Test Report

Report Number: 3148514MPK-001
Project Number: 3148514 & 3149417
Report Date: March 31, 2008

Testing performed on the
Cable TV stand-mounted Cellular Base Station
Model Number: CM-100

FCC ID: V7D-CM-100

to

FCC Part 24 Subpart E

for
Public Wireless

A2LA Certificate Number: 1755-01

Test Performed by:	**Test Authorized by:**
Intertek Testing Services NA, Inc	Public Wireless
1365 Adams Court	1325A McCandless Drive
Menlo Park, CA 94025	Milpitas, CA 95035

Prepared by: David Chernomordik — **Date:** March 31, 2008
David Chernomordik, EMC Technical Manager

Reviewed by: Ollie Moyrong — **Date:** March 31, 2008
Ollie Moyrong, EMC Department Manager

TABLE OF CONTENTS

1.0 Introduction

1.1 Product Description

The Equipment under Test (EUT), model: CM-100 is the GSM/EDGE Base Station. The EUT is designed to provide cellular coverage in small areas where existing gaps in the cellular exist. The unit is installed on the existing messenger cable, that is used to support the cable.

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

Whether quantity (>1) production is planned	Yes
Type	GSM?EDGE Base Station
Rated RF Output Power	30 dBm
Frequency Ranges, MHz	1930 – 1990 MHz
Type of modulation	GSM, EDGE
Channel bandwidth	230 kHz
Antenna & Gain	6 dBi
Detachable antenna?	yes
Operating temperature	-30^0C to $+55^0$C

EUT receive date: March 19, 2008
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: March 19, 2008
Test completion date: March 28, 2008

1.2 Summary of Test Results

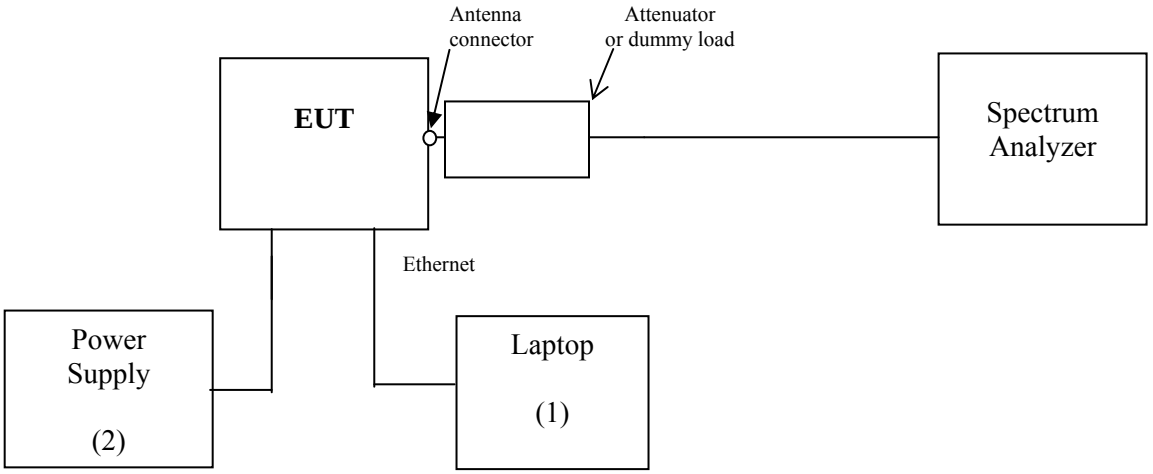
FCC Rule	RSS-133 Rule	Description of Test	Result
2.1046	6.4	RF Power Output	Complies
24.232	6.4	EIRP	Complies
2.1047	-	Modulation characteristics	Not Applicable
2.1049		Occupied Bandwidth	Complies
2.1051, 24.238	6.5	Out of Band Emissions at Antenna Terminals	Complies
2.1053, 24.238	6.5	Transmitter Spurious Radiation	Complies
2.1055, 24.235	6.3	Frequency Stability vs. Temperature and Voltage	Complies
2.1091	RSS-102	RF Exposure evaluation	Complies
15.109	6.7	Receiver Radiated Emissions	Complies

1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.
1	Laptop	Compaq nc6220
2	Alpha Technologies Power Supply	APX 6008

1.3.2 Block diagram of Test Setup



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

1.3.3 Mode of operation

During the testing the EUT was setup in the "Beacon" mode allows to select the frequency, the modulation and the power level. The transmitter was setup to transmit continuously with 100% duty cycle.

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 EUT was setup to transmit continuously the maximum power.

The spectrum analyzed was setup to measure a peak power with the resolution bandwidth of 1 MHz. The 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).

2.2 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer

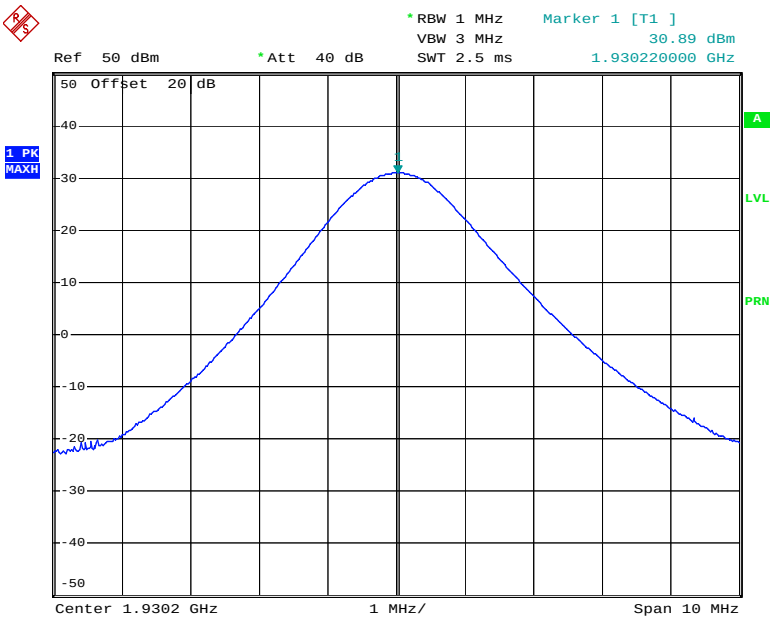
2.3 Test Results

Channel	Frequency (MHz)	Measured Maximum Output Power (dBm)			
		GSM with duplexer	GSM without duplexer	EDGE with duplexer	EDGE without duplexer
512	1930.2	30.9	31.8	21.4	22.8
661	1960.0	31.2	32.1	22.0	23.0
810	1989.8	31.0	31.7	20.7	23.4

