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Certification Test Report

CFR 47 FCC Part 2 and Part 24, Subparts C and E And CFR 47, Part 27, Subpart C

Model: Optical Remote

FCC ID NO.: BCR-TFAM1719

Project Code: W7072
Report Code: W7072-1

Revision: 1

Prepared for:	Andrew Corporation 108 Rand Park Drive Garner, North Carolina 27529
Author:	Tom Tidwell, Manager of Wireless Services
Issued:	31 May, 2007

Report Summary

NTS Plano

Accreditation Numbers: FCC: 101741
IC: 46405-4319 File # IC-4319A-1

Applicant: Andrew Corporation
108 Rand Park Drive
Garner, North Carolina 27529

Customer Representative: Michael Williamson

EUT Description:

EUT Description	Manufacturer	Model	Revision	Serial Number
The EUT is a remote fiber, in-building repeater system designed to repeat various types of rf signals in the North American PCS 1900 band and the AWS band.	Andrew Wireless Systems Gmbh	ION-B TFAM1719	0	064803467

Test Summary

Appendix	Test/Requirement Description	Deviations from:			Pass / Fail	Applicable Rule Parts
		Base Standard	Test Basis	NTS Procedure		
A	RF Power Output	No	No	No	PASS	CFR 47, Part 2, Para. 2.1046 CFR 47, Part 24, Para. 24.232 CFR 47, Part 27, Para. 27.50
B	Modulation Characteristics	No	No	No	NOT TESTED[1]	CFR 47, Part 2, Para. 2.1047
C	Occupied Bandwidth	No	No	No	PASS	CFR 47, Part 2, Para. 2.1049 CFR 47, Part 24, Para. 24.238 CFR 47, Part 27, Para. 27.53
D	Spurious Emissions at Antenna Terminals	No	No	No	PASS	CFR 47, Part 2, Para. 2.1051 CFR 47, Part 24, Para. 24.238 CFR 47, Part 27, Para. 27.53
E	Field Strength of Spurious Radiation	No	No	No	PASS	CFR 47, Part 2, Para. 2.1053 CFR 47, Part 24, Para. 24.238 CFR 47, Part 27, Para. 27.53
F	Frequency Stability	No	No	No	PASS	CFR 47, Part 2, Para. 2.1055 CFR 47, Part 24, Para. 24.235 CFR 47, Part 27, Para. 27.54

[1]This device processes a modulated rf carrier but does not create the waveform. Thus there are no modulation circuits to test. A description of the modulated waveforms is given on page 16 to satisfy this requirement.

Test Result: The product presented for testing complied with test requirements as shown above.

This is to certify that the preceding report is true and correct to the best of my knowledge.

Robert Stevens,
Quality Assurance Manager

Tom Tidwell,
Wireless Test Engineer

Table of Contents

Register of revisions

Revision	Reason for Revision	Release Date
0	Original	29 March, 2007
1	Changed “Channel” to “Frequency (MHz) in Table A.8	
	Changed GXW emission designator to G7W throughout report.	31 May, 2007

INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Plano to demonstrate compliance of the ION-B to FCC Part 24 Subparts C and E and Part 27, Subpart C in accordance with the certification requirements of CFR 47, Part 2.

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	ION-B	ION-B TFAM1719	0	064803467
RF Exposure Classification	Fixed. The antenna is mounted using a wall mounting kit provided by the manufacturer. The device functions as an indoor distributed antenna system and consists of an Optical Master Unit(TFLF) and Optical Remote Unit(TFAM).			
Channels/Frequency Range	1930 – 1990 MHz 2110 – 2155 MHz Channelization varies depending on the type of signal that is processed. Channel configurations were set according to normal channel conventions as described in the TIA standard for each technology.			
Power	**Downlink:** **Output Power Reference Table** Output power per carrier @ each antenna port, dBm Number of Carriers: 1 / 2 / 4 / 8 CW1700*: 22 / 19 / 16 / 13 CDMA1700: 19 / 16 / 13 / 10 W-CDMA1700: 16 / 12 / 8 / 5 GSM1900: 21 / 18 / 15 / 12 Analog1900: 21 / 18 / 15 / 12 TDMA1900: 20 / 17 / 14 / 11 EDGE1900: 19 / 16 / 13 / 10 CDMA1900: 18 / 15 / 12 / 9 W-CDMA1900: 15 / 11 / 7 / 4 **Uplink:** RX only. The signal is passed to the Base Station via fiber optic cable.			
Emission Designator:	**IS-95 CDMA: F9W** **W-CDMA: F9W** **G7W: GSM** **G7W: GSM-EDGE** **DXW: TDMA**			

TX antenna details	Maximum antenna gain 12 dBi
Functional Description	The ION-B is used to enhance coverage of a cellular network within a building. The Optical Master Unit(OMU) is connected directly to a base station transceiver or to a repeater via coaxial cable. The OMU converts the incoming rf signal from the base station (downlink) to an optical signal and sends via fiber to the Optical Remote Unit(ORU). The ORU then converts the optical signal back to rf, amplifies the rf, and sends to nearby mobiles via an antenna. In the reverse path, the ORU receives an rf signal from a mobile, converts the rf to an optical signal, and sends the optical signal to the OMU via fiber. The OMU then converts the optical signal back to rf and sends it to the base station or repeater via coaxial cable. The system uses analogue modulated optical transport scheme for sending the modulated rf signal via fiber. The rf signal is not de-modulated in this process but simply rides on the laser signal. Therefore, the rf signal is identical at the input of the rf to optical converter and the output of the optical to rf converter.

2.1.1 EUT POWER

Voltage	220 Vac, 60 Hz
Number of Feeds	Single phase (L1 and Neutral)

2.2 EUT CABLES

Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			
1		EUT	AC power main	Unshielded	Power cord	3.0
1	Gore	IQ Signal Generator	EUT	Shielded (coaxial)	Coaxial cable	1.5
1	Gore	EUT	50 ohm load	Shielded (coaxial)	Coaxial cable	2

2.3 MODE OF OPERATION DURING TESTS

The device was tested in the following operating mode:

- Downlink, maximum rf output power

While operating in this mode, the device was tested with variations in the following parameters:

- RF channel configurations
  - Low channel – The lowest frequency on which the device will operate with a particular rf signal type is fed to the OMU input.
  - Mid channel – A frequency in the center of the band is fed to the OMU input.

  - High channel – The highest frequency on which the device will operate with a particular rf signal type is fed to the OMU input.
- Gain and rf input level configurations
  - Highest gain setting with maximum rf input level before compression (+8dBm)

The rf power output of the device can only be adjusted by increasing or reducing the rf input level. The rf gain is not adjustable.

Note: Each test was done with a series of modulated carriers as described on page 6 of this report. The modulation mode was chosen to represent a worst-case signal for each technology type. In each case the rf input level was set to +8 dBm.

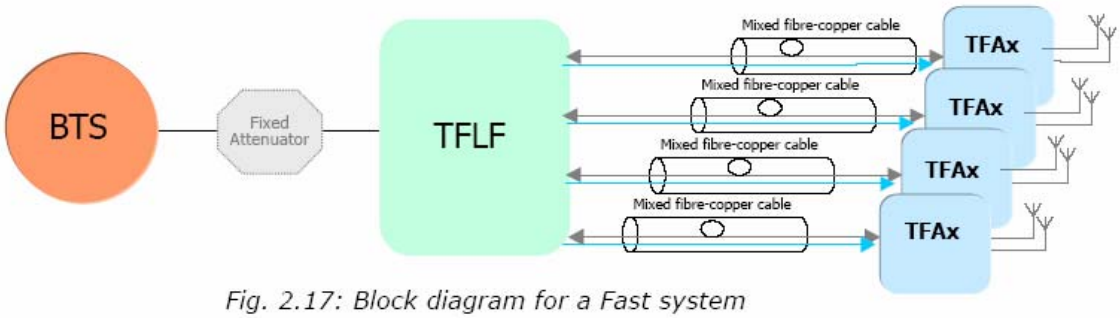


Fig. 2.17: Block diagram for a Fast system

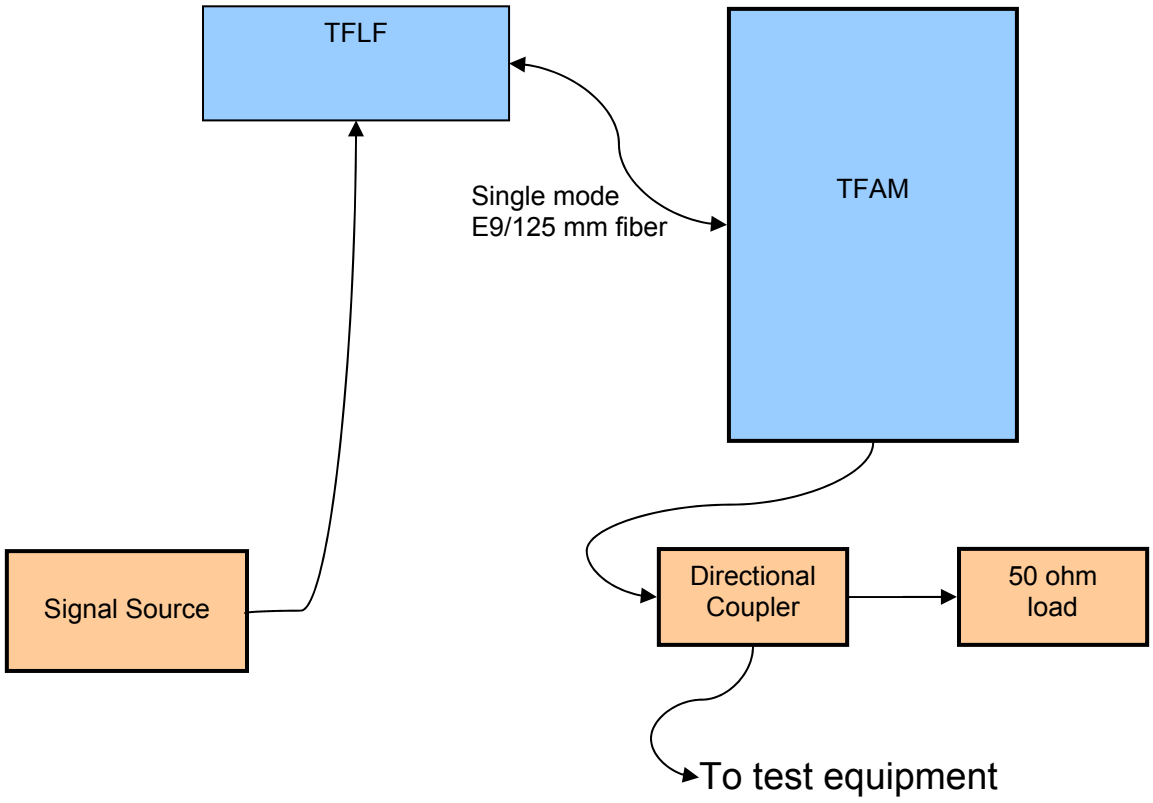
3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

The radio was activated using customer-supplied test software.

3.2 TEST BED/PERIPHERAL CABLES

.



APPENDICES

APPENDIX A: 2.1046 RF POWER OUTPUT

A.1. Base Standard & Test Basis

Base Standard	FCC PART 2.1046
Test Basis	TIA 603-C, 2004
Test Method	TIA 603-C, 2004

A.2. Specifications

24.232 Power and antenna height limits.

(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph 24.232(b).
(b) Base stations that are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census, are limited to 3280 watts peak equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT.
(c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

Applicable RF Power Limit from Above: 1640 watts EIRP

27.50 Power and antenna height limits.

(d) The following power and antenna height requirements apply to stations transmitting in the 1710–1755 MHz and 2110–2155 MHz bands:

(1) The power of each fixed or base station transmitting in the 2110–2155 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to a peak equivalent isotropically radiated power (EIRP) of 3280 watts. The power of each fixed or base station transmitting in the 2110–2155 MHz band from any other location is limited to a peak EIRP of 1640 watts. A licensee operating a base or fixed station utilizing a power of more than 1640 watts EIRP must coordinate such operations in advance with all Government and non-Government satellite entities in the 2025–2110 MHz band. Operations above 1640 watts EIRP must also be coordinated in advance with the following licensees within 120 kilometers (75 miles) of the base or fixed station: all Broadband Radio Service (BRS) licensees authorized under part 27 in the 2155–2160 MHz band and all AWS licensees in the 2110–2155 MHz band.
(2) Fixed, mobile, and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to a peak EIRP of 1 watt. Fixed stations operating in this band are limited to a maximum antenna height of 10 meters above ground, and mobile and portable stations must employ a means for limiting power to the minimum necessary for successful communications.

A.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

A.4. Test Procedure

TIA 603-C, 2004

A.5. Test Results

The EUT is in compliance with the limits as specified above. The maximum rf output power at the antenna terminals is dBm (watts (downlink). This is dB the rated rf power output.

A.6. Operating Mode During Test

The transmitter was tested while in a continuous transmit mode. The EUT was tuned to a low, middle, and high channel in both the downlink (base to mobile) and uplink (mobile to base) directions. RF power output was measured with an rf input level at the point just before the 3 dB compression point of the amplifier. This is the point of maximum rf output power.

A.7. Sample Calculation

Rf power(watts) = $10^{(\text{rf power(dBm)}/10)}$ x 1000

A.8. Test Data

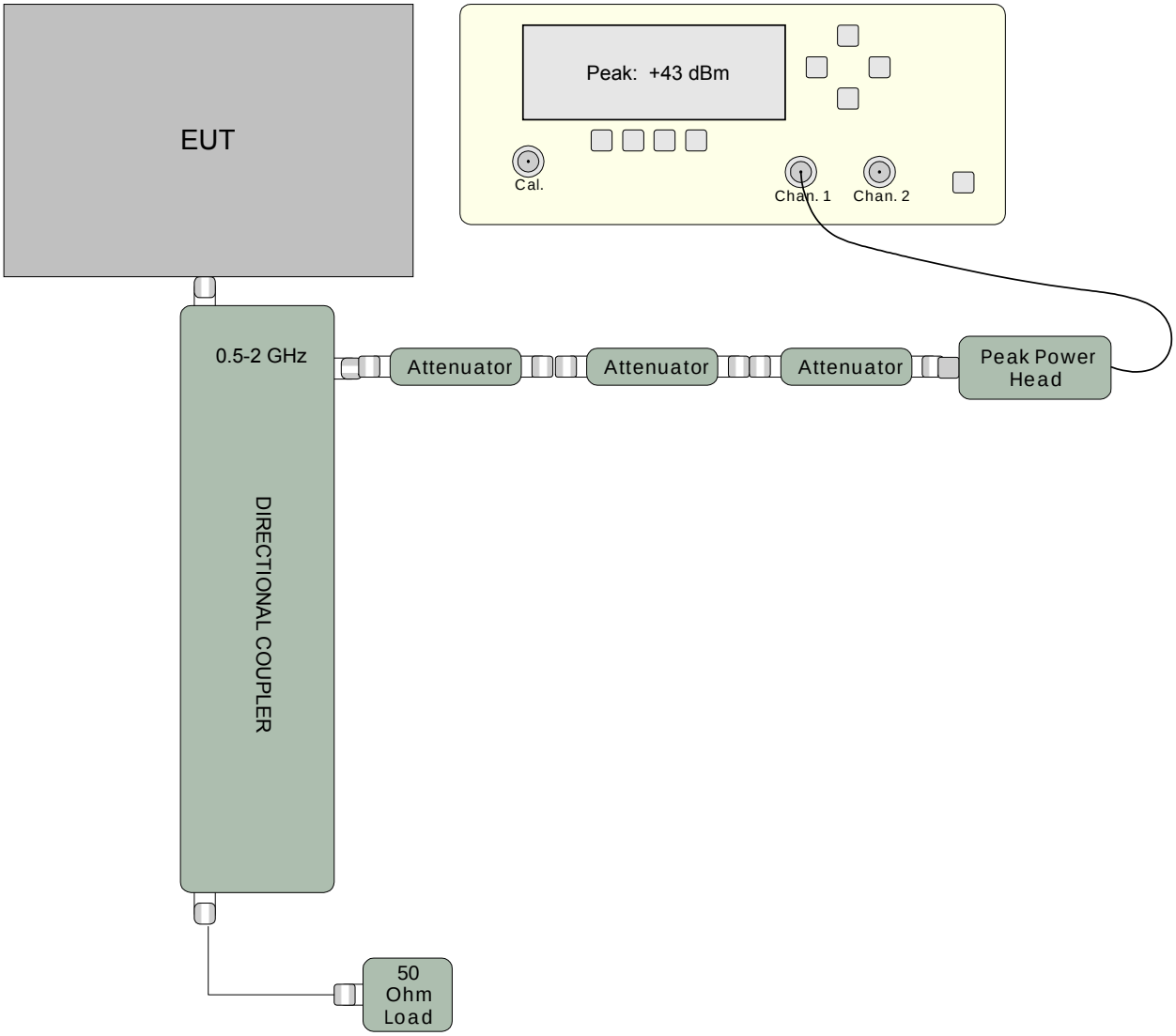
Frequency (MHz)	Signal Path	Modulation Mode	RF Power Output at Antenna Terminals (dBm)
2110.05	DL	CW1700	22.1
2132.50	DL	CW1700	22.0
2154.95	DL	CW1700	22.0
1930.05	DL	CW1900	21.0
1960.0	DL	CW1900	21.0
1989.95	DL	CW1900	21.0
1930.05	DL	DXW (TDMA1900)	20.0
1960.00	DL	DXW (TDMA1900)	20.0
1989.95	DL	DXW (TDMA1900)	20.0
1930.25	DL	G7W (EDGE1900)	19.0
1960.00	DL	G7W (EDGE1900)	19.1
1989.75	DL	G7W (EDGE1900)	19.1
1930.25	DL	G7W (GSM1900)	21.0
1960.00	DL	G7W (GSM1900)	21.0
1989.75	DL	G7W (GSM1900)	21.0
2111.25	DL	F9W (CDMA1700)	19.0
2132.50	DL	F9W (CDMA1700)	19.0
2153.75	DL	F9W (CDMA1700)	19.0
1931.25	DL	F9W (CDMA1900)	21.0
1960.00	DL	F9W (CDMA1900)	21.0
1988.75	DL	F9W (CDMA1900)	21.0
2115.00	DL	F9W (W-CDMA1700)	22.0
2132.00	DL	F9W (W-CDMA1700)	22.0
2150.00	DL	F9W (W-CDMA1700)	22.0
1933.10	DL	F9W (W-CDMA1900)	21.0
1960.00	DL	F9W (W-CDMA1900)	21.0
1986.90	DL	F9W (W-CDMA1900)	21.0

Note: RF power output was measured using a peak rf power meter designed to quantify the true peak power using a high number of samples (10 Ms).

*DL = Downlink (BTS to Mobile) path.

Test Date: December 21, 2006

A.9. Test Diagram



A.10. Tested By

Name: Tom Tidwell,
Function: Manager of Wireless Services

APPENDIX B: 2.1047 MODULATION CHARACTERISTICS

B.1. Base Standard & Test Basis

Base Standard	FCC 2.1047
Test Basis	FCC 2.1047 Modulation Characteristics
Test Method	TIA 603-C, 2004

B.2. Specifications

2.1047 – Modulation Characteristics

(a) *Voice modulated communication equipment.* A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.
(b) *Equipment which employs modulation limiting.* A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.
(c) *Single sideband and independent sideband radiotelephone transmitters which employ a device or circuit to limit peak envelope power.* A curve showing the peak envelope power output versus the modulation input voltage shall be supplied. The modulating signals shall be the same in frequency as specified in paragraph (c) of §2.1049 for the occupied bandwidth tests.
(d) *Other types of equipment.* A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

B.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

B.4. Test Method

This device does not generate any modulation signals but only repeats a modulated rf waveform.

B.5. Test Results

Not applicable – The device does not produce a baseband signal but simply repeats a modulated rf waveform.

Test Data Summary

Emission Designators

IS-95 CDMA: F9W
W-CDMA: F9W
G7W: GSM
G7W: GSM-EDGE
DXW: TDMA

The above emission designators are based on preferred designations as presented by FCC engineering staff.

B.6. Test Diagram

N/A

B.7. Tested By

Name: Tom Tidwell
Function: Manager of Wireless Services

APPENDIX C: 2.10.49 OCCUPIED BANDWIDTH

C.1. Base Standard & Test Basis

Base Standard	FCC 2.1049
Test Basis	FCC 2.1049 Occupied Bandwidth
Test Method	TIA 603-C, 2004

C.2. Specifications

24.238 Emission limitations for Broadband PCS equipment

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

27.53 Emission limits for AWS equipment

(g) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB.

(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

C.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

C.4. Test Method

TIA 603-C, 2004

The modulated rf carrier fed to the device during testing is described below. The rf input to the amplifier was +8 dBm.

- IS-95 CDMA carrier:

Data source: PRBS (Pseudo-Random Bit Sequence)
Modulation: QPSK 2 b/sym
Symbol Rate: 1.2288 Msym/sec
Filter: IS-95 + Equalizer
Coding: None

- W-CDMA carrier: .

Data source: PRBS(Pseudo-Random Bit Sequence)
Modulation: QPSK
Symbol Rate: 4.096 MHz
Sequence Length: 65536 sym
Filter: Root Cosine
Roll Off: 0.22
Window Function: Hanning

- GSM carrier: .

Data source: PRBS(Pseudo-Random Bit Sequence)
Modulation: GMSK, 1 b/sym
Symbol Rate: 270, 833.3 sym/s
Filter: Gaussian
Roll Off: 0.3

- GSM EDGE carrier: .

Data source: PRBS(Pseudo-Random Bit Sequence)
Modulation: 8PSK, 3 b/sym
Symbol Rate: 270, 833.3 sym/s
Filter: Gaussian Linear

- TDMA carrier: .

Data source: PRBS(Pseudo-Random Bit Sequence)
Modulation: π/4DQPSK
Symbol Rate: 24, 300 sym/s
Filter: Sqrt Cos
Roll Off: 0.35
Coding: NADC

C.5. Test Results

Compliant. The 26 dB bandwidth was plotted for each modulation.

C.6. Deviations from Normal Operating Mode During Test

None.

C.7. Sample Calculation

None.

C.8. Test Data

See plots following.

Figure 1 26 dB Occupied Bandwidth – Downlink – CDMA1900 – Channel 25

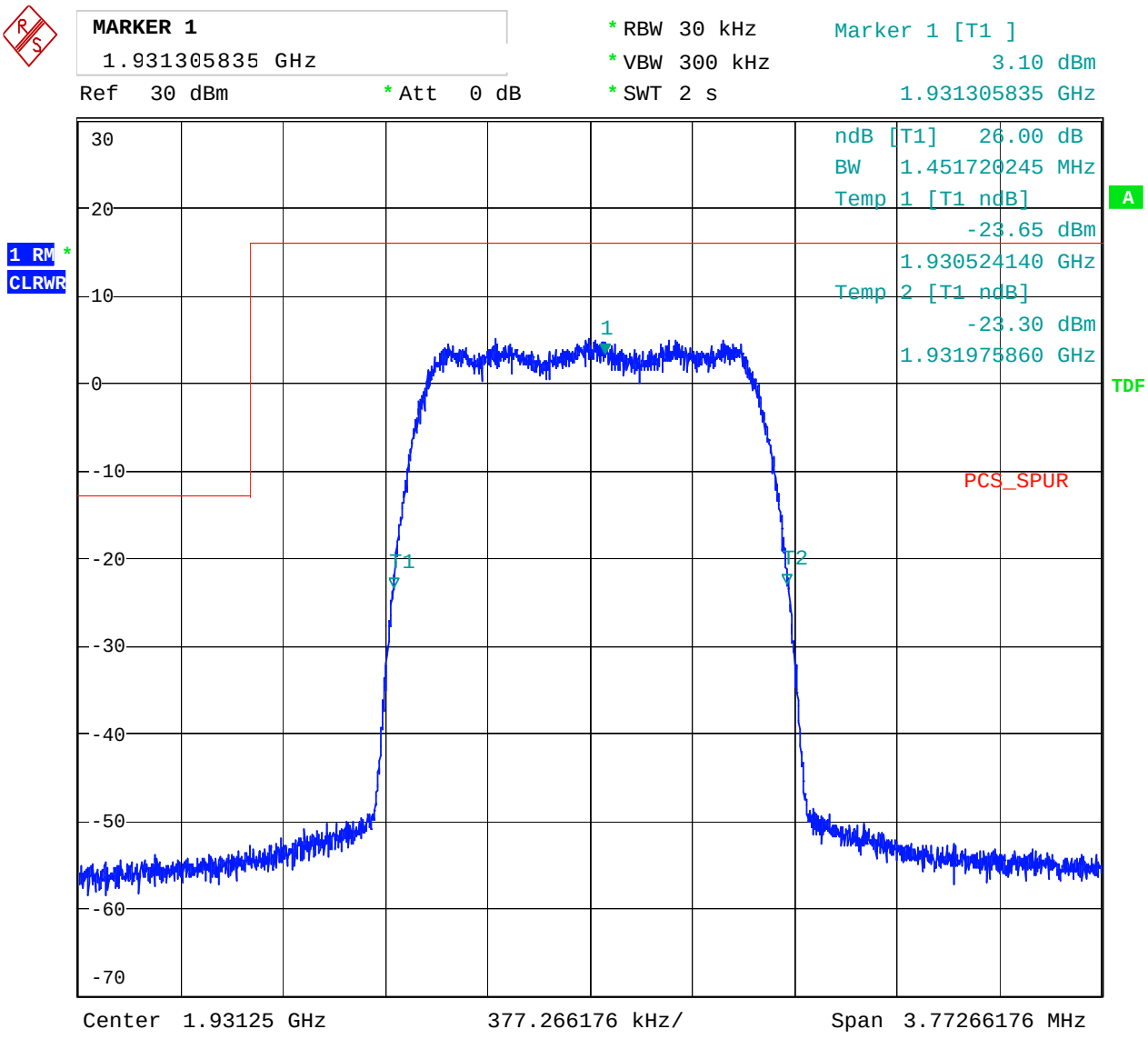


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Figure 2 26 dB Occupied Bandwidth – Downlink – CDMA1900 – Channel 600

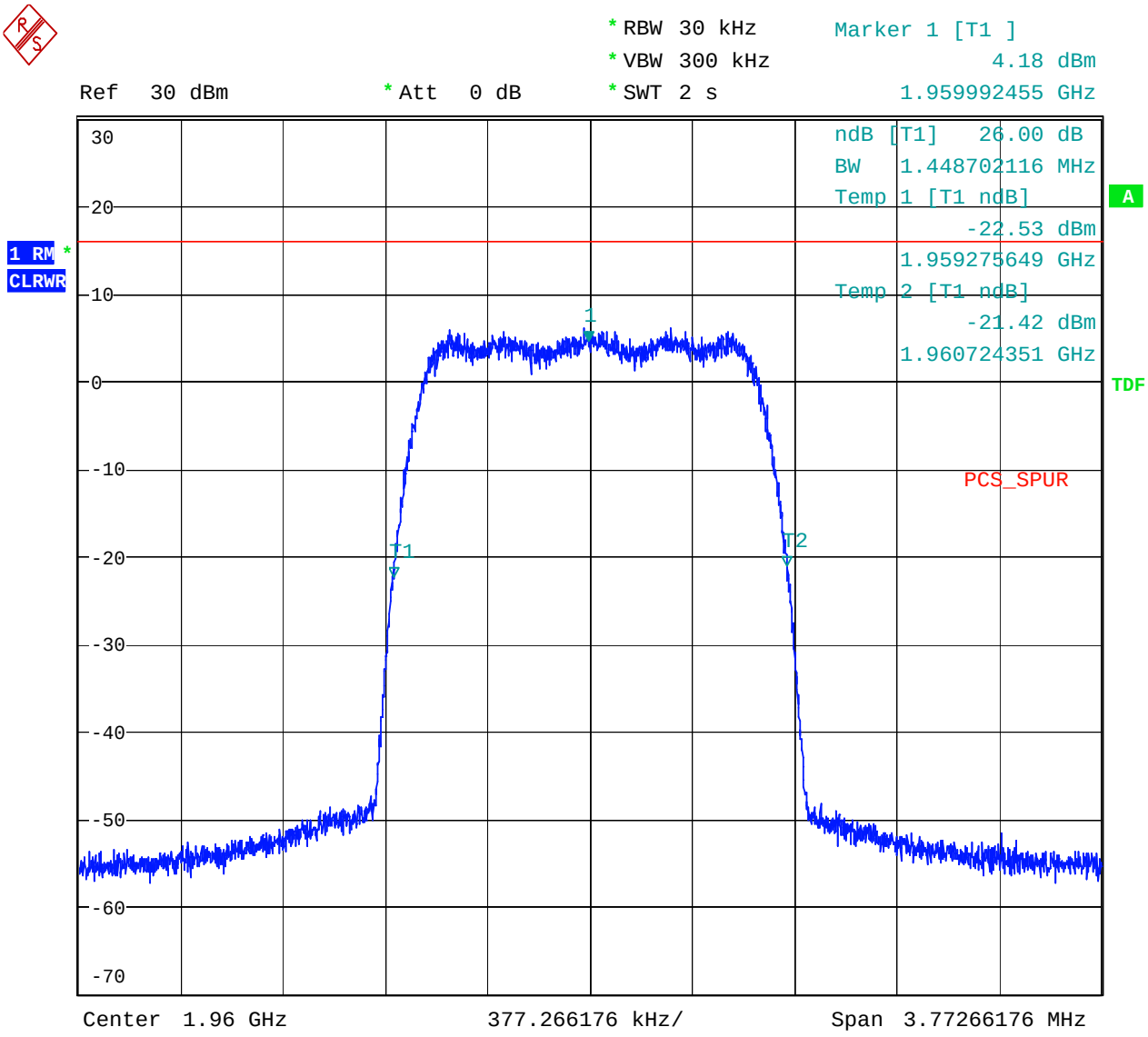

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Figure 3 26 dB Occupied Bandwidth – Downlink – CDMA1900 – Channel 1175

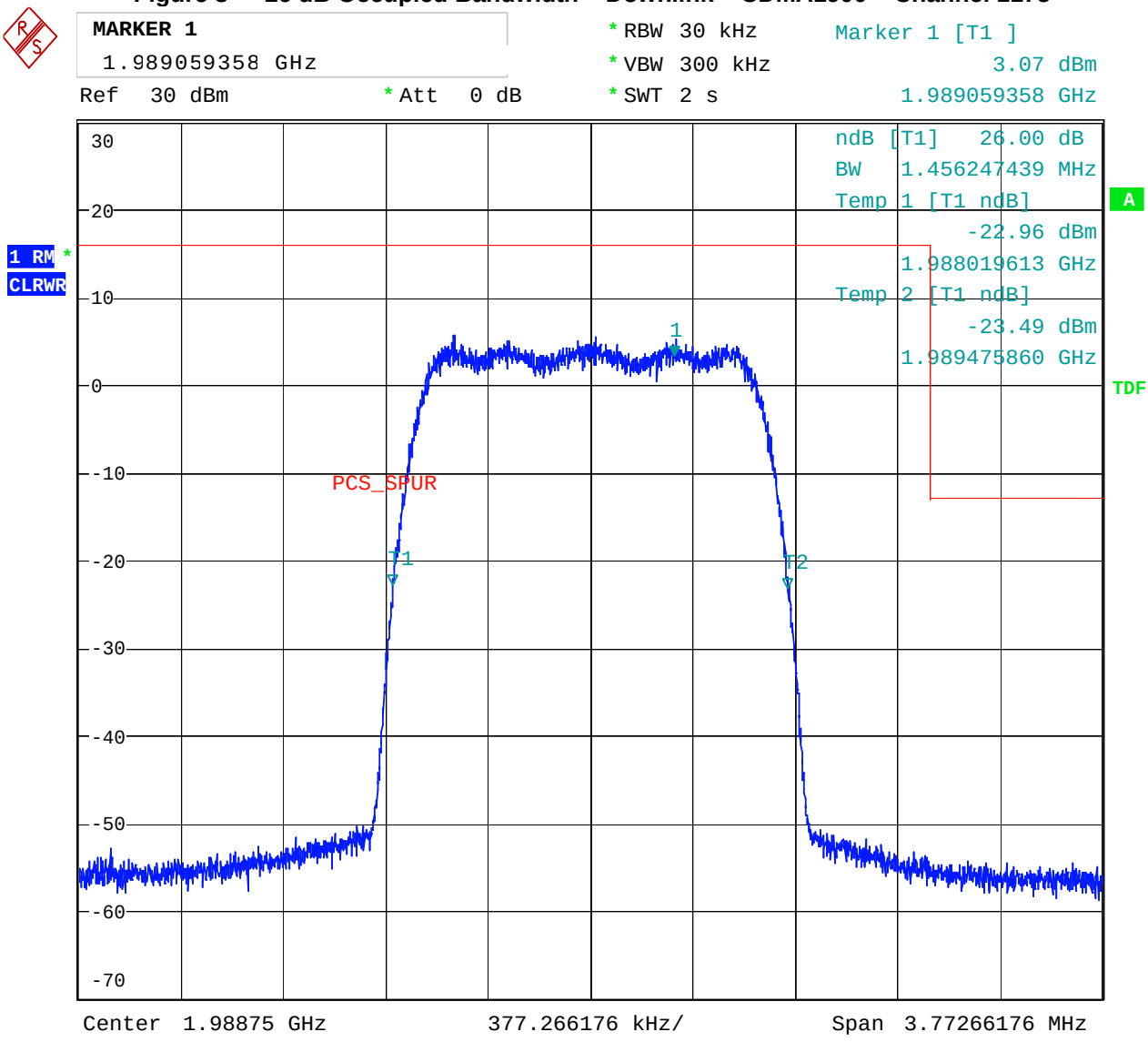

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Figure 4 26 dB Occupied Bandwidth – Downlink – CDMA1700 – Low Channel

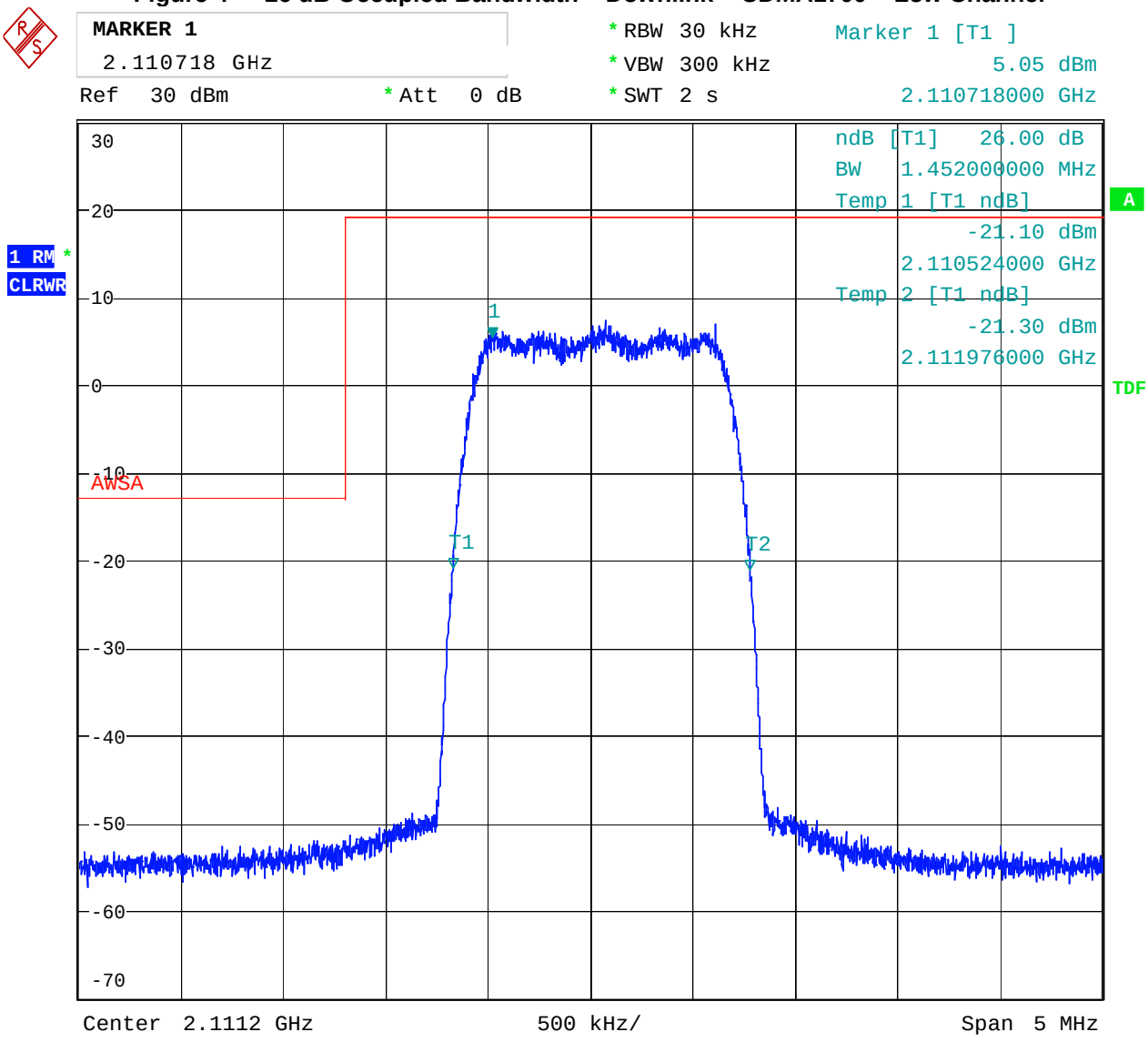

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Figure 5 26 dB Occupied Bandwidth – Downlink – CDMA1700 – Mid Channel

