



## Accredited testing-laboratory

**DAR registration number: DAT-P-176/94-D1**

**Federal Motor Transport Authority (KBA)  
DAR registration number: KBA-P 00070-97**

**Recognized by the Federal Communications Commission**

**Anechoic chamber registration no.: 90462 (FCC)**

**Anechoic chamber registration no.: 3462C-1 (IC)**

**Certification ID: DE 0001**

**Accreditation ID: DE 0002**

**Accredited Bluetooth® Test Facility (BQTF)**

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**Test report no. : 1-0902-01-02/08**  
**Type identification : CT2430LD-S**  
**Applicant : Broadcast Microwave Services GmbH&Co.KG**  
**FCC ID : VFB-CT2430LDLS**

**Test standards : FCC CFR 47 Part 74**

## Table of contents

<b>1</b>	<b>General information.....</b>	<b>3</b>
1.1	Notes .....	3
1.2	Testing laboratory .....	4
1.3	Details of applicant .....	4
1.4	Application details .....	4
<b>2</b>	<b>Technical tests.....</b>	<b>5</b>
2.1	Details of manufacturer.....	5
2.1.1	Test item.....	5
2.1.2	EUT operating modes.....	6
2.1.3	Nominal conditions for testing .....	6
<b>3</b>	<b>Summary of measurement results and list of all performed test cases .....</b>	<b>7</b>
<b>4</b>	<b>RF measurement testing .....</b>	<b>8</b>
4.1	Description of test set-up .....	8
4.1.1	Radiated measurements.....	8
4.1.2	Conducted measurements.....	9
4.2	Referenced documents .....	10
4.3	Additional comments .....	10
4.4	RF output power (conducted) §2.1046 / § 74.636(a) .....	11
4.5	RF output power (radiated) §2.1046 / § 74.636(a).....	17
4.6	Occupied bandwidth §2.1049 / §74.637 (g).....	23
4.7	Emission mask §2.1051 / §74.637(a)(2) .....	38
4.8	Spurious emissions (conducted) §2.1051 / §74.637(a)(2).....	52
4.9	Band-edge compliance §2.1051 / §74.637(a)(2) .....	57
4.10	Spurious emissions (radiated) §2.1051 / §74.637(a)(2) .....	66
4.11	Frequency tolerance §2.1055 / §74.661 .....	69
4.12	MPE calculation.....	70
<b>5</b>	<b>Test equipment and ancillaries used for tests .....</b>	<b>71</b>
<b>6</b>	<b>Photographs of the test setup.....</b>	<b>72</b>
<b>7</b>	<b>Internal photographs of the EUT .....</b>	<b>74</b>
<b>8</b>	<b>External photographs of the EUT.....</b>	<b>76</b>

## 1 General information

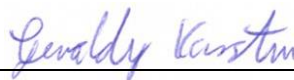
### 1.1 Notes

The test results of this test report relate exclusively to the test item specified in 3.1.1. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations 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 the CETECOM ICT Services GmbH.

Test laboratory manager:

2009-03-22

Karsten Geraldty



Date

Name

Signature

Technical responsibility for area of testing:

2009-03-23

Nicolas Stamber



Date

Name

Signature



## 1.2 Testing laboratory

### CETECOM ICT Services GmbH

Untertürkheimer Straße 6 - 10

66117 Saarbrücken

Germany

Phone: + 49 681 5 98 - 0

Fax: + 49 681 5 98 - 9075

e-mail: [info@ICT.cetecom.de](mailto:info@ICT.cetecom.de)

Internet: <http://www.cetecom-ict.de>

State of accreditation: The test laboratory (area of testing) is accredited according to  
DIN EN ISO/IEC 17025  
DAR registration number: DAT-P-176/94-D1

Accredited by: Federal Motor Transport Authority (KBA)  
DAR registration number: KBA-P 00070-97

Testing location, if different from CETECOM ICT Services GmbH:

Name :  
Street :  
Town :  
Country :  
Phone :  
Fax :

## 1.3 Details of applicant

Name:	Broadcast Microwave Services GmbH&Co.KG
Street:	Schwalbacherstrasse 12
Town:	65321 Heidenrod Kemel
Country:	Germany
Telephone:	+49 6124 7239-27
Fax:	+49 6124 7239-29
Contact:	Mr. Christian Rothe
E-mail:	<a href="mailto:crothe@bms-inc.com">crothe@bms-inc.com</a>
Telephone:	+49 6124 7239-27

## 1.4 Application details

Date of receipt of order:	2008-10-29
Date of receipt of test item:	2009-03-09
Date of start test:	2009-03-09
Date of end test	2008-03-13
Persons(s) who have been present during the test:	Mr. Otto

## 2 Technical tests

### 2.1 Details of manufacturer

Name:	Broadcast Microwave Services GmbH&Co.KG
Street:	Schwalbacherstrasse 12
Town:	65321 Heidenrod Kemel
Country:	Germany

#### 2.1.1 Test item

Kind of test item:	TV Broadcast Auxiliary Station
Type identification:	CT2430LD-S
P/N / S/N:	P/N 11 2467 110, S/N 081 2025
Frequency:	2025-2110 MHz
Type of Modulation:	COFDM 2k with sub-modulation: QPSK, 16QAM, 64QAM
Emission Designator:	6 MHz channel band width: 5M667D7F 7 MHz channel band width: 6M603D7F 8 MHz channel bandwidth: 7M564D7F
Antenna:	SMA-antenna connector with rod antenna type VLA1903LP
Power Supply:	11.0 - 17.5 Vdc, 12 W, battery powered
Temperature Range:	-20 °C to +55 °C

Max. peak power conducted: 36.9 dBm  
 Max. RMS power conducted: 28.7 dBm  
 Max. peak EIRP: 40.0 dBm

FCC ID: VFB-CT2430LDLS

#### **Remark:**

The signal is COFDM 2k modulated. There are 3 different sub-modulations (QPSK, 16QAM and 64QAM) which have no significant effect on the measurement results as shown on the plots.

### 2.1.2 EUT operating modes

EUT operating mode no.*)	Description of operating modes	Additional information
Op. 0	Normal mode	Normal temperature and power source conditions
Op. 1		low temperature, nominal power source conditions
Op. 2		high temperature, nominal power source conditions

\*) EUT operating mode no. is used to simplify the test plan

### 2.1.3 Nominal conditions for testing

Description	Shortcut	Unit	Value
Nominal Temperature	T <sub>nom</sub>	°C	23
Nominal Humidity	H <sub>nom</sub>	%	45
Nominal Power Source	V <sub>nom</sub>	Vdc	13.8

Type of power source: 13.8 V DC

Extreme conditions are reported in chapter 4.10.

### 3 Summary of measurement results and list of all performed test cases

- ☒ No deviations from the technical specifications were ascertained  
☐ There were deviations from the technical specifications ascertained

TC identifier	Description	Verdict	Date	Remark
RF-Testing	FCC CFR 47 Part 74	PASS	2009-03-22	-/-

Test Specification / Clause	Test Case	Pass	Fail	N/A	N/P	Results
§ 2.1046 / § 74.636	Measurements required: RF power output / Power limitations (conducted)	X				Channel bandwidth: 6 MHz: 36.9 dBm 7 MHz: 36.7 dBm 8 MHz: 36.5 dBm
§ 2.1046 / § 74.636	Measurements required: RF power output / Power limitations (radiated)	X				Channel Bandwidth: 6 MHz: 40.0 dBm 7 MHz: 40.0 dBm 8 MHz: 39.2 dBm
§ 2.1049	Measurements required: Occupied bandwidth	X				Channel bandwidth: 6 MHz: 5.667 MHz 7 MHz: 6.603 MHz 8 MHz: 7.564 MHz
§2.1051 / § 74.637	Measurements required: Spurious emissions at antenna terminals / Emission mask	X				complies
§ 2.1051 / § 74.637	Measurements required: Spurious emissions at antenna terminals / Spurious Emissions - conducted	X				complies
§ 2.1051 / § 74.637	Measurements required: Spurious emissions at antenna terminals / Band-Edge compliance	X				complies
§ 2.1053 / § 74.637	Measurements required: Field strength of spurious radiation / Spurious Emissions - radiated	X				complies
§ 2.1055 / § 74.661	Measurements required: Frequency stability / Frequency tolerance	X				max. 2.6 ppm

N/A: Not Applicable

N/P: Not Performed

## 4 RF measurement testing

### 4.1 Description of test set-up

#### 4.1.1 Radiated measurements

##### EIRP Measurements

Measuring the EIRP using Substitution Method:

- (a) The measurements were performed with full rf output power and modulation.
- (b) Test was performed at listed 3m test site (listed with FCC, IC).
- (c) The transmitter under test was placed at the specified height on a non-conducting turntable (80 cm height)
- (d) The TRILOG antenna (20 MHz to 1 GHz) or HORN antenna (1 GHz to 18 GHz) was used for measuring.
- (e) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level  
Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor  
 $E \text{ (dBuV/m)} = \text{Reading (dBuV)} + \text{Total Correction Factor (dB/m)}$
- (f) Set the EMI Receiver and #2 as follows:  
Center Frequency: test frequency  
Resolution BW: 100 kHz  
Video BW: same  
Detector Mode: positive  
Average: off  
Span: 3 x the signal bandwidth
- (g) The test antenna was lowered or raised from 1 to 4 meters until the maximum signal level was detected.
- (h) The transmitter was rotated through 360° about a vertical axis until a higher maximum signal was received.
- (i) The test antenna was lowered or raised again from 1 to 4 meters until a maximum was obtained. This level was recorded.
- (j) The recorded reading was corrected to the true field strength level by adding the antenna factor, cable loss and subtracting the pre-amplifier gain.
- (k) The above steps were repeated with both transmitters' antenna and test receiving antenna placed in vertical and horizontal polarization. Both readings with the antennas placed in vertical and horizontal polarization shall be recorded.
- (l) Repeat for all different test signal frequencies

##### Measuring the EIRP of Spurious/Harmonic Emissions using Substitution Method

- (a) Set the EMI Receiver (for measuring E-Field) and Receiver #2 (for measuring EIRP) as follows:  
Center Frequency : equal to the signal source  
Resolution BW : 10 kHz  
Video BW : same  
Detector Mode : positive  
Average : off  
Span : 3 x the signal bandwidth
- (b) Load an appropriate correction factors file in EMI Receiver for correcting the field strength reading level  
Total Correction Factor recorded in the EMI Receiver = Cable Loss + Antenna Factor  
 $E \text{ (dBuV/m)} = \text{Reading (dBuV)} + \text{Total Correction Factor (dB/m)}$
- (c) Select the frequency and E-field levels for ERP/EIRP measurements.
- (d) Substitute the EUT by a signal generator and one of the following transmitting antennas (substitution antenna):  
DIPOLE antenna for frequency from 30-1000 MHz or .HORN antenna for frequency above 1 GHz}.
- (e) Mount the transmitting antenna at 1.5 meter high from the ground plane.
- (f) Use one of the following antenna as a receiving antenna: .DIPOLE antenna for frequency from 30-1000 MHz or .HORN antenna for frequency above 1 GHz }.
- (g) If the DIPOLE antenna is used, tune its elements to the frequency as specified in the calibration manual.
- (h) Adjust both transmitting and receiving antenna in a VERTICAL polarization.
- (i) Tune the EMI Receivers to the test frequency.
- (j) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.



- (k) The transmitter was rotated through 360° about a vertical axis until a higher maximum signal was received.
- (l) Lower or raise the test antenna from 1 to 4 meters until the maximum signal level was detected.
- (m) Adjust input signal to the substitution antenna until an equal or a known related level to that detected from the transmitter was obtained in the test receiver.
- (n) Record the power level read from the Average Power Meter and calculate the ERP/EIRP as follows:  

$$P = P_1 - L_1 = (P_2 + L_2) - L_1 = P_3 + A + L_2 - L_1$$

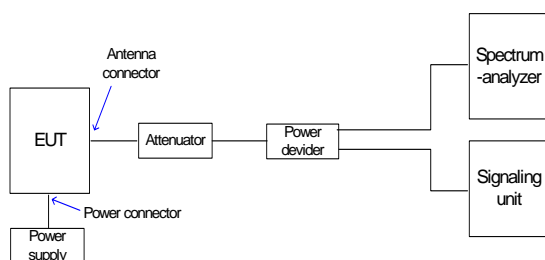
$$\text{EIRP} = P + G_1 = P_3 + L_2 - L_1 + A + G_1$$

$$\text{ERP} = \text{EIRP} - 2.15 \text{ dB}$$
 Total Correction factor in EMI Receiver # 2 =  $L_2 - L_1 + G_1$   
 Where: P: Actual RF Power fed into the substitution antenna port after corrected.  
 P1: Power output from the signal generator  
 P2: Power measured at attenuator A input  
 P3: Power reading on the Average Power Meter  
 EIRP: EIRP after correction  
 ERP: ERP after correction
- (o) Adjust both transmitting and receiving antenna in a HORIZONTAL polarization, then repeat step (k) to (o)
- (p) Repeat step (d) to (o) for different test frequency
- (q) Repeat steps (c) to (j) with the substitution antenna oriented in horizontal polarization.
- (r) Actual gain of the EUT's antenna is the difference of the measured EIRP and measured RF power at the RF port. Correct the antenna gain if necessary.

## 4.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is connected to the spectrum analyzer. The specific losses for signal path are first checked within a calibration. The measurement readings on the spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signaling unit and the spectrum analyzer are impedance matched on 50 Ohm.

Exemplary test setup:



## 4.2 Referenced documents

none

## 4.3 Additional comments

The system transmit frequency is programmable in 1 MHz steps in the range from 2025 to 2110 MHz via user interface (multifunctional display).

Per remote control via serial interface 125 kHz steps are possible.

We used three frequencies for testing: carrier at the lower edge of the band, in the middle of the band and at the upper edge of the band. As the occupied bandwidth is completely contained within the band, all emissions of the modulated wanted signal are within the band.

**4.4 RF output power (conducted)****§2.1046 / § 74.636(a)****Bandwidth 6 MHz**

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)			2028	2068	2107
$T_{nom}$ 23 °C	$V_{nom}$ 13.8 Vdc	Peak	36.8	36.8	36.9
		RMS	28.6	28.6	28.7
Measurement uncertainty			±3dB		

**RBW / VBW: 20 MHz****Bandwidth 7 MHz**

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)			2028.5	2068	2106.5
$T_{nom}$ 23 °C	$V_{nom}$ 13.8 Vdc	Peak	26.7	36.6	36.7
		RMS	28.5	28.4	28.4
Measurement uncertainty			±3dB		

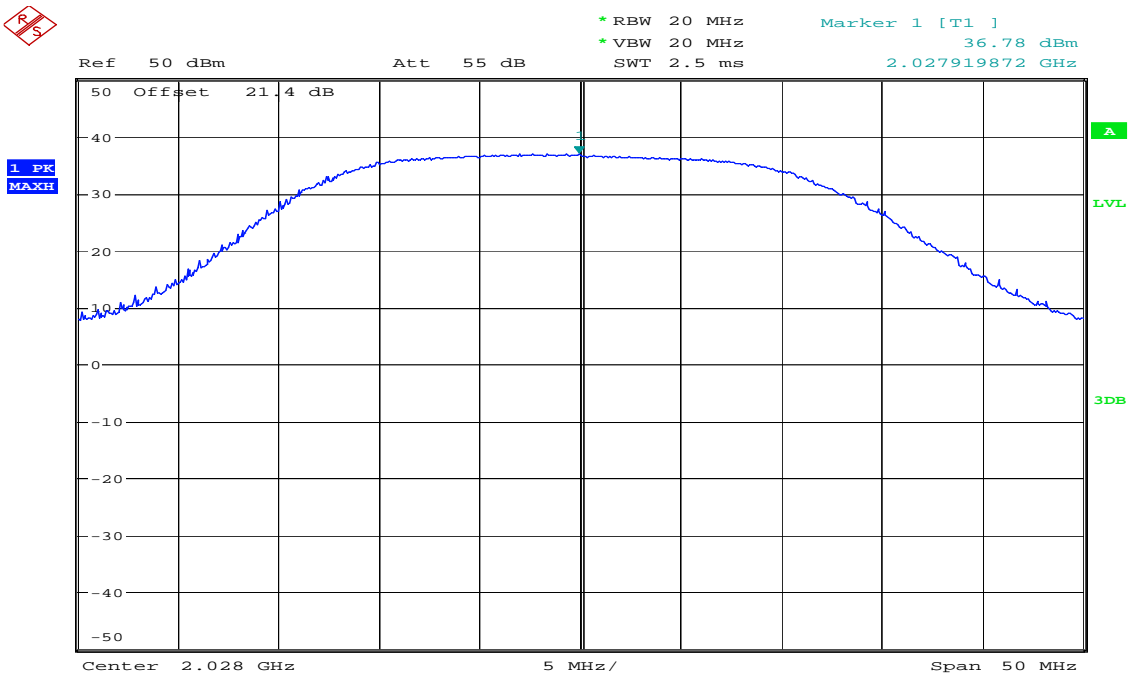
**RBW / VBW: 20 MHz****Bandwidth 8 MHz**

TEST CONDITIONS			MAXIMUM PEAK OUTPUT POWER (dBm)		
Frequency (MHz)			2029	2068	2106
$T_{nom}$ 23 °C	$V_{nom}$ 13.8 Vdc	Peak	36.4	36.5	36.5
		RMS	28.1	28.1	28.0
Measurement uncertainty			±3dB		

**RBW / VBW: 20 MHz****Remark:**

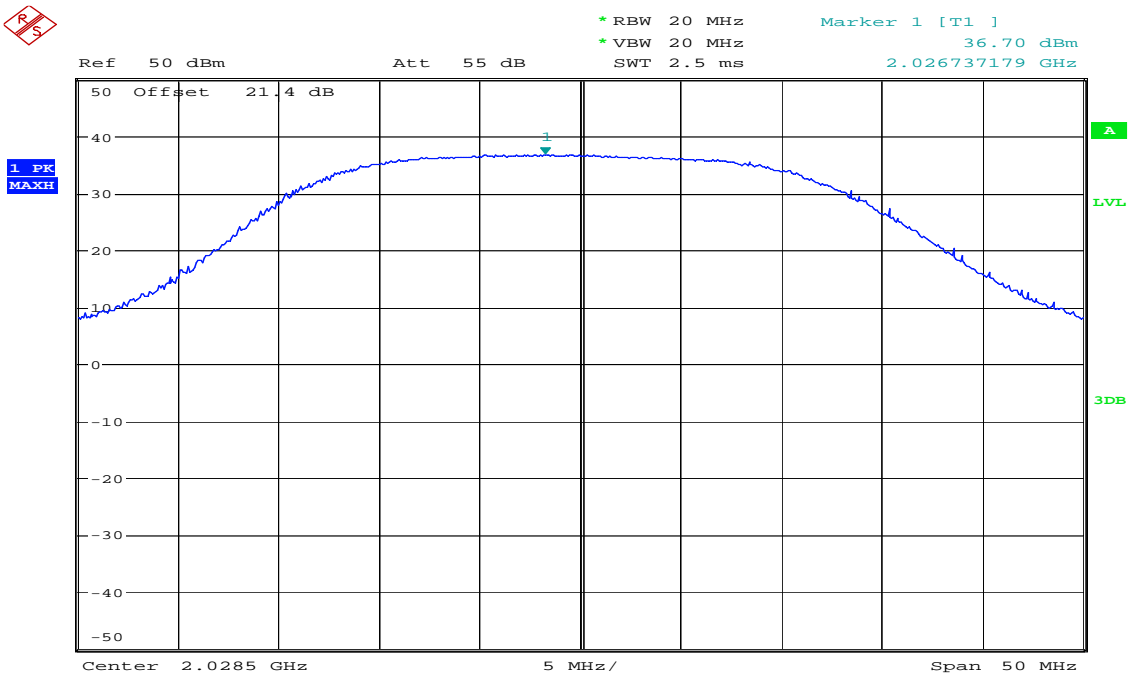
The conducted RF output power was measured with all three sub-modulations QPSK, 16QAM and 64QAM. Also different FEC-rates were tested. As no differences in the output power were established only the 64QAM results were recorded as representative values for all sub-modulations.

Plot 1: Peak RF output power 2028 MHz / 6 MHz (conducted)



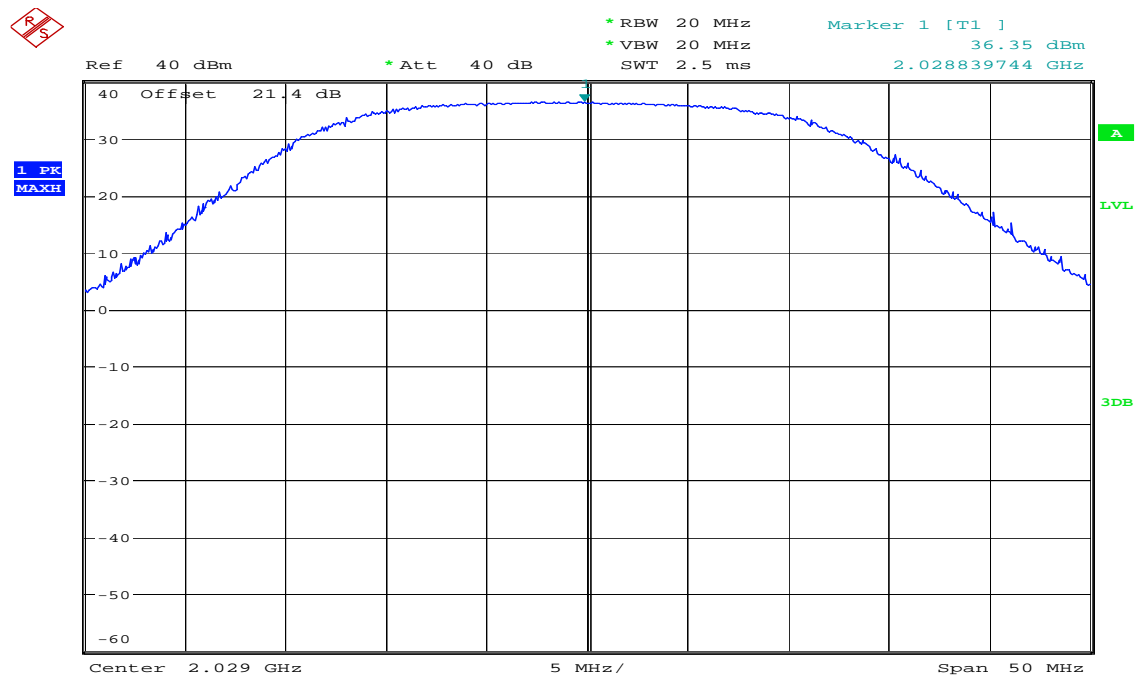
Date: 11.MAR.2009 13:30:38

Plot 2: Peak RF output power 2028.5 MHz / 7 MHz (conducted)



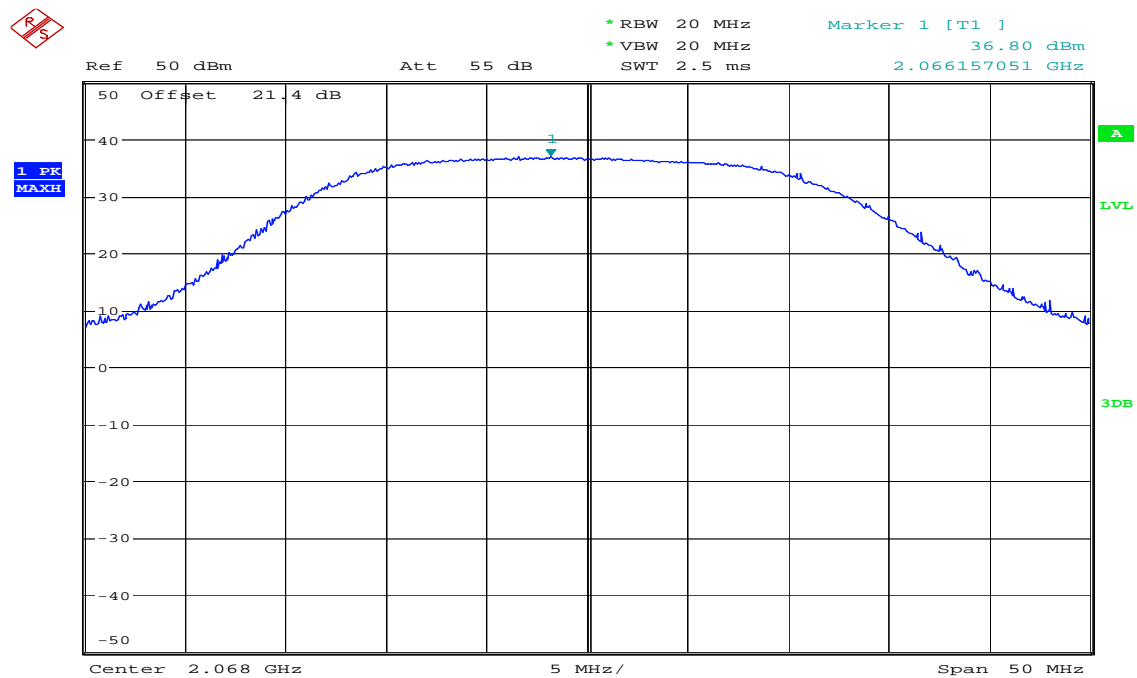
Date: 11.MAR.2009 11:26:05

Plot 3: Peak RF output power 2029 MHz / 8 MHz (conducted)



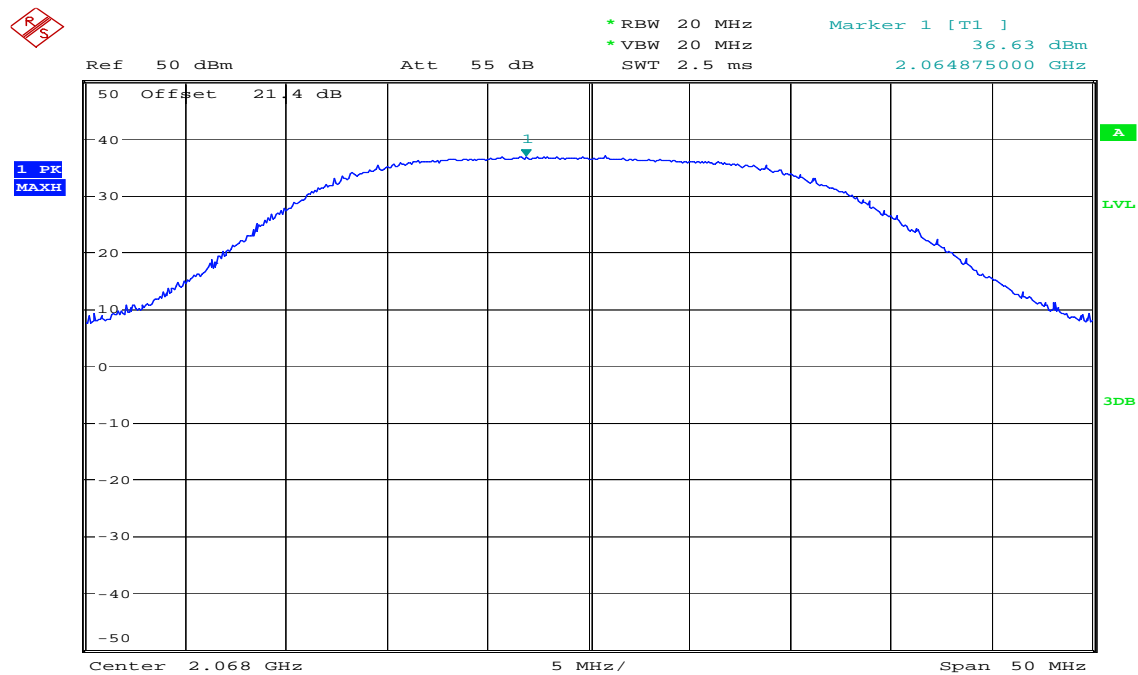
Date: 9.MAR.2009 11:35:41

Plot 4: Peak RF output power 2068 MHz / 6 MHz (conducted)



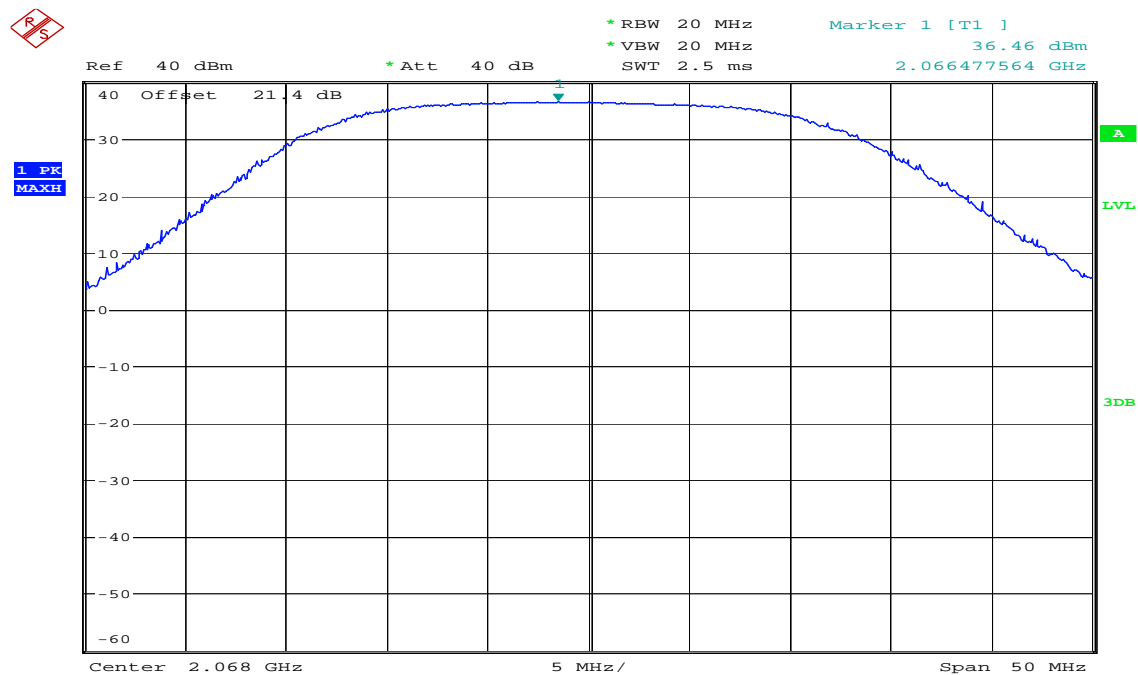
Date: 11.MAR.2009 13:31:55

Plot 5: Peak RF output power 2068 MHz / 7 MHz (conducted)



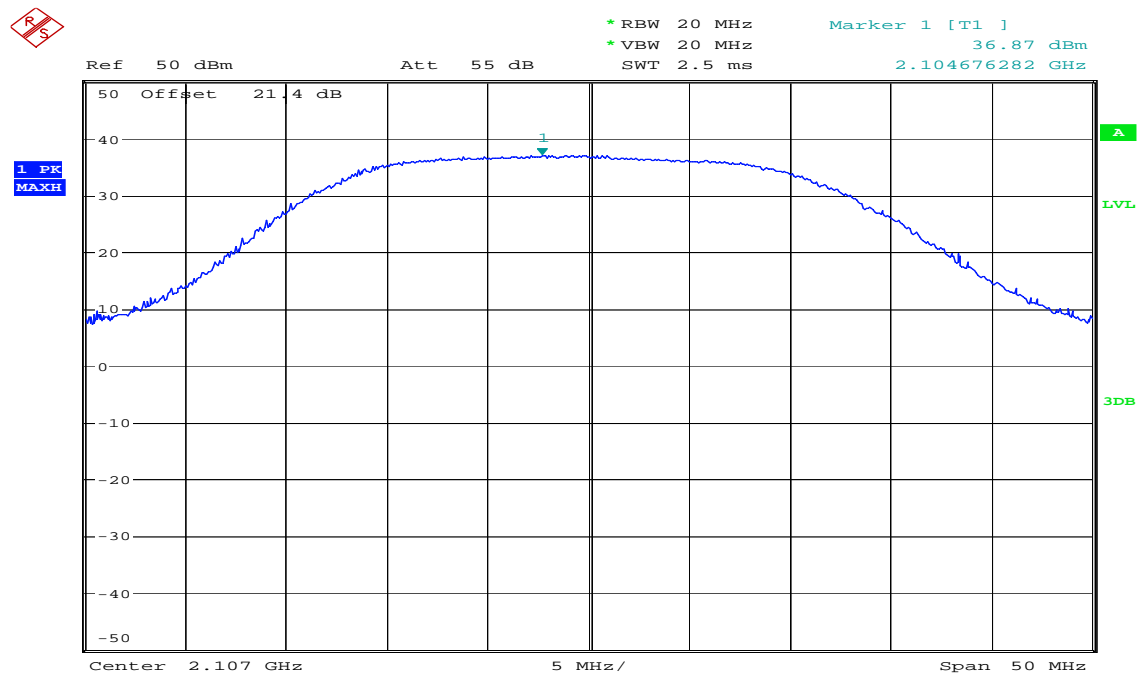
Date: 11.MAR.2009 11:29:05

Plot 6: Peak RF output power 2068 MHz / 8 MHz (conducted)



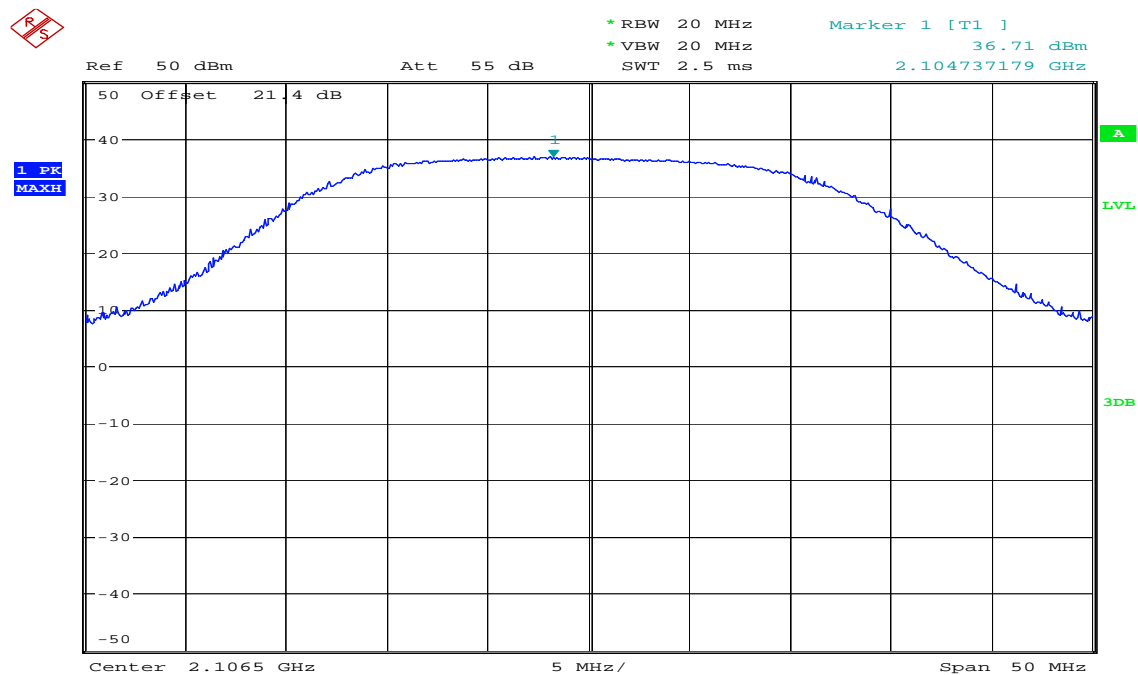
Date: 9.MAR.2009 11:34:01

Plot 7: Peak RF output power 2107 MHz / 6 MHz (conducted)



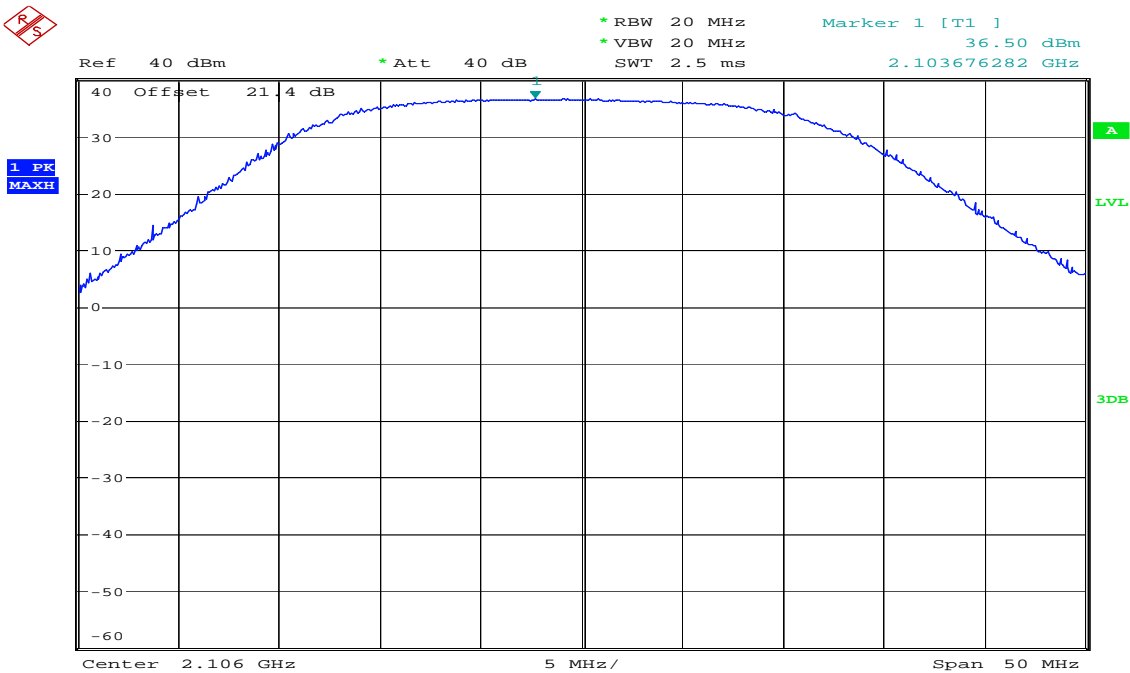
Date: 11.MAR.2009 13:32:37

Plot 8: Peak RF output power 2106.5 MHz / 7 MHz (conducted)



Date: 11.MAR.2009 11:30:07

Plot 9: Peak RF output power 2106 MHz / 8 MHz (conducted)



