Nemko-CCL, Inc.

1940 West Alexander Street
Salt Lake City, UT 84119
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Test Report

Declaration of Conformity

Test Of: MICRO-RM2.4

Test Specifications:

ETSI EN 300 328 v1.7.1 (2006-10)

Test Report Serial No.: 270648-2.1

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

Dates of Test: October 2, 2014

Report Issue Date: October 27, 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 devices described below with the requirements of ETSI EN 300 328 v1.7.1 (2006-10). This report may be reproduced in full. Partial reproduction may only be made with the written consent of the laboratory. The results in this report apply only to the samples tested.

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

On this 27th 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: Norman P. Hansen
EMC Technician

Reviewed by: Thomas C. Jackson
Certification Manager

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant

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

Contact Name: John Schuldt
Title: President

1.2 Manufacturer

Company Name: MicroRidge Systems, Inc.
56888 Enterprise Drive
Sunriver, OR 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, OR 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:	None
Dimensions:	2.1 cm x 1.2 cm

2.2 Description of EUT

The MICRO-RM2.4 is a compact and low-power 2.4 GHz wireless module designed for industrial and consumer 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 MICRO-RM2.4 is an 802.15.4 compliant transceiver module. Testing was performed using a host PCB to provide the necessary connections for exercising the EUT. The host PCB received power from a computer USB port.

The MICRO-RM2.4 transceivers use 16 channels in the 2400 to 2483.5 MHz frequency range. See the table of frequencies below.

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2405	15	2425	19	2445	23	2465
12	2410	16	2430	20	2450	24	2470
13	2415	17	2435	21	2455	25	2475
14	2420	18	2440	22	2460	26	2480

This report covers the transceiver and testing was performed to EN 300 328. The digital and control circuitry of this device is subject to other standards is to be tested and is covered in a Nemko-CCL, Inc. report # 270648-5.

2.3 EUT and Support Equipment

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: None	Transceiver Module	See Section 2.4
BN: Dell MN: Vostro SN: 2878353565	Computer	USB/USB cable
BN: MicroRidge MN: Host PCB SN: #1	Host PCB	USB/USB cable Power/Serial communication lines/Directly soldered to host PCB (Note 2)
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

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

2.5 Modification Incorporated/Special Accessories on EUT

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

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specifications

Title: ETSI EN 300 328 v1.7.1 (2006-10)

Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission system; Data transmission equipment operating in the 2.4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive

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

3.2 Methods & Procedures

The testing was performed according to the procedures in ETSI EN 300 328 v1.7.1 (2006-10). Testing was performed at Nemko-CCL, Inc.'s 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.

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 Conditions

Power Supply:	5 VDC from USB port to EUT Host PCB
Temperature:	19.8°C
Relative Humidity:	31%

4.2 Extreme Test Conditions

Power Supply:	5 VDC from USB port to EUT Host PCB
Temperature:	-20°C to +55°C

4.3 Operating Modes

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 placed flat on the table and connected to the support equipment. The EUT was set to transmit data constantly. For receiver tests, the EUT was placed in receive mode.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 Summary of Tests

Clause	Description	Requirement Conditionality	Result
4.3.1	Equivalent Isotropic Radiated Power	Unconditional	Complied
4.3.2	Maximum Spectral Power Density	Only for modulations other than FHSS	Complied
4.3.3	Frequency Range	Unconditional	Complied
4.3.4.1	Dwell Time	Only for FHSS	Not Applicable
4.3.4.2	Hopping Channel	Only for FHSS	Not Applicable
4.3.4.3	Hopping Sequence	Only for FHSS	Not Applicable
4.3.5	Medium Access Protocol	Unconditional	Complied
4.3.6	Transmitter Spurious Emissions	Unconditional	Complied
4.3.7	Receiver Spurious Emissions	Unconditional	Complied

5.2 Result

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

SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS

6.1 General Comments

The maximum antenna gain is 0.0 dBi. A duty cycle of 100% (1.0) was used in calculations. Conducted measurements at the antenna port were taken and the e.i.r.p. (P) and spectral power density (PD) were calculated using the formula P or PD = A + G + 10 log (1/x) where A is the measurement and G is the gain of the antenna with x being the duty cycle.