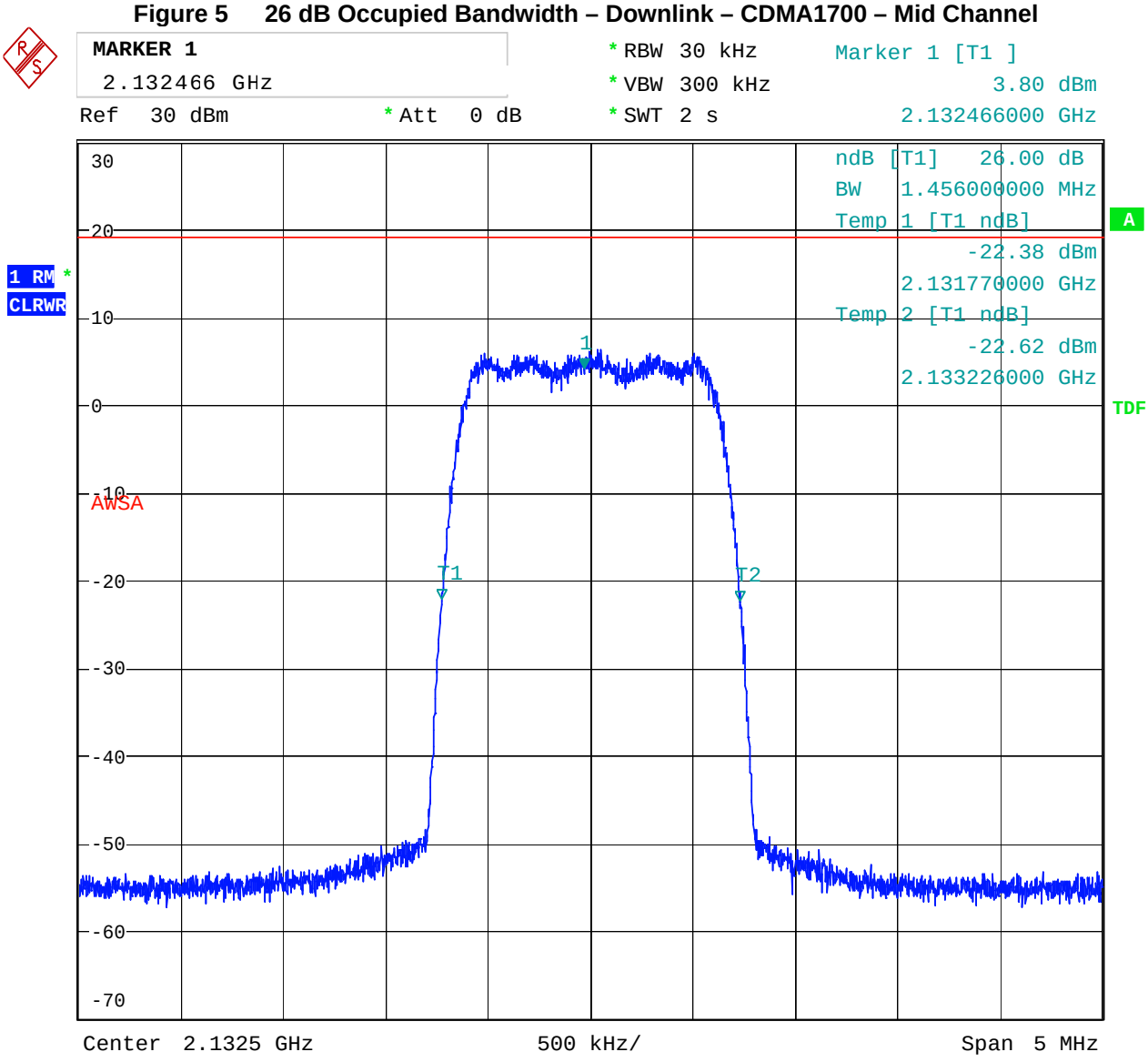

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Figure 6 26 dB Occupied Bandwidth – Downlink – CDMA1700 – High Channel

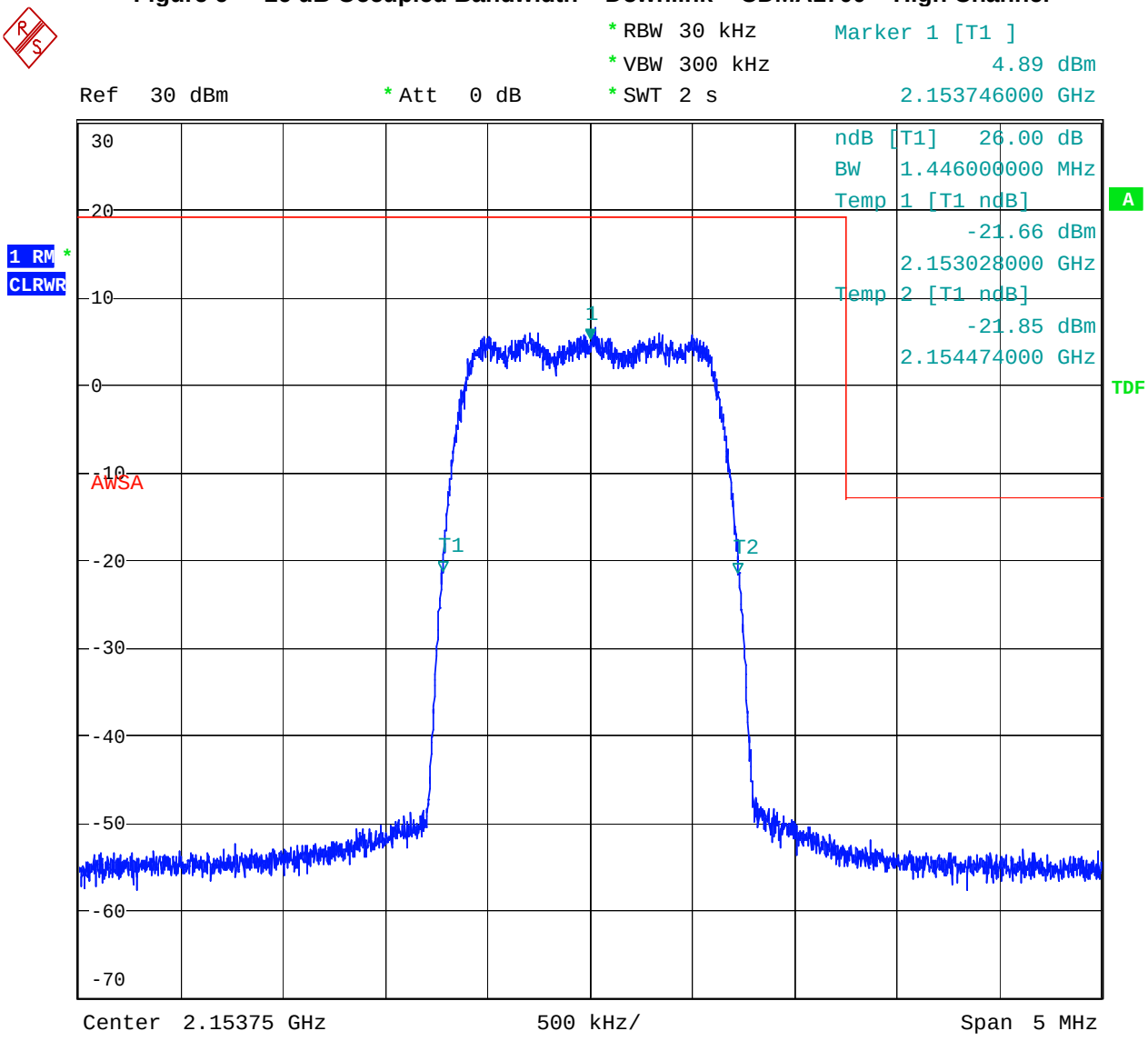

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Figure 7 26 dB Occupied Bandwidth – Downlink – W-CDMA1900 – Low Channel

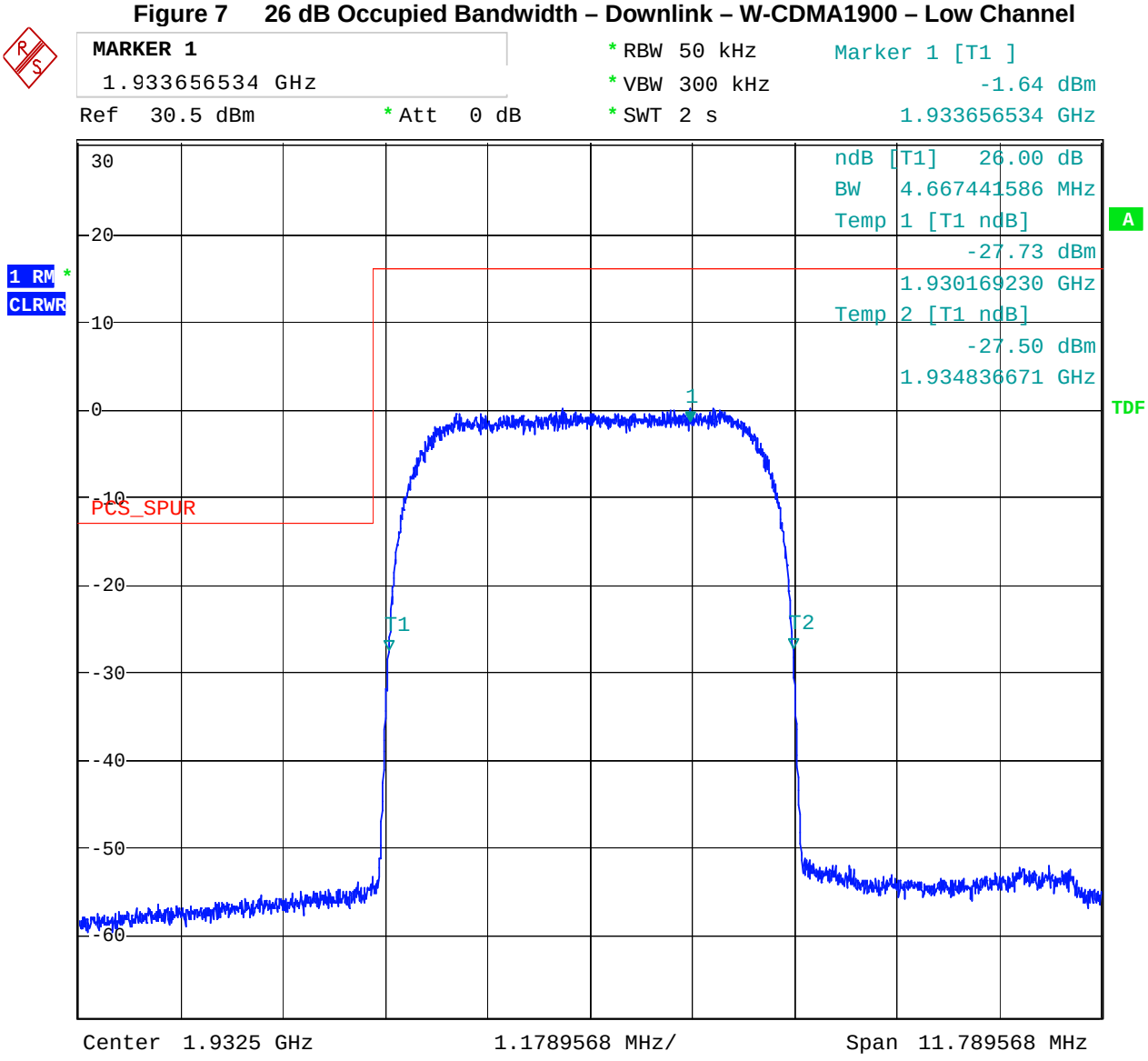

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Figure 8 26 dB Occupied Bandwidth – Downlink – W-CDMA1900 – Mid Channel

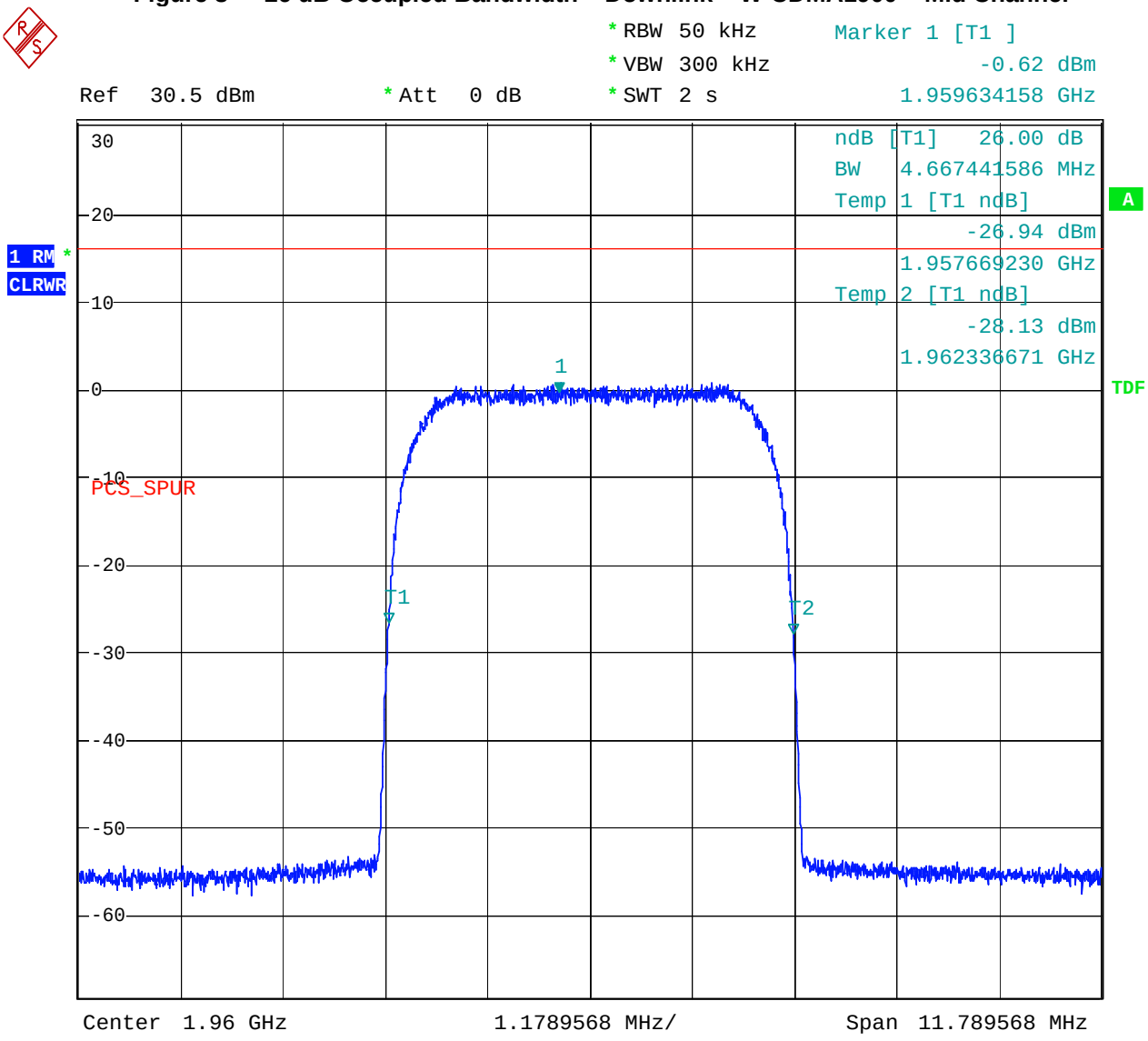

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Figure 9 26 dB Occupied Bandwidth – Downlink – W-CDMA1900 – High Channel

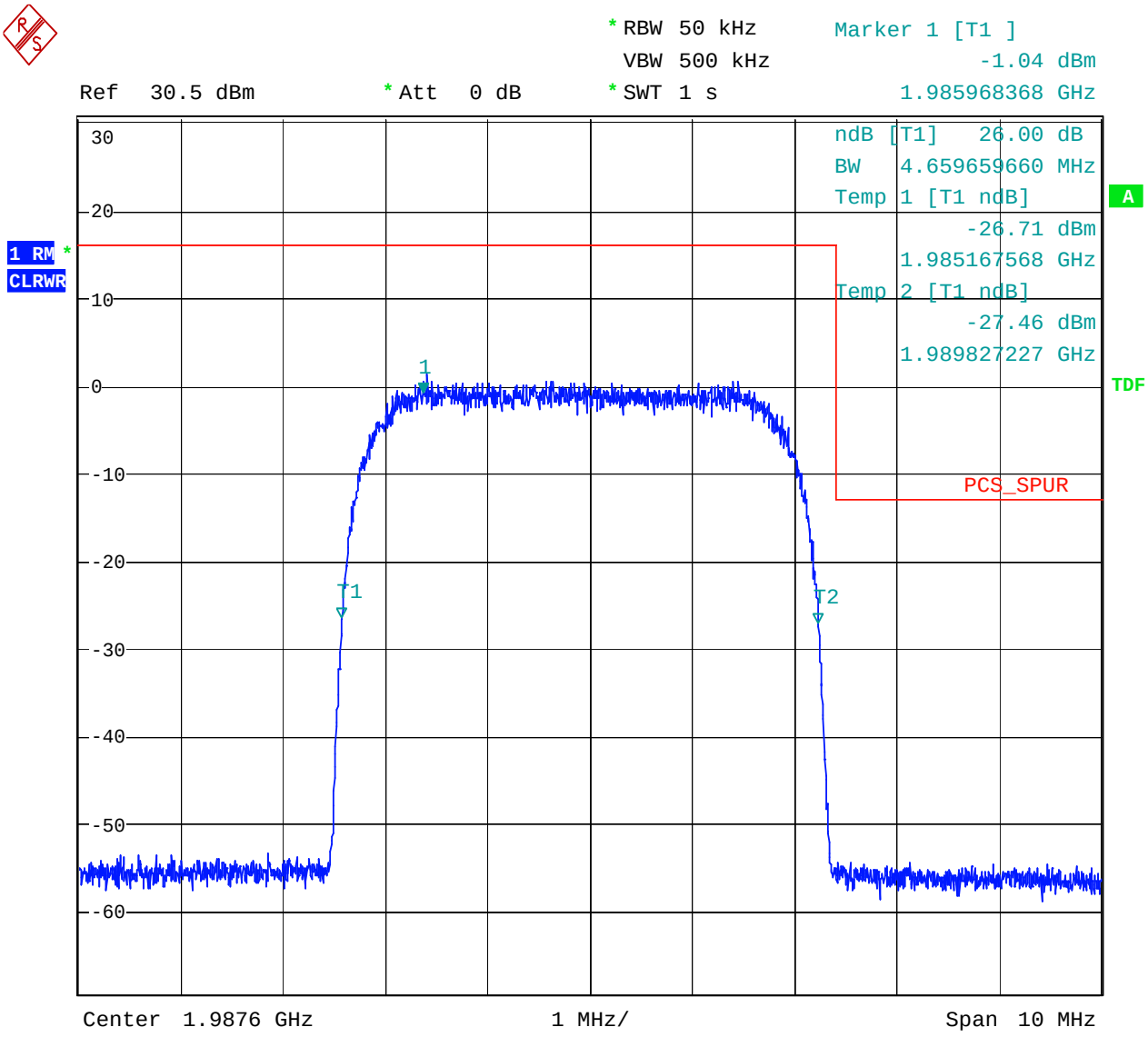

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Figure 10 26 dB Occupied Bandwidth – Downlink – W-CDMA1700 – Low Channel

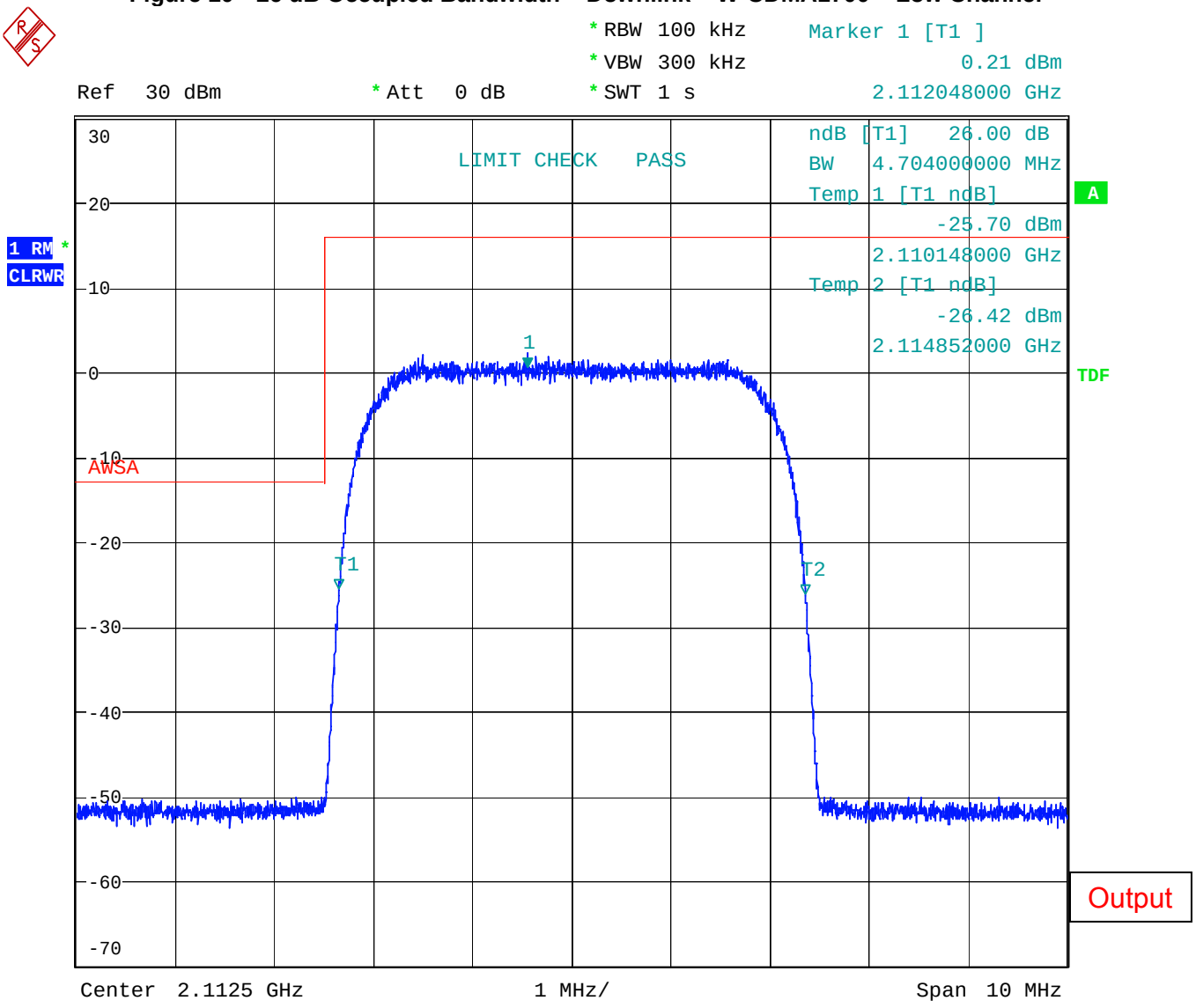

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Figure 11 26 dB Occupied Bandwidth – Downlink – W-CDMA1700 – Mid Channel

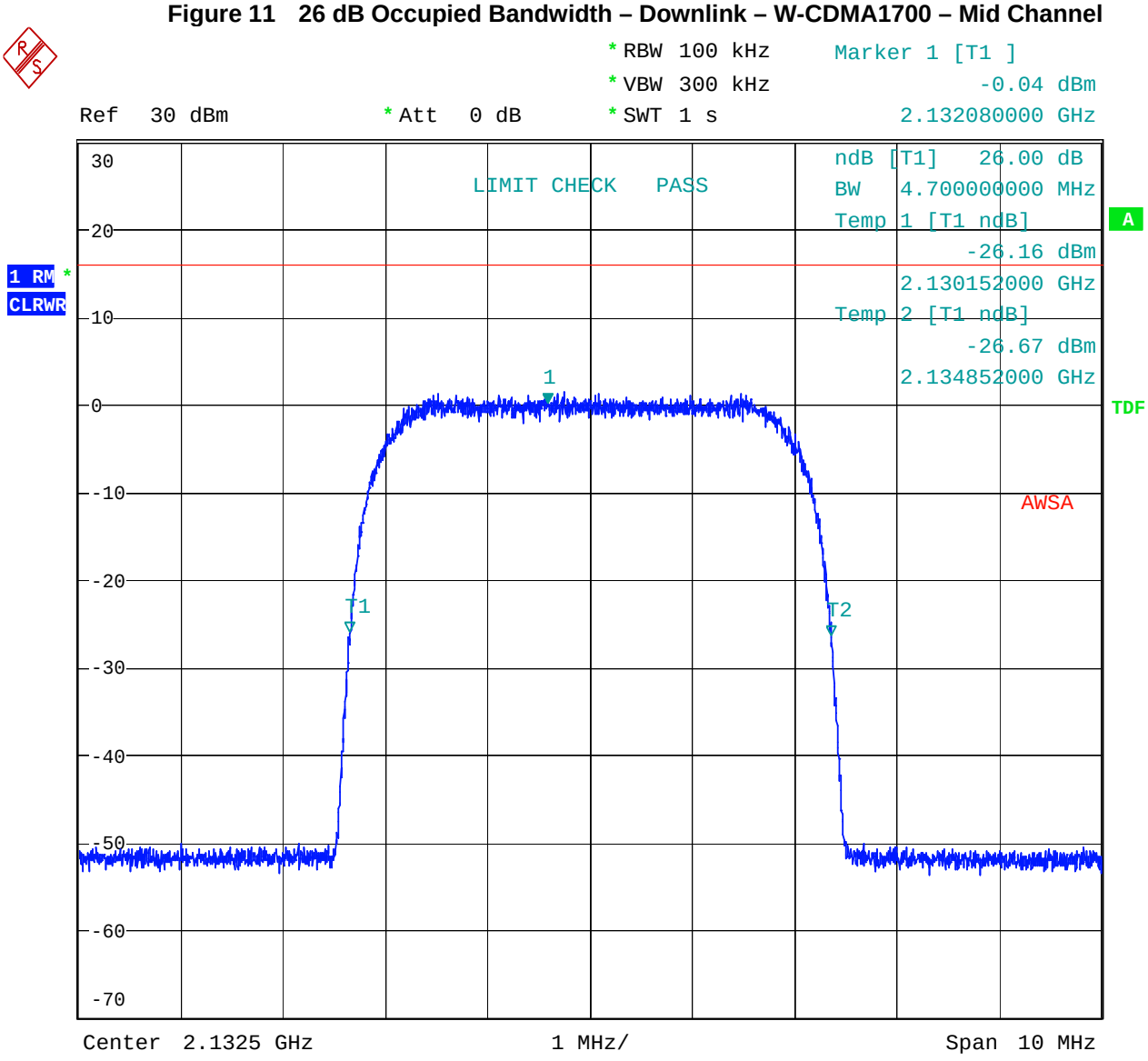

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Figure 12 26 dB Occupied Bandwidth – Downlink – W-CDMA1700 – High Channel

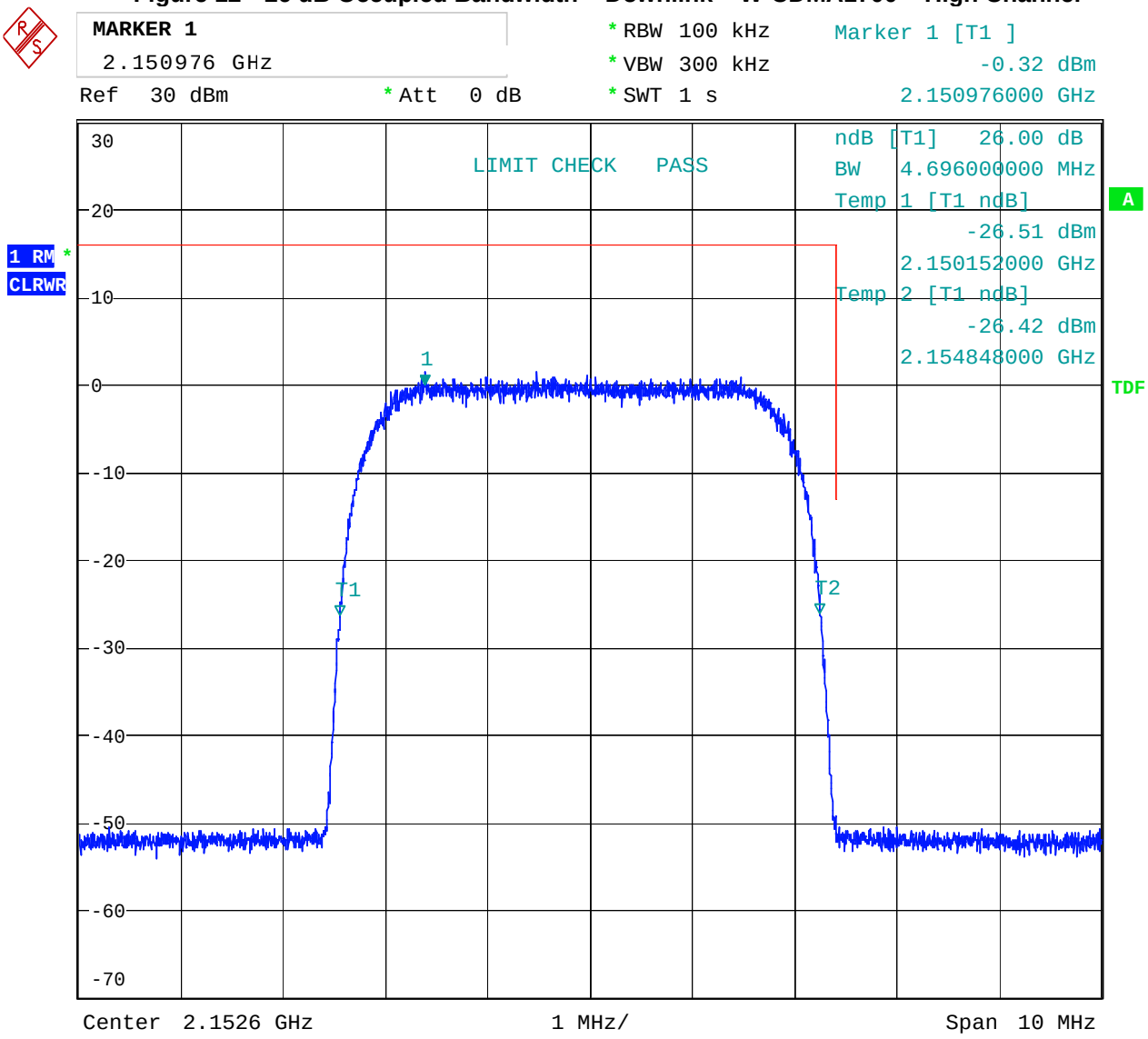

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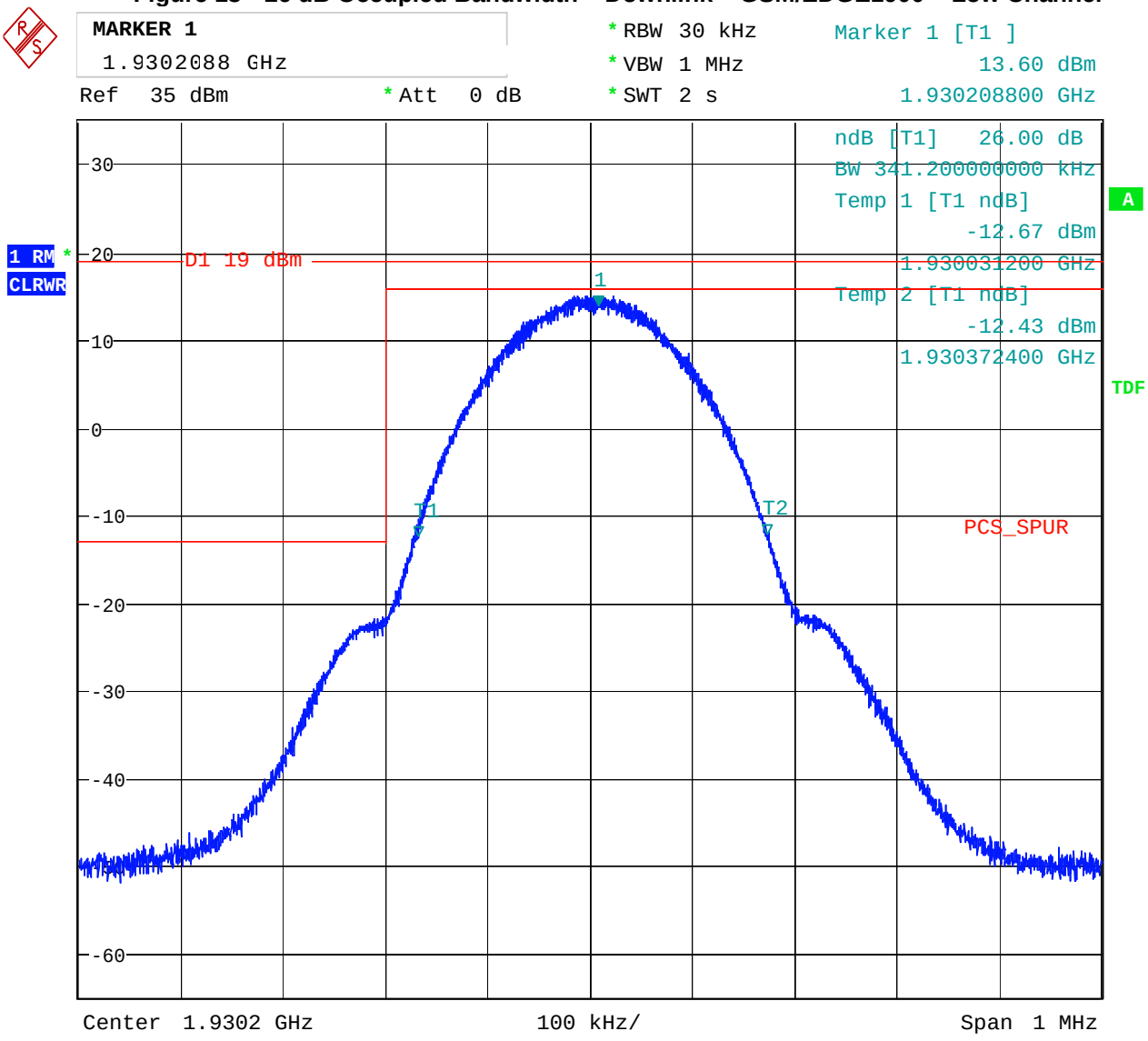
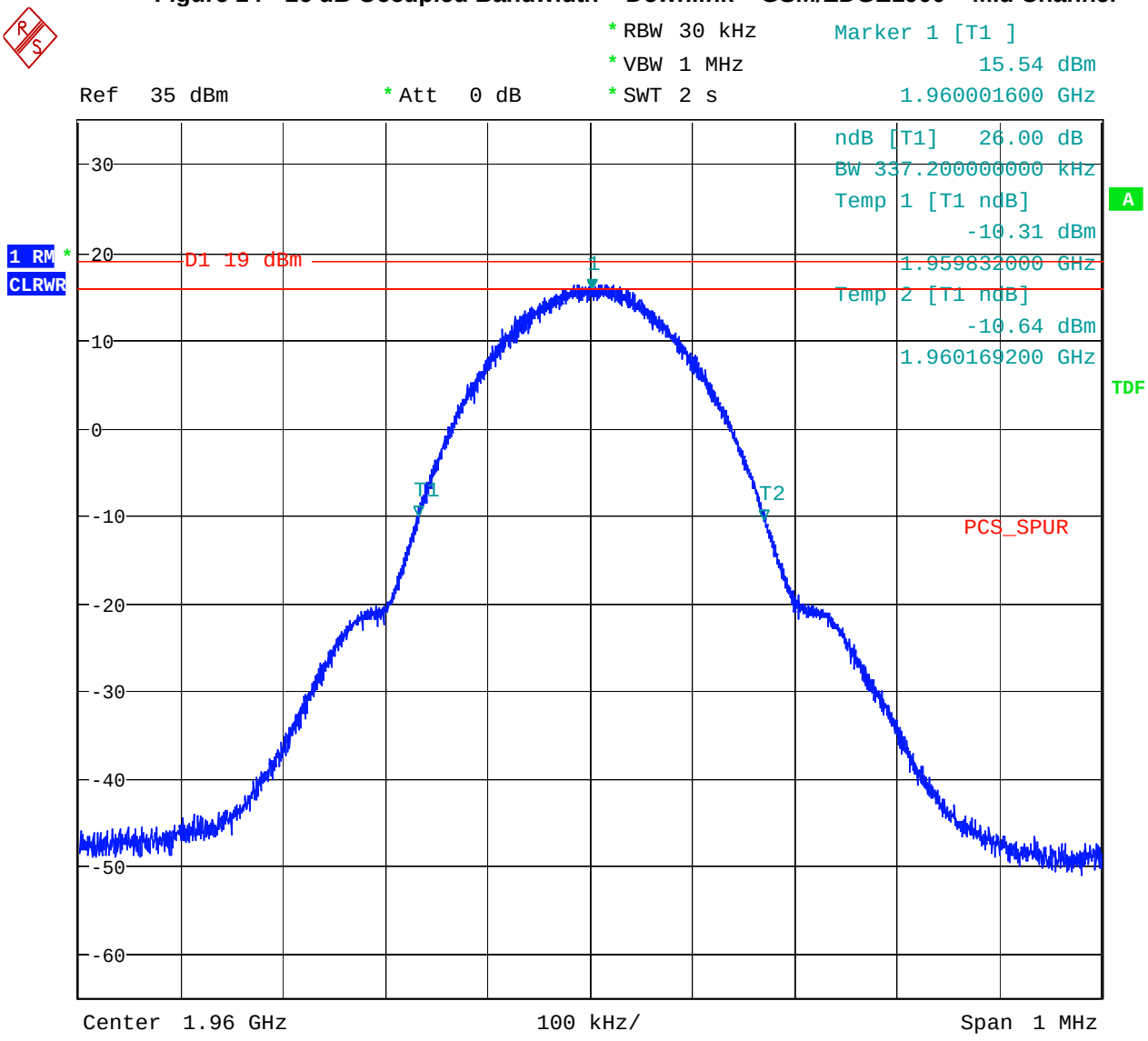
Figure 13 26 dB Occupied Bandwidth – Downlink – GSM/EDGE1900 – Low Channel



