TEST REPORT

Report Number: 103023687MPK-014
Project Number: G103023687
June 27, 2017

Testing performed on
Tile Style and Tile Sport - Bluetooth Location Finder
Models: T4001 (Tile Style) and T4002 (Tile Sport)
FCC ID: 2ABXLT4001
IC: 11858A-T4001
to

FCC Part 15 Subpart C (15.247)
Industry Canada RSS-247 Issue 2
NCC Low Power 0002 (LP0002 2016)

For

Tile, Inc.

Test Performed by:	Test Authorized by:
Intertek	Tile, Inc.
1365 Adams Court	2121 S El Camino Real Ste 9th Floor
Menlo Park, CA 94025 USA	San Mateo, CA 94403 USA

Prepared by: _____ **Date:** June 27, 2017
Aaron Chang

Reviewed by: _____ **Date:** June 27, 2017
Krishna K Vemuri

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Report No. 103023687MPK-014

Equipment Under Test:	Tile Style and Tile Sport – Bluetooth Location Finder
Trade Name:	Tile, Inc.
Model Numbers:	T4001 and T4002
Applicant:	Tile, Inc.
Contact:	Cindy Wong
Address:	Tile, Inc. 2121 S El Camino Real Ste 9th Floor San Mateo, CA 95765
Country	USA
Tel. Number:	(408) 348-0990
Email:	Cindy.wong@thetileapp.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) Industry Canada RSS-247 Issue 2 NCC Low Power 0002 (LP0002 2016)
Date of Test:	June 14 – 21, 2017

We attest to the accuracy of this report:

Aaron Chang
Project Engineer

Krishna K Vemuri
Engineering Team Lead

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1.0 Summary of Tests

Test	Reference FCC	Reference Industry Canada	Result
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	Not Applicable*
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)
RF Exposure	15.247(i), 2.1093(d)	RSS-102	Complies

*EUT is battery operated. The battery is single use only.

Test	Reference FCC	Reference LP0002	Result
RF Output Power	15.247(b)(3)	3.10.1.2(1)(C)	Complies
6 dB Bandwidth	15.247(a)(2)	3.10.1.6(2)(A)	Complies
Power Density	15.247(e)	3.10.1.6(2)(B)	Complies
Out of Band Antenna Conducted Emission	15.247(d)	3.10.1.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	3.10.1.5, 2.7, 2.8	Complies
AC Line Conducted Emission	15.207	2.3	Not Applicable*
Antenna Requirement	15.203	2.2	Complies (Internal Antenna & Unique connector)
RF Exposure	15.247(i), 2.1093(d)	ANSI/IEEE C95.1	Complies

*EUT is battery operated. The battery is single use only.

EUT receive date: June 14, 2017

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: June 14, 2017

Test completion date: June 21, 2017

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

2.0 General Information

2.1 Product Description

Tile, Inc.supplied the following description of the EUT:

Equipment under Test (EUT) is the Tile Style and Tile Sport - Bluetooth Location Finder, Model T4001 and T4002. As described by the manufacturer, Tile Style and Tile Sport is intended to be used on a variety of items in order to track them using a smartphone enabled with Bluetooth Low Energy technology.

Tile Style, model T4001, and Tile Sport, model T4002, have identical electrical hardware. The cabinet is the only difference between the two model.

Information about the Bluetooth 4.0 (BLE) radio is presented below:

For more information, refer to the following product specification, declared by the manufacturer.

Information about the 2.4 GHz radio is presented below:

Applicant	Tile, Inc.
Model No.	T4001 and T4002
FCC Identifier	2ABXLT4001
IC Identifier	11858A-T4001
Type of transmission	Digital Transmission System (DTS)
Rated RF Output	11.87 dBm
Antenna(s) & Gain	Internal Antenna, Gain: 1.55 dBi
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK / 1Mbit/s
Number of Channel(s)	40
Applicant Name & Address	Tile, Inc. 2121 S El Camino Real Ste 9th Floor San Mateo, CA 95765 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 v04), 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	-

Measurement	Expanded Uncertainty (k=2)			
	0.15 MHz – 30MHz	30 – 200 MHz	200 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	4.6	5.1 dB
AC mains conducted emissions	2.1 dB	-	-	-

3.0 System Test Configuration

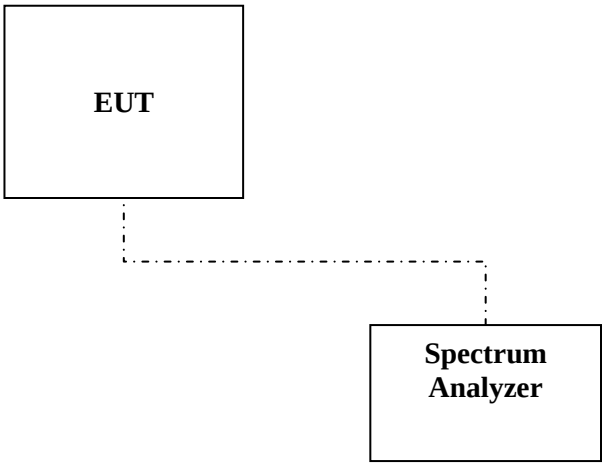
3.1 Support Equipment

None. No support equipment was used for testing

3.2 Block Diagram of Test Setup

Equipment Under Test			
Description	**Manufacturer**	**Model Number**	**Serial Number/MPK Number**
Location transceiver	Tile, Inc.	T4001 and T4002	MPK1706271549-001 (T4001) MPK1706271549-004 (T4002)

Antenna was removed and co-axial connector with a cable was installed for Conducted 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.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by Tile, 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

No modifications were made by the manufacturer or Intertek to the EUT in order to bring the EUT 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 99% 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 v04 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.

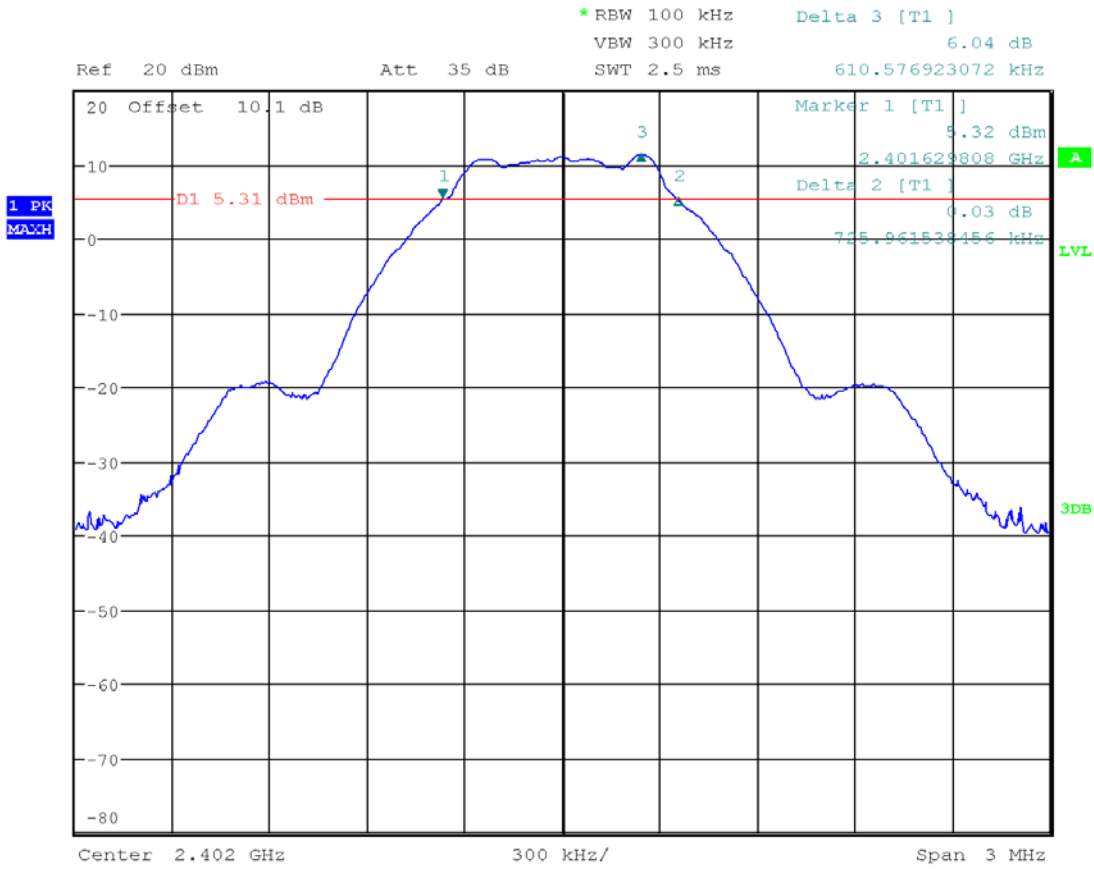
For 99% power bandwidth measurement, the bandwidth was determined by using the built-in 99% occupied bandwidth function of the spectrum analyzer. The resolution bandwidth is set to 1% of the selected span as is without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.

4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, kHz	Occupied bandwidth, RSS-GEN, MHz	Plot
2402	610.577	--	1.1
	--	1.029	1.4
2440	600.962	--	1.2
	--	1.029	1.5
2480	610.577	--	1.3
	--	1.038	1.6

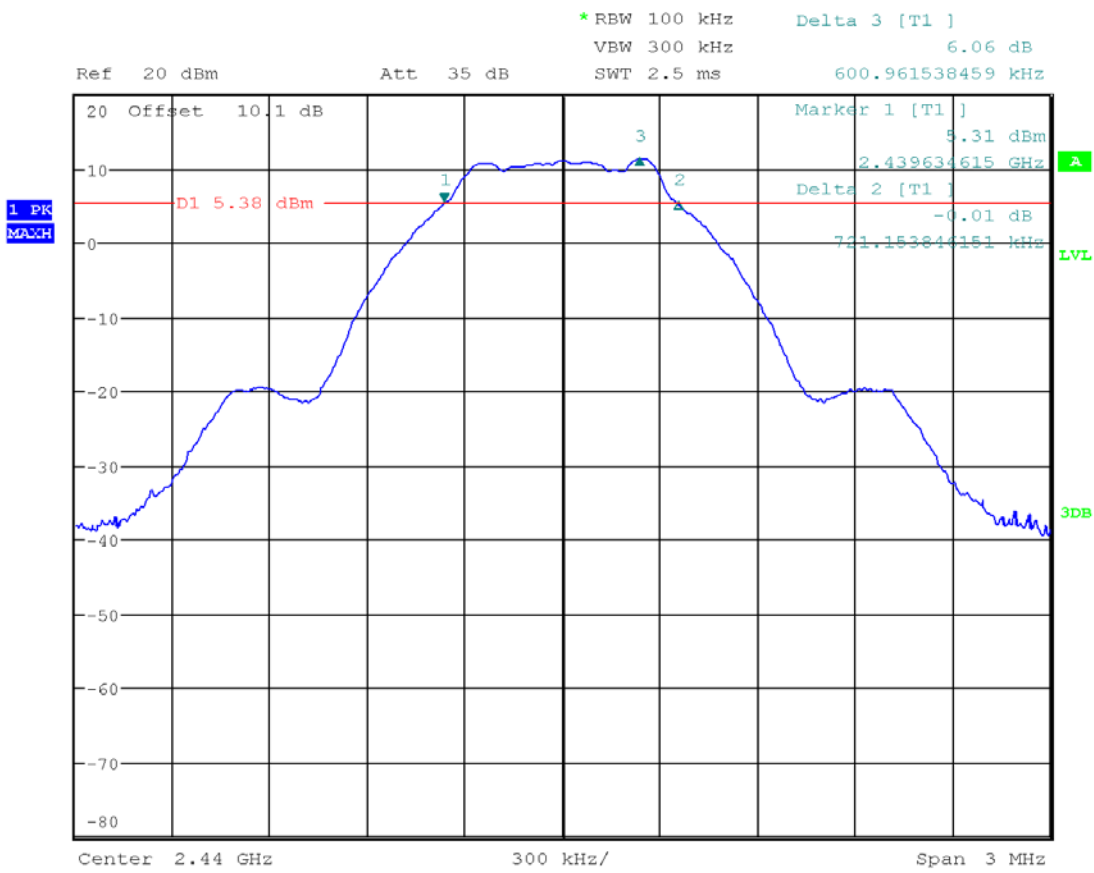
Date of Test:	June 16, 2017
Results	**Complies**

