



LS RESEARCH LLC

Wireless Product Development

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ENGINEERING TEST REPORT # 313086 A LSR Job #: C-1700

Compliance Testing of:

Queue Interface

Test Date(s):

July 23 and August 2, 14, 21 2013

Prepared For:

Scott Safety, A Division of Scott Technologies, Inc.
Attn: Craig Parkulo
Monroe Corporate Center
4320 Goldmine Road
Monroe, NC 28112-7355
USA

This Test Report is issued under the Authority of: Adam Alger, EMC Engineer

Signature: Date: 8-30-13

Test Report Reviewed by:

Khairul Aidi Zainal, Senior EMC Engineer / Lab Supervisor

Signature: Date: 8-23-13

Report by:

Adam Alger, EMC Engineer

Signature: Date: 8-23-13

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Prepared For: Scott Health & Safety-Division of Scott Technologies, Inc.	Name: Queue Interface
Report: TR 313086 A	Model: 201211
LSR: C-1700	Serial: none (engineering sample)

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LS Research, LLC in Review

As an EMC Testing Laboratory, our Accreditation and Assessments are recognized through the following:



TESTING CERT #1255.01

A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope of Accreditation
A2LA Certificate Number: 1255.01



Federal Communications Commission (FCC) – USA

Listing of 3 Meter Semi-Anechoic Chamber based on Title 47 CFR – Part 2.948
FCC Registration Number: 90756



Industrie Canada

Industry Canada



Industry Canada

On file, 3 Meter Semi-Anechoic Chamber based on RSS-212 – Issue 1

File Number: IC 3088-A

On file, 3 and 10 Meter OATS based on RSS-212 – Issue 1

File Number: IC 3088



U. S. Conformity Assessment Body (CAB) Validation

Validated by the European Commission as a U. S. Competent Body operating under the U. S./EU, Mutual Recognition Agreement (MRA) operating under the European Union Electromagnetic Compatibility –Council Directive 2004/108/EC (formerly 89/336/EEC, Article 10.2).

Date of Validation: January 16, 2001

Validated by the European Commission as a U.S. Notified Body operating under the U.S. /EU, Mutual Recognition Agreement (MRA) operating under the European Union Telecommunication Equipment – Council Directive 99/5/EC, Annex V.

Date of Validation: November 20, 2002

Notified Body Identification Number: 1243

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1.0 Summary of Test Report

In July and August 2013 the EUT, Queue Interface was tested and MEETS the following requirements:

FCC and IC Paragraph	Test Requirements	Compliance (Yes/No)
N/A	Bandwidth	Yes
FCC: 15.209 IC: RSS-GEN Section 7.2.5	Fundamental and Spurious Emissions below 30 MHz	Yes
FCC: 15.209 / 15.109 IC: RSS-GEN Section 6, 7.2.5	Radiated Emissions 30-1000 MHz (RFID transmitter Emissions / Receive / Digital Device)	Yes
FCC: 15.205 / 15.209 IC: RSS-GEN Section 7.2.2, 7.2.5	2.4 GHz Radio Harmonics in restricted bands (Co-location test)	Yes
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	N/A ⁽¹⁾

Note 1: Manufacturer declares EUT powered by DC battery only.

2.0 Test Facilities

All testing was performed at:

LS Research, LLC
W66 N220 Commerce Court
Cedarburg, Wisconsin, 53012 USA

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to the requirements of ISO/IEC 17025, 2005 "General Requirements for the Competence of Calibration and Testing Laboratories".

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted.

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3.0 Client Information

Manufacturer Name:	Scott Safety, A Division of Scott Technologies, Inc.
Address:	Monroe Corporate Center 4320 Goldmine Road Monroe, NC 28112-7355 USA
Contact Person:	Craig Parkulo

3.1 Equipment Under Test (EUT) Information

The following information has been supplied by the applicant.

Product Name:	Queue Interface
Model Number:	201211
Serial Number:	None (engineering sample)
FCC ID	T5E-201211
IC Number	6453A-201211

3.2 Product Description

Scott Emergency Management System (SEMS II) is a telemetry system for firefighter, capable of bidirectional communications with a base station (gateway). The Queue Interface is part of the firefighter telemetry system.

3.3 Modifications Incorporated In the EUT for Compliance Purposes

1. Added 1 μ F capacitor across the pins of J5 (DC Power Input)
2. Added muRata ferrite bead (BLM18AG221SN1) placed at pin 4 of U7 between pin 4 and C52

3.4 Deviations & Exclusions from Test Specifications

None noted at time of test

3.5 Additional Information

Manufacturer declares use of single 2.4 GHz channel of 2.405 GHz.