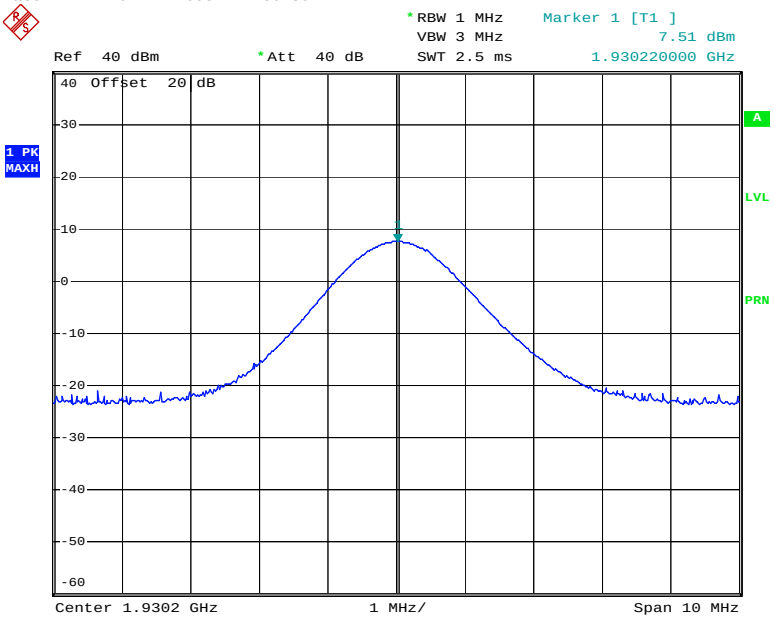
Note: the measured minimum power is about 7 dBm

For more details refer to the attached plots.

