849 NW STATE ROAD 45
NEWBERRY, FL 32669 USA
PH: 888.472.2424 OR 352.472.5500
FAX: 352.472.2030
EMAIL: TEI@TIMCOENGR.COM
HTTP://WWW.TIMCOENGR.COM

# INDUSTRY CANADA RSS-131 AND FCC PART 90 TEST REPORT

| | |
|---|---|
| **Applicant** | FIPLEX COMMUNICATIONS INC. |
| **Address** | 7331 N.W. 54TH STREET<br>MIAMI FL 33166 - USA |
| **FCC ID** | P3TBDA85S-1B3LC |
| **IC Label** | 8986A-BDA85S1B3LC |
| **Model Number** | BDA85S-1B3LC |
| **Product Description** | ESMR BI-DIRECTIONAL AMPLIFIER |
| **Date Sample Received** | 4/27/2010 |
| **Date Tested** | 5/3/2010 |
| **Tested By** | Nam Nguyen |
| **Approved By** | Mario de Aranzeta |
| **Report No.** | 968AUT10TestReport.doc |
| **Test Results** | ☒ PASS ☐ FAIL |



ACCREDITED
Test Certificate #0955-01

**TABLE OF CONTENTS**

## ATTESTATION STATEMENT

**Summary**

The device under test does:
☒ fulfill the general approval requirements as identified in this test report
☐ not fulfill the general approval requirements as identified in this test report

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report. All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025:2005 requirements.

A2LA ACCREDITED
Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at TIMCO ENGINEERING, INC. located at 849 N.W. State Road 45, Newberry, Florida 32669.

Authorized Signatory Name: Mario de Aranzeta

Signature:

Function: Engineer

Date: 6/18/2010

## REPORT SUMMARY

| | |
|---|---|
| Disclaimer | The test results relate only to the items tested. |
| Report Purpose | To demonstrate the modified unit continues to comply with FCC and Industry Canada RS-131 requirements for a Part 90 amplifier. |
| Applicable Rule Part(s) | Pt 90, Pt 15.109, RSS-131 |
| Test Procedure(s) | ANSI/TIA-603-C: 2004 |

## TEST ENVIRONMENT

| | |
|---|---|
| Test Facilities | All required tests were performed by Timco Engineering Inc. that is located at 849 NW State Road 45 Newberry, FL 32669. |
| Test Conditions | Temperature: 26°C Relative Humidity: 50% |

## TEST SETUP

| | |
|---|---|
| Deviation to the rules | There was no deviation from the test standards. |
| Modification to the DUT | No modification was made to the DUT. |
| Test Exercise (e.g. software description, test signal, etc.) | The DUT was placed in continuous transmit mode of operation. |

## DEVICE UNDER TEST INFORMATION

| | |
|---|---|
| Manufactured by | FIPLEX COMMUNICATIONS INC. |
| DUT Description | ESMR BI-DIRECTIONAL AMPLIFIER |
| FCC ID | P3TBDA85S-1B3LC |
| IC Label | IC: 8986A-BDA85S1B3LC |
| Model Name | BDA85S-1B3LC |
| Operating Frequency | Uplink 806 – 824 MHz<br>Downlink 851 – 869 MHz |
| | |
| Emission Designators | 20K0GXW (IDEN), 8K10F1E , 8K10F1D (APCO25) |
| Modulation(s) | IDEN, APCO25 |
| User Power Range & Control | There are NO user power controls |
| Test Item | Pre-Production |
| DC Voltage and Current into final amplifier | Power Into Final Amplifier (uplink) Vcc = 27.0 Vdc, 1.8 A<br>Power Input (downlink) Vcc= 27.0 Vdc, 2.0 A |
| Type of Equipment | Fixed |

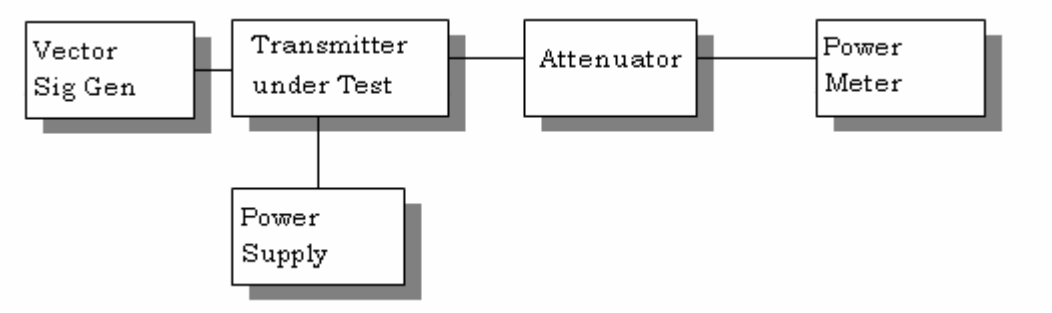
## EQUIPMENT LIST

| Device | Manufacturer | Model | Serial Number | Cal/Char Date | Due Date |
|---|---|---|---|---|---|
| 3-Meter Semi-Anechoic Chamber | Panashield | N/A | N/A | Listed 3/10/10 | 3/10/12 |
| AC Voltmeter | HP | 400FL | 2213A14499 | CAL 3/23/09 | 3/23/11 |
| Antenna: Dipole Kit | Electro-Metrics | TDA-30/1-4 | 153 | CHAR 6/10/09 | 6/10/11 |
| Frequency Counter | HP | 5385A | 3242A07460 | CAL 5/26/09 | 5/26/11 |
| Hygro-Thermometer | Extech | 445703 | 0602 | CAL 1/30/09 | 1/30/11 |
| Modulation Analyzer | HP | 8901A | 3435A06868 | CAL 5/26/09 | 5/26/11 |
| Digital Multimeter | Fluke | FLUKE-77-3 | 79510405 | CAL 5/18/09 | 5/18/11 |
| Analyzer Tan Tower Preamplifier | HP | 8449B-H02 | 3008A00372 | CAL 11/21/09 | 11/21/11 |
| Analyzer Tan Tower Quasi-Peak Adapter | HP | 85650A | 3303A01690 | CAL 11/22/09 | 11/22/11 |
| Analyzer Tan Tower RF Preselector | HP | 85685A | 3221A01400 | CAL 11/21/09 | 11/21/11 |
| Analyzer Tan Tower Spectrum Analyzer | HP | 8566B Opt 462 | 3138A07786 3144A20661 | CAL 11/24/09 | 11/24/11 |
| Temperature Chamber | Tenney Engineering | TTRC | 11717-7 | CHAR 4/25/10 | 4/25/12 |

## TEST PROCEDURE

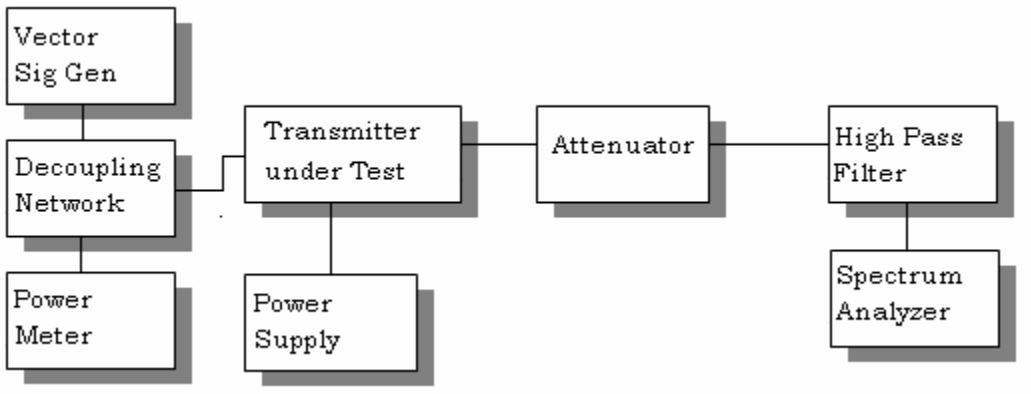
**RF Power Output**
RF power is measured by connecting a 50-ohm, resistive wattmeter to the RF output connector. With a nominal voltage and the amplifier properly adjusted the RF output measures.

RF Output Power Test Setup Diagram




**Input/Output Modulated Amplitude Comparison And Band-Edges Compliance**
On the following plot, the reference level was calibrated using a resolution bandwidth wider than the emission bandwidth. First the gain was measured for the maximum output power. Then for each frequency and type of modulation, an attenuation equals to the gain of the amplifier was added on the measurement side of the amplifier, as to overlay the input versus output modulated envelope.

Test Setup Diagram

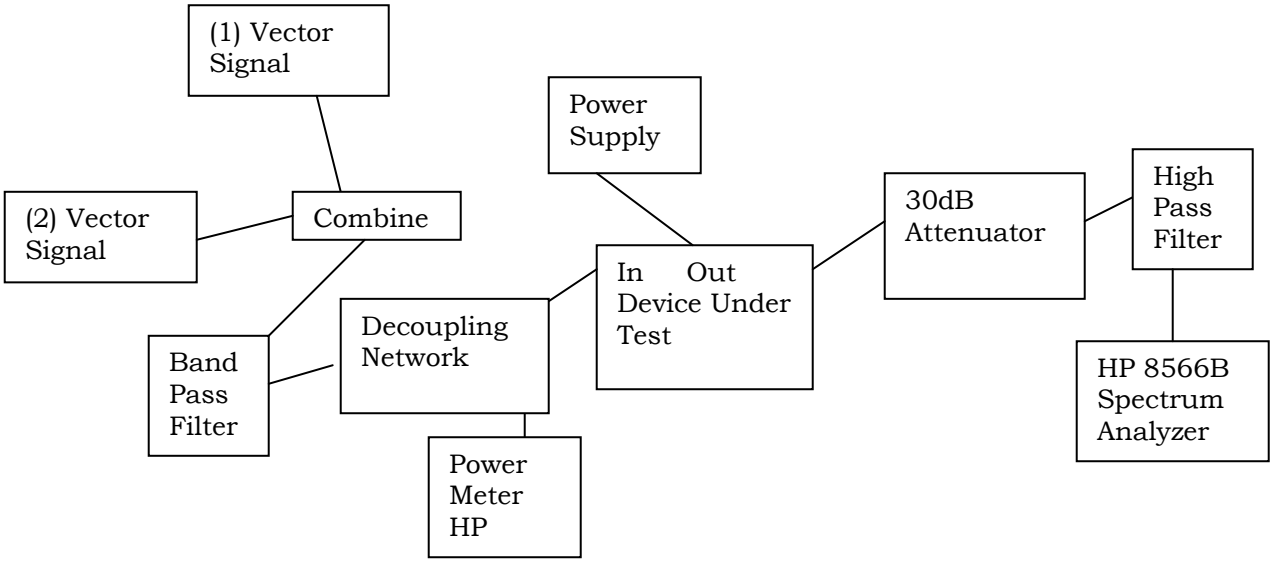



[Continued]

**Intermodulation Product Spurious Emissions**
The procedure used was ANSI/TIA-603-C: 2004. The spectrum was scanned from 9 kHz to at least the tenth harmonic of the fundamental using a HP 8566B spectrum analyzer.

The modulation type was tested using the two-tone / three tone test method. The input power to the amplifier was set at maximum drive level by combining the two tones. The two tones were chosen in such a way (1) the third order intermodulation product frequencies are located within the pass band of the DUT and (2) they produce the worst-case emissions out of band.

