# Emission Test Report
## Standard: FCC Part 15 Subpart C / IC RSS-210
## Class II Permissive change

**Document Number : FCC 19-0228-0**

**Product: IBM High Rate Wireless LAN Mini PCI Adapter III**

measured with **IBM ThinkPad G40 Series**

**FCC ID: ANO20020200BRX**
**IC: 349E-802MIP**

**February 27, 2003**

**Prepared:**
**EMC R&D Staff Engineer**
**Takeshi Asano**
**Signature:**
**IBM Japan, Ltd.**
**EMC Engineering**
**LAB-S59**
**1623-14, Shimotsuruma,**
**Yamato-shi Kanagawa-ken 242, Japan**
**Phone: +81-46-215-4779**
**Fax: +81-46-273-7420**
**E-Mail: asano@jp.ibm.com**

**Reviewed and Checked:**
**EMC R&D Staff Engineer**
**Toshiya Murota**
**Signature:**
**IBM Japan, Ltd.**
**EMC Engineering**
**LAB-S59**
**1623-14, Shimotsuruma,**
**Yamato-shi Kanagawa-ken 242, Japan**
**Phone: +81-46-215-6574**
**Fax: +81-46-273-7420**
**E-Mail: murota@jp.ibm.com**

**Approved :**
**Manager, EMC Engineering**
**Akihisa Sakurai**
**Signature:**
**IBM Japan, Ltd.**
**EMC Engineering**
**LAB-S59**
**1623-14, Shimotsuruma,**
**Yamato-shi Kanagawa-ken 242, Japan**
**Phone: +81-46-215-2613**
**Fax: +81-46-273-7420**
**E-Mail: akihisa@jp.ibm.com**

# MEASUREMENT / TECHNICAL REPORT – Part 15 Subpart C
## (Intentional Radiator)

# IBM High Rate Wireless LAN Mini PCI Adapter III
## (with ThinkPad G40 Series)

## FCC ID : ANO20020200BRX

**February 26, 2003**

This report concerns: (check one)
Original Grant _____
Class I change _____
Class II change ___✓___

Equipment type: Wireless LAN device

This report shall not be reproduced except in full, without the written permission of this test lab.

The measurement results contained in this report relate only to the item which was tested.

Measurement procedure used is ANSI C63.4-2000 unless otherwise specified.
Other test procedure: _____

The FCC has issued provisional acceptance of this test laboratory for Declaration of Conformity testing per letter dated 1997.

*APPLICANT ANTI-DRUG ABUSE CERTIFICATION:*
By checking yes, the applicant certifies that, in the case of an individual applicant, he or she is not subject to a denial of federal benefits, that includes FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse of 1988, 21 U.S.C. 853(a), or, in the case of a non-individual applicant (e.g. corporation, partnership or other unincorporated association), no party to the application is subject to a denial of federal benefits, that includes FCC benefits, pursuant to that section. For the definition of a "party" for these purposes, see 47 CFR 1.2002(b).

(Yes) or No

"Report shall not be reproduced except in full, without the written approval of the laboratory" "the report must not be used by the client to claim product endorsement by NVLAP or any agency of the US government"

Prepared by: Takeshi Asano
IBM Japan Corporation, Yamato EMC Enginnering
LAB-S59, 1623-14, Shimotsuruma, Yamato-shi Kanagawa-ken 242-8502, Japan
Tel: +81-46-215-4779 Fax: +81-46-273-7420

# - Index -

# A. General Information

| | |
|---|---|
| APPLICANT | : IBM Japan, Ltd. |
| TEST SITE | : IBM Japan, Ltd., Yamato Semi-anechoic chamber #1 |
| TEST SITE ADDRESS | : 1623 – 14 Shimotsuruma, Yamato-shi, Kanagawa 242-8502 Japan<br>Tel: +81-46-215-4779, Fax: +81-46-273-7420 |
| REGULATION | : FCC Part 15 Subpart C<br>Industry Canada RSS-210 (Issue No.5) |
| MODEL NAME | : IBM High Rate Wireless LAN Mini PCI Adapter III |
| FCC ID<br>IC Certification Number | : ANO20020200BRX<br>: 349E-802MIP |
| SERIAL NUMBER | : 4B300102 |
| PYSICAL CONDITION | : Preproduction |
| KIND OF EQUIPMENT | : DTS: IEEE802.11b Wireless LAN Mini-PCI card |
| TESTED DATE | : January 14, 17, 20, 24, and February 26, 2003 |

## A.1 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4-2000. Radiated testing was performed at an antenna to EUT distance of 3 meters.

## A.2 Test Facility / NVLAP Accreditation

The semi-anechoic chamber #2 used to correct the data are located in Yamato Laboratory, IBM Japan.

- This facility has been fully described in a report dated September 1998, submitted to the FCC office, and accepted in a letter, dated Nov. 2,1998(31040/SIT).
- IBM Yamato EMC Engineering is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with Criteria established in Title 15, Part 285 Code of Federal Regulations.(NVLAP Lab code: 200198-0)
- This facility is accepted by **Industry Canada** in a letter dated March 19, 2001 as number **IC 349E** for chamber #2, and January 25, 2002 as number **IC 4221** for chamber #1.

## A.3 EUT details

Table A EUT details

| **Model and S/N** | **FCC ID**<br>**IC Certification Number** | **Description** |
|---|---|---|
| IBM High Rate Wireless LAN Mini PCI Adapter III (s/n 4B300102) | FCC ID: ANO20020200BRX<br>IC:349E-802MIP | **Applying modular transmitter**<br>Built_in type IEEE802.11b Wireless LAN Mini-PCI card without antenna |
| ThinkPad G40 Series<br>M/T 2388-2UU<br>(s/n BA00022) | N/A | Host equipment<br>IBM Notebook PC with built_in antenna<br>CPU:Intel® Desktop Pentium® 4, 2.4GHz |
| P/N 02K7085 | N/A | Universal AC adapter 120W, Unshielded power cord |

# B. Summary of Test Results

Table-B presents the list of the measurement items for Spread Spectrum, Direct Sequence devices under FCC Part 15 Subpart C and Industry Canada RSS-210.
The section numbers of upper portion are showing FCC number, and the other (lower) ones are for IC.

Table-B List of the measurements

| Section(s) | Test Items | | Condition | Result |
|---|---|---|---|---|
| | **Transmit mode (TX):** | | | |
| **15.247(a)(2)**<br>**5.9.1** | Bandwidth at 6 dB below | | Conducted | Pass |
| **15.247(c)**<br>**5.9.1**<br>**6.2.2 (o) (e1)** | Occupied BW (or Band-edge) Out of Band Emissions (Bandwidth at 20 dB below) | The radiated emission in any 100kHz of outband shall be at least 20dB below the highest inband spectral density. | Conducted | Pass |
| **15.247(b)**<br>**6.2.2 (o) (b)** | Transmitter output power | Shall not exceed 1.0 W. | Conducted | Pass |
| **15.247(d)**<br>**6.2.2 (o) (b)** | Transmitter power spectral Density | Shall not be greater than 8 dBm in any 3kHz band. | Conducted | Pass |
| **15.207**<br>**6.6** | AC Wireline Conducted Emissions 150kHz - 30MHz | Class B:<br>Freq.(MHz) QP(dB$\mu$V) Ave.(dB$\mu$V)<br>0.15 - 0.5 66 - 56 56 - 46<br>0.5 - 5 56 46<br>5 - 30 60 50 | Conducted | Pass |
| **15.205 / 209**<br>**6.2.1 / 6.3** | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | Shall not exceed the limits specified in FCC 15.209 or RSS-210 Table3. | Radiated (30MHz -1GHz) | Pass |
| | | | Radiated (1– 25GHz) | Pass |

| | **Receive mode (RX):** | | | |
|---|---|---|---|---|
| **15.207**<br>**7.4** | AC Wireline Conducted Emissions 150kHz - 30MHz | Class B:<br>Freq.(MHz) QP(dB$\mu$V) Ave.(dB$\mu$V)<br>0.15 - 0.5 66 - 56 56 - 46<br>0.5 - 5 56 46<br>5 - 30 60 50 | Conducted | Pass |
| **15.209**<br>**7.3** | General Field Strength Limits (Radiated Emission Limits) | Shall not exceed the limits specified in RSS-210. | Radiated (30MHz -1GHz) | Pass |
| | | | Radiated (1– 25GHz) | Pass |

# C. Operation Mode of EUT

All tests were performed using the "PRISM Test Utility Program", Version 3.0.24. The following modulation modes were used for testing with appropriate bit rates:

Table C-1 Transmit mode (TX)

| Operation Frequency [GHz] | Rated output power (conducted) [dBm] | | Test performed* |
|---|---|---|---|
| | Bit rate 1M / 2Mbps (IEEE802.11 – DSSS) | Bit rate 5.5M / 11Mbps (IEEE802.11b – CCK) | |
| 2.412 (Ch. 1) | +15 | +15 | X |
| 2.417 (Ch. 2) | +15 | +15 | |
| 2.422 (Ch. 3) | +15 | +15 | |
| 2.427 (Ch. 4) | +15 | +15 | |
| 2.432 (Ch. 5) | +15 | +15 | |
| 2.437 (Ch. 6) | +15 | +15 | X |
| 2.442 (Ch. 7) | +15 | +15 | |
| 2.447 (Ch. 8) | +15 | +15 | |
| 2.452 (Ch. 9) | +15 | +15 | |
| 2.457 (Ch. 10) | +15 | +15 | |
| 2.462 (Ch. 11) | +15 | +15 | X |

Table C-2 Receive mode (RX)

| Operation Frequency [GHz] | Test performed |
|---|---|
| 2.412 (Ch. 1) | |
| 2.417 (Ch. 2) | |
| 2.422 (Ch. 3) | |
| 2.427 (Ch. 4) | |
| 2.432 (Ch. 5) | |
| 2.437 (Ch. 6) | X |
| 2.442 (Ch. 7) | |
| 2.447 (Ch. 8) | |
| 2.452 (Ch. 9) | |
| 2.457 (Ch. 10) | |
| 2.462 (Ch. 11) | |

# D. Justification

Both modulation modes (DSSS and CCK) were investigated for conducted measurements.
Then the worst case data were taken in this report for EMI conducted and radiated measurements (i.e. 11Mb/s transmission mode).

# E. Test Instruments

Table-D List of Measuring Instruments

| Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|
| Computer | IBM 5551-L | #4 | N/A | N/A |
| Computer | IBM 6589-13J | 97-15613 | N/A | N/A |
| Spectrum Analyzer (100Hz-1.5GHz) | HP 85680B | 3019A05155 | 02/15/02 | 1 year |
| Spectrum Analyzer (100Hz-1.5GHz) | HP 85680B | 2841A04252 | 06/17/02 | 1 year |
| Spectrum Analyzer (100Hz-1.5GHz) | HP 85680B | 2601A02634 | 08/28/02 | 1 year |
| Spectrum Analyzer Display | HP 85662A | 3026A19353 | 02/15/02 | 1 year |
| Spectrum Analyzer Display | HP 85662A | 2816A16831 | 06/17/02 | 1 year |
| Spectrum Analyzer Display | HP 85662A | 2542A12308 | 08/28/02 | 1 year |
| Quasi-Peak Adapter | HP 85650A | 2811A01156 | 06/17/02 | 1 year |
| Quasi-Peak Adapter | HP 85650A | 3033A01449 | 02/15/02 | 1 year |
| Quasi-Peak Adapter | HP 85650A | 2043A00062 | 08/28/02 | 1 year |
| Amplifier (100KHz - 1.3GHz) | | | | |
| - for 30-200MHz | HP 8447D | 2805A02919 | 04/15/02 | 1 year |
| - for 200-1000MHz | HP 8447D | 2944A03506 | 04/15/02 | 1 year |
| Amplifier (1GHz - 26.5GHz) | HP 8449B | 3008A00582 | 06/13/02 | 1 year |
| Spectrum Analyzer EMI Test Receiver | R&S ESI26 | 836119/003 | 07/18/02 | 1 year |
| Receiver (9kHz-30MHz) | R&S ESH3 | 891806/012 | 10/07/02 | 1 year |
| Receiver (20MHz-1.3GHz) | R&S ESVP | 893202/018 | 02/06/02 | 1 year |
| Biconical Antenna (30-200MHz) | EMCO 3108 | 2309 | 05/06/02 | 1 year |
| Log-Periodic Antenna (200-1000MHz) | EMCO 3146 | 1585 | 05/06/02 | 1 year |
| Horn Antenna (1- 18GHz) | EMCO 3115 | 9903-5774 | 07/18/02 | 1 year |
| Horn Antenna (3.95- 5.85GHz) | EMCO 3160-5 | 1099 | 04/17/02 | 1 year |
| Horn Antenna (5.85- 8.20GHz) | EMCO 3160-6 | 9712-1044 | 04/17/02 | 1 year |
| Horn Antenna (8.20- 12.40GHz) | EMCO 3160-7 | 1156 | 04/17/02 | 1 year |
| Horn Antenna (18- 26.5GHz) | EMCO 3160-9 | 0004-1202 | 04/17/02 | 1 year |
| LISN | EMCO 3825/2 | 1426 | 09/01/02 | 1 year |
| Power Meter | HP 437B | 3043U03437 | 11/08/02 | 1 year |
| Power Sensor | HP 8481A | US41030582 | 11/08/02 | 1 year |
| Switch/control unit | HP 3488A | 2719A17226 | N/A | N/A |
| | | 2719A17228 | N/A | N/A |
| Plotter | HP 7550A | 2631A33619 | N/A | N/A |
| SF106 cables: | Length: | | | |
| - Horn Ant <=> RF Amp. | 6 m | - EM206SCO | 09/05/02 | 1 year |
| - RF Amp.<=>Spectrum Analyzer | 15m | - EM215SCO | 09/05/02 | 1 year |
| N-Coax cables: | | | | |
| - Bi-coni Ant <=> 10m Cable | 9 m | - EM103L01 | 04/15/02 | 1 year |
| - 10m Cable <=> Shield Panel | 10 m | - EM103L02 | 04/15/02 | 1 year |
| - Shield Panel <=> RF Amp | 7 m | - EM103L03 | 04/15/02 | 1 year |
| - RF Amp <=> Power Splitter | 0.5m | - EM103L04 | 04/15/02 | 1 year |

| | | | | |
|---|---|---|---|---|
| - Log-peri Ant <=> 10m Cable | 9 m | - EM103H01 | 04/15/02 | 1 year |
| - 10m Cable <=> Shield Panel | 10 m | - EM103H02 | 04/15/02 | 1 year |
| - Shield Panel <=> RF Amp | 7 m | - EM103H03 | 04/15/02 | 1 year |
| - RF Amp <=> Power Splitter | 0.5m | - EM103H04 | 04/15/02 | 1 year |
| Coax cables: | | | | |
| - Lisn-L <=> SW/Con.unit (SW100) | 4 m | - EMIC-L | 04/15/02 | 1 year |
| - Lisn-N <=> SW/Con.unit (SW101) | 4 m | - EMIC-N | 04/15/02 | 1 year |
| - SW/Con.unit <=> RCVR (Input) | 1 m | - EMIC-R | 04/15/02 | 1 year |
| - SW/Con.unit<=> Spe Ana.(Signal In) | 1 m | - EMIC-S | 04/15/02 | 1 year |
| - Power Splitter <=> SW/Con.unit (SW110) | 1 m | - EM103L05 | 04/15/02 | 1 year |
| - Power Splitter <=> SW/Con.unit (SW300) | 1 m | - EM103L06 | 04/15/02 | 1 year |
| - Power Splitter <=> SW/Con.unit (SW100) | 1 m | - EM103H05 | 04/15/02 | 1 year |
| - Power Splitter <=> SW/Con.unit (SW301) | 1 m | - EM103H06 | 04/15/02 | 1 year |
| - SW/Con.unit <=> Receiver (Input) | 2 m | - EM1RCV | 04/15/02 | 1 year |
| - SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz | 2 m | - EM1SPL | 04/15/02 | 1 year |
| - SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz | 2 m | - EM1SPH | 04/15/02 | 1 year |

Notes.

- The above equipment calibration is traceable to National standards.
- HP: Hewlett Packard, R&S: Rohde & Schwarz

# F. Measurement Uncertainty

Uncertainties of the both, the Yamato EMI radiated test facilities (EMI chambers, #1 and #2) and the Yamato EMI conducted test facility are derived with the NIS 81 " Treatment of uncertainty in EMC measurements" 1994.

Estimated site uncertainty values are as follows.

EMI chamber #1 : 4.39dB
EMI chamber #2 : 4.40dB
EMI conducted measurement system : 2.4dB

Detail should be referred to "Treatment of Uncertainty, Calculations and Policy" report, document number TCR 10-0015.

# G. Temperature and Humidity

The temperature is controlled within range of 17° to 28°.
The relative humidity is controlled within range of 40% to 70%.

# H. Related Submittal(s)/Grant(s)/Notes

The host unit with full peripheral devices including the applying modular as an unintentional radiator is classified as a Digital Device under the FCC Part 15 Subpart B or the Industry Canada Class B Emission Compliance (ICES-003), and subject to SDoC.

# 1. Bandwidth at 6 dB below

## 1.1 Test Procedure

The bandwidth at 6 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.
The spectrum analyzer is set to:
RBW=100kHz, VBW=100kHz*1, Span=30MHz, Sweep=suitable duration based on the EUT specification
*1: To be adjusted accordingly based on the spectrum stability

## 1.2 Test Instruments and Measurement Setup

Table 1-1 : 6 dB Bandwidth Test Instruments

| **Description** | **Model** | **Serial Number** |
|---|---|---|
| Spectrum Analyzer EMI Test Receiver | R&S ESI26 | 836119/003 |
| Coax cables:<br>- Spectrum Analyzer <=> EUT | Length: Loss:<br>110 cm 1.3 dB | |

Notes: - R&S: Rohde & Schwarz

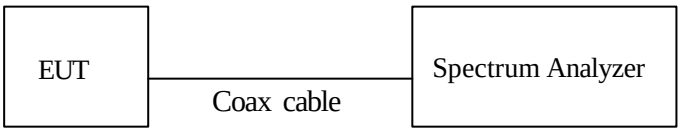



Figure 1: Measurement setup for 6dB bandwidth test

## 1.3 Measurement Results

Test Date: February, 26, 2003

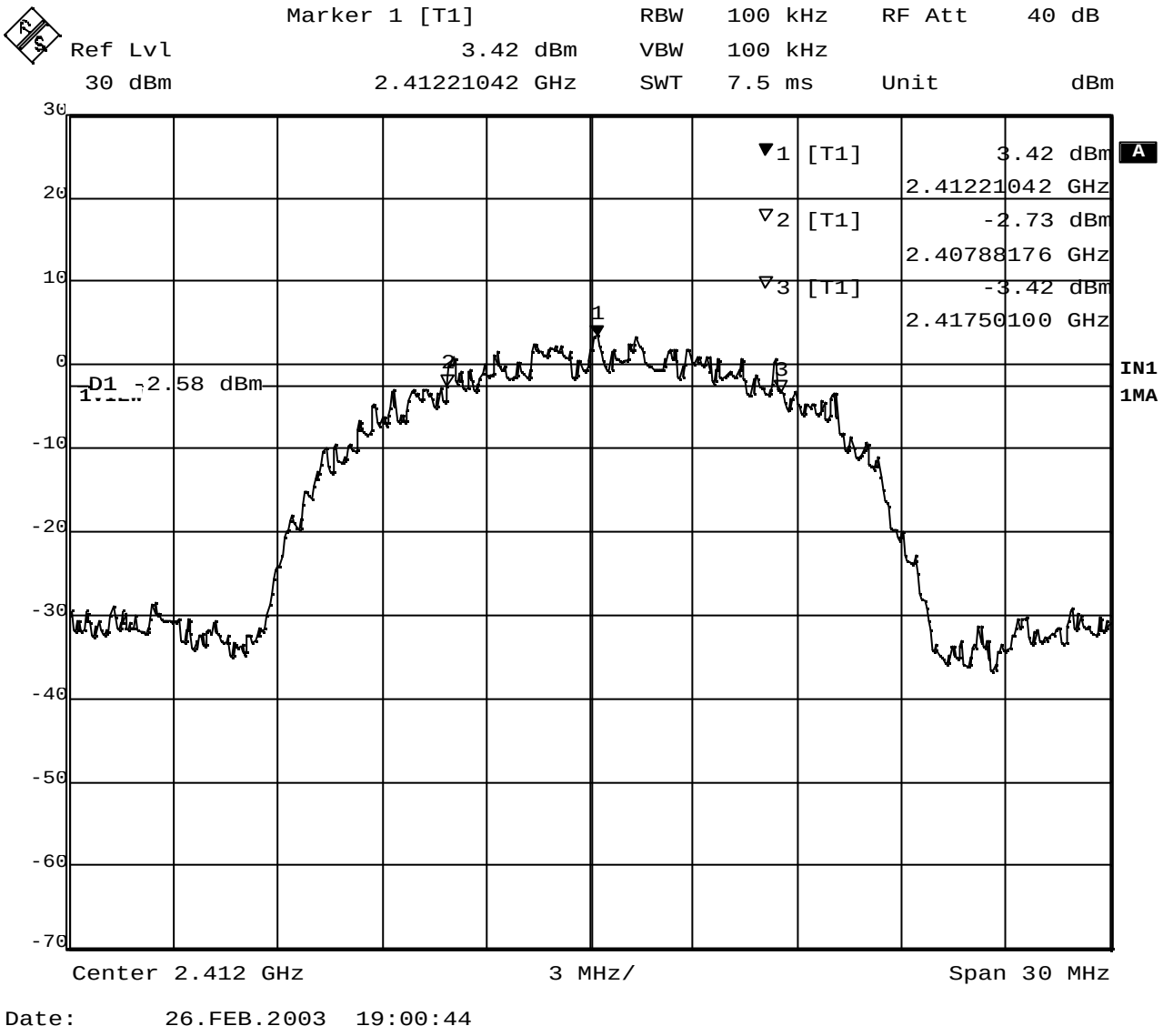
Table 1-2. EUT: M/T 2388-2UU, s/n BA00022 , TX mode 11Mbps

| Center Frequency (MHz) | Trace number | Lower frequency (MHz) | Upper frequency (MHz) | Bandwidth at 6 dB below (MHz) | note |
|---|---|---|---|---|---|
| 2412 | Plot 1-1 | 2407.88 | 2417.50 | 9.62 | > 500kHz |
| 2437 | Plot 1-2 | 2432.82 | 2442.50 | 9.68 | |
| 2462 | Plot 1-3 | 2457.82 | 2467.50 | 9.68 | |

