

EMC TEST REPORT

No. JSH007120114-001

Applicant : Azalea Networks U.S.A, Inc
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United States

Manufacturer : RAYSON ELECTRONIC MFY
2ND INDUSTRIAL ZONE, LOU VILLAGE.BAO'AN,
GONG MING, SHENZHEN, GUANGDONG, CHINA

Equipment : Outdoor Wireless Mesh Router

Type/Model : MSR4K44S

SUMMARY

The equipment complies with the requirements according to the following standard(s):

47CFR Part 15 (2007): Radio Frequency Devices

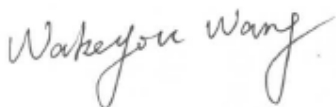
ANSI C63.4 (2003): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

RSS-210 Issue 7 (June 2007): Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

RSS-Gen Issue 2 (June 2007): General Requirements and Information for the Certification of Radiocommunication Equipment

Date of issue: Jan 10, 2008

Tested by:



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Description of Test Facility

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Content

| | |
|--|-----------|
| SUMMARY | 1 |
| DESCRIPTION OF TEST FACILITY..... | 2 |
| 1. GENERAL INFORMATION | 5 |
| 1.1 Applicant Information..... | 5 |
| 1.2 Identification of the EUT | 5 |
| 1.3 Technical specification | 6 |
| 1.4 Mode of operation during the test / Test peripherals used..... | 7 |
| 2. TEST SPECIFICATION | 8 |
| 2.1 Instrument list | 8 |
| 2.2 Test Standard | 8 |
| 3. MINIMUM 6DB BANDWIDTH..... | 10 |
| 3.1 Limit..... | 10 |
| 3.2 Test Configuration | 10 |
| 3.3 Test Procedure and test setup..... | 10 |
| 3.4 Test Protocol | 11 |
| 3.5 Measurement uncertainty..... | 11 |
| 4. MAXIMUM PEAK OUTPUT POWER..... | 12 |
| 4.1 Test limit | 12 |
| 4.2 Test Configuration | 12 |
| 4.3 Test procedure and test setup | 12 |
| 4.4 Test protocol | 13 |
| 4.5 Measurement uncertainty..... | 13 |
| 5. POWER SPECTRUM DENSITY | 14 |
| 5.1 Test limit | 14 |
| 5.2 Test Configuration | 14 |
| 5.3 Test procedure and test setup | 14 |
| 5.4 Test Protocol | 15 |
| 5.5 Measurement uncertainty..... | 15 |
| 6. SPURIOUS EMISSION | 16 |
| 6.1 Test limit..... | 16 |
| 6.2 Test Configuration | 16 |
| 6.3 Test procedure and test setup | 16 |
| 6.4 Test protocol | 17 |
| 6.5 Measurement uncertainty..... | 19 |
| 7. RESTRICT BAND RADIATED EMISSION..... | 20 |
| 7.1 Test limit..... | 20 |
| 7.2 Test Configuration | 20 |
| 7.3 Test procedure and test setup | 21 |
| 7.4 Test protocol | 22 |
| 7.5 Measurement uncertainty..... | 22 |
| 8. EMISSION OUTSIDE THE FREQUENCY BAND | 23 |
| 8.1 Limit..... | 23 |
| 8.2 Test Configuration | 23 |
| 8.3 Test procedure and test setup | 23 |
| 8.4 Test protocol | 24 |
| 8.5 Measurement uncertainty..... | 24 |

| | |
|---|-----------|
| 9. POWER LINE CONDUCTED EMISSION..... | 25 |
| 9.1 Limit..... | 25 |
| 9.2 Test configuration | 25 |
| 9.3 Test procedure and test set up..... | 26 |
| 9.4 Test protocol | 27 |
| 9.5 Measurement Uncertainty | 27 |
| 10. CHANNEL NUMBER OF HOPPING SYSTEM..... | 28 |
| 10.1 Limit..... | 28 |
| 10.2 Test Configuration | 28 |
| 10.3 Test procedure and test setup..... | 28 |
| 10.4 Test protocol | 29 |
| 10.5 Measurement uncertainty | 29 |
| 11. AVERAGE TIME OF OCCUPANCY IN ANY CHANNEL | 30 |
| 11.1 Limit..... | 30 |
| 11.2 Test Configuration | 30 |
| 11.3 Test procedure and test setup..... | 30 |
| 11.4 Test protocol | 31 |
| 11.5 Measurement uncertainty | 31 |
| 12. OCCUPIED BANDWIDTH..... | 32 |
| 12.1 Test limit..... | 32 |
| 12.2 Test Configuration | 32 |
| 12.3 Test procedure and test setup..... | 32 |
| 12.4 Test protocol | 33 |
| 12.5 Measurement uncertainty | 33 |
| 13. SPURIOUS EMISSION FOR RECEIVER..... | 34 |
| 13.1 Test limit..... | 34 |
| 13.2 Test Configuration | 34 |
| 13.3 Test procedure and test setup..... | 34 |
| 13.4 Test protocol | 35 |
| 13.5 Measurement uncertainty | 35 |

1. General Information

1.1 Applicant Information

Applicant: Azalea Networks U.S.A, Inc
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Manufacturer: RAYSON ELECTRONIC MFY
2ND INDUSTRIAL ZONE, LOU VILLAGE.BAO'AN,
GONG MING, SHENZHEN, GUANGDONG, CHINA

Sample received date : Dec 10, 2007
Date of test : Dec 10, 2007~ Jan 7, 2008

1.2 Identification of the EUT

Equipment: Outdoor Wireless Mesh Router
Type/model: MSR4K44S
FCC ID: URP- MSR4K44S
IC: 6822A- MSR4K44S

1.3 Technical specification

| | |
|---------------------------|---|
| Operation Frequency Band: | 2400-2483.5MHz |
| Modulation: | 802.11b: CCK, QPSK and BPSK 802.11g: OFDM |
| Antenna Designation: | Replaceable antenna using N-K reverse connector to connect to the EUT. As a result, warning information is included in the User Manual as “The installation should be done by experienced antenna installer”. |
| Gain of Antenna: | 14dBi max. |
| Rating: | AC 110V ~ 240V, 50/60Hz, 1.5A |
| Description of EUT: | <p>Here is one model only.</p> <p>The EUT is an outdoor mesh router. It is built on including AWR wireless routing, Motrix cruss-net roaming, intelligent radio-frequency management and fine-grained quality of service.</p> <p>There are four RF output terminals which have same RF performance on the EUT. At a certain time, only one of them can work and the others are disabled.</p> <p>While using, 802.11 b and 802.11 g can not be set to work simultaneously.</p> |

Channel Description:

| Channel | Central frequency (MHz) |
|---------|-------------------------|
| 1 | 2412 |
| 2 | 2417 |
| 3 | 2422 |
| 4 | 2427 |
| 5 | 2432 |
| 6 | 2437 |
| 7 | 2442 |
| 8 | 2447 |
| 9 | 2452 |
| 10 | 2457 |
| 11 | 2462 |

1.4 Mode of operation during the test / Test peripherals used

Within this test report, EUT was tested under 120V/60Hz. The channel 1, 6 and 11 as the lowest, middle and highest channel were chosen to perform test.

For 802.11 b, there are four communication rates namely 1Mbps, 2 Mbps, 5.5Mbps and 11Mbps. Here to obtain the worst test data, 11Mbps was chosen to perform test as representative.

For 802.11 g, the communication rate of 54Mbps was chosen to perform test.

2. Test Specification

2.1 Instrument list

| Equipment | Type | Manu. | Internal no. | Cal. Date | Due date |
|-------------------------|------------|-------------------|--------------|-----------|-----------|
| Test Receiver | ESIB 26 | R&S | EC 3045 | 2007-6-1 | 2008-5-31 |
| Semi-anechoic chamber | - | Albatross project | EC 3048 | 2007-6-1 | 2008-5-31 |
| A.M.N. | ESH2-Z5 | R&S | EC 3119 | 2007-1-23 | 2008-1-22 |
| Test Receiver | ESCS 30 | R&S | EC 2107 | 2007-1-23 | 2008-1-22 |
| Ultra-broadband antenna | HL 562 | R&S | EC 3046-1 | 2007-6-30 | 2008-6-29 |
| Horn antenna | HF 906 | R&S | EC 3049 | 2007-6-30 | 2008-6-29 |
| Pre-amplifier | Pre-amp 18 | R&S | EC 3222 | 2007-6-30 | 2008-6-29 |
| Pre-amplifier | Pre-amp 40 | Beijing Radio 2 | - | 2007-3-4 | 2008-3-3 |
| Horn antenna | K638A | Beijing Radio 2 | - | 2007-3-4 | 2008-3-3 |
| Power meter | PM2002 | AR | EC3043-7 | 2007-1-23 | 2008-1-22 |
| Power sensor | PH2000 | AR | EC3043-8 | 2007-1-23 | 2008-1-22 |
| Signal generator | SMR 20 | R&S | EC 3044-1 | 2007-8-21 | 2008-8-20 |

2.2 Test Standard

47CFR Part 15 (2007)
ANSI C63.4: 2003
RSS-210 Issue 7 (June 2007)
RSS-Gen Issue 2 (June 2007)

2.3 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

| TEST ITEM | FCC REFERENCE | IC REFERENCE | RESULT |
|--|-------------------|---------------------------------|--------|
| Minimum 6dB Bandwidth | 15.247(a)(2) | RSS-210 Issue 7 Annex 8 | Pass |
| Maximum peak output power | 15.247(b)(1) | RSS-210 Issue 7 Annex 8 | Pass |
| Power spectrum density | 15.247(e) | RSS-210 Issue 7 Annex 8 | Pass |
| Spurious emission | 15.209 | RSS-210 Issue 7 Clause 2 | Pass |
| Restrict band radiated emission | 15.205 | RSS-210 Issue 7 Clause 2 | Pass |
| Emission outside the frequency band | 15.247(d) | RSS-210 Issue 7 Annex 8 | Pass |
| Power line conducted emission | 15.207 | RSS-Gen Issue 2 Clause 7.2.2 | Pass |
| Channel number of hopping system | 15.247(a)(1)(iii) | RSS-210 Issue 7 Annex 8 | NA |
| Average time of occupancy in any channel | 15.247(a)(1)(iii) | RSS-210 Issue 7 Annex 8 | NA |
| Occupied bandwidth | - | RSS-Gen Issue 2 Clause 4.6.1 | Tested |
| Spurious emission for receiver | - | RSS-210 Issue 7 Clause 2.3 | Pass |

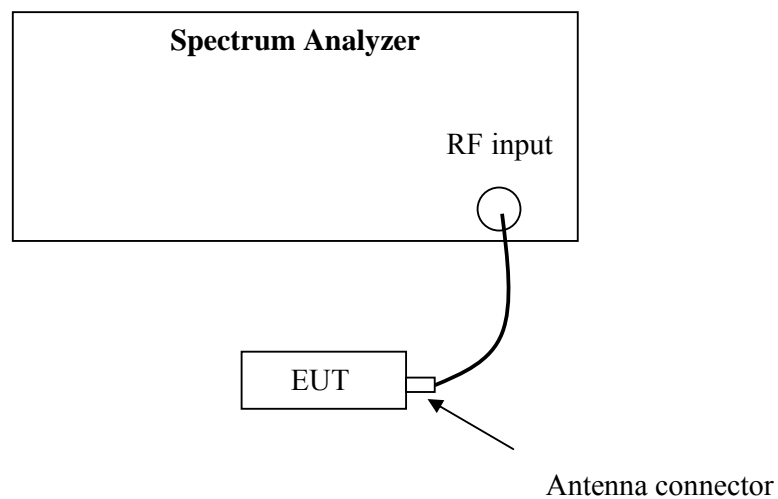
3. Minimum 6dB Bandwidth

Test result: PASS

3.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Test Configuration



3.3 Test Procedure and test setup

The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW. The test was performed at 3 channels (lowest, middle and highest channel).

3.4 Test Protocol

Temperature : 22°C
 Relative Humidity : 43%

For 802.11.b

| Channel | Bandwidth (MHz) | Limit (MHz) |
|---------|-----------------|-------------|
| 1 | 11.72 | ≥ 0.5 |
| 6 | 11.36 | ≥ 0.5 |
| 11 | 10.64 | ≥ 0.5 |

Remark: Margin = Bandwidth - Limit

For 802.11.g

| Channel | Bandwidth (MHz) | Limit (MHz) |
|---------|-----------------|-------------|
| 1 | 16.65 | ≥ 0.5 |
| 6 | 16.65 | ≥ 0.5 |
| 11 | 16.59 | ≥ 0.5 |

Remark: Margin = Bandwidth - Limit

3.5 Measurement uncertainty

The measurement uncertainty is $\pm 100\text{Hz}$.

4. Maximum peak output power

Test result: Pass

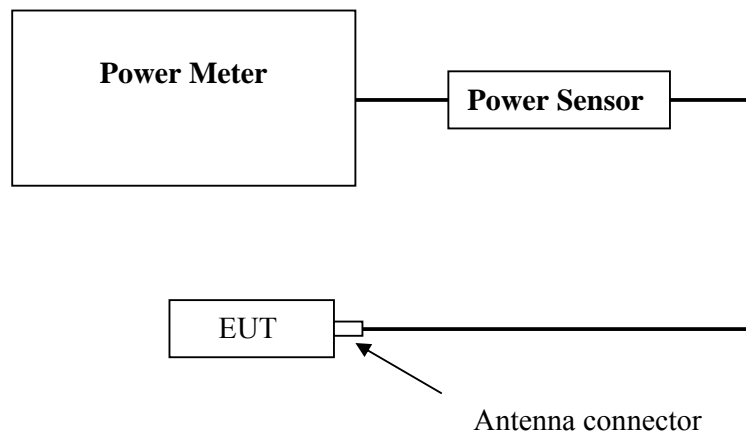
4.1 Test limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt

For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.2 Test Configuration



4.3 Test procedure and test setup

The power output per FCC § 15.247(b)(1) was measured on the EUT using a power meter via power sensor. The test was performed at 3 channels (lowest, middle and highest channel).

4.4 Test protocol

Temperature : 22 °C
 Relative Humidity : 43 %

For 802.11.b

| Channel | Cable loss (dB) | Reading of receiver (dBm) | Limit (dBm) |
|---------|-----------------|---------------------------|-------------|
| 1 | 0 | 21.53 | 22 |
| 6 | 0 | 20.06 | 22 |
| 11 | 0 | 21.31 | 22 |

Remark: 1. Limit = 30dBm – (gain of antenna – 6dBi) = 30 – (14- 6) = 22dBm
2. The cable used to test is a part of EUT, connecting RF port and antenna.
Here no cable loss is taken into account.

For 802.11.g

| Channel | Cable loss (dB) | Reading of receiver (dBm) | Limit (dBm) |
|---------|-----------------|---------------------------|-------------|
| 1 | 0 | 20.82 | 22 |
| 6 | 0 | 21.79 | 22 |
| 11 | 0 | 21.24 | 22 |

Remark: 1. Limit = 30dBm – (gain of antenna – 6dBi) = 30 – (14- 6) = 22dBm
2. The cable used to test is a part of EUT, connecting RF port and antenna.
Here no cable loss is taken into account.

4.5 Measurement uncertainty

The measurement uncertainty is ±1dB.

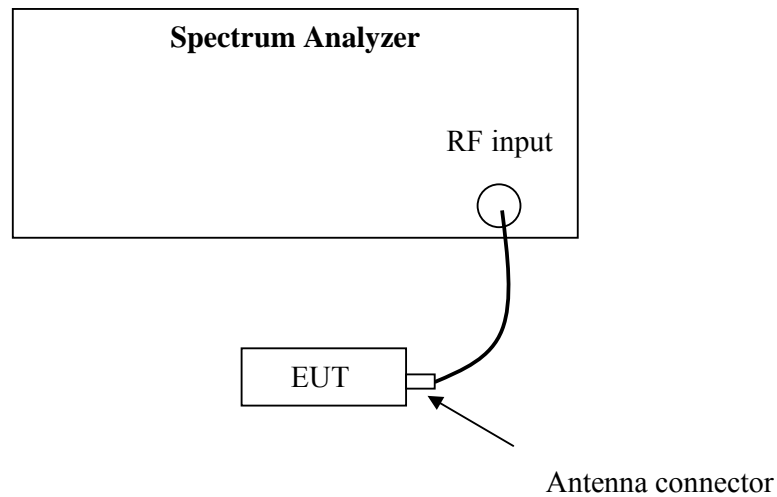
5. Power spectrum density

Test result: Pass

5.1 Test limit

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

5.2 Test Configuration



5.3 Test procedure and test setup

The power output per FCC §15.247(e) was measured using the Spectrum Analyzer with the resolutions bandwidth set at 3kHz, the video bandwidth set at 3kHz. The test was performed at 3 channels (lowest, middle and highest channel).

5.4 Test Protocol

Temperature : 22 °C
 Relative Humidity : 43 %

For 802.11.b

| Channel | Reading of Receiver (dBm) R | Cable loss (dB) L | Corrected Reading (dBm/3kHz) C | Limit (dBm/3kHz) |
|---------|--|--------------------------------|---|---------------------|
| 1 | -3.53 | 0 | -3.53 | ≤ 8 |
| 6 | -2.42 | 0 | -2.42 | ≤ 8 |
| 11 | -1.95 | 0 | -1.95 | ≤ 8 |

Remark: **C = R+ L**

For 802.11.g

| Channel | Reading of Receiver (dBm) R | Cable loss (dB) L | Corrected Reading (dBm/3kHz) C | Limit (dBm/3kHz) |
|---------|--|--------------------------------|---|---------------------|
| 1 | -9.92 | 0 | -9.92 | ≤ 8 |
| 6 | -7.49 | 0 | -7.49 | ≤ 8 |
| 11 | -7.73 | 0 | -7.73 | ≤ 8 |

Remark: **C = R+ L**

5.5 Measurement uncertainty

The measurement uncertainty is ±1dB/3kHz.

6. Spurious emission

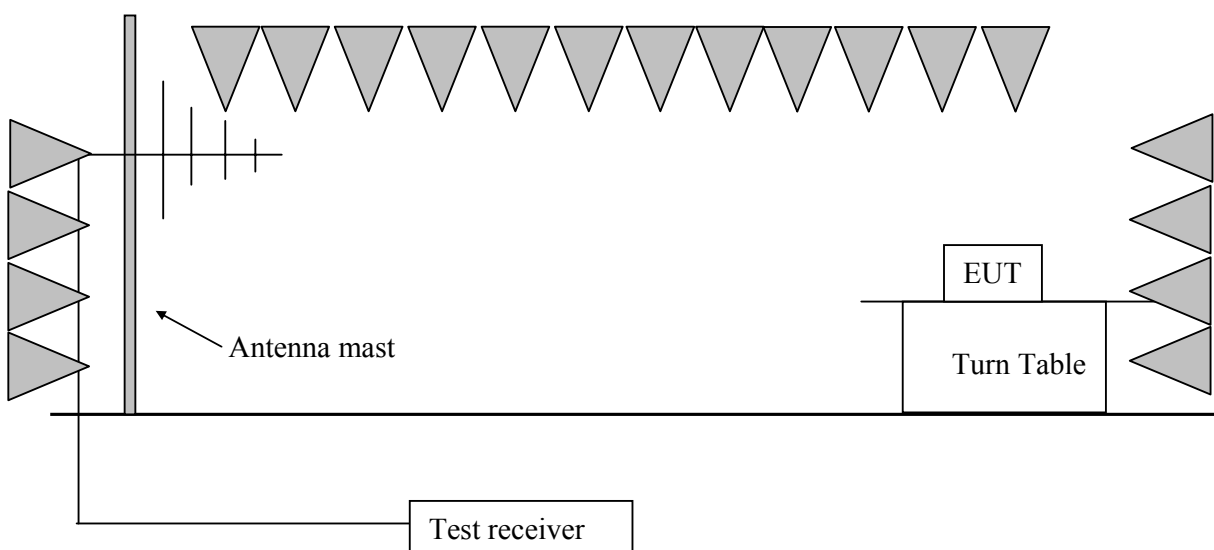
Test result: PASS

6.1 Test limit

The spurious emission shall test through the 10th harmonic or to 40GHz, whichever is lower. It must comply with the radiated emission limits specified in §15.209(a) showed as below:

| Frequency (MHz) | Field Strength (dBuV/m) | Measurement Distance (m) |
|--------------------|----------------------------|-----------------------------|
| 30 - 88 | 40.0 | 3 |
| 88 - 216 | 43.5 | 3 |
| 216 - 960 | 46.0 | 3 |
| Above 960 | 54.0 | 3 |

6.2 Test Configuration



6.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, the pre-amplifier is equipped just at the output terminal of the antenna.

The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

6.4 Test protocol

802.11b

Spurious emission for QP test below 1GHz, highest reading related to the limit

| Channel | Antenna | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---------|---------|-----------------|-----------------------|----------------------------|----------------|-------------|
| 1 | H | 140.78 | 10.50 | 31.20 | 43.50 | 12.30 |
| 1 | V | 140.78 | 10.50 | 41.90 | 43.50 | 1.60 |
| 6 | H | 140.78 | 10.50 | 31.10 | 43.50 | 12.40 |
| 6 | V | 140.78 | 10.50 | 42.30 | 43.50 | 1.20 |
| 11 | H | 166.64 | 10.80 | 37.50 | 43.50 | 6.00 |
| 11 | V | 140.78 | 10.50 | 41.80 | 43.50 | 1.70 |

- Remark: 1. Correct Factor = Antenna Factor + Cable Loss
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. For more details, please refer to the test data.

Spurious emission for test above 1GHz, highest reading related to the limit

| Channel | Antenna | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---------|---------|-----------------|-----------------------|----------------------------|----------------|-------------|----------|
| 1 | H | 2412.96 | -1.20 | 90.10 | Fundamental | / | PK |
| 1 | H | 4826.53 | -0.90 | 46.60 | 54.00 | 7. 40 | PK |
| 1 | V | 2412.96 | -1.20 | 103.50 | Fundamental | / | PK |
| 1 | V | 4826.53 | -0.90 | 52.40 | 54.00 | 1. 60 | PK |
| 6 | H | 2438.25 | -1.20 | 91.70 | Fundamental | / | PK |
| 6 | H | 4878.73 | -0.90 | 45.30 | 54.00 | 8. 70 | PK |
| 6 | V | 2438.25 | -1.20 | 101.90 | Fundamental | / | PK |
| 6 | V | 4878.73 | -0.90 | 51.50 | 54.00 | 2. 50 | PK |
| 11 | H | 2463.61 | -1.20 | 90.20 | Fundamental | / | PK |
| 11 | H | 4928.84 | -0.90 | 46.10 | 54.00 | 7. 90 | PK |
| 11 | V | 2463.61 | -1.20 | 102.90 | Fundamental | / | PK |
| 11 | V | 4928.84 | -0.90 | 52.00 | 54.00 | 2. 00 | PK |

- Remark: 1. Correct Factor = Antenna Factor + Cable Loss - Gain of Preamplifier
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. Here the PK value is evaluated with AV limit. As a result, the AV test can be elided.

802.11g

Spurious emission for QP test below 1GHz, highest reading related to the limit

| Channel | Antenna | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---------|---------|-----------------|-----------------------|----------------------------|----------------|-------------|
| 1 | H | 175.04 | 11.30 | 32.40 | 43.50 | 11.10 |
| 1 | V | 136.87 | 10.20 | 40.50 | 43.50 | 3.00 |
| 6 | H | 175.04 | 11.30 | 30.30 | 43.50 | 13.20 |
| 6 | V | 135.91 | 10.20 | 39.80 | 43.50 | 3.70 |
| 11 | H | 136.87 | 10.20 | 28.70 | 43.50 | 14.80 |
| 11 | V | 142.77 | 10.50 | 40.90 | 43.50 | 2.60 |

- Remark: 1. Correct Factor = Antenna Factor + Cable Loss
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. For more details, please refer to the test data.

Spurious emission for test above 1GHz, highest reading related to the limit

| Channel | Antenna | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|---------|---------|-----------------|-----------------------|----------------------------|----------------|-------------|----------|
| 1 | H | 2413.58 | -1.20 | 89.50 | Fundamental | / | PK |
| 1 | H | 4828.32 | -0.90 | 46.20 | 54.00 | 7. 80 | PK |
| 1 | V | 2413.58 | -1.20 | 100.70 | Fundamental | / | PK |
| 1 | V | 4828.32 | -0.90 | 51.40 | 54.00 | 2. 60 | PK |
| 6 | H | 2439.46 | -1.20 | 90.60 | Fundamental | / | PK |
| 6 | H | 4880.13 | -0.90 | 47.80 | 54.00 | 6. 20 | PK |
| 6 | V | 2439.46 | -1.20 | 101.90 | Fundamental | / | PK |
| 6 | V | 4880.13 | -0.90 | 52.20 | 54.00 | 1. 80 | PK |
| 11 | H | 2464.21 | -1.20 | 89.80 | Fundamental | / | PK |
| 11 | H | 4929.73 | -0.90 | 47.10 | 54.00 | 6. 90 | PK |
| 11 | V | 2464.21 | -1.20 | 101.10 | Fundamental | / | PK |
| 11 | V | 4929.73 | -0.90 | 51.70 | 54.00 | 2. 30 | PK |

- Remark: 1. Correct Factor = Antenna Factor + Cable Loss - Gain of Preamplifier
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. Here the PK value is evaluated with AV limit. As a result, the AV test can be elided.

6.5 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.

Measurement uncertainty of radiated emission is: $\pm 5.31\text{dB}$

The measurement uncertainty is given with a confidence of 95%, $k=2$.

The measurement uncertainty is traceable to internal procedure TI-036.

7. Restrict band radiated emission

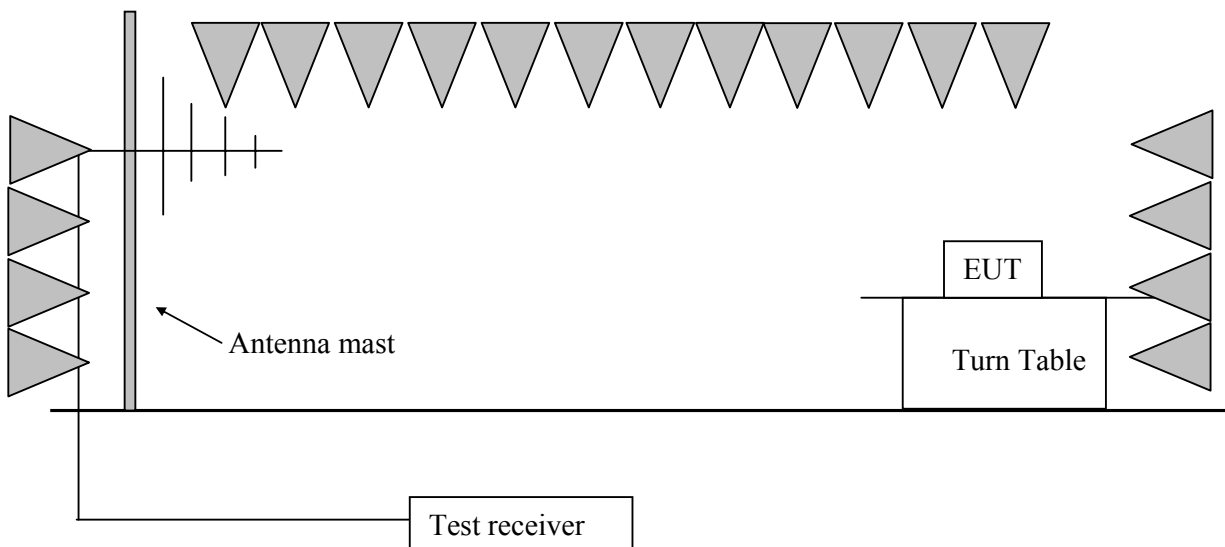
Test result: PASS

7.1 Test limit

The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

| Frequency (MHz) | Field Strength (dBuV/m) | Measurement Distance (m) |
|--------------------|----------------------------|-----------------------------|
| 30 - 88 | 40.0 | 3 |
| 88 - 216 | 43.5 | 3 |
| 216 - 960 | 46.0 | 3 |
| Above 960 | 54.0 | 3 |

7.2 Test Configuration



7.3 Test procedure and test setup

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge.
5. Radiated emissions that are removed by more than two "standard" bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

7.4 Test protocol

802.11b

Highest reading on restrict band 2310MHz ~ 2390MHz, test on the lowest channel

| Detector | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) |
|----------|-----------------|-----------------------|----------------------------|----------------|
| PK | 2389.88 | -1.20 | 43.13 | 74 |
| AV | 2389.88 | -1.20 | 32.05 | 54 |

Highest reading on restrict band 2483.5MHz ~ 2500MHz, test on the highest channel

| Detector | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) |
|----------|-----------------|-----------------------|----------------------------|----------------|
| PK | 2483.65 | -1.20 | 43.72 | 74 |
| AV | 2483.50 | -1.20 | 32.11 | 54 |

802.11g

Highest reading on restrict band 2310MHz ~ 2390MHz, test on the lowest channel

| Detector | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) |
|----------|-----------------|-----------------------|----------------------------|----------------|
| PK | 2389.88 | -1.20 | 53.87 | 74 |
| AV | 2389.88 | -1.20 | 34.12 | 54 |

Highest reading on restrict band 2483.5MHz ~ 2500MHz, test on the highest channel

| Detector | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) |
|----------|-----------------|-----------------------|----------------------------|----------------|
| PK | 2483.51 | -1.20 | 59.26 | 74 |
| AV | 2483.74 | -1.20 | 38.53 | 54 |

7.5 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.

