



<b>Test Report No.:</b>		<b>13053102.fcc01</b>	Page 1 of 35
<i>Client:</i>	<b>Tacx b.v.</b> Rijksstraatweg 52, 2241BW Wassenaar, Netherlands		
<i>Test Item:</i>	<b>Digital Transmission System (DTS)</b> <b>USB Antenna</b>		
<i>Identification:</i>	<b>T2028</b>	<i>Serial Number:</i>	--
<i>Project No.:</i>	<b>13053102</b>	<i>Date of Receipt:</i>	<b>July 16, 2013</b>
<i>Testing Location:</i>	<b>TÜV Rheinland EPS</b> Eiberkamp 10 9351VT Leek		
<i>Test Specification:</i>	FCC 47 CFR Part 15, Subpart C, Section 15.247 (10-1-12 Edition) RSS-Gen (issue 3, December 2010) an RSS-210 (Issue 8, December 2010) ANSI C63.10:2009 KDB Publication No. 558074 D01 V3.01: Measurement of Digital Transmission Systems Operating under Section 15.247 (10/4/13)		
<i>Test Result:</i>	The test item <b>passed</b> the test specification(s).		
<i>Testing Laboratory:</i>	<b>TÜV Rheinland EPS</b> Eiberkamp 10 9351 VT Leek		
<i>Tested by:</i>		<i>Reviewed by:</i>	
2013-08-02	R. van der Meer / Inspector	2013-08-02	O. Hoekstra / Reviewer
<i>Date</i>	<i>Name/Position</i>	<i>Signature</i>	<i>Date</i>
			<i>Name/Position</i>
			<i>Signature</i>
<i>Other Aspects:-.</i>			
<i>Abbreviations:</i> P(ass) = passed F(ail) = failed N/A = not applicable NT = not tested			
This report shall not be reproduced, except in full, without the written permission of TÜV Rheinland EPS The test results relate only to the item(s) tested.			

Test Report No.:

**13053102.fcc01**

Page 2 of 35

## TEST SUMMARY

### **5.1.1 CONDUCTED MEASUREMENTS AT ANTENNA PORT**

*RESULT: PASS*

### **5.1.2 6dB AND 99% BANDWIDTH**

*RESULT: PASS*

### **5.1.3 PEAK POWER SPECTRAL DENSITY**

*RESULT: PASS*

### **5.1.4 BAND EDGE CONDUCTED EMISSIONS**

*RESULT: Pass*

### **5.1.5 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER**

*RESULT: PASS*

### **5.1.6 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER IN RESTRICTED BANDS**

*RESULT: PASS*

### **5.2.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER**

*RESULT: PASS*

## Contents

<b>1.</b>	<b>GENERAL REMARKS .....</b>	<b>4</b>
<b>1.1</b>	<b>COMPLEMENTARY MATERIALS .....</b>	<b>4</b>
<b>2.</b>	<b>TEST SITES .....</b>	<b>4</b>
<b>2.1</b>	<b>TEST FACILITIES .....</b>	<b>4</b>
<b>2.2</b>	<b>LIST OF TEST AND MEASUREMENT INSTRUMENTS TABLE 1: LIST OF TEST AND MEASUREMENT EQUIPMENT.....</b>	<b>5</b>
<b>2.3</b>	<b>MEASUREMENT UNCERTAINTY .....</b>	<b>6</b>
<b>3.</b>	<b>GENERAL PRODUCT INFORMATION.....</b>	<b>7</b>
<b>3.1</b>	<b>PRODUCT FUNCTION AND INTENDED USE.....</b>	<b>7</b>
<b>3.2</b>	<b>SYSTEM DETAILS .....</b>	<b>7</b>
<b>3.3</b>	<b>COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....</b>	<b>8</b>
<b>4.</b>	<b>TEST SET-UP AND OPERATION MODES .....</b>	<b>9</b>
<b>4.1</b>	<b>TEST METHODOLOGY .....</b>	<b>9</b>
<b>4.2</b>	<b>OPERATION MODES .....</b>	<b>9</b>
<b>4.3</b>	<b>PHYSICAL CONFIGURATION FOR TESTING .....</b>	<b>10</b>
<b>4.4</b>	<b>TEST SOFTWARE .....</b>	<b>11</b>
<b>4.5</b>	<b>SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT .....</b>	<b>12</b>
<b>5.</b>	<b>TEST RESULTS .....</b>	<b>13</b>
<b>5.1</b>	<b>CONDUCTED MEASUREMENTS AT ANTENNA PORT.....</b>	<b>13</b>
5.1.1	<i>Conducted Output Power.....</i>	<i>13</i>
5.1.2	<i>6dB and 99% Bandwidth.....</i>	<i>16</i>
5.1.3	<i>Peak Power Spectral Density .....</i>	<i>19</i>
5.1.4	<i>Band Edge Conducted Emissions .....</i>	<i>22</i>
5.1.5	<i>Radiated Spurious Emissions of Transmitter.....</i>	<i>25</i>
5.1.6	<i>Radiated Spurious Emissions of Transmitter in restricted bands .....</i>	<i>32</i>
<b>5.2</b>	<b>AC POWER LINE CONDUCTED MEASUREMENTS.....</b>	<b>35</b>
5.2.1	<i>AC Power Line Conducted Emission of Transmitter.....</i>	<i>35</i>

Test Report No.:

**13053102.fcc01**

Page 4 of 35

## **1. General Remarks**

### **1.1 Complementary Materials**

There is no attachment to this test report.

## **2. Test Sites**

### **2.1 Test Facilities**

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland EPS , located in Leek, 9351VT Eiberkamp 10, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-2. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: 120VAC/60Hz
Air pressure	: 950 – 1050 hPa

When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

Test Report No.:

**13053102.fcc01**

Page 5 of 35

## 2.2 List of Test and Measurement Instruments

**Table 1: List of Test and Measurement Equipment**

Kind of Equipment	Manufacturer	Model Name	Inventory number	Calibration date (mm/yyyy)	Calibration due date (mm/yyyy)
<b>For Antenna Port Conducted Emission</b>					
Temperature-Humiditymeter	Extech	SD500	99857	02/2012	02/2014
Spectrum Analyzer	Rohde & Schwarz	FSV	99733	05/2013	05/2014
<b>For Radiated Emission</b>					
Measurement Receiver	Rohde & Schwarz	ESCI	99699	03/2013	03/2014
RF Cable S-AR	Gigalink	APG0500	99858	02/2013	02/2014
Controller	Maturo	SCU/088/8090811	99861	N/A	N/A
Controller	EMCS	DOC202	99608	N/A	N/A
Controller	Heinrich Deisel	4630-100	99107	N/A	N/A
Test facility	Comtest	FCC listed: 90828 IC: 2932G-2	99580/99847	12/2011	12/2014
Spectrum Analyzer	Rohde & Schwarz	FSV	99733	05/2013	05/2014
Controller	EMCS	DOC202	99608	N/A	N/A
Antenna mast	EMCS	AP-4702C	99609	N/A	N/A
Temperature-Humiditymeter	Extech	SD500	99855	02/2012	02/2014
Guidehorn 1-18 GHz	EMCO	3115	12484	04/2013	04/2014
Guidehorn 18-40 GHz	EMCO	RA42-K-F-4B-C	12488	04/2013	04/2014
Biconilog Testantenna	Chase	CBL 6111B	15633	01/2013	01/2014
2.4 GHz bandreject filter	BSC	XN-1783	14450	N/A	N/A
Bandpass filter 4-10 GHz	Reactel	7AS-7G-6G-511	99076	N/A	N/A
Bandpass filter 10-26 GHz	Reactel	9HS-10G/26.5G-S11	99136	N/A	N/A
Preamplifier 0.5 - 18 GHz	Miteq	AMF-5D-005180-28-13p	99596	N/A	N/A
Filterbox	EMCS	RFS06S	99606	10/2012	10/2013

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.

Test Report No.:

**13053102.fcc01**

Page 6 of 35

## 2.3 Measurement Uncertainty

**Table 2: Emission Measurement Uncertainty**

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	±0.5dB
	> 1GHz	±0.7dB
Radiated Emission	150kHz - 30MHz	±5.0dB
	30MHz - 1GHz	±5.0dB
	> 1GHz	±5.5dB

### **3. General Product Information**

#### **3.1 Product Function and Intended Use**

The brand Tacx model T2028, hereafter referred to as EUT, is a wireless network adapter module. The module will support and utilizes GFSK modulation techniques and is connected to a computer by USB.

The content of this report and measurement results have not been changed other than the way of presenting the data.

#### **3.2 System Details**

Details and an overview of the system and all of its components, as it has been tested, may be found below.

