EMC Testing Laboratories, Inc.

RF Emissions Test Report
To Determine Compliance With:
FCC, Part 15.231
Rules and Regulations

Model number: SHC-G-MR-433 and SHC-G-433
FCC ID: WPV-SEQR10001
Date: April 26, 2010

Manufacturer: Sequentric Energy Systems, LLC.
2840 South College Rd.
Wilmington, NC 28412

Contents Section

Section 1

GENERAL INFORMATION

Manufacturer:	Sequentric Energy Systems, LLC. 2840 .South College Rd. Wilmington, NC 28412
Manufacturer representative:	**Mr. Daniel Flohr**
Equipment covered by this report:	Model nos. SHC-G-MR-433 and SHC-G-433
Options covered by this report:	None
Transmitting Frequency:	433.92 MHz
Test specifications:	To determine compliance with: FCC, Part 15.231, Subpart B and C, Rules and Regulations, Class B.
Test report number:	10-166A-1
Test commenced:	April 12, 2010
Test completed:	April 26, 2010
Test engineer:	**Gene Bailey**

Test Facility: The test facility used to perform these tests is on file with the FCC under registration number 637500 and located at:

EMC Testing Laboratories, Inc.
2100 Brandon Trail
Suite 101
Alpharetta, GA 30004

Section 2

PRODUCT DESCRIPTION AND TEST SUMMARY

Product description:
The product covered by this report is a multi-node system that utilizes the transmission of a control signal in a similar manner as those used with alarm systems, door openers, remote switches, etc.
The SQR system is comprised of one master control unit, the Gateway, and a number of slave units. The Gateway includes a microcontroller with an Ethernet interface that communicates using Internet protocol to convey control commands from a utility or other entity's control server to the control modules installed into the premises to actively manage peak demand power usage or other related services. The Gateway communicates with slave modules using a transceiver The Gateway also acts as a receive-only wireless power meter reading device. The Gateway contains a 433 MHz band receiver that receives the current kilowatt reading from compatible residential and commercial power meters, and communicates this information using the Ethernet interface.
The integral L-shaped wire antenna.

SHC-G-433 is identical to model no. SHC-G-MR-433 except without populating the integrated 915 meter reading receiver.

The test results apply only to the products identified on the test report.

Test configuration:
The equipment under test (EUT) was set-up and configured as specified by the manufacturer as follows:

1- The product was connected to the following support peripherals:

A. A Power supply model no. HHA12-1000.

2- The EUT utilized the following cables and were connected as indicated below:

A- An Ethernet cable between the product and laptop.

B- Two USB cables

C- Power cable

Product Description and Test Summary …

Worst case transmit duty Cycle:
The duty cycle factor used in the calculation of average radiated limits (15.209 (d)) is described below.

Maximum transmit time On equals 10mS over a 125 mS period.

The worst case Duty Cycle is calculated as follows:

(10/100) 100% = 10%

In terms of voltage dB: 20 log (10/100) = -20 dB

Modifications:
The following modifications were required to comply with the radiated emission limits:

1- None

Engineering Statement:
All measurement data of this test report was taken in accordance with the FCC, Part 15.231, Class B Rules and Regulations and ANSI C63.4-(09) by EMC Testing Laboratories, Inc. located in Alpharetta, Georgia. Although this data is taken under stringent laboratory conditions and to the best of our knowledge, represents accurate data, it must be recognized that emissions from or immunity to this type equipment may be greatly affected by the final installation of the equipment. Therefore, EMC Testing Laboratories, Inc., while supporting the accuracy of the data in this report, takes no responsibility for use of equipment based on these tests. The manufacturer of this equipment must take full responsibility for any field problems which may arise, and agrees that EMC Testing Laboratories, Inc., in performing its functions in accordance with its objectives and purposes, does not assume or undertake to discharge any responsibility of the manufacturer to any other party or parties.

Conclusion:
With the above-indicated modifications, the product covered by this report has been tested and found to comply with the above-indicated standards.

Tested by: **Gene Bailey, RF Engineer**

Approved by: _____
Glenn Barnes, RF Engineer,
EMC Testing Laboratories, Inc.

Section 3

STANDARD REFERENCE

The following primary standards were used for this test:

1- **ANSI C63.4-09:** Method of Measurements of Radio-Noise Emissions from Low- Voltage Electrical and Electronic Equipment in the 9 KHz to 40 GHz.

