

TEST REPORT

Report Number: 101325174MPK-001

Project Number: G101325174

September 27, 2013

**Testing performed on the
Qolsys IQSmartSocket
Model: IQSmartSocket
FCC ID: 2AAJXQS2100
IC: 11205A-QS2100
to**

**FCC Part 15.249
RSS-210, Annex 2.9
FCC Part 15, Subpart B
Industry Canada ICES-003**

**for
Qolsys, Inc.**

Test Performed by:

Intertek
1365 Adams Court
Menlo Park, CA 94025 USA

Test Authorized by:

Qolsys, Inc.
2011 Stevens Creek Blvd., Suite 280
Cupertino, CA 95014 USA

Prepared by:


Anderson Soungpanya

Date: September 27, 2013

Reviewed by:


Krishna K Vemuri

Date: September 27, 2013

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Report No. 101325174MPK-001

Equipment Under Test:	Qolsys IQSmartSocket
Trade Name:	Qolsys, Inc.
Model Number:	IQSmartSocket
Serial Number:	QSGX130100011, QSGX123S00025
Applicant:	Qolsys, Inc.
Contact:	Mark Skeen
Address:	Qolsys, Inc. 20111 Stevens Creek Blvd., Suite 280 Cupertino, CA 95014
Country	USA
Tel. Number:	408-857-8415
Email:	mark.skeen@qolsys.com
Applicable Regulation:	FCC Part 15.249 RSS-210, Annex 2.9 FCC Part 15, Subpart B Industry Canada ICES-003
Date of Test:	September 09 to 11, 2013

We attest to the accuracy of this report:



Anderson Soungpanya
Project Engineer



Krishna K Vemuri
EMC Senior Staff Engineer

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1.0 Summary of Tests

TEST	REFERENCE FCC Part 15C	REFERENCE IC RSS-210/ RSS-Gen	RESULT
Field Strength of Fundamental	15.249a	A2.9(1) RSS-210	Complies
Field Strength of Harmonics	15.249a	A2.9(1) RSS-210	Complies
Radiated Emissions outside the band	15.249c	A2.9(2) RSS-210	Complies
Occupied Bandwidth	15.215(c)	4.4.1 RSS-Gen	Complies
Line Conducted Emissions	15.207	7.2.2 RSS-Gen	Complies
Antenna requirement	15.203	7.1.4 RSS-Gen	Complies
Radiated and Conducted Emissions from Digital Part and receiver	FCC 47CFR 15B	ICES 003	Complies

2.0 General Description

2.1 Product Description

The Equipment Under Test (EUT) is the Qolsys IQSmartSocket, model: IQSmartSocket, is an accessory to an IQ Panel, which is a combination wireless home security, life safety, and home automation system. The EUT consists of one Zwave radio.

The IQSmartSocket was directly powered by 120VAC/60Hz mains.

Information about the Zwave radio is presented below:

Applicant name & address	Qolsys, Inc. 20111 Stevens Creek Blvd., Suite 280 Cupertino, CA 95014 USA
Manufacturer name & address	HONG FU JIN PRECISION INDUSTRY (SHENZHEN) CO., LTD 10TH YOUSONG INDUSTRIAL DISTRICT, 2ND DONGHUAN RD NO 2, BAO'AN LONGHUA TOWN, SHENZHEN GUANGDONG 518109 CHINA
Model No.	IQSmartSocket
FCC Identifier	2AAJXQS2100
IC	11205A-QS2100
Frequency Range	908.4MHz and 908.42MHz
Rated RF Output	80.5 dB(μ V/m) at 3m
Number of Channel(s)	2
Type of Modulation	FSK
Data Rate	40Kbps for 908.4MHz Channel 9.6 Kbps for 908.42MHz Channel
Antenna(s) & Gain	-3dBi quarter wavelength dipole PCB wire antenna

EUT receive date: September 09, 2013

EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.

Test start date: September 09, 2013

Test completion date: September 11, 2013

The test results in this report pertain only to the item tested.

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "Data Sheet" of this report. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

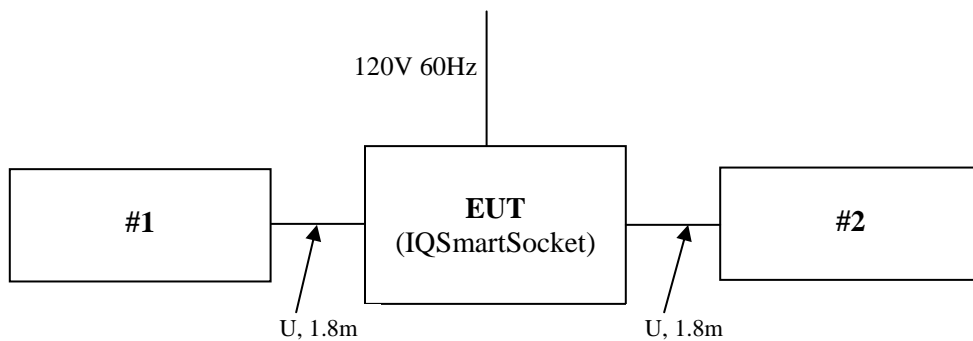
Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-
Radiated emissions	4.2 dB	3.4 dB	4.4 dB
AC mains conducted emissions	2.4 dB	-	-

3.0 System Test Configuration

3.1 Support Equipment and description

Item #	Description	Model No.	Serial No.
1	Workforce Light Fixture	265669	Not Labeled
2	Workforce Light Fixture	L-18	Not Labeled

3.2 Block Diagram of Test Setup



S = Shielded	F = With Ferrite
U = Unshielded	M = Meter

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT is attached to peripherals and they are connected and operational (as typical as possible). The EUT is wired to transmit full power. During testing, all cables are manipulated to produce worst-case emissions.