Plot 1. 1



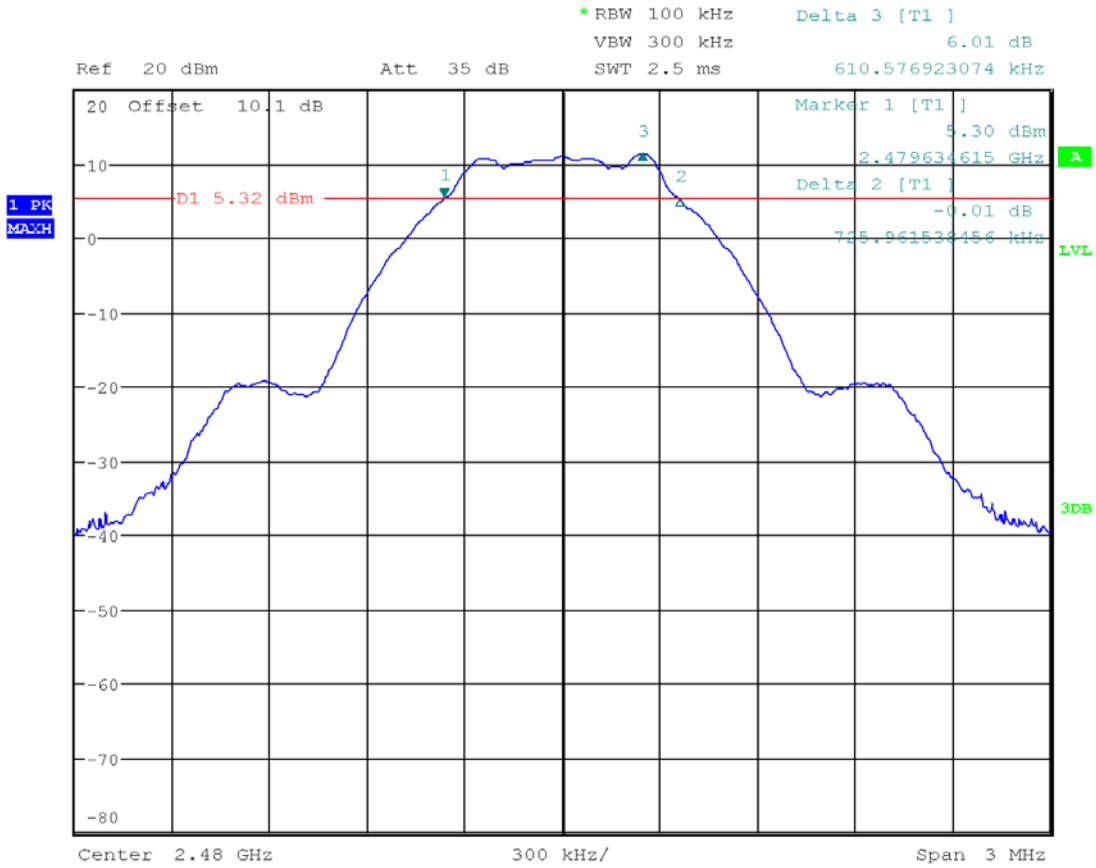
Date: 16.JUN.2017 13:45:45

Plot 1. 2



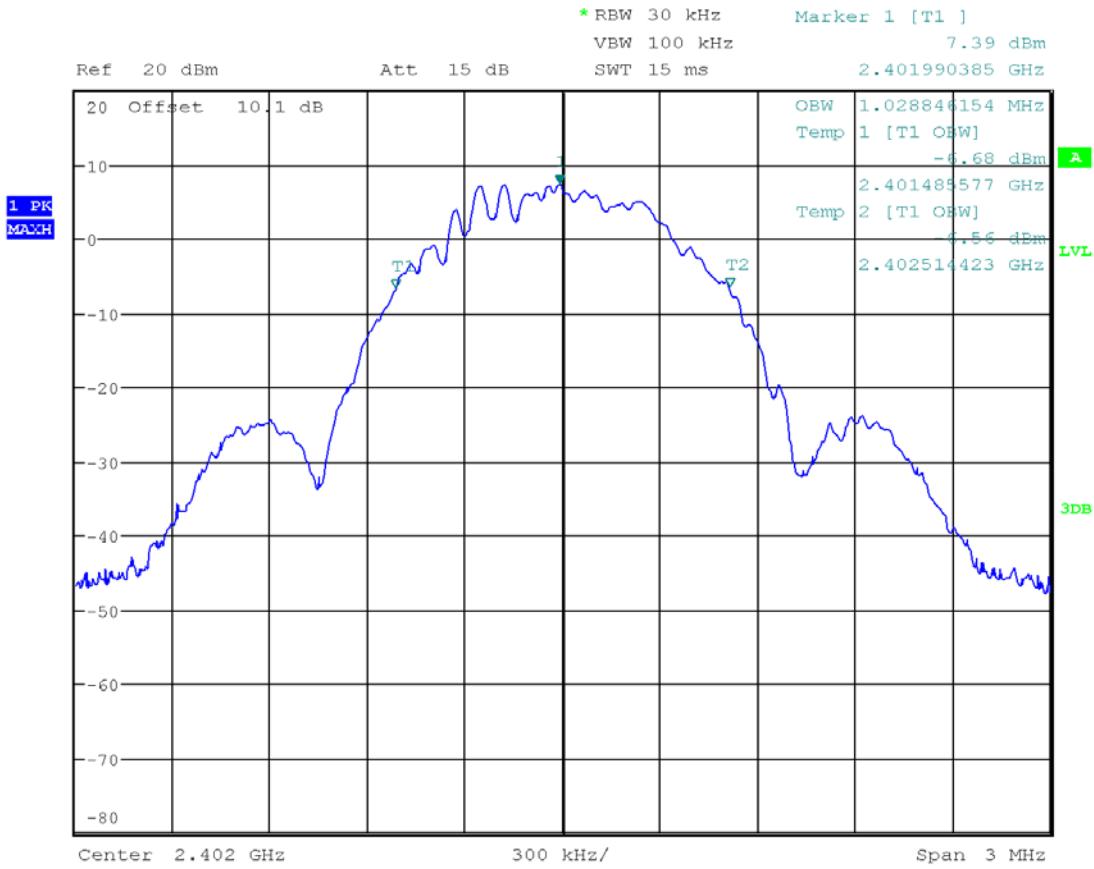
Date: 16.JUN.2017 13:48:57

Plot 1. 3



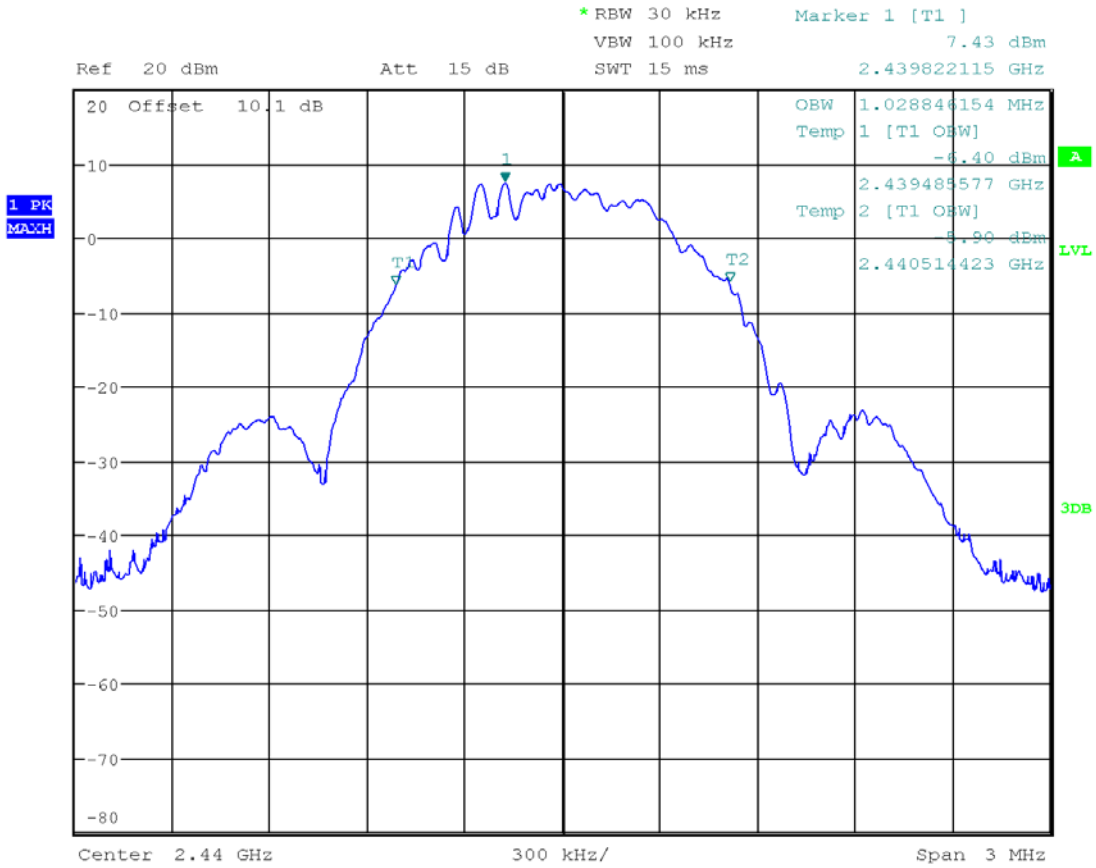
Date: 16.JUN.2017 13:43:17

Plot 1. 4



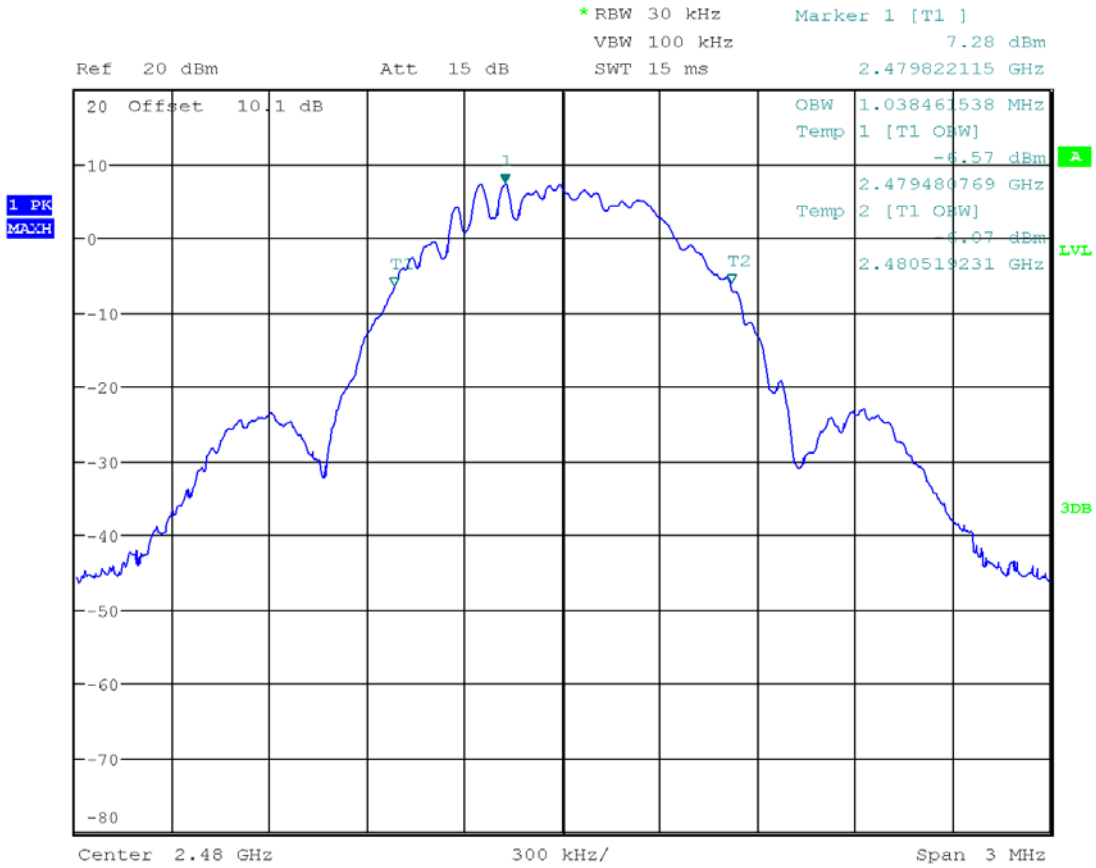
Date: 16.JUN.2017 13:54:57

Plot 1.5



Date: 16.JUN.2017 13:52:16

Plot 1.6



Date: 16.JUN.2017 13:53:49

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 v04 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 – 2.6 for the test details.

Tile Style, model: T4001

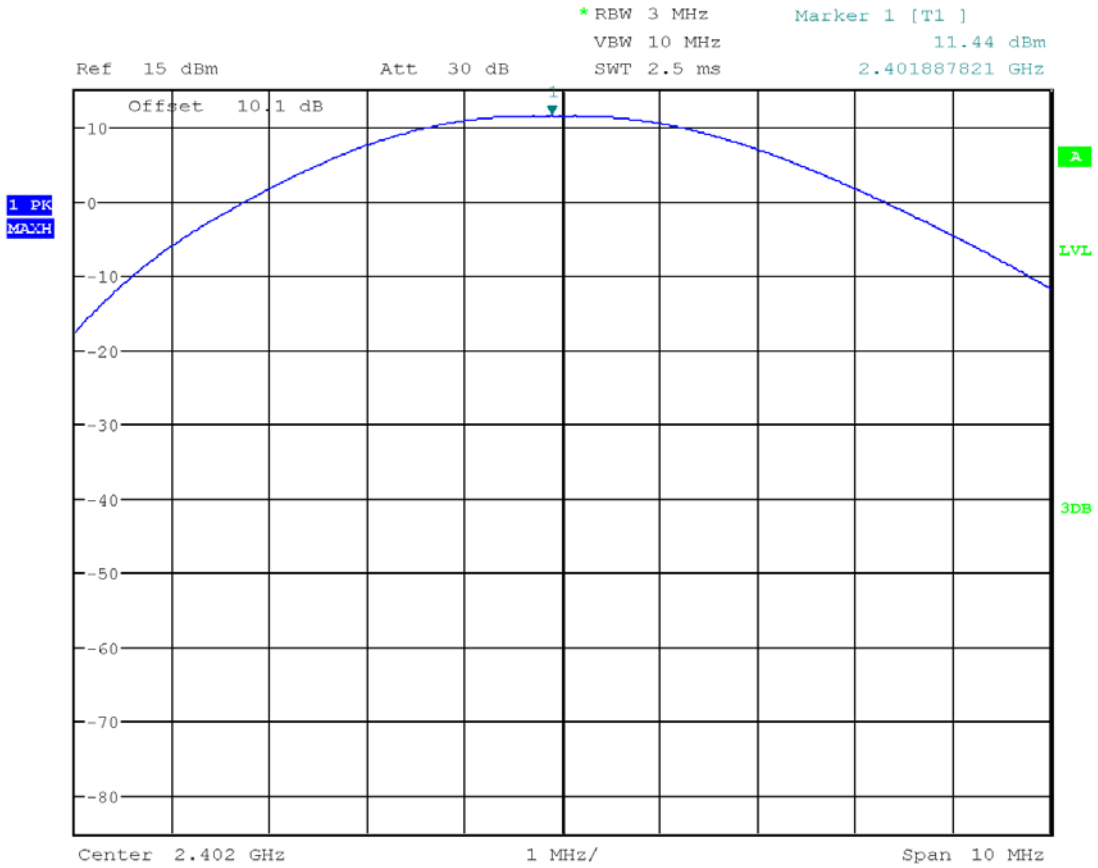
Frequency, MHz	Conducted Power (peak), dBm	Conducted Power (peak), mW	Plot
2402	11.44	13.93	2.1
2440	11.49	14.09	2.2
2480	11.38	13.74	2.3

Tile Sport, model: T4002

Frequency, MHz	Conducted Power (peak), dBm	Conducted Power (peak), mW	Plot
2402	11.87	15.38	2.4
2440	11.64	14.59	2.5
2480	11.05	12.74	2.6

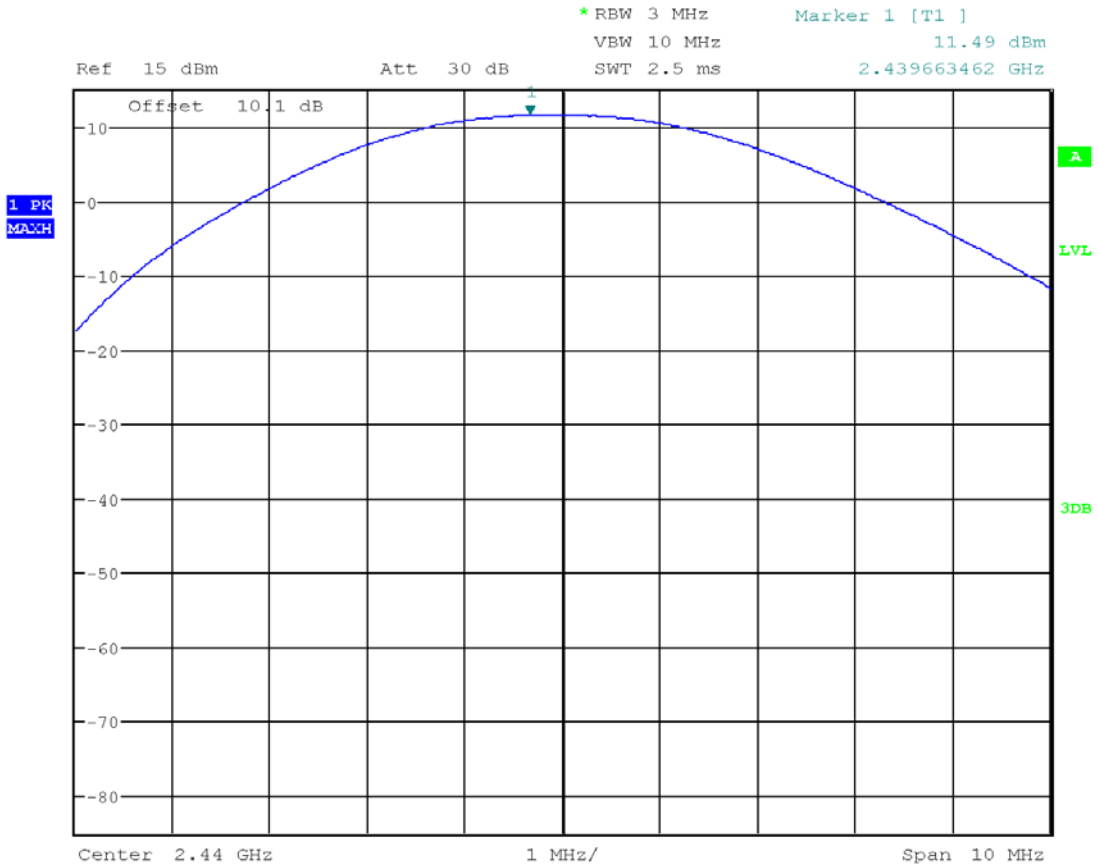
Date of Test:	June 20-21, 2017
Results	**Complies**

