Nemko-CCL, Inc.

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

Test Report

Certification

Test Of: MICRO-RM2.4-LB

IC: 12298A-RM2

Test Specifications:

RSS-Gen Issue 3 (December 2010)
RSS-210 Issue 8 (December 2010)

Test Report Serial No.: 270649-4.1

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

Dates of Test: October 1 – 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 device described below with the requirements of RSS-Gen Issue 3 (December 2010) and RSS-210 Issue 8 (December 2010). 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 sample tested.

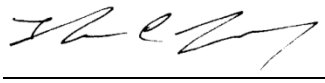
- Applicant: MicroRidge Systems, Inc.
- Manufacturer: MicroRidge Systems, Inc.
- Brand Name: MicroRidge
- Model Number: MICRO-RM2.4-LB
- IC: 12298A-RM2

On this 27th day 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 recognized that the Nemko-CCL, Inc. EMC testing facilities are in good standing, 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
Test Technician



Reviewed by: Thomas C. Jackson
Certification Manager

TABLE OF CONTENTS

PAGE

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

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	MicroRidge
Model Number:	MICRO-RM2.4-LB
Serial Number:	None
Dimensions:	2.1 cm x 1.2 cm

2.2 Description of EUT:

The Micro-RM2.4-LB 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-LB 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-LB 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 circuitry of the devices subject to RSS-210. The circuitry of the device subject to ICES-003 was found to be compliant and is covered in Nemko-CCL, Inc. report 270649-2

2.3 EUT and Support Equipment:

The IC numbers for all the EUT and support equipment used during the test are listed below:

Brand Name Model Number Serial Number	IC Number or Compliance	Description	Name of Interface Ports / Interface Cables
BN: MicroRidge MN: MICRO-RM2.4-LB (Note 1) SN: None	12298A-RM2	Transceiver Module	See Section 2.4
BN: Dell MN: Vostro SN: 2878353565	DoC	Computer	USB/USB cable
BN: MicroRidge MN: Host PCB SN: #1	None	Host PCB	USB/USB cable Power/Serial communication lines/Directly soldered to host PCB (Note 2)
BN: MicroRidge MN: USB Base SN: None	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 we no modifications or special accessories required to comply with the specification.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title: RSS-Gen Issue 3 (December 2010)
RSS-210 Issue 8 (December 2010)

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

3.2 Requirements:

3.2.1 RSS-Gen 4.6.1 Occupied Bandwidth

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

3.2.2 RSS-Gen Section 5.6 Exposure of Humans to RF Fields

Category I and Category II equipment shall comply with the applicable requirements of RSS-102.

3.2.3 RSS-Gen Section 7.1.2 Transmitter Antenna

A transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification

is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits.

User manuals for transmitters shall display the following notice in a conspicuous location:

> Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.
>
> The notice may be affixed to the device instead of displayed in the user manual.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

> This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi) and required impedance for each.

3.2.4 RSS-Gen Section 7.1.3 User Manual

User manuals for licence-exempt LPDs shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both.

> This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

3.2.5 RSS-Gen 7.1.4 Radio Apparatus Containing Digital Circuits (ICES-003)

Radio apparatus containing digital circuitry which can function separately from the operation of a transmitter or an associated transmitter, shall comply with ICES-003. In such cases, the labeling requirements of the applicable RSS apply, rather than the labeling requirements in ICES-003.

3.2.6 RSS-Gen 7.2.2 Emissions Falling Within Restricted Frequency Bands

Restricted bands, identified in Table 1, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:

(a) Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 1;
(b) Unwanted emissions falling into restricted bands of Table 1 shall comply with the limits specified in RSS-Gen;
(c) Unwanted emissions not falling within restricted frequency bands shall either comply with the limits specified in the applicable RSS, or with those specified in RSS-Gen.

3.2.7 RSS-Gen Section 7.2.4 AC Power Lines Conducted Emission Limits

Except when the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply, either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The more stringent limit applies at the frequency range boundaries.

The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network (LISN).

Table 4 – AC Power Lines Conducted Emission Limits

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5*	66 to 56*	56 to 46*
0.5 – 5	56	46
5 - 30	60	50

*Decreases with the logarithm of the frequency.

3.2.8 RSS-210 Annex 8

3.2.8.1 RSS-210 Section A8.2 Digital Modulation Systems

These include systems employing digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to all three bands.

(a) The minimum -6 dB bandwidth shall be at least 500 kHz.

(b) The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section A8.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

3.2.8.2 RSS-210 Section A8.4 Transmitter Output Power and e.i.r.p. Requirements

For systems employing digital modulation techniques operating in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands, the maximum peak conducted power shall not exceed 1 W. Except as provided in Section A8.5(5), the e.i.r.p. shall not exceed 4 W.

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

3.2.8.3 RSS-210 Section A8.5 Out-of-band Emissions

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in RSS-Gen is not required.

3.3 Test Procedure:

The testing was performed according to the procedures in RSS-Gen Issue 3 and RSS-210 Issue 8. 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 Industry Canada, and was accepted under Industry Canada Assigned Code 2041A-2 effective until February 14, 2015.

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 Operating Environment:

Power Supply: 120 VAC/60 Hz to computer/5 VDC from USB port to EUT Host PCB

4.2 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-LB placed flat on the table and connected to the support equipment. The EUT was set to transmit data constantly.

4.3 EUT Exercise Software:

MicroRidge ComTestSerial – FCC_Testing test software was used to exercise the EUT.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 RSS-Gen and RSS-210

The EUT was subjected to each of the tests shown in the summary table below.

5.1.1 Summary of Tests:

Section	Environmental Phenomena	Frequency Range (MHz)	Result
RSS-Gen 4.6.1	Occupied Bandwidth	2400 – 2483.5	Reported
RSS-Gen 5.6	Exposure of Humans to RF Fields	2400 – 2483.5	Complied
RSS-Gen 6	Receiver Spurious Emissions Limits	30 – 7500	Exempt
RSS-Gen 7.1.2	Transmitter Antenna	2400 – 2483.5	Complied
RSS-Gen 7.1.3	User Manual Notice for Licence-Exempt Apparatus	N/A	Complied
RSS-Gen 7.1.4	Radio Apparatus Containing Digital Circuits (ICES-003)	30 – 2000	Complied
RSS-Gen 7.2.2	Emissions Falling Within Restricted Frequency Bands	0.009 – 24835.0	Complied
RSS-Gen 7.2.4	AC Power Line Conducted Emissions Limits	0.15 – 30	Complied
RSS-210 A8.2	Digital Modulation Systems – 6 dB Bandwidth and Spectral Density	2400 – 2483.5	Complied
RSS-210 A8.4	Transmitter Output Power and e.i.r.p. Requirements	2400 – 2483.5	Complied
RSS-210 A8.5	Out of Band Emissions	0.009 – 24835.0	Complied

5.2 Result

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

SECTION 6.0 802.11b/g/n TRANSCEIVER – MEASUREMENTS AND RESULTS

6.1 General Comments:

This section contains the test results and determinations 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 RSS-Gen 4.6.1 Occupied Bandwidth

The 99% emission bandwidth was measured with the Rohde & Schwartz ESU40 using Industry Canada procedures. The 99% emission bandwidths are shown below.

Frequency (MHz)	Emission 99% bandwidth (MHz)
2405	2.21
2440	2.23
2480	2.25

6.2.2 RSS-Gen 5.6 Exposure of Humans to RF Fields

See documents filed with this report.

6.2.3 RSS-Gen 6 Receiver Spurious Emission Standard

As per Notice 2012 DRS0126, this section is not required.

6.2.4 RSS-Gen 7.1.2 Antenna Requirement

The EUT uses a Johansen ANT-2450AT42B100 chip antenna soldered to the PCB and is not user replaceable.

6.2.5 RSS-Gen 7.1.3 User Manual

The User Manual contains the following statement in both English and French:

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

See documents filed with this report for a copy of the User Manual.

6.2.6 RSS-Gen 7.1.4 Digital Circuits

The MICRO-RM2.4-LB was tested to the requirements of ICES-003 and found to comply. See Nemko-CCL, Inc. Test Report 270649-2.

6.2.7 RSS-Gen 7.2.2 Emissions Falling Within Restricted Frequency Bands

The frequency range from the lowest frequency generated or used in the device to the tenth harmonic of the highest fundamental frequency was investigated to measure any radiated emissions in the restricted bands of RSS-Gen Table 3. The emissions in the restricted bands must meet the limits specified in RSS-Gen Table 5.

Emissions not in the restricted bands are also shown below. Those emissions not in the restricted bands must be attenuated 20 dB from the fundamental emission. These emissions were compared to the limits of RSS-Gen Table 5 and found compliant.

The tabular data shows the emissions from the EUT transceiver. Shown below are plots with the EUT tuned to the upper and lower channels demonstrating compliance at the band edges.

AVERAGE FACTOR

There was no average factor applied.

