EMC Engineering Test Report
Ingenium Project Number: JCEAQ1090

EMC Testing of:
API Healthcare Corporation 'Prox Badge Reader'

Prepared for:
API Healthcare Corporation
Attention: Mr. Gary Sutcliffe
1550 Innovation Way
Hartford, WI 53027
United States of America

Test Date(s):
June 17th through June 25th, 2009

In accordance with:
U.S. Code of Federal Regulation, Title 47, part 15
Subpart 209, Radiated Emission Limits, General Requirements.

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Contents

INTRODUCTION **7**

1.1 SCOPE **7**

1.2.1 General Product Description *8*
1.2.2 Detailed Product Description *9*
1.2.3 Modes of operation *11*
1.2.4 EQUIPMENT UNDER TEST (EUT) INFORMATION *12*
1.2.5 EUT's Technical Specifications *13*
1.2.6 Associated Antenna Description *13*

1.3 APPLICABLE NORMATIVE DOCUMENTS **14**

1.4 DEFINED PERFORMANCE CRITERION **15**

1.5 APPLICABLE TEST MATRIX AND TEST RESULTS **16**

1.6 NOTES AND EXCEPTIONS TO REPORT **17**

1.7 DECLARATION OF CONFORMITY **18**

1.8 SIGNATORIES **19**

1.9 TEST FACILITY AND ACCREDITATIONS **21**

1.9.1 Ingenium Testing, LLC Accreditation *21*
1.9.2 Location of Test Facility *21*

TEST DETAILS **22**

2.1 ELECTROMAGNETIC EMISSION TESTS **22**

2.1.1 Radiated RF Emissions Measurements *22*
2.1.2 Conducted RF Emission onto AC Mains Measurements *42*
2.1.3 Conducted RF Performance Parameters – Occupied Bandwidth Measurements *53*
2.1.4 Radiated RF Performance Parameters – Band-Edge Measurements *57*
2.1.5 Conducted RF Performance Parameters – Conducted RF Power Output Measurements *61*
2.1.6 Conducted RF Performance Parameters – Power Spectral Density Measurements *61*
2.1.7 Conducted RF Performance Parameters – Spurious RF Emission Measurements *61*
2.1.8 Conducted RF Performance Parameters – Carrier Frequency and RF Power Stability Measurements (Voltage and Temperature Variation) *61*

3.1 ELECTROMAGNETIC SUSCEPTIBILITY TESTS **62**

APPENDIX A **64**

A INGENIUM TESTING, LLC APPLICABLE ACCREDITATIONS **64**

TABLE OF FIGURES

FIGURE 1: THE API HEALTHCARE HID PROX BADGE READER MODULE....8
FIGURE 2: THE API HEALTHCARE MODEL AP500 BADGE READER USED AS A HOST CONTROLLER DURING TESTING....9
FIGURE 3: INTER-RELATIONSHIPS BETWEEN THE EUT AND OTHER PERIPHERAL OR SYSTEM COMPONENTS....10
FIGURE 4: EUT TRANSMIT MODULE IN 'VERTICAL' ORIENTATION. 25
FIGURE 5: EUT TRANSMIT MODULE IN 'HORIZONTAL' ORIENTATION....25
FIGURE 6: EUT MODULE EMBEDDED INSIDE THE HOST KEYPAD AND CARD READER (OPENED FOR PHOTO)....26
FIGURE 7: EUT SHOWN ON PEDESTAL , INSIDE TEST CHAMBER....27
FIGURE 8: TRANSMIT RF EMISSION SIGNATURE, ANTENNA VERTICAL, 9 KHZ-150 KHZ, AT 3 M - MODULAR. 34
FIGURE 9: TRANSMIT RF EMISSION SIGNATURE, ANTENNA HORIZONTAL, 150 KHZ-30 MHZ, AT 3 M – MODULAR. 35
FIGURE 10: TRANSMIT RF EMISSION SIGNATURE, ANTENNA VERTICAL, 30 MHZ - 1 GHZ, AT 10 M - MODULAR. 36
FIGURE 11: TRANSMIT RF EMISSION SIGNATURE, ANTENNA HORIZONTAL, 30 MHZ - 1 GHZ, AT 10 M - MODULAR. 37
FIGURE 12: TRANSMIT RF EMISSION SIGNATURE, ANTENNA VERTICAL, 9 KHZ-150 KHZ, AT 3 M - EMBEDDED. 38
FIGURE 13: TRANSMIT RF EMISSION SIGNATURE, ANTENNA HORIZONTAL, 150 KHZ-30 MHZ, AT 3 M – EMBEDDED. 39
FIGURE 14: TRANSMIT RF EMISSION SIGNATURE, ANTENNA VERTICAL, 30 MHZ - 1 GHZ, AT 10 M - EMBEDDED. 40
FIGURE 15: TRANSMIT RF EMISSION SIGNATURE, ANTENNA HORIZONTAL, 30 MHZ - 1 GHZ, AT 10 M - EMBEDDED. 41
FIGURE 16: EUT SETUP DURING CONDUCTED RF EMISSIONS TESTING, WITH AC SUPPLY PROVIDING POWER-OVER-ETHERNET. 44
FIGURE 17: CLOSE UP VIEW OF CONDUCTED RF EMISSION TESTING, SHOWING EUT IN 'MODULAR TRANSMITTER' TEST SETUP....45
FIGURE 18: CLOSE UP VIEW OF CONDUCTED RF EMISSION TESTING, SHOWING THE REAR OF THE EUT, THE ETHERNET CABLE AND THE FERRITE CLAMP APPLICATION ACCORDING TO THE MANUFACTURER'S INSTRUCTION MANUAL. 45
FIGURE 19: CONDUCTED RF EMISSION SIGNATURE, L1, MODULAR. 50
FIGURE 20: CONDUCTED RF EMISSION SIGNATURE, L2, MODULAR 50
FIGURE 21: CONDUCTED RF EMISSION SIGNATURE, L1, EMBEDDED. 51
FIGURE 22: CONDUCTED RF EMISSION SIGNATURE, L2, EMBEDDED. 51
FIGURE 23: EUT TRANSMIT MODULE IN 'VERTICAL' ORIENTATION, DURING OCCUPIED BANDWIDTH TESTS. 54
FIGURE 24: OCCUPIED BANDWIDTH AT (-6DBC) LEVEL. 56
FIGURE 25: OCCUPIED BANDWIDTH AT (-20DBC) LEVEL. 56
FIGURE 26: EUT TRANSMIT MODULE IN 'VERTICAL' ORIENTATION, DURING BAND-EDGE TESTS. 58
FIGURE 27: EMISSION SIGNATURE AT THE LOWER BAND-EDGE (SHOWN WITH REDUCED BANDWIDTH FOR BETTER RESOLUTION)....59
FIGURE 28: EMISSION SIGNATURE SHOWING FUNDAMENTAL AND NO OTHER SPURIOUS EMISSIONS. 60

TABLE OF REVISION HISTORY

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Authorizing Agent:	Abtin Spantman

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Affected Section or Area:	Section 1.2.1
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Reason for change:	Added explanation of TTL communication between host and RFID module, to consist of only 'read' cycle requests. Excess requests are ignored by module.
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Introduction

1.1 Scope

Between June 17th and June 25th, 2009, a series of radiated and Mains-conducted RF Emissions (EMC) tests were performed on two identical samples of the API Healthcare "HID Prox Badge Reader", serial numbers "A141368" and "0703-349145", here forth collectively referred to as the "*Equipment Under Test*" or "*EUT*".

The radio frequency (RF) emission tests were performed are in accordance with 47 CFR, Part 15.209, released (2008-07-10) operating under Class C for an intentional radiator product, at a frequencies of 125.0 kHz, using the emission test procedures outlined in ANSI C63.4 (2003), with test instruments adhering to CISPR 16-2 guidelines. The tests were performed, with the EUT in pre-defined operating modes and performance criterion as defined in advance by API Healthcare Corporation, here forth referred to as the *"API Test Plan"*.

The tests were performed to allow verification, in part, of the product's EMI compliance in accordance with the EMC standards in the United States of America and abroad. This was accomplished by testing the units in two configurations. The units were tested, first, as modular transceivers, and second, embedded in a "TA500" type host. The tests were performed by Abtin Spantman, EMC Engineer at Ingenium Testing and witnessed by Mr. Gary Sutcliffe, Assistant Director of Engineering, representing API Healthcare Corporation.

1.2.1 General Product Description

The API Healthcare HID Prox Badge Reader is an RFID product operating at fixed center frequency of 125.0 kHz. The Badge Reader is a modular product that may be added to a host 'entry point console'. The Badge Reader will only be installed in products under the control of API Healthcare Corporation.

Figure 1: The API healthcare HID Prox Badge Reader Module

The HID Prox Badge Reader will be available for use exclusively in API access point control applications. The HID Prox Badge Reader is designed to be installed in different API Hosts, with the host capable of accepting different 'Reader' accessories such as magnetic stripe readers and bar-code readers. The accessory 'HID Prox Badge Reader' is the subject of this test report. The HID Prox Badge Reader is not self-sufficient and can not operate without the use of an API Host unit. The Badge Reader receives regulated power and commands from the Host unit, and sends communication back to the Host unit. **The HID Prox Badge Reader unit is defined as the Equipment Under Test or 'EUT', but is tested in conjunction with the API Access Point Host.**

The HID Prox Badge Reader receives regulated power from the host unit. Transmissions are controlled by the Prox's internal processor. The API Host only receives data that the Prox module reads from the badge. Communication from the Prox module to the API Host is one-way. Prox Badges have a number hardwired into them during the manufacturing process. When a badge is put into the RF field of the Prox Badge Reader, the number is read by the Reader. The number is then transferred to the Host by a two wire clock and data scheme using TTL level (5V) signals.

The application of the HID Prox Badge Reader is limited to API host units, and as such, is not threatened by uncontrolled installations. ***API Healthcare would have control over the installation and use of the HID Prox Badge Reader module in all cases.***

1.2.2 Detailed Product Description

The HID Prox Badge Reader (also referred to as the proximity reader) has a Multi-Turn Loop type antenna installed on-board the module. The antenna is not accessible or modifiable by the user. This particular HID Prox Badge Reader is being qualified with a 140mm X 40mm loop antenna.

Transmissions are controlled by the Prox' s internal processor. The API Host only receives data that the Prox module reads from the badge. The module uses two wire (Clock and data signal) TTL level serial communication from the module to the Host, through a four-pin standard 0.1 inch SIP header. This header also provides the +5VDC regulated power needed to operate the module.

The RF characteristics of the module are controlled by a proprietary RF sub-module PCB. The TTL level communication between the host and the module consists of simple request for data in form of a 'read' cycle. This request is processed by the circuitry on the module, which is in complete control of the RF characteristics. The module will ignore excess 'read' cycle requests during it's operation.

Table 1: Table of Interfaces to/from the HID Prox Badge Reader Module

Num.	Description	Type
J8-4	CLK	TTL – Unbalanced
J8-5	TX-Data	TTL - Unbalanced
J8-1	+5VDC Regulated Power Input Line	DC
J8-2	Ground Reference and Return line for the DC power.	Ground (DC)

The HID Prox Badge Reader would be a 'reader option' that gets installed on a host. The TA500 host reader was chosen as a host during this series of tests.

Figure 2: The API Healthcare model AP500 Badge Reader used as a host controller during testing.

The TA500 was chosen as a host because it has many of the features that would be incorporated in a typical host reader. The TA500 has an LCD display window, LED indicators, input/output relays, the capability to use a key-pad, an optical bar-code reader, a magnetic card reader, as well as a

proximity reader (the module we are testing). ***The host used in testing was configured with the LCD, LEDs, Keypad, and a magnetic card reader, considered as the configuration that may have the most interaction with the proximity reader module under test.***

The TA500 host may be powered by a linear step-down wall-transformer, or by a switch-mode AC-to-DC supply that provides Power-over-Ethernet (POE) to the system, as shown below.

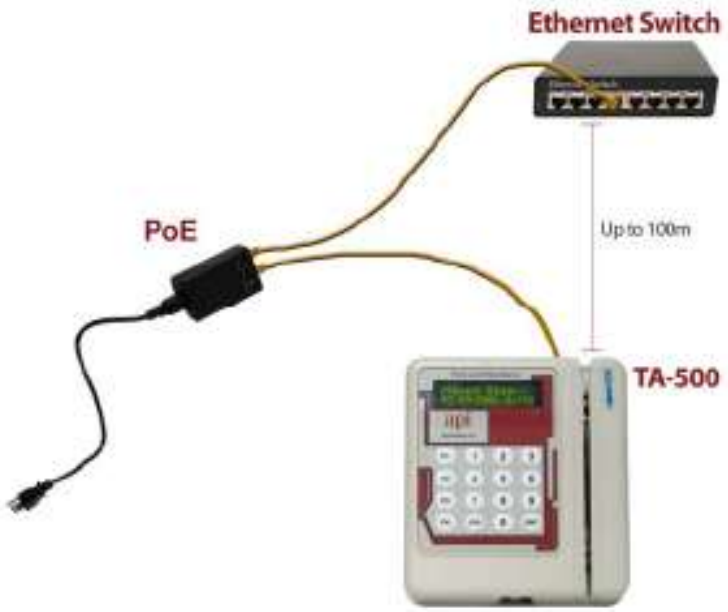

Figure 3: Inter-relationships between the EUT and other Peripheral or System components

The switch-mode supply with POE was considered to be the worst case test situation. This system is installed with a clamp-on ferrite suppressor as defined in the TA500 installation manual, pages 14 through 18. ***The TA500 host was powered by a switch-mode AC-to-DC supply that provides Power-over-Ethernet (POE) to the system, during this series of testing. The TA500 host unit was tested to CLASS B limits for residential and light industrial applications.***

1.2.3 Modes of operation

Testing was performed in worst-case conditions. The TA500 host used in testing was configured with the LCD, LEDs, Keypad, and a magnetic card reader, considered as the configuration that may have the most interaction with the proximity reader module under test. The TA500 host was powered by a switch-mode AC-to-DC supply that provides Power-over-Ethernet (POE) to the system, during this series of testing.

1.2.3.1 Mode of operation during RF Emission testing

For RF emission testing, the EUT was set in its standard configuration where the Prox module operates in its mode to continuously look for a badge to enter its field. The API Host monitors for any data sent by the Prox module.

The module is to be tested as a stand-alone (with 10 cm tether cable), and as installed in a host unit. In both cases, the EUT shall be connected to the AC source capable of providing 'Power-Over-Ethernet' (POE), and the Ethernet port should be connected to a live network or hub.