EUT	:	Digital Transmission System, USB Antenna
Manufacturer	:	Tacx b.v.
Brand	:	Tacx
Model(s)	:	T2028
Serial Number	:	--
Voltage input rating	:	4.0 to 5.25Vdc (usb power)
Voltage output rating	:	--
Current input rating	:	--
Antenna	:	Internal, integrated on the PCB
Antenna Gain	:	2.0 dBi (declared)
Operating frequency	:	2403MHz-2480MHz.
Modulation	:	GFSK
Remarks	:	n.a.

Test Report No.:

**13053102.fcc01**

Page 8 of 35

**Table 3: Interfaces present on the EUT**

No.	Port	From	To	Remarks
1.	Mains	Mains	Laptop (AUX1)	Through a AC/DC power supply
2.	Data com.	Laptop USB	EUT USB	--
3.	Antenna port	EUT	Spectrum analyzer	Conducted tests

### **3.3 Countermeasures to achieve EMC Compliance**

No additional measures were employed to achieve compliance.



## **4. Test Set-up and Operation Modes**

### **4.1 Test Methodology**

The test methodology used is based on the requirements of RSS-GEN, RSS-210, 47 CFR Part 15, Sections 15.31, 15.33, 15.35, 15.205, 15.207, 15.209, 15.247 and ANSI C63.10:2009

The test methods, which have been used, are based on ANSI C63.10-2009.

For details, see under each test item.

### **4.2 Operation Modes**

Testing was performed at the lowest operating frequency (2403 MHz), at the operating frequency in the middle of the specified frequency band (2442 MHz) and at the highest operating frequency (2480 MHz). These operation modes were selected after review of the capabilities and characteristics of the EUT. The test software as mentioned in section 4.4 enabled the settings of these modes.

The EUT has been tested in the modes as described in table below

<b>Operation Mode</b>	<b>EUT Status</b>	<b>Frequency (MHz)</b>	<b>TX power</b>	<b>Channel period (Hz)</b>
Transmit (Tx)	On	2403	3 (=max)	200 (=max)
Transmit (Tx)	On	2442	3 (=max)	200 (=max)
Transmit (Tx)	On	2480	3 (=max)	200 (=max)

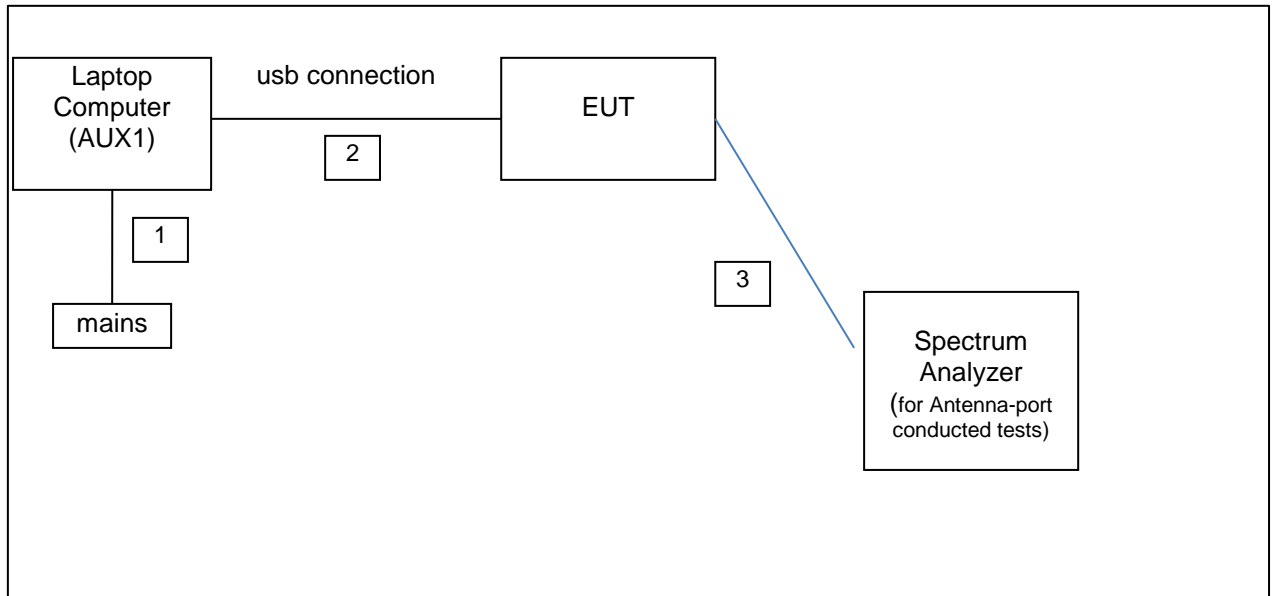
### 4.3 Physical Configuration for Testing

The EUT was connected to the usb port of a laptop computer. The laptop computer was used to configure the EUT to continuously transmit at a specified output power and channel as specified in the testdata. See section 4.5 for Auxiliary details.

The EUT was tested on a stand-alone basis and the test system was configured in a typical fashion (as a customer would normally use it).

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10-2009.

**Figure 1: Test Setup Diagram**



**Notes:**

For more details, refer to the document: Test Set-Up Photographs document.

Test Report No.:

**13053102.fcc01**

Page 11 of 35

#### 4.4 Test Software

A continuous transmit or receive mode could be initiated by using test software as supplied by Intel Corporation. The test software was used to define various different operational modes of the EUT for the purpose of compliance testing. The version of the test software, as supplied by the applicant and used during all tests is:

Test software : ANTware2



This software was running on a laptop computer (AUX1). It was used to enable the test operation modes listed in section 4.2 as appropriate.

*Test Report No.:*

**13053102.fcc01**

*Page 12 of 35*

#### **4.5 Special Accessories and Auxiliary Equipment**

The product has been tested together with the following additional accessories:

1. AUX1  
Product: Laptop Computer  
Brand: HP  
Model: Compaq 610  
Serial Number: CNU94710WB  
Remark: host for testsoftware

Test Report No.:

**13053102.fcc01**

Page 13 of 35

## 5. Test Results

### 5.1 Conducted Measurements at Antenna Port

#### 5.1.1 Conducted Output Power

**RESULT: PASS**

Date of testing: 2013-07-18

Requirements:

FCC 15.247(b)(3)

For systems using digital modulation in the 2400-2483.5 MHz band, the maximum peak output power is 1W (+30dBm).

RSS-Gen: the e.i.r.p. shall not exceed 4 W (36 dBm).

Test procedure:

ANSI C63.10:2009

.

The Peak Conducted Output Power was measured using the channel integration method according to section 9.1.2 in KDB 558074 D01.

The maximum peak output power (conducted) was measured at the antenna connector with a spectrum analyzer. The final measurement takes into account the loss generated by all the involved cables.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Notes:  $mW = 10^{(dBm/10)}$

$dBm = 10 \times \log(mW)$

**plots : Peak power plots,**

Figures 1a, 1b and 1c show plots of the Peak Power outputs, correction factors (= 0.6dB Cableloss) included in the reading.

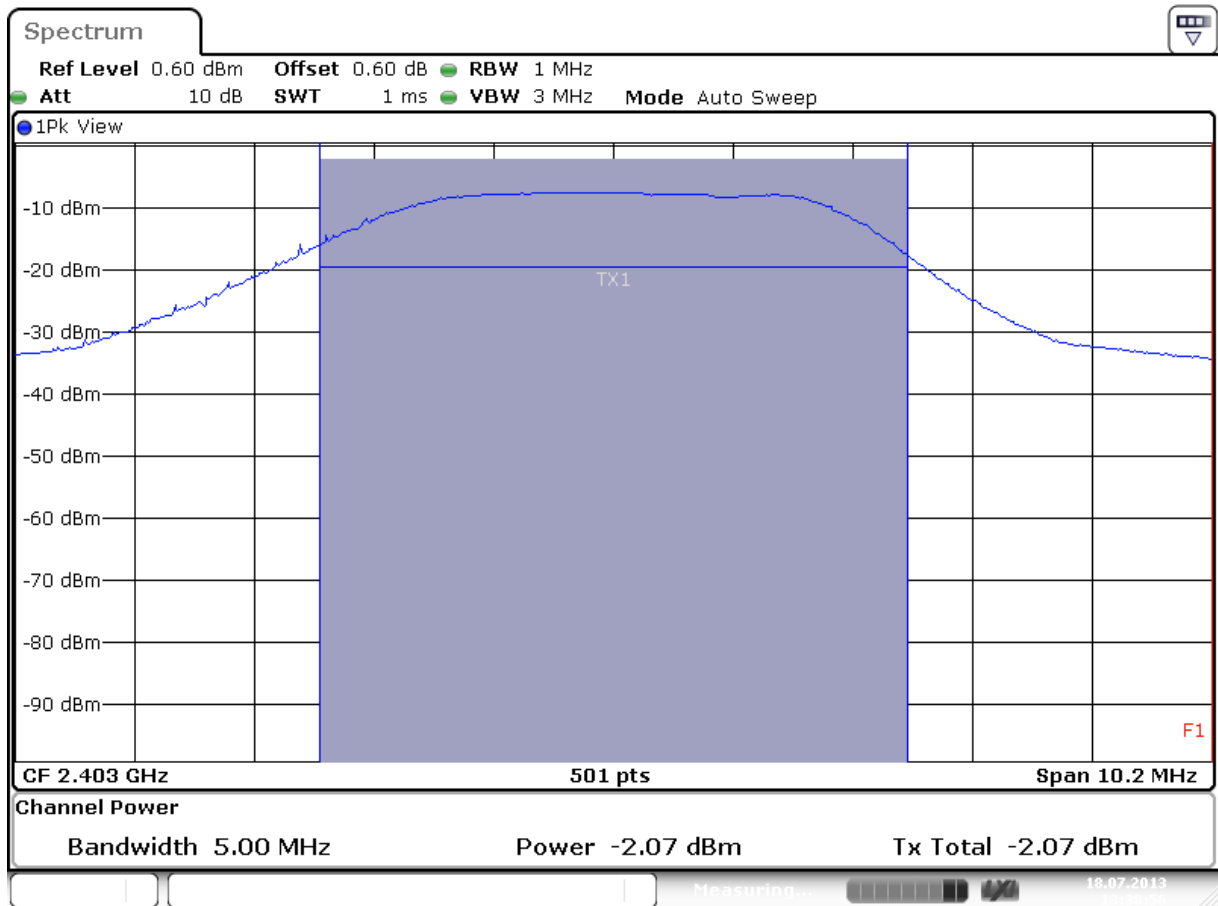
Test Report No.:

**13053102.fcc01**

Page 14 of 35

**Conducted Output Power**

Frequency [MHz]	Output Power [dBm]	Output Power [mW]	Limit [dBm]	Limit [mW]	Antenna Gain (dBi)	EIRP (dBm)	EIRP (mW)	Plot number
2402	-2.1	0.617	+30	1000	2.0	-0.10	0.977	1A
2442	-2.6	0.550	+30	1000	2.0	-0.60	0.871	1B
2480	-5.9	0.257	+30	1000	2.0	-3.90	0.407	1C



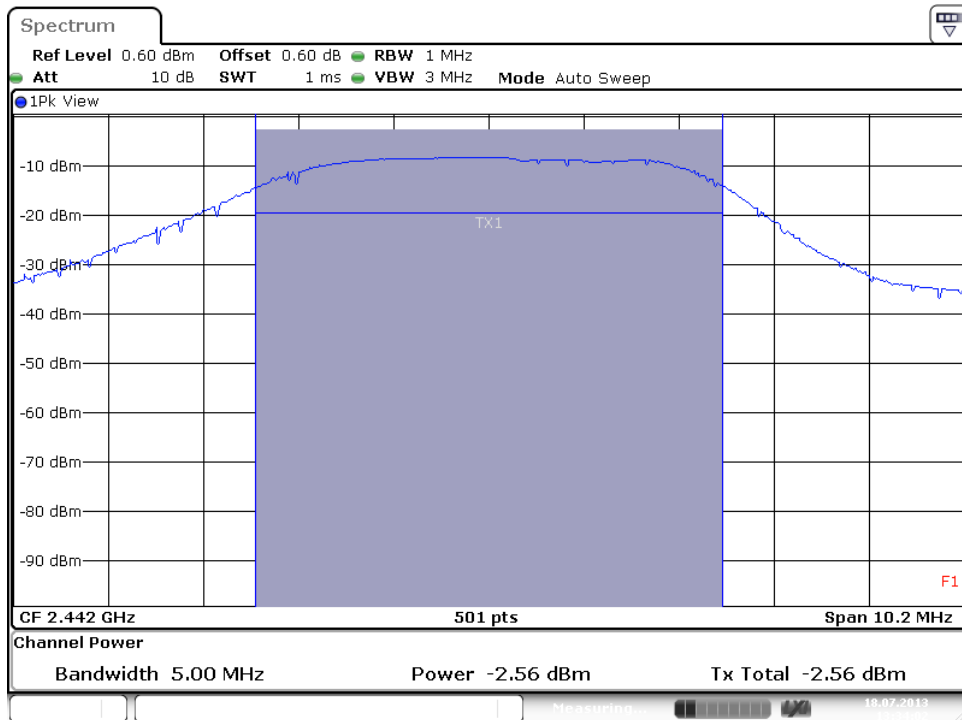
Date: 18.JUL.2013 13:38:57

Plot A

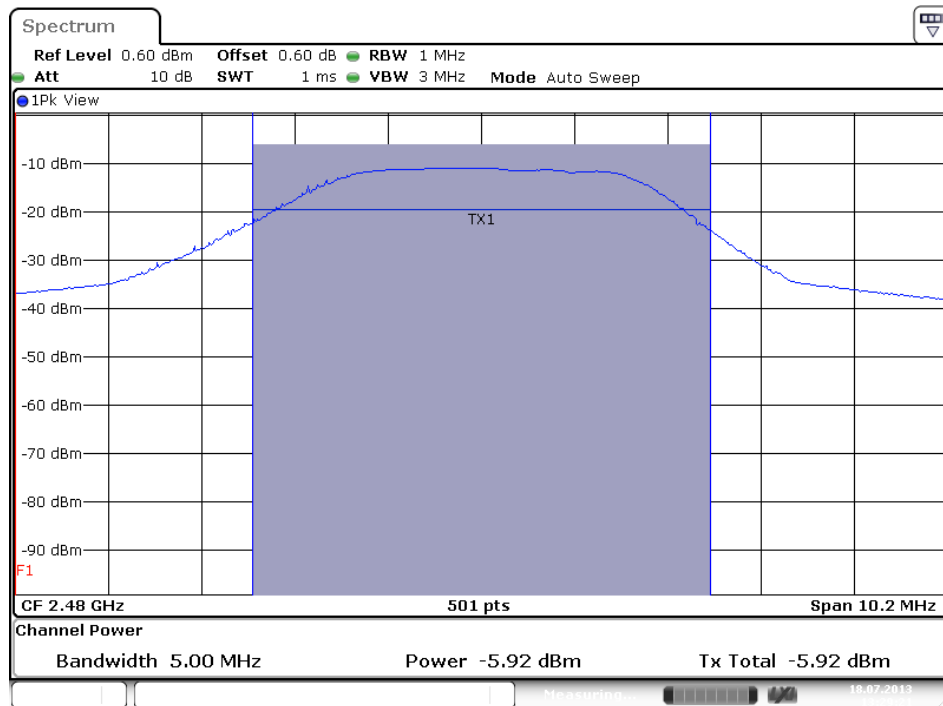
Test Report No.:

**13053102.fcc01**

Page 15 of 35



Plot B



Plot C

Test Report No.:

**13053102.fcc01**

Page 16 of 35

## 5.1.2 6dB and 99% Bandwidth

### RESULT: Pass

Date of testing: 2013-07-18

#### Requirements:

FCC 15.247(a)(2) and RSS-210 Section A8.2(a)

For systems using digital modulation in the 2400-2483.5MHz band, the 6dB bandwidth shall be at least 500kHz.

For 99% Bandwidth: RSS-Gen Section 4.6.1: No requirement is given.

#### Test procedure 6dB bandwidth:

ANSI C63.10:2009

.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 100kHz, video bandwidth to 300kHz and the span wide enough to capture the modulated carrier.

#### For 99% Bandwidth:

ANSI C63.10-2009 and RSS-Gen.

The transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.

A spectrum analyzer was connected to the antenna port of the EUT. The spectrum analyzer resolution bandwidth was set to 1% of the selected span, Video bandwidth was set to 3 times the resolution bandwidth. The span was set to capture the whole modulation process. The Spectrum analyzers automated function for 99% BW was used.

Plots shown on the next pages are of the 6 dB bandwidth.



