

# CETECOM ICT Services GmbH

Radio Satellite Communication

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RSC14

issue test report consist of 55 Pages

Page 1 (55)

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**TTI-P-G 166/98-30**

## **Accredited Bluetooth™ Test Facility (BQTF)**

**Test report no.: 2-2695-01-02/01**  
**FCC Part 15.247 / CANADA RSS-210**  
**M-RU77**  
**FCC-ID: DZL201513**

**CETECOM – ICT Services GmbH**  
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66117 Saarbrücken, Germany

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### 1 General information

#### 1.1 Notes

**The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM ICT Services GmbH.**

#### 1.2 Testing laboratory

CETECOM ICT Services GmbH

Untertürkheimer Straße 6 - 10

66117 Saarbrücken

Germany

Telephone : + 49 681 598 - 9100

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Internet : www.cetecom.de

**Accredited testing laboratory**

**DAR-registration number : TTI-P-G 166/98-30**

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

BLUETOOTH is a trademark owned by Bluetooth SIG, Inc. and licensed to CETECOM

## 1.3 Details of applicant

**Name** : LOGITECH Europe SA  
**Street** : ZI Moulin du Choc  
**City** : 1122 Romanel / Morges  
**Country** : Switzerland  
**Telephone** : +41 21 863 51 11  
**Telefax** : +41 21 863 53 11  
**Contact** : Mr. Francesco Spina  
**Telephone** : +41 21 863 52 23

## 1.4 Application details

Date of receipt of application : 21.12.01  
Date of receipt of test item : 21.12.01  
Date of test : 10.01.02

## 1.5 Test item

Type of equipment : **Cordless BT Presentation device**  
Type designation : **M-RU77**  
Manufacturer : applicant  
Street :  
City :  
Country :  
Serial number : See photographs

### **Additional informations: :**

Frequency : 2402 – 2480 MHz  
Type of modulation : 1M00FXD / 79M8FXD (FHSS)  
Number of channels : 79  
Antenna : integral antenna  
Power supply : 3,0 V DC powered by battery  
Output power : EIRP: 0.91 mW / -0.41 dBm  
FCC ID : DZL201513  
Type of equipment : cordless Bluetooth™ presentation device  
Temperature range : -20°C - +55°C

**1.6 Test standards:** **FCC Part 15 §15.247**  
**CANADA RSS-210**

## 2 Technical test

### 2.1 Summary of test results

The radiated measurements were performed vertical and horizontal over the whole frequency range. We start at 1 m high with vertical receiving antenna and rotate the dish continuously. During rotation we use the antenna lift system to vary the high from 1 to 4 m. So we find maximum radiation output. At this points we do manual remeasurements. After this we do the same measurements in horizontal position of the receiving antenna. This (horizontal and vertical) is made for all the three planes of the test sample. We use the maximum received results.

The detector function and selection of bandwidth are according ANSI C63.2-1996 item 8.2.1 and ANSI C63.4-1992 Item 4.2.

Antennas are conform with ANSI C63.2-1996 item 15.

150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, passive loop antenna.

30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna

>1GHz: Average, RBW 1MHz, VBW 10 MHz, waveguide horns

The antenna gain is given by the applicant with -2 dBi.

All measurements were made radiated, as there is no coax adapter at the sample.

The correction factor for the standard gain horn at 0.5 m distance is 24.5 dB.

All measurement settings are according to FCC 15.35, 15.205, 15.209, 15.247 and the „Measurement guidelines for FHSS systems“, especially regarding the radiated measurements.

The product fullfills also the requirements for CANADA RSS-210

No deviations from the technical specification(s) were ascertained in the course of the tests.

**Final verdict : PASS**

Technical responsibility for area of testing :

16.01.02

RSC 8414 Ames H.



Date

Section

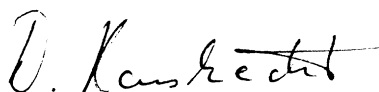
Name

Signature

Technical responsibility for area of testing :

16.01.02

RSC8412 Hausknecht D.



Date

Section

Name

Signature

## 2.2 Testreport

### TEST REPORT

Testreport no. : 2-2695-01-02/01

## TEST REPORT REFERENCE

## LIST OF MEASUREMENTS

| Paragraph       | PARAMETER TO BE MEASURED                   | PAGE |
|-----------------|--------------------------------------------|------|
|                 | Transmitter parameters                     |      |
| § 15.204        | Antenna gain                               | 7    |
| § 15.247 (a)    | Carrier frequency separation               | 8    |
| § 15.247 (a)    | Number of hopping channels                 | 9    |
| § 15.247 (a)    | Time of occupancy (dwell time)             | 10   |
| § 15.247 (d)    | Power spectral density (Inquiry/Page mode) | 15   |
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| §15.247         | Band edge compliance                       | 24   |
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Test report nr.: 2-2695-01-02/01

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Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

**Antenna Gain**

**SUBCLAUSE § 15.204**

**The gain is -2.0 dBi**

**- declared by the applicant -**

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
**(for reference numbers see test equipment listing)**

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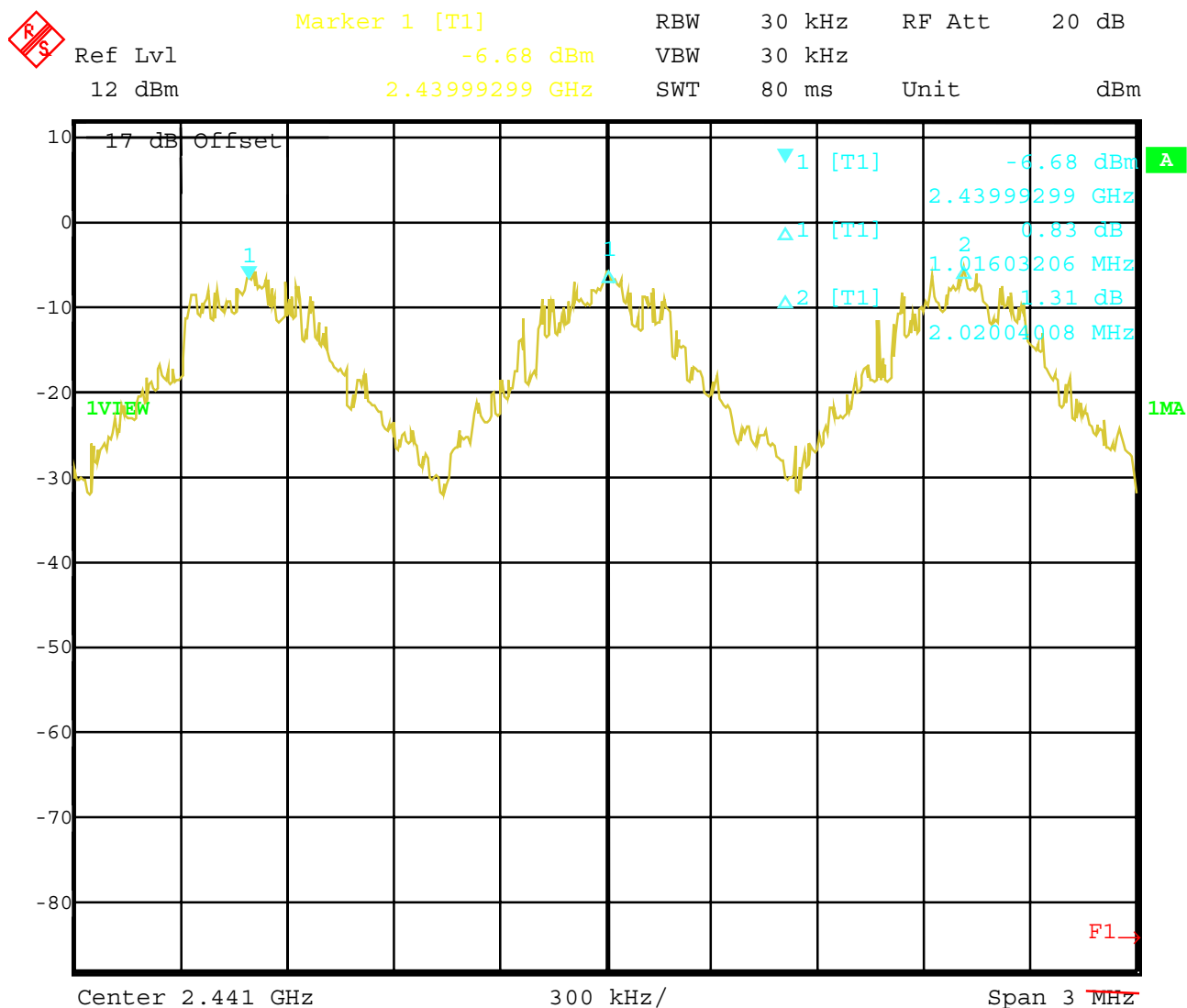
Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

Carrier frequency separation

§15.247(a)



Date: 14.JAN.2002 15:28:50

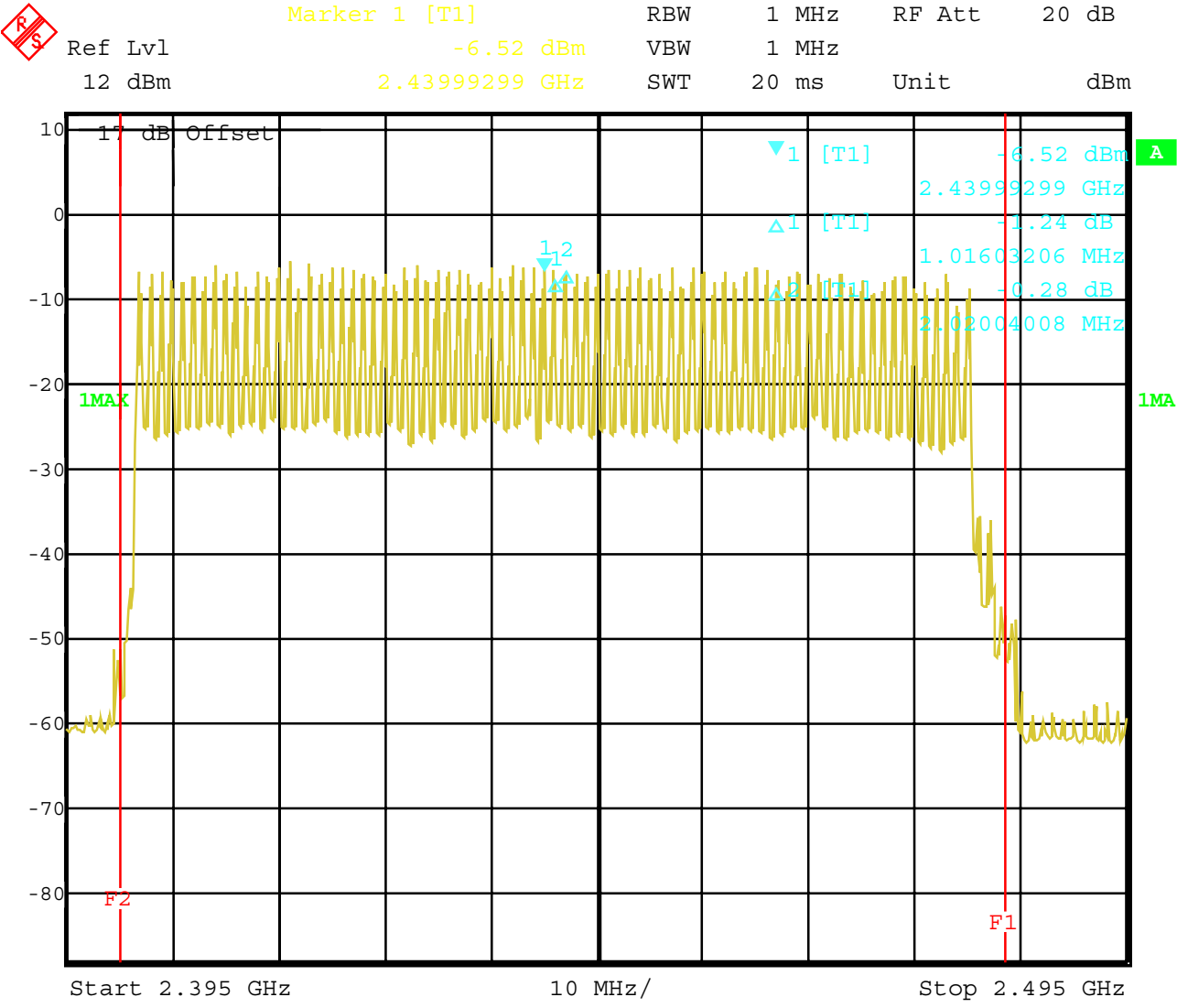
The carrier frequency separation is about 1 MHz.

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)



Equipment under test : M-RU77  
Ambient temperature : 22°C  
Relative humidity : 34%

Number of hopping channels §15.247(a)



Date: 14.JAN.2002 15:39:10

The number of hopping channels is 79.

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

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**§15.247(a)**

**So we have  $303.9 * 390 \mu s = 118.52 \text{ ms}$  per 30 seconds.**



**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

# CETECOM ICT Services GmbH

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Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

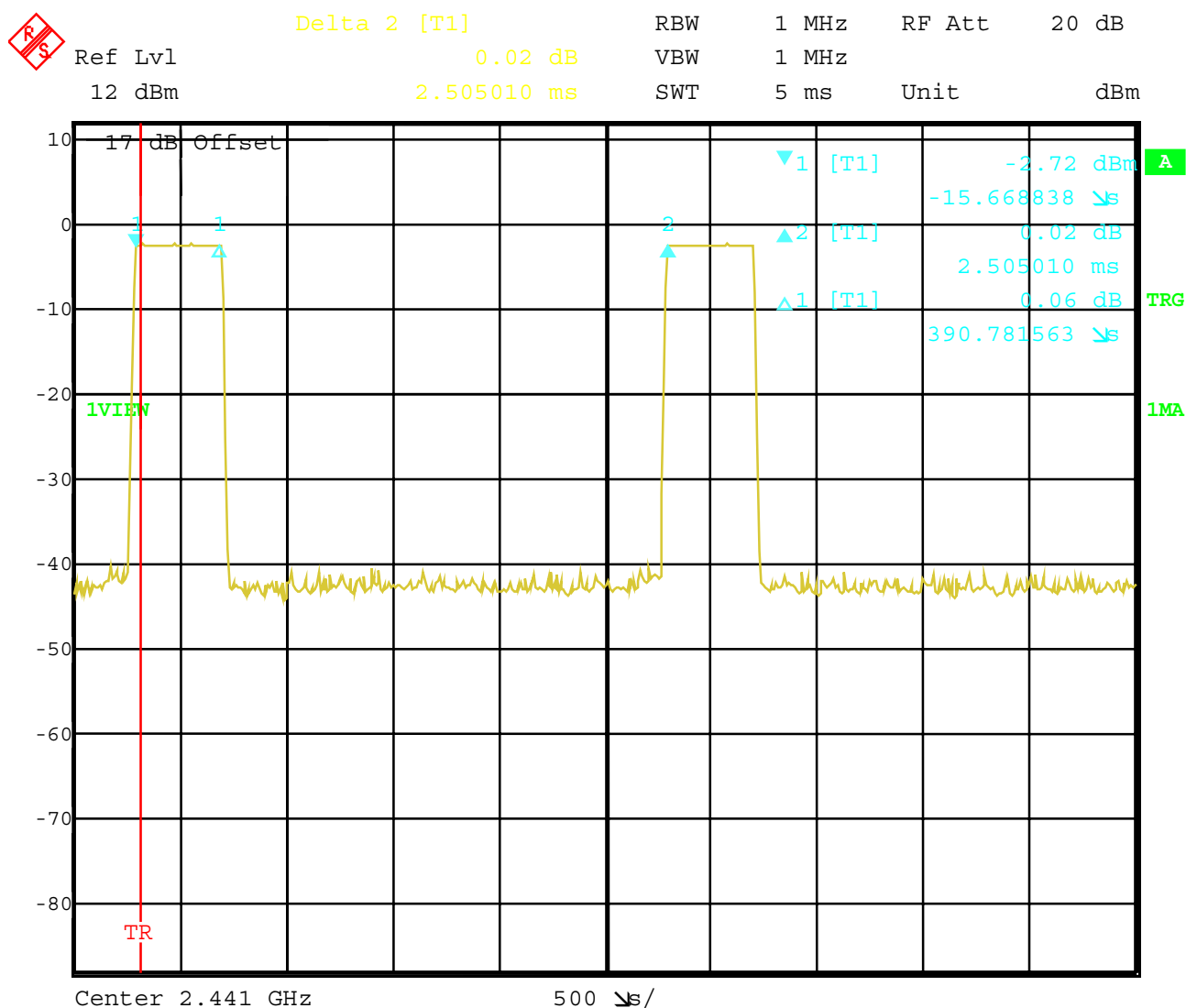
Time of occupancy (dwell time) for DH3

§15.247(a)

A DH3 Packets has max. 3 time slots for transmit (here 1) and 1 for receiving, then the system makes worst case 400 hops per second with 79 channels. So you have each channel 5.1 times per second and for 30 seconds you have 153 times of appearance .

Each tx-time per appearance is 0.39 ms.

So we have  $153 * 0.39 \text{ ms} = 59.7 \text{ ms}$  per 30 seconds.