Date: 23.MAR.2007 20:43:15

Figure 14 26 dB Occupied Bandwidth – Downlink – GSM/EDGE1900 – Mid Channel



Date: 23.MAR.2007 20:43:41

Figure 15 26 dB Occupied Bandwidth – Downlink – GSM/EDGE1900 – High Channel

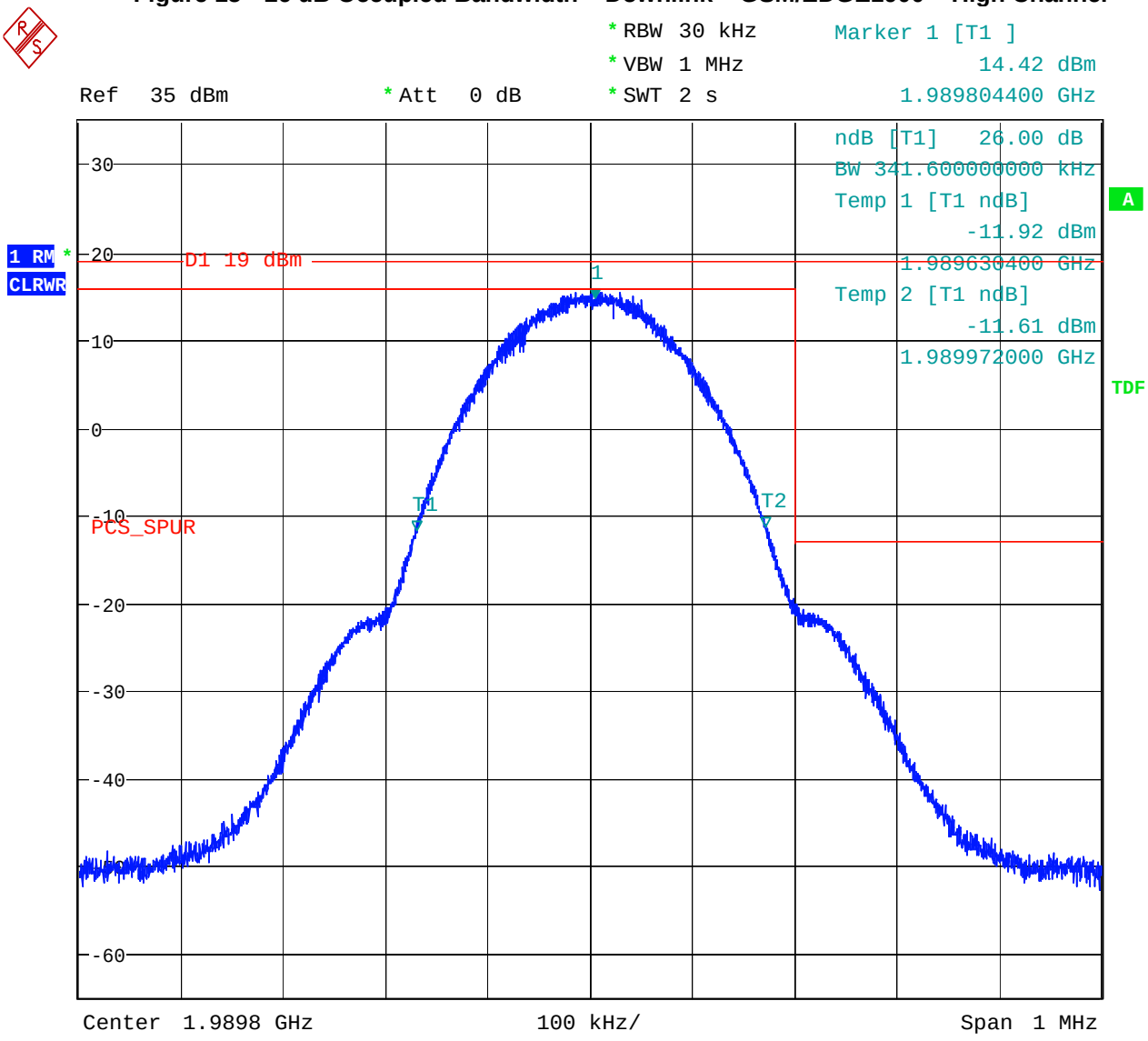


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Figure 16 26 dB Occupied Bandwidth – Downlink – TDMA1900 – Low Channel

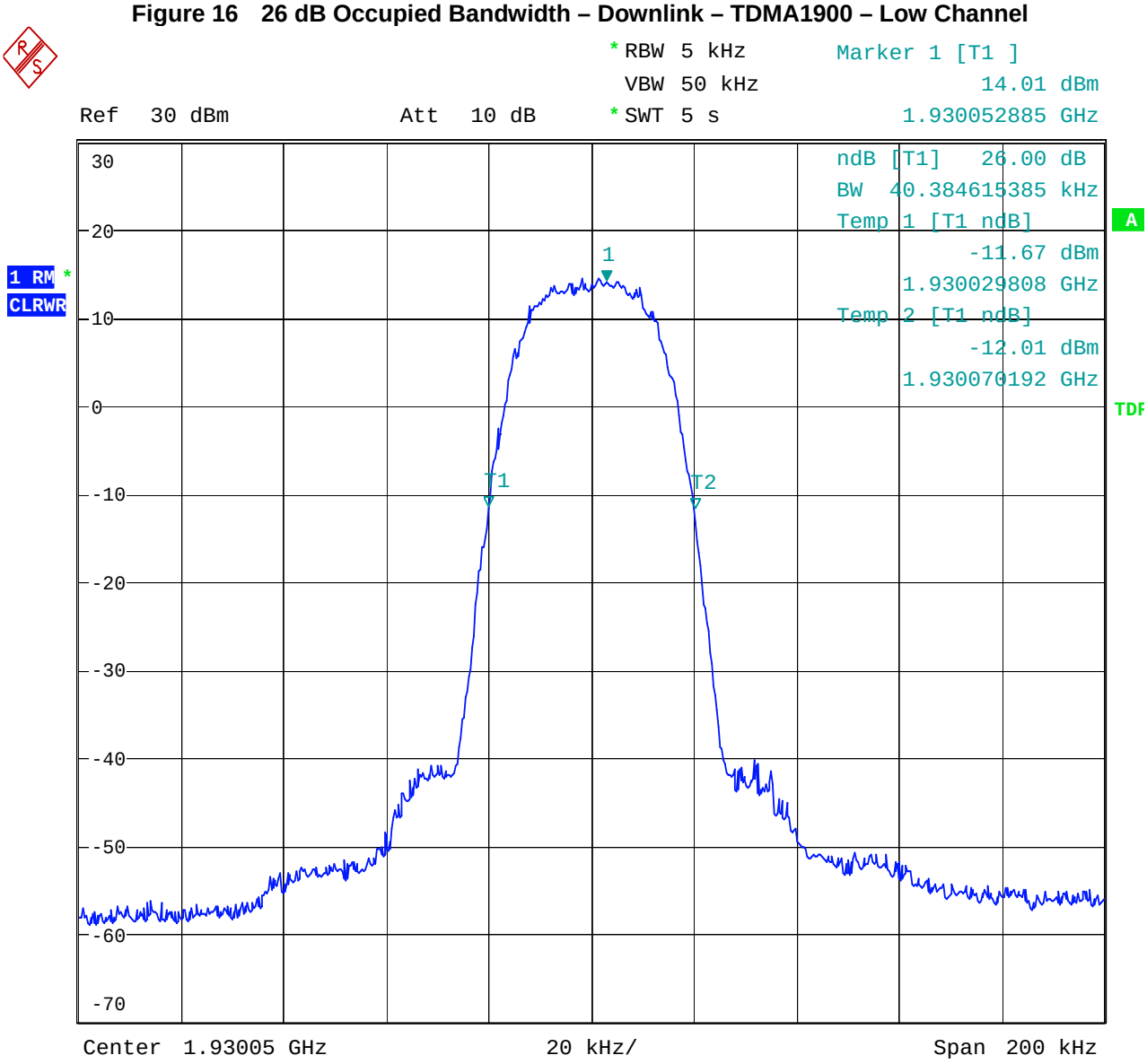


Figure 17 26 dB Occupied Bandwidth – Downlink – TDMA1900 – Mid Channel

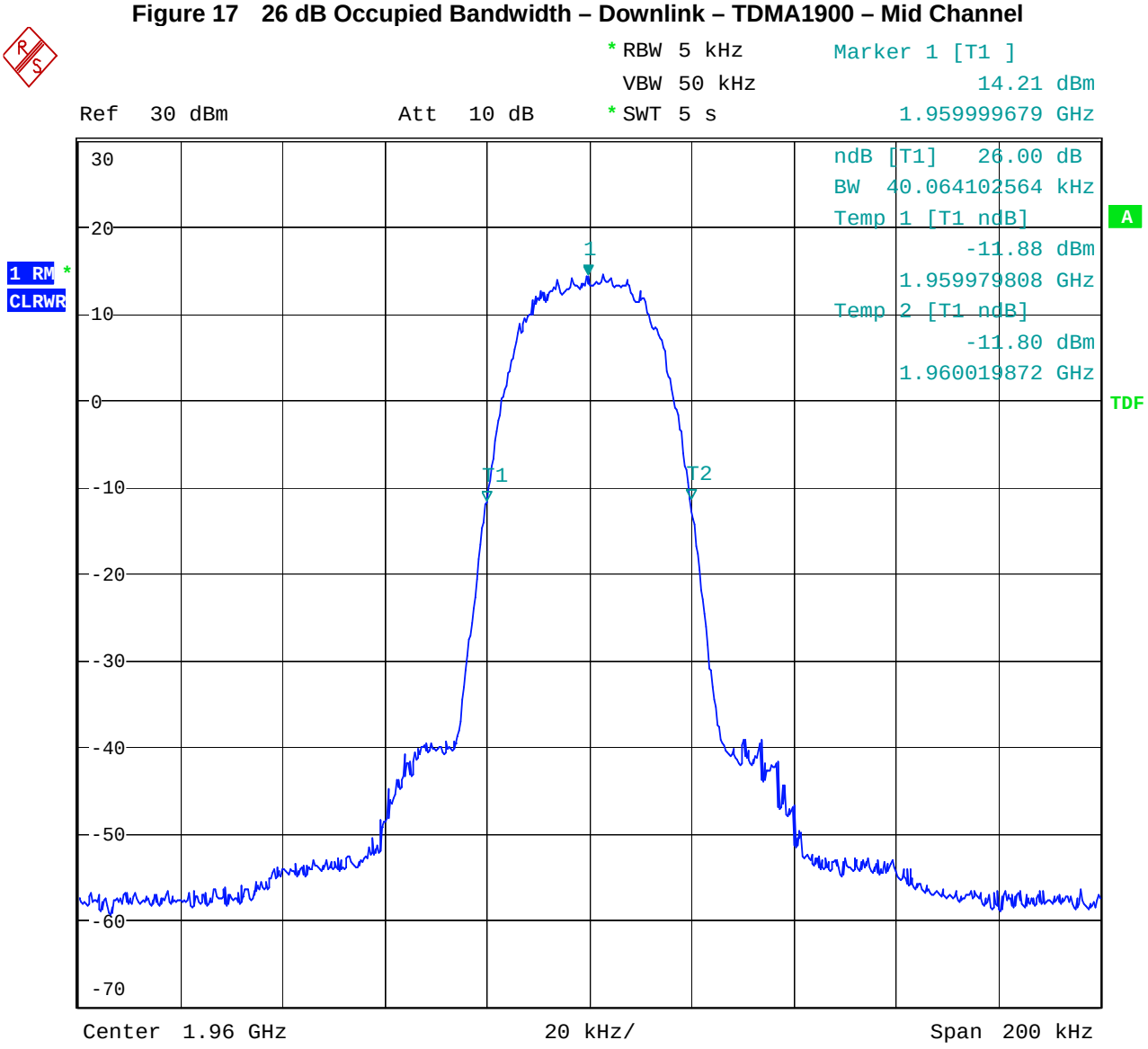
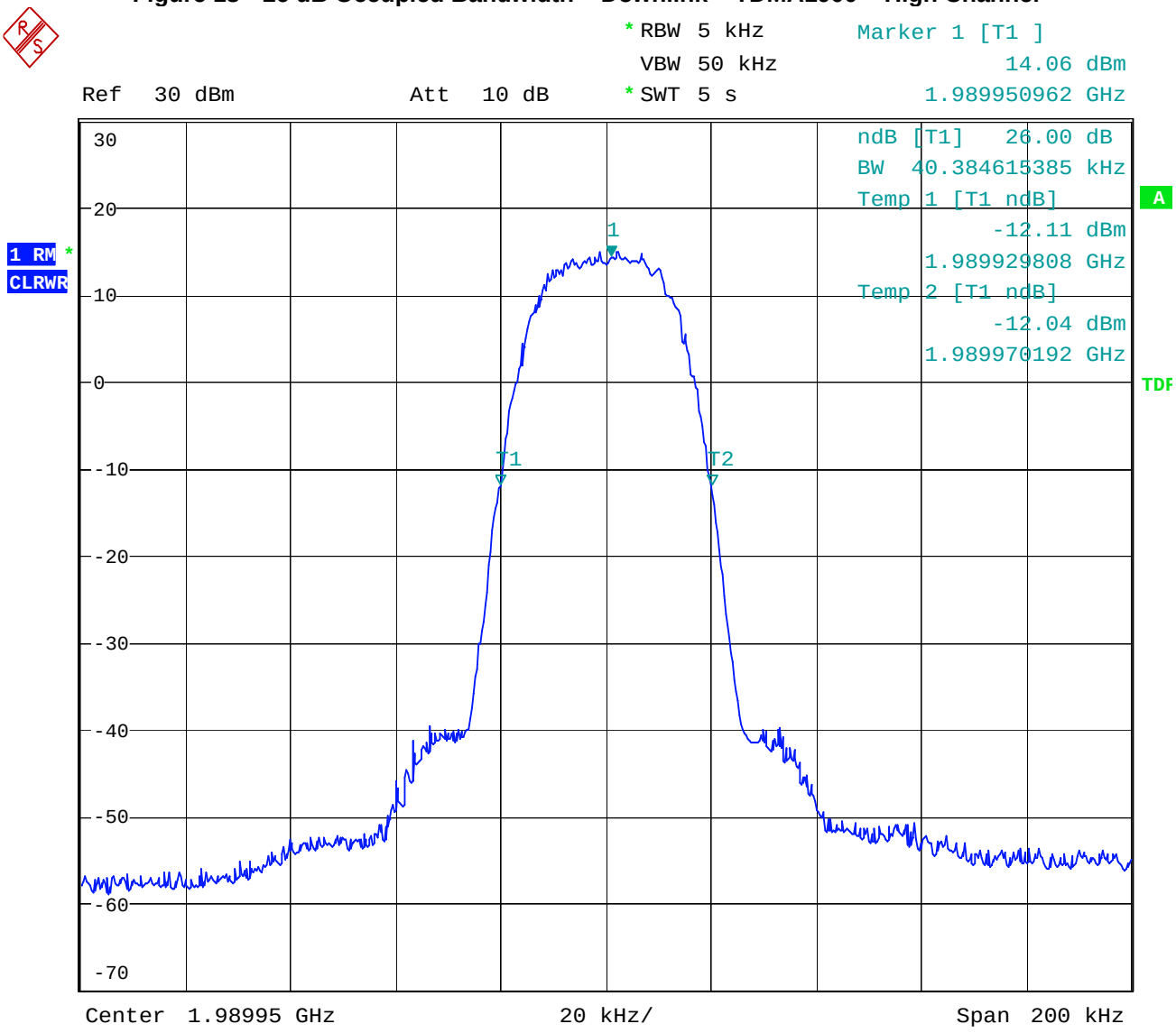
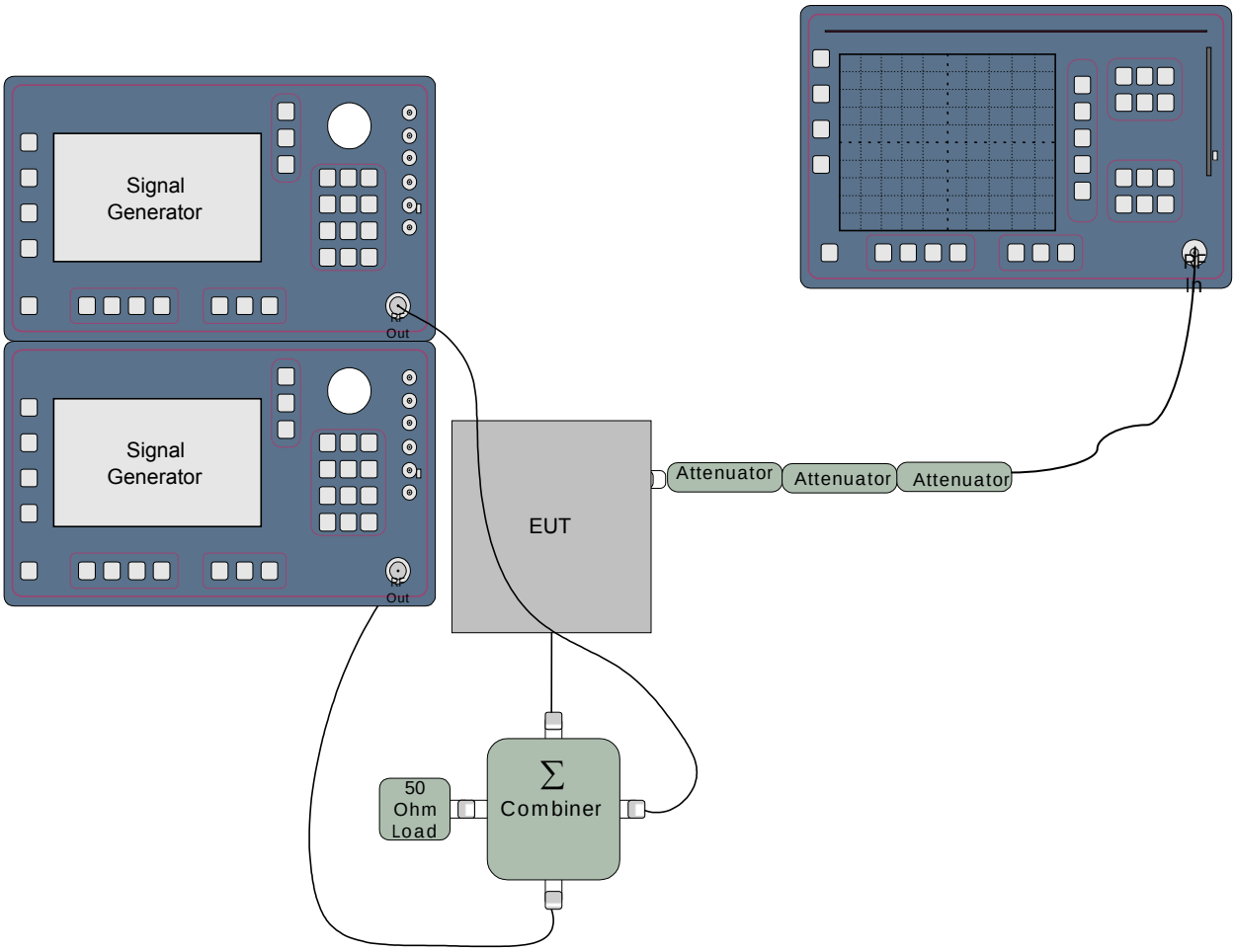


Figure 18 26 dB Occupied Bandwidth – Downlink – TDMA1900 – High Channel



C.9. Test Diagram



C.10. Tested By

Name: Tom Tidwell,
Function: Manager of Wireless Services

APPENDIX D: 2.1051 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

D.1. Base Standard & Test Basis

Base Standard	FCC 2.1051
Test Basis	FCC 2.1051 Spurious Emissions at Antenna Terminals
Test Method	TIA 603-C, 2004

D.2. Specifications

24.238 Emission limitations for Broadband PCS equipment

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

27.53 Emission limits for AWS equipment

(g) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB.

(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

D.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
+1.11/-1.22

D.4. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

D.5. Test Results

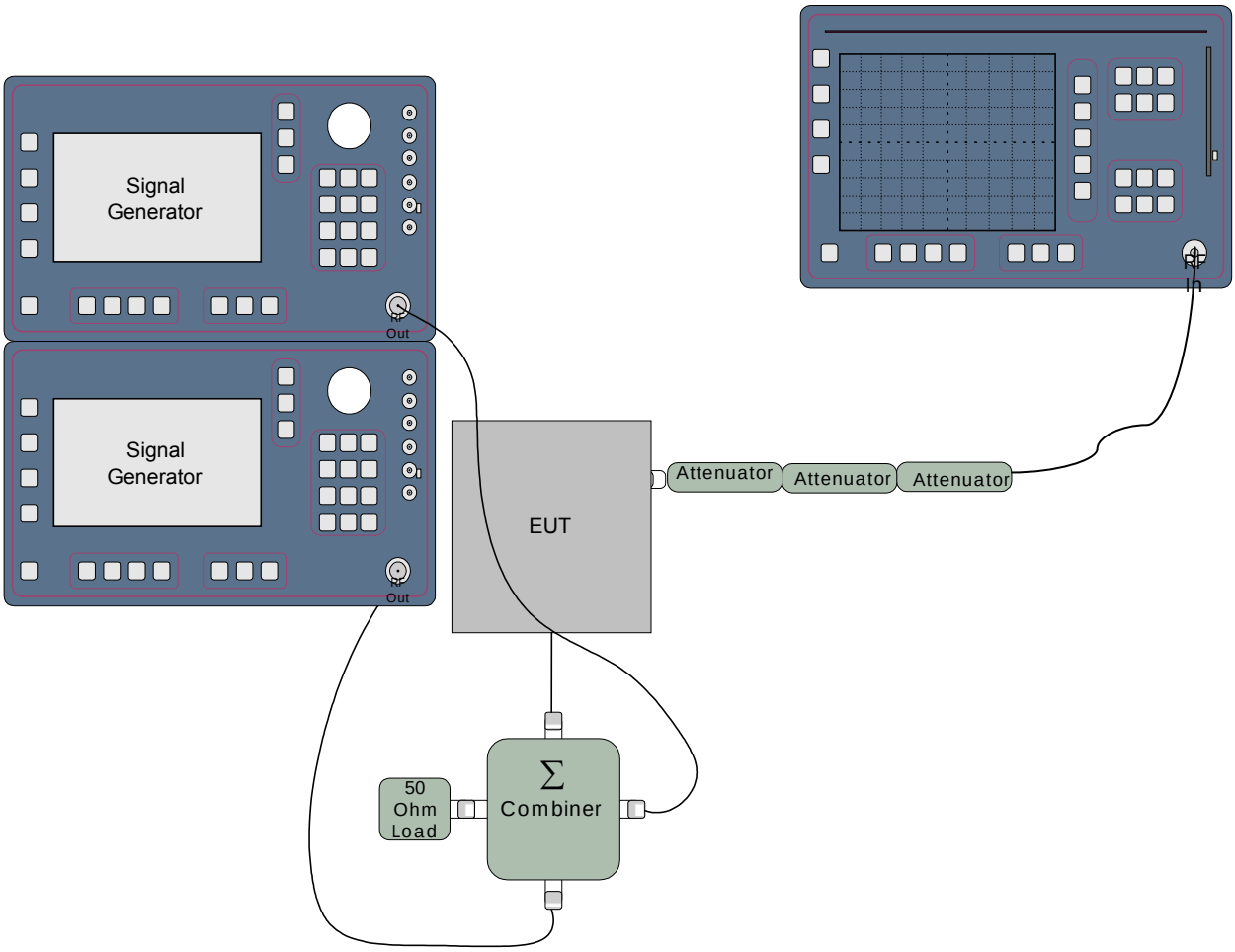
Complies. All emissions meet the out of band limits.

Out-of-Band Emissions limit is 43 + 10 log(P) which relates to -13 dBm absolute power.

Attenuation limit = 43 + 10 log(0.158) = 35 dB

22 dBm – 35 dB = -13 dBm

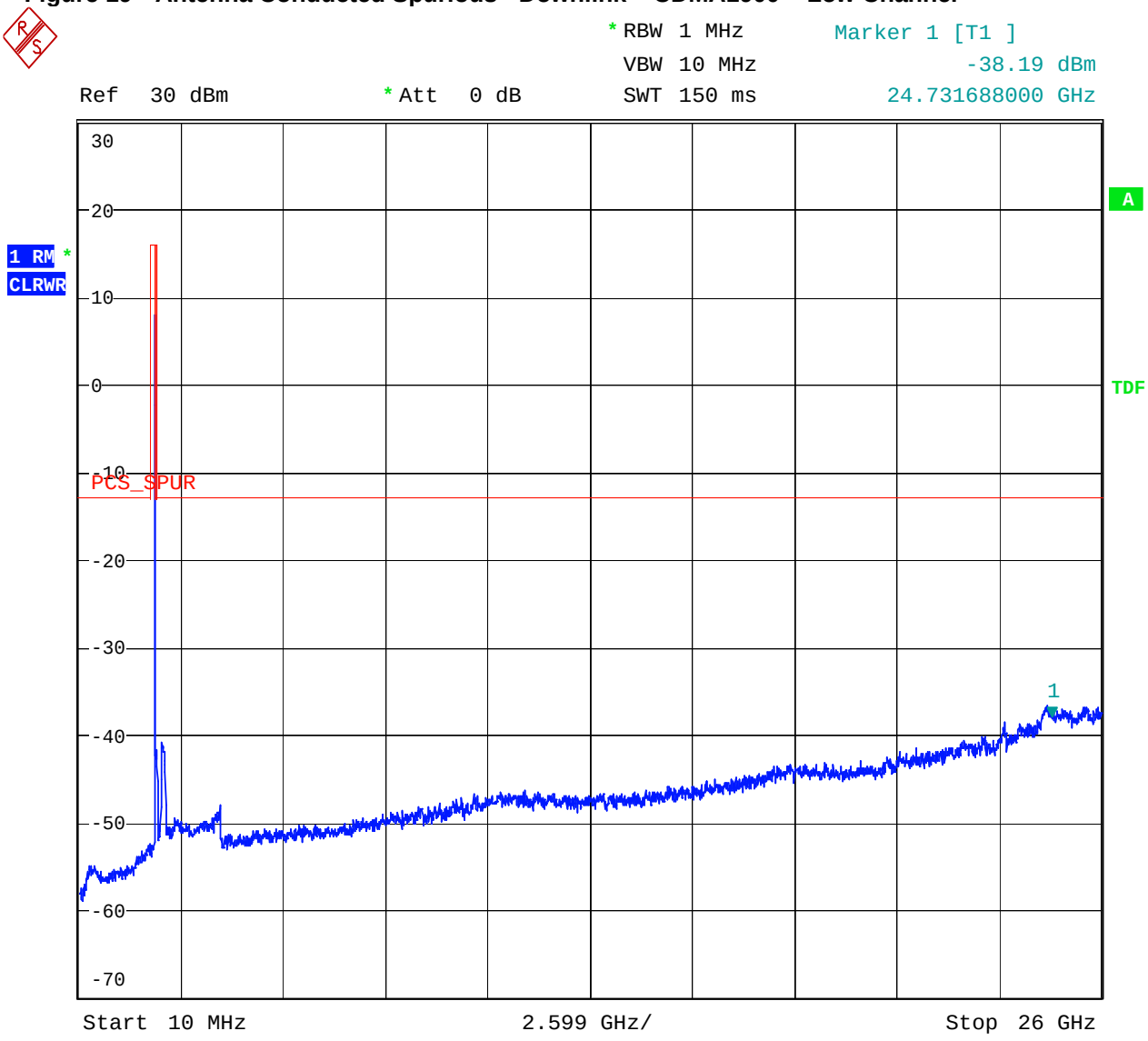
D.6. Test Diagram



D.7. Test Data

See following pages.