2- **US Code of Federal Regulations (CFR):** Title 47, Part 15, Radio Frequency Devices, Subpart B, Intentional Radiators.

Note: Applicable amendments were applied to all standards.

Section 4

TEST METHOD

INTRODUCTION:

The product(s) covered by this report were subjected to electromagnetic interference emissions measurements to determine compliance with the FCC, Part 15 and RSS-210 requirements.

Radiated and conducted emissions were measured in accordance with the Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz, ANSI C63.4.

MEASUREMENT CALCULATIONS:

Radiated Emissions:

For radiated emissions measurements, the signal attenuation due to impedance losses in the antenna and signal cable were significant and was added to the spectrum analyzer reading to give corrected signal strength reading. If a preamplifier was used, the signal gain was subtracted from the signal strength reading. Radiated emissions data was specified as decibels above 1 microvolt per meter (dBμV/m) of radiated field strength.

Radiated emissions (dBμV) = Analyzer reading (dBμV) plus
antenna factor (dB) plus cable factor (dB) minus Amplifier gain (dB)

Conducted Emissions:

For conducted emissions, the signal attenuation due to impedance losses in the LISN and signal cables was negligible and assumed to be 0dB. The conducted emissions were directly equal to the spectrum analyzer reading. Conducted emissions data was specified as decibels above 1 microvolt (dBμV) of conducted line voltage.

Conducted emissions (dBμV) = Analyzer reading (dBμV)

Test Method cont…

RADIATED EMISSIONS MEASUREMENT:

Radiated emissions measurements were performed at an open field test site. The receiving antenna was positioned 3 meters from the equipment under test along the center axis of the test site. Measurements were made with broadband antennas and if necessary, detected emissions were verified with dipole antennas. The dipole antenna was manually tuned to the signal frequency by adjusting the length of the antenna elements. The radiated emissions were measured for both the horizontal and vertical signal planes by rotating the antennas. Additionally, the EUT was rotated by the turntable and the antenna height was raised and lowered 1 to 4 meters to locate the maximum emission strength at each frequency.

The radiated emissions were measured over the frequency span of 30 MHz to 9.200 GHz. The following antennas were used to measure the radiated emissions within the specified frequency spans.

CONDUCTED EMISSIONS MEASUREMENT:

Conducted emissions measurements were performed on a ground plane that was electrically bonded to earth ground. The equipment under test was positioned 0.8 meter above the ground plane and 0.8 meter minimum from the LISN that was positioned on the ground plane. The LISN housings were electrically bonded to the ground plane. The conducted emissions for both the ungrounded supply conductor (L1) and the grounded conductor (L2) of the power supply cord were measured. The conducted emissions were measured over the frequency span of 0.15 to 30 MHz. The measurements were conducted in the quasi-peak and average detector modes.

INSTRUMENTATION:

Radiated and conducted signal strength measurements were taken with a spectrum analyzer. Radiated emissions were measured with broadband and tuned dipole antennas. Conducted emissions were measured with a 50 UH line impedance stabilization network (LISN).

Test Method cont…

DETECTOR FUNCTION:

Unless otherwise indicated in this report, all measurements were taken using a peak hold signal detector function. In this mode, the spectrum analyzer makes continuous scans across the frequency band and stores the highest emission value detected at each frequency for all scans. The peak hold integration will detect transient or low duty cycle emissions peak, which might be missed on single scan measurement. The emission value at each frequency was a true value.

SPECTRUM ANALYZER SETTING:

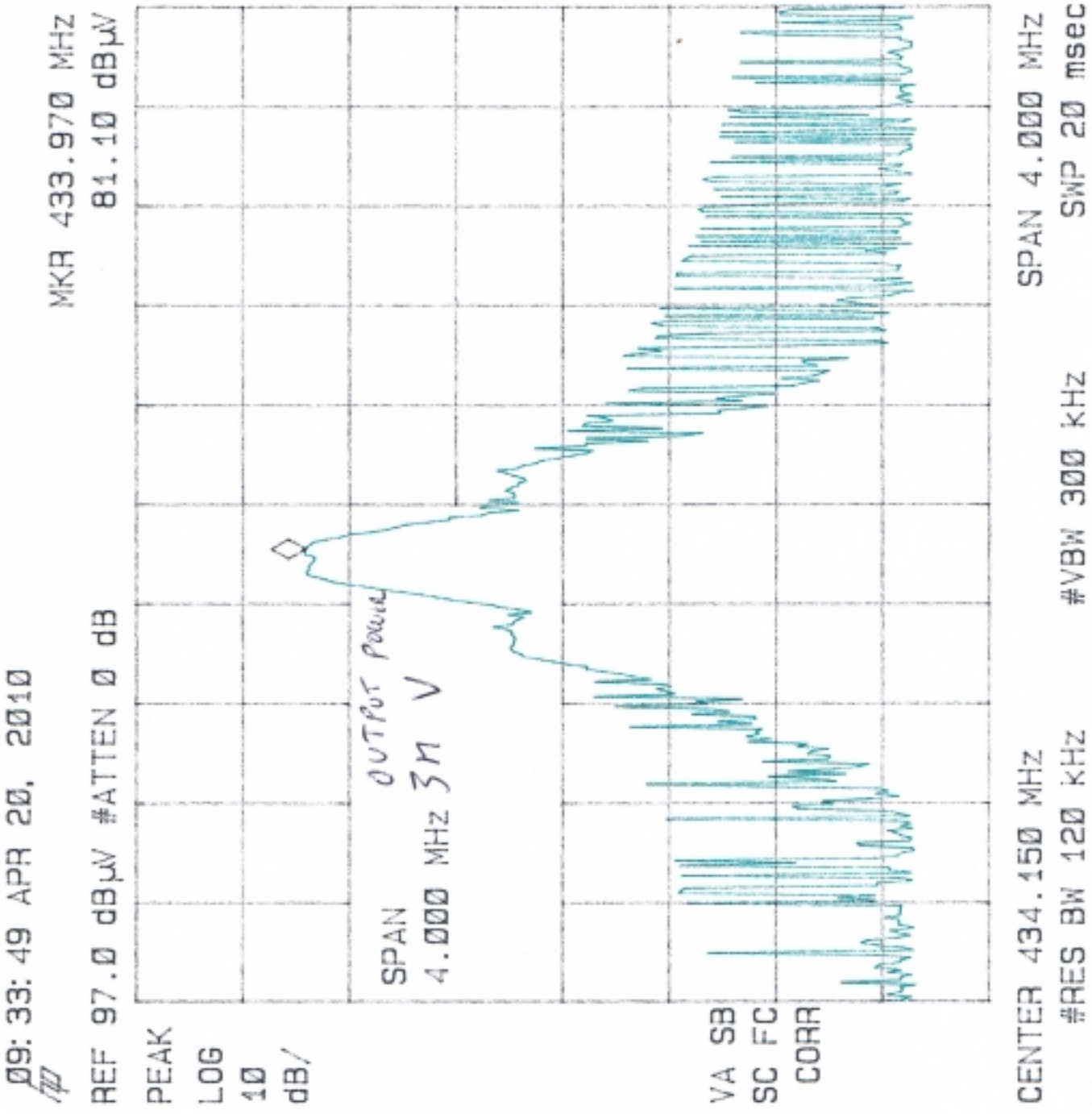
For all measurements, the spectrum analyzer was set for 10 dB input attenuation, 10 dB/Division vertical scale and 90 or 100 dBµV reference level. The resolution bandwidth was set at 9 KHz for the 0.15 - 30 MHz span and at 120 KHz for 30 – 9.200 GHz span. The video bandwidth and sweep rate were automatically coupled by the analyzer.