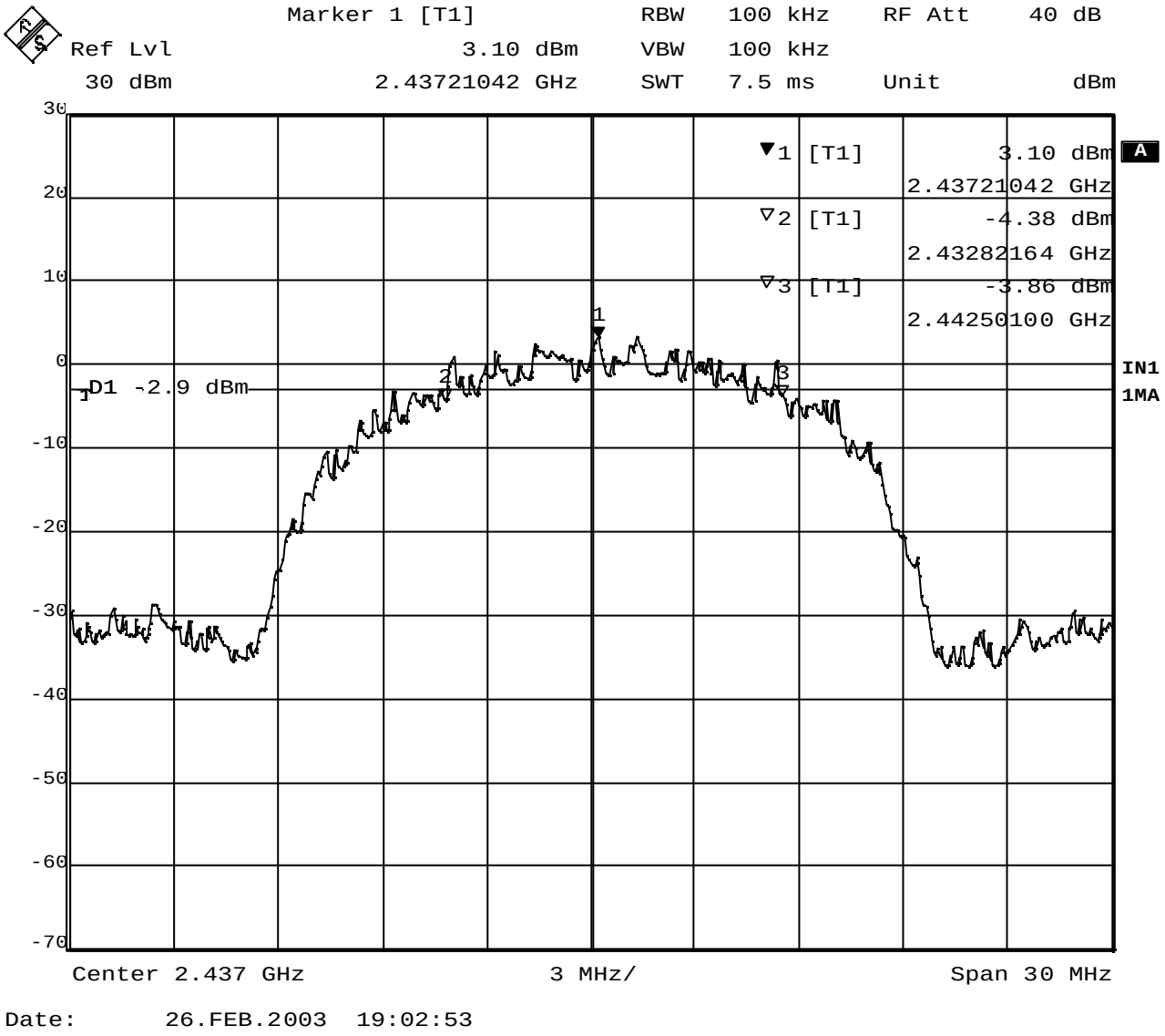
Table 1-3. EUT: M/T 2388-2UU, s/n BA00022 , TX mode 1Mbps

| Center Frequency (MHz) | Trace number | Lower frequency (MHz) | Upper frequency (MHz) | Bandwidth at 6 dB below (MHz) | note |
|---|---|---|---|---|---|
| 2412 | Plot 1-4 | 2406.92 | 2417.08 | 10.16 | > 500kHz |
| 2437 | Plot 1-5 | 2432.40 | 2443.58 | 11.18 | |
| 2462 | Plot 1-6 | 2456.92 | 2468.58 | 11.66 | |

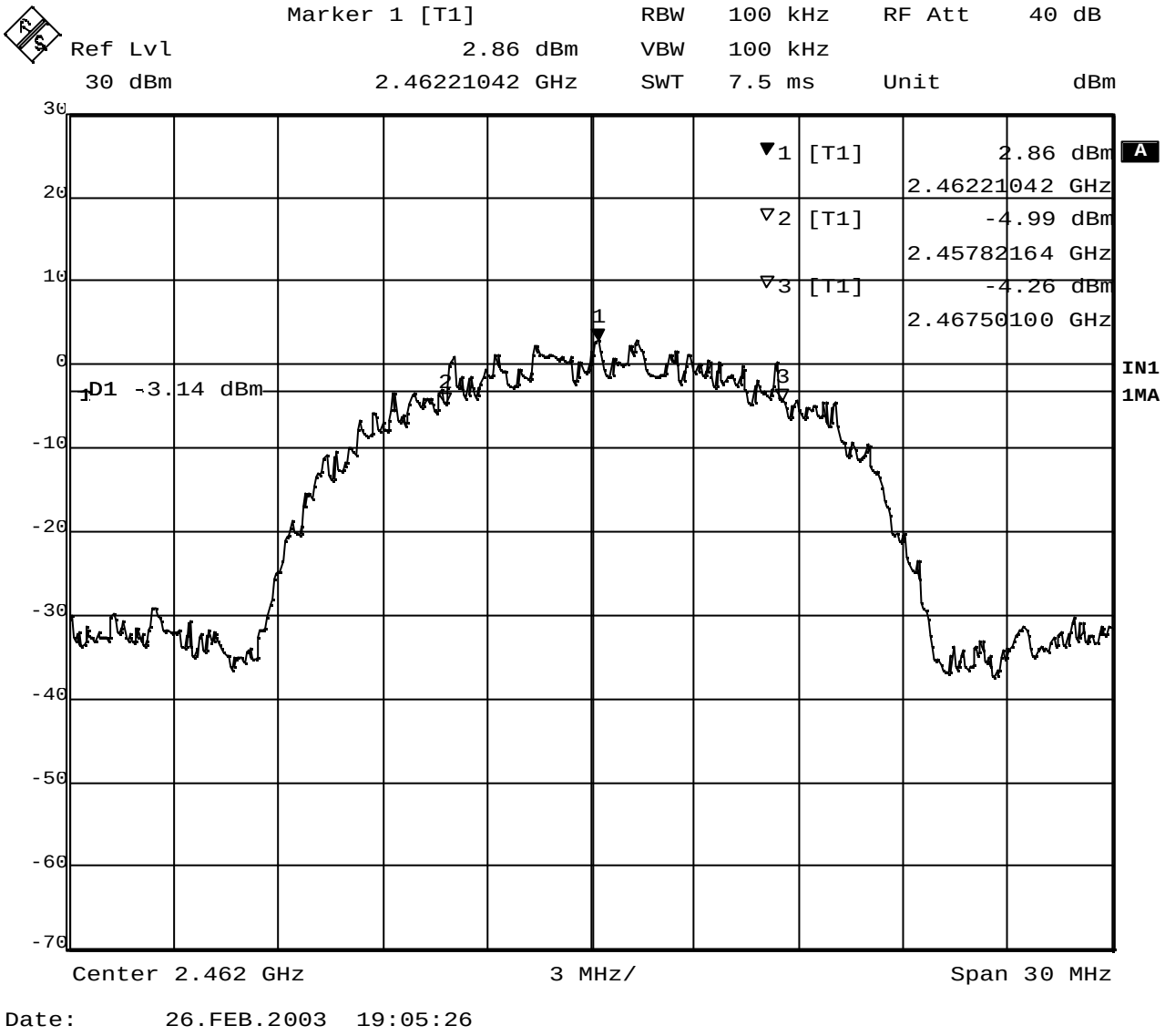
## 1.4 Trace Data



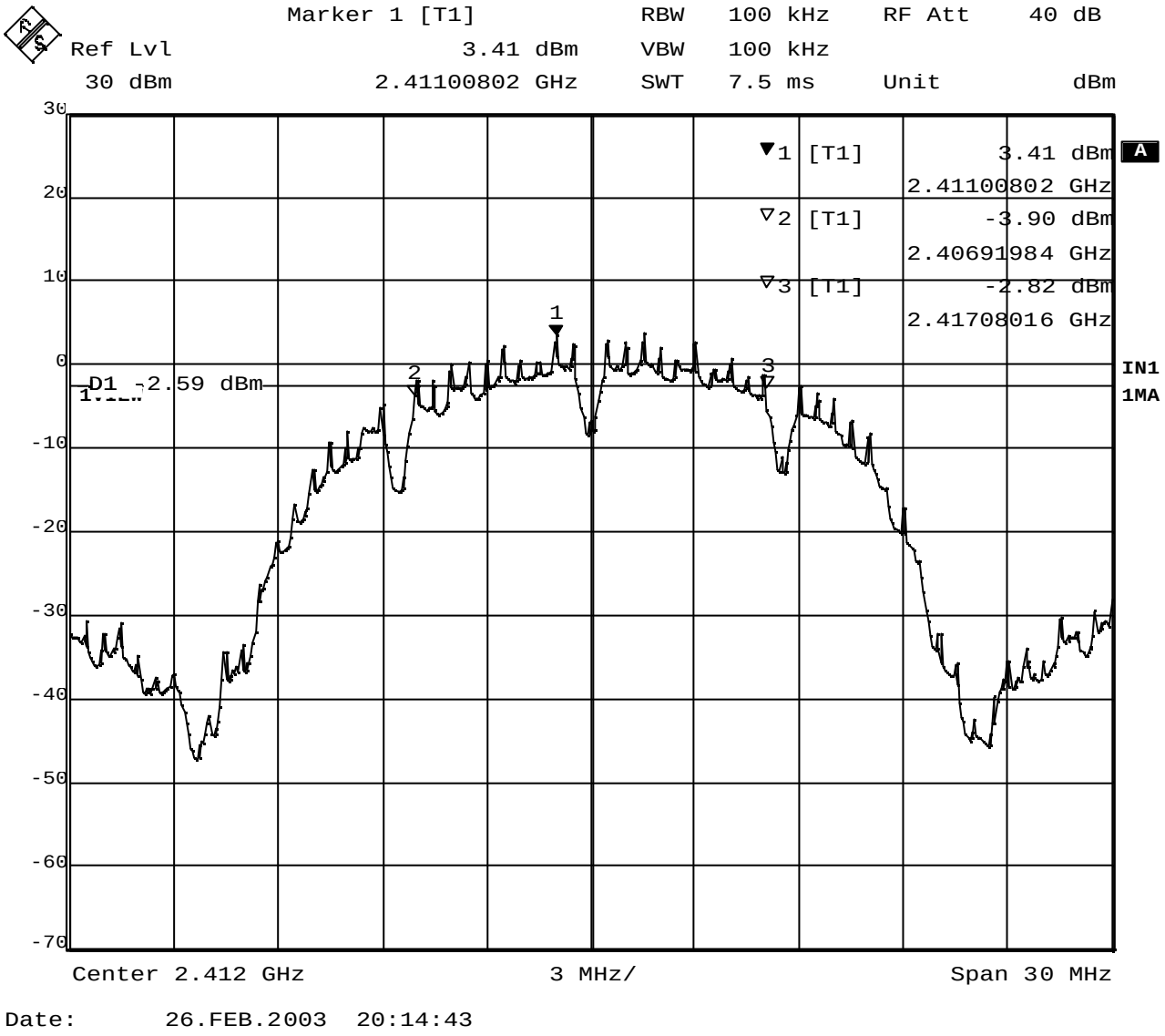

Plot 1-1. 6dB BW at 2412MHz (11Mb/s)



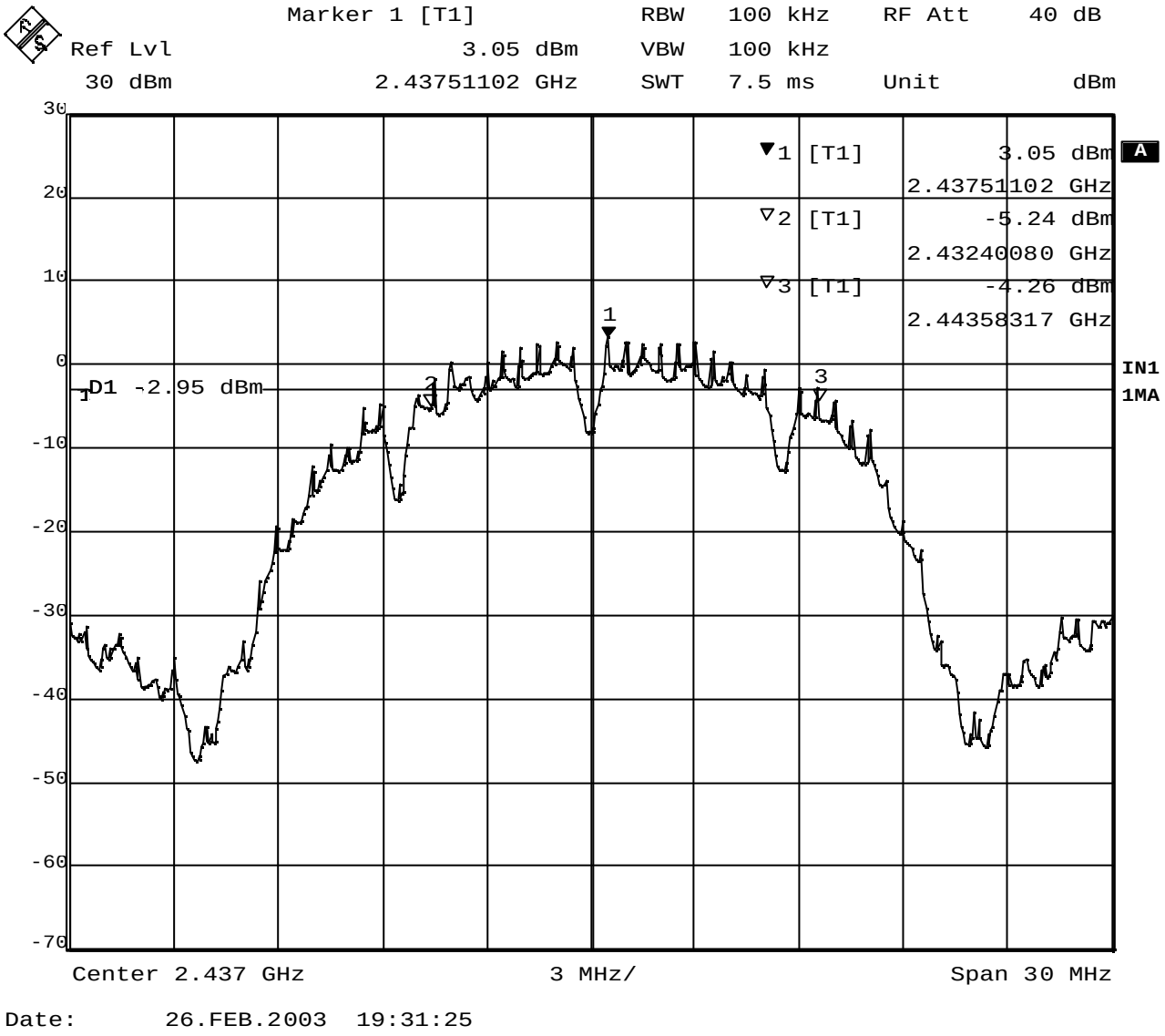

Plot 1-2. 6dB BW at 2437MHz (11Mb/s)



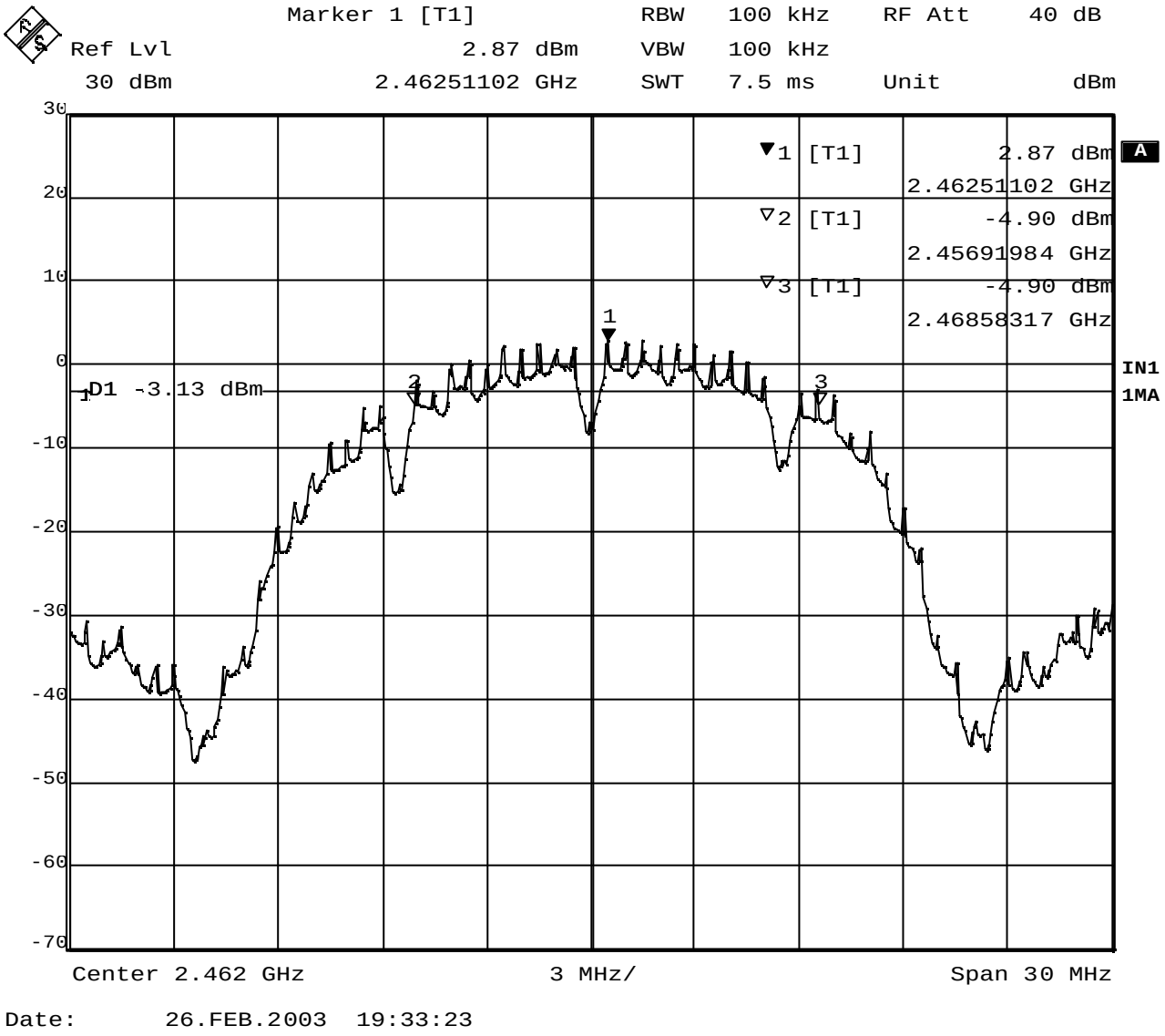

Plot 1-3. 6dB BW at 2462MHz (11Mb/s)




Plot 1-4. 6dB BW at 2412MHz (1Mb/s)




Plot 1-5. 6dB BW at 2437MHz (1Mb/s)




Plot 1-6. 6dB BW at 2462MHz (1Mb/s)

# 2. Occupied Bandwidth / Band-edge (at 20 dB below), and Out of Band Emissions

## 2.1 Test Procedure

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.
The spectrum analyzer is set to:
RBW=100kHz, VBW=100kHz*1, Span=50MHz, Sweep=suitable duration based on the EUT specification
*1: To be adjusted accordingly based on the spectrum stability

## 2.2 Test Instruments and Measurement Setup

Same as the Chapter 1(Table 1-1 & Figure 1).