Setup Diagram

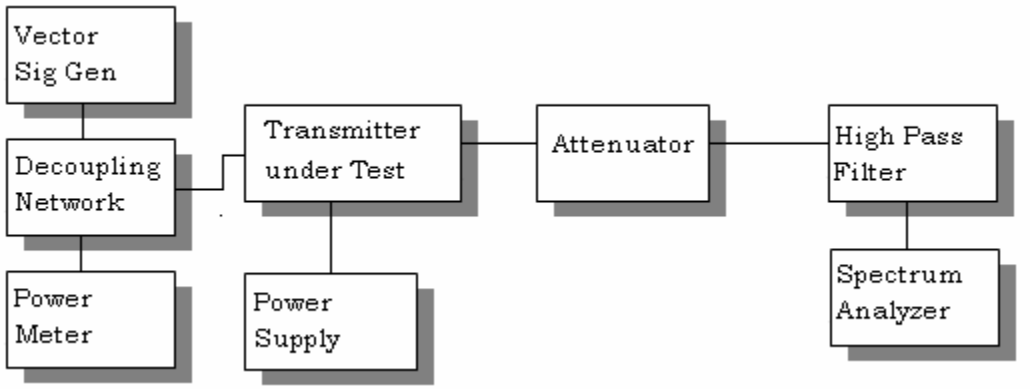



**Spurious Emissions at Antenna Terminals**
The procedure used was ANSI/TIA-603-C: 2004. The spectrum was scanned from 9 kHz to at least the tenth harmonic of the fundamental using a HP model 8566B spectrum analyzer.

Data on the following page shows the level of conducted spurious responses. For analog modulation, the carrier was modulated 100% using a 2500 Hz tone. For digital modulation, the carrier is modulated to its maximum extent. The spectrum was scanned from 9 kHz to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA-603-C: 2004. The maximum input power was set for each test.

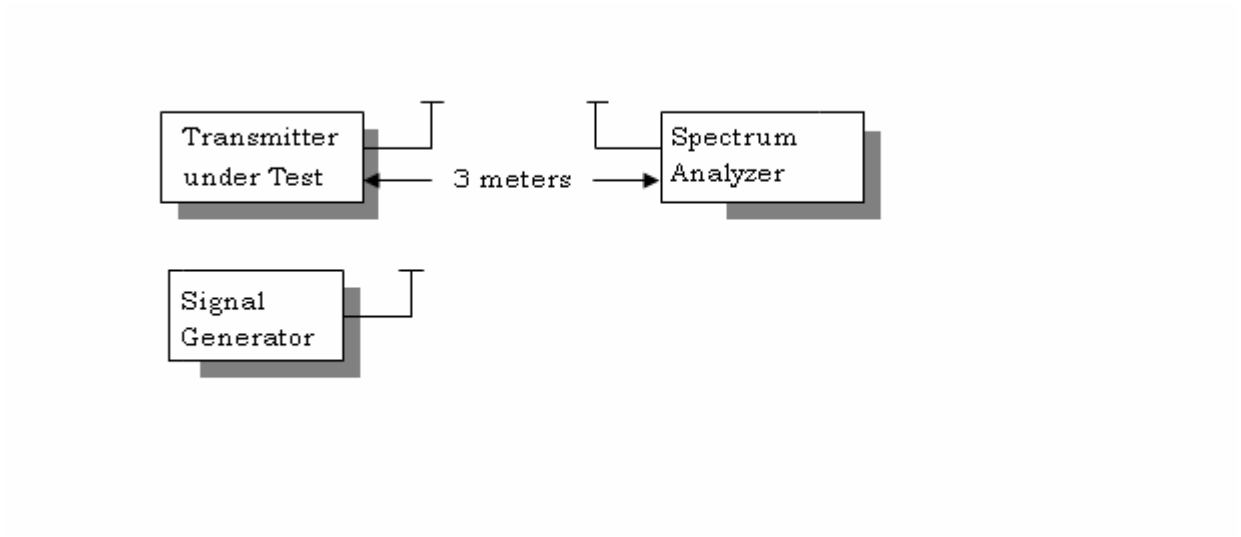
[Continued]

Conducted Spurious Emissions Test Setup Diagram




**Radiated Spurious Emissions**
The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. The CW signal was used to perform this test. This test was conducted per ANSI/TIA-603-C: 2004 using the substitution method.

Radiated Spurious Emissions Test Setup Diagram




Equipment placed 80 cm above ground on a rotating table platform.

**RF POWER OUTPUT**

**Rule Part(s) No.:** Pt 2.1046(a)

**Requirements:** Pt 2.1046(a)

**Test Result:** As the following table indicates..

Test Data Table 1 – Output Power – IDEN – Uplink/Downlink

| Tuned Frequency (MHz) | Power Input (dBm) | Power Output (dBm) | Power Output (mW) |
|---|---|---|---|
| 806.02 | -41.3 | 26.4 | 436 |
| 815.00 | -41.6 | 27.0 | 505 |
| 823.98 | -40.1 | 27.0 | 497 |

| Tuned Frequency (MHz) | Power Input (dBm) | Power Output (dBm) | Power Output (mW) |
|---|---|---|---|
| 851.02 | -36.4 | 33.9 | 2438 |
| 860.00 | -38.4 | 34.5 | 2793 |
| 868.98 | -37.2 | 34.4 | 2773 |

Test Data Table 2 – Output Power – APCO25 – Uplink/Downlink

| Tuned Frequency (MHz) | Power Input (dBm) | Power Output (dBm) | Power Output (mW) |
|---|---|---|---|
| 806.02 | -32.4 | 24.0 | 249 |
| 815.00 | -32.7 | 25.1 | 327 |
| 823.98 | -32.7 | 23.7 | 233 |

| Tuned Frequency (MHz) | Power Input (dBm) | Power Output (dBm) | Power Output (mW) |
|---|---|---|---|
| 851.02 | -25.9 | 34.4 | 2780 |
| 860.00 | -27.8 | 35.0 | 3184 |
| 868.98 | -25.9 | 35.2 | 3304 |

## INPUT/OUTPUT MODULATED AMPLITUDE COMPARISON AND BAND-EDGES COMPLIANCE

**Rule Parts No.:** Pt 2.1049, Pt 2.1051 Part 90

**Requirements:** The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB and 50 + 10log(Po).

**Test Data:** The DUT to meet the requirements.

Bandedge compliance: Measurements were performed in accordance with Part 90

The Reference level on the following plots was calibrated using a 3MHz RBW=VBW.

Compensating for RBW (1%) using 10 log (12.5/3)= 6.2 dB we get the following amplitudes at the bandedge:

Test Data Table 3 – IDEN – Uplink/Downlink

| Channel (MHz) | Bandedge Frequency (MHz) | Amplitude bandedge (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| 806.02 | 805.99 | -44.17 | -13 | 31.17 |
| 823.98 | 824.01 | -43.6 | -13 | 30.6 |
| 851.02 | 850.99 | -24.64 | -13 | 11.64 |
| 868.98 | 869.01 | -27.73 | -13 | 14.73 |