1.2.3.2 Mode of operation during Susceptibility testing

For Voltage and Temperature variation testing, the EUT was functioning with the Prox module operating in its normal, factory set mode. In this mode, the module automatically, and continuously searches for a badge in its RF field. In this mode, the API Host monitors the lines for data from the Indala module.
The frequency of operation and relative output power level were monitored during the tests for excursions. The module is to be tested as a stand-alone (with 10 cm tether cable), and as installed in a host unit.

1.2.4 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Table 2: Equipment Under Test (EUT) Product Information

Product Name:	HID Prox Badge Reader
Model Number:	HID Prox Badge Reader
Serial Number:	A141368 used as stand-alone with 10cm tether cable. 0703-349145 used as installed in host unit.

Table 3: Support Equipment Product Information

Product Name:	Access Point Host (Used in the embedded testing): With a magnetic stripe card reader.
Model Number:	TA500
Serial Number:	A141245

Product Name:	Access Point Host (Used in the modular testing): With a magnetic stripe card reader.
Model Number:	TA500
Serial Number:	A141615

Product Name:	I.T.E. Power Supply (for POE testing)
Model Number:	PW130, rev B.
Serial Number:	N/A

Product Name:	10/100 Ethernet Switch
Model Number:	SD208, V1.1
Serial Number:	RE-G10G293170

1.2.5 EUT's Technical Specifications

Additional Information:

Table 4: Equipment Under Test (EUT) Technical Specifications

Frequency Range (in MHz)	125.0 kHz
RF Power (W)	0.04677 mW (Equivalent ERP)
Field Strength (and at what distance)	81.9 dBµV/m at 3m
Occupied Bandwidth (99% BW)	887 Hz
Type of Modulation	AM-OOK
Emission Designator	A1D
Transmitter Spurious (worst case)	65.1 dBµV/m at 3m, 150 kHz
Frequency Tolerance %, Hz, ppm	50 ppm (700Hz)
Microprocessor Model # (if applicable)	N/A
EUT will be operated under FCC Rule Part(s)	47CFR15.209
Modular Filing	☒ Yes ☐ No
Power Requirements	Host: 100-240 VAC, 47-63 Hz, 1.0A Module: +5VDC, 200mA
Environmental Operating conditions	Host: (0 to 40 °C) 20 – 80 % RH, Indoor,Non-condensing

1.2.6 Associated Antenna Description

The antenna is a proprietary design PCB-trace 'Loop' type antenna.
The antenna is permanently installed on the module and is not accessible to the user.
The antenna is not outfitted with a connector.
The rectangular antenna dimensions are approximately 140mm X 40mm.

1.3 Applicable Normative Documents

Table 5: Regulatory documents

Publication	Year	Title
47 CFR, Parts 0-15 (FCC)	Released on: 2008-07-10	United States of America Code of Federal Regulations Title 47 - Telecommunications
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval
ICES-003	Issue 4 (2004-02)	Industry Canada Spectrum Management and Telecommunications Interference Causing Equipment Standard Digital Apparatus
RSS-210	Issue 7 (2007-06)	Industry Canada Spectrum Management and Telecommunications Radio Standard Specification. Low-power License-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 16-1-1	Edition 2.1 (2006-11)	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.
CISPR 16-1-2	Edition 1.2 (2006-08)	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Ancillary equipment – conducted disturbances..
CISPR 16-2-1	Edition 1.1 (2005-09)	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement.
CISPR 16-2-2	Edition 1.2 (2005-09)	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-2: Measurement of disturbance power.
CISPR 16-2-3	Second Edition (2006-07)	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-3: Methods of Measurement of disturbance and immunity – Radiated disturbance measurements

Table 6: Non-Regulatory controlled documents from API Healthcare or Ingenium Testing.

Document	Owner	Title
DSI Version 2	API Healthcare Corporation	TA-500 Badge Reader Installation and Configuration Guide
JCEAQ1090	Ingenium Testing	Statement of Work

1.4 Defined Performance Criterion

Manufacturer and Device-Specific Operational Definitions and Performance Criterion:

In normal operational mode, the "EUT" shall operate per manufacturer specifications.
In specific programmed test mode, the "EUT" shall operate continuously, transmitting as fast as possible, within the speed boundaries of the on-board microprocessor and support system.

Performance Criterion A:
N/A

Performance Criterion B:
N/A

Performance Criterion C:
N/A

1.5 Applicable Test Matrix and Test Results

The following matrix defines the scope of testing as covered by this report, and agreed to between API Healthcare Corporation (Client) and Ingenium Testing, LLC.

This series of testing is performed to verify that the electromagnetic performance of the HID Prox Badge Reader Module, as used in conjunction with the TA500 host device / controller, adheres to the expected performance stated in the aforementioned standards. These tests verified that the transmitter characteristics meet the specific limits dictated by 47CFR 15.209, and that the receiver characteristics meet the specific limits dictated by 47CFR 15.109. The following matrix describes the test regiment.

Table 7: Test Matrix and Test Results

Port Definition	Description/ Detail	Basic Standard	Performance Criteria	Pass / Fail
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions 47 CFR 15.209	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits	Pass
	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions Occupied Bandwidth 47 CFR 15.209	9kHz-1.0 GHz RF Energy from the Fundamental transmission should be contained within the allowed frequency band of operation.	Pass
	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions Band-Edge 47 CFR 15.205	9kHz-1.0 GHz RF Energy from the Fundamental transmission should not fall within the restricted band of operation.	Pass
	HID Prox Module installed on-board TA-500 Host ***Transmit Mode***	Radiated RF Emissions 47 CFR 15.209	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits	Pass
AC Power	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Conducted RF Emissions 47 CFR 15.207	150kHz-30 MHz Measured RF Emission should be Below specified Limits	Pass
	HID Prox Module installed on-board TA-500 Host ***Transmit Mode***	Conducted RF Emissions 47 CFR 15.207	150kHz-30 MHz Measured RF Emission should be Below specified Limits	Pass
Enclosure	HID Prox Module Modular with 10cm tether cable	Radiated RF Emissions 47 CFR 15.109	9kHz-1.0 GHz Measured RF Emission should be Below specified	Pass

	To TA-500 Host ***Receive Mode***		Limits	
	HID Prox Module installed on-board TA-500 Host ***Receive Mode***	Radiated RF Emissions 47 CFR 15.109	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits	Pass
AC Power	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Receive Mode***	Conducted RF Emissions 47 CFR 15.107	150kHz-30 MHz Measured RF Emission should be Below specified Limits	Pass
	HID Prox Module installed on-board TA-500 Host ***Receive Mode***	Conducted RF Emissions 47 CFR 15.107	150kHz-30 MHz Measured RF Emission should be Below specified Limits	Pass

Notes:

1.6 Notes and Exceptions to Report

None.

1.7 Declaration of Conformity

DECLARATION OF CONFORMITY

The API Healthcare Corporation model "HID Prox Badge Reader" was found to ***MEET*** *the emission and performance requirements as described within the specifications of Title 47, Part 15, of the Code of Federal Regulations for the United States of America.*

The API Healthcare Corporation model "HID Prox Badge Reader" unit meets the requirements of 47 CFR 15.209, subpart C, for an intentional radiator product in transmit mode, and meets the requirements of 47 CFR 15.109, subpart B, for an un-intentional radiator in receive mode, as well as the Industry Canada requirements specified within ICES-003 for a digital device.. The conformity statement is limited in scope to the testing that was commissioned and administered and covered in this report.

If some emissions are seen to be within 3 dB of their respective limits:
As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

Ingenium Testing, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

1.8 Signatories

The test matrix presented in section 1.5 of this report was generated, in agreement, by the cognizant parties representing the client as the manufacturer of the equipment, and by the cognizant parties at Ingenium Testing. The performance of the tests and reporting of the results are accurate to the best of our collective knowledge as presented within the body of this report.

The testing of this product was approved by the cognizant parties representing the manufacturer:

Mr. Gary Sutcliffe **Assistant Director of Engineering**	**Date**

Manufacturer Name:	**API Healthcare Corporation** 1550 innovation Way Hartford, WI 53027 United States of America
Contact Person: (Administrative)	Ms. Gail Rohde Contract Administrative Representative 1550 innovation Way Hartford, WI 53027 Ph: +1 262 670 2869 Fx: +1 262 673 2650 EM: Gail.Rohde@APIHealthcare.com
Contact Person: (Technical)	Mr. Gary Sutcliffe Assistant Director of Engineering 1550 innovation Way Hartford, WI 53027 Ph: +1 262 670 2789 Fx: +1 262 673 2650 EM: Gary.Sutcliffe@APIHealthcare.com

This Test Report is issued under the Authority of:

Michael M. Miller	**Date**
Laboratory Manager, Ingenium Testing, LLC	

The testing was performed by:

Abtin Spantman	22 August, 2009 **Date**
RF/EMC Engineer, Ingenium Testing, LLC	

1.9 Test Facility and Accreditations

1.9.1 Ingenium Testing, LLC Accreditation

Ingenium Testing, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 “General Requirements for the Competence of Calibration and Testing Laboratories”.

Ingenium Testing, LLC’s scope of accreditation includes all test methods listed herein, unless otherwise noted. A copy of the accreditation may be accessed on our web site: www.IngeniumTesting.com. Accreditation status can be verified at A2LA’s web site: www.a2la2.net.

1.9.2 Location of Test Facility

All testing was performed at Ingenium Testing, LLC, 3761 South Central Avenue, Rockford, Illinois, 61102-4292, United States of America, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at Ingenium Testing, LLC:

- 10-meter Semi-Anechoic Chamber, designated Chamber number 6.
- RF Shielded room, designated Chamber 12.

Test Details

2.1 Electromagnetic Emission Tests

2.1.1 Radiated RF Emissions Measurements

2.1.1.1 Test Criterion

The following ports should be tested for compliance according to the test matrix:

Port Definition	Description/ Detail	Basic Standard	Performance Criteria
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions 47 CFR 15.209	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits
	HID Prox Module installed on-board TA-500 Host ***Transmit Mode***	Radiated RF Emissions 47 CFR 15.209	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Receive Mode***	Radiated RF Emissions 47 CFR 15.109	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits
	HID Prox Module installed on-board TA-500 Host ***Receive Mode***	Radiated RF Emissions 47 CFR 15.109	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits

The stated test conditions and expected performance levels are stated below:
The EUT functions as a transceiver. The testing of this device will be divided into transmitter testing and a receiver testing.

Transmitter test limits:

The following tables present the limits for intentional radiated RF emissions, at the fundamental frequency, as specified in Title 47 CFR, Section 15.209, sub-sections (a) through (f). These limits also include elements of 47 CFR, Section 15.205 for limits within restricted bands of operation. In the frequency range between 9kHz and 30 MHz, the limits are mathematically adjusted by an extrapolation factor of 40 dB/decade, as described in the procedures in 47 CFR, Section 15.31(f)(2).

Table 8: Field Strength Limit for Intentional Radiators under 47CFR 15.209.

Frequency (MHz)	15.209 Field Strength Limit (μV/m)	Field Strength Limit (dBμV/m at 3m)	Field Strength Limit (dBμV/m at 10m)
0.009 – 0.490	2400/F (kHz) @ 300m	N/A	N/A
0.490 – 1.705	24000/F (kHz) @ 30m	N/A	N/A
1.705 – 30.0	30 μV/m @ 30m	69.54	48.63
30.0 – 88.0	100 μV/m @ 3 m	40.00	29.54
88.0 – 216.0	150 μV/m @ 3 m	43.52	33.06
216.0 – 960.0	200 μV/m @ 3 m	46.02	35.56
Above 960.0	500 μV/m @ 3 m	54.00	43.52

Notes: In the calculations for margin below the limit, the limits are rounded to one digit past the decimal.

Table 9: Field Strength Limit for the fundamental and harmonics on a 125 kHz transmitter.

Frequency (kHz)	15.209 Field Strength Limit (μV/m)	Field Strength Limit (dBμV/m at 3m)	Field Strength Limit (dBμV/m at 10m)
125	2400/F (kHz) @ 300m	105.67	84.75
250	2400/F (kHz) @ 300m	99.65	78.73
375	2400/F (kHz) @ 300m	96.12	75.21
500	24000/F (kHz) @ 30m	73.62	52.71
625	24000/F (kHz) @ 30m	71.69	50.77
750	24000/F (kHz) @ 30m	70.10	49.19
875	24000/F (kHz) @ 30m	68.76	47.85
1000	24000/F (kHz) @ 30m	67.60	46.69
1125	24000/F (kHz) @ 30m	66.58	45.67
1250	24000/F (kHz) @ 30m	65.67	44.75

Notes: In the calculations for margin below the limit, the limits are rounded to one digit past the decimal.

Receiver test limits:

The following table presents the limits for unintentional radiated RF emissions as specified in Title 47 CFR, Part 15.109, section (a), for products qualifying as Class B Digital Devices. These limits were also applied to any signals found in the restricted frequency bands as defined in 47 CFR, Part 15.205.

Table 10: Field Strength Limits for Un-intentional Radiators under 47CFR 15.109, Class B Digital Devices.

Frequency (MHz)	Field Strength Limit at 3m (µV/m)	Field Strength Limit at 3m (dBµV/m)	Field Strength Limit at 10m (dBµV/m)
30 – 88	100.0	40.0	29.5
88 - 216	150.0	43.5	33.0
216 – 960	200.0	46.0	35.5
Above 960	500.0	54.0	43.5

Notes: In the calculations for margin below the limit, the limits are rounded to one digit past the decimal.

2.1.1.2 Test Equipment

All equipment is calibrated according to governing standards, and is N.I.S.T. traceable. The equipment is used according to the operation manuals as provided by the manufacturers.

List of Equipment Used:

Manufacturer	Model	Ingenium Asset Number	Description	Last Cal data	Cal due date
Agilent	E4440A	1207	PSA Spec. Analyzer	18 Dec 2008	18 Dec 2009
Agilent	N9039A	1206	Pre-Selector	23 Dec 2008	23 Dec 2009
Agilent	N5182	1208	RF Generator	18 Dec 2008	18 Dec 2009
HP	8447	RP-0054	Pre-Amplifier	13 Mar 2009	13 Sep 2009
ETS	3142C	1360	Hybrid Antenna	17 Mar 2008	17 Mar 2010
ETS	6507	1315	Active Loop Antenna	26 Jan 2009	20 Feb 2010

The data presented accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected measurement result.

