

TEST REPORT

Report Number: 101534046MPK-001A

Project Number: G101534046

May 15, 2014

**Testing performed on
Tile**

Model: T1001

FCC ID: 2ABXLT1001

IC: 11858A-T1001

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

Tile, Inc.

Test Performed by:

Intertek

1365 Adams Court

Menlo Park, CA 94025 USA

Test Authorized by:

Tile, Inc.

2121 S. El Camino Real Suite C-100

San Mateo, CA 94403, USA


Prepared by:



Anderson Soungpanya

Date: May 15, 2014

Reviewed by:



Krishna K Vemuri

Date: May 15, 2014

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Report No. 101534046MPK-001A

Equipment Under Test:**Trade Name:****Model Number:****Serial Numbers:**

Tile

Tile

T1001

MPK1403271022-001 (Radiated Sample)

MPK1403271022-003 (Conducted Sample)

Applicant:**Contact:****Address:**

Tile, Inc.

Sandor Kiss

Tile, Inc.

2121 S. El Camino Real Suite C-100

San Mateo, CA 94403

USA

Country**Tel. Number:****Email:**

(415) 902-9629

sandor@thetileapp.com

Applicable Regulation:

FCC Part 15 Subpart C (15.247)

Industry Canada RSS-210 Issue 8, Annex 8

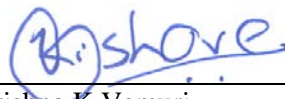
FCC Part 15, Subpart B

Industry Canada ICES-003

Date of Test:

March 27 to May 2, 2014

We attest to the accuracy of this report:

Anderson Soungpanya
Project Engineer

Krishna K Vemuri
EMC Senior Staff Engineer

TABLE OF CONTENTS

1.0	Summary of Tests	5
2.0	General Information.....	6
2.1	Product Description	6
2.2	Related Submittal(s) Grants.....	7
2.3	Test Facility	7
2.4	Test Methodology	7
2.5	Measurement Uncertainty	7
3.0	System Test Configuration.....	8
3.1	Support Equipment	8
3.2	Block Diagram of Test Setup.....	8
3.5	Mode of Operation during Test.....	9
3.5	Modifications Required for Compliance	9
3.6	Additions, Deviations and Exclusions from Standards.....	9
4.0	Measurement Results.....	10
4.1	6-dB Bandwidth and Occupied Bandwidth	10
4.1.1	Requirement.....	10
4.1.2	Procedure	10
4.1.3	Test Result	10
4.2	Maximum Peak Conducted Output Power at Antenna Terminals	17
4.2.1	Requirement.....	17
4.2.2	Procedure	17
4.3.3	Test Result	17
4.3	Maximum Power Spectral Density	21
4.3.1	Requirement.....	21
4.3.2	Procedure	21
4.3.3	Test Result	21
4.4	Unwanted Conducted Emissions	25
4.4.1	Requirement.....	25
4.4.2	Procedure	25
4.4.3	Test Result	25
4.5	Transmitter Radiated Emissions	56
4.5.1	Requirement.....	56
4.5.2	Procedure	56
4.5.3	Field Strength Calculation	57
4.5.4	Test Results.....	57
4.6	Radiated Emissions.....	70
4.6.1	Requirement.....	70
4.6.2	Procedures.....	71
4.6.3	Test Results.....	71
4.6.4	Test Configuration Photographs	73
5.0	List of Test Equipment	75



6.0	Document History	76
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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	Not applicable ¹
RF Output Power	15.247(b)(3)	RSS-210, A8.4	Complies
6 dB Bandwidth	15.247(a)(2)	RSS-210, A8.2	Complies
Power Density	15.247(e)	RSS-210, A8.2b	Complies
Out of Band Antenna Conducted Emission	15.247(d)	RSS-210, A8.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	RSS-210, A8.5	Complies
AC Line Conducted Emission	15.207	RSS-GEN	Not applicable ¹
Antenna Requirement	15.203	RSS-GEN	Complies (Internal Antenna)
RF Exposure	15.247(i), 2.1093(d)	RSS-102	Complies *

¹ EUT is battery powered only & not rechargeable.

* 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: March 27, 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: March 27, 2014

Test completion date: May 02, 2014

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

2.0 General Information

2.1 Product Description

Equipment under Test (EUT) is the Tile, Model T1001. As described by the manufacturer, Tile is intended to be used on a variety of items in order to track them using a smartphone enabled with Bluetooth Low Energy technology. Description of product as it is marketed as “Tile Bluetooth Location Finder -The World’s Largest Lost & Found”.

Information about the 2.4GHz radio is presented below:

Applicant	Tile, Inc.
Model No.	T1001
FCC Identifier	2ABXLT1001
IC Identifier	11858A-T1001
IEEE Reference standard	802.15.1 Bluetooth Low Energy (LE)
Type of transmission	Direct Sequence Spread Spectrum (DSSS)
Modes	Single mode (Classic Bluetooth mode is not supported)
Rated RF Output	0.33 dBm (0.927 mW)
Frequency Range	2402 – 2480 MHz
Type of modulation/data rate	GFSK / 1Mbps
Number of Channel(s)	40 (from 0 to 39)
Duty Cycle (during testing)	98%
Antenna(s) & Gain	Meandering inverted F PCB antenna, Gain: 0 dBi
Manufacturer Name & Address	Tile, Inc. 2121 S. El Camino Real Suite C-100 San Mateo, CA 94403, 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), 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	-	-

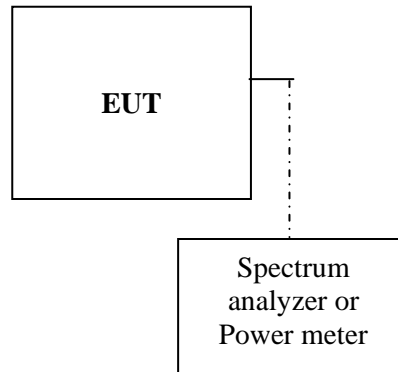
3.0 System Test Configuration

3.1 Support Equipment

EUT was tested as a standalone device. No Support equipment is used in test setup.

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.



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 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

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.

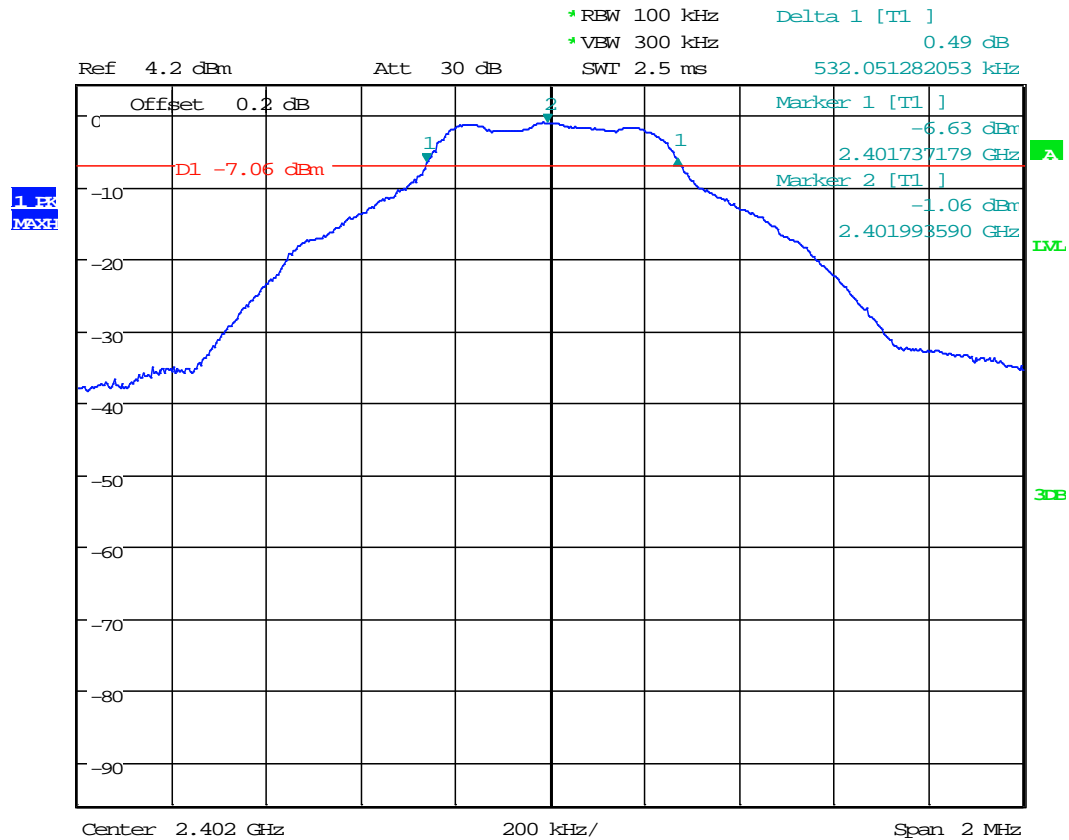
The occupied bandwidth was measured using the built-in spectrum analyzer function for 99% power bandwidth measurement.

4.1.3 Test Result

Frequency (MHz)	6-dB bandwidth FCC 15.247 & RSS-GEN, kHz	Occupied bandwidth, RSS-GEN, kHz	Plot
2402	532.0		1.1
		907.1	1.4
2440	532.0		1.2
		891.0	1.5
2480	544.9		1.3
		903.8	1.6

Results	Complies
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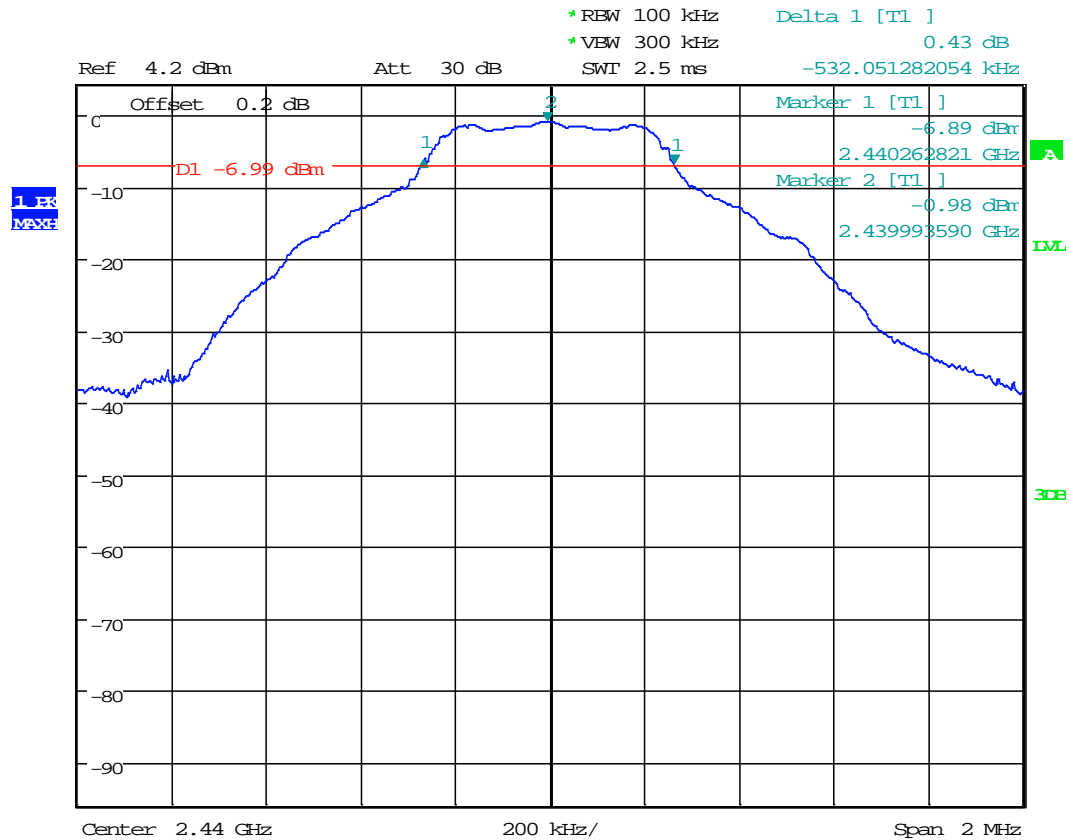
Plot 1. 1



Occupied Bandwidth

Date: 7.APR.2014 14:42:01

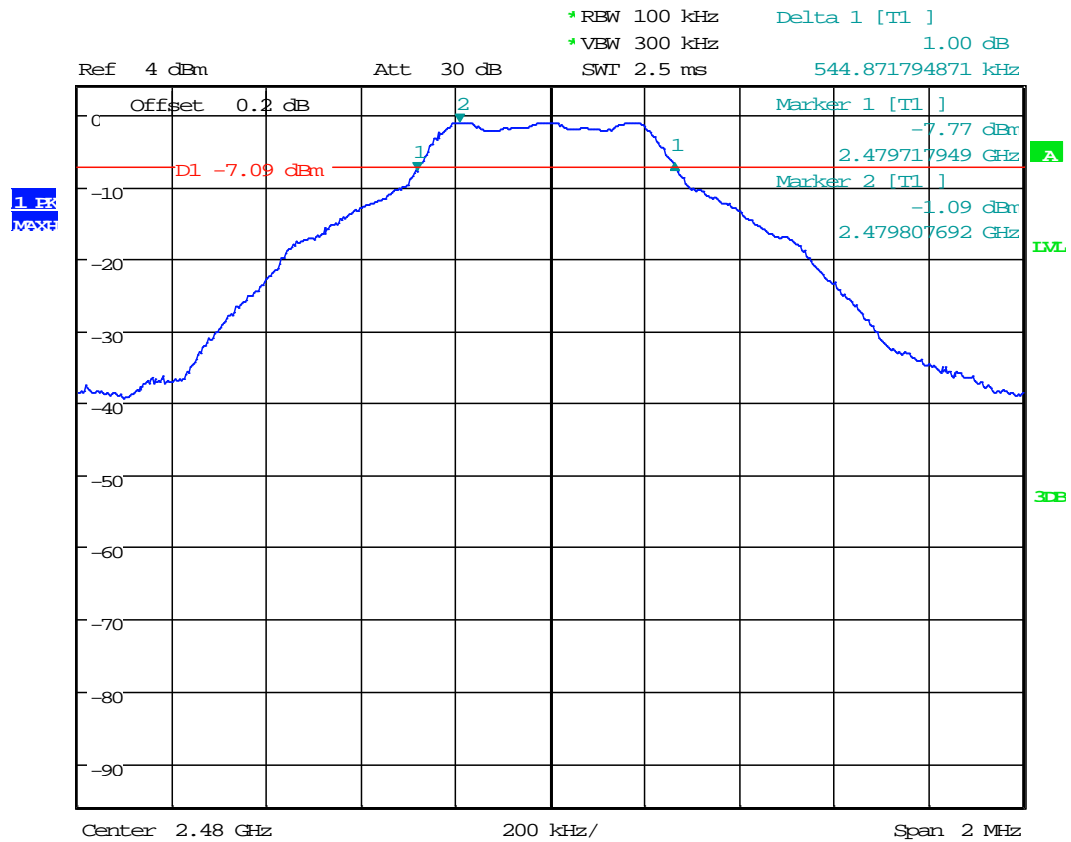
Plot 1.2



Occupied Bandwidth

Date: 7.APR.2014 14:43:37

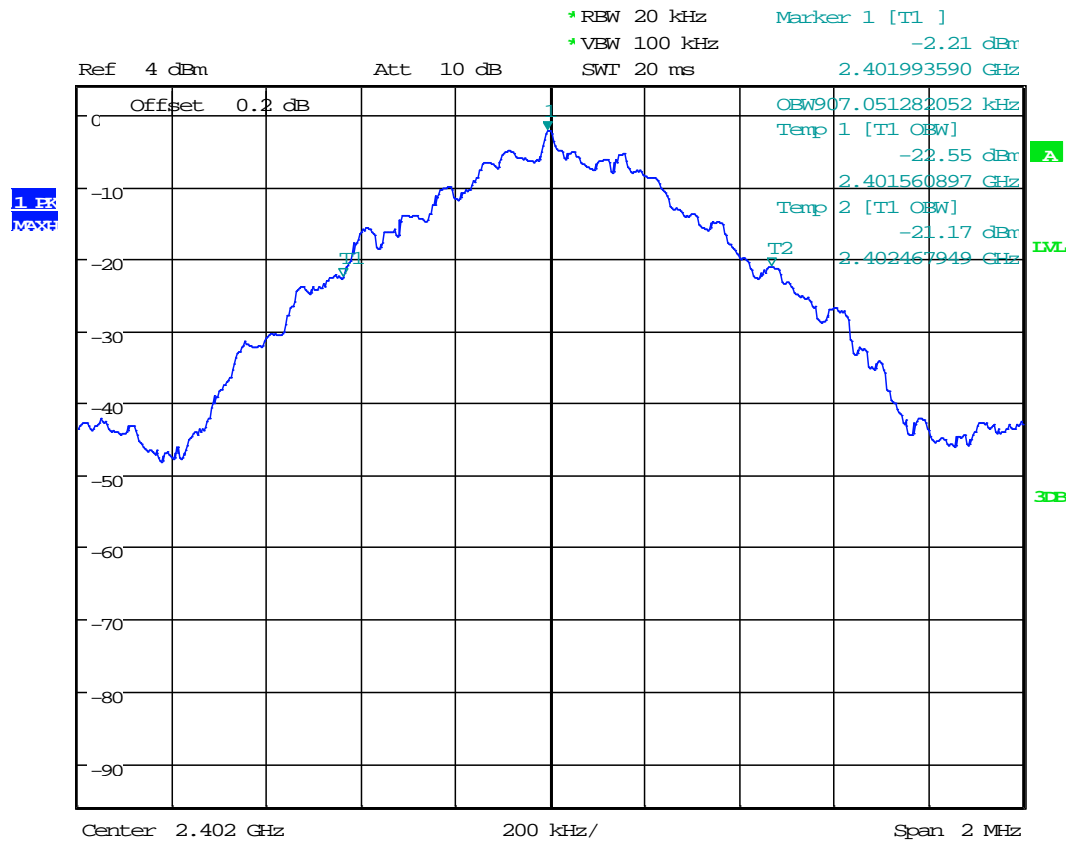
Plot 1.3



Occupied Bandwidth

Date: 7.APR.2014 14:46:03

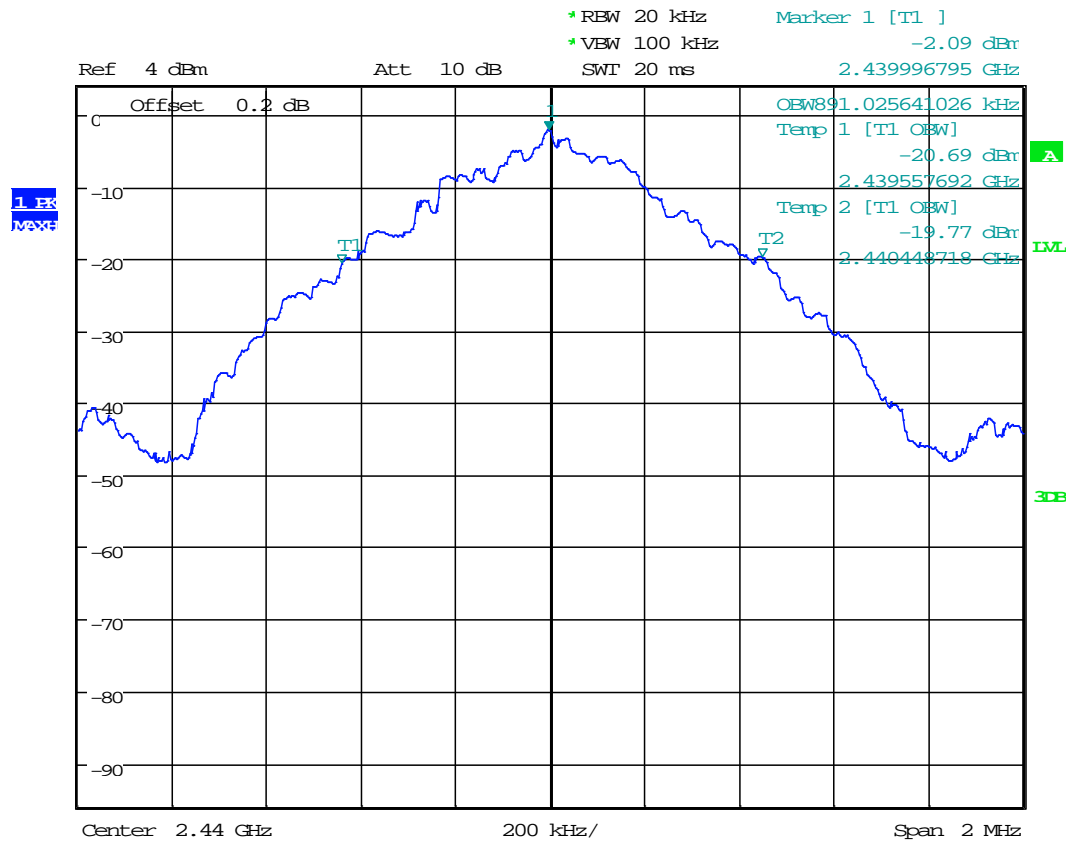
Plot 1.4



OCB

Date: 31.MAR.2014 17:39:35

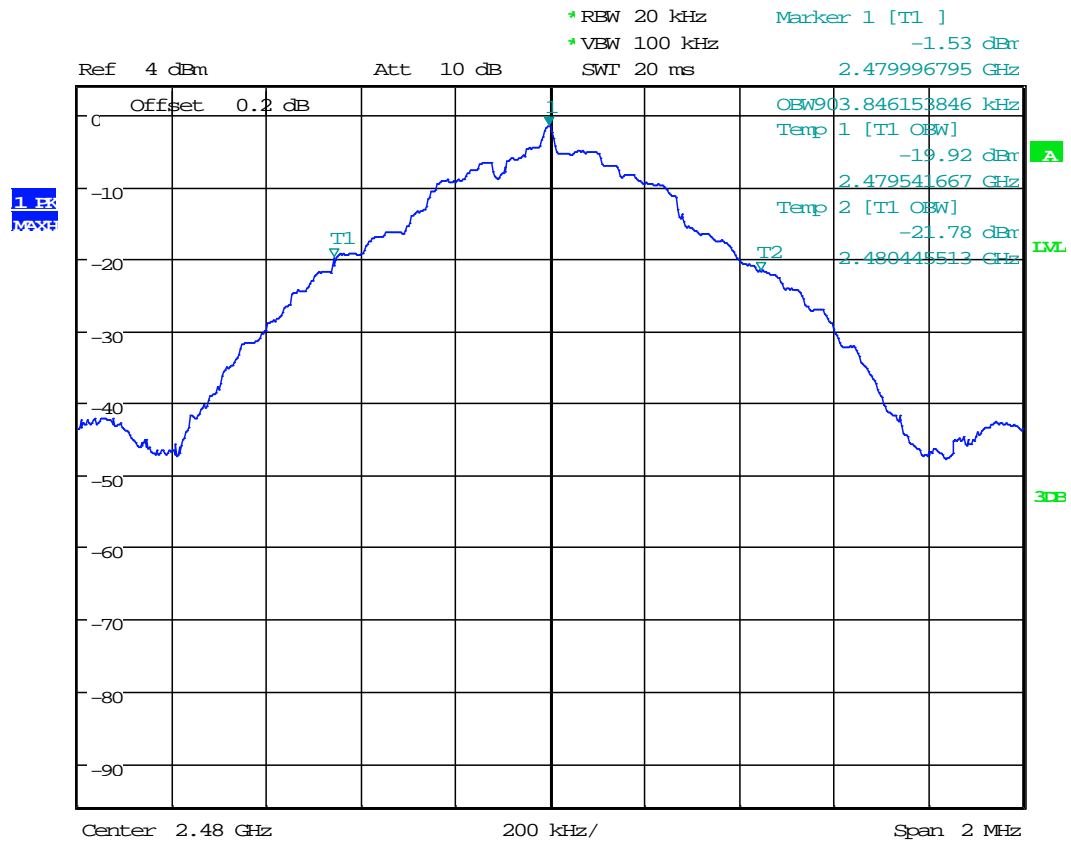
Plot 1.5



OCB

Date: 31.MAR.2014 17:38:51

Plot 1.6



OCB

Date: 31.MAR.2014 17:38:03

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 $RBW > DTS \text{ Bandwidth}$.

