Compliance Testing, LLC
Previously Flom Test Lab
EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268
fax: (480) 926-3598
http://www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: Hexagon Mining Brasil

Model: HUB SM | UG

Description: Device that enables communication and location between the mining assets and the UG Dispatch System

Serial Number: 00000001

FCC ID: 2AFYJ-HUBSMUGA

To

FCC Part 15B
Class A

And

IC ICES-003 Issue 6 (January 2016)

Date of Issue: July 28, 2016
Date of Reissue: September 19, 2016

On the behalf of the applicant: **Hexagon Mining Brasil**
Av. Raja Gabaglia, 959-9^{0} andar
Cidade Jardim – Belo Horizonte, MG
Brazil

Attention of: **Gustavo Henrique Lima Severino, Electronics and Electronics Engineer**
Ph: 30.380-403-Brazil
E-Mail: gustavo.severino@hexagonmining.com

Prepared By
Compliance Testing, LLC
1724 S. Nevada Way
Mesa, AZ 85204
(480) 926-3100 phone / (480) 926-3598 fax
www.compliancetesting.com
Project ID: p1670009

Paul Hay
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	7/21/16	Paul Hay	Original Document
2.0	9/19/16	Amanda Reed	Updated FCC ID

Table of Contents

The applicant has been cautioned as to the following

FCC

15.21 – Information to user

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a) – Special Accessories

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in the part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in §2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Industry Canada

Products subject to Industry Canada ICES-003 must be labeled in English and/or French (based on the intended market and any other applicable provincial or federal regulations) as follows:

CAN ICES-3 (A)/NMB-3(A)

ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to the joint ISO-ILAC-IAF Communiqué dated January 2009).

The tests results contained within this test report all fall within our scope of accreditation, unless noted below.

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

FCC Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

Test and Measurement Data
Subpart 2.1033(b)

All tests and measurement data shown were performed in accordance with FCC Rule Parts: 15.107, 15.109 (Unintentional Radiators).

All tests and measurement data shown are deemed satisfactory evidence of compliance with Industry Canada Interference-Causing Equipment Standard ICES-003.

Name of Test	FCC Section	ICES-003
A/C Powerline Conducted Emissions	15.107	Section 6
Radiated Emissions	15.109	Section 6

Standard Engineering Practices

Unless otherwise indicated, the procedures contained in ANSI C63.4-2009 were observed during testing.

Prior to testing, the EUT was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

Measurement results, unless otherwise noted, are worst case measurement.

Standard Test Conditions and Engineering Practices

Unless otherwise indicated in the specific measurement results, the ambient temperature was maintained within the range of 10º to 40ºC (50º to 104ºF) and the relative humidity levels were in the range of 10% to 90%.

Environmental Conditions	
Temperature (ºC)	**Humidity (%)**
26.9 – 27.3	33.0 – 39.4

EUT Description
Model: HUB SM | UG
Description: Device that enables communication and location between the mining asses and the UG Dispatch System
Serial Number: N/A
Additional Information:
None

EUT Operation during Tests
The EUT was setup for normal operation during testing. Power was provided with 120VAC 60Hz.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Laptop	Dell	3500	9K6NXP1
1	Power Supply	Leica Geosystems	N/A	N/A
1	RF Antenna	Antennex	TRA BT1560	N/A
1	Tag Antenna	Laird Technologies	N/A	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
3	USB to RSB 232	<3m	N	N	Laptop
1	Power Cable Integra Radio	>3m	N	N	HUB
1	DTR emulator cable	>3m	N	N	HUB
1	Power Cable	>3m	N	N	HUB
1	Test Cable	>3m	N	N	HUB

Modifications: None

Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.107	A/C Powerline Conducted Emissions	Pass	
15.109	Radiated Emissions	Pass	