2.4 GHz radio programmed for continuous transmit and receive via serial to Ember redbox controller connected to a laptop with use of telnet commands. RFID did not require programming as it was configured for continuous (pulsed) mode as used in normal operation.

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4.0 Conditions of Test

Environmental:

Temperature: 20-25° C
Relative Humidity: 30-60%
Atmospheric Pressure: 86-106 kPa

Mains Voltage: 120VAC 60Hz
DC Supply: 12 VDC

5.0 Test Equipment

All test equipment is calibrated by a calibration laboratory accredited by A2LA to the requirements of ISO 17025. For a complete list of test equipment and calibration dates, see Appendix A. Unless otherwise noted, resolution bandwidth of measuring instrument used during testing for given frequency range, see below.

Frequency Range	Resolution Bandwidth
9 kHz – 150 kHz	100 Hz
150 kHz – 30 MHz	9 kHz
30 MHz – 1000 MHz	120 kHz
Above 1000 MHz	1 MHz

6.0 Conformance Summary

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.209 and 15.109, and Industry Canada RSS-GEN Issue 3.

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.

LS Research, 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.

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Appendix A – Test Equipment



Date : 23-Jul-2013

Type Test : Harmonic colocation

Job # : C-1700

Prepared By: Aidi

Customer : Tyco/Scott Health and Safety

Quote # : 313086

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/28/2013	5/28/2014	Active Calibration
2	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	2/11/2013	2/11/2014	Active Calibration
3	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	System	System	System
4	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/29/2013	1/29/2014	Active Calibration
5	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMC	WLA622-4 / 3160-09	123001	9/26/2012	9/26/2013	Active Calibration

Project Engineer: Aidi

Quality Assurance: None



Date : 23-Jul-2013

Type Test : Radiated Emissions 30-1000 MHz

Job # : C-1700

Prepared By: Adam

Customer : Tyco/Scott Health and Safety

Quote # : 313086

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	2/11/2013	2/11/2014	Active Calibration
2	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	2/11/2013	2/11/2014	Active Calibration
3	AA 960150	Bicon Antenna	ETS	3110B	0003-3346	12/12/2012	12/12/2013	Active Calibration
4	AA 960004	Log Periodic Antenna	EMCO	93146	9512-4276	9/17/2012	9/17/2013	Active Calibration

Project Engineer: Adam

Quality Assurance: None



Date : 23-Jul-2013

Type Test : Rad harmonics

Job # : C-1700

Prepared By: Adam

Customer : Tyco/Scott Health and Safety

Quote # : 313086

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/28/2013	5/28/2014	Active Calibration
2	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	1/29/2013	1/29/2014	Active Calibration
3	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	2/11/2013	2/11/2014	Active Calibration
4	EE 960146	Std. Gain Horn Ant. w/preamp	Adv. Micro / EMC	WLA622-4 / 3160-09	123001	9/26/2012	9/26/2013	Active Calibration
5	AA 960007	Double Ridge Horn Antenna	EMCO	3115	9311-4138	6/10/2013	6/10/2014	Active Calibration
6	EE 960013	EMI Receiver	HP	8546A System	3617A00320;3448A	2/11/2013	2/11/2014	Active Calibration
7	EE 960014	EMI Receiver-filter section	HP	85460A	3448A00296	2/11/2013	2/11/2014	Active Calibration

Project Engineer: Adam

Quality Assurance: None



Date : 23-Jul-2013

Type Test : Emissions Below 30 MHz

Job # : C-1700

Prepared By: Adam

Customer : Tyco/Scott Health and Safety

Quote # : 313086

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960073	Spectrum Analyzer	Agilent	E4446A	US45300564	5/28/2013	5/28/2014	Active Calibration
2	AA 960006	Active Loop Antenna	EMCO	6502	9205-2753	9/21/2011	9/21/2013	Active Calibration

Project Engineer: Adam

Quality Assurance: None

Prepared For: Scott Health & Safety-Division of Scott Technologies, Inc.	Name: Queue Interface
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LSR: C-1700	Serial: none (engineering sample)

