

## TEST REPORT

**Report Number: 101712159MPK-001**

**Project Number: G101712159**

**July 17, 2014**

**Testing performed on  
TripSaver II Controller  
Model: TSII-CONTRL  
FCC ID: U3D-TSIICONTRL  
IC: 5349C-TSIICONTRL**

**to**

**FCC Part 15 Subpart C (15.247)  
Industry Canada RSS-210 Issue 8, Annex 8  
FCC Part 15, Subpart B  
Industry Canada ICES-003**

**For**

**S&C Electric Company**

Test Performed by:

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Test Authorized by:

S&C Electric Company

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**Date:** July 17, 2014

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Krishna K Vemuri

**Date:** July 17, 2014

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## Report No. 101534046MPK-001A


<b>Equipment Under Test:</b>	TripSaver II Controller
<b>Trade Name:</b>	TripSaver II Controller
<b>Model Number:</b>	TSII-CONTRL
<b>Serial Numbers:</b>	00110017.00001591 (Radiated Sample) 00110017.00001590 (Conducted Sample)
<b>Applicant:</b>	S & C Electric Company
<b>Contact:</b>	Muhammad Tabani
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<b>Applicable Regulation:</b>	FCC Part 15 Subpart C (15.247) Industry Canada RSS-210 Issue 8, Annex 8 FCC Part 15, Subpart B Industry Canada ICES-003
<b>Date of Test:</b>	July 01 – July 10, 2014

*We attest to the accuracy of this report:*



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Minh Ly  
Project Engineer



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Krishna K Vemuri  
EMC Senior Staff Engineer

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## 1.0 Summary of Tests

Test	Reference FCC	Reference Industry Canada	Result
<b>Radiated Emissions</b>	15.109	ICES-003	Complies
<b>AC Line Conducted Emission</b>	15.107	ICES-003	Complies
<b>RF Output Power</b>	15.247(b)(3)	RSS-210, A8.4	Complies
<b>6 dB Bandwidth</b>	15.247(a)(2)	RSS-210, A8.2	Complies
<b>Power Density</b>	15.247(e)	RSS-210, A8.2b	Complies
<b>Out of Band Antenna Conducted Emission</b>	15.247(d)	RSS-210, A8.5	Complies
<b>Transmitter Radiated Emissions</b>	15.247(d), 15.209, 15.205	RSS-210, A8.5	Complies
<b>AC Line Conducted Emission</b>	15.207	RSS-GEN	Complies
<b>Antenna Requirement</b>	15.203	RSS-GEN	Complies (Internal Antenna)
<b>RF Exposure</b>	15.247(i), 2.1093(d)	RSS-102	Complies *

\* Compliance with the SAR requirements is considered without testing because the RF power of channel is below SAR Test Exclusion Threshold. The SAR Test Exclusion Threshold (TET in mW) was calculated according to the KDB 447498, sec 4.3.1.1) using formula:

$$TET = 3 \times d / \sqrt{f_{(GHz)}}$$

where d = 5 mm – is the minimum test separation distance. At f = 2.45 GHz, TET = 9.6 mW (10 mW if rounded).

**EUT receive date:** July 01, 2014

**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:** July 01, 2014

**Test completion date:** July 10, 2014

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

## 2.0 General Information

### 2.1 Product Description

The S&C Electric TripSaver II Controller (Model Number TSII-CONTRL) is an electronic control module used to control the self-powered S&C TripSaver II (TSII) Cutout-Mounted Recloser. Housed in the TSII, the control module processes all electronic / electrical functions required for the proper operation of the TSII. Aside from its primary functions, the controller can be wirelessly accessed via the IEEE 802.15.4 protocol for performing TSII maintenance.

Information about the 2.4 GHz radio module is presented below:

<b>Applicant</b>	S & C Electric Company
<b>Model No.</b>	TSII-CONTRL
<b>FCC Identifier</b>	U3D-TSIICONTRL
<b>IC Identifier</b>	5349C-TSIICONTRL
<b>Type of transmission</b>	Digital Transmission System (DTS)
<b>Rated RF Output</b>	2.90 dBm (1.954 mW)
<b>Frequency Range</b>	2405 – 2480 MHz
<b>Type of modulation/data rate</b>	O-QPSK / <200kbps
<b>Number of Channel(s)</b>	16 (from 11 to 26)
<b>Antenna(s) &amp; Gain</b>	PCB antenna, Gain: -5 dBi
<b>Manufacturer Name &amp; Address</b>	S&C Electric Company 6601 N Ridge Blvd Chicago, IL 60626

## 2.2 Related Submittal(s) Grants

None.

## 2.3 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.

## 2.4 Test Methodology

Antenna conducted measurements were performed according to the FCC documents “Guidance for Performing Compliance Measurement on Digital Transmission Systems (DTS) Operating under §15.247” (KDB 558074), and RSS-210, RSS-GEN, and

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.

## 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	-	-

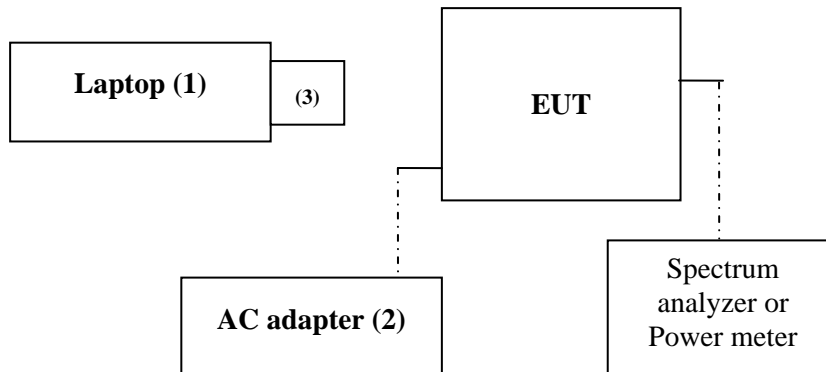
### 3.0 System Test Configuration

#### 3.1 Support Equipment

Item #	Description	Model No./ Part No.	Serial No.
1	Dell Laptop	Vostro 1440	33602643757
2	CUI AC/DC Power Adapter	EMSA120050	Not Labeled
3	USB Dongle	MC1322x	01.01.0D.A5

#### 3.2 Block Diagram of Test Setup

Antenna was removed and co-axial connector with a cable was installed for Conducted Measurements.  
Internal antenna was used for Radiated Measurements.





### 3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT is programmed to transmit full power.

### 3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by S & C Electric.

### 3.5 Mode of Operation during Test

During transmitter testing, the transmitter was setup to transmit at maximum RF power on low, middle and high frequencies/channels.

### 3.5 Modifications Required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product into compliance.

### 3.6 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusions from the standard were made.

#### 4.0 Measurement Results

##### 4.1 6-dB Bandwidth and Occupied Bandwidth FCC Rule: 15.247(a)(2); RSS-210 A8.2 and RSS-GEN;

###### 4.1.1 Requirement

The minimum 6-dB bandwidth shall be at least 500 kHz

###### 4.1.2 Procedure

The Procedure described in the FCC Publication 558074 was used. 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 6 dB lower than PEAK level. The 6-dB bandwidth was determined from where the channel output spectrum intersected the display line.

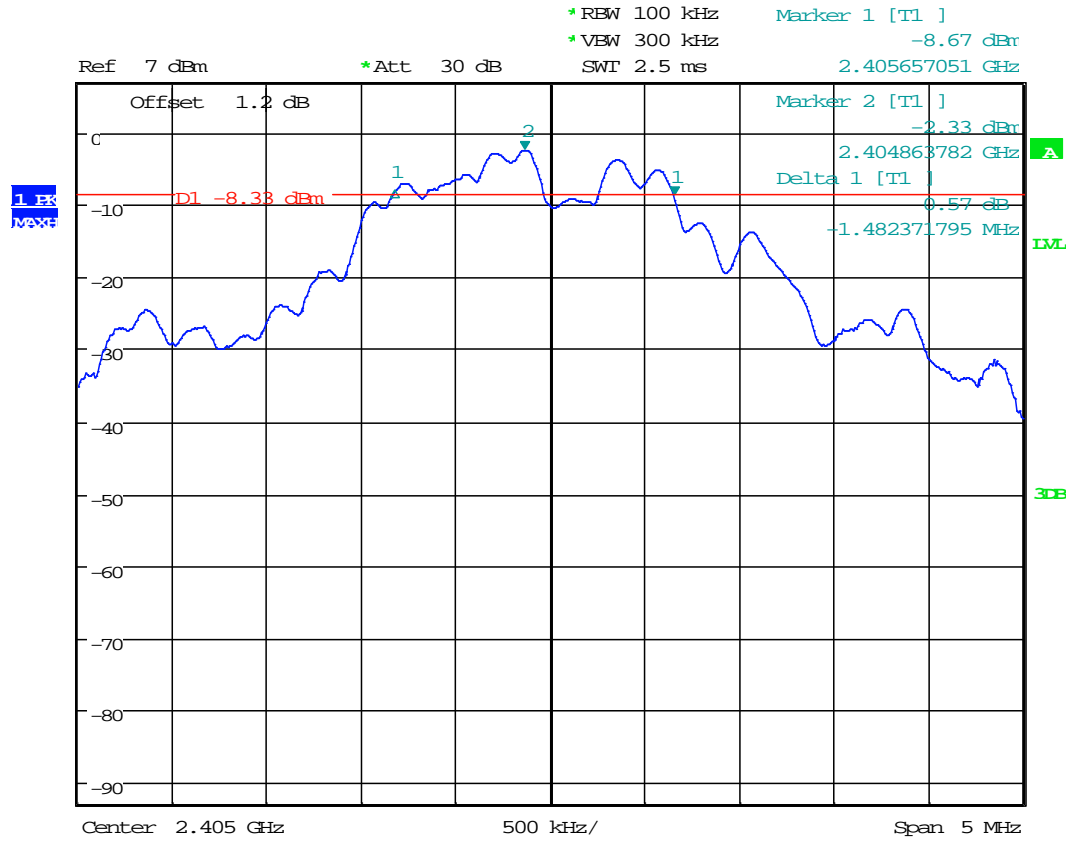
The occupied bandwidth was measured using the built-in spectrum analyzer function for 99% power bandwidth measurement.

###### 4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, MHz	Occupied bandwidth, RSS-GEN, MHz	Plot
2405	1.482		1.1
		2.596	1.4
2440	1.498		1.2
		2.604	1.5
2480	1.482		1.3
		2.620	1.6

<b>Results</b>	<b>Complies</b>
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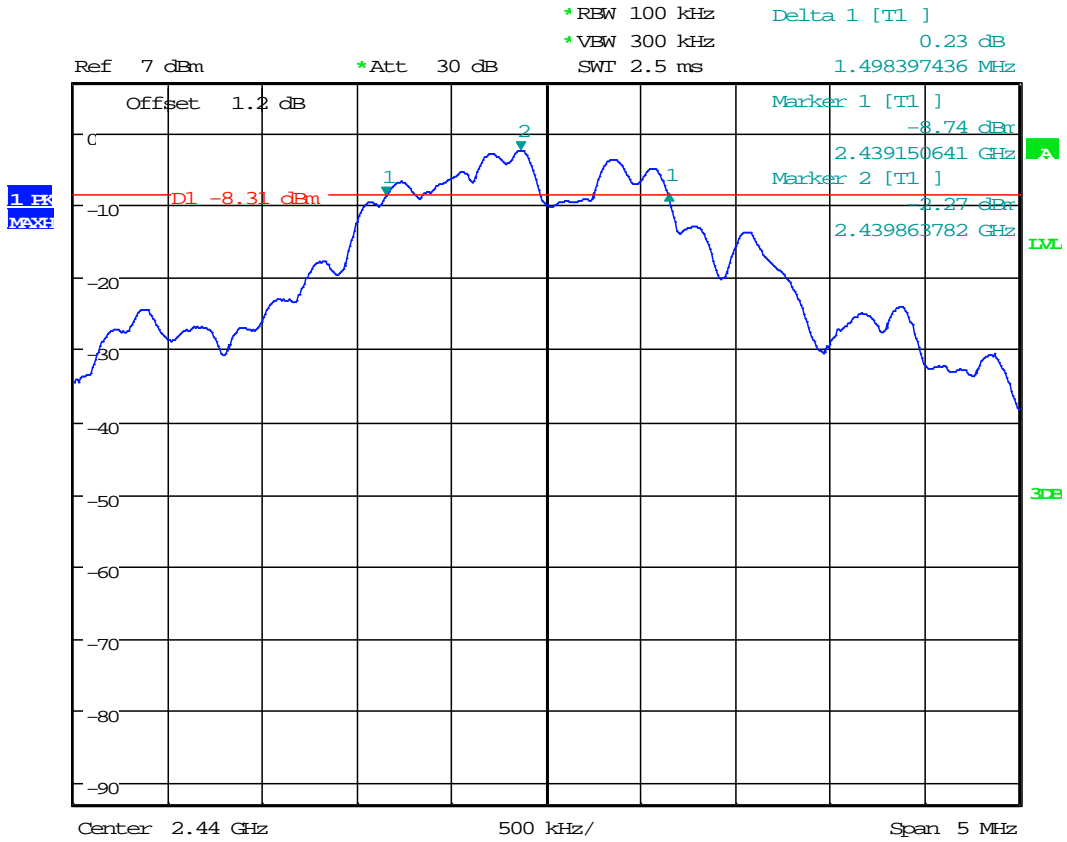
Plot 1. 1