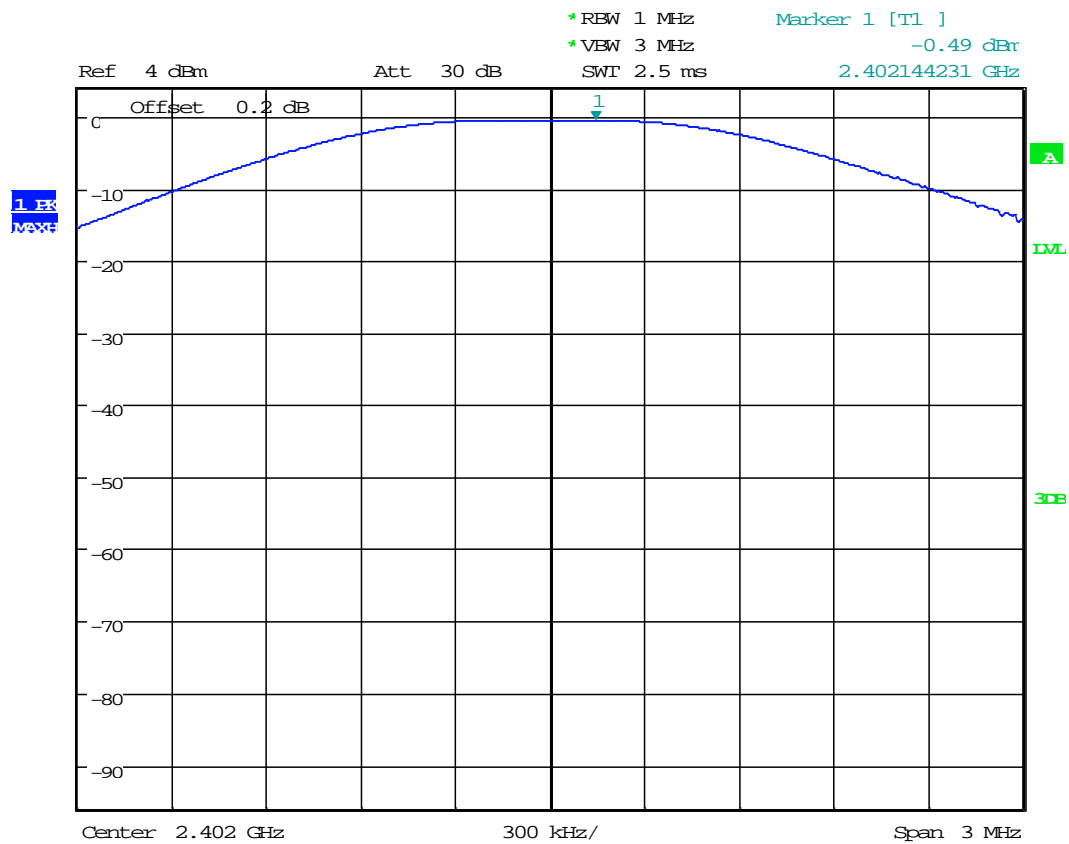
4.3.3 Test Result

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

Frequency, MHz	Conducted Power (peak), dBm	Conducted Power (peak), mW	Plot
2402	-0.49	0.893	2.1
2440	-0.33	0.927	2.2
2480	-0.50	0.891	2.3

Results	Complies
----------------	-----------------

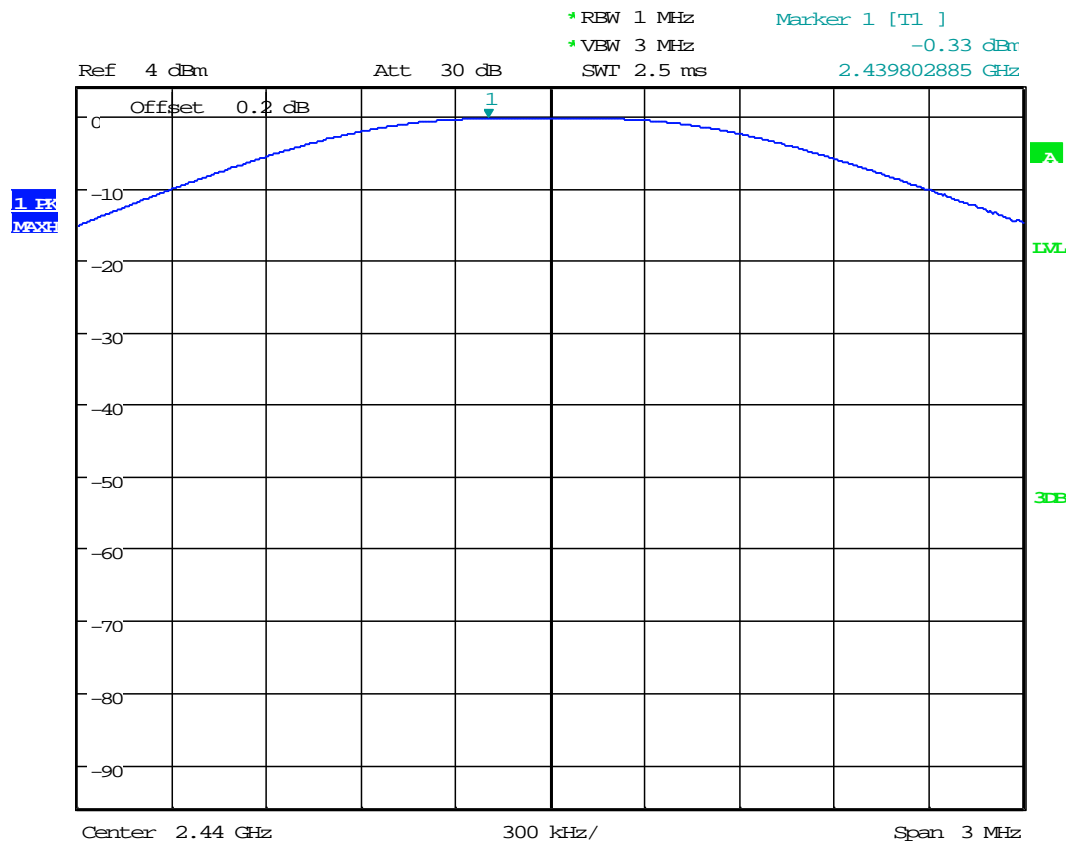
Plot 2. 1



Output Power

Date: 31.MAR.2014 17:42:07

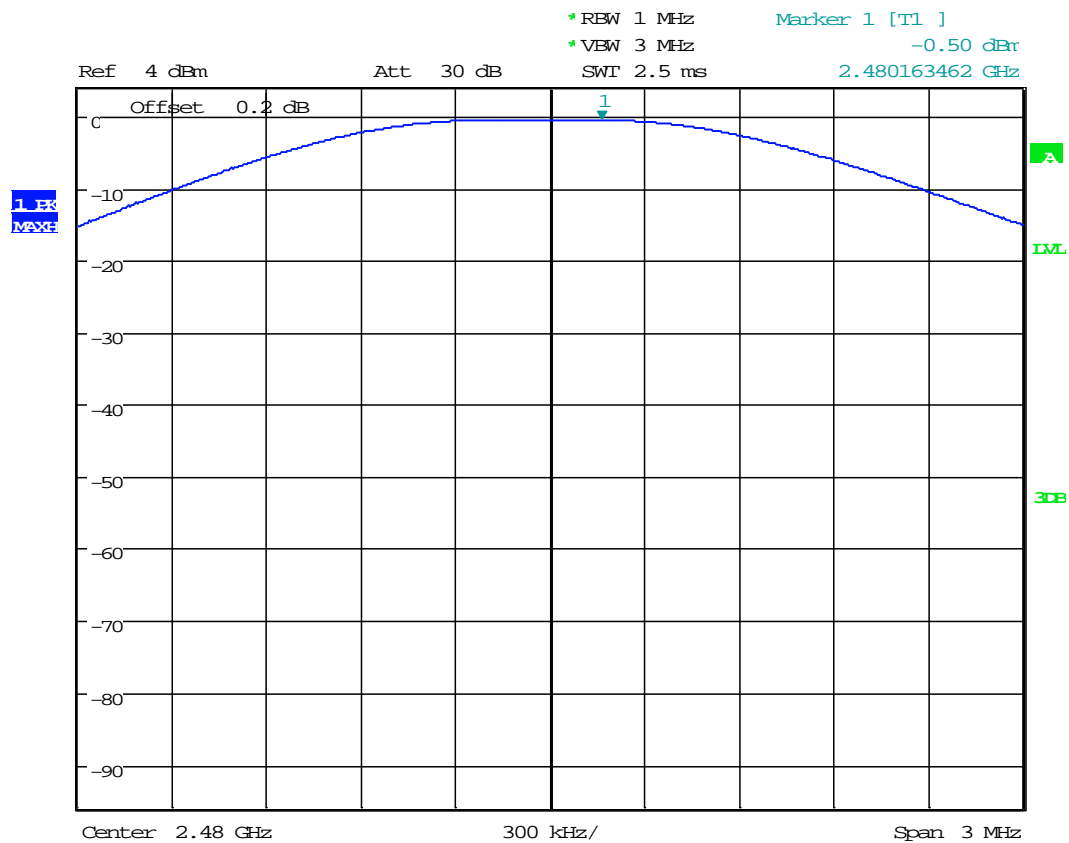
Plot 2. 2



Output Power

Date: 31.MAR.2014 17:43:34

Plot 2.3



Output Power

Date: 31.MAR.2014 17:44:06

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.

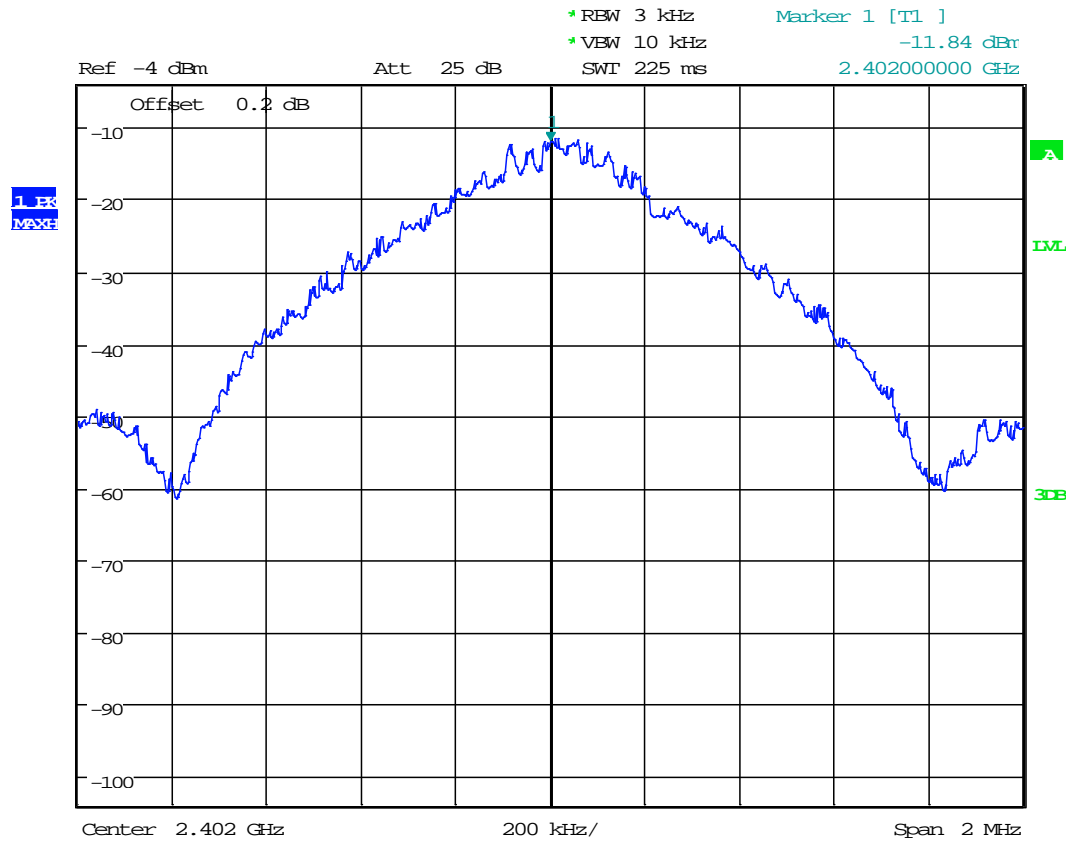
4.3.3 Test Result

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
2402	-11.84	8.0	-19.84	3.1
2440	-11.47	8.0	-19.47	3.2
2480	-11.95	8.0	-19.95	3.3

Results	Complies
----------------	-----------------

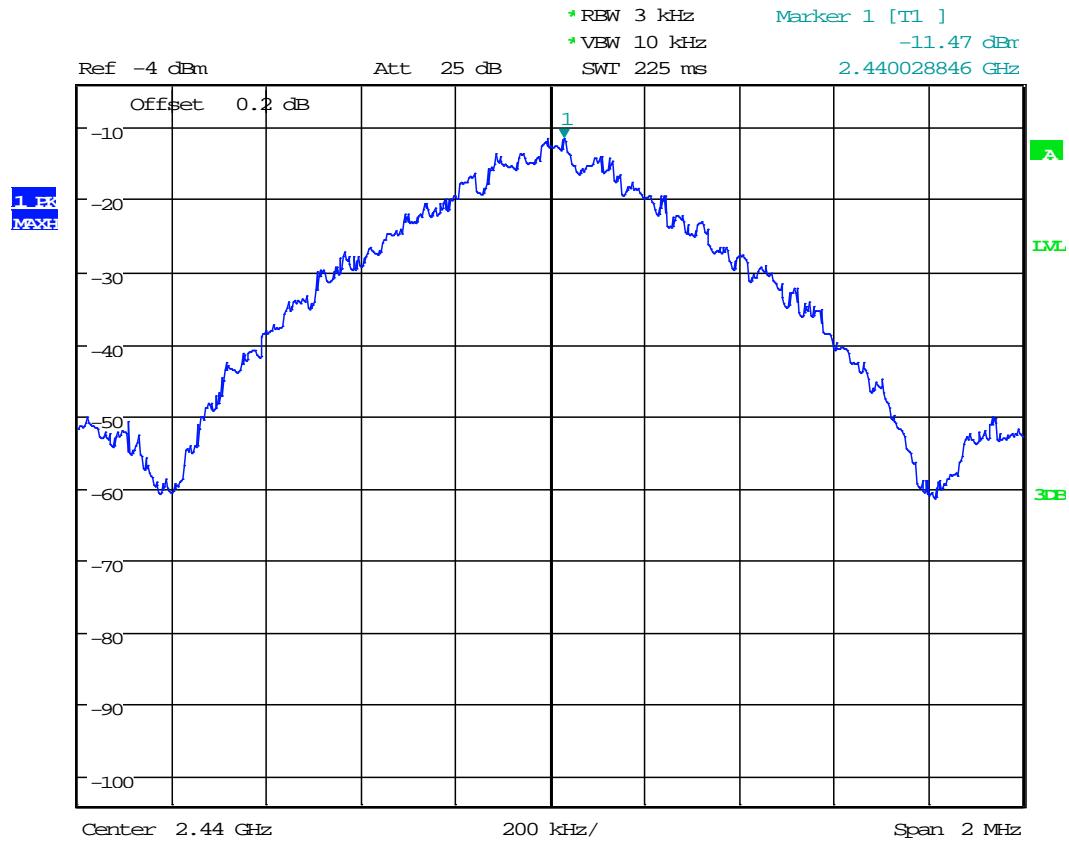
Plot 3. 1



PSD

Date: 7.APR.2014 14:51:59

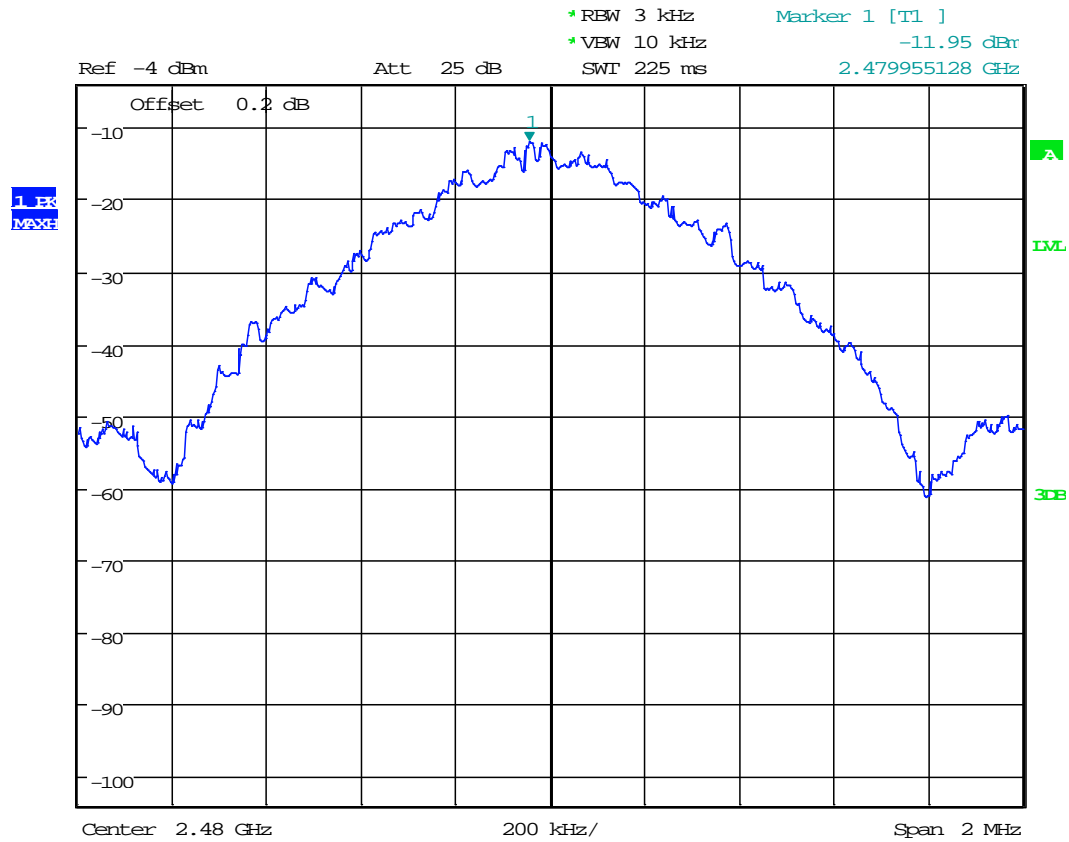
Plot 3.2



PSD

Date: 7.APR.2014 14:51:10

Plot 3.3



PSD

Date: 7.APR.2014 14:50:20

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

The test results are summarized in The Table 4.1.

