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## **REPORT ON**

Limited FCC CFR 47: Parts 15 and 24 Testing in support of an  
Application for Grant of Equipment Authorisation  
of an IP Access Ltd 165B (1900MHz nano Basestation)

FCC ID: QGGKU02ZZP

**COMMERCIAL-IN-CONFIDENCE**

**Report No OR614552/01 Issue 1**

**November 2005**

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Product Service





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**REPORT ON**

Limited FCC CFR 47: Parts 15 and 24 Testing in support of an  
Application for Grant of Equipment Authorisation of an IP Access Ltd  
165B (1900MHz nano Basestation) Tri-Band Terminal Equipment

FCC ID: QGGKU02ZZP

Report No OR614552/01 Issue 1

November 2005

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**DATED**

24<sup>th</sup> November 2005

**ENGINEERING STATEMENT**

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47: Parts 15 and 24. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;



T Hubbard



S Hartley



A Guy



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## **SECTION 1**

### **REPORT SUMMARY**

Limited FCC CFR 47: Parts 15 and 24 Testing in support of an  
Application for Grant of Equipment Authorisation  
of an IP Access Ltd 165B (1900MHz nano Basestation)



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## 1.1 STATUS

|                                          |                                                                                                              |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Equipment Under Test</b>              | 165B (1900MHz nano Basestation)                                                                              |
| <b>Objective</b>                         | To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification. |
| <b>Name and Address of Client</b>        | IP Access Ltd<br>Building 2020<br>Cambourne Business Park<br>Cambourne<br>Cambridge<br>CB3 6DW               |
| <b>Type Number</b>                       | 165B (1900MHz nano Basestation)                                                                              |
| <b>Serial Number</b>                     | 000295FFFE0E<br>000295FFFE10<br>000295FFFE17<br>000295FFFE11                                                 |
| <b>Software Version</b>                  | V57d0                                                                                                        |
| <b>Test Specification / Issue / Date</b> | FCC CFR 47: Part 15, Subparts B and C, August 2002,<br>and Part 24, Subpart D, January 2001                  |
| <b>Number of Items Tested</b>            | Four                                                                                                         |
| <b>Security Classification of EUT</b>    | Commercial-in-Confidence                                                                                     |
| <b>Disposal</b>                          | Held pending disposal                                                                                        |
| <b>Reference Number</b>                  | Not Applicable                                                                                               |
| <b>Date</b>                              | Not Applicable                                                                                               |
| <b>Order Number</b>                      | PO08178                                                                                                      |
| <b>Date</b>                              | 27 <sup>th</sup> July 2005                                                                                   |
| <b>Start of Test</b>                     | 13 <sup>th</sup> October 2005                                                                                |
| <b>Finish of Test</b>                    | 4 <sup>th</sup> November 2005                                                                                |
| <b>Related Documents</b>                 | ANSI C63.4: 2001<br>FCC DA 00-705: 2000                                                                      |



## 1.2 INTRODUCTION

The information contained within this report is intended to show limited verification of compliance of the IP Access Ltd 165B (1900MHz nano Basestation) to the requirements of FCC Specification Part 24.

Testing was carried out in support of an application for Grant of Equipment Authorisation in the name of IP Access Ltd

### 1.3 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out is shown below.

FCC CFR 47: Part 15, Subpart B, RSS-210, RSS-132 and RSS-133

| Test | Spec Clause |                            | Test Description            | Result | Comments |
|------|-------------|----------------------------|-----------------------------|--------|----------|
|      | FCC         | Industry Canada            |                             |        |          |
| 2.1  | 15.109      | RSS-132, 6.6<br>RSS-133, 9 | Spurious Radiated Emissions | Pass   |          |
|      | 15.107      | RSS-210, 6.6               | Conducted Emissions         | N/A    |          |

FCC CFR 47: Part 24, Subpart E and RSS-133

| Test | Spec Clause                                          |                 | Test Description                                    | Result | Comments |
|------|------------------------------------------------------|-----------------|-----------------------------------------------------|--------|----------|
|      | FCC                                                  | Industry Canada |                                                     |        |          |
| 2.2  | Part 2<br>2.1046<br>Part 24<br>24.232                | RSS-133, 6.2    | Maximum Peak Output Power -<br>Conducted            | Pass   |          |
| 2.3  | Part 2<br>22.1046<br>Part 24<br>24.232 (b)           | RSS-133, 6.2    | Maximum Peak Output Power –<br>Radiated             | Pass   |          |
| 2.4  | Part 2<br>2.1047(d)                                  | Not Applicable  | Modulation Characteristics                          | Pass   |          |
| 2.5  | Part 2<br>2.1049,<br>Part 24<br>24.238 (b)           | Not Applicable  | Occupied Bandwidth                                  | Pass   |          |
| 2.6  | Part 2<br>2.1051,<br>Part 24<br>24.229 and<br>24.238 | RSS-133, 6.3    | Spurious Emissions at Antenna<br>Terminals          | Pass   |          |
| 2.7  | Part 2<br>22.1053,<br>Part 24<br>24.238              | RSS-133, 6.3    | Radiated Spurious Emissions                         | Pass   |          |
| 2.8  | Part 2<br>2.1051,<br>Part 24<br>24.238 (a)           | Not Applicable  | Conducted Spurious Emissions                        | Pass   |          |
| 2.9  | Part 2<br>2.1055,<br>Part 24<br>24.235               | RSS-133, 7      | Frequency Stability Under<br>Temperature Variations | Pass   |          |
| 2.10 | Part 2<br>2.1055,<br>Part 24<br>24.235               | RSS-133, 7      | Frequency Stability Under Voltage<br>Variations     | Pass   |          |

## **1.4 PRODUCT INFORMATION**

### **1.4.1 Technical Description**

The IP Access Ltd 165B (1900MHz nano basestation) operates from a 48 volt dc power supply.

### **1.4.2 Modes of Operation**

Modes of operation of the EUT during testing were as follows:

The 165B (1900MHz nano basestation) employs GSM, GPRS and EDGE technology. However, as the GSM and GPRS modes use the same modulation (GMSK) it was decided to operate the EUT in GSM mode only. The difference in GSM and GPRS Modes is the protocol, which will have no bearing on the RF Performance of the EUT.

All time slots were activated at once which provided a worst case scenario.

Applicable testing was carried out with the EUT transmitting at maximum power or receiving as detailed in Section 1.5.3.

Test Mode 1: GPRS 1900MHz Transmitting on the following channels and frequencies;

|                    |   |           |
|--------------------|---|-----------|
| Bottom Channel 512 | : | 1930.2MHz |
| Middle Channel 661 | : | 1960.2MHz |
| Top Channel 810    | : | 1989.8MHz |
| Extra Channel 760  | : | 1980.0MHz |

Test Mode 2: EDGE 1900MHz Transmitting on the following channels and frequencies;

|                    |   |           |
|--------------------|---|-----------|
| Bottom Channel 512 | : | 1930.2MHz |
| Middle Channel 661 | : | 1960.2MHz |
| Top Channel 810    | : | 1989.8MHz |
| Extra Channel 760  | : | 1980.0MHz |

## **1.5 TEST CONDITIONS**

The EUT was set-up simulating a typical user installation on the Alternative Open Field Test Site under Registration Number: 90987, and tested in accordance with the applicable specification.

For all tests, the IP Access Ltd 165B (1900MHz nano basestation) was powered by 48v dc power supply.

## **1.6 DEVIATIONS FROM THE STANDARD**

No deviations to the standard were made.

## **1.7 MODIFICATION RECORD**

No modifications were made to the EUT during testing.

## **1.8 ALTERNATIVE TEST SITE**

Under our group UKAS Accreditation, TUV Product Service conducted the following tests at our Maplewood Facility, Basingstoke Test Laboratory

- 2.1 Part 15B Radiated Emissions
- 2.3 Part 24 Maximum Peak Output Power Radiated (GPRS mode)
- 2.7 Part 24 Radiated Emissions (GPRS mode)

## **SECTION 2**

### **TEST DETAILS**

Limited FCC CFR 47: Parts 15 and 24 Testing in support of an  
Application for Grant of Equipment Authorisation  
of an IP Access Ltd 165B (1900MHz nano basestation)

## **2.1 SPURIOUS RADIATED EMISSIONS (Unintentional Radiator)**

### **2.1.1 Specification Reference**

FCC CFR 47: Part 15 Subpart B, Section 15.107

### **2.1.2 Equipment Under Test**

165B (1900MHz nano basestation)

### **2.1.3 Date of Test**

3<sup>rd</sup> November 2005

### **2.1.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.1.5 Test Procedure**

Test Performed in accordance with ANSI C63.4 and RSS-212.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT. The list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector.

Emissions identified within the range 1GHz – 10GHz were then formally measured using Peak and Average Detectors, as appropriate.

The measurements were performed at a 3m distance unless otherwise stated.

## 2.1 SPURIOUS RADIATED EMISSIONS

### 2.1.6 Test Results

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.107 and Industry Canada RSS-132, 6.6 and RSS-133, 9 for Spurious Radiated Emissions (30MHz – 1GHz).

Measurements were made with the EUT in GPRS 1900 Idle Mode.

#### EUT Receiving

| Emission Frequency | Polarisation | Height | Azimuth | Field Strength |       | Limit  |       |
|--------------------|--------------|--------|---------|----------------|-------|--------|-------|
| MHz                |              | cm     | degree  | dBμV/m         | μV/m  | dBμV/m | μV/m  |
| 38.90              | Vertical     | 100    | 073     | 29.4           | 29.5  | 40.0   | 100.0 |
| 39.50              | Vertical     | 100    | 073     | 29.4           | 29.5  | 40.0   | 100.0 |
| 312.00             | Horizontal   | 100    | 261     | 43.8           | 159.0 | 46.0   | 200.0 |
| 520.00             | Horizontal   | 176    | 299     | 41.8           | 123.0 | 46.0   | 200.0 |
| 624.00             | Vertical     | 100    | 184     | 37.4           | 74.1  | 46.0   | 200.0 |
| 780.00             | Vertical     | 100    | 205     | 41.5           | 118.9 | 46.0   | 200.0 |
| 780.00             | Horizontal   | 100    | 126     | 39.1           | 90.2  | 46.0   | 200.0 |
| 910.00             | Horizontal   | 100    | 151     | 39.8           | 97.7  | 46.0   | 200.0 |



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## 2.1 SPURIOUS RADIATED EMISSIONS

### 2.1.6 Test Results - continued

Equipment Designation: Unintentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart B, Section 15.107 and Industry Canada RSS-132, 6.6 and RSS-133, 9 for Spurious Radiated Emissions (1GHz- 20GHz).

Measurements were made with the EUT in GPRS 1900 Mode.

#### EUT Receiving

| Frequency | Antenna      |        | Turntable | Peak Field Strength | Peak Limit | Average Field Strength | Average Limit |
|-----------|--------------|--------|-----------|---------------------|------------|------------------------|---------------|
|           | Polarisation | Height | Azimuth   |                     |            |                        |               |
| GHz       |              | cm     | degree    | dBμV/m              | dBμV/m     | dBμV/m                 | dBμV/m        |
| 1.000     | Horizontal   | 140    | 057       | 44.5                | 74.0       | 34.6                   | 54.0          |
| 1.400     | Vertical     | 1300   | 000       | 45.2                | 74.0       | 37.6                   | 54.0          |
| 1.450     | Horizontal   | 100    | 316       | 47.7                | 74.0       | 38.5                   | 54.0          |
| 1.500     | Horizontal   | 100    | 320       | 48.7                | 74.0       | 38.1                   | 54.0          |
| 1.800     | Vertical     | 100    | 025       | 46.5                | 74.0       | 38.1                   | 54.0          |

## 2.2 MAXIMUM PEAK OUTPUT POWER (CONDUCTED)

### 2.2.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.232

### 2.2.2 Equipment Under Test

165B (1900MHz nano basestation)

### 2.2.3 Date of Test

13<sup>th</sup> October 2005

### 2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.2.5 Test Procedure

Using a spectrum analyser and attenuator(s), the output power of the EUT was measured at the antenna terminals. The EUT supports both GMSK and EDGE. The carrier was modulated by it's normal GMSK and EDGE modulation with all timeslots (0-7) active.

The spectrum analyser RBW and VBW were set to 1MHz and the path loss measured and entered as a reference level offset.

### 2.2.6 Test Results

#### Maximum Power - GMSK

| Frequency (MHz) | Output Power (dBm) | Path Loss (dB) | Result (dBm) | Result (W) |
|-----------------|--------------------|----------------|--------------|------------|
| 1930.2          | +12.51             | 10.66          | 24.04        | 0.254      |
| 1960.0          | +13.59             | 10.66          | 24.08        | 0.256      |
| 1989.8          | +13.28             | 10.67          | 24.35        | 0.272      |



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## 2.2 MAXIMUM PEAK OUTPUT POWER (CONDUCTED)

### 2.2.6 Test Results - Continued

#### Maximum Power - EDGE

| Frequency (MHz) | Output Power (dBm) | Path Loss (dB) | Result (dBm) | Result (mW) |
|-----------------|--------------------|----------------|--------------|-------------|
| 1930.2          | +7.1               | 10.7           | 16.62        | 45.92       |
| 1960.0          | +6.98              | 10.7           | 16.47        | 44.36       |
| 1989.8          | +7.16              | 10.7           | 16.71        | 46.88       |

|       |                  |
|-------|------------------|
| Limit | <100W or <+50dBm |
|-------|------------------|

#### Remarks

EUT complies with CFR 47 2.1046 and 24.232(b). The EUT does not exceed 100W or +55dBm at the measured frequencies.

## **2.3 MAXIMUM PEAK OUTPUT POWER (RADIATED)**

### **2.3.1 Specification Reference**

FCC CFR 47: Part 24 Subpart E, Section 24.232

### **2.3.2 Equipment Under Test**

165B (1900MHz nano basestation)

### **2.3.3 Date of Test**

26<sup>th</sup> October 2005 (GPRS)  
2<sup>nd</sup> November 2005 (EDGE)

### **2.3.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.3.5 Test Procedure**

Test Performed in accordance with ANSI C63.4.

The EUT contains an antenna port and therefore the Maximum Peak Output Power was made using the conducted method.

The EUT was connected to a Digital Storage Oscilloscope via an attenuator and Crystal Detector. The DC output from the Crystal Detector was measured on the Oscilloscope. The EUT was then substituted for a Signal Generator. The generators frequency was adjusted to that of the EUT and the amplitude increased to give the same DC level as measured from the EUT. The level was read from the Signal Generator which gave the maximum output power.

### **2.3.6 Test Results**

Measurements were made with the EUT in GPRS 1900MHz Mode 1.

The EUT met the requirements of FCC Part 24, Section 24.232, Power and Antenna Height Limits.

| Frequency (MHz) | Result ERP (dBm) | Result ERP (mW) |
|-----------------|------------------|-----------------|
| 1930.2          | 21.42            | 139             |
| 1959.8          | 17.65            | 58              |
| 1979.9          | 23.66            | 232             |
| Limit           | 33.00            | 2000            |

## 2.3 MAXIMUM PEAK OUTPUT POWER (RADIATED)

### 2.3.6 Test Results - Continued

Measurements were made with the EUT in EDGE 1900MHz Mode 1.

The EUT met the requirements of FCC Part 24, Section 24.232, Power and Antenna Height Limits.

| Frequency (MHz) | Result ERP (dBm) | Result ERP (mW) |
|-----------------|------------------|-----------------|
| 1930            | 20.6             | 115             |
| 1960            | 14.9             | 31              |
| 1990            | 13.9             | 25              |
| Limit           | 33.0             | 2000            |

## **2.4 MODULATION CHARACTERISTICS**

### **2.4.1 Specification Reference**

FCC CFR 47: Part 24 Subpart E, Section 2.1047(d)

### **2.4.2 Equipment Under Test**

165B (1900MHz nano basestation)

### **2.4.3 Date of Test**

13<sup>th</sup> October 2005

### **2.4.4 Test Equipment Used**

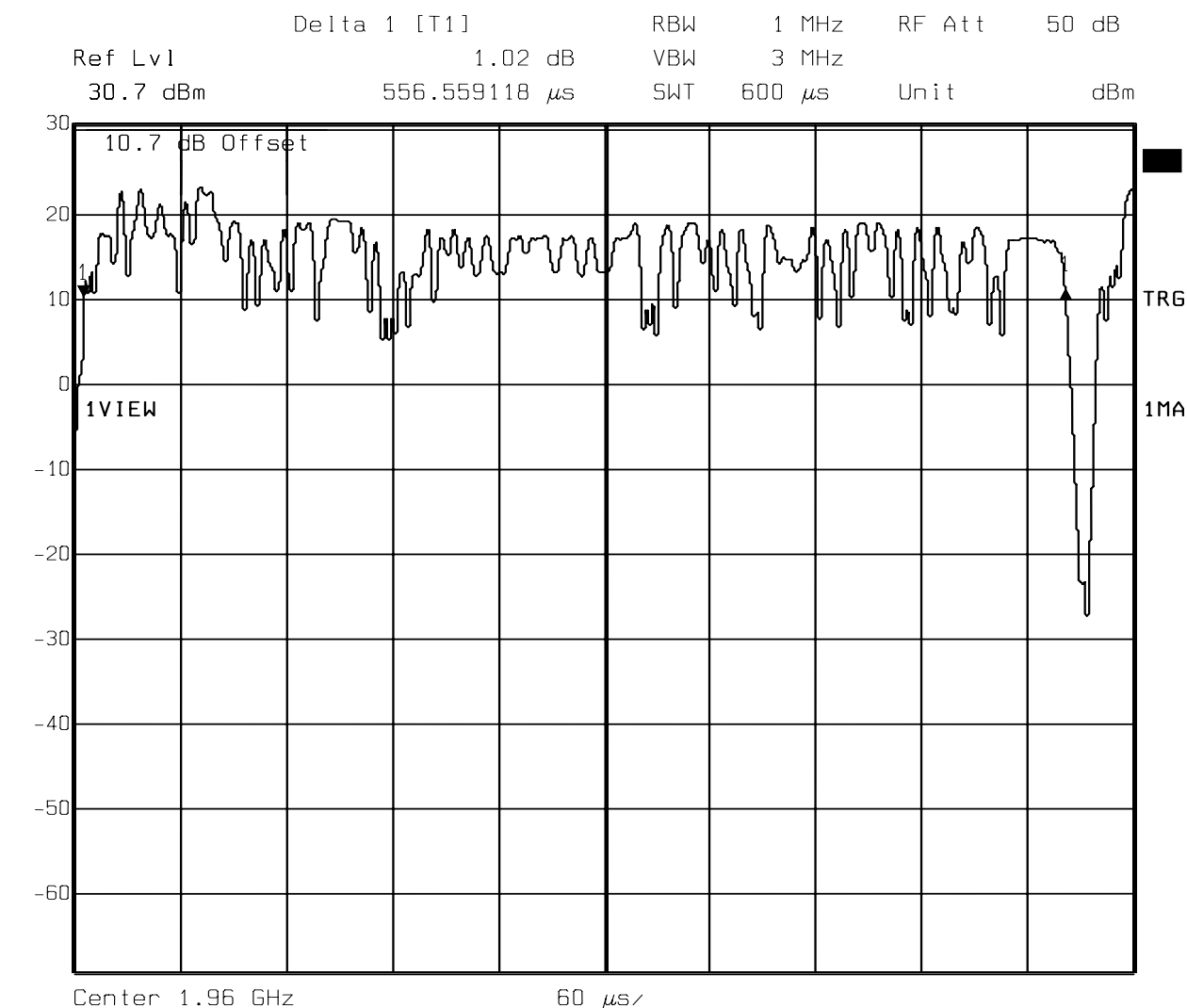
The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.4.5 Test Procedure**

Two views are shown for GSM and EDGE modes of operation. One view shows one active time slot over the complete screen. The other view shows the alternative time slots over a complete frame.