Occupied Bandwidth

Date: 1.JUL.2014 13:45:28

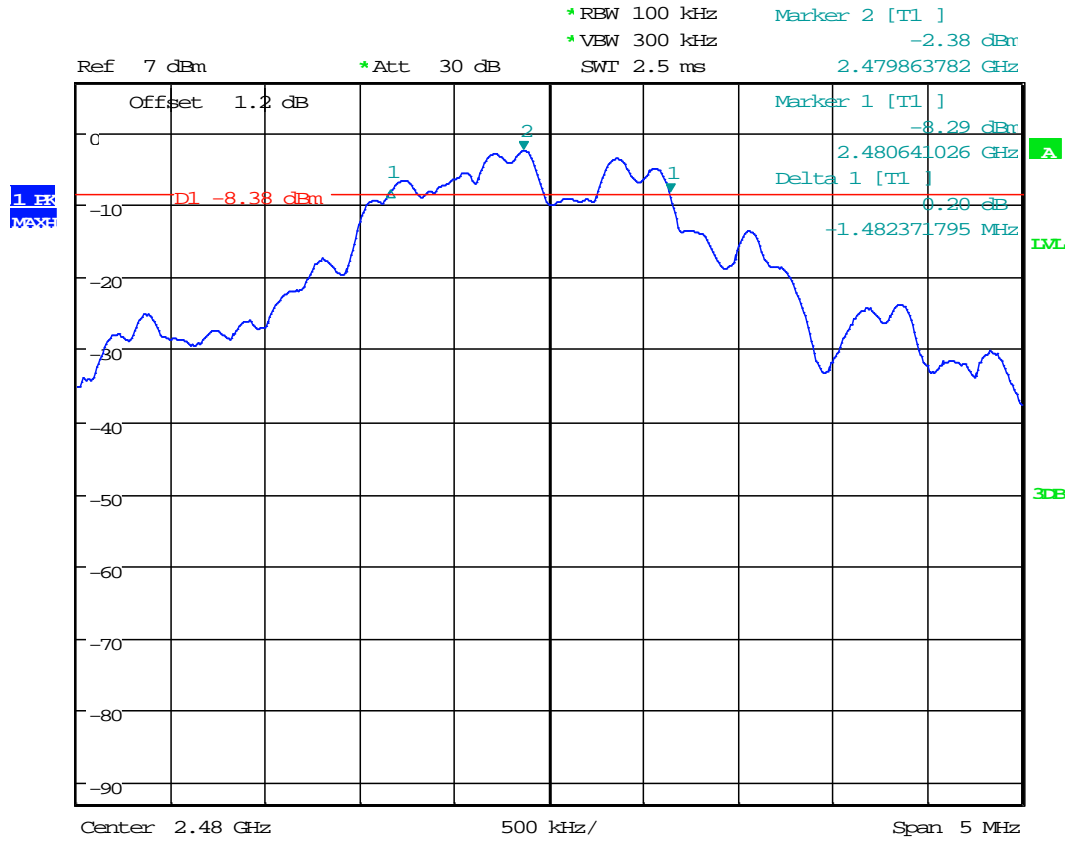
Plot 1.2



Occupied Bandwidth

Date: 1.JUL.2014 13:42:10

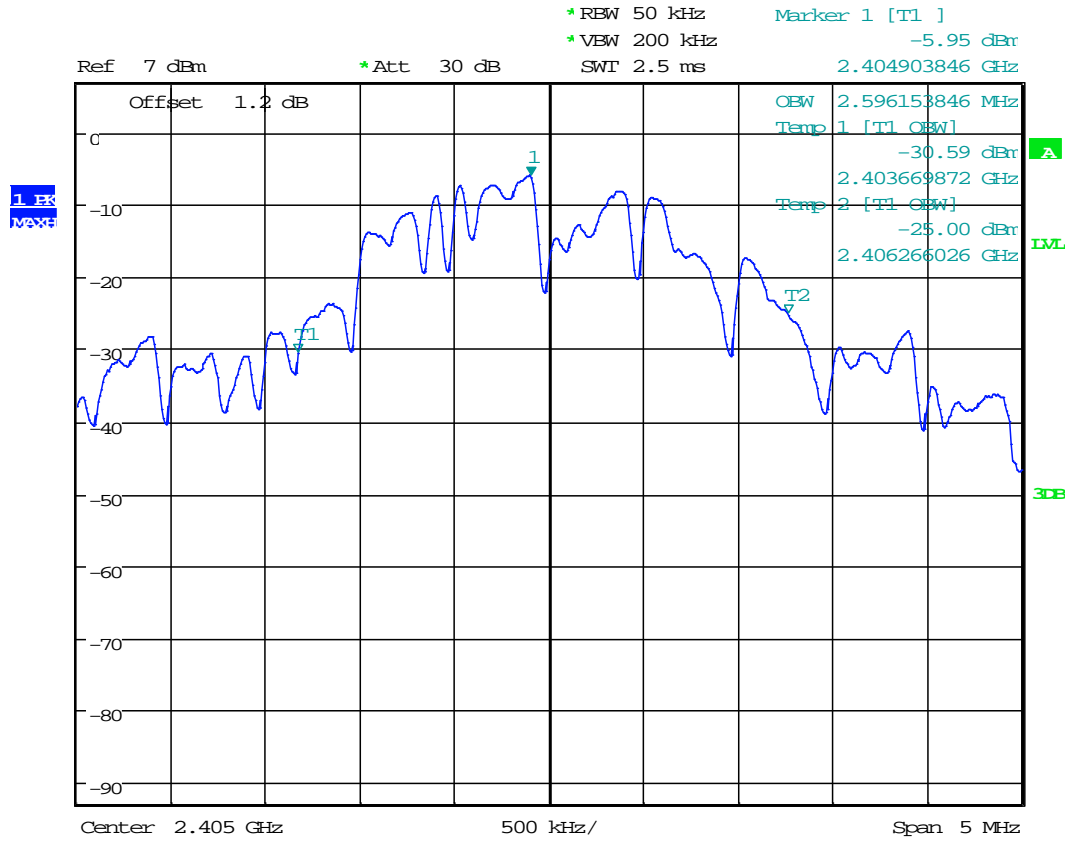
Plot 1.3



Occupied Bandwidth

Date: 1.JUL.2014 13:40:16

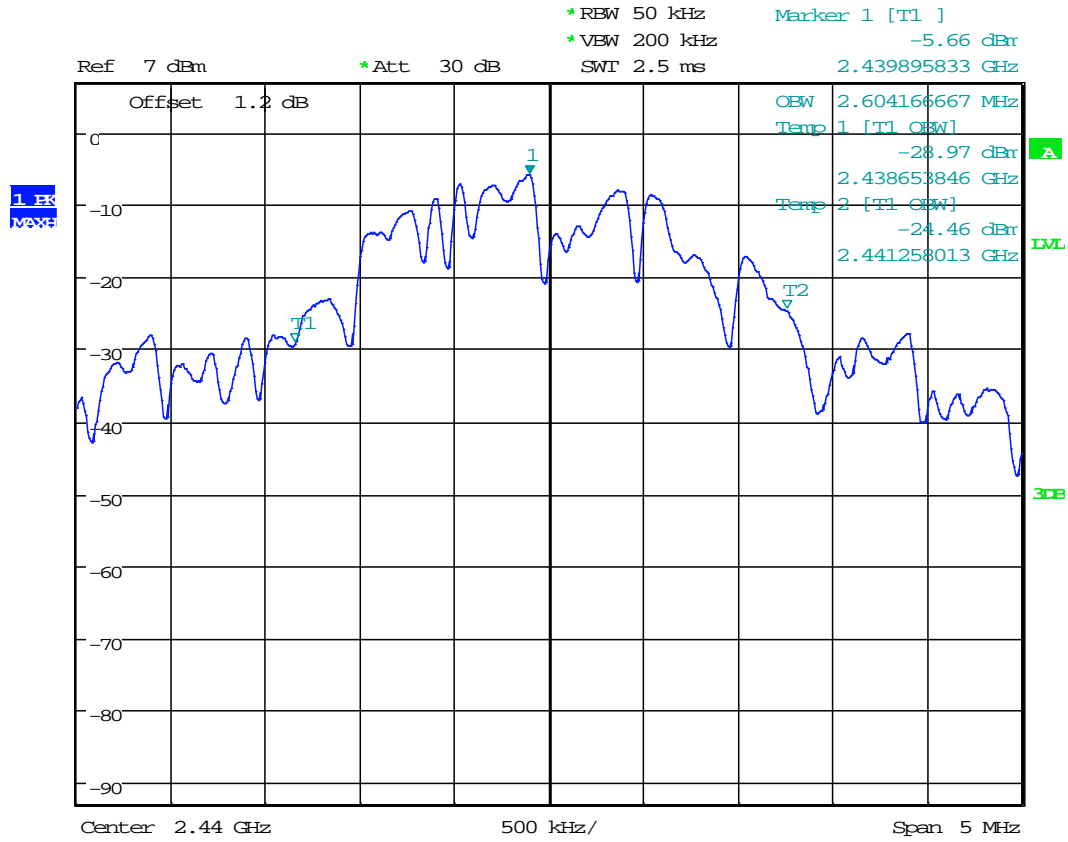
Plot 1.4



Occupied Bandwidth

Date: 1.JUL.2014 13:54:21

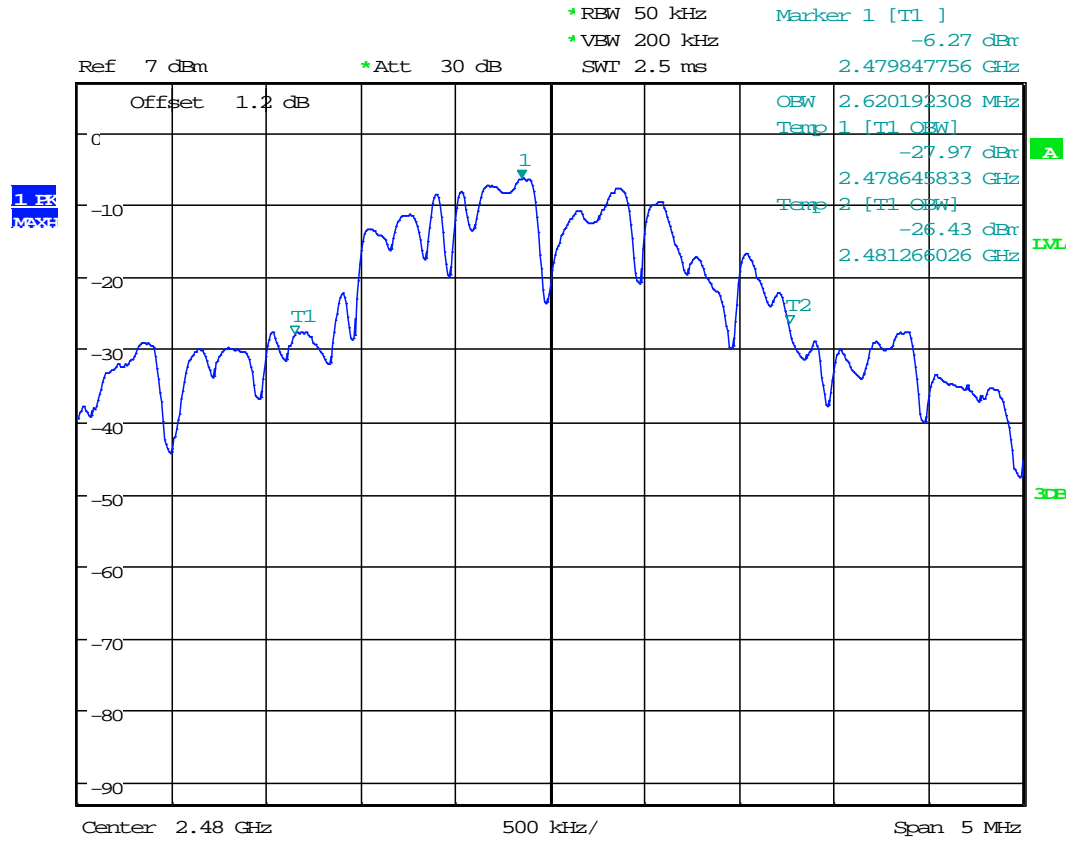
Plot 1.5



Occupied Bandwidth

Date: 1.JUL.2014 13:55:33

Plot 1.6



Occupied Bandwidth

Date: 1.JUL.2014 13:57:49



4.2 Maximum Peak Conducted Output Power at Antenna Terminals  
 FCC Rule: 15.247(b)(3); RSS-210 A8.4;

4.2.1 Requirement

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt or 30 dBm.  
 For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer/power meter to measure the Maximum Conducted Transmitter Output Power.

The procedure described in FCC Publication 558074, was used. Specifically, section 9.1.1 for Maximum Peak Conducted Output Power, with the spectrum analyzer’s peak detector and Resolution Bandwidth RBW > DTS Bandwidth.

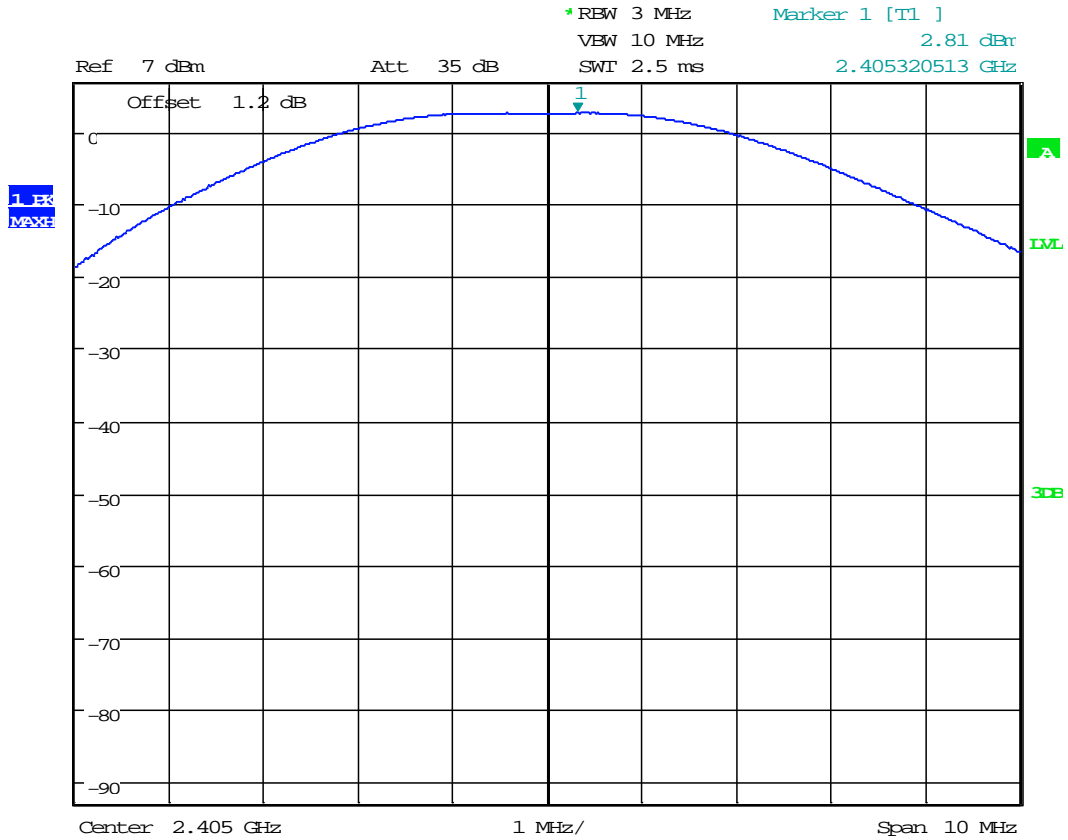
4.3.3 Test Result

Refer to the following plots 2.1 – 2.3 for the test details.

Frequency, MHz	Conducted Power (peak), dBm	Conducted Power (peak), mW	Plot
2405	2.81	1.914	2.1
2440	2.90	1.954	2.2
2480	2.88	1.945	2.3

<b>Results</b>	<b>Complies</b>
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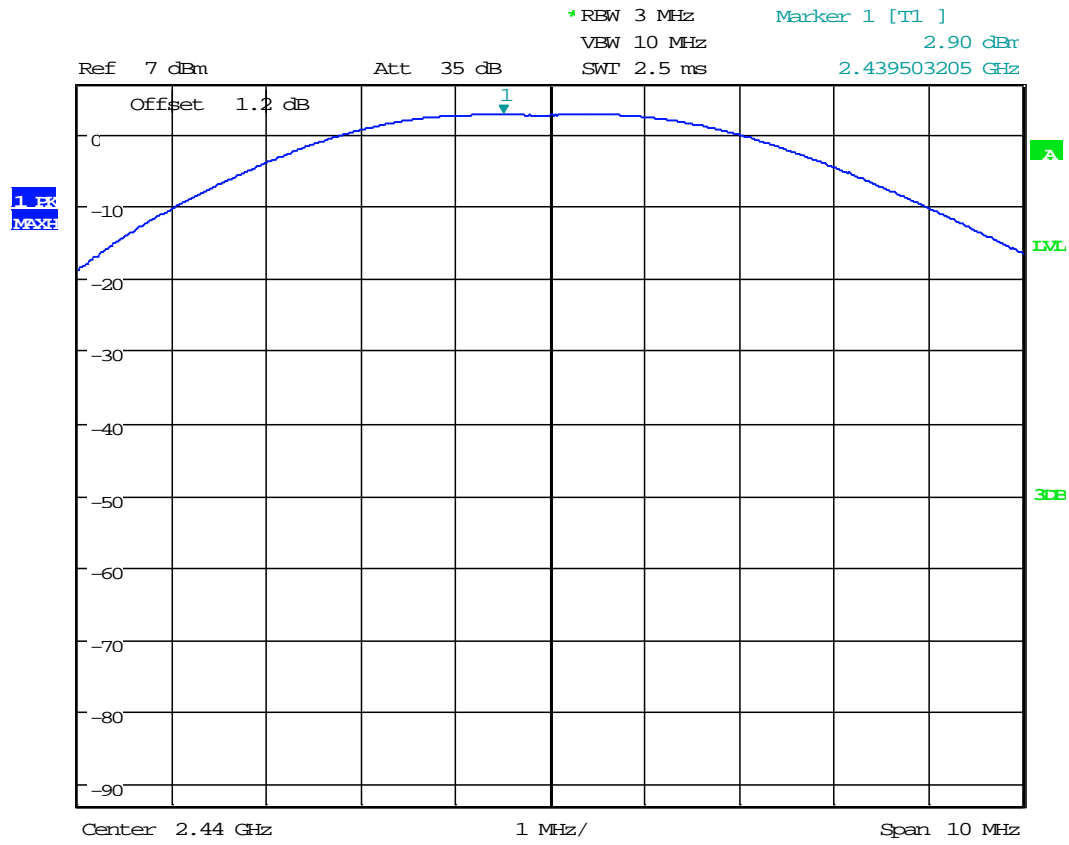
Plot 2.1