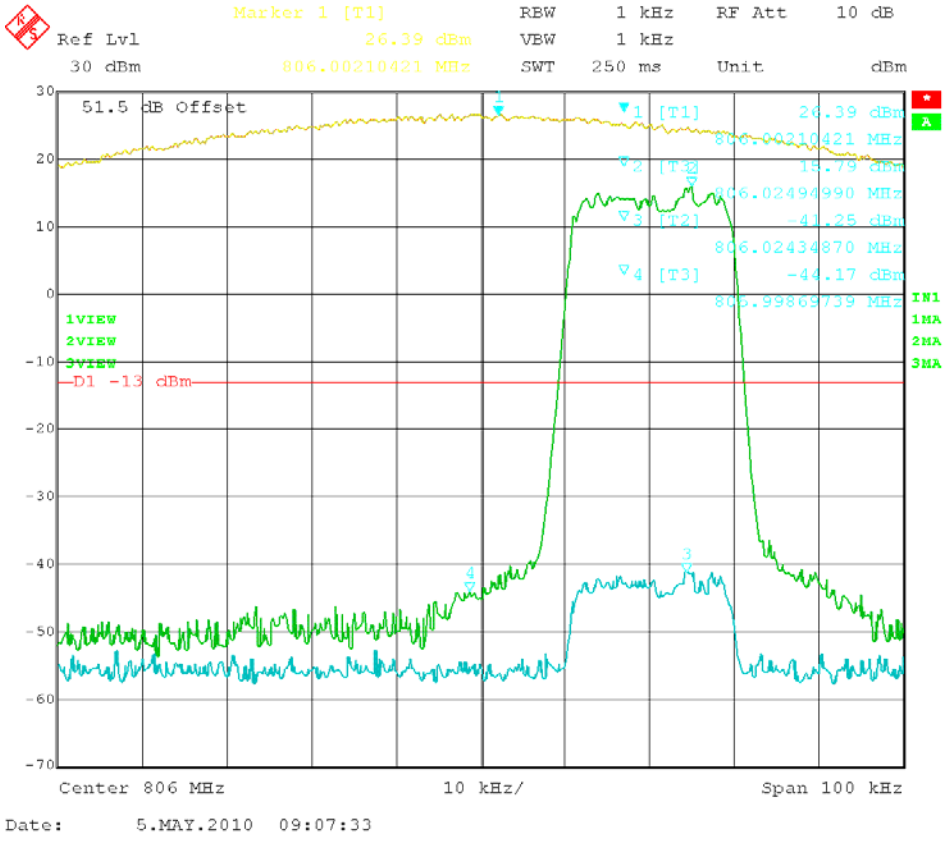



Figure 1: IDEN – In vs. Out 806.02MHz

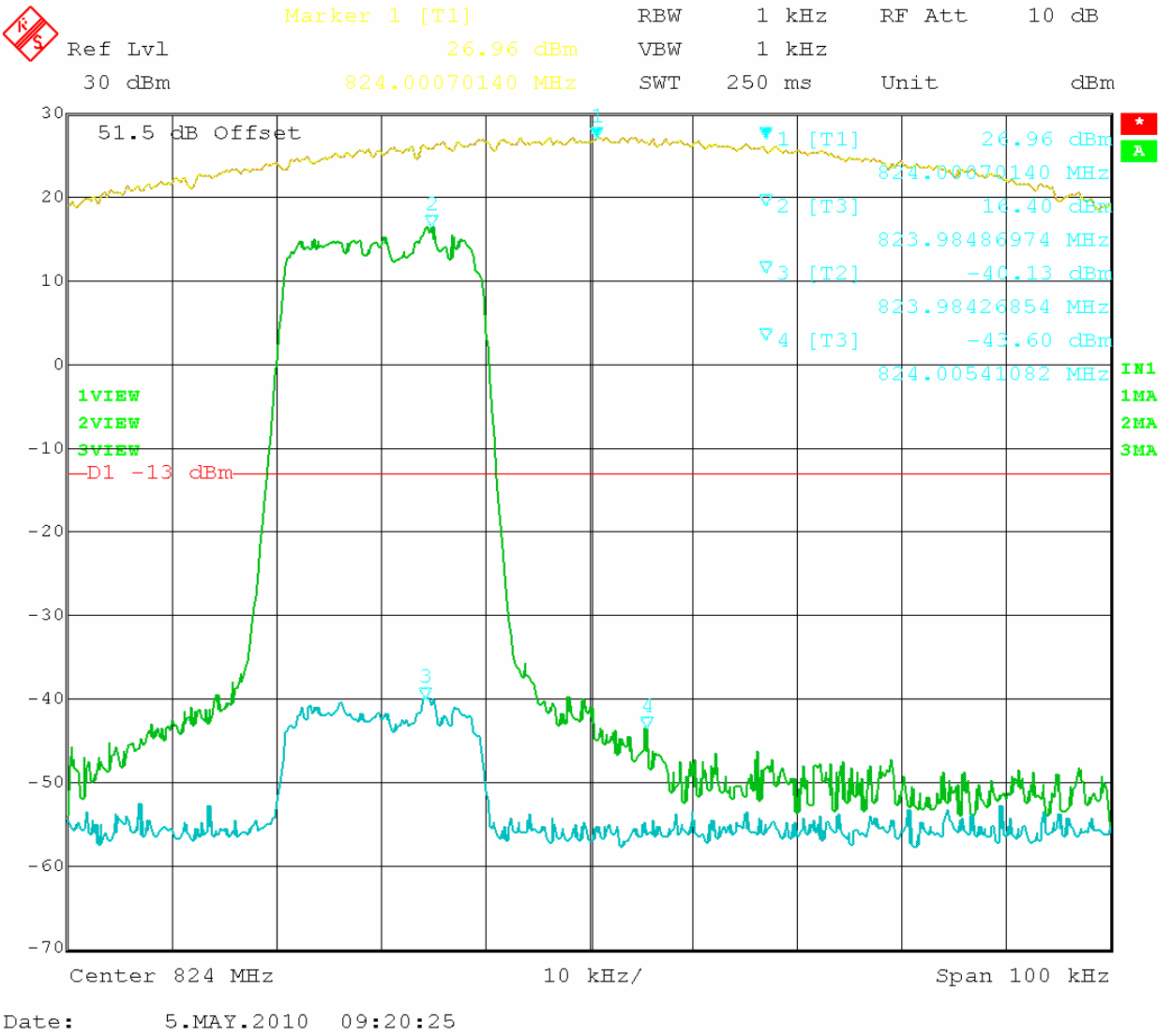



Figure 2: IDEN – In vs. Out 823.98 MHz

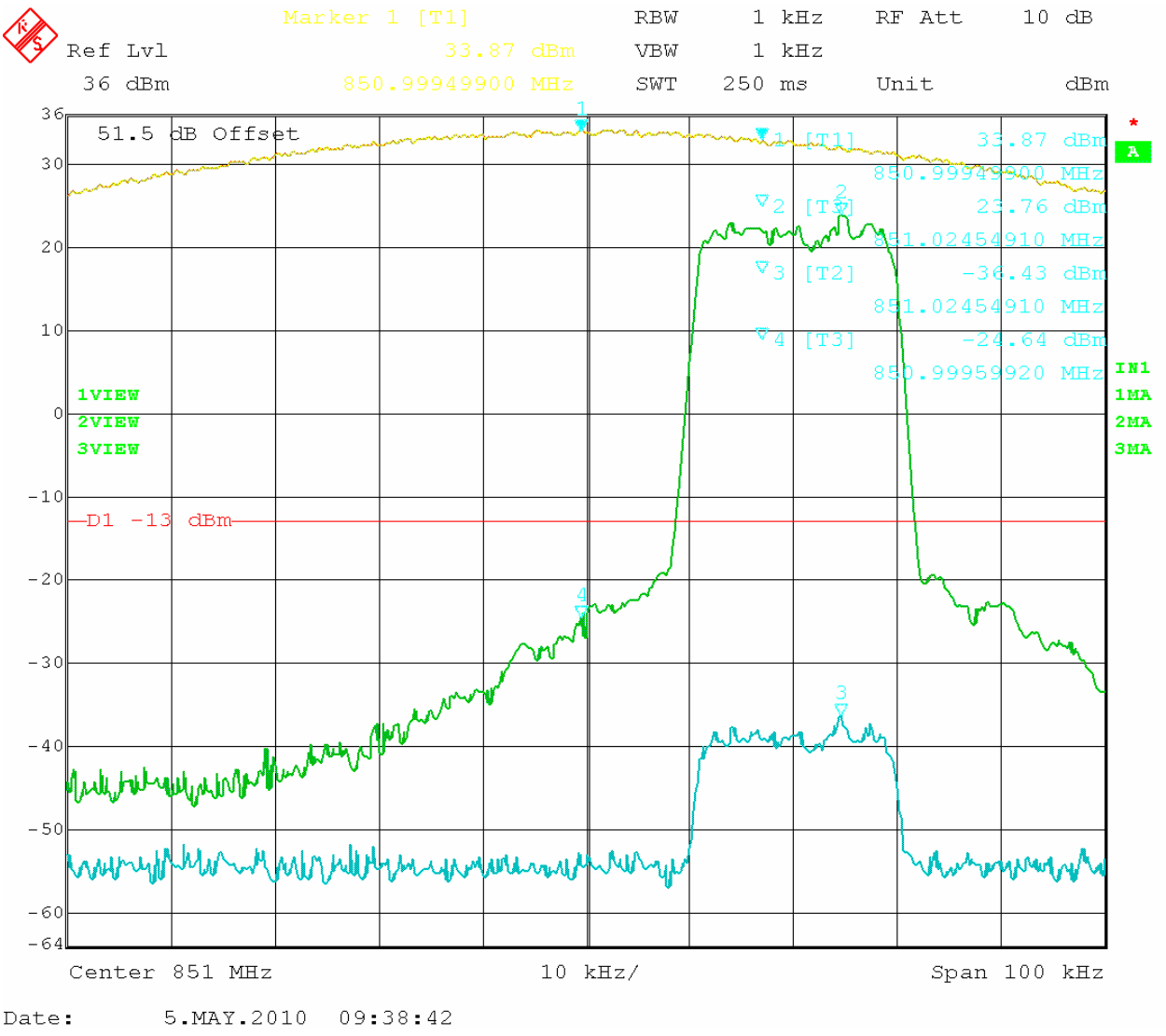



Figure 3: IDEN – In vs. Out 851.02 MHz

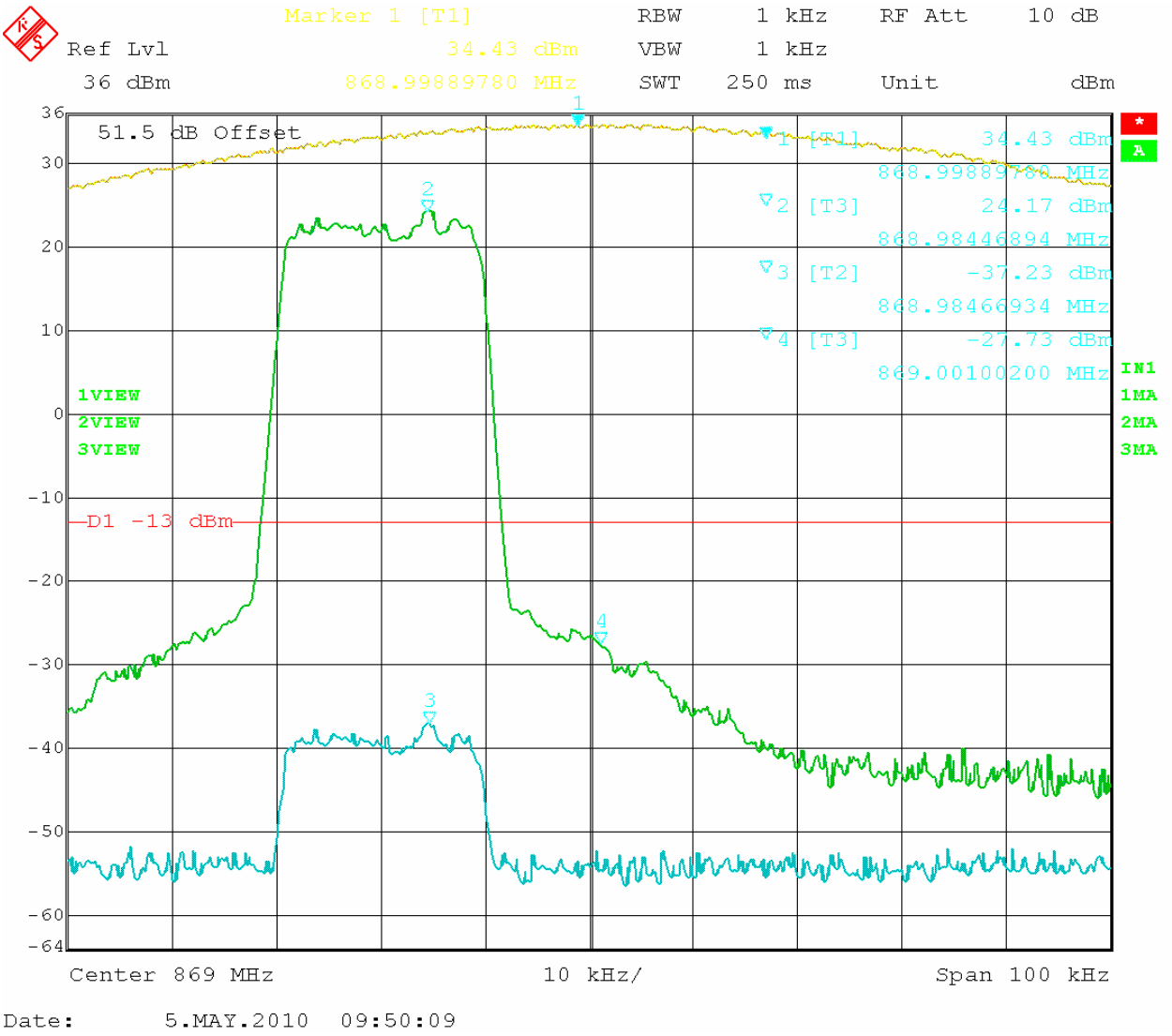



Figure 4: IDEN – In vs. Out 868.98 MHz

Test Data Table 4 – APCO25 – Uplink/Downlink

| Channel (MHz) | Bandedge Frequency (MHz) | Amplitude bandedge (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| 806.02 | 805.99 | -38.41 | -13 | 25.41 |
| 823.98 | 824.01 | -38 | -13 | 25 |
| 851.02 | 850.99 | -29.72 | -13 | 16.72 |
| 868.98 | 869.01 | -28.15 | -13 | 15.15 |