Transmitting at the Lowest Frequency

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4810.0	Peak	Vertical	10.6	39.0	49.6	74.0	-24.4
4810.0	Average	Vertical	-1.1	39.0	37.9	54.0	-16.1
4810.0	Peak	Horizontal	14.0	39.0	53.0	74.0	-21.0

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4810.0	Average	Horizontal	4.2	39.0	43.2	54.0	-10.8
7215.0	Peak	Vertical	2.4	43.7	46.1	74.0	-27.9
7215.0	Average	Vertical	-7.9	43.7	35.8	54.0	-18.2
7215.0	Peak	Horizontal	1.8	43.7	45.5	74.0	-28.5
7215.0	Average	Horizontal	-8.4	43.7	35.3	54.0	-18.7
9620.0	Peak	Vertical	0.2	46.8	47.0	74.0	-27.0
9620.0	Average	Vertical	-10.0	46.8	36.8	54.0	-17.2
9620.0	Peak	Horizontal	1.7	46.8	48.5	74.0	-25.5
9620.0	Average	Horizontal	-7.5	46.8	39.3	54.0	-14.7
12025.0	Peak	Vertical	-0.3	49.4	49.1	74.0	-24.9
12025.0	Average	Vertical	-11.7	49.4	37.7	54.0	-16.3
12025.0	Peak	Horizontal	-0.2	49.4	49.2	74.0	-24.8
12025.0	Average	Horizontal	-11.3	49.4	38.1	54.0	-15.9

Transmitting at the Middle Frequency

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4880.0	Peak	Vertical	8.8	39.1	47.9	74.0	-26.1
4880.0	Average	Vertical	-4.1	39.1	35.0	54.0	-19.0
4880.0	Peak	Horizontal	13.8	39.1	52.9	74.0	-21.1
4880.0	Average	Horizontal	3.6	39.1	42.7	54.0	-11.3
7320.0	Peak	Vertical	1.9	44.1	46.0	74.0	-28.0
7320.0	Average	Vertical	-7.5	44.1	36.6	54.0	-17.4
7320.0	Peak	Horizontal	5.0	44.1	49.1	74.0	-24.9
7320.0	Average	Horizontal	-2.5	44.1	41.6	54.0	-12.4
9760.0	Peak	Vertical	0.8	47.0	47.8	74.0	-26.2
9760.0	Average	Vertical	-8.4	47.0	38.6	54.0	-15.4
9760.0	Peak	Horizontal	1.5	47.0	48.5	74.0	-25.5
9760.0	Average	Horizontal	-7.2	47.0	39.8	54.0	-14.2
12200.0	Peak	Vertical	-0.8	49.3	48.5	74.0	-25.5
12200.0	Average	Vertical	-12.6	49.3	36.7	54.0	-17.3
12200.0	Peak	Horizontal	0.0	49.3	49.3	74.0	-24.7

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
12200.0	Average	Horizontal	-10.2	49.3	39.1	54.0	-14.9

Transmitting at the Highest Frequency

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4960.0	Peak	Vertical	7.0	39.3	46.3	74.0	-27.7
4960.0	Average	Vertical	-5.4	39.3	33.9	54.0	-20.1
4960.0	Peak	Horizontal	12.9	39.3	52.2	74.0	-21.8
4960.0	Average	Horizontal	3.3	39.3	42.6	54.0	-11.4
7440.0	Peak	Vertical	4.4	44.4	48.8	74.0	-25.2
7440.0	Average	Vertical	-4.1	44.4	40.3	54.0	-13.7
7440.0	Peak	Horizontal	11.2	44.4	55.6	74.0	-18.4
7440.0	Average	Horizontal	-2.1	44.4	42.3	54.0	-11.7
9920.0	Peak	Vertical	1.5	47.1	48.6	74.0	-25.4
9920.0	Average	Vertical	-8.5	47.1	38.6	54.0	-15.4
9920.0	Peak	Horizontal	2.3	47.1	49.4	74.0	-24.6
9920.0	Average	Horizontal	-6.3	47.1	40.8	54.0	-13.2
12400.0	Peak	Vertical	-0.5	49.3	48.8	74.0	-25.2
12400.0	Average	Vertical	-12.7	49.3	36.6	54.0	-17.4
12400.0	Peak	Horizontal	1.4	49.3	50.7	74.0	-23.3
12400.0	Average	Horizontal	-7.8	49.3	41.5	54.0	-12.5

No other emissions were seen in the restricted bands. Noise floor was greater than 6 dB below the limit. At frequencies above 12.5 GHz, a 1 meter measurement distance was used.

6.2.8 RSS-Gen 7.2.4 Transmitter and Receiver AC Power Lines Conducted Emissions

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.18	Hot	Quasi-Peak (Note 1)	46.9	54.5	-7.6
0.26	Hot	Peak (Note 1)	46.1	51.5	-5.4
0.31	Hot	Peak (Note 1)	41.0	50.1	-9.1
0.37	Hot	Peak (Note 1)	34.9	48.4	-13.5
0.65	Hot	Peak (Note 1)	30.5	46.0	-15.5
2.59	Hot	Peak (Note 1)	31.7	46.0	-14.3
0.20	Neutral	Peak (Note 1)	44.4	53.6	-9.2
0.23	Neutral	Peak (Note 1)	37.7	52.5	-14.8
0.26	Neutral	Peak (Note 1)	36.5	51.5	-15.0
0.33	Neutral	Peak (Note 1)	32.2	49.6	-17.4
0.38	Neutral	Peak (Note 1)	30.0	48.2	-18.2
4.80	Neutral	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.

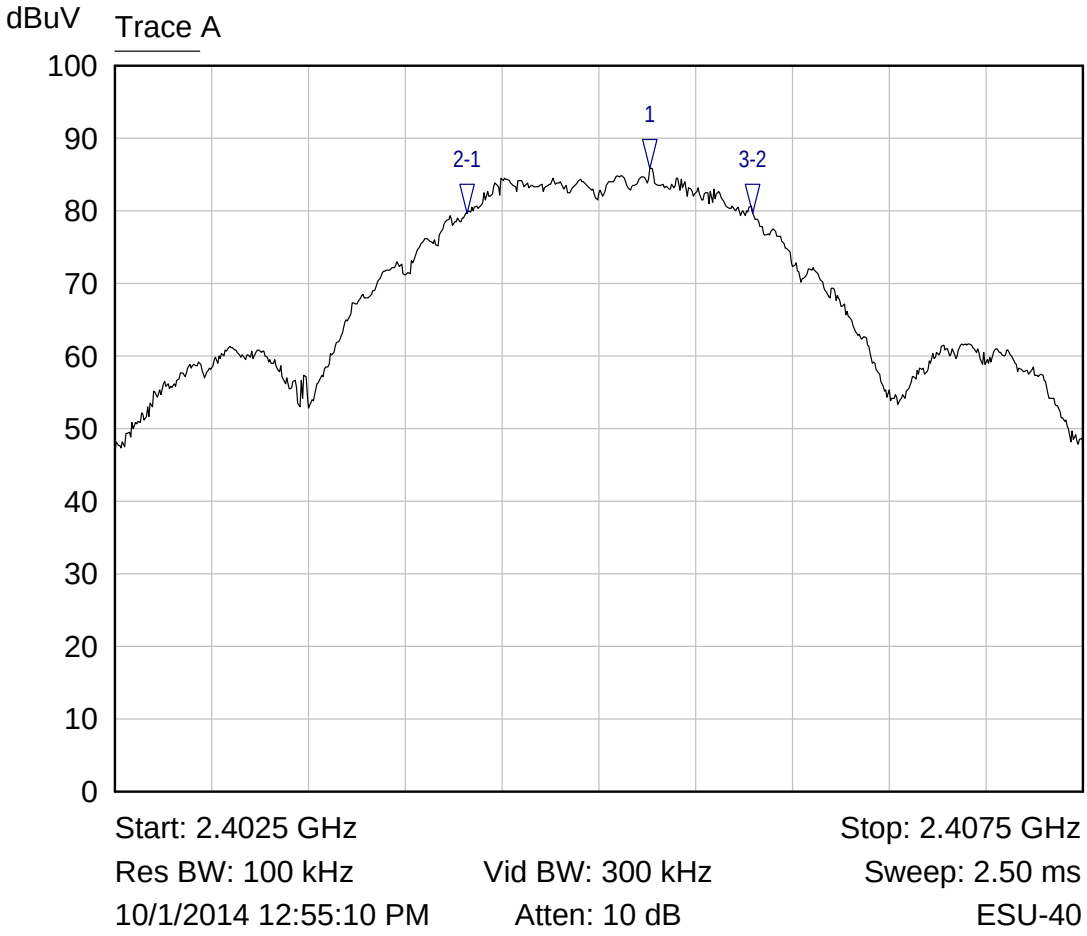
Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

6.2.9 RSS-210 A8.2 Digital Modulation Systems

The EUT shall have a minimum of 6dB bandwidth of 500 kHz. Plots and tabular data is shown below.

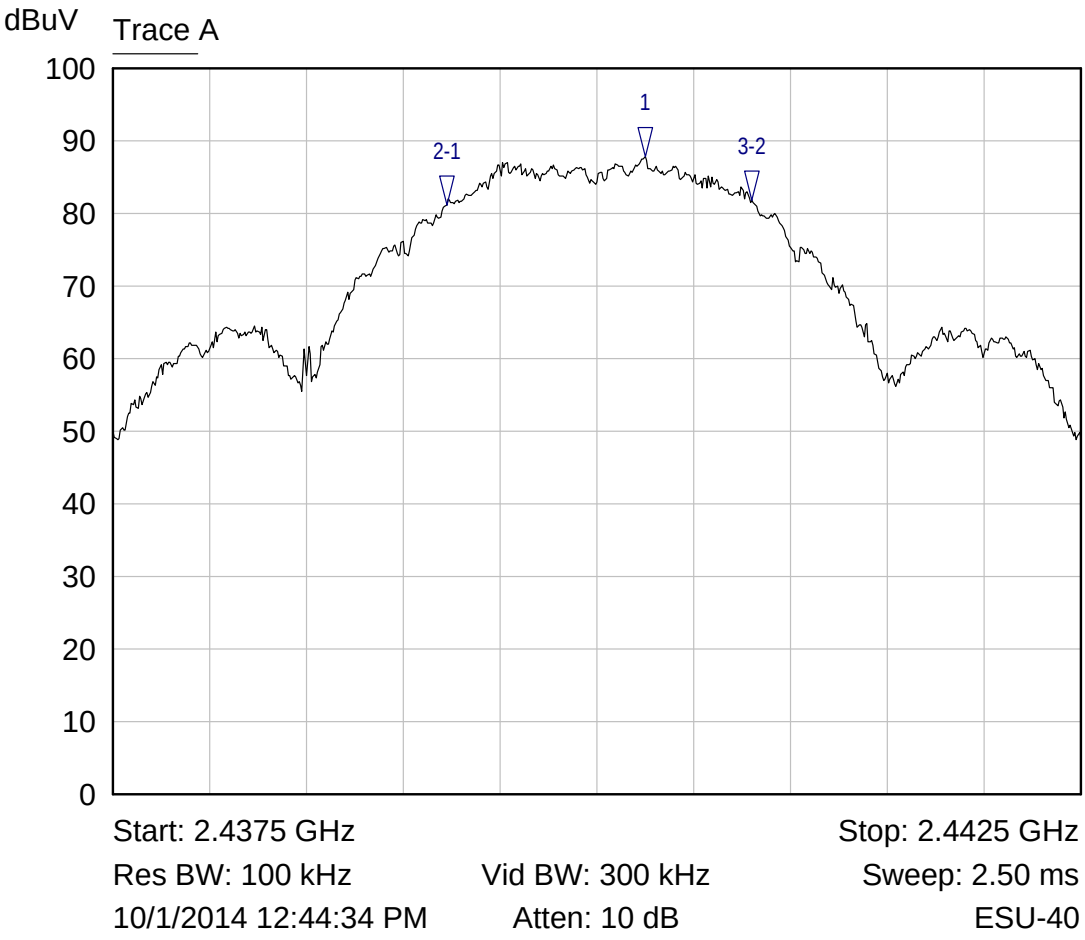
Frequency (MHz)	Emission 6 dB bandwidth (kHz)
2405	1474.4
2440	1578.5
2480	1605.0