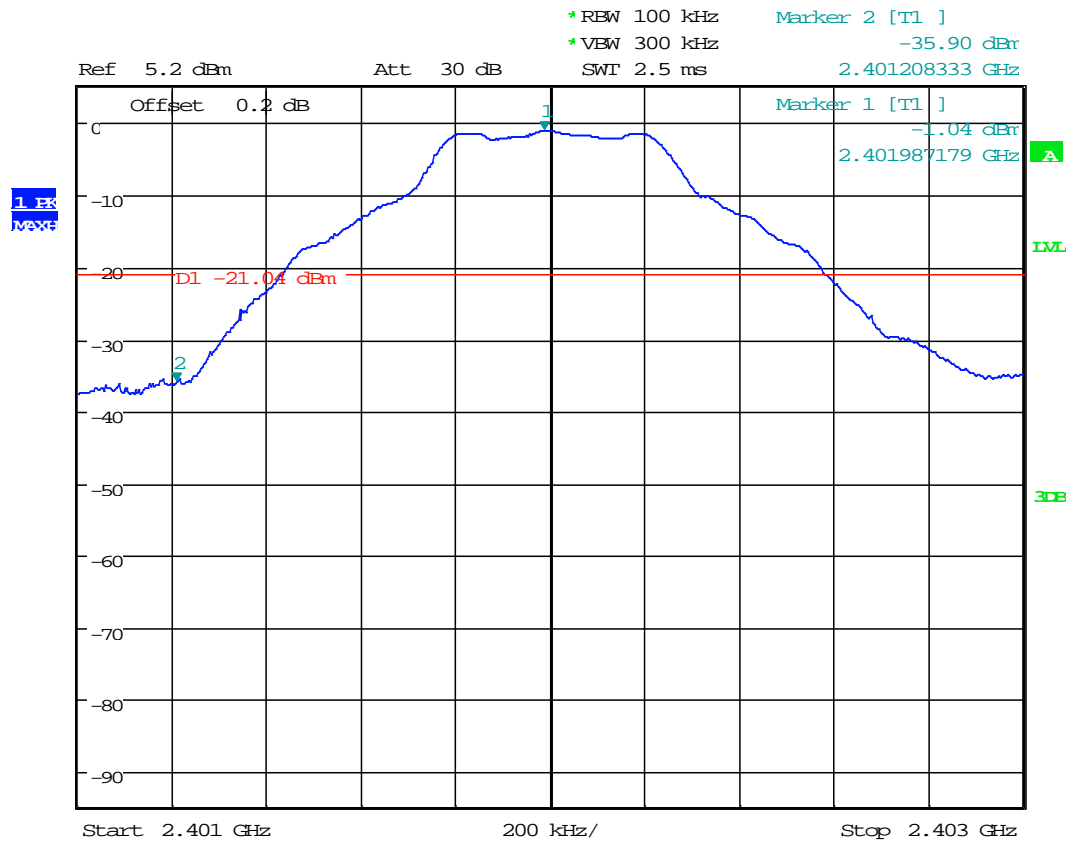
Table 4.1
Unwanted Conducted Emissions

Frequency, MHz	In-band Emissions, dBm	Worst case Unwanted Emissions, dBm	Unwanted Emissions Limit, dB	Margin to 20 dB Attenuation Limit, dB
2402	-1.04	- 47.10	-21.04	-26.06
2440	-0.96	- 46.56	-20.96	-25.60
2480	-1.01	- 46.88	-21.01	-25.87

See plots below for details.

Results	Complies
----------------	-----------------

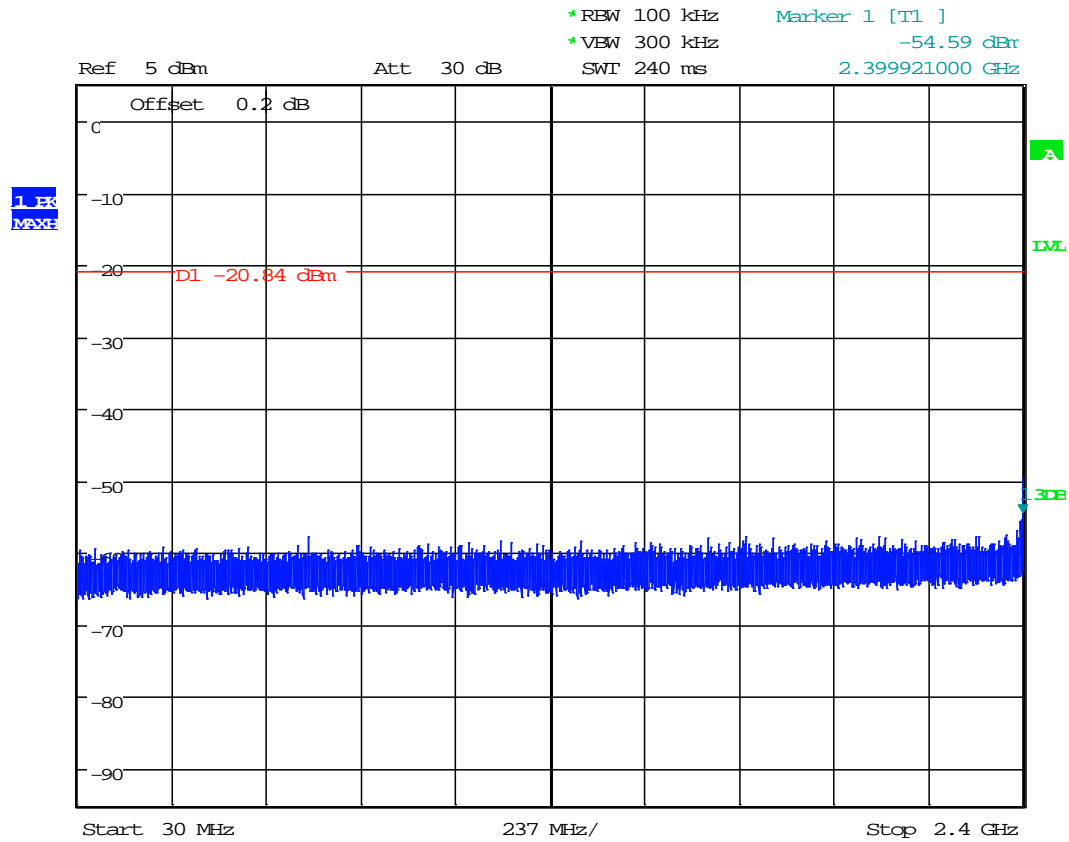
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 15:12:02

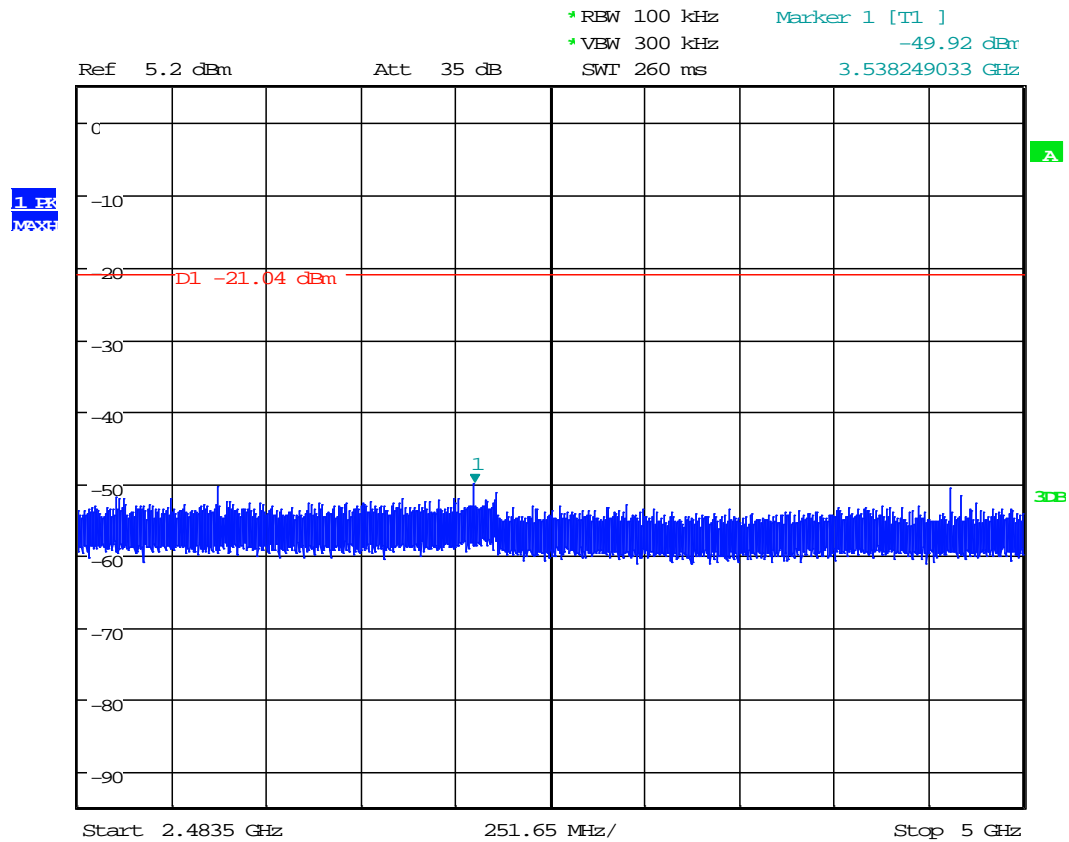
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 15:52:58

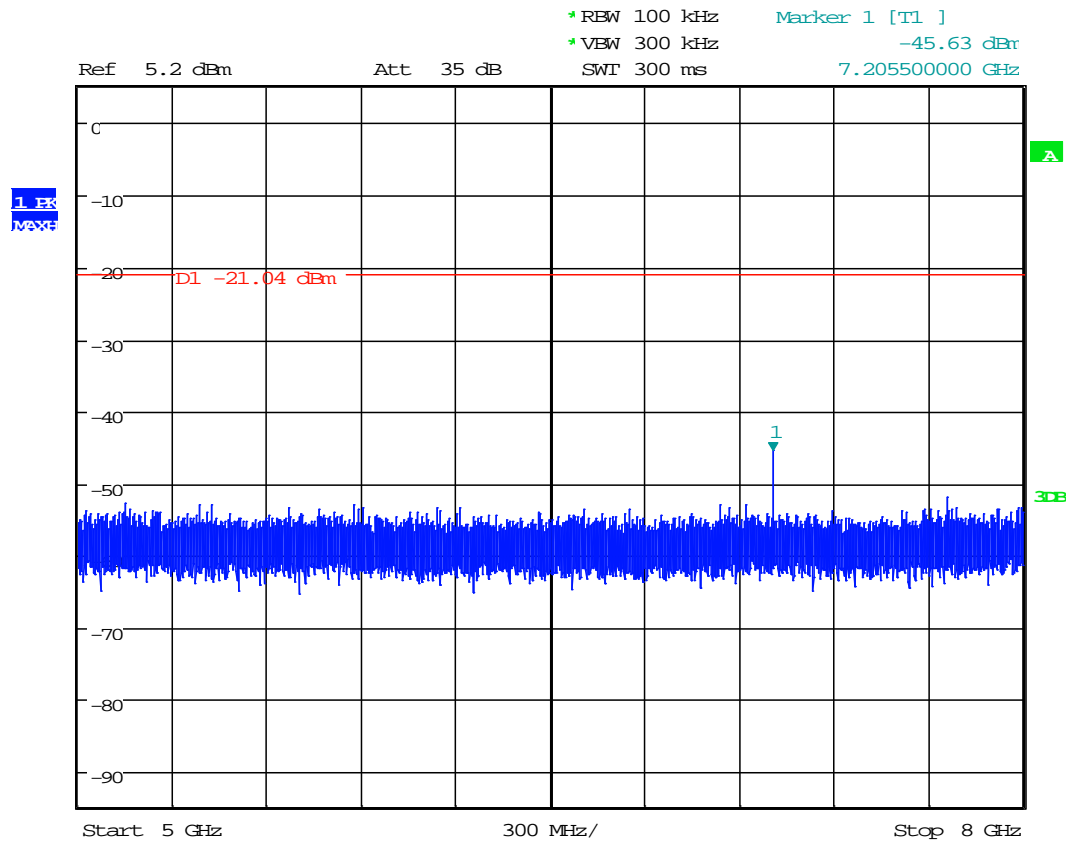
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:02:50

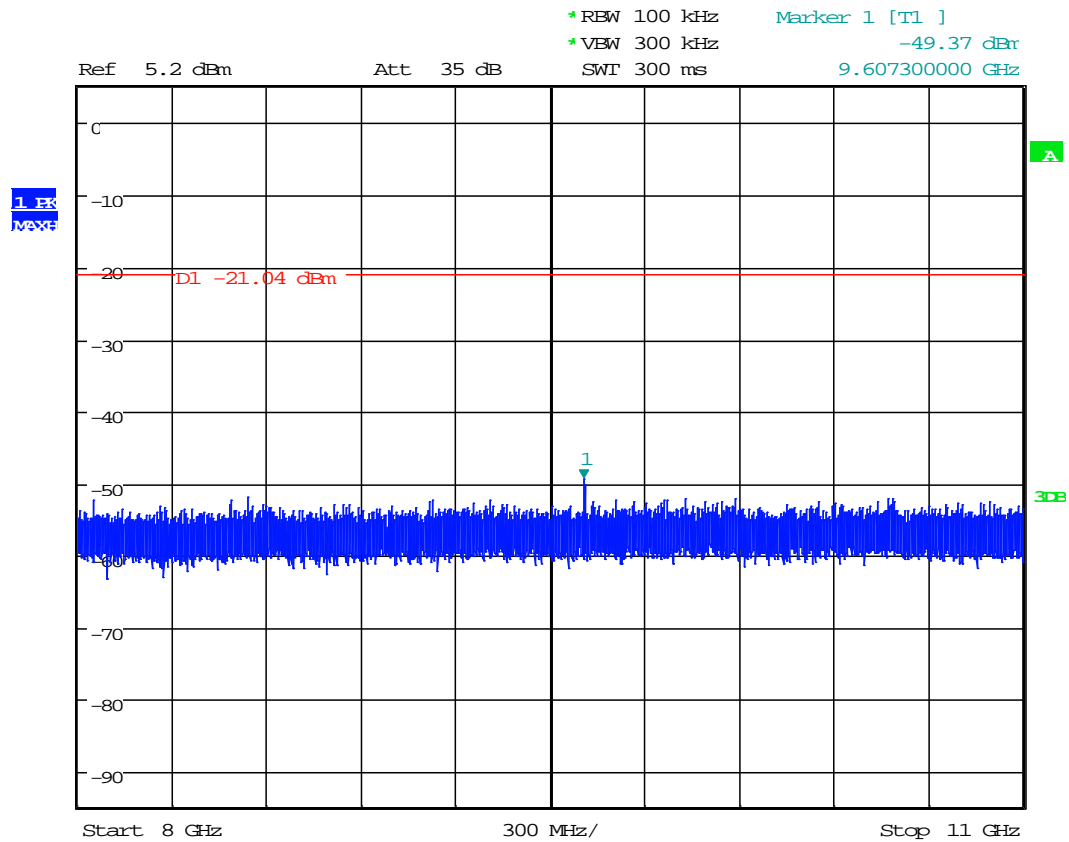
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:03:04

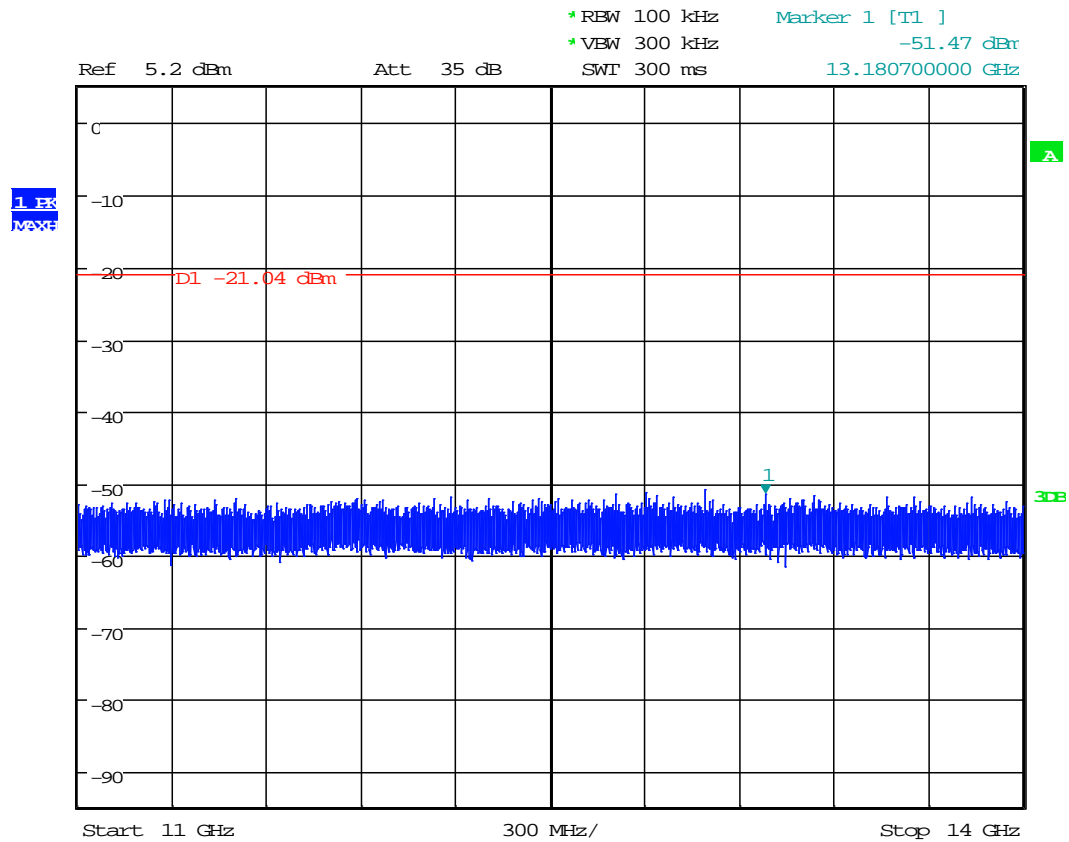
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:03:31

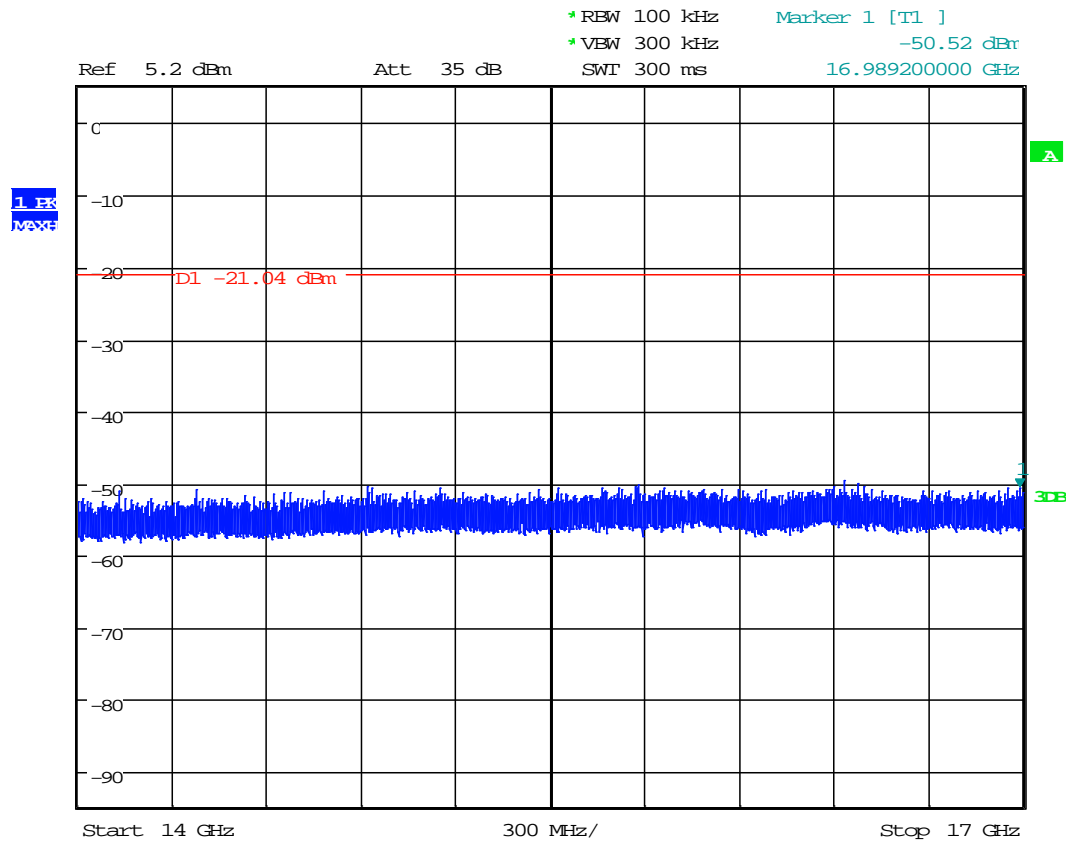
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:04:01

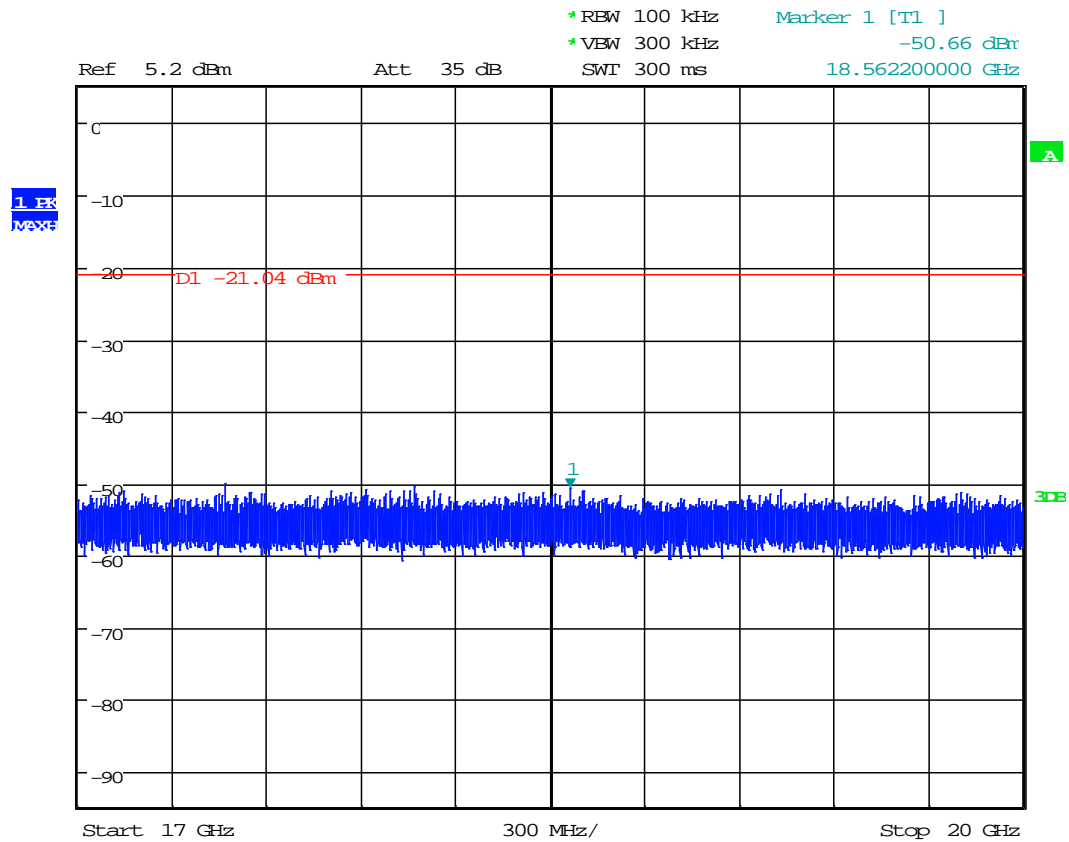
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:05:36