## 2.3 Measurement Results of Occupied Bandwidth / Band-edge

Test Date: February, 26, 2003

Table 2-1. EUT: M/T 2388-2UU, s/n BA00022 , TX mode 11Mbps

| Center Frequency (MHz) | Trace number | Lower Frequency 20dB below (MHz) | Upper Frequency 20dB below (MHz) | Bandwidth at 20dB below (MHz) | Margin to Lower bandedge (MHz) | Margin to Upper bandedge (MHz) |
|---|---|---|---|---|---|---|
| 2412 | Plot 2-1 | 2403.65 | 2420.69 | 17.04 | 3.65 | |
| 2437 | Plot 2-2 | 2428.63 | 2445.64 | 17.01 | | |
| 2462 | Plot 2-3 | 2453.63 | 2470.69 | 17.06 | | 12.81 |

Table 2-2. EUT: M/T 2388-2UU, s/n BA00022 , TX mode 1Mbps

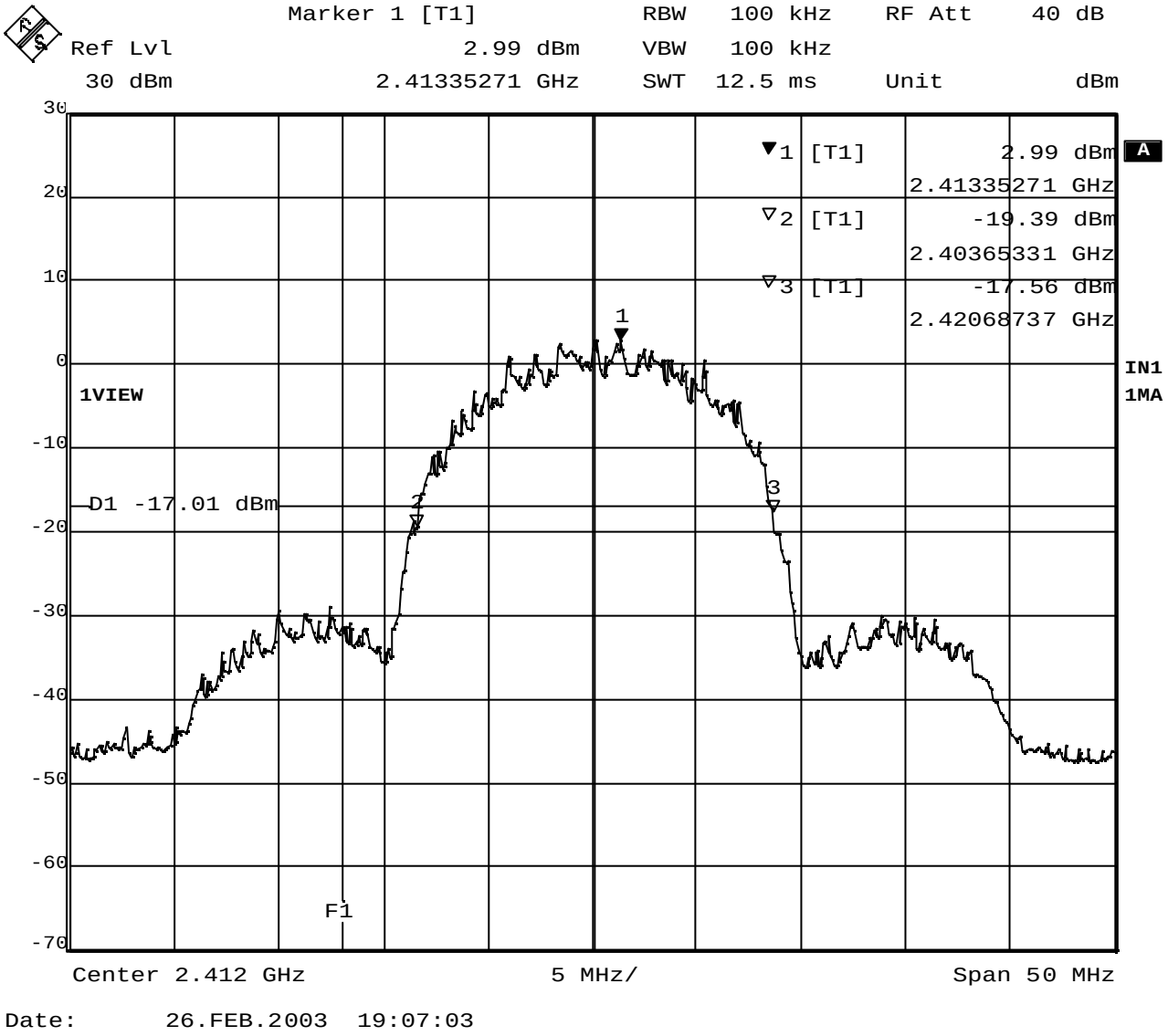
| Center Frequency (MHz) | Trace number | Lower Frequency 20dB below (MHz) | Upper Frequency 20dB below (MHz) | Bandwidth at 20dB below (MHz) | Margin to Lower bandedge (MHz) | Margin to Upper bandedge (MHz) |
|---|---|---|---|---|---|---|
| 2412 | Plot 2-4 | 2403.35 | 2420.69 | 17.34 | 3.35 | |
| 2437 | Plot 2-5 | 2428.33 | 2445.64 | 17.31 | | |
| 2462 | Plot 2-6 | 2453.33 | 2470.69 | 17.36 | | 12.81 |

## 2.4 Measurement Results of Out of Band Emissions

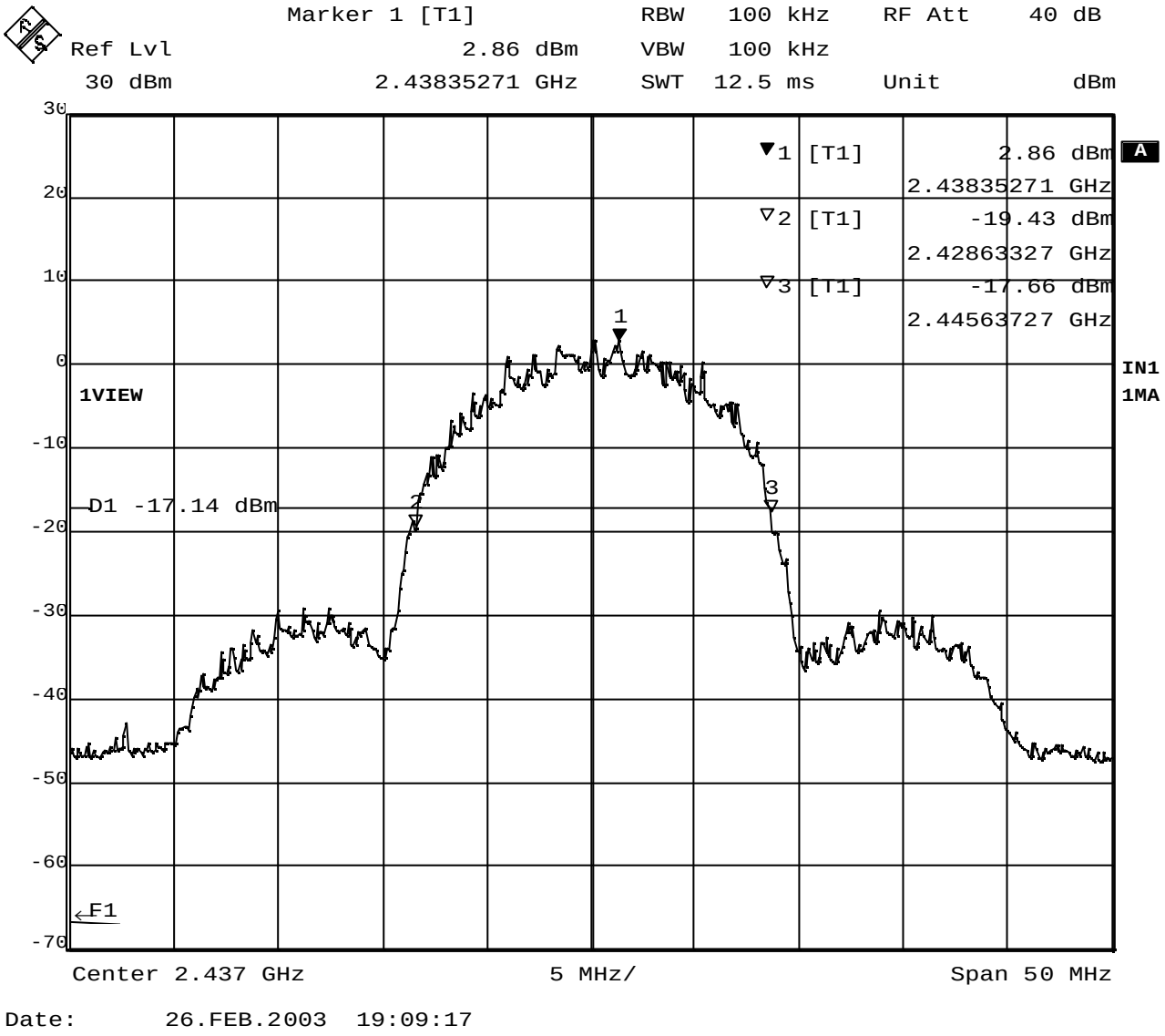
All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density.

Test Date: February 26, 2003 : See Plot 2-7 to 2-12.

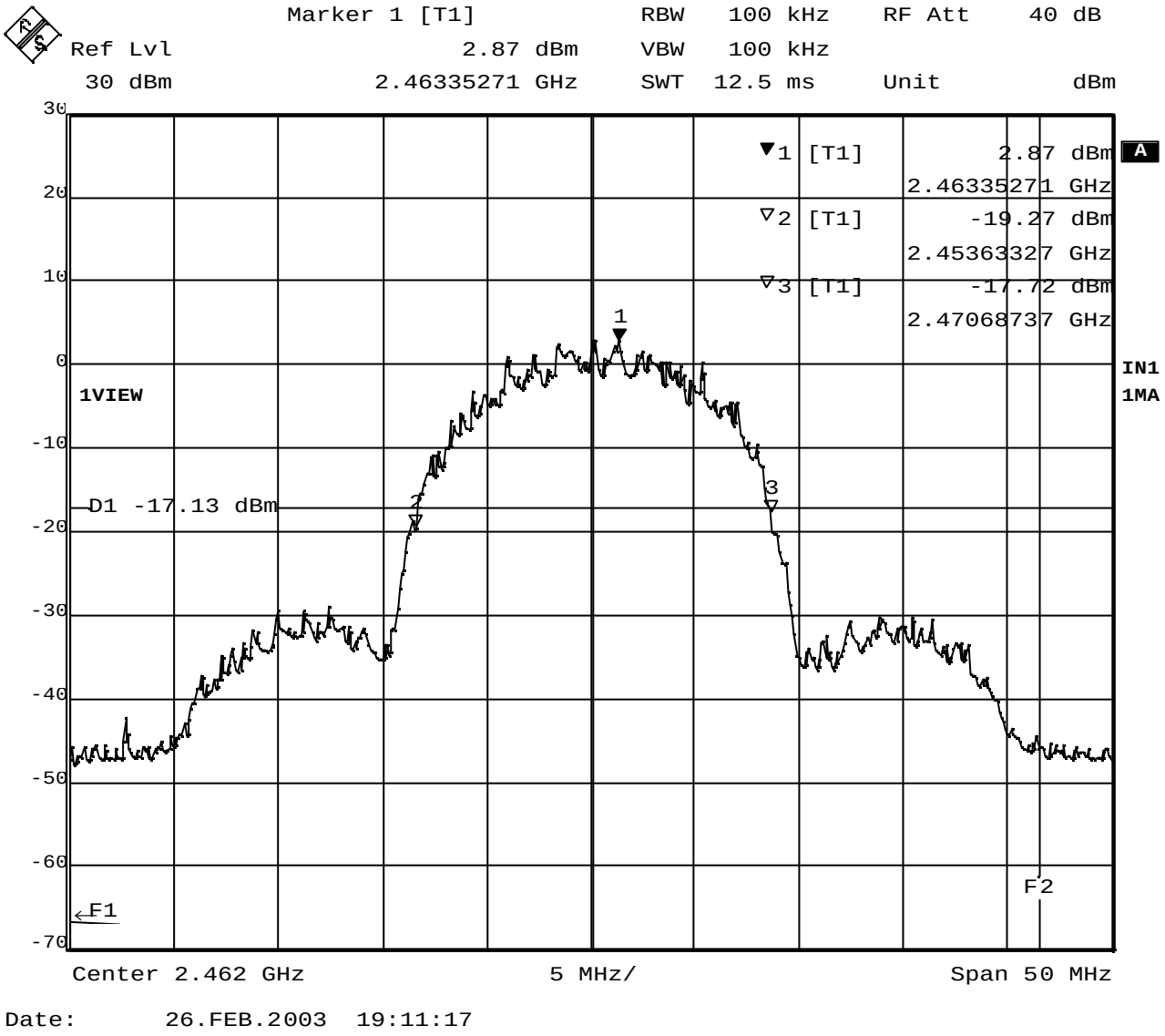
## 2.5 Trace Data of Band-edge



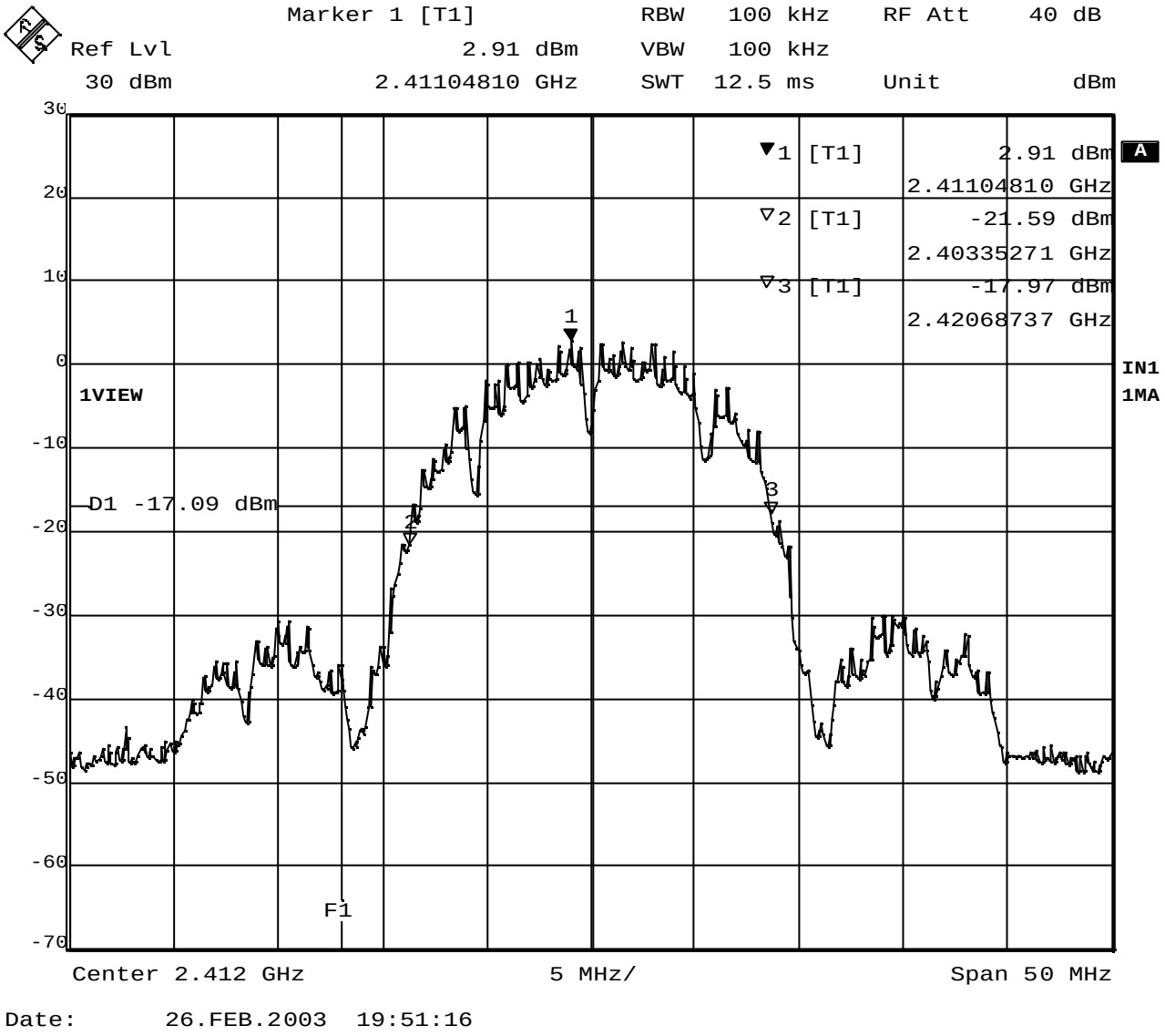

Plot 2-1. 20dB BW at 2412MHz (11Mb/s)



