Nemko-CCL, Inc.

1940 West Alexander Street
Salt Lake City, UT 84119
801-972-6146

Test Report

Declaration of Conformity

Test Of: MICRO-RM2.4

Test Specifications:

EN 301 489-1 V1.9.2 (2011-09)
as specified in
EN 301 489-17 V2.2.1 (2012-09)

Test Report Serial No: 270648-5.1

Applicant:
MicroRidge Systems, Inc.
56888 Enterprise Drive
Sunriver, Oregon 97707
U.S.A

Dates of Test: October 2-7, 2014

Report Issue Date: October 21, 2014

Accredited Testing Laboratory By:

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Nemko-CCL, Inc. to document compliance of the device described below with the requirements of EN 301 489-1 V1.9.2 (2011-09) as specified in EN 301 489-17 V2.2.1 (2012-09) as shown in the summarization table of Section 5 of this report. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

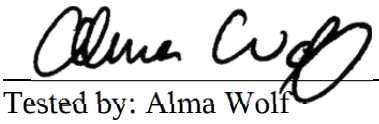
- Applicant: MicroRidge Systems, Inc.
- Manufacturer: MicroRidge Systems, Inc.
- Brand Name: MicroRidge
- Model Number: MICRO-RM2.4

On this 21st day of October 2014, I, individually and for Nemko-CCL, Inc., certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

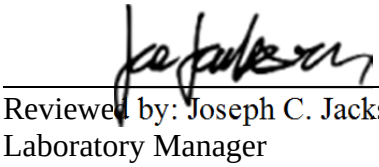
Although NVLAP has accredited the Nemko-CCL, Inc. EMC testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Nemko-CCL, Inc.

Tested by: Norm Hansen
EMC Test Technician



Tested by: Alma Wolf
Immunity Test Technician



Reviewed by: Joseph C. Jackson
Laboratory Manager

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: MicroRidge Systems, Inc.
56888 Enterprise Drive
Sunriver, Oregon 97707
U.S.A.

Contact Name: John Schuldt
Title: President

1.2 Manufacturer:

Company Name: MicroRidge Systems, Inc.
56888 Enterprise Drive
Sunriver, Oregon 97707
U.S.A.

Contact Name: John Schuldt
Title: President

1.3 Party Responsible for Declaration of Conformity:

Company Name: MicroRidge Systems, Inc.
56888 Enterprise Drive
Sunriver, Oregon 97707
U.S.A.

Contact Name: John Schuldt
Title: President

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	MicroRidge
Model Number:	MICRO-RM2.4
Serial Number:	9600-N-8-1
Options Fitted:	N/A
Dimensions:	7.2 cm x 5.6 cm x 1.3 cm

2.2 Description of EUT:

Compact and low-power 2.4 GHz wireless module designed for industrial and consumer ZigBee/IEEE 802.15.4, 6LoWPAN, RF4CE and high data rate 2.4 GHz ISM band applications. The wireless module is built around an Atmel ATmega2564RFR2 AVR microcontroller that has an integrated radio transceiver. The wireless module also contains a chip antenna, crystals and de-coupling capacitors. This wireless module is designed to be integrated into products that require low-power short range wireless connectivity.

The equipment under test consists of the wireless module attached to a carrier board that supplies programming access, USB connectivity to a virtual serial port on a PC, a 3.3 VDC power source and a module reset button.

2.3 EUT and Support Equipment for Emissions and Immunity:

The EUT and support equipment used during the test are listed below:

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: MicroRidge MN: MICRO-RM2.4 (Note 1) SN: 9600-N-8-1	Transceiver Module	See Section 2.4
BN: Dell MN: Vostro SN: 2878353565	Computer	USB/USB cable
BN: MicroRidge MN: Host PCB (Note 2) SN: #1	Host PCB	USB/USB cable Power/Serial communication lines/Directly soldered to host PCB

Brand Name Model Number Serial Number	Description	Name of Interface Ports / Interface Cables
BN: MicroRidge MN: USB Base SN: None	USB Base	USB/USB cable

Note: (1) EUT
(2) Interface port connected to EUT (See Section 2.4)

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.4 Interface Ports on EUT

2.4.1 Interface Ports on EUT for Emissions:

Name of Ports	No. of Ports Fitted to EUT	Cable Descriptions/Length
System Interface	1	Soldered directly to host PCB providing power source and communication interface

2.4.2 Interface Ports on EUT for Immunity:

Name of Ports	No. of Ports Fitted to EUT	Cable Descriptions/Length
System Interface	1	Soldered directly to host PCB providing power source and communication interface over USB. USB-A to USB-A / 5.0 m

2.5 Modification Incorporated/Special Accessories on EUT

There were no modifications or special accessories required to comply with the specification.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specifications:

Title: EN 301 489-17 V2.1.1 (2009-05)

Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for Broadband Data Transmission Systems

EN 301 489-1 V1.8.1 (2008-04)

Electromagnetic compatibility and Radio spectrum Matter (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

Purpose of Test: The tests were performed to demonstrate initial compliance.

3.2 Specified Tests and Methods:

The testing was performed according to the methods and procedures of EN 301 489-1 as specified in EN 301 489-17. Below are shown Tables 1 and 2 of EN 301 489-1, summarizing the specified tests to be performed and the applicable paragraph of the standard. The limits used in determining compliance for emissions limits are specified in EN 301 489-1 Clause 8.

EN 301 489-1 Table 1: EMC emission measurements for radio and associated ancillary equipment specified in the present document, overview

Phenomenon	Application	Equipment test requirement			Reference clause in the present document (EN 301 489-1)
		Radio and ancillary equipment for fixed use (e.g. base station equipment)	Radio and ancillary equipment for vehicular use (e.g. mobile equipment)	Radio and ancillary equipment for portable use (portable equipment)	
Radiated emission	Enclosure of ancillary equipment	Applicable for stand-alone testing	Applicable for stand-alone testing	Applicable for stand-alone testing	8.2
Conducted emission	DC power input/output port	Applicable	Applicable	Not applicable	8.3
Conducted emission	AC mains input/output port	Applicable	Not applicable	Not applicable	8.4
Harmonic current emissions	AC mains input port	Applicable	Not applicable	Not applicable	8.5
Voltage fluctuations & flicker	AC mains input port	Applicable	Not applicable	Not applicable	8.6

Phenomenon	Application	Equipment test requirement			Reference clause in the present document (EN 301 489-1)
		Radio and ancillary equipment for fixed use (e.g. base station equipment)	Radio and ancillary equipment for vehicular use (e.g. mobile equipment)	Radio and ancillary equipment for portable use (portable equipment)	
Conducted emission	Telecommunication port	Applicable	Not applicable	Not applicable	8.7

EN 301 489-1 Table 2: Immunity tests for radio and associated ancillary equipment specified in the present document, overview

