Test Report

Report Number: 30693501
Project Numbers: 3069350

Report Date: December 27, 2004

Testing performed on the

Wireless mobile data device
Model Number: MDC 1xRTT
FCC ID: RZ3MDC0V01
IC: 2234A-MDC0V01

to
FCC Parts: 22H & 24E and Part 15B
for
Mentor Engineering Inc.

A2LA Certificate Number: 1755-01

Test Performed by:	**Test Authorized by:**
Intertek Testing Services NA, Inc 1365 Adams Court Menlo Park, CA 94025	Mentor Engineering Inc. Suite 230, 2891 Sunridge Way NE Calgary Alberta, T1Y 7K7, Canada

Prepared by: _____ **Date:** 12/27/04
Bruce Gordon, Test Engineer

Reviewed by: _____ **Date:** 12/27/04
David Chernomordik, EMC Technical Manager

VERIFICATION OF COMPLIANCE
Report No. 30693501

Verification is hereby issued to the named APPLICANT and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below.

Equipment Under Test:	Wireless mobile data device
Trade Name:	Mentor Engineering
Model No.:	MDC 1xRTT
Serial No.:	Not Labled
FCC ID:	RZ3MDC0V01
IC ID:	2234A-MDC0V01
Applicant:	Mentor Engineering, Inc.
Contact:	Mr. Jonade Khan
Address:	Suite 230, 2891 Sunridge Way NE Calgary Alberta, T1Y 7K7
Country	Canada
Tel. number:	403-777-3760 ext 226
Fax number:	403-777-3769
Manufacturer:	Mentor Engineering, Inc.
Contact:	Mr. Jonade Khan
Address:	Suite 230, 2891 Sunridge Way NE Calgary Alberta, T1Y 7K7
Country	Canada
Tel. number:	403-777-3760 ext 226
Fax number:	403-777-3769
Applicable Regulation:	FCC Part 22H, FCC Part 24E, FCC Part 15B
Test Site Location:	ITS - Site 1 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	December 13 - 23 , 2004

We attest to the accuracy of this report:

Bruce Gordon
Test Engineer

David Chernomordik
EMC Technical Manager

TABLE OF CONTENTS

1.0 Introduction

1.1 Product Description

The Equipment under Test (EUT) is wireless mobile data device designed for installation in a vehicle. It is intended for use with a Computer Aided Dispatch system. The device contains an internal RF data modem, which operates in the Cellular and PCS bands.

The EUT contains also an internal GPS receiver to provide Automatic Vehicle Location capability as well as the ability to interface to multiple inputs and outputs from the vehicle and peripheral devices.

For more information about the radio, refer to the attached product description.

Use of Product	In vehicle
Whether quantity (>1) production is planned	Yes
Cellular Phone standard	CDMA
Rated RF Output Power	23.5 dBm (Cell band) 23.5 dBm (PCS band)
Frequency Ranges	824.7 - 848.31 MHz, CDMA channels: 1013 - 777 1851.25 - 1908.75 MHz, CDMA channels: 25 - 1175
Antenna (e) & Gain	Max 3 dBi
Detachable antenna?	yes
External input	Data
Operating temperature	-30^0C to $+60^0$C

EUT receive date: December 10, 2004
EUT receive condition: The prototype version of the EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date: December 13, 2004
Test completion date: December 23, 2004

1.2 Summary of Test Results

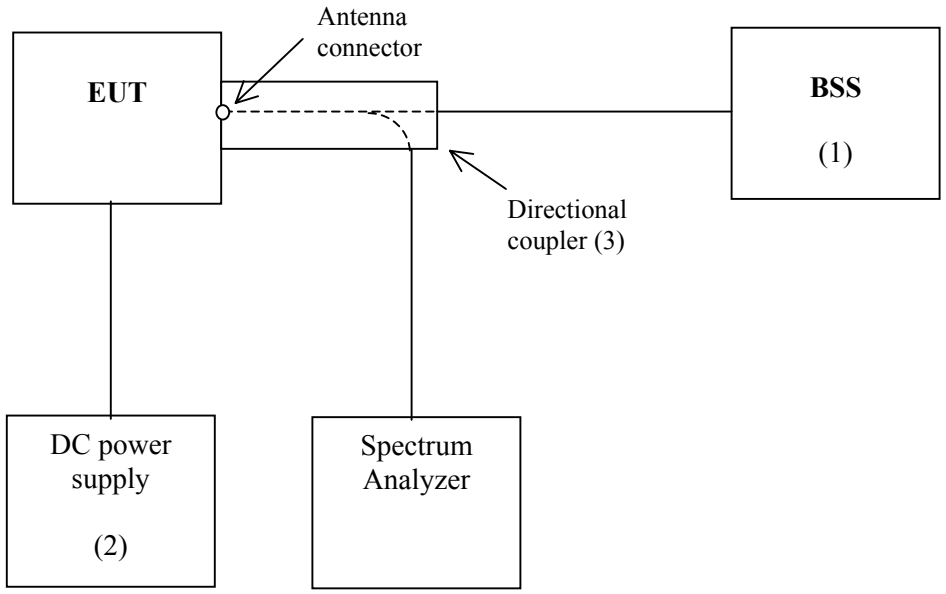
FCC Rule	Description of Test	Result	Page
2.1046	RF Power Output	Complies	8
22.913(a), 24.232(b)	ERP, EIRP	Complies	16
2.1047	Modulation characteristics	Not Applicable	-
2.1049	Occupied Bandwidth, Emission Designator	1M25F9W	17
2.1051, 22.917(a), 24.238(a)	Out of Band Emissions at Antenna Terminals	Complies	20
2.1053, 22.917(a), 24.238(a)	Part 22/24 Spurious Radiation	Complies	54
2.1055	Frequency Stability vs. Temperature and Voltage	Complies	57
2.1091	RF Exposure evaluation	Complies	59
15.109	Part 15 Radiated Emissions	Complies	60

1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.	S/N
1	Wireless communications test set (Base Station Simulator)	Agilent 8960 Series 10	GB43133135
2	DC Power Supply	GPR-6030	PC303RP1
3	Directional Coupler	CDD 1000-80-5, 101020020	

1.3.2 Block diagram of Test Setup



Note: For radiated emission test, Spectrum Analyzer and Directional coupler were not connected to the EUT

1.4 Related Submittal(s) Grants

None

2.0 RF Power Output

FCC 2.1046

2.1 Test Procedure

The EUT RF output was connected as shown on the diagram in sec.1.3.2. The BSS was setup to "originate call" and control the EUT (as a mobile station) to transmit the maximum power.

The spectrum analyzed was setup to measure a channel power in 1.23 MHz bandwidth. The directional coupler attenuation and cable loss were added to the spectrum analyzed reading by using OFFSET function.

Measurements were performed at three frequencies (low, middle, and high channels) in both Cellular in PCS bands.

2.2 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer
Directional Coupler, IFI, CDD 1000-80-5
Directional Coupler, Krytar, 101020020

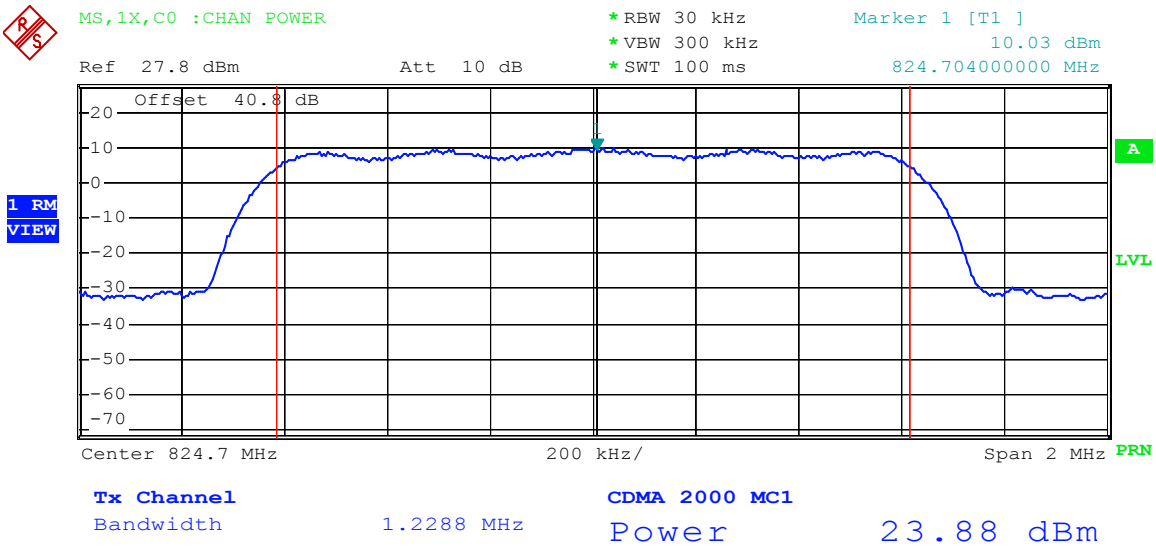
2.3 Test Results

Channel	Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (Watt)
Cellular Band			
1013	824.7	23.9	0.245
384	836.52	23.6	0.229
777	848.31	23.2	0.209
PCS Band			
25	1851.25	23.6	0.229
600	1880.0	23.6	0.229
1175	1908.75	23.5	0.224

For more details refer to the attached plots:

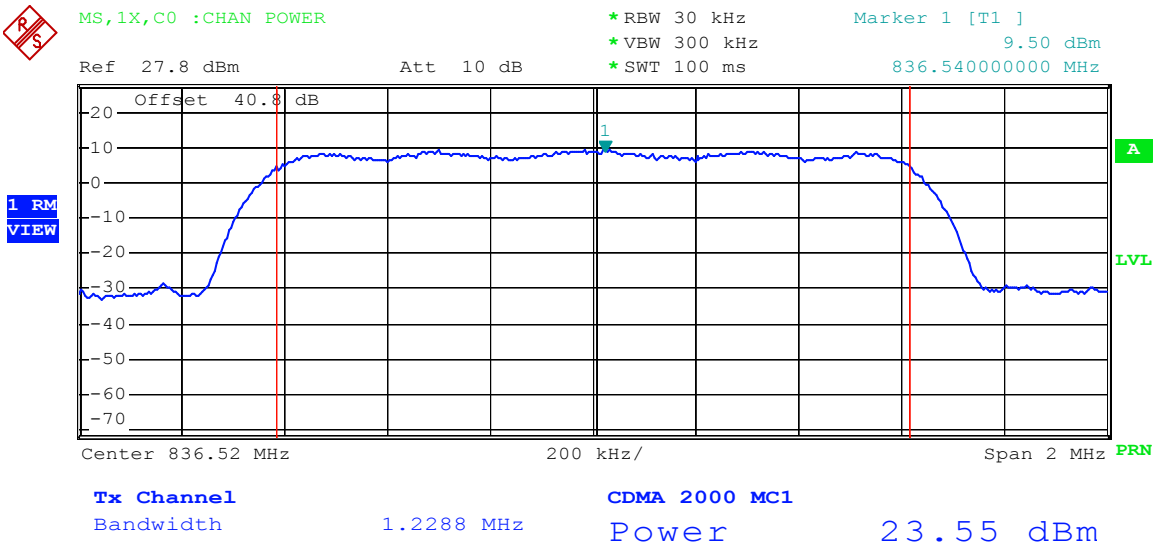
Cellular Band		
Plot Number	**Channel Number**	**Description**
2.1	1013	Channel Power
2.2	384	Channel Power
2.3	777	Channel Power
PCS Band		
Plot Number	**Channel Number**	**Description**
2.4	25	Channel Power
2.5	600	Channel Power
2.6	1175	Channel Power

Plot 2.1



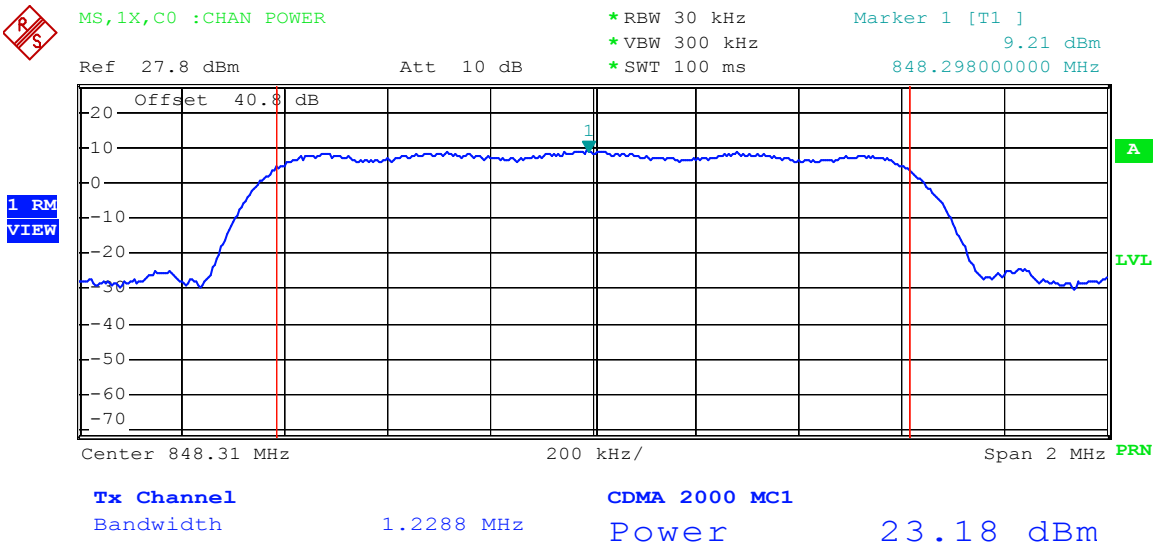
Comment: Channel power, Cell band, CH# 1013
Date: 20.DEC.2004 11:32:26

Plot 2.2



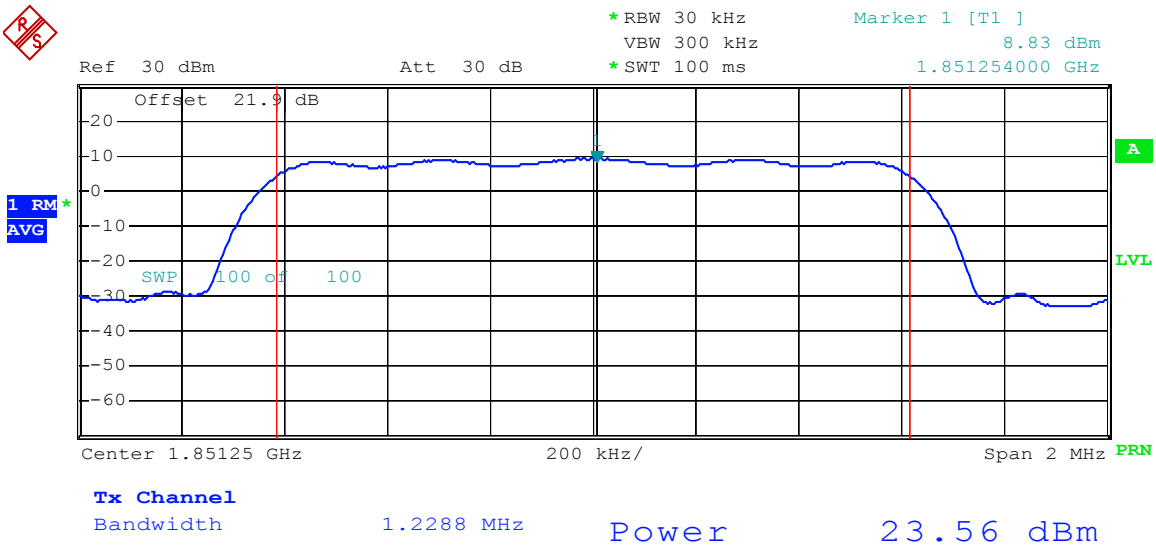
Comment: Channel power, Cell band, CH# 384
Date: 20.DEC.2004 11:35:48

Plot 2.3



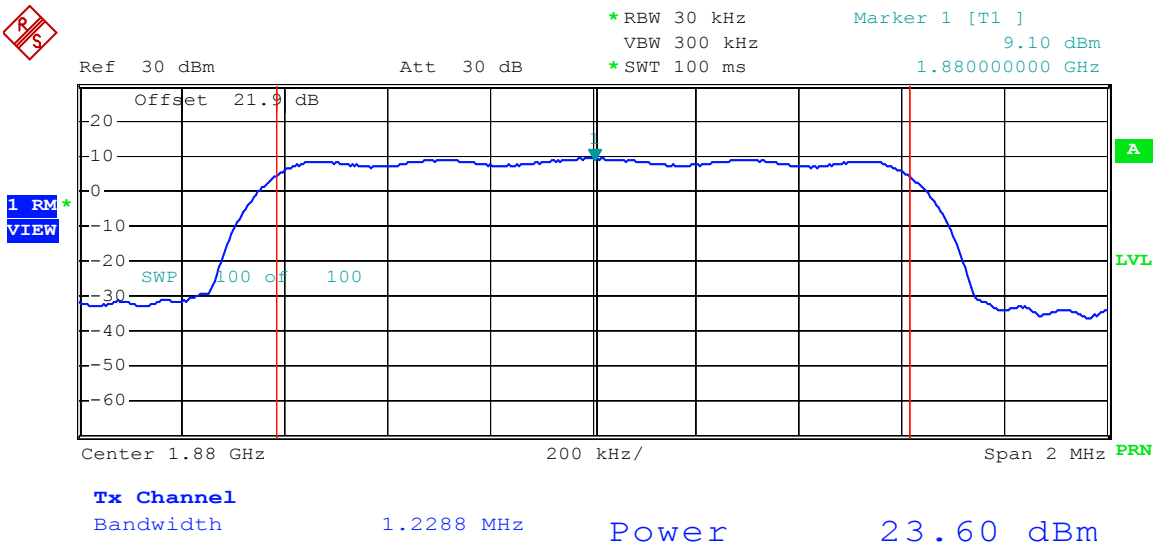
Comment: Channel power, Cell band, CH# 777
Date: 20.DEC.2004 11:42:12

Plot 2.4



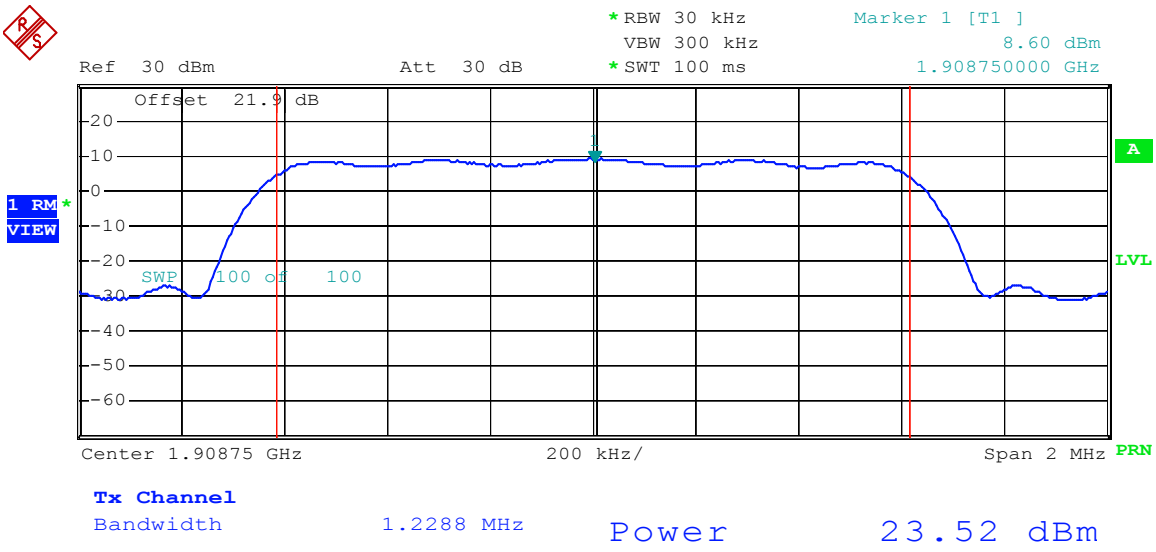
Comment: Channel power, PCS band, CH# 25
Date: 20.DEC.2004 14:59:48

Plot 2.5



Comment: Channel power, PCS band, CH# 600
Date: 20.DEC.2004 15:01:26

Plot 2.6



Comment: Channel power, PCS band, CH# 1175
Date: 20.DEC.2004 15:03:09

3.0 Radiated Power

3.1 Requirement

FCC 22.913(a)

The Effective Radiated Power (ERP) of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

FCC 24.232(b)

The Equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

3.2 Test Procedure

The radiated power: ERP (for cellular band) or EIRP (for PCS band) was calculated by adding the antenna gain to the output power in dBm.

$ERP = P_{max} + G_{dBd}$; $EIRP = P_{max} + G_{dBi}$

3.3 Test Equipment

None

3.4 Test Results

According to the Installation Guide, a typical 3 dBi (0.9 dBd) gain antenna is used with the EUT. Therefore, the calculated maximum radiated power is:

ERP = 23.9 + 0.9 = 24.8 dBm (or 0.3 W)
EIRP = 23.6 + 3.0 = 26.9 dBm (or 0.4 W)

Complies

4.0 Occupied Bandwidth

FCC 2.1049

4.1 Test Procedure

The EUT RF output was connected as shown on the diagram in sec.1.3.2. The BSS was setup to "originate call" and control the EUT (as a mobile station) to transmit the maximum power.

The spectrum analyzed was setup to measure the Occupied Bandwidth (defined as the 99% Power Bandwidth). The Occupied Bandwidth was measured at middle channel in each frequency band.