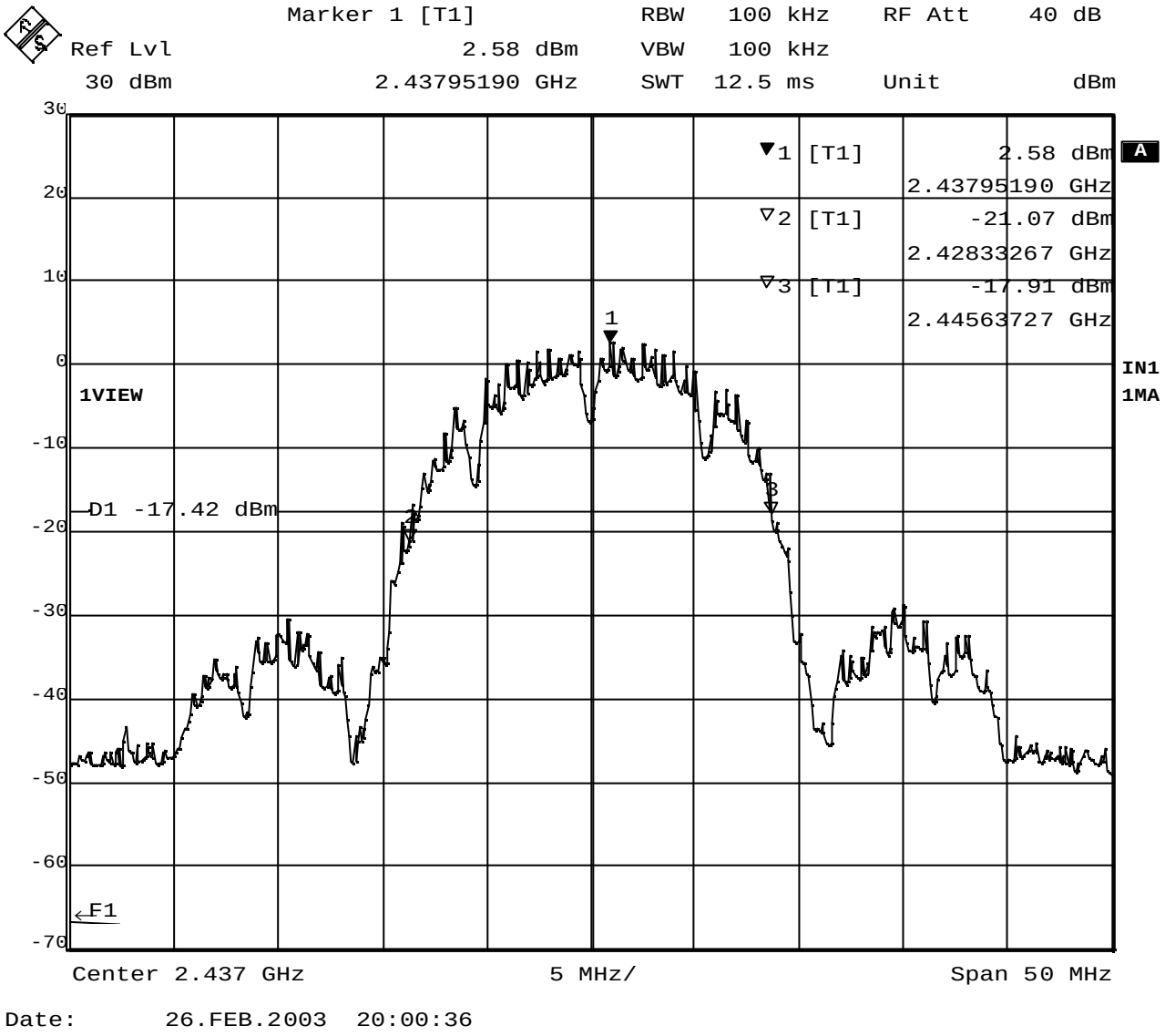

Plot 2-2. 20dB BW at 2437MHz (11Mb/s)



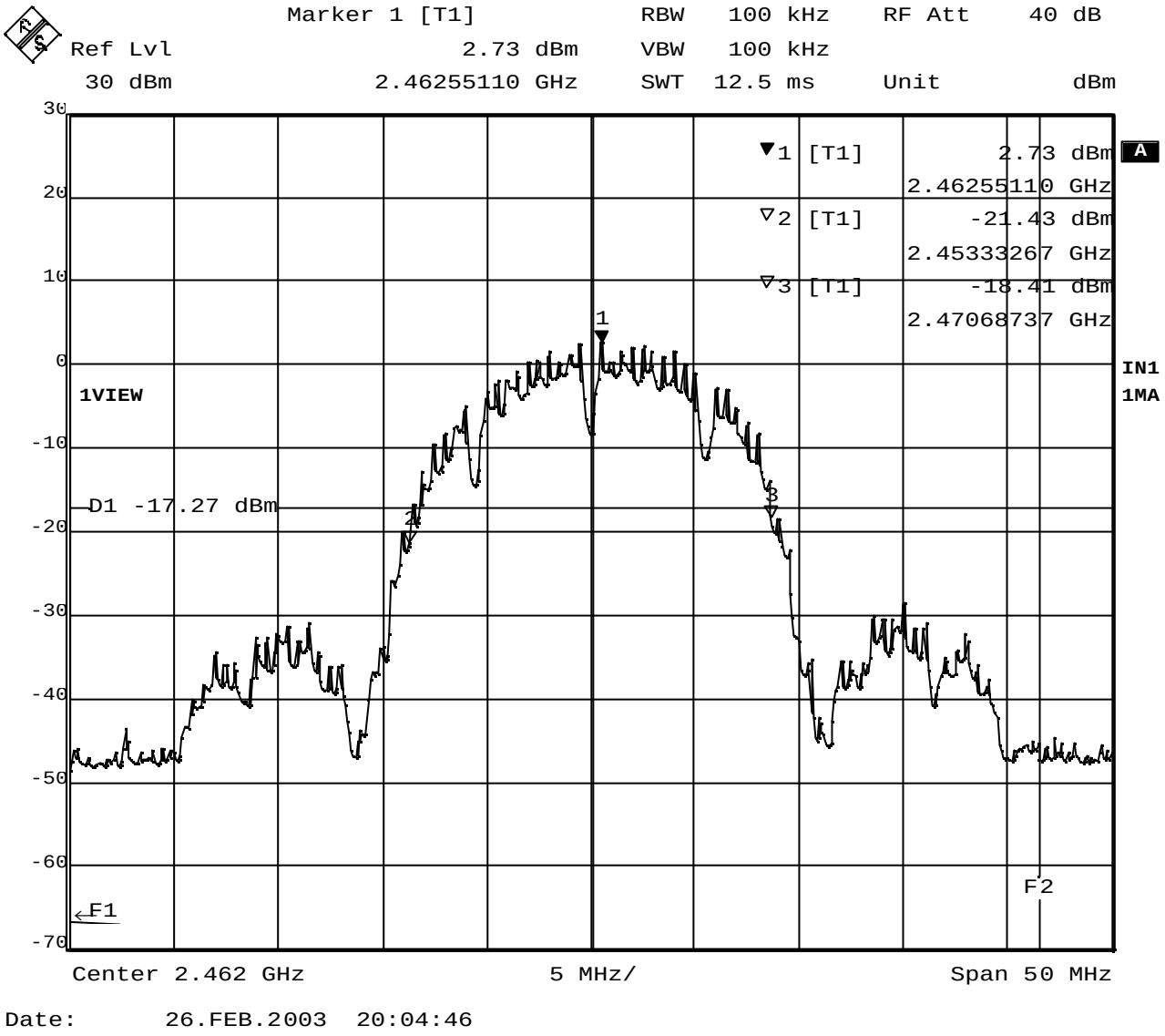

Plot 2-3. 20dB BW at 2462MHz (11Mb/s)




Plot 2-4. 20dB BW at 2412MHz (1Mb/s)

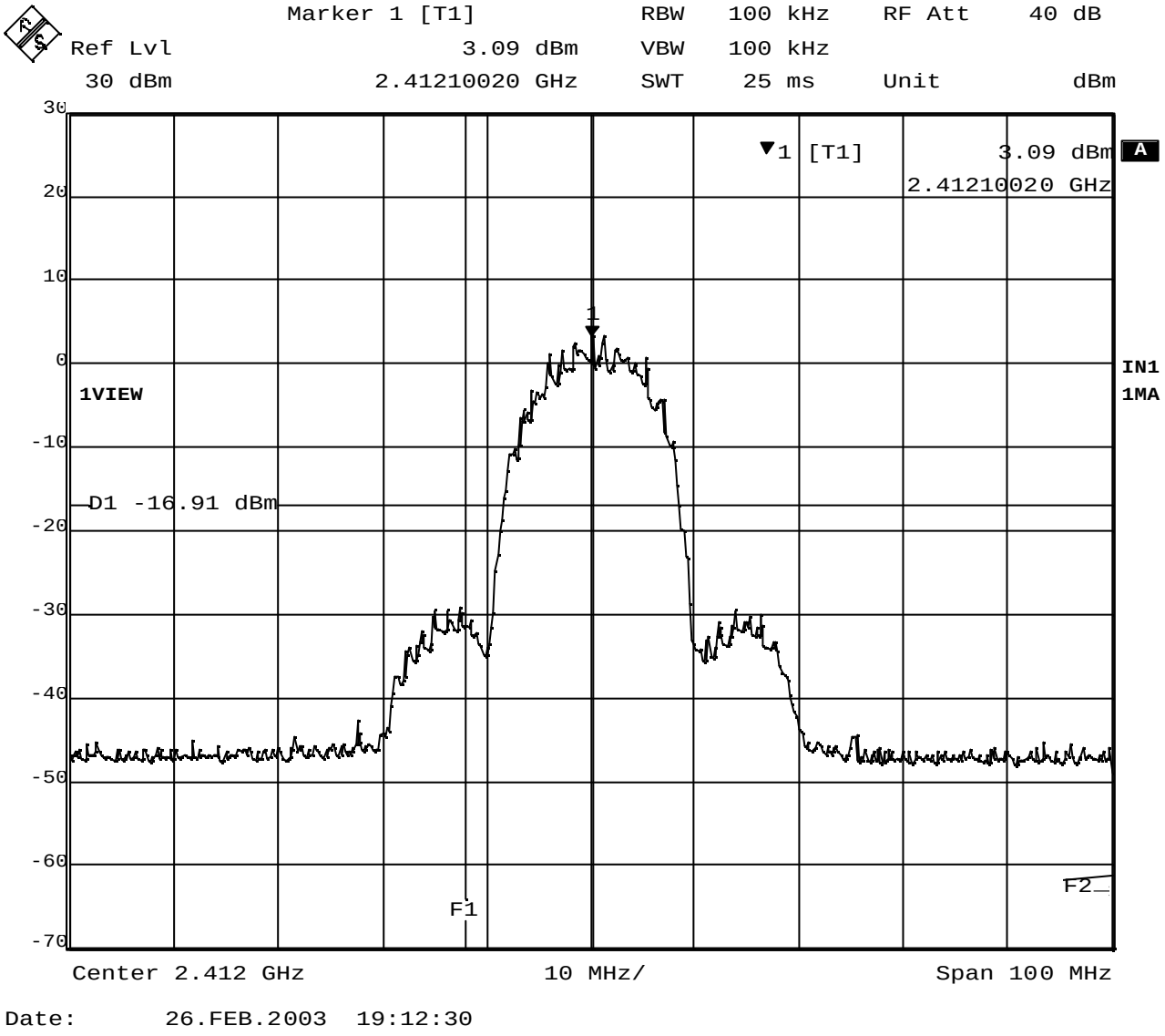



Plot 2-5. 20dB BW at 2437MHz (1Mb/s)

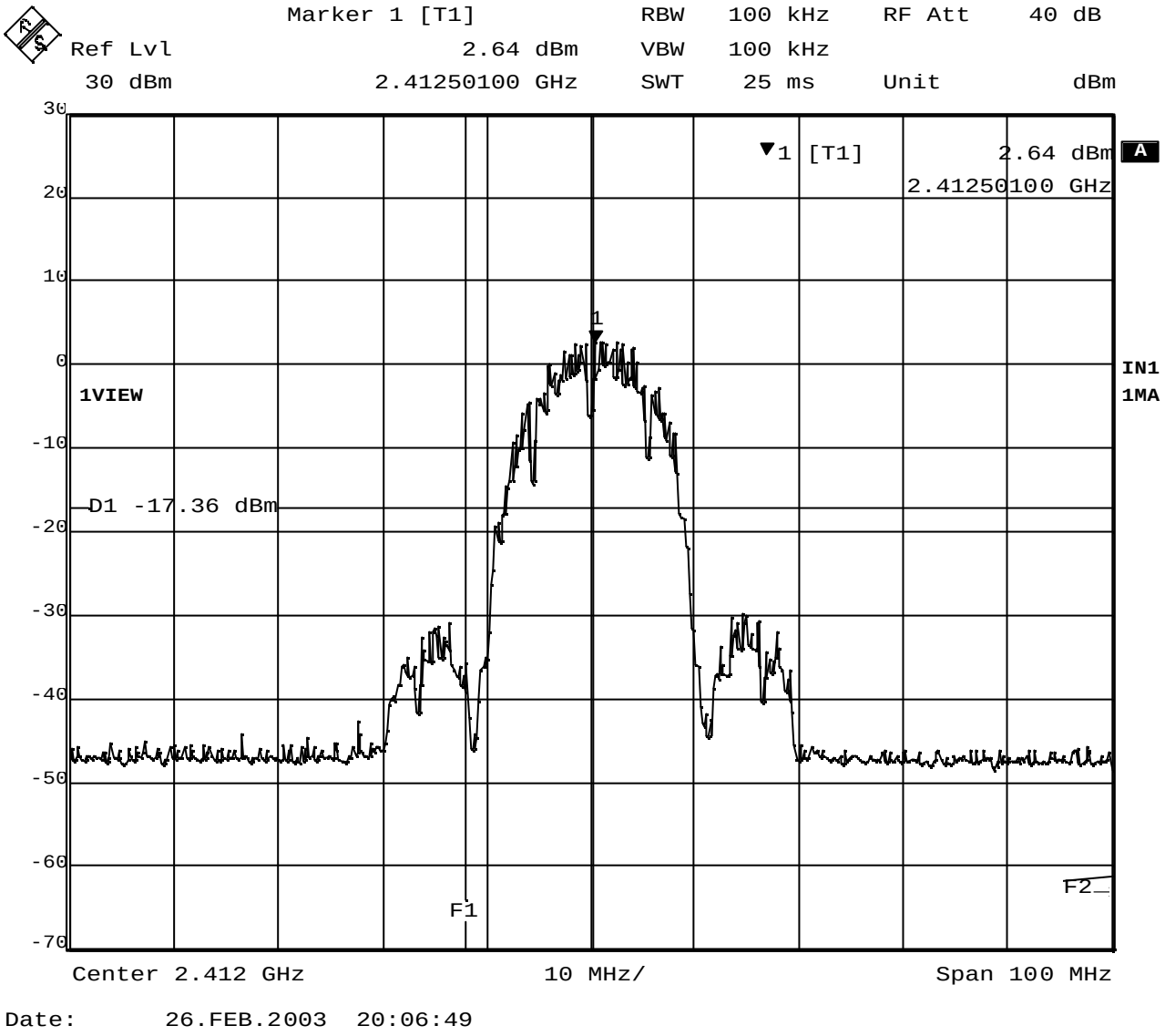



Plot 2-6. 20dB BW at 2462MHz (1Mb/s)

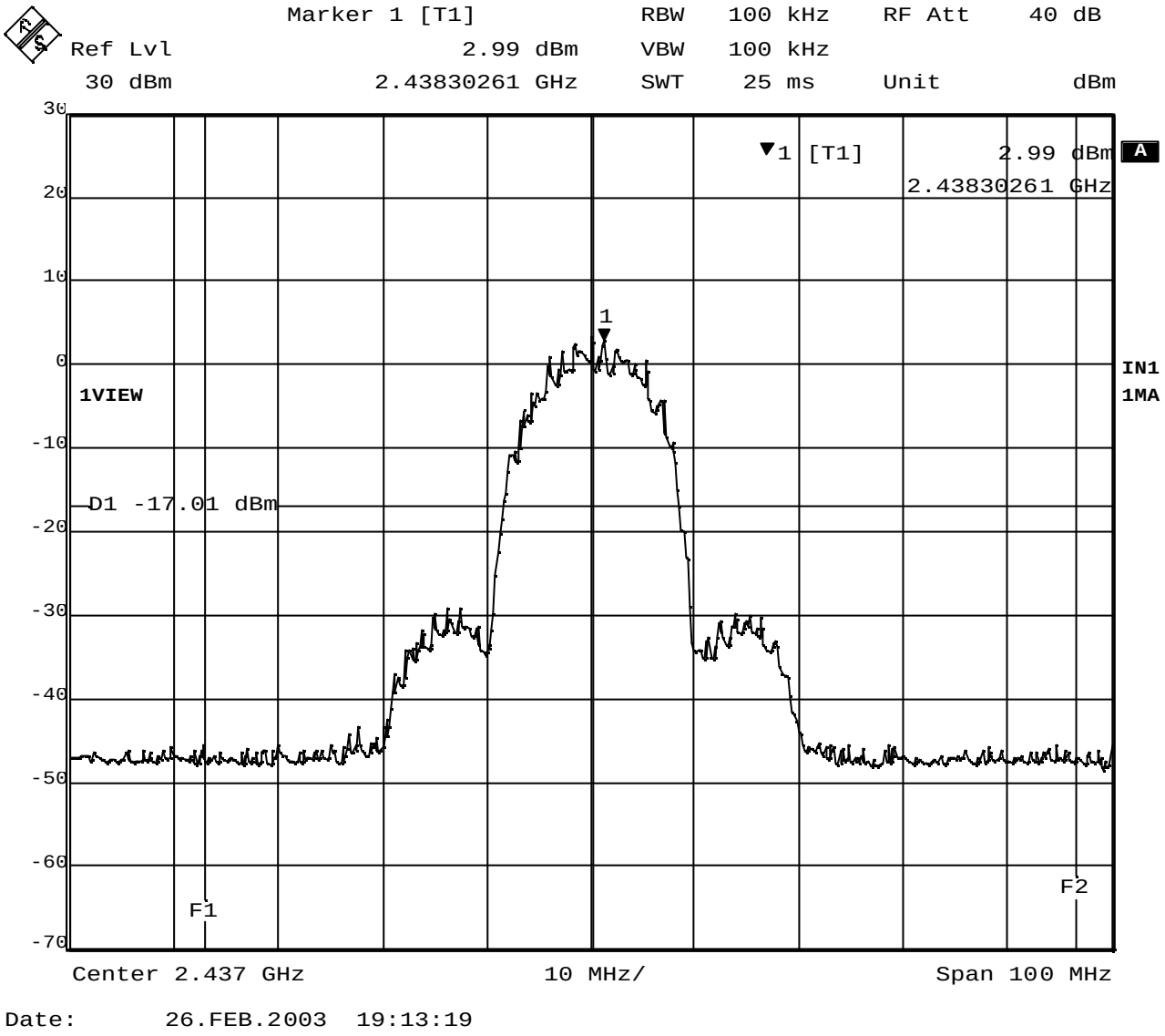
## 2.6 Trace Data of Out of Band Emissions



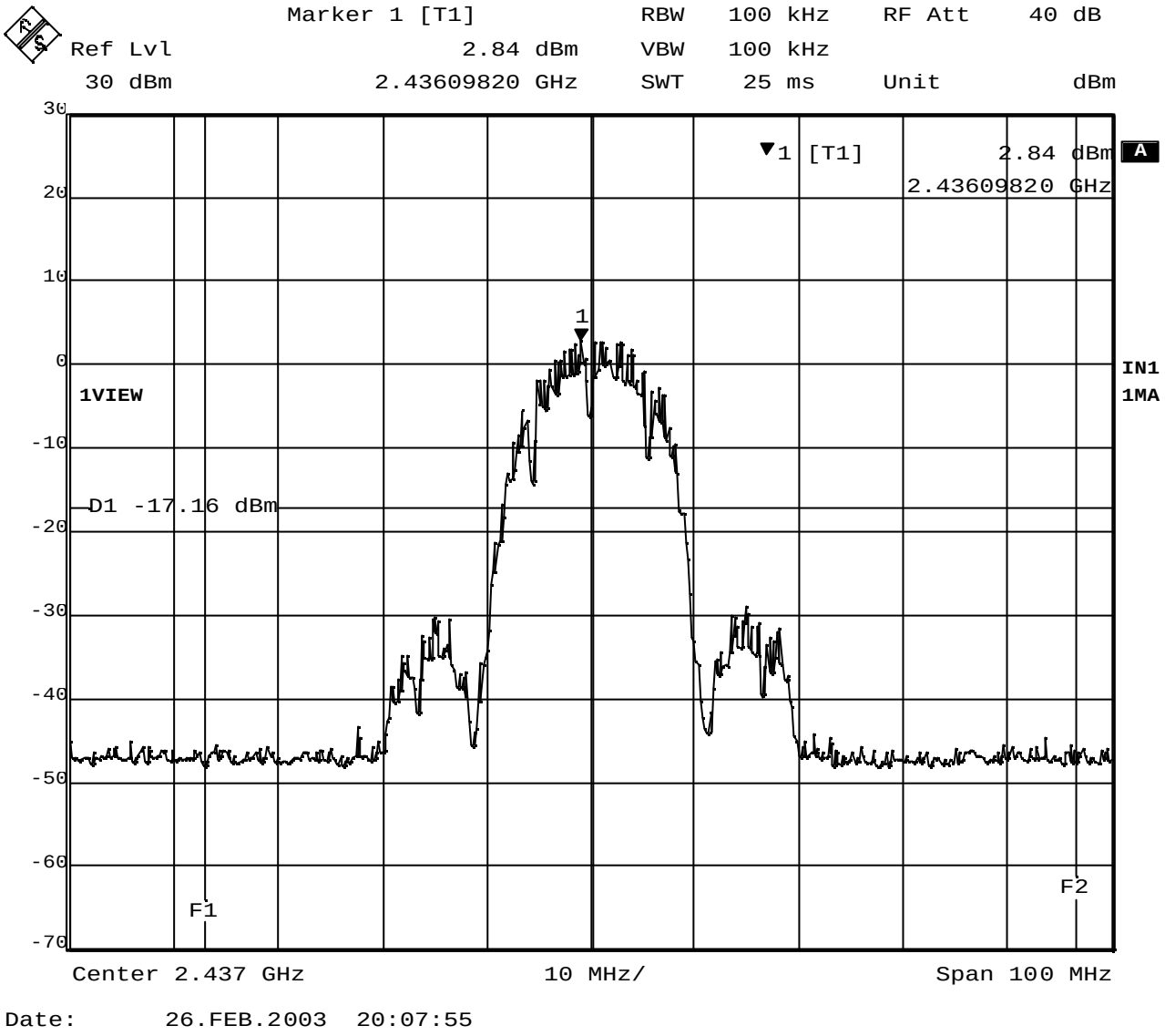

Plot 2-7. Out of band emissions around 2412MHz (11Mb/s)



