



Accredited testing-laboratory

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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. : 1-3178-01-02/11-A
Type identification : CT6540ARINC6466
Applicant : Broadcast Microwave Services GmbH & Co. KG
FCC ID : VFB-CT6540ARI6466
IC ID : 7191A-CT6540F6466

Test standards : FCC CFR 47 Part 74
IC SRSP-306.4 / 306.5

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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:

| | | |
|------------|--------------|--|
| 2011-08-17 | Meheza Walla |  |
| Date | Name | Signature |

Technical responsibility for area of testing:

| | | |
|------------|------------------|--|
| 2011-08-17 | Karsten Geraldly |  |
| Date | Name | Signature |



1.2 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

e-mail: info@cetecom.com

Internet: <http://www.cetecom.com>

State of accreditation: The test laboratory (area of testing) is accredited according to
DIN EN ISO/IEC 17025
DAkkS registration number: D-PL-12076-01-01

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: | crothe@bms-inc.com |
| Telephone: | +49 6124 7239-27 |

1.4 Application details

| | |
|---|------------|
| Date of receipt of order: | 2011-02-25 |
| Date of receipt of test item: | 2011-03-23 |
| Date of start test: | 2011-05-02 |
| Date of end test | 2011-07-16 |
| 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: | CT6540ARINC6466 |
| P/N / S/N: | P/N 11.2535.100, S/N 090 6001 |
| Frequency: | 6425 - 6525 MHz |
| Type of Modulation: | COFDM 2k with sub-modulation: QPSK, 16QAM, 64QAM |
| Emission Designator: | 6 MHz channel band width: 5M77D7F 7 MHz channel band width: 6M68D7F 8 MHz channel bandwidth: 7M63D7F |
| Antenna: | N-antenna connector |
| Power Supply: | 28 V DC $\pm 10\%$, 350 W, battery powered |
| Temperature Range: | -10 °C to +50 °C |

Max. RMS power conducted: 38.8 dBm (7.6 W)
Max. RMS EIRP: 44.8 dBm (30.2 W, based on a 6 dBi antenna)

FCC ID: VFB-CT6540ARI6466
IC ID: 7191A-CT6540F6466

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.

SRSP-306.4 covers Fixed Line-of-Sight Radio Systems operating in the Band 6425-6930 MHz.

SRSP-306.5 describes the technical requirements for Line-of-sight Radio Systems operating in the Fixed Service and Providing Television Auxiliary Services in the Bands 6590-6770 and 6930-7125 MHz.

Both SRSPs were cited by the Certification and Engineering Bureau of Industry Canada on request.

As stated in the SRSP-306.4, section 2.2 radio systems conforming to these technical requirements will be given priority in licensing over non-standard radio systems operating in this band.

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 _{nom} | °C | 23 |
| Nominal Humidity | H _{nom} | % | 45 |
| Nominal Power Source | V _{nom} | V DC | 28 |

Type of power source: 28.0 V DC

Extreme conditions are reported in chapter 4.11.

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 IC SRSP-306.4 / 306.5 | PASS | 2011-07-21 | -/- |

| Test Specification / Clause | Test Case | Pass | Fail | N/A | N/P | Results |
|---|--|------|------|-----|-----|---|
| § 2.1046 / § 74.636 SRSP-306.4, 5.2 | Measurements required: RF power output / Power limitations (conducted) Transmitter power limits | X | | | | Channel bandwidth: 6 MHz: 38.8 dBm 7 MHz: 38.5 dBm 8 MHz: 38.7 dBm (RMS-values) |
| § 2.1046 / § 74.636 SRSP-306.4, 7 | Measurements required: RF power output / Power limitations (radiated) Maximum EIRP | X | | | | Channel bandwidth: 6 MHz: 44.8 dBm 7 MHz: 44.5 dBm 8 MHz: 44.7 dBm (RMS-values) |
| § 2.1049 | Measurements required: Occupied bandwidth | X | | | | Channel bandwidth: 6 MHz: 5.77 MHz 7 MHz: 6.68 MHz 8 MHz: 7.63 MHz |
| § 2.1051 / § 74.637 SRSP-306.4, 5.4 | Measurements required: Spurious emissions at antenna terminals / Emission mask Emission limits | X | | | | complies |
| § 2.1051 / § 74.637 SRSP-306.4, 5.4 | Measurements required: Spurious emissions at antenna terminals / Spurious Emissions - conducted Emission limits | 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 SRSP-306.4, 5.3 | Measurements required: Frequency stability / Frequency tolerance | X | | | | max. 2.3 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:

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

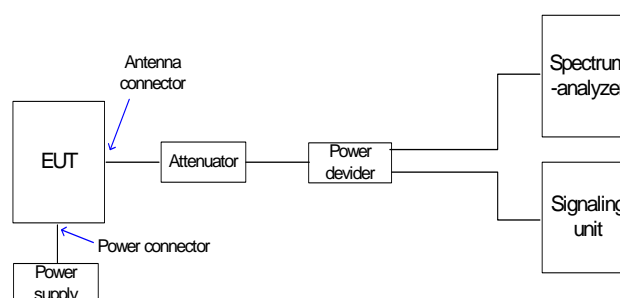
$$\text{EIRP} = P + G_1 = P_3 + L_2 - L_1 + A + G_1$$

$$\text{ERP} = \text{EIRP} - 2.15 \text{ dB}$$
 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, signalling 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 6425 to 6525 MHz via user interface (multifunctional display).

Per remote control via serial interface also 1 MHz 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 OUTPUT POWER (dBm) | | |
|-------------------------|---------------------------|------|----------------------------|------|------|
| Frequency (MHz) | | | 6431 | 6475 | 6519 |
| T _{nom} 23 °C | V _{nom} 28.0 Vdc | Peak | 44.8 | 44.5 | 44.4 |
| | | RMS | 38.8 | 38.3 | 38.1 |
| Measurement uncertainty | | | ±1dB | | |

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

| TEST CONDITIONS | | | MAXIMUM OUTPUT POWER (dBm) | | |
|-------------------------|---------------------------|------|----------------------------|------|------|
| Frequency (MHz) | | | 6432 | 6475 | 6518 |
| T _{nom} 23 °C | V _{nom} 28.0 Vdc | Peak | 44.8 | 44.6 | 44.2 |
| | | RMS | 38.5 | 38.2 | 37.9 |
| Measurement uncertainty | | | ±1dB | | |

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

| TEST CONDITIONS | | | MAXIMUM OUTPUT POWER (dBm) | | |
|-------------------------|---------------------------|------|----------------------------|------|------|
| Frequency (MHz) | | | 6432 | 6475 | 6518 |
| T _{nom} 23 °C | V _{nom} 28.0 Vdc | Peak | 44.9 | 44.6 | 44.3 |
| | | RMS | 38.7 | 38.1 | 37.8 |
| Measurement uncertainty | | | ±1dB | | |

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

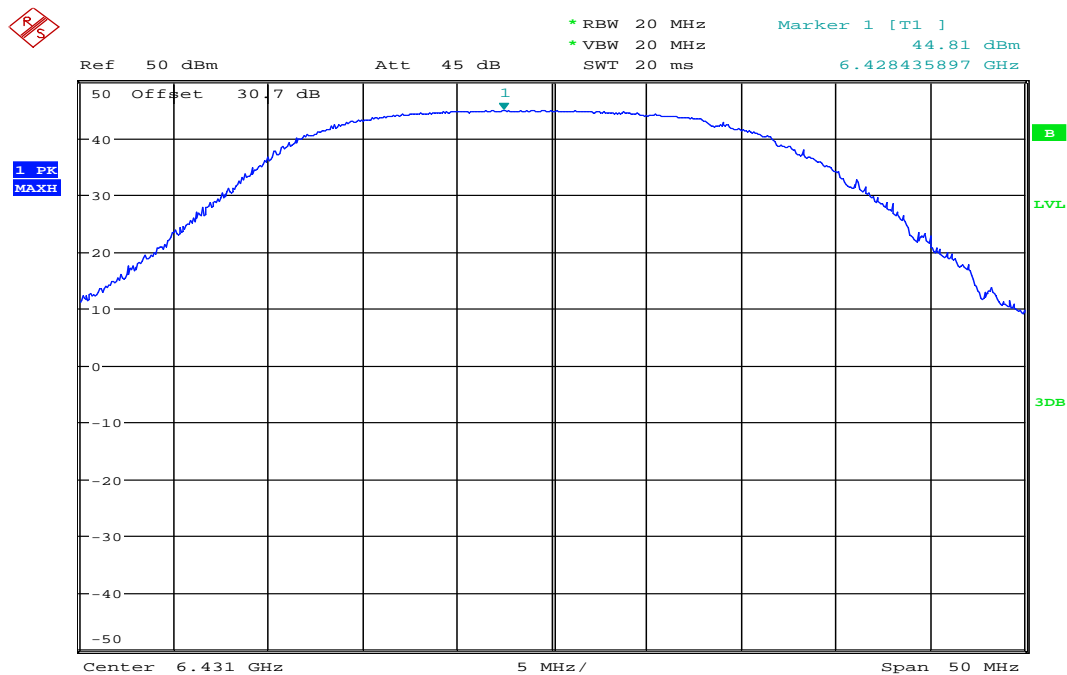
The conducted RF output power was measured with all three sub-modulations QPSK, 16QAM and 64QAM. Also different FEC-rates were tested. As no significant differences in the output power were measured only the 64QAM results were recorded as representative values for all sub-modulations.

Limit according to §74.636(a):

| | |
|-----------------------------------|--|
| Under normal test conditions only | For the frequency band 6425 to 6525 MHz: Maximum allowable transmitter power: 12.0 W / 40.8 dBm |
|-----------------------------------|--|

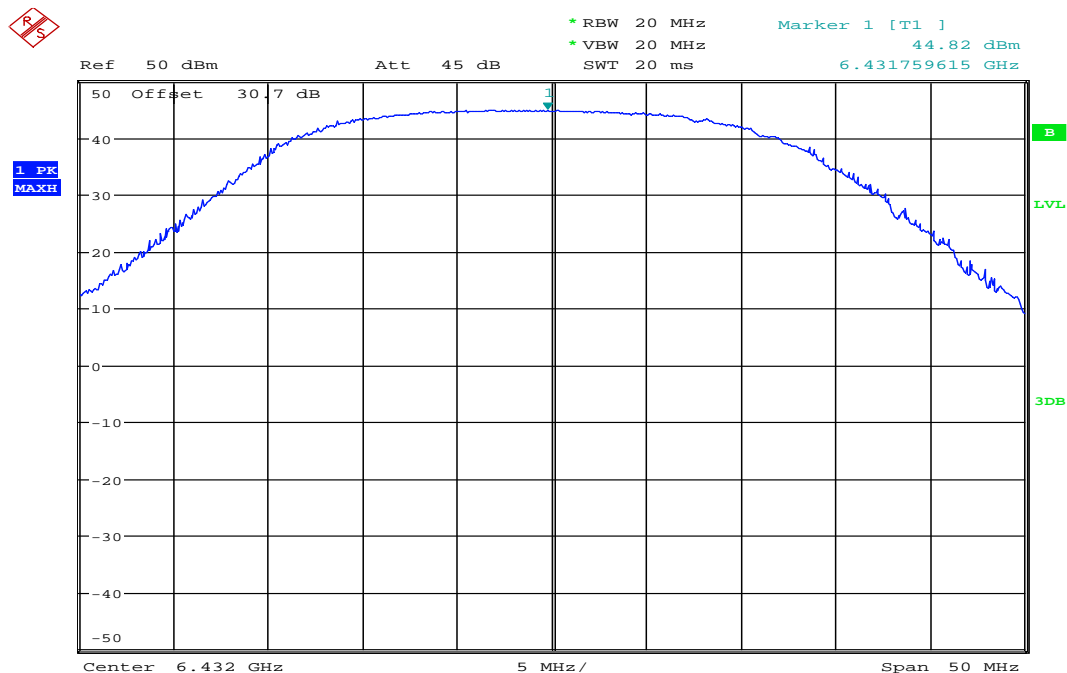
Results: The measurement is passed.

Plot 1: Peak RF output power 6431 MHz / 6 MHz (conducted)



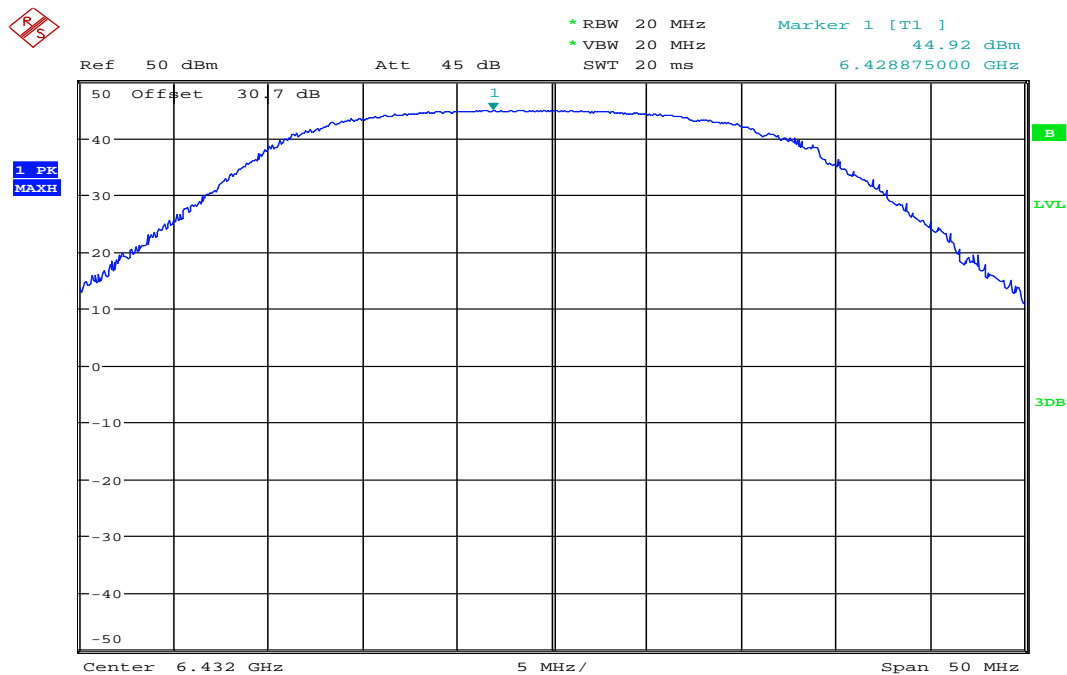
Date: 22.JUN.2011 15:10:47

Plot 2: Peak RF output power 6432 MHz / 7 MHz (conducted)



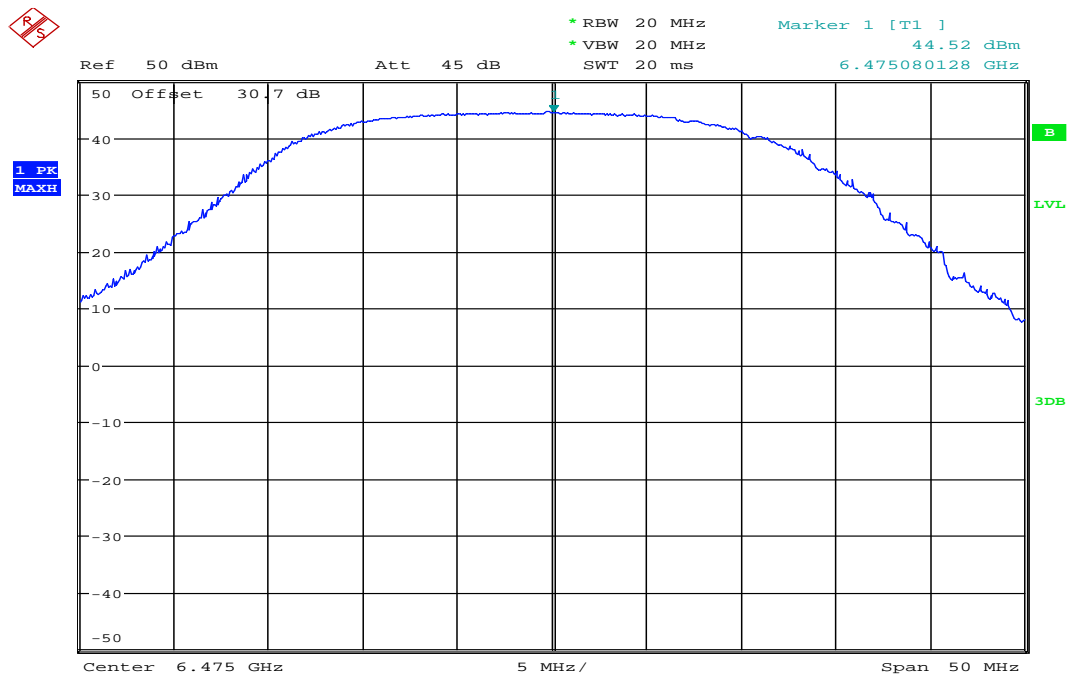
Date: 22.JUN.2011 15:22:52

Plot 3: Peak RF output power 6432 MHz / 8 MHz (conducted)



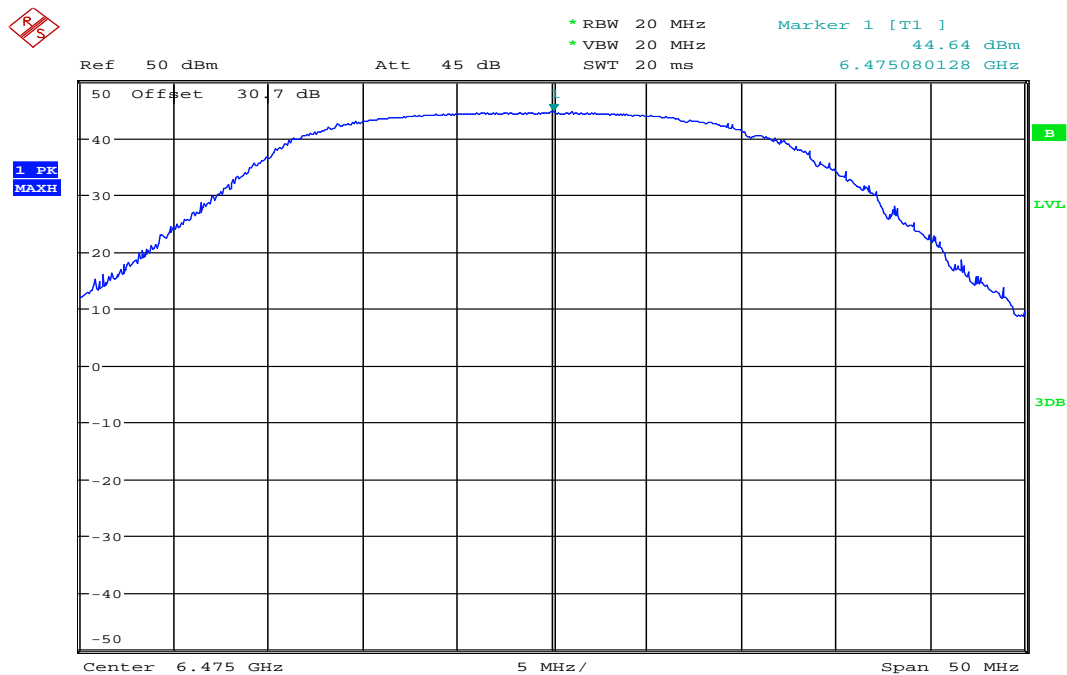
Date: 22.JUN.2011 15:41:19

Plot 4: Peak RF output power 6475 MHz / 6 MHz (conducted)



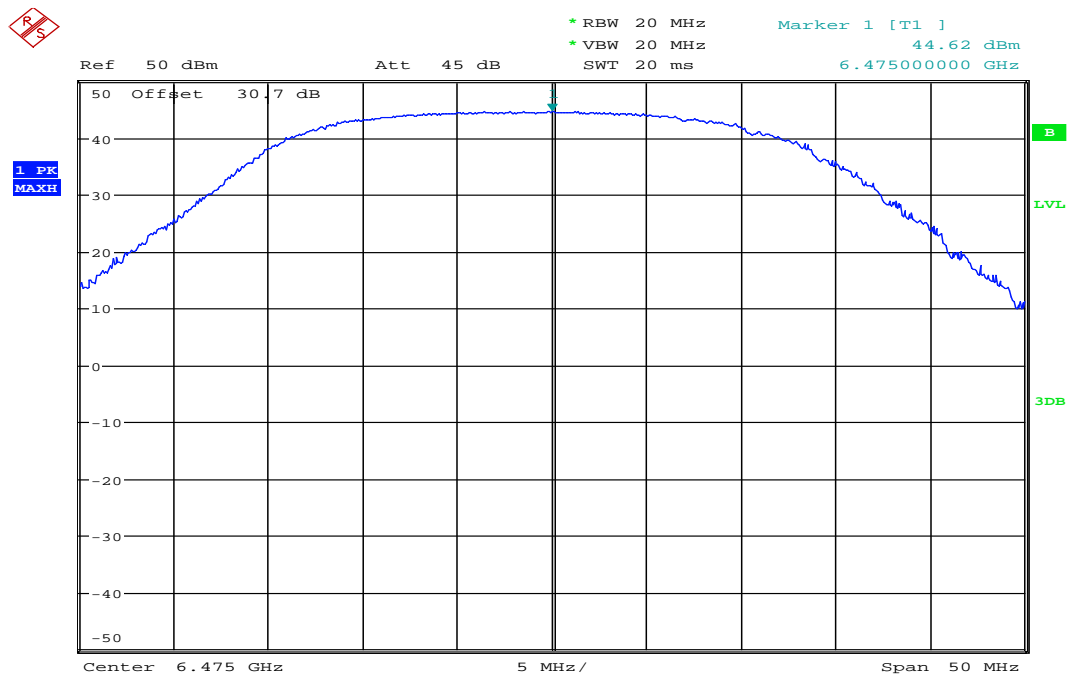
Date: 22.JUN.2011 15:52:53

Plot 5: Peak RF output power 6475 MHz / 7 MHz (conducted)



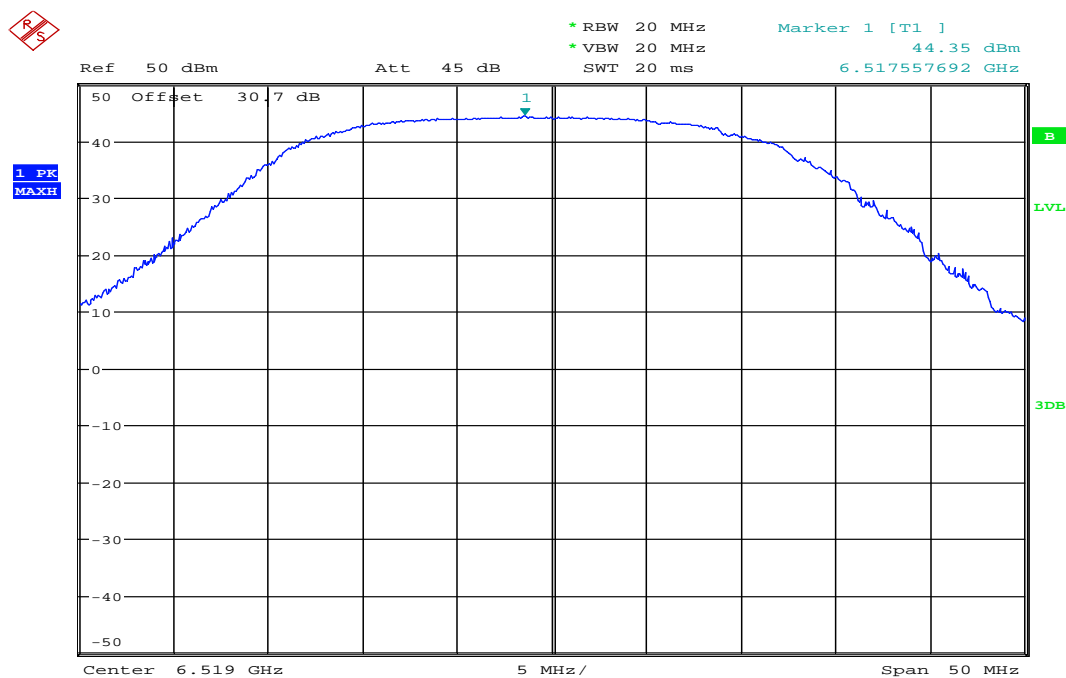
Date: 22.JUN.2011 16:09:46

Plot 6: Peak RF output power 6475 MHz / 8 MHz (conducted)



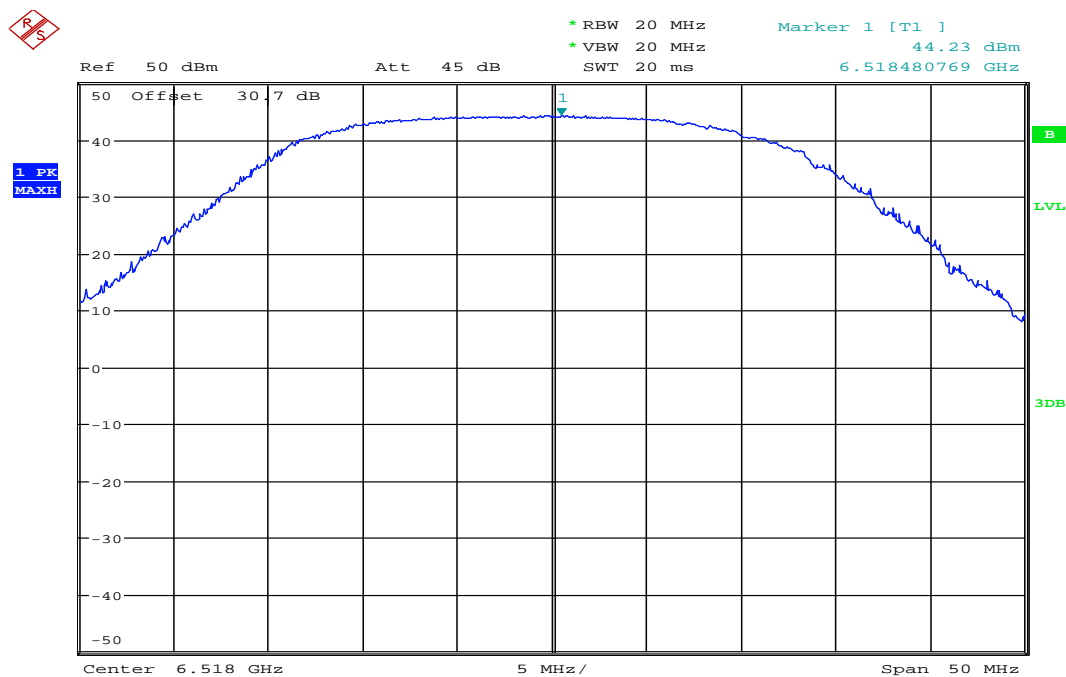
Date: 22.JUN.2011 16:17:35

Plot 7: Peak RF output power 6519 MHz / 6 MHz (conducted)



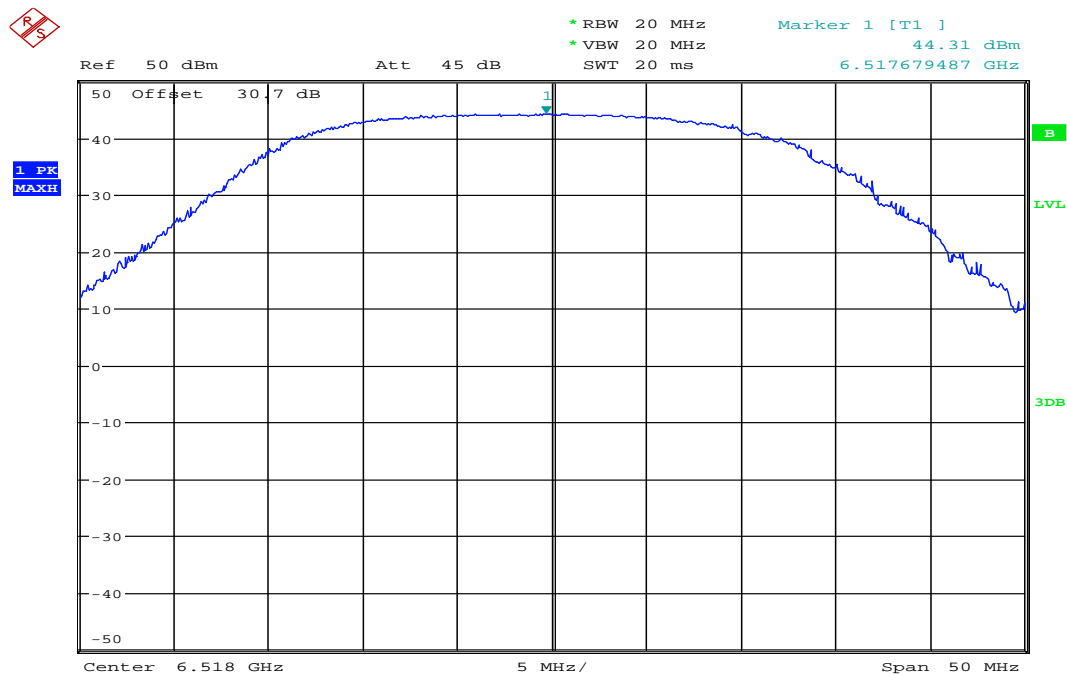
Date: 22.JUN.2011 16:40:16

Plot 8: Peak RF output power 6518 MHz / 7 MHz (conducted)



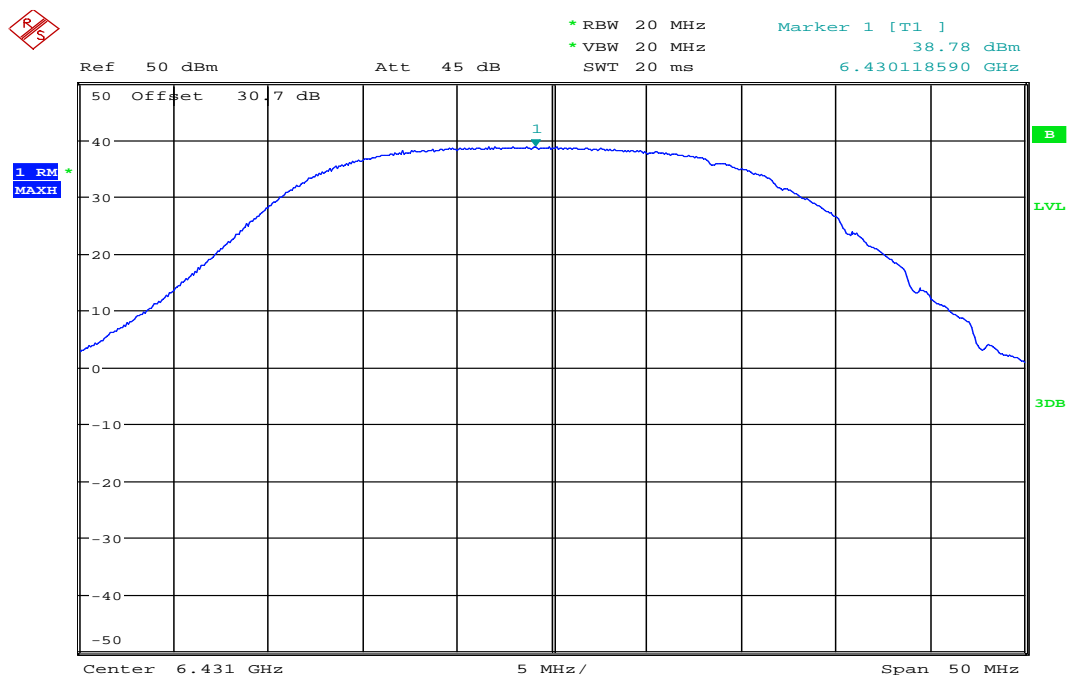
Date: 22.JUN.2011 17:08:27

Plot 9: Peak RF output power 6518 MHz / 8 MHz (conducted)



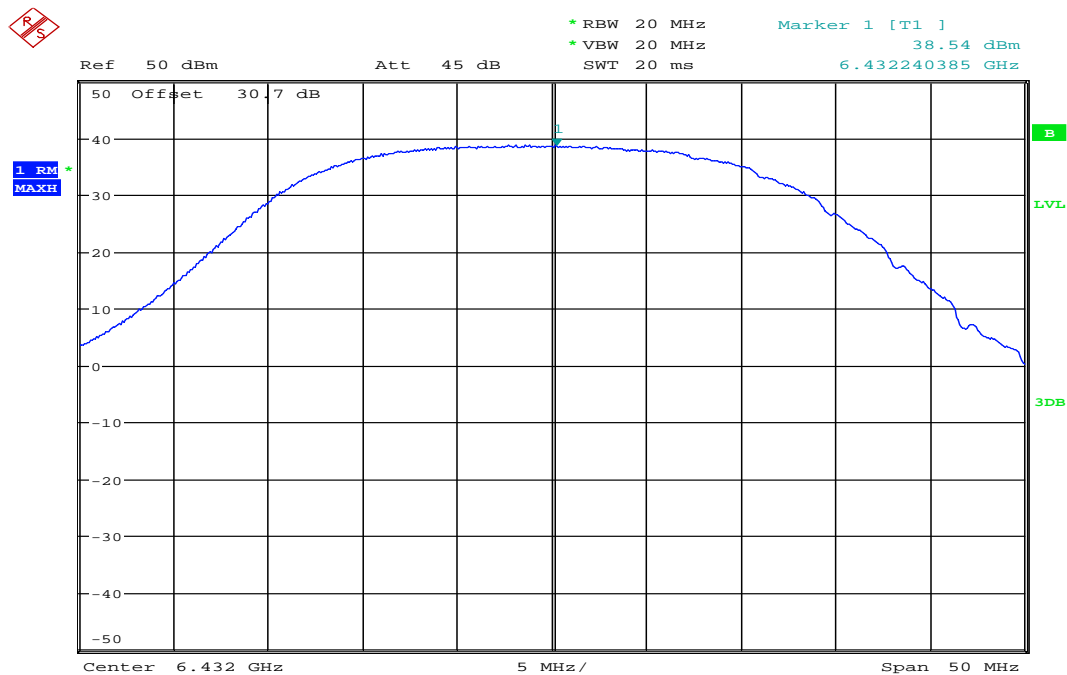
Date: 22.JUN.2011 17:36:50

Plot 10: RMS RF output power 6431 MHz / 6 MHz (conducted)



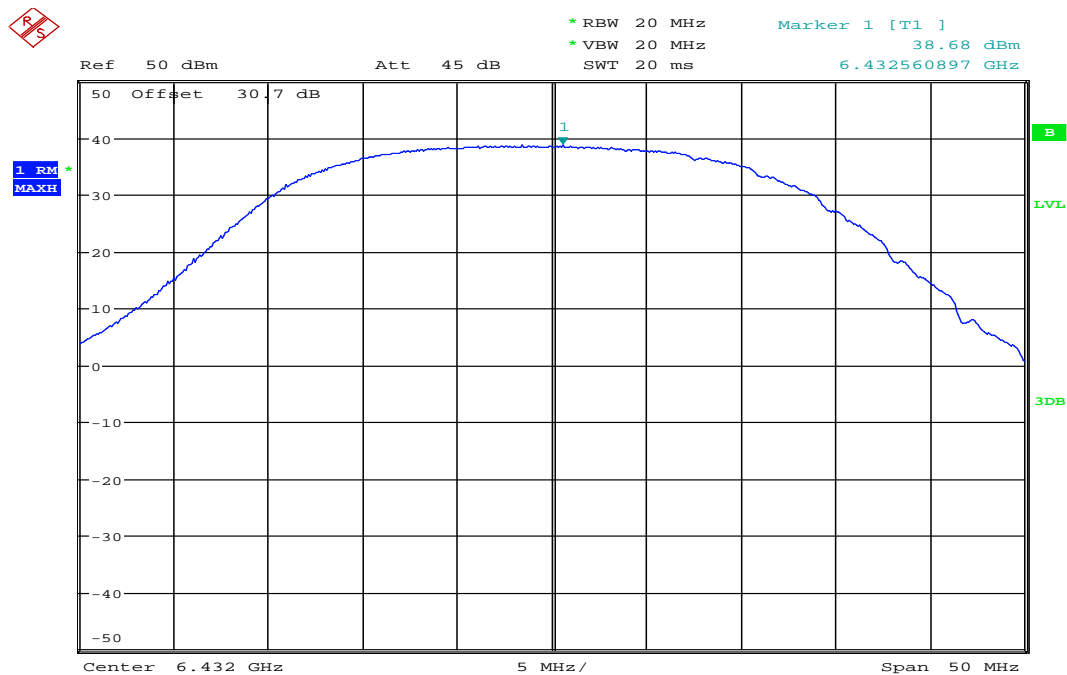
Date: 22.JUN.2011 15:11:36

Plot 11: RMS RF output power 6432 MHz / 7 MHz (conducted)



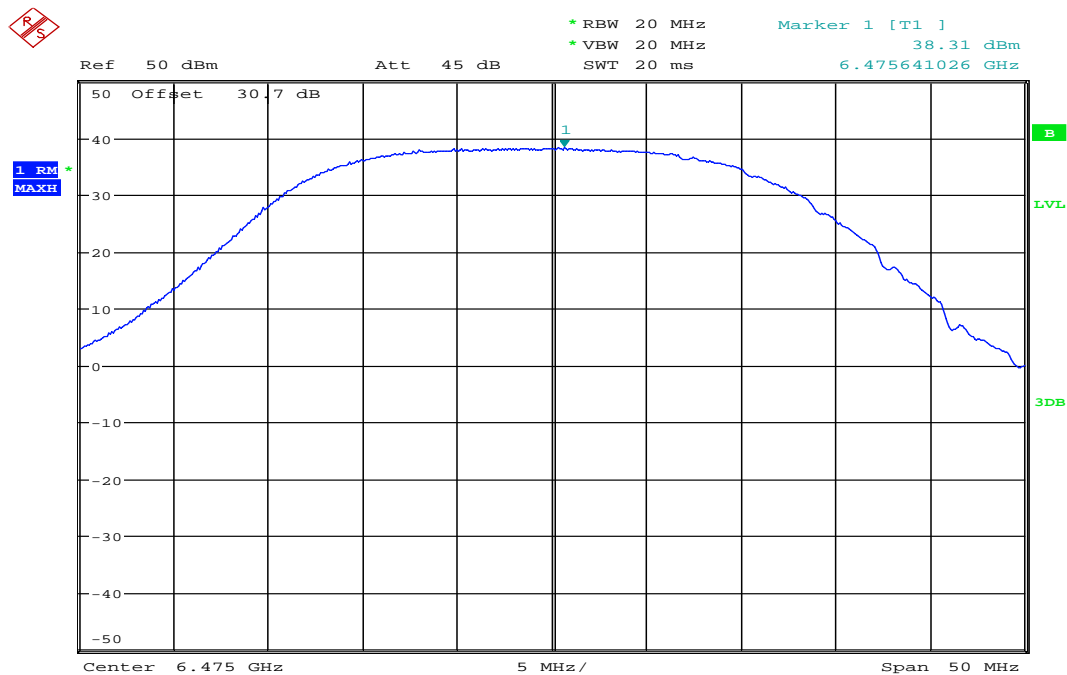
Date: 22.JUN.2011 15:22:10

Plot 12: RMS RF output power 6432 MHz / 8 MHz (conducted)