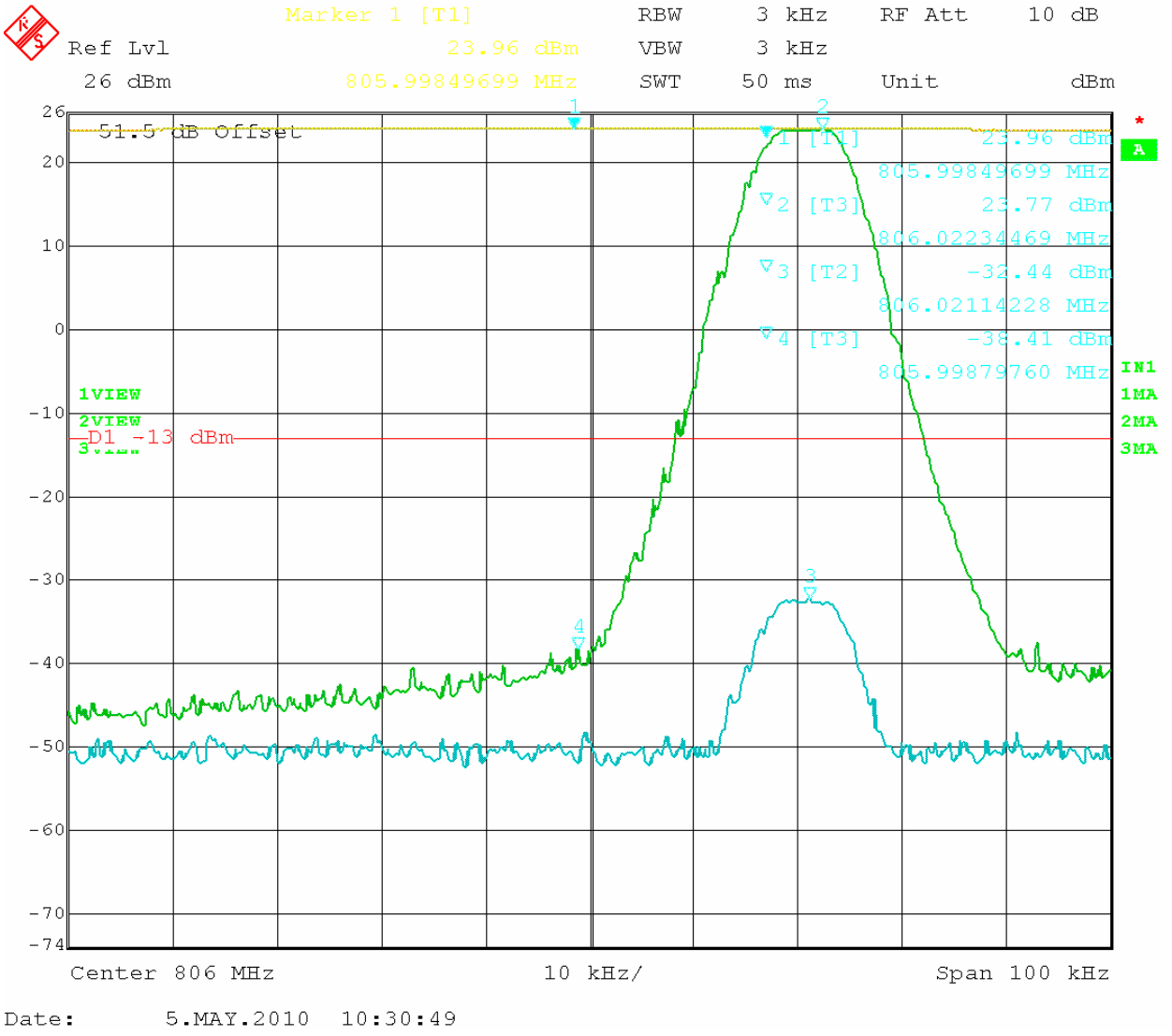



Figure 5: APCO25 – In vs. Out 806.02 MHz

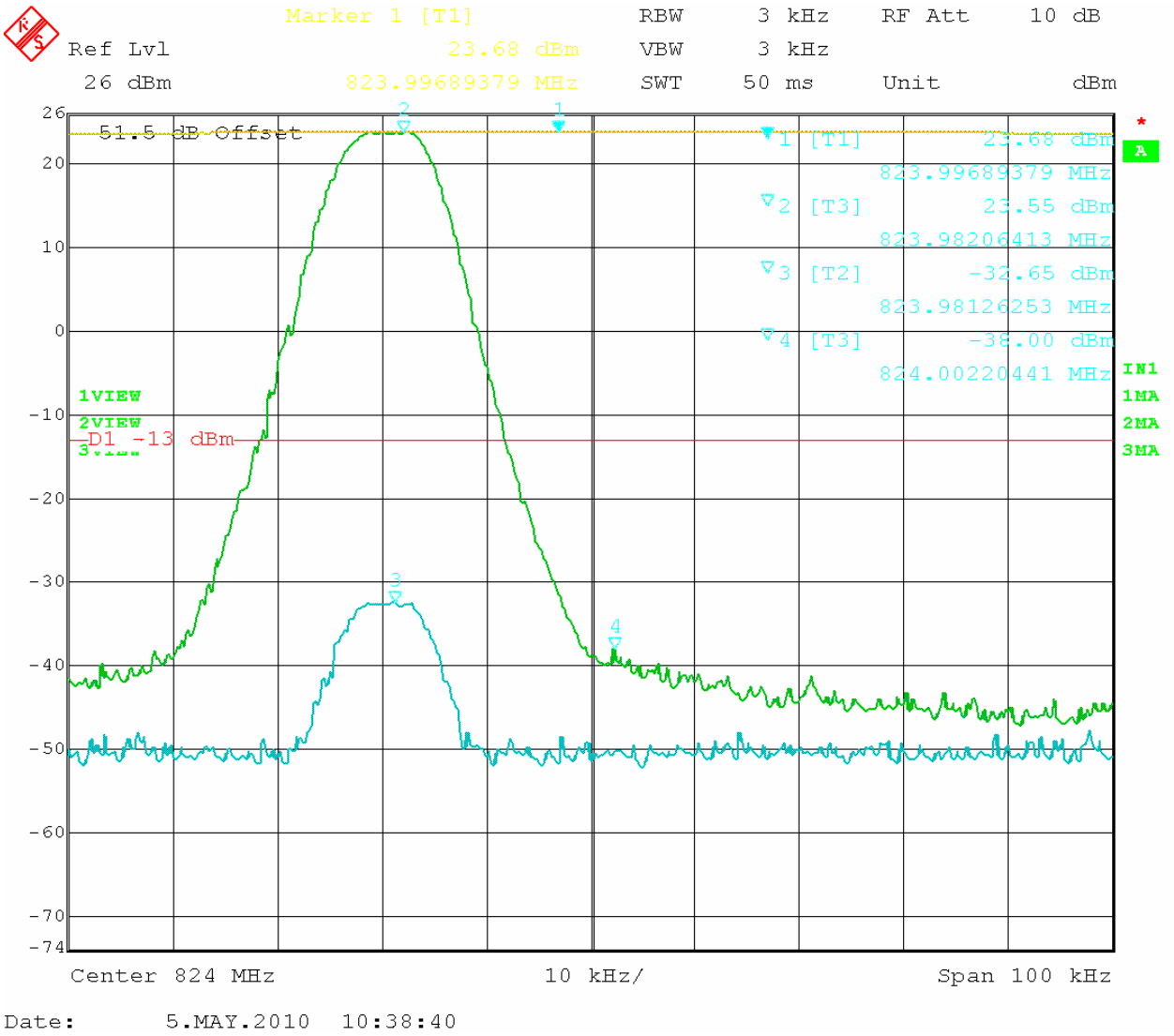



Figure 6: APCO25 – In vs. Out 823.98 MHz

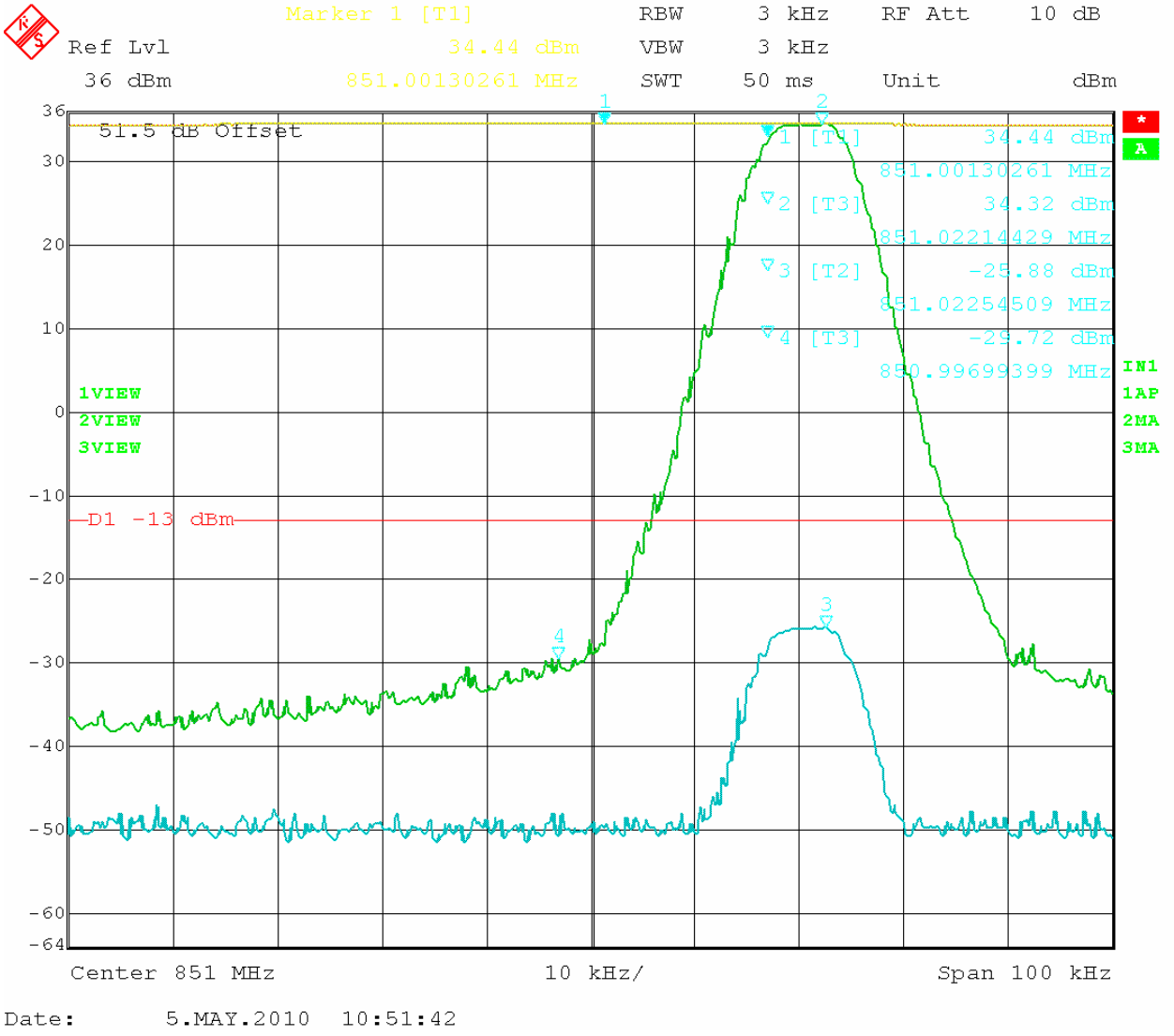



Figure 7: APCO25 – In vs. Out 851.02 MHz

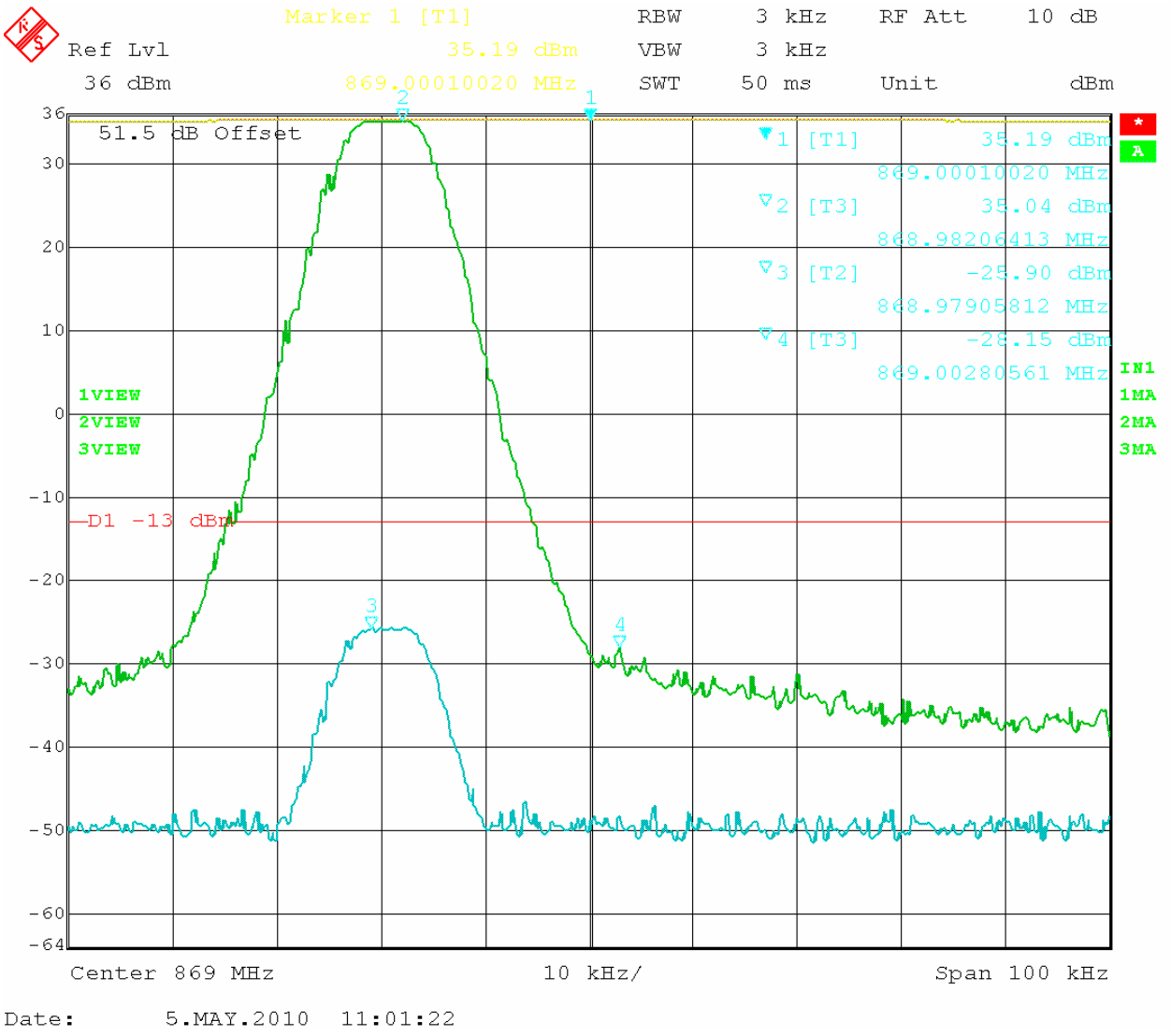



Figure 8: APCO25 – In vs. Out 868.98 MHz

## INTERMODULATION PRODUCT SPURIOUS EMISSIONS

Rule Parts No.: Pt 2.1051

**Requirements:** Emissions must be 43 + 10 log (Po) dB below the mean power output of the transmitter or below the –13dBm

All the modulation types were tested using the three tone test method. A