Highest Clock or Oscillator Frequency used is 40MHz; therefore Radiated Emissions from Digital Parts need only be tested up to 1000MHz.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

3.5 Mode of operation during test

During the test the EUT was set to transmit the modulated signal with 100% duty cycle.

3.6 Modifications required for Compliance

No modifications were installed by Intertek during compliance testing in order to bring the product into compliance.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Transmitter Radiated Emissions

FCC Rules: 15.249, 15.209; IC Rules: RSS-210 (A2.9), RSS-Gen

Requirements

The Field Strength of emissions at a distance of 3 meters shall not exceed the following levels:

94 dB(μ V/m) for fundamental frequency,

54 dB(μ V/m) for harmonics.

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

Procedure

Radiated emission measurements were performed from 30 MHz to 10 GHz according to the procedure described in ANSI C64.10. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak measurements were performed.

Radiated emissions are taken at 10 meters for frequencies below 1 GHz and at 3 meters for frequencies above 1 GHz

The EUT is placed on a plastic turntable that is 80 cm in height. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Test was performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage as per FCC Rule 15.31(e).

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.



Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$FS = RA + AF + CF - AG$; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(μ V/m)

RA = Receiver Amplitude (including preamplifier) in dB(μ V); AF = Antenna Factor in dB(1/m)

CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μ V) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μ V/m). This value in dB(μ V/m) was converted to its corresponding level in μ V/m.

RA = 52.0 dB(μ V)

AF = 7.4 dB(1/m)

CF = 1.6 dB

AG = 29.0 dB

FS = $52.0 + 7.4 + 1.6 - 29.0 = 32$ dB(μ V/m).

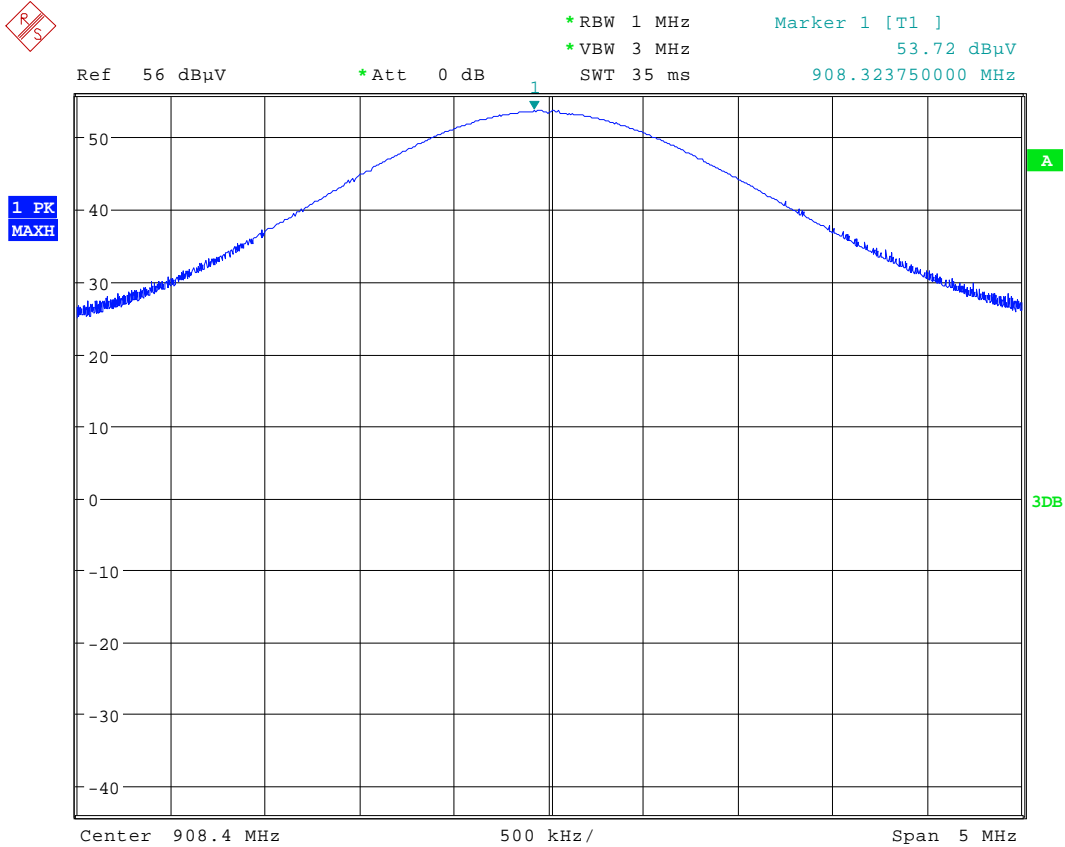
Level in μ V/m = Common Antilogarithm [$(32 \text{ dB}\mu\text{V/m})/20$] = 39.8 μ V/m.

Test Result

The data below shows the significant emission frequencies, the limit and the margin of compliance.

The EUT passed 13.5dB.

Radiated emissions at fundamental frequency



Transmitter Output Power
 Date: 9.SEP.2013 21:05:11

The Field Strength of Fundamental at a distance of 3 meters is 80.5 dBµV (margin to Fundamental frequency Field Strength limit by 13.5dB).