Phenomenon	Application	Equipment test requirement			Reference clause in the present document (EN 301 489-1)
		Radio and ancillary equipment for fixed use (e.g. base station equipment)	Radio and ancillary equipment for vehicular use (e.g. mobile equipment)	Radio and ancillary equipment for portable use (portable equipment)	
RF electromagnetic field (80 MHz to 1 000 MHz and 1 400 MHz to 2 700 MHz)	enclosure	applicable	applicable	applicable	9.2
electrostatic discharge	enclosure	applicable	not applicable	applicable	9.3
fast transients common mode	signal, telecommunication and control ports, DC and AC power ports	applicable	not applicable	not applicable	9.4
RF common mode 0,15 MHz to 80 MHz	signal, telecommunication and control ports, DC and AC power ports	applicable	not applicable	not applicable	9.5
transients and surges	DC power input ports	not applicable	applicable	not applicable	9.6
voltage dips and interruptions	AC mains power input ports	applicable	not applicable	not applicable	9.7
surges, line to line and line to ground	AC mains power input ports, telecommunication ports	applicable	not applicable	not applicable	9.8

3.3 Test Procedure

The conducted disturbance at mains and telecommunications ports and radiated disturbance testing was performed according to the procedures in EN 301 489-1, Section 8 as specified in EN 301 489-17, Clause 7.1. Testing was performed at the Nemko-CCL, Inc. Wanship open area test site #2, located at 29145 Old Lincoln Highway, Wanship, UT. This site has been registered with the FCC, and was renewed February 15, 2012 (90504). This registration is valid for three years.

Immunity testing to EN 301 489-1, Section 9 as specified in EN 301 489-17, Clause 7.2 was performed at the Nemko-CCL, Inc. test site #6 in Salt Lake City, UT, U.S.A.

Nemko-CCL, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2015.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Normal Test Environment:

4.1.1 Normal Test Environment for Emissions:

Power Supply:	3.3 VDC to transceiver module from external power supply
Temperature:	21°C
Relative Humidity:	22%

4.1.2 Normal Test Environment for Immunity:

Power Supply:	3.3 VDC to transceiver module from external power supply
Temperature:	18.4°C
Relative Humidity:	38.7%

4.2 Operating Mode:

4.2.1 Operating Mode for Emissions:

Each mode of operation was exercised to produce worst-case emissions and the EUT was tested on 3 orthogonal axes. The worst-case emissions were with the Micro-RM2.4-LB connected to the support equipment, placed horizontally on the table, and the EUT wirelessly connected to the USB Base with data transfer.

4.2.2 Operating Mode for Immunity:

The MICRO-RM2.4 was transmitting packets of data via Zigbee wireless module to the MobileCollect USB Base over short range.

4.3 EUT Exercise Software:

FCC, IC & CE Test Firmware with RFR2 Radio @ 2.4 GHz
Version Number: 5.01
Version Date: 6-24-14

4.4 Performance Criteria

For this EUT, the client has stated that the performance criteria defined in EN 301 489-1, ETSI EN 301 489-17 should be applied as follows: The EUT shall continue to operate as intended, with no degradation of performance allowed.

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following clauses.

Criteria	During test	After test
A	Shall operate as intended. May show degradation of performance (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 2). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 1). No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2).

NOTE 1: Degradation of performance during the test is understood as degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.
If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

4.5 Monitoring of the EUT

The MICRO-RM2.4 was monitored using a laptop computer and a USB Base receiver.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 EN 301 489-1 V1.8.1 (2008-04)

5.1.1 Summary of Tests:

Phenomenon	Application	Frequency Range (MHz)	Result
Emissions			
Radiated Emission	Enclosure	30 - 6000	Complied
Conducted Emission	DC Power Input/Output Port	0.15 - 30	Not Applicable
Conducted Emission	AC Mains Input/Output Port	0.15 - 30	Complied
Harmonic Current Emission	AC Mains Input Port	0.15 - 30	Not Applicable
Voltage Fluctuations and Flicker	AC Mains Input Port	0.15 - 30	Not Applicable
Conducted Emission	Telecommunication Port	0.15 - 30	Not Applicable
Immunity			
RF Electromagnetic Field	Enclosure	80MHz – 1GHz, 1.4GHz – 2.7GHz	Complied
Electrostatic Discharge	Enclosure	N/A	Not Tested
Fast Transients	Signal, Telecommunication, Control, DC and AC Power Ports	N/A	Complied
RF Common Mode	Signal, Telecommunication, Control, DC and AC Power Ports	150kHz – 80MHz	Complied
Transients and Surges	DC Power Input Port	N/A	Not Applicable
Voltage Dips and Interruptions	AC Mains Input Port	N/A	Not Applicable
Surges	AC Mains Input, Telecommunication Ports	N/A	Not Applicable

5.2 Result

In the configurations tested, the EUT complied with the requirements of the specification as shown in the above table.

SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS

6.1 General Comments:

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Appendix 1 of this report.

6.2 Test Results:

6.2.1 Radiated Disturbance Data (Vertical Polarity)

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	10 m Limit (dBμV/m)	Margin (dB)
37.7	Peak (Note 1)	8.0	13.5	21.5	30.0	-8.5
60.4	Peak (Note 1)	16.3	7.5	23.8	30.0	-6.2
116.0	Peak (Note 1)	7.0	8.2	15.2	30.0	-14.8
120.8	Peak (Note 1)	6.9	8.0	14.9	30.0	-15.1
133.2	Peak (Note 1)	6.2	8.0	14.2	30.0	-15.8
214.4	Peak (Note 1)	4.4	12.0	16.4	30.0	-13.6
372.8	Peak (Note 1)	3.1	18.1	21.2	37.0	-15.8

Note 1: The reference detector used for the measurements was peak or quasi-peak and the data was compared to the quasi-peak limit.

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 4.3 dB from 30 MHz to 200 MHz and ± 2.7 dB from 200 MHz to 1 GHz at a 10 meter measurement distance.

RESULT

The EUT complied with the specification limit by a margin of 6.2 dB.

6.2.2 Radiated Disturbance Data (Horizontal Polarity)

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	10 m Limit (dBμV/m)	Margin (dB)
65.2	Peak (Note 1)	7.6	7.2	14.8	30.0	-15.2
132.7	Peak (Note 1)	4.8	8.0	12.8	30.0	-17.2
175.0	Peak (Note 1)	3.6	10.4	14.0	30.0	-16.0
192.9	Peak (Note 1)	0.0	11.6	11.6	30.0	-18.4
444.8	Peak (Note 1)	-1.9	19.2	17.3	37.0	-19.7
738.4	Peak (Note 1)	-1.7	26.0	24.3	37.0	-12.7

Note 1: The reference detector used for the measurements was peak or quasi-peak and the data was compared to the quasi-peak limit.