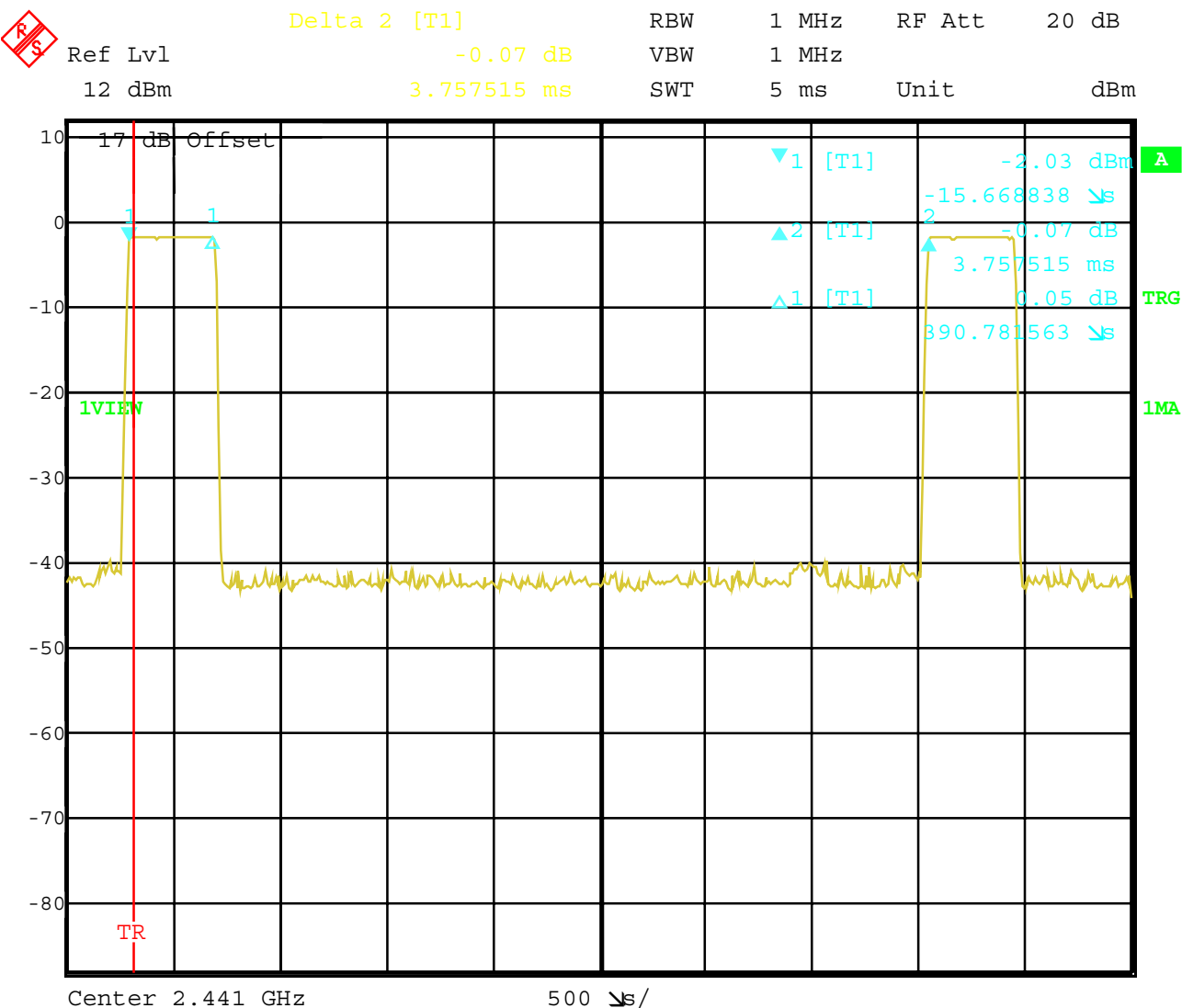
Date: 14.JAN.2002 15:48:39

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : M-RU77  
Ambient temperature : 22°C  
Relative humidity : 34%

Time of occupancy (dwell time) for DH5 §15.247(a)

At DH5 Packets you have max. 5 time slots for transmit (here 1) and 1 for receiving, so the system makes worst case 266.7 hops per second with 79 channels. So you have each channel 3.36 times per second and for 30 seconds you have 100.8 times of appearance .  
Each tx-time per appearance is 0.39 ms.  
So we have  $100.8 * 0.39 \text{ ms} = 39.3 \text{ ms}$  per 30 seconds.



Date: 14.JAN.2002 15:51:01

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

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Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

Time of occupancy (dwell time) for page mode /Inquiry mode (TX-on time) §15.247(a)

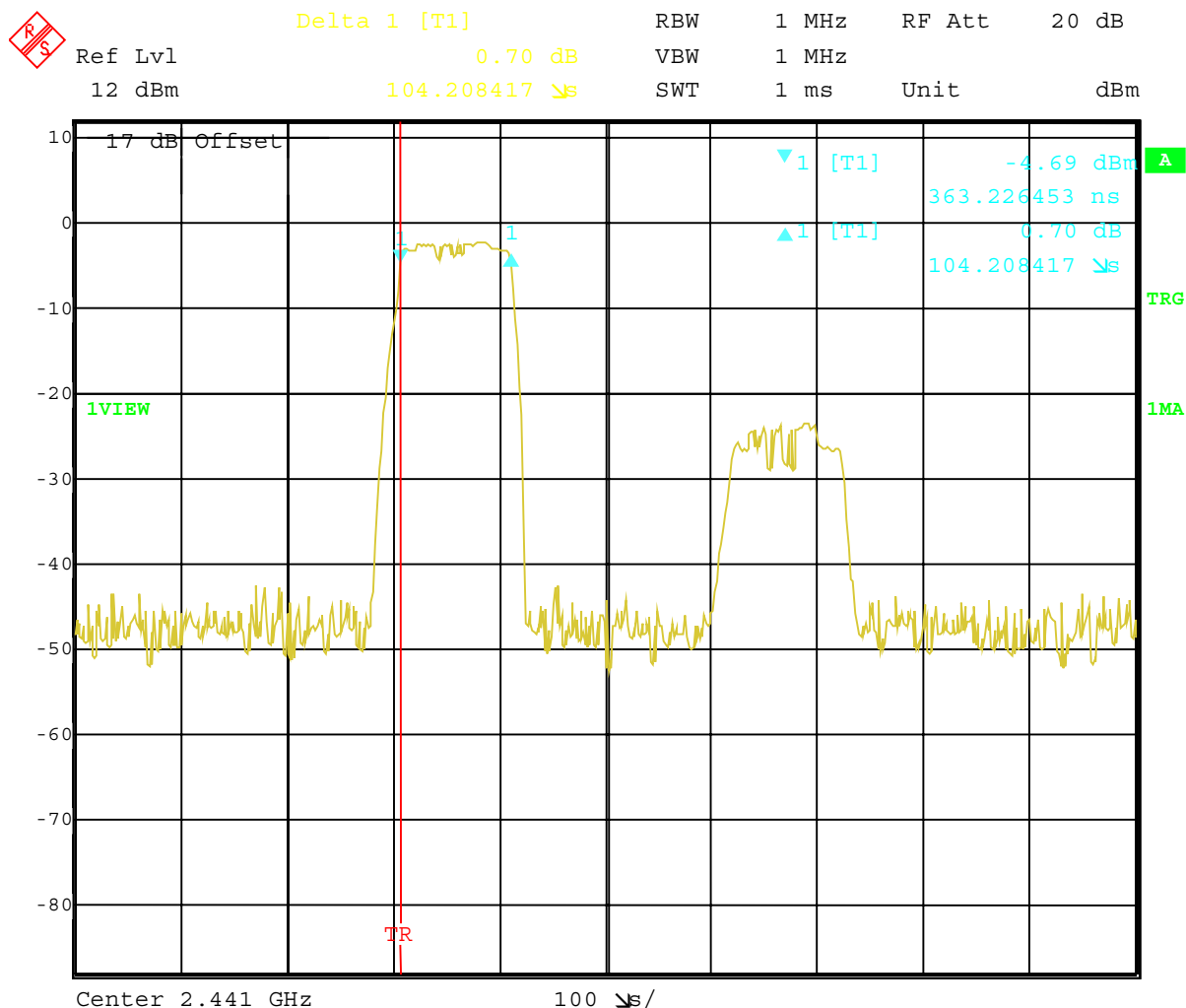
At paging mode the system makes first hopping with 16 channels. One sequence( called train A) lasts 10 ms. Every 1.28s frequencies change and a second train A starts with different frequencies. After max  $7 \times 1.28$  s 16 new more distance frequencies (Train B) are used. So we have in the worst case (same frequency is in every train) the following time scedule. First:  $7 \times 128 \times 10$ ms. For the next 7 seconds train B with other frequencies.

Then train A and B changes frequently.

⇒ so we have  $7 \times 104 \times 176.784 \mu\text{s}$ , then 8.96 s other frequencies, then again  $7 \times 104 \times 176.784 \mu\text{s}$

⇒ together in 30 s maximal 2 sequences =>maximal 0.257 s per 30 second period.

## Page mode (TX-on time) / Inquiry mode (TX-on time)

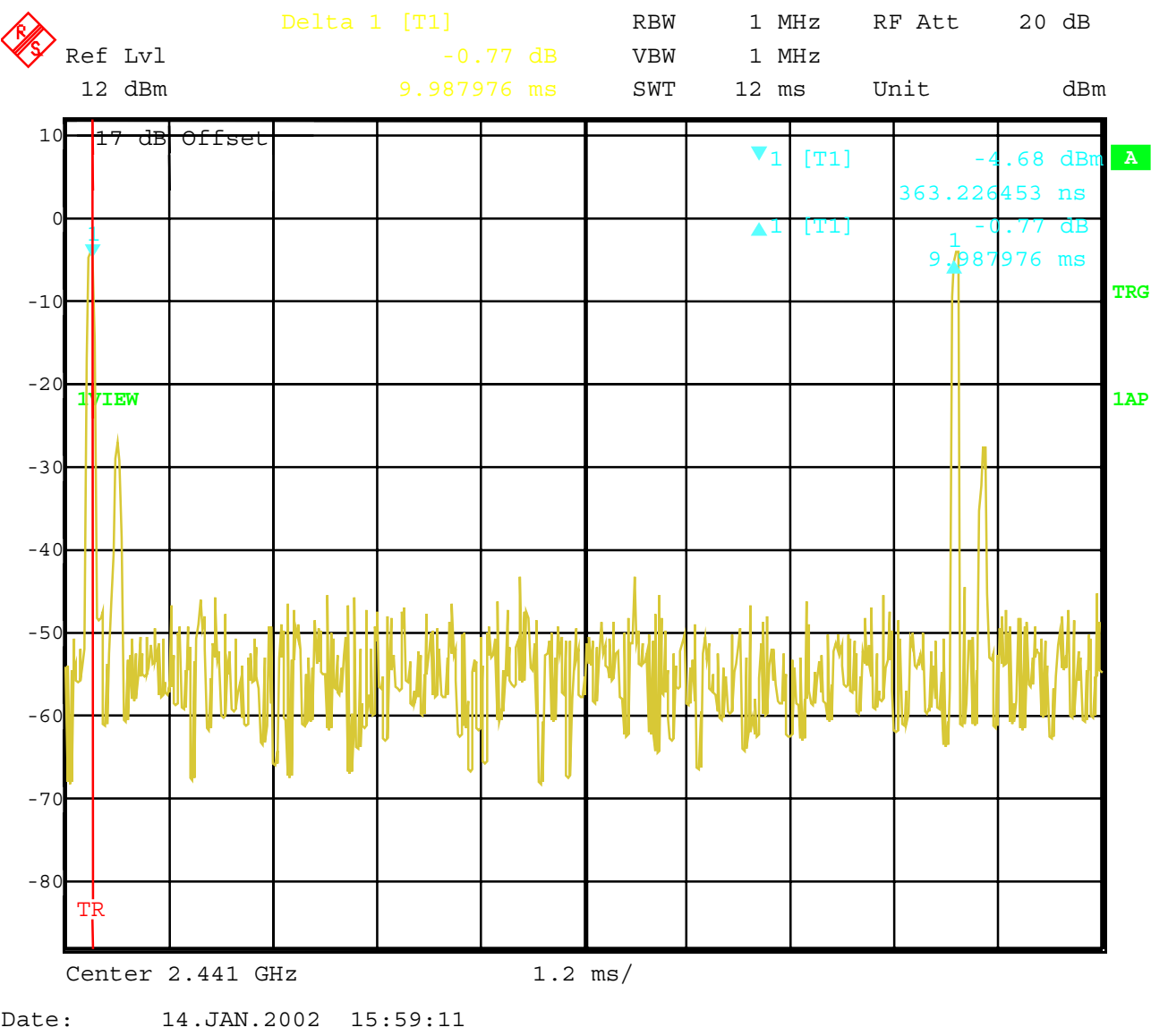


Date: 14.JAN.2002 15:56:35

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Equipment under test : M-RU77  
Ambient temperature : 22°C  
Relative humidity : 34%

Page mode (complete sequence) / Inquiry mode (complete sequence)



REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

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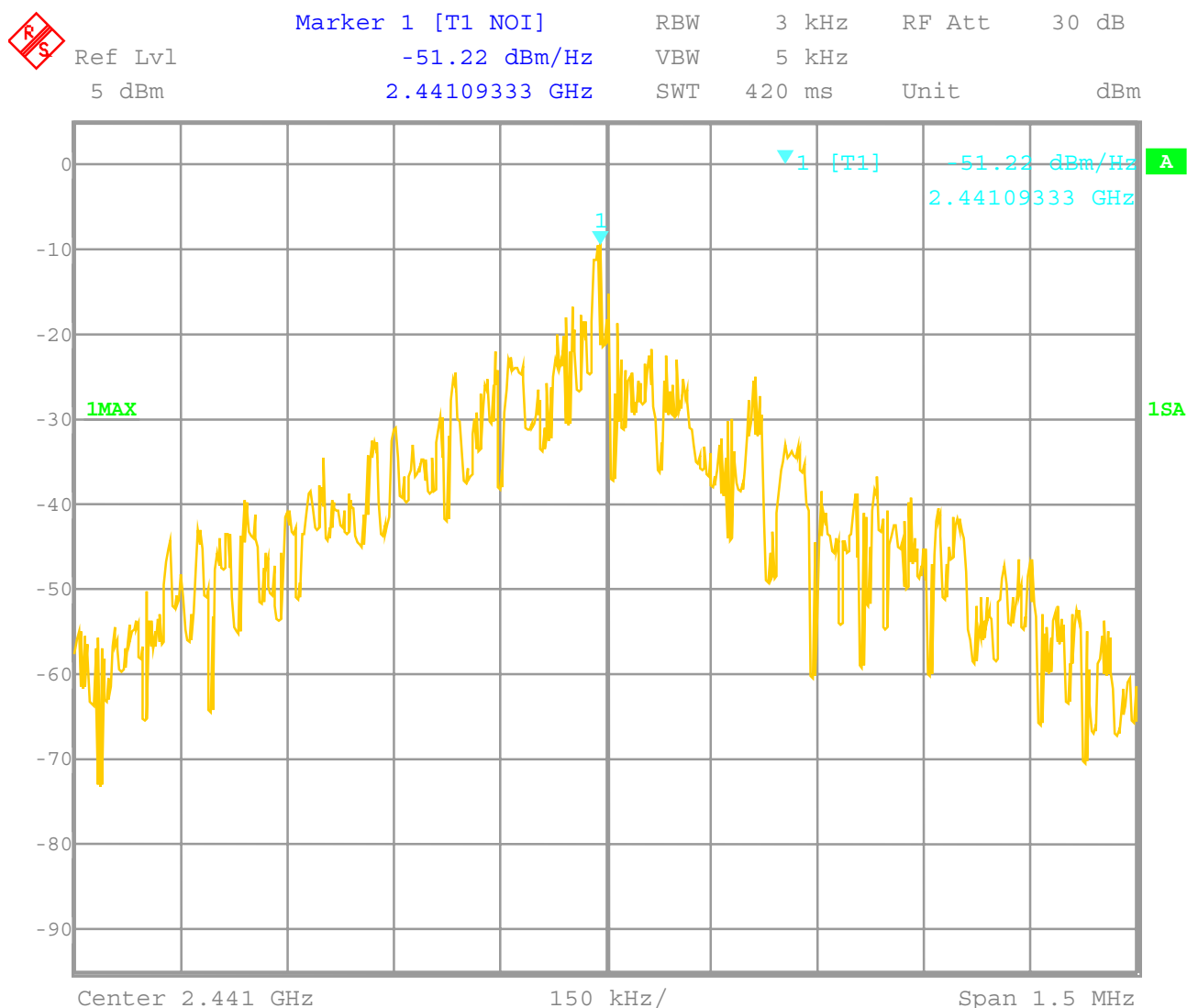
Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

Power Spectral density (Hybrid system in Inquiry mode / Page scan)

§15.247(d)



We use the noise density fuction of the analyzer. This results have to be corrected to the required bandwidth. The correction factor from dBm/Hz to dBm/3KHz is +34,8 dB.