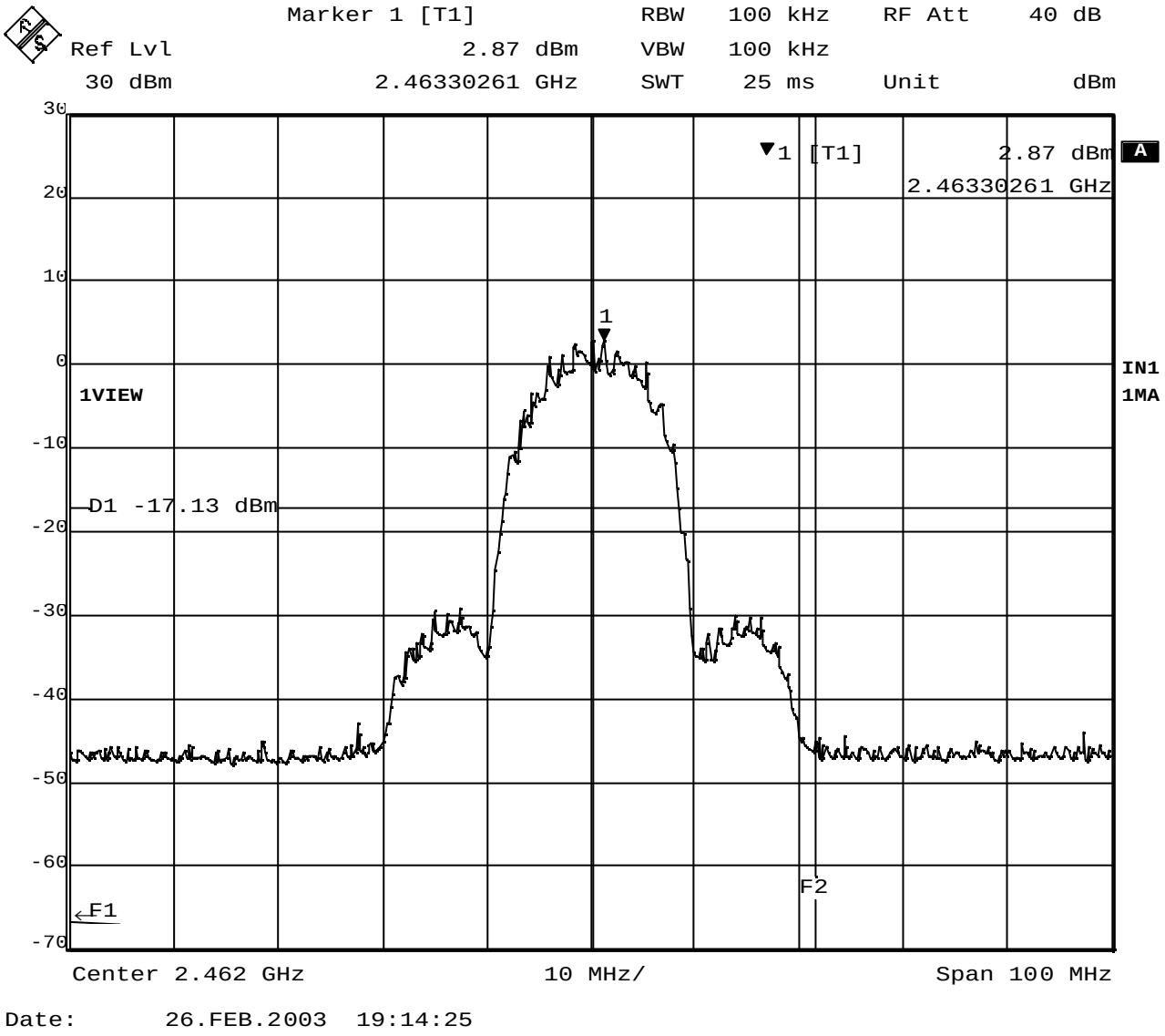

Plot 2-8. Out of band emissions around 2412MHz (1Mb/s)



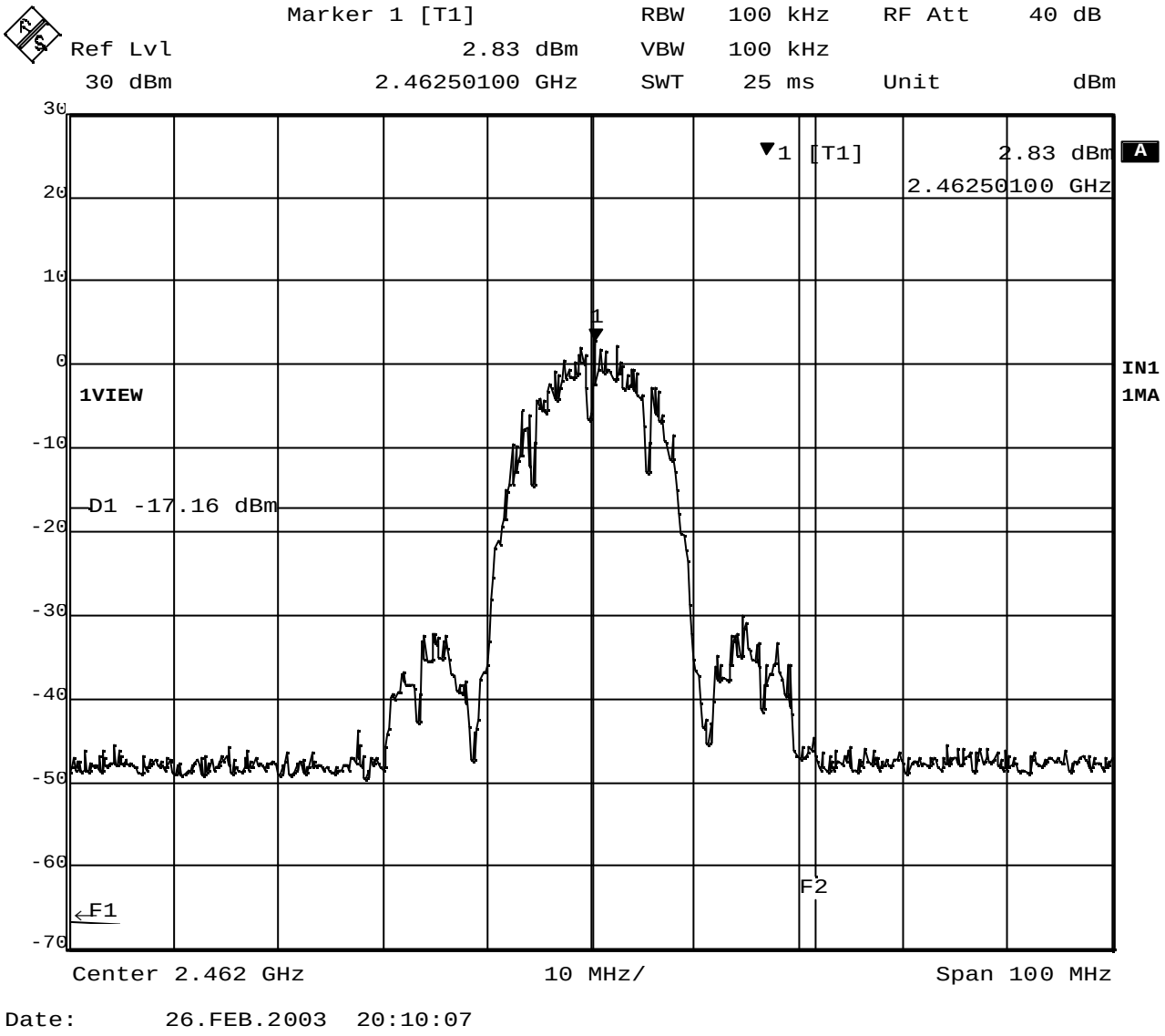

Plot 2-9. Out of band emissions around 2437MHz (11Mb/s)




Plot 2-10. Out of band emissions around 2437MHz (1Mb/s)




Plot 2-11. Out of band emissions around 2462MHz (11Mb/s)




Plot 2-12. Out of band emissions around 2462MHz (1Mb/s)

# 3. Transmitter Output Power

## 3.1 Test Procedure

- A transmitter antenna terminal of EUT is connected to the input of a RF power sensor.
- Measurement is made while EUT is operating in transmission mode at the appropriate center frequency.

Table 3-1 : 6 dB Bandwidth Test Instruments

| **Description** | **Model** | **Serial Numbe r** |
|---|---|---|
| Power Meter | HP 437B | 3043U03437 |
| Power Sensor | HP 8481A | US41030582 |
| Coax cables:<br>- Power Sensor <=> EUT | Length: Loss:<br>20 cm 0.7dB | |

Notes: - HP: Hewlett Packard

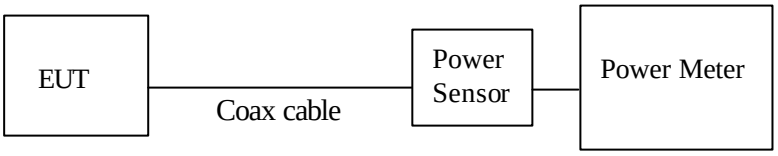



Figure 3: Measurement setup for RF output power

## 3.2 Measurement Results

Test Date: January 14, 2003

Table 3-2. EUT: M/T 2388-2UU, s/n BA00022, TX mode 11Mbps

| Measured Frequency (MHz) | Power Meter Reading (dBm) | Cable Loss (dB) | Results | | Limit [1W] (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| | | | (dBm) | (W) | | |
| 2412 (ch. 1) | 15.1 | 0.7 | 15.8 | 0.0380 | 30.0 | 14.2 |
| 2437 (ch. 6) | 14.8 | 0.7 | 15.5 | 0.0355 | 30.0 | 14.5 |
| 2462 (ch. 11) | 14.7 | 0.7 | 15.4 | 0.0347 | 30.0 | 14.6 |

Table 3-3. EUT: M/T 2388-2UU, s/n BA00022, TX mode 1Mbps

| Measured Frequency (MHz) | Power Meter Reading (dBm) | Cable Loss (dB) | Results | | Limit [1W] (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| | | | (dBm) | (W) | | |
| 2412 (ch. 1) | 15.0 | 0.7 | 15.7 | 0.0372 | 30.0 | 14.3 |
| 2437 (ch. 6) | 14.8 | 0.7 | 15.5 | 0.0355 | 30.0 | 14.5 |
| 2462 (ch. 11) | 14.6 | 0.7 | 15.3 | 0.0339 | 30.0 | 14.7 |

# 4. Transmitter Power Spectral Density

## 4.1 Test Procedure

The peak power density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.
The spectrum analyzer is set to:
RBW= 3kHz, VBW=100kHz, Span=10MHz, Sweep = 2.8 seconds

## 4.2 Test Instruments and Measurement Setup

Same as the Chapter 1(Table 1-1 & Figure 1).

## 4.3 Measurement Results

Test Date: February 26, 2003

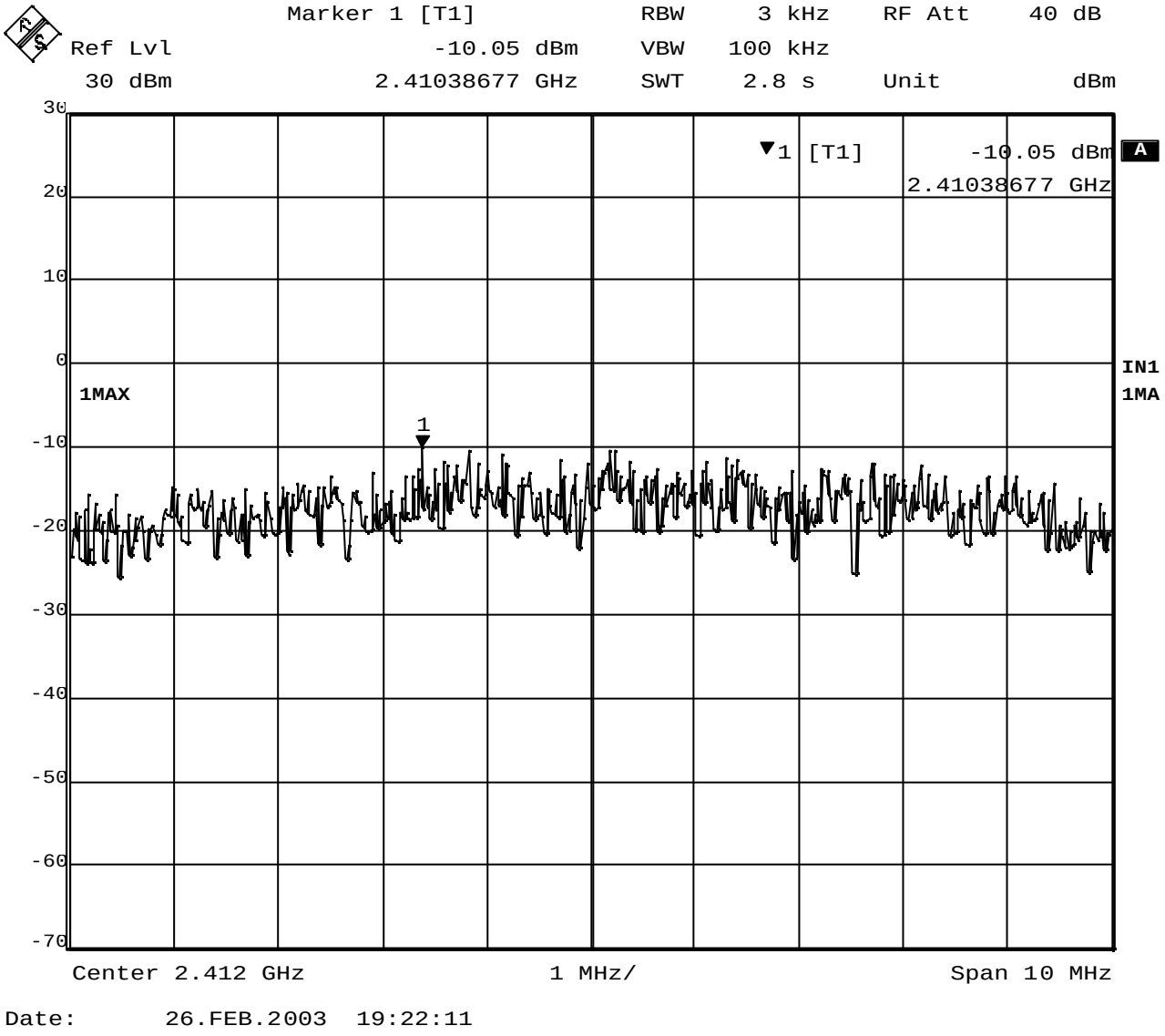
Table 4-1. EUT: M/T 2388-2UU, s/n BA00022 , TX mode 11Mbps

| Ch No. | Frequency (MHz) | **Analyzer Reading** (dBm) | Trace number | Cable loss (dB) | Result (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1 | 2410.39 | -10.05 | Plot 4-1 | 1.3 | -8.75 | 8.0 | 16.75 |
| 6 | 2435.39 | -10.13 | Plot 4-2 | 1.3 | -8.83 | 8.0 | 16.83 |
| 11 | 2460.39 | -10.25 | Plot 4-3 | 1.3 | -8.95 | 8.0 | 16.95 |

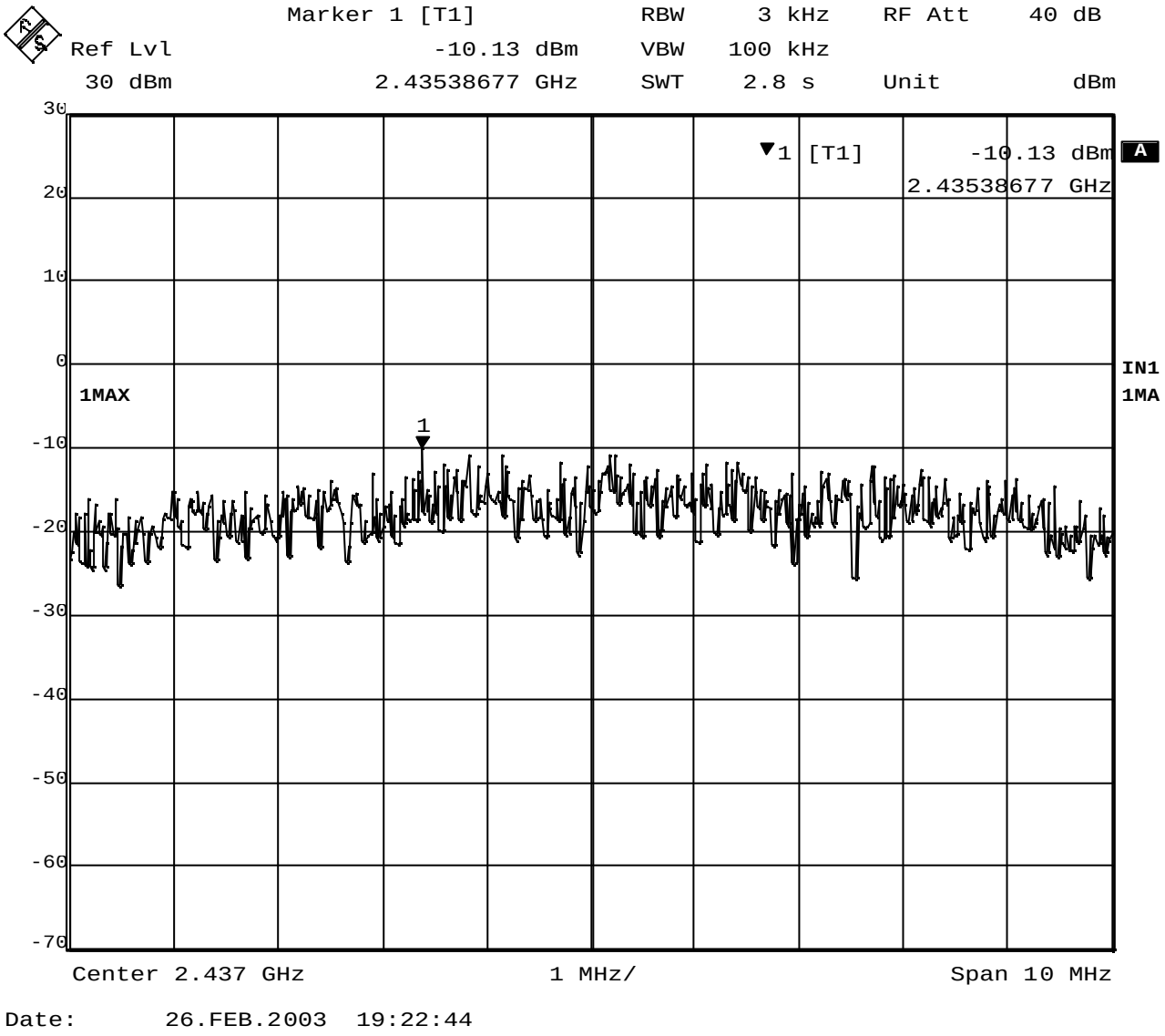
Table 4-2. EUT: M/T 2388-2UU, s/n BA00022 , TX mode 1Mbps

| Ch No. | Frequency (MHz) | **Analyzer Reading** (dBm) | Trace number | Cable loss (dB) | Result (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1 | 2413.63 | -13.08 | Plot 4-4 | 1.3 | -11.78 | 8.0 | 19.78 |
| 6 | 2438.63 | -13.43 | Plot 4-5 | 1.3 | -12.13 | 8.0 | 20.13 |
| 11 | 2463.63 | -13.14 | Plot 4-6 | 1.3 | -11.84 | 8.0 | 19.84 |