## 2.4 MODULATION CHARACTERISTICS

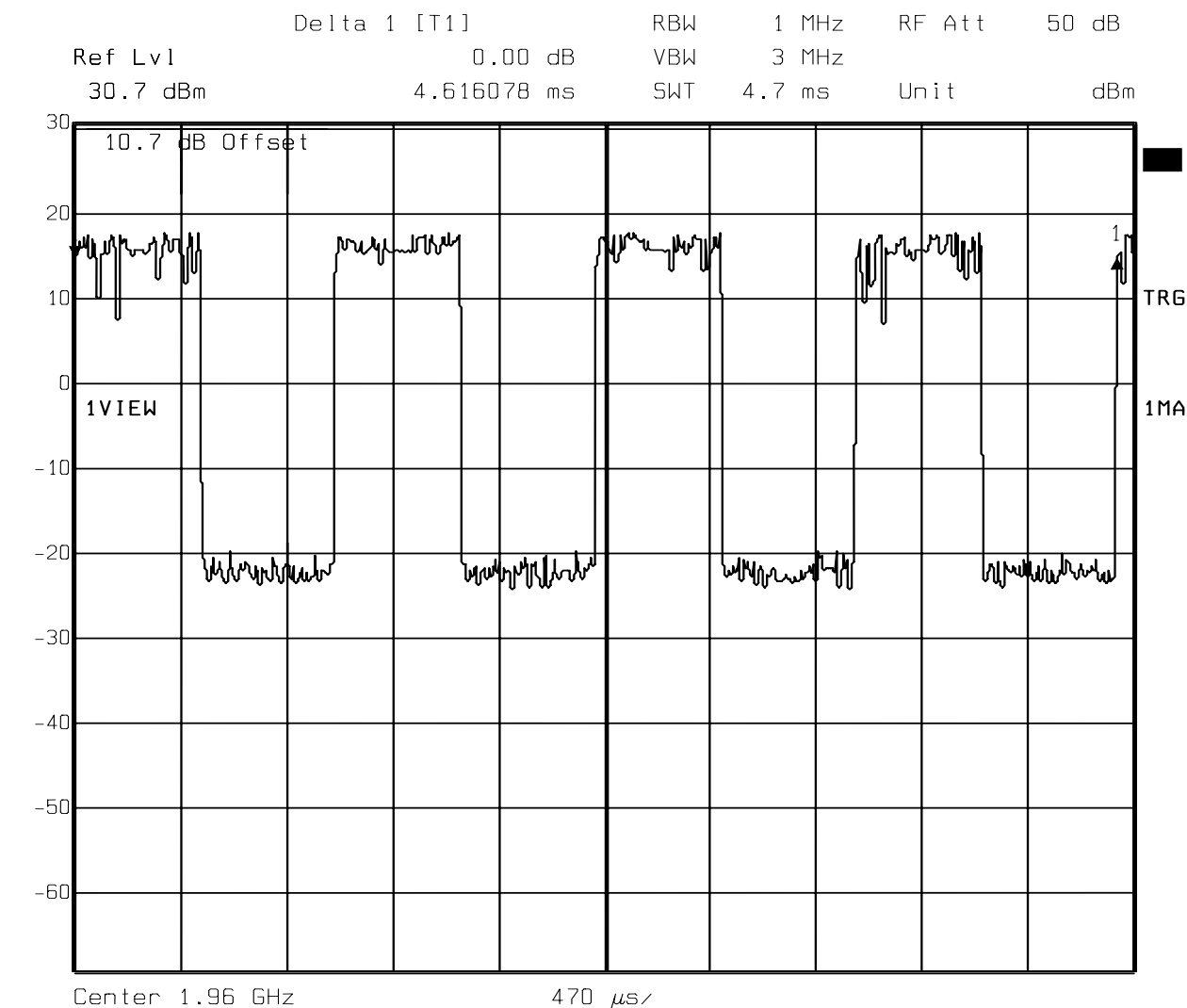


Date: 13.OCT.05 10:31:46

GSM Mode. Single Shot View



## 2.4 MODULATION CHARACTERISTICS



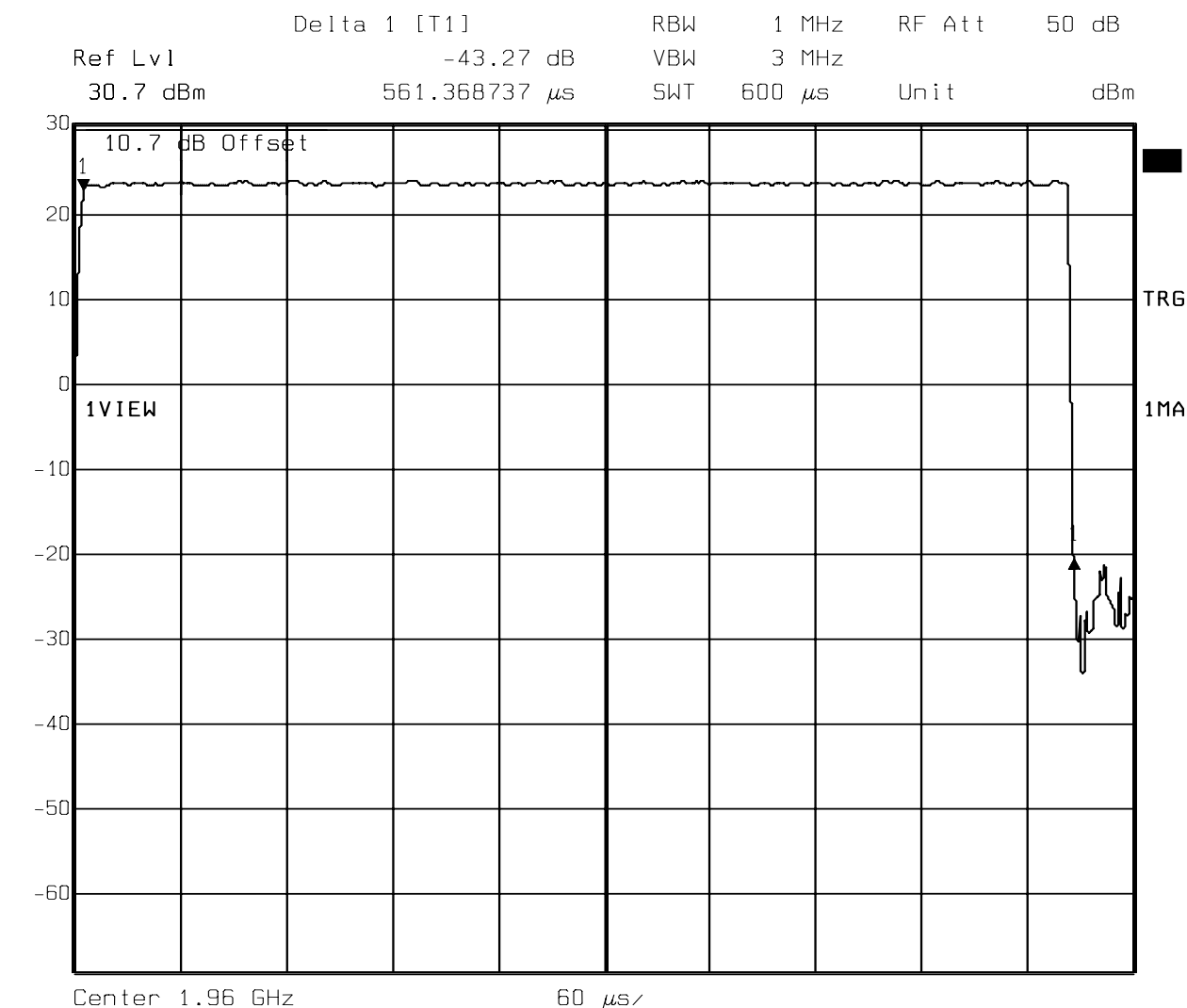
Date: 13.OCT.05 10:35:10

GSM Mode. Alternative Slot View



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## 2.4 MODULATION CHARACTERISTICS

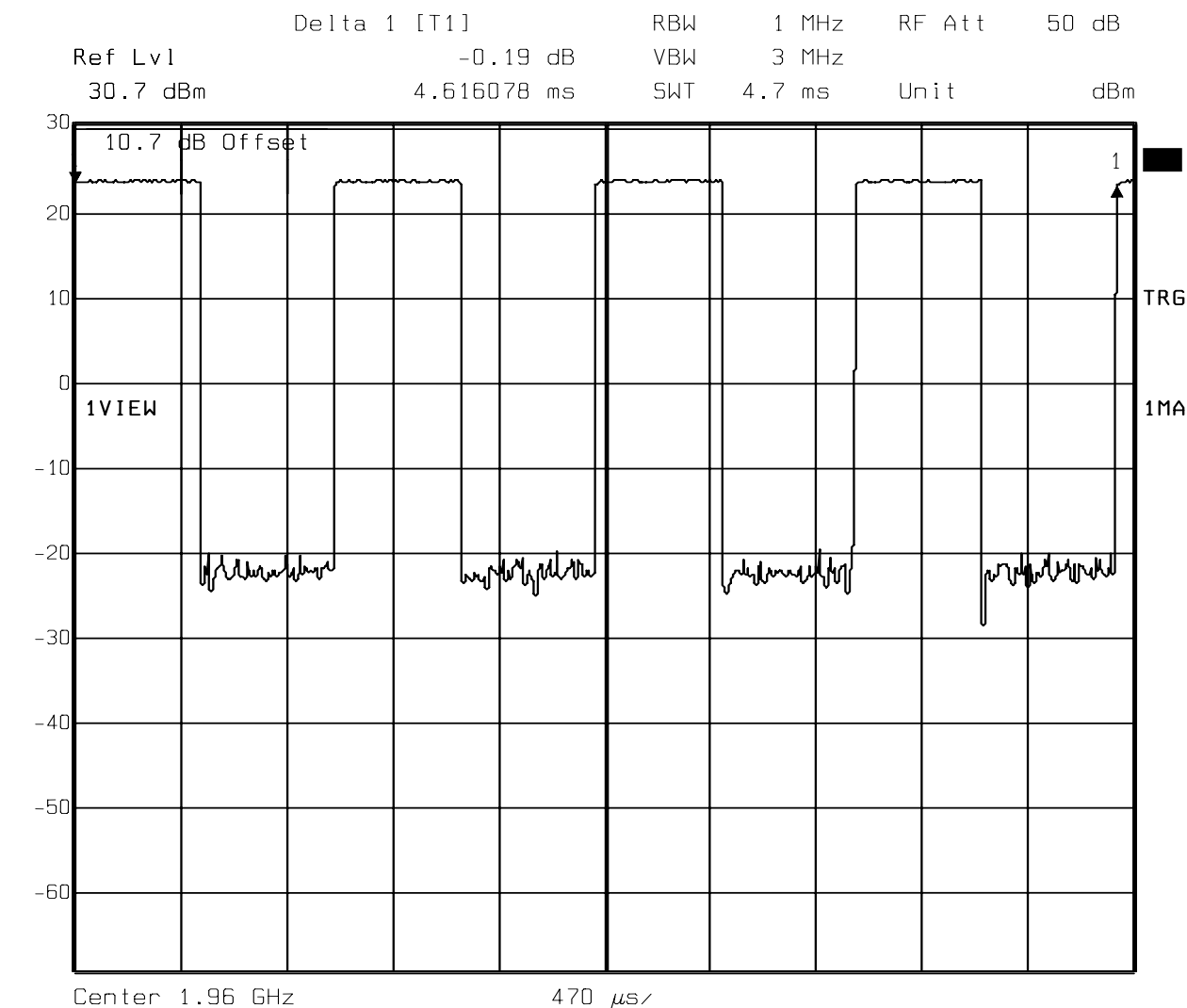


Date: 13.OCT.05 10:42:20

EDGE Mode. Single Shot View



## 2.4 MODULATION CHARACTERISTICS



Date: 13.OCT.05 10:40:10

EDGE Mode. Alternative Slot View

## 2.5 OCCUPIED BANDWIDTH

### 2.5.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.238(b)

### 2.5.2 Equipment Under Test

165B (1900MHz nano basestation)

### 2.5.3 Date of Test

13<sup>th</sup> October 2005

### 2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.4.5 Test Procedure

The EUT was set to transmit on maximum power and measurements were made on all Timeslots (0-7) for both GMSK and EDGE modes.

Using a resolution bandwidth of 10kHz and a video bandwidth of 30kHz, the –26dBc points were established and the emission bandwidth determined.

The plots below show the resultant display from the Spectrum Analyser.

#### 26dB Bandwidth GMSK Mode

| Frequency (MHz) | 26dB Bandwidth (kHz) |
|-----------------|----------------------|
| 1960.0          | 342.685370           |

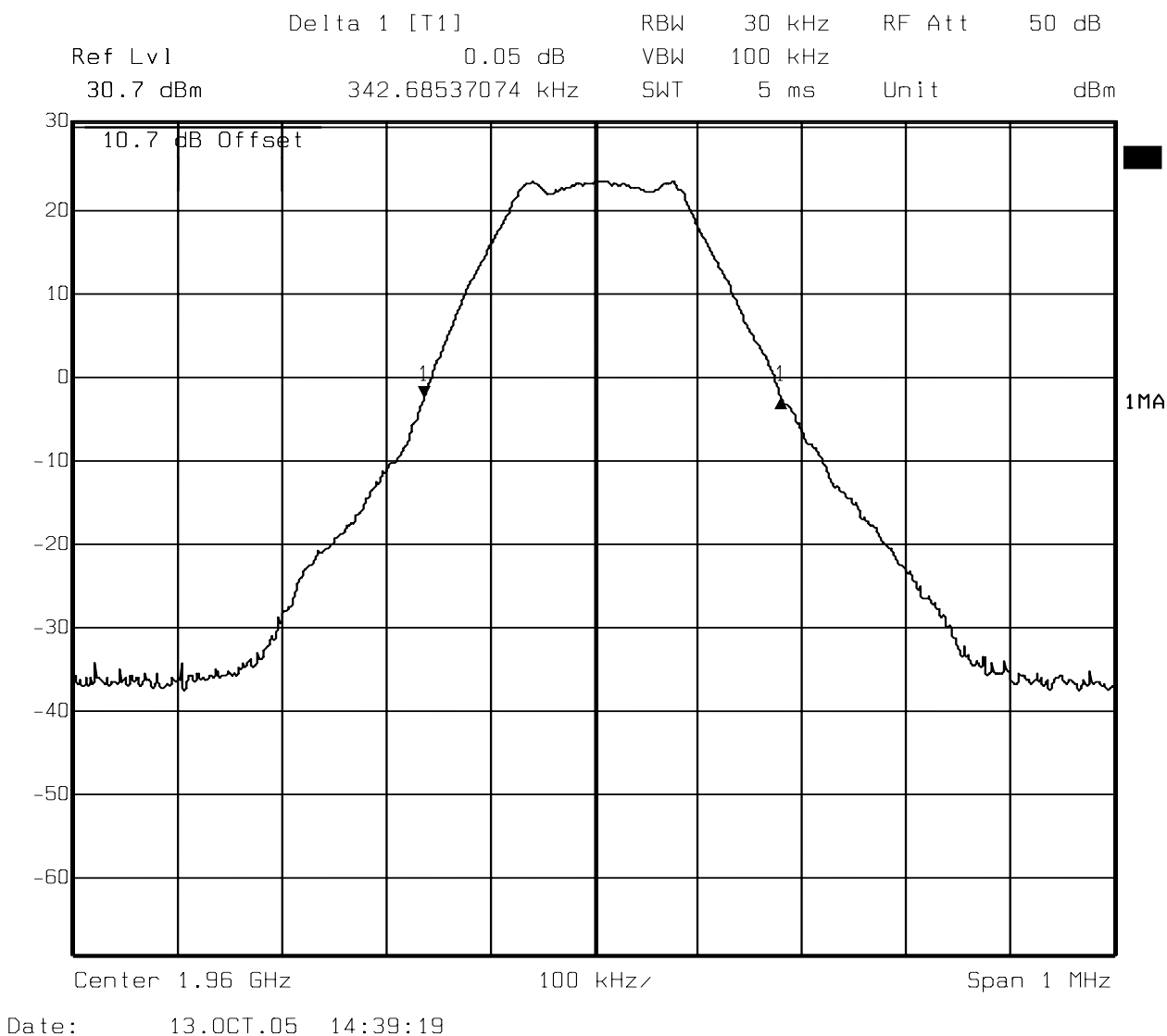
#### 26dB Bandwidth EDGE Mode

| Frequency (MHz) | 26dB Bandwidth (kHz) |
|-----------------|----------------------|
| 1960.0          | 330.661322           |



