TEST REPORT

Report Number: 102289738MPK-004
Project Number: G102289738
October 30, 2015

Testing performed on
DragonBoard 410C
Model: DragonBoard 410C
FCC ID: 2AFQA-DB410C
IC: 20763-DB410C
to

FCC Part 15 Subpart C (15.247)
Industry Canada RSS-247 Issue 1
FCC Part 15, Subpart B
Industry Canada ICES-003

For

Arrow Electronics, Inc.

Test Performed by:	Test Authorized by:
Intertek	Arrow Electronics, Inc.
1365 Adams Court	7459 South Lima Bldg. 1
Menlo Park, CA 94025 USA	Englewood, CO 80112 USA

Prepared by: _____ **Date:** October 30, 2015
Anderson Soungpanya

Reviewed by: _____ **Date:** October 30, 2015
Krishna K Vemuri

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Report No. 102289738MPK-004

Equipment Under Test:	DragonBoard 410C
Trade Name:	DragonBoard
Model Number:	DragonBoard 410C
Serial Number:	AE-3915-006048
Applicant:	Arrow Electronics, Inc.
Contact:	Amanda Meyer
Address:	Arrow Electronics, Inc. 7459 South Lima Bldg. 1 Englewood, CO 80112
Country	USA
Tel. Number:	(303) 824-1711
Email:	ameyer@arrow.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 1 FCC Part 15, Subpart B Industry Canada ICES-003
Date of Test:	September 28 – 30, 2015

We attest to the accuracy of this report:

Anderson Soungpanya	Krishna K Vemuri
Project Engineer	EMC Senior Staff Engineer

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1.0 Summary of Tests

Test	Reference FCC	Reference Industry Canada	Result
Radiated Emissions	15.109	ICES-003	Complies
AC Line Conducted Emission	15.107	ICES-003	Complies
RF Output Power	15.247(b)(3)	RSS-247, 5.4.4	Complies
6 dB Bandwidth	15.247(a)(2)	RSS-247, 5.2.1	Complies
Power Density	15.247(e)	RSS-247, 5.2.2	Complies
Out of Band Antenna Conducted Emission	15.247(d)	RSS-247, 5.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-247, 5.5	Complies
AC Line Conducted Emission	15.207	RSS-GEN	Complies
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna & Unique connector)
RF Exposure	15.247(i), 2.1093(d)	RSS-102	Complies

EUT receive date: September 15, 2015
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 28, 2015
Test completion date: September 30, 2015
The test results in this report pertain only to the item tested.

2.0 General Information

2.1 Product Description

The DragonBoard™ 410c is the first development board based on a Qualcomm® Snapdragon™ 400 series processor. It features advanced processing power, Wi-Fi, Bluetooth connectivity, and GPS, all packed into a board the size of a credit card. Based on the 64-bit capable Snapdragon 410 processor, the DragonBoard 410c is designed to support rapid software development, education and prototyping, and is compliant with the96Boards Consumer Edition specification. All this makes it ideal for enabling embedded computing and Internet of Things (IoT) products, including the next generation of robotics, cameras, medical devices, vending machines, smart buildings, digital signage, casino gaming consoles, and much more.

Information about the 2.4 GHz radio is presented below:

Applicant	Arrow Electronics, Inc.
Model No.	DragonBoard 410C
FCC Identifier	2AFQA-DB410C
IC Identifier	20763-DB410C
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	2.73 dBm (1.87 mW)
Antenna(s) & Gain	PIFA Antenna, 3.6 dBi peak gain & Internal PCB Antenna, 0.7dBi peak gain
EIRP	2.73 dBm + 3.60 dBi = 6.33 dBm (4.30 mW)
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK 1Mb
Number of Channel(s)	40
Applicant Name & Address	Arrow Electronics, Inc. 7459 South Lima Bldg. 1 Englewood, CO 80112 USA

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 D01 DTS Meas Guidance v03r03 June 9, 2015), and RSS-247, RSS-GEN.

Radiated emissions and AC mains conducted emissions measurements were performed according to the procedures in ANSI C63.10-2013. 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	-	-

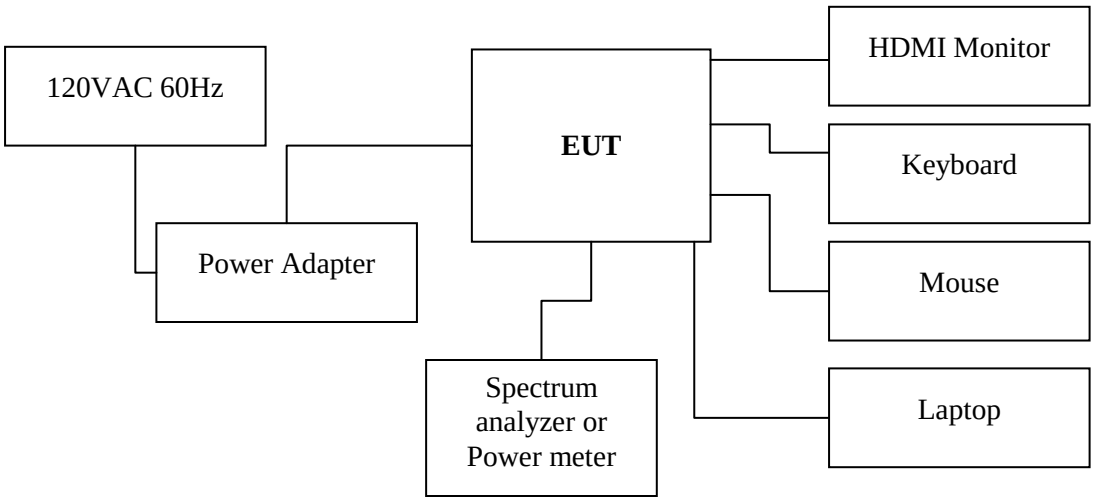
3.0 System Test Configuration

3.1 Support Equipment

Description	Manufacturer	Model No./ Part No.
Power Adapter	Power Partners	SAW24-120-2000
HDMI Monitor	HP	ZR2440W
Keyboard	HP	KU-0316
Mouse	Logitech	M-B0001
Laptop	Asus	Eee PC Seashell Series

3.2 Block Diagram of Test Setup

Antenna was removed and co-axial connector with a cable was installed for Conducted Measurements.
50Ohm Load was used for Radiated Measurements.



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

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 Arrow Electronics, Inc.

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-247 A8.2 and RSS-GEN;

4.1.1 Requirement

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

4.1.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter.

For FCC 6dB Channel Bandwidth the Procedure described in the FCC Publication 558074 D01 DTS Meas Guidance v03r03 June 9, 2015 was used to determine the DTS occupied bandwidth. Section 8.1 Option 1 was used.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

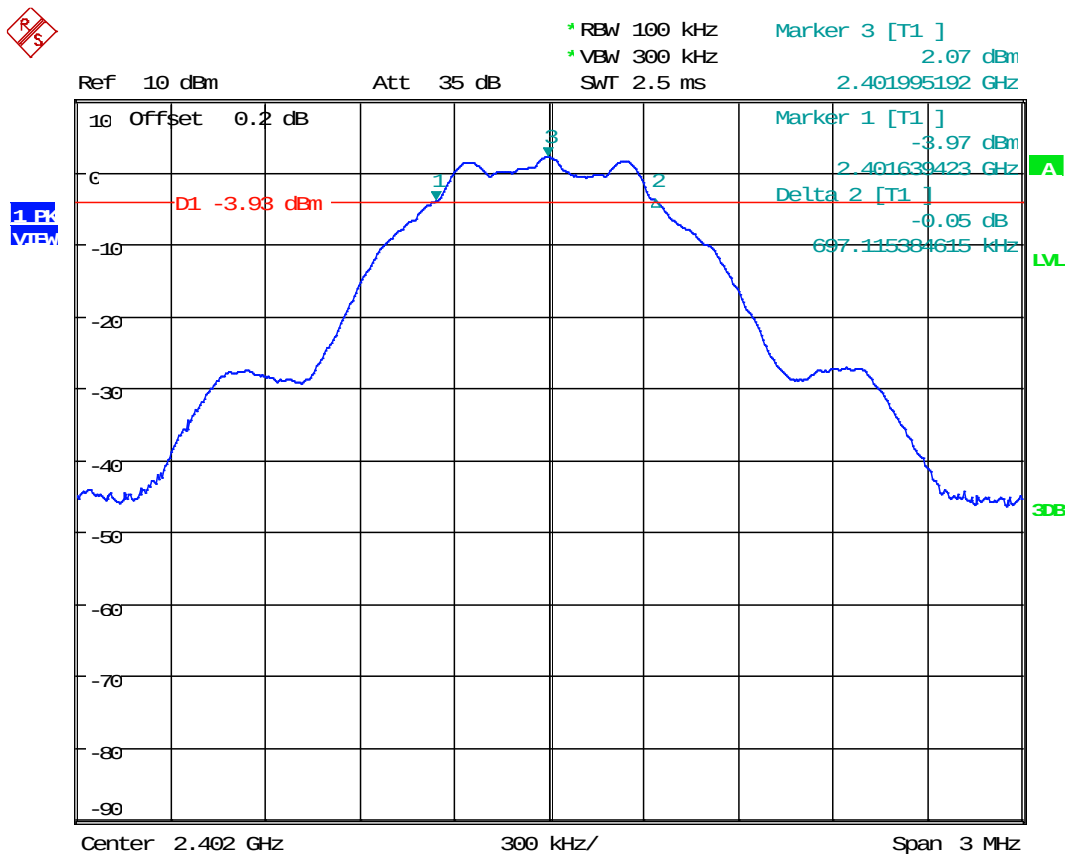
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, MHz	Occupied bandwidth, RSS-GEN, MHz	Plot
2402	0.697	--	1.1
	--	1.063	1.4
2440	0.702	--	1.2
	--	1.063	1.5
2480	0.692	--	1.3
	--	1.058	1.6

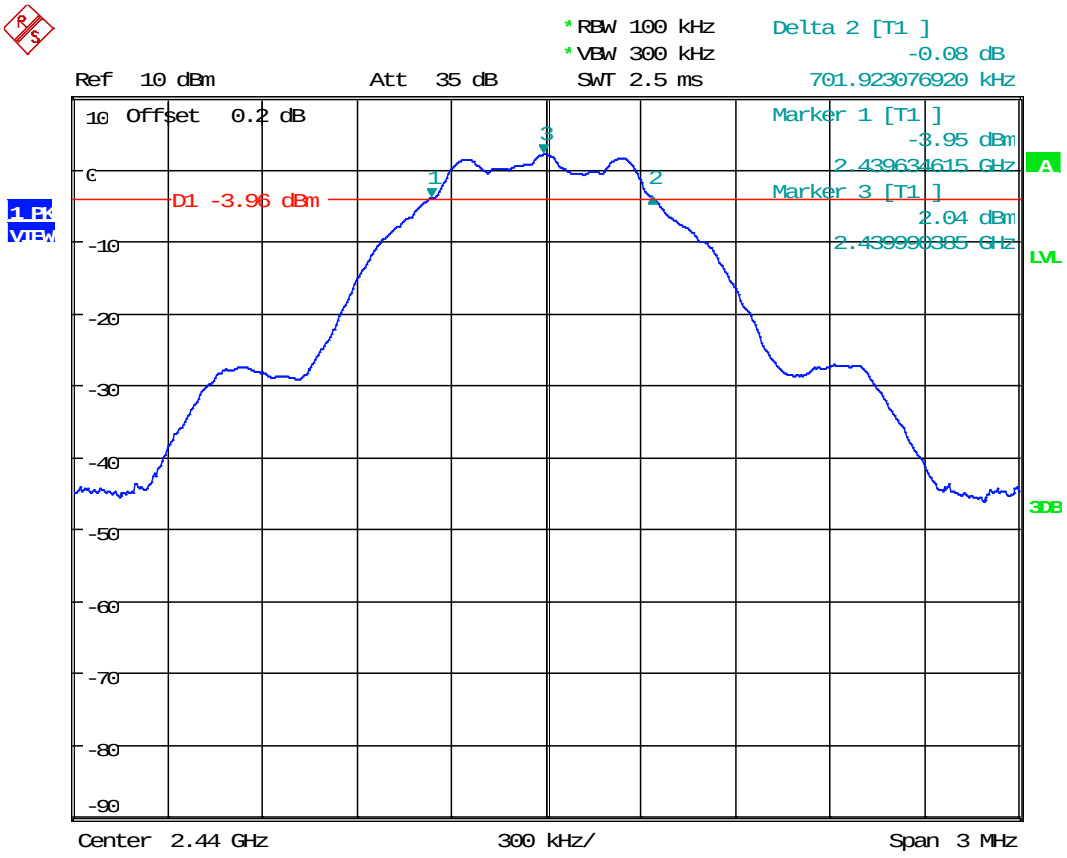
Date of Test:	September 30, 2015
Results	**Complies**