4.2 Test Equipment

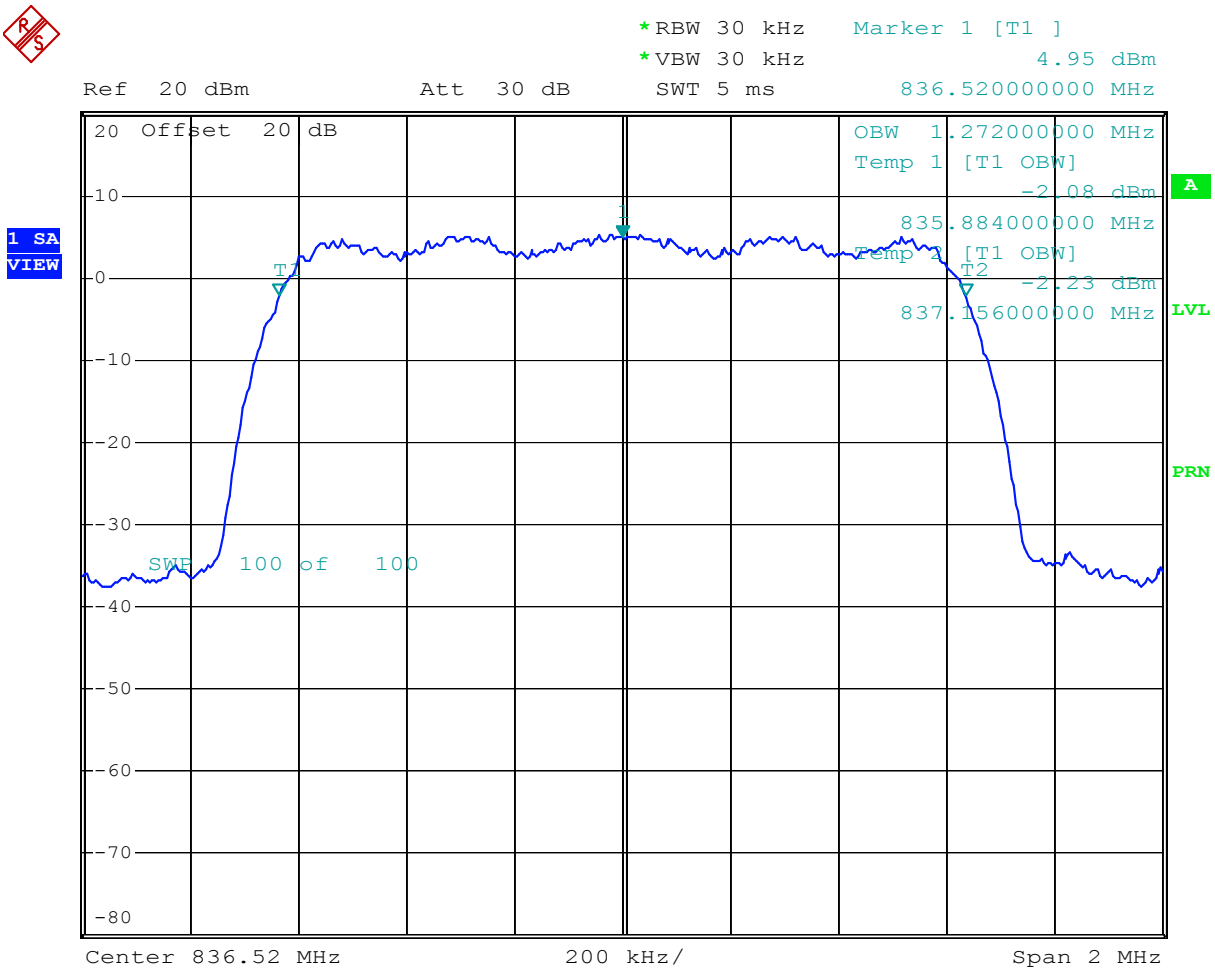
Rohde & Schwarz FSP40 Spectrum Analyzer
Directional Coupler, IFI, CDD 1000-80-5
Directional Coupler, Krytar, 101020020

4.3 Test Results

Refer to the attached plots 4.1 and 4.2.

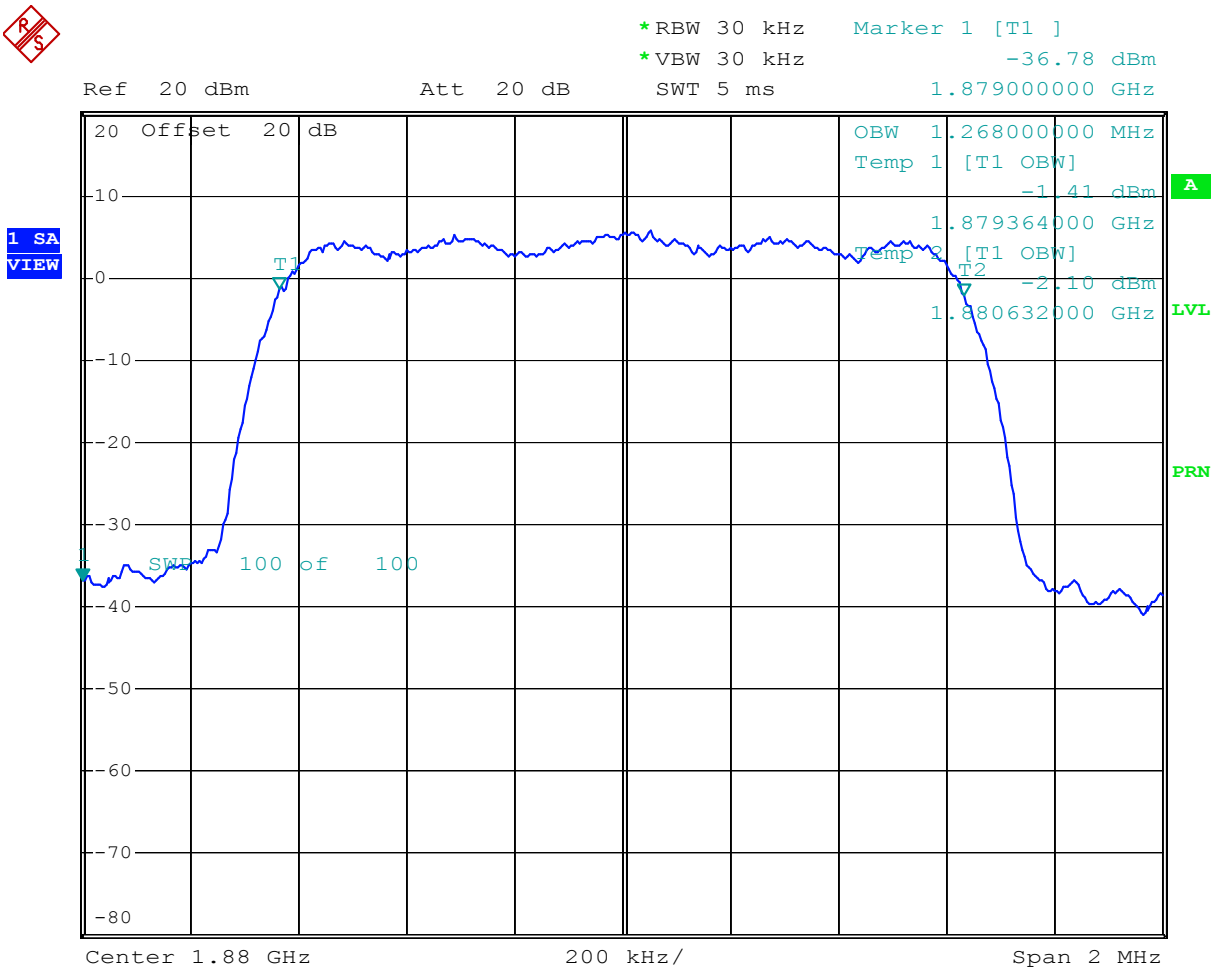
The Emission Designator is determined as 1M25F9W

Plot 4.1



Comment: OBW, Cellular, CH# 384
Date: 17.DEC.2004 17:38:11

Plot 4.2



Comment: OBW, PCS, CH# 600
Date: 17.DEC.2004 17:39:50

5.0 Out of Band Emissions at Antenna Terminals

FCC 22.917(a), 24.238(a)

5.1 Requirement

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (43 + 10 log P) dB.

Note: That corresponds to the level of -13 dBm for any out-of-band and spurious emissions.

5.2 Test Procedure

The EUT RF output was connected as shown on the diagram in sec.1.3.2. The BSS was setup to "originate call".

For emission measurement at the band-edge frequencies, the spectrum analyzed was set to measure a channel power in 13 kHz bandwidth (which is approximately 1% of the signal bandwidth). The directional coupler attenuation and cable loss were added to the spectrum analyzed reading by using OFFSET function. Measurements were performed at two frequencies (lowest, and highest channels) in both Cellular in PCS bands.

For emission measurement at the frequencies which are more than 1 MHz away from the band-edge frequencies, the spectrum analyzed resolution bandwidth (RBW) was set to:
100 kHz - for measurements below 1 GHz,
1 MHz - for measurements above 1 GHz.

Measurements were performed at three frequencies (low, middle, and high channels) in both Cellular in PCS bands.

Sufficient scans were taken to show the out-of-band emissions up to 10th harmonic.

5.3 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer
Directional Coupler, IFI, CDD 1000-80-5
Directional Coupler, Krytar, 101020020

5.4 Test Results

Complies	Refer to the following plots

Out-of-band emissions at the band-edge frequencies and within ±1 MHz

Cellular Band			
Plot #	**Channel**	**Description**	**Margin to -13 dBm level**
5.1.1	1013	823 – 824 MHz	-8.5 dB
5.1.2	777	849 – 850 MHz	-3.1 dB
PCS Band			
Plot #	**Channel**	**Description**	
5.1.3	25	1.849 – 1.850 GHz	-17.9 dB
5.1.4	1175	1.910 – 1.911 GHz	-18.8 dB

Out-of-band and spurious emissions, maximum RF power output

Cellular Band			
Plot #	**Channel**	**Description**	**Comment**
5.2.1	1013	30 MHz – 823 MHz	
5.2.2	1013	850 MHz – 1 GHz	
5.2.3	1013	1 GHz – 10 GHz	
5.3.1	384	30 MHz – 824 MHz	
5.3.2	384	849 MHz – 1 GHz	
5.3.3	384	1 GHz – 10 GHz	
5.4.1	777	30 MHz – 824 MHz	
5.4.2	777	850 MHz – 1 GHz	
5.4.3	777	1 GHz – 10 GHz	

PCS Band			
Plot #	**Channel**	**Description**	**Comment**
5.5.1	25	30 MHz – 1 GHz	
5.5.2	25	1 GHz – 1.848 GHz	
5.5.3	25	1.848 GHz – 1.849 GHz	Measured with RBW = 300 kHz, therefore BCF= 5.2 dB is added to the spectrum analyzer reading.
5.5.4	25	1.91 GHz – 20 GHz	
5.6.1	600	30 MHz – 1 GHz	
5.6.2	600	1 GHz – 1.850 GHz	
5.6.3	600	1.91 GHz – 20 GHz	
5.7.1	1175	30 MHz – 1 GHz	
5.7.2	1175	1 GHz – 1.850 GHz	
5.7.3	1175	1.911 GHz – 20 GHz	

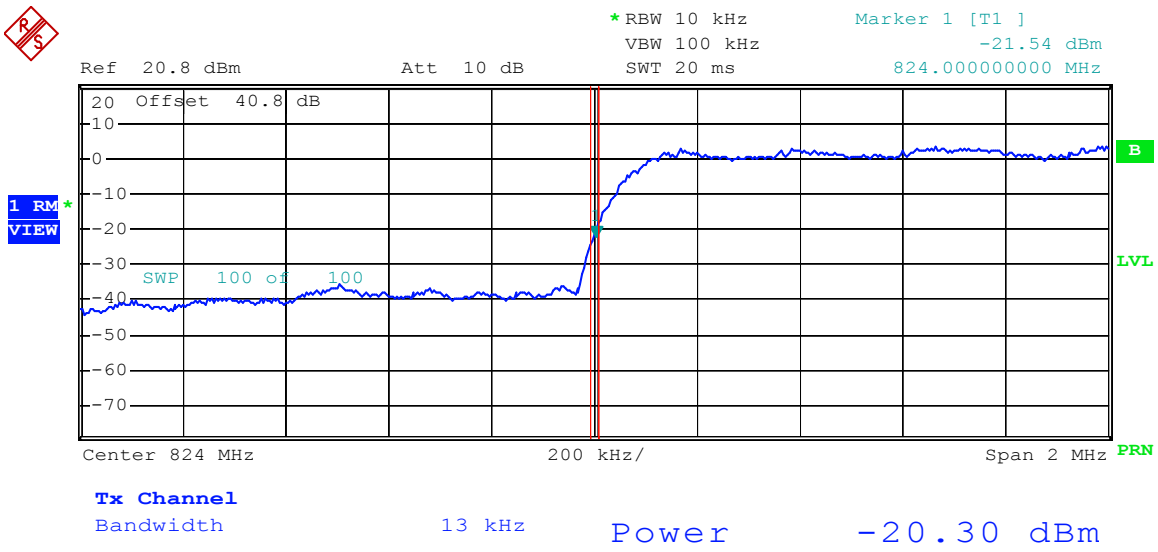
BCF is a Bandwidth Correction Factor

Out-of-band and spurious emissions, minimum RF power output

Cellular Band			
Plot #	**Channel**	**Description**	**Comment**
5.8.1	1013	30 MHz – 824 MHz	
5.8.2	1013	849 MHz – 1 GHz	
5.8.3	1013	1 GHz – 10 GHz	
5.9.1	777	849 MHz – 1 GHz	
5.9.2	777	1 GHz – 10 GHz	

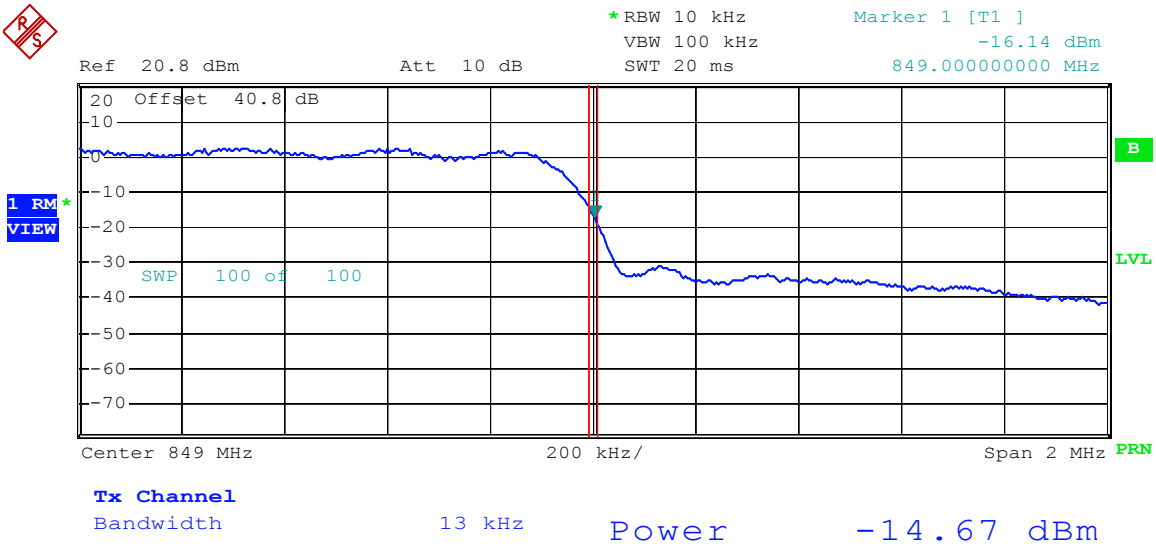
PCS Band			
Plot #	**Channel**	**Description**	**Comment**
5.10.1	25	30 MHz – 1 GHz	
5.10.2	25	1 GHz – 1.85 GHz	
5.11.1	1175	1.91 GHz – 20 GHz	

Plot 5.1.1



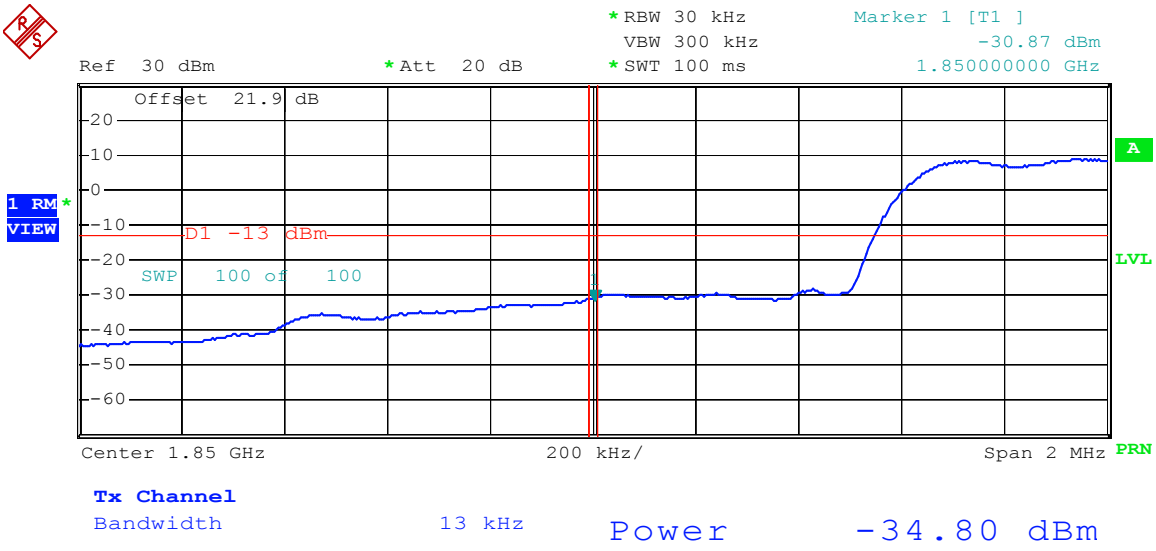
Comment: Band-edge, Cell band, CH# 1013
Date: 20.DEC.2004 13:03:35

Plot 5.1.2



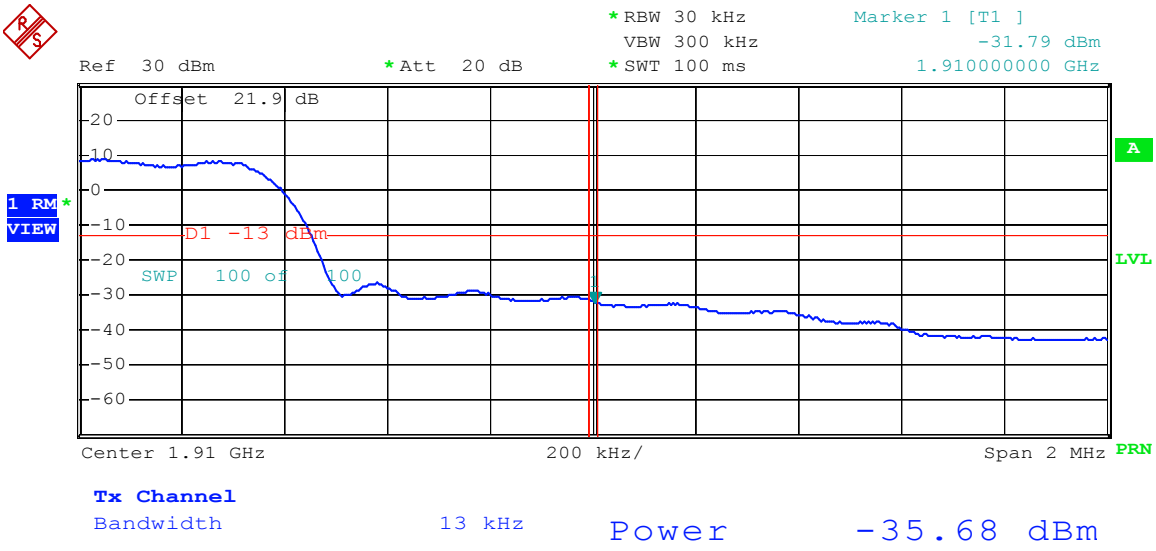
Comment: Band-edge, Cell band, CH# 777
Date: 20.DEC.2004 13:00:46