6.2 Test Results:

6.2.1 Equivalent Isotropic Radiated Power

2405GHz Transmitter Frequency			
Temperature (°C)	Voltage (VDC)	EIRP (mW)	Limit (mW)
20°C	5.0	0.624	100
-20°C	5.0	0.697	100
+55°C	5.0	0.592	100

2440GHz Transmitter Frequency			
Temperature (°C)	Voltage (VDC)	EIRP (mW)	Limit (mW)
20°C	5.0	0.752	100
-20°C	5.0	0.820	100
+55°C	5.0	0.711	100

2480GHz Transmitter Frequency			
Temperature (°C)	Voltage (VDC)	EIRP (mW)	Limit (mW)
20°C	5.0	0.681	100
-20°C	5.0	0.736	100
+55°C	5.0	0.638	100

6.2.2 Maximum Spectral Power Density

Frequency (MHz)	Temperature (°C)	Voltage (VDC)	EIRP (mW)	Limit (mW)
2405	20°C	5.0	0.034	10
2440	-20°C	5.0	0.039	10
2480	+55°C	5.0	0.035	10

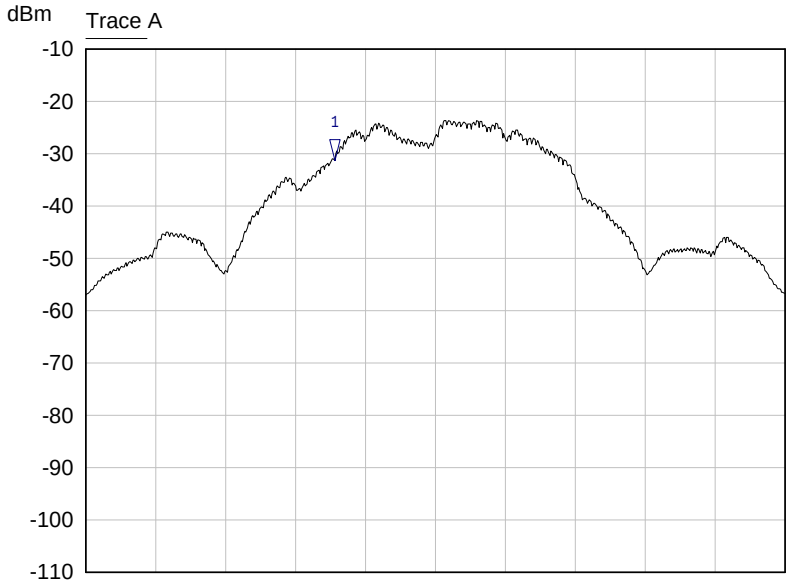
6.2.3 Frequency Range

2405 MHz Transmitter Frequency			
Temperature (°C)	Voltage (VAC)	Lower Frequency (-30 dBm point) (MHz)	Allowed Frequency Band (MHz)
20°C	5.0	2404.278846	2400 – 2483.5
-20°C	5.0	2404.262821	2400 – 2483.5
+55°C	5.0	2404.286859	2400 – 2483.5

2480 MHz Transmitter Frequency			
Temperature (°C)	Voltage (VAC)	Upper Frequency (-30 dBm point) (MHz)	Allowed Frequency Band (MHz)
20°C	5.0	2480.945513	2400 – 2483.5
-20°C	5.0	2480.953526	2400 – 2483.5
+55°C	5.0	2480.865385	2400 – 2483.5