Plot 1. 1



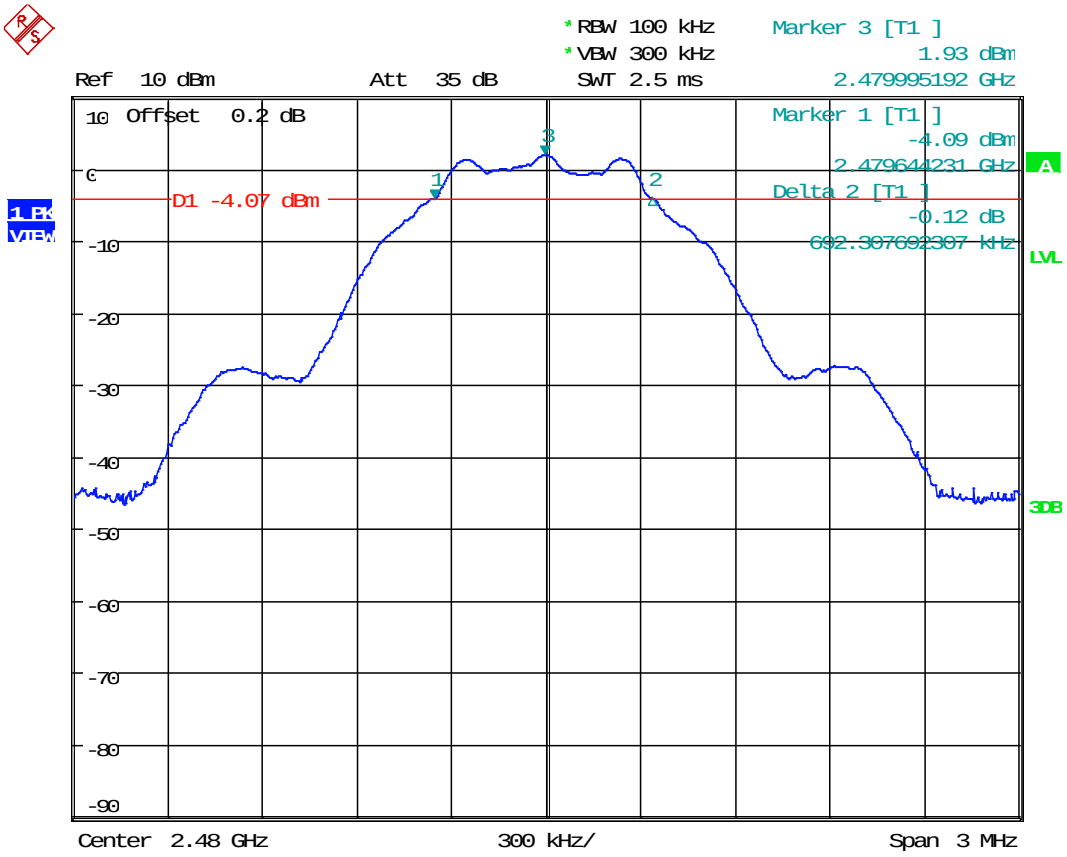
Date: 30.SEP.2015 11:29:33

Plot 1. 2



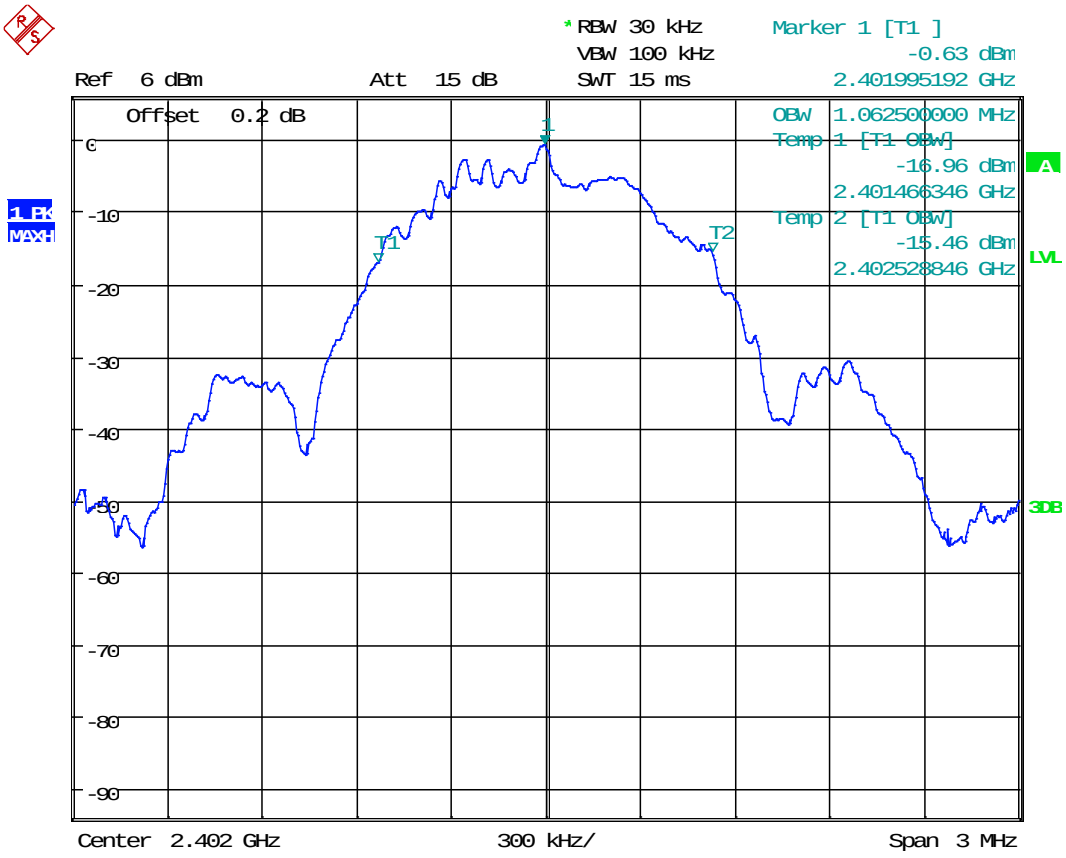
Date: 30.SEP.2015 11:27:37

Plot 1. 3



Date: 30.SEP.2015 11:25:11

Plot 1. 4



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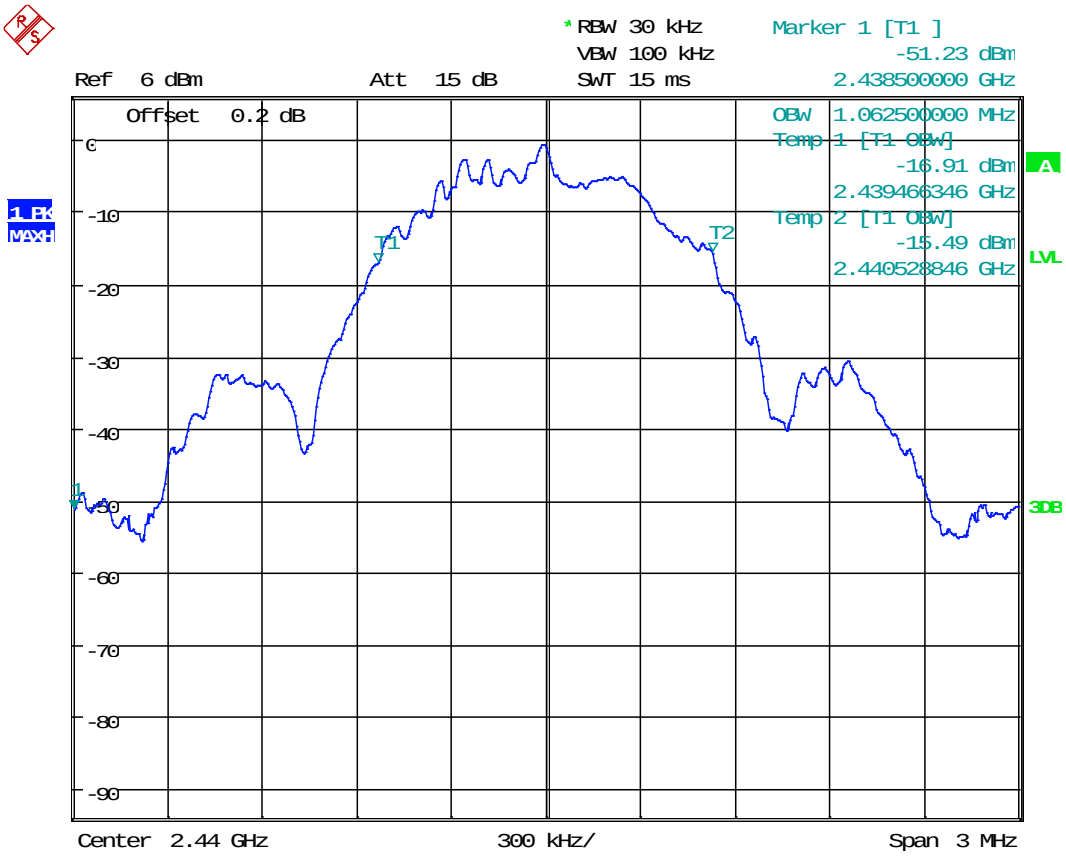
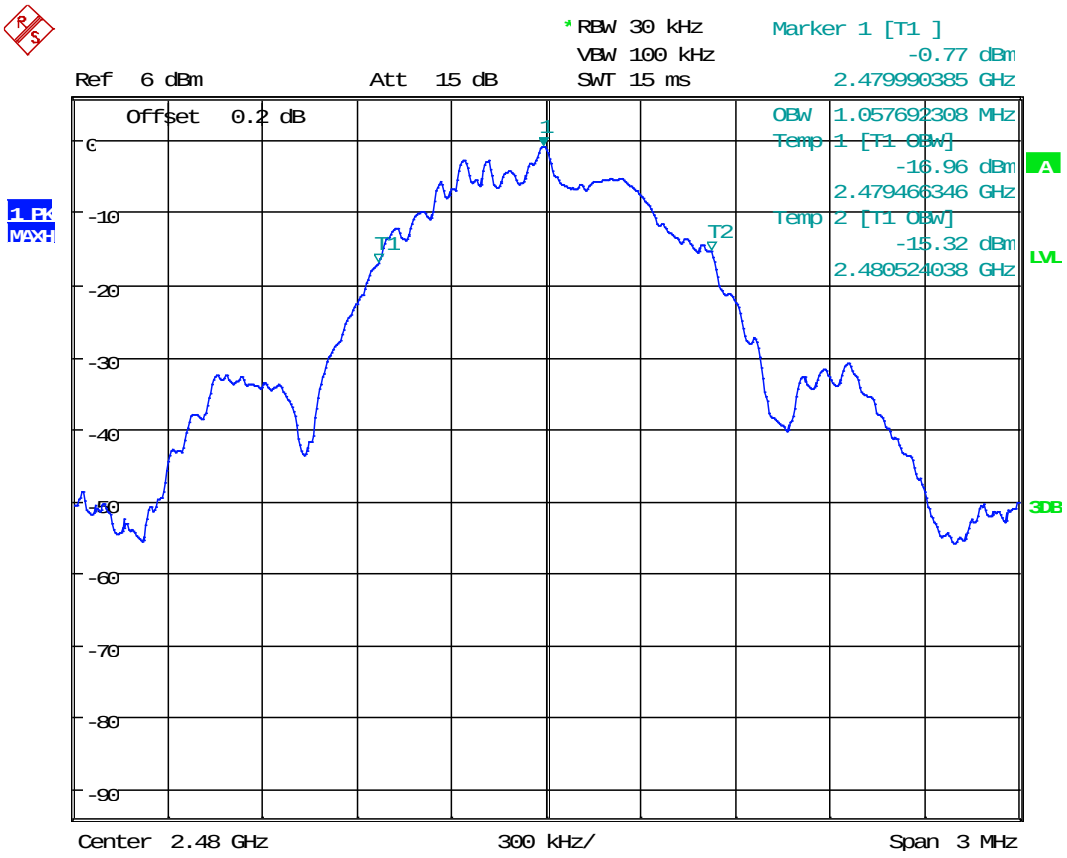
Plot 1.5



Date: 30.SEP.2015 11:32:41

Plot 1.6



Date: 30.SEP.2015 11:33:24

4.2 Maximum Peak Conducted Output Power at Antenna Terminals
FCC Rule: 15.247(b)(3); RSS-247 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 procedure described in FCC Publication 558074 D01 DTS Meas Guidance v03r03 June 9, 2015 was used. Specifically, section 9.1.1 RBW ≥ DTS Bandwidth was utilized as the spectrum analyzer's resolution bandwidth was greater than the DTS bandwidth.

1. Set the RBW ≥ DTS Bandwidth
2. Set the VBW ≥ 3 x RBW
3. Set the span ≥ 3 x RBW
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max Hold
7. Allow trace to fully stabilize
8. Use peak marker function to determine the peak amplitude level.

A spectrum analyzer was connected to the antenna port of the transmitter.

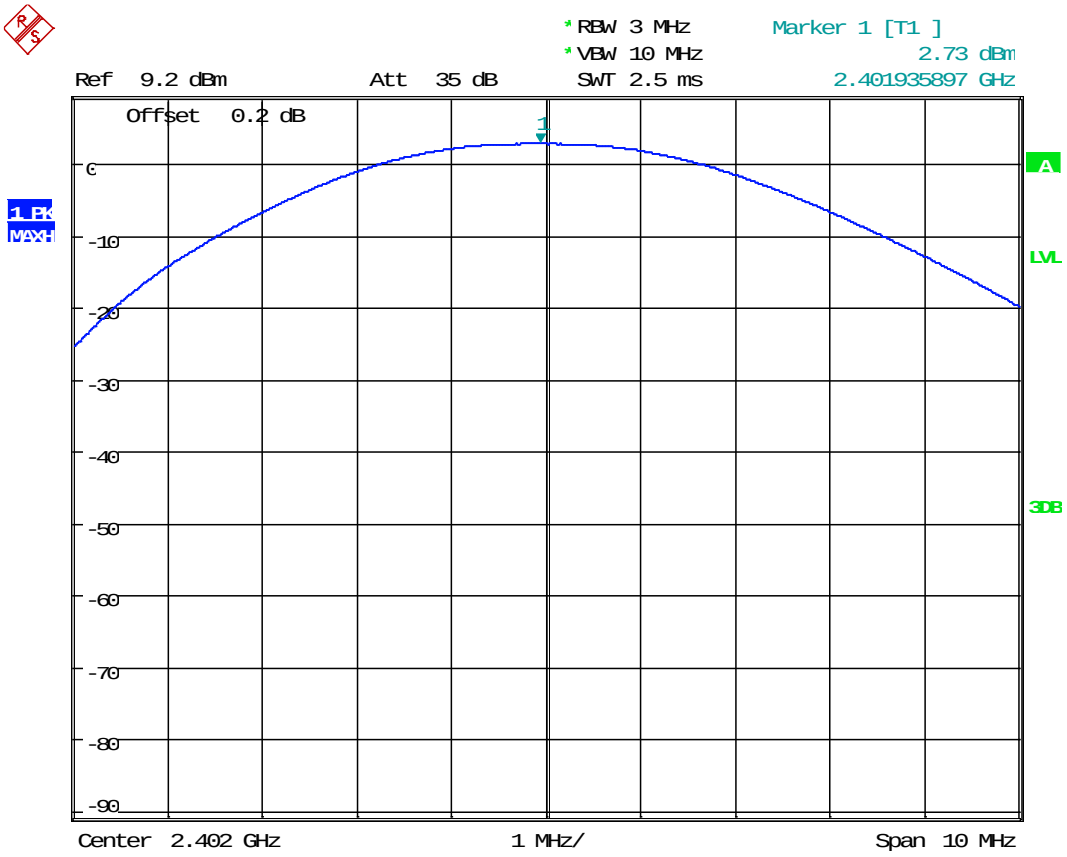
4.3.3 Test Result

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

Frequency, MHz	Conducted Power (peak), dBm	Conducted Power (peak), mW	Plot
2402	2.73	1.87	2.1
2440	2.62	1.83	2.2
2480	2.57	1.81	2.3

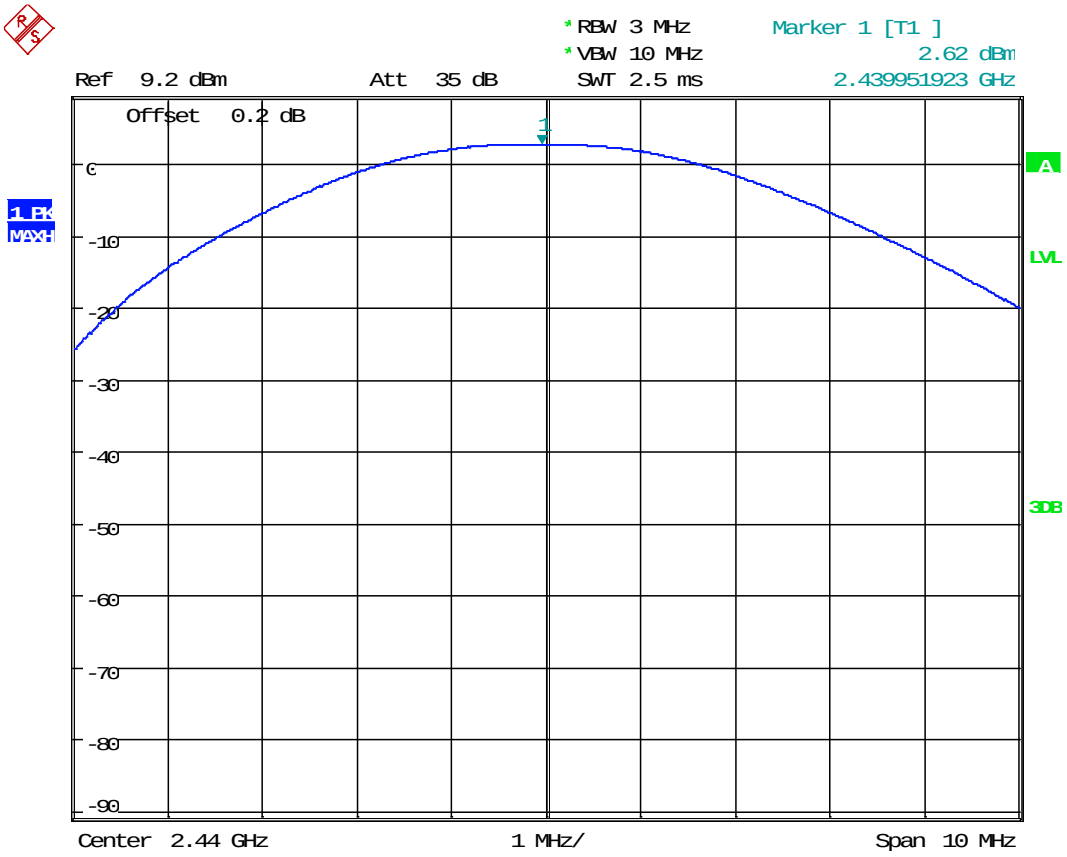
Date of Test:	September 30, 2015
Results	**Complies**

Plot 2. 1



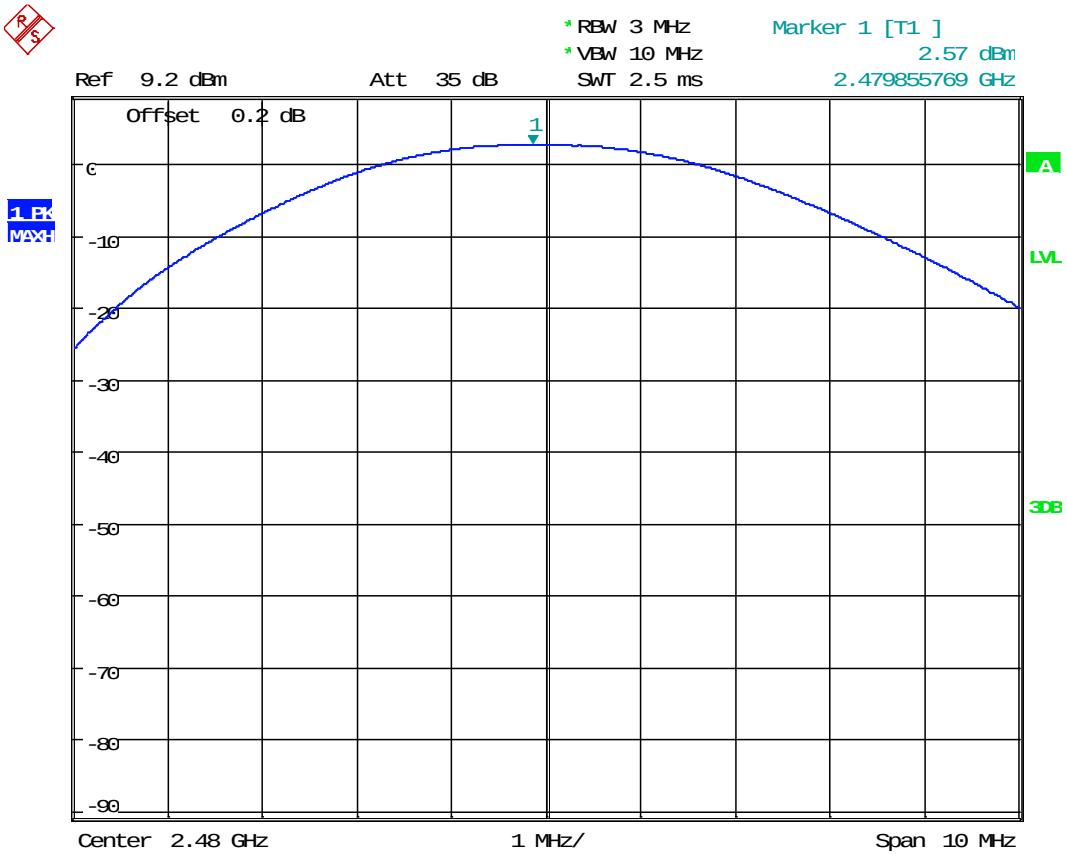
Date: 30.SEP.2015 11:20:15

Plot 2. 2



Date: 30.SEP.2015 11:21:36

Plot 2. 3



Date: 30.SEP.2015 11:22:21

4.3 Maximum Power Spectral Density
FCC: 15.247 (e); RSS-247 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

A spectrum analyzer was connected to the antenna port of the transmitter.