Appendix B – Test Data

B.1 – Radiated Emissions

Rule Part(s)	FCC: 15.209 / 15.205 / 15.109 IC: RSS-GEN Section 7.2.5 / 7.2.2 / 6.0			
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 – 2009			
Test Location	LS Research, LLC - FCC Listed 3 meter Semi-Anechoic Chamber			
Test Distance	See data section			
EUT Placement	80 cm height non-conductive table above reference ground plane			
Frequency Range of Measurement	Loop Antenna: 9 kHz – 30 MHz	Biconical: 30-300 MHz	Log Periodic Dipole Array: 300-1000 MHz	Double-Ridged Waveguide Horn: 1-18 GHz
Measurement Detectors	RBW: 9-150 kHz: 100 Hz RBW: 150 kHz -30MHz: 9kHz Peak, Quasi-Peak, Average	30-1000MHz RBW: 120 kHz VBW: At least 300 kHz Peak, Quasi-Peak, Average	1 - 40 GHz: RBW: 1MHz VBW: 3(MHz) Peak 10 Hz Average	
Description of Measurement	<ol style="list-style-type: none"> 1) The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are preformed. The data is gathered and reported as the corrected values. 2) The EUT is placed on a non-conductive pedestal centered on a turn-table in the test location with the antenna at the test distance from the EUT 3) Above 30 MHz the maximum radiated RF emissions are determined by rotation of azimuth and scanning the sense antenna between 1 and 4 meters in height using both horizontal and vertical antenna polarities. Maximized levels are manually noted at degree values of azimuth and at sense antenna height. 4) Below 30 MHz the loop antenna was set at a 3 meter distance from the EUT with the center of the loop at 1 m above the ground plane. The loop was positioned in three orthogonal positions with maximum results reported. 			
Example Calculations	Reported Measurement data = Raw receiver measurement + Antenna Correction Factor + Cable factor (dB) - amplification factor (when applicable) + Additional factor (when applicable)			

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Model: 201211

LSR: C-1700

Serial: none (engineering sample)

FCC Part 15.209 / IC RSS-GEN Section 7.2.5 Limits:

Frequency (MHz)	Limit (μ V/m)	3 m Limit (dB μ V/m)	Distance	Type
0.009 - 0.490	2400/F(kHz)	128.5 - 93.8	300	Quasi-Peak / Average*
0.490 - 1.705	24000/F(kHz)	73.8 - 62.97	30	Quasi-Peak
1.705 - 30	30	69.54	30	Quasi-Peak

*Average Limit 9-90 and 110-490 kHz

Below 30 MHz distance correction = $40 * \log (300/3)$ or $40 * \log (30/3)$

Frequency (MHz)	3 m Limit (μ V/m)	3 m Limit (dB μ V/m)	Type
30-88	100	40.0	Quasi-Peak
88-216	150	43.5	Quasi-Peak
216-960	200	46.0	Quasi-Peak
Above 960	500	54.0	Average (>1 GHz)

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B.1.1 – Radiated Fundamental and Emissions below 30 MHz

Manufacturer	Scott Health & Safety-Division of Scott Technologies, Inc.
Date	8-2-13
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.209 / 15.109 / RSS-GEN
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	3 meter
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak
Additional Notes	<ul style="list-style-type: none"> 1) Peak emissions compared to applicable limits. 2) 127 kHz fundamental (RFID) tested in continuous pulsed transmission mode (normal operation) 3) Tested with 2.4 GHz radio in continuous transmit on single channel, continuous receive on single channel, and stand-by. No appreciable difference in emissions noted. Worst case reported.

Example Calculation:

FCC 15.209 Limit @ 3 meter (dB μ V/m) – Peak Reading (dB μ V/m) = Margin

Bandwidth

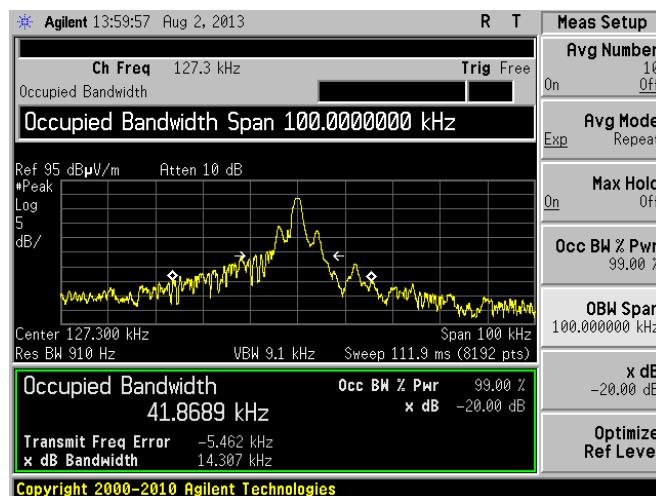
Frequency (kHz)	20 dB (kHz)	99 % (kHz)
127.3	14.31	41.86

