



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

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Test Report

Prepared for: Devex Mining (a Hexagon Mining Co)

Model: AP360

Description: Intelligent Ethernet to Serial (RS-232) Converter to Underground Mines

Serial Number: 00001

To

FCC Part 15B
Class A

And

IC ICES-003 Issue 5 August 2012

Date of Issue: July 20, 2015

On the behalf of the applicant:

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Attention of:

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Paul Hay
Project Test Engineer

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All results contained herein relate only to the sample tested.

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	7/20/15	Paul Hay	Original Document

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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 10° to 40°C (50° to 104°F) and the relative humidity levels were in the range of 10% to 90%.

Environmental Conditions	
Temperature (°C)	Humidity (%)
25.3 – 25.4	47.0 – 48.7

EUT Description

Model: AP360

Description: Intelligent Ethernet to Serial (RS-232) Converter to Underground Mines

Serial Number: 00001

Additional Information:

The EUT was powered at 120VAC 60Hz.

EUT Operation during Tests:

The EUT was connected to a Dell laptop to monitor the RX and TX ports of the AP360. A DOS window with a "ping" command and "Putty" software were used to monitor the TX_PACKET and RX_PACKET transactions.



Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Laptop	Dell	Vostro 3500	H1FVVQ1
1	AC Adapter for Laptop	Dell	PA-2E Family	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	USB to RS-232 Cable	<1m	N	N	N/A
1	RS-232 TO DB9 Cable	<1m	N	N	N/A
1	Communication Cable with loopback	<1m	N	N	N/A
1	Power Cord	2m	N	N	N/A
1	Ethernet Cable	2m	N	N	N/A

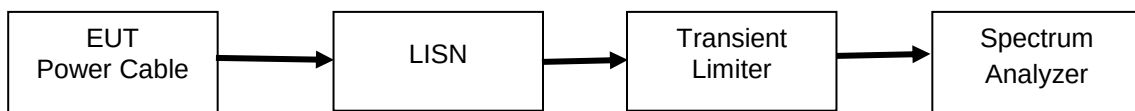
Modifications: None

Test Summary

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

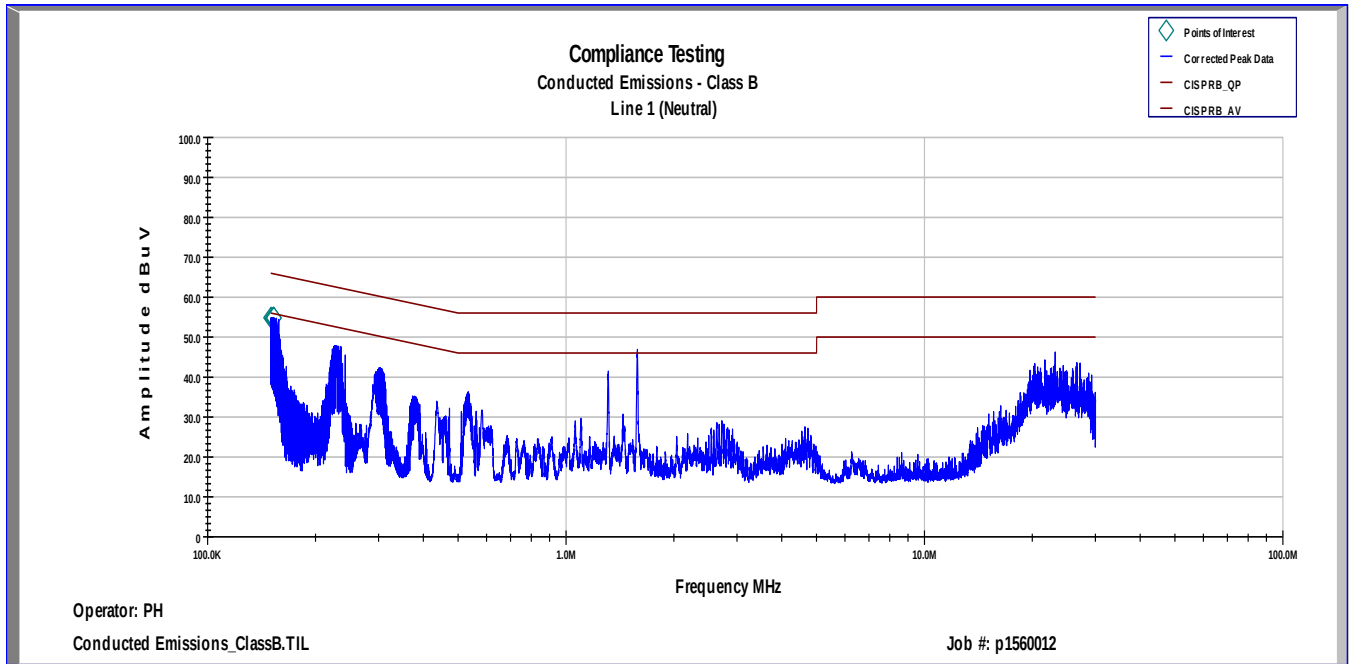
15.107 A/C Powerline Conducted Emissions**Engineer:** Paul Hay**Test Date:** 7/17/15**Test Procedure**