=> Power density : -51.22 dBm/Hz = -16.42 dBm / 3 KHz

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

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Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

Spectrum Bandwith of a FHSS System

§15.247(a)

20 dB bandwidth

| TEST CONDITIONS           |                           | 20 dB BANDWIDTH ( kHz ) |         |         |
|---------------------------|---------------------------|-------------------------|---------|---------|
| Frequency (MHz)           |                           | 2402                    | 2441    | 2480    |
| T <sub>nom</sub> ( 22 )°C | V <sub>nom</sub> ( 3.0 )V | 889.779                 | 883.767 | 853.707 |
| Measurement uncertainty   |                           | ±1kHz                   |         |         |

RBW / VBW as provided in the „Measurement Guidelines“ (DA 00-705, March 30, 2000)

LIMIT

SUBCLAUSE §15.247(a) (1)

The maximum 20dB bandwith shall be at maximum 1000 KHz

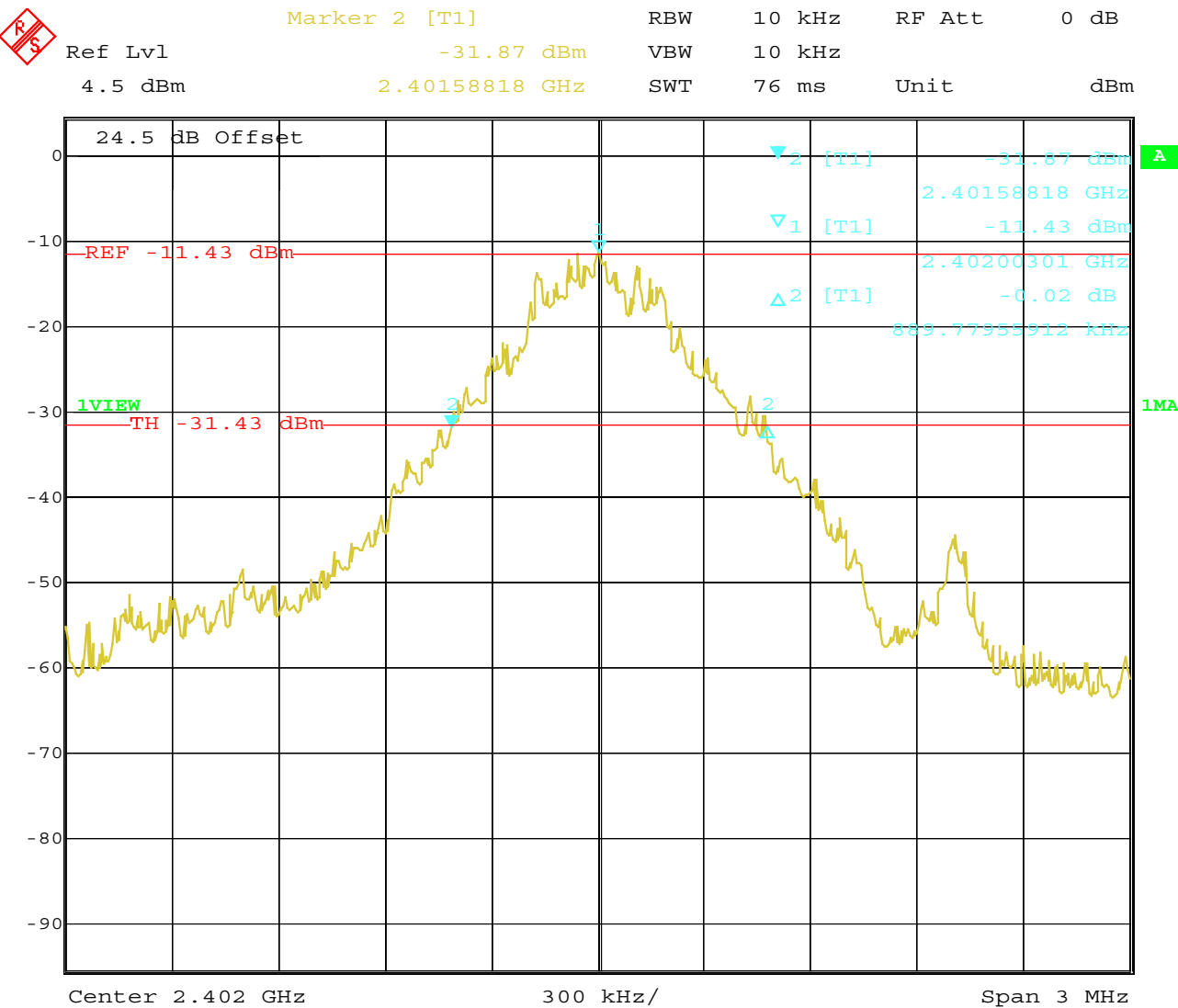
REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)



Equipment under test : M-RU77  
Ambient temperature : 22°C  
Relative humidity : 34%

Spectrum Bandwith of a FHSS System      §15.247(a)  
20 dB bandwidth

Channel 1



Date: 15.JAN.2002 07:40:41

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

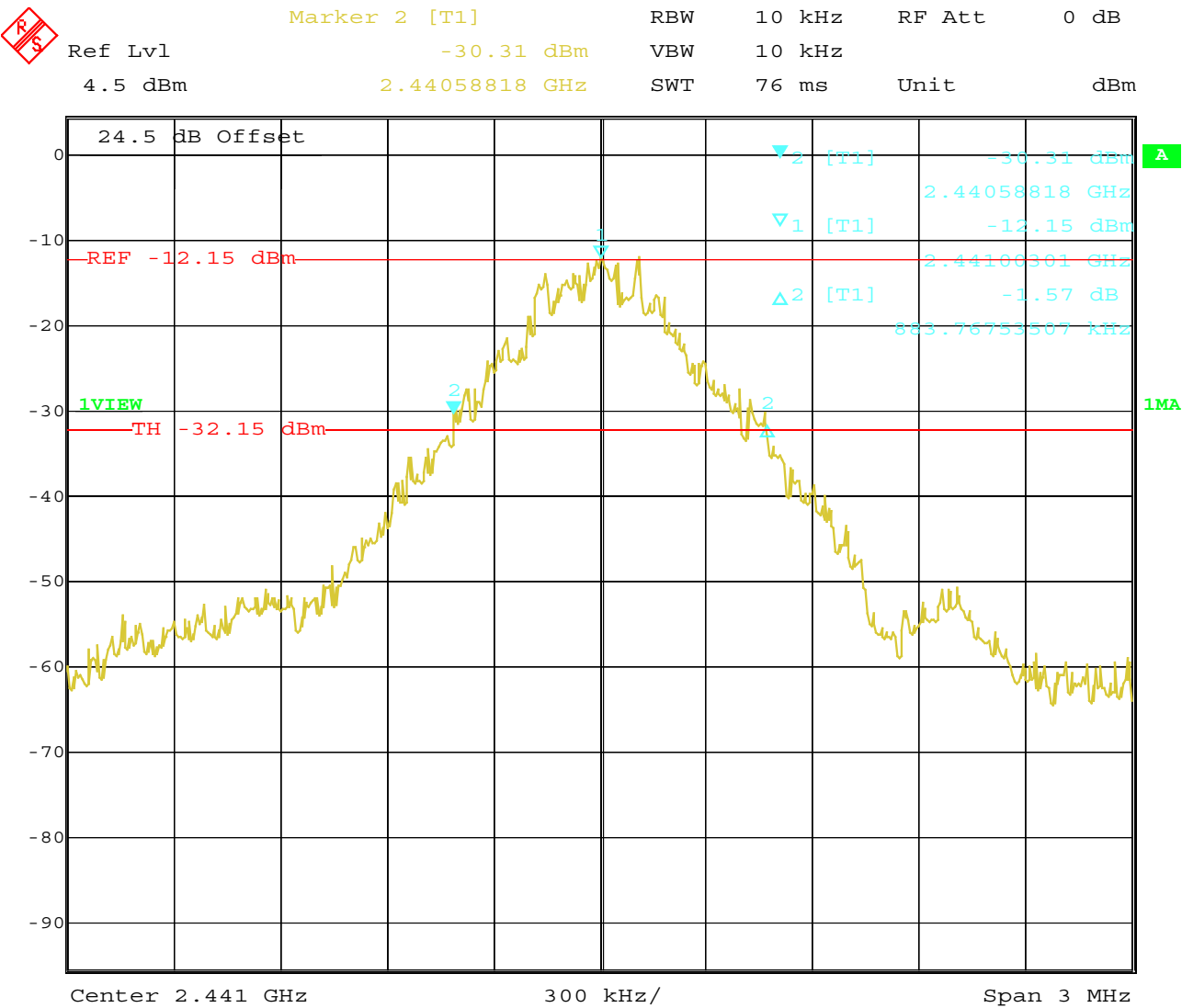
Equipment under test : M-RU77  
Ambient temperature : 22°C  
Relative humidity : 34%

Spectrum Bandwith of a FHSS System

§15.247(a)

20 dB bandwidth

Channel 2



Date: 15.JAN.2002 08:14:10

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

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Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

**MAXIMUM PEAK OUTPUT POWER  
(RADIATED)**

**SUBCLAUSE § 15.247 (b) (1)**

| TEST CONDITIONS                                                         |                           | MAXIMUM PEAK OUTPUT POWER (mW) |                |                |
|-------------------------------------------------------------------------|---------------------------|--------------------------------|----------------|----------------|
| Frequency (MHz)                                                         |                           | 2402                           | 2441           | 2480           |
| T <sub>nom</sub> ( 22 )°C                                               | V <sub>nom</sub> ( 3,0 )V | 0.74                           | 0.87           | 0.91           |
| Maximum deviation from output power under extreme test conditions (dBc) |                           | not applicable                 | not applicable | not applicable |
| Measurement uncertainty                                                 |                           | ±3dB                           |                |                |

**RBW/VBW : 3 MHz**

**Measured at a distance of 3m**

**LIMIT**

**SUBCLAUSE § 15.247 (b) (1)**

| Frequency range | RF power output |
|-----------------|-----------------|
| 2400-2483.5 MHz | 1.0 Watt        |

**REFERENCE NUMBER(S) OF TEST EQUIPMENT USED**  
(for reference numbers see test equipment listing)

# CETECOM ICT Services GmbH

Test report nr.: 2-2695-01-02/01

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Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

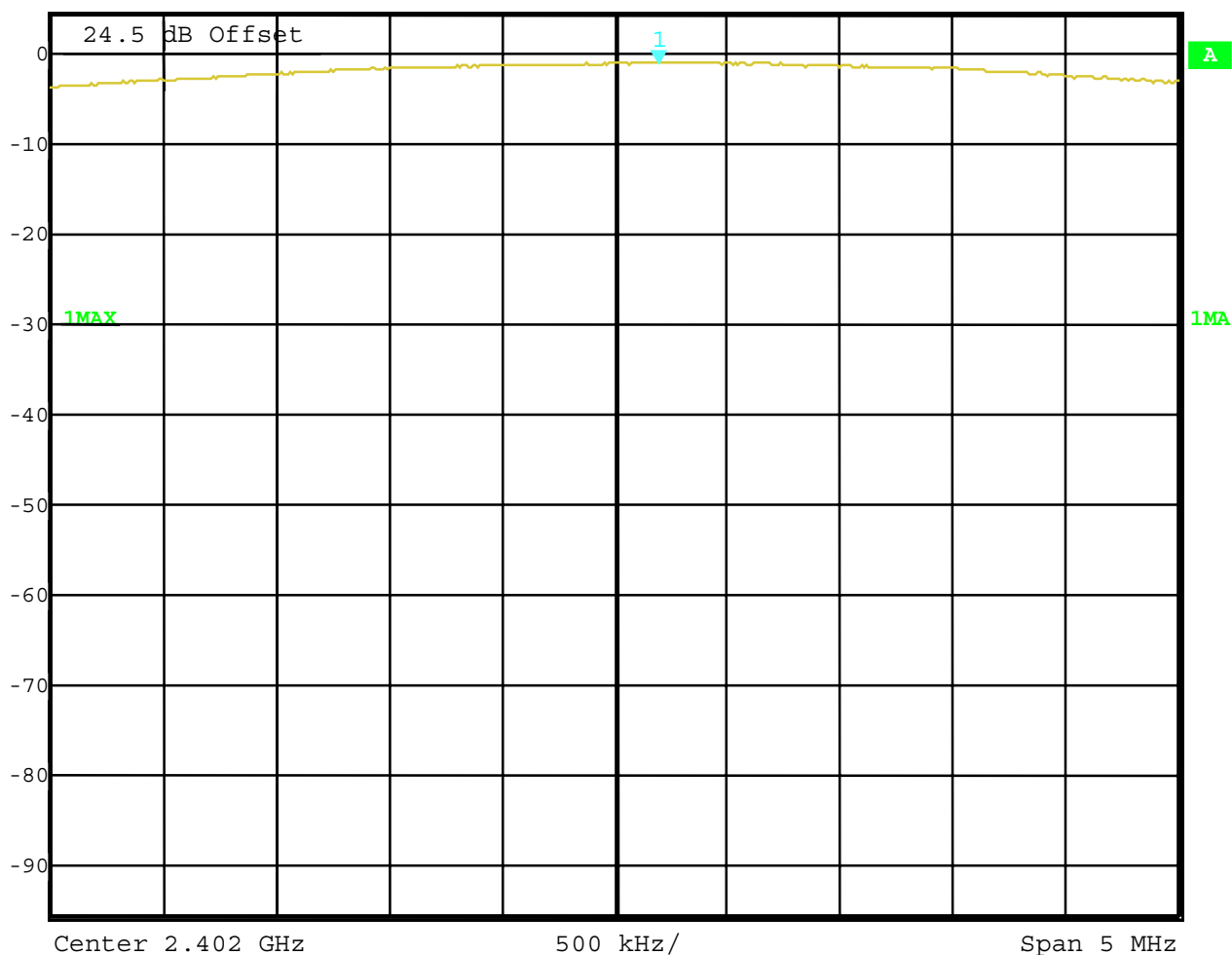
Peak output power (radiated) , measured with standard gain horn

§15.247 (b)

Channel 1: -1.21 dBm at 2402 MHz



Marker 1 [T1] RBW 3 MHz RF Att 0 dB  
Ref Lvl -1.21 dBm VBW 3 MHz  
4.5 dBm 2.40211723 GHz SWT 5 ms Unit dBm



Date: 15.JAN.2002 08:51:51

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

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Issue Date: 01.03.02

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Equipment under test : M-RU77

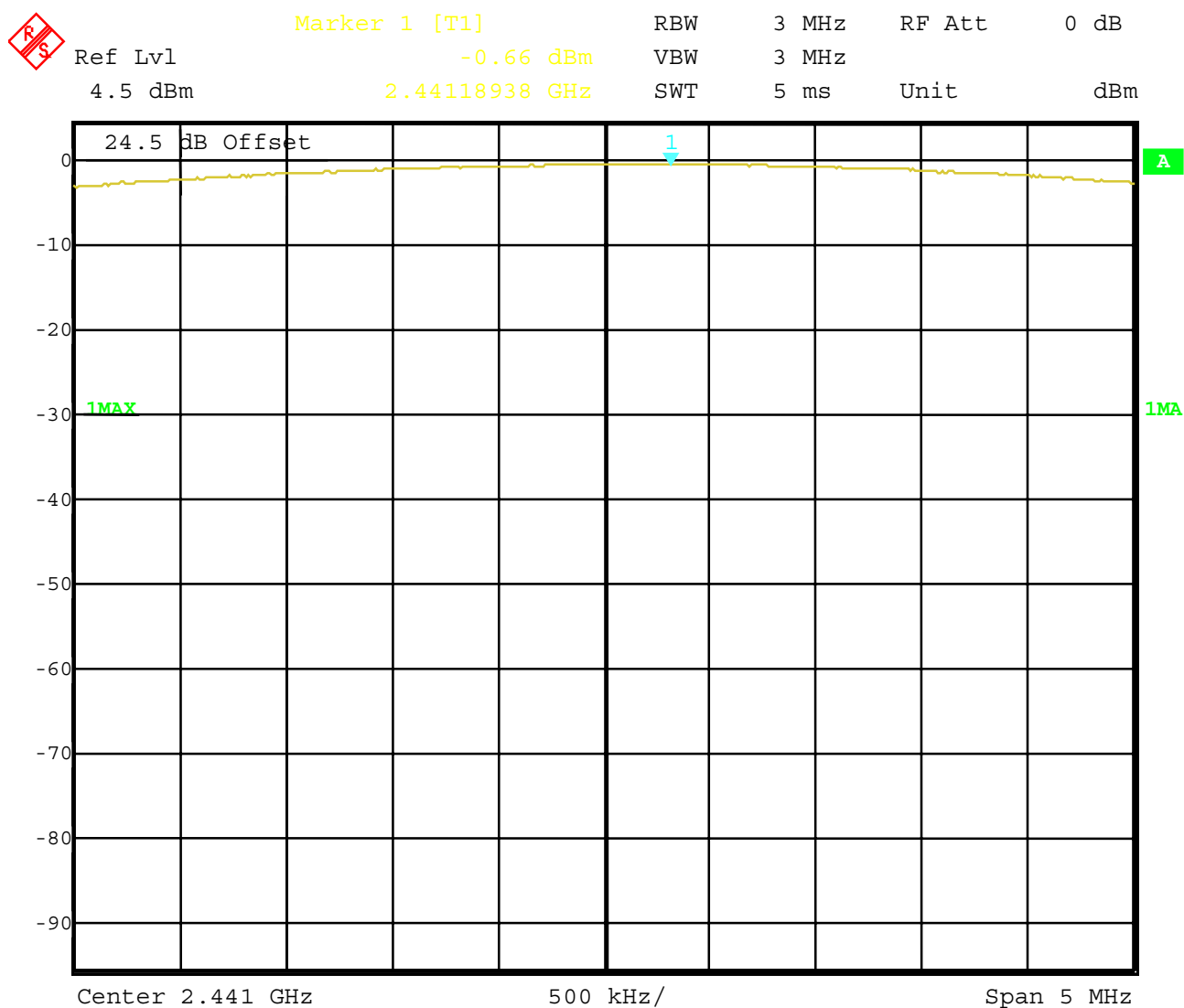
Ambient temperature : 22°C

Relative humidity : 34%

Peak output power (radiated) , measured with standard gain horn

§15.247 (b)

Channel 2: -0.66 dBm at 2441 MHz



Date: 15.JAN.2002 08:54:32

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

# CETECOM ICT Services GmbH

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Equipment under test : M-RU77