2.1.1.3 Test Setup

The EUT was considered as a "mobile" type modular transmitter, and tested as a "table-top" unit as described in ANSI C63.4. The EUT module was tested in two setup variants: separated from the host for modular testing, and embedded into the host as in normal operation. For the modular tests, the EUT module was separated from the host using a 10 cm harness cable and located as far from the host as the cable allowed. The EUT was tested in vertical and horizontal orientations as shown in the photos below. For the embedded tests, the module would normally be positioned in a horizontal orientation within the host. In both cases, the EUT was placed on a non-conductive table, centered on a flush-mounted 3 meter-diameter turntable in the 10 Meter FCC Listed Semi-Anechoic Chamber located at Ingenium Testing. The test setup complies with the necessary procedures as described in the ANSI standard. The EUT was powered over the Ethernet cable, and exercised as fast as possible under standard operating conditions as described in section 1.2.3.1 of this report. The host was powered by 120VAC/60Hz Mains.

Test Setup Photos

Figure 4: EUT transmit module in 'Vertical' orientation.

Figure 5: EUT transmit module in 'Horizontal' orientation.

Side Orientation

Side orientation where the module would be co-planar with the ground plane would not be used in any installations by API Healthcare, and hence is not tested

.

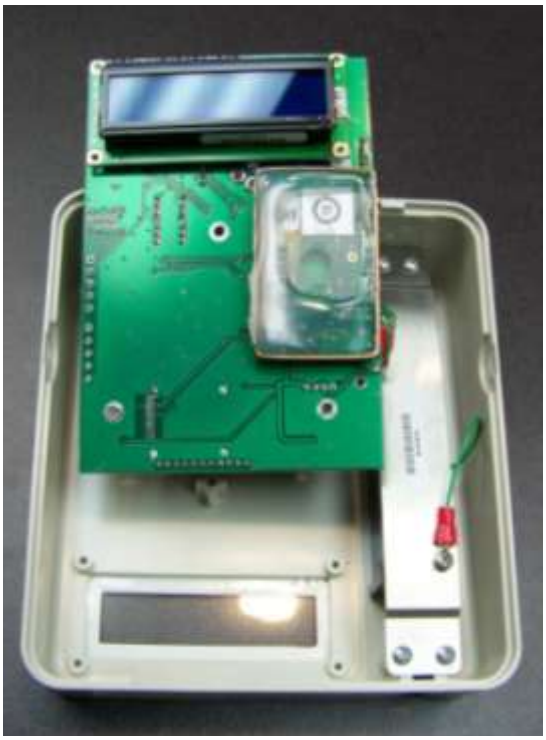

Figure 6: EUT module embedded inside the host keypad and card reader (opened for photo).

Figure 7: EUT shown on pedestal , inside test chamber.

2.1.1.4 Test Procedure

The EUT was measured for Radiated RF Emissions in the 10 Meter FCC Listed Semi-Anechoic Chamber located at Ingenium Testing. The frequency range from 9 kHz to 1000 MHz was investigated for RF emissions, and emission levels were noted along with the fixed degree settings of azimuth on the turntable and sense antenna height. The EUT was placed on a non-conductive pedestal (table), centered on a turn-table with a conductive rotating surface, flush and in contact with the conductive ground plane. The antenna mast was placed such that the antenna was separated by 10 meters from the test object for general emissions. Transmitter emissions measurements at the fundamental frequency and harmonics were measured at 3 meters separation distances. An Active Loop antenna was used to measure emissions from 9 kHz to 30 MHz, and a Hybrid Biconni-Log Antenna was used to measure emissions from 30 MHz to 1000 MHz. The maximum radiated emissions were found by raising and lowering the antenna between 1 and 4 meters in height (30 MHz to 1 GHz Range only), and by rotating the Loop antenna about its vertical axis (360 degrees) and horizontal axis (45 degrees), at a height of 1 meter above the ground reference plane, while utilizing the turn-table to rotate the product. The process was repeated using both horizontal and vertical antenna polarizations. The maximum emission levels were then recorded along with the attitude of the product. The test was then repeated two more times with the module installed within the host units.

The receiver was operated with the IF resolution bandwidth (RBW) of 200 Hz for measurements between the frequencies of 9 kHz and 150 kHz (video bandwidth of 2 kHz), 9 kHz for measurements between the frequencies of 150 kHz and 30 MHz (video bandwidth of 30 kHz), and a resolution bandwidth of 120 kHz for measurements between 30 MHz and 1 GHz (video bandwidth of 300 kHz).

With the EUT at the attitude of highest measured emissions, the AC Mains supply was varied between 102 VAC (85 % of V_{NOM}) and 138 VAC (115 % of V_{NOM}) and the power output and frequency were monitored.

The EUT was set-up and operated, by the client cognizant engineer, in the proper mode as defined in section 1.2.3.1 for emission testing.

The applicable general emission limits, as noted in 47 CFR Part 15.209 were applied for transmitter testing. The applicable limits, as noted in 47 CFR Part 15.109 limits, for a CLASS B type product were applied for receiver testing. The applicable limits, as noted in 47 CFR Part 15.109 limits, for a CLASS B type product were applied for general emissions testing with the AT 500 host unit.

By virtue of how this RFID system operates, with the unit active in normal operation, the characteristics of the transmitter and receiver may be measured at the same time. The test results and graphs reflect this concept on broad-band sweeps.

2.1.1.5 Test Results

The EUT was found to **MEET** the requirements as described within the specifications of the FCC, Title 47 CFR, Part 15.209, for products qualifying as intentional radiators, as well as meeting the requirements set forth by 47 CFR, Section 15.205. The EUT was found to **MEET** the requirements as described within the specifications of the FCC, Title 47 CFR, Part 15.109 for radiated emissions from a Class B product, as well as the Industry Canada requirements specified within ICES-003 for a Class B digital device. Supporting evidence of significant measured RF emissions, are tabulated and presented below.

Port Definition	Description/ Detail	Basic Standard	Performance Criteria	Pass / Fail
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions 47 CFR 15.209	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits	Pass
	HID Prox Module installed on-board TA-500 Host ***Transmit Mode***	Radiated RF Emissions 47 CFR 15.209	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits	Pass
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Receive Mode***	Radiated RF Emissions 47 CFR 15.109	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits	Pass
	HID Prox Module installed on-board TA-500 Host ***Receive Mode***	Radiated RF Emissions 47 CFR 15.109	9kHz-1.0 GHz Measured RF Emission should be Below specified Limits	Pass

The EUT was not affected in performance by the variation in AC Mains voltage. The emission level and frequency of the EUT did not change beyond the resolution of the instrument.

CLIMATE TEST CONDITIONS

Temperature:	75 °F (24 °C)
Humidity:	48 % RH

Table 11: Embedded configuration: Level of significant spurious radiated RF emissions measured in Transmit and Receive mode in normal operation.

Mode (Tx / Rx)	Frequency (MHz)	Ant. Polariz.	Ant. Height (cm)	Table Azimuth (0°-360°)	Measured Distance (m)	Measured EFI Peak (dBµV/m)	Measured EFI Quasi-Peak (dBµV/m)	Measured EFI Average (dBµV/m)	15.109 Limit (dBµV/m)	Margin (dB)
Tx & Rx	0.015	V	100	330	3	69.2	65.1	60.8 (Note 4)	124.1 (Note 2)	63.3
Tx & Rx	0.100	V	100	205	3	53.9	49.9 (Note 4)	45.5	107.6	57.7
Tx & Rx	0.145	V	100	40	3	53.1	45.8	42.4 (Note 4)	104.4 (Note 2)	62.0
Tx & Rx	45.76	V	100	165	3		24.1		29.5	5.4
Tx & Rx	53.52	V	100	340	3		22.2		29.5	7.3
Tx & Rx	60.19	V	100	225	10		21.9		29.5	7.6
Tx & Rx	64.79	V	100	265	10		20.9		29.5	8.6
Tx & Rx	91.59	V	100	80	10		24.2		33.0	8.8
Tx & Rx	98.51	V	100	145	10		24.4		33.0	8.6
Tx & Rx	101.90	V	100	260	10		25.5		33.0	7.5
Tx & Rx	143.25	V	100	50	10		25.5		33.0	7.5
Tx & Rx	145.31	V	100	300	10		23.6		33.0	9.4
Tx & Rx	148.10	V	100	325	10		28.5		33.0	4.5
Tx & Rx	175.50	V	100	90	10		23.7		33.0	9.3
Tx & Rx	913.79	V	100	15	10		21.1		35.5	14.4
Tx & Rx	387.08	V	100	240	10		21.2		35.5	14.3

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. Measurements using the Average detector are published in the table above for frequencies above 1 GHz. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements below 30 MHz were made using a Quasi-Peak detector function, except for the frequency ranges **between 9-90 kHz and 110-490 kHz, where an Average detector function was utilized** in the measurements.
3) Measurements above 1 GHz were made at 1 meters of separation from the EUT.
4) Measurement at receiver system noise floor, and better than 20 dB below limits.

Table 12: Modular configuration: Level of significant spurious radiated RF emissions measured in Transmit and Receive mode in normal operation.

Mode (Tx / Rx)	Frequency (MHz)	Ant. Polariz.	Ant. Height (cm)	Table Azimuth (0°-360°)	Measured Distance (m)	Measured EFI Peak (dBµV/m)	Measured EFI Quasi-Peak (dBµV/m)	Measured EFI Average (dBµV/m)	15.109 Limit (dBµV/m)	Margin (dB)
Tx & Rx	0.015	V	100	140	3	72.0	65.0	61.4 (Note 4)	124.1 (Note 2)	62.7
Tx & Rx	0.100	V	100	180	3	53.9	49.4 (Note 4)	45.1	107.6	58.2
Tx & Rx	0.145	V	100	230	3	49.7	46.0	42.9 (Note 4)	104.4 (Note 2)	61.5
Tx & Rx	45.763	V	100	255	10		24.7		29.5	4.8
Tx & Rx	101.900	V	100	310	10		26.7		33.0	6.3
Tx & Rx	143.250	V	100	20	10		27.0		33.0	6.0
Tx & Rx	148.100	V	100	10	10		26.7		33.0	6.3
Tx & Rx	151.610	V	100	255	10		26.1		33.0	6.9
Tx & Rx	223.270	V	100	245	10		28.7		35.5	6.8
Tx & Rx	303.060	V	100	195	10		29.1		35.5	6.4
Tx & Rx	334.940	V	100	5	10		29.4		35.5	6.1
Tx & Rx	366.830	V	100	30	10		28.7		35.5	6.8
Tx & Rx	387.080	V	100	270	10		22.4		35.5	13.1
Tx & Rx	398.720	V	100	5	10		27.0		35.5	8.5
Tx & Rx	940.350	V	100	230	10		25.6		35.5	9.9
Tx & Rx	175.500	H	100	160	10		16.4		33.0	16.6
Tx & Rx	207.268	H	100	5	10		16.5		33.0	16.5
Tx & Rx	223.273	H	100	5	10		21.4		35.5	14.1
Tx & Rx	287.171	H	100	340	10		22.9		35.5	12.6
Tx & Rx	303.055	H	100	165	10		24.4		35.5	11.1
Tx & Rx	318.939	H	100	10	10		21.9		35.5	13.6
Tx & Rx	334.944	H	100	165	10		27.0		35.5	8.5
Tx & Rx	366.833	H	100	310	10		25.2		35.5	10.3
Tx & Rx	387.081	H	100	250	10		24.0		35.5	11.5
Tx & Rx	919.854	H	100	335	10		25.8		35.5	9.8

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. Measurements using the Average detector are published in the table above for frequencies above 1 GHz. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements below 30 MHz were made using a Quasi-Peak detector function, except for the frequency ranges **between 9-90 kHz and 110-490 kHz, where an Average detector function was utilized** in the measurements.
3) Measurements above 1 GHz were made at 1 meters of separation from the EUT.
4) Measurement at receiver system noise floor, and better than 20 dB below limits.

Table 13: Embedded configuration: Level of significant radiated RF emissions measured in transmit fundamental and harmonic frequencies.

Host Mode	Frequency (MHz)	Ant./EUT Polarization	Ant. Height (cm)	Table Azimuth (0°-360°)	Measured Distance (m)	Measured EFI Peak (dBµV/m)	Measured EFI Quasi-Peak (dBµV/m)	Measured EFI Average (dBµV/m)	15.109 Limit (dBµV/m)	Margin (dB)
Embedded	0.125	A_V, E_V	100	320	3	67.4	62.7	54.4	105.6 (Note 2)	51.2
Embedded	0.250	A_V, E_V	100	235	3	64.9	60.7	53.8 (Note 4)	99.6 (Note 2)	45.8
Embedded	0.375	A_V, E_V	100	190	3	60.1	56.9	50.1 (Note 4)	96.1 (Note 2)	46.0
Embedded	0.500	A_V, E_V	100	105	3	58.0	54.2 (Note 4)	47.6	73.6	19.4
Embedded	0.625	A_V, E_V	100	65	3	56.1	52.3 (Note 4)	45.6	71.6	19.3
Embedded	0.750	A_V, E_V	100	180	3	54.2	50.5 (Note 4)	43.8	70.1	19.6
Embedded	0.875	A_V, E_V	100	155	3	52.3	48.9 (Note 4)	42.2	68.7	19.8
Embedded	1.000	A_V, E_V	100	60	3	52.7	47.6 (Note 4)	40.5	67.6	20.0
Embedded	1.125	A_V, E_V	100	340	3	50.9	46.3 (Note 4)	39.5	66.5	20.2
Embedded	1.250	A_V, E_V	100	340	3	49.5	45.7 (Note 4)	38.9	65.6	19.9

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. Measurements using the Average detector are published in the table above for frequencies above 1 GHz. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements below 30 MHz were made using a Quasi-Peak detector function, except for the frequency ranges **between 9-90 kHz and 110-490 kHz, where an Average detector function was utilized** in the measurements.
3) Measurements above 1 GHz were made at 1 meters of separation from the EUT.
4) Measurement at receiver system noise floor, and better than 20 dB below limits.

Table 14: Modular configuration: Level of significant radiated RF emissions measured in transmit fundamental and harmonic frequencies.