The procedure described in FCC Publication 558074 D01 DTS Meas Guidance v03r03 June 9, 2015, specifically section 10.2 Method PKPSD (peak PSD).

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

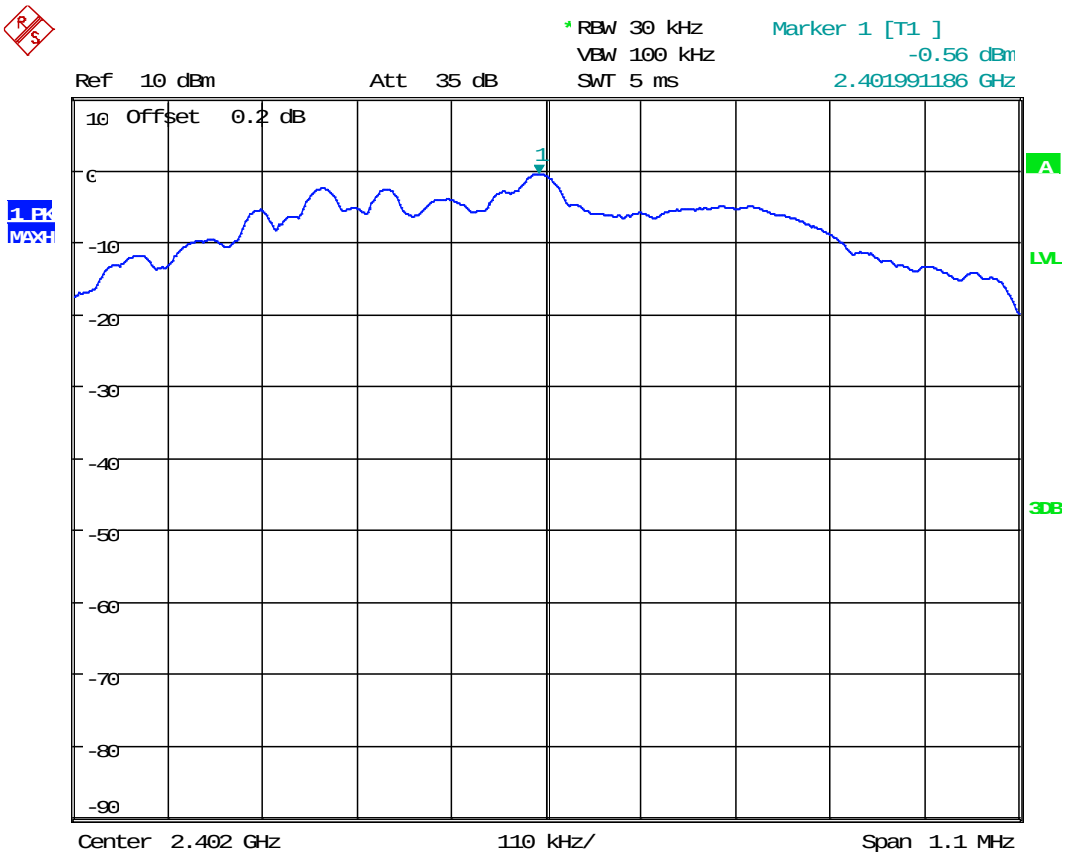
4.3.3 Test Result

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
2402	-0.56	8.0	-8.56	3.1
2440	-0.58	8.0	-8.58	3.2
2480	-0.72	8.0	-8.72	3.3

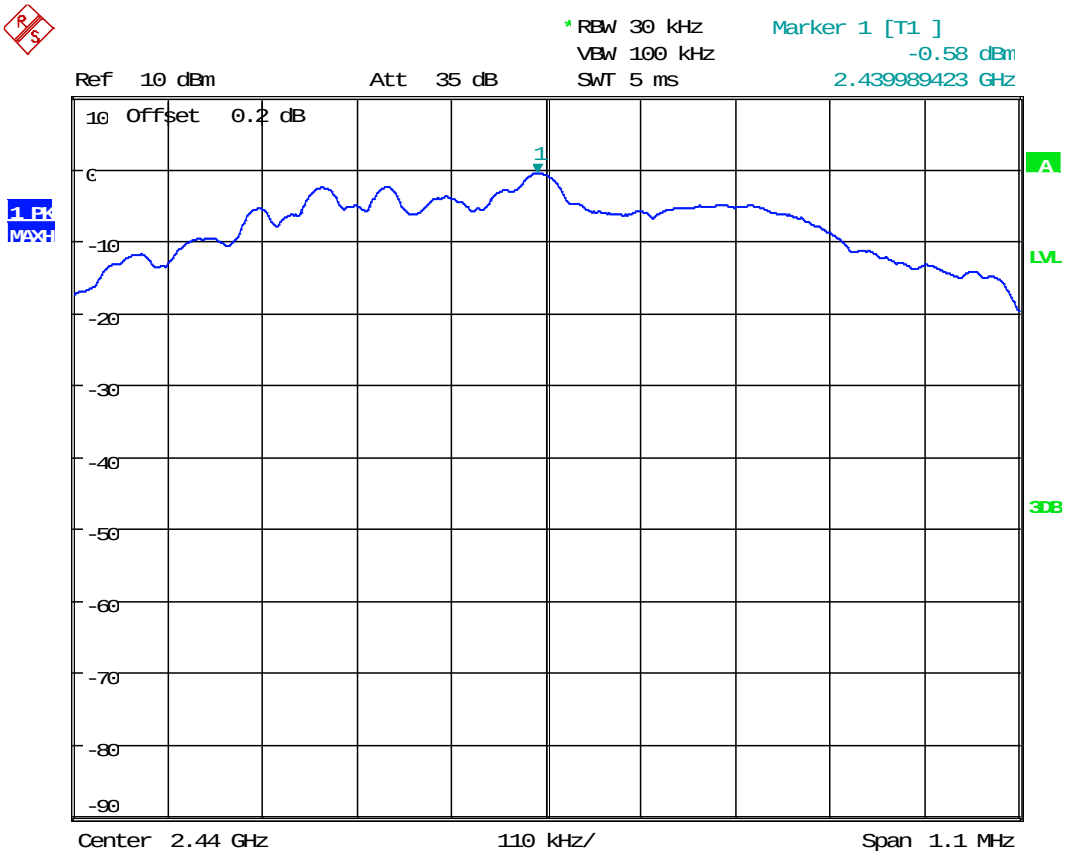
Date of Test:	September 30, 2015
Results	**Complies**

Plot 3. 1



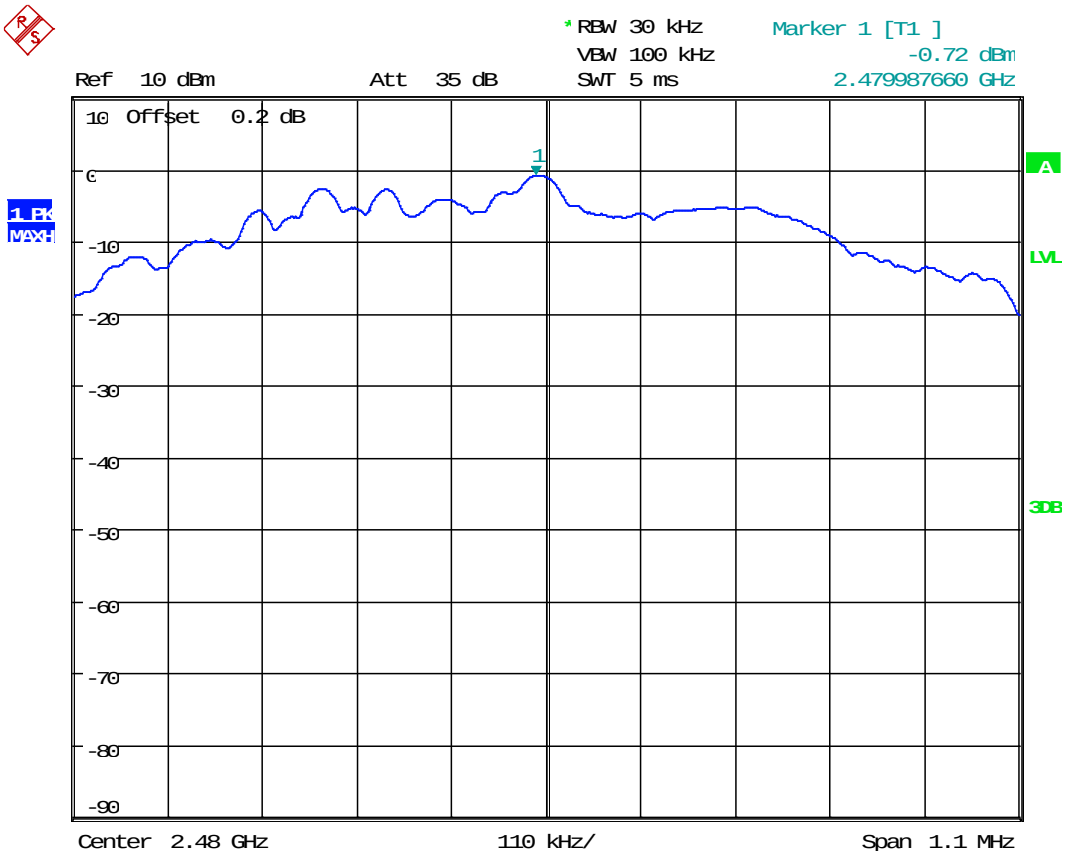
Date: 30.SEP.2015 11:49:50

Plot 3. 2



Date: 30.SEP.2015 11:48:59

Plot 3. 3



Date: 30.SEP.2015 11:34:45

4.4 Unwanted Conducted Emissions
FCC: 15.247(d); RSS-247 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

The procedure described in FCC Publication 558074 D01 DTS Meas Guidance v03r03 June 9, 2015, specifically section 11.0 Emissions in non-restricted frequency bands.

A spectrum analyzer was connected to the antenna port of the transmitter.

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 3 x RBW.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

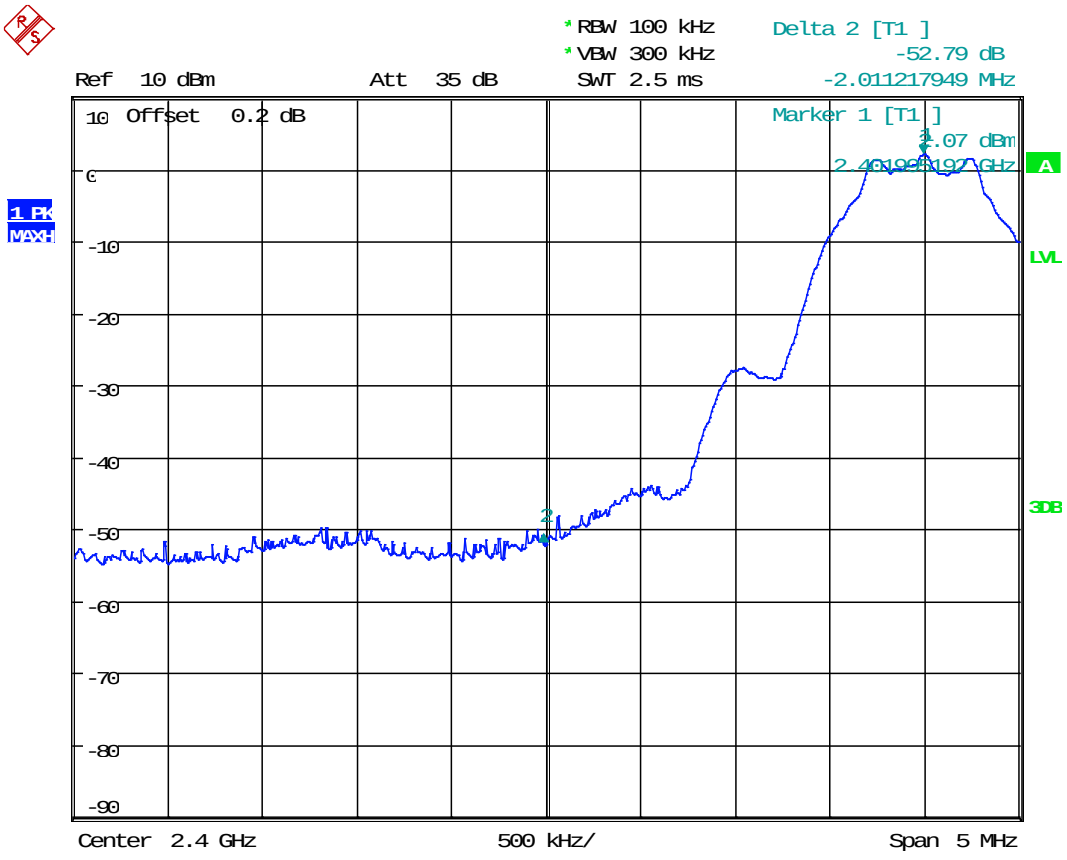
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

4.4.3 Test Result

Refer to the following plots 4.1 – 4.5 for unwanted conducted emissions. The plot shows -20dB attenuation limit line.

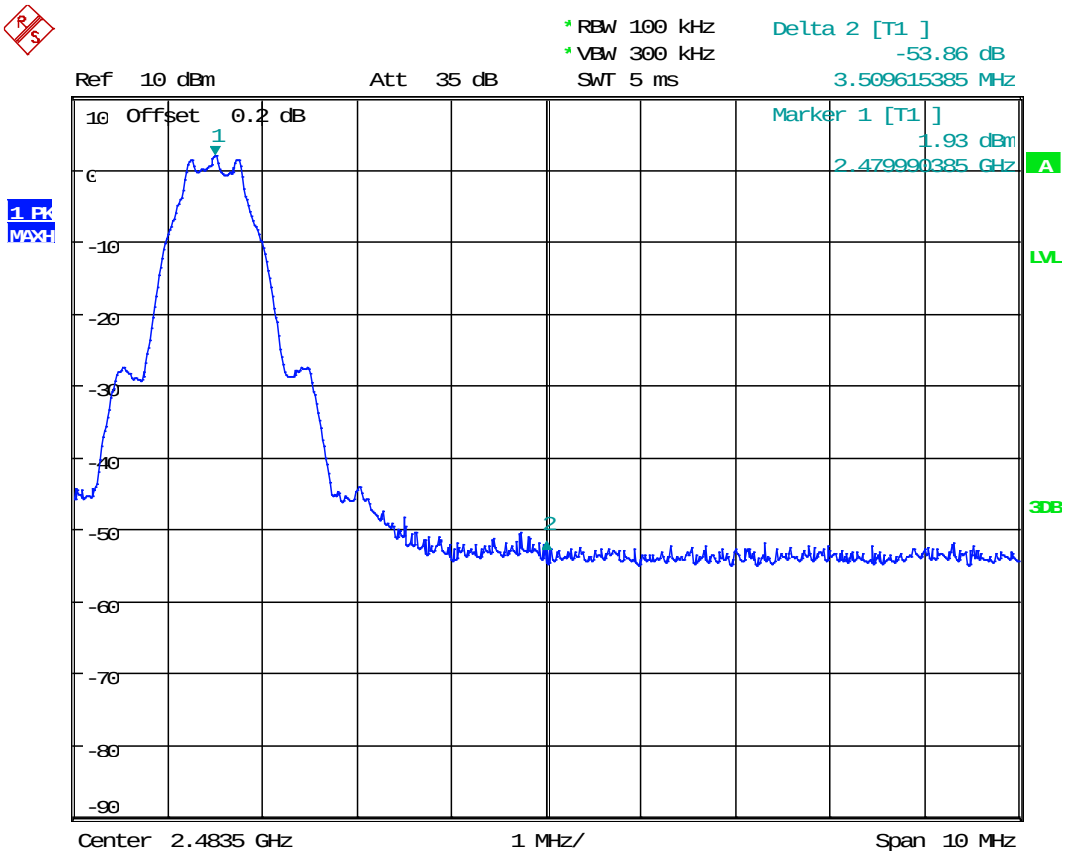
Date of Test:	September 30, 2015
Results	**Complies**