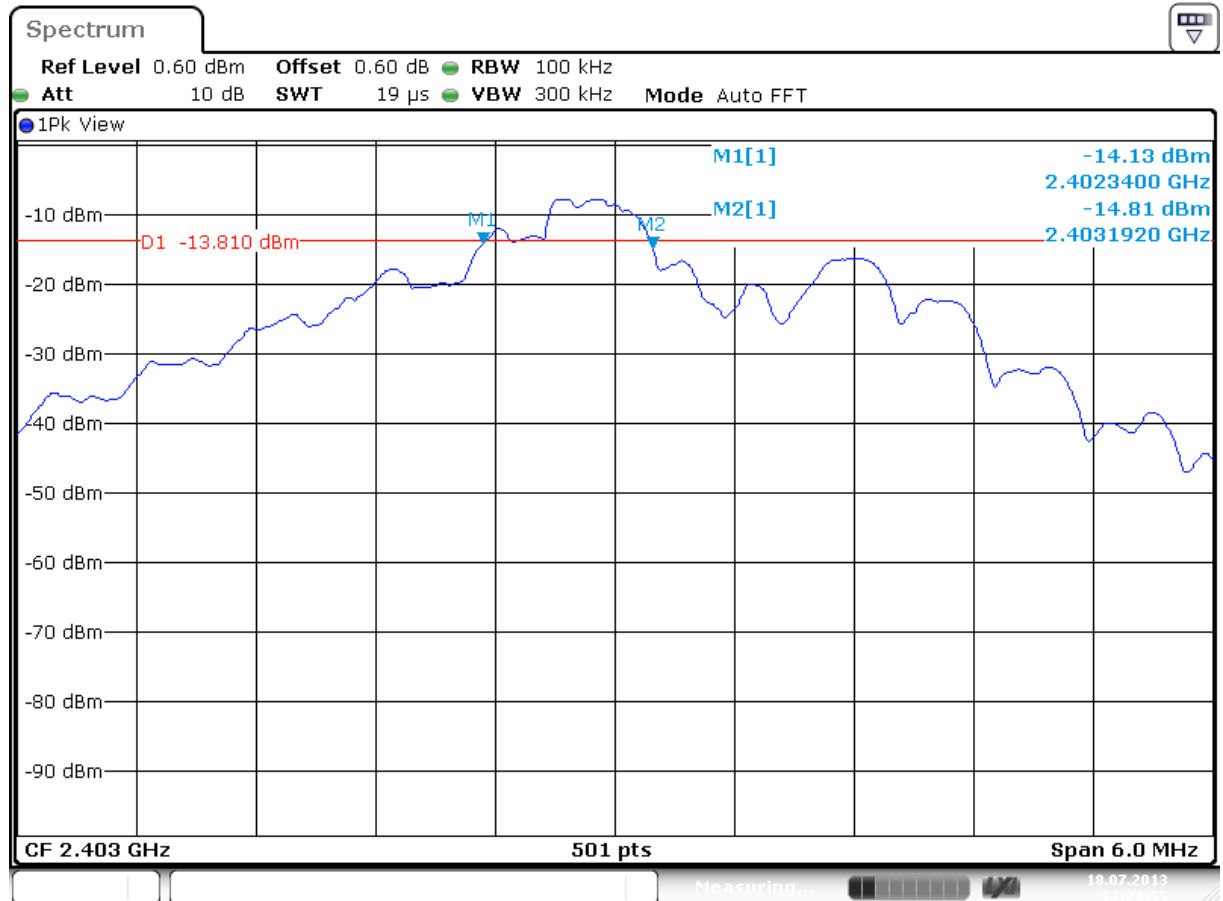
Test Report No.:

**13053102.fcc01**

Page 17 of 35

**6dB Bandwidth**

Operating Frequency [MHz]	99% Bandwidth [kHz]	6dB Bandwidth [kHz]	Limit [kHz]	Plot number
2402	4000	852	>500	A
2442	4623	612	>500	B
2480	3396	888	>500	C



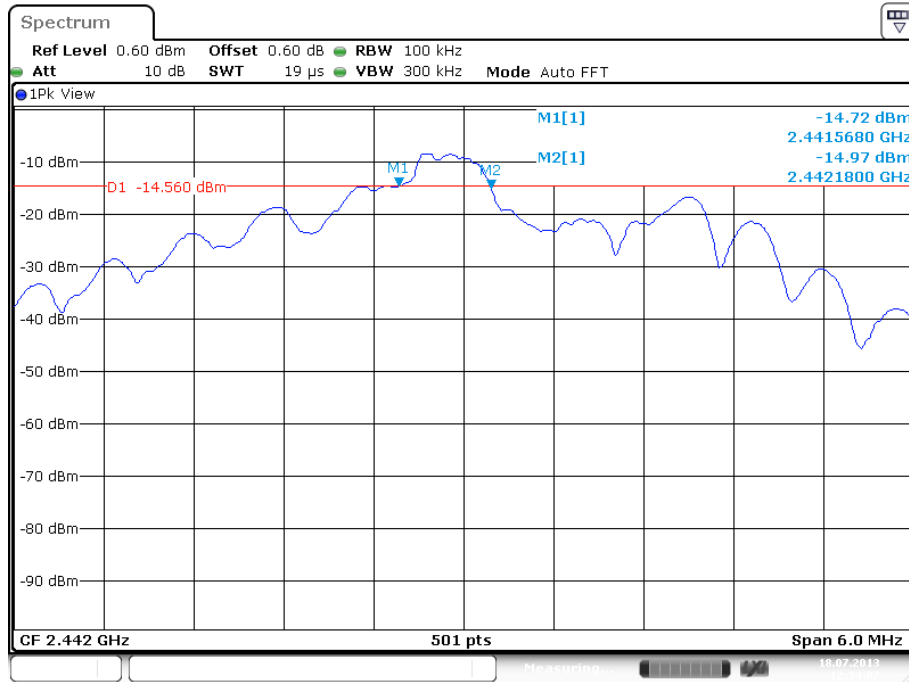
Date: 18. JUL. 2013 12:29:55

Plot A

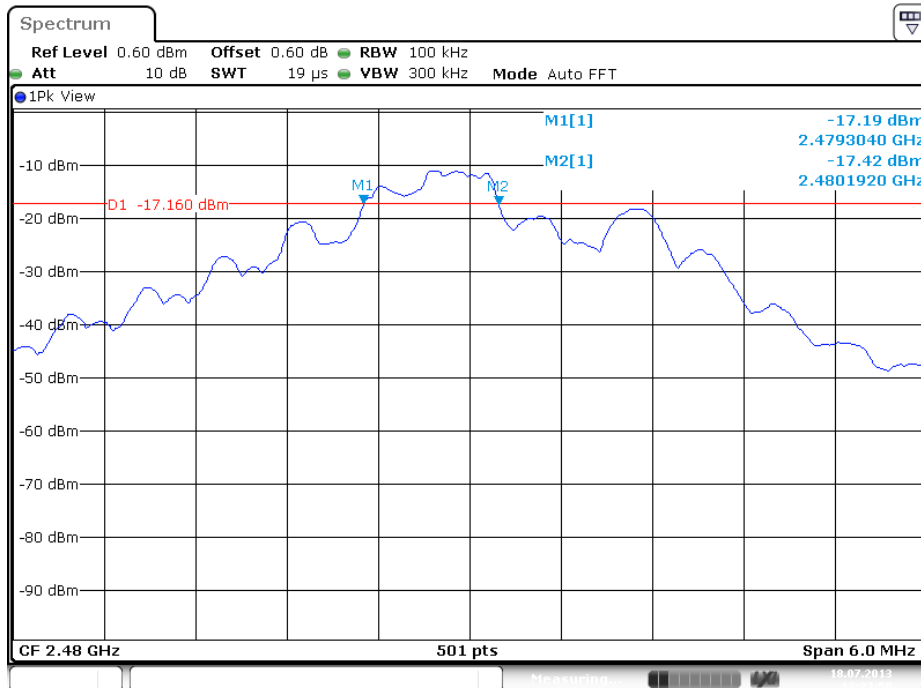
Test Report No.:

**13053102.fcc01**

Page 18 of 35



Plot B



Plot C

Test Report No.:

**13053102.fcc01**

Page 19 of 35

### **5.1.3 Peak Power Spectral Density**

**RESULT: Pass**

Date of testing: 2013-07-18

Requirements:

FCC 15.247(e) and RSS-210 section A8.2(b)

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

Test procedure:

ANSI C63.10:2009

The section 10.2 PKPSD peak PSD procedure was used. A spectrum analyzer was connected to the antenna port of the EUT. The analyzer resolution bandwidth was set to 3kHz and the video bandwidth was set to 10kHz. The sweep time was set to auto couple and the trace was allowed to stabilize before making the final measurement. By using the Peak marker function the maximum amplitude was determined. The final measurement takes into account the loss generated by all the involved cables (0.6 dB).