Measurement uncertainty of radiated emission is: $\pm 5.31\text{dB}$

The measurement uncertainty is given with a confidence of 95%, $k=2$.

The measurement uncertainty is traceable to internal procedure TI-036.

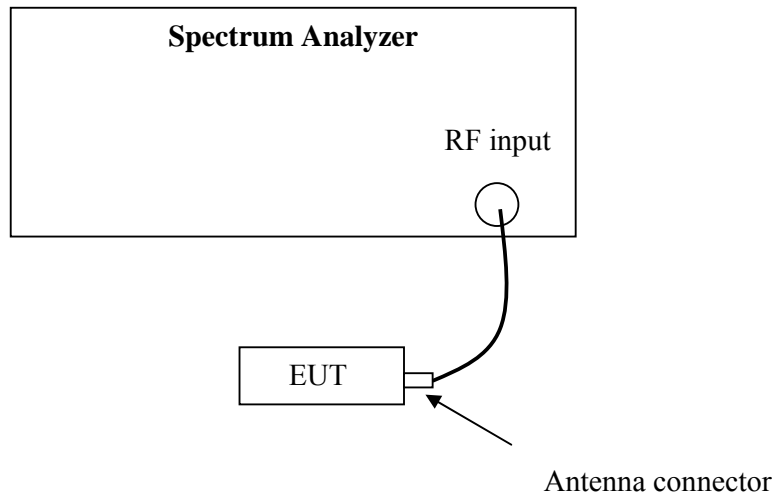
8. Emission outside the frequency Band

Test result: PASS

8.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

8.2 Test Configuration



8.3 Test procedure and test setup

The Emission outside the frequency Band per FCC §15.247(d) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW.

8.4 Test protocol

802.11b

| Highest level outside the band edge (dBm) | Highest emission within the band edge (dBm) | Delta (dBm) | Limit |
|--|---|----------------|--------------------|
| -34.39 (frequency lower than 2.4GHz) | 7.32 | 41.71 | $\geq 20\text{dB}$ |
| -35.50 (frequency higher than 2.4835GHz) | 8.47 | 43.97 | $\geq 20\text{dB}$ |

802.11g

| Highest level outside the band edge (dBm) | Highest emission within the band edge (dBm) | Delta (dBm) | Limit |
|--|---|----------------|--------------------|
| -25.16 (frequency lower than 2.4GHz) | 5.49 | 30.65 | $\geq 20\text{dB}$ |
| -35.81 (frequency higher than 2.4835GHz) | 7.16 | 42.97 | $\geq 20\text{dB}$ |

8.5 Measurement uncertainty

The measurement uncertainty is $\pm 1\text{dB}$.

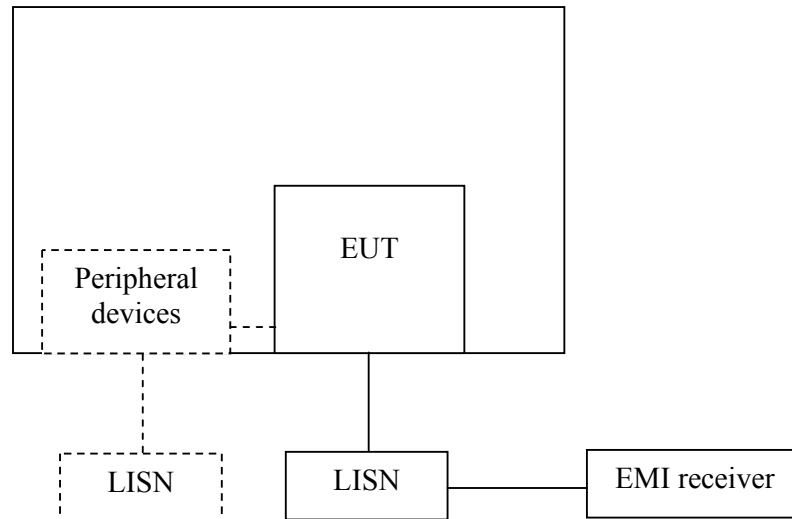
9. Power line conducted emission

Test result: Pass

9.1 Limit

| Frequency of Emission (MHz) | Conducted Limit (dBuV) | |
|--|------------------------|------------|
| | QP | AV |
| 0.15-0.5 | 66 to 56* | 56 to 46 * |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |
| * Decreases with the logarithm of the frequency. | | |

9.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

9.3 Test procedure and test set up

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 Ω /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 Ω /50uH coupling impedance with 50 Ω termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement. The bandwidth of the test receiver is set at 9 kHz.

9.4 Test protocol

Power line: L

| Frequency | Correct Factor (dB) | Corrected Reading (dBuV) | | Limit (dBuV) | | Margin (dB) | |
|--|---------------------|--------------------------|-------|--------------|-------|-------------|-------|
| | | QP | AV | QP | AV | QP | AV |
| 0.15 | 3.00 | 46.08 | * | 66.00 | * | 19.92 | * |
| 0.20 | 3.00 | 60.93 | 49.22 | 63.55 | 53.55 | 2.62 | 4.33 |
| 0.30 | 3.00 | 50.21 | 38.40 | 60.18 | 50.18 | 9.97 | 11.78 |
| 0.40 | 3.00 | 41.39 | 30.66 | 57.79 | 47.79 | 16.40 | 17.13 |
| 0.81 | 3.00 | * | 27.52 | * | 46.00 | * | 18.48 |
| 7.44 | 3.00 | 41.96 | 36.25 | 60.00 | 50.00 | 18.04 | 13.75 |
| Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading. | | | | | | | |

Power line: N

| Frequency | Correct Factor (dB) | Corrected Reading (dBuV) | | Limit (dBuV) | | Margin (dB) | |
|--|---------------------|--------------------------|-------|--------------|-------|-------------|-------|
| | | QP | AV | QP | AV | QP | AV |
| 0.15 | 3.00 | 46.72 | 18.91 | 66.00 | 56.00 | 19.28 | 37.09 |
| 0.20 | 3.00 | 61.15 | 49.18 | 63.55 | 53.55 | 2.40 | 4.37 |
| 0.30 | 3.00 | 50.45 | 38.76 | 60.18 | 50.18 | 9.73 | 11.42 |
| 0.40 | 3.00 | 41.59 | 30.76 | 57.79 | 47.79 | 16.20 | 17.03 |
| 0.81 | 3.00 | * | 27.45 | * | 46.00 | * | 18.55 |
| 7.27 | 3.00 | * | * | * | * | * | * |
| Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading. | | | | | | | |

9.5 Measurement Uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.

Measurement uncertainty at mains terminal: $\pm 1.99\text{dB}$

The measurement uncertainty is given with a confidence of 95%, $k=2$.

The measurement uncertainty is traceable to internal procedure TI-036.

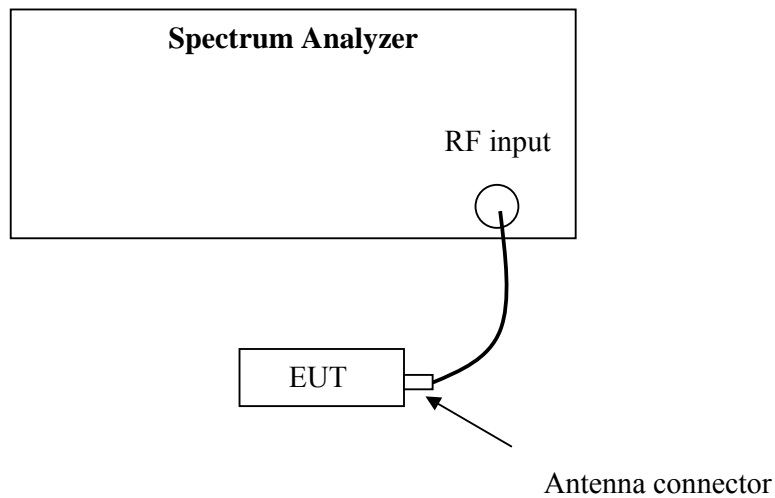
10. Channel Number of hopping system

Test result: NA

10.1 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

10.2 Test Configuration



10.3 Test procedure and test setup

The channel number per FCC §15.247(a)(1)(iii) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW.

The RF passband of the EUT was divided into 3 appropriate bands to test.

10.4 Test protocol

| Channel Number | Limit |
|----------------|-----------|
| - | ≥ 15 |

10.5 Measurement uncertainty

The measurement uncertainty is ± 1 dB.

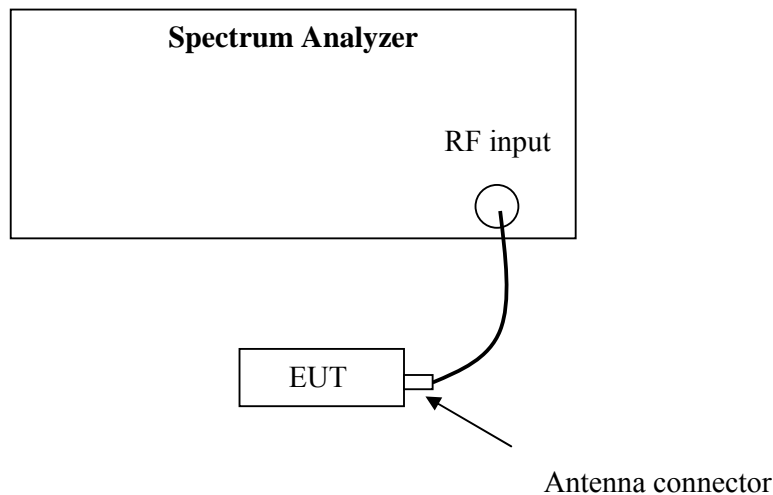
11. Average time of occupancy in any channel

Test result: NA

11.1 Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

11.2 Test Configuration



11.3 Test procedure and test setup

Average time of occupancy in any channel per FCC § 15.247(a)(1)(iii) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN set to be 0Hz to test in time domain. The test is performed at the middle channel.

11.4 Test protocol

| Packet | Observed period (s) P | Time of occupancy for single hopping (ms) O | Hops among the interval of 3.6 s I | Average time of occupancy (s) T | Limit (s) |
|----------------|---------------------------------|---|--|---|-----------|
| Packet Type 4 | - | - | - | - | ≤0.4 |
| Packet Type 11 | - | - | - | - | ≤0.4 |
| Packet Type 15 | - | - | - | - | ≤0.4 |

Remark: 1. There are 79 channels in all. So the observed period $P = 0.4 * 79 = 31.6$ s.
2. Average time of occupancy $T = O * I * P / 3.6$

11.5 Measurement uncertainty

The measurement uncertainty is $\pm 10\mu\text{s}$.

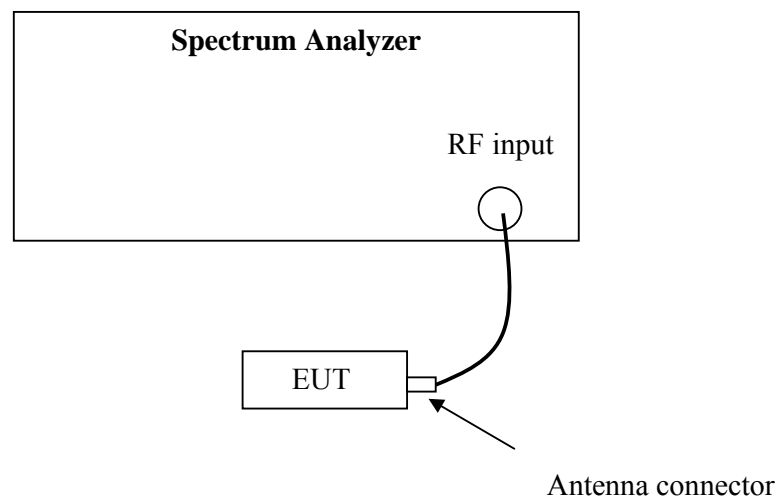
12. Occupied Bandwidth

Test Status: Tested

12.1 Test limit

None

12.2 Test Configuration



12.3 Test procedure and test setup

The occupied bandwidth per RSS-Gen Issue 2 Clause 4.6.1 was measured using the Spectrum Analyzer with the resolutions bandwidth set at 1MHz, the video bandwidth set at 3MHz. The test was performed at 3 channels (lowest, middle and highest channel).

12.4 Test protocol

Temperature : 22 °C
 Relative Humidity : 43 %

802.11b

| Channel | Occupied Bandwidth (MHz) | Max. Value (MHz) |
|---------|--------------------------|------------------|
| 1 | 15.75 | 15.81 |
| 6 | 15.81 | |
| 11 | 15.63 | |

Remark: “Max. Value” is the maximum test result of the three measured occupied bandwidth.

802.11g

| Channel | Occupied Bandwidth (MHz) | Max. Value (MHz) |
|---------|--------------------------|------------------|
| 1 | 18.34 | 18.46 |
| 6 | 18.46 | |
| 11 | 18.10 | |

Remark: “Max. Value” is the maximum test result of the three measured occupied bandwidth.

12.5 Measurement uncertainty

The measurement uncertainty is ± 1 dB.

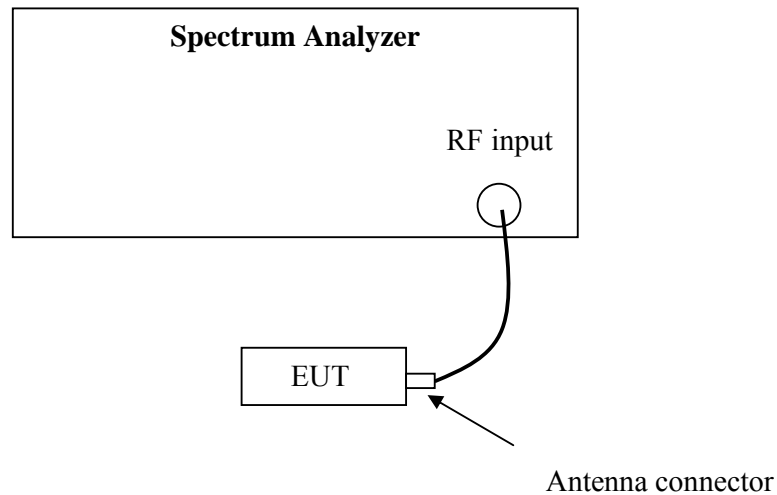
13. Spurious emission for receiver

Test result: PASS

13.1 Test limit

The spurious emission shall test through 3 times tuneable or local oscillator frequency whichever is the higher, without exceeding 40 GHz. If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5nW above 1 GHz.

13.2 Test Configuration



13.3 Test procedure and test setup

The receiver spurious emission per RSS-210 Issue 7 Clause 2.3 is measured using the Spectrum Analyzer with the resolution bandwidth / video bandwidth set at 5kHz for 30MHz ~ 1GHz and with the resolution bandwidth / video bandwidth set at 1MHz for higher than 1GHz.

13.4 Test protocol

802.11b, highest reading related to the limit

| Detector | Frequency (MHz) | Correct Factor (dB) | Corrected Receiver Reading (dBm) | Limit (dBm) |
|----------|--------------------|---------------------|----------------------------------|-------------|
| PK | $\leq 1\text{GHz}$ | 0 | < -80 | -57 |
| PK | $> 1\text{GHz}$ | 0 | < -60 | -53 |

Note: For frequency higher than 1GHz, the PK detector is employed while the limit is AV limit.

802.11g, highest reading related to the limit

| Detector | Frequency (MHz) | Correct Factor (dB) | Corrected Receiver Reading (dBm) | Limit (dBm) |
|----------|--------------------|---------------------|----------------------------------|-------------|
| PK | $\leq 1\text{GHz}$ | 0 | < -80 | -57 |
| PK | $> 1\text{GHz}$ | 0 | < -60 | -53 |

Note: For frequency higher than 1GHz, the PK detector is employed while the limit is AV limit.

13.5 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.

Measurement uncertainty of radiated emission is: $\pm 5.31\text{dB}$

The measurement uncertainty is given with a confidence of 95%, $k=2$.

The measurement uncertainty is traceable to internal procedure TI-036.