Tx @ Low Channel, 2400 MHz Band Edge
Plot 4.1



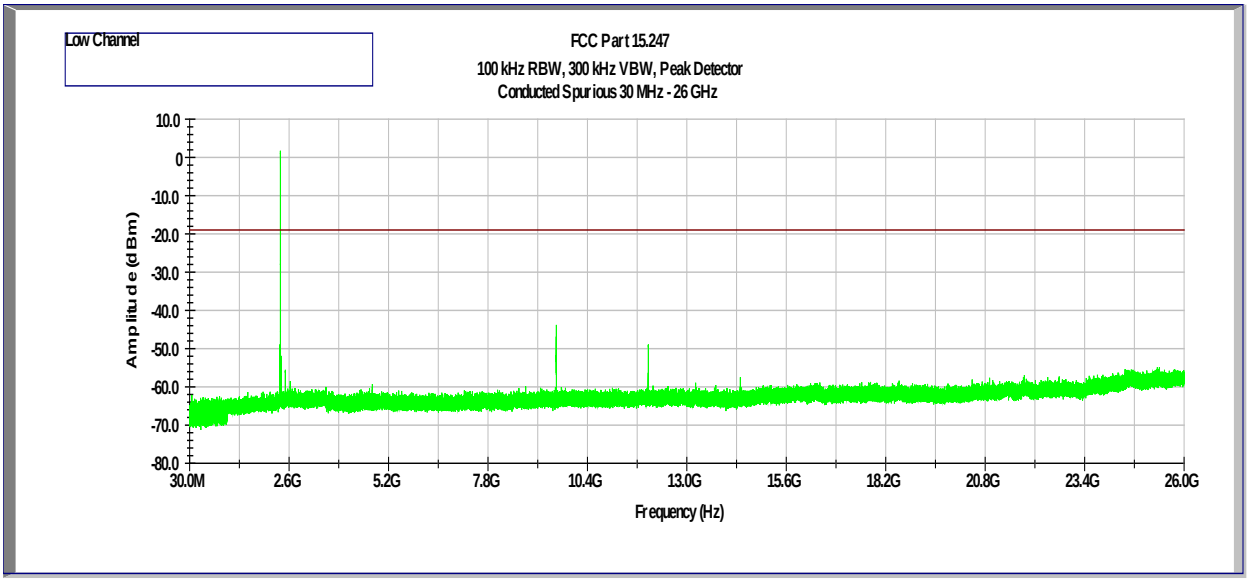
Date: 30.SEP.2015 11:51:17

Tx @ Low Channel, 2483.5 MHz Band Edge
Plot 4.2

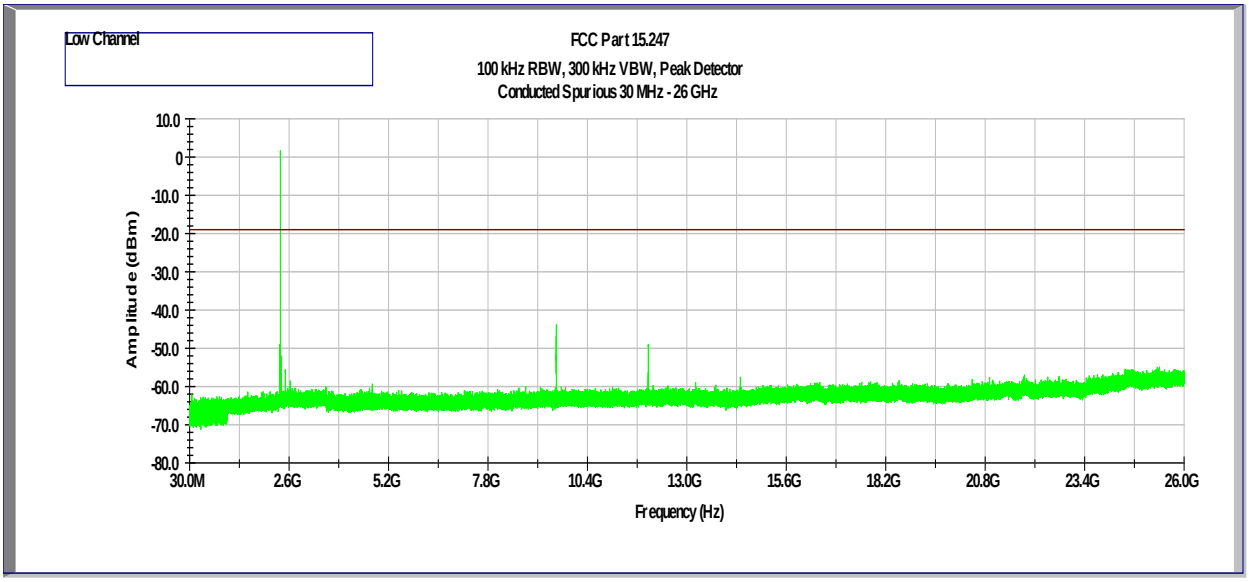


Date: 30.SEP.2015 11:52:25

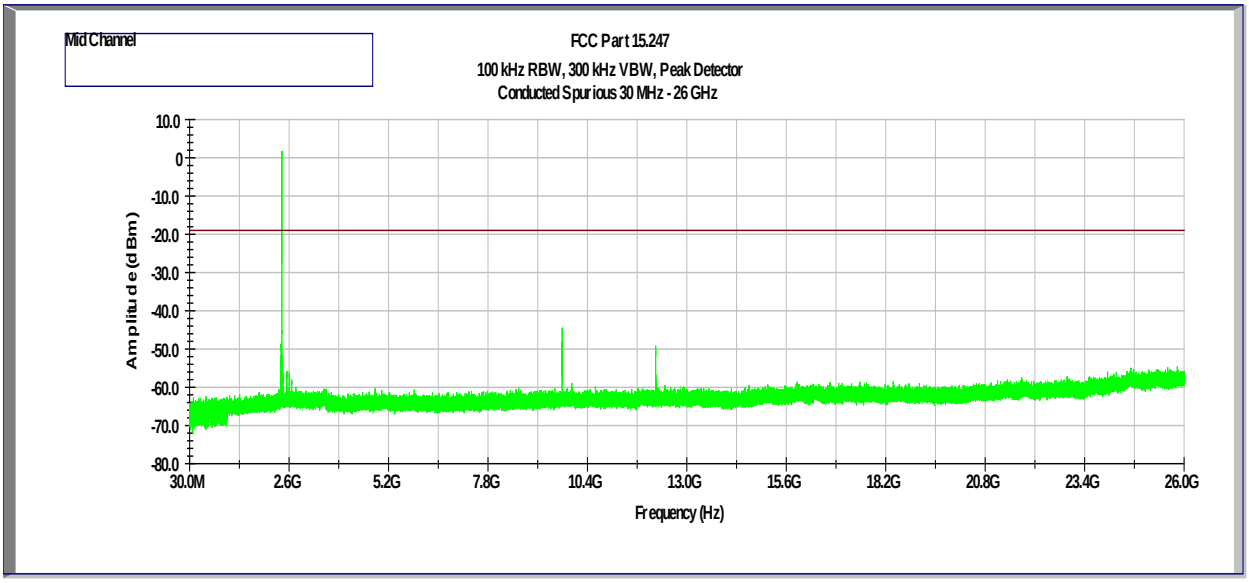
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Plot 4.3



Tx @ Mid Channel, 2440 MHz
30MHz -26GHz Conducted Spurious
Plot 4.5



Tx @ High Channel, 2480 MHz
30MHz -26GHz Conducted Spurious
Plot 4.5



4.5 Transmitter Radiated Emissions
FCC Rules: 15.247(d), 15.209, 15.205; RSS-247;

4.5.1 Requirement

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) (see §15.205(c)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

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 for below 1000MHz and 1.5m in height for above 1GHz. 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 3 meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Measurements made from 1 GHz to 18GHz had a 2.4-2.5GHz notch filter in place. A preamp was used from 30MHz to 26GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 26GHz.

Data is included 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(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); 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(μV) 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(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
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(μV/m).
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m.

4.5.4 Antenna-port conducted measurements

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

4.5.6 General Procedure for conducted measurements in restricted bands

a) Measure the conducted output power (in dBm) using the detector specified for determining quasi-peak, peak, and average conducted output power, respectively.

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (*e.g.*, Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
$E = EIRP - 20\log D + 104.8$
where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.
f) Compare the resultant electric field strength level to the applicable limit.
g) Perform radiated spurious emission test

4.5.7 Test Results

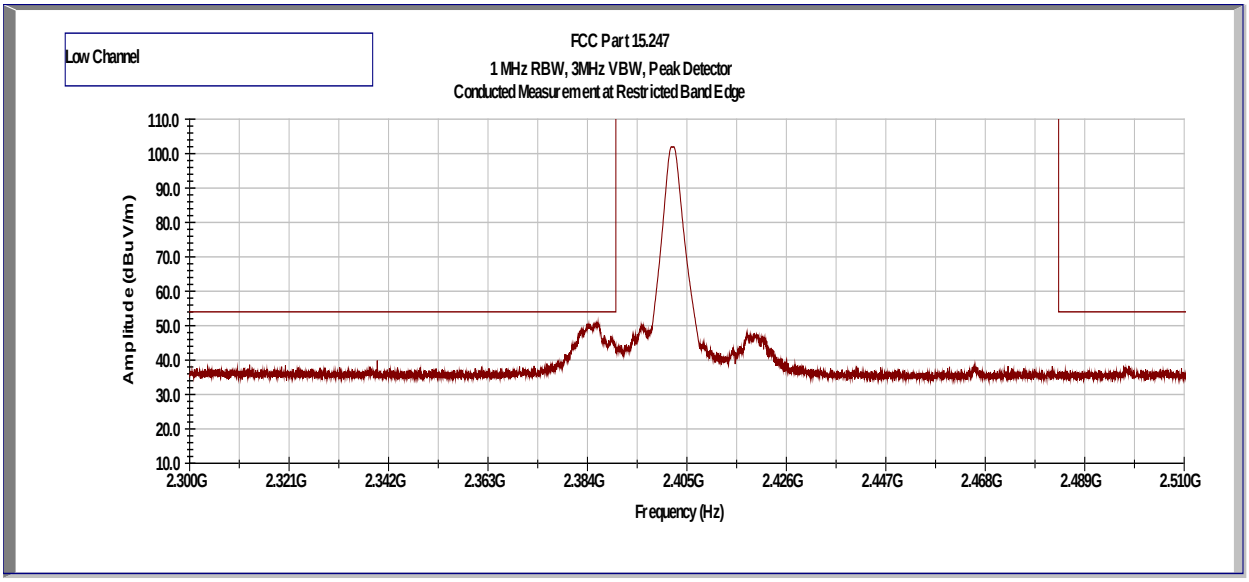
The data on the following pages list the significant emission frequencies, the limit and the margin of compliance where emissions are within 3dB of the limit.

All conducted antenna port plots are corrected with the consideration of a 3.6dBi Antenna Gain.

Radiated emission measurements were performed up to 26GHz. No Emissions were identified when scanned from 18-25 GHz.

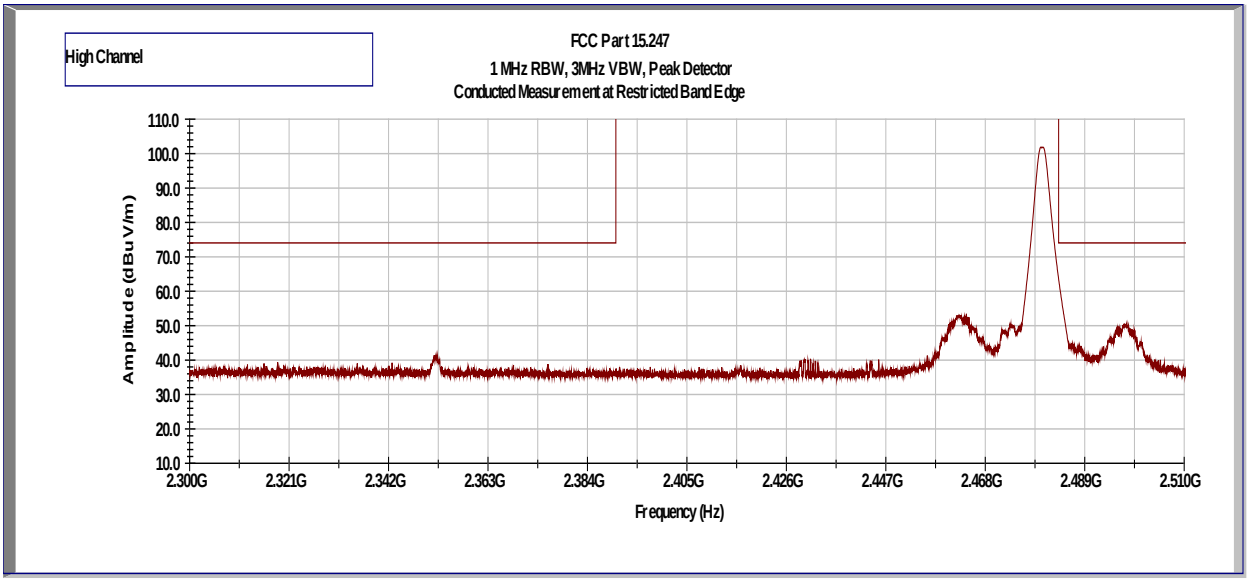
Test Results: 15.209/15.205 Restricted Band Emissions at Antenna Port

Out-of-Band Spurious Emissions at the Band Edge – Tx @ 2402 MHz



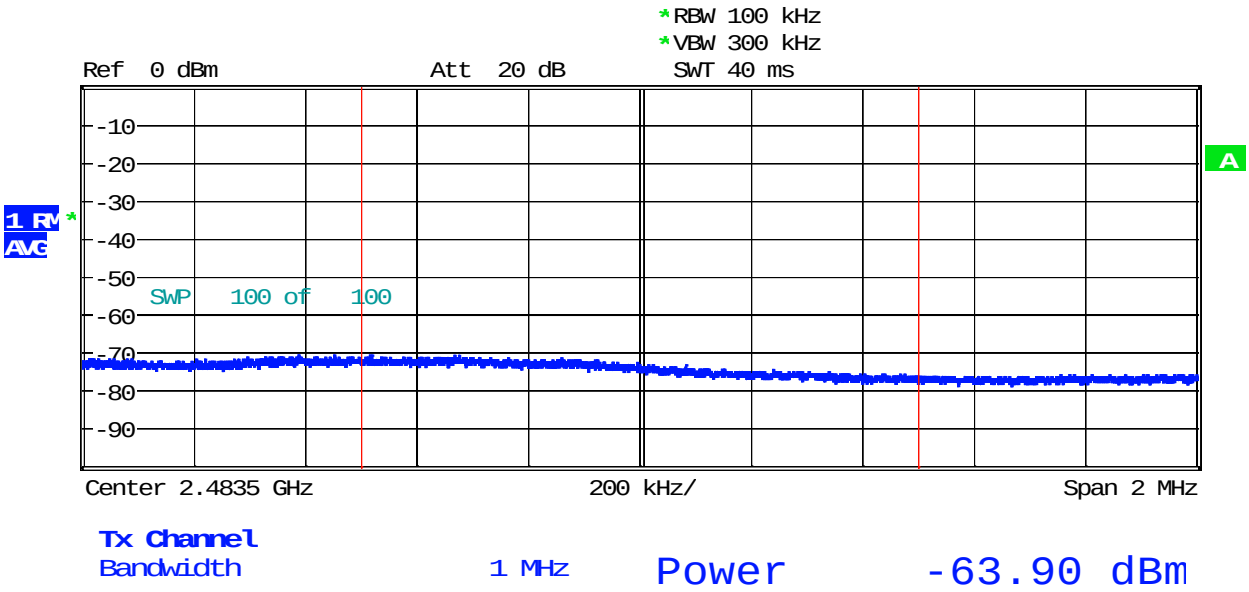
Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dBµV/m	dBµV/m	dB		
2.386	50.9	54	3.1	Peak	Pass

Out-of-Band Spurious Emissions at the Band Edge – Tx @ 2480 MHz



Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dBµV/m	dBµV/m	dB		
2.4835	64.4	74	9.6	Peak	Pass

Out-of-Band Spurious Emissions at the Band Edge – Tx @ 2480 MHz



Frequency	Detector	Corrected Amplitude	Raw Amplitude	Antenna Factor	Cable Loss	EIRP	δ(dB)*	Corr. Factor at 3 m	Average Limit	Margin
MHz	Peak / Avg	dB(uV)	dBm	dBi	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
2483.5	Avg	37.8	-63.9	3.6	0.8	-59.5	2.0	9.5	54	-16.1

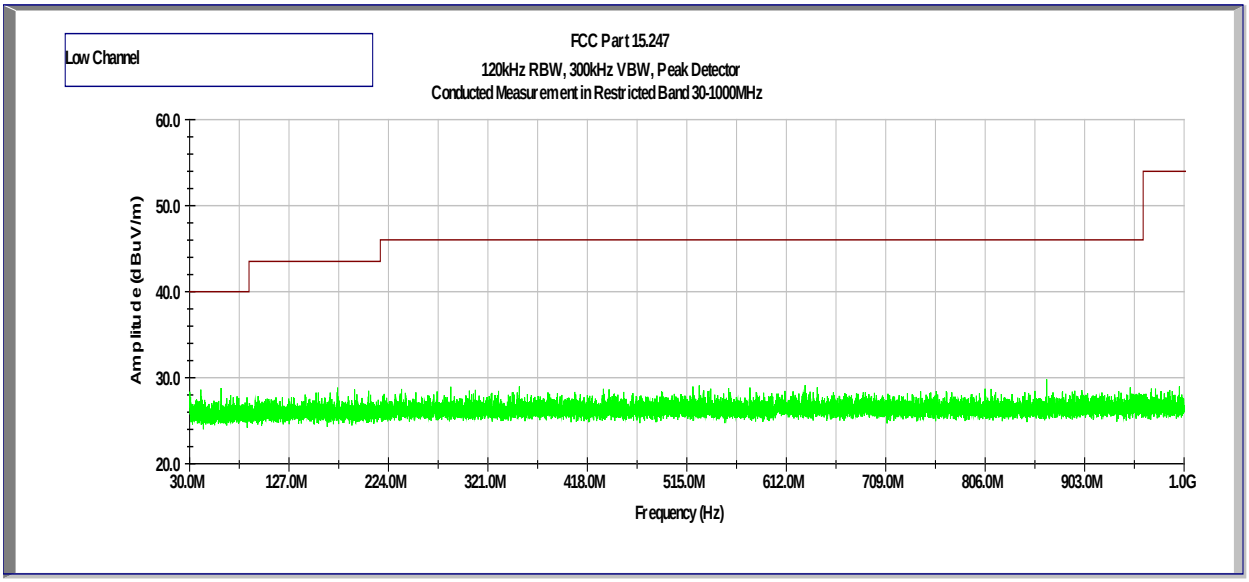
* **δ(dB) -** Duty Cycle Correction Factor. See Appendix A for Duty Cycle measurement and calculation. Duty cycle Correction Factor was applied for Average Field Strength (FS).

