4.1 MAXIMUM PEAK OUTPUT POWER (CONDUCTED)

4.1.6 Test Results

Maximum Power - GSM

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (W)
1850.2	12.12	17.0	29.12	0.817
1880.0	12.26	17.0	29.26	0.843
1909.8	12.57	16.7	29.27	0.845

Minimum Power- GSM

Frequency (MHz)	Output Power (dBm)	Path Loss (dB)	Result (dBm)	Result (mW)
1850.2	-17.18	17.0	-0.18	0.959
1880.0	-16.96	17.0	+0.04	1.009
1909.8	-16.56	16.7	+0.14	1.033

Limit	<2W or <+33dBm

Remarks

EUT complies with CFR 47 2.1046 and 24.232(b). The EUT does not exceed 2W or +33dBm at the measured frequencies.

4.2 MAXIMUM PEAK OUTPUT POWER (RADIATED)

4.2.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.232

4.2.2 Equipment Under Test

SND321

4.2.3 Date of Test

25th March 2005

4.2.4 Test Equipment Used (See Section 3.1 for details)

The major items of test equipment used for the above tests are identified within the Test Equipment Used table shown in Section 5.1.

Items: 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26

4.2.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

The EUT has an Integral antenna, therefore the Maximum Peak Output Power (EIRP) was made using the Radiated method.

The Spectrum Analyser was tuned to the test frequency. The device Output Power setting was controlled as specified in the Product Information, Section 1.5 of this document. The device was then rotated through 360 degrees, and the measuring antenna height searched (1m – 4m) until the highest power level was observed in both horizontal and vertical polarisation. The device was then replaced with a substitution antenna, whose input signal to the antenna was adjusted until the received level matched that of the previously detected emission.

4.2.6 Test Results

Measurements were made with the EUT in PCS 1900MHz.

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

Frequency (MHz)	Raw Result (dBm)	Substitution Level (dBm)	Substitution Antenna Gain (dB)	Result EIRP (dBm)	EIRP Limit (dBm)	Result EIRP (mW)
1850.2	-17.8	21.8	8.7-5.4 cable	25.1	33.0	323.59
1880.0	-20.9	18.7	8.7-5.3 cable	22.1	33.0	162.18
1909.8	-20.0	19.6	8.7-5.4 cable	22.9	33.0	194.98

4.3 MODULATION CHARACTERISTICS

4.3.1 Specification Reference

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

4.3.2 Equipment Under Test

SND321

4.3.3 Date of Test

8th March 2005

4.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified within the Test Equipment Used table shown in Section 5.1.

Items: 1, 2, 3, 4, 5, 6, 7, 8

4.3 MODULATION CHARACTERISTICS

4.3.5 Modulation Description

DETAILED DESCRIPTION OF S1 (SND321) MODULATION SYSTEM

A detailed description of the modulation system employed is provided in this exhibit, per the requirements of § 2.1033(c)(13).

In general, the GSM system utilizes a Time Division Multiple Access (TDMA) scheme with eight basic physical channels per carrier. Carrier separation is 200 kHz. The basic radio resource is a time slot that lasts approximately 577 µs during which information is transmitted at a modulation rate of approximately 270.833 kb/s. The modulation scheme is Gaussian MSK (GMSK) with a bandwidth-time (BT) product of 0.3.

The following description of the GSM modulation system is taken directly from Chapter 4 of Volume 1, Radio Path Physical Layer, in the Personal Communications Services, Air Interface Specification, J-STD-007.

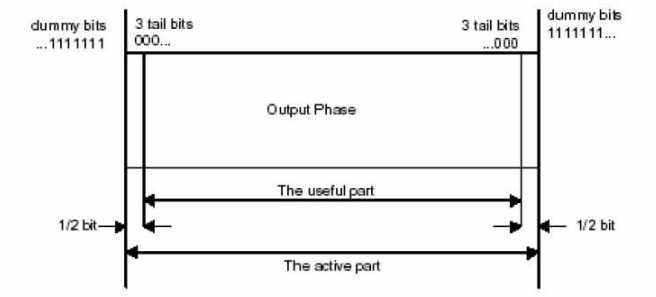
4.0 Modulation
This chapter defines the theoretical requirements of the modulator, inclusive of the differential encoder. The modulator receives the bits from the encryption unit and produces and RF modulated signal. The information bits are first differentially encoded and then passed to the modulator. The modulation is GMSK (Gaussian Minimum Shift Keying) with a BT product of 0.3.

4.1 Modulation Format
4.1.1 Modulating Bit Rate

The modulating bit rate is 1/T = 1625/6 kb/s (approximately 270.833 kb/s).

4.1.2 Start and Stop of the Burst

The bits contained within a burst are defined in Chapter 2. For the purpose of the modulator specification as follows, the bits entering the differential encoder prior to the first bit of the burst and following the last bit of the burst are consecutive logical ones and are denoted by the term dummy bits which define the start and end points of the useful and active parts of the burst as shown in Figure 4.1. The actual state of these bits is left to the manufacturer's implementation subject to the requirement that all performance specifications of this volume are met. Nothing is specified about the actual phase of the modulator output signal outside of the useful part of the burst. Figure 4.1 depicts the relationship between the active and useful part of the burst, the tail bits and dummy bits for a normal burst. The useful part of the burst lasts for 147 modulating bits.



Printed 24 February 2005 - This Document is uncontrolled when printed.

4.3 MODULATION CHARACTERISTICS

4.3.6 Modulation Description

Figure 4.: Normal Burst

4.1.3 Differential Encoding

Each data value di = [0,1] is differentially encoded. The output of the differential encoder is:
d'i = di ⊕ di-1 where ⊕ denotes modulo 2 addition.
The modulating data value _i input to the modulator is: _i = 1 - 2d'i where _i _ {-1, 1}

4.1.4 Filtering

The modulating data values □i as represented by Dirac pulses excite a linear filter with impulse response
defined by:
g(t) = h(t) □rect(t/T)

where the function rect(x) is defined by rect(t/T) = 1/T for t< T/2
rect(t/T) = 0 otherwise
and □means convolution. h(t) is defined by

$$h(t) = \frac{e^{\left(\frac{-t^2}{2\sigma^2 T^2}\right)}}{\sqrt{2\pi}\sigma T}$$ where σ = √{ln(2)}/(2πBT) and BT = 0.3

where B is the 3 dB bandwidth of the filter with impulse response h(t) and T is the duration of the one input data bit.

4.1.5 Output Phase

The phase of the modulated signal is:

$$\vartheta(t') = \sum_i \alpha i \pi h \int_{-\infty}^{t'-iT} g(u)du$$

where the modulating index h is ½ (maximum phase change in radians is ½ per data interval).

The time reference t' = 0 is the start of the active part of the burst as shown in Figure 4. The is also the start of the bit period of bit number 0 (the first tail bit) as defined in chapter 2.

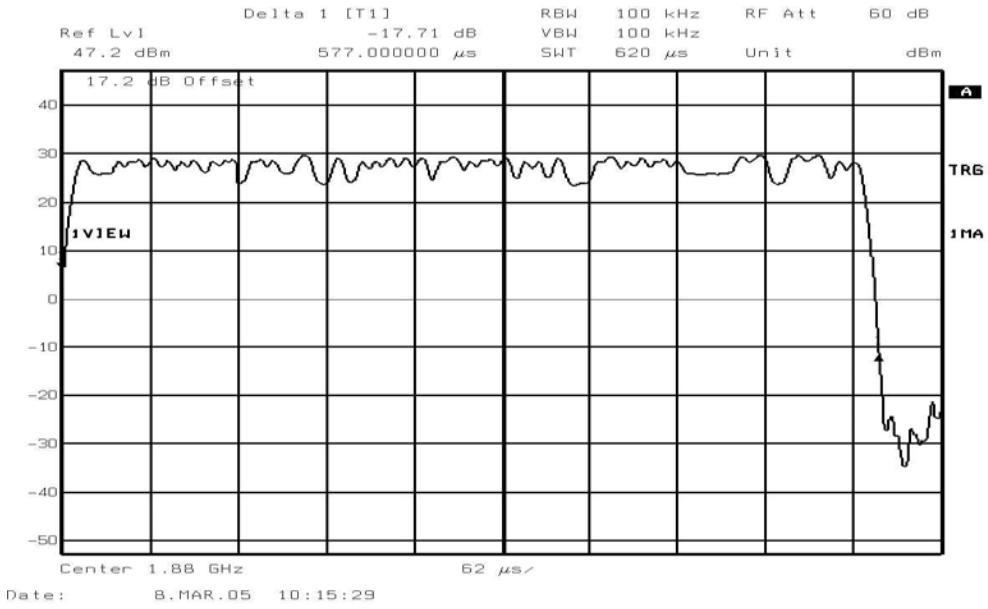
4.1.6 Modulation

The modulated RF carrier, except for start and stop of the TDMA burst may therefore be expressed as:

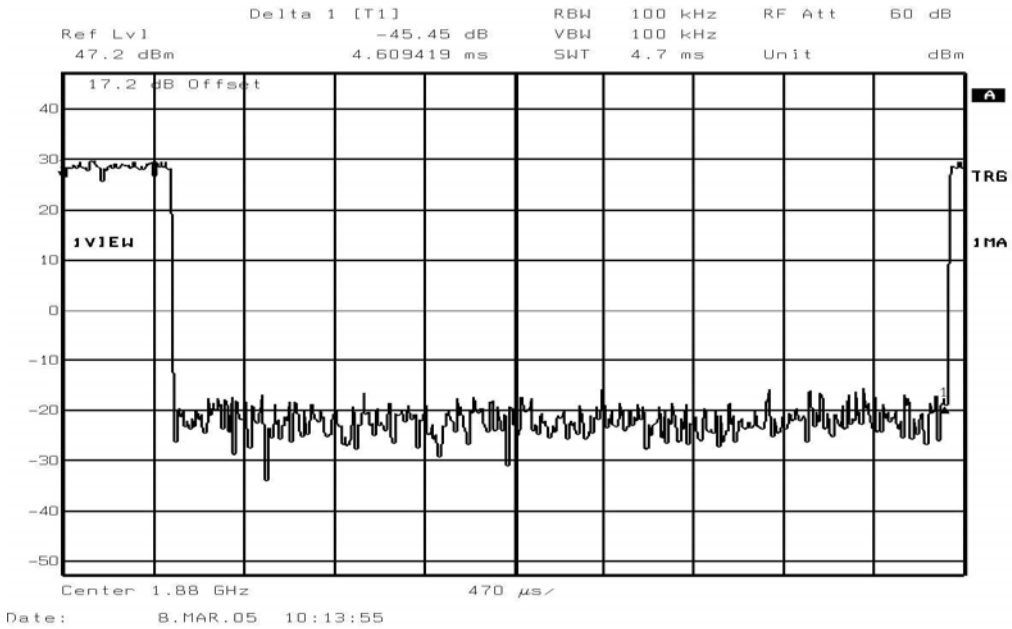
$$x(t') = \sqrt{\frac{2Ec}{T}}\cos(2\pi f_o t' + \varphi(t') + \vartheta_o)$$

where Ec is the energy modulating bit, fo is the center frequency, and ϑo is a random phase and is constant during one burst.

4.3 **MODULATION CHARACTERISTICS** - CONTINUED



GSM Mode. View of TS3



GSM Mode. View of One Complete Frame Showing TS3

4.4 OCCUPIED BANDWIDTH

4.4.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.238(b), 2.1049

4.4.2 Equipment Under Test

SND321

4.4.3 Date of Test

4th March 2005

4.4.4 Test Equipment Used (See Section 3.1 for details)

The major items of test equipment used for the above tests are identified as within the Test Equipment Used table shown in Section 5.1.

Items: 1, 2, 3, 4, 5, 6, 7, 8

4.4.5 Test Procedure

GSM

The EUT was set to transmit on maximum power and measurements were made on Timeslot 3.

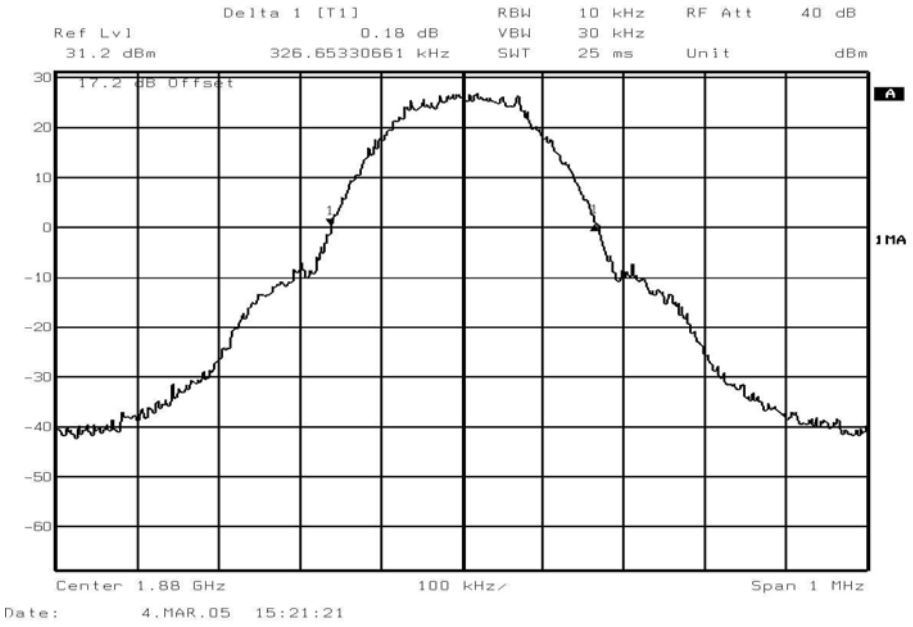
Using a resolution bandwidth of 10kHz and a video bandwidth of 30kHz, the –26dBc points were established and the emission bandwidth determined.

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

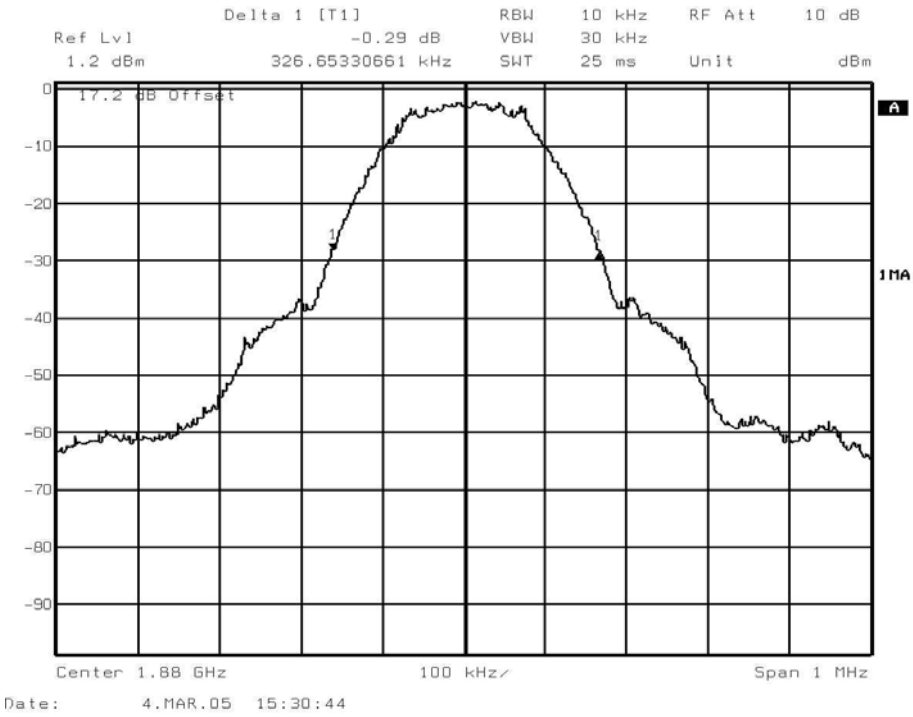
4.4 OCCUPIED BANDWIDTH - Continued

4.4.5 Test Results

Occupied Bandwidth As Defined By The - 26dBc Points



Maximum Power – Circuit Switched (GSM)



Minimum Power – Circuit Switched (GSM)

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1kHz)

4.5.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.229, 2.1051

4.5.2 Equipment Under Test

SND321

4.5.3 Date of Test

7th March 2005

4.5.4 Test Equipment Used (See Section 3.1 for details)

The major items of test equipment used for the above tests are identified as within the Test Equipment Used table shown in Section 5.1.

Items: 1, 2, 3, 4, 5, 6, 7, 8

4.5.5 Test Procedure

In accordance with Part 24.238, at least 1% of the 26dB bandwidth was used for the resolution and video bandwidths up to 1MHz away from the Block Edge. At greater than 1MHz, the resolution and video bandwidths were increased to 1MHz.

The reference power and path losses of all channels used for testing in each frequency block were measured. It was found that there was <0.6dB variation in all channels, thus the worst case reference level offset was used throughout. Having entered the reference level offset, the limit line was displayed, showing the –13dBm, (43+10logP), limit.

The EUT was tested at it's maximum power level.

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

Frequency Block (MHz)	Lower Block Edge Test Channels/Frequencies	Upper Block Edge Test Channels/Frequencies
A	Channel : 513 Frequency : 1850.4 MHz	Channel : 584 Frequency : 1864.6 MHz
B	Channel : 613 Frequency : 1870.4 MHz	Channel : 684 Frequency : 1884.6 MHz
C	Channel : 738 Frequency : 1895.4 MHz	Channel : 759 Frequency : 1899.6 MHz
C	Channel : 763 Frequency : 1900.4 MHz	Channel : 784 Frequency : 1904.6MHz
C	Channel : 788 Frequency : 1905.4 MHz	Channel : 809 Frequency : 1909.6 MHz
D	Channel : 588 Frequency : 1865.4 MHz	Channel : 609 Frequency : 1869.6 MHz
E	Channel : 688 Frequency : 1885.4 MHz	Channel : 709 Frequency : 1889.6 MHz
F	Channel : 713 Frequency : 1890.4 MHz	Channel : 734 Frequency : 1894.6 MHz

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

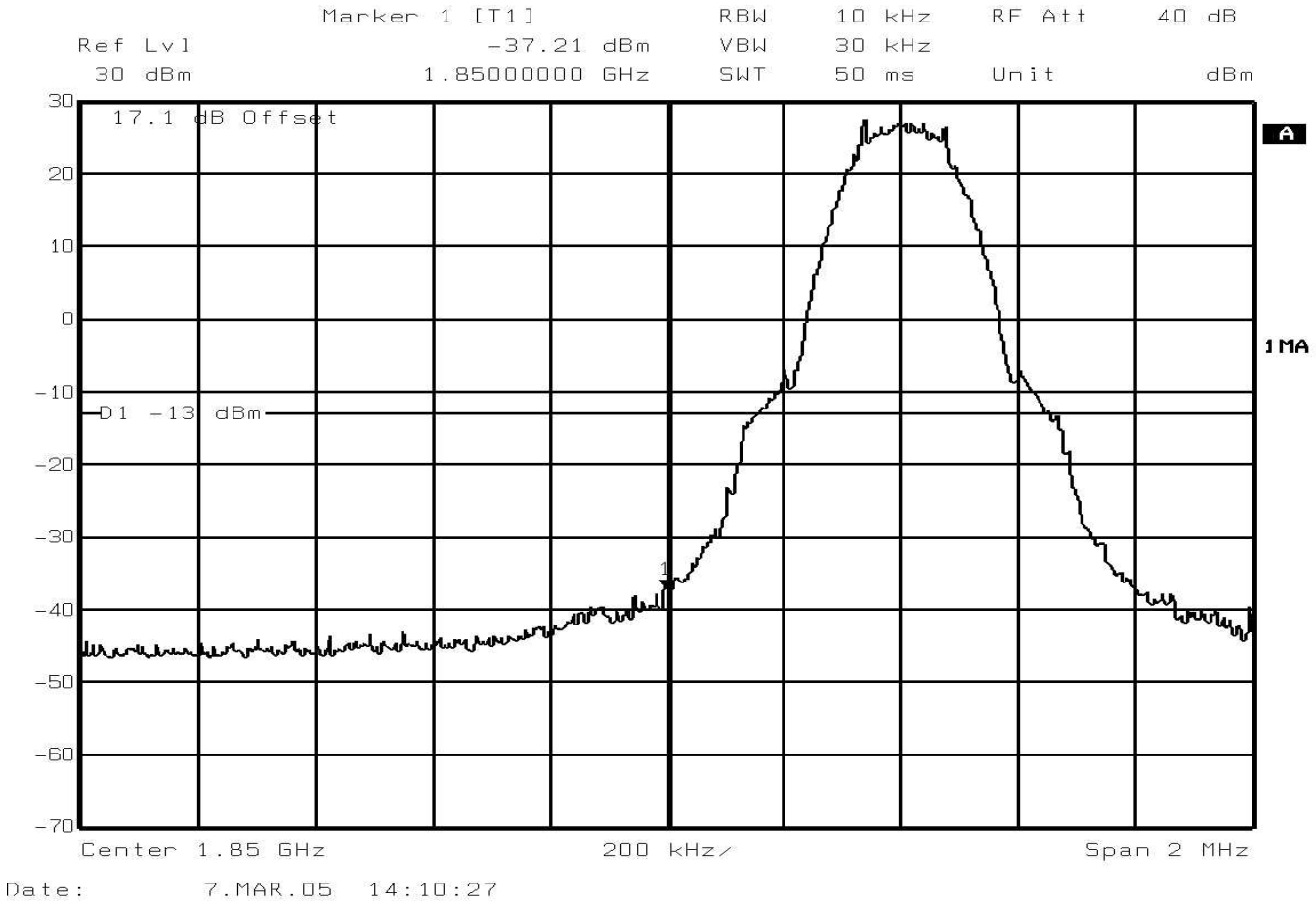
4.5.6 Test Results

The measurement plots are shown on the following pages.