Plot 2. 1



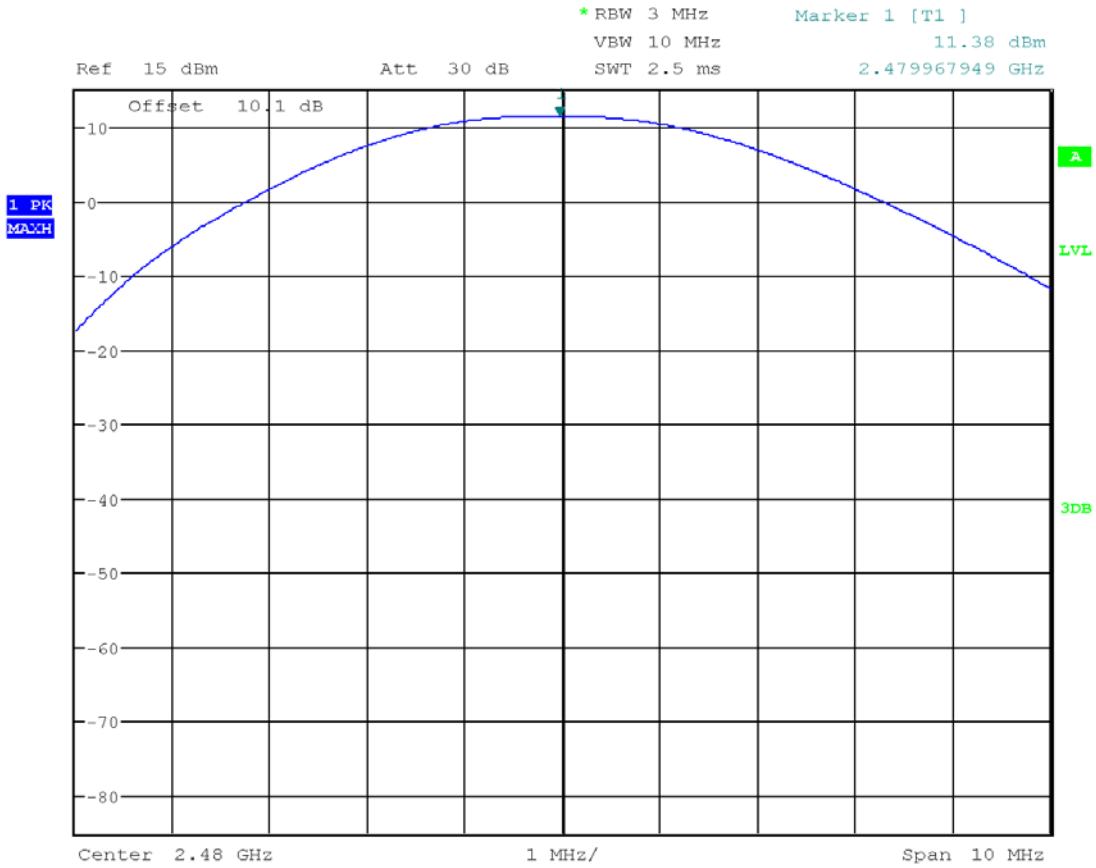
Date: 20.JUN.2017 15:02:09

Plot 2. 2



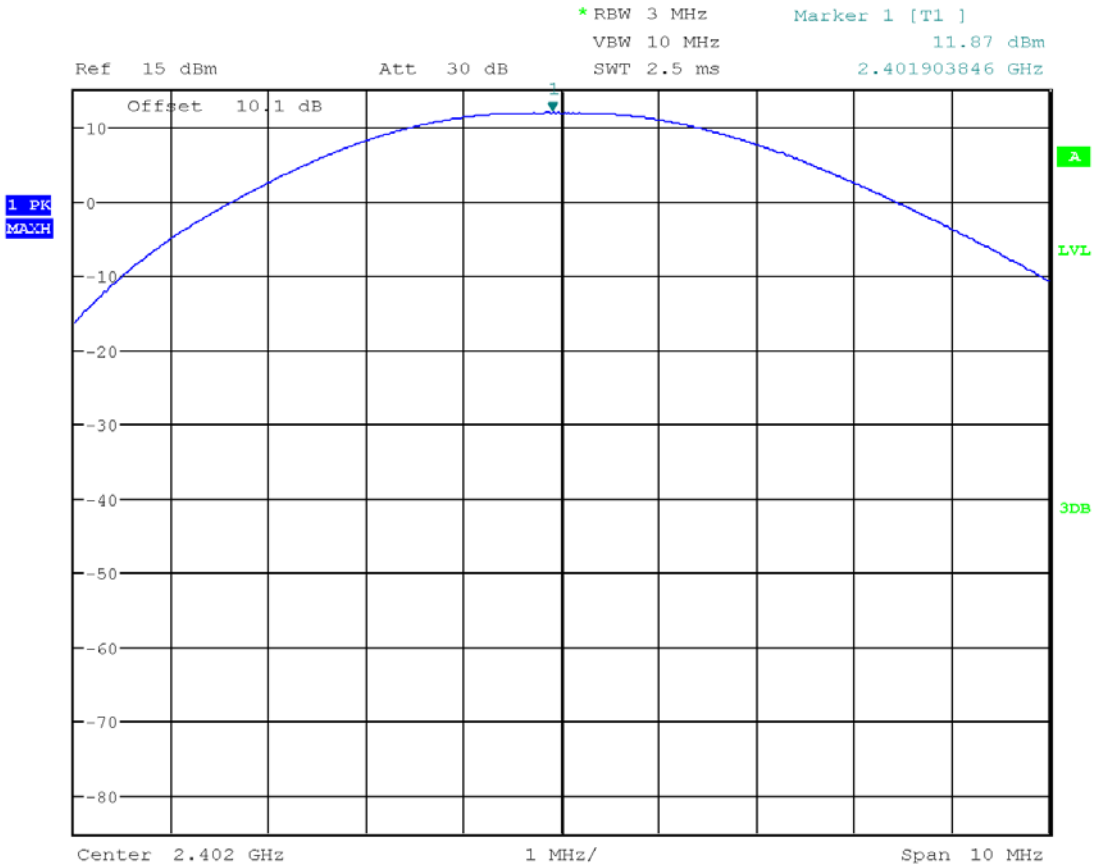
Date: 20.JUN.2017 15:02:58

Plot 2. 3



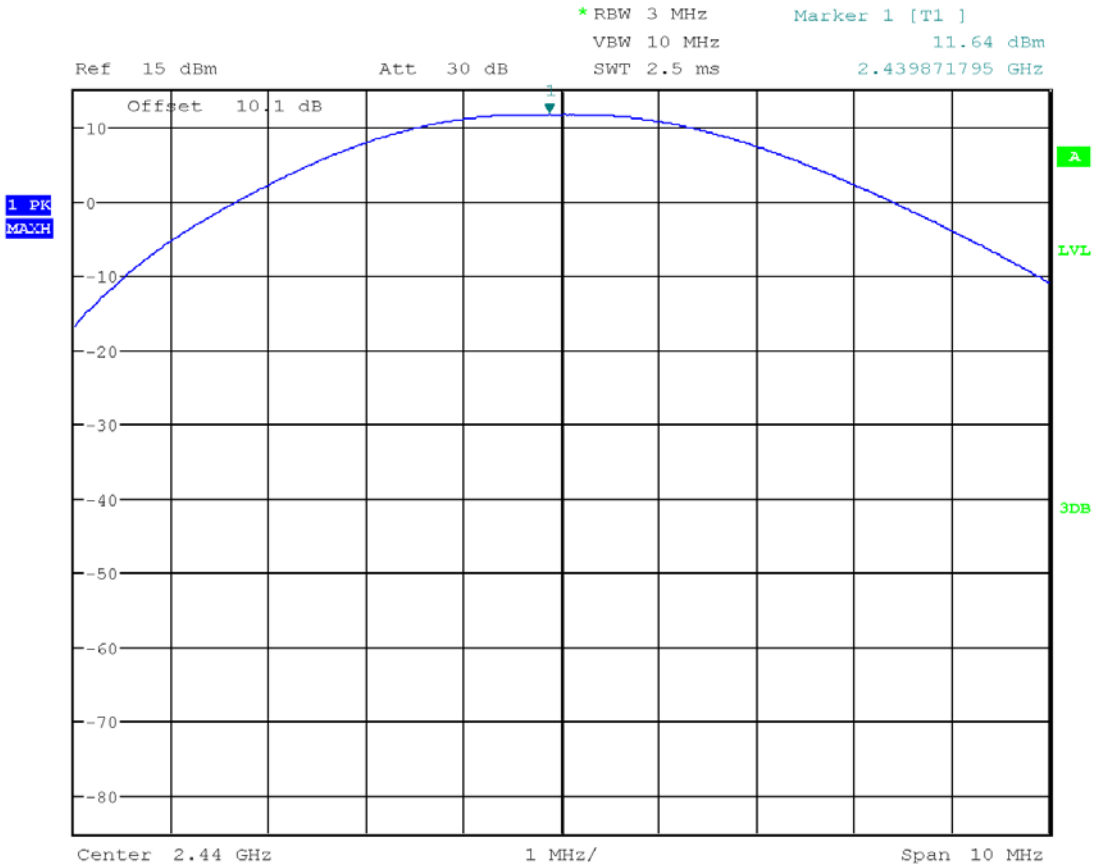
Date: 20.JUN.2017 15:03:47

Plot 2. 4



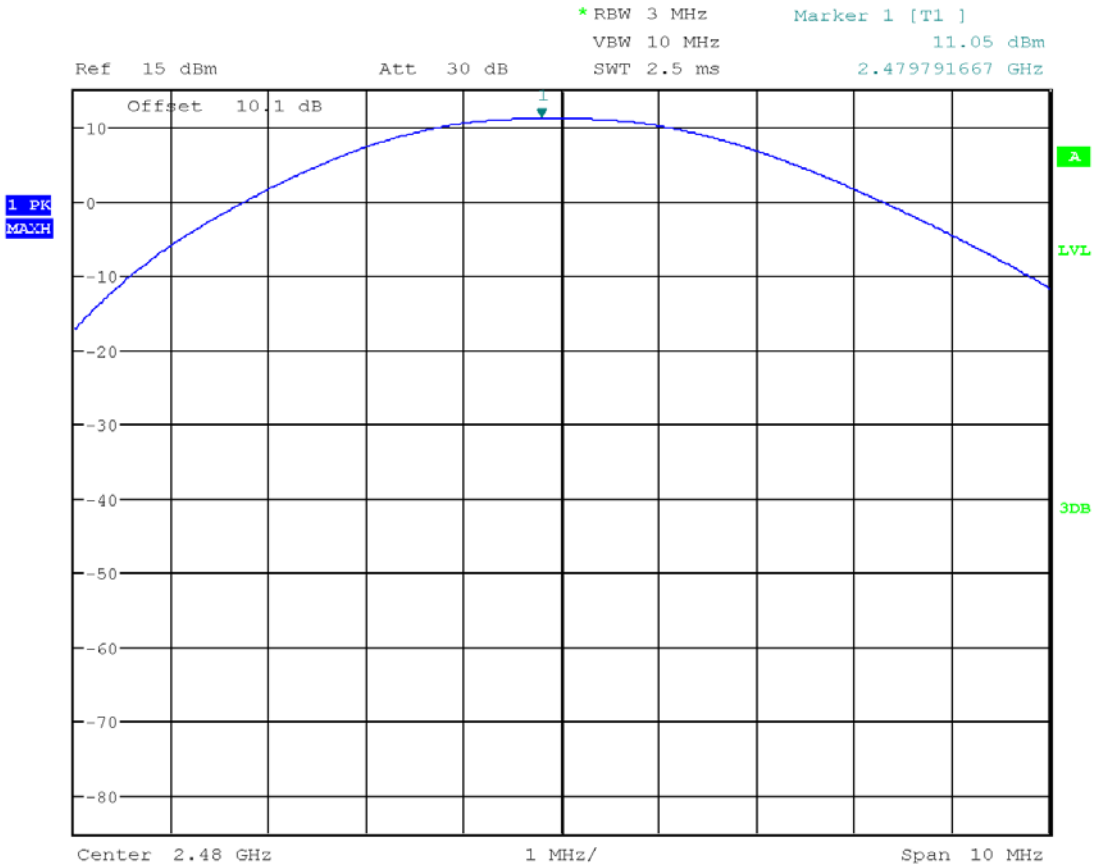
Date: 21.JUN.2017 17:34:19

Plot 2. 5



Date: 21.JUN.2017 17:35:02

Plot 2. 6



Date: 21.JUN.2017 17:35:36

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 v04, 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.

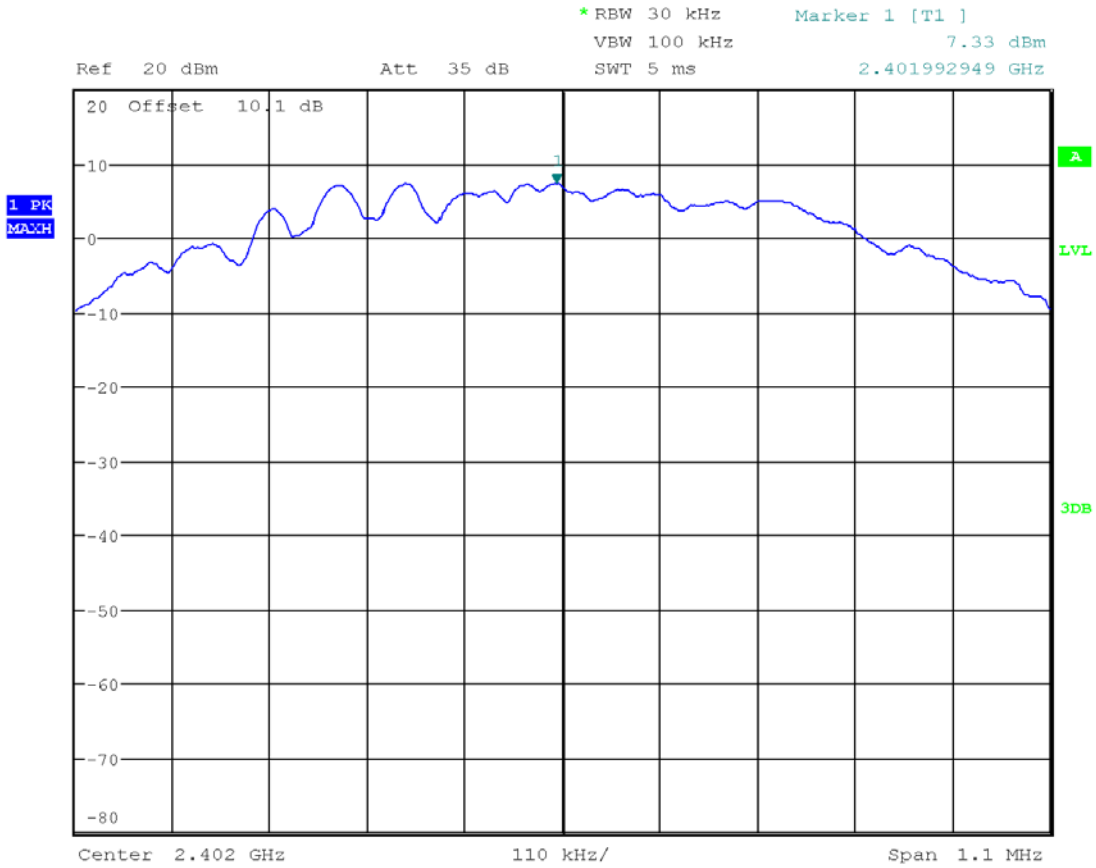
4.3.3 Test Result

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	7.33	8.0	-0.67	3.1
2440	7.34	8.0	-0.66	3.2
2480	7.17	8.0	-0.83	3.3

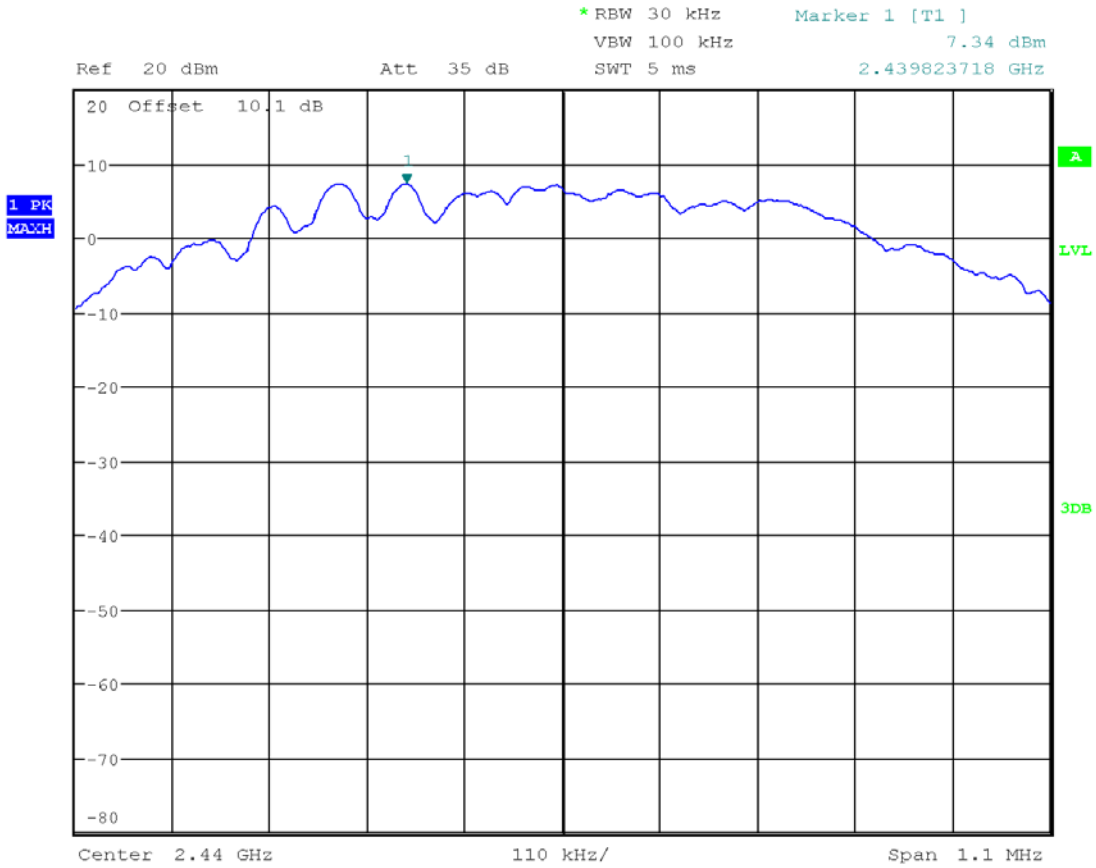
Date of Test:	June 16, 2017
Results	**Complies**

Plot 3. 1



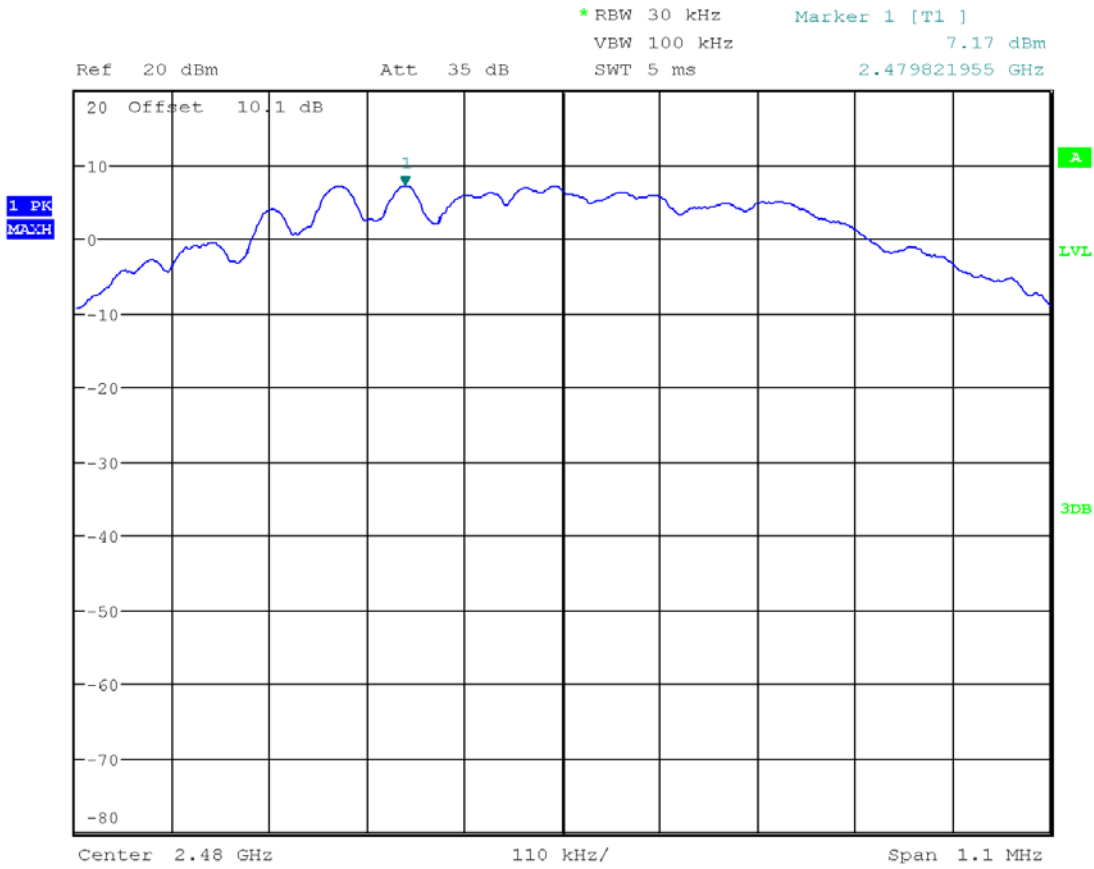
Date: 16.JUN.2017 13:56:44

Plot 3. 2



Date: 16.JUN.2017 13:57:30

Plot 3. 3



Date: 16.JUN.2017 13:58:10

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 v04, 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.

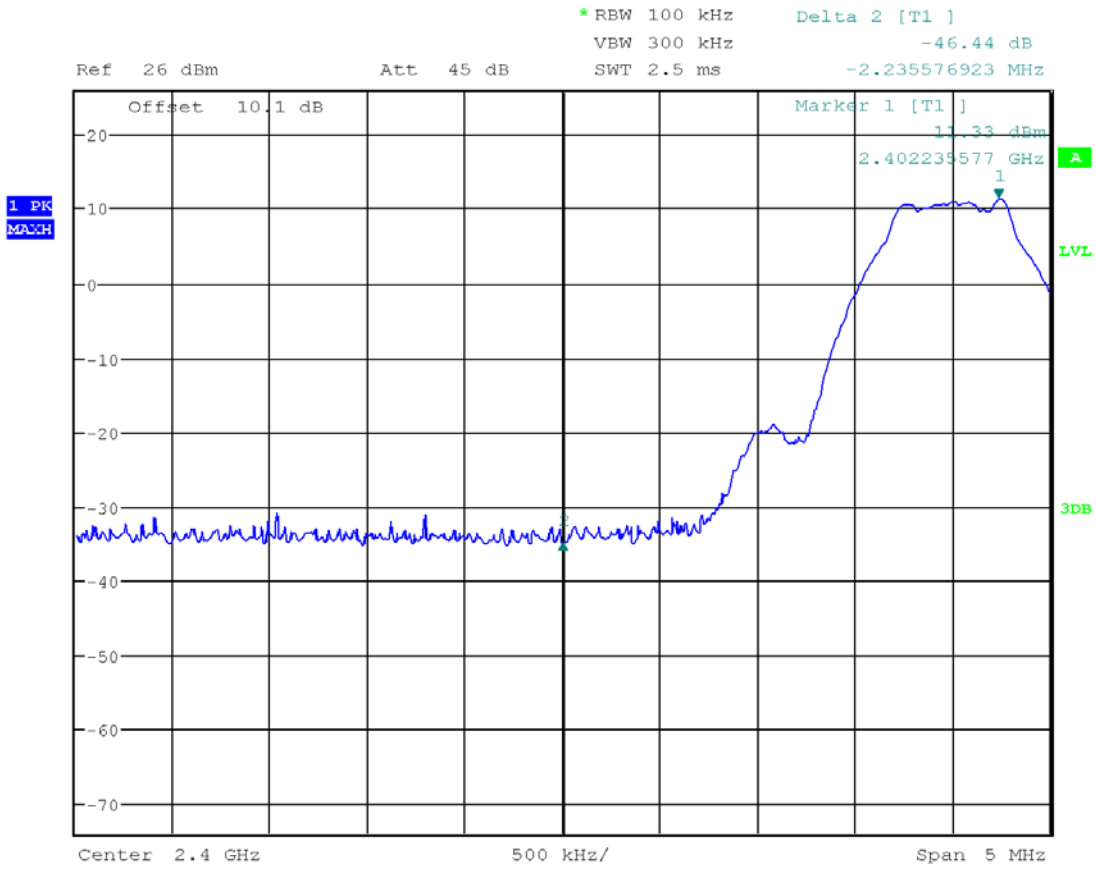
The unwanted emissions were measured from 30 MHz to 25 GHz. Plots below are corrected for cable loss and then compared to the limits.