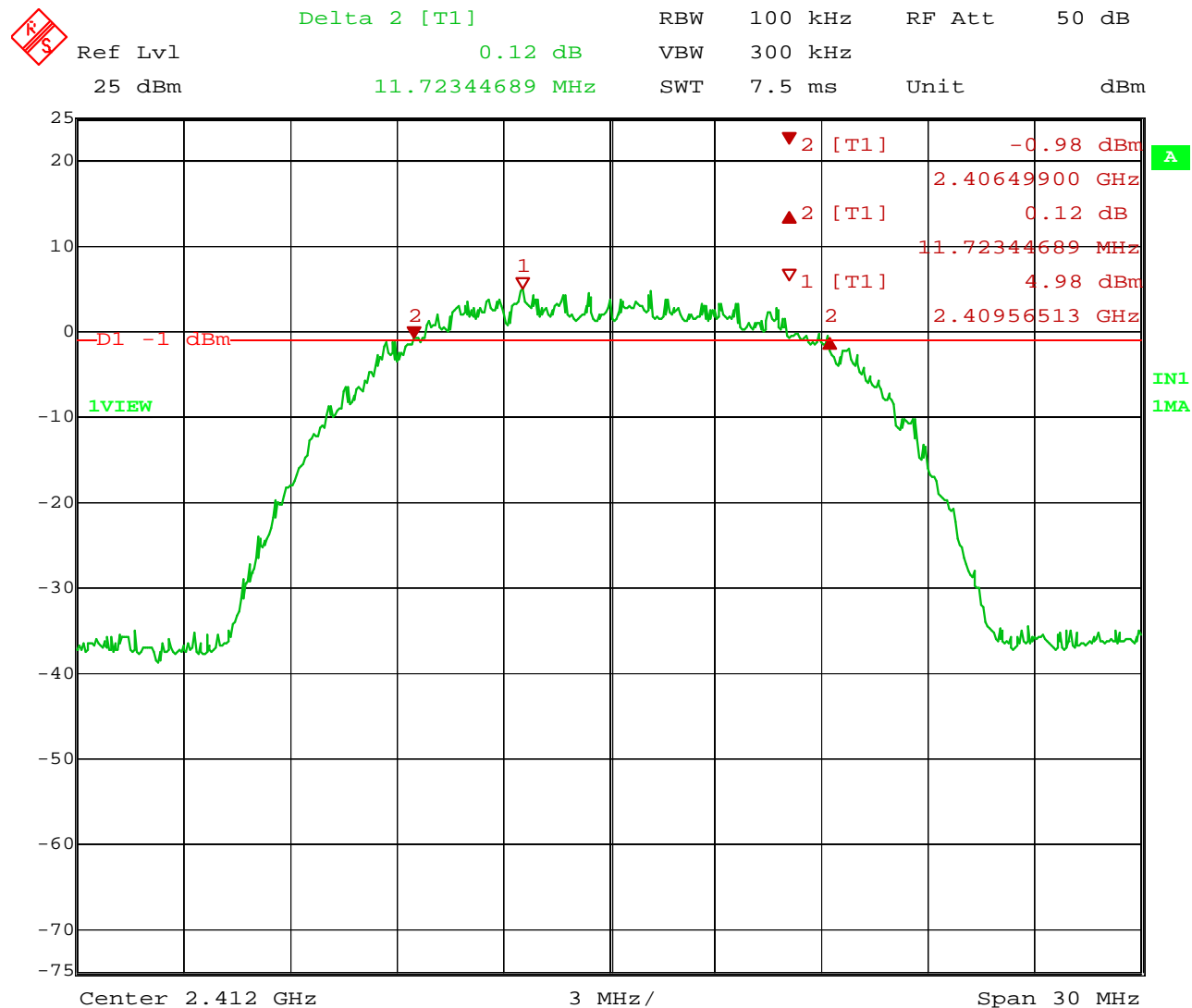
Test

Data

1. Minimum 6dB bandwidth

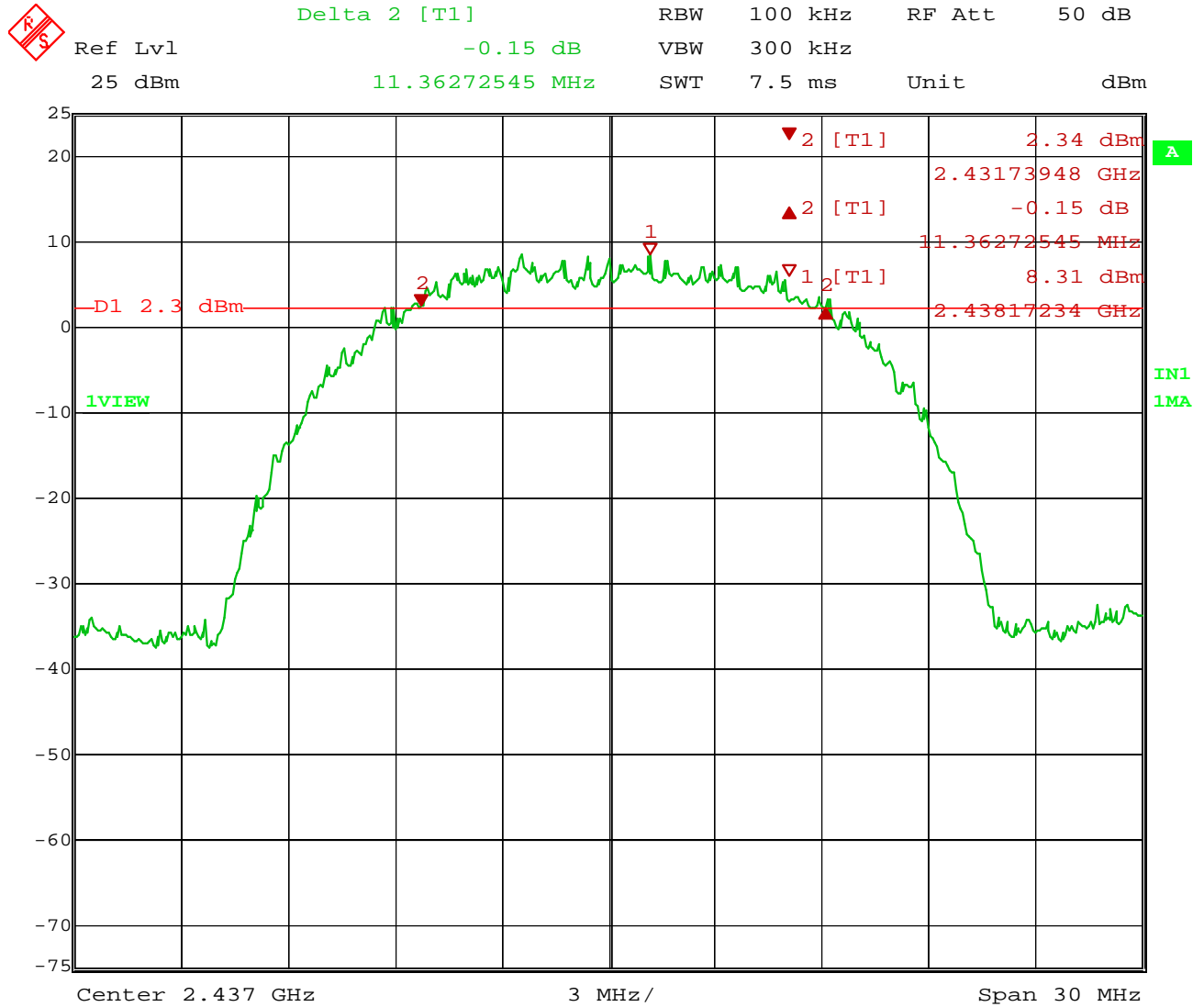
802.11b

Channel 1



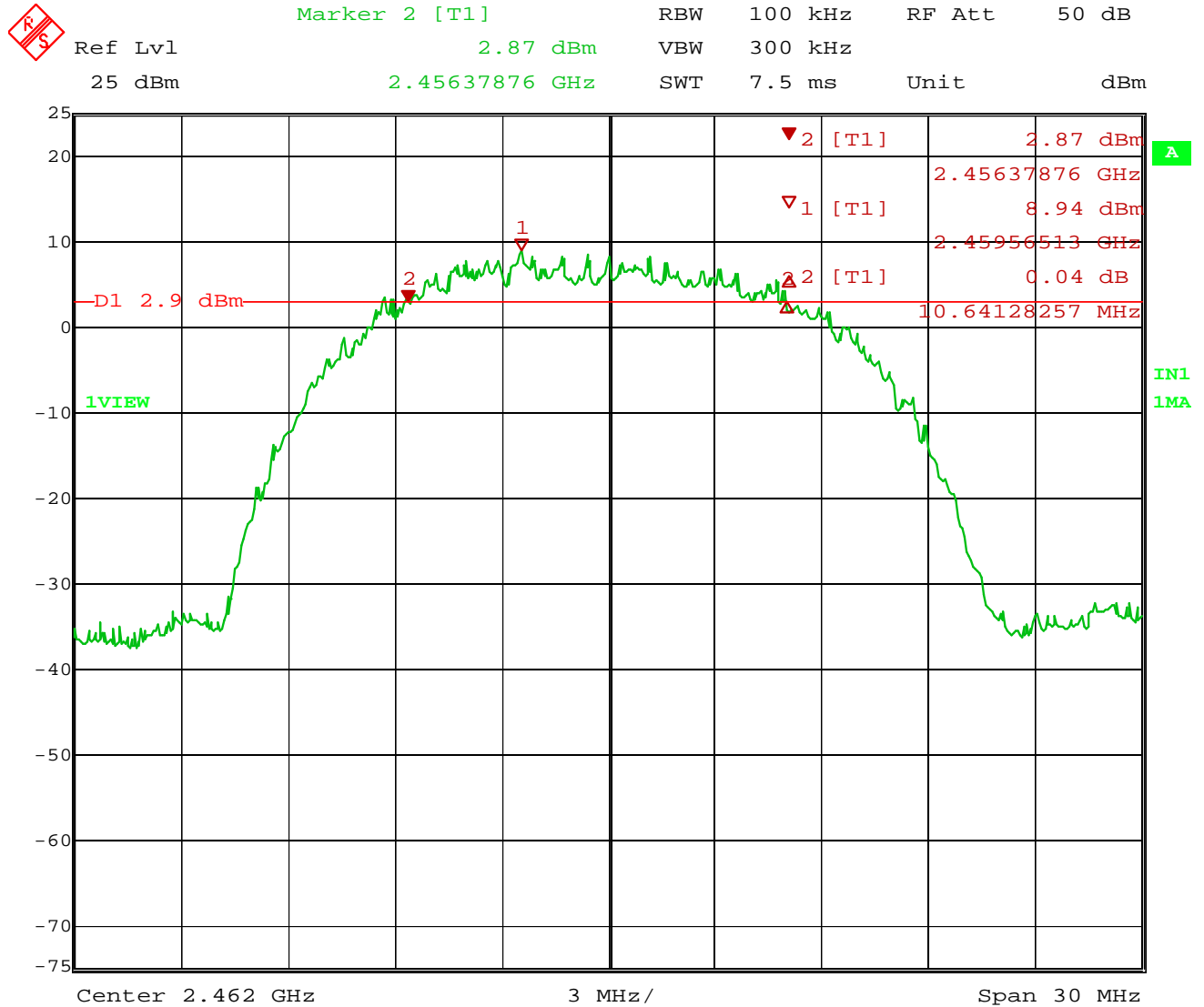
Date: 28.NOV.2007 09:41:13

Channel 6



Date: 28.NOV.2007 09:54:24

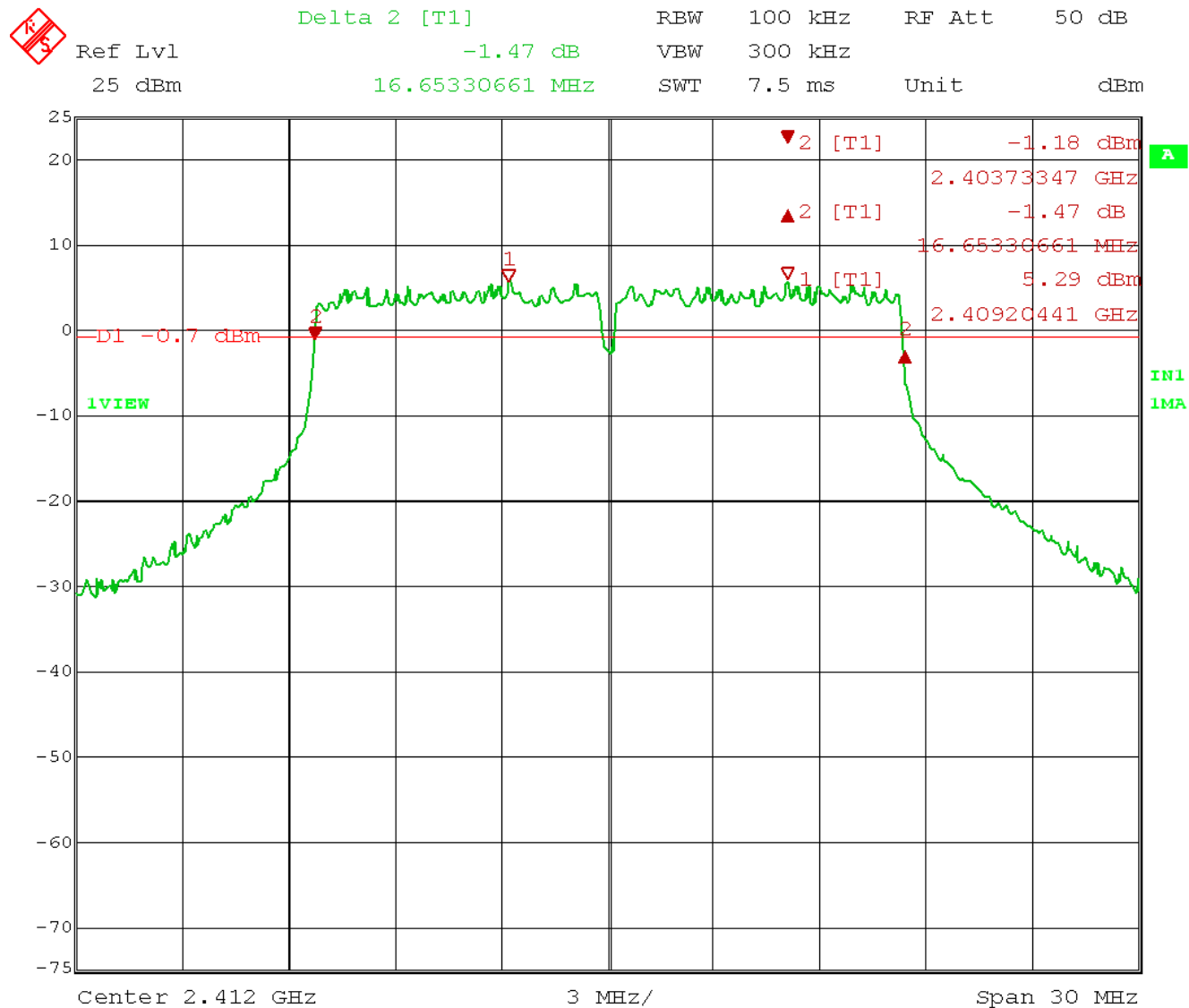
Channel 11



Date: 28.NOV.2007 09:50:10

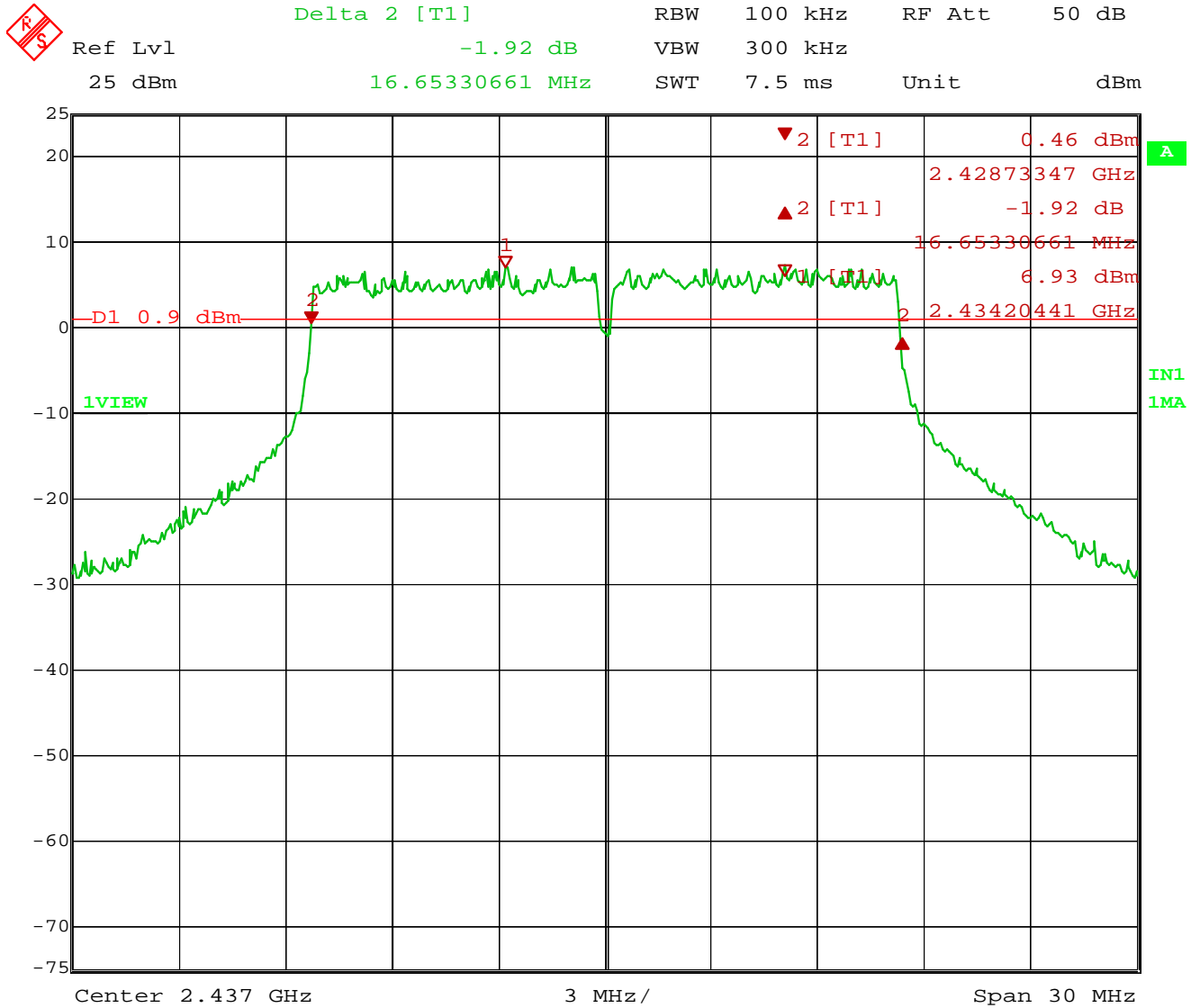
802.11g

Channel 1



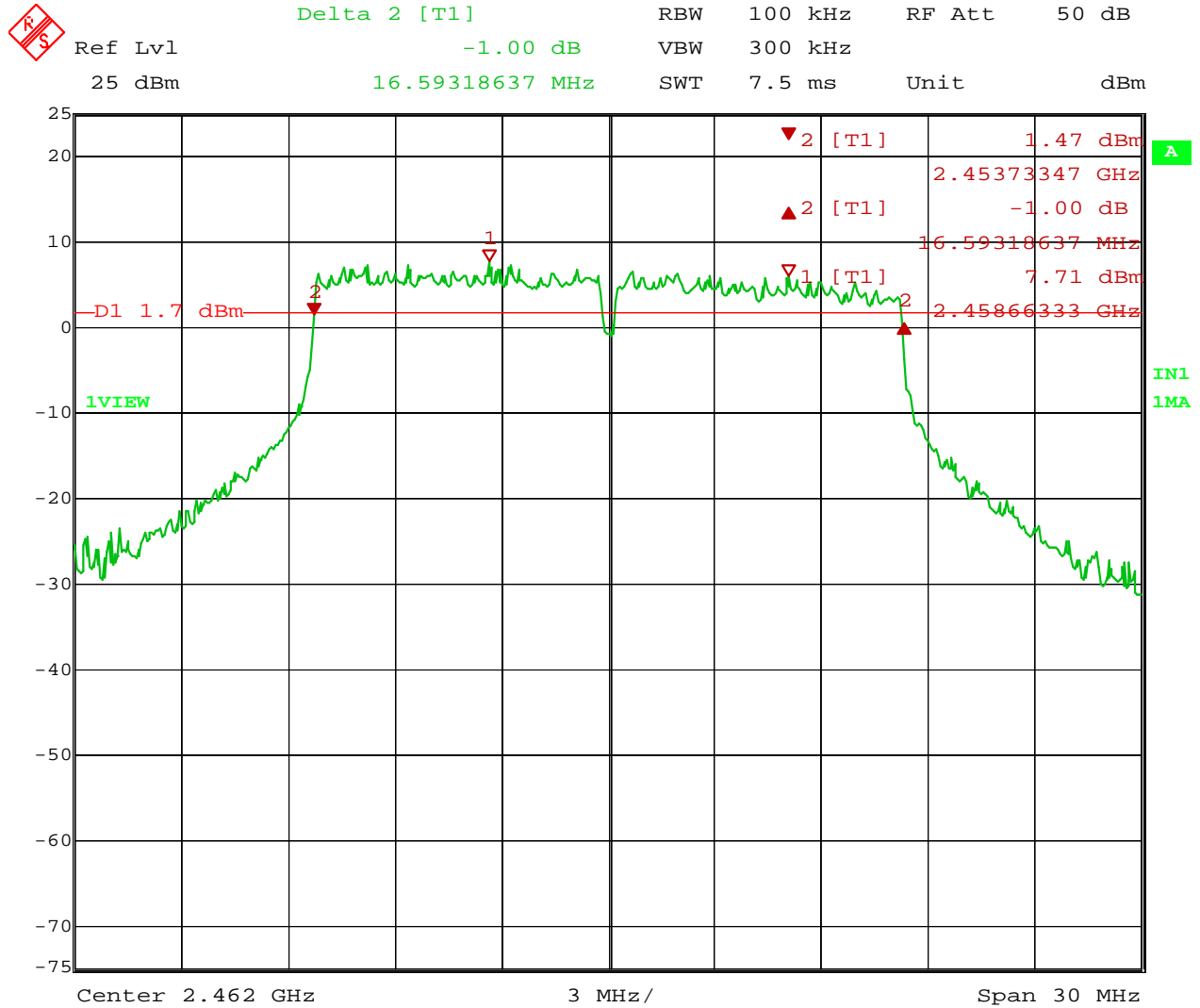
Date: 28.NOV.2007 10:03:31

Channel 6



Date: 28.NOV.2007 10:06:37

Channel 11

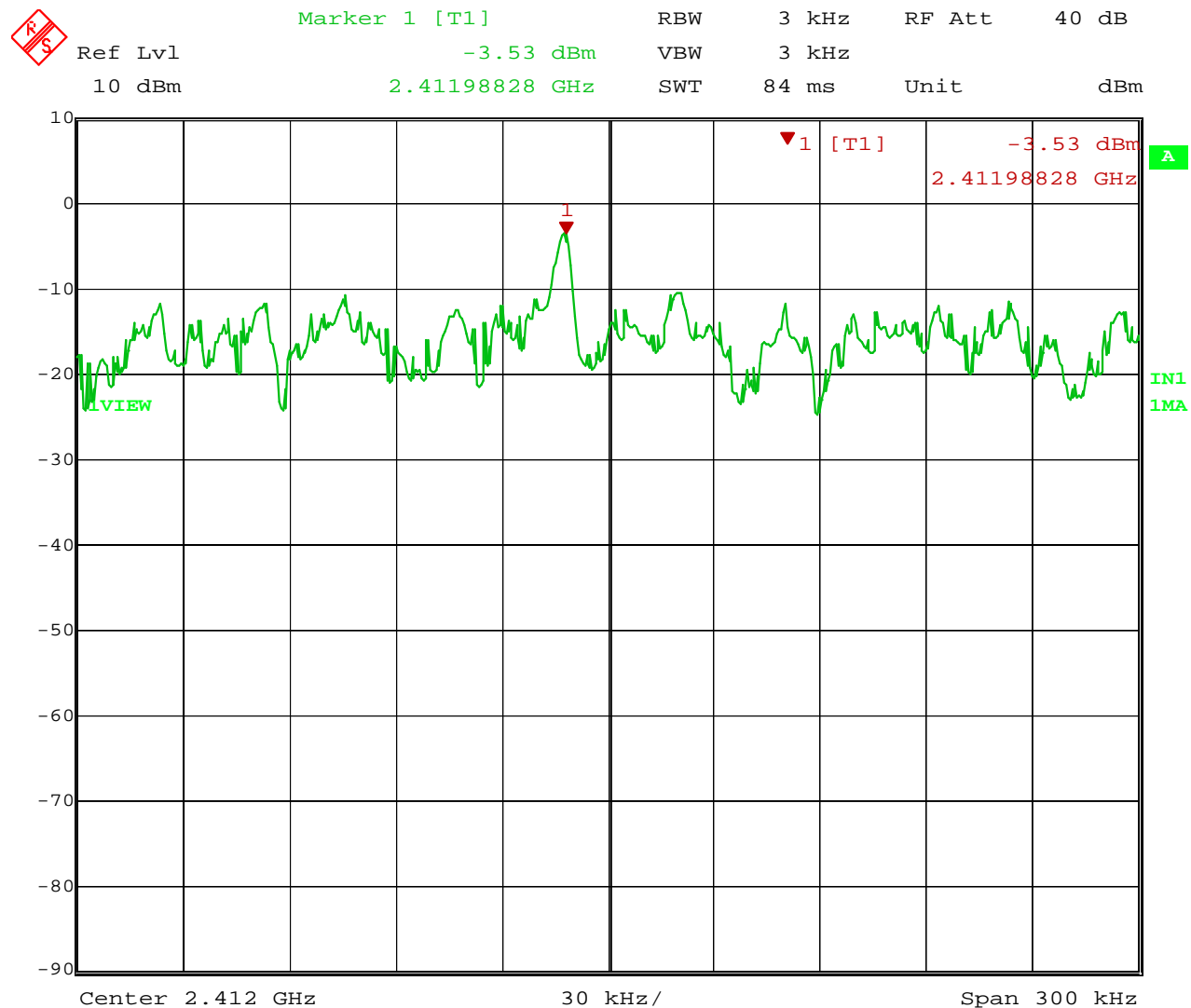


Date: 28.NOV.2007 10:08:29

2. Power spectrum density

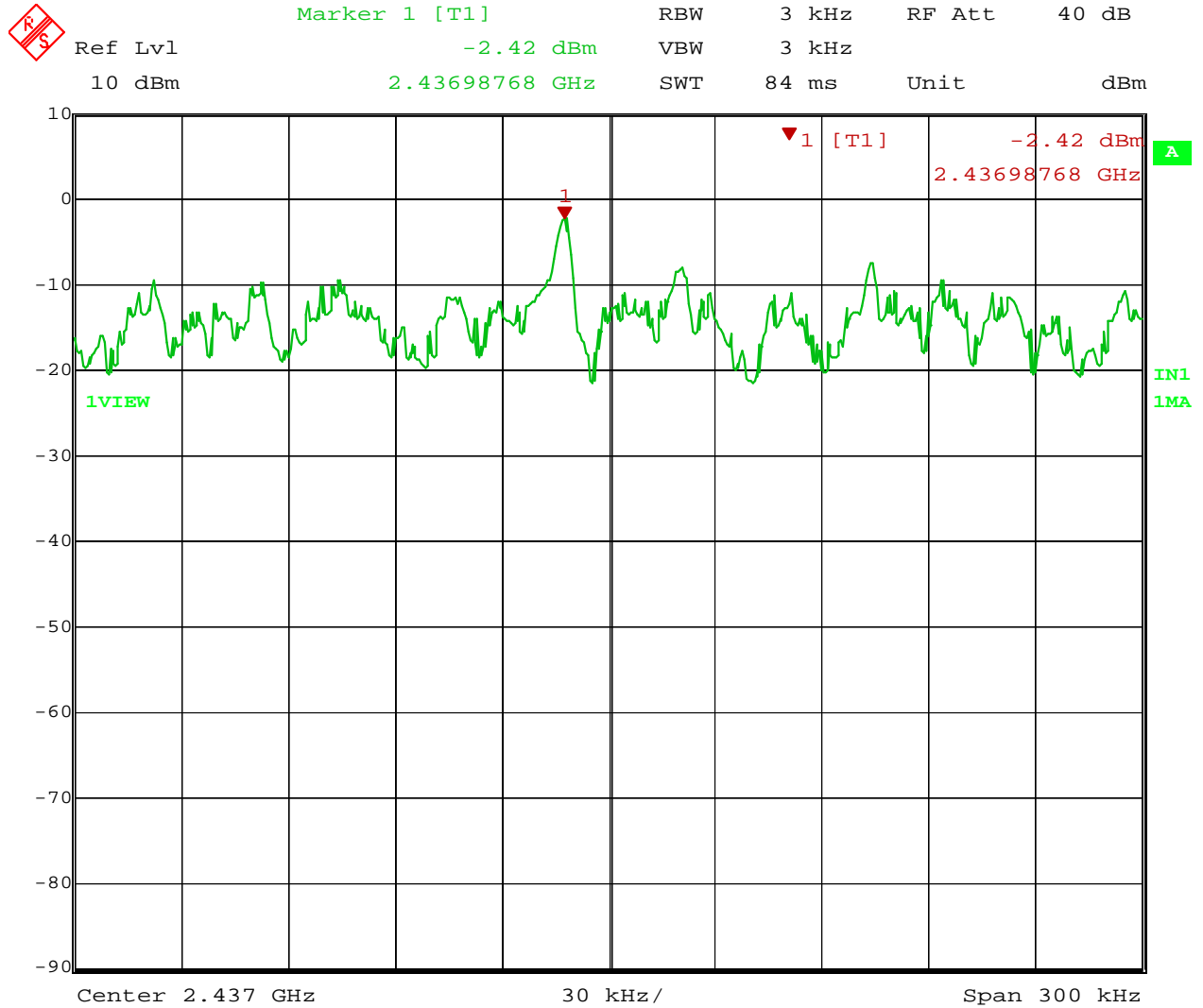
802.11b

Channel 1



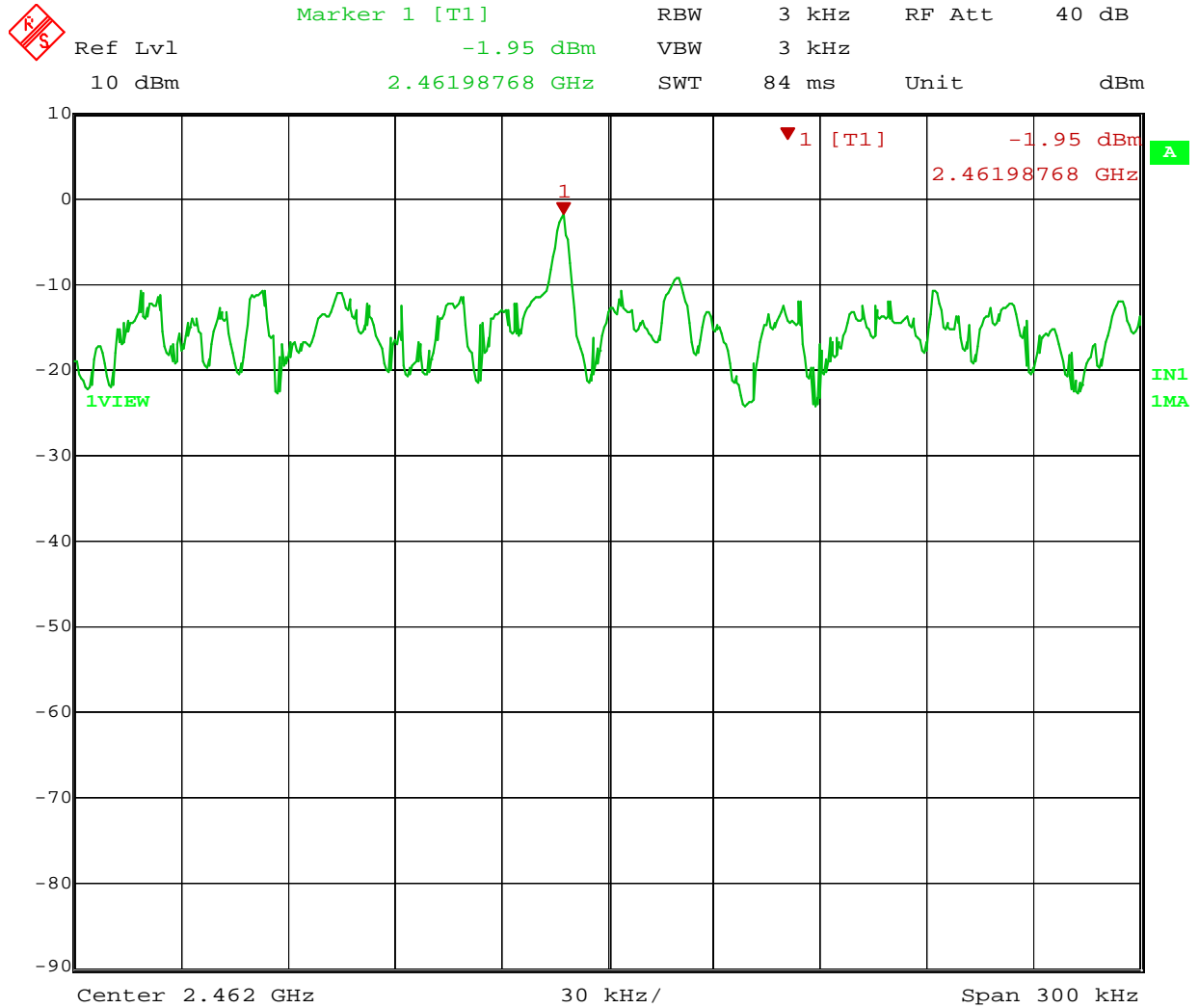
Date: 28.NOV.2007 10:55:26

