)
1.705 – 13.110 14.010 – 30.0	30 (@ 30m)	§15.225(d), §15.209
30.00 – 88.00	100 (@ 3m)	§15.225(d), §15.209
88.00 – 216.00	150 (@ 3m)	§15.225(d), §15.209
216.00 – 960.00	200 (@ 3m)	§15.225(d), §15.209
Above 960	500 (@ 3m)	§15.225(d), §15.209

4.2.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on an Open Area Test Site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured

Testing at frequencies below 30 MHz was performed at ten meters with a loop antenna. Bandwidths used were 10kHz RBW and 10Hz VBW. Limits were interpolated from the 30 meter limit to the equivalent at 10 meters using the 40dB/decade roll-off. Three orientations of the loop antenna were tested.

Emissions were scanned up to 1GHz. Only the 2nd harmonic of the fundamental frequency was detected. No other emissions were detected that were related to the RFID Transmitter. All other emissions detected were related to digital emissions of the PayPass Credit Card Bezel electronics. Since the EUT is used in a commercial application, these digital emissions were compared to the Class A limit of §15.109(b). For emissions up to 30MHz and above 1 GHz peak levels were recorded. Emissions from 30 MHz to 1000 MHz were measured using a Quasi-peak detector. Worst case emissions are reported in the data table. Note: The Class A digital emissions (above 30MHz) were conducted at 3 meters with the limit adjusted appropriately.

The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

Sample Calculation:

Spectrum Analyzer Voltage (SA Level):	VdBµV
Antenna Factor (Ant Corr):	AFdB/m
Cable Loss Correction (Cable Corr):	CCdB
Amplifier Gain:	GdB (if applicable)
Electric Field (Corr Level):	EdBµV/m = VdBµV + AFdB/m + CCdB - GdB
To convert to linear units:	Eµ V/m = antilog (EdBµV/m/20)

4.2.2 Test Results

The EUT complies with the radiated emission requirements of §15.225. The following tables provide the test data.

Table 5: Radiated Emission Test Data below 30 MHz

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
13.560	X	90.0	1.0	48.80	10.5	1.1	60.4	1044.1	158480.0	-43.6
13.560	Y	90.0	1.0	49.00	10.5	1.1	60.6	1068.5	158480.0	-43.4
13.560	Z	90.0	1.0	46.30	10.5	1.1	57.9	783.0	158480.0	-46.1
27.119	X	270.0	1.0	8.90	8.8	1.4	19.1	9.0	300.0	-30.5
27.119	Y	180.0	1.0	9.00	8.8	1.4	19.2	9.1	300.0	-30.4
27.119	Z	270.0	1.0	4.90	8.8	1.4	15.1	5.7	300.0	-34.5
13.553	X	90.0	1.0	26.90	10.5	1.0	38.5	83.9	3340.0	-32.0
13.553	Y	80.0	1.0	29.10	10.5	1.0	40.7	108.1	3340.0	-29.8
13.553	Z	0.0	1.0	23.80	10.5	1.0	35.4	58.7	3340.0	-35.1
13.567	X	90.0	1.0	20.30	10.5	1.1	31.9	39.2	3340.0	-38.6
13.567	Y	90.0	1.0	25.40	10.5	1.1	37.0	70.6	3340.0	-33.5
13.567	Z	0.0	1.0	16.00	10.5	1.1	27.6	23.9	3340.0	-42.9
13.490	X	80.0	1.0	20.40	11.0	1.0	32.4	41.9	3340.0	-38.0
13.490	Y	23.0	1.0	22.00	10.5	1.0	33.6	47.7	3340.0	-36.9
13.490	Z	300.0	1.0	22.30	10.5	1.0	33.9	49.4	3340.0	-36.6
13.631	X	10.0	1.0	17.80	10.5	1.1	29.4	29.4	3340.0	-41.1
13.631	Y	90.0	1.0	25.70	10.5	1.1	37.3	73.1	3340.0	-33.2
13.631	Z	90.0	1.0	24.10	10.5	1.1	35.7	60.8	3340.0	-34.8
13.348	X	90.0	1.0	22.70	10.5	1.0	34.3	51.7	1060.0	-26.2
13.348	Y	10.0	1.0	20.70	10.5	1.0	32.3	41.1	1060.0	-28.2
13.348	Z	90.0	1.0	23.10	10.5	1.0	34.7	54.1	1060.0	-25.8
13.771	X	270.0	1.0	16.10	10.5	1.1	27.7	24.2	1060.0	-32.8
13.771	Y	45.0	1.0	23.30	10.5	1.1	34.9	55.5	1060.0	-25.6
13.771	Z	90.0	1.0	20.70	10.5	1.1	32.3	41.1	1060.0	-28.2
11.020	X	90.0	1.0	15.20	10.6	0.9	26.7	21.7	300.0	-22.8
11.020	Y	90.0	1.0	19.80	10.6	0.9	31.3	36.8	300.0	-18.2
11.020	Z	170.0	1.0	18.90	10.6	0.9	30.4	33.2	300.0	-19.1
20.021	X	270.0	1.0	20.80	10.3	1.2	32.3	41.2	300.0	-17.2
20.021	Y	190.0	1.0	22.50	10.3	1.2	34.0	50.1	300.0	-15.5
20.021	Z	80.0	1.0	21.50	10.3	1.2	33.0	44.7	300.0	-16.5