Plot 5.1.3



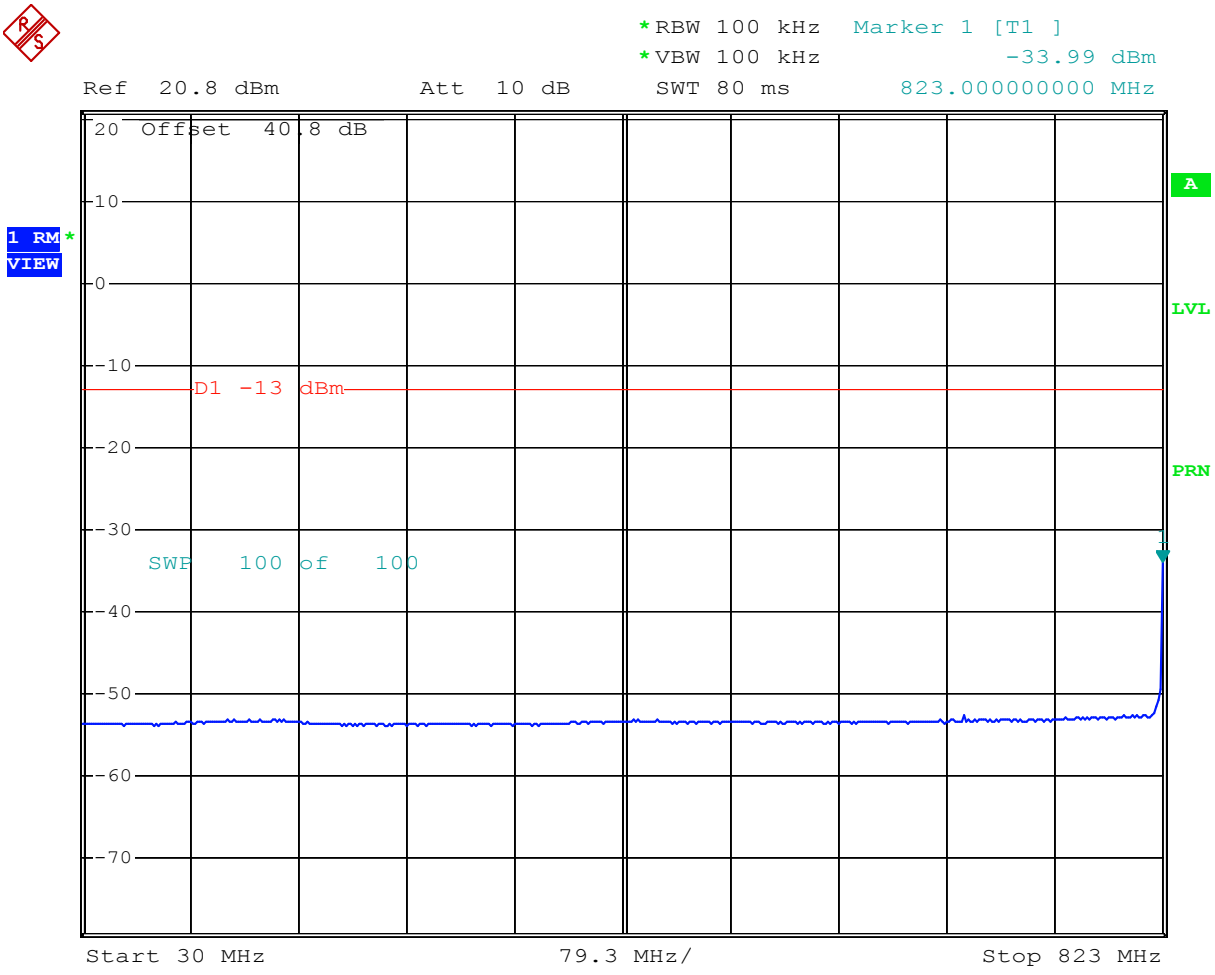
Comment: Band-edge, PCS band, CH# 25
Date: 20.DEC.2004 15:10:24

Plot 5.1.4



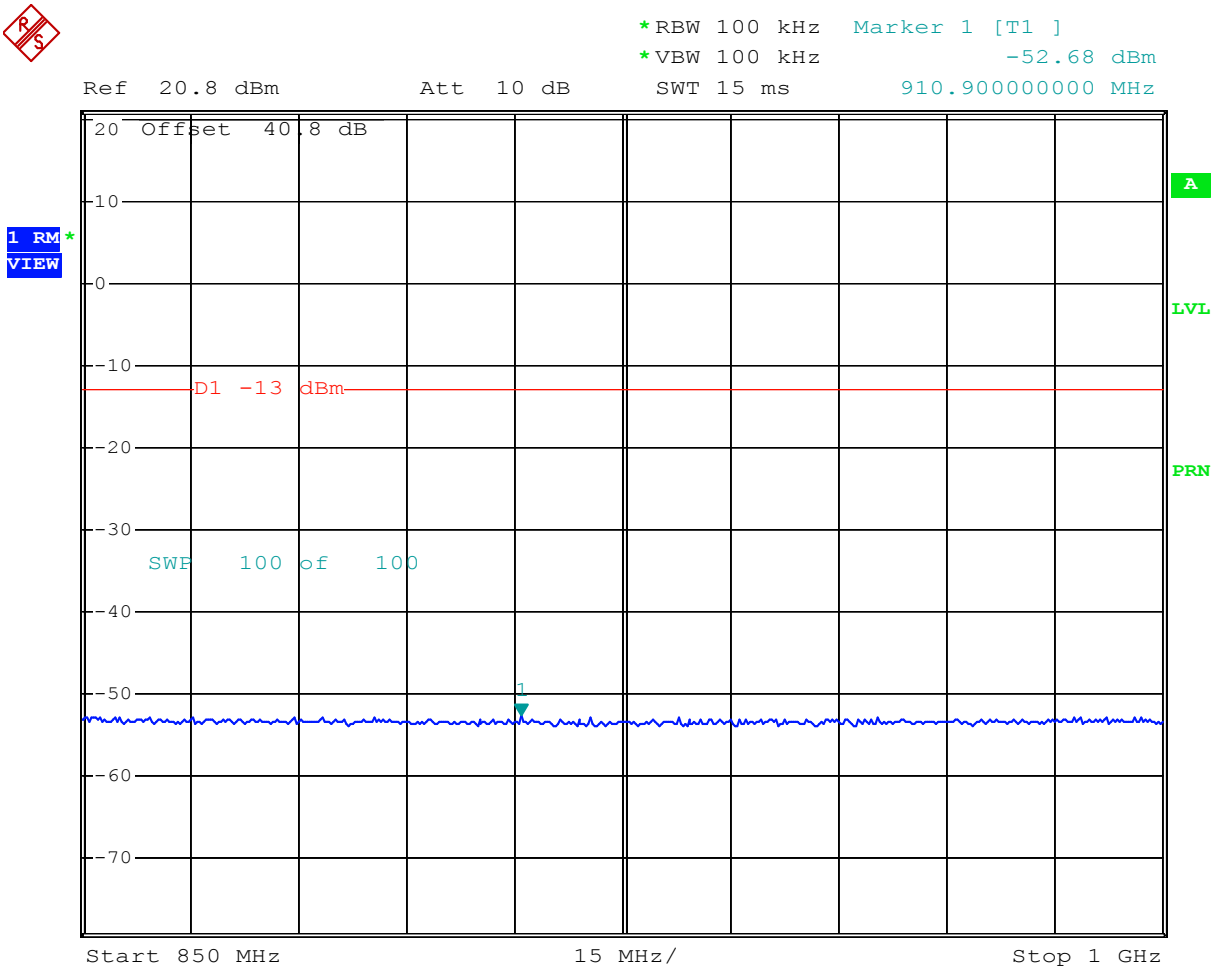
Comment: Band-edge, PCS band, CH# 1175
Date: 20.DEC.2004 15:13:00

Plot 5.2.1



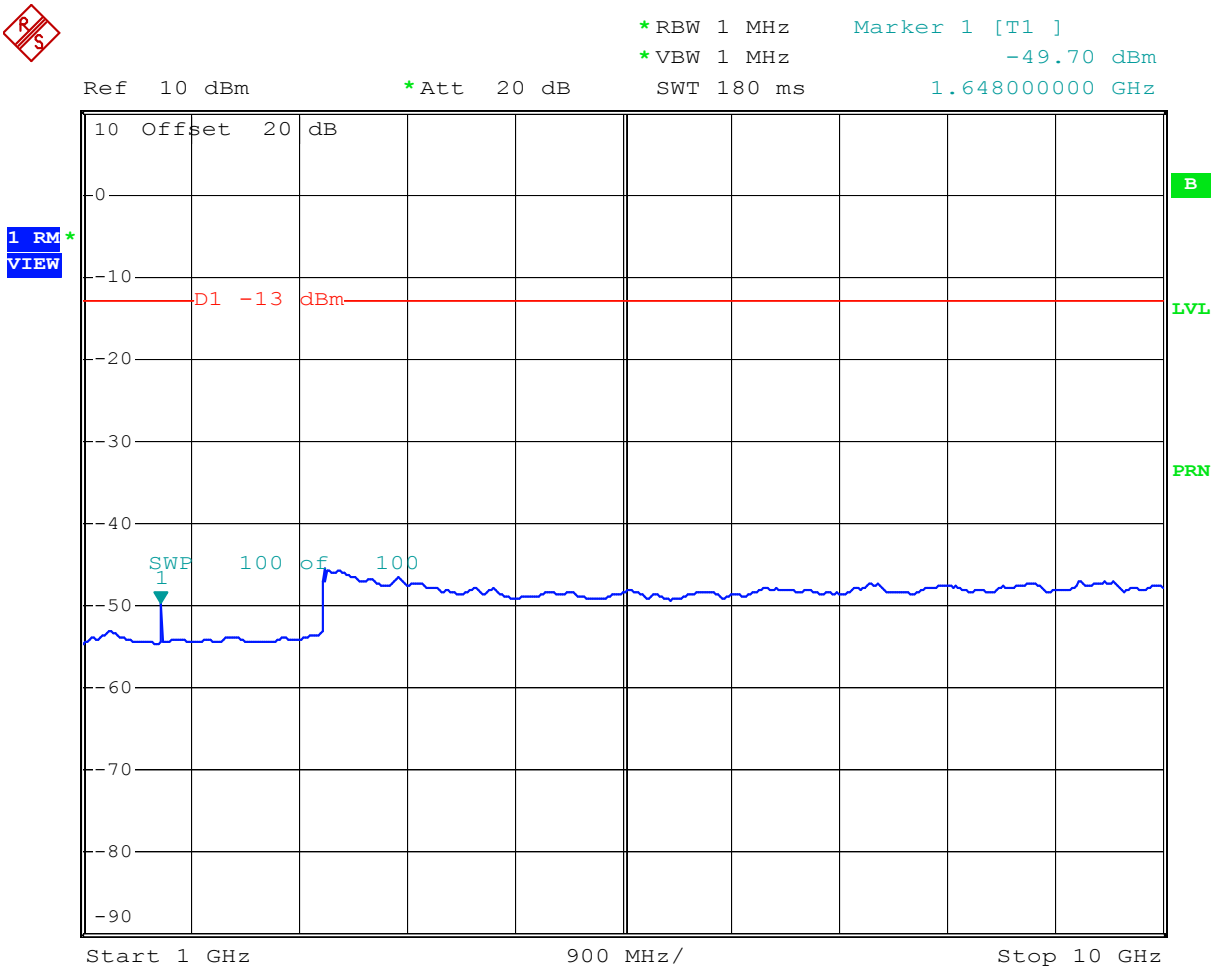
Comment: Out-of-band, Cell band, CH# 1013
Date: 20.DEC.2004 13:14:51

Plot 5.2.2



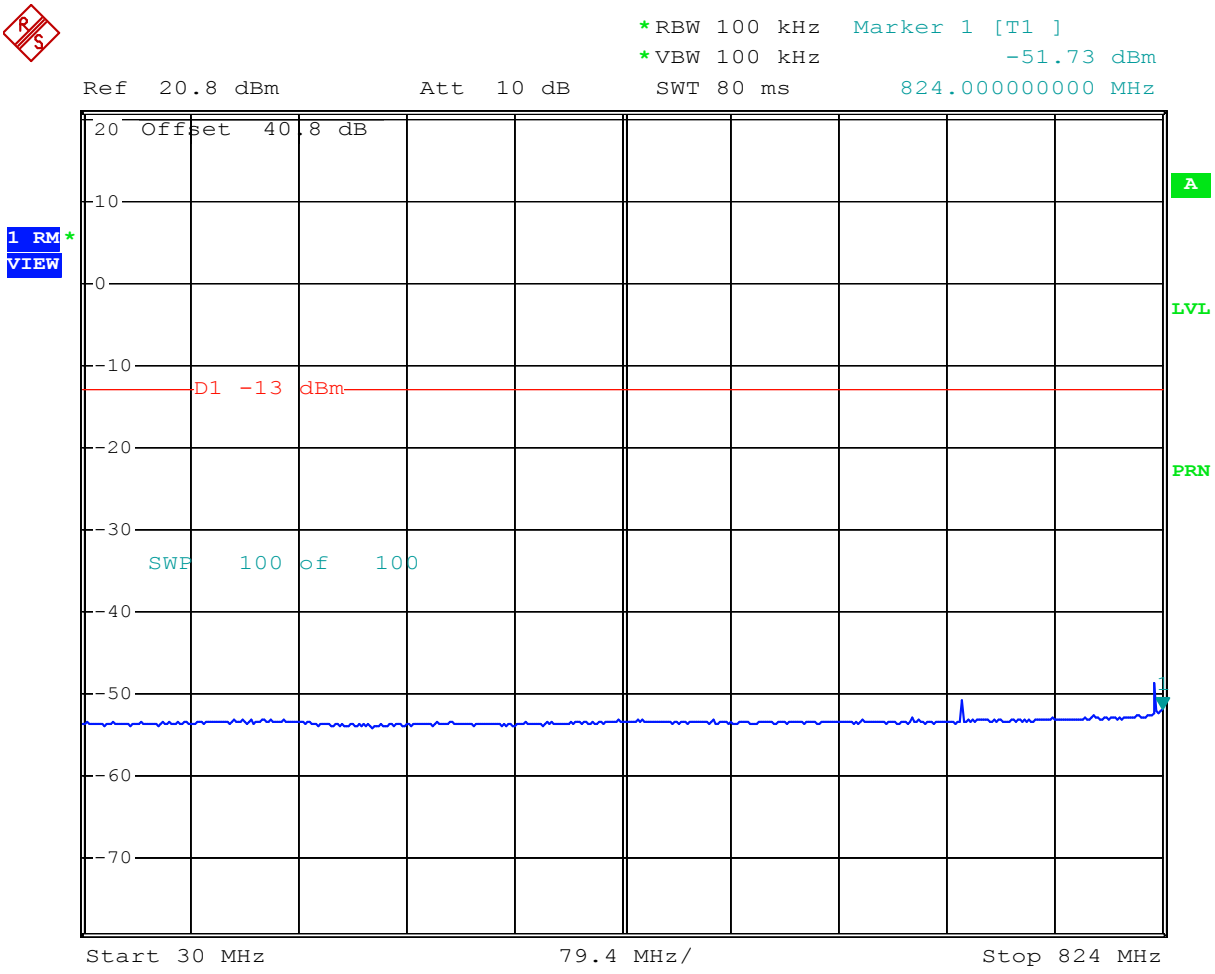
Comment: Out-of-band, Cell band, CH# 1013
Date: 20.DEC.2004 13:16:52

Plot 5.2.3



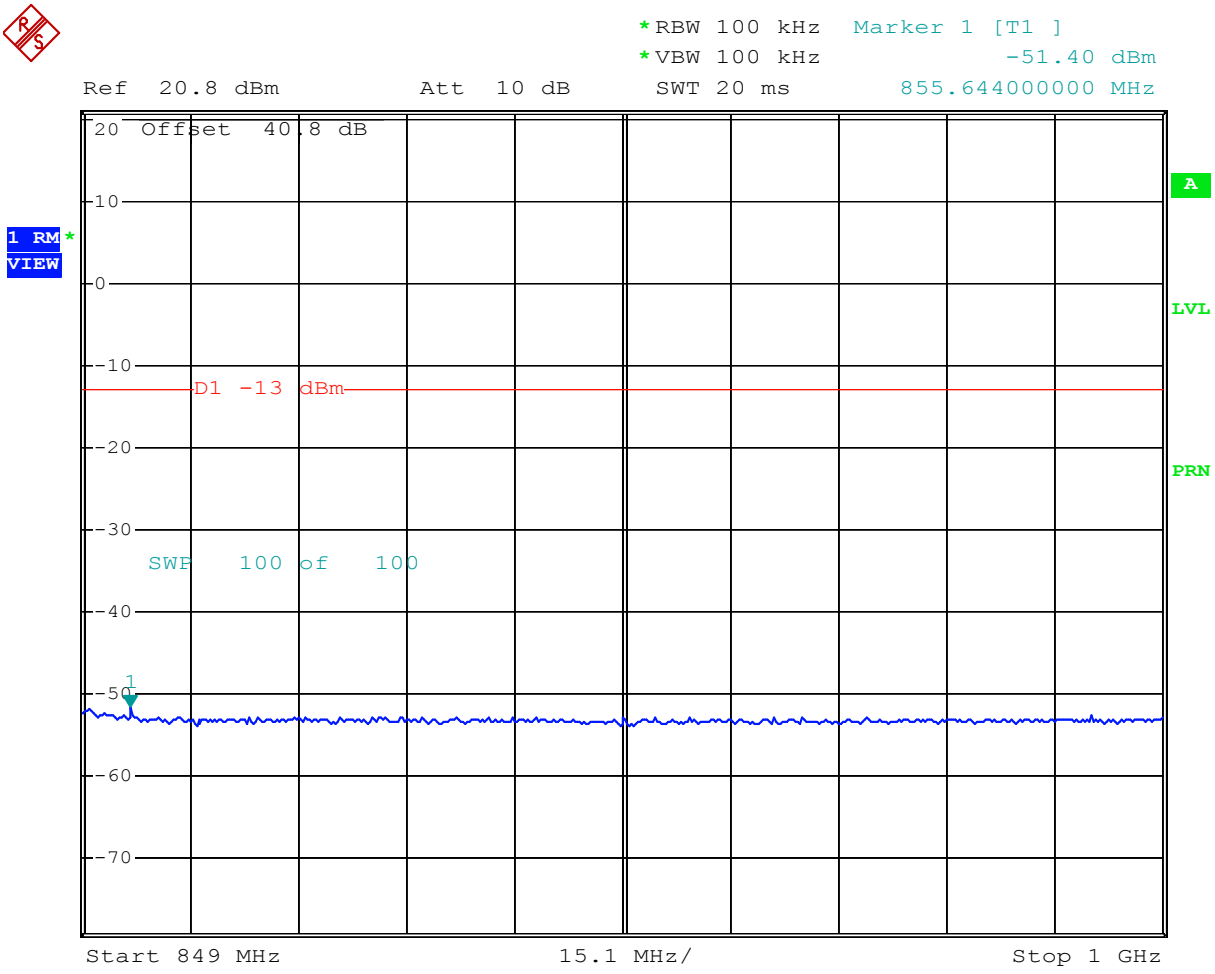
Comment: Out-of-band, cel band, CH# 1013
Date: 20.DEC.2004 16:51:32

Plot 5.3.1



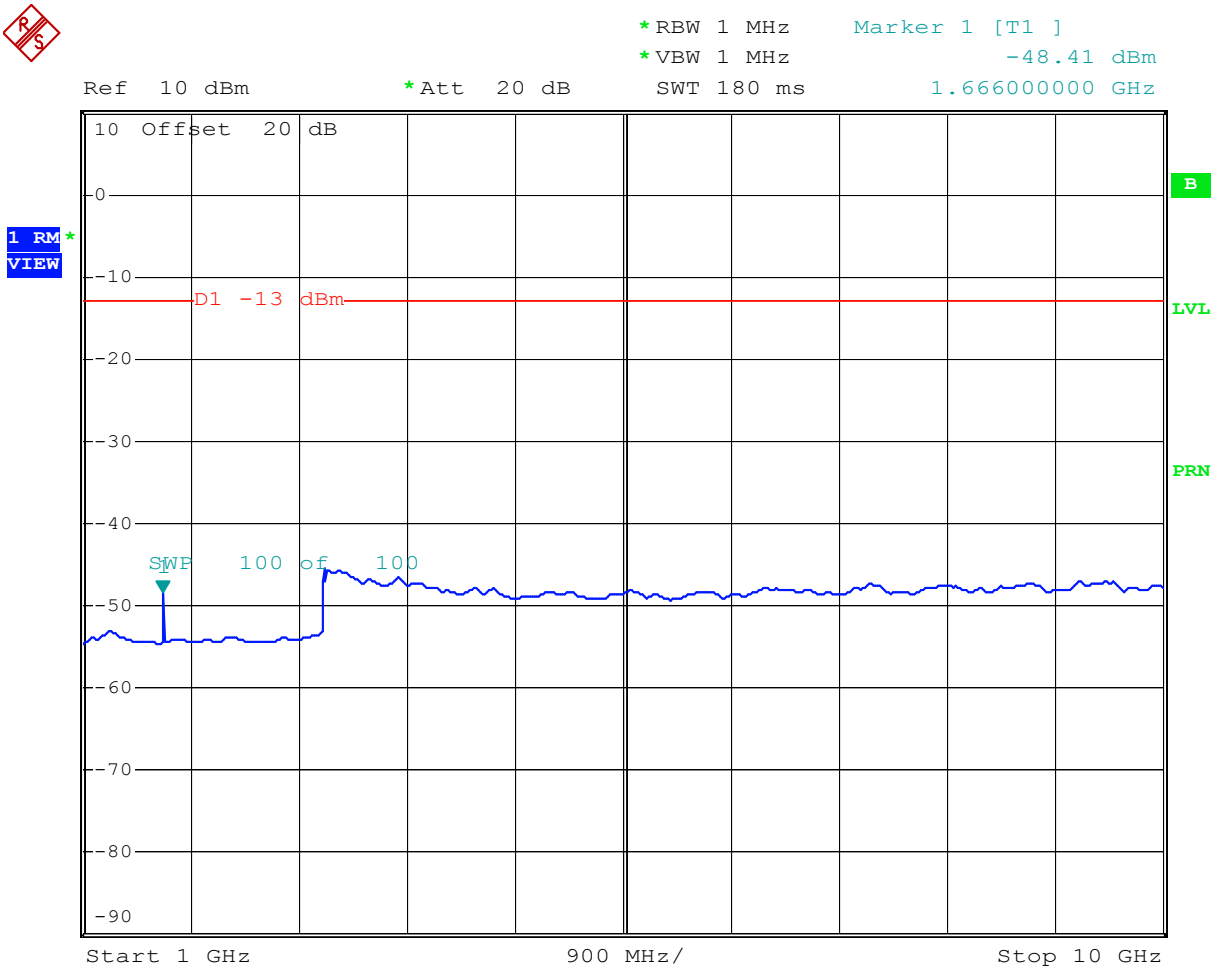
Comment: Out-of-band, Cell band, CH# 384
Date: 20.DEC.2004 13:19:00