Channel 6



Date: 28.NOV.2007 10:54:30

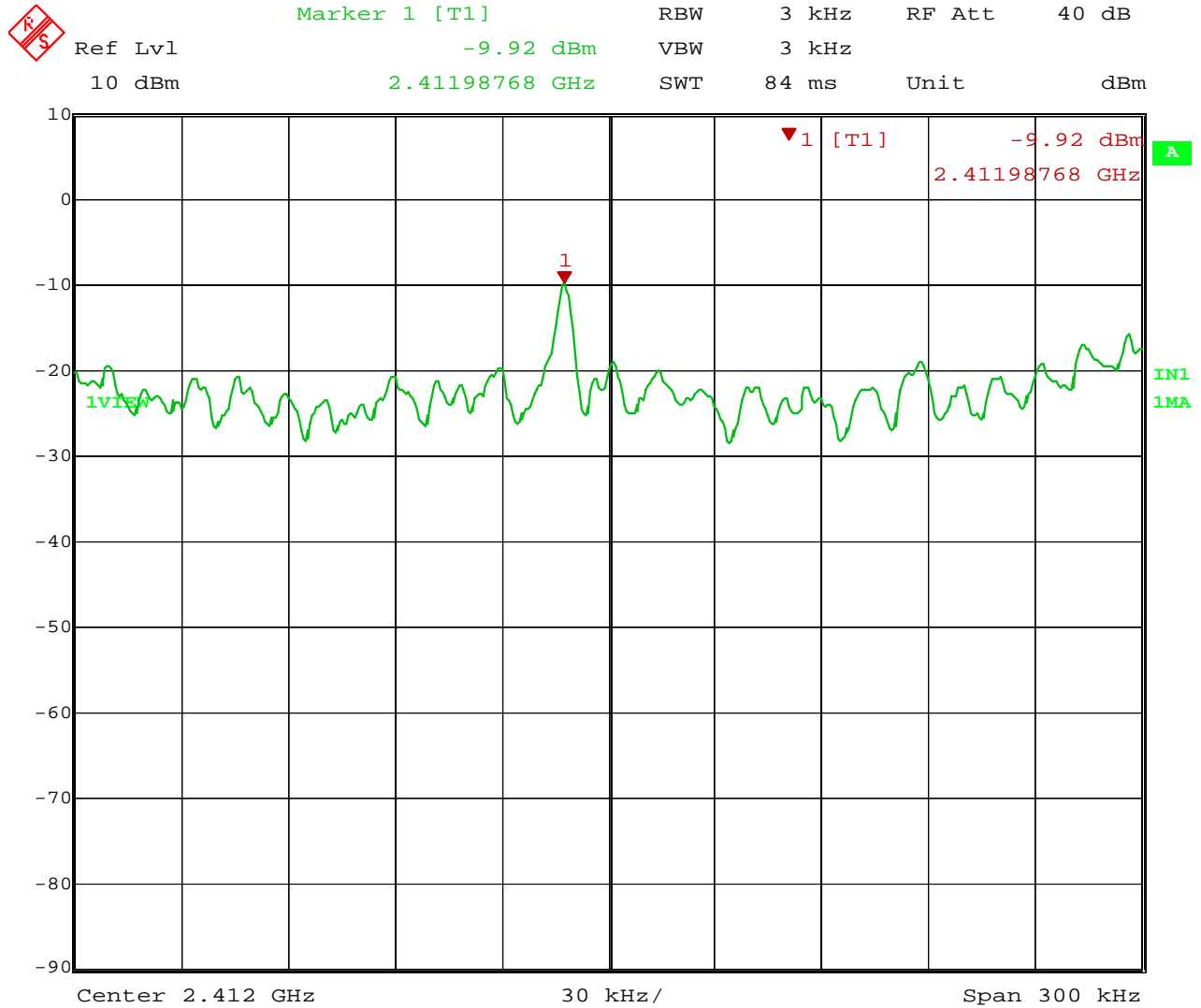
Channel 11



Date: 28.NOV.2007 10:56:16

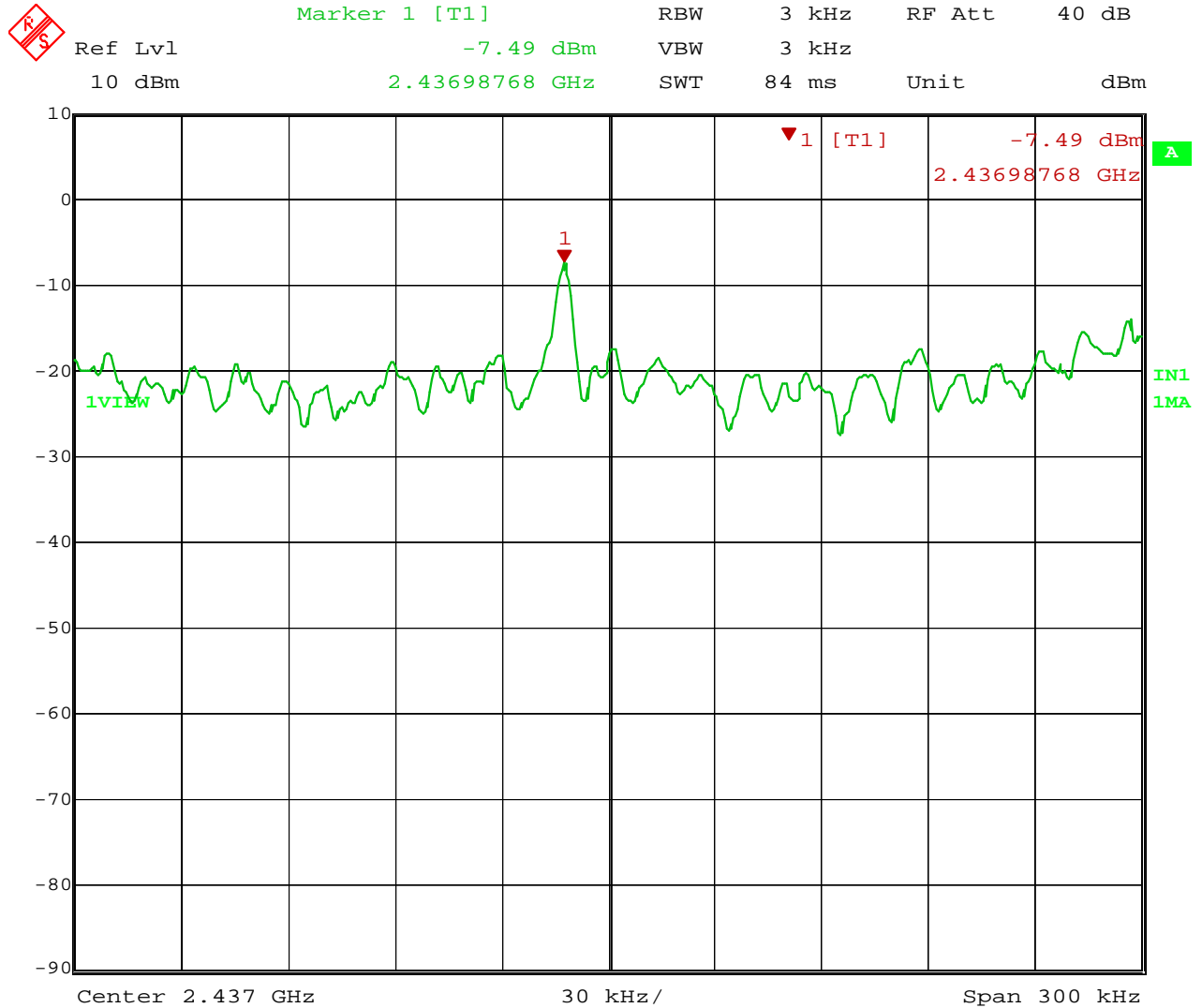
802.11g

Channel 1



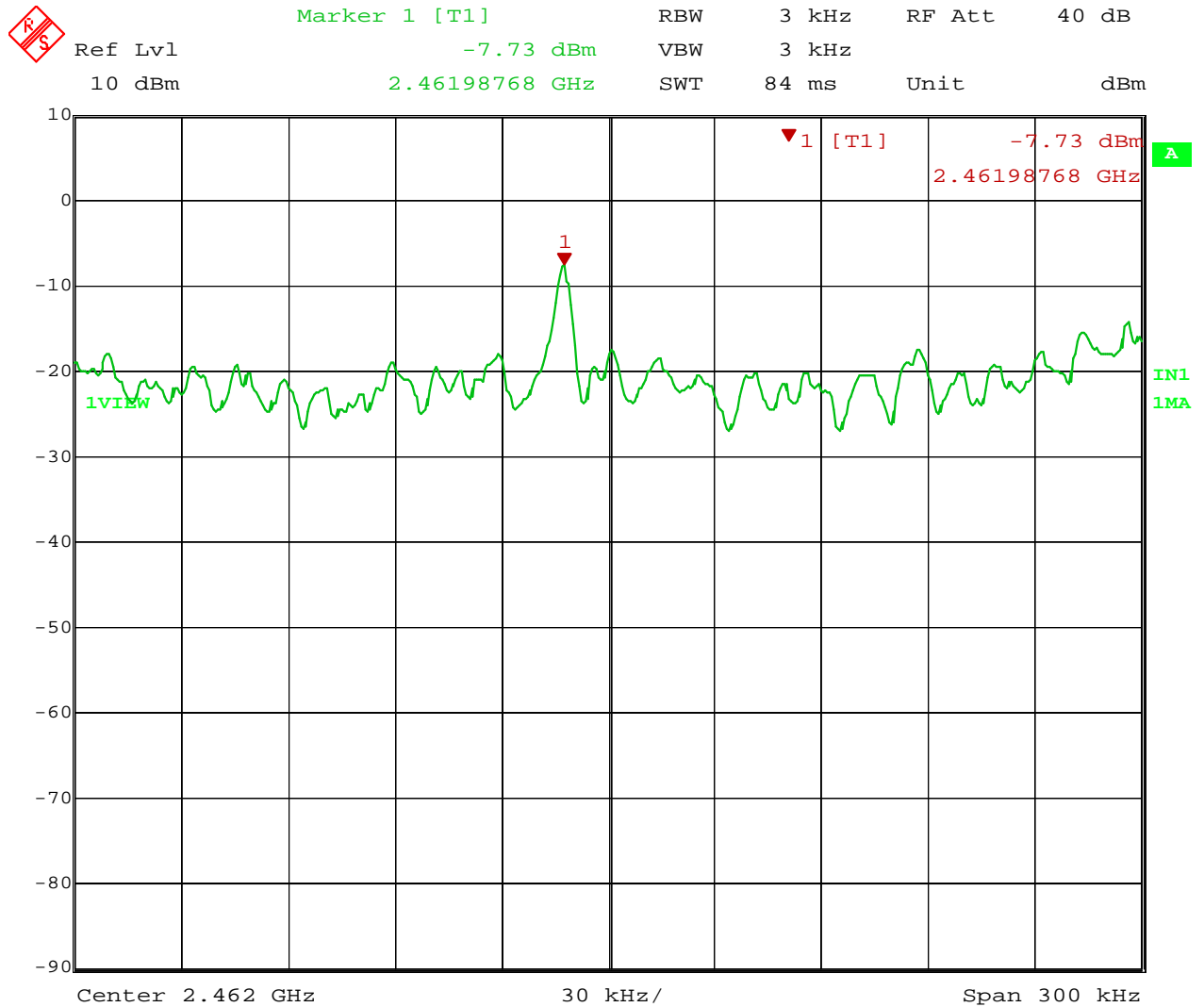
Date: 28.NOV.2007 10:57:55

Channel 6



Date: 28.NOV.2007 10:58:51

Channel 11

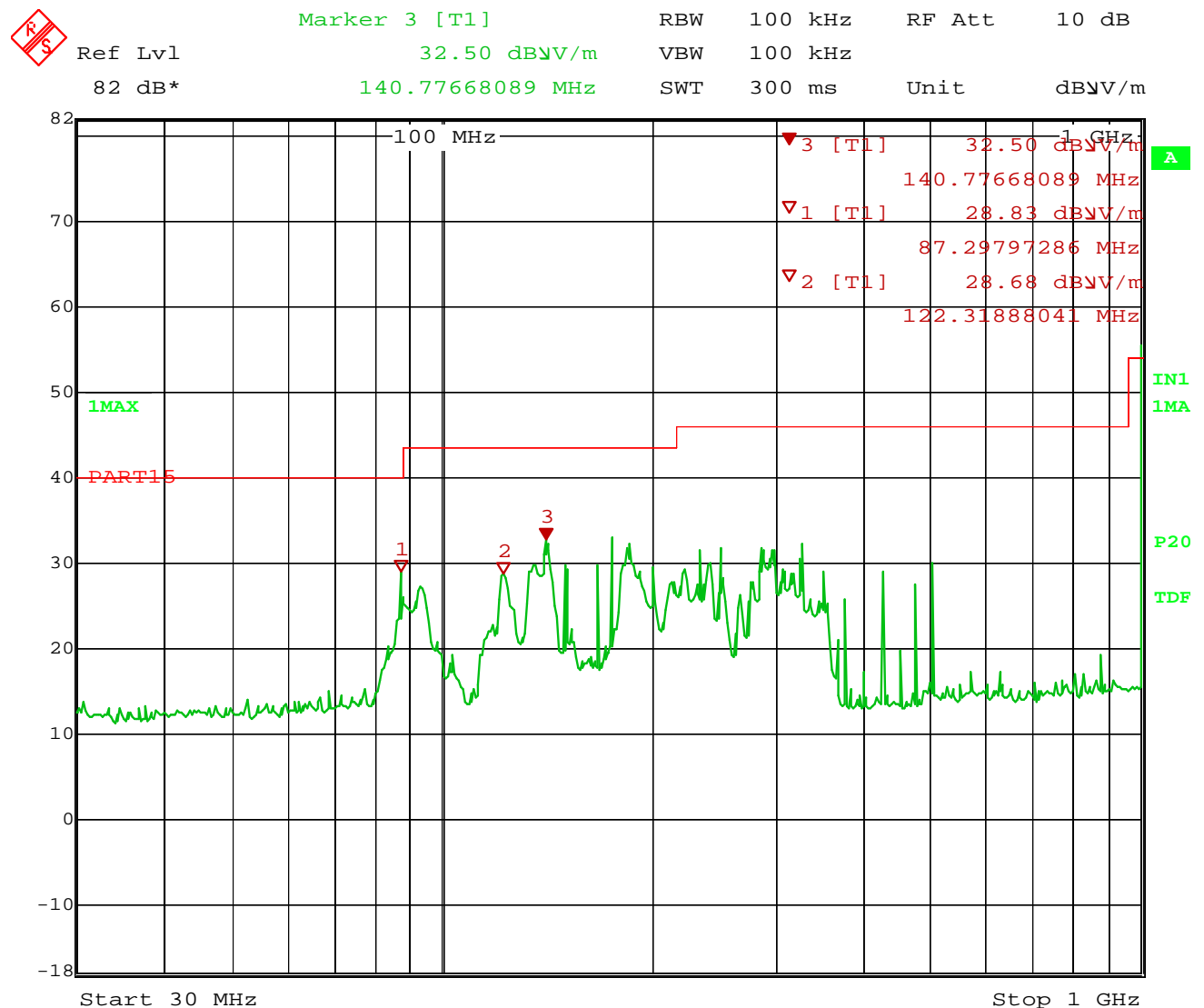


Date: 28.NOV.2007 10:59:39

3. Spurious Emission (data below are corrected PK reading, please refer to the test report for QK reading)

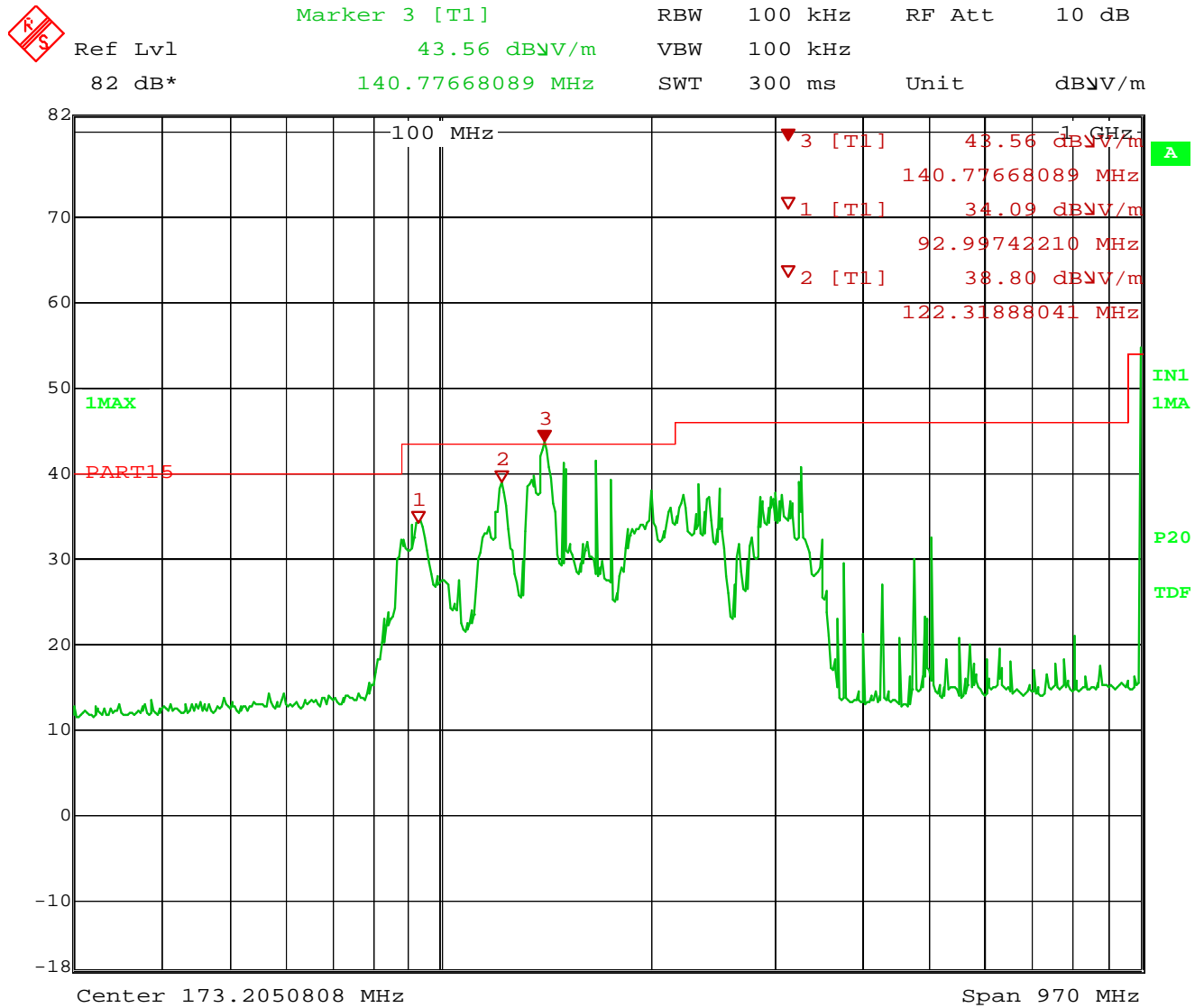
802.11b

Channel 1, Horizontal



Date: 1.DEC.2007 20:06:23

Channel 1, Vertical



Date: 1.DEC.2007 20:01:17

Ref Lvl 82 dB* Marker 3 [T1] 30.29 dBμV/m RBW 100 kHz VBW 100 kHz RF Att 10 dB Unit dBμV/m