Section 5

OUTPUT POWER

Test Results

Frequency (MHz)	Antenna Polarization	Output in dBµV/m	Corrected reading	FCC Limits dBµV/m	Margin dBµV/m
433.970	H	80.17	77.07	80.8	-3.73
433.970	V	81.10	77.90	80.8	-2.90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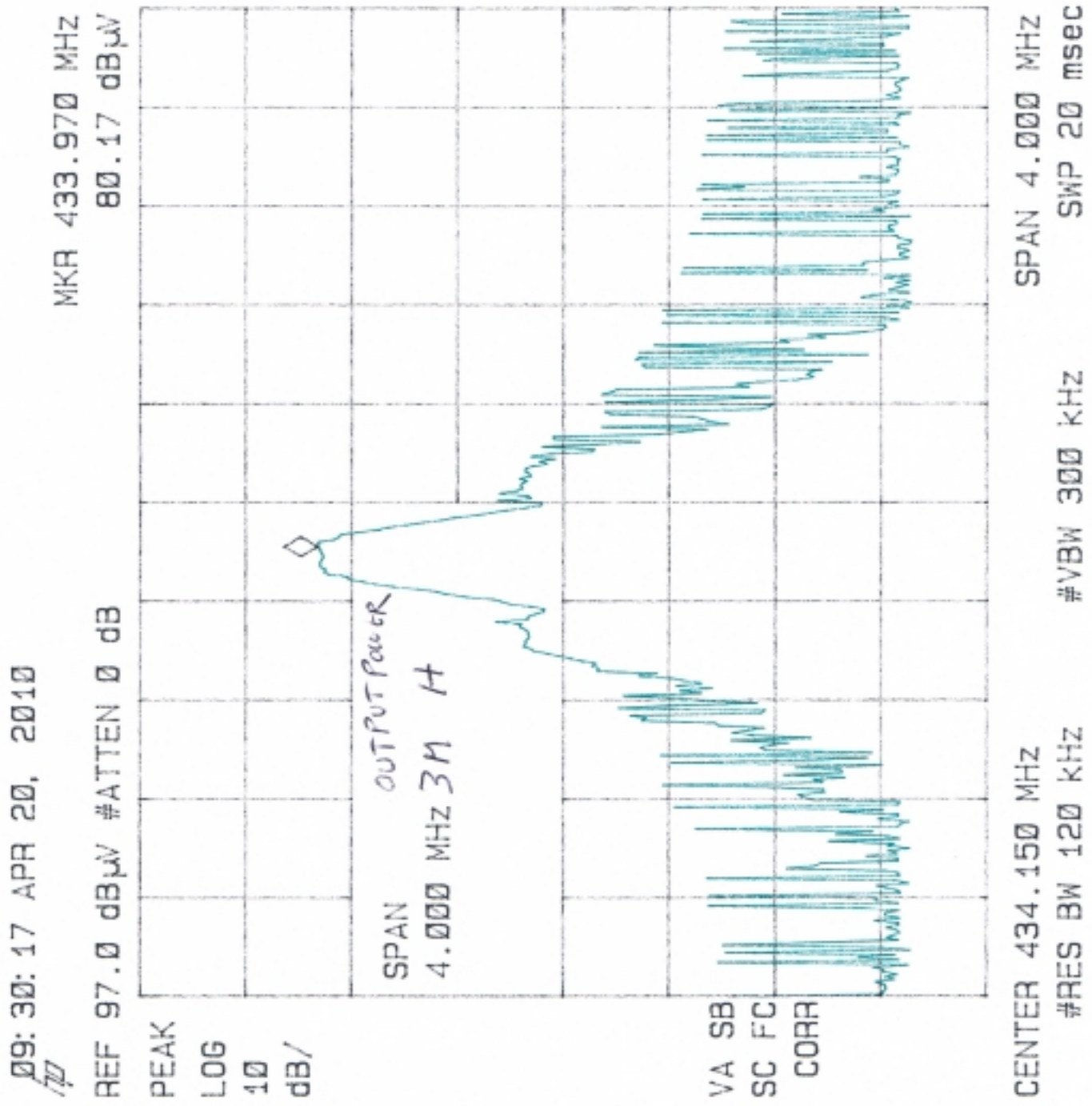
81.10 dBµV
REF 97.0 dBµV #ATTEN 0 dB
PEAK
LOG
10
dB/
SPAN
4.000 MHz
output power