Host Mode	Frequency (MHz)	Ant./EUT Polarization	Ant. Height (cm)	Table Azimuth (0°-360°)	Measured Distance (m)	Measured EFI Peak (dBµV/m)	Measured EFI Quasi-Peak (dBµV/m)	Measured EFI Average (dBµV/m)	15.109 Limit (dBµV/m)	Margin (dB)
Embedded	0.125	A_V, E_V	100	200	3	81.9	78.9	69.0	105.6 (Note 2)	36.6
Embedded	0.250	A_V, E_V	100	235	3	64.9	60.7	53.8 (Note 4)	99.6 (Note 2)	45.8
Embedded	0.375	A_V, E_V	100	190	3	60.1	56.9	50.2 (Note 4)	96.1 (Note 2)	45.9
Embedded	0.500	A_V, E_V	100	105	3	58.0	54.2 (Note 4)	47.7	73.6	19.4
Embedded	0.625	A_V, E_V	100	65	3	56.1	52.3 (Note 4)	45.6	71.6	19.3
Embedded	0.750	A_V, E_V	100	180	3	54.2	50.5 (Note 4)	43.8	70.1	19.6
Embedded	0.875	A_V, E_V	100	155	3	52.3	48.9 (Note 4)	42.2	68.7	19.8
Embedded	1.000	A_V, E_V	100	60	3	52.7	47.6 (Note 4)	40.5	67.6	20.0
Embedded	1.125	A_V, E_V	100	340	3	50.9	46.3 (Note 4)	39.5	66.5	20.2
Embedded	1.250	A_V, E_V	100	340	3	49.5	45.7 (Note 4)	38.9	65.6	19.9

Notes:

1) A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak as well as an Average Detector was used in measurements above 1 GHz. Measurements using the Average detector are published in the table above for frequencies above 1 GHz. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.
2) Measurements below 30 MHz were made using a Quasi-Peak detector function, except for the frequency ranges **between 9-90 kHz and 110-490 kHz, where an Average detector function was utilized** in the measurements.
3) Measurements above 1 GHz were made at 1 meters of separation from the EUT.
4) Measurement at receiver system noise floor, and better than 20 dB below limits.

Uncertainty Calculations – All Factors Combined Includes a comparison between CISPR 16-4-2 and Ingenium Testing			
Measurement		**U_{CISPR}**	**Ingenium Testing**
Radiated Disturbance	30 MHz – 300 MHz	7.4 dB	5.4 dB
Radiated Disturbance	300 MHz – 1 GHz	6.5 dB	5.1 dB

Notes: Date of Estimation: November 02, 2007.

SCREEN CAPTURES – RADIATED RF EMISSIONS TESTING

These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured with the sense antenna both in vertical and horizontal polarity.

Transmit Mode – Modular setup

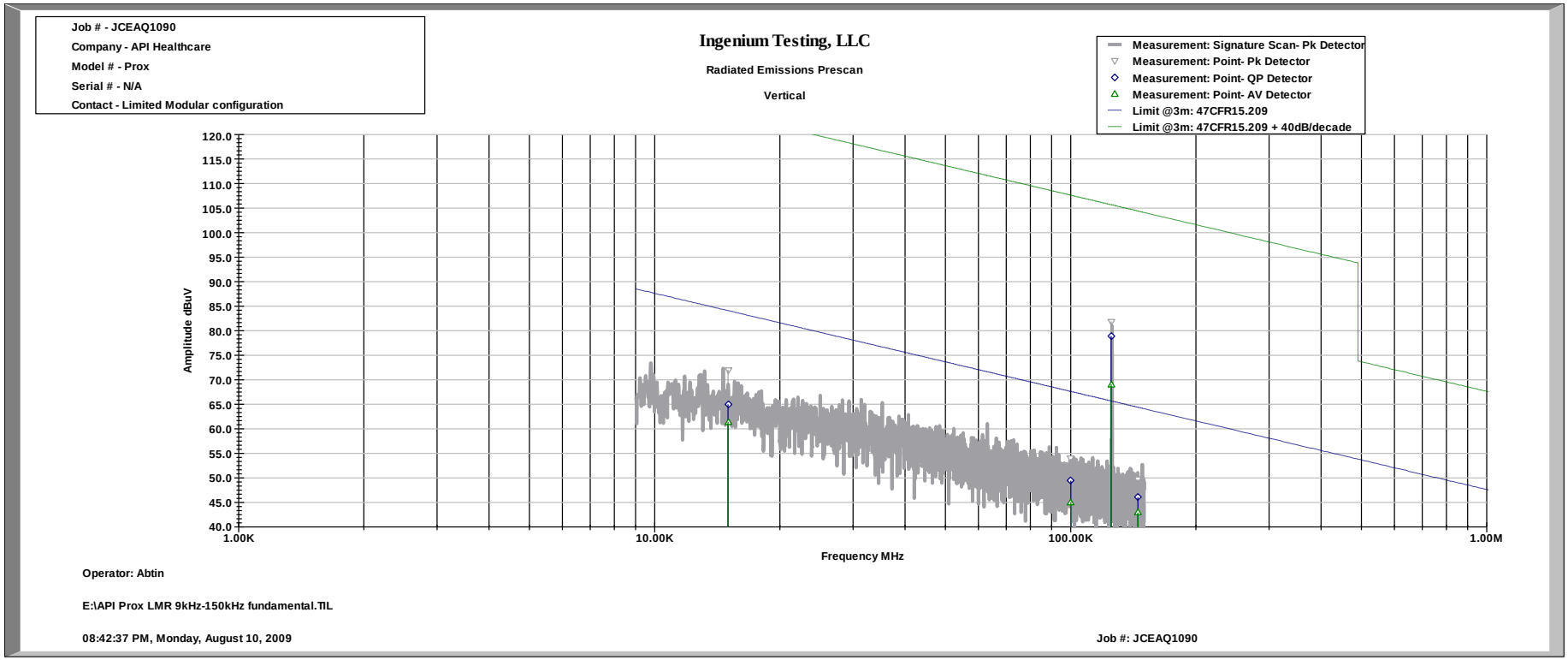

Figure 8: Transmit RF Emission Signature, Antenna Vertical, 9 kHz-150 kHz, at 3 m - Modular.

Transmit Mode – Modular setup (Continued)

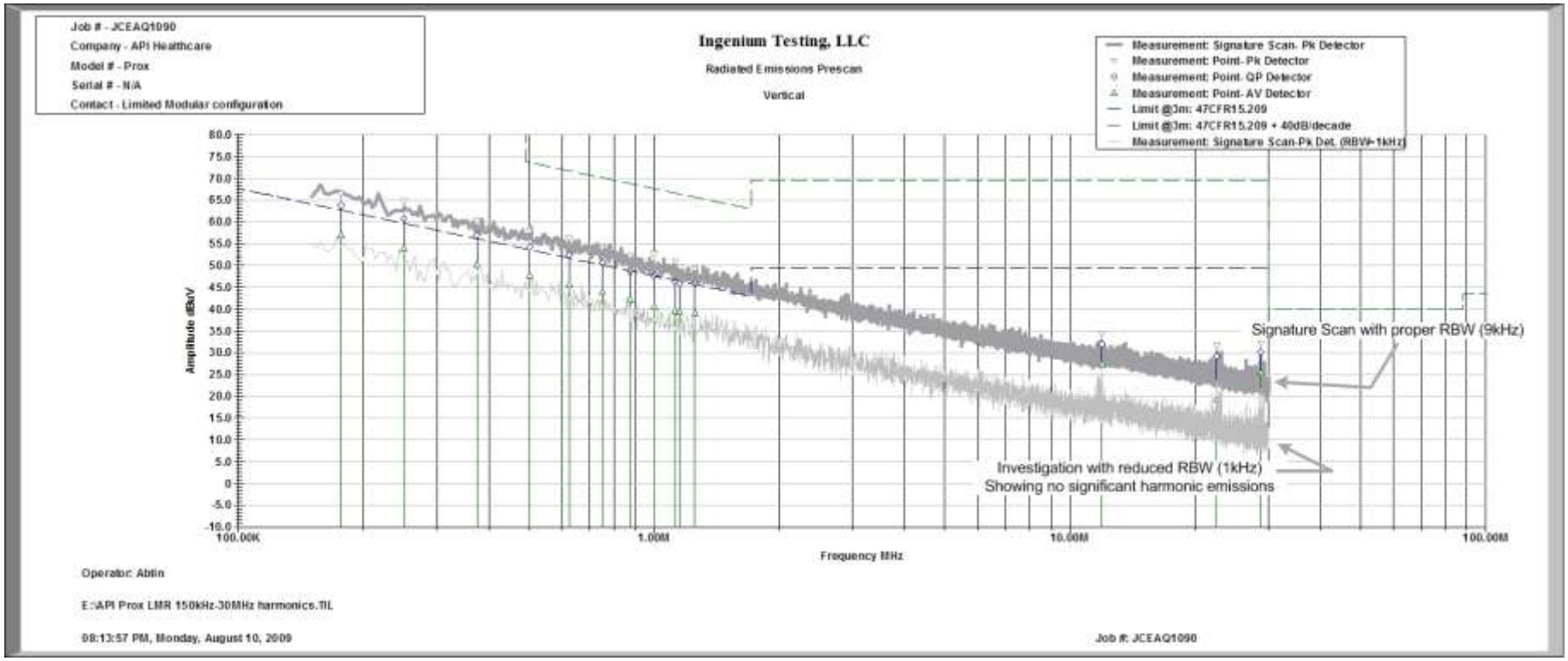

Figure 9: Transmit RF Emission Signature, Antenna Horizontal, 150 kHz-30 MHz, at 3 m – Modular.

Screen Captures - Radiated Emissions Testing *(continued)*

Transmit & Receive Mode – Modular setup

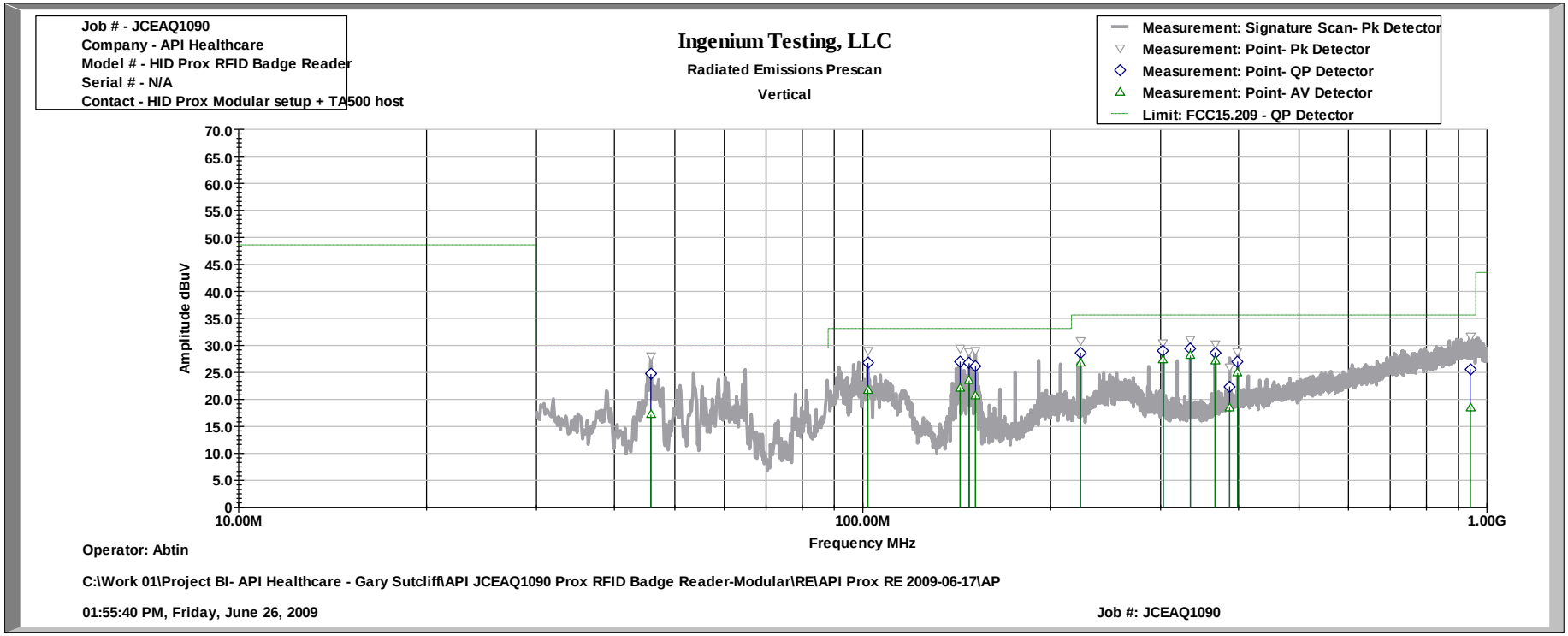

Figure 10: Transmit RF Emission Signature, Antenna Vertical, 30 MHz - 1 GHz, at 10 m - Modular.

Transmit & Receive Mode – Modular setup (Continued)

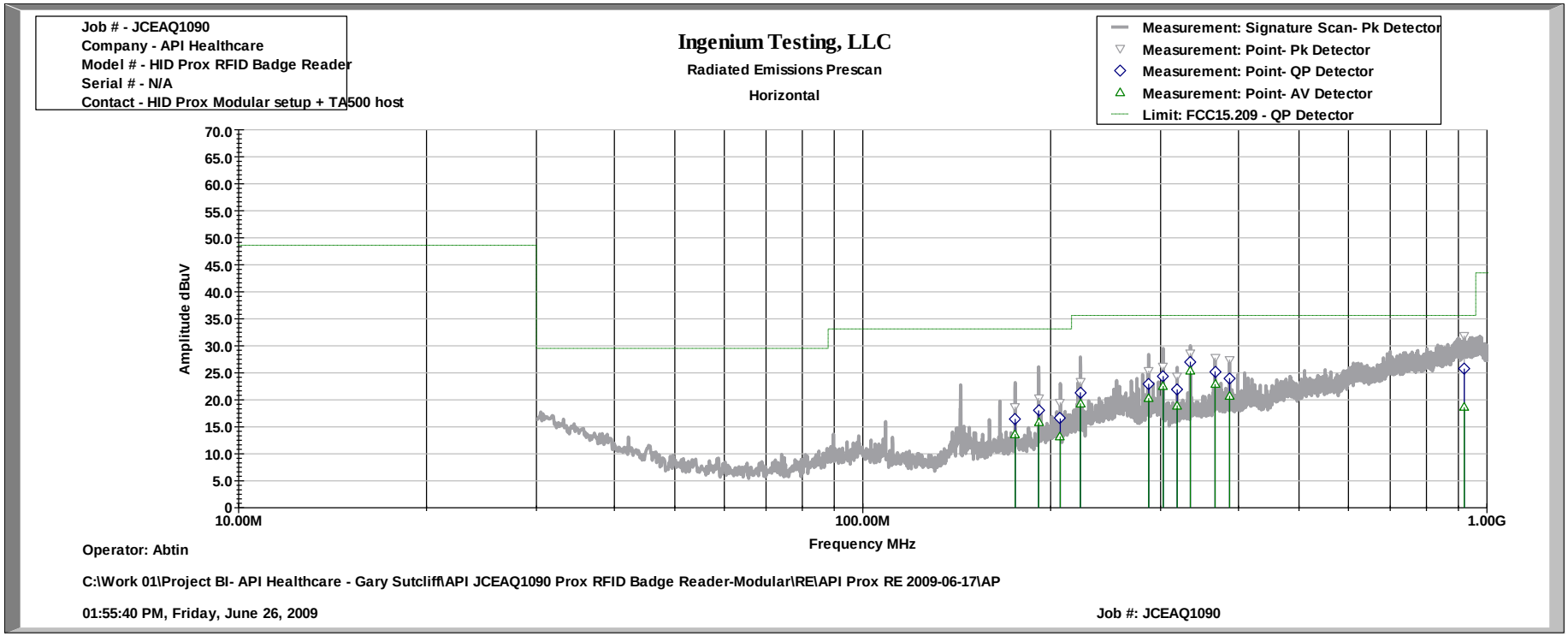

Figure 11: Transmit RF Emission Signature, Antenna Horizontal, 30 MHz - 1 GHz, at 10 m - Modular.