Date: 9.MAR.2009 11:24:16

Limit according to §74.636(a):

Under normal test conditions only	For the frequency band 2025 to 2110 MHz: Maximum allowable transmitter power: 12.0 W / 40.8 dBm
-----------------------------------	--

Test Result: passed



## 4.5 RF output power (radiated)

§2.1046 / § 74.636(a)

## Bandwidth 6 MHz

TEST CONDITIONS			MAXIMUM PEAK EIRP (dBm)		
Frequency (MHz)			2028	2068	2107
T <sub>nom</sub> 23 °C	V <sub>nom</sub> 13.8 Vdc	Peak	39.9	39.8	40.0
Measurement uncertainty			±3dB		

RBW / VBW: 20 MHz

## Bandwidth 7 MHz

TEST CONDITIONS			MAXIMUM PEAK EIRP (dBm)		
Frequency (MHz)			2028.5	2068	2106.5
T <sub>nom</sub> 23 °C	V <sub>nom</sub> 13.8 Vdc	Peak	39.8	39.8	40.0
Measurement uncertainty			±3dB		

RBW / VBW: 20 MHz

## Bandwidth 8 MHz

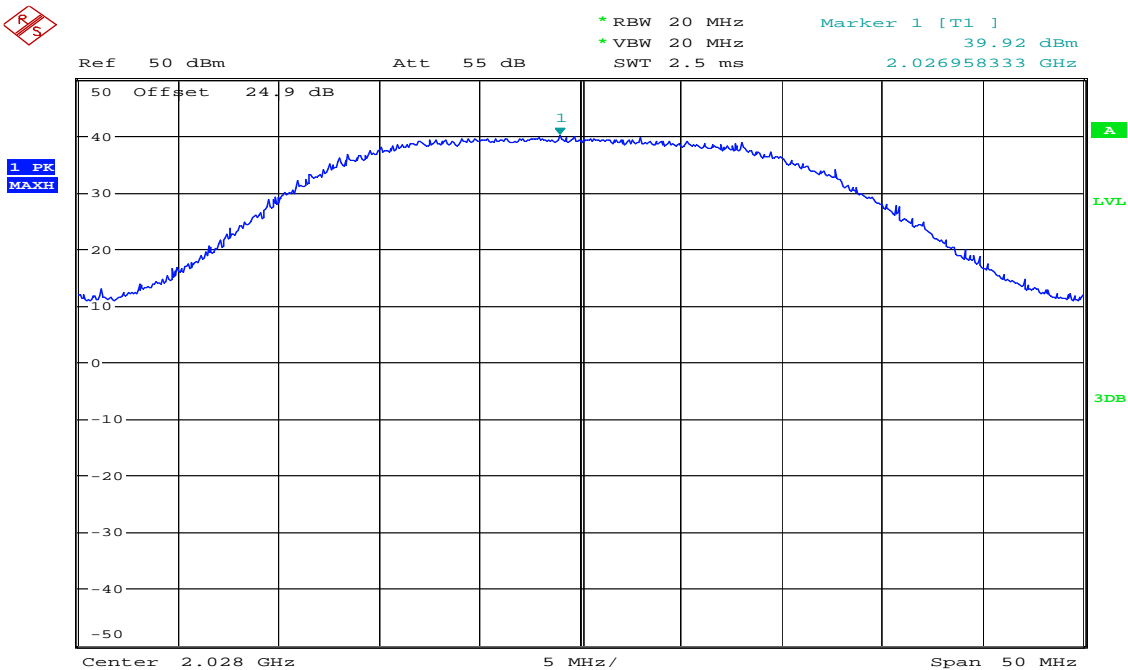
TEST CONDITIONS			MAXIMUM PEAK EIRP (dBm)		
Frequency (MHz)			2029	2068	2106
T <sub>nom</sub> 23 °C	V <sub>nom</sub> 13.8 Vdc	Peak	38.9	39.1	39.2
Measurement uncertainty			±3dB		

RBW / VBW: 20 MHz

**Remark:**

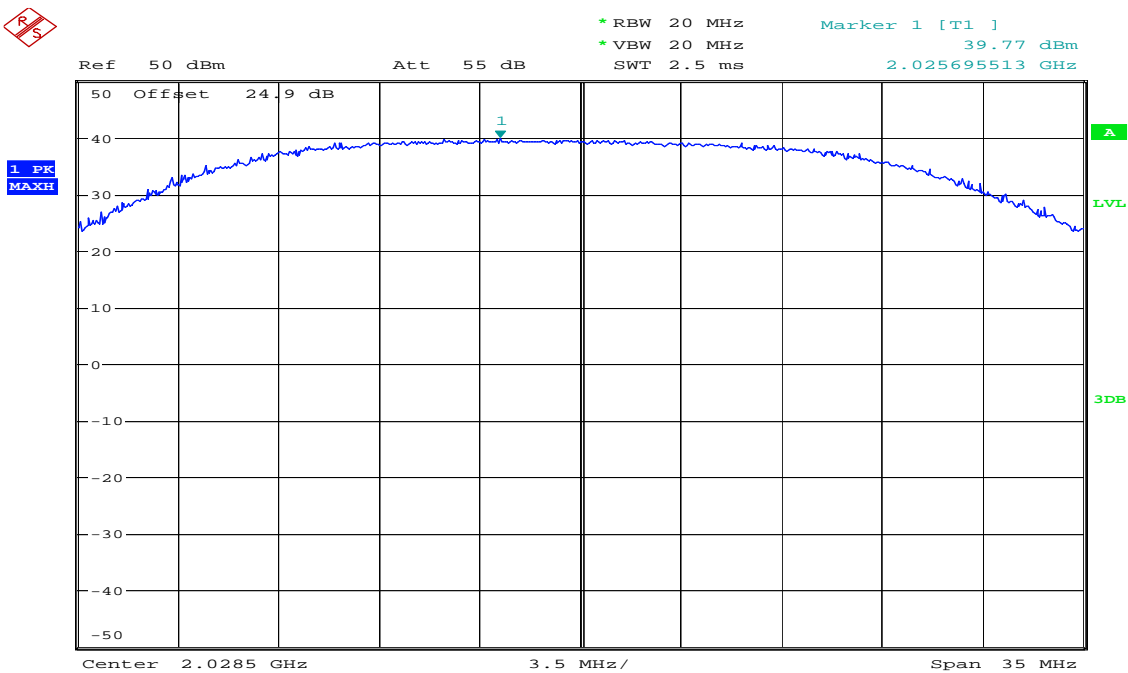
The radiated RF output power was measured with all three sub-modulations QPSK, 16QAM and 64QAM. Also different FEC-rates were tested. As no differences in the output power were established only the 64QAM results were recorded as representative values for all sub-modulations.

Plot 10: Peak RF output power 2028 MHz / 6 MHz (radiated)



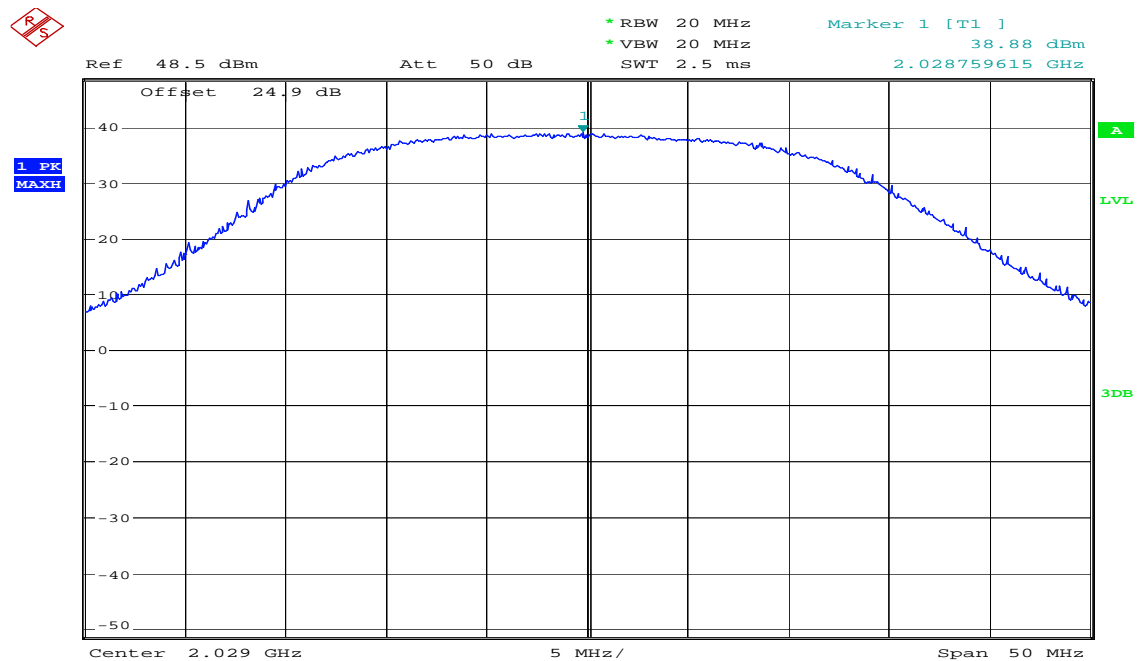
Date: 11.MAR.2009 16:45:02

Plot 11: Peak RF output power 2028.5 MHz / 7 MHz (radiated)



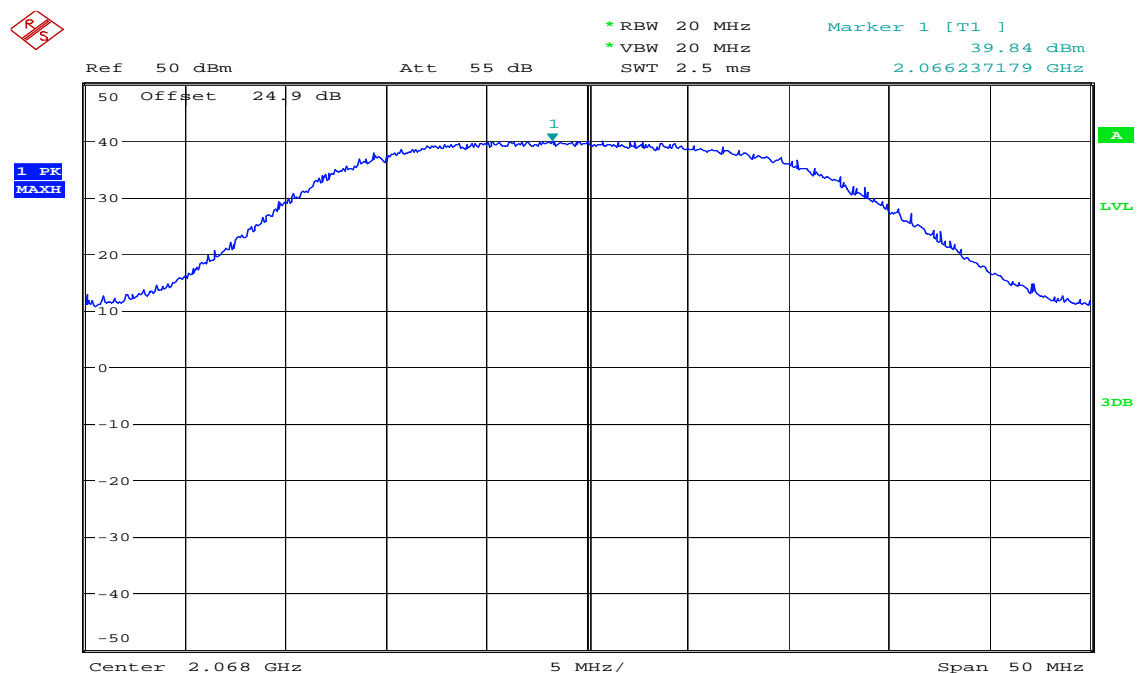
Date: 11.MAR.2009 12:35:04

Plot 12: Peak RF output power 2029 MHz / 8 MHz (radiated)



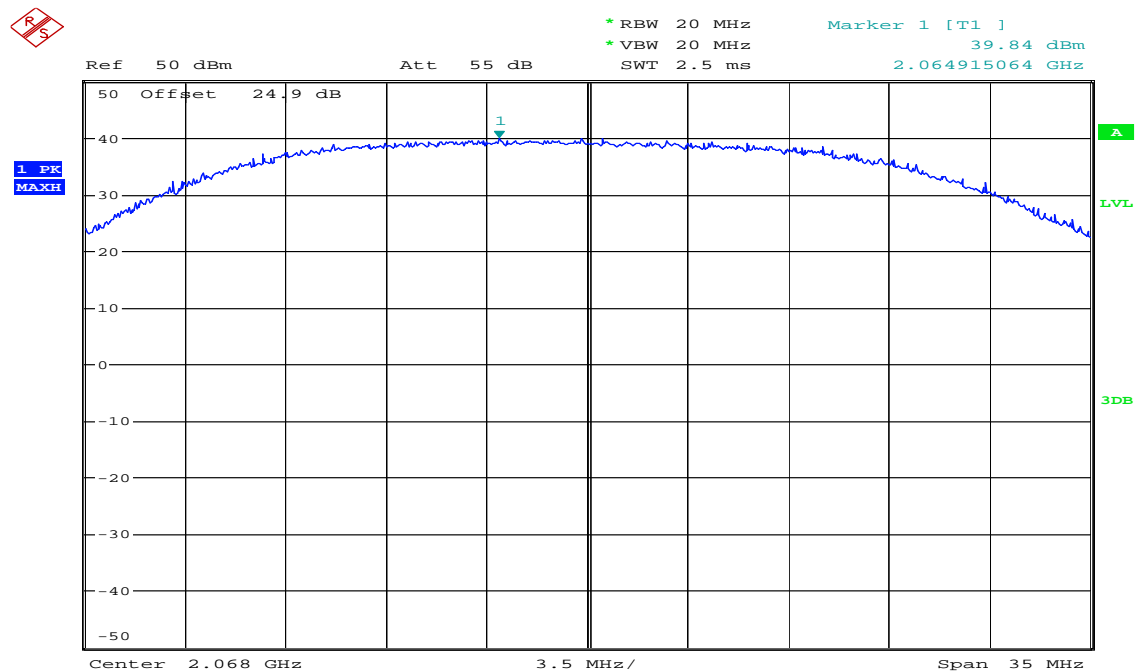
Date: 9.MAR.2009 15:33:15

Plot 13: Peak RF output power 2068 MHz / 6 MHz (radiated)



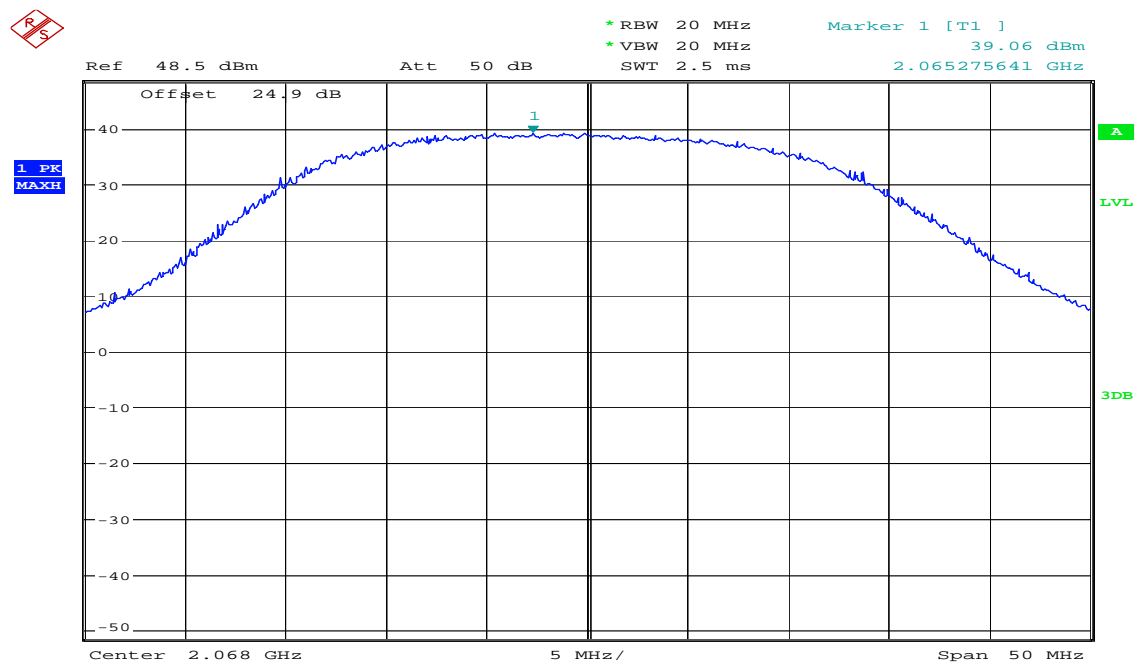
Date: 11.MAR.2009 16:43:42

Plot 14: Peak RF output power 2068 MHz / 7 MHz (radiated)



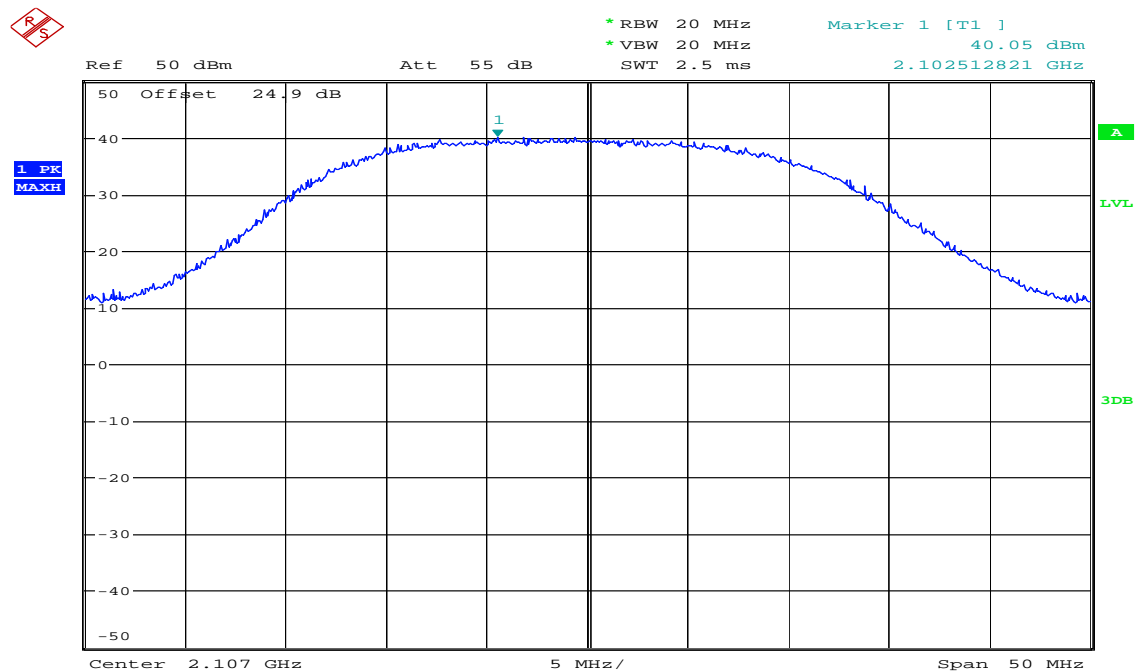
Date: 11.MAR.2009 12:33:48

Plot 15: Peak RF output power 2068 MHz / 8 MHz (radiated)



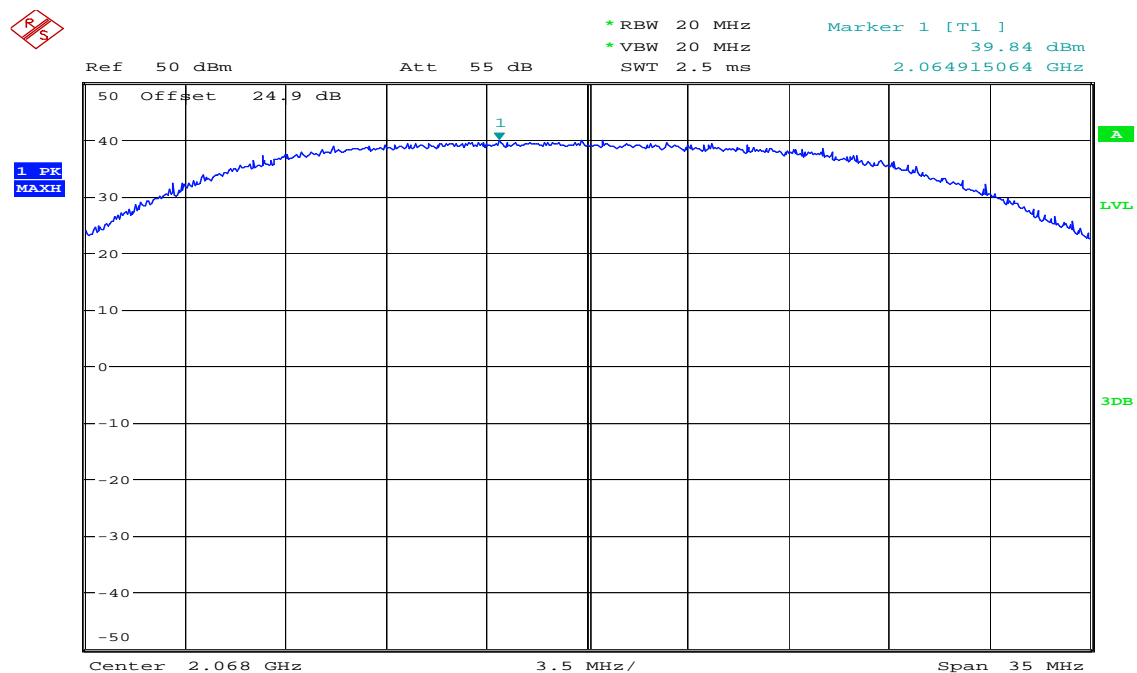
Date: 9.MAR.2009 15:29:57

Plot 16: Peak RF output power 2107 MHz / 6 MHz (radiated)



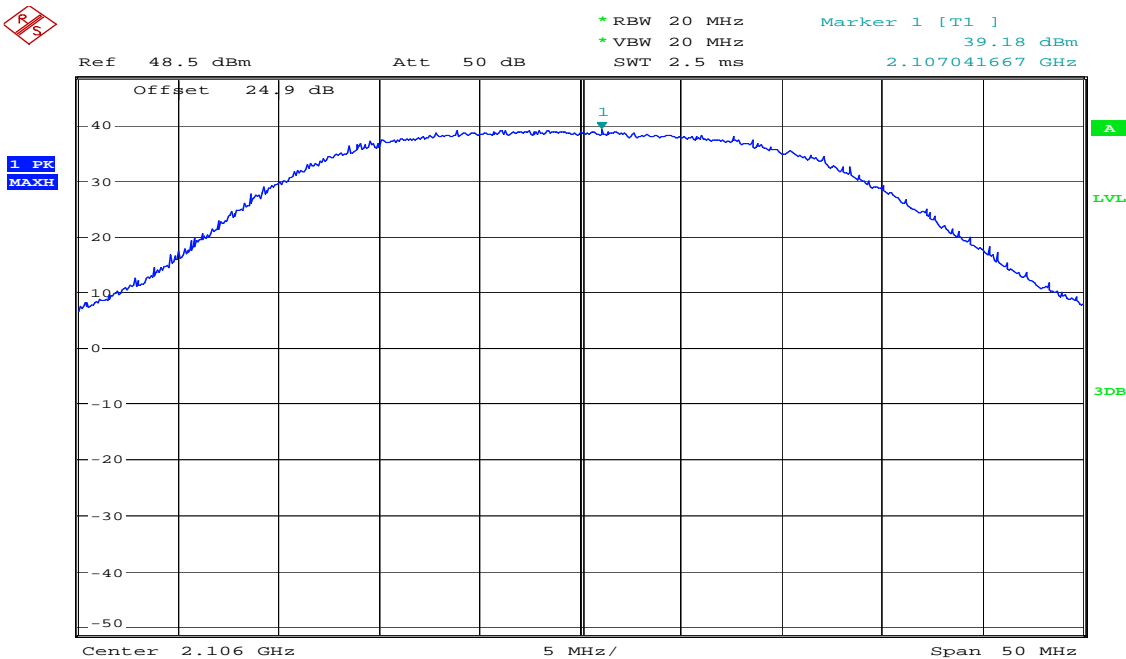
Date: 11.MAR.2009 16:42:12

Plot 17: Peak RF output power 2106 MHz / 7 MHz (radiated)



Date: 11.MAR.2009 12:33:48

Plot 18: Peak RF output power 2106 MHz / 8 MHz (radiated)



Date: 9.MAR.2009 15:23:37

Limit according to §74.636(a):

Under normal test conditions only	For the frequency band 2025 to 2110 MHz: Maximum allowable EIRP: 35.0 dBW / 65.0 dBm
-----------------------------------	---

Test Result: passed

## 4.6 Occupied bandwidth

§2.1049 / §74.637 (g)

## Bandwidth 6 MHz

TEST CONDITIONS			OCCUPIED BANDWIDTH (MHz)		
Frequency (MHz)			2028	2068	2107
$T_{nom}$ 23 °C	$V_{nom}$ 13.8 Vdc	Max	QPSK: 5.667 MHz 16QAM: 5.667 MHz 64QAM: 5.667 MHz	QPSK: 5.667 MHz 16QAM: 5.667 MHz 64QAM: 5.667 MHz	QPSK: 5.667 MHz 16QAM: 5.667 MHz 64QAM: 5.667 MHz
Measurement uncertainty			± 10 kHz		

RBW / VBW: 3 kHz

## Bandwidth 7 MHz

TEST CONDITIONS			OCCUPIED BANDWIDTH (MHz)		
Frequency (MHz)			2028.5	2068	2106.5
$T_{nom}$ 23 °C	$V_{nom}$ 13.8 Vdc	Max	QPSK: 6.603 MHz 16QAM: 6.603 MHz 64QAM: 6.603 MHz	QPSK: 6.603 MHz 16QAM: 6.603 MHz 64QAM: 6.603 MHz	QPSK: 6.603 MHz 16QAM: 6.603 MHz 64QAM: 6.587 MHz
Measurement uncertainty			± 10 kHz		

RBW / VBW: 3 kHz

## Bandwidth 8 MHz

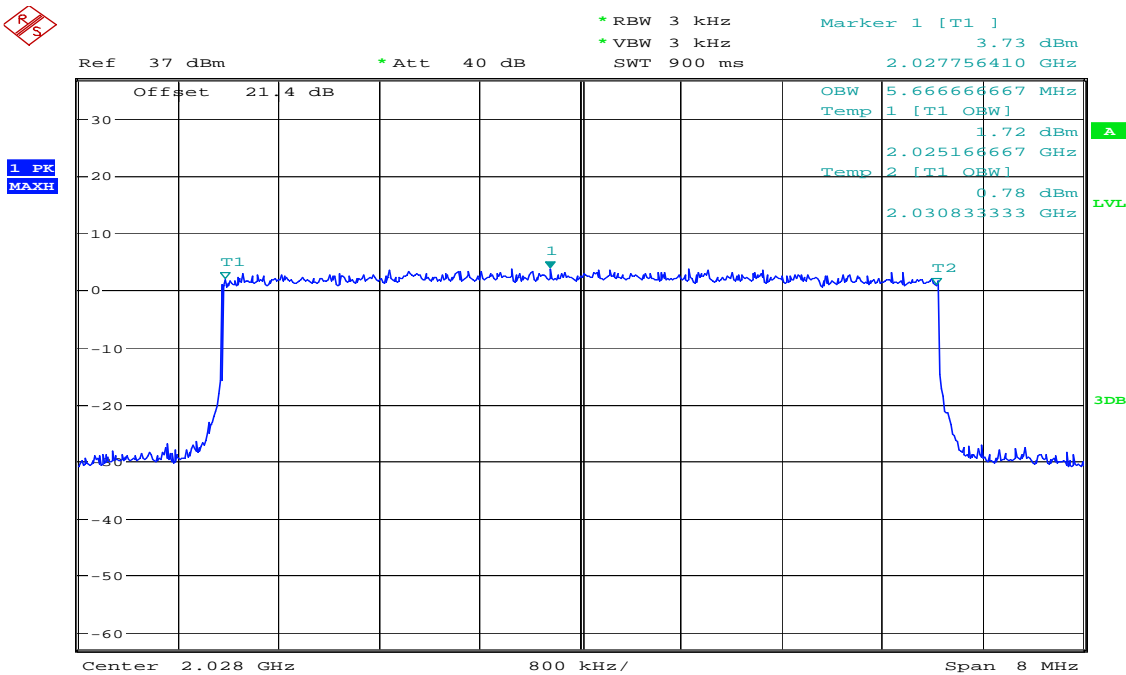
TEST CONDITIONS			OCCUPIED BANDWIDTH (MHz)		
Frequency (MHz)			2029	2068	2106
$T_{nom}$ 23 °C	$V_{nom}$ 13.8 Vdc	Max	QPSK: 7.564 MHz 16QAM: 7.564 MHz 64QAM: 7.564 MHz	QPSK: 7.564 MHz 16QAM: 7.564 MHz 64QAM: 7.548 MHz	QPSK: 7.548 MHz 16QAM: 7.548 MHz 64QAM: 7.564 MHz
Measurement uncertainty			± 10 kHz		

RBW / VBW: 3 kHz

Remark:

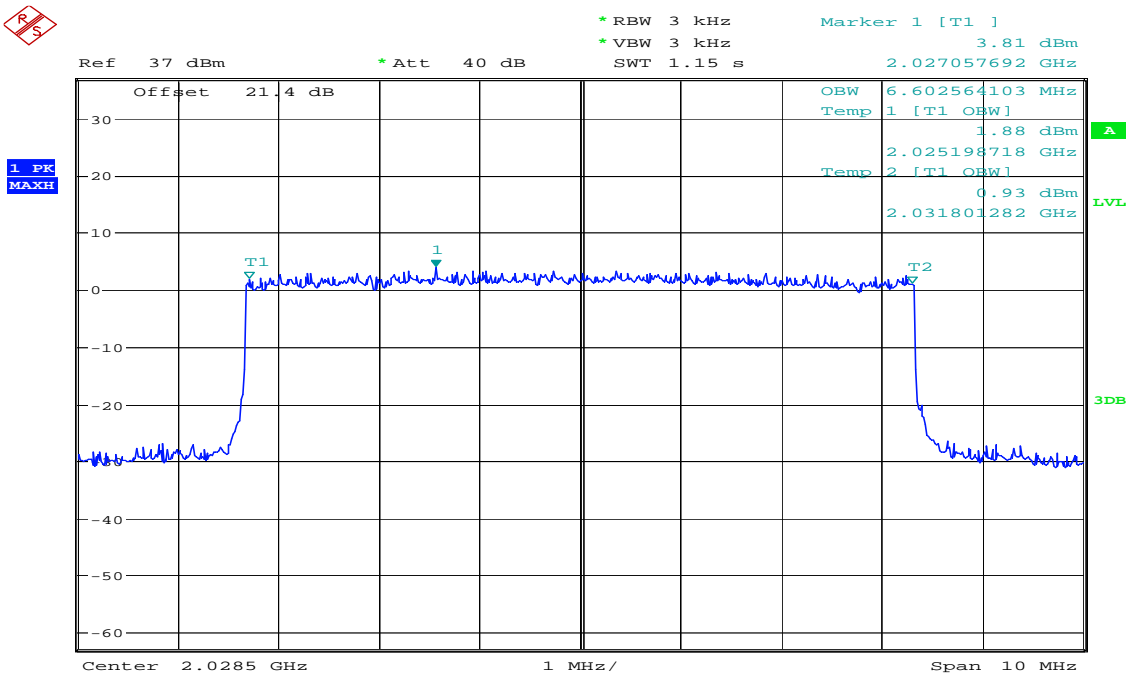
The internal function of the spectrum analyzer was used to determine the occupied bandwidth (99%).

Plot 19: Occupied bandwidth 2028 MHz / 6 MHz QPSK



Date: 11.MAR.2009 16:56:47

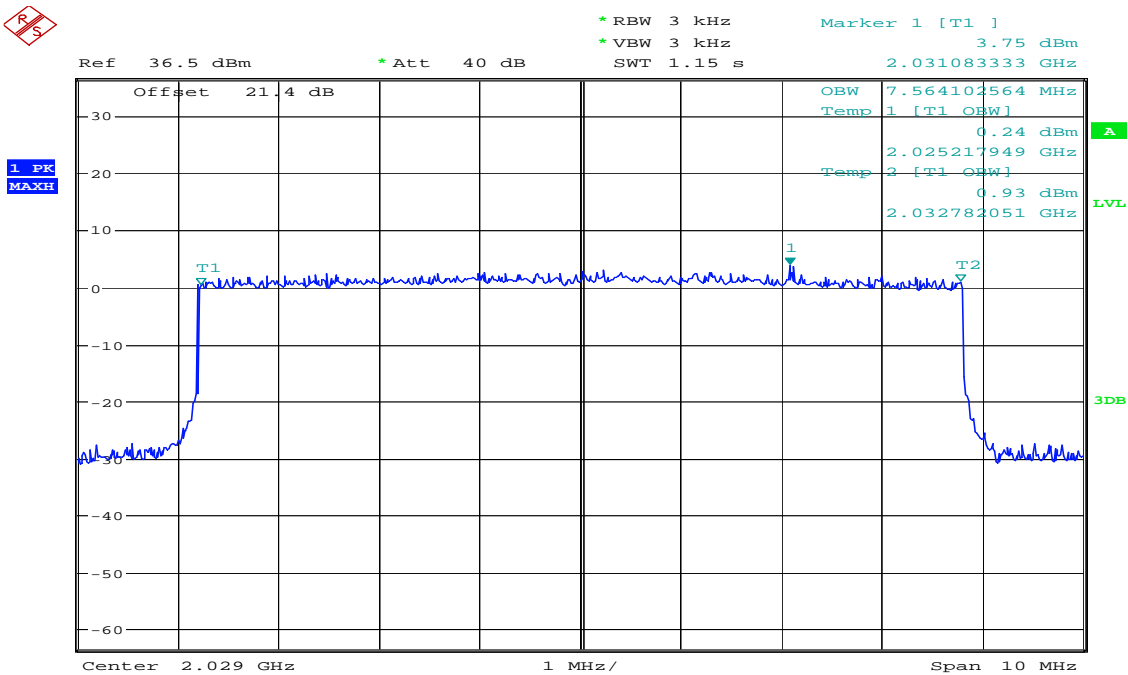
Plot 20: Occupied bandwidth 2028.5 MHz / 7 MHz QPSK