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 4.3 dB from 30 MHz to 200 MHz and ± 2.7 dB from 200 MHz to 1 GHz at a 10 meter measurement distance.

RESULT

The EUT complied with the specification limit by a margin of 12.7 dB.

6.2.3 Conducted Disturbance at Mains Ports Data (Hot Lead)

Frequency (MHz)	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.18	Quasi-Peak (Note 1)	46.9	54.5	-7.6
0.26	Peak (Note 1)	46.1	51.5	-5.4
0.31	Peak (Note 1)	41.0	50.1	-9.1
0.37	Peak (Note 1)	34.9	48.4	-13.5
0.65	Peak (Note 1)	30.5	46.0	-15.5
2.59	Peak (Note 1)	31.7	46.0	-14.3
Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.				

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 3.3 dB.

RESULT

The EUT complied with the specification limit by a margin of 5.4 dB.

6.2.4 Conducted Disturbance at Mains Ports Data (Neutral Lead)

Frequency (MHz)	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.20	Peak (Note 1)	44.4	53.6	-9.2
0.23	Peak (Note 1)	37.7	52.5	-14.8
0.26	Peak (Note 1)	36.5	51.5	-15.0
0.33	Peak (Note 1)	32.2	49.6	-17.4
0.38	Peak (Note 1)	30.0	48.2	-18.2
4.80	Peak (Note 1)	33.1	46.0	-12.9
Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.				

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was ± 3.3 dB.

RESULT

The EUT complied with the specification limit by a margin of 9.2 dB.

6.3 Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor), to the measured level from the receiver. The receiver amplitude reading is compensated for any amplifier gain. The basic equation with a sample calculation is shown below:

FS = RA + CF Where

FS = Field Strength
RA = Receiver Amplitude Reading (Receiver Reading - Amplifier Gain)
CF = Correction Factor (Antenna Factor + Cable Factor)

Assume a receiver reading of 42.5 dBμV is obtained from the receiver, an amplifier gain of 26.5 dB and a correction factor of 8.5 dB/m. The field strength is calculated by subtracting the amplifier gain and adding the correction factor, giving a field strength of 24.5 dBμV/m, FS = (42.5 - 26.5) + 8.5 = 24.5 dBμV/m

6.4.1 RF Electromagnetic Field

Port: Enclosure
Basic Standard: EN 61000-4-3:2006 (IEC 61000-4-3:2006)
Performance Criterion: A
Limit: 3 V/m
Modulation: 1 kHz 80% Amplitude Modulated

Temperature during testing: 18.4°C
Relative Humidity during testing: 38.7%
Atmospheric Pressure during testing: 877 mbar

Frequency (MHz)	Level* (V/m)	Exposed Area	Comment	Result
80 - 1000	3	Front	Note 1	Complied
80 - 1000	3	Right Side	Note 1	Complied
80 - 1000	3	Left Side	Note 1	Complied
80 - 1000	3	Rear	Note 1	Complied
1400 – 2700	3	Front	Note 1	Complied
1400 – 2700	3	Right Side	Note 1	Complied
1400 – 2700	3	Left Side	Note 1	Complied
1400 – 2700	3	Rear	Note 1	Complied
Note 1: There was no observable degradation in the performance of the EUT.				

RESULT

In the configuration tested, the EUT complied with the specification.

6.4.2 RF Common Mode

Port: Signal lines and telecommunication lines
Basic Standard: EN 61000-4-6:2009 (IEC 61000-4-6:2008)
Performance Criterion: A
Limit: 3 V
Modulation: 1 kHz 80% Amplitude Modulated
Temperature during testing: 18.7°C
Relative Humidity during testing: 41.0%

Frequency (MHz)	Level (V)	Exposed Cable	Comment	Result
0.15 – 80	3.0	USB-A	Note 1	Complied
Note 1: There was no observable degradation in the performance of the EUT.				

RESULT

In the configuration tested, the EUT complied with the specification.

6.4.3 Fast Transients Common Mode

Port: Signal lines and telecommunication lines
Basic Standard: EN 61000-4-4:2004 (IEC 61000-4-4:2004)
Performance Criterion: B
Limit: 0.5 kV
Temperature during testing: 18.8°C
Relative Humidity during testing: 41.7%

Line	Severity Level (kV)	Polarity	Duration	Comment	Result
USB-A	0.5	Pos & Neg	2 Min	Note 1	Complied
Note 1: There was no observable degradation in the performance of the EUT.					

RESULT

In the configuration tested, the EUT complied with the specification.

APPENDIX 1 TEST EQUIPMENT

A.1.1 Conducted Disturbance at Mains and Telecommunication Ports:

Type of Equipment	Manufacturer	Model Number	Barcode Number	Date of Last Calibration	Due Date of Calibration
Wanship Open Area Test Site #2	Nemko	N/A	830	12/10/2013	12/10/2014
Test Software	Nemko	Conducted Emissions	Revision 1.2	N/A	N/A
Spectrum Analyzer	Hewlett Packard	8566B	644	02/25/2014	02/25/2015
Quasi-Peak Detector	Hewlett Packard	85650A	572	03/10/2014	03/10/2015
LISN	Nemko	LISN-COMM-50	1424	03/04/2014	03/04/2015
T-LISN	Teseq	ISN T800	1181	10/07/2013	10/07/2014
Capacitive Voltage Probe	Teseq	CVP 2200A	1182	07/08/2013	07/08/2015
Current Probe	Schaffner	CSP 9160	1131	07/08/2013	07/08/2015
Conductance Cable Wanship Site #2	Nemko	Cable J	840	12/19/2013	12/19/2014
Transient Limiter	Hewlett Packard	11947A	641	12/18/2013	12/18/2014

An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

A.1.2 Radiated Disturbance:

Type of Equipment	Manufacturer	Model Number	Barcode Number	Date of Last Calibration	Due Date of Calibration
Wanship Open Area Test Site #2	Nemko	N/A	830	12/10/2013	12/10/2014
Test Software	Nemko	Radiated Emissions	Revision 1.3	N/A	N/A
Spectrum Analyzer/Receiver	Rohde & Schwarz	ESU40	1229	04/08/2014	04/08/2015
Spectrum Analyzer	Hewlett Packard	8566B	644	02/25/2014	02/25/2015
Quasi-Peak Detector	Hewlett Packard	85650A	572	03/10/2014	03/10/2015
Biconilog Antenna	EMCO	3142	713	10/10/2012	10/10/2014
Double Ridged Guide Antenna	EMCO	3115	735	03/07/2013	03/07/2015
High Frequency Amplifier	Miteq	AFS4-00102650-35-10P-4	1299	05/08/2014	05/08/2015
20’ High Frequency Cable	Microcoax	UFB197C-1-3120-000000	1297	05/08/2014	05/08/2015
10 Meter Radiated Emissions Cable Wanship Site #2	Nemko	Cable L	842	12/19/2013	12/19/2014
Pre/Power-Amplifier	Hewlett Packard	8447F	762	09/05/2014	09/05/2015
6 dB Attenuator	Hewlett Packard	8491A	1103	12/23/2013	12/23/2014

An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

A.1.3 RF Electromagnetic Field

The EUT was tested to the test procedures outlined in EN 61000-4-3:2006 Section 8.