## 2.5 OCCUPIED BANDWIDTH

### 2.5.5 Test Results



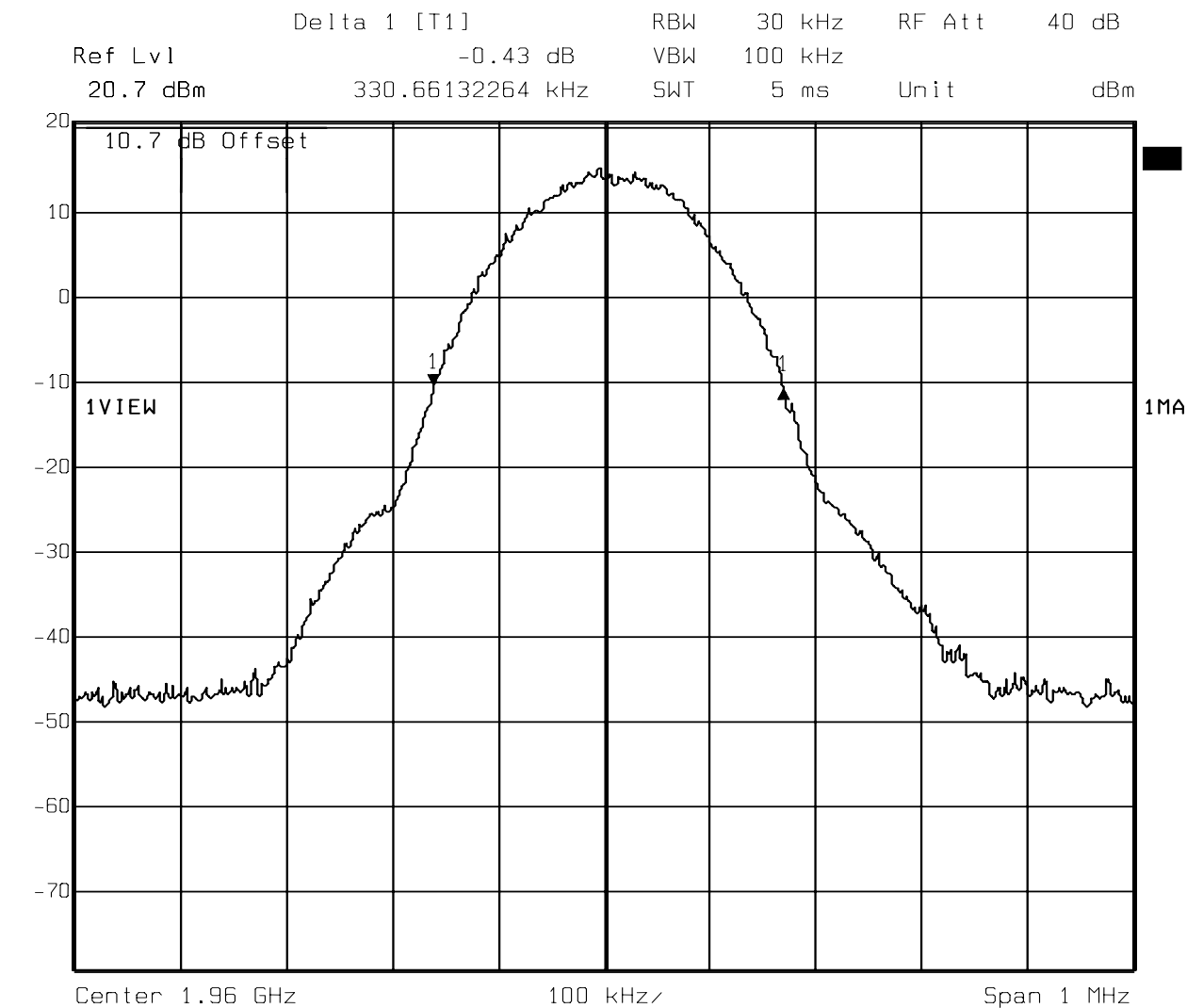
GMSK Mode - Occupied Bandwidth As Defined By The - 26dBc Points



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## 2.5 OCCUPIED BANDWIDTH

### 2.5.5 Test Results



Date: 13.OCT.05 14:43:23

EDGE Mode - Occupied Bandwidth As Defined By The - 26dBc Points

## **2.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz)**

### **2.6.1 Specification Reference**

FCC CFR 47: Part 24 Subpart E, Section 24.229

### **2.6.2 Equipment Under Test**

165B (1900MHz nano basestation)

### **2.6.3 Date of Test**

13<sup>th</sup> October 2005

### **2.6.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.6.5 Test Procedure**

In accordance with Part 24.238(b) and 24.229, using a spectrum analyser and attenuators, the emissions were measured between the block edge frequency up to 1MHz away to ensure compliance with the 43 +10Log P limit. Measurements were performed using a peak detector with the trace display set to Max Hold. A resolution bandwidth at least 1% of the 26dB bandwidth was used, in this case 5kHz resolution bandwidth and 20kHz video bandwidth. The measured path loss was entered as a reference level offset into the Spectrum Analyser.

The EUT was tested in GSM and EDGE modes of operation.

Below are the Frequency Blocks the EUT was tested against along with the tested channels.

| Frequency Block (MHz) | Lower Block Edge Test Channels/Frequencies |
|-----------------------|--------------------------------------------|
| A                     | Channel: 512<br>Frequency: 1930.2 MHz      |
| C                     | Channel: 810<br>Frequency: 1989.8 MHz      |

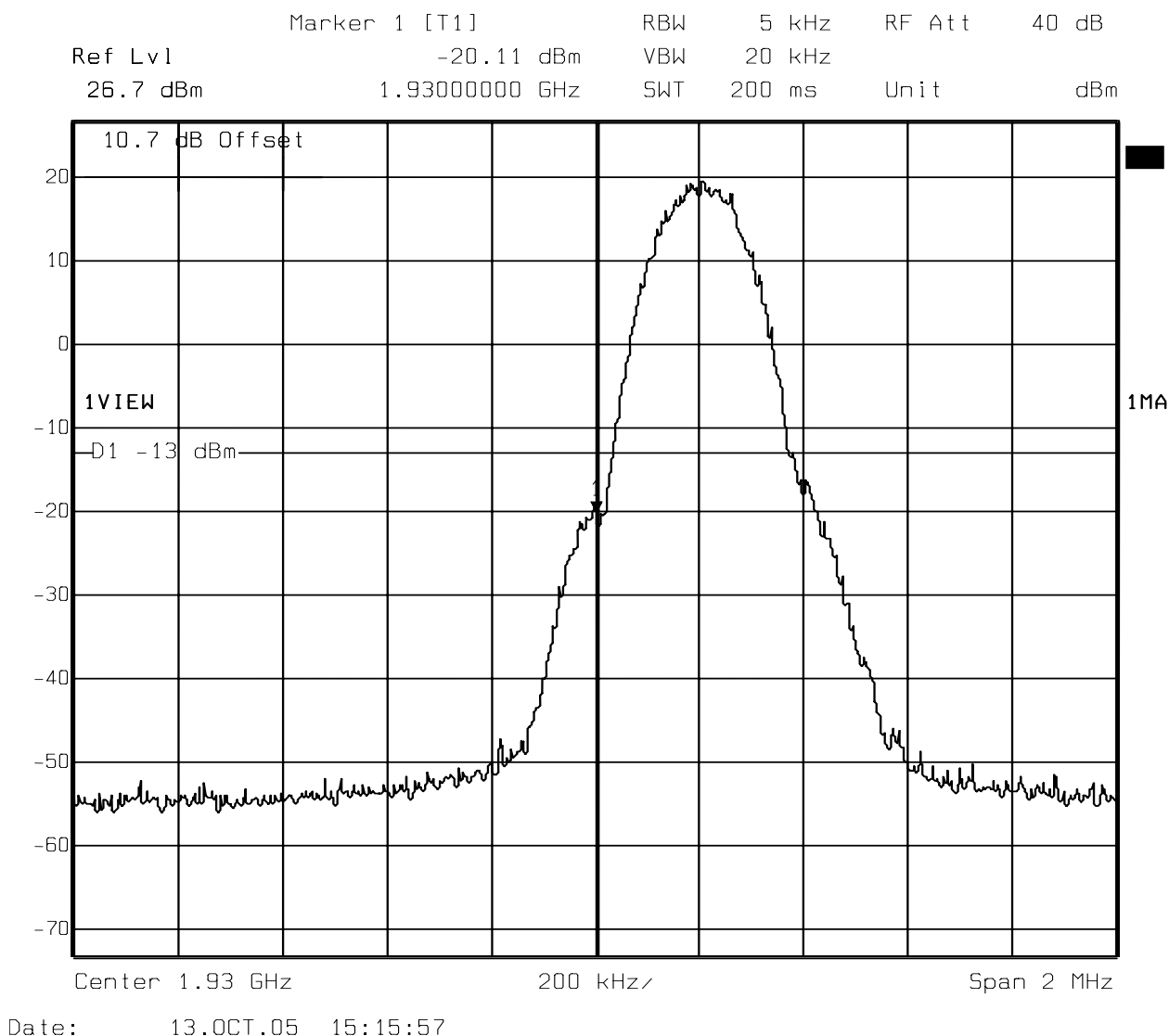
### **2.6.6 Test Results**

The measurement plots are shown on the following pages.



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## 2.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz)



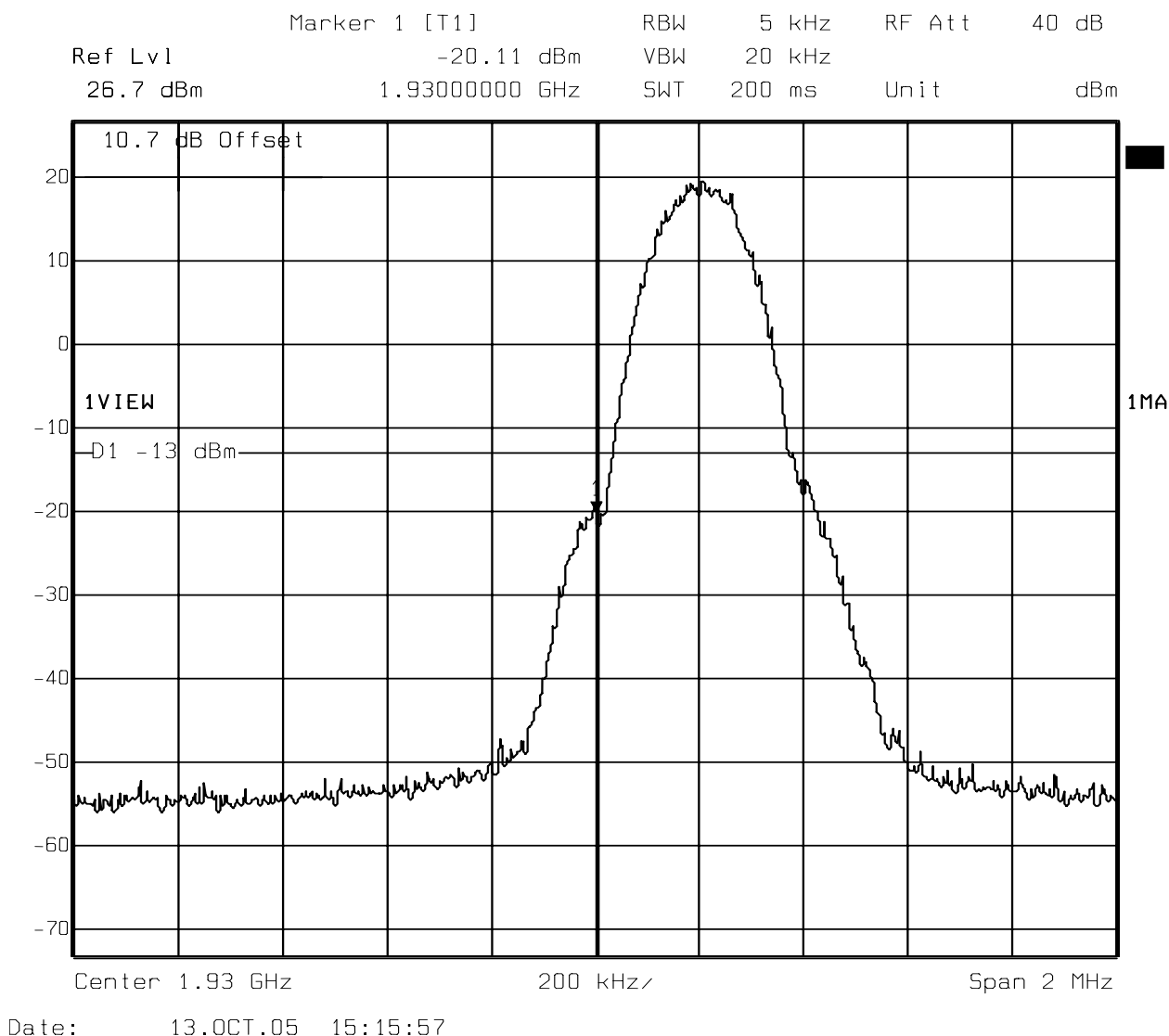
GMSK Mode

Block Edge Measurement with EUT Transmitting on full power  
on Channel 512, (1930.2MHz)



Product Service

## 2.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz)



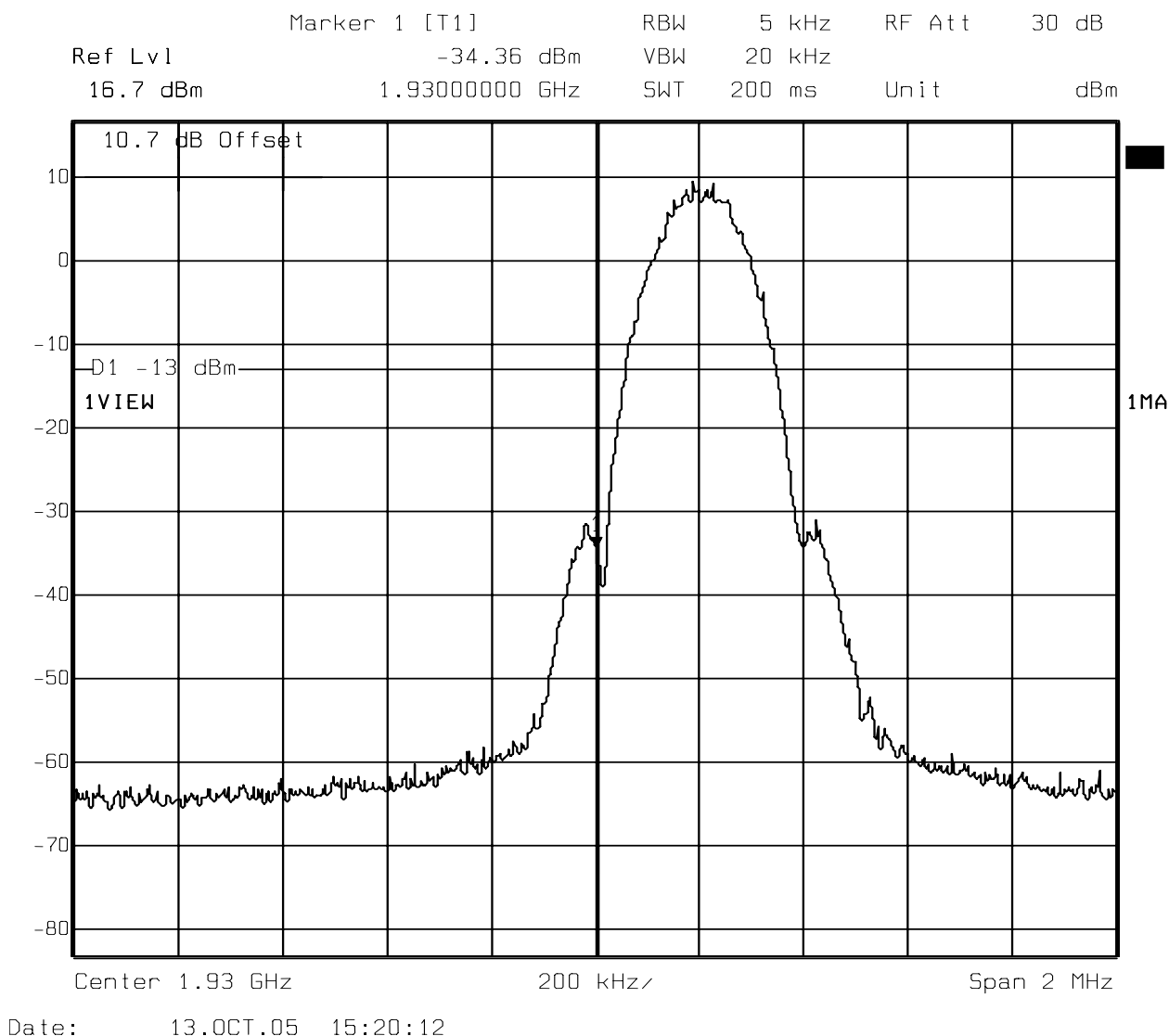
GMSK Mode

Block Edge Measurement with EUT Transmitting on full power

Channel 810, (1989.8MHz)



## 2.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz)



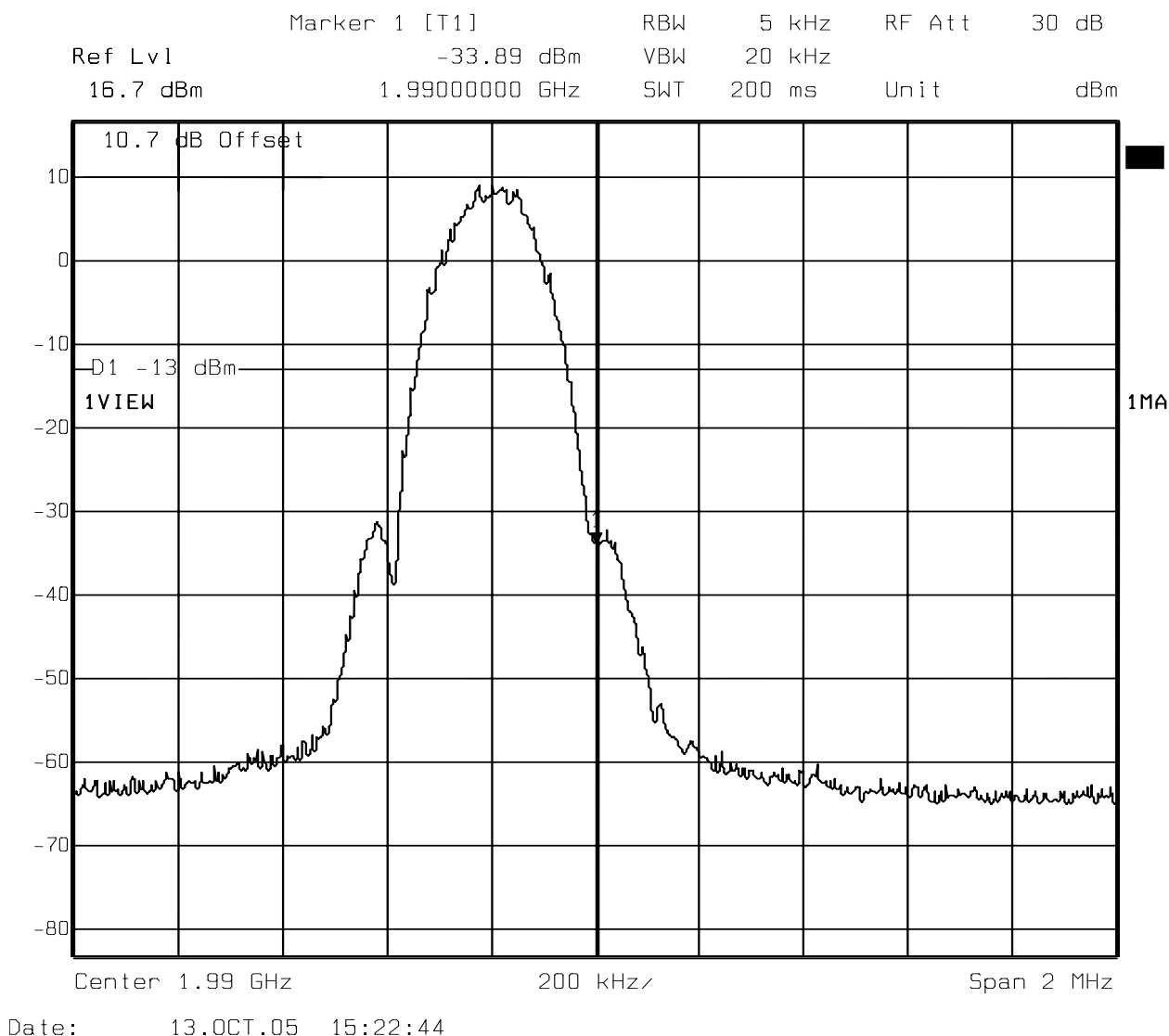
EDGE Mode

Block Edge Measurement with EUT Transmitting on full power

Channel 512, (1930.2MHz)



## 2.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz)



EDGE Mode

Block Edge Measurement with EUT Transmitting on full power

Channel 810, (1989.8MHz)

### 2.5.5 Test Results

All emissions are below -13dBm up to 1MHz away from each block edge.