Ambient temperature : 22°C

Relative humidity : 34%

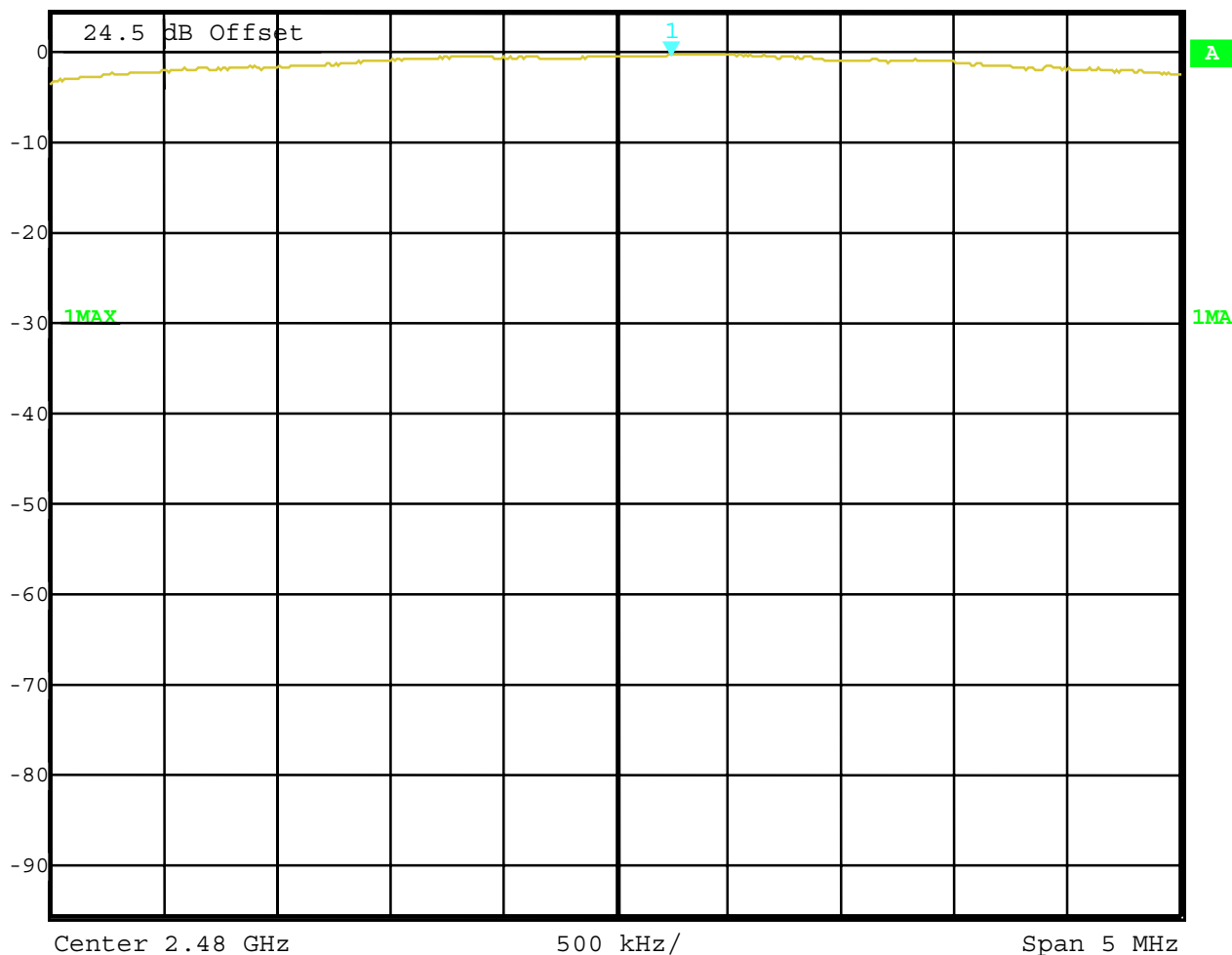
Peak output power (radiated) , measured with standard gain horn

§15.247 (b)

Channel 3: -0.41 dBm at 2480 MHz



Marker 1 [T1] RBW 3 MHz RF Att 0 dB  
Ref Lvl -0.41 dBm VBW 3 MHz  
4.5 dBm 2.48014729 GHz SWT 5 ms Unit dBm



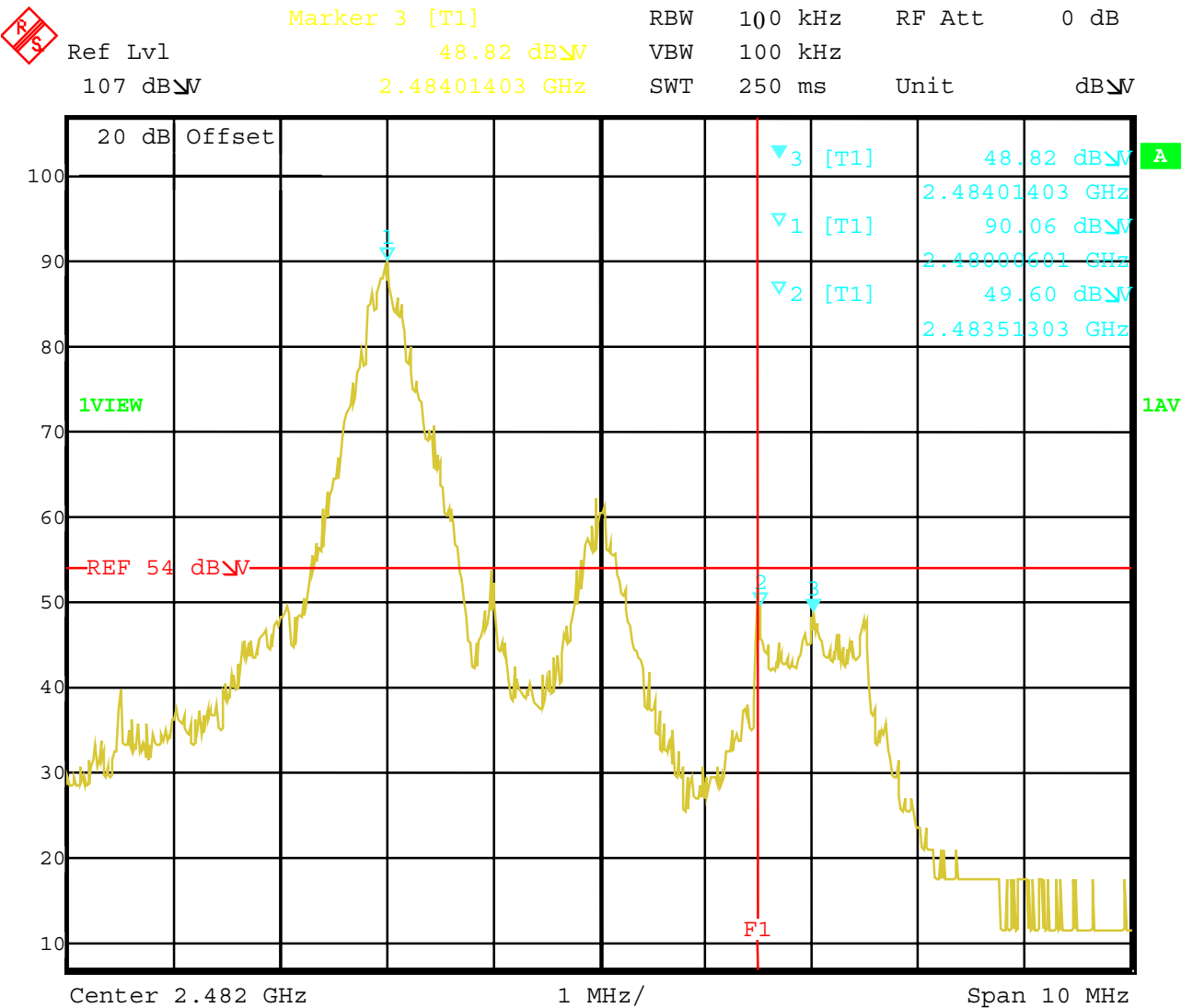
Date: 15.JAN.2002 08:55:48

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED  
(for reference numbers see test equipment listing)

Band-edge compliance of radiated emissions

§15.247 (c)

high frequency section (hopping off), Ref level is related to the effective radiated power.



Date: 15.JAN.2002 09:06:39

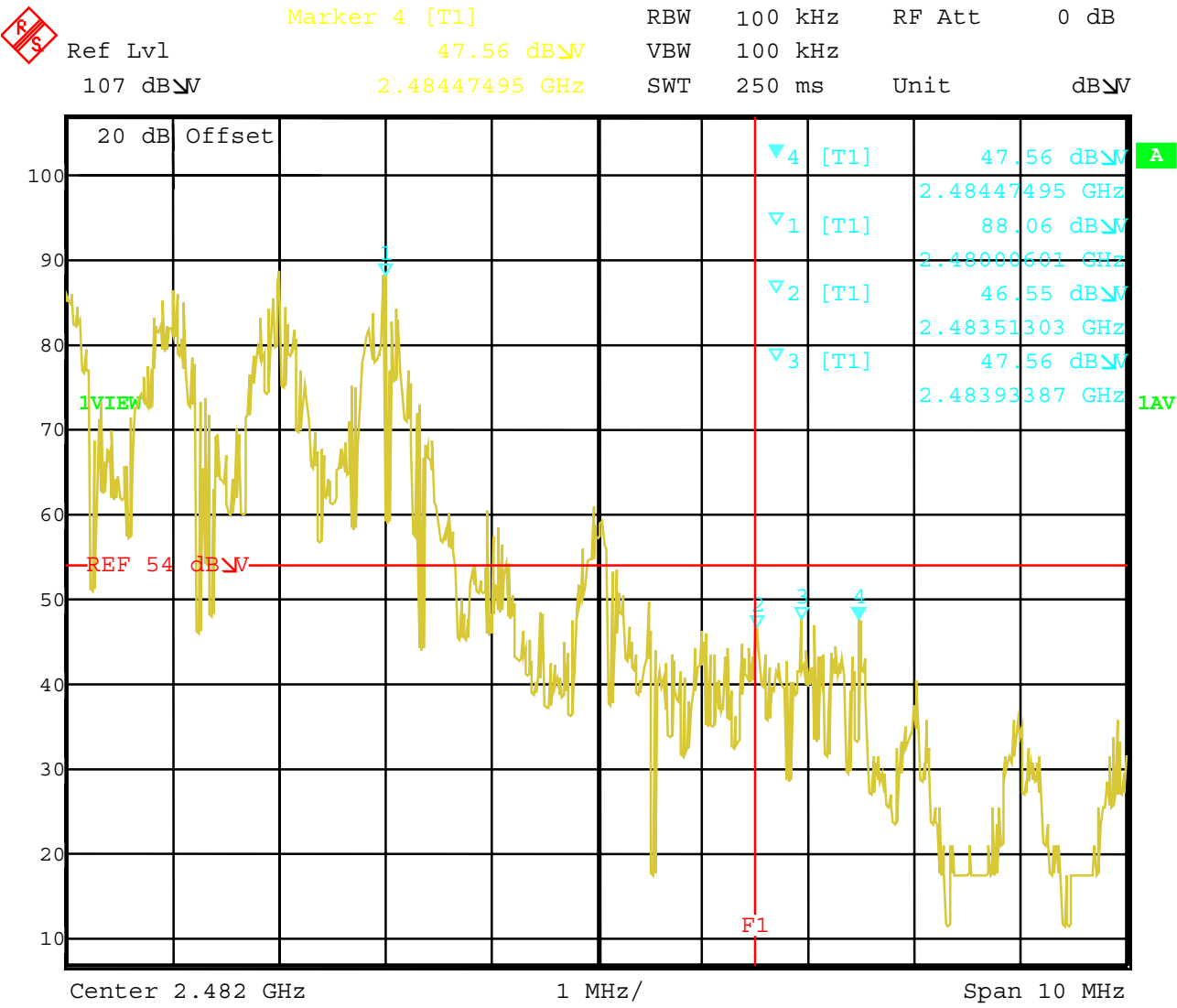
This measurement was made to show that the behavior of the system is conform to

FCC 15.205 (restricted bands)



Band-edge compliance of radiated emissions §15.247 (c)

high frequency section (hopping on) , Ref level is related to the effective radiated power.



Date: 15.JAN.2002 09:10:13

This measurement was made to show that the behavior of the system is conform to  
FCC 15.205 (restricted bands)

## SPURIOUS RADIATED EMISSION

§ 15.247 (c) (1)

| EMISSION LIMITATIONS    |              |                                                   |                                                 |                                                      |          |
|-------------------------|--------------|---------------------------------------------------|-------------------------------------------------|------------------------------------------------------|----------|
| f<br>(MHz)              | polarization | amplitude of<br>emission<br>(dBµV/m)<br>QUASIPeAK | amplitude of<br>emission<br>(dBµV/m)<br>average | limit<br>max. allowed<br>emmission power<br>(dBµV/m) | results  |
| CH 1                    |              |                                                   |                                                 |                                                      |          |
| 4804                    | vertical     |                                                   | 16.2                                            | 54.0                                                 | complies |
| no other peak found     |              |                                                   |                                                 |                                                      |          |
|                         |              |                                                   |                                                 |                                                      |          |
|                         |              |                                                   |                                                 |                                                      |          |
| CH 2                    |              |                                                   |                                                 |                                                      |          |
|                         |              |                                                   |                                                 |                                                      |          |
| no peaks found          |              |                                                   |                                                 |                                                      |          |
|                         |              |                                                   |                                                 |                                                      |          |
|                         |              |                                                   |                                                 |                                                      |          |
| CH 3                    |              |                                                   |                                                 |                                                      |          |
|                         |              |                                                   |                                                 |                                                      |          |
| no peaks found          |              |                                                   |                                                 |                                                      |          |
|                         |              |                                                   |                                                 |                                                      |          |
|                         |              |                                                   |                                                 |                                                      |          |
| Measurement uncertainty |              | ± 3dB                                             |                                                 |                                                      |          |

## LIMITS

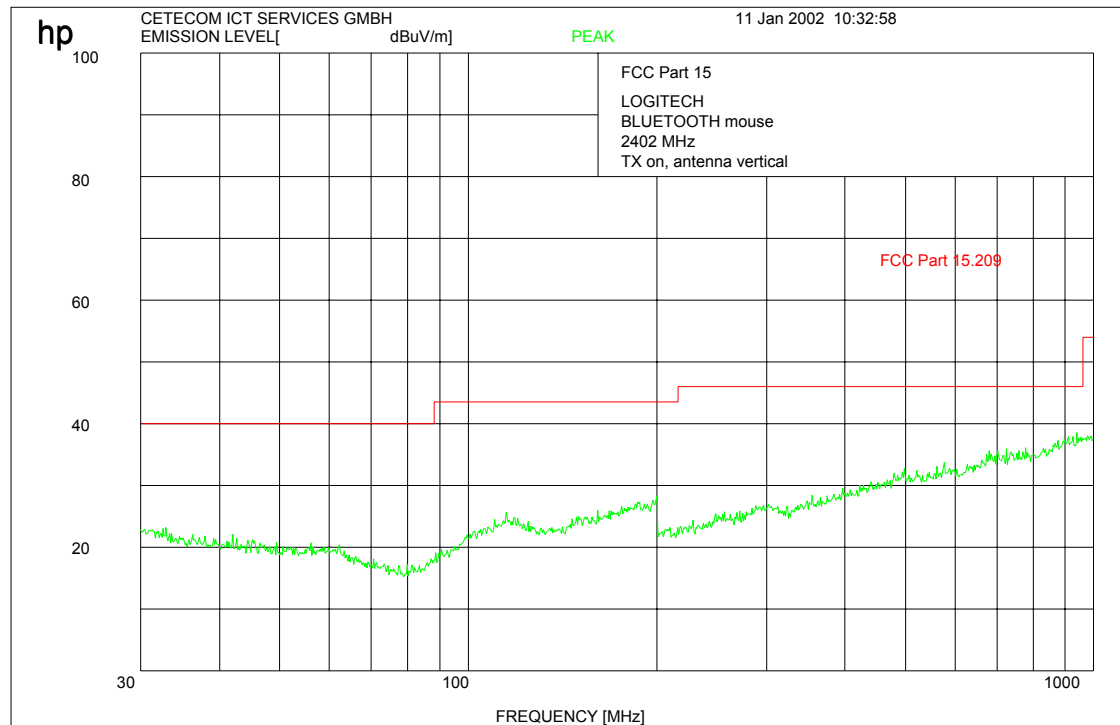
SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