3m V
VA SB
SC FC
CORR
CENTER 434.150 MHz
#RES BW 120 kHz
#VBW 300 kHz
SPAN 4.000 MHz
SWP 20 msec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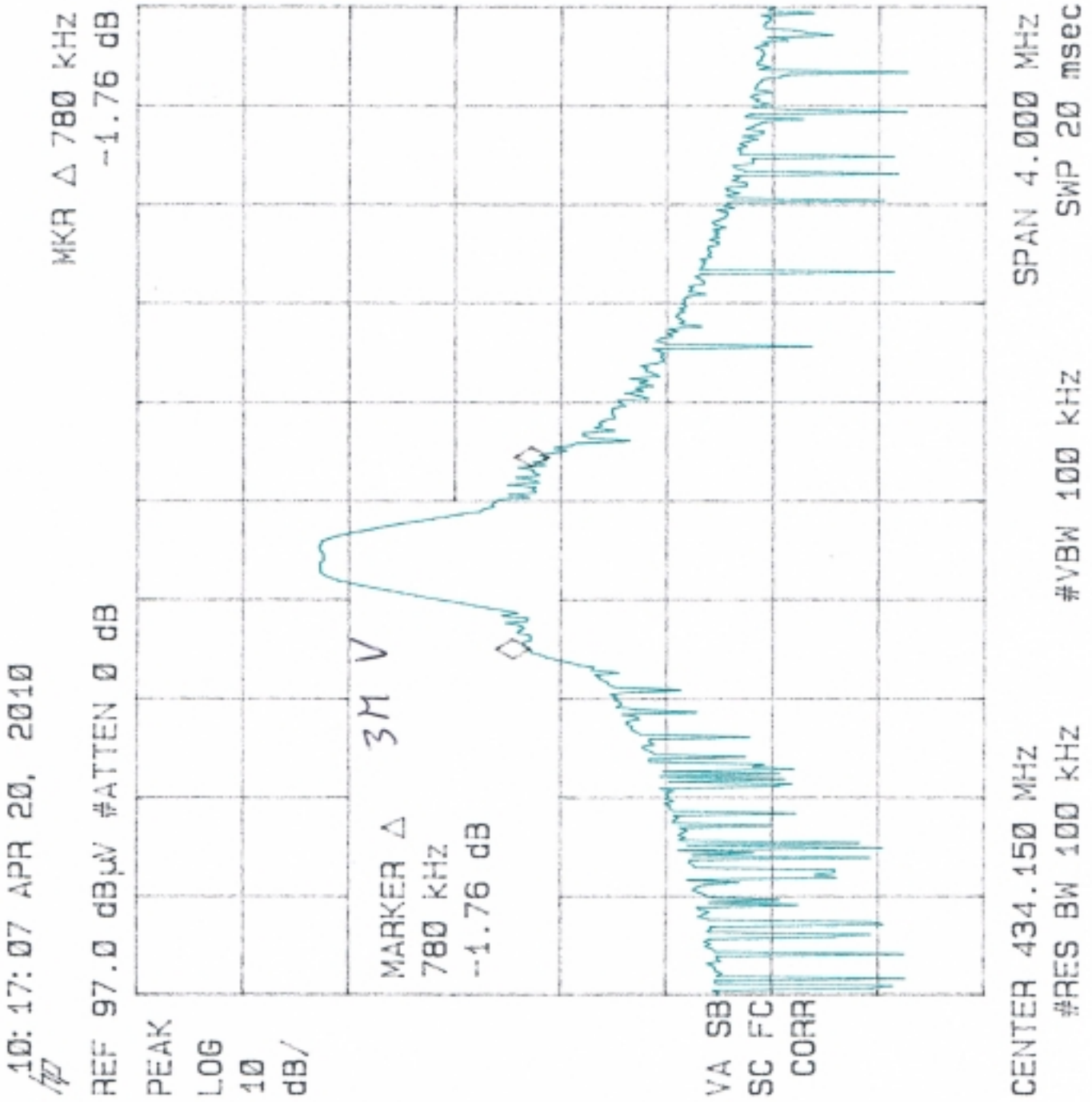
MKR 433.970 MHz
80.17 dBµV
REF 97.0 dBµV #ATTEN 0 dB
PEAK
LOG
10
dB/
SPAN
4.000 MHz
OUTPUT POWER
3M H
VA SB
SC FC
CORR
CENTER 434.150 MHz
#RES BW 120 KHz
#VBW 300 KHz
SPAN 4.000 MHz
SWP 20 msec