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 513, (1850.4MHz)

Block A

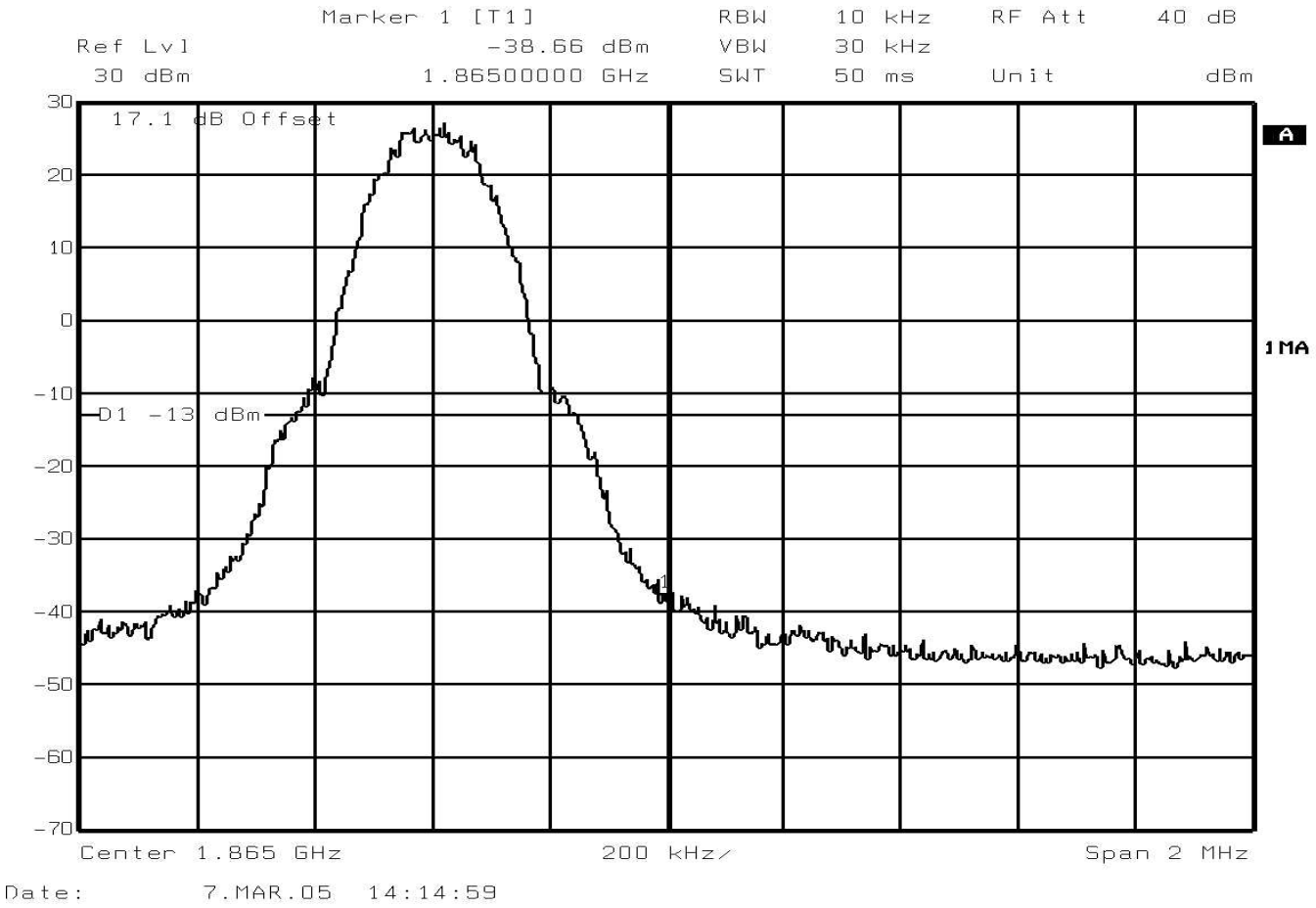


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 584, (1864.6MHz)

Block A

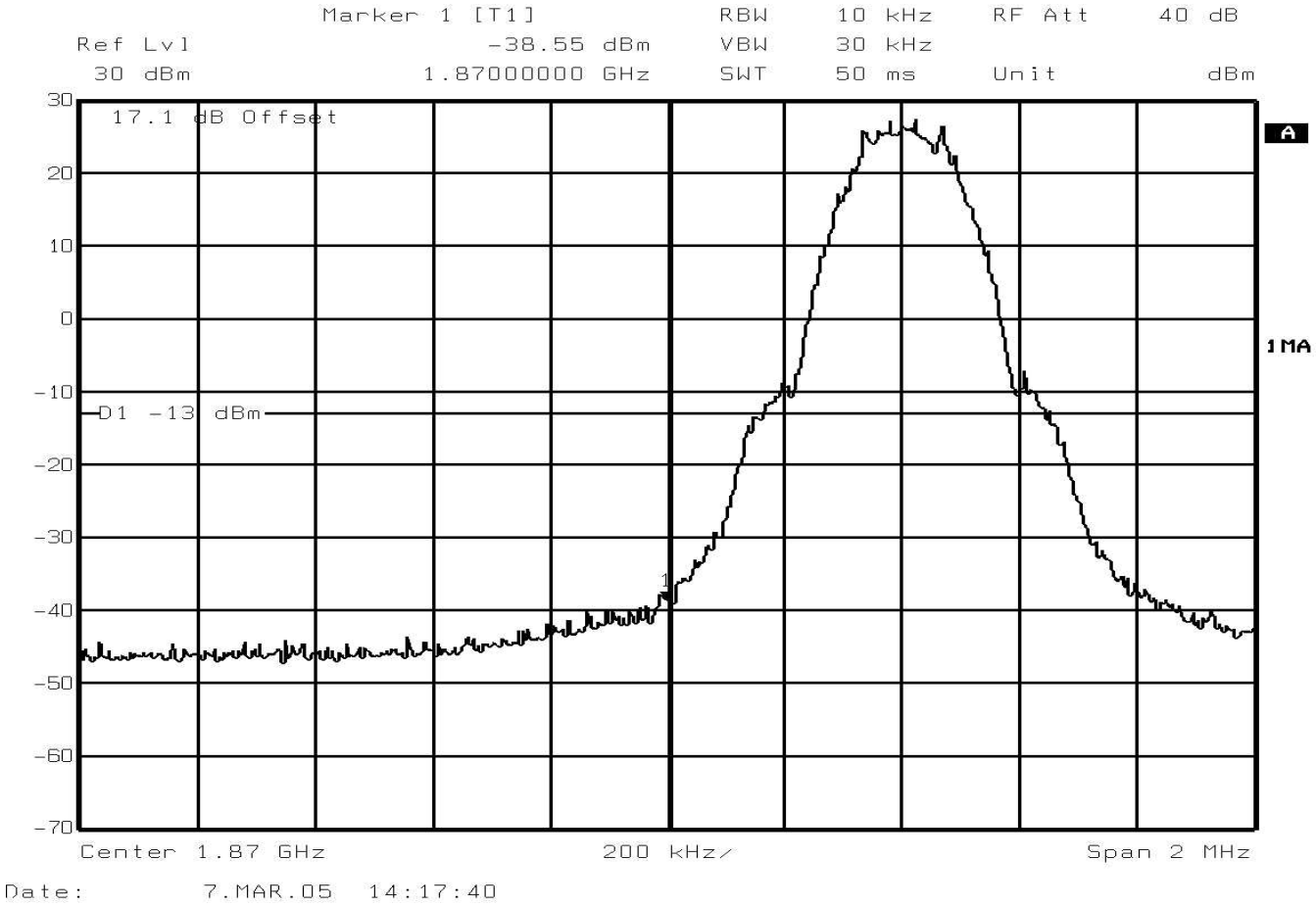


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 613, (1870.4MHz)

Block B

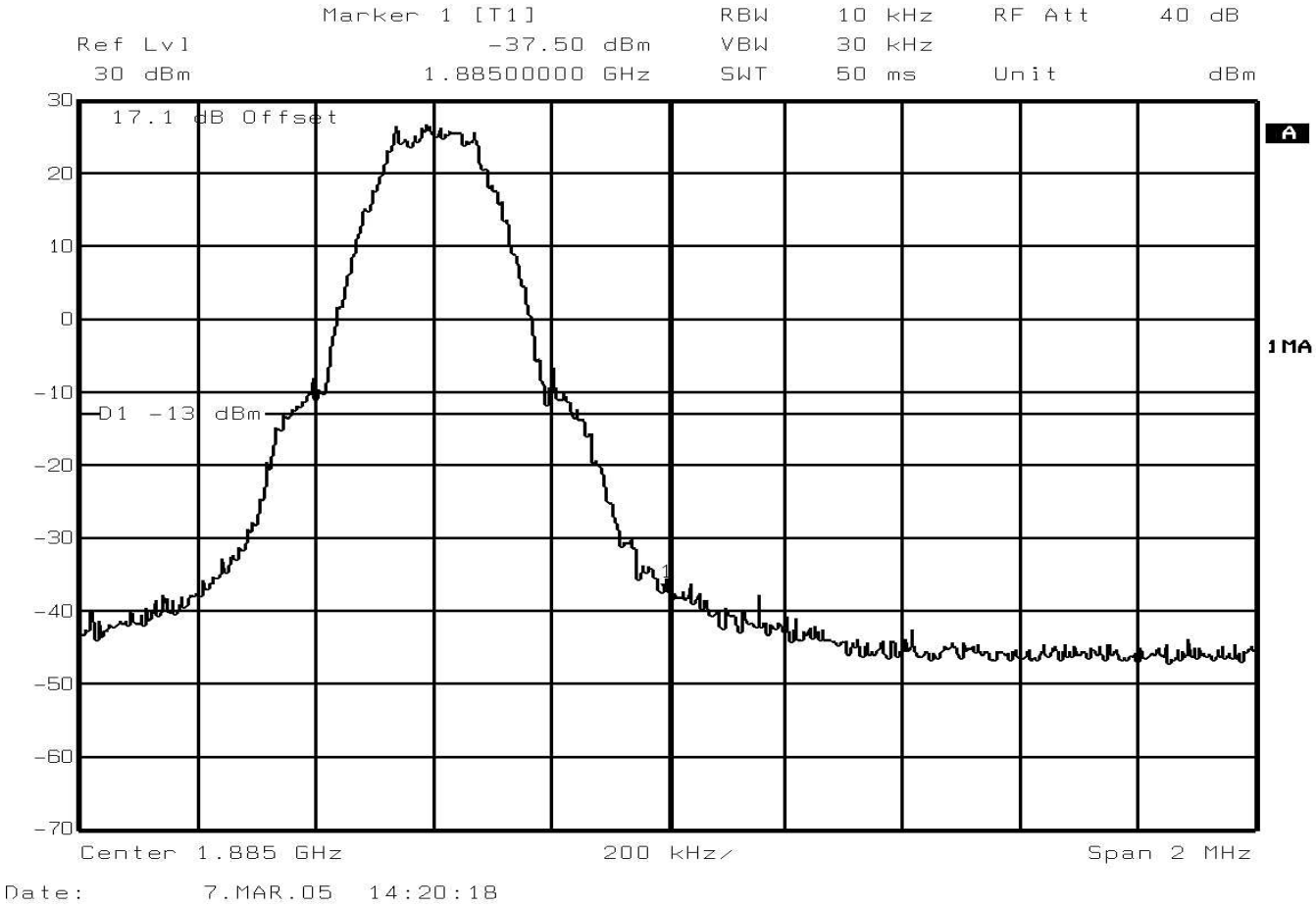


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 684, (1884.6MHz)

Block B

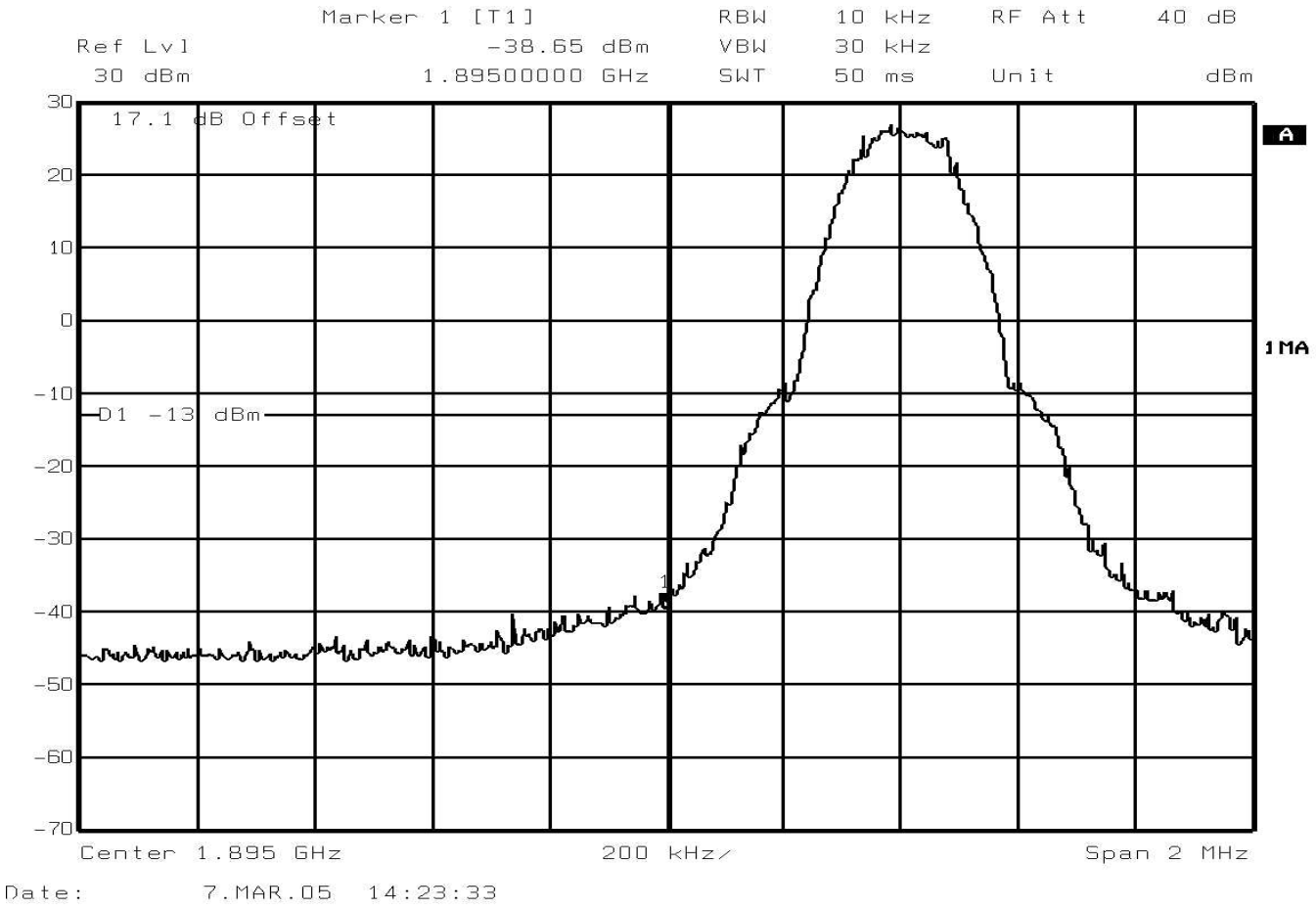


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 738, (1895.4MHz)

Block C

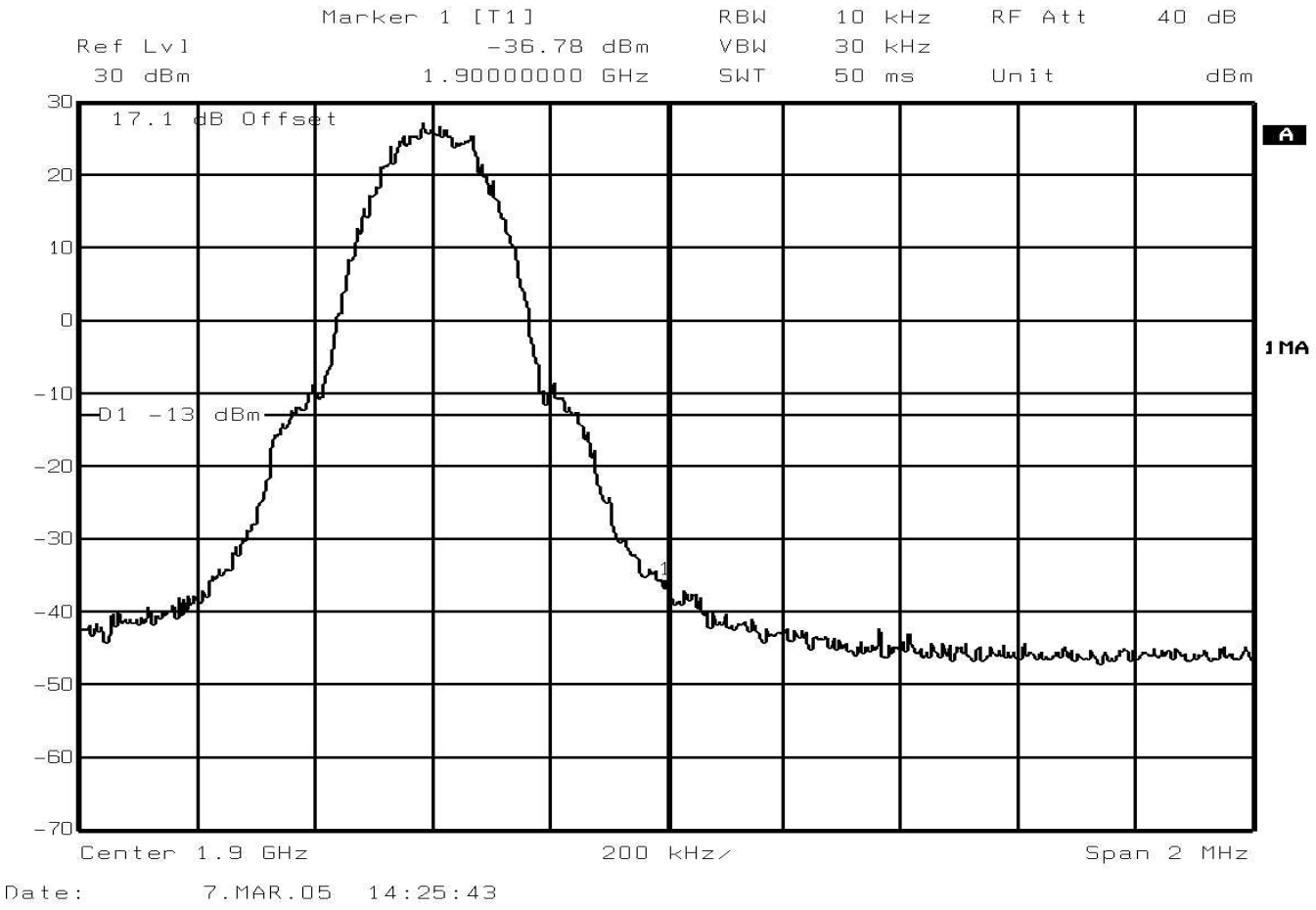


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 759, (1899.6MHz)