Table 6: Digital Radiated Emission Test Data (Class A limit)

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin (dB)
30.000	V	180.0	1.0	12.0	13.9	0.7	26.6	21.4	300.0	-22.9
44.230	V	270.0	1.0	15.1	10.9	0.8	26.8	21.8	300.0	-22.8
149.149	V	90.0	2.4	14.9	12.6	2.1	29.6	30.1	500.0	-24.4
176.262	V	125.0	2.0	14.3	13.8	2.3	30.4	33.3	500.0	-23.5
189.819	V	270.0	2.0	14.3	14.4	2.5	31.2	36.3	500.0	-22.8
203.402	V	245.0	2.6	13.6	15.2	2.1	30.9	35.1	500.0	-23.1
216.952	V	90.0	2.0	15.2	15.8	2.1	33.1	45.3	700.0	-23.8
284.770	V	180.0	2.5	13.4	20.1	3.1	36.6	67.6	700.0	-20.3
311.880	V	90.0	1.3	16.2	13.8	3.2	33.2	45.7	700.0	-23.7
378.010	V	180.0	2.0	11.2	16.6	3.4	31.2	36.3	700.0	-25.7
406.800	V	45.0	1.7	15.6	16.8	3.8	36.2	64.6	700.0	-20.7
420.355	V	180.0	2.0	13.2	17.4	3.8	34.4	52.5	700.0	-22.5
433.920	V	270.0	2.4	12.8	17.4	3.8	34.0	50.0	700.0	-22.9
840.720	V	45.0	1.7	4.0	22.0	5.7	31.7	38.4	700.0	-25.2
44.230	H	240.0	3.6	17.6	10.9	0.8	29.3	29.1	300.0	-20.3
122.032	H	0.0	3.4	19.6	12.9	2.1	34.6	53.7	500.0	-19.4
149.149	H	0.0	2.4	21.6	12.6	2.1	36.3	65.1	500.0	-17.7
176.262	H	0.0	2.0	18.0	13.8	2.3	34.1	51.0	500.0	-19.8
189.819	H	270.0	2.5	21.7	14.4	2.5	38.6	85.0	500.0	-15.4
203.402	H	180.0	1.6	19.5	15.2	2.1	36.8	69.2	500.0	-17.2
216.952	H	290.0	2.5	23.8	15.8	2.1	41.7	121.8	700.0	-15.2
230.530	H	270.0	3.0	18.5	16.2	2.6	37.3	73.3	700.0	-19.6
257.650	H	90.0	2.0	13.1	18.0	2.9	34.0	50.2	700.0	-22.9
271.202	H	270.0	2.0	13.9	19.2	3.0	36.1	63.9	700.0	-20.8
284.770	H	270.0	1.5	17.7	20.1	3.1	40.9	110.9	700.0	-16.0
298.330	H	90.0	1.6	9.1	20.8	3.1	33.0	44.6	700.0	-23.9
311.880	H	90.0	1.7	21.3	13.8	3.2	38.3	82.3	700.0	-18.6
393.260	H	90.0	1.4	15.0	16.5	3.4	34.9	55.8	700.0	-22.0
406.800	H	90.0	1.5	15.2	16.8	3.8	35.8	61.7	700.0	-21.1
420.355	H	90.0	1.3	17.5	17.4	3.8	38.7	86.1	700.0	-18.2
433.920	H	90.0	1.3	10.6	17.4	3.8	31.8	38.8	700.0	-25.1
610.240	H	245.0	2.3	8.1	18.7	4.7	31.5	37.7	700.0	-25.4

Note: Class A limit adjusted to 3 meters

4.3 Frequency Stability: (FCC Part §2.1055)

Frequency as a function of temperature and voltage variation shall be maintained within the FCC-prescribed tolerances. Per §15.225(e) the frequency tolerance shall be maintained within ±0.01% of the reference frequency.