Figure 19 - Antenna Conducted Spurious - Downlink – CDMA1900 – Low Channel



Date: 23.MAR.2007 21:18:48

Figure 20- Antenna Conducted Spurious- Downlink – CDMA1900 – Mid Channel

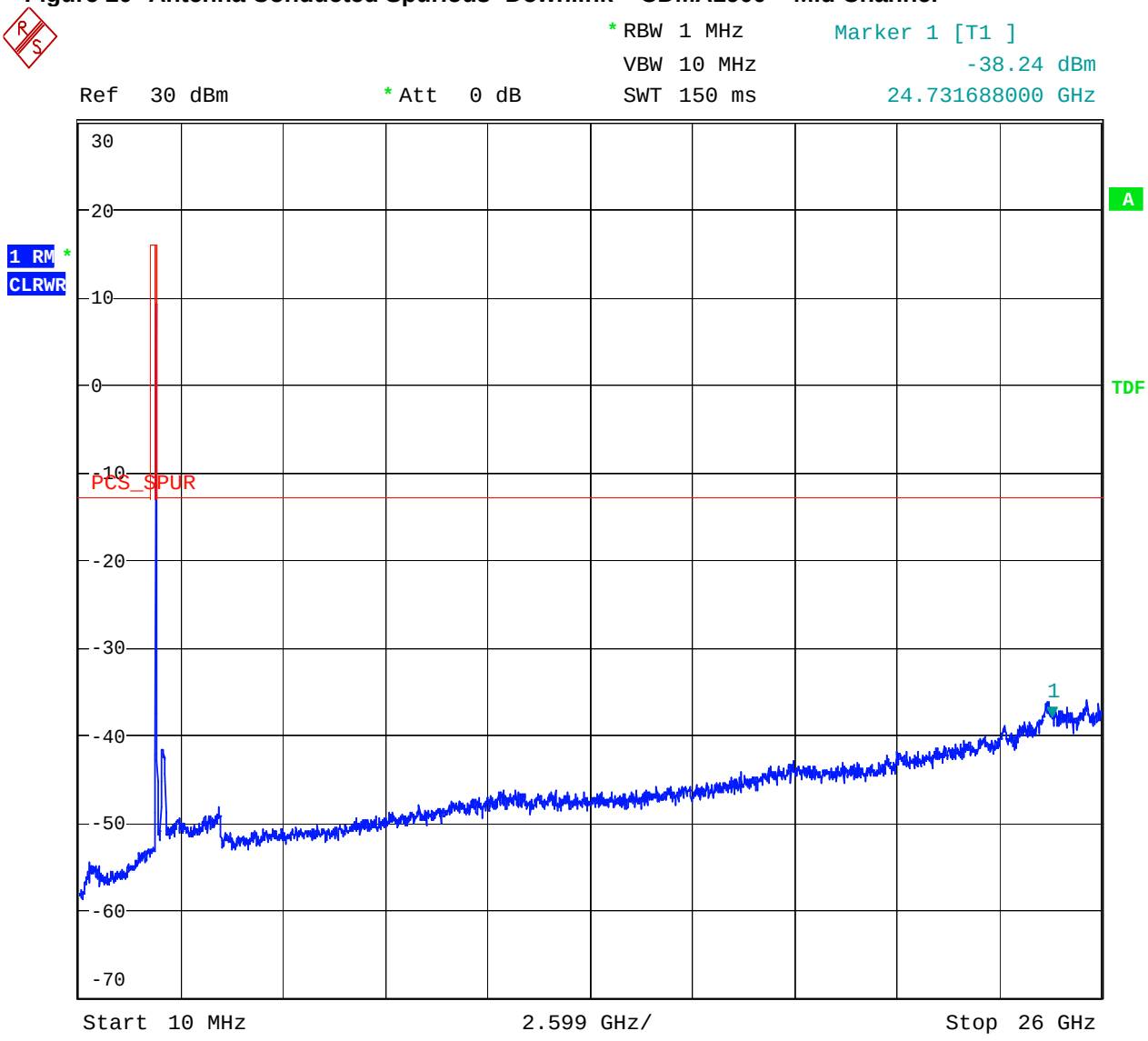
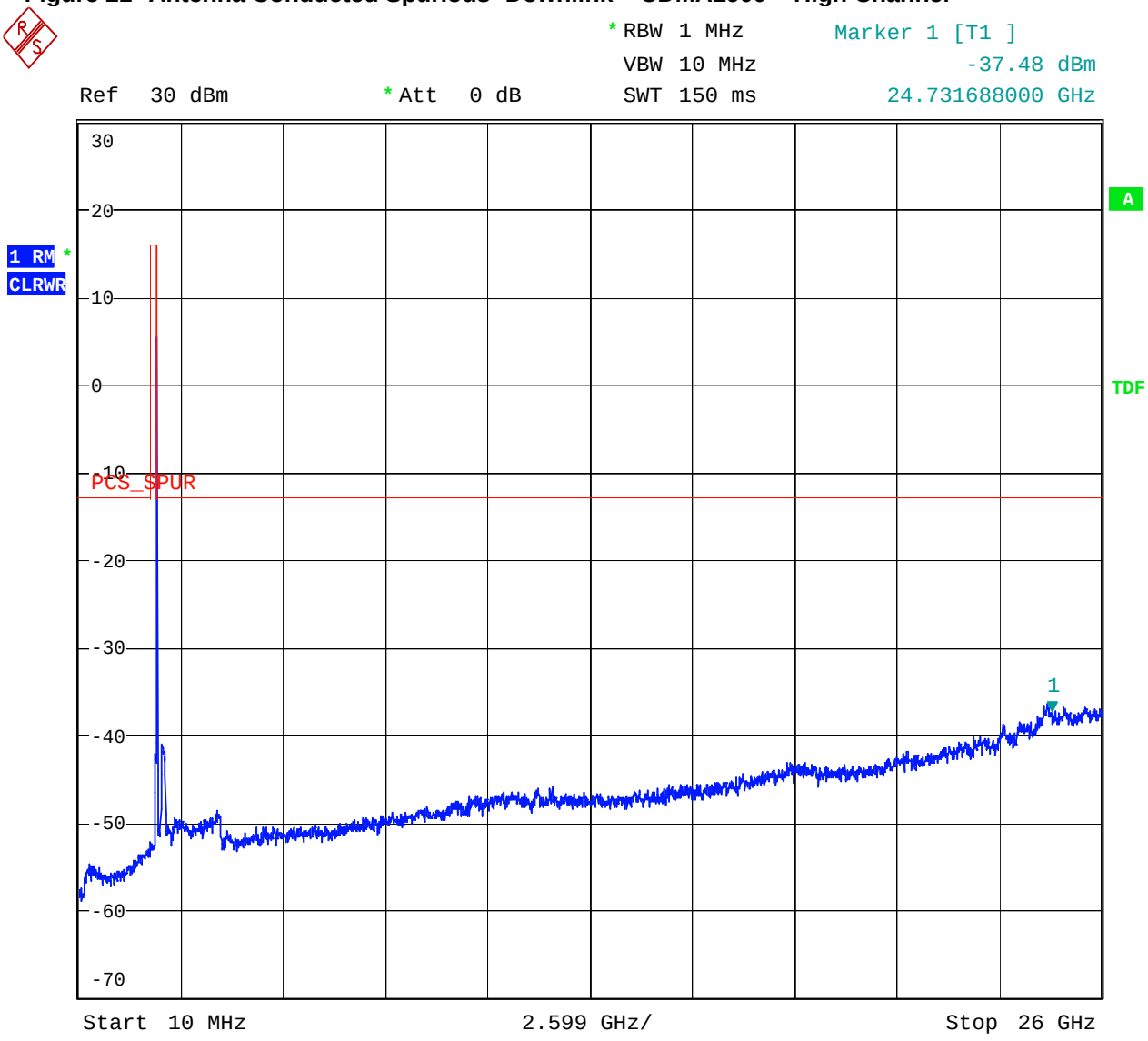
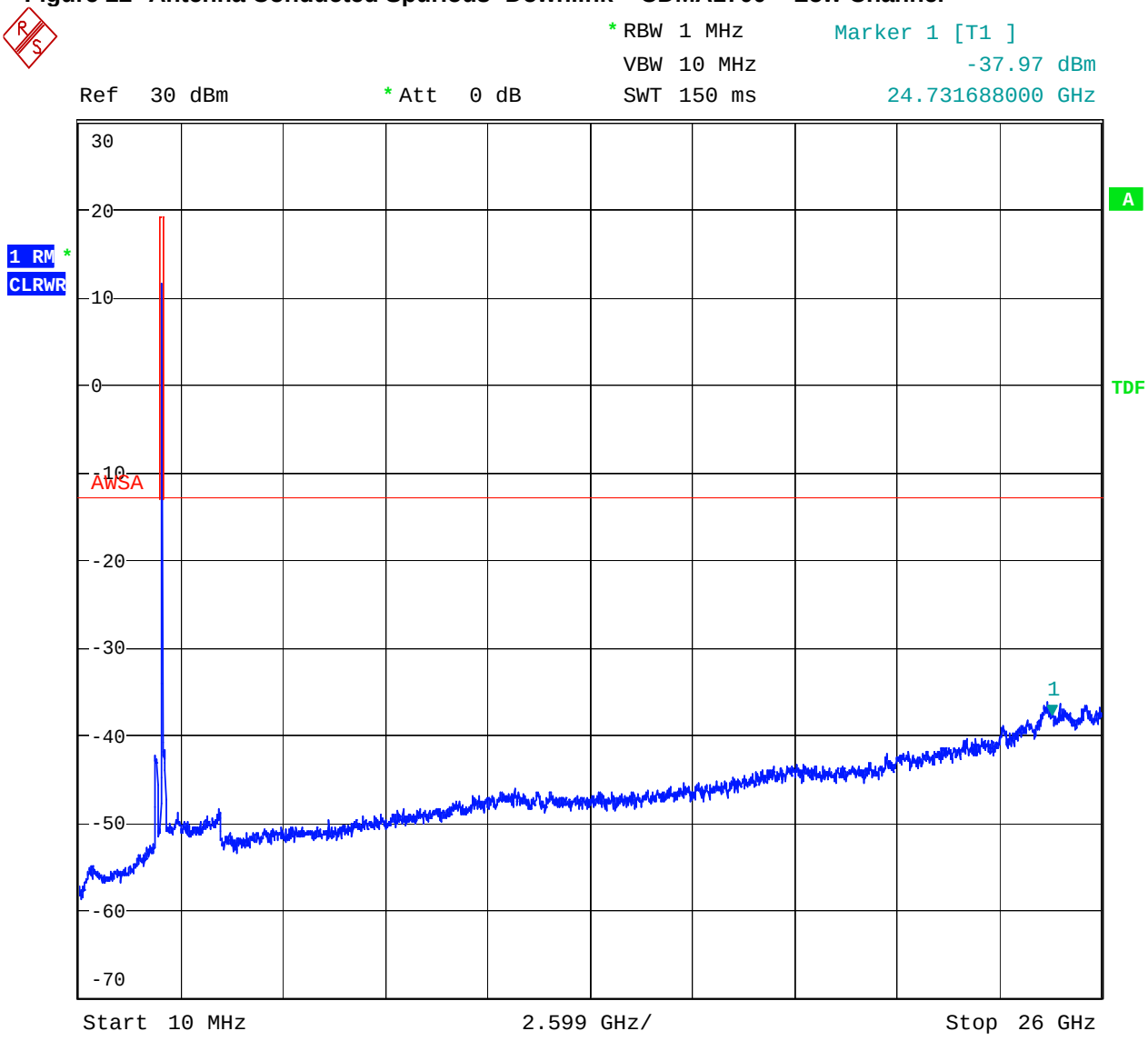