Output Power

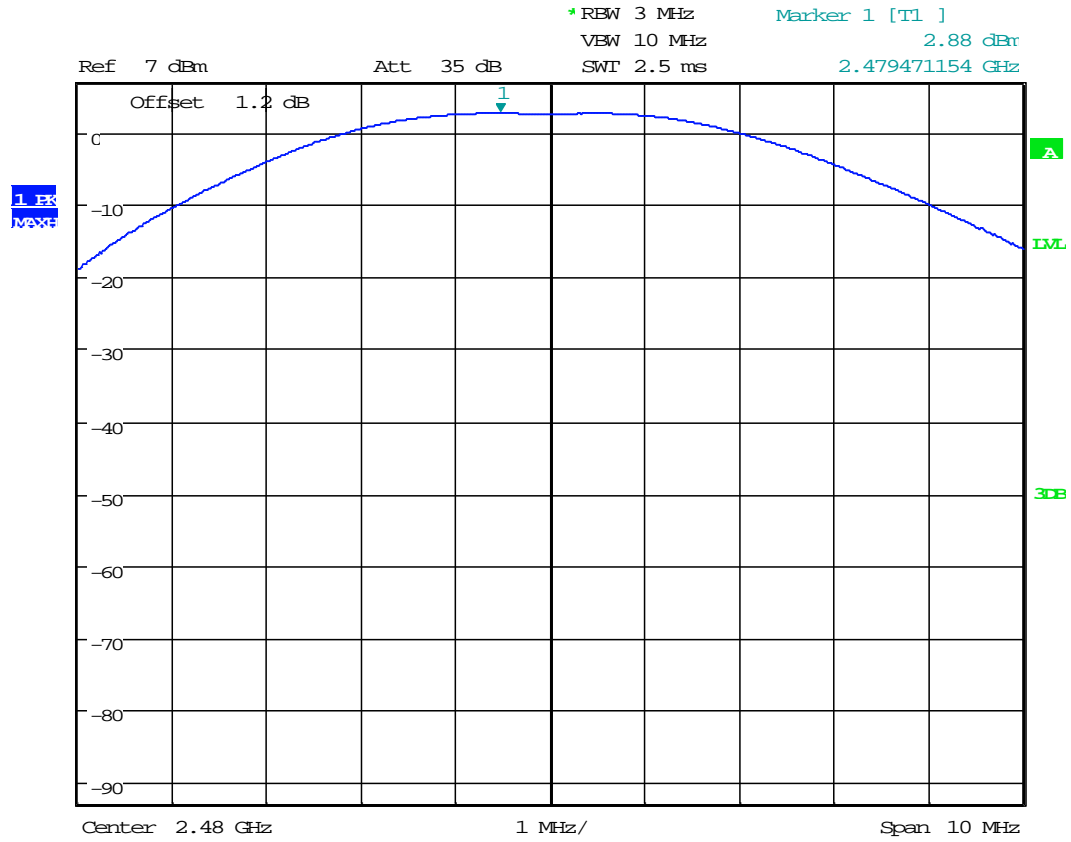
Date: 1.JUL.2014 15:56:45

Plot 2. 2



Output Power  
Date: 1.JUL.2014 15:55:07

Plot 2.3



Output Power

Date: 1.JUL.2014 15:51:48

4.3 Maximum Power Spectral Density  
FCC: 15.247 (e); RSS-210 A8.2b;

4.3.1 Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Transmitter Power Density (PSD).

The procedure described in FCC Publication 558074 was used. Specifically, section 10.2, Peak PSD, with peak detector and max hold trace mode. Spectrum analyzer resolution bandwidth was set to 3 kHz and span to at least 1.5 times the DTS (6 dB) channel bandwidth.

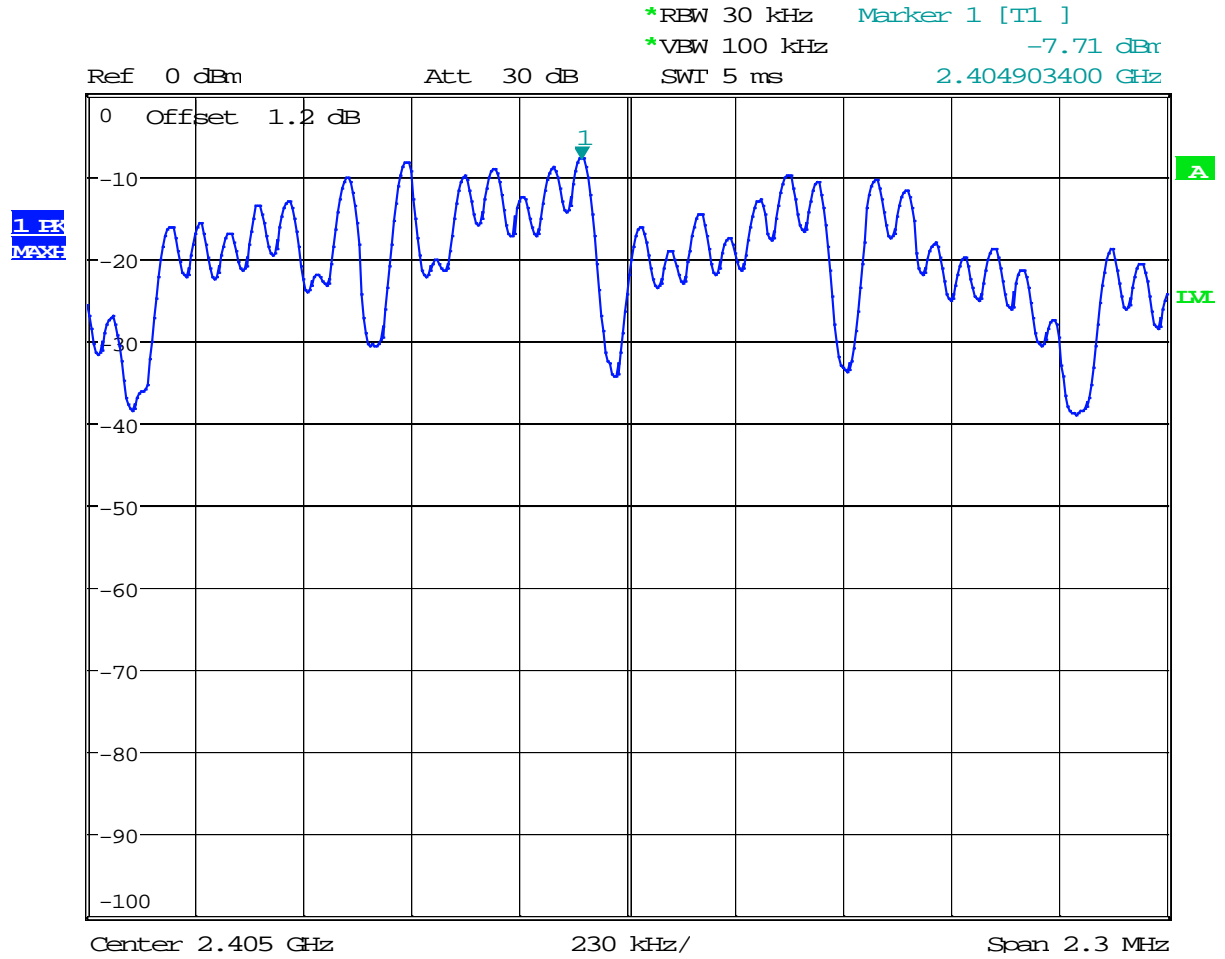
4.3.3 Test Result

Refer to the following plots for the test result

Frequency, MHz	Maximum Power Spectral Density, dBm	Maximum Power Spectral Density Limit, dBm	Margin, dB	Plot
2405	-7.71	8.0	-15.71	3.1
2440	-7.85	8.0	-15.85	3.2
2480	-7.56	8.0	-15.56	3.3

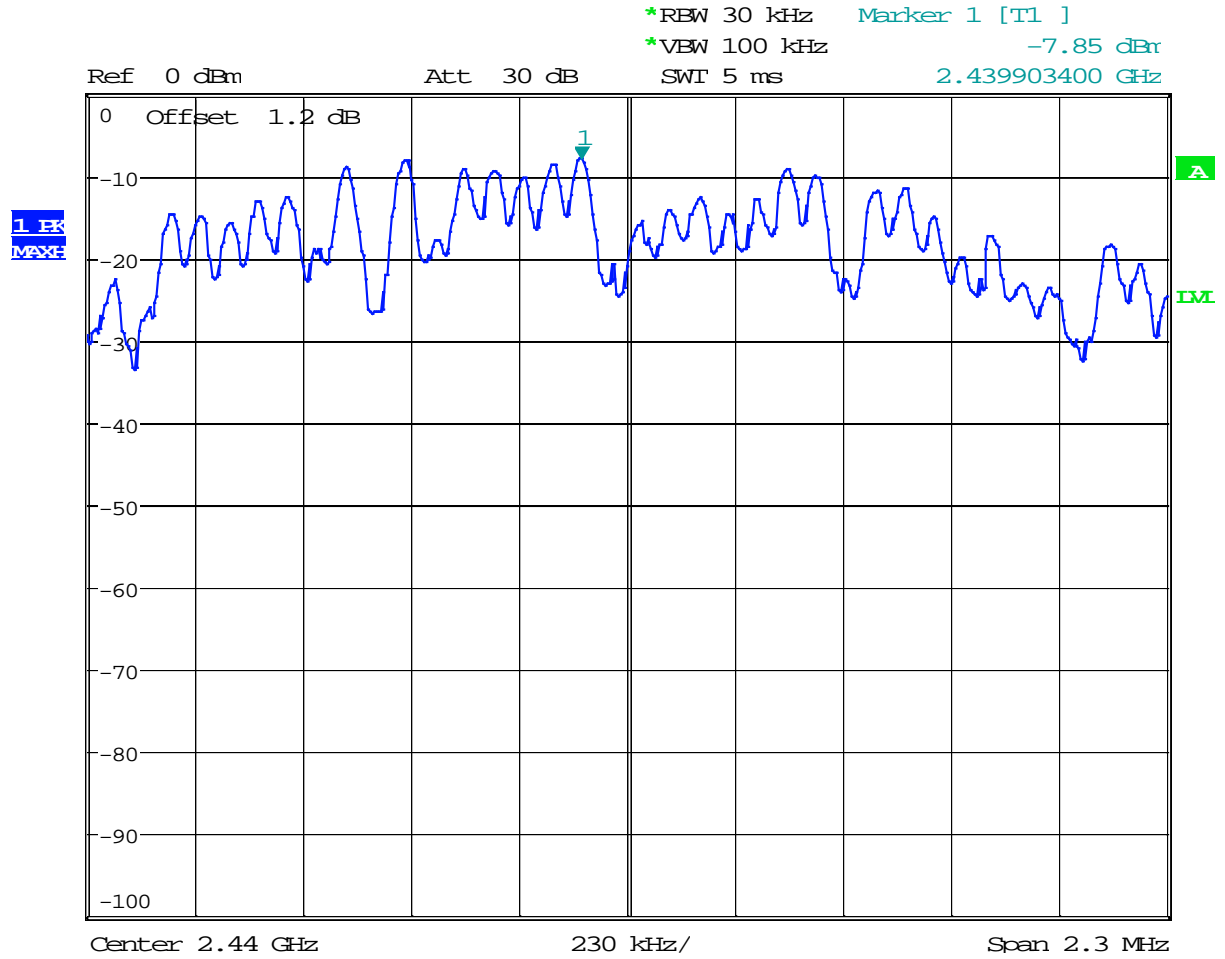
<b>Results</b>	<b>Complies</b>
----------------	-----------------

Plot 3. 1



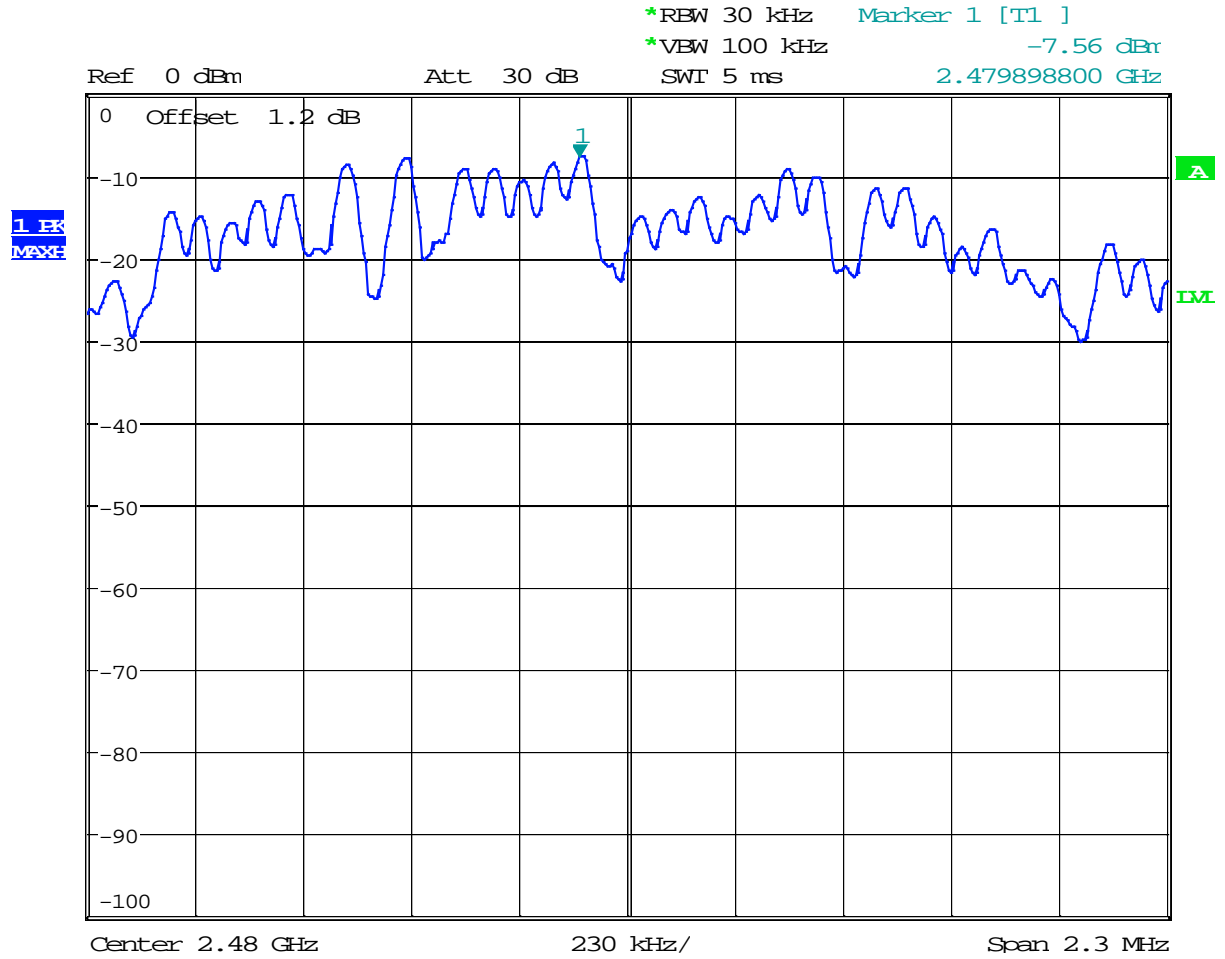
Date: 1.JUL.2014 14:10:58

Plot 3.2



Date: 1.JUL.2014 14:12:03

Plot 3.3



Date: 1.JUL.2014 14:12:48



4.4 Unwanted Conducted Emissions  
FCC: 15.247(d); RSS-210 A8.5;

4.4.1 Requirement

In any 100 kHz bandwidth outside the EUT pass-band, the RF power shall be below the maximum in-band 100 kHz emissions by at least 20 dB (if peak power of in-band emission is measured) or 30 dB (if average power of in-band emission is measured).

