Nemko-CCL, Inc.
1940 West Alexander Street
Salt Lake City, UT 84119
801-972-6146

Test Report

Certification

Test Of: YRMZW2-US

FCC ID: U4A-YRHCPZW0FM

Test Specifications:

FCC PART 15, Subpart C

Test Report Serial No: 296434-3.2

Applicant:
Assa Abloy Inc.
110 Sargent Drive
New Haven, CT 06511
U.S.A

Date of Test: October 22 and 29, 2015

Report Issue Date: January 6, 2016

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 Federal Communications Commission (FCC) Part 15, Subpart C. 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: Assa Abloy Inc.
- Manufacturer: Assa Abloy Inc.
- Brand Name: Yale
- Model Number: YRMZW2-US
- FCC ID: U4A-YRHCPZW0FM

On this 6th day of January 2016, 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

Revision History		
Revision	Description	Date
1	Original Report Release	November 23, 2015
2	Corrected FCC ID from U4-YRHCPZW0FM to U4A-YRHCPZW0FM	January 6, 2016

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name:	Assa Abloy Inc. 110 Sargent Drive New Haven, CT 06511 U.S.A
Contact Name:	Andrea Waterman
Title:	Compliance Specialist

1.2 Manufacturer:

Company Name:	Assa Abloy Inc. 110 Sargent Drive New Haven, CT 06511 U.S.A
Contact Name:	Andrea Waterman
Title:	Compliance Specialist

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	Yale
Model Number:	YRMZW2-US
Serial Number:	None
Dimensions:	5.5 cm x 2.6 cm x 0.5 cm

2.2 Description of EUT:

The YRMZW2-US is a transceiver module with a Zwave transceiver that interfaces a home automation/control system. The YRMZW2-US is installed in a door lock assembly and interfaces header connectors in the lock module slot. 6 Vdc to power the YRMZW2-US comes from the 4 AA batteries of the lock assembly. For testing conducted emissions at the AC mains as required for modules, an Anome Electric Co. LTD AEC-4850 AC to DC adapter was connected to the power pins of the YRMZB2. The Zwave transceiver operates on 3 frequencies. If the data rate is 100 kbps, 916.0 MHz is used. If operating at 40 kbps, 908.4 MHz is used. When operating at 9.6 kbps, 908.42 MHz is used. The module was tested at all 3 frequencies using the associated data rates.

This report covers the transmitter circuitry of the device subject to FCC Part 15, Subpart C. The circuitry of the device, subject to FCC Part 15, Subpart B is covered in Nemko-CCL, Inc. report 296434-2.

2.3 EUT and Support Equipment:

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

Brand Name Model Number Serial Number	FCC ID Number or Compliance	Description	Name of Interface Ports / Interface Cables
BN: Yale MN: YRMZW2-US SN: None	U4A-YRHCPZW0FM	Transceiver Module	See Section 2.4

2.4 Interface Ports on EUT:

Normally the EUT connects directly to header connectors in the door lock module slot. For testing, the EUT was cabled as shown in the table.

Name of Port	No. of Ports Fitted to EUT	Cable Descriptions/Length
Power/data	1	10 cm Ribbon cable from battery assembly or power source/1.5 meters

2.5 Modification Incorporated/Special Accessories on EUT:

The following modifications were made to the EUT by the Client during testing to comply with the specification. This report is not complete without an accompanying signed attestation, that the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market.

1. When operating at data rates of 100 kbps and 40 kbps, the maximum power setting allowed in firmware will be 29. This setting will be incorporated in production firmware.
2. When operating at a data rate of 9.6 kbps, the maximum power setting allowed in firmware will be 28. This setting will be incorporated in production firmware.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title:	FCC PART 15, Subpart C (47 CFR 15) 15.203, 15.207, and 15.249 Limits and methods of measurement of radio interference characteristics of radio frequency devices
Purpose of Test:	The tests were performed to demonstrate initial compliance

3.2 Methods & Procedures:

3.2.1 §15.203 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

3.2.2 §15.207 Conducted Limits

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHZ to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

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.

3.2.3 §15.249 Operation within the bands 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

(b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.

(2) The frequency tolerance of the carrier signal shall be maintained within ±0.001% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(3) Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

(c) Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

(e) As shown in § 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

3.3 Test Procedure

The testing was performed according to the procedures in ANSI C63.10: 2013. 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 January 22, 2015 (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, 2016.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply: 6 VDC

4.2 Operating Modes:

The EUT was tested on 3 orthogonal axes while in a constant transmit mode. The fundamental emission maximum field strength was when placed flat on the table as when installed in a lock. The spurious emissions worst-case field strengths were found when the EUT was placed, with the edge that would be at the front of the lock when installed, on the table.

4.3 EUT Exercise Software:

Test software was used to program and exercise the EUT.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests:

Section	Environmental Phenomena	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.249(a)	Field Strength of the Fundamental Frequency	902 – 928	Complied
15.249(a)	Field Strength of the Harmonics	902 – 9280	Complied
15.249(d)	Field Strength of Spurious Emissions	0.05 – 9280	Complied

5.2 Result

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

SECTION 6.0 MEASUREMENTS AND 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 §15.203 Antenna Requirements

The EUT uses a trace antenna of the PCB and is not user replaceable.

RESULT

The EUT complied with the specification.

6.2.2 §15.207 Conducted Disturbance at the AC Mains Ports

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.16	Hot Lead	Peak (Note 1)	46.3	55.7	-9.4
0.22	Hot Lead	Peak (Note 1)	43.9	52.9	-9.0
0.27	Hot Lead	Peak (Note 1)	41.3	51.2	-9.9
0.35	Hot Lead	Peak (Note 1)	35.9	49.0	-13.1
0.46	Hot Lead	Peak (Note 1)	32.7	46.7	-14.0
0.60	Hot Lead	Peak (Note 1)	32.8	46.0	-13.2
0.15	Neutral Lead	Peak (Note 1)	51.9	56.0	-4.1
0.20	Neutral Lead	Peak (Note 1)	45.9	53.6	-7.7
0.27	Neutral Lead	Peak (Note 1)	38.3	51.2	-12.9
0.33	Neutral Lead	Peak (Note 1)	33.7	49.6	-15.9
0.61	Neutral Lead	Peak (Note 1)	29.0	46.0	-17.0
0.72	Neutral Lead	Peak (Note 1)	29.7	46.0	-16.3

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
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.					

RESULT

In the configuration tested, the EUT complied with the specification by 4.1 dB.

6.2.3 §15.249(a) Fundamental Field Strength

The table below shows the fundamental emission, measured at 3 meters using peak detection.

Frequency (MHz)	Detector	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	3 m Limit (dBμV/m)	Margin (dB)	Polarity
908.40	Quasi-Peak	63.2	30.7	93.9	94.0	-0.1	Horizontal
908.42	Quasi-Peak	62.9	30.7	93.6	94.0	-0.4	Horizontal
916.00	Quasi-Peak	63.2	30.7	93.9	94.0	-0.1	Horizontal

RESULT

The EUT complied with the specification.