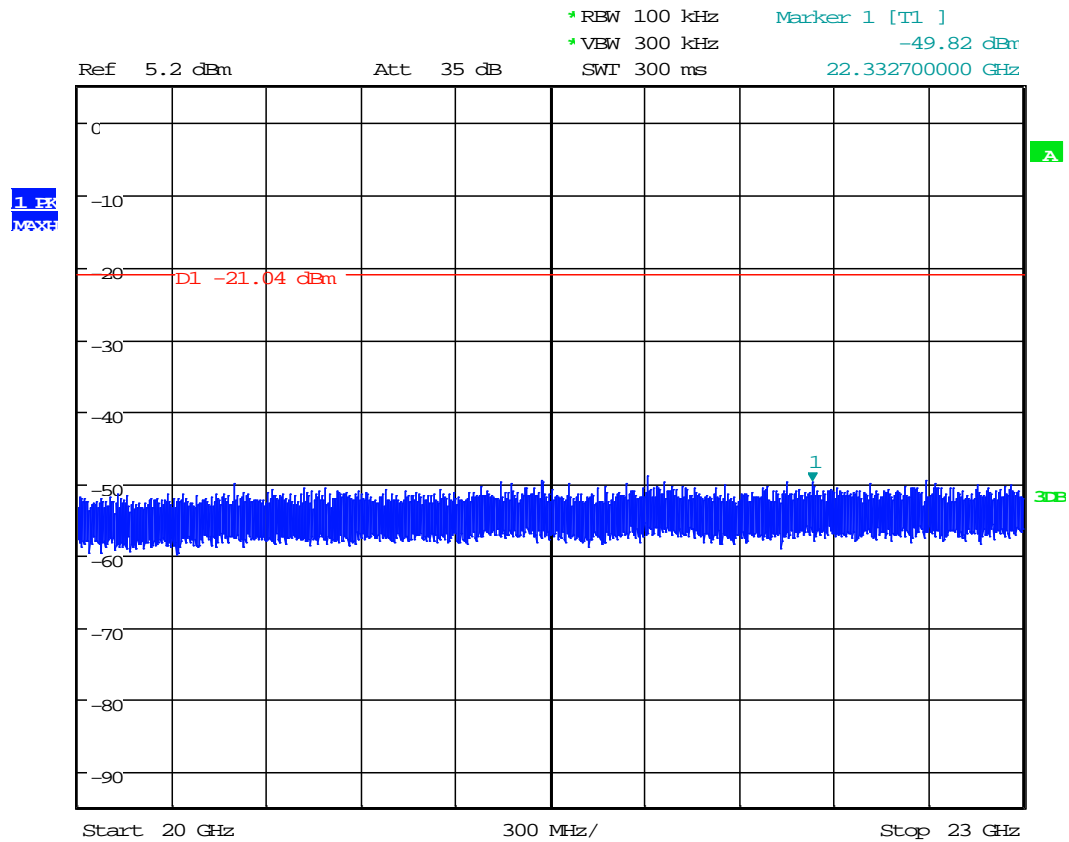
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:23:07

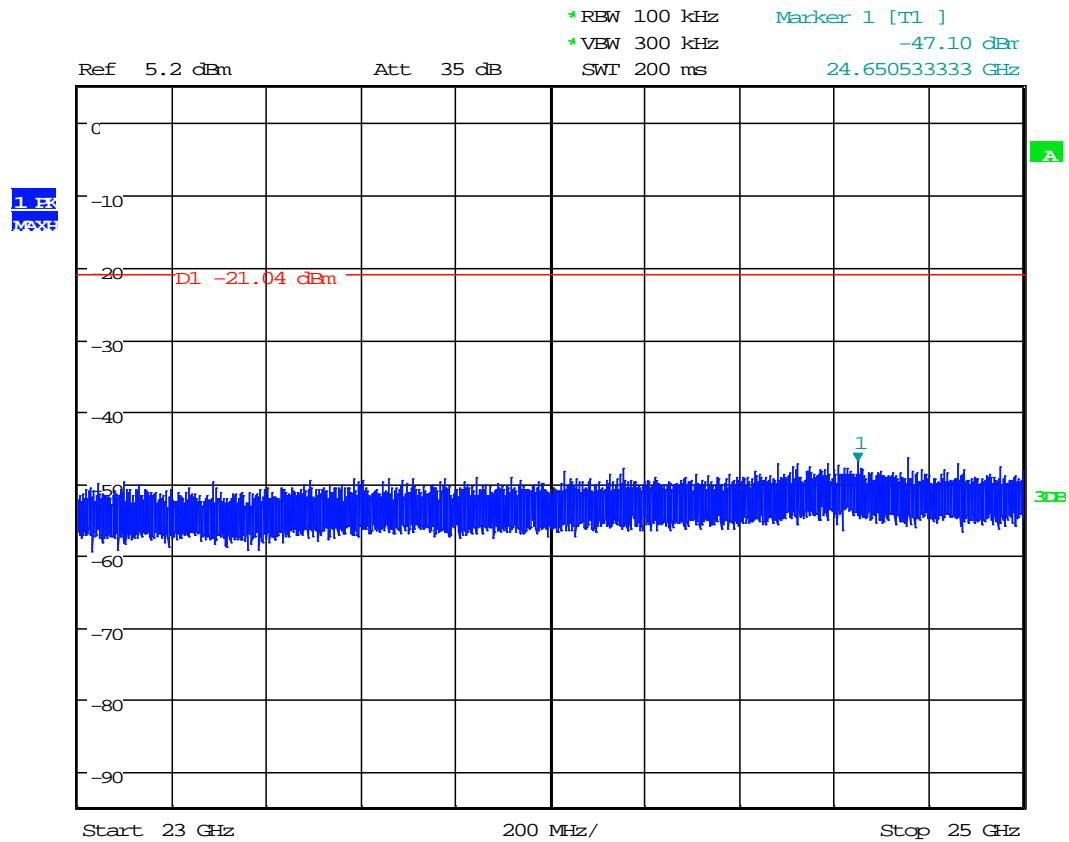
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:23:40

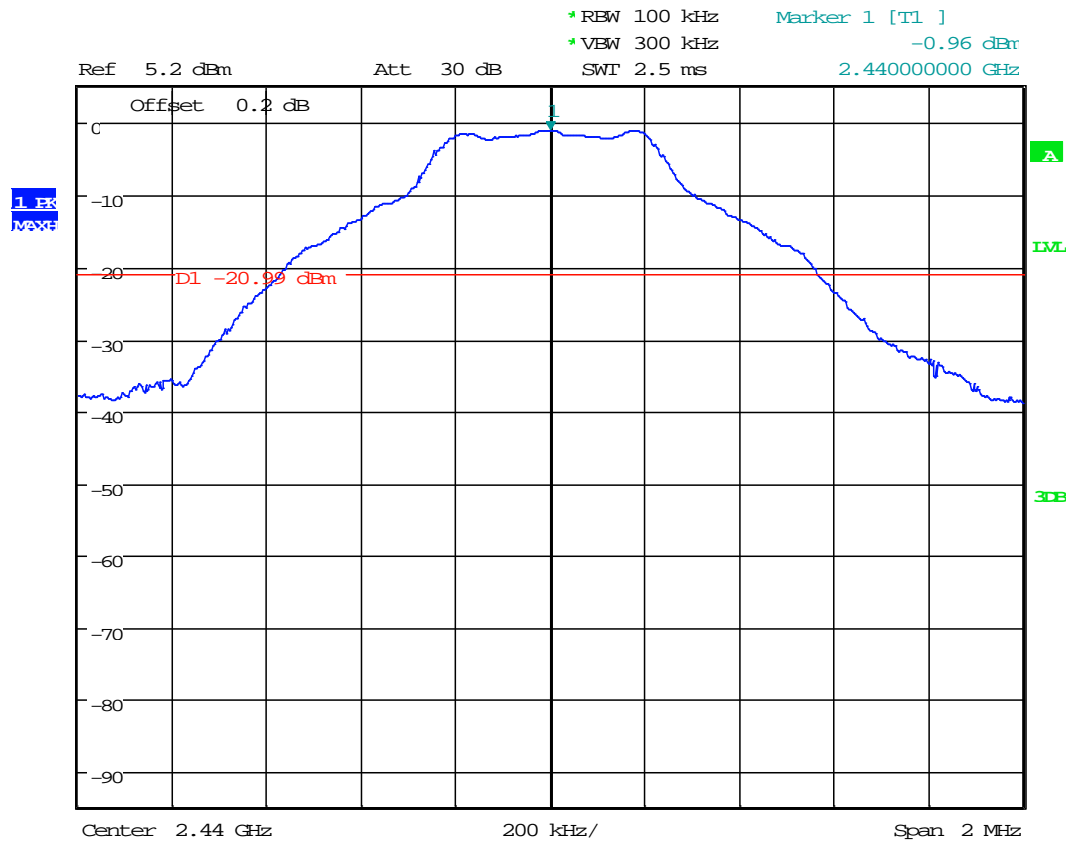
Tx @ Low Channel, 2402 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:24:04

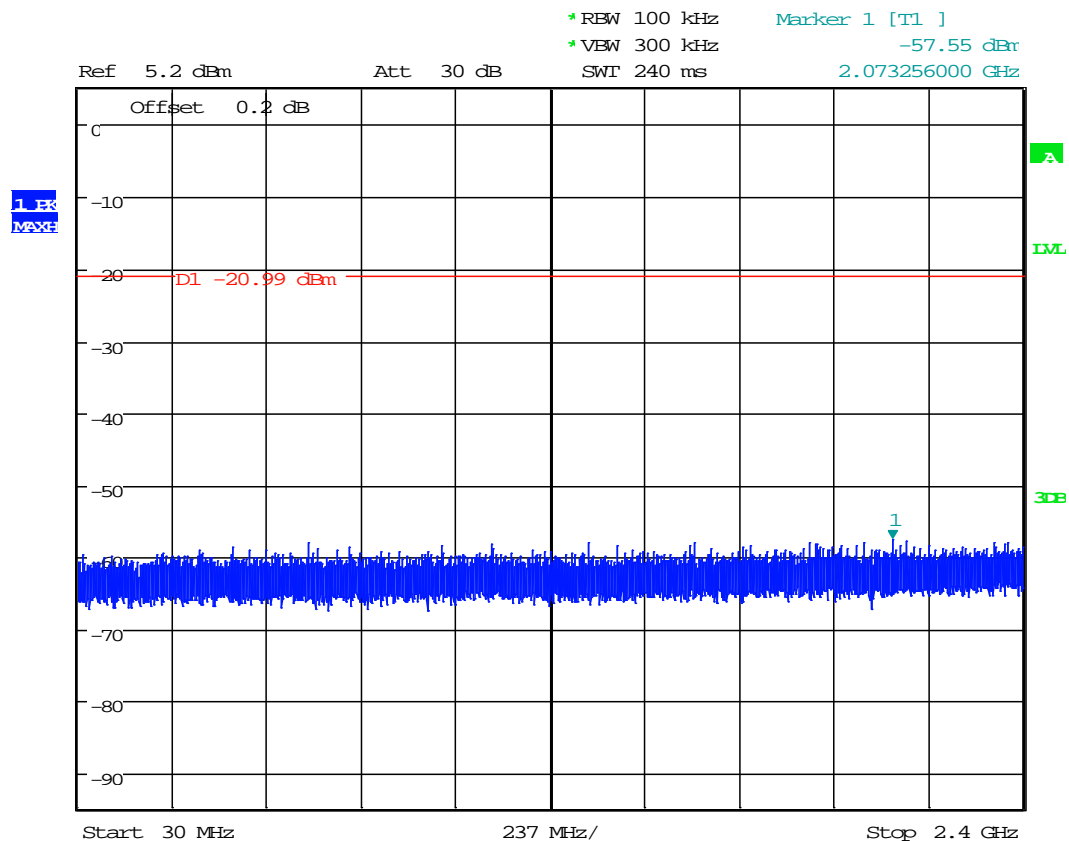
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:08:54

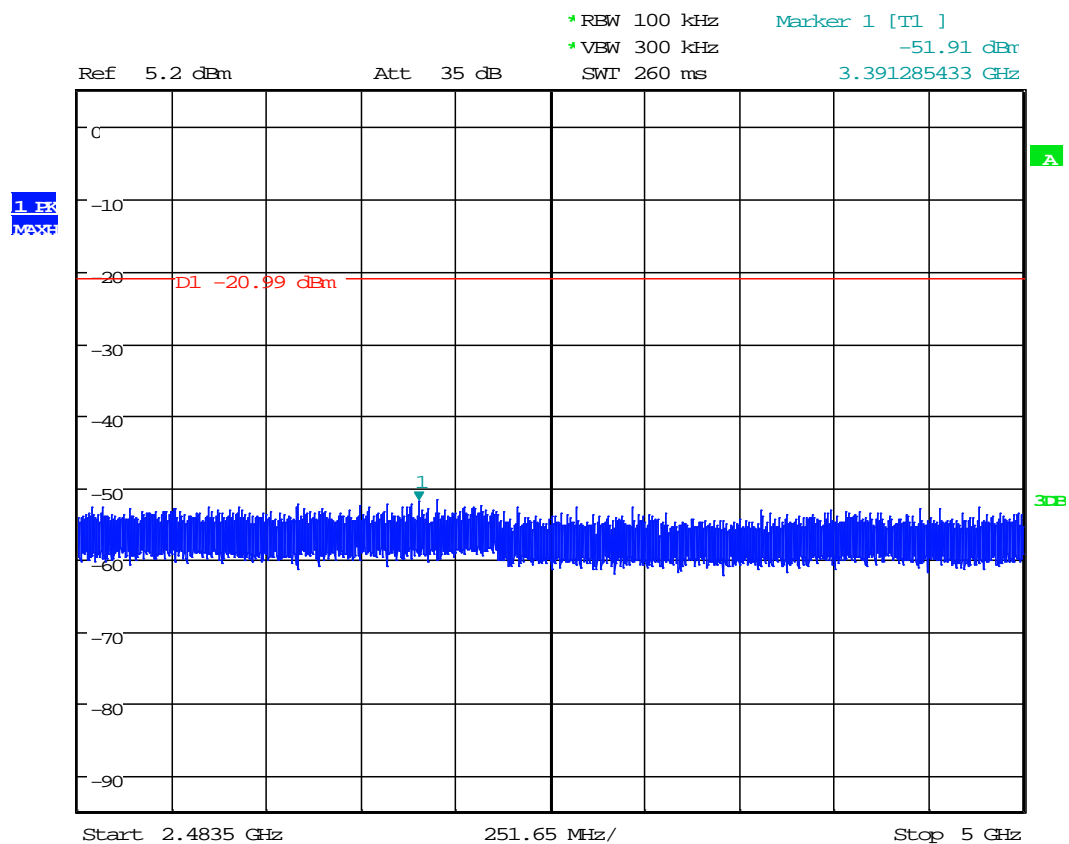
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:10:00

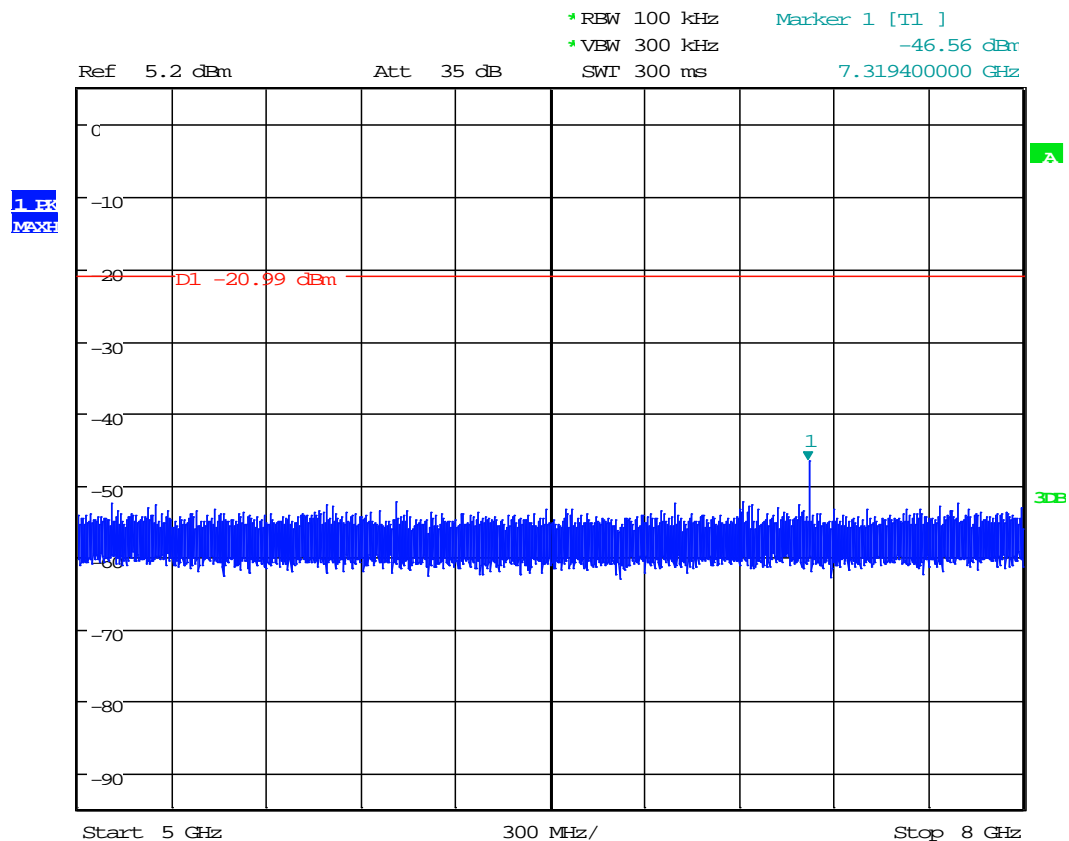
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:13:08

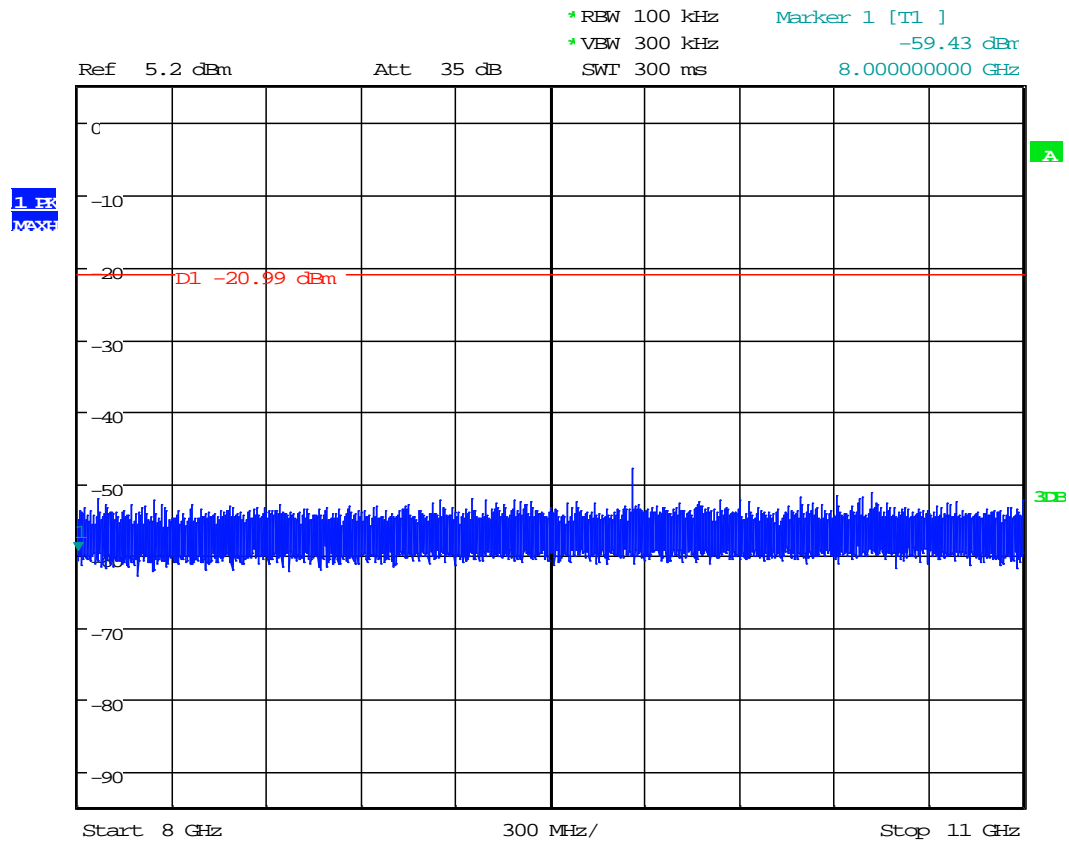
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:13:32

