

## TEST REPORT

Test report no.: 1-3636/11-02-02



### Testing laboratory

**CETECOM ICT Services GmbH**  
Untertuerkheimer Strasse 6 – 10  
66117 Saarbruecken / Germany  
Phone: + 49 681 5 98 - 0  
Fax: + 49 681 5 98 - 9075  
Internet: <http://www.cetecom.com>  
e-mail: [ict@cetecom.com](mailto:ict@cetecom.com)

#### Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS). The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01  
Area of Testing: Radio/Satellite Communications

### Applicant

**RF Technologies Ltd.**  
472, Nippa-cho, Kohoku-ku  
223-0057 Yokohama / JAPAN  
Phone: -/-  
Fax: +81-45-534-0646  
Contact: Kazuyuki Ohnishi  
e-mail: [ohnishi@rt.jp](mailto:ohnishi@rt.jp)  
Phone: +81-45-534-0645

### Manufacturer

**RF Technologies Ltd.**  
472, Nippa-cho, Kohoku-ku  
223-0057 Yokohama / JAPAN

### Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS – 210 Issue 8	Low Power Licence-exempt Radiocommunication Devices Annex 13, Section A13.1 Vehicle -Mounted Field Disturbance Sensors in the Band 76.0 - 77.0 GHz

For further applied test standards please refer to section 3 of this test report.

### Test Item

Kind of test item:	Radio Detection and Ranging Device for Vehicle
Model name:	FT0019B
FCC ID:	BABFT0019B
IC:	2024B-FT0019B
Frequency:	76.5 GHz
Technology tested:	76 GHz – 77 GHz
Antenna:	12.0 V DC from power supply
Power Supply:	-20 °C to +55 °C
Temperature Range:	76 GHz – 77 GHz



Test report authorised:

*Gerald Karsten*

2012-03-01 Karsten Gerald

Test performed:

*M. Walla*

2012-03-01 Meheza Walla



## 1 Table of contents

1	Table of contents .....	2
2	General information .....	3
2.1	Notes and disclaimer .....	3
2.2	Application details .....	3
3	Test standard/s .....	3
4	Test environment .....	4
5	Test item .....	4
6	Test laboratories sub-contracted .....	4
7	RF measurement testing .....	5
7.1	Description of test setup .....	5
7.1.1	Radiated measurements .....	5
7.1.2	Conducted measurements .....	6
7.1.3	Additional comments .....	6
8	Summary of measurement results .....	7
9	Measurement results .....	8
9.1	Power density (in motion / not in motion mode) .....	8
9.2	Maximum Permissible Exposure (MPE) .....	18
9.3	Occupied bandwidth .....	20
9.4	Field strength of emissions (radiated spurious) .....	30
9.5	Frequency stability .....	39
10	Test equipment and ancillaries used for tests .....	40
Annex A	Photographs of the test setup .....	42
Annex B	External photographs of the EUT .....	45
Annex C	Internal photographs of the EUT .....	50
Annex D	Document history .....	56
Annex E	Further information .....	56
Annex F	Accreditation Certificate .....	57

## 2 General information

### 2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.

The testing service provided by CETECOM ICT Services GmbH has been rendered under the current "General Terms and Conditions for CETECOM ICT Services GmbH".

CETECOM ICT Services GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.

Under no circumstances does the CETECOM ICT Services GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.

Under no circumstances does the CETECOM ICT Services GmbH test report include or imply any product or service warranties from CETECOM ICT Services GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CETECOM ICT Services GmbH.

All rights and remedies regarding vendor's products and services for which CETECOM ICT Services GmbH has prepared this test report shall be provided by the party offering such products or services and not by CETECOM ICT Services GmbH.

In no case this test report can be considered as a Letter of Approval.

### 2.2 Application details

Date of receipt of order:	2011-12-07
Date of receipt of test item:	2012-01-16
Start of test:	2012-01-16
End of test:	2012-02-21
Person(s) present during the test:	-/-

## 3 Test standard/s

Test standard	Version	Test standard description
47 CFR Part 15	2010-12	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS – 210 Issue 8	2010-12	Low Power Licence-exempt Radiocommunication Devices Annex 13, Section A13.1 Vehicle -Mounted Field Disturbance Sensors in the Band 76.0 - 77.0 GHz

#### 4 Test environment

Temperature:	$T_{nom}$	+22 °C during room temperature tests
	$T_{max}$	+55 °C during high temperature tests
	$T_{min}$	-20 °C during low temperature tests
Relative humidity content:		55 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	$V_{nom}$	12.0 V DC from power supply
	$V_{max}$	13.8 V DC
	$V_{min}$	10.2 V DC

#### 5 Test item

Kind of test item	:	Radio Detection and Ranging Device for Vehicle
Type identification	:	FT0019B
S/N serial number	:	None
HW hardware status	:	85G-029111-0333 v
SW software status	:	271000-522
Frequency band	:	76 GHz – 77 GHz
Type of modulation	:	FMCW
Number of channels	:	1
Antenna	:	Tri-plate antenna
Power supply	:	12.0 V DC from power supply
Temperature range	:	-20 °C to +55 °C

#### 6 Test laboratories sub-contracted

None

## 7 RF measurement testing

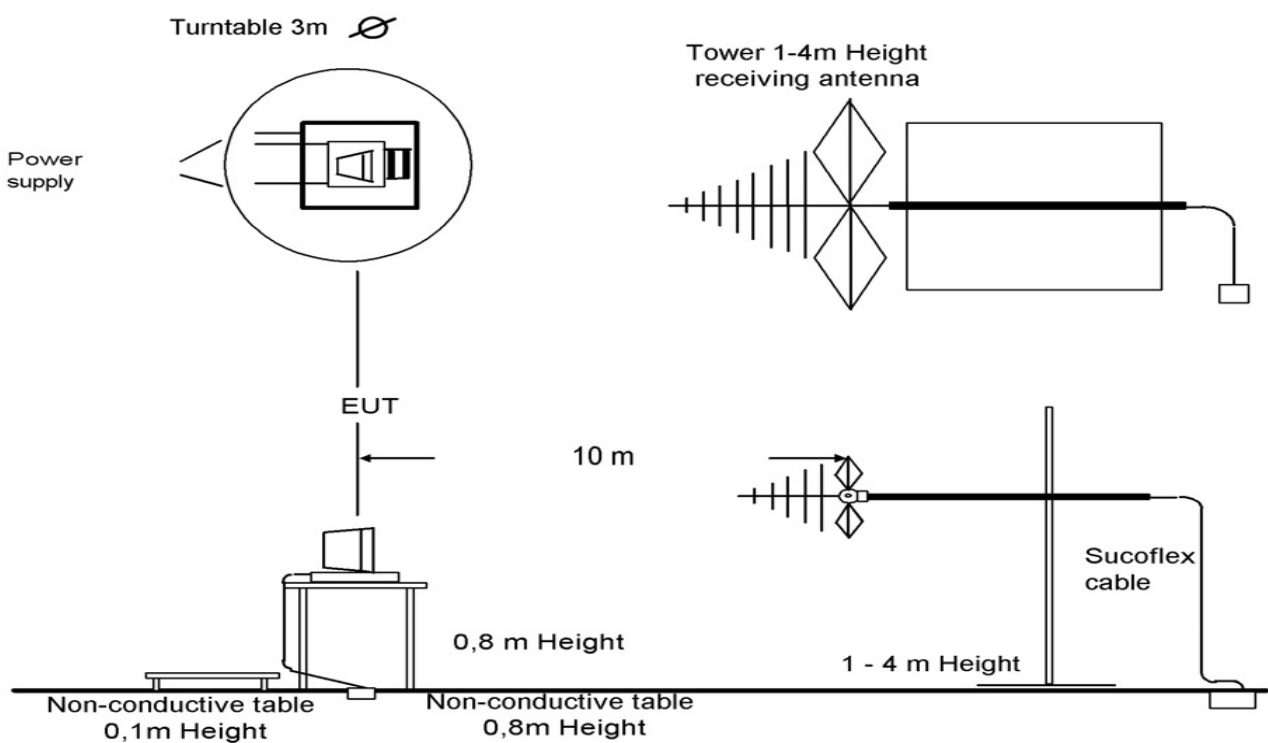
### 7.1 Description of test setup

#### 7.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.2-1996 clause 15 and ANSI C63.4-2009 clause 4.1.5. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63-4-2009 clause 4.2.

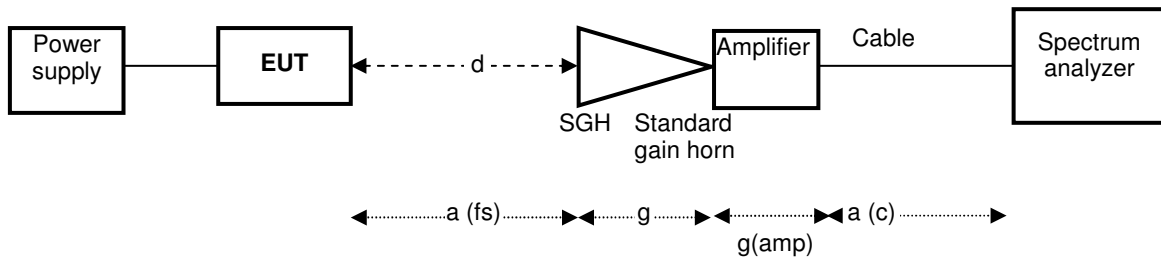
Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber



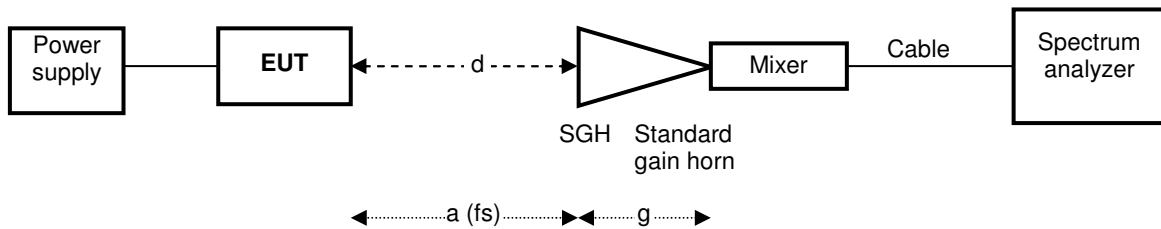
Picture 1: Diagram radiated measurements (Up to 18 GHz)

Test set-up for the measurement of spurious radiation in the frequency range 18 GHz to 50 GHz:



Picture 2: Diagram radiated measurements (18 GHz – 50 GHz)

Test set-up for the measurement of spurious radiation and EIRP in the frequency range 50 GHz to 325 GHz:



Picture 3: Diagram radiated measurements (50 GHz – 325 GHz)

## 7.1.2 Conducted measurements

**Not applicable!**

## 7.1.3 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

## 8 Summary of measurement results

<input checked="" type="checkbox"/>	<b>No deviations from the technical specifications were ascertained</b>
<input type="checkbox"/>	There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	47 CFR Part 15 / RSS – 210 Issue 8, Annex 13	Passed	2012-03-01	-/-

Test specification clause	Test case	Temperature conditions	Power source voltages	Pass	Fail	NA	NP	Results (max.)
§15.253 (b) (1)(2)	Power density	Nominal and Extreme	Nominal and Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	21.1 dBm
§1.1310	MPE Calculation	Nominal and Extreme	Nominal and Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§2.1049	Occupied bandwidth (99% bandwidth 26 dB bandwidth)	Nominal and Extreme	Nominal and Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.253 (c)(2)(ii) §15.253 (3) / §15.209 (a)	Field strength of emissions (radiated spurious)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§15.253 (e)	Frequency stability	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies

**Note:** NA = Not Applicable; NP = Not Performed

## 9 Measurement results

### 9.1 Power density (in motion / not in motion mode)

#### Normal Mode:

TEST CONDITIONS	TRANSMITTER EIRP		
	EIRP (Average) [dBm/MHz]	Bandwidth correction factor [dB] *	EIRP [dBm]
$T_{nom} / V_{nom}$	-8.6	5.1 dB @ 3.2 MHz	-3.5
$T_{min} / V_{min} - V_{max}$	-6.3	5.1 dB @ 3.2 MHz	-1.2
$T_{max} / V_{min} - V_{max}$	-7.8	5.1 dB @ 3.2 MHz	-2.7

\*Bandwidth correction factor [dB] =  $10 \times \log(\text{measured } 99\% \text{occ.bw @ test CW-Mode} / \text{resbw})$ , resbw = 1 MHz

#### CW Mode:

TEST CONDITIONS low frequency	TRANSMITTER EIRP (low)		
	EIRP (Average) [dBm/MHz]	Bandwidth correction factor [dB] *	EIRP [dBm]
$T_{nom} / V_{nom}$	14.9	5.1 dB @ 3.2 MHz	20.0
$T_{min} / V_{min} - V_{max}$	16.0	5.1 dB @ 3.2 MHz	21.1
$T_{max} / V_{min} - V_{max}$	15.5	5.1 dB @ 3.2 MHz	20.6

TEST CONDITIONS center frequency	TRANSMITTER EIRP (center)		
	EIRP (Average) [dBm/MHz]	Bandwidth correction factor [dB] *	EIRP [dBm]
$T_{nom} / V_{nom}$	12.9	5.1 dB @ 3.2 MHz	18.0
$T_{min} / V_{min} - V_{max}$	14.2	5.1 dB @ 3.2 MHz	19.3
$T_{max} / V_{min} - V_{max}$	13.0	5.1 dB @ 3.2 MHz	18.1

TEST CONDITIONS high frequency	TRANSMITTER EIRP (high)		
	EIRP (Average) [dBm/MHz]	Bandwidth correction factor [dB] *	EIRP [dBm]
$T_{nom} / V_{nom}$	11.5	5.1 dB @ 3.2 MHz	16.6
$T_{min} / V_{min} - V_{max}$	12.9	5.1 dB @ 3.2 MHz	18.0
$T_{max} / V_{min} - V_{max}$	11.6	5.1 dB @ 3.2 MHz	16.7

\*Bandwidth correction factor [dB] =  $10 \times \log(\text{measured } 99\% \text{occ.bw}^{**} \text{ @ test CW-Mode} / \text{resbw})$ , resbw = 1 MHz



**Not in Motion Mode:**

TEST CONDITIONS	TRANSMITTER EIRP		
	EIRP (Average) [dBm/MHz]	Bandwidth correction factor [dB]	EIRP [dBm]
$T_{nom} / V_{nom}$	-33.2	5.1 dB @ 3.2 MHz	-28.1
$T_{min} / V_{min} - V_{max}$	-33.1	5.1 dB @ 3.2 MHz	-28.0
$T_{max} / V_{min} - V_{max}$	-33.2	5.1 dB @ 3.2 MHz	-28.1

\*Bandwidth correction factor [dB] =  $10 \times \log(\text{measured } 99\% \text{occ. bw}^{**} @ \text{test CW-Mode} / \text{resbw})$ , resbw = 1 MHz

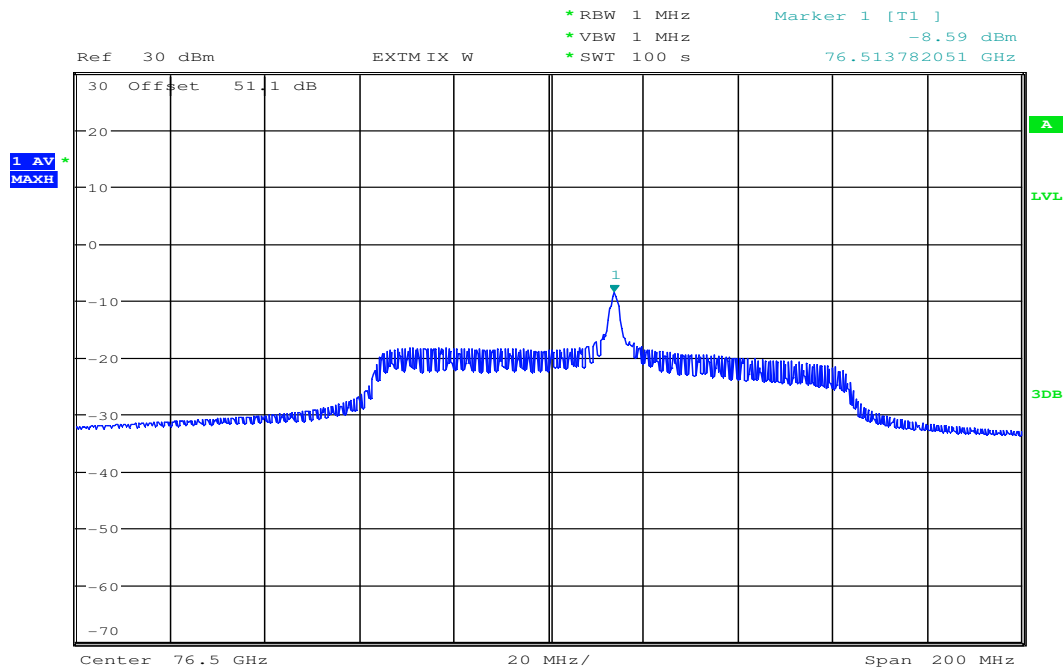
**Limits:**

FCC §15.253 (b) (1) (2)

76.0 GHz to 77.0 GHz	Measurement distance	Power Density → EIRP
Vehicle in motion	3.0 m	$60 \mu\text{W}/\text{cm}^2 \rightarrow 48.3 \text{ dBm}$
Vehicle not in motion	3.0 m	$200 \text{ nW}/\text{cm}^2 \rightarrow 23.5 \text{ dBm}$

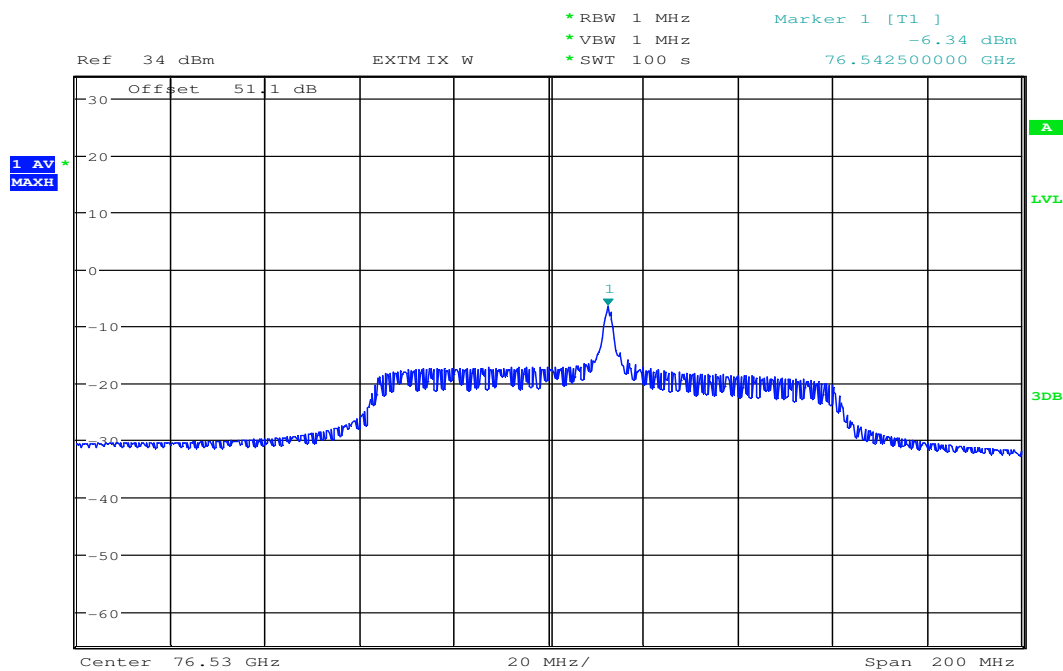
**Result:** The measurement is passed.