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.

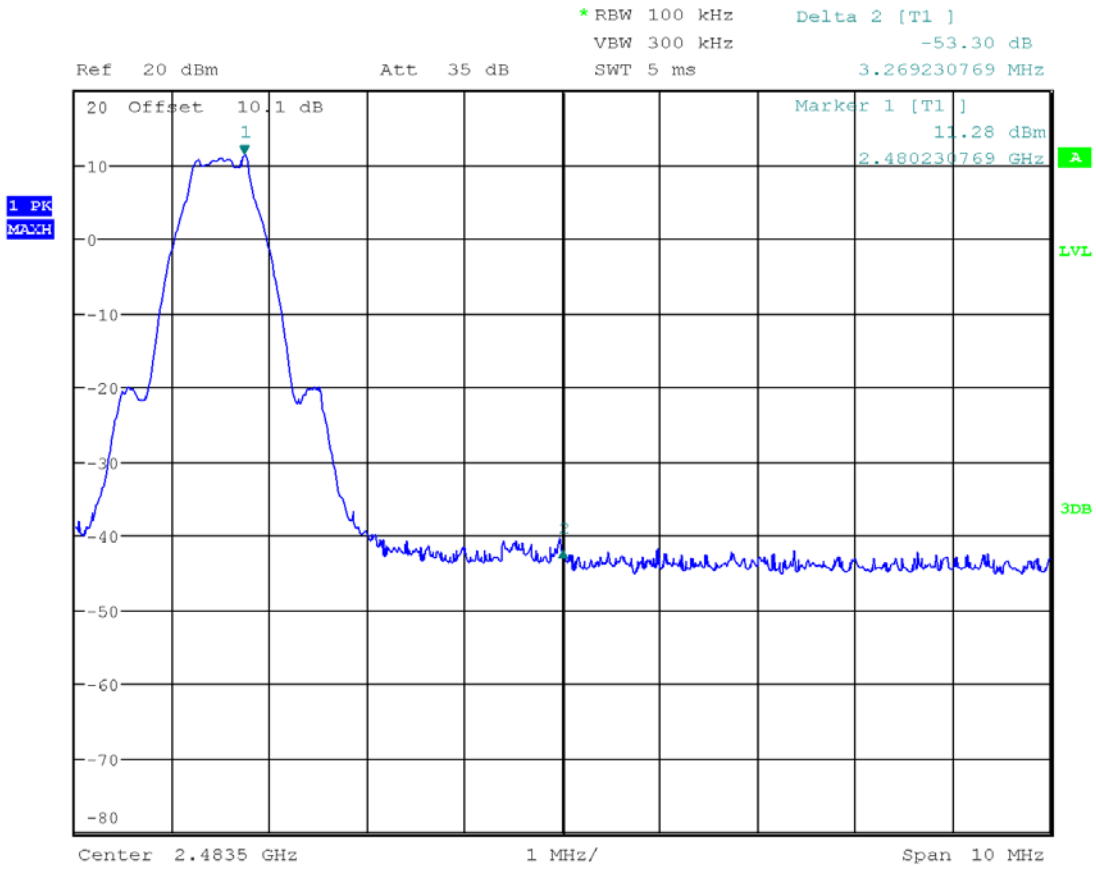
Date of Test:	June 16, 2017
Results	**Complies**

Tx @ Low Channel, 2400 MHz Band Edge
Plot 4.1



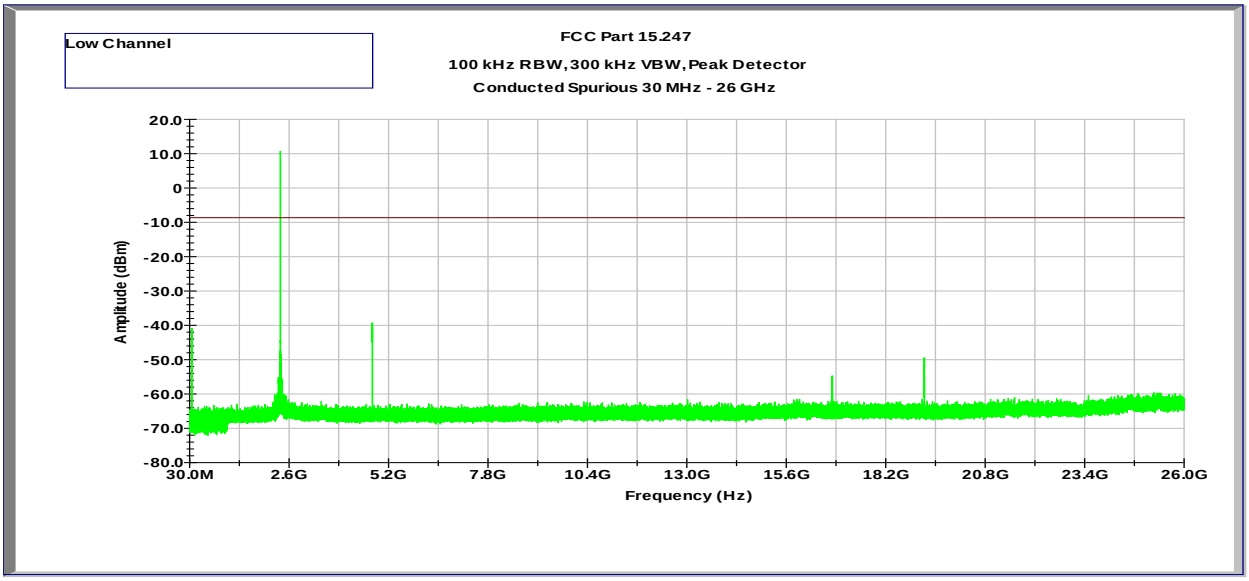
Date: 16.JUN.2017 14:32:49

Tx @ Low Channel, 2483.5 MHz Band Edge
Plot 4.2

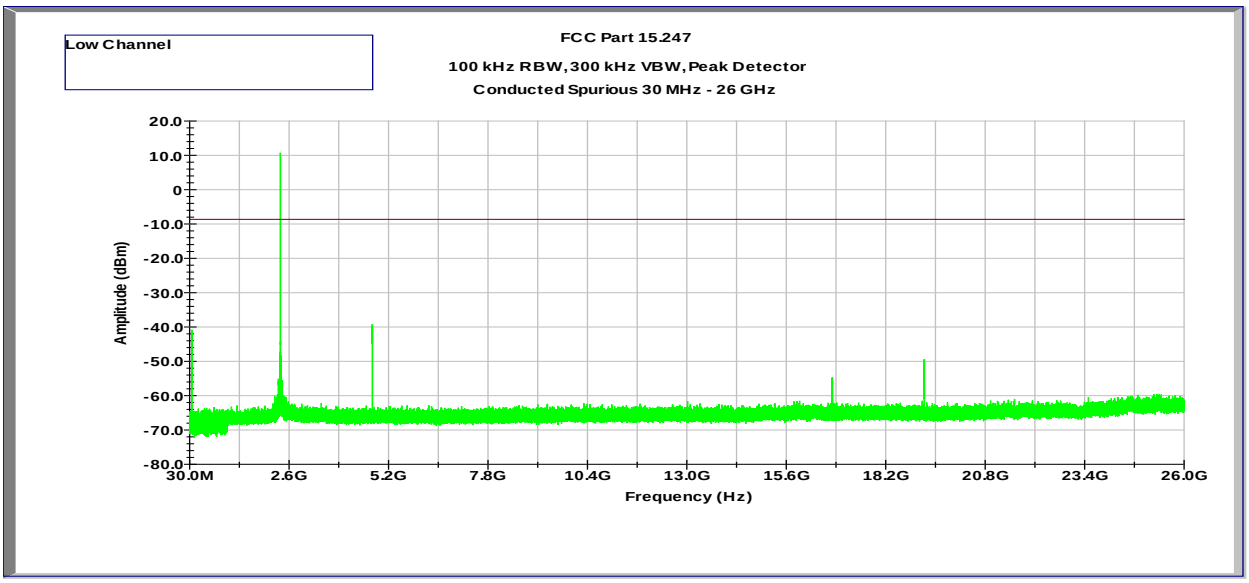


Date: 16.JUN.2017 14:30:18

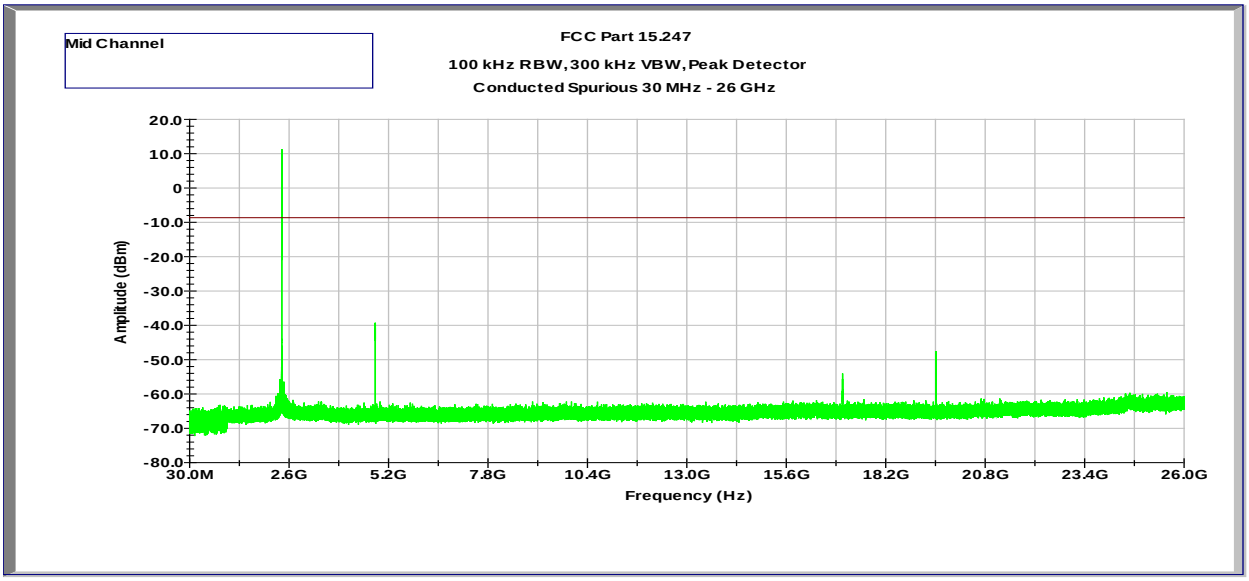
Tx @ Low Channel, 2402 MHz
30MHz -26GHz Conducted Spurious
Plot 4.3



Tx @ Mid Channel, 2440 MHz
30MHz -26GHz Conducted Spurious
Plot 4.4



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 C63.10: 2013. 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 – 20log D + 104.8+DCF (DCF for Average measurements)
where:
E = electric field strength in dBμV/m,
EIRP = equivalent isotropic radiated power in dBm
D = specified measurement distance in meters.
DCF = Duty Cycle Correction Factor
f) Compare the resultant electric field strength level to the applicable limit.
g) Perform radiated spurious emission test

4.5.7 Test Results

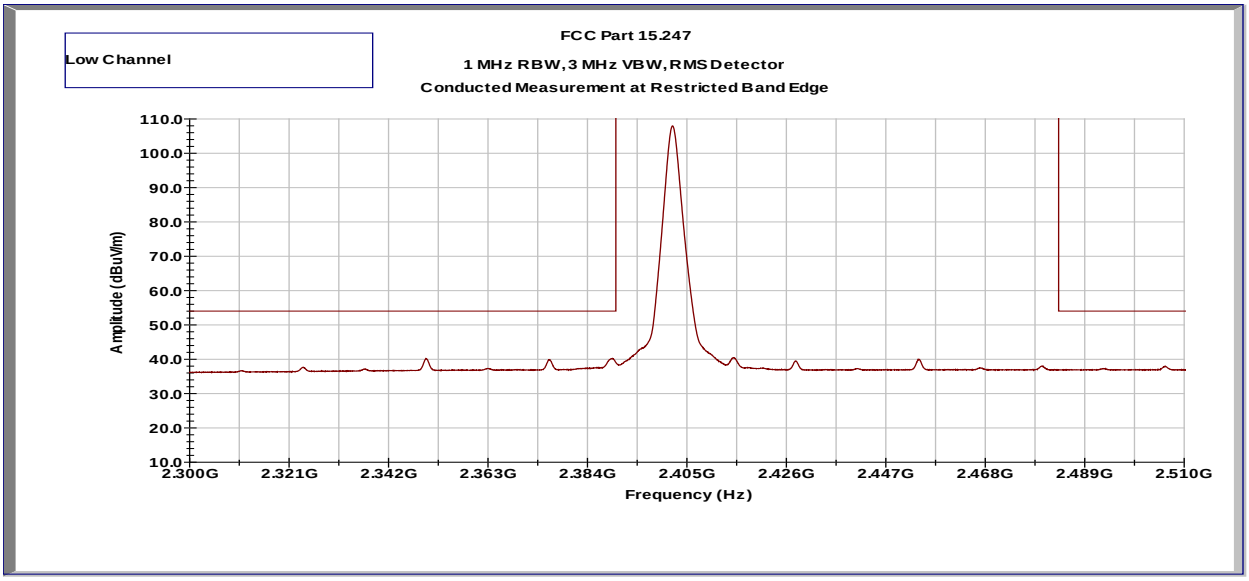
The data on the following pages list the significant emission frequencies, the limit and the margin of compliance where emissions are within 3dB of the limit.

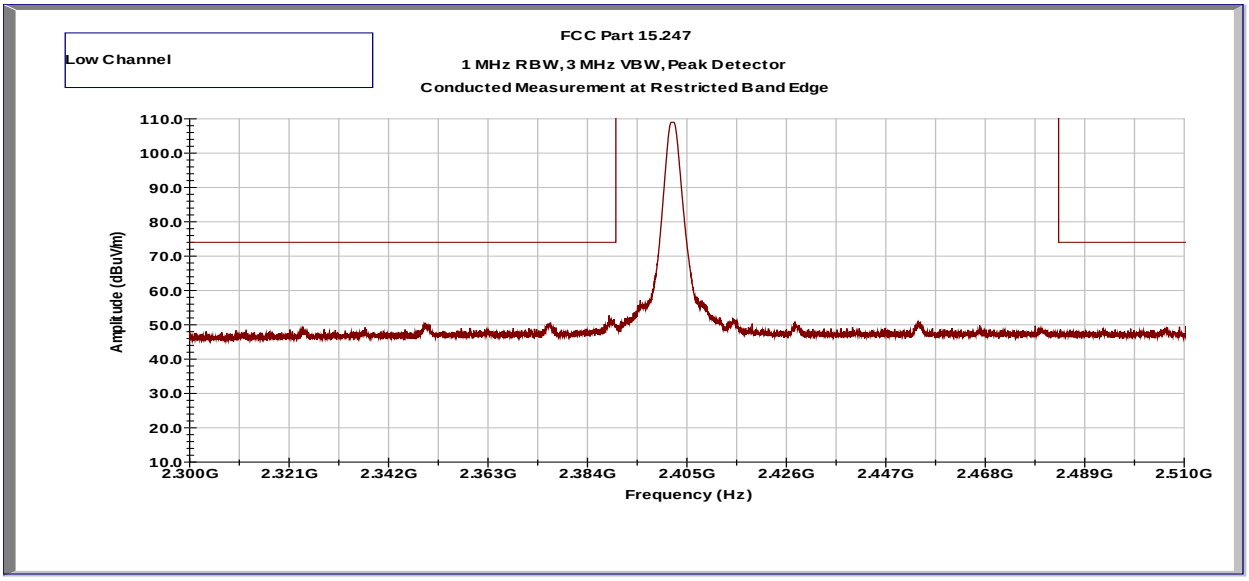
All conducted antenna port plots are corrected with the consideration of a 2 dBi Antenna Gain.

Date of Test:	June 14 - 20, 2017
Results	**Complies**

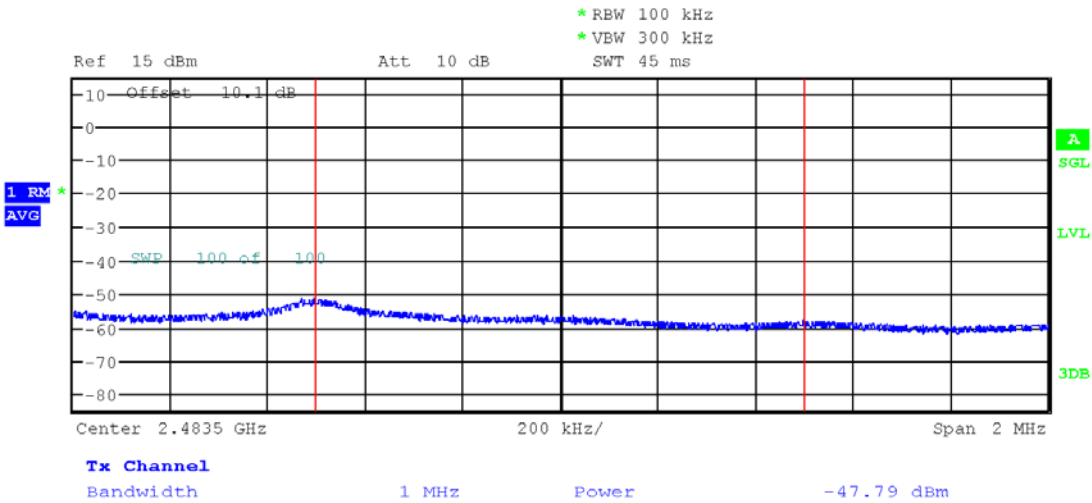
Test Results: 15.209/15.205 Restricted Band Emissions at Antenna Port

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



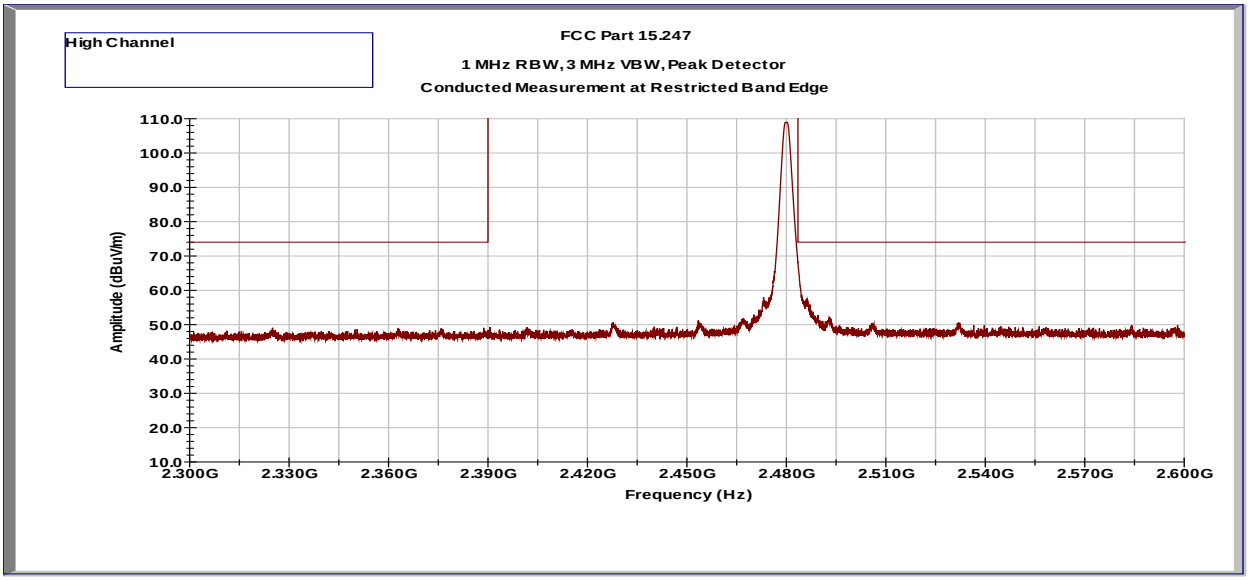


Out-of-Band Spurious Emissions at the Band Edge – Tx @ 2480 MHz



Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dBµV/m	dBµV/m	dB		
2.4835	49	54	-5.0	RMS	Pass

E = EIRP – 20log D + 104.8
EIRP = -47.79 + 1.55
D = 3 (meters)
Trace averaging with continuous EUT transmission at full power was utilized from section 13.3.1 in KDB 558074 D01 DTS Meas Guidance v04.