15.107 A/C Powerline Conducted Emissions

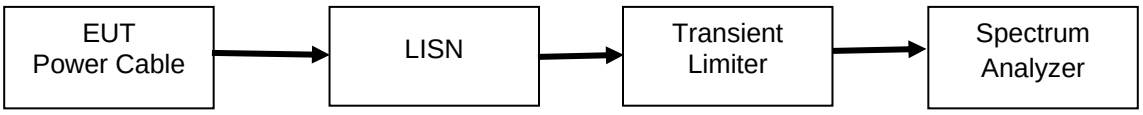
Engineer: Paul Hay

Test Date: 7/20/16

Test Procedure

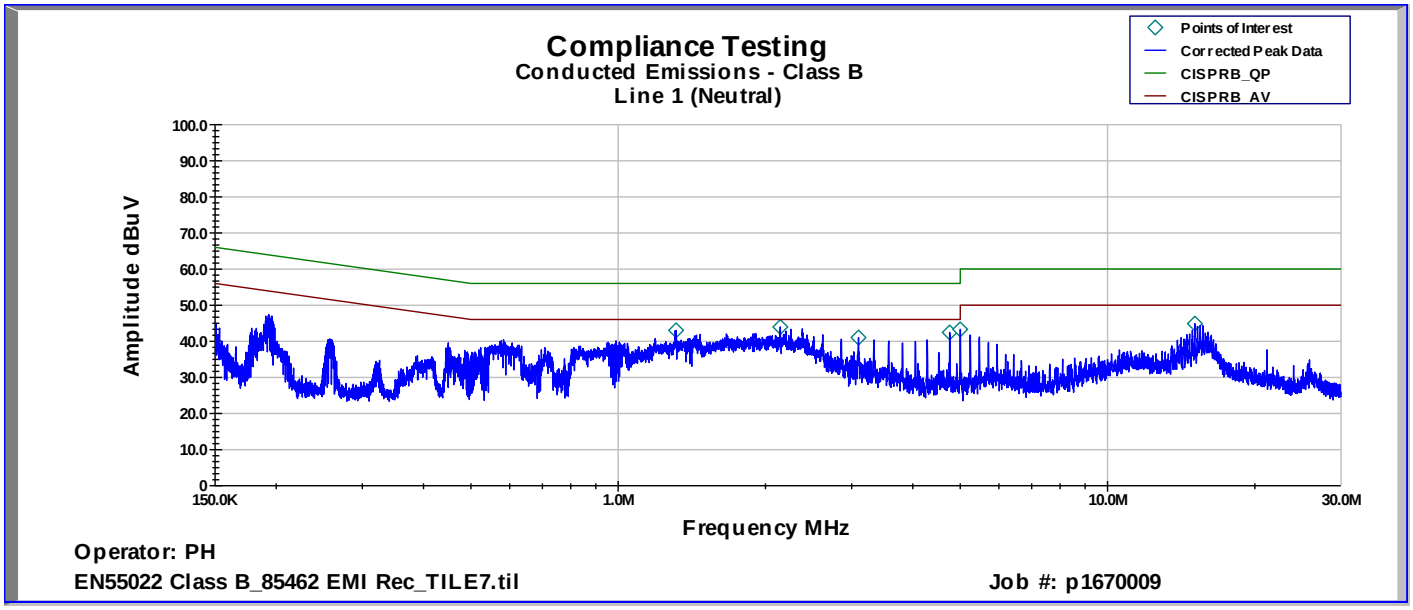
The EUT power cable was connected to a LISN and the monitored output of the LISN was connected to a transient limiter, which then connected directly to a spectrum analyzer. The conducted emissions from 150 kHz to 30 MHz were measured and compared to the specification limits.