## **2.7 RADIATED EMISSIONS**

### **2.7.1 FCC CFR 47: Part 24 Subpart E, Section 24.238**

### **2.7.2 Equipment Under Test**

165B (1900MHz nano basestation)

### **2.7.3 Date of Test**

1<sup>st</sup> November 2005 (GPRS 30MHz – 1GHz)  
3<sup>rd</sup> November 2005 (EDGE 30MHz – 1GHz)  
26<sup>th</sup> October 2005 and 27<sup>th</sup> October 2005 (GPRS 1GHz – 20GHz)  
1<sup>st</sup> November 2005 (EDGE 1GHz – 20GHz)

### **2.7.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.7.5 Test Procedure**

Test Performed in accordance with ANSI C63.4.

In order to determine the Radiated Emission Limits, measurements of Transmitting power (P) were first carried out on the top and bottom channels using a peak detector, and the results are shown in the following table.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT. The list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector.

Emissions identified within the range 1GHz – 20GHz were then formally measured using Peak and Average Detectors, as appropriate.

The measurements were performed at a 3m distance unless otherwise stated.

## 2.7 RADIATED EMISSIONS

### 2.7.6 Test Results - continued

#### **30MHz – 1GHz Frequency Range**

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 24.238 for Radiated Emissions (30MHz – 1GHz).

Measurements were made with the EUT in GPRS 1900MHz Mode 1.

#### **EUT transmitting on four channels**

| Frequency | Antenna Polarisation | Height | Azimuth | Peak Field Strength | Limit        |
|-----------|----------------------|--------|---------|---------------------|--------------|
| MHz       |                      | cm     | degree  | dB $\mu$ V/m        | dB $\mu$ V/m |
| 65.00     | Vertical             | 100    | 000     | -54.37              | -13.0        |

Measurements were made with the EUT in EDGE 1900MHz Mode 2.

#### **EUT transmitting on four channels**

| Frequency | Antenna Polarisation | Height | Azimuth | Peak Field Strength | Average Field Strength |
|-----------|----------------------|--------|---------|---------------------|------------------------|
| MHz       |                      | cm     | degree  | dB $\mu$ V/m        | dB $\mu$ V/m           |
| 88.0      | Vertical             | 100    | 254     | -53.1               | -13.0                  |
| 131.7     | Horizontal           | 100    | 287     | -52.7               | -13.0                  |

## 2.7 RADIATED EMISSIONS

### 2.7.6 Test Results - continued

#### 1GHz – 20GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 24.238 for Radiated Emissions (1GHz- 20GHz).

Measurements were made with the EUT in GPRS 1900MHz Mode 1.

#### **EUT transmitting on four channels**

No emissions that were above the noise floor were detected. All emissions were 20dB or more below the specification limit.

Measurements were made with the EUT in EDGE 1900MHz Mode 1.

#### **EUT transmitting on four channels**

| Frequency | Antenna Polarisation | Height | Azimuth | Peak Field Strength | Peak Limit |
|-----------|----------------------|--------|---------|---------------------|------------|
| GHz       |                      | cm     | degree  | dBµV/m              | dBµV/m     |
| 5.039     | Horizontal           | 113    | 349     | -40.7               | -13.0      |
| 5.128     | Horizontal           | 115    | 169     | -39.8               | -13.0      |
| 5.217     | Horizontal           | 123    | 099     | -40.5               | -13.0      |
| 6.718     | Vertical             | 131    | 146     | -37.5               | -13.0      |
| 6.837     | Vertical             | 100    | 056     | -40.4               | -13.0      |
| 10.435    | Horizontal           | 144    | 055     | -34.6               | -13.0      |

## **2.8 CONDUCTED SPURIOUS EMISSIONS**

### **2.8.1 Specification Reference**

FCC CFR 47: Part 24 Subpart E, Section 24.238(a)

### **2.8.2 Equipment Under Test**

165B (1900MHz nano basestation)

### **2.8.3 Date of Test**

13<sup>th</sup> October 2005

### **2.8.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.8.5 Test Procedure**

In accordance with Part 2.1051, the spurious emissions from the antenna terminal were measured. The Transmitting output power was attenuated using a combination of filters and attenuators and the frequency spectrum investigated from 9kHz to 20 GHz. The EUT was set to transmit on full power with all (0-7) timeslot active. The EUT was tested on Bottom, Middle and Top channels. The resolution and video bandwidths were set to 1MHz in accordance with Part 24.238. The spectrum analyser detector was set to Max Hold.

For measuring the range 9kHz to 4GHz, on maximum power, a 10dB attenuator was used. From 4 to 20GHz, attenuators and a 4GHz high pass filter were used.

The maximum path loss across the measurement band was used as the reference level offset to ensure worst case

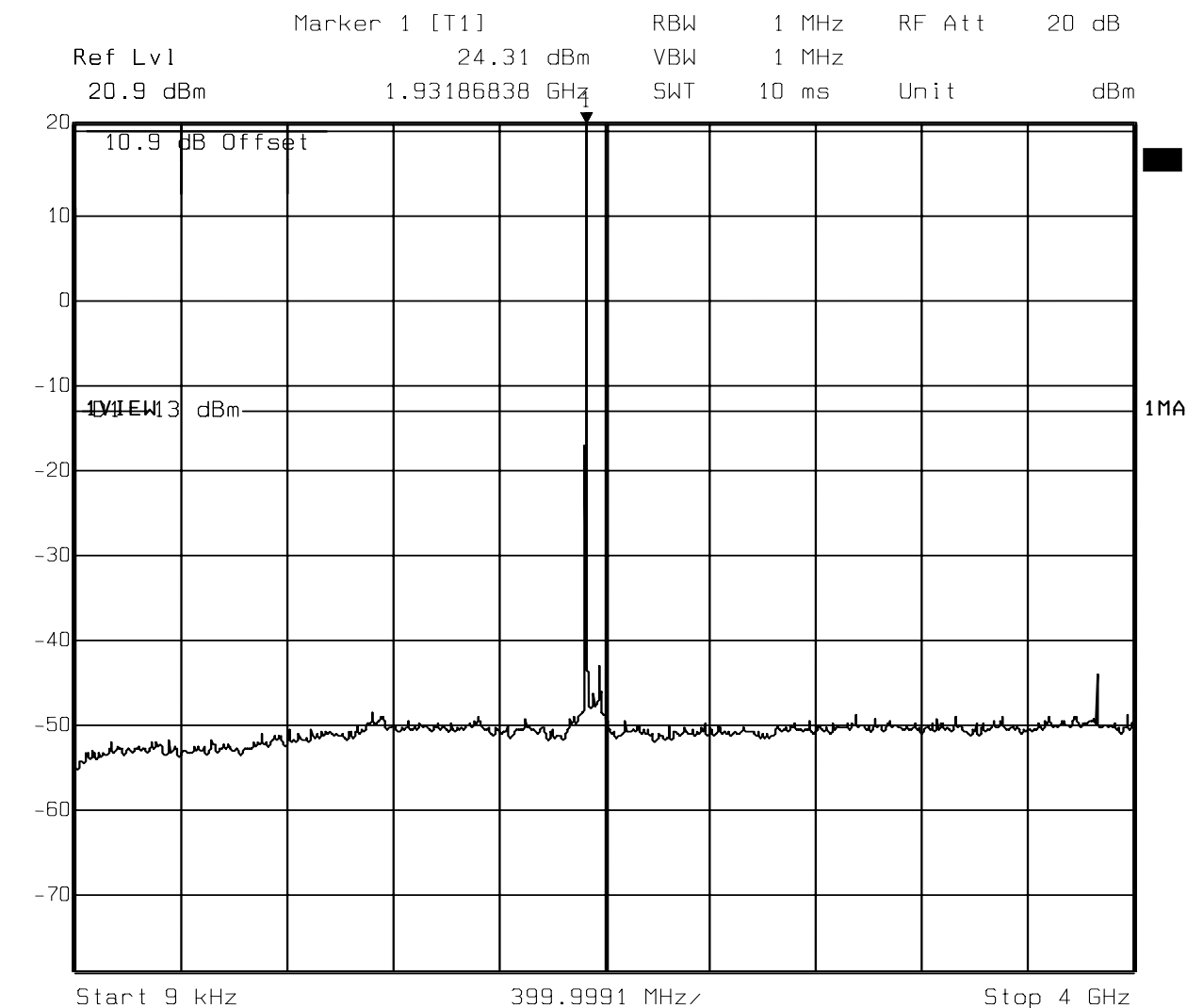
Both GPRS and EGDE Modes were tested.

### **2.8.6 Test Results**

The EUT passed the requirements laid out in 24.238. The plots on the following pages show the frequency spectrum from 9kHz to 20GHz of the EUT.



## 2.8 CONDUCTED SPURIOUS EMISSIONS



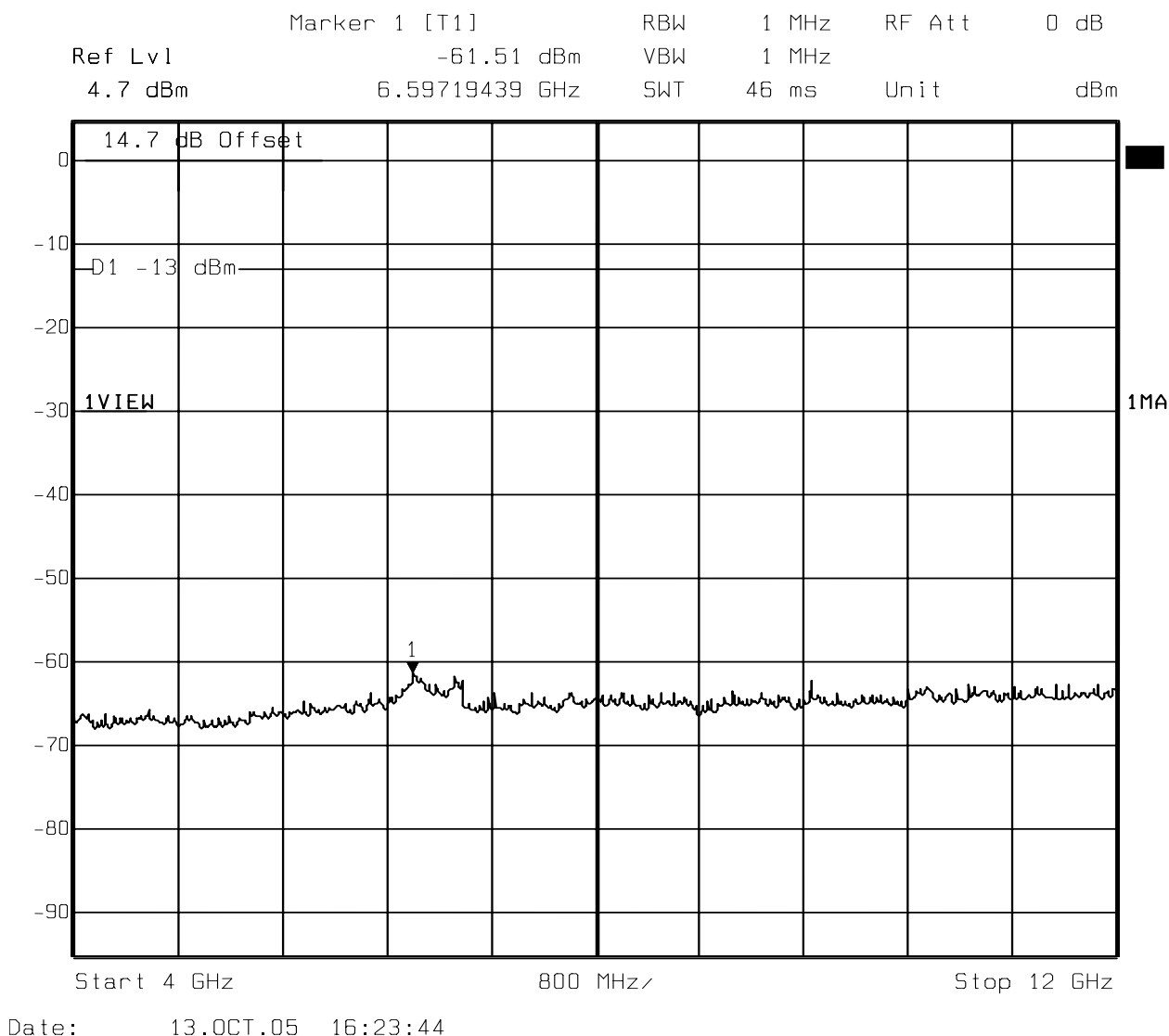
Date: 13.OCT.05 15:38:22

Spurious Emissions (9kHz – 4GHz)  
GMSK Mode Channel 512 (1930.2MHz) - Maximum Power



Product Service

## 2.8 CONDUCTED SPURIOUS EMISSIONS

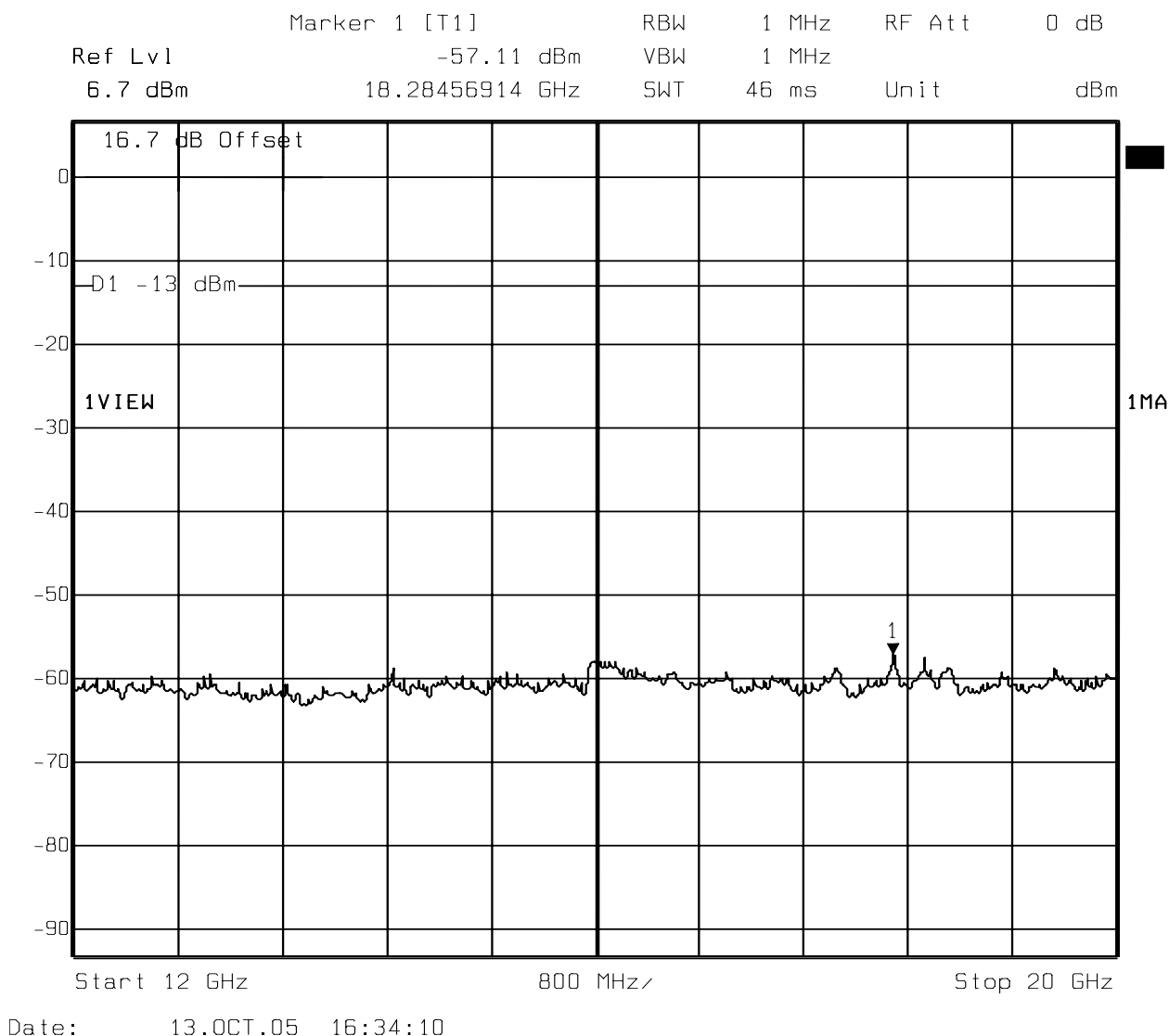


Spurious Emissions (4GHz – 12GHz)  
GMSK Mode Channel 512 (1930.2MHz) - Maximum Power