Plot 2.1
Power with duplexer, GSM

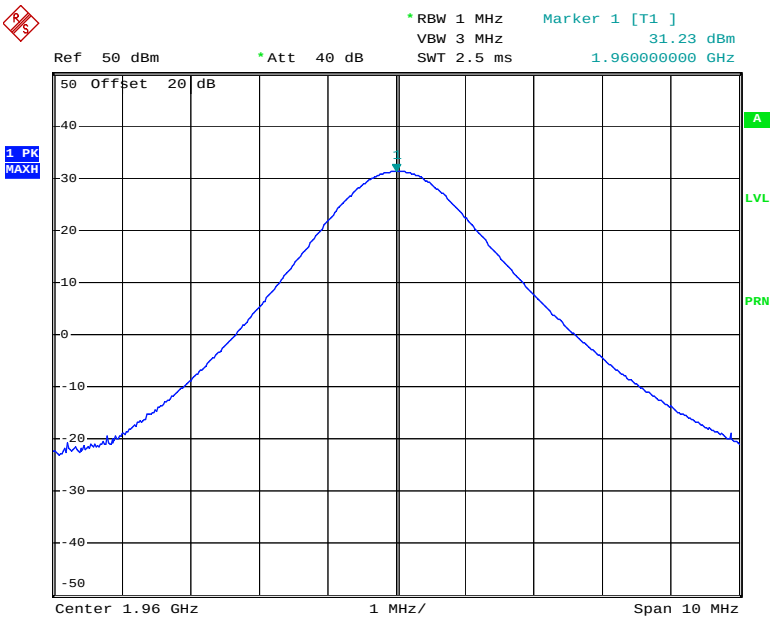


Comment: Power output, high
Date: 20.MAR.2008 17:30:30

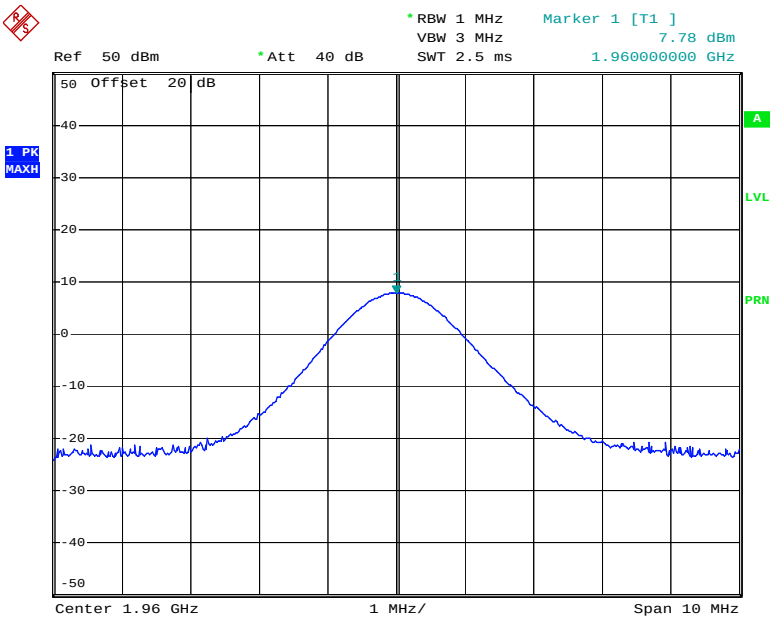


Comment: Power output, low
Date: 20.MAR.2008 17:28:04

Plot 2.2
Power with duplexer, GSM

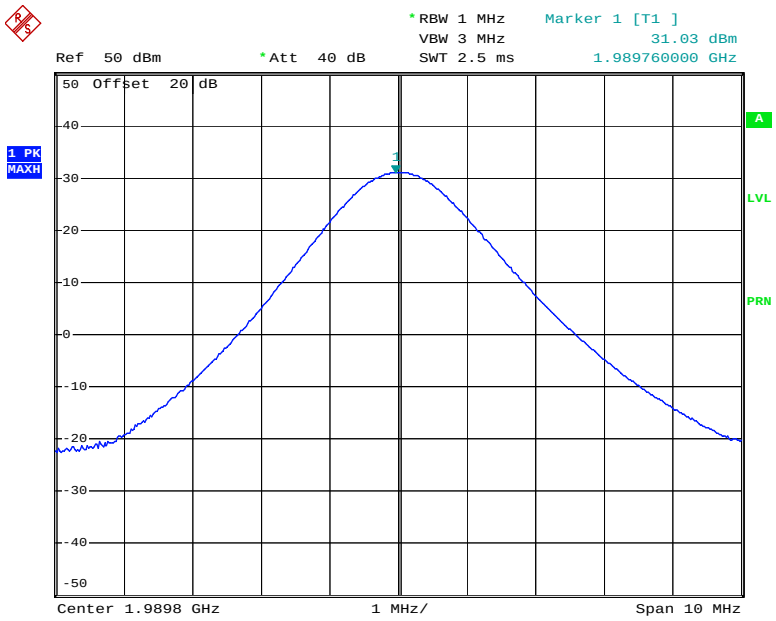


Comment: Power output, high, ch 661
Date: 20.MAR.2008 17:35:36

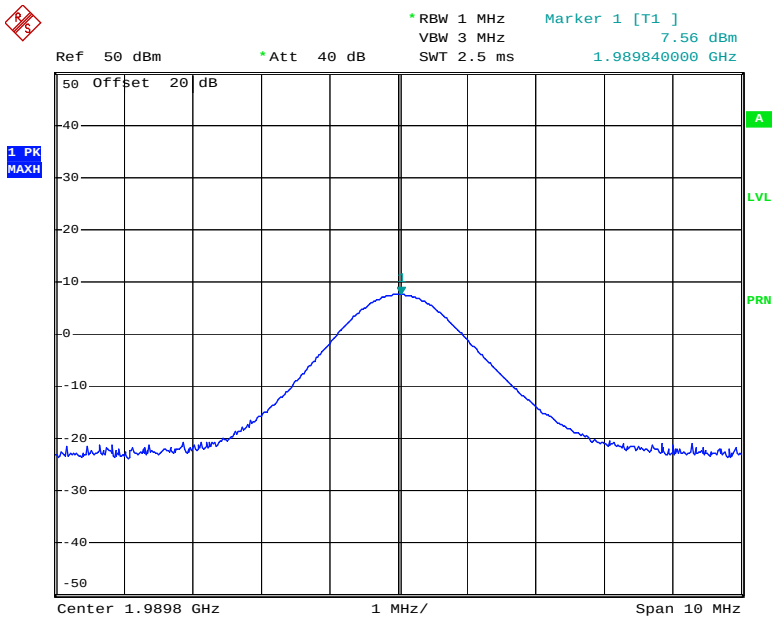


Comment: Power output, low, ch 661
Date: 20.MAR.2008 17:36:28

Plot 2.3
Power with duplexer, GSM

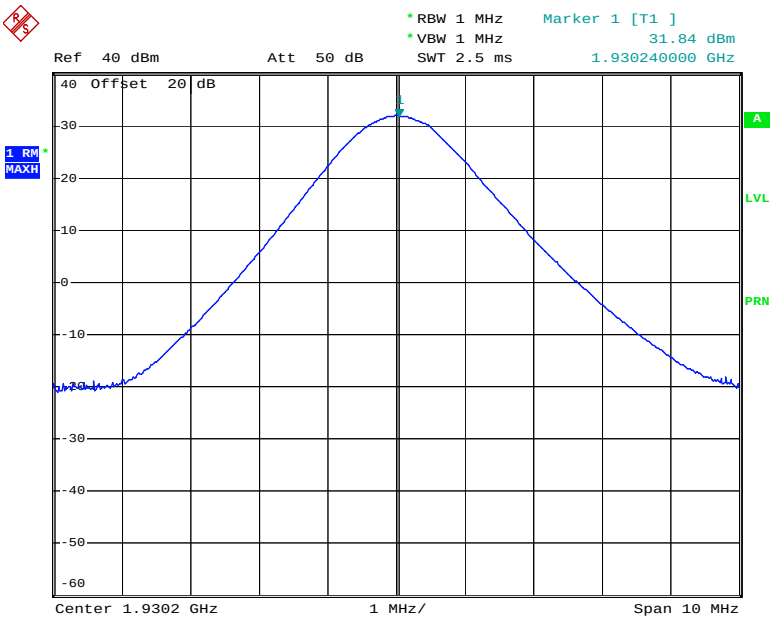


Comment: Power output, high, ch 810