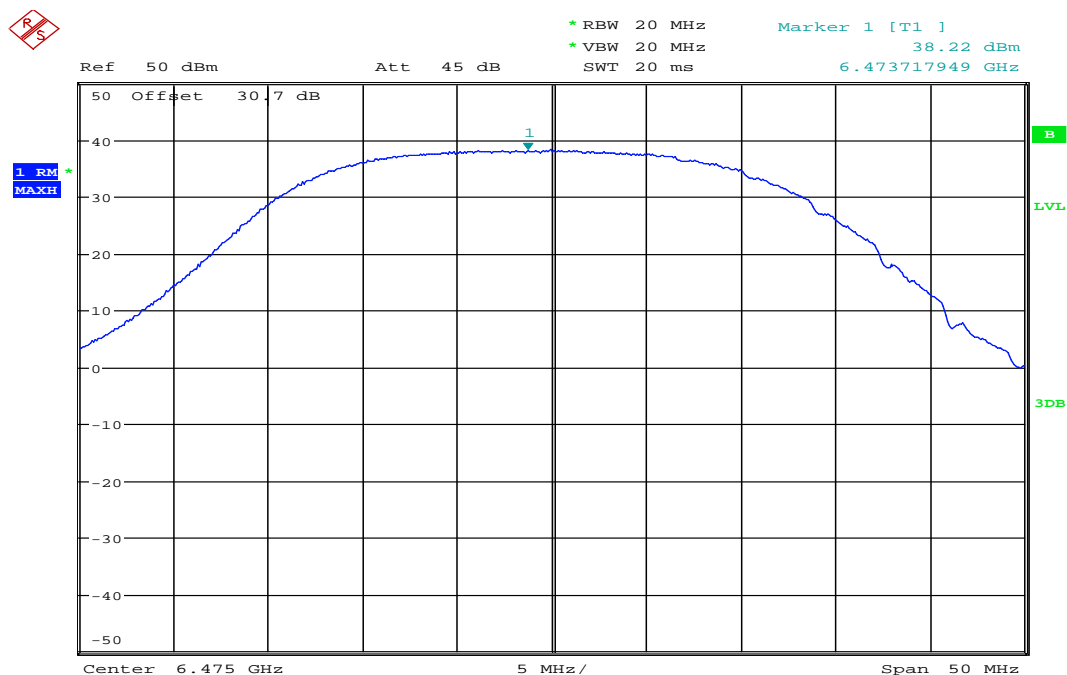
Date: 22.JUN.2011 15:42:07

Plot 13: RMS RF output power 6475 MHz / 6 MHz (conducted)



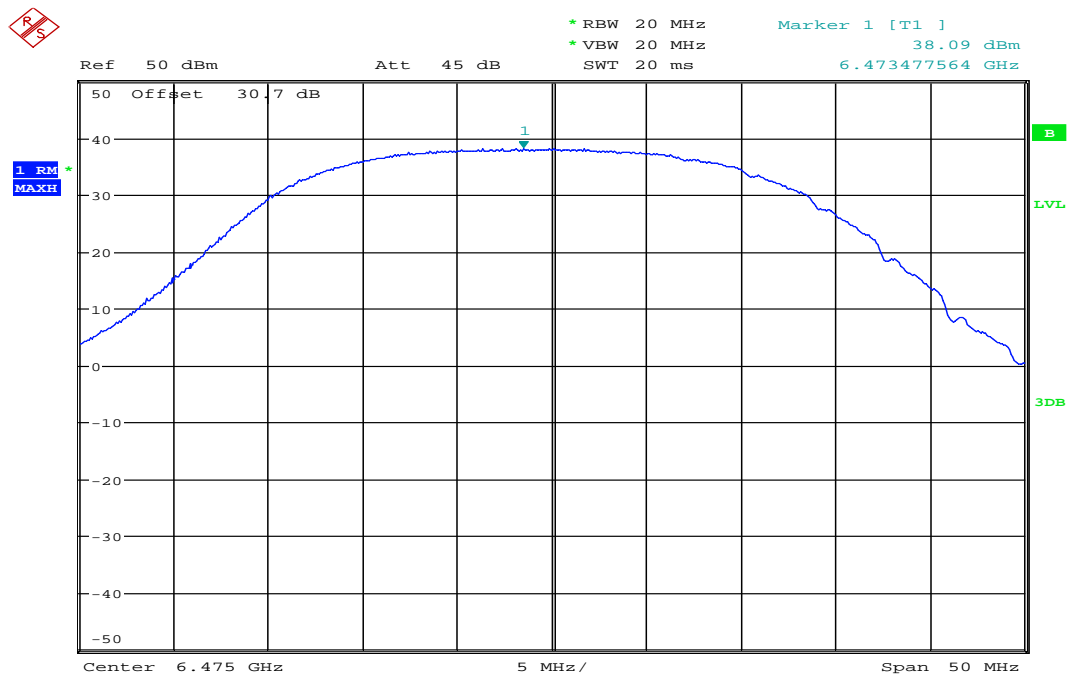
Date: 22.JUN.2011 15:52:09

Plot 14: RMS RF output power 6475 MHz / 7 MHz (conducted)



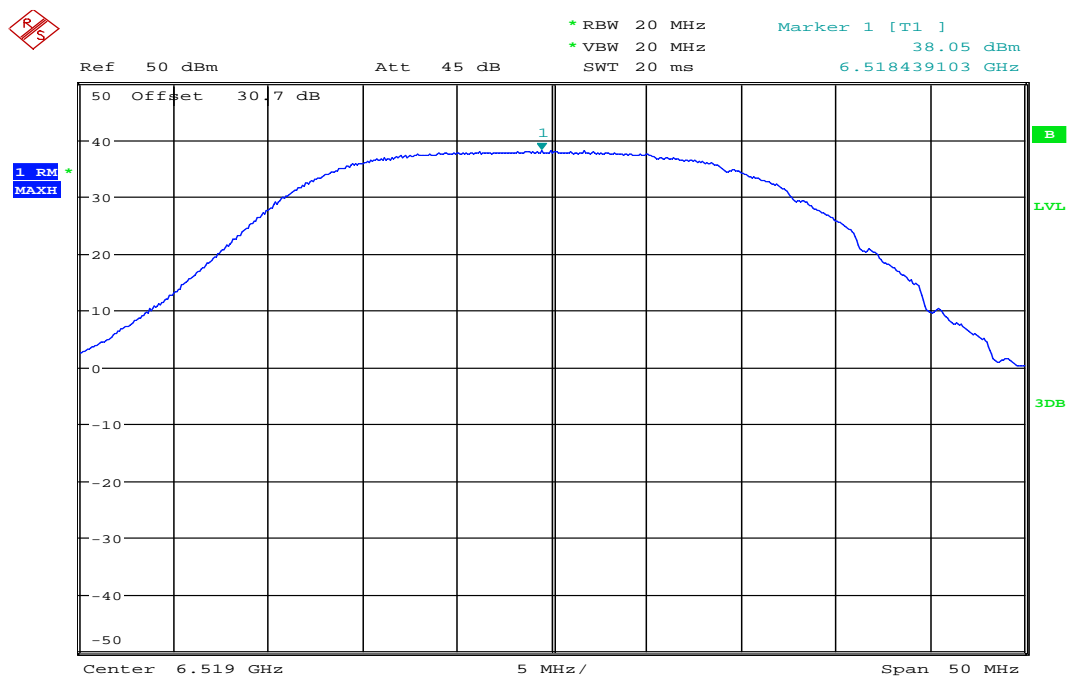
Date: 22.JUN.2011 16:10:26

Plot 15: RMS RF output power 6475 MHz / 8 MHz (conducted)



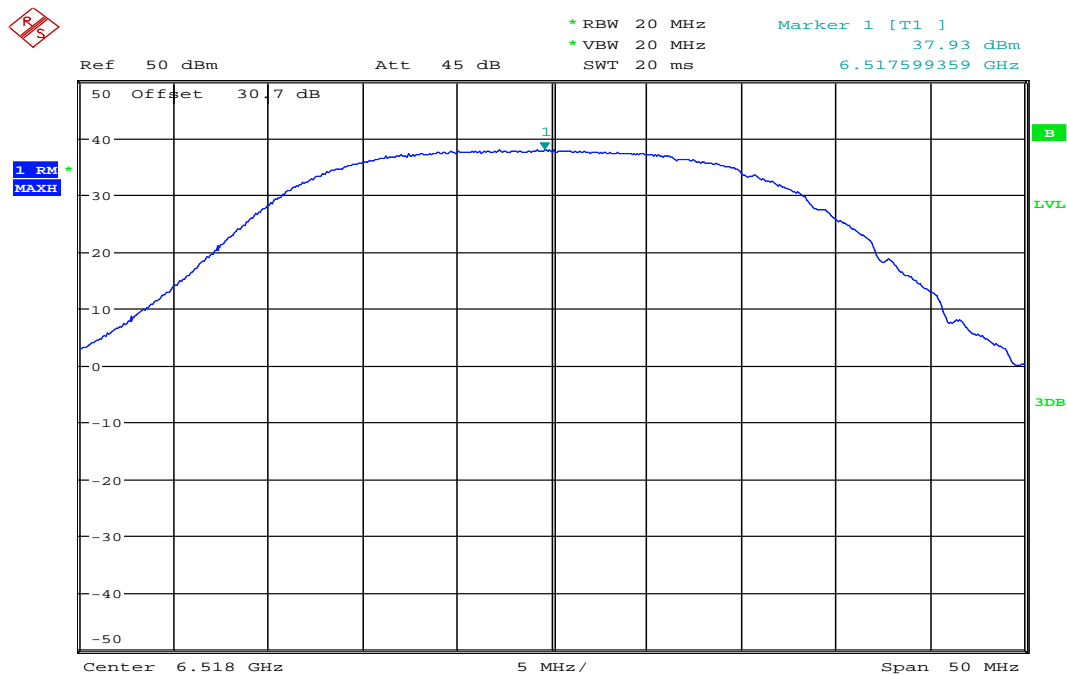
Date: 22.JUN.2011 16:15:36

Plot 16: RMS RF output power 6519 MHz / 6 MHz (conducted)



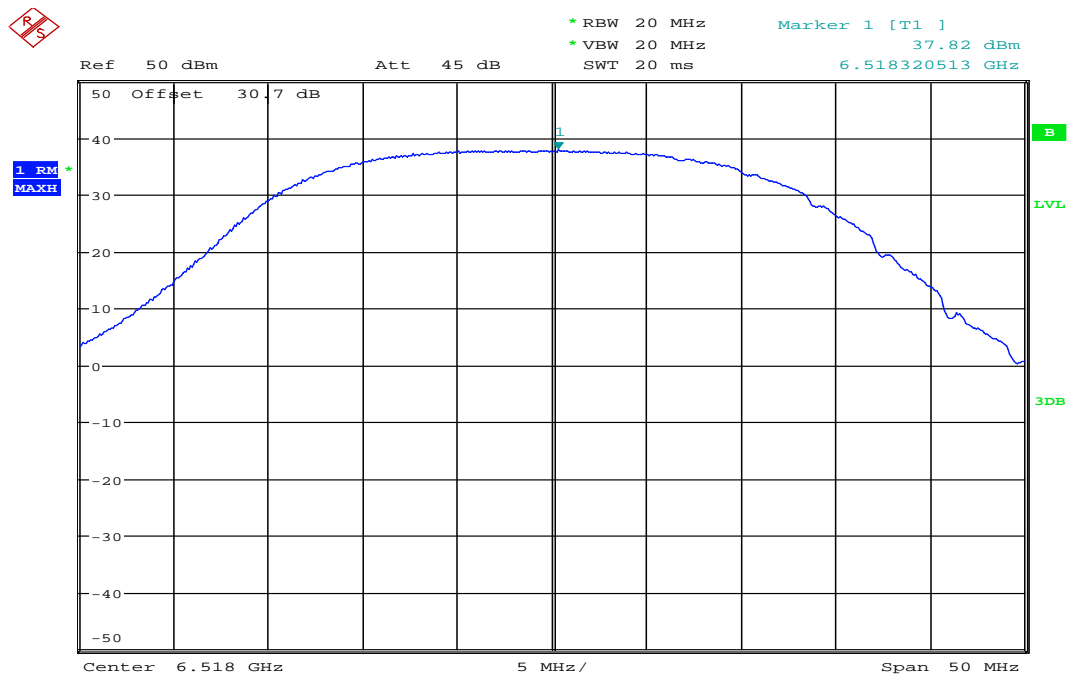
Date: 22.JUN.2011 17:56:35

Plot 17: RMS RF output power 6518 MHz / 7 MHz (conducted)



Date: 22.JUN.2011 17:07:56

Plot 18: RMS RF output power 6518 MHz / 8 MHz (conducted)



Date: 22.JUN.2011 17:36:06

4.5 RF output power (radiated)**§2.1046 / § 74.636(a)****Bandwidth 6 MHz**

| TEST CONDITIONS | | | MAXIMUM EIRP (dBm) | | |
|-------------------------|---------------------------|------|--------------------|------|------|
| Frequency (MHz) | | | 6431 | 6475 | 6519 |
| T _{nom} 23 °C | V _{nom} 28.0 Vdc | Peak | 50.8 | 50.5 | 50.4 |
| | | RMS | 44.8 | 44.3 | 44.1 |
| Measurement uncertainty | | | ±1dB | | |

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

| TEST CONDITIONS | | | MAXIMUM EIRP (dBm) | | |
|-------------------------|---------------------------|------|--------------------|------|------|
| Frequency (MHz) | | | 6432 | 6475 | 6518 |
| T _{nom} 23 °C | V _{nom} 28.0 Vdc | Peak | 50.8 | 50.6 | 50.2 |
| | | RMS | 44.5 | 44.2 | 43.9 |
| Measurement uncertainty | | | ±1dB | | |

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

| TEST CONDITIONS | | | MAXIMUM EIRP (dBm) | | |
|-------------------------|---------------------------|------|--------------------|------|------|
| Frequency (MHz) | | | 6432 | 6475 | 6518 |
| T _{nom} 23 °C | V _{nom} 28.0 Vdc | Peak | 50.9 | 50.6 | 50.3 |
| | | RMS | 44.7 | 44.1 | 43.8 |
| Measurement uncertainty | | | ±1dB | | |

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

The radiated RF output power (EIRP) was calculated based on the values of the conducted peak output power plus an antenna gain of 6 dBi as specified by the manufacturer / applicant. (see antenna data sheet).

Limit according to §74.636(a):

| | |
|-----------------------------------|---|
| Under normal test conditions only | For the frequency band 6425 to 6525 MHz: Maximum allowable EIRP: 35.0 dBW / 65.0 dBm |
|-----------------------------------|---|

Results: The measurement is passed.

4.6 Occupied bandwidth

§2.1049 / §74.637 (g)

Bandwidth 6 MHz

| TEST CONDITIONS | | | OCCUPIED BANDWIDTH (MHz) | | |
|-------------------------|------------------|-----|--|--|--|
| Frequency (MHz) | | | 6431 | 6475 | 6519 |
| T _{nom} | V _{nom} | Max | QPSK: 5.75 MHz 16QAM: 5.76 MHz 64QAM: 5.75 MHz | QPSK: 5.77 MHz 16QAM: 5.77 MHz 64QAM: 5.74 MHz | QPSK: 5.75 MHz 16QAM: 5.75 MHz 64QAM: 5.75 MHz |
| Measurement uncertainty | | | ± 10 kHz | | |

RBW / VBW: 30 kHz

Bandwidth 7 MHz

| TEST CONDITIONS | | | OCCUPIED BANDWIDTH (MHz) | | |
|-------------------------|------------------|-----|--|--|--|
| Frequency (MHz) | | | 6432 | 6475 | 6518 |
| T _{nom} | V _{nom} | Max | QPSK: 6.68 MHz 16QAM: 6.68 MHz 64QAM: 6.68 MHz | QPSK: 6.68 MHz 16QAM: 6.68 MHz 64QAM: 6.68 MHz | QPSK: 6.67 MHz 16QAM: 6.68 MHz 64QAM: 6.68 MHz |
| Measurement uncertainty | | | ± 10 kHz | | |

RBW / VBW: 30 kHz

Bandwidth 8 MHz

| TEST CONDITIONS | | | OCCUPIED BANDWIDTH (MHz) | | |
|-------------------------|------------------|-----|--|--|--|
| Frequency (MHz) | | | 6432 | 6475 | 6518 |
| T _{nom} | V _{nom} | Max | QPSK: 7.61 MHz 16QAM: 7.63 MHz 64QAM: 7.60 MHz | QPSK: 7.63 MHz 16QAM: 7.63 MHz 64QAM: 7.63 MHz | QPSK: 7.61 MHz 16QAM: 7.61 MHz 64QAM: 7.61 MHz |
| Measurement uncertainty | | | ± 10 kHz | | |

RBW / VBW: 30 kHz

Remark:

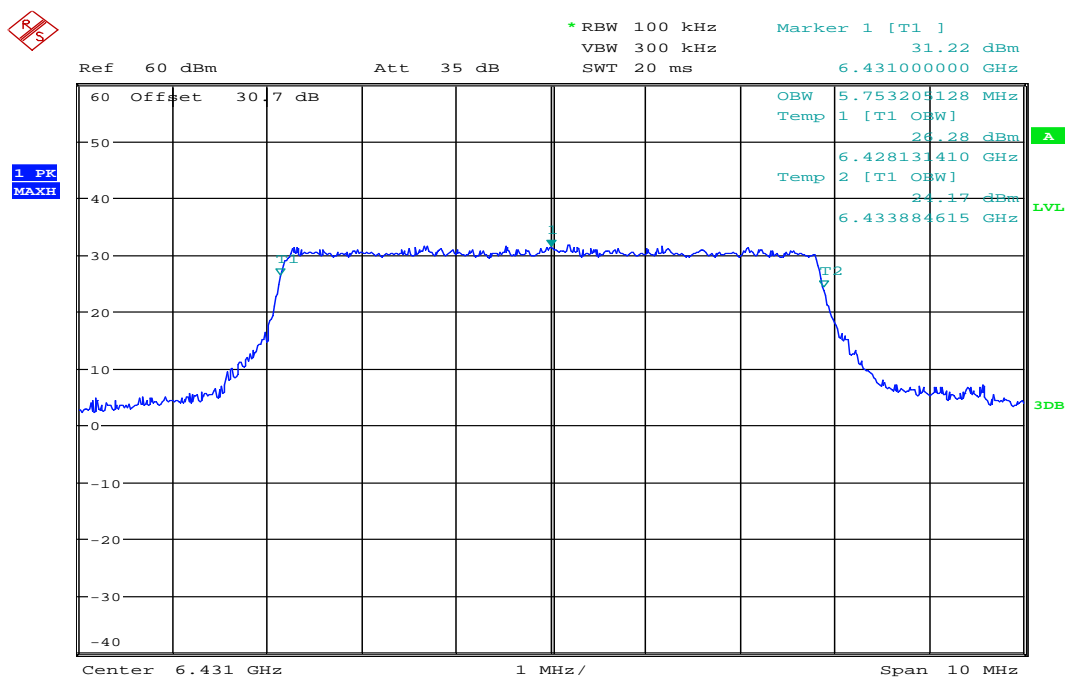
The internal function of the spectrum analyzer was used to determine the occupied bandwidth (99%).

Limit according to §74.637(g):

| | |
|-----------------------------------|--|
| Under normal test conditions only | For the frequency band 6425 to 6525 MHz: Maximum authorized bandwidth: 25 MHz |
|-----------------------------------|--|

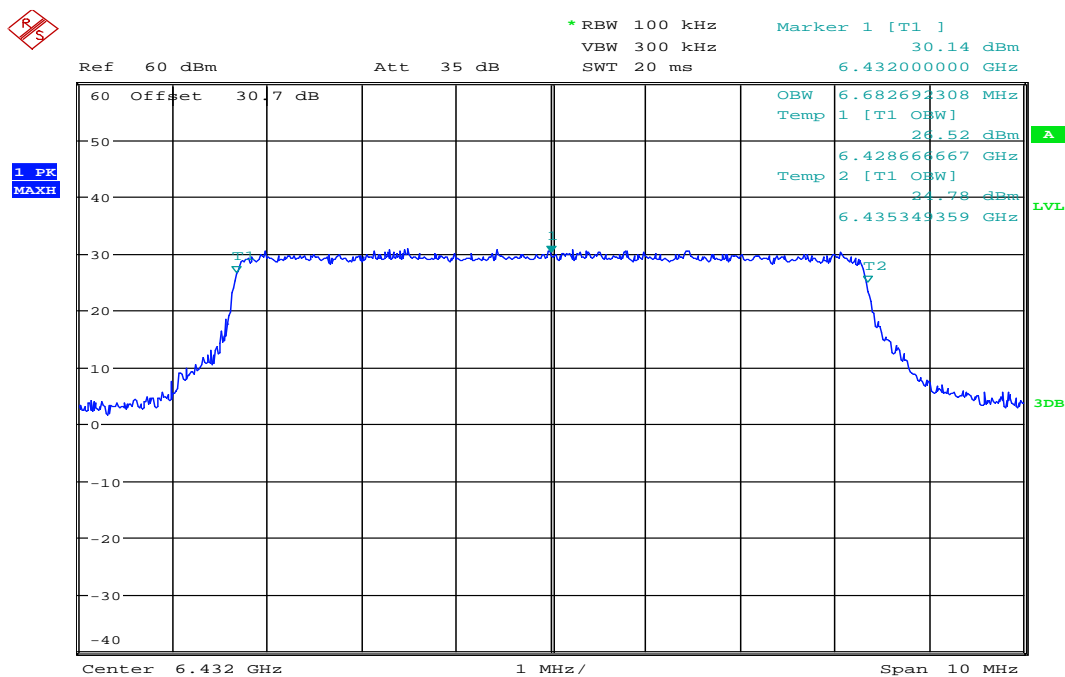
Results: The measurement is passed.