Note: RA = 53.7 dB(µV)

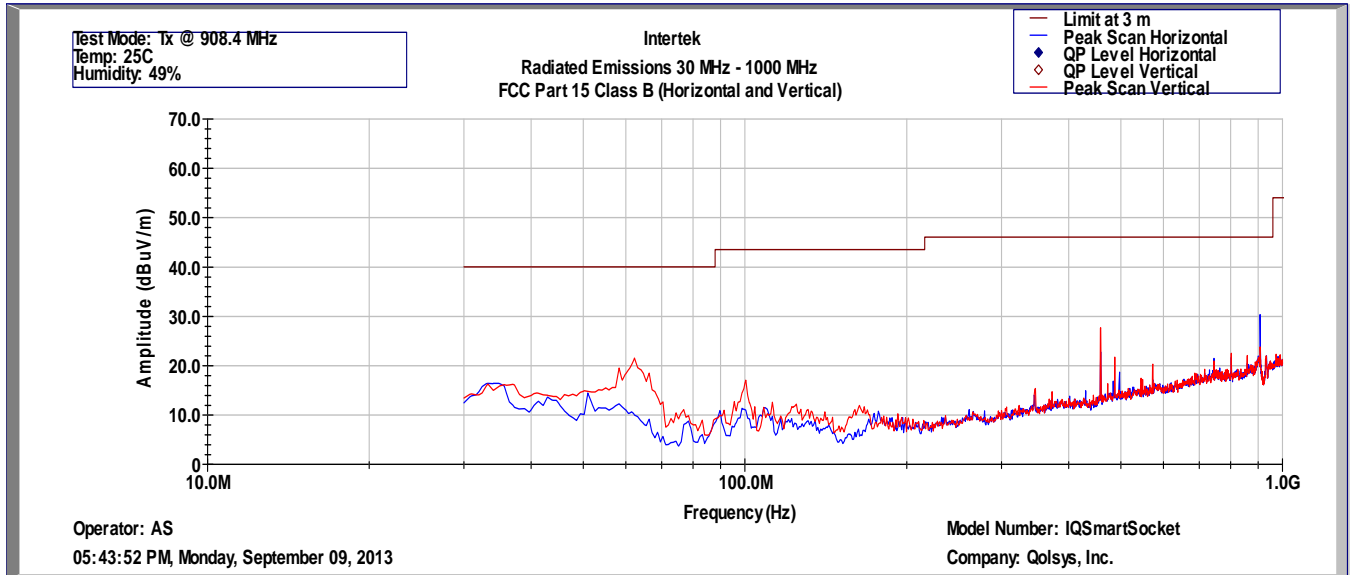
AF = 23.20 dB(1/m)

CF = 3.6 dB

FS = 53.7+23.2+3.6= 80.5 dB(µV/m).

Note: The supply voltage was varied between 85% and 115% of the nominal rated Voltage. No Fundamental frequency Field Strength variation was observed.

Transmitter Radiated Emissions below 1GHz



Plot 1: Spurious Emissions, 30MHz to 1GHz, Peak

Intertek Testing Services
Radiated Emissions 30 MHz- 1000 MHz
FCC Part 15 Class B (Peak)

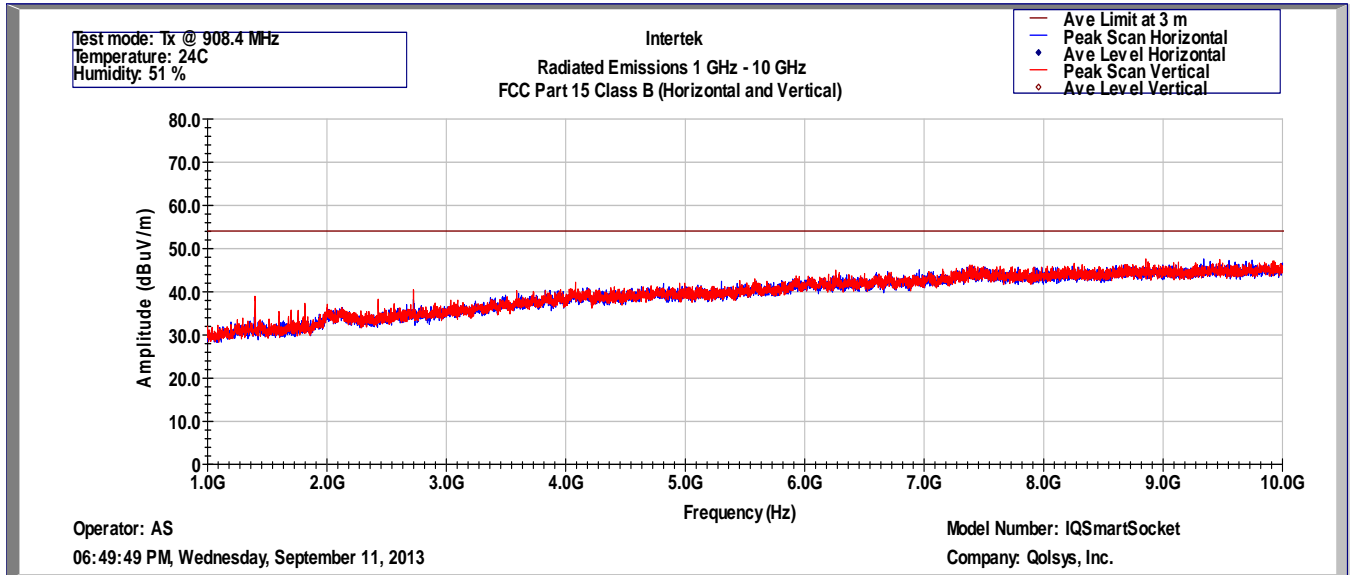
Operator: AS
9-Sep-13

Model Number: IQSmartSocket
Company: Qolsys, Inc.