Date: 11.MAR.2009 11:44:36

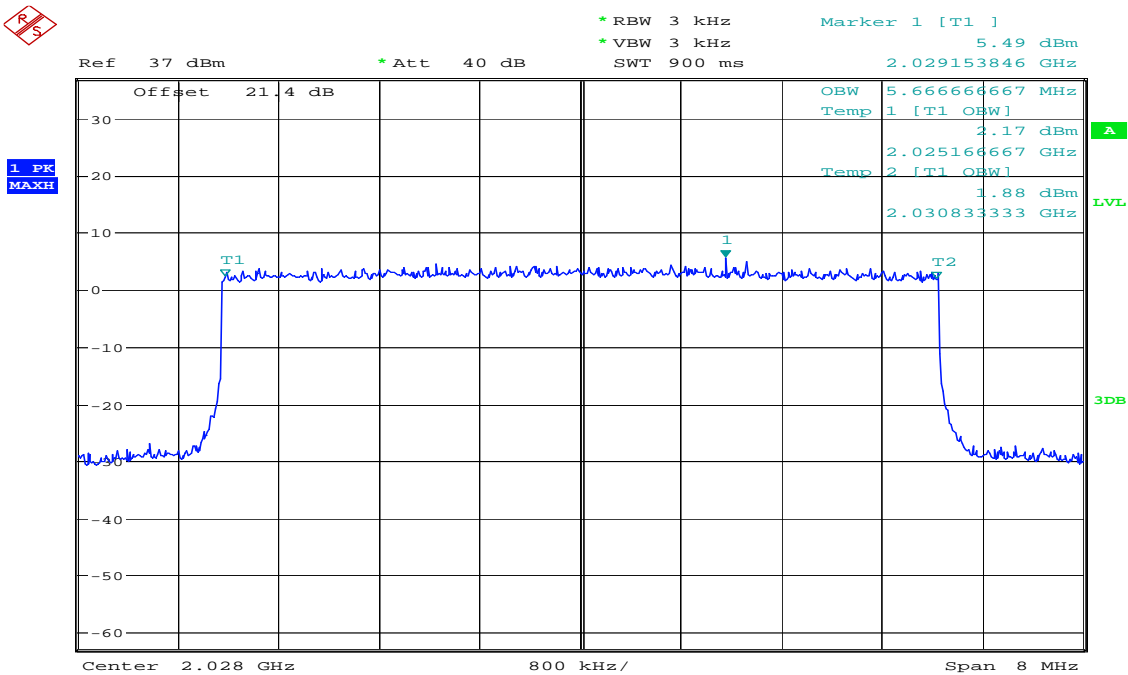


Plot 21: Occupied bandwidth 2029 MHz / 8 MHz QPSK



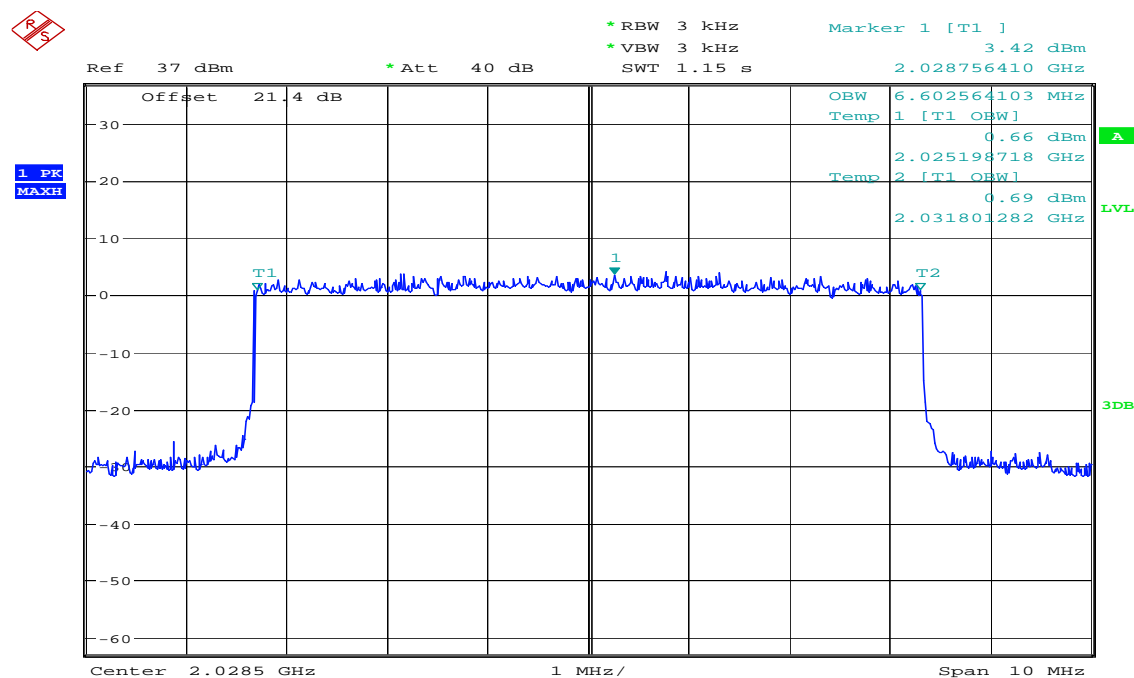
Date: 9.MAR.2009 12:37:35

Plot 22: Occupied bandwidth 2028 MHz / 6 MHz 16QAM



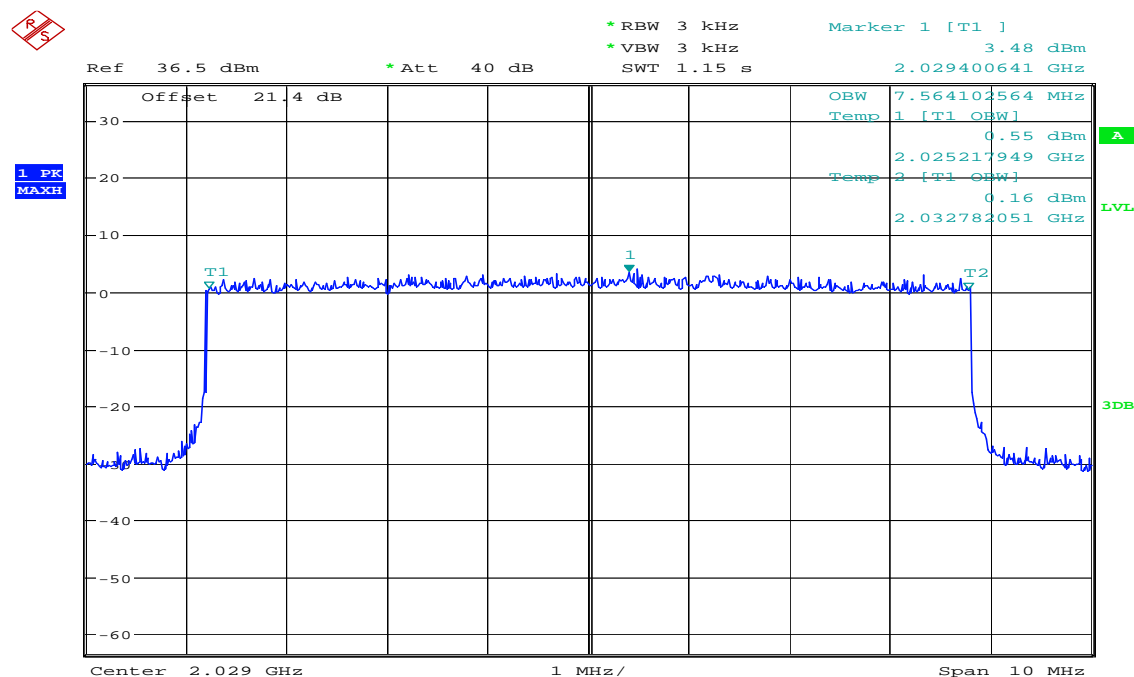
Date: 11.MAR.2009 16:54:00

Plot 23: Occupied bandwidth 2028.5 MHz / 7 MHz 16QAM



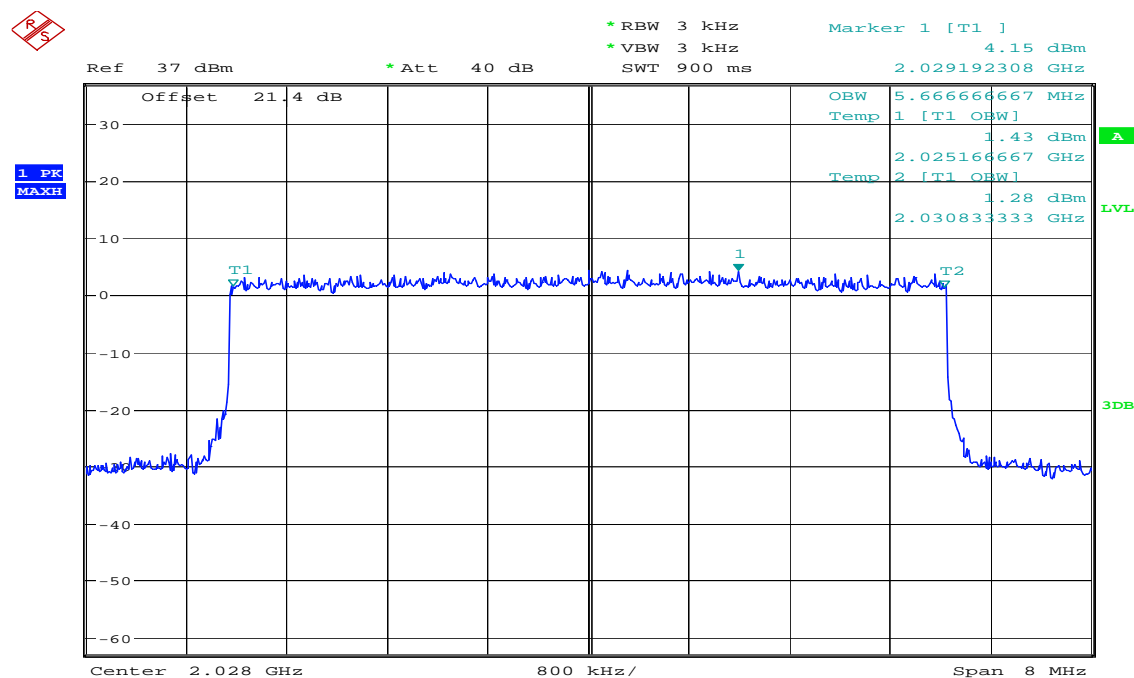
Date: 11.MAR.2009 11:45:11

Plot 24: Occupied bandwidth 2029 MHz / 8 MHz 16QAM



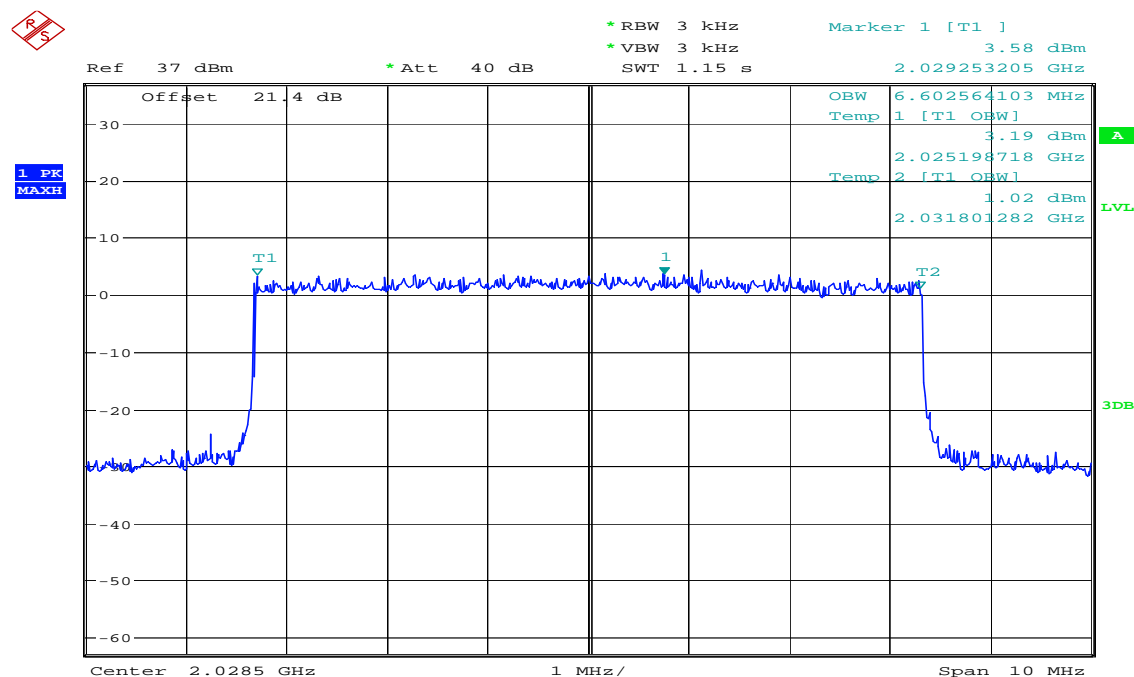
Date: 9.MAR.2009 12:39:02

Plot 25: Occupied bandwidth 2028 MHz / 6 MHz 64QAM



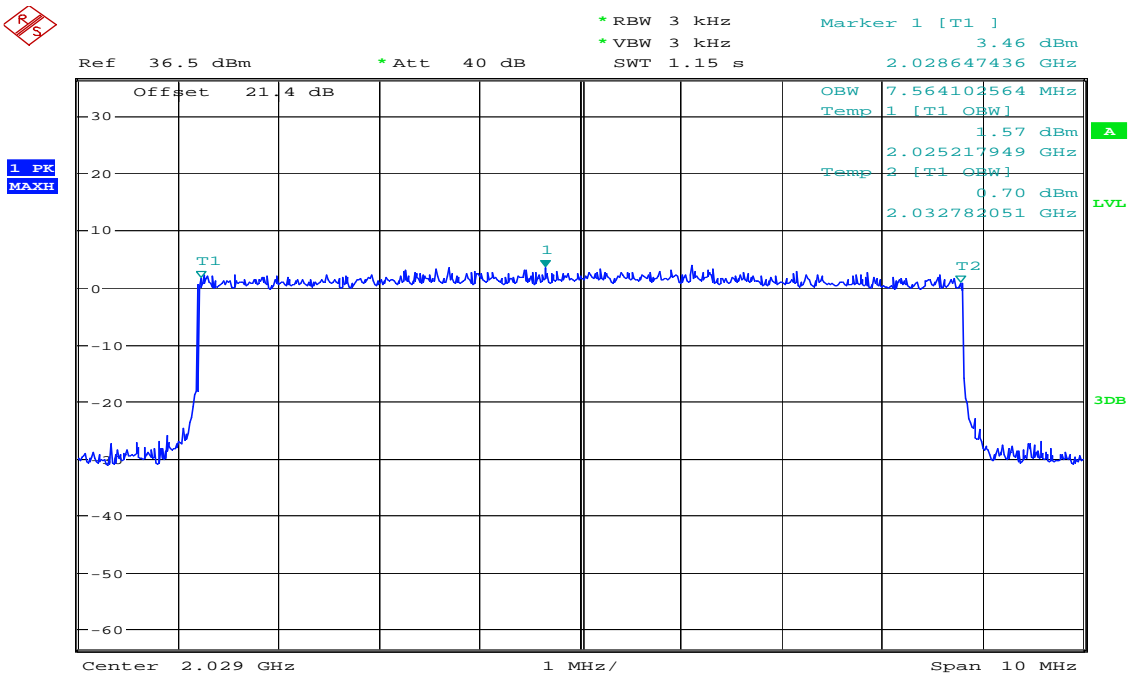
Date: 11.MAR.2009 16:49:48

Plot 26: Occupied bandwidth 2028.5 MHz / 7 MHz 64QAM



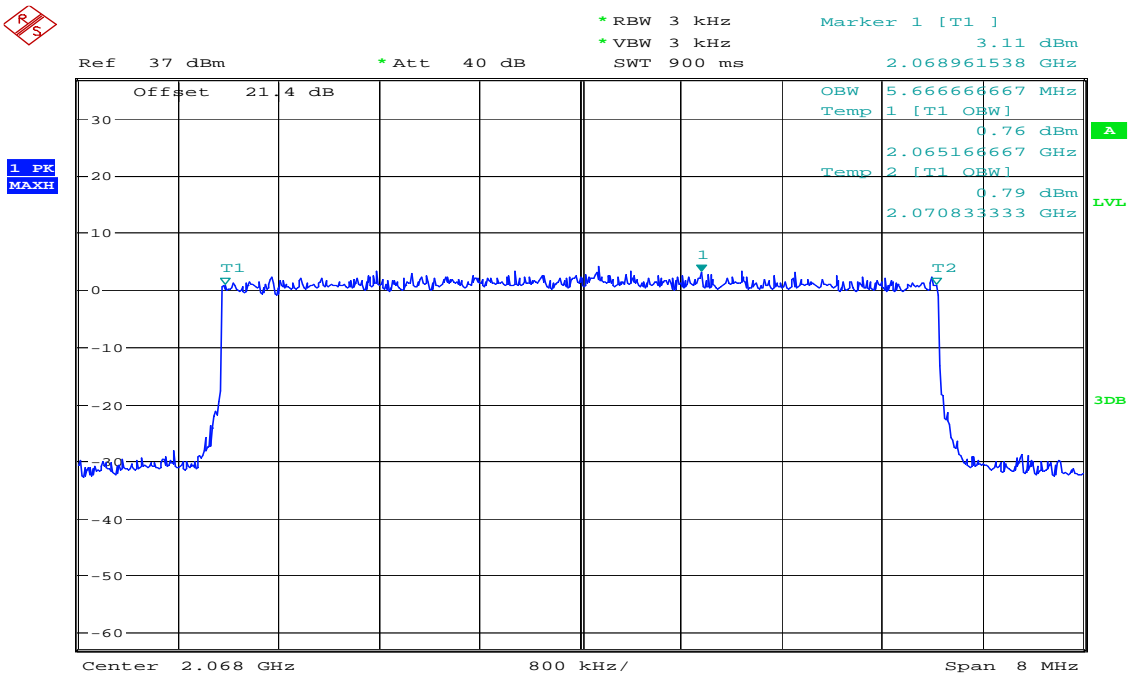
Date: 11.MAR.2009 11:45:38

Plot 27: Occupied bandwidth 2029 MHz / 8 MHz 64QAM



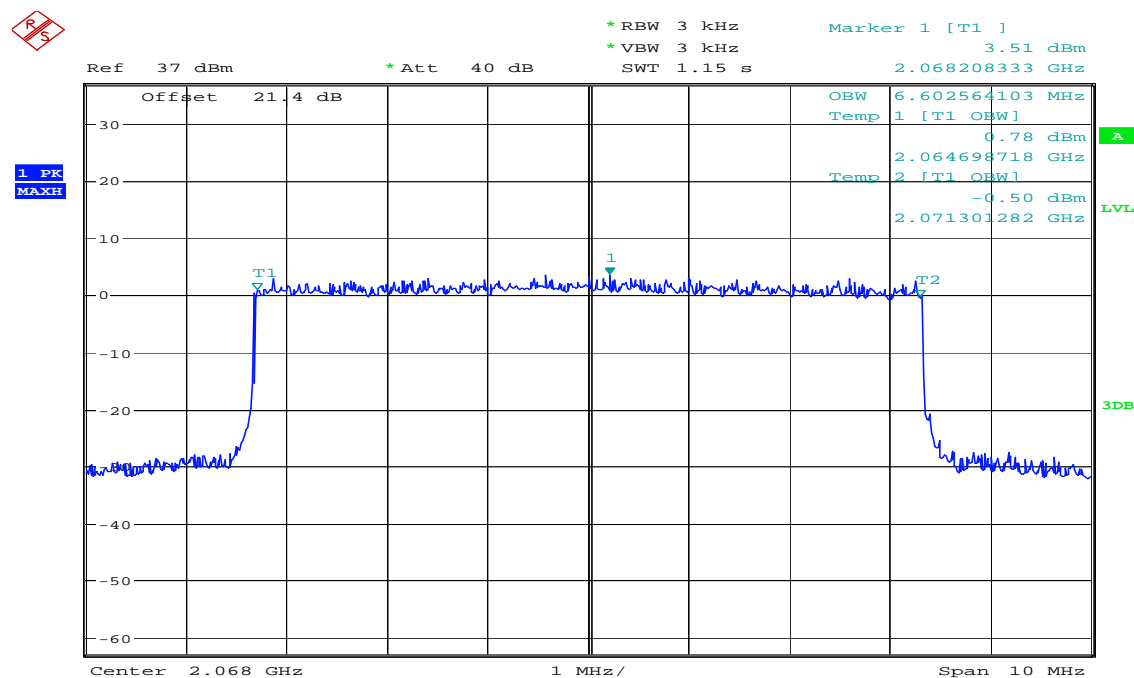
Date: 9.MAR.2009 11:52:12

Plot 28: Occupied bandwidth 2068 MHz / 6 MHz QPSK



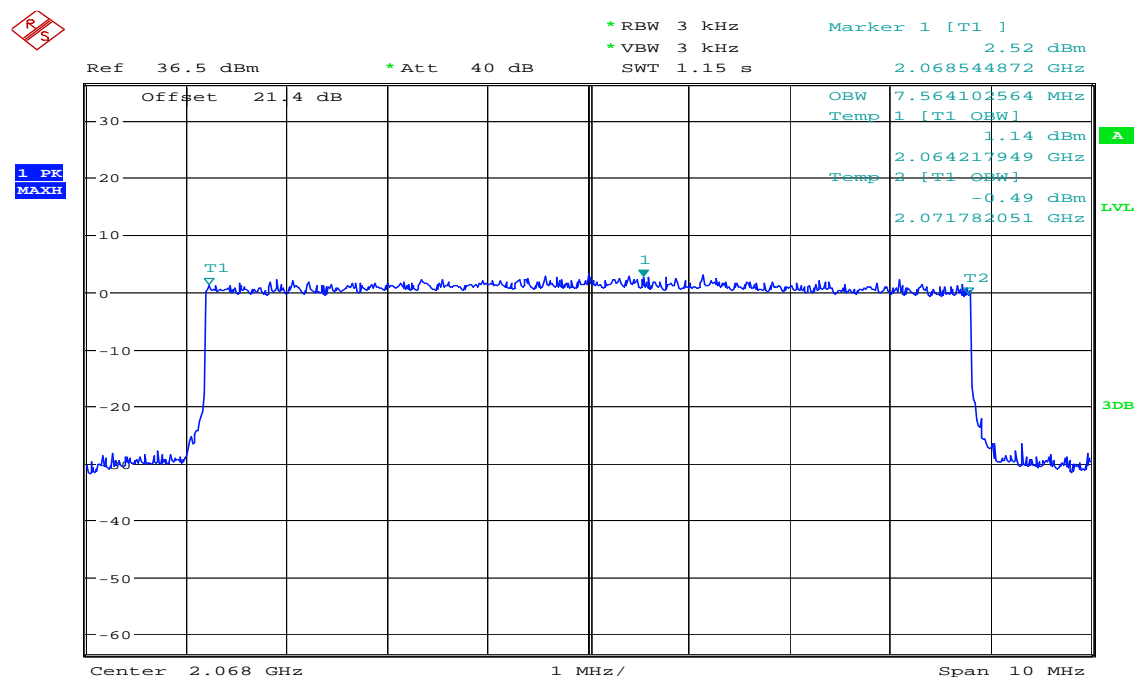
Date: 11.MAR.2009 16:57:34

Plot 29: Occupied bandwidth 2068 MHz / 7 MHz QPSK



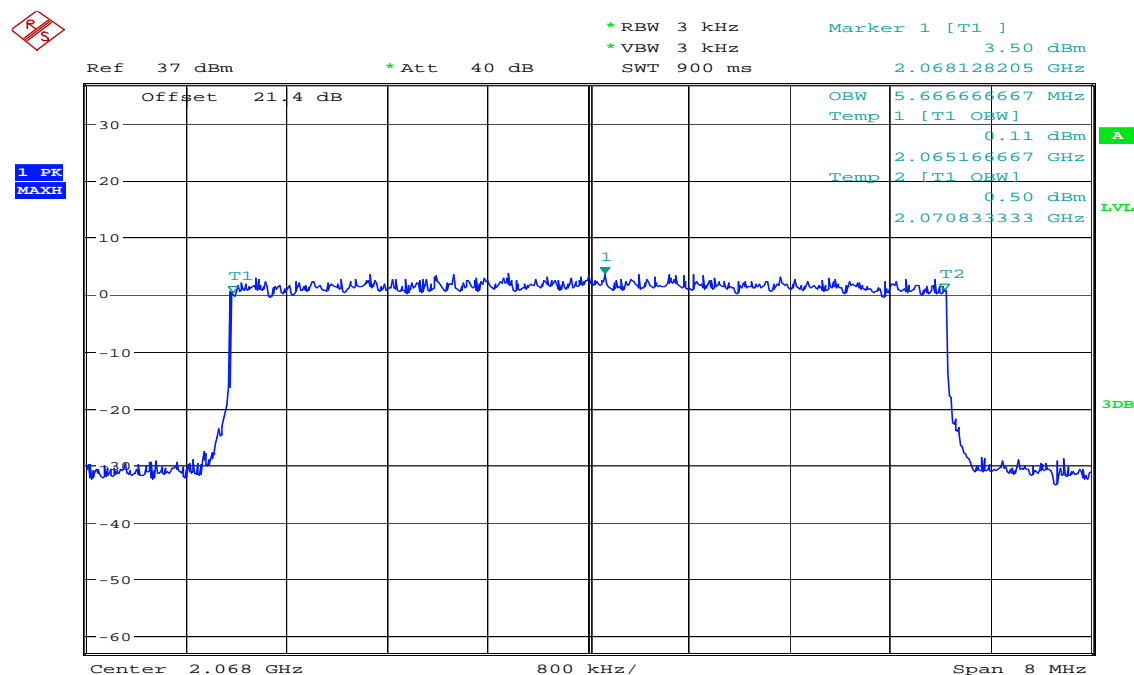
Date: 11.MAR.2009 11:43:22

Plot 30: Occupied bandwidth 2068 MHz / 8 MHz QPSK



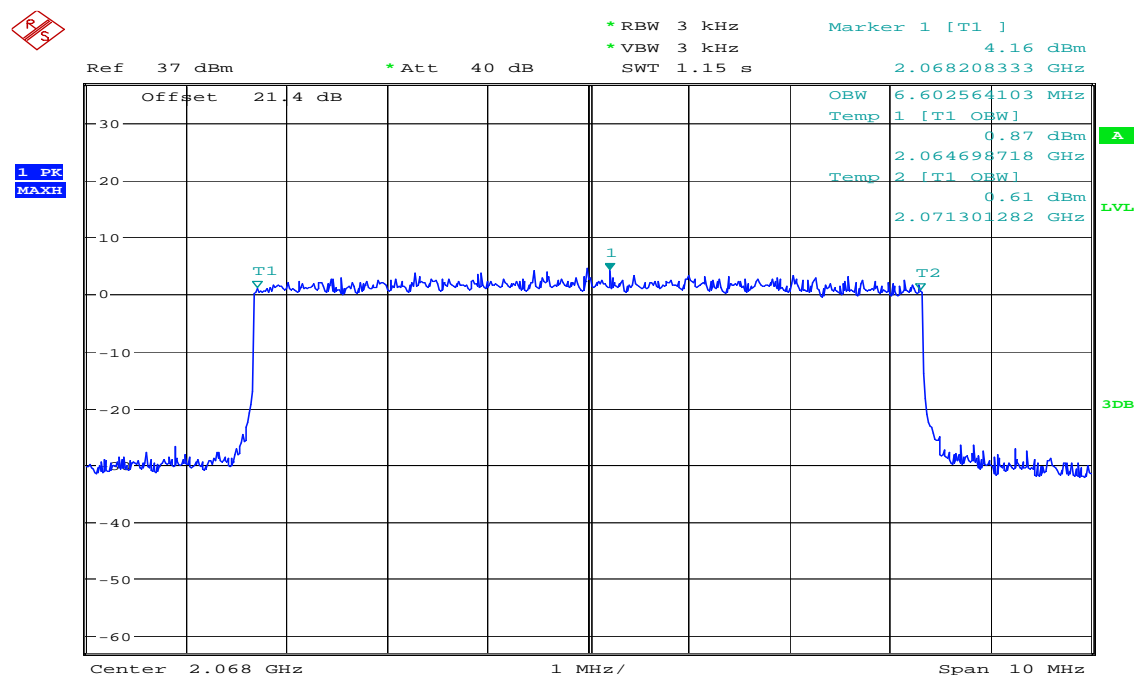
Date: 9.MAR.2009 12:36:05

Plot 31: Occupied bandwidth 2068 MHz / 6 MHz 16QAM



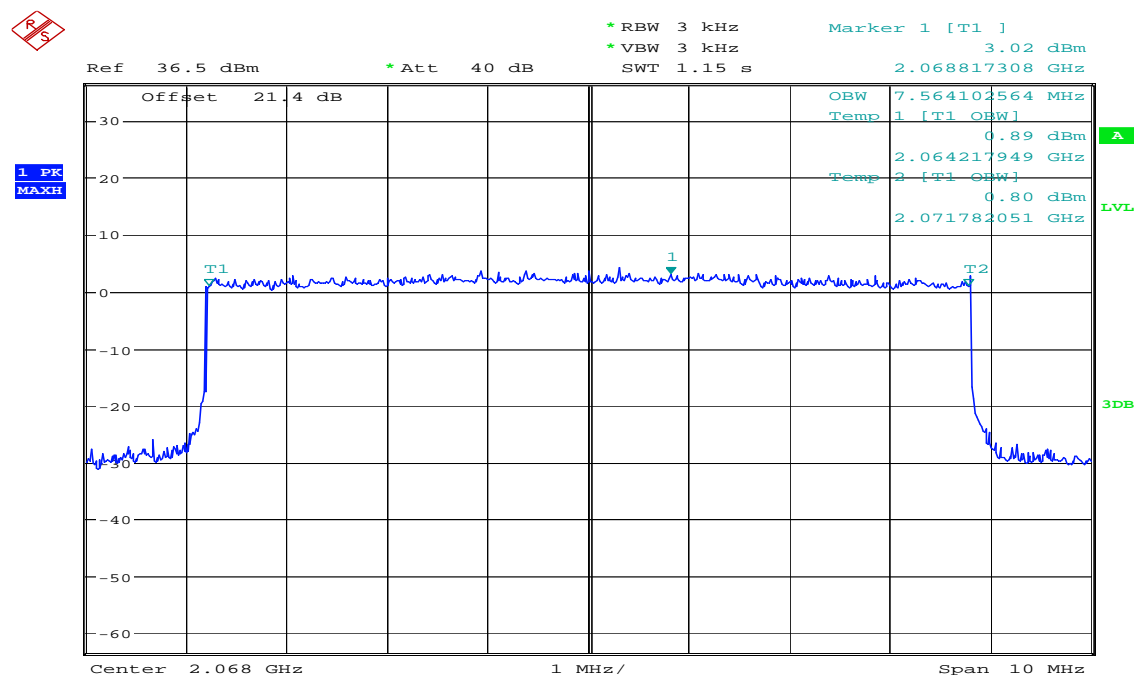
Date: 11.MAR.2009 16:58:17

Plot 32: Occupied bandwidth 2068 MHz / 7 MHz 16QAM



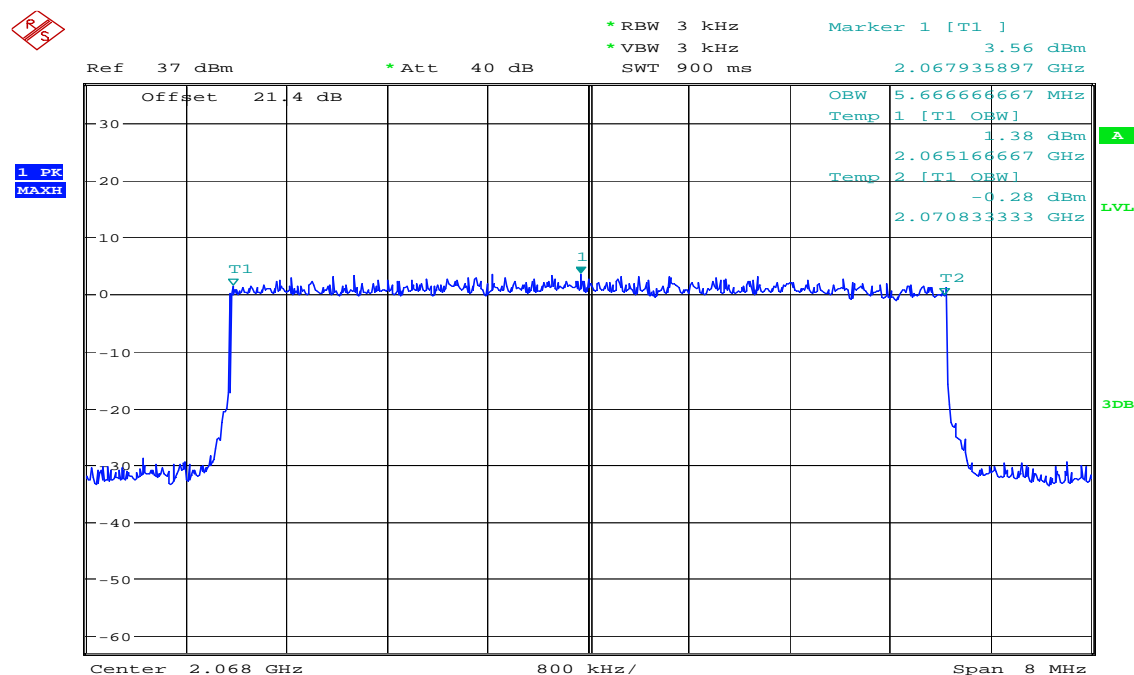
Date: 11.MAR.2009 11:42:53

Plot 33: Occupied bandwidth 2068 MHz / 8 MHz 16QAM



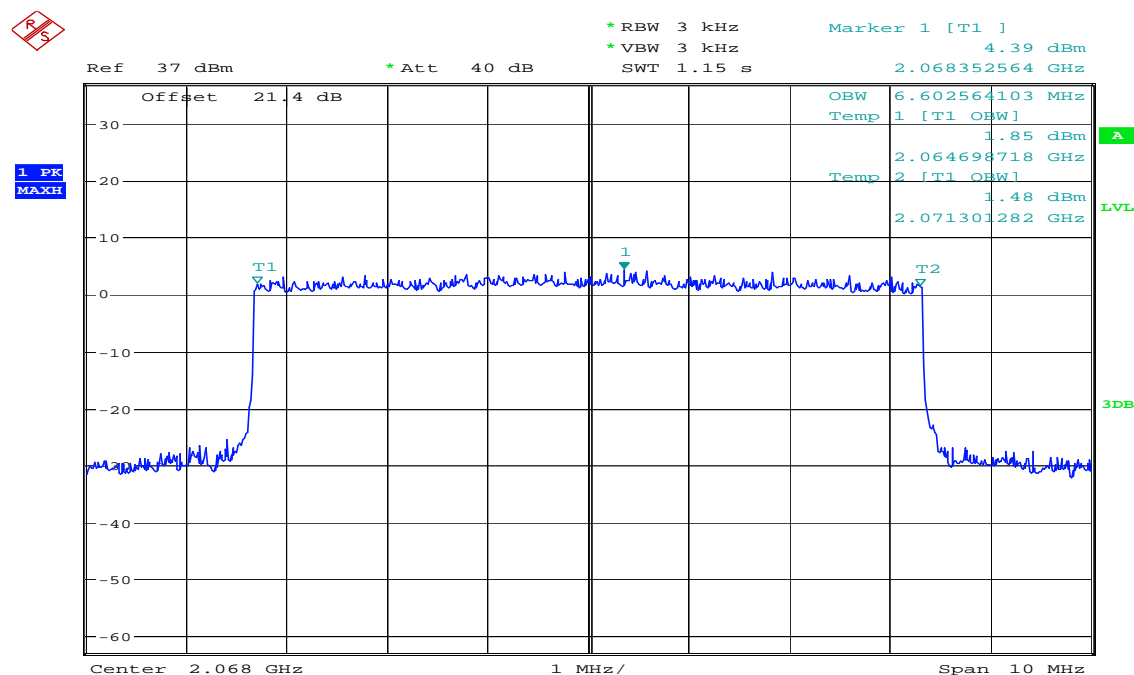
Date: 9.MAR.2009 12:42:02

Plot 34: Occupied bandwidth 2068 MHz / 6 MHz 64QAM



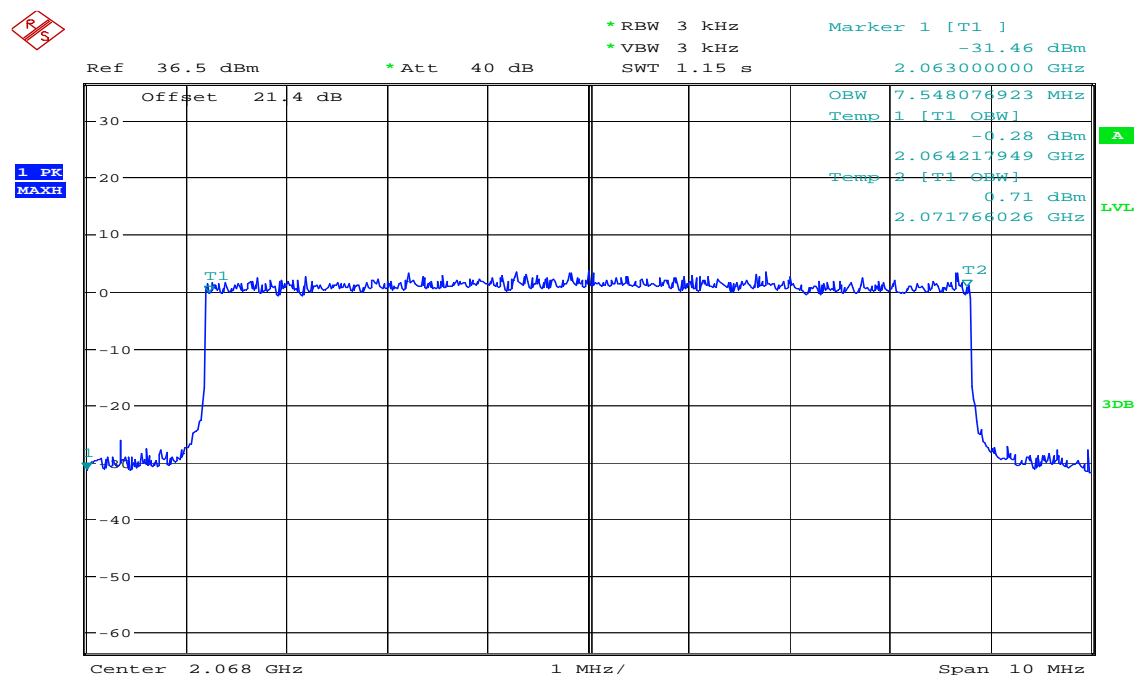
Date: 11.MAR.2009 16:58:39

Plot 35: Occupied bandwidth 2068 MHz / 7 MHz 64QAM



Date: 11.MAR.2009 11:41:36

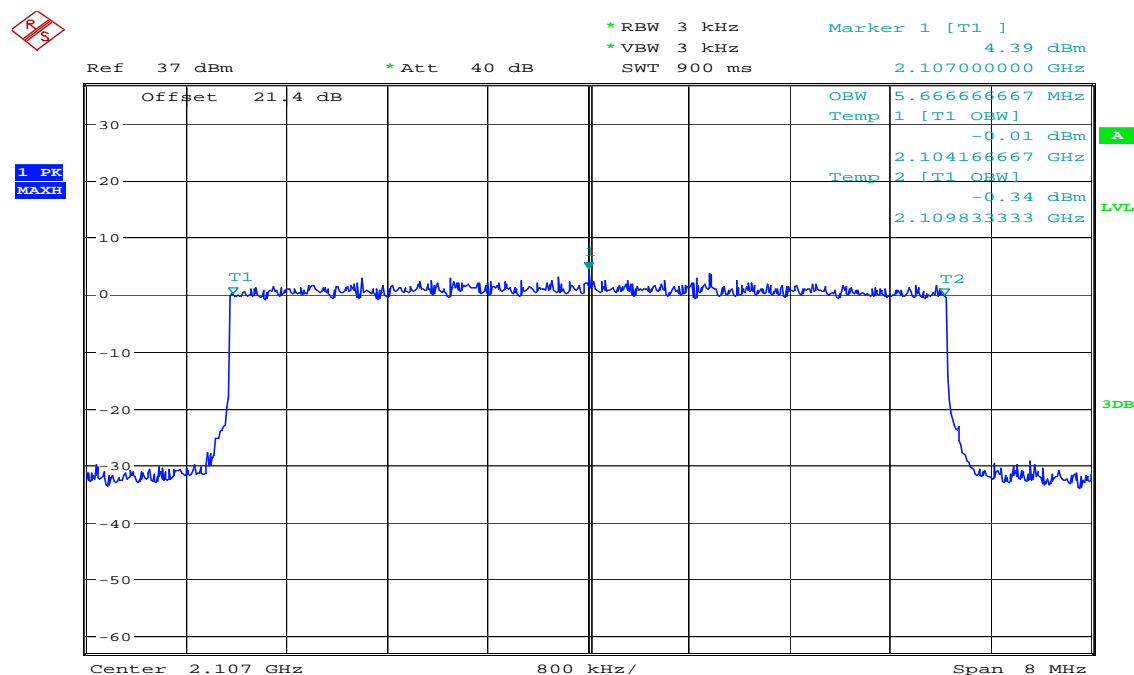
Plot 36: Occupied bandwidth 2068 MHz / 8 MHz 64QAM