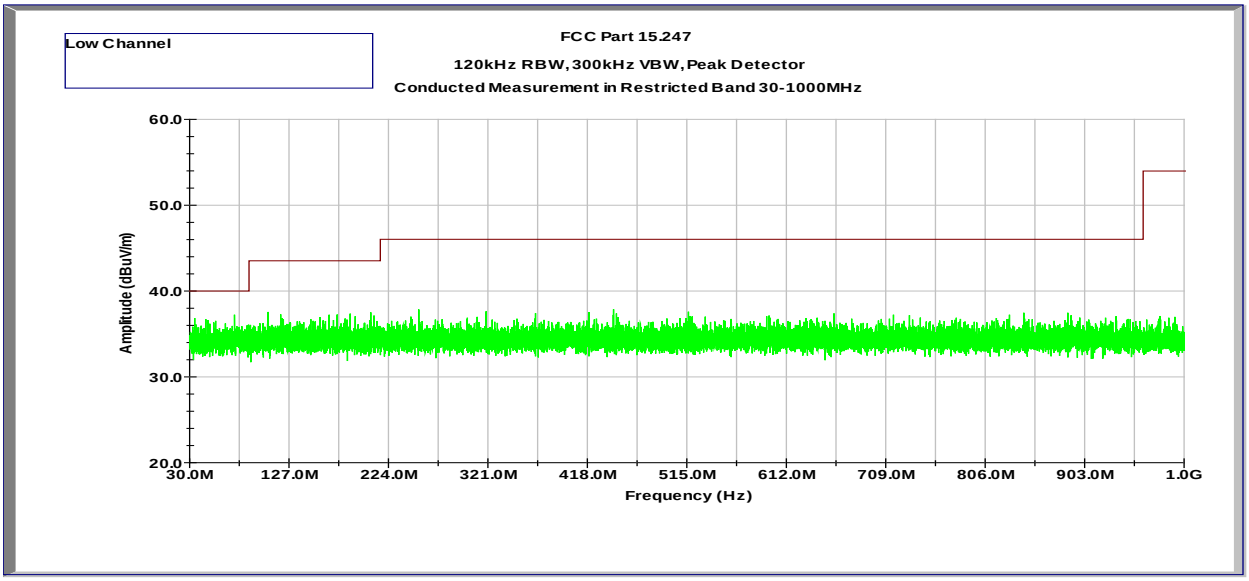


Frequency	Corrected Amplitude	Peak Limit	Margin	Detector	Results
GHz	dBµV/m	dBµV/m	dB		
2.4835	66.5	74	-7.5	Peak	Pass

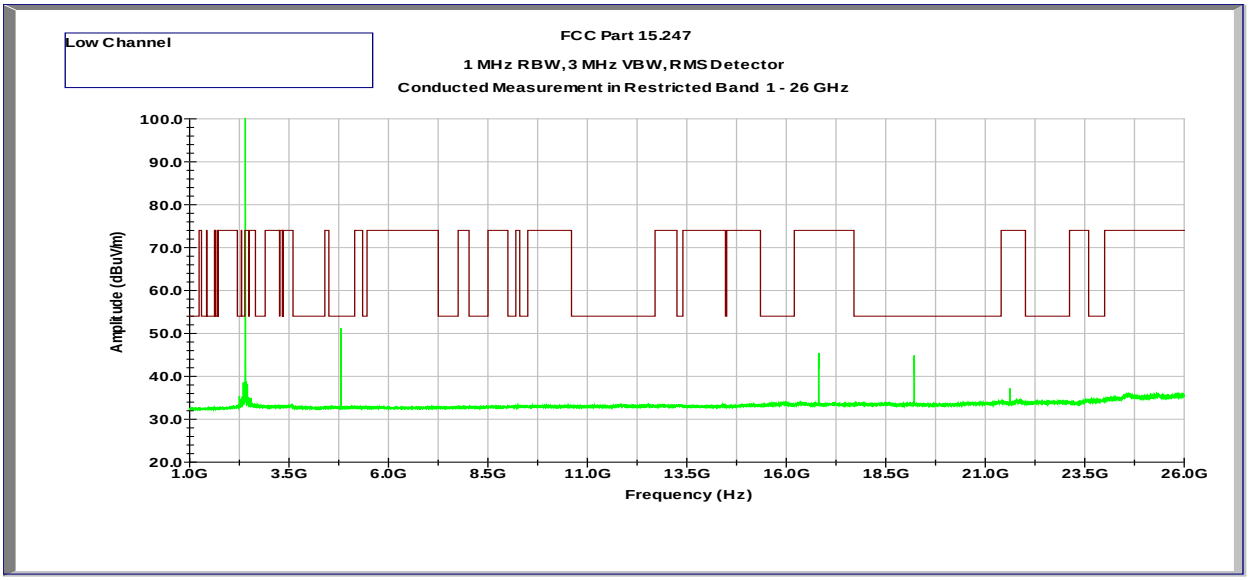
Out-of-Band Conducted Spurious Emissions (at Antenna Port)

Tx @ 2402MHz

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

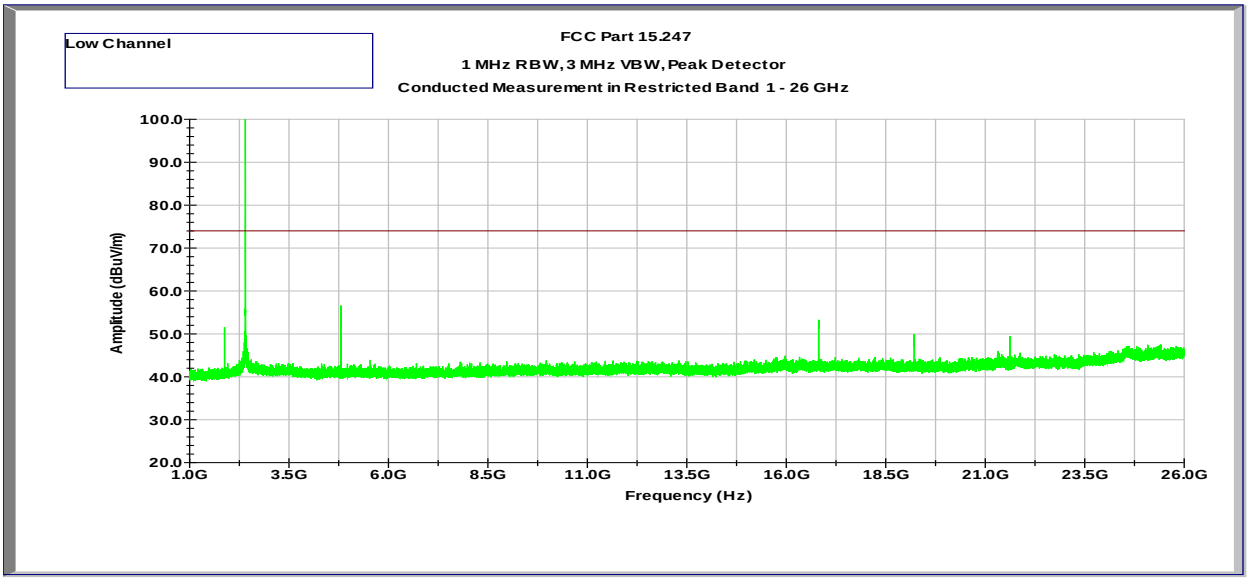


Out-of-Band Spurious Emissions at Antenna Port – 1 - 26 GHz RMS Detector vs Avg Limit



Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dBµV/m	dBµV/m	dB		
4.804	51.2	54	-2.8	RMS	Pass

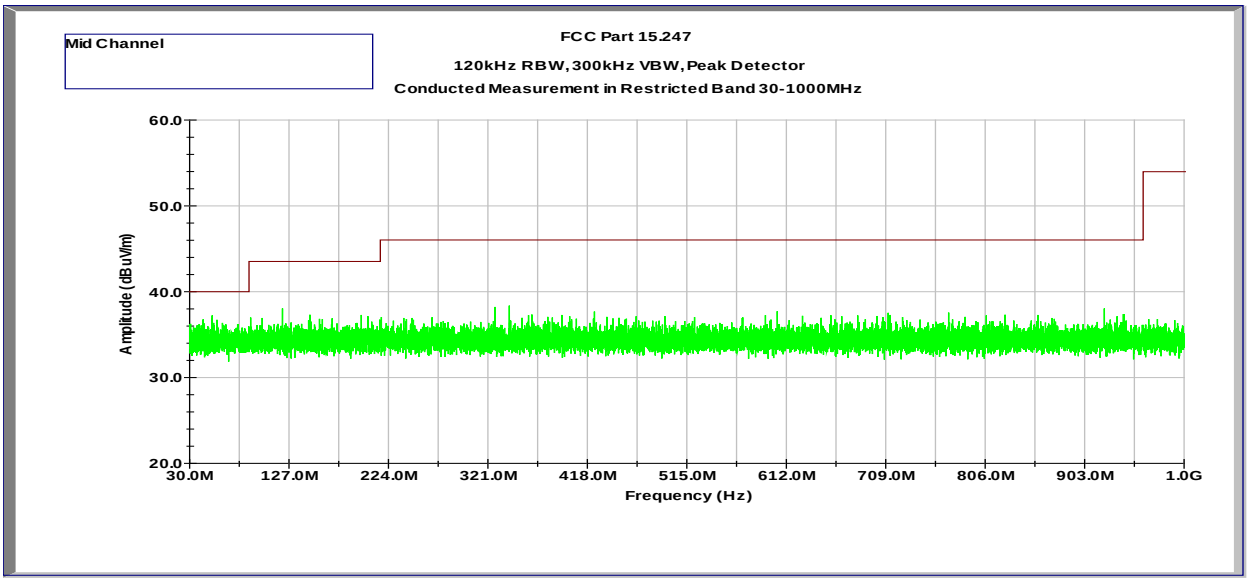
Out-of-Band Spurious Emissions at Antenna Port – 1 - 26 GHz Peak Detector vs Peak Limit



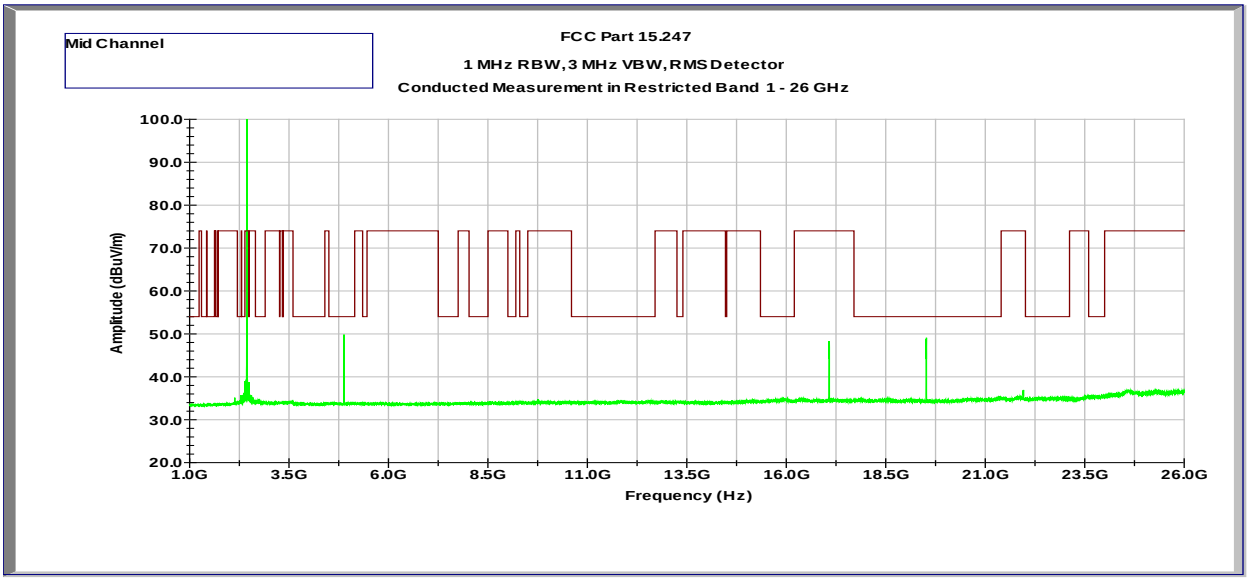
Out-of-Band Conducted Spurious Emissions (at Antenna Port)

Tx @ 2440MHz

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

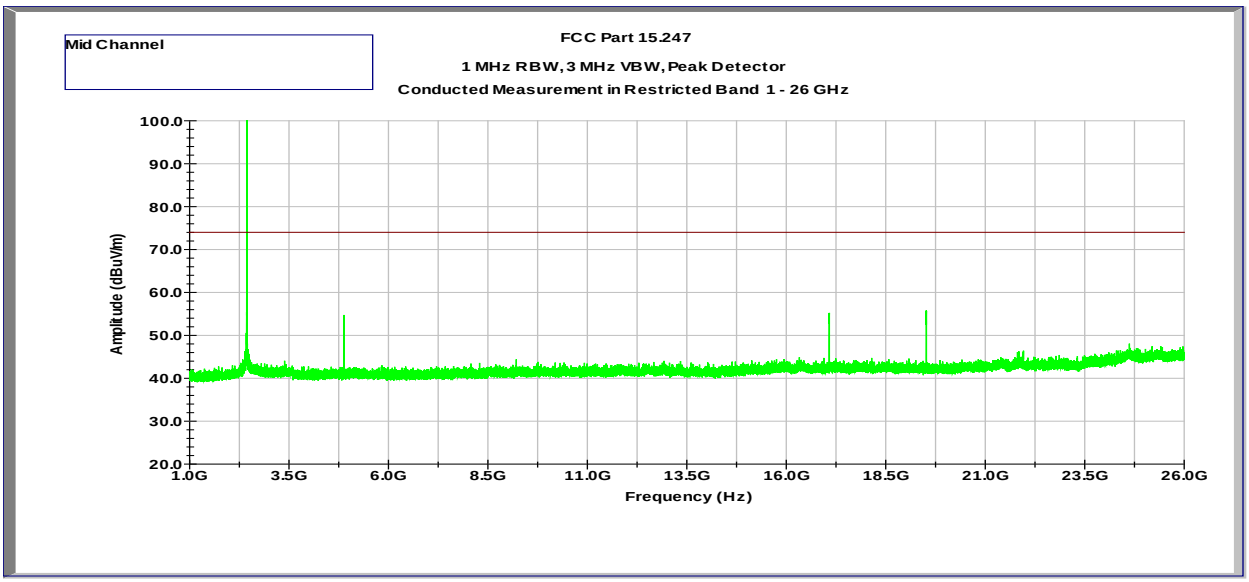


Out-of-Band Spurious Emissions at Antenna Port – 1 - 26 GHz RMS Detector vs Avg Limit



Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dBµV/m	dBµV/m	dB		
4.880	49.8	54	-4.2	RMS	Pass
19.520	49.1	54	-4.7	RMS	Pass

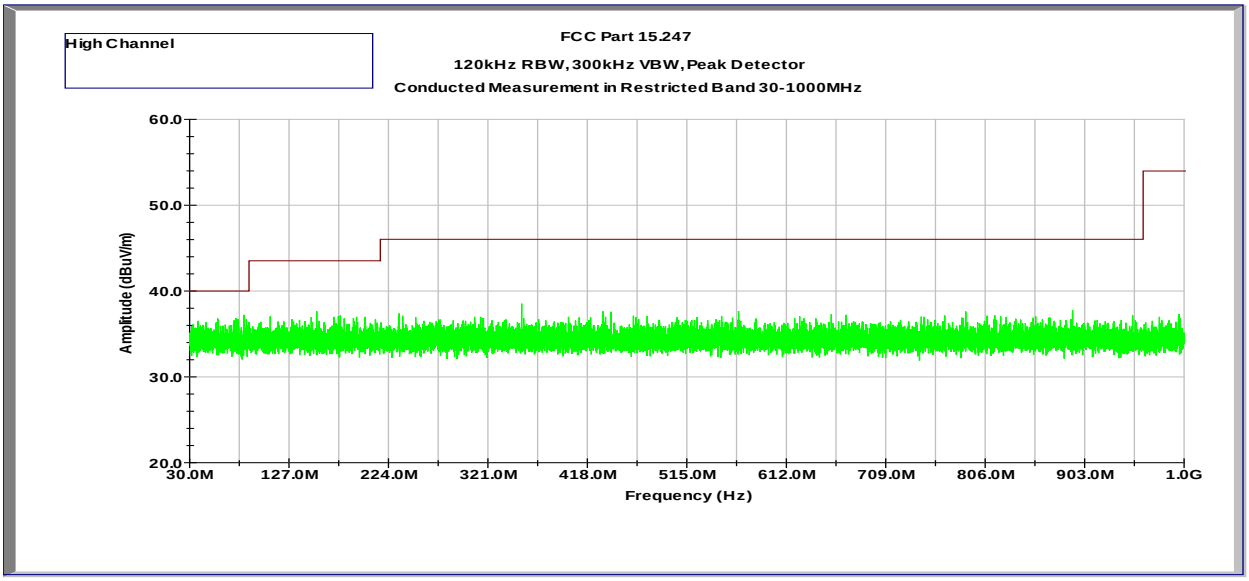
Out-of-Band Spurious Emissions at Antenna Port – 1 - 26 GHz Peak Detector vs Peak Limit