Frequency (Hz)	Peak FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA db(uV)	CF dB	AG dB	AF dB(1/m)	Polarization
6.233E+07	21.6	40.0	-18.4	43.5	0.6	32.1	9.6	V
1.003E+08	16.9	43.5	-26.6	37.5	0.7	32.1	10.8	V
4.592E+08	27.8	46.0	-18.2	40.8	1.7	32.0	17.3	V
4.875E+08	21.8	46.0	-24.2	34.6	1.7	32.1	17.6	V
9.087E+08	23.9	46.0	-22.1	30.4	2.4	31.6	22.7	V
9.733E+08	22.3	54.0	-31.7	28.0	2.5	31.1	22.9	V
3.323E+07	16.4	40.0	-23.6	29.7	0.4	32.1	18.4	H
1.084E+08	11.5	43.5	-32.0	31.9	0.8	32.1	10.9	H
4.592E+08	22.9	46.0	-23.1	35.9	1.7	32.0	17.3	H
9.087E+08	30.4	46.0	-15.6	36.9	2.4	31.6	22.7	H

Test Mode: Tx @ 908.4 MHz
Temp: 25C
Humidity: 49%

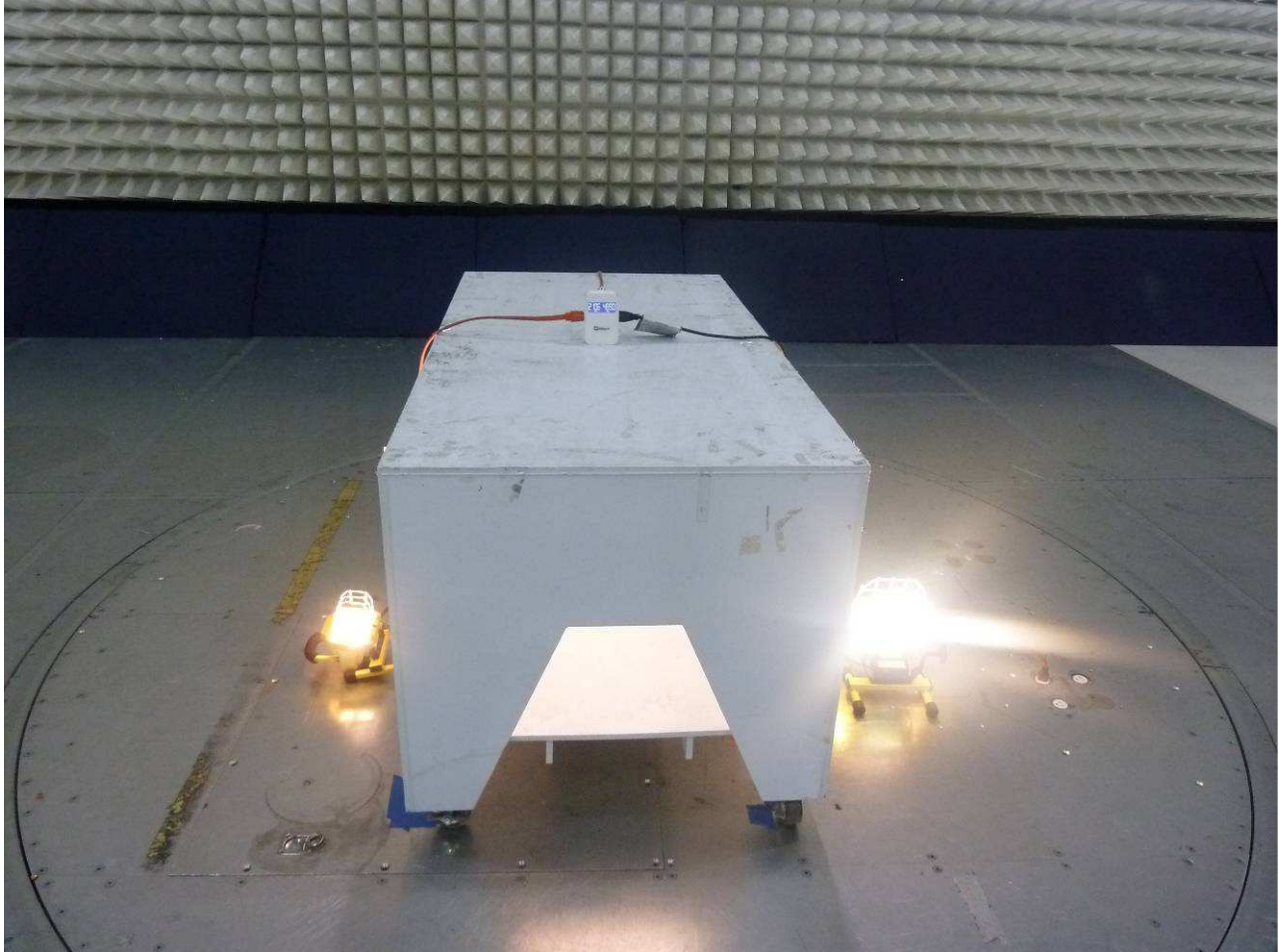
Transmitter Radiated Emissions above 1GHz



Plot 2: Spurious Emissions, 1GHz to 10GHz, Peak (RBW=1MHz and VBW=3MHz)
 ** Peak FS < Average FS Limit [54 dB(uV/m)]

Test setup photographs

The following photographs show the testing configurations used.



Test setup photographs (Continued)



4.2 Occupied Bandwidth
FCC Rules: 15.215(c); IC Rules: RSS-Gen

Requirements

No limits for 20 dB Bandwidth and Occupied Bandwidths.

Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 20 dB lower than PEAK level. The 20 dB bandwidth was determined from where the channel output spectrum intersected the marker delta.

The occupied bandwidth was measured using the built-in spectrum analyzer function for 99% power bandwidth measurement.

Test Results

Frequency MHz	20-dB bandwidth kHz	Occupied bandwidth kHz
908.4	161.4	146.9



Occupied Bandwidth

Date: 9.SEP.2013 21:14:16

Plot 1: 20dB Bandwidth & 99% Bandwidth

4.3 Radiated Emissions from Digital Parts
FCC Ref: 15.109

Requirements

*Limits for Electromagnetic Radiated Emissions, FCC Section 15.109(b) and ICES 003 **

Frequency (MHz)	Class A at 10m dB(μV/m)	Class B at 3m dB(μV/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4.

Example Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor to from the measured reading, followed by subtracting the Amplifier Gain (if any) and Distance Correction Factor (if any). The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - PA - DCF$$

Where

FS = Field Strength in dB ($\mu\text{V}/\text{m}$)

RA = Receiver Amplitude (including preamplifier) in dB (μV)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB (1/m)

AG = Amplifier Gain in dB

DCF=Distance Correction Factor in dB

(Formula: $DCF = 20\log_{10}(\text{measurement distance}/\text{specification distance})$)

Assume a receiver reading of 52.0 dB (μV) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB and DCF of 10.5 dB (DCF in this example: $20\log_{10}(10/3)$) is subtracted, giving field strength of 21.5 dB ($\mu\text{V}/\text{m}$).

$$RA = 52.0 \text{ dB } (\mu\text{V})$$

$$AF = 7.4 \text{ dB } (1/\text{m})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$DCF=10.5 \text{ dB}$$

$$FS = RF + AF + CF - AG - DCF$$

$$FS = 52.0 + 7.4 + 1.6 - 29.0 - 10.5$$

$$FS = 21.5 \text{ dB } (\mu\text{V}/\text{m})$$

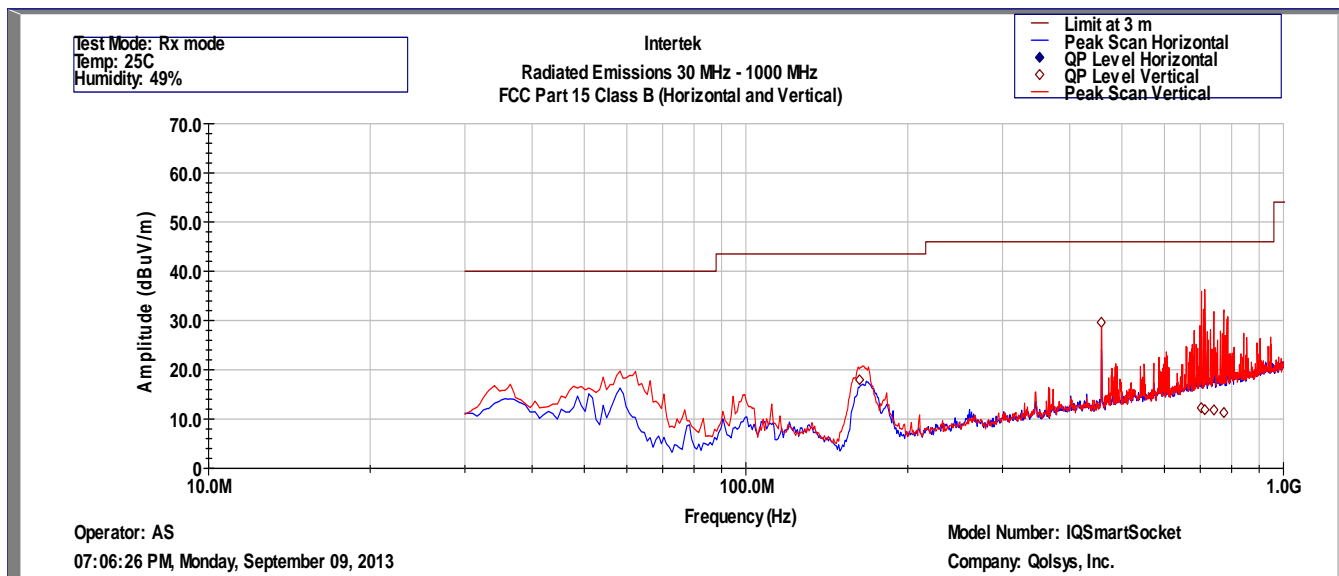
Test Results

Radiated emission measurements were performed from 30 MHz to 1000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater below 1000 MHz and 1 MHz - above 1000 MHz.

The EUT passed 16.3dB for Class B.



FCC and ICES 003, Radiated Disturbance



Intertek Testing Services
 Radiated Emissions 30 MHz- 1000 MHz
 FCC Part 15 Class B (QP)