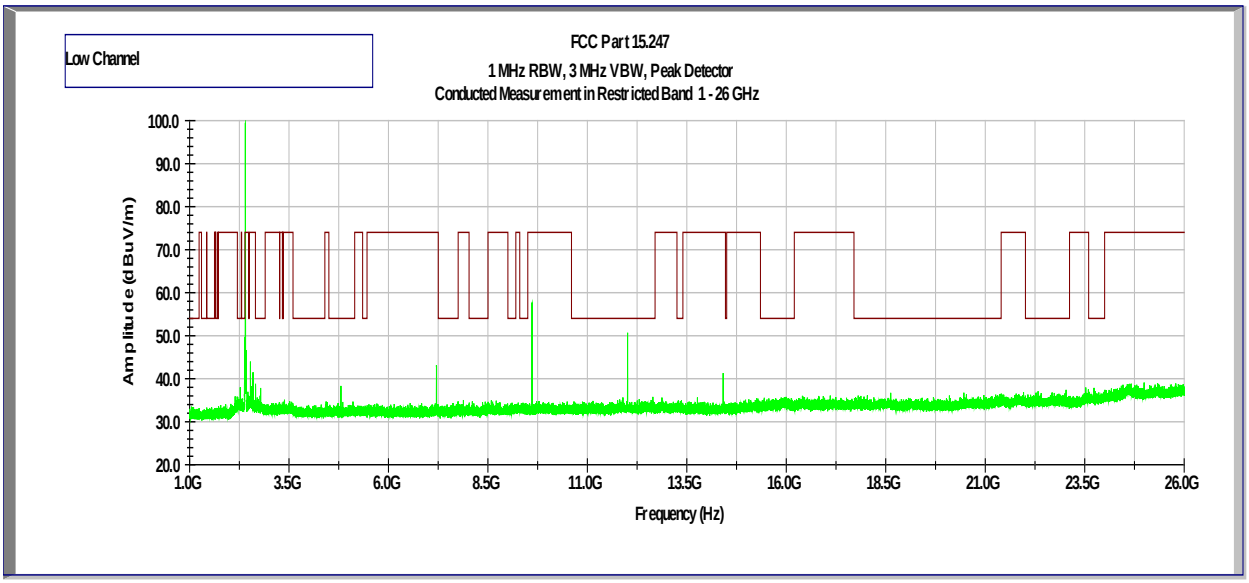
Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:
E = EIRP + δ(dB) – 20log D + 104.8
where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.

Out-of-Band Conducted Spurious Emissions (at Antenna Port)

Tx @ 2402MHz

Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

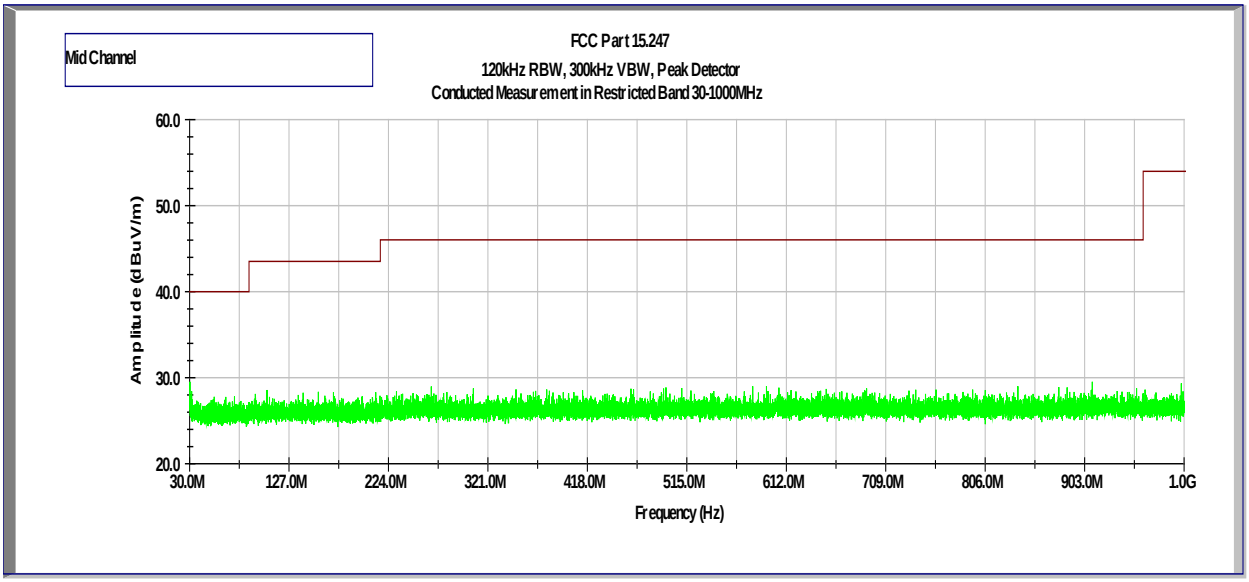


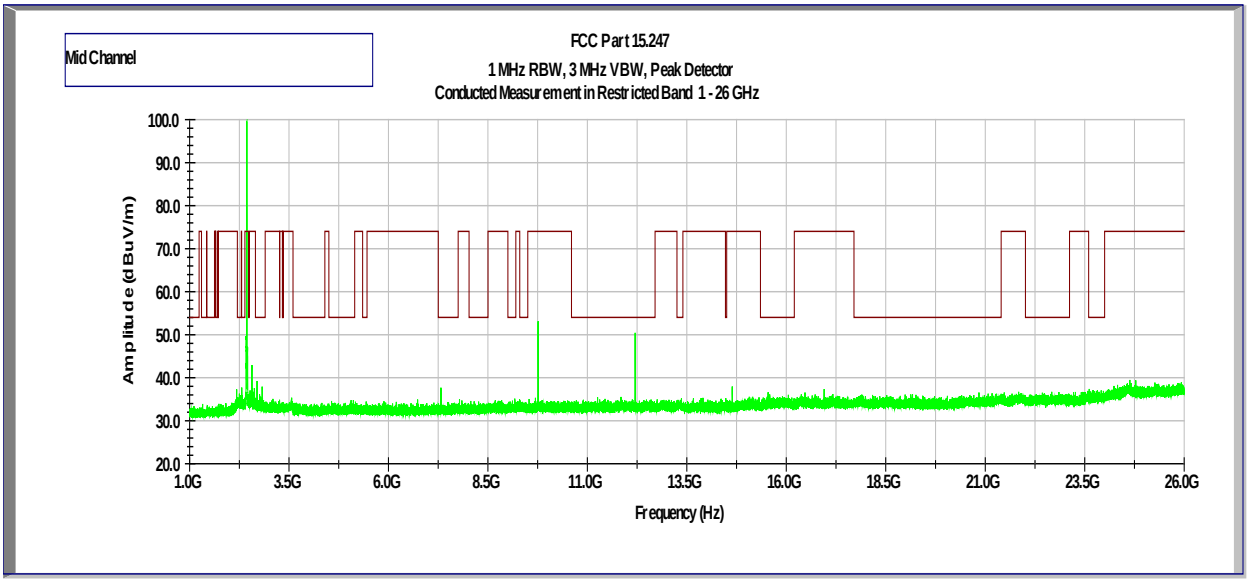


Out-of-Band Conducted Spurious Emissions (at Antenna Port)

Tx @ 2440MHz

Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

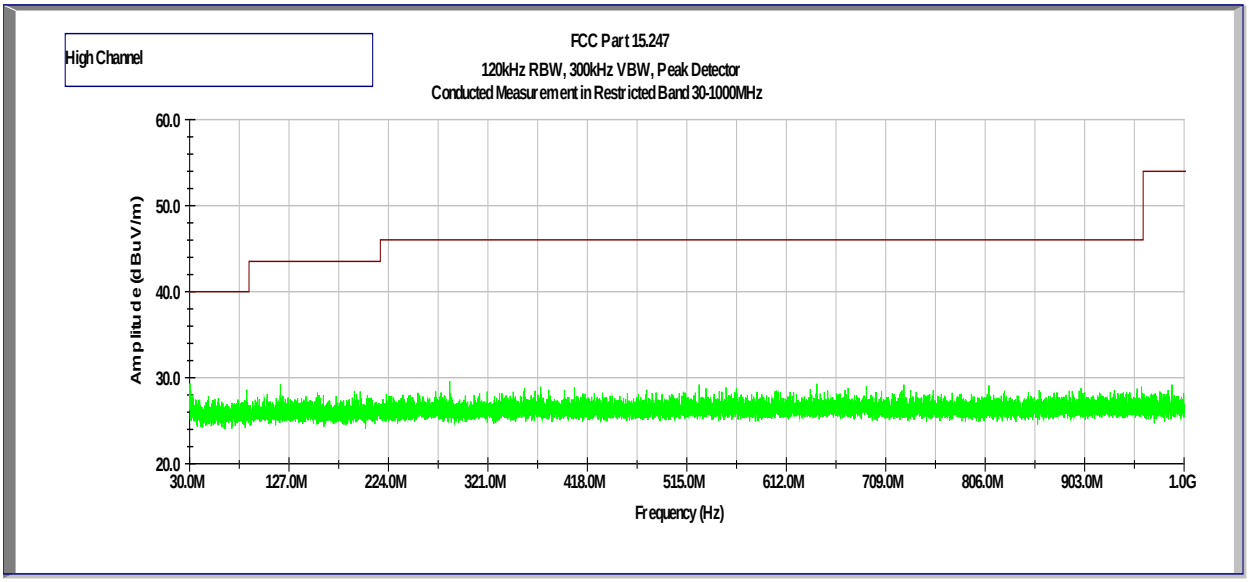


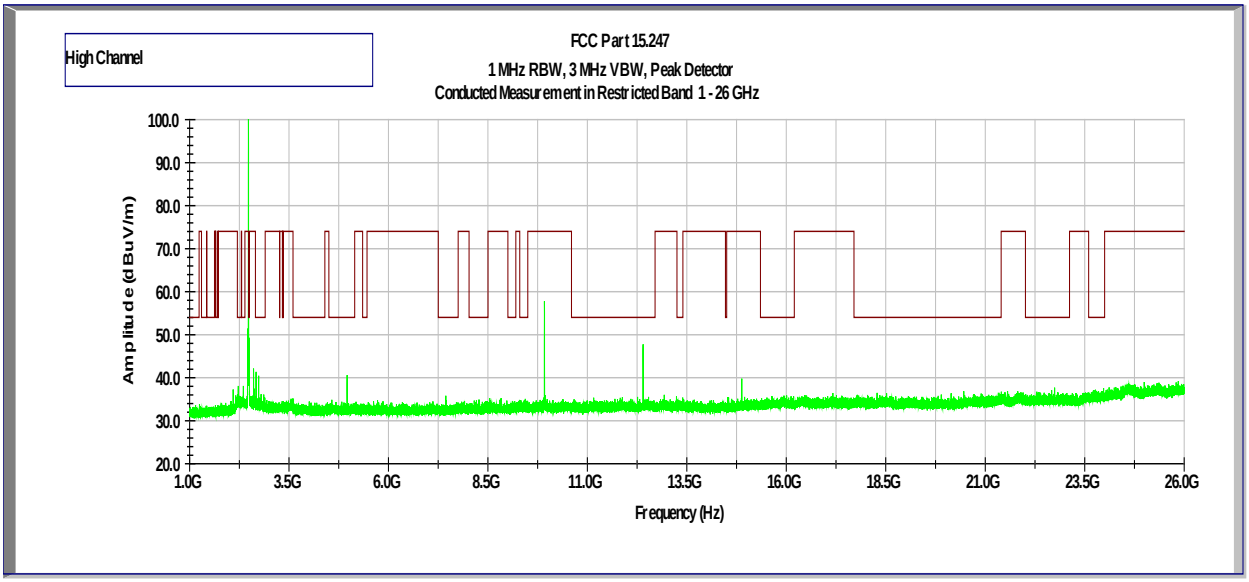


Out-of-Band Conducted Spurious Emissions (at Antenna Port)

Tx @ 2480MHz

Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

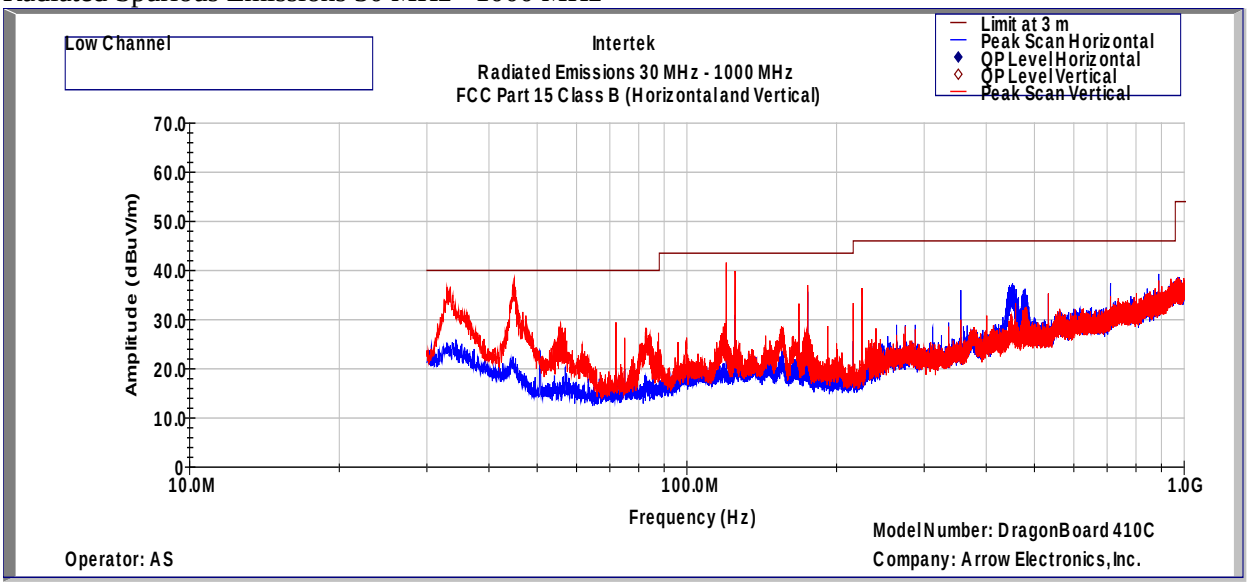




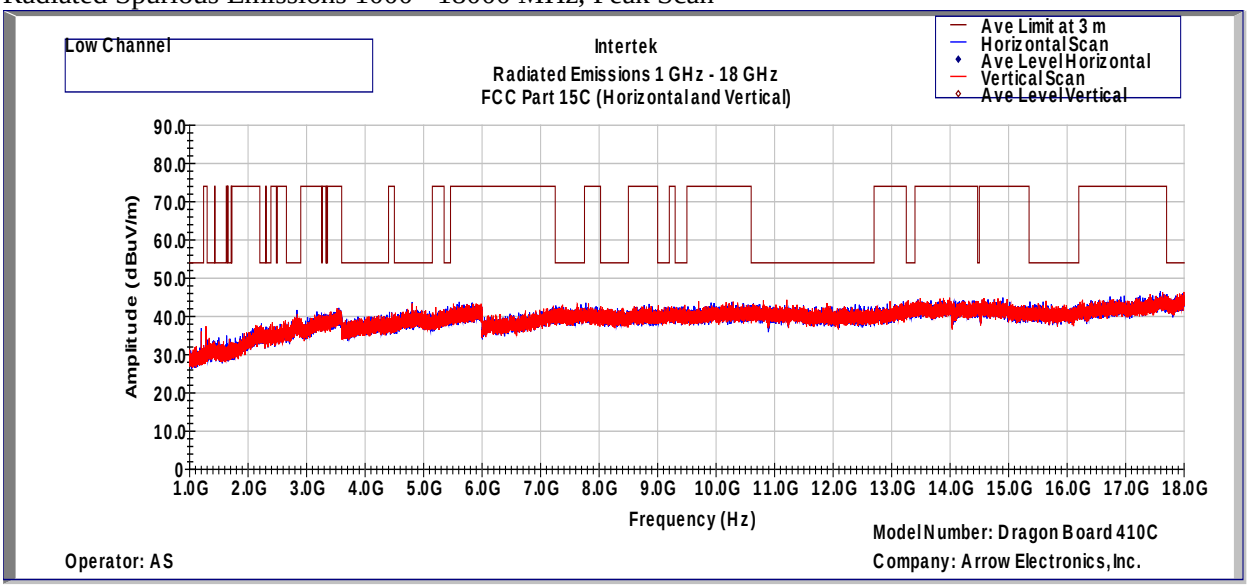
Out-of-Band Radiated Spurious Emissions (Cabinet Radiation)