Plot 1: EIRP (Average detector),  $T_{nom} / V_{nom}$ , Normal Mode



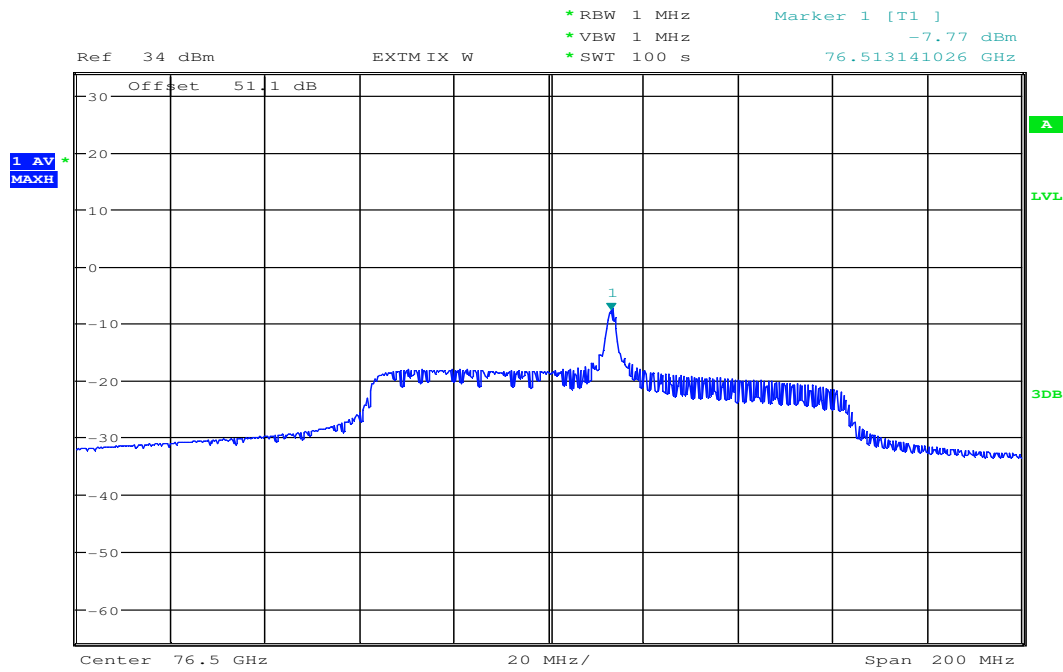
Date: 21.FEB.2012 11:02:21

Plot 2: EIRP (Average detector),  $T_{min} / V_{min} - V_{max}$ , Normal Mode



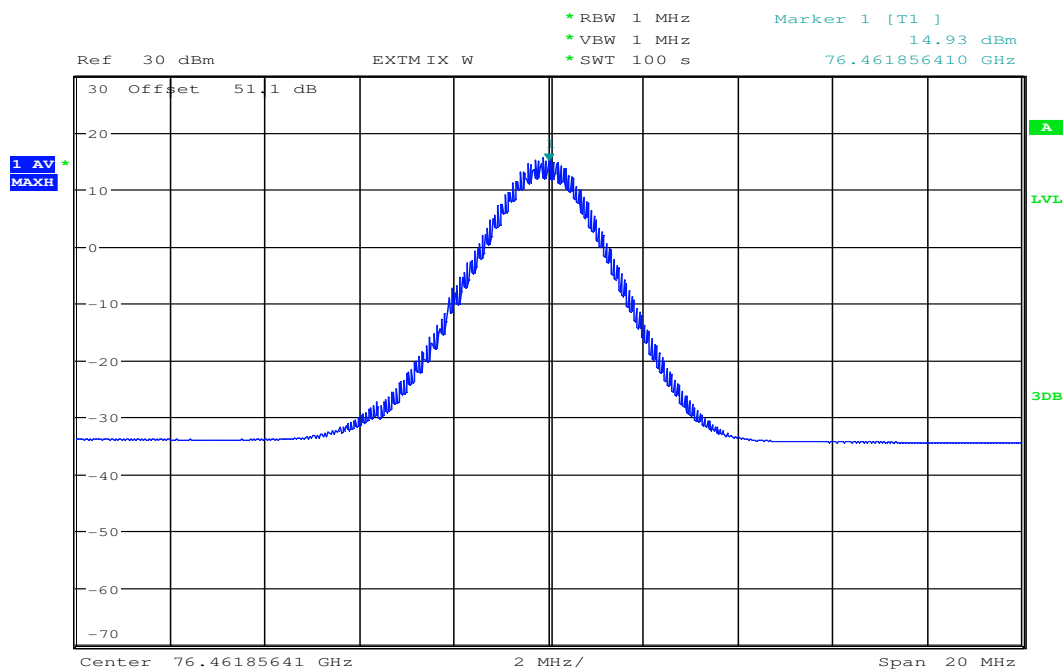
Date: 21.FEB.2012 14:02:11

Plot 3: EIRP (Average detector),  $T_{max} / V_{min} - V_{max}$ , Normal Mode



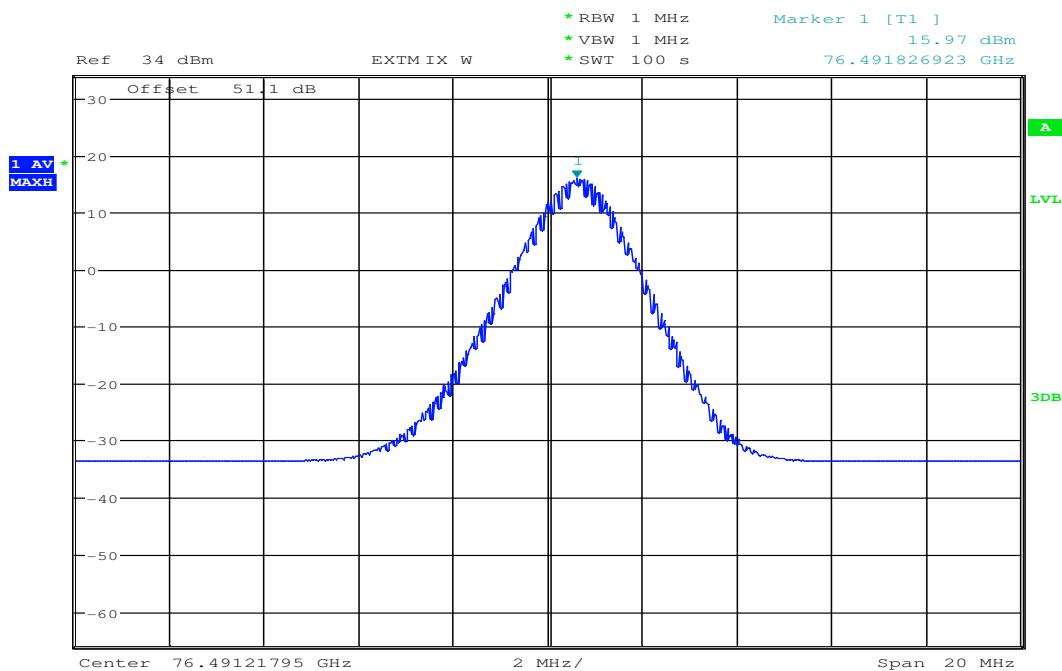
Date: 21.FEB.2012 15:30:55

Plot 4: EIRP (Average detector),  $T_{nom} / V_{nom}$ , CW Mode, low frequency



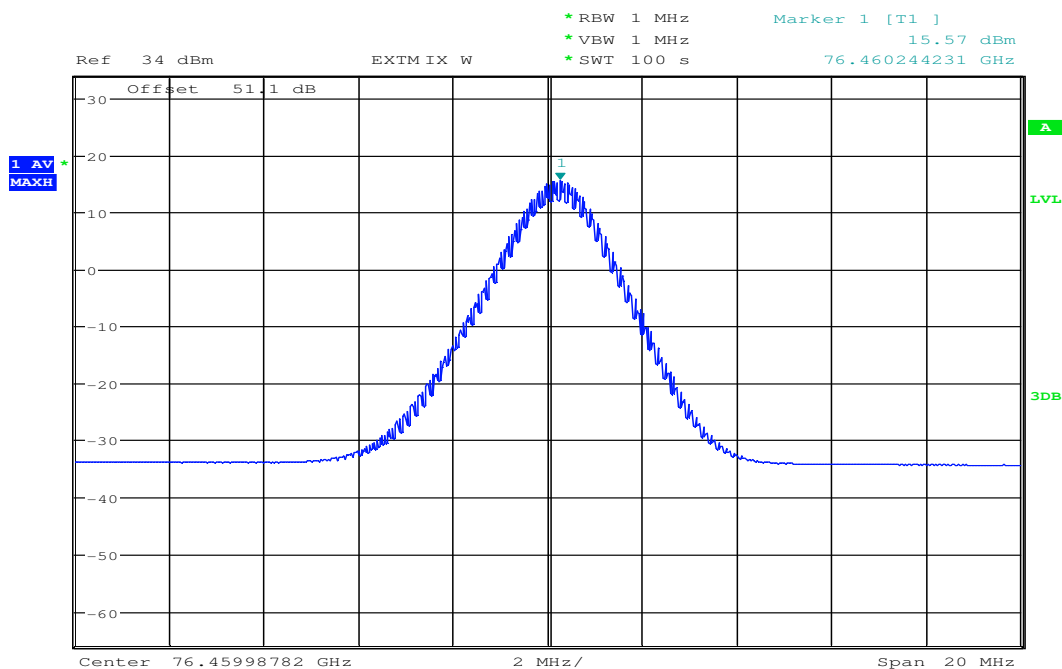
Date: 21.FEB.2012 10:33:59

Plot 5: EIRP (Average detector),  $T_{min} / V_{min} - V_{max}$ , CW Mode, low frequency



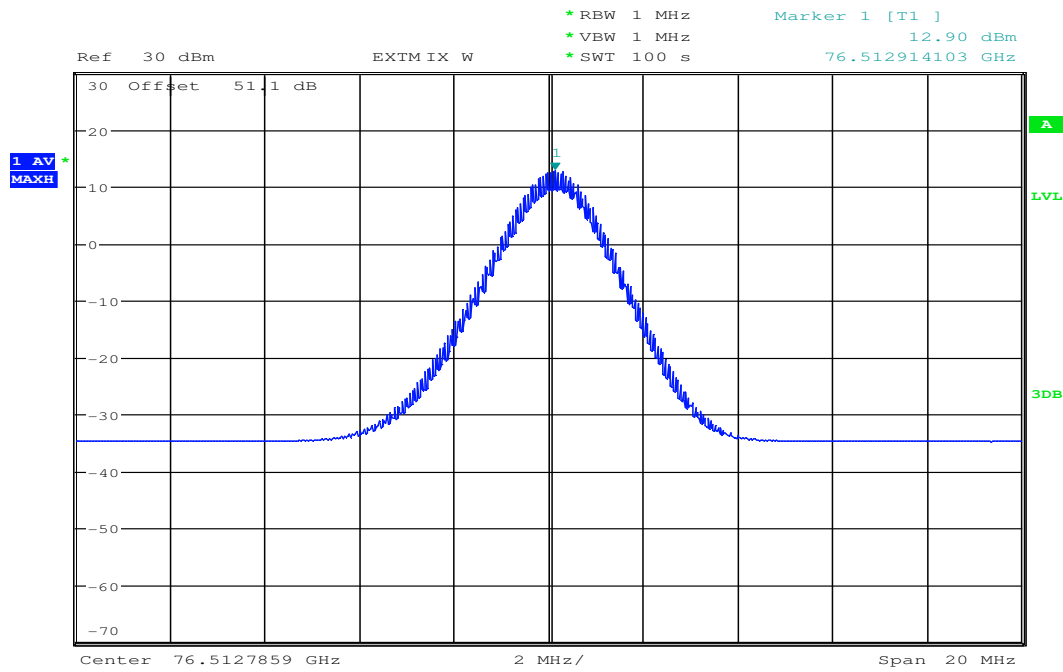
Date: 21.FEB.2012 13:41:09

Plot 6: EIRP (Average detector),  $T_{max} / V_{min} - V_{max}$ , CW Mode, low frequency



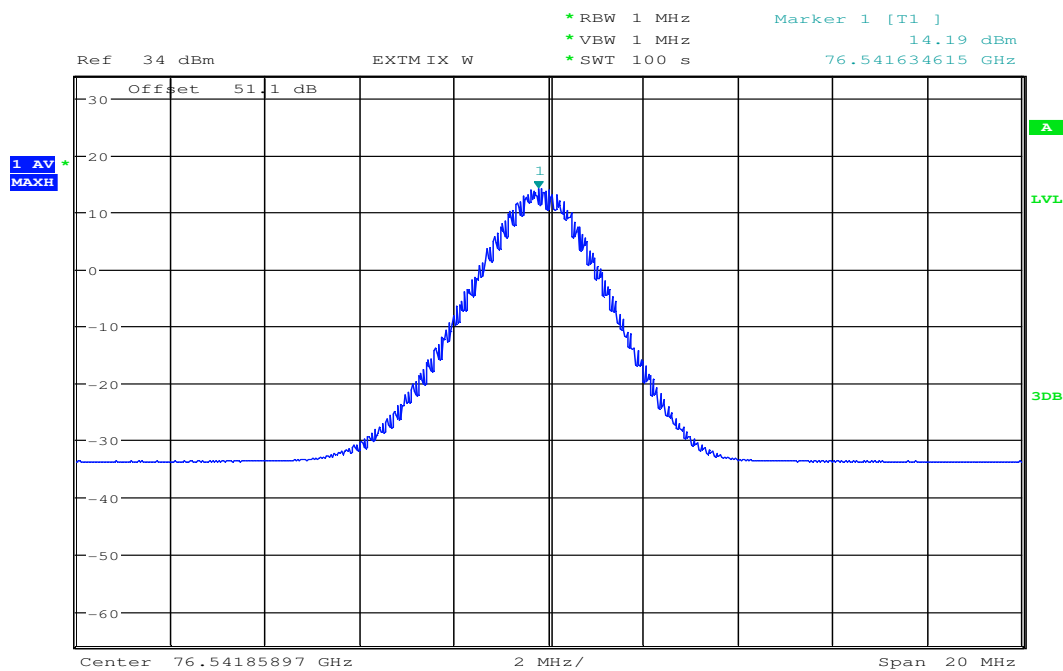
Date: 21.FEB.2012 15:10:41

Plot 7: EIRP (Average detector),  $T_{nom} / V_{nom}$ , CW Mode, center frequency



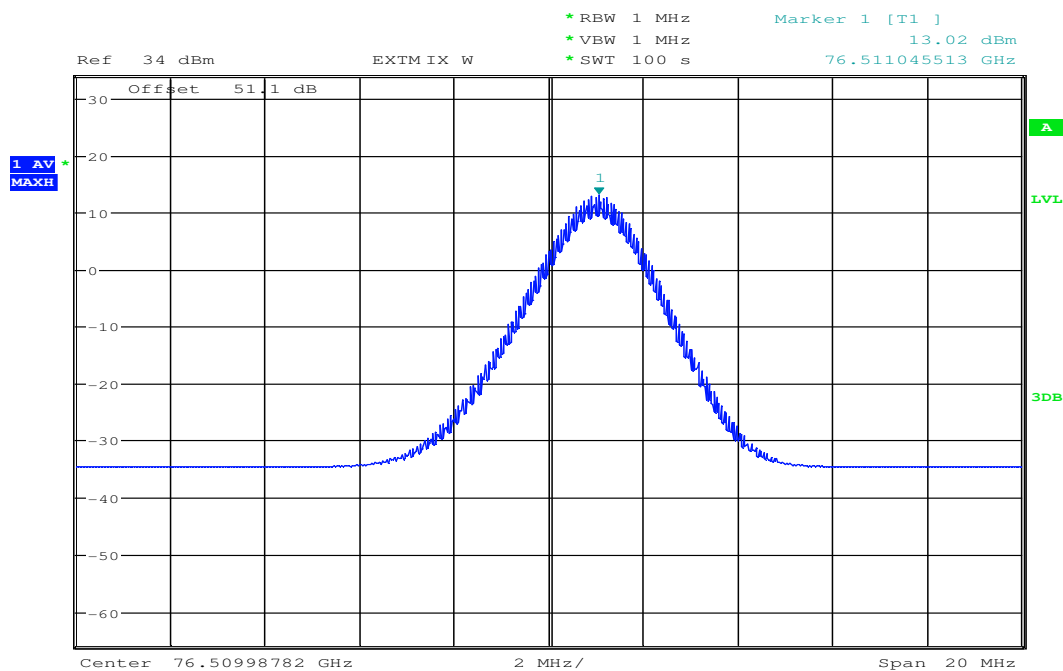
Date: 21.FEB.2012 10:26:33

Plot 8: EIRP (Average detector),  $T_{min} / V_{min} - V_{max}$ , CW Mode, center frequency



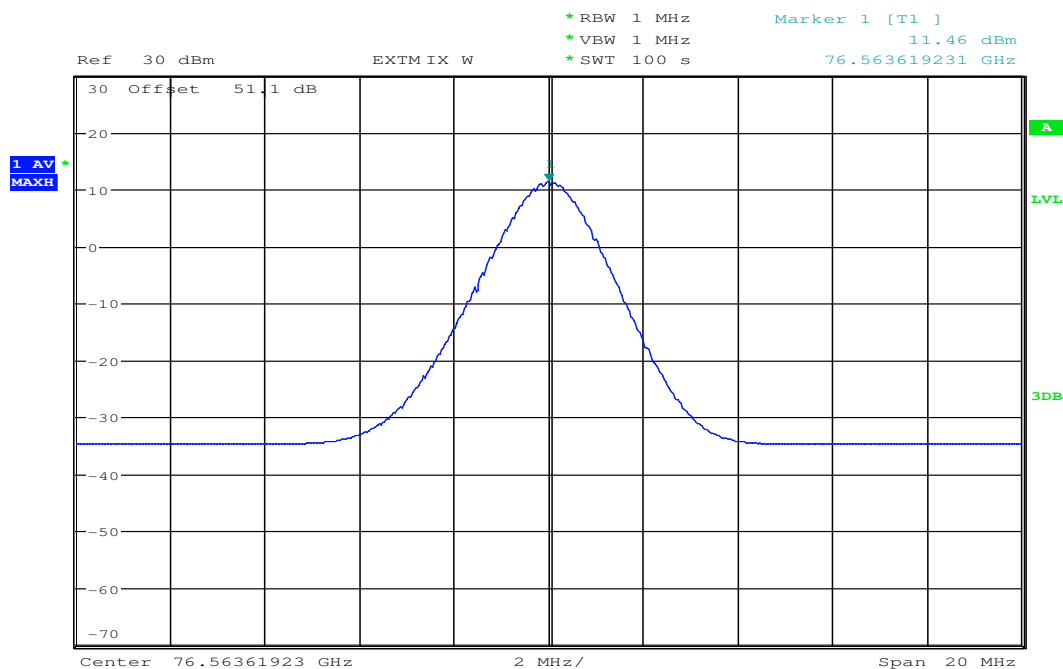
Date: 21.FEB.2012 13:46:24

Plot 9: EIRP (Average detector),  $T_{max} / V_{min} - V_{max}$ , CW Mode, center frequency



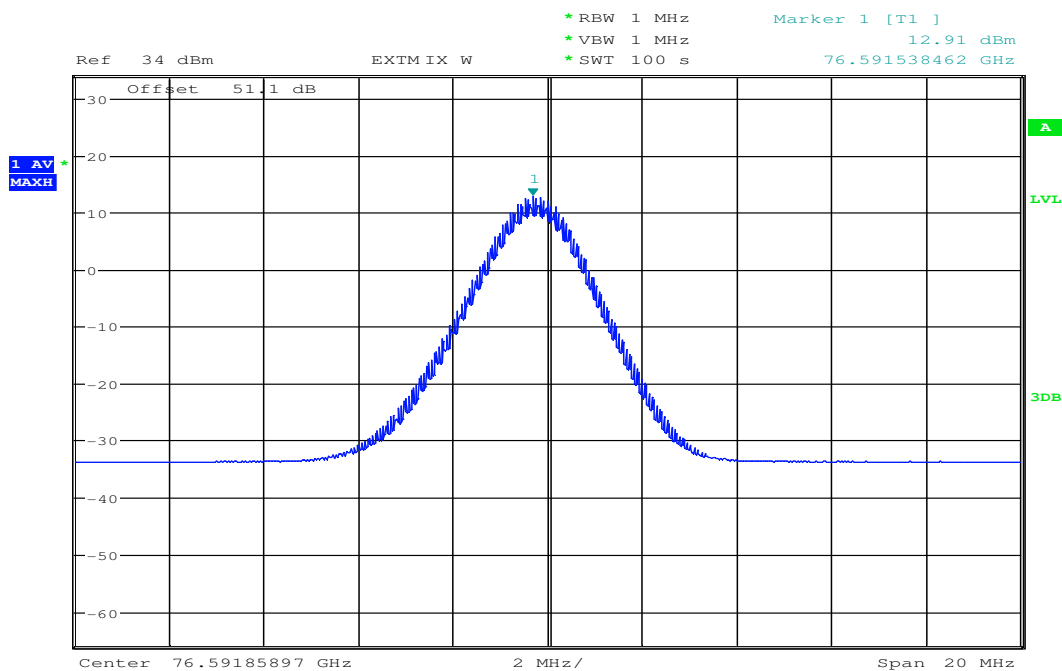
Date: 21.FEB.2012 15:03:11

Plot 10: EIRP (Average detector),  $T_{nom} / V_{nom}$ , CW Mode, high frequency



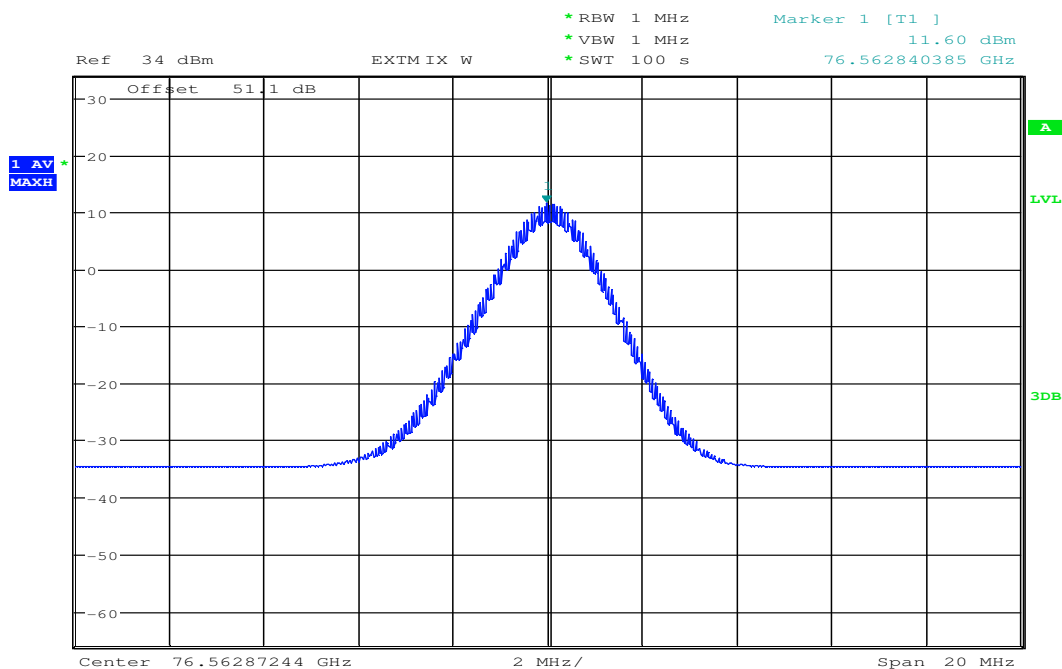
Date: 21.FEB.2012 10:43:18

Plot 11: EIRP (Average detector),  $T_{min} / V_{min} - V_{max}$ , CW Mode, high frequency