The EUT was configured for normal operation as described in Sections 4.2 and 4.3.

The measurements are performed in a semi anechoic chamber, 6.2 m x 8.5 m. The EUT is placed 2 m from the back of the chamber and at least 2 m from each side. The radiating antenna is placed 3 m from the EUT and 1 m from the back of the chamber.

The chamber is calibrated for field uniformity every twelve months using the constant field strength calibration method (EN 61000-4-3:2006 6.2.1). Additionally, when changes have been made in the enclosure configuration the full field calibration is repeated. Before each batch of testing (see Clause 8), the validity of the calibration is verified. A vertical plane that is 1.5 m by 1.5 m defines the uniform field area. The bottom of this vertical plane is 0.8 m above the floor of the chamber. Sixteen points are defined in this vertical plane located 0.5-m apart arranged in a grid pattern in the plane. The uniformity of the chamber is met if 12 of the 16 points are within -0 to +6 dB of the nominal field level. The point with the maximum forward power measured is used for the calibration power when determining the field level at that frequency.

The uniformity of the chamber is determined by placing an isotropic field strength probe 3-m from the transmitting antenna at a height of 0.8 m from the floor of the chamber in the corner of the vertical field (position #1). The frequency range is swept incrementally (1% of fundamental) from 80 MHz to 1000 MHz. The forward power from the amplifier required to produce the desired field strength is measured and recorded. After the entire frequency range has been swept the probe is moved to the next position and the process is repeated until all 16 positions have been measured and recorded.

The radiating antenna was placed 3 m from the front of the EUT, in the exact position used during calibration.

The EUT is placed on a non-conducting foam table that is 0.8 m from the floor of the chamber, at the distance specified above. The frequency range is swept incrementally from 80 MHz to 1000 MHz using the previously recorded power levels to re-establish the field. The EUT is rotated in 90° increments to ensure that all four sides are exposed to the radiating field.

The dwell time at each frequency shall be not less than the time necessary for the EUT to be exercised, and be able to respond. The sensitive frequencies, the clock frequency (ies) and harmonics or frequencies of dominant interest are analyzed separately.

Type of Equipment	Manufacturer	Model Number	Barcode Number
Laser Probe Interface	Amplifier Research	FI7000	1207
Laser Probe	Amplifier Research	FL7218	1487
Directional Coupler 80 – 1000 MHz	Amplifier Research	DC6180A	1188
Directional Coupler 800 MHz – 4.2 GHz	Amplifier Research	DC7144A	1189
RF Power Meter	Boonton	4232A	1190
RF Power Sensor	Boonton	51011-EMC	1193
Biconilog Antenna	EMCO	3141	825
Double Ridge Guide Antenna	A.H. Systems, Inc.	SAS-570	1185
RF Power Amp 80 – 1000 MHz 500 Watts	Amplifier Research	500W1000A	1184
RF Power Amp 800 MHz – 4.2 GHz 100 Watts	Amplifier Research	100S1G4M1	1200
Signal Generator	Hewlett Packard	8647A	458

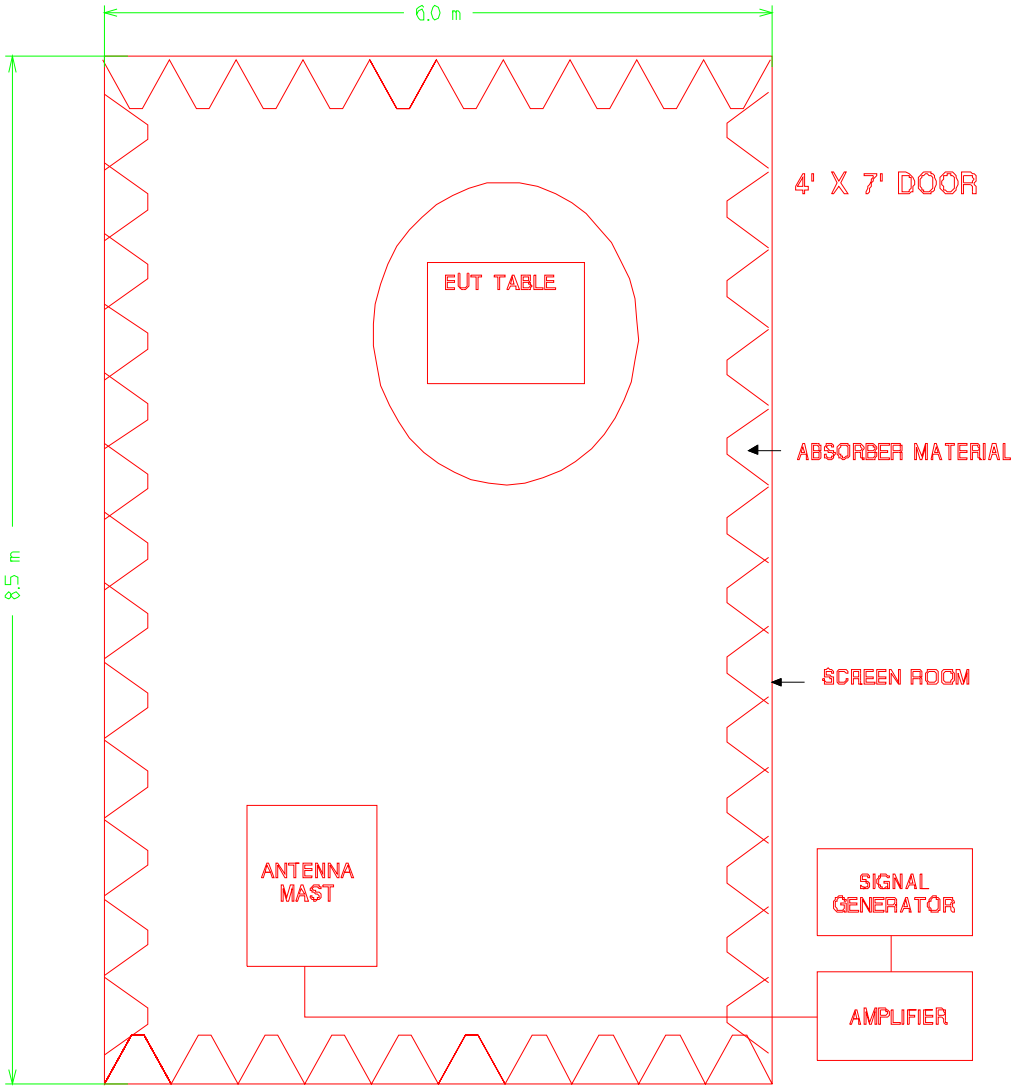
Artificial Ear (if used)

Type of Equipment	Manufacturer	Model Number	Barcode Number
Spectrum Analyzer	Hewlett Packard	3585A	N/A
Mixer/Amplifier	Yamaha	MG10/2	1363
Microphone (modified)	Digital Reference	DR-VX1	N/A

An independent calibration laboratory calibrates all the equipment listed above every 12 months or the equipment is calibrated by Nemko-CCL, Inc. personnel following outlined calibration procedures.