Plot 5.3.2



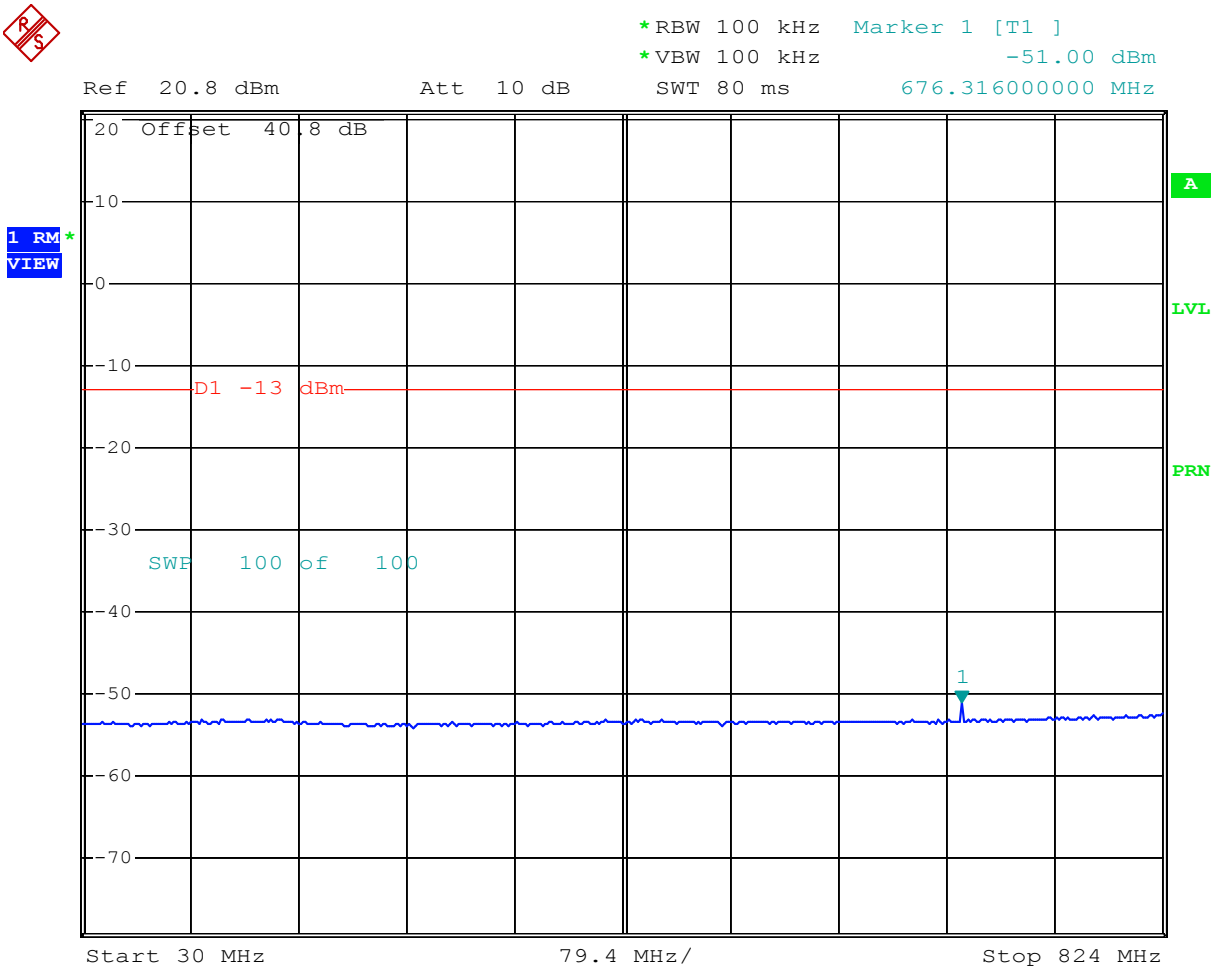
Comment: Out-of-band, Cell band, CH# 384
Date: 20.DEC.2004 13:20:02

Plot 5.3.3



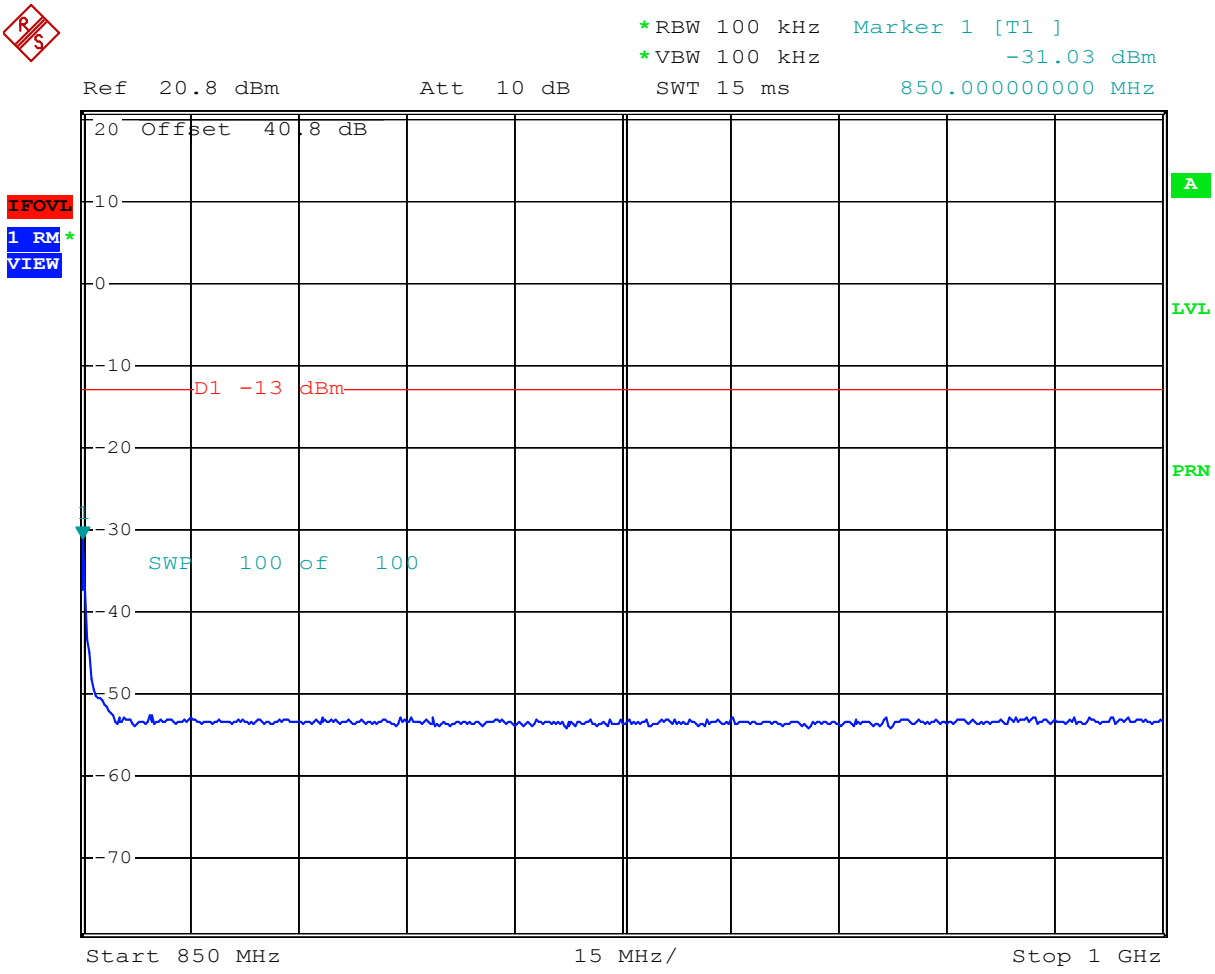
Comment: Out-of-band, cel band, CH# 384
Date: 20.DEC.2004 16:58:53

Plot 5.4.1



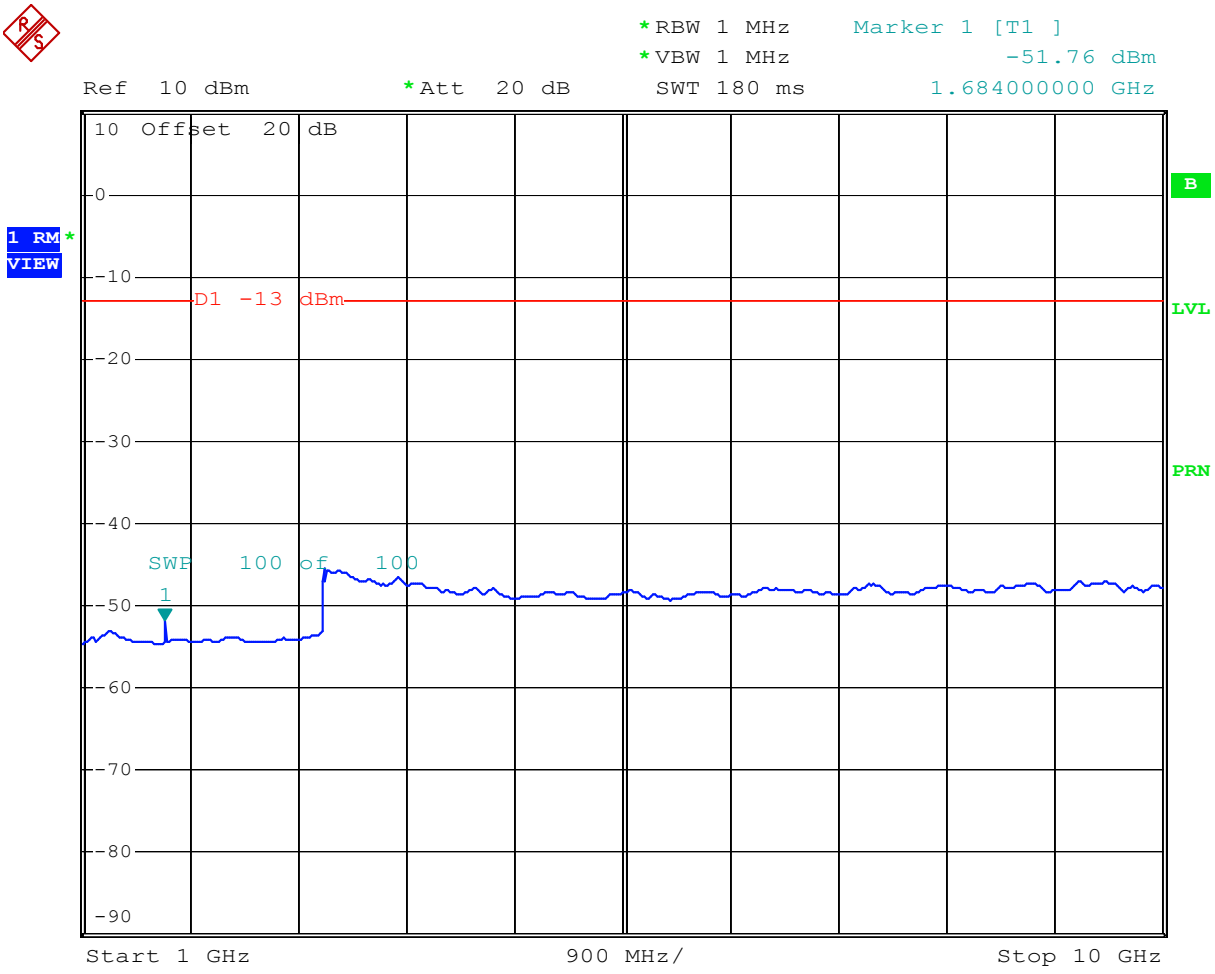
Comment: Out-of-band, Cell band, CH# 777
Date: 20.DEC.2004 13:21:41

Plot 5.4.2



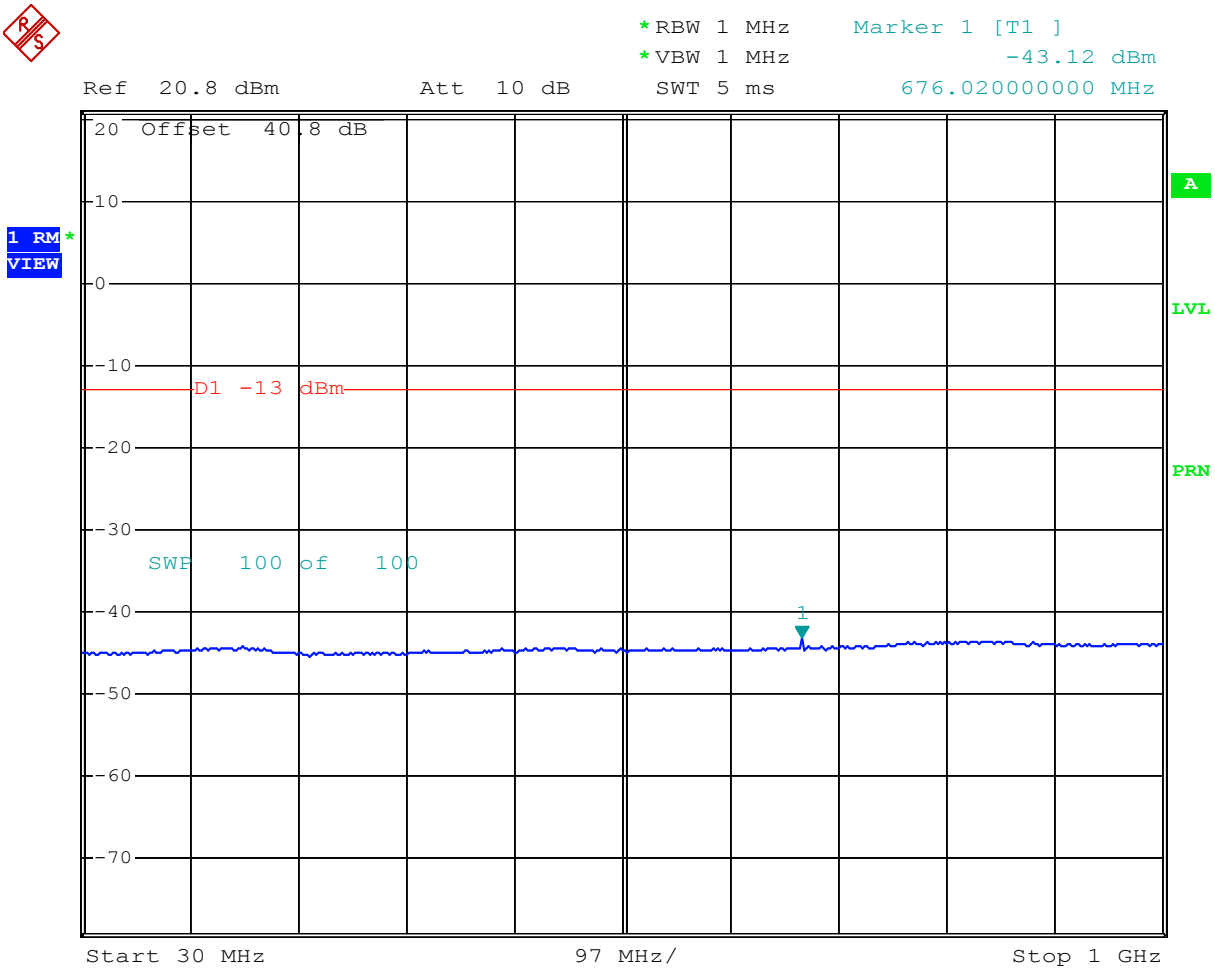
Comment: Out-of-band, Cell band, CH# 777
Date: 20.DEC.2004 13:23:25

Plot 5.4.3



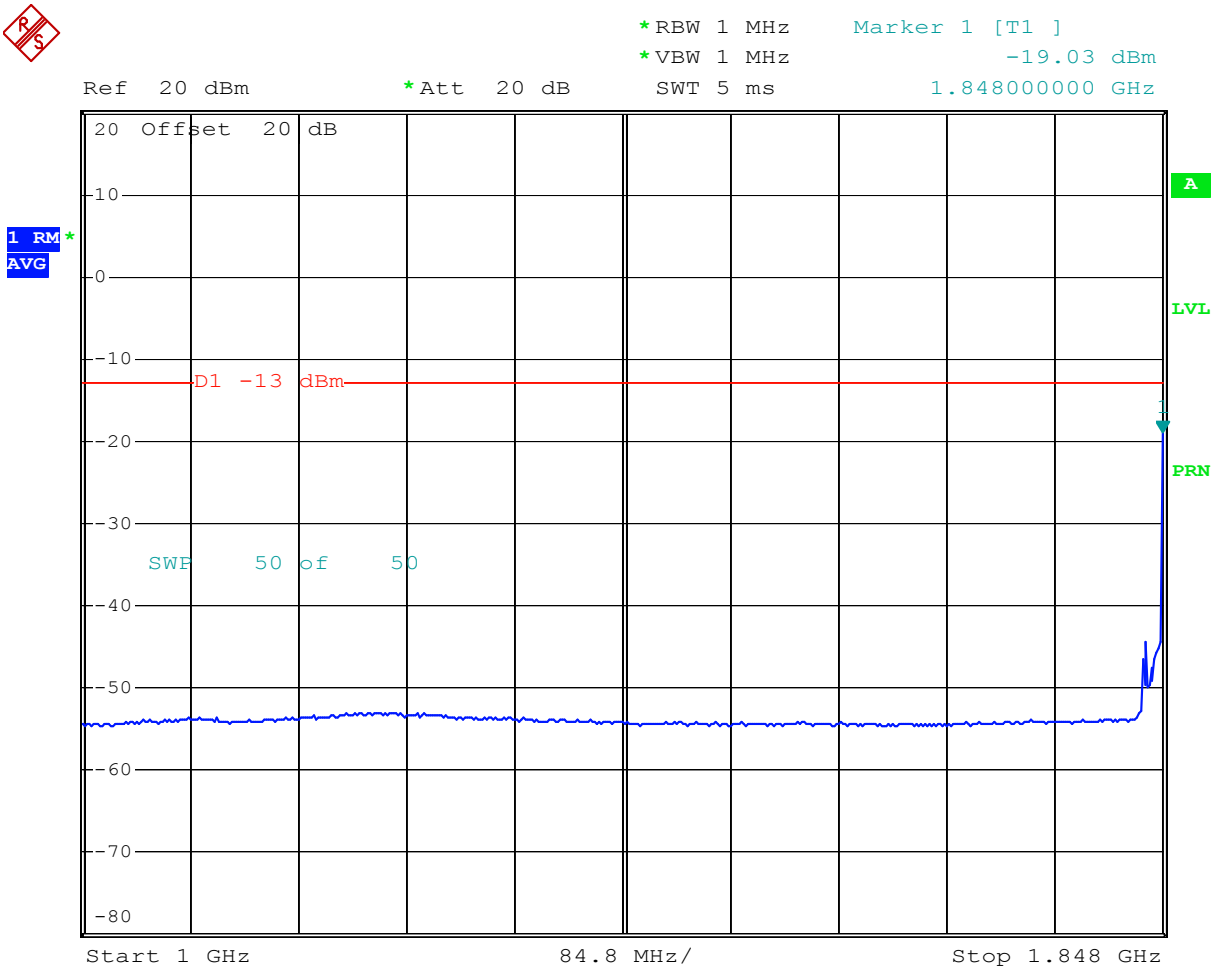
Comment: Out-of-band, cel band, CH# 777
Date: 20.DEC.2004 16:55:28

Plot 5.5.1



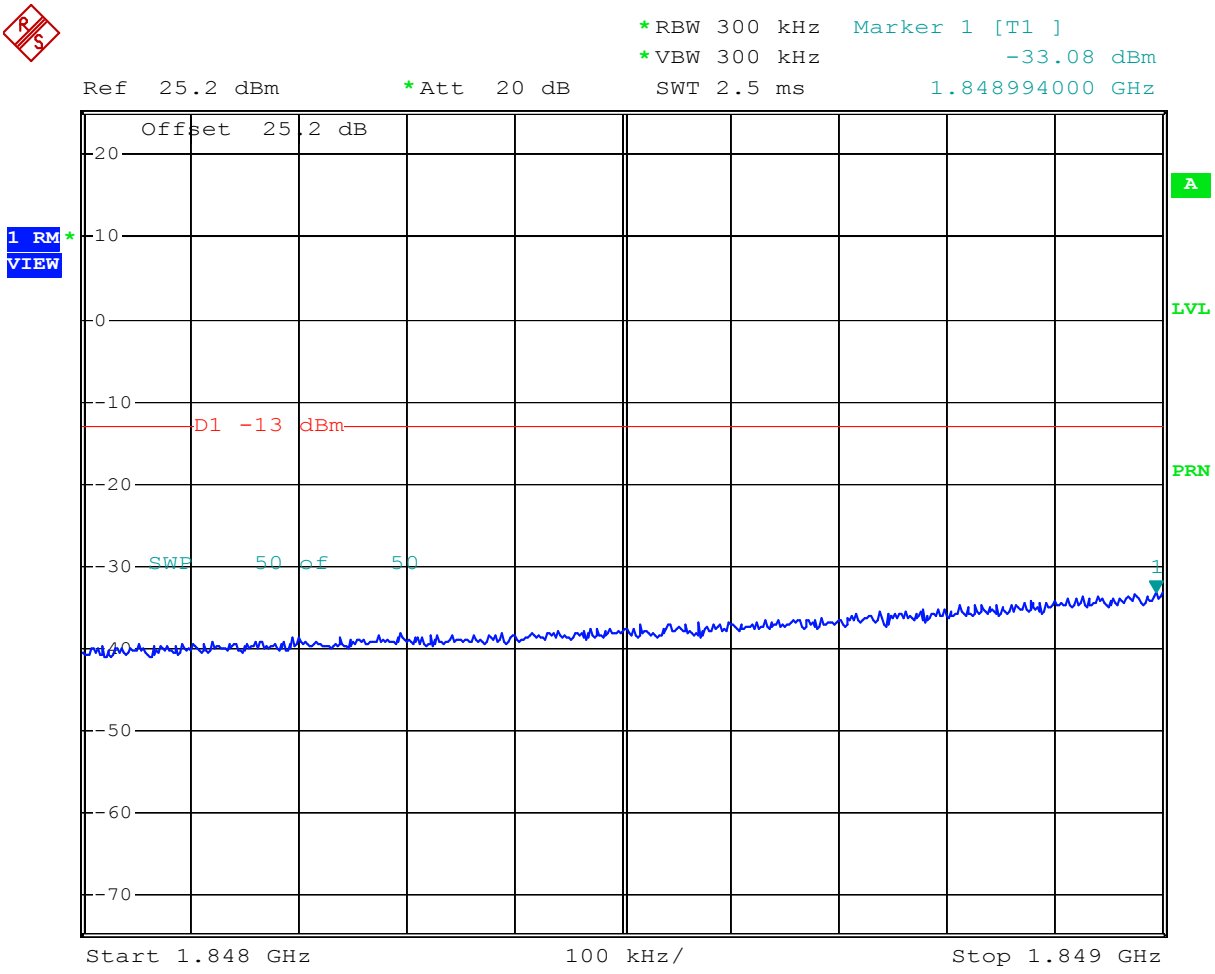
Comment: Out-of-band, PCS band, CH# 25
Date: 20.DEC.2004 14:11:13