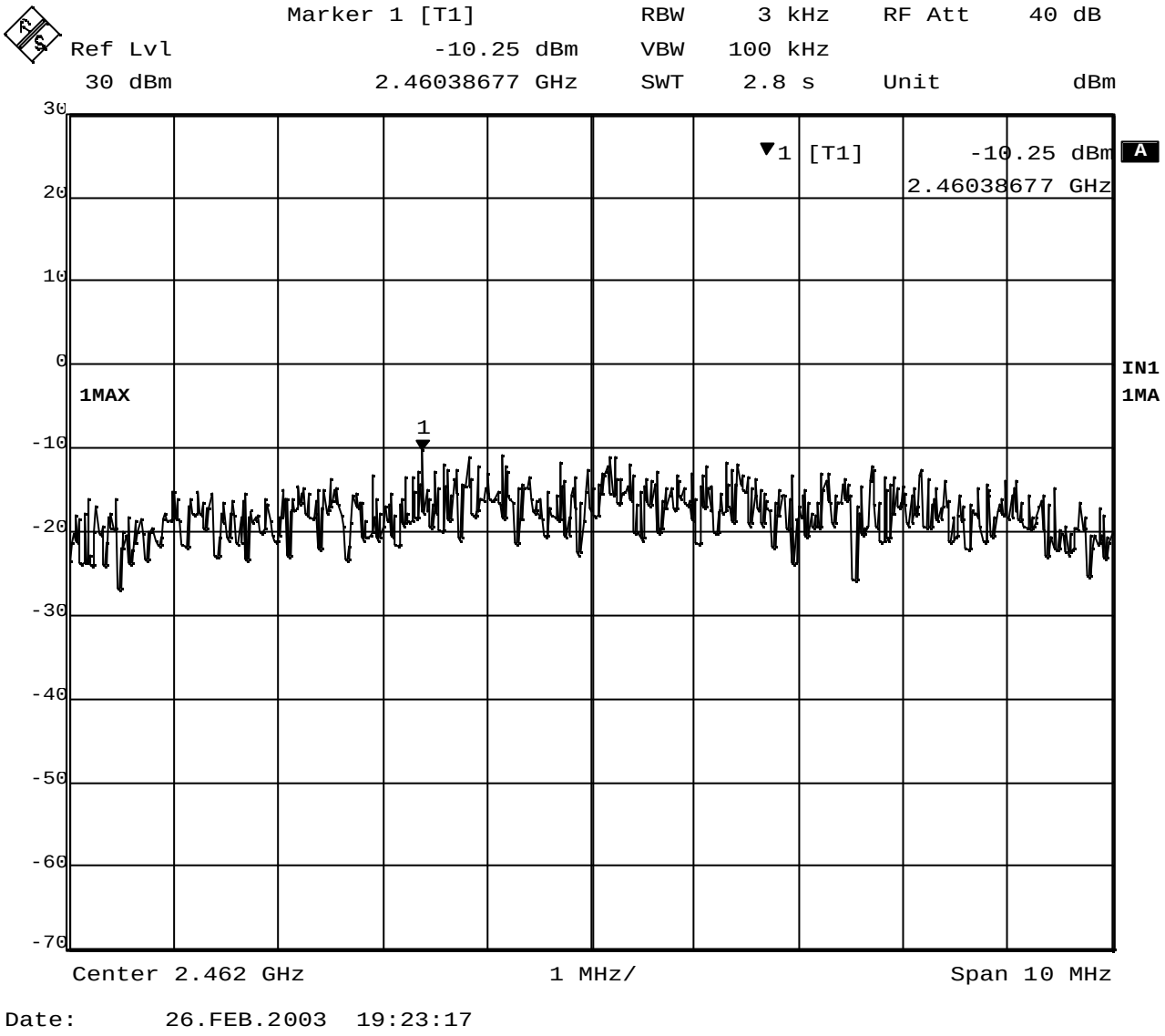
## 4.4 Trace Data



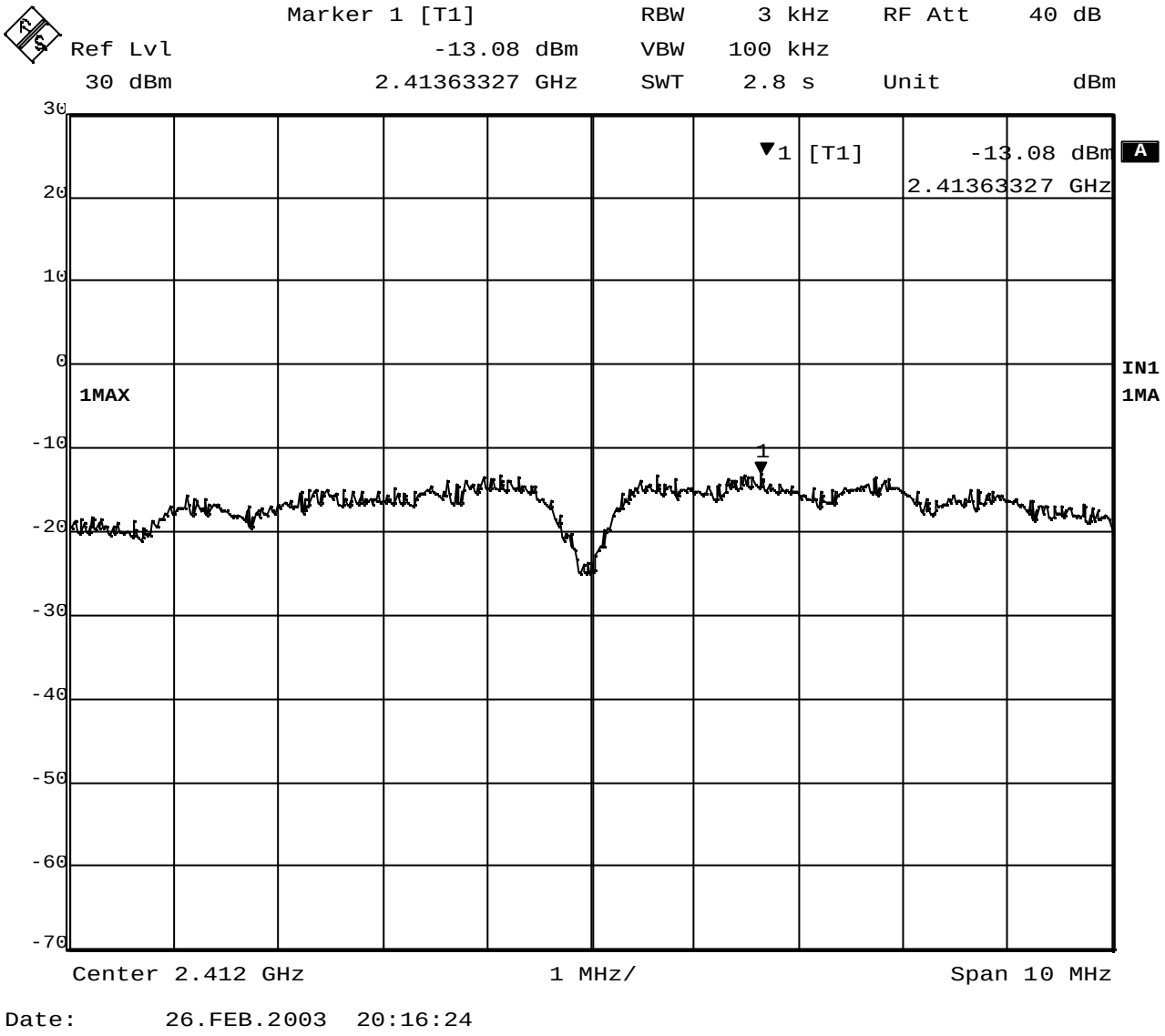

Plot 4-1. Peak Power Spectral Density of 2412MHz (11Mb/s)



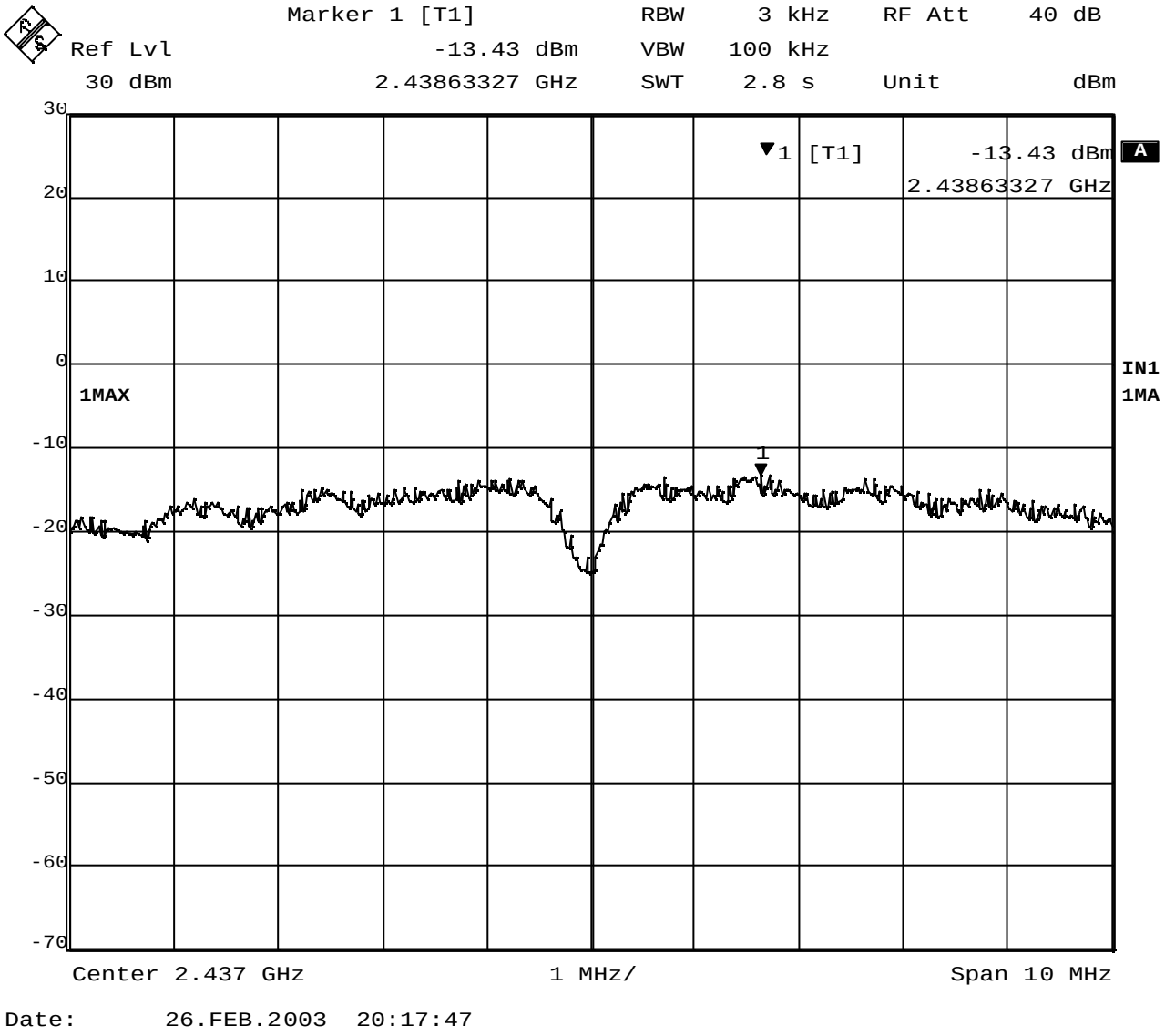

Plot 4-2. Peak Power Spectral Density of 2437MHz (11Mb/s)



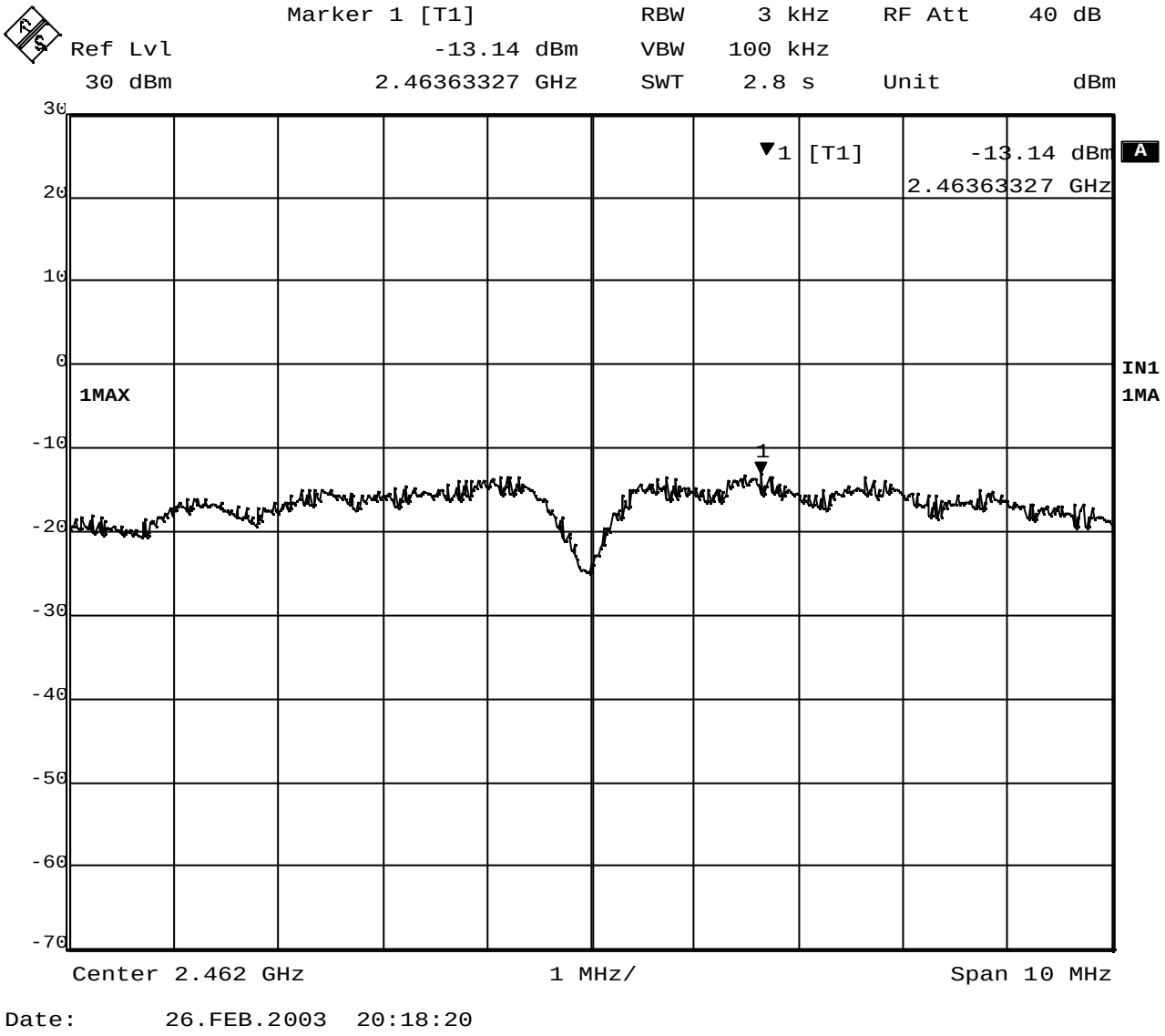

Plot 4-3. Peak Power Spectral Density of 2462MHz (11Mb/s)




Plot 4-4. Peak Power Spectral Density of 2412MHz (1Mb/s)




Plot 4-5. Peak Power Spectral Density of 2437MHz (1Mb/s)




Plot 4-6. Peak Power Spectral Density of 2462MHz (1Mb/s)

# 5. AC WIRELINE CONDUCTED EMISSIONS (150KHz – 30MHz)

## 5.1 Test Procedure

The conducted emissions are measured in the IBM shielded room with a spectrum analyzer in peak hold. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9KHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

## 5.2 Test Instruments and Measurement Setup

Table 5-1. Conducted Emission Test Instrumentation

| **Description** | **Model** | **Serial Number** |
|---|---|---|
| Computer | IBM 6589-13J | 97-15613 |
| Spectrum Analyzer (100Hz-1.5GHz) | HP 85680B | 2601A02634 |
| Spectrum Analyzer Display | HP 85662A | 2542A12308 |
| Quasi-Peak Adapter | HP 85650A | 2043A00062 |
| Receiver (9kHz-30MHz) | R&S ESH3 | 891806/012 |
| LISN | EMCO 3825/2 | 1426 |
| Switch/control unit | HP 3488A | 2719A17228 |
| Plotter | HP 7550A | 2631A33619 |
| Coax cables:<br>- Lisn-L <=> SW/Con.unit (SW100)<br>- Lisn-N <=> SW/Con.unit (SW101)<br>- SW/Con.unit <=> RCVR (Input)<br>- SW/Con.unit<=> Spe Ana.(Signal In) | Length:<br>4 m<br>4 m<br>1 m<br>1 m | <br>- EMIC-L<br>- EMIC-N<br>- EMIC-R<br>- EMIC-S |

Notes: - HP: Hewlett Packard, R&S: Rohde & Schwarz

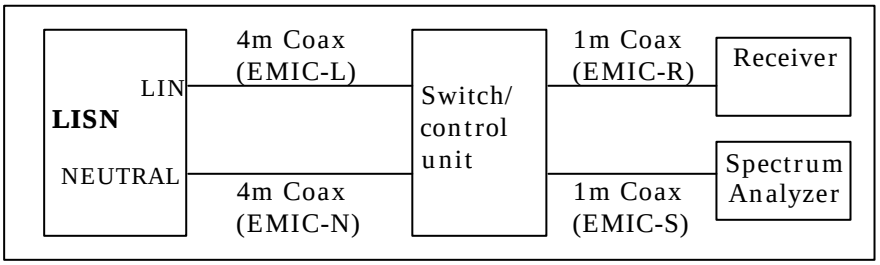



Figure 5. Cables for Conducted Emission Test

## 5.3 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 7.6dB. The 6 highest emissions relative to the limits are reported.