Figure 21- Antenna Conducted Spurious- Downlink – CDMA1900 – High Channel



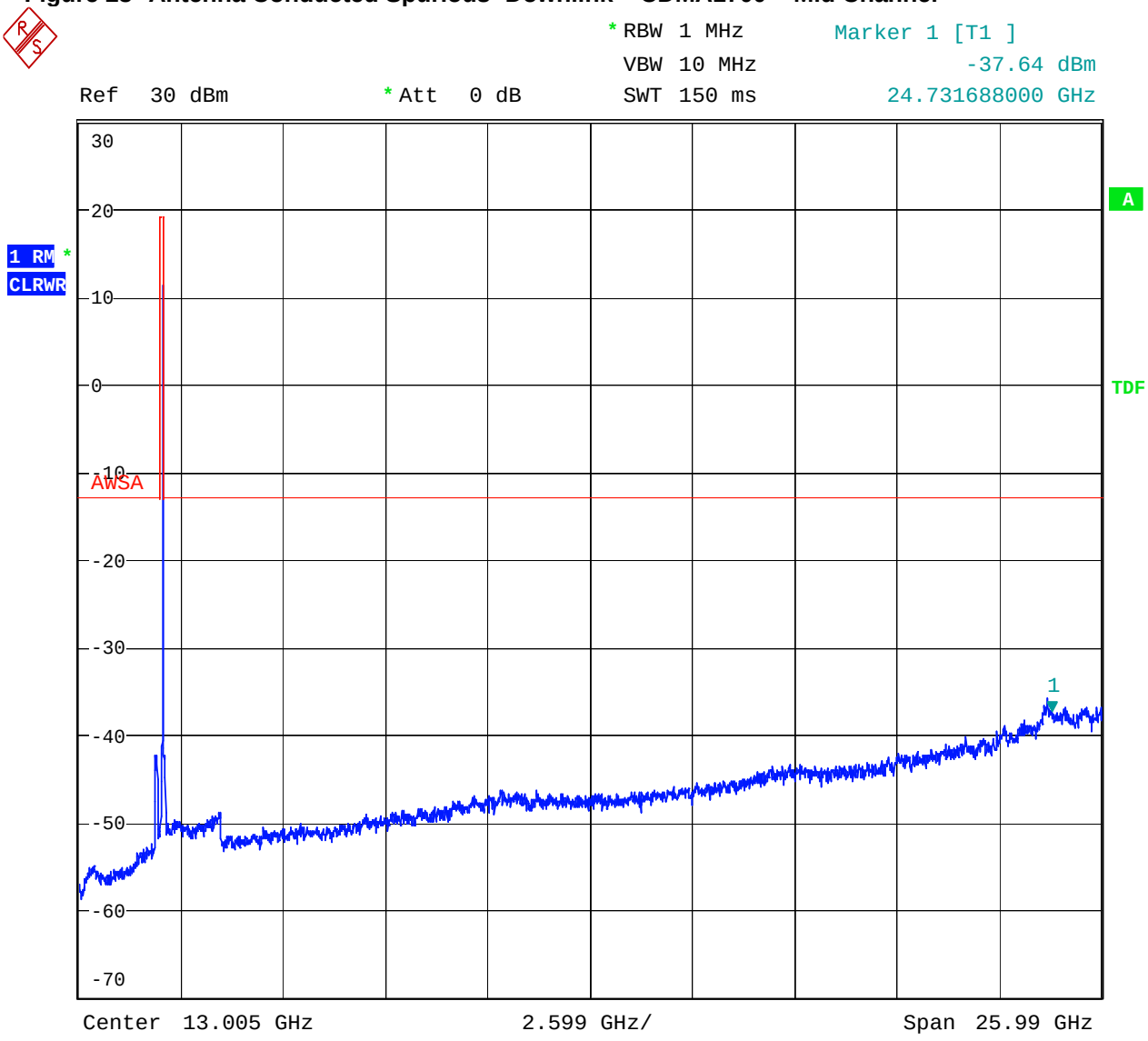
Date: 23.MAR.2007 21:19:56

Figure 22- Antenna Conducted Spurious- Downlink – CDMA1700 – Low Channel



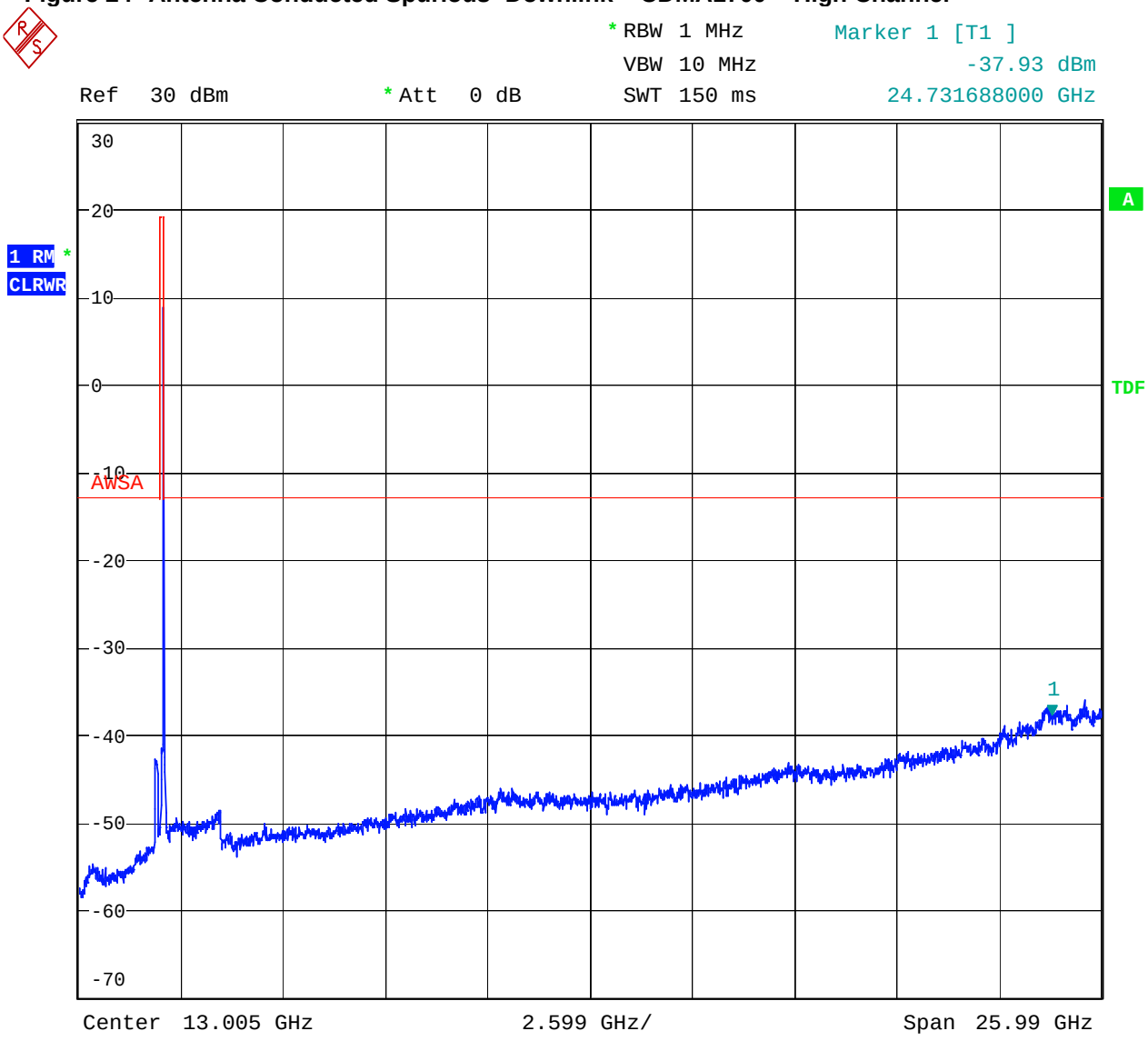
Date: 23.MAR.2007 21:16:55

Figure 23- Antenna Conducted Spurious- Downlink – CDMA1700 – Mid Channel



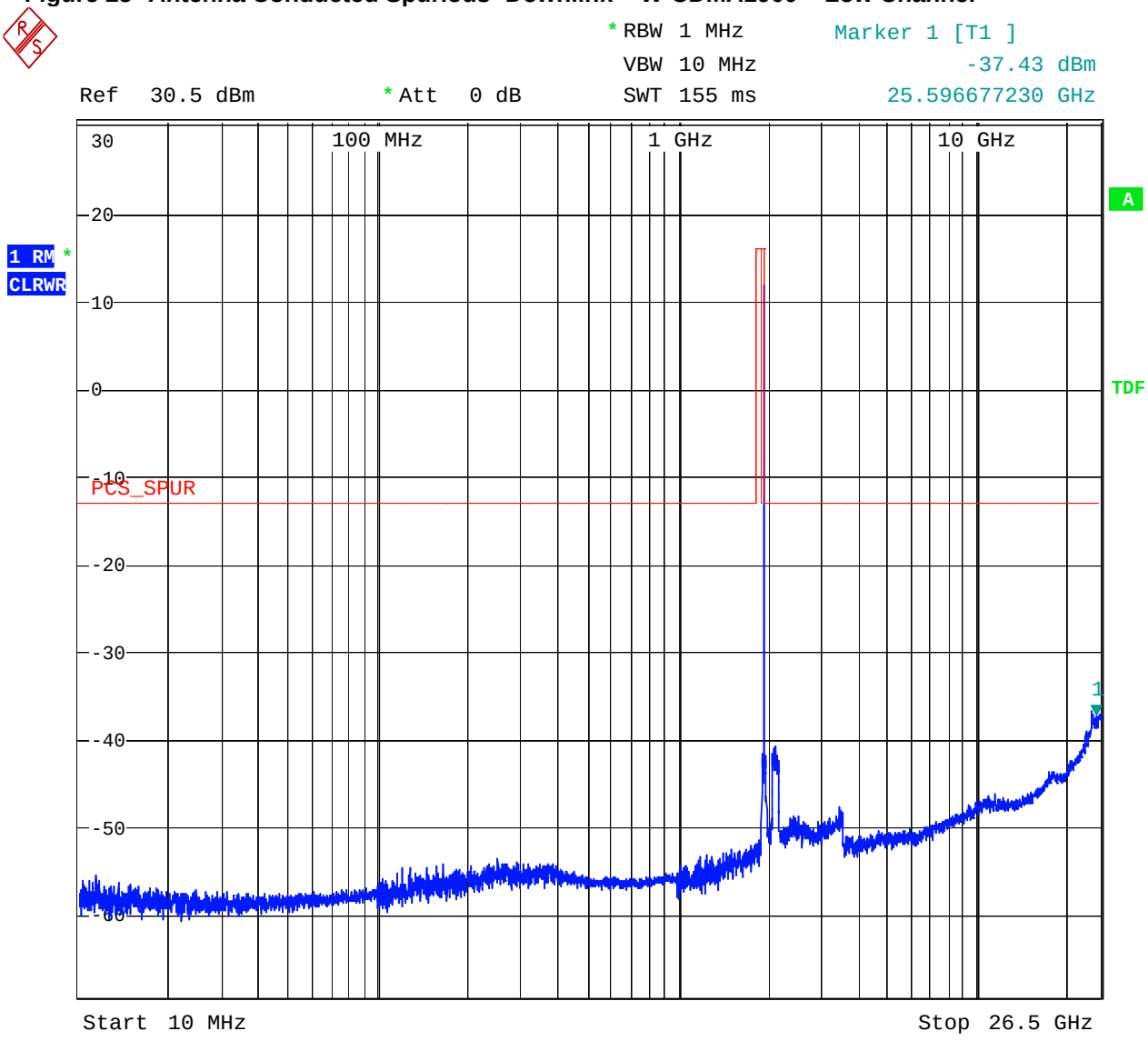
Date: 23.MAR.2007 21:16:26

Figure 24- Antenna Conducted Spurious- Downlink – CDMA1700 – High Channel



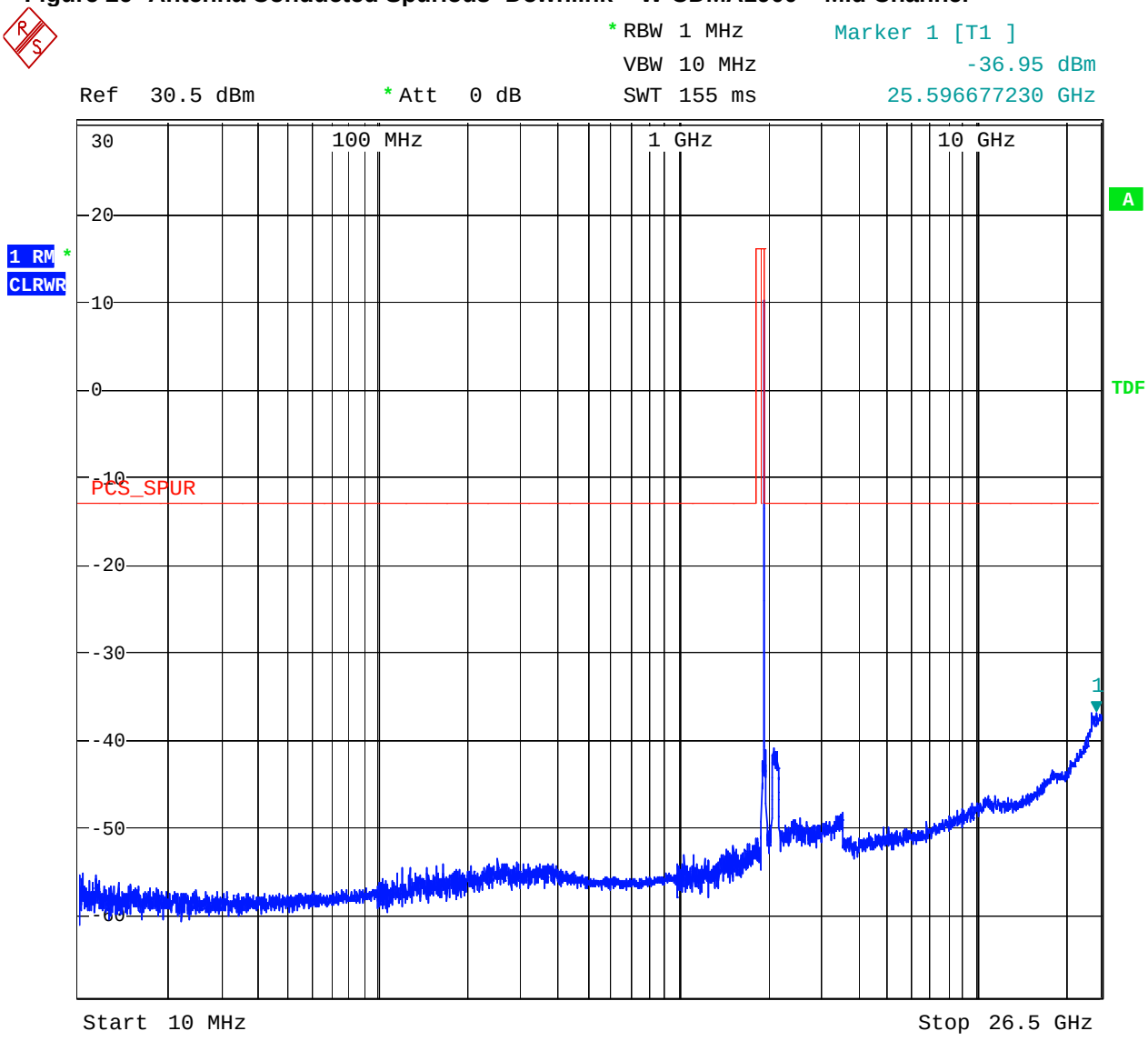
Date: 23.MAR.2007 21:15:48

Figure 25- Antenna Conducted Spurious- Downlink – W-CDMA1900 – Low Channel



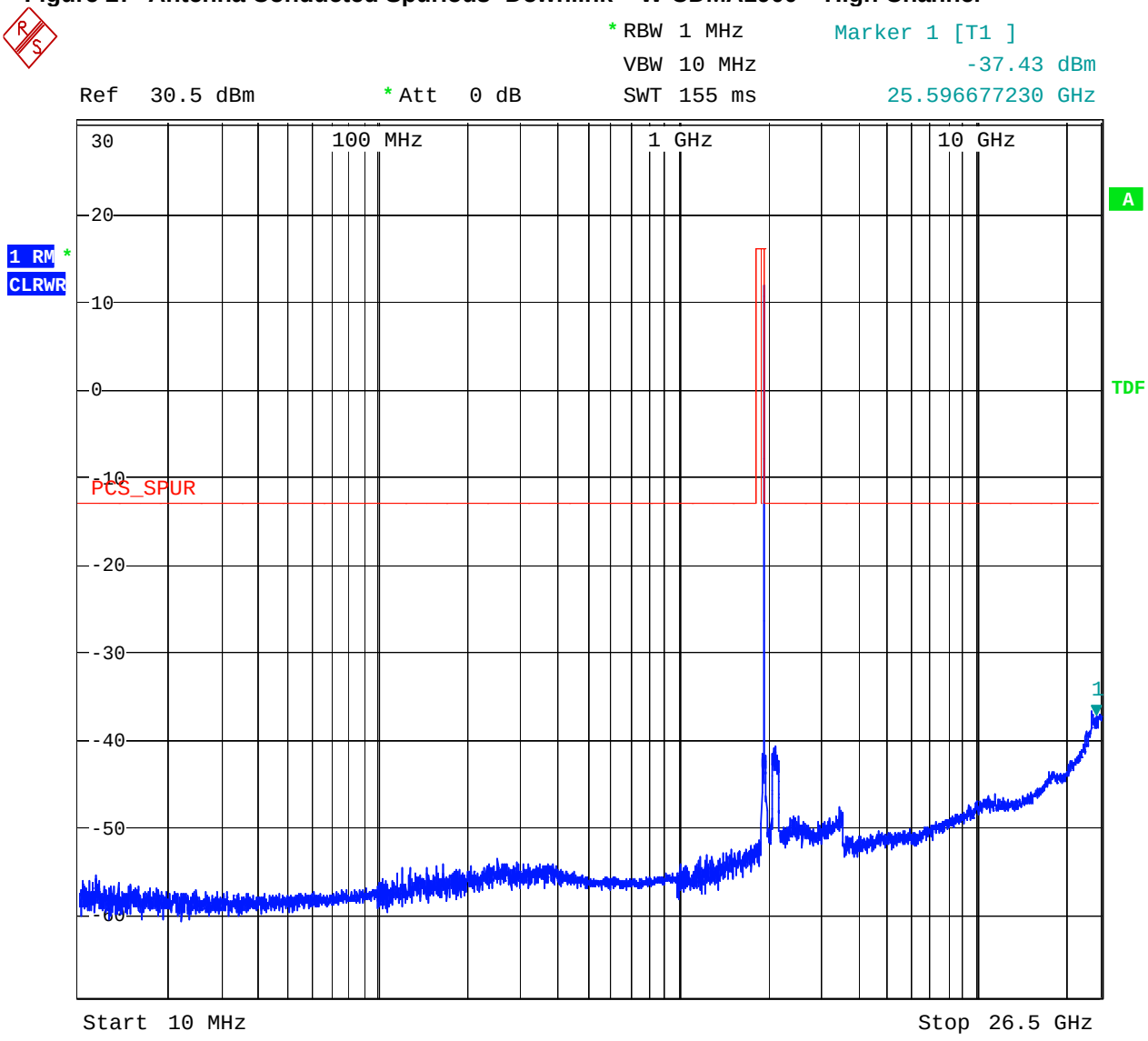
Date: 23.MAR.2007 19:27:46

Figure 26- Antenna Conducted Spurious- Downlink – W-CDMA1900 – Mid Channel



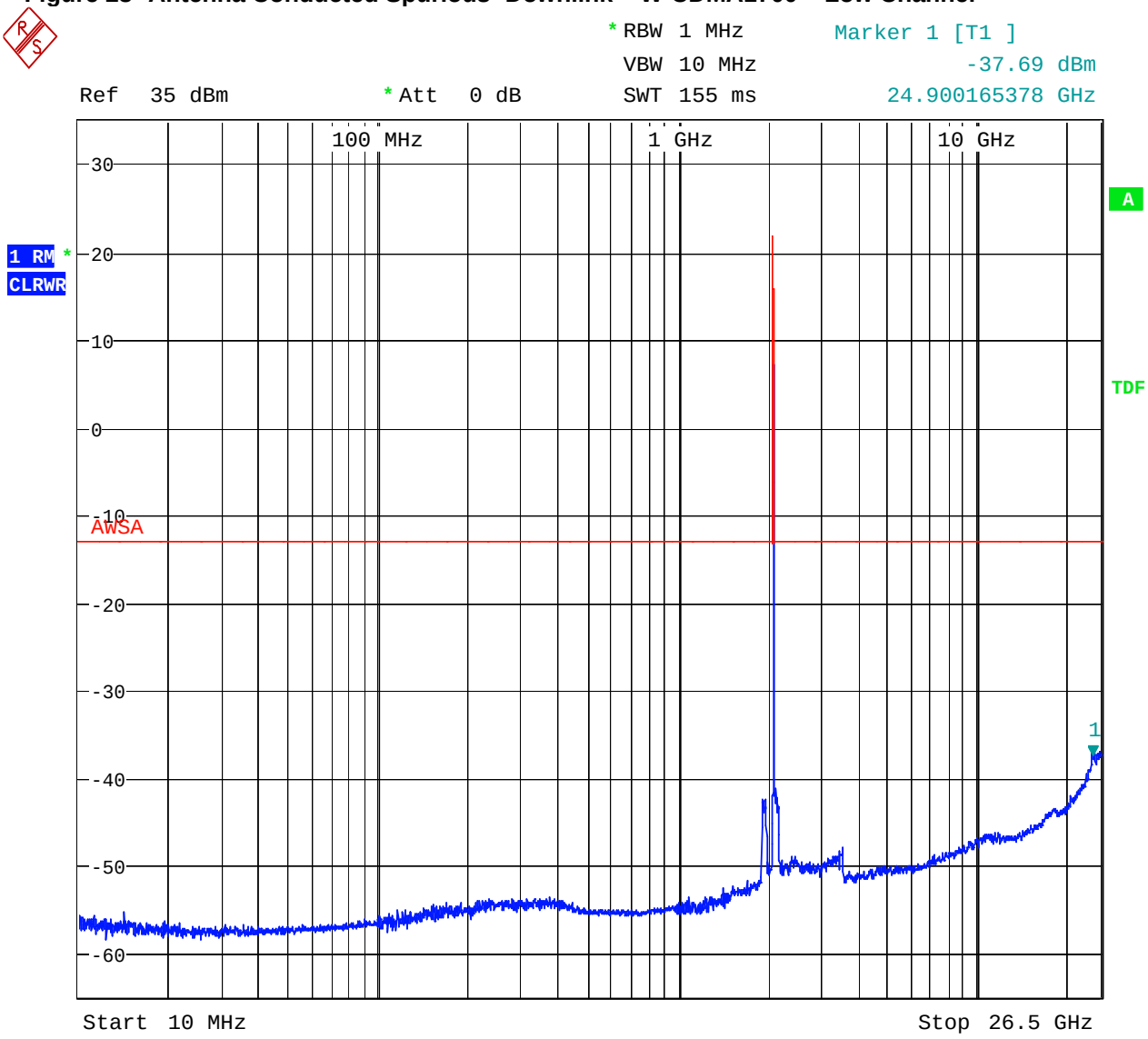
Date: 23.MAR.2007 19:27:08

Figure 27- Antenna Conducted Spurious- Downlink – W-CDMA1900 – High Channel



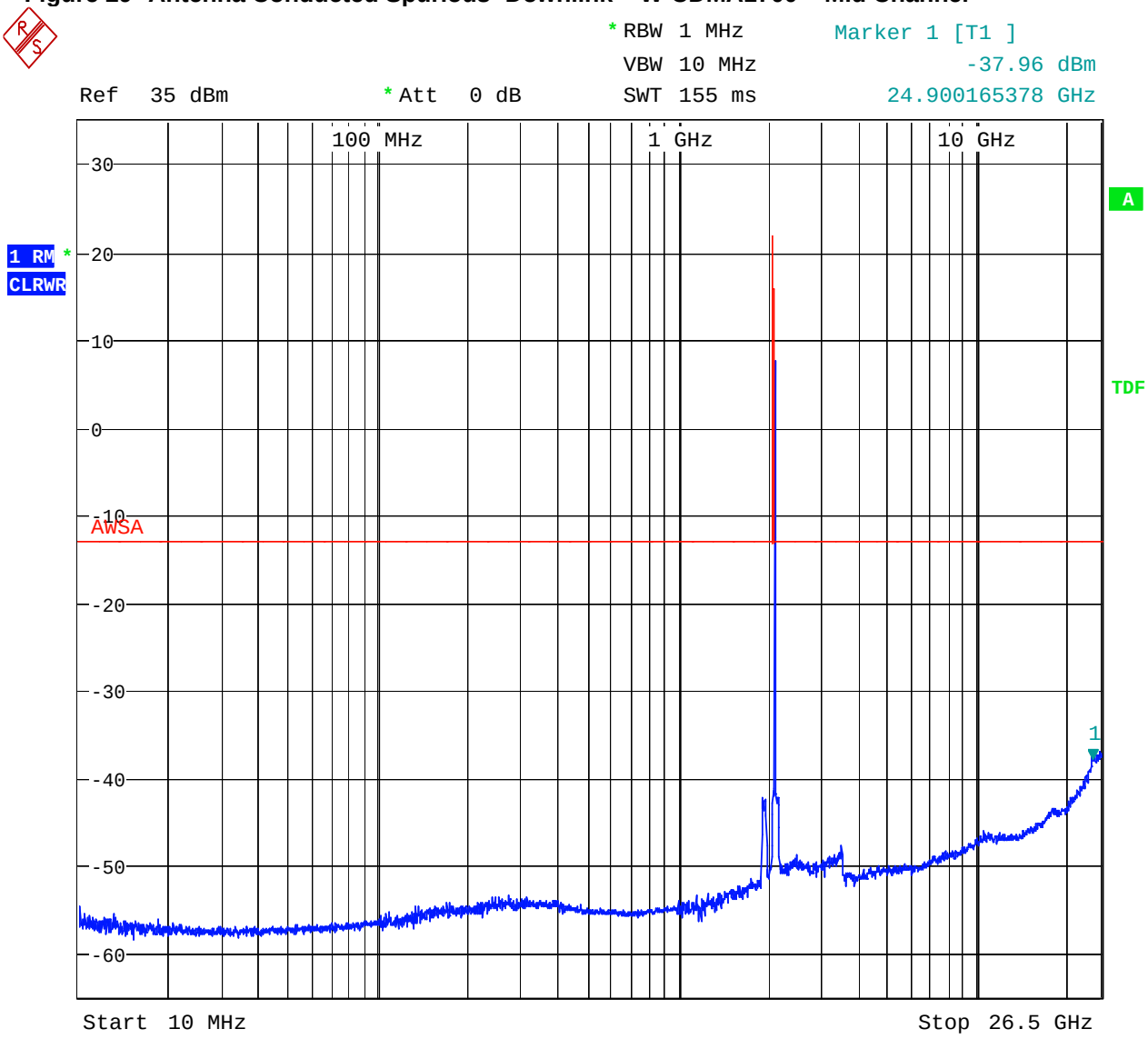
Date: 23.MAR.2007 19:28:49

Figure 28- Antenna Conducted Spurious- Downlink – W-CDMA1700 – Low Channel



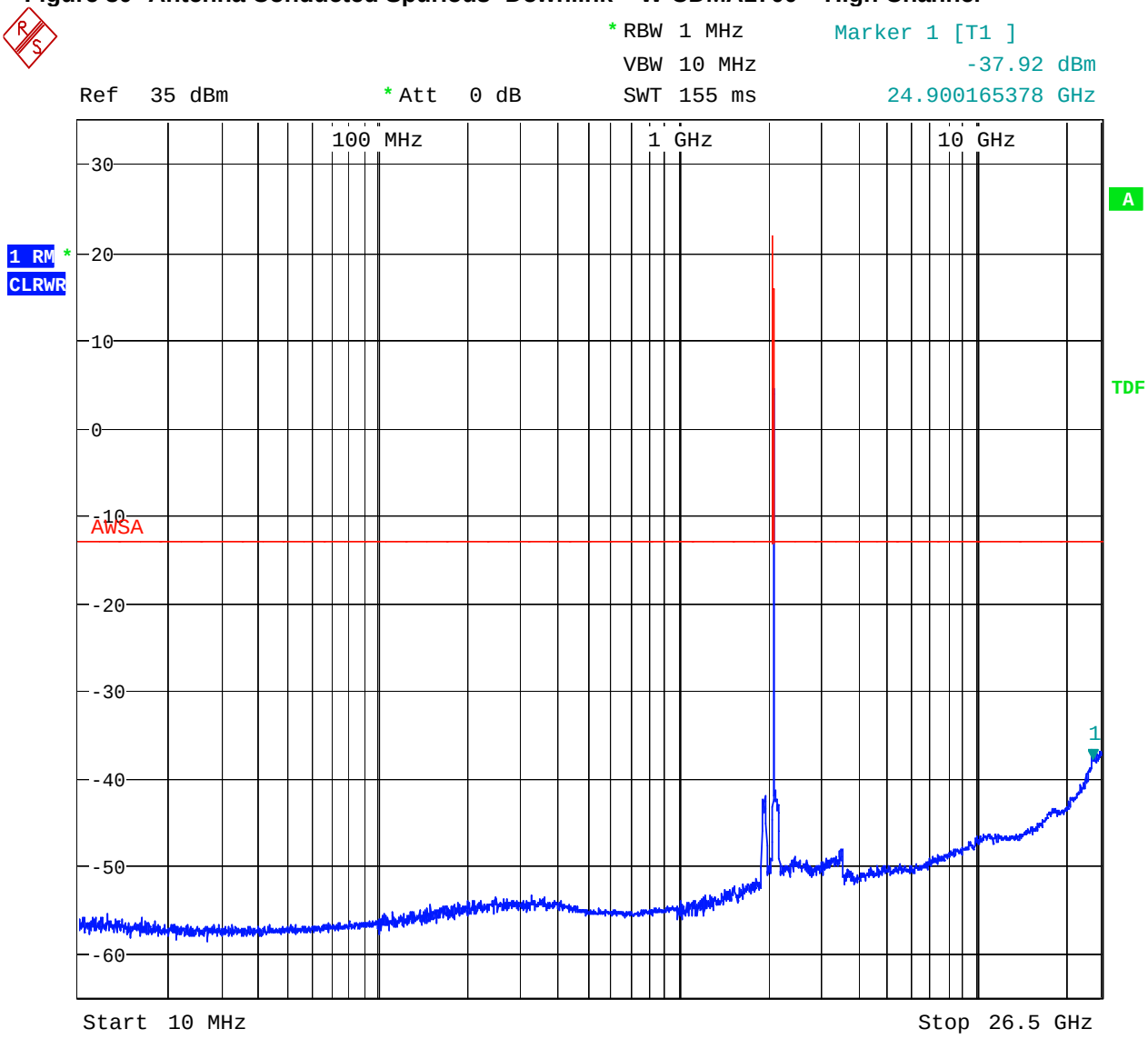
Date: 23.MAR.2007 20:04:54

Figure 29- Antenna Conducted Spurious- Downlink – W-CDMA1700 – Mid Channel



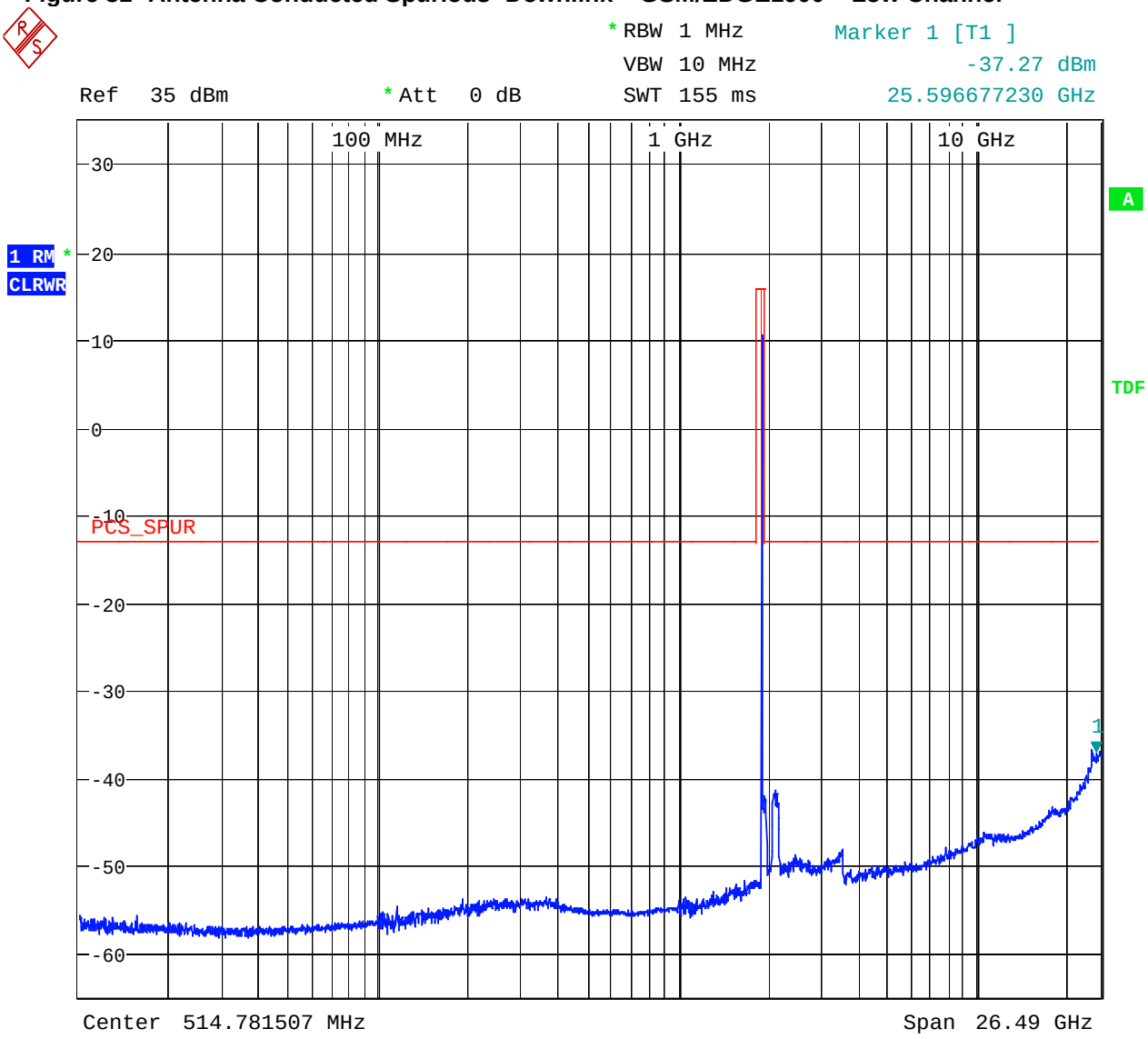
Date: 23.MAR.2007 20:05:32

Figure 30- Antenna Conducted Spurious- Downlink – W-CDMA1700 – High Channel



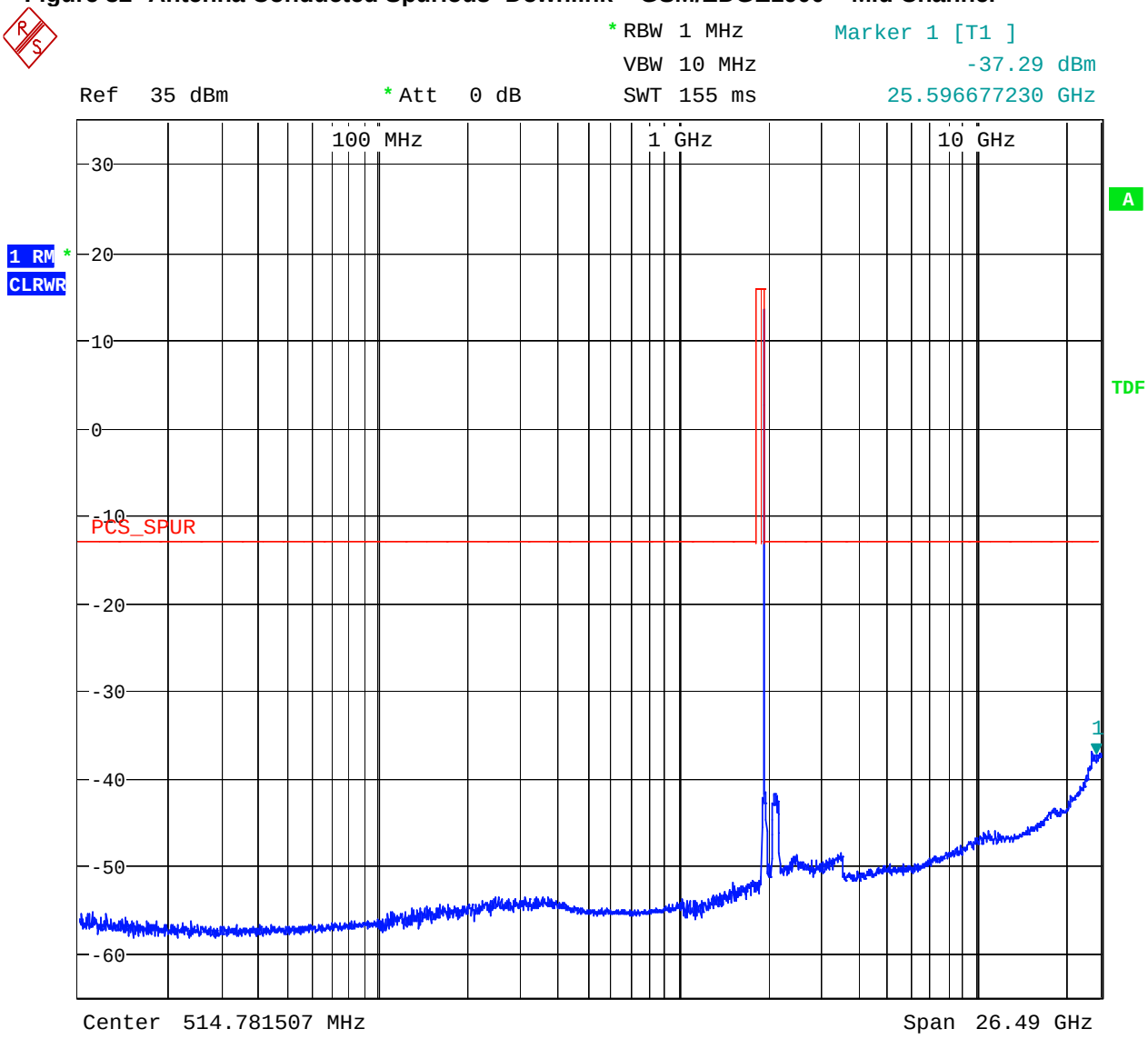
Date: 23.MAR.2007 20:04:12

Figure 31- Antenna Conducted Spurious- Downlink – GSM/EDGE1900 – Low Channel



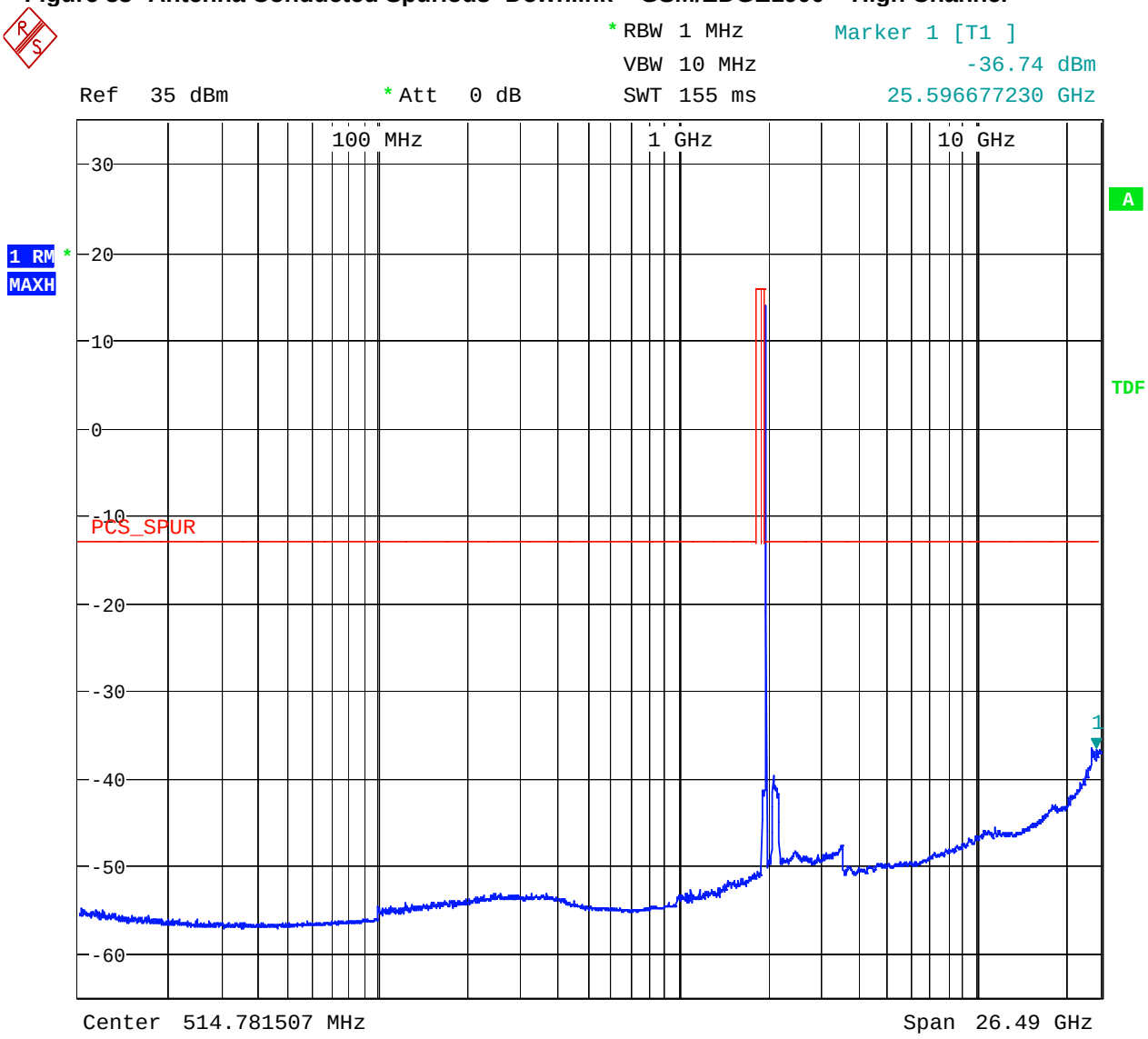
Date: 23.MAR.2007 20:47:00

Figure 32- Antenna Conducted Spurious- Downlink – GSM/EDGE1900 – Mid Channel



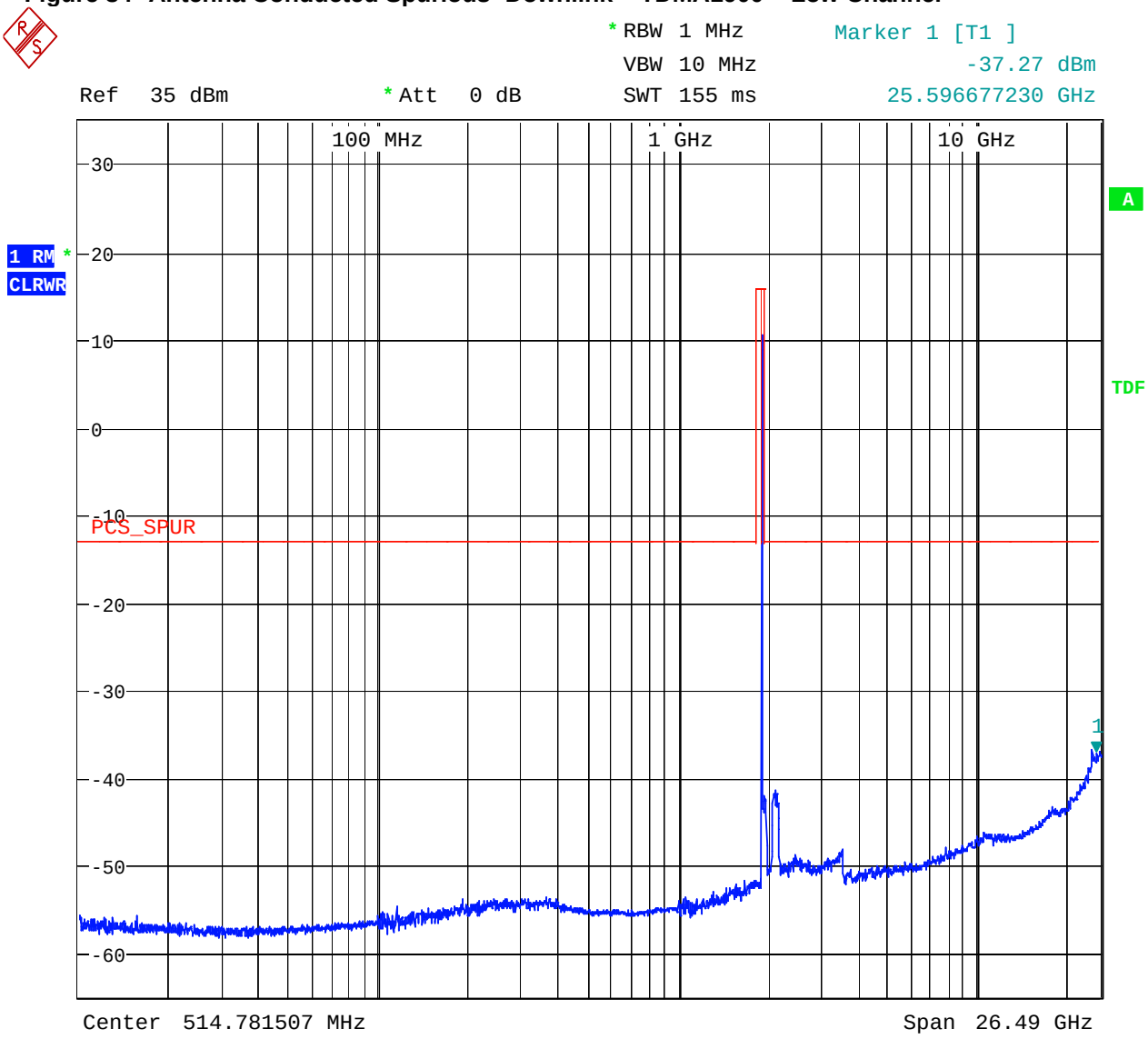
Date: 23.MAR.2007 20:46:35

Figure 33- Antenna Conducted Spurious- Downlink – GSM/EDGE1900 – High Channel



Date: 23.MAR.2007 20:46:04

Figure 34- Antenna Conducted Spurious- Downlink – TDMA1900 – Low Channel



Date: 23.MAR.2007 20:47:00

Figure 35- Antenna Conducted Spurious- Downlink – TDMA1900 – Mid Channel

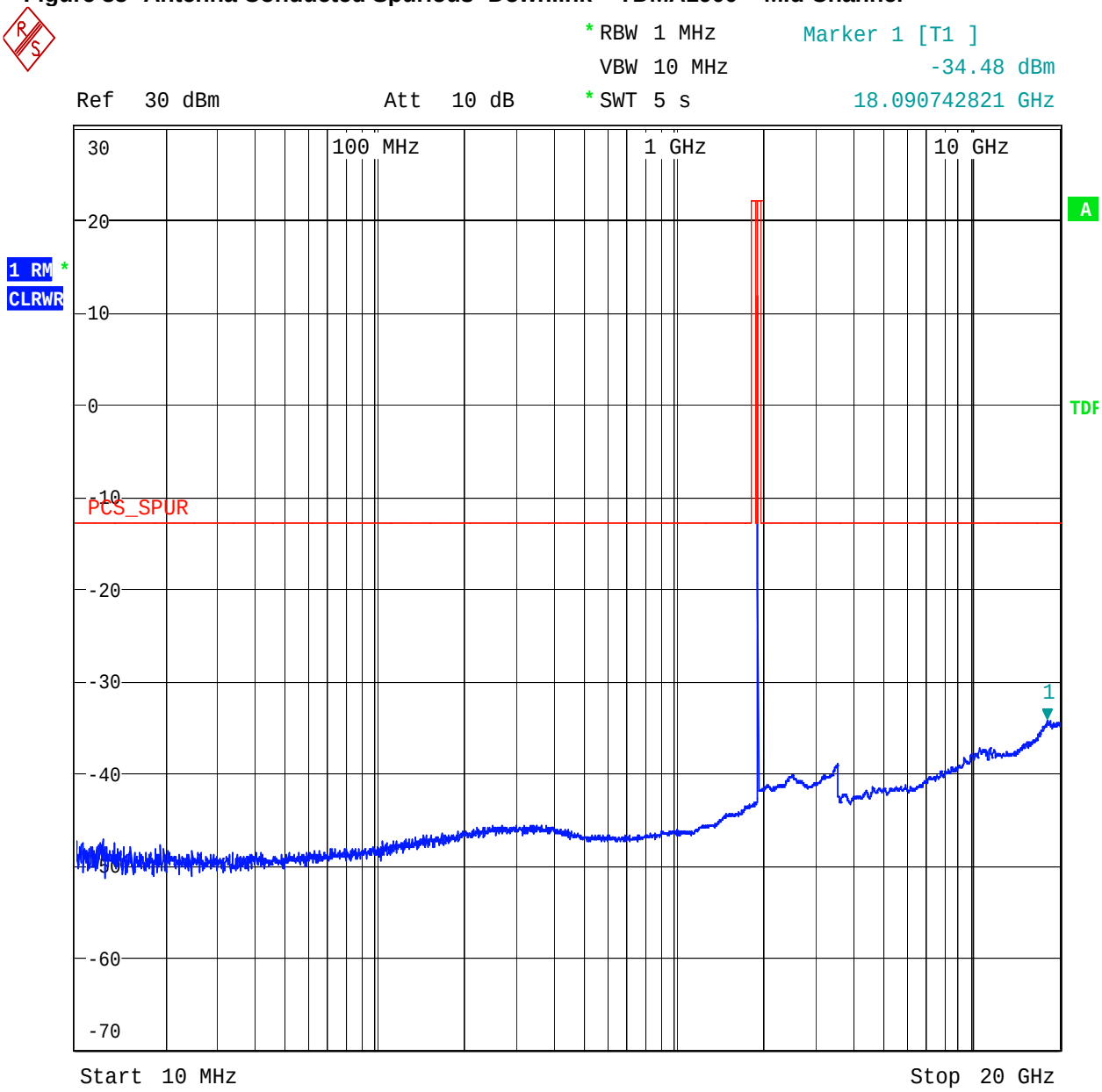


Figure 36- Antenna Conducted Spurious- Downlink – TDMA1900 – High Channel

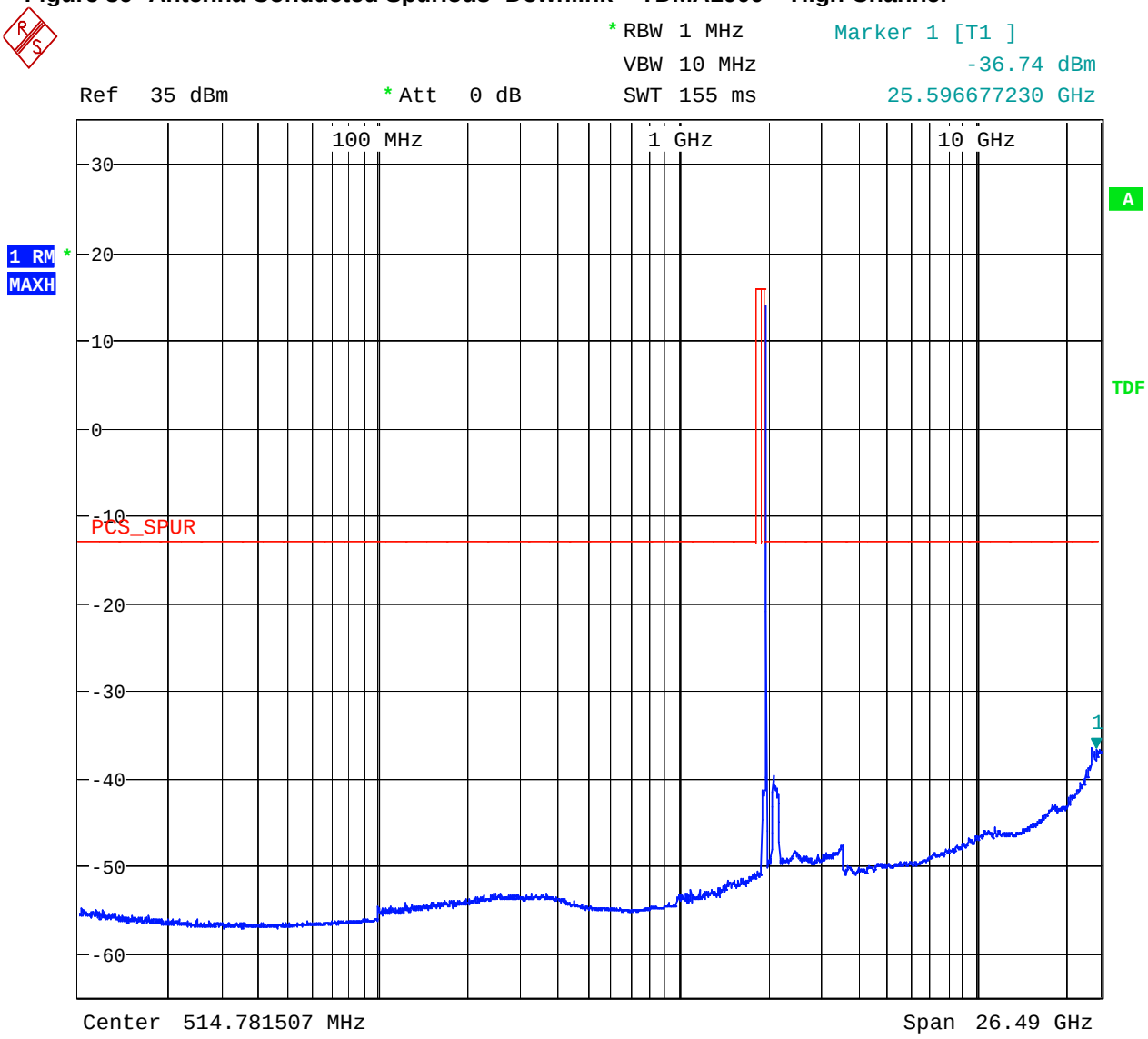
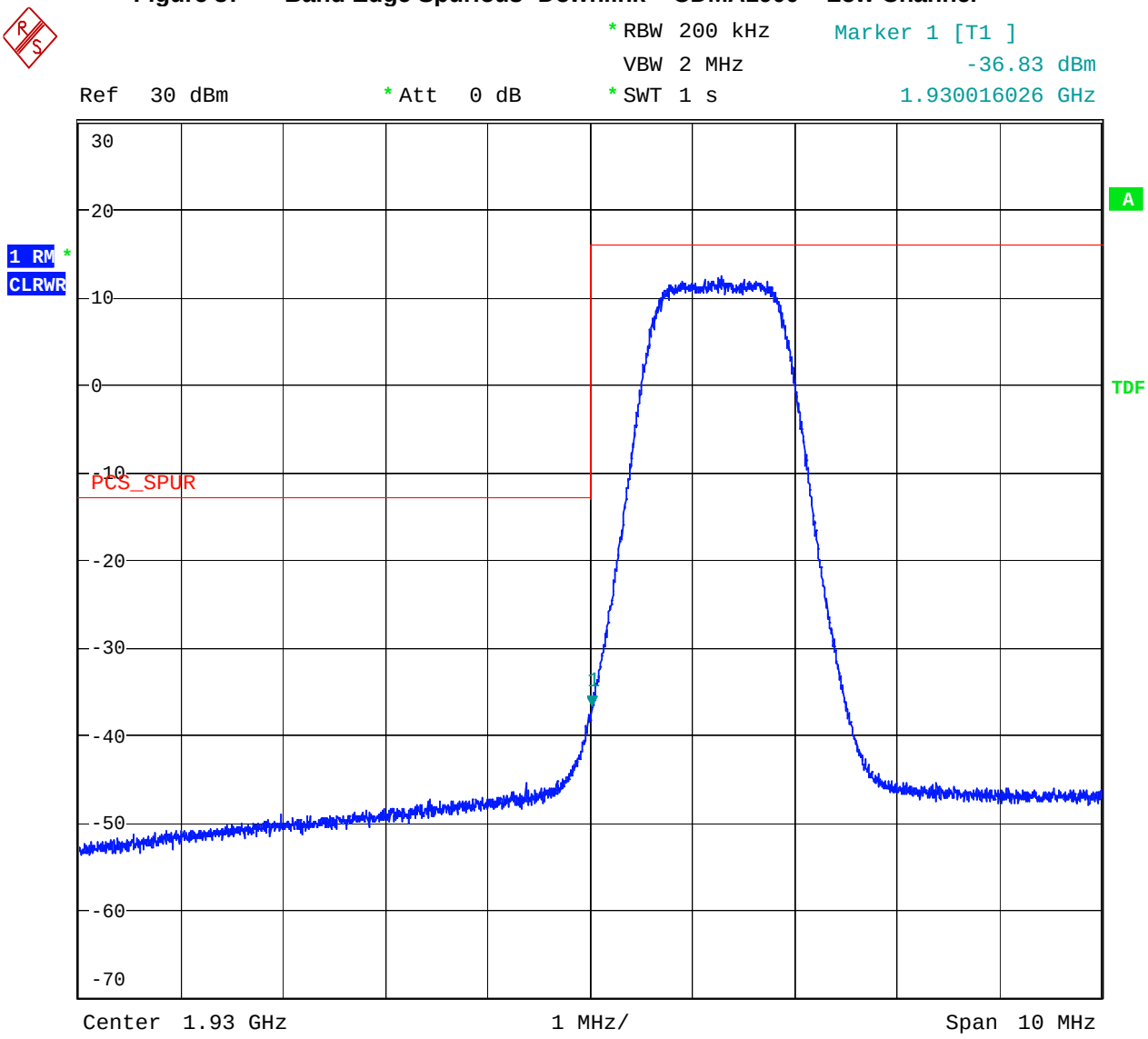
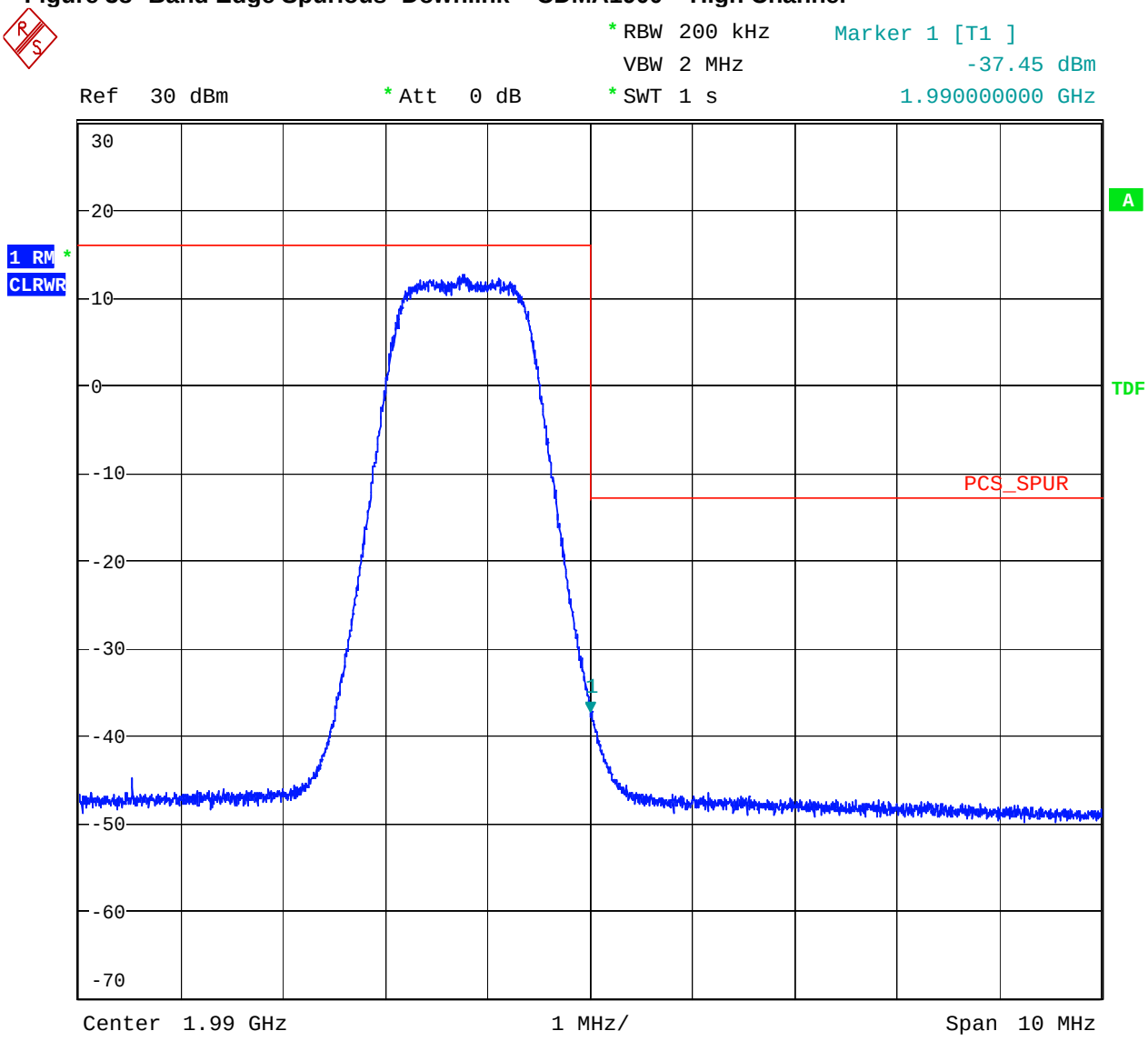