Test Setup

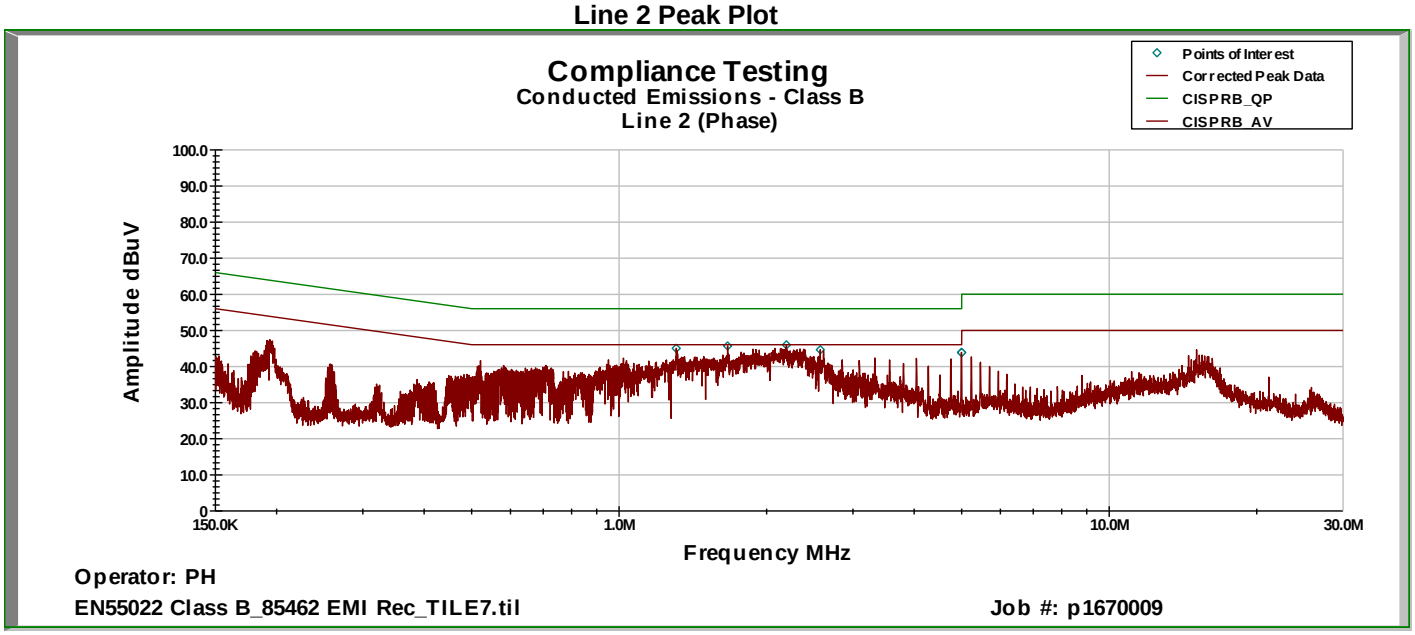


Conducted Emissions Test Results

Line 1 Peak Plot



Line 2 Peak Plot



Line 1 Neutral Avg Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
1.3103 MHz	26.5	0	0.046	10.1	36.642	46	-9.358
2.143 MHz	24.57	0	0.06	10.1	34.727	46	-11.273
3.091 MHz	27.78	0	0.08	10.155	38.015	46	-7.985
4.7563 MHz	30.43	0	0.1	10.2	40.733	46	-5.267
4.9932 MHz	32.05	0	0.1	10.2	42.35	46	-3.65
15.086 MHz	26.56	0	0.19	10.3	37.053	50	-12.947

Line 2 Phase Avg Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	Avg Margin (dB)
1.3108 MHz	26.86	0	0.046	10.1	37.009	46	-8.991
1.662 MHz	24.47	0	0.06	10.1	34.627	46	-11.373
2.204 MHz	16.44	0	0.06	10.1	26.6	46	-19.4
2.5767 MHz	16.01	0	0.07	10.1	26.177	46	-19.823
4.9896 MHz	31.4	0	0.1	10.2	41.697	46	-4.303
4.989 MHz	31.07	0	0.1	10.2	41.37	46	-4.63

Line 1 Neutral QP Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
1.3103 MHz	30.95	0	0.046	10.1	41.096	56	-14.904
2.143 MHz	29.56	0	0.06	10.1	39.72	56	-16.28
3.091 MHz	28.8	0	0.08	10.155	39.035	56	-16.965
4.7563 MHz	30.98	0	0.1	10.2	41.28	56	-14.72
4.9932 MHz	32.37	0	0.1	10.2	42.67	56	-13.33
15.086 MHz	31.77	0	0.19	10.3	42.26	60	-17.74