Date: 9.MAR.2009 11:53:03

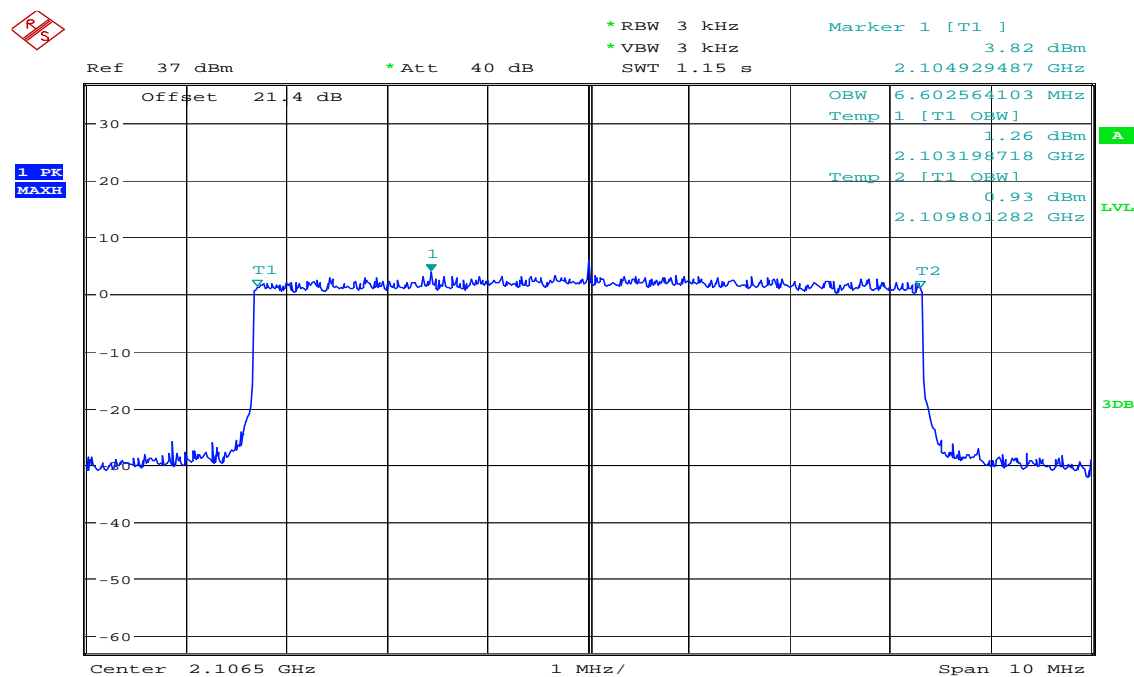


Plot 37: Occupied bandwidth 2107 MHz / 6 MHz QPSK



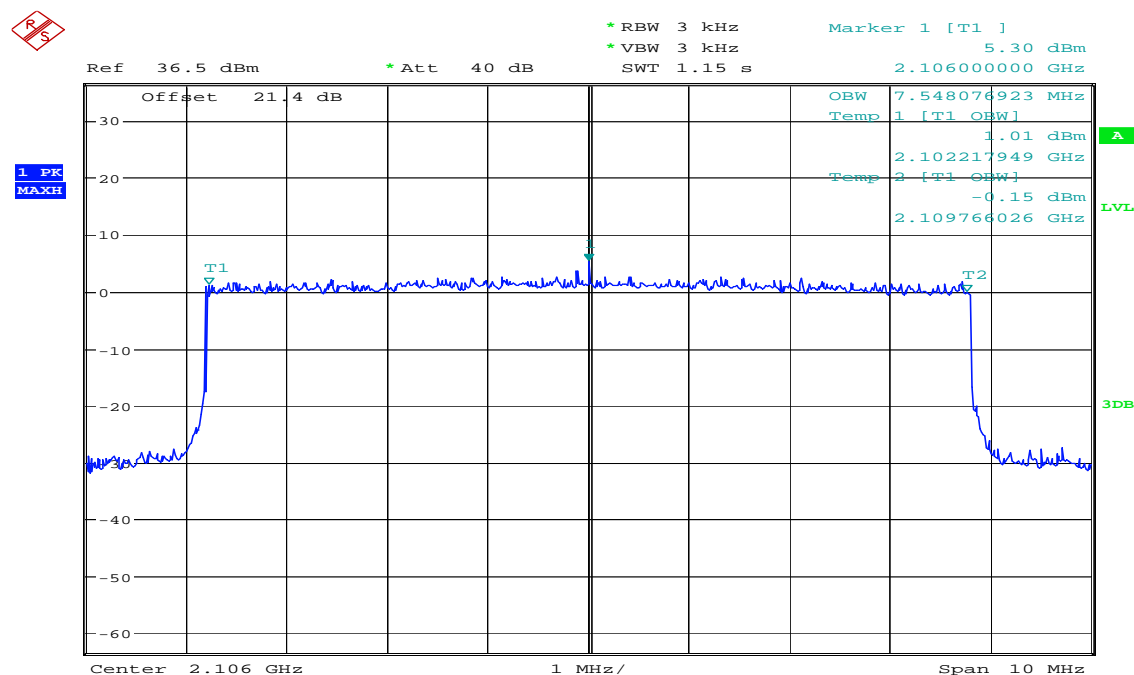
Date: 11.MAR.2009 17:01:57

Plot 38: Occupied bandwidth 2106.5 MHz / 7 MHz QPSK



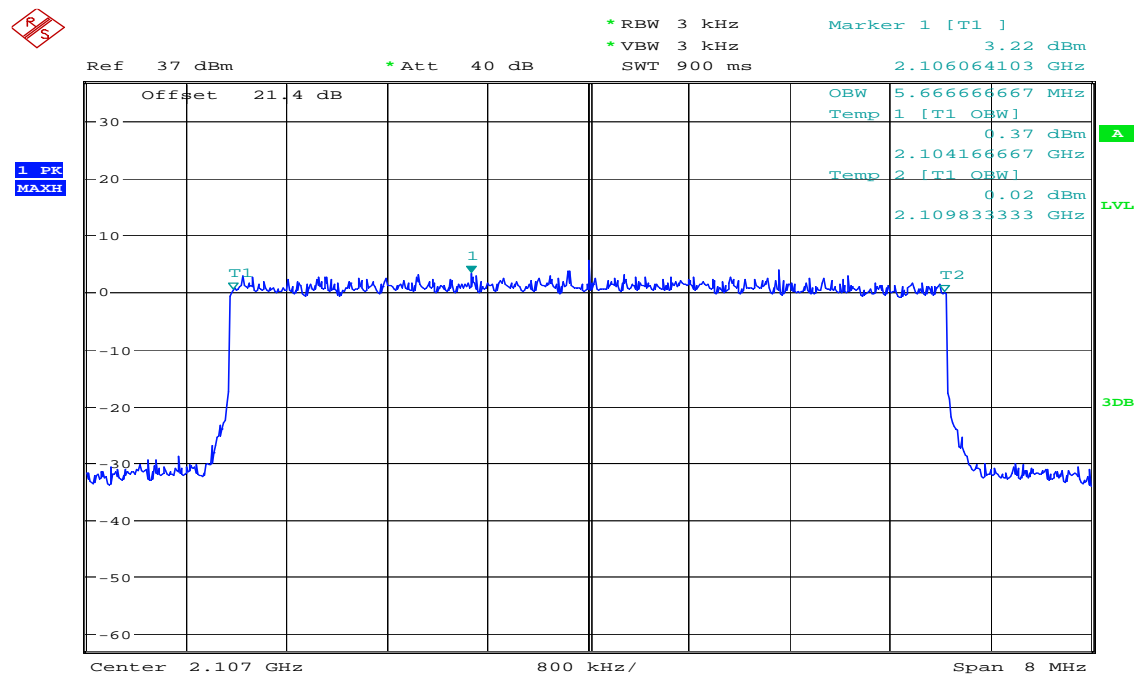
Date: 11.MAR.2009 11:39:32

Plot 39: Occupied bandwidth 2106 MHz / 8 MHz QPSK



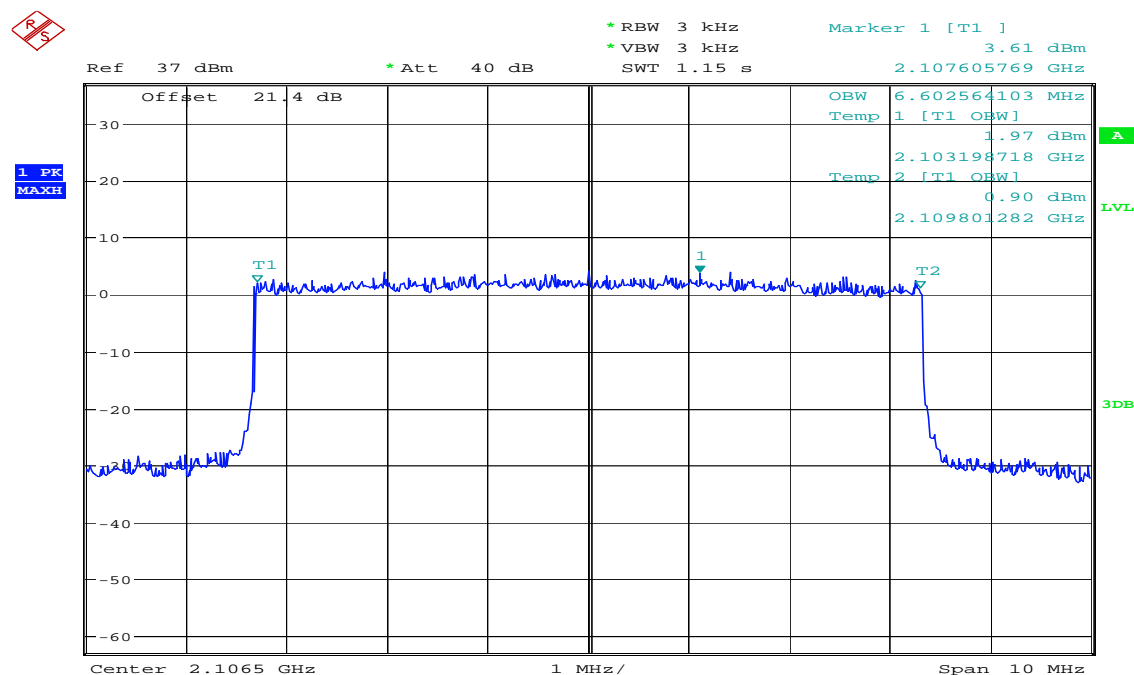
Date: 9.MAR.2009 12:00:21

Plot 40: Occupied bandwidth 2107 MHz / 6 MHz 16QAM



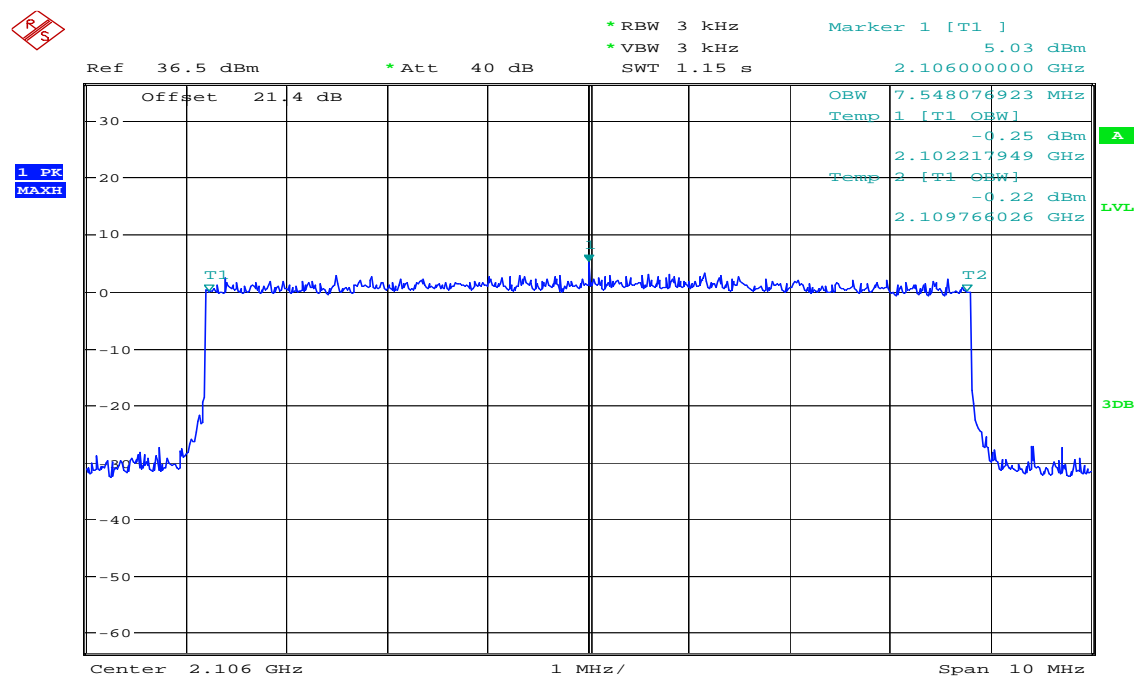
Date: 11.MAR.2009 17:01:26

Plot 41: Occupied bandwidth 2106.5 MHz / 7 MHz 16QAM



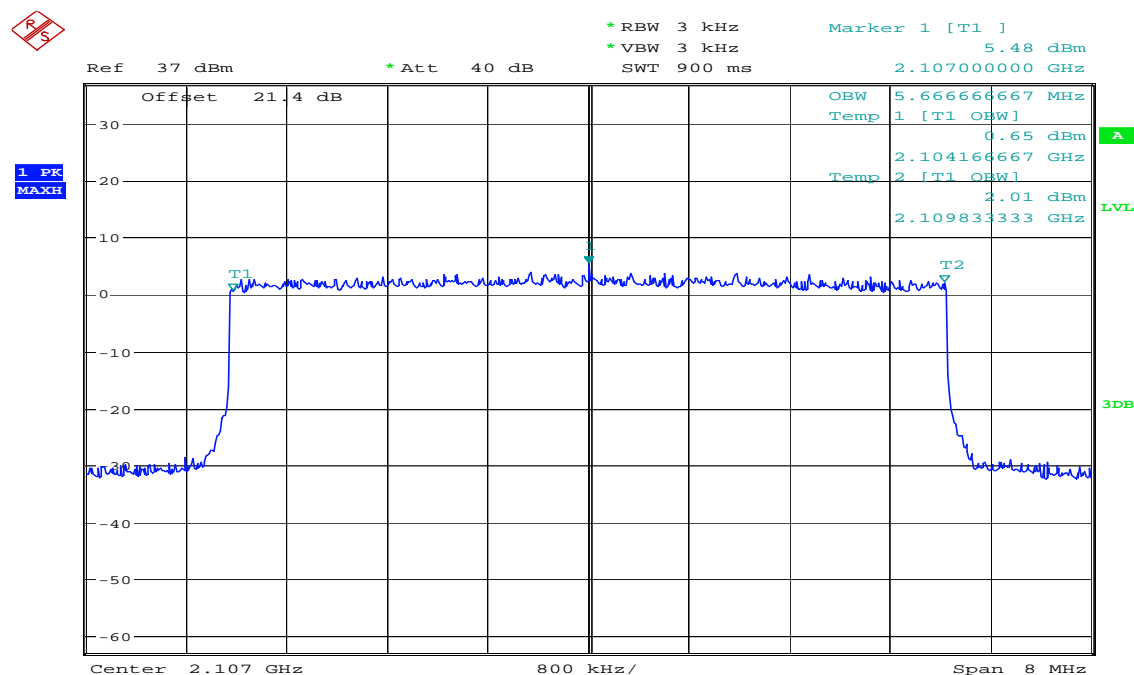
Date: 11.MAR.2009 11:40:04

Plot 42: Occupied bandwidth 2106 MHz / 8 MHz 16QAM



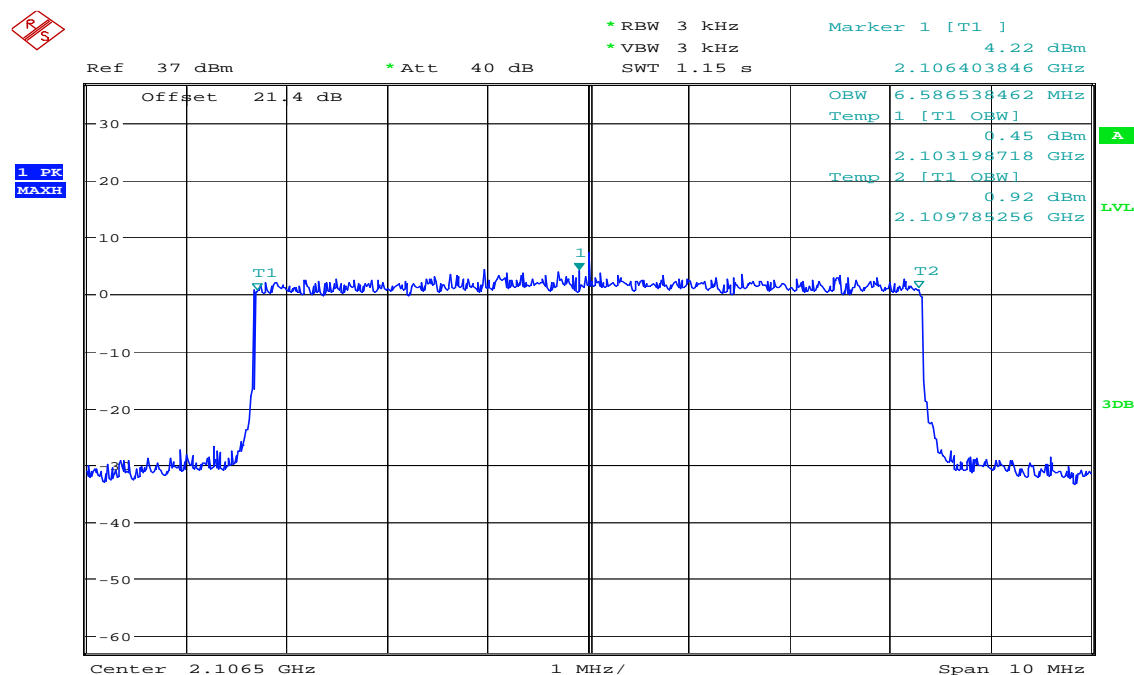
Date: 9.MAR.2009 12:42:58

Plot 43: Occupied bandwidth 2107 MHz / 6 MHz 64QAM



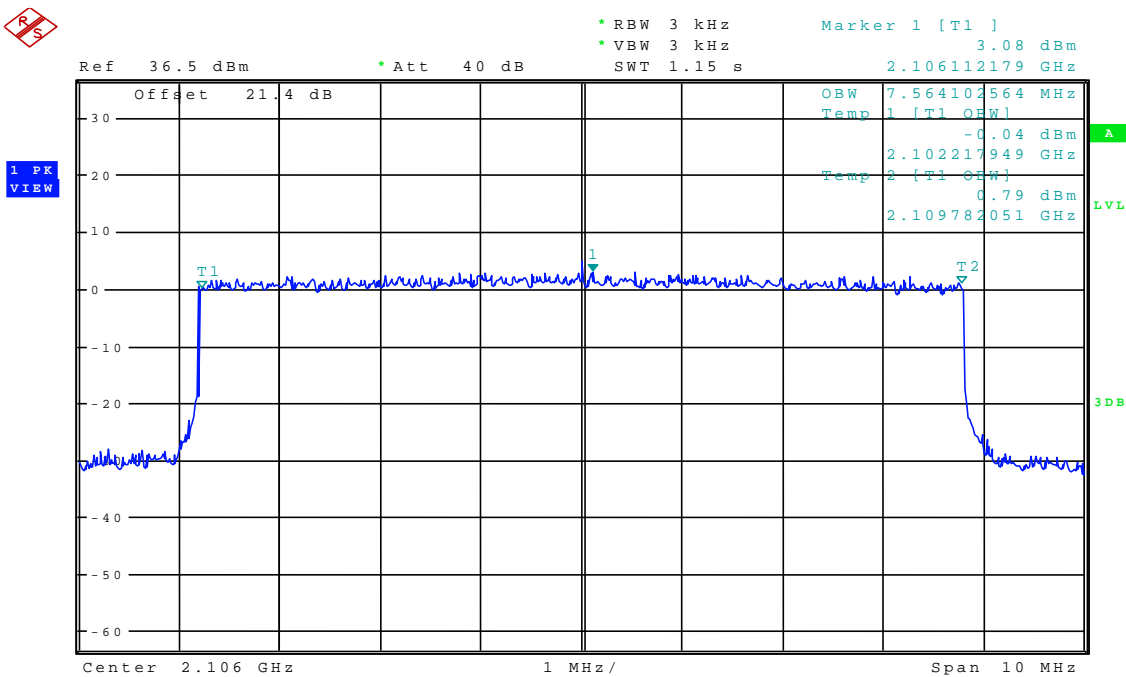
Date: 11.MAR.2009 17:00:55

Plot 44: Occupied bandwidth 2106.5 MHz / 7 MHz 64QAM



Date: 11.MAR.2009 11:40:30

Plot 45: Occupied bandwidth 2106 MHz / 8 MHz 64QAM



Date: 9.MAR.2009 11: 55: 41

Limit according to §74.637(g):

Under normal test conditions only	For the frequency band 1900 to 2110 MHz: Maximum authorized bandwidth: 18 MHz
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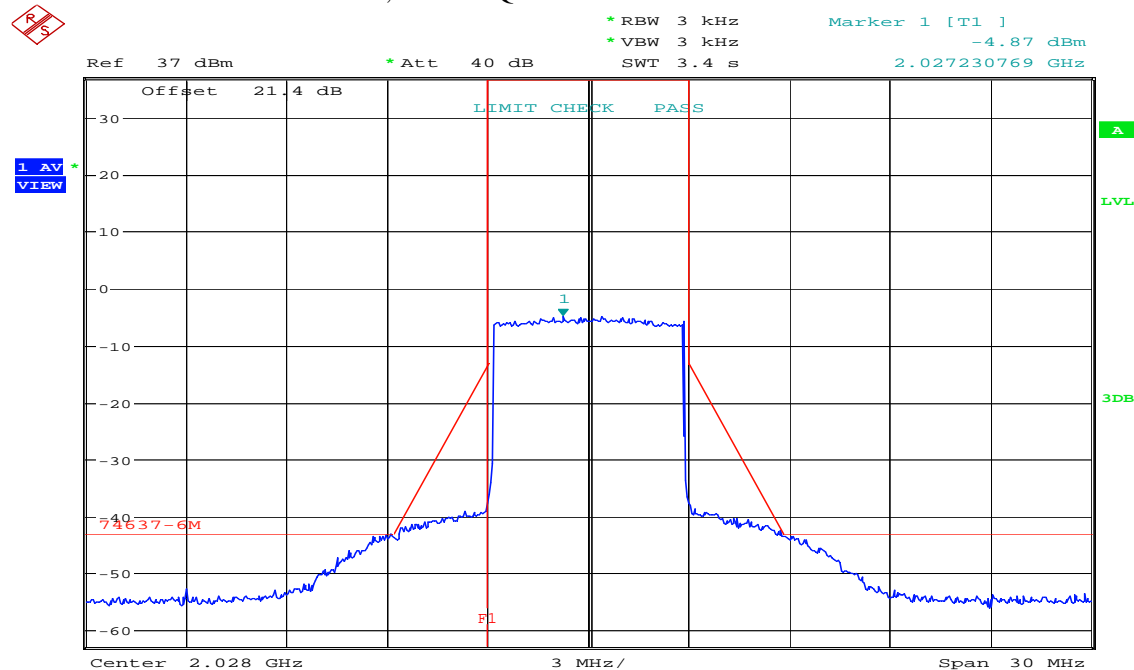
Test Result: passed

## 4.7 Emission mask

§2.1051 / §74.637(a)(2)

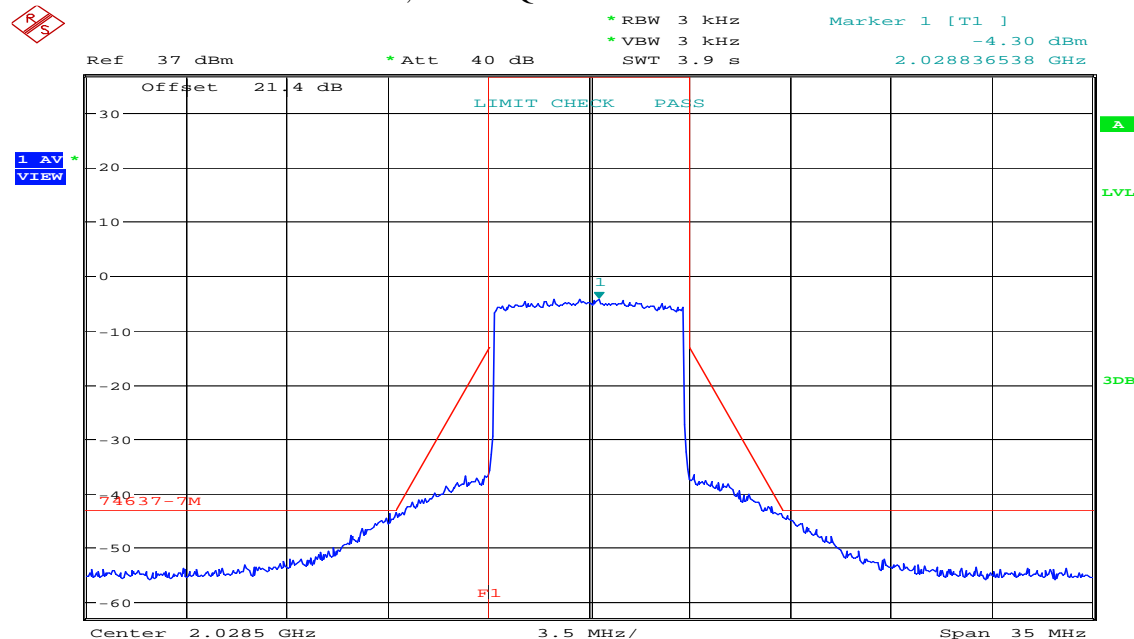
Measurement was done using the emission mask for using transmissions employing digital modulation techniques:

Plot 46: Emission mask 2028 MHz, 6 MHz / QPSK



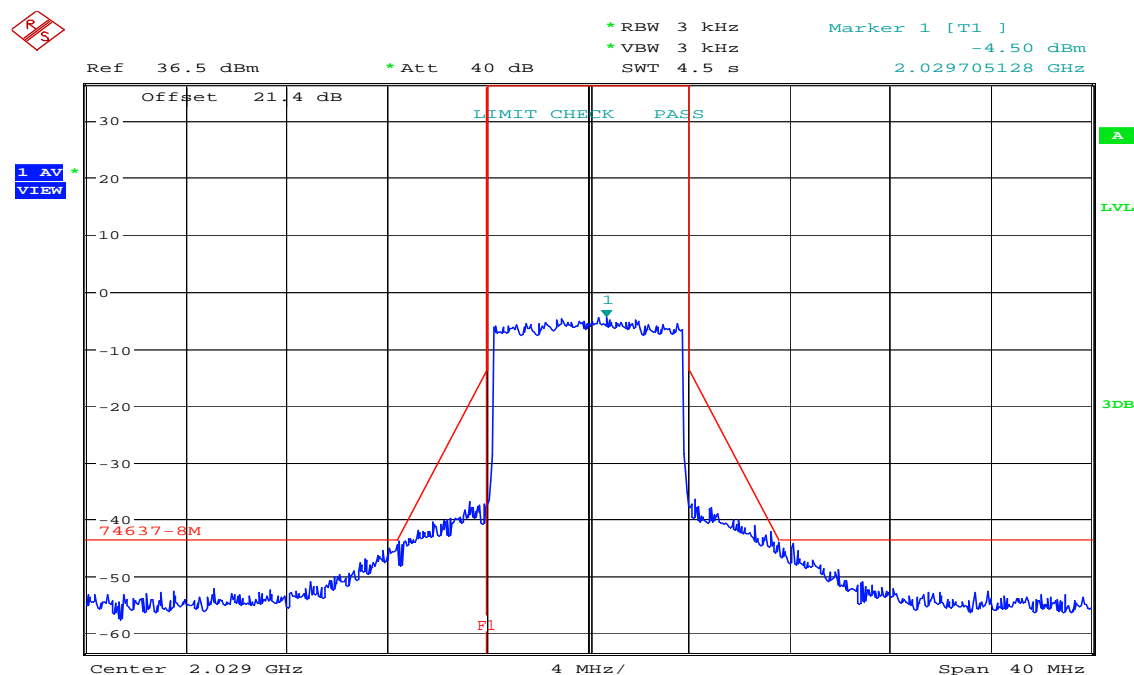
Date: 11.MAR.2009 15:14:42

Plot 47: Emission mask 2028.5 MHz, 7 MHz / QPSK



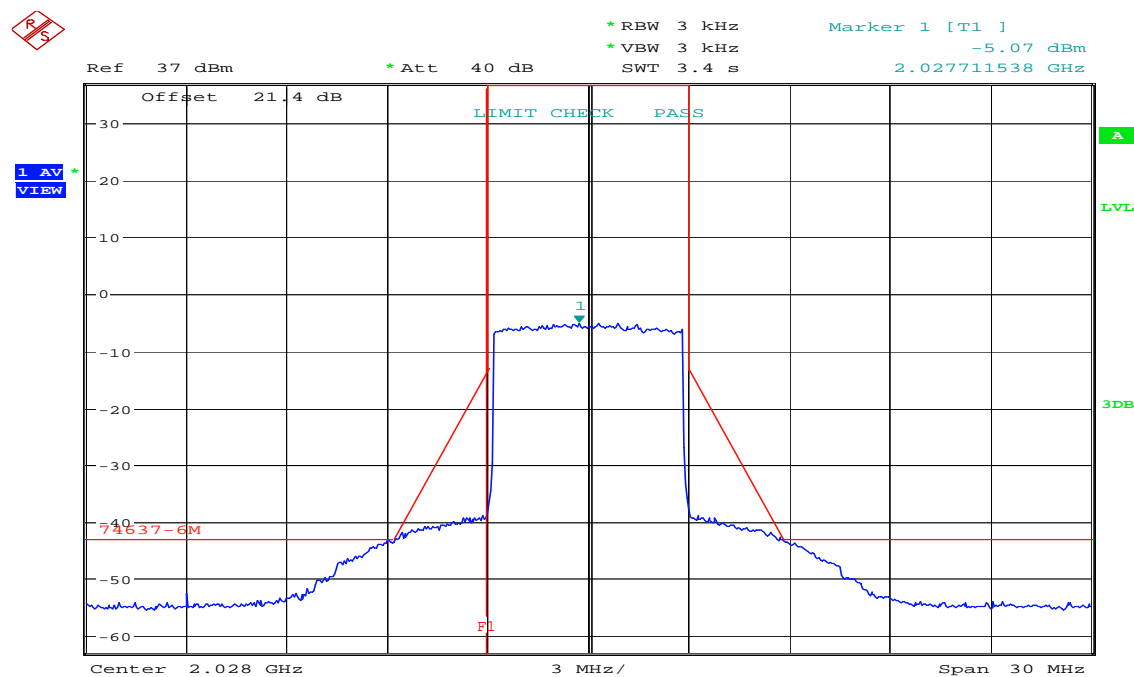
Date: 11.MAR.2009 12:00:54

Plot 48: Emission mask 2029 MHz, 8 MHz / QPSK



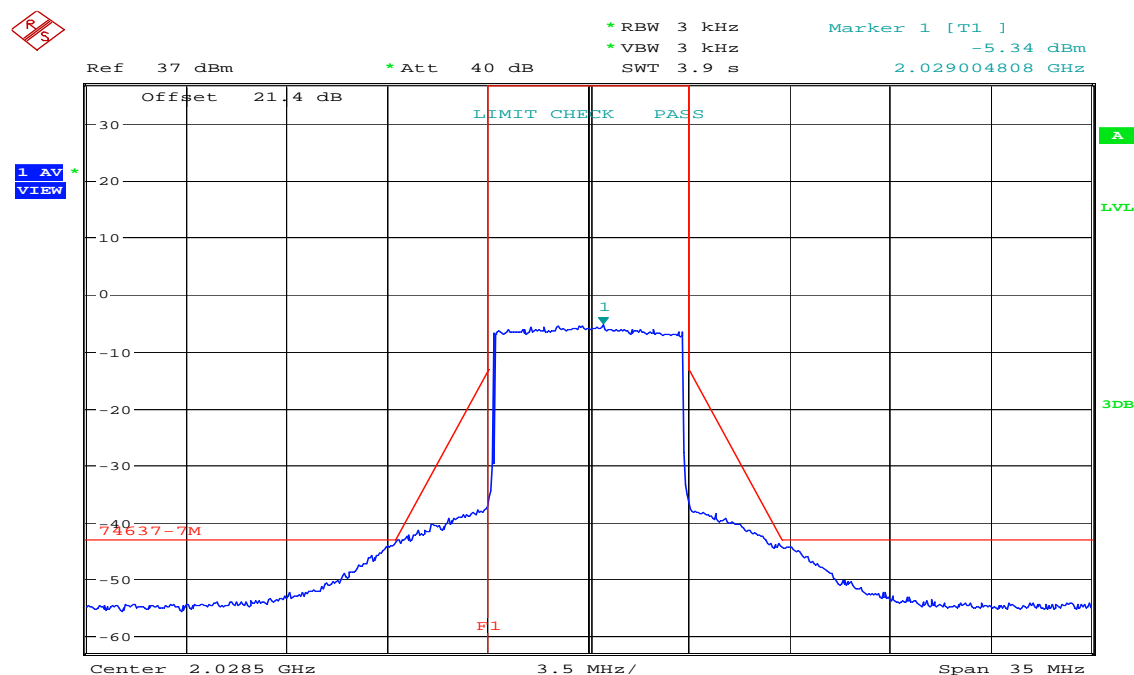
Date: 9.MAR.2009 12:56:27

Plot 49: Emission mask 2028 MHz, 6 MHz / 16QAM



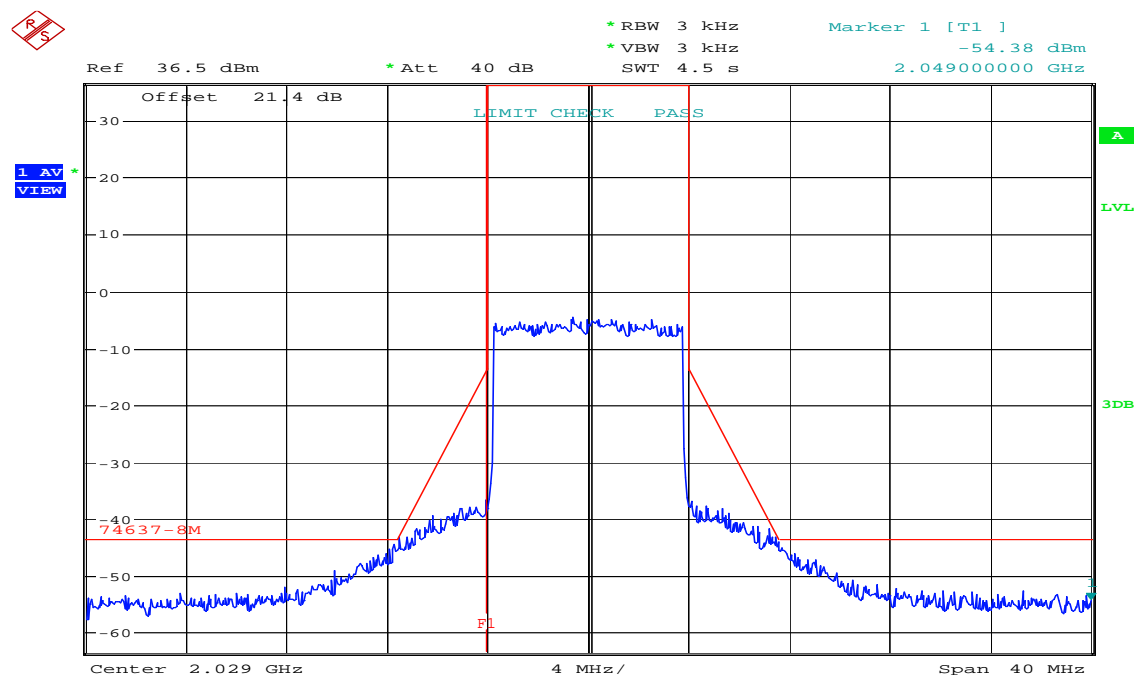
Date: 11.MAR.2009 15:16:15

Plot 50: Emission mask 2028.5 MHz, 7 MHz / 16QAM



Date: 11.MAR.2009 11:59:12

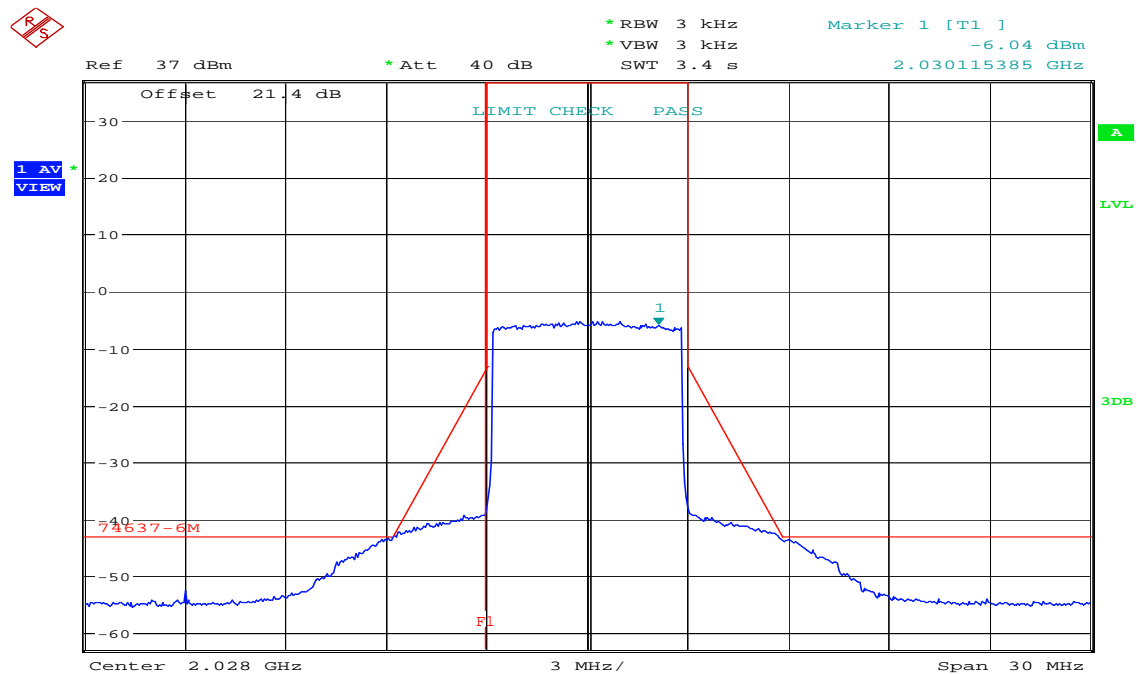
Plot 51: Emission mask 2029 MHz, 8 MHz / 16QAM