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)

4.4.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and unwanted peak emission measurements (with max hold) were performed. For the wideband scan, Spectrum Analyzer setting of number of points 30000 was used.

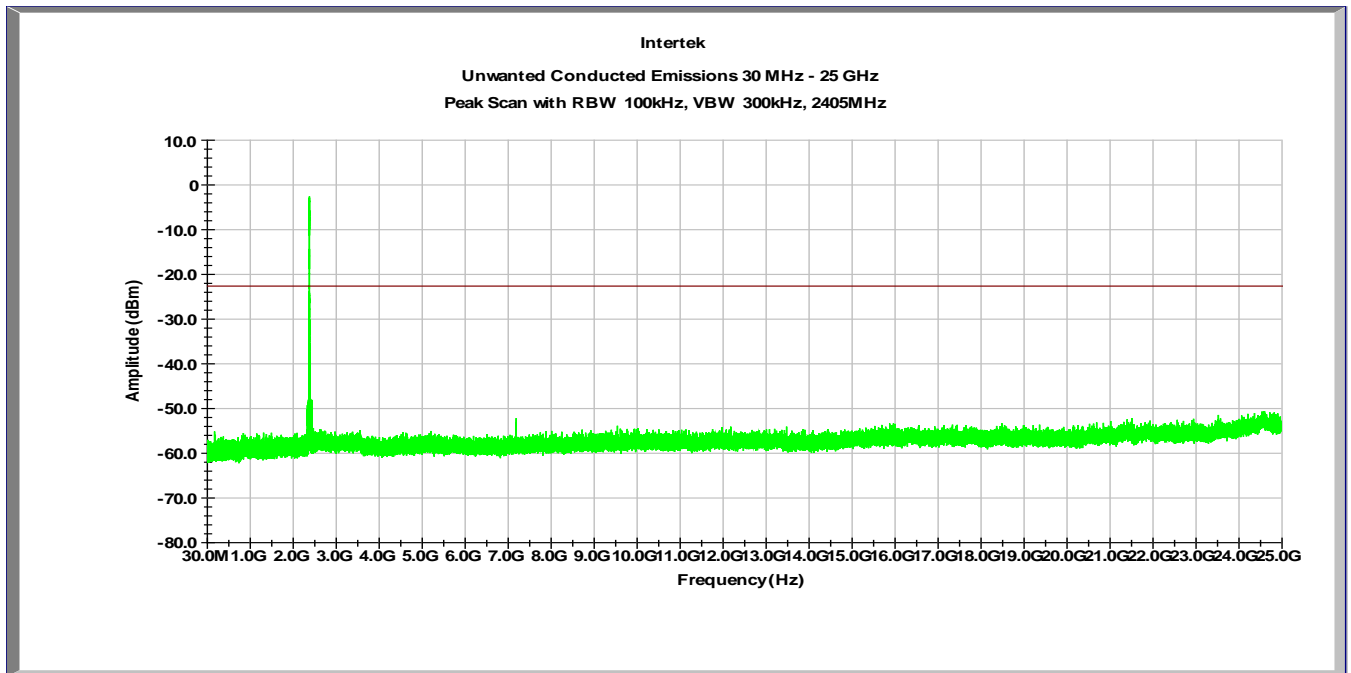
The unwanted emissions were measured from 30 MHz to 25 GHz.

4.4.3 Test Result

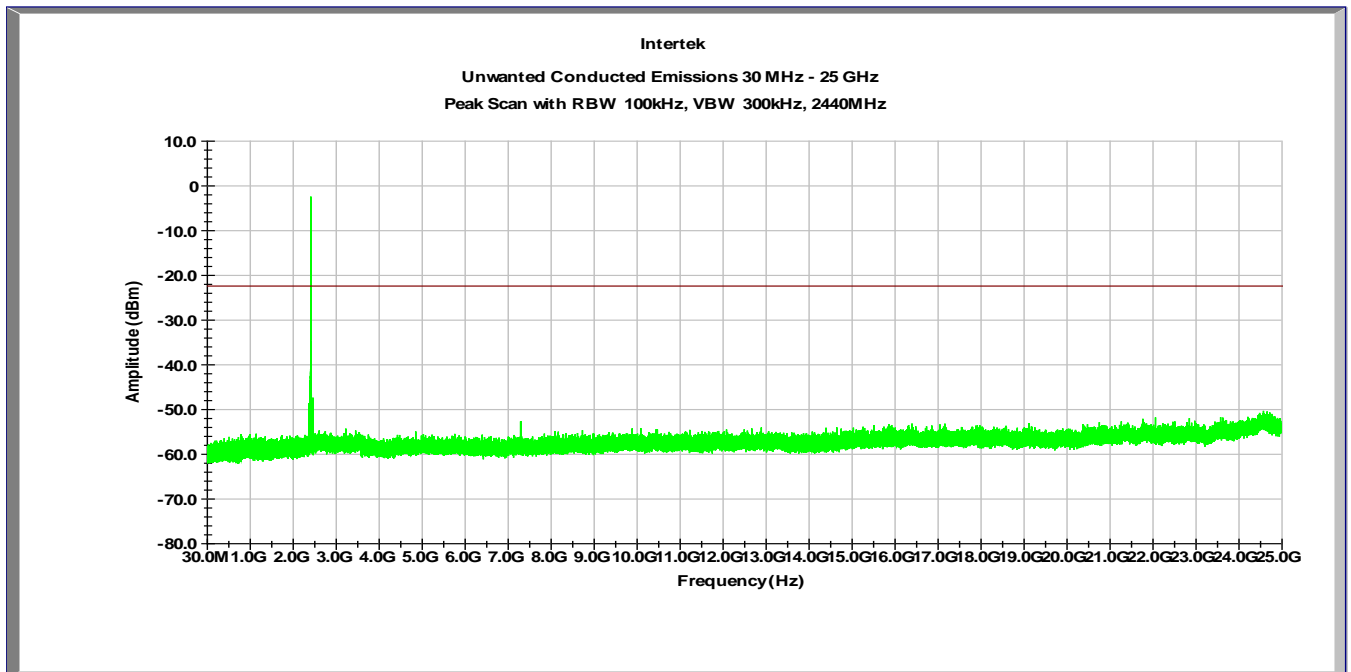
Refer to the following plots 4.1 – 4.3 for unwanted conducted emissions. The plot shows -20dB attenuation limit line.

<b>Results</b>	<b>Complies</b>
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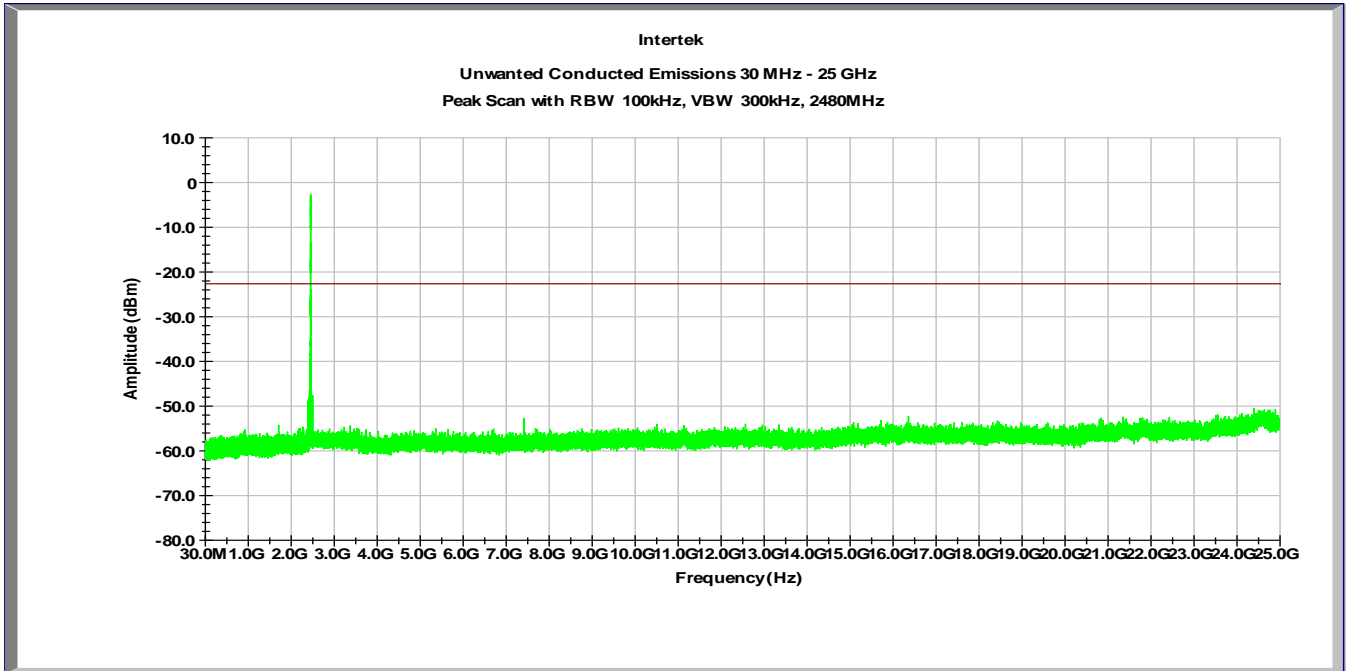
Plot 4.1 Tx @ Low Channel, 2405 MHz



Plot 4.2 Tx @ Mid Channel, 2440 MHz



Plot 4.3 Tx @ High Channel, 2480 MHz



#### 4.5 Transmitter Radiated Emissions FCC Rules: 15.247(d), 15.209, 15.205; RSS-210;

##### 4.5.1 Requirement

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

In any 100 kHz bandwidth outside the EUT pass-band, the RF power shall be below the maximum in-band 100 kHz emissions by at least 20 dB (if peak power of in-band emission is measured) or 30 dB (if average power of in-band emission is measured).

##### 4.5.2 Procedure

Radiated emission measurements were performed from 30 MHz to 25 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 and Average measurements were performed.

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.

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

Data included is representative of the worst-case configuration (the configuration which resulted in the highest emission levels).

#### 4.5.3 Field Strength Calculation

##### 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( $\mu$ V/m)

RA = Receiver Amplitude (including preamplifier) in dB( $\mu$ 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( $\mu$ 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( $\mu$ V/m). This value in dB( $\mu$ V/m) was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB( $\mu$ 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( $\mu$ V/m).

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

#### 4.5.4 Test Results

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

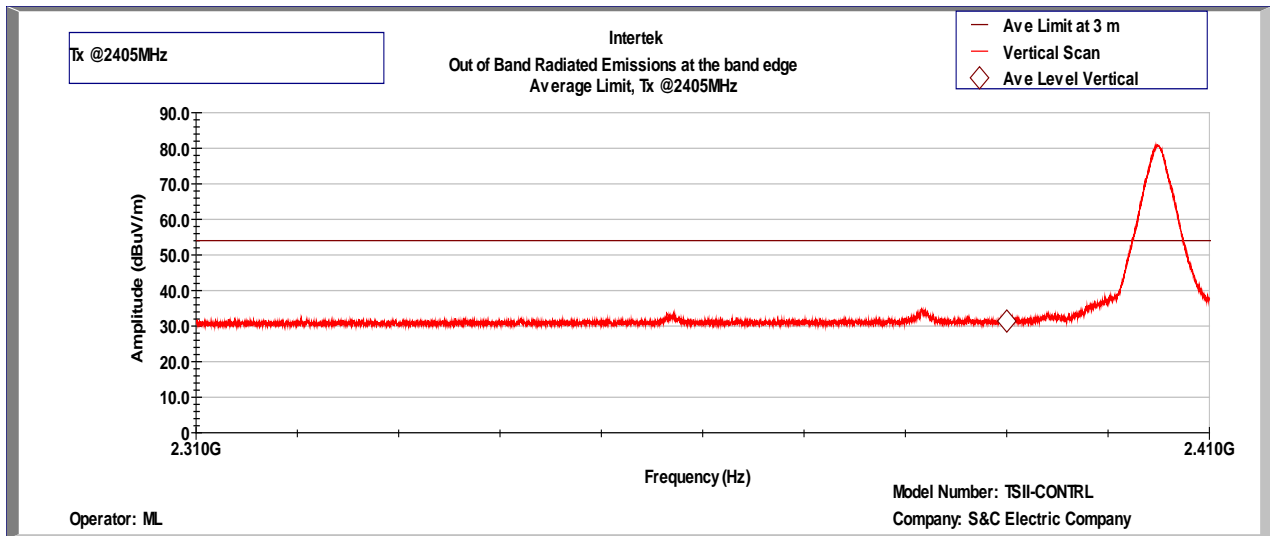
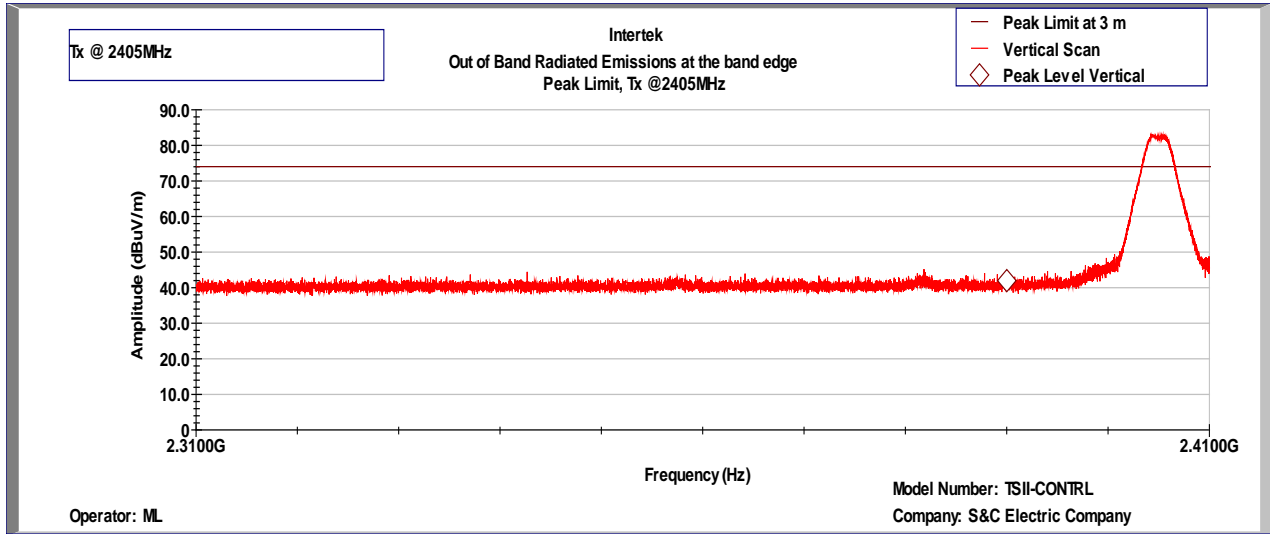
Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz.