Emissions

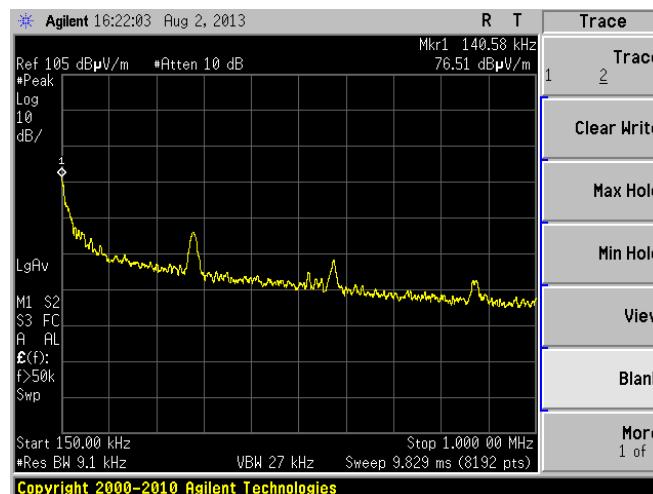
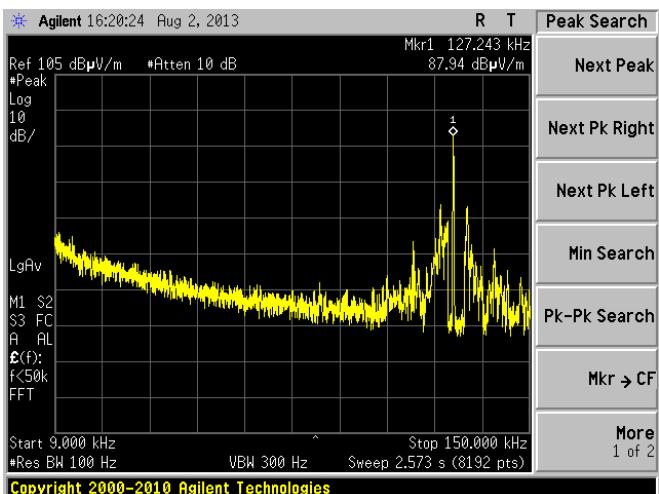
Frequency (kHz)	Antenna Orientation	Azimuth (Degree)	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin
127.3	Front	0	88.78	105.5	16.72
636.5	Front	0	53.97	71.53	17.56
891.1	Front	0	49.42	68.6	19.18
4705.8	Front	0	41.29	69.54	28.25

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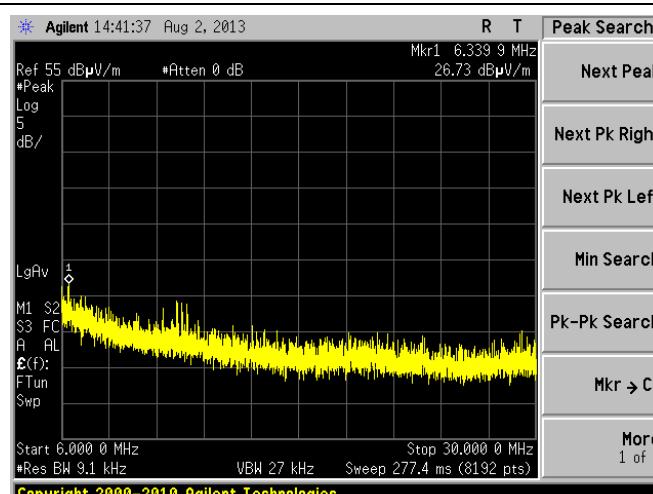
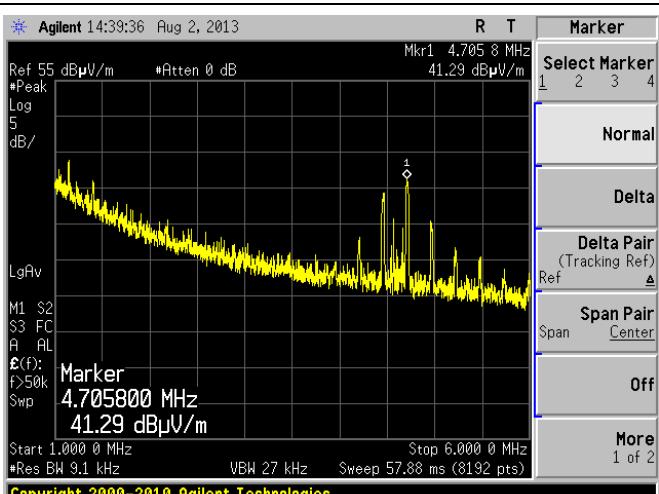
Plots