6.2.4 §15.249(a) and §15.249(d) Field Strength of Harmonics and Spurious Emissions

The spurious emissions and harmonic emissions were measured from 0.009 MHz to 9160 MHz. The table below shows the emissions from the transmitter. Emissions from the digital circuitry and receivers of the EUT are shown in Nemko-CCL, Inc. report 296434.2.

6.2.4.1 Operating on 908.4 MHz

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1816.8	Peak	Vertical	6.9	30.3	37.2	74.0	-36.8
1816.8	Average	Vertical	-5.4	30.3	24.9	54.0	-29.1
1816.8	Peak	Horizontal	6.8	30.3	37.1	74.0	-36.9
1816.8	Average	Horizontal	-5.1	30.3	25.2	54.0	-28.8
2725.2	Peak	Vertical	6.5	33.7	40.2	74.0	-33.8
2725.2	Average	Vertical	-5.0	33.7	28.7	54.0	-25.3
2725.2	Peak	Horizontal	6.4	33.7	40.1	74.0	-33.9
2725.2	Average	Horizontal	-5.3	33.7	28.4	54.0	-25.6
3633.6	Peak	Vertical	4.4	36.8	41.2	74.0	-32.8
3633.6	Average	Vertical	-7.7	36.8	29.1	54.0	-24.9
3633.6	Peak	Horizontal	4.2	36.8	41.0	74.0	-33.0
3633.6	Average	Horizontal	-7.2	36.8	29.6	54.0	-24.4
4542.0	Peak	Vertical	6.2	38.3	44.5	74.0	-29.5
4542.0	Average	Vertical	-0.6	38.3	37.7	54.0	-16.3
4542.0	Peak	Horizontal	5.7	38.3	44.0	74.0	-30.0
4542.0	Average	Horizontal	-2.3	38.3	36.0	54.0	-18.0
5450.4	Peak	Vertical	3.7	40.4	44.1	74.0	-29.9
5450.4	Average	Vertical	-8.1	40.4	32.3	54.0	-21.7
5450.4	Peak	Horizontal	3.6	40.4	44.0	74.0	-30.0
5450.4	Average	Horizontal	-8.0	40.4	32.4	54.0	-21.6
6358.8	Peak	Vertical	3.0	41.4	44.4	74.0	-29.6
6358.8	Average	Vertical	-8.6	41.4	32.8	54.0	-21.2
6358.8	Peak	Horizontal	3.1	41.4	44.5	74.0	-29.5
6358.8	Average	Horizontal	-8.7	41.4	32.7	54.0	-21.3
7267.2	Peak	Vertical	3.0	43.5	46.5	74.0	-27.5
7267.2	Average	Vertical	-7.5	43.5	36.0	54.0	-18.0

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
7267.2	Peak	Horizontal	2.6	43.5	46.1	74.0	-27.9
7267.2	Average	Horizontal	-7.7	43.5	35.8	54.0	-18.2
8175.6	Peak	Vertical	4.0	45.0	49.0	74.0	-25.0
8175.6	Average	Vertical	-5.7	45.0	39.3	54.0	-14.7
8175.6	Peak	Horizontal	2.7	45.0	47.7	74.0	-26.3
8175.6	Average	Horizontal	-7.4	45.0	37.6	54.0	-16.4
9084.0	Peak	Vertical	3.1	46.3	49.4	74.0	-24.6
9084.0	Average	Vertical	-8.6	46.3	37.7	54.0	-16.3
9084.0	Peak	Horizontal	3.3	46.3	49.6	74.0	-24.4
9084.0	Average	Horizontal	-7.4	46.3	38.9	54.0	-15.1

RESULT

The EUT complied with the specification.

6.2.4.2 Operating on 908.42 MHz

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1816.84	Peak	Vertical	6.6	30.3	36.9	74.0	-37.1
1816.84	Average	Vertical	-5.2	30.3	25.1	54.0	-28.9
1816.84	Peak	Horizontal	6.3	30.3	36.6	74.0	-37.4
1816.84	Average	Horizontal	-5.2	30.3	25.1	54.0	-28.9
2725.26	Peak	Vertical	4.5	33.7	38.2	74.0	-35.8
2725.26	Average	Vertical	-3.4	33.7	30.3	54.0	-23.7
2725.26	Peak	Horizontal	4.5	33.7	38.2	74.0	-35.8
2725.26	Average	Horizontal	-3.4	33.7	30.3	54.0	-23.7
3633.68	Peak	Vertical	1.3	36.8	38.1	74.0	-35.9
3633.68	Average	Vertical	-5.5	36.8	31.3	54.0	-22.7
3633.68	Peak	Horizontal	1.3	36.8	38.1	74.0	-35.9
3633.68	Average	Horizontal	-5.5	36.8	31.3	54.0	-22.7
4542.1	Peak	Vertical	5.9	38.3	44.2	74.0	-29.8
4542.1	Average	Vertical	-0.4	38.3	37.9	54.0	-16.1

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4542.1	Peak	Horizontal	5.0	38.3	43.3	74.0	-30.7
4542.1	Average	Horizontal	-3.1	38.3	35.2	54.0	-18.8
5450.52	Peak	Vertical	-0.6	40.4	39.8	74.0	-34.2
5450.52	Average	Vertical	-6.6	40.4	33.8	54.0	-20.2
5450.52	Peak	Horizontal	-0.6	40.4	39.8	74.0	-34.2
5450.52	Average	Horizontal	-6.6	40.4	33.8	54.0	-20.2
6358.94	Peak	Vertical	0.0	41.4	41.4	74.0	-32.6
6358.94	Average	Vertical	-7.0	41.4	34.4	54.0	-19.6
6358.94	Peak	Horizontal	0.0	41.4	41.4	74.0	-32.6
6358.94	Average	Horizontal	-7.0	41.4	34.4	54.0	-19.6
7267.36	Peak	Vertical	-0.2	43.5	43.3	74.0	-30.7
7267.36	Average	Vertical	-7.5	43.5	36.0	54.0	-18.0
7267.36	Peak	Horizontal	-0.2	43.5	43.3	74.0	-30.7
7267.36	Average	Horizontal	-7.5	43.5	36.0	54.0	-18.0
8175.78	Peak	Vertical	0.4	45.0	45.4	74.0	-28.6
8175.78	Average	Vertical	-7.6	45.0	37.4	54.0	-16.6
8175.78	Peak	Horizontal	0.4	45.0	45.4	74.0	-28.6
8175.78	Average	Horizontal	-7.6	45.0	37.4	54.0	-16.6
9084.2	Peak	Vertical	0.4	46.3	46.7	74.0	-27.3
9084.2	Average	Vertical	-7.2	46.3	39.1	54.0	-14.9
9084.2	Peak	Horizontal	0.4	46.3	46.7	74.0	-27.3
9084.2	Average	Horizontal	-7.2	46.3	39.1	54.0	-14.9

RESULT

The EUT complied with the specification.