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.

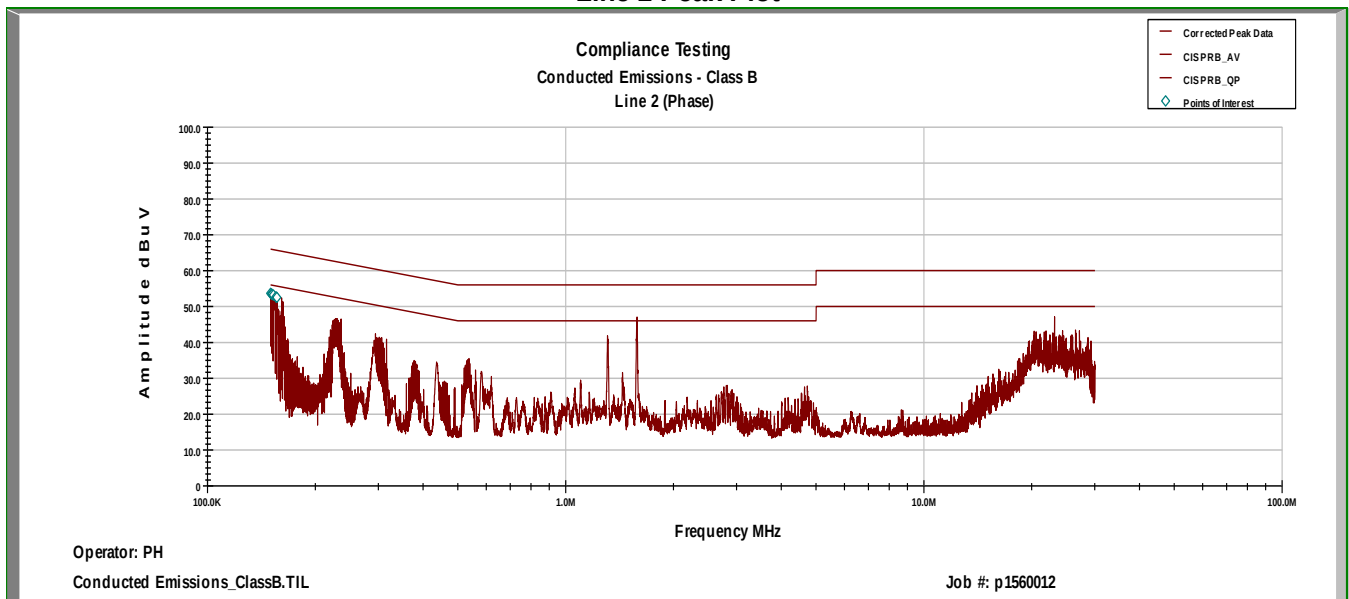
Test Setup

Conducted Emissions Test Results

Line 1 Peak Plot



Line 2 Peak Plot



The signals at 1.30 and 1.57 MHz are ambient test signals and not part of the EUT.