Block C

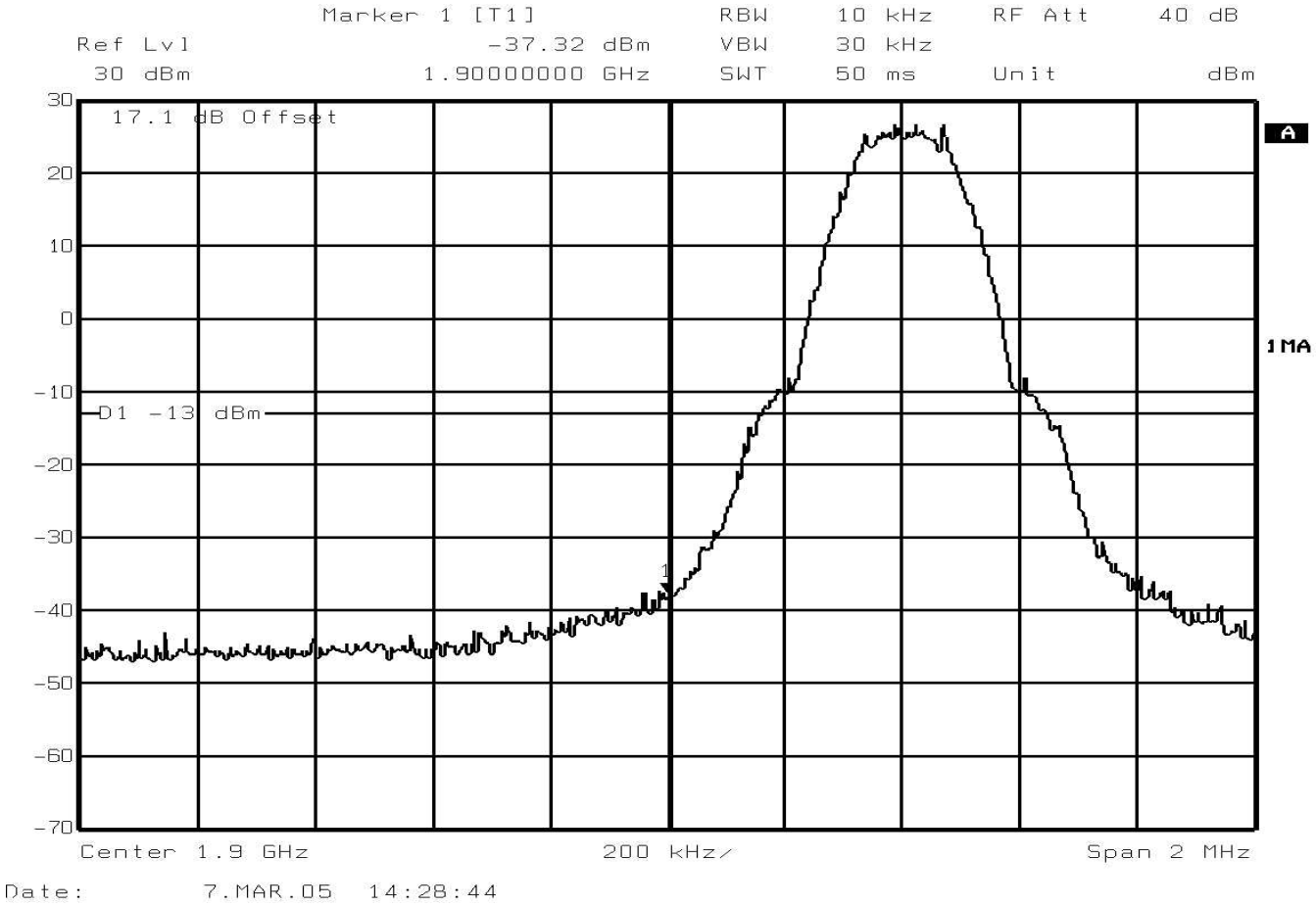


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 763, (1900.4MHz)

Block C

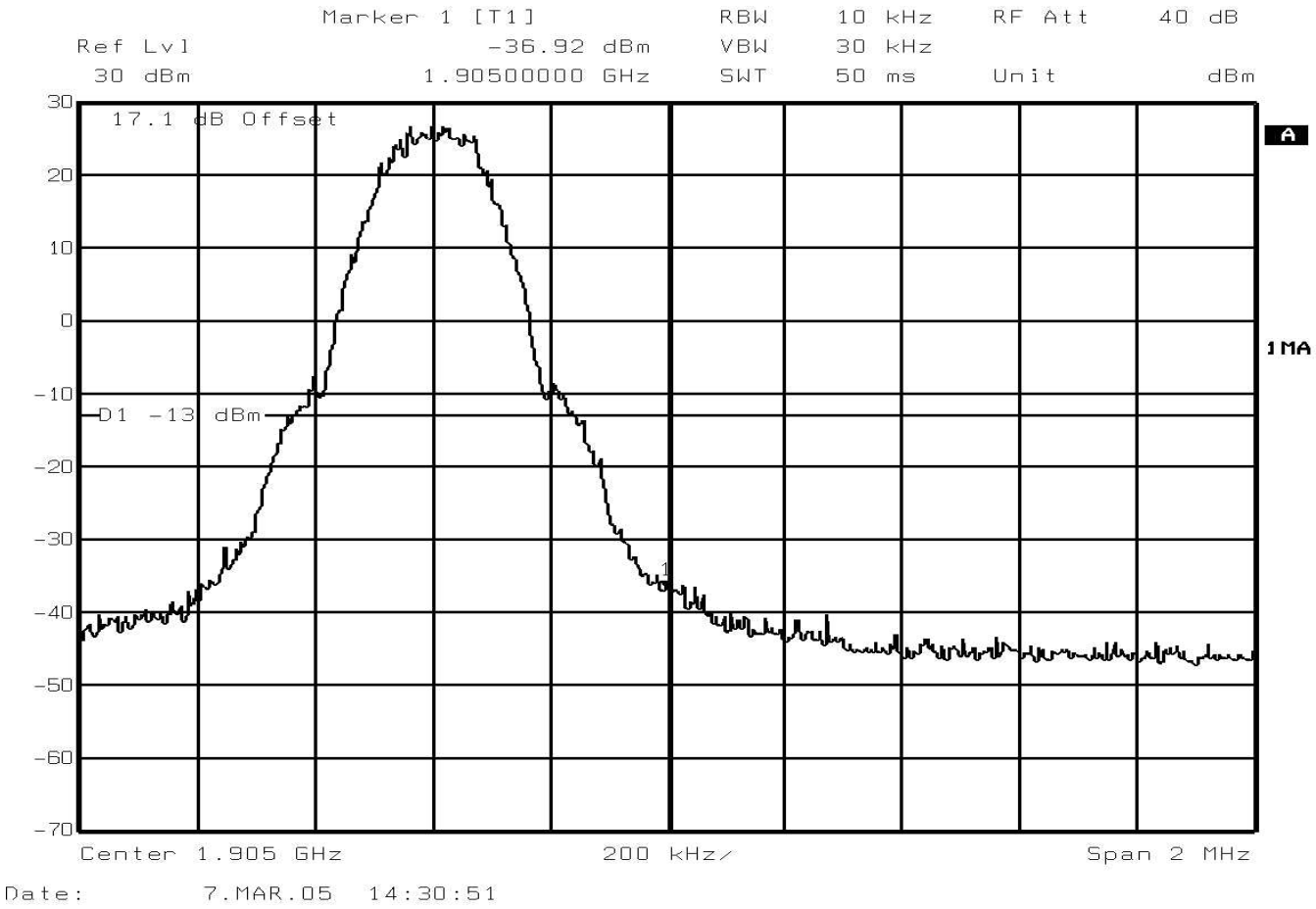


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 784, (1904.6MHz)

Block C

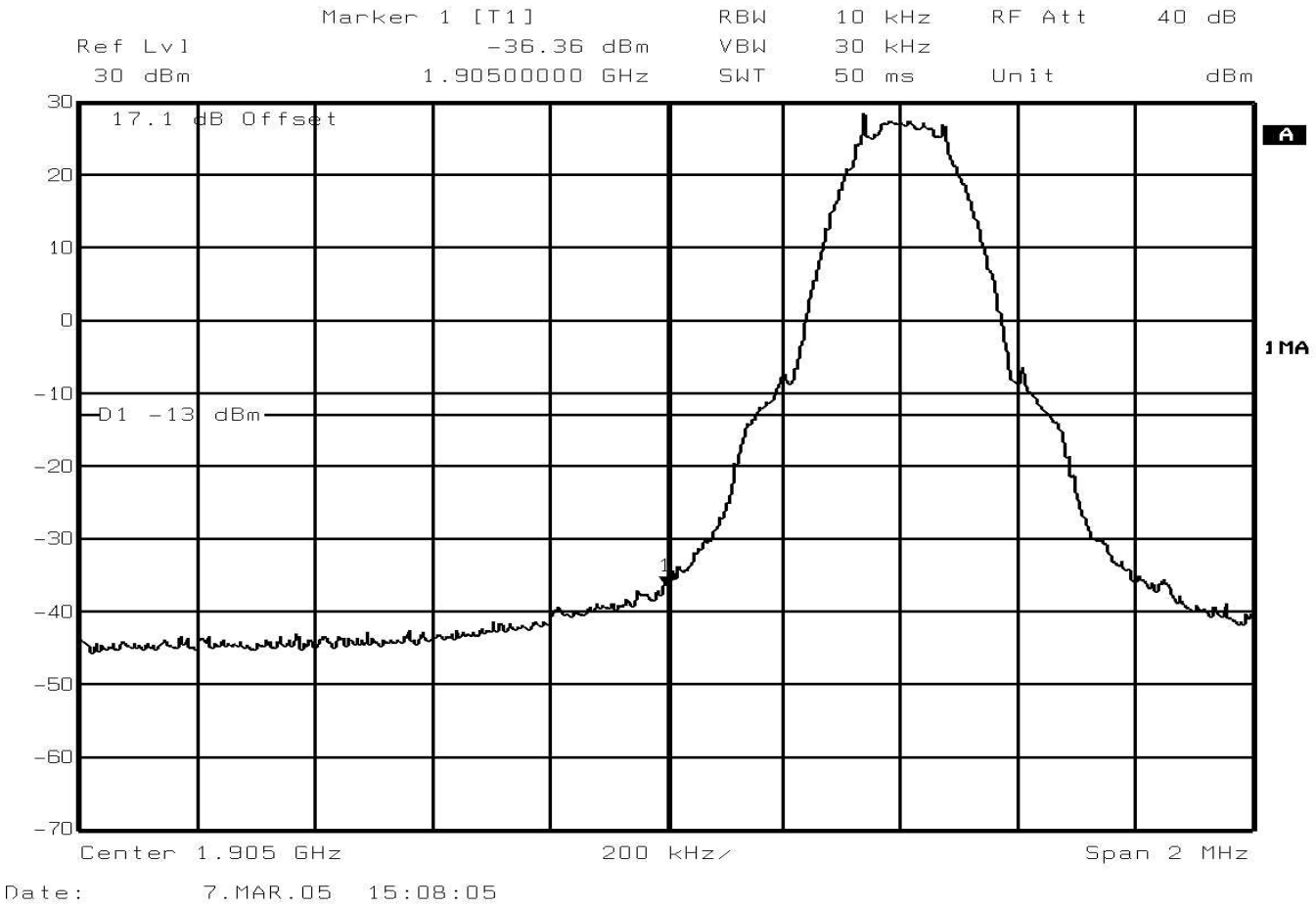


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 788, (1905.4MHz)

Block C

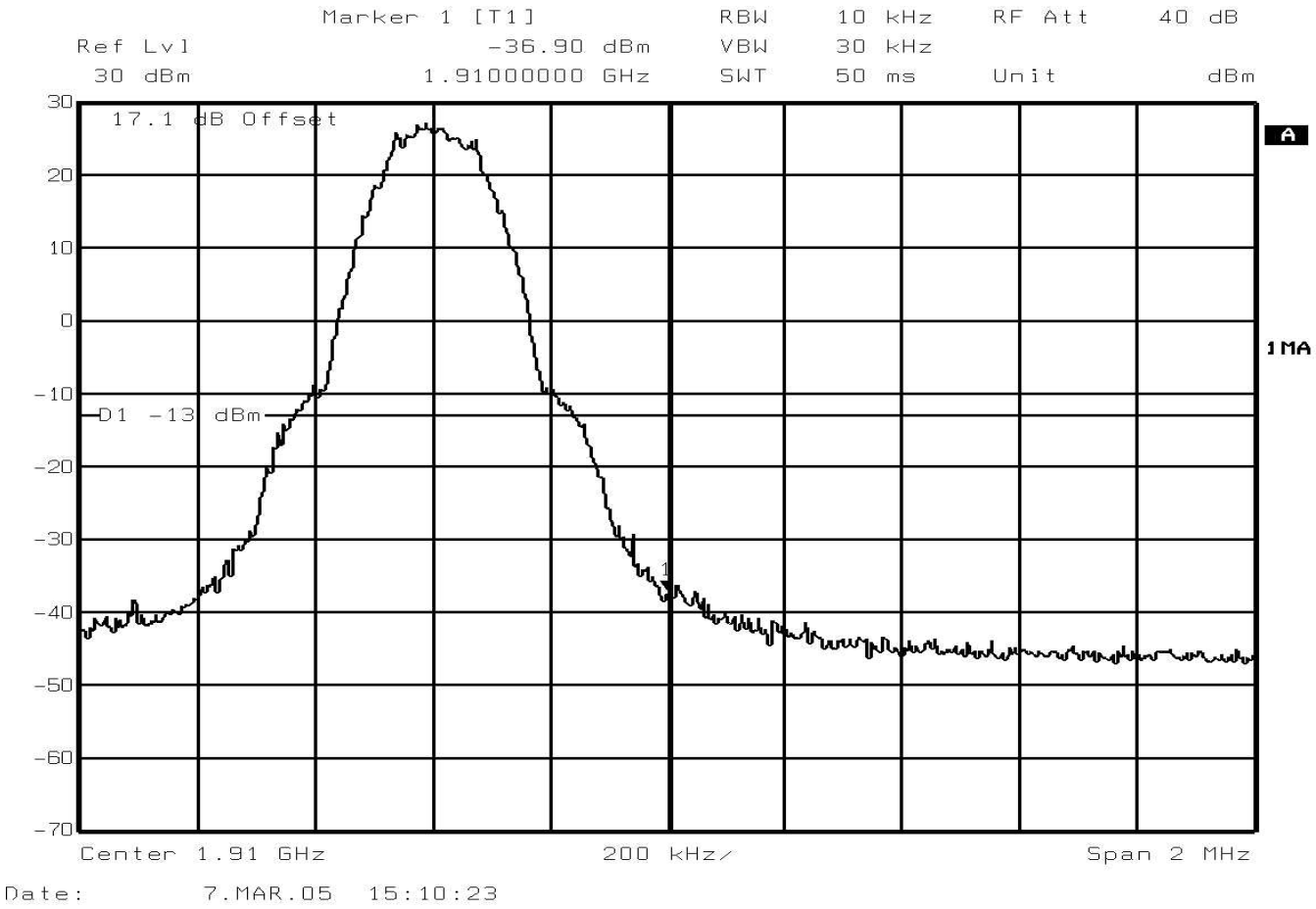


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 809, (1909.6MHz)

Block C

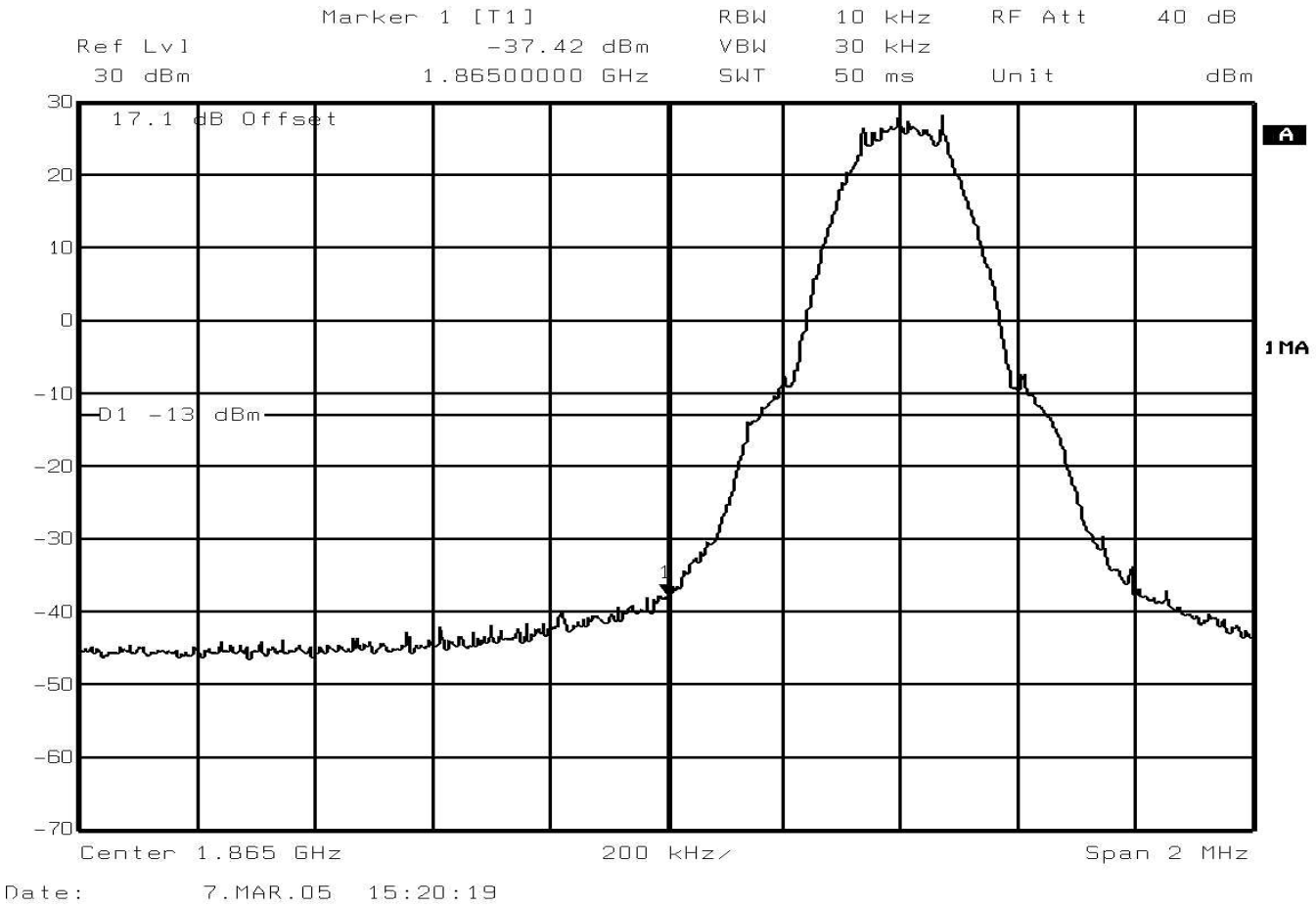


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 588, (1865.4MHz)

Block D

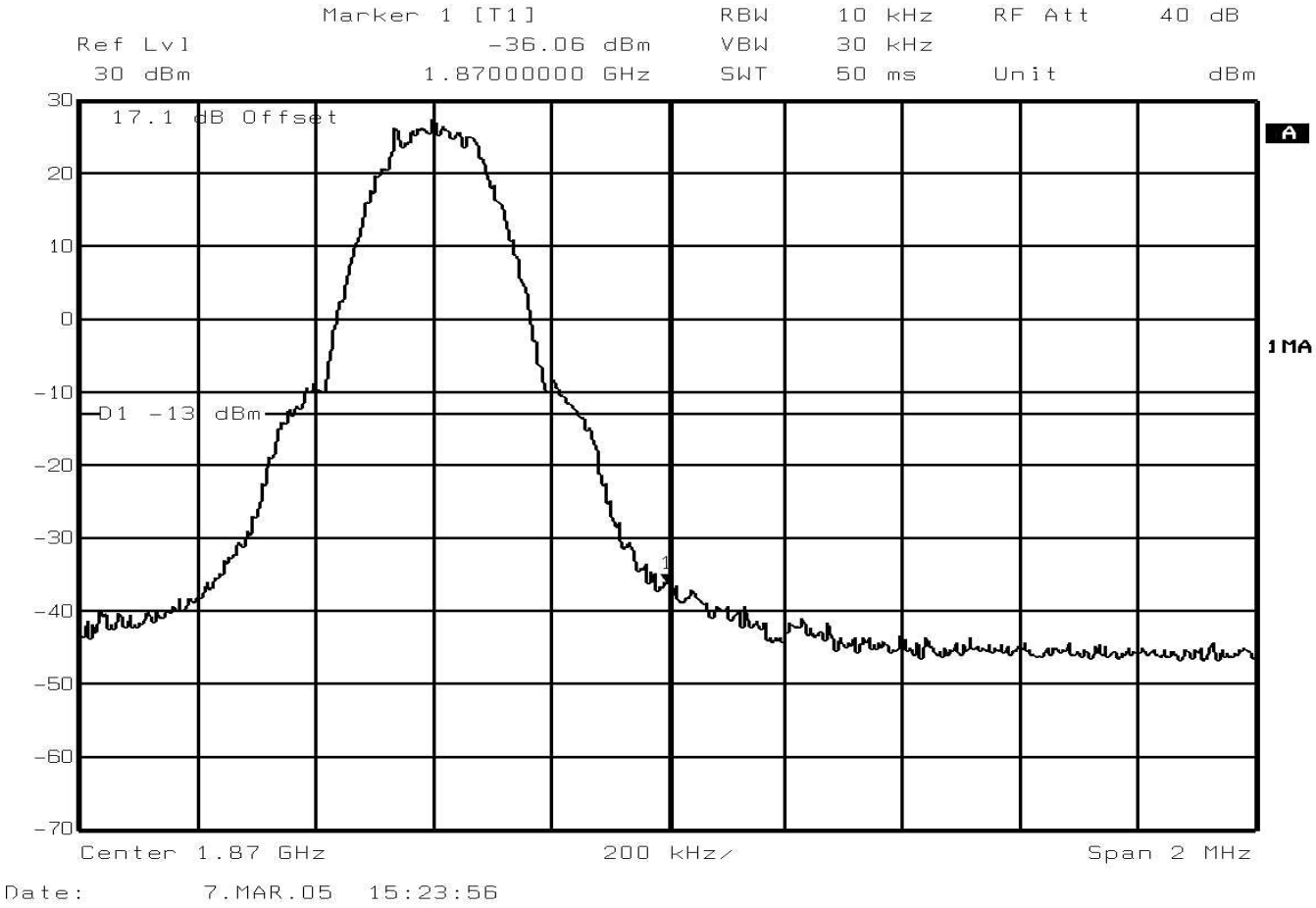


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 609, (1869.6MHz)