6.2.4.3 Operating on 916.00 MHz

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1832.0	Peak	Vertical	6.8	30.3	37.1	74.0	-36.9
1832.0	Average	Vertical	-5.0	30.3	25.3	54.0	-28.7

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1832.0	Peak	Horizontal	6.3	30.3	36.6	74.0	-37.4
1832.0	Average	Horizontal	-5.1	30.3	25.2	54.0	-28.8
2748.0	Peak	Vertical	6.9	33.8	40.7	74.0	-33.3
2748.0	Average	Vertical	-4.8	33.8	29.0	54.0	-25.0
2748.0	Peak	Horizontal	6.9	33.8	40.7	74.0	-33.3
2748.0	Average	Horizontal	-5.4	33.8	28.4	54.0	-25.6
3664.0	Peak	Vertical	3.7	36.9	40.6	74.0	-33.4
3664.0	Average	Vertical	-7.6	36.9	29.3	54.0	-24.7
3664.0	Peak	Horizontal	2.4	36.9	39.3	74.0	-34.7
3664.0	Average	Horizontal	-7.7	36.9	29.2	54.0	-24.8
4580.0	Peak	Vertical	6.1	38.4	44.5	74.0	-29.5
4580.0	Average	Vertical	-1.1	38.4	37.3	54.0	-16.7
4580.0	Peak	Horizontal	5.3	38.4	43.7	74.0	-30.3
4580.0	Average	Horizontal	-1.6	38.4	36.8	54.0	-17.2
5496.0	Peak	Vertical	3.0	40.5	43.5	74.0	-30.5
5496.0	Average	Vertical	-8.6	40.5	31.9	54.0	-22.1
5496.0	Peak	Horizontal	3.4	40.5	43.9	74.0	-30.1
5496.0	Average	Horizontal	-8.5	40.5	32.0	54.0	-22.0
6412.0	Peak	Vertical	2.7	41.5	44.2	74.0	-29.8
6412.0	Average	Vertical	-8.9	41.5	32.6	54.0	-21.4
6412.0	Peak	Horizontal	2.9	41.5	44.4	74.0	-29.6
6412.0	Average	Horizontal	-8.2	41.5	33.3	54.0	-20.7
7328.0	Peak	Vertical	3.1	43.7	46.8	74.0	-27.2
7328.0	Average	Vertical	-6.5	43.7	37.2	54.0	-16.8
7328.0	Peak	Horizontal	2.7	43.7	46.4	74.0	-27.6
7328.0	Average	Horizontal	-7.8	43.7	35.9	54.0	-18.1
8244.0	Peak	Vertical	3.3	45.2	48.5	74.0	-25.5
8244.0	Average	Vertical	-7.0	45.2	38.2	54.0	-15.8
8244.0	Peak	Horizontal	4.0	45.2	49.2	74.0	-24.8
8244.0	Average	Horizontal	-6.9	45.2	38.3	54.0	-15.7
9160.0	Peak	Vertical	2.7	46.4	49.1	74.0	-24.9
9160.0	Average	Vertical	-7.7	46.4	38.7	54.0	-15.3
9160.0	Peak	Horizontal	3.1	46.4	49.5	74.0	-24.5

Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
9160.0	Average	Horizontal	-7.2	46.4	39.2	54.0	-14.8

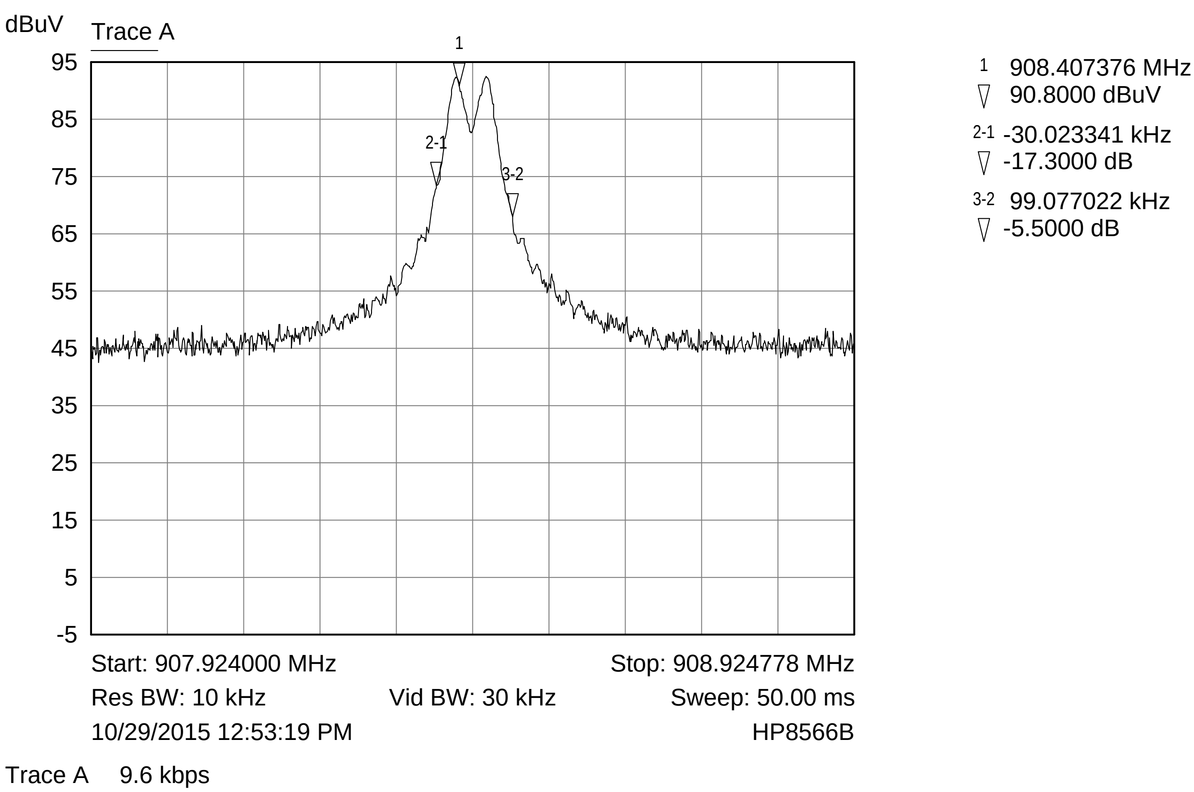
RESULT

The EUT complied with the specification.