Date: 20.MAR.2008 17:38:43

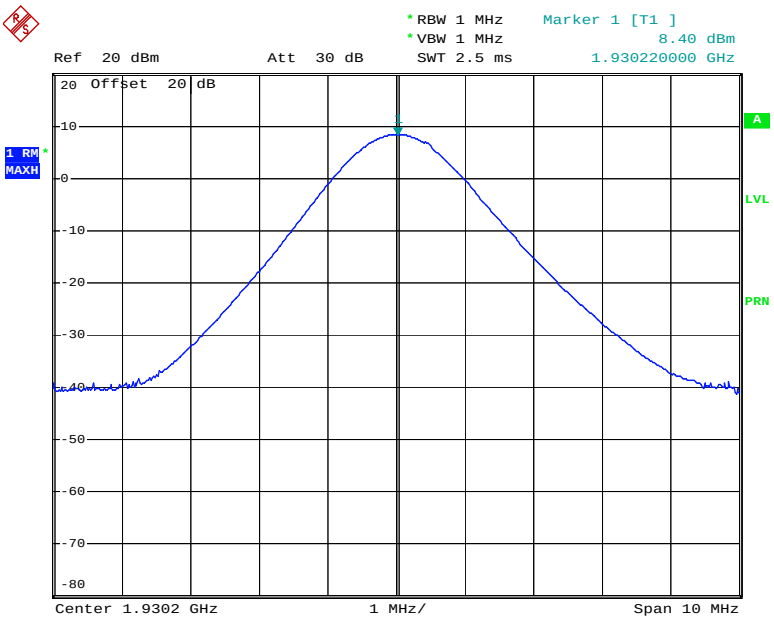


Comment: Power output, low, ch 810
Date: 20.MAR.2008 17:37:48

Plot 2.4
Power without duplexer, GSM

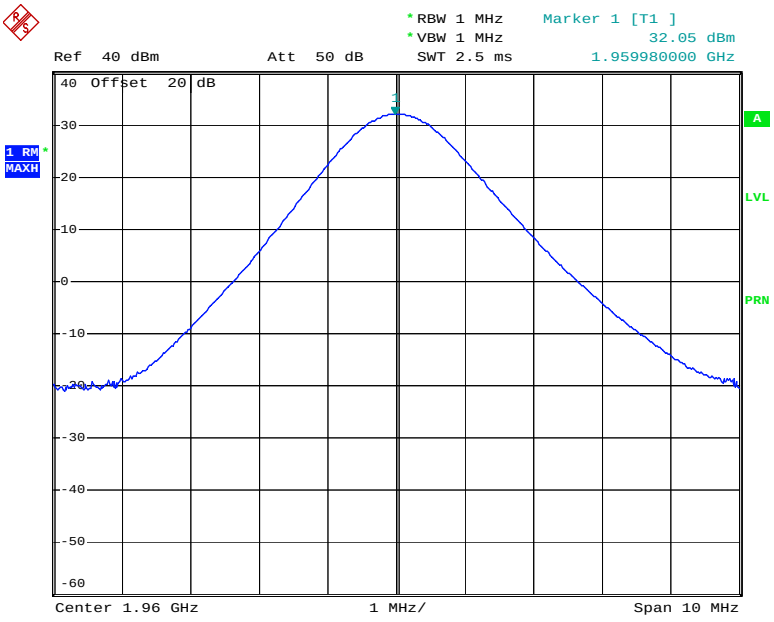


Comment: Power output, high power, ch 512
Date: 28.MAR.2008 18:13:43

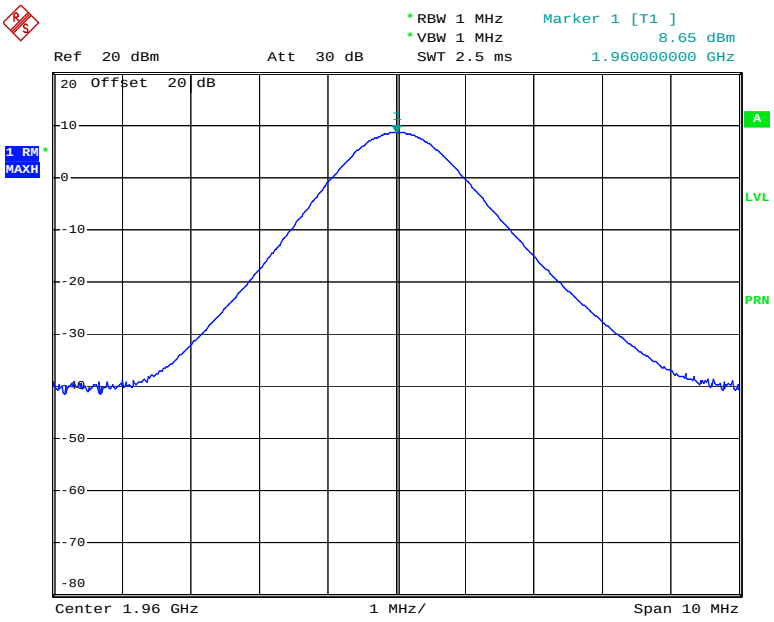


Comment: Power output, low power, ch 512
Date: 28.MAR.2008 18:19:47

Plot 2.5
Power without duplexer, GSM

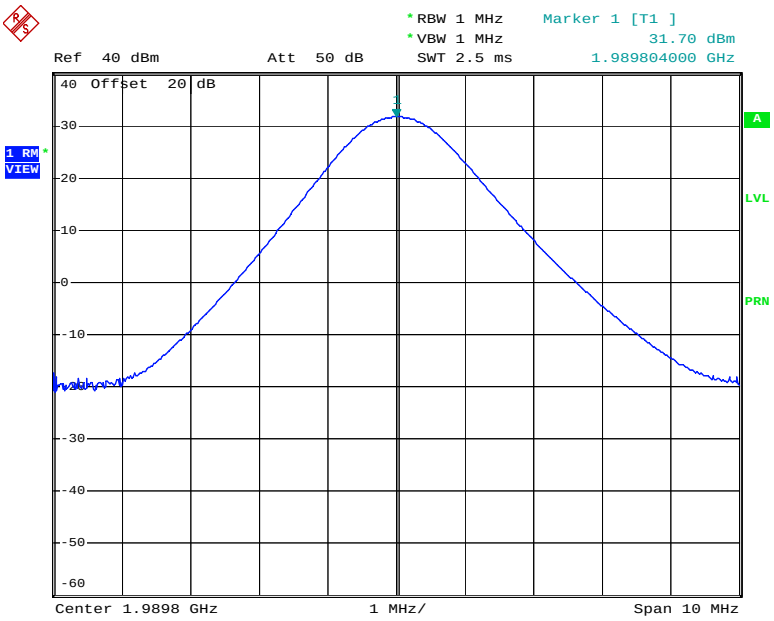


Comment: Power output, high power, ch 661
Date: 28.MAR.2008 18:22:13

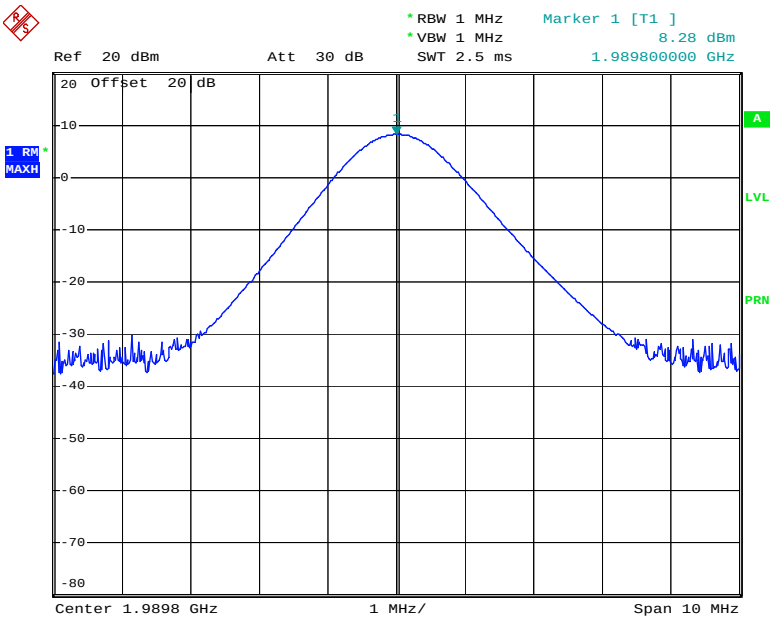