Date: 9.MAR.2009 12:55:14

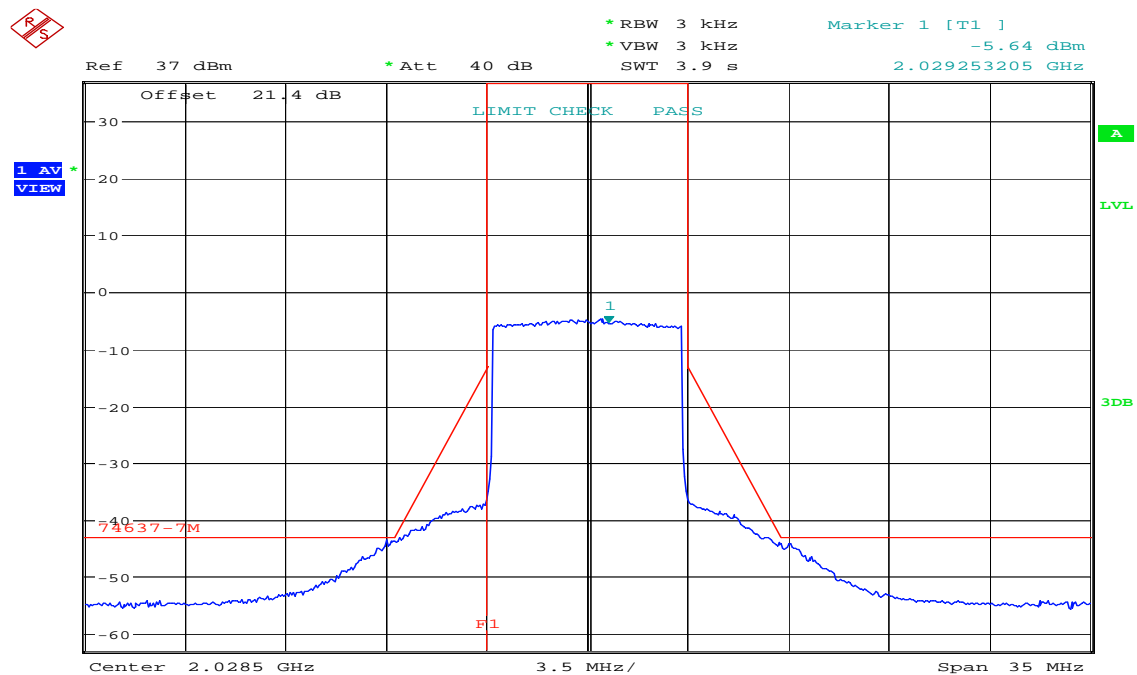


Plot 52: Emission mask 2028 MHz, 6 MHz / 64QAM



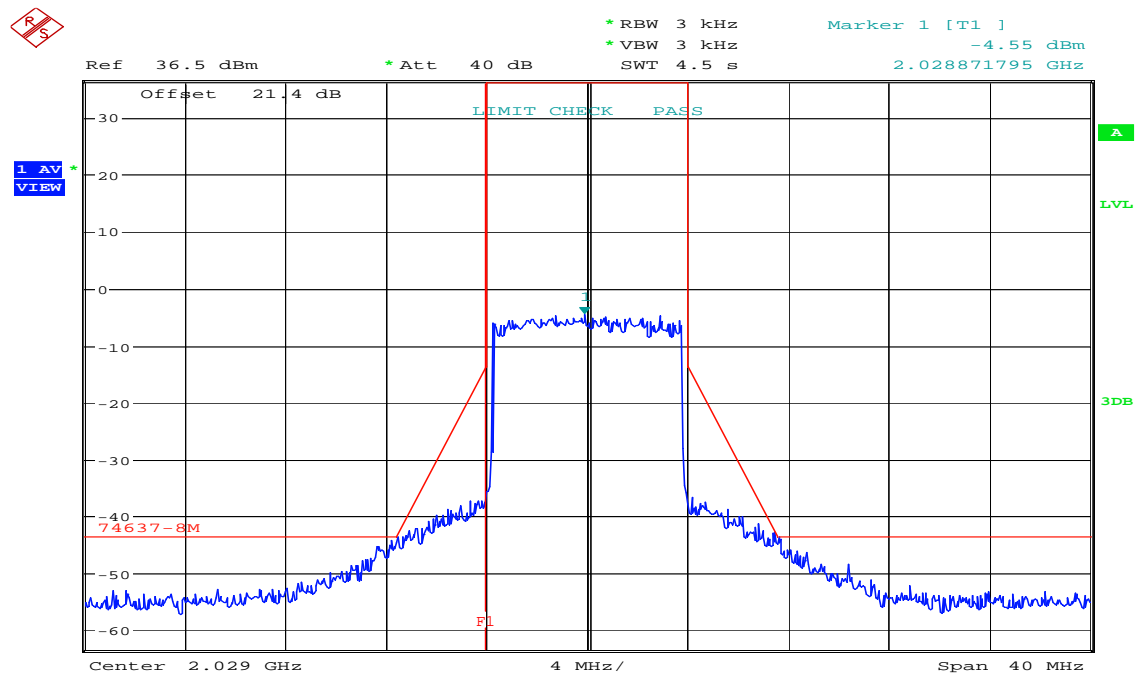
Date: 11.MAR.2009 15:24:18

Plot 53: Emission mask 2028.5 MHz, 7 MHz / 64QAM



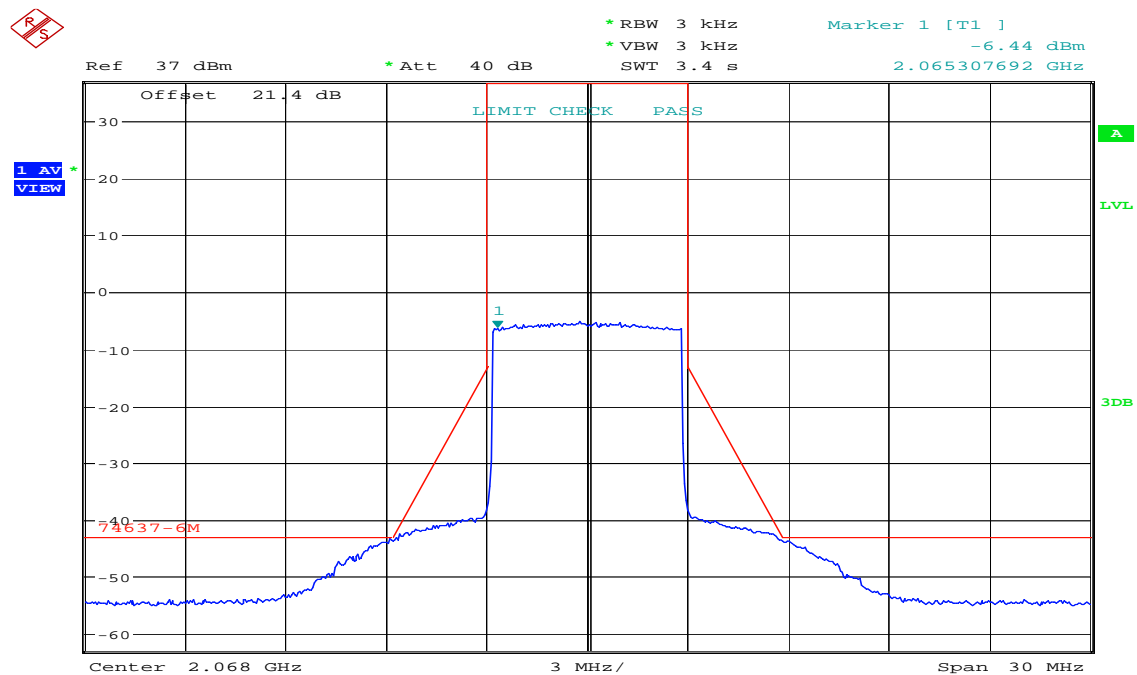
Date: 11.MAR.2009 11:57:05

Plot 54: Emission mask 2029 MHz, 8 MHz / 64QAM



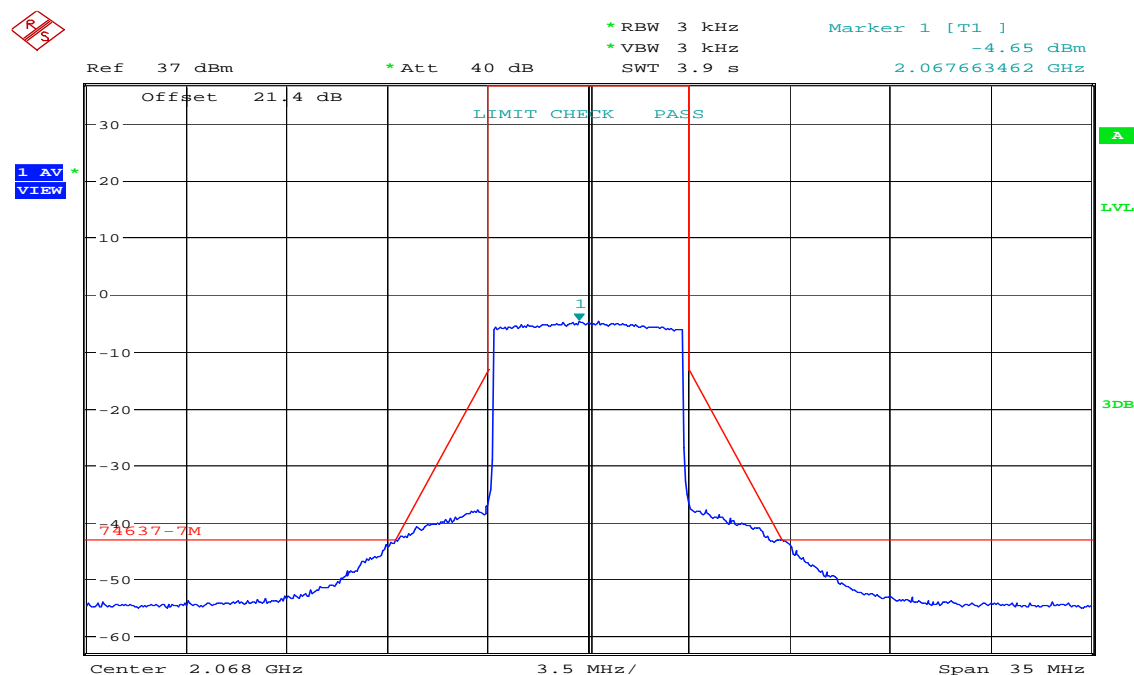
Date: 9.MAR.2009 11:44:03

Plot 55: Emission mask 2068 MHz, 6 MHz / QPSK



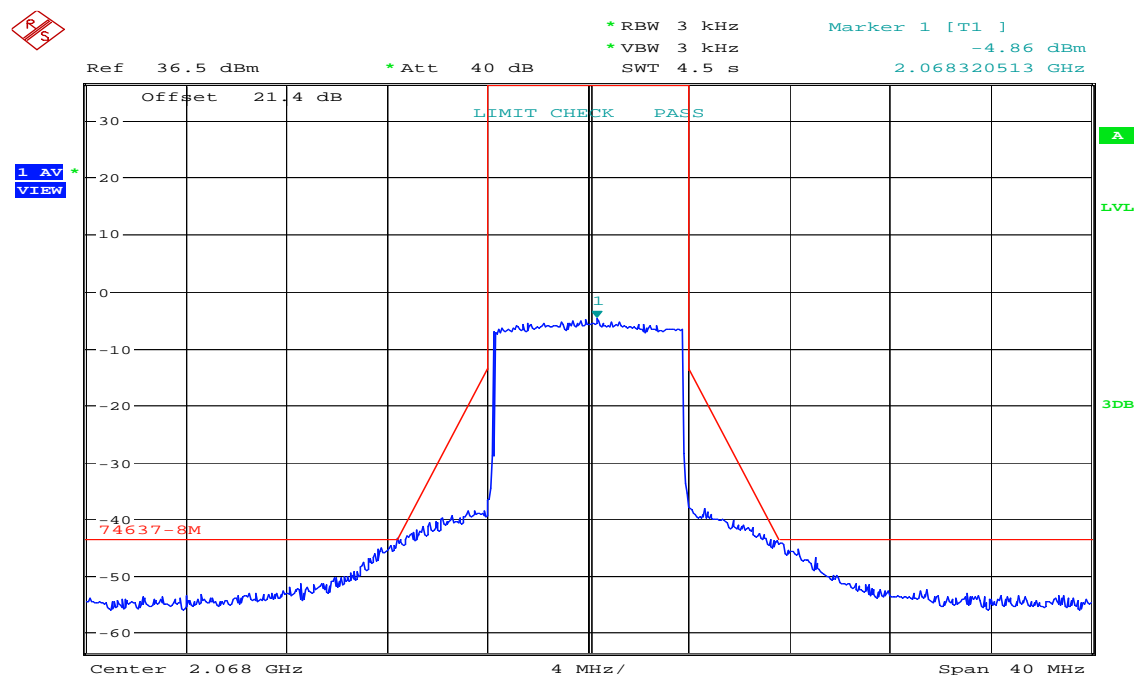
Date: 11.MAR.2009 15:12:51

Plot 56: Emission mask 2068 MHz, 7 MHz / QPSK



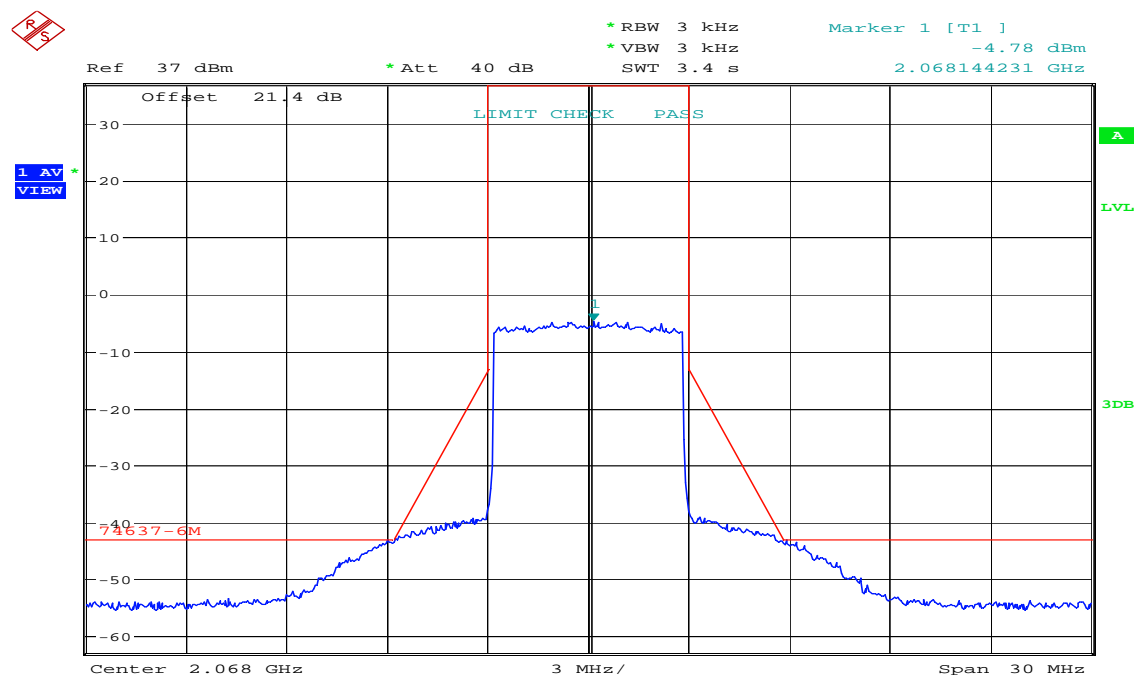
Date: 11.MAR.2009 12:19:11

Plot 57: Emission mask 2068 MHz, 8 MHz / QPSK



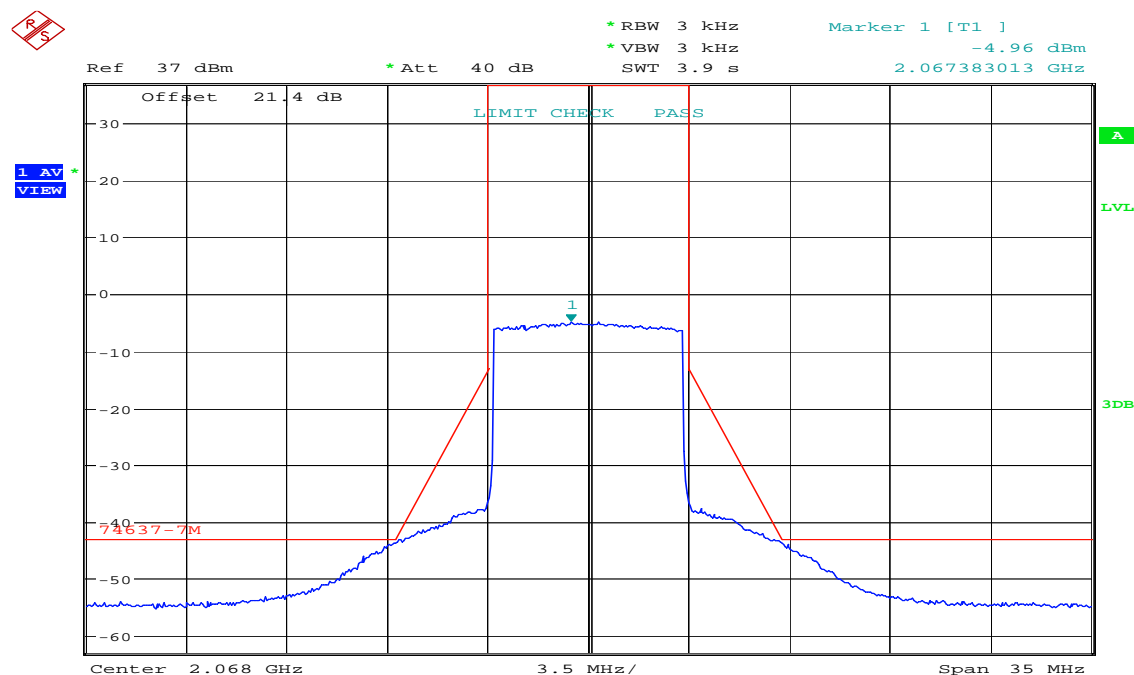
Date: 9.MAR.2009 12:52:53

Plot 58: Emission mask 2068 MHz, 6 MHz / 16QAM



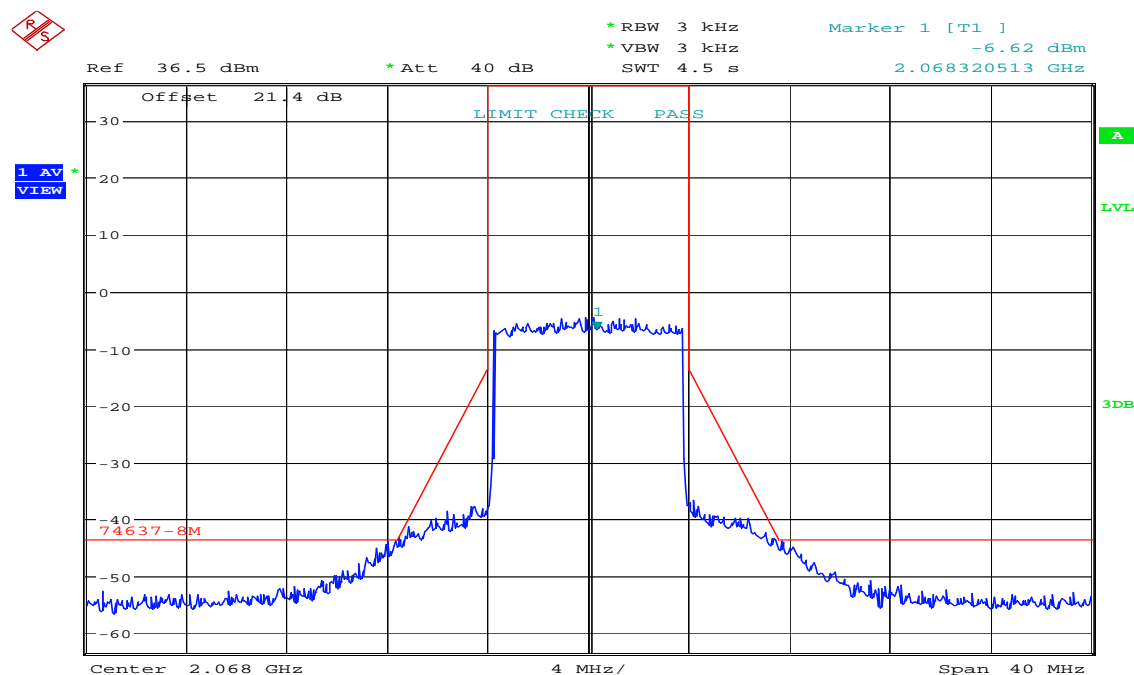
Date: 11.MAR.2009 15:06:28

Plot 59: Emission mask 2068 MHz, 7 MHz / 16QAM



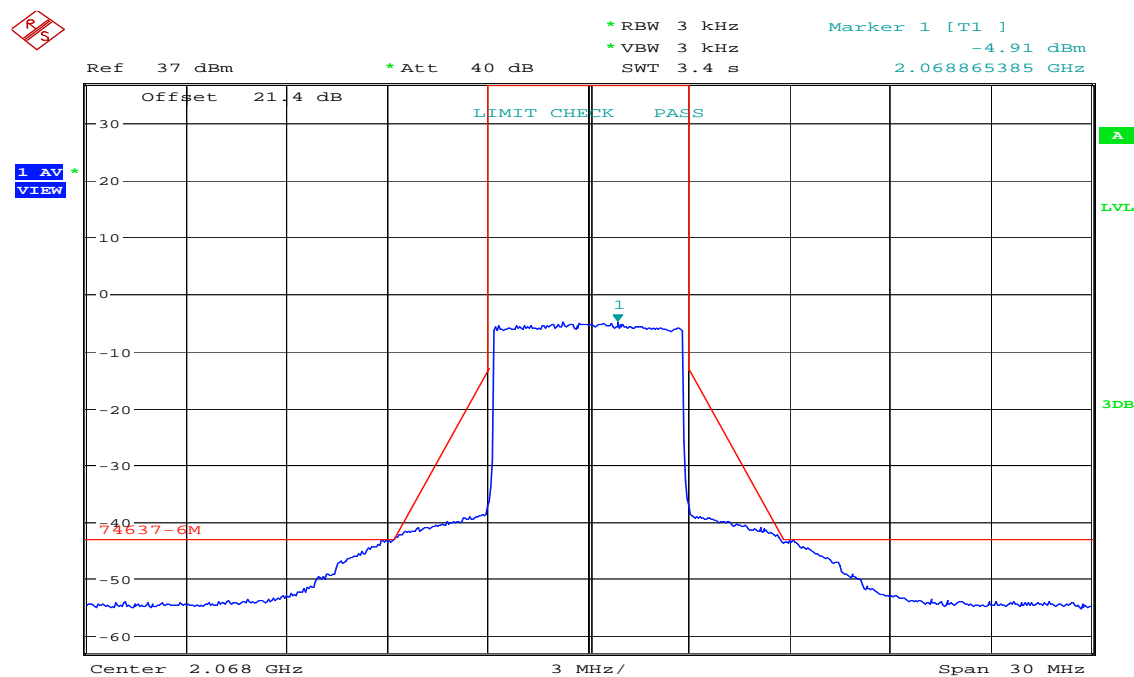
Date: 11.MAR.2009 12:24:19

Plot 60: Emission mask 2068 MHz, 8 MHz / 16QAM



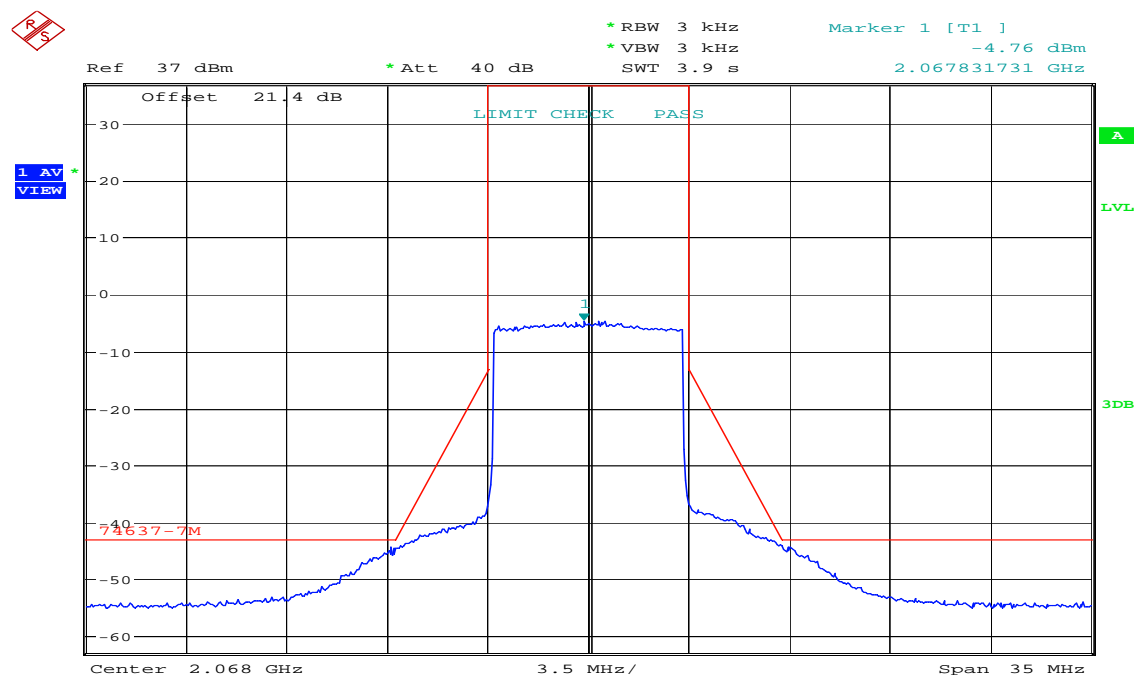
Date: 9.MAR.2009 12:53:46

Plot 61: Emission mask 2068 MHz, 6 MHz / 64QAM



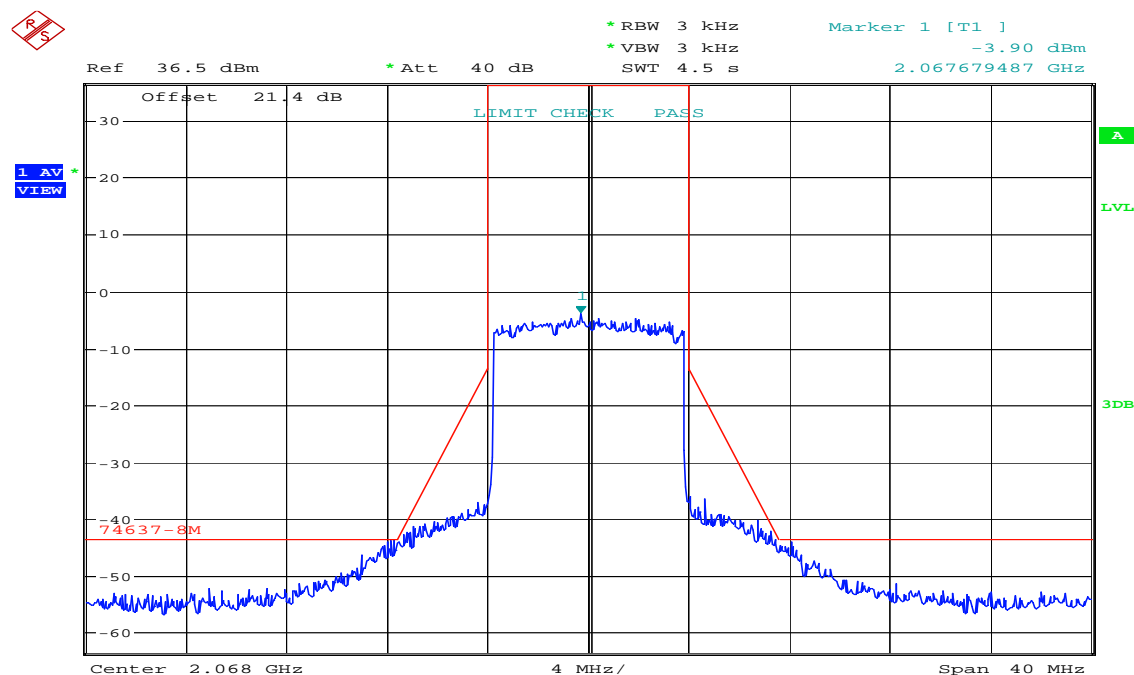
Date: 11.MAR.2009 14:52:49

Plot 62: Emission mask 2068 MHz, 7 MHz / 64QAM



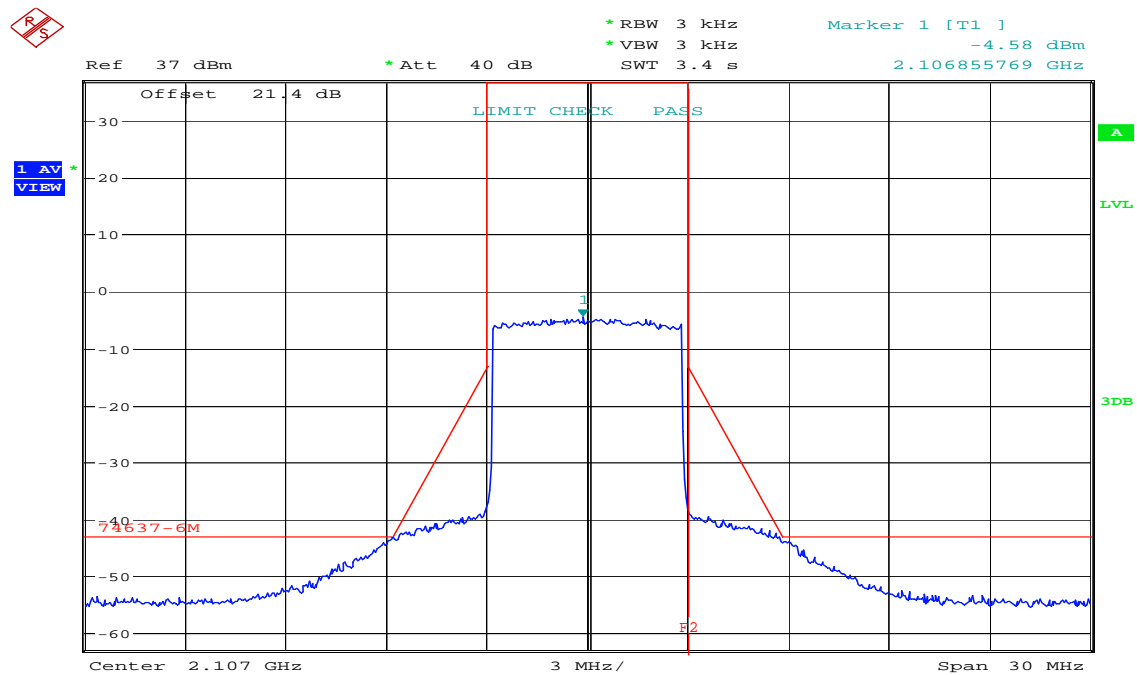
Date: 11.MAR.2009 12:26:15

Plot 63: Emission mask 2068 MHz, 8 MHz / 64QAM



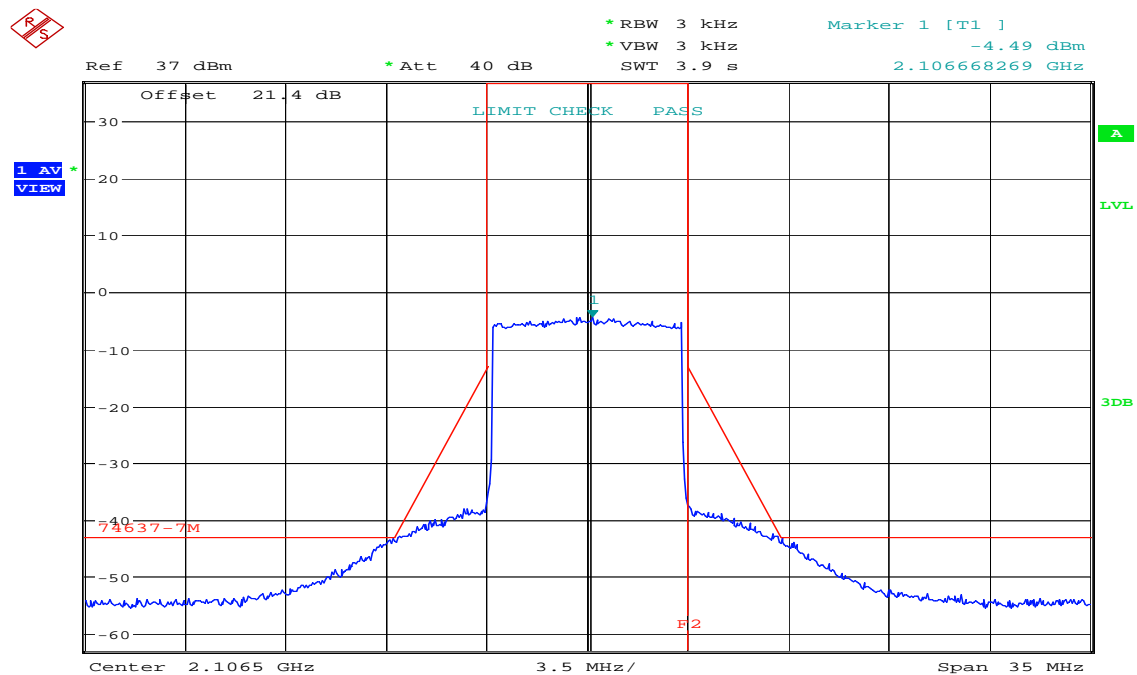
Date: 9.MAR.2009 11:41:57

Plot 64: Emission mask 2107 MHz, 6 MHz / QPSK



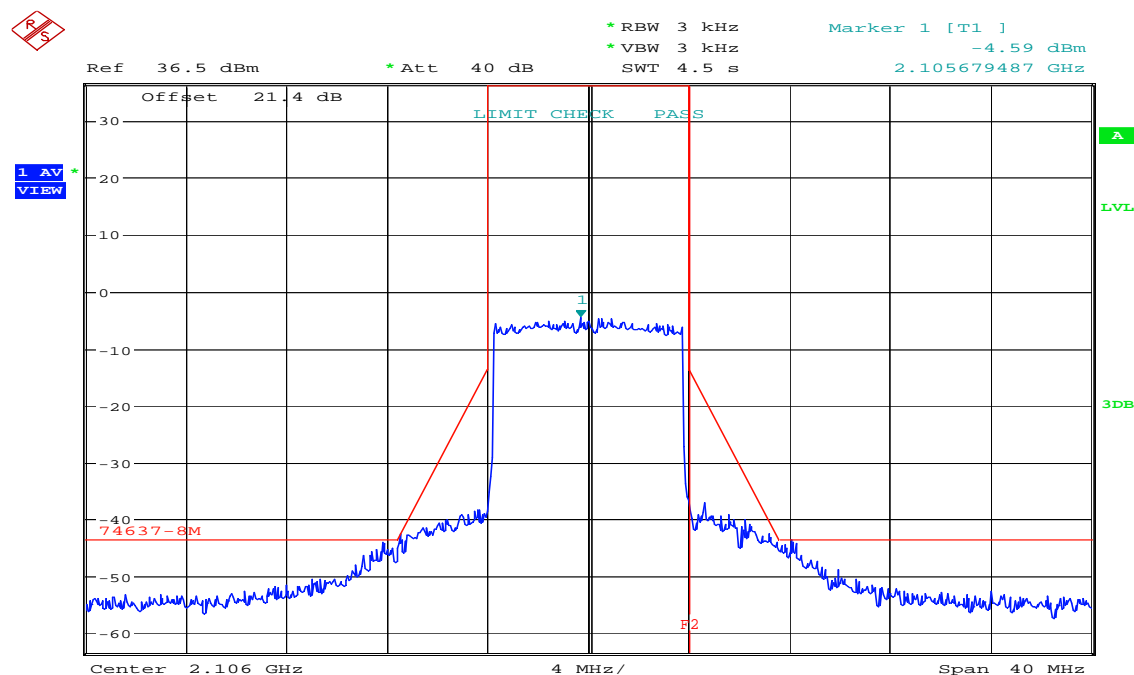
Date: 11.MAR.2009 14:42:54

Plot 65: Emission mask 2106.5 MHz, 7 MHz / QPSK



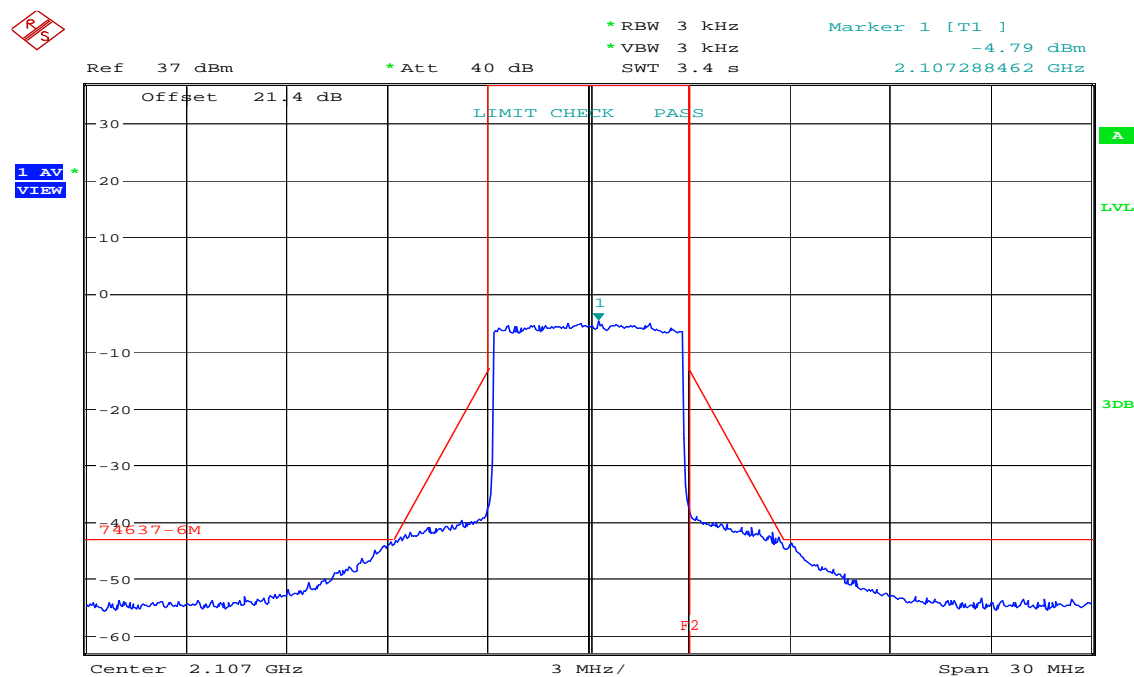
Date: 11.MAR.2009 11:37:21

Plot 66: Emission mask 2106 MHz, 8 MHz / QPSK



Date: 9.MAR.2009 12:49:48

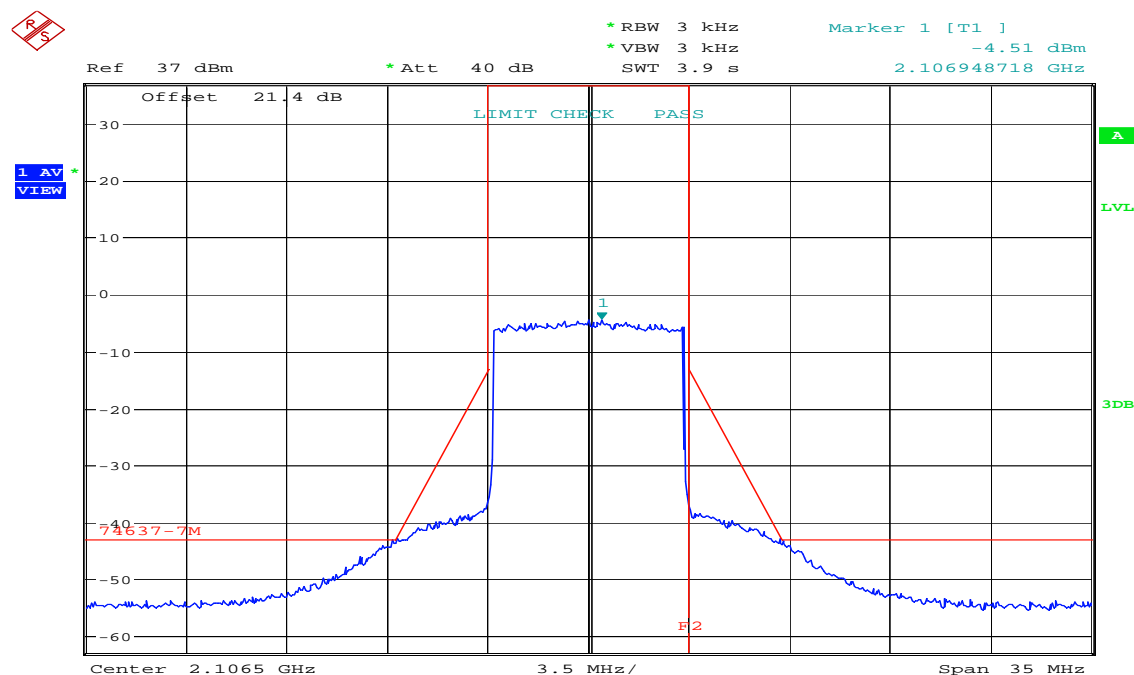
Plot 67: Emission mask 2107 MHz, 6 MHz / 16QAM