Block D

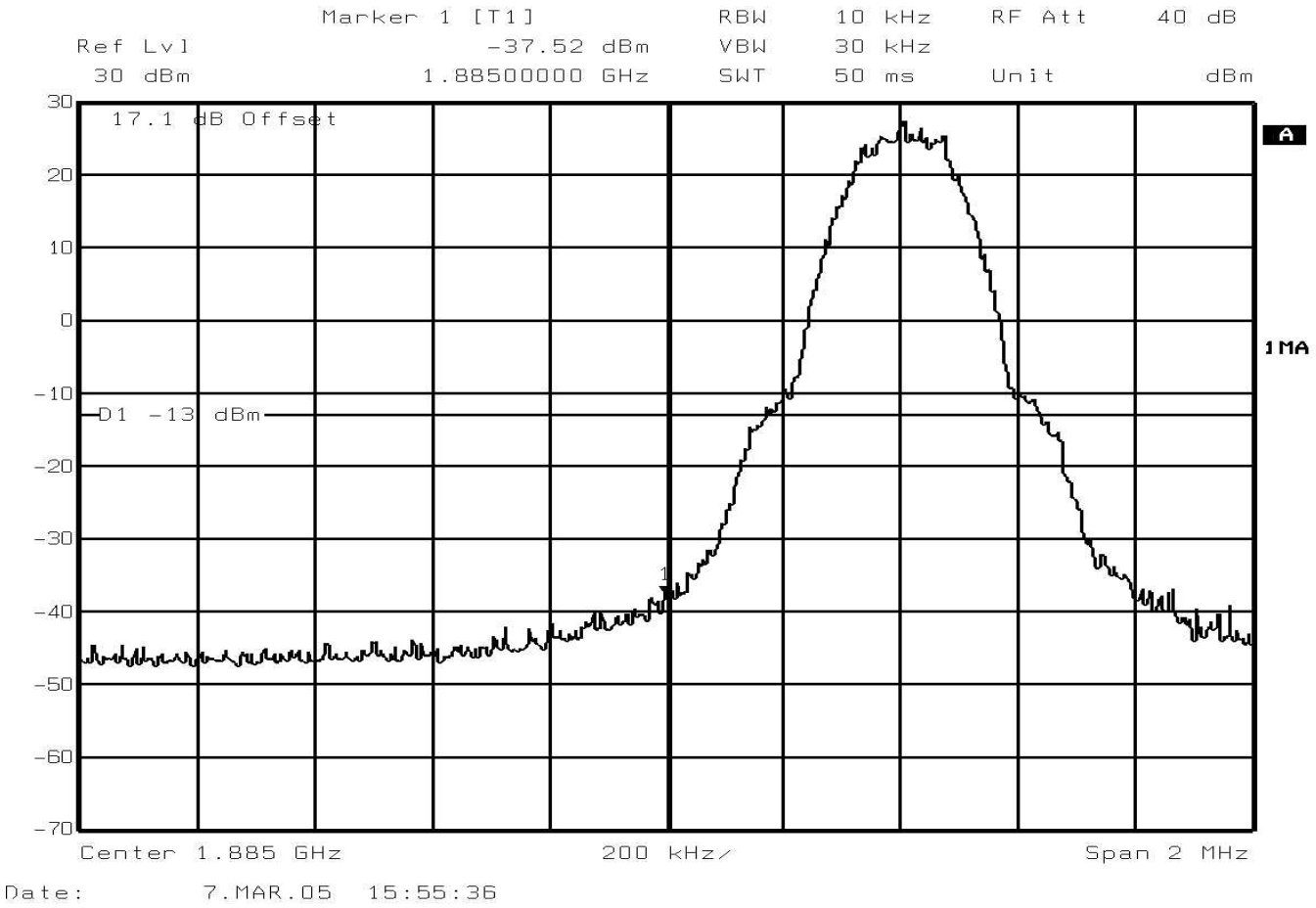


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 688, (1885.4MHz)

Block E

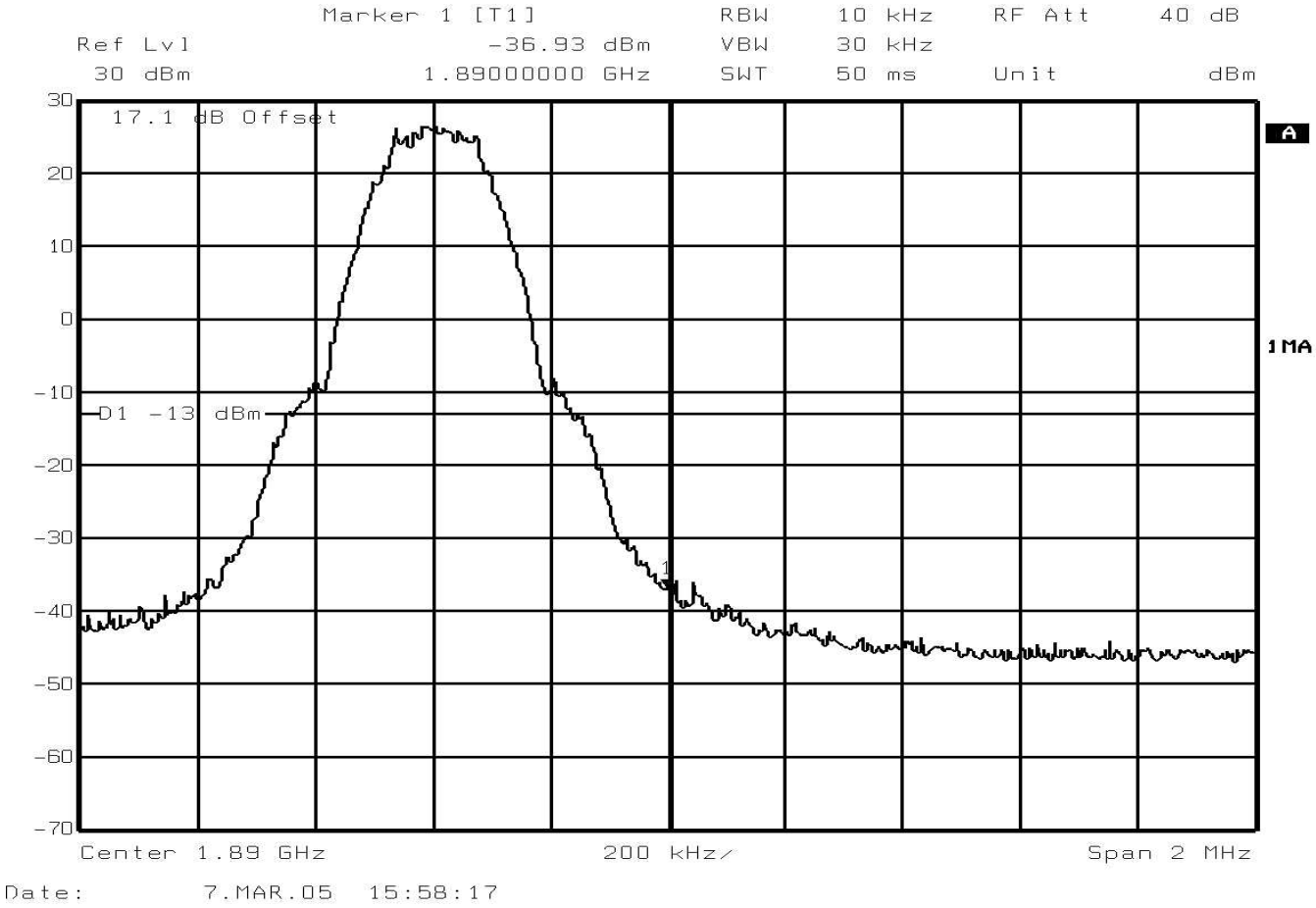


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 709 (1889.8MHz)

Block E

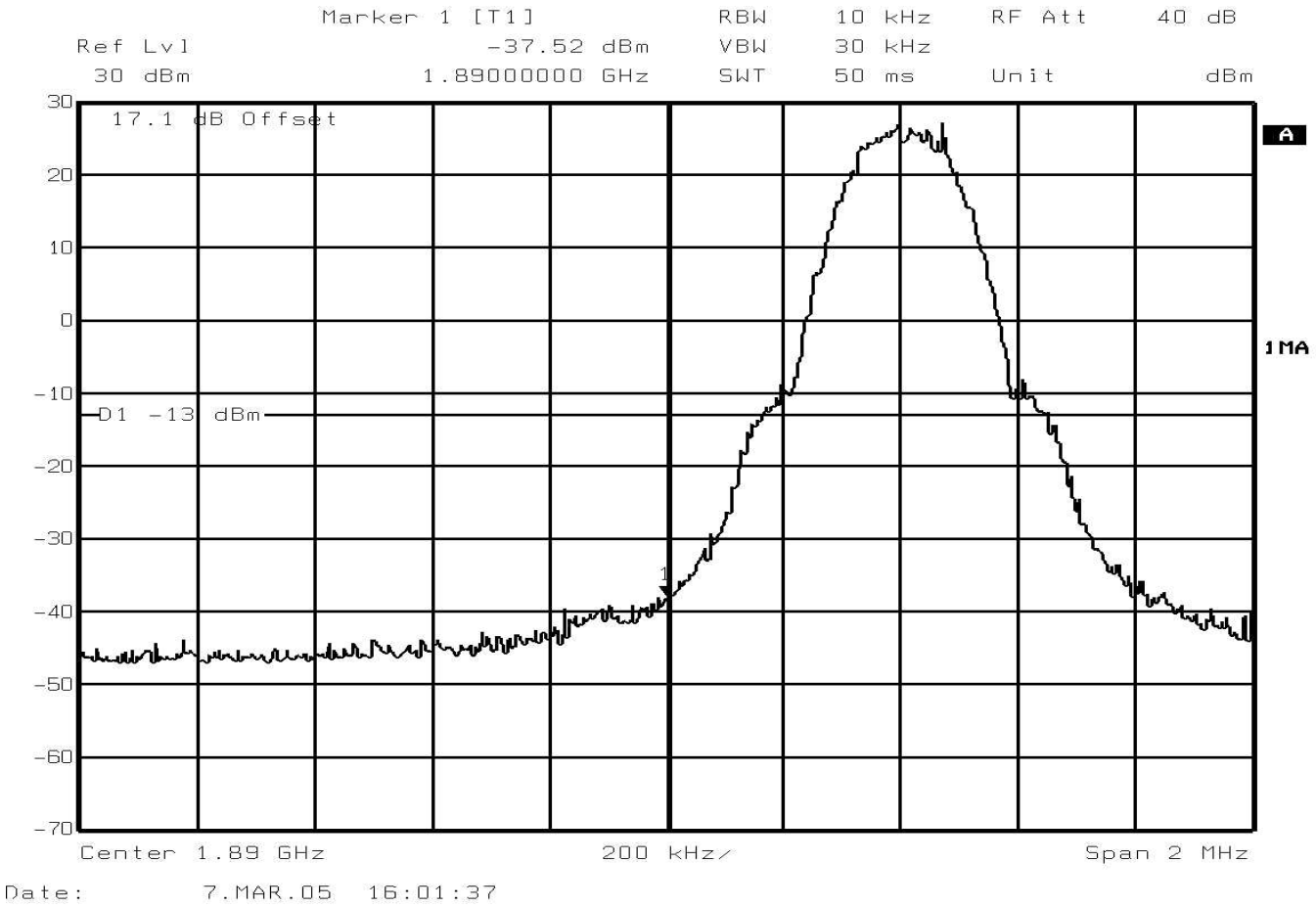


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 713, (1890.4MHz)

Block F

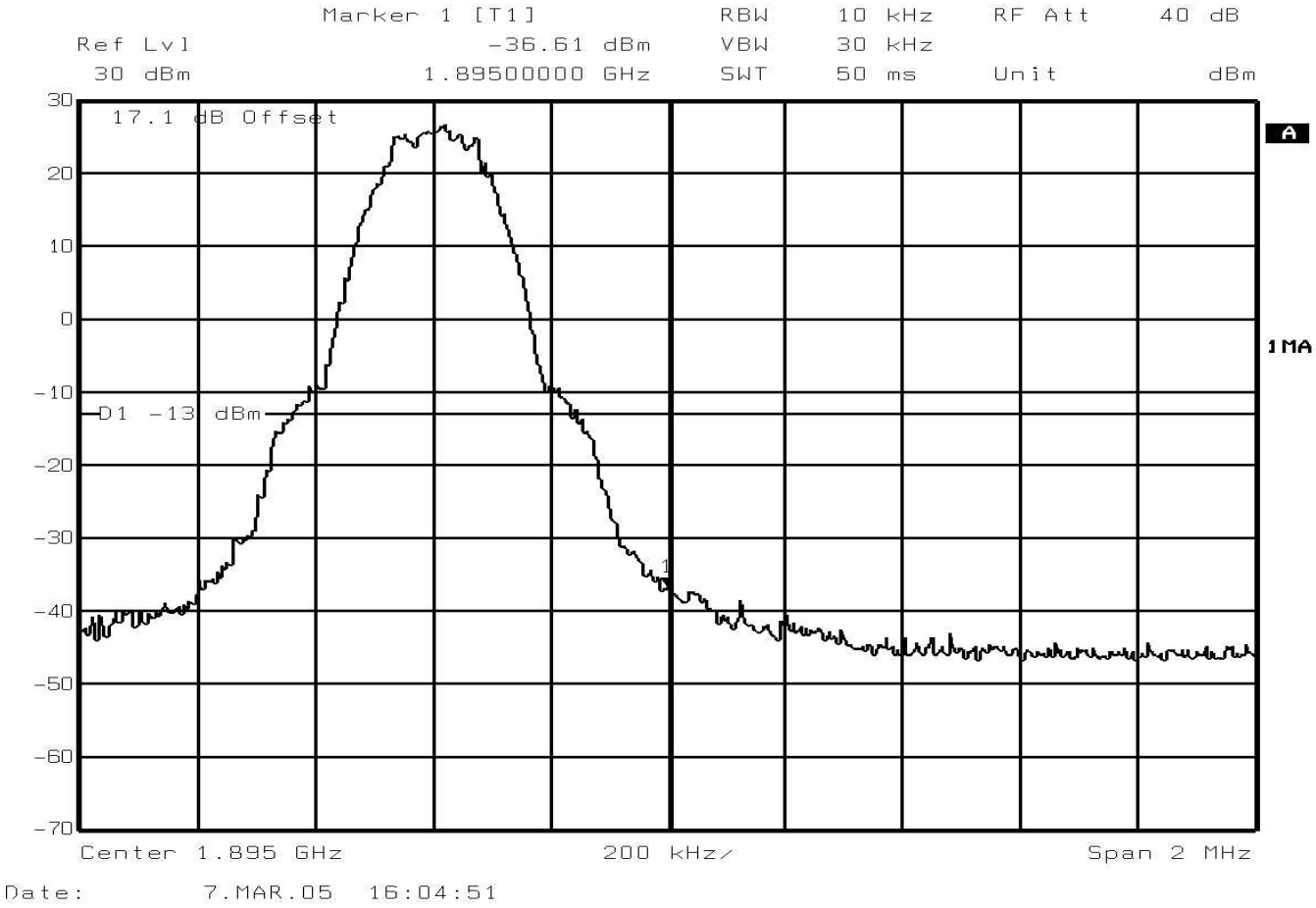


GSM – Circuit Switched

4.5 SPURIOUS EMISSIONS AT ANTENNA TERMINALS (+/-1MHz) – Continued

Block Edge Measurement with EUT Transmitting on full power on Channel 734, (1894.6MHz)

Block F



GSM – Circuit Switched

4.6 RADIATED EMISSIONS

4.6.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.238

4.6.2 Equipment Under Test

SND321

4.6.3 Date of Test

25th & 26th March 2005

4.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as within the Test Equipment Used table shown in Section 3.1.

Items:, 13-26

4.6.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

In order to determine the Radiated Emission Limits, measurements of transmitter 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 Anechoic Chamber (3 metres) 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.

Product Service

4.6 RADIATED EMISSIONS - continued

4.6.5 Test Procedure - continued

The limits for Spurious Emissions have been calculated, as shown in the table below using the following formula:

Field Strength of Carrier -(43 + 10Log (P)) dBµV/m

Where:
Field Strength is measured in dBµV/m
P is Measured Transmitter Power in Watts

Configuration 1

Test Mode	Carrier Frequency GHz	Carrier Field Strength dBµV/m	Measured Power W	Limit for Spurious Emissions dBµV/m
GSM 1900	1850.2	120.7	0.323	82.6
GSM 1900	1880.0	118.9	0.162	83.8
GSM 1900	1909.8	120.7	0.194	84.8

Configuration 2

Test Mode	Carrier Frequency GHz	Carrier Field Strength dBµV/m	Measured Power W	Limit for Spurious Emissions dBµV/m
GSM 1900	1850.2	120.2	0.323	82.1
GSM 1900	1880.0	118.9	0.162	83.8
GSM 1900	1909.8	121.0	0.194	85.1

These limits have been used to determine Pass or Fail for the harmonics measured and detailed in the following tables.

Product Service

4.6 RADIATED EMISSIONS - continued

4.6.6 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 GSM 1900 Mode (see Section 1.3.3 for details).

Configuration 1

EUT Tx on Bottom Channel (1850.2MHz)

No emissions were detected within 20dB of the limit.

The test limit being 82.6dBµV/m

EUT Tx on Middle Channel (1880.0MHz)

No emissions were detected within 20dB of the limit.

The test limit being 83.8dBµV/m

EUT Tx on Top Channel (1909.8MHz)

No emissions were detected within 20dB of the limit.

The test limit being 84.8dBµV/m

Product Service

4.6 RADIATED EMISSIONS - continued

4.6.6 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 GSM 1900 Mode (see Section 1.3.3 for details).

Configuration 2

EUT Tx on Bottom Channel (1850.2MHz)

No emissions were detected within 20dB of the limit.

The test limit being 82.1dBµV/m

EUT Tx on Middle Channel (1880.0MHz)

No emissions were detected within 20dB of the limit.

The test limit being 83.8dBµV/m

EUT Tx on Top Channel (1909.8MHz)

No emissions were detected within 20dB of the limit.

The test limit being 85.1dBµV/m

Product Service

4.6 RADIATED EMISSIONS - continued

4.6.6 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 GSM 1900 Mode (see Section 1.3.3 for details).

Configuration 1

EUT Tx on Bottom Channel (1850.2MHz)

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Test Limit
MHz	H/V	cm	deg	dBµV/m	dBµV/m
4.025	V	100	100	55.4	82.6
5.550	H	112	033	60.2	82.6
7.400	H	107	330	55.4	82.6

EUT Tx on Middle Channel (1880.0MHz)

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Test Limit
MHz	H/V	cm	deg	dBµV/m	dBµV/m
4.025	H	120	176	55.8	83.8
5.640	V	104	149	60.9	83.8
7.520	H	100	300	55.4	83.8
15.039	H	106	214	63.1	83.8

EUT Tx on Top Channel (1909.8MHz)

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Test Limit
MHz	H/V	cm	deg	dBµV/m	dBµV/m
4.025	V	100	083	54.9	84.8
5.729	V	100	250	59.3	84.8
15.278	H	108	206	62.4	84.8

EIRP Results are only taken for frequencies that fall Outside the Restricted Band.

Product Service

4.6 RADIATED EMISSIONS - continued

4.6.6 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 GSM 1900 Mode (see Section 1.3.3 for details).

Configuration 2

EUT Tx on Bottom Channel (1850.2MHz)

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Test Limit
MHz	H/V	cm	deg	dBµV/m	dBµV/m
4.025	V	100	090	56.9	82.1
5.550	H	121	034	60.0	82.1
7.400	H	100	307	54.3	82.1
16.657	H	104	219	59.6	82.1

EUT Tx on Middle Channel (1880.0MHz)

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Test Limit
MHz	H/V	cm	deg	dBµV/m	dBµV/m
4.025	V	100	093	56.3	83.8
5.640	V	108	140	60.4	83.8
7.520	H	100	296	55.5	83.8
11.280	V	109	199	57.7	83.8
15.039	H	137	261	62.3	83.8

Product Service

4.6 RADIATED EMISSIONS - continued

4.6.6 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 GSM 1900 Mode (see Section 1.3.3 for details).

