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No. 1 / 1**224568II**

Date of handing in: 23.11.2012

Tested by:



Pekka Kälviäinen, Test Engineer

Reviewed by:



Timo Hietala, Test Engineer

SORT OF EQUIPMENT:

**2.4 GHz Transceiver**

TRADE MARK:

**SCANRECO**

TYPE:

**G5 LP1, G5 LP2, G5 LP3, G5 LP4, G5 LP5, G5 LP6, G5 LP7, G5 LP8**

MANUFACTURER:

**Scanreco Industrietechnik AB**

CLIENT:

**Scanreco Industrietechnik AB**

ADDRESS:

**Årsta Skolgränd 22, S – 100 74 Stockholm, Sweden**

TEST LABORATORY:

**Nemko Oy**

FCC REG. NO.

**359859 October 20, 2011**

IC FILE NO.

**2040F-1 November 22, 2012****SUMMARY:**

In regard to the performed tests the equipment under test fulfils the requirements defined in the test specifications, see page 2 for details

The test results are valid for the tested unit only. Without a written permission of Nemko Oy it is allowed to copy this report as a whole, but not partially.

### Summary of performed tests and test results

<i>Section in CFR 47</i>	<i>Section in RSS-GEN or RSS-210</i>		<i>Result</i>
15.249 (a)	A2.9	Field strength of fundamental	PASS
15.249 (d)(e), 15.209	A2.9	Band-edge compliance of RF emissions	PASS
15.249 (d)(e), 15.209	A2.9	Spurious radiated emissions	PASS
15.207	7.2.2	AC power line conducted emissions	N.A.

Explanations:

- PASS The EUT passed that particular test.  
FAIL The EUT failed that particular test.  
N.A. The test not applicable, battery operated equipment  
X The measurement was done, but there is no applicable performance criteria.

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## 1. EUT and Accessory Information

### 1.1 EUT description

2.4 GHz transceiver, Digital modulated, 16 channels  
 Type: G5 LP1, G5 LP2, G5 LP3, G5 LP4, G5 LP5, G5 LP6, G5 LP7, G5 LP8

### 1.2 EUT and accessories

	<i>unit</i>	<i>type</i>	<i>s/n</i>
<i>EUT1</i>	Tranceiver	G5	5

Operating voltages

**4.5 VDC 3 \* AAA Battery**

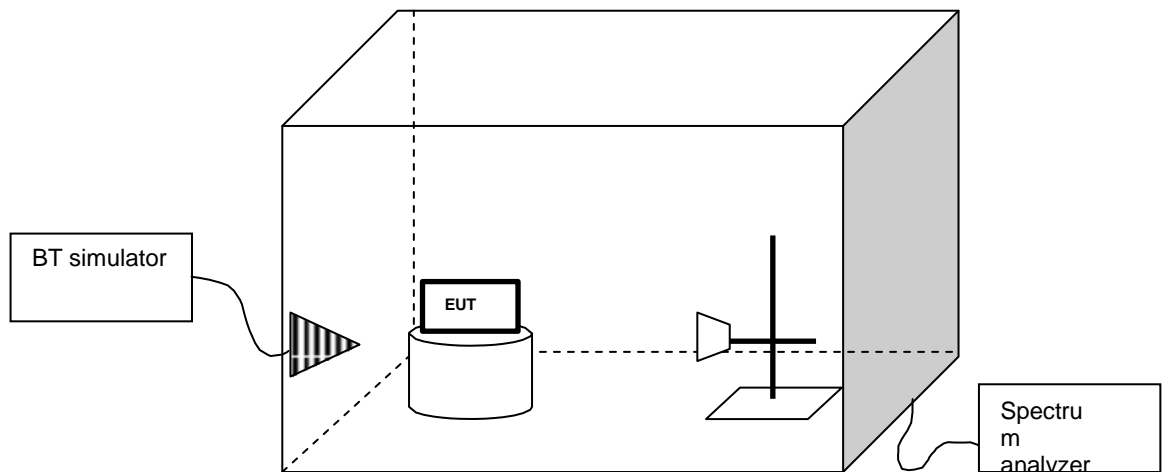
### 1.3 Additional information related to testing

Tested Technology:	<b>Digital modulated, 16 channels</b>	
Antenna:	<b>Integral, gain 5.5dBi</b>	
Type of Unit	<b>Transmitter</b>	
Modulation:	<b>DSSS, continuous transmission</b>	
Power Supply Requirement:	<b>Nominal</b>	<b>4.5V</b>
Transmit Frequency Range	<b>2400 MHz to 2483.5 MHz</b>	
Transmit Channels Tested:	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	<b>0</b>	<b>2405</b>
	<b>7</b>	<b>2440</b>
	<b>15</b>	<b>2480</b>

## 2. Test setups

### Setup (Radiated measurements)

The test was performed inside a semi anechoic shielded room. For the duration of the test the EUT was placed on a non-conductive support 0.8 m high standing on the turntable. The tower and turn table were remotely controlled to turn the EUT and change the antenna polarization. The measured signal was routed from the measuring antenna to the spectrum analyzer. A BT simulator was not used.