Lowest Channel Emission 6 dB Bandwidth



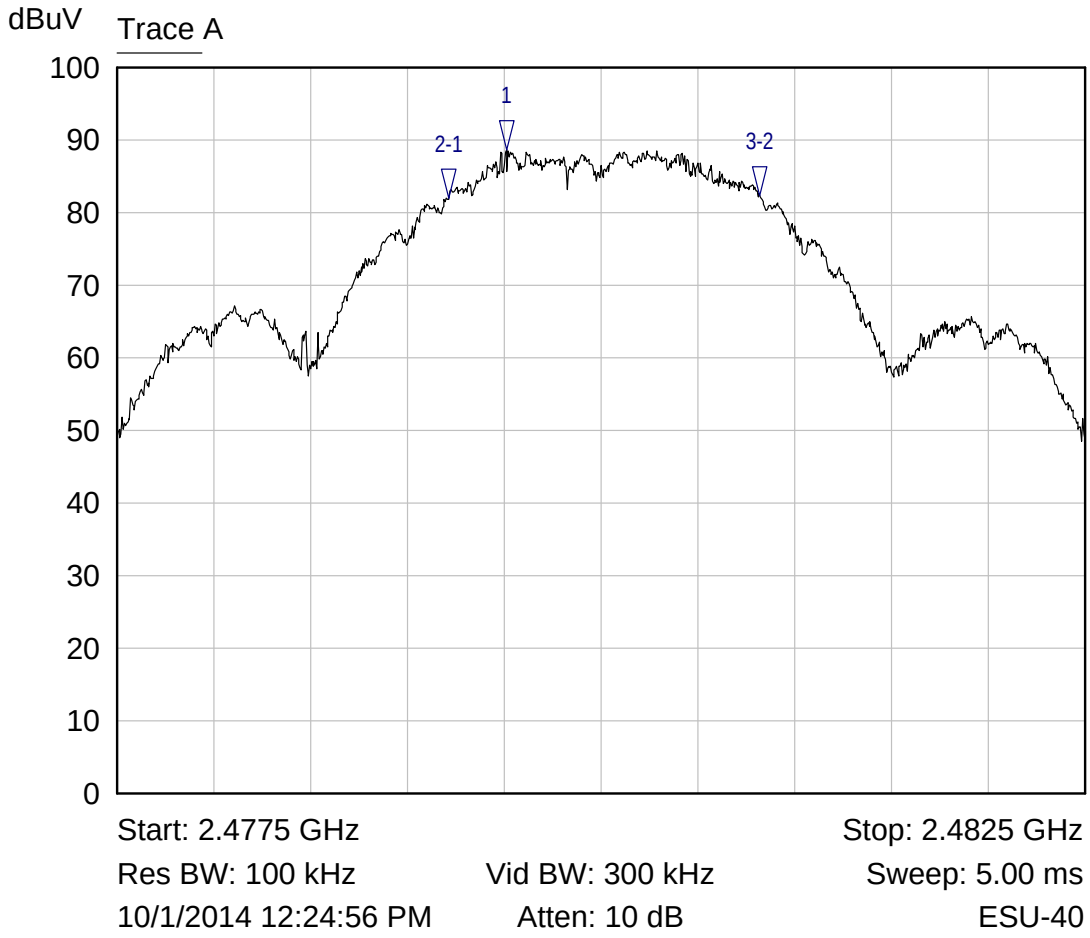
Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4053 GHz	85.82 dBuV	
2-1	Trace A	-945.5128 kHz	-6.12 dB	
3-2	Trace A	1.4744 MHz	-0.08 dB	

Middle Channel Emission 6 dB Bandwidth



Mkr	Trace	X-Axis	Value	Notes
1	Trace A	2.4402 GHz	87.88 dBuV	
2-1	Trace A	-1.0256 MHz	-6.70 dB	
3-2	Trace A	1.5785 MHz	0.62 dB	

Highest Channel Emission 6 dB Bandwidth



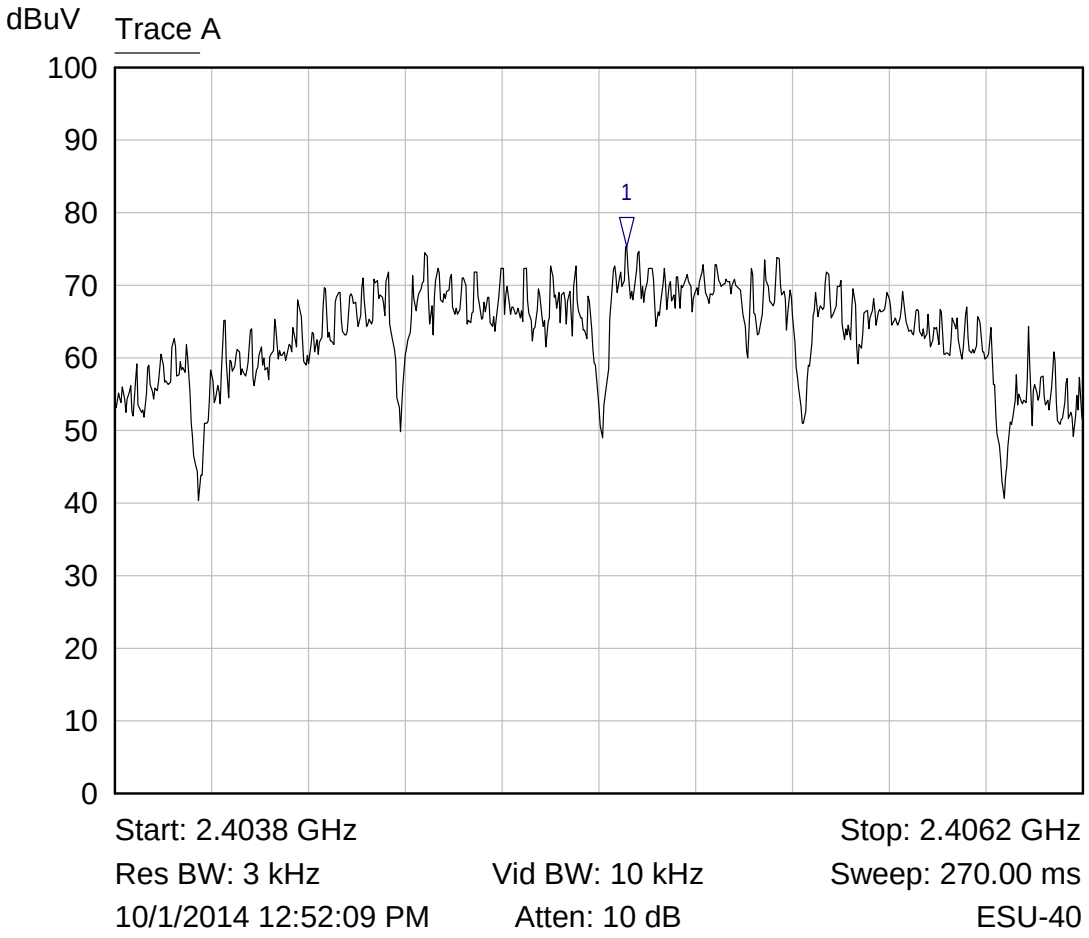
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4795 GHz	88.59 dBuV	
2-1 ▽	Trace A	-295.0000 kHz	-6.57 dB	
3-2 ▽	Trace A	1.6050 MHz	0.37 dB	

6.2.9.1 3 kHz Power Spectral Density

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. Radiated measurements were taken as the EUT has an integral antenna. The radiated field strengths were converted to conducted power using the guidance of 558074 D01 DTS Meas Guidance v03r02. Plots are shown below and the results of this testing are summarized in the table.

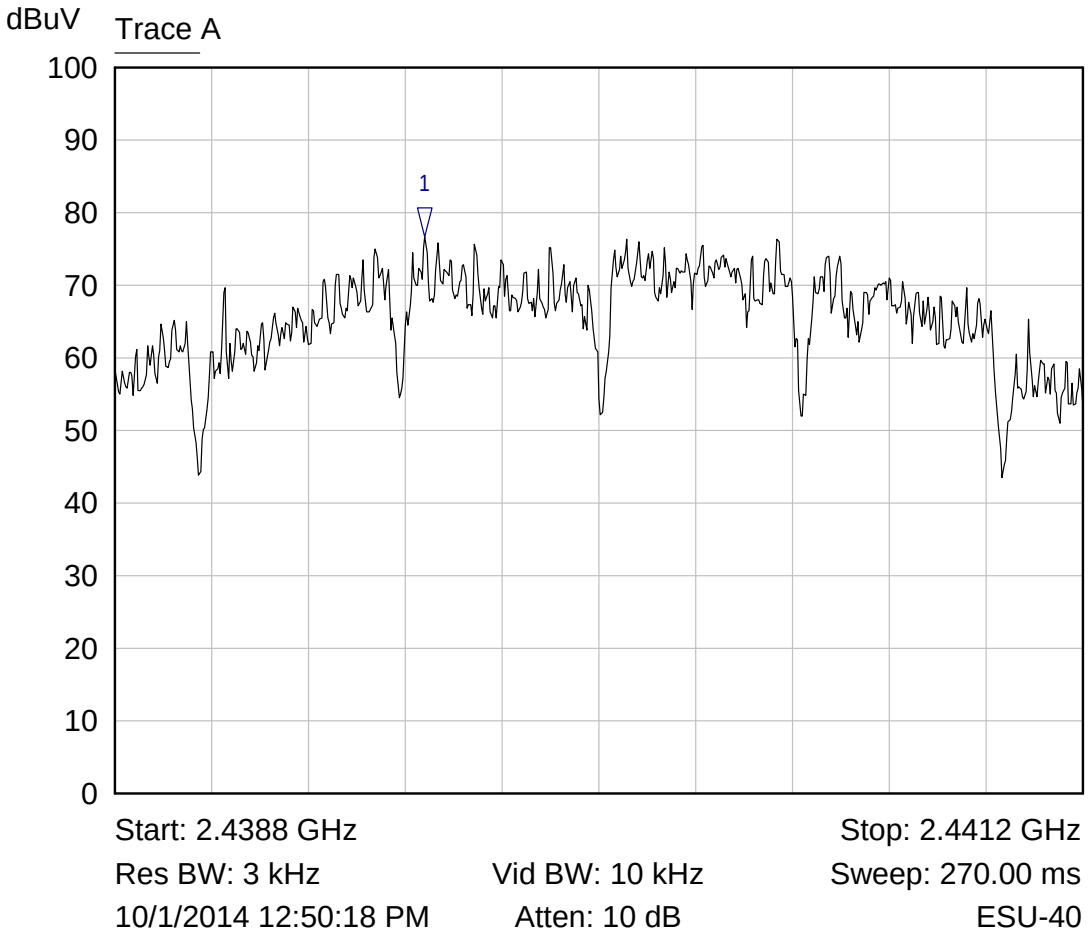
Frequency (MHz)	Measured Field Strength (dBuV/m)	Calculated 3 kHz Spectral Density (dBm)
2405	75.35	-19.87
2440	76.61	-18.62
2480	79.60	-15.63