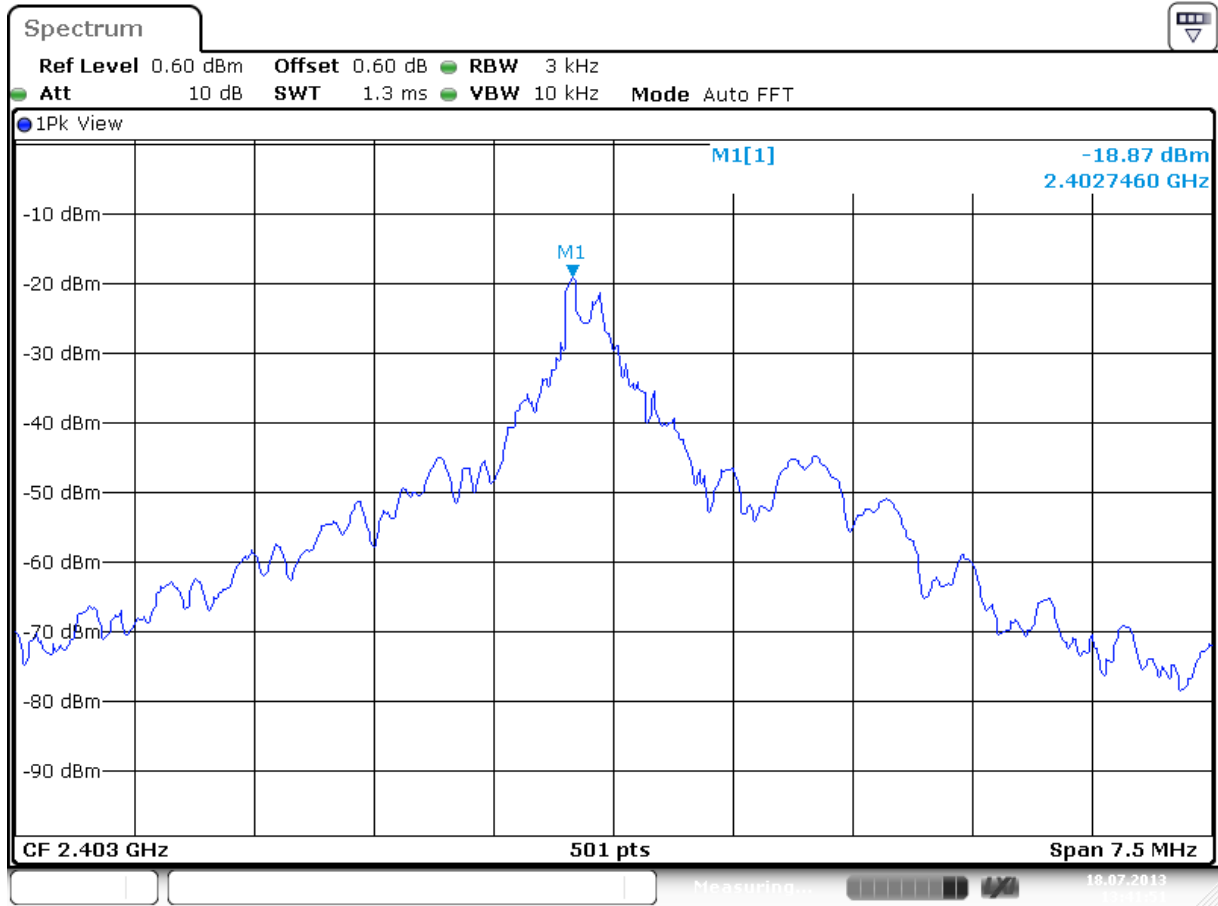
Test Report No.:

**13053102.fcc01**

Page 20 of 35

**Peak Power Spectral Density**

Operating Frequency [MHz]	Max PSD [dBm]	Limit [dBm]	Verdict [Pass/Fail]	Plot
2402	-18.87	8	Pass	A
2442	-19.03	8	Pass	B
2480	-21.36	8	Pass	C



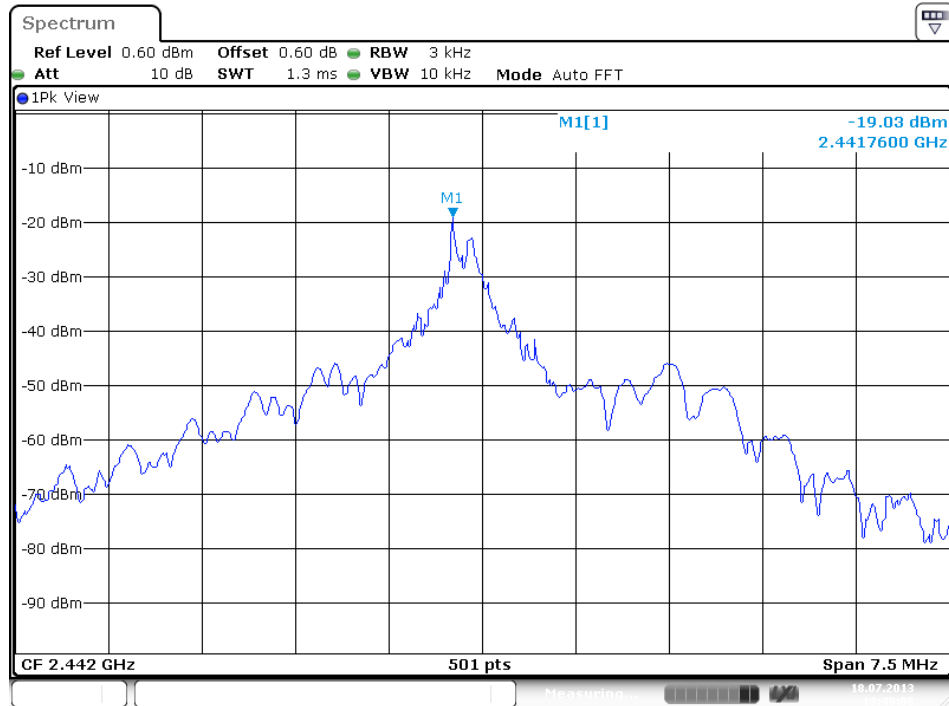
Date: 18.JUL.2013 13:41:51

Plot A:

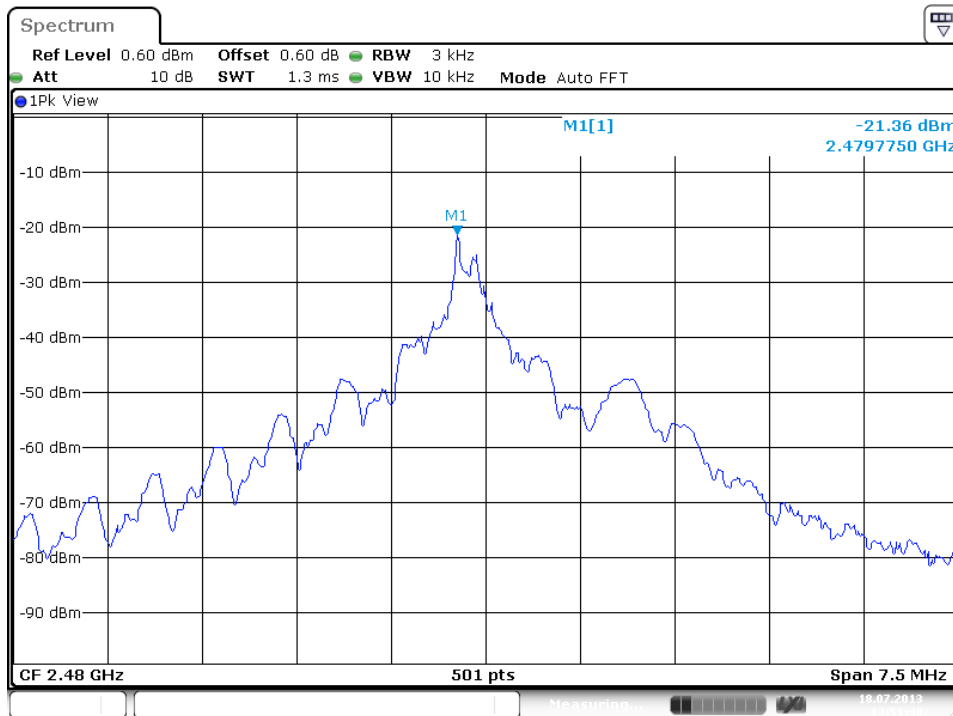
Test Report No.:

**13053102.fcc01**

Page 21 of 35



Plot B



Plot C

Test Report No.:

**13053102.fcc01**

Page 22 of 35

## 5.1.4 Band Edge Conducted Emissions

**RESULT: Pass**

Date of testing: 2013-07-18

Requirements:

FCC 15.205, FCC 15.209, FCC 15.247(d) and RSS-210 section A8.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test procedure:

ANSI C63.10:2009

.

The marker-delta method, as described in ANSI C63.10 was used.

Measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings:  
RBW = 100kHz, VBW = 300kHz.