Figure 37 – Band Edge Spurious- Downlink – CDMA1900 – Low Channel



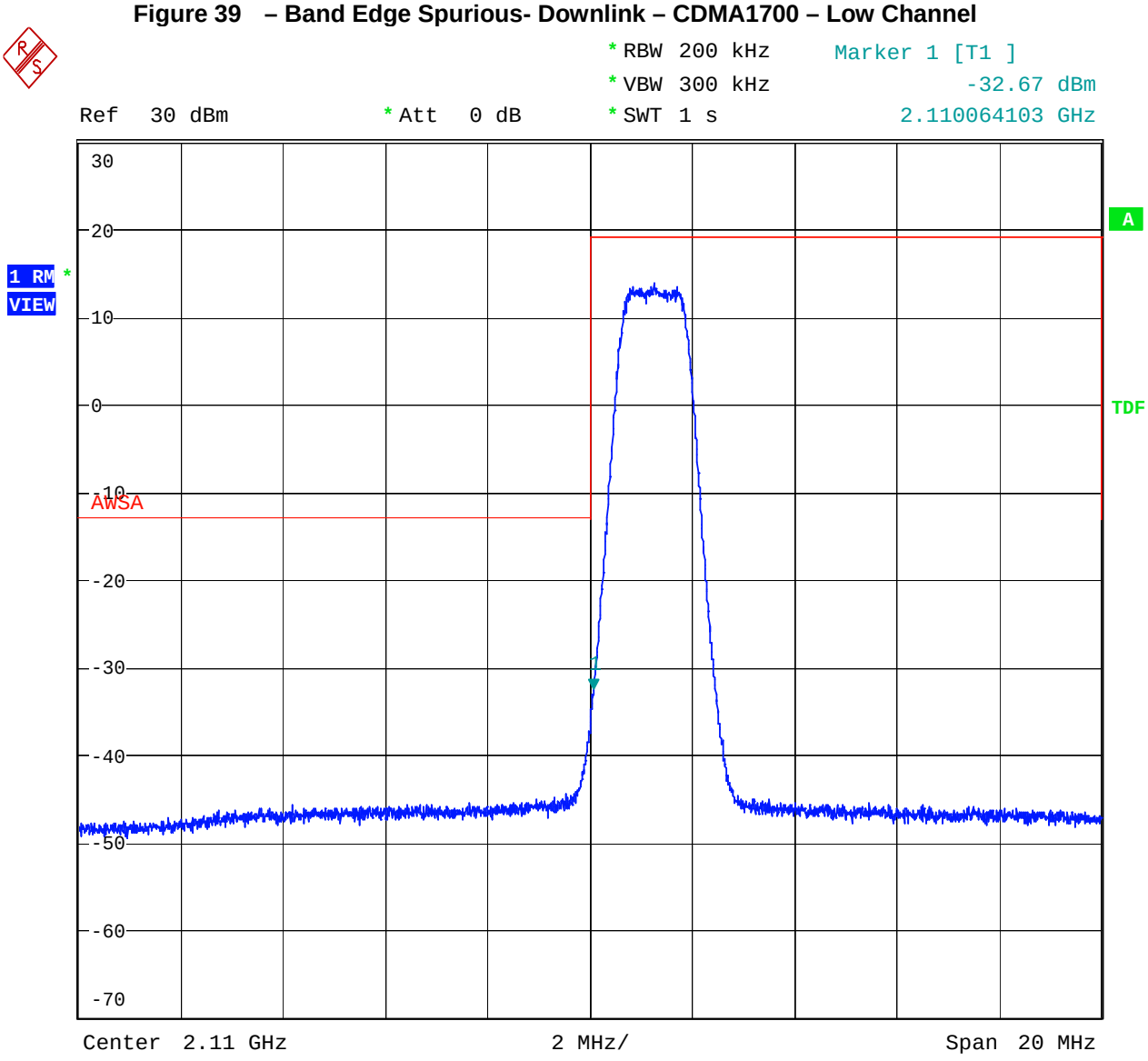
Date: 23.MAR.2007 21:22:15

Figure 38- Band Edge Spurious- Downlink – CDMA1900 – High Channel



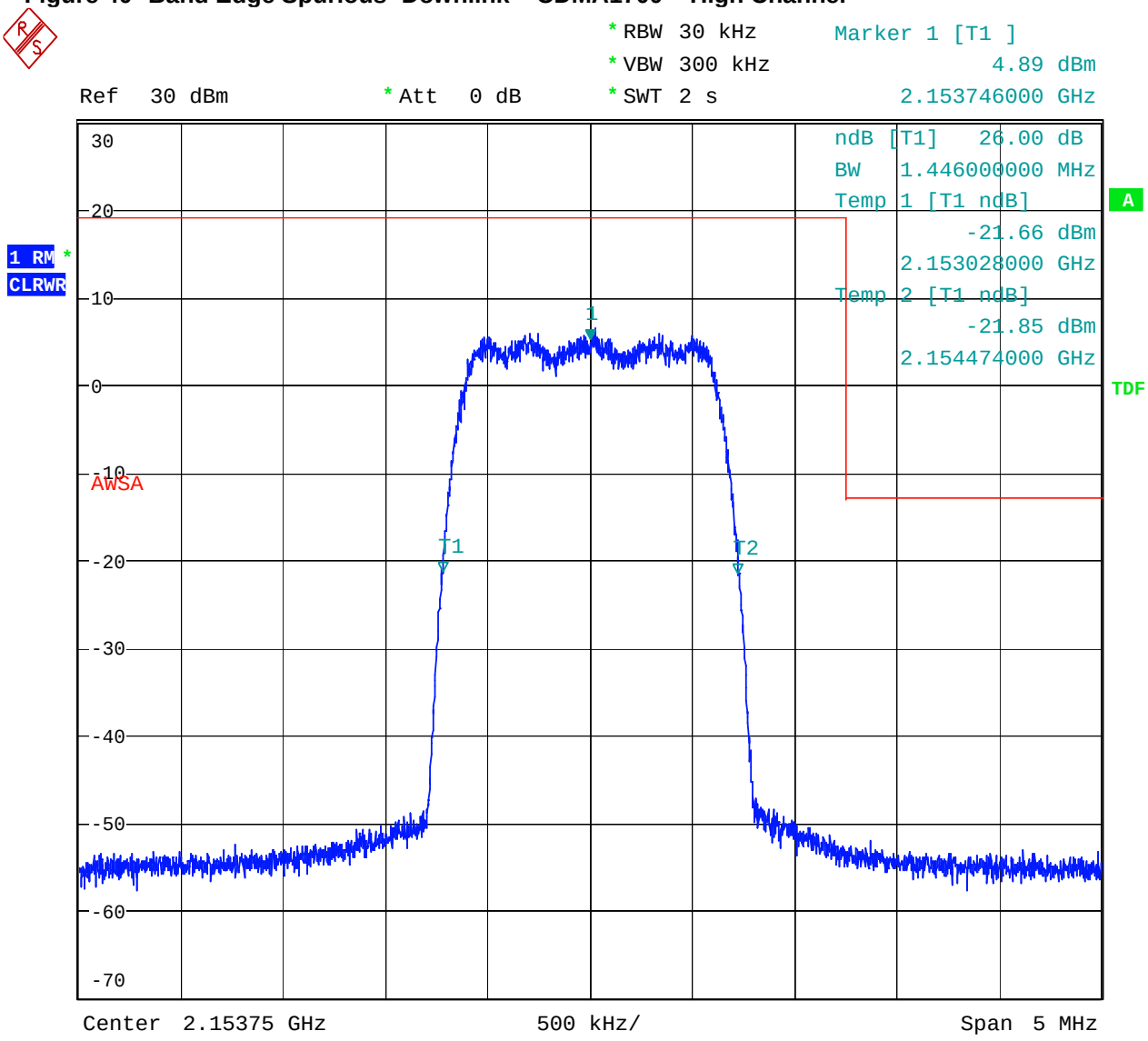
Date: 23.MAR.2007 21:21:25

Figure 39 – Band Edge Spurious- Downlink – CDMA1700 – Low Channel



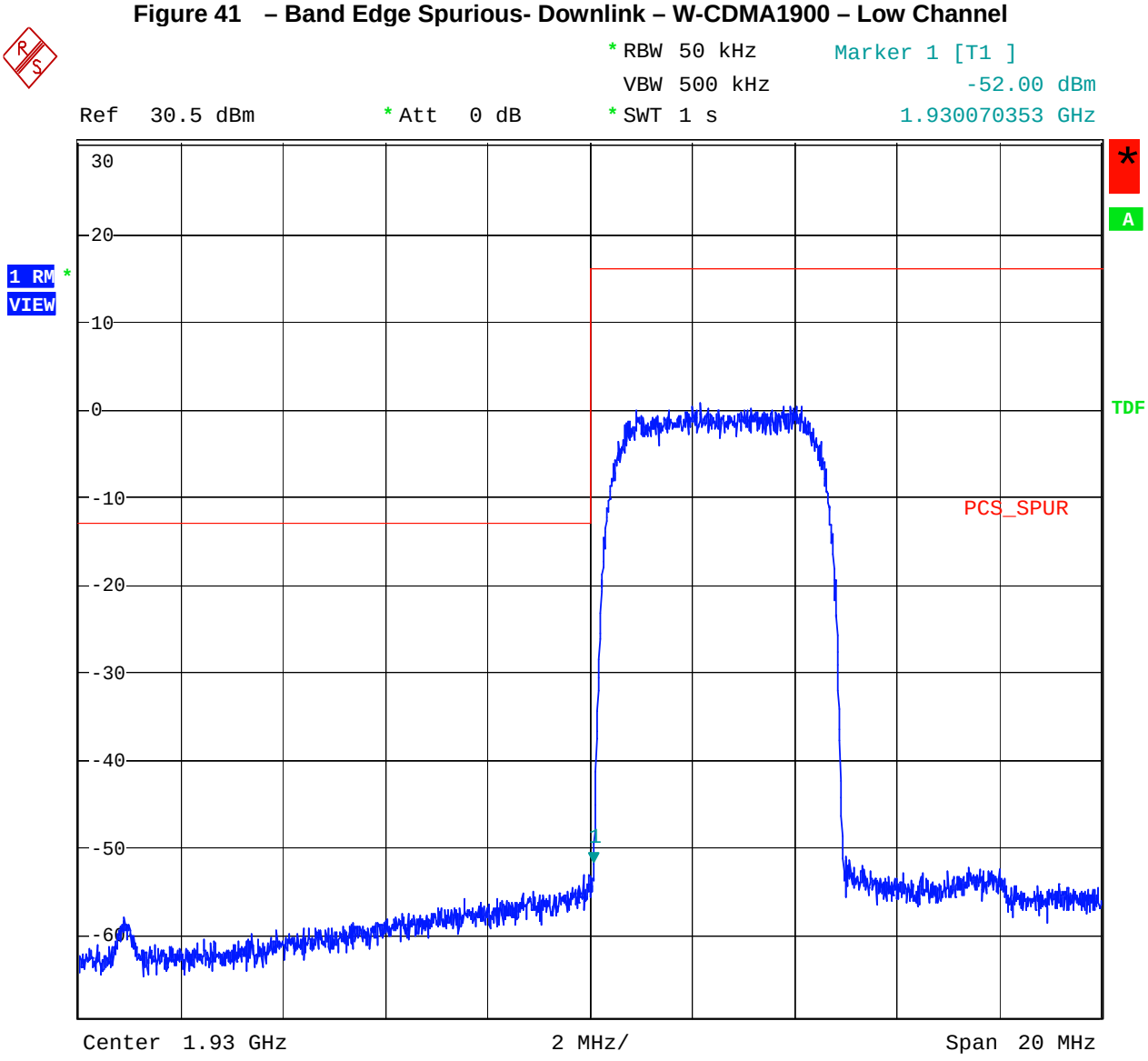
Date: 23.MAR.2007 21:07:38

Figure 40- Band Edge Spurious- Downlink – CDMA1700 – High Channel



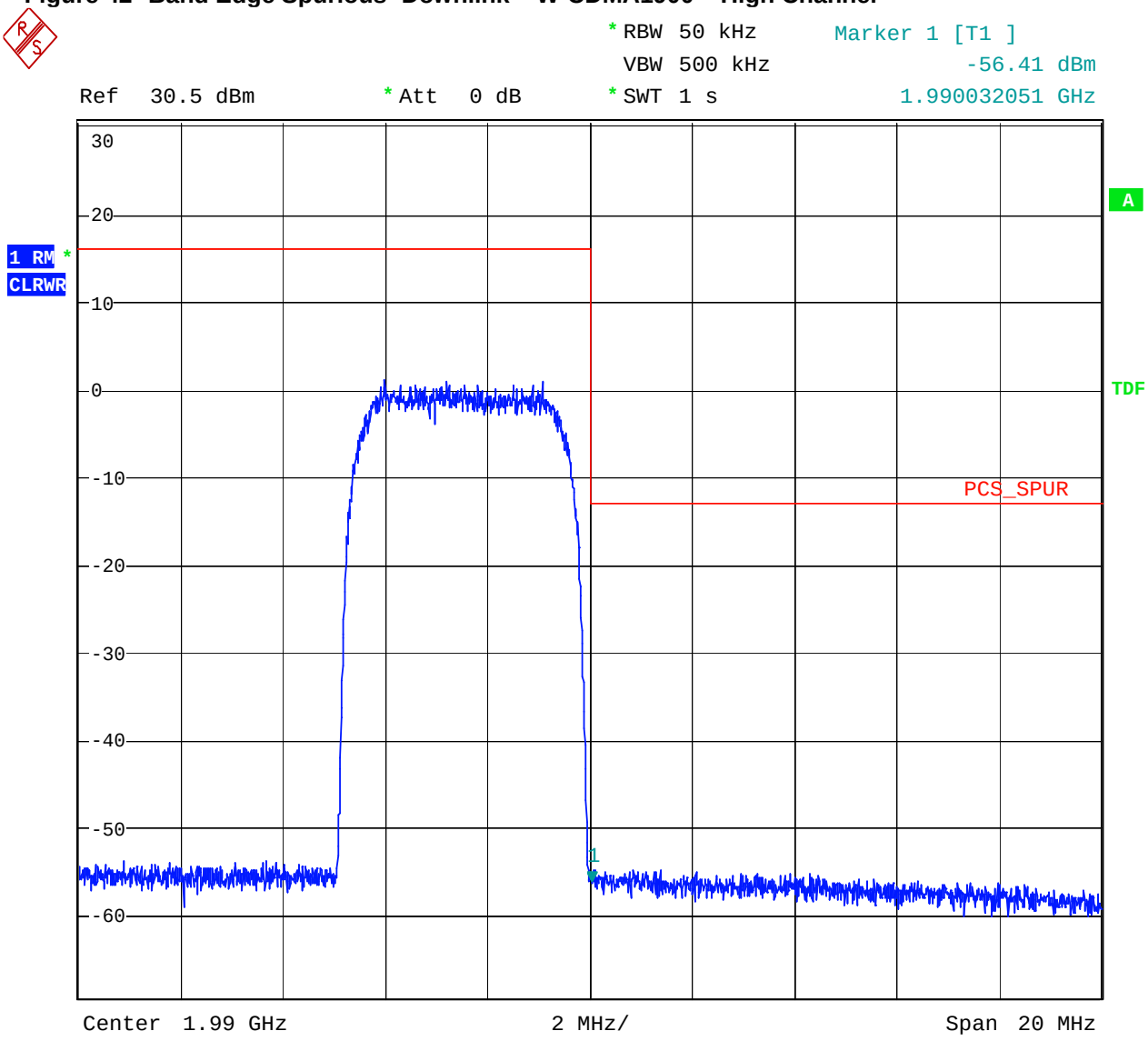
Date: 23.MAR.2007 21:13:10

Figure 41 – Band Edge Spurious- Downlink – W-CDMA1900 – Low Channel



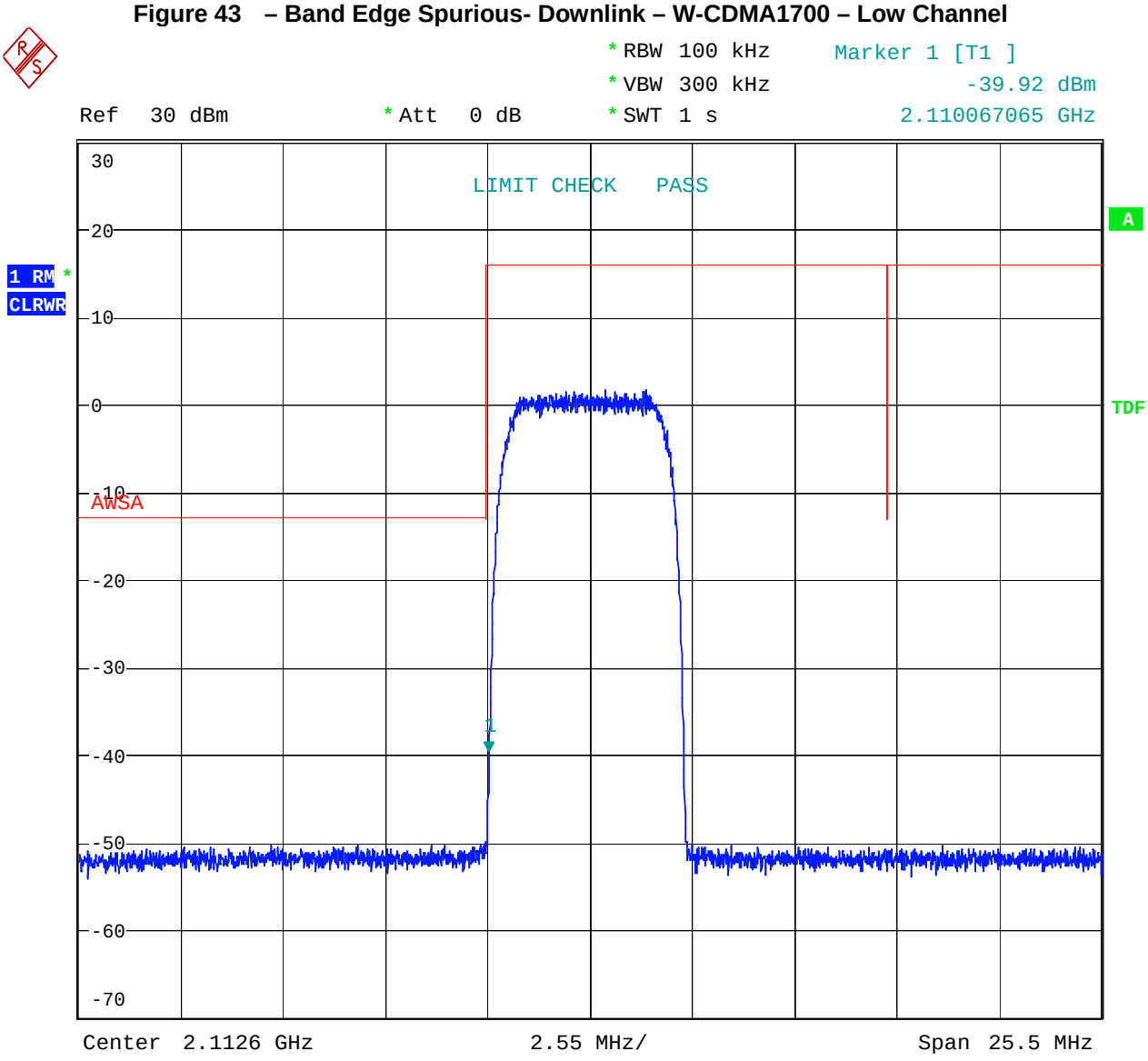
Date: 23.MAR.2007 19:19:11

Figure 42- Band Edge Spurious- Downlink – W-CDMA1900 – High Channel



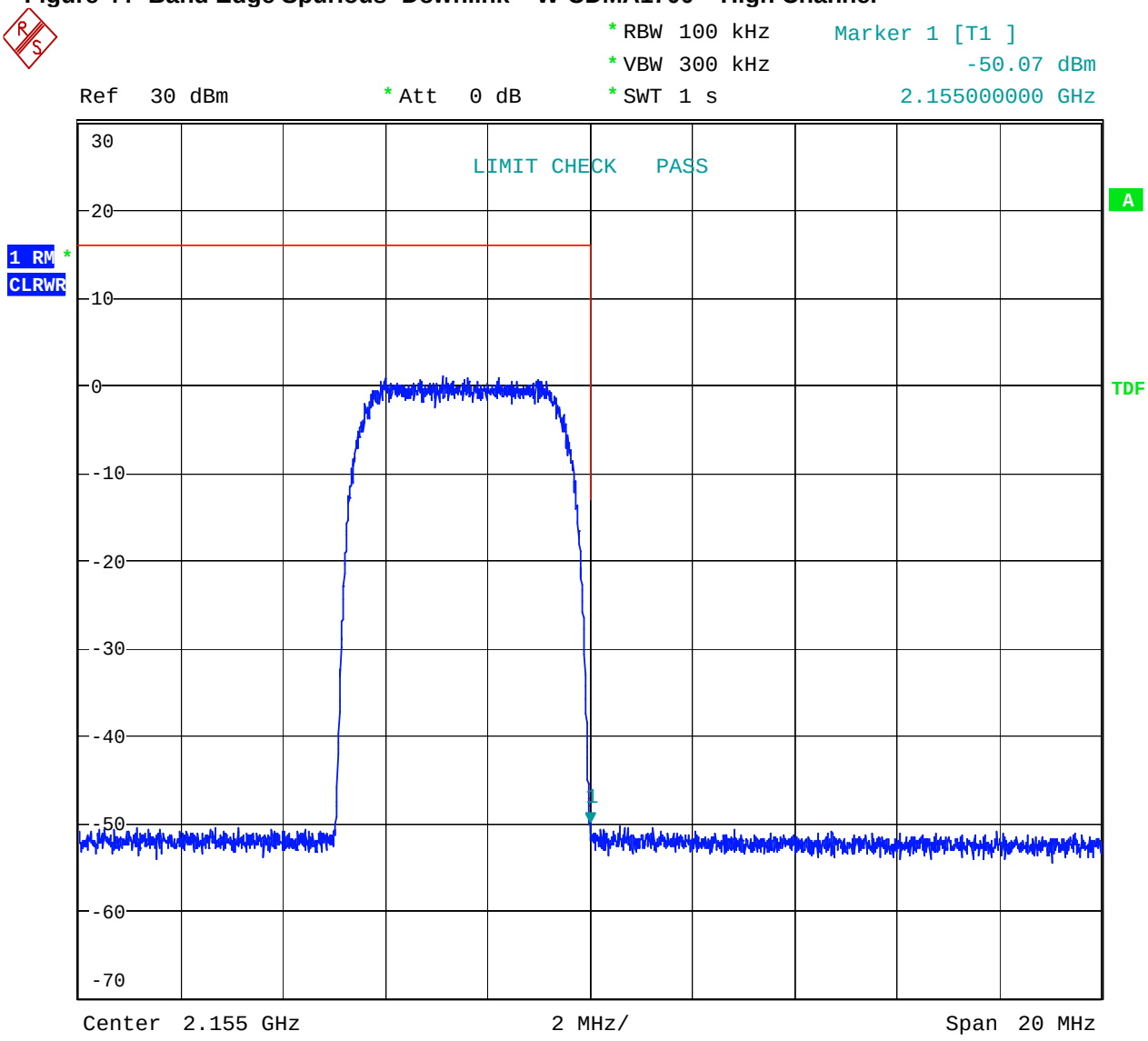
Date: 23.MAR.2007 19:20:40

Figure 43 – Band Edge Spurious- Downlink – W-CDMA1700 – Low Channel



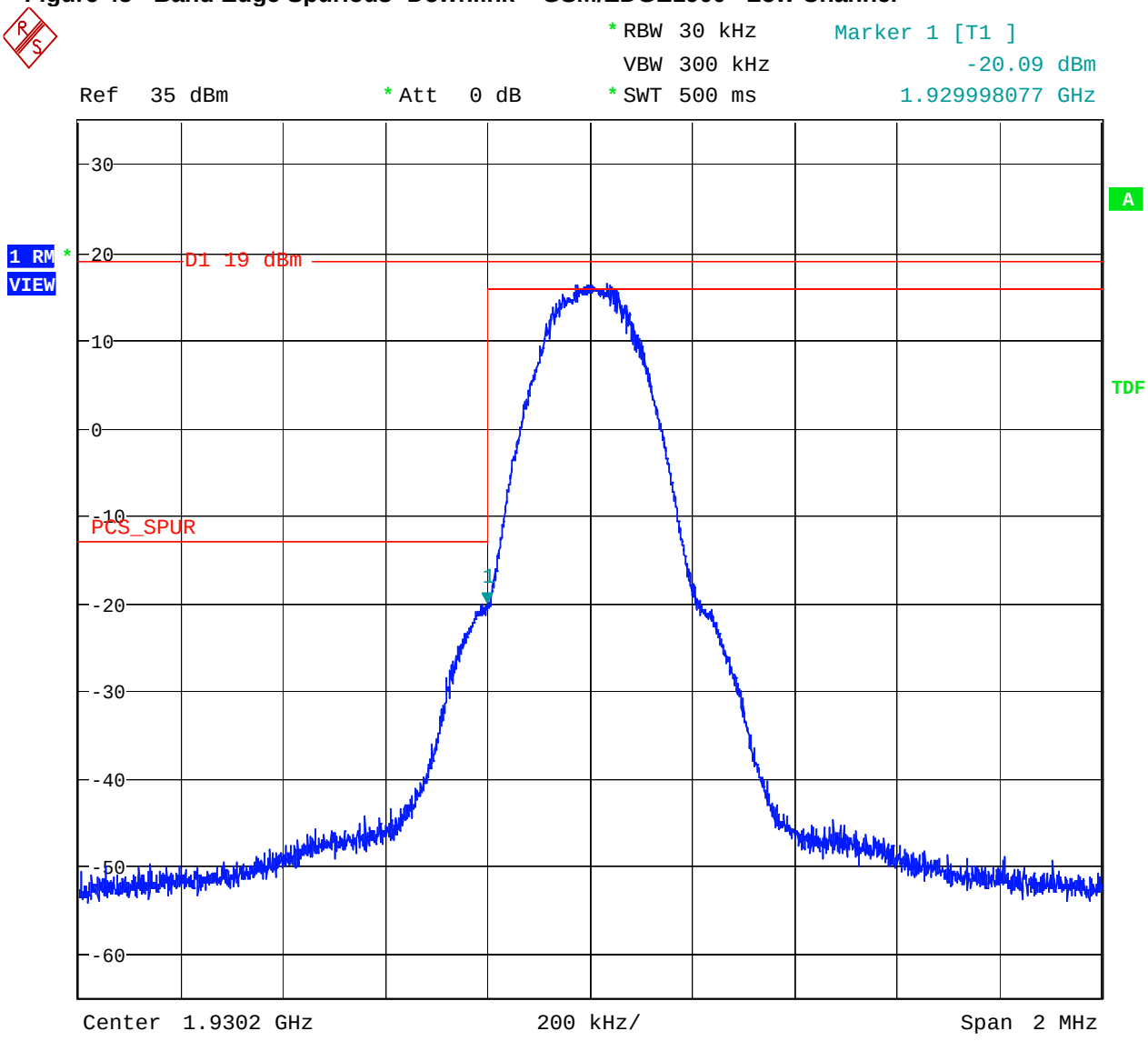
Date: 23.MAR.2007 19:41:22

Figure 44- Band Edge Spurious- Downlink – W-CDMA1700 – High Channel



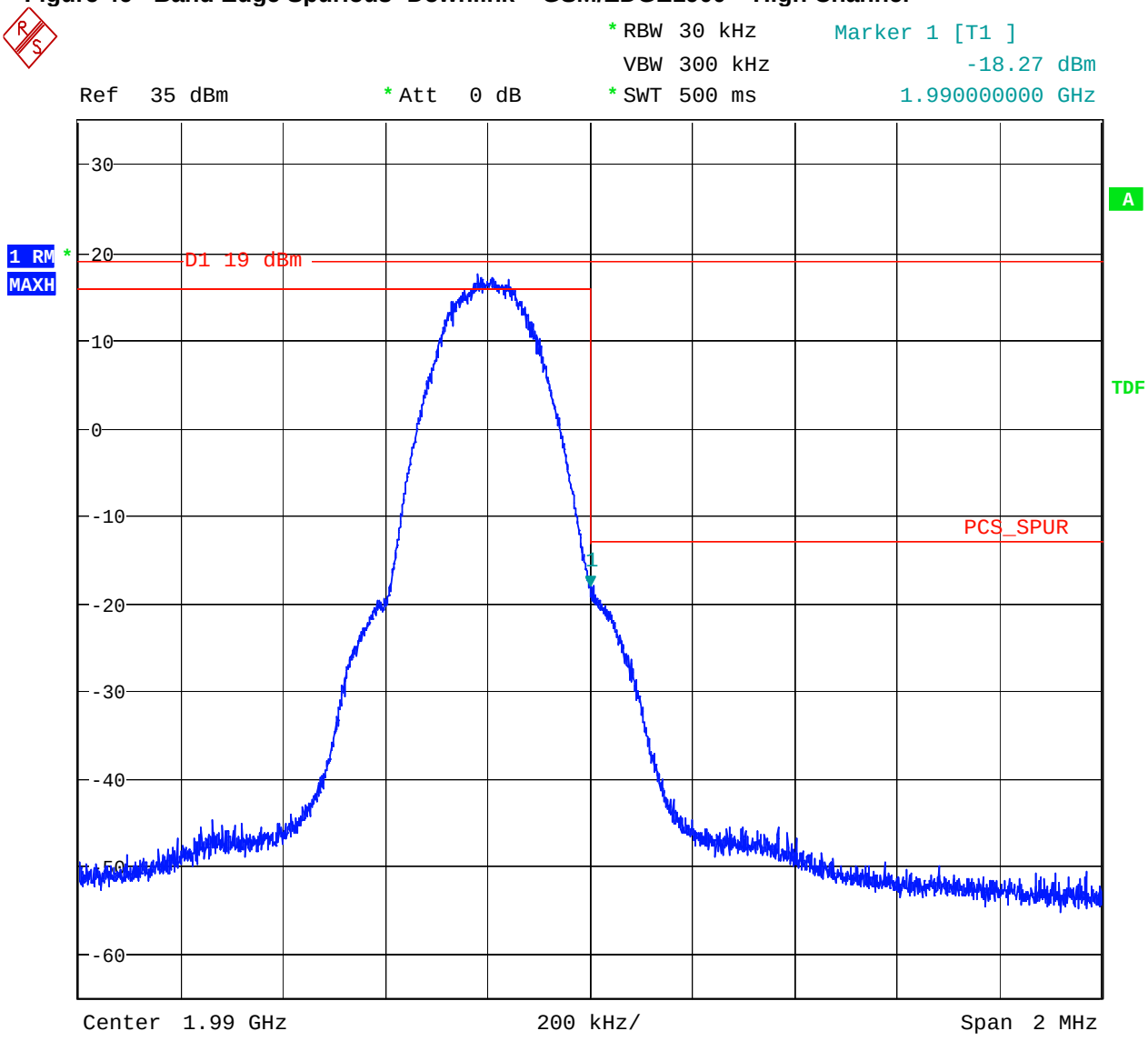
Date: 23.MAR.2007 19:43:05

Figure 45– Band Edge Spurious- Downlink – GSM/EDGE1900 –Low Channel



Date: 23.MAR.2007 20:37:02

Figure 46– Band Edge Spurious- Downlink – GSM/EDGE1900 – High Channel



Date: 23.MAR.2007 20:39:13

Figure 47– Band Edge Spurious- Downlink – TDMA1900 –Low Channel

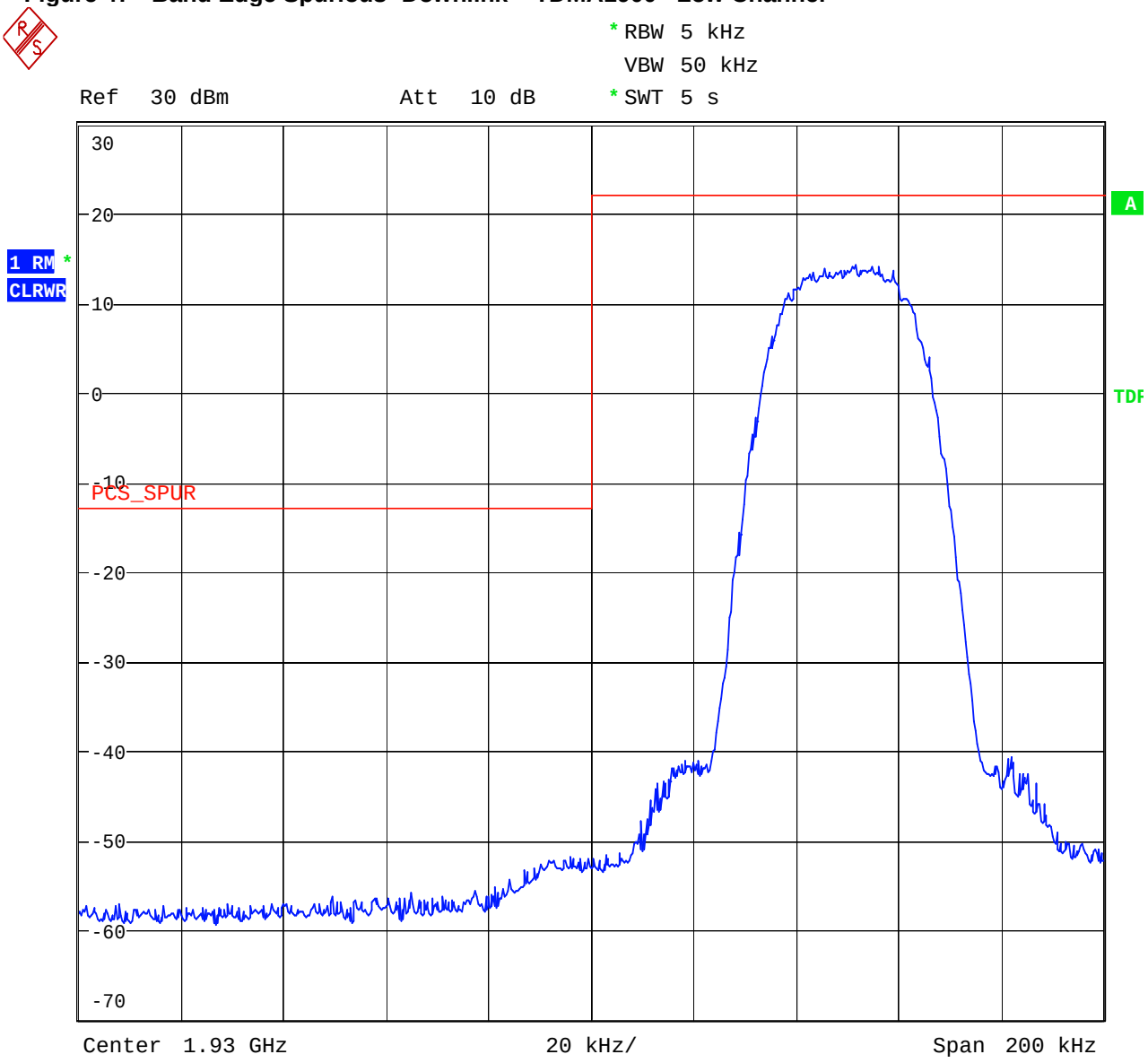


Figure 48– Band Edge Spurious- Downlink – TDMA1900 – High Channel

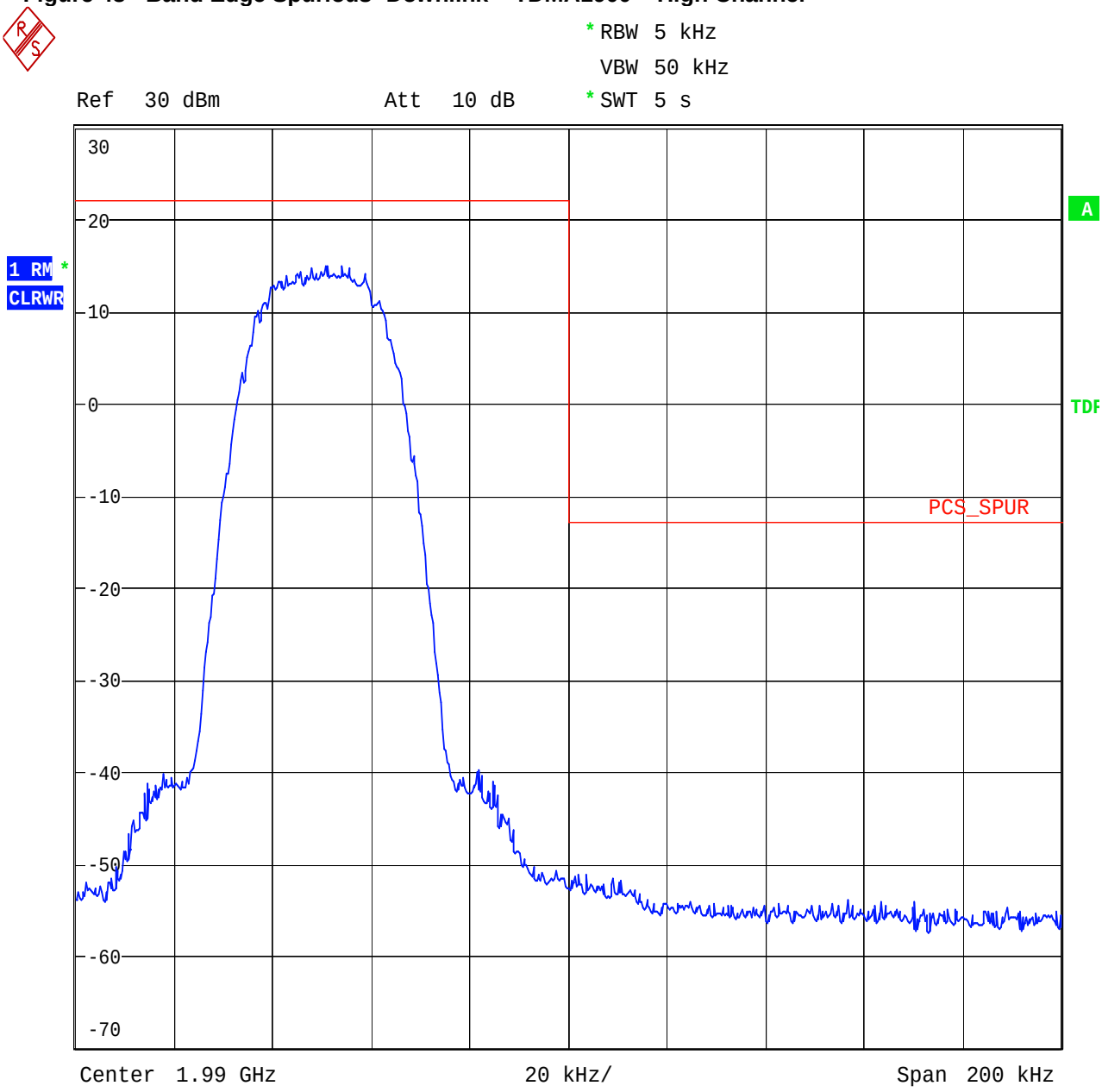
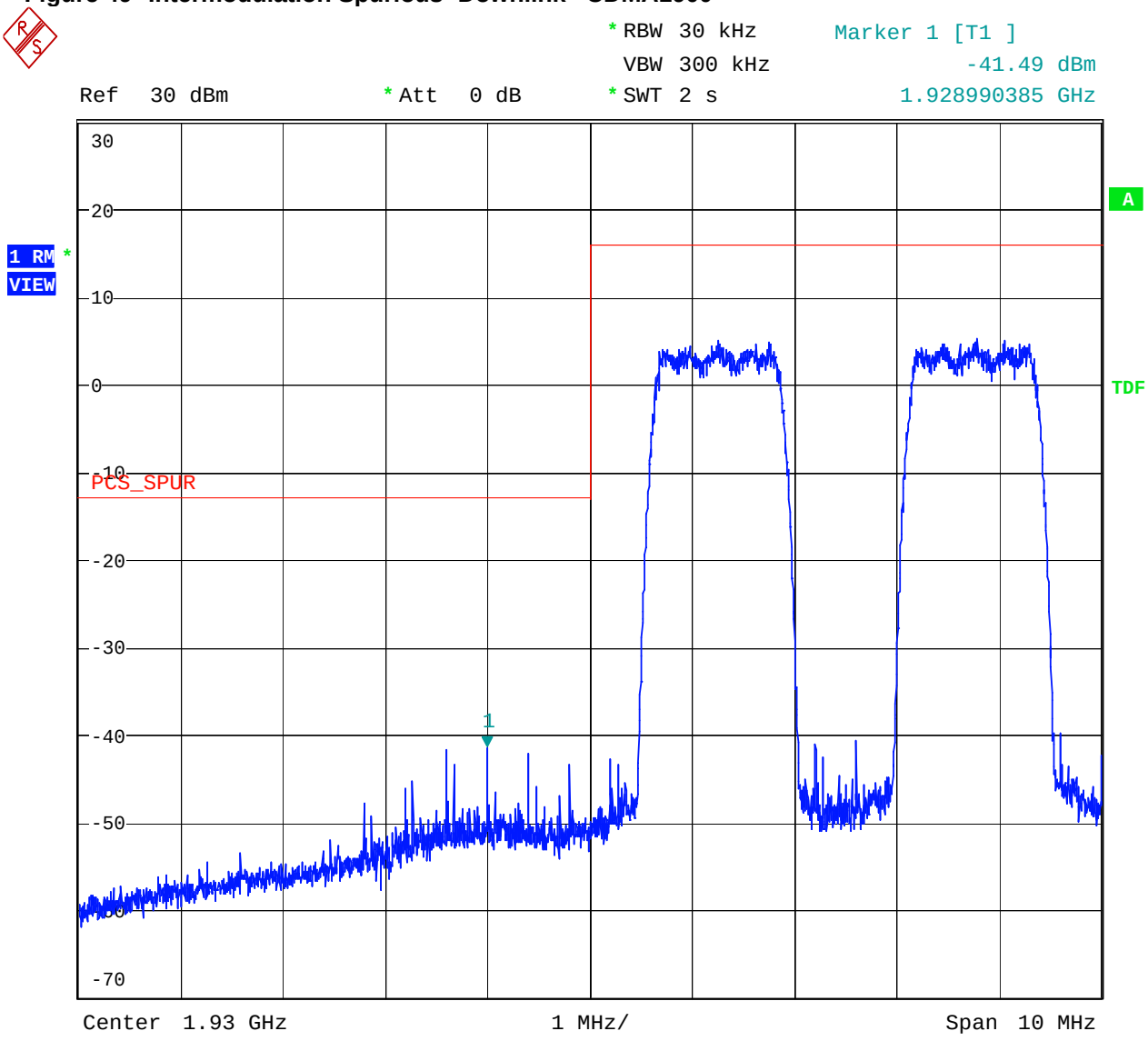