Comment: Power output, low power, ch 661
Date: 28.MAR.2008 18:21:12

Plot 2.6
Power without duplexer, GSM

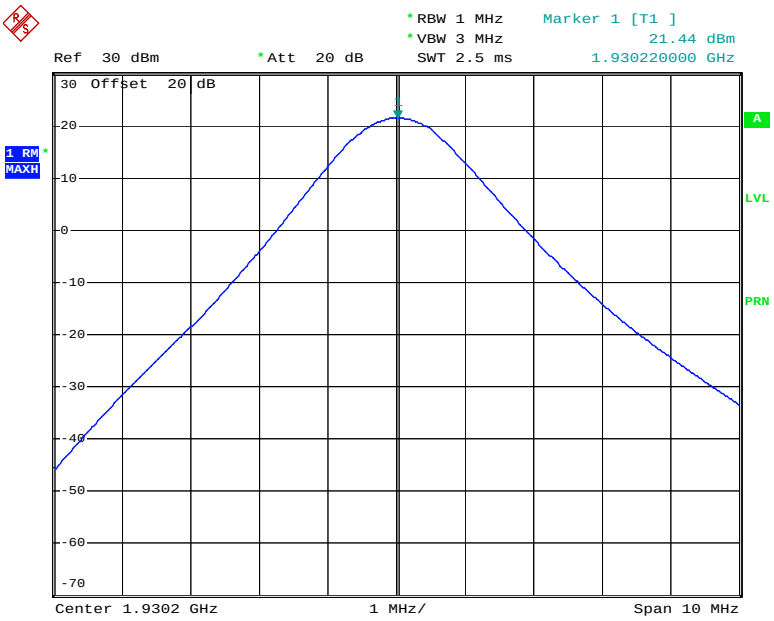


Comment: Power output, high power, ch 810
Date: 28.MAR.2008 18:10:14

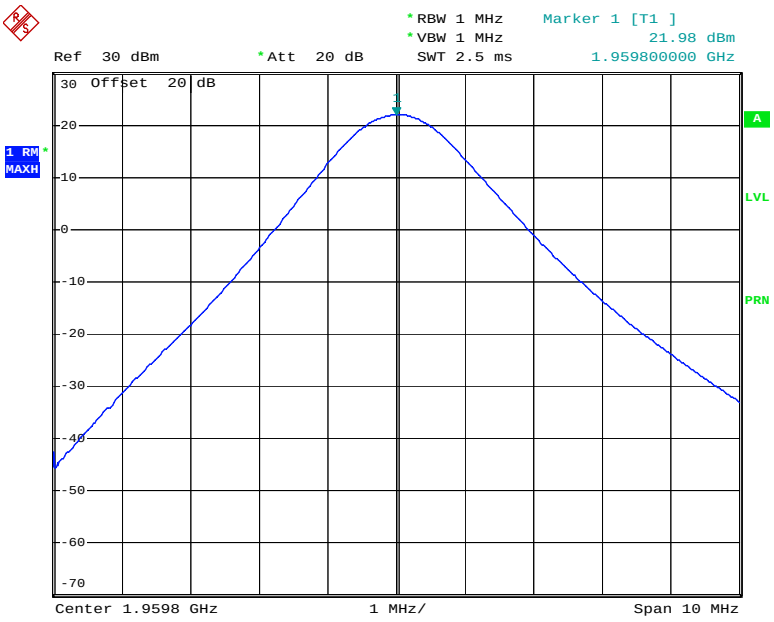


Comment: Power output, low power, ch 810
Date: 28.MAR.2008 18:23:31

Plot 2.7
Power with duplexer, EDGE

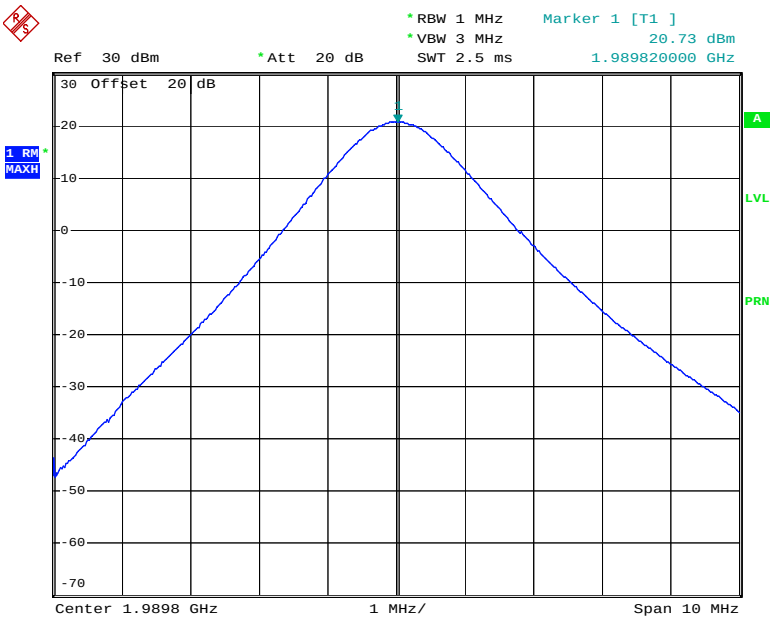


Comment: Power output, EDGE, ch 512
Date: 2.APR.2008 14:11:16



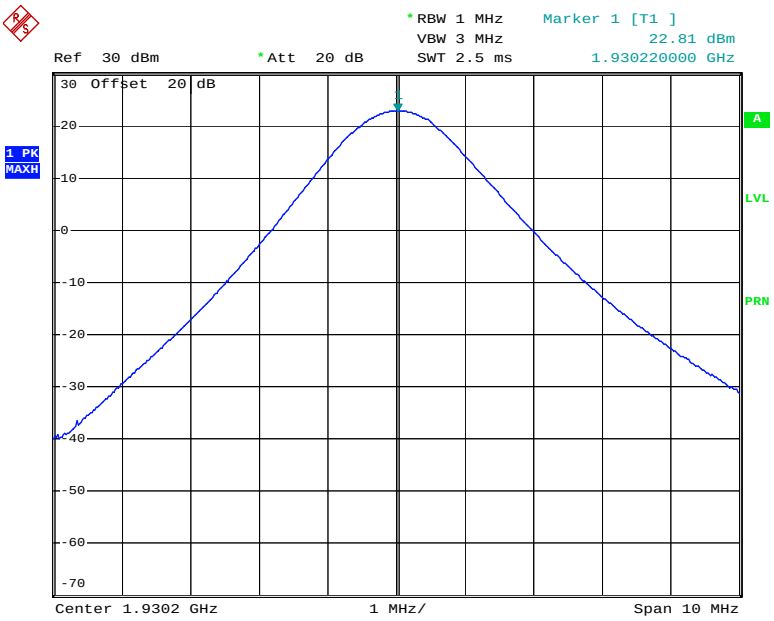
Comment: Power output, EDGE, ch 660
Date: 2.APR.2008 14:32:23

Plot 2.8
Power with duplexer, EDGE