## EMISSION LIMITATIONS (Transmitter)

## SUBCLAUSE § 15.247 (c) (1)

2402 MHz (30 MHz – 1 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

## LIMITS

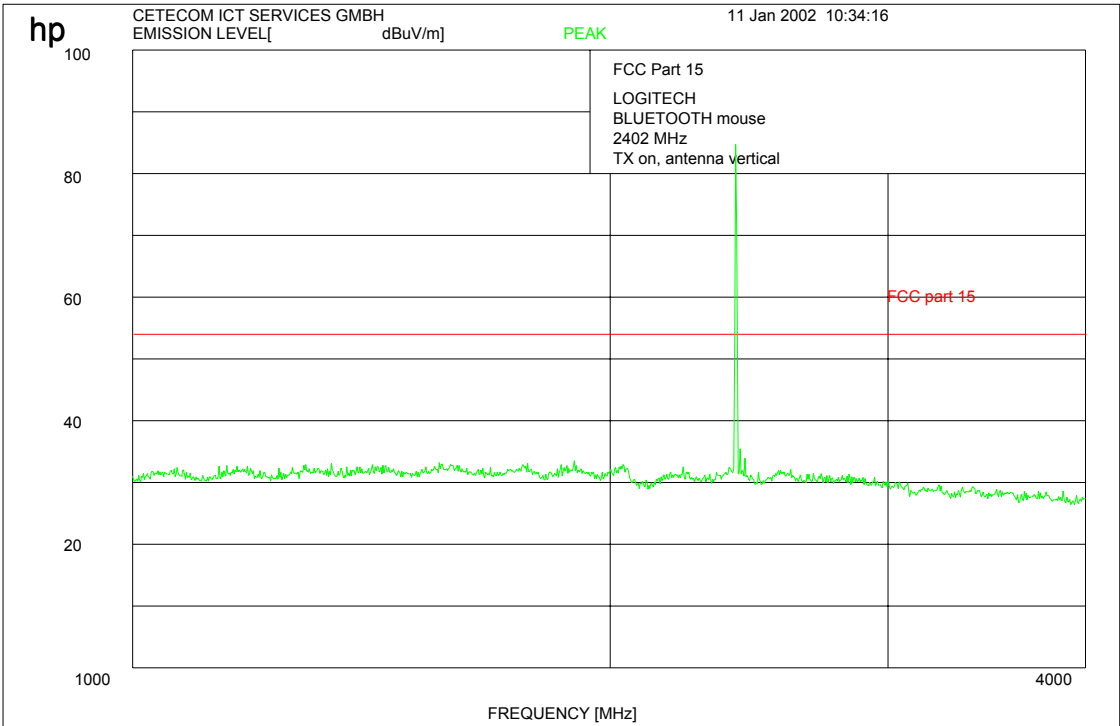
## SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

EMISSION LIMITATIONS (Transmitter)

SUBCLAUSE § 15.247 (c) (1)

2402 MHz (1 – 4 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

LIMITS

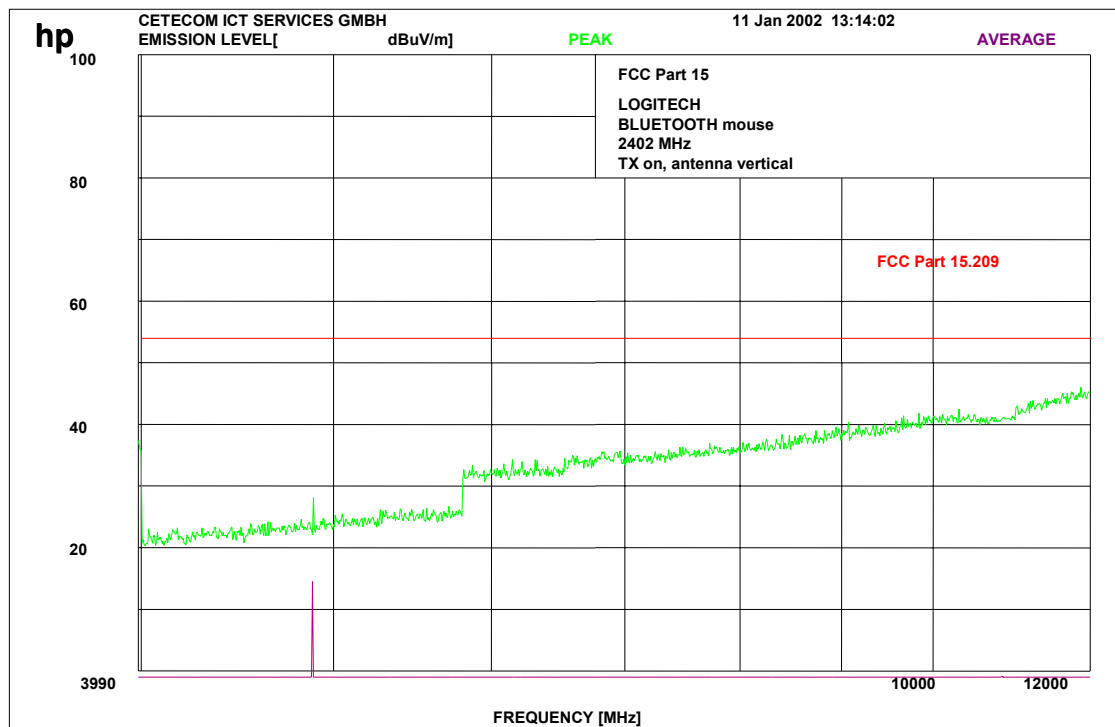
SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

## EMISSION LIMITATIONS (Transmitter)

## SUBCLAUSE § 15.247 (c) (1)

2402 MHz (4 – 12 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

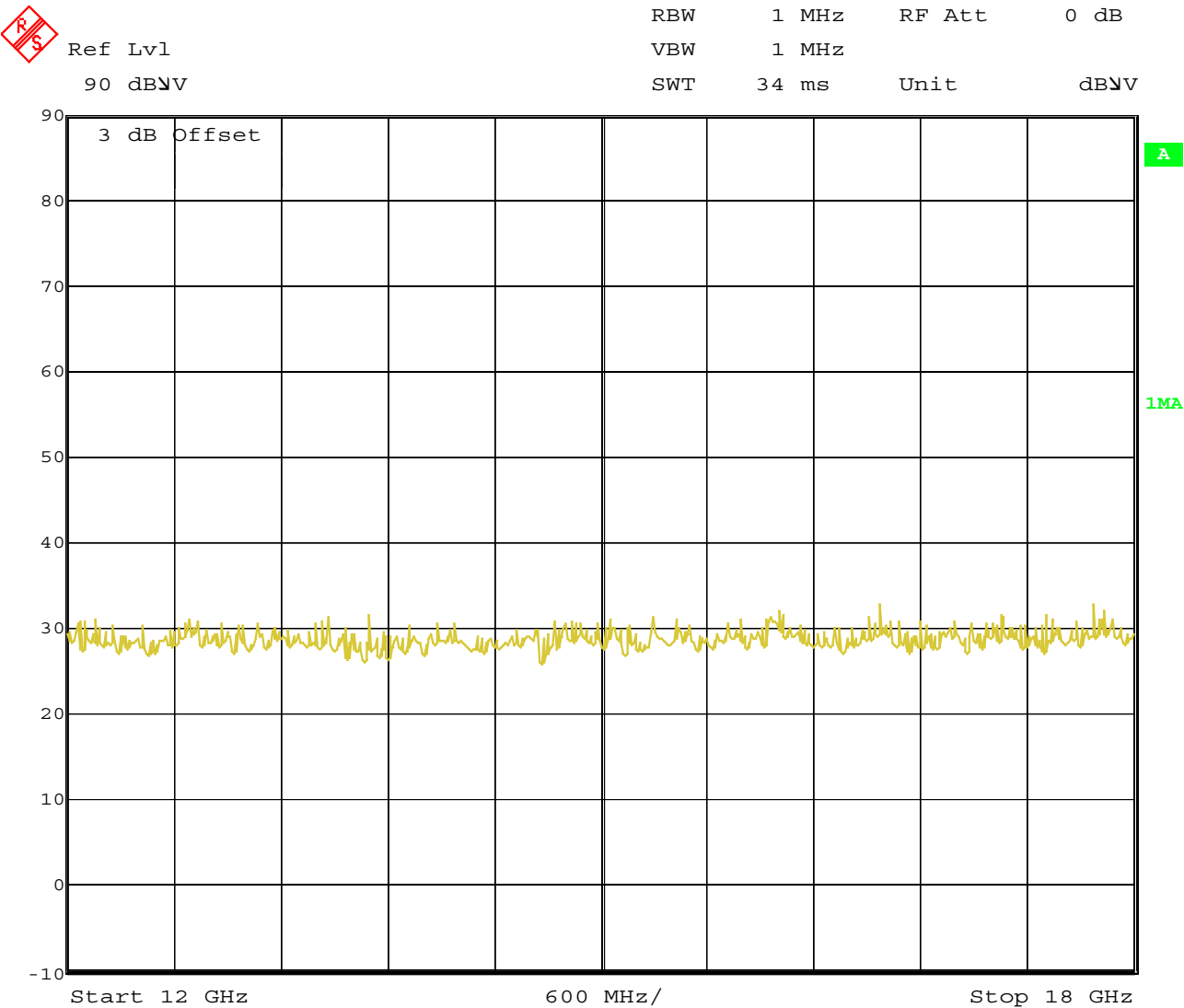
## LIMITS

## SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

EMISSION LIMITATIONS (Transmitter)      SUBCLAUSE § 15.247 (c) (1)

12 GHz – 18 GHz peak (valid for all three frequencies)

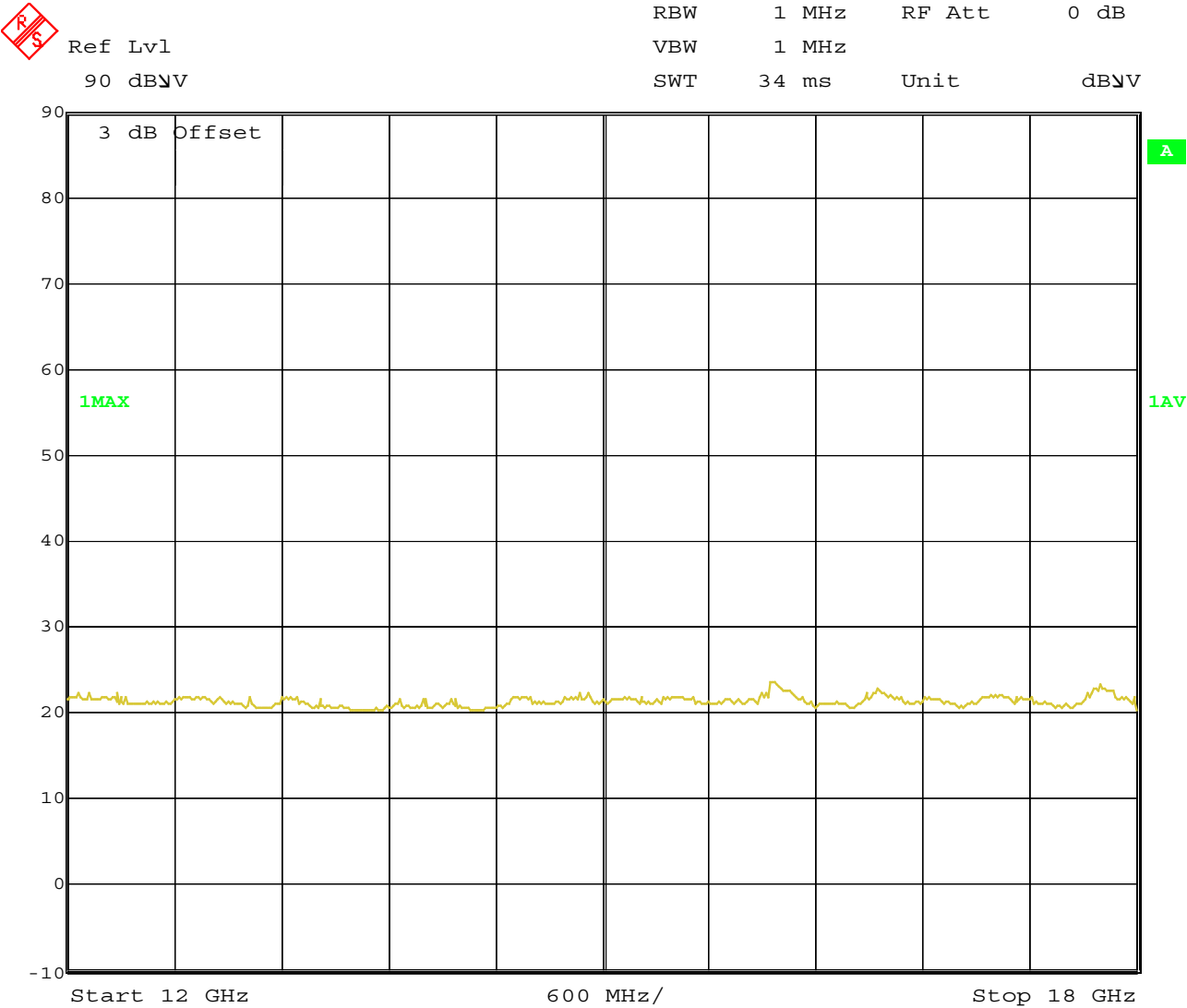


Date: 15.JAN.2002 09:19:35  
f < 1 GHz : RBW/VBW: 100 kHz      f ≥ 1GHz : RBW/VBW: 1 MHz

LIMITS      SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

**EMISSION LIMITATIONS (Transmitter)      SUBCLAUSE § 15.247 (c) (1)**  
**12 GHz – 18 GHz average (valid for all three frequencies)**



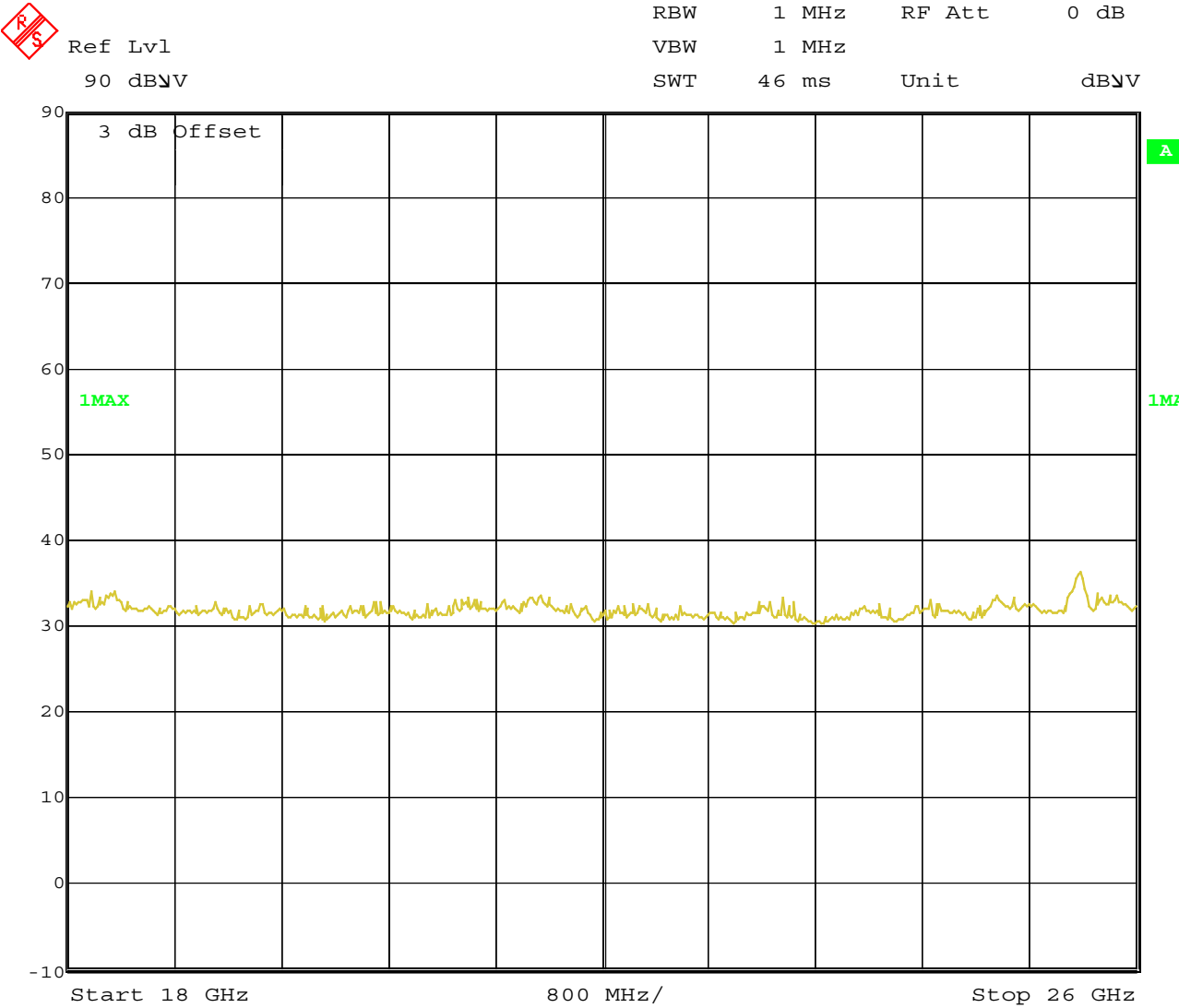
Date:      15.JAN.2002      09:20:04  
f < 1 GHz : RBW/VBW: 100 kHz      f ≥ 1GHz : RBW/VBW: 1 MHz

**LIMITS      SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

EMISSION LIMITATIONS (Transmitter)      SUBCLAUSE § 15.247 (c) (1)

18 GHz – 25 GHz peak (valid for all three frequencies)



Date: 15.JAN.2002 09:22:58  
f < 1 GHz : RBW/VBW: 100 kHz      f ≥ 1GHz : RBW/VBW: 1 MHz