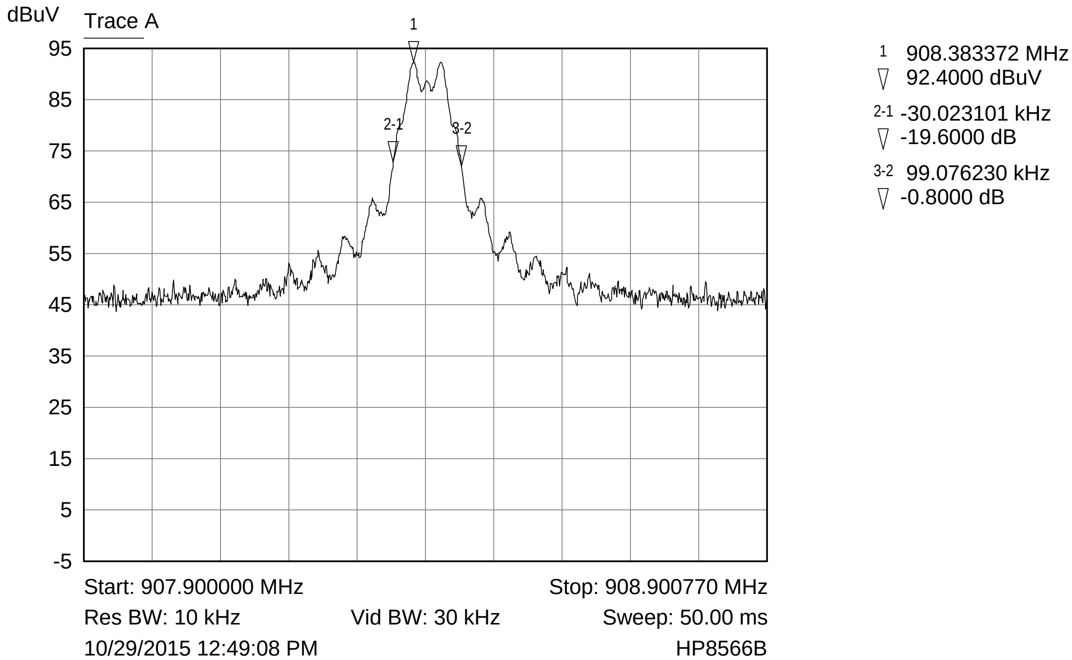
6.2.5 Channel Bandwidth

The 20 dB bandwidths of the channels are shown in the plots below. These plots show the fundamental emission 20 dB band width is contained totally within the 902 – 928 MHz frequency band using all modulations.

6.2.5.1 9.6 kbps Data Rate

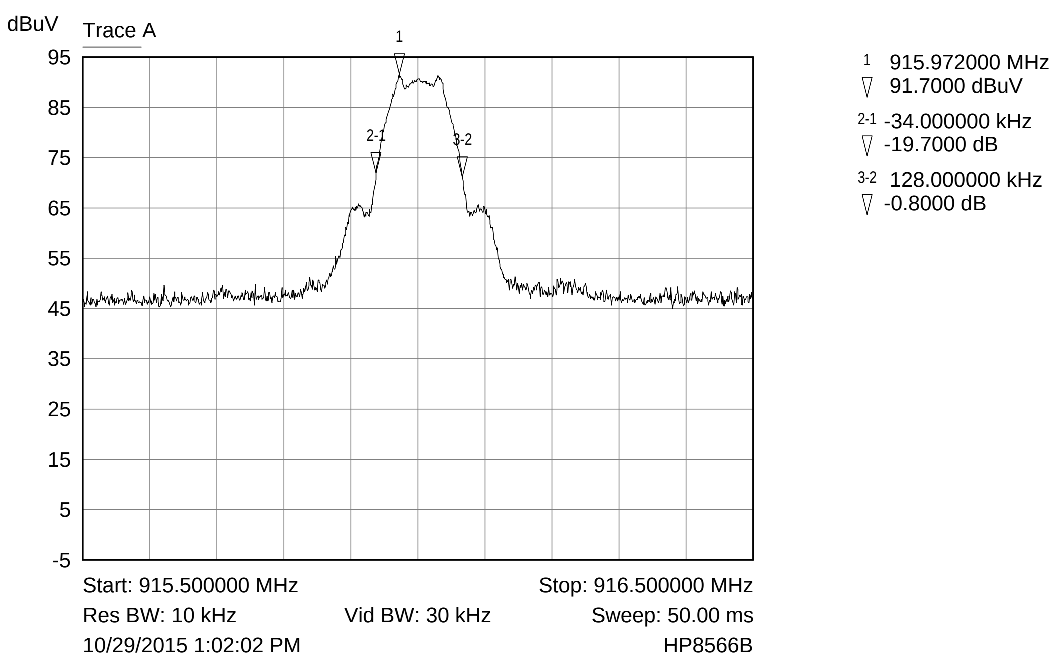


6.2.5.2 40 kbps Data Rate



Trace A 40 kbps

6.2.5.3 100 kbps Data Rate



Trace A 100 kbps

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 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:

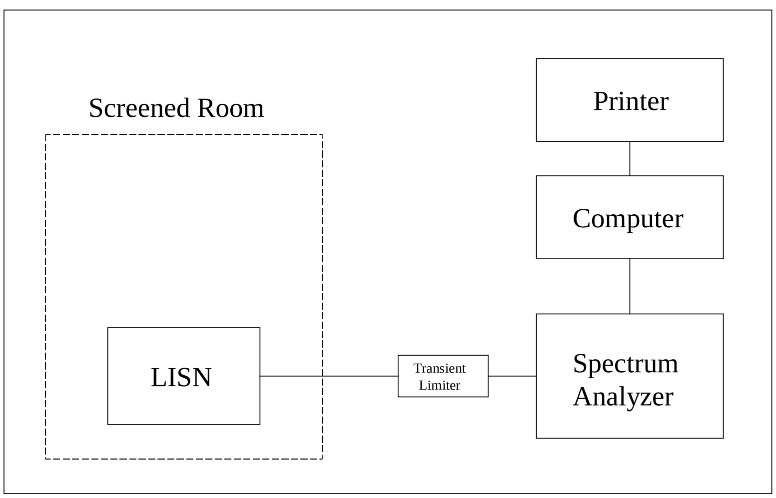
(a) Each power cord, which is terminated in a mains supply plug, shall be tested separately.
(b) Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
(c) Power cords which are specified by the manufacturer to be connected via a host unit 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
Spectrum Analyzer	Hewlett Packard	8566B	644	03/23/2015	03/23/2016
Quasi-Peak Detector	Hewlett Packard	85650A	1130	03/16/2015	03/16/2016
LISN	Nemko	LISN-COMM-50	1424	02/25/2015	02/25/2016
Conductance Cable Wanship Site #2	Nemko	Cable J	840	12/23/2014	12/23/2015
Transient Limiter	Hewlett Packard	11947A	768	12/23/2014	12/23/2015

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 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 Pyramidal Horn antenna was used to measure the frequency range of 18 GHz to 25 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 EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated disturbance. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were 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.

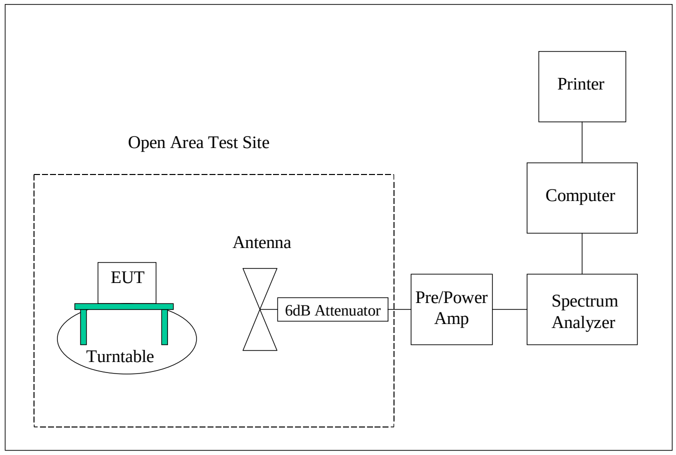
Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