Screen Captures - Radiated Emissions Testing *(continued)*

Transmit Mode – Embedded within host setup

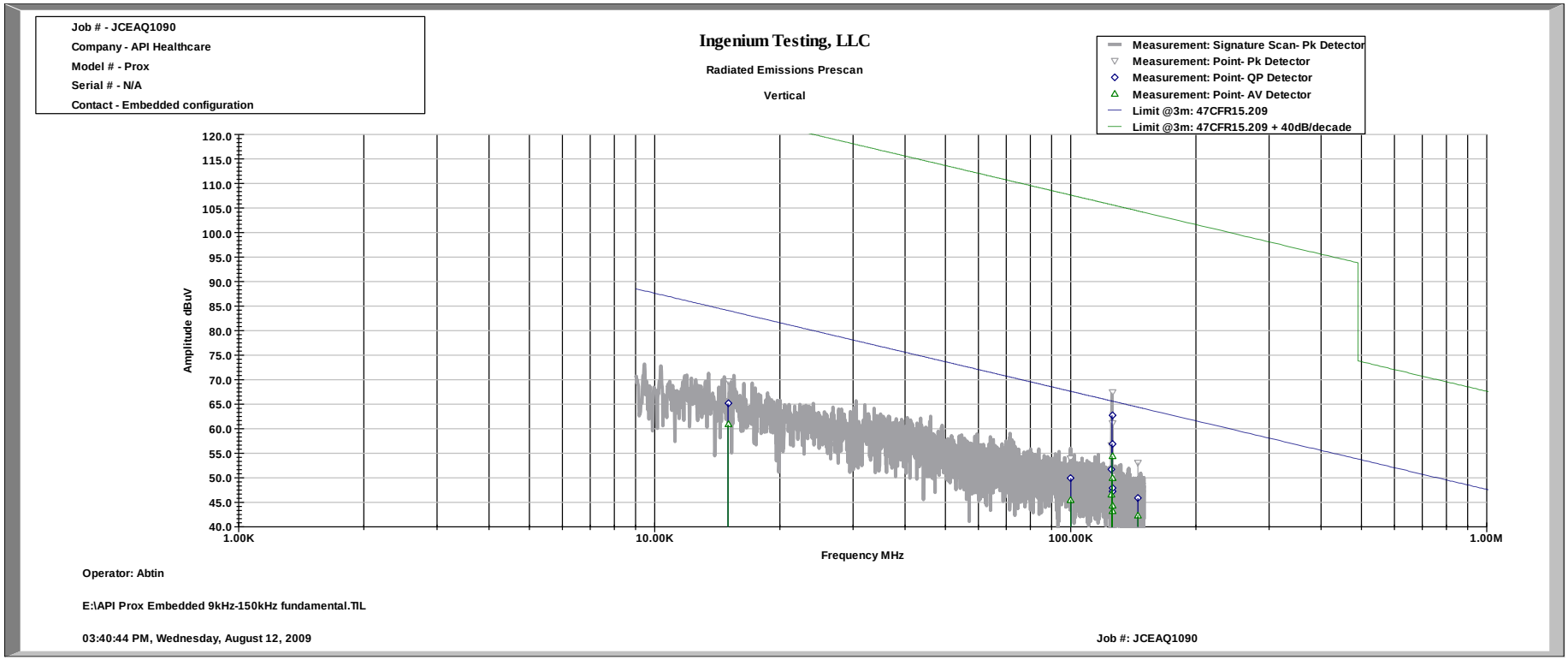

Figure 12: Transmit RF Emission Signature, Antenna Vertical, 9 kHz-150 kHz, at 3 m - Embedded.

Transmit Mode – Embedded within host setup (Continued)

Figure 13: Transmit RF Emission Signature, Antenna Horizontal, 150 kHz-30 MHz, at 3 m – Embedded.

Screen Captures - Radiated Emissions Testing *(continued)*

Transmit and Receive Mode – Embedded within host setup

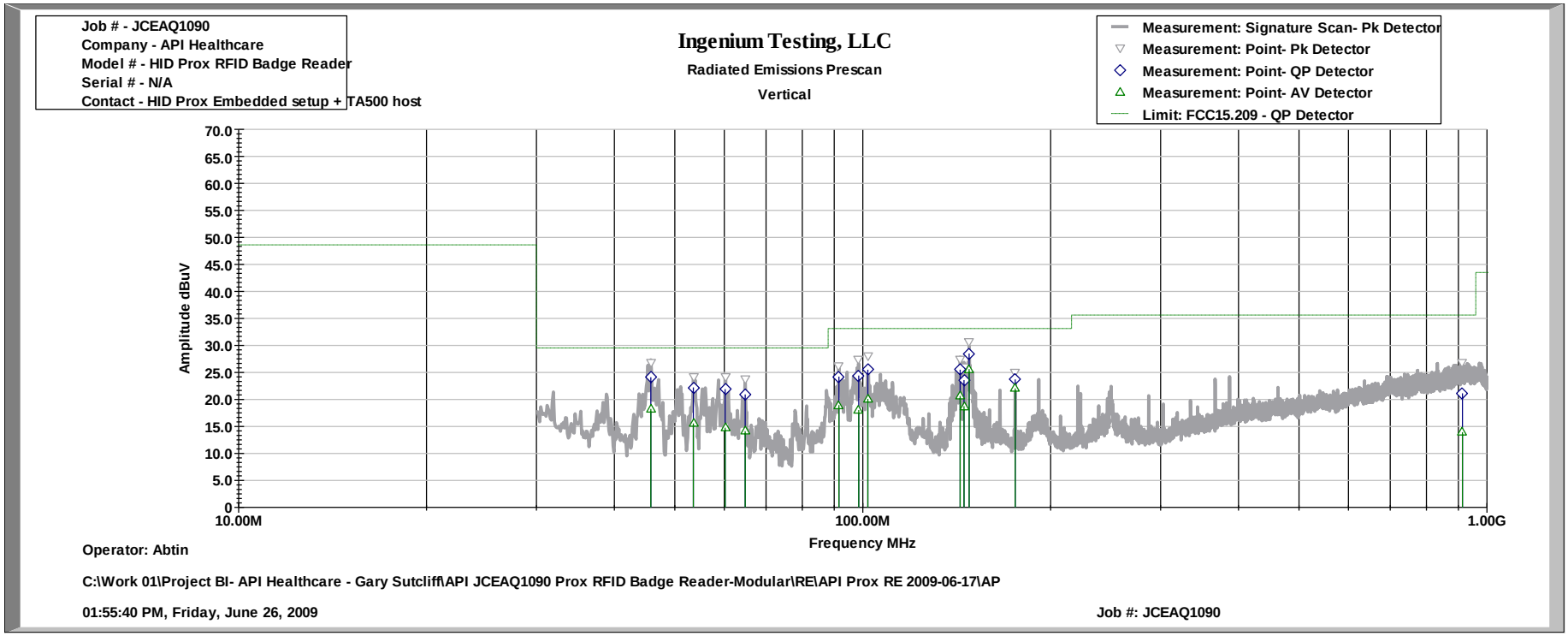

Figure 14: Transmit RF Emission Signature, Antenna Vertical, 30 MHz - 1 GHz, at 10 m - Embedded.

Transmit and Receive Mode – Embedded within host setup (Continued)

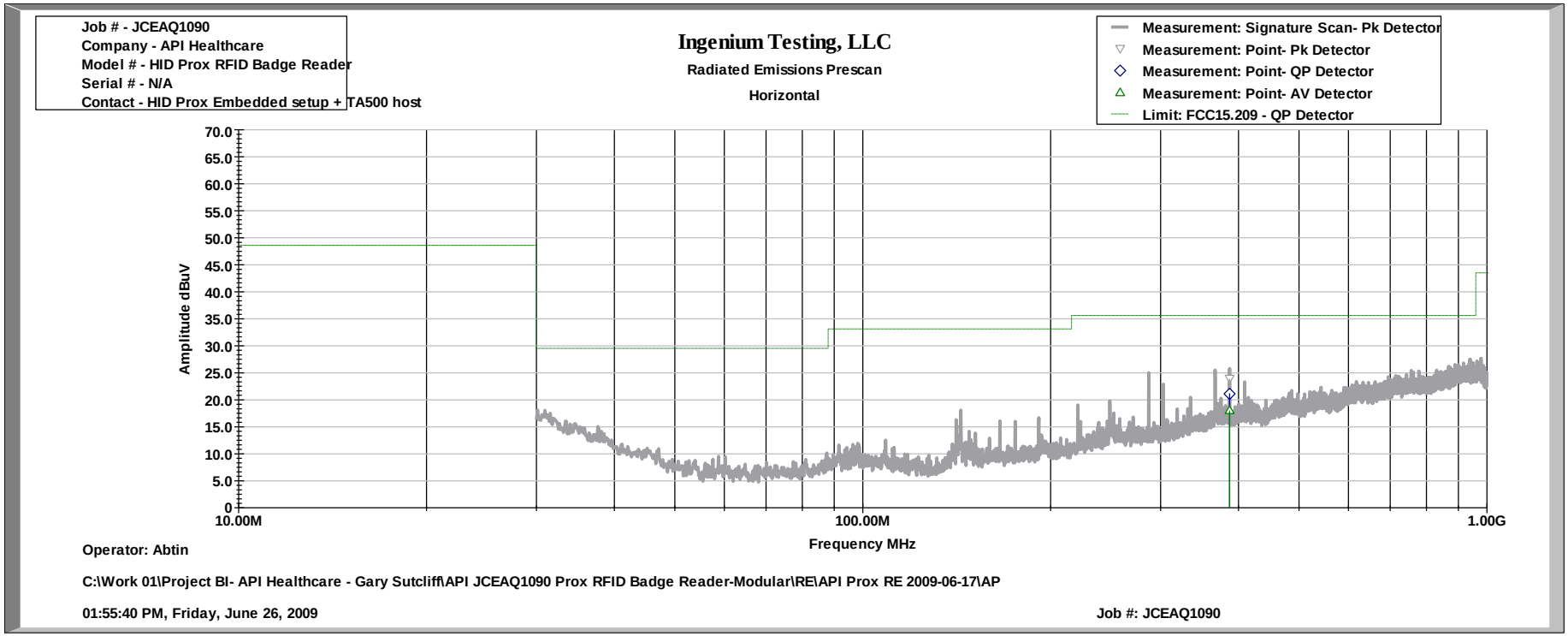

Figure 15: Transmit RF Emission Signature, Antenna Horizontal, 30 MHz - 1 GHz, at 10 m - Embedded.

2.1.2 Conducted RF Emission onto AC Mains Measurements

2.1.2.1 Test Criterion

The test matrix in section 1.5 was used as a guide for test points and conditions.
The following table presents the limits for unintentional RF emissions conducted onto AC Mains, as specified in the FCC Title 47 CFR, Part 15.207, for intentional radiators, as well as the limits specified in the FCC Title 47 CFR, Part 15.107, section (a), for un-intentional radiators and products qualifying as Class B Digital Devices.

Frequency (MHz)	Conducted RF Voltage Quasi-peak Limit (dBμV)	Conducted RF Voltage Average Limit (dBμV)
0.15 – 0.50	66.0 Decreasing linearly with logarithm of frequency to 56.0	56.0 Decreasing linearly with logarithm of frequency to 46.0
0.50 – 5.0	56.0	46.0
5.0 – 30.0	60.0	50.0

Notes: In the calculations for margin below the limit, the limits are rounded to one digit past the decimal.

The following ports should be tested for compliance according to the test matrix:

Port Definition	Description/ Detail	Basic Standard	Performance Criteria
AC Power	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Conducted RF Emissions 47 CFR 15.207	150kHz-30 MHz Measured RF Emission should be Below specified Limits
	HID Prox Module installed on-board TA-500 Host ***Transmit Mode***	Conducted RF Emissions 47 CFR 15.207	150kHz-30 MHz Measured RF Emission should be Below specified Limits
AC Power	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Receive Mode***	Conducted RF Emissions 47 CFR 15.107	150kHz-30 MHz Measured RF Emission should be Below specified Limits
	HID Prox Module installed on-board TA-500 Host ***Receive Mode***	Conducted RF Emissions 47 CFR 15.107	150kHz-30 MHz Measured RF Emission should be Below specified Limits

2.1.2.2 Test Equipment

All equipment is calibrated according to governing standards, and is N.I.S.T. traceable. The equipment is used according to the operation manuals as provided by the manufacturers.

List of Equipment Used:

Manufacturer	Model	Ingenium Asset Number	Description	Last Cal data	Cal due date
Hewlett Packard	8546A	1133	EMI analyzer	26 Jan 2009	26 Jan 2010
ETS	3816/2	1363	Dual LISN	11 Mar 2009	11 Mar 2010
Agilent	11947A	1314	Transient Limiter	18 Dec 2008	18 Dec 2009

Correction factors and cable loss factors were entered into the appropriate test equipment. As a result, the data taken accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected measurement result.

2.1.2.3 Test Setup

The EUT was tested as a "Table-Top" type product, as described in ANSI C63.4. The EUT was placed on a non-conductive pedestal, 80 cm above the reference ground plane, inside a Shielded Chamber located at Ingenium Testing. The EUT's power cable was plugged into a 50Ω (ohm), 50/250 μH Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided to the LISN via appropriate broadband EMI Filters. The LISN used has the ability to terminate the unused RF sampling port connection with a 50Ω (ohm) load, when switched to either L1 (line) or L2 (neutral). A transient limiter was installed in the RF path to protect the detection equipment.

Figure 16: EUT setup during Conducted RF Emissions testing, with AC supply providing Power-Over-Ethernet.

Figure 17: Close up view of Conducted RF Emission testing, showing EUT in 'Modular transmitter' test setup.