Plot 19: Occupied bandwidth 6431 MHz / 6 MHz QPSK



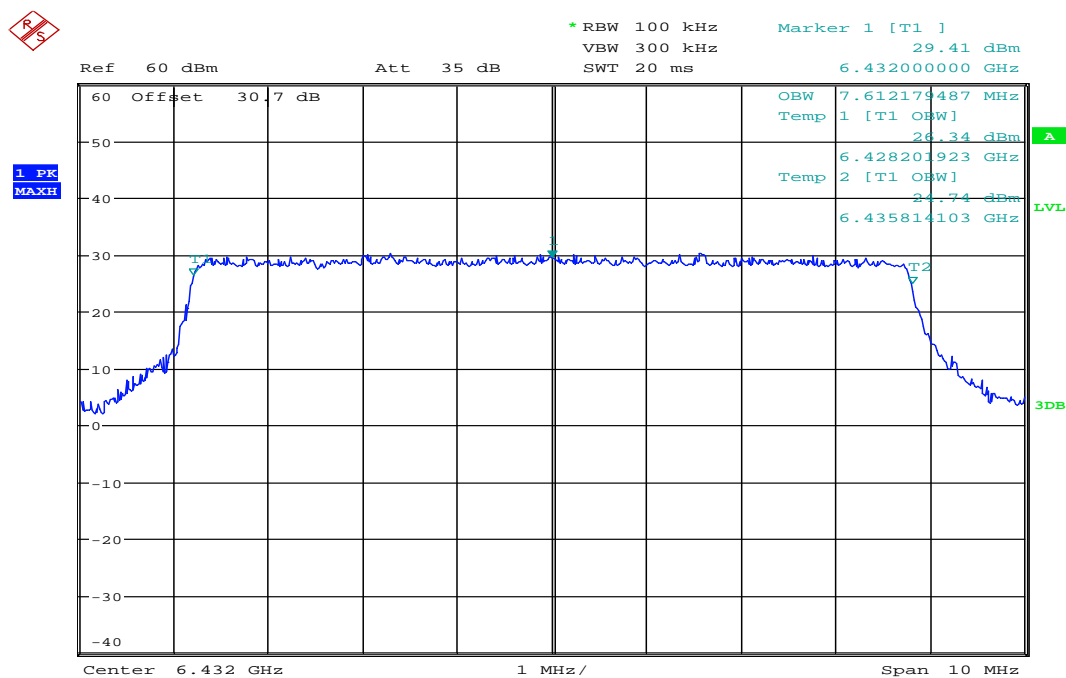
Date: 22.JUN.2011 15:03:43

Plot 20: Occupied bandwidth 6432 MHz / 7 MHz QPSK



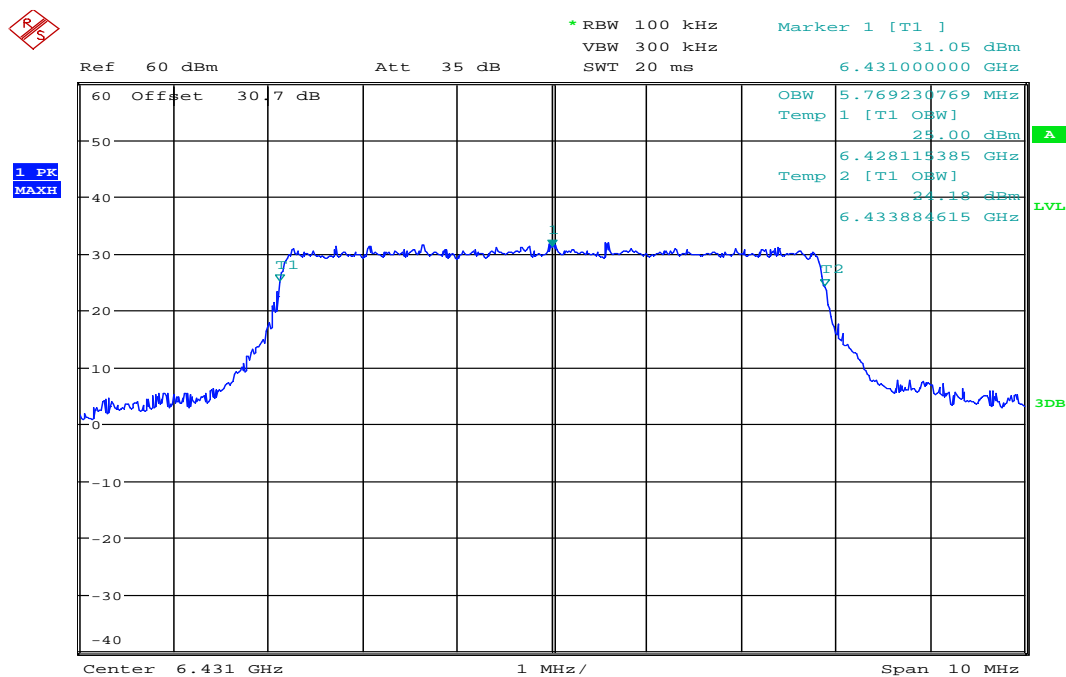
Date: 22.JUN.2011 15:28:27

Plot 21: Occupied bandwidth 6432 MHz / 8 MHz QPSK



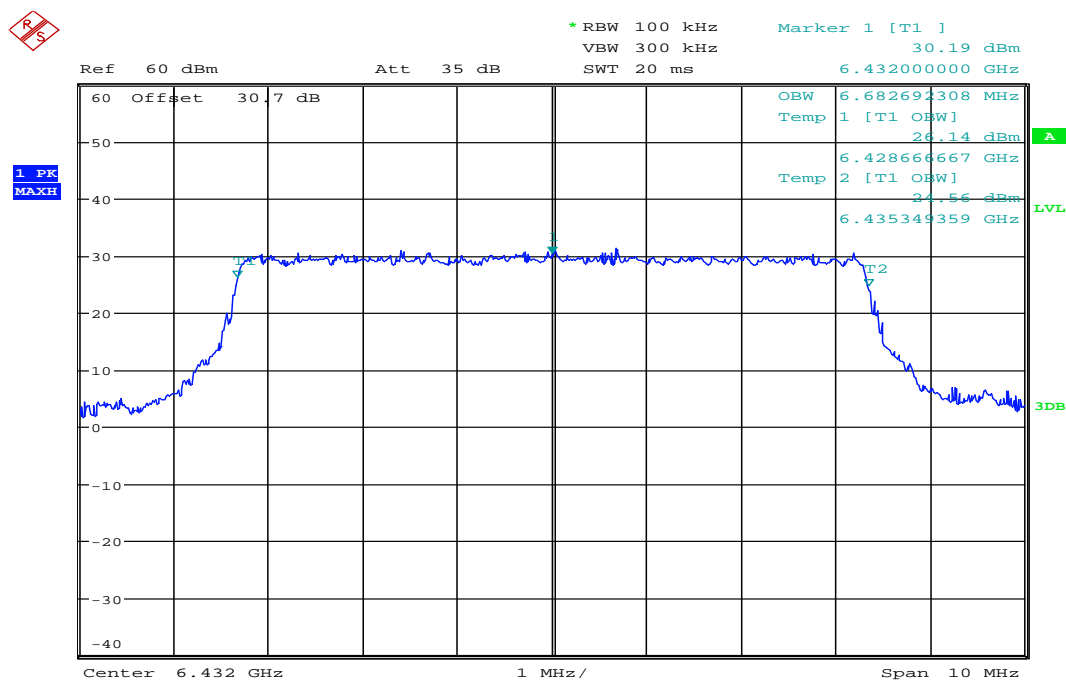
Date: 22.JUN.2011 15:35:08

Plot 22: Occupied bandwidth 6431 MHz / 6 MHz 16QAM



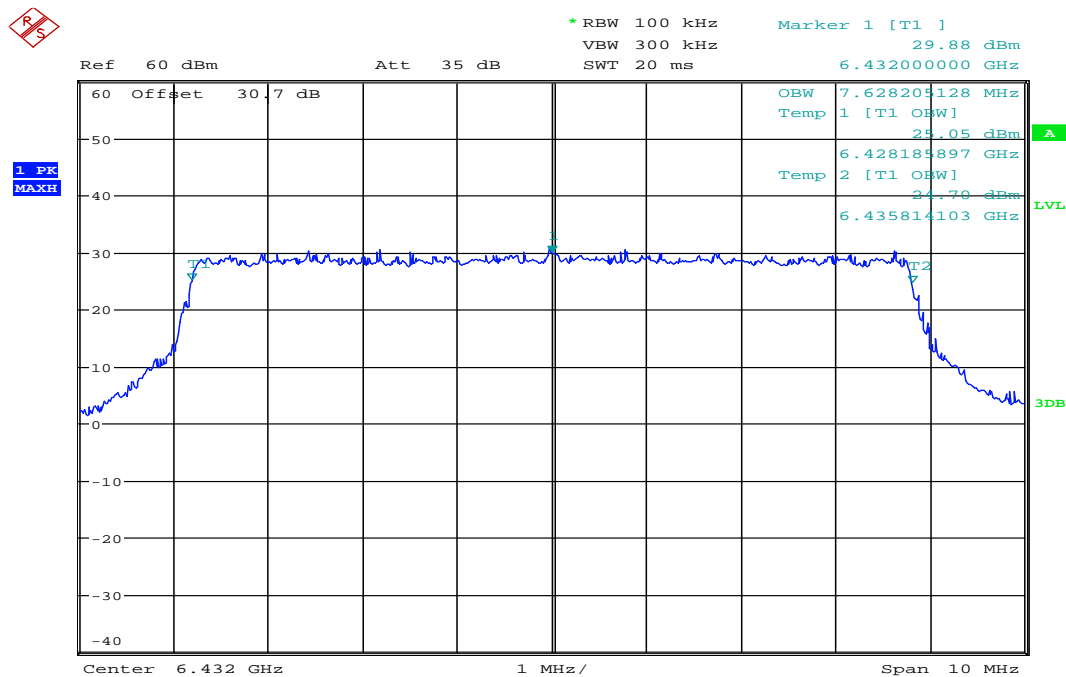
Date: 22.JUN.2011 15:07:20

Plot 23: Occupied bandwidth 6432 MHz / 7 MHz 16QAM



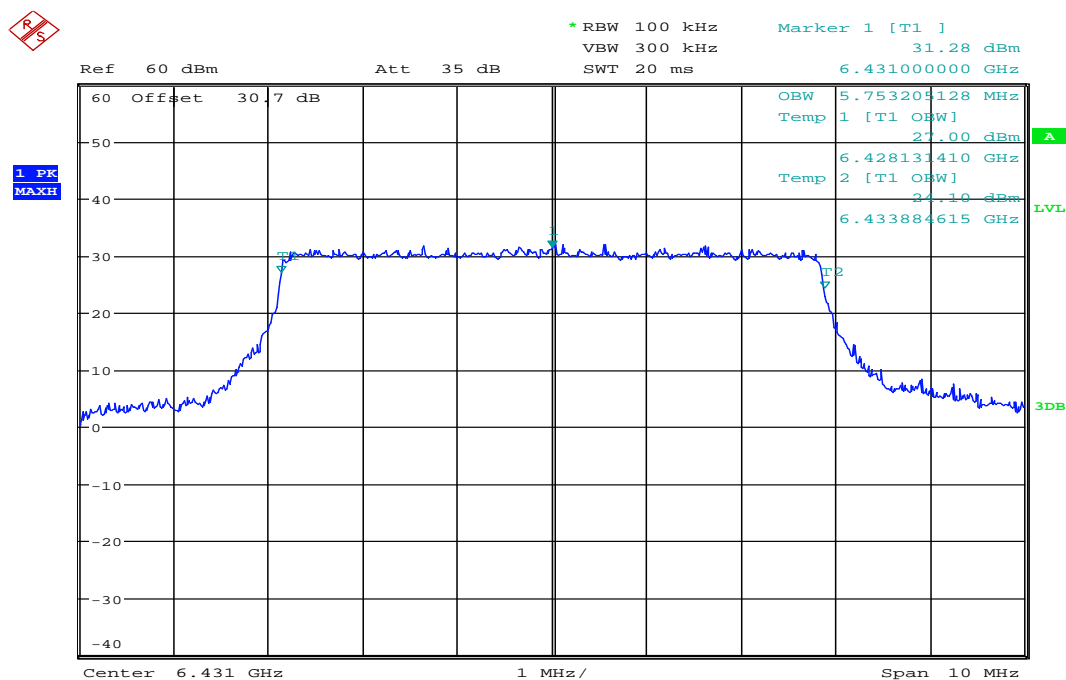
Date: 22.JUN.2011 15:27:01

Plot 24: Occupied bandwidth 6432 MHz / 8 MHz 16QAM



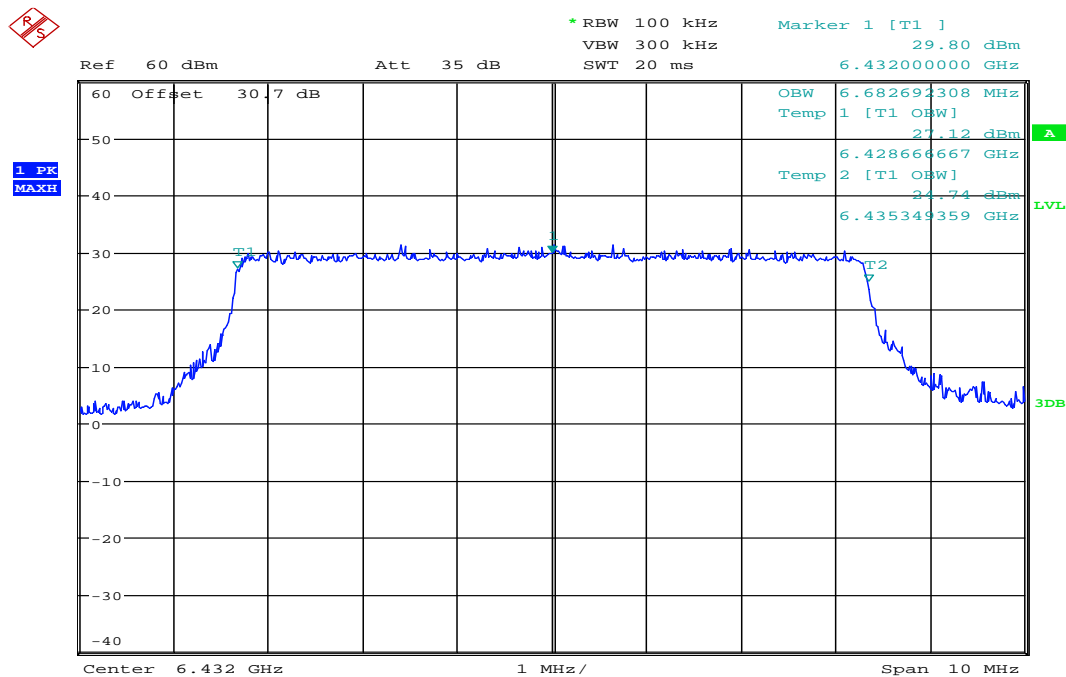
Date: 22.JUN.2011 15:36:22

Plot 25: Occupied bandwidth 6431 MHz / 6 MHz 64QAM



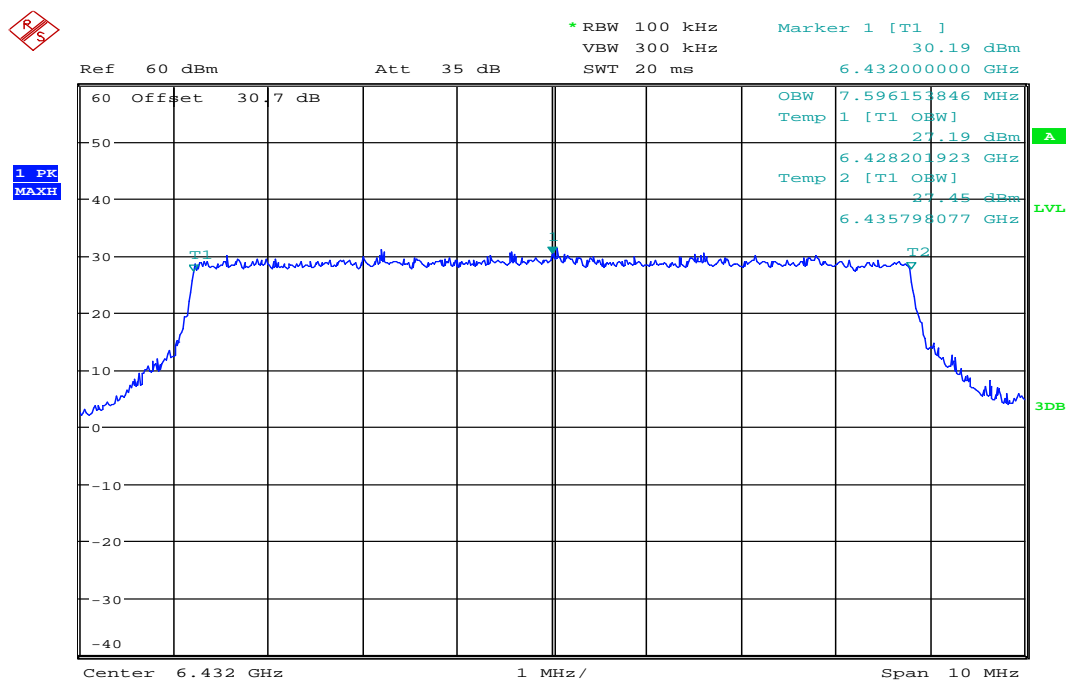
Date: 22.JUN.2011 15:12:48

Plot 26: Occupied bandwidth 6432 MHz / 7 MHz 64QAM



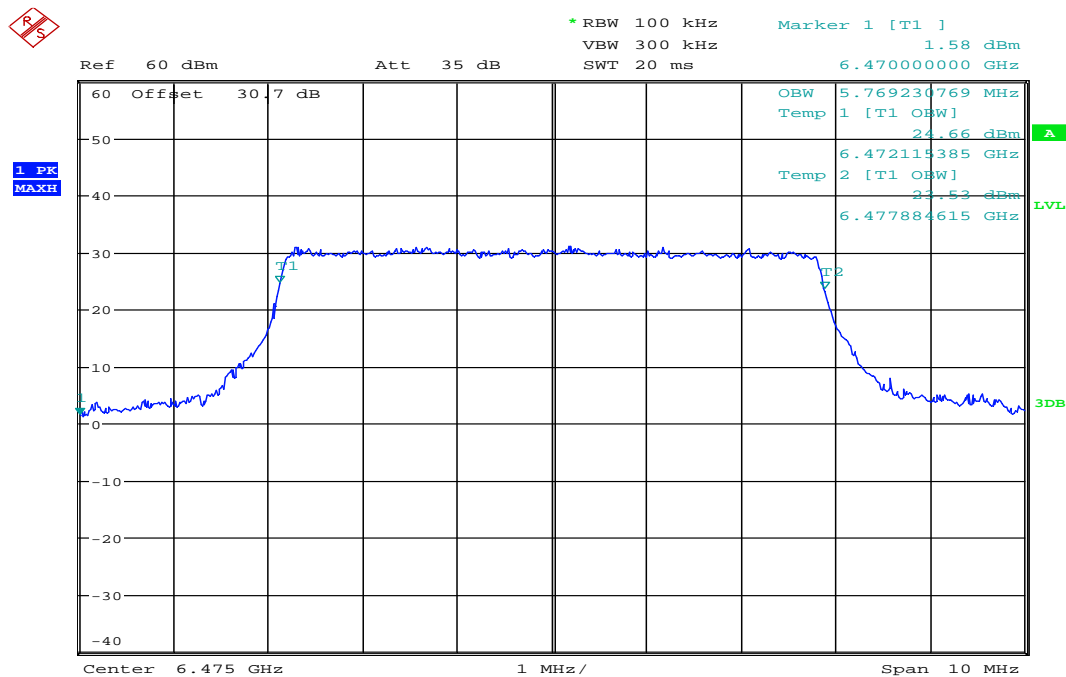
Date: 22.JUN.2011 15:21:13

Plot 27: Occupied bandwidth 6432 MHz / 8 MHz 64QAM



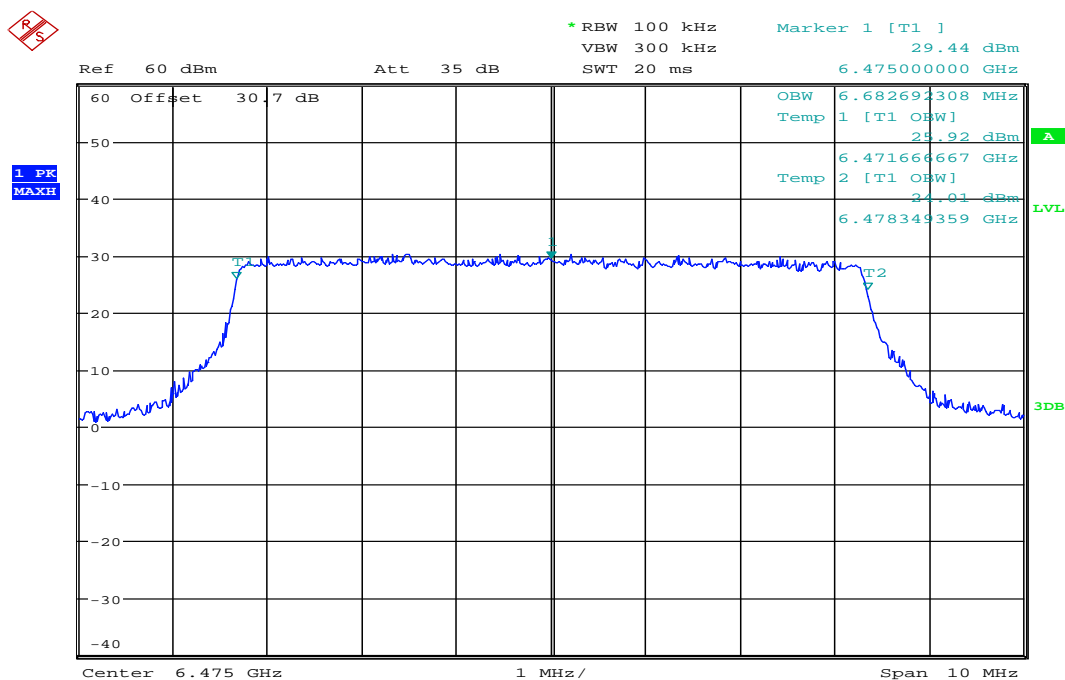
Date: 22.JUN.2011 15:43:02

Plot 28: Occupied bandwidth 6475 MHz / 6 MHz QPSK



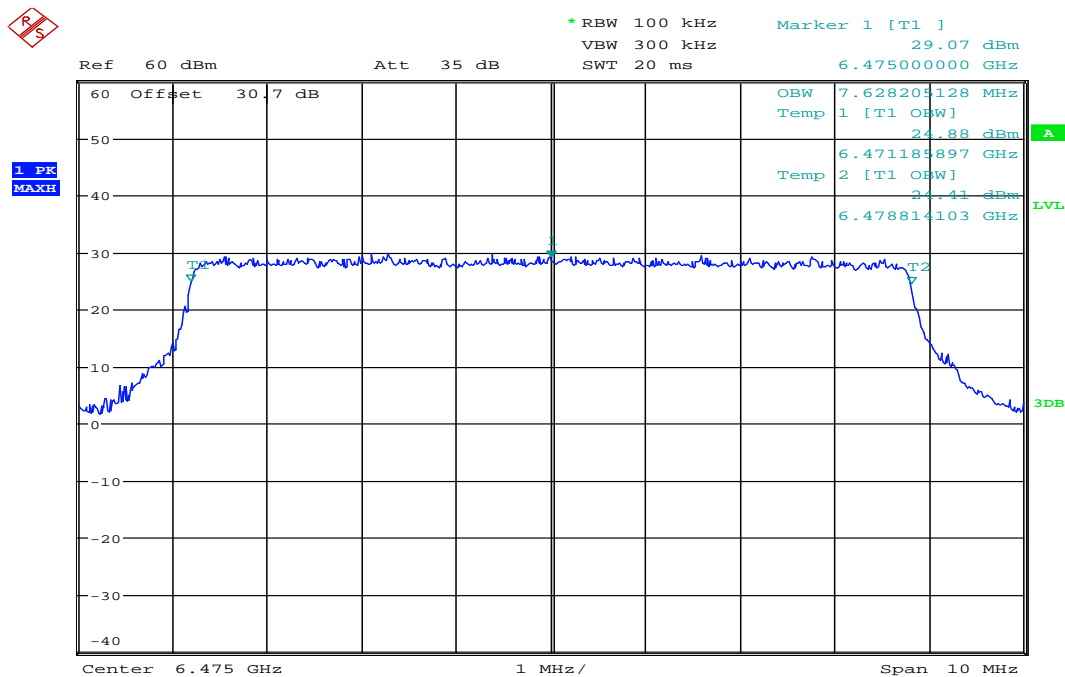
Date: 22.JUN.2011 15:48:30

Plot 29: Occupied bandwidth 6475 MHz / 7 MHz QPSK



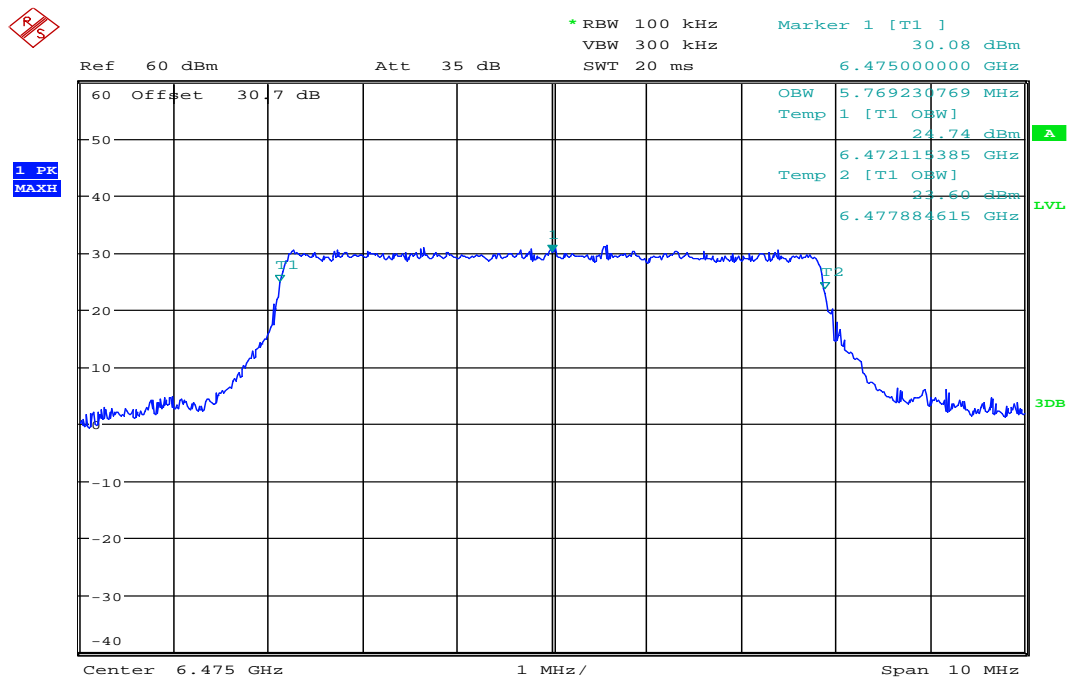
Date: 22.JUN.2011 16:02:27

Plot 30: Occupied bandwidth 6475 MHz / 8 MHz QPSK



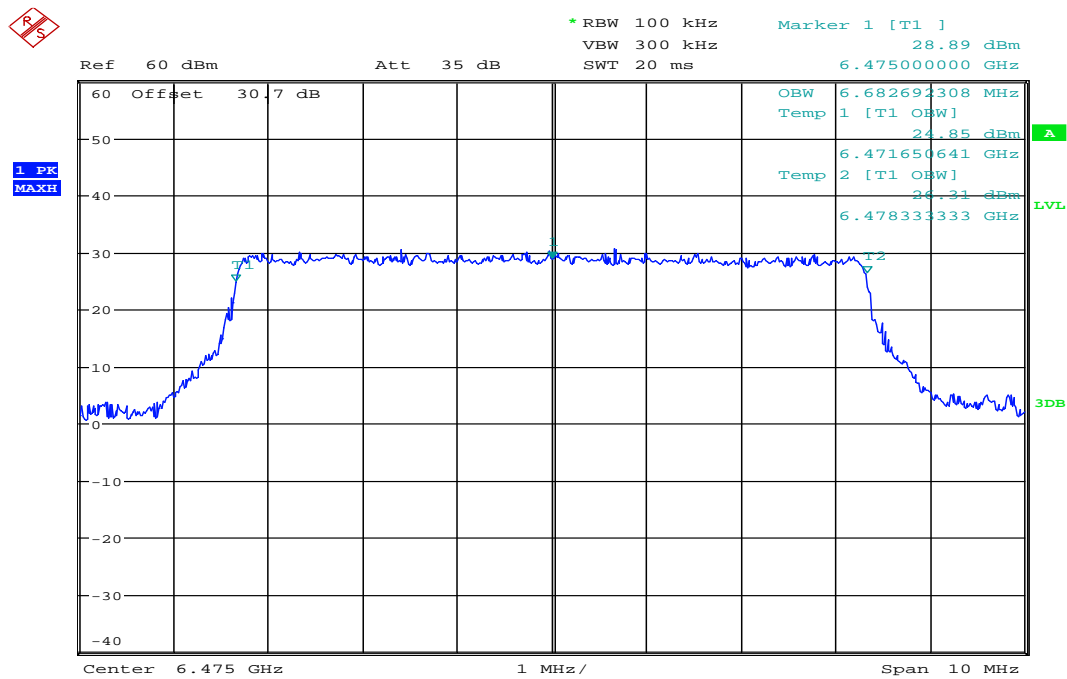
Date: 22.JUN.2011 16:25:40

Plot 31: Occupied bandwidth 6475 MHz / 6 MHz 16QAM



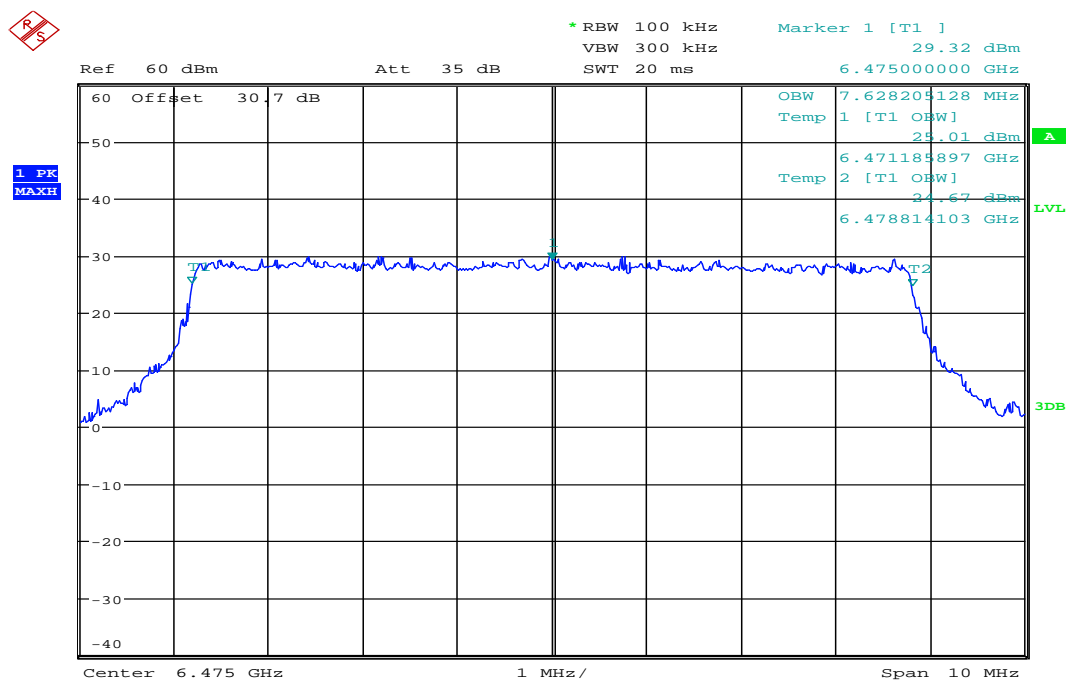
Date: 22.JUN.2011 15:49:37

Plot 32: Occupied bandwidth 6475 MHz / 7 MHz 16QAM



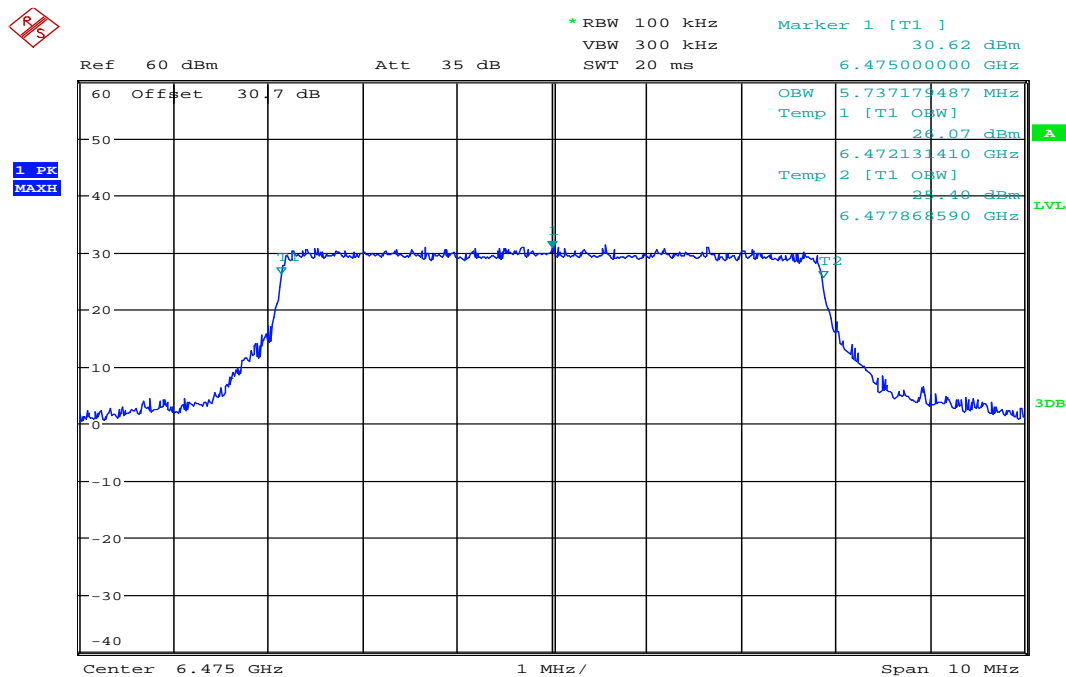
Date: 22.JUN.2011 16:03:23