82 dB* 149.96761077 MHz SWT 300 ms

100 MHz

▼3 [T1] 30.29 dBμV/m

▼1 [T1] 27.00 dBμV/m

▼2 [T1] 32.18 dBμV/m

140.77668089 MHz

IMAX

PART15

IN1

1MA

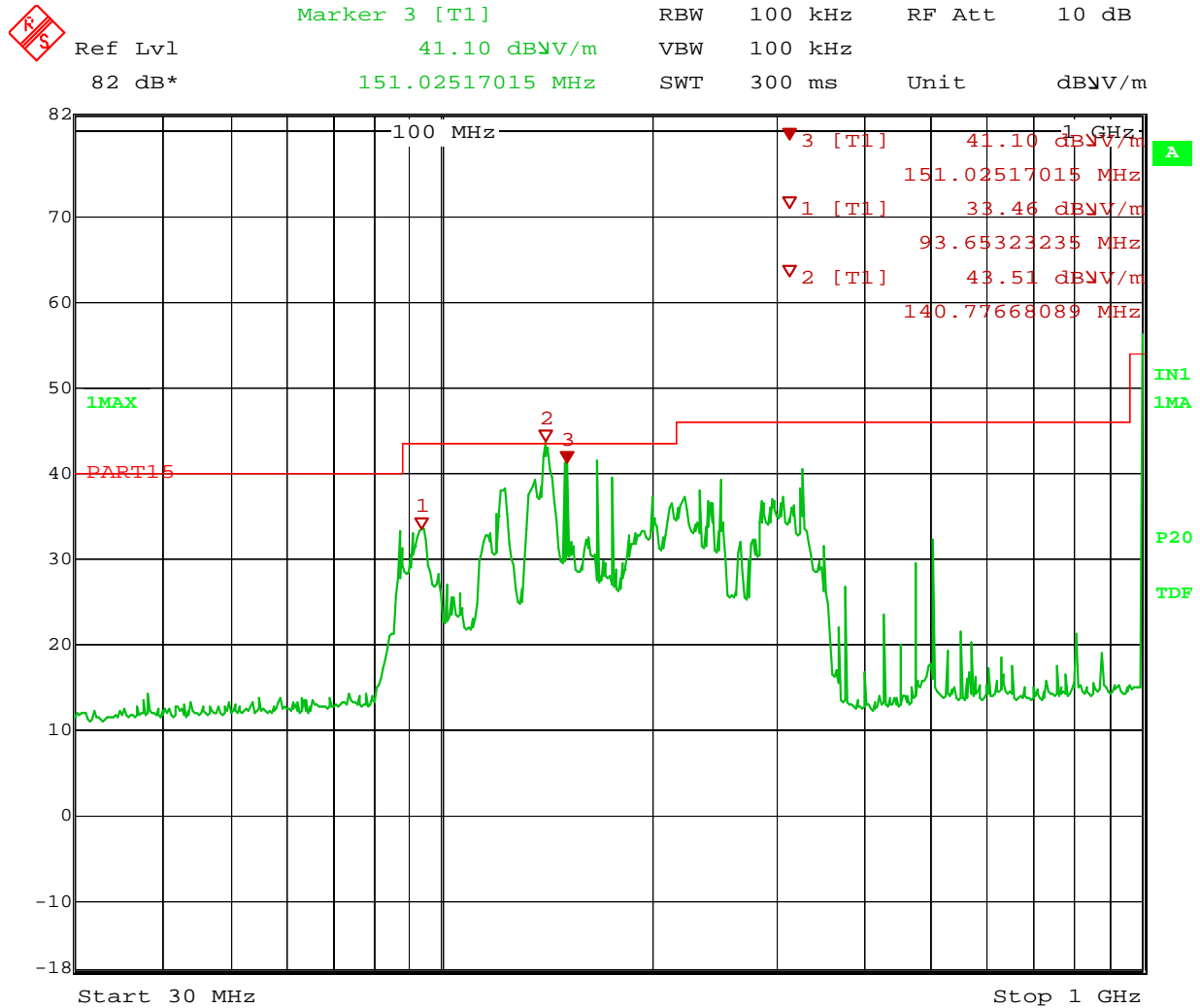
P20

TDF

Start 30 MHz Stop 1 GHz

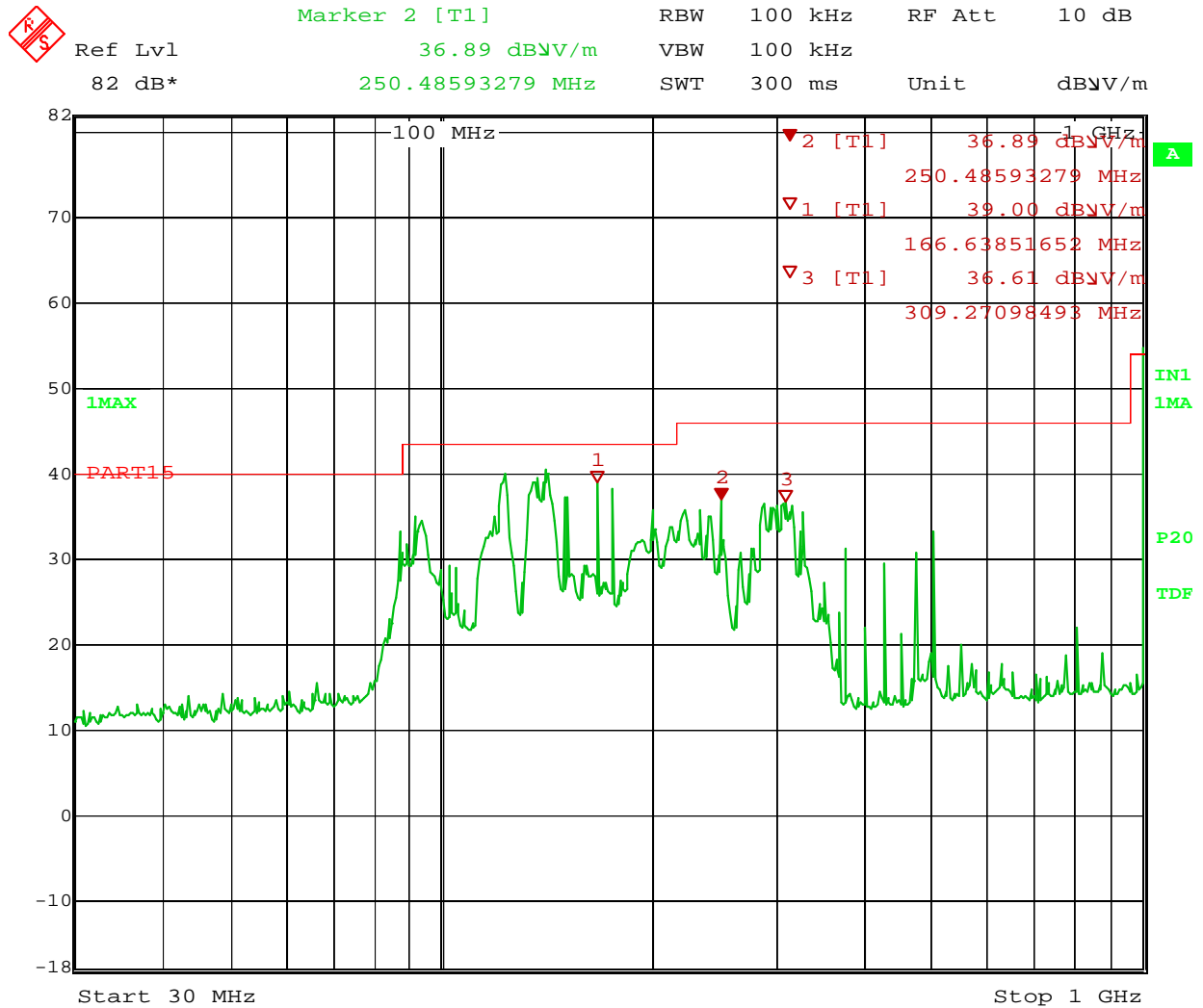
Date: 1.DEC.2007 20:12:31

Channel 6, Vertical



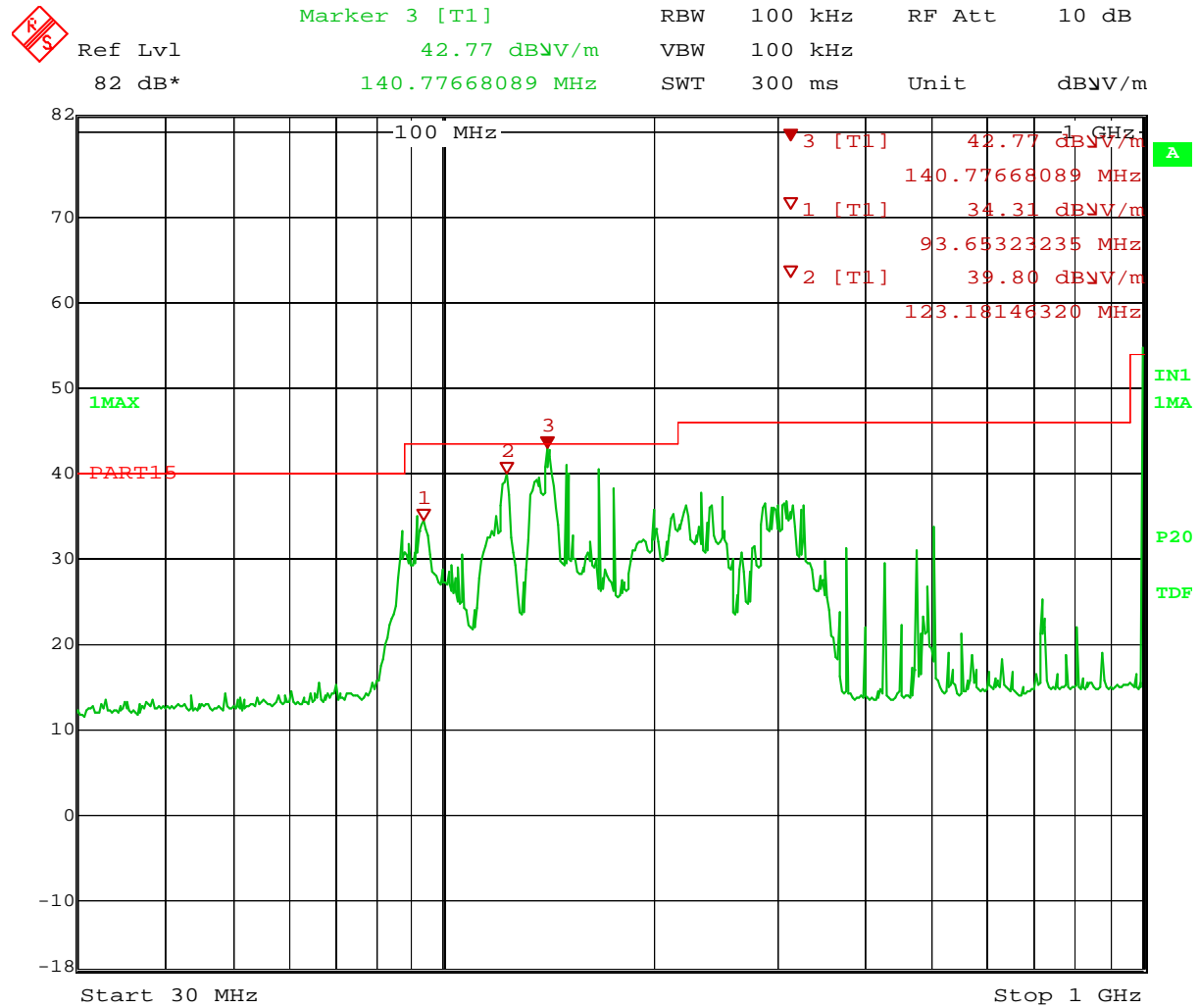
Date: 1.DEC.2007 20:15:06

Channel 11, Horizontal



Date: 1.DEC.2007 20:17:52

Channel 11, Vertical

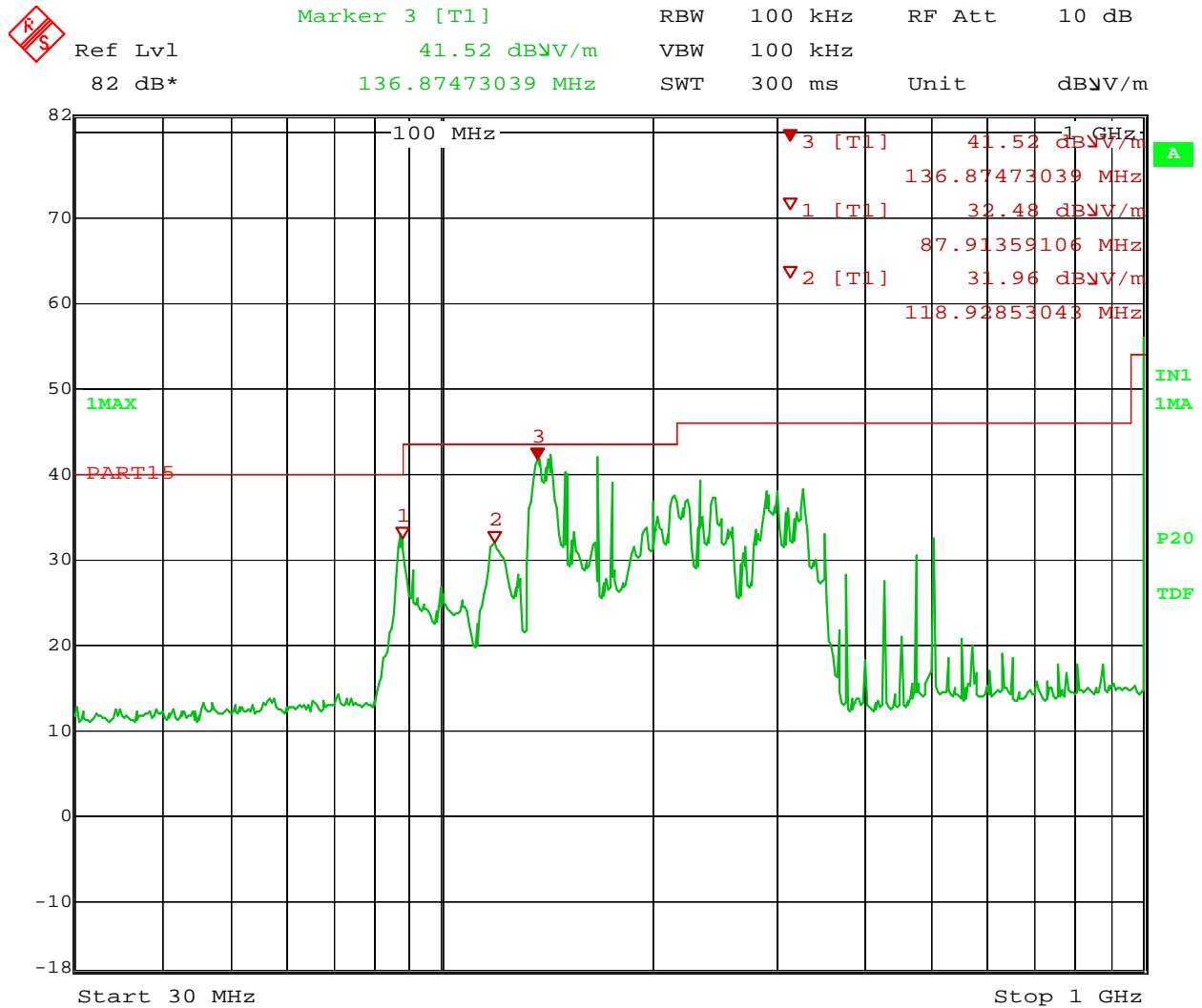


Date: 1.DEC.2007 20:21:33

Channel 1, horizontal

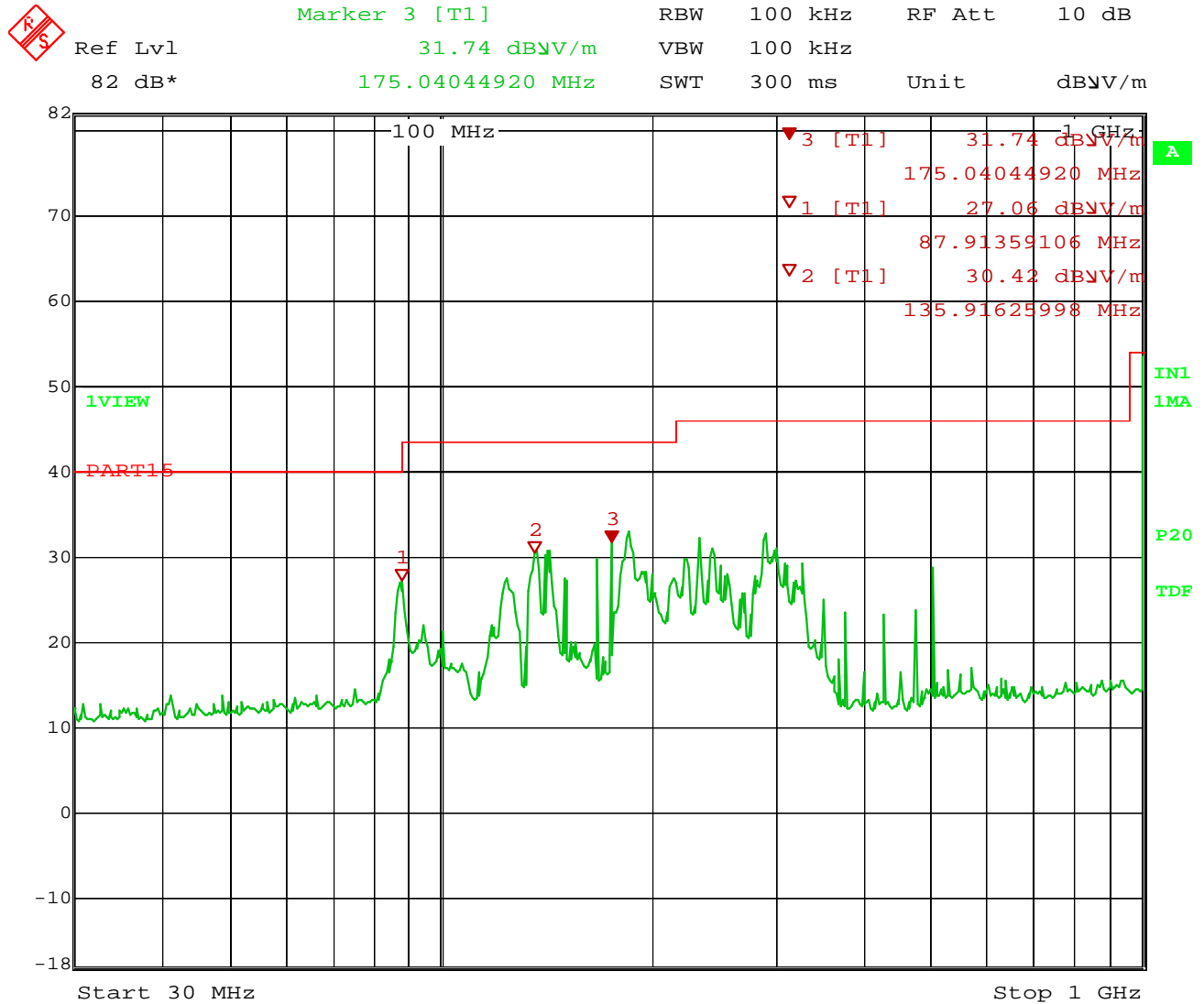


Channel 1, vertical



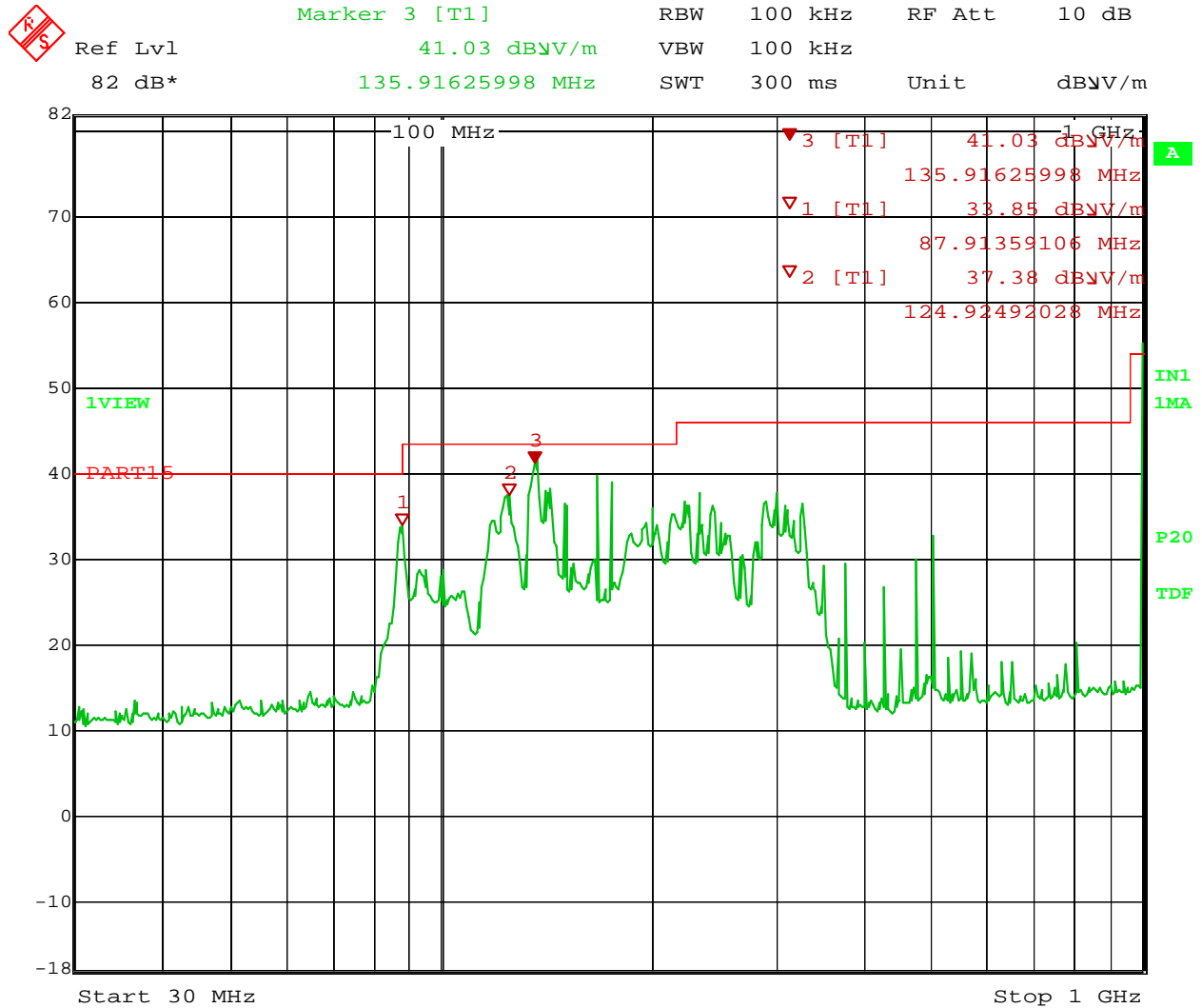
Date: 1.DEC.2007 20:25:19

Channel 6, horizontal



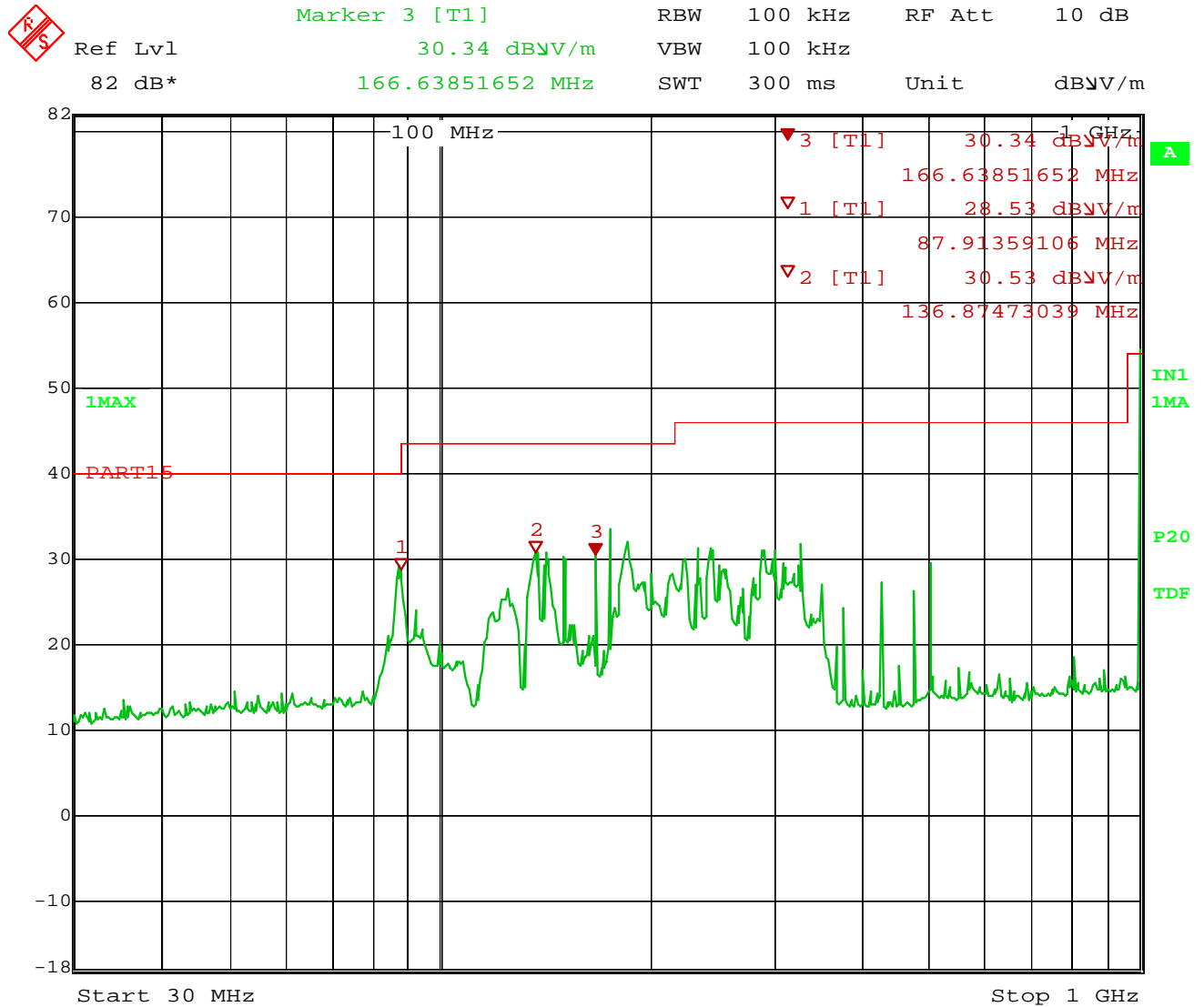
Date: 1.DEC.2007 20:30:32

Channel 6, vertical



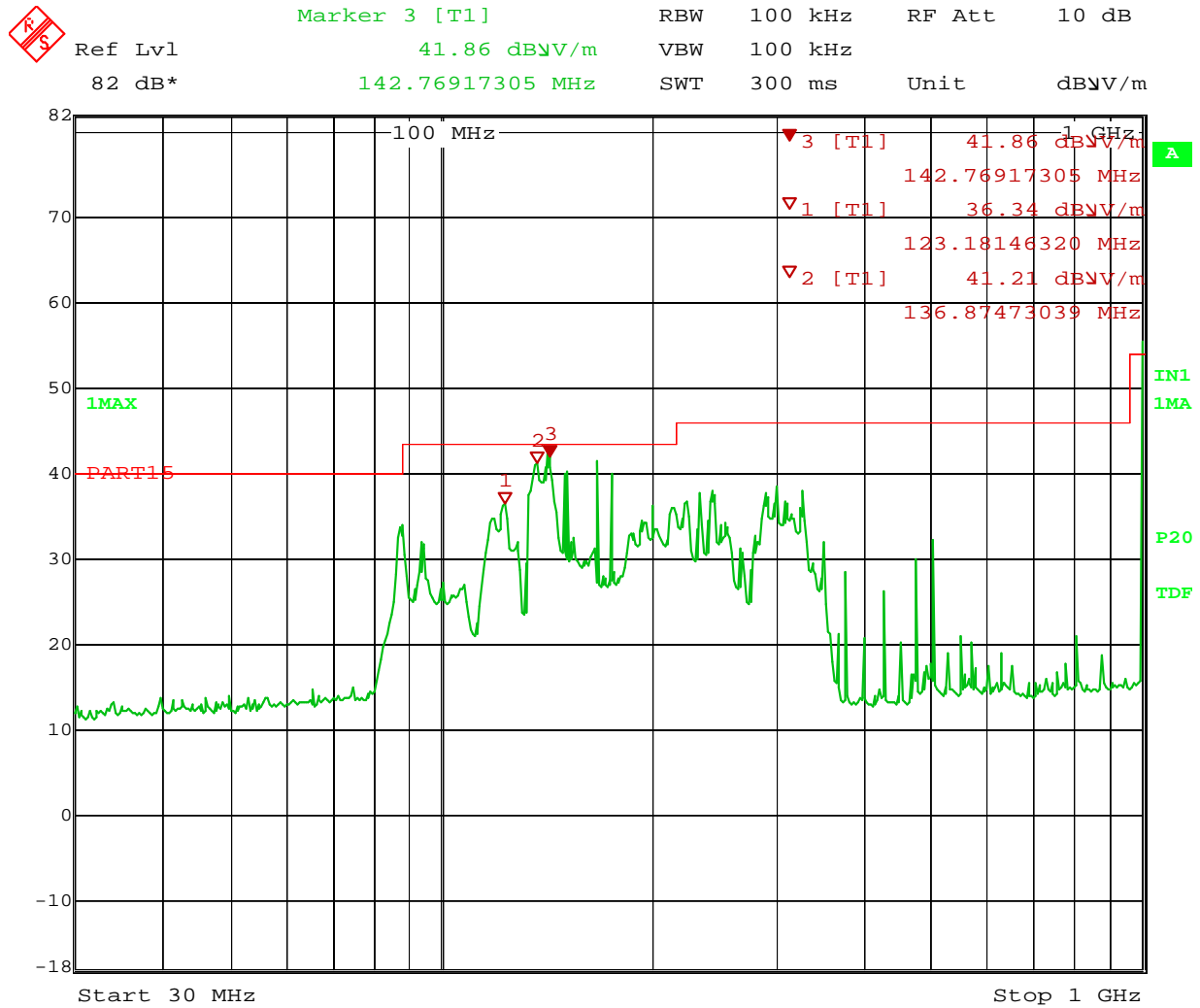
Date: 1.DEC.2007 20:33:11

Channel 11, horizontal



Date: 1.DEC.2007 20:41:56

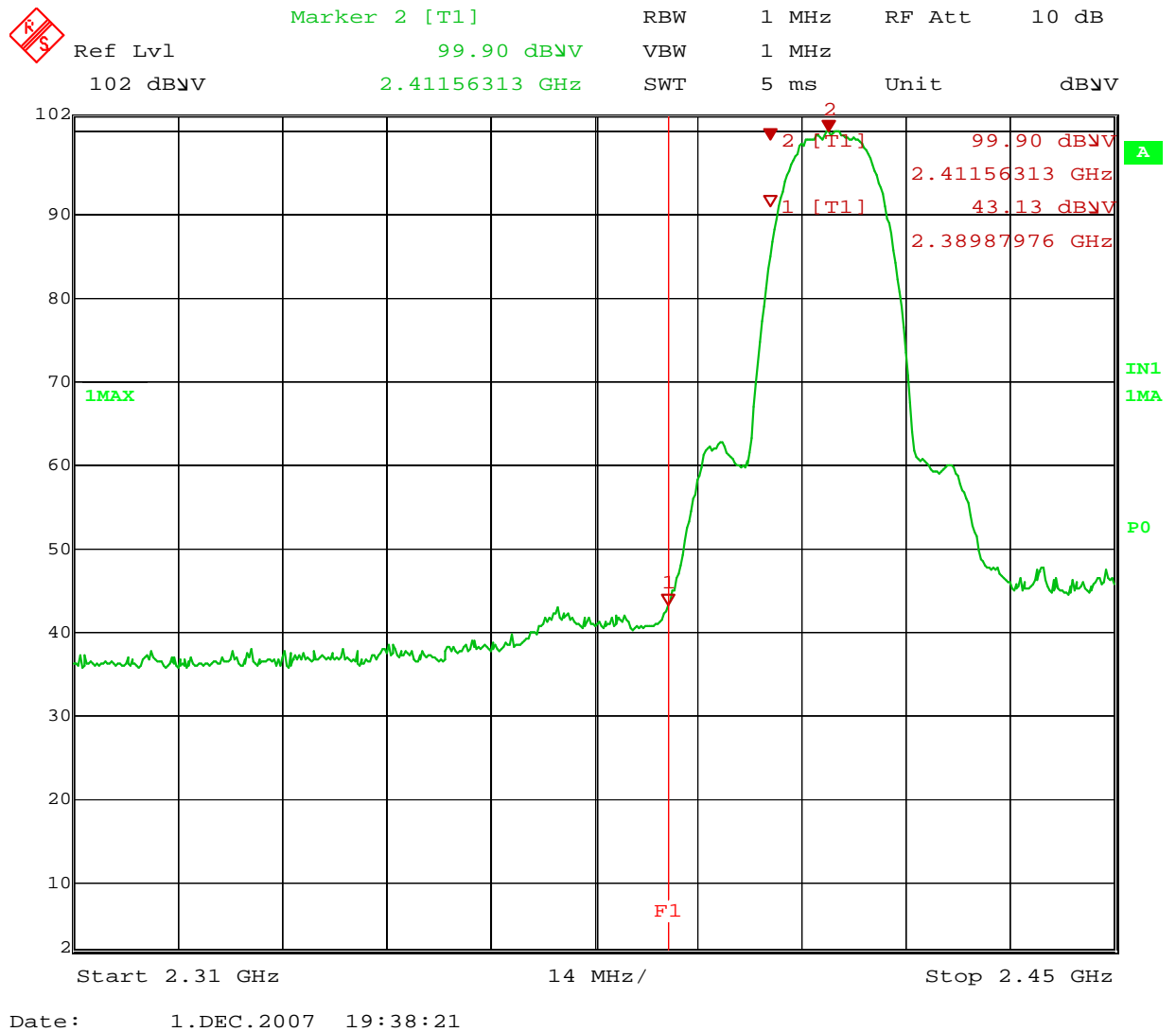