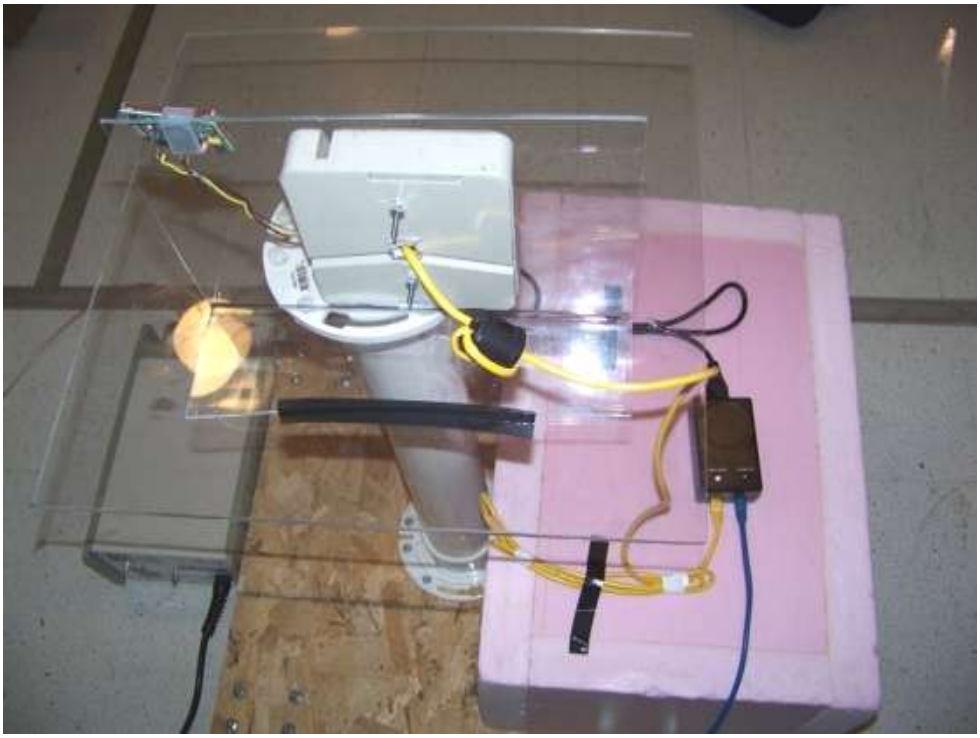

Figure 18: Close up view of Conducted RF Emission testing, showing the rear of the EUT, the Ethernet cable and the ferrite clamp application according to the manufacturer's instruction manual.

2.1.2.4 Test Procedure

The EUT was measured for RF Emissions conducted onto AC Mains lines, in an RF shield-room located at Ingenium Testing. Frequency range from 150 kHz to 30 MHz was investigated for RF emissions. Measurements were made via a LISN, equipped with a 50 Ω RF sampling port.
The measurements were made using the "Quasi-Peak" and "Average" detector functions as defined in CISPR 16-1-1, and available on the test equipment selected for this test.

The EUT was investigated in continuous transmit mode, particular setup for emission testing as defined in section 1.2.3.1 of this report. The EUT was also investigated in normal operation mode for general emissions while embedded in the host units. By nature of RFID operation, the transmitter is active during these tests as polled by the system.

The receiver was operated with the IF resolution bandwidth (RBW) of 9 kHz for measurements between the frequencies of 150 kHz and 30 MHz (video bandwidth of 30 kHz). The applicable Class B limits, as noted in 47 CFR 15.107 were applied when testing emissions with the AT500 host unit.

Automation software TILE4 was used to perform the Conducted RF Emission measurements.

With the EUT in normal operation, the AC Mains supply was varied between 102 VAC (85 % of V_{NOM}) and 138 VAC (115 % of V_{NOM}) and the effects on the conducted emission levels were monitored.

2.1.2.5 Test Results

The EUT was found to **MEET** the requirements as described within the specifications of the FCC, Title 47 CFR, Part 15.107 for conducted emissions from a Class B product, onto AC Mains, as well as the Industry Canada requirements specified within ICES-003 for a Class B digital device. Supporting evidence of significant measured RF emissions, are tabulated and presented below.

Port Definition	Description/ Detail	Basic Standard	Performance Criteria	Pass / Fail
AC Power	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Conducted RF Emissions 47 CFR 15.207	150kHz-30 MHz Measured RF Emission should be Below specified Limits	Pass
	HID Prox Module installed on-board TA-500 Host ***Transmit Mode***	Conducted RF Emissions 47 CFR 15.207	150kHz-30 MHz Measured RF Emission should be Below specified Limits	Pass
AC Power	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Receive Mode***	Conducted RF Emissions 47 CFR 15.107	150kHz-30 MHz Measured RF Emission should be Below specified Limits	Pass
	HID Prox Module installed on-board TA-500 Host ***Receive Mode***	Conducted RF Emissions 47 CFR 15.107	150kHz-30 MHz Measured RF Emission should be Below specified Limits	Pass

The EUT was not affected in performance by the variation in AC Mains voltage. The emission level of the EUT did not change beyond the resolution of the instrument.

CLIMATE TEST CONDITIONS

Temperature:	75 °F (24 °C)
Humidity:	50 % RH

Table 15: Level of significant Conducted RF Emissions measured in Transmit mode, in the Modular mode.

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	**Line**	**QP Measurement (dBµV)**	**QP Limit (dBµV)**	**QP Margin (dB)**	**Average Measurement (dBµV)**	**Average Limit (dBµV)**	**Average Margin (dB)**
0.155	L1	25.3	65.9	40.6	-0.2	55.9	56.0
0.178	L1	23.5	65.2	41.7	-2.6	55.2	57.8
0.182	L1	23.8	65.1	41.3	-3.3	55.1	58.4
0.458	L1	24.6	57.2	32.6	20.7	47.2	26.5
2.052	L1	30.9	56.0	25.1	25.9	46.0	20.1
6.548	L1	33.7	60.0	26.3	31.6	50.0	18.4
11.897	L1	30.0	60.0	30.0	26.0	50.0	24.0
21.671	L1	35.4	60.0	24.6	34.3	50.0	15.7
21.674	L1	26.9	60.0	33.1	25.9	50.0	24.1
23.132	L1	39.8	60.0	20.2	37.9	50.0	12.1
28.693	L1	37.8	60.0	22.2	36.0	50.0	14.0
29.239	L1	40.4	60.0	19.6	38.4	50.0	11.6
0.197	L2	27.9	64.7	36.7	21.2	54.7	33.5
0.861	L2	26.1	56.0	29.9	20.4	46.0	25.6
1.786	L2	32.2	56.0	23.8	28.8	46.0	17.2
2.119	L2	28.7	56.0	27.3	25.5	46.0	20.5
5.754	L2	34.3	60.0	25.7	30.7	50.0	19.3
12.812	L2	33.3	60.0	26.7	29.2	50.0	20.8
20.816	L2	33.9	60.0	26.1	32.1	50.0	17.9
21.669	L2	41.0	60.0	19.0	39.9	50.0	10.1
23.131	L2	39.8	60.0	20.2	37.7	50.0	12.3
28.689	L2	42.2	60.0	17.8	39.8	50.0	10.2
29.241	L2	40.3	60.0	19.7	38.6	50.0	11.4

Notes: All other emissions were better than 20 dB below the limits.

Table 16: Level of significant Conducted RF Emissions measured in Normal Operation (Transmit & Receive) with module embedded within host unit.

		QUASI-PEAK			AVERAGE		
Frequency (MHz)	Line	QP Measurement (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Average Measurement (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.466	L1	29.6	57.0	27.4	25.6	47.0	21.4
2.051	L1	32.2	56.0	23.8	27.2	46.0	18.8
6.614	L1	32.2	60.0	27.8	26.2	50.0	23.8
12.507	L1	32.2	60.0	27.8	28.8	50.0	21.2
21.670	L1	38.3	60.0	21.7	37.3	50.0	12.7
21.671	L1	34.0	60.0	26.0	33.3	50.0	16.7
21.916	L1	31.5	60.0	28.5	30.7	50.0	19.3
23.130	L1	38.9	60.0	21.1	36.7	50.0	13.3
28.293	L1	36.4	60.0	23.6	33.7	50.0	16.3
29.240	L1	40.2	60.0	19.8	38.7	50.0	11.3
0.200	L2	40.2	64.6	24.4	23.1	54.6	31.5
0.290	L2	33.3	62.0	28.7	7.4	52.0	44.6
0.713	L2	28.0	56.0	28.0	3.0	46.0	43.0
1.786	L2	31.9	56.0	24.1	27.7	46.0	18.3
4.295	L2	31.1	56.0	24.9	25.5	46.0	20.5
5.686	L2	34.5	60.0	25.5	31.7	50.0	18.3
12.753	L2	32.7	60.0	27.3	28.0	50.0	22.0
20.816	L2	32.9	60.0	27.1	31.4	50.0	18.6
21.668	L2	40.7	60.0	19.3	39.6	50.0	10.4
23.131	L2	39.4	60.0	20.6	37.3	50.0	12.7
29.239	L2	41.3	60.0	18.7	39.4	50.0	10.6

Notes: All other emissions were better than 20 dB below the limits.

Uncertainty Calculations Includes a comparison between CISPR 16-4-2 and Ingenium Testing			
Measurement		U_{CISPR}	Ingenium Testing
Conducted Disturbance	150 kHz – 30 MHz	5.1 dB	4.2 dB

Notes:

Date of Estimation: November 02, 2007.

SCREEN CAPTURES – RADIATED RF EMISSIONS TESTING

These screen captures represent Peak Emissions. For conducted emission measurements, both a Quasi-Peak detector and an Average detector function is utilized.

Transmit Mode – Modular

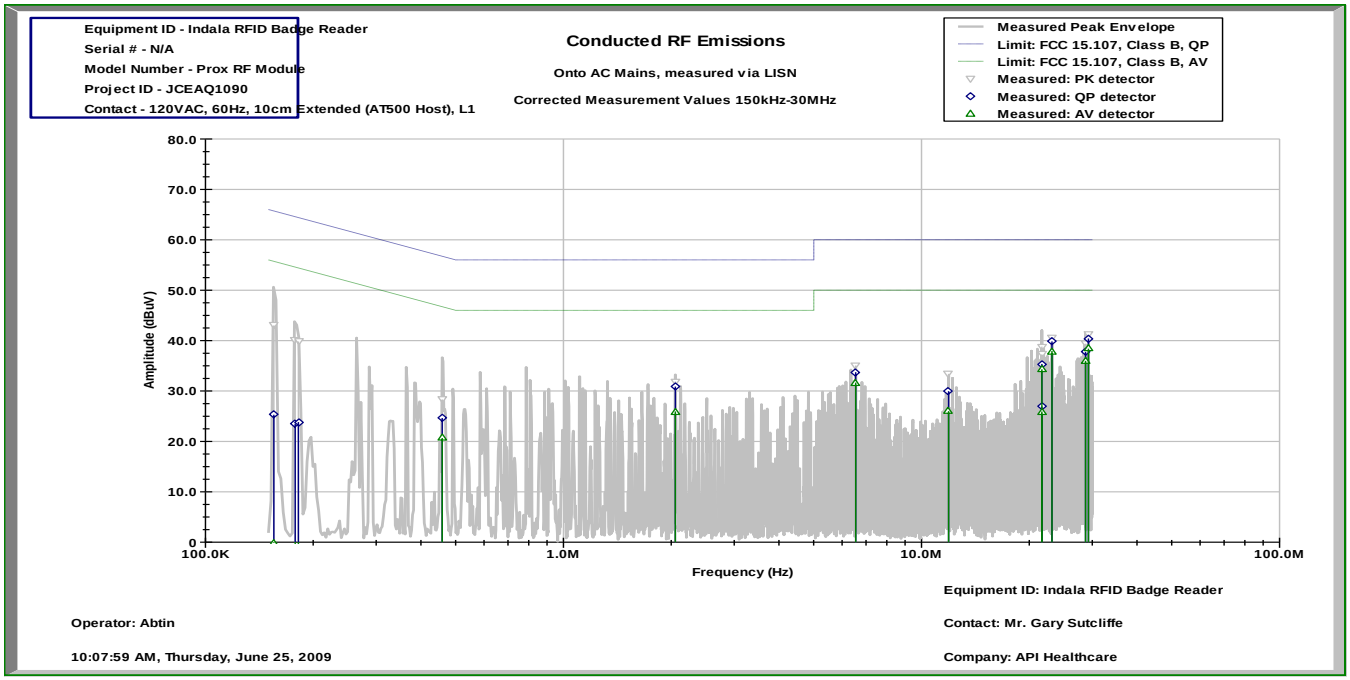

Figure 19: Conducted RF Emission Signature, L1, Modular.