### 3. Standards and measurement methods

The test were performed in guidance of the CFR 47, FCC Rules Part 15 Subpart C, ANSI C63.4 (2003), CISPR 22 Ed. 6.0, Public notice DA 00-705, ANSI C63.10 (2009), IC standards RSS-GEN (Issue 3, December 2010) and RSS-210 (Issue 8, December 2010).

### 4. Test results

#### 4.1 Field strength of fundamental

The test was performed as a compliance test. The test parameters concerned were as follows:

<i>EUT</i>	<b>EUT1</b>
<i>Site name</i>	<b>Nemko Oy / Perkkaa</b>
<i>FCC rule part</i>	<b>§ 15.249 (a)</b>
<i>Section in RSS-210</i>	<b>A2.9</b>
<i>Date of testing</i>	<b>14.03.2013</b>
<i>Test equipment</i>	<b>566, 525, 350</b>
<i>Test conditions</i>	<b>22 °C, 31 % RH</b>

#### 4.1.1 EUT operation mode

<i>EUT channel</i>	<b>0, 7 and 15</b>
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#### 4.1.2 Test method and limit

<i>Frequency range (MHz)</i>	<i>Limit Average (dBµV/m)</i>	<i>Limit Peak (dBµV/m)</i>
<b>2400 – 2483.5</b>	<b>≤ 94</b>	<b>≤ 114</b>

The measurement results were obtained as described below.

$$E [\mu V/m] = U_{RX} + A_{CABLE} + AF$$

Where

$U_{RX}$  receiver reading

$A_{CABLE}$  attenuation of the cable

$AF$  antenna factor

### 4.1.3 Test results

Channel / f (MHz)	E Average (dB $\mu$ V/m)	E Peak (dB $\mu$ V/m)	Result
0 / 2405	86.97	91.15	PASS
7 / 2440	85.45	91.05	PASS
15 / 2480	85.90	90.25	PASS