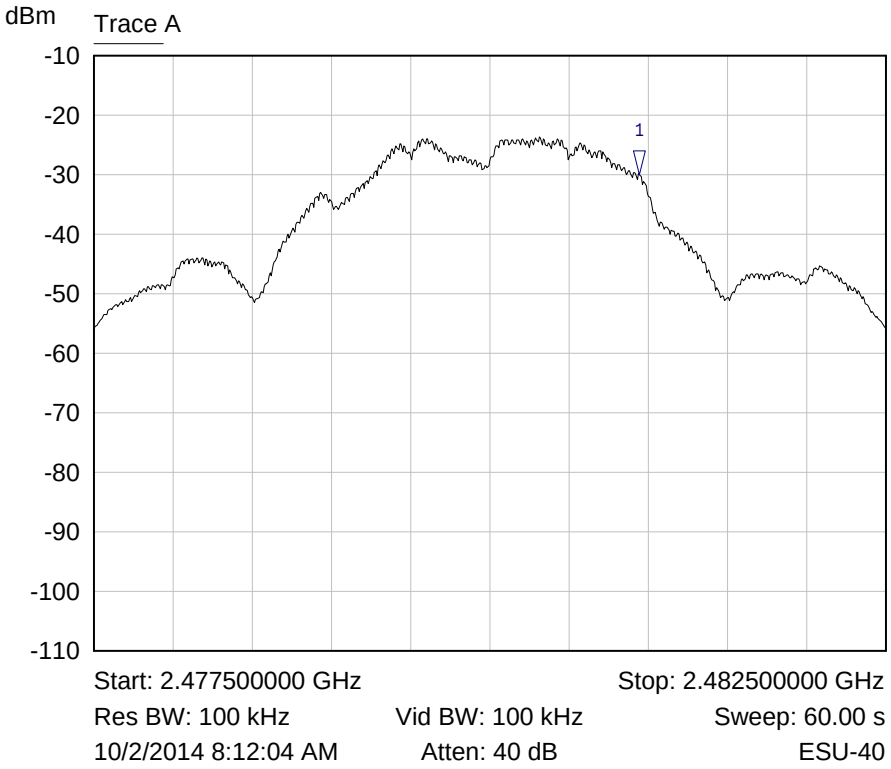
The frequency range of the EUT is 2404.262821 MHz to 2480.953526 MHz, which lies totally within the band of 2400 to 2483.5 MHz. The plots below show the frequency range under normal test conditions.

Lowest Channel in Normal Test Conditions Frequency Range Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.404278846 GHz	-31.25 dBm	

Highest Channel in Normal Test Conditions Frequency Range Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.480945513 GHz	30.07 dBm	

6.2.4 Medium Access Protocol

The EUT uses a listen before transmit protocol.

6.2.5 Transmitter Spurious Emissions (Radiated by cabinet and antenna)

2405 MHz Transmitter Frequency						
Frequency (MHz)	Measurement		Limit		Narrow Band	Wide Band
	(dBm)	(dBm/Hz)	(dBm)	(dBm/Hz)		
4810	-52.5	--	-30.0	--	X	--
7215	-62.3	--	-30.0	--	X	--
9620	-59.3	--	-30.0	--	X	--
12025	-59.6	--	-30.0	--	X	--

2440 MHz Transmitter Frequency						
Frequency (MHz)	Measurement		Limit		Narrow Band	Wide Band
	(dBm)	(dBm/Hz)	(dBm)	(dBm/Hz)		
4880	-52.9	--	-30.0	--	X	--
7320	-62.4	--	-30.0	--	X	--
9760	-59.3	--	-30.0	--	X	--
12200	-59.9	--	-30.0	--	X	--

2480 MHz Transmitter Frequency						
Frequency (MHz)	Measurement		Limit		Narrow Band	Wide Band
	(dBm)	(dBm/Hz)	(dBm)	(dBm/Hz)		
4960	-53.5	--	-30.0	--	X	--
7440	-61.0	--	-30.0	--	X	--
9920	-59.8	--	-30.0	--	X	--
12400	-60.0	--	-30.0	--	X	--

6.2.6 Receiver Spurious Emissions (Radiated by cabinet and antenna)

Frequency (MHz)	Measurement		Limit		Narrow Band	Wide Band
	(dBm)	(dBm/Hz)	(dBm)	(dBm/Hz)		
2405.0	--	-127.6	--	-97.0	--	X
2480.0	--	-127.4	--	-97.0	--	X

Note: Emissions shown are above noise floor. No emissions were seen from the receiver.