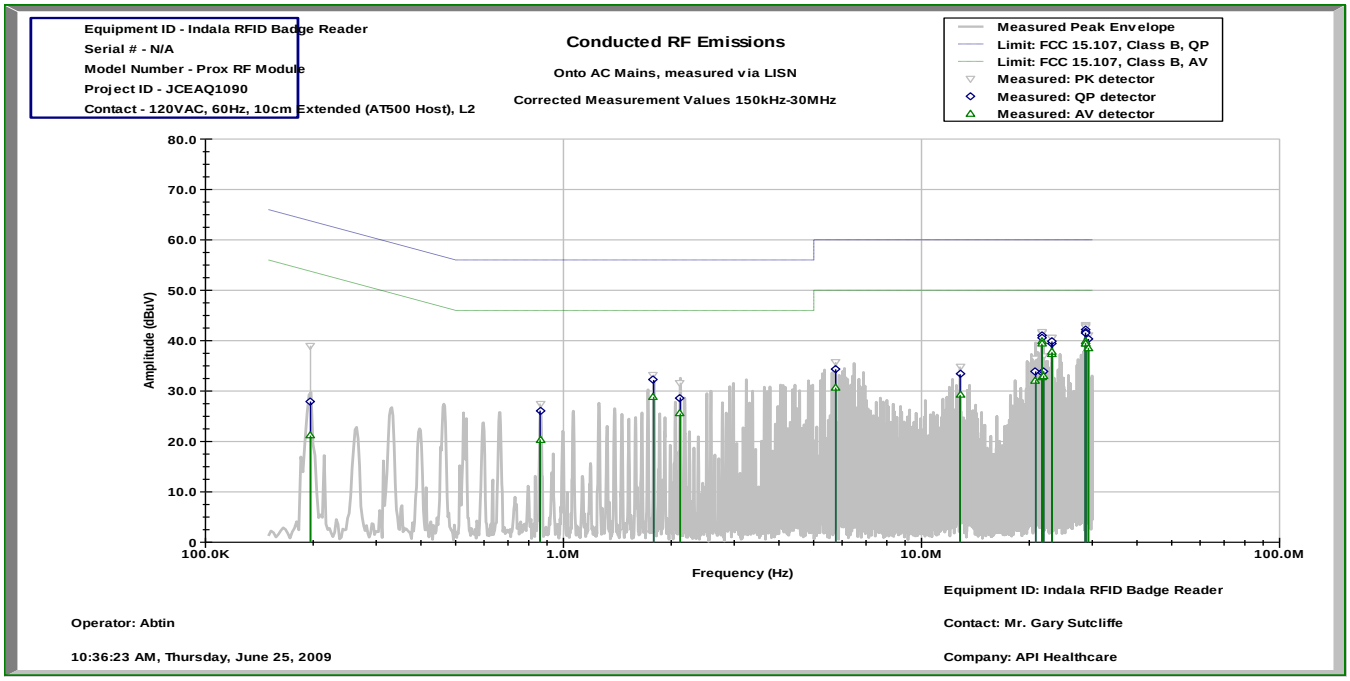

Figure 20: Conducted RF Emission Signature, L2, Modular

Transmit Mode – Embedded within Host

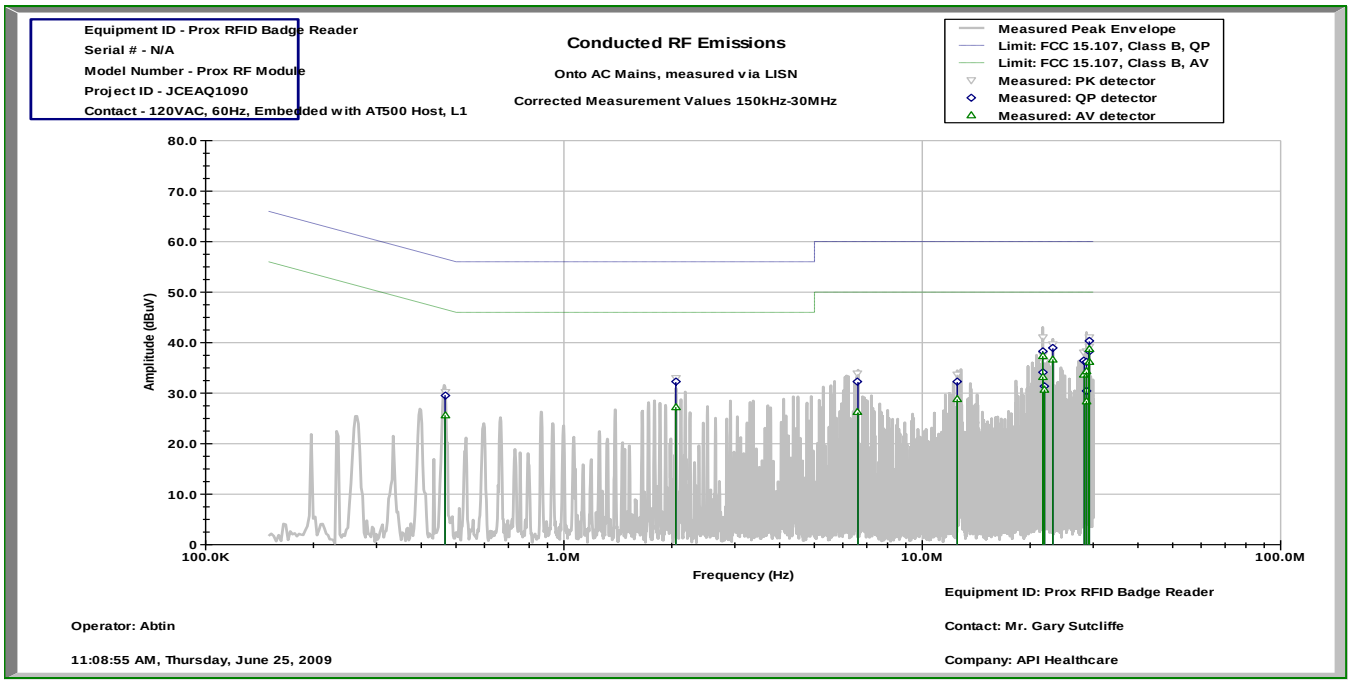

Figure 21: Conducted RF Emission Signature, L1, Embedded.

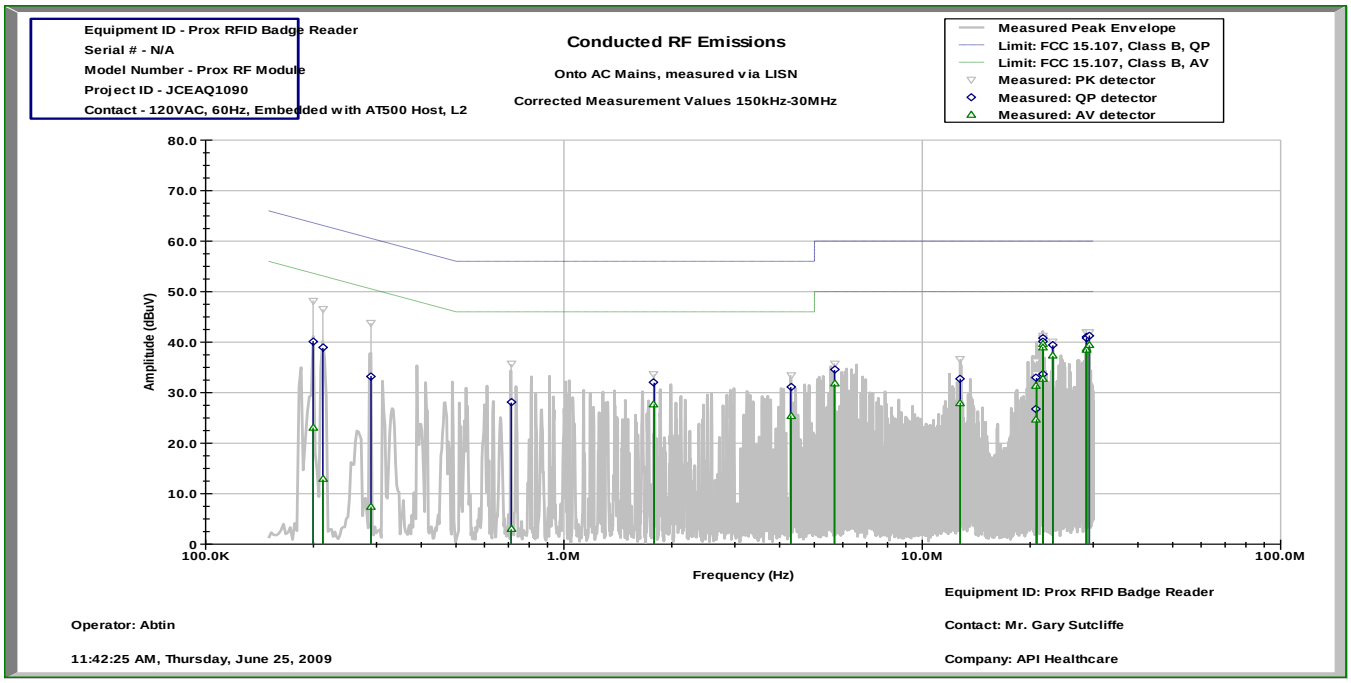

Figure 22: Conducted RF Emission Signature, L2, Embedded.

Receive Mode
(Same as Transmit mode Embedded within Host)

For receive mode testing, the module was Embedded in the Host unit, and tested in normal operation. In normal operation, both the transmit and receive functions are active and can be tested. Since the unit conformed to the limit even with the transmit function enabled, there was no need to perform additional tests with the transmit function forced off.

2.1.3 Conducted RF Performance Parameters – Occupied Bandwidth Measurements

2.1.3.1 Test Criterion

The applicable general emission limits, as noted in 47 CFR Part 15.209 were applied for transmitter Occupied Bandwidth testing. The bandwidth limits for this product are defined as the frequency band of operation contained between 110 kHz and 495 kHz.

Port Definition	Description/ Detail	Basic Standard	Performance Criteria	Pass / Fail
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions Occupied Bandwidth 47 CFR 15.209	9kHz-1.0 GHz RF Energy from the Fundamental transmission should be contained within the allowed frequency band of operation.	Pass

2.1.3.2 Test Equipment

All Ingenium Testing, LLC test and monitoring equipment/instrumentation is calibrated for Testing Laboratory requirements of ISO/IEC 17025:2005, and is N.I.S.T. traceable. The equipment is used according to the operation manuals as provided by the manufacturers. Calibration information was checked and recorded before each test in which the equipment was used.

List of Equipment Used:

Manufacturer	Model	Ingenium Asset Number	Description	Last Cal data	Cal due date
Agilent	E4440A	1207	PSA Spec. Analyzer	18 Dec 2008	18 Dec 2009
Agilent	N9039A	1206	Pre-Selector	23 Dec 2008	23 Dec 2009
Agilent	N5182	1208	RF Generator	18 Dec 2008	18 Dec 2009
HP	8447	RP-0054	Pre-Amplifier	13 Mar 2009	13 Sep 2009
ETS	6507	1315	Active Loop Antenna	26 Jan 2009	20 Feb 2010

The data presented accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected measurement result.

2.1.3.3 Test Setup

The EUT disposition, in which the highest radiated RF emission level was measured, was selected as the mode of operation and EUT disposition for this test. The highest emission was measured with the EUT in the 'Limited Modular' test setup, with the EUT in the vertical orientation.
The EUT was placed on a non-conductive table, centered on a flush-mounted 3 meter-diameter turntable in the 10 Meter FCC Listed Semi-Anechoic Chamber located at Ingenium Testing. The EUT was powered over the Ethernet cable, and exercised as fast as possible under standard operating conditions as described in section 1.2.3.1 of this report. The host was powered by 120VAC/60Hz Mains.

Test Setup Photos

Figure 23: EUT transmit module in 'Vertical' orientation, during Occupied Bandwidth tests.

2.1.3.4 Test Procedure

The EUT was positioned for highest measured radiated RF emission, at the fundamental frequency of operation. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer using 100 kHz RBW and VBW=300 kHz.

The receiver was operated with the IF resolution bandwidth (RBW) of 200 Hz (video bandwidth of 2 kHz). With the EUT at the attitude of highest measured emissions, the emission spectra was investigated and recorded on a spectrum analyzer.

The applicable general emission limits, as noted in 47 CFR Part 15.209 were applied for transmitter Occupied Bandwidth testing. The bandwidth limits for this product are defined as the frequency band of operation contained between 110 kHz and 495 kHz. The product was assessed to ensure that the fundamental transmission does not exceed the allowed band of operation.

2.1.3.5 Test Results

The EUT meets the limits on the Occupied Bandwidth for the fundamental transmission, as defined in the general emission limits, 47 CFR Part 15.209. All fundamental transmissions from this EUT are contained within the 110 kHz to 495 kHz frequency band of operation.

CLIMATE TEST CONDITIONS

Temperature:	72 °F (22 °C)
Humidity:	40 % RH

Port Definition	Description/ Detail	Basic Standard	Performance Criteria	Pass / Fail
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions Occupied Bandwidth 47 CFR 15.209	9kHz-1.0 GHz RF Energy from the Fundamental transmission should be contained within the allowed frequency band of operation.	Pass

Table 17: Occupied Bandwidth measurements.

Mode of Operation	Center Frequency (MHz)	Measured -6 dBc Occ. BW (kHz)	Measured -20 dBc Occ.Bw (kHz)
10 cm cable Limited Modular	0.125	0.295	0.887

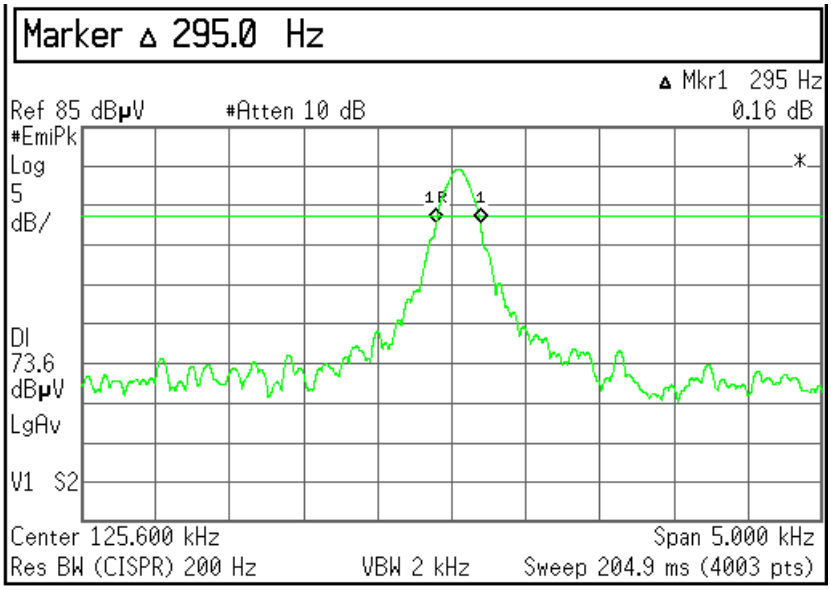

Figure 24: Occupied Bandwidth at (-6dBc) level.

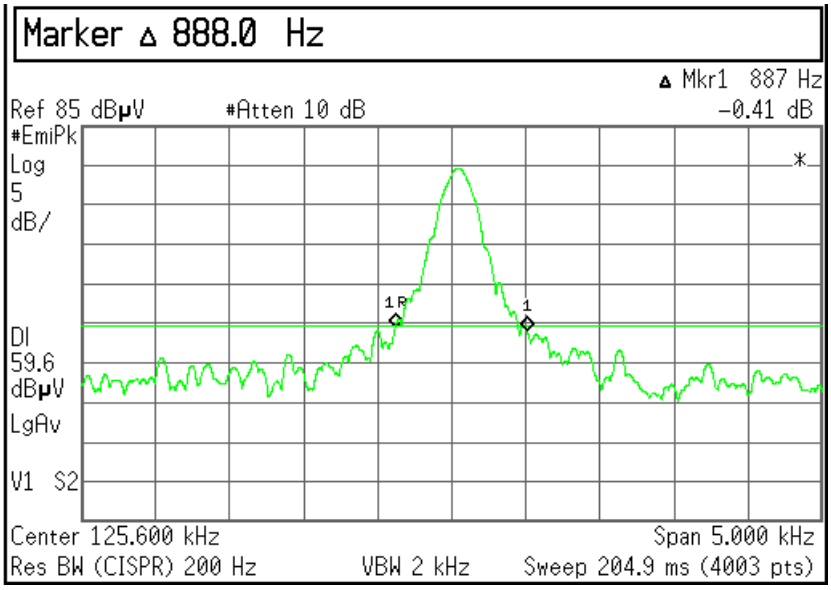

Figure 25: Occupied Bandwidth at (-20dBc) level.