Section 6

BANDWIDTH

The measured occupied 20 dB bandwidth is 780 KHz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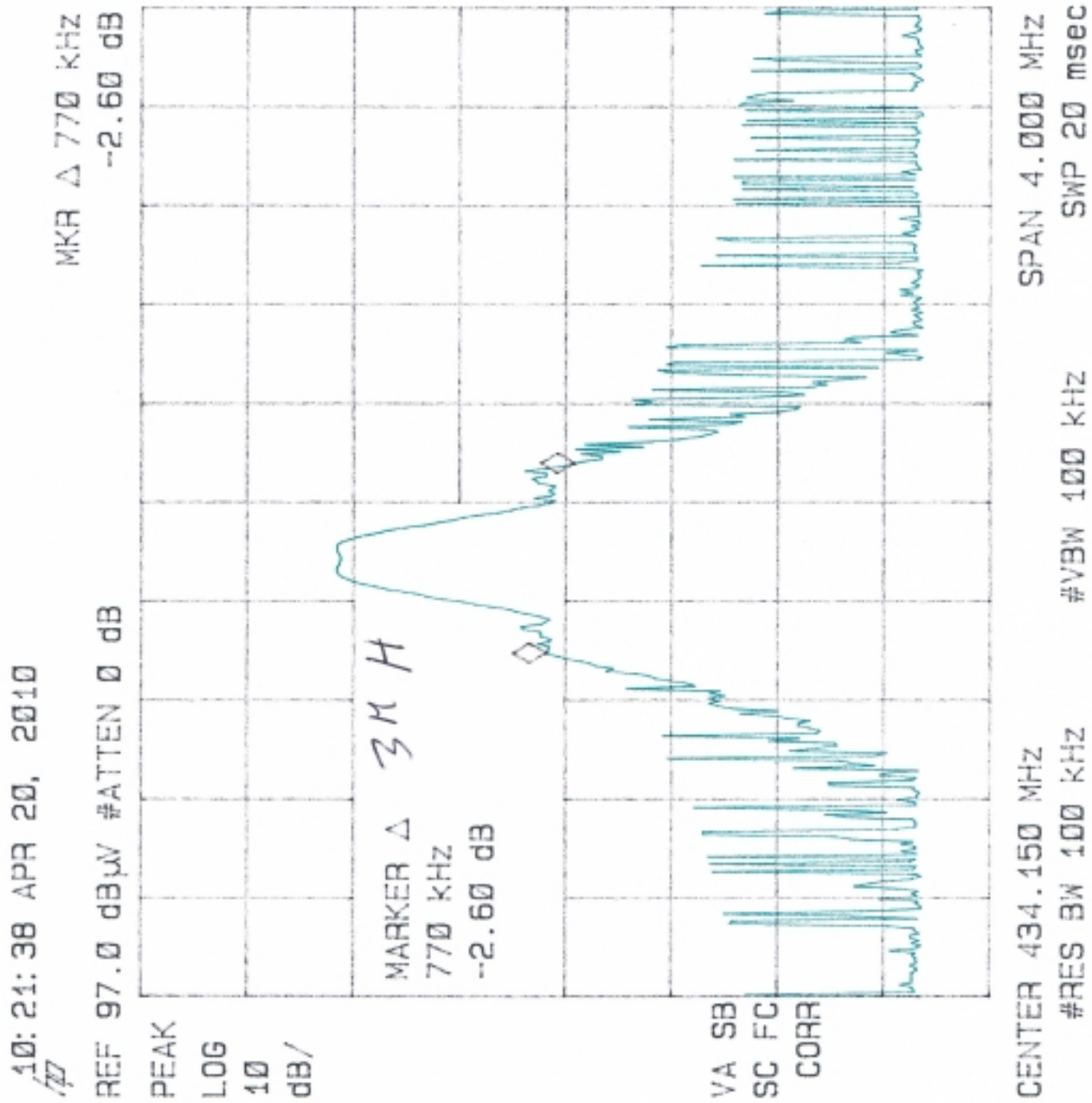
MKR Δ 780 kHz
-1.76 dB
REF 97.0 dBμV #ATTEN 0 dB
PEAK
LOG
10
dB/
MARKER Δ
780 kHz
-1.76 dB
3M V
VA SB
SC FC
CORR
CENTER 434.150 MHz
#RES BW 100 kHz
#VBW 100 kHz
SPAN 4.000 MHz
SWP 20 msec


10:21:38 APR 20, 2010
MKR Δ 770 kHz
-2.60 dB
REF 97.0 dBμV #ATTEN 0 dB
PEAK
LOG
10
dB/
MARKER Δ
770 kHz
-2.60 dB
3 H
VA SB
SC FC
CORR
CENTER 434.150 MHz
#RES BW 100 kHz
#VBW 100 kHz
SPAN 4.000 MHz
SWP 20 msec

Section 7

RADIATED EMISSIONS MEASUREMENTS

Radiated Emissions Measurements cont…

RADIATED EMISSIONS MEASUREMENTS

General: The following represents the highest measured radiated emissions.