APPENDIX 1 TEST EQUIPMENT

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	714	04/25/2013	04/25/2015
Double Ridged Guide Antenna	EMCO	3115	735	03/07/2013	03/07/2015
2.4 GHz Filter	Microtronics	HPM50111-03	1244	05/08/2014	05/08/2015
Pyramidal Standard Gain Horn	EMC Test System	3160-09	1052	04/10/2009	ICO
High Frequency Amplifier	Miteq	AFS-4-00102650-35-10P-4	1299	05/08/2014	05/08/2015
20’ High Frequency Cable	Microcoax	UFB197C-1-3120-000000	1297	05/08/2014	05/08/2015
3 Meter Radiated Emissions Cable Wanship Site #2	Microcoax	UFB205A-0-4700-000000	1295	05/08/2014	05/08/2015
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

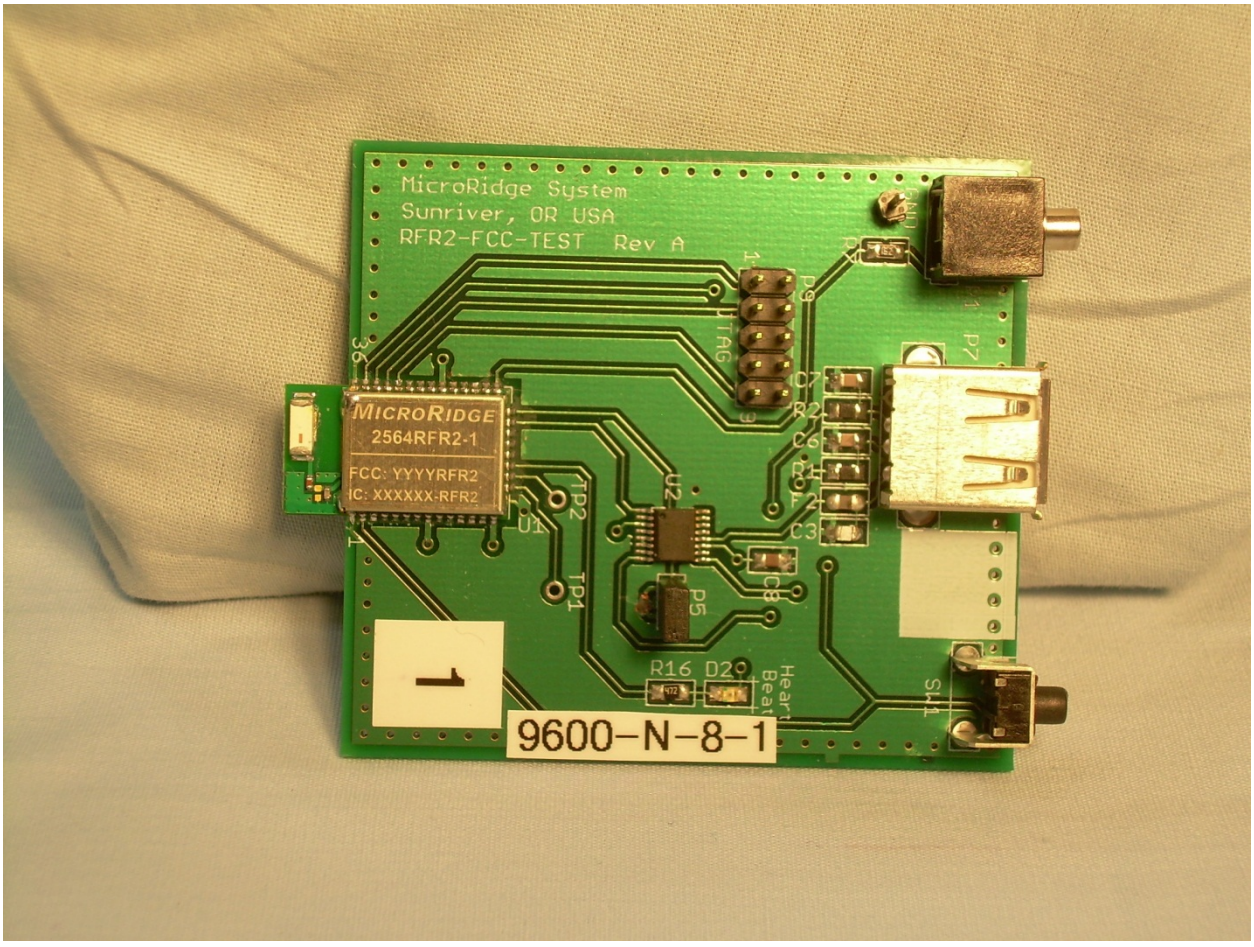
An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology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