Plot 5.5.2



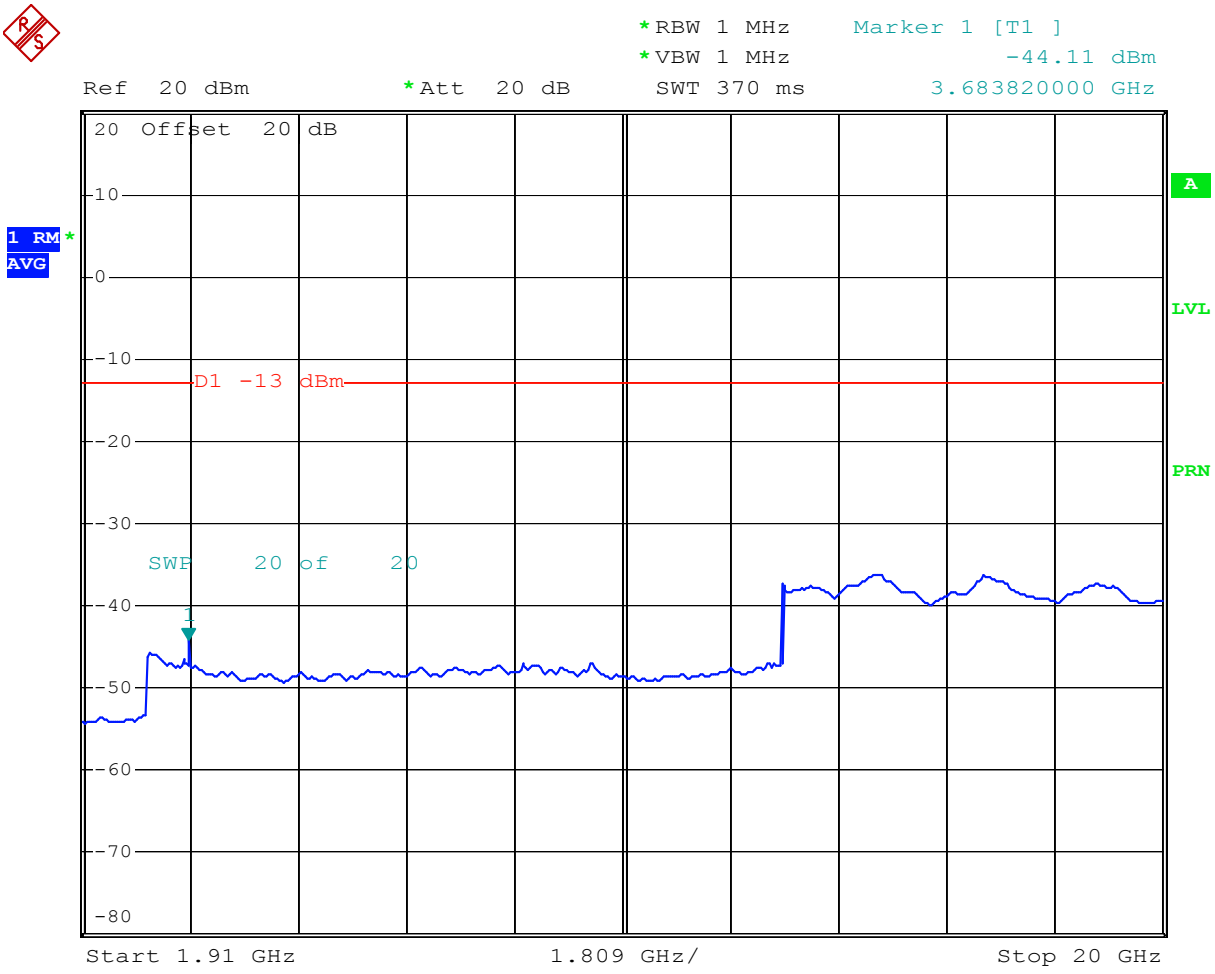
Comment: Out-of-band, PCS, CH# 25
Date: 17.DEC.2004 18:17:51

Plot 5.5.3



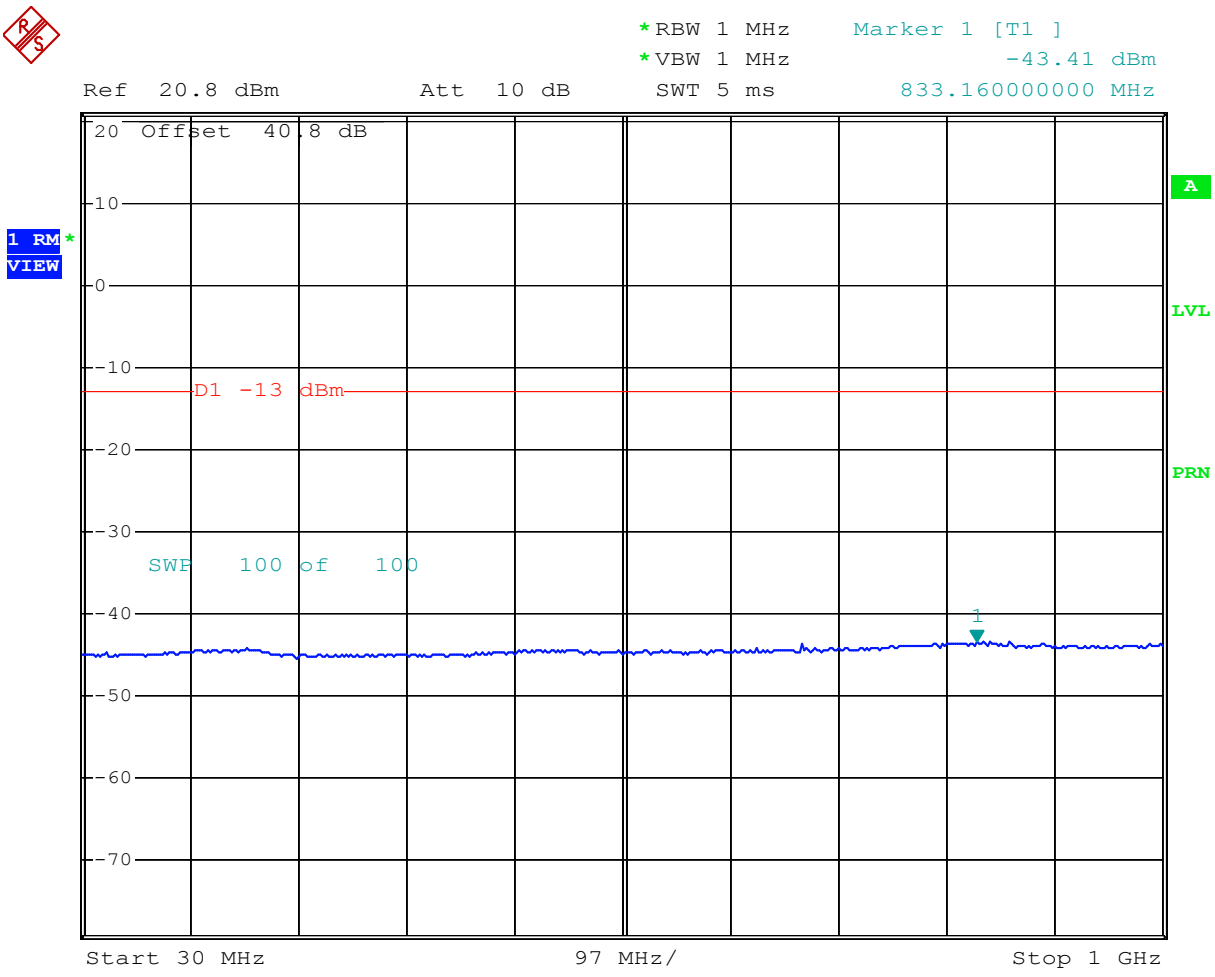
Comment: Out-of-band, PCS, CH# 25, BCF=5.2 dB
Date: 17.DEC.2004 18:15:45

Plot 5.5.4



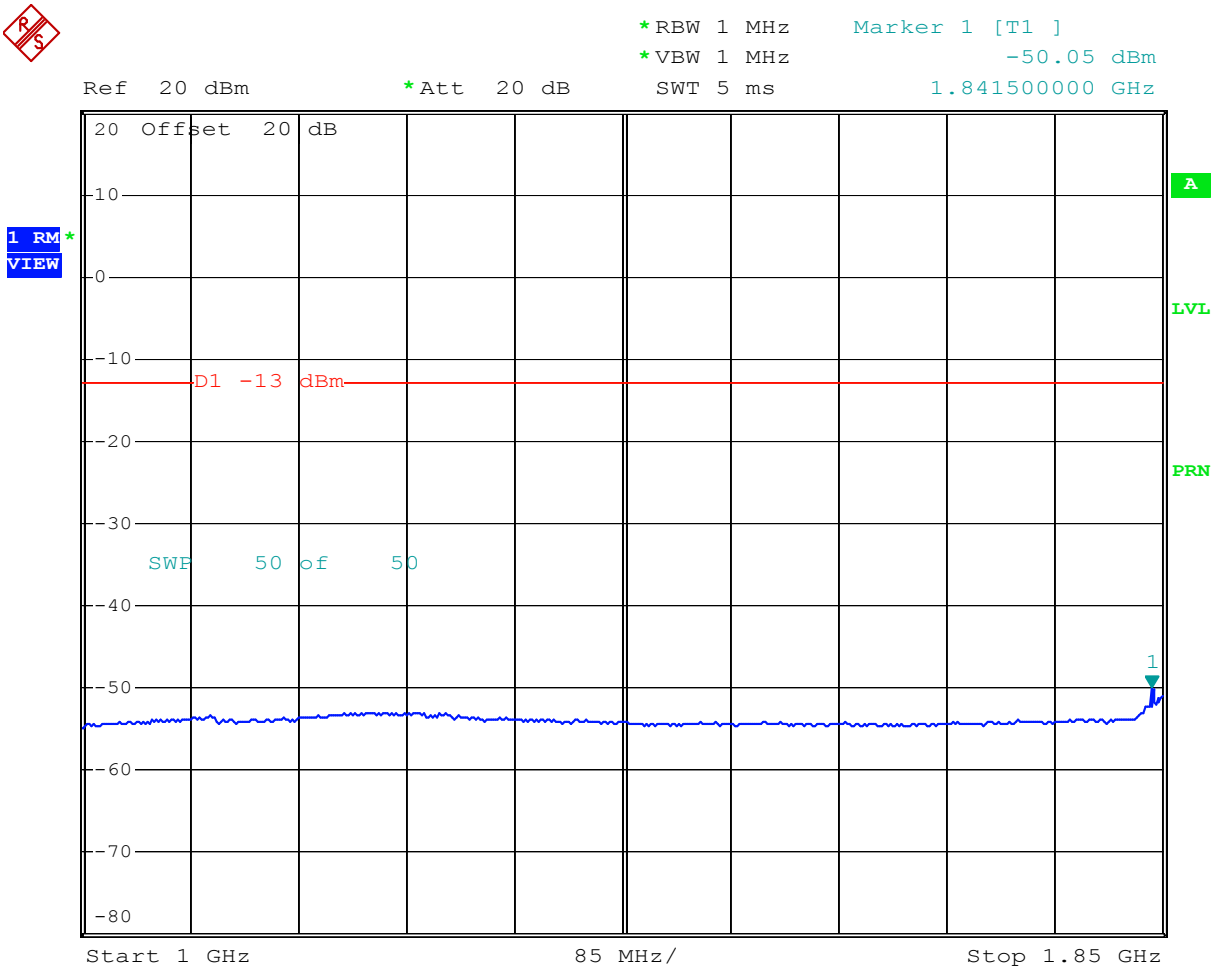
Comment: Out-of-band, PCS, CH# 25
Date: 17.DEC.2004 18:06:14

Plot 5.6.1



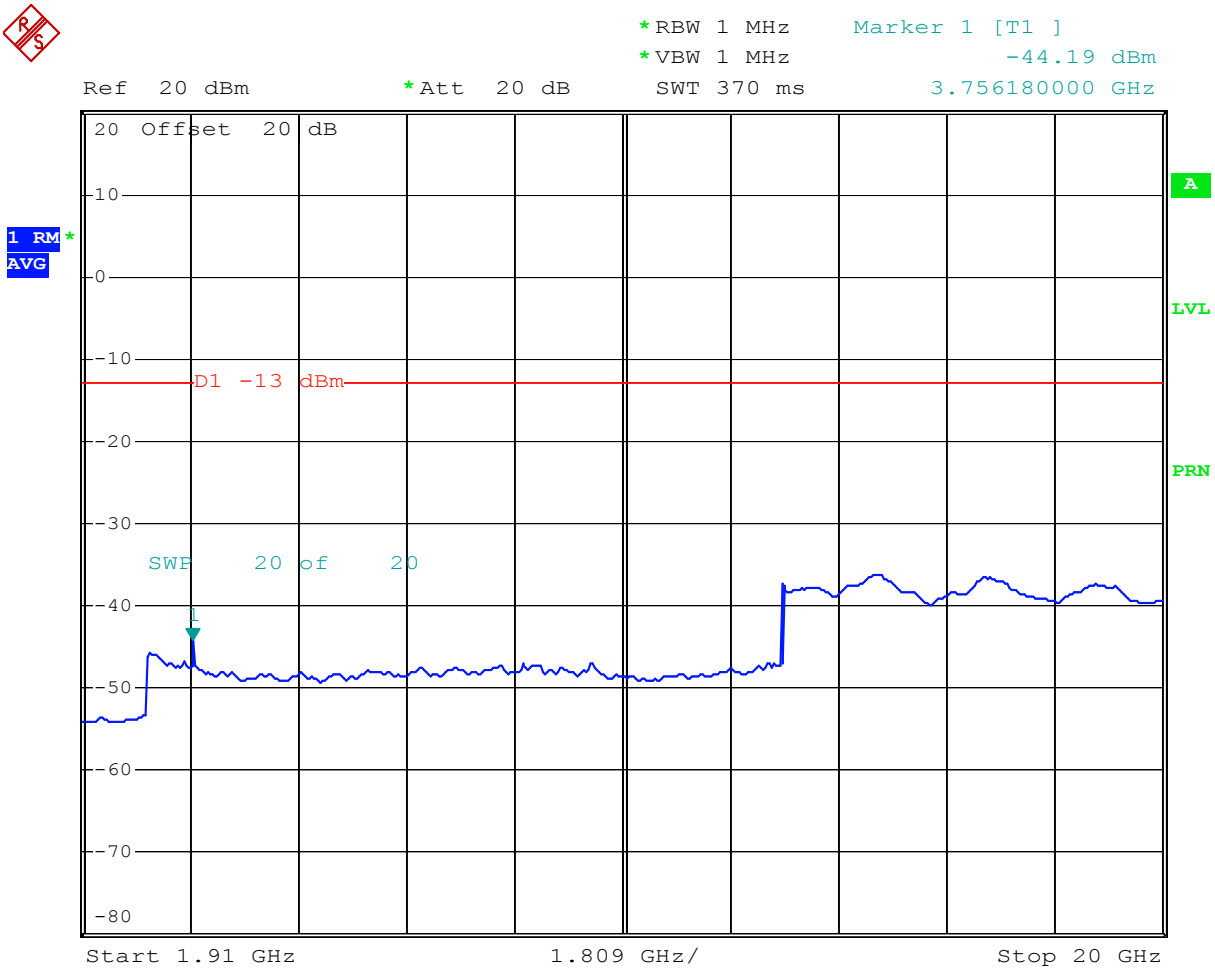
Comment: Out-of-band, PCS band, CH# 600
Date: 20.DEC.2004 14:12:29

Plot 5.6.2



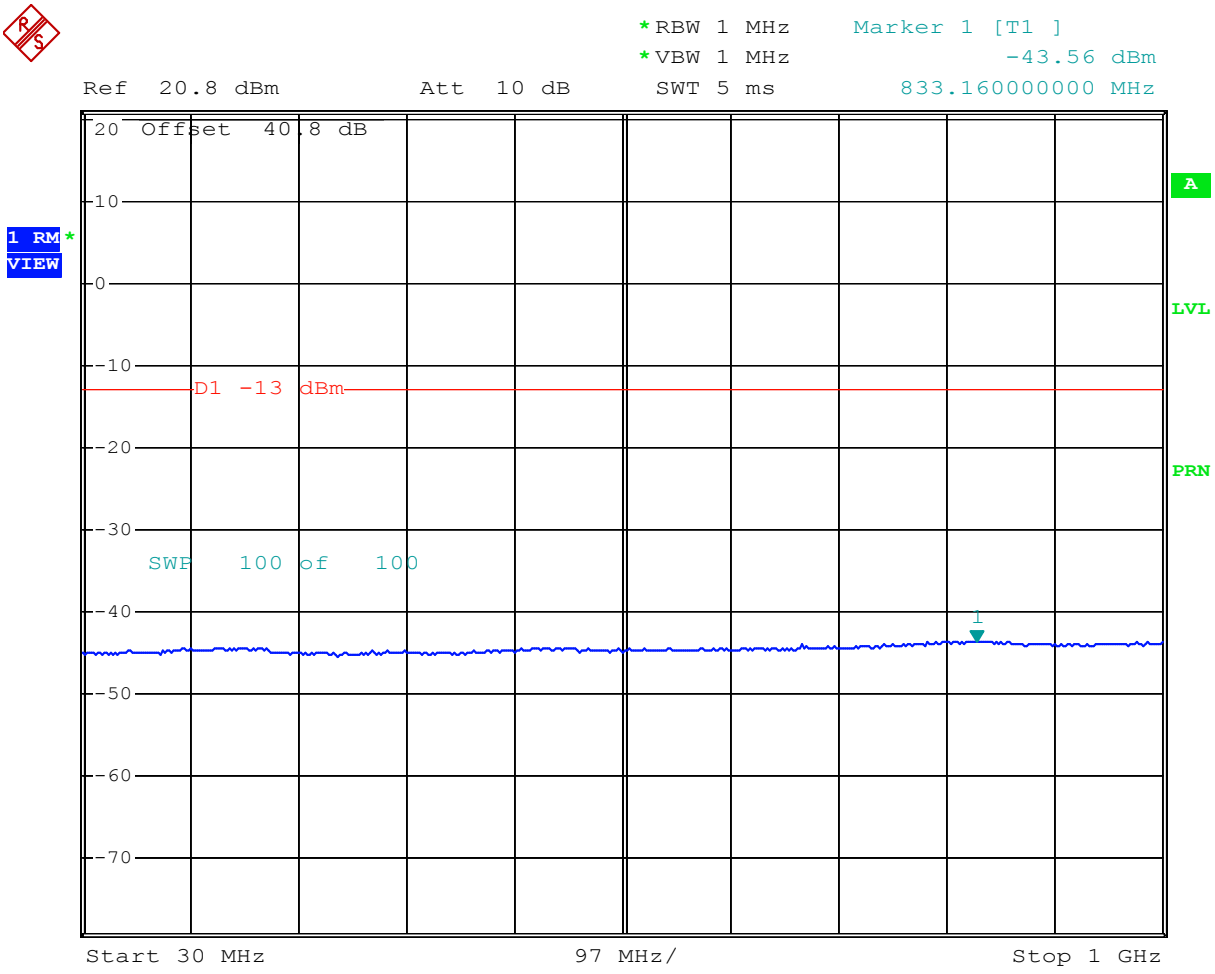
Comment: Out-of-band, PCS, CH# 600
Date: 17.DEC.2004 18:19:24