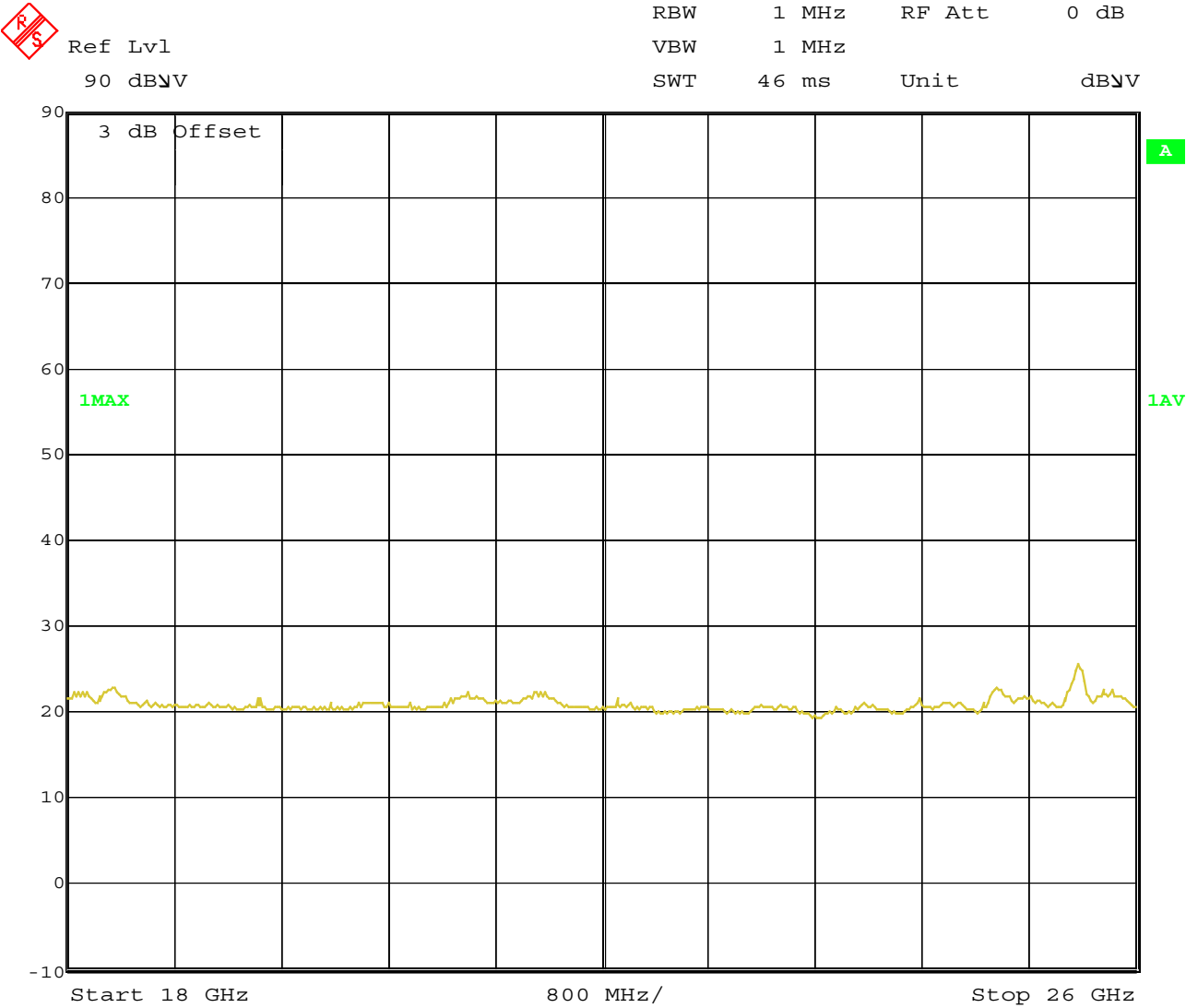
LIMITS      SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).



EMISSION LIMITATIONS (Transmitter)      SUBCLAUSE § 15.247 (c) (1)

18 GHz – 25GHz average (valid for all three frequencies)

Date: 15.JAN.2002 09:21:38  
f < 1 GHz : RBW/VBW: 100 kHz      f ≥ 1GHz : RBW/VBW: 1 MHz

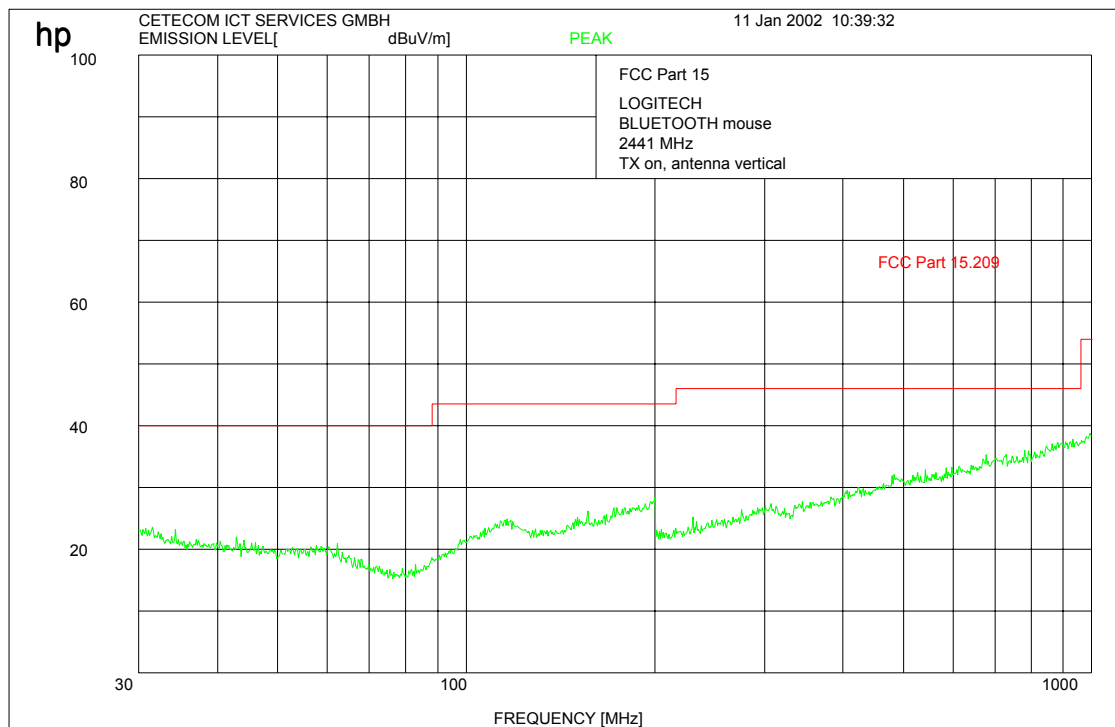
LIMITS      SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

## EMISSION LIMITATIONS (Transmitter)

## SUBCLAUSE § 15.247 (c) (1)

2441 MHz (30 MHz – 1 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

## LIMITS

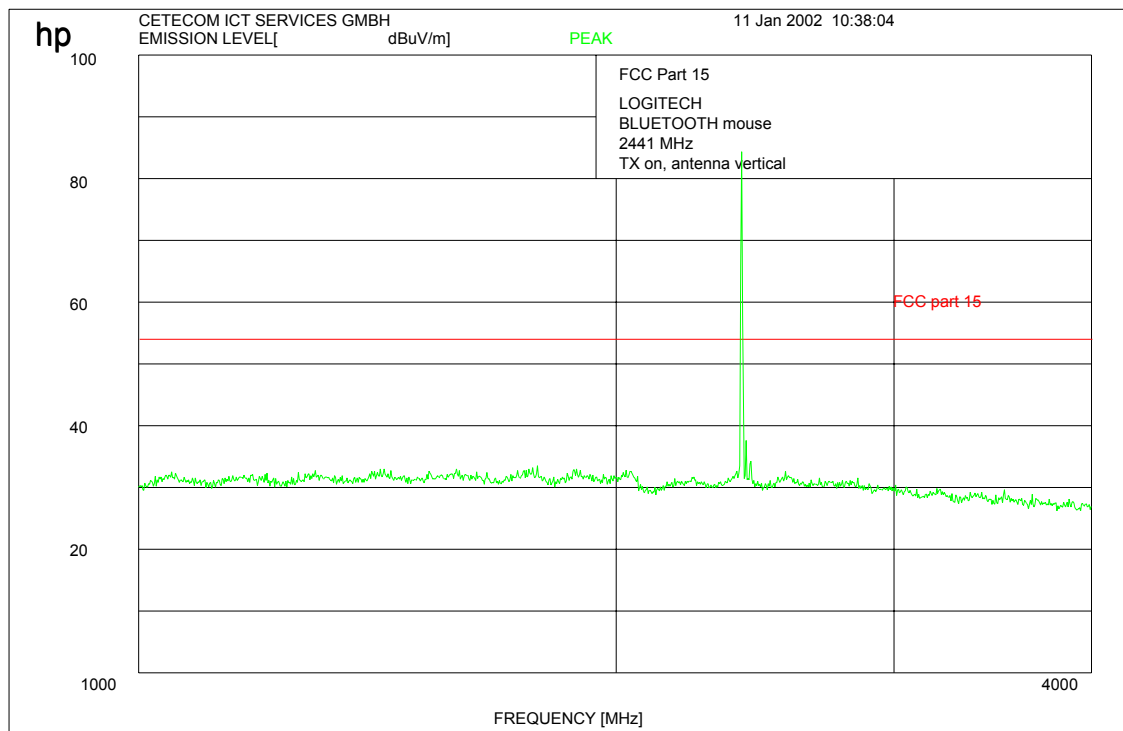
## SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

EMISSION LIMITATIONS (Transmitter)

SUBCLAUSE § 15.247 (c) (1)

2441 MHz (1 GHz – 4 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

LIMITS

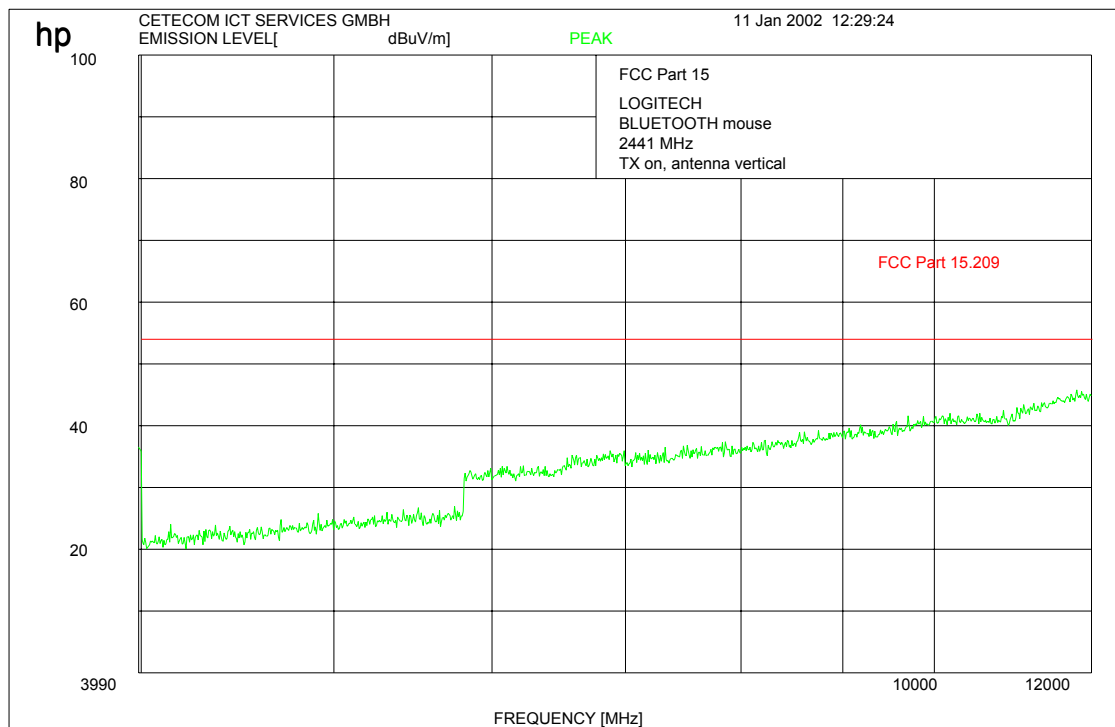
SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

## EMISSION LIMITATIONS (Transmitter)

## SUBCLAUSE § 15.247 (c) (1)

2441 MHz (4 GHz – 12 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

## LIMITS

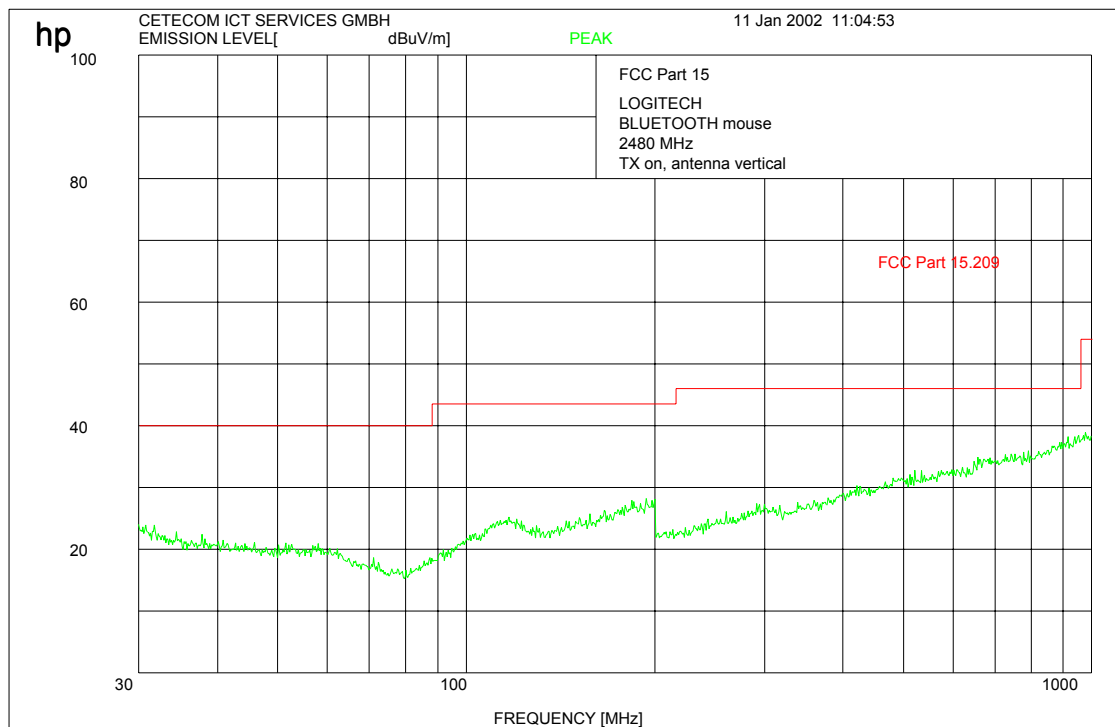
## SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

## EMISSION LIMITATIONS (Transmitter)

## SUBCLAUSE § 15.247 (c) (1)

2480 MHz (30 MHz – 1 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

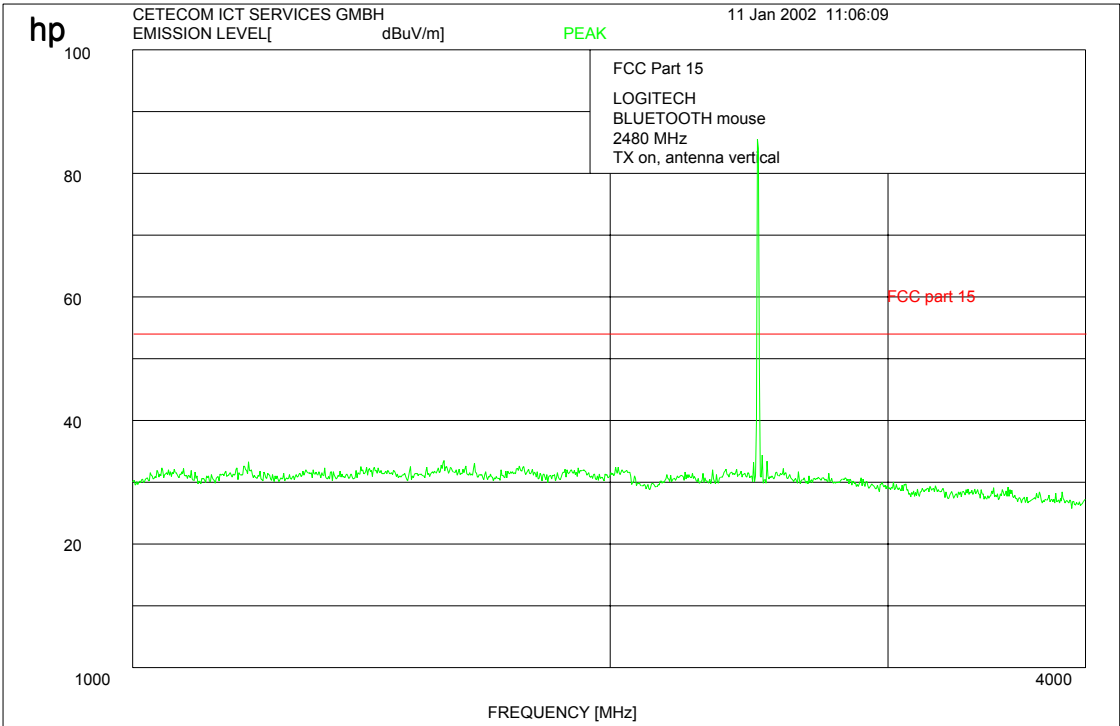
## LIMITS

## SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

EMISSION LIMITATIONS (Transmitter)      **CLAUSE § 15.247 (c) (1)**

2480 MHz ( 1 GHz – 4 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz       $f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