Channel 11, vertical



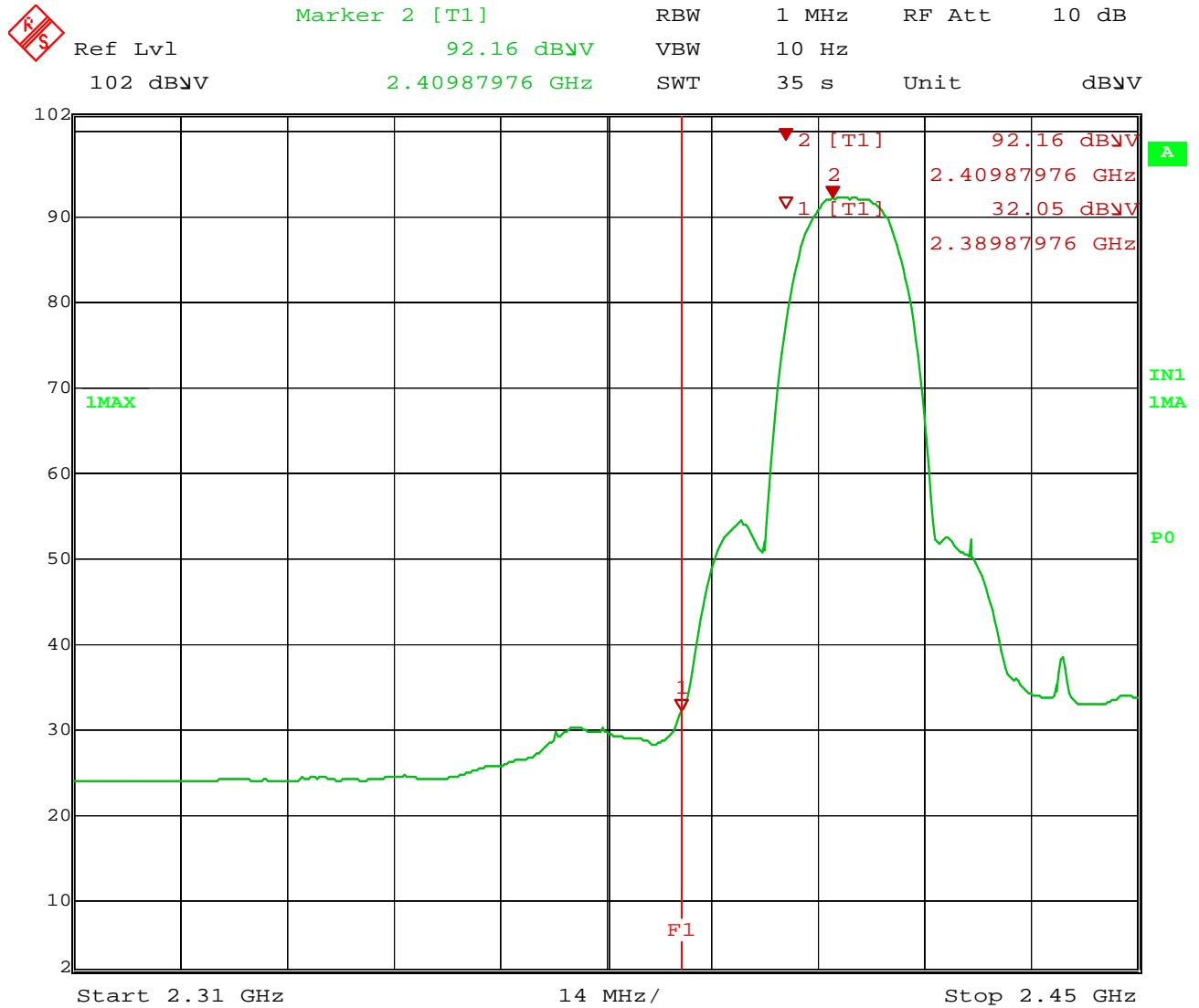
Date: 1.DEC.2007 20:39:32

4. Restrict band radiated Emission

802.11b, Restrict band 2310MHz ~ 2390MHz, PK

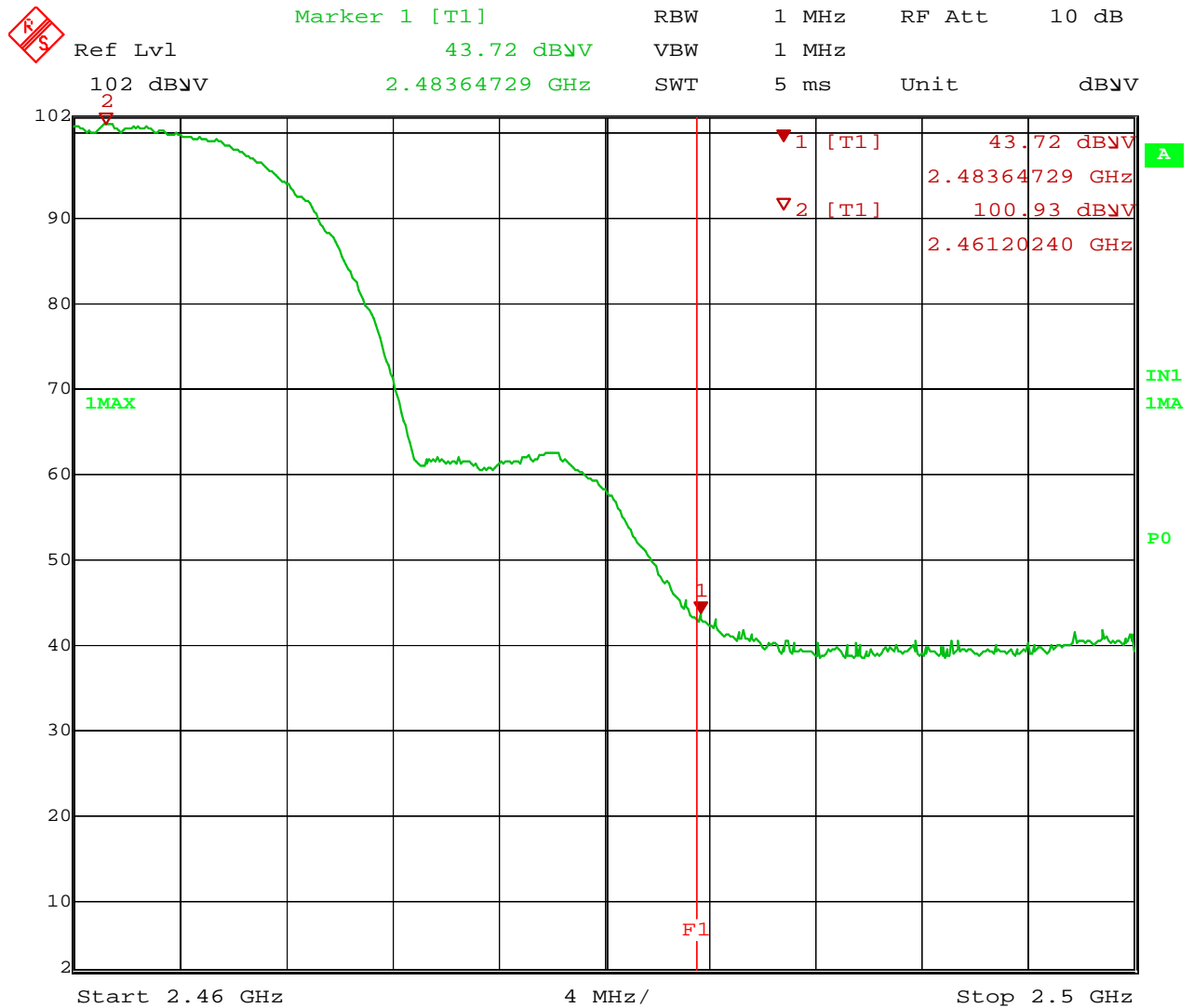


802.11b, Restrict band 2310MHz ~ 2390MHz, AV



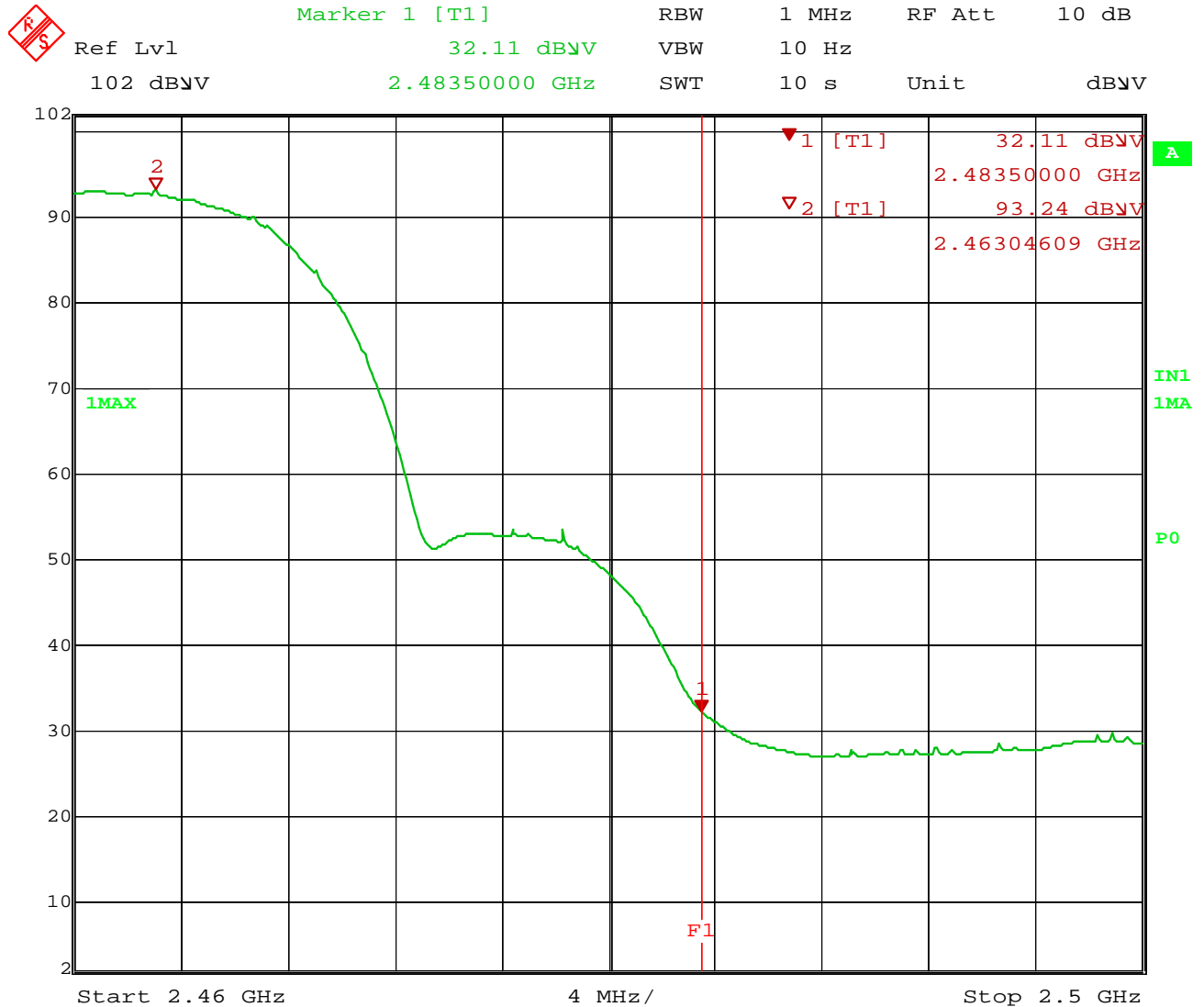
Date: 1.DEC.2007 19:36:27

802.11b, Restrict band 2483.5MHz ~ 2500MHz, PK



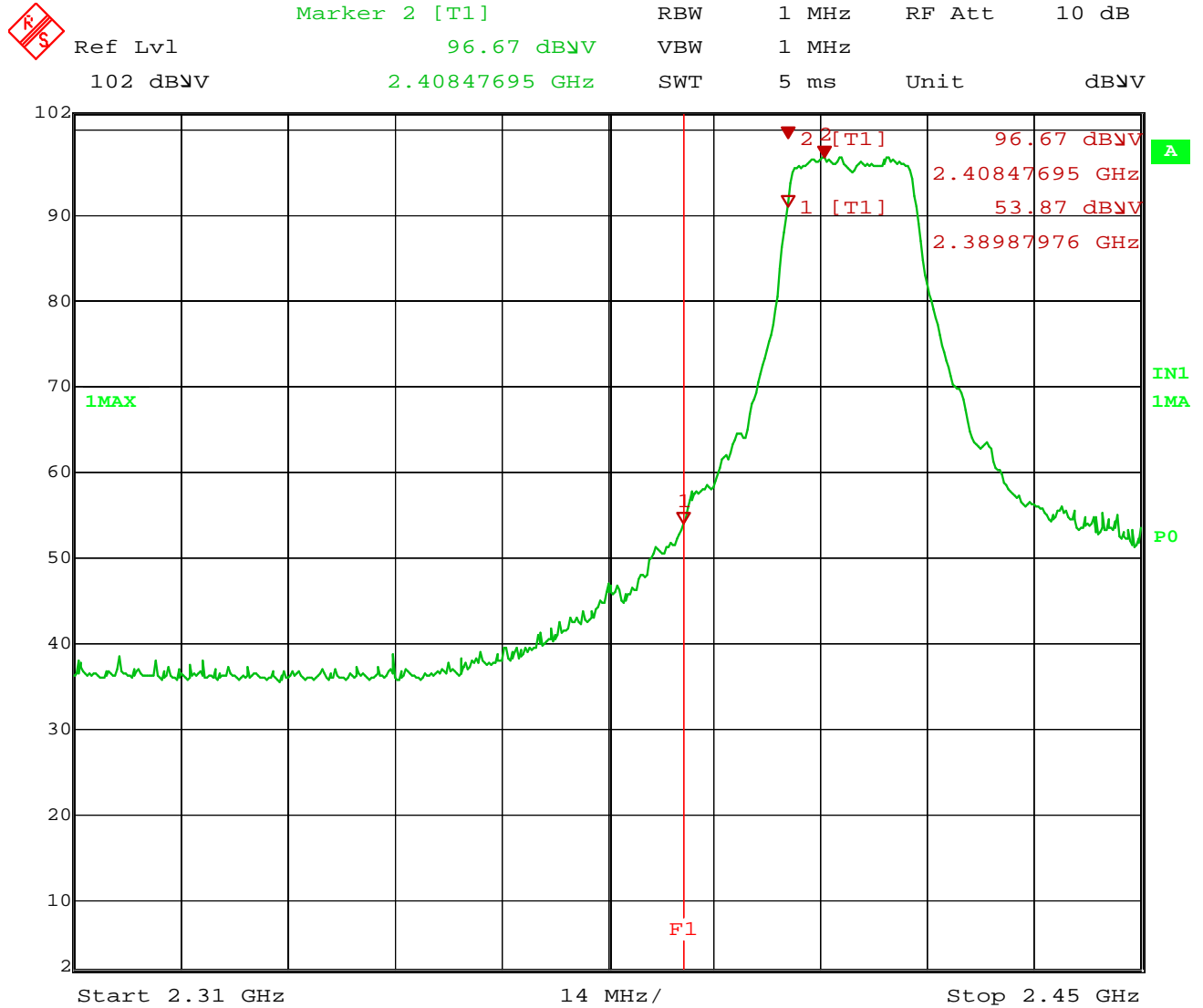
Date: 1.DEC.2007 19:40:43

802.11b, Restrict band 2483.5MHz ~ 2500MHz, AV



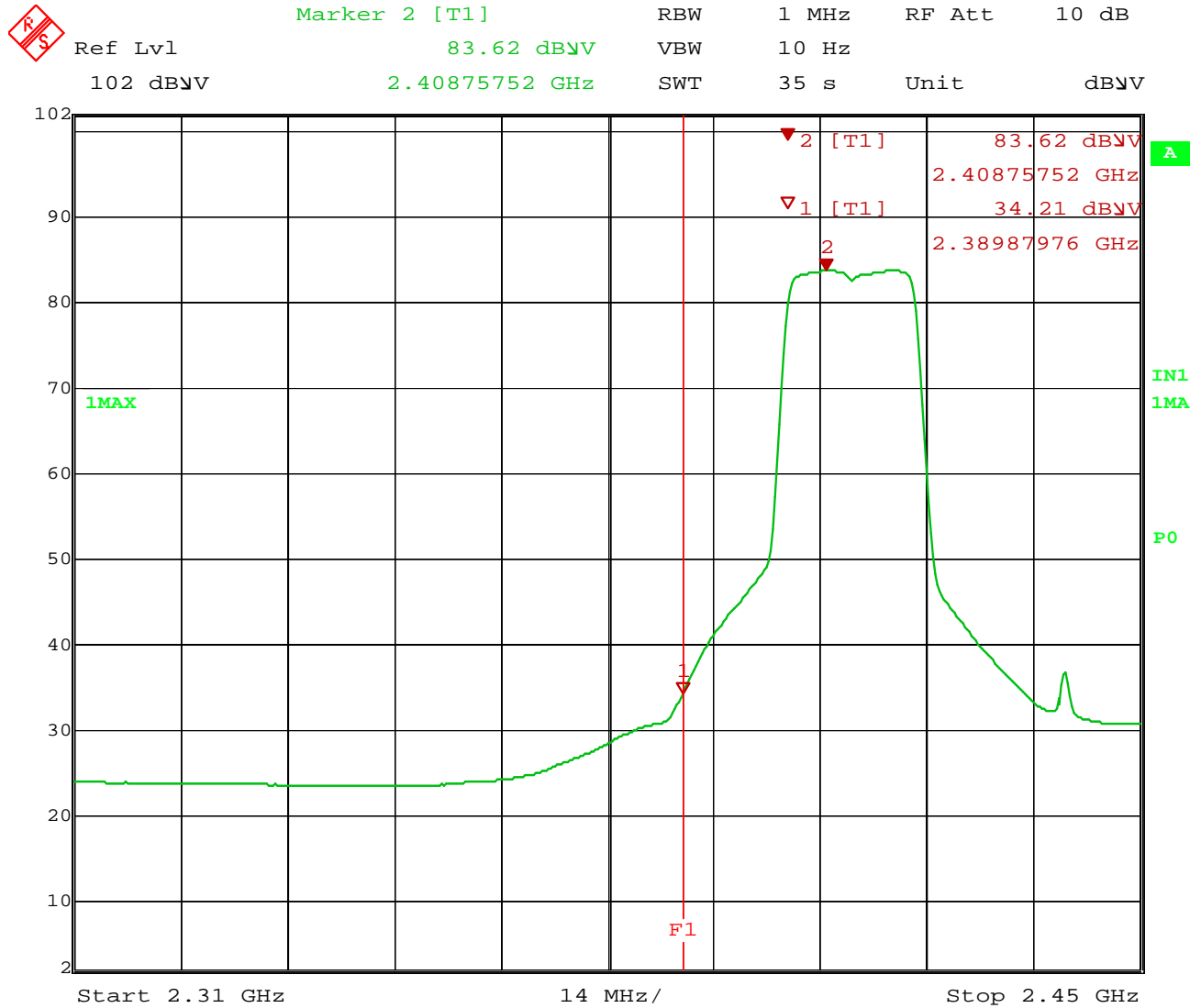
Date: 1.DEC.2007 19:43:04

802.11g, Restrict band 2310MHz ~ 2390MHz, PK



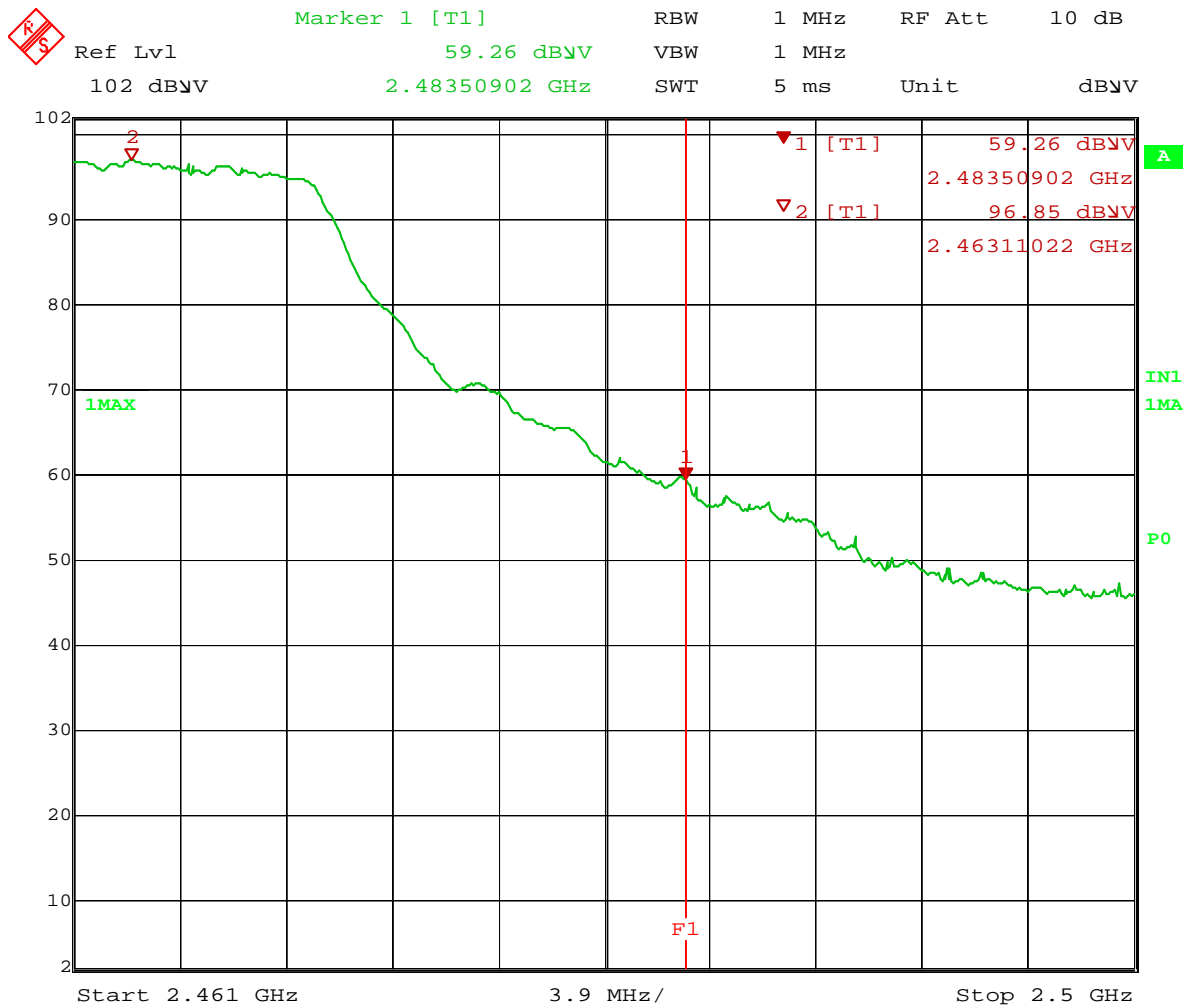
Date: 1.DEC.2007 19:28:54

802.11g, Restrict band 2310MHz ~ 2390MHz, AV



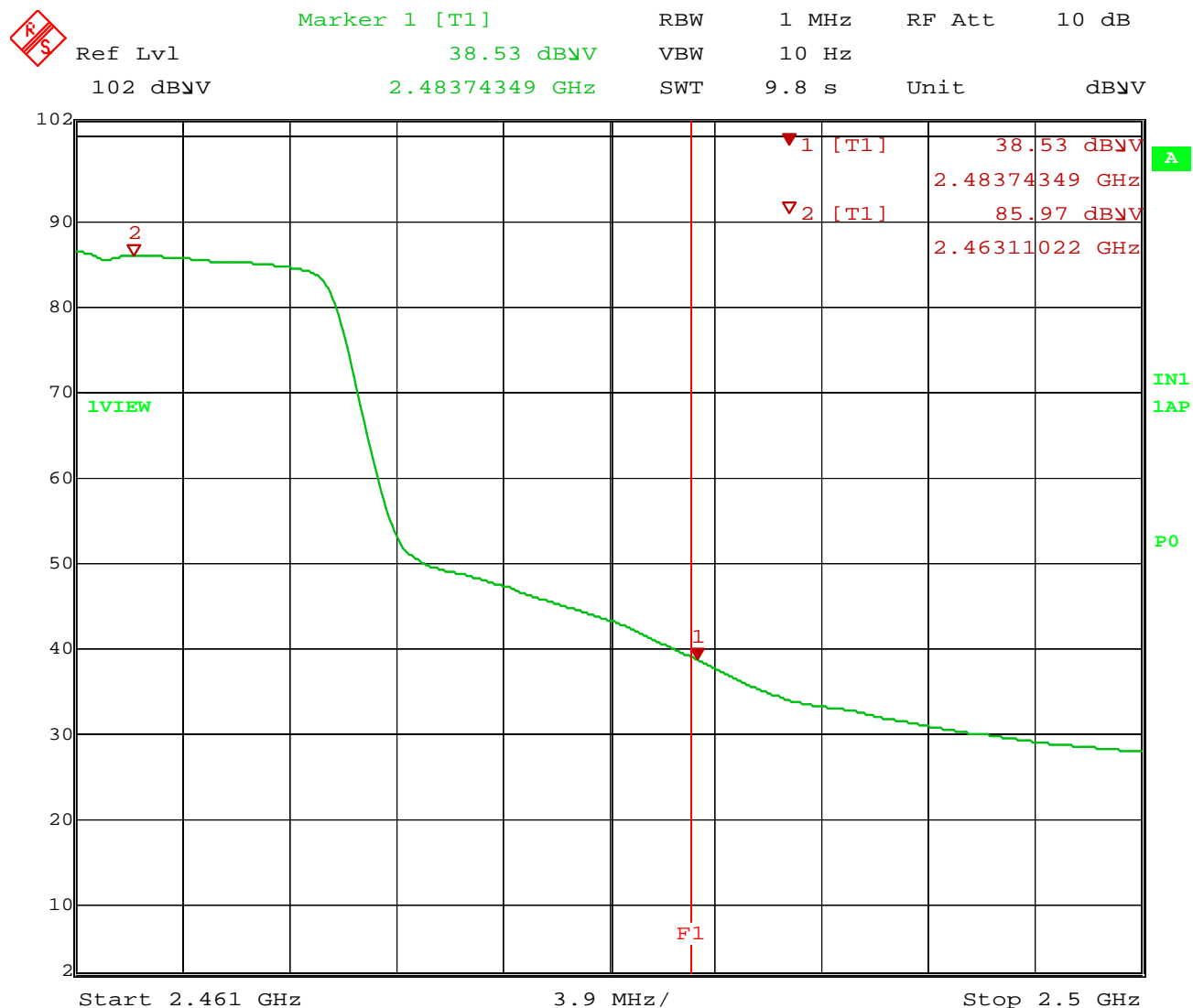
Date: 1.DEC.2007 19:30:59

802.11g, Restrict band 2483.5MHz ~ 2500MHz, PK



Date: 1.DEC.2007 19:26:23

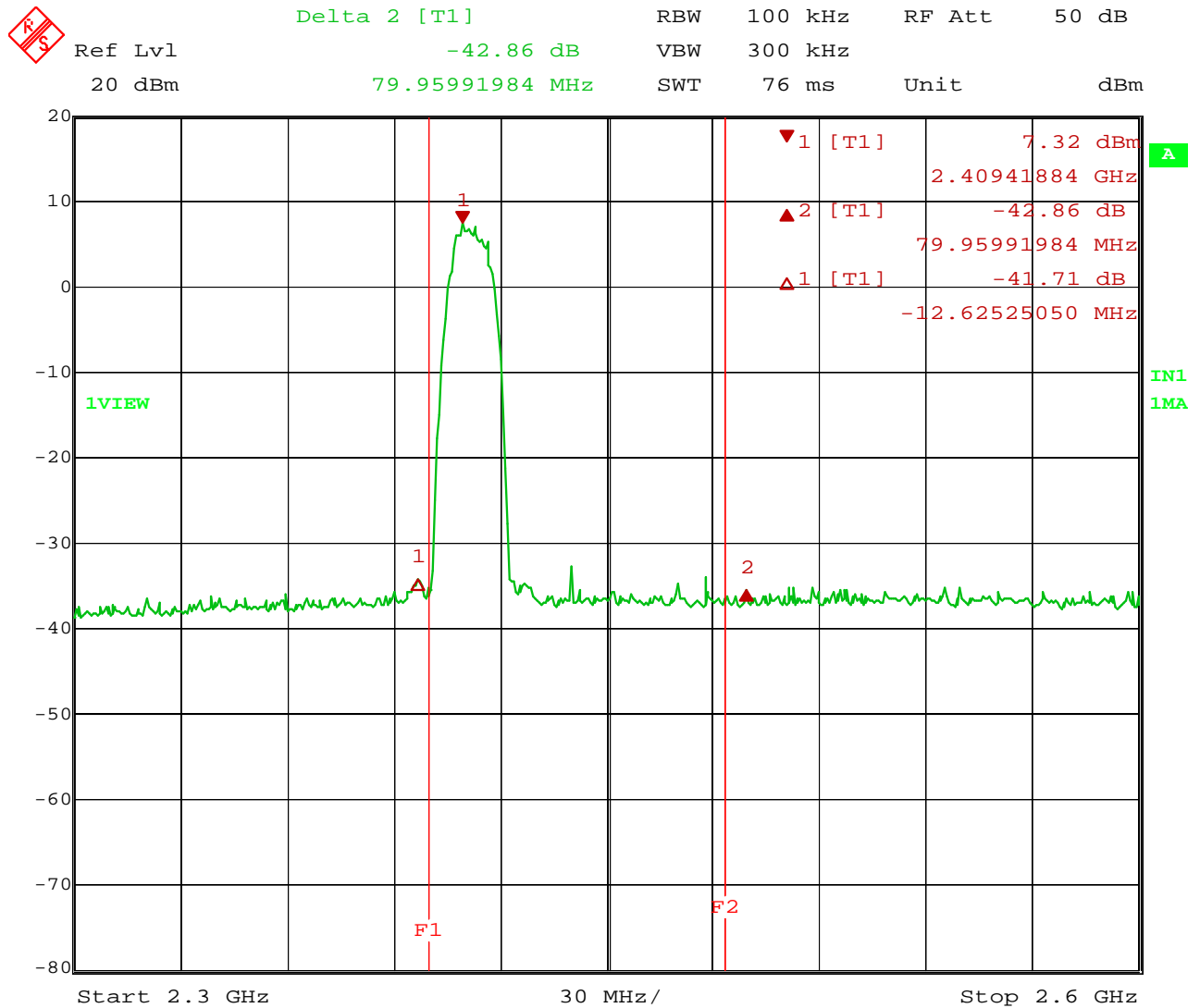
802.11g, Restrict band 2483.5MHz ~ 2500MHz, AV