Plot 5.6.3



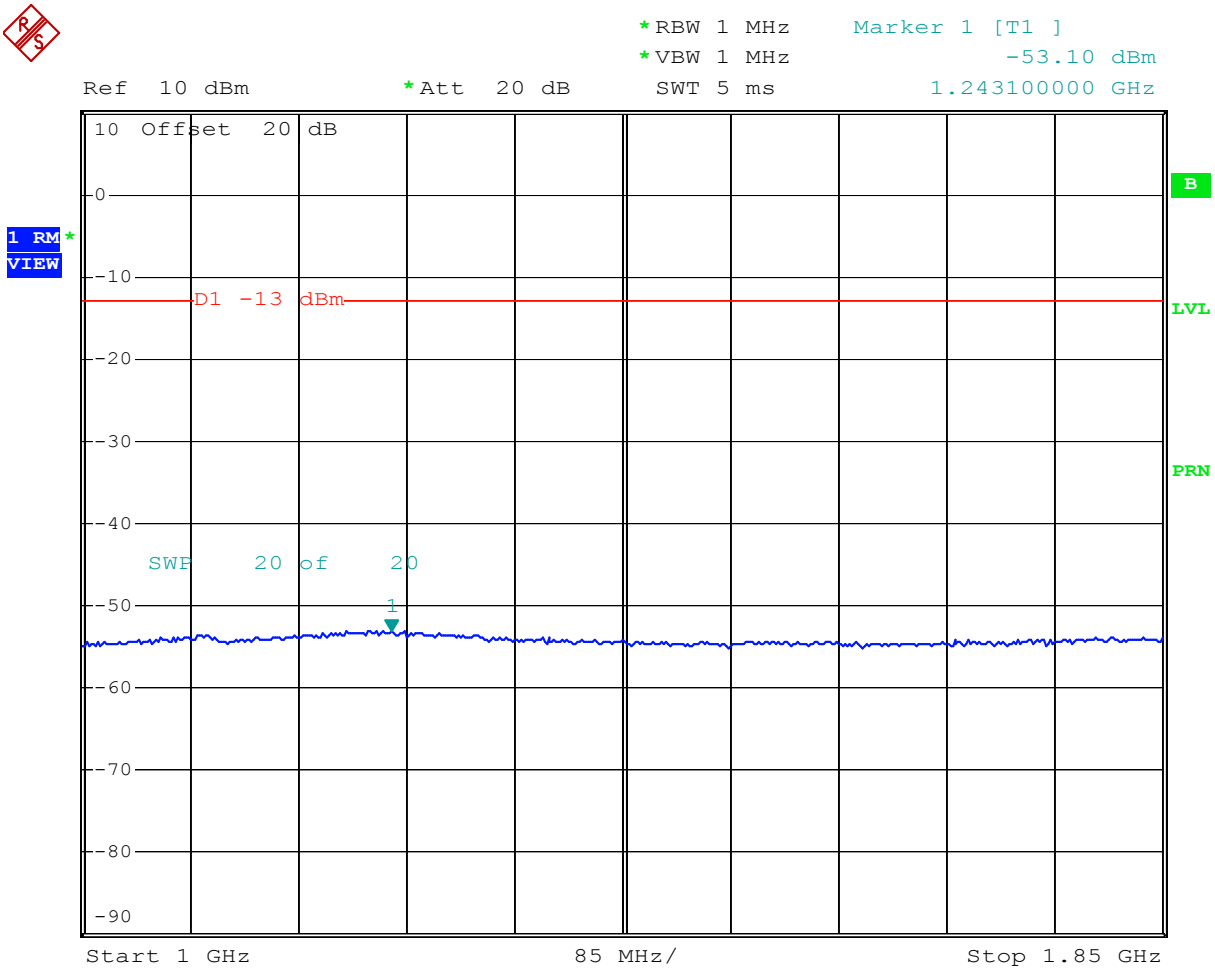
Comment: Out-of-band, PCS, CH# 600
Date: 17.DEC.2004 18:03:39

Plot 5.7.1



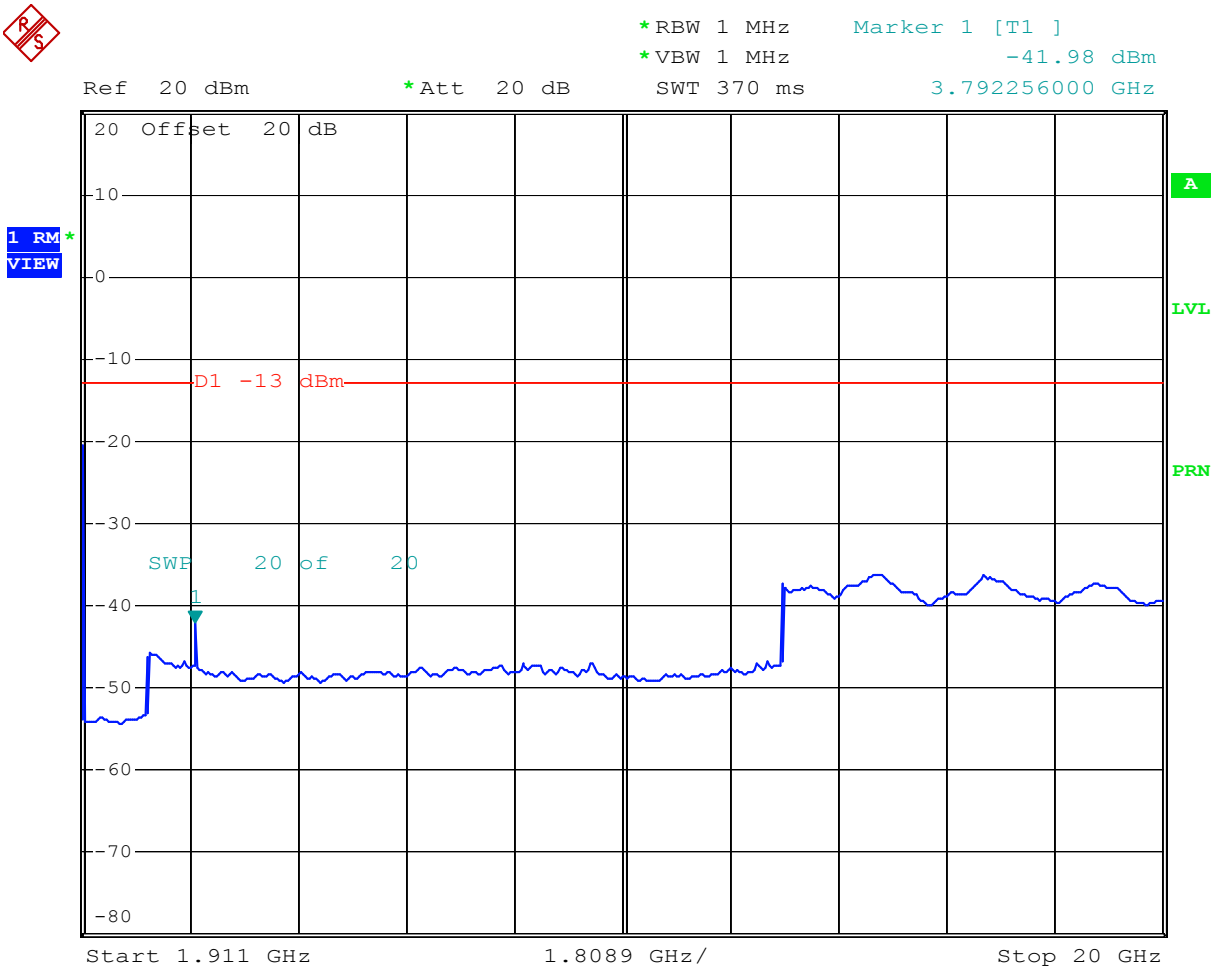
Comment: Out-of-band, PCS band, CH# 1175
Date: 20.DEC.2004 14:13:36

Plot 5.7.2



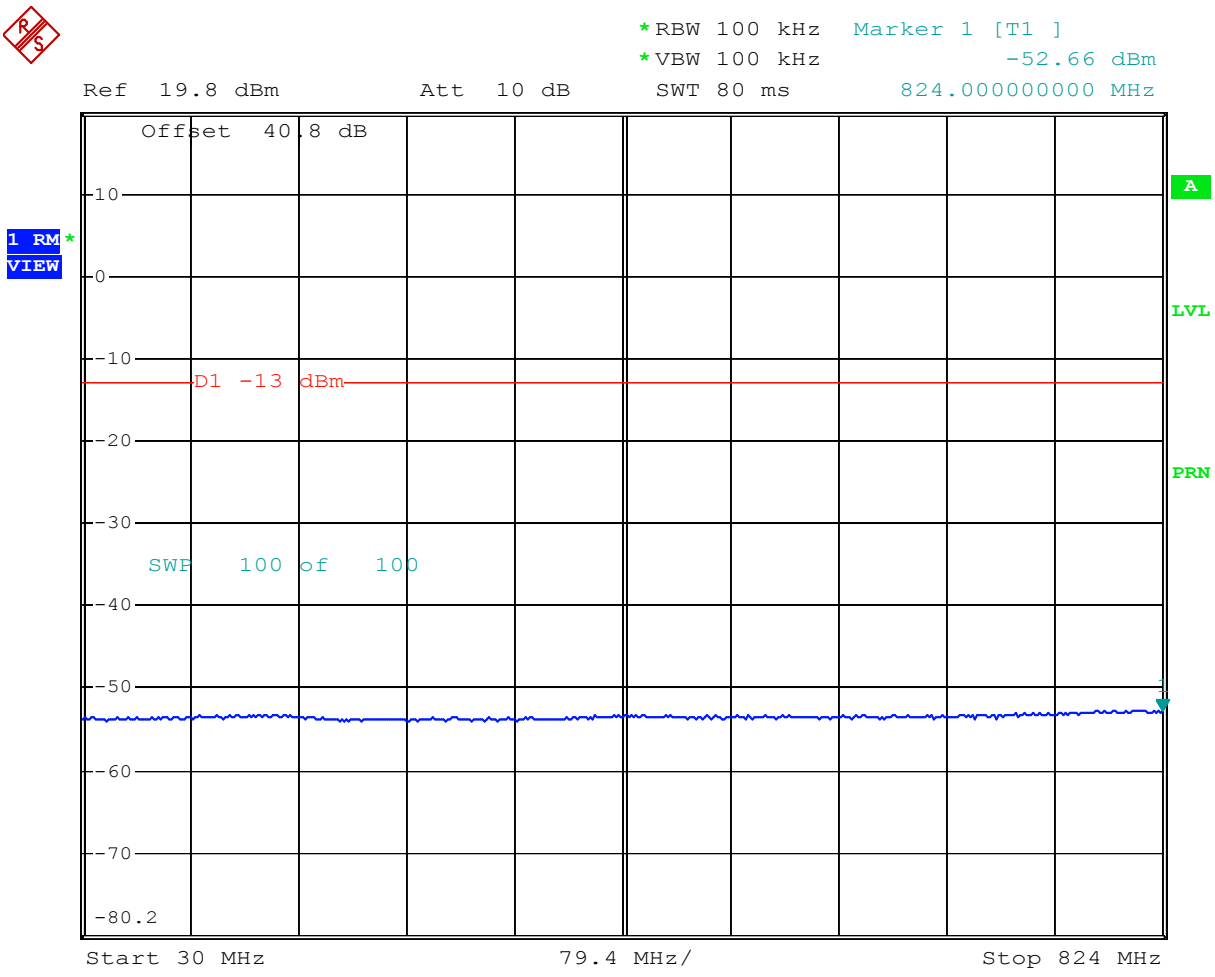
Comment: Out-of-band, PCS band, CH# 1175
Date: 20.DEC.2004 16:45:01

Plot 5.7.3



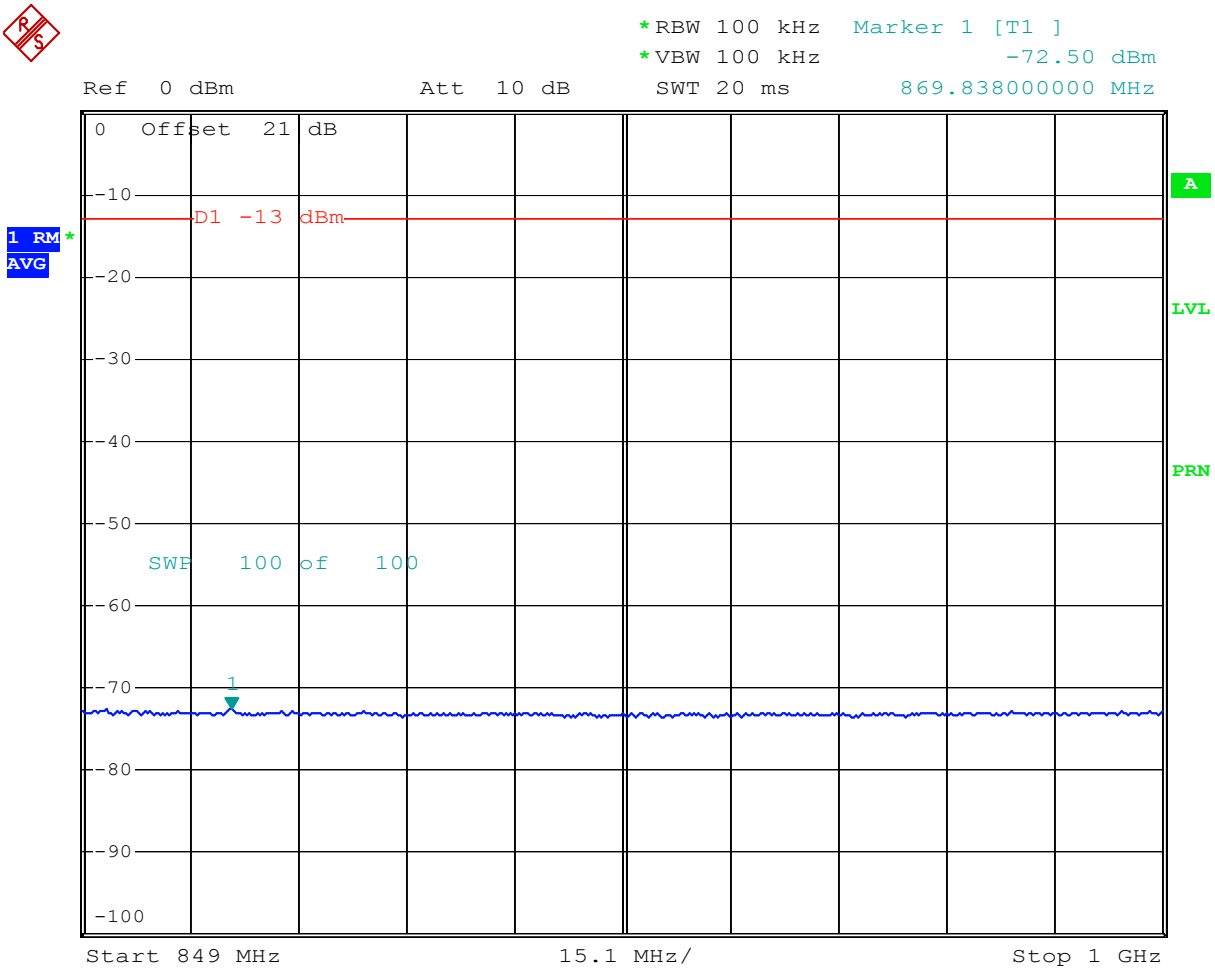
Comment: Out-of-band, PCS, CH# 1175
Date: 17.DEC.2004 17:55:18

Plot 5.8.1



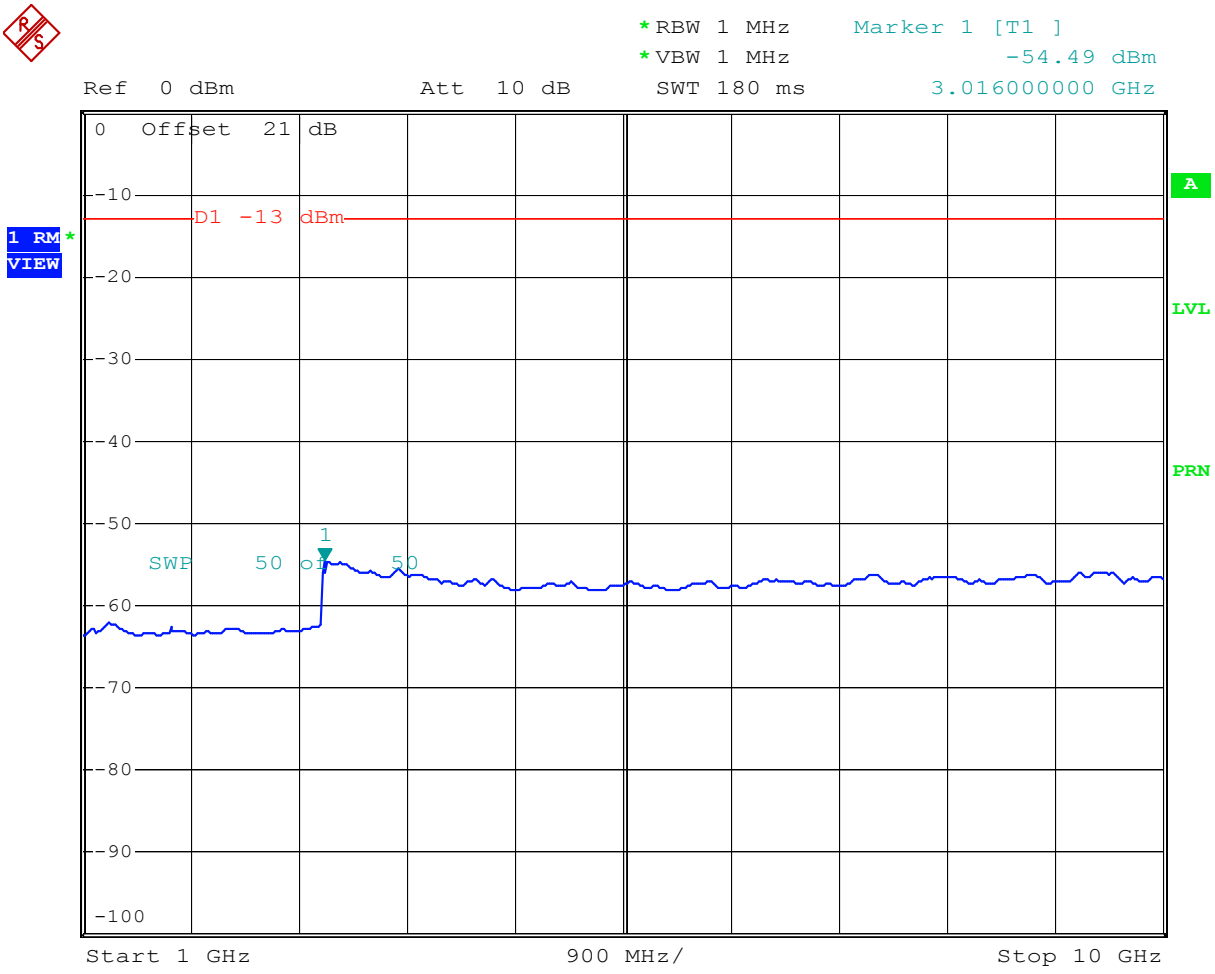
Comment: Out-of band emissions, minimum power, cell band, ch# 1013
Date: 13.JAN.2005 13:20:54

Plot 5.8.2



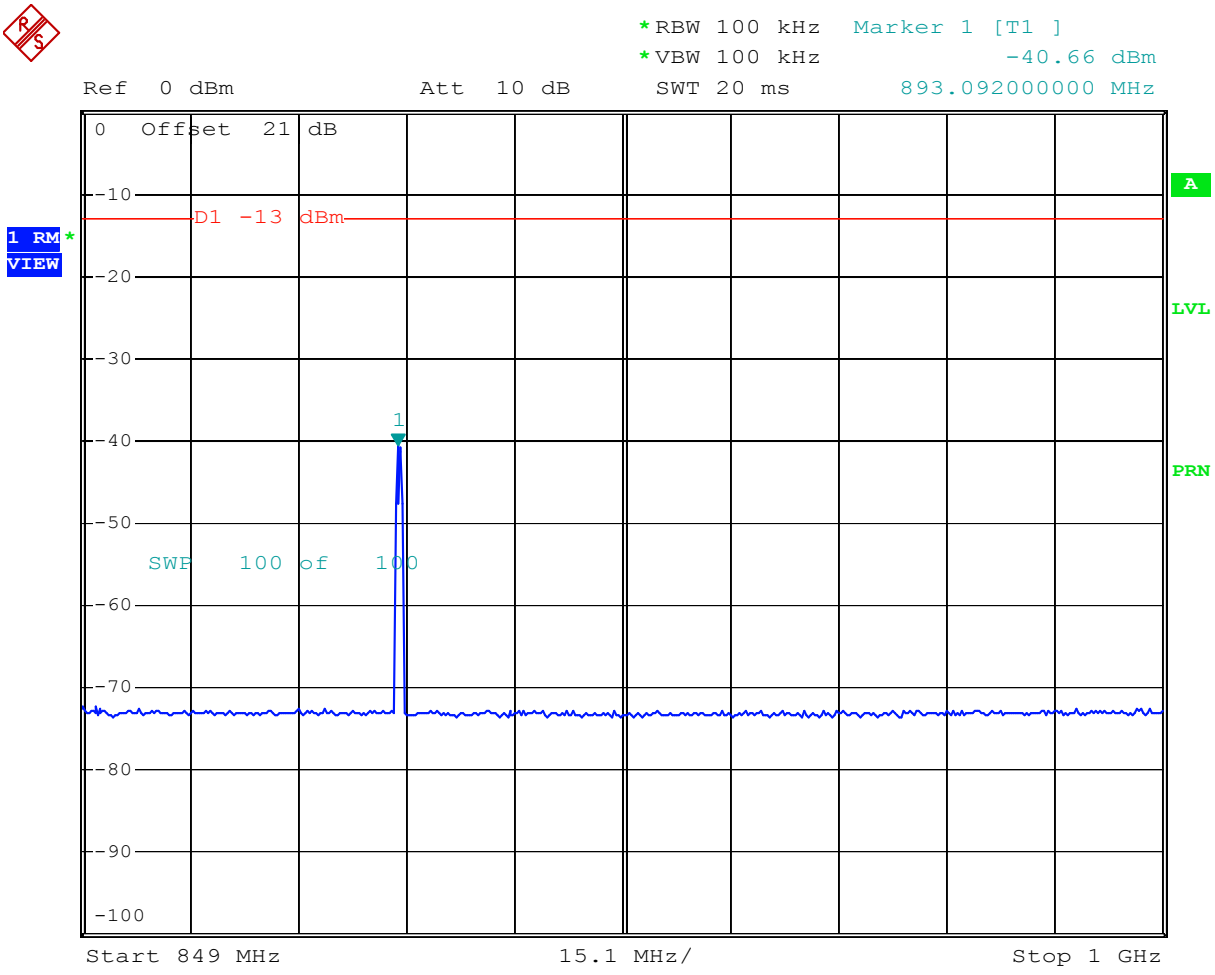
Comment: Out-of-band emissions, minimum power, cell band, ch# 1013
Date: 14.JAN.2005 13:14:44