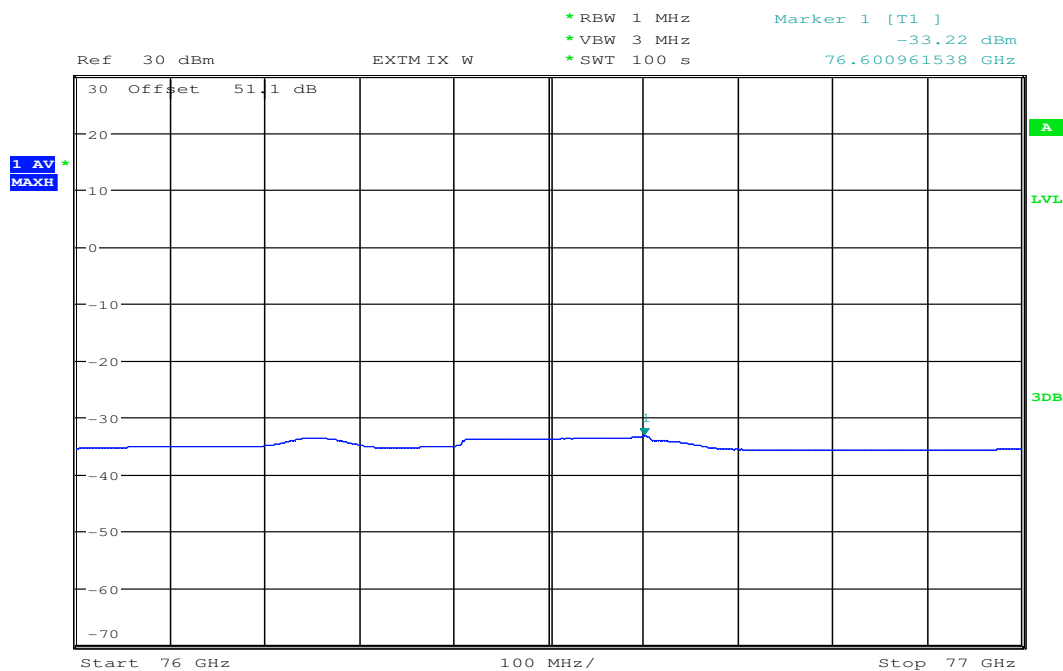
Date: 21.FEB.2012 13:50:10

Plot 12: EIRP (Average detector),  $T_{max} / V_{min} - V_{max}$ , CW Mode, high frequency



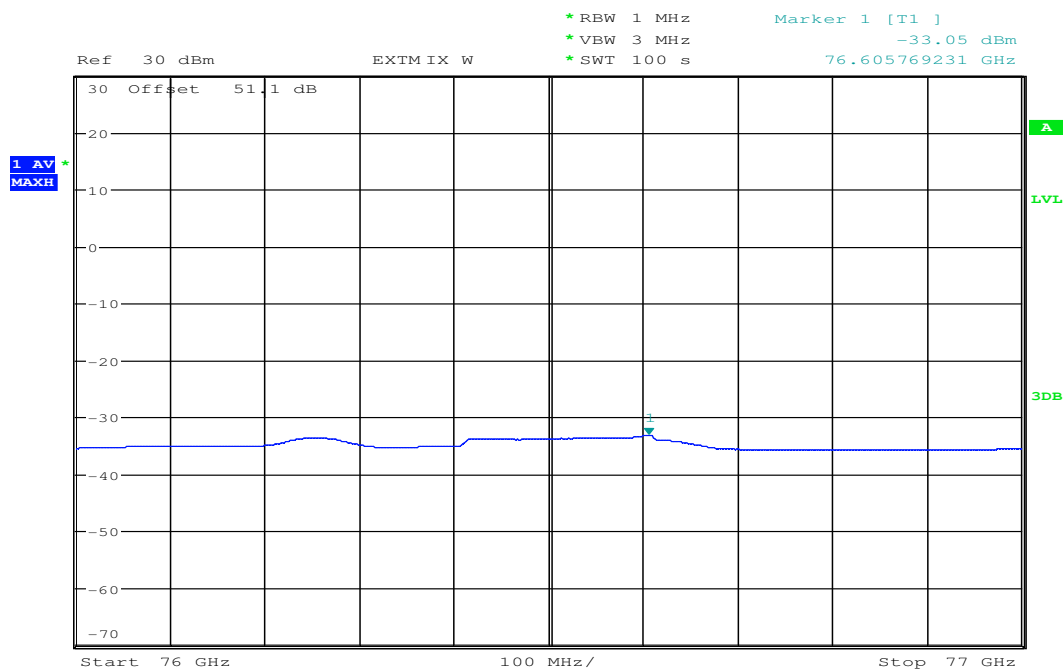
Date: 21.FEB.2012 15:15:30

Plot 13: EIRP (Average detector),  $T_{nom} / V_{nom}$ , Not in Motion Mode



Date: 18.JAN.2012 11:42:51

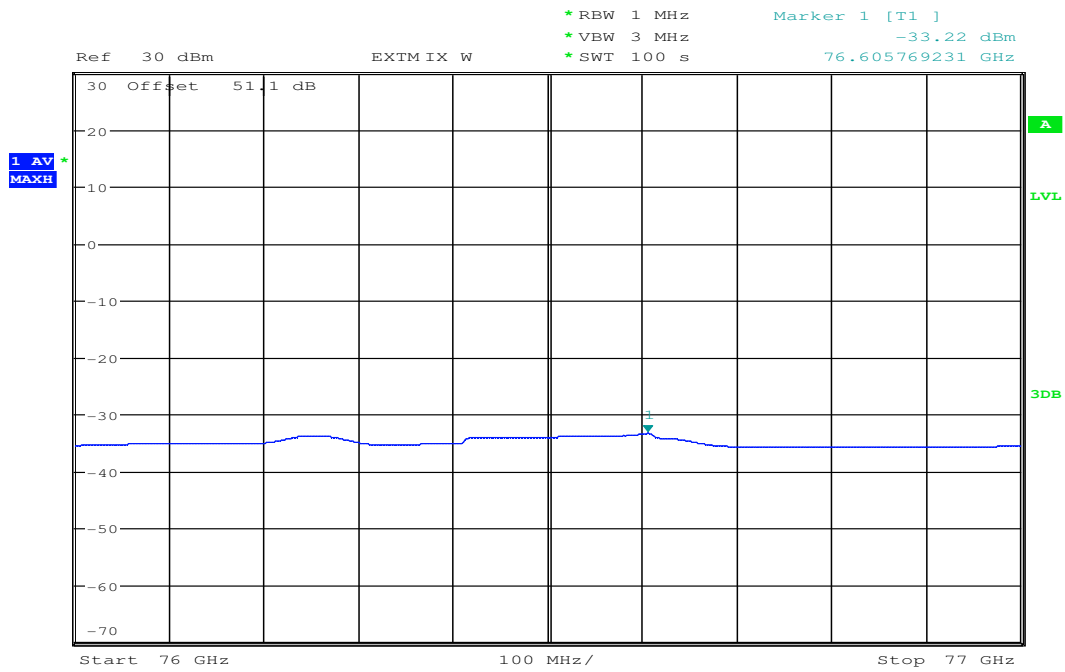
Plot 14: EIRP (Average detector),  $T_{min} / V_{min} - V_{max}$ , Not in Motion Mode



Date: 18.JAN.2012 13:06:53



Plot 15: EIRP (Average detector),  $T_{max} / V_{min} - V_{max}$ , Not in Motion Mode



Date: 18.JAN.2012 13:44:33

## 9.2 Maximum Permissible Exposure (MPE)

### MPE Calculation:

$$PD = \frac{OP + AG}{(4 \times \pi \times d^2)}$$

PD = Power Density (mW/cm<sup>2</sup>)  
 OP = DUT Output Power (dBm)  
 AG = DUT Antenna Gain (dBi)  
 d = MPE Distance (cm)

Note: OP [mW], AG as lin.factor

### § 1.1310 Radiofrequency radiation exposure limits.

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC’s OST/OET Bulletin Number 65, “Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation.”

NOTE TO INTRODUCTORY PARAGRAPH: These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in “Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,” NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3.

Copyright NCRP, 1986, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, exposure limits for field strength and power density are also generally based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,” ANSI/IEEE C95.1–1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

**Results:**

Refer to 9.1: the max. EIRP measured = 21.1 dBm = 128.8 mW (CW-test mode)

d = 20 cm

→ PD = 0.0256 mW/cm<sup>2</sup>

**Limits:**

FCC §1.1310 (B)

Frequency (GHz)	Power Density (mW/cm <sup>2</sup> )
1.500 GHz – 100.000 GHz	1 mW/cm <sup>2</sup>

**Result:** The measurement is passed.

### 9.3 Occupied bandwidth

#### Normal Mode:

TEST CONDITIONS	Occupied Bandwidth (99%)	
	$f_{low} / f_{high}$ [GHz]	Bandwidth [MHz]
$T_{nom} / V_{nom}$	76.4625 / 76.5641	101.6
$T_{min} / V_{min} - V_{max}$	76.4922 / 76.5922	100.0
$T_{max} / V_{min} - V_{max}$	76.4612 / 76.5635	102.2

TEST CONDITIONS	Occupied Bandwidth (26 dB)	
	$f_{low} / f_{high}$ [GHz]	Bandwidth [MHz]
$T_{nom} / V_{nom}$	76.4526 / 76.5699	117.3
$T_{min} / V_{min} - V_{max}$	76.4832 / 76.5983	115.1
$T_{max} / V_{min} - V_{max}$	76.4522 / 76.5696	117.3

#### CW Mode:

TEST CONDITIONS low frequency	Occupied Bandwidth (99%) (low)	
	$f_{low} / f_{high}$ [GHz]	Bandwidth [MHz]
$T_{nom} / V_{nom}$	76.4754 / 76.4786	3.1
$T_{min} / V_{min} - V_{max}$	76.4937 / 76.4969	3.1
$T_{max} / V_{min} - V_{max}$	76.4605 / 76.4638	3.2

TEST CONDITIONS center frequency	Occupied Bandwidth (99%) (center)	
	$f_{low} / f_{high}$ [GHz]	Bandwidth [MHz]
$T_{nom} / V_{nom}$	76.5263 / 76.5295	3.1
$T_{min} / V_{min} - V_{max}$	76.5438 / 76.5469	3.1
$T_{max} / V_{min} - V_{max}$	76.5113 / 76.5145	3.2

TEST CONDITIONS high frequency	Occupied Bandwidth (99%) (high)	
	$f_{low} / f_{high}$ [GHz]	Bandwidth [MHz]
$T_{nom} / V_{nom}$	76.5777 / 76.5806	2.9
$T_{min} / V_{min} - V_{max}$	76.5943 / 76.5974	3.1
$T_{max} / V_{min} - V_{max}$	76.5625 / 76.5657	3.2

**Not in Motion Mode:**

TEST CONDITIONS	Occupied Bandwidth (99%)	
	$f_{low} / f_{high}$ [GHz]	Bandwidth [MHz]
$T_{nom} / V_{nom}$	76.4488 / 76.6507	201.9
$T_{min} / V_{min} - V_{max}$	76.4749 / 76.6757	200.8
$T_{max} / V_{min} - V_{max}$	76.4582 / 76.6602	202.0

TEST CONDITIONS	Occupied Bandwidth (26 dB)	
	$f_{low} / f_{high}$ [GHz]	Bandwidth [MHz]
$T_{nom} / V_{nom}$	76.4448 / 76.6579	213.4
$T_{min} / V_{min} - V_{max}$	76.4737 / 76.6859	212.2
$T_{max} / V_{min} - V_{max}$	76.4443 / 76.6578	213.5

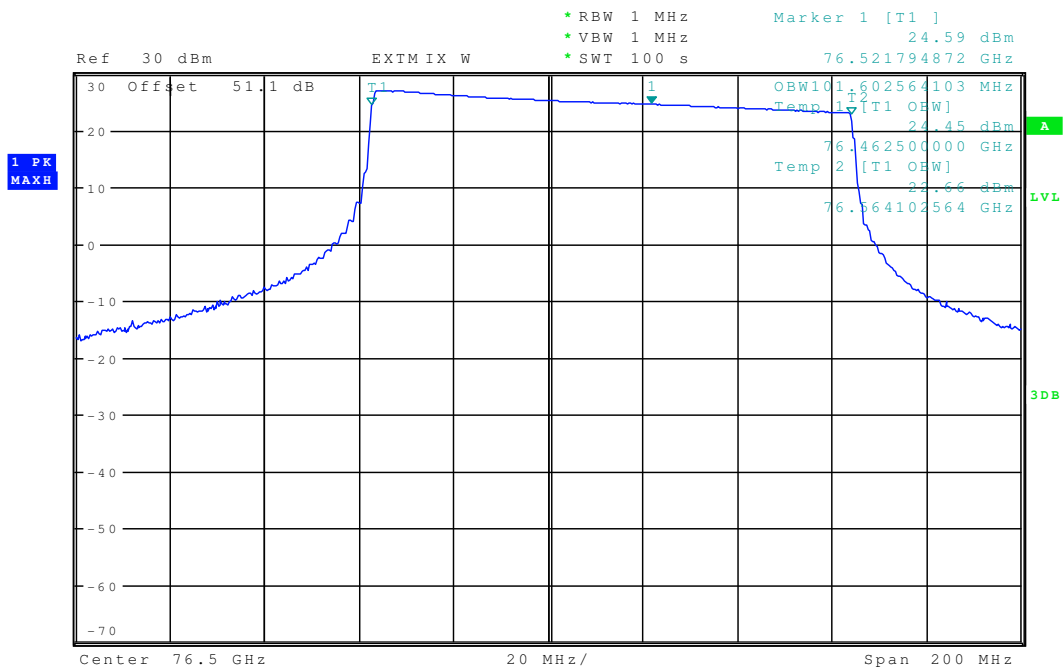
**Limits:**

FCC §2.1049

Frequency range	$f(\text{lowest}) > 76.0 \text{ GHz}$	$f(\text{highest}) < 77.0 \text{ GHz}$
-----------------	---------------------------------------	--

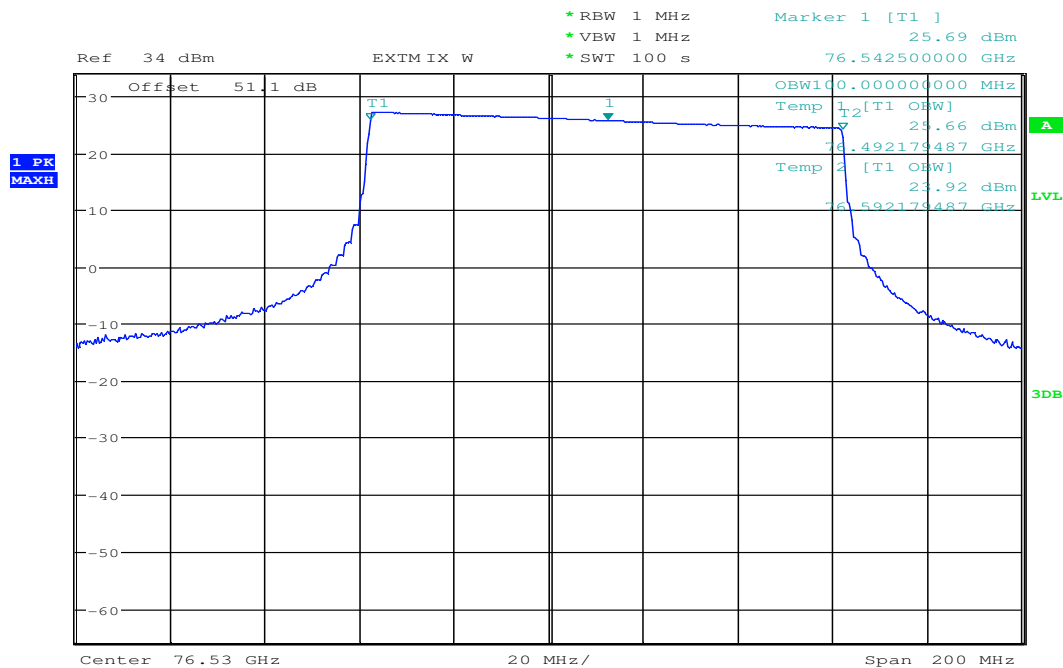
**Result:** The measurement is passed.