Test Date: January 20, 2003

1) EUT in transmission mode

Table 5-2-1. EUT: M/T 2388-2UU, s/n BA00022, Ch.1(2412MHz) TX mode 11Mbps

| Frequency (MHz) | Phase | QP Voltage (dBμV) | CISPR22 QP Limit (dBμV) | AV Voltage (dBμV) | CISPR22 AV Limit (dBμV) |
|---|---|---|---|---|---|
| 0.3948 | LINE | 34.4 | 58.0 | 31.8 | 48.0 |
| 0.4619 | NEUTRAL | 38.0 | 56.7 | 35.3 | 46.7 |
| 0.5293 | NEUTRAL | 32.3 | 56.0 | 32.3 | 46.0 |
| 0.6650 | NEUTRAL | 33.3 | 56.0 | 30.9 | 46.0 |
| 0.7325 | NEUTRAL | 41.3 | 56.0 | 37.7 | 46.0 |
| 0.7988 | NEUTRAL | 31.5 | 56.0 | 29.2 | 46.0 |

Table 5-2-2. EUT: M/T 2388-2UU, s/n BA00022 , Ch.6(2437MHz) TX mode 11Mbps

| Frequency (MHz) | Phase | QP Voltage (dBμV) | CISPR22 QP Limit (dBμV) | AV Voltage (dBμV) | CISPR22 AV Limit (dBμV) |
|---|---|---|---|---|---|
| 0.4651 | NEUTRAL | 39.2 | 56.6 | 38.7 | 46.6 |
| 0.5321 | LINE | 31.6 | 56.0 | 29.4 | 46.0 |
| 0.6701 | NEUTRAL | 31.9 | 56.0 | 30.8 | 46.0 |
| 0.7325 | NEUTRAL | 41.7 | 56.0 | 38.4 | 46.0 |
| 0.8034 | NEUTRAL | 31.1 | 56.0 | 28.8 | 46.0 |
| 0.9994 | NEUTRAL | 30.4 | 56.0 | 29.7 | 46.0 |

Table 5-2-3. EUT: M/T 2388-2UU, s/n BA00022, Ch.11(2462MHz) TX mode 11Mbps

| Frequency (MHz) | Phase | QP Voltage (dBμV) | CISPR22 QP Limit (dBμV) | AV Voltage (dBμV) | CISPR22 AV Limit (dBμV) |
|---|---|---|---|---|---|
| 0.3977 | LINE | 33.9 | 57.9 | 31.1 | 47.9 |
| 0.4644 | NEUTRAL | 45.7 | 56.6 | 37.0 | 46.6 |
| 0.5329 | LINE | 30.6 | 56.0 | 28.6 | 46.0 |
| 0.6018 | NEUTRAL | 30.1 | 56.0 | 25.3 | 46.0 |
| 0.6650 | NEUTRAL | 31.8 | 56.0 | 30.6 | 46.0 |
| 0.7333 | NEUTRAL | 41.6 | 56.0 | 38.4 | 46.0 |

2) EUT in receiving mode

Table 5-2-4. EUT: M/T 2388-2UU, s/n BA00022, Ch.6(2437MHz) RX mode

| Frequency (MHz) | Phase | QP Voltage (dBμV) | CISPR22 QP Limit (dBμV) | AV Voltage (dBμV) | CISPR22 AV Limit (dBμV) |
|---|---|---|---|---|---|
| 0.3322 | NEUTRAL | 35.6 | 59.4 | 32.9 | 49.4 |
| 0.4681 | NEUTRAL | 39.0 | 56.5 | 38.2 | 46.5 |
| 0.5351 | LINE | 30.6 | 56.0 | 28.6 | 46.0 |
| 0.6661 | NEUTRAL | 32.6 | 56.0 | 31.7 | 46.0 |
| 0.7329 | LINE | 41.1 | 56.0 | 38.3 | 46.0 |
| 0.9361 | NEUTRAL | 31.0 | 56.0 | 30.3 | 46.0 |

# 6. RESTRICTED BANDS RADIATIONS (30MHz – 1GHz)

## 6.1 Test Procedure

Preliminary radiated emissions are measured in the semi-anechoic chamber at a 3 meter distance on every azimuth in both horizontal and vertical polarity. The antennas are also scanned in height. The emissions are recorded with a spectrum analyzer in peak hold mode. The identified emissions are further maximized by a cable manipulation. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120kHz. The highest emissions relative to the limit are listed.

## 6.2 Test Instruments and Measurement Setup

Table 6-1 Radiated Emission Test Instrumentation

| **Description** | **Model** | **Serial Number** |
|---|---|---|
| Computer | IBM 5551-L | #4 |
| Spectrum Analyzer (100Hz-1.5GHz) for 30-200MHz | HP 85680B | 3019A05155 |
| Spectrum Analyzer Display for 30-200MHz | HP 85662A | 3026A19353 |
| Quasi-Peak Adapter for 30-200MHz | HP 85650A | 3033A01449 |
| Spectrum Analyzer (100Hz-1.5GHz) for 200-1000MHz | HP 85680B | 2841A04252 |
| Spectrum Analyzer Display for 200-1000MHz | HP 85662A | 2816A16831 |
| Quasi-Peak Adapter for 200-1000MHz | HP 85650A | 2811A01156 |
| Amplifier (100KHz-1.3GHz)<br>- for 30-200MHz<br>- for 200-1000MHz | <br>HP 8447D<br>HP 8447D | <br>2805A02919<br>2944A03506 |
| Biconical Antenna (30-200MHz) | EMCO 3108 | 2309 |
| Log-Periodic Antenna (200-1000MHz) | EMCO 3146 | 1585 |
| Receiver (20MHz-1.3GHz) | R&S ESVP | 893202/018 |
| Switch/control unit | HP 3488A | 2719A17226 |
| N-Coax cables:<br>- Bi-coni Ant <=> 10m Cable<br>- 10m Cable <=> Shield Panel<br>- Shield Panel <=> RF Amp<br>- RF Amp <=> Power Splitter<br>- Log-peri Ant <=> 10m Cable<br>- 10m Cable <=> Shield Panel<br>- Shield Panel <=> RF Amp<br>- RF Amp <=> Power Splitter | Length:<br>9 m<br>10 m<br>7 m<br>0.5m<br>9 m<br>10 m<br>7 m<br>0.5m | <br>- EM103L01<br>- EM103L02<br>- EM103L03<br>- EM103L04<br>- EM103H01<br>- EM103H02<br>- EM103H03<br>- EM103H04 |
| Coax cables:<br>- Power Splitter <=> SW/Con.unit (SW110)<br>- Power Splitter <=> SW/Con.unit (SW300)<br>- Power Splitter <=> SW/Con.unit (SW100)<br>- Power Splitter <=> SW/Con.unit (SW301)<br>- SW/Con.unit <=> Receiver (Input)<br>- SW/Con.unit <=> Spe Ana.(Signal In) for 30- 200MHz | <br>1 m<br>1 m<br>1 m<br>1 m<br>2 m<br>2 m | <br>- EM103L05<br>- EM103L06<br>- EM103H05<br>- EM103H06<br>- EM1RCV<br>- EM1SPL |

| | | |
|---|---|---|
| - SW/Con.unit <=> Spe Ana.(Signal In) for 200-1000MHz | 2 m | - EM1SPH |

Notes:
- HP: Hewlett Packard, R&S: Rohde & Schwarz

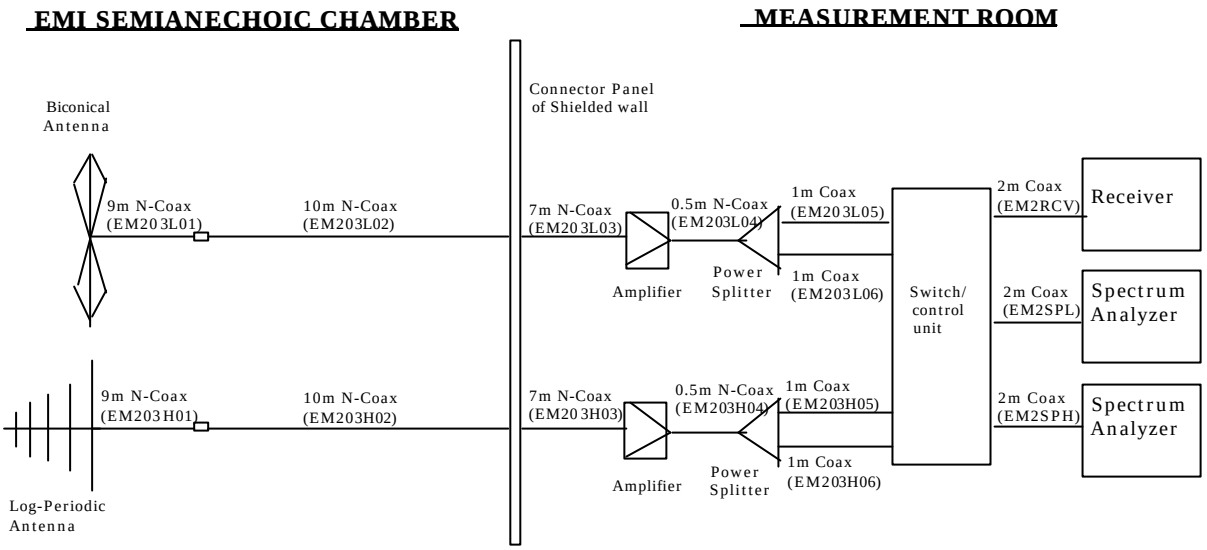



Figure 6 Cables for Radiated Emission Test

## 6.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver. All factors are included in the reported data.

$$FS = R + AF + CORR$$

where:

FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL - AG
CL = Cable Loss
AG = Amplifier Gain

For example :
Given a Receiver input reading of 51.5dB$\mu$V; Antenna Factor of 8.5dB/m; Cable Loss of 1.3dB; and an Amplifier Gain of 26dB. The Field Strength of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 = 35.3 dB\mu V/m$$

Conversion between dB$\mu$V/m (or dB$\mu$V) and $\mu$V/m (or $\mu$V) are done as:

$$Level(dB\mu V/m) = 20 \times Log( Level(\mu V/m) )$$

40dB$\mu$V/m = 100$\mu$V/m
48dB$\mu$V/m = 250$\mu$V/m

## 6.4 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 6.3 dB at 30MHz - 1000MHz band.
The 6 highest emissions relative to the limits are reported.

Test Date: January 14, 2003

1) EUT in transmission mode

Table 6-2-1. EUT: M/T 2388-2UU, s/n BA00022, Ch.1(2412MHz) TX mode 11Mbps

| Frequency (MHz) | Polarity (H/V) | Measured (dBμV) | Antenna Factor (dB/m) | Corr. Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Field Strength (μV/m) | Limit (μV/m) |
|---|---|---|---|---|---|---|---|---|
| 192.591 | H | 38.9 | 13.4 | -15.9 | 36.4 | 43.5 | 66.1 | 150 |
| 332.314 | V | 36.8 | 14.1 | -13.9 | 37.0 | 46.0 | 70.8 | 200 |
| 450.996 | V | 35.9 | 16.4 | -13.7 | 38.6 | 46.0 | 85.1 | 200 |
| 465.069 | V | 33.9 | 16.8 | -13.8 | 36.9 | 46.0 | 70.0 | 200 |
| 830.423 | H | 24.0 | 21.6 | -9.7 | 35.9 | 46.0 | 62.4 | 200 |
| 862.215 | H | 27.2 | 22.1 | -10.2 | 39.1 | 46.0 | 90.2 | 200 |

Table 6-2-2. EUT: M/T 2388-2UU, s/n BA00022, Ch.6(2437MHz) TX mode 11Mbps

| Frequency (MHz) | Polarity (H/V) | Measured (dBμV) | Antenna Factor (dB/m) | Corr. Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Field Strength (μV/m) | Limit (μV/m) |
|---|---|---|---|---|---|---|---|---|
| 332.746 | V | 38.0 | 14.1 | -13.9 | 38.2 | 46.0 | 81.3 | 200 |
| 351.997 | V | 35.8 | 14.3 | -13.6 | 36.5 | 46.0 | 66.8 | 200 |
| 450.543 | V | 35.2 | 16.4 | -13.7 | 37.9 | 46.0 | 78.5 | 200 |
| 465.315 | V | 34.3 | 16.8 | -13.8 | 37.3 | 46.0 | 73.3 | 200 |
| 832.475 | H | 24.6 | 21.6 | -9.7 | 36.5 | 46.0 | 66.8 | 200 |
| 862.821 | H | 25.1 | 22.1 | -10.2 | 37.0 | 46.0 | 70.8 | 200 |

Table 6-2-3. EUT: M/T 2388-2UU, s/n BA00022, Ch.11(2462MHz) TX mode 11Mbps

| Frequency (MHz) | Polarity (H/V) | Measured (dBμV) | Antenna Factor (dB/m) | Corr. Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Field Strength (μV/m) | Limit (μV/m) |
|---|---|---|---|---|---|---|---|---|
| 193.978 | H | 31.8 | 13.5 | -15.9 | 29.4 | 43.5 | 29.5 | 150 |
| 332.059 | V | 36.3 | 14.1 | -13.9 | 36.5 | 46.0 | 66.8 | 200 |
| 449.278 | V | 34.0 | 16.3 | -13.8 | 36.5 | 46.0 | 66.8 | 200 |
| 463.598 | V | 35.5 | 16.7 | -13.9 | 38.3 | 46.0 | 82.2 | 200 |
| 832.484 | H | 25.1 | 21.6 | -9.7 | 37.0 | 46.0 | 70.8 | 200 |
| 860.282 | H | 26.6 | 22.1 | -10.3 | 38.4 | 46.0 | 83.2 | 200 |

2) EUT in receiving mode

Table 6-2-4. EUT: M/T 2388-2UU, s/n BA00022, RX mode

| Frequency (MHz) | Polarity (H/V) | Measured (dBμV) | Antenna Factor (dB/m) | Corr. Factor (dB) | Field Strength (dBμV/m) | Limit (dBμV/m) | Field Strength (μV/m) | Limit (μV/m) |
|---|---|---|---|---|---|---|---|---|
| 299.092 | H | 36.4 | 14 | -14.2 | 36.2 | 46.0 | 64.6 | 200 |
| 331.911 | V | 37.1 | 14.1 | -13.9 | 37.3 | 46.0 | 73.3 | 200 |
| 450.543 | V | 35.0 | 16.4 | -13.7 | 37.7 | 46.0 | 76.7 | 200 |
| 465.594 | V | 35.5 | 16.8 | -13.8 | 38.5 | 46.0 | 84.1 | 200 |
| 832.489 | H | 25.1 | 21.6 | -9.7 | 37.0 | 46.0 | 70.8 | 200 |
| 862.871 | H | 27.8 | 22.1 | -10.2 | 39.7 | 46.0 | 96.6 | 200 |

# 7. RESTRICTED BANDS RADIATIONS (1GHz – 25GHz)

## 7.1 Test Procedure

Radiated emissions were measured in the frequency range with 1 GHz to 25GHz in transmitting mode and 1 GHz to 12.5 GHz in receiving mode. All tests were performed in the semi-anechoic chamber at a 3-meter distance (except for the frequency range with 18 GHz to 25 GHz where test distance was reduced to 1 meter) on both horizontal and vertical polarities. The antenna was also scanned in height. The emissions are recorded with a spectrum analyzer in peak hold mode. The identified emissions are further maximized as a function of cable manipulation, azimuth, and antenna height. The emissions closest to the limits are measured in the peak mode with the tuned spectrum analyzer using a bandwidth of 1MHz and the average setting mode with the tuned spectrum analyzer using resolution bandwidth of 1MHz / video bandwidth of 1kHz or 100Hz. The highest emissions relative to the limit are listed.

## 7.2 Test Instruments and Measurement Setup

Table 7 Radiated Emission Test Instrumentation (1GHz – 25GHz)

| **Description** | **Model** | **Serial Number** |
|---|---|---|
| Spectrum Analyzer EMI Test Receiver | R&S ESI26 | 836119/003 |
| Amplifier (1-26.5GHz) | HP 8449B | 3008A00582 |
| Horn Antenna (1- 18GHz) | EMCO 3115 | 9903-5774 |
| Horn Antenna (3.95 – 5.85GHz) | EMCO 3160-5 | 1099 |
| Horn Antenna (5.85 – 8.20GHz) | EMCO 3160-6 | 9712-1044 |
| Horn Antenna (8.20 – 12.40GHz) | EMCO 3160-7 | 1156 |
| Horn Antenna (18- 26.5GHz) | EMCO 3160-9 | 0004-1202 |
| SF106 cables:<br>- Horn Ant <=> RF Amp.<br>- RF Amp.<=>Spectrum Analyzer | Length:<br>6 m<br>15 m | <br>- EM206SCO<br>- EM215SCO |

Notes: - HP: Hewlett Packard, R&S: Rohde & Schwarz

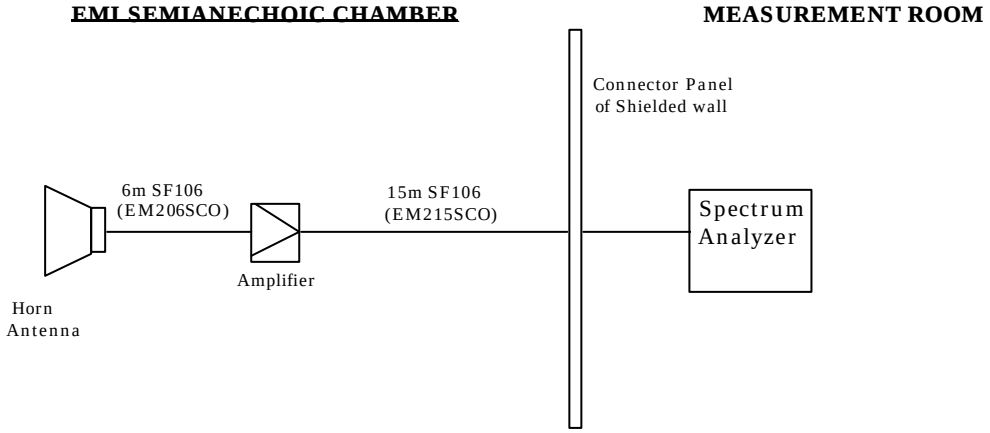



Figure 7 Cables for Radiated Emission Test

Prepared by T. Asano

## 7.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

FS = R + AF + CORR - FO

where:

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR= Correction Factor = CL-AG
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor

For example:
Given a Spectrum Analyzer input reading of 51.5 dBμV; Antenna Factor of 8.5 dB/m; Cable Loss of 1.3 dB; Falloff Factor of 0 dB; and an Amplifier Gain of 26 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 – 26 – 0.0 = 35.6 dBμV/m

Conversions between dBμV/m (or dBμV) and μV/m (or μV) are done as :

Level(dBμV/m) = 20 × Log (Level(μV/m))
40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

## 7.4 Measurement Results

The EUT was found to comply to the limits of FCC Part 15 Subpart C and RSS-210 with a margin of 6.1 dB. The measurement was done for the frequency range of 1 GHz to 25 GHz in TX mode and 1 GHz to 12.5GHz in RX mode.

Test Date: January 17 and 24, 2003

1) EUT in transmission mode

Table 7-2-1. EUT: M/T 2388-2UU, s/n BA00022, Ch.1(2412MHz) TX mode 11Mbps

| Frequency (GHz) | Polarity (H/V) | Measured (dBμV) ***(peak)*** | Measured (dBμV) ***(average)*** | Antenna Factor (dB/m) | Corr. Factor (dB) | Falloff Factor (dB) | Field Strength (dBμV/m) ***(peak)*** | FCC Limit (dBμV/m) ***(peak)*** | Field Strength (dBμV/m) ***(average)*** | FCC Limit (dBμV/m) ***(average)*** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.065 | V | 52.9 | - | 24.6 | -32.7 | 0.0 | 44.8 | 74.0 | - | 54.0 |
| 1.325 | V | 55.2 | - | 25.6 | -31.8 | 0.0 | 49.0 | 74.0 | - | 54.0 |
| 1.498 | V | 50.9 | - | 25.5 | -31.5 | 0.0 | 44.9 | 74.0 | - | 54.0 |
| 2.347 | H | 50.0 | - | 28.1 | -30.3 | 0.0 | 47.8 | 74.0 | - | 54.0 |
| 2.370 | H | 51.9 | - | 28.1 | -30.3 | 0.0 | 49.7 | 74.0 | - | 54.0 |
| 2.390 | H | 57.3 | 50.1 | 28.2 | -30.4 | 0.0 | 55.1 | 74.0 | 47.9 | 54.0 |
| 2.413 | H | 110.1 | 102.4 | 28.3 | -30.4 | 0.0 | 108.0 | OB* | 100.3 | OB* |
| 4.076 | V | 46.3 | - | 27.2 | -28.4 | 0.0 | 45.1 | 74.0 | - | 54.0 |
| 4.828 | V | 40.0 | - | 27.1 | -27.2 | 0.0 | 39.9 | 74.0 | - | 54.0 |
| 8.152 | V | 46.5 | - | 30.0 | -25.7 | 0.0 | 50.8 | 74.0 | - | 54.0 |

*Note: OB means “operation band” (2400-2483.5MHz); in this case limit is 1W (measured conducted with power meter).