Bandwidth – 20 dB and 99%



9 – 150 kHz



1 – 6 MHz

6 – 30 MHz

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Name: Queue Interface
Model: 201211
Serial: none (engineering sample)

B.1.2 – Radiated Emissions 30-1000 MHz

Manufacturer	Scott Health & Safety-Division of Scott Technologies, Inc.
Date	8-14-13
Operator	Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.209 / 15.109 / RSS-GEN
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	3 meter
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak, Quasi-Peak
Additional Notes	1) Tested with 2.4 GHz radio in transmit and receive mode single channel with 127 kHz (RFID) in continuous (pulsed) operation (normal operation)

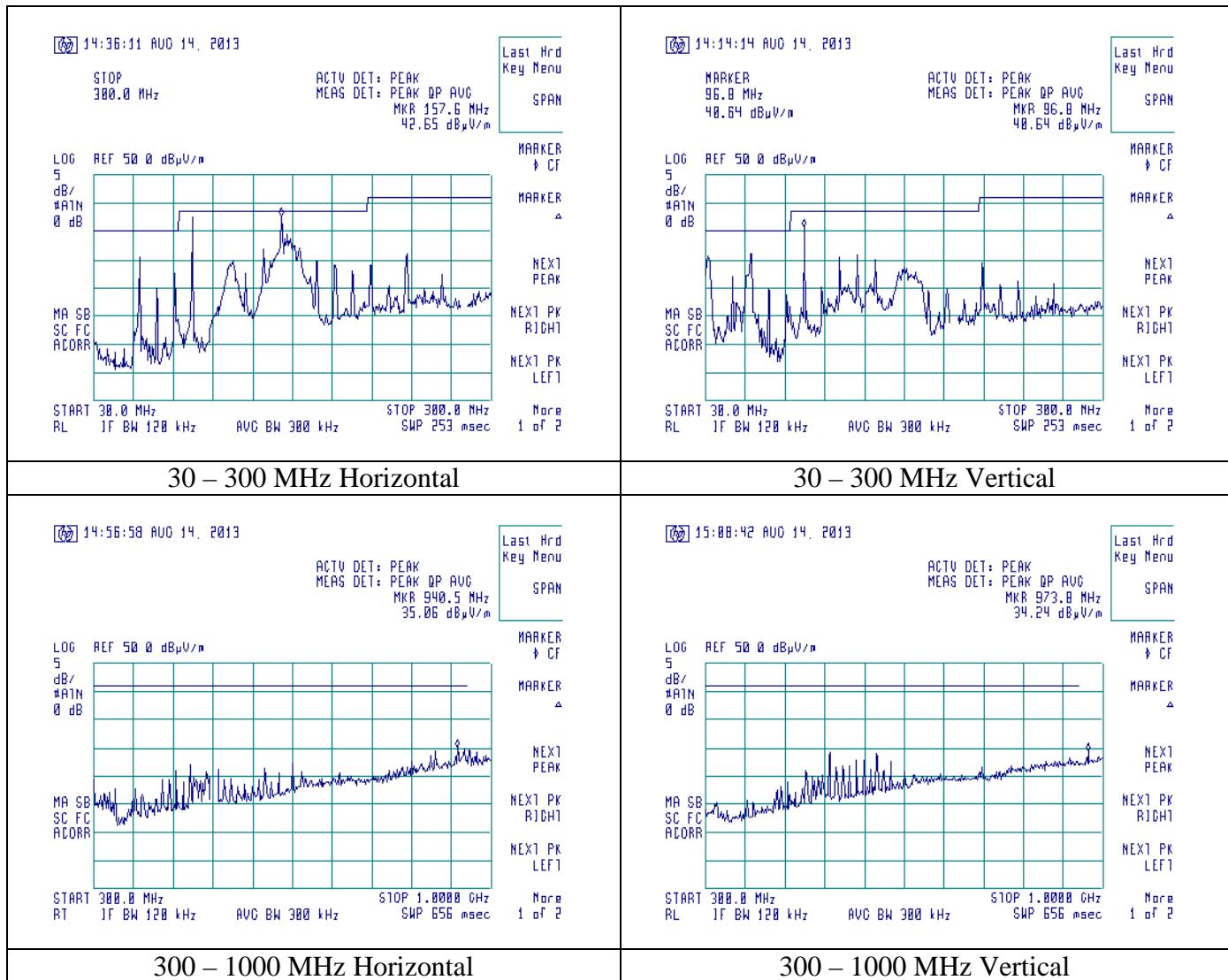
Example Calculation:

Quasi-Peak Limit @ 3 meter (dB μ V/m) – Quasi-Peak Reading (dB μ V/m) = Margin

Table

Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dB μ V/m)	Quasi Peak Limit (dB μ V/m)	Margin (dB)	Antenna Polarity
96.1	1.00	0	40.30	43.50	3.20	Vertical
132.0	1.00	97	36.40	43.50	7.10	Vertical
60.4	1.00	312	32.00	40.00	8.00	Vertical
144.6	1.00	105	33.00	43.50	10.50	Vertical
73.2	1.00	282	28.30	40.00	11.70	Vertical
48.2	1.00	0	29.40	40.00	10.60	Vertical
32.0	1.00	313	31.80	40.00	8.20	Vertical
216.0	1.00	0	33.50	46.00	12.50	Vertical
156.0	2.01	268	40.90	43.50	2.60	Horizontal
96.0	2.25	41	42.10	43.50	1.40	Horizontal
124.5	1.73	54	34.80	43.50	8.70	Horizontal
61.1	1.55	55	29.70	40.00	10.30	Horizontal
158.7	1.85	0	32.80	43.50	10.70	Horizontal
144.0	1.77	274	37.34	43.50	6.16	Horizontal

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B.1.3 – Radiated Emissions 1 – 25 GHz

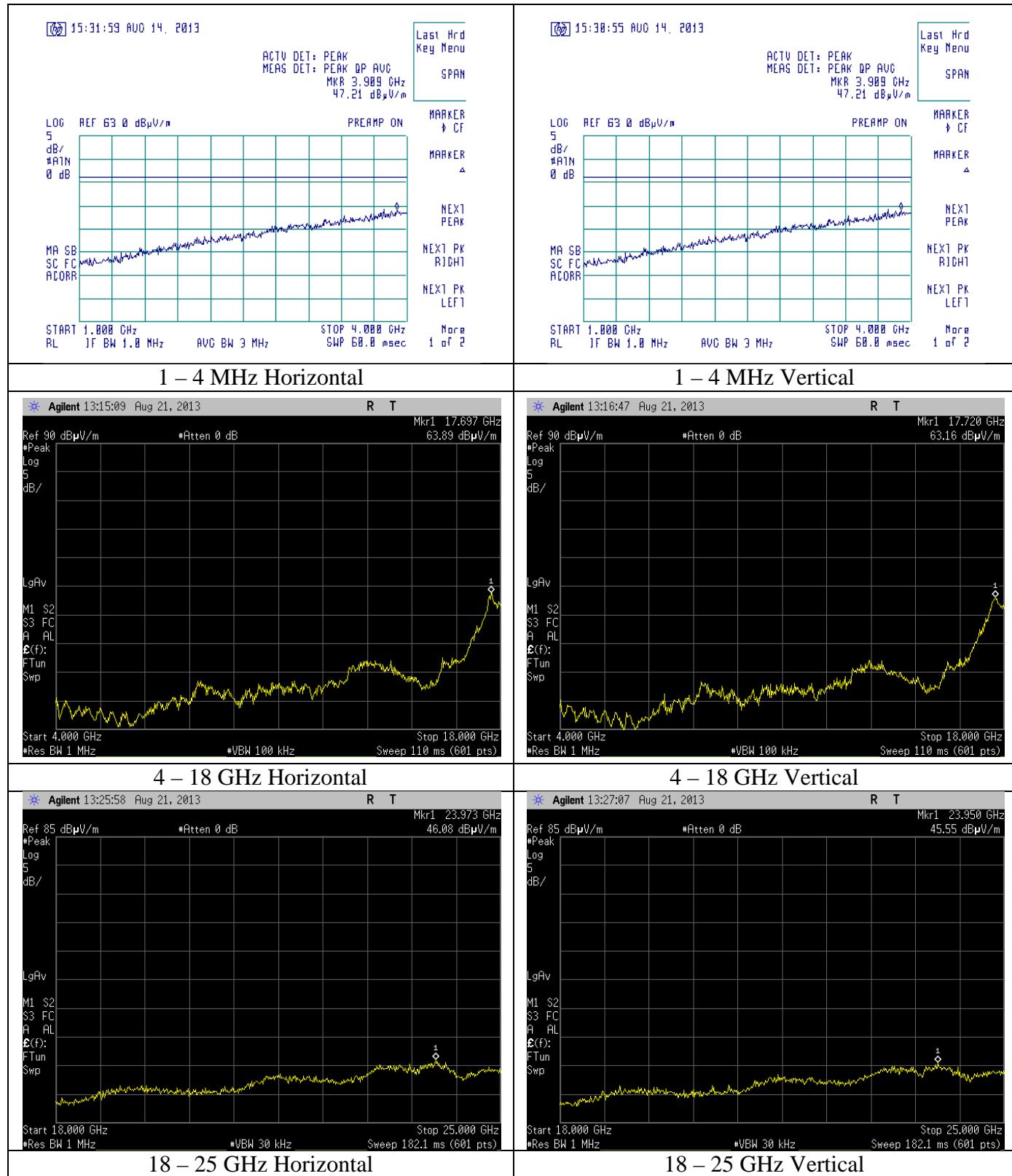
Manufacturer	Scott Health & Safety-Division of Scott Technologies, Inc.
Date	7-23, 8-14, 8-21 2013
Operator	Aidi / Adam A
Temp. / R.H.	20 - 25° C / 30-60% R.H.
Rule Part	15.209 / 15.109
Measurement Procedure	ANSI C63.4 - 2003 ANSI C63.10 - 2009
Test Distance	1-4 GHz (3 meter); 4-25 GHz (1 meter)
EUT Placement	80 cm height non-conductive table centered on turn-table
Detectors	Peak and Average
Additional Notes	<ol style="list-style-type: none">1) Tested with 127 kHz (RFID) in continuous (pulsed) operation (normal operation)2) Continuous receive mode single channel tested (no emissions found above system noise floor)3) Transmitter harmonics in restricted bands tested to ensure co-location of radios maintains compliance of emissions.