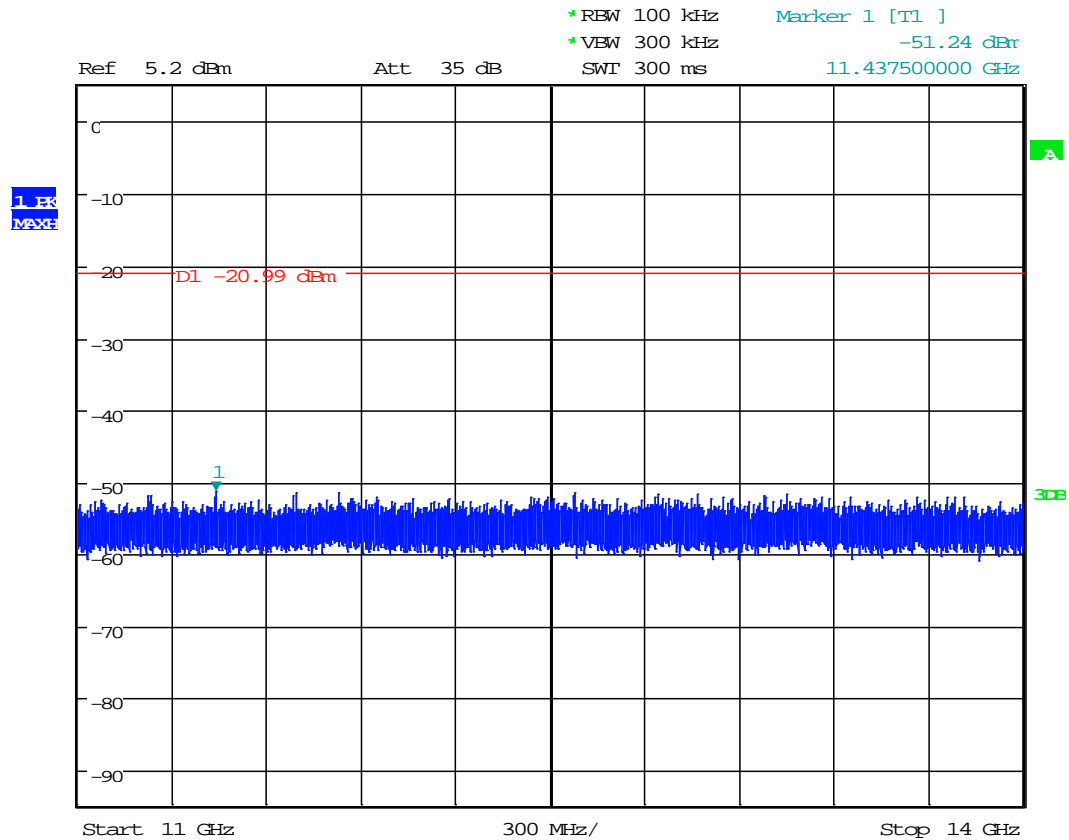
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:13:56

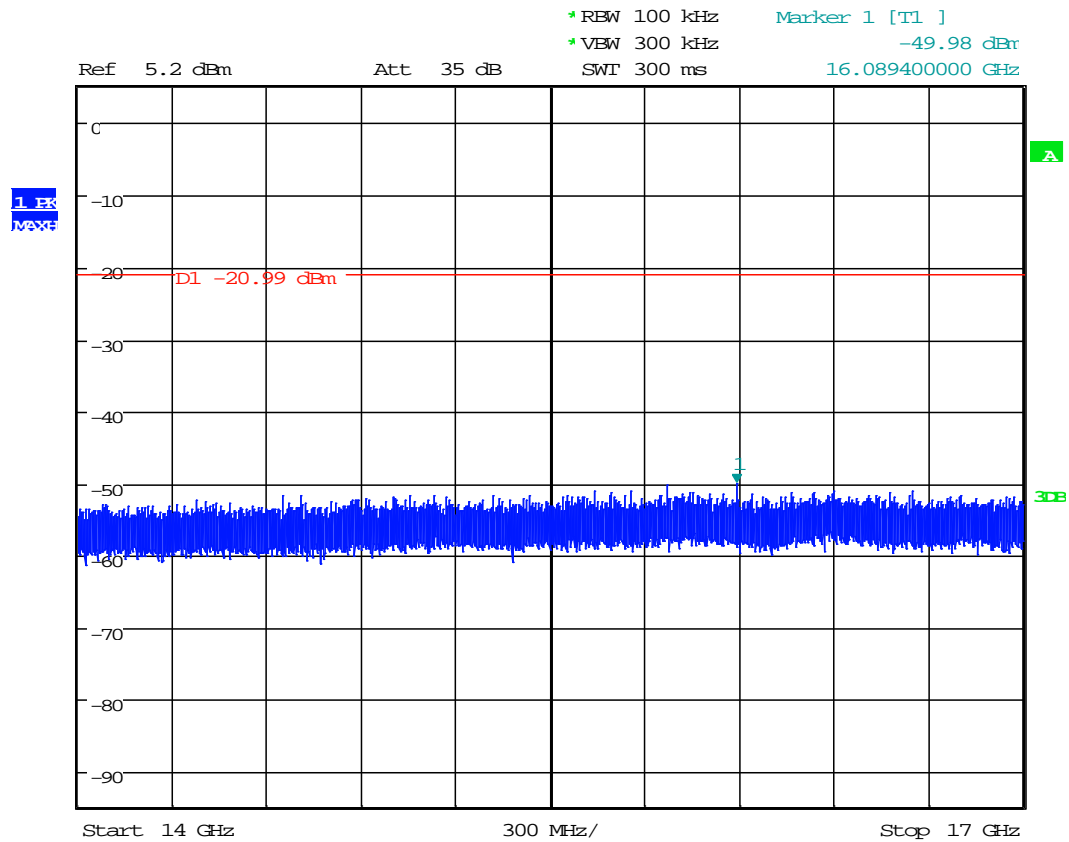
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:14:27

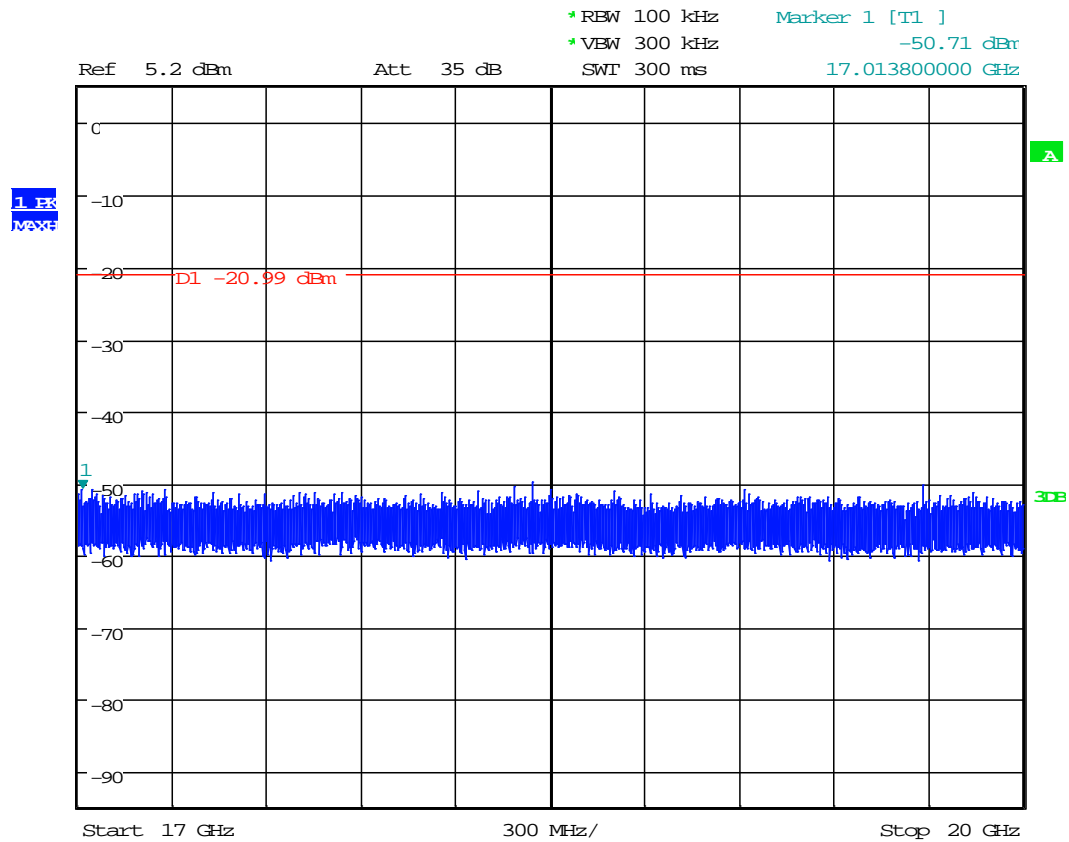
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:14:52

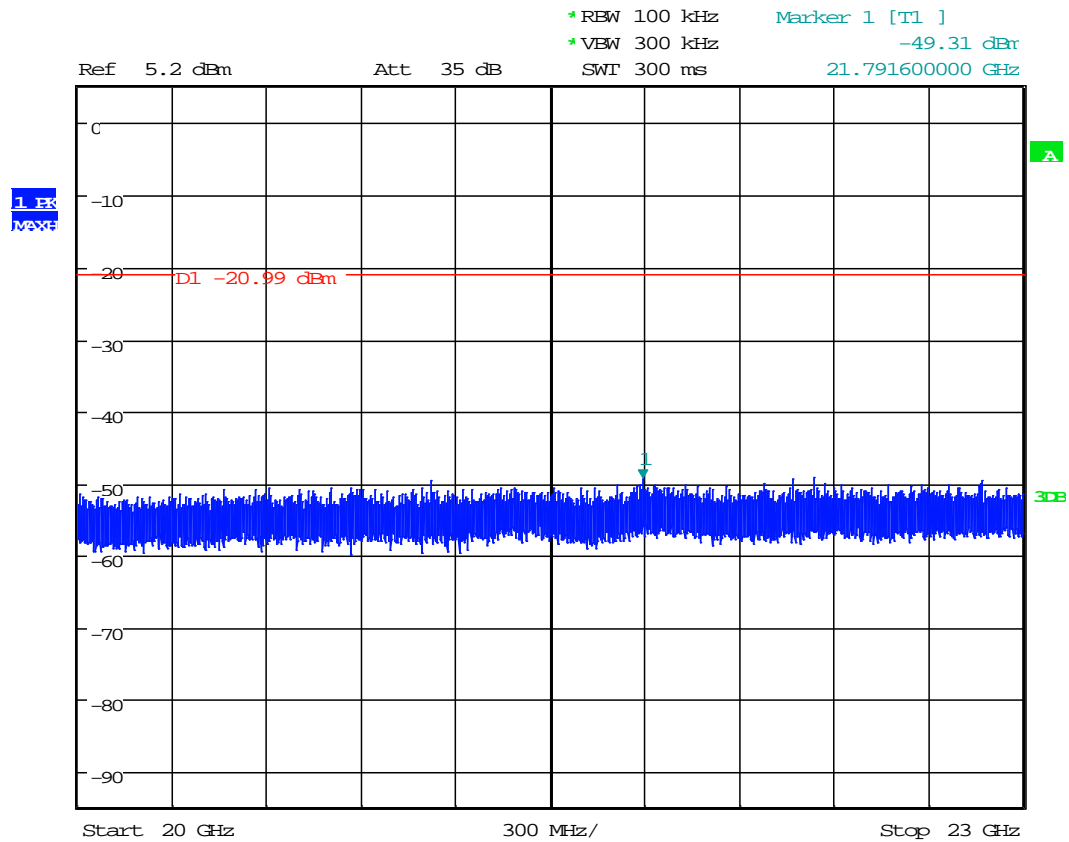
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:15:15

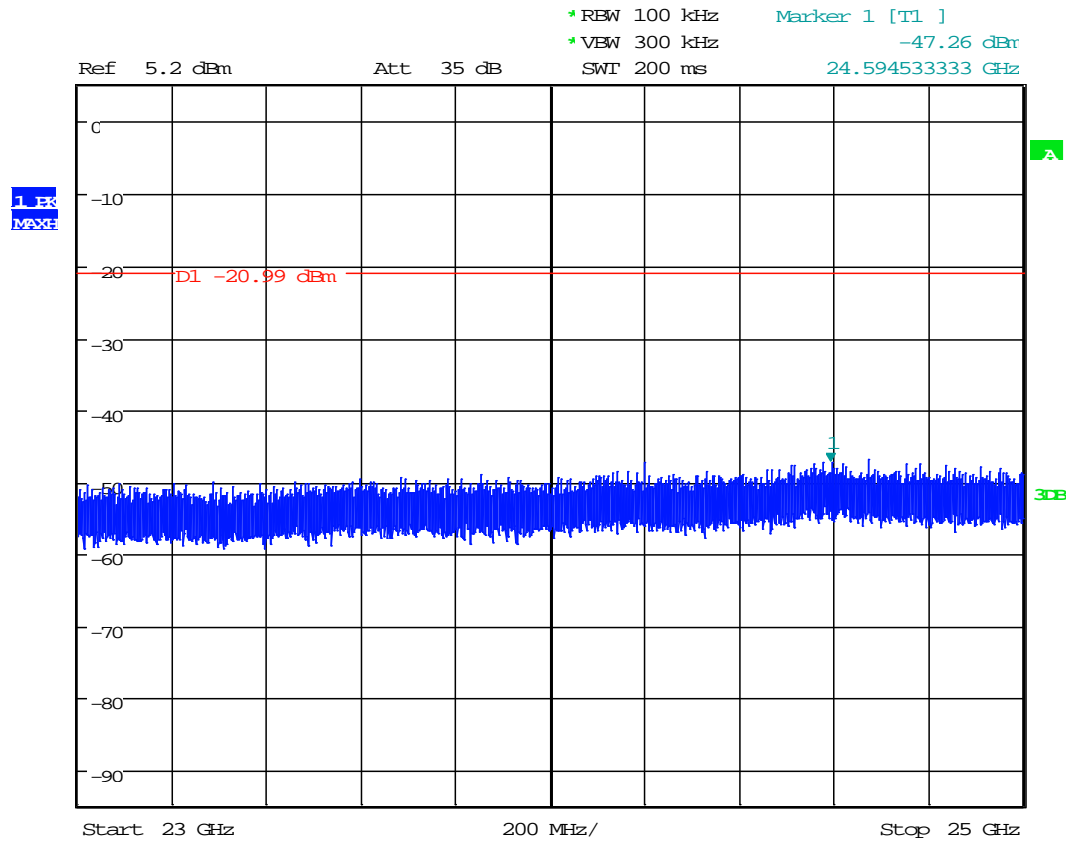
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:15:47

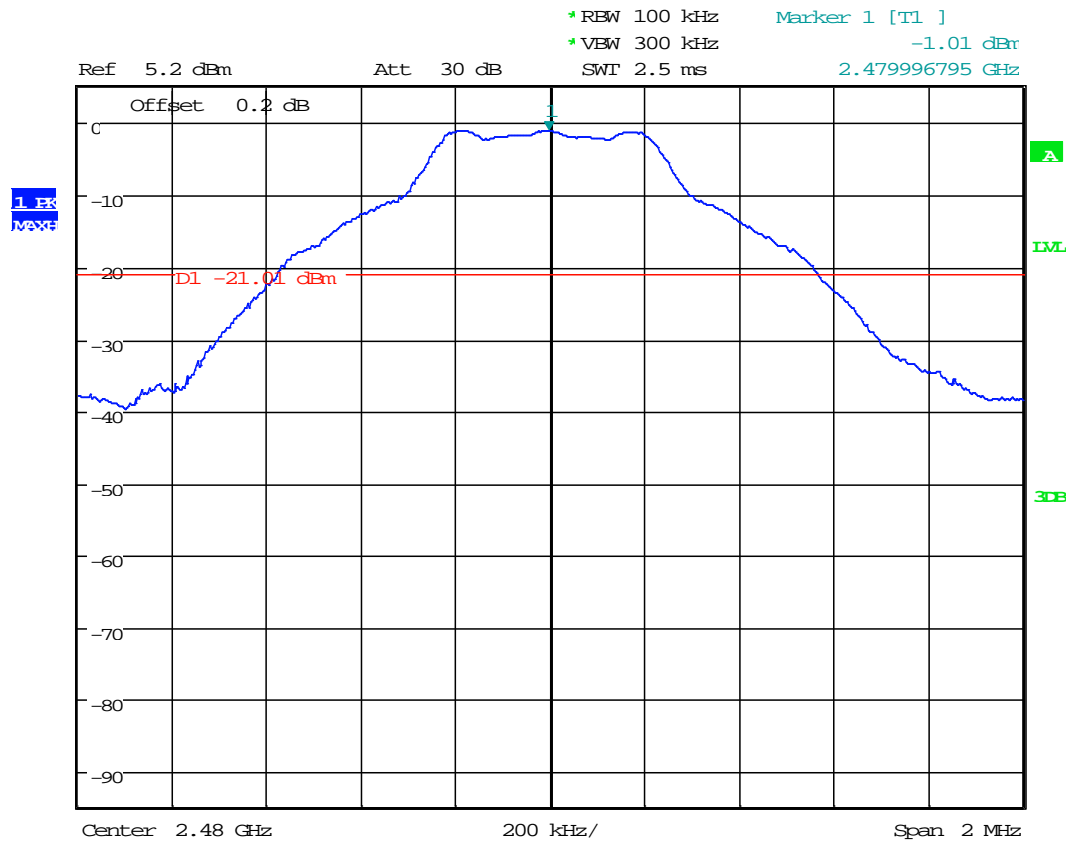
Tx @ Middle Channel, 2440 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:16:16

Tx @ High Channel, 2480 MHz

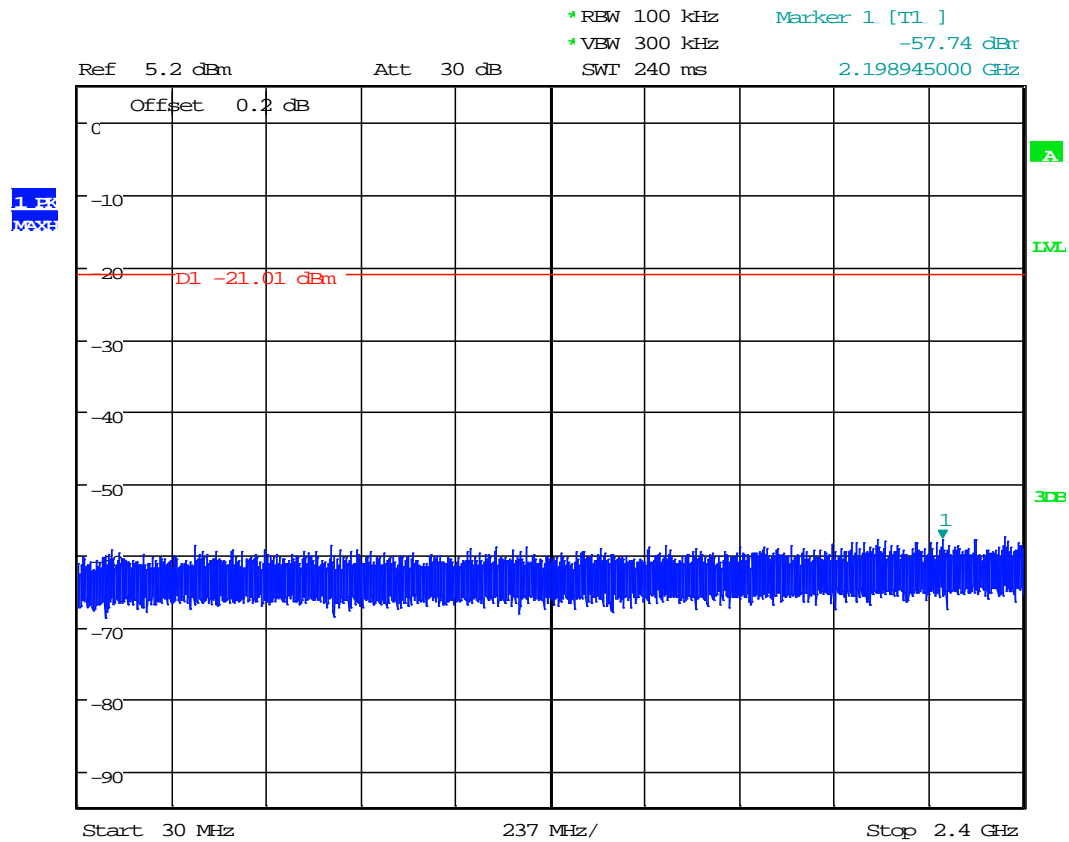


Conducted Spurious Emission

Date: 7.APR.2014 16:26:37

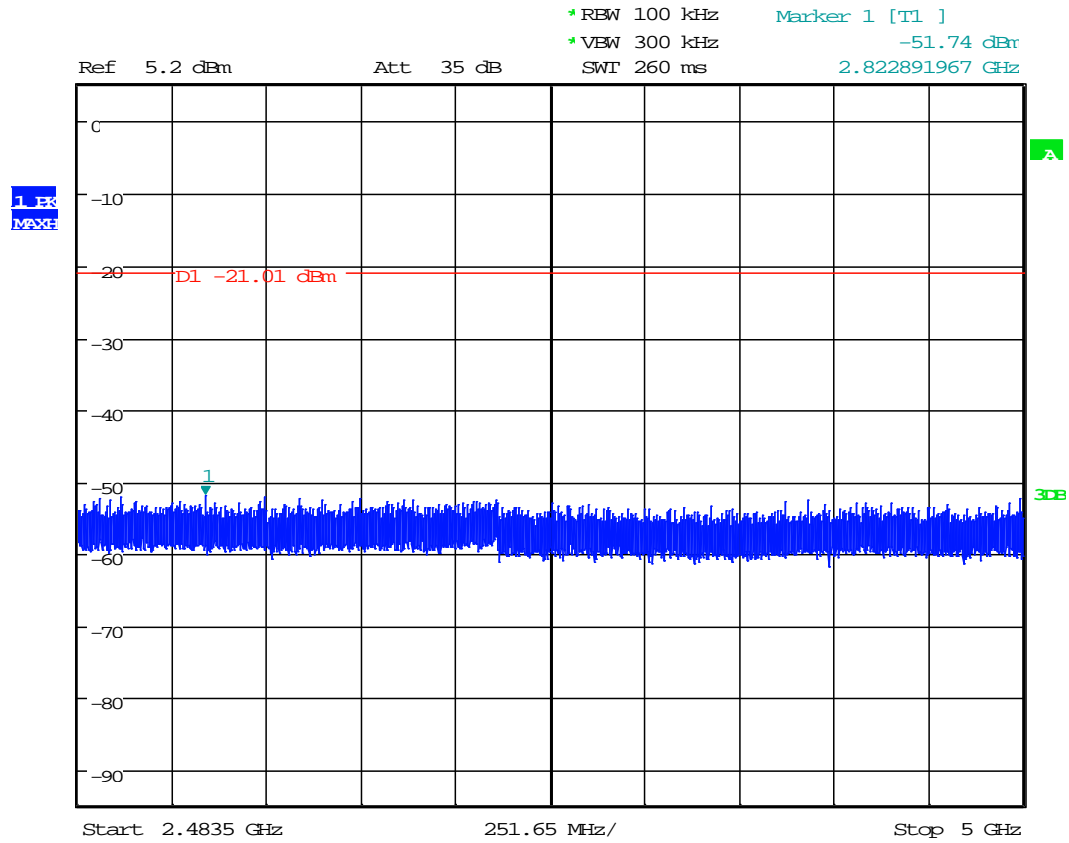


Tx @ High Channel, 2480 MHz



Conducted Spurious Emission
Date: 7.APR.2014 16:27:37

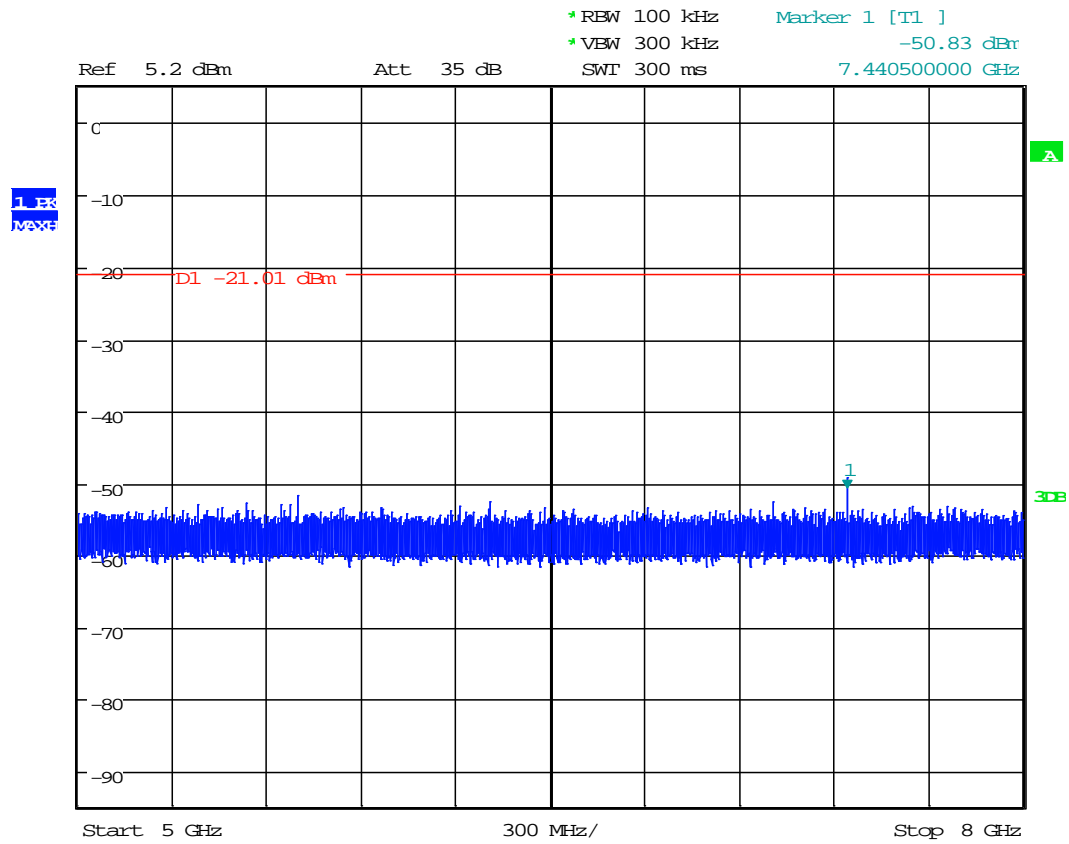
Tx @ High Channel, 2480 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:28:50