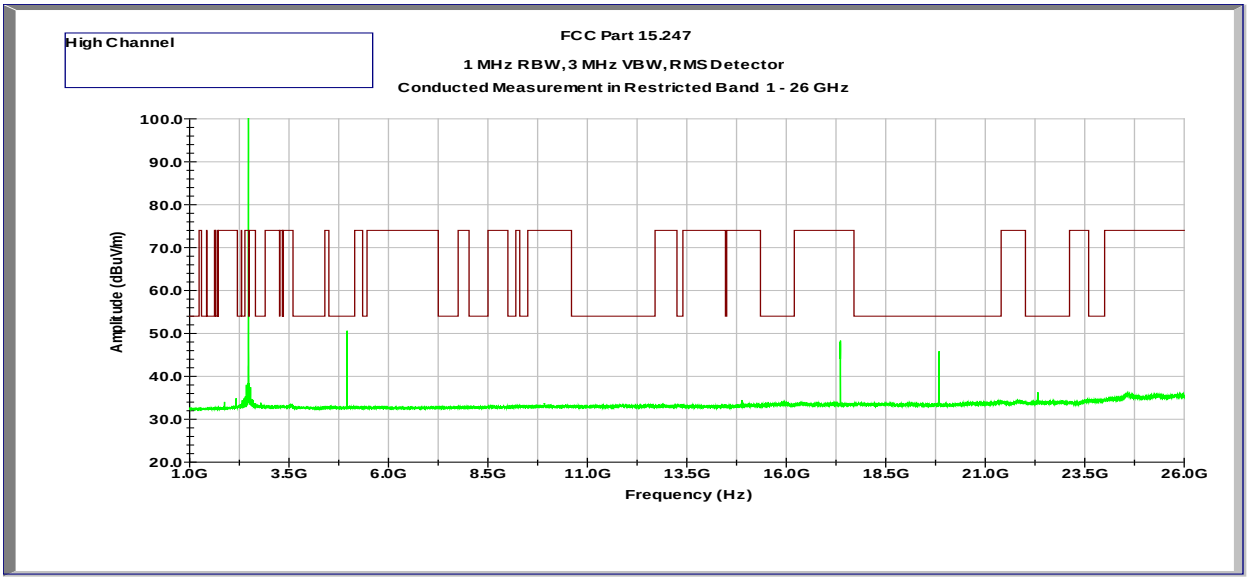
Out-of-Band Conducted Spurious Emissions (at Antenna Port)

Tx @ 2480MHz

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

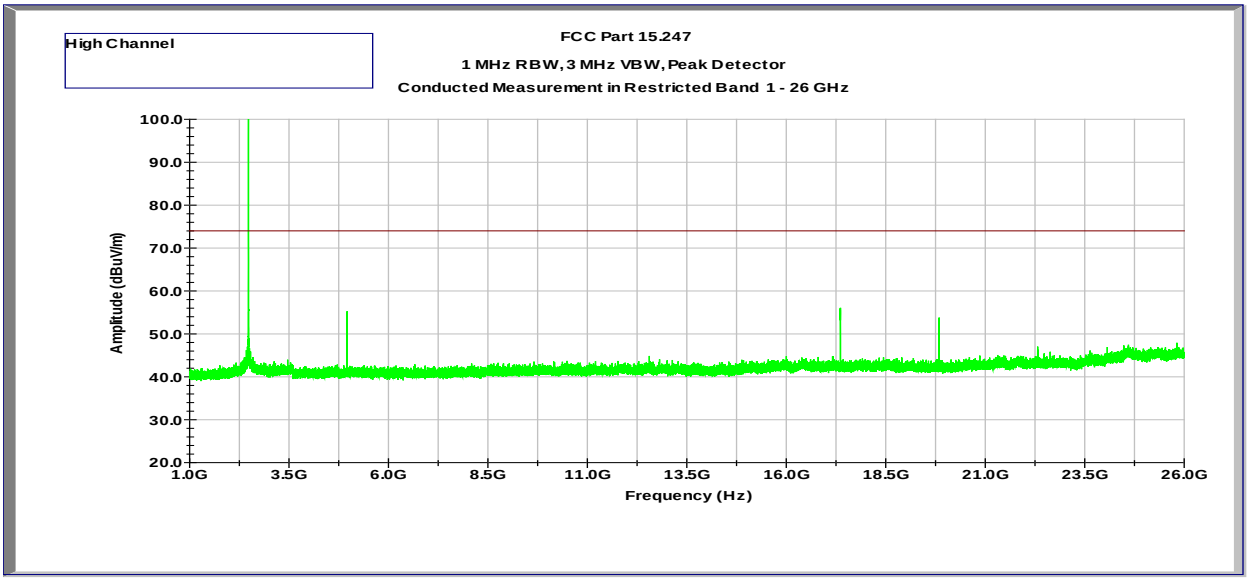


Out-of-Band Spurious Emissions at Antenna Port – 1 - 26 GHz RMS Detector vs Avg Limit



Frequency	Corrected Amplitude	Avg Limit	Margin	Detector	Results
GHz	dBµV/m	dBµV/m	dB		
4.960	50.6	54	-3.4	RMS	Pass
19.840	45.9	54	-8.1	RMS	Pass

Out-of-Band Spurious Emissions at Antenna Port – 1 - 26 GHz Peak Detector vs Peak Limit

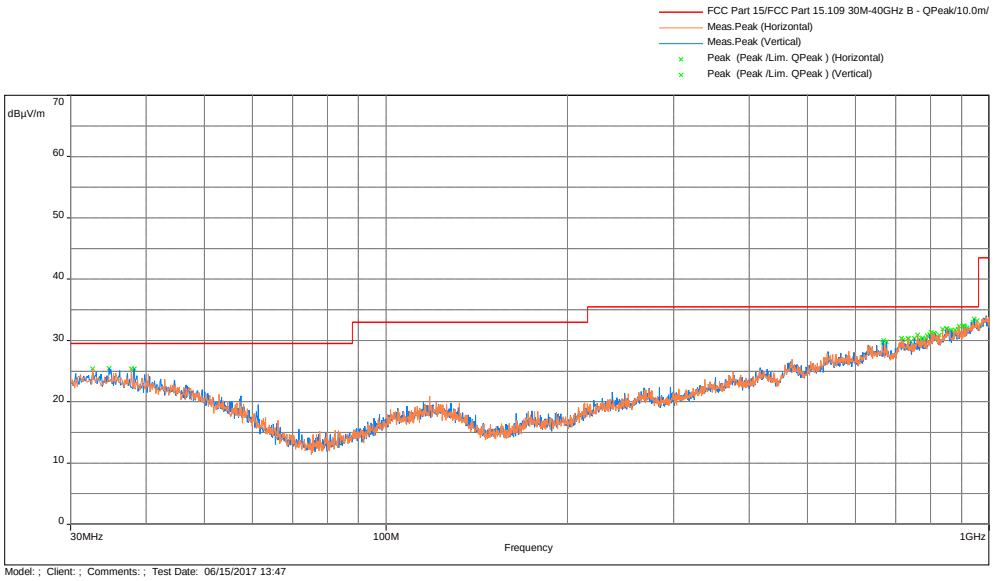


Out-of-Band Radiated Spurious Emissions (Cabinet Radiation)

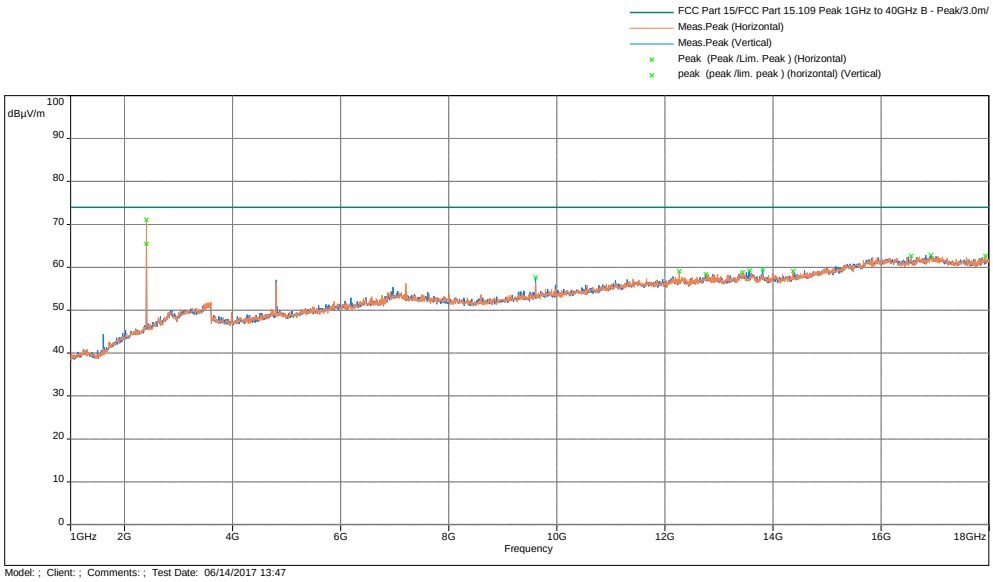
Test Results: 15.209 Radiated Spurious Emissions Low Channel
Tile Style, model: T4001

Tx at 2402MHz

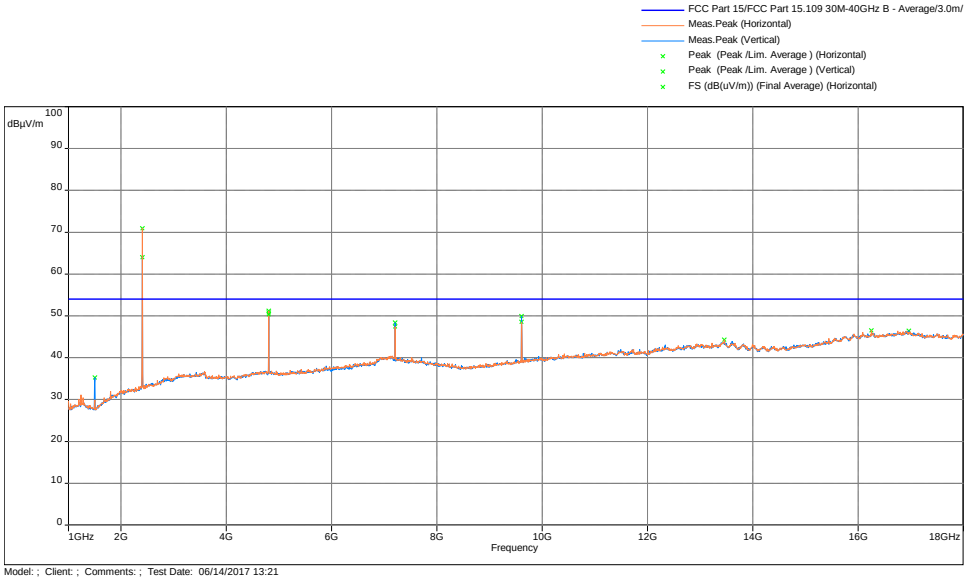
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit



Frequency	Avg	Lim.	Margin	Height	Angle	Comment	Correction
MHz	dBµV/m	dBµV/m	dB	m	°		dB
4804.6	51.18	54	-2.82	2.98	213.75	Horizontal polarization	8.75
4804.6	50.81	54	-3.19	2.02	118.5	Vertical polarization	8.75
9608.8	49.89	54	-4.11	1.02	146.75	Vertical polarization	13.93
9608.8	48.58	54	-5.42	1	277.5	Horizontal polarization	13.93

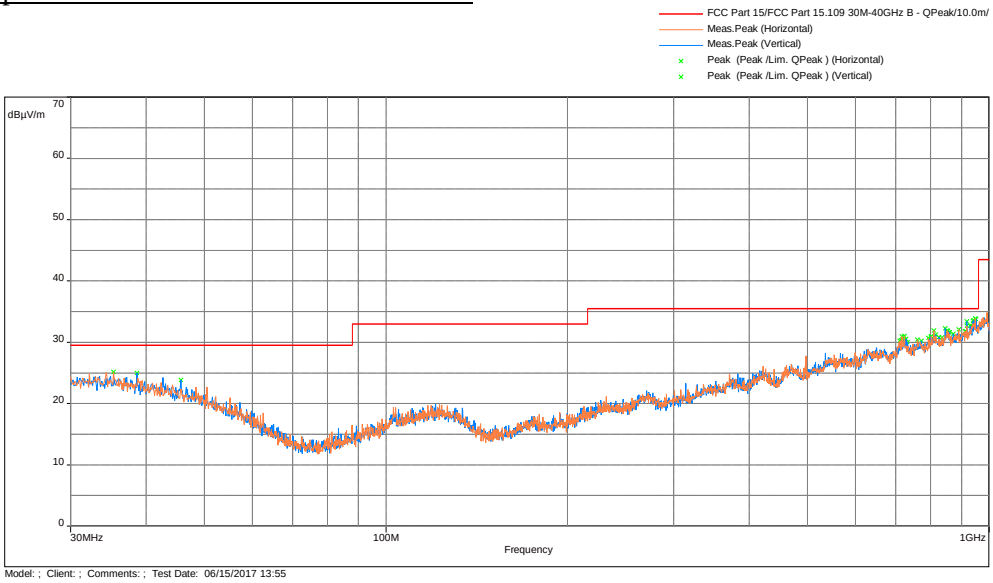
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Note: FS@3m = RA + AF + CF - Preamp

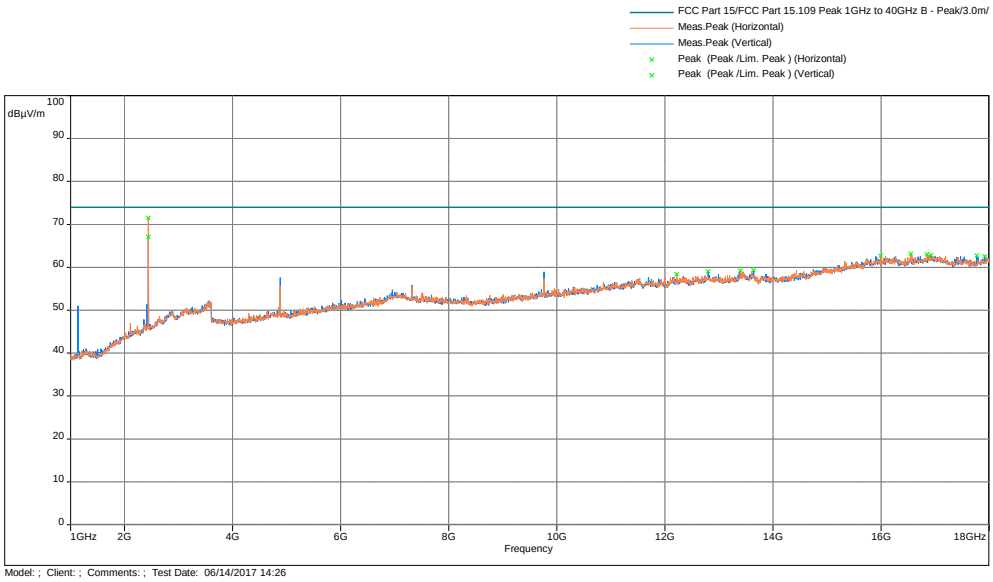
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions Mid Channel
Tile Style, model: T4001
Tx at 2440MHz

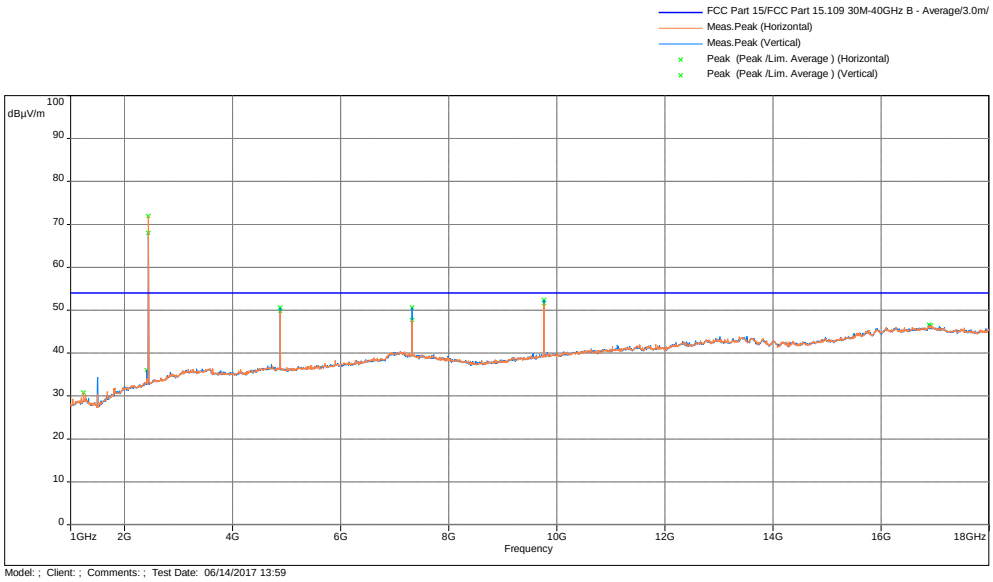
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit



Frequency	Avg	Lim.	Margin	Height	Angle	Comment	Correction
MHz	dBµV/m	dBµV/m	dB	m	°		dB
4879.4	50.57	54	-3.43	2.02	57.75	Vertical polarization	8.81
4879.4	49.87	54	-4.13	1.98	82.75	Horizontal polarization	8.81
7318.9	50.63	54	-3.37	2.02	89	Vertical polarization	13.54
7318.9	47.66	54	-6.34	3.98	145.75	Horizontal polarization	13.54
9761.8	52.42	54	-1.58	1.02	113.5	Vertical polarization	14.1
9760.1	51.59	54	-2.41	1.01	306.75	Horizontal polarization	14.1