Lowest Channel



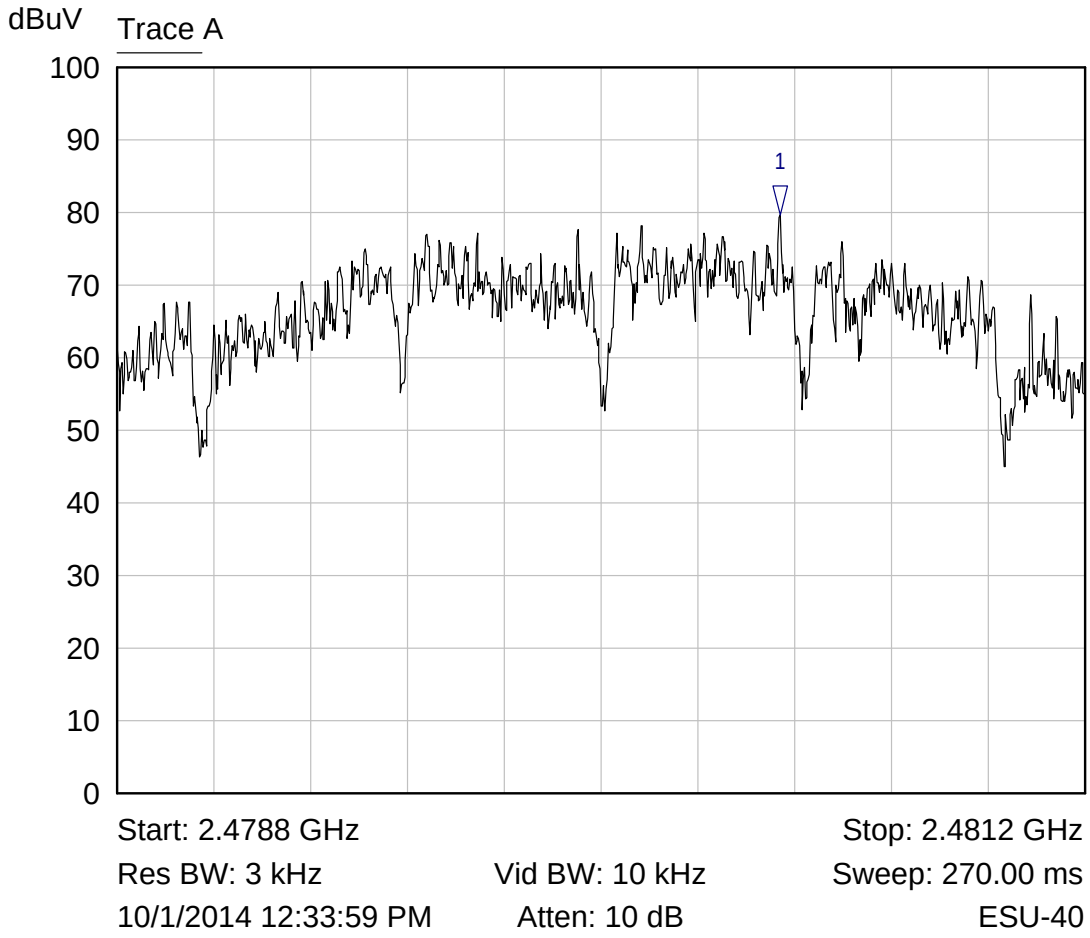
Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4051 GHz	75.35 dBuV	

Middle Channel



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4396 GHz	76.61 dBuV	

Upper Channel



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4804 GHz	79.60 dBuV	

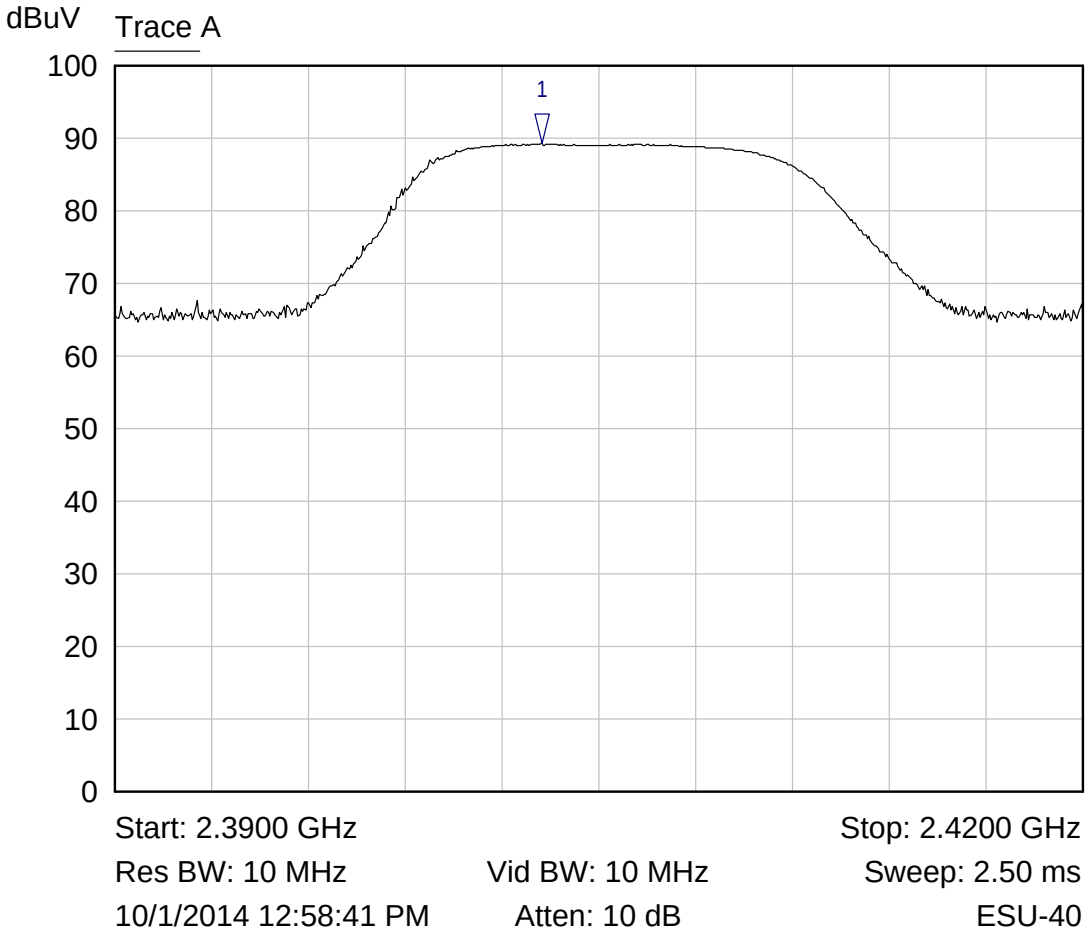
6.2.10 RSS-210 A8.4 Transmitter Output Power and e.i.r.p.

The maximum peak RF Peak output power calculated for this device was 0.677 mW. The limit is 1 Watt when using antennas with 6 dBi or less gain. The antenna has a gain of 0 dBi.

The radiated field strengths were converted to conducted power using the guidance of 558074 D01 DTS Meas Guidance v03r02. Plots are shown below and the results of this testing are summarized in the table.