Date: 11.MAR.2009 14:44:15

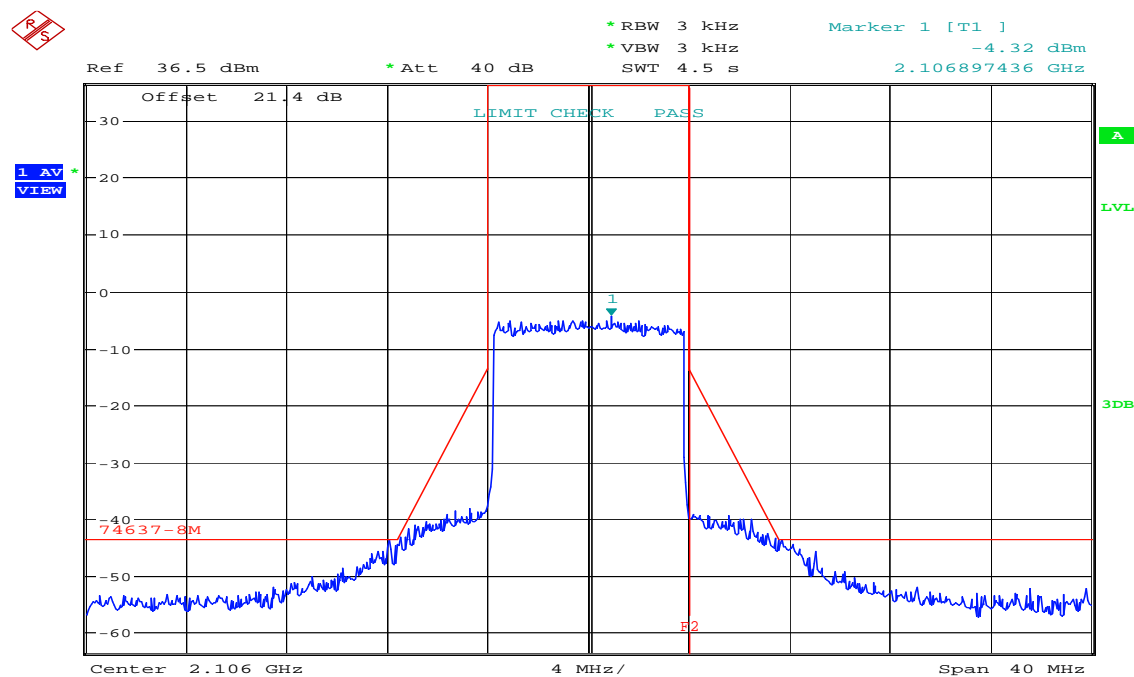


Plot 68: Emission mask 2106.5 MHz, 7 MHz / 16QAM



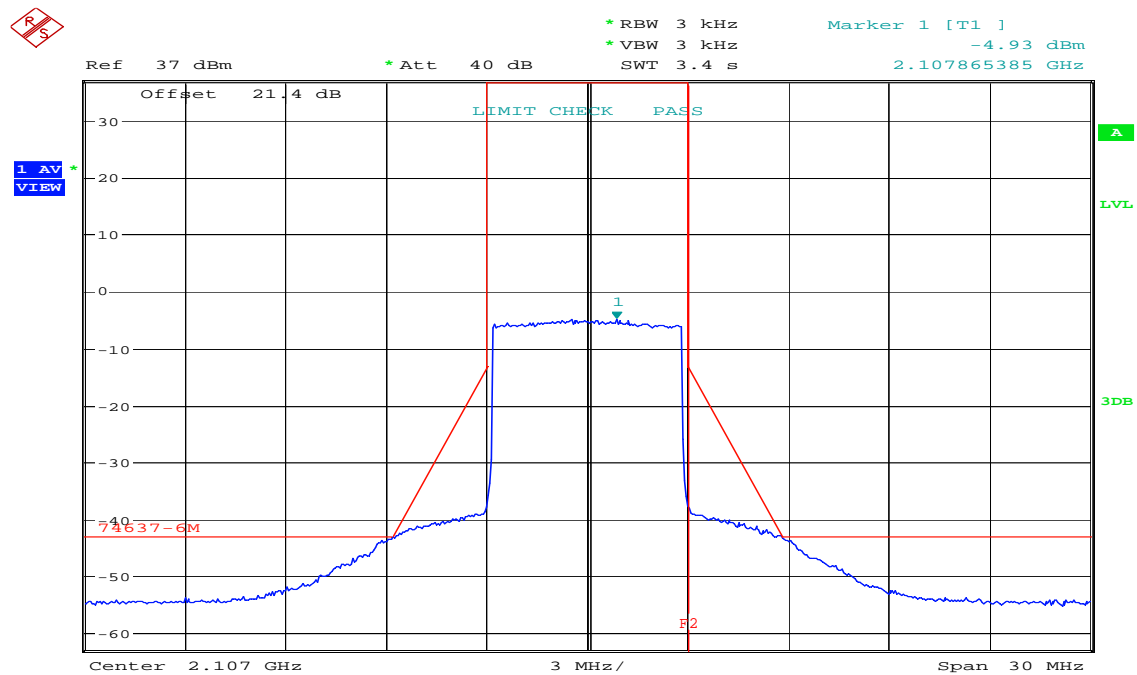
Date: 11.MAR.2009 11:36:16

Plot 69: Emission mask 2106 MHz, 8 MHz / 16QAM



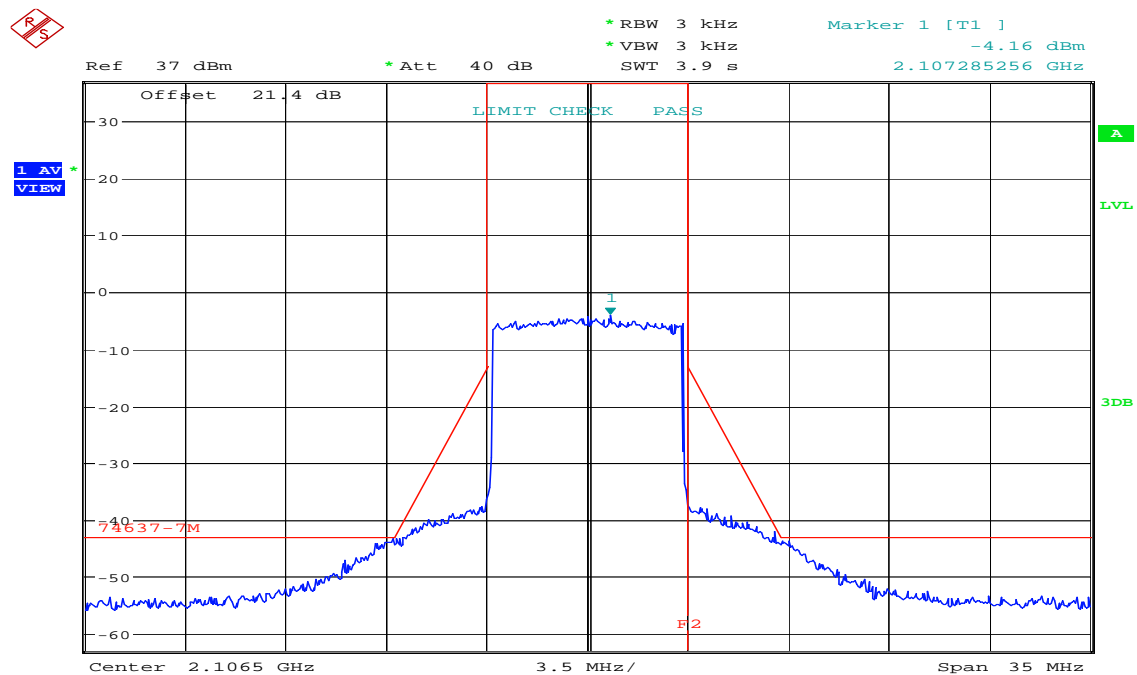
Date: 9.MAR.2009 12:48:29

Plot 70: Emission mask 2107 MHz, 6 MHz / 64QAM



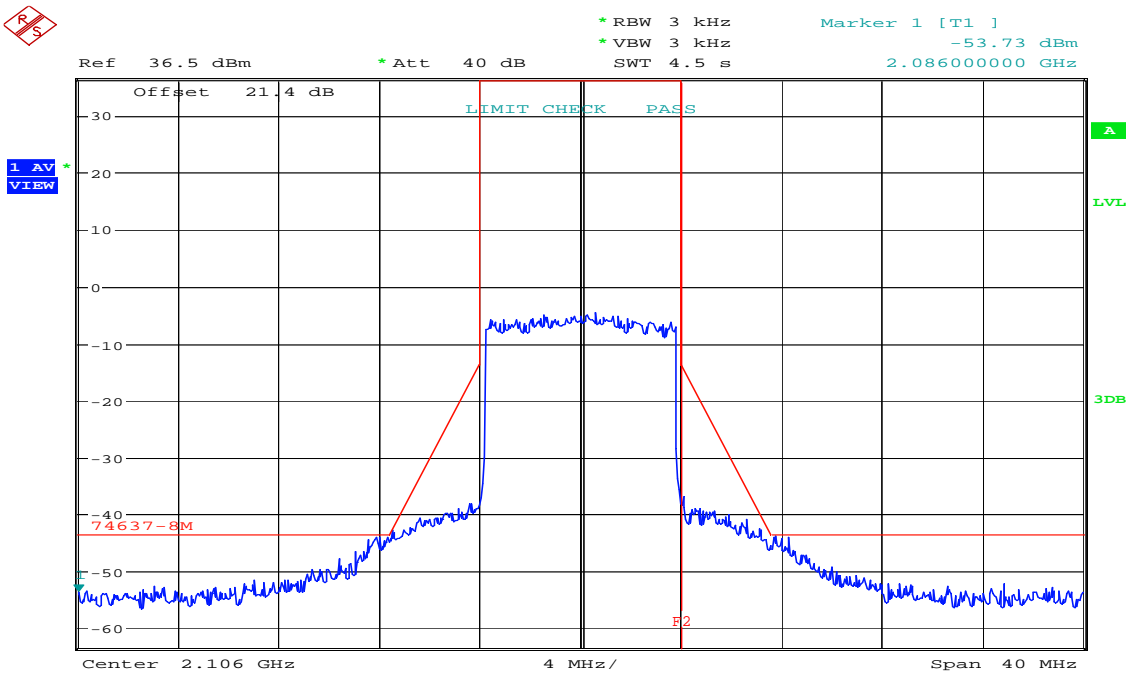
Date: 11.MAR.2009 14:49:15

Plot 71: Emission mask 2106.5 MHz, 7 MHz / 64QAM



Date: 11.MAR.2009 11:34:40

Plot 72: Emission mask 2106 MHz, 8 MHz / 64QAM



Date: 9.MAR.2009 11:43:25

Remark:  
Frequency lines F1 and F2 show the lower resp. upper band edge of the used frequency band.

Limit according to §74.637(a)(2)(ii):

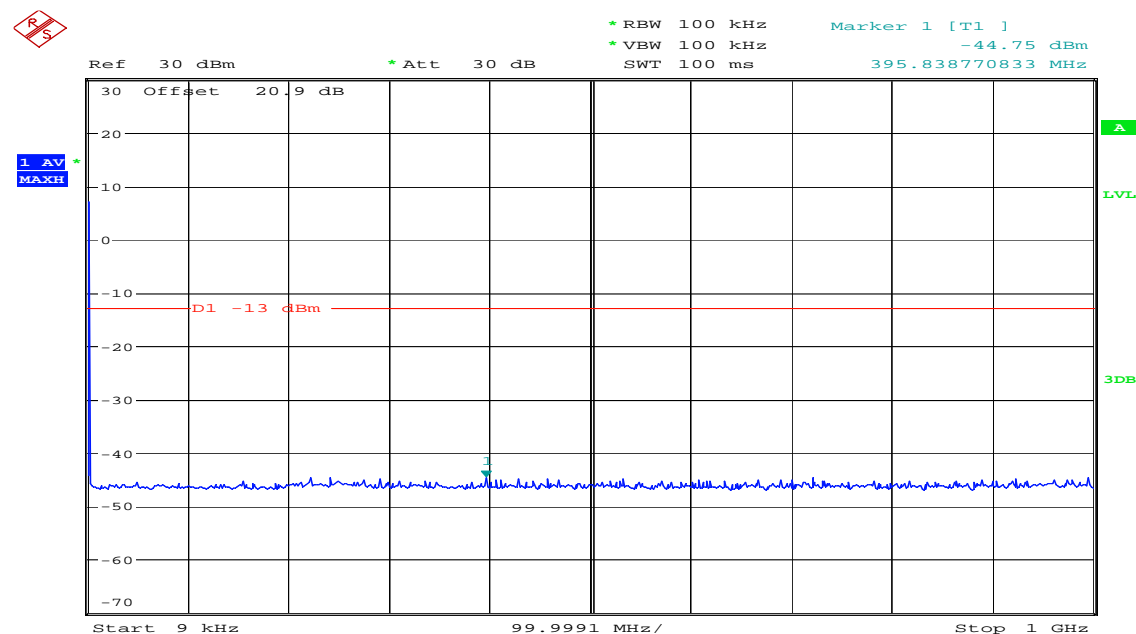
Under normal test conditions only	<p>The mean power of emissions shall be attenuated below the mean transmitter power (<math>P_{\text{MEAN}}</math>) in accordance with the following schedule:</p> <p>When using transmissions employing digital modulation techniques: For operating frequencies below 15 GHz, in any 4 kHz reference bandwidth (<math>B_{\text{REF}}</math>), the center frequency of which is removed from the assigned frequency by more than 50 percent up to and including 250 percent of the authorized bandwidth: As specified by the following equation but in no event less than 50 decibels:</p> $A = 35 + 0.8 (G - 50) + 10 \log_{10} B$ <p>Attenuation greater than 80 decibels is not required.</p>
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Test Result: passed

## 4.8 Spurious emissions (conducted)

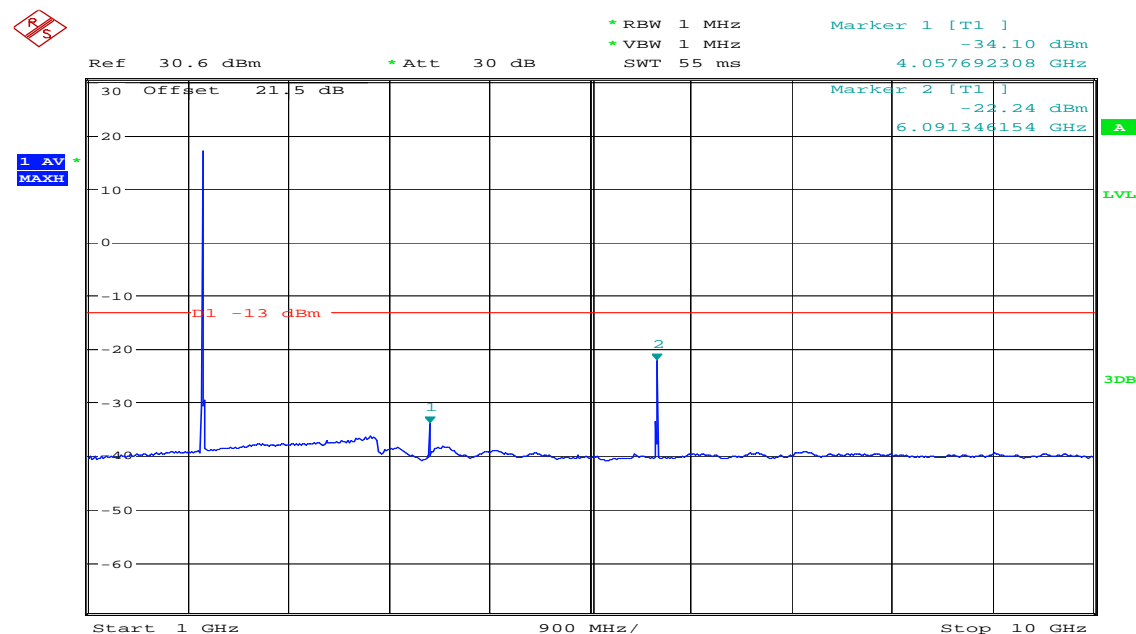
§2.1051 / §74.637(a)(2)

Plot 73: 9 kHz - 1 GHz (2029 MHz)



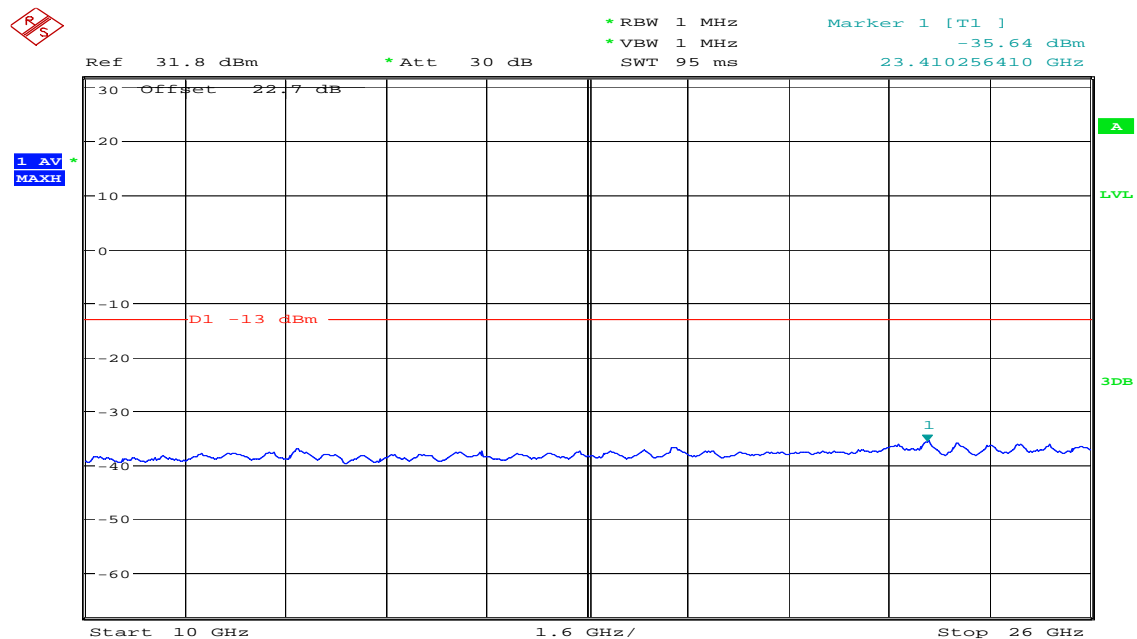
Date: 9.MAR.2009 14:54:34

Plot 74: 1 GHz - 10 GHz (2029 MHz)



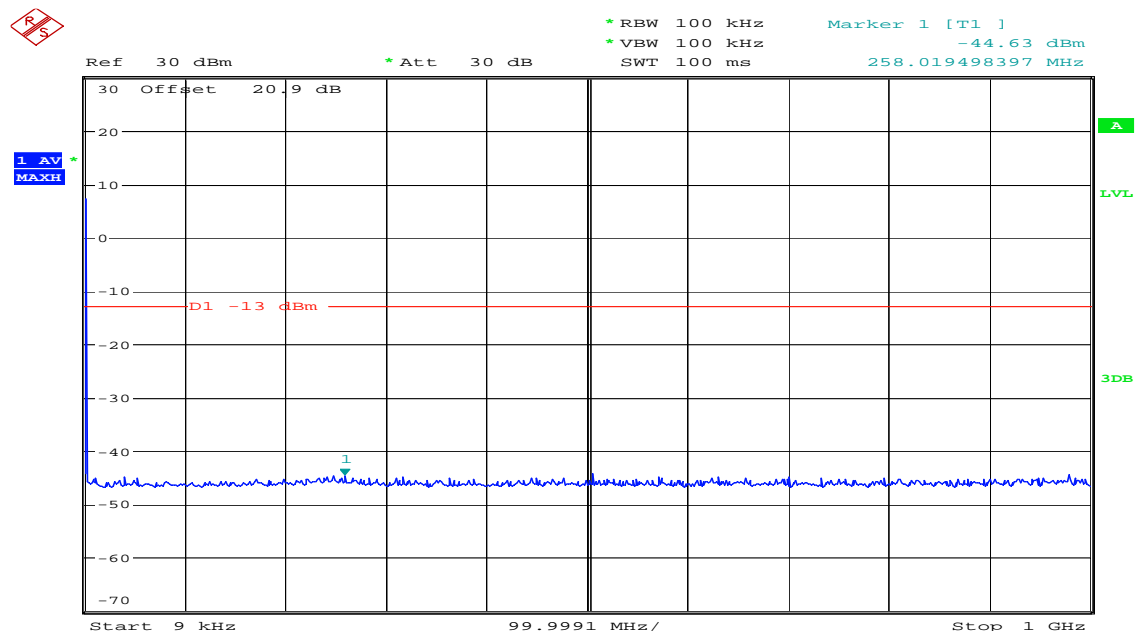
Date: 9.MAR.2009 14:53:18

Plot 75: 10 GHz - 26 GHz (2029 MHz)



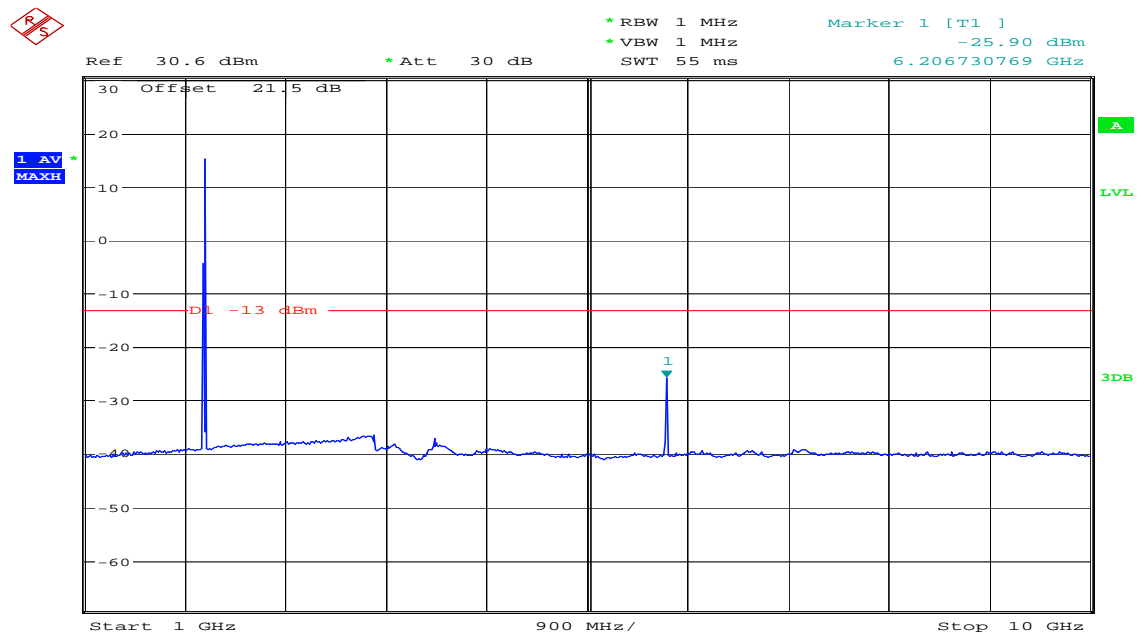
Date: 9.MAR.2009 14:52:14

Plot 76: 9 kHz - 1 GHz (2068 MHz)



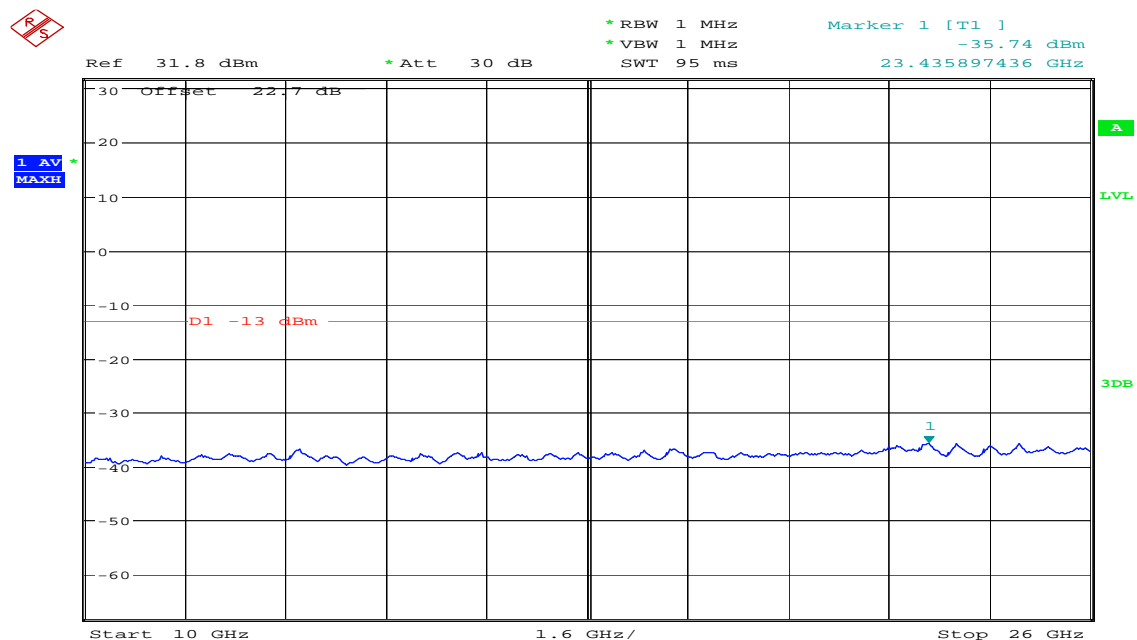
Date: 9.MAR.2009 14:48:46

Plot 77: 1 GHz - 10 GHz (2068 MHz)



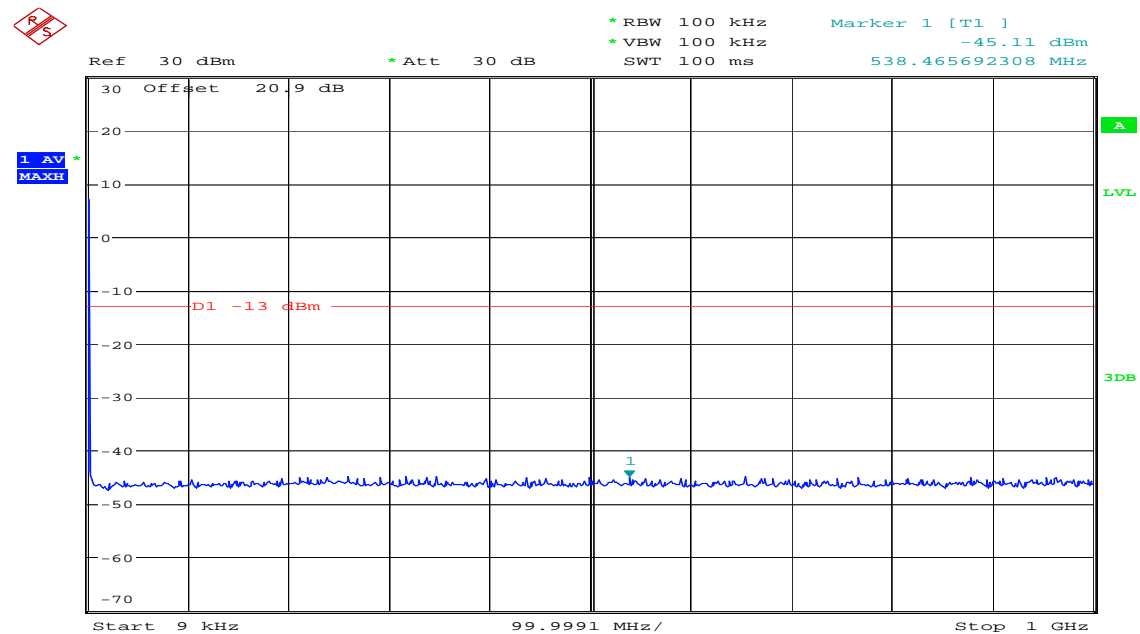
Date: 9.MAR.2009 14:50:37

Plot 78: 10 GHz - 26 GHz (2068 MHz)



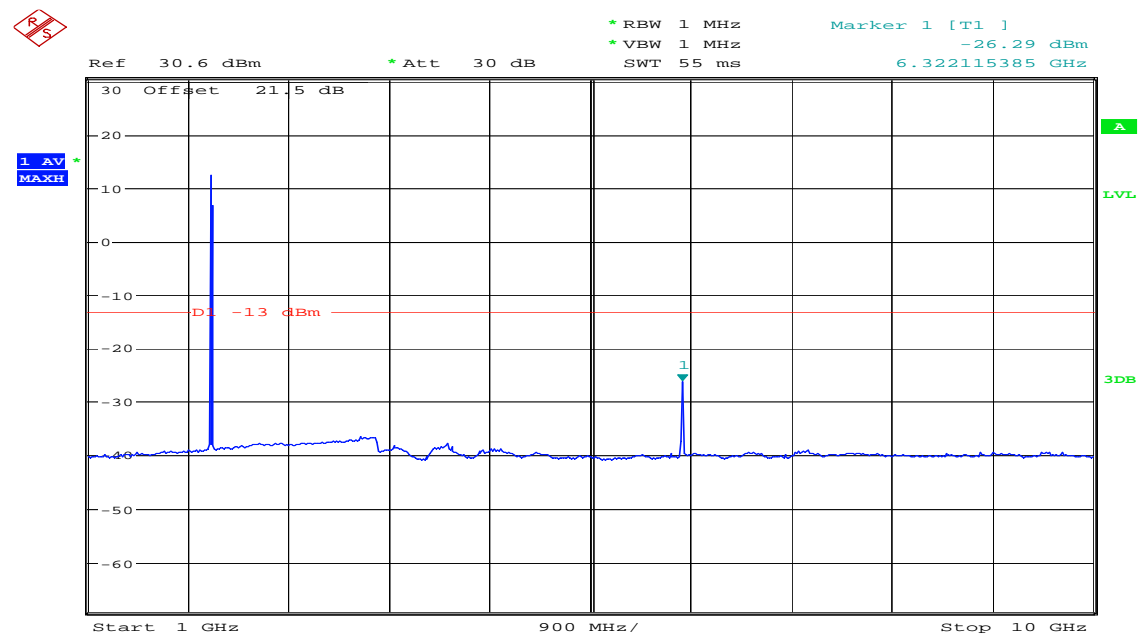
Date: 9.MAR.2009 14:51:30

Plot 79: 9 kHz - 1 GHz (2106 MHz)



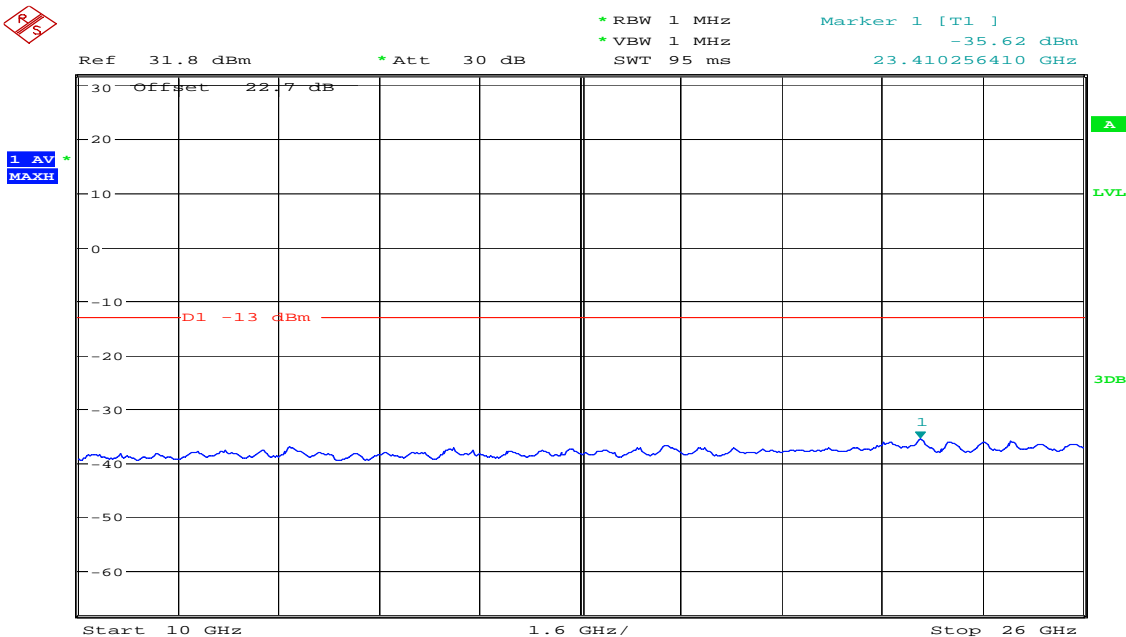
Date: 9.MAR.2009 14:56:03

Plot 80: 1 GHz - 10 GHz (2106 MHz)



Date: 9.MAR.2009 14:56:56

Plot 81: 10 GHz - 26 GHz (2106 MHz)



Date: 9.MAR.2009 14:57:45

SPURIOUS EMISSIONS LEVEL (dBm)								
2029 MHz			2068 MHz			2106 MHz		
F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]
4057.7	AVG	-34.1		AVG			AVG	
6091.3	AVG	-22.2	6206.7	AVG	-25.9	6322.1	AVG	-26.3
Measurement uncertainty			±3 dB					

RBW: 100 kHz/1MHz VBW: 100 kHz/1MHz

Limit according to §74.637(a)(2)(iii):

Under normal test conditions only	The mean power of emissions shall be attenuated below the mean transmitter power ( $P_{\text{MEAN}}$ ) in accordance with the following schedule: When using transmissions employing digital modulation techniques: In any 4 kHz reference bandwidth ( $B_{\text{REF}}$ ), the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \text{ Log}_{10} (P_{\text{MEAN}}$ in watts) decibels, or 80 decibels, whichever is the lesser attenuation
-----------------------------------	--