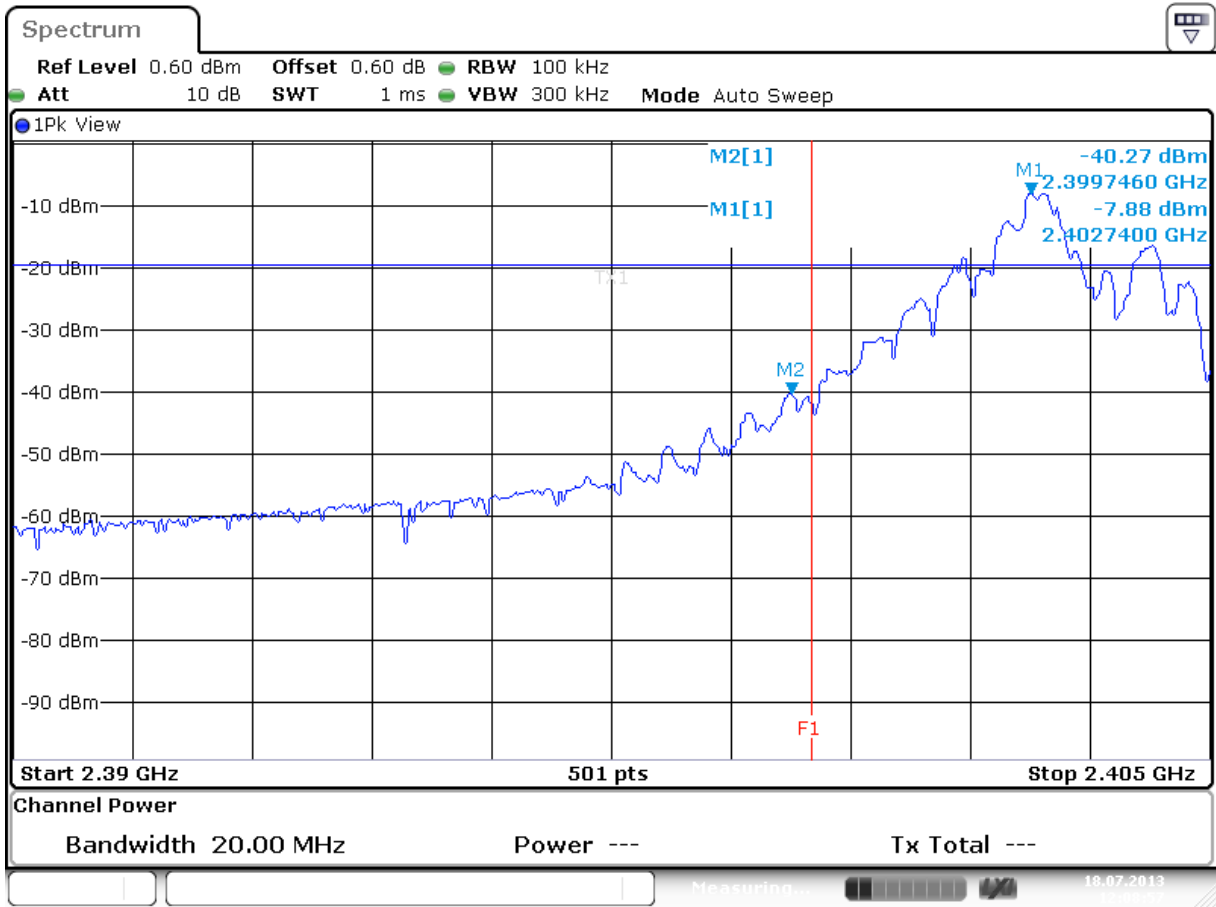
The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Results: All out of band spurious emissions are more than 20 dB below the fundamental. See the figures on the following pages.

Test Report No.:

**13053102.fcc01**

Page 23 of 35



Date: 18.JUL.2013 12:08:58

Plot: Band Edge Conducted Emission, Spectral Diagram, 2403 MHz

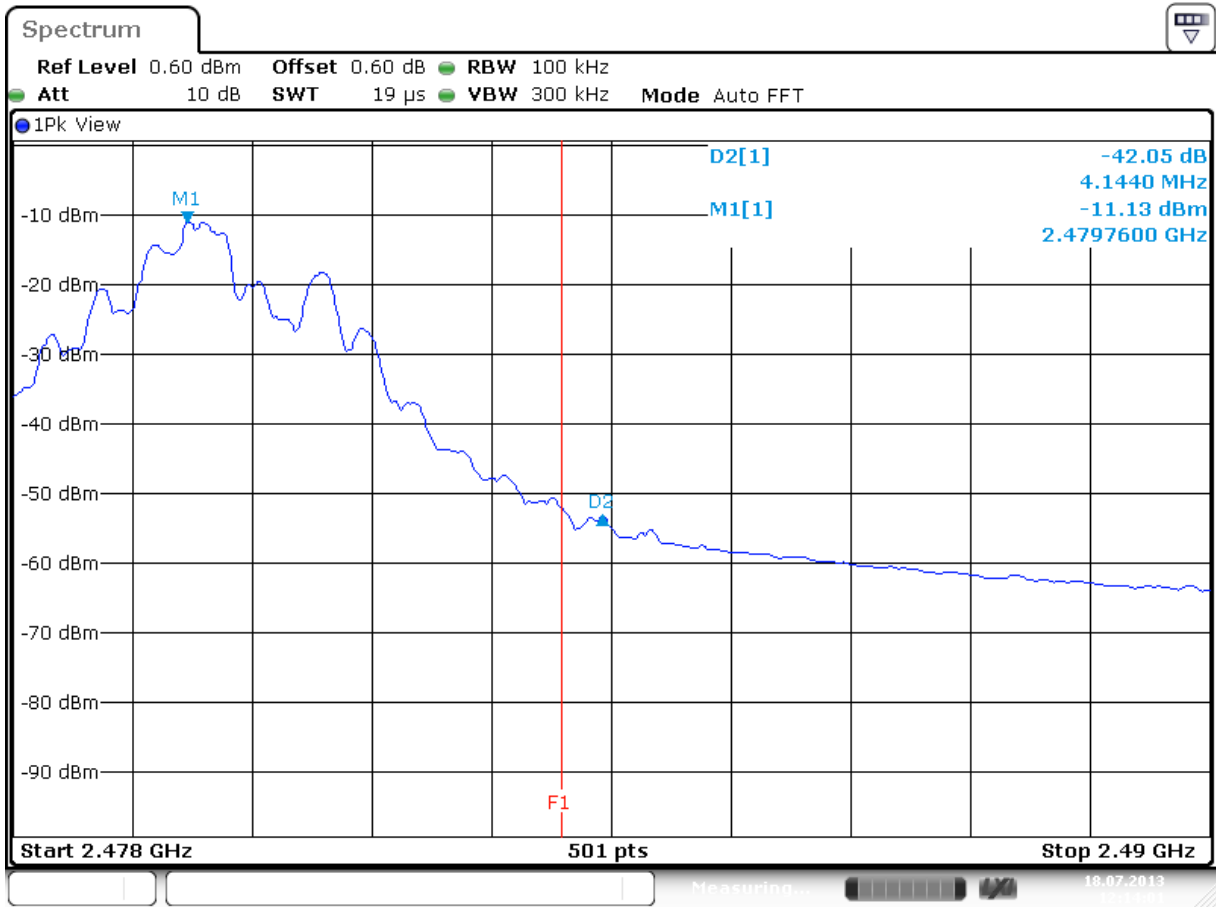
Plot showing more than 20 dB band edge attenuation.

F1 shows the band edge frequency of 2400 MHz.

Test Report No.:

**13053102.fcc01**

Page 24 of 35



Date: 18.JUL.2013 12:14:01

Plot: Band Edge Conducted Emission, Spectral Diagram, 2480 MHz.  
Plot showing more than 20 dB band edge attenuation.  
F1 shows the band edge frequency of 2483,5 MHz.



Test Report No.:

**13053102.fcc01**

Page 25 of 35

## 5.1.5 Radiated Spurious Emissions of Transmitter

### RESULT: Pass

Date of testing: 2013-07-19 and 2013-07-23

Frequency range: 30MHz - 25GHz

Requirements:

FCC 15.209 and FCC 15.247(d) and RSS-Gen

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC 15.209(a) or be attenuated at least 20dB below the power level in the 100kHz bandwidth within the band that contains the highest level of the desired power (the less severe limit applies).

Test procedure:

ANSI C63.10:2009

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz). Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit.

Correction factors are incorporated in the spectrum analyzers as an automated function. Refer to section 4.2 for the power settings and modes.

Correction factors includes: antenna factor, cable loss and pre-amplifier gain.