Frequency (MHz)	Measured Field Strength at 3 m (dBuV/m)	Calculated Output Power (mW)
2405	89.31	0.256
2440	91.68	0.443
2480	93.47	0.677

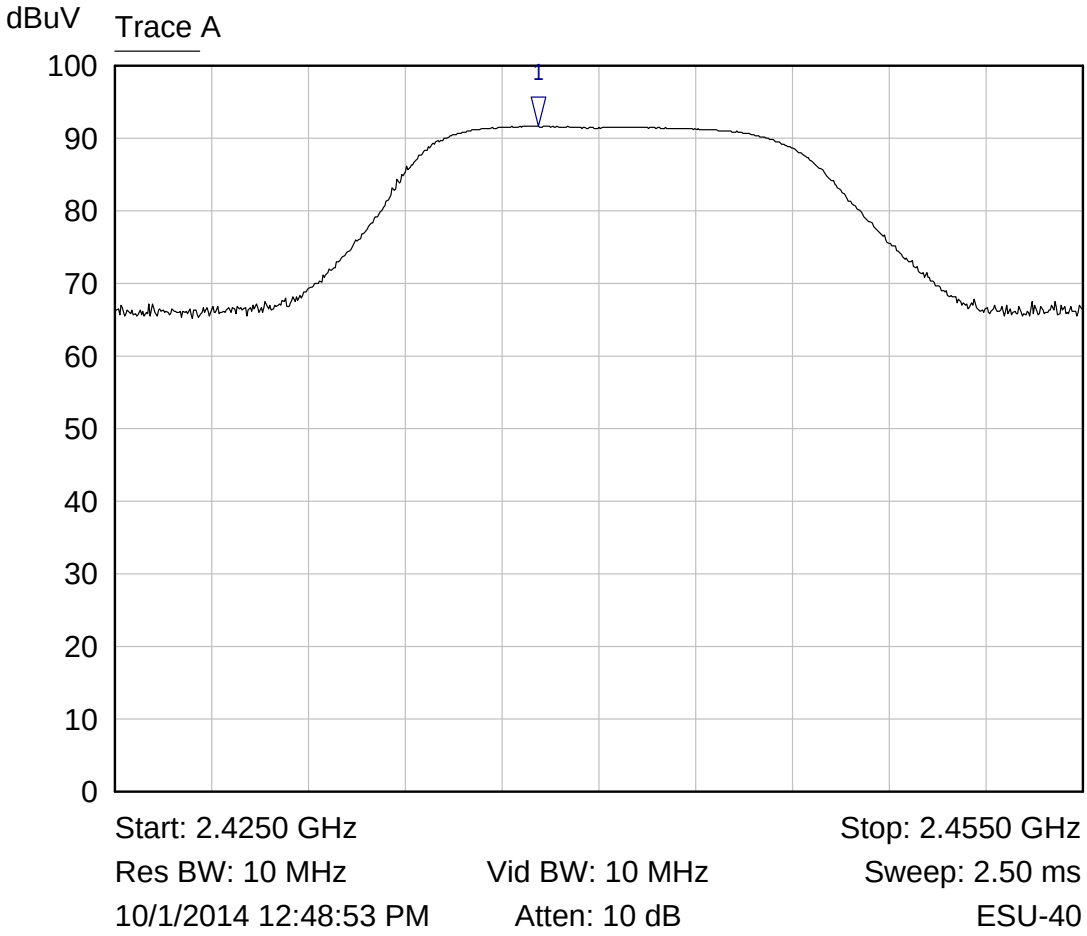
Lowest Channel Peak Field Strength Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4032 GHz	89.31 dBuV	

Trace A peak field strength

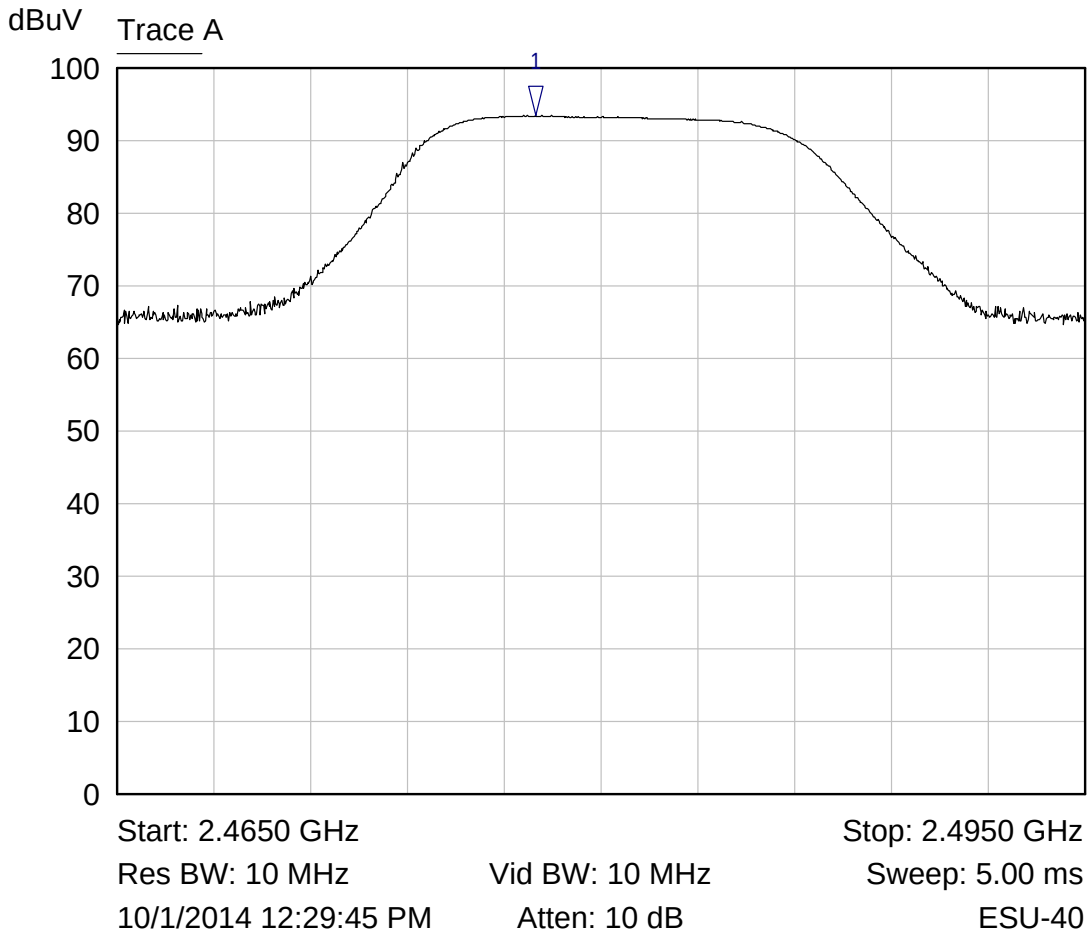
Middle Channel Peak Field Strength Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4381 GHz	91.68 dBuV	

Trace A peak field strength

Highest Channel Peak Field Strength Plot



Mkr	Trace	X-Axis	Value	Notes
1 ▽	Trace A	2.4780 GHz	93.47 dBuV	

Trace A peak field strength

6.2.11 RSS-210 A8.5 Out-of-Band Emissions

The out of band emissions are shown in Section 6.2.7 of this report.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 RSS-Gen Conducted Disturbance at the AC Mains

The conducted disturbance at mains ports from the EUT was measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted disturbance at mains ports measurements are performed in a screen room using a (50 Ω/50 μH) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of equipment with each device having its own power cord, the point of connection for the LISN is determined from the following rules:

(a) Each power cord, which is terminated in a mains supply plug, shall be tested separately.
(b) Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
(c) Power cords which are specified by the manufacturer to be connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.
(d) Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.
(e) When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

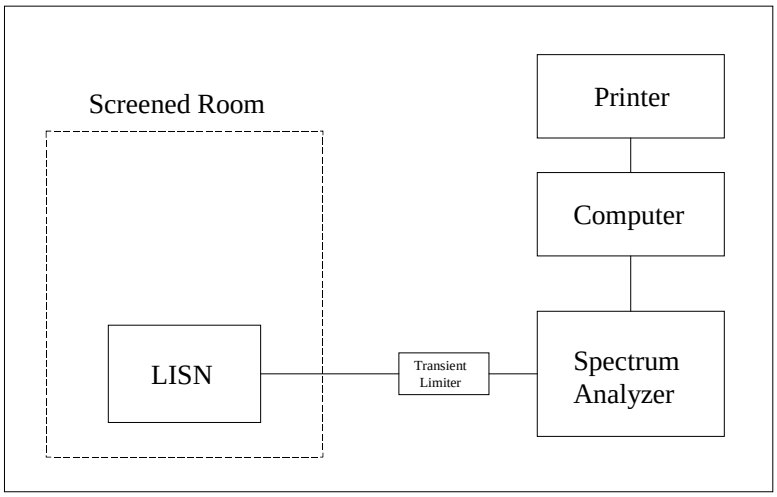
For AC mains port testing, desktop EUT are placed on a non-conducting table at least 0.8 meters from the metallic floor and placed 40 cm from the vertical coupling plane (copper plating in the wall behind EUT table). Floor standing equipment is placed directly on the earth grounded floor.

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

Type of Equipment	Manufacturer	Model Number	Barcode Number	Date of Last Calibration	Due Date of Calibration
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
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.

Conducted Emissions Test Setup



A1.2 RSS-Gen Radiated Spurious Emissions in the Restricted Bands

The radiated emissions from the intentional radiator were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings.

A loop antenna was used to measure emissions below 30 MHz. Emission readings more than 20 dB below the limit at any frequency may not be listed in the reported data. For frequencies between 9 kHz and 30 MHz, or the lowest frequency generated or used in the device greater than 9 kHz, and less than 30 MHz, the spectrum analyzer resolution bandwidth was set to 9 kHz and the video bandwidth was set to 30 kHz. For average measurements, the spectrum analyzer average detector was used.

For frequencies above 30 MHz, an amplifier and preamplifier were used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges. For peak emissions above 1000 MHz the spectrum analyzer's resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz. For average measurements above 1000 MHz the spectrum analyzer's resolution bandwidth was set to 1 MHz and the average detector of the analyzer was used.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz and a Double Ridge Guide Horn antenna was used to measure the frequency range of 1 GHz to 18 GHz and a standard gain horn antenna was used at frequencies above 18 GHz at a distance of 3 meters and/or 1 meter from the EUT. The readings obtained by the antenna are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors.