Product Service

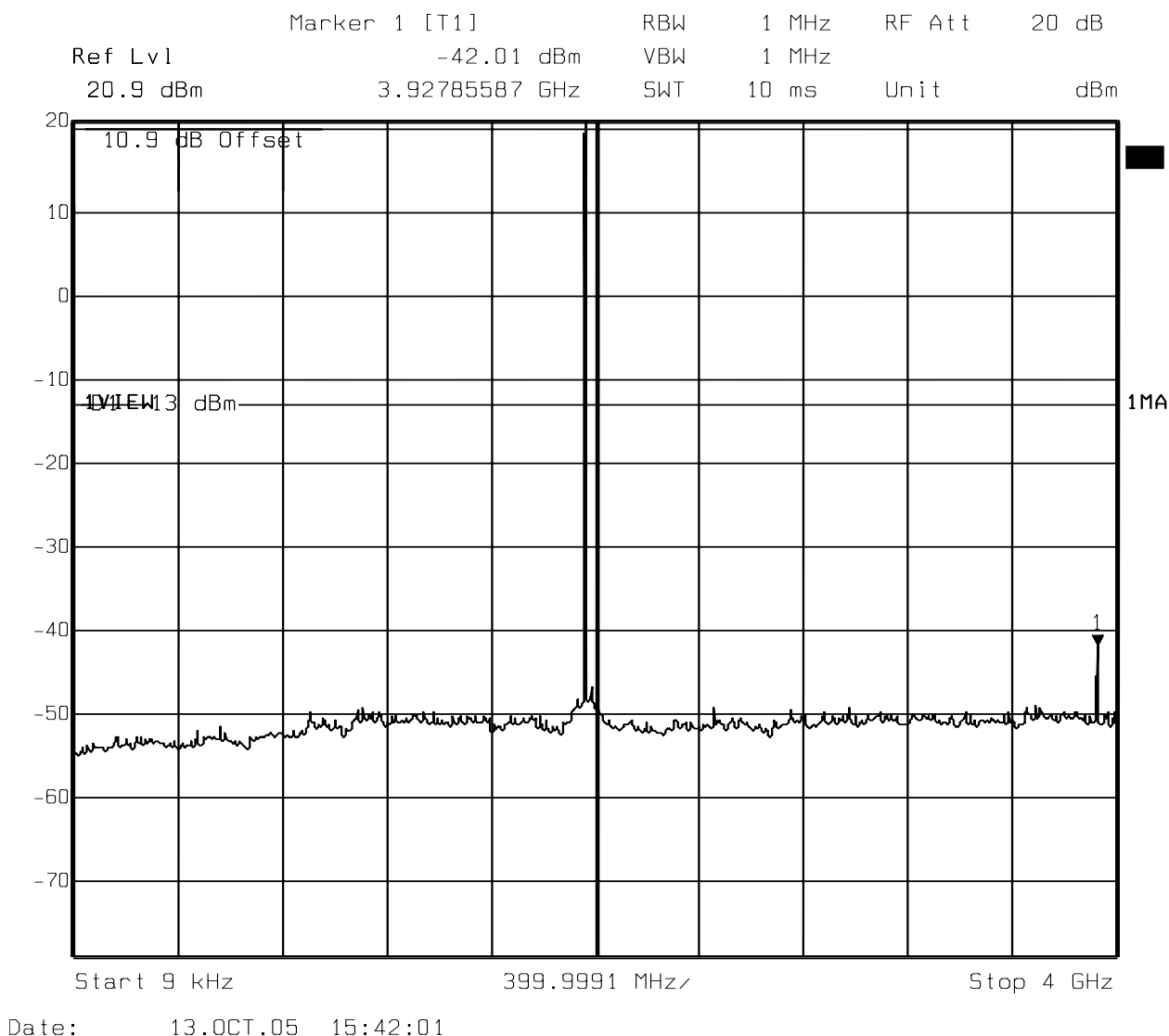
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (12GHz – 20GHz)  
GMSK Mode Channel 512 (1930.2MHz) - Maximum Power



## 2.8 CONDUCTED SPURIOUS EMISSIONS

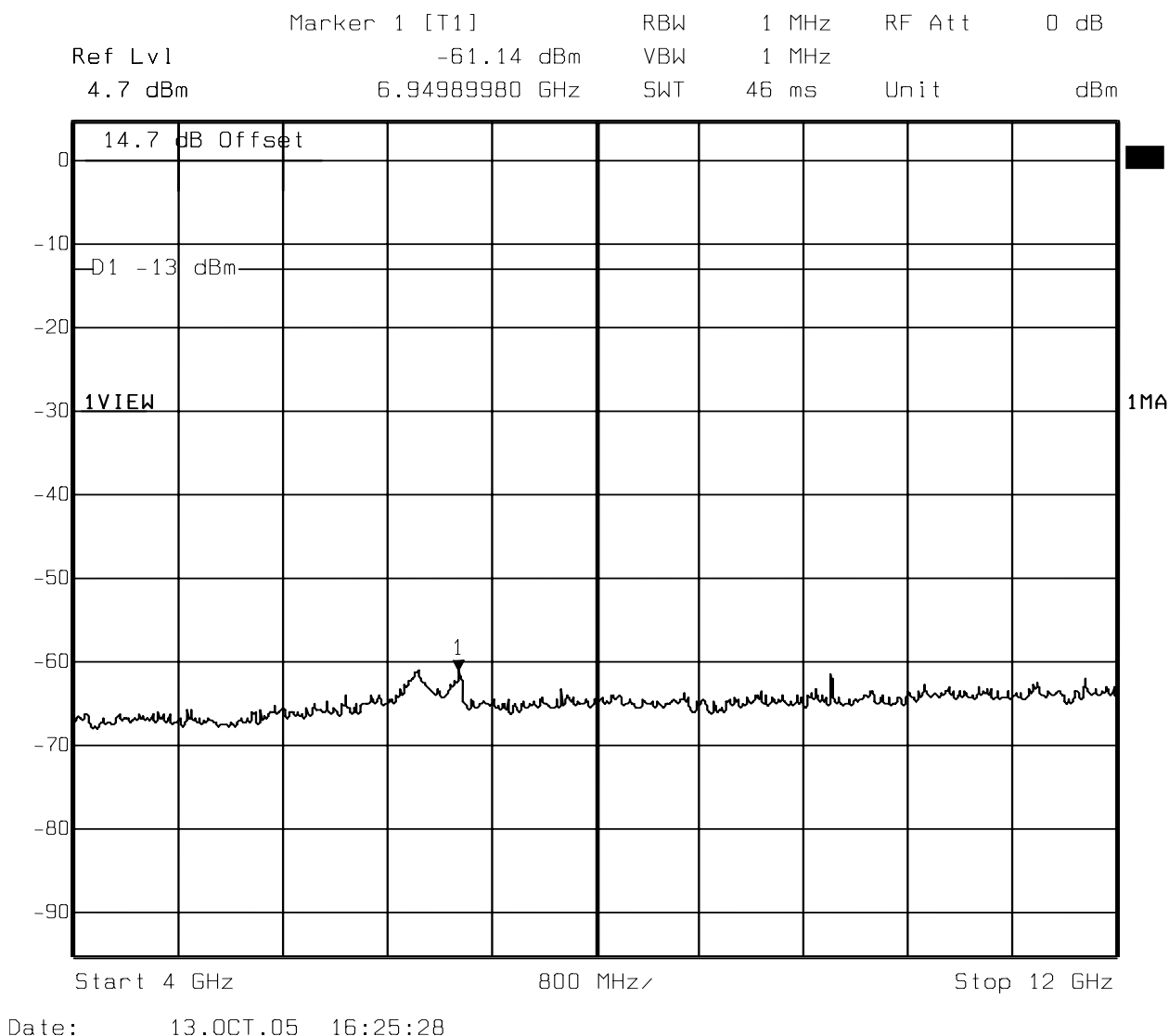


Spurious Emissions (9kHz – 4GHz)  
GMSK Mode Channel 661 (1960.0MHz) - Maximum Power



Product Service

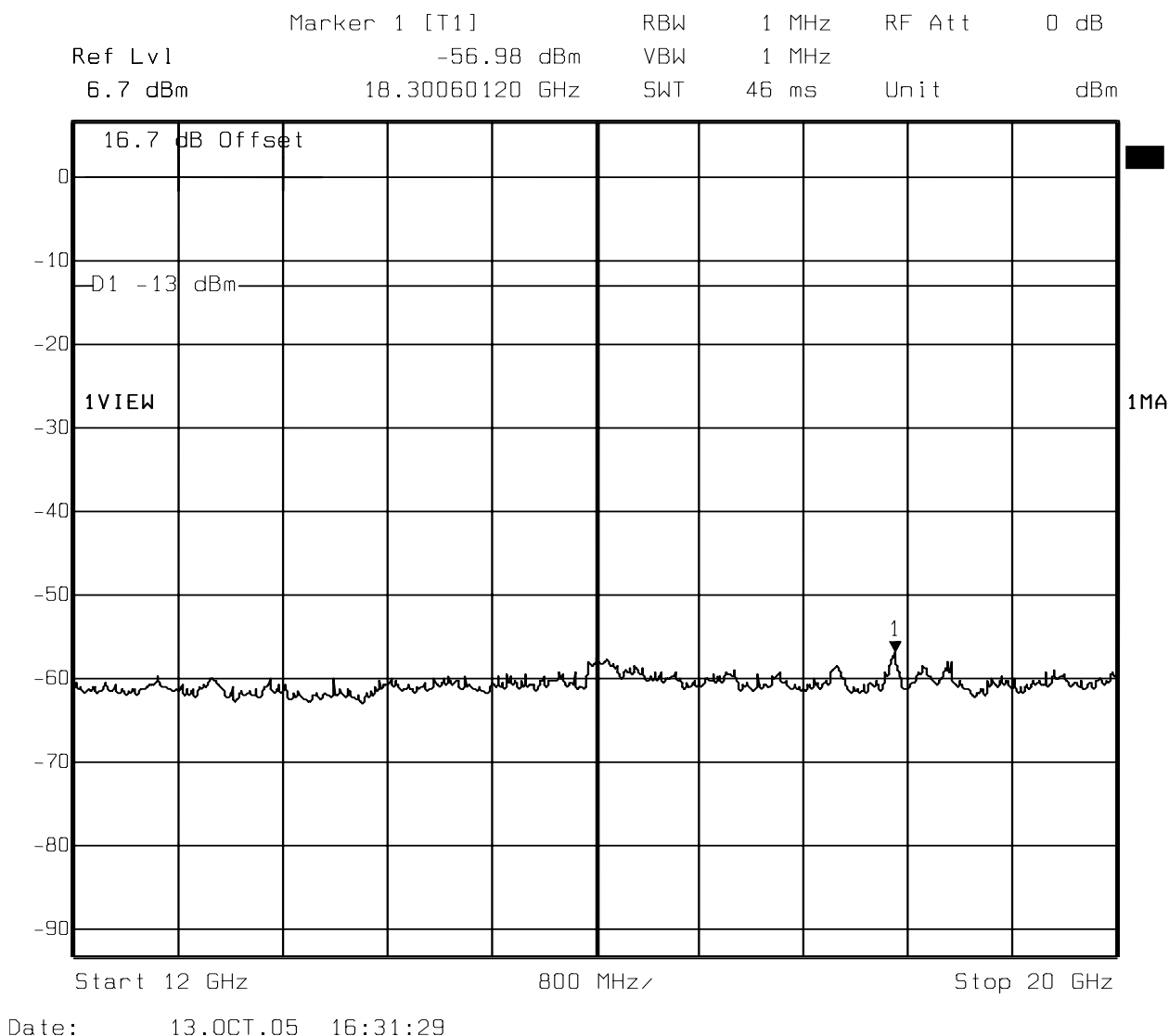
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (4GHz – 12GHz)  
GMSK Mode Channel 661 (1960.0MHz) - Maximum Power



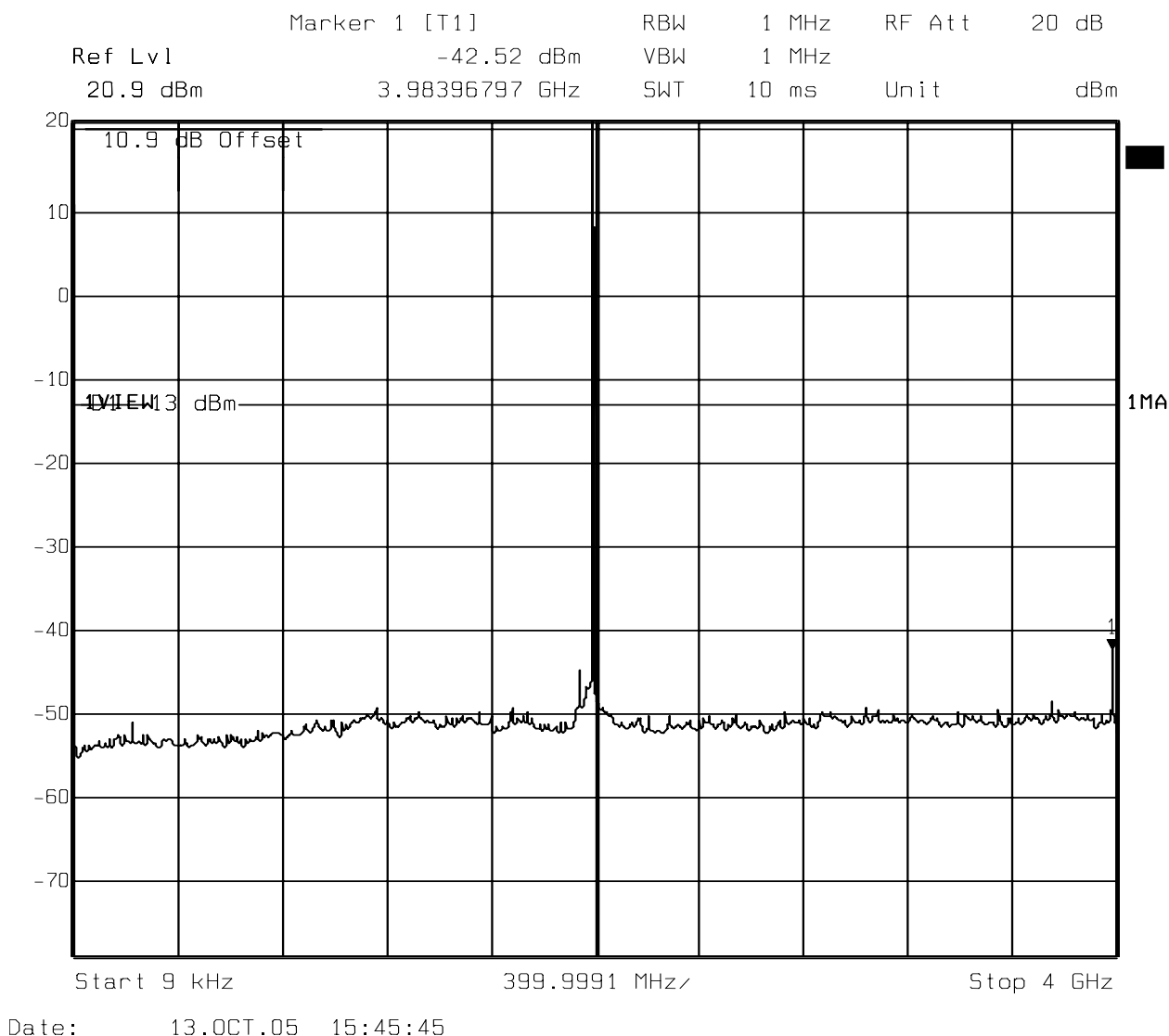
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (12GHz – 20GHz)  
GMSK Mode Channel 661 (1960.0MHz) - Maximum Power



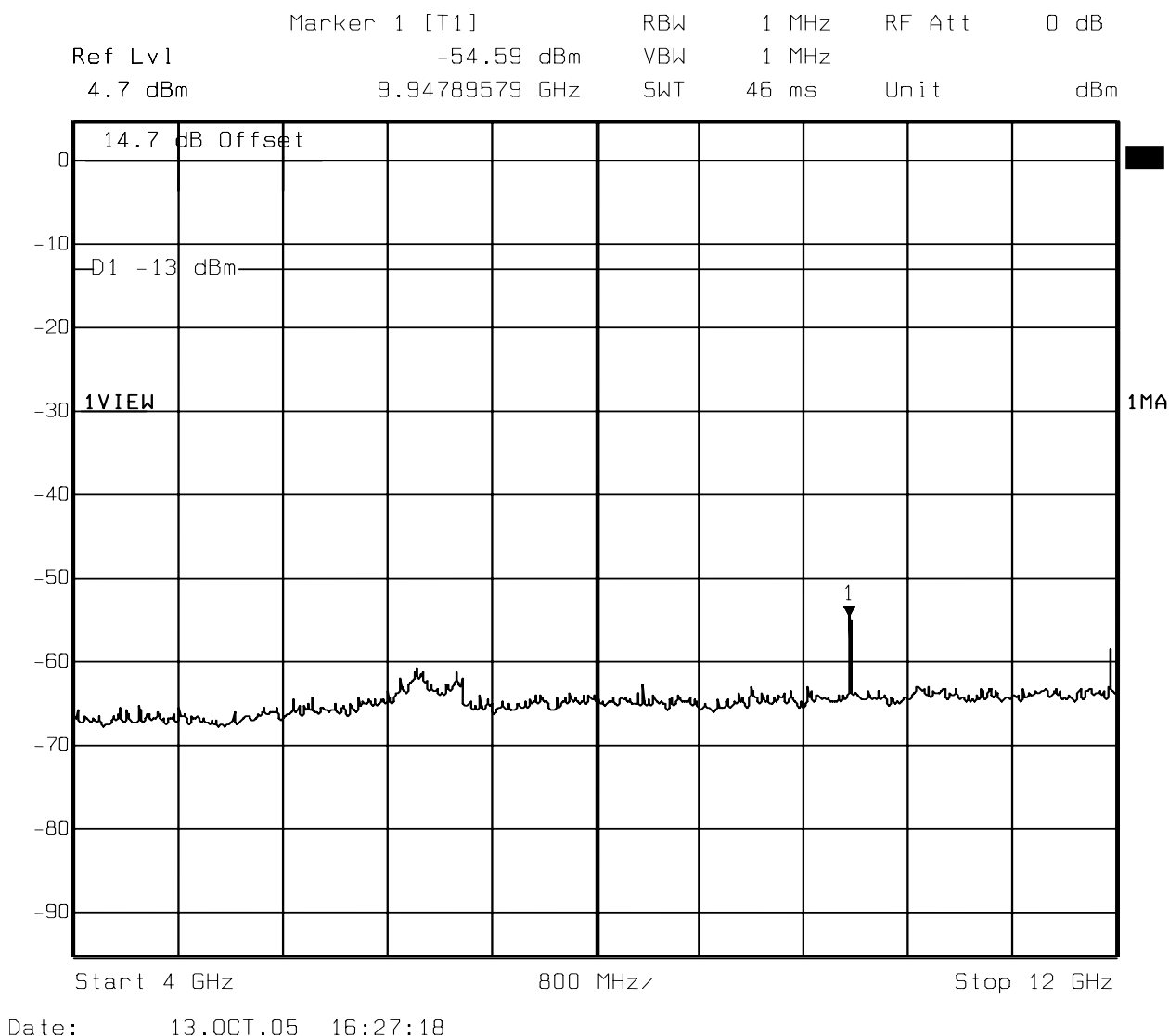
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (9kHz – 4GHz)  
GMSK Mode Channel 810 (1989.8MHz) - Maximum Power