Operator: AS
 9-Sep-13

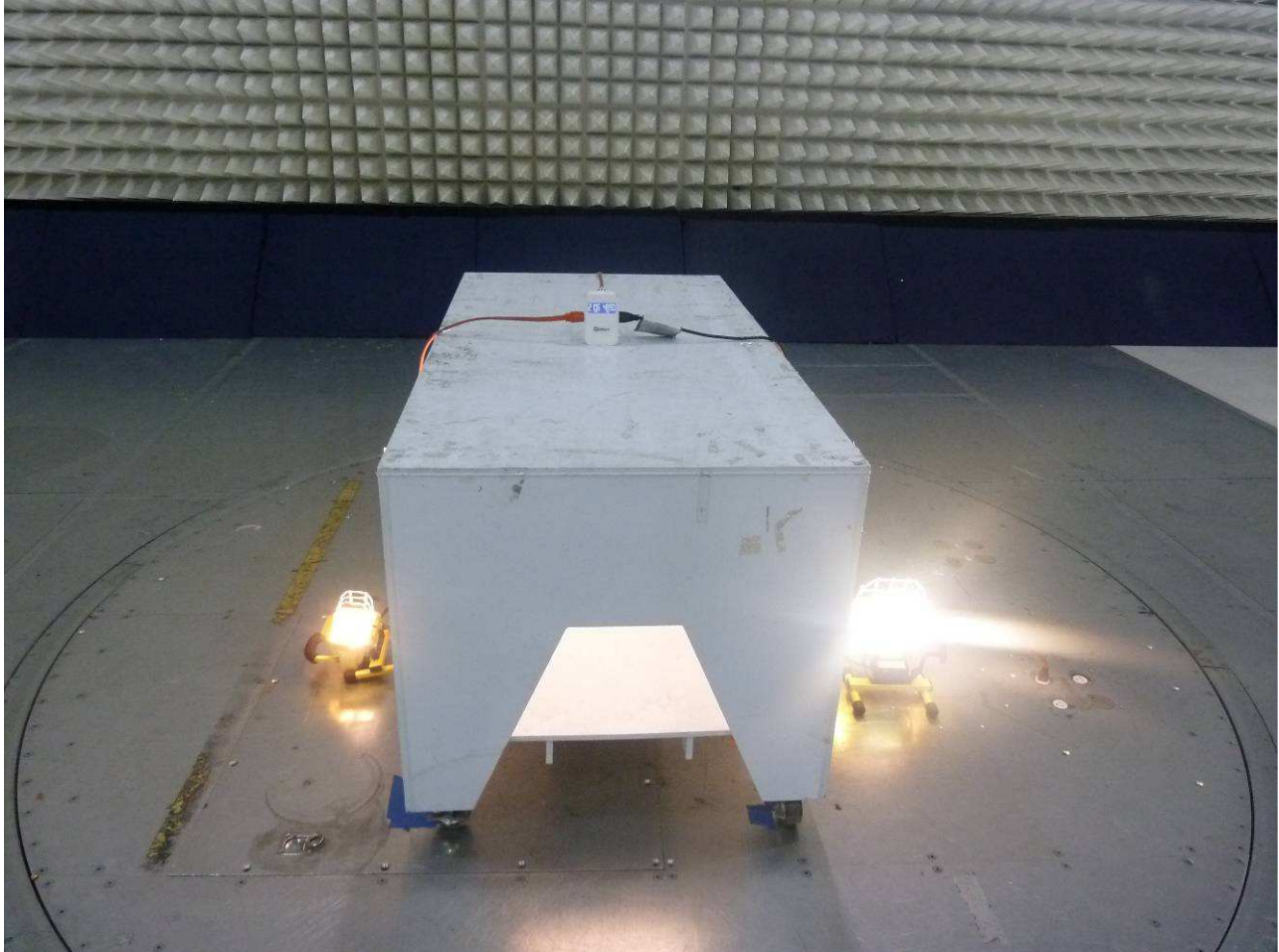
Model Number: IQSmartSocket
 Company: Qolsys, Inc.

Frequency (Hz)	Peak FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA db(uV)	CF dB	AG dB	AF dB(1/m)	Polarization
1.627E+08	18.0	43.5	-25.5	40.2	1.0	32.0	8.8	V
4.582E+08	29.7	46.0	-16.3	42.8	1.7	32.0	17.2	V
7.032E+08	12.3	46.0	-33.7	22.1	2.1	32.3	20.4	V
7.138E+08	11.9	46.0	-34.1	21.2	2.1	32.3	20.9	V
7.420E+08	11.8	46.0	-34.2	21.1	2.2	32.3	20.8	V
7.745E+08	11.3	46.0	-34.7	20.4	2.2	32.2	20.9	V

Test Mode: Rx mode
 Temp: 25C
 Humidity: 49%

Test setup photographs

The following photographs show the testing configurations used.



Test setup photographs (Continued)



4.4 Line Conducted Emissions
 FCC Rules: 15.207; IC Rules: RSS-Gen
 FCC Rules: 15.107; IC Rules: ICES 003

Requirements

Frequency Band MHz	Class B Limit dB(μV)	
	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *
0.50-5.00	56	46
5.00-30.00	60	50

*Note: *Decreases linearly with the logarithm of the frequency
 At the transition frequency the lower limit applies.*

Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

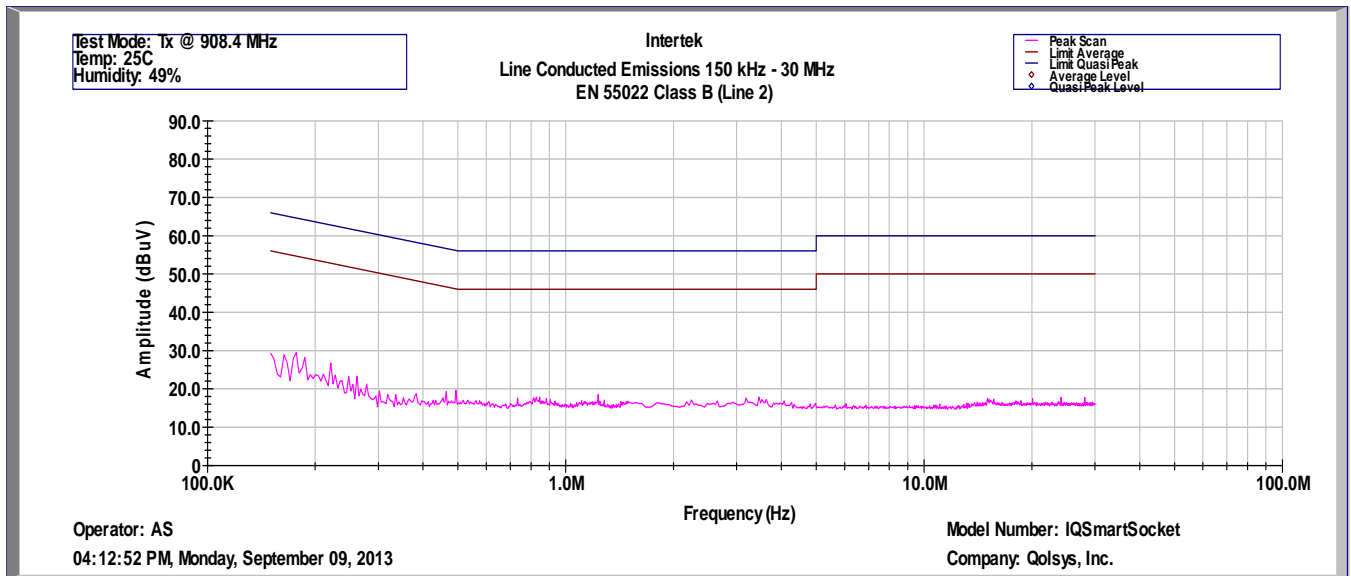
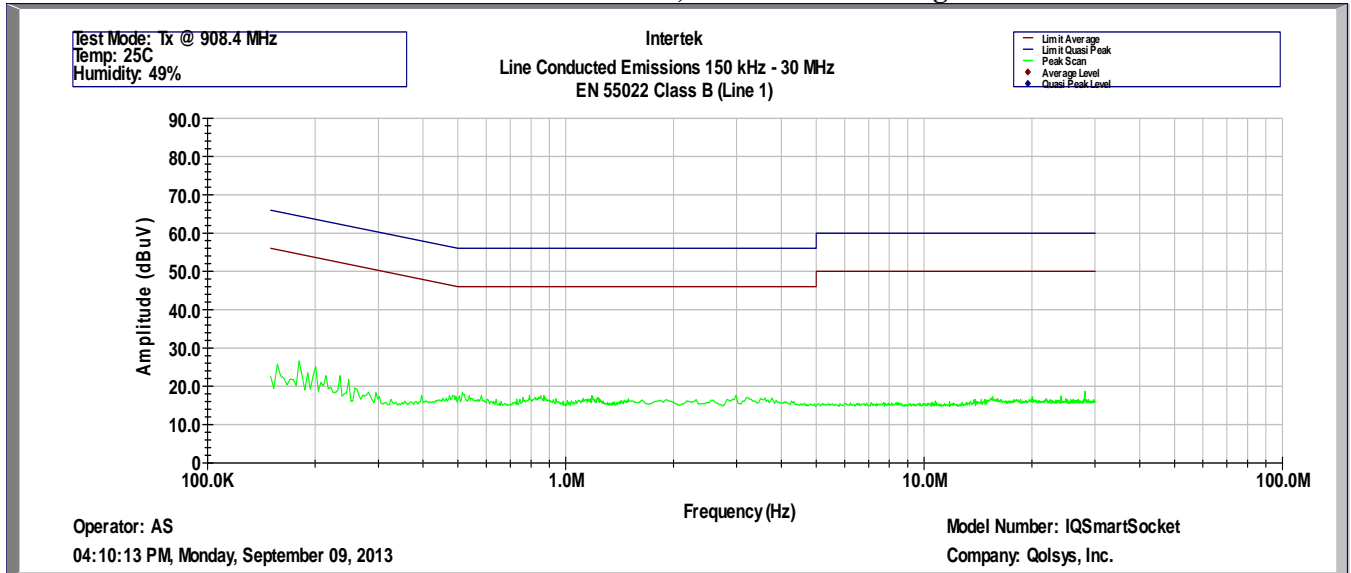
The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