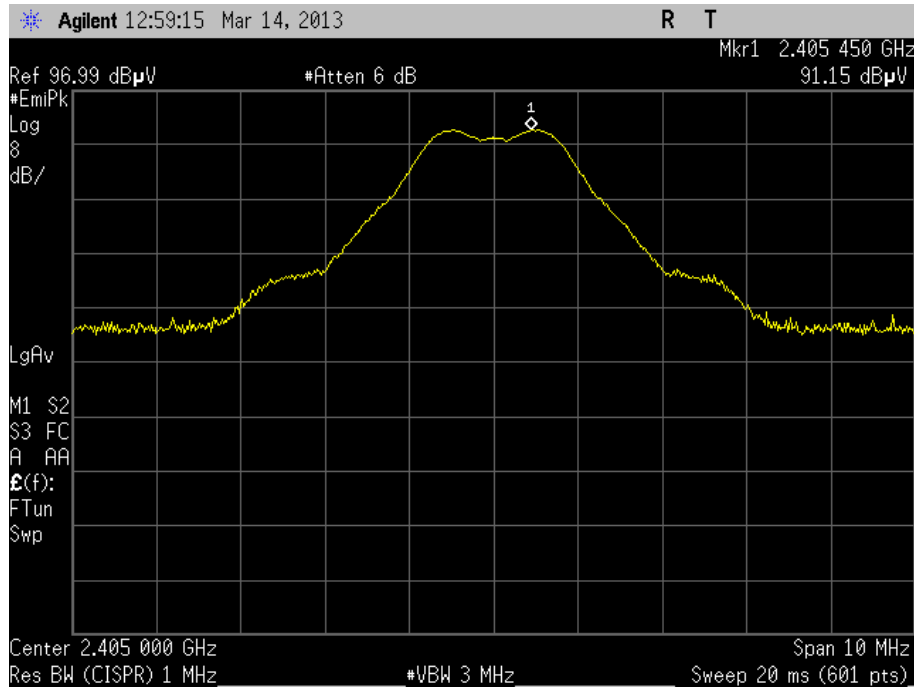


Figure 1. channel 0, Field strength of fundamental, peak

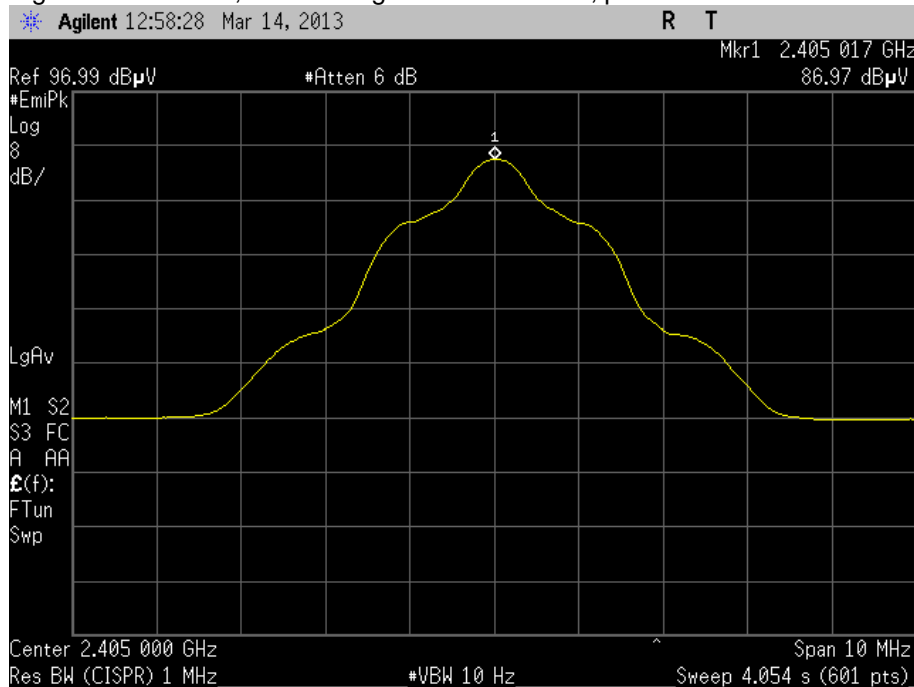


Figure 2. channel 7, Field strength of fundamental, average

## 4.2 Band-edge compliance of RF emissions

The test was performed as a compliance test. The test parameters concerned were as follows:

<i>EUT</i>	<b>EUT1</b>
<i>Site name</i>	<b>Nemko Oy / Perkkaa</b>
<i>FCC rule part</i>	<b>§ 15.249 (d)(e), § 15.209</b>
<i>Section in RSS-210</i>	<b>A2.9</b>
<i>Date of testing</i>	<b>14.03.2013</b>
<i>Test equipment</i>	<b>566, 525, 350</b>
<i>Test conditions</i>	<b>22 °C, 30 % RH</b>
<i>Test result</i>	<b>PASS</b>

### 4.2.1 EUT operation mode

<i>EUT channel</i>	<b>0 and 15</b>
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### 4.2.2 Test method and limit

The measurement is made according to Public notice DA 00-705 and IC standard RSS-210.

3m measurement distance

<i>Frequency range (MHz)</i>	<i>Limit Average (dBµV/m)</i>	<i>Limit Peak (dBµV/m)</i>
<b>Below 2390 and above 2483.5</b>	<b>≤ 54</b>	<b>≤ 74</b>

The measurement results were obtained as described below.

$$E [\mu V/m] = U_{RX} + A_{CABLE} + AF$$

Where

$U_{RX}$  receiver reading

$A_{CABLE}$  attenuation of the cable

$AF$  antenna factor



#### 4.2.3 Test results

Channel 0:

Below 2400 MHz:

<i>Detector (RBW: 1MHz)</i>	<i>E (dB<math>\mu</math>V/m)</i>	<i>Result</i>
<b>Peak</b>	<b>48.81</b>	<b>PASS</b>
<b>Average</b>	<b>35.92</b>	<b>PASS</b>

Channel 15:

Above 2483.5 MHz:

<i>Detector (RBW: 1MHz)</i>	<i>E (dB<math>\mu</math>V/m)</i>	<i>Result</i>
<b>Peak</b>	<b>51.59</b>	<b>PASS</b>
<b>Average</b>	<b>40.86</b>	<b>PASS</b>