4.3.1 Test Procedure

The temperature stability was measured with the unit in an environmental chamber used to vary the temperature of the sample. The sample was held at each temperature step to allow the temperature of the sample to stabilize.

The frequency stability of the transmitter was examined at the voltage extremes and for the temperature range of -20°C to +50°C. The carrier frequency was measured while the EUT was in the temperature chamber. The reference frequency of the EUT was measured at the ambient room temperature with the frequency counter.

The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range.

The RF carrier frequency shall not depart from the reference frequency (reference frequency is the frequency at 20ºC and rated supply voltage) in excess of +/-1356 Hz.

The EUT is powered by 5Vdc voltage supplied via an external AC power supply.

4.3.2 Test Results

The EUT complies with the temperature stability requirements of FCC §15.225(e). Test results are given in Table 7.

Table 7: Frequency Stability Test Data

Temp (C)	Freq (MHz)	Difference (Hz)	Deviation (%)
Ambient	13.560306	0.0	0
-20	13.561183	877.0	0.006467
-10	13.560937	631.0	0.004653
0	13.560898	592.0	0.004366
10	13.560623	317.0	0.002338
20	13.560320	14.0	0.000103
30	13.560312	6.0	0.000044
40	13.560268	-38.0	0.000280
50	13.560256	-50.0	0.000369

Voltage (Volts)	Freq (MHz)	Difference (Hz)	Deviation (%)	Voltage (Volts)
At rated	13.560271	0	0.0	5.01
At 85%	13.560242	29	0.000214	4.25
At 115%	13.560303	-32	0.000236	5.75

4.4 Conducted Emissions (AC Power Line)

The EUT was placed on an 80 cm high 1 x 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 µH Line Impedance Stabilization Network bonded to a 3 x 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power and data cables were moved about to obtain maximum emissions.

The 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak or peak, as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth.

AC Power Line conducted emissions test data are included in Table 8.

Table 8: AC Power Conducted Emissions Test Data

LINE 1 - NEUTRAL

Frequency (MHz)	Level QP (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Limit QP (dBµV)	Level Corr (dBµV)	Margin QP (dB)	Level AVG (dBµV)	Cable Loss (dB)	Level Corr (dBµV)	Limit AVG (dBµV)	Margin AVG (dB)
0.202	31.5	10.2	0.5	79.0	42.2	-36.8	28.8	10.2	39.5	66.0	-26.5
0.506	20.4	10.3	0.3	73.0	31.0	-42.0	13.9	10.3	24.5	60.0	-35.5
0.907	30.3	10.5	0.2	73.0	41.0	-32.0	26.1	10.5	36.8	60.0	-23.2
2.323	23.9	10.5	0.5	73.0	34.9	-38.1	18.9	10.5	29.9	60.0	-30.1
3.635	23.6	10.5	0.7	73.0	34.8	-38.2	18.4	10.5	29.6	60.0	-30.4
4.846	23.5	10.7	0.8	73.0	35.0	-38.0	18.1	10.7	29.6	60.0	-30.4
13.560	30.0	11.9	2.0	60.0	43.9	-16.1	27.4	11.9	41.3	50.0	-8.7
29.587	21.1	12.8	5.2	73.0	39.1	-33.9	10.9	12.8	28.9	60.0	-31.1

LINE 2 - PHASE

Frequency (MHz)	Level QP (dBµV)	Cable Loss (dB)	LISN Corr (dB)	Limit QP (dBµV)	Level Corr (dBµV)	Margin QP (dB)	Level AVG (dBµV)	Cable Loss (dB)	Level Corr (dBµV)	Limit AVG (dBµV)	Margin AVG (dB)
0.202	31.3	10.2	0.3	79.0	41.7	-37.3	30.8	10.2	41.2	66.0	-24.8
0.506	19.3	10.3	0.2	73.0	29.8	-43.2	10.2	10.3	20.7	60.0	-39.3
0.907	30.5	10.5	0.2	73.0	41.2	-31.8	26.1	10.5	36.8	60.0	-23.2
2.323	22.6	10.5	0.6	73.0	33.7	-39.3	16.3	10.5	27.4	60.0	-32.6
3.635	22.2	10.5	0.9	73.0	33.6	-39.4	16.4	10.5	27.8	60.0	-32.2
4.846	21.9	10.7	1.1	73.0	33.7	-39.3	15.4	10.7	27.2	60.0	-32.8
13.560	33.0	11.9	2.7	60.0	47.6	-12.4	31.0	11.9	45.6	50.0	-4.4
29.587	21.3	12.8	6.2	73.0	40.3	-32.7	10.8	12.8	29.8	60.0	-30.2