Figure 49- Intermodulation Spurious- Downlink –CDMA1900



Date: 23.MAR.2007 21:25:38

Figure 50- Intermodulation Spurious- Downlink –CDMA1900

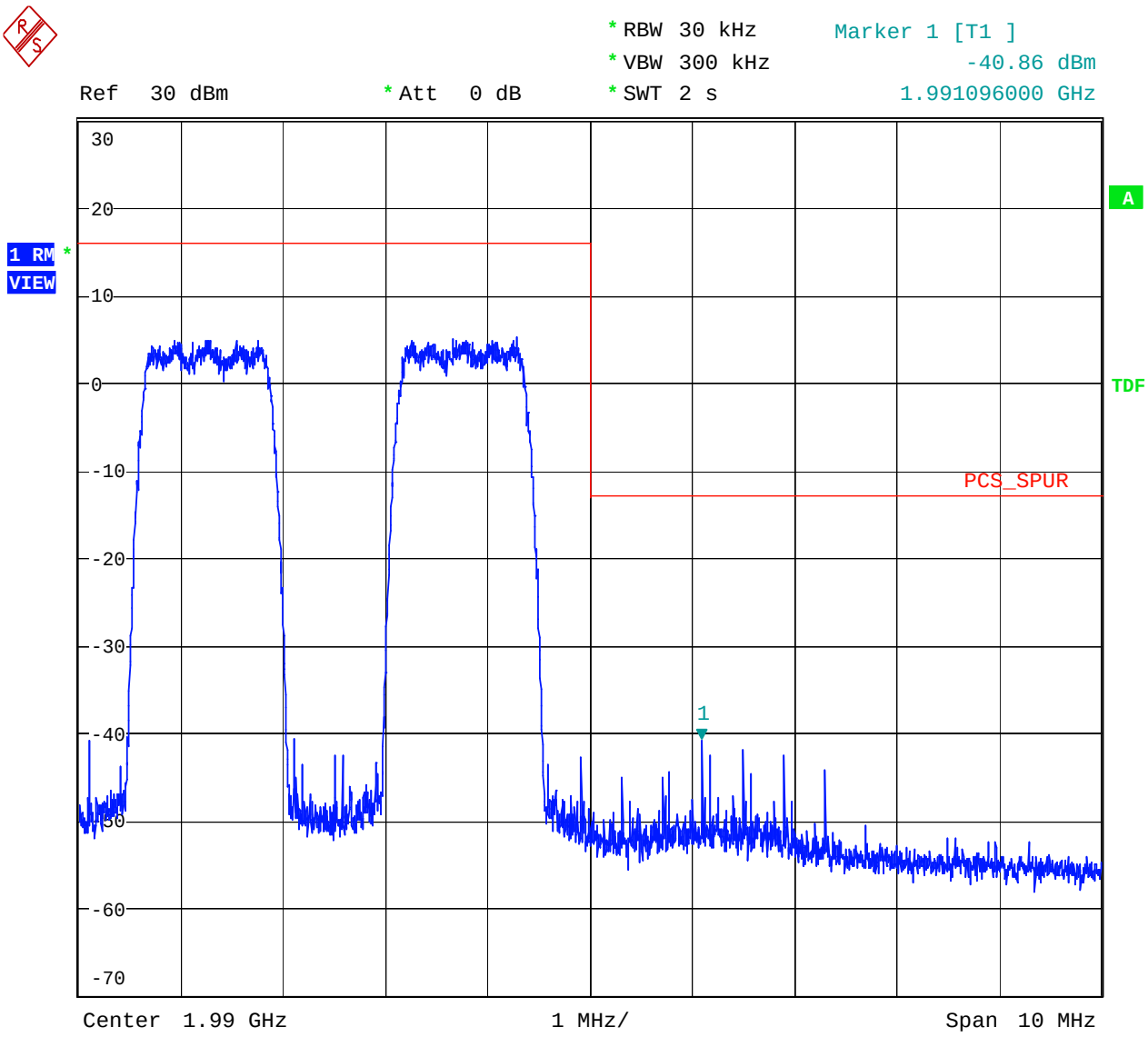
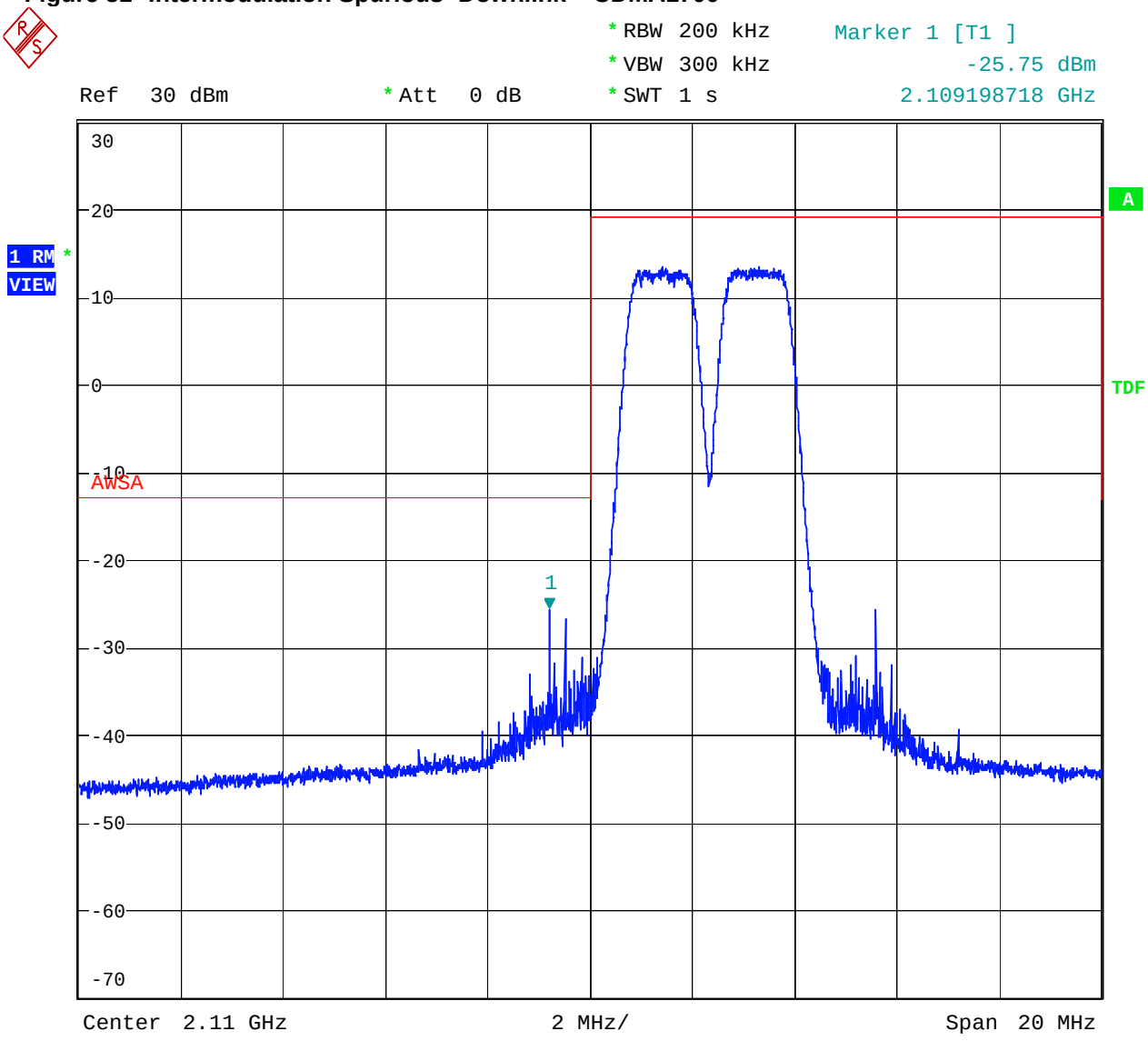
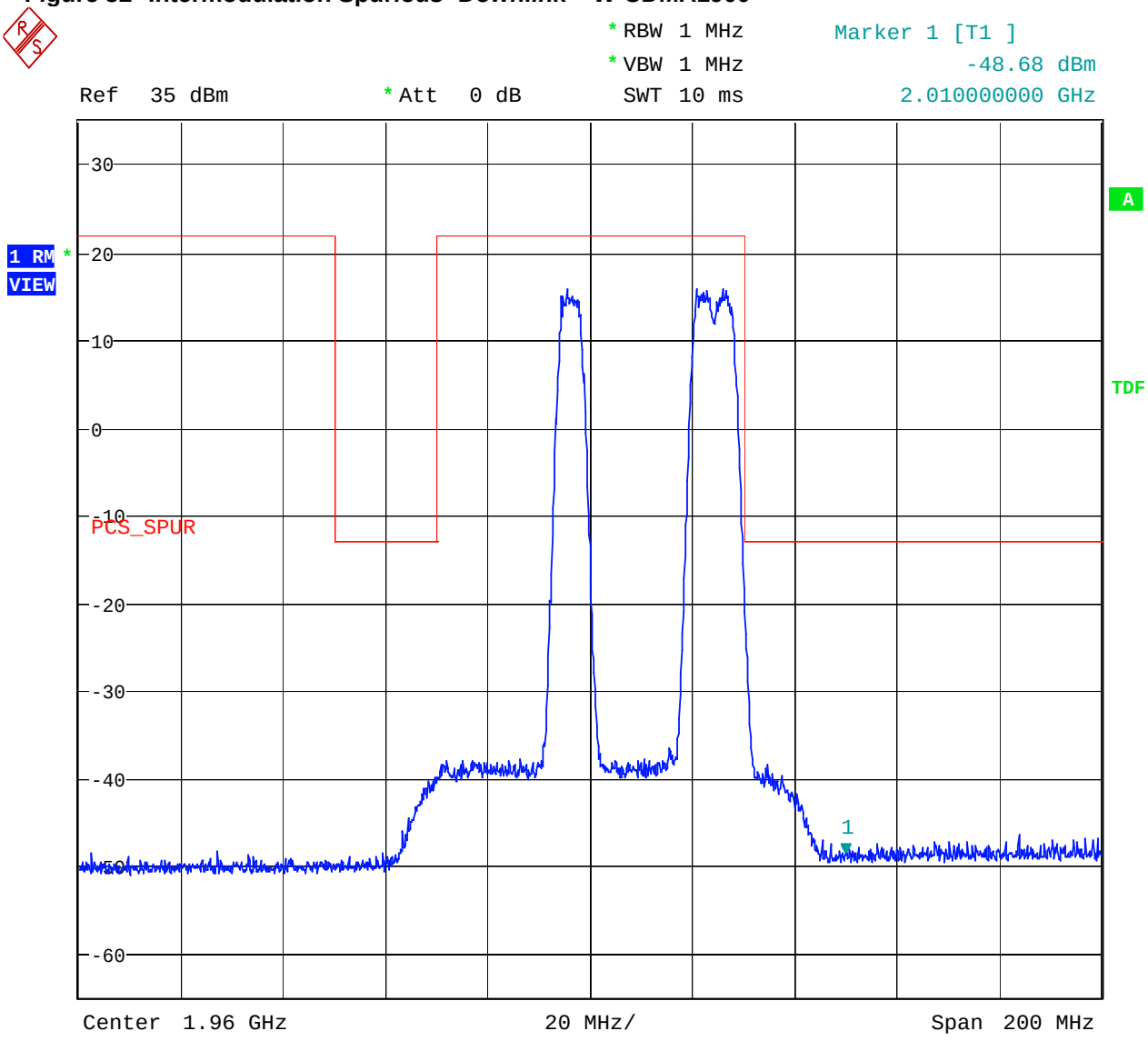


Figure 51- Intermodulation Spurious- Downlink – CDMA1700



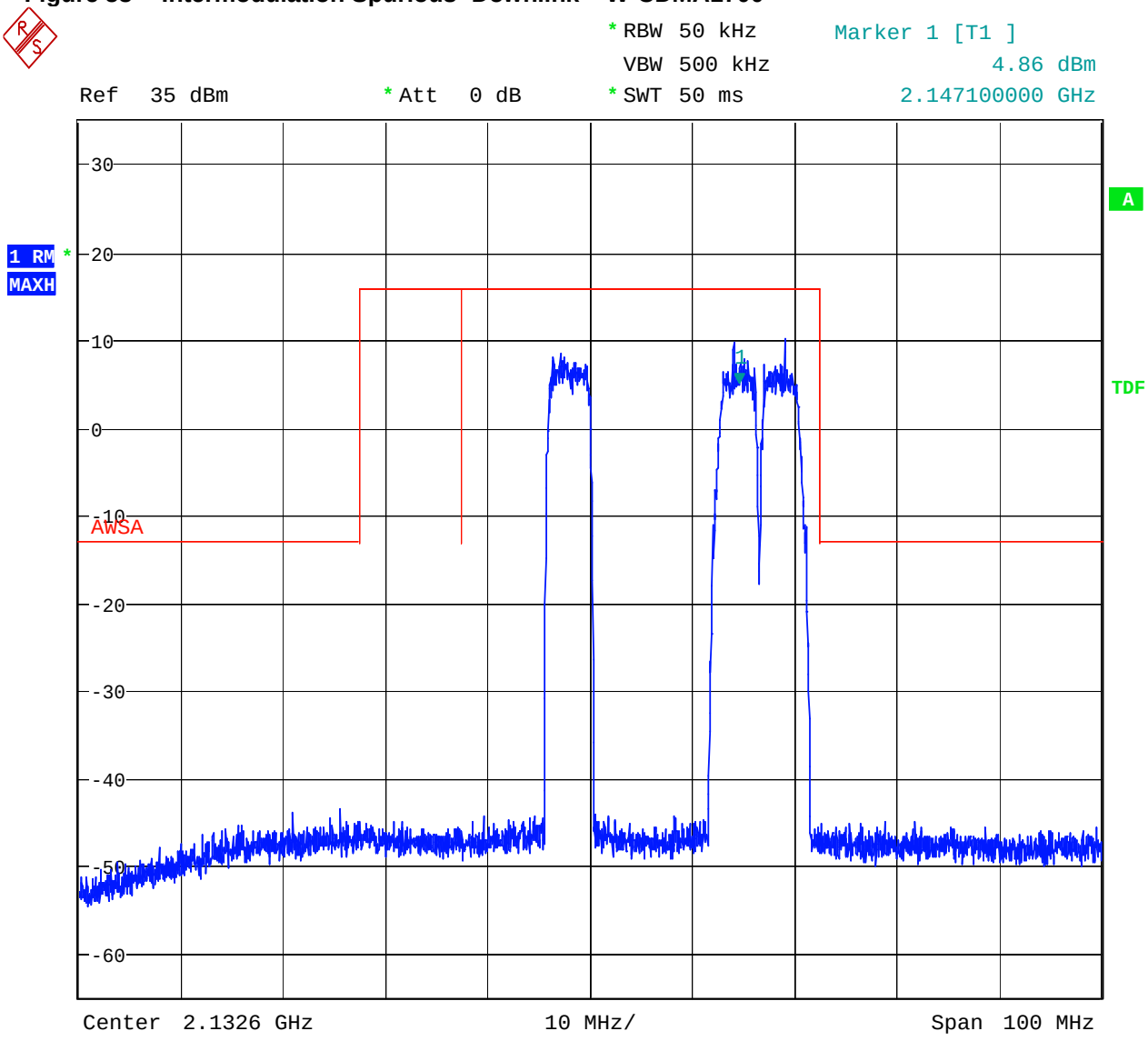
Date: 23.MAR.2007 21:05:51

Figure 52- Intermodulation Spurious- Downlink – W-CDMA1900



Date: 23.MAR.2007 19:07:22

Figure 53 - Intermodulation Spurious- Downlink – W-CDMA1700



Date: 23.MAR.2007 20:12:18

Figure 54 - Intermodulation Spurious- Downlink – GSM/EDGE1900

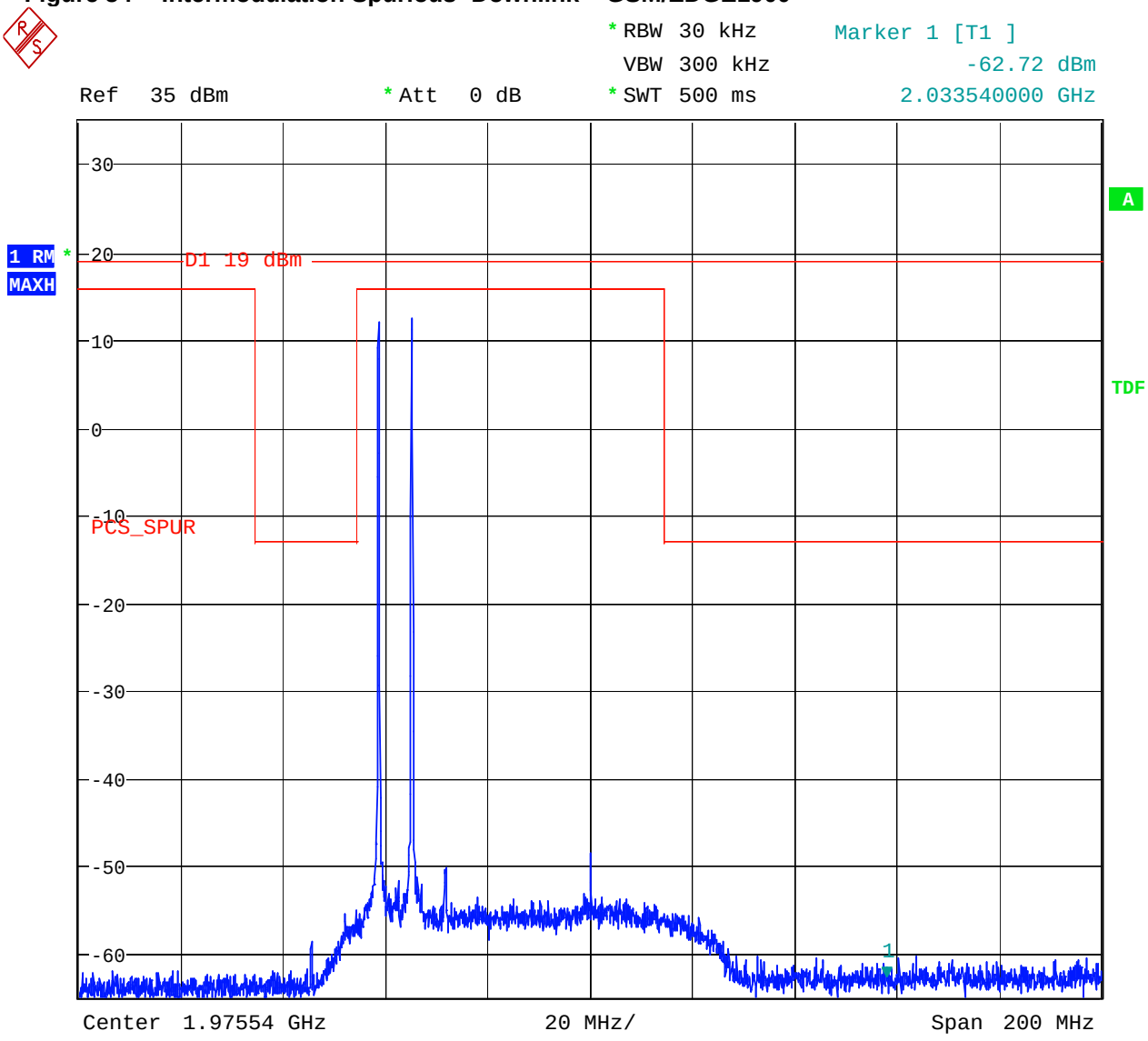
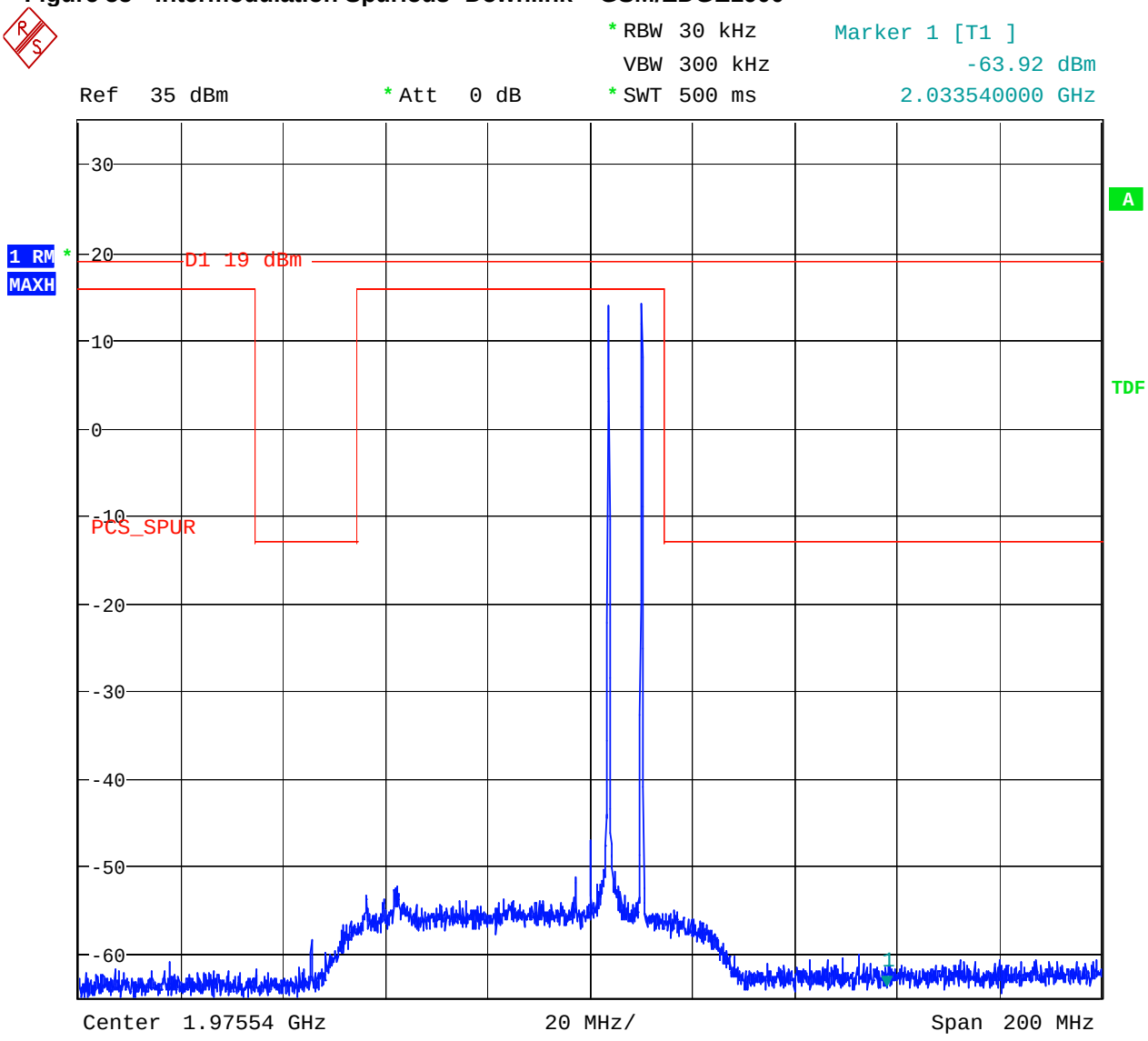


Figure 55- Intermodulation Spurious- Downlink – GSM/EDGE1900



Date: 23.MAR.2007 20:32:36

Figure 56 - Intermodulation Spurious- Downlink – TDMA1900

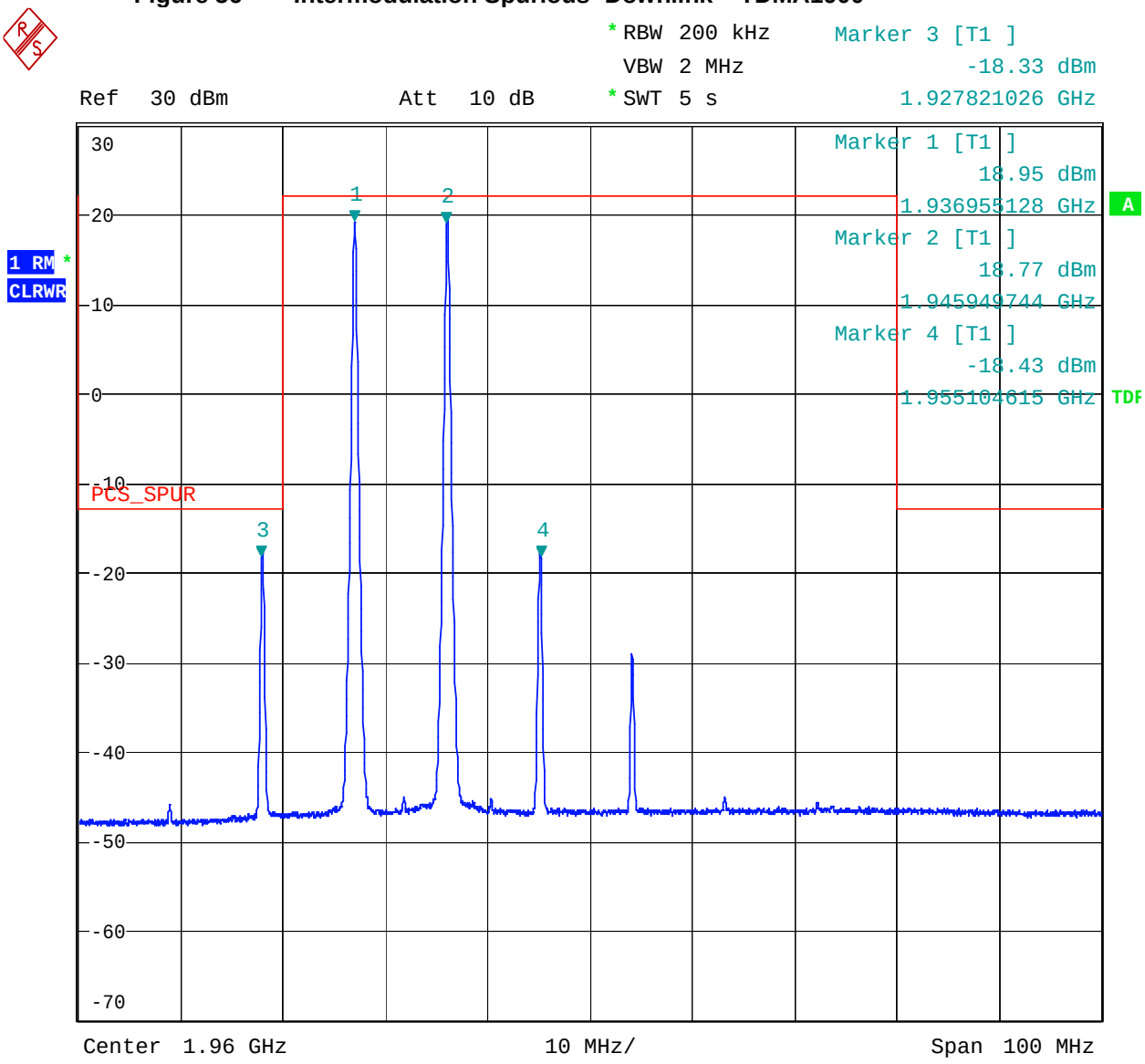
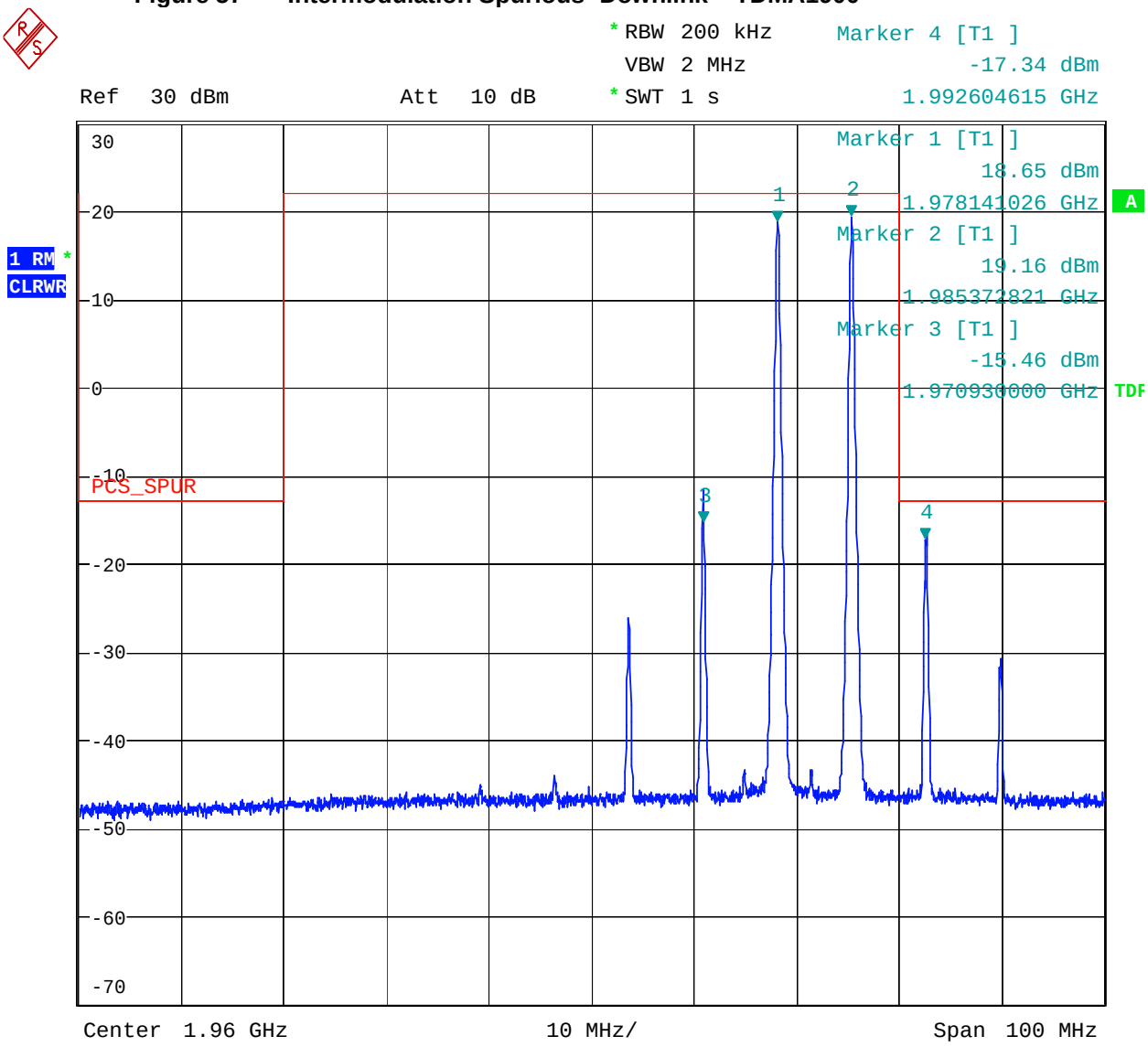


Figure 57 - Intermodulation Spurious- Downlink – TDMA1900



D.8. Tested By

Name: Tom Tidwell,
Function: Manager of Wireless Services
Date: 3/23/2007

APPENDIX E: 2.1053 FIELD STRENGTH OF SPURIOUS RADIATION

E.1. Base Standard & Test Basis

Base Standard	FCC 2.1053
Test Basis	FCC 2.1053 Field Strength of Spurious Radiation
Test Method	TIA 603-C, 2004 Substitution Antenna Method

E.2. Limits

24.238 Emission limitations for Broadband PCS equipment

(a) *Out of band emissions.* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

27.53 Emission limits for AWS equipment

(g) For operations in the 1710–1755 MHz and 2110–2155 MHz bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB.

(1) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(3) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

E.3. Test Results

Compliant. The worst-case spurious emission level was -28.4 dBm at 21,320.0 MHz. This level is 15.4 dB below the specification limit of -13 dBm. The spectrum was searched up to 26 GHz with the device operating on three channels in the Downlink direction in each band.

E.4. Deviations from Normal Operating Mode During Test

None.