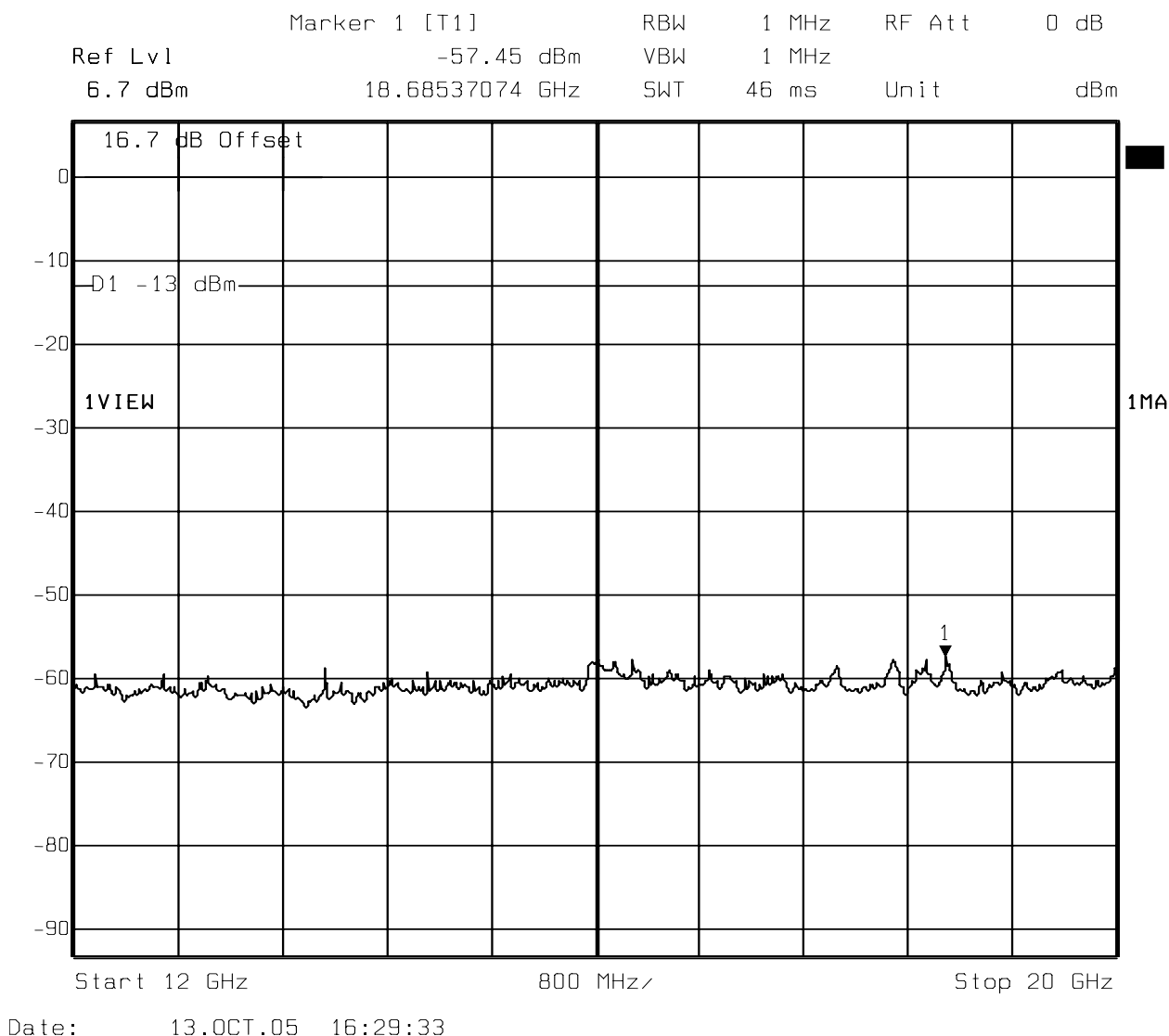
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (4GHz – 12GHz)  
GMSK Mode Channel 810 (1989.8MHz) - Maximum Power



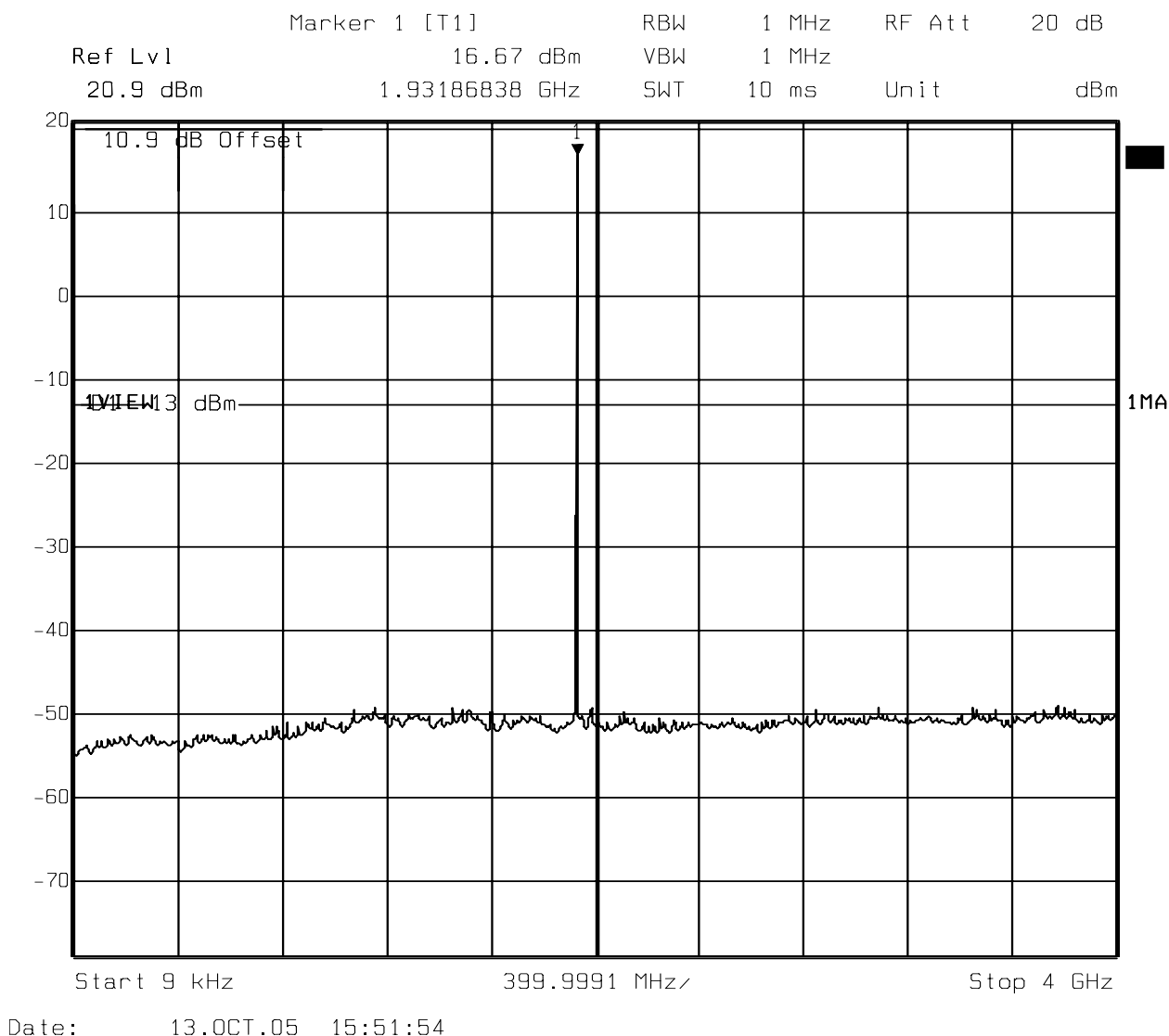
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (12GHz – 20GHz)  
GMSK Mode Channel 810 (1989.8MHz) - Maximum Power



## 2.8 CONDUCTED SPURIOUS EMISSIONS

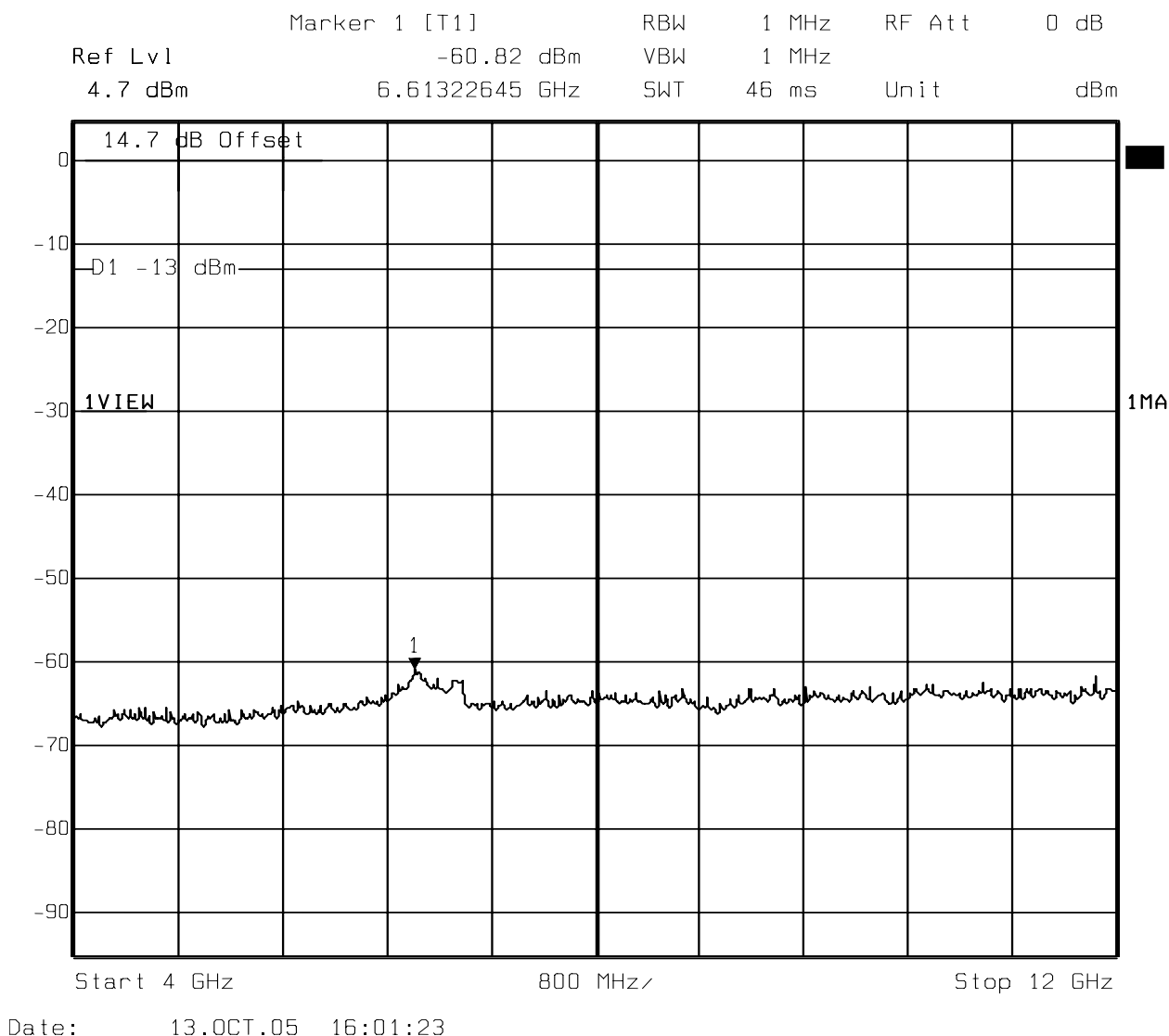


Spurious Emissions (9kHz – 4GHz)  
EDGE Mode Channel 512 (1930.2MHz) - Maximum Power



Product Service

## 2.8 CONDUCTED SPURIOUS EMISSIONS

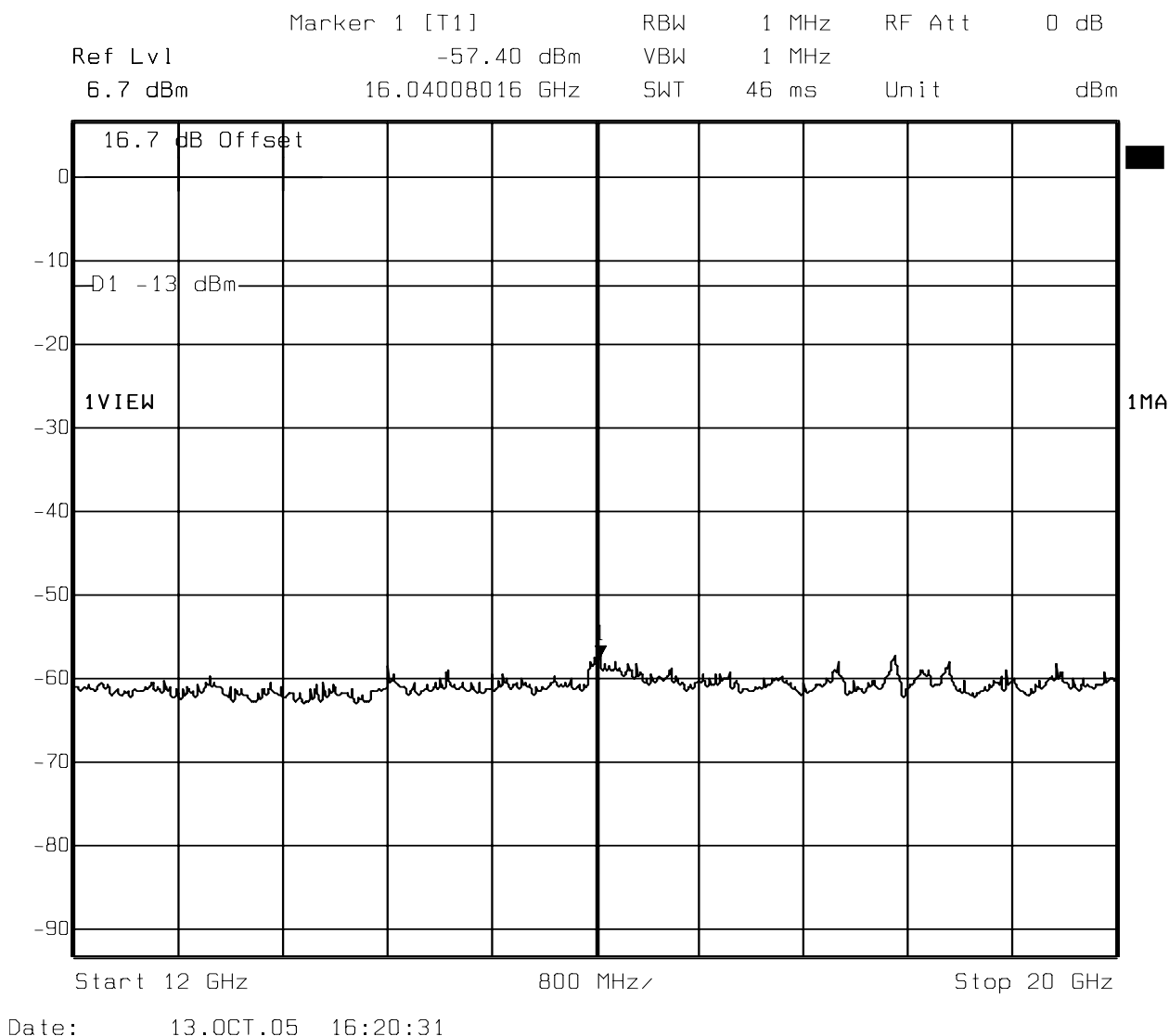


Spurious Emissions (4GHz – 12GHz)  
EDGE Mode Channel 512 (1930.2MHz) - Maximum Power