Test Report No.:

**13053102.fcc01**

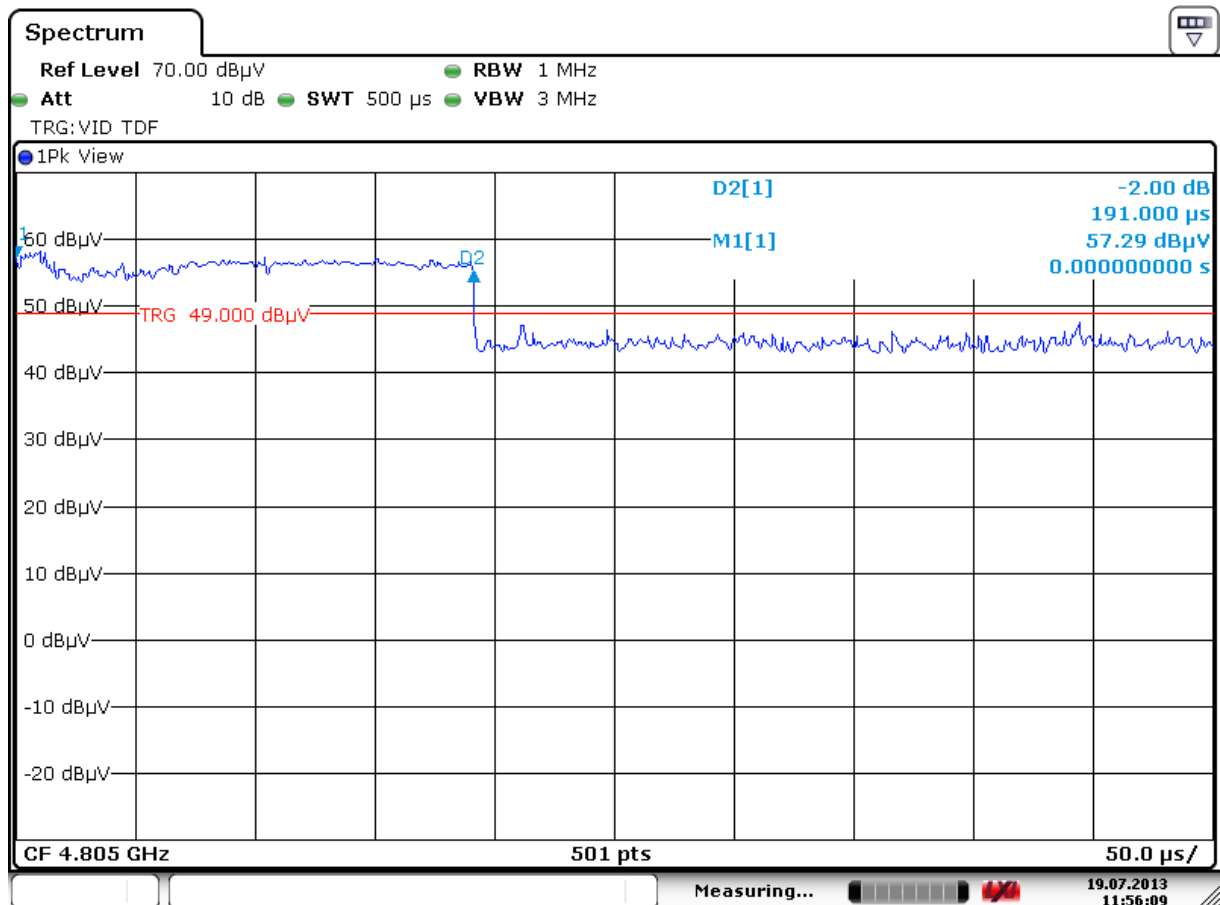
Page 26 of 35

For the range 1 GHz - 25 GHz measured peak levels are corrected with a Duty Cycle Correction Factor to calculate the Average value.

### Duty Cycle correction

Duty cycle correction factor (Cf) = 20 Log (RF On time / Repetition rate)  
Cf = 20 Log (0.191 ms / 10 ms) = -34.38 dB.

The plots below and on the next page provide the RF On time and Repetition rate data.



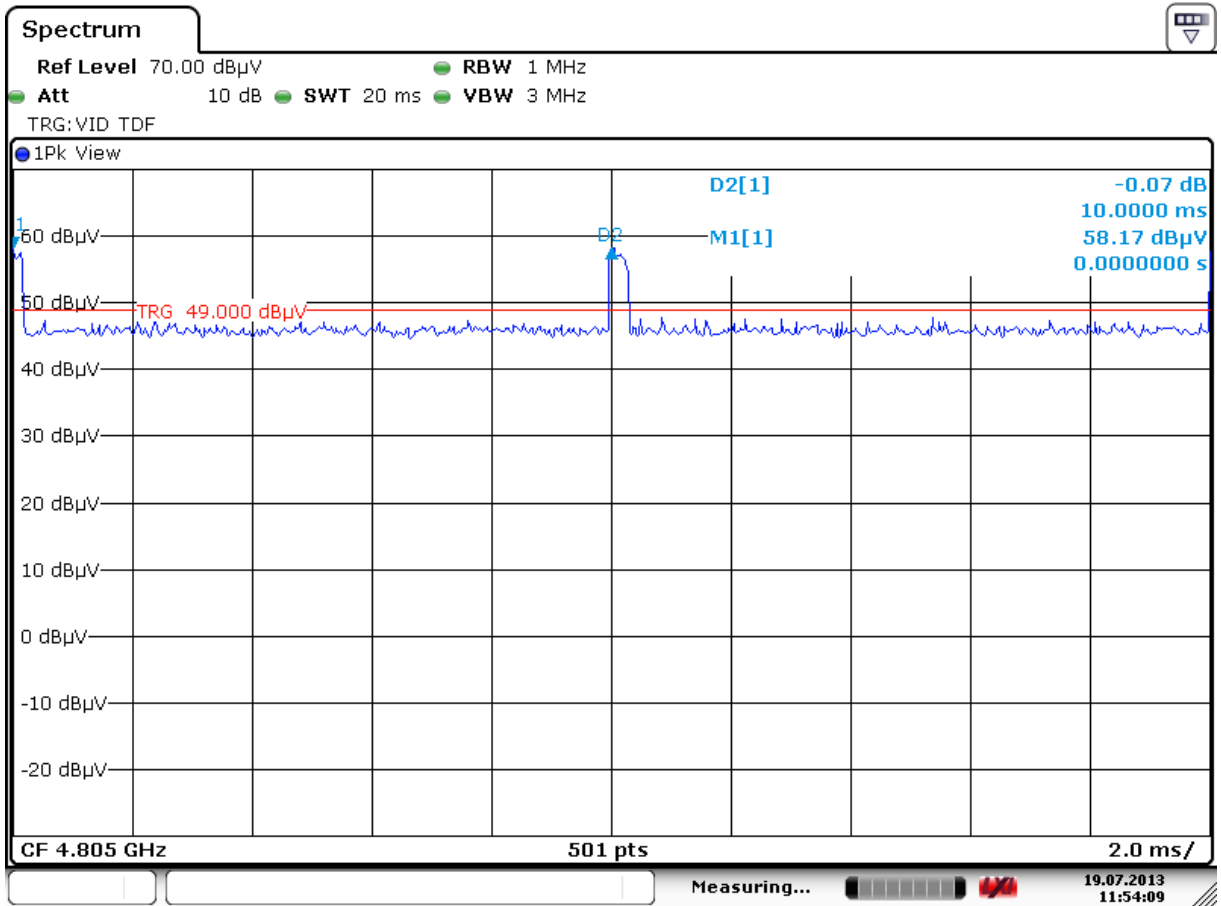
Date: 19.JUL.2013 11:56:08

Plot: RF On time is 0.191 ms as measured on a spectrum analyzer.

Test Report No.:

**13053102.fcc01**

Page 27 of 35



Date: 19.JUL.2013 11:54:09

Plot: Repetition Rate is 10.00 ms as measured on a spectrum analyzer.

Test Report No.:

**13053102.fcc01**

Page 28 of 35

**Radiated Emission, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations**

<b>Freq. [MHz]</b>	<b>Antenna Orientation</b>	<b>Level QP [dBµV/m]</b>	<b>Limit [dBµV/m]</b>	<b>Margin [dB]</b>
48.000 <small>(harmonic of the 16.000 MHz crystal osc.)</small>	Horizontal	27.8	40.0	12.2
115.36	Vertical	29.8	43.5	13.7
183.26	Horizontal	23.9	43.5	19.6
206.54	Vertical	25.6	43.5	17.9
346.22	Vertical	35.1	46.0	10.9
528.58	Horizontal	35.7	46.0	10.3
534.40	Vertical	35.9	46.0	10.1

- Note:
- Level QP = Reading QP + Factor
  - Tested in modes as described in section 4.2, highest values noted.
- Preliminary measurements indicated that the radiated emissions from EUT were not affected by the EUT's operating frequency.
- Quasi Peak detector used with a bandwidth of 120 kHz

Test Report No.:

**13053102.fcc01**

Page 29 of 35

**Radiated Emission, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2403 MHz, Peak values.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
1930.2	Vertical	Pk	1	49.0	74	-25.0
1997.7	Vertical	Pk	1	54.6	74	-19.4
3193.0	Vertical	Pk	1	44.4	74	-29.6
3602.0	Vertical	Pk	1	47.7	74	-26.3
3997.0	Vertical	Pk	1	47.5	74	-26.5
4806.0 (harmonic)	Vertical	Pk	1	65.4	74	-8.6
9608.8 (harmonic)	Vertical	Pk	1	53.8	74	-20.2