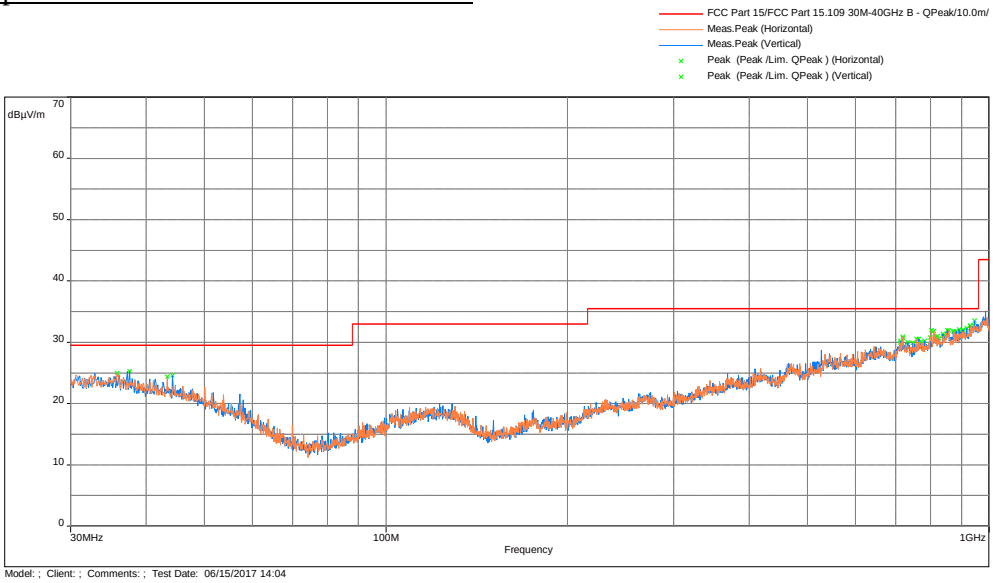
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Note: FS@3m = RA + AF + CF - Preamp

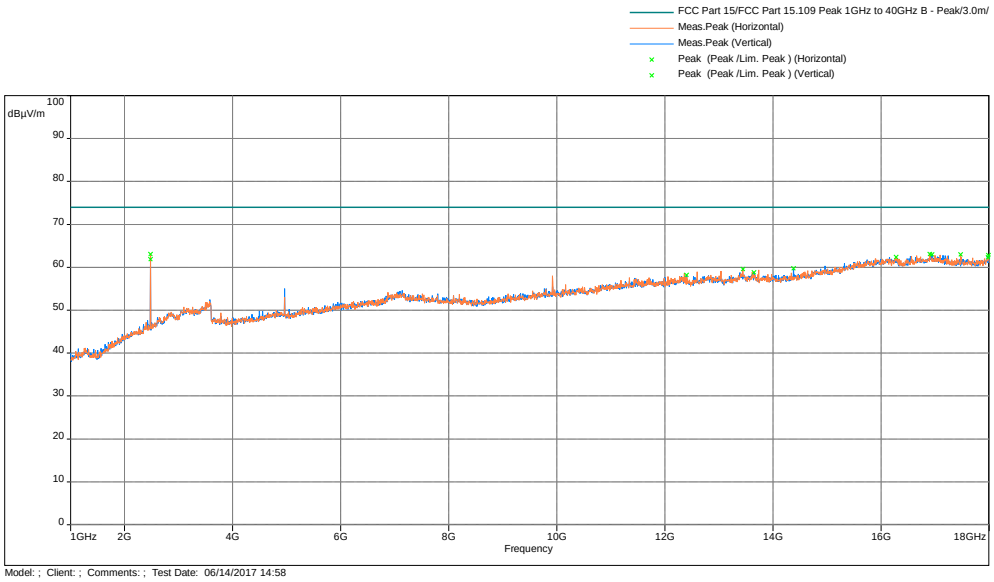
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions High Channel
Tile Style, model: T4001
Tx at 2480MHz

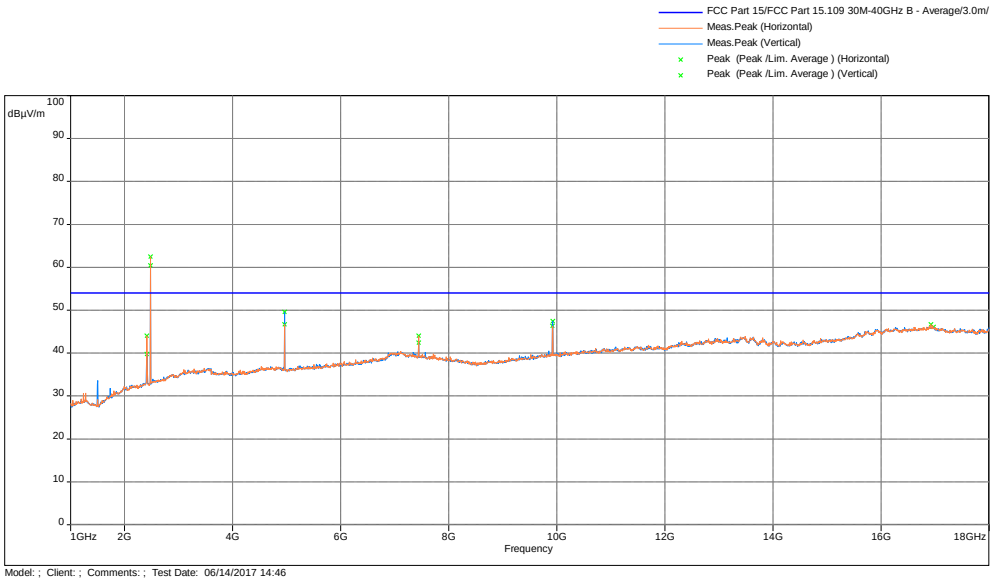
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit



Frequency	Avg	Lim.	Margin	Height	Angle	Comment	Correction
MHz	dBµV/m	dBµV/m	dB	m	°		dB
4959.3	46.68	54	-7.32	1.98	83.75	Horizontal polarization	8.85
4959.3	49.6	54	-4.4	3.02	143.75	Vertical polarization	8.85
9919.9	46.36	54	-7.64	2.98	26.5	Horizontal polarization	14.26
9921.6	47.44	54	-6.56	2.02	27	Vertical polarization	14.27

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

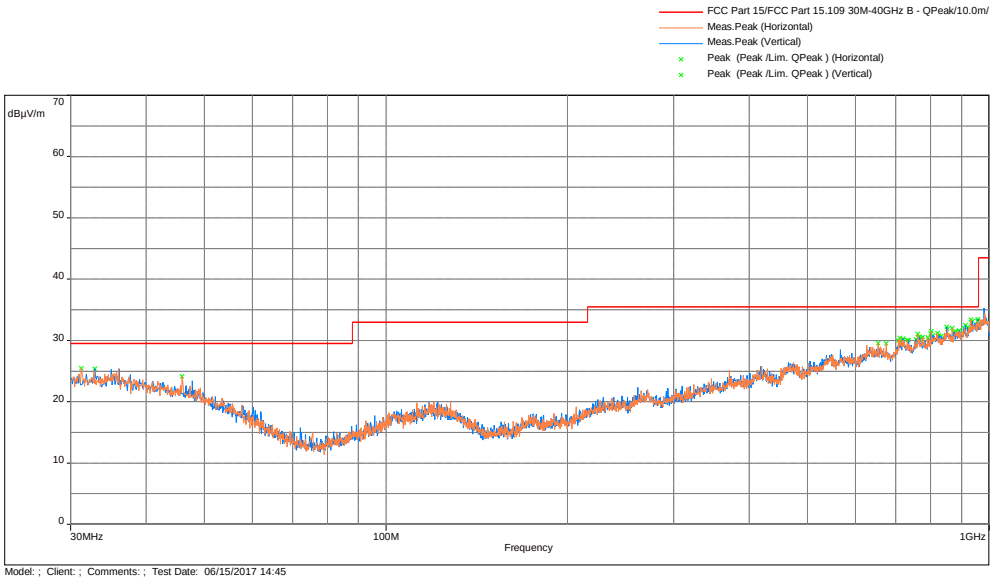
Note: FS@3m = RA + AF + CF - Preamp

Results	**Complies**

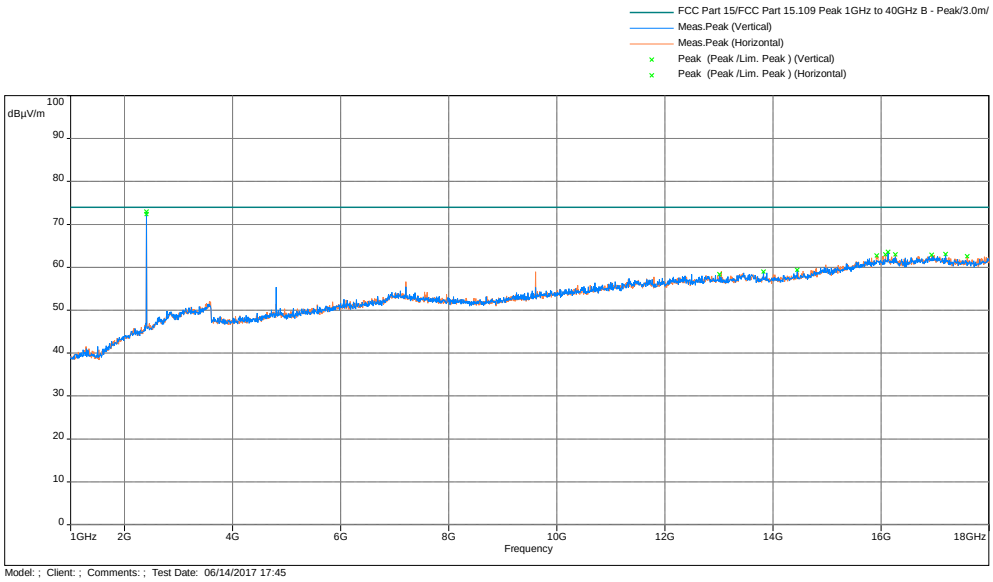
Test Results: 15.209 Radiated Spurious Emissions Low Channel
Tile Sport, model: T4002

Tx at 2402MHz

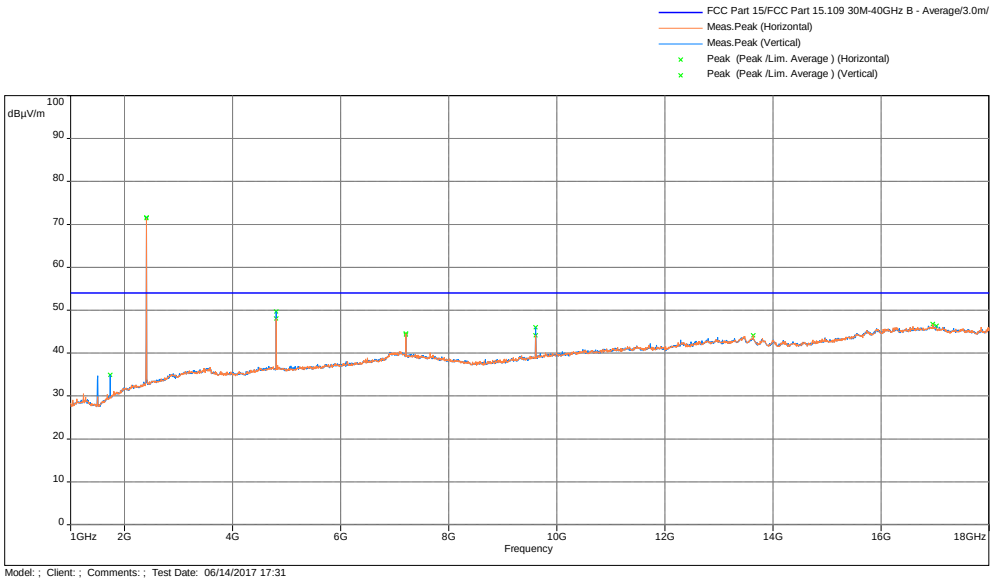
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit



Frequency	Avg	Lim.	Margin	Height	Angle	Comment	Correction
MHz	dBµV/m	dBµV/m	dB	m	°		dB
4804.6	48.07	54	-5.93	2.98	88.5	Horizontal polarization	8.75
4804.6	49.68	54	-4.32	2.02	119.75	Vertical polarization	8.75
9608.8	44.09	54	-9.91	1.98	0	Horizontal polarization	13.93
9607.1	46.04	54	-7.96	2.02	26.25	Vertical polarization	13.93

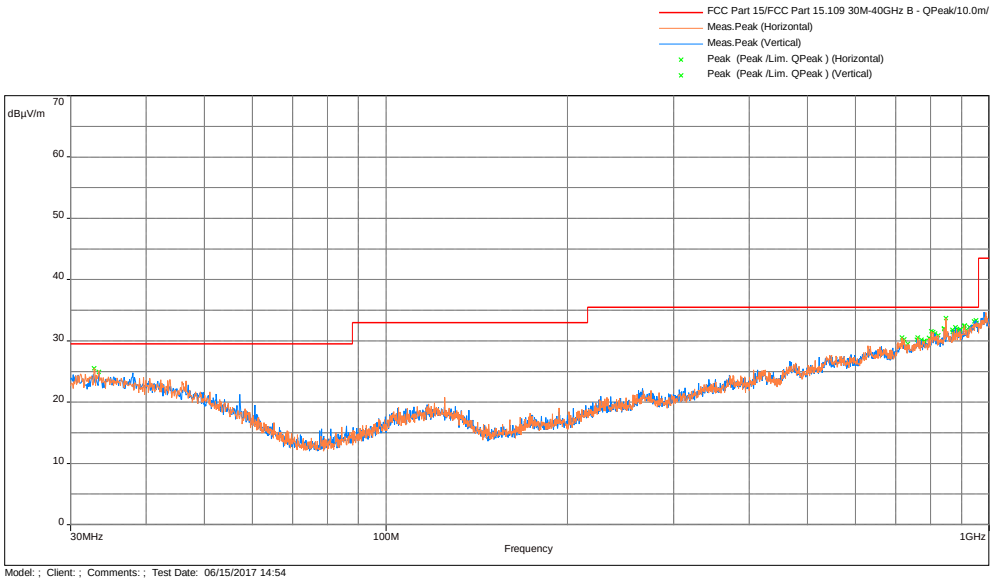
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Note: FS@3m = RA + AF + CF - Preamp

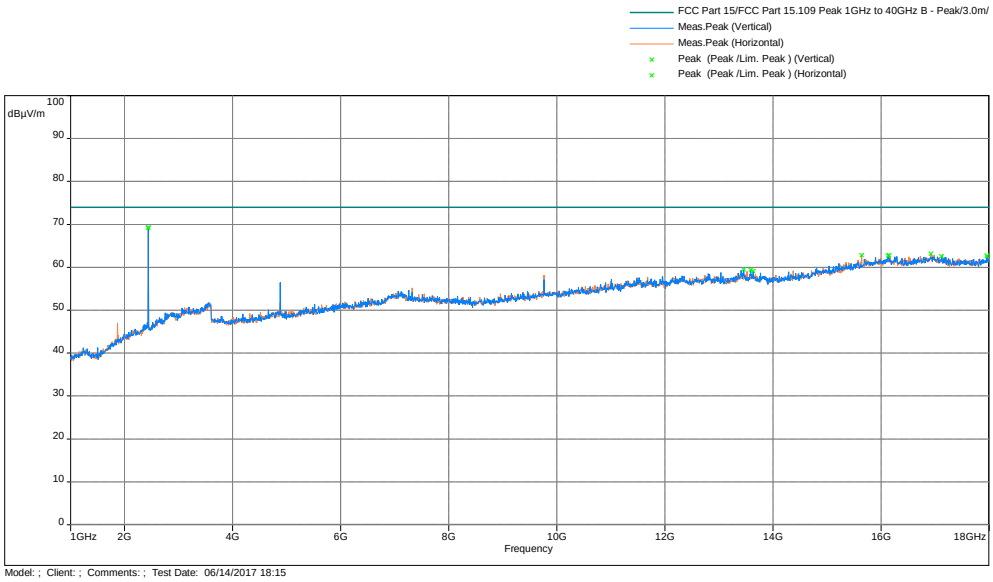
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions Mid Channel
Tile Sport, model: T4002
Tx at 2440MHz

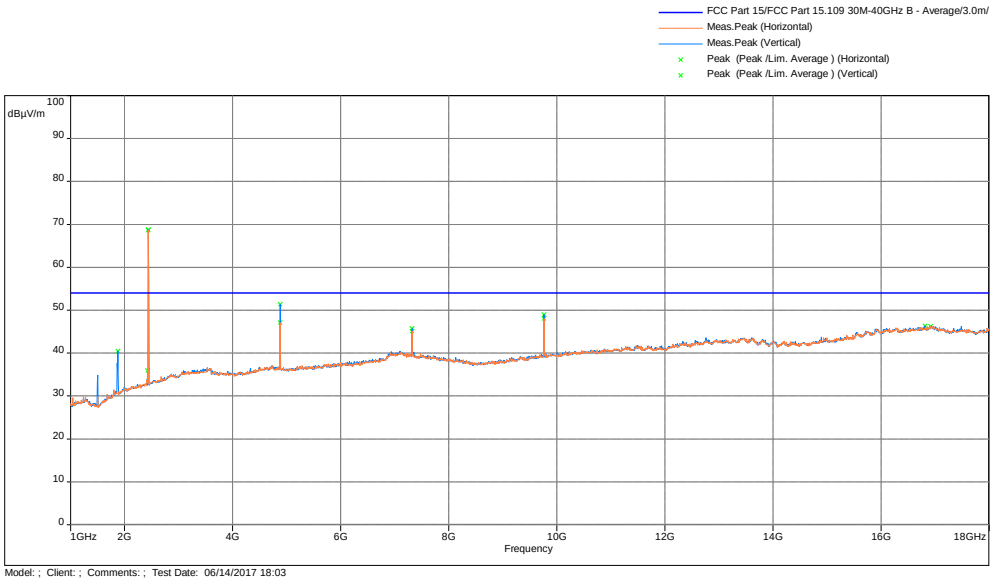
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit



Frequency	Avg	Lim.	Margin	Height	Angle	Comment	Correction
MHz	dBµV/m	dBµV/m	dB	m	°		dB
4879.4	47.07	54	-6.93	1.98	84.75	Horizontal polarization	8.81
4879.4	51.34	54	-2.66	2.02	118.5	Vertical polarization	8.81
9761.8	48.01	54	-5.99	2.98	57.5	Horizontal polarization	14.1
9758.4	48.97	54	-5.03	1.02	18.5	Vertical polarization	14.09