Date: 1.DEC.2007 19:24:13

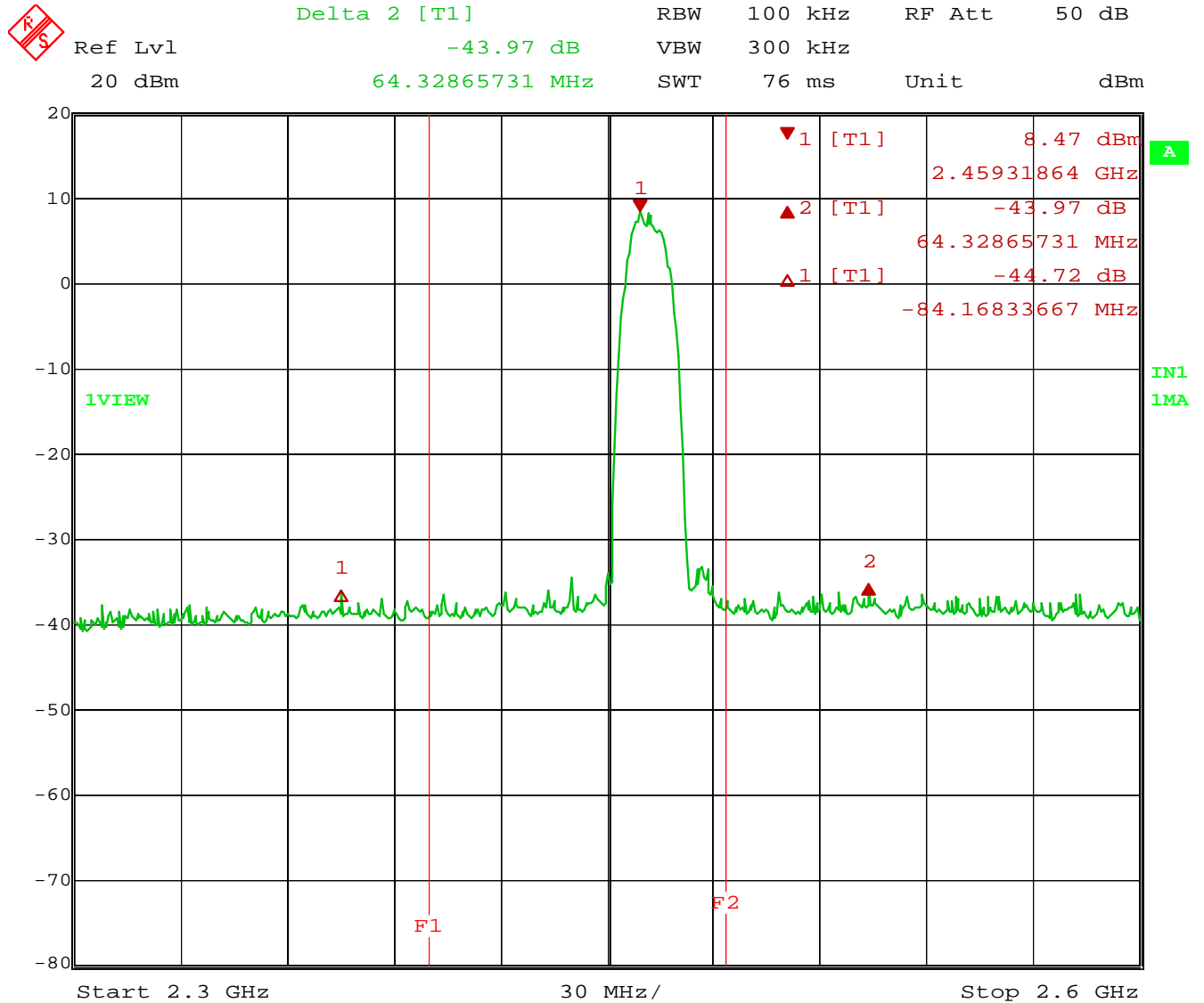
5. Emission outside the frequency band

802.11b, Lower than frequency band



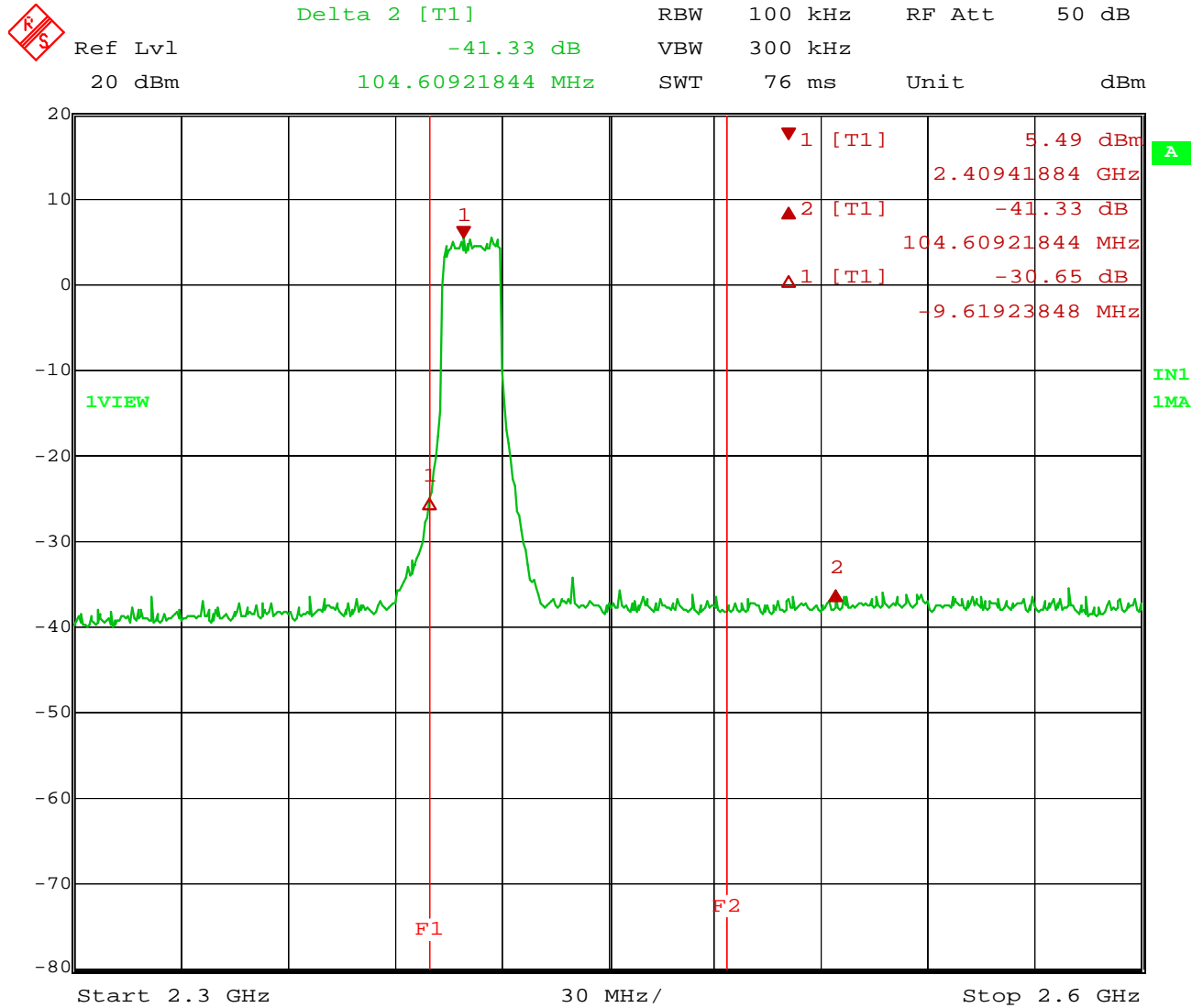
Date: 28.NOV.2007 11:10:17

802.11b, Higher than frequency band



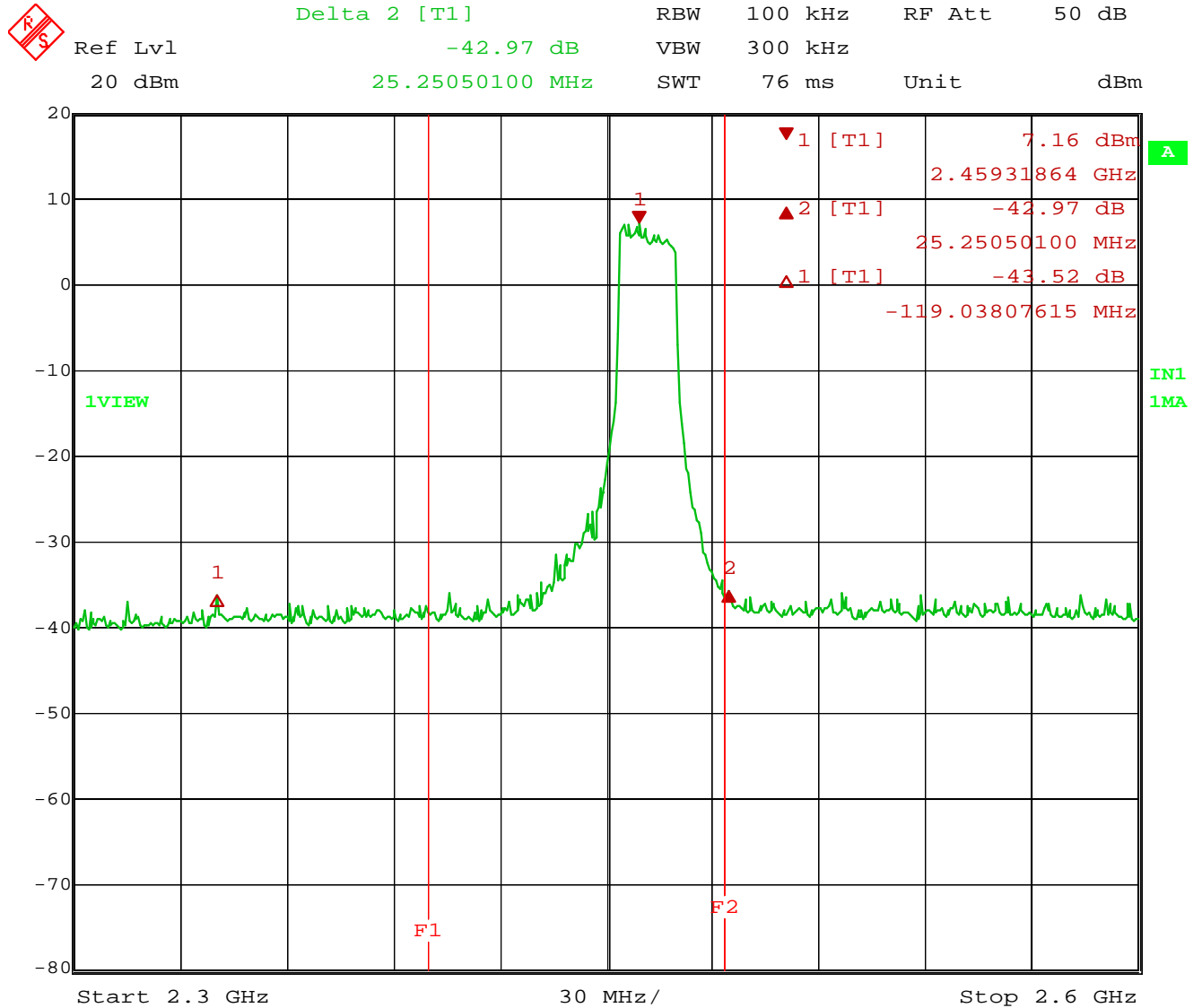
Date: 28.NOV.2007 11:12:56

802.11g, Lower than frequency band



Date: 28.NOV.2007 11:14:46

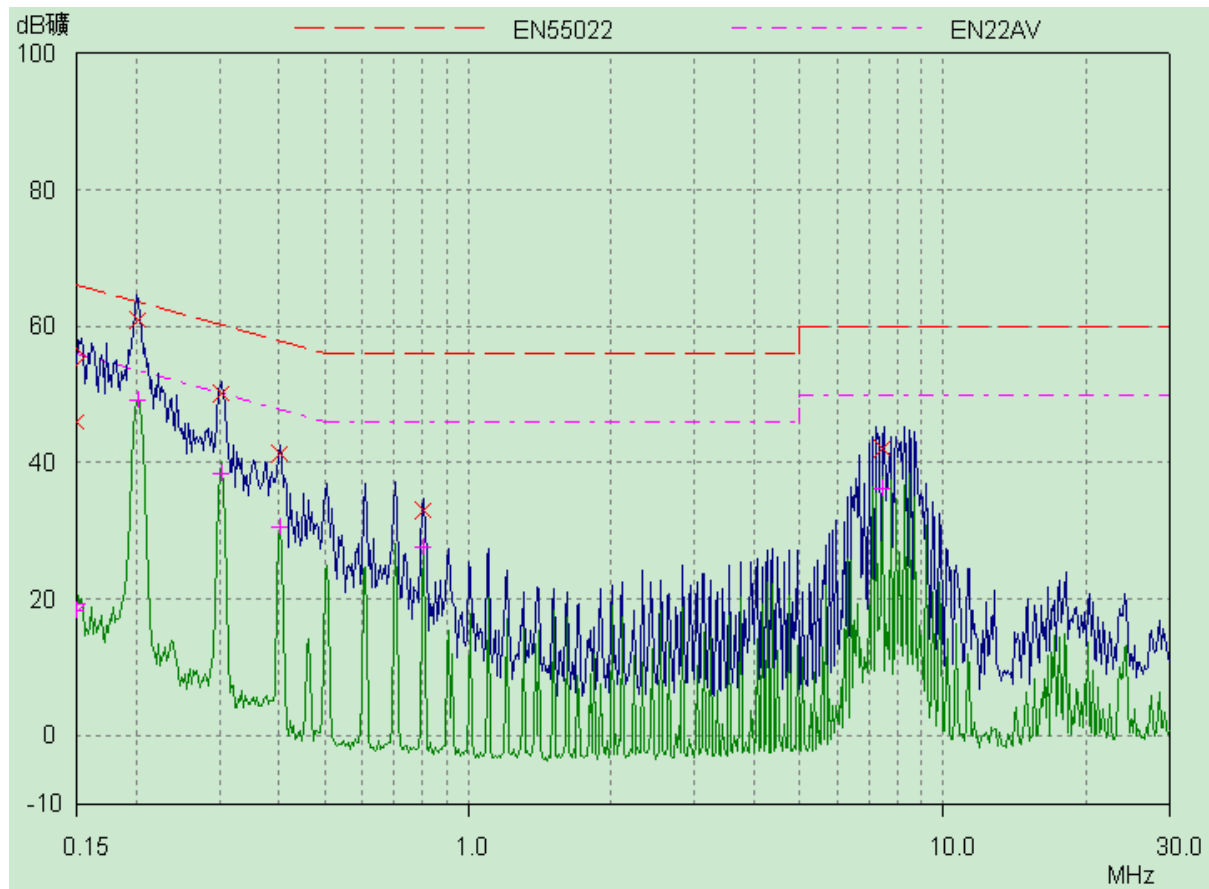
802.11g, Higher than frequency band



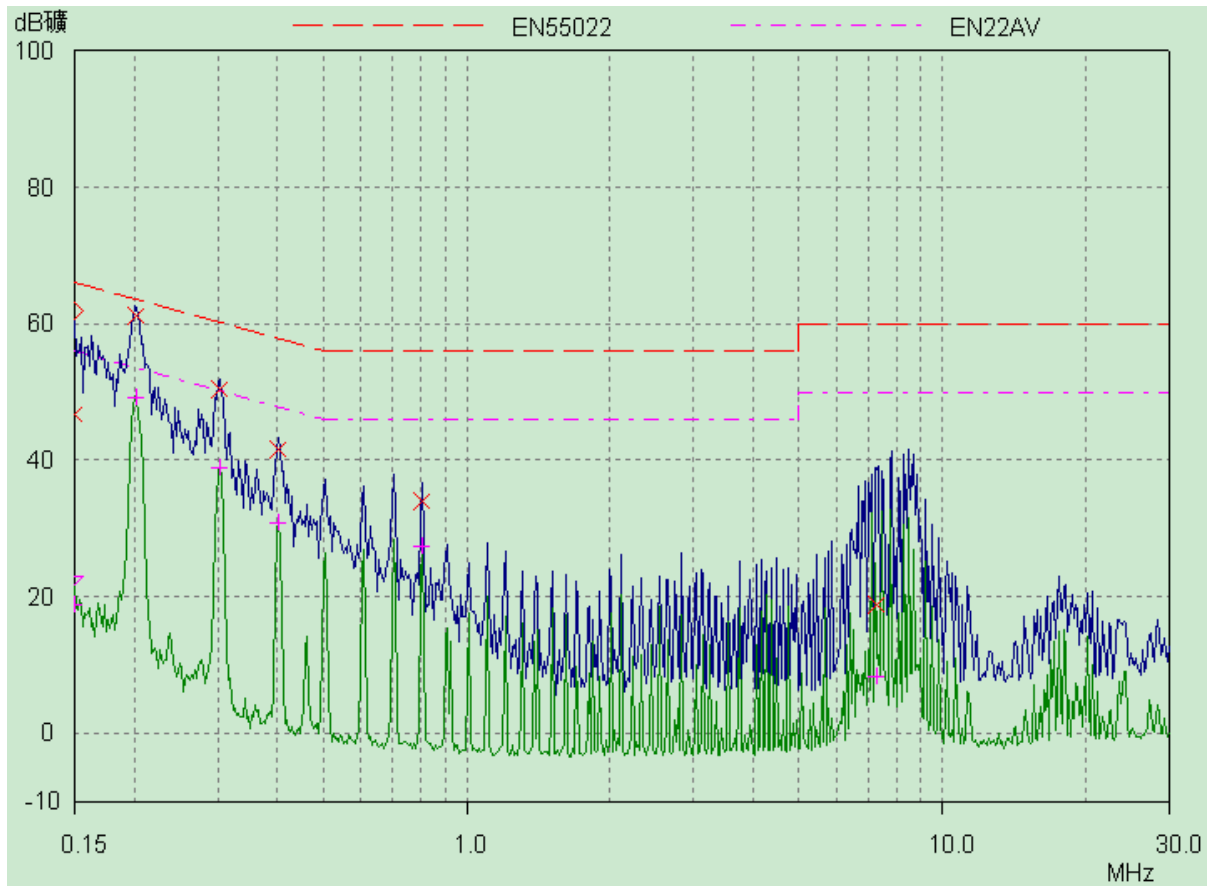
Date: 28.NOV.2007 11:16:58

6. Conducted Emission

Power line: L



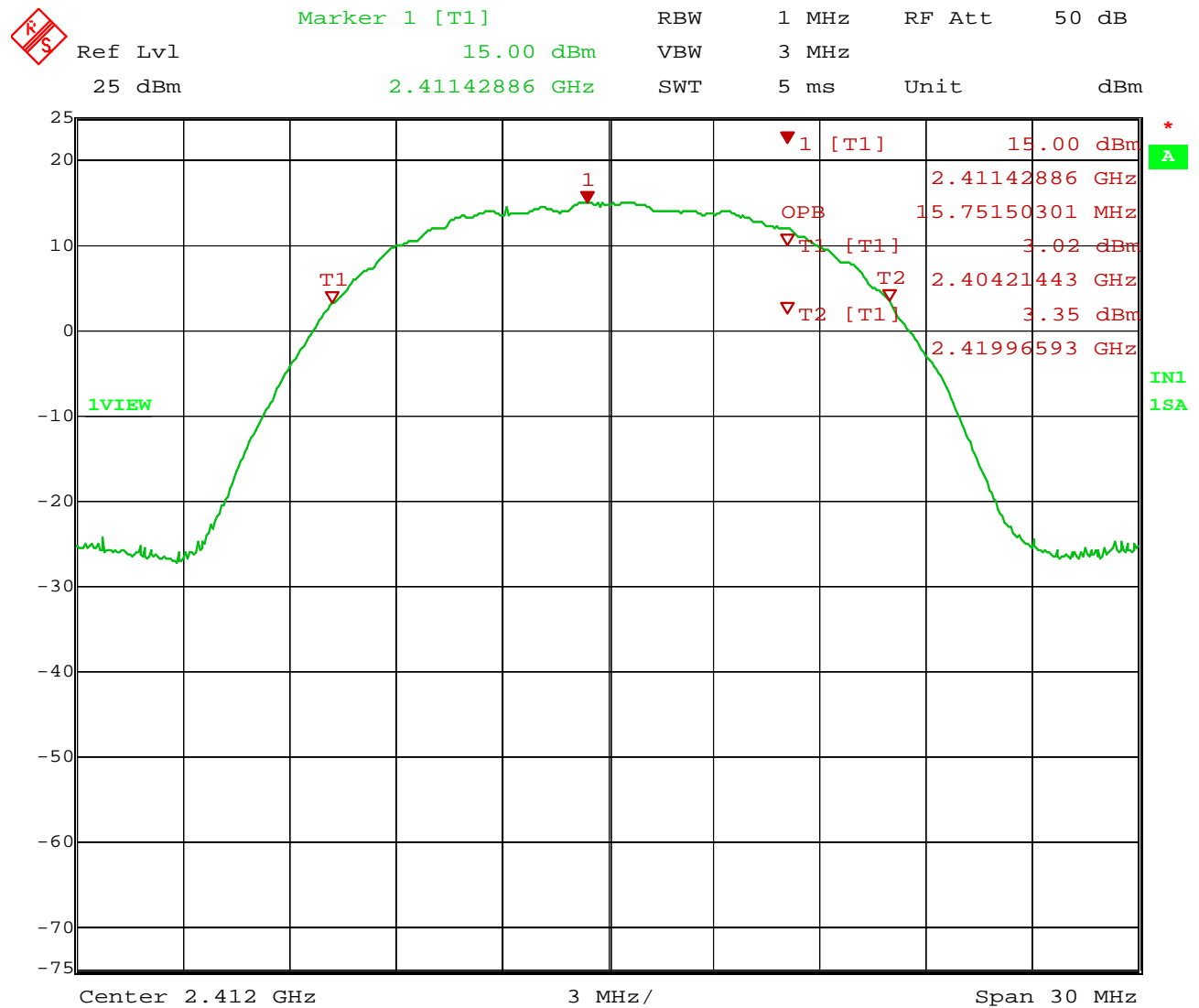
Power line: N



7. Occupied Bandwidth

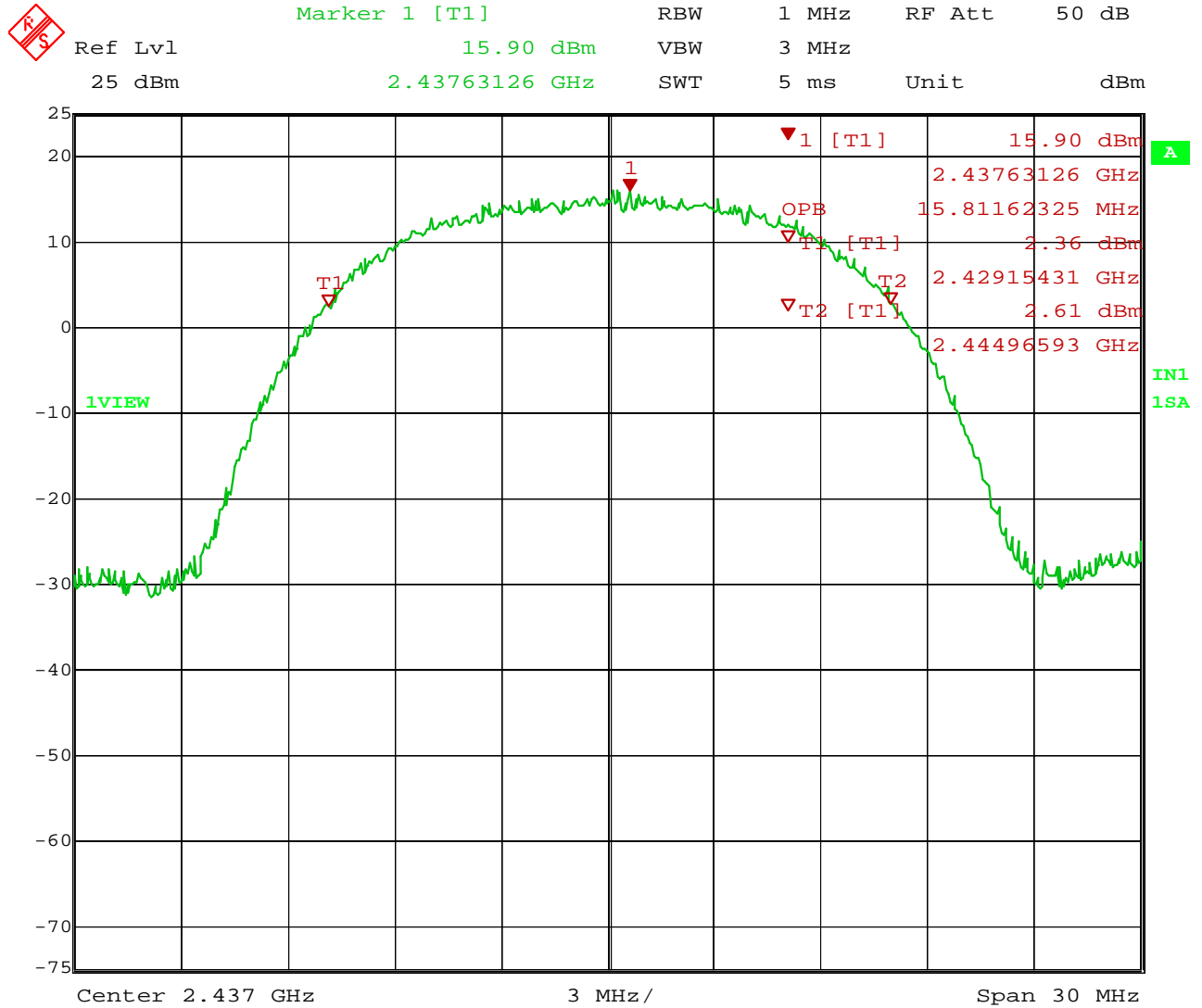
802.11b

Channel 1