CW signal was use instead of and F1D modulations. The input power to the amplifier was set at maximum drive level by combining the three tones. The three tones were chosen in such a way (1)the third order intermodulation product frequencies are located within the pass band of the DUT and (2) they produce the worst-case emissions out of band.

**Test Data:** The DUT appears to meet the requirements.

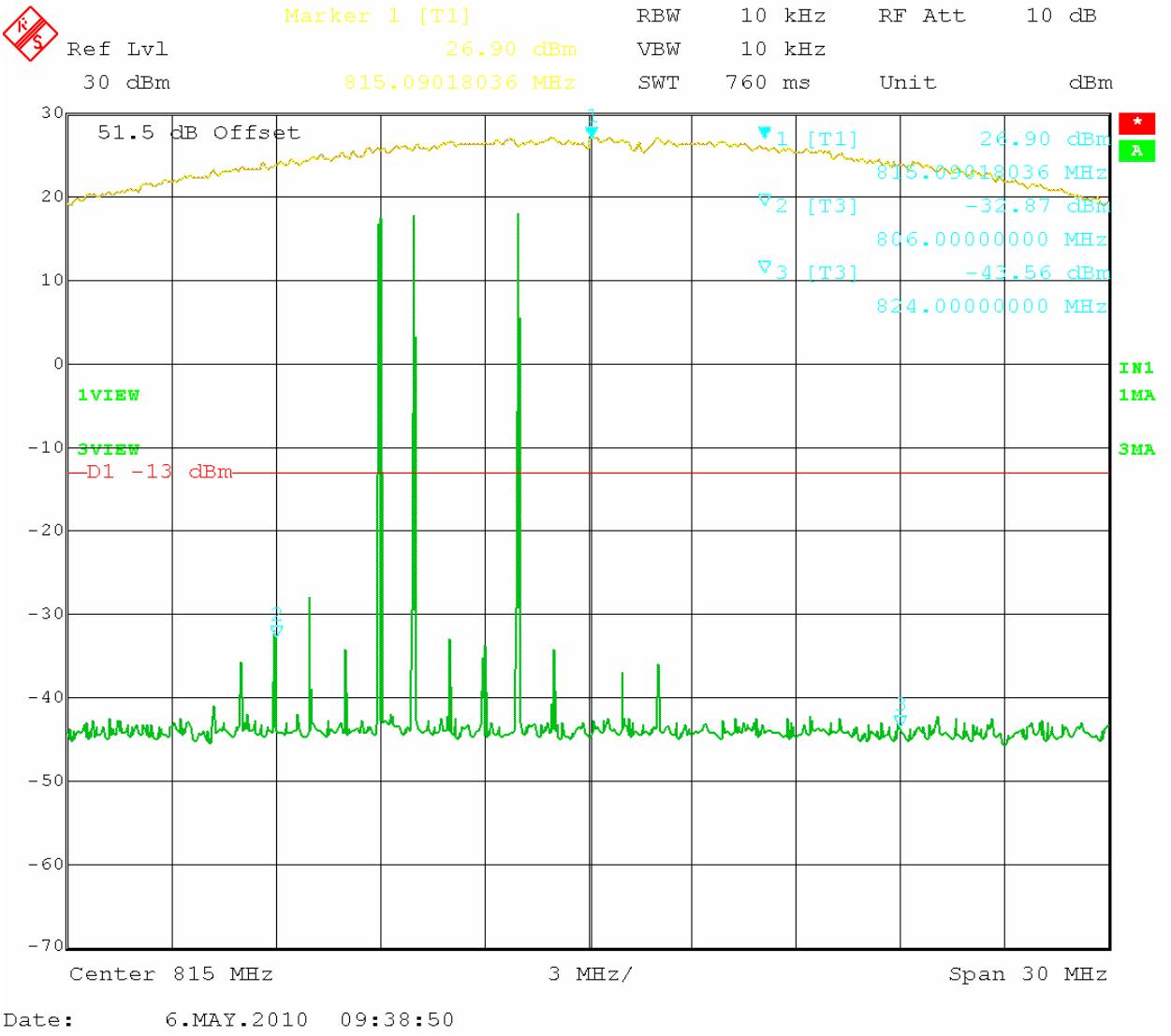



Figure 9: IDEN 3 tones intermodulation - (806 – 824) MHz.

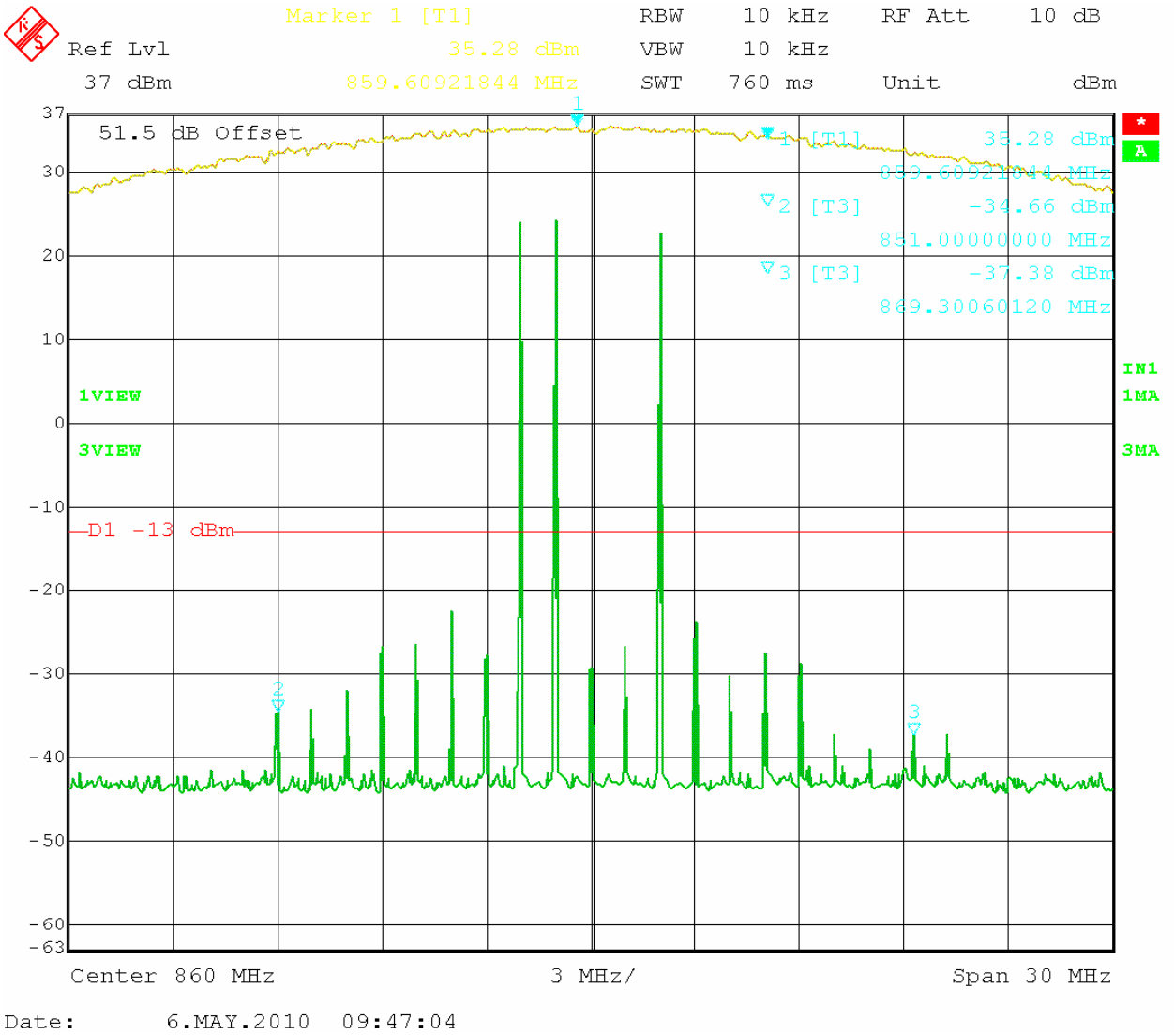



Figure 10: IDEN 3 tones intermodulation - (851 - 869) MHz.