The configuration of the intentional radiator was varied to find the maximum radiated emission. The intentional radiator was connected to the peripherals listed in Section 2.4 via the interconnecting cables listed in Section 2.5. These interconnecting cables were manipulated manually by a technician to obtain worst case radiated emissions. The intentional radiator was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there are multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

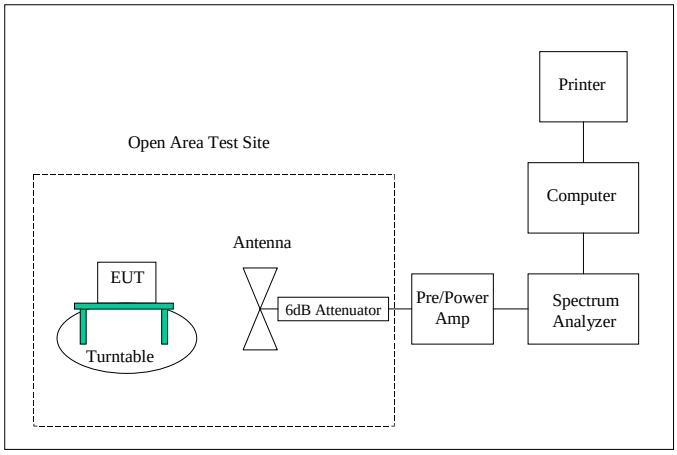
Desktop intentional radiators are measured on a non-conducting table 80 centimeters above the ground plane. The table is placed on a turntable which is level with the ground plane. The turntable has slip rings, which supply AC power to the intentional radiator. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

For radiated emission testing at 30 MHz or above that is performed at distances closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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
Loop Antenna	EMCO	6502	176	03/04/2013	03/04/2015
Biconilog Antenna	EMCO	3142	714	04/25/2013	04/25/2015
Double Ridged Guide Antenna	EMCO	3115	735	03/07/2013	03/07/2015
Pyramidal Standard Gain Horn	EMC Test System	3160-09	1052	04/10/2009	ICO
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
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

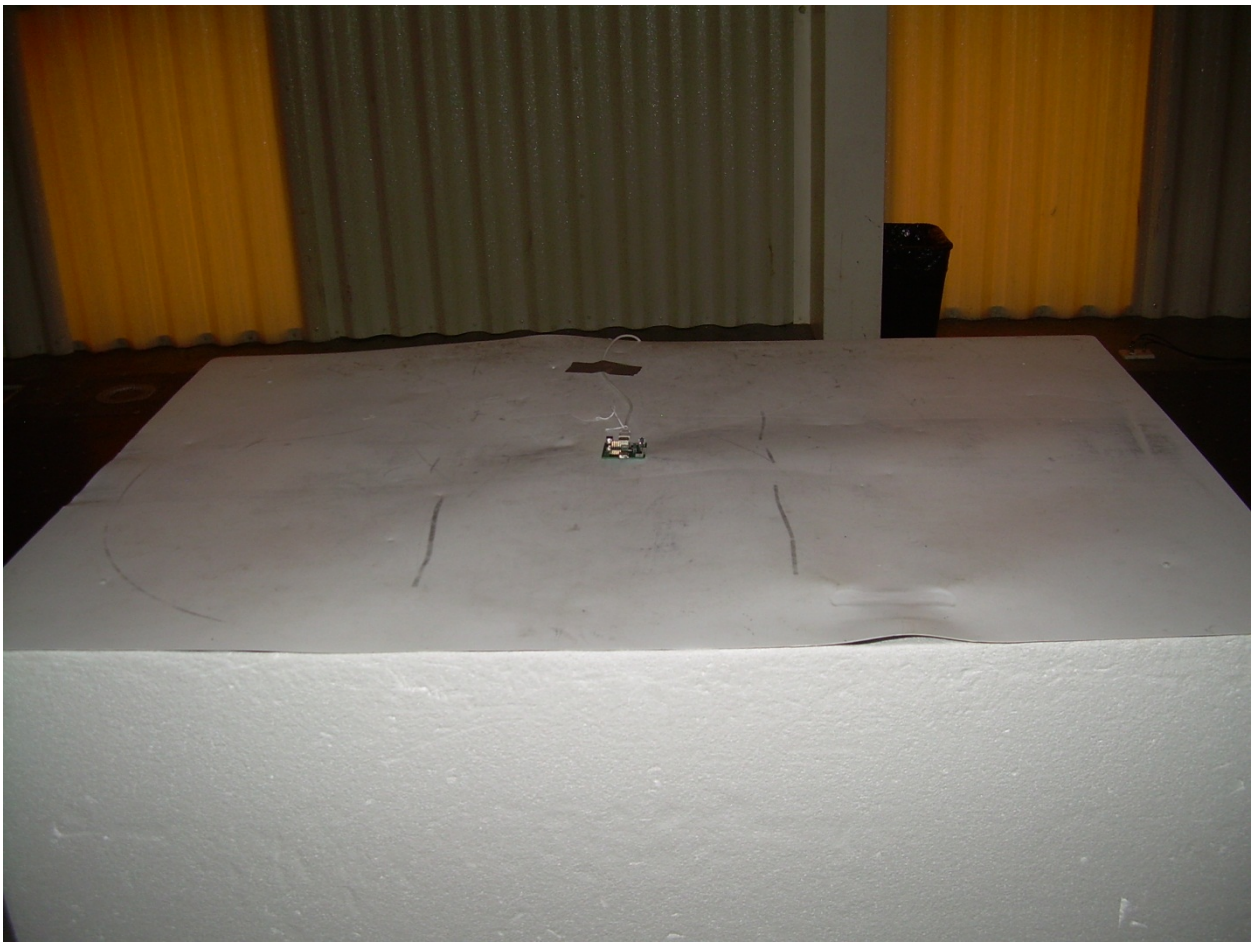
An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology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

Radiated Emissions Test Setup

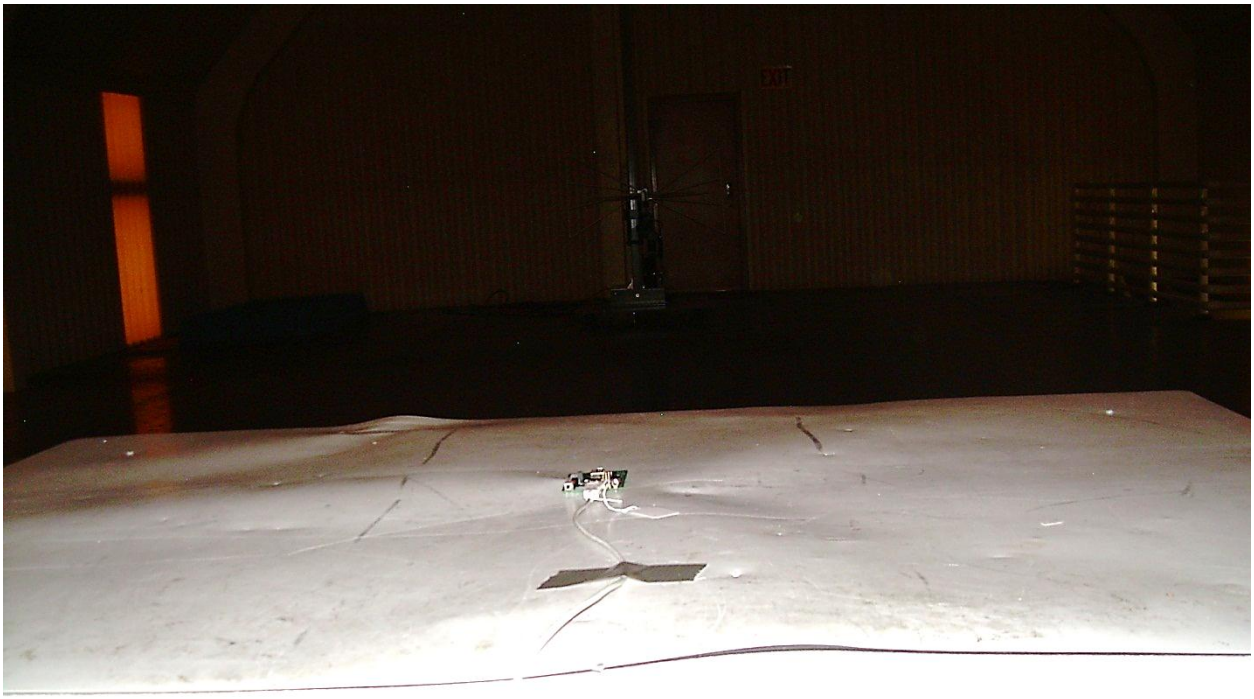


APPENDIX 2 PHOTOGRAPHS

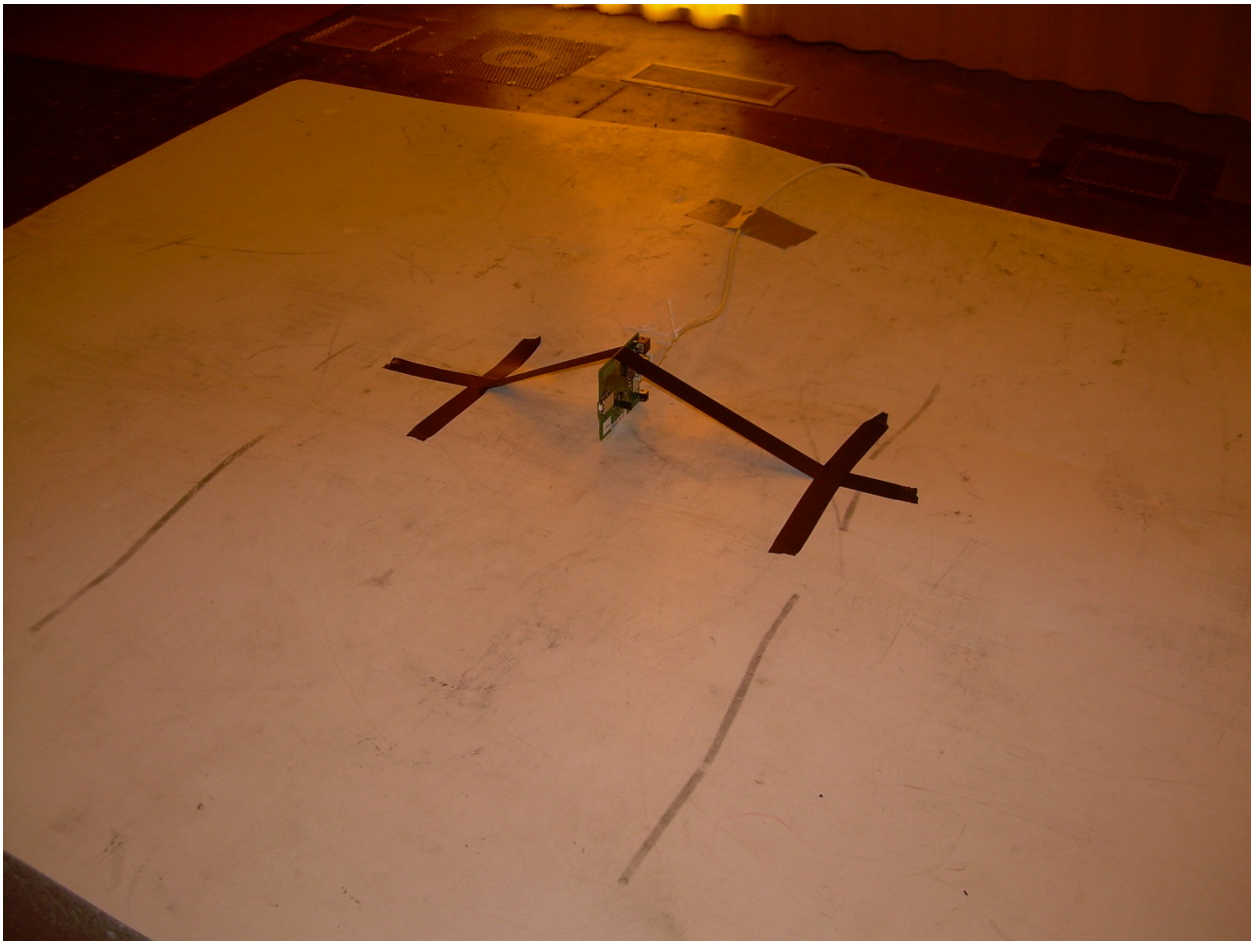
Photograph 1 – Front View Radiated Disturbance Worst Case Configuration – EUT Horizontal