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2402MHz

Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan

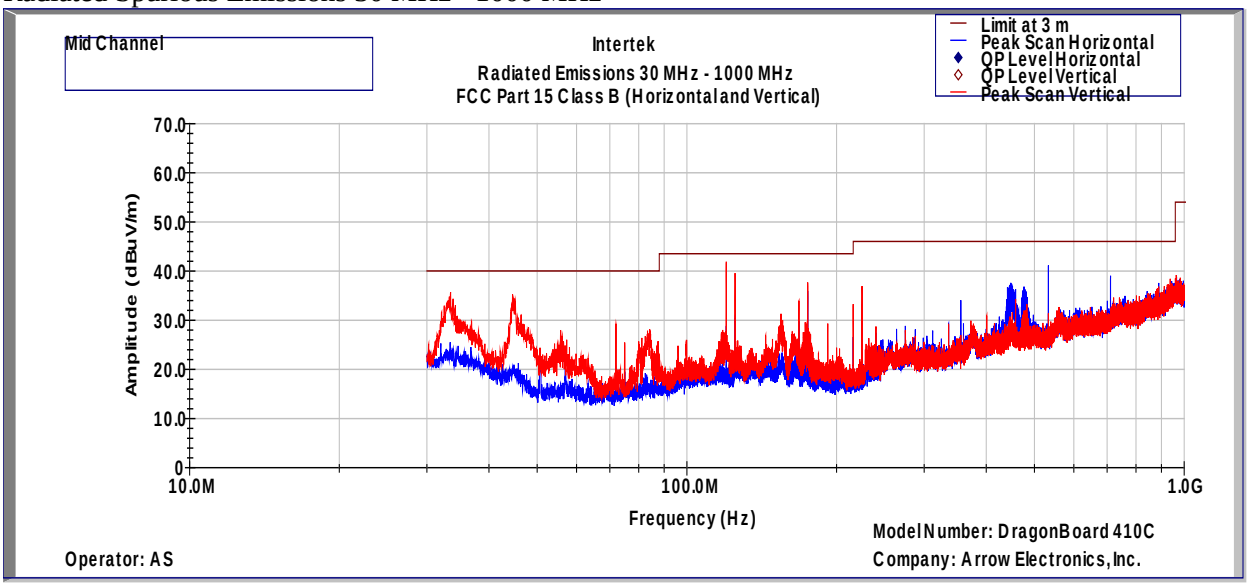


Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

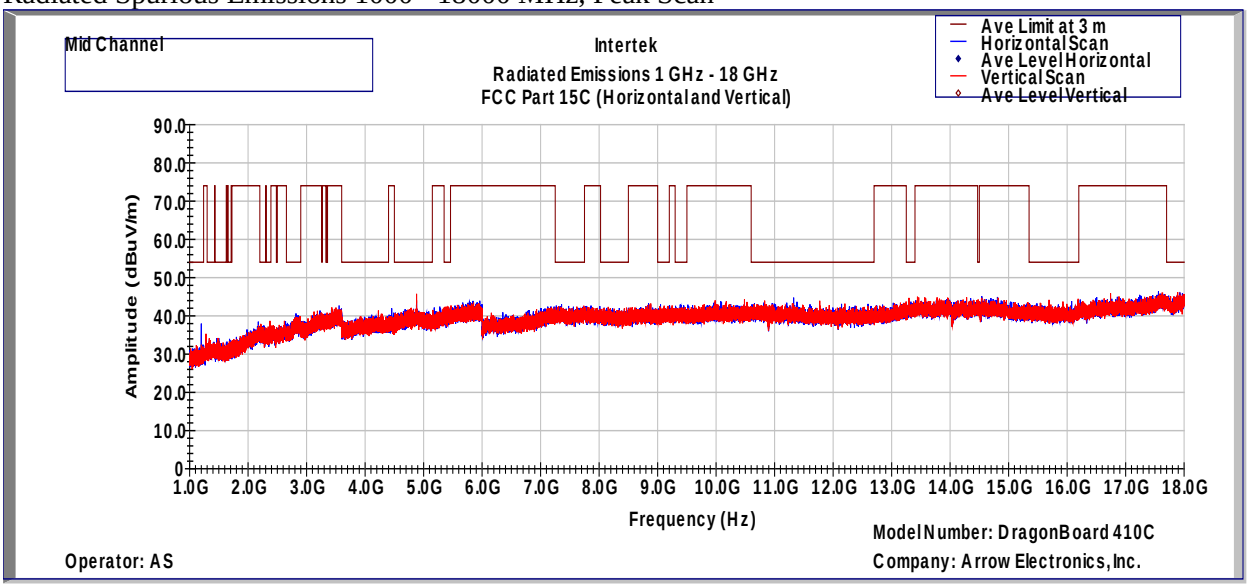
Note: FS@3m = RA + AF + CF - Preamp, (Peak)
Corrected Peak Scans are under the Average Limit of 54.

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

Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan

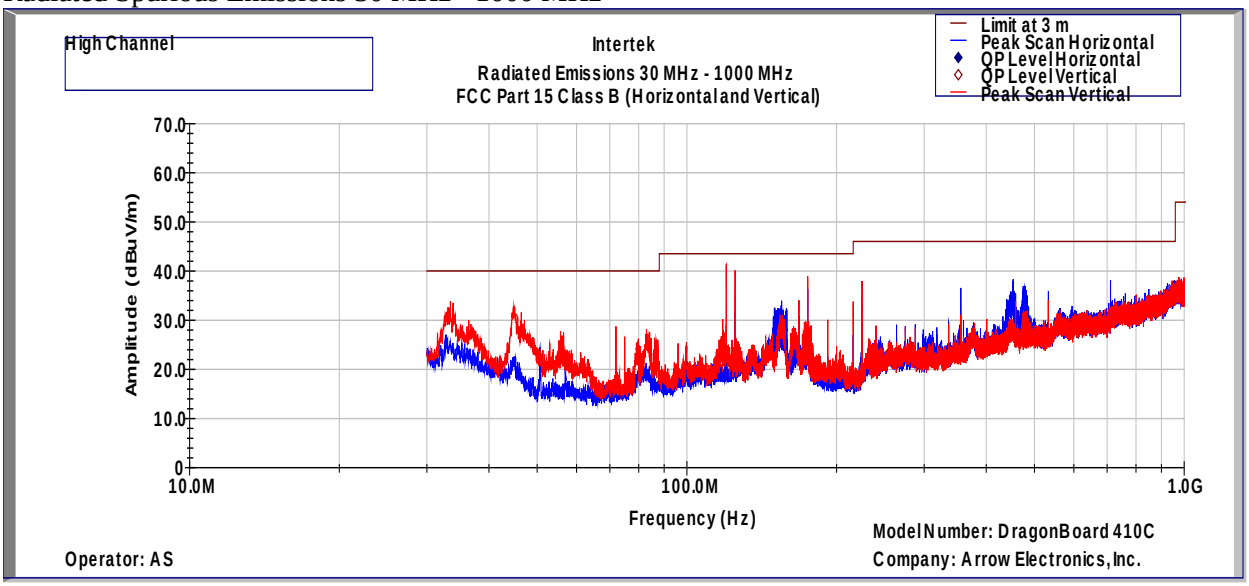


Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

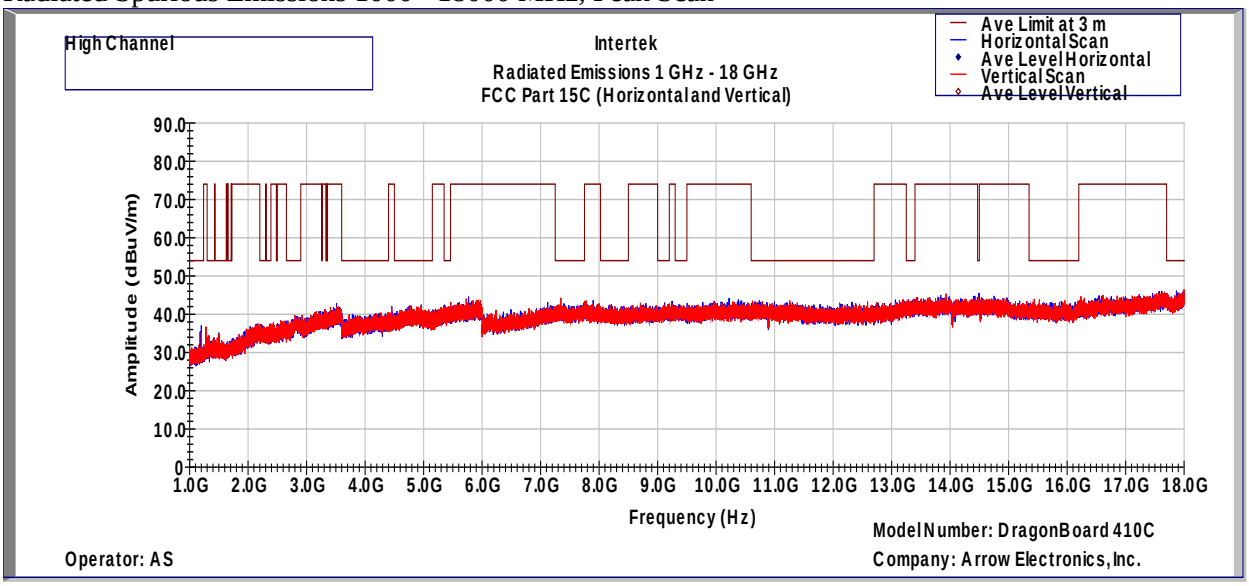
Note: FS@3m = RA + AF + CF - Preamp, (Peak)
Corrected Peak Scans are under the Average Limit of 54.

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

Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



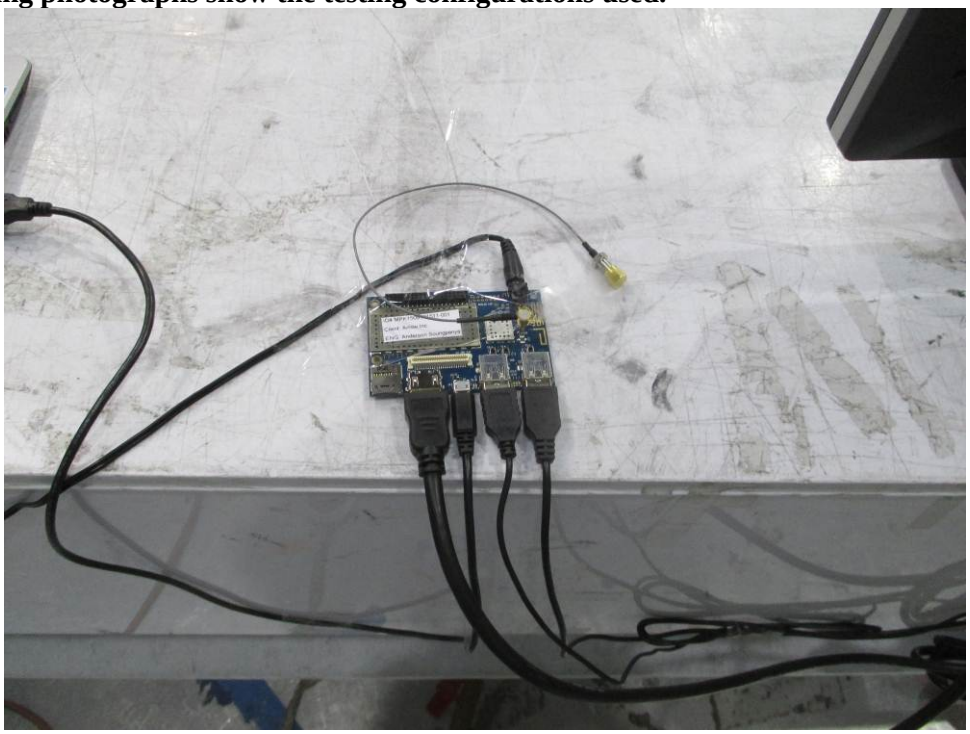
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

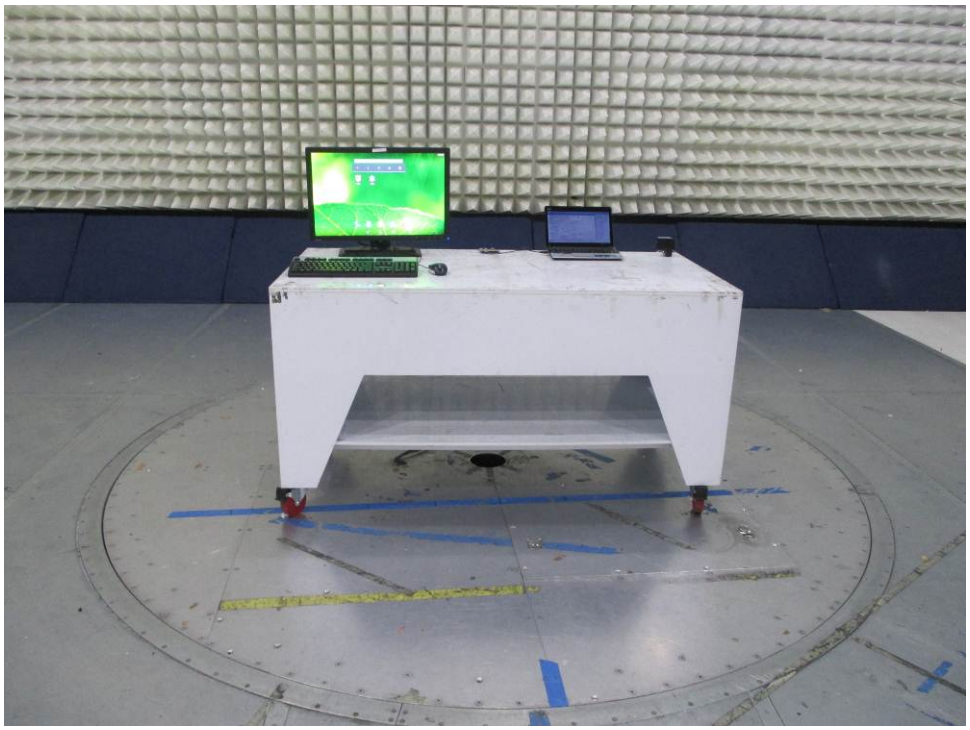
Note: FS@3m = RA + AF + CF - Preamp, (Peak)
Corrected Peak Scans are under the Average Limit of 54.

Results	**Complies**

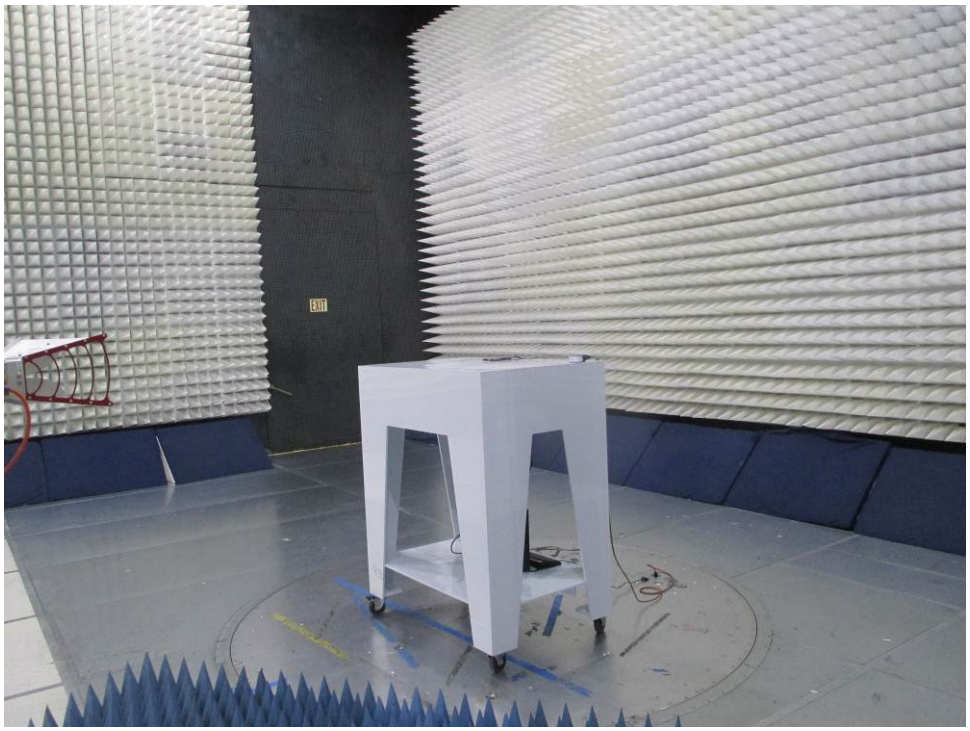
4.5.5 Test setup photographs

The following photographs show the testing configurations used.





4.5.5 Test setup photographs (Continued)



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

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

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.