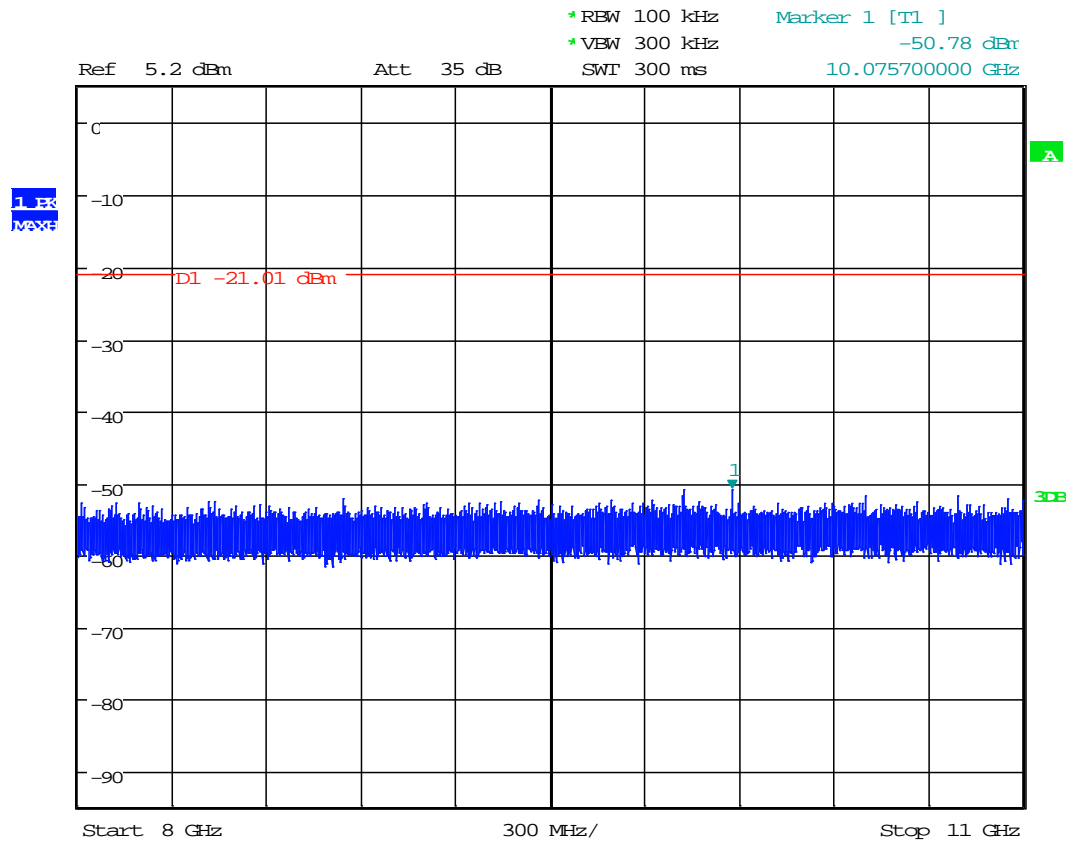
Tx @ High Channel, 2480 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:29:20

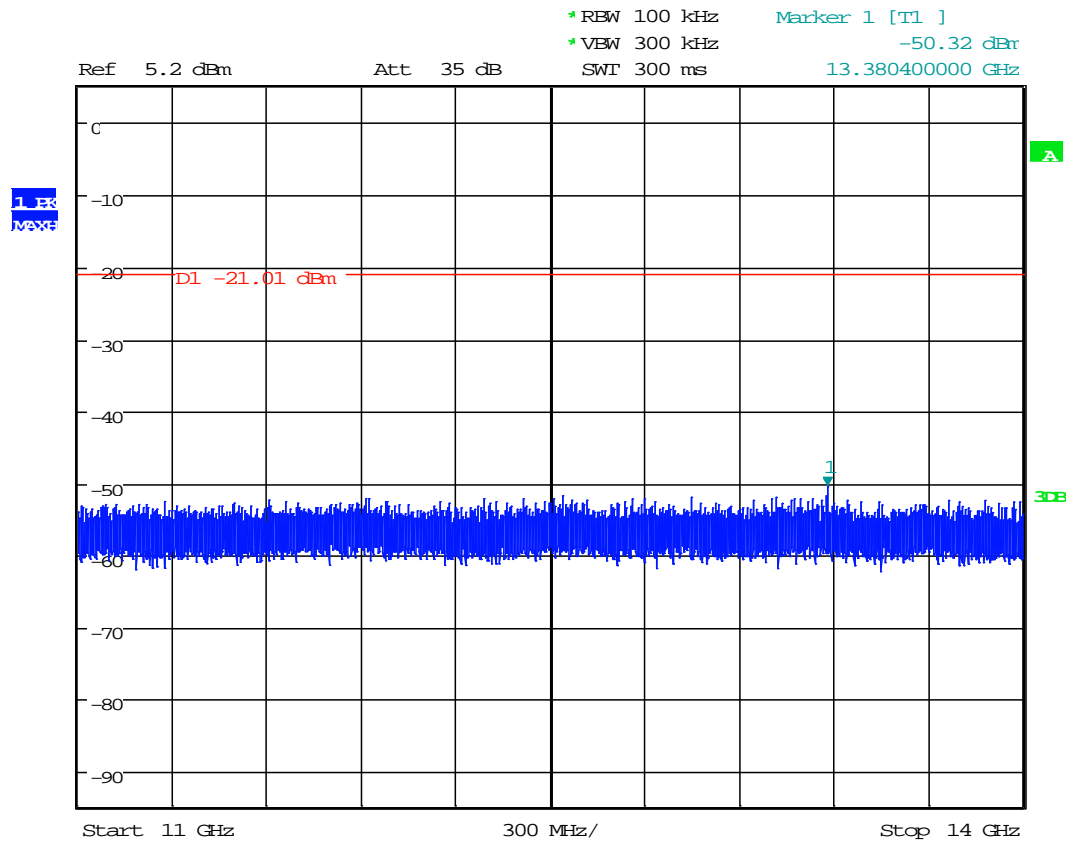
Tx @ High Channel, 2480 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:29:46

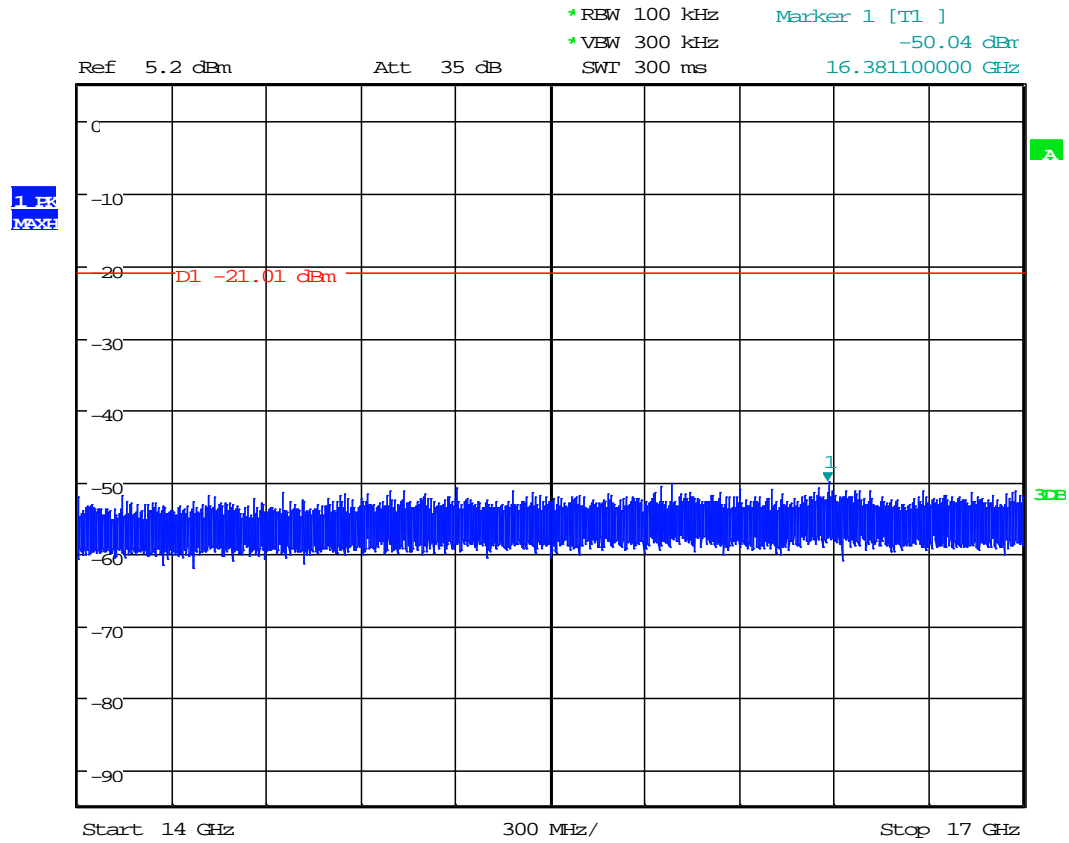
Tx @ High Channel, 2480 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:30:08

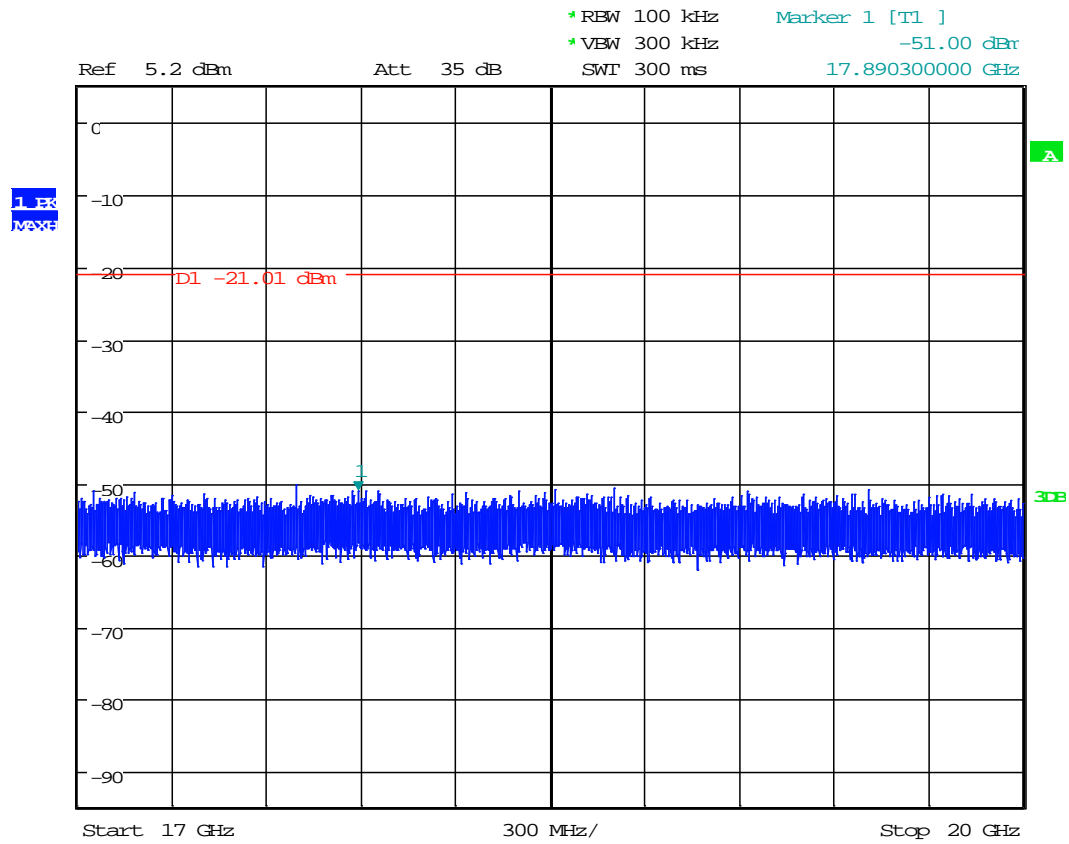
Tx @ High Channel, 2480 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:30:34

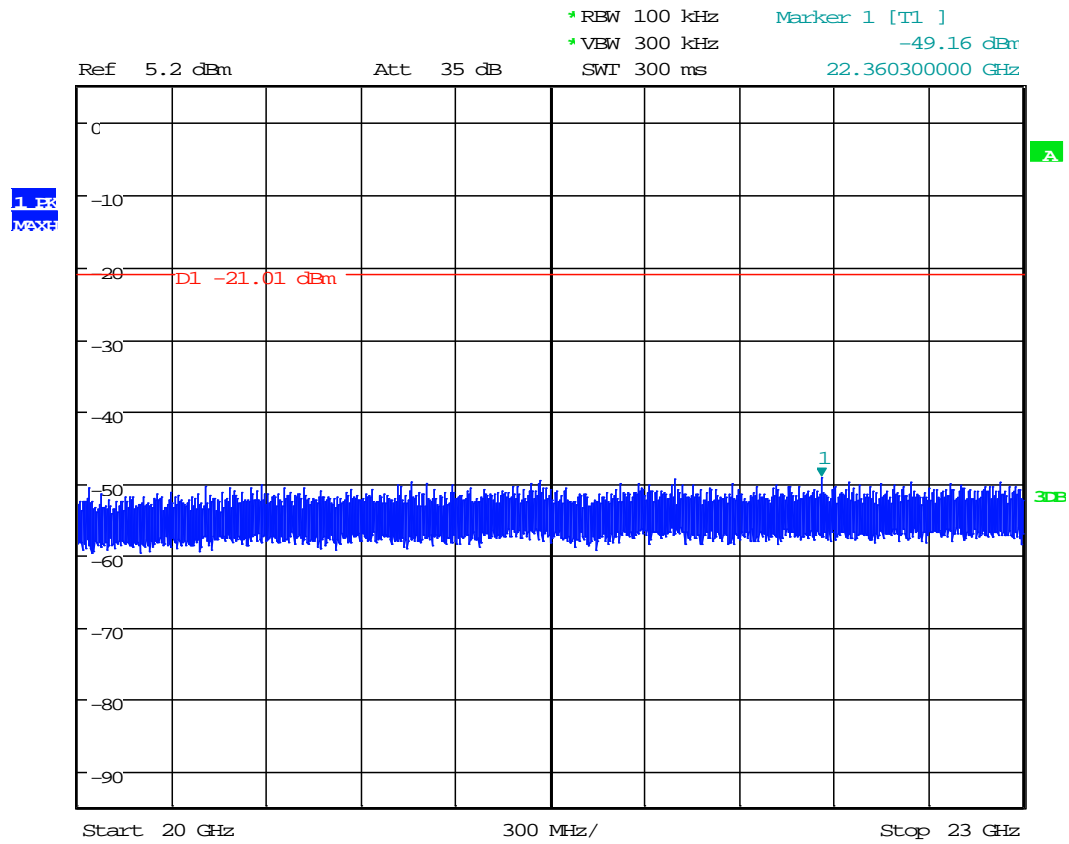
Tx @ High Channel, 2480 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:30:54

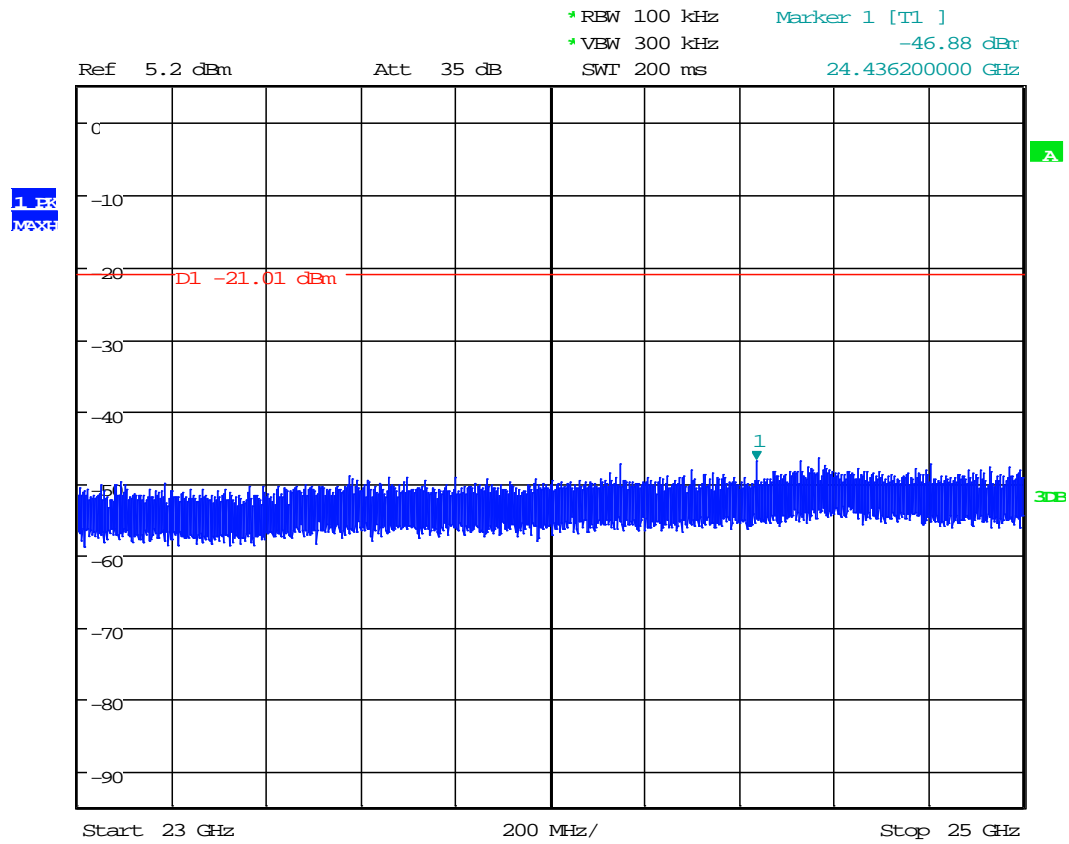
Tx @ High Channel, 2480 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:31:21

Tx @ High Channel, 2480 MHz



Conducted Spurious Emission

Date: 7.APR.2014 16:32:00

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(μ V/m)

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

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

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

RA = 52.0 dB(μ V)

AF = 7.4 dB(1/m)

CF = 1.6 dB

AG = 29.0 dB

$FS = 52.0 + 7.4 + 1.6 - 29.0 = 32 \text{ dB}(\mu\text{V/m})$.