Plot 33: Occupied bandwidth 6475 MHz / 8 MHz 16QAM



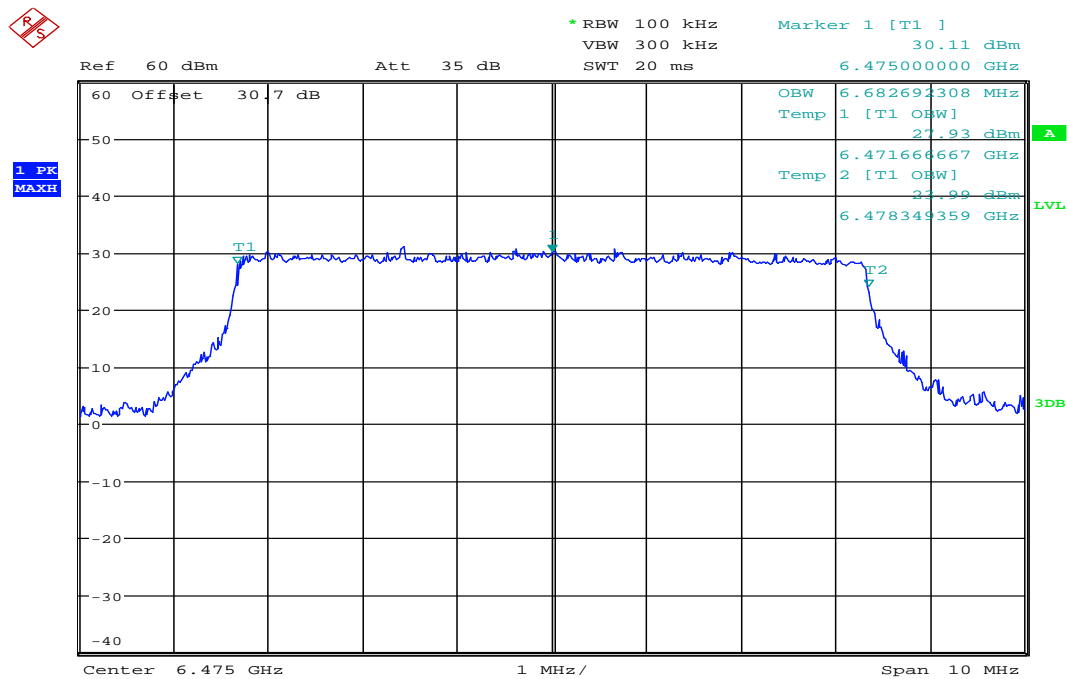
Date: 22.JUN.2011 16:24:44

Plot 34: Occupied bandwidth 6475 MHz / 6 MHz 64QAM



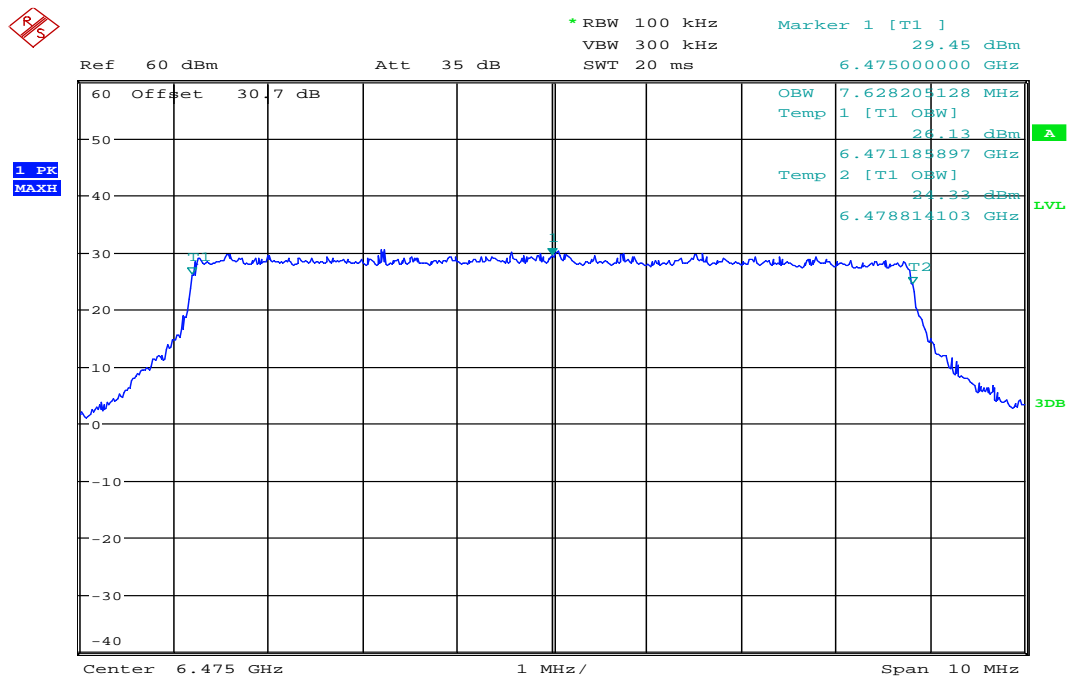
Date: 22.JUN.2011 15:50:42

Plot 35: Occupied bandwidth 6475 MHz / 7 MHz 64QAM



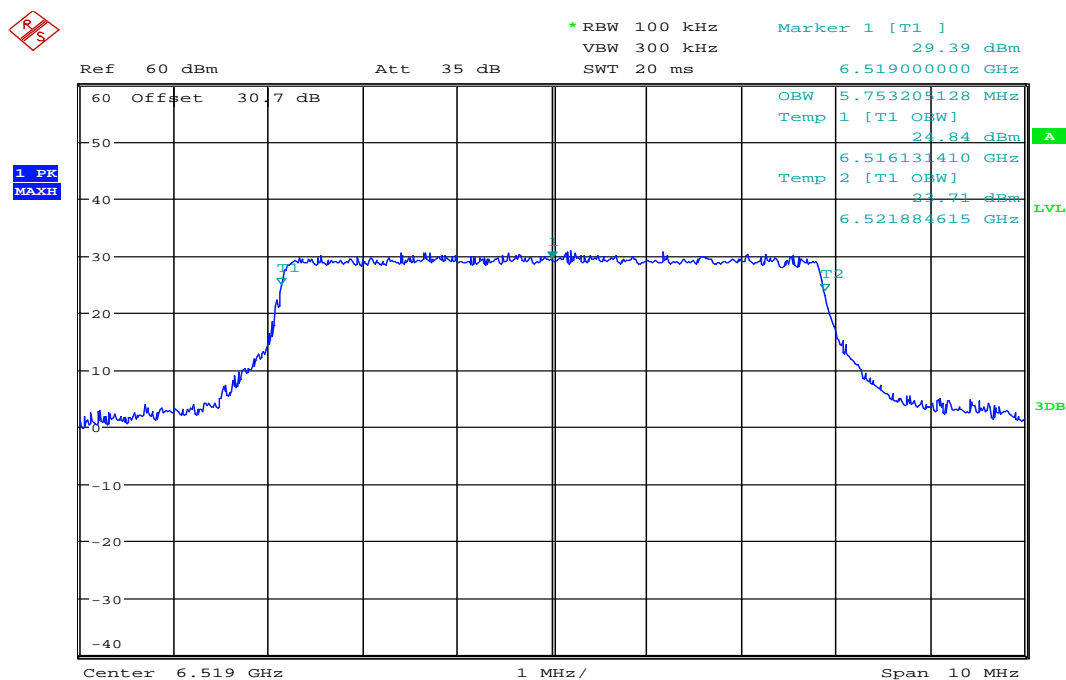
Date: 22.JUN.2011 16:11:41

Plot 36: Occupied bandwidth 6475 MHz / 8 MHz 64QAM



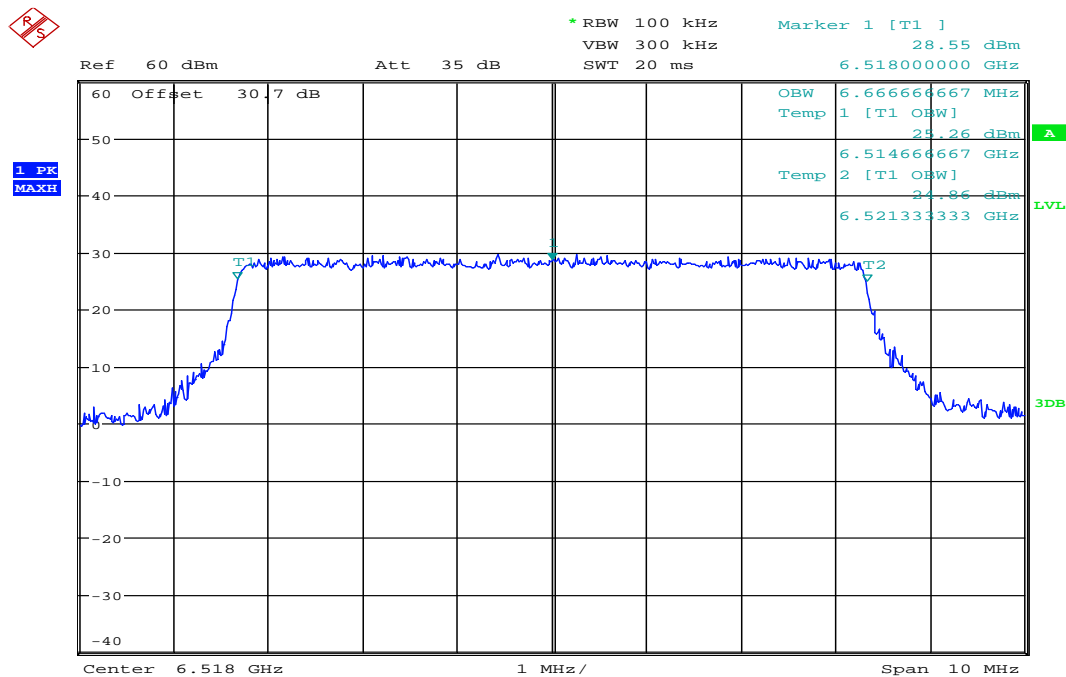
Date: 22.JUN.2011 16:13:26

Plot 37: Occupied bandwidth 6519 MHz / 6 MHz QPSK



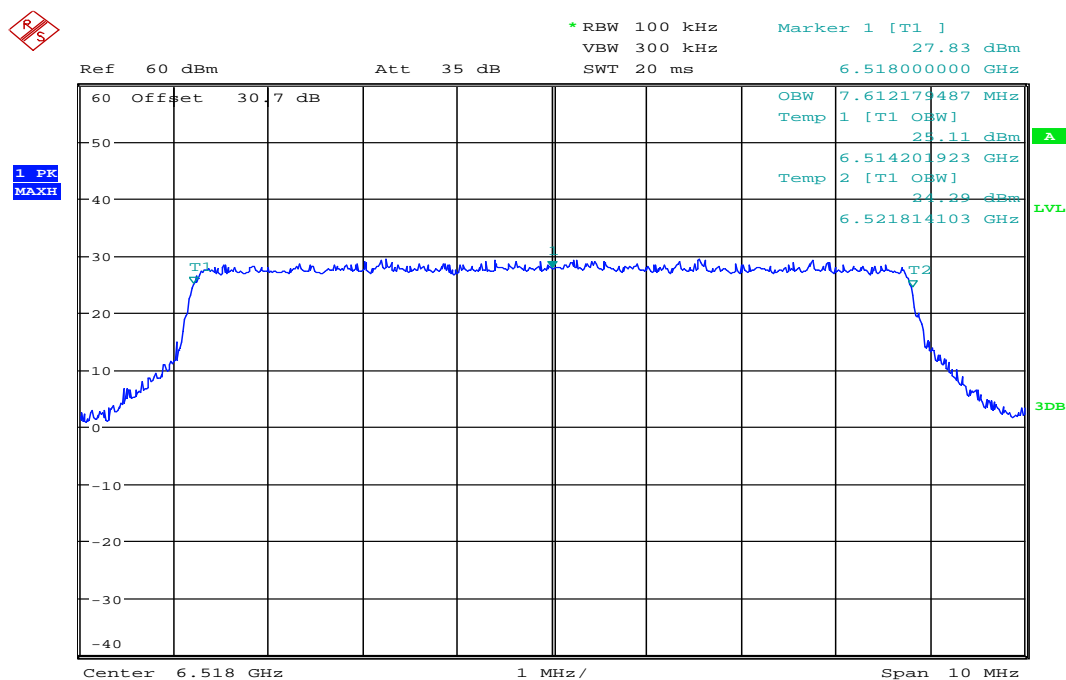
Date: 22.JUN.2011 16:33:34

Plot 38: Occupied bandwidth 6518 MHz / 7 MHz QPSK



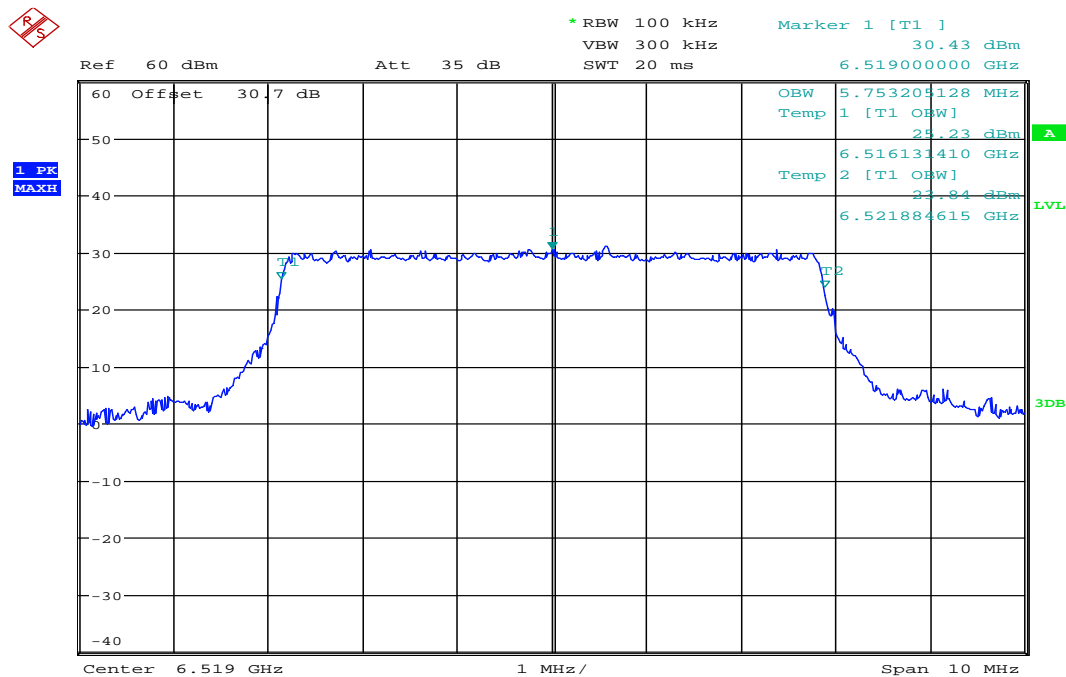
Date: 22.JUN.2011 16:52:07

Plot 39: Occupied bandwidth 6518 MHz / 8 MHz QPSK



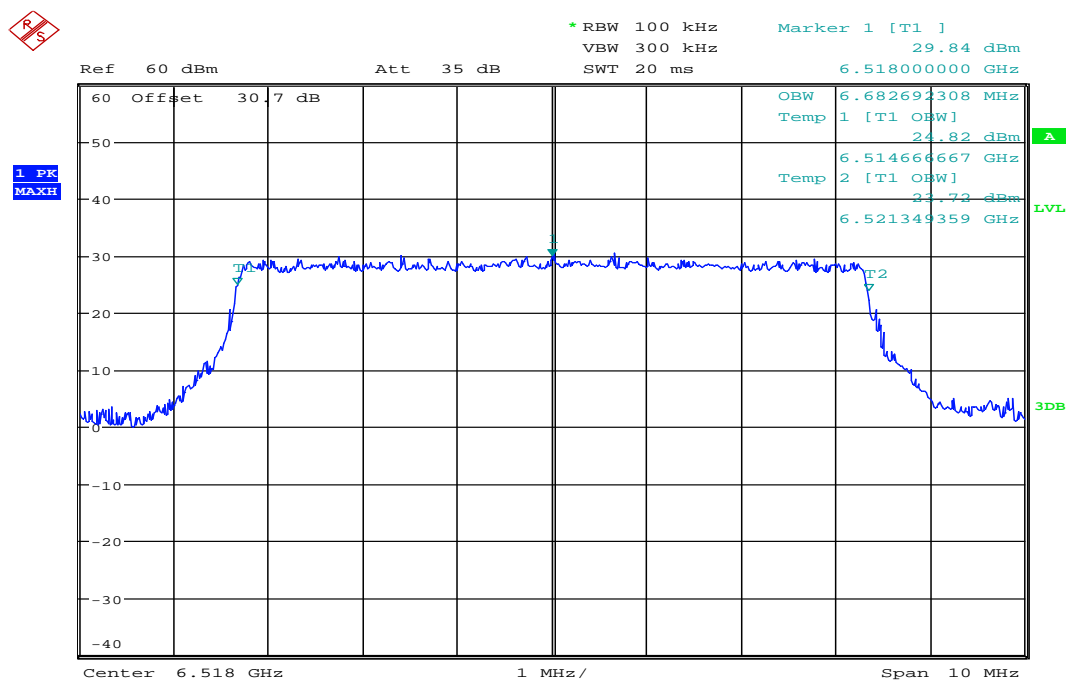
Date: 22.JUN.2011 17:28:59

Plot 40: Occupied bandwidth 6519 MHz / 6 MHz 16QAM



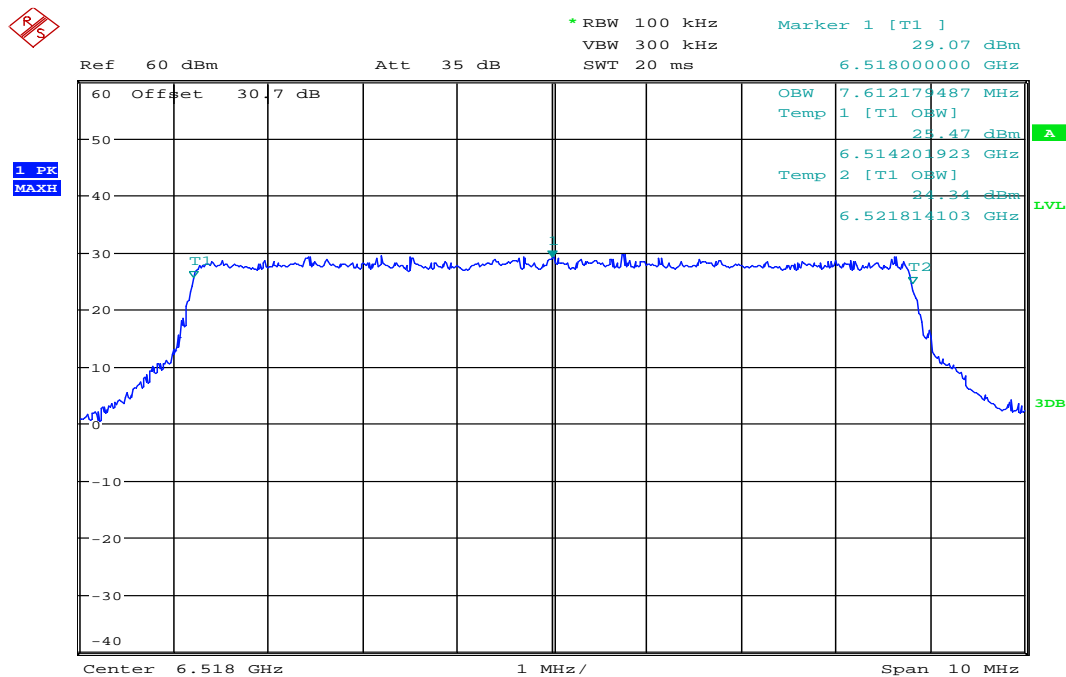
Date: 22.JUN.2011 16:35:11

Plot 41: Occupied bandwidth 6518 MHz / 7 MHz 16QAM



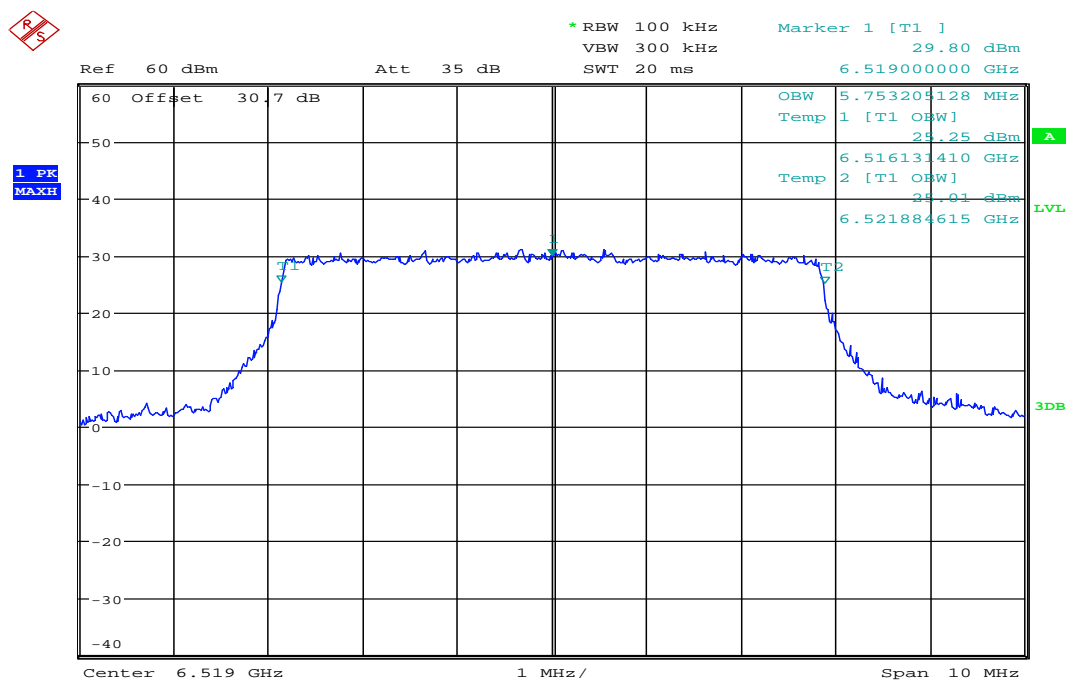
Date: 22.JUN.2011 17:05:41

Plot 42: Occupied bandwidth 6518 MHz / 8 MHz 16QAM



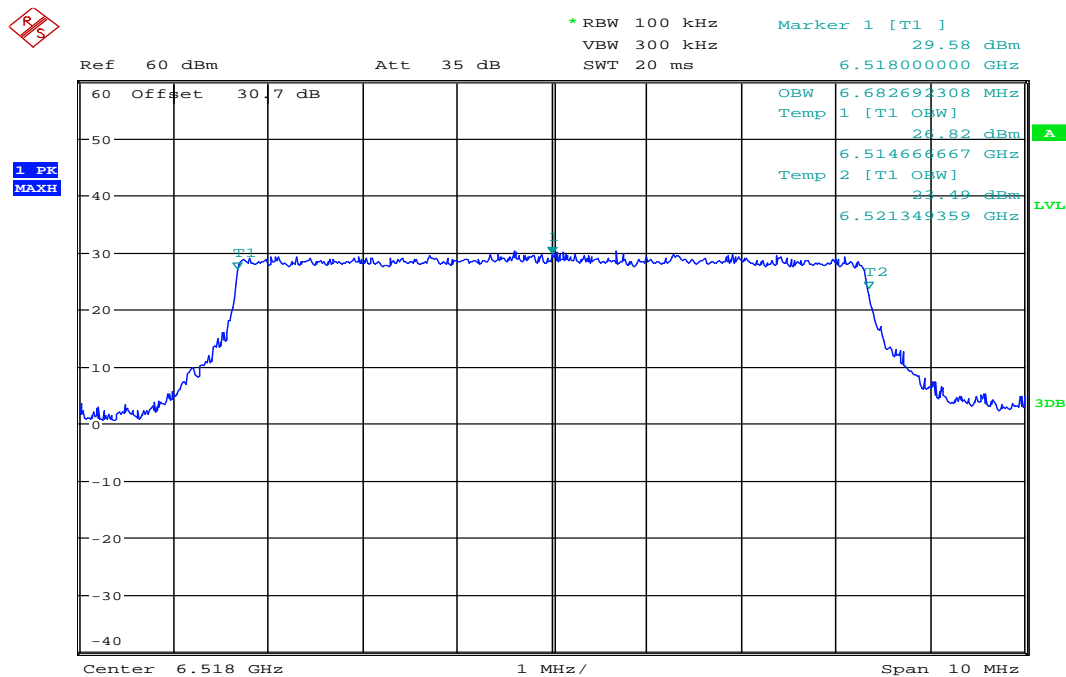
Date: 22.JUN.2011 17:33:08

Plot 43: Occupied bandwidth 6519 MHz / 6 MHz 64QAM



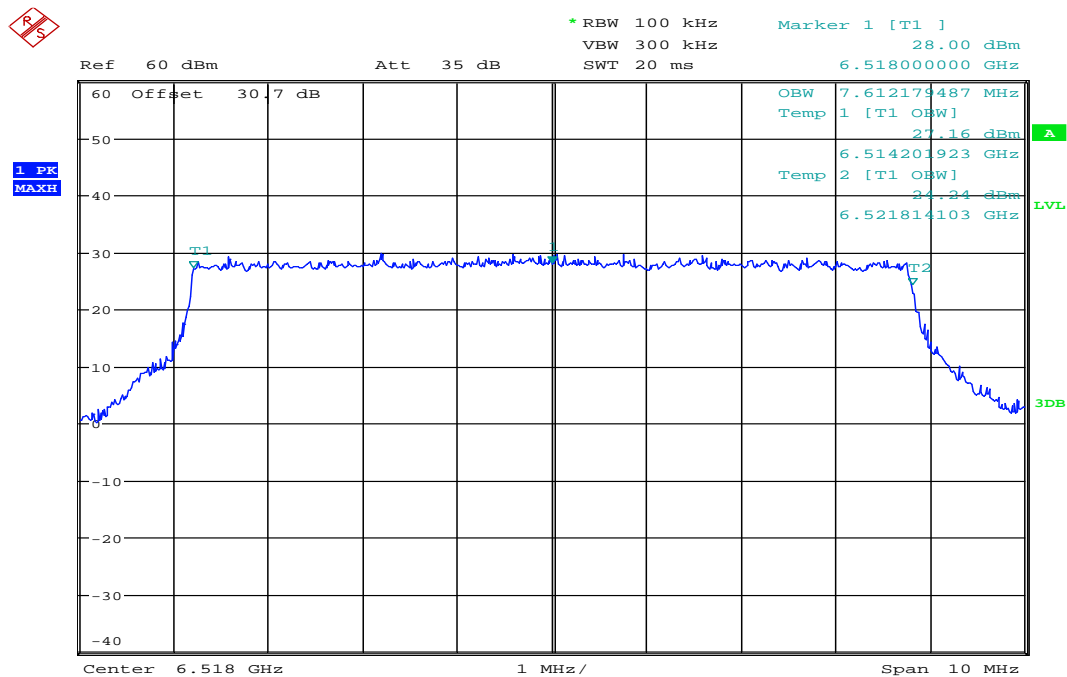
Date: 22.JUN.2011 16:43:08

Plot 44: Occupied bandwidth 6518 MHz / 7 MHz 64QAM



Date: 22.JUN.2011 17:06:51

Plot 45: Occupied bandwidth 6518 MHz / 8 MHz 64QAM



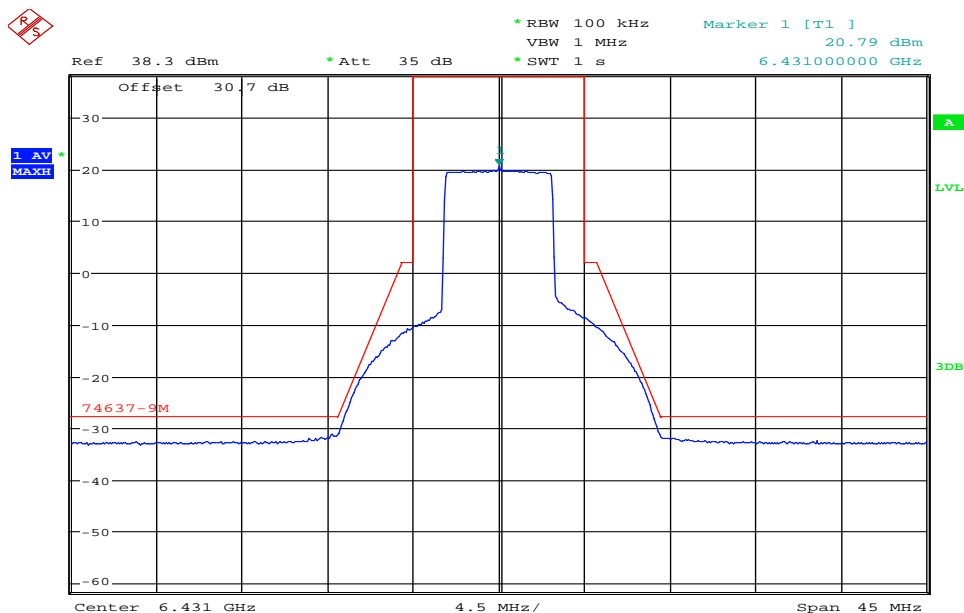
Date: 22.JUN.2011 17:34:11

4.7 Emission mask

§2.1051 / §74.637(a)(2)

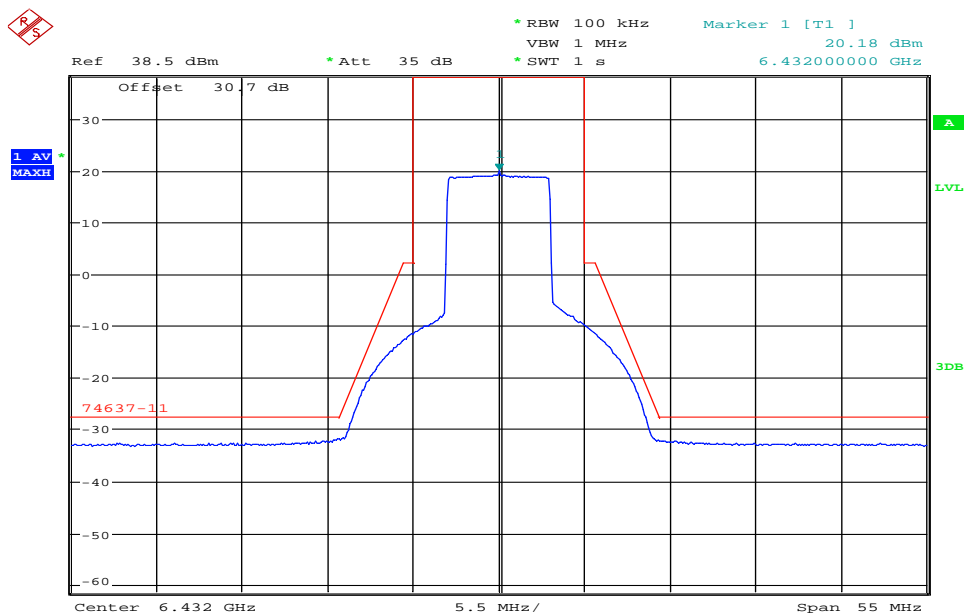
Measurement was done using the emission mask for using transmissions employing digital modulation techniques:

Plot 46: Emission mask 6431 MHz, 6 MHz / QPSK



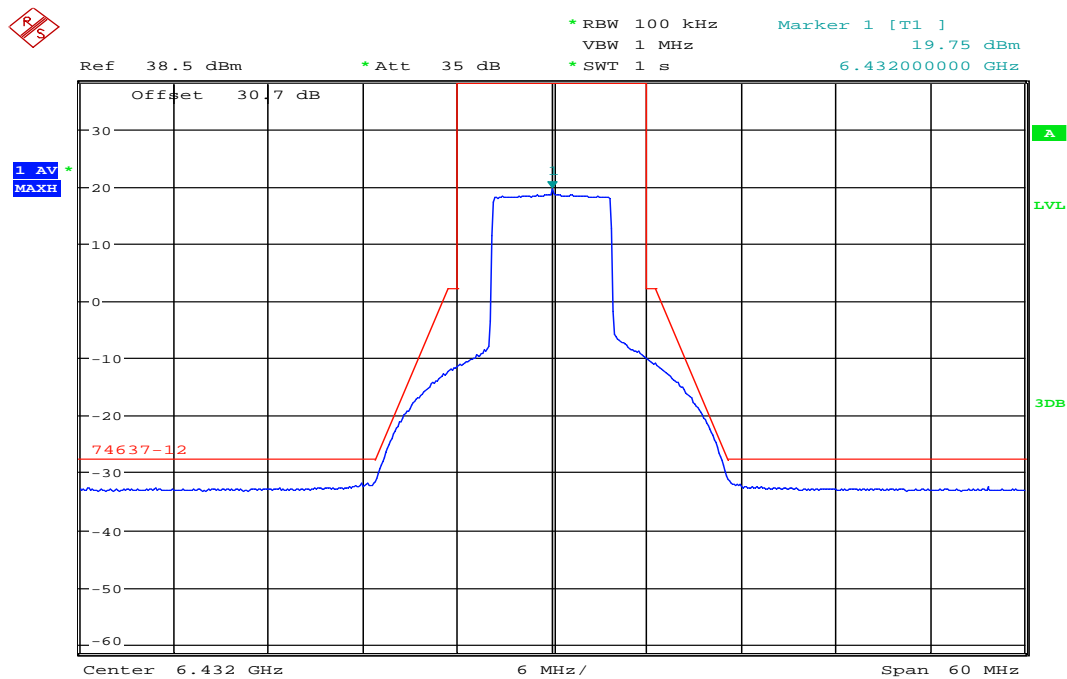
Date: 26.JUN.2011 18:05:19

Plot 47: Emission mask 6432 MHz, 7 MHz / QPSK



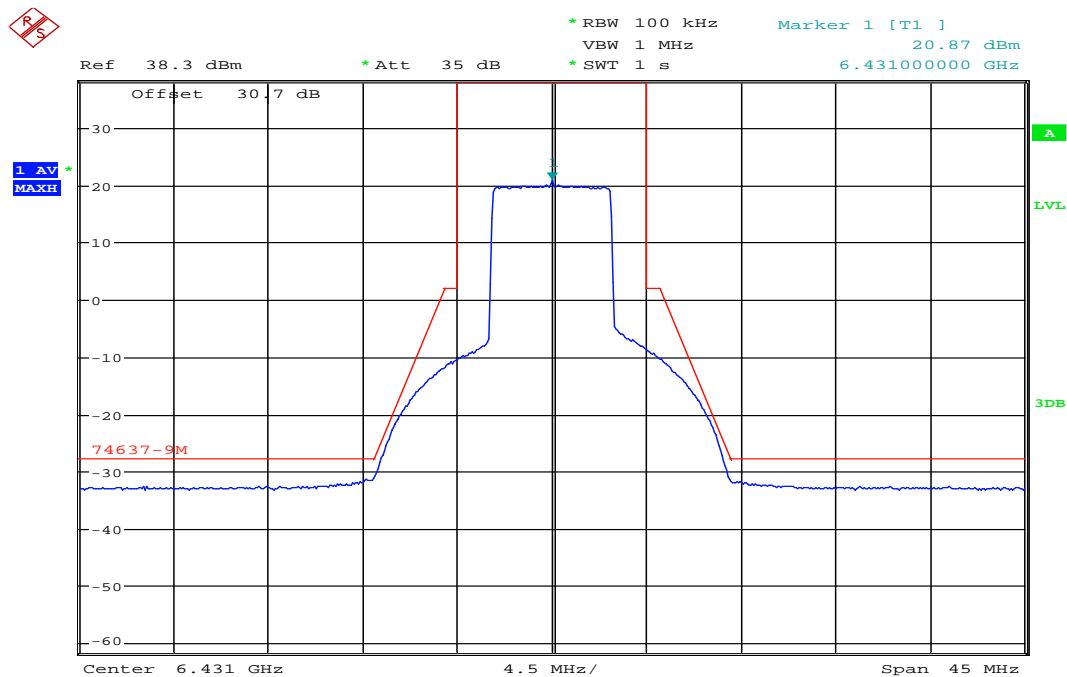
Date: 26.JUN.2011 18:19:35

Plot 48: Emission mask 6432 MHz, 8 MHz / QPSK



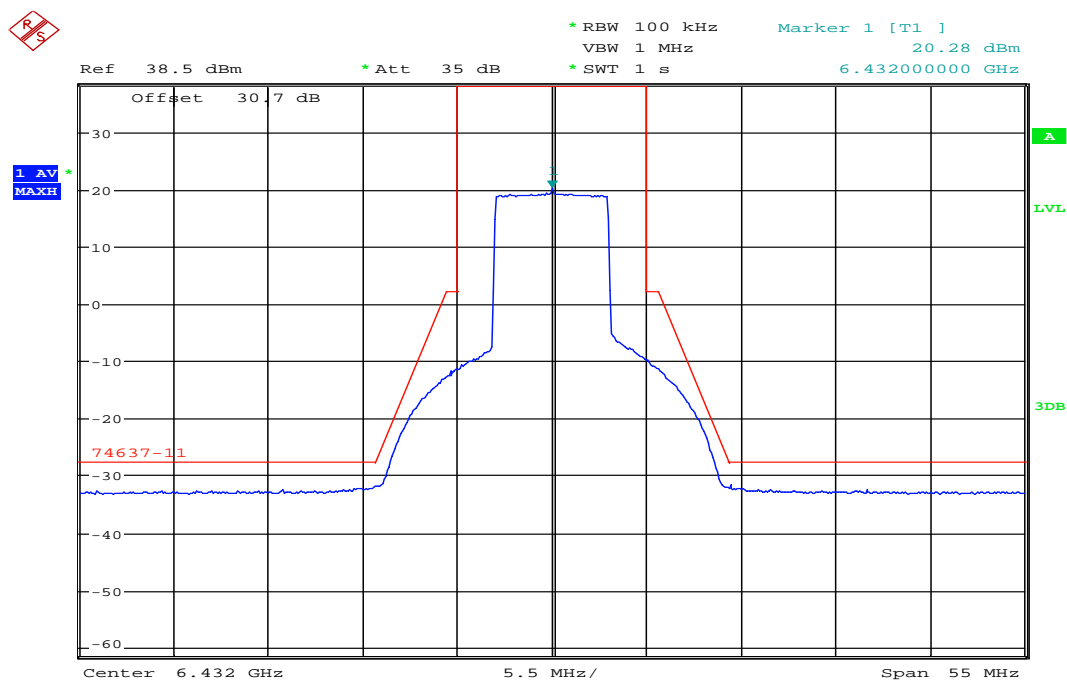
Date: 26.JUN.2011 18:34:56

Plot 49: Emission mask 6431 MHz, 6 MHz / 16QAM



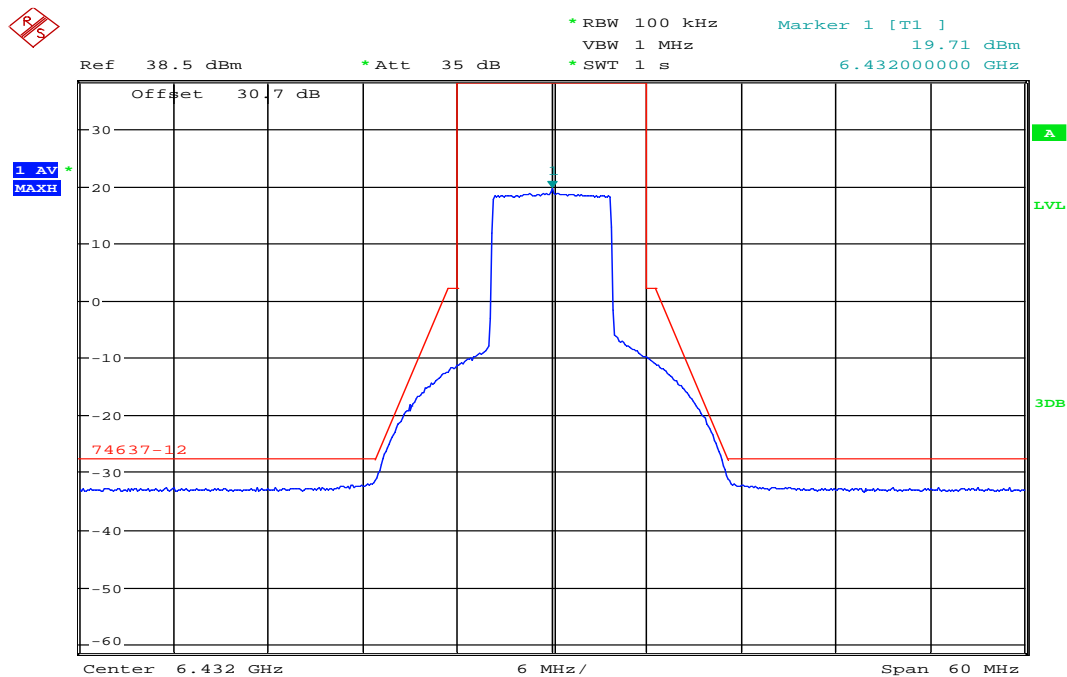
Date: 26.JUN.2011 18:06:53

Plot 50: Emission mask 6432 MHz, 7 MHz / 16QAM



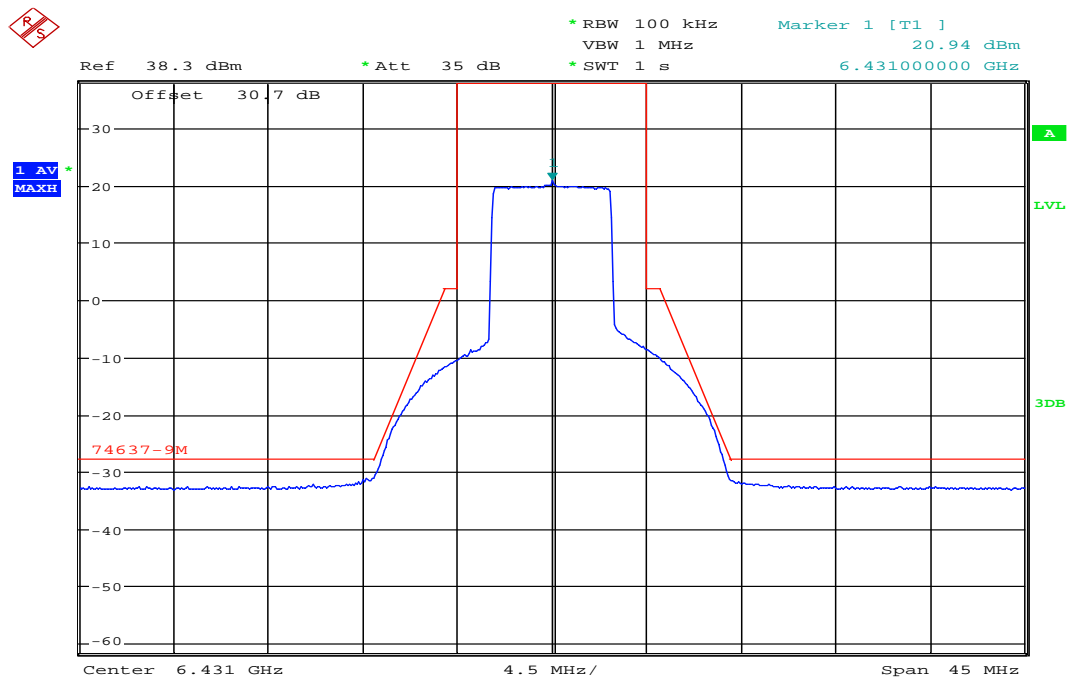
Date: 26.JUN.2011 18:21:04

Plot 51: Emission mask 6432 MHz, 8 MHz / 16QAM



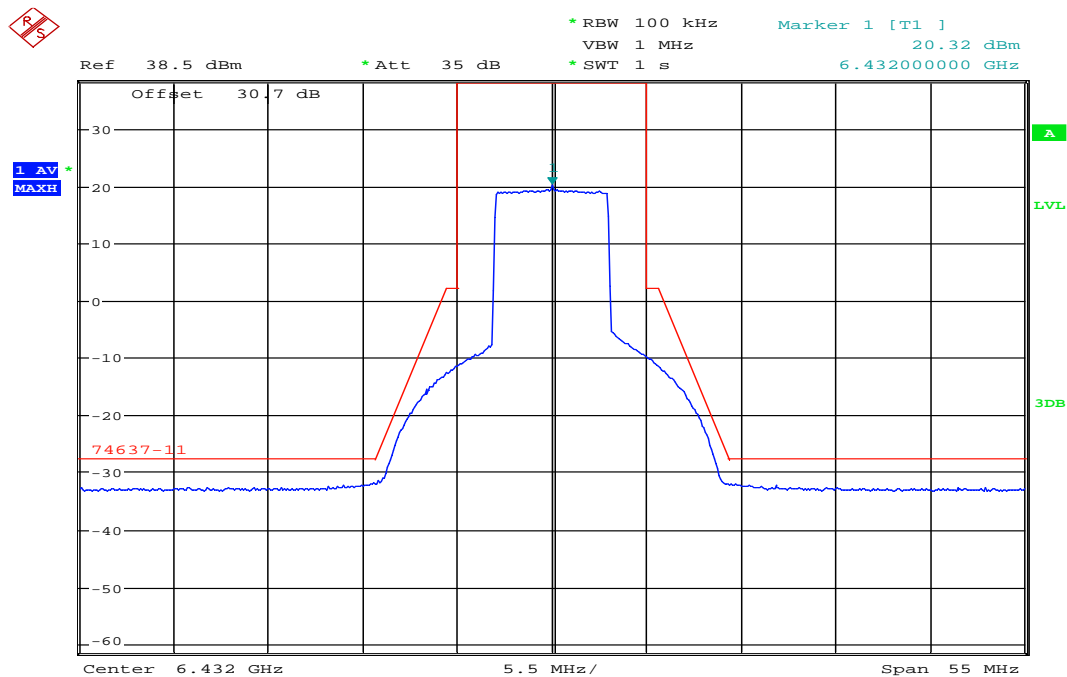
Date: 26.JUN.2011 18:35:43

Plot 52: Emission mask 6431 MHz, 6 MHz / 64QAM



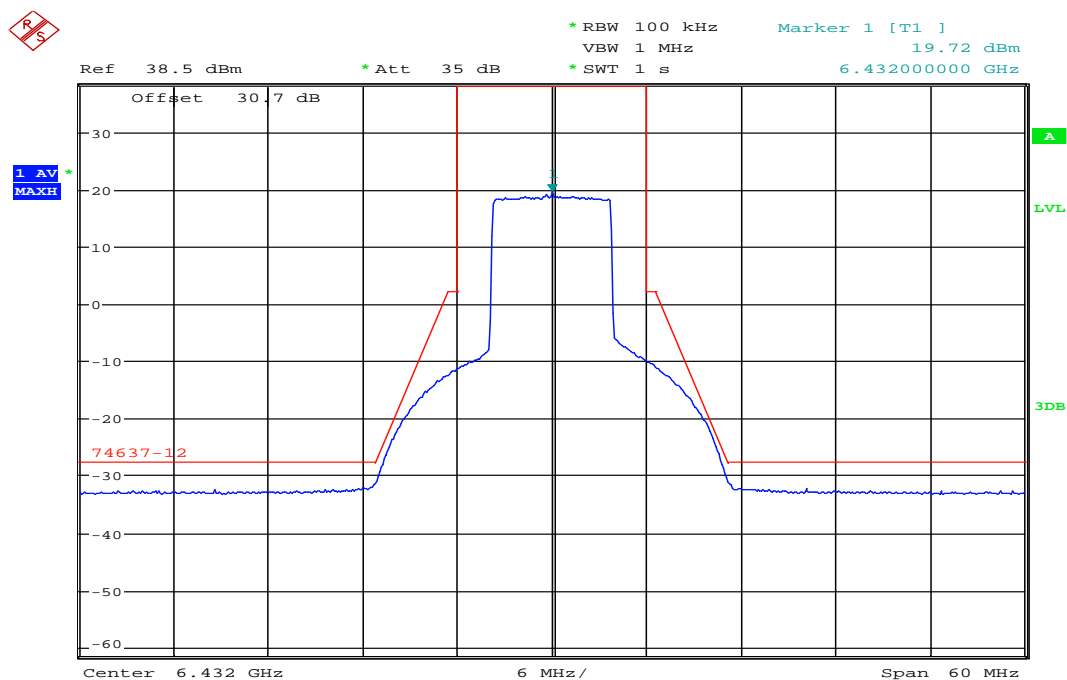
Date: 26.JUN.2011 18:08:36

Plot 53: Emission mask 6432 MHz, 7 MHz / 64QAM



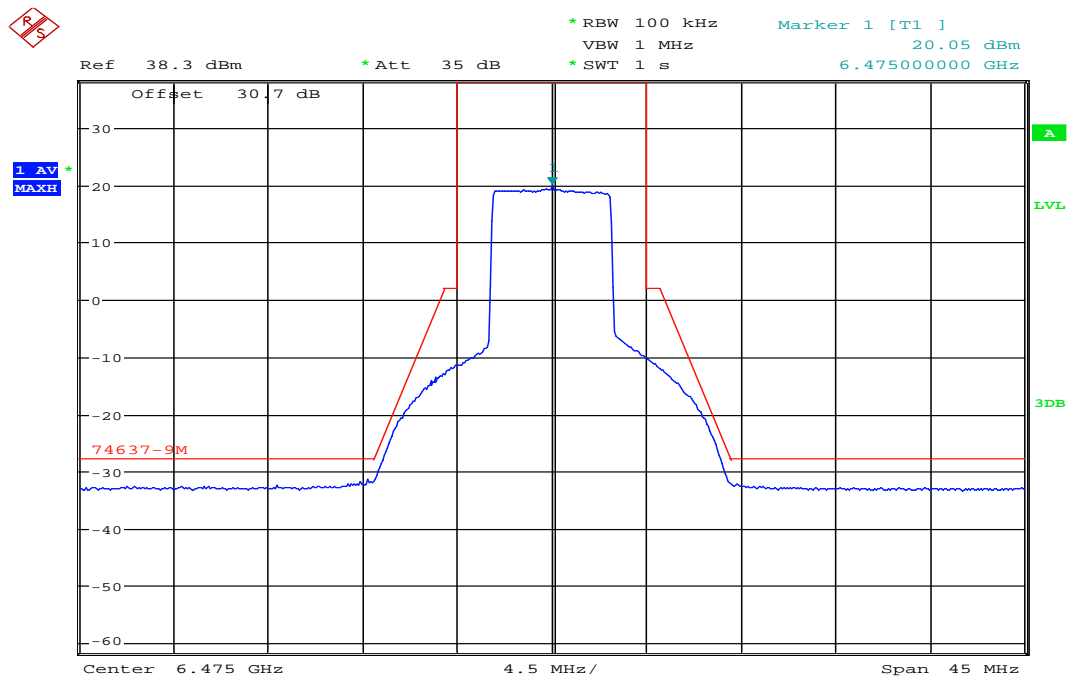
Date: 26.JUN.2011 18:22:17

Plot 54: Emission mask 6432 MHz, 8 MHz / 64QAM



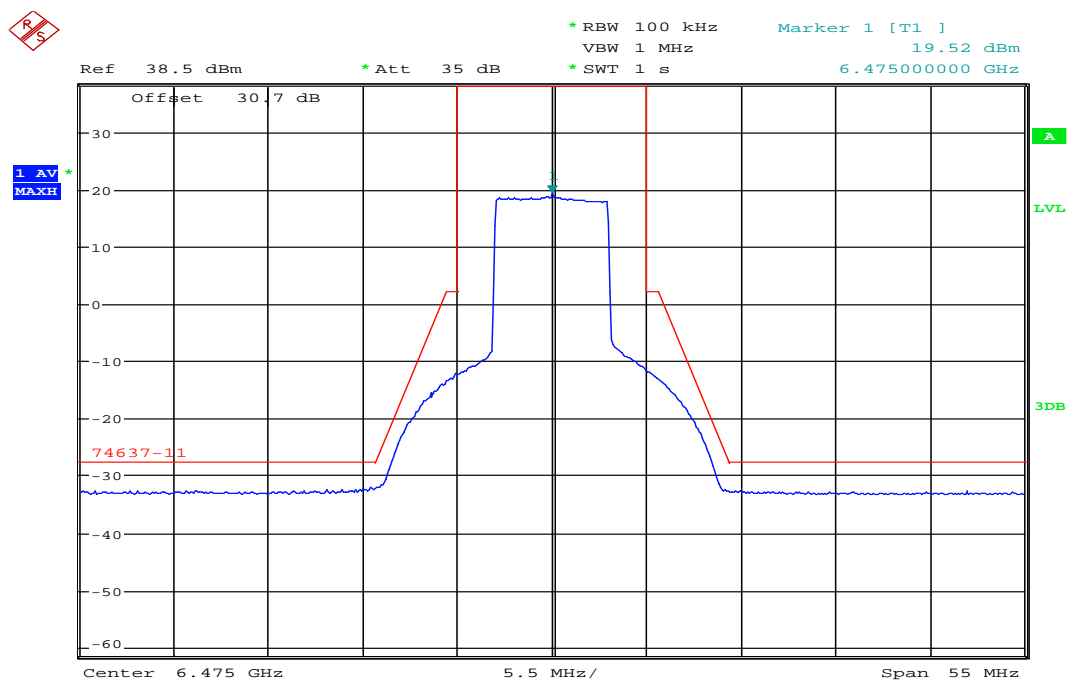
Date: 26.JUN.2011 18:37:02

Plot 55: Emission mask 6475 MHz, 6 MHz / QPSK



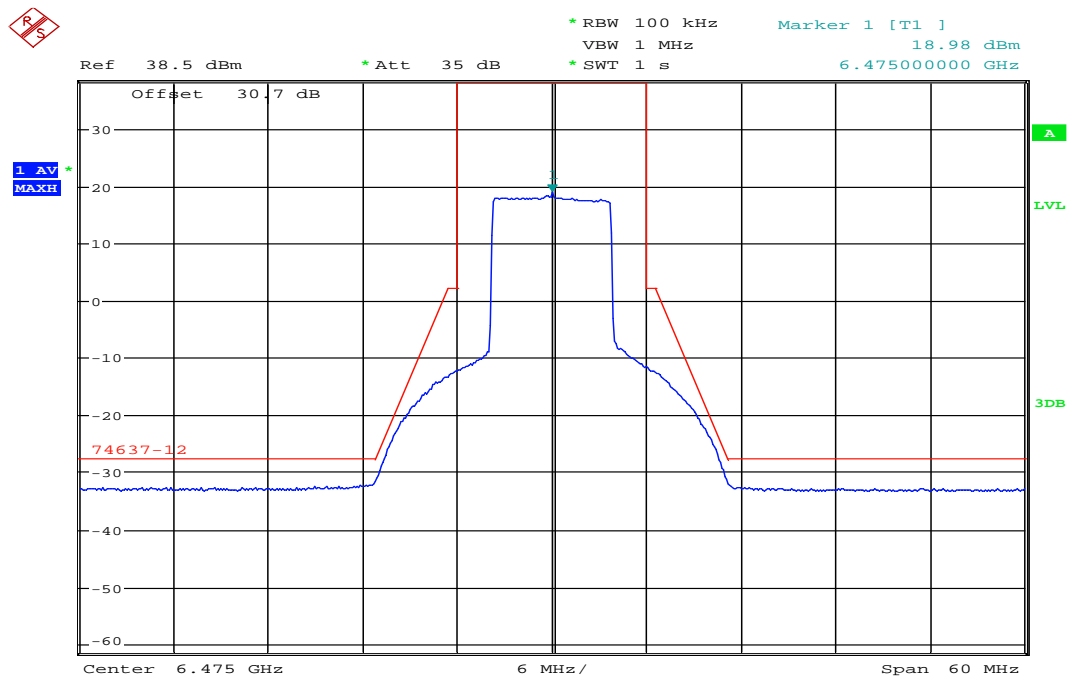
Date: 26.JUN.2011 18:10:37

Plot 56: Emission mask 6475 MHz, 7 MHz / QPSK



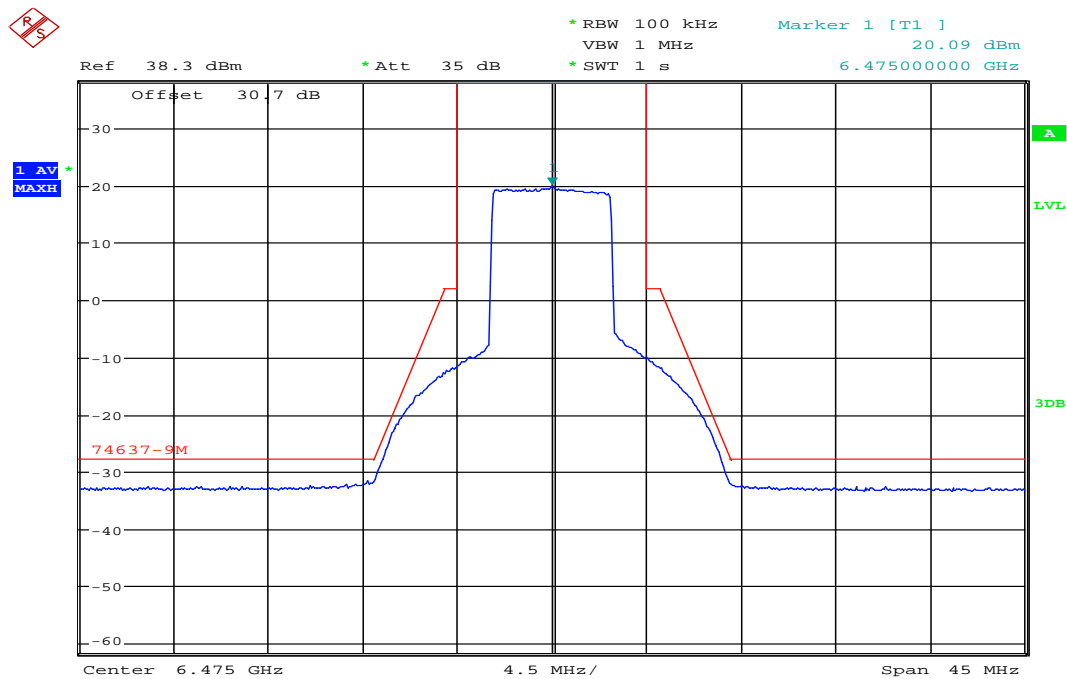
Date: 26.JUN.2011 18:23:42

Plot 57: Emission mask 6475 MHz, 8 MHz / QPSK



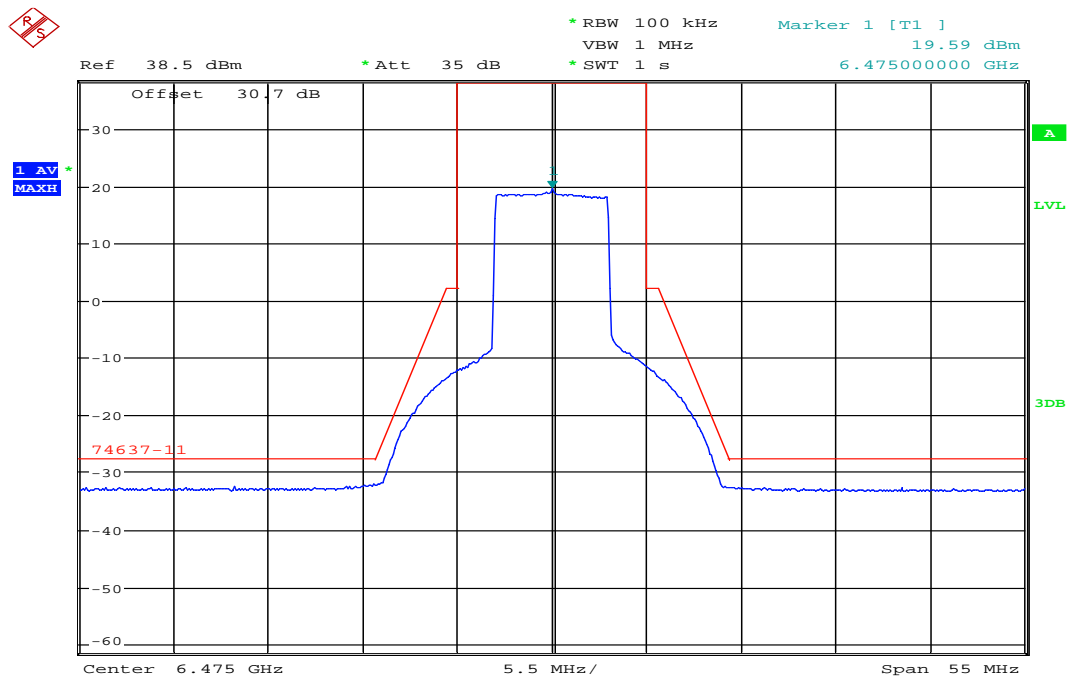
Date: 26.JUN.2011 18:39:08

Plot 58: Emission mask 6475 MHz, 6 MHz / 16QAM



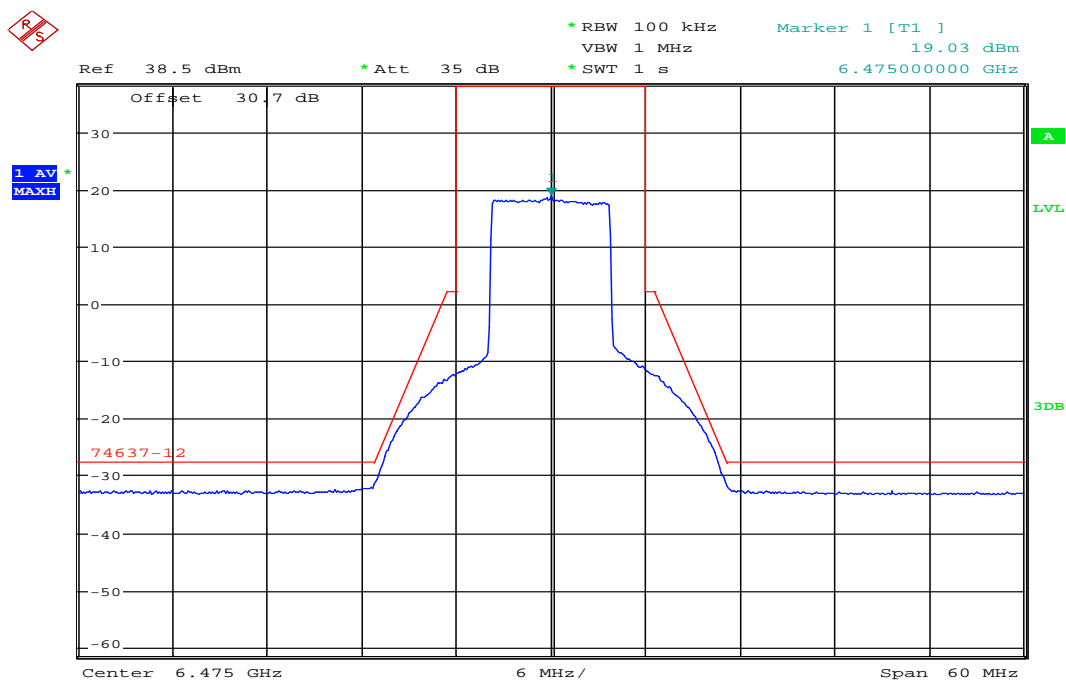
Date: 26.JUN.2011 18:11:35

Plot 59: Emission mask 6475 MHz, 7 MHz / 16QAM



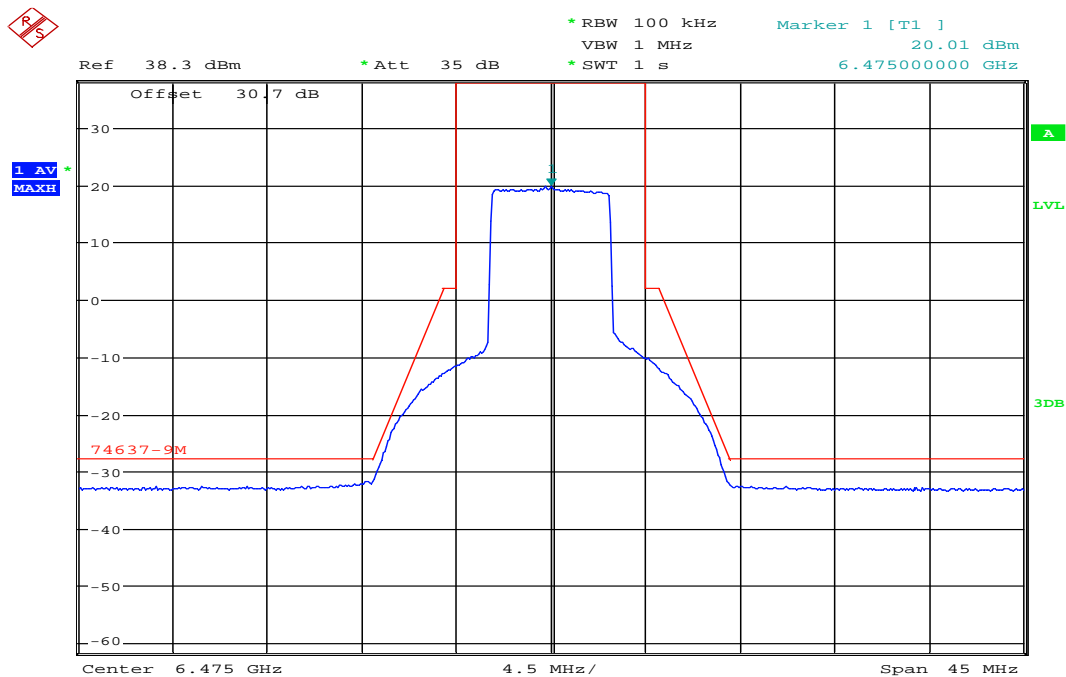
Date: 26.JUN.2011 18:25:03

Plot 60: Emission mask 6475 MHz, 8 MHz / 16QAM



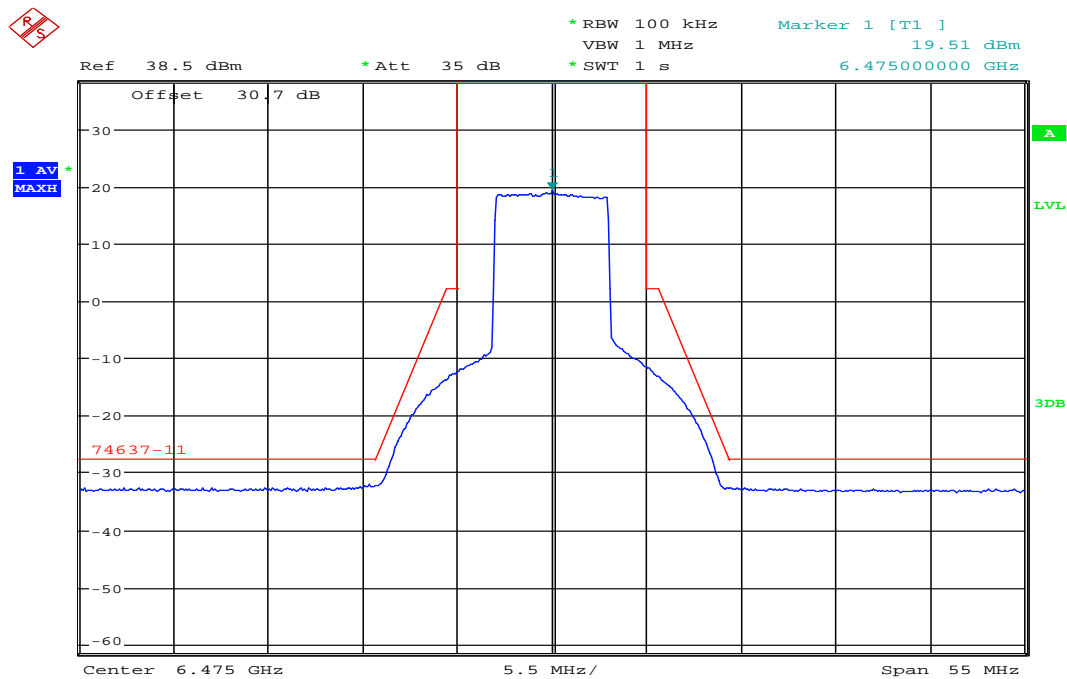
Date: 26.JUN.2011 18:41:55

Plot 61: Emission mask 6475 MHz, 6 MHz / 64QAM



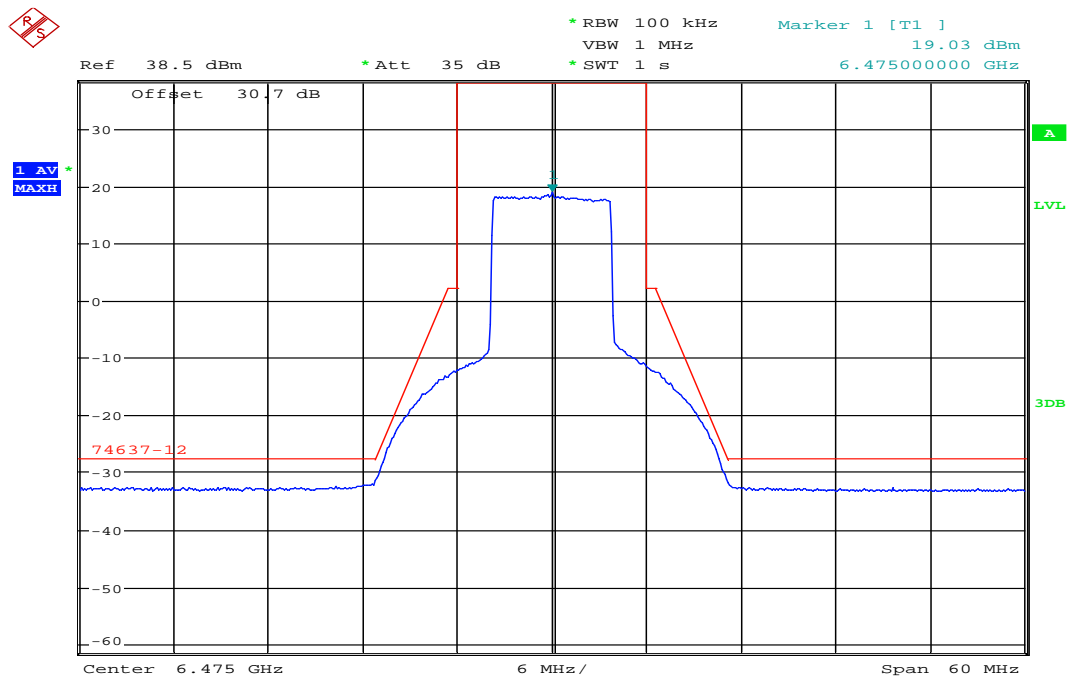
Date: 26.JUN.2011 18:12:21

Plot 62: Emission mask 6475 MHz, 7 MHz / 64QAM



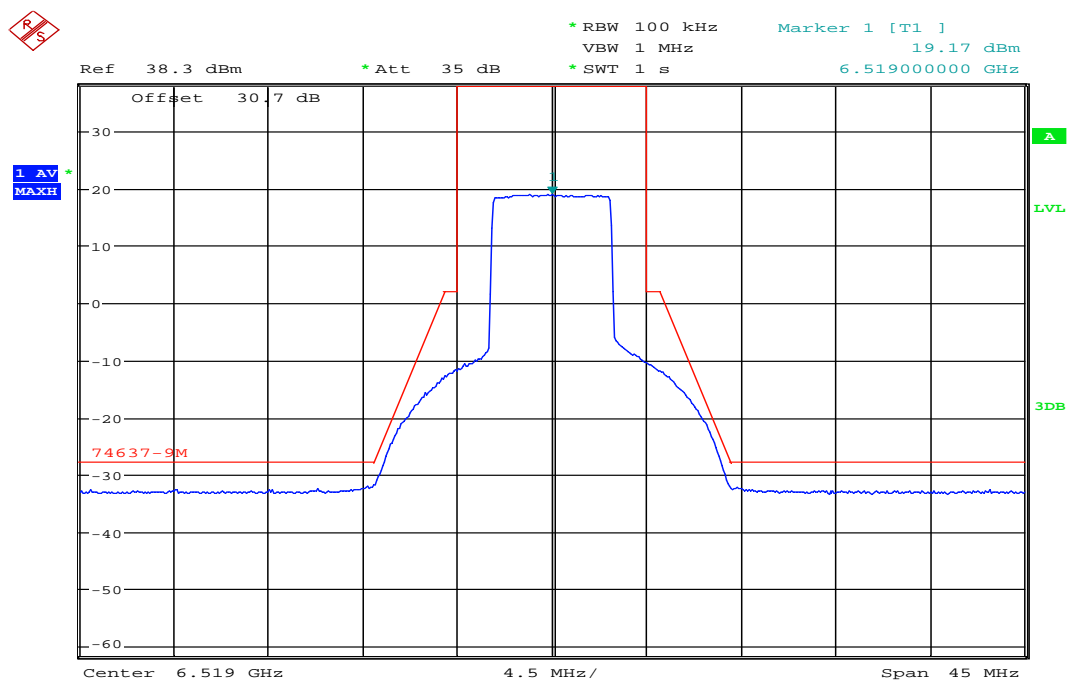
Date: 26.JUN.2011 18:25:57

Plot 63: Emission mask 6475 MHz, 8 MHz / 64QAM



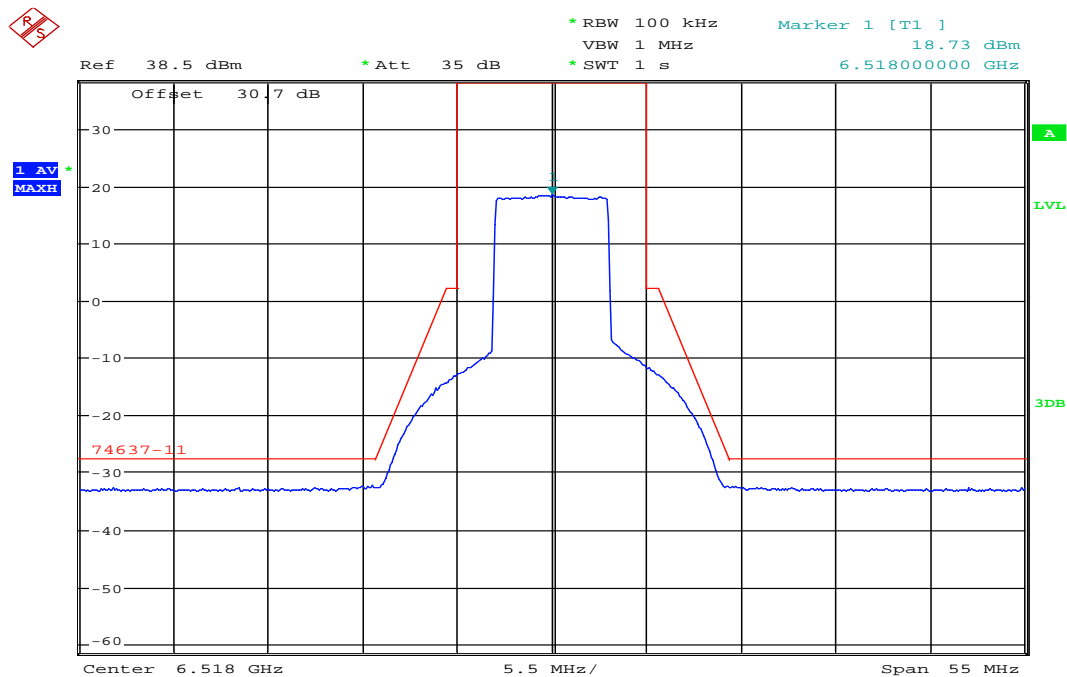
Date: 26.JUN.2011 18:41:55

Plot 64: Emission mask 6519 MHz, 6 MHz / QPSK



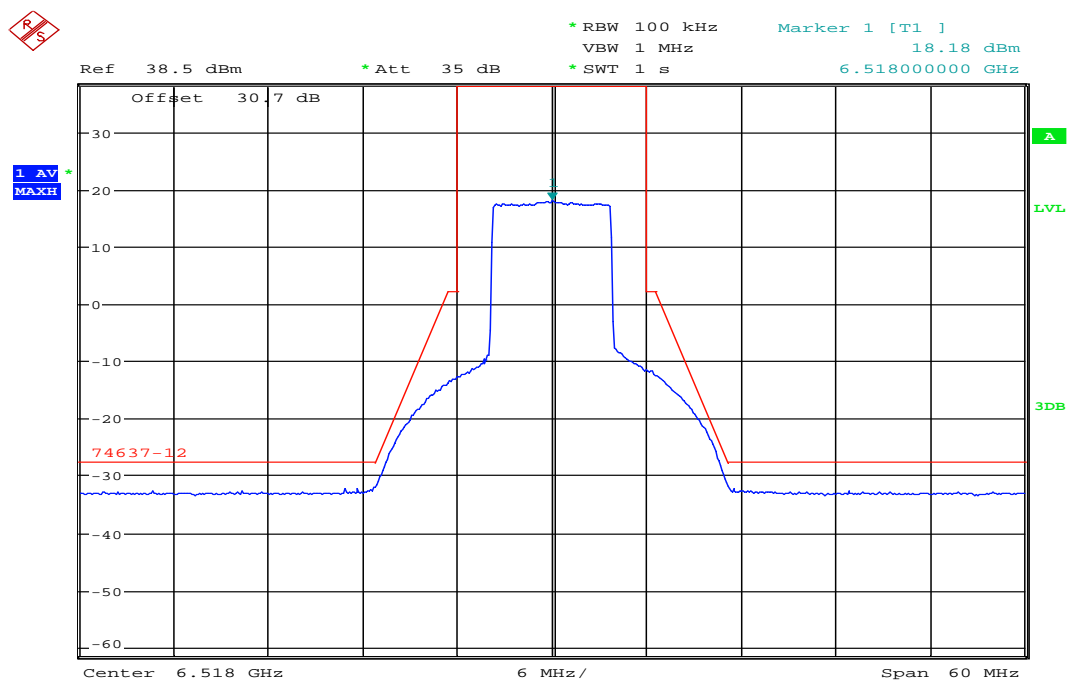
Date: 26.JUN.2011 18:14:22

Plot 65: Emission mask 6518 MHz, 7 MHz / QPSK



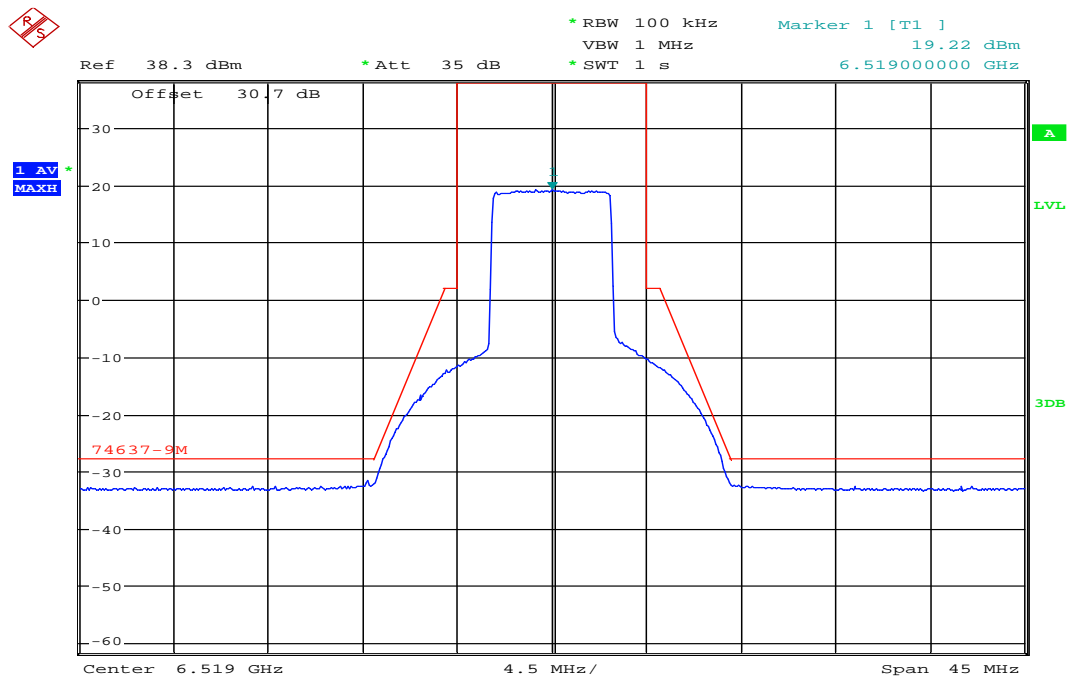
Date: 26.JUN.2011 18:28:04

Plot 66: Emission mask 6518 MHz, 8 MHz / QPSK



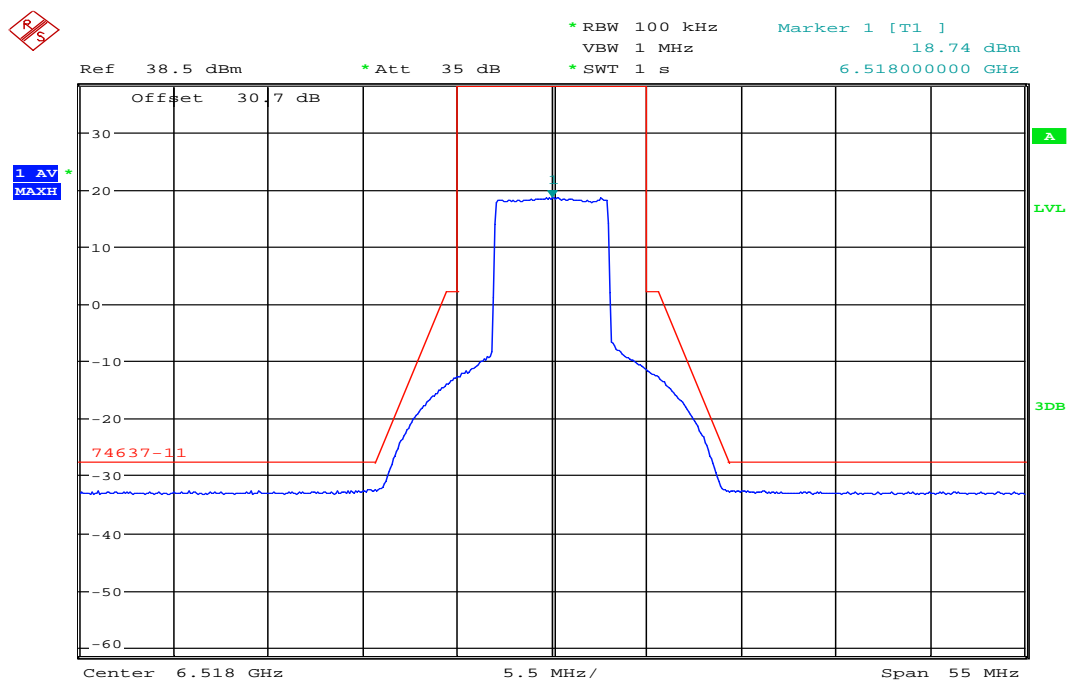
Date: 26.JUN.2011 18:43:42

Plot 67: Emission mask 6519 MHz, 6 MHz / 16QAM



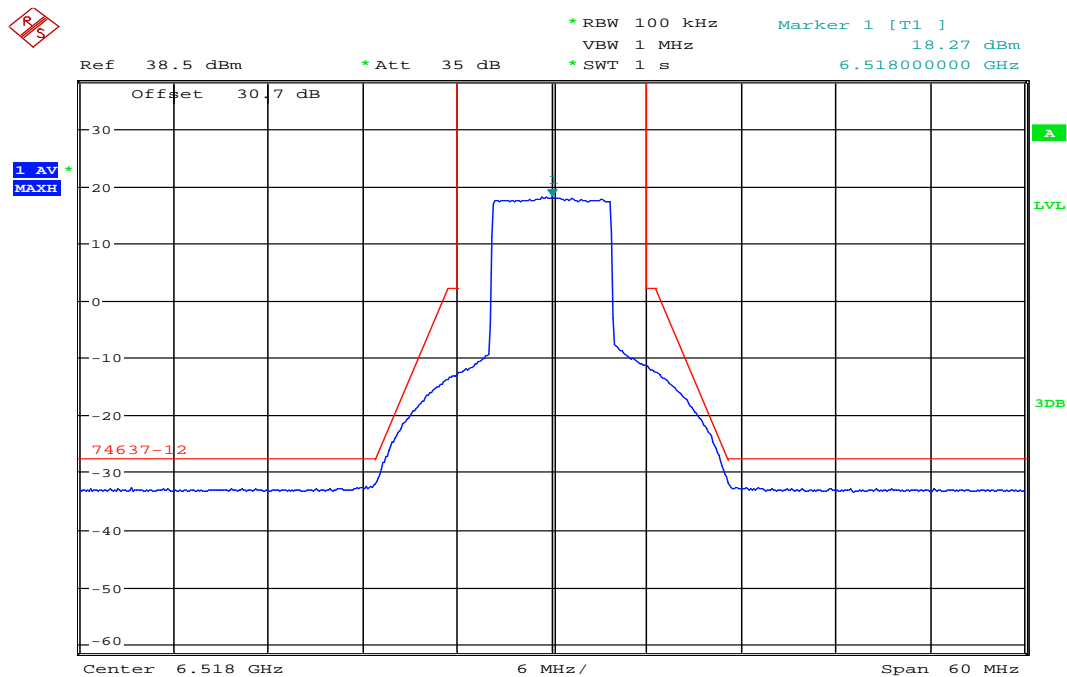
Date: 26.JUN.2011 18:15:06

Plot 68: Emission mask 6518 MHz, 7 MHz / 16QAM



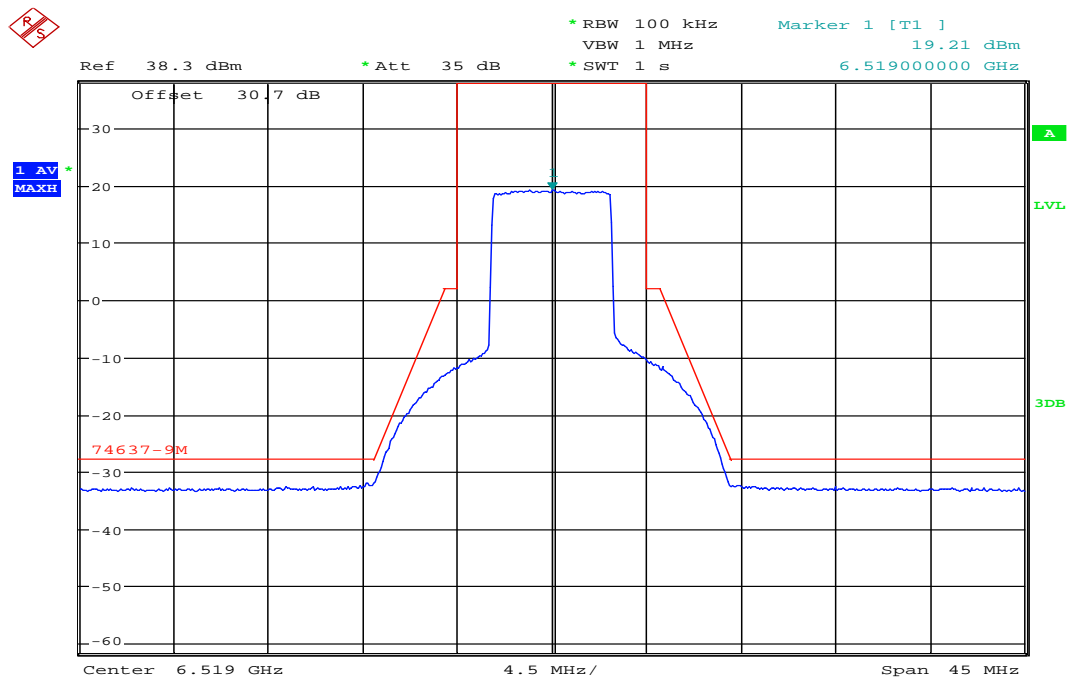
Date: 26.JUN.2011 18:29:41

Plot 69: Emission mask 6518 MHz, 8 MHz / 16QAM



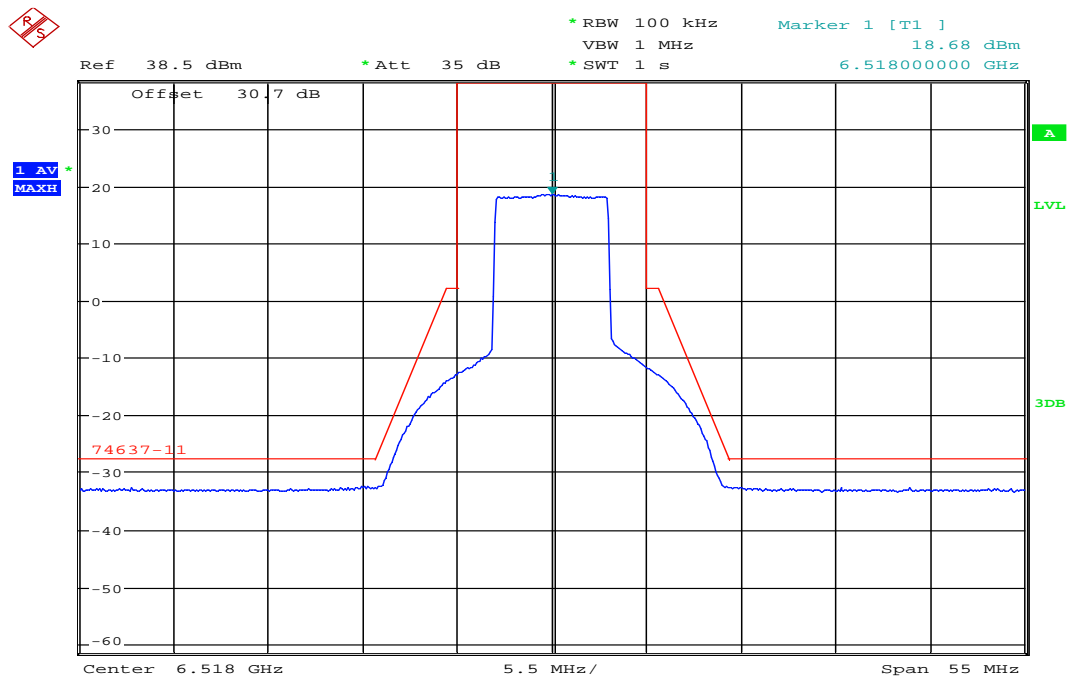
Date: 26.JUN.2011 18:44:46

Plot 70: Emission mask 6519 MHz, 6 MHz / 64QAM



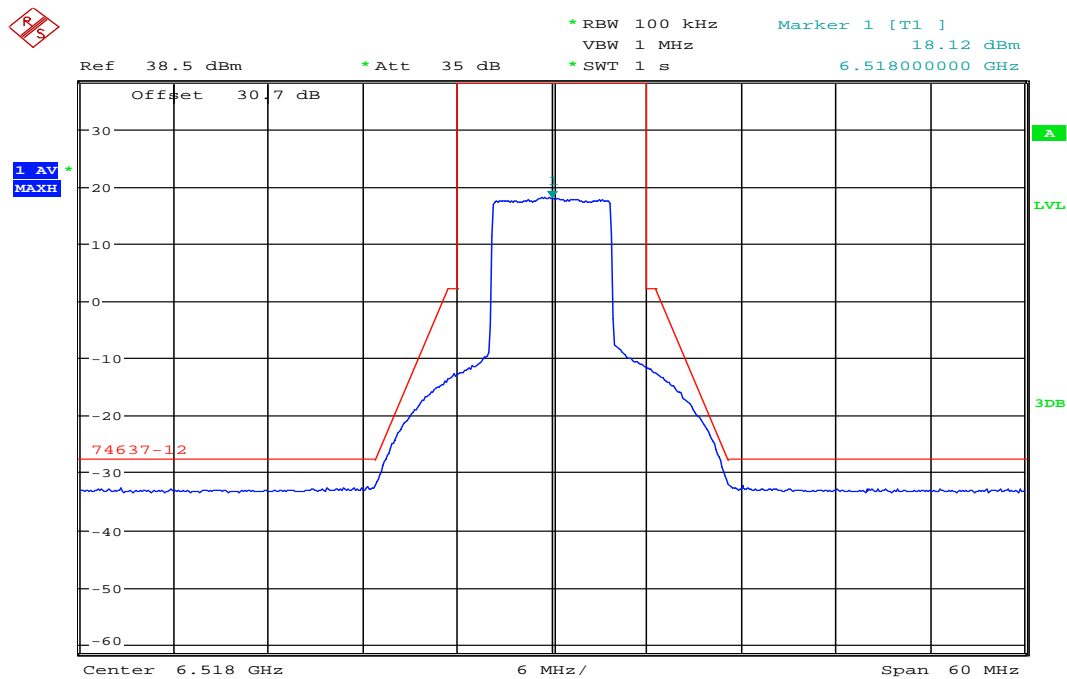
Date: 26.JUN.2011 18:16:10

Plot 71: Emission mask 6518 MHz, 7 MHz / 64QAM



Date: 26.JUN.2011 18:30:38

Plot 72: Emission mask 6518 MHz, 8 MHz / 64QAM



Date: 26.JUN.2011 18:45:32

Limit according to §74.637(a)(2)(ii):

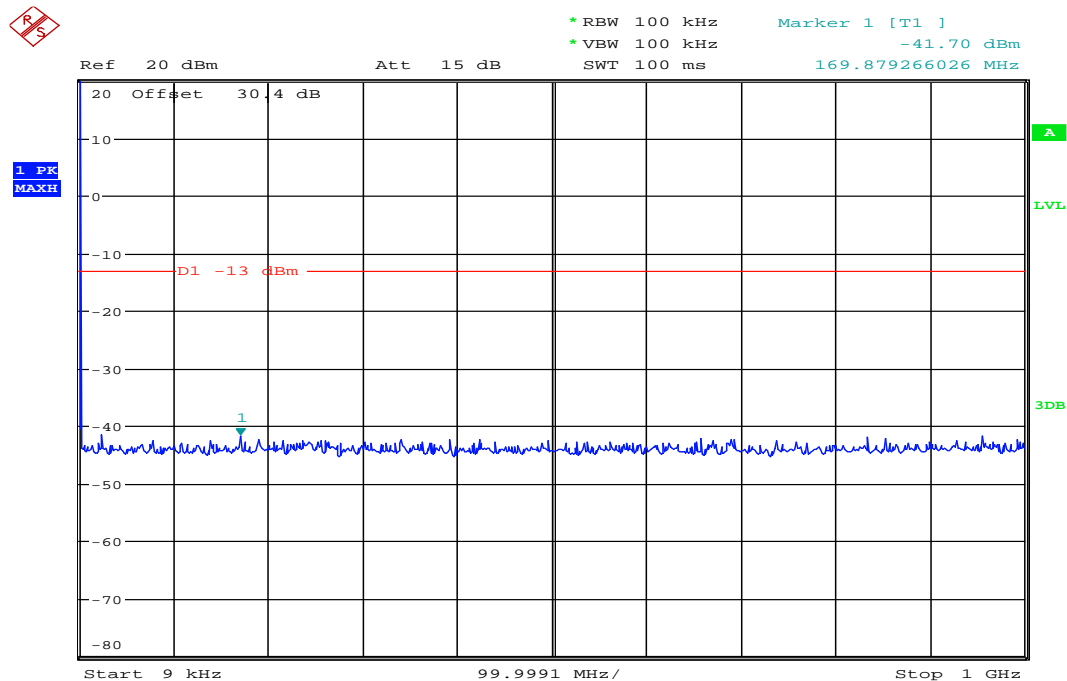
| | |
|-----------------------------------|---|
| Under normal test conditions only | <p>The mean power of emissions shall be attenuated below the mean transmitter power (P_{MEAN}) in accordance with the following schedule:</p> <p>When using transmissions employing digital modulation techniques: For operating frequencies below 15 GHz, in any 4 kHz reference bandwidth (B_{REF}), 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> $A = 35 + 0.8 (G - 50) + 10 \text{ Log}_{10} B$ <p>Attenuation greater than 80 decibels is not required.</p> |
|-----------------------------------|---|

Results: The measurement is passed.