E.5. Sample Calculation

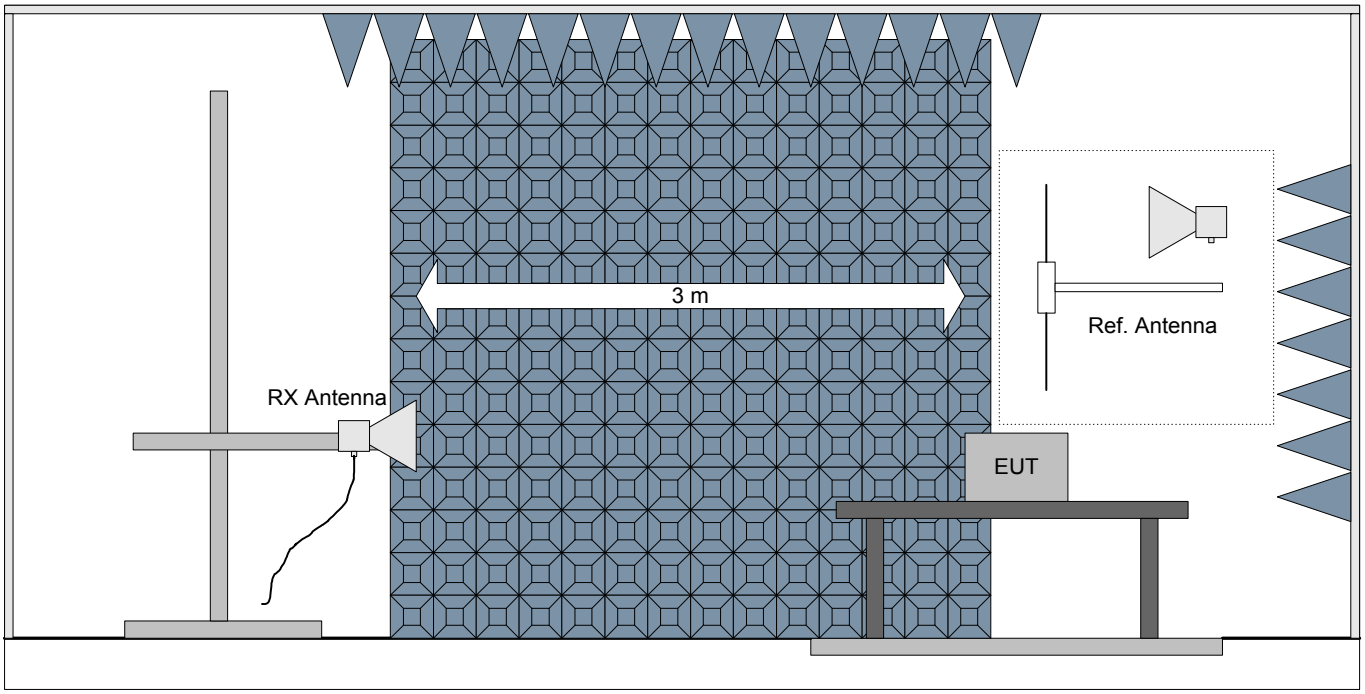
Final measured value (dBm) = Substitution level (dBm) + Antenna Gain (dBi)

Minimum attenuation limit (dB) = 43 + 10 log(P) where P = Peak power of the carrier in watts.

Min. Atten. Limit dB) = 43 + 10 * log(0.158 watts)
= 35 dB

22 dBm – 35 dB = -13 dBm

E.6. Test Diagram



Note: The EUT is set to repeat a signal at maximum rf output power into a coaxial load for this testing.

E.7. Test Data

Project No: W7072
Model: ION-B
Comments: Operating with CW signal tranmitting at 2111.25, 2132.5, and 2153.75 MHz to produce 0.158 watt rf output power.

Distance: 3 m

Standard: CFR 47, Part 2 RBW: 1 MHz VBW: Peak = RBW, Avg. = 10 Hz

Notes	Polarization	Frequency		Substitution Level	Substitution Antenna Gain	Final Measured Value		Peak Carrier Power		Limit	Margin
	(V/H)	(MHz)		(dBm)	(dBd)	(dBm)	(watts)	(dBm)	(watts)	(dBm)	(dB)
	H	1820.4		-74.6	6.5	-68.1	1.55E-10	22	0.158	-13	55.1
	V	1820.4		-75.2	6.5	-68.7	1.35E-10	22	0.158	-13	55.7
	H	4222.5		-69.4	8.1	-61.3	7.41E-10	22	0.158	-13	48.3
	V	4222.5		-70.4	8.1	-62.3	5.89E-10	22	0.158	-13	49.3
	H	4265		-68.6	8.1	-60.5	8.91E-10	22	0.158	-13	47.5
	V	4265		-68.5	8.1	-60.4	9.12E-10	22	0.158	-13	47.4
	H	4307.5		-68.4	8.1	-60.3	9.33E-10	22	0.158	-13	47.3
	V	4307.5		-68.2	8.1	-60.1	9.77E-10	22	0.158	-13	47.1
Noise Floor	H	6397.5		-64.9	9.7	-55.2	3.02E-09	22	0.158	-13	42.2
Noise Floor	V	6397.5		-65.1	9.7	-55.4	2.88E-09	22	0.158	-13	42.4
Noise Floor	H	8530		-58.4	9.3	-49.1	1.23E-08	22	0.158	-13	36.1
Noise Floor	V	8530		-58.6	9.3	-49.3	1.17E-08	22	0.158	-13	36.3
Noise Floor	H	10622.5		-57.4	10.5	-46.9	2.04E-08	22	0.158	-13	33.9
Noise Floor	V	10622.5		-56.8	10.5	-46.3	2.34E-08	22	0.158	-13	33.3
Noise Floor	H	12795		-54.3	11.2	-43.1	4.9E-08	22	0.158	-13	30.1
Noise Floor	V	12795		-53.2	11.2	-42	6.31E-08	22	0.158	-13	29
Noise Floor	H	213200		-42.9	14.4	-28.5	1.41E-06	22	0.158	-13	15.5
Noise Floor	V	213200		-42.8	14.4	-28.4	1.45E-06	22	0.158	-13	15.4

Notes:
(1) A positive margin indicates a passing result
(2) If duty cycle correction is indicated, plots are included in the test report to validate the factor used.

Project No:	W7072
Model:	ION-B
Comments:	Operating with CW signal tranmitting at 1930.05, 1960.0, and 1989.95 MHz to produce 0.158 watt rf output power.

Distance:	3 m	Standard:	CFR 47, Part 2	RBW: 1 MHz	VBW: Peak = RBW, Avg. = 10 Hz

Notes	Polarization	Frequency		Substitution Level	Substitution Antenna Gain	Final Measured Value		Peak Carrier Power		Limit	Margin
	(V/H)	(MHz)		(dBm)	(dBd)	(dBm)	(watts)	(dBm)	(watts)	(dBm)	(dB)
	H	3860.1		-69.4	7.6	-61.8	6.61E-10	22	0.158	-13	48.8
	V	3860.1		-69.6	7.6	-62	6.31E-10	22	0.158	-13	49
	H	3920.1		-68.8	7.4	-61.4	7.24E-10	22	0.158	-13	48.4
	V	3920.1		-68.4	7.4	-61	7.94E-10	22	0.158	-13	48
	H	3980		-69.6	7.4	-62.2	6.03E-10	22	0.158	-13	49.2
	V	3980		-69.8	7.4	-62.4	5.75E-10	22	0.158	-13	49.4
Noise Floor	H	5790.15		-65.1	9.3	-55.8	2.63E-09	22	0.158	-13	42.8
Noise Floor	V	5790.15		-65.5	9.3	-56.2	2.4E-09	22	0.158	-13	43.2
Noise Floor	H	7720.2		-60	9.2	-50.8	8.32E-09	22	0.158	-13	37.8
Noise Floor	V	7720.2		-60.3	9.2	-51.1	7.76E-09	22	0.158	-13	38.1
Noise Floor	H	9650.25		-54	9.9	-44.1	3.89E-08	22	0.158	-13	31.1
Noise Floor	V	9650.25		-55.3	9.9	-45.4	2.88E-08	22	0.158	-13	32.4
Noise Floor	H	11580.3		-58.4	10.6	-47.8	1.66E-08	22	0.158	-13	34.8
Noise Floor	V	11580.3		-59.8	10.6	-49.2	1.2E-08	22	0.158	-13	36.2
Noise Floor	H	19300		-40.4	11.2	-29.2	1.2E-06	22	0.158	-13	16.2
Noise Floor	V	19300		-40.6	11.2	-29.4	1.15E-06	22	0.158	-13	16.4

Notes:
(1) A positive margin indicates a passing result
(2) If duty cycle correction is indicated, plots are included in the test report to validate the factor used.

NOTE: Measurements were made with the device operating in the following modes:

1) AWS band, Low, Mid, High channels
2) PCS1900 band, Low, Mid, High channels

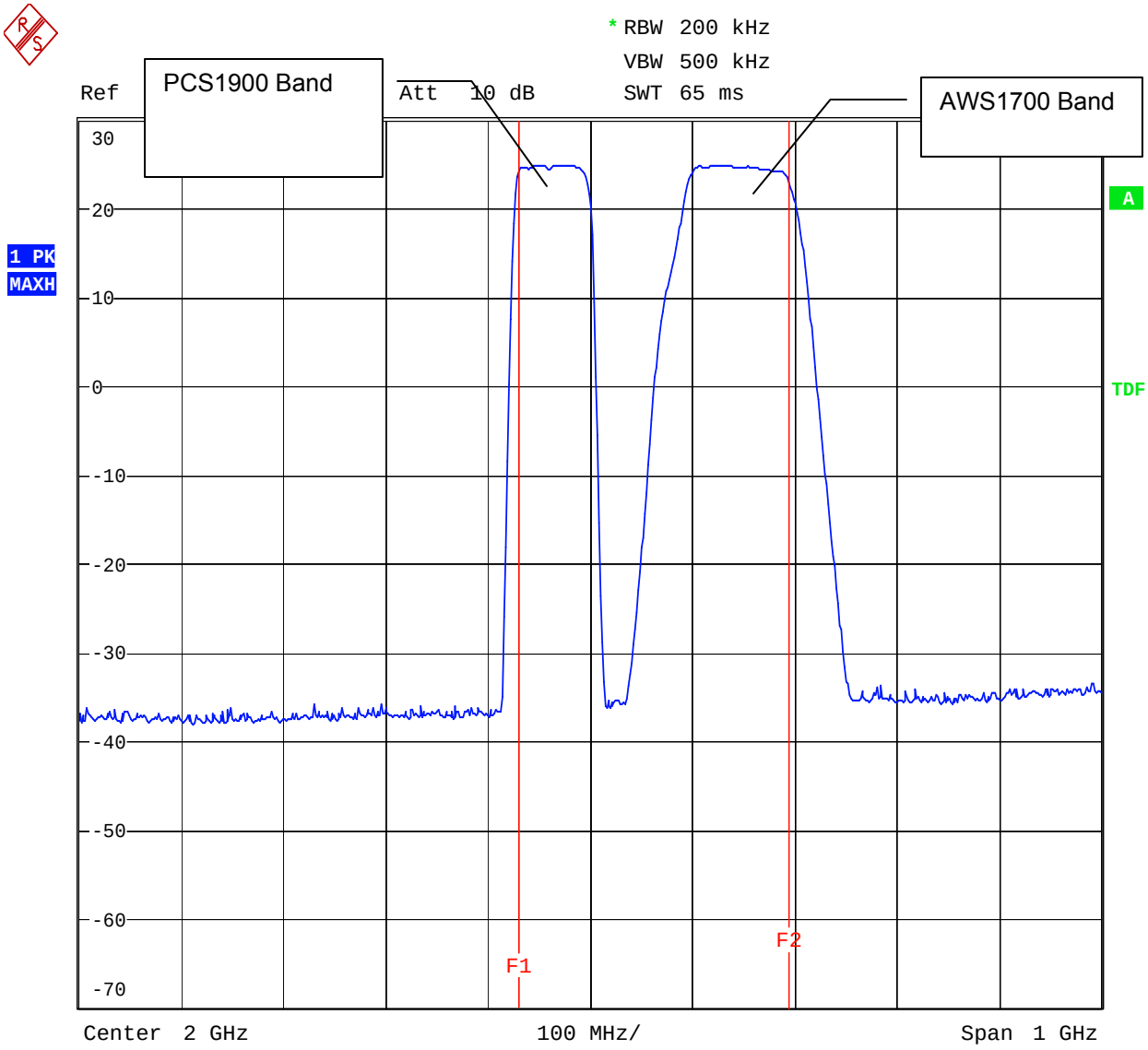
E.8. Test Photos

E.9. Tested By

Name: Tom Tidwell,
Function: Manager of Wireless Services
Date: 12/27/2006

APPENDIX F: 2.1053 FILTER PLOTS

These plots demonstrate the filter band pass characteristics of the device.



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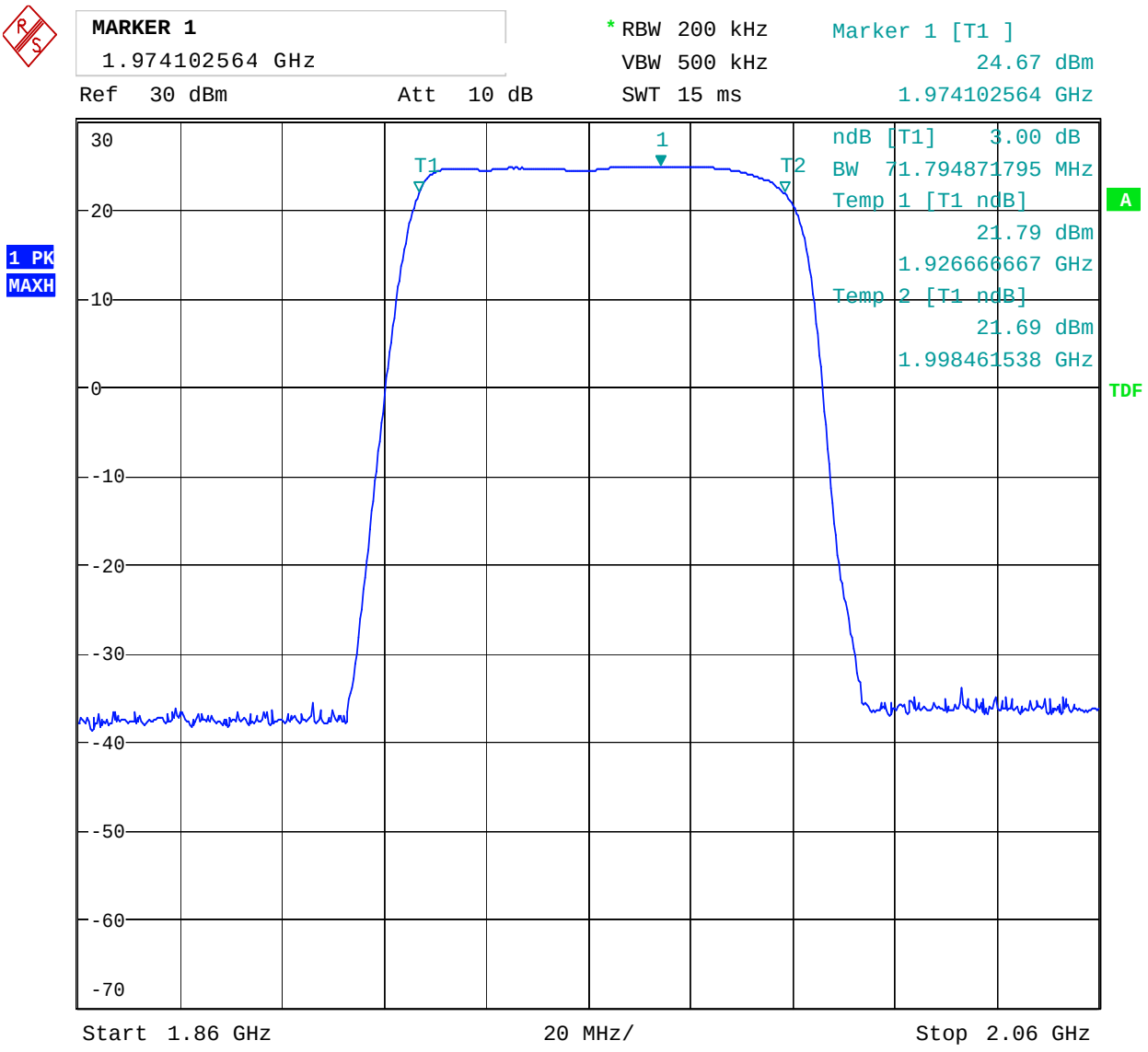

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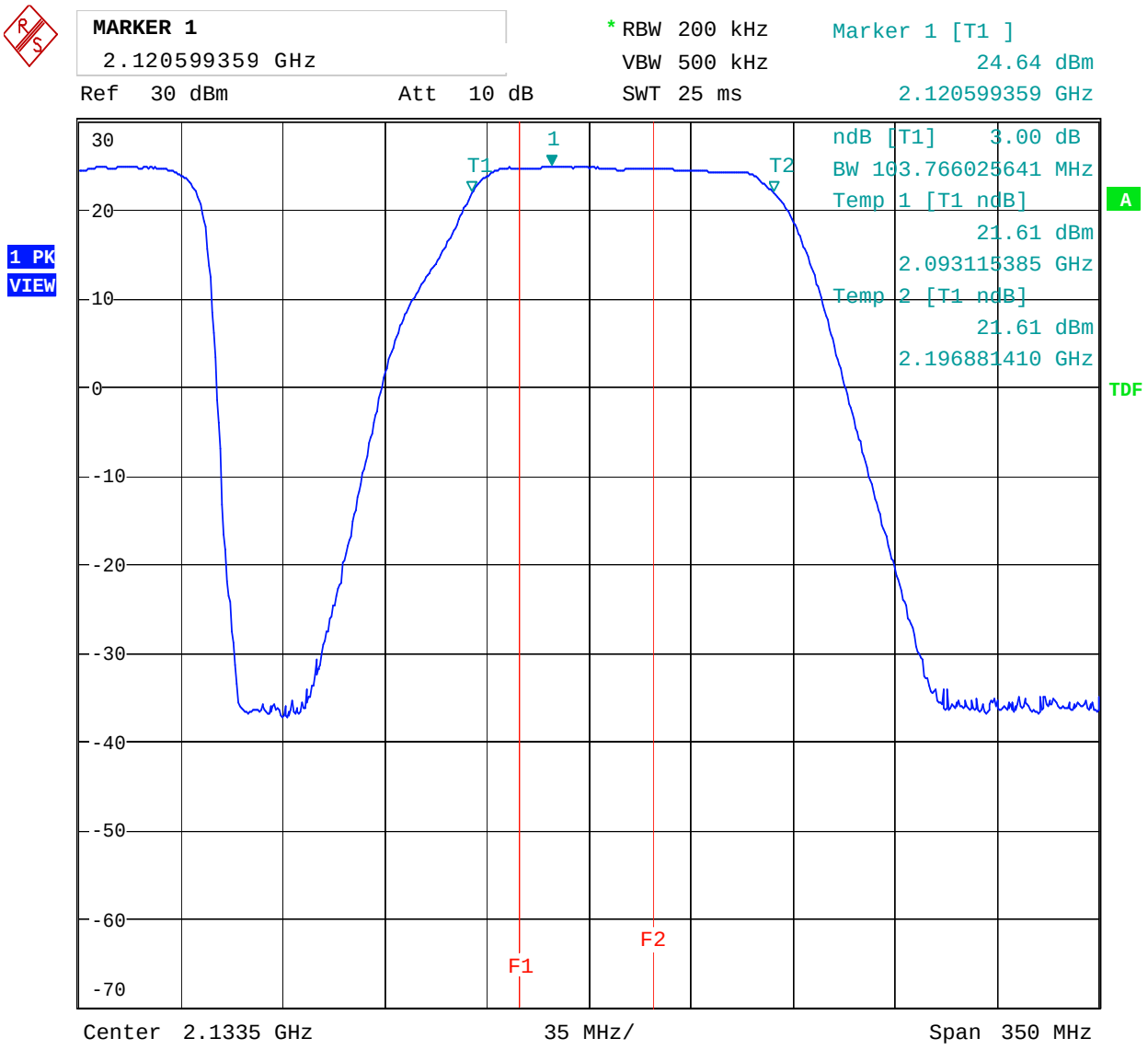


Date: 21.FEB.2007 20:10:49

APPENDIX G: 2.1055 FREQUENCY STABILITY

G.1. Base Standard & Test Basis

Base Standard	FCC 2.1055
Test Method	TIA 603-C, 2004

Specifications

24.235 Frequency Stability

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

27.54 Frequency Stability

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

G.2. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

G.3. Test Results

Complies with the above requirement. The frequency drift over temperature and voltage variations was 0 ppm..

G.4. Observations

None

G.5. Deviations from Normal Operating Mode During Test

None.

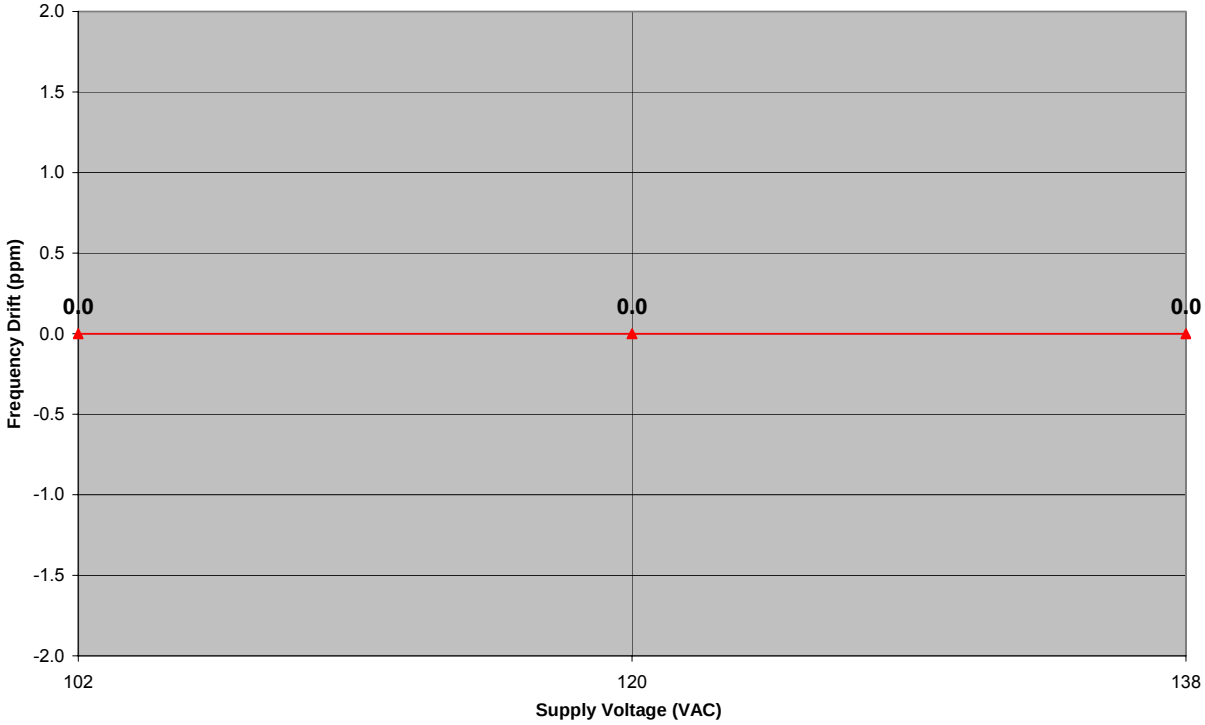
G.6. Sample Calculation

Frequency drift (ppm) = Frequency Drift (Hz)/Authorized frequency (MHz)

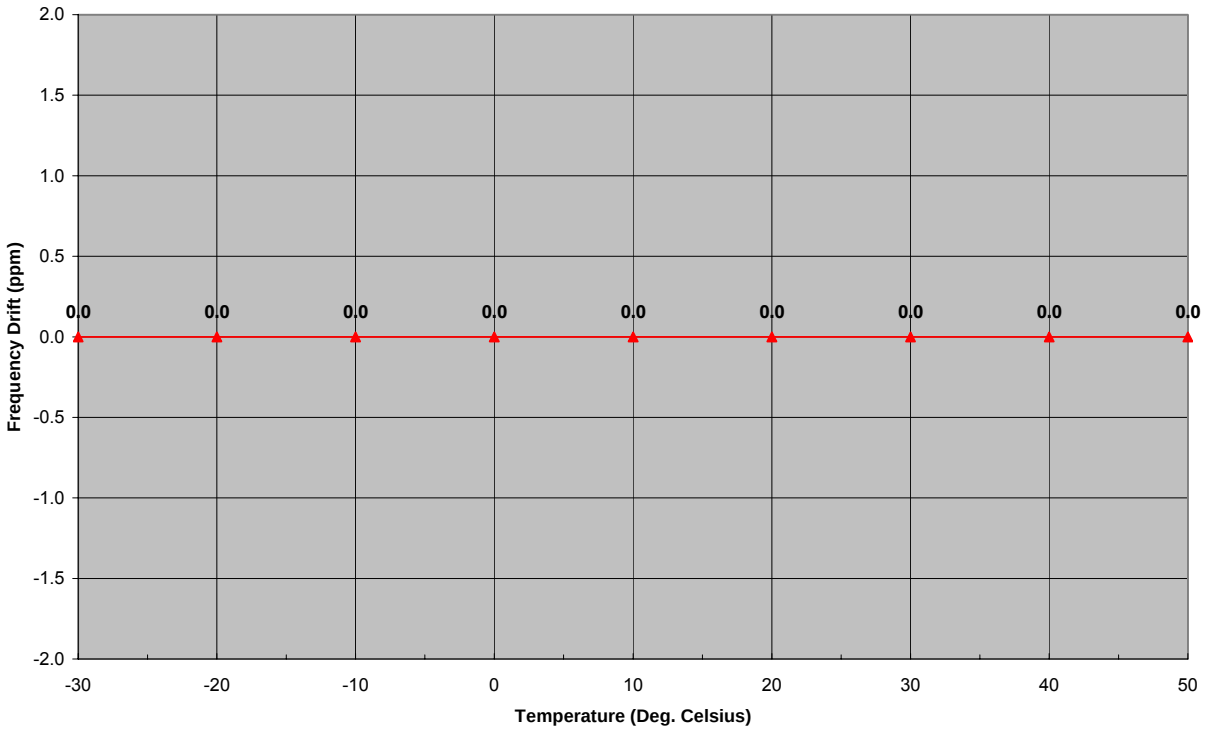
G.7. Test Data

Supply Voltage VAC	Ambient temperature Deg. Celsius	Assigned Transmit Frequency MHz	Measured Frequency MHz	Frequency Drift (Hz)	Frequency Drift (ppm)
102	20	1960.000000	1960.000000	0	0.0
120	20	1960.000000	1960.000000	0	0.0
138	20	1960.000000	1960.000000	0	0.0
120	-30	1960.000000	1960.000000	0	0.0
120	-20	1960.000000	1960.000000	0	0.0
120	-10	1960.000000	1960.000000	0	0.0
120	0	1960.000000	1960.000000	0	0.0
120	10	1960.000000	1960.000000	0	0.0
120	20	1960.000000	1960.000000	0	0.0
120	30	1960.000000	1960.000000	0	0.0
120	40	1960.000000	1960.000000	0	0.0
120	50	1960.000000	1960.000000	0	0.0

Frequency Drift with Supply Voltage Variation

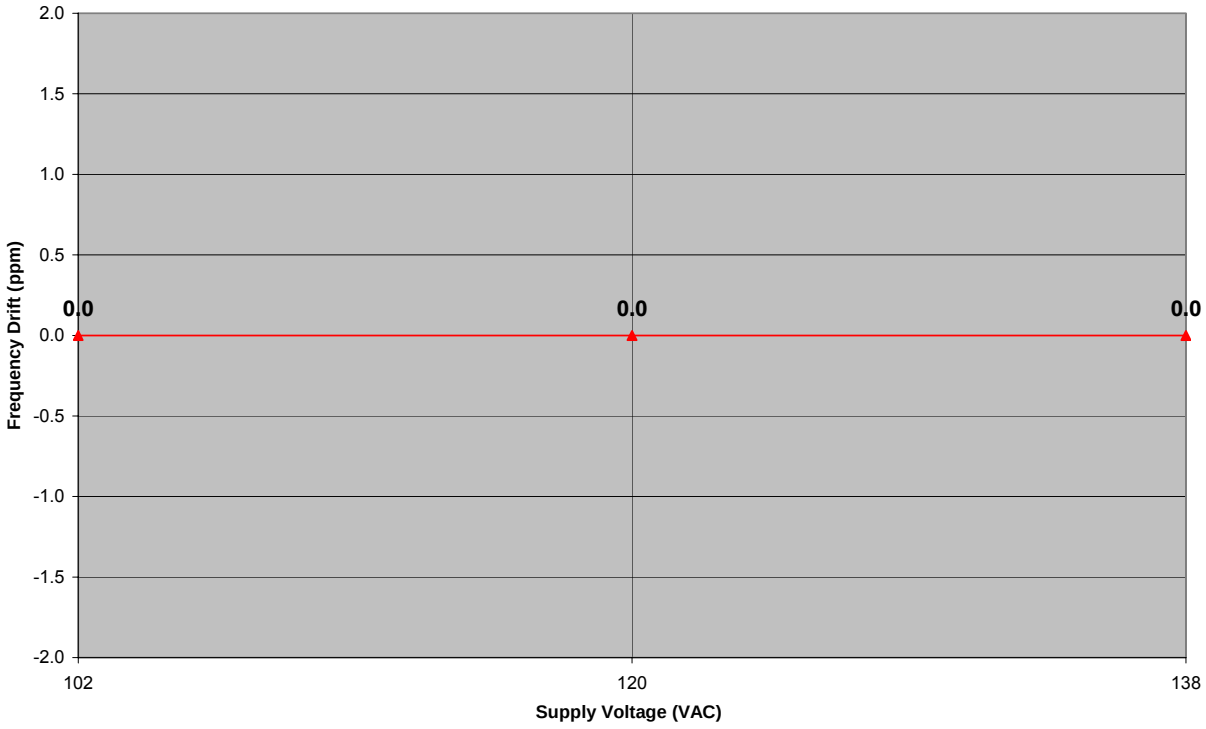


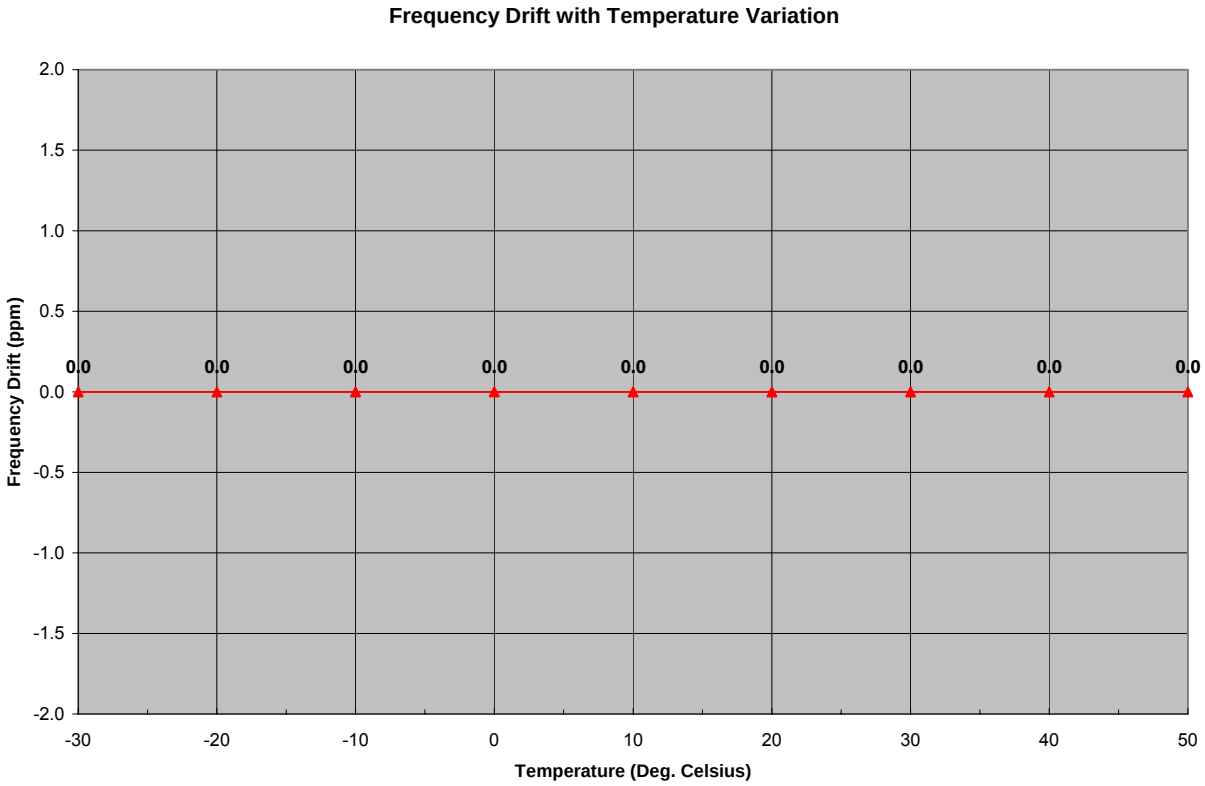
Frequency Drift with Temperature Variation



Supply Voltage VAC	Ambient temperature Deg. Celsius	Assigned Transmit Frequency MHz	Measured Frequency MHz	Frequency Drift (Hz)	Frequency Drift (ppm)
102	20	2132.500000	2132.500000	0	0.0
120	20	2132.500000	2132.500000	0	0.0
138	20	2132.500000	2132.500000	0	0.0
120	-30	2132.500000	2132.500000	0	0.0
120	-20	2132.500000	2132.500000	0	0.0
120	-10	2132.500000	2132.500000	0	0.0
120	0	2132.500000	2132.500000	0	0.0
120	10	2132.500000	2132.500000	0	0.0
120	20	2132.500000	2132.500000	0	0.0
120	30	2132.500000	2132.500000	0	0.0
120	40	2132.500000	2132.500000	0	0.0
120	50	2132.500000	2132.500000	0	0.0

Frequency Drift with Supply Voltage Variation





G.8. Test Diagram

None

G.9. Tested By

.

Name: Tom Tidwell,
Function: Manager of Wireless Services
Date: 3/23/2007

APPENDIX H: TEST EQUIPMENT LIST

H.1. Field Strength of Spurious Emissions 30 MHz – 26.5 GHz Measurement Equipment

Description	Manufacturer	Type/Model	Calibration Frequency	Cal Due	NTS Control No.
3m ANECHOIC CHAMBER					
RX Bilog Antenna	ETS	3142C	12 Months	8/17/07	E1288P
Ref. Horn Antenna	ETS	3115	12 Months	11/1/07	E1019P
RX Horn Antenna	ETS	3115	12 Months	11/1/07	E1022P
High Frequency - Cable 1	MegaPhase	TM26-3135-144	12 Months	8/23/07	W1010P
Tunable Notch Filter	K&L Microwave	3TNF-1000/2000-N/N	N/A*	N/A*	S/N 614
Reference Antenna	ETS	3121 Dipole Set	12 months	8/8/07	S/N. 274
CONTROL ROOM					
Test Receiver	Rohde & Schwarz	FSQ 26	12 Months	9/21/07	W1020P
High Frequency - Cable 2	MegaPhase	NA	12 Months	8/23/07	W1011P
Amplifier	HP	8449B	12 Months	4/30/07	E1010P

H.2. Antenna Conducted Emissions Measurement Equipment

Instrument	Manufacturer	Model	Calibration Frequency	Calibration Due
ANTENNA CONDUCTED EMISSIONS				
Spectrum Analyzer	Rohde & Schwarz	FSQ 26	12 Months	9/21/07
High Frequency - Cable 1	MegaPhase	TM26-3135-144	12 Months	8/23/07
Directional Coupler	Narda	3020A	12 Months	8/28/07
Directional Coupler	Narda	4242-10	12 Months	8/28/07
50 ohm loads	Amphenol	50R	12 Months	8/28/07
I/Q Signal Generator	Rohde & Schwarz	SMIQ 03	12 Months	8/25/07
I/Q Modulation Generator	Rohde & Schwarz	AMIQ	12 Months	8/28/07
Combiner	Mini-Circuits	ZFSC-2-2500	N/A*	N/A*

*This device was not used for calibrated measurements.

END OF DOCUMENT