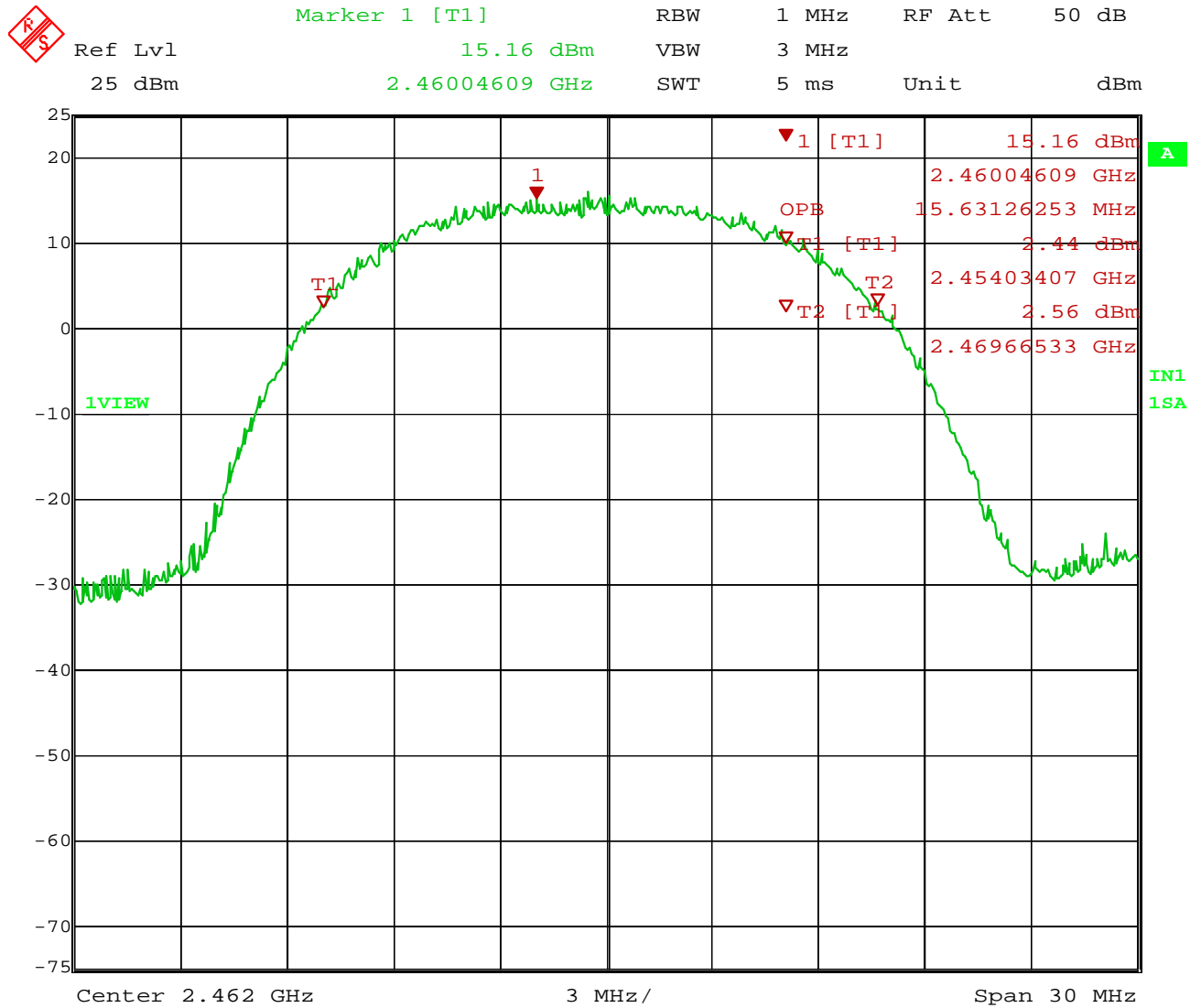
Date: 28.NOV.2007 10:29:21

Channel 6



Date: 28.NOV.2007 10:32:16

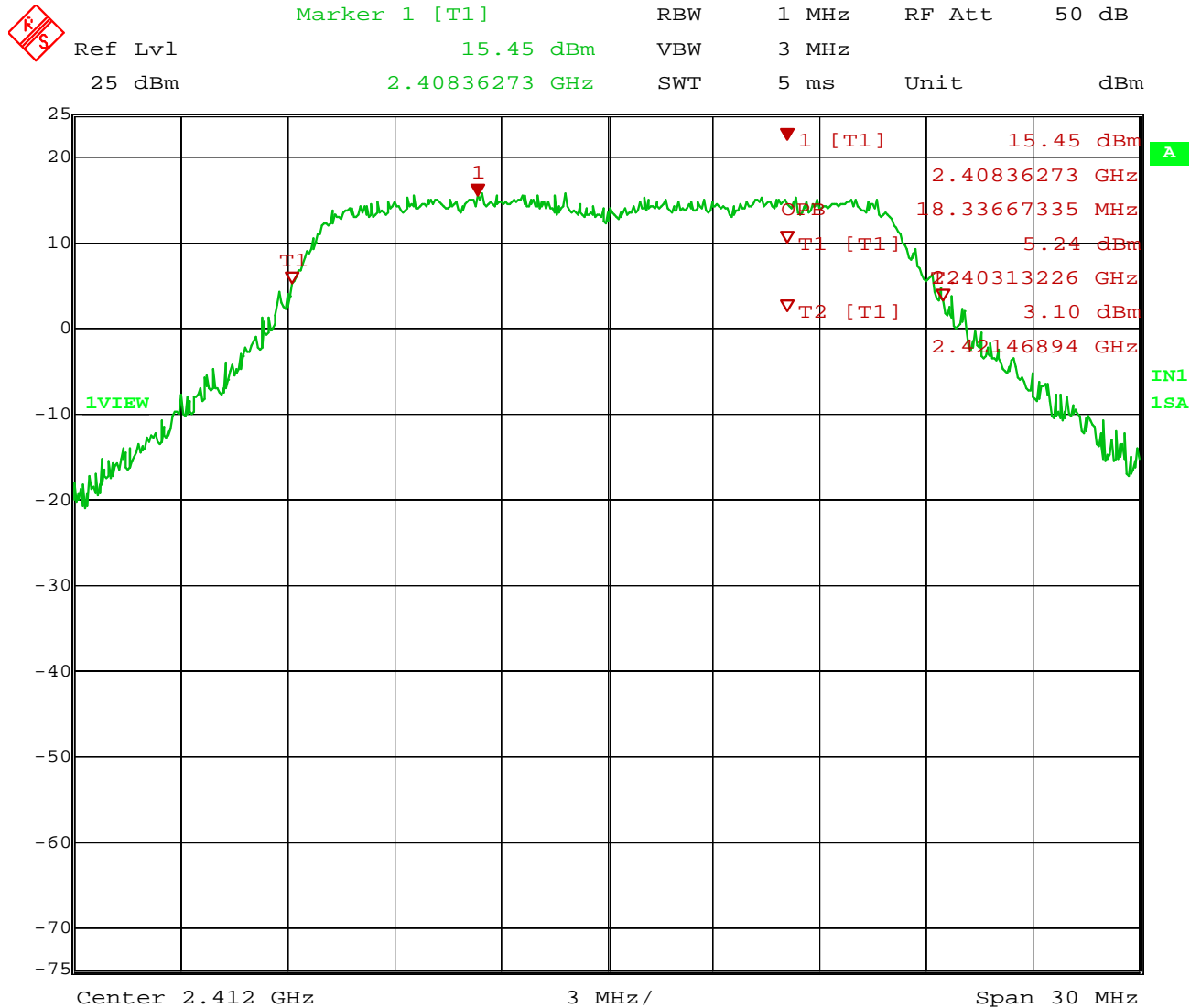
Channel 11



Date: 28.NOV.2007 10:35:14

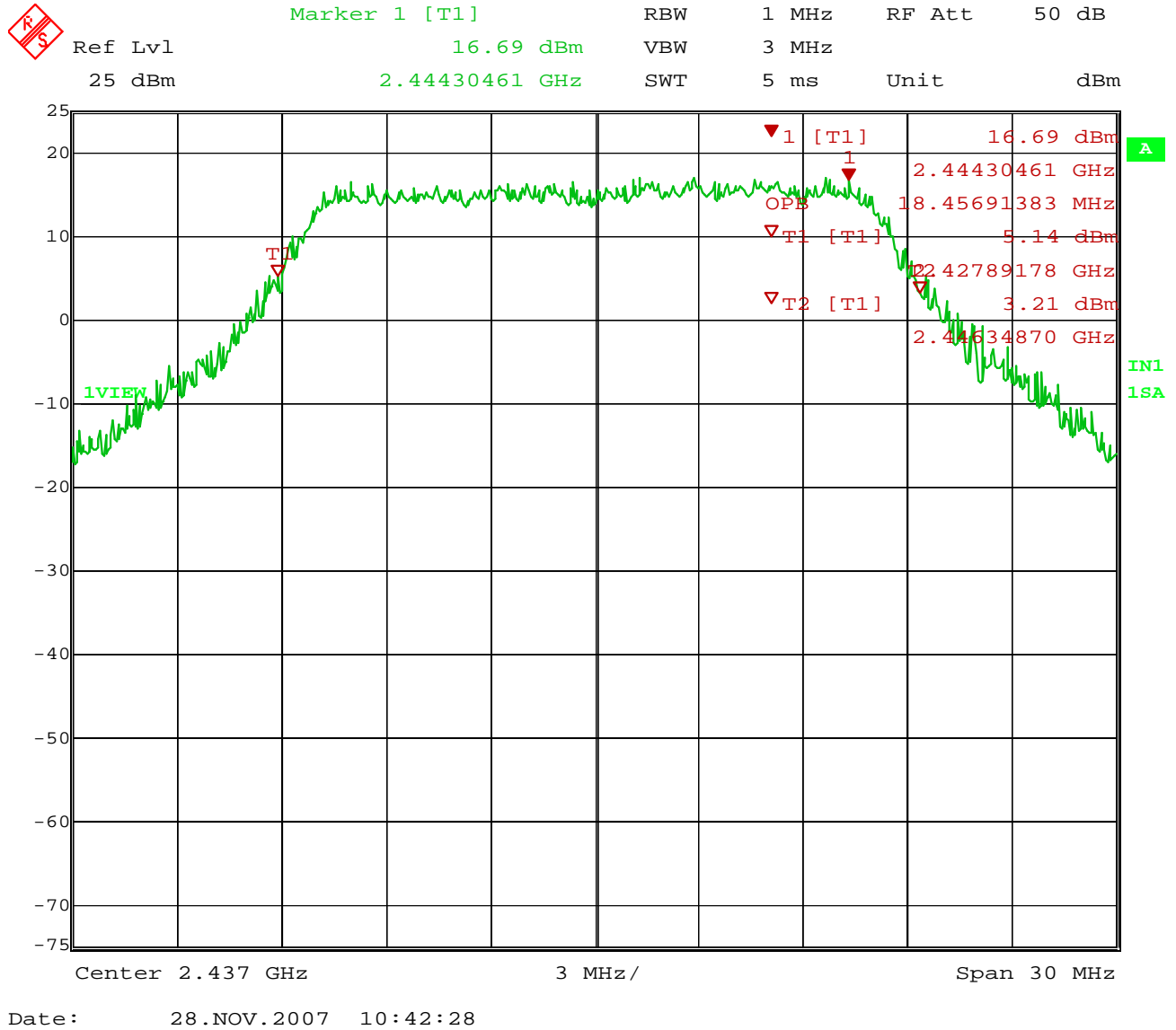
802.11g

Channel 1

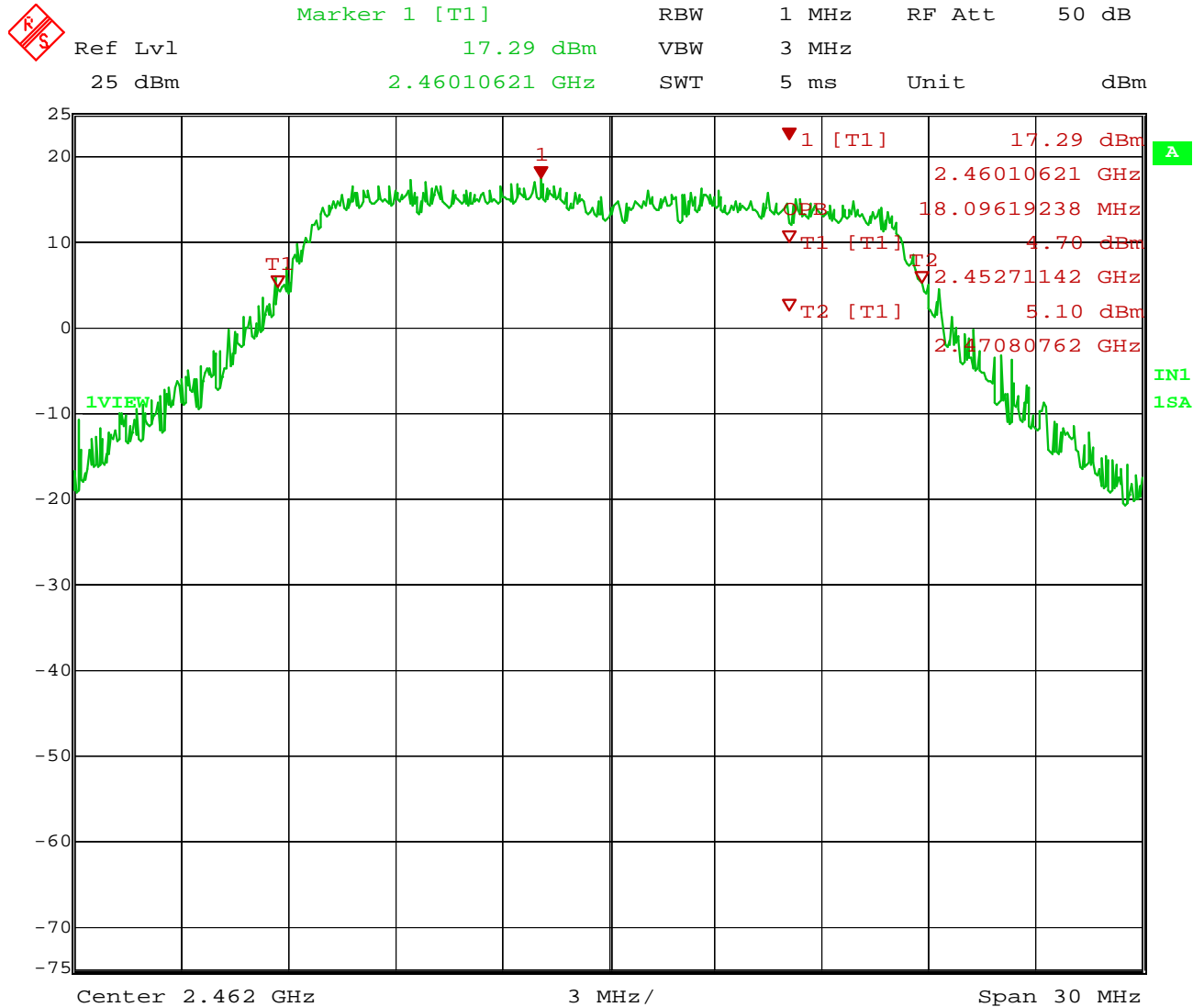


Date: 28.NOV.2007 10:40:22

Channel 6



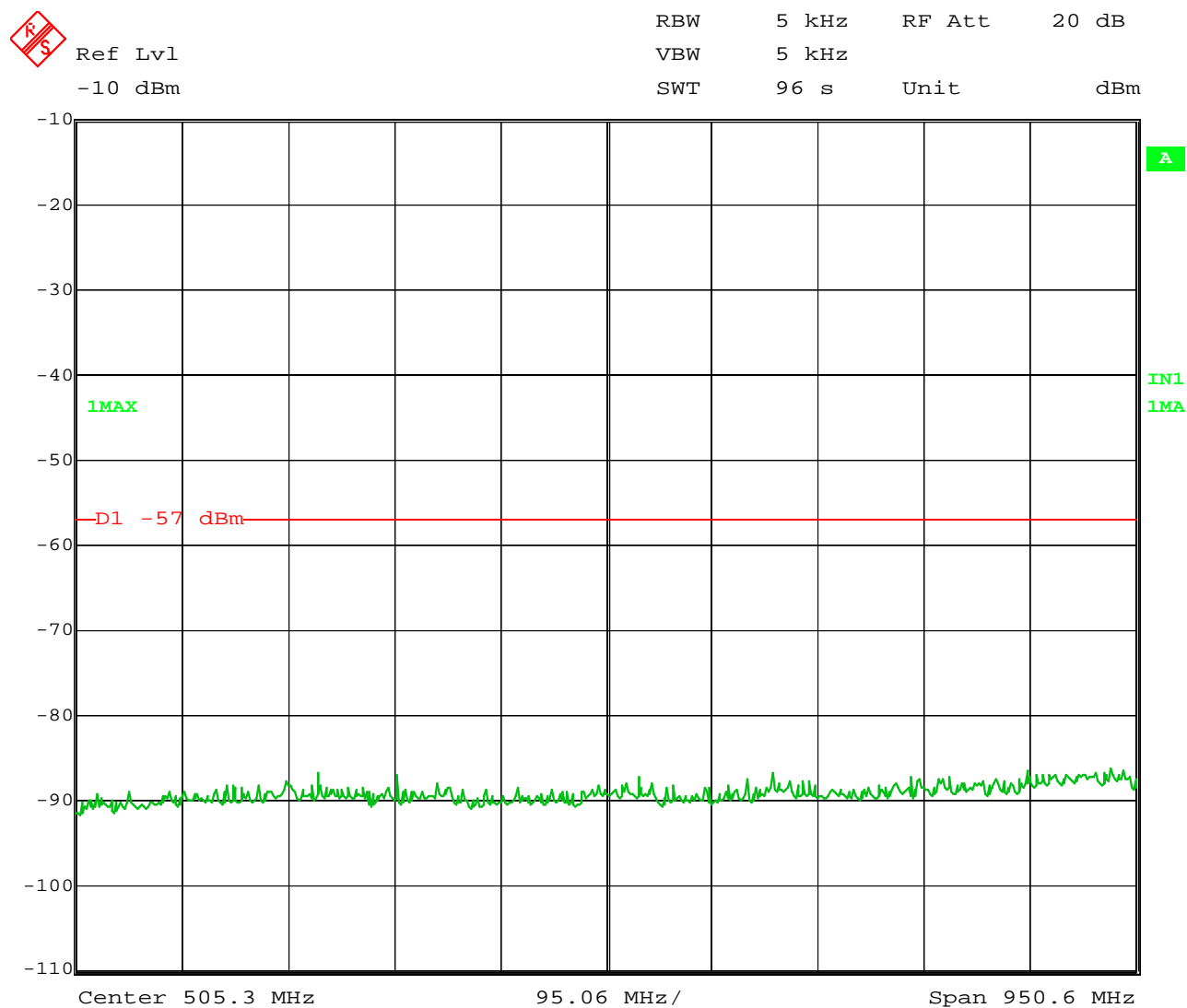
Channel 11



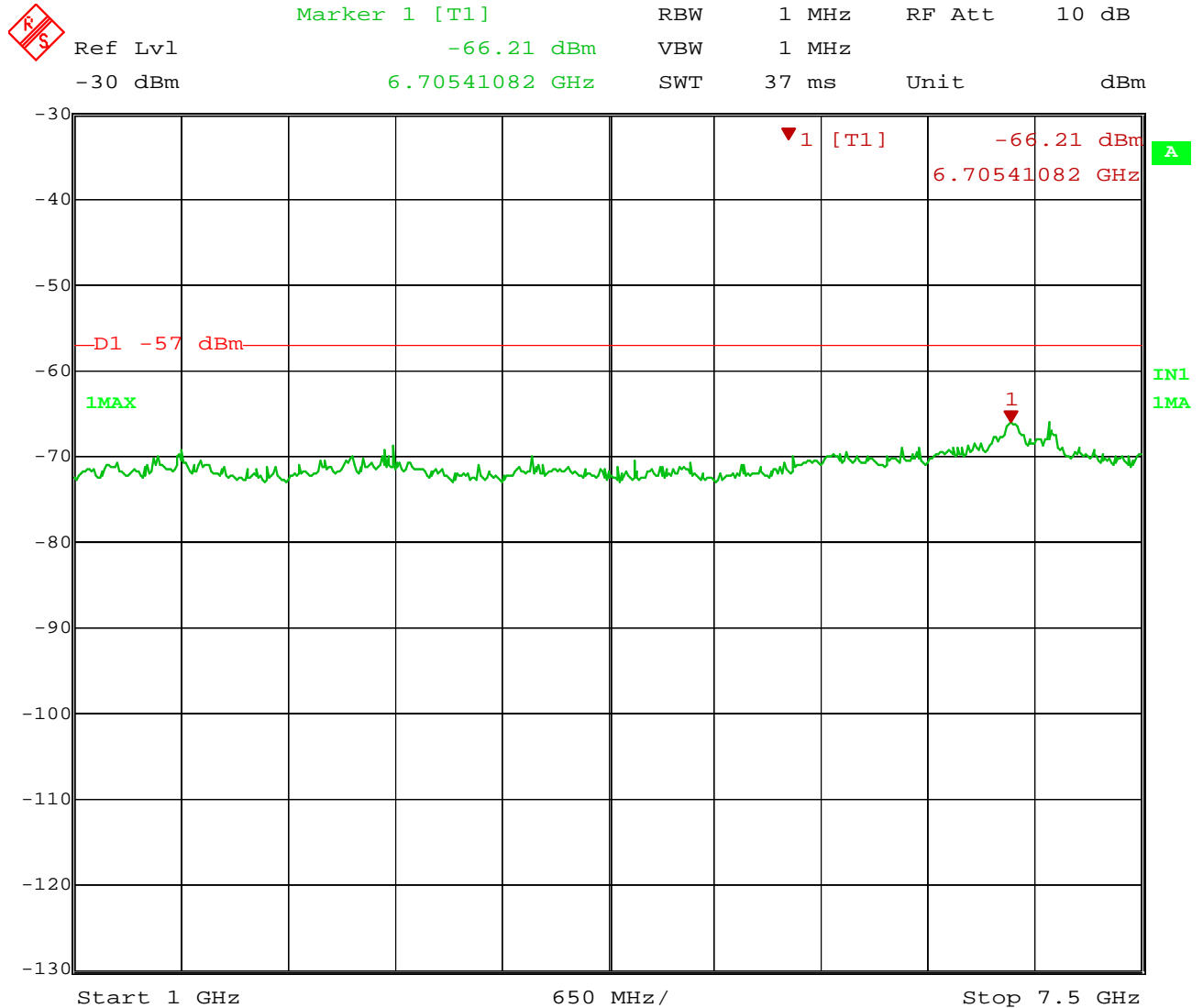
Date: 28.NOV.2007 10:44:28

8. Receiver spurious emission

802.11b

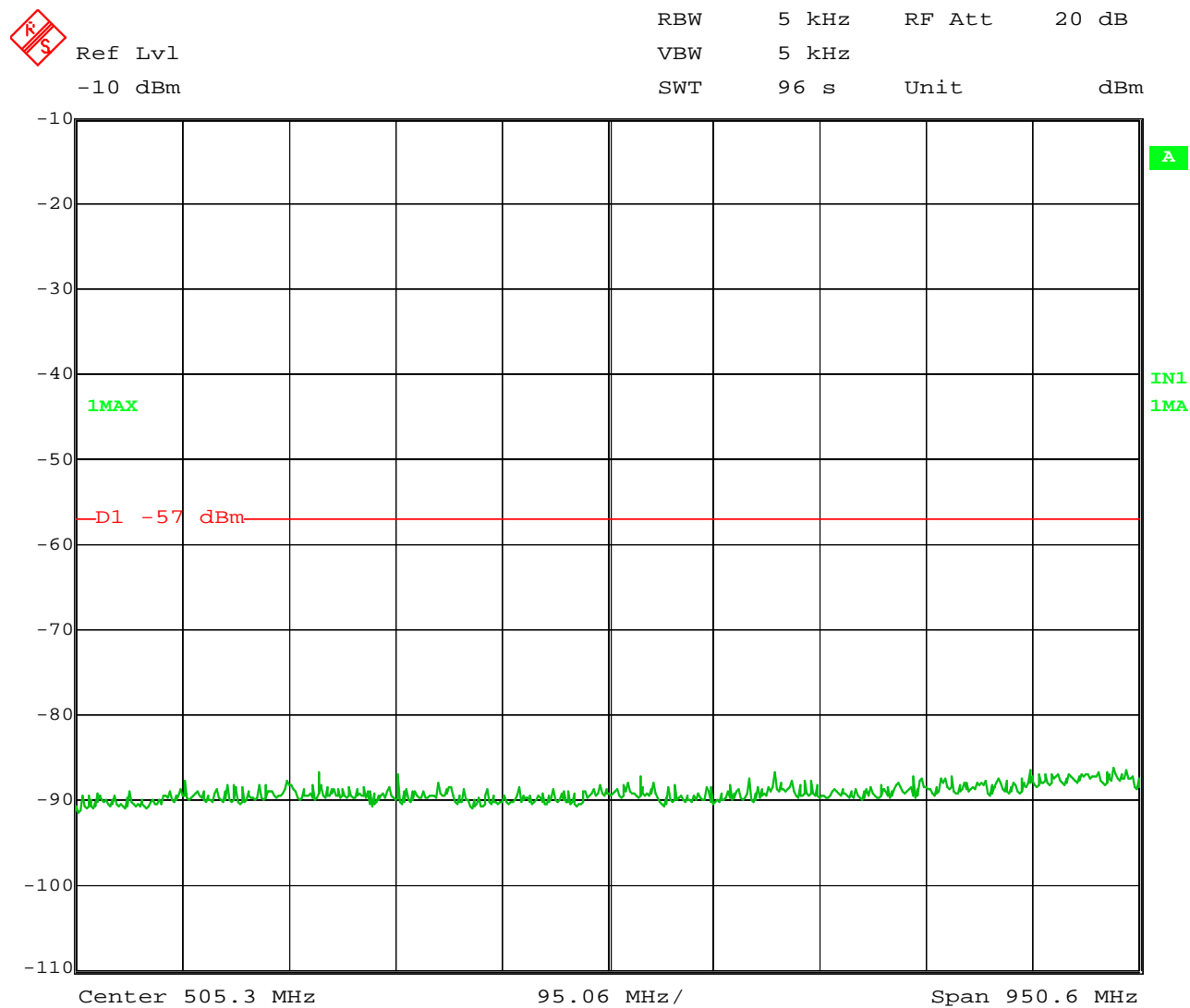


Date: 28.NOV.2007 11:24:43

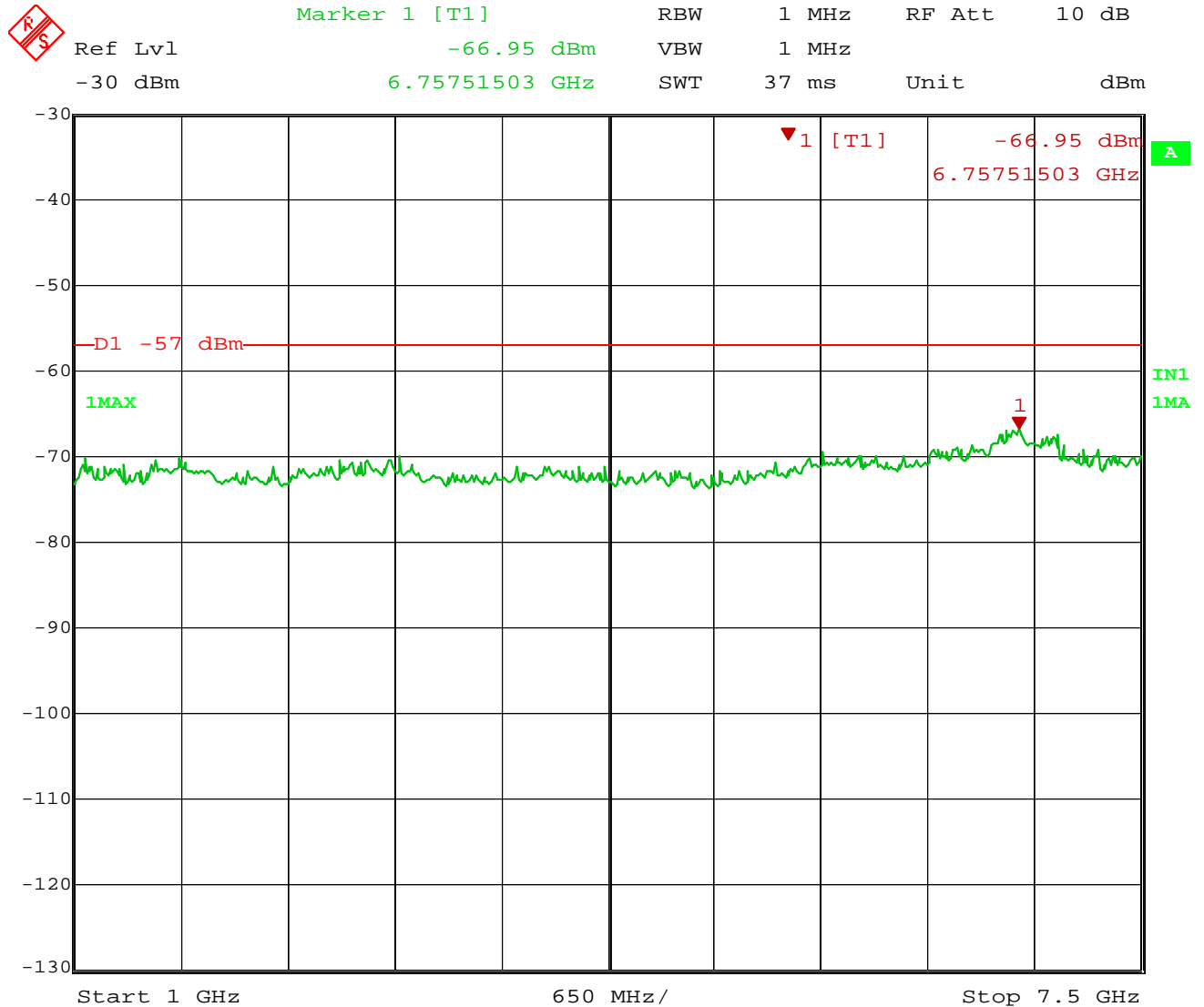


Date: 28.NOV.2007 11:30:05

802.11g



Date: 28.NOV.2007 11:25:10



Date: 28.NOV.2007 11:27:59