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
Spectrum Analyzer/Receiver	Rohde & Schwarz	ESU40	1229	04/07/2015	04/07/2016
Spectrum Analyzer	Hewlett Packard	8566B	644	03/23/2015	03/23/2016
Quasi-Peak Detector	Hewlett Packard	85650A	1130	03/16/2015	03/16/2016
Loop Antenna	EMCO	6502	176	03/17/2015	03/17/2017
Biconilog Antenna	EMCO	3142	713	10/22/2014	10/22/2016
Double Ridged Guide Antenna	EMCO	3115	735	03/17/2015	03/17/2017
High Frequency Amplifier	Miteq	AFS4-00101800-35-10P-4	1179	06/29/2015	06/29/2016
20’ High Frequency Cable	Microcoax	UFB197C-1-3120-000000	1297	12/23/2014	12/23/2015
3 Meter Radiated Emissions Cable Wanship Site #2	Microcoax	UFB205A-0-4700-000000	1295	12/23/2014	12/23/2015
Pre/Power-Amplifier	Hewlett Packard	8447F	762	09/18/2015	09/18/2016
6 dB Attenuator	Hewlett Packard	8491A	1103	12/23/2014	12/23/2015

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.

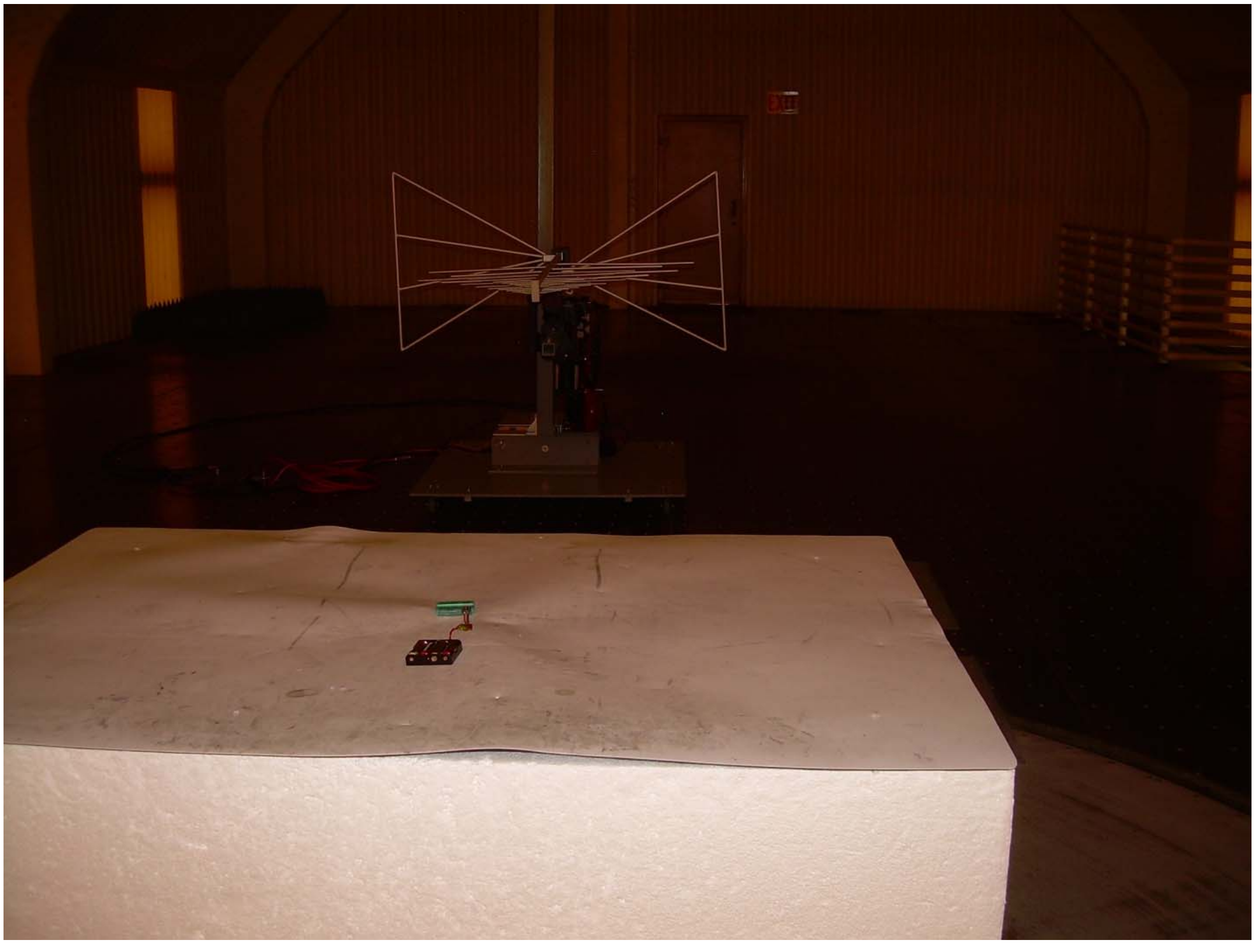
Radiated Emissions Test Setup



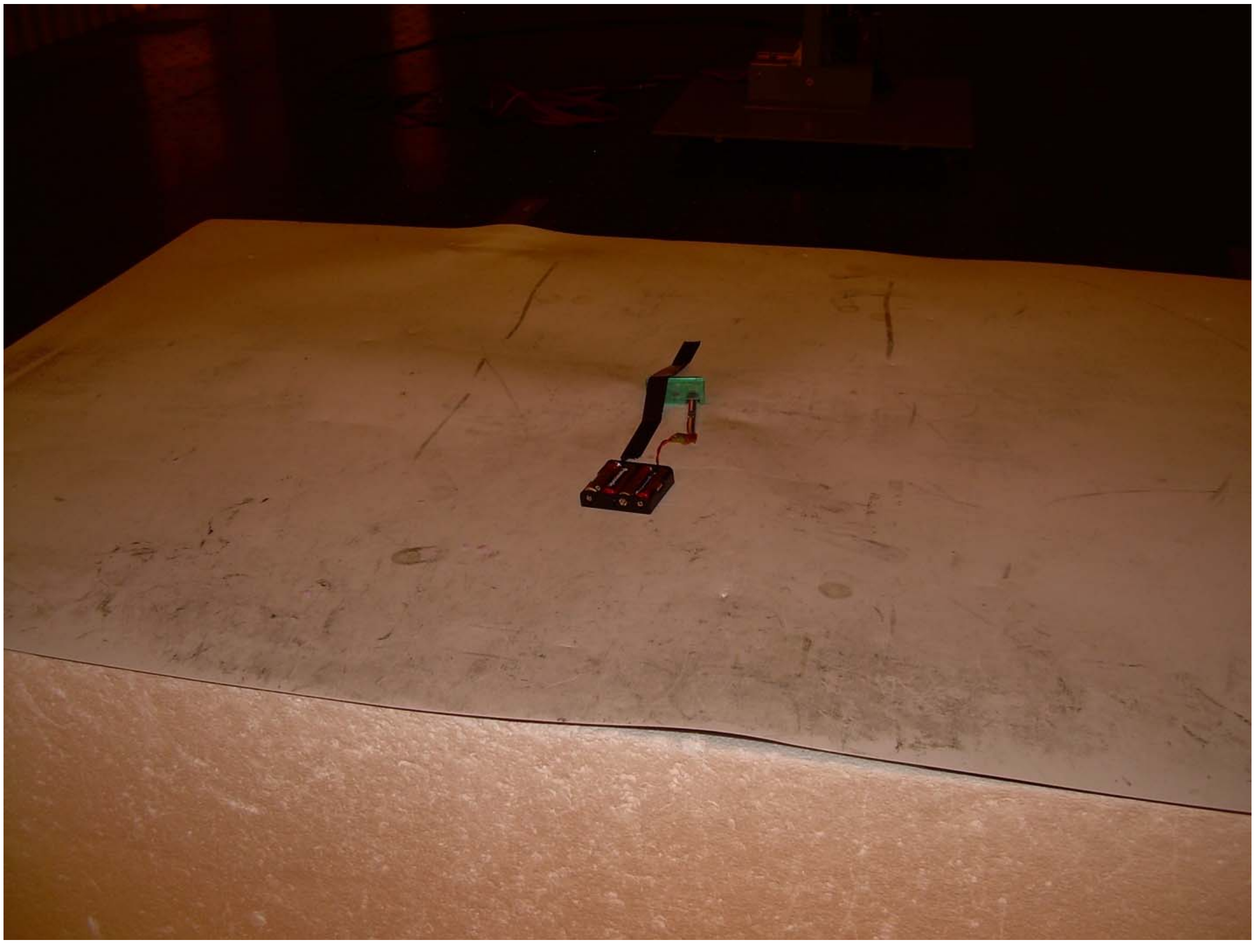
APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Front View Radiated Disturbance Flat Configuration