Configuration 2

EUT Tx on Top Channel (1909.8MHz)

Frequency	Antenna Polarisation	Height	Azimuth	Peak Field Strength	Test Limit
MHz	H/V	cm	deg	dBµV/m	dBµV/m
4.025	V	100	109	56.6	85.1
5.729	V	100	251	59.3	85.1
15.278	H	100	207	62.1	85.1

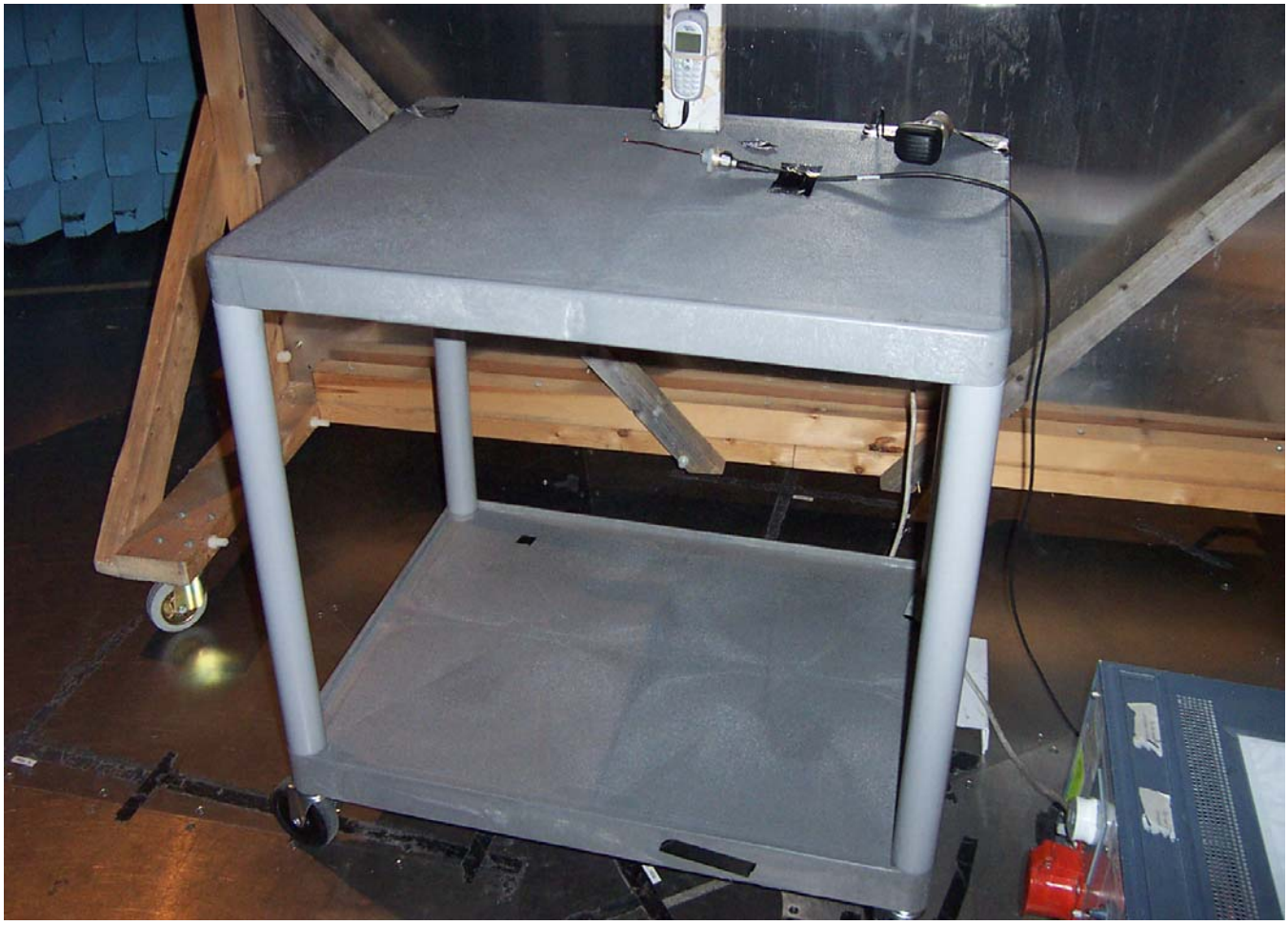
ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation

Product Service

4.6 RADIATED EMISSIONS - continued

4.6.7 Set Up Photograph



Radiated Emissions Set Up Photograph

4.7 CONDUCTED SPURIOUS EMISSIONS

4.7.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.238(a), 2.1051

4.7.2 Equipment Under Test

SND321

4.7.3 Date of Test

28th February 2005

4.7.4 Test Equipment Used (See Section 3.1 for details)

The major items of test equipment used for the above tests are identified as within the Test Equipment Used table shown in Section 3.1.

Items: 1, 2, 3, 4, 5, 6, 7, 8, 9, 32

4.7.5 Test Procedure

In accordance with Part 2.1051, the spurious emissions from the antenna terminal were measured. The transmitter 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 timeslot 3 active and minimum power with timeslot 3 active. The EUT was tested on Bottom, Middle and Top channels for both power levels. 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 high pass filter were used.

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

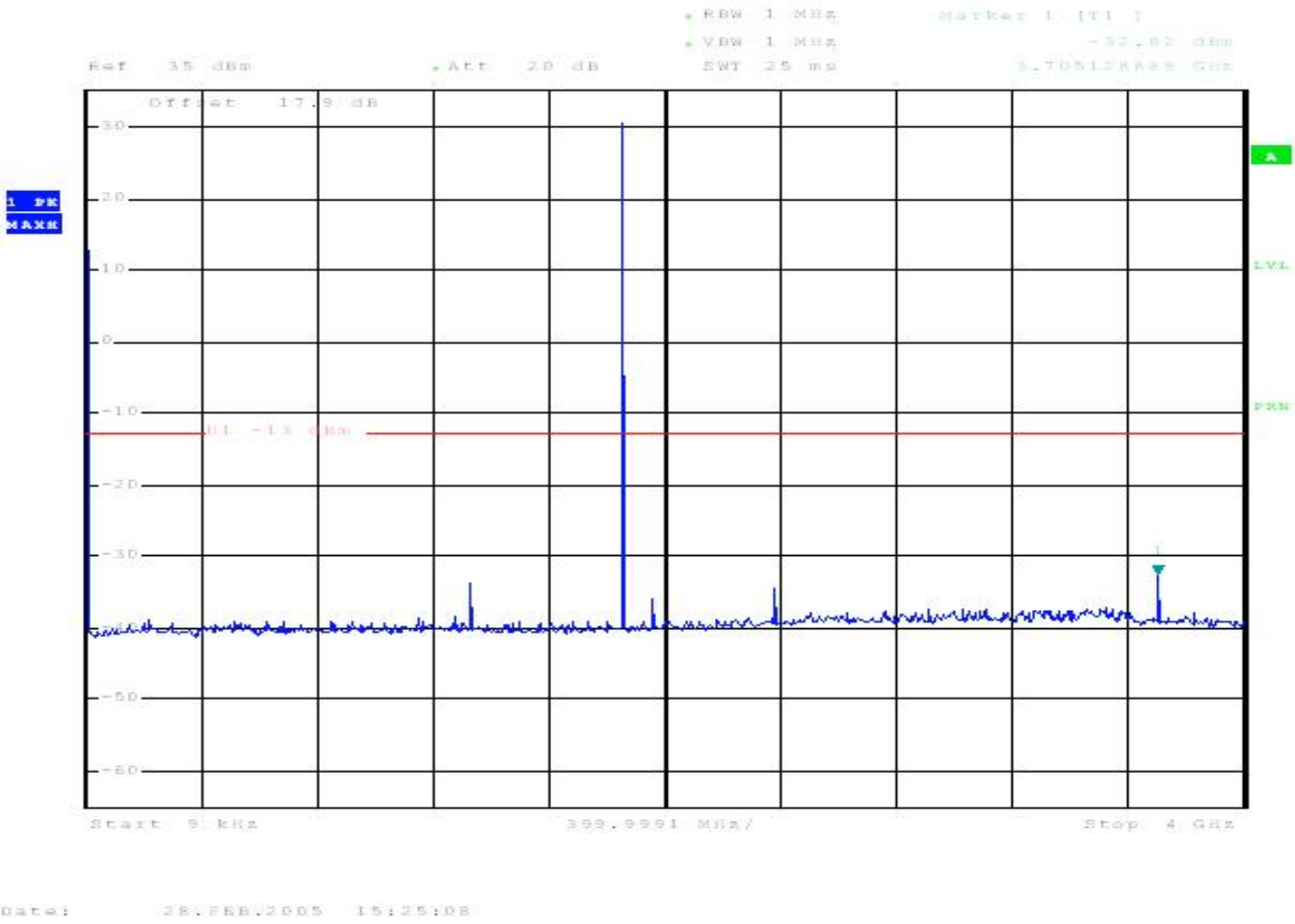
In addition, measurements were made up to the 10th harmonic of the fundamental.

4.7.6 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.

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

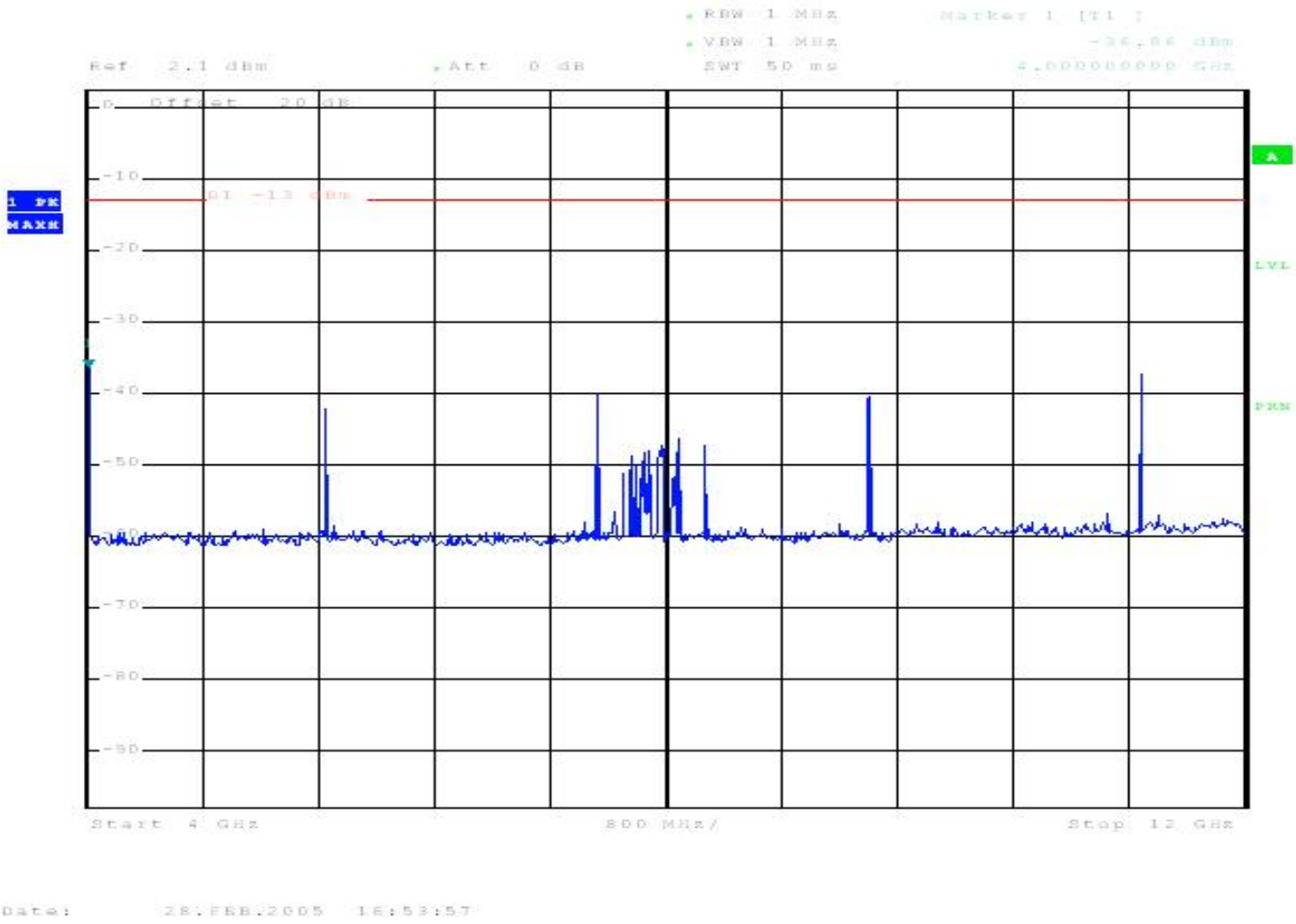
Spurious Emissions (9kHz – 4GHz)
Channel 512 (1850.2MHz) - Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS – Continued

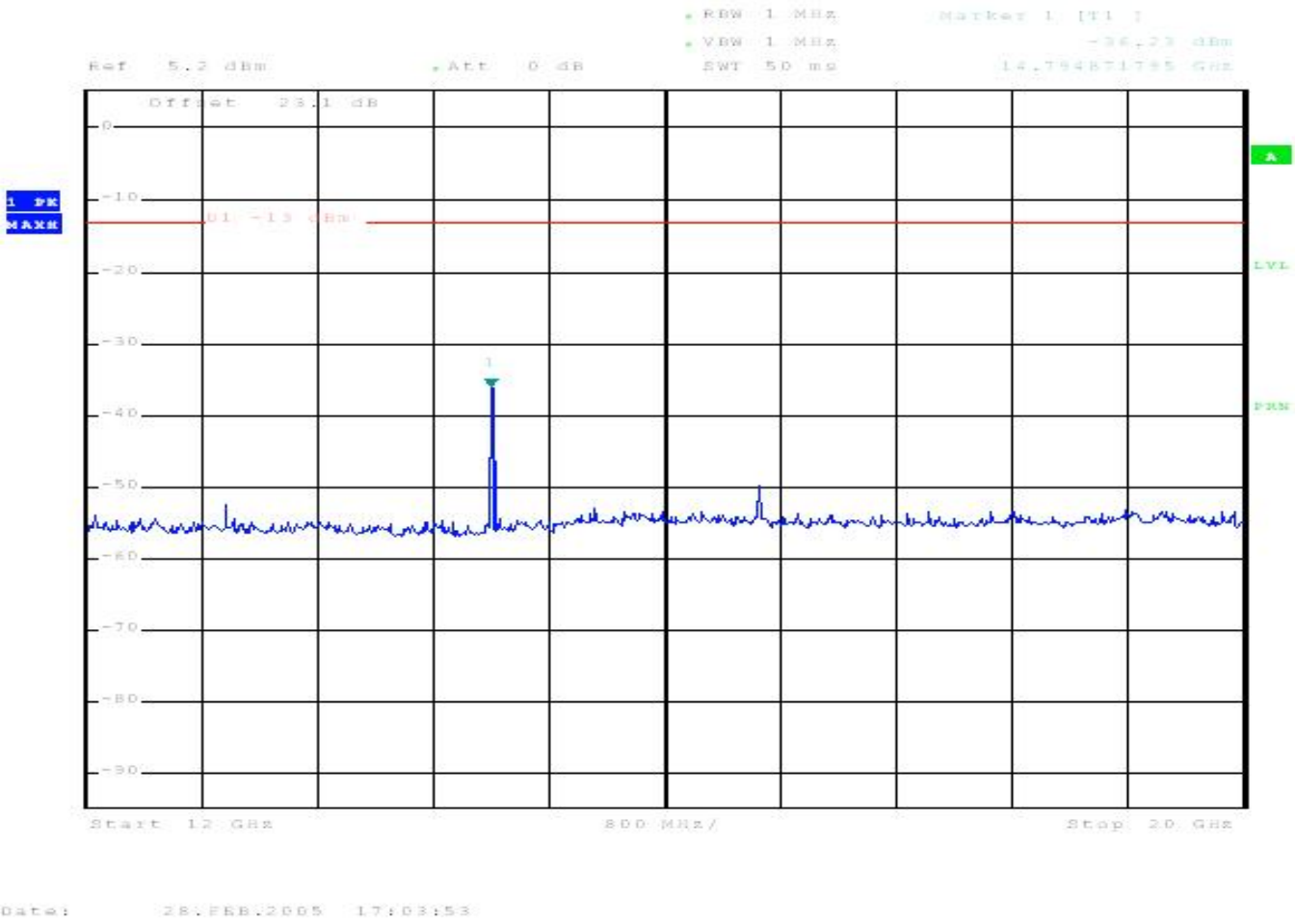
Spurious Emissions (4GHz – 12GHz)
Channel 512 (1850.2MHz) – Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

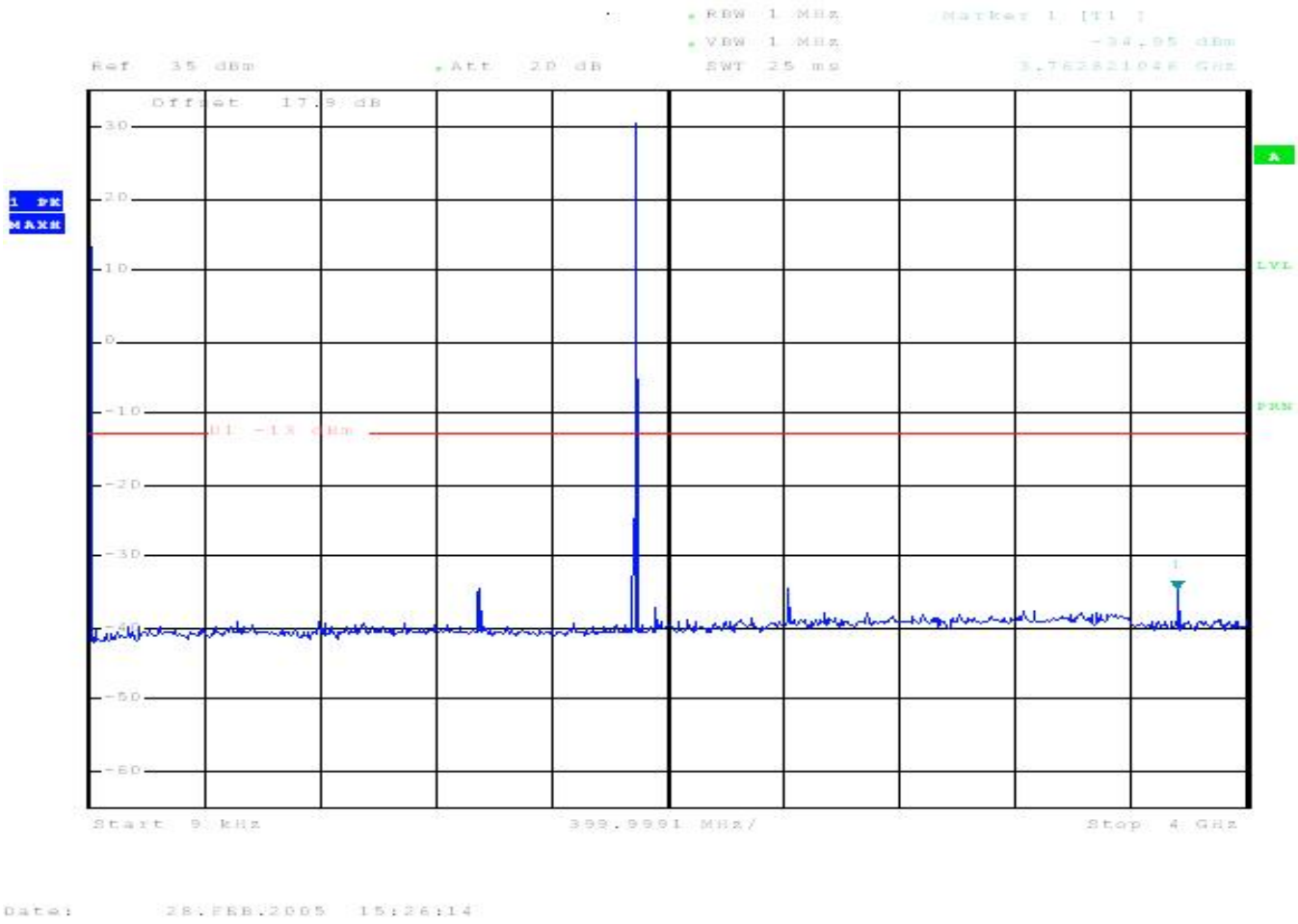
Spurious Emissions (12GHz – 20GHz)
Channel 512 (1850.2MHz) – Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