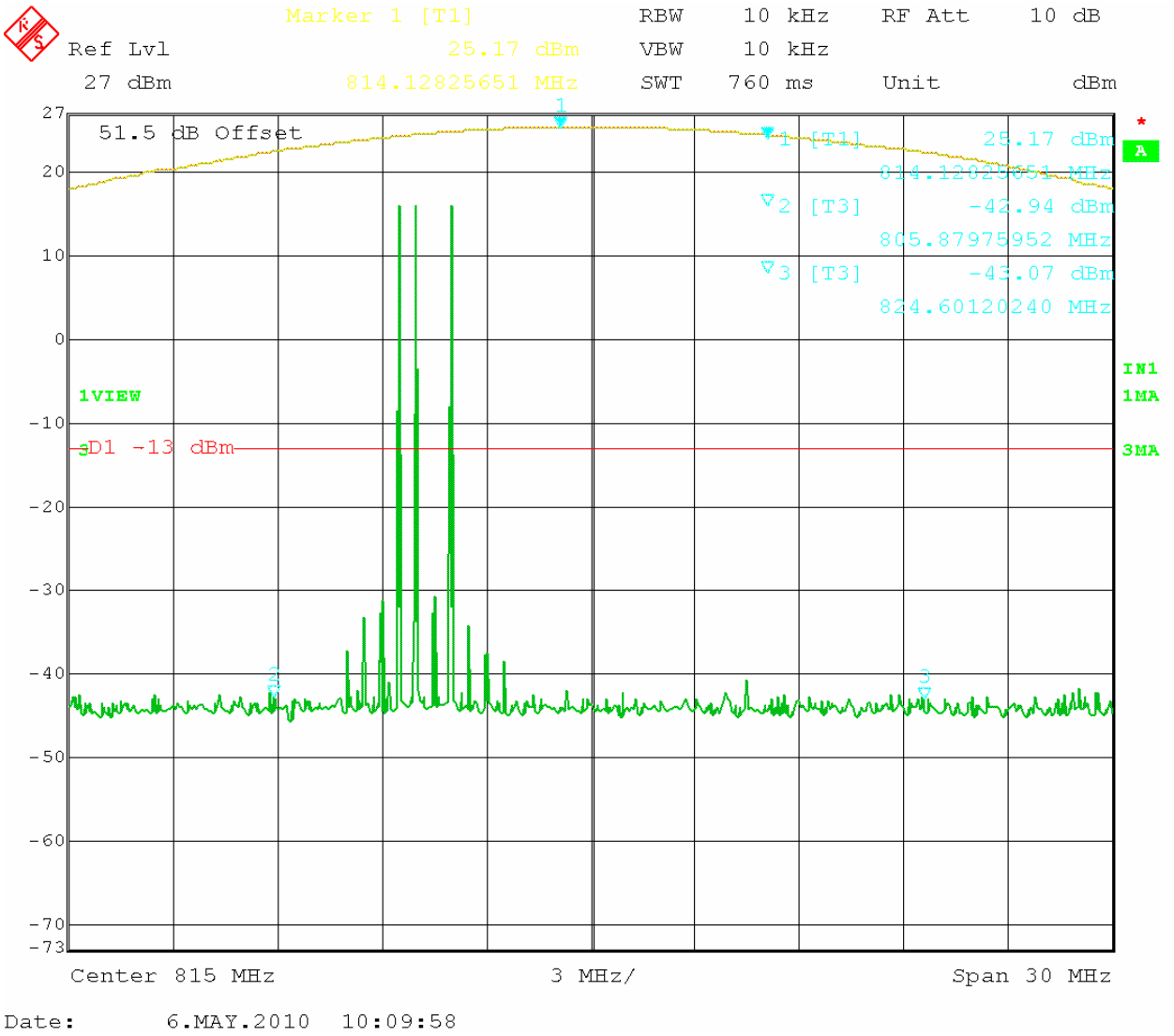



Figure 11: APCO25 3 tones intermodulation – (806 – 824) MHz.

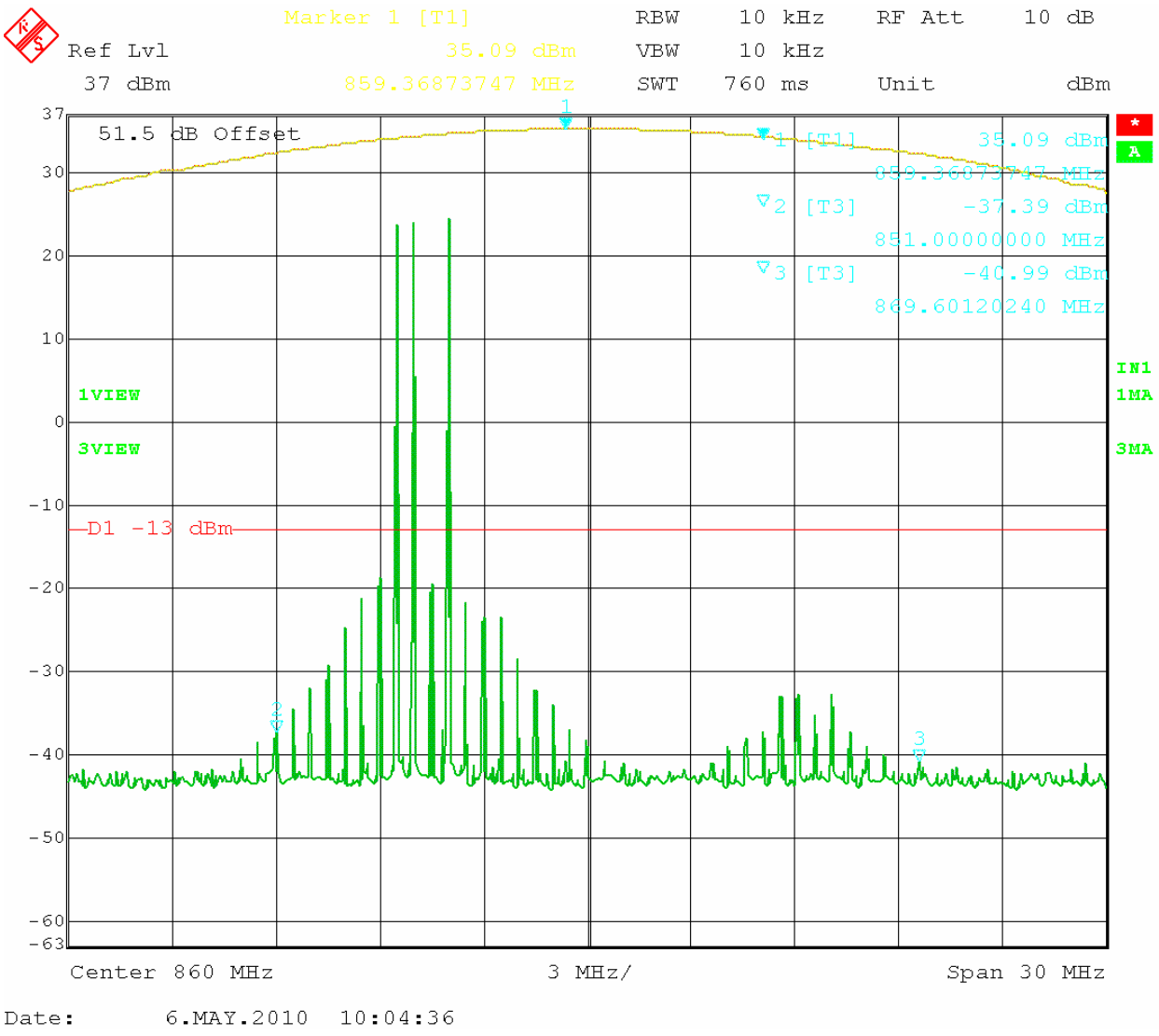



Figure 12: APCO25 3 tones intermodulation - (851 – 869) MHz.

## SPURIOUS EMISSIONS AT ANTENNA TERMINALS

**Rule Parts No.:** Pt 2.1051

**Requirements:** Emissions must be 43 +10log (Po) dB below the mean power output of the transmitter:

806 – 824 MHz: 43 + 10log (0.50) = 40 dBc
851 – 869 MHz: 43 + 10log (3.30) = 48 dBc

50 + 10log(3.30) = 55 dB

**Test Result:** The DUT appears to meet the requirements.

Test Data Table 5 – Conducted Emissions – iDEN – Uplink

| Emission Frequency MHz | dB Below Carrier (dBc) | Emission Frequency MHz | dB Below Carrier (dBc) | Emission Frequency MHz | dB Below Carrier (dBc) |
|---|---|---|---|---|---|
| 806.02 | 0 | 815.00 | 0 | 823.98 | 0 |
| 1612.04 | 75.8 | 1630.00 | 76.3 | 1647.96 | 74.9 |
| 2418.06 | 74.2 | 2445.00 | 77.5 | 2471.94 | 75.5 |
| 3224.08 | 75.4 | 3260.00 | 77.8 | 3295.92 | 75.3 |
| 4030.10 | 75.7 | 4075.00 | 76.7 | 4119.90 | 75.3 |
| 4836.12 | 75.3 | 4890.00 | 76.9 | 4943.88 | 74.5 |
| 5642.14 | 71.5 | 5705.00 | 73.7 | 5767.86 | 71.9 |
| 6448.16 | 72.2 | 6520.00 | 74.5 | 6591.84 | 70.2 |
| 7254.18 | 71.7 | 7335.00 | 73.6 | 7415.82 | 71.7 |
| 8060.20 | 72.7 | 8150.00 | 73.3 | 8239.80 | 70.8 |

Test Data Table 6 – Conducted Emissions – iDEN – Downlink

| Emission Frequency MHz | dB Below Carrier (dBc) | Emission Frequency MHz | dB Below Carrier (dBc) | Emission Frequency MHz | DB Below Carrier (dBc) |
|---|---|---|---|---|---|
| 851.02 | 0 | 860.00 | 0 | 868.98 | 0 |
| 1702.04 | 82.6 | 1720.00 | 84.5 | 1737.96 | 83.1 |
| 2553.06 | 82.4 | 2580.00 | 84.6 | 2606.94 | 83.4 |
| 3404.08 | 82.7 | 3440.00 | 85.0 | 3475.92 | 83.2 |
| 4255.10 | 82.3 | 4300.00 | 84.2 | 4344.90 | 82.7 |
| 5106.12 | 81.2 | 5160.00 | 83.6 | 5213.88 | 81.9 |
| 5957.14 | 79.2 | 6020.00 | 80.8 | 6082.86 | 79.8 |
| 6808.16 | 78.4 | 6880.00 | 80.9 | 6951.84 | 77.5 |
| 7659.18 | 79.7 | 7740.00 | 80.9 | 7820.82 | 79.8 |
| 8510.20 | 80.1 | 8600.00 | 79.9 | 8689.80 | 80.3 |