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test is: ± 0.8 V/m. The applied radio frequency electromagnetic field level was increased to account for this measurement uncertainty.



A.1.4 Fast Transients Common Mode

The EUT was tested to the test procedures outlined in EN 61000-4-4:2004 Section 8.

The EUT was configured for normal operation as described in Section 4.2 and 4.3.

The tests were performed in a shielded room that provides a ground reference plane (GRP) on the floor of the room, and is large enough to provide a minimum distance of 1 m between the EUT and the walls of the room. The test set-up consists of a wooden table, 0.8 m high, standing on the GRP.

The Electrical Fast Transients (EFT) are coupled to the EUT's power supply lines via a coupling network that is equipped with a mains socket to supply power to the EUT. The coupling network provides the capability of applying the transients to L1/E/L2 in any number of combinations. The selected test voltage is applied to the following lines for duration of 2 minutes in both the positive and negative polarities: L1/E/L2.

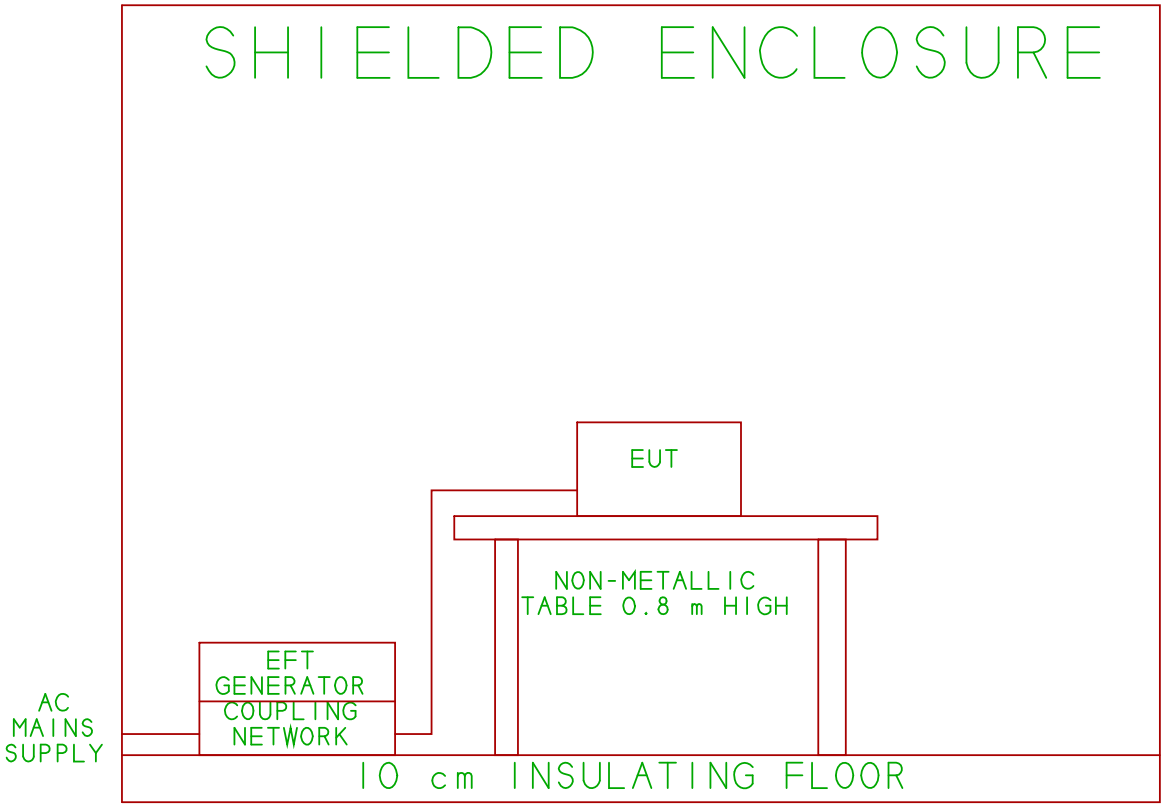
The EFT is coupled to any signal and control lines via a capacitive coupling clamp. The coupling clamp provides the capability of applying the transients to cables with diameters of 4 mm to 40 mm (1/16" to 1.5"). The selected test voltage is applied to the cable for duration of 2 minutes in both the positive and negative polarities.

Type of Equipment	Manufacturer	Model Number	Barcode Number
EMC Test System	Teseq	NSG 3040	1359
Software	Teseq	WIN3000	N/A
Capacitive Coupling Clamp	Schaffner	CDN 125	460

An independent calibration laboratory calibrates all the equipment listed above every 12 months or the equipment is calibrated by Nemko-CCL, Inc. personnel following outlined calibration procedures.

Measurement Uncertainty

The fast transient/burst pulse generator used to inject the pulses meets the specifications of this standard and where precision and reproducibility are concerned, often exceeds them.



A.1.5 RF Common Mode

The EUT was tested to the test procedures outlined in EN 61000-4-6:2009 Section 8.

The EUT was configured for normal operation as described in Sections 4.2 and 4.3.

The tests were performed in a shielded room that provides a ground reference plane (GRP) on the floor of the room, and is large enough to provide a minimum distance of 1 m between the EUT and the walls of the room. The test set-up consists of a wooden table, 0.1 m high, standing on the GRP.

The field strength is calibrated via an IBM compatible computer running custom software. The computer, signal generator, amplifier, and spectrum analyzer are located on the outside of the chamber during the tests. The CDN network or injection probe is configured into their calibration jigs and connected to the spectrum analyzer, to monitor the calibration. The software is designed to monitor the field strength as the frequency is swept incrementally from 150 kHz to 80 MHz. The step size shall not exceed 1% of the fundamental. The signal level to the coupling network is then adjusted until the required field intensity is indicated on the spectrum analyzer. This signal level is stored by the computer, without the EUT present, to be used during the testing routine.

The EUT is placed on a wooden table that is 0.1 m from the floor of the chamber and connected to the coupling network. The frequency range is swept incrementally from 150 kHz to 80 MHz using the previously recorded power levels to re-establish the field.