APPENDIX 2 PHOTOGRAPHS

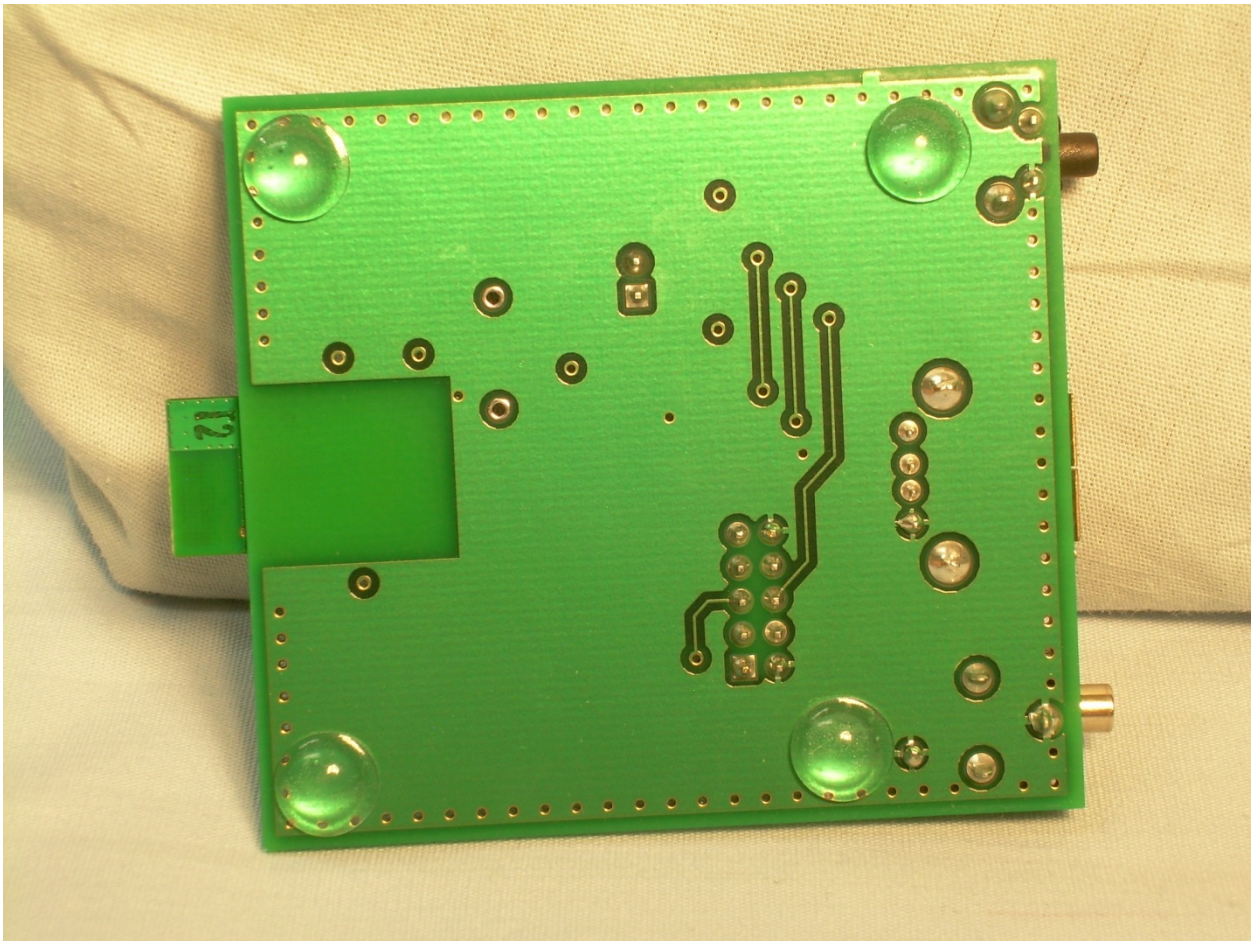
Photograph 1 – Front View of Radiated Spurious Emission Worst-Case Configuration