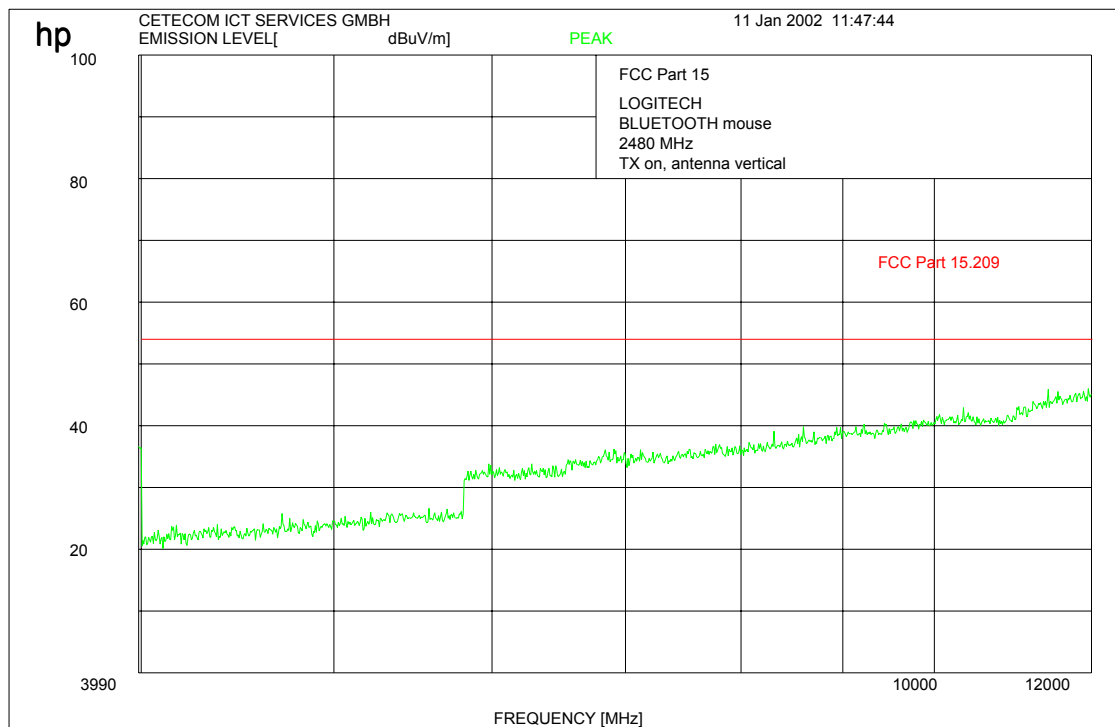
**LIMITS**      **SUBCLAUSE § 15.247 (c)**

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

## EMISSION LIMITATIONS (Transmitter)

## CLAUSE § 15.247 (c) (1)

2480 MHz (4 GHz – 12 GHz)



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

## LIMITS

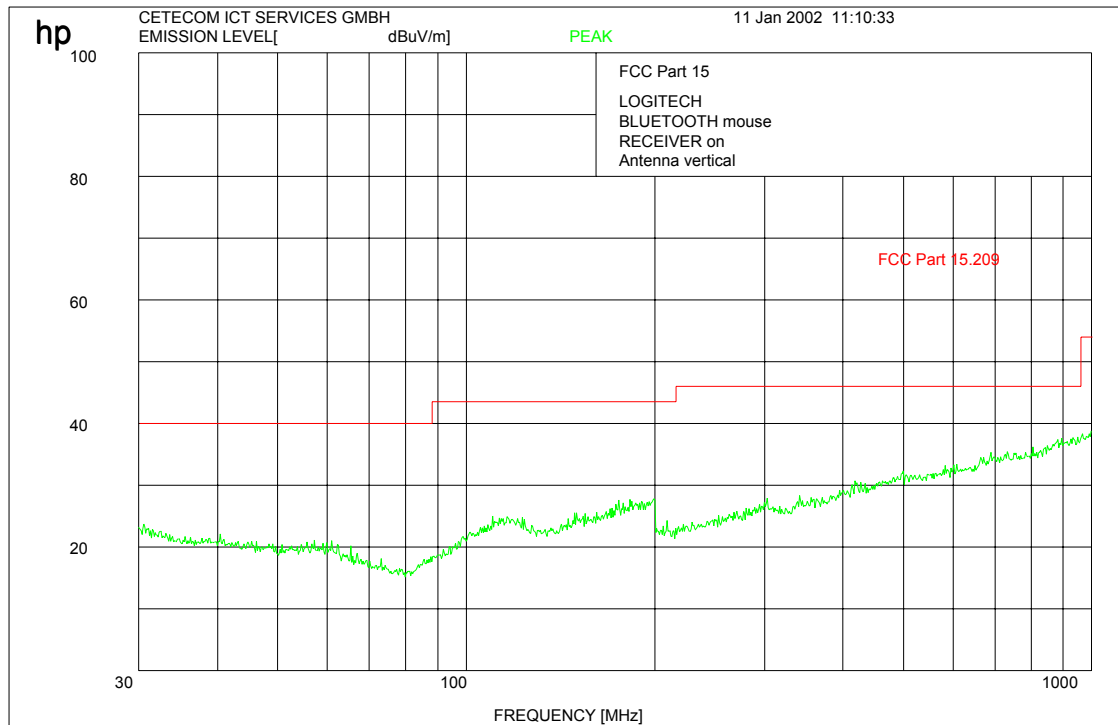
## SUBCLAUSE § 15.247 (c)

In any 100 kHz bandwidth outside the frequency band at least 20dB below the highest level of the desired power. In addition, 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) (see §15.205(c)).

## RECEIVER SPURIOUS RADIATION

§ 15.209

30 MHz – 1 GHz



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

### Limits

SUBCLAUSE § 15.209

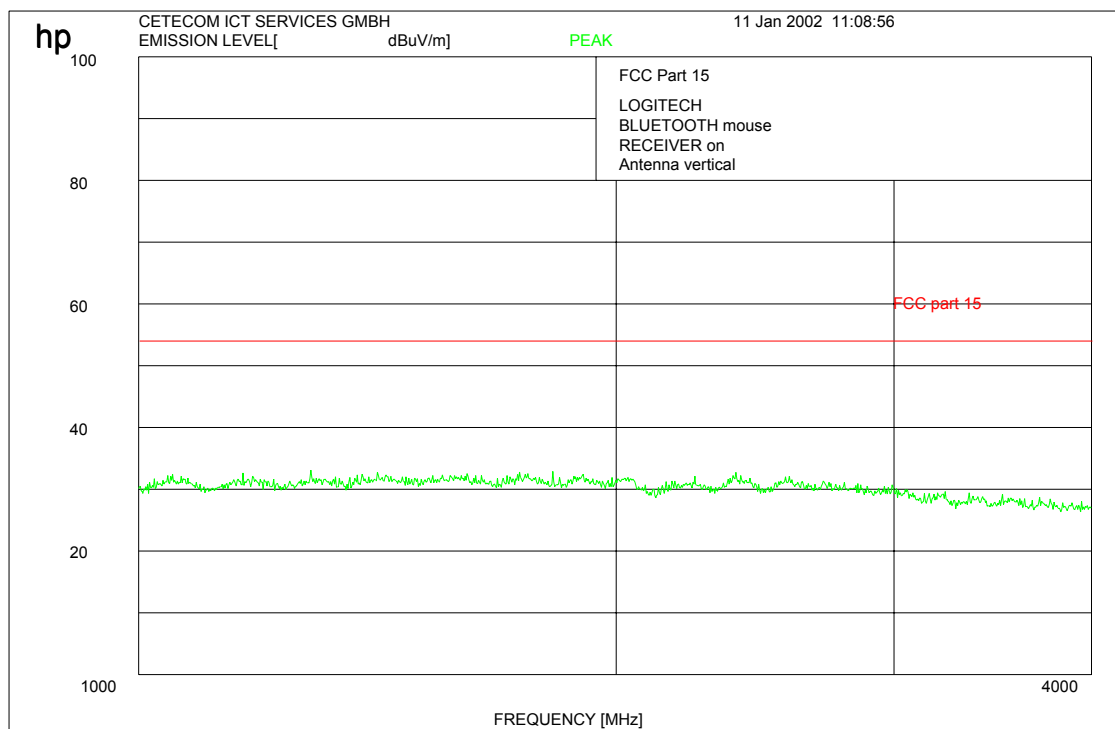
| Frequency (MHz) | Field strength ( $\mu\text{V/m}$ ) | Measurement distance (m) |
|-----------------|------------------------------------|--------------------------|
| 0.009 - 0.490   | 2400/F(kHz)                        | 300                      |
| 0.490 - 1.705   | 24000/F(kHz)                       | 30                       |
| 1.705 - 30.0    | 30                                 | 30                       |
| 30 - 88         | 100                                | 3                        |
| 88 - 216        | 150                                | 3                        |
| 216 - 960       | 200                                | 3                        |
| above 960       | 500                                | 3                        |



## RECEIVER SPURIOUS RADIATION

§ 15.209

1 GHz – 4 GHz



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

### Limits

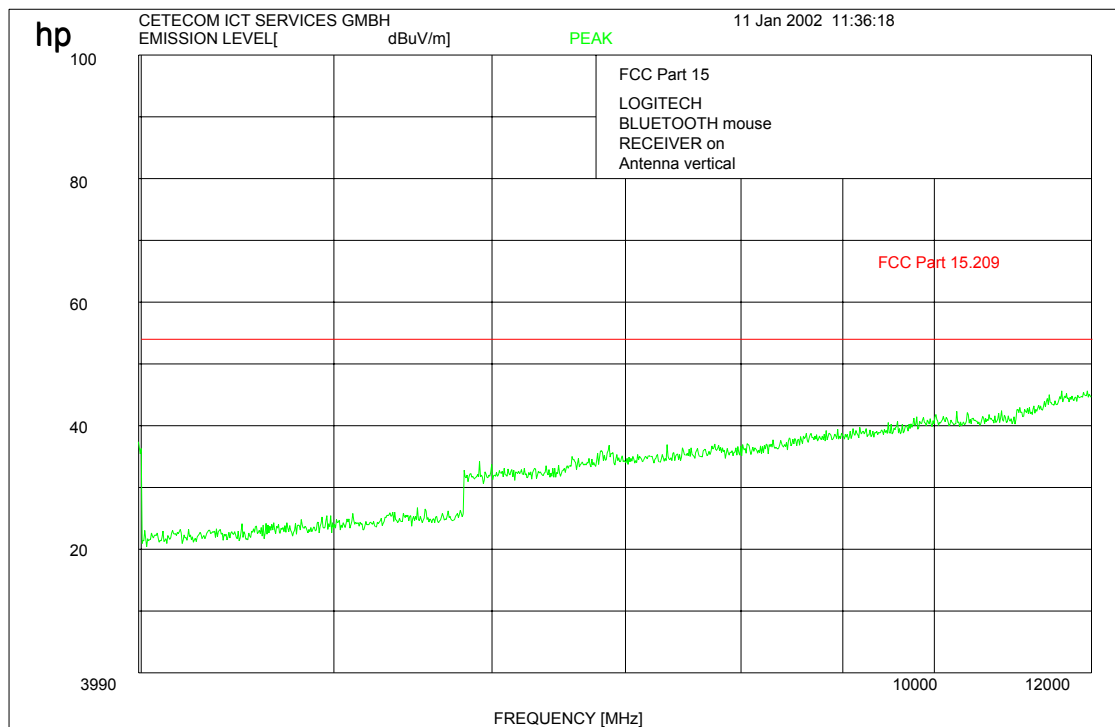
SUBCLAUSE § 15.209

| Frequency (MHz) | Field strength ( $\mu\text{V/m}$ ) | Measurement distance (m) |
|-----------------|------------------------------------|--------------------------|
| 0.009 - 0.490   | 2400/F(kHz)                        | 300                      |
| 0.490 - 1.705   | 24000/F(kHz)                       | 30                       |
| 1.705 - 30.0    | 30                                 | 30                       |
| 30 - 88         | 100                                | 3                        |
| 88 - 216        | 150                                | 3                        |
| 216 - 960       | 200                                | 3                        |
| above 960       | 500                                | 3                        |

## RECEIVER SPURIOUS RADIATION

§ 15.209

4 GHz – 12 GHz



$f < 1 \text{ GHz}$  : RBW/VBW: 100 kHz

$f \geq 1 \text{ GHz}$  : RBW/VBW: 1 MHz

**The measurements were performed up to 25 GHz. There were no spurious found.**

### Limits

### SUBCLAUSE § 15.209

| Frequency (MHz) | Field strength ( $\mu\text{V/m}$ ) | Measurement distance (m) |
|-----------------|------------------------------------|--------------------------|
| 30 - 88         | 100                                | 3                        |
| 88 - 216        | 150                                | 3                        |
| 216 - 960       | 200                                | 3                        |
| above 960       | 500                                | 3                        |

## TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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

| No | Instrument/Ancillary  | Type      | Manufacturer    | Serial No.  |
|----|-----------------------|-----------|-----------------|-------------|
| 01 | Spectrum Analyzer     | 8566 A    | Hewlett-Packard | 1925A00257  |
| 02 | Analyzer Display      | 8566 A    | Hewlett-Packard | 1925A00860  |
| 03 | Oscilloscope          | 7633      | Tektronix       | 230054      |
| 04 | Radio Analyzer        | CMTA 54   | Rohde & Schwarz | 894 043/010 |
| 05 | System Power Supply   | 6038 A    | Hewlett-Packard | 2848A07027  |
| 06 | Signal Generator      | 8111 A    | Hewlett-Packard | 2215G00867  |
| 07 | Signal Generator      | 8662 A    | Hewlett-Packard | 2224A01012  |
| 08 | Funktionsgenerator    | AFGU      | Rohde & Schwarz | 862 480/032 |
| 09 | Regeltrenntrafo       | MPL       | Erfi            | 91350       |
| 10 | Netznachbildung       | NNLA 8120 | Schwarzbeck     | 8120331     |
| 11 | Relais-Matrix         | PSU       | Rohde & Schwarz | 893 285/020 |
| 12 | Power-Meter           | 436 A     | Hewlett-Packard | 2101A12378  |
| 13 | Power-Sensor          | 8484 A    | Hewlett-Packard | 2237A10156  |
| 14 | Power-Sensor          | 8482 A    | Hewlett-Packard | 2237A00616  |
| 15 | Modulationsmeter      | 9008      | Racal-Dana      | 2647        |
| 16 | Frequenzzähler        | 5340 A    | Hewlett-Packard | 1532A03899  |
| 17 | Absorber Schirmkabine | ---       | MWB             | 87400/002   |
| 18 | Spectrum Analyzer     | 85660 B   | Hewlett-Packard | 2747A05306  |
| 19 | Analyzer Display      | 85662 A   | Hewlett-Packard | 2816A16541  |
| 20 | Quasi Peak Adapter    | 85650 A   | Hewlett-Packard | 2811A01131  |
| 21 | RF-Preselector        | 85685 A   | Hewlett-Packard | 2833A00768  |
| 22 | Biconical Antenne     | 3104      | Emco            | 3758        |
| 23 | Log. Per. Antenne     | 3146      | Emco            | 2130        |
| 24 | Double Ridge Horn     | 3115      | Emco            | 3088        |
| 25 | EMI-Testreceiver      | ESAI      | Rohde & Schwarz | 863 180/013 |
| 26 | EMI-Analyzer-Display  | ESAI-D    | Rohde & Schwarz | 862 771/008 |
| 27 | Biconical Antenne     | HK 116    | Rohde & Schwarz | 888 945/013 |
| 28 | Log. Per. Antenne     | HL 223    | Rohde & Schwarz | 825 584/002 |
| 29 | Relais-Switch-Unit    | RSU       | Rohde & Schwarz | 375 339/002 |
| 30 | Highpass              | HM985955  | FSY Microwave   | 001         |
| 31 | Amplifier             | P42-GA29  | Tron-Tech       | B 23602     |
| 32 | Absorber Schirmkabine |           | Frankonia       |             |
| 33 | Steuerrechner         | PSM 7     | Rohde & Schwarz | 834 621/004 |
| 34 | EMI Test Reciever     | ESMI      | Rohde & Schwarz | 827 063/010 |
| 35 | EMI Test Receiver     | Display   | Rohde & Schwarz | 829 808/010 |

# CETECOM ICT Services GmbH

Test report nr.: 2-2695-01-02/01

Issue Date: 01.03.02

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## TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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

| No | Instrument/Ancillary                      | Type      | Manufacturer    | Serial No.   |
|----|-------------------------------------------|-----------|-----------------|--------------|
| 36 | Controler                                 | HD 100    | Deisel          | 100/322/93   |
| 37 | Relais Matrix                             | PSN       | Rohde & Schwarz | 829 065/003  |
| 38 | Control Unit                              | GB 016 A2 | Rohde & Schwarz | 344 122/008  |
| 39 | Relais Switch Unit                        | RSU       | Rohde & Schwarz | 316 790/001  |
| 40 | Power Supply                              | 6032A     | Hewlett Packard | 2846A04063   |
| 41 | Spektrum Monitor                          | EZM       | Rohde & Schwarz | 883 720/006  |
| 42 | Meßempfänger                              | ESH 3     | Rohde & Schwarz | 890 174/002  |
| 43 | Meßempfänger                              | ESVP      | Rohde & Schwarz | 891 752/005  |
| 44 | Biconi Ant. 20-300MHz                     | HK 116    | Rohde & Schwarz | 833 162/011  |
| 45 | Logper Ant. 0.3-1 GHz                     | HL 223    | Rohde & Schwarz | 832 914/010  |
| 46 | Amplifier 0.1-4 GHz                       | AFS4      | Miteq Inc.      | 206461       |
| 47 | Logper Ant. 1-18 GHz                      | HL 024 A2 | Rohde & Schwarz | 342 662/002  |
| 48 | Polarisationsnetzwerk                     | HL 024 Z1 | Rohde & Schwarz | 341 570/002  |
| 49 | Double Ridge G Horn<br>Antenne 1-26.5 GHz | 3115      | EMCO            | 9107-3696    |
| 50 | Microw. Sys. Amplifier<br>0.5- 26.5 GHz   | 8317A     | Hewlett Packard | 3123A00105   |
| 51 | Audio Analyzer                            | UPD       | Rohde & Schwarz | 1030.7500.04 |
| 52 | Steuerrechner                             | PSM 7     | Rohde & Schwarz | 883 086/026  |
| 53 | DC V-Netzwerk                             | ESH3-Z6   | Rohde & Schwarz | 861 406/005  |
| 54 | Standard gain horn                        | Model 643 | NARDA           | 8112         |
| 55 | Standard gain horn                        | Model 640 | NARDA           | 8406         |
| 56 | Standard gain horn                        | 1824-20   | FMI             | 286          |
| 57 | AC 2 Phasen V-<br>Netzwerk                | ESH3-Z5   | Rohde & Schwarz | 894 981/019  |
| 58 | AC-3 Phasen V-<br>Netzwerk                | ESH2-Z5   | Rohde & Schwarz | 882 394/007  |
| 59 | Stromversorgung                           | 6032A     | Rohde & Schwarz | 2933A05441   |
| 60 | HF-Test Empfänger                         | ESVP.52   | Rohde & Schwarz | 881 487/021  |
| 61 | Spectrum Monitor                          | EZM       | Rohde & Schwarz | 883 086/026  |
| 62 | HF-Test Empfänger                         | ESH3      | Rohde & Schwarz | 881 515/002  |
| 63 | Relais Matrix                             | PSU       | Rohde & Schwarz | 882 943/029  |
| 64 | Relais Matrix                             | PSU       | Rohde & Schwarz | 828 628/007  |
| 65 | Spectrum Analyzer                         | FSIQ 26   | Rohde & Schwarz | 119.6001.27  |
| 66 | Spectrum Analyzer                         | HP 8565E  | Hewlett Packard | 3473A00773   |
| 67 | Standard gain horn                        | Model 638 | NARDA           | 1006         |