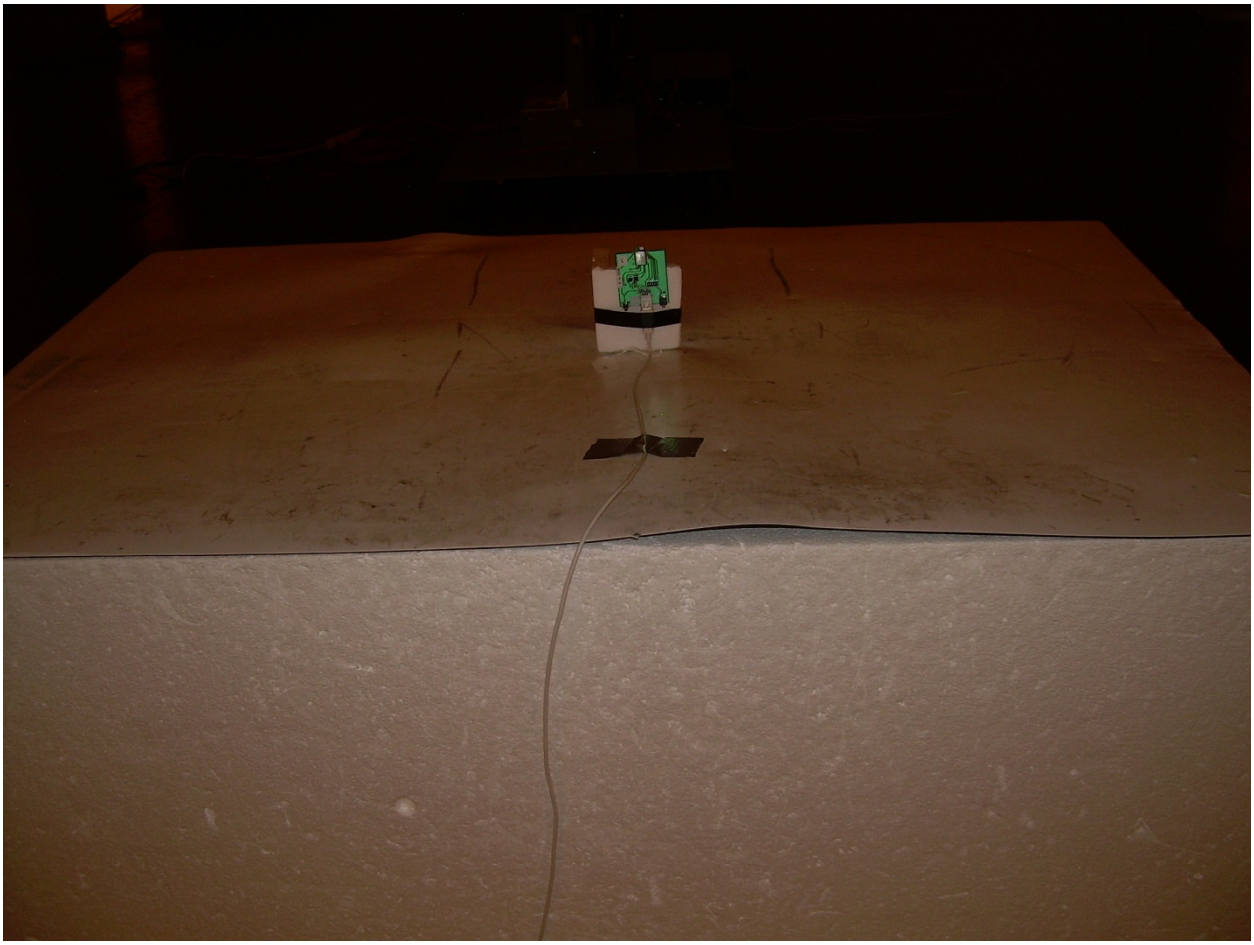
Photograph 2 – Back View Radiated Disturbance Worst Case Configuration – EUT Horizontal



Photograph 3 – Radiated Disturbance Configuration – On Edge



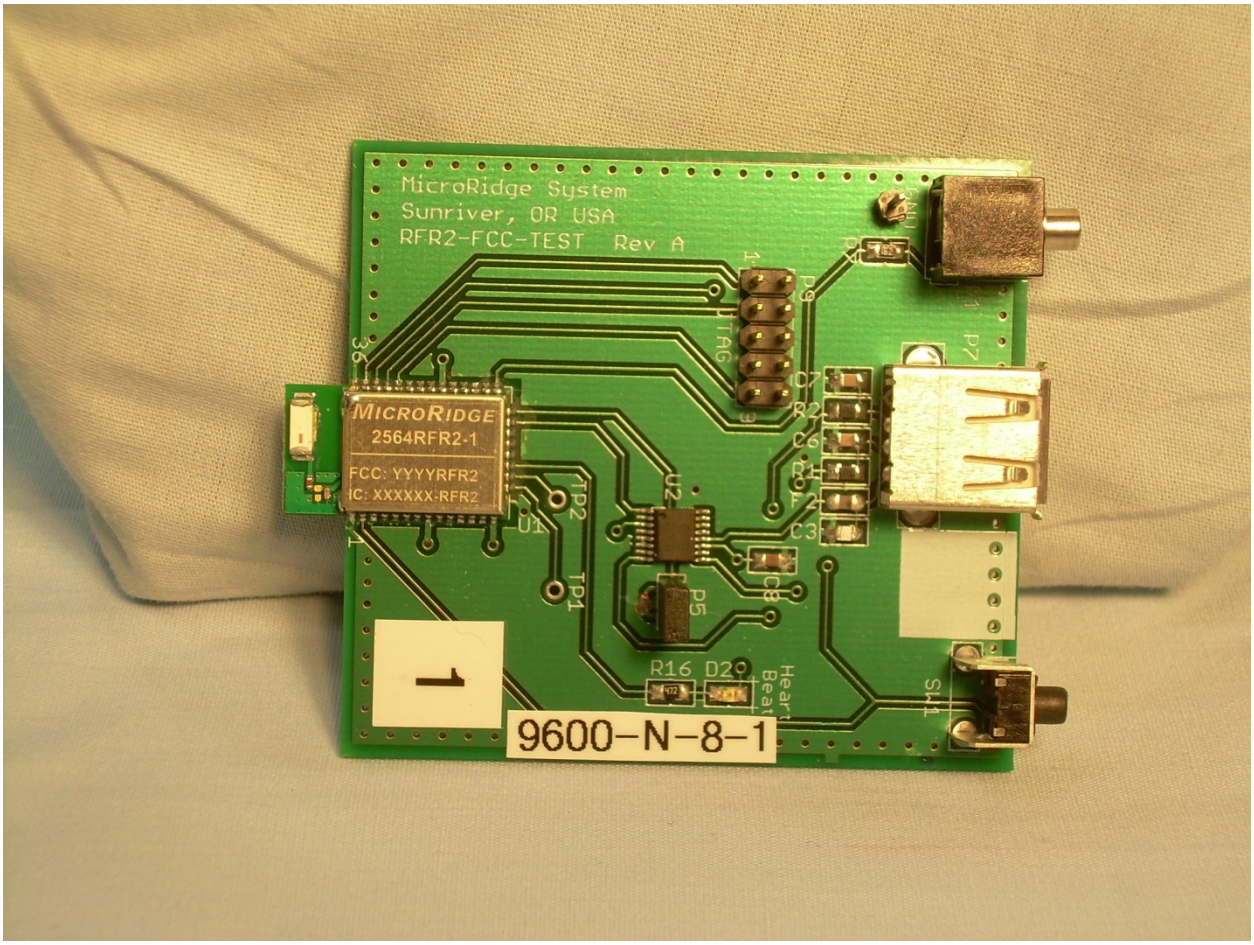
Photograph 4 – Radiated Disturbance Configuration – Vertical