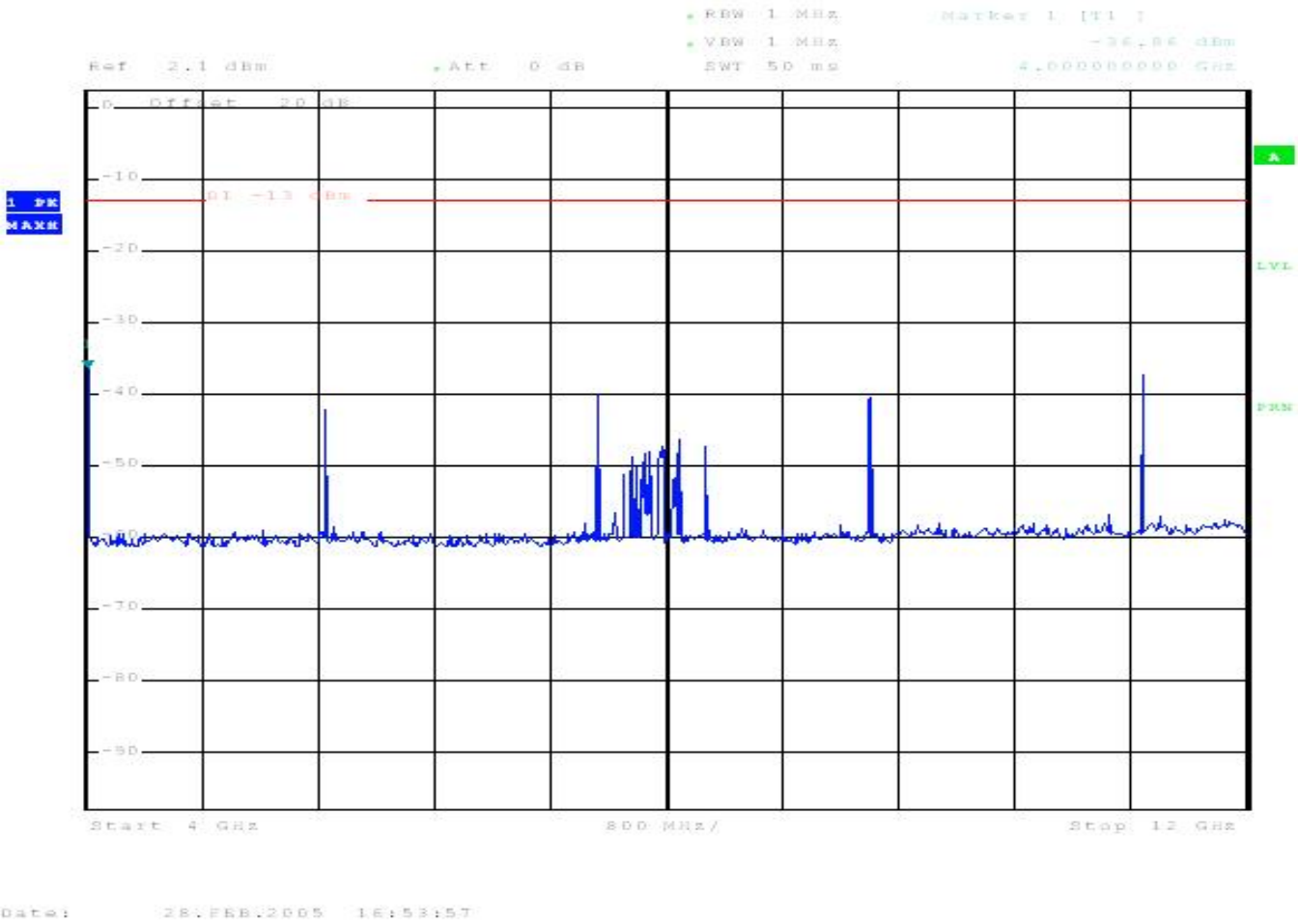
Spurious Emissions (9kHz – 4GHz)
Channel 661 (1880.0MHz) – Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

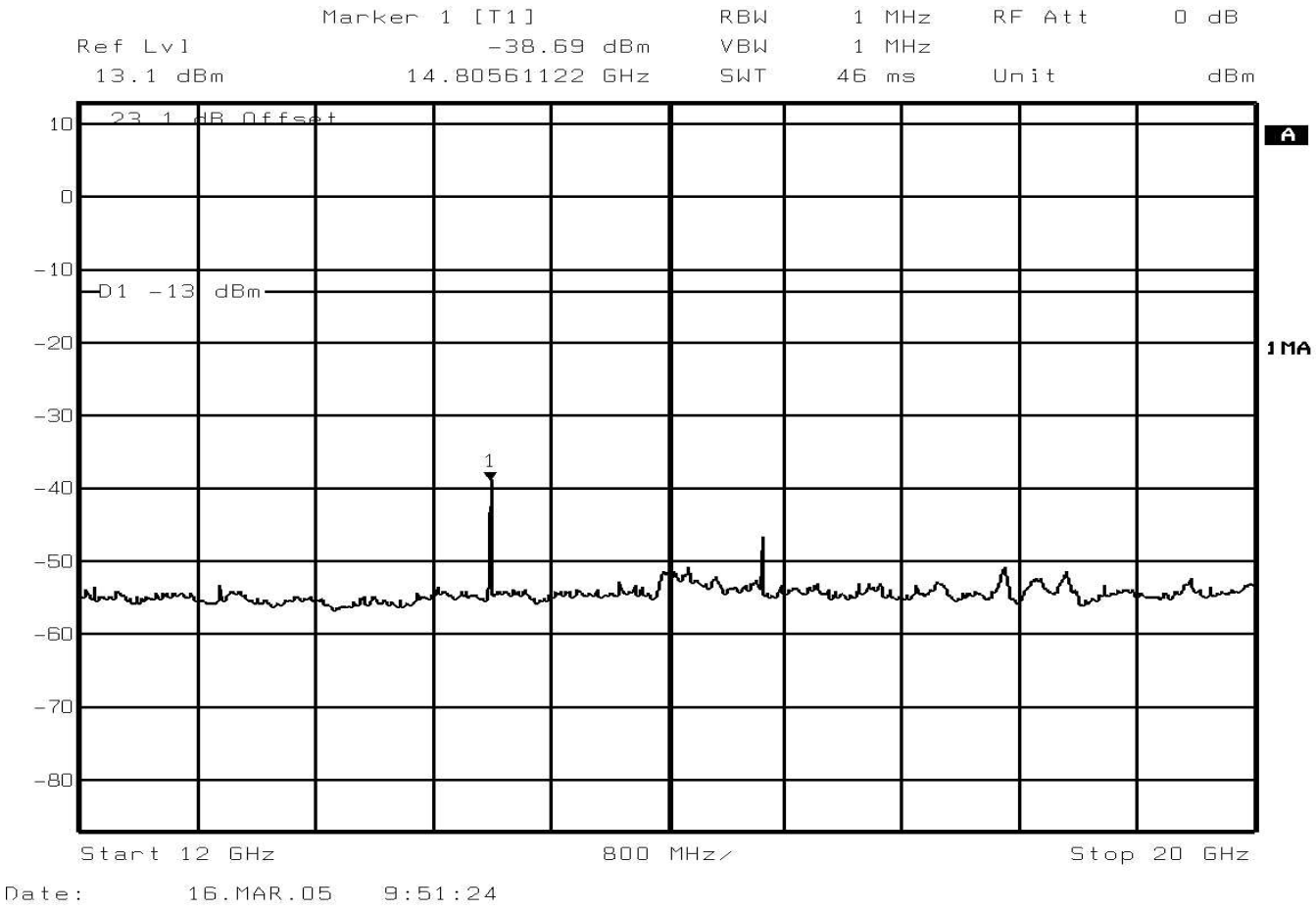
Spurious Emissions (4GHz - 12GHz)
Channel 661 (1880.0MHz) – Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

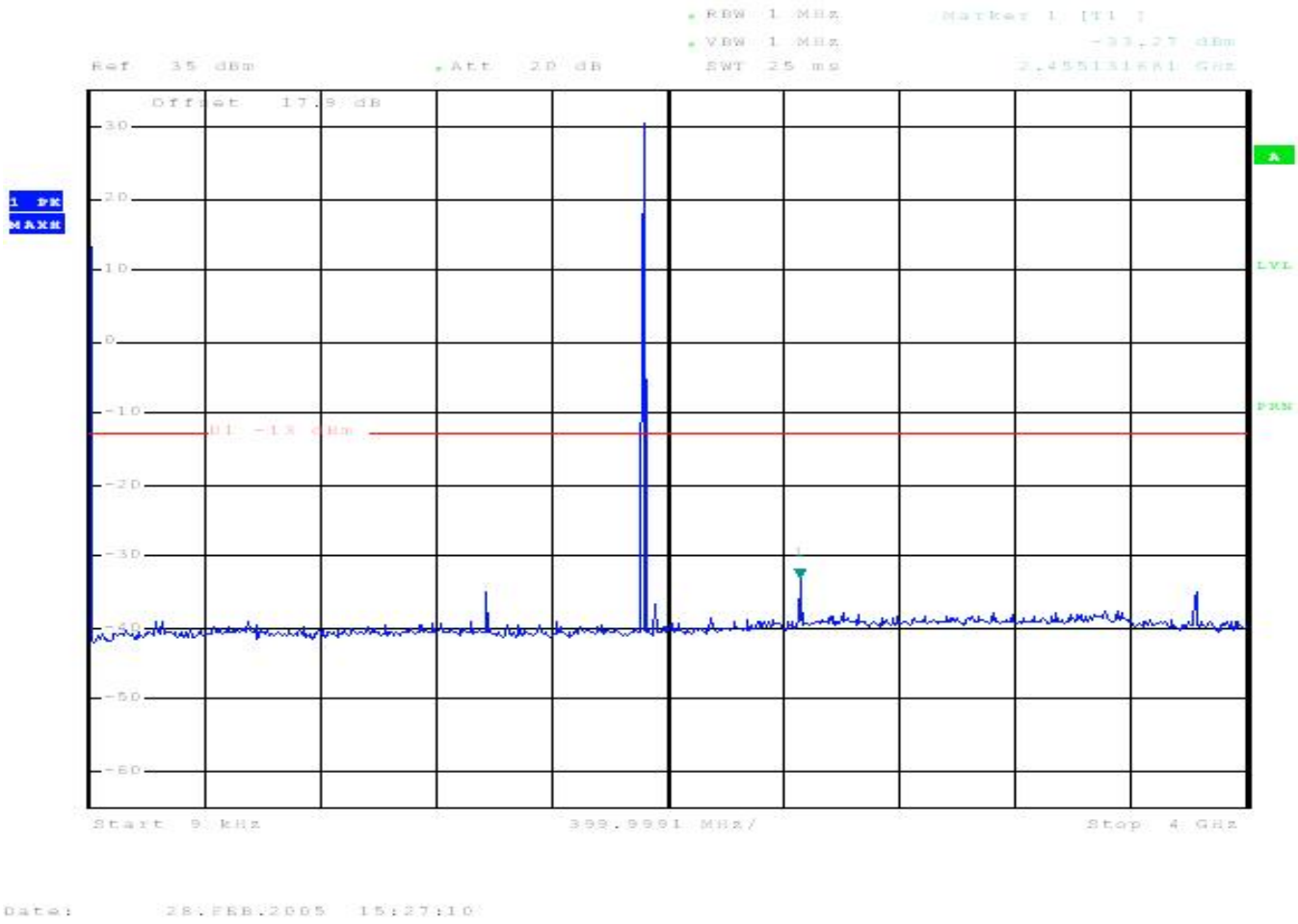
Spurious Emissions (12GHz – 20GHz)
Channel 661 (1880.0MHz) – Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

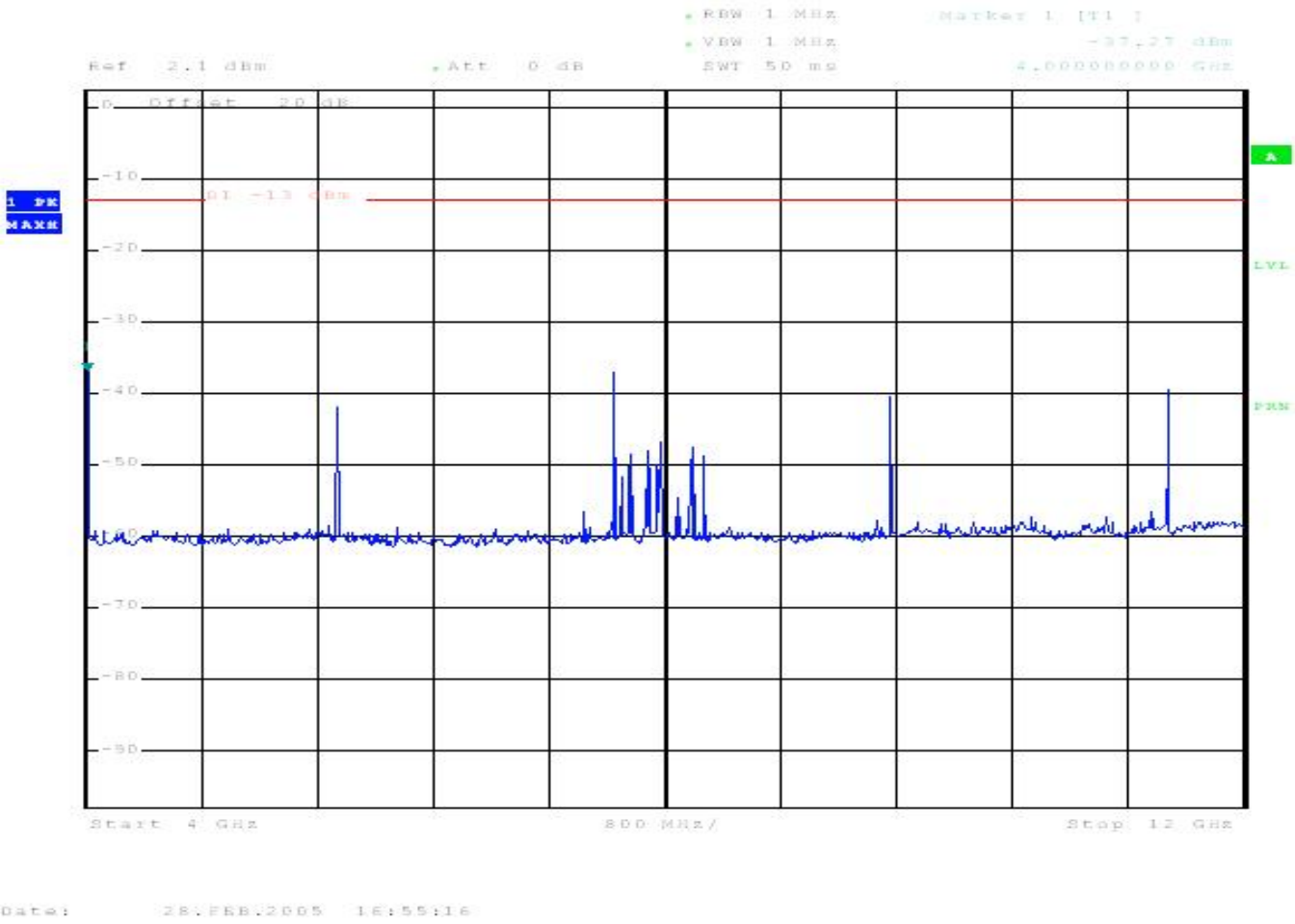
Spurious Emissions (9kHz – 4GHz)
Channel 810 (1909.8MHz) – Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

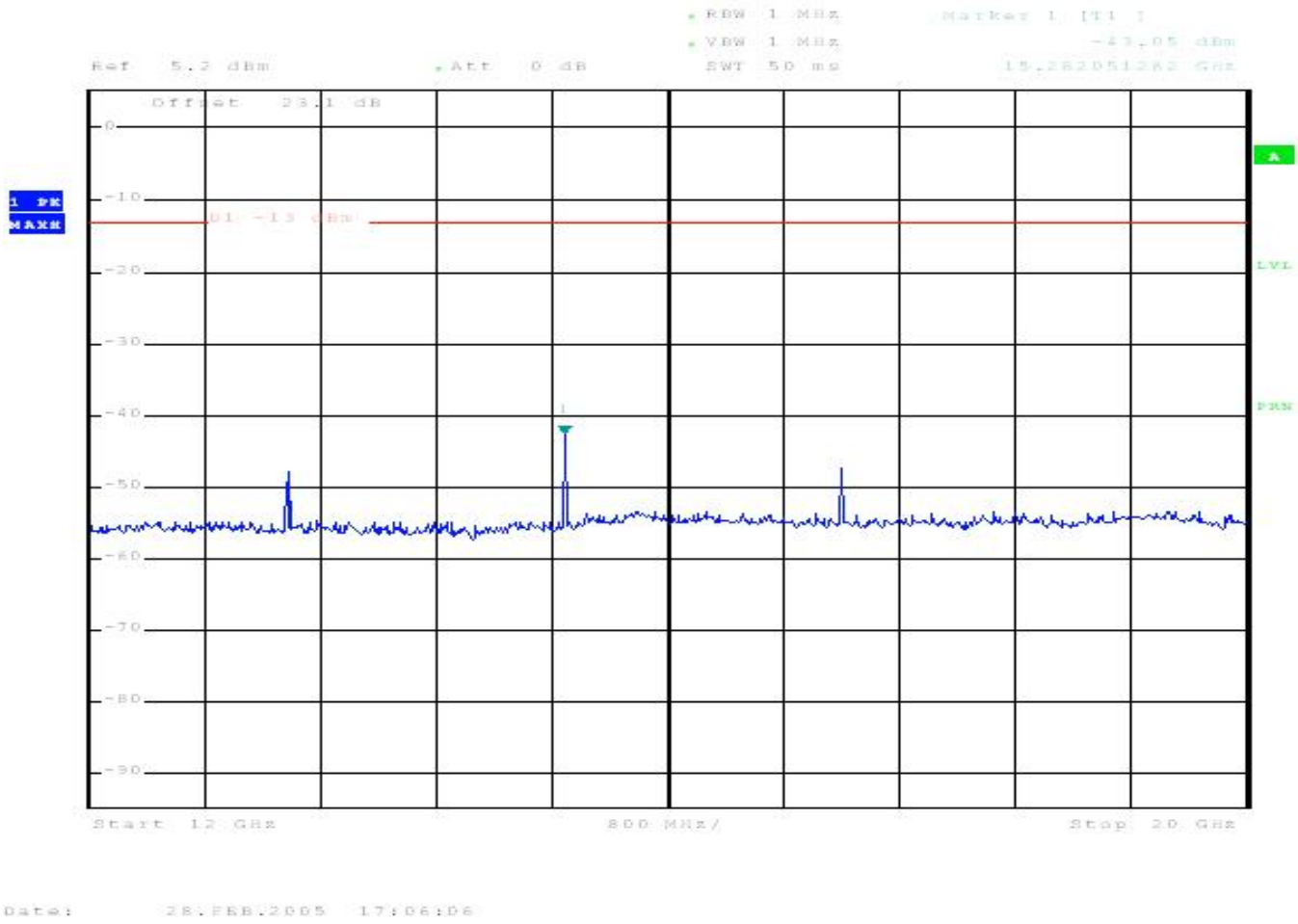
Spurious Emissions (4GHz – 12GHz)
Channel 810 (1909.8MHz) – Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

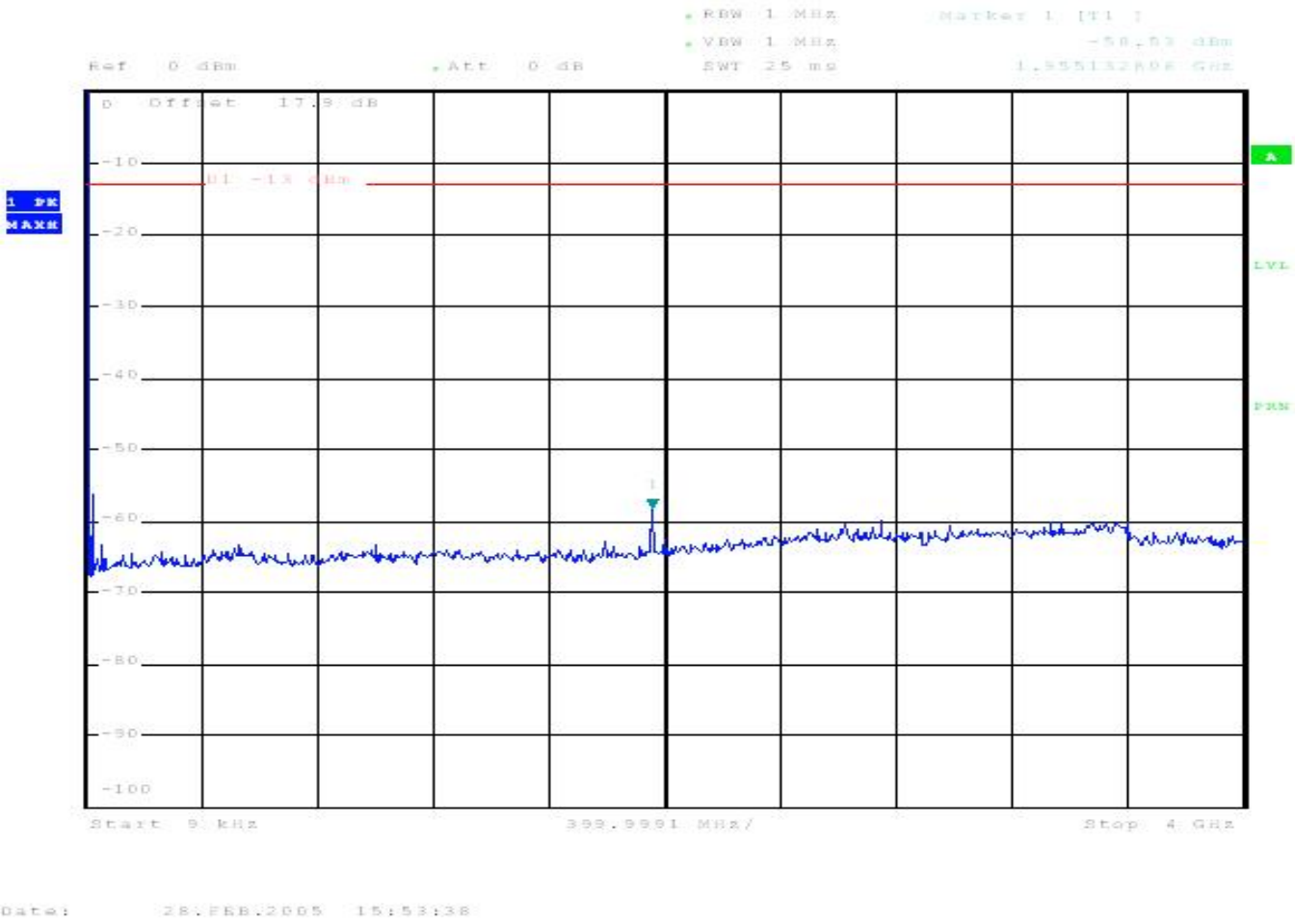
Spurious Emissions (12GHz – 20GHz)
Channel 810 (1909.8MHz) – Maximum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