Model number: SHC-G-MR-433 **Test Date:** April 12, 2010

Test distance: 3 meters Antenna Polarization: Vertical

Frequency, MHz	**Measuremen Reading, dBμV/m**	**Corrected Reading, dBμV/m**	**FCC Limit, dBμV/m**	**Minimum Margin, dBμV/m**
867.7*	54.82	59.22	71.94	-12.72
1301	43.70	33.80	61.94	-28.14
1735	45.11	36.81	61.94	-25.13
2169	46.68	41.18	61.94	-20.76
2603	46.77	43.17	61.94	-18.77
3037	40.81	39.21	61.94	-22.73
3471	41.07	40.97	61.94	-20.97
3905	40.08	37.98	61.94	-23.96
4339	40.10	36.90	61.94	-25.04

* Due to ambient noise, this measurement was made at 1 meter.

Note: The measured levels are the ambient noise floor. No harmonics emissions were observed.

Radiated Emissions Measurements cont…

RADIATED EMISSIONS MEASUREMENTS

Model number: SHC-G-MR-433 **Test Date:** April 12, 2010

Test distance: 3 meters Antenna Polarization: Horizontal

Frequency, MHz	**Measuremen Reading, dBμV/m**	**Corrected Reading, dBμV/m**	**FCC Limit, dBμV/m**	**Minimum Margin, dBμV/m**
867.7*	54.87	59.27	71.94	-12.67
1301	43.57	32.77	61.94	-29.17
1735	44.47	36.17	61.94	-25.77
2169	48.11	42.61	61.94	-19.33
2603	46.88	43.28	61.94	-18.66
3037	41.40	39.6	61.94	-22.34
3471	41.38	41.28	61.94	-20.66
3905	40.69	38.59	61.94	-23.35
4339	40.03	36.83	61.94	-25.11

* Due to ambient noise, this measurement was made at 1 meter.

Note: The measured levels are the ambient noise floor. No harmonics emissions were observed.

Section 8

CONDUCTED EMISSIONS MEASUREMENTS

Conducted Emissions Measurements cont…

CONDUCTED EMISSIONS MEASUREMENTS

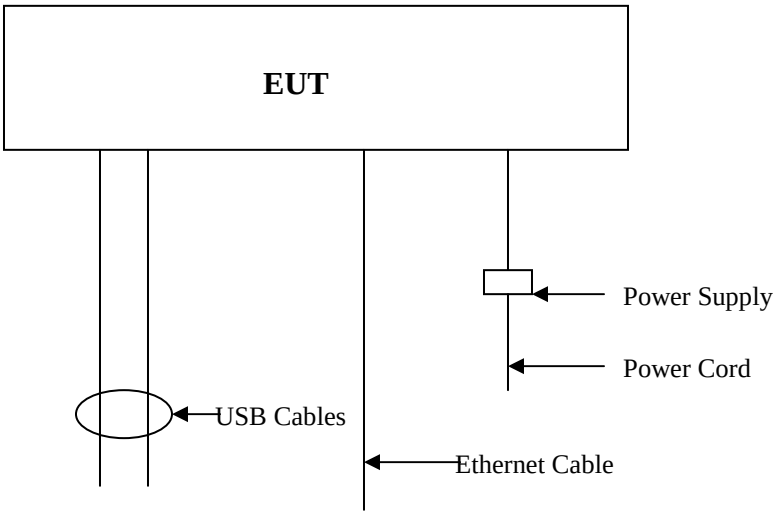
Model no. SHC-G-MR-433

Test voltage: 120V, 60Hz **Test date:** April 12, 2010

Frequency MHz	**Reading * dBuV, L1**	**Frequency MHz**	**Reading * dBuV, L2**	**CISPR Limit, dBuV****	**Margin dBuV**
There were no measurable conducted emissions from the device within 20 dB from the limits					

Section 9

CONFIGURATION



Section 10

TEST EQUIPMENT

Test Equipment	**Model No.**	**Cal. Due**
Spectrum Analyzer	8592L	Jan 2011
LISN	LI-210	Jul 2010
Preamplifier	8449B	Jan 2011

Antennas	**Frequency Span**	**Cal. Due**
Biconical	20 - 200 MHz	Feb. 2011
Log Periodic	200 - 1000 MHz	Feb. 2011
Horn	1-18 GHz	Feb. 2011

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