Test Data Table 7 – Conducted Emissions – APCO25 – Uplink

| Emission Frequency MHz | dB Below Carrier (dBc) | Emission Frequency MHz | dB Below Carrier (dBc) | Emission Frequency MHz | dB Below Carrier (dBc) |
|---|---|---|---|---|---|
| 806.02 | 0 | 815.00 | 0 | 823.98 | 0 |
| 1612.04 | 74.6 | 1630.00 | 75.3 | 1647.96 | 73.9 |
| 2418.06 | 74.6 | 2445.00 | 75.2 | 2471.94 | 73.8 |
| 3224.08 | 74.4 | 3260.00 | 75.5 | 3295.92 | 73.9 |
| 4030.10 | 74.4 | 4075.00 | 74.3 | 4119.90 | 73.7 |
| 4836.12 | 74.0 | 4890.00 | 75.1 | 4943.88 | 73.3 |
| 5642.14 | 70.5 | 5705.00 | 72.1 | 5767.86 | 69.9 |
| 6448.16 | 70.7 | 6520.00 | 72.6 | 6591.84 | 68.7 |
| 7254.18 | 71.6 | 7335.00 | 72.4 | 7415.82 | 70.0 |
| 8060.20 | 71.5 | 8150.00 | 73.0 | 8239.80 | 70.1 |

Test Data Table 8 – Conducted Emissions – APCO25 – Downlink

| Emission Frequency MHz | dB Below Carrier (dBc) | Emission Frequency MHz | dB Below Carrier (dBc) | Emission Frequency MHz | DB Below Carrier (dBc) |
|---|---|---|---|---|---|
| 851.02 | 0 | 860.00 | 0 | 868.98 | 0 |
| 1702.04 | 83.5 | 1720.00 | 86.1 | 1737.96 | 84.2 |
| 2553.06 | 84.0 | 2580.00 | 86.7 | 2606.94 | 84.6 |
| 3404.08 | 83.5 | 3440.00 | 85.9 | 3475.92 | 84.4 |
| 4255.10 | 83.7 | 4300.00 | 85.5 | 4344.90 | 84.1 |
| 5106.12 | 83.0 | 5160.00 | 85.3 | 5213.88 | 83.2 |
| 5957.14 | 79.8 | 6020.00 | 81.7 | 6082.86 | 80.6 |
| 6808.16 | 78.8 | 6880.00 | 81.5 | 6951.84 | 79.1 |
| 7659.18 | 80.7 | 7740.00 | 82.5 | 7820.82 | 80.7 |
| 8510.20 | 80.5 | 8600.00 | 83.0 | 8689.80 | 81.0 |

## OUT OF BAND REJECTION: FREQUENCY RESPONSE

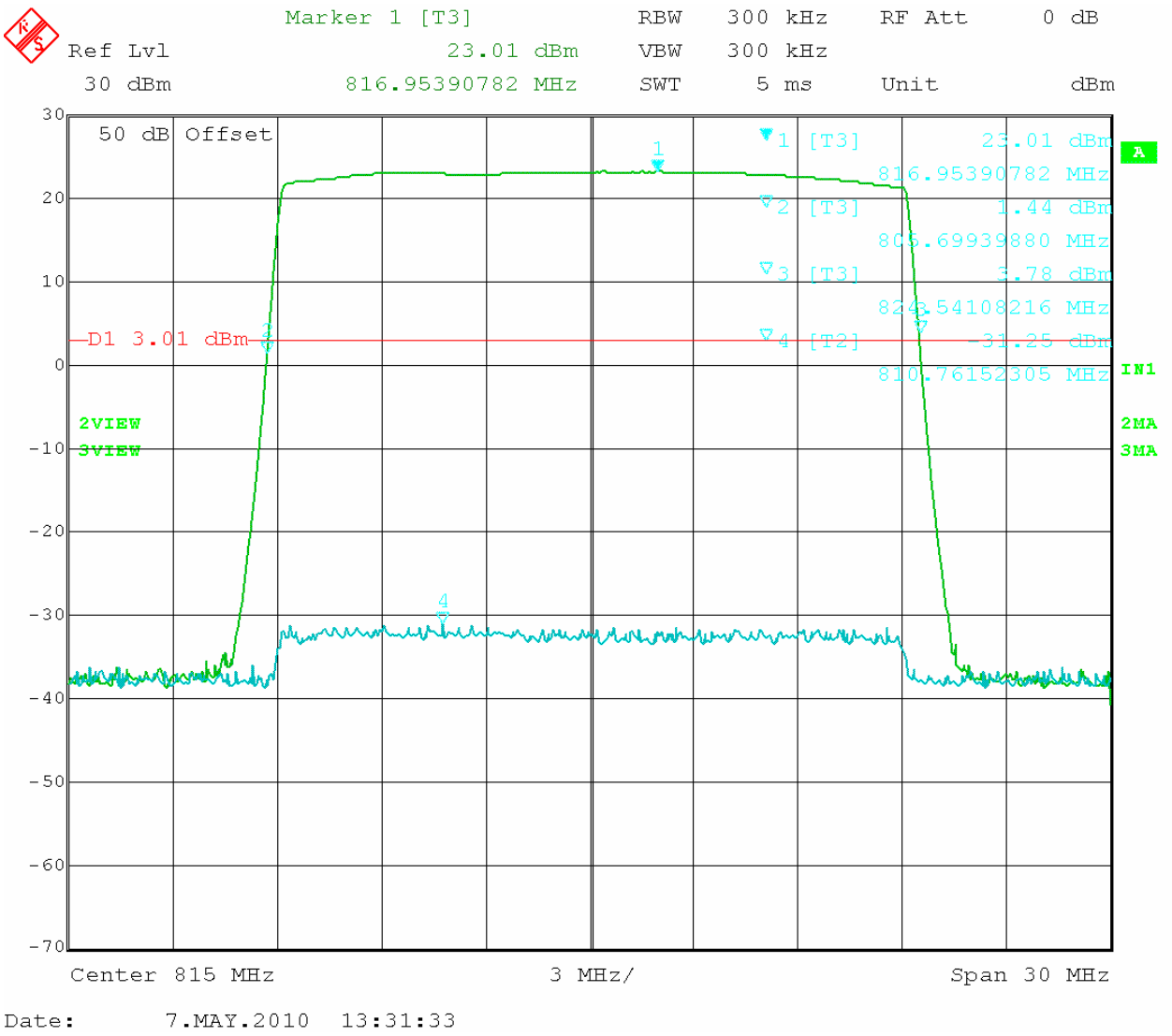



Figure 13. Frequency response (806 – 824) MHz band

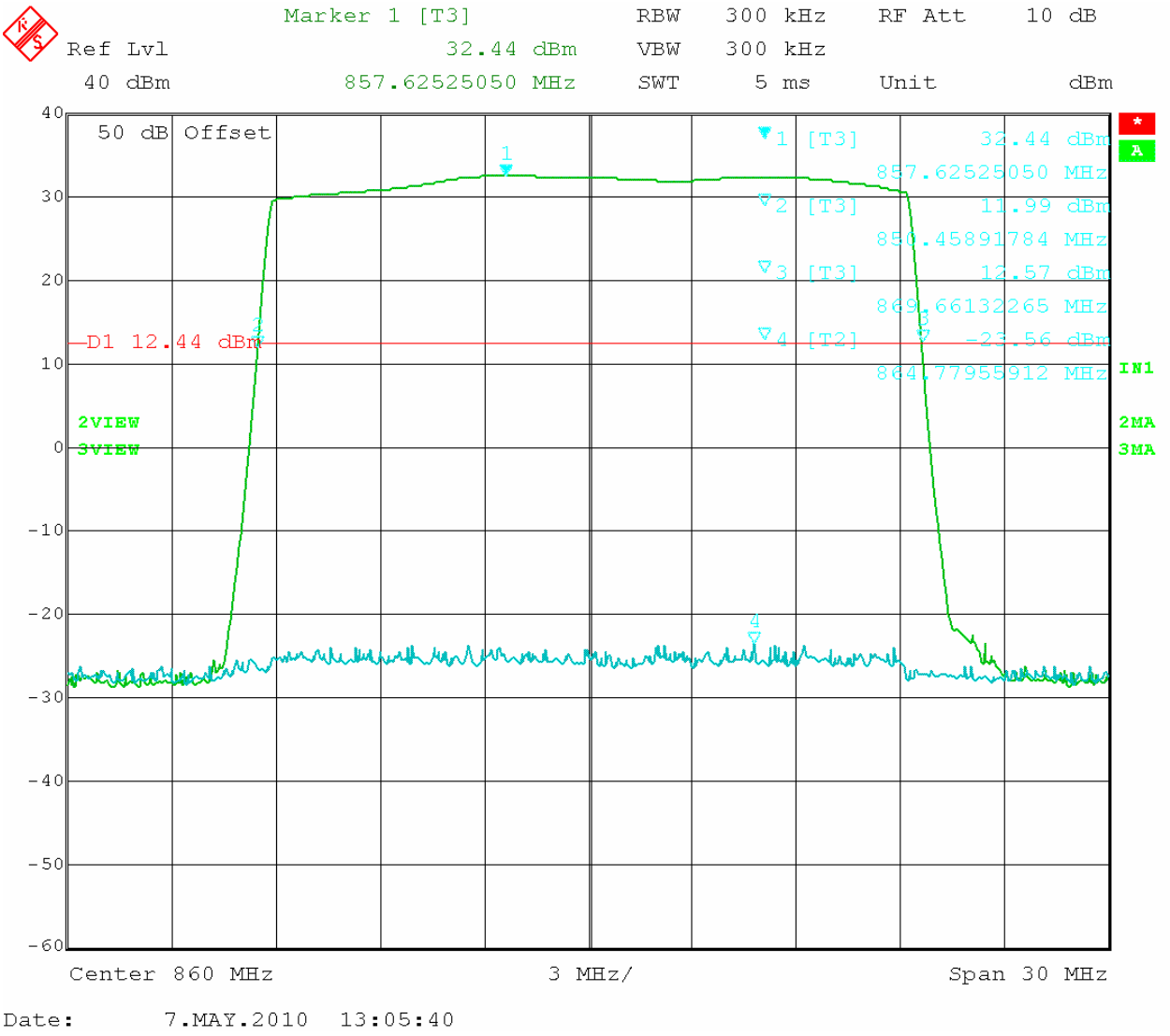



Figure 14. Frequency response (851 – 869) MHz band

## FIELD STRENGTH OF SPURIOUS EMISSIONS

**Rule Parts No.:** Pt 2.1053

**Requirements:** Emissions must be 43+10log(Po) dB below the mean power output of the amplifier:

43 + 10log(0.50) = 40 dB
43 + 10log(3.30) = 48 dB
50 + 10log(3.30) = 55 dB

**Test Result:** The test data indicates the DUT meets the requirements

Test Data Table 9 – Radiated Emissions - CW

| Emission Frequency (MHz) | Ant. Polarity (V/H) | Corrected DUT Signal Reading | Coax Loss (dB) | Substitution Antenna (dBd) | dB Below Carrier (dBc) |
|---|---|---|---|---|---|
| 815.00 | | 27.00 | 0 | 0 | 0 |
| 1630.00 | V | -66.50 | 1.07 | 5.03 | 89.54 |
| 2445.00 | V | -62.00 | 1.21 | 6.65 | 83.55 |
| 3260.00 | V | -59.50 | 1.34 | 7.40 | 80.44 |
| 4075.00 | V | -59.70 | 1.48 | 7.65 | 80.53 |
| 4890.00 | V | -56.80 | 1.62 | 7.90 | 77.52 |
| 5705.00 | V | -55.40 | 1.76 | 8.62 | 75.54 |
| 6520.00 | V | -58.20 | 1.89 | 8.74 | 78.35 |
| 7335.00 | V | -56.70 | 2.03 | 8.24 | 77.49 |
| 8150.00 | V | -57.00 | 2.17 | 7.69 | 78.48 |