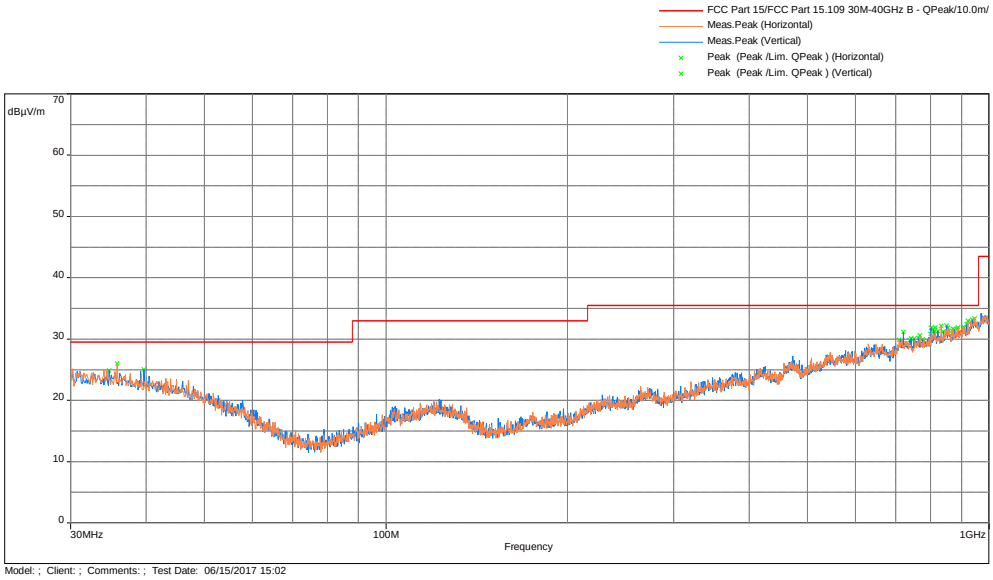
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Note: FS@3m = RA + AF + CF - Preamp

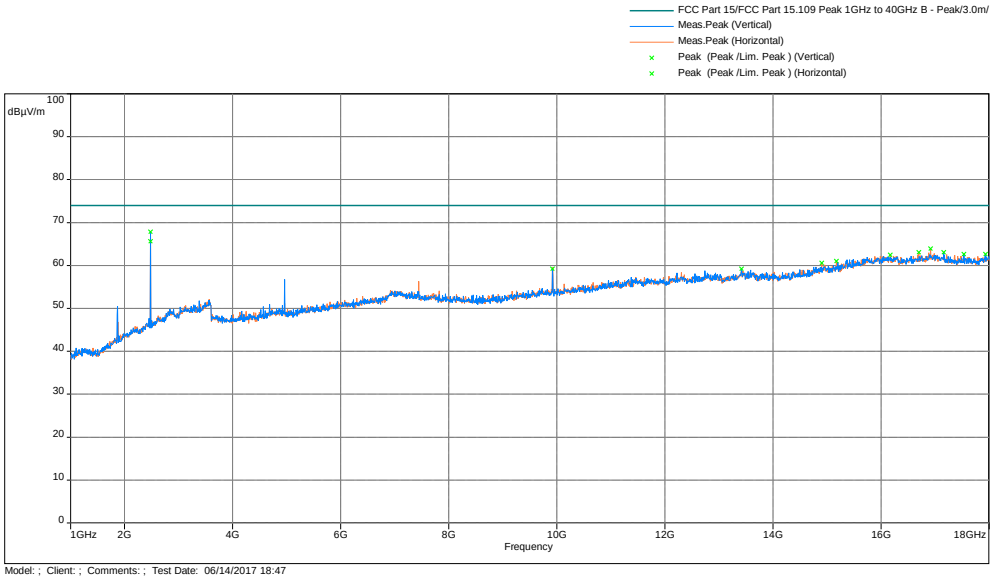
Results	**Complies**

Test Results: 15.209 Radiated Spurious Emissions High Channel
Tile Sport, model: T4002
Tx at 2480MHz

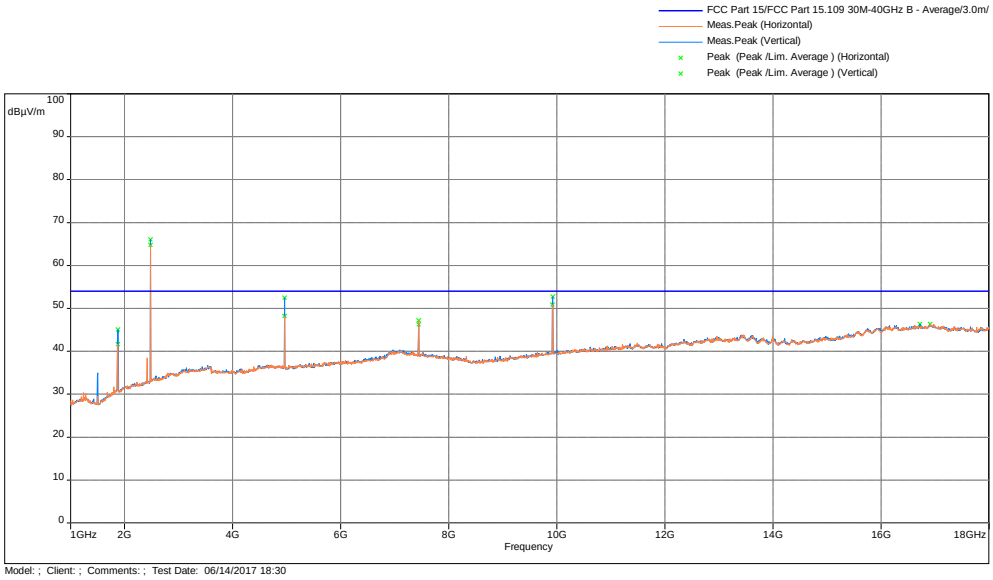
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan vs Peak Limit



Radiated Spurious Emissions 1000 - 18000 MHz, Avg Scan vs Avg Limit



Frequency	Avg	Lim.	Margin	Height	Angle	Comment	Correction
MHz	dBµV/m	dBµV/m	dB	m	°		dB
4961	48.21	54	-5.79	1.98	83.5	Horizontal polarization	8.85
4959.3	52.47	54	-1.53	2.02	119.25	Vertical polarization	8.85
9919.9	50.86	54	-3.14	2.98	0	Horizontal polarization	14.26
9921.6	52.7	54	-1.3	2.02	25.5	Vertical polarization	14.27

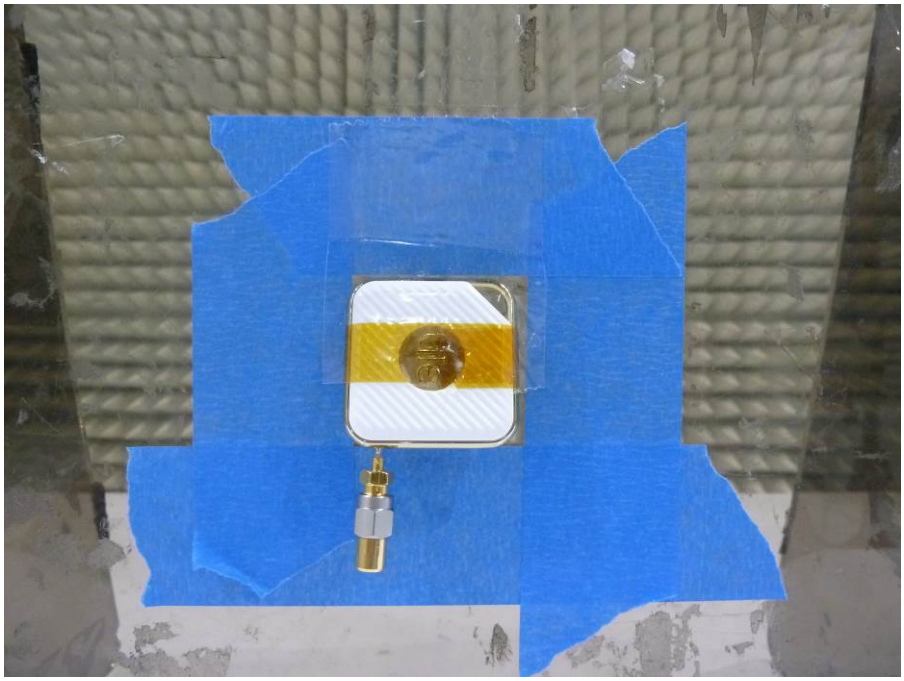
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

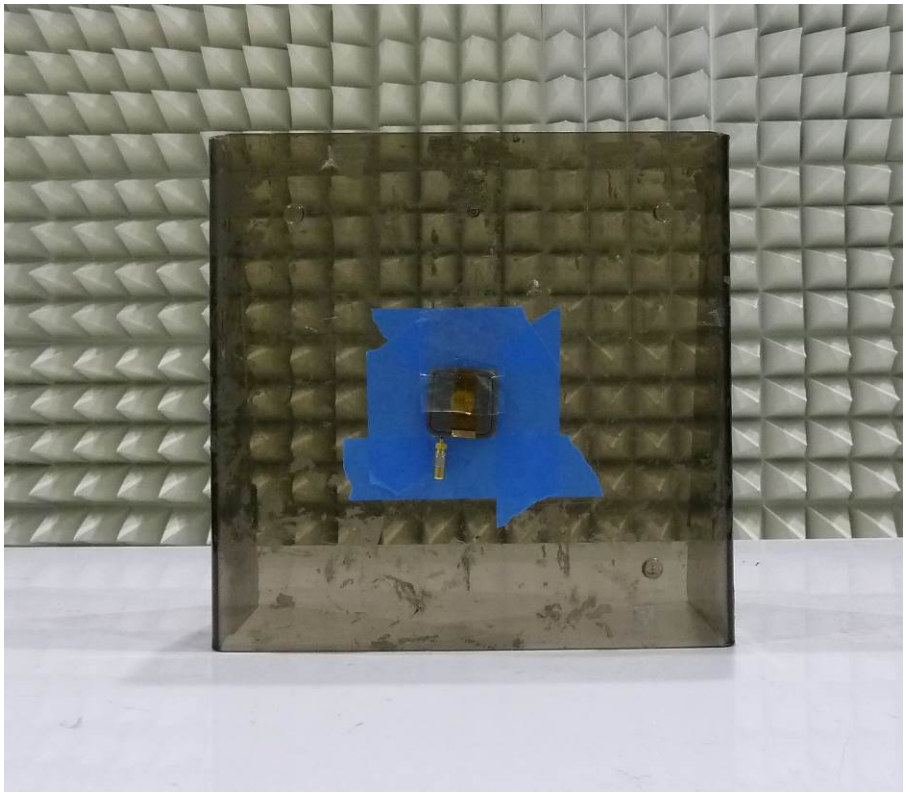
Note: FS@3m = RA + AF + CF - Preamp

Results	**Complies**

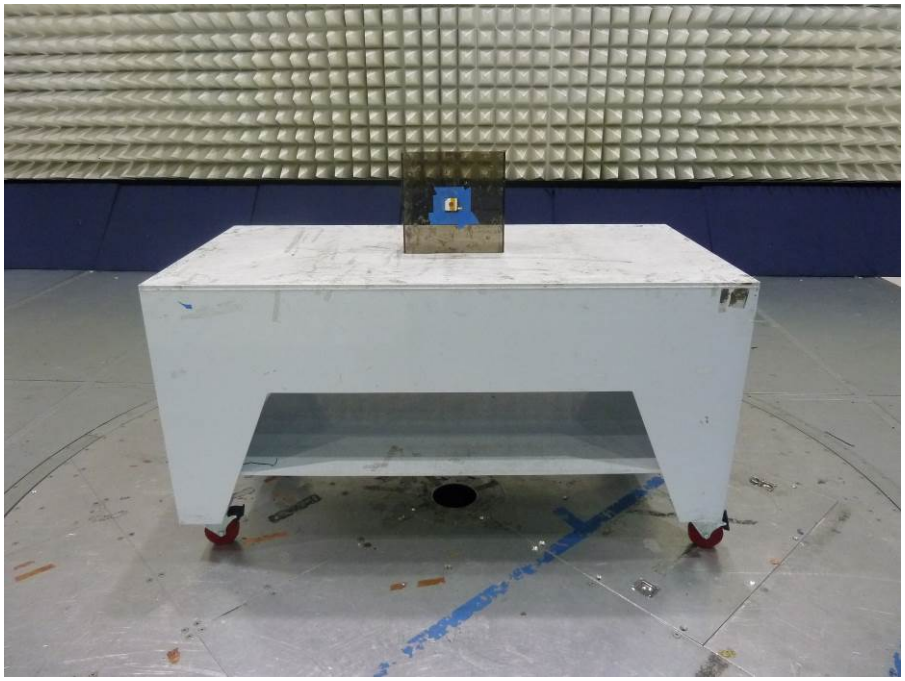
4.5.8 Test setup photographs

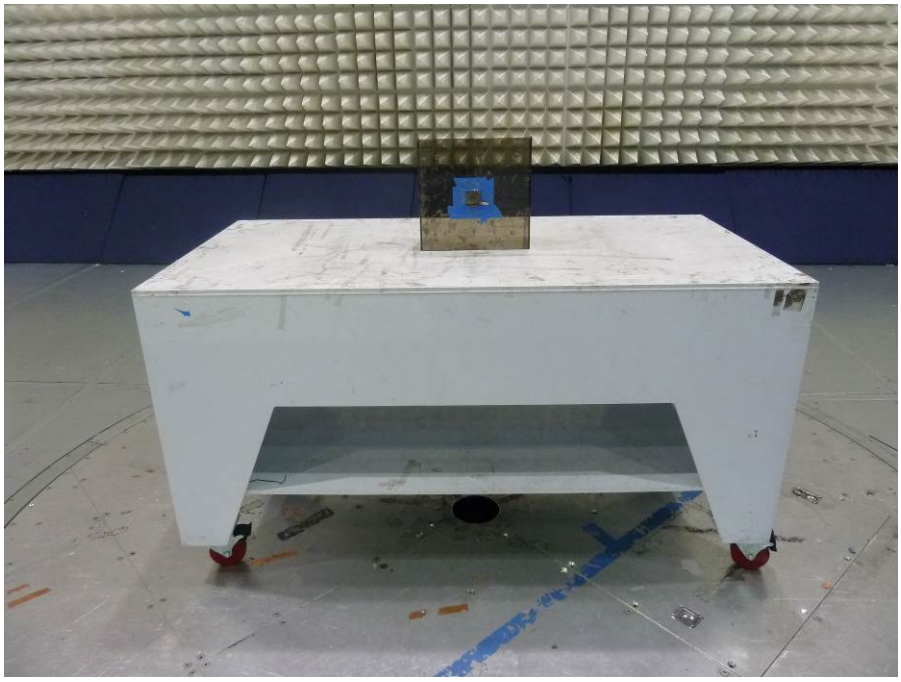
The following photographs show the testing configurations used.



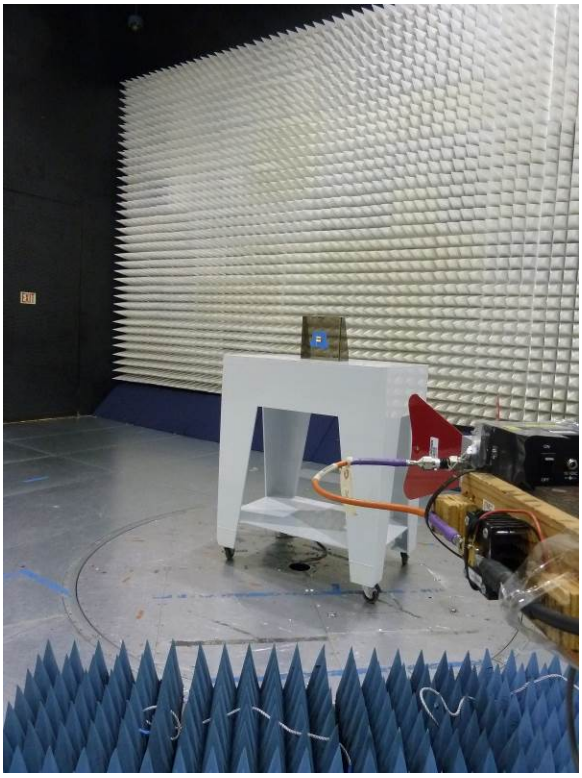


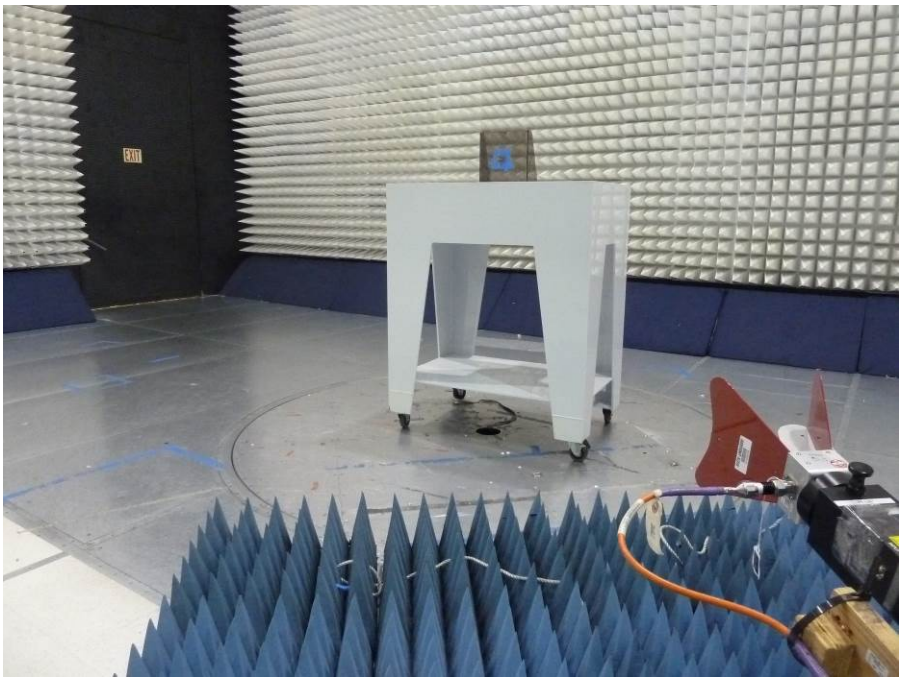
4.5.8 Test Setup Photographs (Continued)





4.5.8 Test Setup Photographs (Continued)





5.0 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	ITS 00913	12	01/12/18
Pyramidal Horn Antenna	EMCO	3160-09	ITS 00571	#	#
Pre-Amplifier (18-40GHz)	Miteq	TTA1840-35-S-M	ITS 01393	12	04/18/18
Pre-Amplifier (1-18GHz)	Miteq	AMF-4D-001180-24-10P	ITS 00526	12	09/29/17
Horn Antenna	ETS-Lindgren	3117	ITS 01325	12	09/07/17
Notch Filter	Micro-Tronics	BRM50702	ITS 01166	12	02/08/18
EMI Receiver	Rohde and Schwarz	ESU	ITS 00961	12	07/07/17
BI-Log Antenna	Antenna Research	LPB-2513	ITS 00355	12	09/09/17
Pre-Amplifier	Sonoma Instrument	310	ITS 01493	12	09/28/17

No Calibration required

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
Tile	Quantum Change	3.4.K.22	Conducted Restricted Band Edge_Avg Conducted Restricted Band Edge_Peak Conducted Restricted Band_1-26GHz Conducted Restricted Band_30M-1GHz Conducted Spurious_30M-26GHz
BAT-EMC	Nexio	3.16.0.64	102971715_VeriFone.bpp
RS Commander	Rohde Schwarz	1.6.4	Not Applicable (Screen grabber)

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G103023687	AC	KV	June 27, 2017	Original document