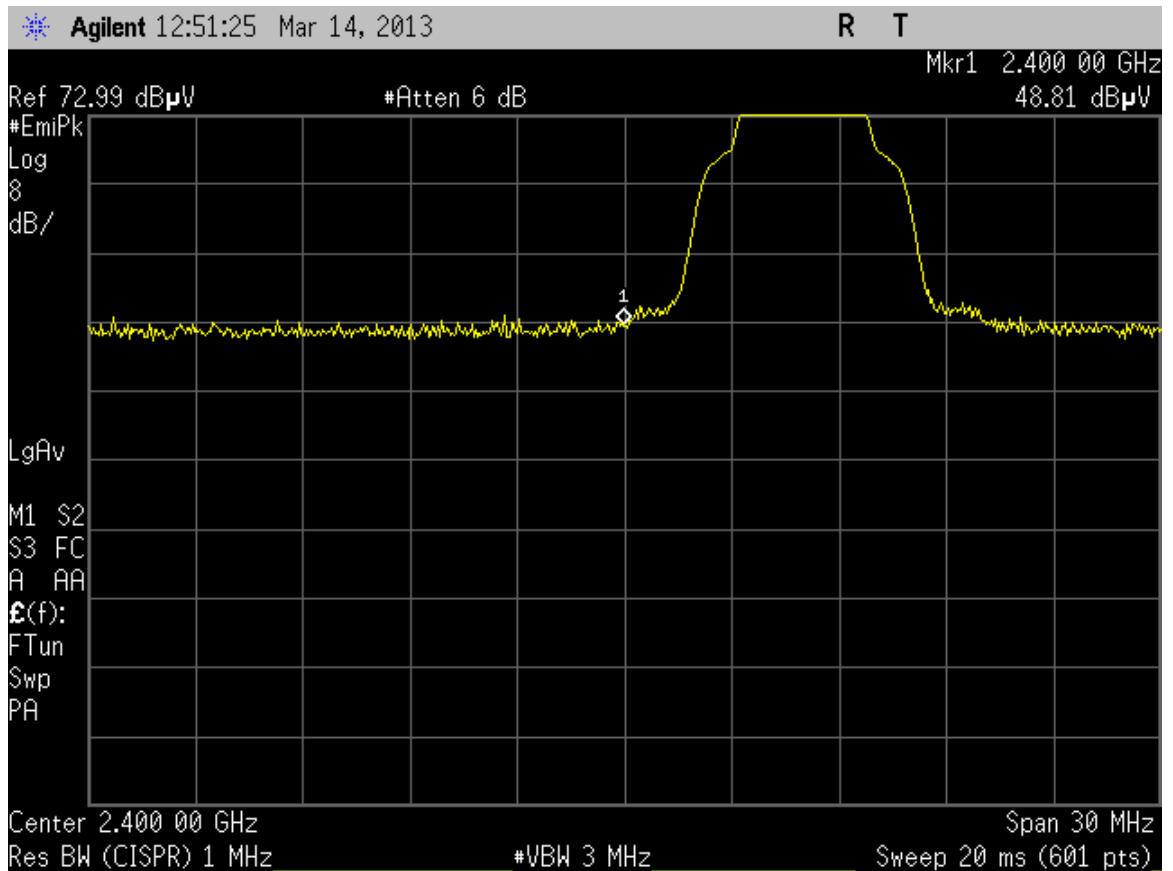


Figure 6. Channel 0, Band-edge compliance, low end, peak

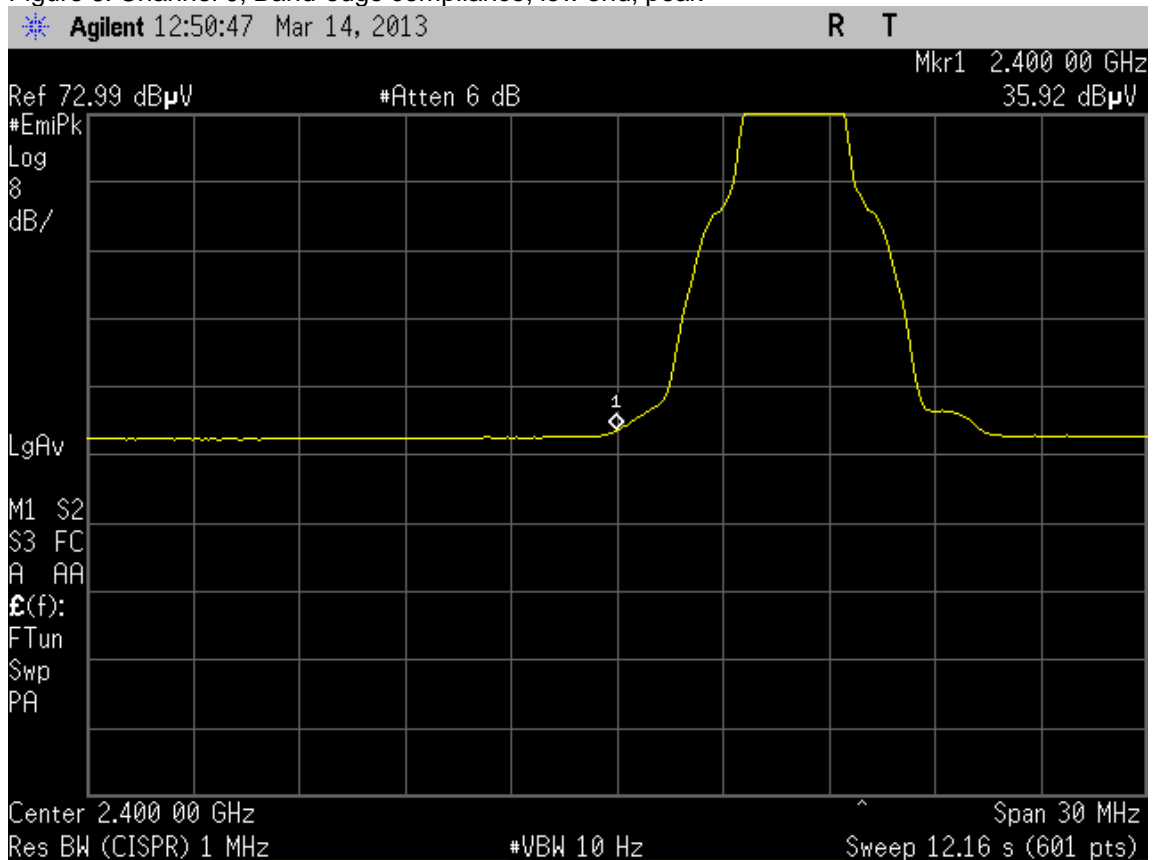


Figure 7. Channel 0, Band-edge compliance, low end, average