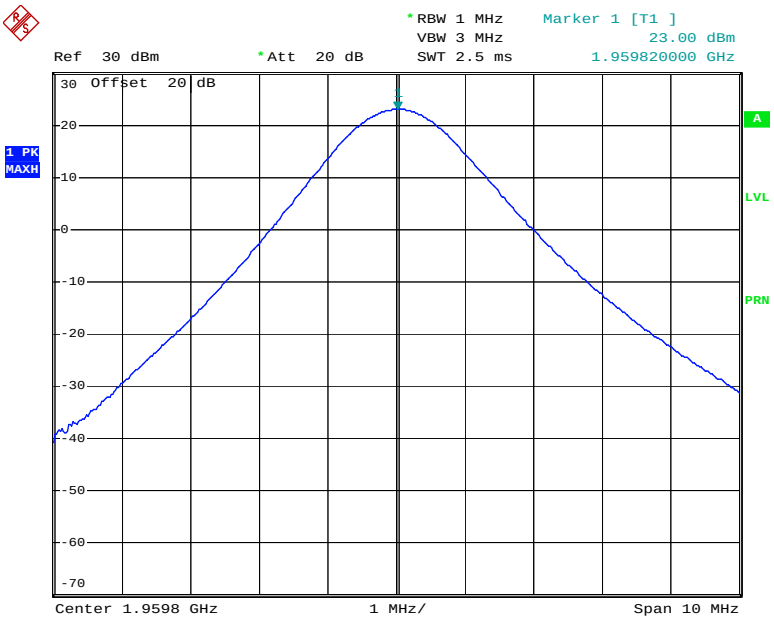


Comment: Power output, EDGE, ch 810
Date: 2.APR.2008 14:05:30

Plot 2.9
Power without duplexer, EDGE

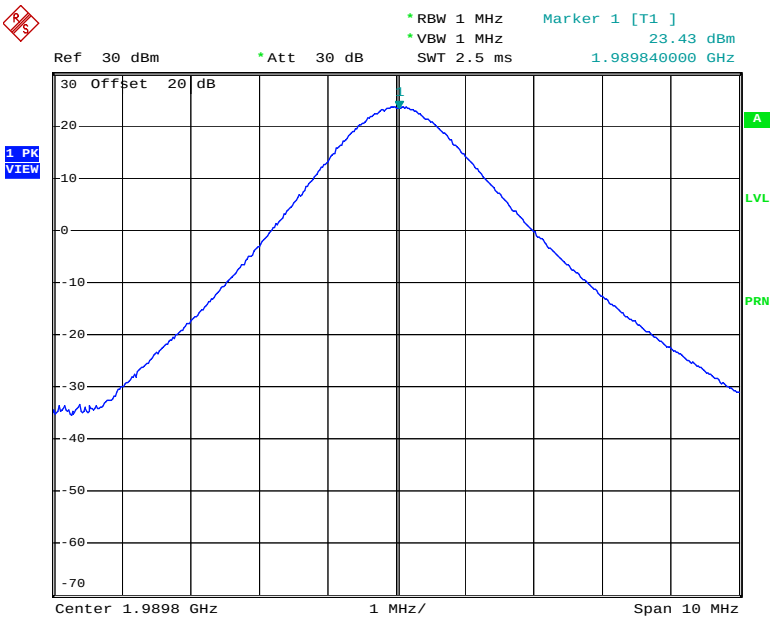


Comment: Power output, high power, EDGE, ch 512
Date: 1.APR.2008 20:06:04



Comment: Power output, high power, EDGE, ch 660
Date: 1.APR.2008 19:41:44

Plot 2.10
Power without duplexer, EDGE



Comment: Output power,high power, EDGE, ch 810
Date: 1.APR.2008 20:42:15

3.0 Radiated Power

FCC 24.232

3.1 Requirement

FCC 24.232(a)

The maximum Equivalent Isotropically Radiated Power (EIRP) is 1640 Watts.