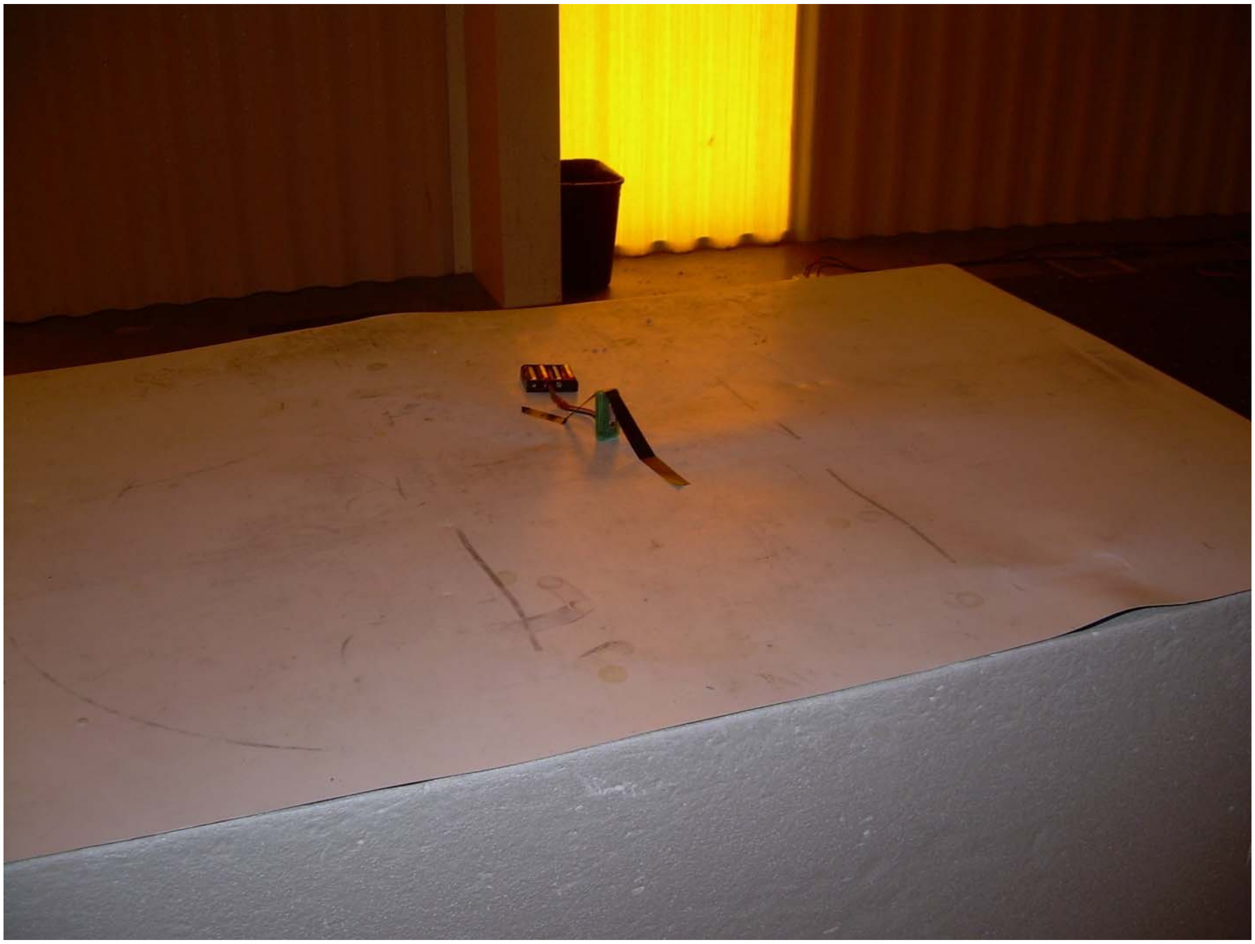
Photograph 2 – Back View Radiated Disturbance Flat Configuration