Photograph 2 – Back View of Radiated Spurious Emission Worst-Case Configuration

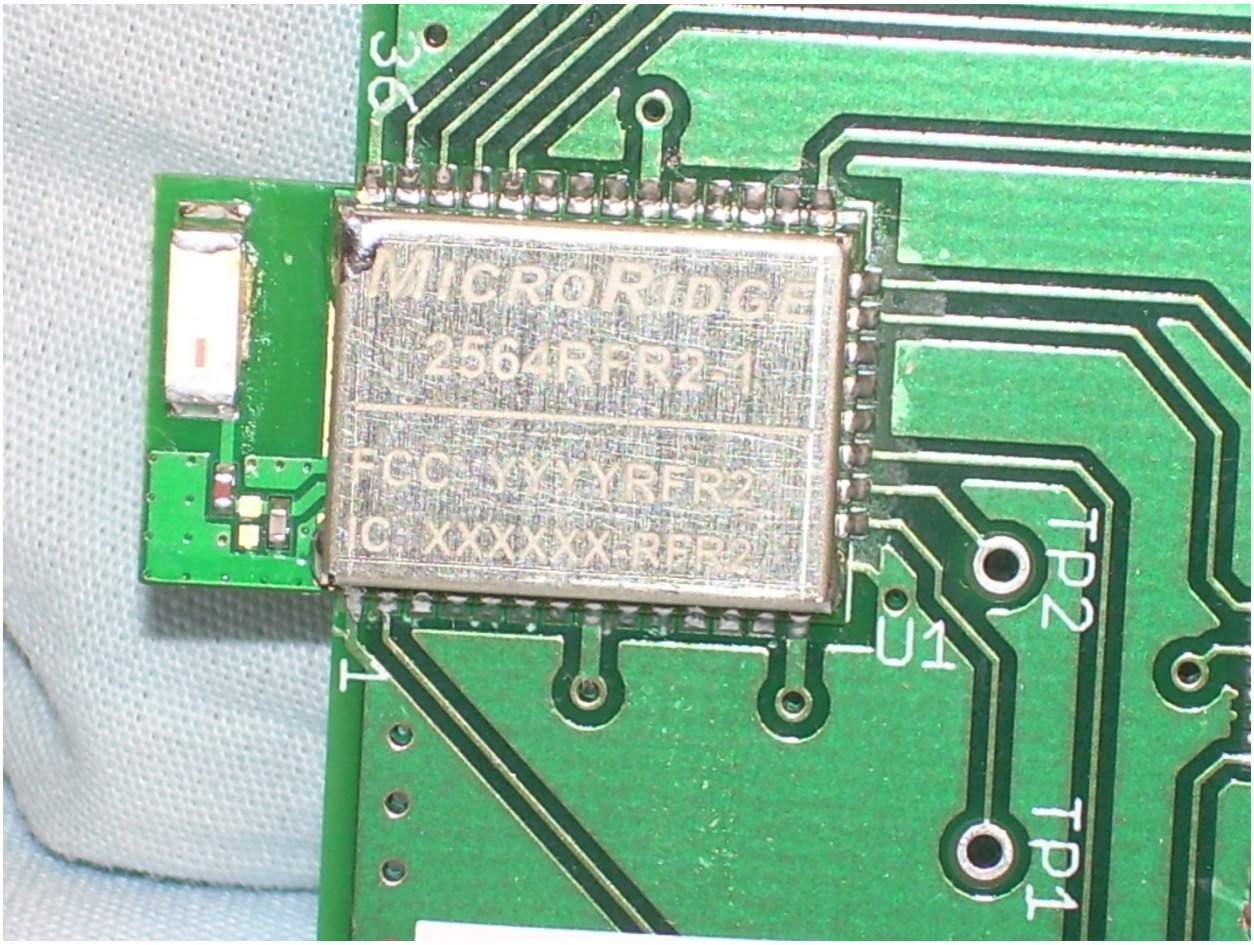
Photograph 3 – Front View of the EUT on Host