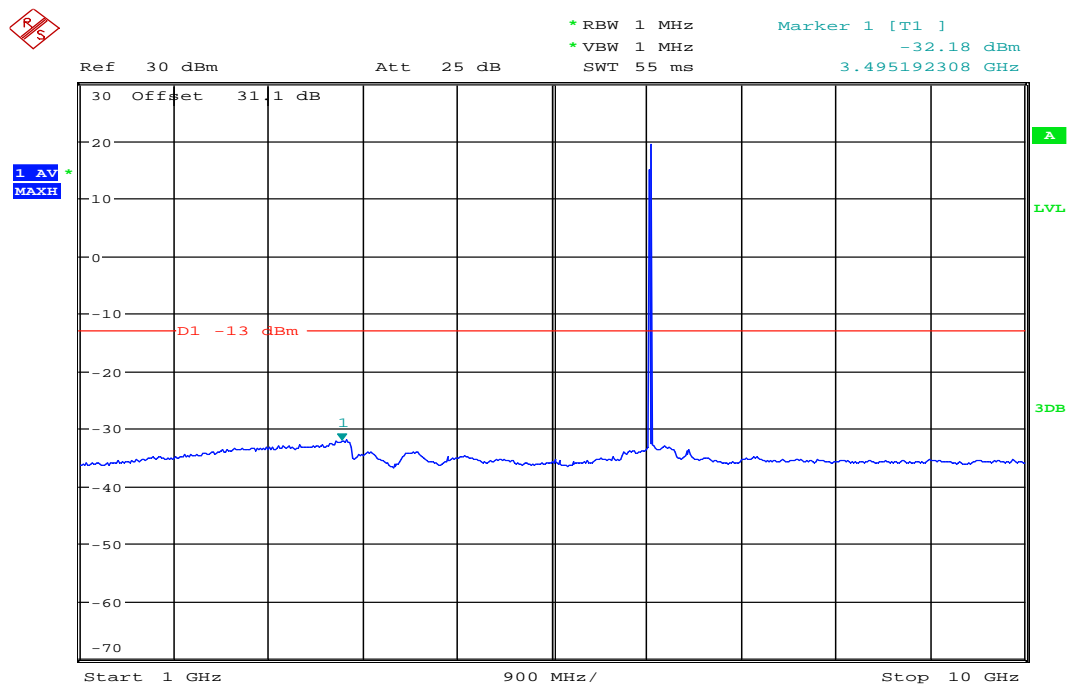
4.8 Spurious emissions (conducted)

§2.1051 / §74.637(a)(2)

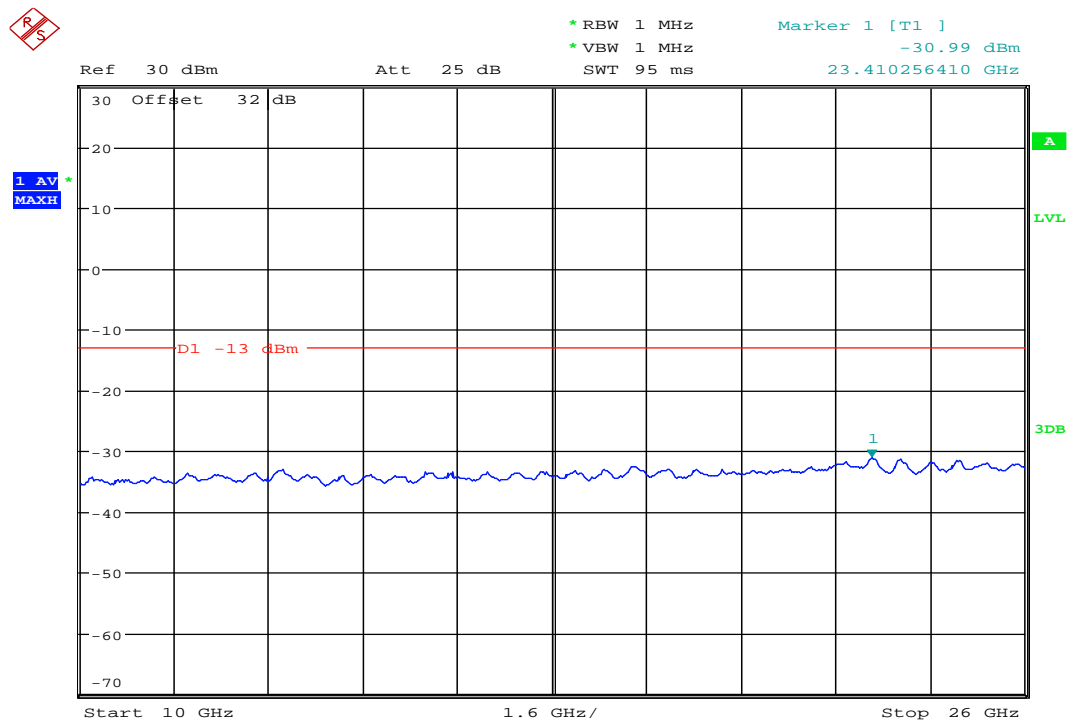
Plot 73: 9 kHz - 1 GHz (6432 MHz)



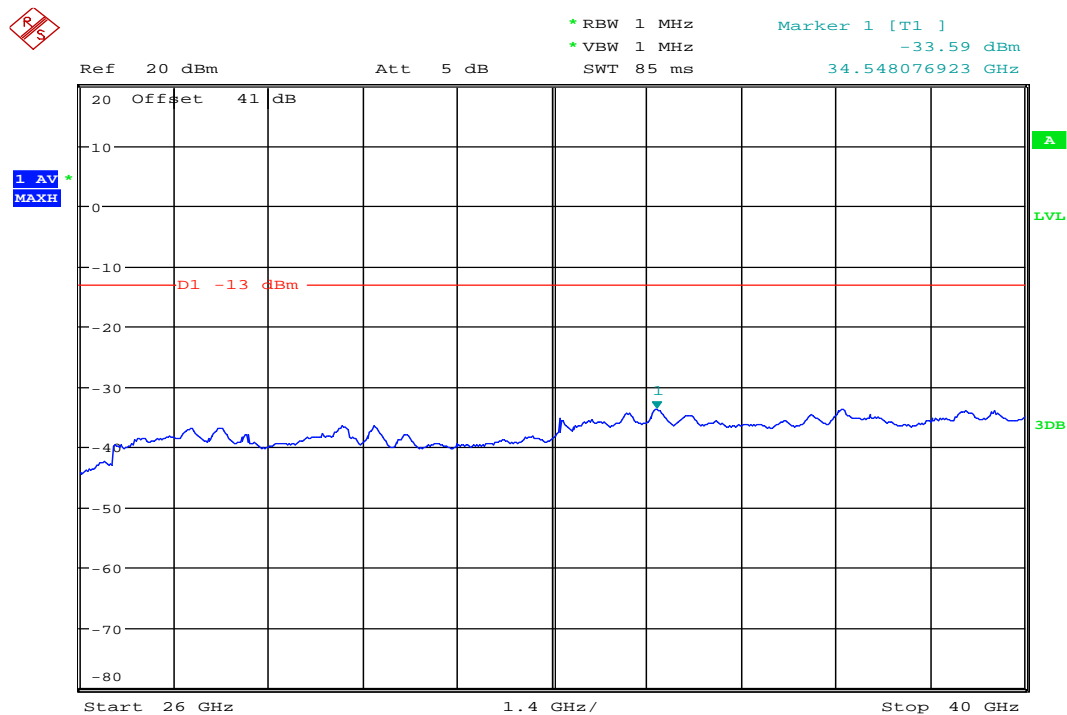
Plot 74: 1 GHz - 10 GHz (6432 MHz)



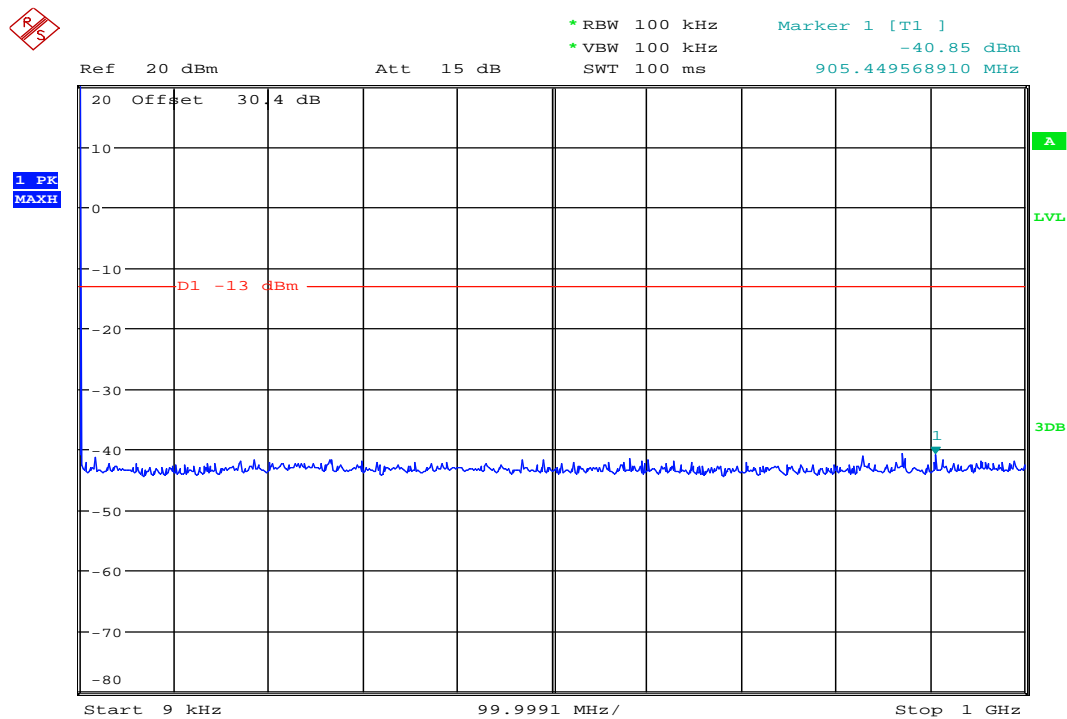
Plot 75: 10 GHz - 26 GHz (6432 MHz)



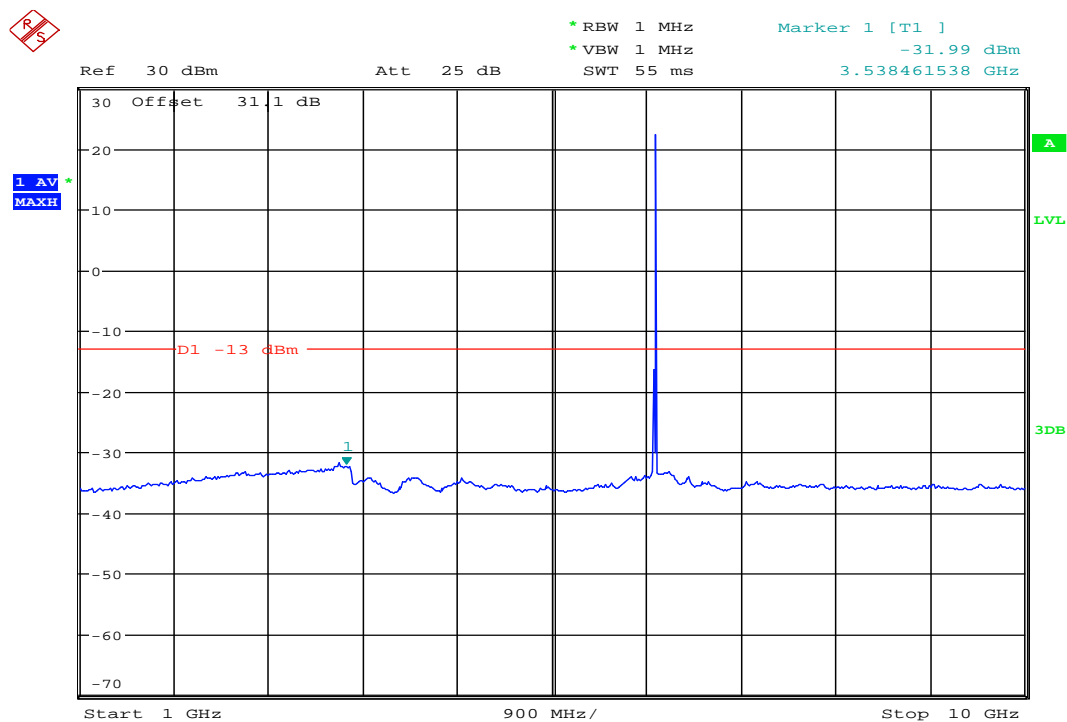
Plot 76: 26 GHz - 40 GHz (6432 MHz)



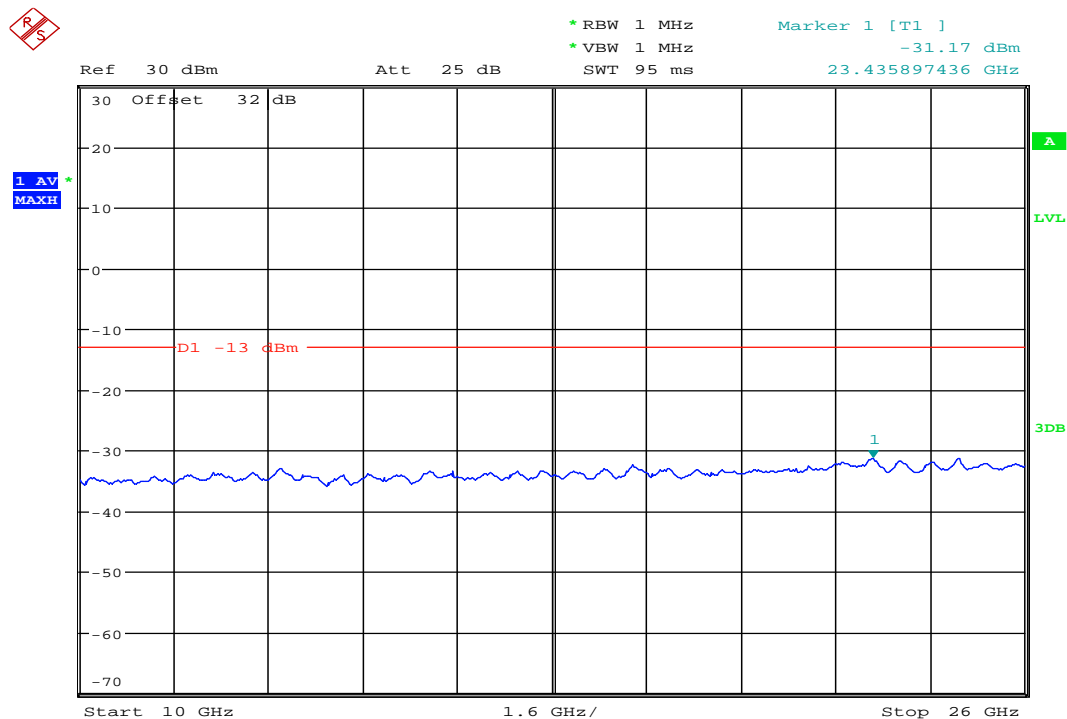
Plot 77: 9 kHz - 1 GHz (6475 MHz)



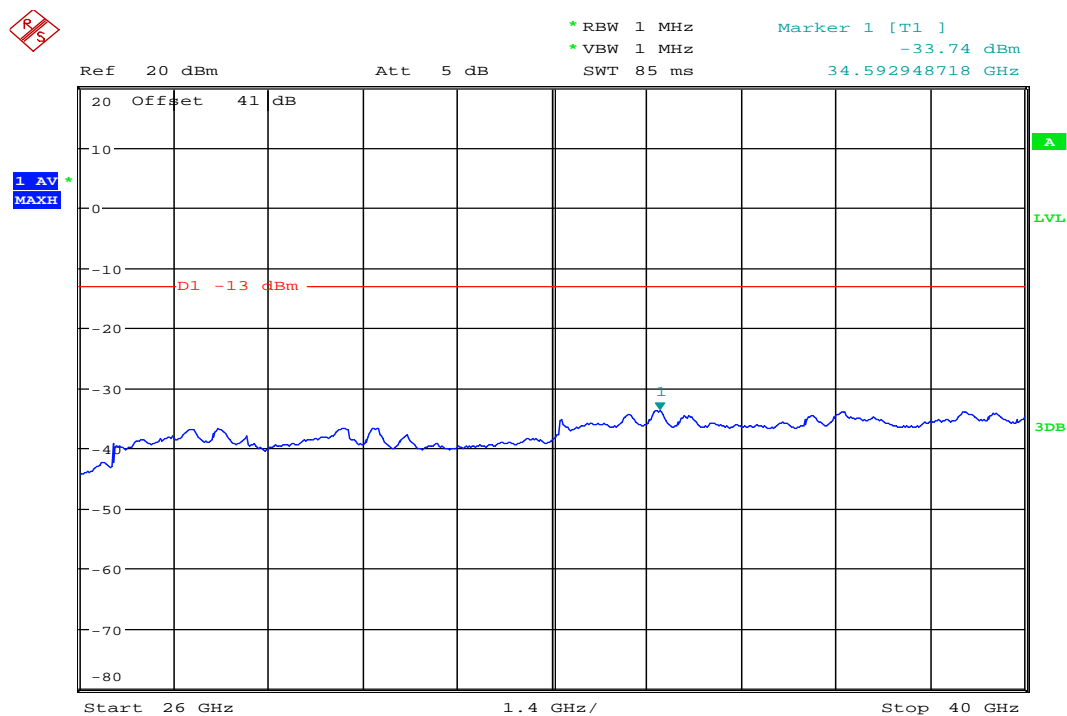
Plot 78: 1 GHz - 10 GHz (6475 MHz)



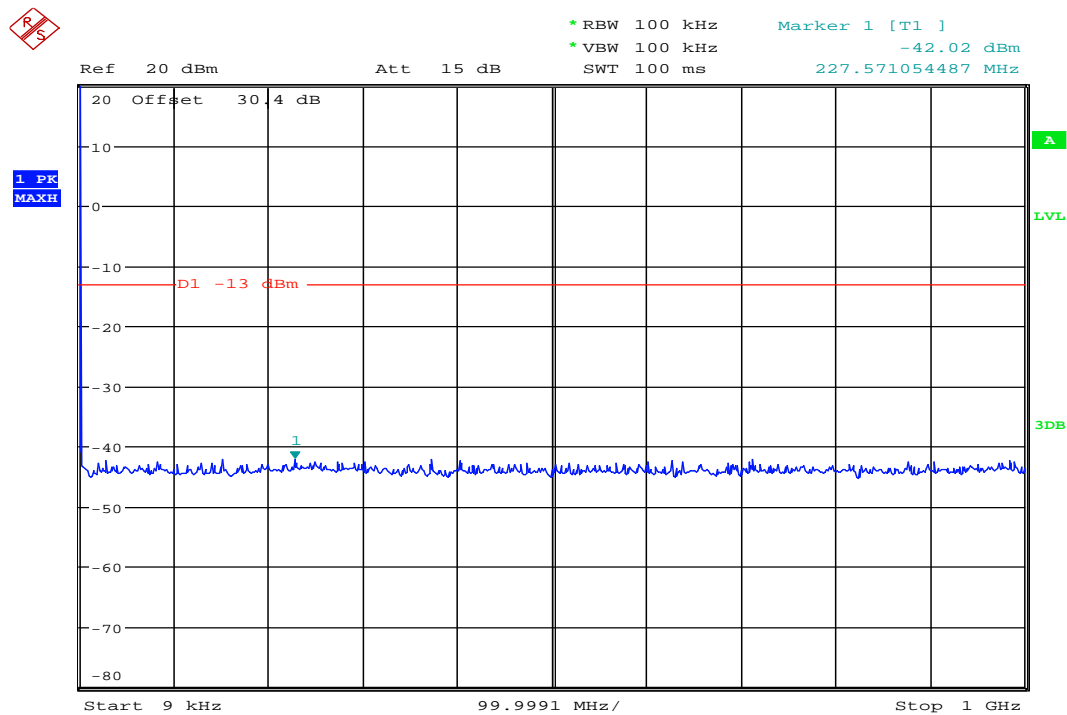
Plot 79: 10 GHz - 26 GHz (6475 MHz)



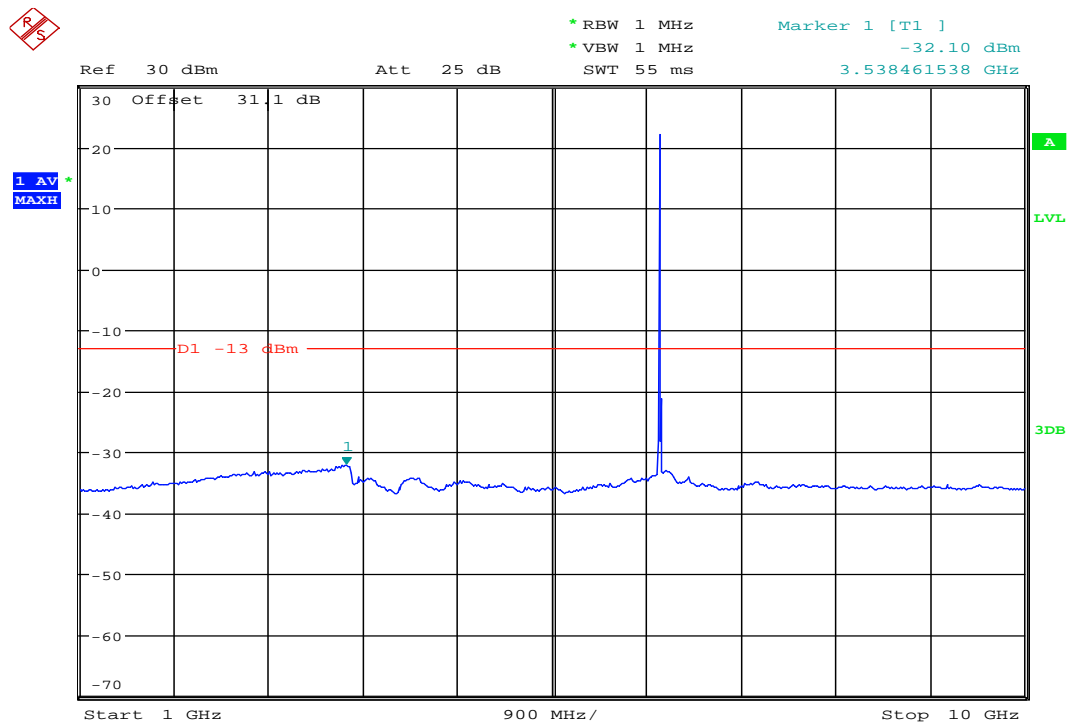
Plot 80: 26 GHz - 40 GHz (6475 MHz)



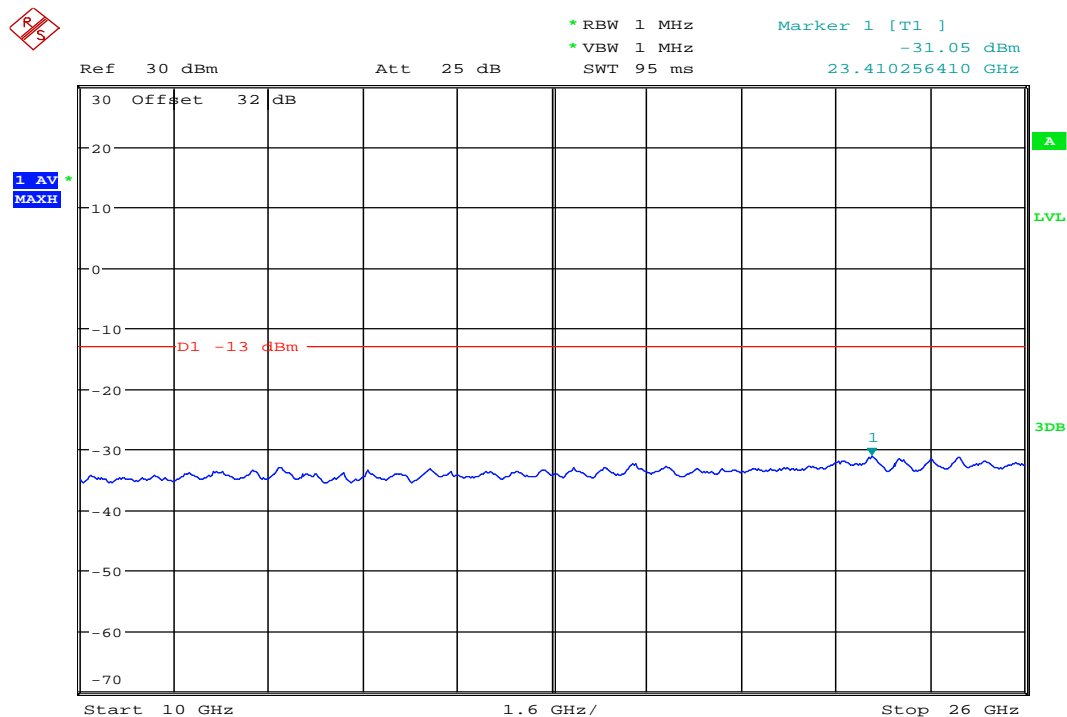
Plot 81: 9 kHz - 1 GHz (6518 MHz)



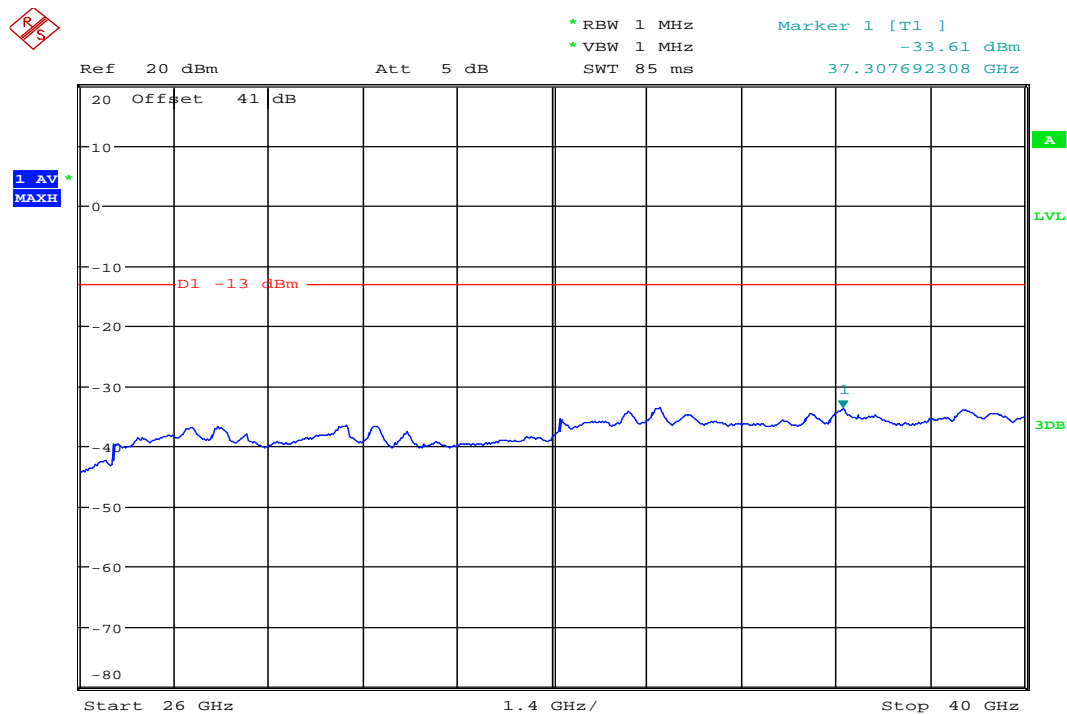
Plot 82: 1 GHz - 10 GHz (6518 MHz)



Plot 83: 10 GHz - 26 GHz (6518 MHz)



Plot 84: 26 GHz - 40 GHz (6518 MHz)



| SPURIOUS EMISSIONS LEVEL (dBm) | | | | | | | | |
|--------------------------------|----------|-------------|--------------------------|----------|-------------|--------------------------|----------|-------------|
| 6431 MHz / 6432 MHz | | | 6475 MHz | | | 6519 MHz / 6518 MHz | | |
| F [MHz] | Detector | Level [dBm] | F [MHz] | Detector | Level [dBm] | F [MHz] | Detector | Level [dBm] |
| No critical peaks found! | | | No critical peaks found! | | | No critical peaks found! | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Measurement uncertainty | | | ±3 dB | | | | | |

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

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

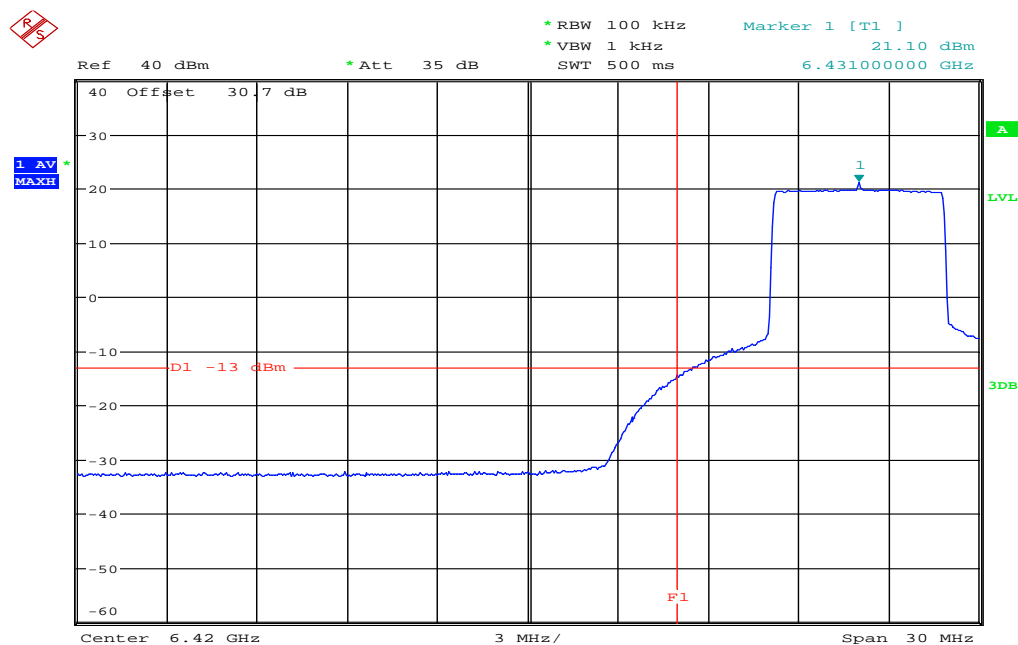
| | |
|-----------------------------------|---|
| Under normal test conditions only | <p>The mean power of emissions shall be attenuated below the mean transmitter power (P_{MEAN}) in accordance with the following schedule:</p> <p>When using transmissions employing digital modulation techniques: In any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

Results: The measurement is passed.

4.9 Band-edge compliance

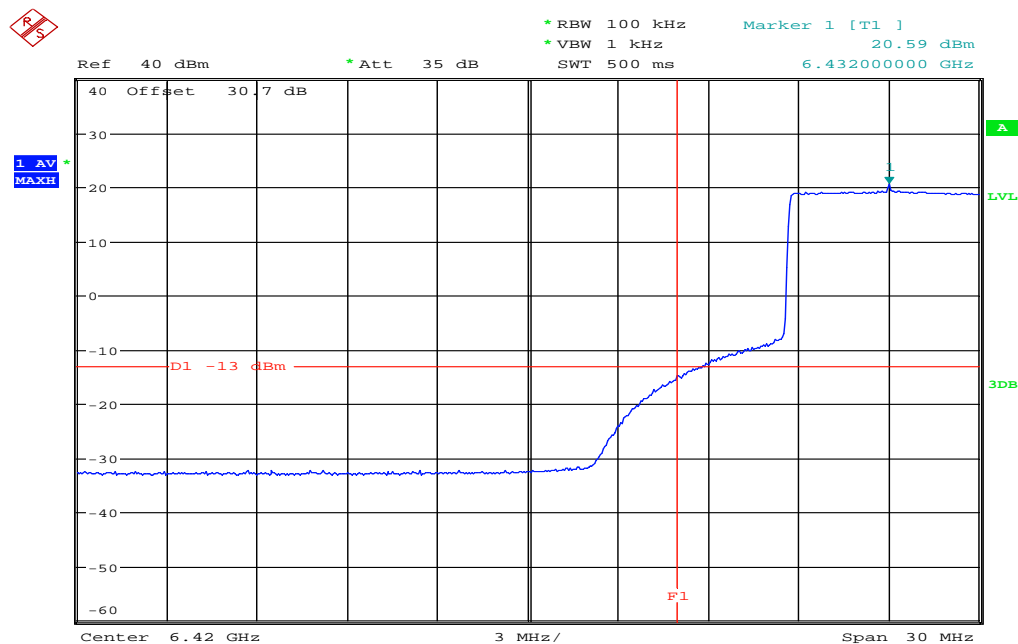
§2.1051 / §74.637(a)(2)