## Test site



## Testsite





## Photographs of the equipment

Photo 1: M-RU77



## Photographs of the equipment

Photo 2: M-RU77





## Photographs of the equipment

**Photo 3: M-RU77**



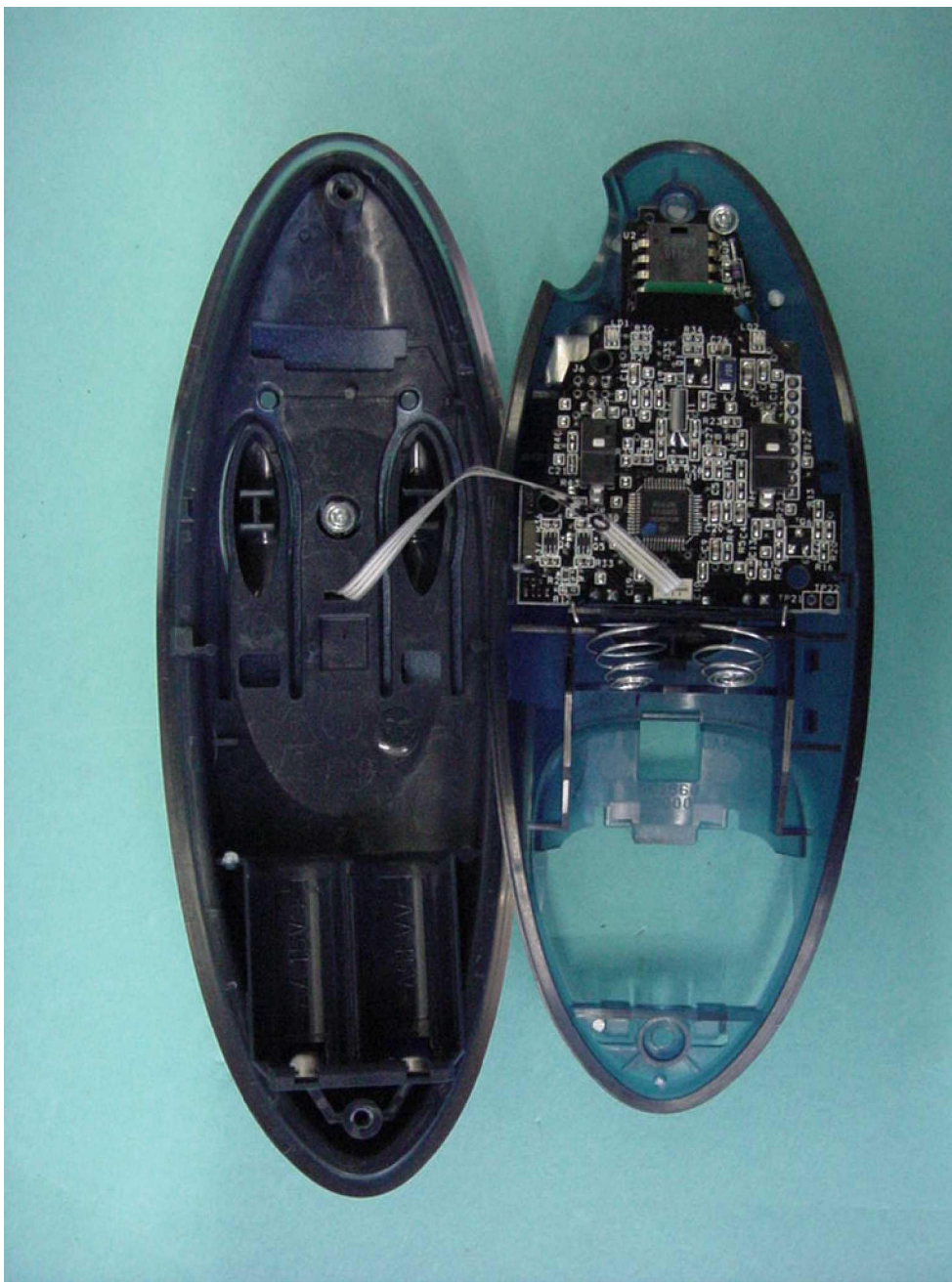
## Photographs of the equipment

Photo 4: M-RU77



## Photographs of the equipment

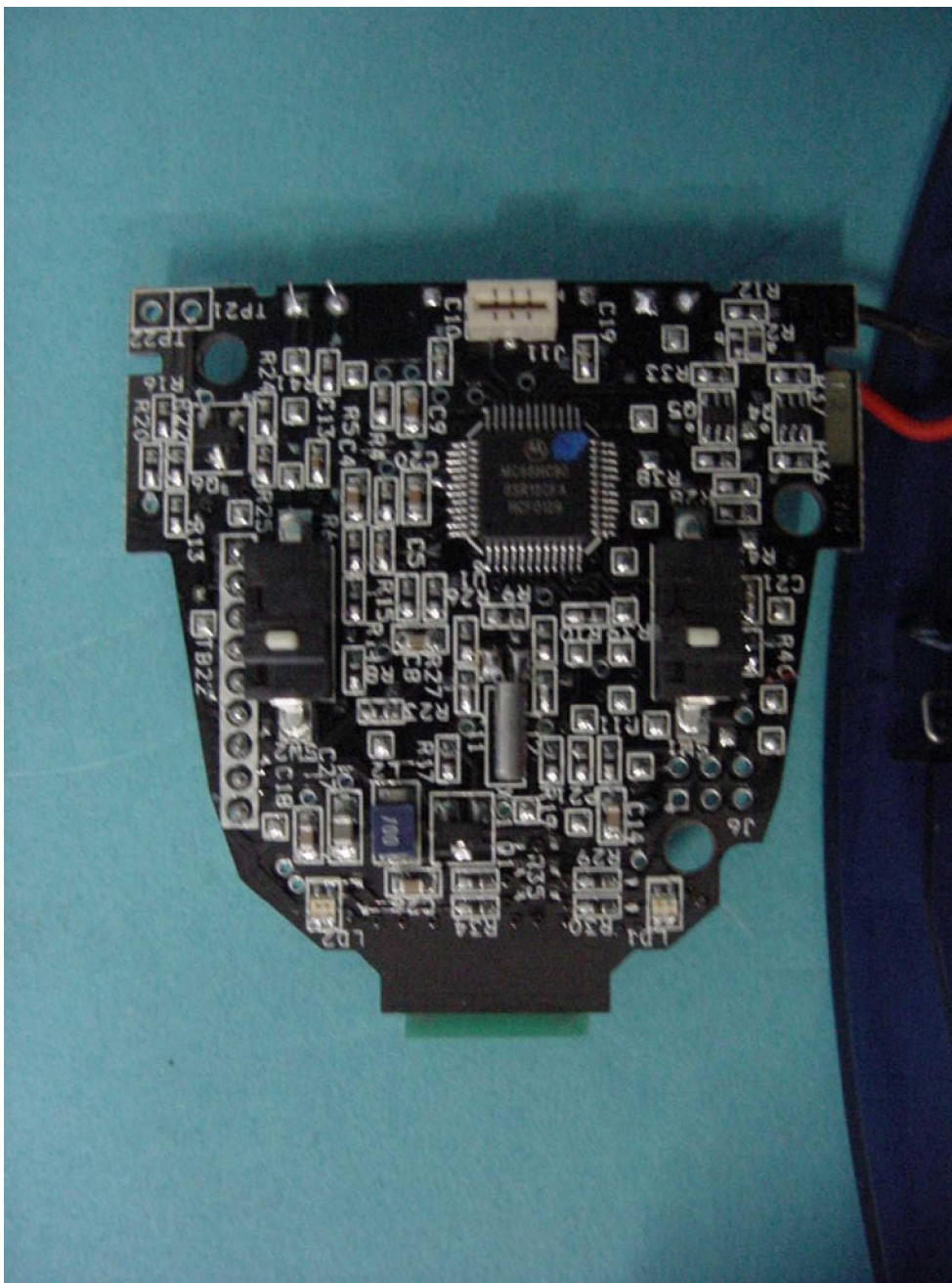
**Photo 5: M-RU77**





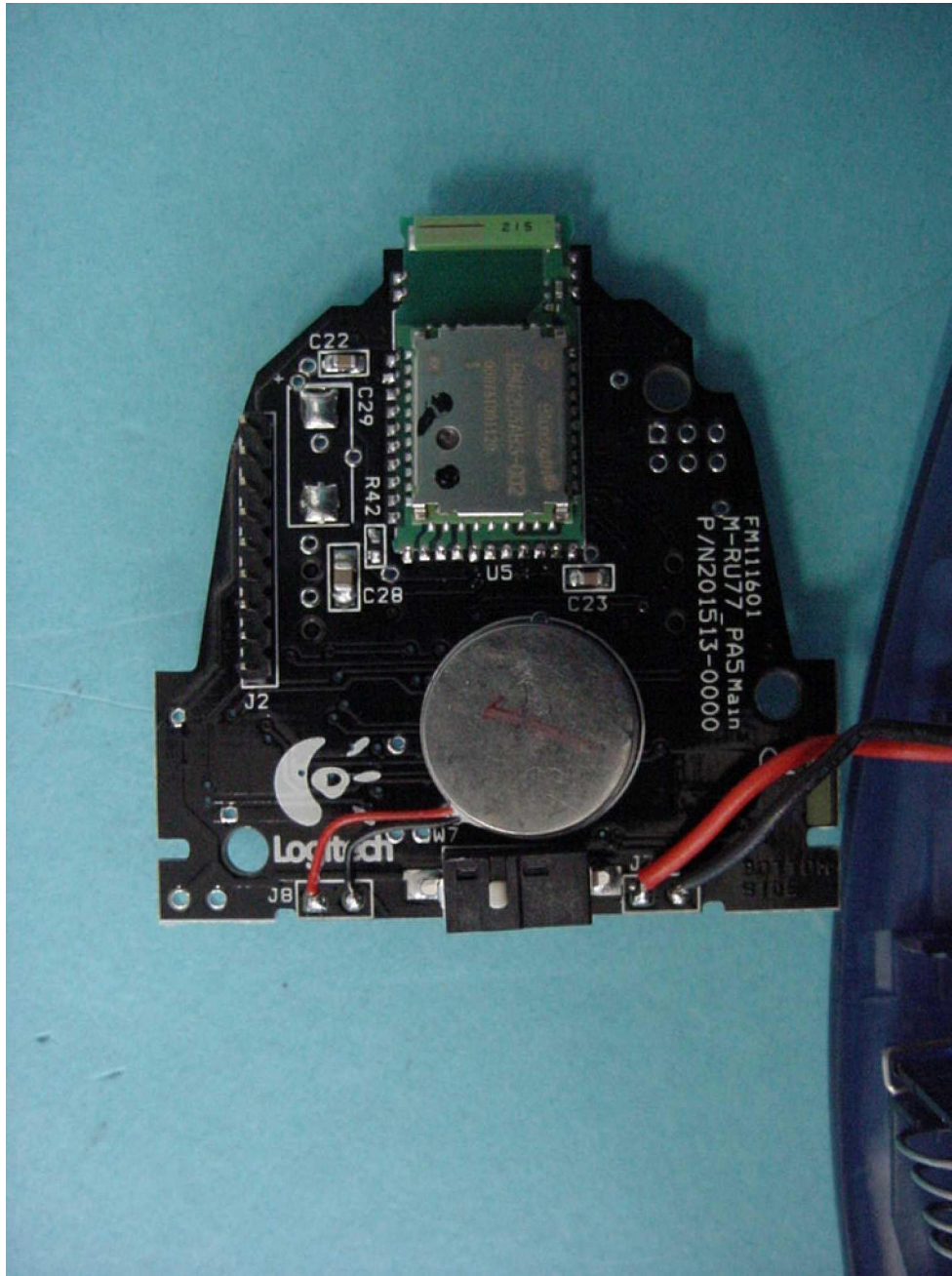
## Photographs of the equipment

Photo 6: M-RU77



## Photographs of the equipment

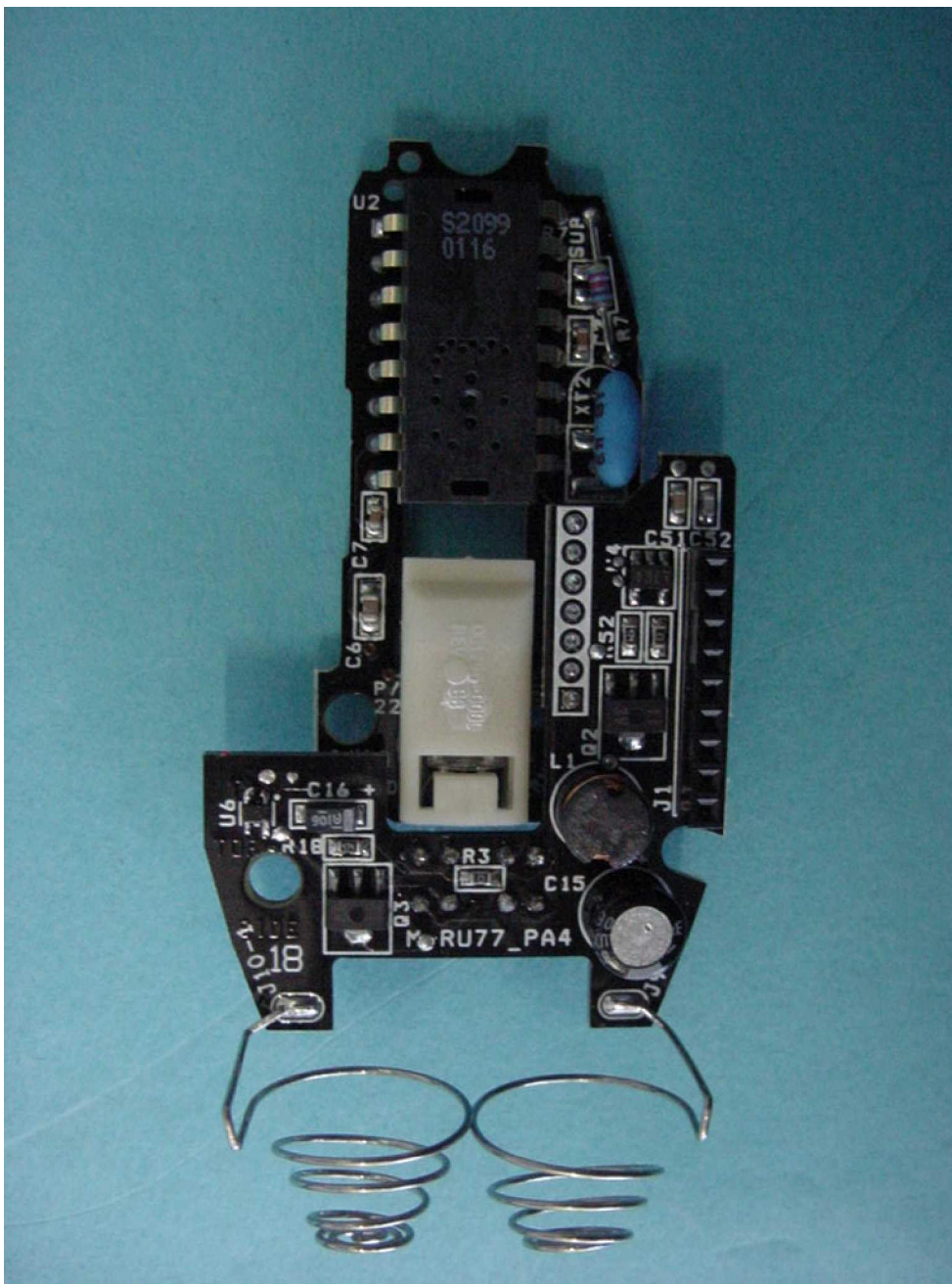
Photo 7: M-RU77





## Photographs of the equipment

**Photo 8: M-RU77**



## Photographs of the equipment

**Photo 9: M-RU77**