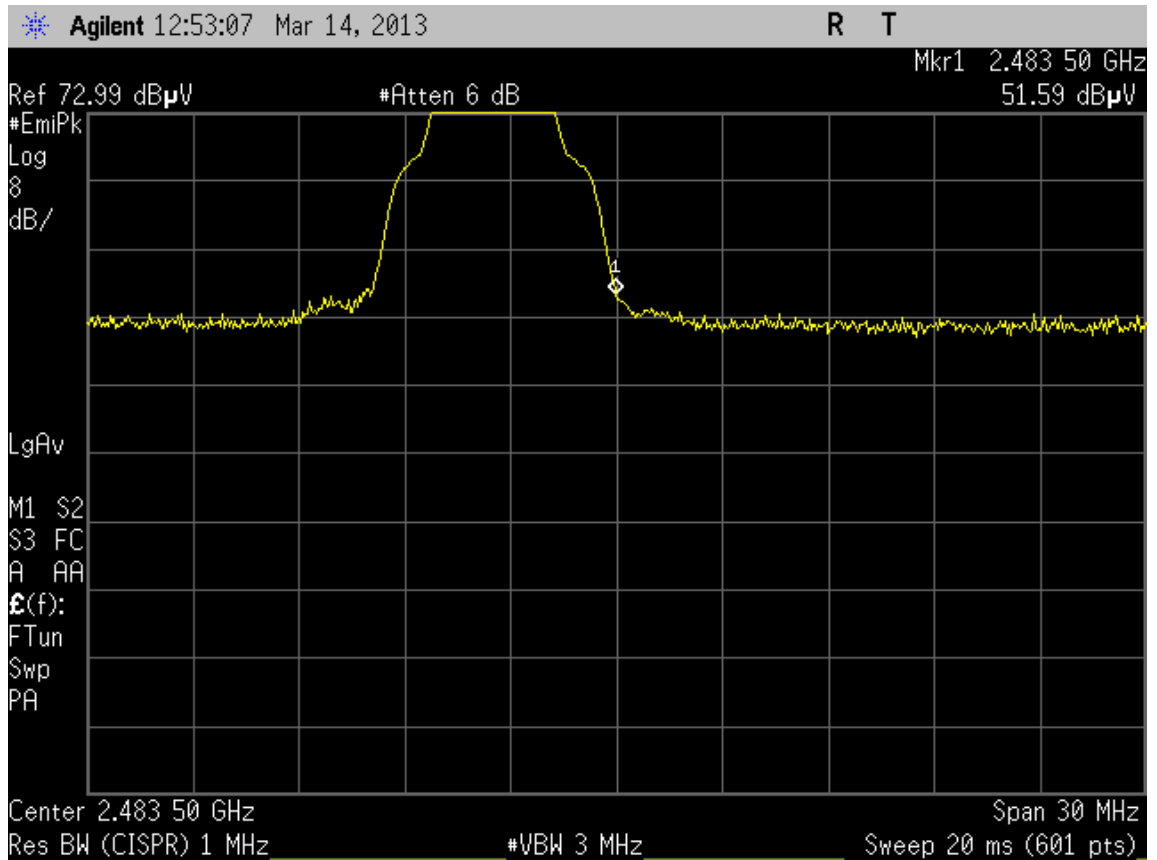


Figure 6. Channel 15, Band-edge compliance, high end, peak

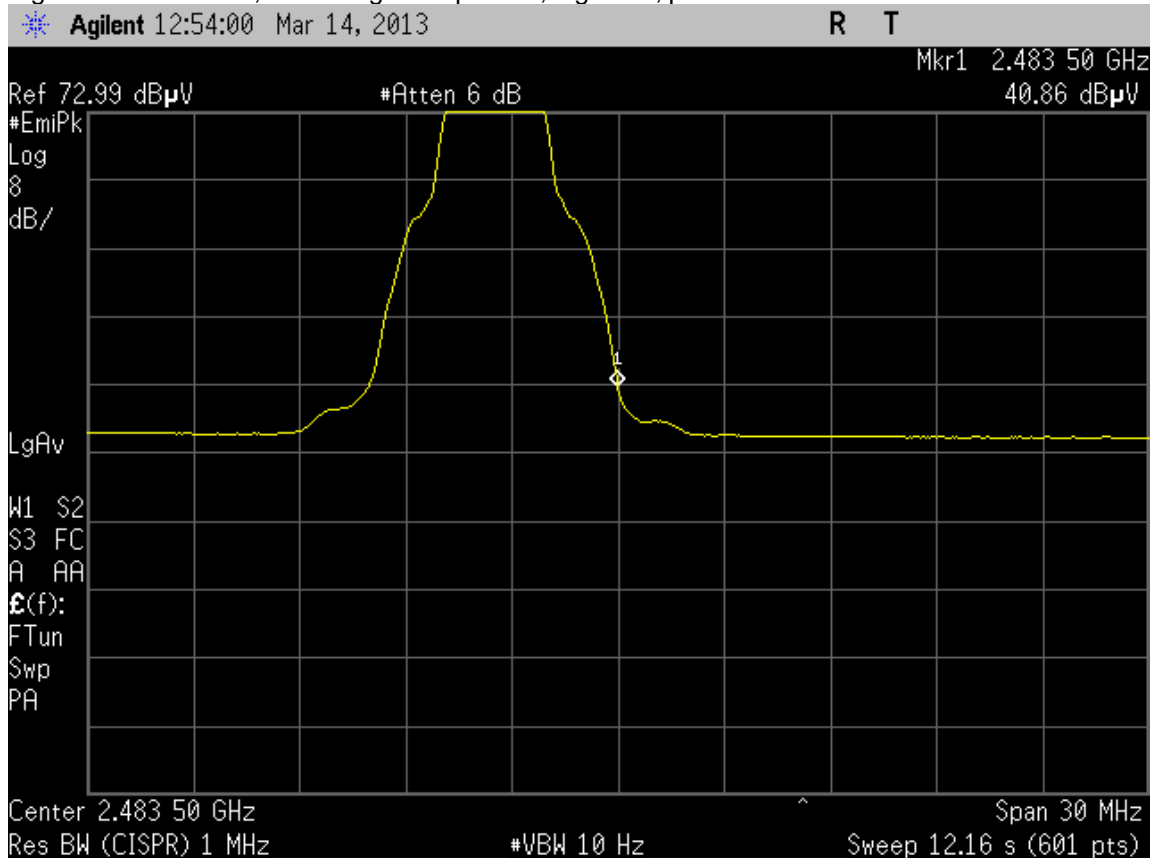


Figure 7. Channel 15, Band-edge compliance, high end, average

### 4.3 Spurious radiated emission

The test was performed as a compliance test. The test parameters concerned were as follows:

<i>EUT</i>	<b>EUT1</b>
<i>Site name</i>	<b>Nemko Oy / Perkkaa</b>
<i>FCC rule part</i>	<b>§ 15.249 (d)(e), § 15.209</b>
<i>Section in RSS-210</i>	<b>A2.9</b>
<i>Date of testing</i>	<b>13.12.2012</b>
<i>Test equipment</i>	<b>566, 709, 564, 559, 525, 319, 544, 393, 350, 88, 710</b>
<i>Test conditions</i>	<b>22 °C, 31 % RH</b>

#### 4.3.1 EUT operation mode

<i>EUT channel</i>	<b>Channel 0, 7 and 15</b>
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#### 4.3.2 Test method and limit

The test was performed in a semi-anechoic shielded room. The EUT was placed on a non-conductive 0.8 m high table standing on the turntable. During the test the distance from the EUT to the measuring antenna was 3 m. The excess length of the cables of the EUT were made into bundles 30-40 cm in length (see photograph 1). In order to find the maximum levels of the disturbance radiation the angle of the turntable, the height of the measuring antenna and the lay-out of the EUT cables were varied during the tests. The test was performed with the measuring antenna being both in horizontal and vertical polarizations.

Vertical and horizontal polarizations in the frequency range 30 – 1000 MHz was measured by using the peak detector. During the peak detector scan. the turntable was rotated from 0° to 360° with 30° step with the antenna heights 1.0 m and 3.0 m. The highest levels of the radiated interference field strength measured by using the quasi-peak detector were recorded.

Vertical and horizontal polarizations in the frequency range 1000 – 25000 MHz was measured by using the peak detector. During the peak detector scan. the turntable was rotated from 0° to 360° with 15° step with the antenna heights 1.0 m, 1,5m, 2.0m, 2,5m and 3.0 m. The highest levels of the radiated interference field strength measured by using the average and peak detectors were recorded.

**Minimum Standard:** Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

Emissions falling in the restricted bands of 15.205 shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions.

3m measuring distance, FCC Part 15.209

<i>Frequency band MHz</i>	<i>limit, Quasi peak detector dB(μV/m)</i>
<b>30 - 88</b>	<b>40</b>
<b>88 - 216</b>	<b>43.5</b>
<b>216 - 960</b>	<b>46</b>
<b>960 - 1000</b>	<b>54</b>

<i>Frequency band MHz</i>	<i>limit, average detector dB(μV/m)</i>	<i>limit, peak detector dB(μV/m)</i>
<b>1000 - 25000</b>	<b>54</b>	<b>74</b>

3m measuring distance, CISPR 22, class B

<i>Frequency band MHz</i>	<i>limit, Quasi peak detector dB(μV/m)</i>
<b>30 - 230</b>	<b>40</b>
<b>230 - 1000</b>	<b>47</b>

The EUT was tested on three orthogonal axis.

The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33.

The device was tested on three channels per 15.31(l).

The CFR 47 Part 15. Subpart B. Class B limit of 500 μV/m has been calculated to correspond 54 dB(μV/m) as follows:  $[dB(\mu V/m)] = 20 \log[\mu V/m]$ .

The measurement results were obtained as described below.

$$E [\mu V/m] = U_{RX} + A_{CABLE} + AF - G_{PREAMP}$$

Where

$U_{RX}$  receiver reading

$A_{CABLE}$  attenuation of the cable

$AF$  antenna factor

$G_{PREAMP}$  gain of the preamplifier

### 4.3.3 Test results

below 1GHz: RBW 120kHz

above 1GHz: peak, RBW 1MHz, VBW 3MHz; average RBW 1MHz, VBW 10Hz

#### Channel 0

<i>Frequency GHz</i>	<i>Peak dB(μV/m)</i>	<i>Limit dB(μV/m)</i>	<i>Margin dB</i>	<i>Result</i>
<b>4810</b>	<b>46.7</b>	<b>74</b>	<b>27.3</b>	<b>PASS</b>
<b>7215</b>	<b>48.7</b>	<b>74</b>	<b>25.3</b>	<b>PASS</b>
<b>9220</b>	<b>51.5</b>	<b>74</b>	<b>22.5</b>	<b>PASS</b>