Plot 85: Band-edge compliance 6 MHz / QPSK



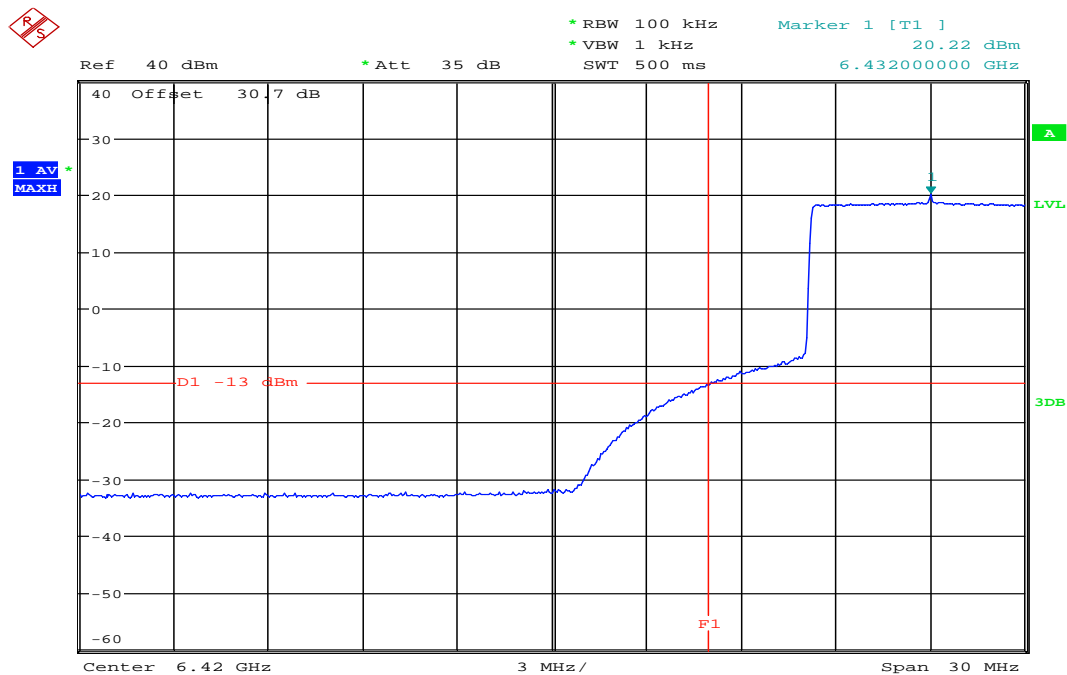
Date: 26.JUN.2011 17:37:51

Plot 86: Band-edge compliance 7 MHz / QPSK



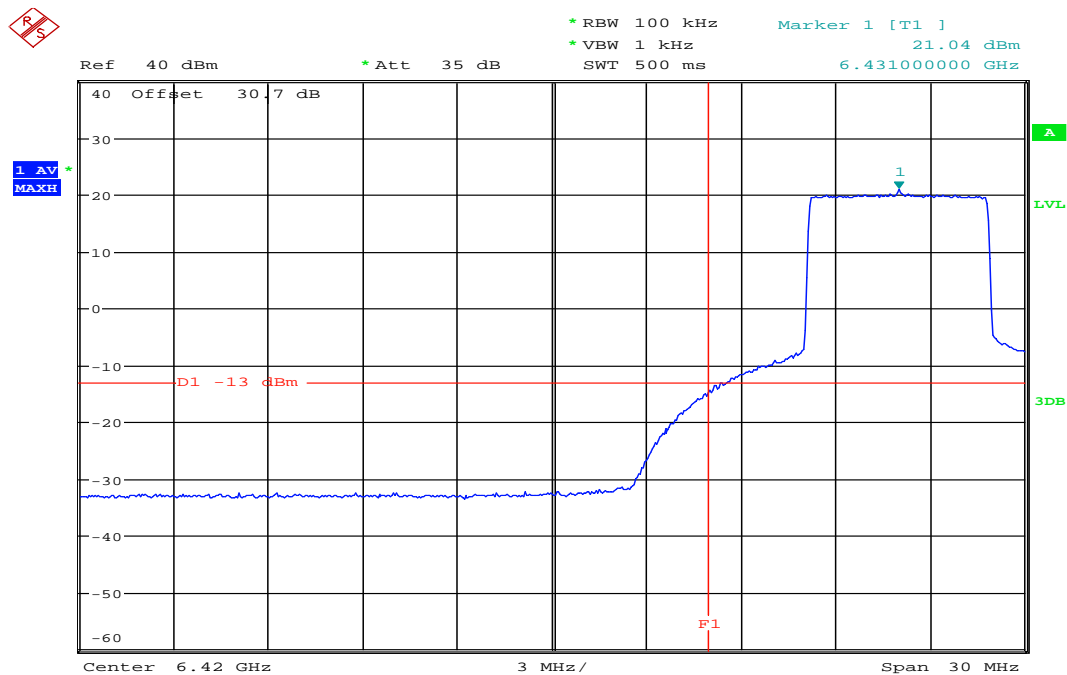
Date: 26.JUN.2011 17:46:37

Plot 87: Band-edge compliance 8 MHz / QPSK



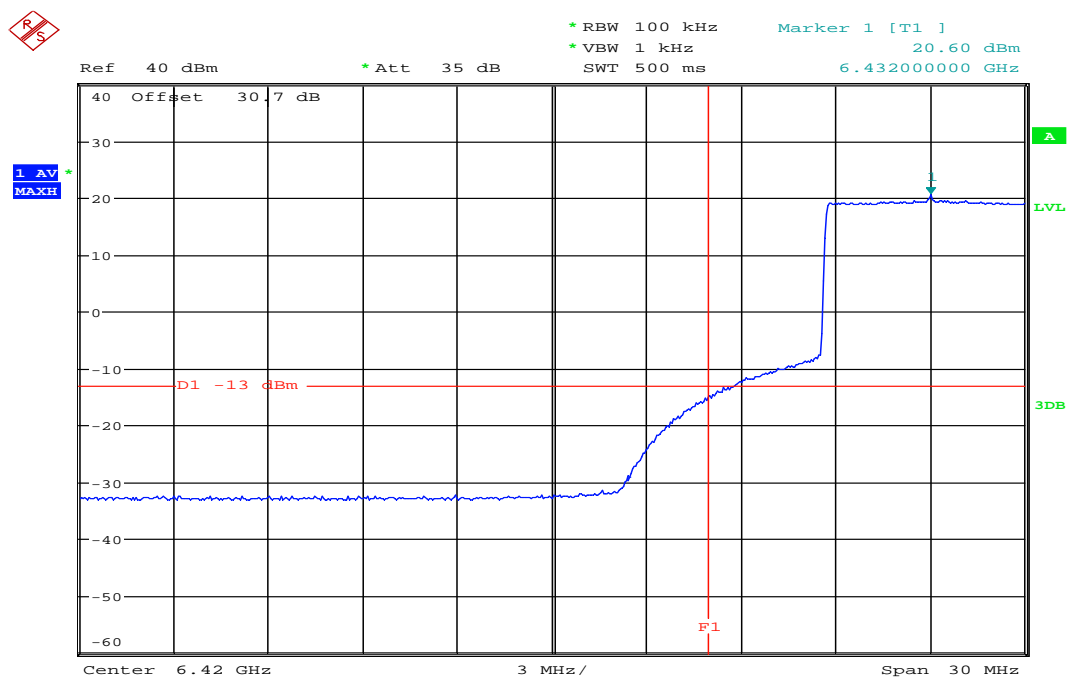
Date: 26.JUN.2011 17:53:55

Plot 88: Band-edge compliance 6 MHz / 16QAM



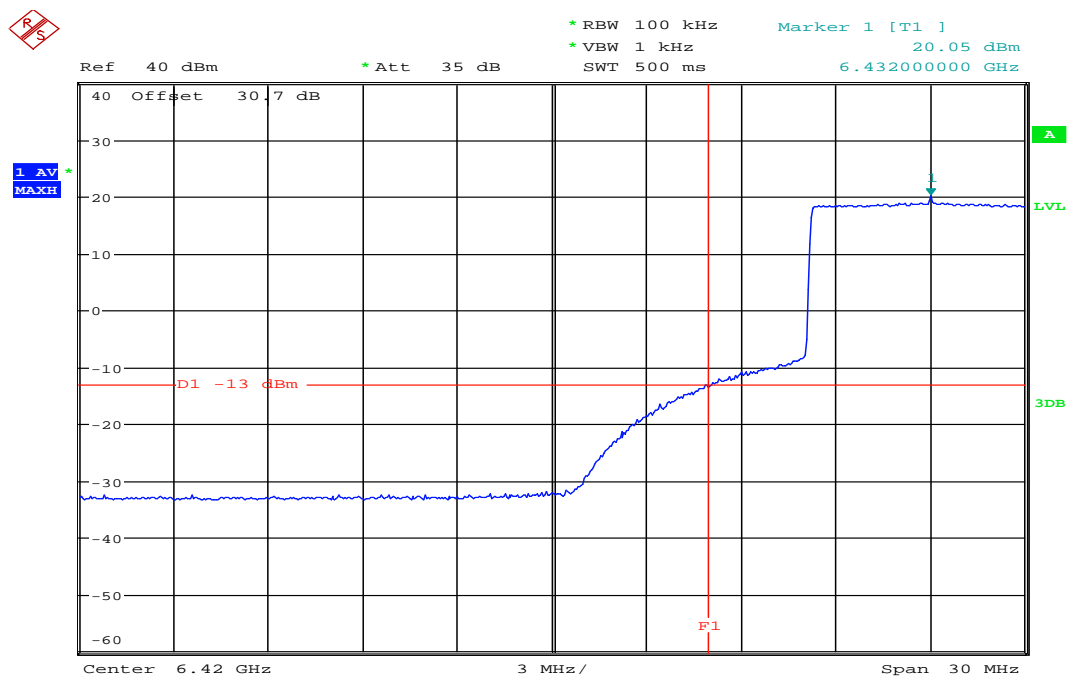
Date: 26.JUN.2011 17:38:22

Plot 89: Band-edge compliance 7 MHz / 16QAM



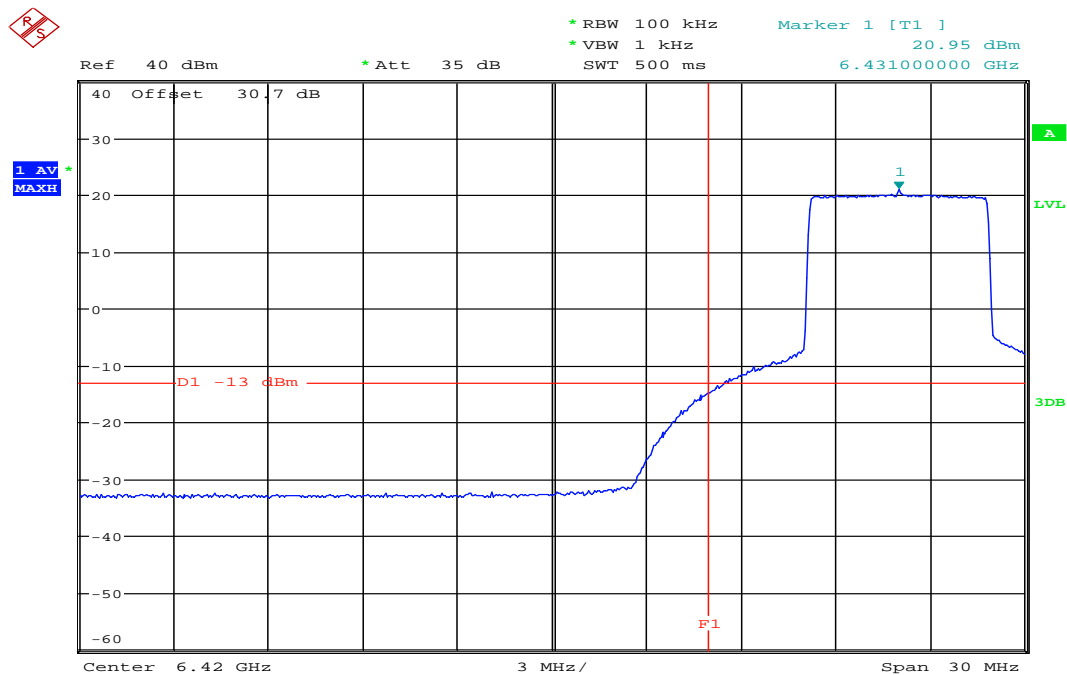
Date: 26.JUN.2011 17:47:27

Plot 90: Band-edge compliance 8 MHz / 16QAM



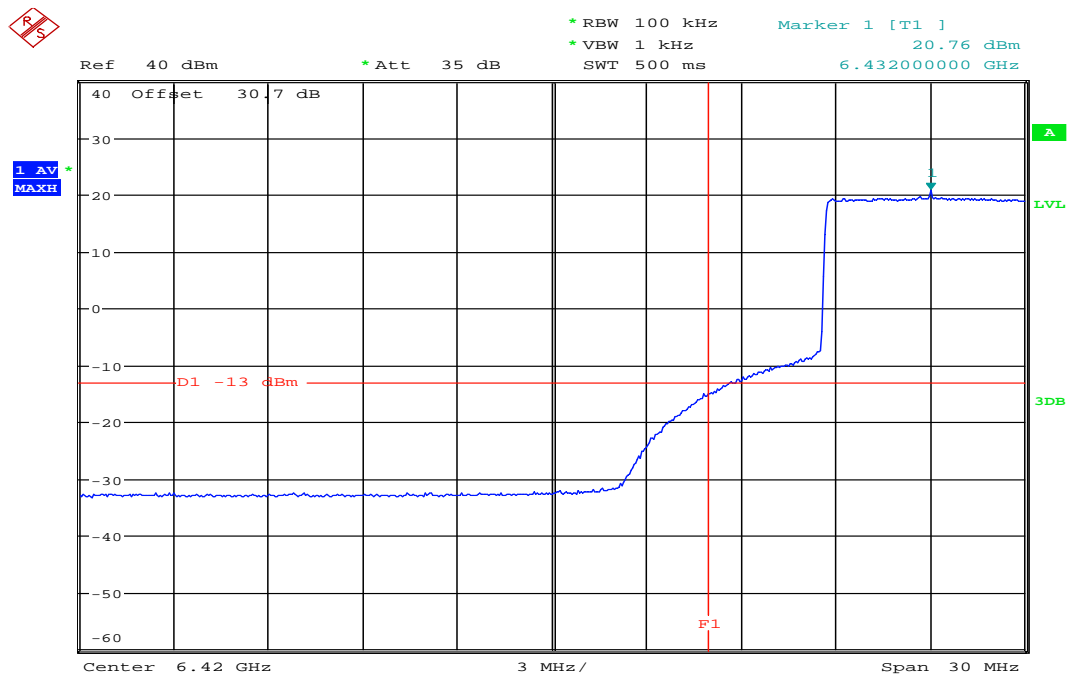
Date: 26.JUN.2011 17:54:32

Plot 91: Band-edge compliance 6 MHz / 64QAM



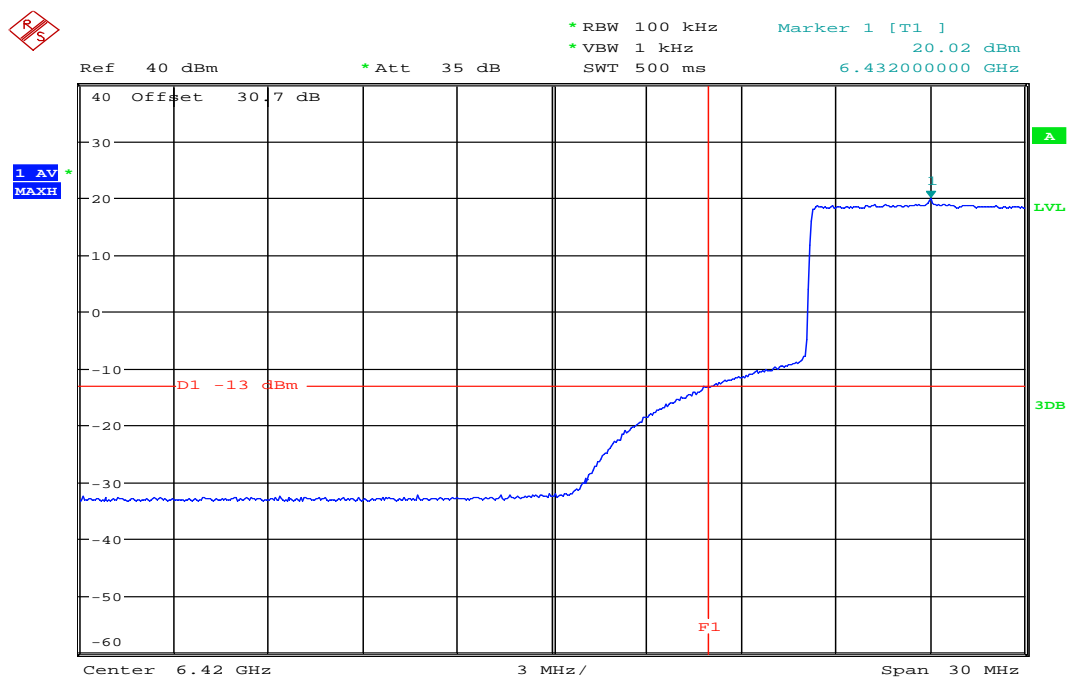
Date: 26.JUN.2011 17:39:33

Plot 92: Band-edge compliance 7 MHz / 64QAM



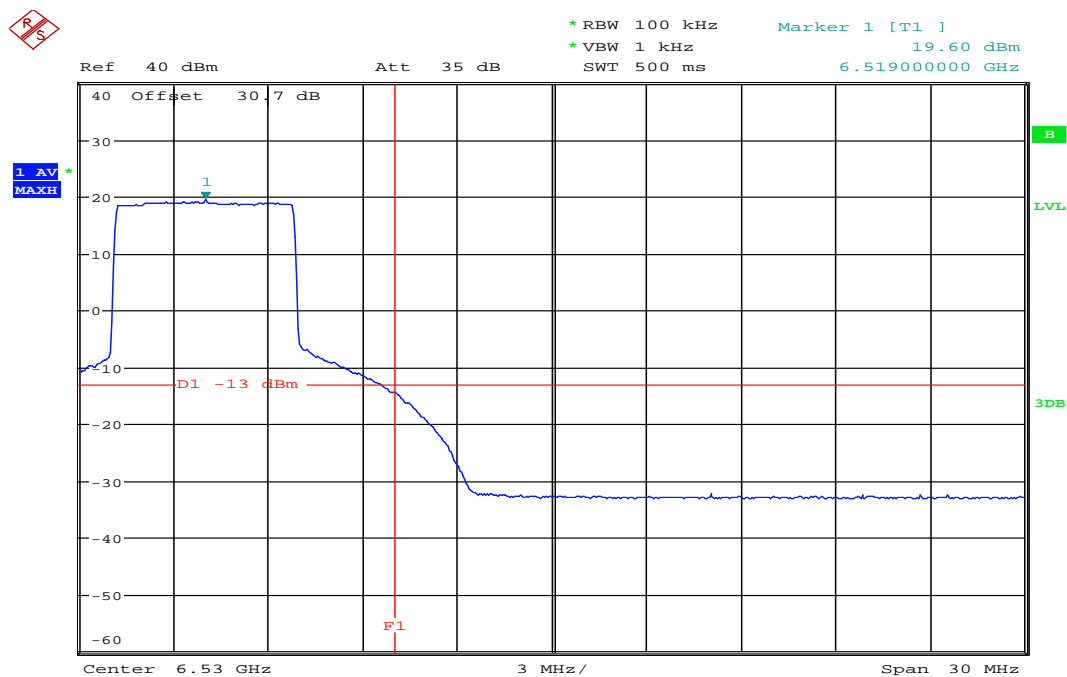
Date: 26.JUN.2011 17:48:14

Plot 93: Band-edge compliance 8 MHz / 64QAM



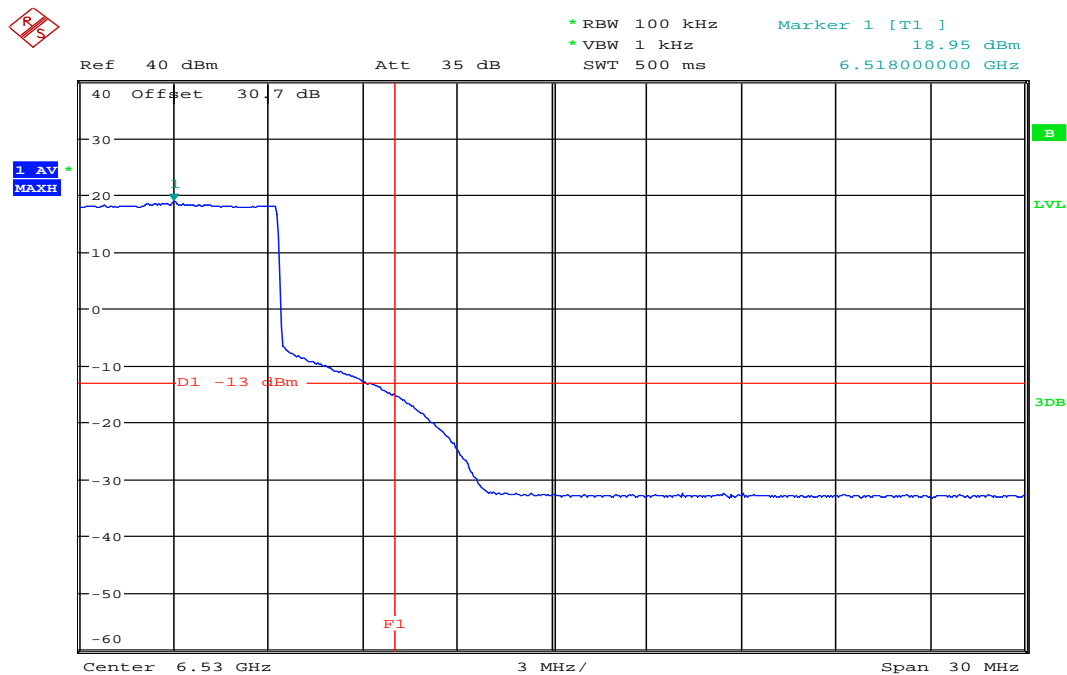
Date: 26.JUN.2011 17:54:57

Plot 94: Band-edge compliance 6 MHz / QPSK



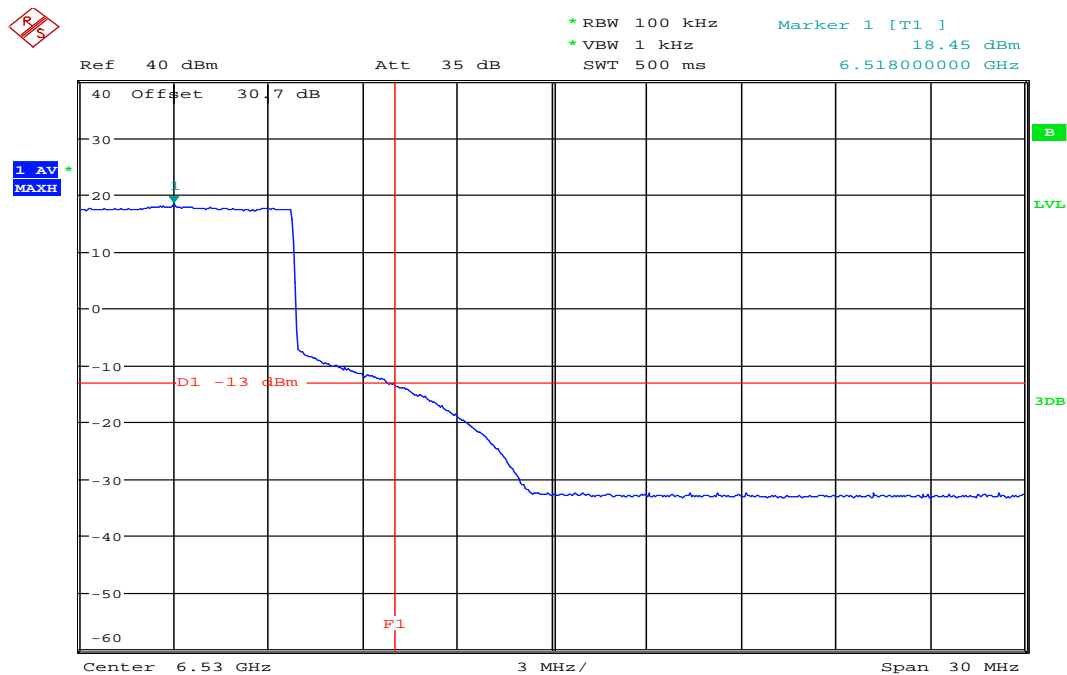
Date: 26.JUN.2011 17:42:33

Plot 95: Band-edge compliance 7 MHz / QPSK



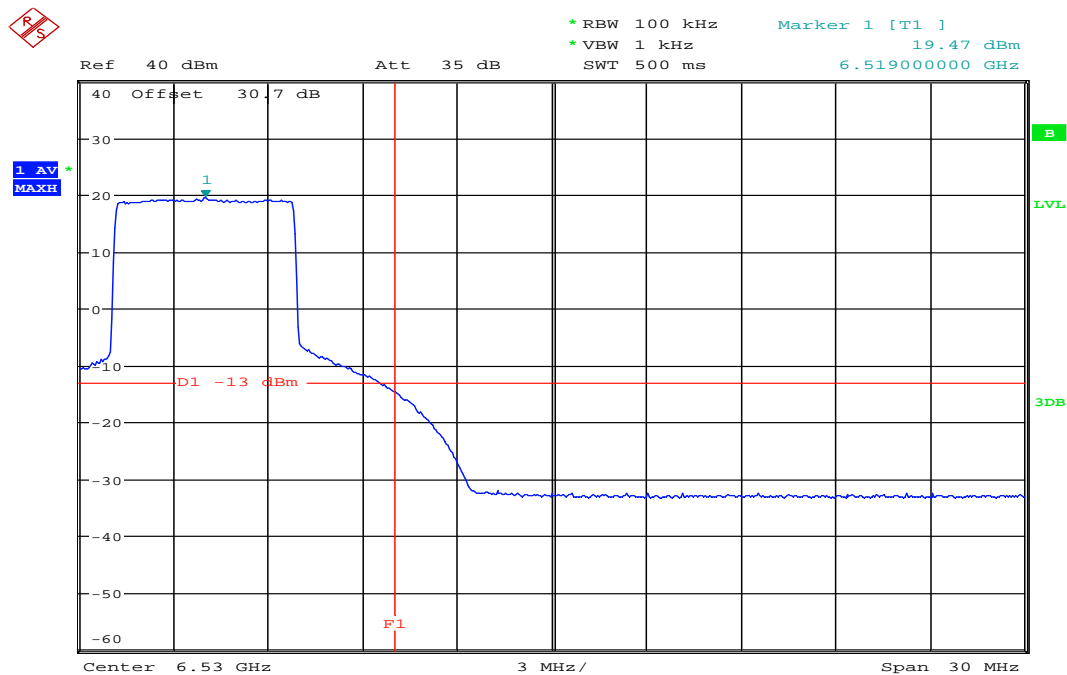
Date: 26.JUN.2011 17:50:09

Plot 96: Band-edge compliance 8 MHz / QPSK



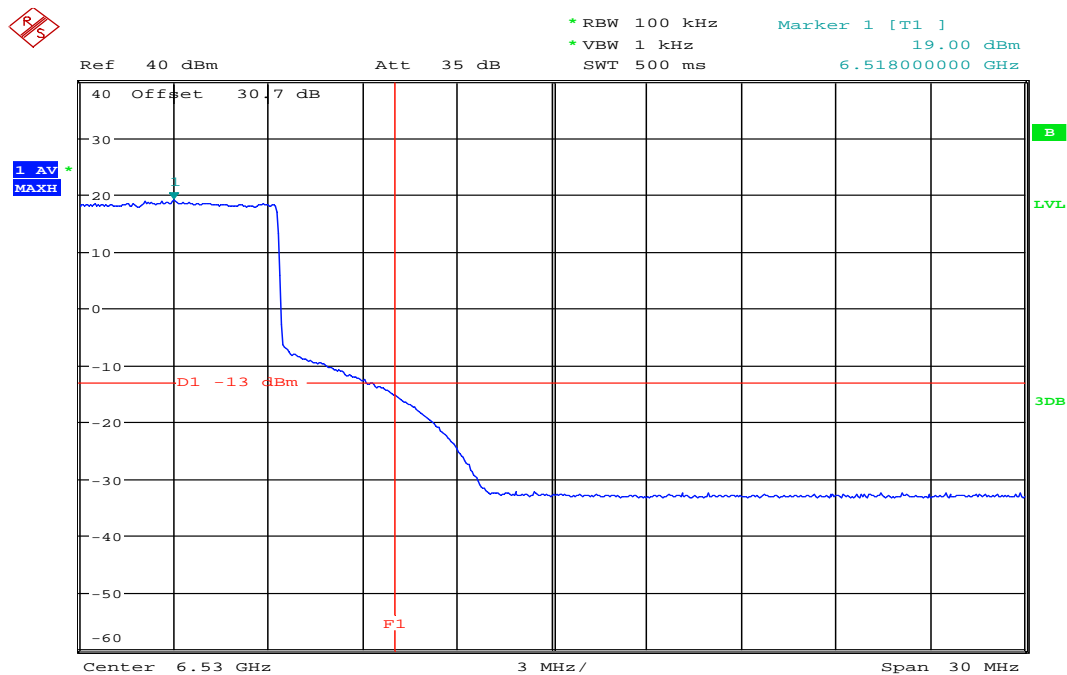
Date: 26.JUN.2011 17:55:54

Plot 97: Band-edge compliance 6 MHz / 16QAM



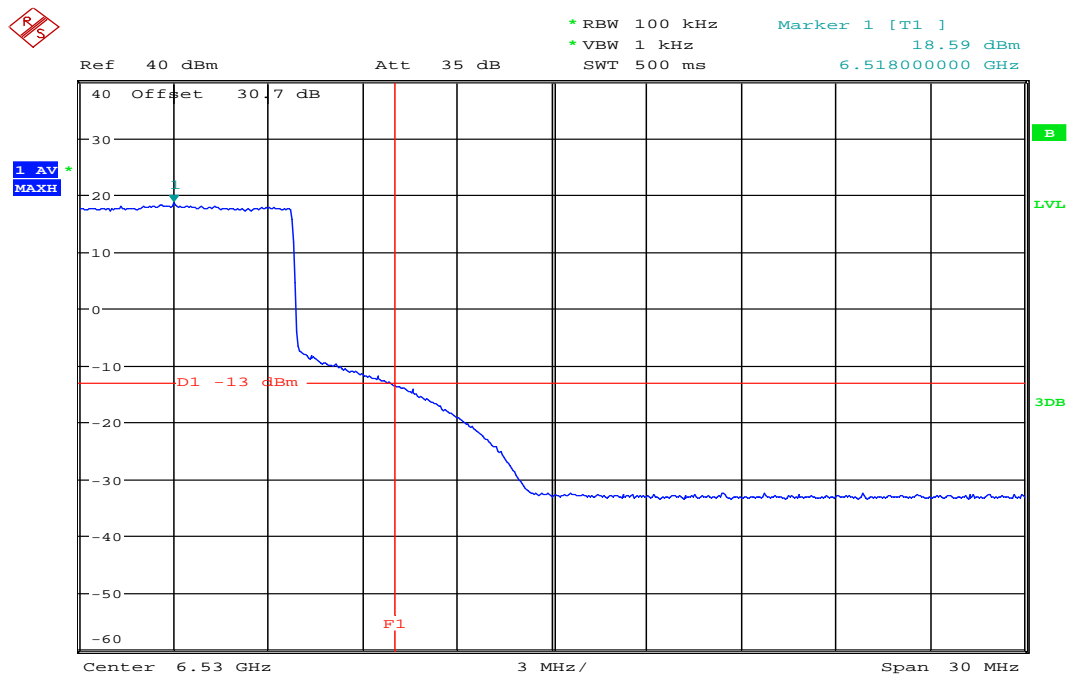
Date: 26.JUN.2011 17:43:15

Plot 98: Band-edge compliance 7 MHz / 16QAM



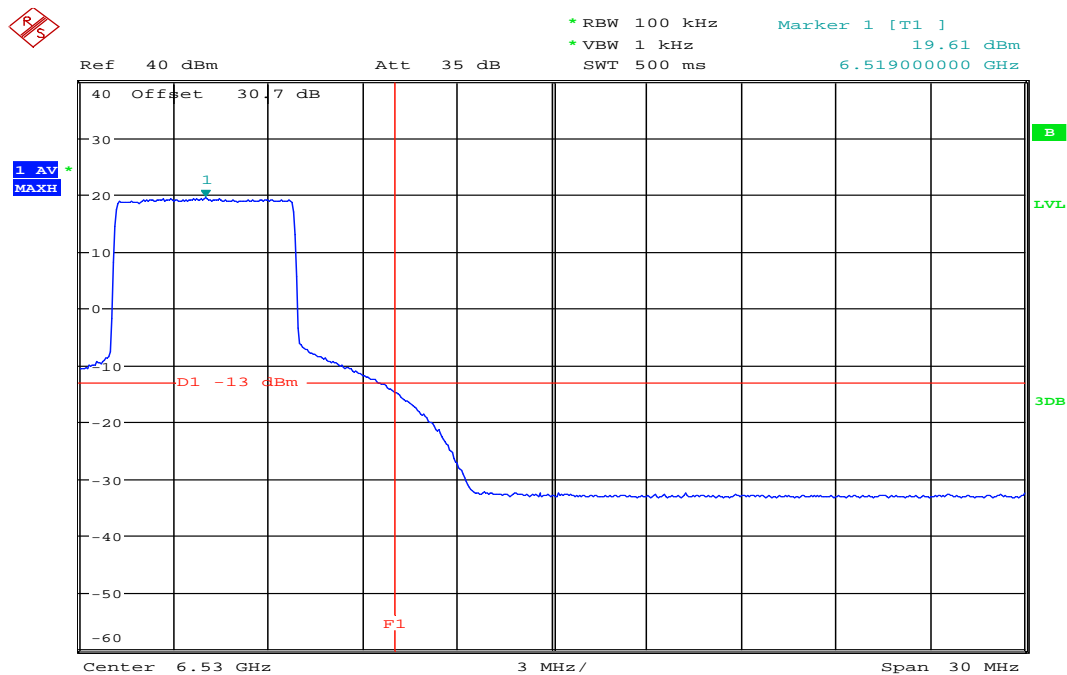
Date: 26.JUN.2011 17:51:00

Plot 99: Band-edge compliance 8 MHz / 16QAM



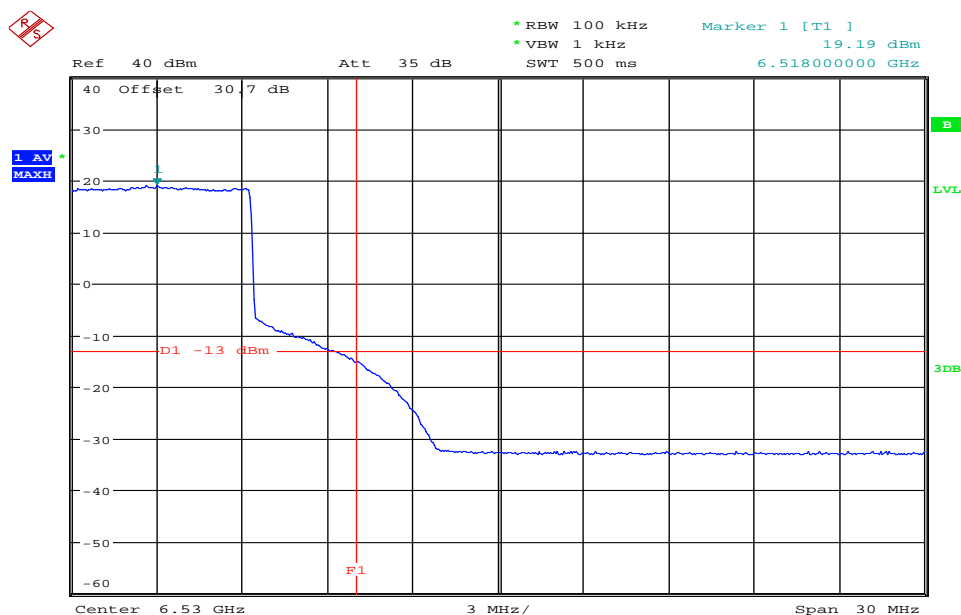
Date: 26.JUN.2011 17:56:30

Plot 100: Band-edge compliance 6 MHz / 64QAM



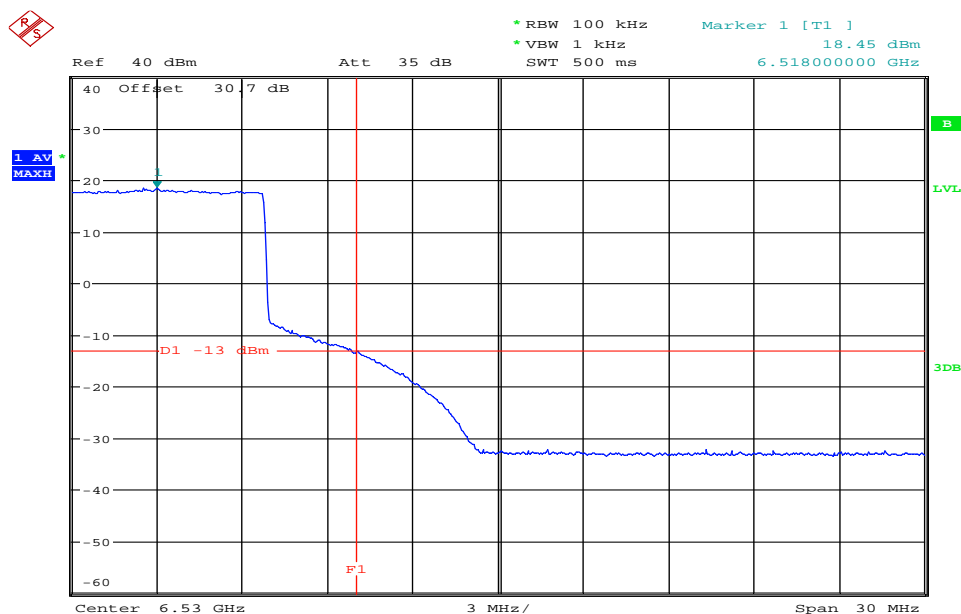
Date: 26.JUN.2011 17:43:52

Plot 101: Band-edge compliance 7 MHz / 64QAM



Date: 26.JUN.2011 17:52:11

Plot 102: Band-edge compliance 8 MHz / 64QAM



Date: 26.JUN.2011 17:56:56

Remark:

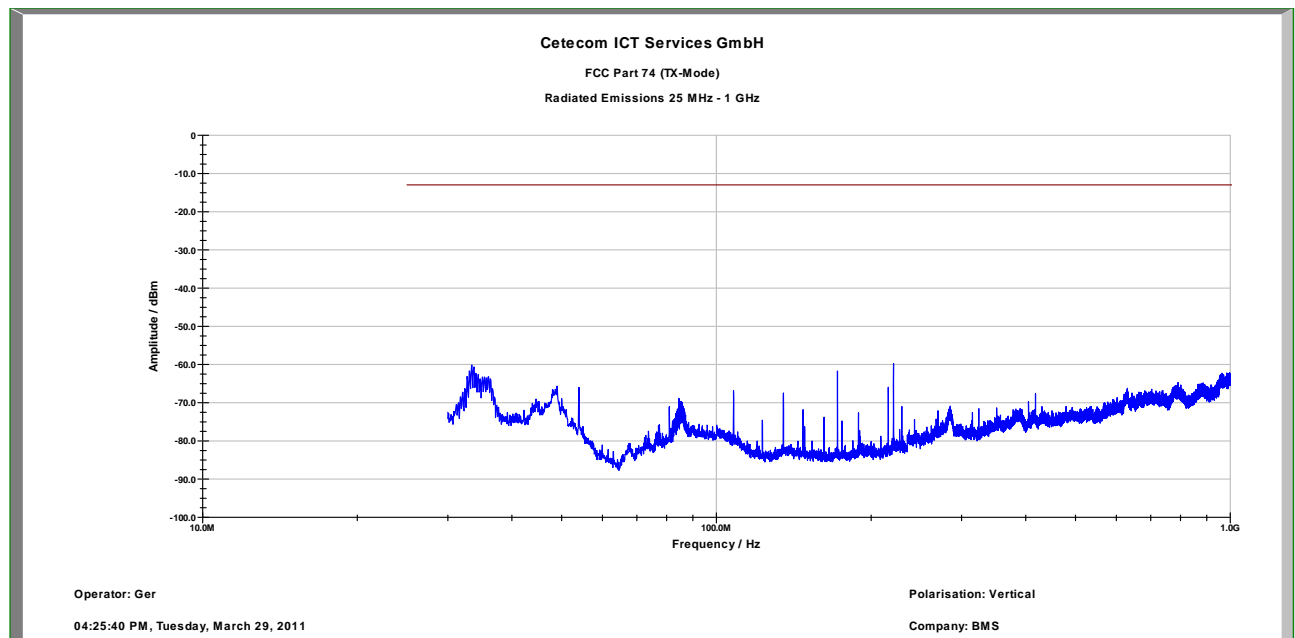
Frequency line F1 shows lower resp. upper band edge of the used frequency band.

Results: The measurement is passed.

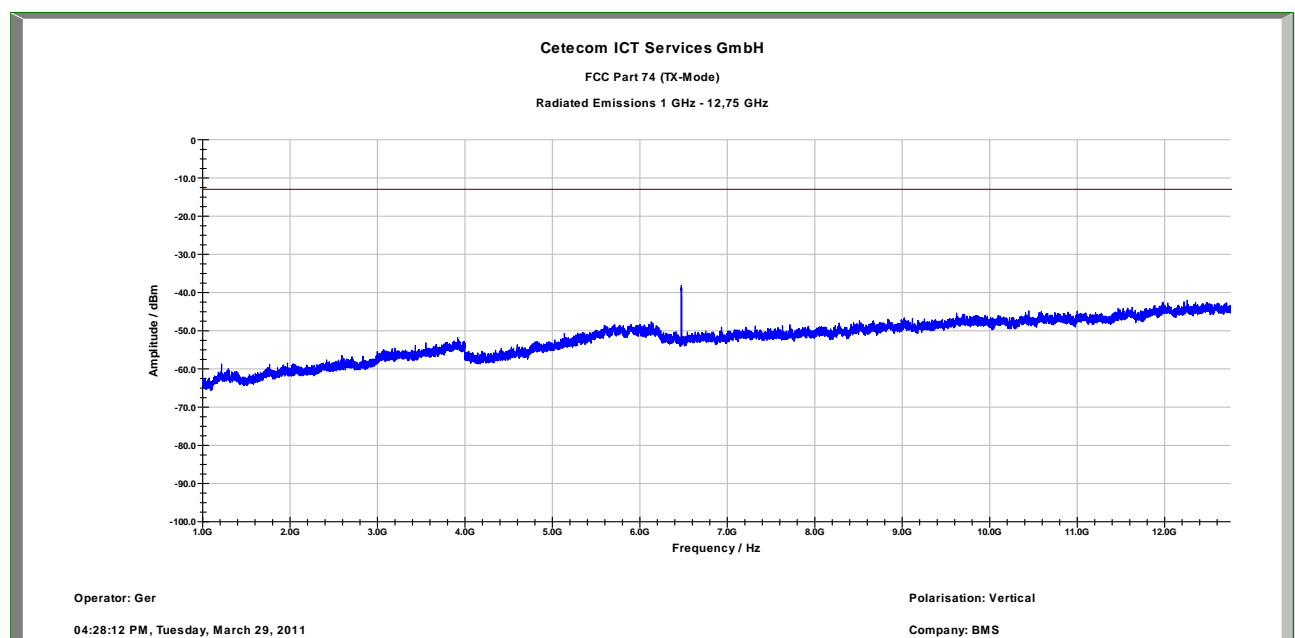
4.10 Spurious emissions (radiated)

§2.1051 / §74.637(a)(2)

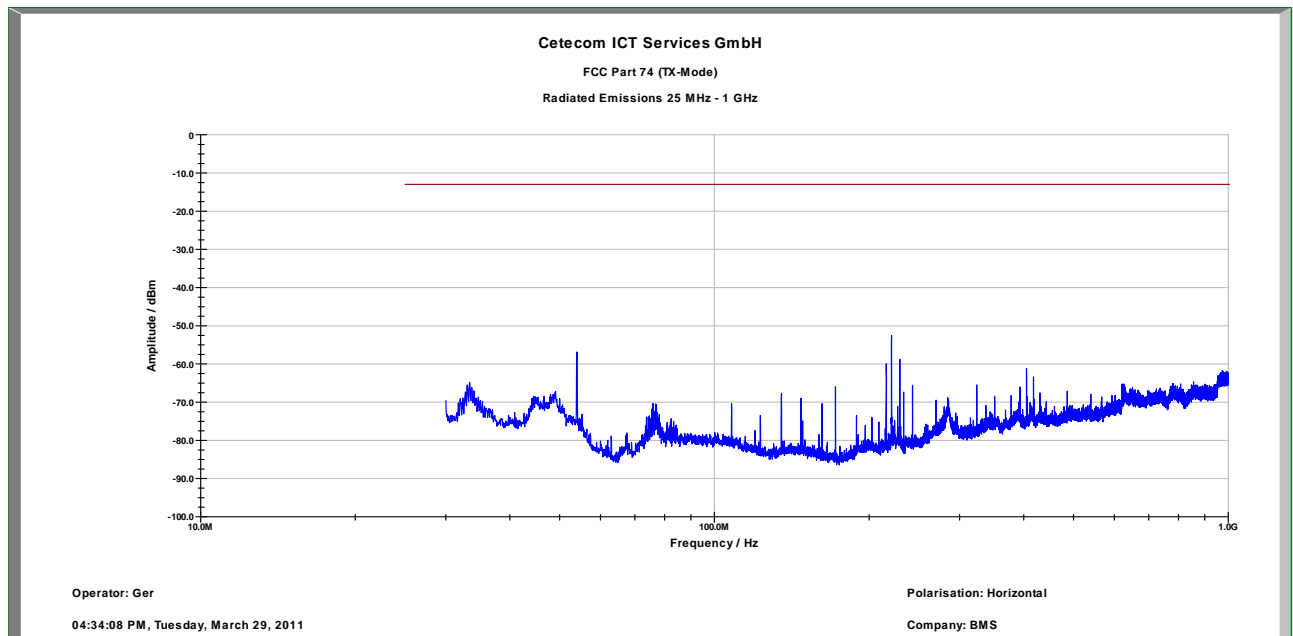
Plot 103: 9 kHz - 30 MHz, vertical polarisation (valid for all modes)



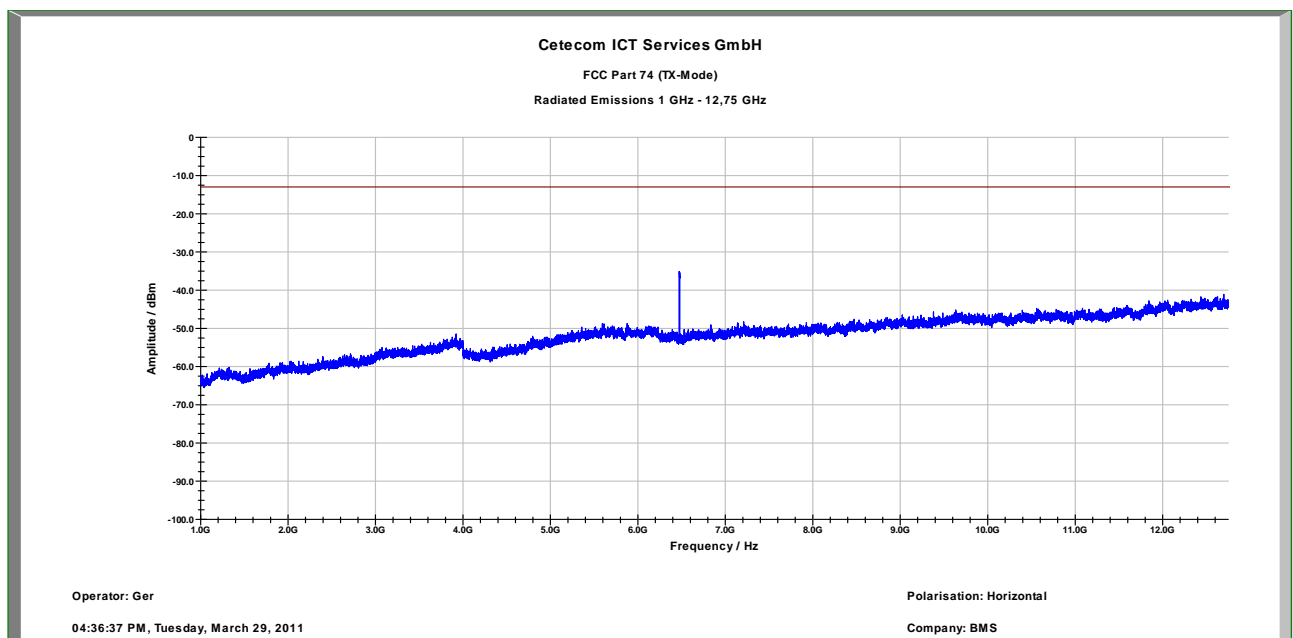
Plot 104: 25 MHz - 12 GHz, vertical polarisation (valid for all modes)