Plot 16: Occupied bandwidth (99 %),  $T_{nom} / V_{nom}$ , Normal Mode



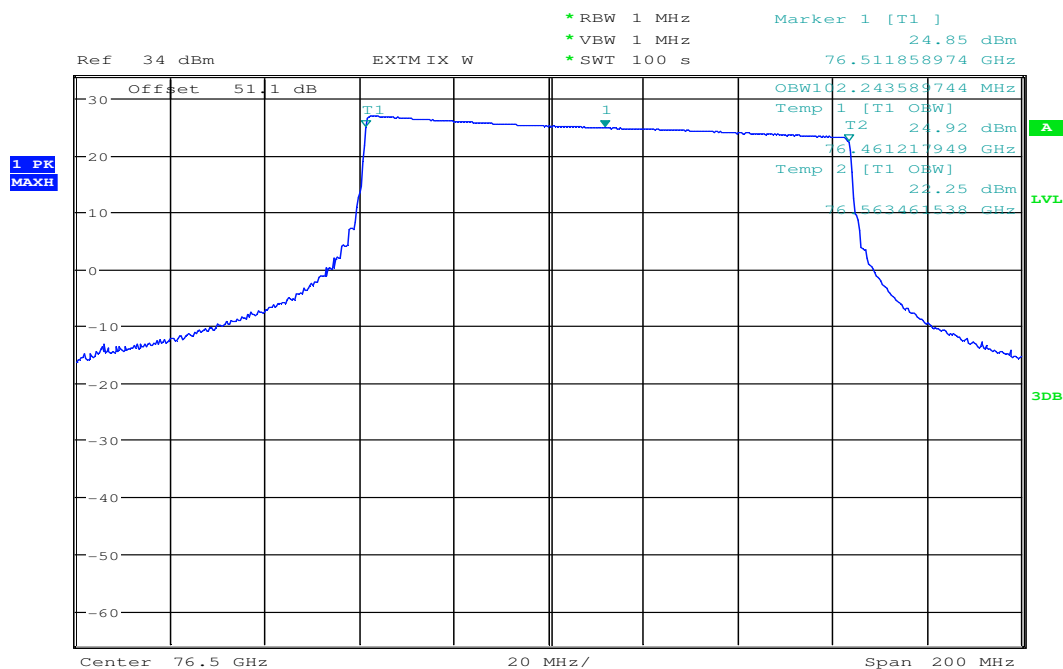
Date: 21.FEB.2012 11:03:36

Plot 17: Occupied bandwidth (99 %),  $T_{min} / V_{min} - V_{max}$ , Normal Mode



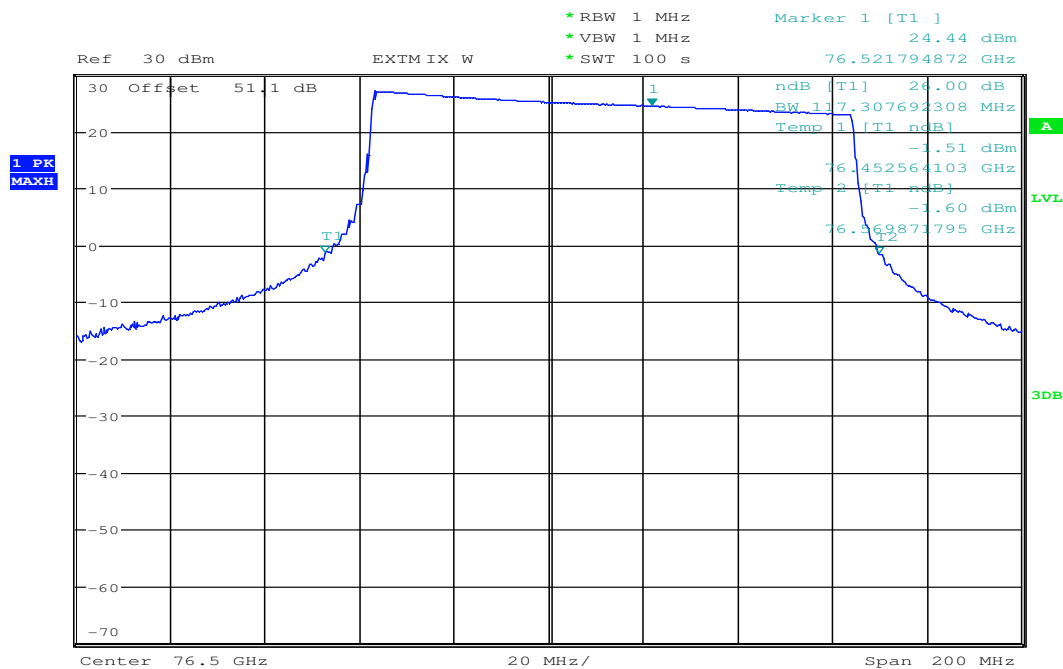
Date: 21.FEB.2012 14:07:16

Plot 18: Occupied bandwidth (99 %),  $T_{max} / V_{min} - V_{max}$ , Normal Mode



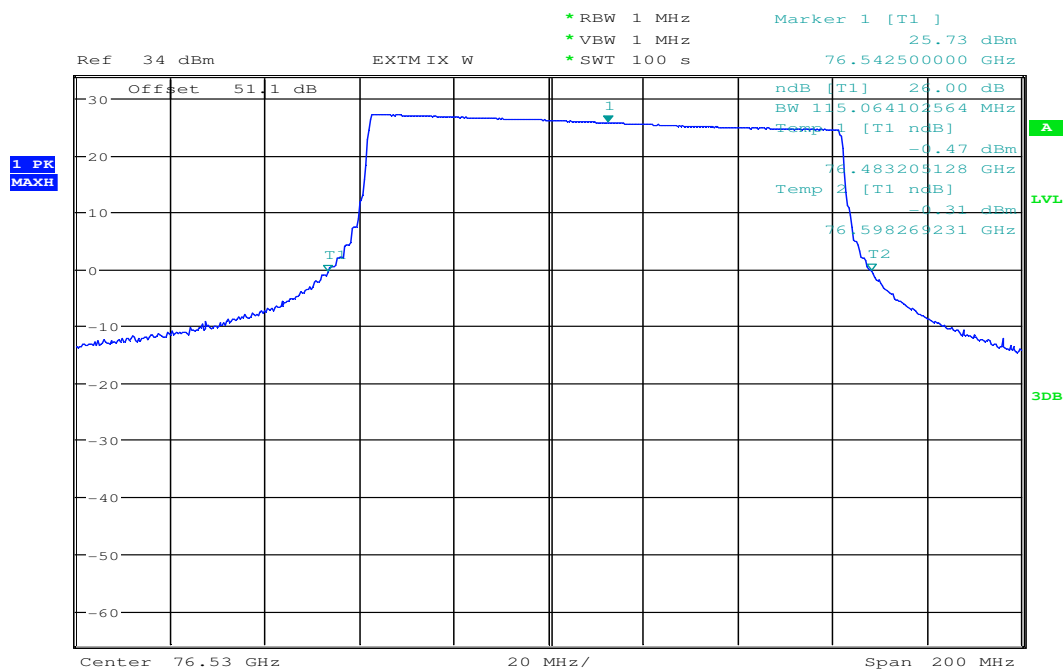
Date: 21.FEB.2012 15:22:18

Plot 19: Occupied bandwidth (26 dB),  $T_{nom} / V_{nom}$ , Normal Mode



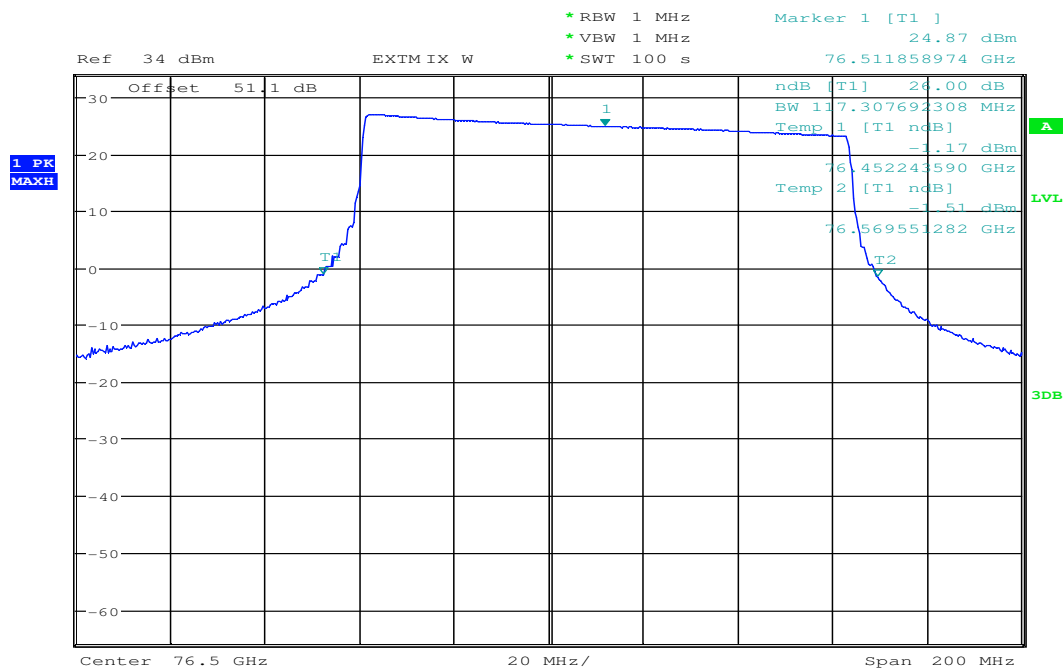
Date: 21.FEB.2012 11:06:14

Plot 20: Occupied bandwidth (26 dB),  $T_{min} / V_{min} - V_{max}$ , Normal Mode



Date: 21.FEB.2012 14:12:07

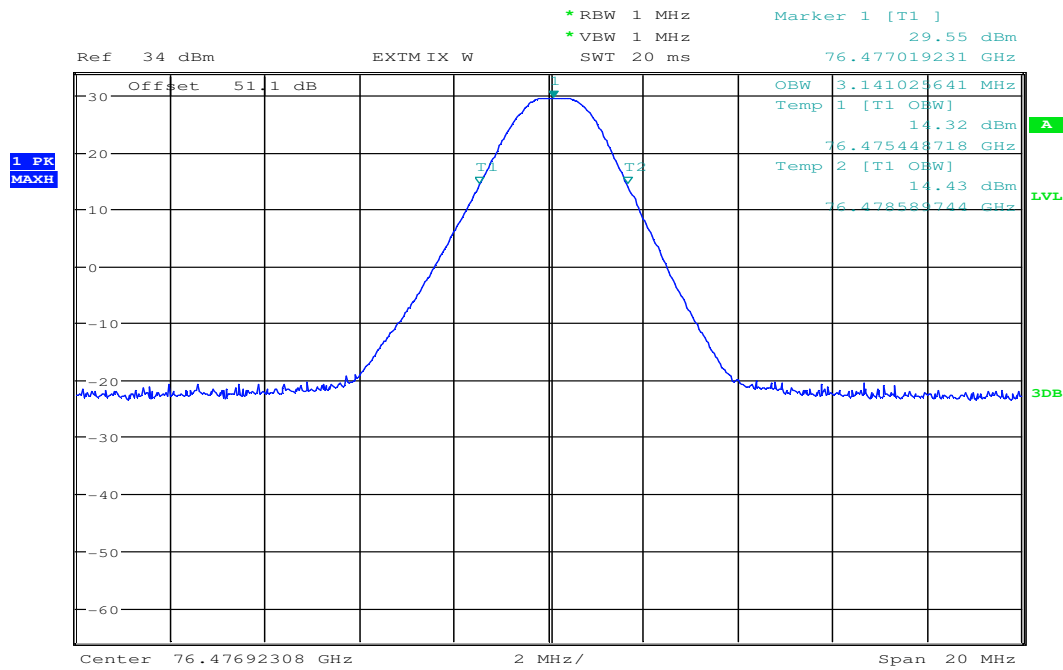
Plot 21: Occupied bandwidth (26 dB),  $T_{max} / V_{min} - V_{max}$ , Normal Mode



Date: 21.FEB.2012 15:20:11

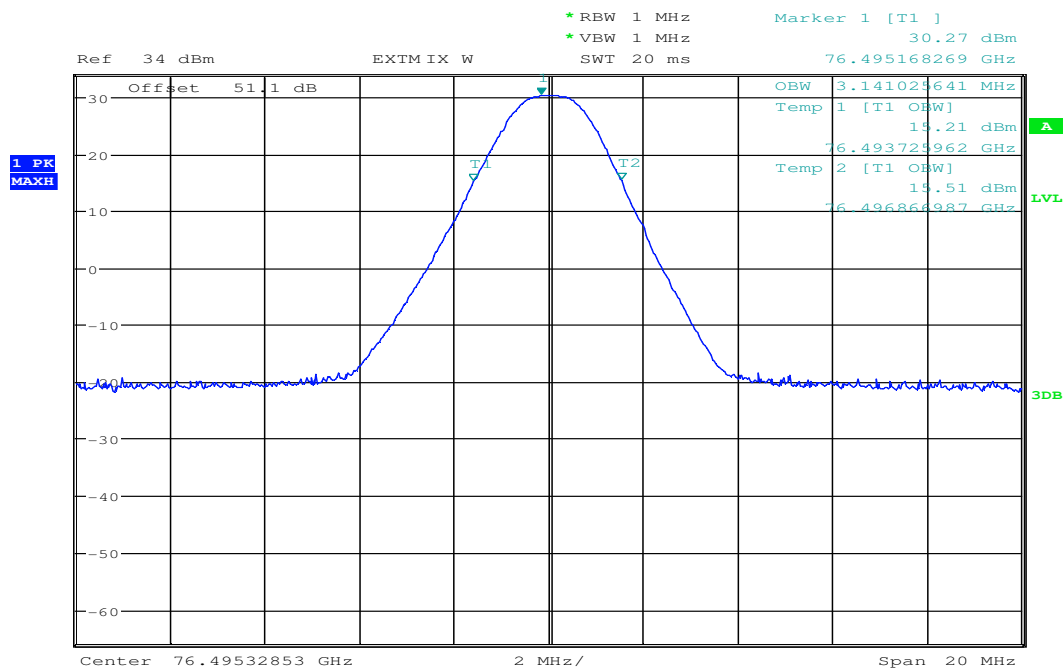


Plot 22: Occupied bandwidth (99 %),  $T_{nom} / V_{nom}$ , CW Mode, low frequency



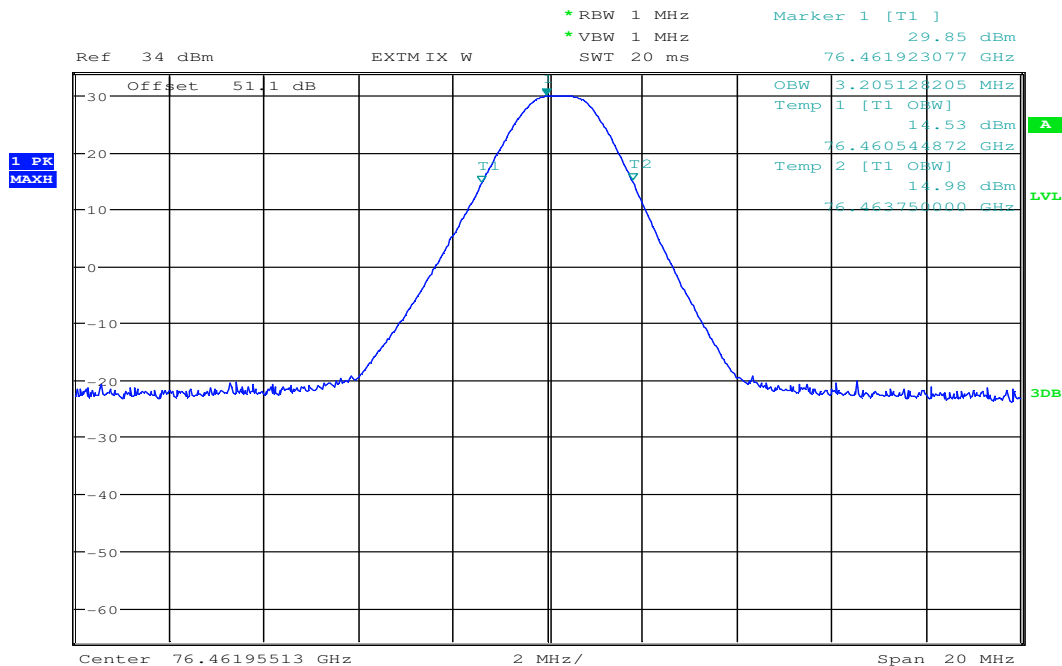
Date: 21.FEB.2012 16:13:18

Plot 23: Occupied bandwidth (99 %),  $T_{min} / V_{min} - V_{max}$ , CW Mode, low frequency



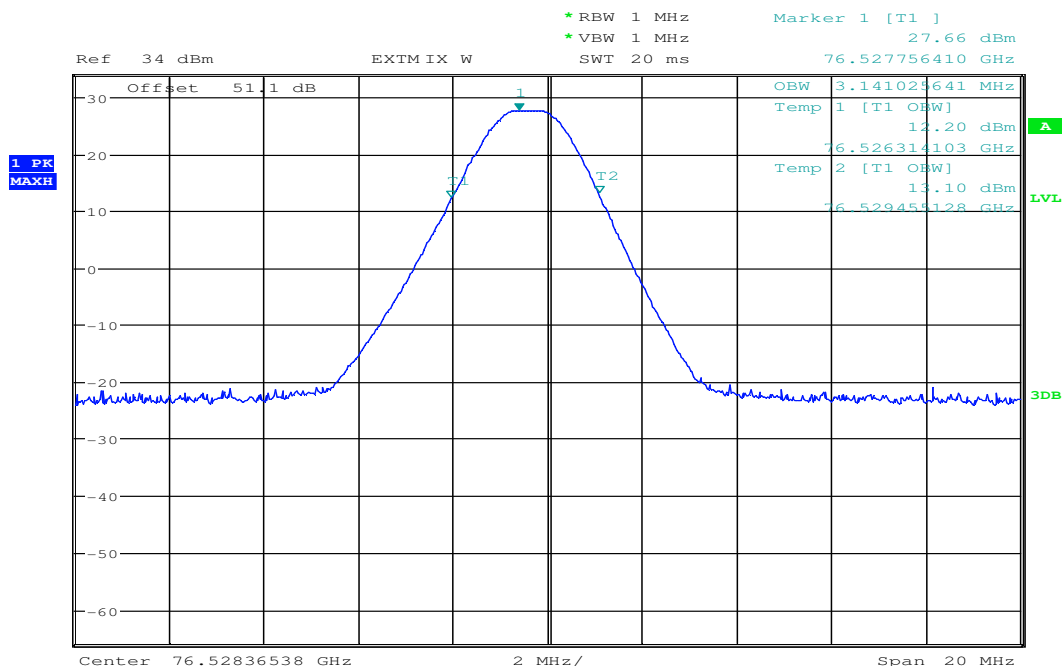
Date: 21.FEB.2012 16:57:14

Plot 24: Occupied bandwidth (99 %),  $T_{max} / V_{min} - V_{max}$ , CW Mode, low frequency



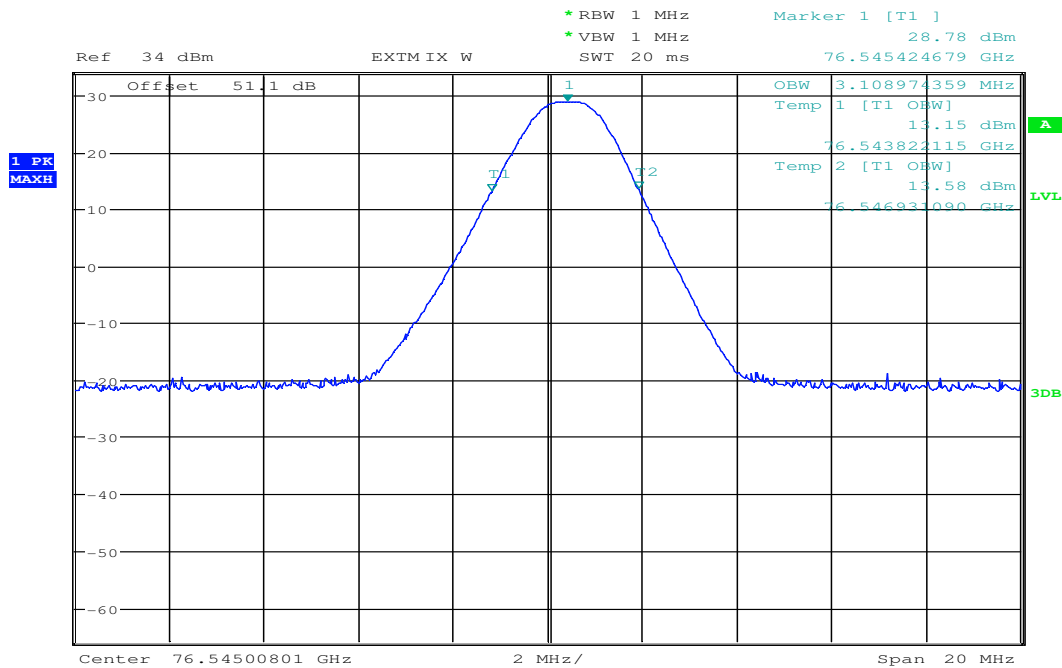
Date: 21.FEB.2012 15:47:59

Plot 25: Occupied bandwidth (99 %),  $T_{nom} / V_{nom}$ , CW Mode, center frequency



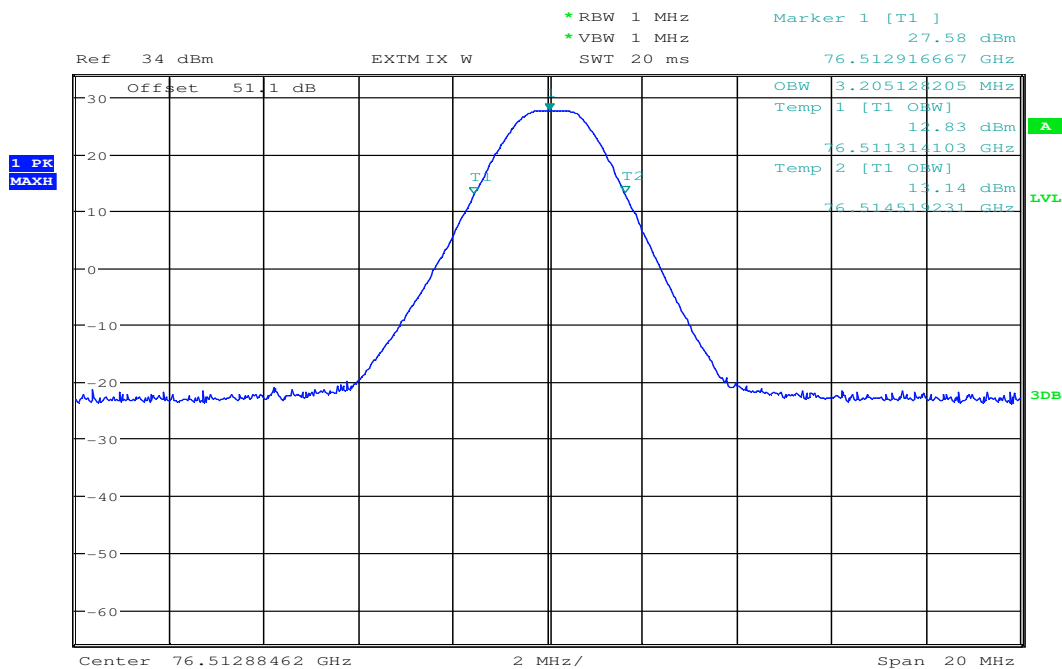
Date: 21.FEB.2012 16:12:29

Plot 26: Occupied bandwidth (99 %),  $T_{min} / V_{min} - V_{max}$ , CW Mode, center frequency



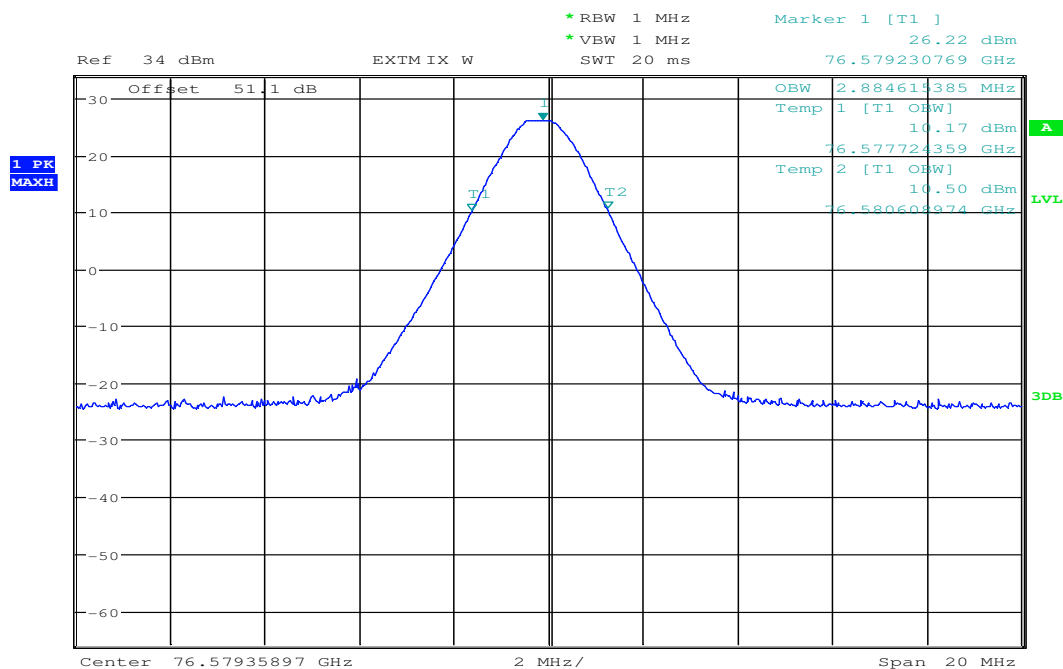
Date: 21.FEB.2012 16:56:06

Plot 27: Occupied bandwidth (99 %),  $T_{max} / V_{min} - V_{max}$ , CW Mode, center frequency



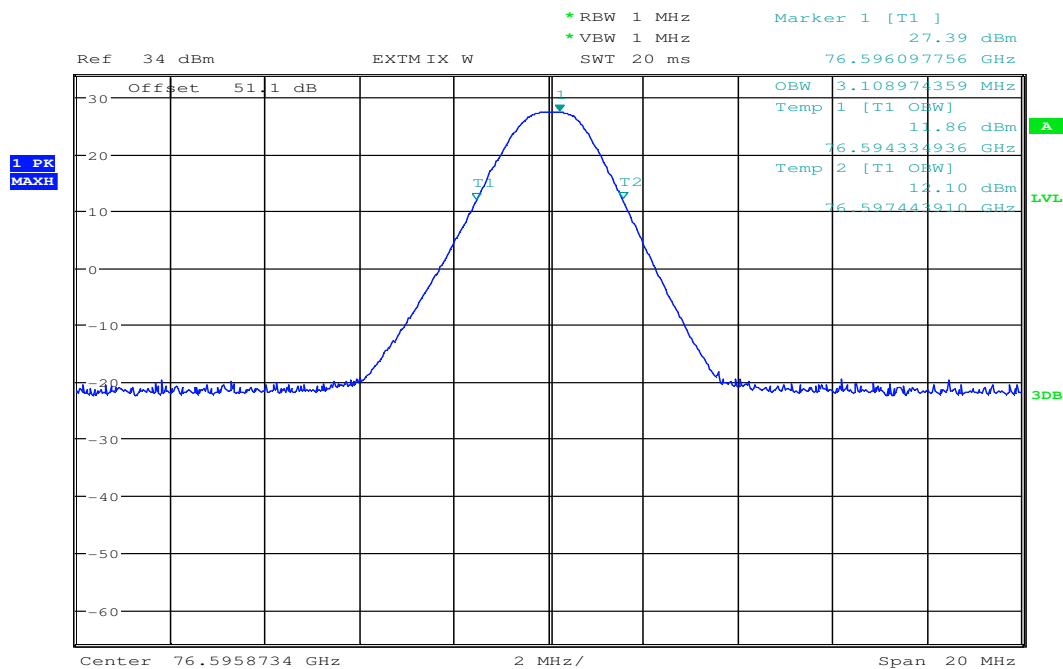
Date: 21.FEB.2012 15:46:04

Plot 28: Occupied bandwidth (99 %),  $T_{nom} / V_{nom}$ , CW Mode, high frequency