The dwell time at each frequency shall be not less than the time necessary for the EUT to be exercised, and be able to respond. The sensitive frequencies, the clock frequencies and harmonics or frequencies of dominant interest are analyzed separately.

Type of Equipment	Manufacturer	Model Number	Barcode Number
Coupling Decoupling Network (CDN)	Fischer Custom Communications, Inc.	FCC-801-M3-25	729
Coupling Decoupling Network (CDN)	Fischer Custom Communications, Inc.	FCC-801-T4	730
Coupling Decoupling Network (CDN)	Teseq	CDN-M016S	1273
Coupling Decoupling Network (CDN)	Com-Power	T8	1310
Injection Probe Calibration Jig	Fischer Custom Communications, Inc.	FCC-BCICF-1	728
Injection Probe	Solar Electronics Inc.	9108-1N	1246
Monitoring Probe	Solar Electronics Inc.	9123-1N	1209

Type of Equipment	Manufacturer	Model Number	Barcode Number
RF Power Amp 500 Watt 10 kHz – 100 MHz	Amplifier Research	500A100AM1	1187
Spectrum Analyzer	Hewlett Packard	8566B	N/A
Signal Generator	Hewlett Packard	8648C	738

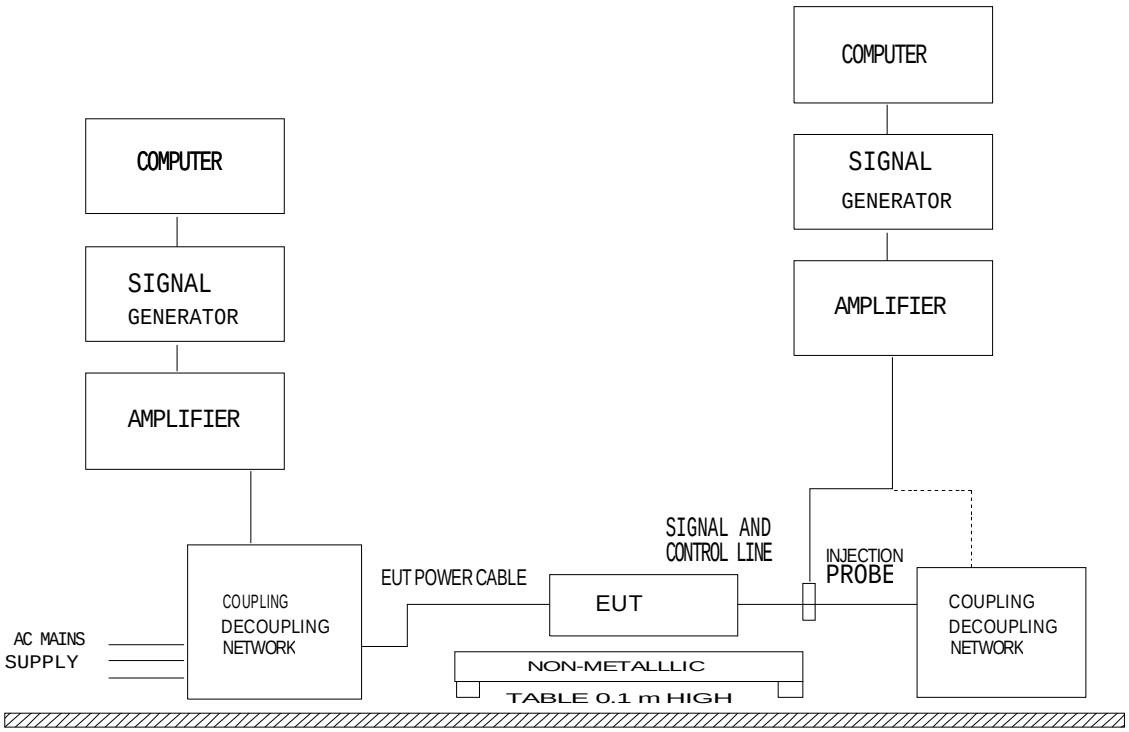
Artificial Ear (if used)

Type of Equipment	Manufacturer	Model Number	Barcode Number
Spectrum Analyzer	Hewlett Packard	3585A	N/A
Mixer/Amplifier	Yamaha	MG10/2	1363
Microphone (modified)	Digital Reference	DR-VX1	N/A

An independent calibration laboratory calibrates all the equipment listed above every 12 months or the equipment is calibrated by Nemko-CCL, Inc. personnel following outlined calibration procedures.

Measurement Uncertainty

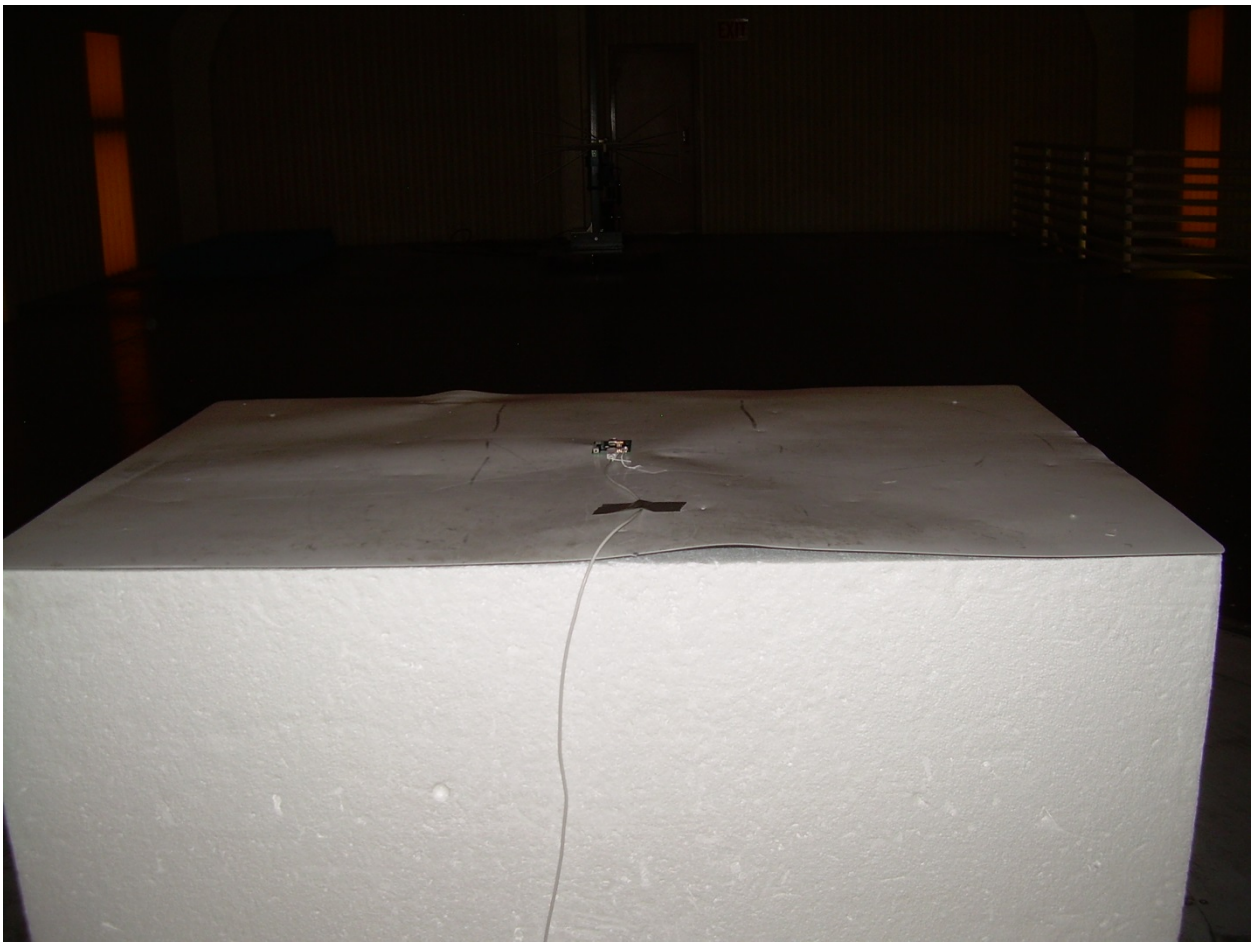
The measurement uncertainty (with a 95% confidence level) for this test is: ± 0.2 V. The test fixture and calibration procedure comply with the specifications of this standard.



APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Front View Radiated Disturbance Worst Case Configuration

Photograph 2 – Back View Radiated Disturbance Worst Case Configuration



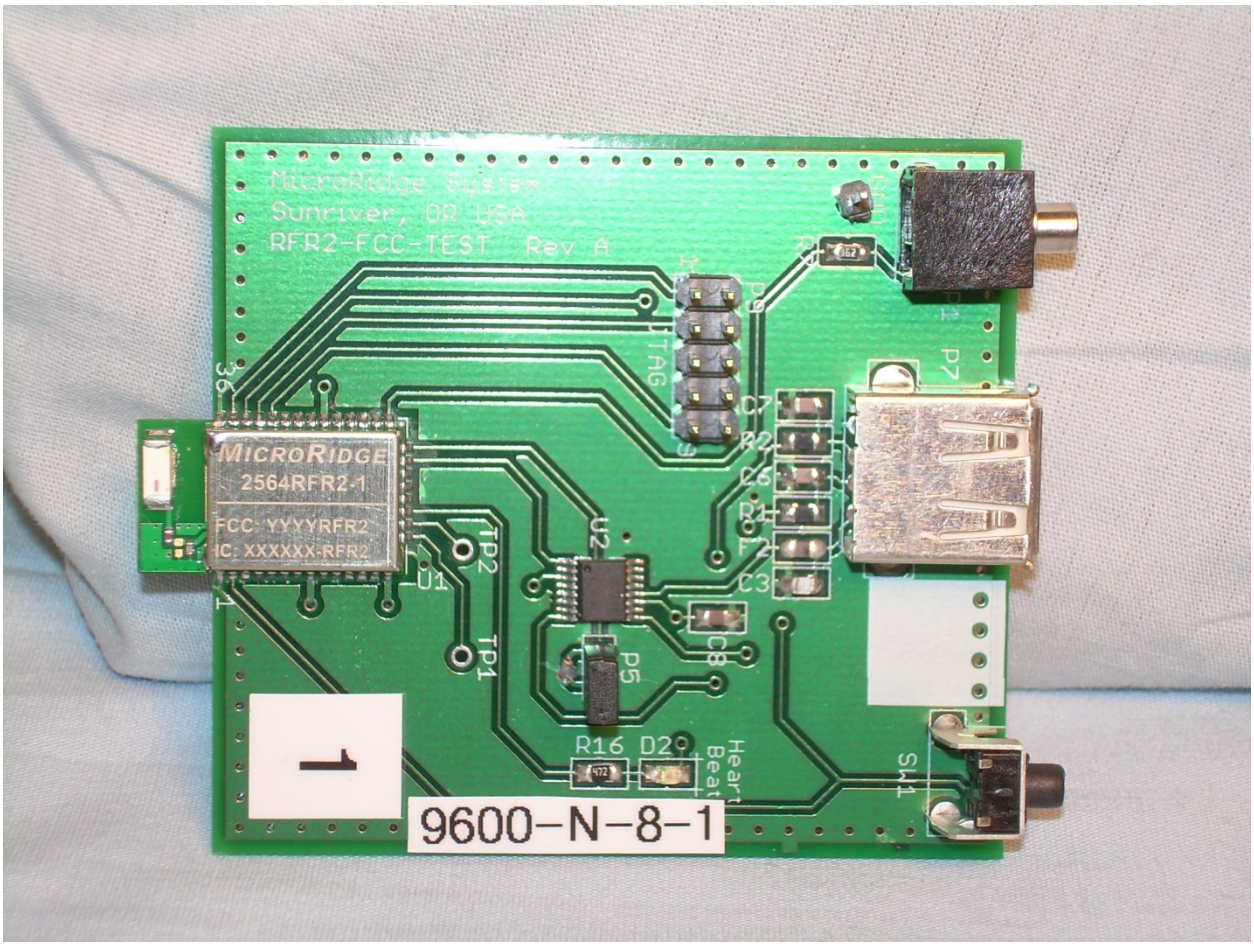
Photograph 3 – Front View Conducted Disturbance Configuration