Table 7-2-2. EUT: M/T 2388-2UU, s/n BA00022, Ch.6(2437MHz) TX mode 11Mbps

| Frequency (GHz) | Polarity (H/V) | Measured (dBμV) ***(peak)*** | Measured (dBμV) ***(average)*** | Antenna Factor (dB/m) | Corr. Factor (dB) | Falloff Factor (dB) | Field Strength (dBμV/m) ***(peak)*** | FCC Limit (dBμV/m) ***(peak)*** | Field Strength (dBμV/m) ***(average)*** | FCC Limit (dBμV/m) ***(average)*** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.065 | V | 53.4 | - | 24.6 | -32.9 | 0.0 | 45.1 | 74.0 | - | 54.0 |
| 1.330 | V | 57.5 | - | 25.6 | -31.9 | 0.0 | 51.2 | 74.0 | - | 54.0 |
| 1.498 | V | 51.1 | - | 25.5 | -31.5 | 0.0 | 45.1 | 74.0 | - | 54.0 |
| 2.284 | H | 51.0 | - | 27.8 | -30.5 | 0.0 | 48.3 | 74.0 | - | 54.0 |
| 2.328 | H | 50.7 | - | 28.0 | -30.3 | 0.0 | 48.4 | 74.0 | - | 54.0 |
| 2.371 | H | 50.8 | - | 28.2 | -30.4 | 0.0 | 48.6 | 74.0 | - | 54.0 |
| 2.438 | H | 110.1 | 101.8 | 28.4 | -30.3 | 0.0 | 108.2 | OB* | 99.9 | OB* |
| 4.126 | V | 48.9 | - | 27.2 | -27.9 | 0.0 | 48.2 | 74.0 | - | 54.0 |
| 4.878 | V | 40.3 | - | 27.0 | -26.9 | 0.0 | 40.4 | 74.0 | - | 54.0 |
| 7.315 | V | 37.3 | - | 29.8 | -25.7 | 0.0 | 41.4 | 74.0 | - | 54.0 |
| 8.251 | V | 41.9 | - | 33.4 | -24.7 | 0.0 | 50.6 | 74.0 | - | 54.0 |

*Note: OB means “operation band” (2400-2483.5MHz); in this case limit is 1W (measured conducted with power meter).

Table 7-2-3. EUT: M/T 2388-2UU, s/n ZZ-00163, Ch.11(2462MHz) TX mode 11Mbps

| Frequency (GHz) | Polarity (H/V) | Measured (dBμV) ***(peak)*** | Measured (dBμV) ***(average)*** | Antenna Factor (dB/m) | Corr. Factor (dB) | Falloff Factor (dB) | Field Strength (dBμV/m) ***(peak)*** | FCC Limit (dBμV/m) ***(peak)*** | Field Strength (dBμV/m) ***(average)*** | FCC Limit (dBμV/m) ***(average)*** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.065 | V | 52.8 | - | 24.6 | -32.9 | 0.0 | 44.5 | 74.0 | - | 54.0 |
| 1.330 | V | 57.7 | - | 25.6 | -31.9 | 0.0 | 51.4 | 74.0 | - | 54.0 |
| 1.498 | V | 51.3 | - | 25.5 | -31.5 | 0.0 | 45.3 | 74.0 | - | 54.0 |
| 2.288 | H | 50.8 | - | 27.8 | -30.5 | 0.0 | 48.1 | 74.0 | - | 54.0 |
| 2.353 | H | 51.0 | - | 28.1 | -30.4 | 0.0 | 48.7 | 74.0 | - | 54.0 |
| 2.463 | H | 109.4 | 101.6 | 28.4 | -30.2 | 0.0 | 107.6 | OB* | 99.8 | OB* |
| 2.484 | H | 55.3 | - | 28.4 | -30.2 | 0.0 | 53.5 | 74.0 | - | 54.0 |
| 2.488 | H | 51.7 | - | 28.4 | -30.2 | 0.0 | 49.9 | 74.0 | - | 54.0 |
| 4.174 | V | 47.5 | - | 27.2 | -27.9 | 0.0 | 46.8 | 74.0 | - | 54.0 |
| 4.928 | V | 41.2 | - | 27.0 | -27.7 | 0.0 | 40.5 | 74.0 | - | 54.0 |
| 7.388 | V | 39.6 | - | 29.8 | -26.2 | 0.0 | 43.2 | 74.0 | - | 54.0 |
| 8.351 | V | 41.7 | - | 33.4 | -24.9 | 0.0 | 50.2 | 74.0 | - | 54.0 |

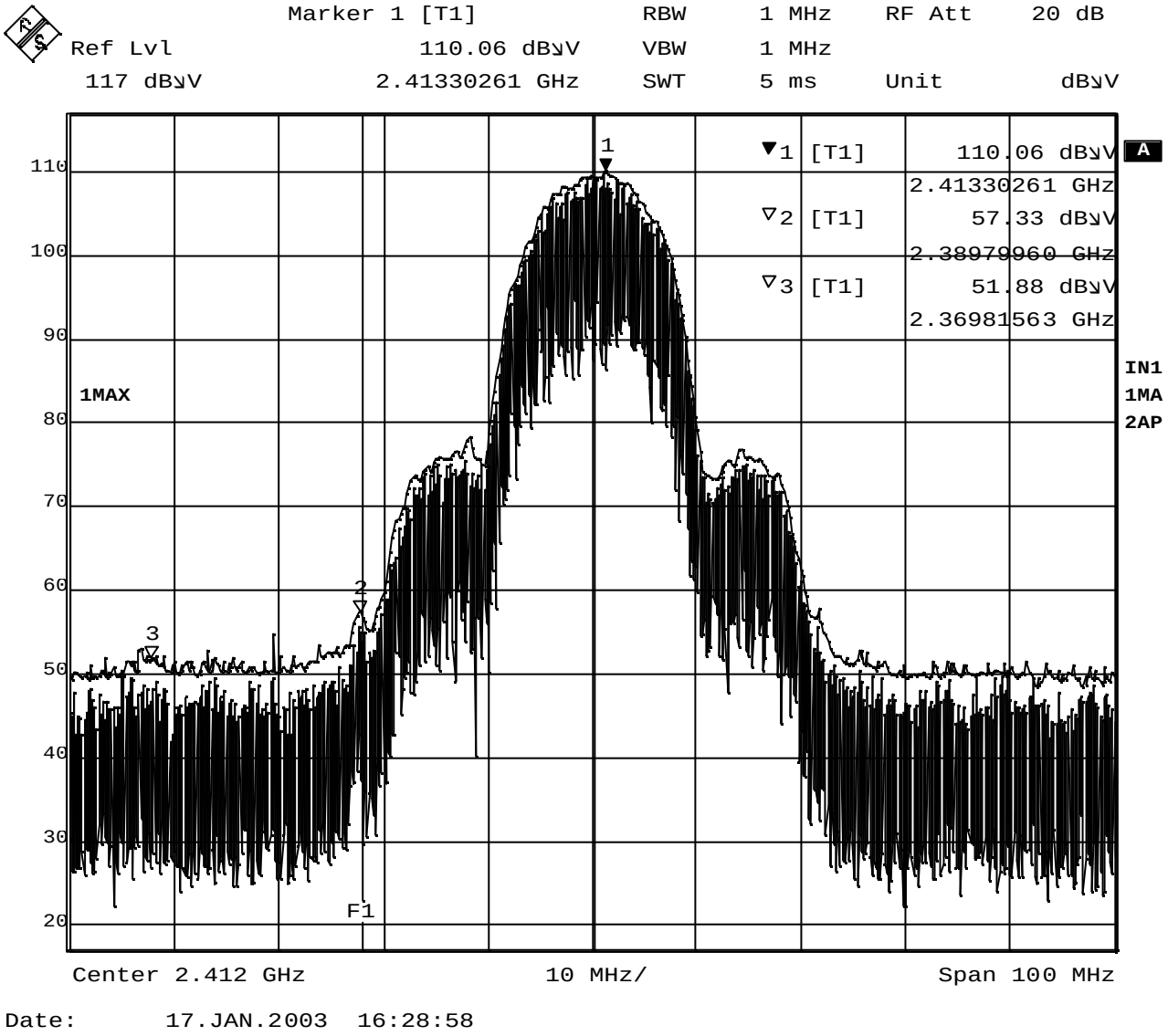
*Note: OB means “operation band” (2400-2483.5MHz); in this case limit is 1W (measured conducted with power meter).

2) EUT in receiving mode

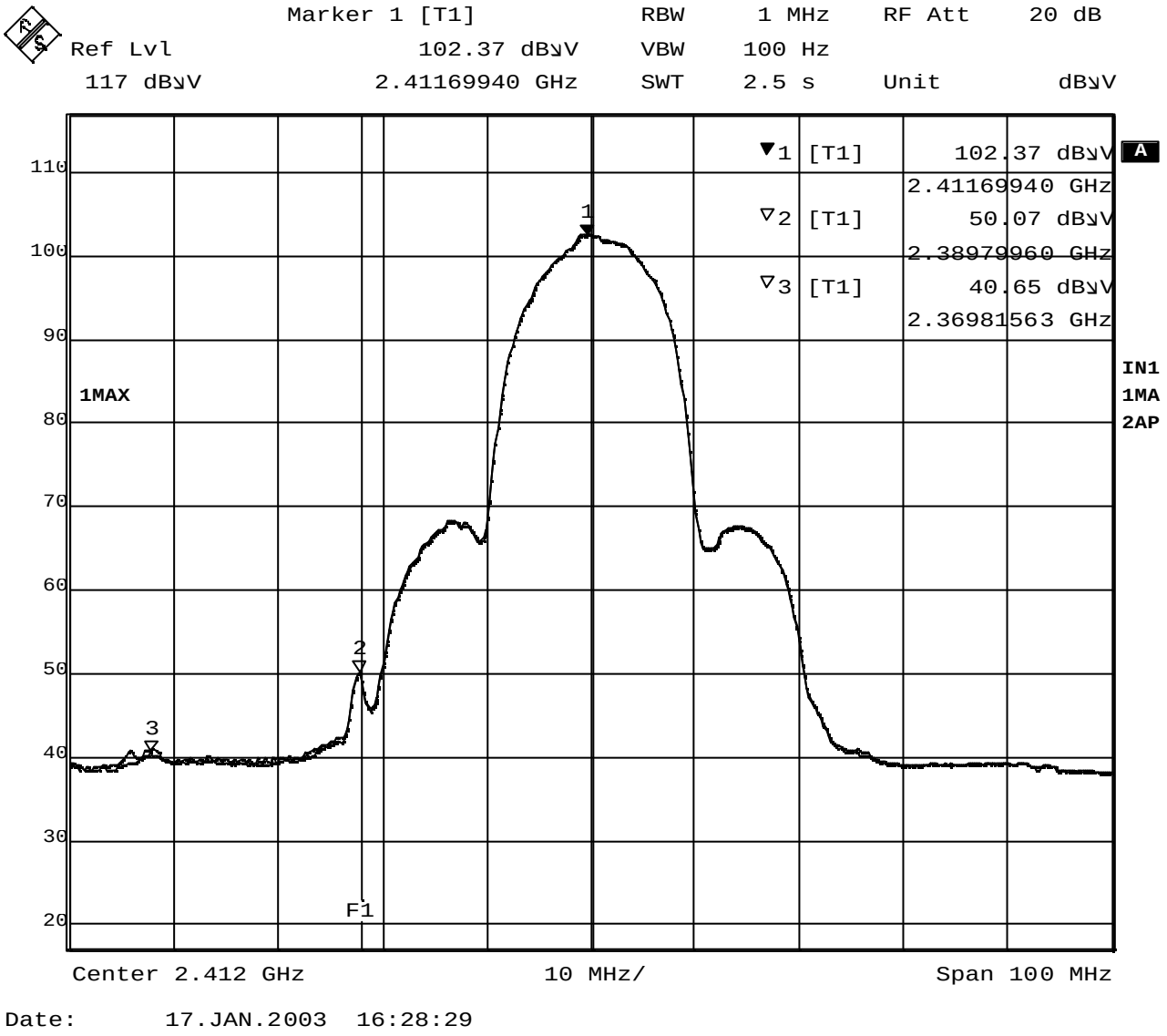
Table 7-2-4. EUT: M/T 2388-2UU, s/n BA00022, Ch.6(2437MHz) RX mode

| Frequency (GHz) | Polarity (H/V) | Measured (dBμV) ***(peak)*** | Measured (dBμV) ***(average)*** | Antenna Factor (dB/m) | Corr. Factor (dB) | Falloff Factor (dB) | Field Strength (dBμV/m) ***(peak)*** | FCC Limit (dBμV/m) ***(peak)*** | Field Strength (dBμV/m) ***(average)*** | FCC Limit (dBμV/m) ***(average)*** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.065 | V | 60.1 | - | 24.6 | -32.9 | 0.0 | 51.8 | 74.0 | - | 54.0 |
| 1.125 | V | 51.0 | - | 24.5 | -32.5 | 0.0 | 43.0 | 74.0 | - | 54.0 |
| 1.498 | V | 51.0 | - | 25.5 | -31.5 | 0.0 | 45.0 | 74.0 | - | 54.0 |
| 4.124 | V | 46.9 | - | 27.2 | -27.9 | 0.0 | 46.2 | 74.0 | - | 54.0 |
| 8.251 | V | 43.9 | - | 33.4 | -24.7 | 0.0 | 52.6 | 74.0 | - | 54.0 |

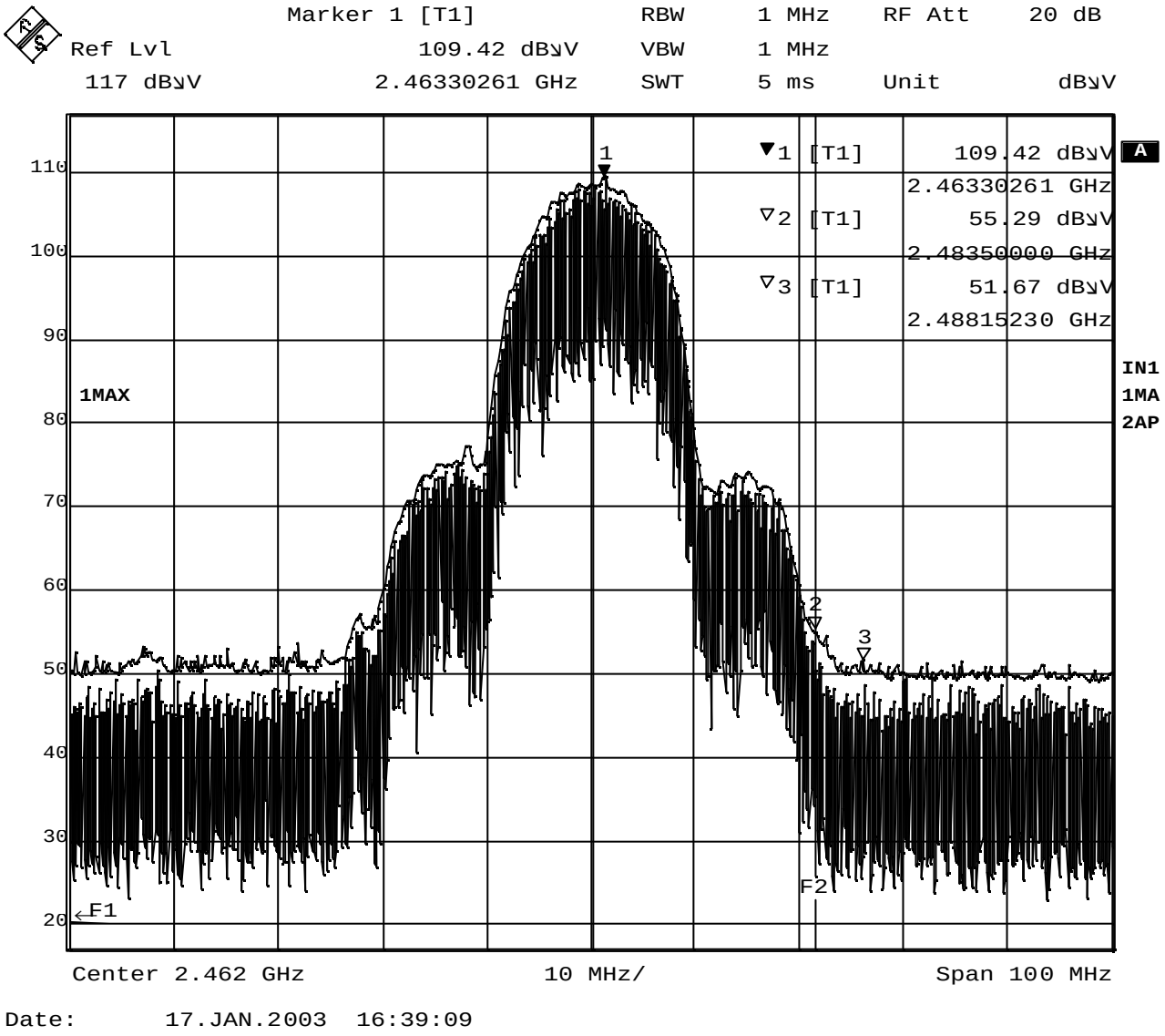
## Measurement plots for adjacent restricted band



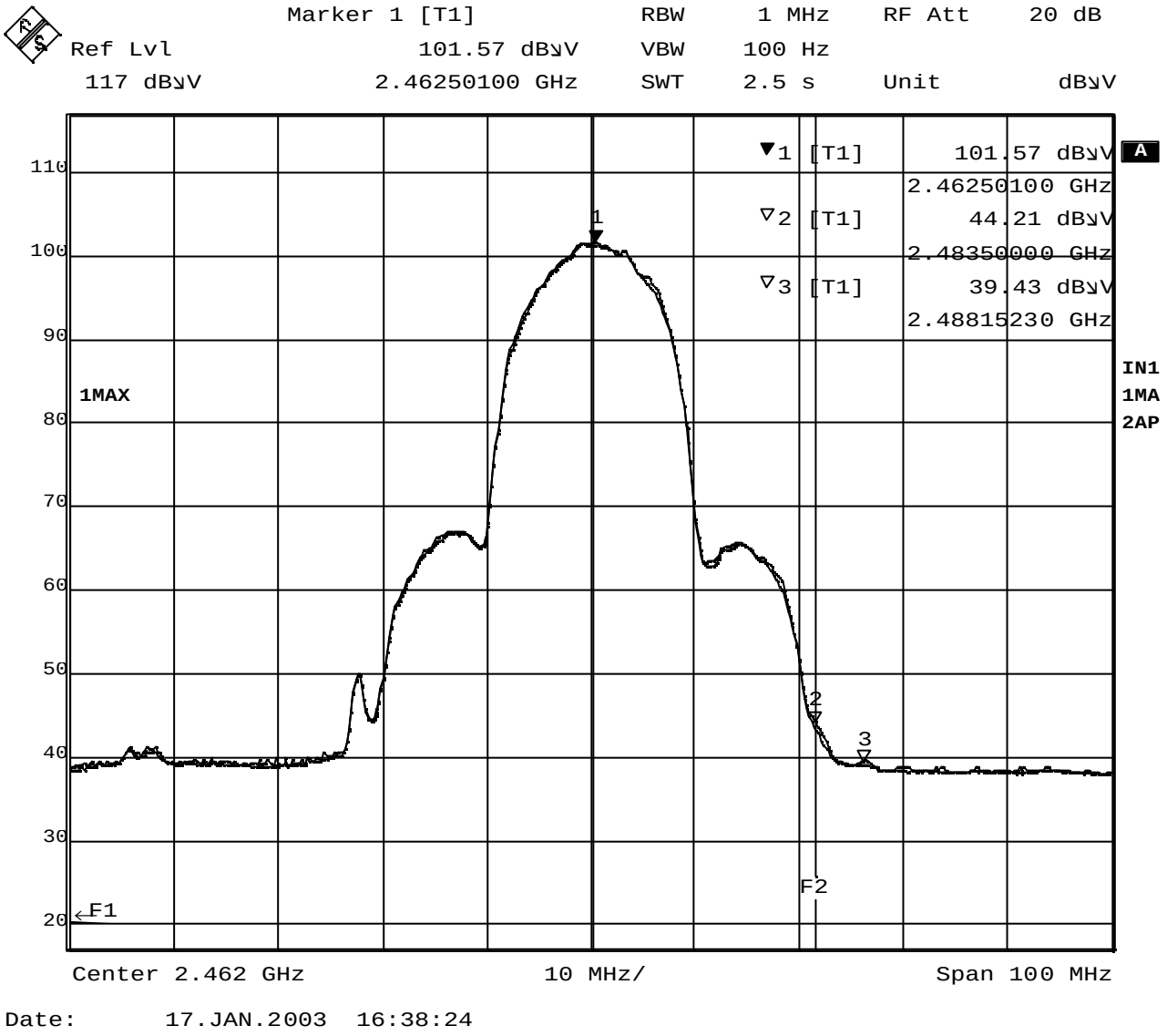

Plot 7-2-1 Ch.1 2412MHz TX 11Mb/s (Peak)




Plot 7-2-2 Ch.1 2412MHz TX11 Mb/s (Average)




Plot 7-2-3 Ch.11 2462MHz TX 11Mb/s (Peak)




Plot 7-2-4 Ch.11 2462MHz TX 11Mb/s (Average)