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)
153.52 KHz	26.86	0.26	0.02	10.2	37.345	55.899	-18.555
152.97 KHz	27.24	0.27	0.02	10.2	37.734	55.915	-18.182
152.59 KHz	27.35	0.27	0.02	10.2	37.847	55.926	-18.079
151.54 KHz	27.51	0.28	0.02	10.2	38.015	55.956	-17.941
151.05 KHz	27.51	0.29	0.02	10.2	38.019	55.97	-17.95
150.98 KHz	27.49	0.29	0.02	10.2	38	55.972	-17.972

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)
150.62 KHz	27.9	0.29	0.02	10.2	38.417	55.982	-17.565
150.4 KHz	28.13	0.3	0.02	10.2	38.649	55.989	-17.339
150.17 KHz	28.42	0.3	0.02	10.2	38.935	55.995	-17.06
150.07 KHz	28.6	0.3	0.02	10.2	39.119	55.998	-16.879
150.03 KHz	28.56	0.3	0.02	10.2	39.083	55.999	-16.916
150.01 KHz	28.64	0.3	0.02	10.2	39.16	56	-16.84

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)
153.52 KHz	42.8	0.265	0.02	10.2	53.285	65.899	-12.615
152.97 KHz	43.03	0.27	0.02	10.2	53.52	65.915	-12.395
152.59 KHz	43.11	0.274	0.02	10.2	53.604	65.926	-12.322
151.54 KHz	43.01	0.285	0.02	10.2	53.515	65.956	-12.441
151.05 KHz	42.8	0.289	0.02	10.2	53.309	65.97	-12.66
150.98 KHz	42.81	0.29	0.02	10.2	53.32	65.972	-12.652

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)
150.62 KHz	40.79	0.29	0.02	10.2	51.304	65.982	-14.679
150.4 KHz	40.63	0.3	0.02	10.2	51.146	65.989	-14.843
150.17 KHz	40.53	0.3	0.02	10.2	51.048	65.995	-14.947
150.07 KHz	40.49	0.3	0.02	10.2	51.009	65.998	-14.989
150.03 KHz	40.38	0.3	0.02	10.2	50.9	65.999	-15.1
150.01 KHz	40.38	0.3	0.02	10.2	50.9	66	-15.1

15.109 Radiated Emissions

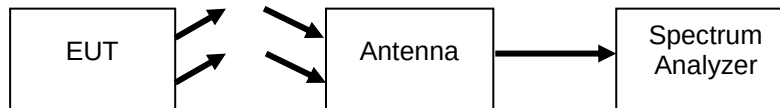
Engineer: Paul Hay

Test Date: 7/20/15

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)
43.803	40.66	49.5	-8.84	100	V	0	QP
47.797	42.73	49.5	-6.77	100	V	0	QP
72.026	46.92	49.5	-2.58	100	V	230	QP
96.023	43.89	54	-10.11	100	V	0	QP
129.96	50.29	54	-3.71	190	H	219	QP
233.958	51.77	56.9	-5.13	100	H	0	QP

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
EMI Receiver	HP	8546A	i00033	2/26/15	2/26/16
Transient Limiter	Com-Power	LIT-153	i00123	Verified on:7/17/15	
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	4/1/15	4/1/16
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/8/13	10/8/15
AC Power Source	Behlman	BL 6000	i00362	Verified on:7/17/15	
EMI Analyzer	Agilent	E7405A	i00379	2/5/15	2/5/16
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	11/26/13	11/26/15
LISN	COM-Power	LI-125	i00446	7/25/14	7/25/15
LISN	COM-Power	LI-125A	i00447	7/25/14	7/25/15

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