Plot 5.8.3



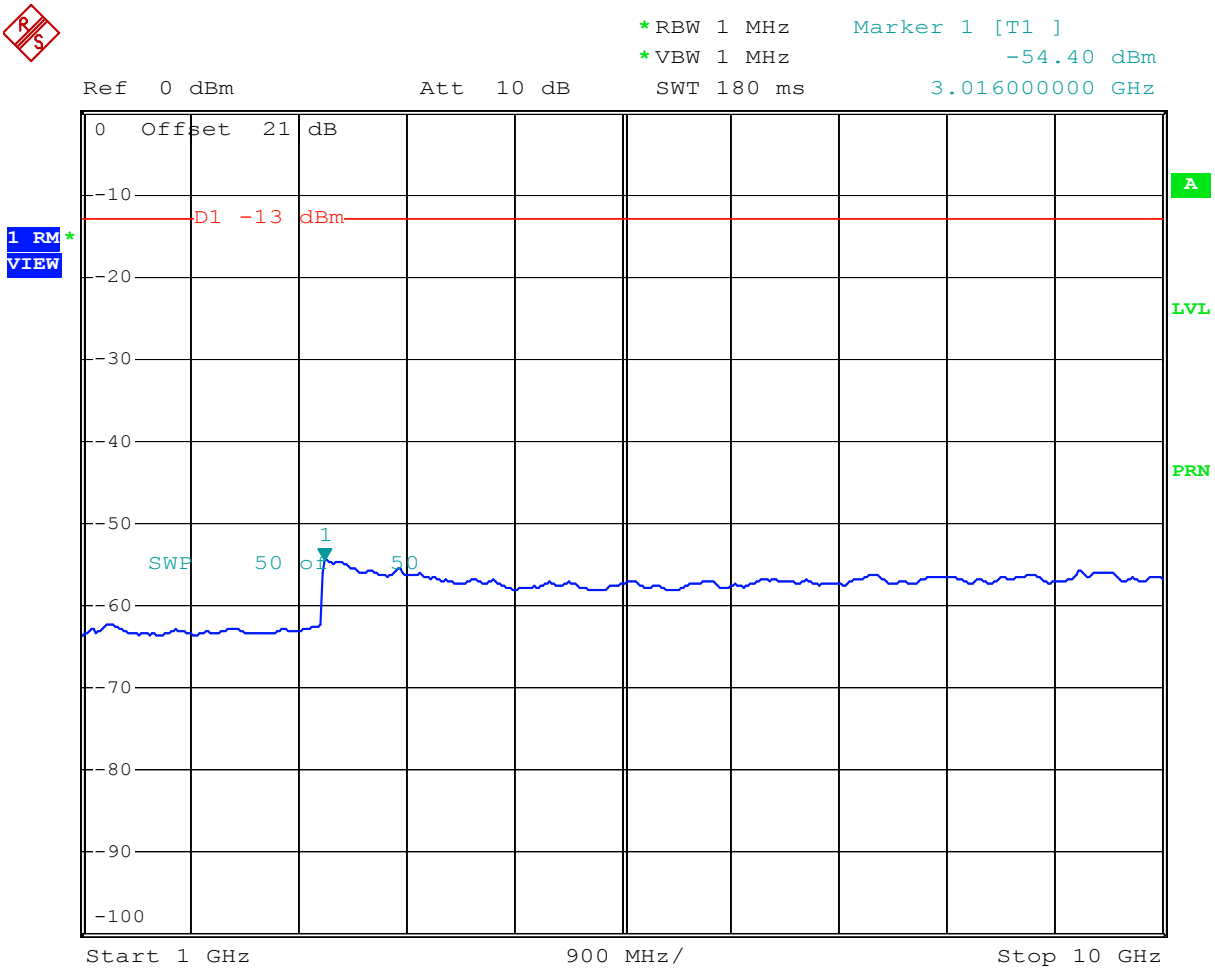
Comment: Out-of band emissions, minimum power, cell band, ch# 1013
Date: 13.JAN.2005 12:47:10

Plot 5.9.1



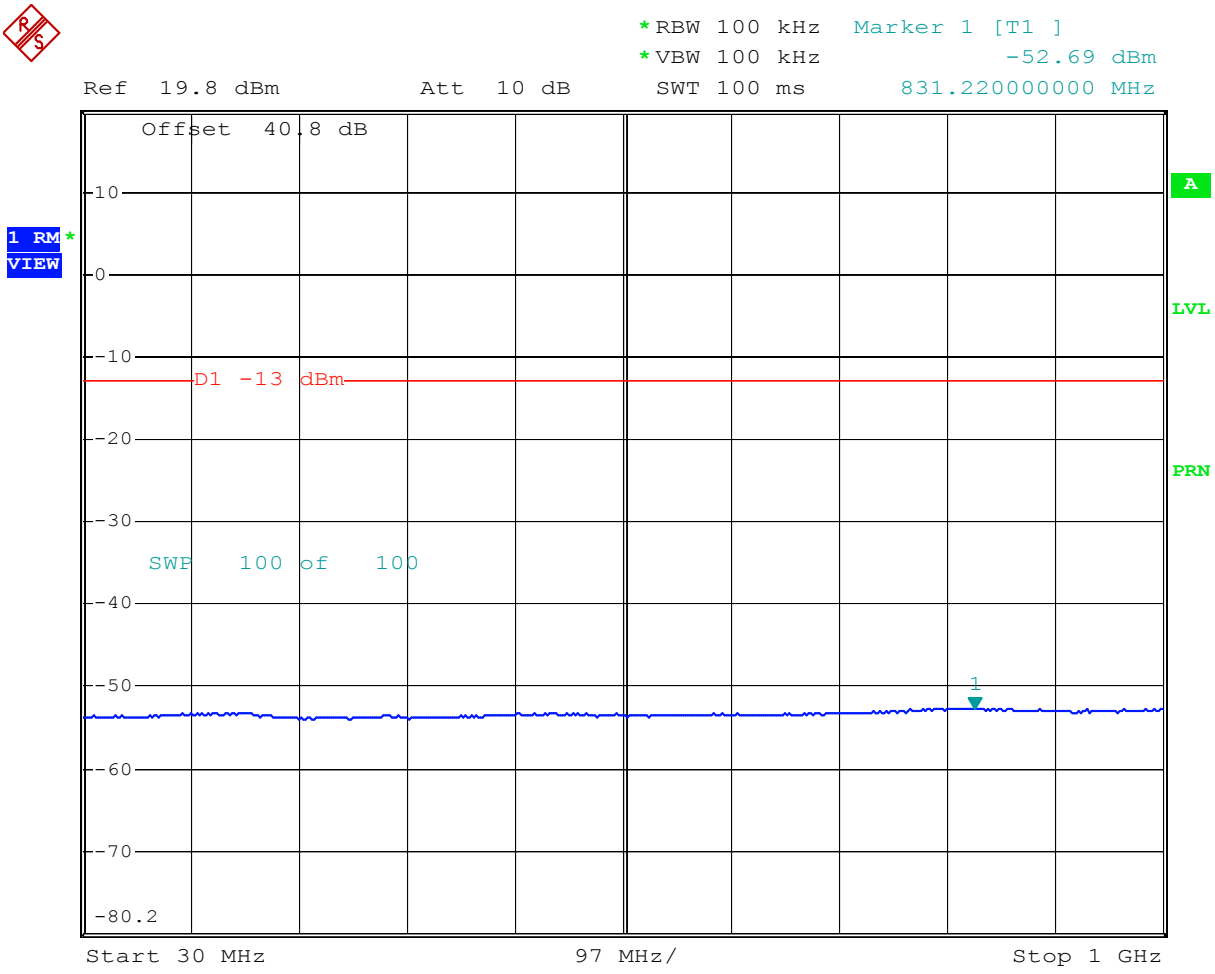
Comment: Out-of band emissions, minimum power, cell band, ch# 777
Date: 13.JAN.2005 12:40:19

Plot 5.9.2



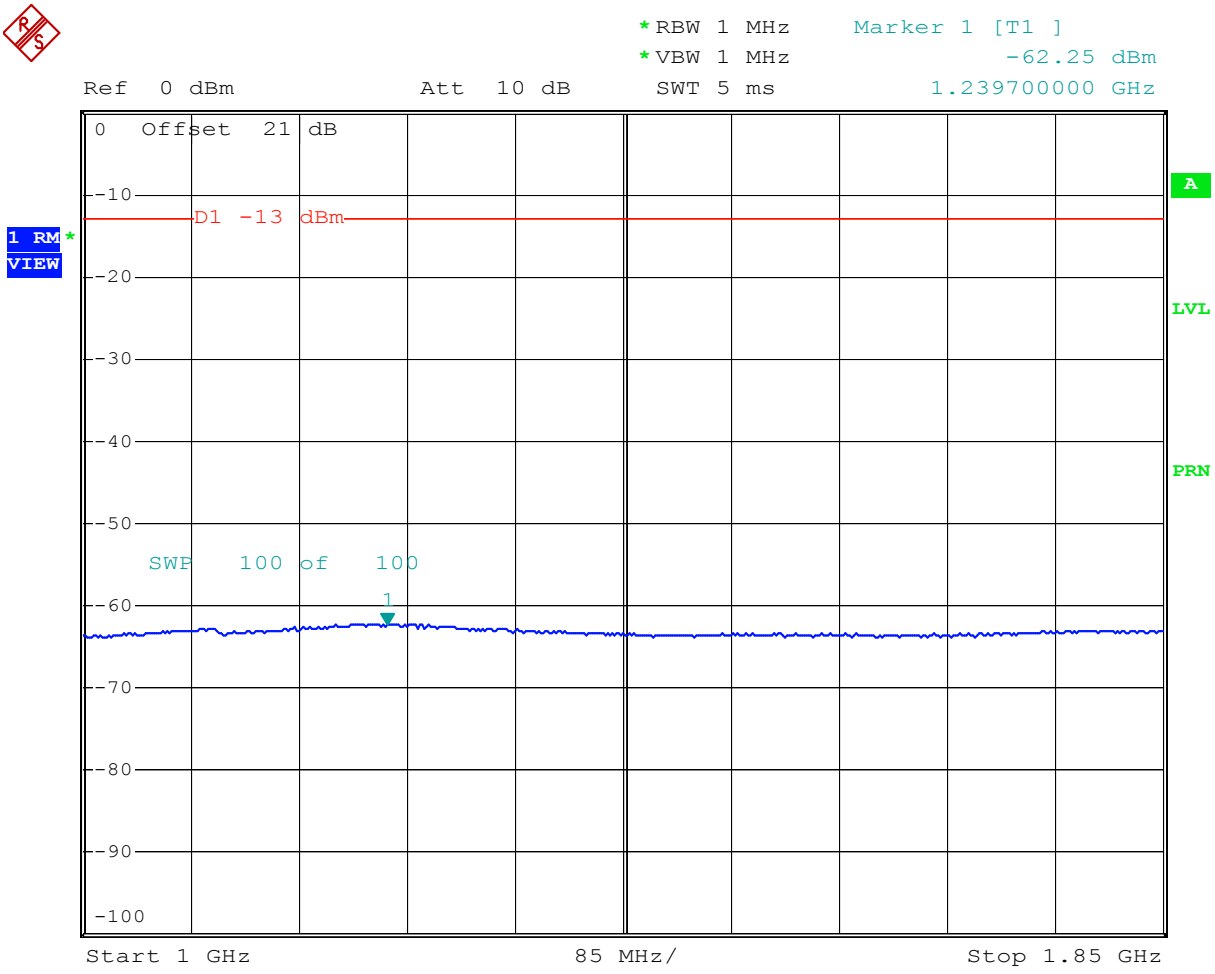
Comment: Out-of band emissions, minimum power, cell band, ch# 777
Date: 13.JAN.2005 12:44:00

Plot 5.10.1



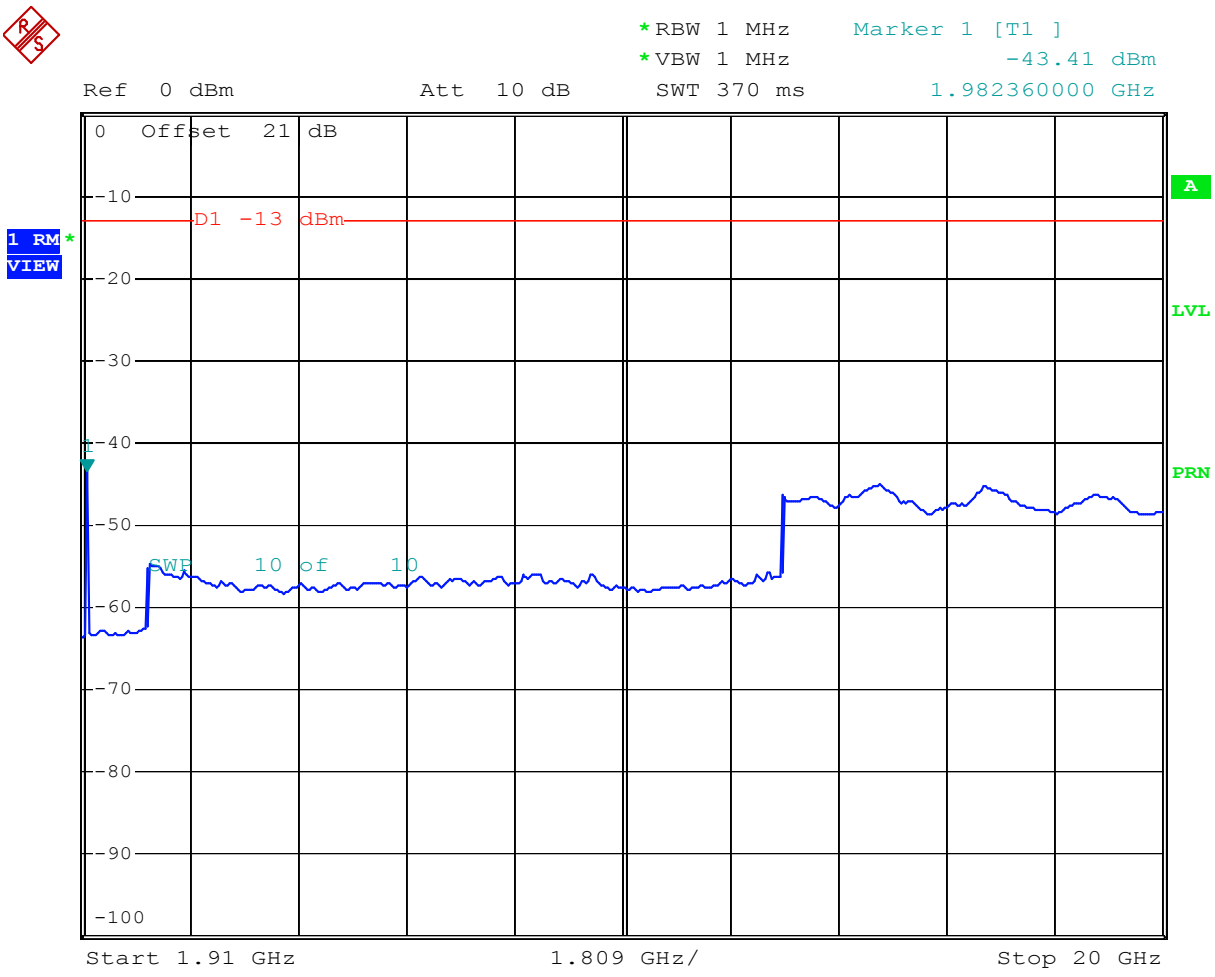
Comment: Out-of band emissions, minimum power, PCS band, ch# 25
Date: 13.JAN.2005 13:24:32

Plot 5.10.2



Comment: Out-of band emissions, minimum power, PCS band, ch# 25
Date: 13.JAN.2005 12:55:46

Plot 5.11.1



Comment: Out-of band emissions, minimum power, PCS band, ch# 1175
Date: 13.JAN.2005 12:52:52

6.0 Part 22/24 Spurious Radiation

FCC 2.1053, 22.917(a), 24.238(a)

6.1 Requirement

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (43 + 10 log P) dB.

Note: That corresponds to the level of -13 dBm for any out-of-band and spurious emissions.

6.2 Test Procedure

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to 10th harmonic of each of the three fundamental frequency (low, middle, and high channels) for each band (cellular and PCS) was investigated. The tests were performed with the EUT placed on three orthogonal axes. The worst case of emissions was reported.

For spurious emissions attenuation, the substitution method was used. The EUT was substituted by a reference antenna (half-wave dipole - below 1 GHz, or Horn antenna - above 1GHz), connected to a signal generator. The signal generator output level ($\mathbf{V_g}$ in dBm) was adjusted to obtain the same reading as from EUT. The ERP/EIRP at the spurious emissions frequency was calculated as follows.

$ERP_{(dBm)} = \mathbf{V_g} + \mathbf{G}_{(dBd)}$; $EIRP_{(dBm)} = \mathbf{V_g} + \mathbf{G}_{(dBi)}$

The spurious emissions attenuation is the difference between ERP/EIRP at the fundamental frequency (see section 3) and at the spurious emissions frequency.

6.3 Test Equipment

EMCO 3115 Horn Antennas
Rohde & Schwarz FSP40 Spectrum Analyzer
Low Pass Filter
Preamplifiers

6.4 Configuration Photographs

FCC Part 22/24 Radiated Emission Test Setup Photographs

6.5 Test Results

Spurious Radiated Emissions

Frequency	Antenna Polariz.	SA Reading (EUT)	Signal Generator Output required to have the same SA Reading as from EUT	ERP*	ERP Limit	ERP Margin
MHz		**dB(µV)**	**V_g dBm**	**dBm**	**dBm**	**dB**
Channel 1013, 824.7 MHz						
1649.4	V	61.1	-50.5	-44.1	-13.0	-31.1
2472.6	V	54.3	-75.7	-68.2	-13.0	-55.2
3296.8	V	54.1	-71.9	-64.2	-13.0	-51.2
Channel 384, 836.5 MHz						
1673.0	V	62.9	-47.6	-41.2	-13.0	-28.2
2509.2	V	55.0	-74.0	-66.5	-13.0	-53.5
3345.6	V	49.8	-75.2	-67.5	-13.0	-54.5
Channel 777, 848.3 MHz						
1696.6	V	65.9	-44.1	-37.7	-13.0	-24.7
2546.4	V	57.1	-70.9	-63.4	-13.0	-50.4
3395.2	V	47.8	-76.7	-69.0	-13.0	-56.0

* ERP is calculated as: $ERP_{(dBm)} = V_{g(dBm)} + G_{(dBd)}$

Frequency	Antenna Polariz.	SA Reading (EUT)	Signal Generator Output required to have the same SA Reading as from EUT	EIRP*	EIRP Limit	EIRP Margin
MHz		**dB(µV)**	**V_g dBm**	**dBm**	**dBm**	**dB**
Channel 1850.2 MHz						
3700.4	V	32.1	-55.6	-45.8	-13.0	-32.8
5550.6	V	51.8	-48.5	-37.5	-13.0	-24.5
7400.8	V	40.0	-57.0	-45.6	-13.0	-32.6
9251.0	V	44.1	-51.7	-39.9	-13.0	-26.9
Channel 1880 MHz						
3760.0	V	31.8	-54.4	-44.6	-13.0	-31.6
5640.0	V	54.1	-46.0	-34.9	-13.0	-21.9
7520.0	V	40.5	-56.0	-44.6	-13.0	-31.6
9400.0	V	48.3	-47.2	-35.4	-13.0	-22.4
Channel 1909.8 MHz						
3819.6	V	30.2	-54.7	-44.9	-13.0	-31.9
5729.4	V	50.7	-48.8	-37.6	-13.0	-24.6
7639.2	V	40.6	-55.4	-44.0	-13.0	-31.0
9549.0	V	46.9	-48.0	-36.2	-13.0	-23.2

* EIRP is calculated as: $EIRP_{(dBm)} = V_{g\,(dBm)} + G_{(dBi)}$

All other emissions not reported are more than 20 dB below the limit.

Test Result:	Complies by more than 20 dB

7.0 Frequency Stability vs Temperature and Voltage
FCC 2.1055, 24.235

7.1 Requirement

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

7.2 Test Procedure

The EUT was powered from a DC power supply and placed inside the temperature chamber. The RF power output was connected to the BSS. The BSS was setup to "originate call" and controlled the EUT to transmit the maximum power.

After the temperature stabilized for approximately 20 minutes, the transmitting frequency was measured by the BSS and recorded.

At the room temperature, the EUT was powered from DC power supply. The frequency was measured when it is powered with the nominal voltage and with 85% and 115% of the nominal voltage.

7.3 Test Equipment

Temperature Chamber
BSS, Agilent 8960

7.4 Test Results

Temperature (°C)	Maximum deviation from nominal, Hz	Maximum deviation from nominal, Hz
	Channel: 384, frequency: 836.52 MHz	Channel: 600, frequency: 1880.00 MHz
-30	5.2	7.8
-20	4.8	7.3
-10	4.8	7.2
0	4.4	7.2
10	4.3	6.8
20	4.2	5.3
30	5.2	6.7
40	5.5	7.8
50	5.6	8.0
60	5.6	8.1

Voltage, V	Maximum deviation from nominal, Hz	Maximum deviation from nominal, Hz
	Channel: 384, frequency: 836.52 MHz	Channel: 600, frequency: 1880.00 MHz
10.2	4.3	5.3
12.0	4.2	5.3
13.8	4.5	5.4

Test Result:	Complies. Emission attenuation on the band-edges frequencies of the frequency block is not affected by the measured frequency instability.

8.0 RF Exposure evaluation

FCC 2.1091

The MDC 1xRTT is a wireless mobile data device used in a vehicle with antenna installed on the roof. Since the device used in mobile application, it may consider that antenna is located at least 20 cm from any body part of the user or nearby persons.

The maximum calculated EIRP is 0.4 W. The Power Density can be calculated using the formula

$$S = EIRP/ 4\pi D^2$$

Where: S is Power Density in W/m^2
D is the distance from the antenna.

At 0.2 m, S = 0.8 W/m^2 - well below the MPE limit which is 6 W/m^2 in the Cellular band, and 12.5 W/m^2 in the PCS band, for General Population/Uncontrolled Exposure.