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

4.5.4 Test Results

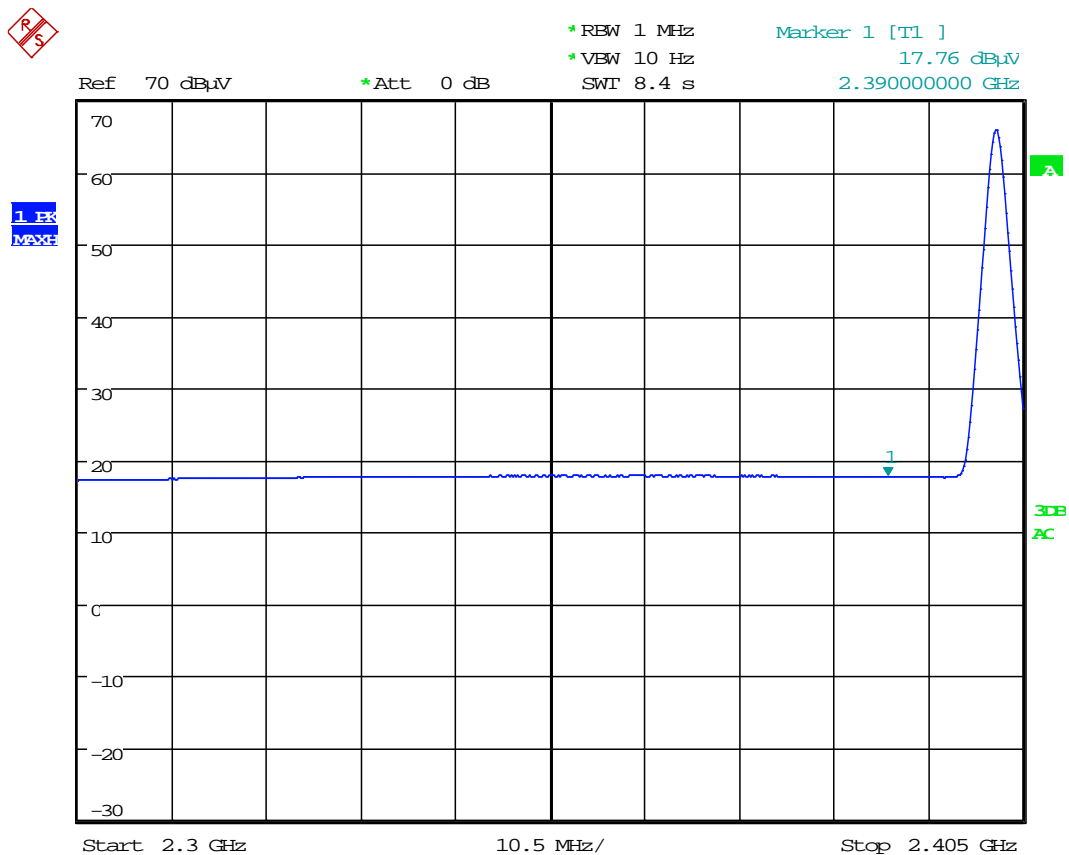
The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

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

The EUT passed the test by 4.8dB

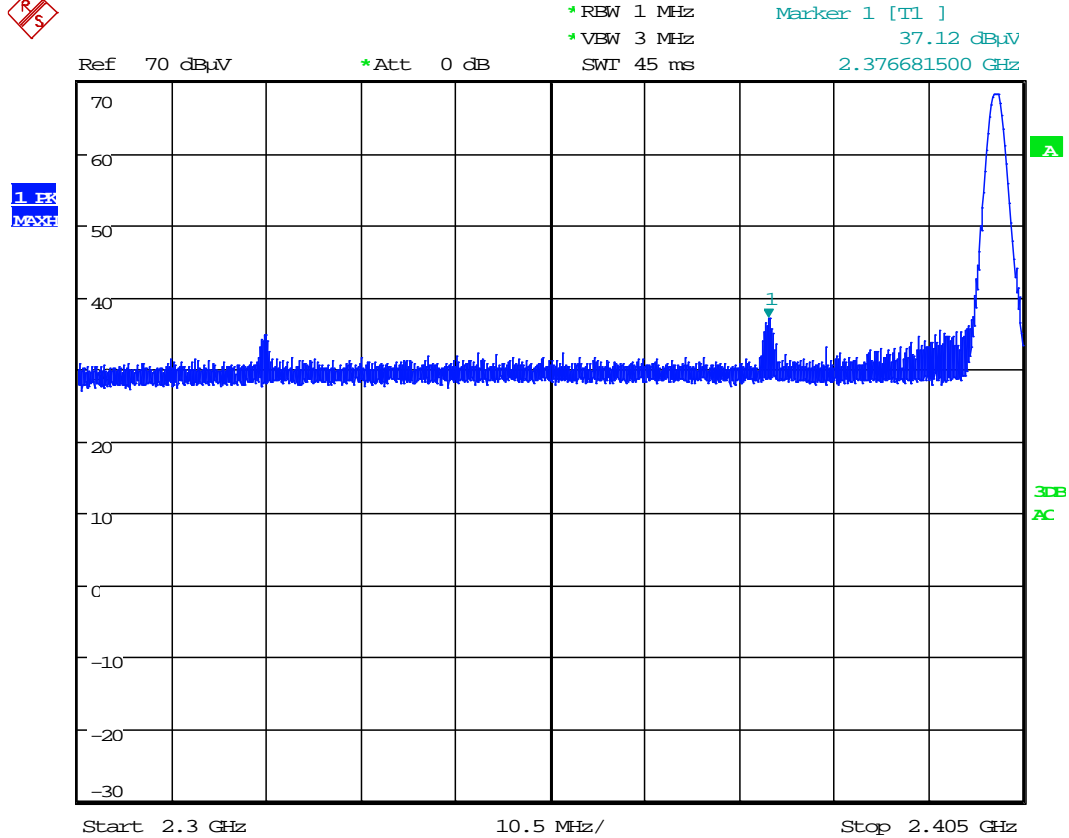
Test Results: 15.209/15.205 Restricted Band Emissions

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



Radiated Band Edge

Date: 30.APR.2014 19:52:23



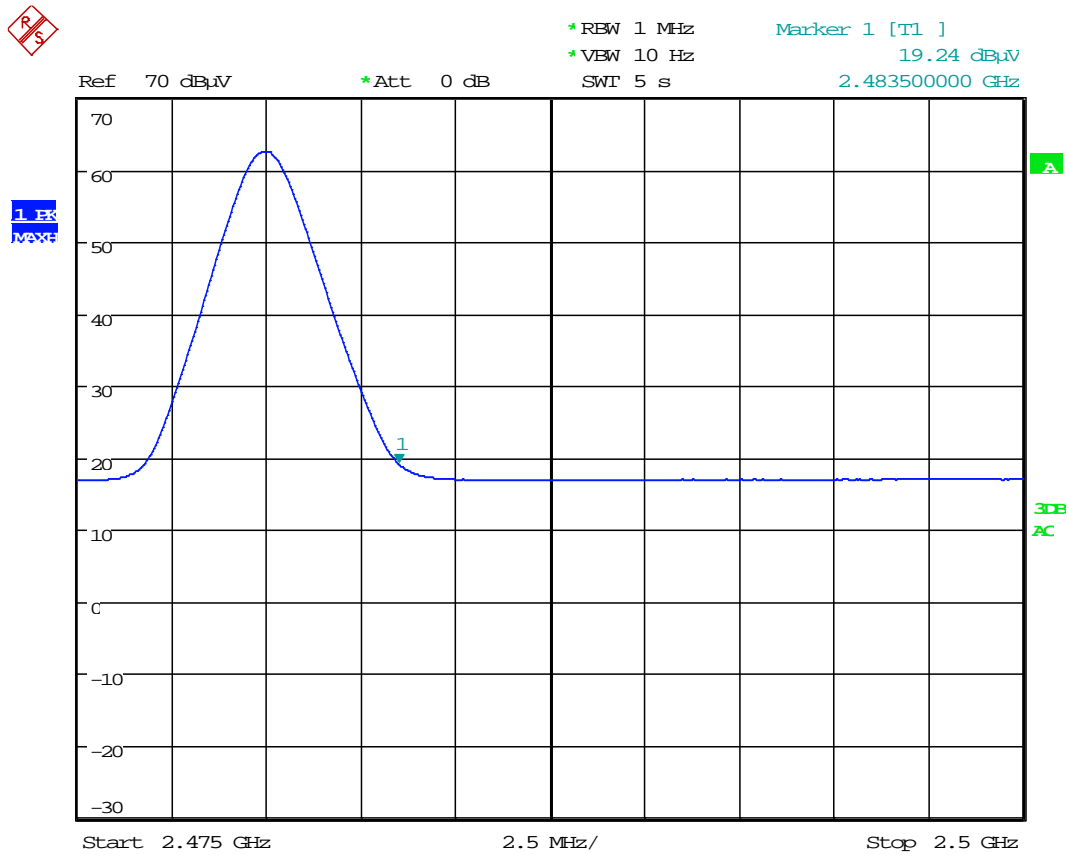
Radiated Band Edge

Date: 30.APR.2014 19:51:40

EUT Frequency	Raw Amplitude @ 3 m	Antenna Correction Factor	Cable Loss	EUT Field Strength Final Amp.	Limit Detector	Limit @ 3 m	Margin
(MHz)	(dBuV/m)	(dB/m)	(dB)	(dBuV/m)	(Peak) / (Average)	(dBuV/m)	(dB)
2402.0	37.12	27.64	1.84	66.60	Peak	74	-7.40
	17.76	27.64	1.84	47.24	Average	54	-6.76

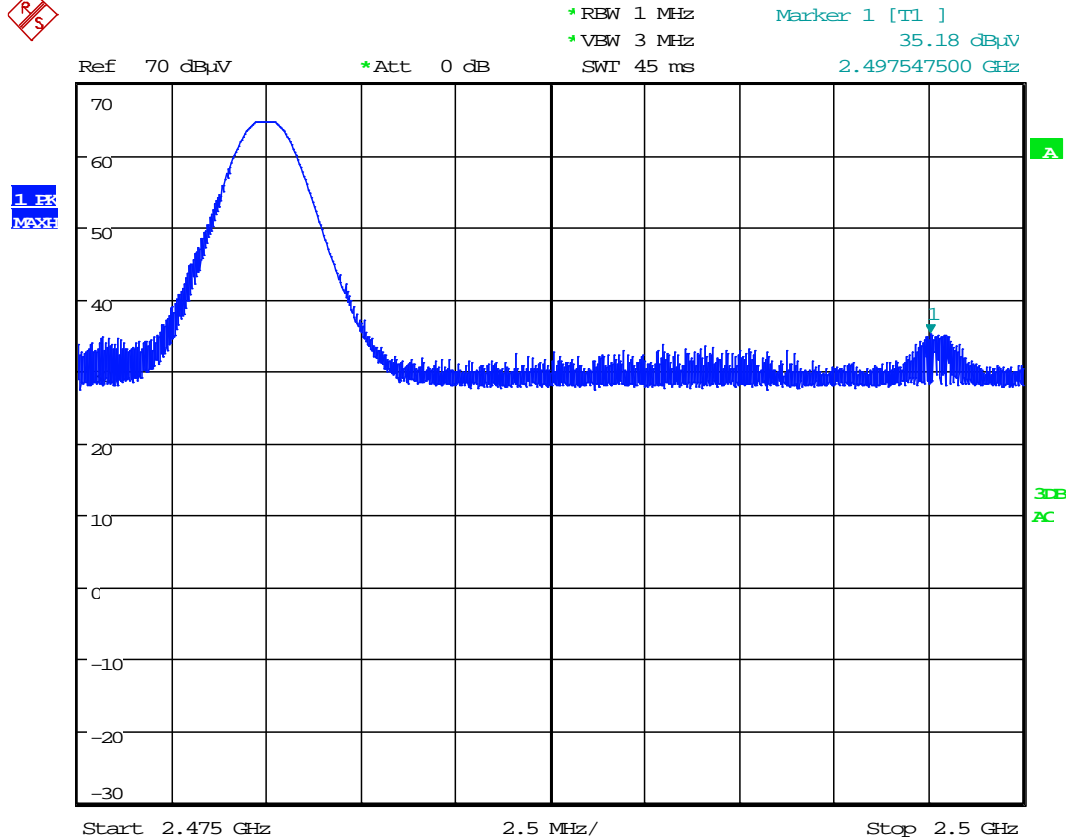
Results ☐ **Complies**

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



Radiated Band Edge

Date: 30.APR.2014 19:45:48



Radiated Band Edge

Date: 30.APR.2014 19:45:12

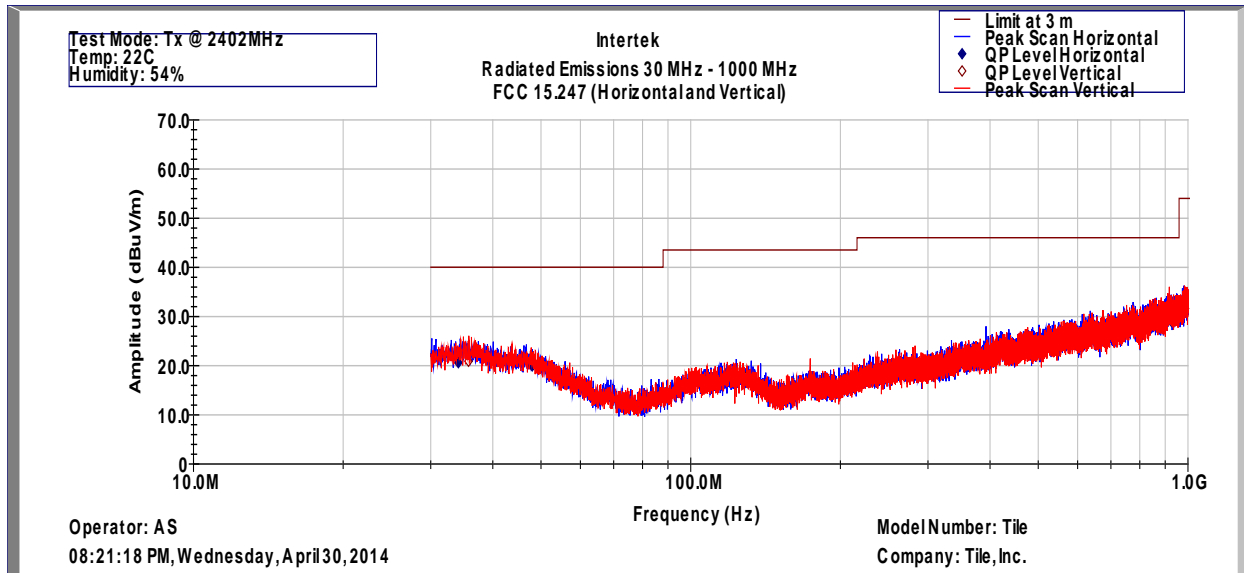
EUT Frequency	Raw Amplitude @ 3 m	Antenna Corection Factor	Cable Loss	EUT Field Strength Final Amp.	Limit Detector	Limit @ 3 m	Margin
(MHz)	(dBuV/m)	(dB/m)	(dB)	(dBuV/m)	(Peak) / (Average)	(dBuV/m)	(dB)
2480.0	35.18	28.11	1.88	65.17	Peak	74	-8.83
	19.24	28.11	1.88	49.23	Average	54	-4.77

Results

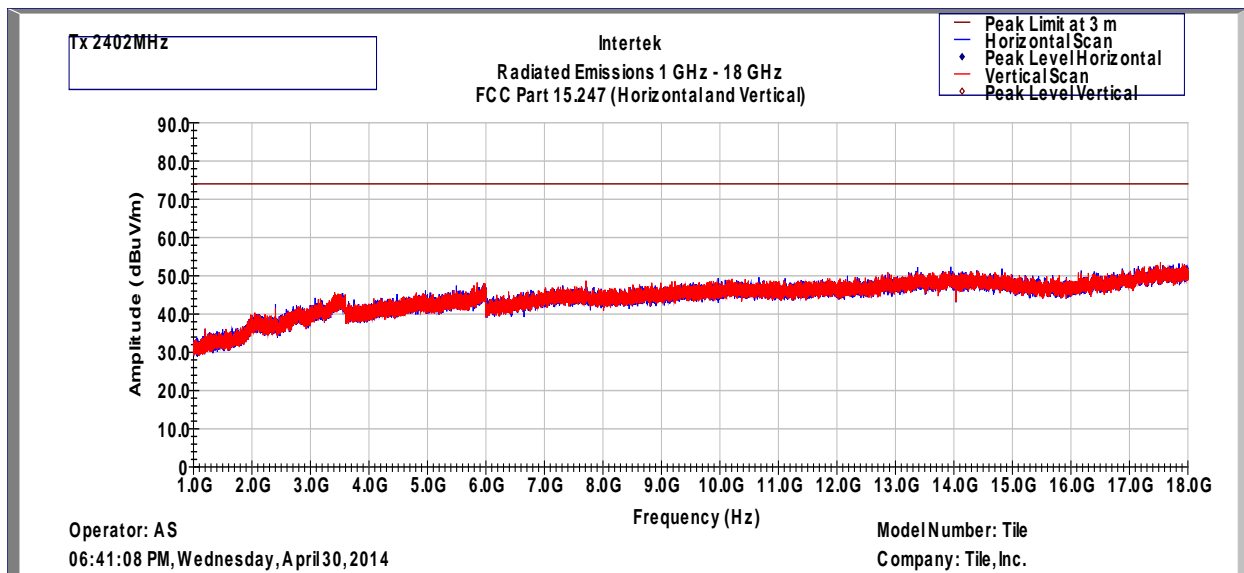
Complies

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

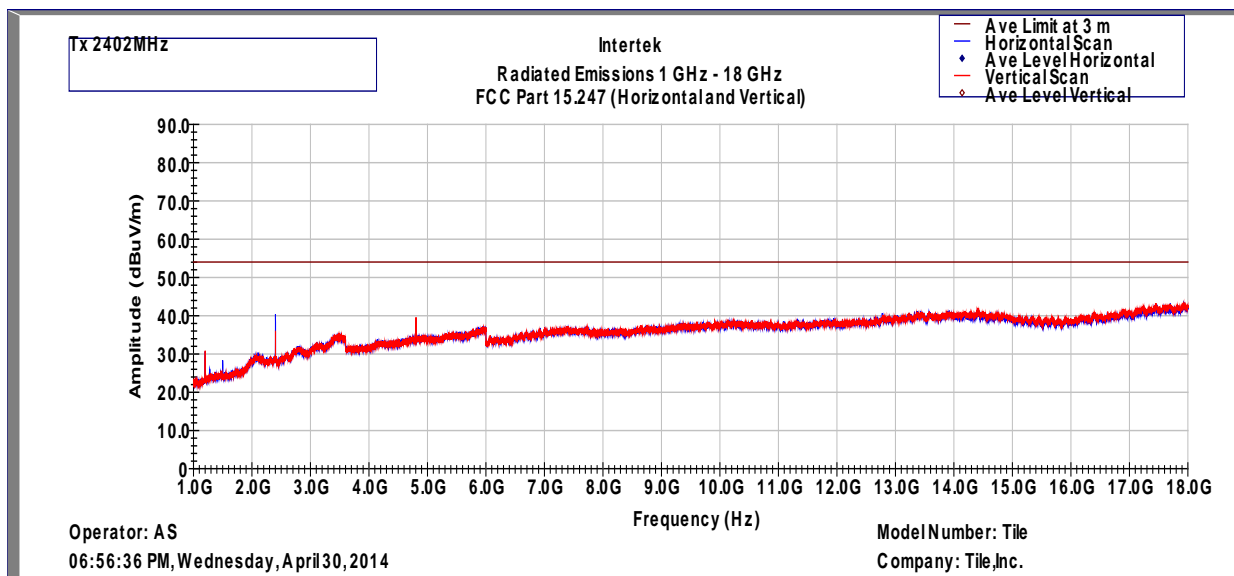
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan

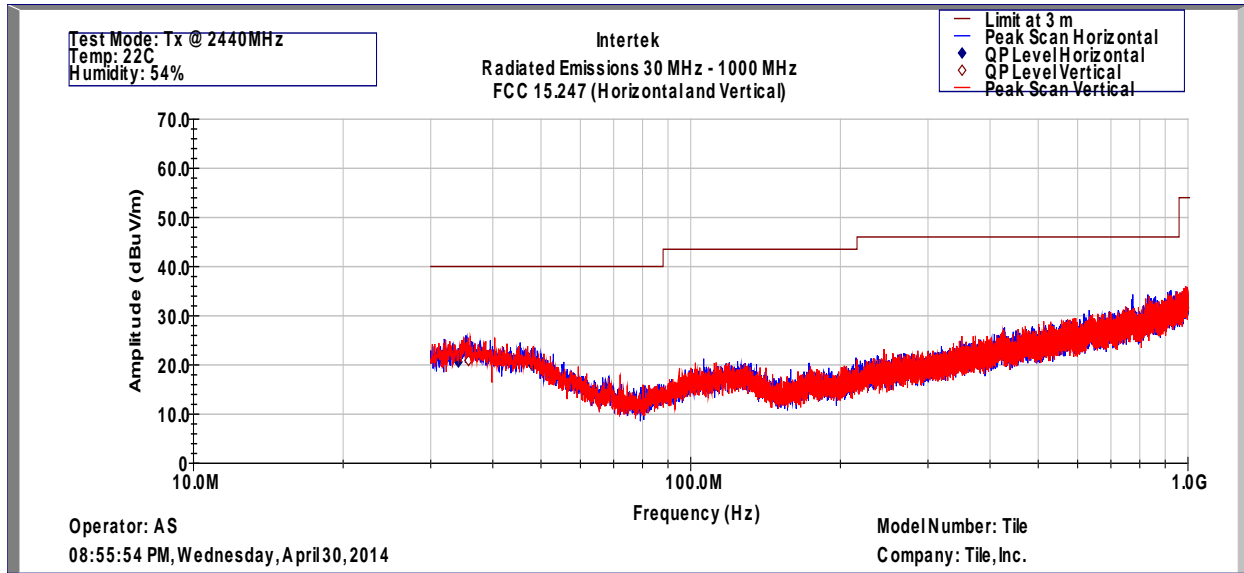


Frequency	Ave Level	Ave Limit@3m	Margin	Raw	Cable	Preamp	AF
MHz	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(dB)	(dB)	dB(1/m)
4804	39.5	54	-14.5	35.5	5.9	34.5	32.6
7206	37.5	54	-16.5	26.5	7.4	33.5	37.1