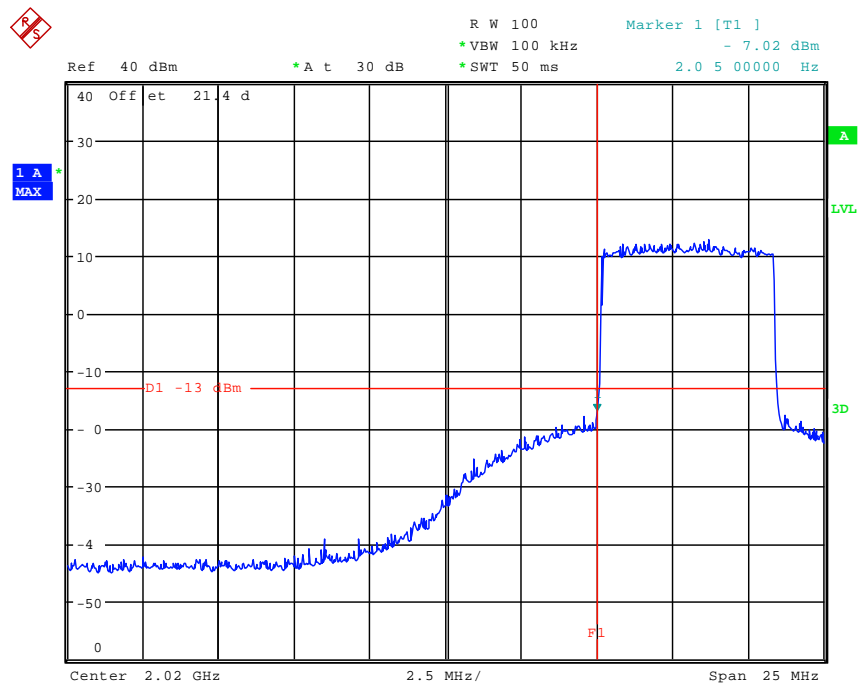
Test Result: passed



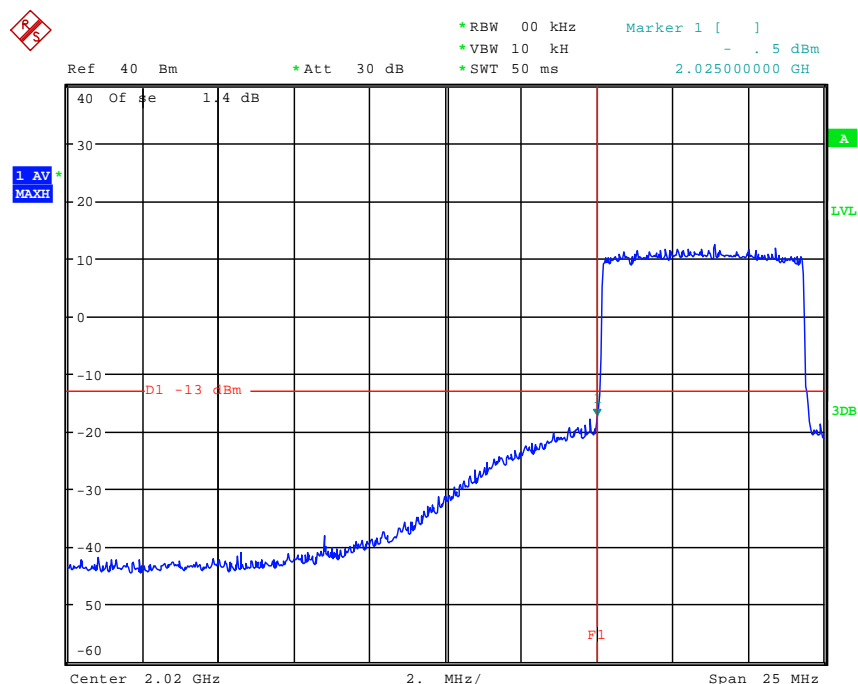
## 4.9 Band-edge compliance

§2.1051 / §74.637(a)(2)

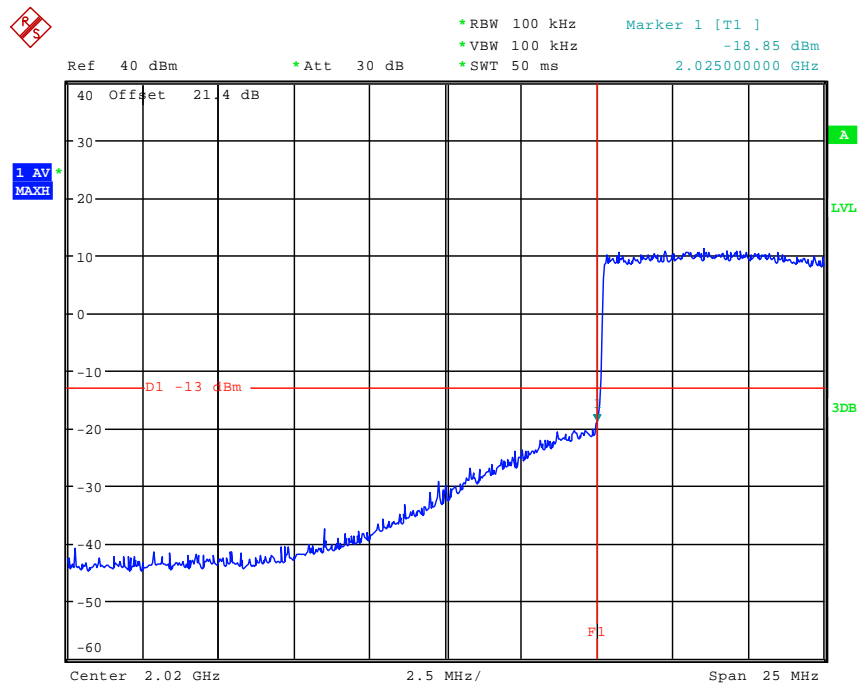
Plot 82: Band-edge compliance 6 MHz / QPSK



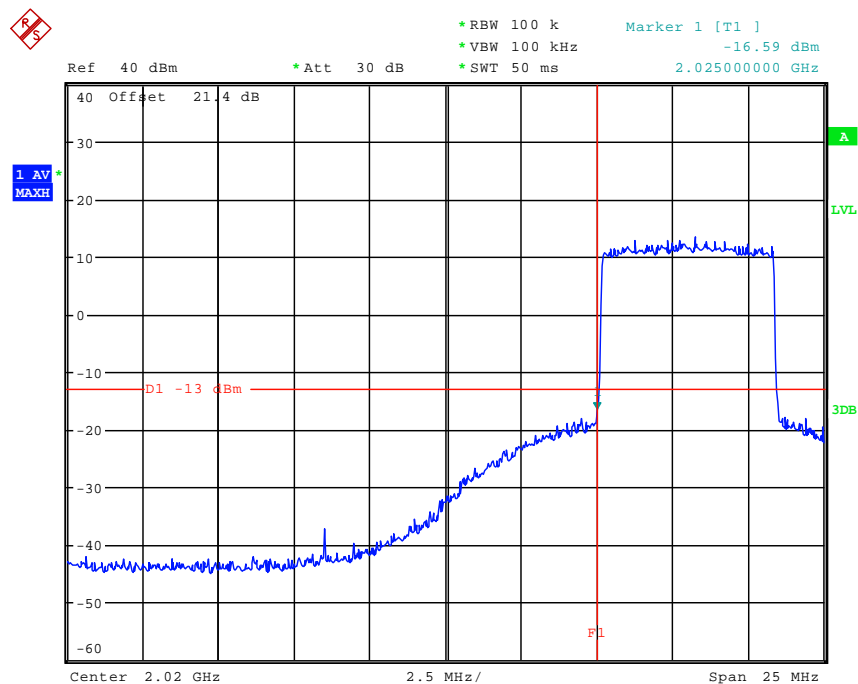
Plot 83: Band-edge compliance 7 MHz / QPSK



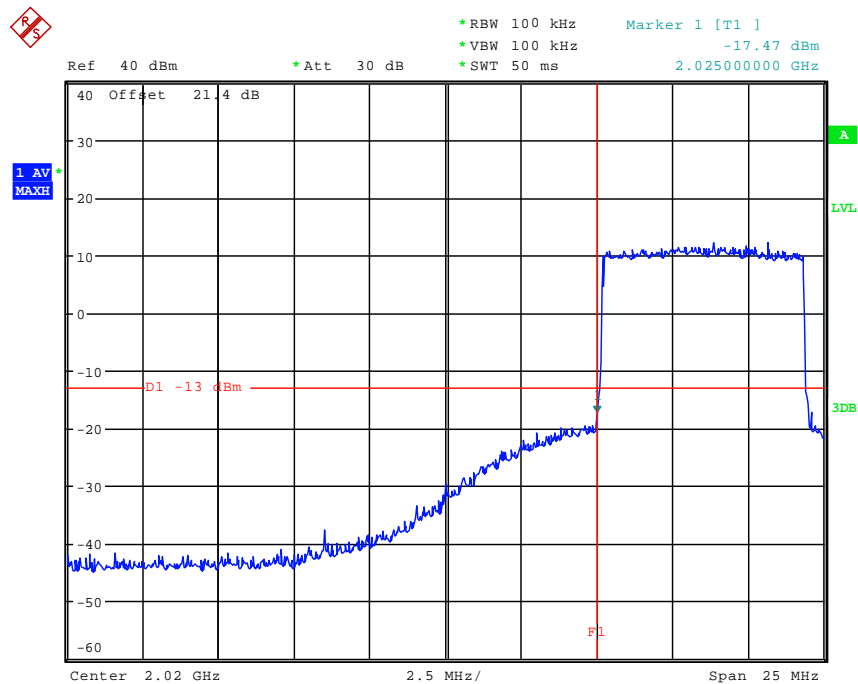
Plot 84: Band-edge compliance 8 MHz / QPSK



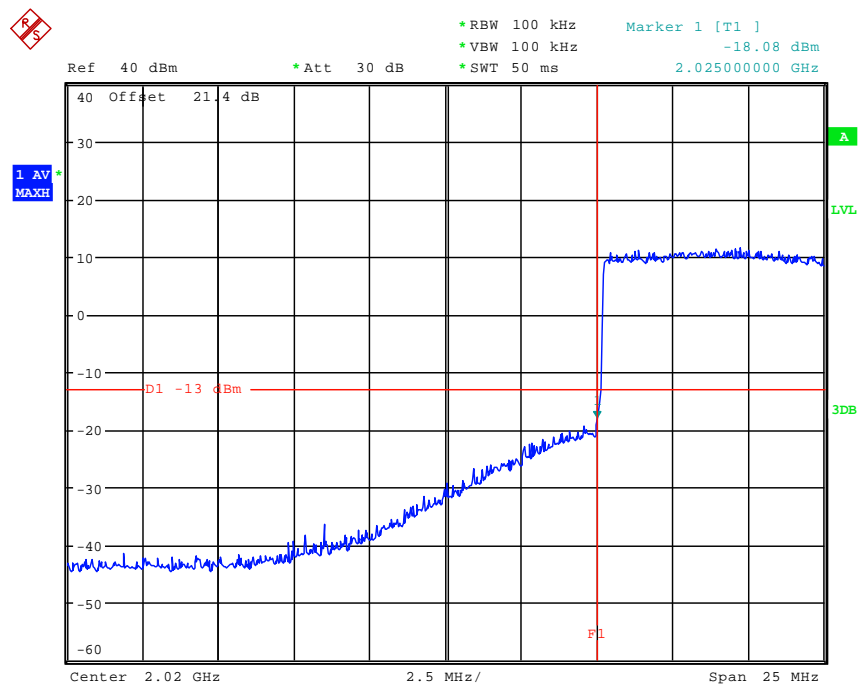
Plot 85: Band-edge compliance 6 MHz / 16QAM



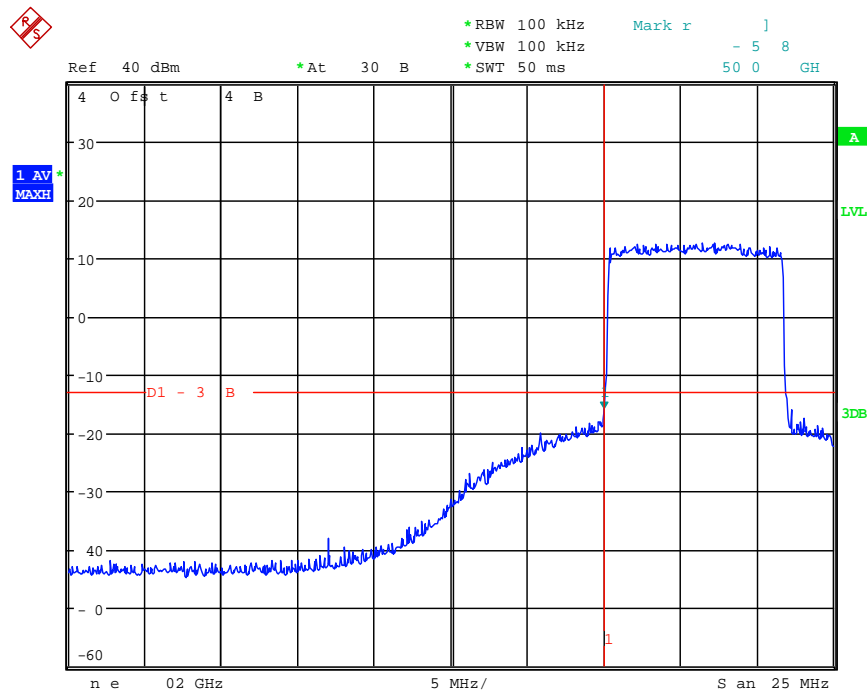
Plot 86: Band-edge compliance 7 MHz / 16QAM



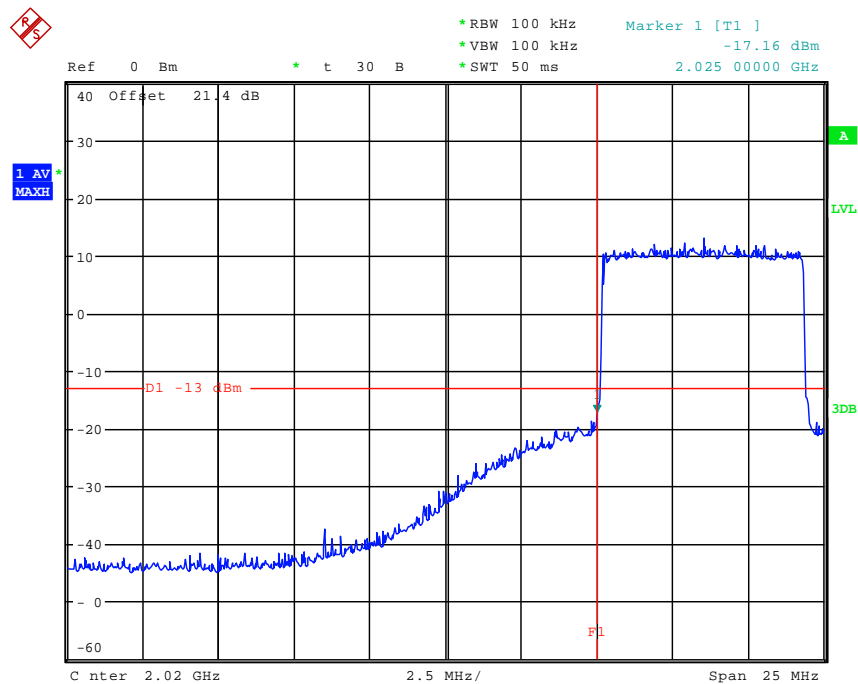
Plot 87: Band-edge compliance 8 MHz / 16QAM



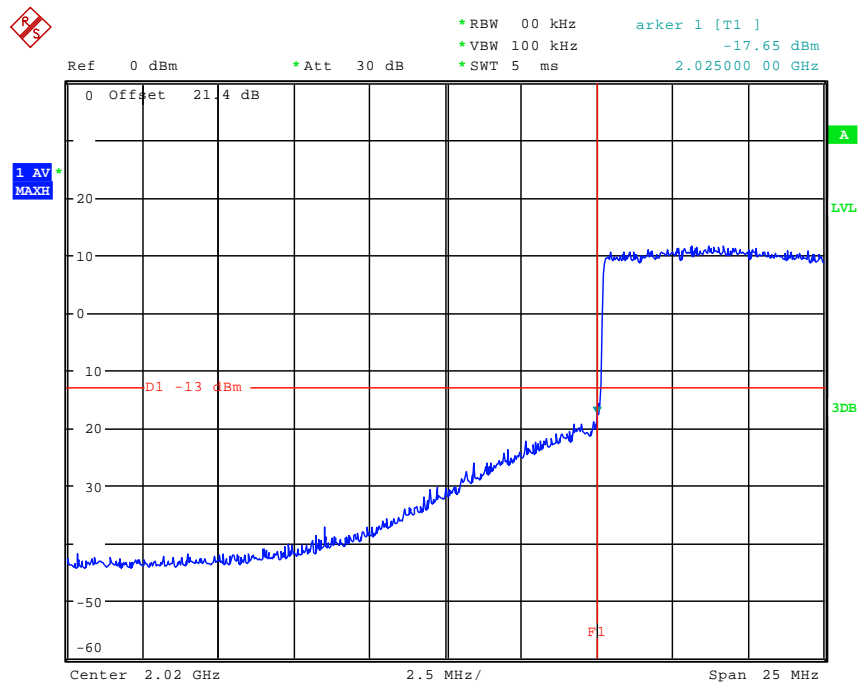
Plot 88: Band-edge compliance 6 MHz / 64QAM



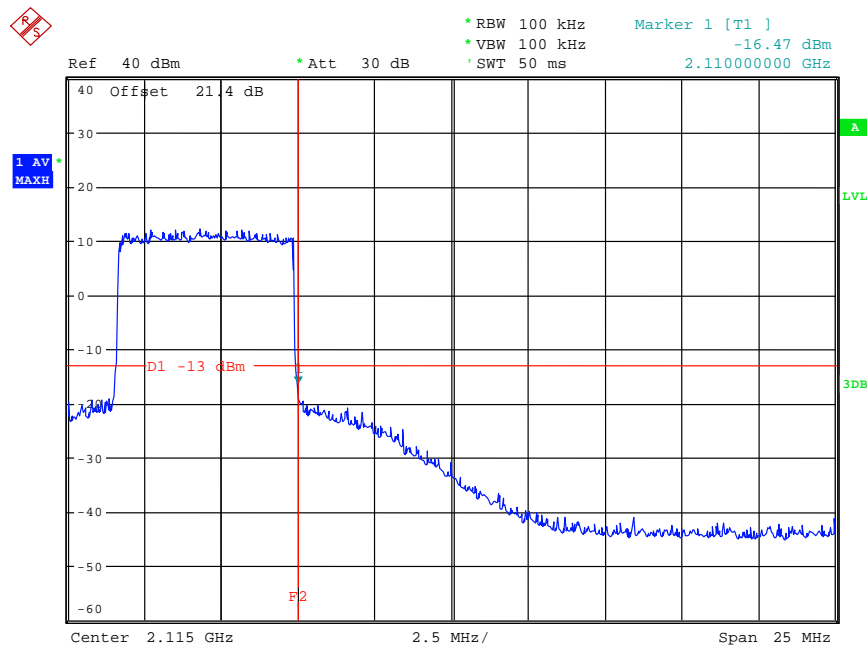
Plot 89: Band-edge compliance 7 MHz / 64QAM



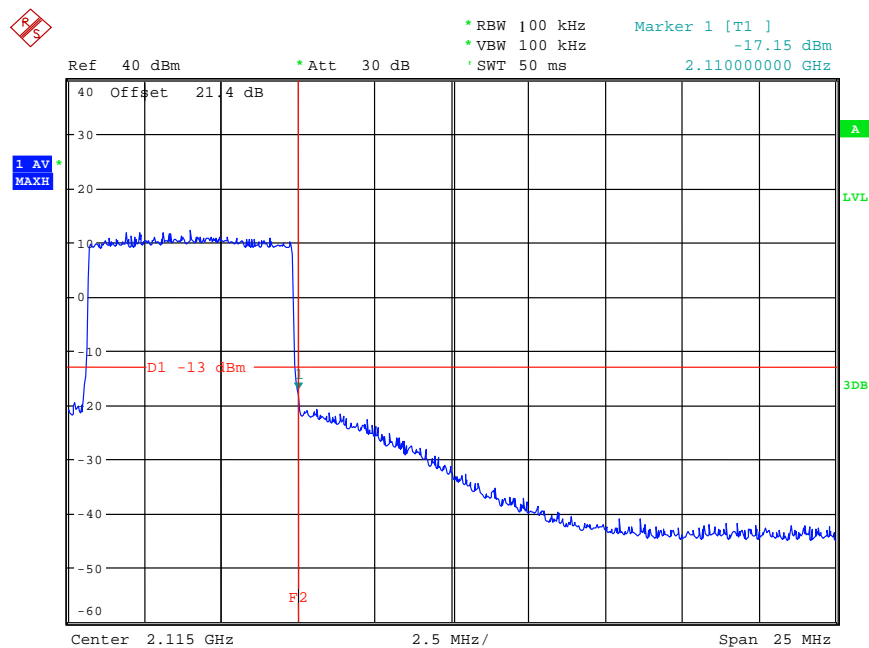
Plot 90: Band-edge compliance 8 MHz / 64QAM



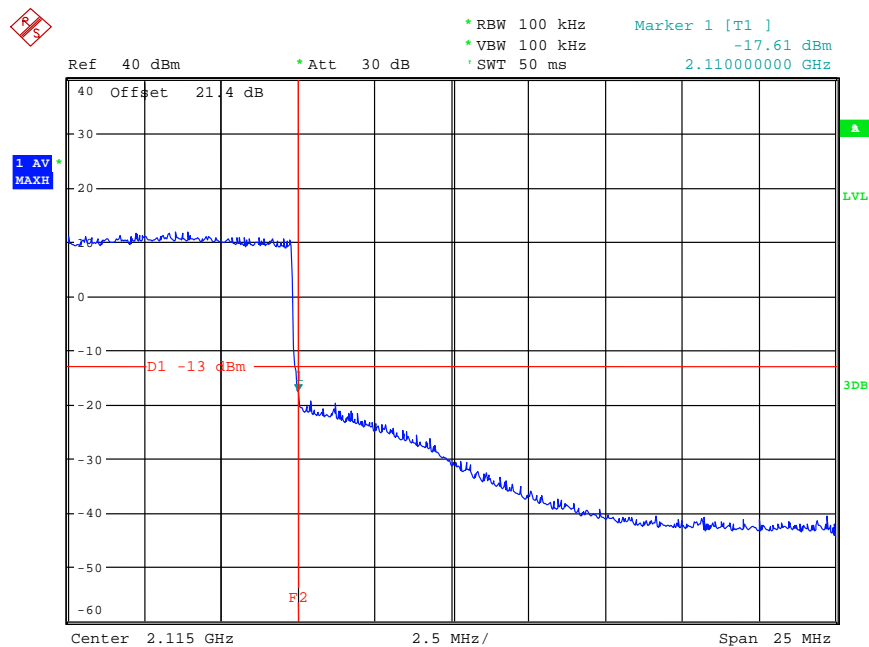
Plot 91: Band-edge compliance 6 MHz / QPSK



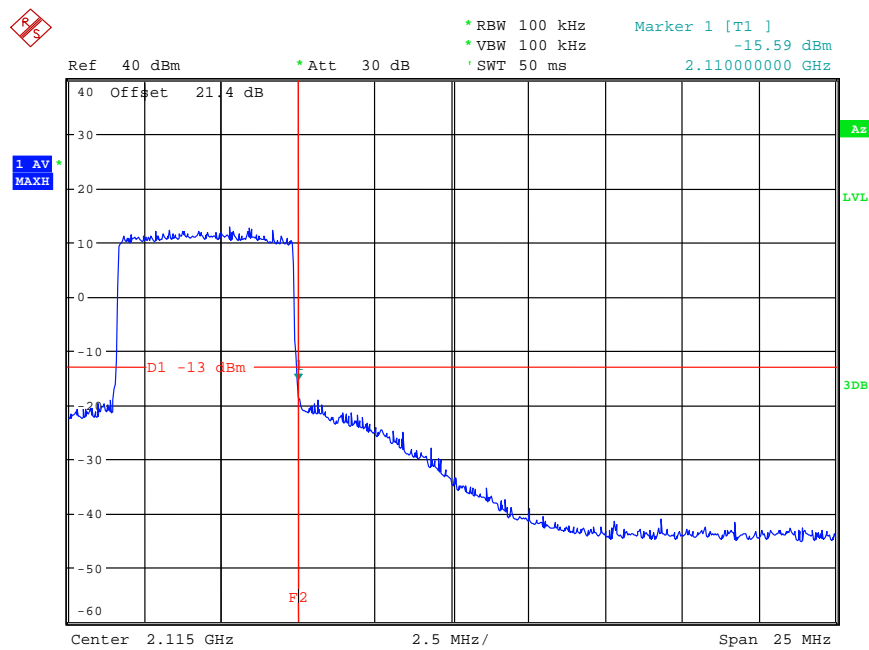
Plot 92: Band-edge compliance 7 MHz / QPSK



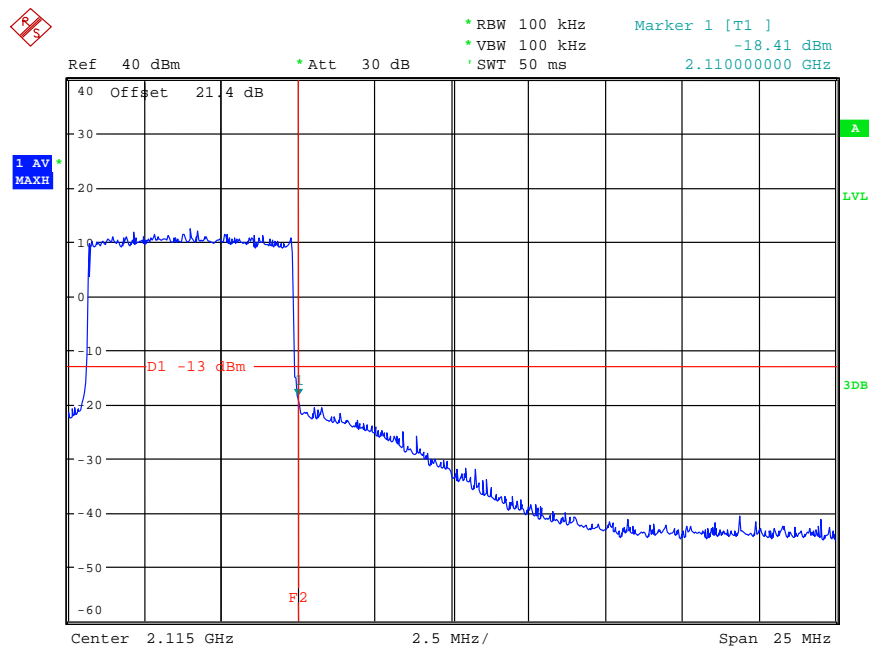
Plot 93: Band-edge compliance 8 MHz / QPSK



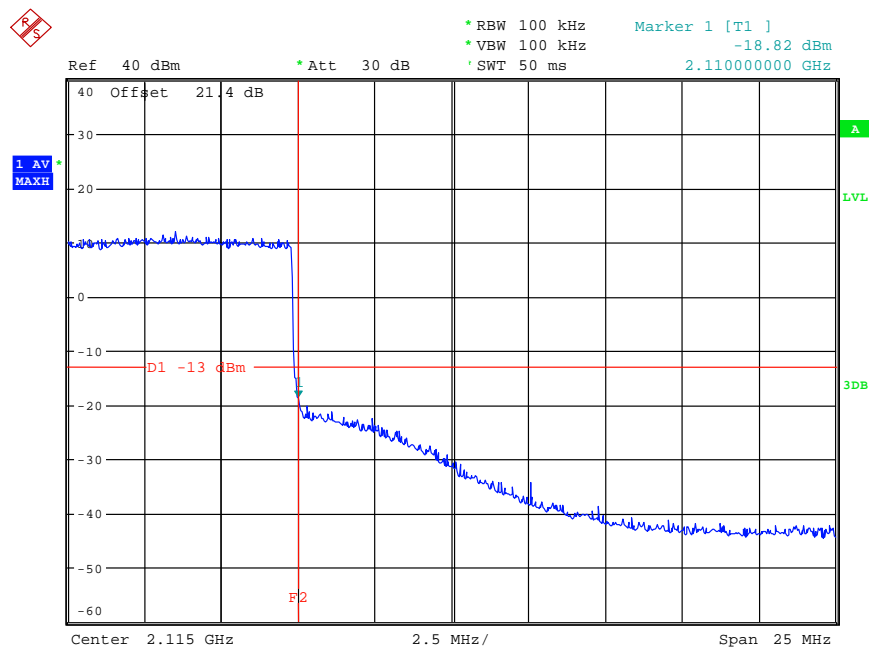
Plot 94: Band-edge compliance 6 MHz / 16QAM



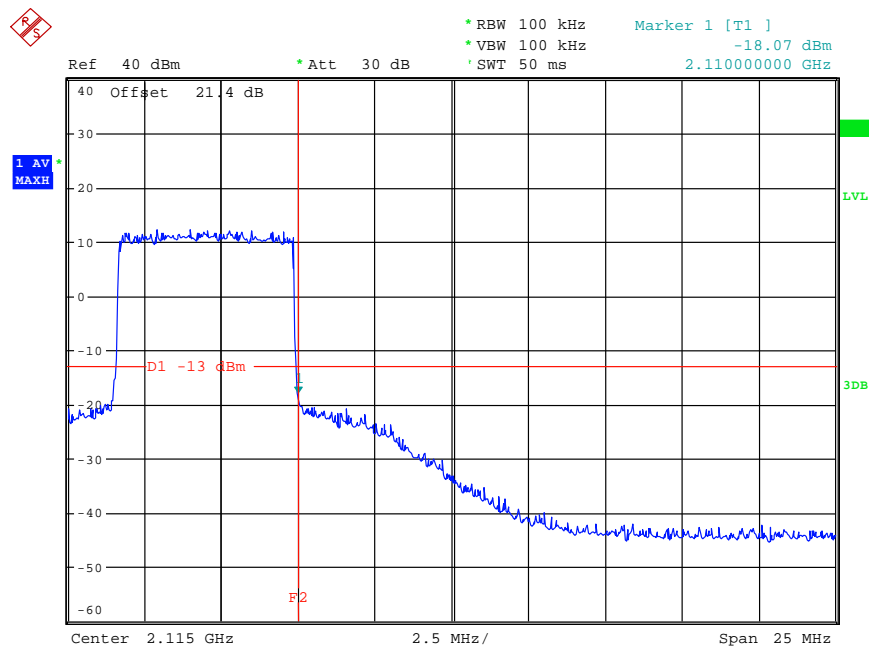
Plot 95: Band-edge compliance 7 MHz / 16QAM



Plot 96: Band-edge compliance 8 MHz / 16QAM

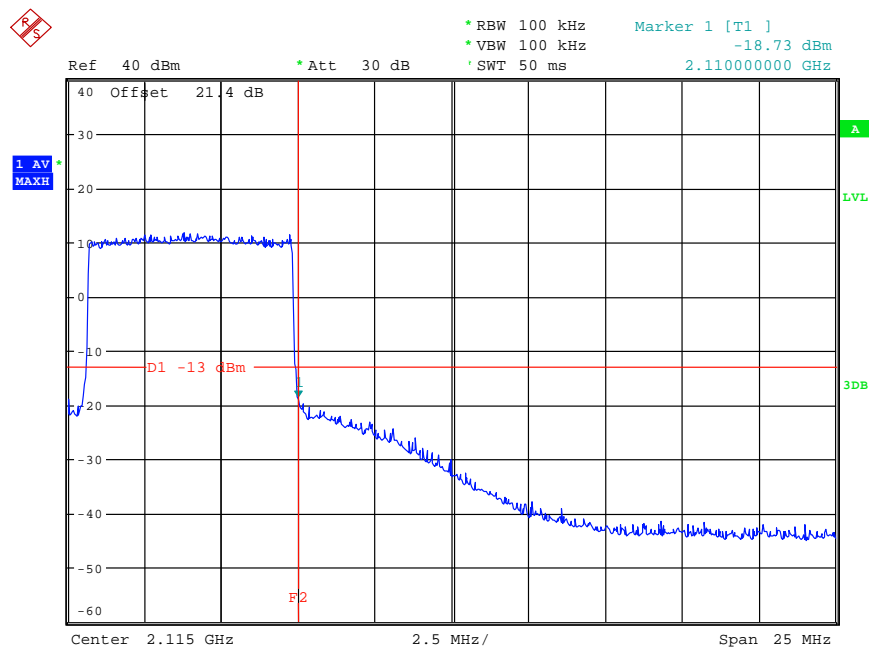


Plot 97: Band-edge compliance 6 MHz / 64QAM

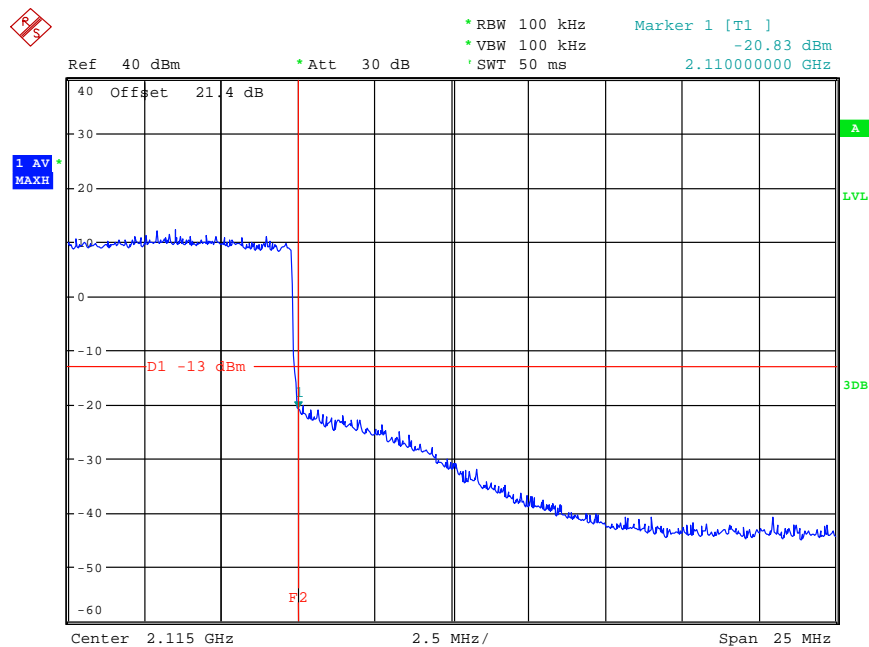




Plot 98: Band-edge compliance 7 MHz / 64QAM



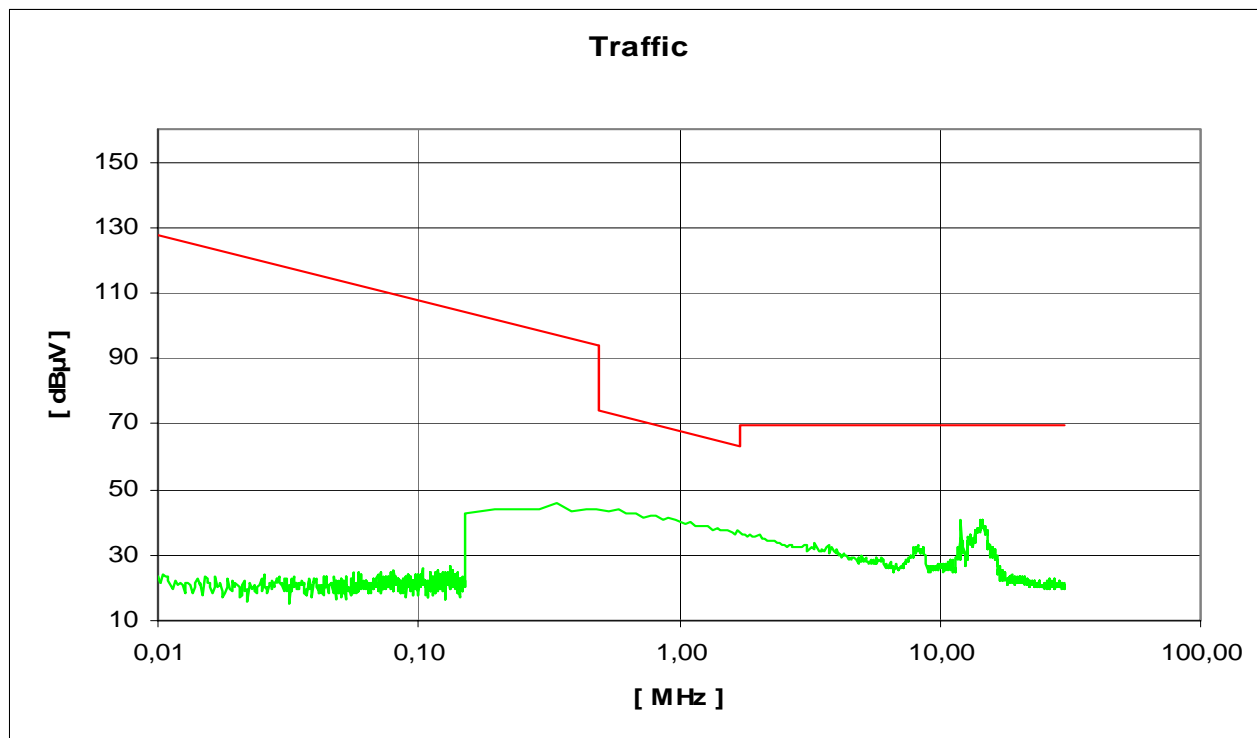
Plot 99: Band-edge compliance 8 MHz / 64QAM



#### 4.10 Spurious emissions (radiated)

§2.1051 / §74.637(a)(2)

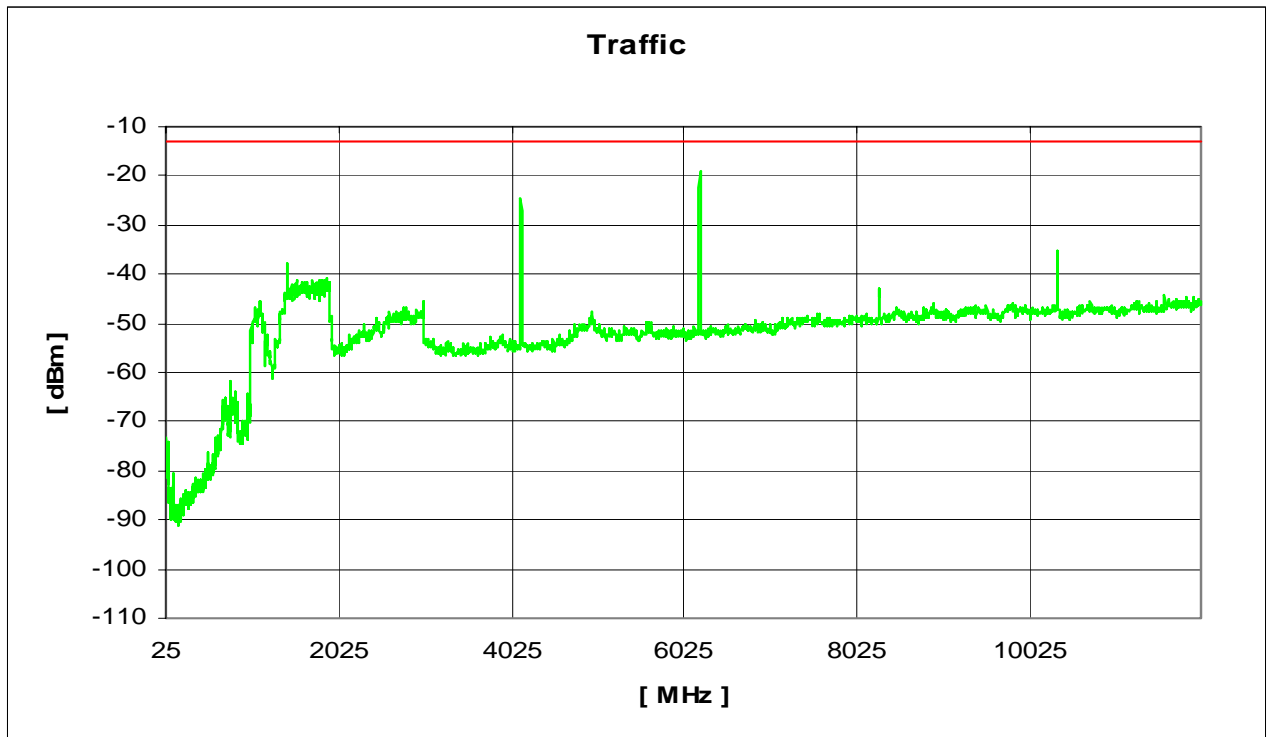
Plot 100: 9 kHz - 30 MHz (valid for all 3 carrier frequencies and all 3 sub-modulations)