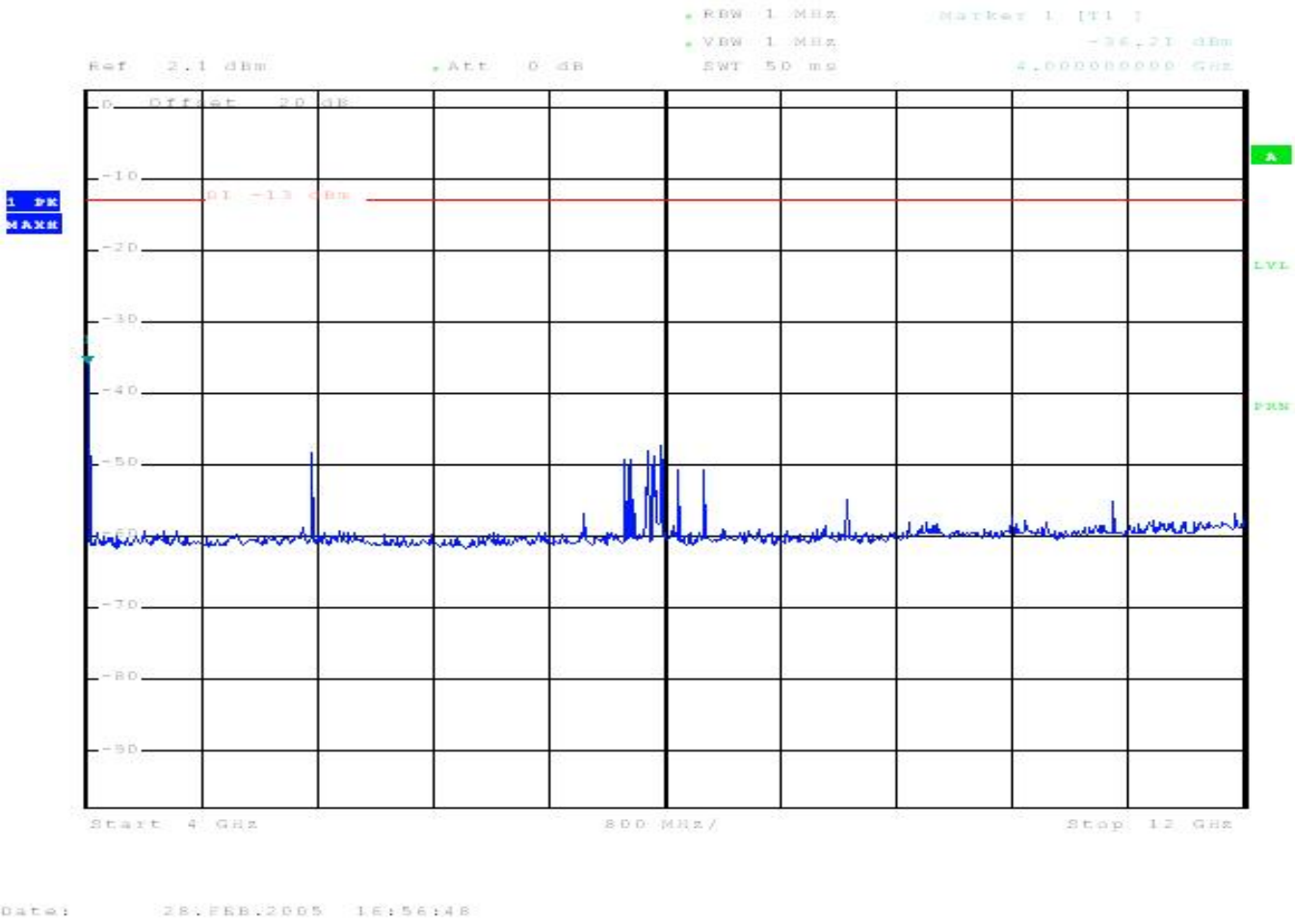
Spurious Emissions (9kHz – 4GHz)
Channel 512 (1850.2MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

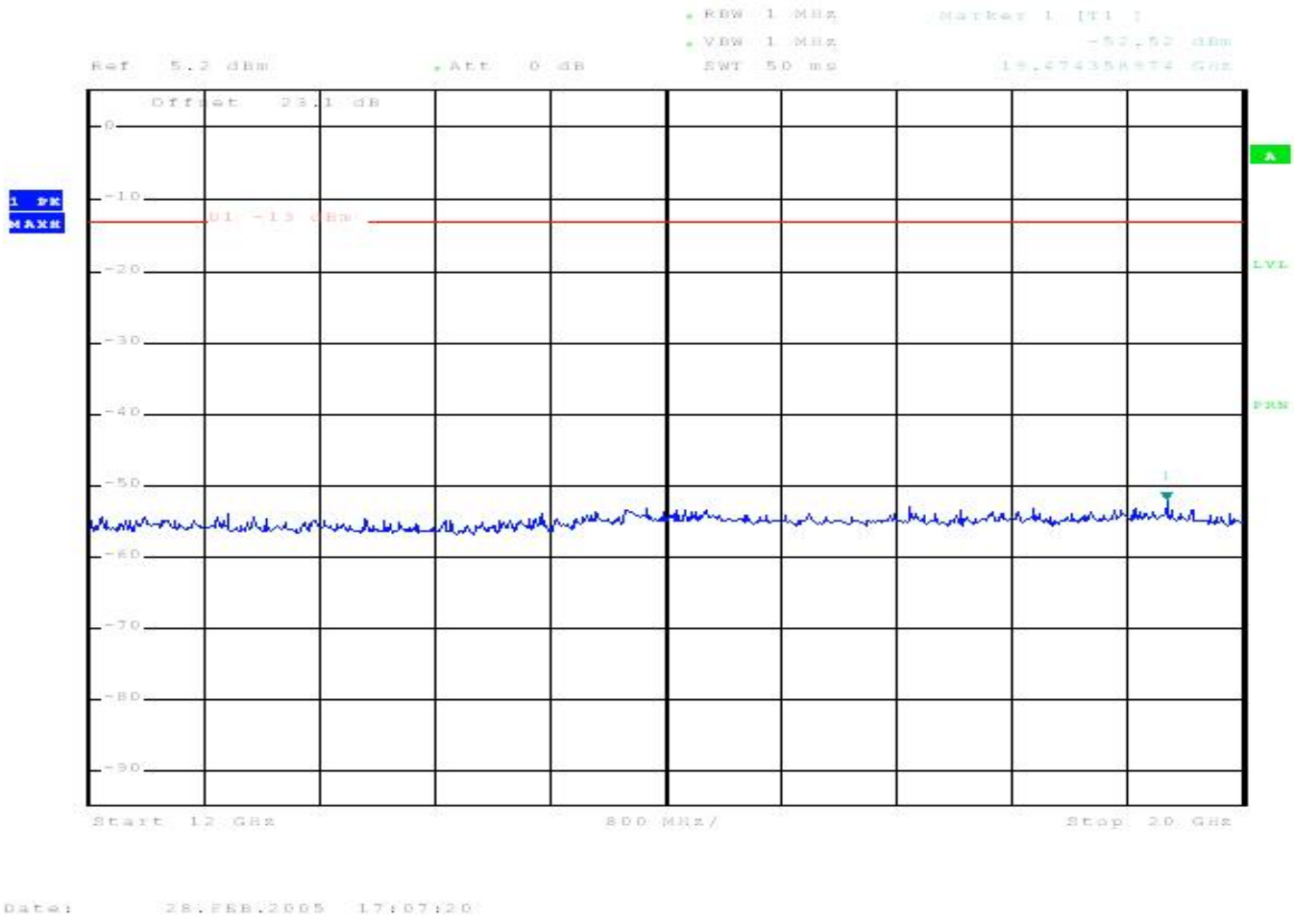
Spurious Emissions (4GHz – 12GHz)
Channel 512 (1850.2MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

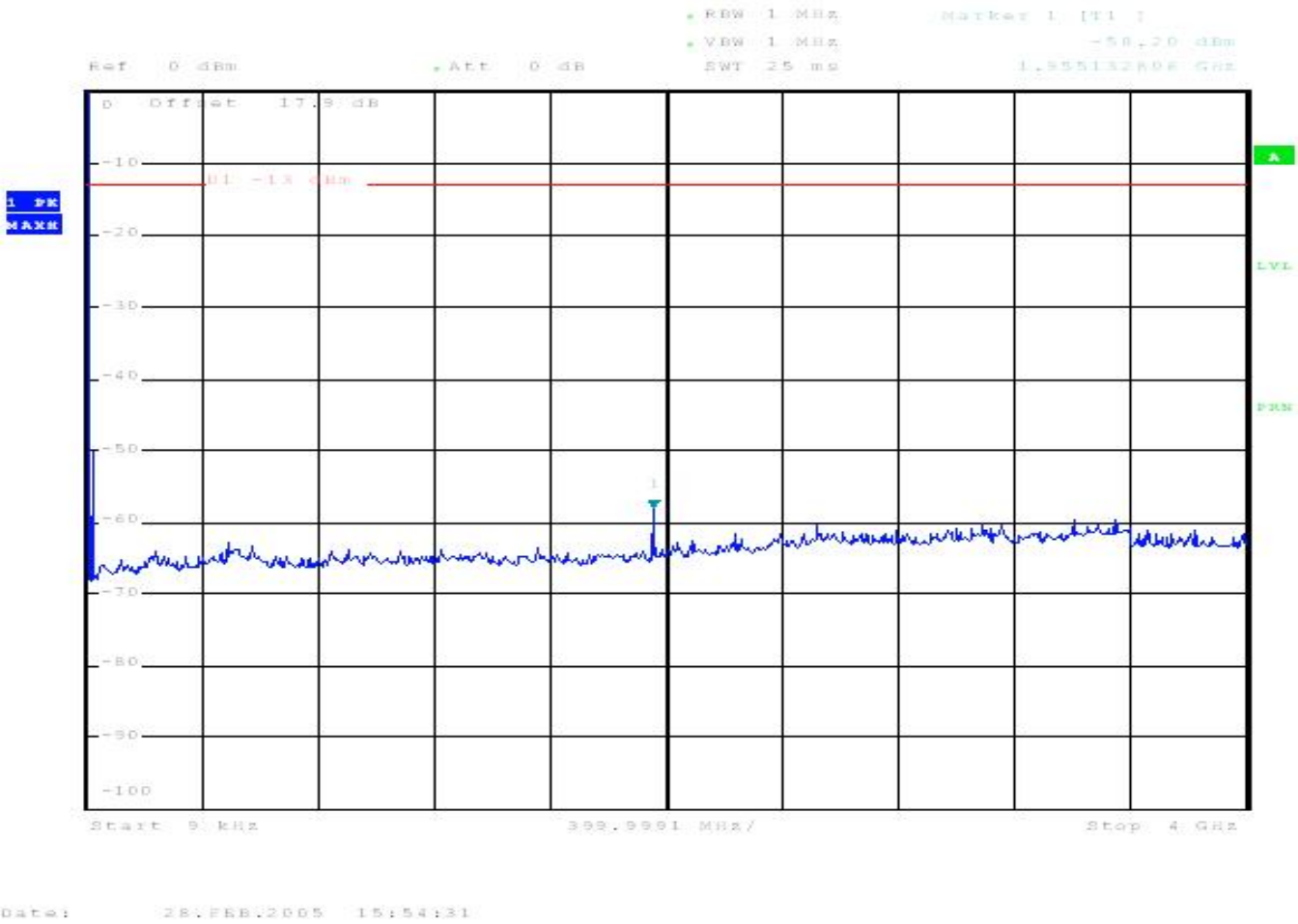
Spurious Emissions (12GHz-20GHz)
Channel 512 (1850.2MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

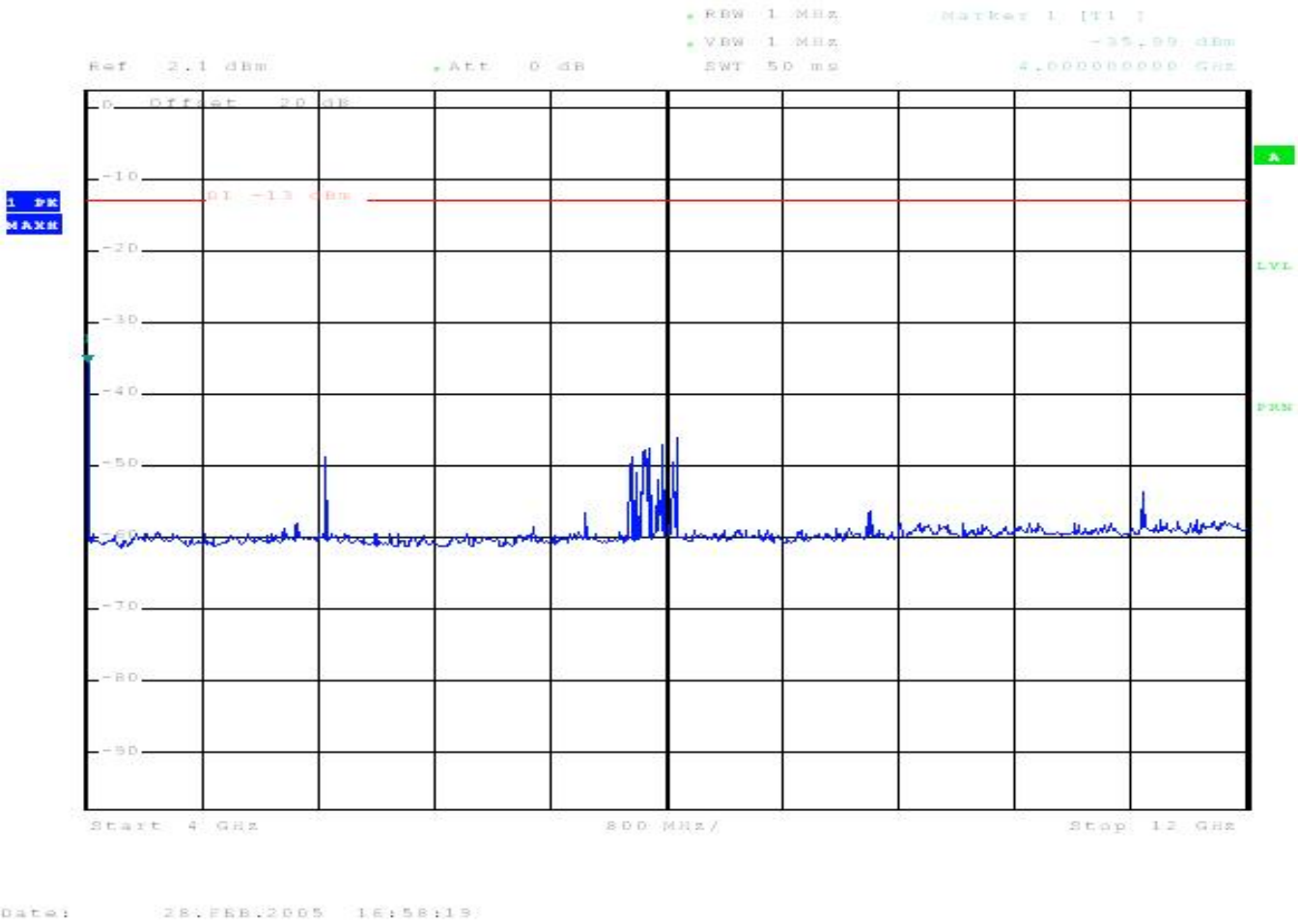
Spurious Emissions (9kHz – 4GHz)
Channel 661 (1880.0MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

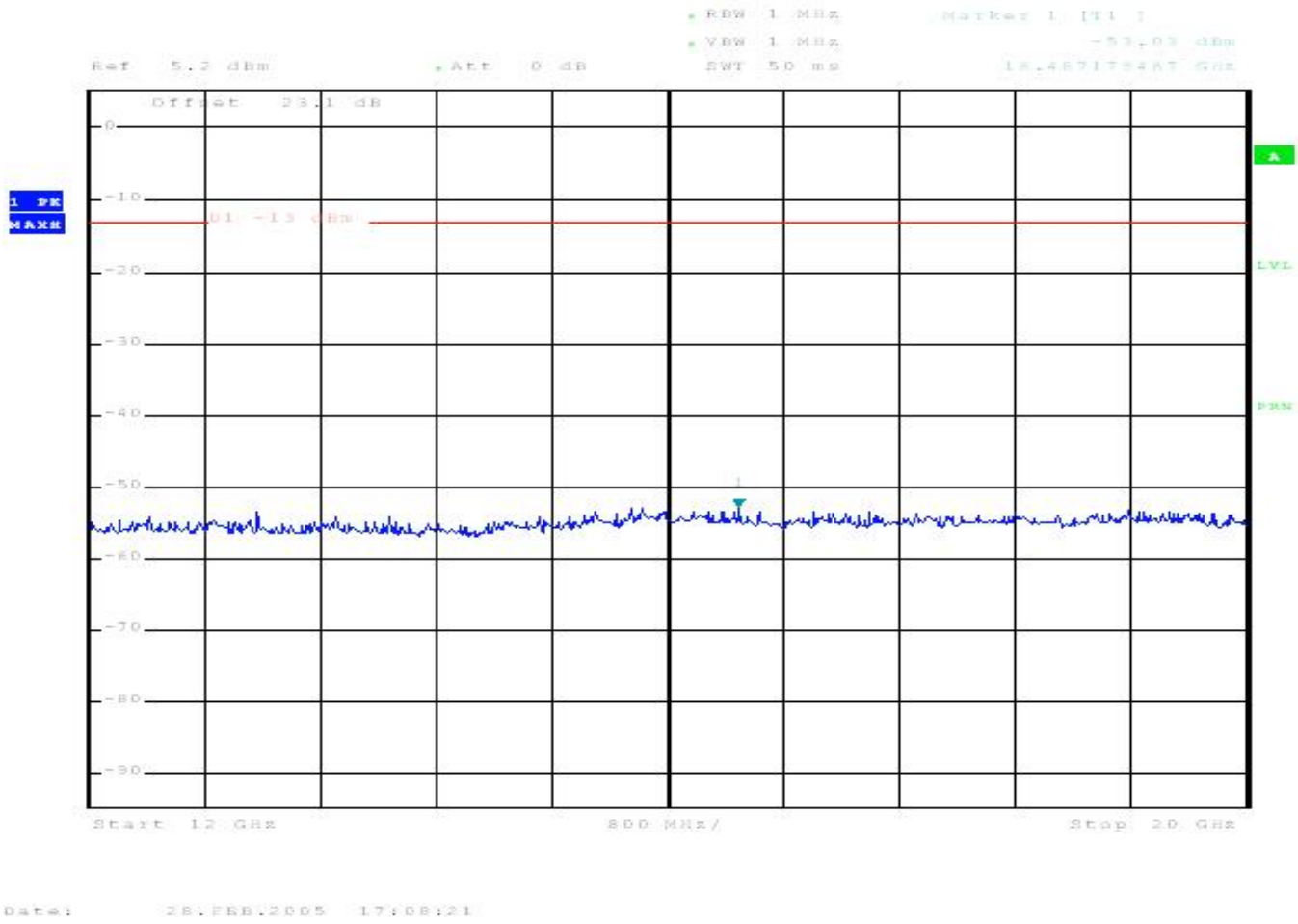
Spurious Emissions (4GHz – 12GHz)
Channel 661 (1880.0MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