Example Calculation:

FCC 15.209 Average Limit @ 3 meter (dB μ V/m) – Average Reading (dB μ V/m) = Average Margin

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Receive Mode of 2.4 GHz Radio



Prepared For: Scott Health & Safety-Division of Scott Technologies, Inc.

Name: Queue Interface

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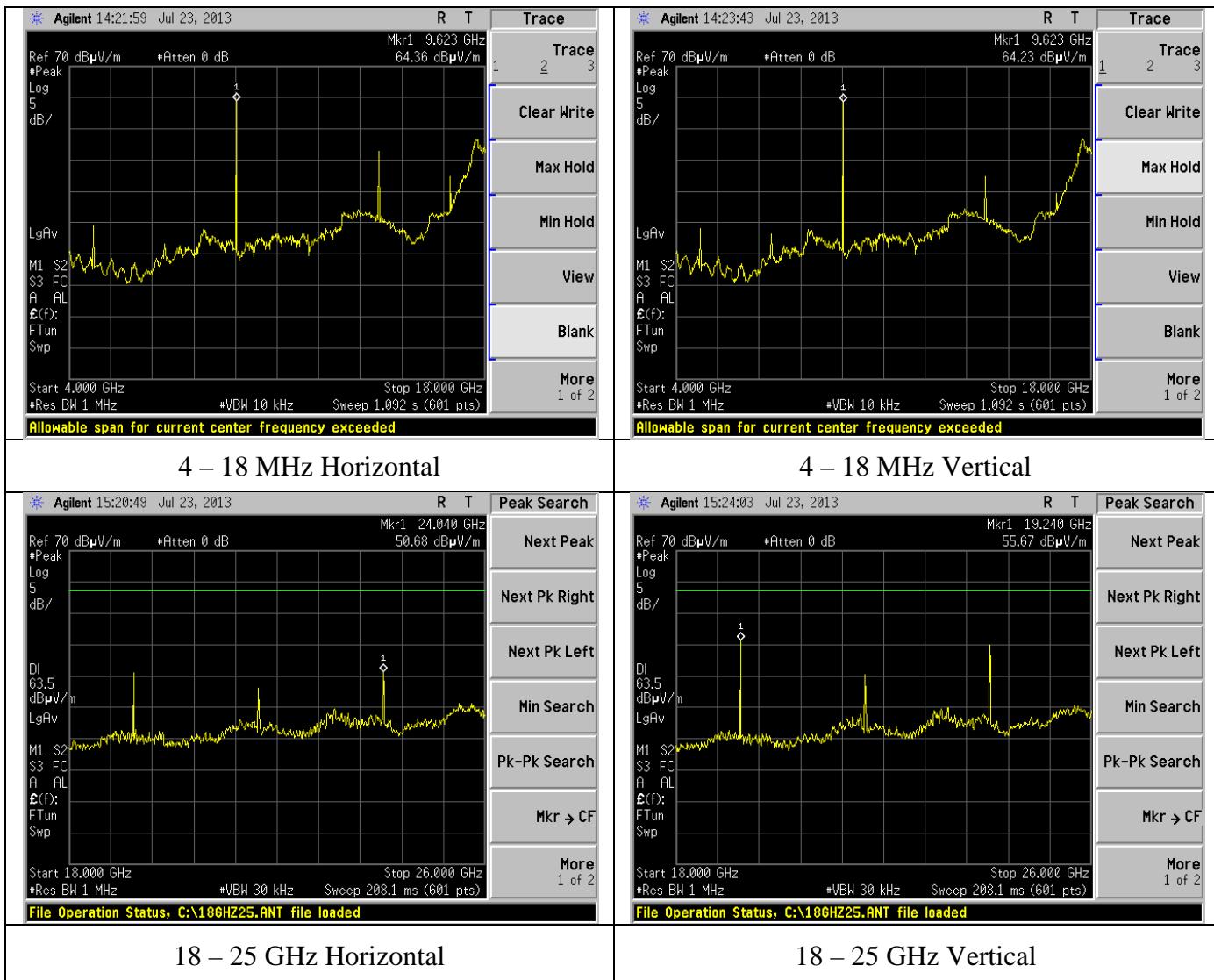
Model: 201211