Line 2 Phase QP Detector

Frequency	Measured Value (dBuV)	LISN Correction Factor (dB)	Cable Loss (dB)	Transient Limiter (dB)	Final Data (dBuV)	Limit (dBuV)	QP Margin (dB)
1.3108 MHz	31.17	0	0.046	10.1	41.316	56	-14.684
1.662 MHz	31.02	0	0.06	10.1	41.18	56	-14.82
2.204 MHz	29.42	0	0.06	10.1	39.58	56	-16.42
2.5767 MHz	27.33	0	0.07	10.1	37.5	56	-18.5
4.9896 MHz	32.47	0	0.1	10.2	42.77	56	-13.23
4.989 MHz	32.27	0	0.1	10.2	42.57	56	-13.43

15.109 Radiated Emissions

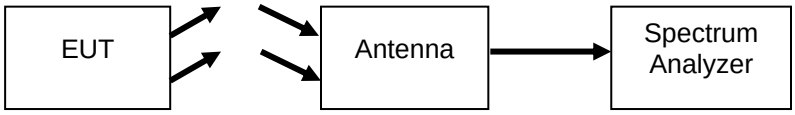
Engineer: Paul Hay

Test Date: 7/21/16

Test Procedure

The EUT was tested in a semi-anechoic chamber with the turntable set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360 degrees with the antennas in both the vertical and horizontal orientation while raised from 1 to 4 meters to ensure the signal levels were maximized. All emissions from 30 MHz to 1 GHz were examined.

Test Setup



Settings

RBW = 120 KHz

VBW = 300 KHz

Detector – Quasi Peak

Sample Calculations

Corrected Value = Measured Value + Correction factor

Correction factor = ACF + Cable loss

Radiated Emissions

Emission Frequency (MHz)	Measured Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Antenna Polarity (V/H)	Turntable Position (deg)	Detector (QP,PK,Avg)
95.9602	44.574	54	-9.43	251	H	38	QP
334.2333	49.915	56.9	-6.98	100	H	131	QP
335.8497	46.668	56.9	-10.23	100	H	351	QP
353.8996	46.914	56.9	-9.99	100	H	253	QP
511.1782	48.901	56.9	-8	181	H	248	QP
570.1621	51.131	56.9	-5.77	145	H	337	QP

Radiated Emissions Test Results
1 – 15 GHz

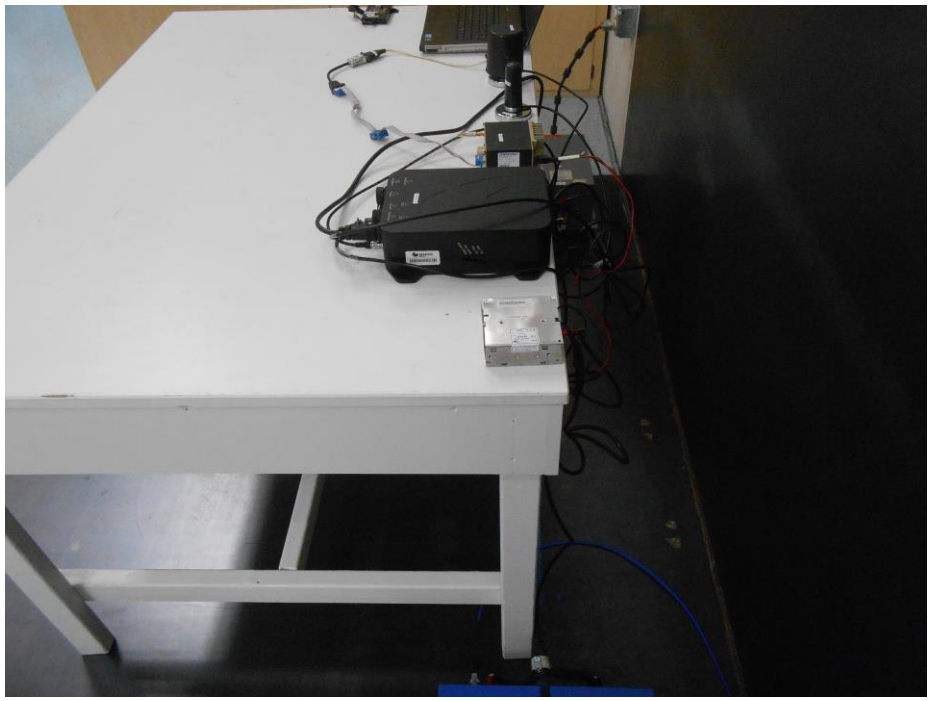
Frequency Range (GHz)	Emission Frequency (GHz)	Measured Level (dBuV/m)	Detector	Limit (dBuV/m)	Margin (dB)
1 – 15	14.405	51.04	Peak	54.0	-2.96