**Radiated Emission, 1 - 25GHz, 2403 MHz, calculated Average values.**

Frequency [MHz]	Level [dB $\mu$ V/m]	Detector	Duty Cycle Correction factor (dB)	Calculated Av Level [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
1930.2	49.0	Pk	-34.2	14.8	54	-39.2
1997.7	54.6	Pk	-34.2	20.4	54	-33.6
3193.0	44.4	Pk	-34.2	10.2	54	-43.8
3602.0	47.7	Pk	-34.2	13.5	54	-40.5
3997.0	47.5	Pk	-34.2	13.3	54	-40.7
4806.0 (harmonic)	65.4	Pk	-34.2	31.2	54	-22.8
9608.8 (harmonic)	53.8	Pk	-34.2	19.6	54	-34.4

Test Report No.:

**13053102.fcc01**

Page 30 of 35

**Radiated Emission, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2442 MHz, Peak values.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1448.5	Horizontal	Pk	1	46.0	74	-8.0
1660.9	Vertical	Pk	1	48.7	74	-25.3
1996.2	Vertical	Pk	1	55.7	74	-18.3
2194.6	Vertical	Pk	1	49.4	74	-24.6
4884.0 (harmonic)	Vertical	Pk	1	60.9	74	-13.1
7007.0	Vertical	Pk	1	53.1	74	-20.9
8777.1		Pk	1	45.7	74	-28.3

**Radiated Emission, 1 - 25GHz, 2442 MHz, calculated Average values.**

Frequency [MHz]	Level [dBµV/m]	Detector	Duty Cycle Correction factor (dB)	Calculated Av Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1448.5	46.0	Pk	-34.2	11.8	54	-42.2
1660.9	48.7	Pk	-34.2	14.5	54	-39.5
1996.2	55.7	Pk	-34.2	21.5	54	-32.5
2194.6	49.4	Pk	-34.2	15.2	54	-38.8
4884.0 (harmonic)	60.9	Pk	-34.2	26.7	54	-27.3
7007.0	53.1	Pk	-34.2	18.9	54	-35.1
8777.1	45.7	Pk	-34.2	11.5	54	-42.5

Test Report No.:

**13053102.fcc01**

Page 31 of 35

**Radiated Emission, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, 2480 MHz, Peak values.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1439.8	Horizontal	Pk	1	47.2	74	-26.8
1660.4	Horizontal	Pk	1	47.3	74	-26.7
1805.7	Vertical	Pk	1	57.8	74	-16.2
1904.3	Vertical	Pk	1	58.8	74	-15.2
1995.1	Vertical	Pk	1	58.8	74	-15.2
2200.1	Vertical	Pk	1	47.0	74	--27.0
3594.0	Vertical	Pk	1	49.9	74	-24.1
4382.0	Vertical	Pk	1	48.3	74	-25.7
4960 (harmonic)	Vertical	Pk	1	63.4	74	-10.6
9920.2 (harmonic)	Vertical	Pk	1	46.6	74	-27.4

**Radiated Emission, 1 - 25GHz, 2480 MHz, calculated Average values.**

Frequency [MHz]	Level [dBµV/m]	Detector	Duty Cycle Correction factor (dB)	Calculated Av Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1439.8	47.2	Pk	-34.2	13.0	54	-41.0
1660.4	47.3	Pk	-34.2	13.1	54	-40.9
1805.7	57.8	Pk	-34.2	23.6	54	-30.4
1904.3	58.8	Pk	-34.2	24.6	54	-29.4
1995.1	58.8	Pk	-34.2	24.6	54	-29.4
2200.1	47.0	Pk	-34.2	12.8	54	-41.2
3594.0	49.9	Pk	-34.2	15.7	54	-38.3
4382.0	48.3	Pk	-34.2	14.1	54	-39.9
4960 (harmonic)	63.4	Pk	-34.2	29.2	54	-24.8
9920.2 (harmonic)	46.6	Pk	-34.2	12.4	54	-41.6

Test Report No.:

**13053102.fcc01**

Page 32 of 35

## 5.1.6 Radiated Spurious Emissions of Transmitter in restricted bands

### RESULT: Pass

Date of testing: 2013-07-19 and 2013-07-23

Frequency range: 30 MHz to 25 GHz

#### Requirements:

FCC 15.205, FCC 15.209 and FCC 15.247(d) and RSS-Gen

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

#### Test procedure:

ANSI C63.10-2009.

The EUT was placed on a nonconductive turntable 0.8m above the ground plane. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 30 MHz to 25 GHz. Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit.

Correction factors are incorporated in the spectrum analyzers as an automated function.

Refer to section 4.2 for the power settings and modes.

Correction factors includes: antenna factor, cable loss and pre-amplifier gain.

Where applicable measured peak levels are corrected with a Duty Cycle Correction Factor to calculate the Average value.



Test Report No.:

**13053102.fcc01**

Page 33 of 35

**Radiated Emission in restricted bands, 1 - 25GHz,  
 Horizontal and Vertical Antenna Orientations, 2403 MHz, Peak values.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1201.1	Vertical	Pk	1	47.9	Av=54 / Pk=74	-6.1
1930.2	Vertical	Pk	1	49.0	Av=54 / Pk=74	-5.0
1997.7	Vertical	Pk	1	53.6	Av=54 / Pk=74	-0.4
2202.0	Vertical	Pk	1	50.0	Av=54 / Pk=74	-4.0
2389.6	Vertical	Pk	1	53.0	Av=54 / Pk=74	-1.0
2485.4	Vertical	Pk	1	45.7	Av=54 / Pk=74	--8.3

Note: - Peak (Pk) levels already within Average (Av) limits, therefor Av not tested.  
 - Margin is compared to Av limit.

**Radiated Emission in restricted bands, 1 - 25GHz,  
 Horizontal and Vertical Antenna Orientations, 2442 MHz, Peak values.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1222.2	Horizontal	Pk	1	47.8	Av=54 / Pk=74	-6.2
2200.1	Vertical	Pk	1	46.4	Av=54 / Pk=74	-7.6
2389.3	Vertical	Pk	1	46.8	Av=54 / Pk=74	-7.2
2499.9	Vertical	Pk	1	48.2	Av=54 / Pk=74	-5.8

Note: - Peak (Pk) levels already within Average (Av) limits, therefor Av not tested.  
 - Margin is compared to Av limit.

Test Report No.:

**13053102.fcc01**

Page 34 of 35

**Radiated Emission in restricted bands, 1 - 25GHz,  
 Horizontal and Vertical Antenna Orientations, 2480 MHz, Peak values.**

Frequency [MHz]	Antenna Orientation	Detector	Bandwidth (MHz)	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1022.1	Vertical	Pk	1	56.1	74	17.9
1068.8	Vertical	Pk	1	54.1	74	19.9
1144.0	Vertical	Pk	1	56.6	74	17.4
1175.1	Vertical	Pk	1	53.1	74	20.9
1317.9	Vertical	Pk	1	55.6	74	18.4
1336.0	Vertical	Pk	1	57.2	74	16.8
1351.6	Vertical	Pk	1	65.1	74	8.9
1356.8	Vertical	Pk	1	54.3	74	19.7
1411.3	Vertical	Pk	1	55.3	74	18.7
1566.6	Vertical	Pk	1	56.9	74	17.1
1665.6	Vertical	Pk	1	56.5	74	17.5
2293.5	Vertical	Pk	1	60.4	74	13.6
2483.6	Vertical	Pk	1	70.6	74	3.4

**Radiated Emission in restricted bands, 1 - 25GHz, 2480 MHz,  
 calculated Average values.**

Frequency [MHz]	Level [dBµV/m]	Detector	Duty Cycle Correction factor (dB)	Calculated Av Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]
1022.1	56.1	Pk	-34.2	21.9	54	32.1
1068.8	54.1	Pk	-34.2	19.9	54	34.1
1144.0	56.6	Pk	-34.2	22.4	54	31.6
1175.1	53.1	Pk	-34.2	18.9	54	35.1
1317.9	55.6	Pk	-34.2	21.4	54	32.6
1336.0	57.2	Pk	-34.2	23.0	54	31.0
1351.6	65.1	Pk	-34.2	30.9	54	23.1
1356.8	54.3	Pk	-34.2	20.1	54	33.9
1411.3	55.3	Pk	-34.2	21.1	54	32.9
1566.6	56.9	Pk	-34.2	22.7	54	31.3
1665.6	56.5	Pk	-34.2	22.3	54	31.7
2293.5	60.4	Pk	-34.2	26.2	54	27.8
2483.6	70.6	Pk	-34.2	36.4	54	17.6

Note: calculated average values are obtained by subtracting the Peak level with the Duty cycle factor. Duty cycle factor details are provided on page 26.

*Test Report No.:*

**13053102.fcc01**

*Page 35 of 35*

## **5.2 AC Power Line Conducted Measurements**

### **5.2.1 AC Power Line Conducted Emission of Transmitter**

AC power line conducted emissions are included in the Part 15B/ICES-003 testreport.  
Refer to documentnumber 13b\_2AAMI-T2028\_Testreport\_FCC-15B-ICES003.

End of report