Product Service

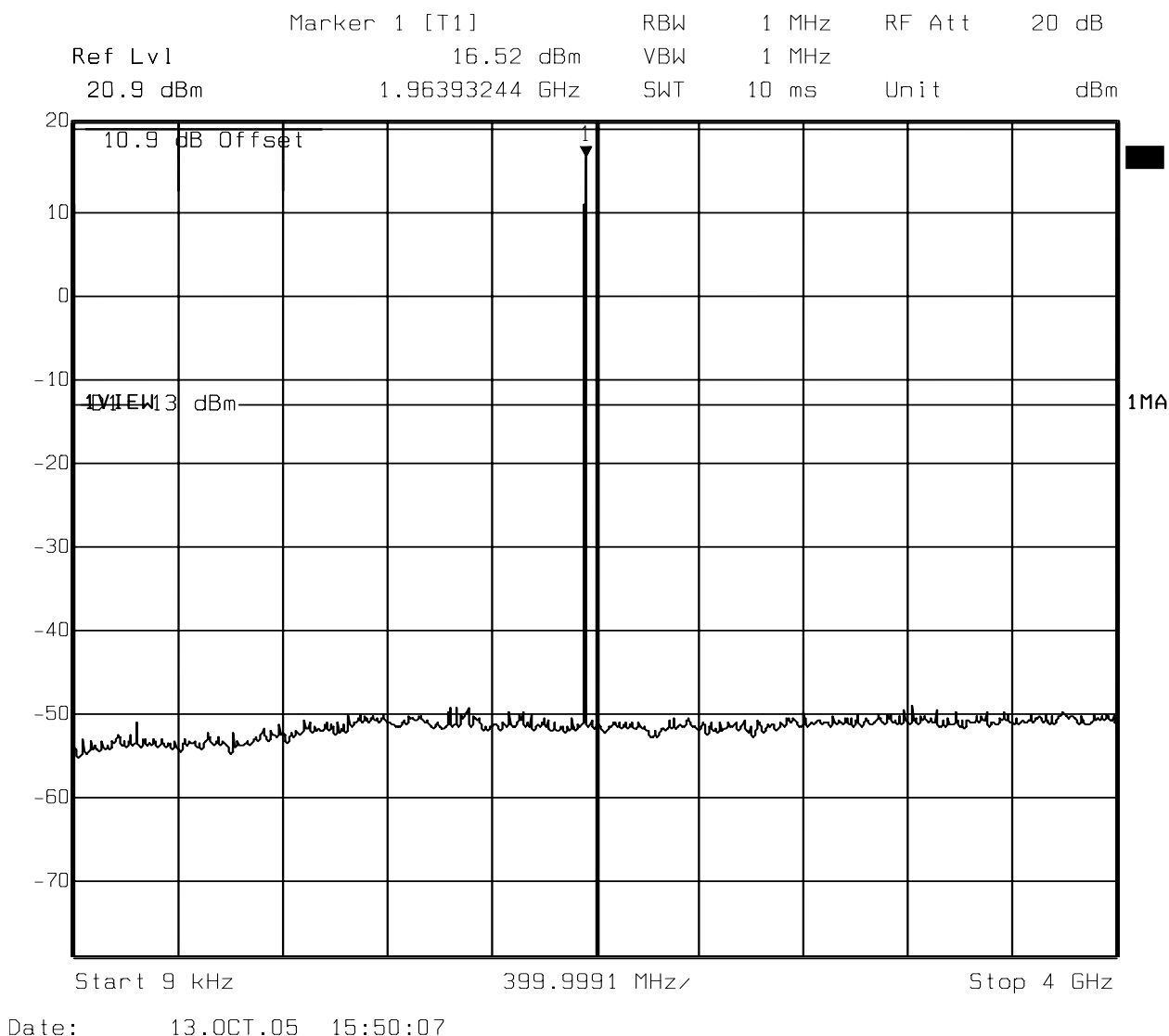
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (12GHz – 20GHz)  
edge Mode Channel 512 (1930.2MHz) - Maximum Power



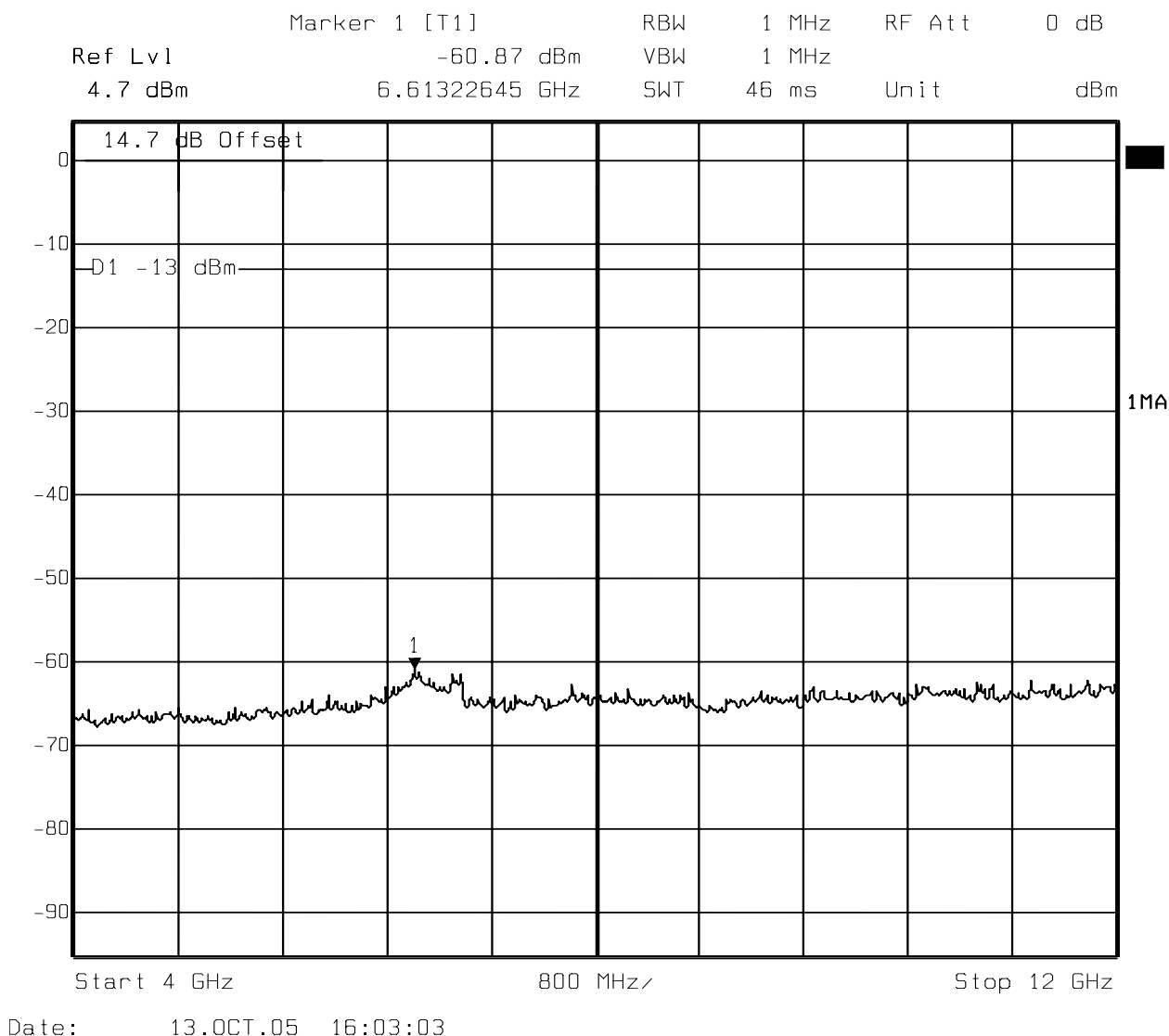
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (9kHz – 4GHz)  
EDGE Mode Channel 661 (1960.0MHz) - Maximum Power



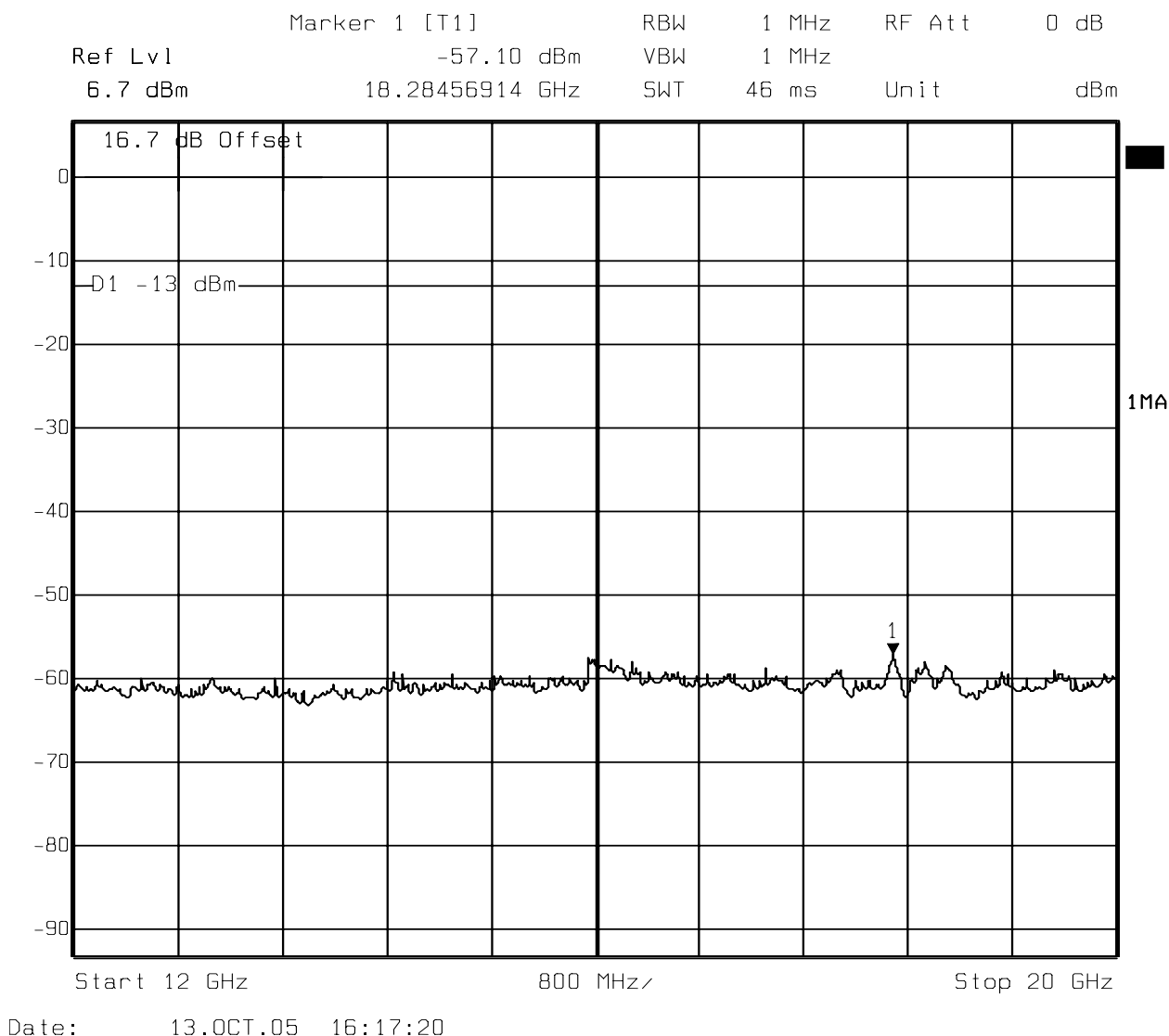
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (4GHz – 12GHz)  
EDGE Mode Channel 661 (1960.0MHz) - Maximum Power



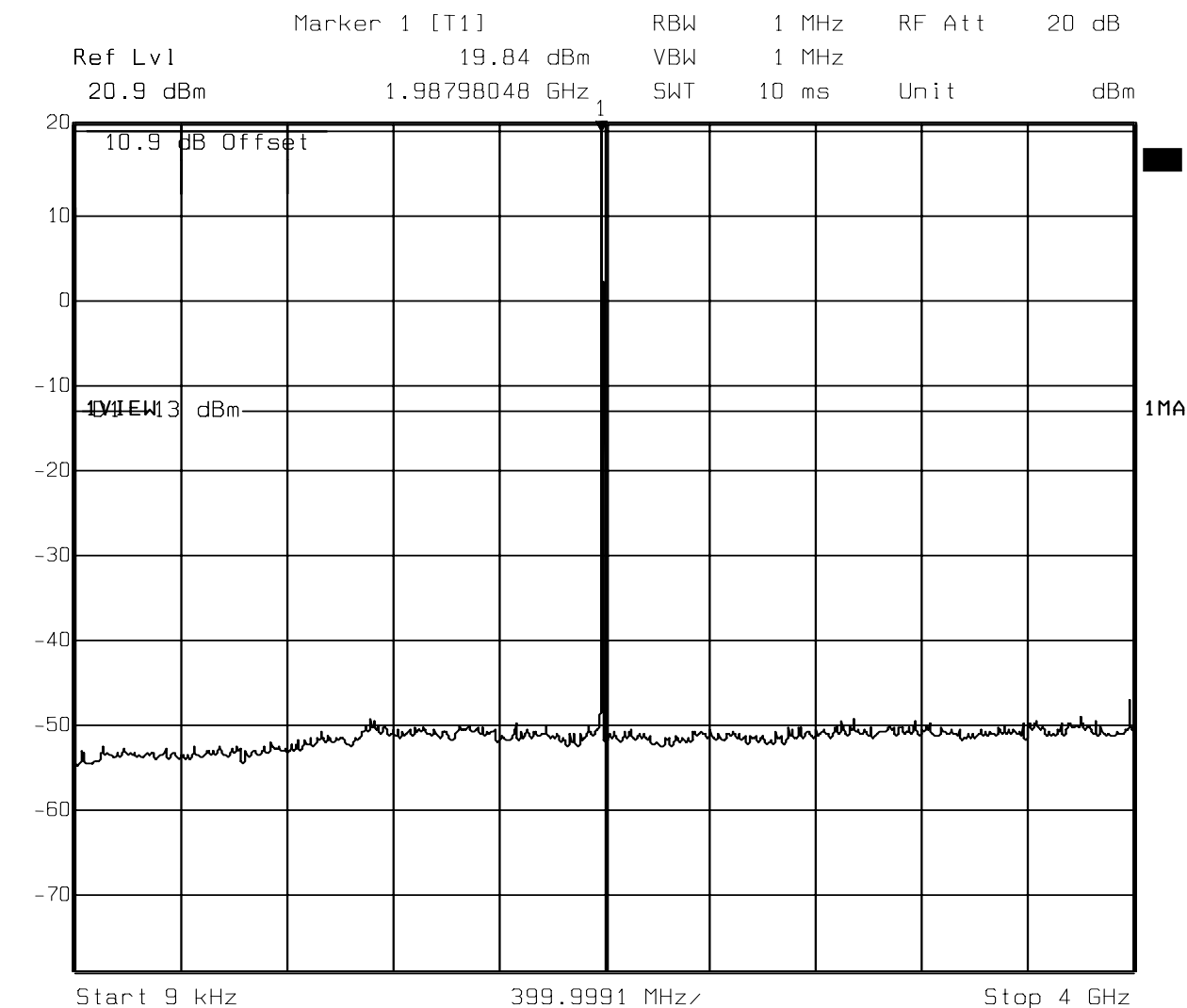
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (12GHz - 20GHz)  
EDGE Mode Channel 661 (1960.0MHz) - Maximum Power



## 2.8 CONDUCTED SPURIOUS EMISSIONS

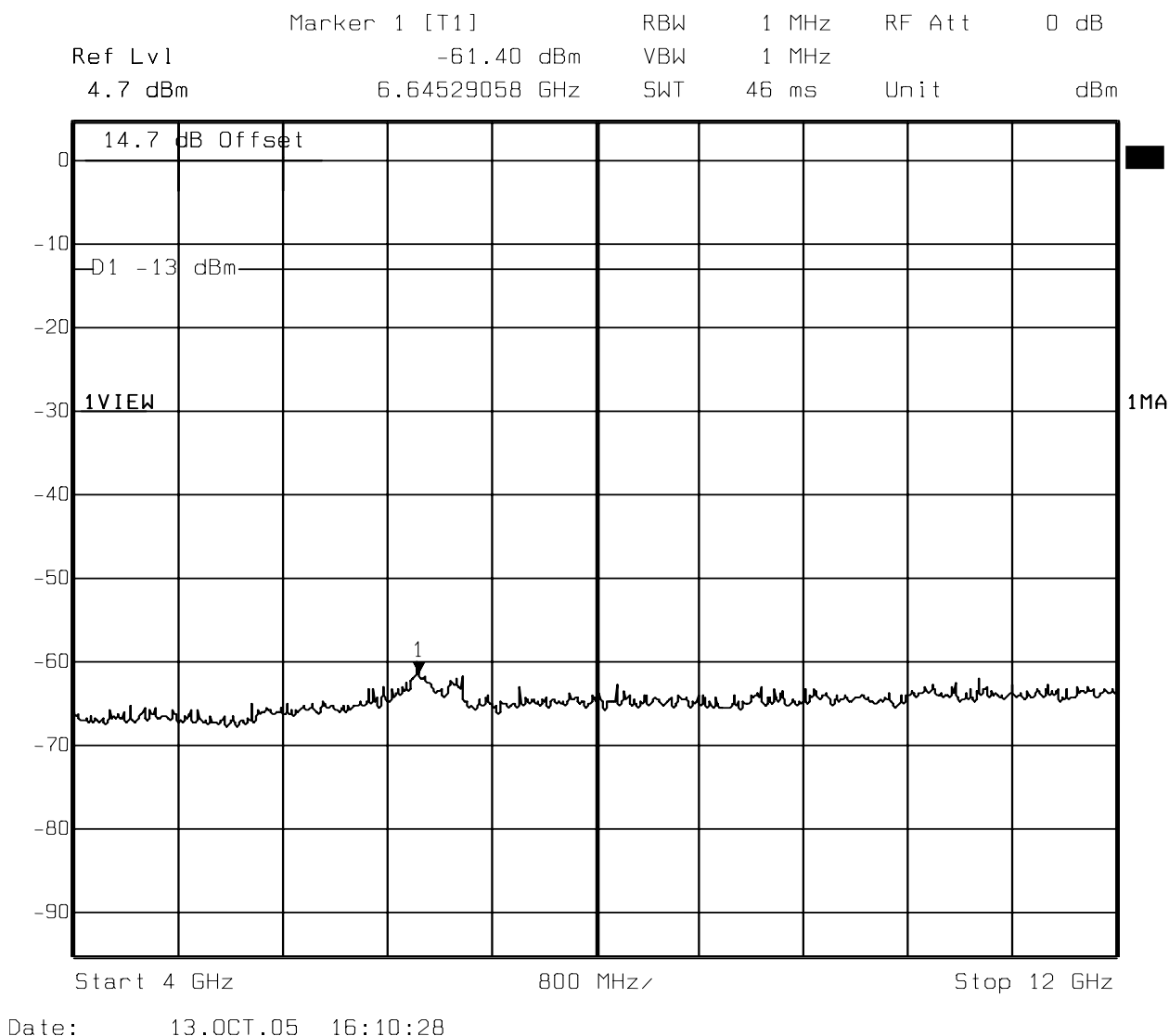


Date: 13.OCT.05 15:48:29

Spurious Emissions (9kHz – 4GHz)  
EDGE Mode Channel 810 (1989.8MHz) - Maximum Power