Photograph 3 – View Radiated Disturbance On Edge Configuration



Photograph 4 – View Radiated Disturbance Vertical Configuration

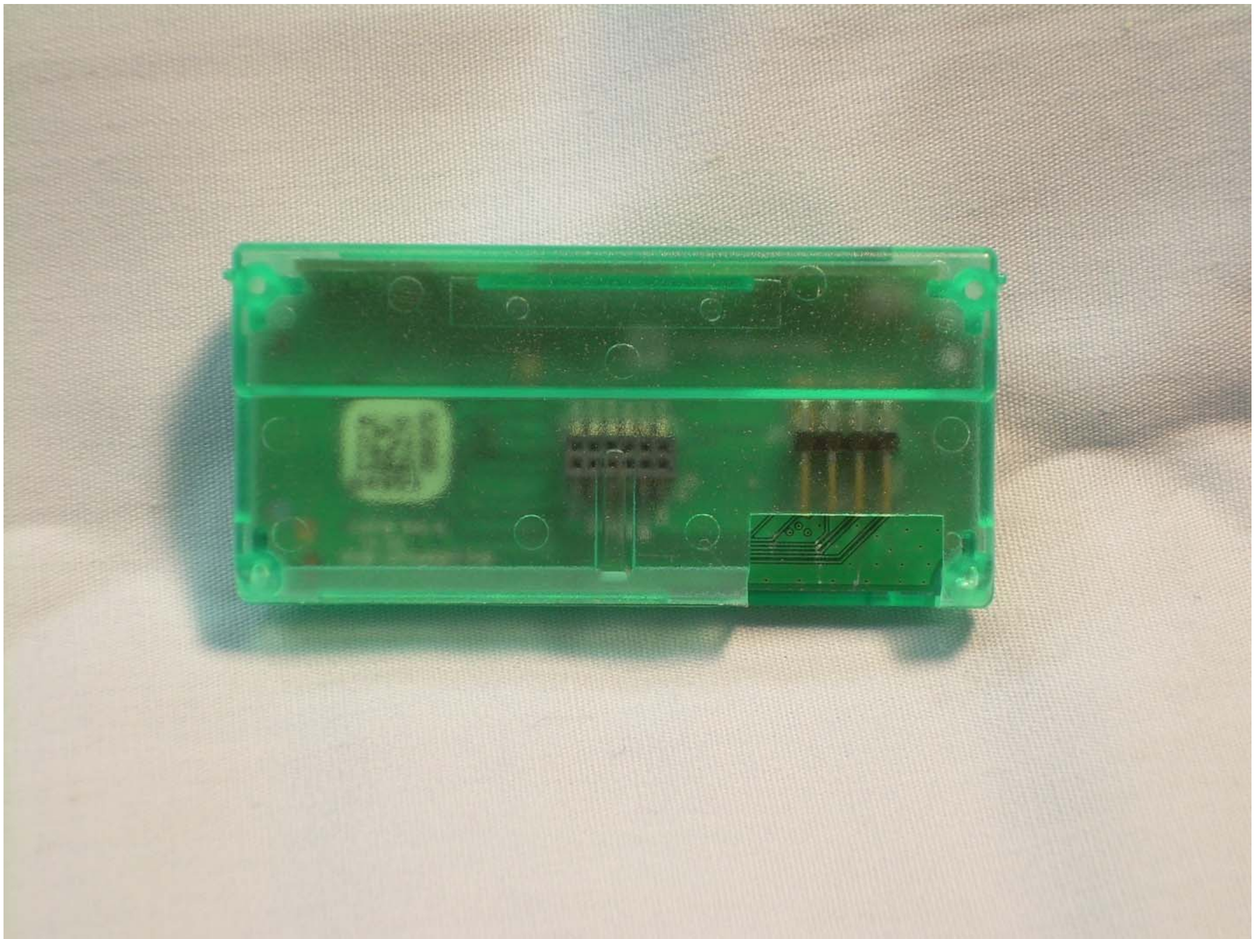


Photograph 5 – Front View Conducted Disturbance Worst Case Configuration

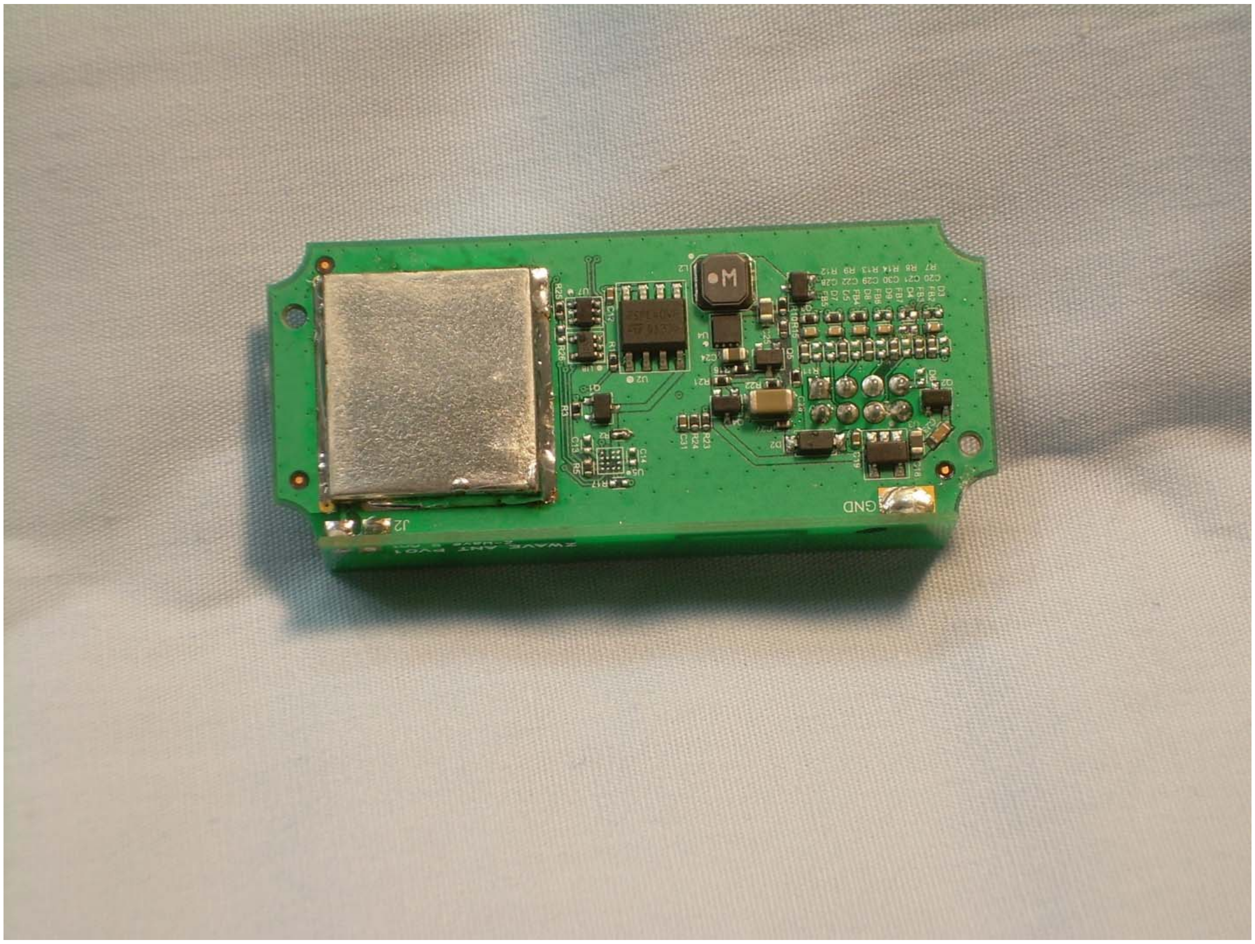
Photograph 6 – Back View Conducted Disturbance Worst Case Configuration

Photograph 7 – Top View of the EUT (Note label is not correct)