The EUT passed the test by 3.5dB



Test Results: 15.209/15.205 Restricted Band Emissions

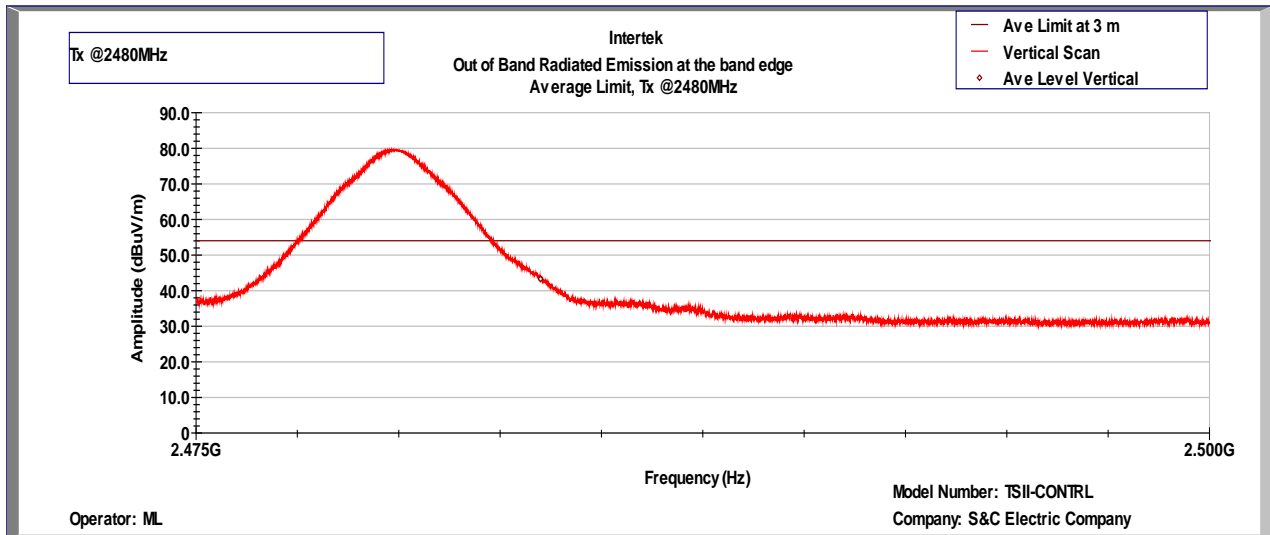
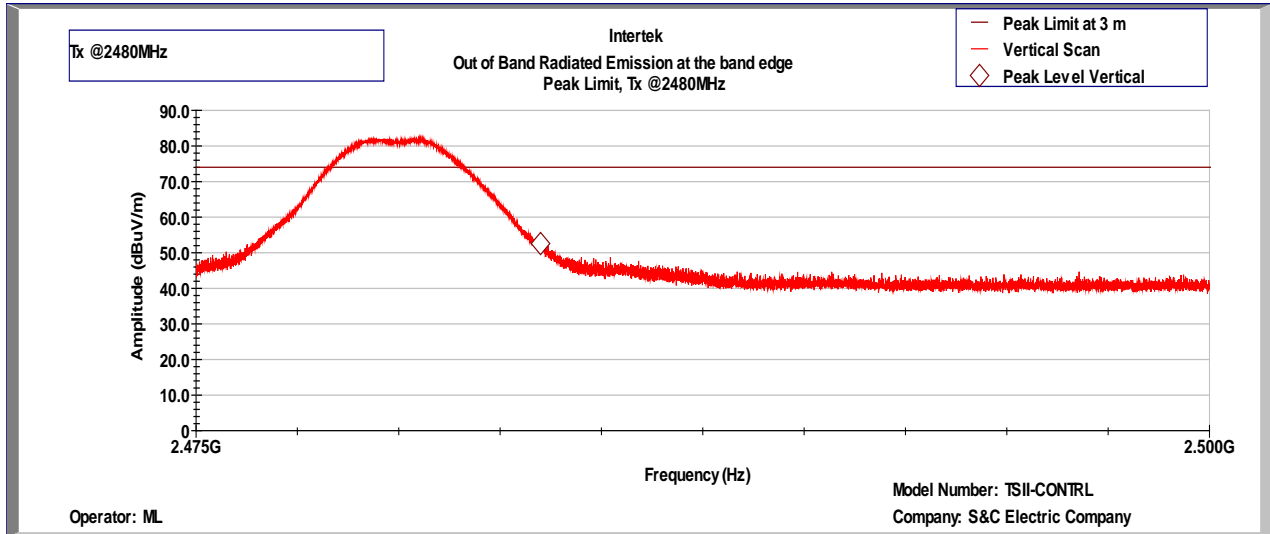
### Out-of-Band Radiated spurious emissions at the Band-edge 2310–2390 MHz



EUT Frequency	RA @ 3 m	AF	AG	CF + Attenuator	FS @ 3m	Detector	Limit @ 3 m	Margin
(MHz)	(dBuV/m)	(dB/m)	(dB)	(dB)	(dBuV/m)	(Peak) / (Average)	(dBuV/m)	(dB)
2405.0	42.1	27.5	34.7	7.1	42.0	Peak	74.0	-32.0
	31.6	27.5	34.7	7.1	31.5	Average	54.0	-22.5



### Out-of-Band Radiated spurious emissions at the Band-edge 2483.5–2500 MHz

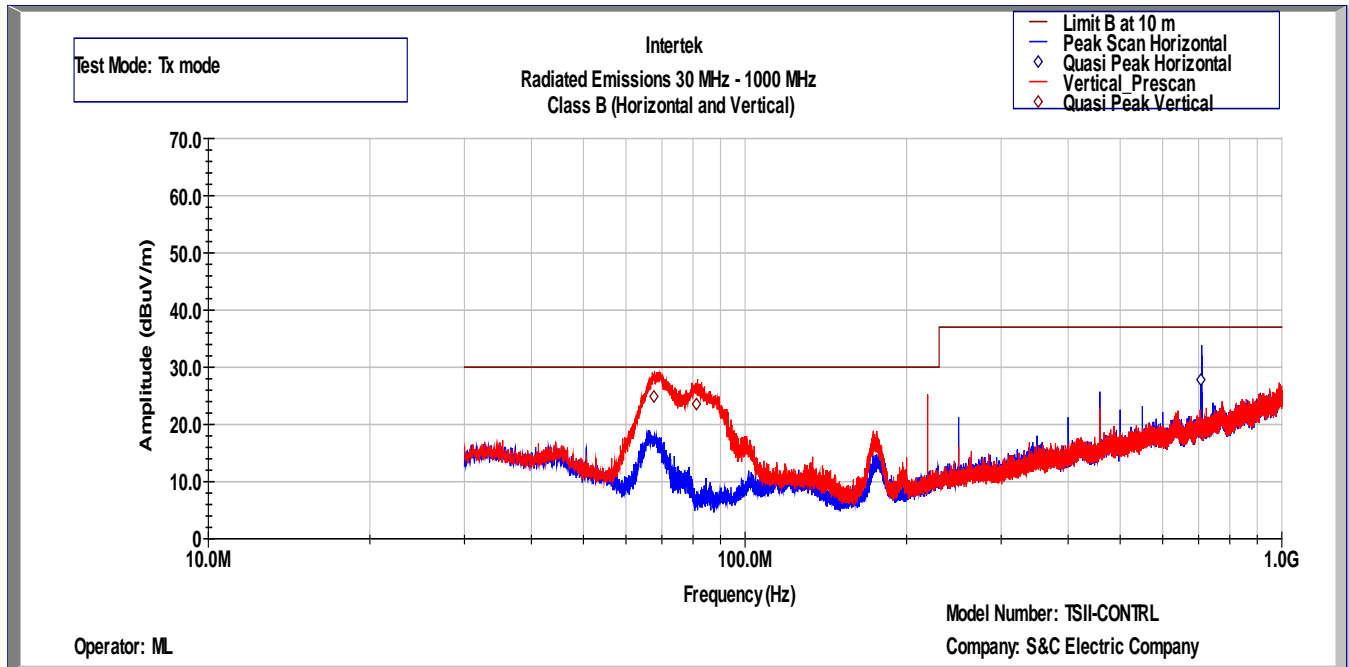


EUT Frequency	RA @ 3 m	AF	AG	CF + Attenuator	FS @ 3m	Detector	Limit @ 3 m	Margin
(MHz)	(dBuV/m)	(dB/m)	(dB)	(dB)	(dBuV/m)	(Peak) / (Average)	(dBuV/m)	(dB)
2480.0	52.4	27.8	34.8	7.1	52.5	Peak	74.0	-21.5
	43.1	27.8	34.8	7.1	43.2	Average	54.0	-10.8



Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2405MHz

Radiated Spurious Emissions 30 MHz - 1000 MHz



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

Operator: ML

Model Number: TSII-CONTRL  
Company: S&C Electric Company

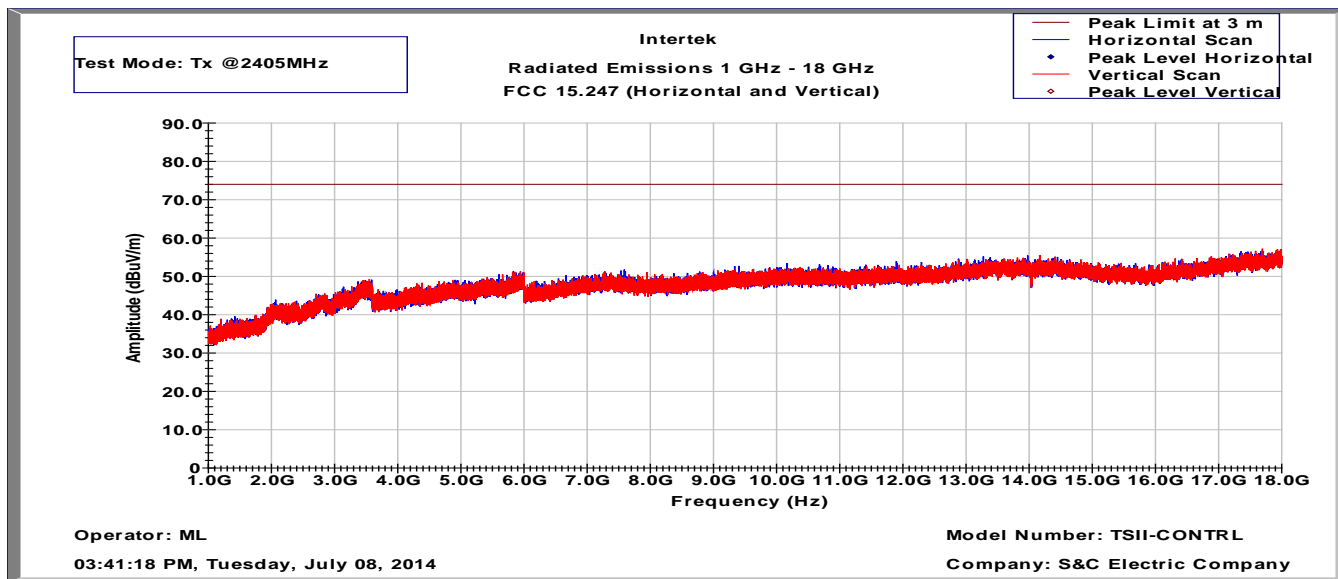
FCC Part 15 Class A (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
67.64	35.4	40	-4.6	48.2	1	32.1	10.5	7.7	360	198
81.2	34.0	40	-6.0	47.6	1.1	32.1	10.5	6.9	0	100
FCC Part 15 Class A (QP-Horizontal)										
707	38.3	46	-7.7	37.6	3.1	32.3	10.5	19.4	170	100

Test Mode: Tx mode

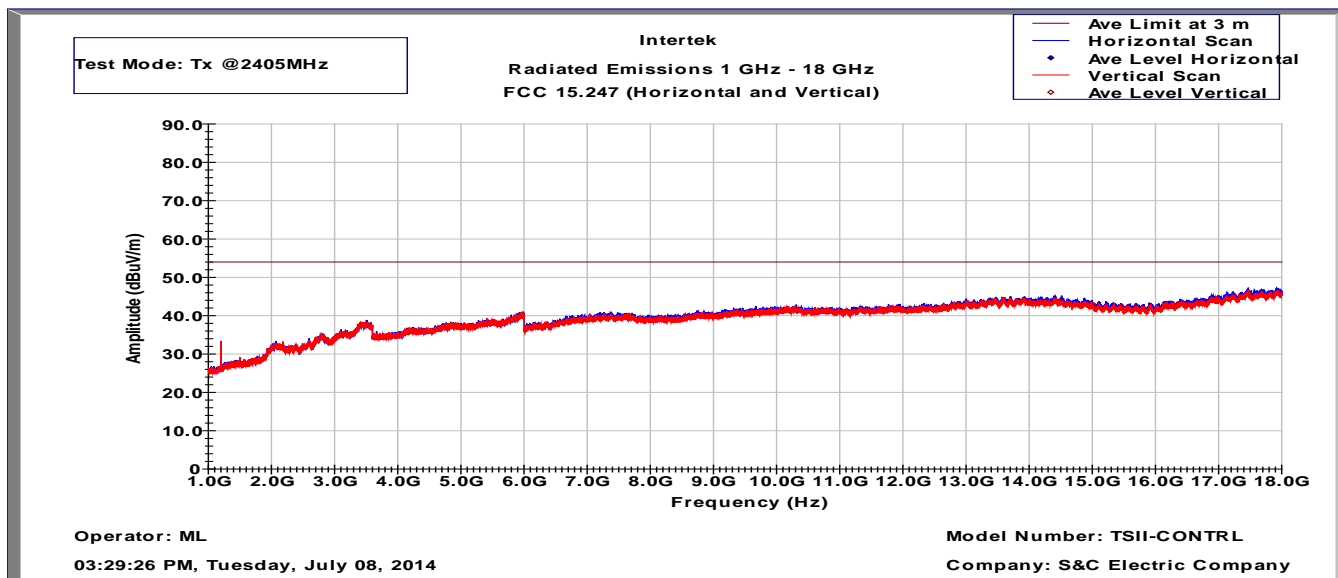




### Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



### Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan

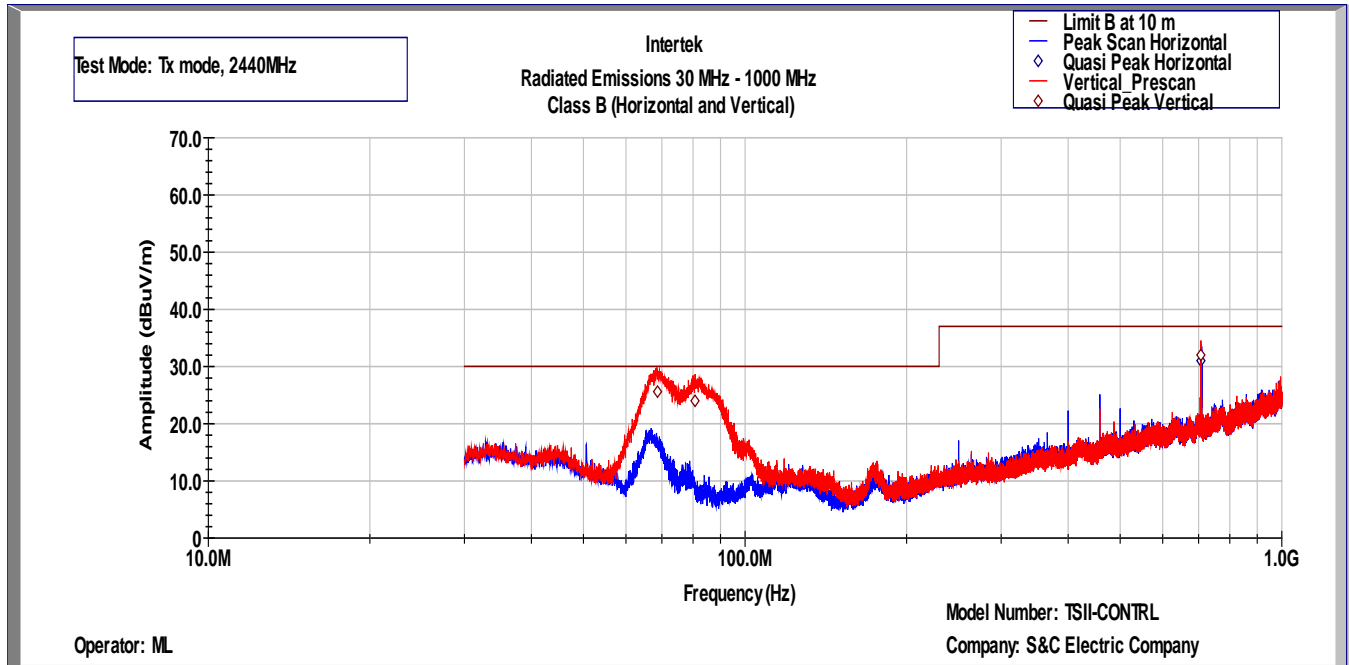


Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz.



Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440MHz

Radiated Spurious Emissions 30 MHz - 1000 MHz



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

Operator: ML

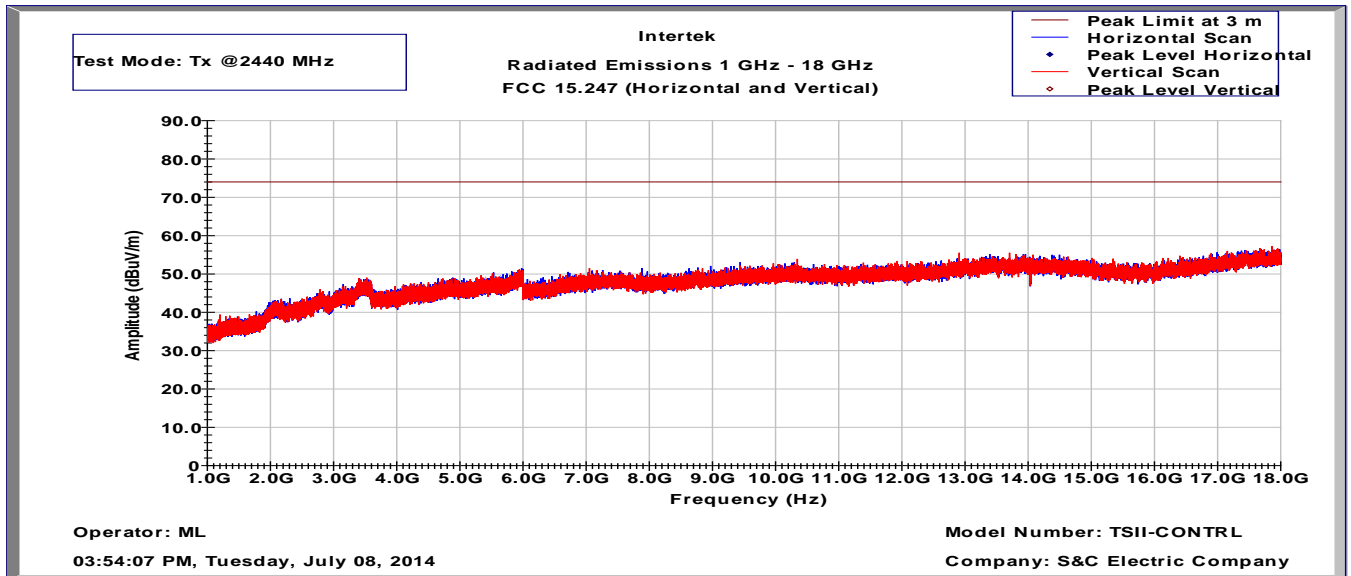
Model Number: TSII-CONTRL  
 Company: S&C Electric Company

FCC Part 15 Class A (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
68.72	36.1	40	-3.9	49.2	1.0	32.1	10.5	7.5	168	216
80.7	34.5	40	-5.5	48.1	1.1	32.1	10.5	6.9	0	100
706.9	42.5	46	-3.5	41.8	3.1	32.3	10.5	19.4	15	100
FCC Part 15 Class A (QP-Horizontal)										
706.9	41.5	46	-4.5	40.8	3.1	32.3	10.5	19.4	0	198

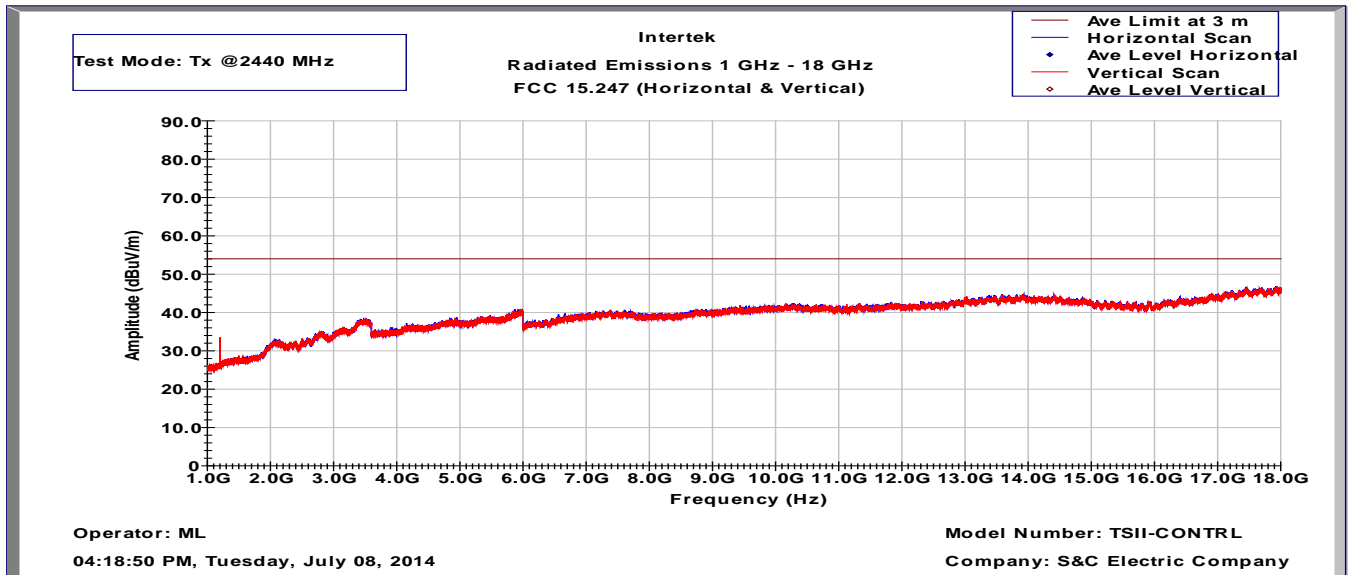
Test Mode: Tx mode



### Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



### Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan

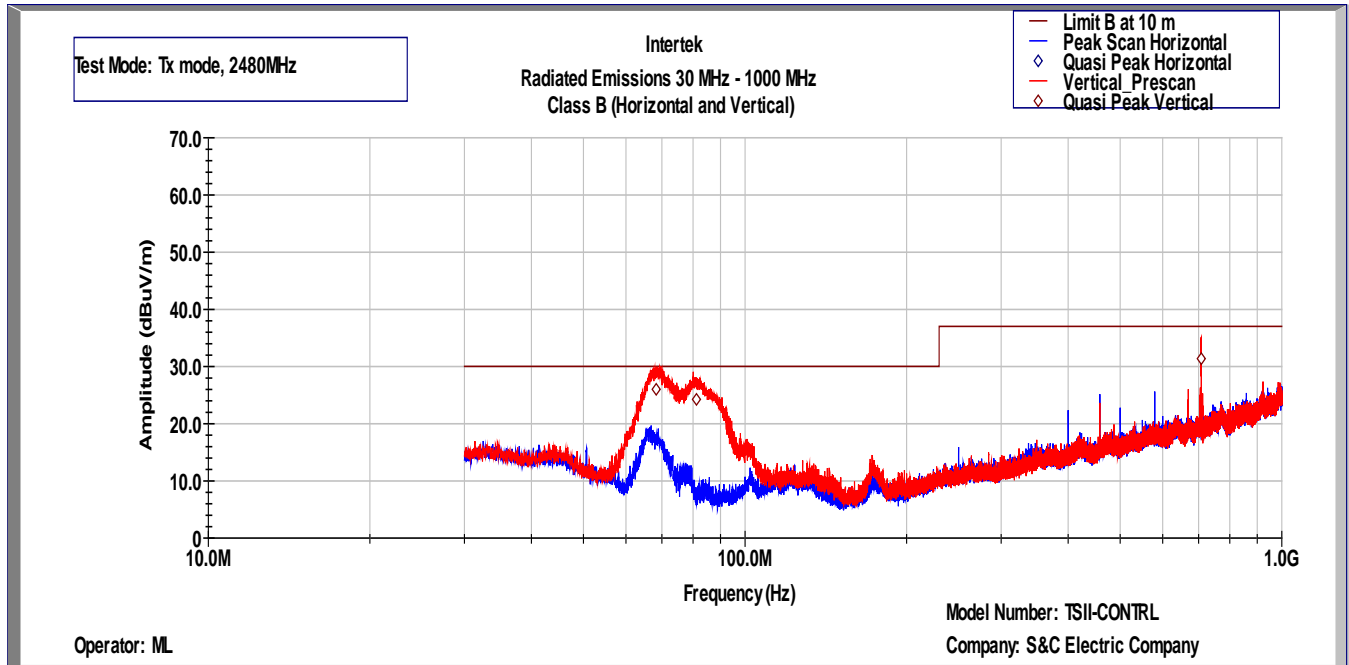


Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz.



Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2480MHz

Radiated Spurious Emissions 30 MHz - 1000 MHz



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

Operator: ML

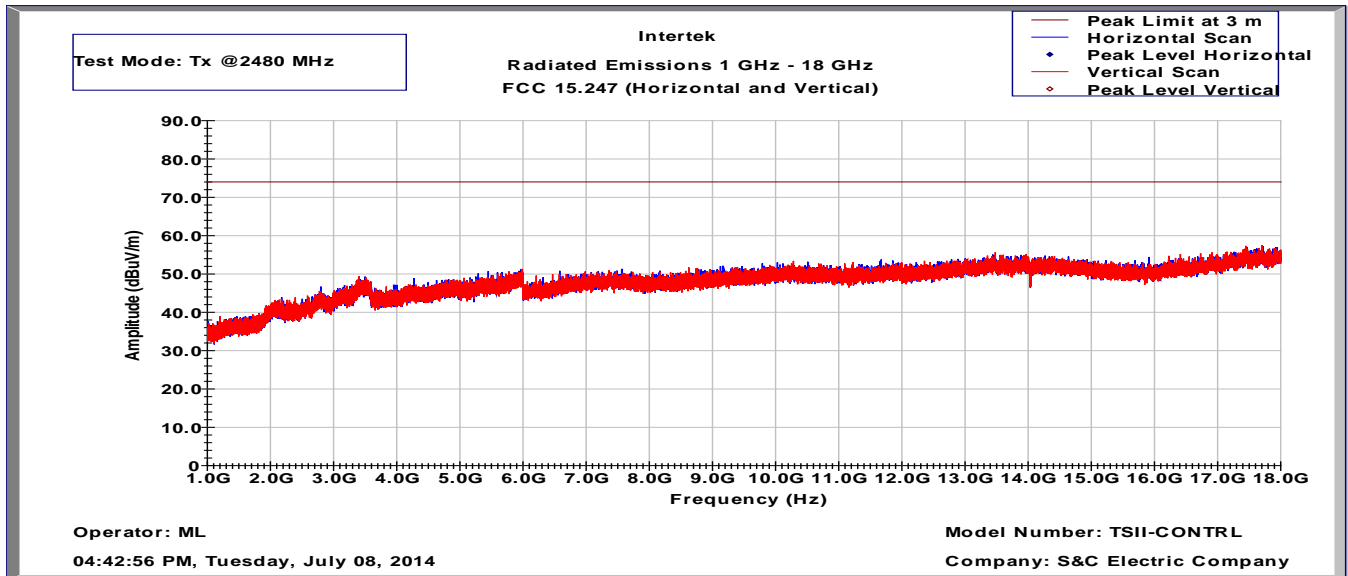
Model Number: TSII-CONTRL  
Company: S&C Electric Company

FCC Part 15 Class A (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
68.3	36.5	40	-3.5	49.5	1.0	32.1	10.5	7.6	360	180
81.2	34.7	40	-5.3	48.3	1.1	32.1	10.5	6.9	112	194
707	41.9	46	-4.1	41.2	3.1	32.3	10.5	19.4	0	100

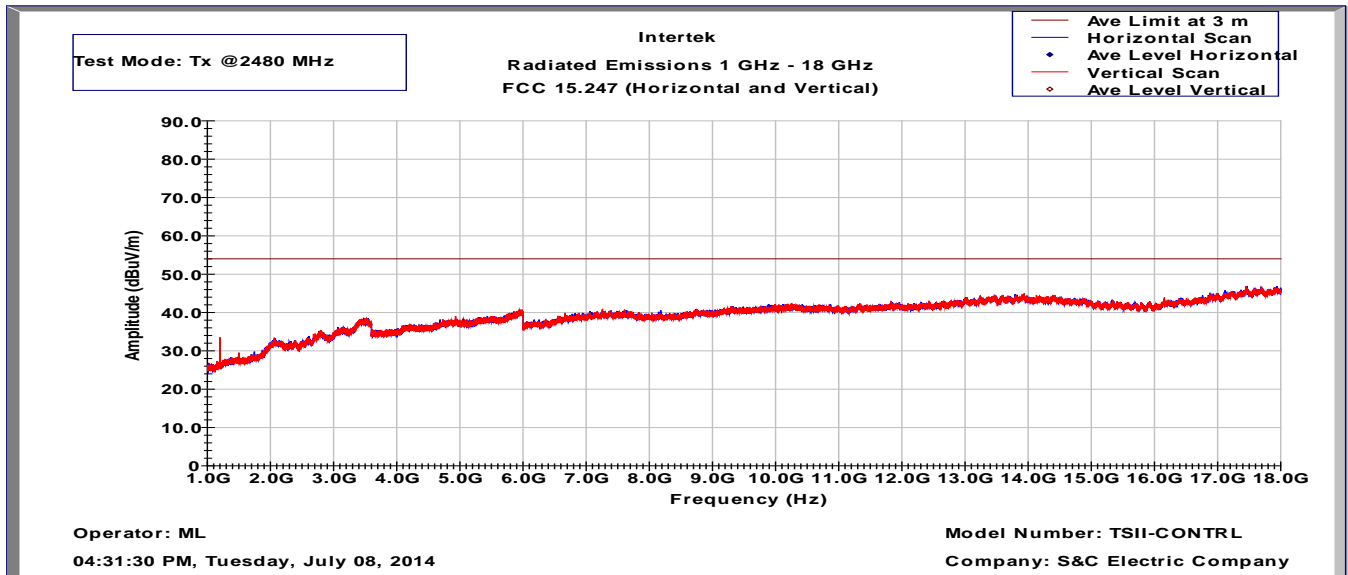
Test Mode: Tx mode



### Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



### Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan

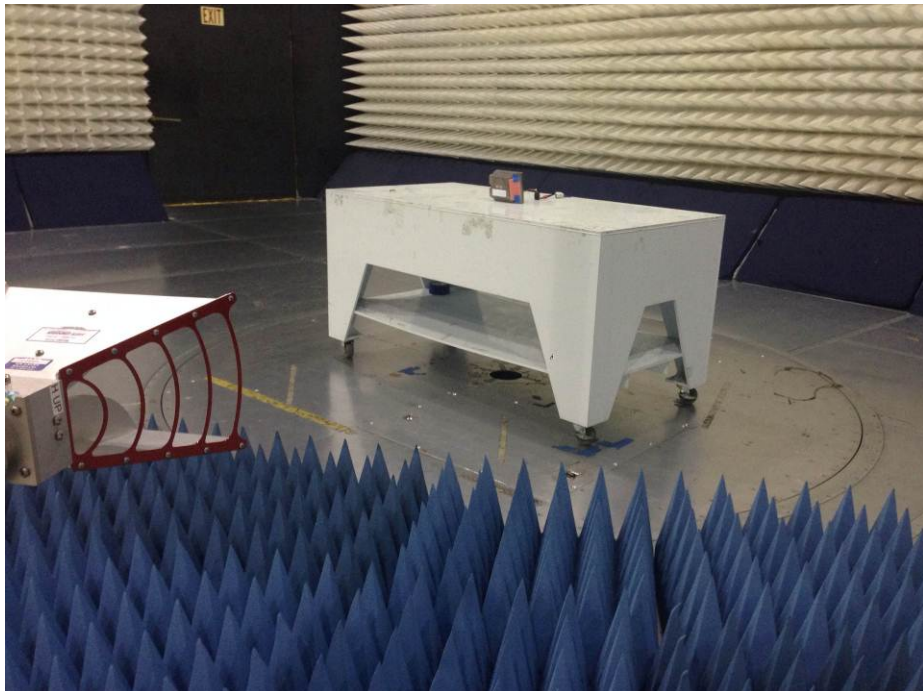
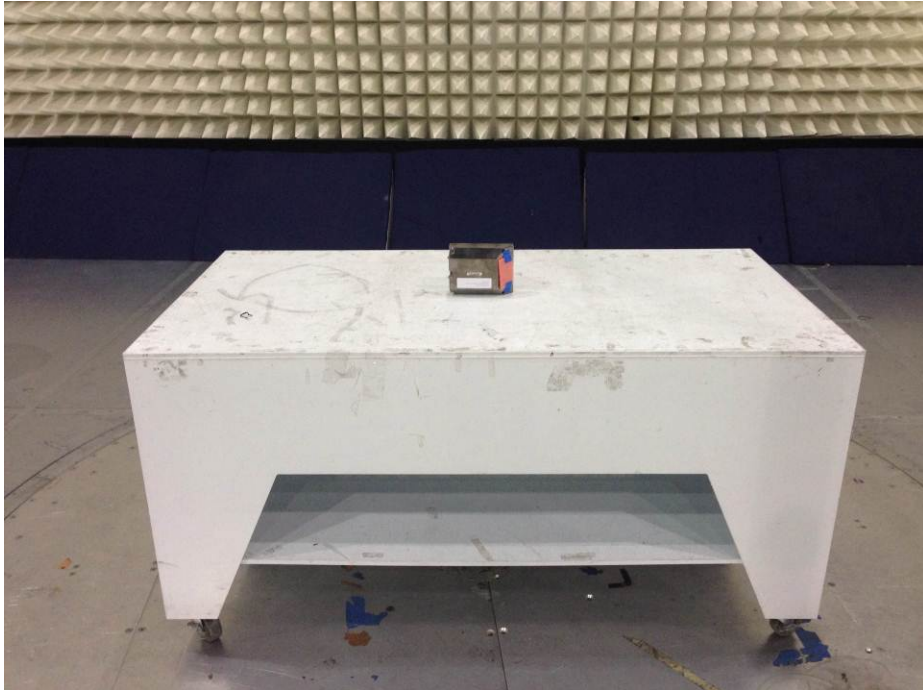


Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz.