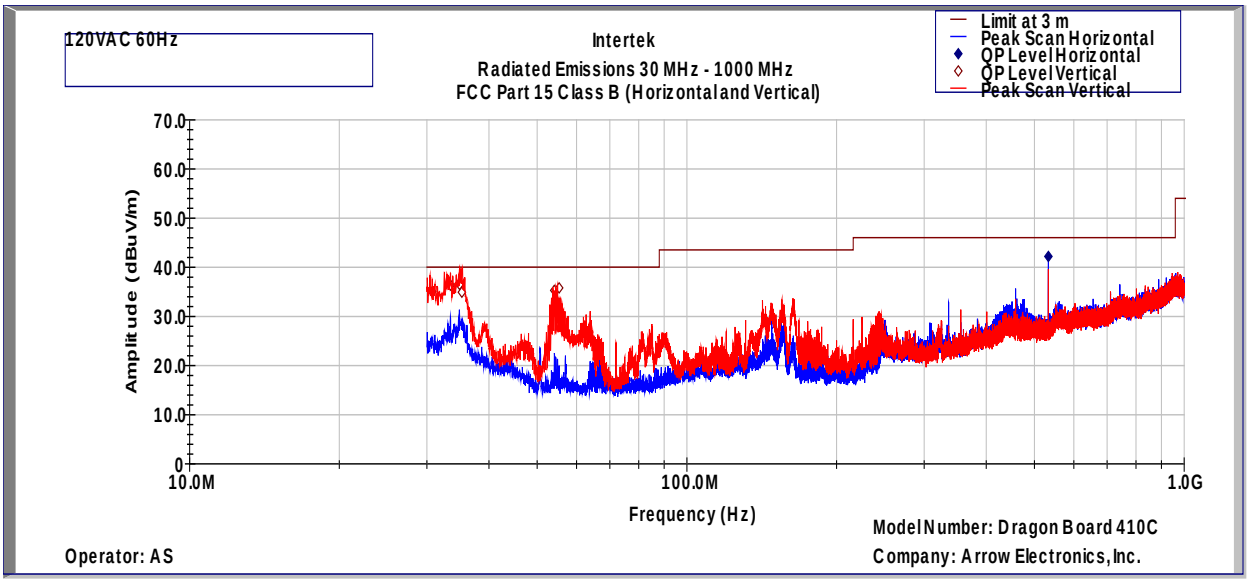
Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 and EN 55022.

4.6.3 Test Results

The highest clock frequency used in the EUT is 72 MHz; therefor 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.

Date of Test:	September 30, 2015
Results	**Complies**

Test Results: Radiated Emissions 30 MHz – 1000 MHz



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

Model Number: DragonBoard
Company: Arrow Electronics, In

FCC Part 15 Class B (QP-Vertical)										
Frequency	**Quasi Pk FS**	**Limit@3m**	**Margin**	**RA**	**CF**	**AG**	**DCF**	**AF**	**Azimuth**	**Height**
MHz	**dB(uV/m)**	**dB(uV/m)**	**dB**	**dB(uV)**	**dB**	**dB**	**dB**	**dB(1/m)**	**deg**	**cm**
30.76	35.0	40	-5.0	40.1	0.6	32.1	10.5	15.9	215	111
33.49	36.3	40	-3.7	42.1	0.6	32.1	10.5	15.2	210	120
34.92	36.5	40	-3.5	42.6	0.7	32.1	10.5	14.8	211	102
35.28	34.9	40	-5.1	41.1	0.7	32.1	10.5	14.7	200	113
54.12	35.3	40	-4.7	49.3	0.9	32.1	10.5	6.7	101	106

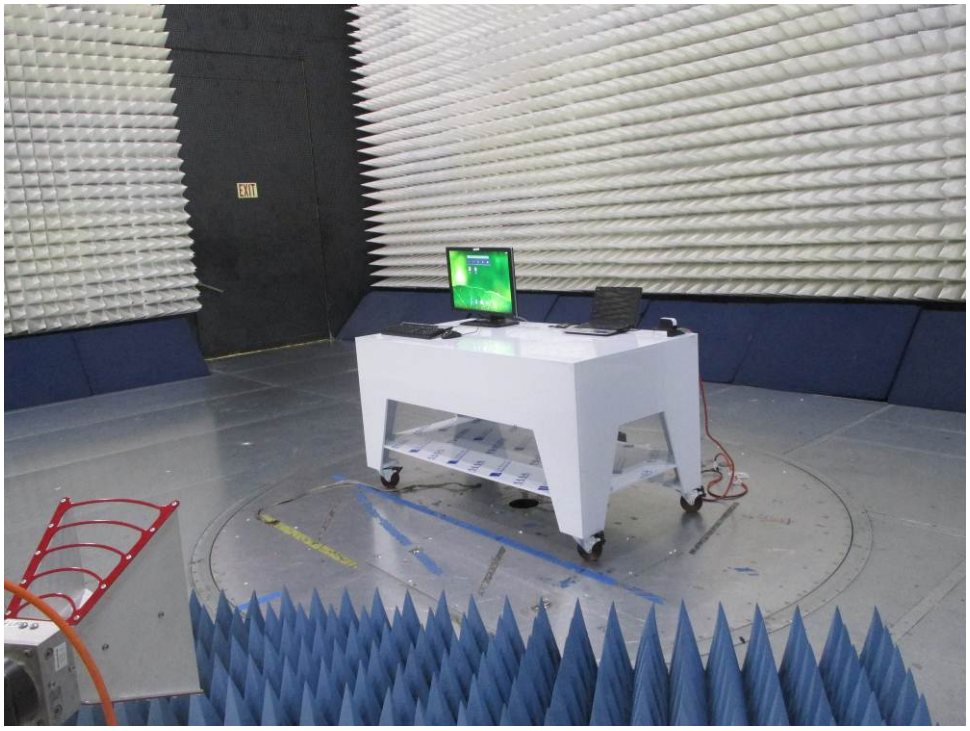
FCC Part 15 Class B (QP-Horizontal)										
Frequency	**Quasi Pk FS**	**Limit@3m**	**Margin**	**RA**	**CF**	**AG**	**DCF**	**AF**	**Azimuth**	**Height**
MHz	**dB(uV/m)**	**dB(uV/m)**	**dB**	**dB(uV)**	**dB**	**dB**	**dB**	**dB(1/m)**	**deg**	**cm**
533.32	42.2	46	-3.8	43.5	2.6	32.1	10.5	17.7	25	182

Test Mode: Normal Mode
Temp.: 23C
Humidity: 51.6%

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(μV)		Class A Limit dB(μV)	
	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.

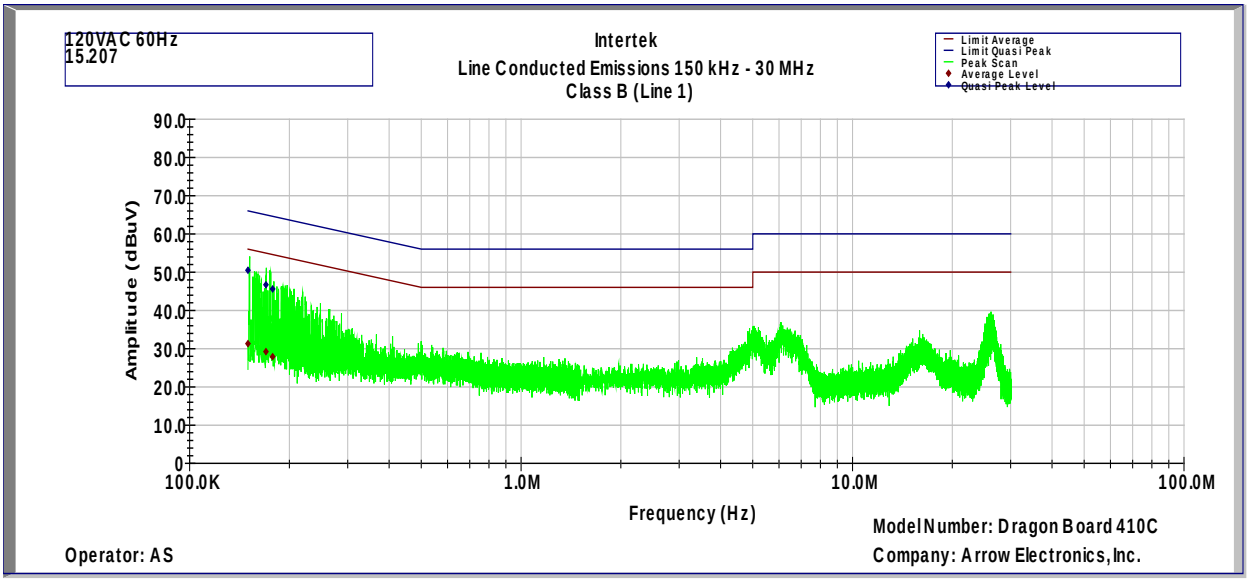
Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

4.7.3 Test Result

Date of Test:	September 30, 2015
Results	**Complies**

4.7.3 Test Result

AC Line Conducted Emission Data, EUT in transmitting mode



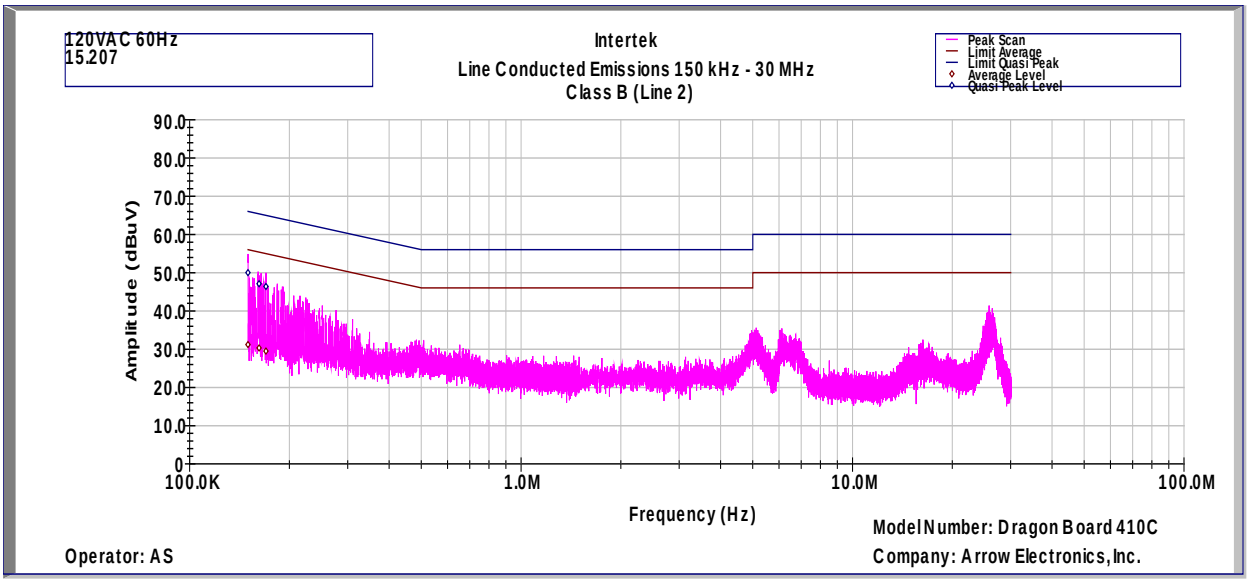
Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC Class B (Line 1)
Operator: AS

Model Number: DragonBoard
Company: Arrow Electronics, Inc.

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	dBuV	dBuV	dBuV	dBuV	dB	dB
0.15	31.3	50.5	56	66	-24.7	-15.5
0.17	29.2	46.7	55.4	65.4	-26.2	-18.7
0.178	27.9	45.6	55.2	65.2	-27.3	-19.6
0.15	31.3	50.5	56	66	-24.7	-15.5

Test Mode: Transmitter On
Temp.: 23C
Humidity: 51.6%

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: AS

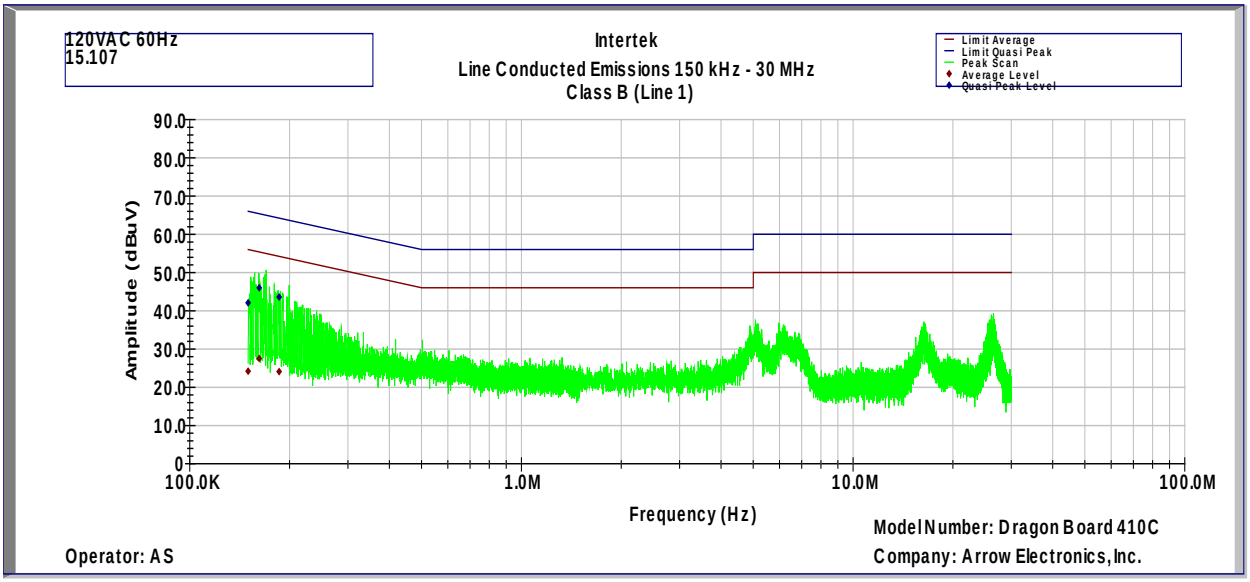
Model Number: DragonBoard
Company: Arrow Electronics, Inc.

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	dBuV	dBuV	dBuV	dBuV	dB	dB
0.15	31.2	50	56	66	-24.8	-16
0.162	30.3	47.1	55.7	65.7	-25.4	-18.6
0.17	29.5	46.4	55.4	65.4	-25.9	-19

Test Mode: Transmitter On
Temp.: 23C
Humidity: 51.6%

Results	**Complies** by 15.5 dB

AC Line Conducted Emission Data, EUT in Receive mode



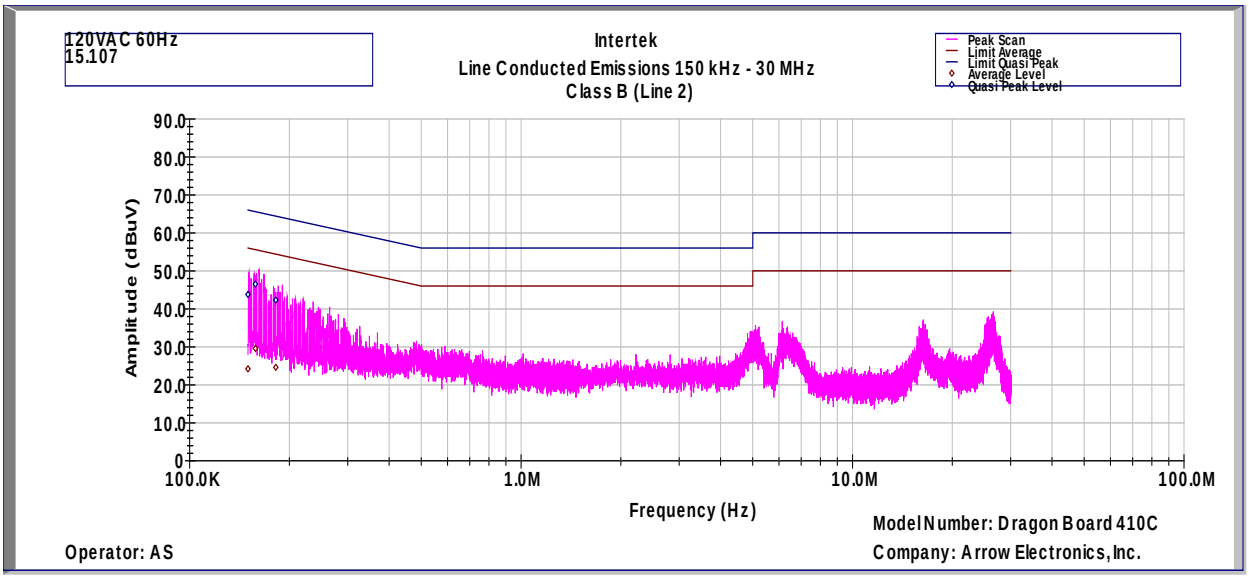
Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC Class B (Line 1)
Operator: AS

Model Number: DragonBoard
Company: Arrow Electronics, Inc.

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	dBuV	dBuV	dBuV	dBuV	dB	dB
0.15	24.2	42.1	56	66	-31.8	-23.9
0.162	27.5	46	55.7	65.7	-28.2	-19.7
0.186	24.1	43.6	55	65	-30.9	-21.4

Test Mode: Receive Mode
Temp.: 23C
Humidity: 51.6%

AC Line Conducted Emission Data, EUT in Receive mode



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

Model Number: DragonBoard
Company: Arrow Electronics, Inc.