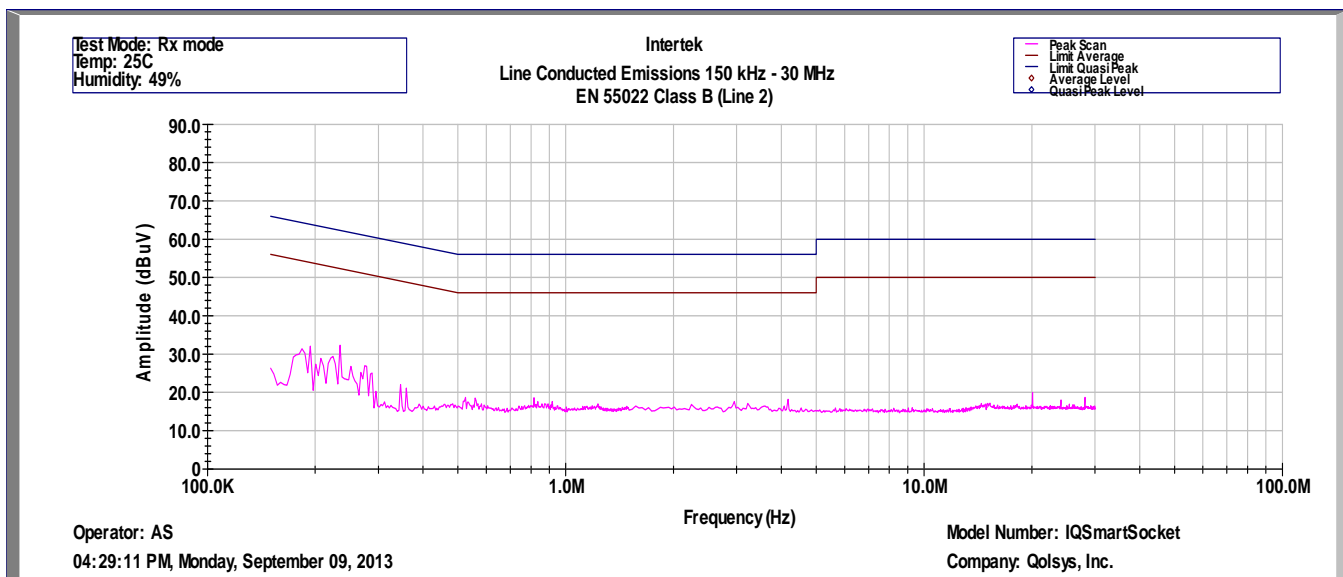
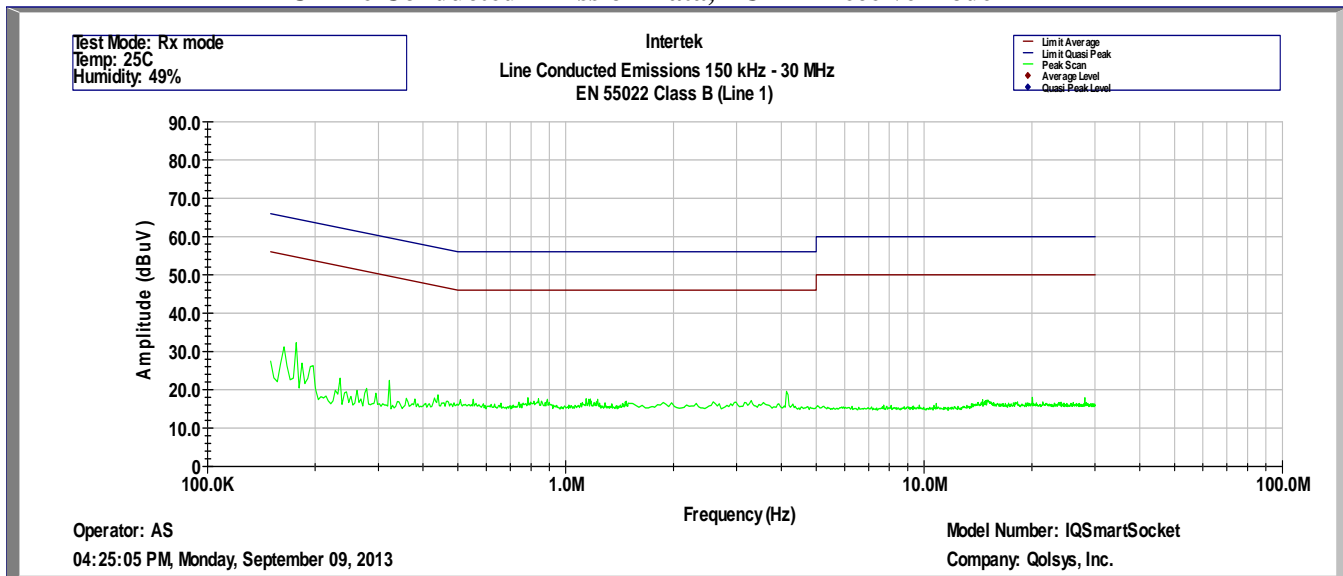
Test Result

AC Line Conducted Emission Data, EUT in transmitting mode



Results Complies by 25.5dB

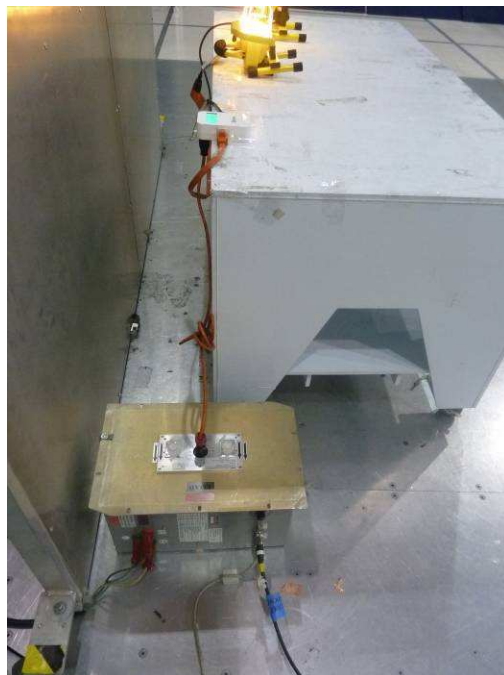
AC Line Conducted Emission Data, EUT in Receive mode



Results Complies by 22.8dB

Test setup photographs

The following photographs show the testing configurations used.



5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	03/12/14
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	03/12/14
BI-Log Antenna	ARA	LPB-2513/A	1154	12	08/01/14
Pre-Amplifier	Sonoma	310	293620	12	11/20/13
LISN	FCC	FCC-LISN-50-50-M-H	2011	12	02/28/14
Spectrum Analyzer	Rohde and Schwartz	FSP	100030	12	11/19/13
Horn Antenna	ETS Lindgren	3115	00126795	12	11/15/13
Pre-Amplifier (1-18GHz)	Miteq	AMF-4D-001180-24-10P	799159	12	09/27/13
Spectrum Analyzer	Rohde and Schwarz	FSU	200482	12	04/05/14

No Calibration required

6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 101325174	AS	September 27, 2013	Original document