<b>Results</b>	<b>Complies</b>
----------------	-----------------

4.5.4 Test setup photographs

**The following photographs show the testing configurations used.**



#### 4.6 Radiated Emissions

FCC Ref: 15.109, ICES 003

##### 4.6.1 Requirement

***Limits for Electromagnetic Radiated Emissions FCC Section 15.109(b), ICES 003\*, RSS GEN***

<b>Frequency (MHz)</b>	<b>Class A at 10m dB(<math>\mu</math>V/m)</b>	<b>Class B at 3m dB(<math>\mu</math>V/m)</b>
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

#### 4.6.2 Procedures

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 EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material.

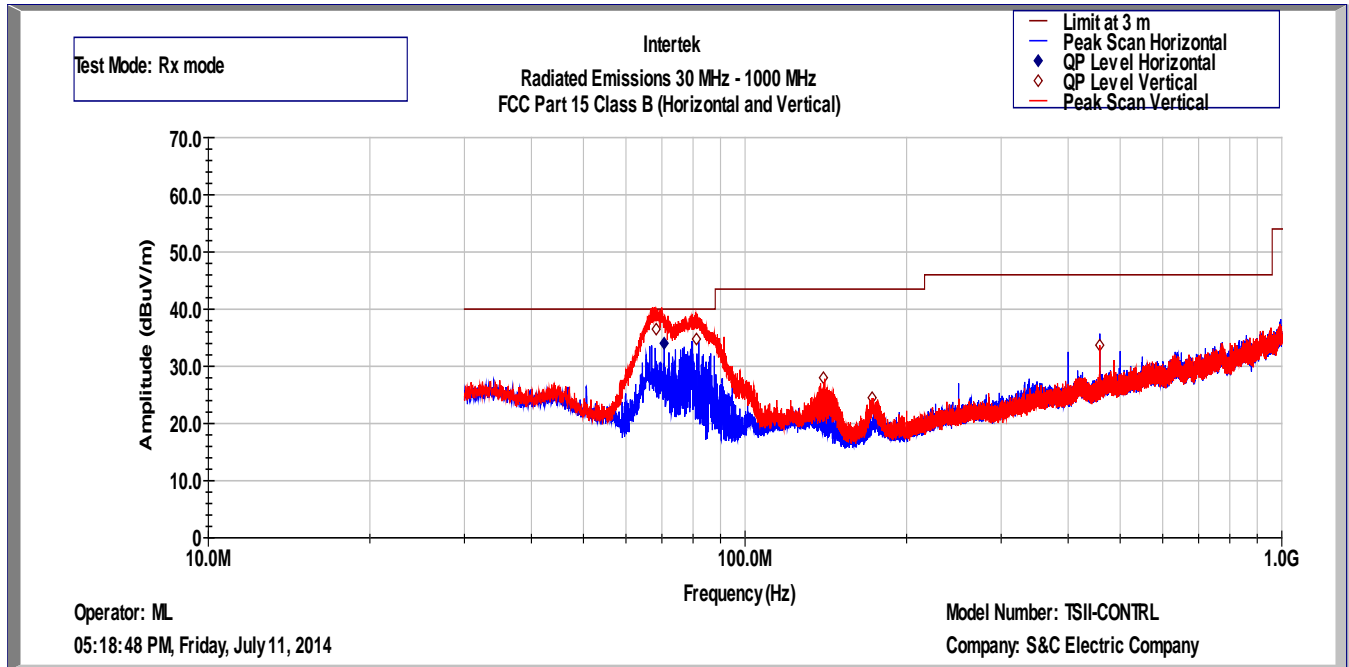
Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 and EN 55022.

#### 4.6.3 Test Results

The highest clock frequency used in the EUT is 50 MHz; therefore testing for Radiated Emissions need be tested up to 1 GHz for FCC 15B. Radiated emission measurements were performed from 30 MHz to 1000 MHz. The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.



Test Results: Radiated Emissions 30 MHz - 1000



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

Operator: ML

Model Number: TSII-CONTRL  
 Company: S&C Electric Company

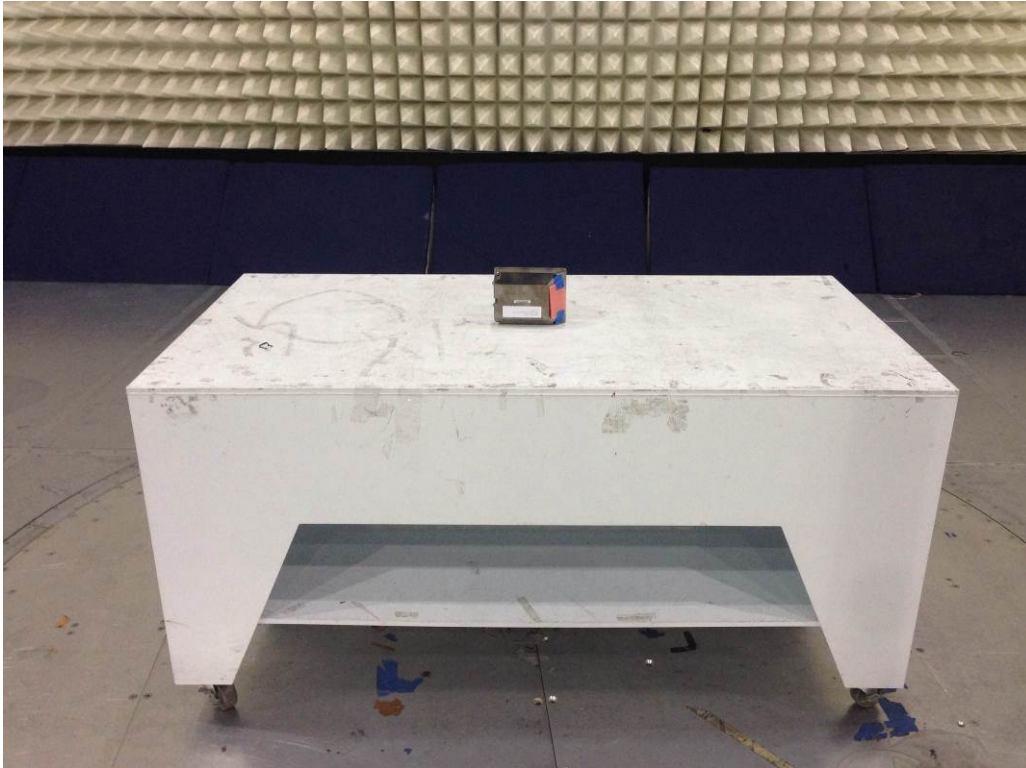
FCC Part 15 Class A (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
68.32	36.5	40	-3.5	49.5	1.0	32.1	10.5	7.6	360	180
81.2	34.7	40	-5.3	48.3	1.1	32.1	10.5	6.9	112	194
140	28.0	43.5	-15.5	39	1.2	32	10.5	9.3	0	100
172.5	24.5	43.5	-19.0	34.5	1.2	32	10.5	10.3	155	150
458	33.7	46	-12.3	36.7	2.4	32	10.5	16.2	15	100
FCC Part 15 Class B (QP-Horizontal)										
70.67	34.0	40	-6.0	47.5	1.0	32.1	10.5	7.1	0	200

Test Mode: Rx mode

**Result: Complies by 3.5 dB**

#### 4.6.4 Test Configuration Photographs

The following photographs show the testing configurations used.



4.7 AC Line Conducted Emission  
FCC: 15.207, 15.107; RSS-GEN;

4.7.1 Requirement

Frequency Band MHz	Class B Limit dB( $\mu$ V)		Class A Limit dB( $\mu$ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

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

4.7.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a 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.

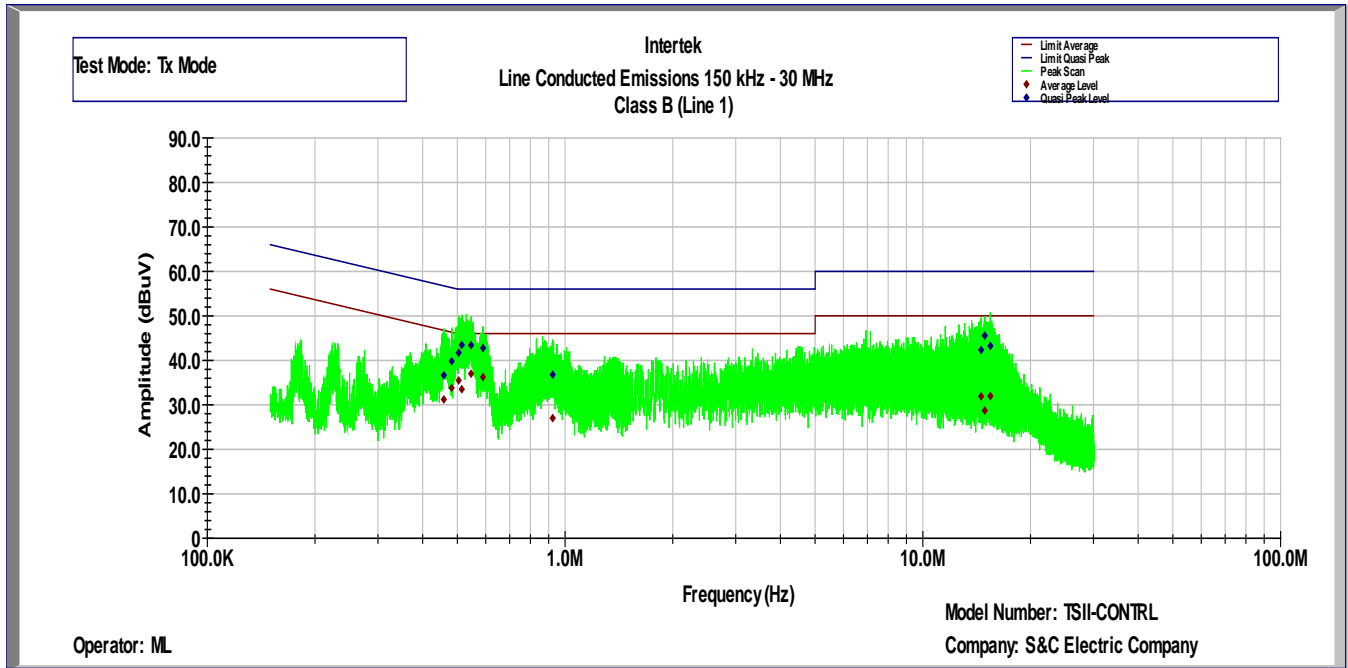
The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground 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.

4.7.3 Test Result

AC Line Conducted Emission Data, EUT in transmitting mode



Intertek Testing Services  
 Line Conducted Emissions 150 kHz - 30 MHz  
 FCC Class B (Line 1)

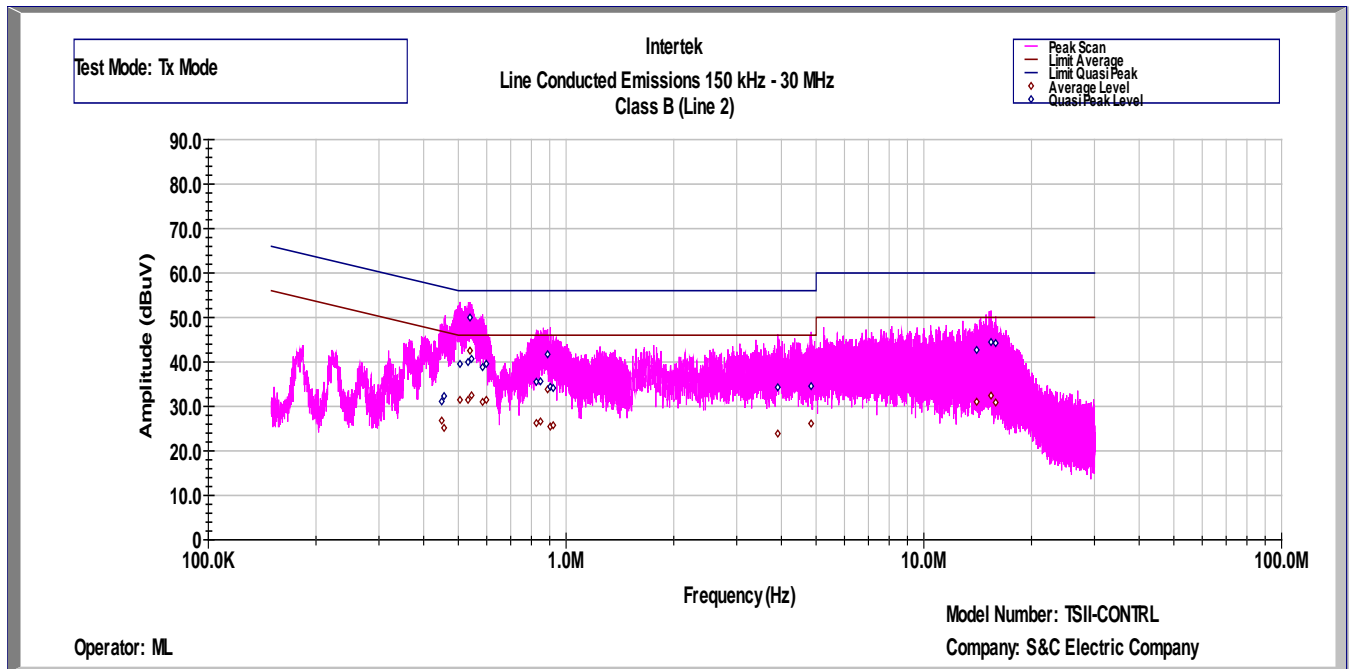
Operator: ML  
 July 11, 2014

Model Number: TSII-CONTRL  
 Company: S&C Electric Company

Frequency Hz	Av Level dBuV	QP Level dBuV	Av Limit dBuV	QP Limit dBuV	Av Margin dB	QP Margin dB
458000	31.2	36.7	47.2	57.2	-16.0	-20.5
482000	33.8	39.8	46.5	56.5	-12.7	-16.7
504300	35.5	41.7	46	56	-10.5	-14.3
514200	33.5	43.4	46	56	-12.5	-12.6
546000	37	43.4	46	56	-9.0	-12.6
589600	36.2	42.8	46	56	-9.8	-13.2
923140	27	36.8	46	56	-19.0	-19.2
1.46E+07	31.9	42.3	50	60	-18.1	-17.7
1.49E+07	28.7	45.6	50	60	-21.3	-14.4
1.54E+07	31.9	43.2	50	60	-18.1	-16.8