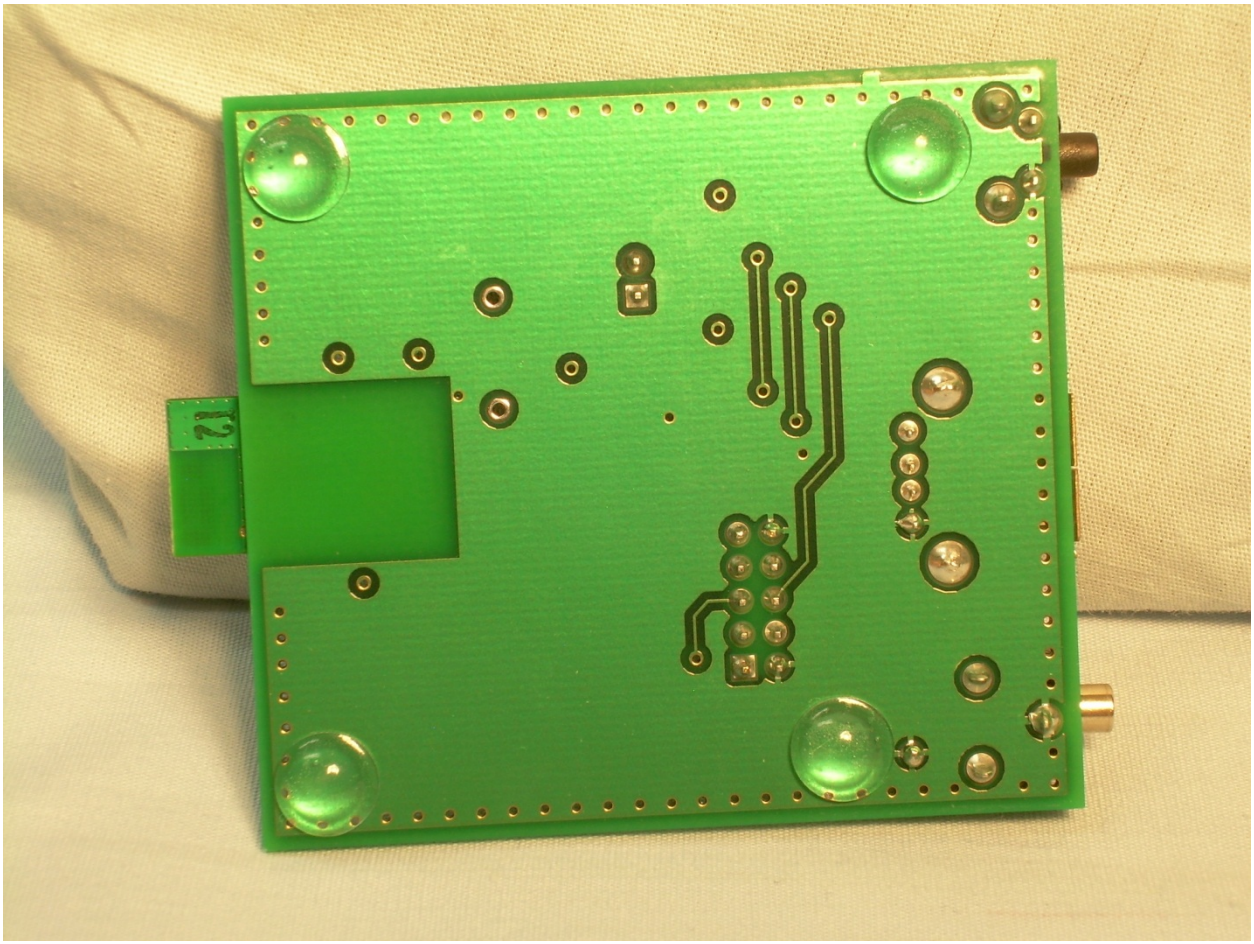
Photograph 5 – Front View Conducted Disturbance Worst Case Configuration

Photograph 6 – Back View Conducted Disturbance Worst Case Configuration

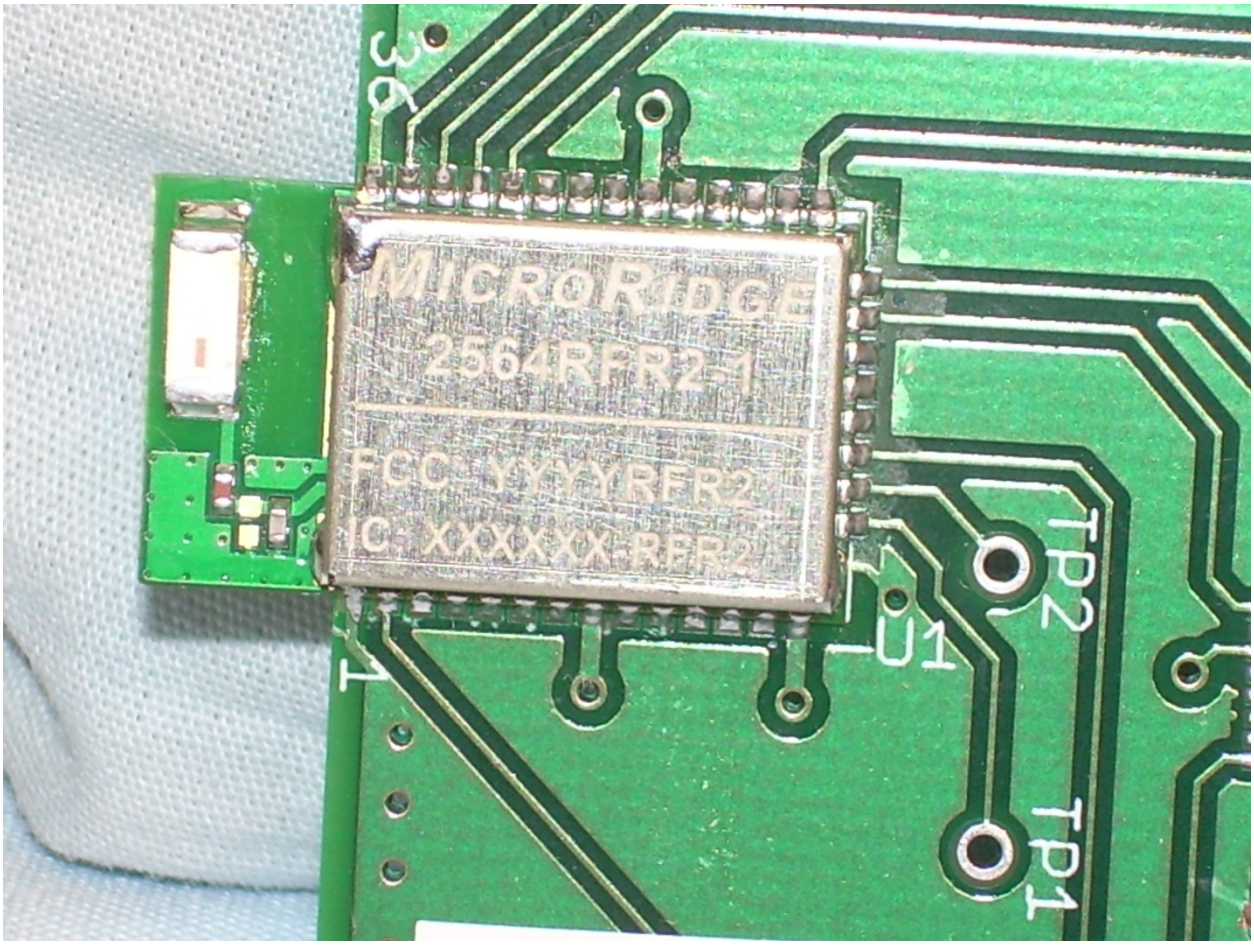
Photograph 7 – Front View of the EUT on Host



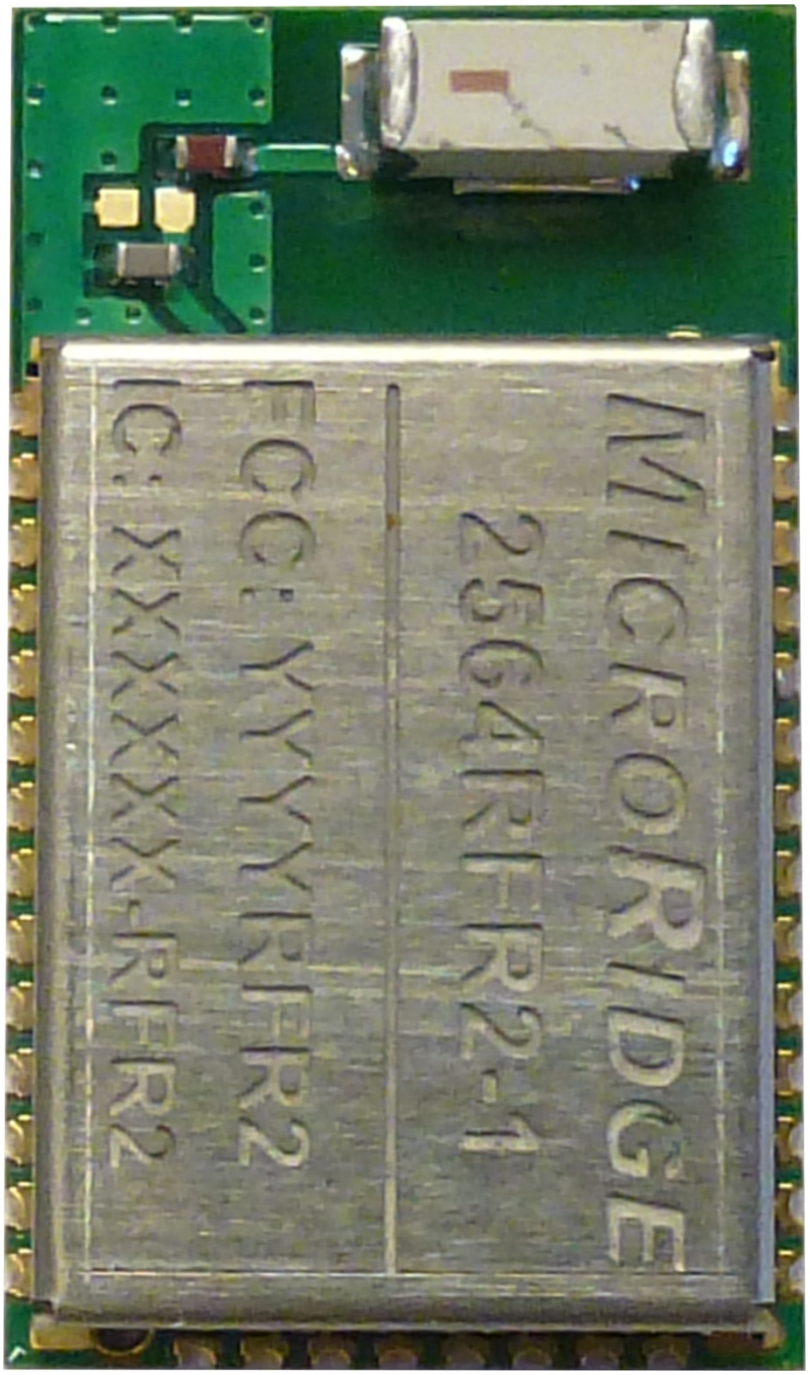
Photograph 8 – Back View of the EUT on Host



Photograph 9 – Internal View of the EUT



Photograph 10 – View of the Module



Photograph 11 – View of the EUT with Shield Removed