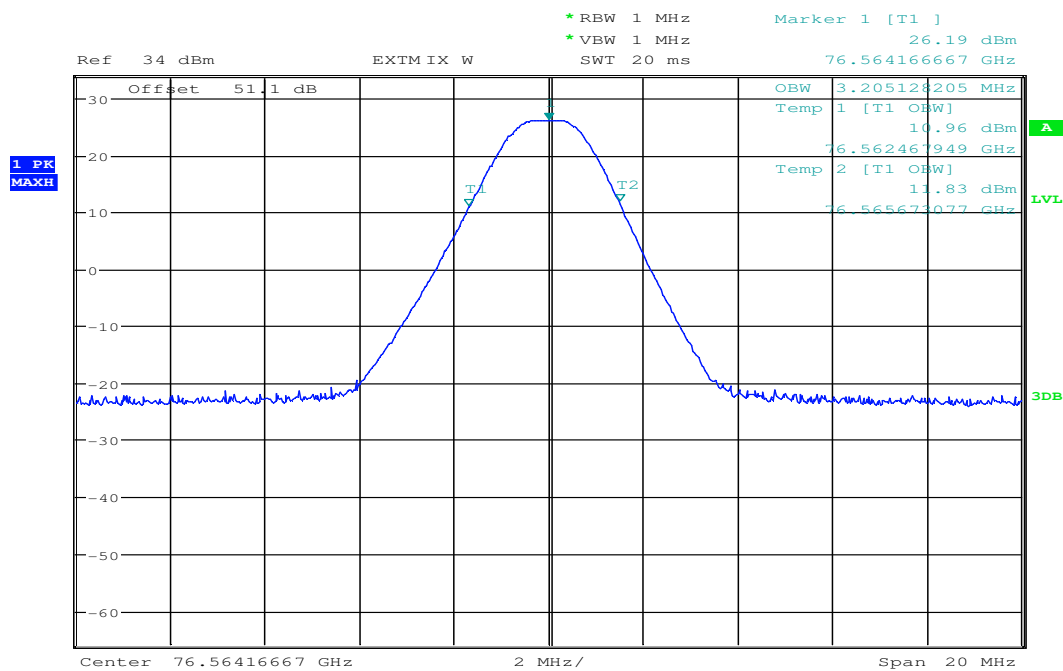
Date: 21.FEB.2012 16:10:20

Plot 29: Occupied bandwidth (99 %),  $T_{min} / V_{min} - V_{max}$ , CW Mode, high frequency



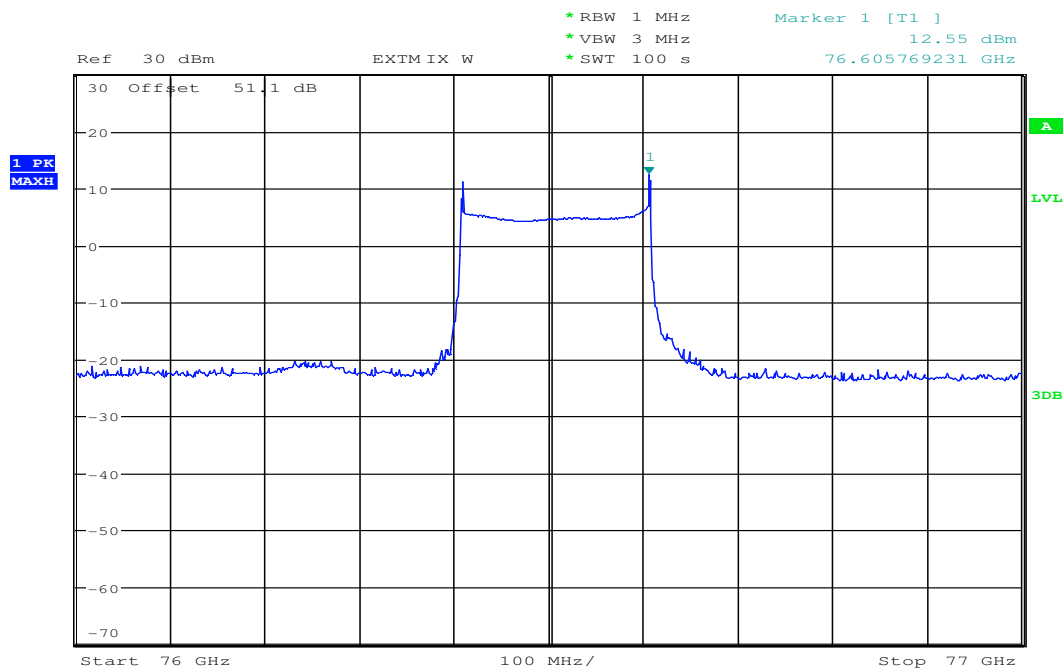
Date: 21.FEB.2012 16:58:45

Plot 30: Occupied bandwidth (99 %),  $T_{max} / V_{min} - V_{max}$ , CW Mode, high frequency



Date: 21.FEB.2012 15:44:23

Plot 31: Occupied bandwidth, representative plot, Not in Motion Mode  $T_{nom} / V_{nom}$



Date: 18.JAN.2012 11:34:49

## 9.4 Field strength of emissions (radiated spurious)

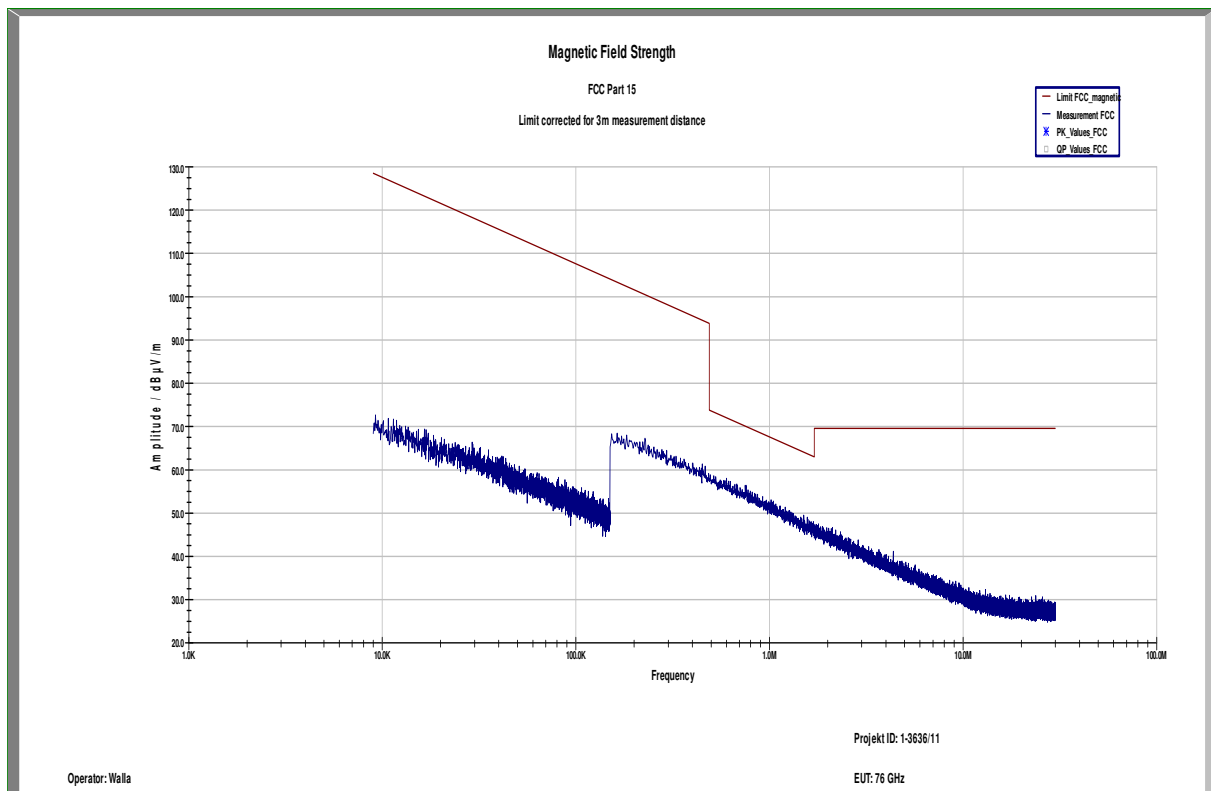
### Description:

Measurement of the radiated spurious emissions in transmit mode.

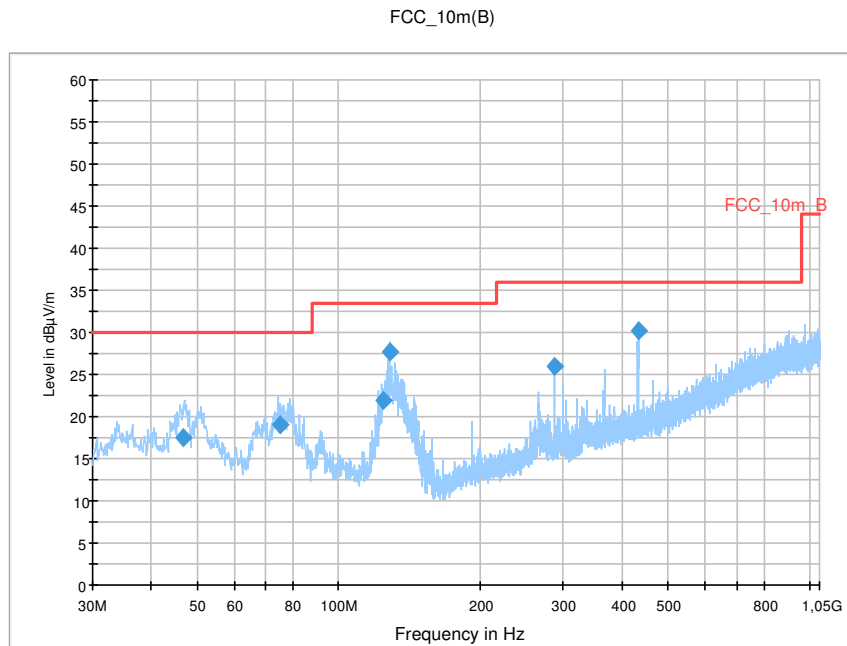
### Measurement:

Measurement parameter	
Detector:	Peak / Quasi Peak
Sweep time:	Auto
Video bandwidth:	Auto
Resolution bandwidth:	F < 1 GHz: 100 kHz F > 1 GHz: 1 MHz
Frequency range:	30 MHz to 235 GHz
Trace-Mode:	Max Hold

Plot 32: 9 kHz – 30 MHz, Loop antenna (valid for all modes and all frequencies)

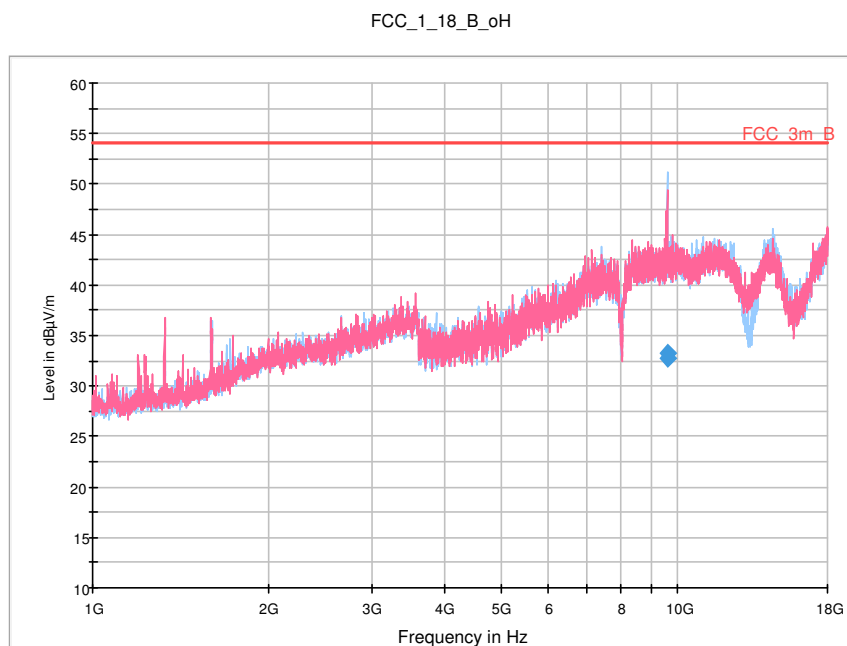


Plot 33: 30 MHz – 1 GHz, antenna horizontal / vertical

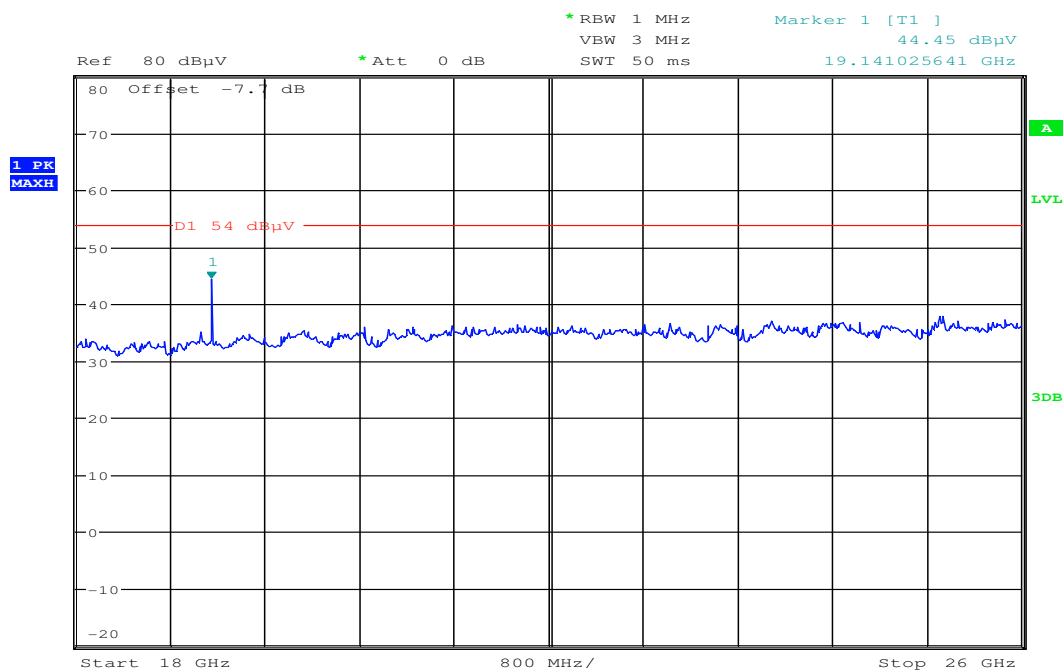


Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
46.817700	17.5	1000.0	120.000	100.0	V	191.0	13.3	12.5	30.0
74.940000	19.0	1000.0	120.000	256.0	V	134.0	9.2	11.0	30.0
124.287900	21.9	1000.0	120.000	158.0	V	118.0	9.9	11.6	33.5
128.007900	27.8	1000.0	120.000	200.0	V	127.0	9.6	5.7	33.5
287.987250	26.0	1000.0	120.000	160.0	V	163.0	14.2	10.0	36.0
433.093200	30.1	1000.0	120.000	100.0	V	174.0	17.4	5.9	36.0

Plot 34: 1 GHz – 18 GHz, antenna horizontal / vertical

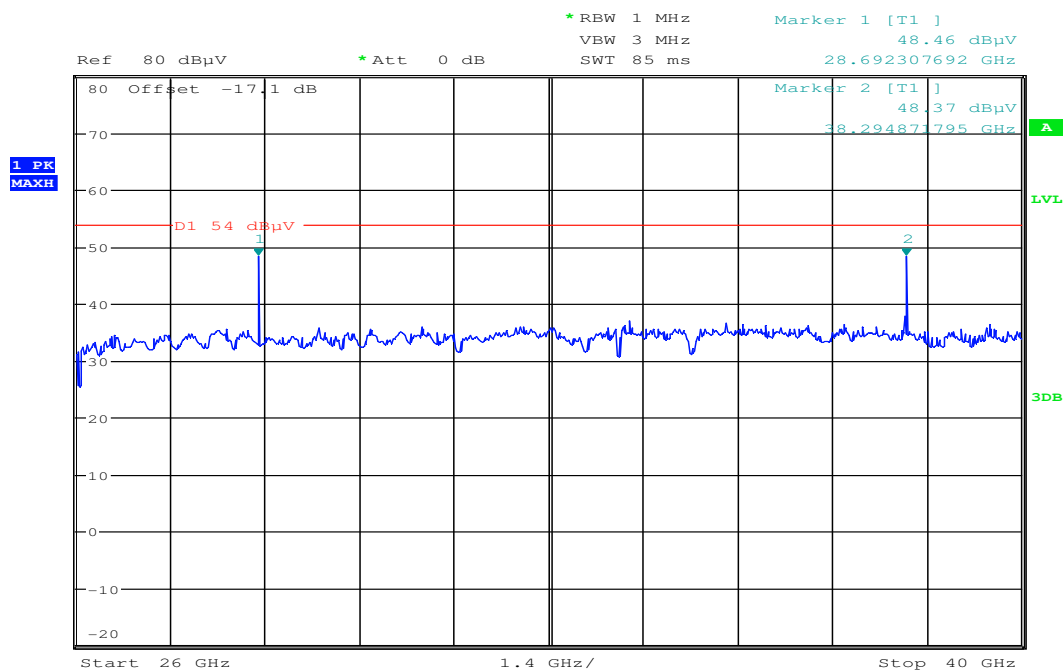


Plot 35: 18 GHz – 26 GHz, antenna horizontal / vertical



Date: 17.JAN.2012 16:38:29

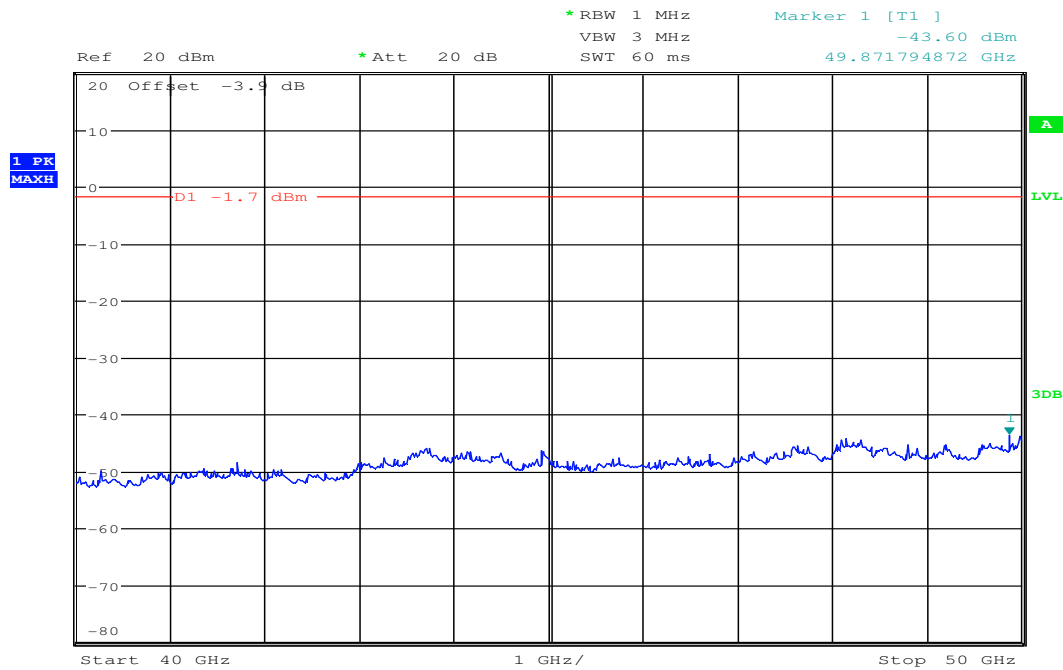
Plot 36: 26 GHz – 40 GHz, antenna horizontal / vertical