Test Mode: Transmitter On, 120V 60Hz  
 Temp.: 23.9C  
 Humidity: 52.9%

**AC Line Conducted Emission Data, EUT in transmitting mode**





Intertek Testing Services  
Line Conducted Emissions 150 kHz - 30 MHz  
FCC Class B (Line 2)

Operator: ML  
July 11, 2014

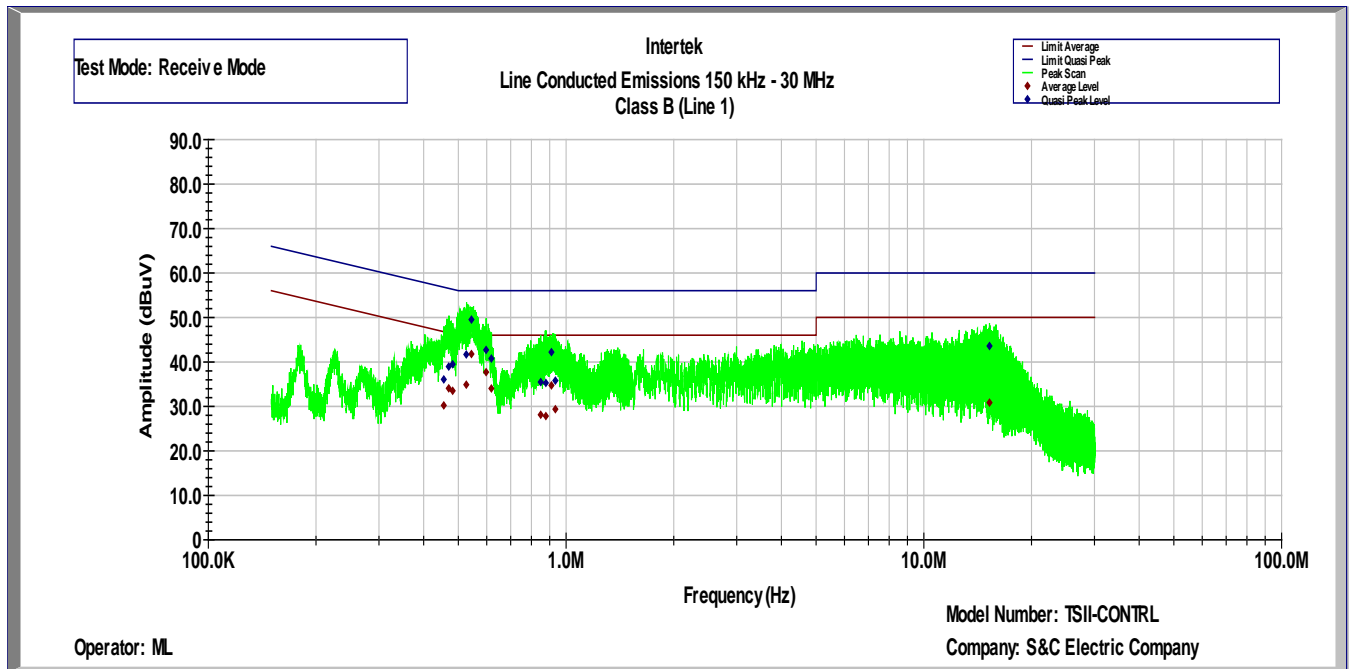
Model Number: TSII-CONTRL  
Company: S&C Electric Company

Frequency Hz	Av Level dBuV	QP Level dBuV	Av Limit dBuV	QP Limit dBuV	Av Margin dB	QP Margin dB
449000	26.8	31.1	47.5	57.5	-20.7	-26.4
456000	25.2	32.3	47.3	57.3	-22.1	-25
505000	31.5	39.6	46	56	-14.5	-16.4
532000	31.4	40	46	56	-14.6	-16
538600	42.5	50	46	56	-3.5	-6.0
544000	32.5	40.7	46	56	-13.5	-15.3
584300	31	38.8	46	56	-15	-17.2
598300	31.5	39.6	46	56	-14.5	-16.4
826000	26.2	35.5	46	56	-19.8	-20.5
848000	26.6	35.6	46	56	-19.4	-20.4
887700	33.8	41.7	46	56	-12.2	-14.3
903400	25.4	34.4	46	56	-20.6	-21.6
920000	25.8	34.1	46	56	-20.2	-21.9
3.90E+06	23.9	34.3	46	56	-22.1	-21.7
4.84E+06	26.1	34.6	46	56	-19.9	-21.4
1.40E+07	31	42.7	50	60	-19	-17.3
1.54E+07	32.4	44.4	50	60	-17.6	-15.6
1.59E+07	30.9	44.2	50	60	-19.1	-15.8

Test Mode: Transmitter On, 120V 60Hz  
Temp.: 23.9C  
Humidity: 52.9%

<b>Results</b>	<b>Complies by 3.5 dB</b>
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### AC Line Conducted Emission Data, Digital Parts Emissions



Intertek Testing Services  
Line Conducted Emissions 150 kHz - 30 MHz  
FCC Class B (Line 1)

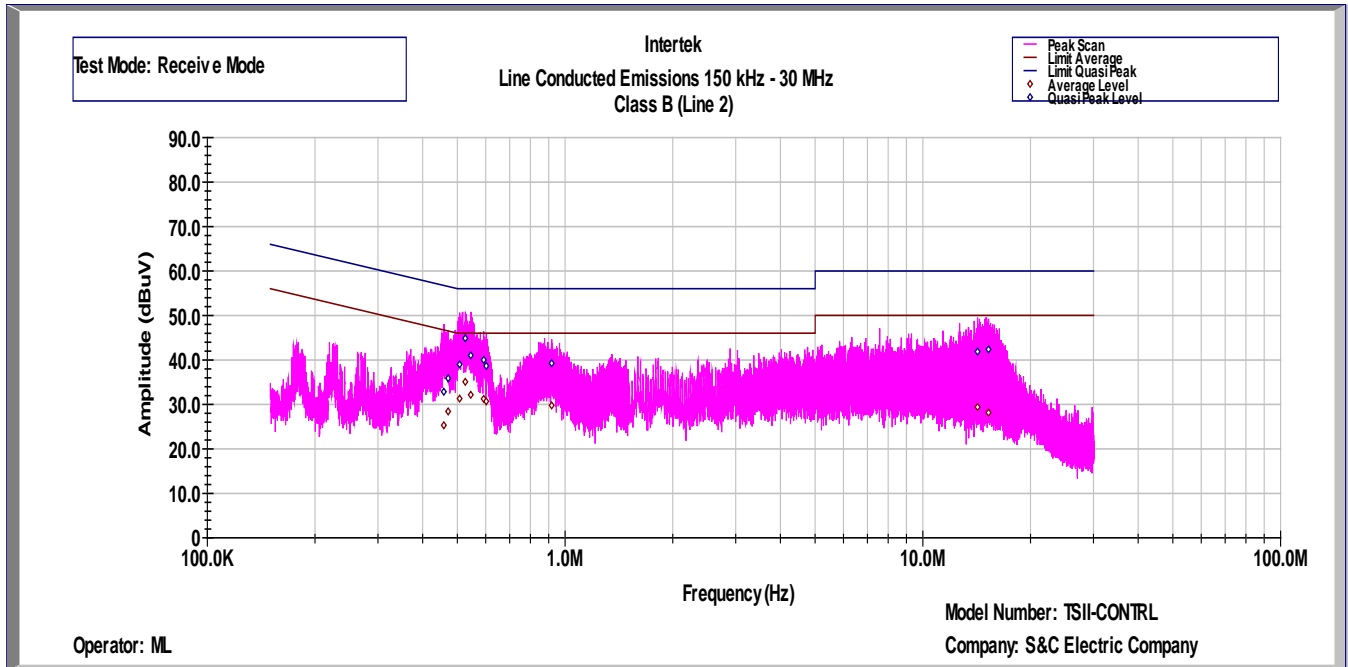
Operator: ML  
July 11, 2014

Model Number: TSII-CONTRL  
Company: S&C Electric Company

Frequency Hz	Av Level dBuV	QP Level dBuV	Av Limit dBuV	QP Limit dBuV	Av Margin dB	QP Margin dB
455000	30.2	36.1	47.3	57.3	-17.1	-21.2
470000	34.1	39	46.9	56.9	-12.8	-17.9
482000	33.5	39.5	46.5	56.5	-13.0	-17.1
526000	34.9	41.7	46	56	-11.1	-14.3
543700	41.8	49.5	46	56	-4.2	-6.5
597400	37.7	42.7	46	56	-8.3	-13.3
618000	34.0	40.7	46	56	-12	-15.3
849200	28.1	35.5	46	56	-17.9	-20.5
878000	27.8	35.3	46	56	-18.2	-20.7
910000	34.7	42.2	46	56	-11.3	-13.8
933000	29.4	35.8	46	56	-16.6	-20.2
1.53E+07	30.8	43.6	50	60	-19.2	-16.4

Test Mode: Receive mode, 120V 60Hz  
Temp.: 23.9C  
Humidity: 52.9%

## AC Line Conducted Emission Data, Digital Parts Emissions



Intertek Testing Services  
Line Conducted Emissions 150 kHz - 30 MHz  
FCC Class B (Line 1)

Operator: ML  
July 11, 2014

Model Number: TSII-CONTRL  
Company: S&C Electric Company

Frequency Hz	Av Level dBuV	QP Level dBuV	Av Limit dBuV	QP Limit dBuV	Av Margin dB	QP Margin dB
458200	25.3	32.9	47.2	57.2	-21.9	-24.3
471000	28.4	35.9	46.8	56.8	-18.4	-21.0
507300	31.3	39	46	56	-14.7	-17.0
526000	35.1	44.9	46	56	-10.9	-11.1
545000	32.2	41	46	56	-13.8	-15.0
592200	31.2	40.0	46	56	-14.8	-16.0
602000	30.7	38.6	46	56	-15.3	-17.4
917000	29.8	39.3	46	56	-16.2	-16.7
1.42E+07	29.4	41.9	50	60	-20.6	-18.1
1.53E+07	28.1	42.4	50	60	-21.9	-17.6

Test Mode: Receive mode, 120V 60Hz  
Temp.: 23.9C  
Humidity: 52.9%

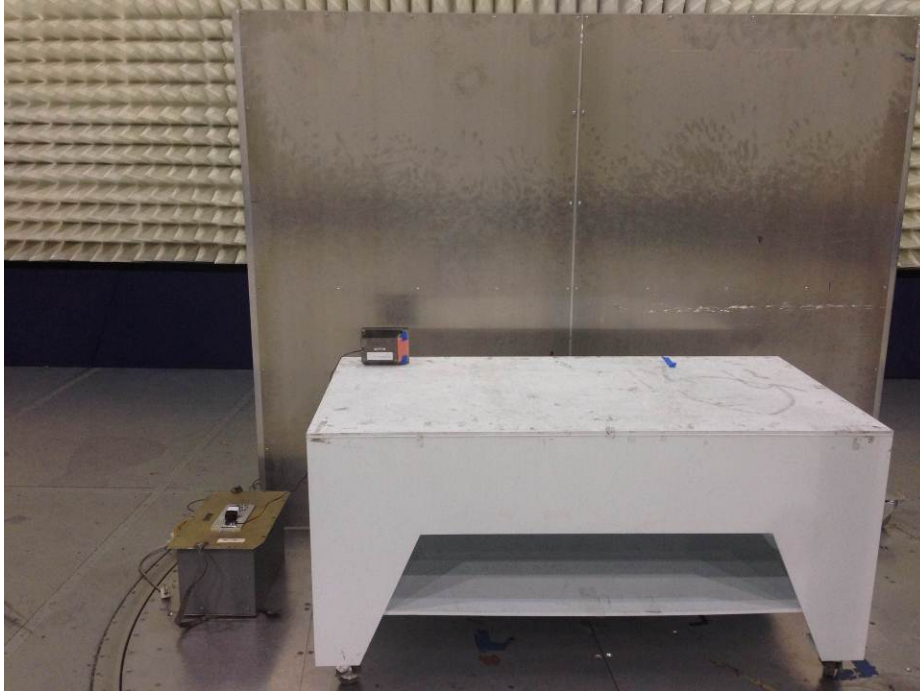
**Results**

**Complies by 4.2 dB**

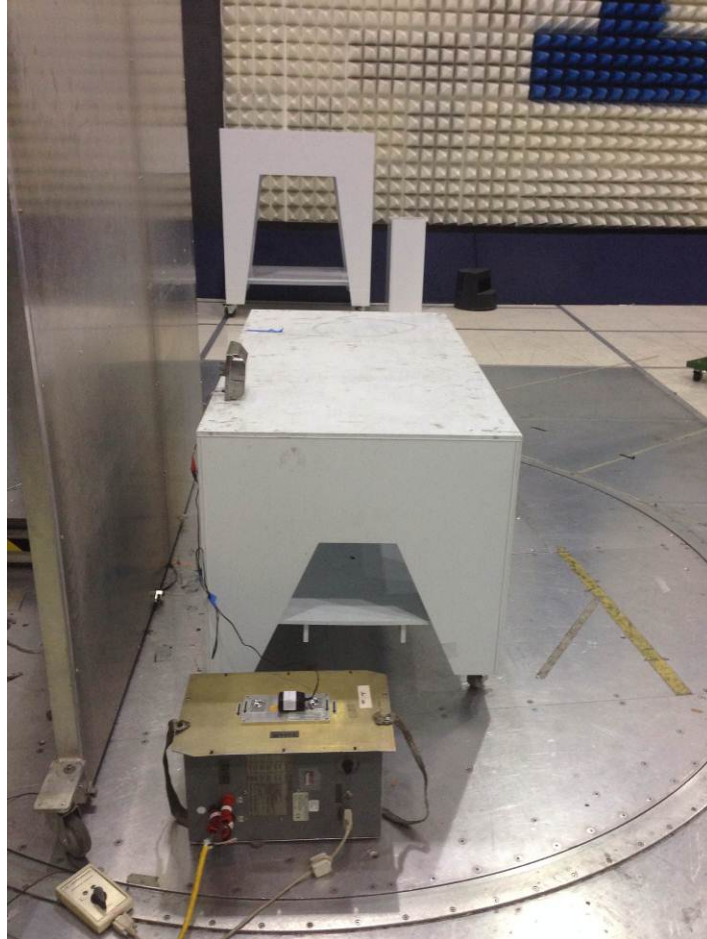


#### 4.7.4 Test Configuration Photographs

The following photographs show the testing configurations used.



#### 4.7.4 Test Configuration Photographs (Continued)



## 5.0 RF Exposure Evaluation

### MPE Evaluation

The EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons.

The maximum Peak EIRP calculated is -2.1 dBm or 0.617 mW; therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The Power Density can be calculated using the formula

$$S = \text{EIRP} / 4\pi D^2$$

Where: S is Power Density in  $\text{W}/\text{m}^2$   
D is the distance from the antenna.

It is considered that 20 cm is the minimum distance that user can go closest to the EUT.

At 20 cm,  $S = 0.00123 \text{ W}/\text{m}^2$ , which is below the MPE Limit of  $10 \text{ W}/\text{m}^2$

## 6.0 List of Test Equipment

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

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
Spectrum Analyzer	Rohde and Schwarz	FSU	ITS00913	12	12/11/14
Spectrum Analyzer	Rohde and Schwarz	ESU	ITS 00961	12	11/04/14
BI-Log Antenna	ARA	LPB-2513/A	ITS00355	12	08/01/14
Pyramidal Horn Antenna	EMCO	3160-09	ITS00571	#	#
Pre-Amplifier	Sonoma Instrument	310N	ITS 00415	12	12/20/14
Pre-Amplifier (1-18GHz)	Miteq	AMF-4D-001180-24-10P	ITS 00526	12	09/27/14
Pre-Amplifier (18-40GHz)	Miteq	JSD44-18004000-305P	ITS 00921	12	05/13/15
Horn Antenna	ETS Lindgren	3115	ITS 00982	12	11/14/14
LISN	FCC	FCC-LISN-50-50-M-H	00552	12	07/17/14

# No Calibration required

## 7.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G101712159	ML	KK	July 17, 2014	Original document
2.0 / G101712159	ML	KK	July 17, 2014	Added Section 5, RF Exposure Evaluation.