2.1.4 Radiated RF Performance Parameters – Band-Edge Measurements

2.1.4.1 Test Criterion

The applicable general emission limits, as noted in 47 CFR Part 15.205 were applied for transmitter Band-Edge testing. The operation of this device should be limited to the frequency band contained between 110 kHz and 495 kHz. No components of the fundamental emission shall be allowed in the restricted bands, as defined in 47 CFR 15.205.

Port Definition	Description/ Detail	Basic Standard	Performance Criteria	Pass / Fail
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions Band-Edge 47 CFR 15.205	9kHz-1.0 GHz RF Energy from the Fundamental transmission should not fall within the restricted band of operation.	Pass

2.1.4.2 Test Equipment

All Ingenium Testing, LLC test and monitoring equipment/instrumentation is calibrated for Testing Laboratory requirements of ISO/IEC 17025:2005, and is N.I.S.T. traceable. The equipment is used according to the operation manuals as provided by the manufacturers. Calibration information was checked and recorded before each test in which the equipment was used.

List of Equipment Used:

Manufacturer	Model	Ingenium Asset Number	Description	Last Cal data	Cal due date
Agilent	E4440A	1207	PSA Spec. Analyzer	18 Dec 2008	18 Dec 2009
Agilent	N9039A	1206	Pre-Selector	23 Dec 2008	23 Dec 2009
Agilent	N5182	1208	RF Generator	18 Dec 2008	18 Dec 2009
HP	8447	RP-0054	Pre-Amplifier	13 Mar 2009	13 Sep 2009
ETS	6507	1315	Active Loop Antenna	26 Jan 2009	20 Feb 2010

The data presented accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected measurement result.

2.1.4.3 Test Setup

The EUT disposition, in which the highest radiated RF emission level was measured, was selected as the mode of operation and EUT disposition for this test. The highest emission was measured with the EUT in the 'Limited Modular' test setup, with the EUT in the vertical orientation.
The EUT was placed on a non-conductive table, centered on a flush-mounted 3 meter-diameter turntable in the 10 Meter FCC Listed Semi-Anechoic Chamber located at Ingenium Testing. The EUT was powered over the Ethernet cable, and exercised as fast as possible under standard operating conditions as described in section 1.2.3.1 of this report. The host was powered by 120VAC/60Hz Mains.

Test Setup Photos

Figure 26: EUT transmit module in 'Vertical' orientation, during Band-Edge tests.

2.1.4.4 Test Procedure

The EUT was positioned for highest measured radiated RF emission, at the fundamental frequency of operation. The band-edges were investigated with spectrum analyzer/EMI receiver. The receiver was operated, for Quasi-Peak measurements, with the IF resolution bandwidth (RBW) of 200 Hz (video bandwidth of 2 kHz), and for Average measurements, with a RBW of 9 kHz (video bandwidth of 1 Hz or below, depending on the instrument). With the EUT at the attitude of highest measured emissions, the emission spectra was investigated and recorded on a spectrum analyzer.

The applicable restricted emission limits, as noted in 47 CFR Part 15.205 were applied for transmitter Band-Edge testing. The operation of this EUT is limited to, and no emissions should be noted outside of the band of operation contained between 110 kHz and 495 kHz. The product was assessed to ensure that the fundamental transmission does not exceed the allowed band of operation.

2.1.4.5 Test Results

The EUT did not exhibit any emission within restricted frequency bands, as noted in 47 CFR Part 15.205. The operation of this device was contained between 110 kHz and 495 kHz.

CLIMATE TEST CONDITIONS

Temperature:	72 °F (22 °C)
Humidity:	40 % RH

Port Definition	Description/ Detail	Basic Standard	Performance Criteria	Pass / Fail
Enclosure	HID Prox Module Modular with 10cm tether cable To TA-500 Host ***Transmit Mode***	Radiated RF Emissions Band-Edge 47 CFR 15.205	9kHz-1.0 GHz RF Energy from the Fundamental transmission should not fall within the restricted band of operation.	Pass

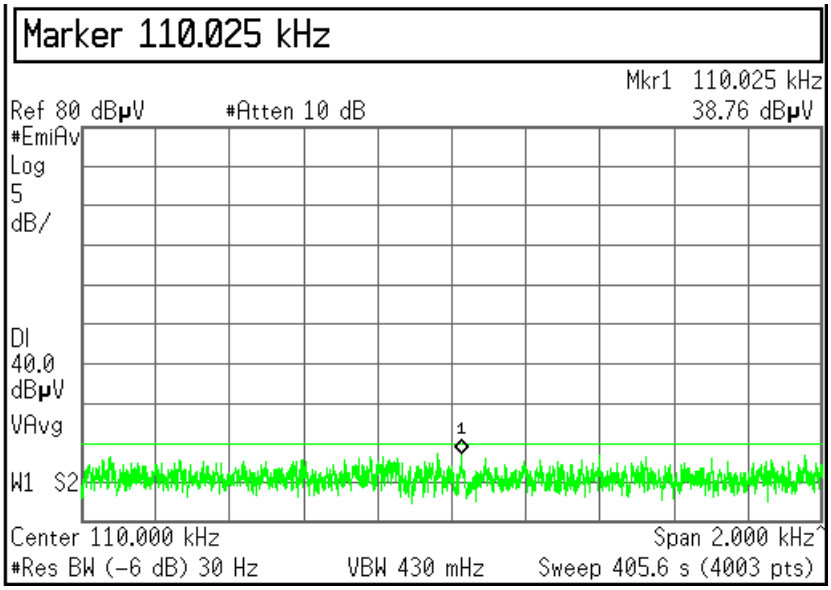

Figure 27: Emission signature at the Lower Band-Edge (shown with reduced bandwidth for better resolution)

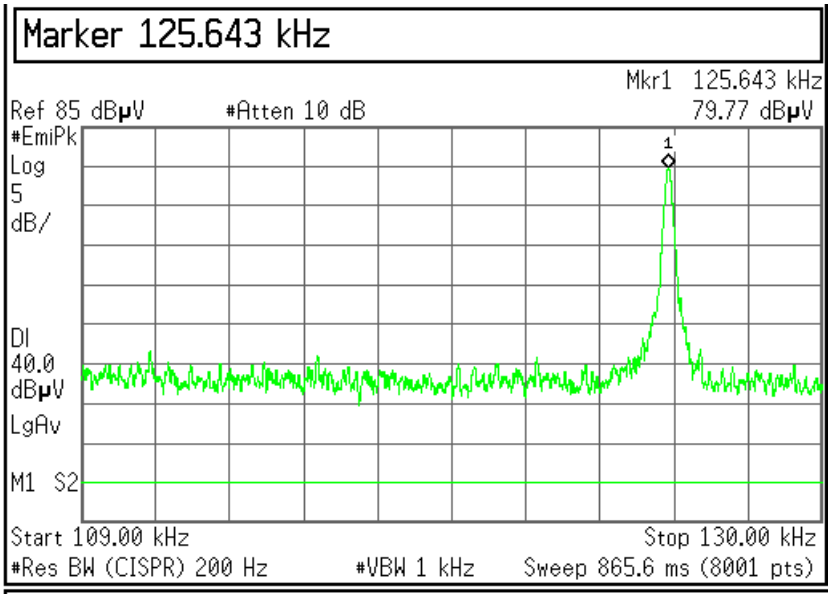

Figure 28: Emission signature showing fundamental and no other spurious emissions.

2.1.5 Conducted RF Performance Parameters – Conducted RF Power Output Measurements

Conducted RF Output Power measurements are not required, under part 15.209, for this transmitter.
No tests were performed.

2.1.6 Conducted RF Performance Parameters – Power Spectral Density Measurements

PSD measurements are not required, under part 15.209, for this transmitter.
No tests were performed.

2.1.7 Conducted RF Performance Parameters – Spurious RF Emission Measurements

Conducted Spurious Emission measurements are not required, under part 15.209, for this transmitter.
No tests were performed.

2.1.8 Conducted RF Performance Parameters – Carrier Frequency and RF Power Stability Measurements (Voltage and Temperature Variation)

Carrier Frequency Stability and RF Output Power Stability measurements are not required (no specified tolerances), under part 15.209, for this transmitter.
The EUT was tested by varying the AC Mains source between 85% and 115% of $V_{NOMINAL}$, and the performance of the EUT was monitored for any variations within the resolution of the test setup.

3.1 Electromagnetic Susceptibility Tests

There are no susceptibility requirements.
No susceptibility tests were performed on this product.

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Appendix A

A Ingenium Testing, LLC Applicable Accreditations.

THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

INGENIUM TESTING, LLC
Rockford, IL

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005*).

Presented this 24th day of January 2008.

President
For the Accreditation Council
Certificate Number 2674.01
Valid to February 28, 2010

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

INGENIUM TESTING, LLC
3761 South Central Avenue
Rockford, IL 61102
James Blaha 815 315 9250 x117

ELECTRICAL

Valid To: February 28, 2010 Certificate Number: 2674.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following electromagnetic compatibility tests:

Test	Test Method
Emissions	
Radiated Emissions	47 CFR FCC Part 15.109, 209, 225, 231, 247, 249 using ANSI C63.4; 47 CFR FCC Part 18 using ANSI C63.4; FCC/OST MP-5; EN 55011; CISPR 11; AS/NZS CISPR 11; EN 55012; CISPR 12; AS/NZS CISPR 12; EN 55014-1; CISPR 14-1; AS/NZS CISPR 14-1; EN 55022; CISPR 22; AS/NZS CISPR 22; EN 61000-6-3; IEC 61000-6-3; EN 61000-6-4; IEC 61000-6-4; AS/NZS 4268+A1/A2; AS/NZS 4251-1; AS/NZS 4251-2; MIL-STD 461(E) (*Methods: RE101, RE102, RE103*); RTCA/DO160 Section 21
Conducted Emissions	47 CFR FCC Part 15.107, 207 using ANSI C63.4; 47 CFR FCC Part 18 using ANSI C63.4; FCC/OST MP-5; EN 55011; CISPR 11; AS/NZS CISPR 11; EN 55012; CISPR 12; AS/NZS CISPR 12; EN 55014-1; CISPR 14-1; AS/NZS CISPR 14-1; EN 55022; CISPR 22; AS/NZS CISPR 22; AS/NZS 4268 +A1/A2; AS/NZS 4251-1; AS/NZS 4251-2; AS/NZS 4250-1; AS/NZS 4250-2; MIL-STD 461(E) (*Methods: CE101, CE102, CE106)*; RTCA/DO160 Section 21
Harmonics	EN 61000-3-2; IEC 61000-3-2; AS/NZS 61000-3-2
Flicker	EN 61000-3-3; IEC 61000-3-3; AS/NZS 61000-3-3
Immunity	
Electrostatic Discharge (ESD)	EN 61000-4-2; IEC 61000-4-2; AS/NZS 61000-4-2; RTCA/DO160 Section 25
Electrical Fast Transient/Burst	EN 61000-4-4; IEC 61000-4-4; AS/NZS 61000-4-4
Surge Immunity	EN 61000-4-5; IEC 61000-4-5; AS/NZS 61000-4-5
Radiated	EN 61000-4-3; IEC 61000-4-3; AS/NZS 61000-4-3; MIL-STD 461(E) (*Methods: RS101, RS103*); RTCA/DO160 Section 20

Test	Test Method
Immunity (cont'd)	
Conducted	EN 61000-4-6; IEC 61000-4-6; AS/NZS 61000-4-6; MIL-STD 461(E) (*Methods: CS101, CS103, CS104, CS105, CS109, CS114, CS115, CS116*); RTCA/DO160 Section 20
Power Frequency Magnetic Field	EN 61000-4-8; IEC 61000-4-8; AS/NZS 61000-4-8; RTCA/DO160 Section 15
Pulsed Magnetic Field	EN 61000-4-9; IEC 61000-4-9
Voltage Dips/Interrupts and Variations	EN 61000-11; IEC 6100-11; AS/NZS 61000-4-11; RTCA/DO160 Section 17
Power Input	RTCA/DO160 Section 16
Audio Frequency Conducted Susceptibility Power Inputs	RTCA/DO160 Section 18
Induced Signal Susceptibility	RTCA/DO160 Section 19
Lightning Inducted Transient	RTCA/DO160 Section 22
Generic and Product Family Standards	EN 61000-6-1; IEC 61000-6-1; AS/NZS 61000-6-1; EN 61000-6-2; IEC 61000-6-2; AS/NZS 61000-6-2; CISPR 14-2; EN 55014-2; AS/NZS CISPR 14-2; CISPR 24; EN 55024; AS/NZS CISPR 24; BS EN 60601-1-2; IEC 60601-1-2; BS EN 60947-1; IEC 60947-1; BS EN 60439-1; IEC 60439-1; BS EN 61326; IEC 61326; BS EN 50130-4; BS EN 50131-1; EN 61800-3, IEC 61800-3 (limited to 75A, 1000V); BS EN ISO 14892, ISO 14892 (using component methods except ISO-7637, ISO-11452-3)
Radio	
European Union	ETSI EN 300220-1 V2.1.1; ETSI EN 300 220-2 V2.1.1; ETSI EN 300 220-3 V1.1.1; ETSI EN 300 328 V1.7.1; ETSI EN 300 328-1 V1.3.1; ETSI EN 300 328-2 V1.2.1; ETSI EN 300 330 V1.2.1; ETSI EN 300 330-1 V1.5.1; ETSI EN 300 330-2 V1.3.1; ETSI EN 300 440-1 V1.3.1; ETSI EN 300 440-2 V1.1.2; ETSI EN 301 489-1 V1.7.1; ETSI EN 301 489-3 V1.4.1; ETSI EN 301 489-17 V1.3.1;
Canada	RSS-119; RSS-210; RSS-243; ICES-001; ICES-002; ICES-003
Telecommunications	47 CFR FCC Parts 2, 90, 95.628

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

June 12, 2008

Ingenium Testing, LLC
3761 South Central Avenue,
Rockford, IL 61102

Attention: James Blaha

Re: Accreditation of Ingenium Testing, LLC
Designation Number: US1107
Test Firm Registration #: 191720

Dear Sir or Madam:

We have been notified by American Association for Laboratory Accreditation that Ingenium Testing, LLC has been accredited as a Conformity Assessment Body (CAB).

At this time Ingenium Testing, LLC is hereby designated to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification under Parts 15 and 18 of the Commission's Rules.

This designation will expire upon expiration of the accreditation or notification of withdrawal of designation.

Sincerely,

George Tannahill

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tronics Engineer