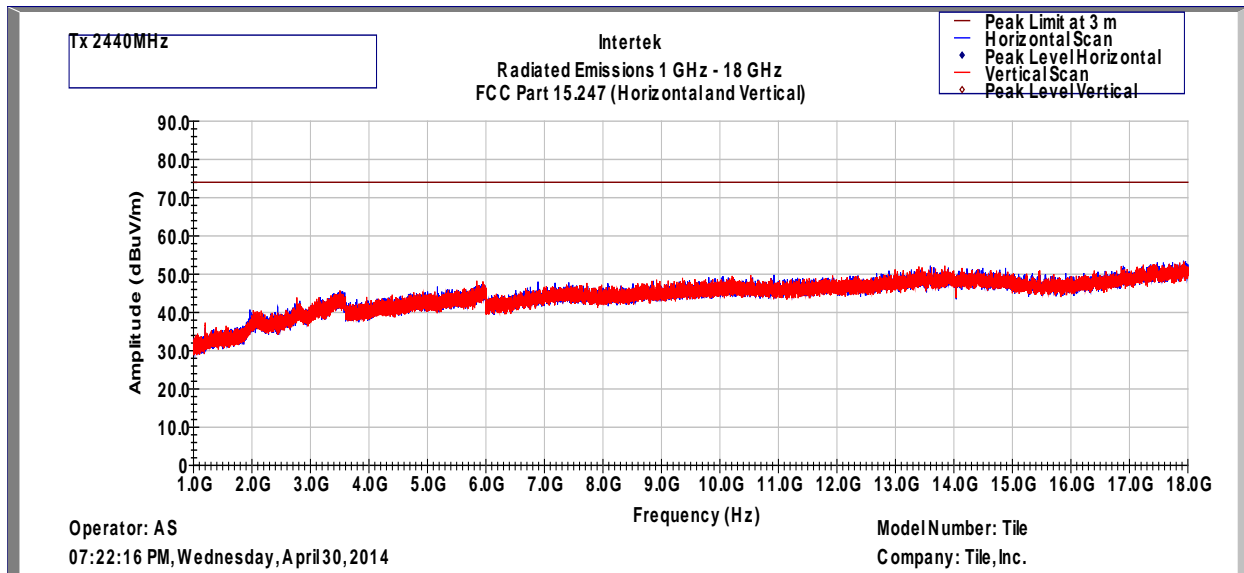
Results	Complies
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Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440MHz

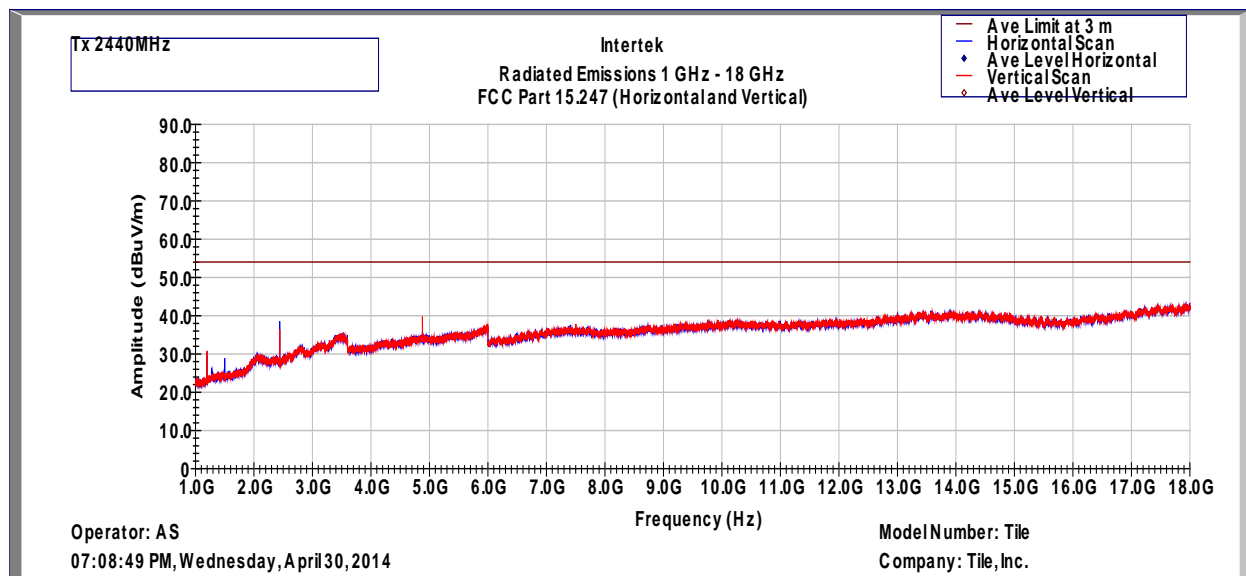
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



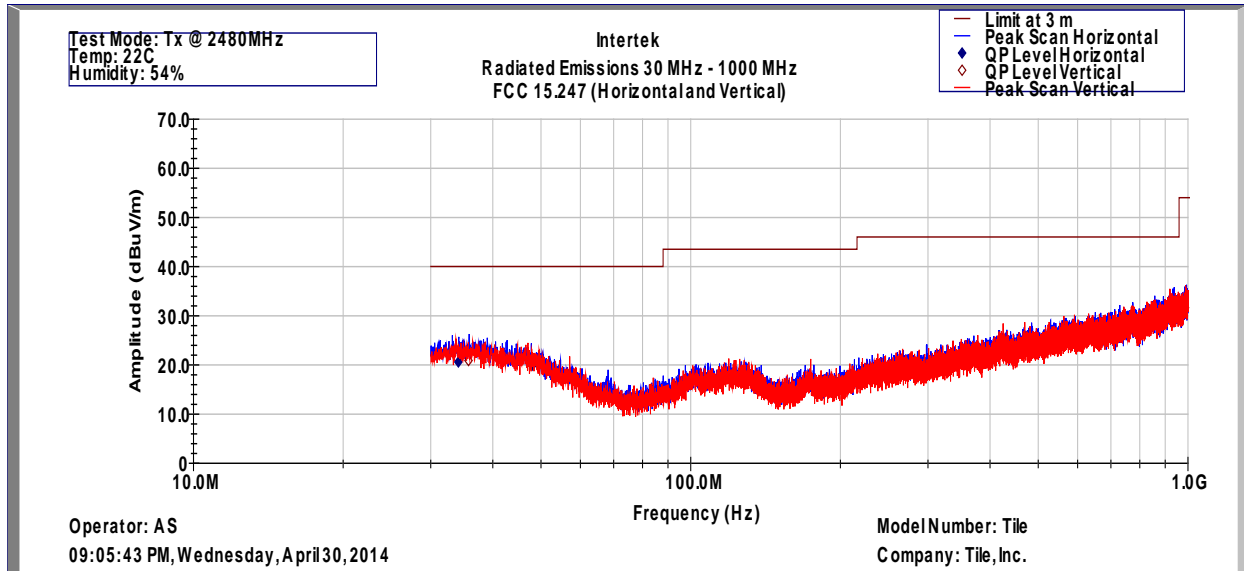
Frequency	Ave Level	Ave Limit@3m	Margin	Raw	Cable	Preamplifier	AF
MHz	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(dB)	(dB)	dB(1/m)
4880	39.3	54	-14.7	35	6	34.4	32.7
7320	37.8	54	-16.2	26.5	7.5	33.5	37.3

Results

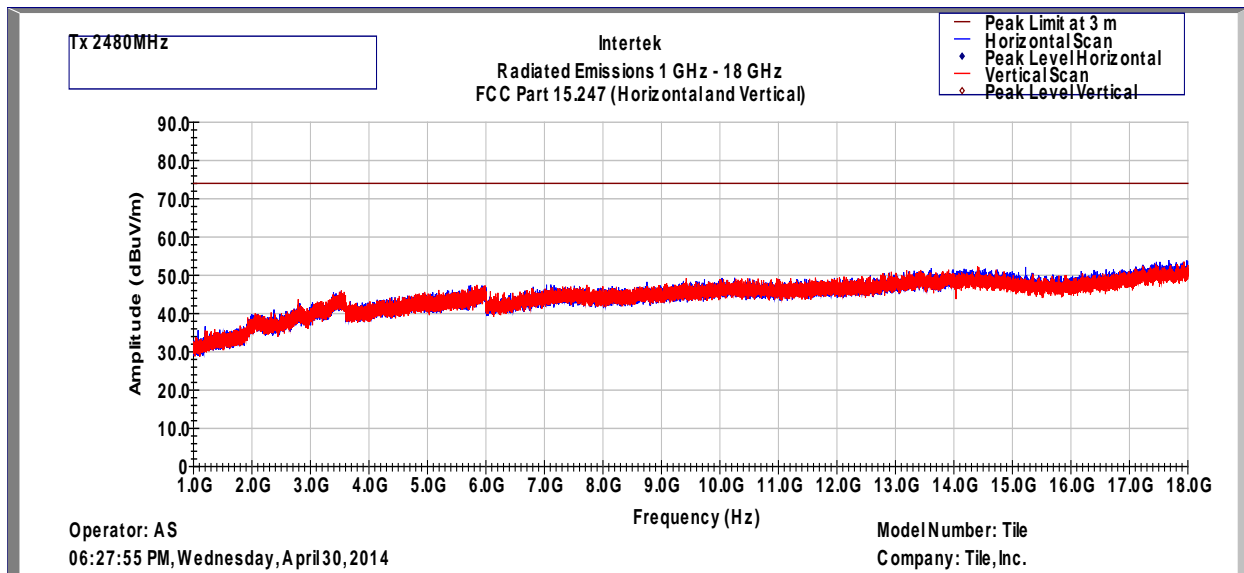
Complies

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

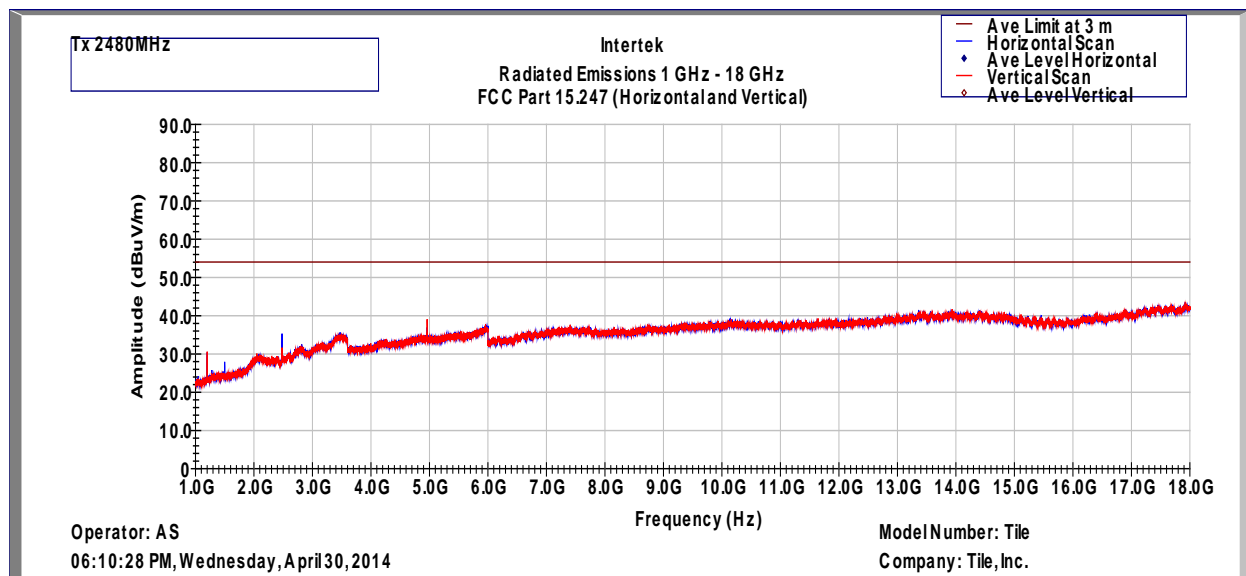
Radiated Spurious Emissions 30 MHz - 1000 MHz



Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



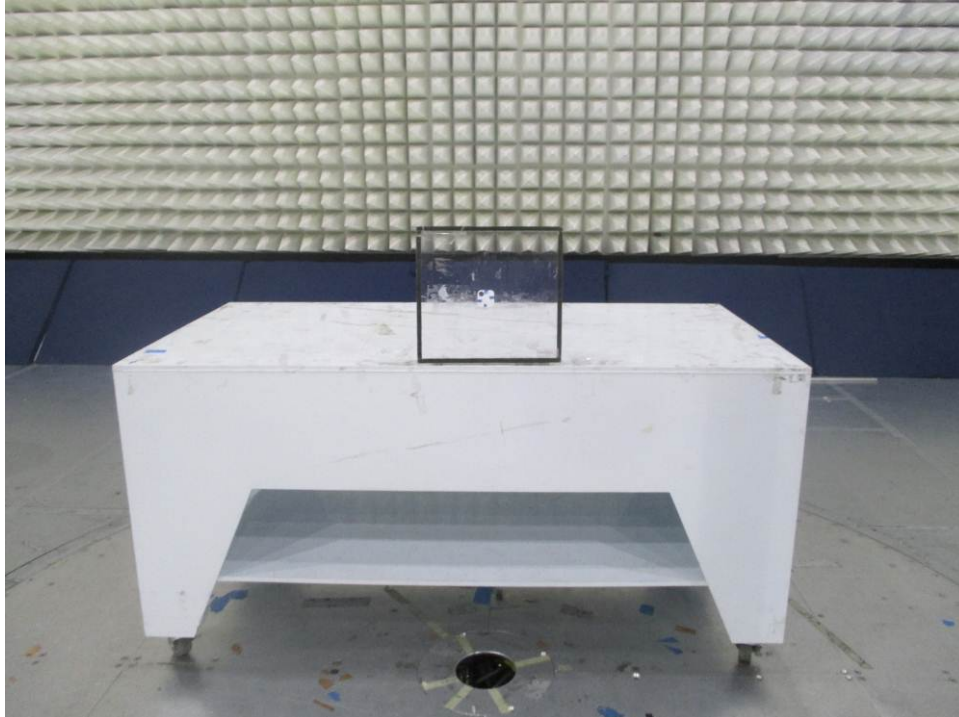
Frequency	Ave Level	Ave Limit@3m	Margin	Raw	Cable	Preamplifier	AF
MHz	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(dB)	(dB)	dB(1/m)
4960	39.7	54	-14.3	35.2	6.0	34.4	32.9
7440	38.0	54	-16.0	26.6	7.5	33.5	37.4

Results

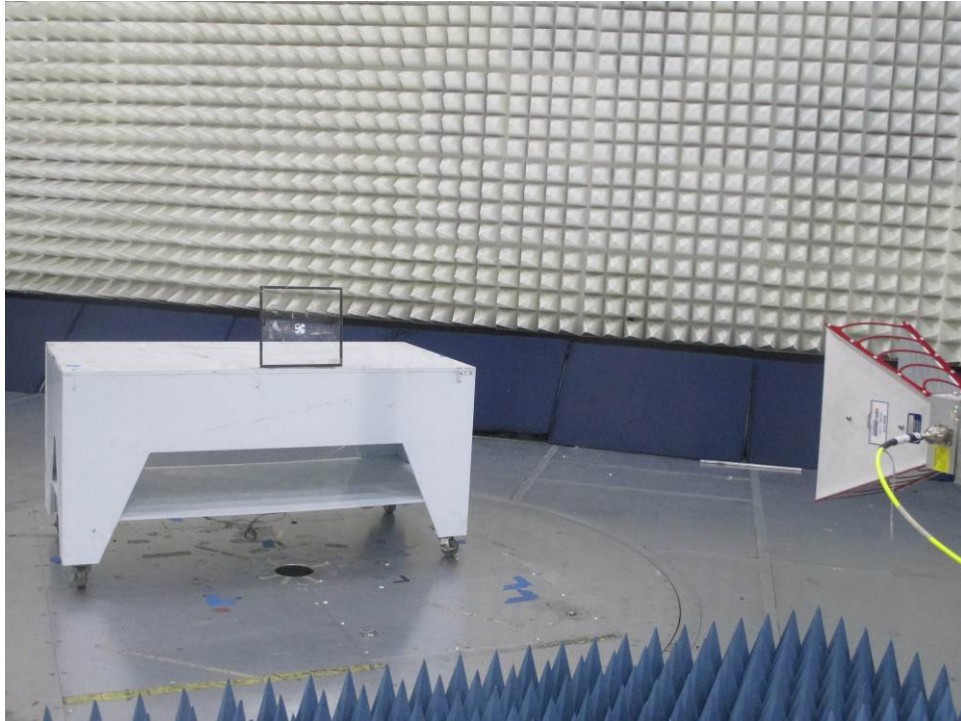
Complies

4.5.4 Test setup photographs

The following photographs show the testing configurations used.



4.5.4 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.

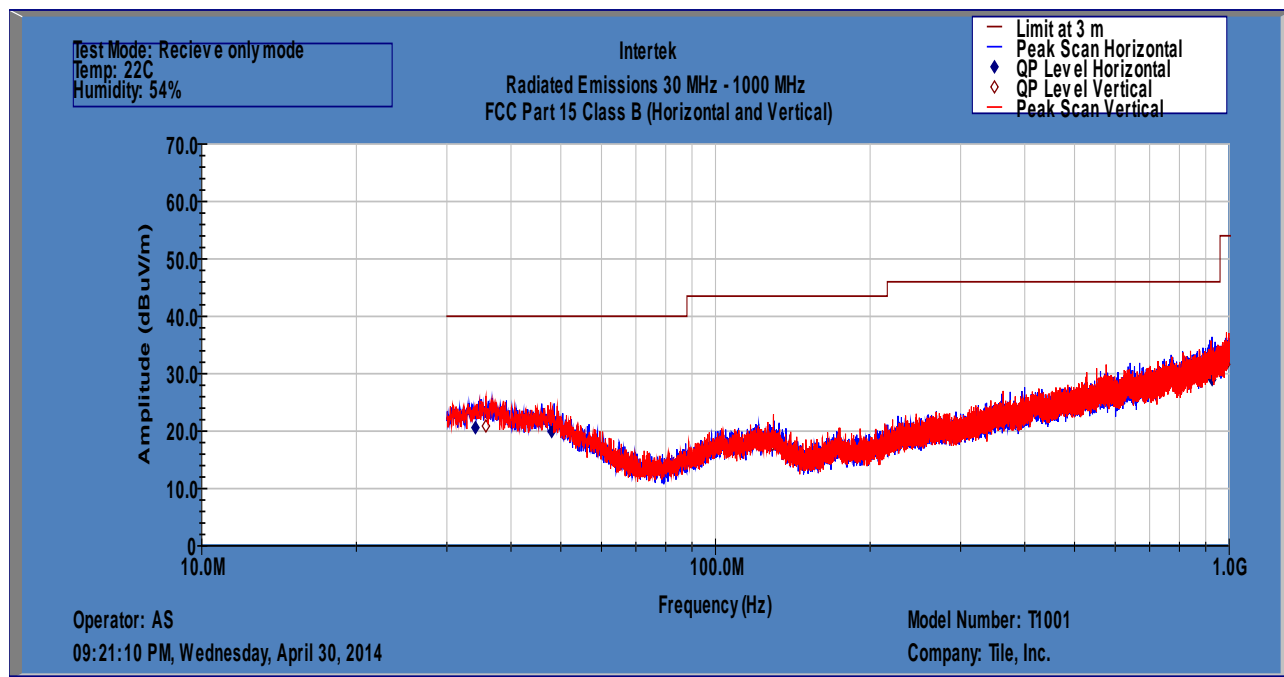
Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material.

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 16 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

Model Number: T1001

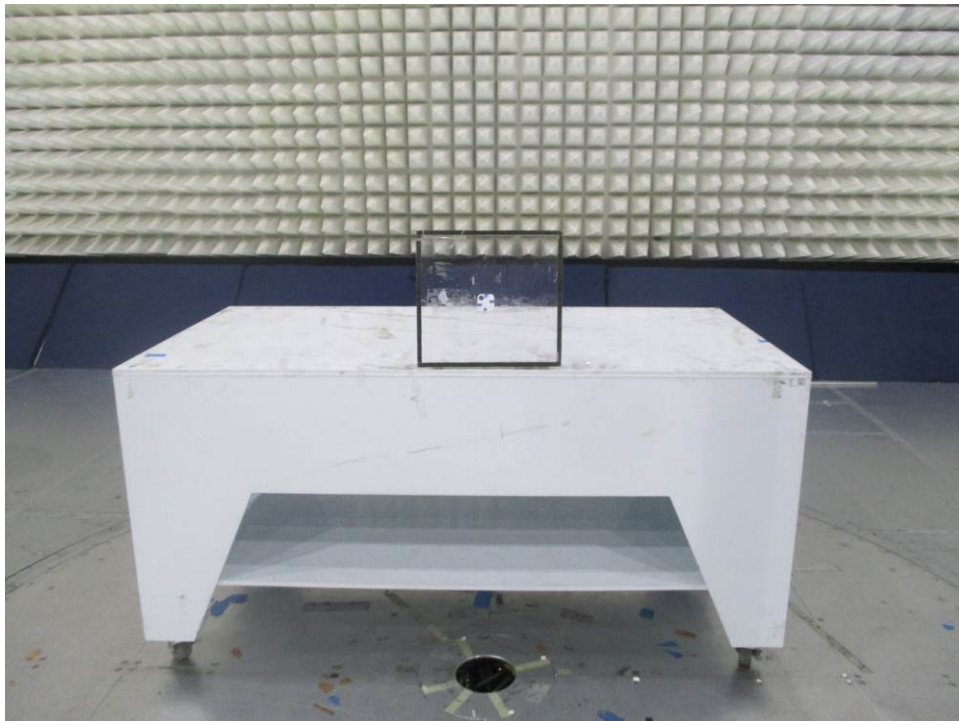
Company: Tile, Inc.

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
34.100	20.6	40.0	-19.4	24.3	0.6	32.1	10.5	17.2	234	100
48.000	19.9	40.0	-20.1	25.4	0.8	32.1	10.5	15.3	123	142
926.300	29.0	46.0	-17.0	24.3	3.6	31.4	10.5	22.0	12	100
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
35.740	20.9	40.0	-19.1	24.6	0.7	32.1	10.5	17.2	321	100
129.200	17.6	43.5	-25.9	26.4	1.2	32.0	10.5	11.6	273	100
986.800	31.6	54.0	-22.4	25.4	3.7	30.9	10.5	22.9	112	142

Result: Complies by 17.0 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.

Results	Not Applicable. EUT is battery powered only.
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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	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	05/13/14
Horn Antenna	ETS Lindgren	3115	ITS 00982	12	11/14/14

No Calibration required

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G101534046	AS	KK	May 15, 2014	Original document