3.2 Test Procedure

The EIRP is calculated by adding the antenna gain to the output power in dBm: $EIRP = P_{max} + G_{dBi}$
As declared by the Applicant, the maximum gain of an antenna, used with the CM-100, is 6 dBi. Therefore, the maximum EIRP is:
38.1 dBm – for GSM,
29.4 dBm – for EDGE.

3.3 Test Results

Result	**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 EUT was setup 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 low, middle, and high channels.

4.2 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer

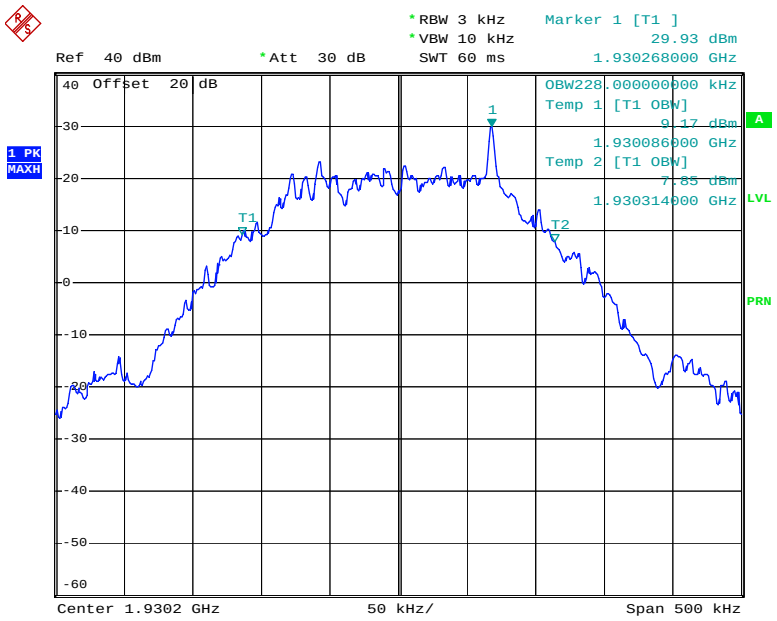
4.3 Test Results

Channel	Frequency (MHz)	Measured Occupied Bandwidth (kHz)	
		GSM	EDGE
512	1930.2	228	228
661	1960.0	229	231
810	1989.8	230	234

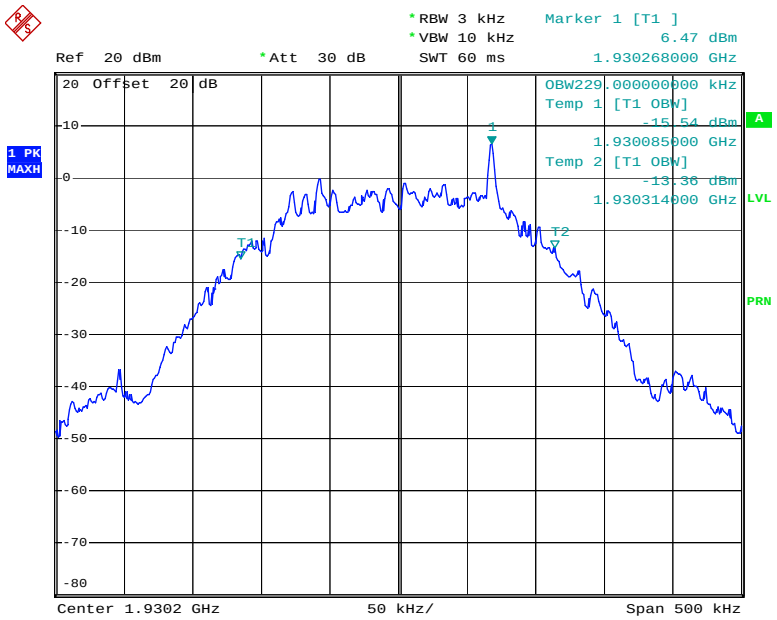
For more details refer to the attached plots.