Photograph 4 – Back View Conducted Disturbance Configuration

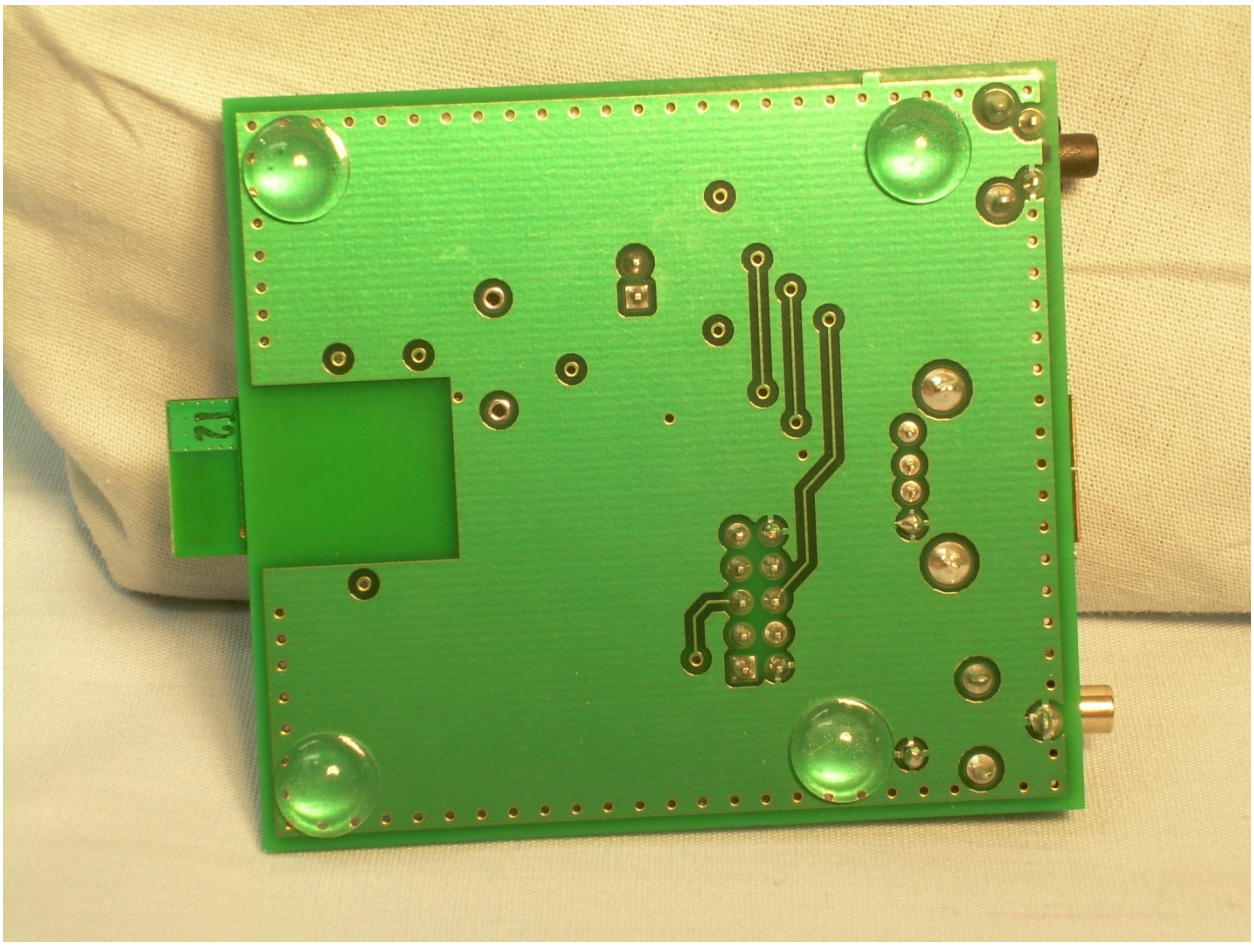
Photograph 5 – Front View Radiated Immunity Configuration

Photograph 6 – Rear View Radiated Immunity Configuration

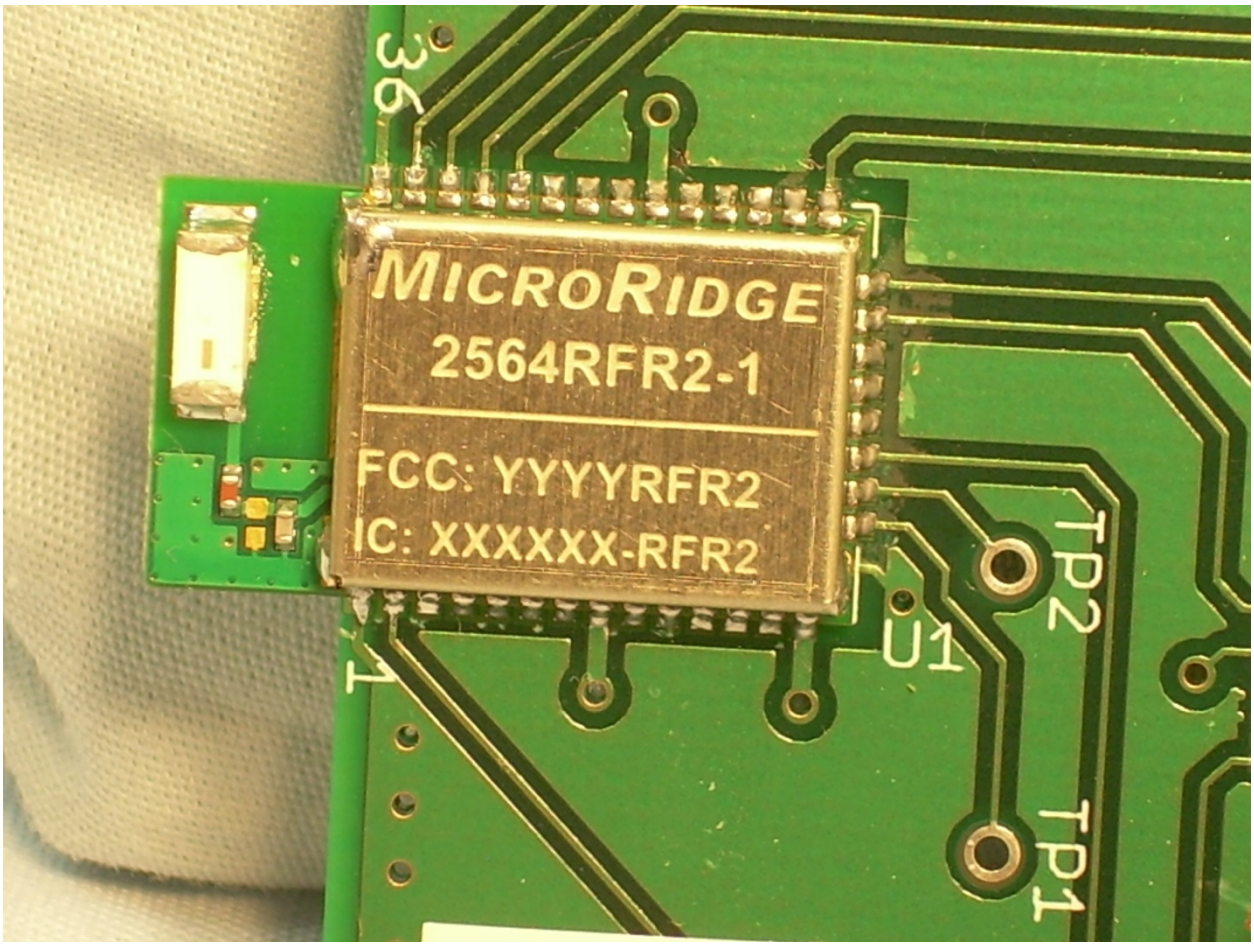
Photograph 7 – Front View of the EUT on Host



Photograph 8 – Back View of the EUT on Host



Photograph 9 – View of the EUT with Shielding



Photograph 10 – View of the EUT without Shielding