#### Channel 0

<i>Frequency GHz</i>	<i>Average dB(μV/m)</i>	<i>Limit dB(μV/m)</i>	<i>Margin dB</i>	<i>Result</i>
<b>4810</b>	<b>38.7</b>	<b>54</b>	<b>15.3</b>	<b>PASS</b>
<b>7215</b>	<b>40.5</b>	<b>54</b>	<b>13.5</b>	<b>PASS</b>
<b>9220</b>	<b>43.4</b>	<b>54</b>	<b>10.6</b>	<b>PASS</b>

#### Channel 7

<i>Frequency GHz</i>	<i>Peak dB(μV/m)</i>	<i>Limit dB(μV/m)</i>	<i>Margin dB</i>	<i>Result</i>
<b>4880</b>	<b>47.5</b>	<b>74</b>	<b>26.5</b>	<b>PASS</b>
<b>7320</b>	<b>49.3</b>	<b>74</b>	<b>24.7</b>	<b>PASS</b>
<b>9760</b>	<b>50.6</b>	<b>74</b>	<b>23.4</b>	<b>PASS</b>

#### Channel 7

<i>Frequency GHz</i>	<i>Average dB(μV/m)</i>	<i>Limit dB(μV/m)</i>	<i>Margin dB</i>	<i>Result</i>
<b>4880</b>	<b>39.5</b>	<b>54</b>	<b>14.5</b>	<b>PASS</b>
<b>7320</b>	<b>41.5</b>	<b>54</b>	<b>12.5</b>	<b>PASS</b>
<b>9760</b>	<b>42.0</b>	<b>54</b>	<b>12.0</b>	<b>PASS</b>

#### Channel 15

<i>Frequency GHz</i>	<i>Peak dB(μV/m)</i>	<i>Limit dB(μV/m)</i>	<i>Margin dB</i>	<i>Result</i>
<b>4960</b>	<b>48.6</b>	<b>74</b>	<b>25.4</b>	<b>PASS</b>
<b>7440</b>	<b>51.0</b>	<b>74</b>	<b>23.0</b>	<b>PASS</b>
<b>9920</b>	<b>51.5</b>	<b>74</b>	<b>22.5</b>	<b>PASS</b>

#### Channel 7

<i>Frequency GHz</i>	<i>Average dB(μV/m)</i>	<i>Limit dB(μV/m)</i>	<i>Margin dB</i>	<i>Result</i>
<b>4960</b>	<b>41.0</b>	<b>54</b>	<b>13.0</b>	<b>PASS</b>
<b>7440</b>	<b>43.1</b>	<b>54</b>	<b>10.9</b>	<b>PASS</b>
<b>9920</b>	<b>44.0</b>	<b>54</b>	<b>10.0</b>	<b>PASS</b>

## 5. List of test equipment

Each active test equipment is calibrated once a year, antennas every 18 months and other passive equipment every 24 months.

Nr.	Equipment	Type	Manufacturer	Serial number	Cal date	Cal due
390	RF attenuator PAD	WA2-10	Weinschel	3784	10.12.2011	12.2013
694	EMI Test Receiver	ESPC	Rohde & Schwarz	842888/023	11.12.2012	12.2013
566	Spectrum analyzer	E4448A	Agilent	US42510236	17.4.2013	4.2014
709	EMI test receiver	ESU8	Rohde & Schwarz	100297	24.07.2013	7.2014
567	RF generator	E8257C	Agilent	MY43320736	25.2.2013	2.2014
544	RF-amplifier	ZFL-2000VH2	Mini-Circuits	QA0749010	9.1.2013	1.2014
564	RF amplifier	CA018-4010	CIAO Wireless	132	9.1.2013	1.2014
710	RF-amplifier	ALS 1826-41-12	ALC Microwave Inc.	0011	28.10.2011	10.2013
745	2-Line V-Network	ENV216	Rohde & Schwarz	101466	11.6.2013	06.2014
319	Antenna	CBL6112	Chase	2018	12.7.2012	1.2014
525	Double-Ridged Horn	3115	Emco	6691	10.10.2012	4.2014
542	Double-Ridged Horn	3115	Emco	00023905	10.10.2012	4.2014
559	Highpass filter	WHKX3.0/18G-10ss	Wainwright	1	7.12.2011	2.2013
88	Waveguide horn	638	Narda	8003	-	-
371	AC Power source	500i-400	California Instr.	HK 52064	23.5.2012	5.2013
350	Semianechoic shielded room	RFD-F-100	Euroshield Oy	1327	26.10.2012	10.2014

## 6. Photographs