Note: For the Frequency ranges of 1 – 15 GHz, the correction factors for Antenna and cable were input to spectrum analyzer as reference level offsets before recording measurements. The Peak measurement of 51.04 dBuV/m is under the Average limit of 54.0 dBuV/m.

A/C Conducted Emissions Test Setup Photos

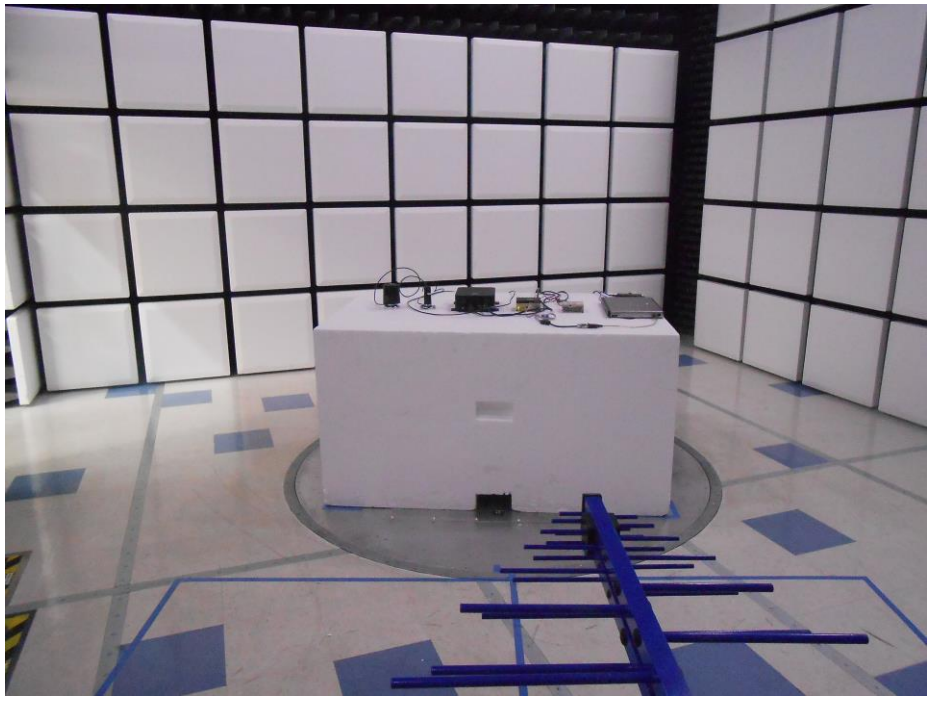
Front View

Side View



Radiated Emissions Test Setup Photos

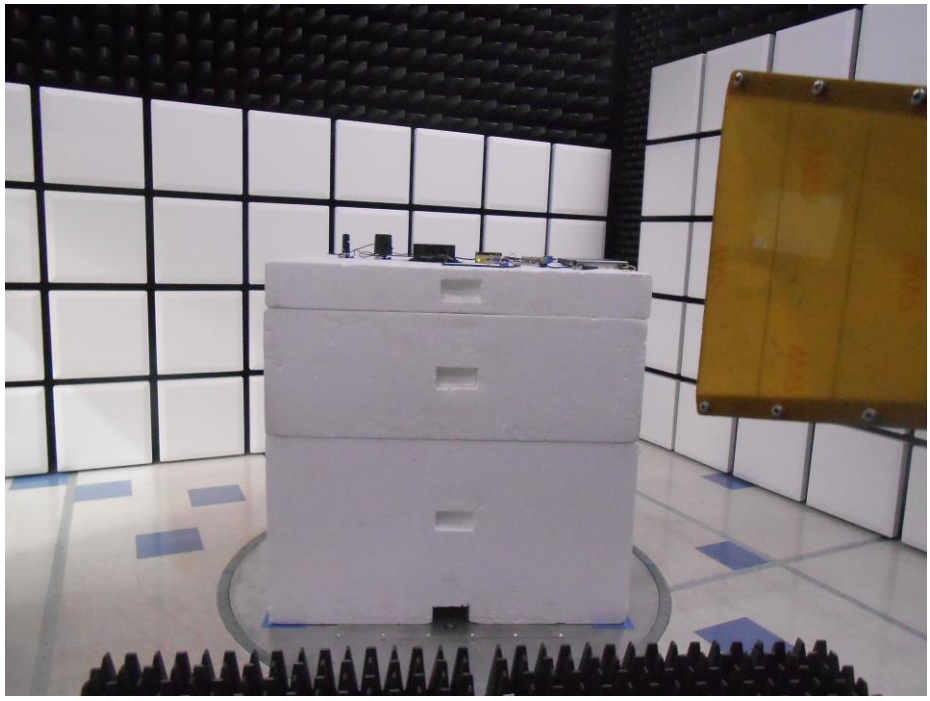
Front View



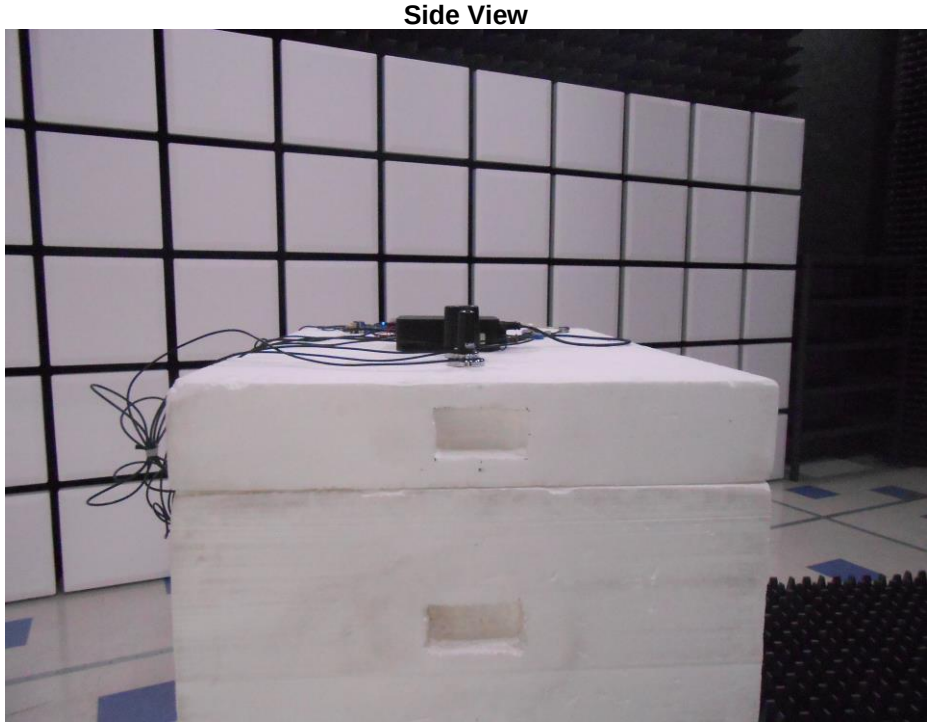
Side View

Radiated Emissions 1-15GHz Test Setup Photos

Front View



Side View



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
EMI Receiver	HP	8546A	i00033	3/29/16	3/29/17
Horn Antenna	EMCO	3115	i00103	1/20/15	1/20/17
Transient Limiter	Com-Power	LIT-153	i00123	Verified on: 7/20/16	
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	5/26/16	5/26/17
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/19/15	10/19/17
EMI Analyzer	Agilent	E7405A	i00379	2/11/16	2/11/17
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	7/27/14	7/27/16
LISN	COM-Power	LI-125A	i00446	4/29/16	4/29/18
LISN	COM-Power	LI-125A	i00448	4/29/16	4/29/18

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF TEST REPORT