Date: 18.JAN.2012 07:00:28

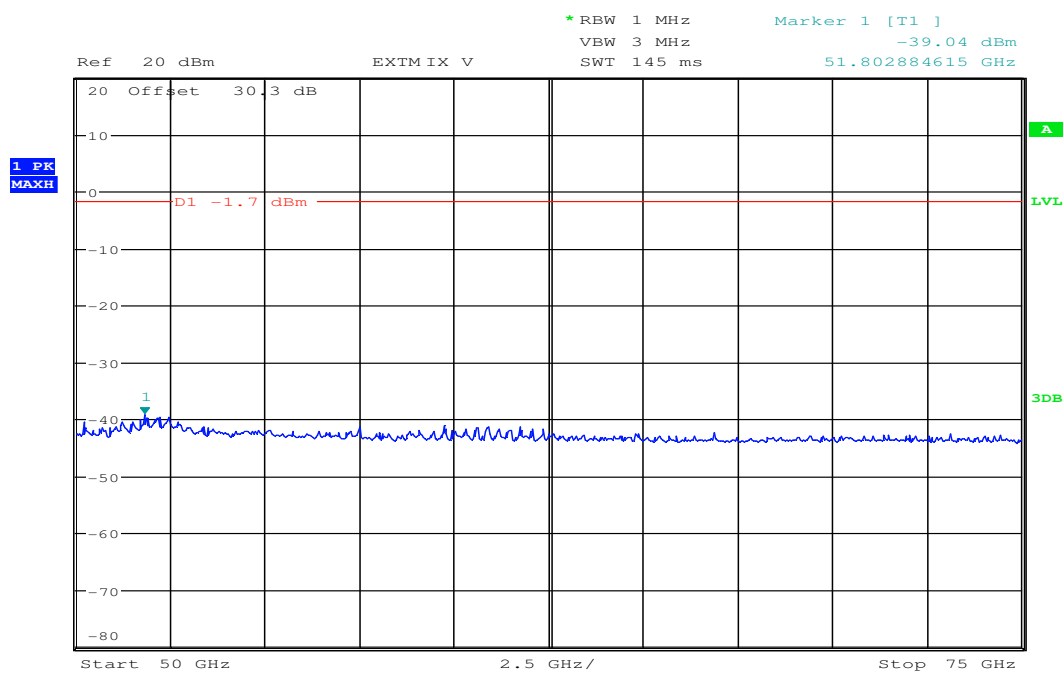


Plot 37: 40 GHz – 50 GHz, antenna horizontal / vertical



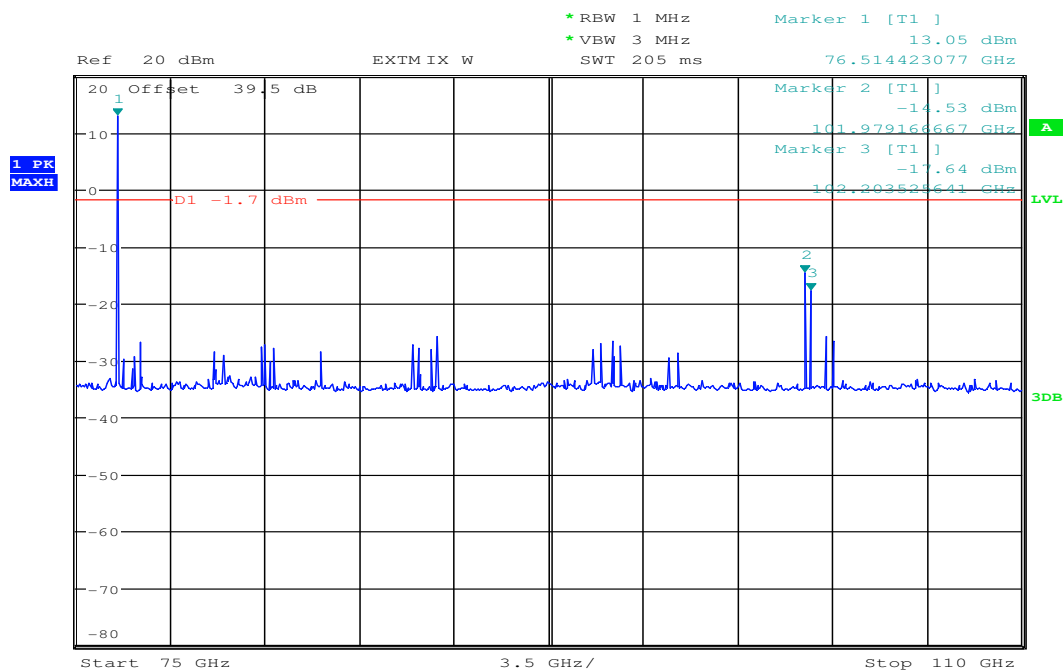
Date: 18.JAN.2012 07:11:45

Plot 38: 50 GHz – 75 GHz, antenna horizontal / vertical



Date: 18.JAN.2012 07:24:07

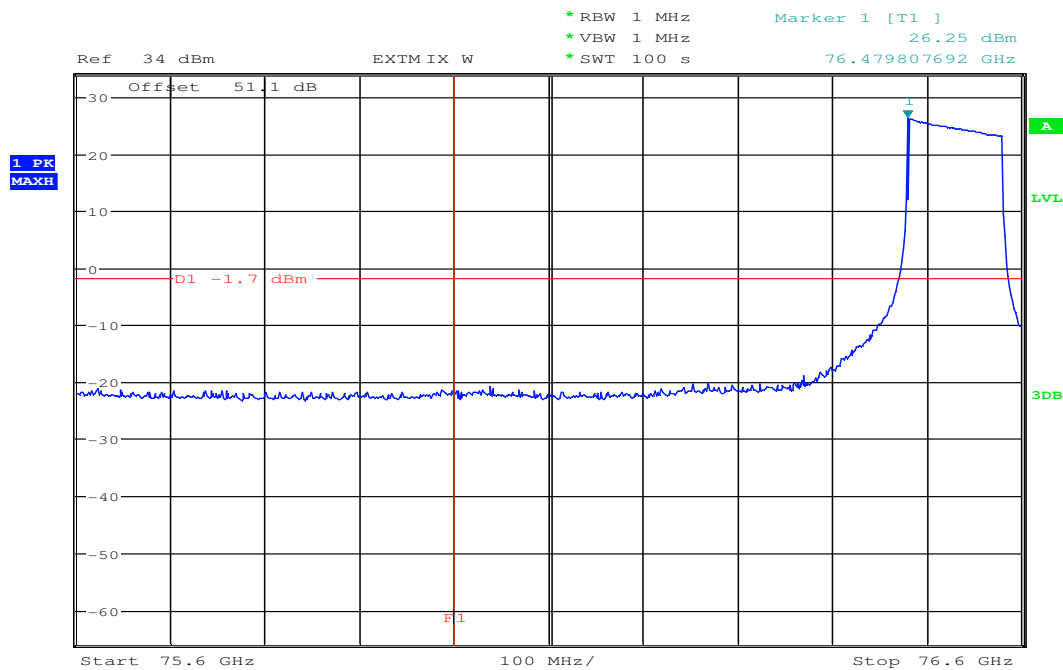
Plot 39: 75 GHz – 110 GHz, antenna horizontal / vertical



Date: 17.JAN.2012 14:53:47

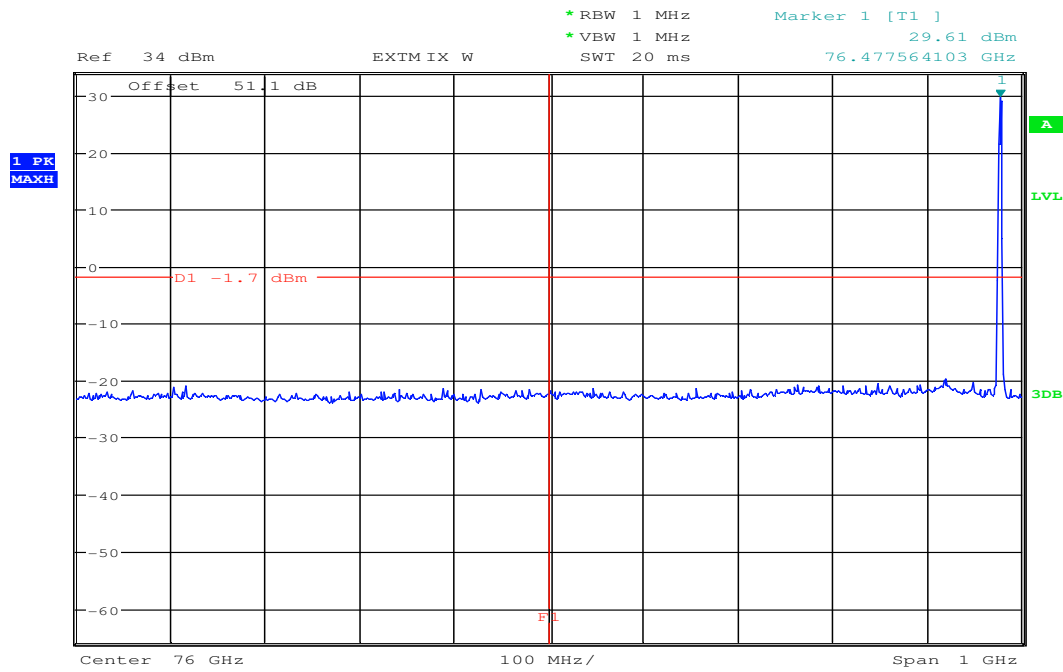
**Note: Marker 1 shows the wanted signal, marker 2 and 3 shows peaks produced by the harmonic mixer!**

Plot 40: Band edge compliance, lower band edge, normal mode



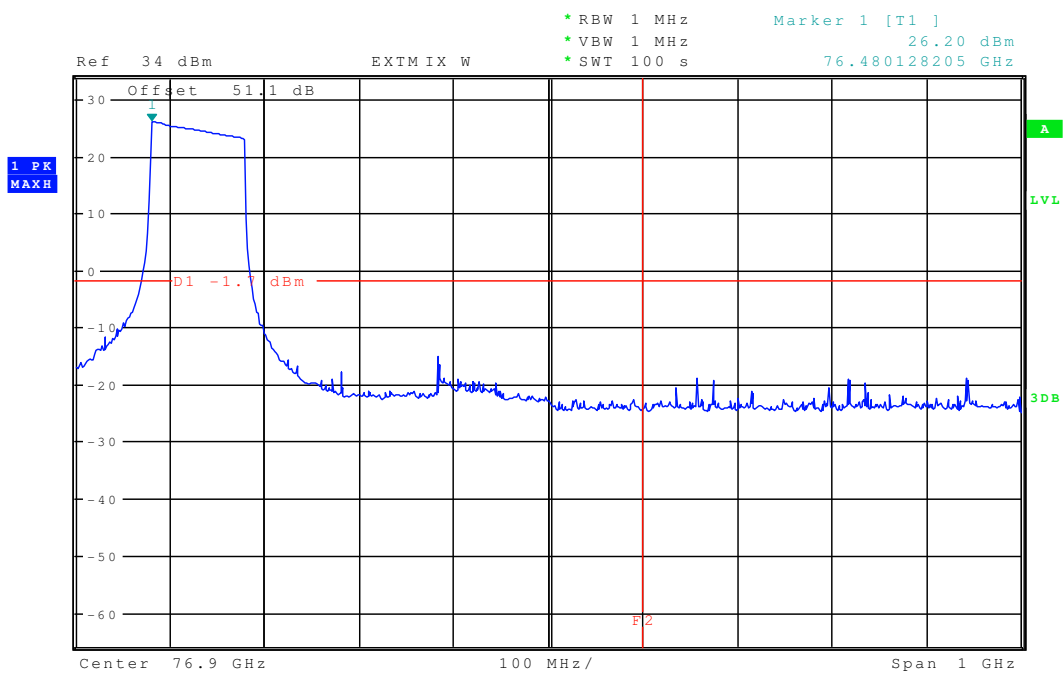
Date: 21.FEB.2012 16:19:09

Plot 41: Band edge compliance, lower band edge, CW test mode, low frequency

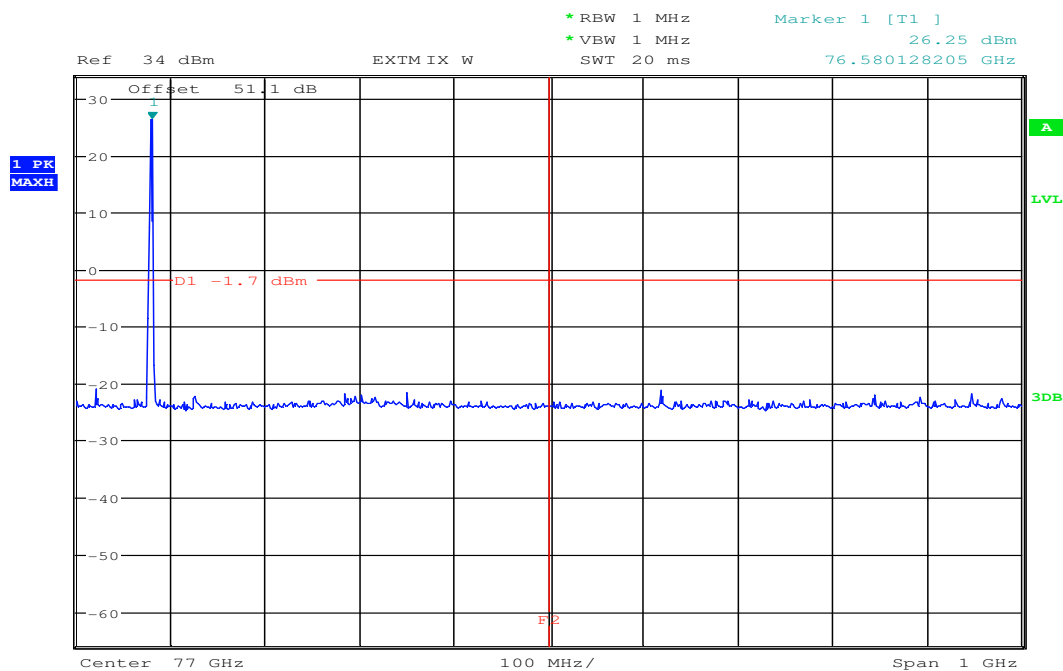


Date: 21.FEB.2012 16:14:58

Plot 42: Band edge compliance, upper band edge, normal mode

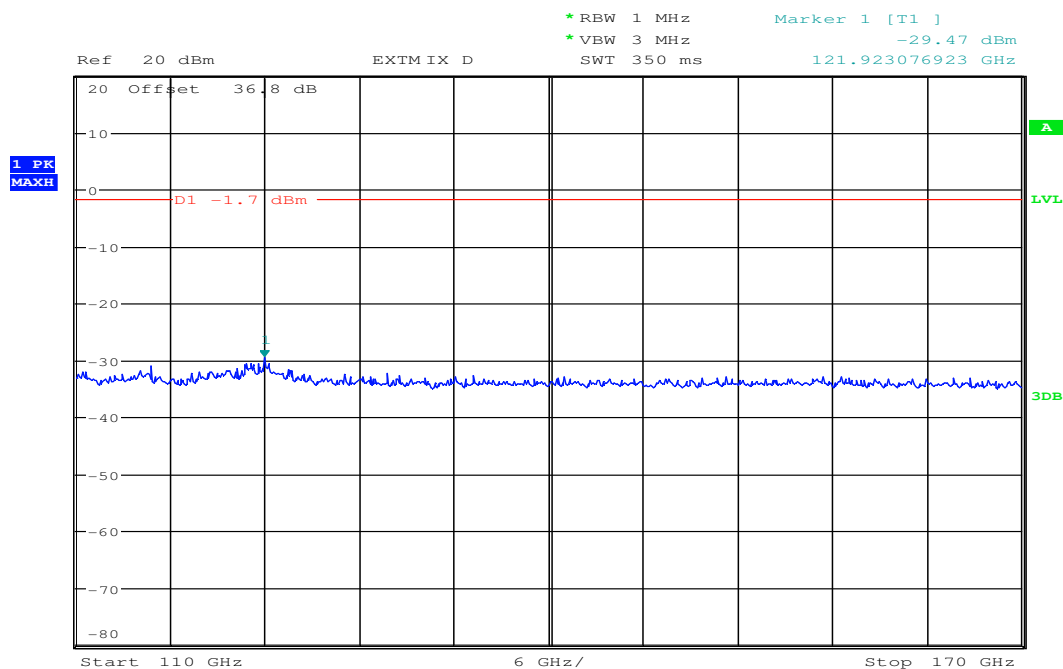


Plot 43: Band edge compliance, upper band edge, CW test mode, high frequency



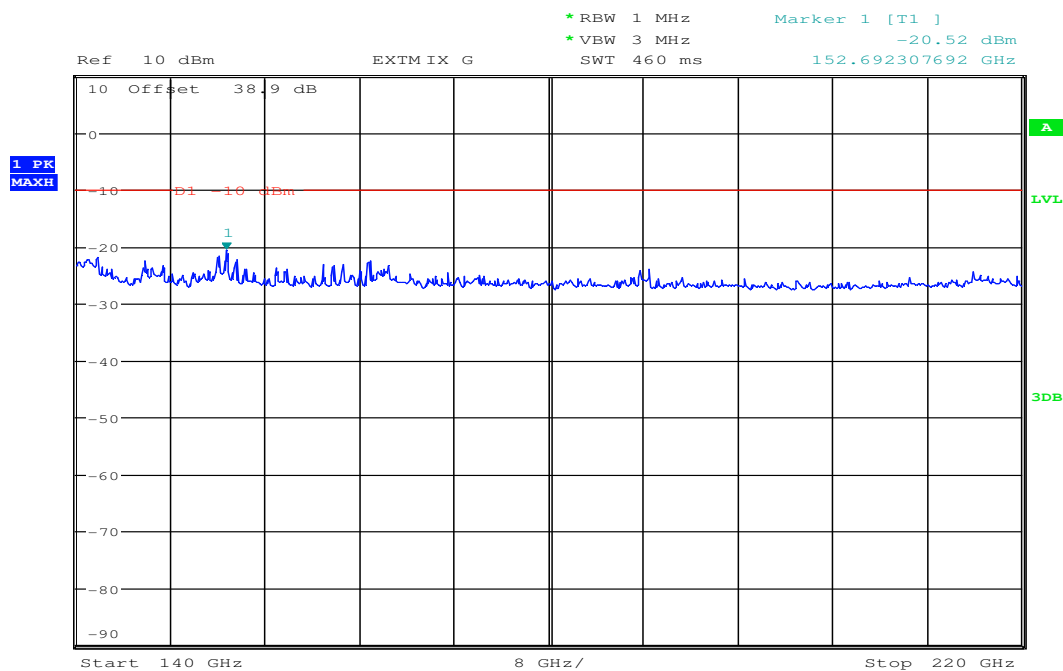
Date: 21.FEB.2012 16:07:56

Plot 44: 110 GHz – 170 GHz, antenna horizontal / vertical



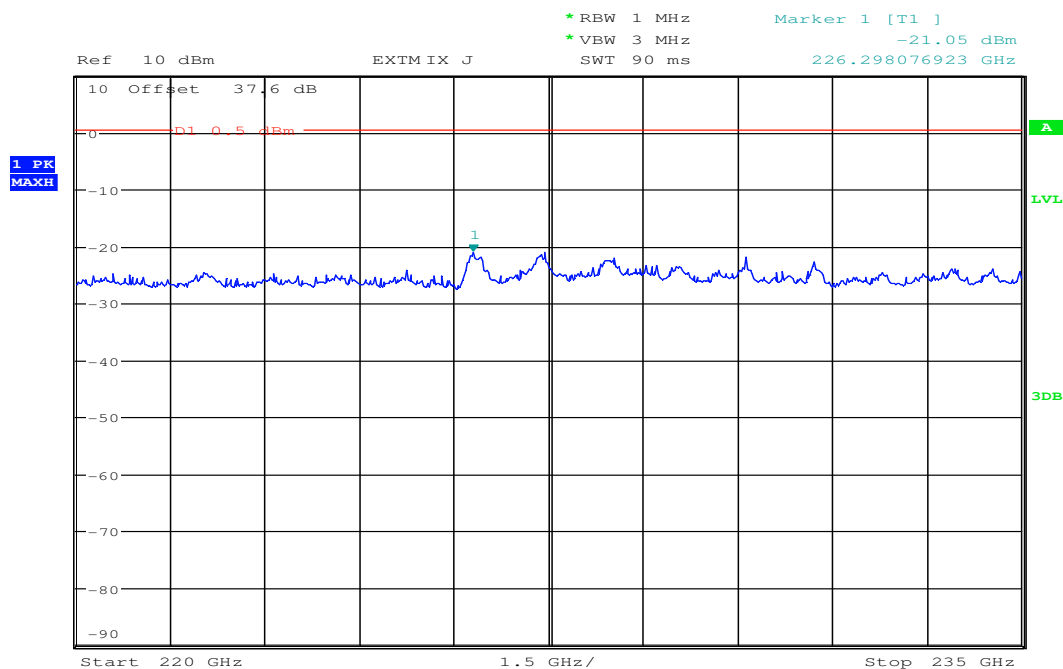
Date: 17.JAN.2012 15:02:45

Plot 45: 140 GHz – 220 GHz, antenna horizontal / vertical



Date: 17.JAN.2012 15:08:18

Plot 46: 220 GHz – 235 GHz, antenna horizontal / vertical



Date: 17.JAN.2012 15:30:59

**Results:**

TX Spurious Emissions Radiated [dBµV/m]								
F [GHz]	Detector	Level [dBµV/m]	F [GHz]	Detector	Level [dBµV/m]	F [GHz]	Detector	Level [dBµV/m]
No critical peaks detected!			No critical peaks detected!			No critical peaks detected!		
Measurement uncertainty			± 3 dB					

**Limits:**

FCC §15.253 / 15.209 / 15.205

FCC		
CFR Part 15.253 (c) (1) / CFR Part 15.209 (a) / CFR Part 15.205		
Radiated Spurious Emissions		
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.		
Frequency [MHz]	Field Strength [dBµV/m]	Measurement distance
0.009 – 0.490	2400/F[kHz]	300
0.490 – 1.705	24000/F[kHz]	30
1.705 – 30.0	30	30
30 – 88	30.0	10
88 – 216	33.5	10
216 – 960	36.0	10
960 – 40 000	54.0	3

**Limits:**

FCC §15.253 (c) (2) (ii) + (3)

Frequency Range [GHz]	Measurement distance	Power Density
40 – 200	3.0 m	600 pW/cm <sup>2</sup> → -1.7 dBm
200 – 231	3.0 m	1000 pW/cm <sup>2</sup> → +0.5 dBm

**Result:** The measurement is passed.

## 9.5 Frequency stability

TEST CONDITIONS	Frequency Stability
$T_{nom} / V_{nom}$	76.5129
$T_{min} / V_{min} - V_{max}$	76.5416
$T_{max} / V_{min} - V_{max}$	76.5110

**Note:**

Frequency stability measurement was performed with sweep stopped in the middle of the used band (CW-test mode, center frequency)

**Limits:**

FCC §15.253 (e)