[Continued]

Test Data Table 10 – Radiated Emissions - CW

| Emission Frequency (MHz) | Ant. Polarity (V/H) | Corrected DUT Signal Reading | Coax Loss (dB) | Substitution Antenna (dBd) | dB Below Carrier (dBc) |
|---|---|---|---|---|---|
| 860.00 | | 37.00 | 0 | 0 | 0 |
| 1720.00 | V | -43.20 | 1.09 | 5.08 | 76.20 |
| 2580.00 | V | -37.20 | 1.23 | 6.91 | 68.52 |
| 3440.00 | V | -39.90 | 1.38 | 7.51 | 70.76 |
| 4300.00 | V | -48.70 | 1.52 | 8.03 | 79.19 |
| 5160.00 | V | -54.60 | 1.67 | 7.94 | 85.32 |
| 6020.00 | V | -51.10 | 1.81 | 9.04 | 80.87 |
| 6880.00 | V | -52.90 | 1.96 | 7.69 | 84.17 |
| 7740.00 | V | -53.00 | 2.10 | 8.08 | 84.02 |
| 8600.00 | V | -52.00 | 2.25 | 8.65 | 82.60 |

Notes: *No other emissions were found up to the 10th harmonics - NOISE FLOOR

[Continued]

## MEAN OUTPUT POWER FOR MULTI-CHANNEL ENHANCER (FOR IC ONLY)

**Rule Part(s) No.:** RSS-131 Issue 2 Para.4.3.1

**Requirements:** For enhancers rated 500 watts or less: Raise the input level to the DUT until the greater level of the intermodulation products at the enhancer output terminals, Po3 or Po4, equals -43 dBW.

For enhancers rated over 500 watts: Raise the input level to the DUT until the greater level of the intermodulation products at the enhancer output terminals, Po3 or Po4, is 67 dB below the level of either output tone level, Po1 or Po2.

Record all signal levels and their frequencies. Calculate the mean output power (Pmean) under this testing condition using Pmean = Po1 + 3 dB.

**Test Result:** As the following table indicates.

Test Data Table 11 – Mean Power

| Channel | Freq (MHz) | dBm | dBw |
|---|---|---|---|
| F1 | 813.287 | 20.37 | |
| F2 | 815.992 | 20.19 | |
| F3 | 810.581 | -27.88 | |
| F4 | 818.697 | -28.93 | |
| Mean | | 23.37 | |
| F1 | 857.986 | 28.7 | |
| F2 | 863.998 | 27.37 | |
| F3 | 851.974 | -13.79 | |
| F4 | 870.010 | -13.21 | |
| Mean | | 31.70 | |

## PASSBAND GAIN AND BANDWIDTH (FOR IC ONLY)

**Rule Part No.:** RSS-131 Issue 2 Para 4.2

**Requirements:** RSS-131 Issue 2 Para 4.2

**Test Data:** See plots

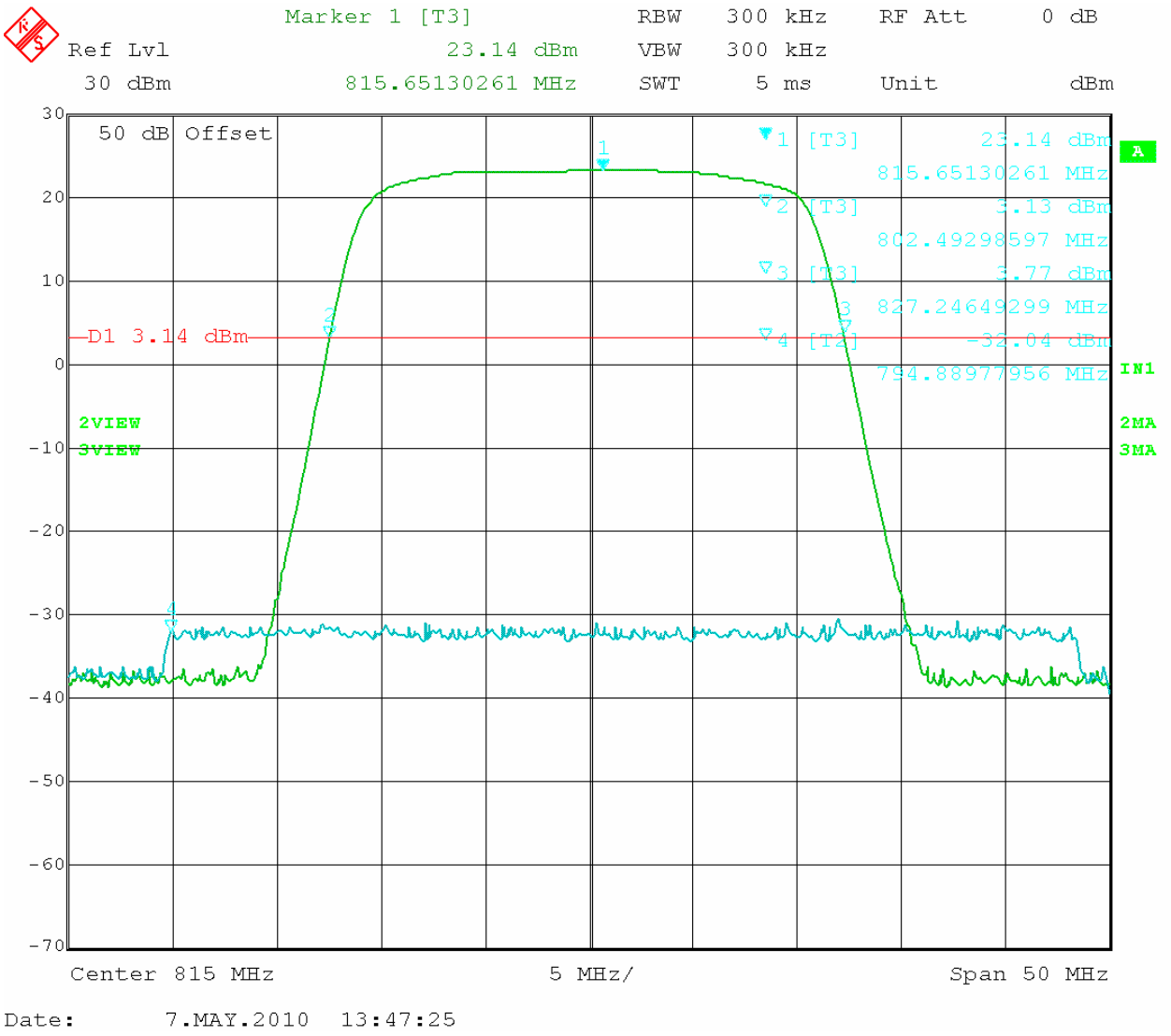



Figure 15: Passband Gain and Bandwidth (uplink 800 MHz)

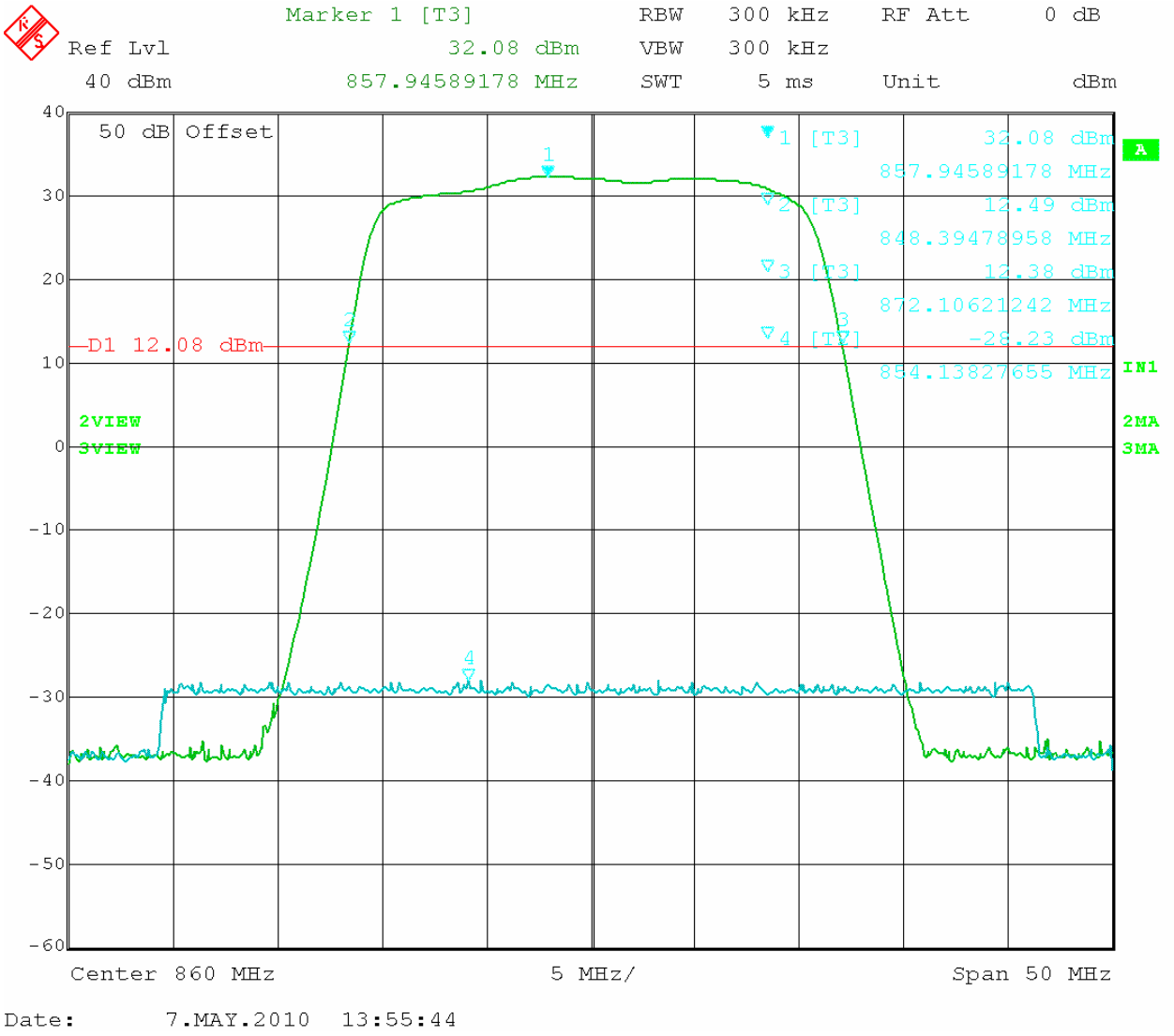



Figure 16: Passband Gain and Bandwidth (downlink 800 MHz)