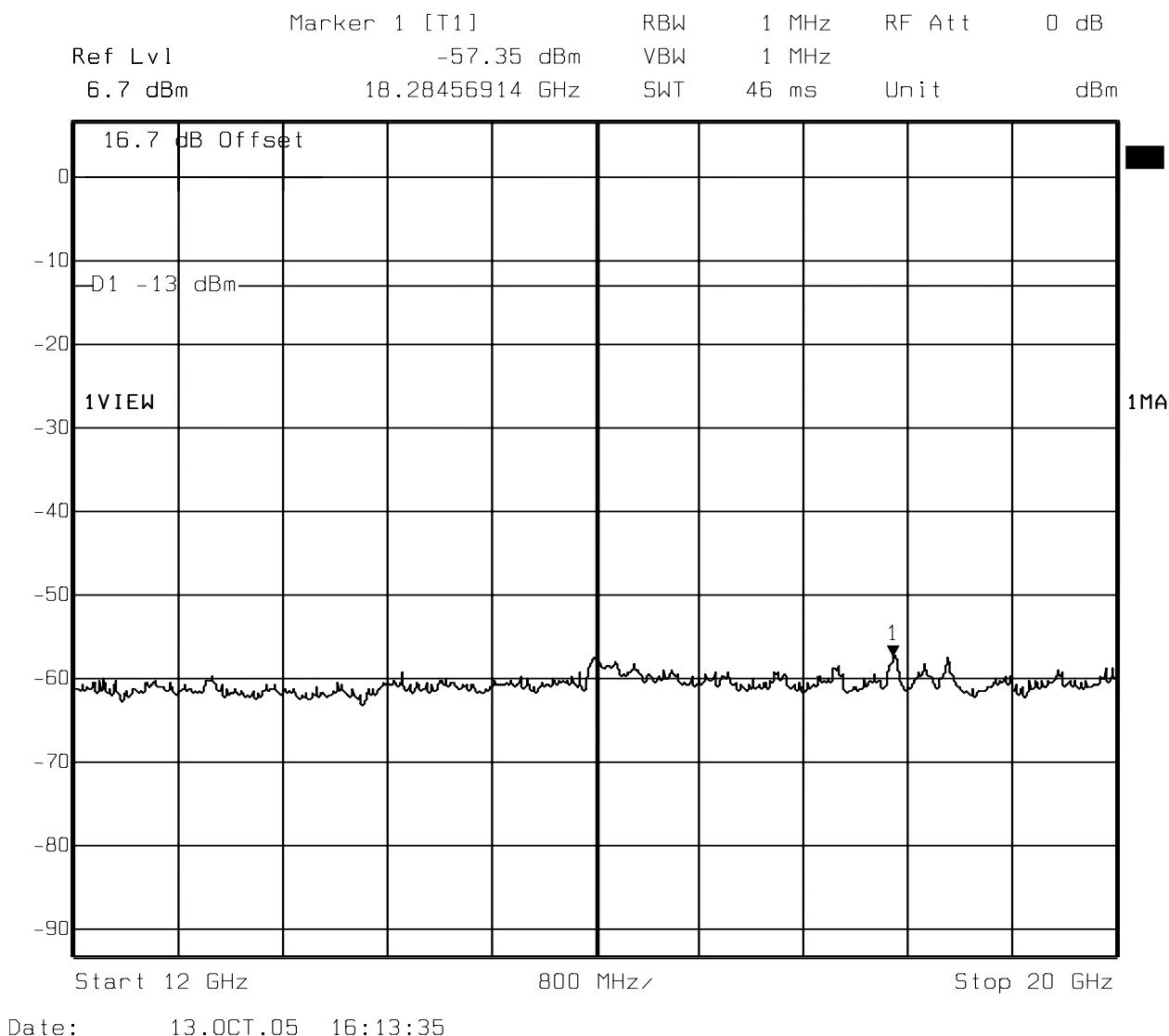
## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (4GHz – 12GHz)  
EDGE Mode Channel 810 (1989.8MHz) - Maximum Power



## 2.8 CONDUCTED SPURIOUS EMISSIONS



Spurious Emissions (12GHz – 20GHz)  
EDGE Mode Channel 810 (1989.8MHz) - Maximum Power

## 2.9 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

### 2.9.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.135(a)

### 2.9.2 Equipment Under Test

165B (1900MHz nano basestation)

### 2.9.3 Date of Test

14<sup>th</sup> October 2005

### 2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

### 2.9.5 Test Procedure

GSM

The EUT was set to transmit on power control level 0 and measurements were made on Timeslot 0. A Digital Communications Analyser, (CMU200), was used to measure the Frequency Error. The maximum result of measurements made over 100 bursts was recorded. The temperature was adjusted between -30°C and +50°C in 10° steps as per 2.1055.

EDGE

The EUT was set to transmit on power control level 5 and measurements were made on Timeslot 0. A Digital Communications Analyser, (CMU200), was used to measure the Frequency Error. The maximum result of measurements made over 100 bursts was recorded. The temperature was adjusted between -30°C and +50°C in 10° steps as per 2.1055.

### 2.9.6 Test Results

#### GSMK – PCS1900 Mode

| Temperature Interval(°C) | Test Frequency (GHz) | Deviation (Hz) |
|--------------------------|----------------------|----------------|
| -30                      | 1960.0               | -34            |
| -20                      | 1960.0               | -39            |
| -10                      | 1960.0               | -39            |
| 0                        | 1960.0               | -37            |
| +10                      | 1960.0               | -43            |
| +20                      | 1960.0               | -24            |
| +30                      | 1960.0               | -27            |
| +40                      | 1960.0               | -27            |
| +50                      | 1960.0               | -30            |

## 2.9 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

### EDGE – PCS1900 Mode

| Temperature Interval(°C) | Test Frequency (GHz) | Deviation (Hz) |
|--------------------------|----------------------|----------------|
| -30                      | 1960.0               | -36            |
| -20                      | 1960.0               | -37            |
| -10                      | 1960.0               | -37            |
| 0                        | 1960.0               | -39            |
| +10                      | 1960.0               | -39            |
| +20                      | 1960.0               | -21            |
| +30                      | 1960.0               | -24            |
| +40                      | 1960.0               | -27            |
| +50                      | 1960.0               | -28            |

|       |                                                                |
|-------|----------------------------------------------------------------|
| Limit | Fundamental must remain within the authorised frequency block. |
|-------|----------------------------------------------------------------|

### Remarks

EUT complies with CFR 47 Part 24.135(a). The frequency drift of the EUT does not take the fundamental outside of the authorised frequency block at any temperature interval across the measured range.

## **2.10 FREQUENCY STABILITY UNDER VOLTAGE VARIATIONS**

### **2.10.1 Specification Reference**

FCC CFR 47: Part 24 Subpart E, Section 24.135(a)

### **2.10.2 Equipment Under Test**

165B (1900MHz nano basestation)

### **2.10.3 Date of Test**

14<sup>th</sup> October 2005

### **2.10.4 Test Equipment Used**

The major items of test equipment used for the above tests are identified in Section 3.1.

### **2.10.5 Test Procedure**

GSM

The EUT was set to transmit on power control level 0 and measurements were made on Timeslot 0. A Digital Communications Analyser, (CMU200), was used to measure the Frequency Error. The maximum result of measurements made over 100 bursts was recorded. The temperature was adjusted between -30°C and +50°C in 10° steps as per 2.1055.

EDGE

The EUT was set to transmit on power control level 5 and measurements were made on Timeslot 0. A Digital Communications Analyser, (CMU200), was used to measure the Frequency Error. The maximum result of measurements made over 100 bursts was recorded. The temperature was adjusted between -30°C and +50°C in 10° steps as per 2.1055.

### **2.10.6 Test Results**

GSMK – PCS1900 Mode

| DC Voltage<br>(V) | Test Frequency<br>(MHz) | Deviation<br>(Hz) |
|-------------------|-------------------------|-------------------|
| 55.2              | 1960.0                  | -23               |
| 48.0              | 1960.0                  | -24               |
| 40.8              | 1960.0                  | -22               |



## 2.10 FREQUENCY STABILITY UNDER VOLTAGE VARIATIONS

### 2.10.6 Test Results

#### EDGE – PCS1900 Mode

| DC Voltage<br>(V) | Test Frequency<br>(MHz) | Deviation<br>(Hz) |
|-------------------|-------------------------|-------------------|
| 55.2              | 1960.0                  | -21               |
| 48.0              | 1960.0                  | -21               |
| 40.8              | 1960.0                  | -23               |

|       |                                                                |
|-------|----------------------------------------------------------------|
| Limit | Fundamental must remain within the authorised frequency block. |
|-------|----------------------------------------------------------------|

#### Remarks

EUT complies with CFR 47 Part 24.135(a). The frequency drift of the EUT does not take the fundamental outside of the authorised frequency block at any temperature interval across the measured range.



Product Service

### **SECTION 3**

### **TEST EQUIPMENT**



### 3.1 TEST EQUIPMENT

| Instrument                                                        | Manufacturer     | Type No              | TE Number | Calibration Due |
|-------------------------------------------------------------------|------------------|----------------------|-----------|-----------------|
| <b>Sections 2.1, 2.3 and 2.7 EMC Radiated Emissions (Bearley)</b> |                  |                      |           |                 |
| Amplifier                                                         | Miteq Corp       | AMF-3d-001080-18-13P | 231       | TU              |
| Double Ridge Guide Antenna (1GHz-18GHz)                           | EMCO             | 3115                 | 234       | 01/07/2006      |
| LNA 18-40 GHz                                                     | Narda            | NARDA DB02-0447      | 237       | 02/06/2006      |
| LNA18-40 GHz                                                      | Narda            | NARDA DB02-0447      | 240       | 02/06/2006      |
| 4m 40GHz Microwave Cable                                          | Rosenberger      | FB142A2040002020     | 485       | 24/10/2006      |
| 7m 40GHz Microwave Cable                                          | Rosenberger      | FB142A2070002020     | 486       | 24/10/2006      |
| High Pass Filter (4GHz)                                           | Sematron         | F-100-4000-5-R       | 564       | TU              |
| Attenuator (10dB, 10W)                                            | Marconi          | 6534/3               | 1048      | TU              |
| Signal Gen                                                        | Hewlett Packard  | 8673B                | 1351      | 09/09/2006      |
| Hygromer                                                          | Rotronic         | A1                   | 1430      | 18/04/2006      |
| Receiver                                                          | Rohde & Schwarz  | ESVP                 | 1658      | 26/06/2006      |
| Test Receiver                                                     | Rohde & Schwarz  | ESVP                 | 1669      | 07/09/2006      |
| Screened Room                                                     | Rayproof         | 1993                 | 1675      | TU              |
| Biconical Antenna                                                 | EMCO             | 3104                 | 1692      | TU              |
| Log Periodic Antenna                                              | EMCO             | 3146                 | 1694      | TU              |
| Signal Generator                                                  | Rohde & Schwarz  | SMT03                | 1702      | 21/10/2006      |
| Antenna Mast                                                      | EMCO             | 1050                 | 1707      | TU              |
| Turntable Controller                                              | Various          | RH253                | 1708      | TU              |
| Spectrum Analyser                                                 | Rohde & Schwarz  | EZM                  | 1823      | TU              |
| Open Area Site 2                                                  | TUV              | OATS2                | 1850      | 28/11/2005      |
| Floppy Disc Station                                               | Rohde & Schwarz  | ROHDE                | 1854      | TU              |
| Turntable Interface                                               | Various          | RH-253.6             | 1855      | TU              |
| Antenna Tower 6m                                                  | EMCO             | 1050                 | 1859      | TU              |
| Bilog Antenna                                                     | York Electronics | CBL6111B             | 1868      | 01/10/2006      |
| Power Supply Unit                                                 | Farnell          | LT30-2               | 2045      | TU              |
| Amplifier (8GHz-18GHz)                                            | Avantec          | AWT-18036            | 2821      | TU              |
| Emi Receiver                                                      | Rohde & Schwarz  | ESIB 40              | 2941      | 11/08/2006      |



## 3.2 TEST EQUIPMENT - Continued

| Instrument                                                          | Manufacturer    | Type No         | TE Number | Calibration Due |
|---------------------------------------------------------------------|-----------------|-----------------|-----------|-----------------|
| <b>Sections 2.3 and 2.7 Radio - Spurious Emissions</b>              |                 |                 |           |                 |
| Spectrum Analyser                                                   | Rohde & Schwarz | FSEM            | 37        | 13/01/2006      |
| Hygrometer                                                          | Rotronic        | A1              | 465       | 20/09/2006      |
| Attenuator (10dB, 10W)                                              | Weinschel       | 23-10-34        | 470       | 11/07/2006      |
| SMA-SMA Cable (2m)                                                  | Reynolds        | 262-0248-2000   | 2399      | 21/07/2006      |
| SMA-SMA Cable (1m)                                                  | Reynolds        | 262-0248-1000   | 2407      | 21/07/2006      |
| 1m sma(m) - sma(m) Cable                                            | Reynolds        | 262-0248-1000   | 2408      | 21/07/2006      |
| Multimeter                                                          | Isotech         | Iso Tech IDM101 | 2424      | 26/07/2006      |
| High Pass Filter (4GHz)                                             | RLC Electronics | F-100-4000-5-R  | 2773      | 16/05/2006      |
| <b>Sections 2.9 and 2.10 Radio (Tx) - Frequency Characteristics</b> |                 |                 |           |                 |
| Hygrometer                                                          | Rotronic        | A1              | 465       | 20/09/2006      |
| Chamber                                                             | Montford        | 2F3,BLD 8       | 467       | TU              |
| Digital Temperature Indicator                                       | Fluke           | 51              | 1385      | 03/08/2006      |
| SMA-SMA Cable (2m)                                                  | Reynolds        | 262-0248-2000   | 2400      | 21/07/2006      |
| Multimeter                                                          | Isotech         | Iso Tech IDM101 | 2424      | 26/07/2006      |
| GSM Test Set                                                        | Rohde & Schwarz | CMU 200         | 2809      | 03/12/2005      |
| <b>Section 2.4 Radio (Tx) - Modulation Characteristics</b>          |                 |                 |           |                 |
| Spectrum Analyser                                                   | Rohde & Schwarz | FSEM            | 37        | 13/01/2006      |
| Hygrometer                                                          | Rotronic        | A1              | 465       | 20/09/2006      |
| Attenuator (10dB, 10W)                                              | Weinschel       | 23-10-34        | 470       | 11/07/2006      |
| 1m sma(m) - sma(m) Cable                                            | Reynolds        | 262-0248-1000   | 2408      | 21/07/2006      |
| Multimeter                                                          | Isotech         | Iso Tech IDM101 | 2424      | 26/07/2006      |
| <b>Section 2.5 Radio (Tx) - Occupied Bandwidth</b>                  |                 |                 |           |                 |
| Spectrum Analyser                                                   | Rohde & Schwarz | FSEM            | 37        | 13/01/2006      |
| Hygrometer                                                          | Rotronic        | A1              | 465       | 20/09/2006      |
| Attenuator (10dB, 10W)                                              | Weinschel       | 23-10-34        | 470       | 11/07/2006      |
| 1m sma(m) - sma(m) Cable                                            | Reynolds        | 262-0248-1000   | 2408      | 21/07/2006      |
| Multimeter                                                          | Isotech         | Iso Tech IDM101 | 2424      | 26/07/2006      |

### 3.3 TEST EQUIPMENT - Continued

| Instrument                                            | Manufacturer    | Type No         | TE Number | Calibration Due |
|-------------------------------------------------------|-----------------|-----------------|-----------|-----------------|
| <b>Section 2.2 Radio (Tx) - Power Characteristics</b> |                 |                 |           |                 |
| Spectrum Analyser                                     | Rohde & Schwarz | FSEM            | 37        | 13/01/2006      |
| Hygrometer                                            | Rotronic        | A1              | 465       | 20/09/2006      |
| Attenuator (10dB, 10W)                                | Weinschel       | 23-10-34        | 470       | 11/07/2006      |
| 1m sma(m) - sma(m) Cable                              | Reynolds        | 262-0248-1000   | 2408      | 21/07/2006      |
| Multimeter                                            | Isotech         | Iso Tech IDM101 | 2424      | 26/07/2006      |

TU Traceability Unscheduled

### 3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

| IN THE FREQUENCY RANGE 30MHz TO 1000MHz                                                                                     |                                                       |                                                 |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------|
| TEST                                                                                                                        | FREQUENCY                                             | AMPLITUDE                                       |
| For 6dB Bandwidth                                                                                                           | $\pm 210.894\text{kHz}$                               | $\pm 0.5\text{dB}$                              |
| For Maximum Output Power                                                                                                    | Not Applicable                                        | $\pm 0.5\text{dB}$                              |
| For Radiated Emissions, Quasi-Peak Measurements using the ESVP Test Receiver and Bilog Antenna                              | $\pm 5\text{ppm} + 500\text{Hz}$                      | $\pm 4.1\text{dB}$                              |
| For Radiated Emissions, Quasi-Peak Measurements taken in Zero Span using the Hewlett Packard EMI Receiver and Bilog Antenna | $\pm 2 \times 10^{-7} \times \text{Centre Frequency}$ | 5.15dB calculated in accordance with CISPR 16-4 |
| For Spurious Conducted Emissions                                                                                            | Not Applicable                                        | $\pm 3.0\text{dB}$                              |
| IN THE FREQUENCY RANGE 1GHz TO 20GHz                                                                                        |                                                       |                                                 |
| TEST                                                                                                                        | FREQUENCY                                             | AMPLITUDE                                       |
| For Spurious Radiated Emissions measurements                                                                                | $\pm 2 \times 10^{-7} \times \text{Centre Frequency}$ | $\pm 3.4\text{dB}$                              |
| For Peak Power Spectral Density                                                                                             | Not Applicable                                        | $\pm 1.8\text{dB}$                              |
| For Effective Radiated Power (ERP) measurements                                                                             | Not Applicable                                        | $\pm 1.45\text{dBm}$                            |

## **SECTION 4**

### **PHOTOGRAPHS**

#### 4.1 PHOTOGRAPH OF EQUIPMENT UNDER TEST (EUT)



Radiated Emissions Test Set up

## **SECTION 5**

### **ACCREDITATION, DISCLAIMERS AND COPYRIGHT**

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This report relates only to the actual item/items tested.

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