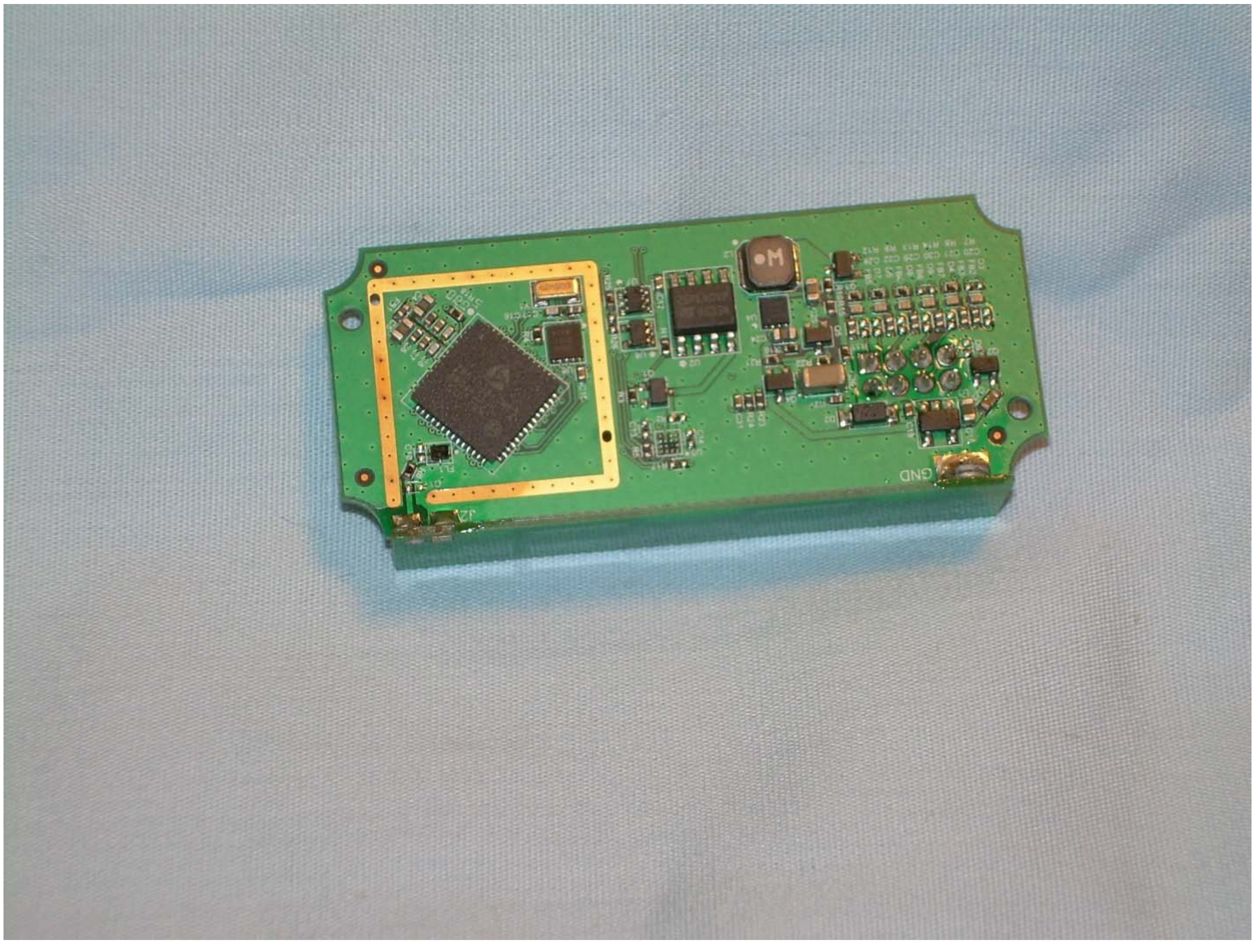
Photograph 8 – Bottom View of the EUT



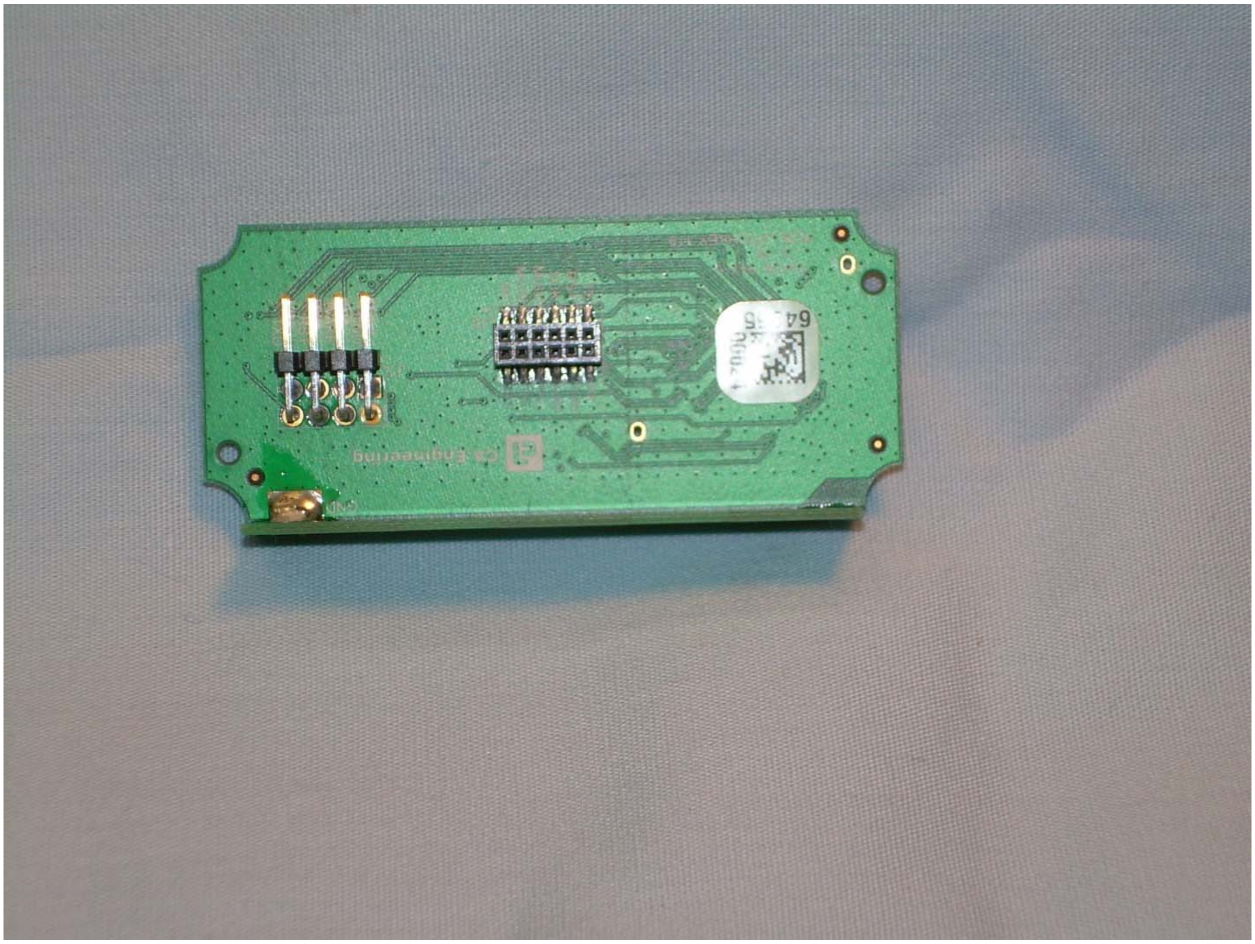
Photograph 9 – View of the Top Side of the PCB



Photograph 10 – View of the Top Side of the PCB with RF Shielding Removed



Photograph 11 – View of the Bottom of the EUT PCB



Photograph 12 – View of the Antenna PCB