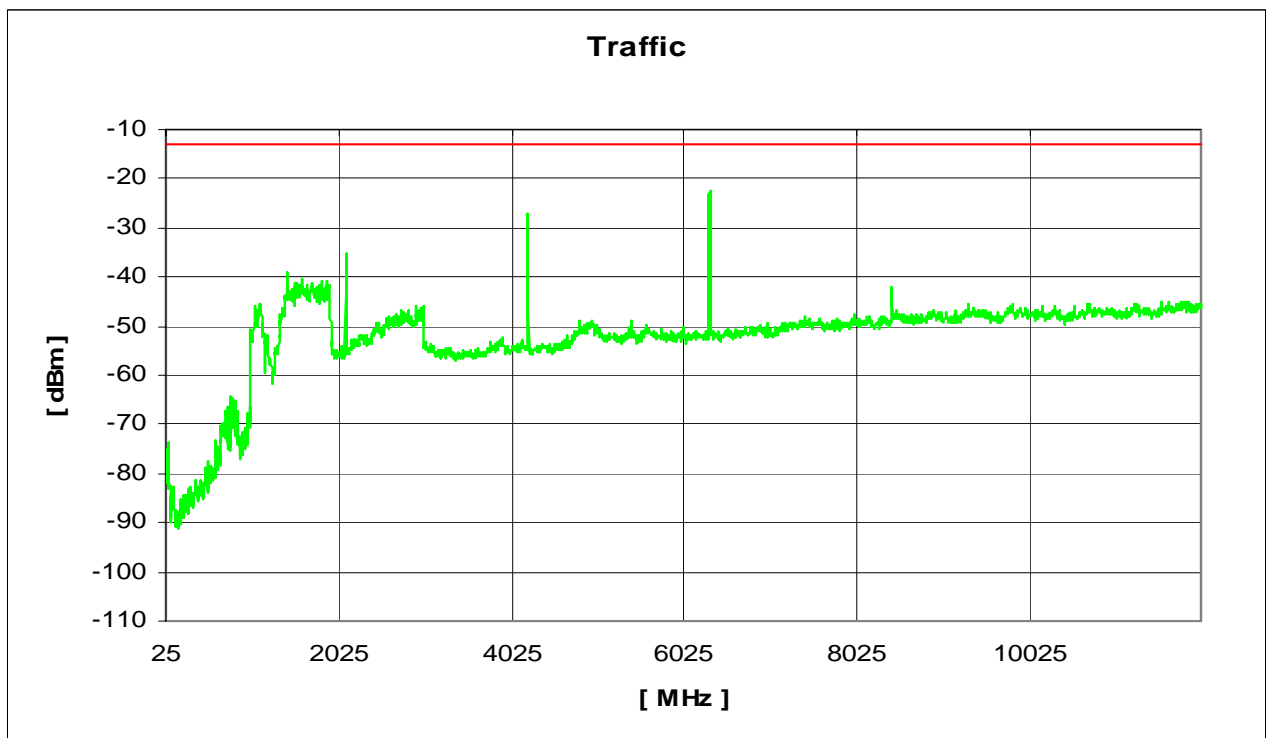
Plot 101: 25 MHz - 12 GHz (2028 MHz) (valid for all 3 sub-modulations)



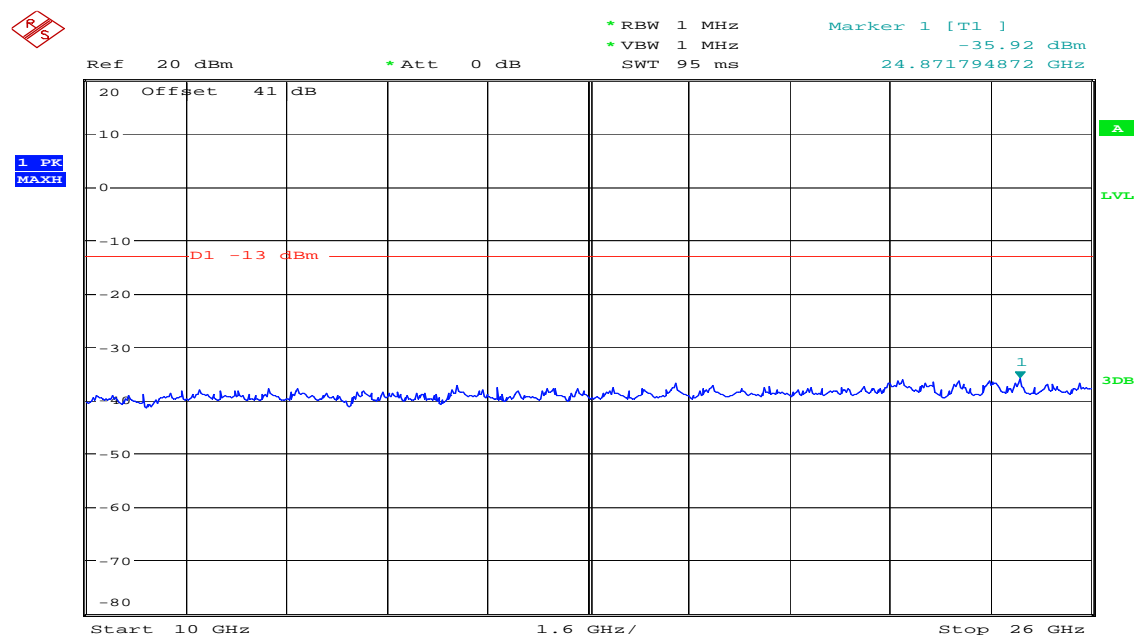
Plot 102: 25 MHz - 12 GHz (2068 MHz) (valid for all 3 sub-modulations)



Plot 103: 25 MHz - 12 GHz (2106 MHz) (valid for all 3 sub-modulations)



Plot 104: 10 GHz - 26 GHz (valid for all 3 carrier frequencies and all 3 sub-modulations)



Date: 9.MAR.2009 15:13:08

SPURIOUS EMISSIONS LEVEL (dBm)								
2028 MHz			2068 MHz			2106 MHz		
F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]	F [MHz]	Detector	Level [dBm]
4058	AVG	-31.6	4135.6	AVG	-37.9	4209.6	AVG	-42.1
6058	AVG	-35.2	6204	AVG	-37.7	6317.4	AVG	-39.5
Measurement uncertainty			±3 dB					

RBW: 100 kHz/1MHz VBW: 100 kHz/1MHz

Limit according to §74.637(a)(2)(iii):

Under normal test conditions only	<p>The mean power of emissions shall be attenuated below the mean transmitter power (<math>P_{\text{MEAN}}</math>) in accordance with the following schedule:</p> <p>When using transmissions employing digital modulation techniques: In any 4 kHz reference bandwidth (<math>B_{\text{REF}}</math>), the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least <math>43 + 10 \log_{10}(P_{\text{MEAN}}</math> in watts) decibels, or 80 decibels, whichever is the lesser attenuation</p>
-----------------------------------	---

**Test Result: passed**

**4.11 Frequency tolerance****§2.1055 / §74.661**

Temperature [°C]	U <sub>DC</sub> [V]	Carrier frequency [MHz]	Measured frequency [MHz]	Difference [kHz]	Difference [ppm]
-30.0	13.8	2068	2068.005391	+5.391	+2.6
-20.0	13.8	2068	2068.004890	+4.890	+2.4
-10.0	13.8	2068	2068.004387	+4.387	+2.1
0.0	13.8	2068	2068.003897	+3.897	+1.9
+10.0	13.8	2068	2068.003342	+3.342	+1.6
+20.0	11.0	2068	2068.002625	+2.625	+1.3
+20.0	13.8	2068	2068.002625	+2.625	+1.3
+20.0	17.5	2068	2068.002625	+2.625	+1.3
+30.0	13.8	2068	2068.001723	+1.723	+0.8
+40.0	13.8	2068	2068.000821	+0.821	+0.4
+50.0	13.8	2068	2068.000812	+0.812	+0.4

**Remark:****For measuring the frequency stability the modulation was switched off.**

Limit according to §74.661:

Stations in this service shall maintain the carrier frequency of each authorized transmitter to within the following percentage of the assigned frequency: 2025 to 2110 MHz: 0.005% / 50 ppm
--

**Test Result: passed**

#### 4.12 MPE calculation

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a “worst case” prediction.

$$S = PG/4\pi R^2$$

where S = power density ( in appropriate units, e.g. mW/cm<sup>2</sup>)  
P = power input to the antenna (in appropriate units e.g. mW)  
G = power gain of the antenna in the direction of interest relative to the isotropic radiator  
R = distance to the center of radiation of the antenna (appropriate units e.g. cm)

Or

$$S = \text{EIRP}/4\pi R^2$$

where EIRP = equivalent isotropically radiated power

##### Calculation:

Calculated for EIRP(RMS)

EIRP (RMS): 31.8 dBm = 1514 mW

calculated at distance of 20 cm:

Peak power density =  $1514 \text{ mW} / 4\pi(20\text{cm})^2 = 0.30 \text{ mW/cm}^2$

Limit:

1mW/ cm<sup>2</sup> is the reference level for general public exposure according to the OET Bulletin 65, Edition 97-01 Table 1.

## 5 Test equipment and ancillaries used for tests

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

All reported calibration intervals are calibrations according to the EN/ISO/IEC 17025 standard. These calibrations were performed from an accredited external calibration laboratory.

Additional to these calibrations the laboratory performed comparison measurements with other calibrated systems and performed a weekly chamber inspection.

All used devices are connected with a 10 MHz external reference.

According to the manufacturer's instruction it is possible to establish a calibration interval for the FSP/FSU unit of 24 month, if the device has an external 10 MHz reference.

### Test chamber A:

No.	Instrument/Ancillary	Manufacturer	Type	Serial-No.	Internal identification
<b>Radiated emission in chamber A</b>					
A-1	Spectrum Analyzer	Rohde & Schwarz	ESU26	100037	300003555
A-2	Signal Generator	Rohde & Schwarz	SMR20B11	1104.0002.20	300003593
A-3	RF System Panel	Rohde & Schwarz	TS RSP	---	300003556
A-4	Relais Matrix	Rohde & Schwarz	PSN	860673/009	300001385
A-5	Horn Antenna	EMCO	3115	9709-5290	300000212
A-6	Bilog.-Log. Antenna	Schwarzbeck	VULB 9163	02/00	300003696
A-7	Notch Filter GSM 900	Wainwright	WRCD 901.9/903.1EE	9	---
A-8	Notch Filter GSM 1800	Wainwright	WRCD 1747/1748-5EE	1	---
A-9	Notch Filter GSM 1900	Wainwright	WRCB 1879.5/1880.5EE	9	---
A-10	Notch Filter GSM 850	Wainwright	WRCT 837-0.2/50-8EE	1	---
A-11	Notch Filter UMTS	Wainwright	WRCD 1800/2000-0.2/40-5EEK	2	---
A-12	Notch Filter ISM 2400	Wainwright	WRCG 2400/2483-2375/2505-50/10SS	26	---
A-13	High Pass Filter 1.1 GHz	Wainwright	WHK 1.1/15G-10SS	---	---
A-14	High Pass Filter 2.6 GHz	Wainwright	WHKX 2.6/18G-12SS	---	---
A-15	High Pass Filter 7 GHz	Wainwright	WHKX 7.0/18G-8SS	---	---
A-14	Amplifier	Miteq	AFS4-00201800-15-10P-6	US42-0050 2650-28-5A	300003204
A-16	Controller	Inn co	CO 2000	2020507	---
A-17	DC Power Supply	Hewlett Packard	HP6632A	---	300000924
A-18	Computer	F+W	---	---	300003303

### Test laboratory 011:

No	Equipment/Type	Manuf.	Serial Nr.	Inv. No. Cetecom	Last Calibration	Frequency (months)	Next Calibration
1	Climatic box VUK 04/500	Heraeus Vötsch	32678	300000297	29.07.2008	24	27.07.2010
2	Spectrum Analyser FSU 50	R&S	200012	300003443	05.06.2008	24	05.06.2010
3	SGH 12 ... 18 GHz	narda	01005	300000787	cyclic verification		
4	SGH 18 ... 27 GHz	narda	01005	300000487	cyclic verification		
5	Adapter WG/SMA	narda	4609	-/-	cyclic verification		
6	Adapter WG/SMA	flann	100484	-/-	cyclic verification		
7	1.5 m 50 Ω / K	Insulated Wire Inc.	101995	300002290	cyclic verification		
8	Attenuator 20dB, k-con.	Inmet	40A-20dB	-/-	cyclic verification		

## 6 Photographs of the test setup

Photo No. 1

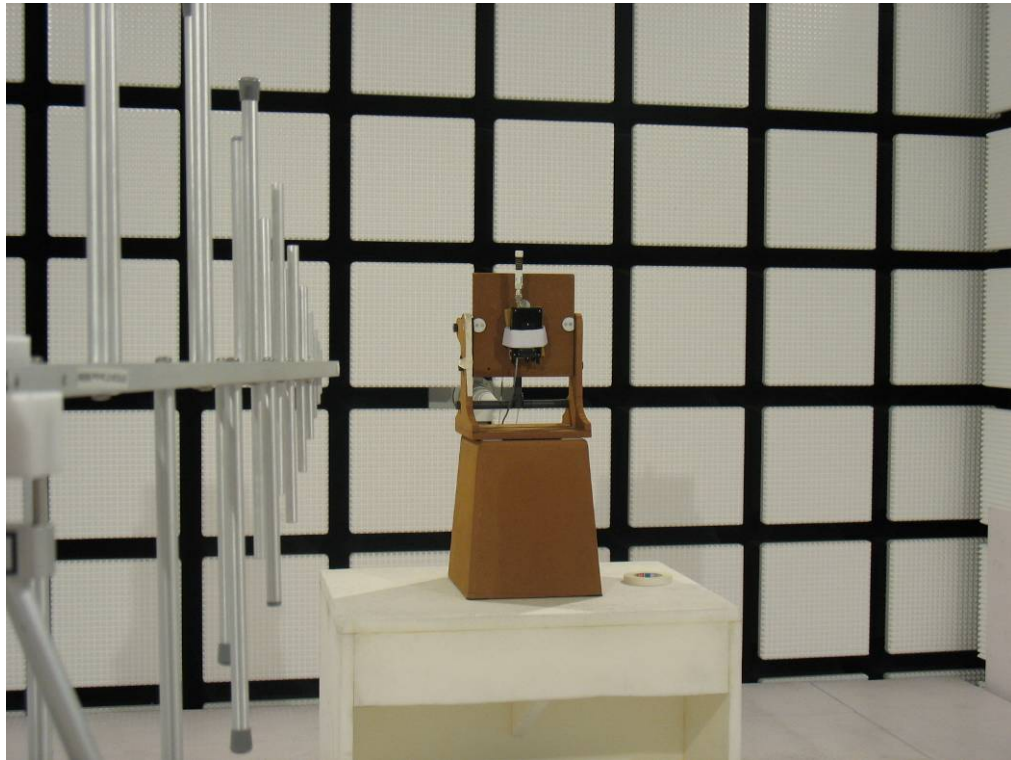


Photo No. 2:

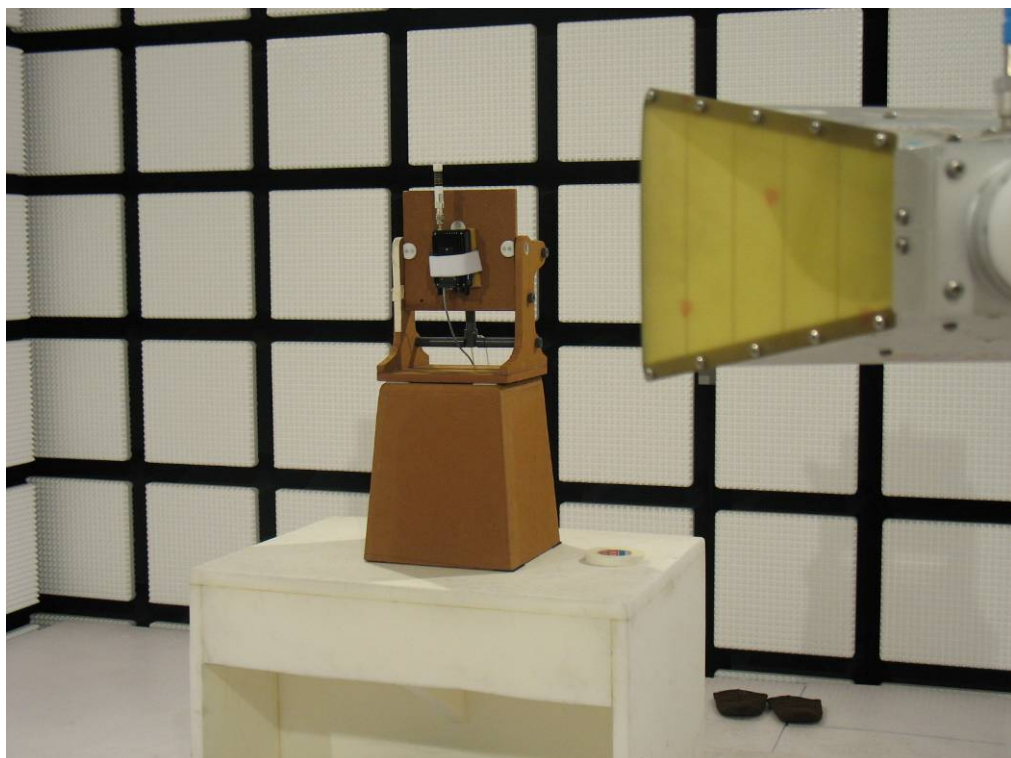
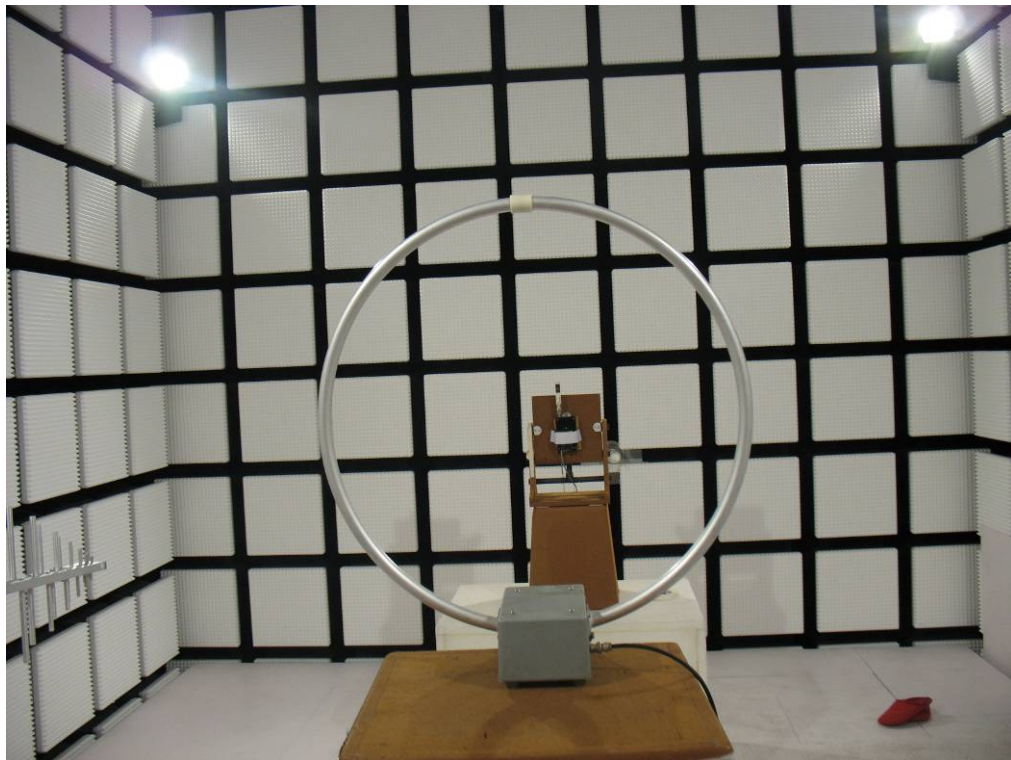




Photo No. 3:



## 7 Internal photographs of the EUT

Photo No. 1 (PA-Module)

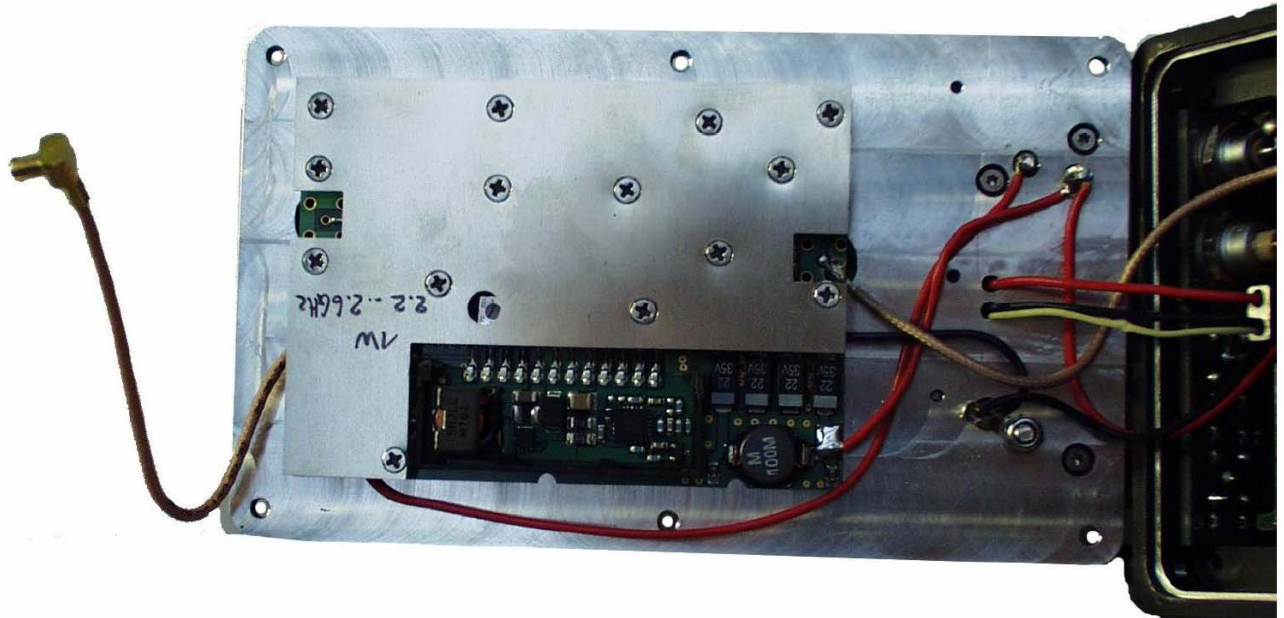


Photo No. 2

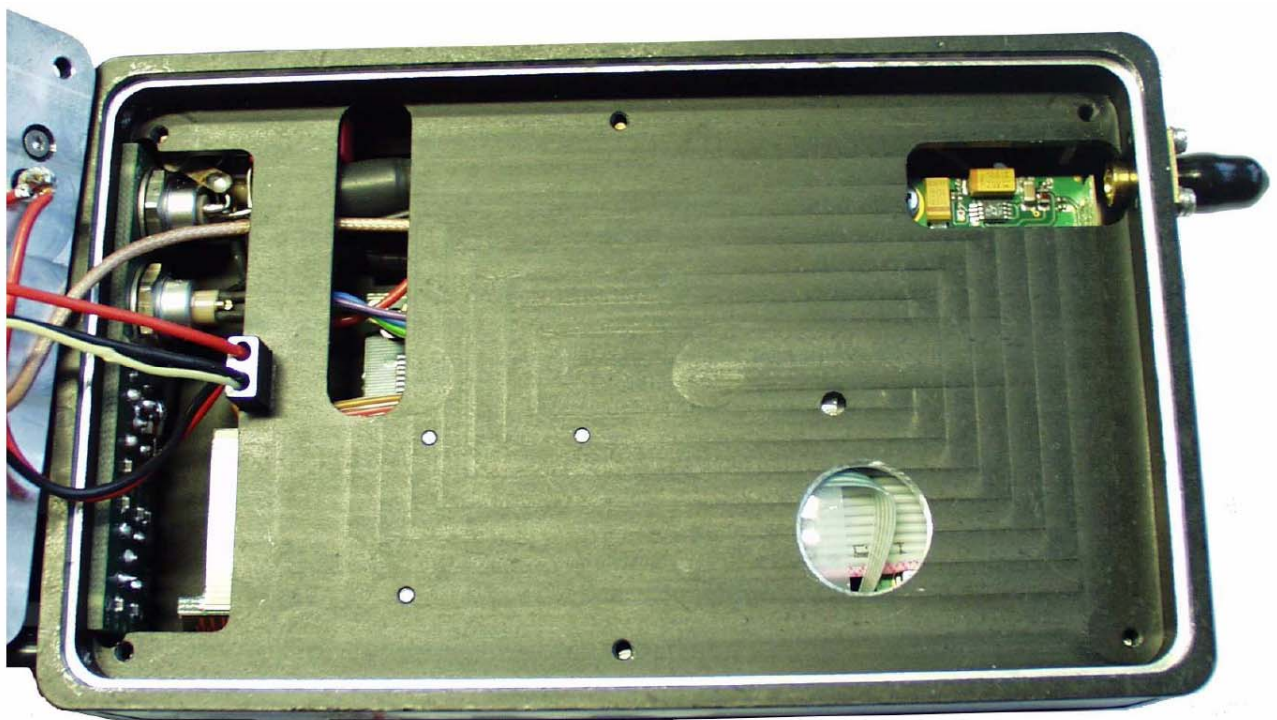
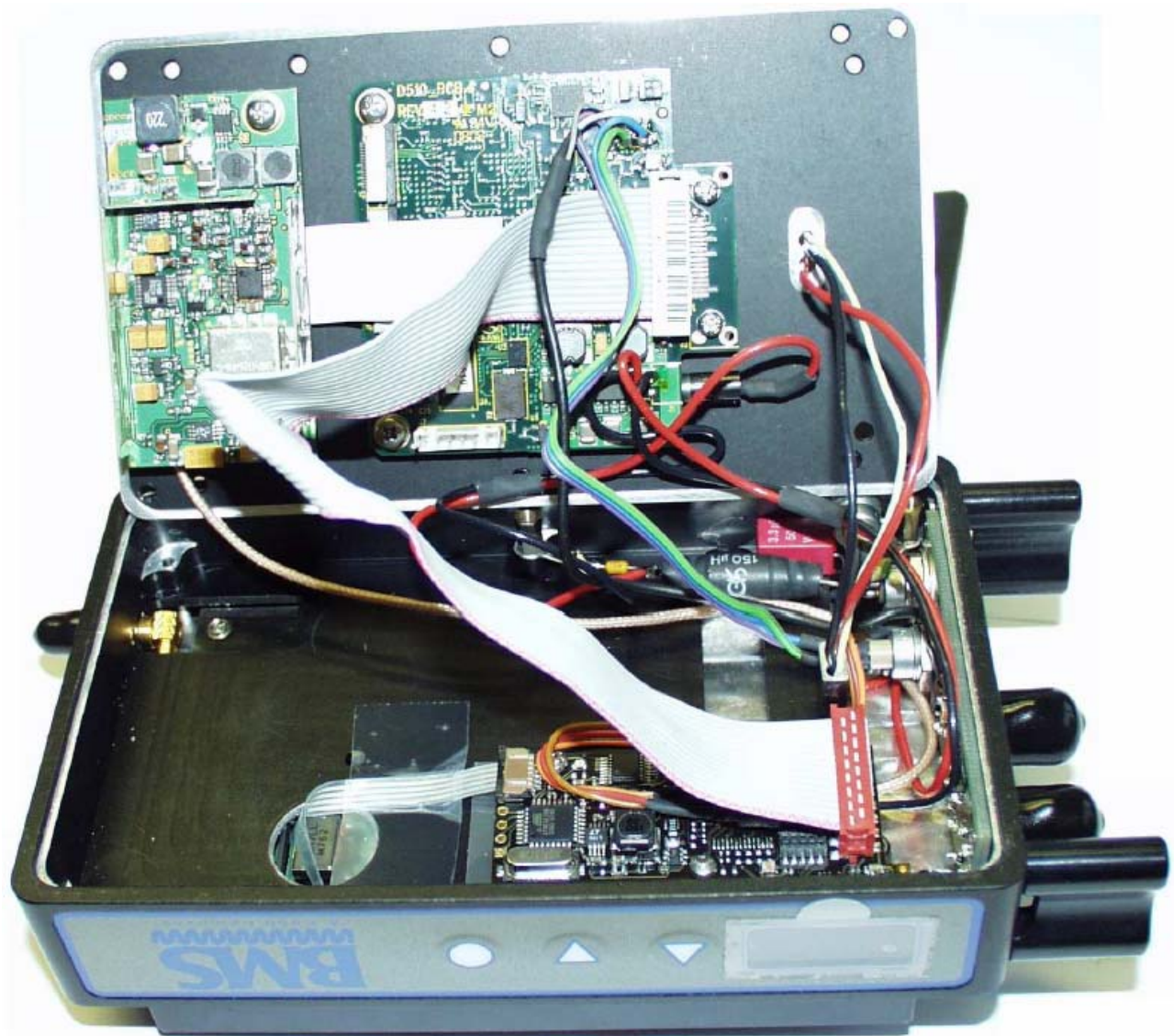




Photo No. 3



## 8 External photographs of the EUT

Photo No. 1

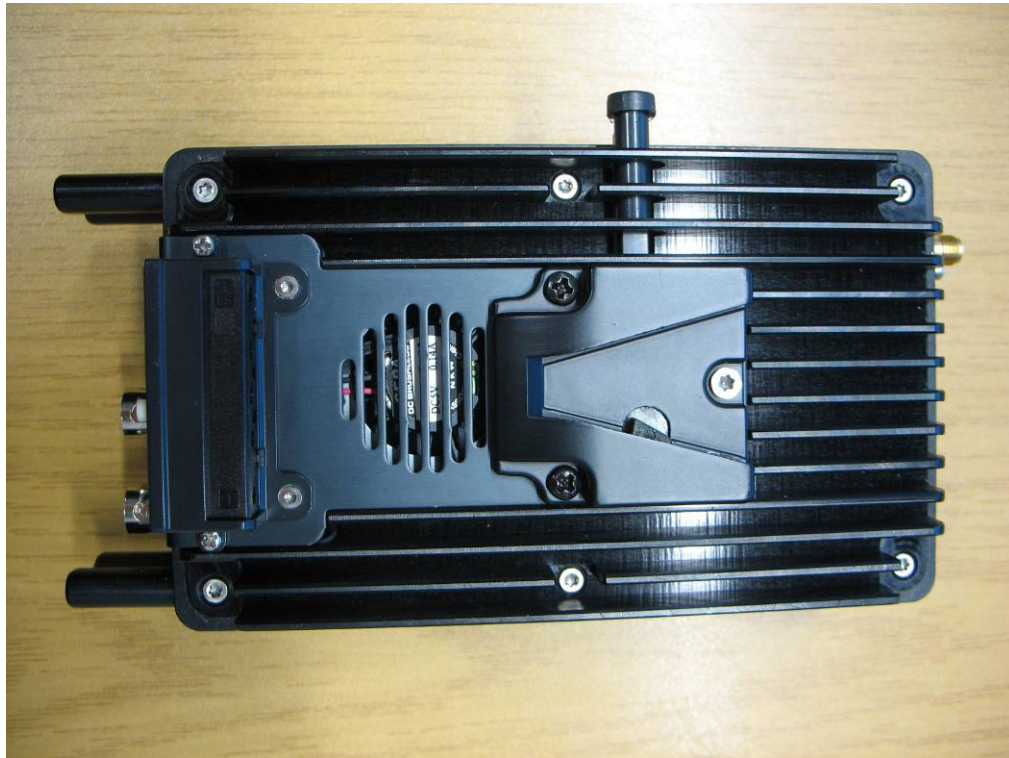


Photo No. 2





Photo No. 3

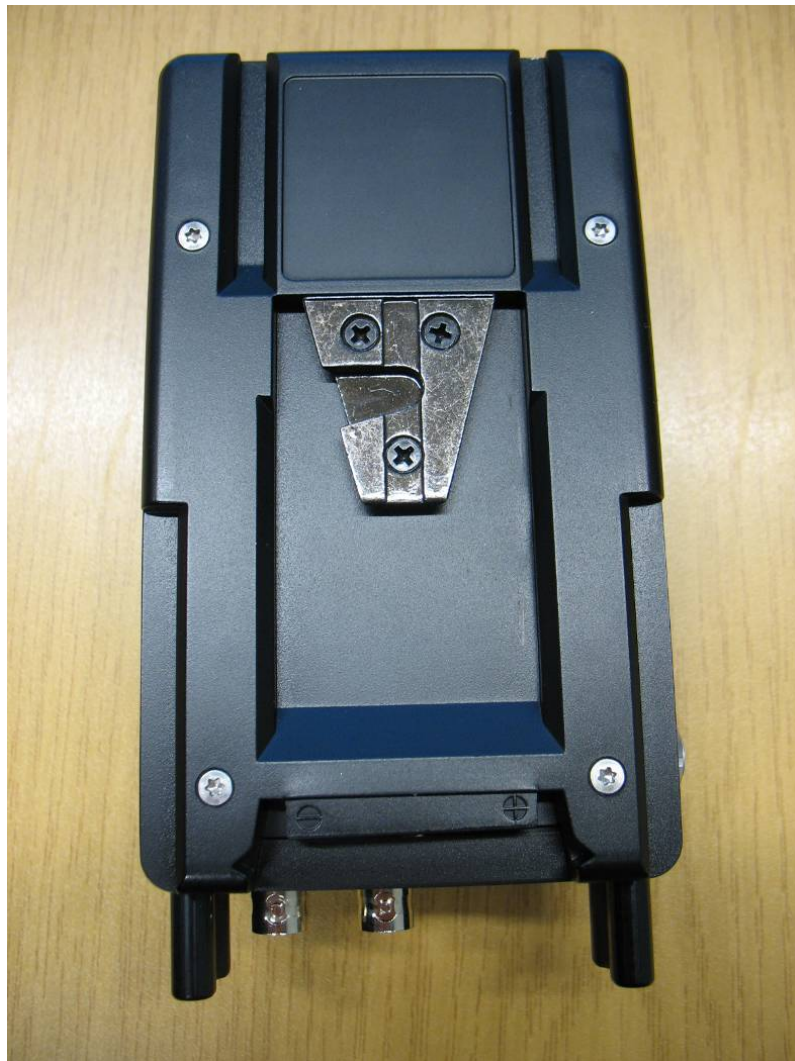


Photo No. 4



Photo No. 5





Photo No. 6

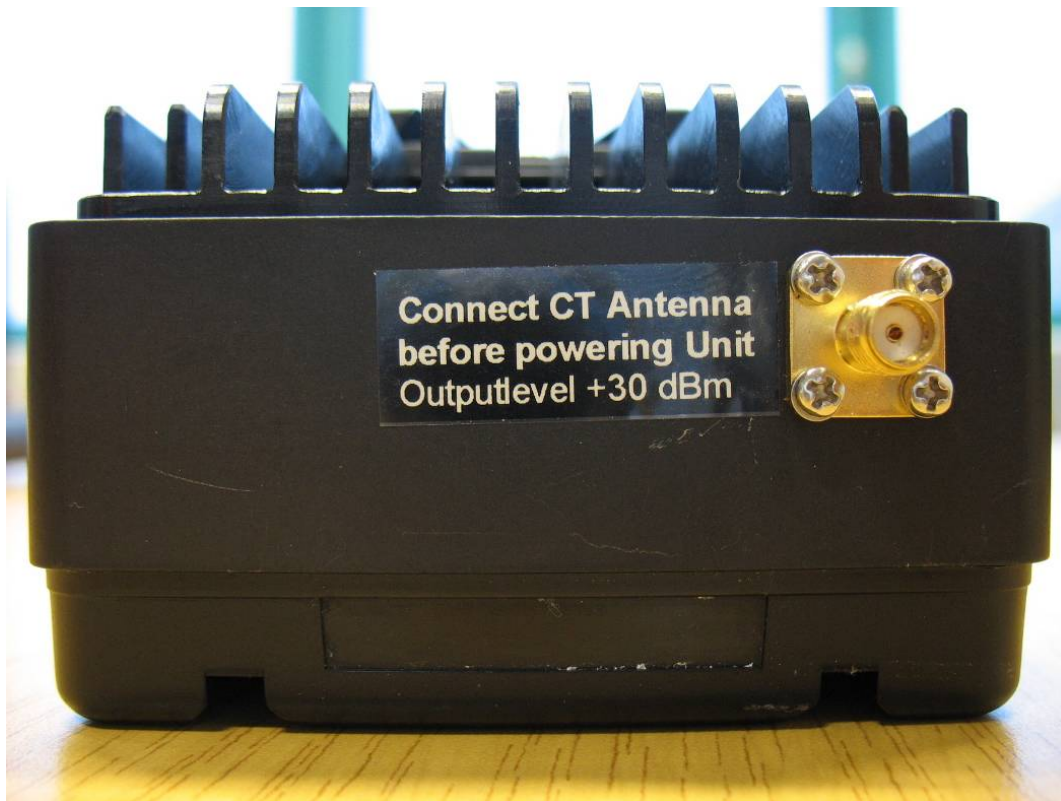


Photo No. 7



Photo No. 8