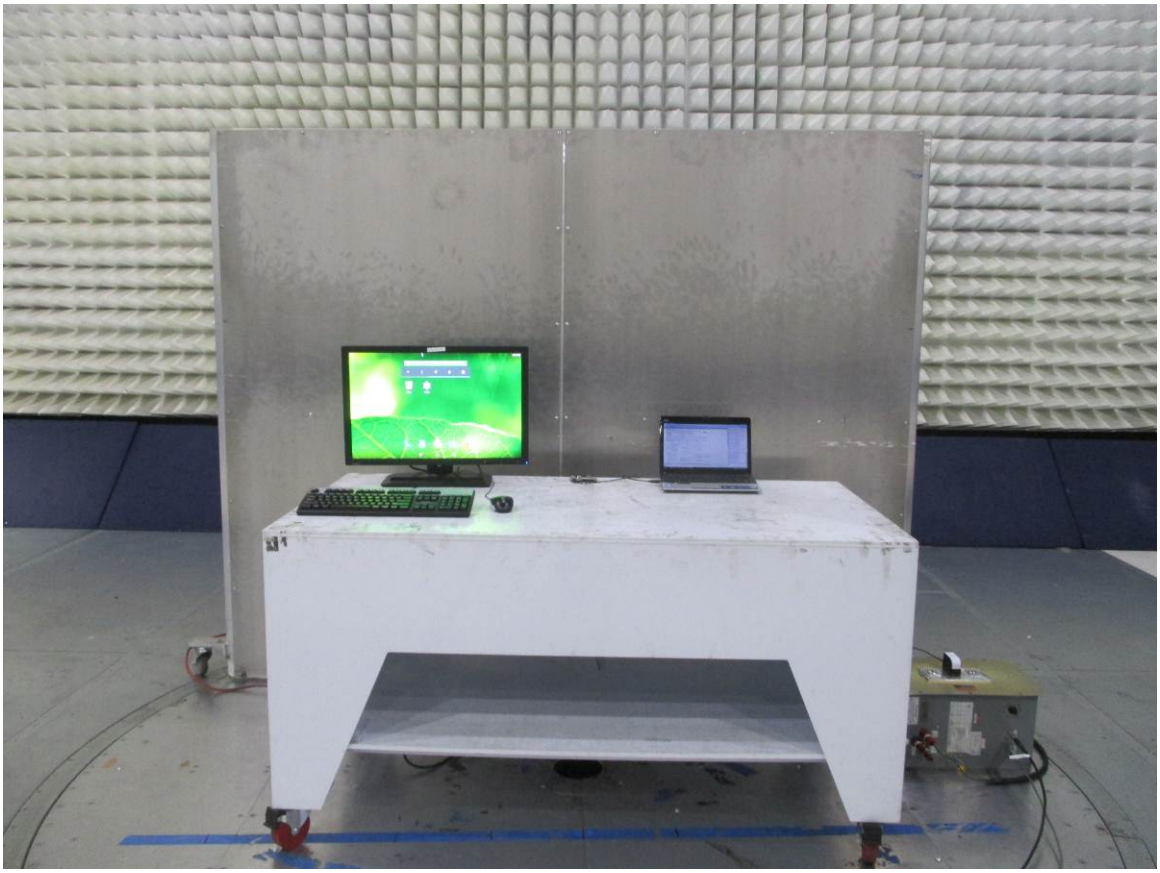
Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	dBuV	dBuV	dBuV	dBuV	dB	dB
0.15	24.2	43.8	56	66	-31.8	-22.2
0.158	29.6	46.5	55.8	65.8	-26.2	-19.3
0.182	24.6	42.3	55.1	65.1	-30.5	-22.8

Test Mode: Receive Mode
Temp.: 23C
Humidity: 51.6%

Results	**Complies** by 7.9 dB

4.7.4 Test Configuration Photographs

The following photographs show the testing configurations used.



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 2.73 dBm (RF Conducted Power) + 3.6 dBi (Antenna Gain) = 6.33 dBm or 4.30 mW; therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The Power Density can be calculated using the formula

$$S = EIRP/ 4\pi D^2$$

Where: S is Power Density in mW/cm^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 =0.00855 W/m^2, which is below the MPE Limit of 10 W/m^2

Date of Test:	September 30, 2015
Results	**Complies**

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	12/16/15
EMI Receiver	Rohde and Schwarz	ESU	ITS 00961	12	06/02/16
Spectrum Analyzer	Rohde and Schwarz	FSP	ITS 01200	12	2/09/16
BI-Log Antenna	Teseq	CBL 6111D	ITS 01058	12	11/21/15
Pyramidal Horn Antenna	EMCO	3160-09	ITS00571	#	#
Pre-Amplifier	Sonoma Instrument	310N	ITS 00942	12	11/26/15
Pre-Amplifier (1-18GHz)	Miteq	AMF-4D-001180-24-10P	ITS 00526	12	10/06/16
Pre-Amplifier (18-40GHz)	Miteq	JSD44-18004000-305P	ITS 00921	12	06/18/16
Horn Antenna	ETS Lindgren	3115	ITS 00982	12	11/21/15
LISN	FCC	FCC-LISN-50-50-M-H	ITS 00552	12	05/05/16

No Calibration required

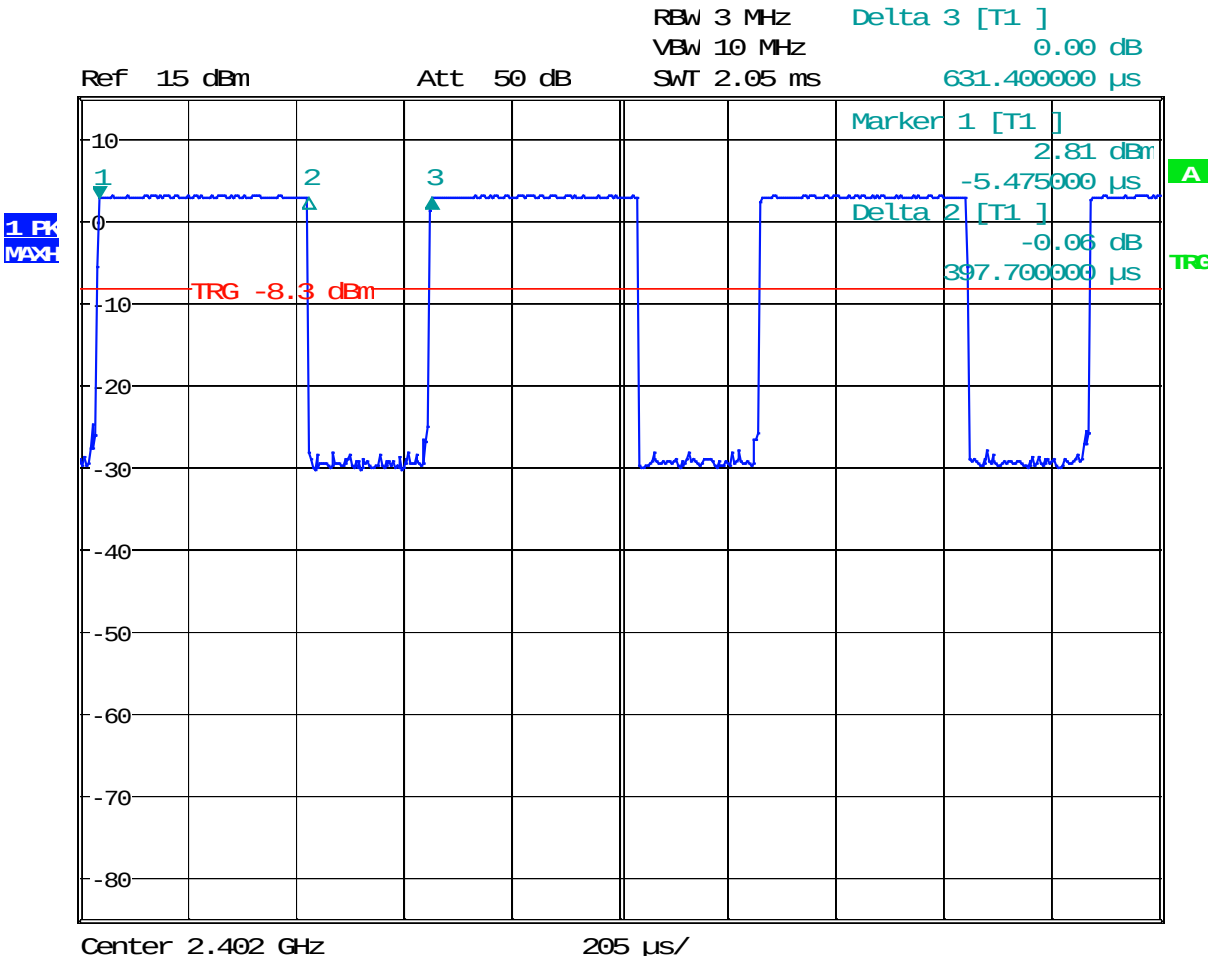
7.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G102289738	AS	KV	October 30, 2015	Original document

Annex A - Duty Cycle Measurement

Date of Test:	June 4, 2015

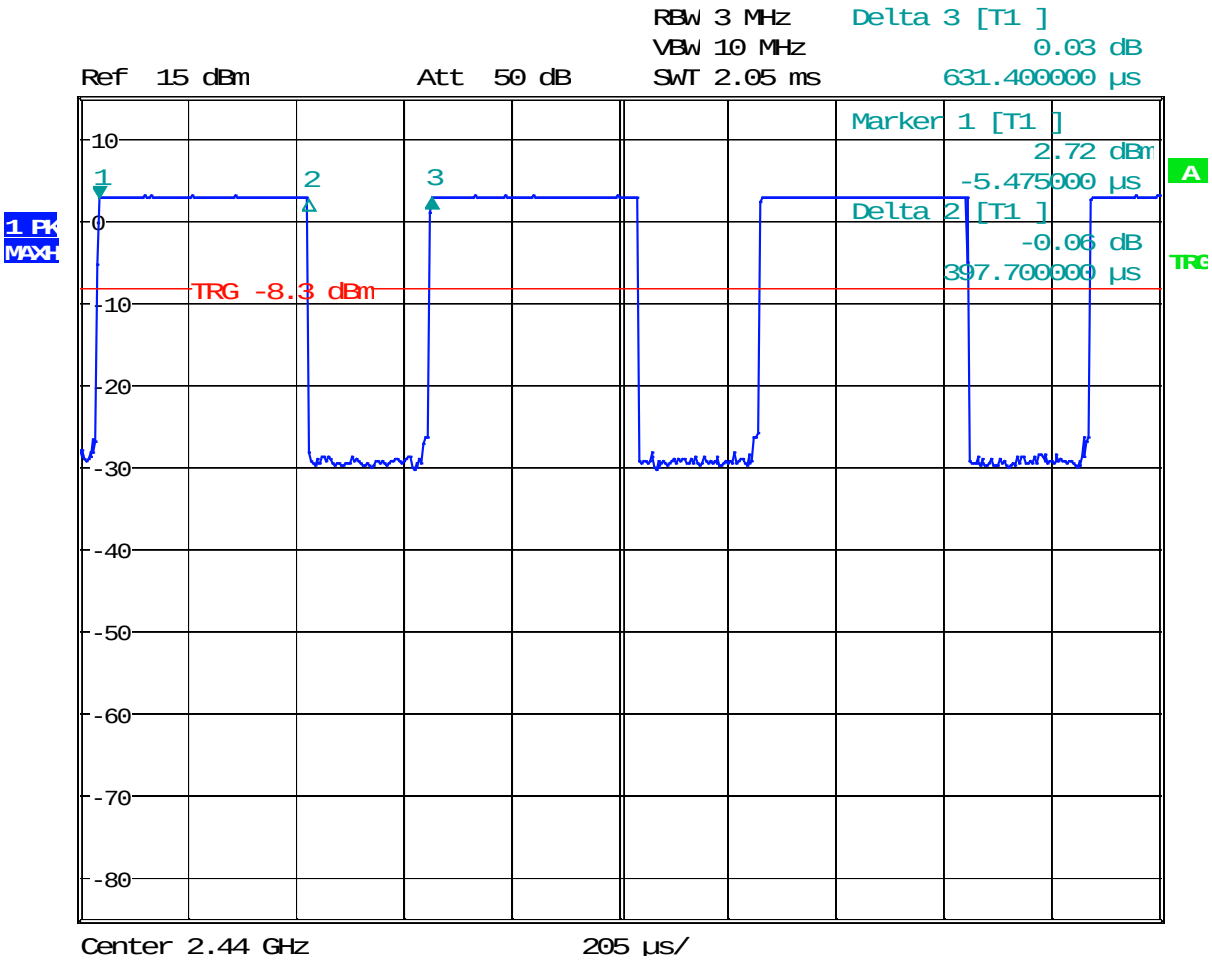
Low Channel @ 2402 MHz



Date: 1.OCT.2015 13:40:43

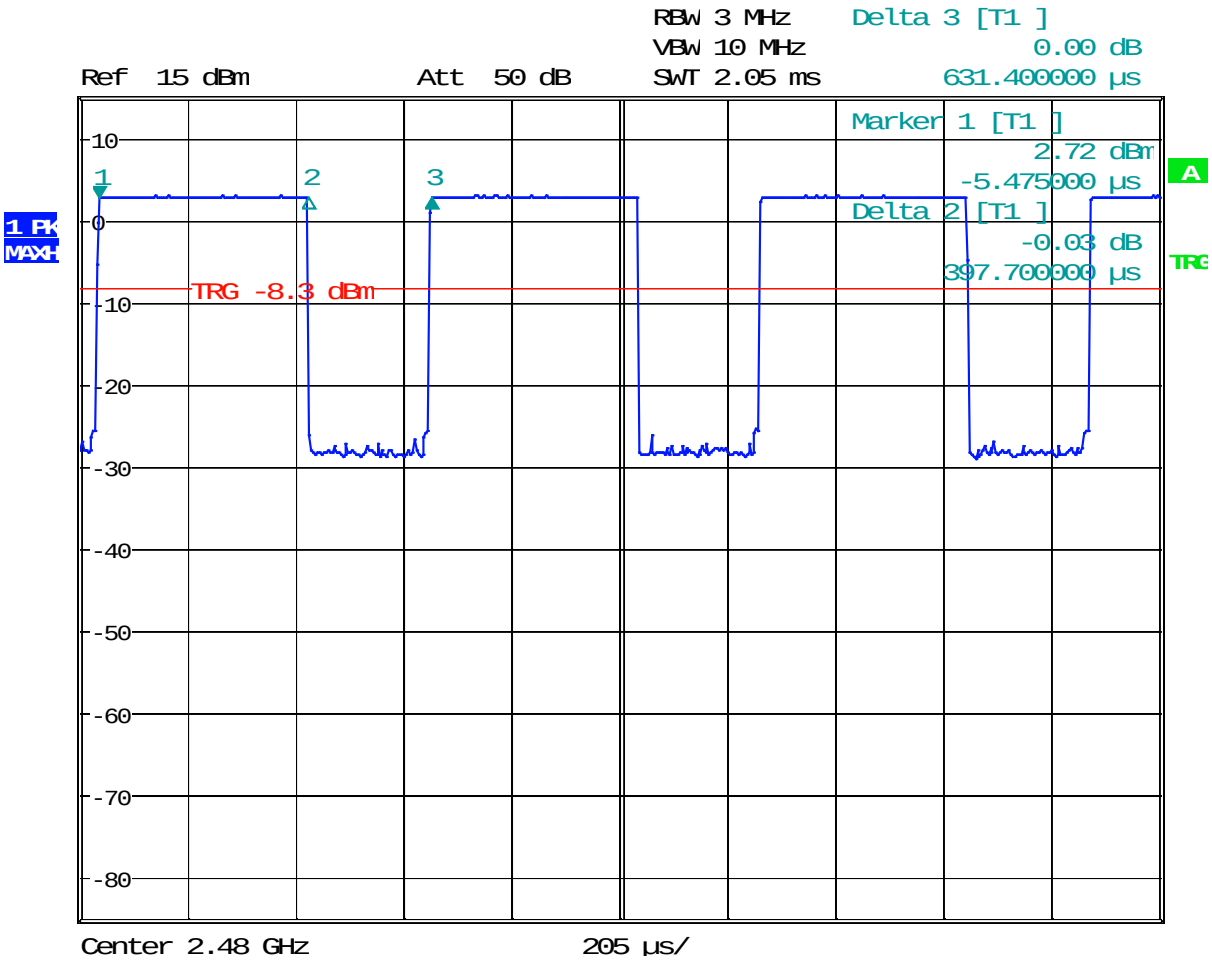
Duty Cycle: DC = 397.7 / 631.4 = 0.630 or 63.0%
Duty Cycle Correction Factor **δ (dB)** = 10 log (397.7 / 631.4) = 2.0dB

Mid Channel @ 2440 MHz



Date: 1.OCT.2015 13:36:41
Duty Cycle: DC = 397.7 / 631.4 = 0.630 or 63.0%
Duty Cycle Correction Factor **δ (dB)** = 10 log (397.7 / 631.4) = 2.0dB

High Channel @ 2480 MHz



Date: 1.OCT.2015 13:36:01
Duty Cycle: DC = 397.7 / 631.4 = 0.630 or 63.0%
Duty Cycle Correction Factor **δ (dB)** = 10 log (397.7 / 631.4) = 2.0dB