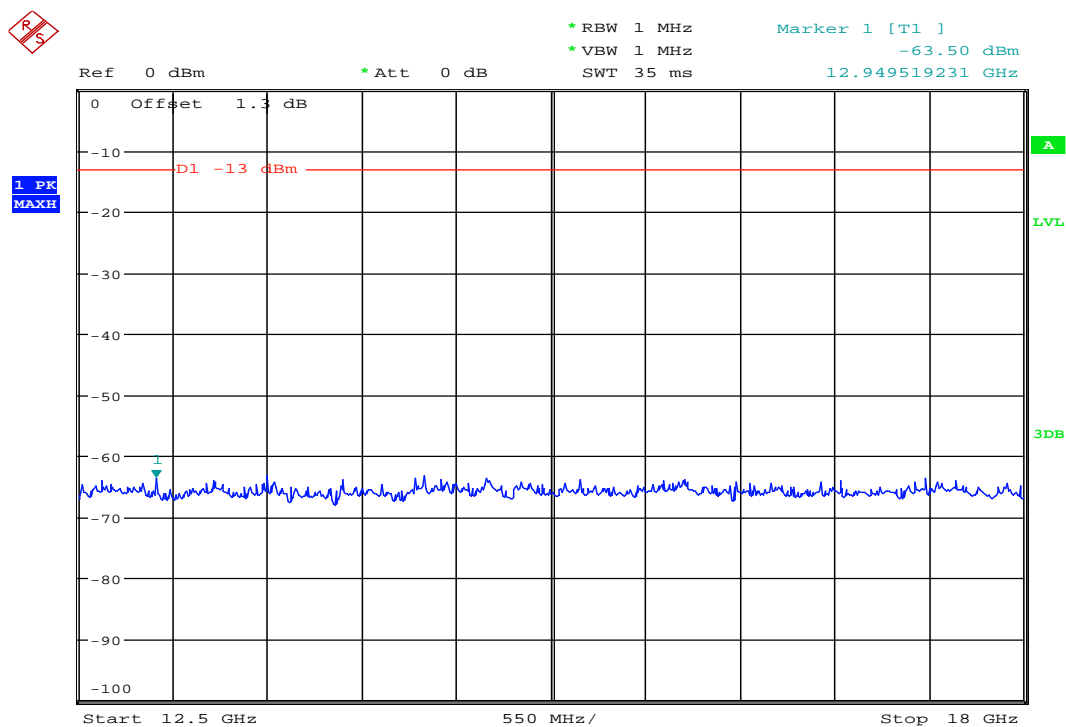
Plot 105: 9 kHz - 30 MHz, horizontal polarisation (valid for all modes)



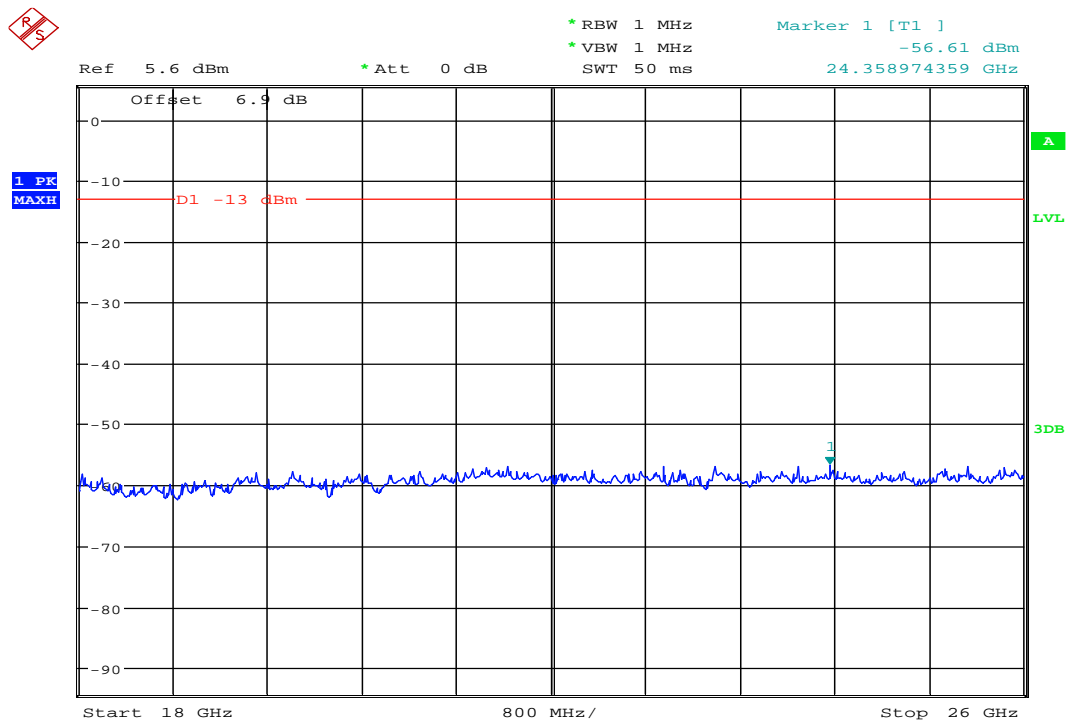
Plot 106: 25 MHz - 12 GHz, horizontal polarisation (valid for all modes)



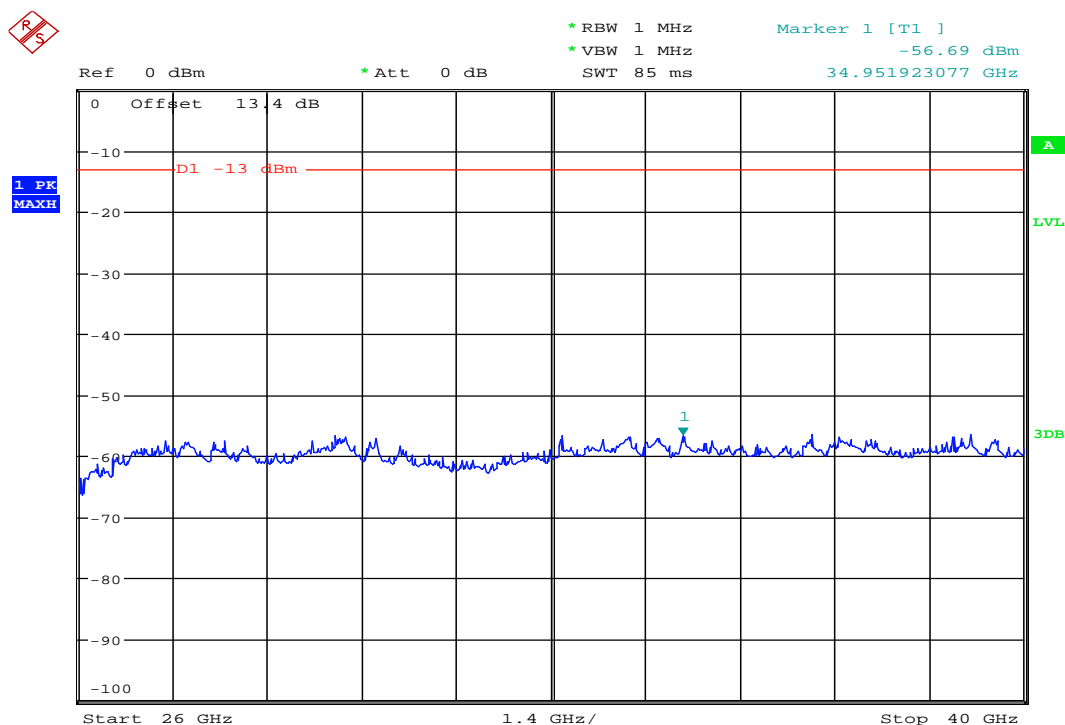
Plot 107: 12 GHz - 18 GHz vertical/horizontal polarization (valid for all modes)



Plot 108: 18 GHz - 26 GHz, vertical/horizontal polarization (valid for all modes)



Plot 109: 26 GHz - 40 GHz, vertical/horizontal polarization (valid for all modes)



| SPURIOUS EMISSIONS LEVEL (dBm) | | | | | | | | |
|--------------------------------|----------|---------------|-----------------|----------|-------------|-----------------|----------|-------------|
| 6475 MHz | | | | | | | | |
| Frequency [MHz] | Detector | Level [dBm] | Frequency [MHz] | Detector | Level [dBm] | Frequency [MHz] | Detector | Level [dBm] |
| 6475 | PEAK | wanted signal | | | | | | |
| 12950 | PEAK | -63.5 | | | | | | |
| | | | | | | | | |
| 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 (P_{MEAN}) in accordance with the following schedule:</p> <p>When using transmissions employing digital modulation techniques: In any 4 kHz reference bandwidth (B_{REF}), the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log_{10}(P_{\text{MEAN}}$ in watts) decibels, or 80 decibels, whichever is the lesser attenuation</p> |
|-----------------------------------|---|

Results: The measurement is passed.

4.11 Frequency tolerance

§2.1055 / §74.661

| Temperature [°C] | U _{DC} [V] | Carrier frequency [MHz] | Measured frequency [MHz] | Difference [kHz] | Difference [ppm] |
|---------------------|------------------------|----------------------------|-----------------------------|---------------------|---------------------|
| -30.0 | 28.0 | 6475 | 6474.988250 | -11.75 | -1.81 |
| -20.0 | 28.0 | 6475 | 6474.987410 | -12.59 | -1.94 |
| -10.0 | 28.0 | 6475 | 6474.985120 | -14.88 | -2.30 |
| 0.0 | 28.0 | 6475 | 6474.985090 | -14.91 | -2.30 |
| +10.0 | 28.0 | 6475 | 6474.987910 | -12.09 | -1.87 |
| +20.0 | 25.0 | 6475 | 6474.992500 | -7.50 | -1.16 |
| +20.0 | 28.0 | 6475 | 6474.992540 | -7.46 | -1.15 |
| +20.0 | 31.0 | 6475 | 6474.992560 | -7.44 | -1.15 |
| +30.0 | 28.0 | 6475 | 6474.997010 | -2.99 | -0.46 |
| +40.0 | 28.0 | 6475 | 6474.999940 | -0.06 | -0.01 |
| +45.5 | 28.0 | 6475 | 6474.999450 | -0.55 | -0.08 |

Remark:

For measuring the frequency stability it was not possible to switch off the modulation.

Resolution bandwidth was reduced until the carrier was clearly visible on the spectrum analyzer display.

The internal temperature protection system switched off the RF-signal when reaching the 45.5 °C (via Hyper Terminal internally measured value: 60.1 °C). Thus, it was not possible to test the frequency stability at 50°C.

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: 6425 to 6525 MHz: 0.005% / 50 ppm

Limit according to IC-SRSP-306.4, 5.3:

The centre frequency of the emission shall be maintained within + 0.005% of the assigned frequency.

Results: The measurement is 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/cm²)
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 max. EIRP (RMS)

max. EIRP (RMS): 44.8 dBm = 30.2 W

calculated minimum safety distance:

$$\underline{R = \sqrt{30200 \text{ mW} / 4\pi}} = 49.0 \text{ cm}$$

Limit:

1mW/ cm² 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 C:

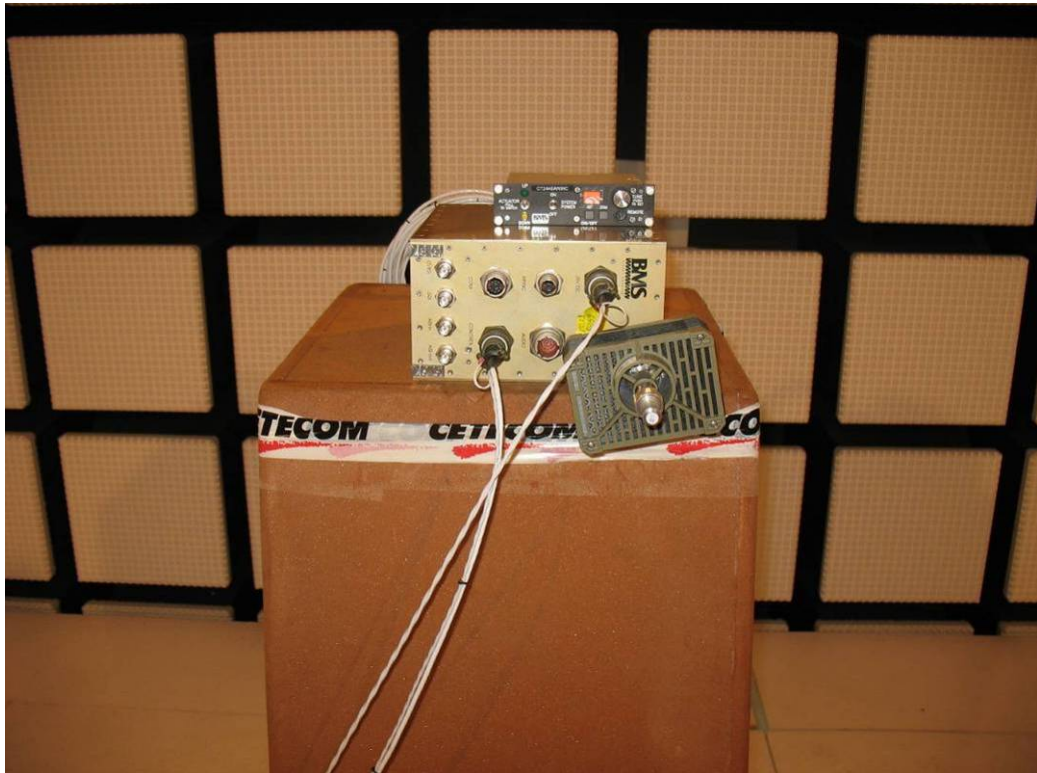
| No | Equipment/Type | Manuf. | Serial Nr. | Inv. No. Cetecom | Last Calibration | Frequency (months) | Next Calibration |
|----|---|-------------|------------|------------------|------------------------------------|--------------------|------------------|
| 1 | Anechoic chamber | MWB | 87400/02 | 300000996 | Monthly verification | | |
| 2 | System-Rack 85900 | HP I.V. | * | 300000222 | n.a. | | |
| 3 | Measurement System 1 | | | | | | |
| 4 | PSA-Spektrumanalysator 3 Hz - 26.5 GHz (E4440A) | Agilent | MY48250080 | 300003812 | 08/2008 | 24 | 08/2010 |
| 5 | EMI Preselector 9 kHz - 1 GHz (N9039A) | Agilent | MY48260003 | 300003825 | 08/2008 | 24 | 08/2010 |
| 6 | Microwave Analog Signal Generator (N5183A) | Agilent | MY47420220 | 300003813 | 08/2008 | 24 | 08/2010 |
| 7 | PC | F+W | | | n.a. | | |
| 8 | TILE | TILE | | | n.a. | | |
| 9 | TRILOG Super Broadband Antenna (VULB9163) | Schwarzbeck | 371 | 300003854 | Monthly verification (System cal.) | | |
| 10 | Double Ridged Antenna 3115 | EMCO | 3088 | 300001032 | Monthly verification (System cal.) | | |
| 11 | Active Loop Antenna 6502 | EMCO | 2210 | 300001015 | Monthly verification (System cal.) | | |
| 12 | Switch / Control Unit 3488A | HP | 2719A15013 | 300001156 | n.a. | | |
| 13 | Power Supply 6032A | HP | 2818A03450 | 300001040 | 01/2009 | 36 | 01/2012 |
| 14 | Switch / Control Unit 3488A | HP | 2605e08770 | 300001443 | n.a. | | |
| 15 | Trenntrafo RT5A | Grundig | 9242 | 300001263 | n.a. | | |
| 16 | Relais Matrix PSU | R&S | 890167/024 | 300001168 | n.a. | | |
| 17 | Netznachbildung ESH3-Z5 | R&S | 828576/020 | 300001210 | n.a. | | |

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 | 28.05.2009 | 24 | 28.05.2013 |
| 2 | Spectrum Analyser FSU 50 | R&S | 200012 | 300003443 | 01.07.2010 | 24 | 01.07.2012 |
| 3 | SGH 12 ... 18 GHz, 639 | narda | 8402 | 300000787 | cyclic verification | | |
| 4 | SGH 18 ... 27 GHz, 638 | narda | 8206 | 300000487 | cyclic verification | | |
| 5 | SGH 26 ... 40 GHz, V637 | narda | 7911 | 300001751 | cyclic verification | | |
| 6 | Adapter WG/SMA | narda | 4609 | -/- | cyclic verification | | |
| 7 | Adapter WG/SMA | flann | 100484 | -/- | cyclic verification | | |
| 8 | Adapter WG/SMA | flann | -/- | -/- | cyclic verification | | |
| 9 | 1.5 m 50 Ω / K | Insulated Wire Inc. | 101995 | 300002290 | cyclic verification | | |
| 10 | Attenuator 20dB, k-con. | Inmet | 40A-20dB | -/- | cyclic verification | | |

6 Photographs of the test setup

Photo No. 1



7 Internal photographs of the EUT

Photo No. 1



Photo No. 2

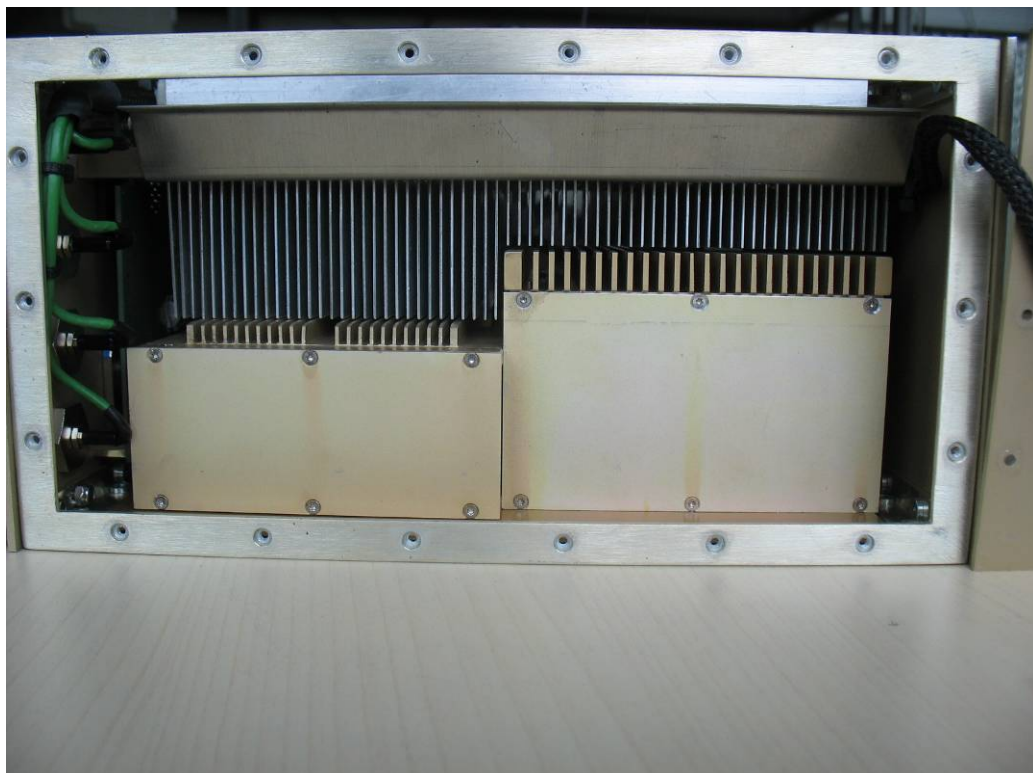


Photo No. 3

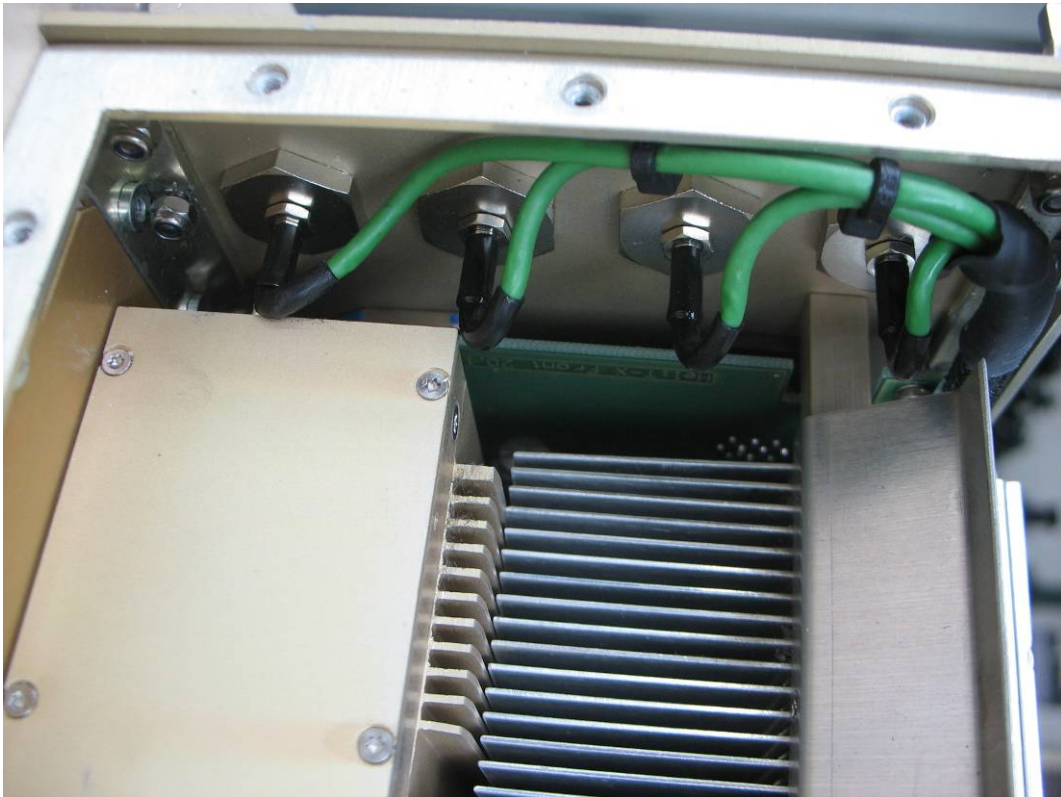


Photo No. 4

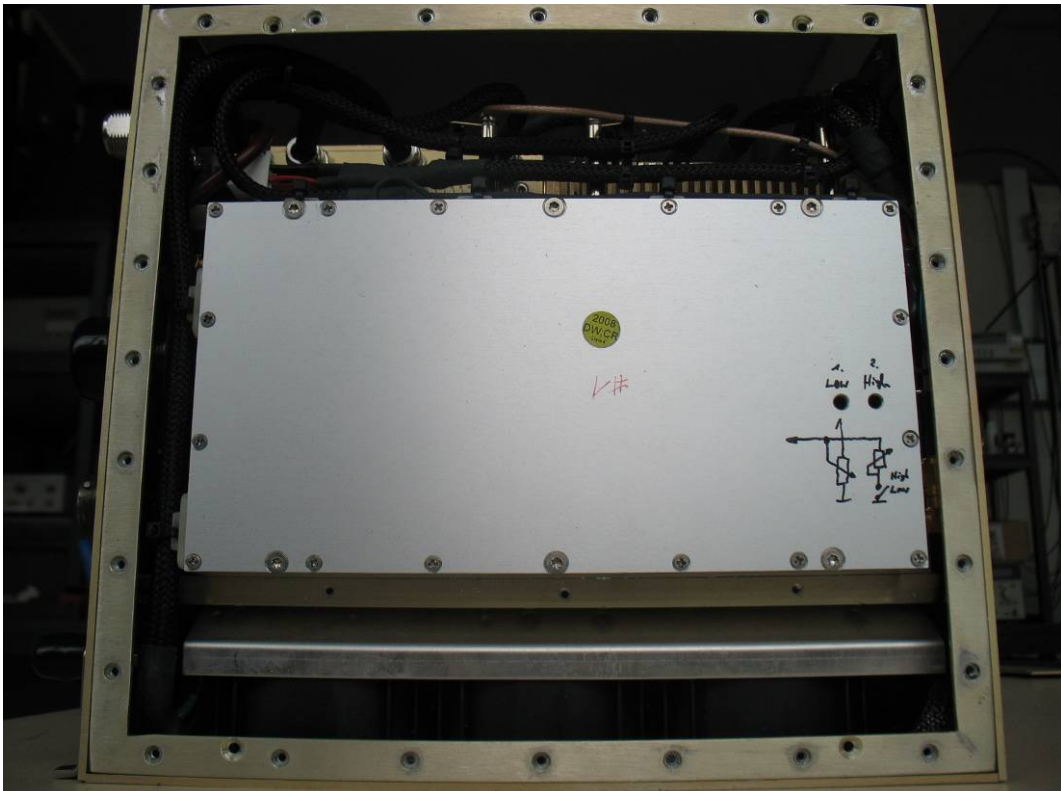


Photo No. 5

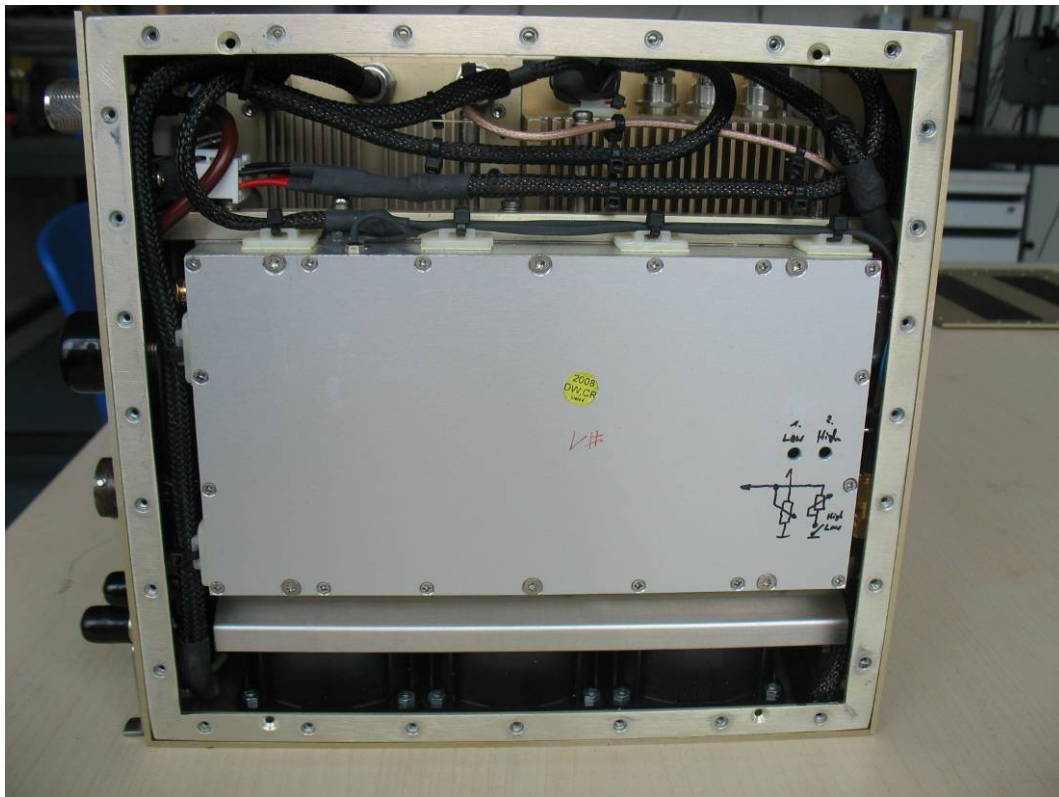


Photo No. 6

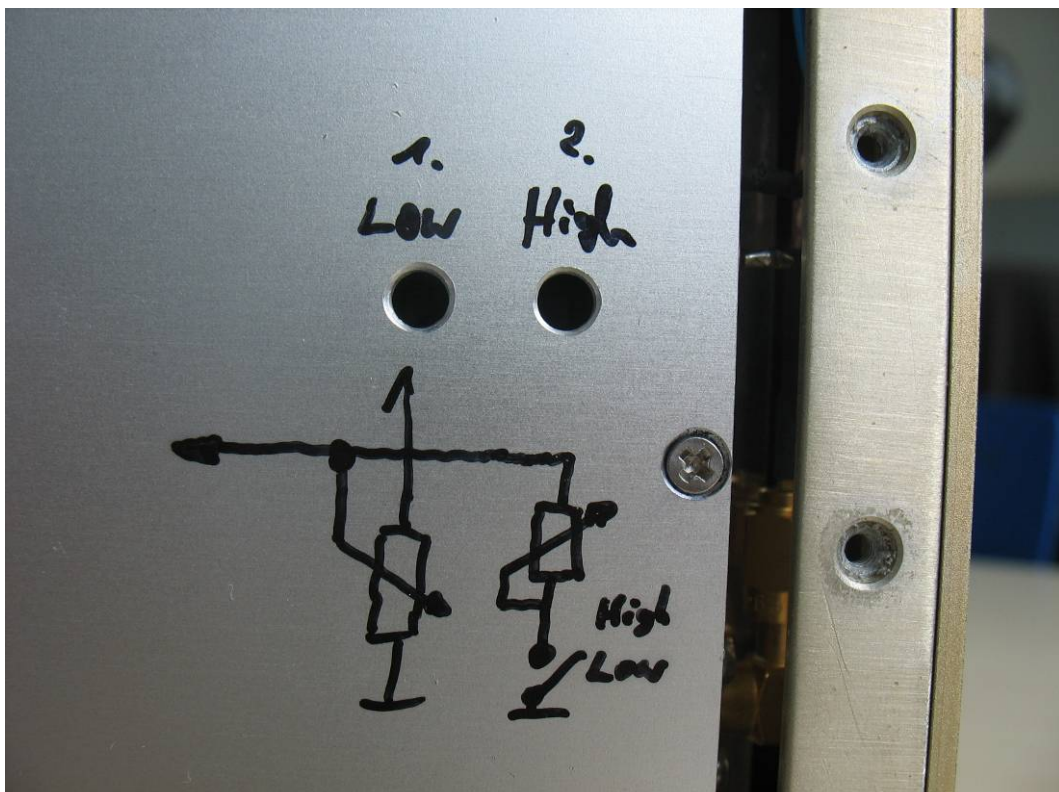


Photo No. 7

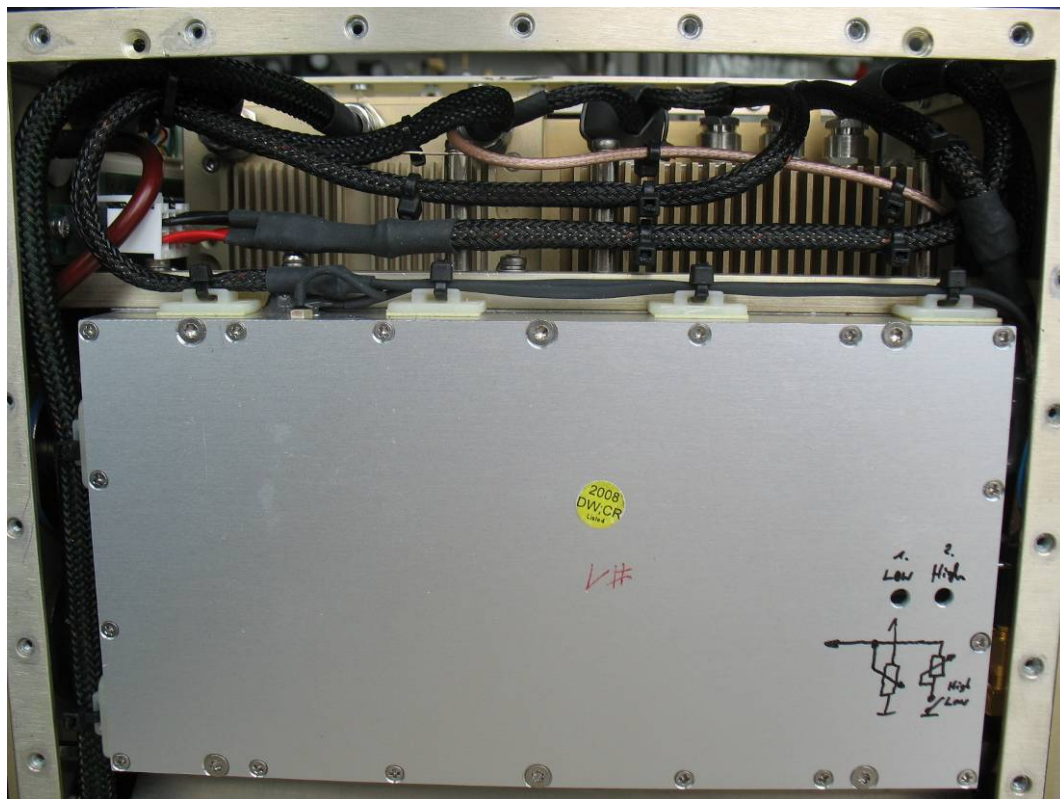


Photo No. 8

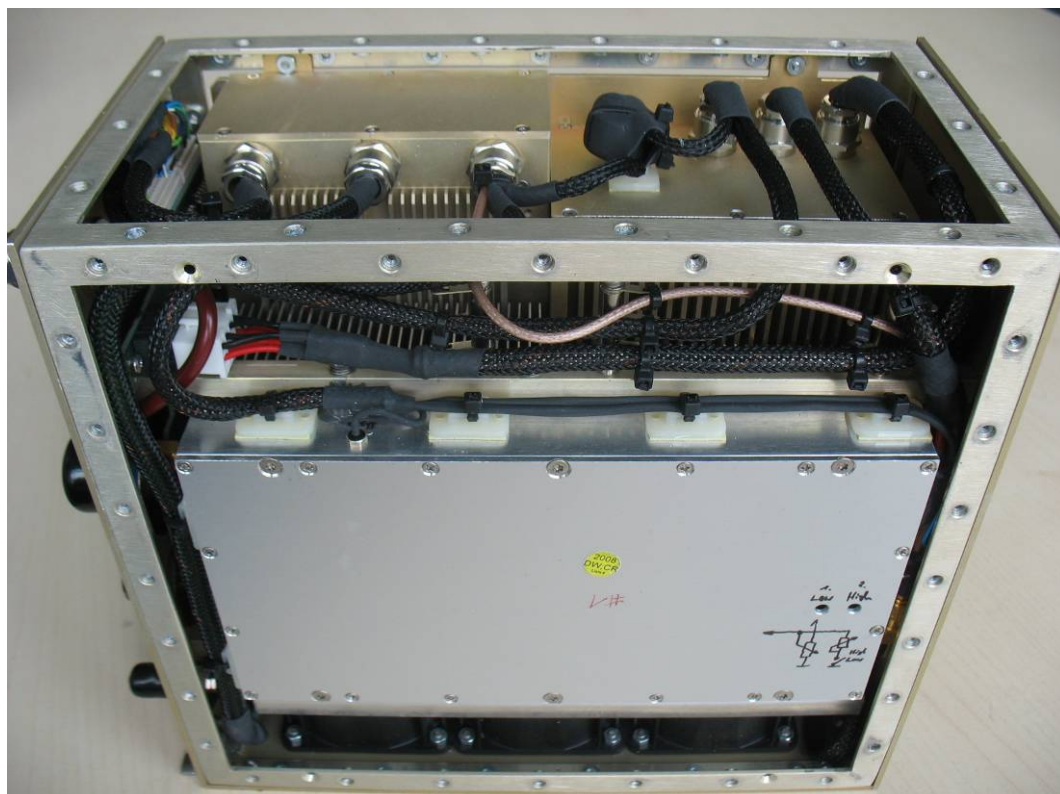


Photo No. 9

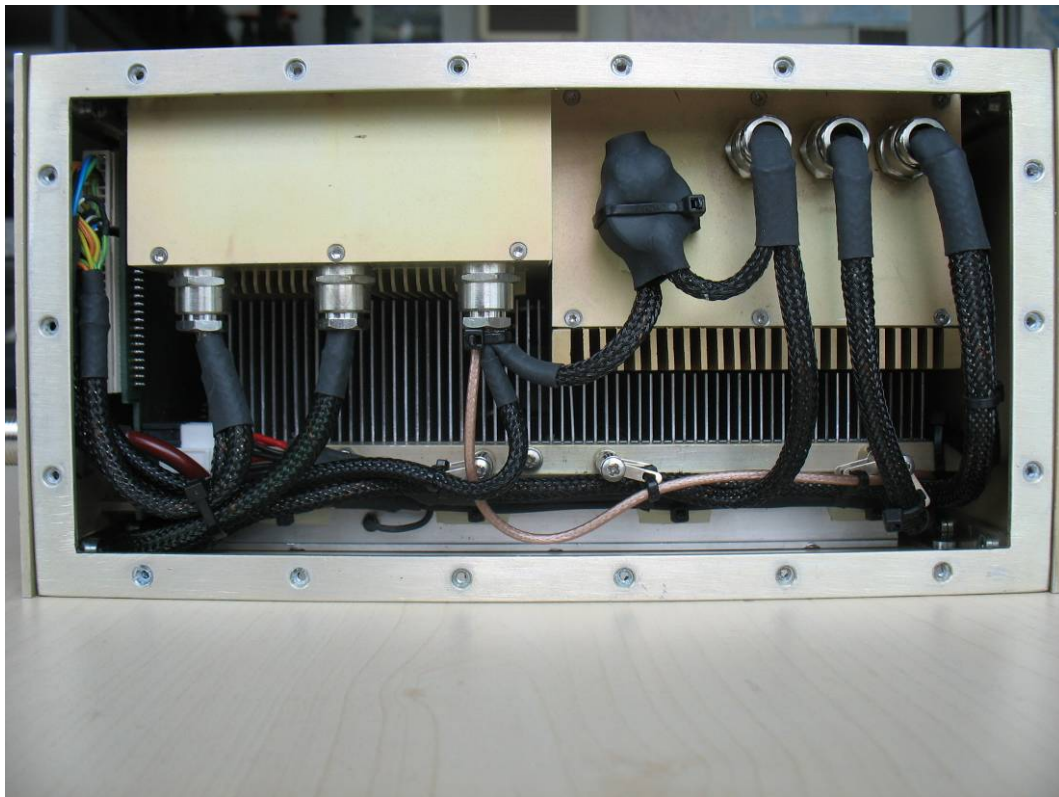


Photo No. 10



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



9 Document history

| Version | Applied changes | Date of release |
|---------|---|-----------------|
| 1.0 | Initial release | 2011-07-21 |
| 2.0 | Antenna gain has changed from 3 dBi to 6 dBi. With respect to this new antenna gain pages 5, 7, 21 and 72 had to be changed concerning following information: - RF output power (radiated) - MPE calculation | 2011-08-18 |