Frequency range	$f(\text{lowest}) > 76.0 \text{ GHz}$	$f(\text{highest}) < 77.0 \text{ GHz}$
-----------------	---------------------------------------	--

**Result:** The measurement is passed.

## 10 Test equipment and ancillaries used for tests

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Labor/Item).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Isolating Transformer	RT5A	Grundig	8041	300001626	g		
2	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	05.03.2009	
3	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
4	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996		23.03.2009	
5	Spec.A. 2_2e	System rack for EMI measurement solution	85900	HP I.V.	*	300000222	ne		
6	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve		
7	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
8	n. a.	Relais Matrix	PSU	R&S	890167/024	300001168	ne		
9	n. a.	Isolating Transformer	RT5A	Grundig	9242	300001263	ne		
10	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
11	n. a.	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
12	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
13	n. a.	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
14	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
15	n. a.	TILE-Software Emission	Quantum Change, Modell TILE-ICS/FULL	EMCO	none	300003451	ne		
16	n. a.	Highpass Filter	WHKX2.9/18G-12SS	Wainwright	1	300003492	ev		
17	n. a.	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev		
18	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
19	n. a.	PSA Spectrum Analyzer 3 Hz - 26.5 GHz	E4440A	Agilent Technologies	MY48250080	300003812	k	08.09.2010	08.09.2012
20	n. a.	MXG Microwave Analog Signal Generator	N5183A	Agilent Technologies	MY47420220	300003813	k	13.09.2010	13.09.2012
21	n. a.	RF Filter Section 9kHz - 1GHz	N9039A	Agilent Technologies	MY48260003	300003825	vIKI!	08.09.2010	08.09.2012
22	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!		
23	n. a.	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	Ve		
24	n. a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	ve	01.07.2010	01.07.2012



25	11b	Microwave System Amplifier, 0.5-26.5 GHz; 25 dB gain	83017A	HP Meßtechnik	00419	300002268	ev	10.03.2011	
26	A026	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda		300000787	ne		
27	A029	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda		300002442	ne		
28	A016	Std. Gain Horn Antenna 14.5-22.0 GHz	1924-20	Flann	33	300001963	ne		
29	A019	Std. Gain Horn Antenna 17.6-26.7 GHz	2024-20	Flann	156	300001968	ne		
30	A021	Std. Gain Horn Antenna 26.4-40.1 GHz	2224-20	Flann	233	300001973	ne		
31	A023	Std. Gain Horn Antenna 39.3-59.7 GHz	2424-20	Flann	75	300001979	ne		
32	n. a.	Amplifier	FLNA-28B	Farran	FTL 1067B	300002843	ne		
33	n. a.	Amplifier		HP					
34	n. a.	Harmonic Mixer Set 60-325 GHz	WM780	Tektronix	div.	300001685b	ne		
35	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
36	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne		
37	n. a.	software	SPS_PHE 1.4f	Spitzberger & Spieß	B5981; 5D1081;B5979	300000210	ne		
38	n. a.	EMI Test Receiver	ESCI 1166.5950.03	R&S	100083	300003312	k	05.01.2011	05.01.2013
39	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	k	14.07.2011	14.07.2013
40	n. a.	Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379	ev		
41	n. a.	Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745	izw		
42	n. a.	Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746	izw		
43	n. a.	Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747	izw		
44	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
45	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne		

Agenda: Kind of Calibration

k	calibration / calibrated		EK	limited calibration
ne	not required (k, ev, izw, zw not required)		zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification		izw	internal cyclical maintenance
Ve	long-term stability recognized		g	blocked for accredited testing
vkI!	Attention: extended calibration interval			
NK!	Attention: not calibrated		*)	next calibration ordered / currently in progress

**Annex A Photographs of the test setup**

Photo No. 1:

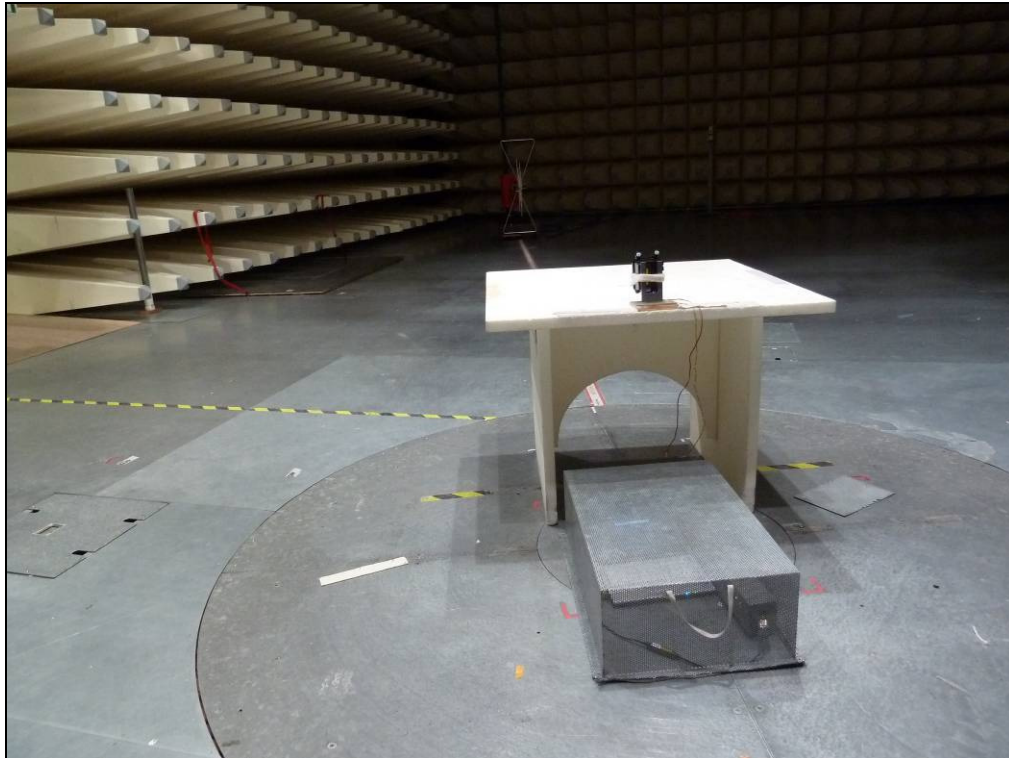


Photo No. 2:

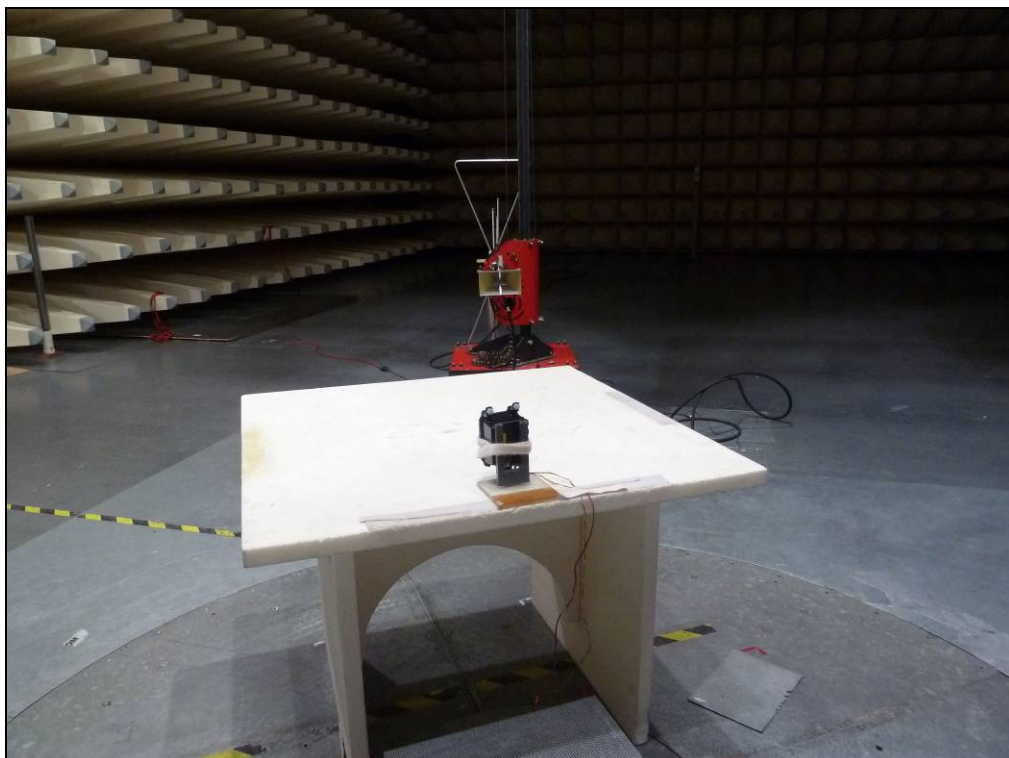


Photo No. 3:

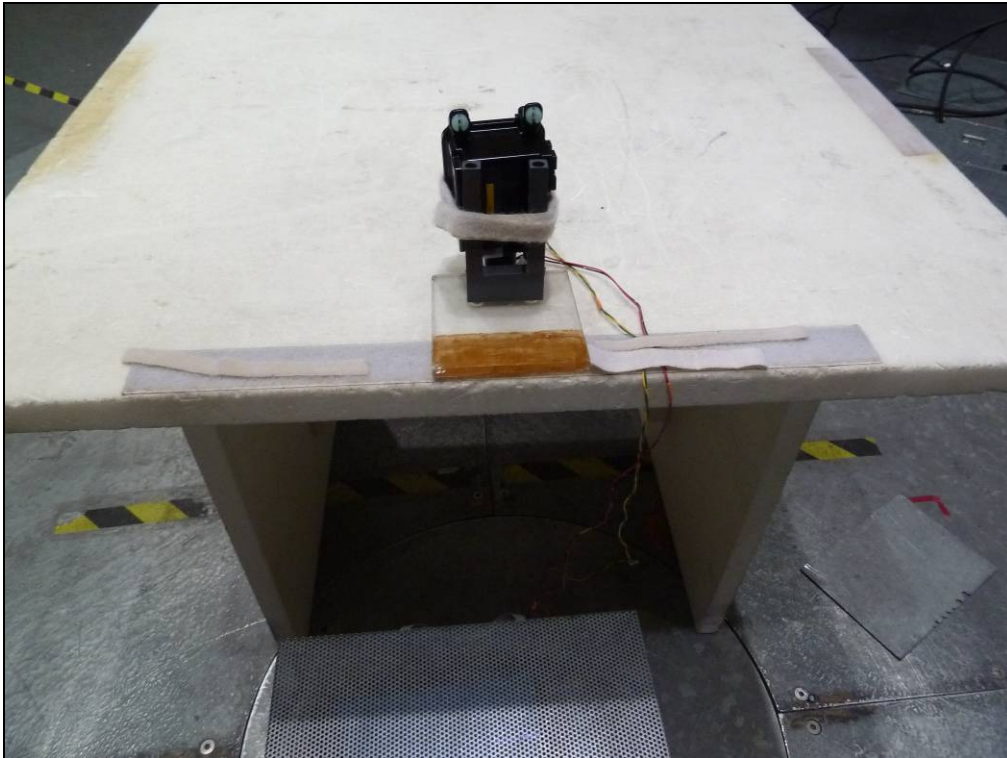


Photo No. 4:





**Annex B External photographs of the EUT**

Photo No. 5:



Photo No. 6:



Photo No. 7:

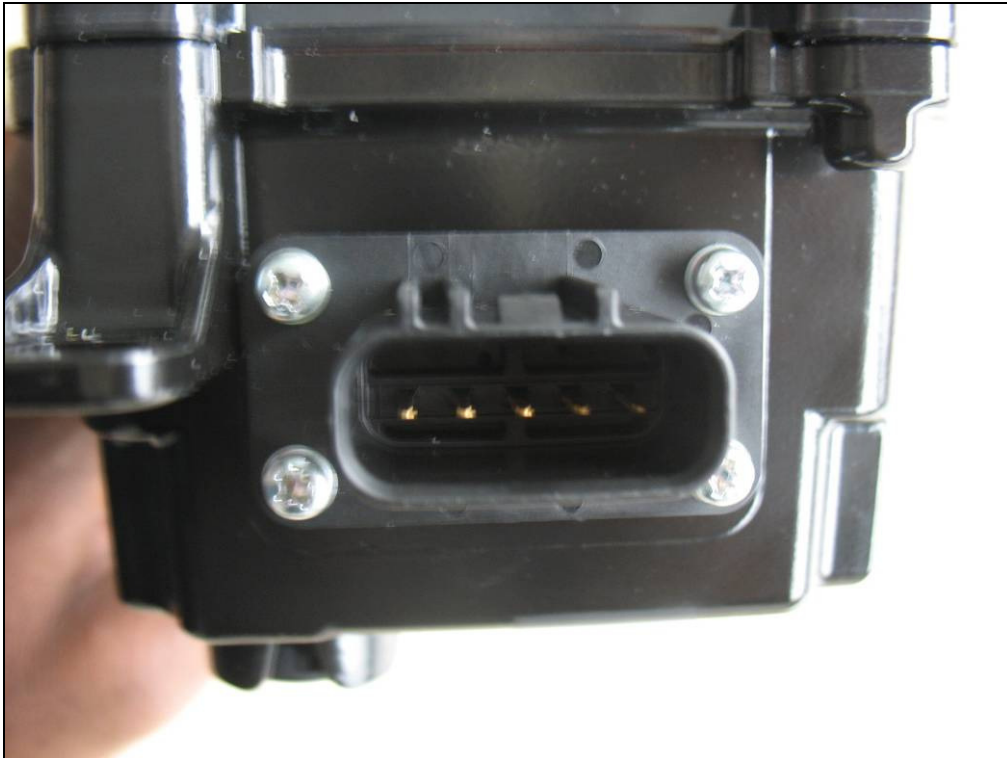


Photo No. 8:



Photo No. 9:



Photo No. 10:



Photo No. 11:

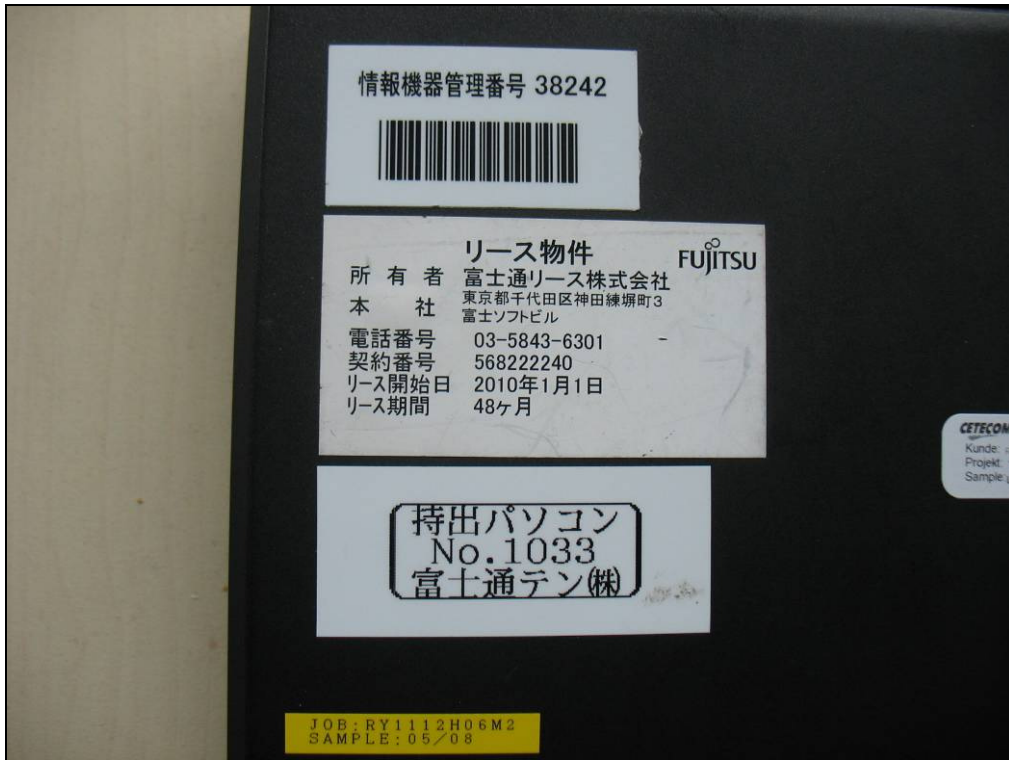


Photo No. 12:





Photo No. 13:

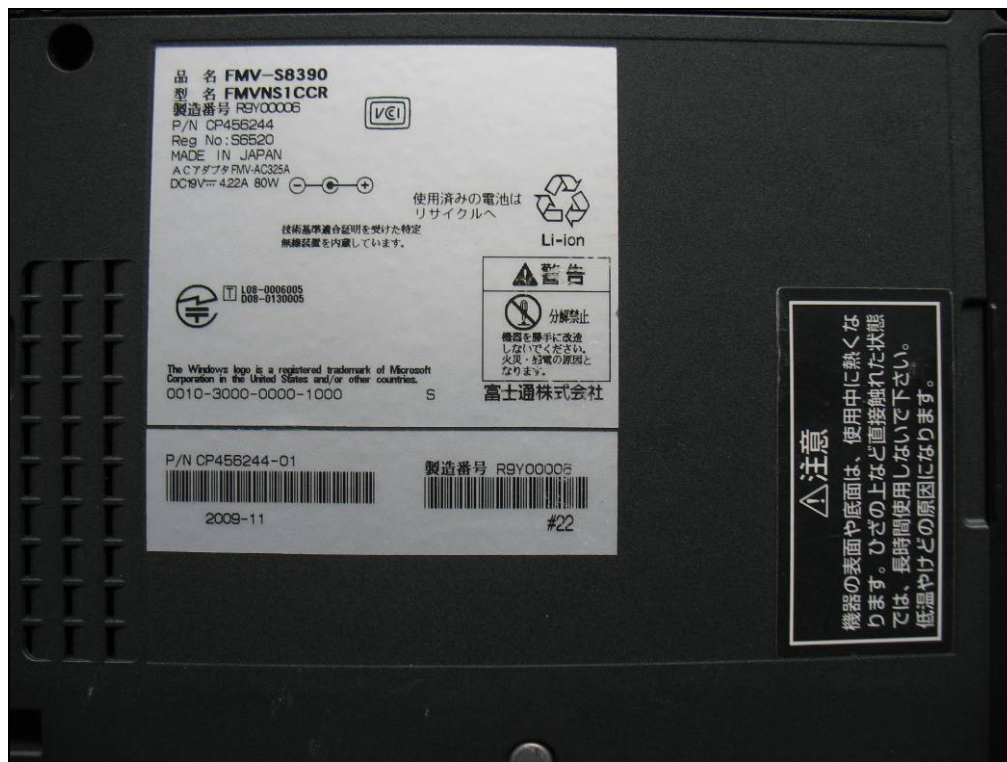


Photo No. 14:



**Annex C Internal photographs of the EUT**

Photo No. 15:



Photo No. 16:





Photo No. 17:

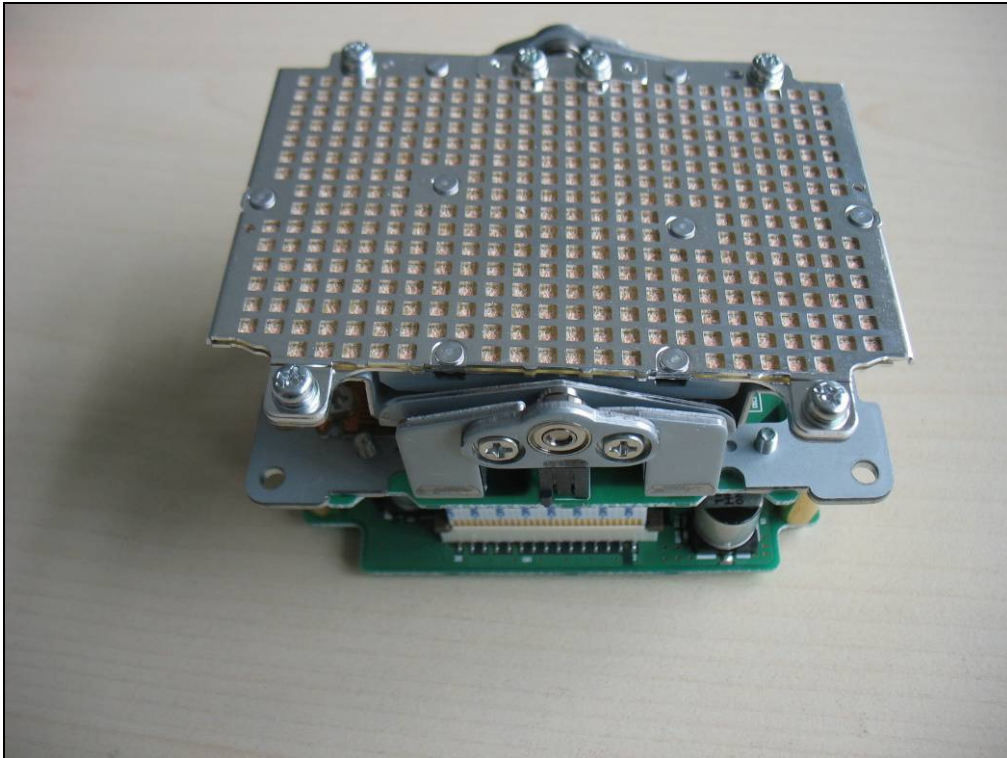


Photo No. 18:

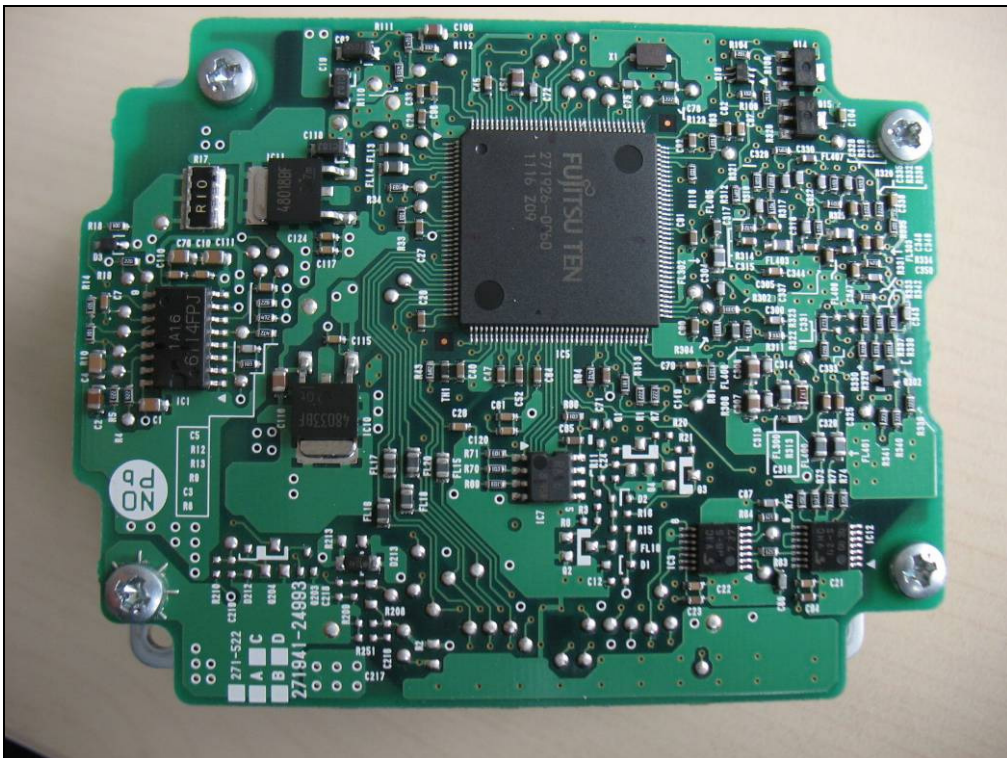


Photo No. 19:

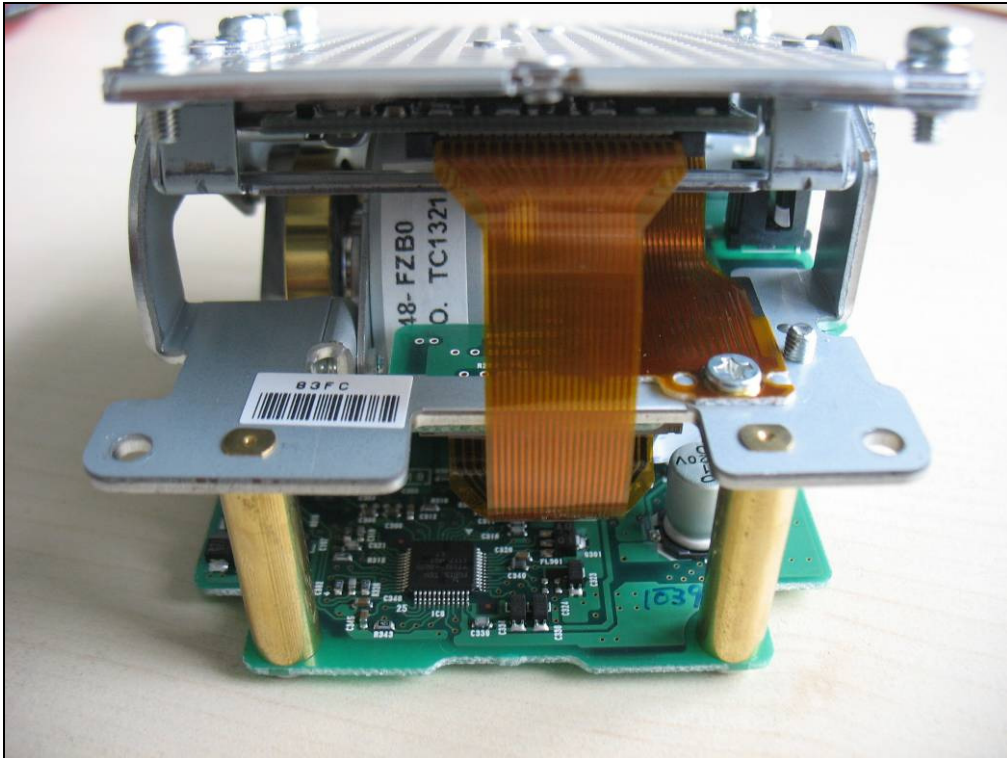


Photo No. 20:

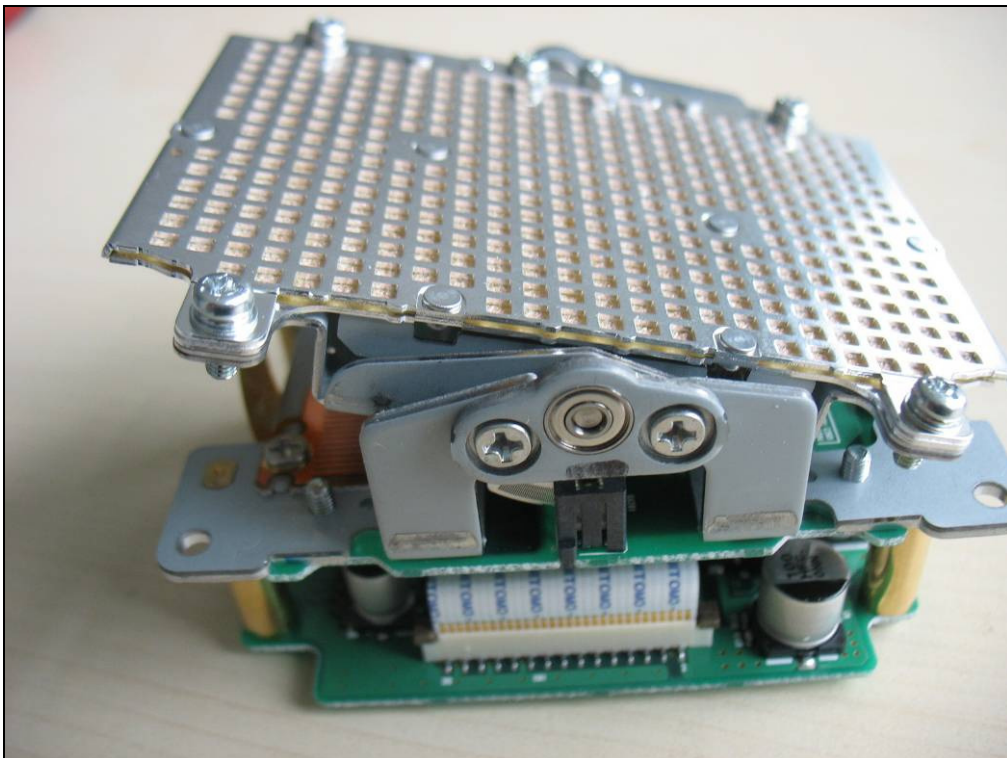




Photo No. 21:

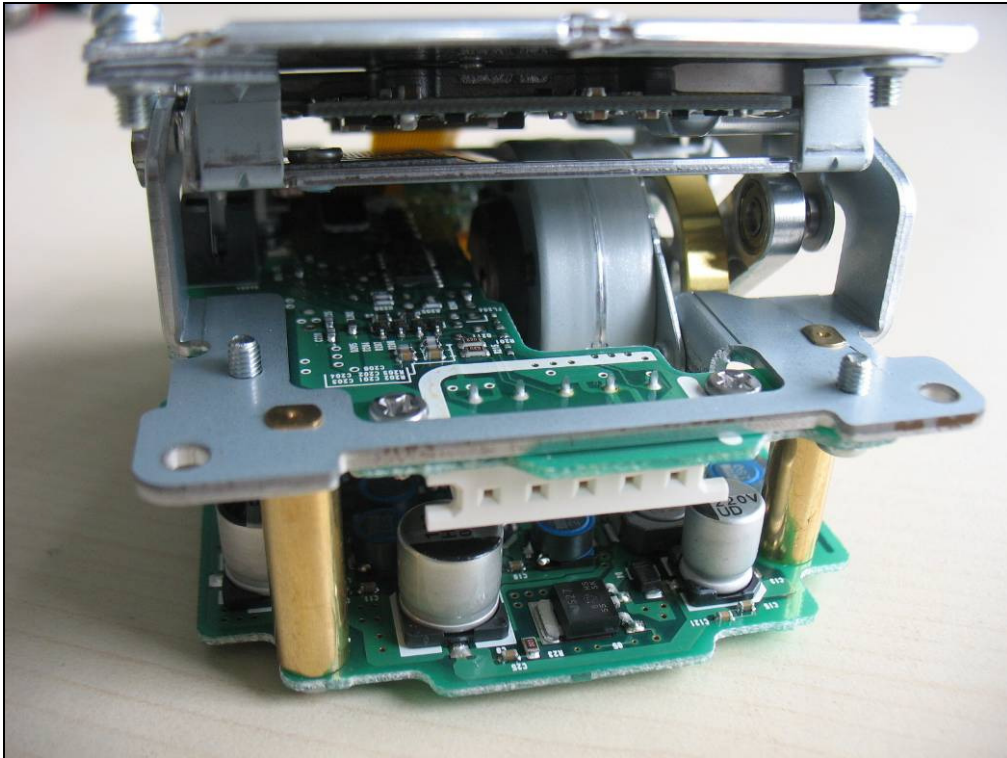


Photo No. 22:

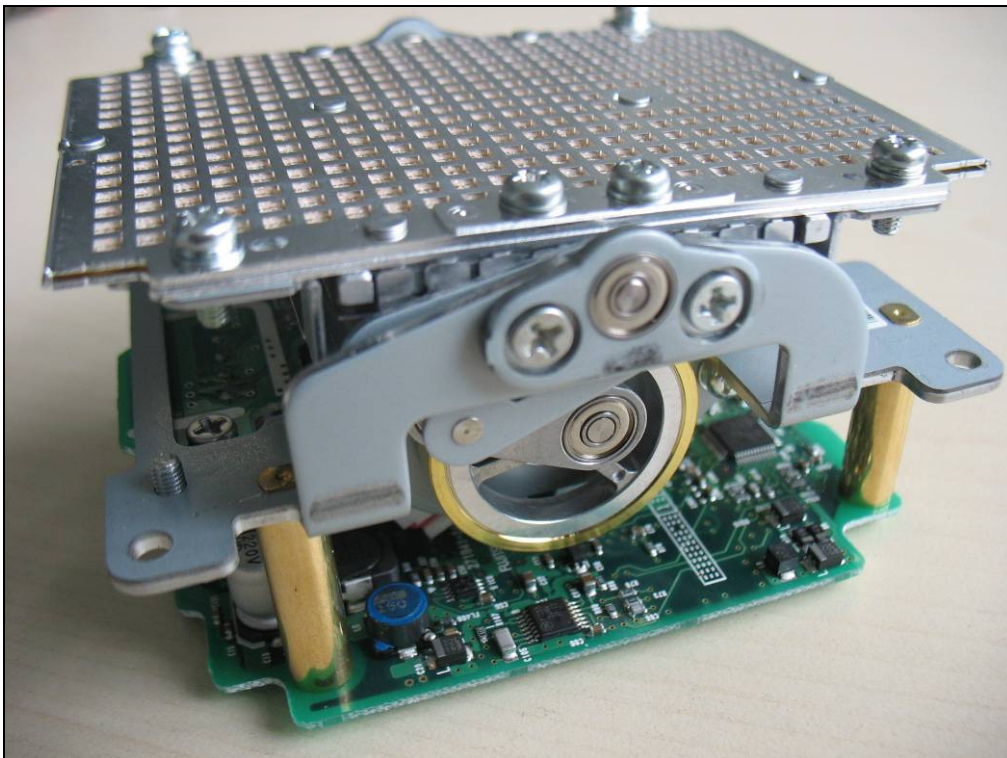


Photo No. 23:



Photo No. 24:

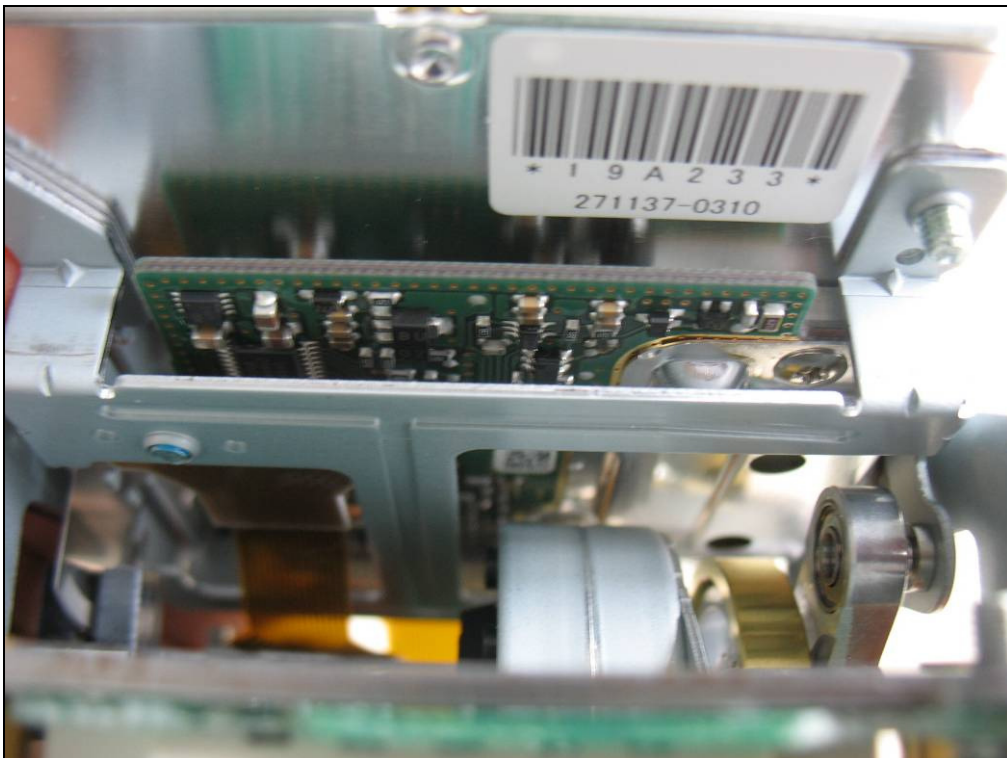




Photo No. 25:

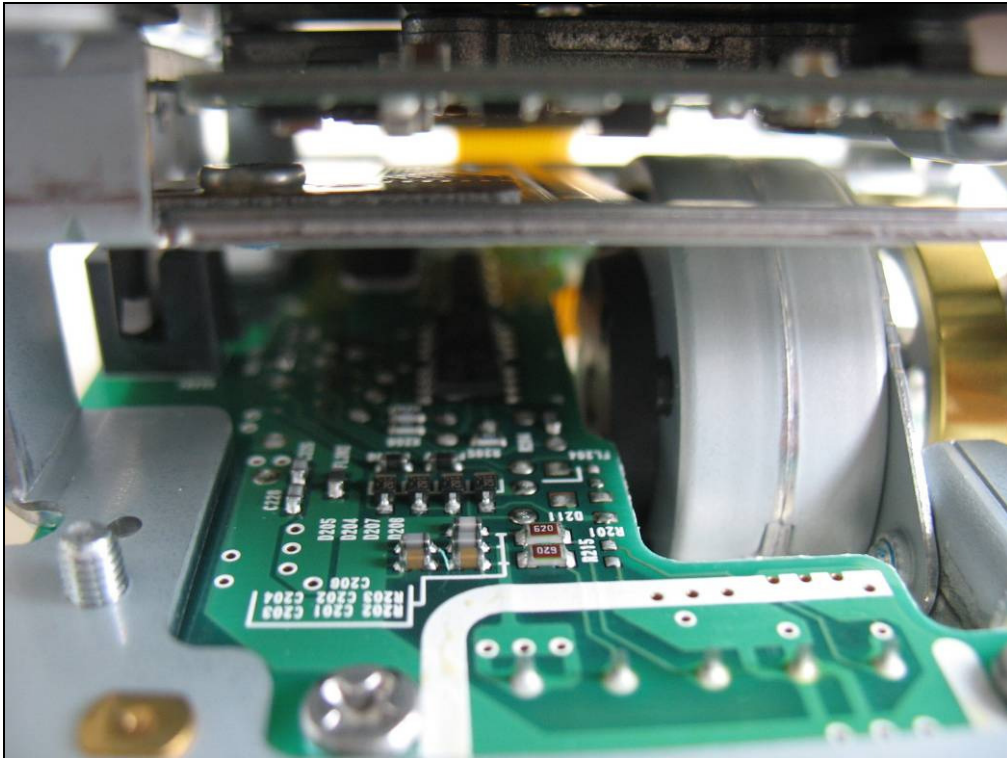
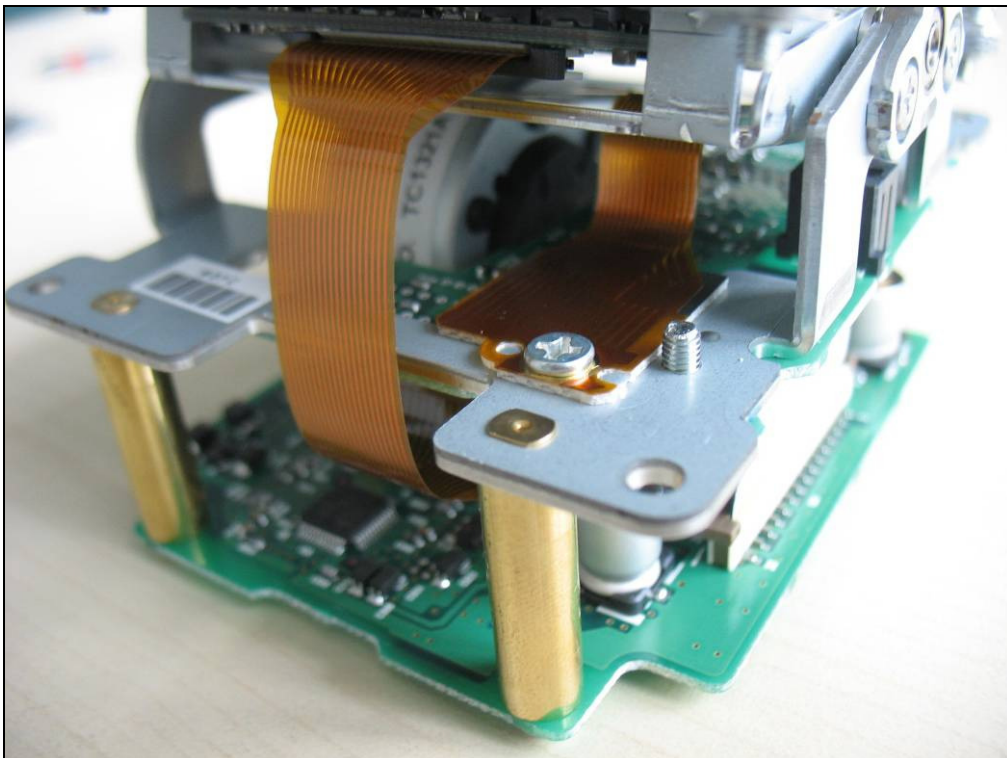


Photo No. 26:



**Annex D Document history**

Version	Applied changes	Date of release
1.0	Initial release	2012-03-01

**Annex E Further information****Glossary**

DUT	-	Device under Test
EMC	-	Electromagnetic Compatibility
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	not applicable
S/N	-	Serial Number
SW	-	Software



## Annex F Accreditation Certificate



Deutsche Akkreditierungsstelle GmbH  
German Accreditation Body

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV  
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition



### Accreditation

The Deutsche Akkreditierungsstelle GmbH (German Accreditation Body) attests that the testing laboratory

**CETECOM ICT Services GmbH**  
Untertürkheimer Straße 6-10  
66117 Saarbrücken

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out tests in the following fields:

**Wired communications and DECT**  
**Acoustic**  
**Radio**  
**Short Range Devices (SRD)**  
**RFID**  
**WiMax and Richtfunk**  
**Mobile radio (GSM / DCS), Over the Air (OTA) Performance**  
**Electromagnetic Compatibility (EMC) incl. Automotive**  
**Product safety**  
**SAR and Hearing Aid Compatibility (HAC)**  
**Environmental simulation**  
**Smart Card Terminals**  
**Bluetooth**  
**Wi-Fi-Services**

The accreditation certificate shall only apply in connection with the notice of accreditation of 13.04.2011 with the accreditation number D-PL-12076-01 and is valid until 03.09.2014. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 82 pages.

Registration number of the certificate: **D-PL-12076-01-01**

Frankfurt am Main, 13.04.2011

Dipl.-Ing. (FH) Peter Egner  
Head of Division 2

This document is a translation. The definitive version is the original German accreditation certificate.  
See notes covered.

Front side of certificate

Deutsche Akkreditierungsstelle GmbH

Office Berlin  
Spittelmarkt 10  
10117 Berlin

Office Frankfurt am Main  
Gartenstraße 6  
60594 Frankfurt am Main

Office Braunschweig  
Bundesallee 100  
38116 Braunschweig

The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.

No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkKS.

The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.

The up-to-date state of membership can be retrieved from the following websites:  
EA: [www.european-accreditation.org](http://www.european-accreditation.org)  
ILAC: [www.ilac.org](http://www.ilac.org)  
IAF: [www.iaf.nu](http://www.iaf.nu)

Back side of certificate

### Note:

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

[http://www.cetecom.com/fileadmin/de/CETECOM\\_D\\_Saarbruecken/accreditations\\_Jan\\_2010/DAKKS\\_Akkredi\\_Urk\\_EN17025-En\\_incl\\_Annex.pdf](http://www.cetecom.com/fileadmin/de/CETECOM_D_Saarbruecken/accreditations_Jan_2010/DAKKS_Akkredi_Urk_EN17025-En_incl_Annex.pdf)