9.0 Part 15 Radiated Emissions from digital part and receiver

FCC 15.109

9.1 Radiated Emission Limits

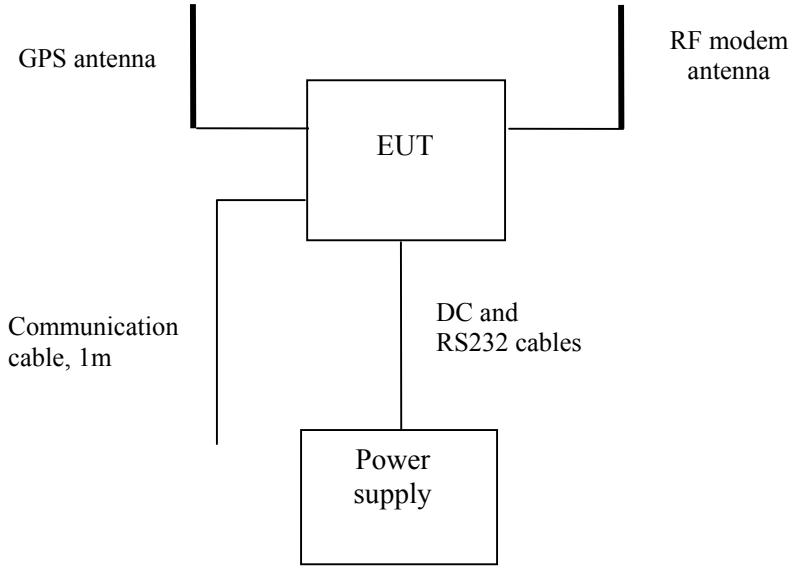
The following radiated emission limits apply to Class A unintentional radiators:

Radiated Emissions Limits, FCC Section 15.109(b)

Frequency MHz	Class A at 10m µV/m	Class A at 10m dB(µV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

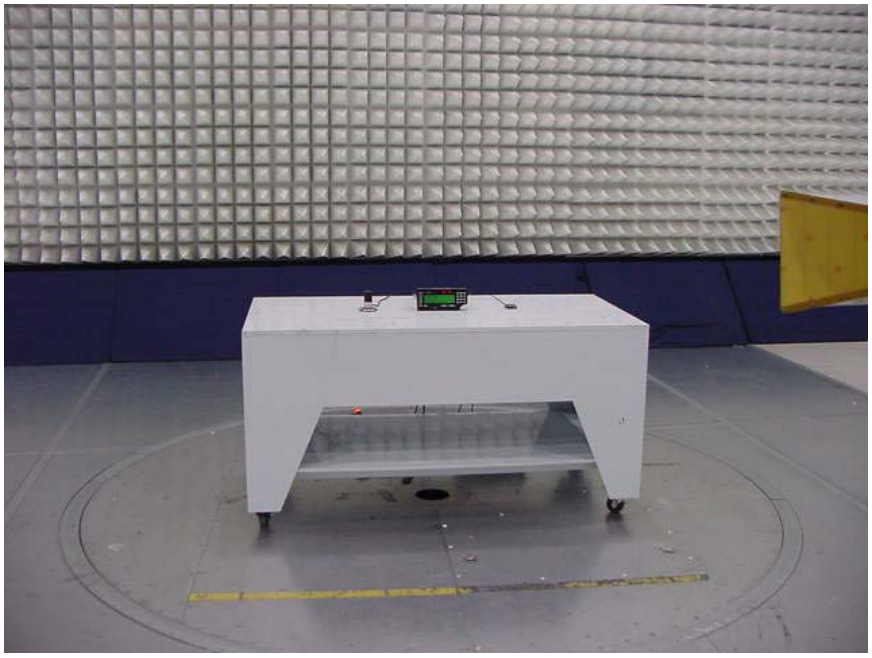
Note: Three sets of units are commonly used for EMI measurement, decibels below one milliwatt (-dBm), decibels above a microvolt, dB (µV), and microvolts (µV). To convert between them, use the following formulas: 20 LOG_{10} (µV) = dB (µV), dB (m) = dB (µV)-107.

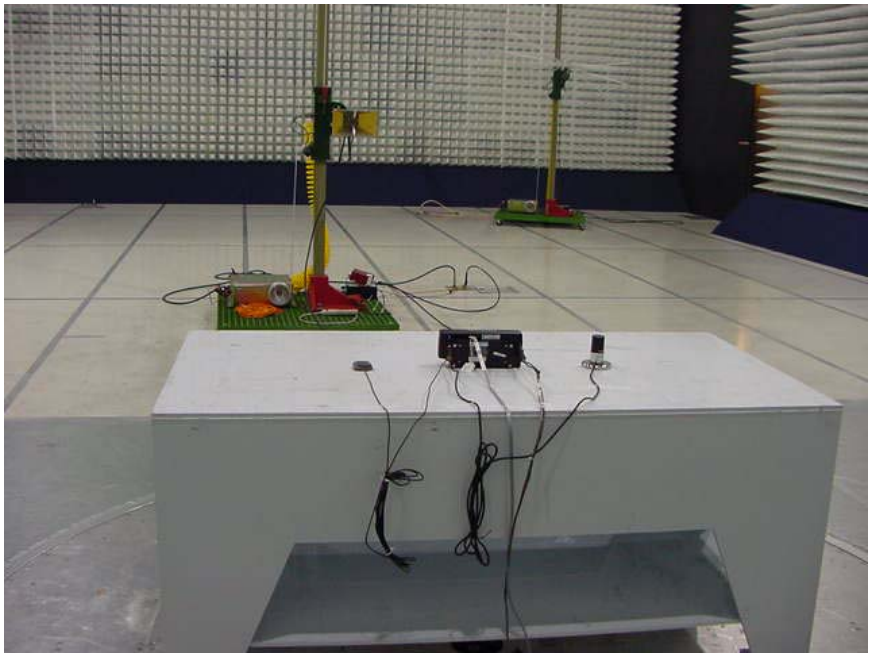
9.2 Block diagram of Test Setup

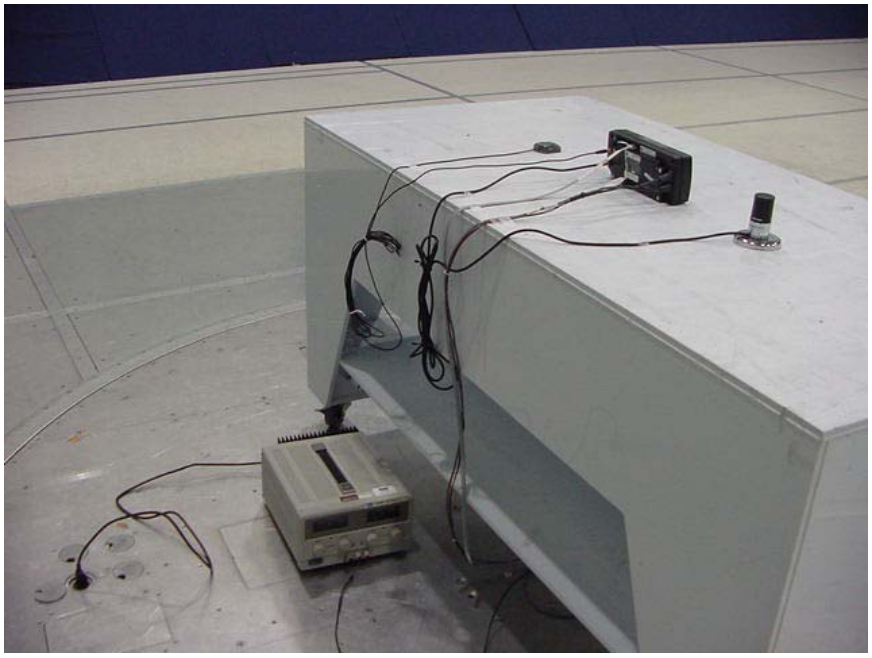


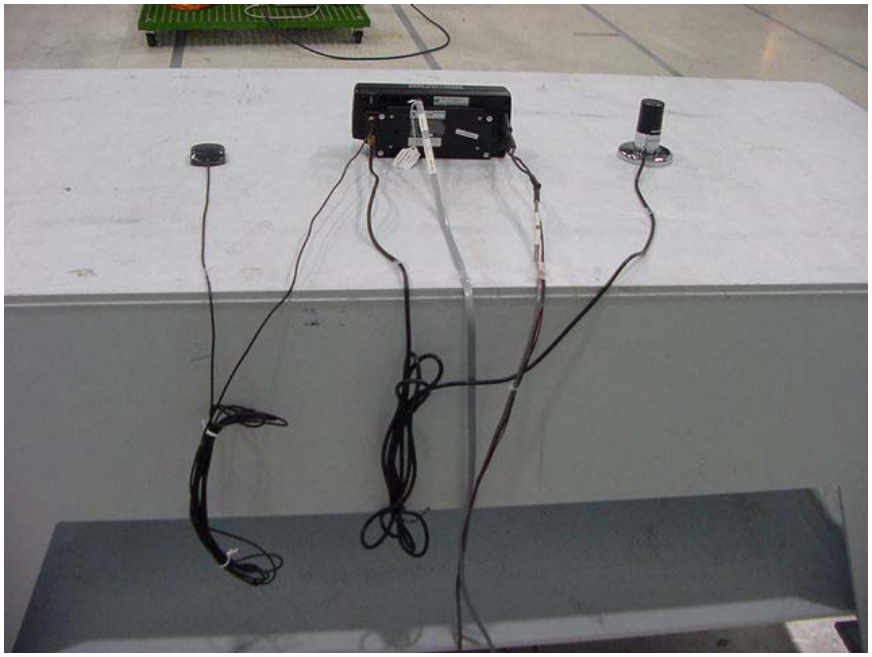
9.3 Configuration Photographs

FCC Part 15 Radiated Emission Test Setup Photographs









9.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(μV/m). This value in dB(μV/m) was converted to its corresponding level in μV/m.
RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(μV/m)
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m

9.5 Test Results

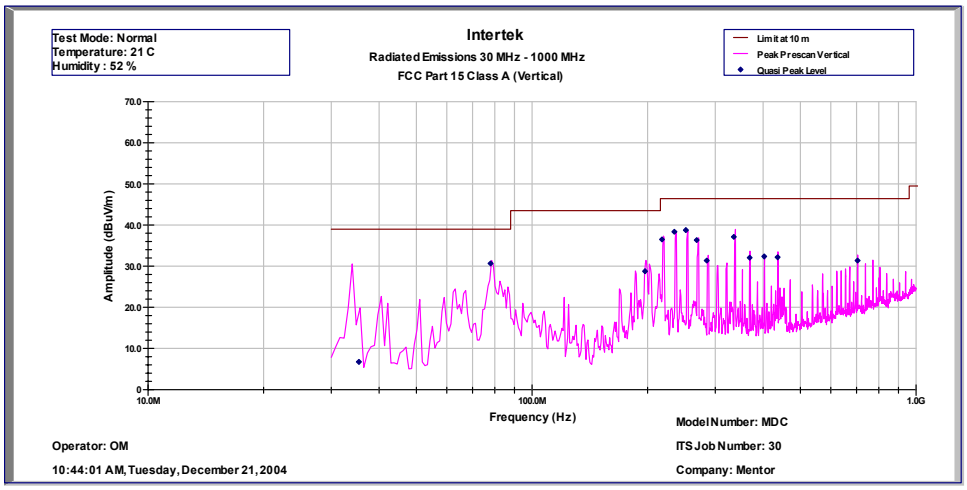
Tested By:	Ollie Moyrong
Test Date:	December 21, 2004

Temperature	**(°C)**	21
Relative Humidity	**(%)**	52

The results on the following page(s) were obtained when the device was tested in the condition described in Section 4.

Results:	**Complies** by 2.8 dB

Note: a) A complete scan from 30 MHz to 7.5 GHz was made with antenna oriented horizontally and vertically.
b) The highest emissions are reported
c) Analyzer setting: RBW = 100 kHz, VBW = 100 kHz - below 1 GHz
RBW =1 MHz, VBW = 30 kHz - above 1 GHz
Detector mode: Peak unless otherwise specified in the data page
d) All other emissions not reported are at least 10 dB below the limit



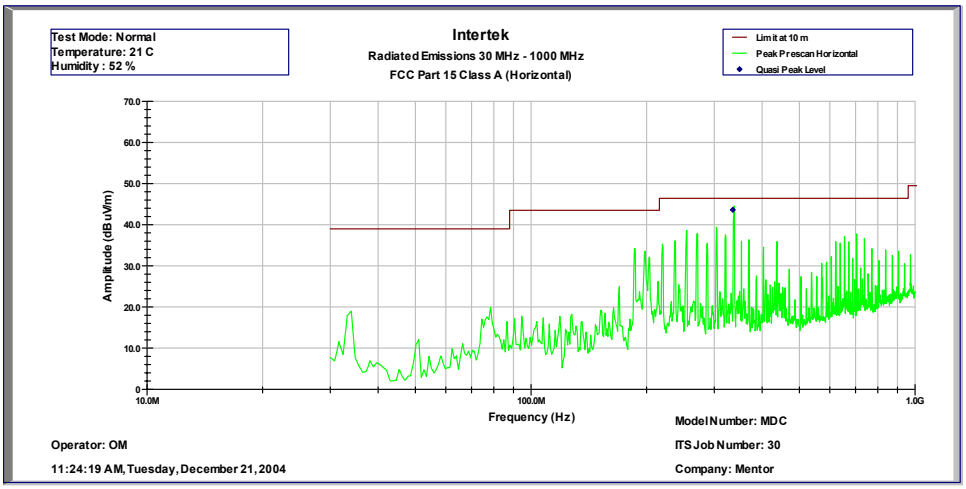
Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class A (QP-Vertical)

Operator: OM
Test distance: 10 m
10:43:57 AM, Tuesday, December 21, 2004

Model Number: MDC
ITS Job Number: 3069350
Company: Mentor Engineering

Frequency	Quasi Pk FS	Limit@10m	Margin	RA	CF	AG	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB	dB	dB	dB(1/m)
78.0	30.7	39.0	-8.3	52.6	4.2	32.3	6.2
197.0	28.8	43.5	-14.7	46.2	5.0	32.3	9.9
218.1	36.5	46.4	-9.9	52.4	5.1	32.2	11.2
234.9	38.4	46.4	-8.0	54.2	5.2	32.2	11.2
251.7	38.8	46.4	-7.6	53.8	5.3	32.2	11.9
268.4	36.3	46.4	-10.1	51.0	5.4	32.2	12.2
285.2	31.4	46.4	-15.0	45.4	5.5	32.2	12.7
335.5	37.1	46.4	-9.3	48.9	5.7	32.2	14.7
369.1	32.1	46.4	-14.3	43.0	5.8	32.3	15.5
402.6	32.4	46.4	-14.0	42.9	6.0	32.3	15.7
436.2	32.2	46.4	-14.2	41.0	6.1	32.3	17.4
704.6	31.3	46.4	-15.1	35.6	7.1	32.6	21.2

Test Mode: Receiving
Temperature: 21 C
Humidity : 52 %



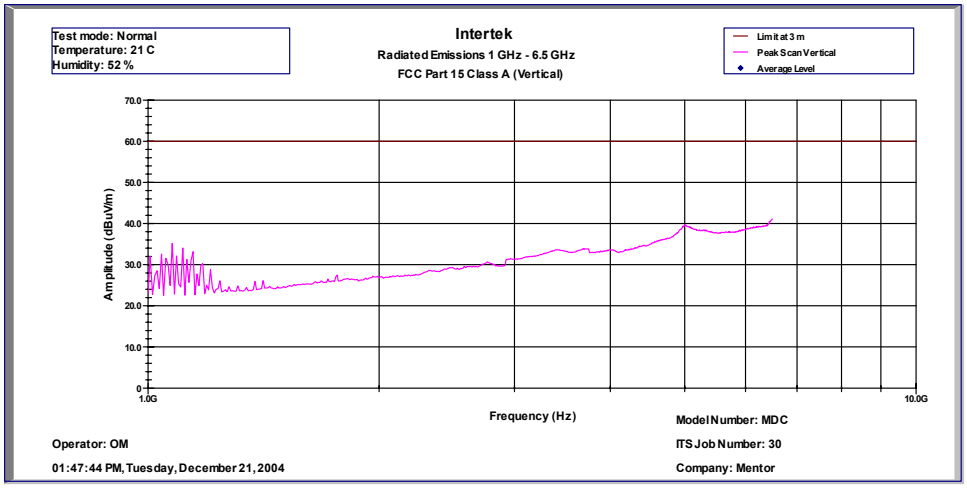
Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class A (QP-Horizontal)

Operator: OM
Test distance: 10 m
11:24:14 AM, Tuesday, December 21, 2004

Model Number: MDC
ITS Job Number: 3069350
Company: Mentor Engineering

Frequency MHz	Quasi Pk FS dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	RA dB(uV)	CF dB	AG dB	AF dB(1/m)
335.6	43.6	46.4	-2.8	55.4	5.7	32.2	14.8

Test Mode: Receiving
Temperature: 21 C
Humidity : 52 %



Intertek Testing Services
Radiated Emissions 1 GHz - 6.5 GHz
FCC Part 15 Class A (Pk-Vertical)

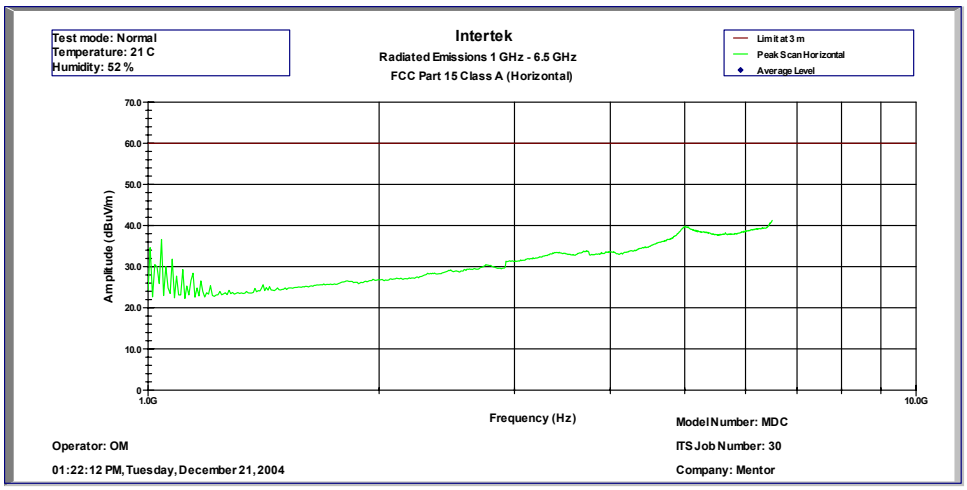
Operator: OM
Test distance: 3 m
01:47:41 PM, Tuesday, December 21, 2004

Model Number: MDC
ITS Job Number: 3069350
Company: Mentor Engineering

Frequency (MHz)	Pk FS (dBuV/m)	Limit@3m (dBuV/m)	Pk Margin (dB)	RA (dBuV)	CF (dB)	AG (dB)	AF dB(1/m)
1007	32.0	60.0	-28.0	37.3	6.0	36.5	25.2
1041	32.5	60.0	-27.5	37.7	6.0	36.5	25.3
1055	31.6	60.0	-28.4	36.6	6.1	36.5	25.4
1076	35.2	60.0	-24.8	40.2	6.1	36.5	25.4
1089	32.1	60.0	-27.9	37.0	6.1	36.5	25.5
1110	34.0	60.0	-26.0	38.9	6.1	36.5	25.5
1144	33.2	60.0	-26.8	37.8	6.2	36.5	25.6
1179	30.3	60.0	-29.7	34.7	6.3	36.5	25.7
6500	41.1 *	60.0	-18.9	27.6	13.9	35.3	34.9

* Noise floor

Test mode: Receiving
Temperature: 21 C
Humidity: 52 %



Intertek Testing Services
Radiated Emissions 1 GHz - 6.5 GHz
FCC Part 15 Class A (Pk-Horizontal)

Operator: OM
Test distance: 3 m
01:22:10 PM, Tuesday, December 21, 2004

Model Number: MDC
ITS Job Number: 3069350
Company: Mentor Engineering

Frequency	Pk Level	Limit@3m	Pk Margin	RA	CF	AG	AF
MHz	(dBuV/m)	(dBuV/m)	(dB)	(dBuV)	(dB)	(dB)	dB(1/m)
1007	34.6	60.0	-25.4	40.2	6.0	36.5	24.9
1041	36.6	60.0	-23.4	42.0	6.0	36.5	25.0
1055	30.0	60.0	-30.0	35.4	6.1	36.5	25.1
1076	31.8	60.0	-28.2	37.1	6.1	36.5	25.2
1110	29.3	60.0	-30.7	34.4	6.1	36.5	25.3
6500	41.2 *	60.0	-18.8	27.7	16.9	35.3	34.9

* Noise floor

Test mode: Receiving
Temperature: 21 C
Humidity: 52 %

10.0 List of Test Equipment

Measurement equipment used for compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
BI-Log Antenna	EMCO	3143	9509-1164	12	4/06/05
Double-ridged Horn Antenna	EMCO	3115	9170-3712	12	6/18/05
Double-ridged Horn Antenna	EMCO	3115	8812-3049	12	4/14/05
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	9/10/05
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	9/10/05
Spectrum Analyzer	Rohde & Schwarz	FSP40	036612004	12	2/04/05
Signal Generator	Hewlett Packard	83732A	322A00119	12	3/04/05
Pre-Amplifier	Sonoma Inst.	310	185634	12	3/25/05
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	3/25/05
Wireless communications test set (BSS)	Agilent	8960 series	GB 43133135	12	7/07/05
Directional Coupler	IFI	CDD 1000-80-5	203A	12	3/22/05
Directional Coupler	Krytar	101020020	70798	12	3/22/05

11.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3069350	DC	December 23, 2003	Original document