LSR: C-1700

Serial: none (engineering sample)

Transmit Harmonics in restricted bands of 2.4 GHz radio

Frequency (MHz)	Antenna	EUT	Height (m)	Azimuth (°)	Peak	Average	limit	Margin
4810.00	H	V	1.00	178	51.9	47.9	63.5	15.6
4810.00	V	V	1.11	81	54.5	51.6	63.5	11.9
12025.00	H	V	1.23	296	52.9	47.5	63.5	16.0
12025.00	V	V	1.00	312	50.8	45.7	63.5	17.8
19240.00	H	V	1.00	98	58.2	56.2	63.5	7.3
19240.00	V	V	1.00	136	56.7	54.7	63.5	8.8



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B2 – AC Mains Conducted Emissions

Test Setup

The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210 and RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the EMI Receiver. The LISN used has the ability to terminate the unused port with a 50Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

Test Procedure

The EUT was investigated in continuous modulated transmit mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements was as specified for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dB μ V)		Measuring Bandwidth
	Quasi-Peak	Average	
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz
0.5 – 5.0	56	46	
5.0 – 30	60	50	

* The limit decreases linearly with the logarithm of the frequency in this range.

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Test Data

Test not applicable. Manufacturer declared unit only powered from vehicle battery only.

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Appendix C - Uncertainty Summary

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.82 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.88 dB
Radiated Emissions	3-Meter Chamber, Horn Antenna	4.85 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.32 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.63 dB
Absolute Conducted Emissions	Agilent PSA/ESA Series	1.38 dB
AC Line Conducted Emissions	Shielded Room/EMCO LISN	3.20 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	2.05 Volts/Meter
Conducted Immunity	3 Volts level	2.33 V
EFT Burst, Surge, VDI	230 VAC	54.4 V
ESD Immunity	Discharge at 15kV	3200 V
Temperature/Humidity	Thermo-hygrometer	0.64°/ 2.88 %RH

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Appendix D - References

Publication	Year	Title
FCC CFR Parts 0-15	2013	Code of Federal Regulations – Telecommunications
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.
RSS-GEN Issue 3	2010	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.10	2009	American National Standard for Testing Unlicensed Wireless Devices

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Report: TR 313086 A	Model: 201211
LSR: C-1700	Serial: none (engineering sample)

END OF REPORT

Date	Version	Comments	Person
8-23-13	V0	Initial Draft Release	Adam A
8-26-13	V1	Final Release	Adam A
8-30-13	V2	Added below 30 MHz equipment sheet, Clarified test distance in section B.1.3	Adam A

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