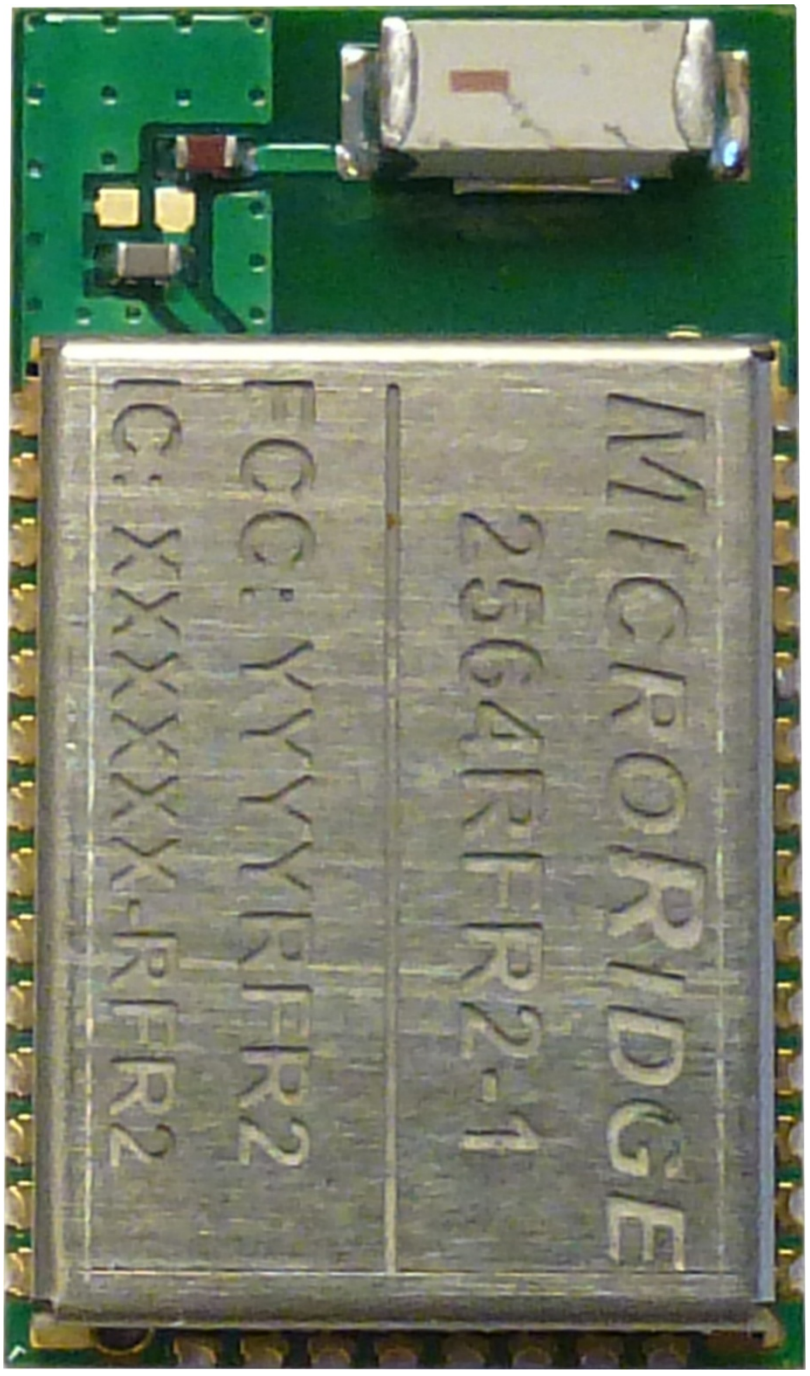
Photograph 4 – Back View of the EUT on Host



Photograph 5 – Internal View of the EUT



Photograph 6 – View of the Module



Photograph 7 – View of the EUT with Shield Removed