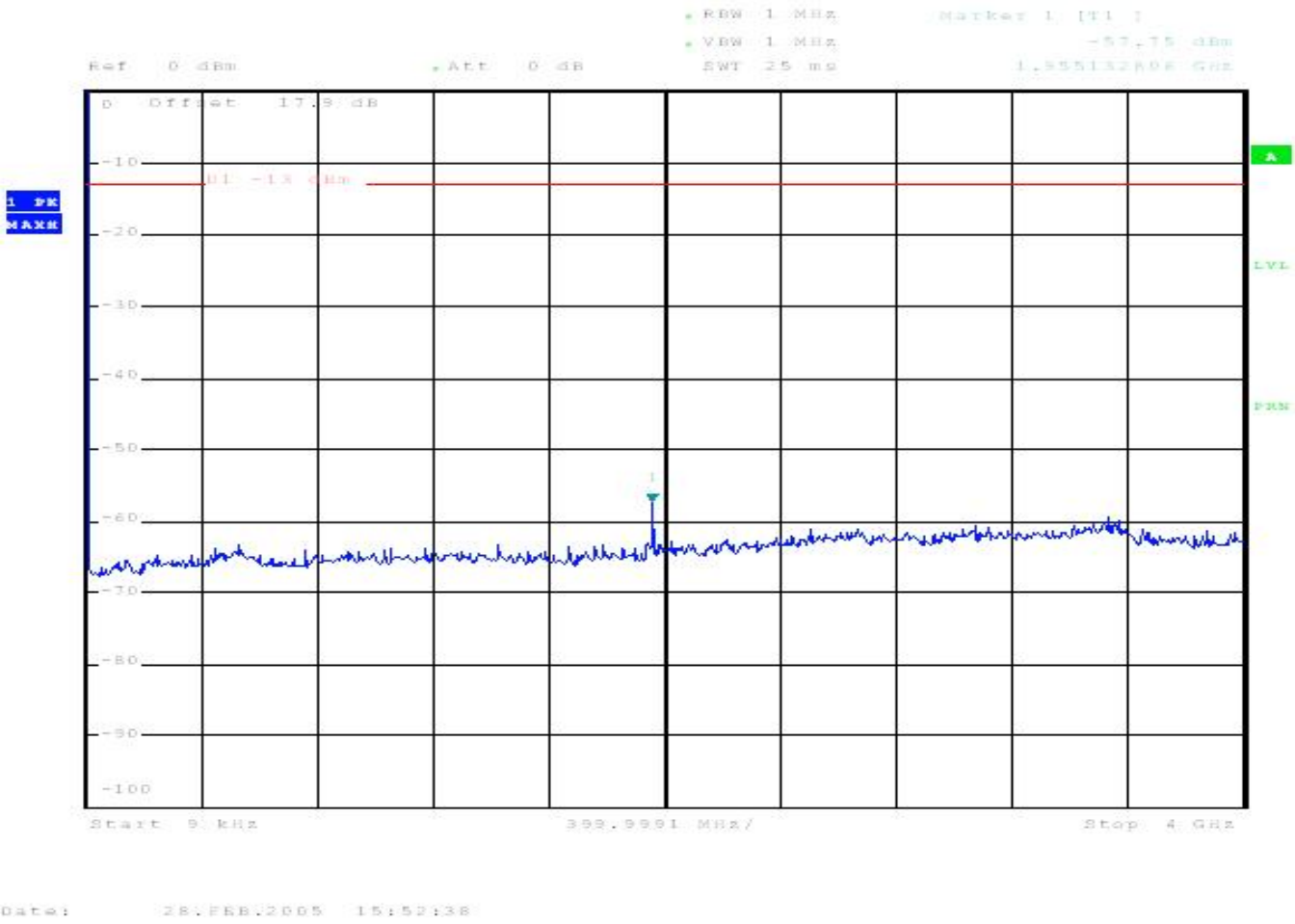
Spurious Emissions (12GHz – 20GHz)
Channel 661 (1880.0MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

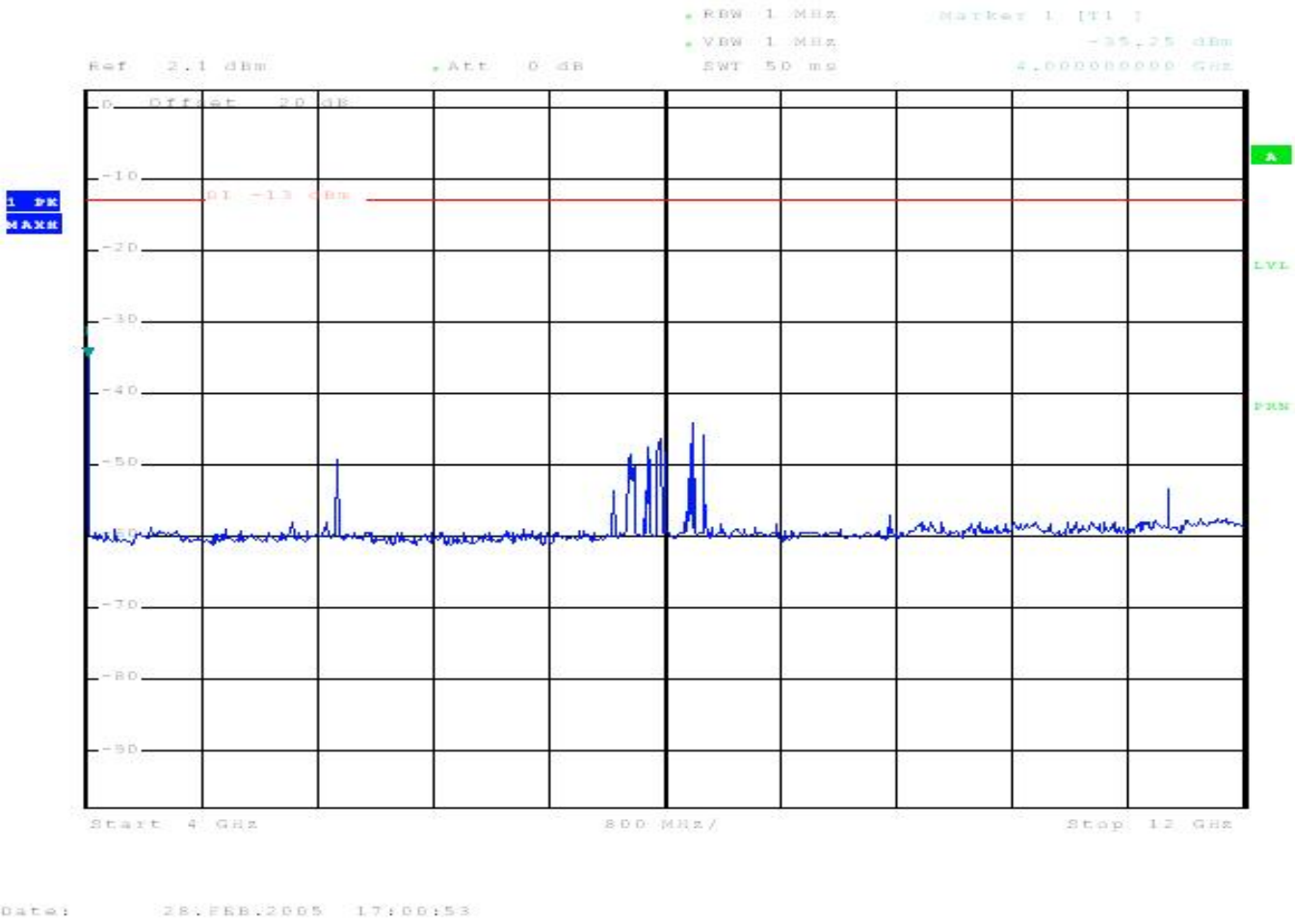
Spurious Emissions (9kHz – 4GHz)
Channel 810 (1909.8MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

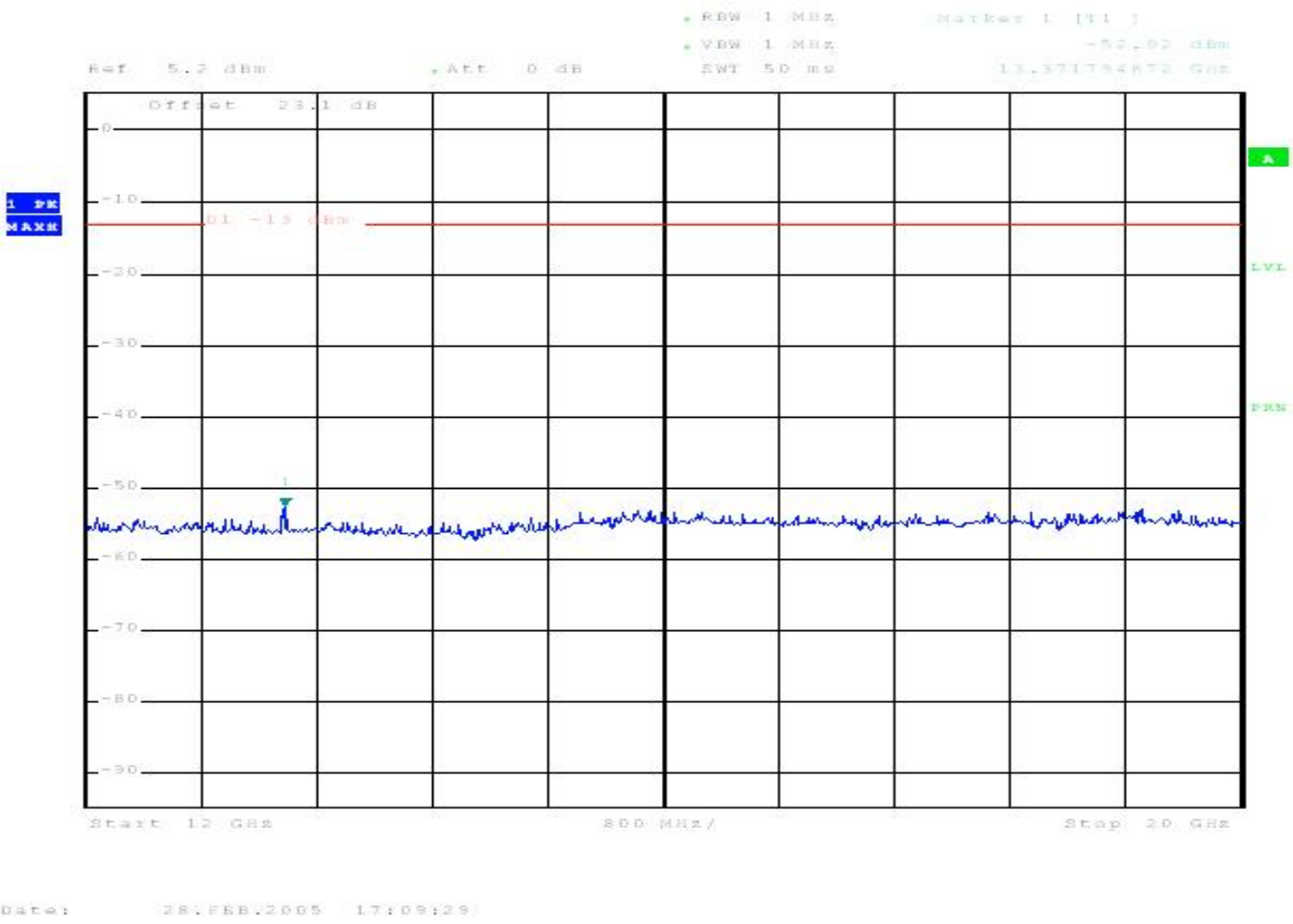
Spurious Emissions (4GHz – 12GHz)
Channel 810 (1909.8MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

Spurious Emissions (12GHz – 20GHz)
Channel 810 (1909.8MHz) – Minimum Power



GSM – Circuit Switched

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

Harmonic Emissions - GSM Channel 512 (1850.2MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.7004	-50.01	16.9	-33.11	-13
5.5506	-62.23	18.6	-43.63	-13
7.4008	-59.76	17.8	-41.96	-13
9.2510	-61.72	18.5	-43.22	-13
11.1012	-55.49	18.4	-37.09	-13
12.9514	-75.94	19.7	-56.24	-13
14.8016	-61.04	19.6	-41.44	-13
16.6518	-76.35*	20.0	-56.35*	-13
18.5020	-78.15*	20.1	-58.05*	-13

*Instrumentation Noise Floor

Harmonic Emissions - GSM Channel 661 (1880.0MHz)– Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.760	-51.11	17.1	-34.01	- 13
5.640	-61.81	18.7	-43.11	- 13
7.520	-58.17	18.2	-39.97	- 13
9.400	-61.22	18.4	-42.82	- 13
11.280	-57.69	18.0	-39.69	- 13
13.160	-74.96	19.2	-55.76	- 13
15.040	-61.26	18.8	-42.46	- 13
16.920	-68.37	20.3	-48.07	- 13
18.800	-78.14*	20.8	-57.34*	- 13

*Instrumentation Noise Floor

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

Harmonic Emissions - GSM Channel 810 (1909.8MHz) – Maximum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.8196	-51.12	17.2	-33.92	-13
5.7294	-61.30	18.8	-42.50	-13
7.6392	-56.08	18.1	-37.98	-13
9.5490	-61.60	18.6	-43.00	-13
11.4588	-61.53	19.1	-42.43	-13
13.3686	-71.45	18.9	-52.55	-13
15.2784	-66.03	18.3	-47.73	-13
17.1882	-69.10	19.6	-49.50	-13
19.0980	-75.76	21.1	-54.66	-13

Harmonic Emissions - GSM Channel 512 (1850.2MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.7004	-78.01	16.9	-61.11	-13
5.5506	-66.91	18.6	-48.31	-13
7.4008	-80.07*	17.8	-62.27	-13
9.2510	-73.96	18.5	-55.46	-13
11.1012	-74.44	18.4	-56.04	-13
12.9514	-75.65	19.7	-55.95	-13
14.8016	-78.18*	19.6	-58-58*	-13
16.6068	-76.47*	20.0	-56.47*	-13
18.4120	-77.92*	20.1	-57.82*	-13

*Instrumentation Noise Floor

Product Service

4.7 CONDUCTED SPURIOUS EMISSIONS - Continued

Harmonic Emissions - GSM Channel 661 (1880.0MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.760	-77.27	17.1	-60.17	- 13
5.640	-67.62	18.7	-48.92	- 13
7.520	-80.26*	18.2	-62.06	- 13
9.400	-75.66	18.4	-57.26	- 13
11.280	-73.00	18.0	-55.00	- 13
13.160	-75.97	19.2	-56.77	- 13
15.040	-78.40*	18.8	-59.60*	- 13
16.920	-77.89*	20.3	-57.59*	- 13
18.800	-79.05	20.8	-58.25*	- 13

*Instrumentation Noise Floor

Harmonic Emissions - GSM Channel 810 (1909.8MHz) – Minimum Power

Frequency (GHz)	Raw Result (dBm)	Path Loss (dB)	Corrected Result (dBm)	Limit (dBm)
3.8196	-76.22	17.2	-59.02	- 13
5.7294	-68.62	18.8	-49.82	- 13
7.6392	-70.55	18.1	-52.45	- 13
9.5490	-78.12	18.6	-59.52	- 13
11.4588	-74.91	19.1	-55.81	- 13
13.3686	-76.15	18.9	-57.25	- 13
15.2784	-78.09*	18.3	-59.79*	- 13
17.1882	-77.99*	19.6	-58.39*	- 13
19.0980	-77.01*	21.1	-55.91	- 13

* Instrumentation Noise Floor

4.8 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

4.8.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.235, 2.1055

4.8.2 Equipment Under Test

SND321

4.8.3 Date of Test

8th March 2005

4.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as within the Test Equipment Used table shown in Section 3.1.

Items: 2, 3, 4, 5, 6, 10, 11

4.8.5 Test Procedure

The EUT was set to transmit on maximum power and measurements were made on Timeslot 3. A Digital Communications Analyser, (CMU200), was used to measure the Frequency Error. The maximum result of measurements made over 200 bursts was recorded.

4.8.6 Test Results

GSM – Circuit Switched

Temperature Interval(ºC)	Test Frequency (GHz)	Deviation (Hz)	Limit (kHz)
- 30	1.88	-25	± 1.88
- 20	1.88	-19	± 1.88
- 10	1.88	+16	± 1.88
0	1.88	-19	± 1.88
+ 10	1.88	-14	± 1.88
+ 20	1.88	-11	± 1.88
+ 30	1.88	-31	± 1.88
+ 40	1.88	-28	± 1.88
+ 50	1.88	-30	± 1.88

Limit	±0.0001% or 1ppm

Remarks

EUT complies with CFR 47 Part 24.135(a). The EUT does not exceed ±1.88kHz at the measured frequency at any temperature interval across the measured range.

4.9 FREQUENCY STABILITY UNDER VOLTAGE VARIATIONS

4.9.1 Specification Reference

FCC CFR 47: Part 24 Subpart E, Section 24.135(a), 2.1055

4.9.2 Equipment Under Test

SND321

4.9.3 Date of Test

8th March 2005

4.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as within the Test Equipment Used table shown in Section 3.1.

Items: 1, 2, 3, 4, 5, 6

4.9.5 Test Procedure

GSM

The EUT was set to transmit on maximum power and measurements were made on Timeslot 3. A Digital Communications Analyser, (CMU200), was used to measure the Frequency Error. The maximum result of measurements made over 200 bursts was recorded.

4.9.6 Test Results

GSM

DC Voltage (V)	Test Frequency (GHz)	Deviation (Hz)	Deviation Limit (kHz)
3.7	1.88	-11	± 1.88

Limit	±0.0001% or 1ppm

Remarks

EUT complies with CFR 47 Part 24.135(a). The EUT does not exceed ±1.88kHz at the measured frequency either at nominal or voltage variation.

SECTION 5

TEST EQUIPMENT USED

5.1 TEST EQUIPMENT USED

Item	Instrument	Manufacturer	Type No	Serial No	EMC / INV No	Cal. Due
1	Spectrum Analyser	Rohde & Schwarz	FSEM	827156/006	INV4034	13/01/2006
2	Hydrometer	Rotronic	I-1000	-	INV3232	07/04/2005
3	Attenuator	Huber & Suhner	6810.17.B	5929	INV4622	15/12/2005
4	Combiner	Weinschel	1506A	KA845	INV4494	05/08/2005
5	Power Supply	Farnell	LT30-2	919	EMC28	TU
6	Fluke	DVM	75 MkIII	69492214	INV3866	04/01/2006
7	GSM Test Set	Rohde & Schwarz	CMU200	833810/015	INV4858	30/06/2005
8	Attenuator	Pasternac	PE7004-10	-	EMC1970	11/11/2005
9	High Pass Filter	RLC Electronics	F-100-4000-5-R	-	INV4970	TU
10	Climatic Chamber	Hereaus Votch	VMT-04/30	26330	INV3248	TU
11	Hydrometer	Rotronic	A1	-	INV3887	14/05/2005
12	Thermometer	Fluke	51 K/J	73860011	INV4222	17/03/2005
13	Turntable Controller	H-D Gmbh	HD 050	050/396	EMC2528	-
14	Antenna Mast	EMCO	1051-2	9101-1570	EMC2182	-
15	Antenna Mast Controller	EMCO	2090	-	-	-
16	Screened Room 5	Siemens	EAC54300	-	EMC2533	-
17	EMI Test Receiver	Rohde & Schwarz	ESIB26	100212	EMC2988	08/04/2005
18	Double Ridge Guide Antenna	EMCO	3115	96964848	EMC2297	07/07/2005
19	DRG Antenna	EMCO	3115	97015079	EMC2397	07/07/2005
20	Attenuator 10dB	Marconi	6534/3	2954	EMC1494	
21	Signal Generator	Marconi	2031	119530069	EMC1979	11/11/2005
22	Digital Barometer	ORE	BAA913HG	-	Room 5	T/U
23	Low Noise Amplifier	Miteq Corp	AMF-3d-001080-18-13P	-	EMC2457	-
24	Solid State Amplifier	Avantek	AWT-18036	F133658452	EMC1081	26/06/2005
25	Spectrum Analyser	Hewlett Packard	8542E	3617A00165-00154	EMC2286	08/01/2006
26	3GHz High Pass Filter	RLC Electronics	F-100-3000-5-R	-	INV4969	10/03/2005
27	Test Receiver	Rohde & Schwarz	ESH3	872742/002	EMC1020	24/09/2005
28	Spectrum Analyser	Rohde & Schwarz	EZM	892242-023	EMC1416	-
29	Three Phase LISN	Rohde & Schwarz	ESH2-Z5	879675-022	EMC1915	87/04/2005
30	Bilog Antenna	Schaffner	CBL6143	5101	EMC2965	12/09/2005
31	Transient Limiter	Hewlett Packard	11947A	3107A01649	EMC2271	19/08/2005
32	Spectrum Analyser	Rohde & Schwarz	FSU 26			

5.2 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	±210.894kHz	±0.5dB
For Maximum Output Power	Not Applicable	±0.5dB
For Radiated Emissions, Quasi-Peak Measurements taken in Zero Span using the Hewlett Packard EMI Receiver and Bilog Antenna	$\pm 2 \times 10^{-7}$ x Centre Frequency	5.15dB calculated in accordance with CISPR 16-4
For Spurious Conducted Emissions	Not Applicable	±3.0dB
IN THE FREQUENCY RANGE 1GHz TO 20GHz		
TEST	**FREQUENCY**	**AMPLITUDE**
For Spurious Radiated Emissions measurements	$\pm 2 \times 10^{-7}$ x Centre Frequency	±3.4dB
For Peak Power Spectral Density	Not Applicable	±1.8dB
For Effective Radiated Power (ERP) measurements	Not Applicable	±1.45dBm

SECTION 6

PHOTOGRAPHS

6.1 TEST SAMPLE PHOTOGRAPHS

Front View of an SND321

Rear View of an SND321 – Battery Removed.

Product Service

SECTION 7

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

7.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

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

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

APPENDIX A

TITCHFIELD FCC SITE COMPLIANCE LETTER

Product Service

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

October 18, 2002

Registration Number: 90987

TUV Product Service Ltd
Segensworth Road
Titchfield
Fareham, Hampshire, PO15 5RH
United Kingdom
Attention: Kevan Adsetts

Re: Measurement facility located at Titchfield
Anechoic chamber (3 meters) and 3 & 10 meter OATS
Date of Listing: October 18, 2002

Gentlemen:

Your request for registration of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC rules. The information has, therefore, been placed on file and the name of your organization added to the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

Thomas W. Phillips

Thomas W Phillips
Electronics Engineer