Emission Designator:
230KGXW – for GSM
234KG7W – for EDGE

Plot 4.1
Occupied Bandwidth, GSM

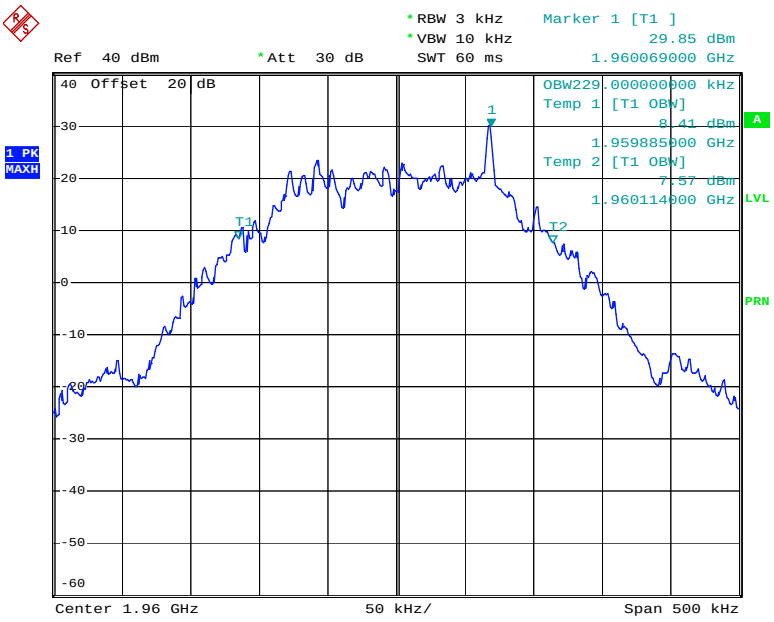


Comment: Occupied bandwidth, high power, ch 512
Date: 26.MAR.2008 17:06:54

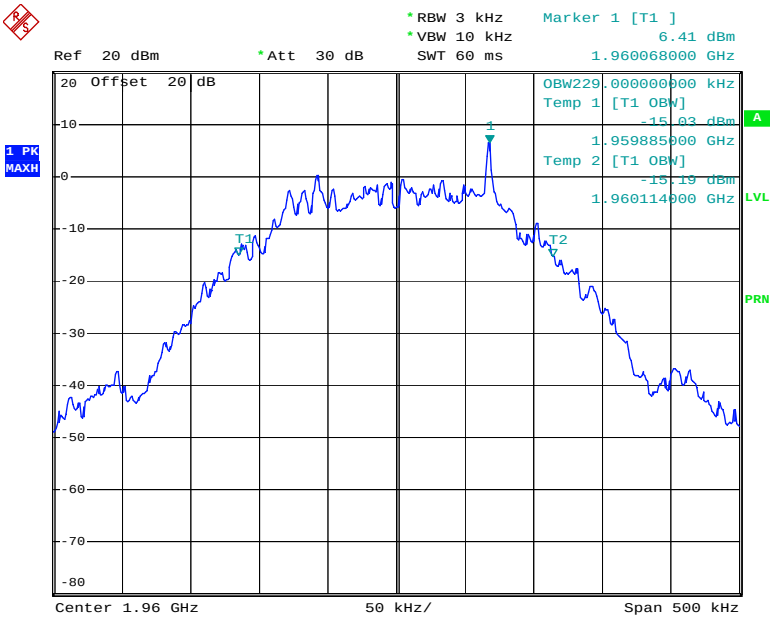


Comment: Occupied bandwidth, low power, ch 512
Date: 26.MAR.2008 17:02:13

Plot 4.2
Occupied Bandwidth, GSM

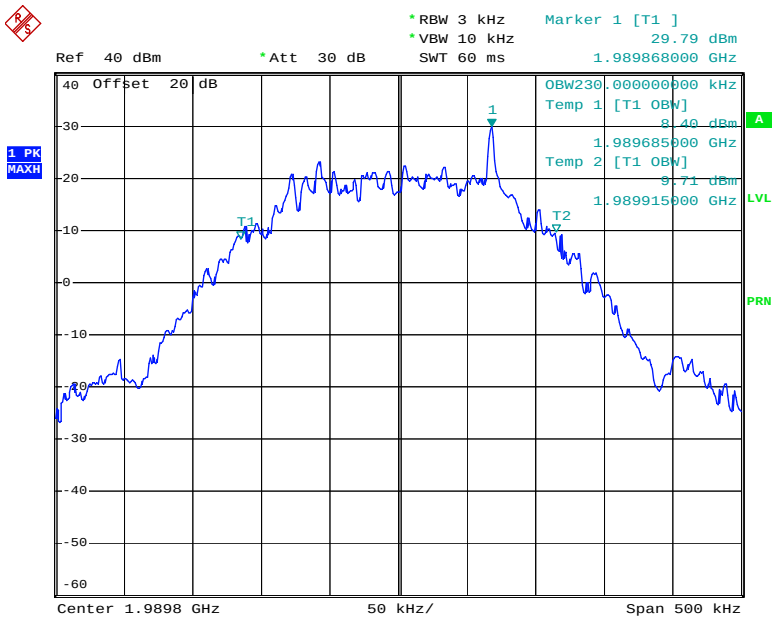


Comment: Occupied bandwidth, high power, ch 661
Date: 26.MAR.2008 16:58:57

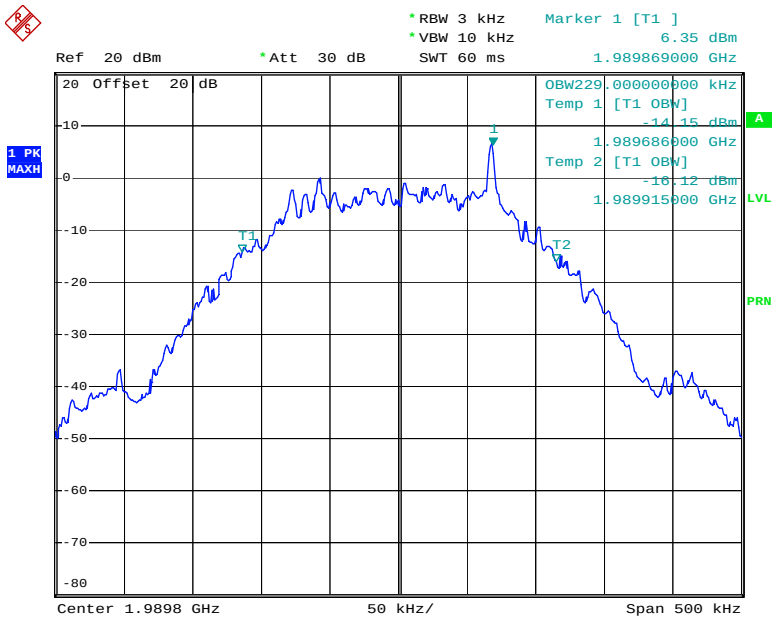


Comment: Occupied bandwidth, low power, ch 661
Date: 26.MAR.2008 17:00:26

Plot
Occupied Bandwidth, GSM

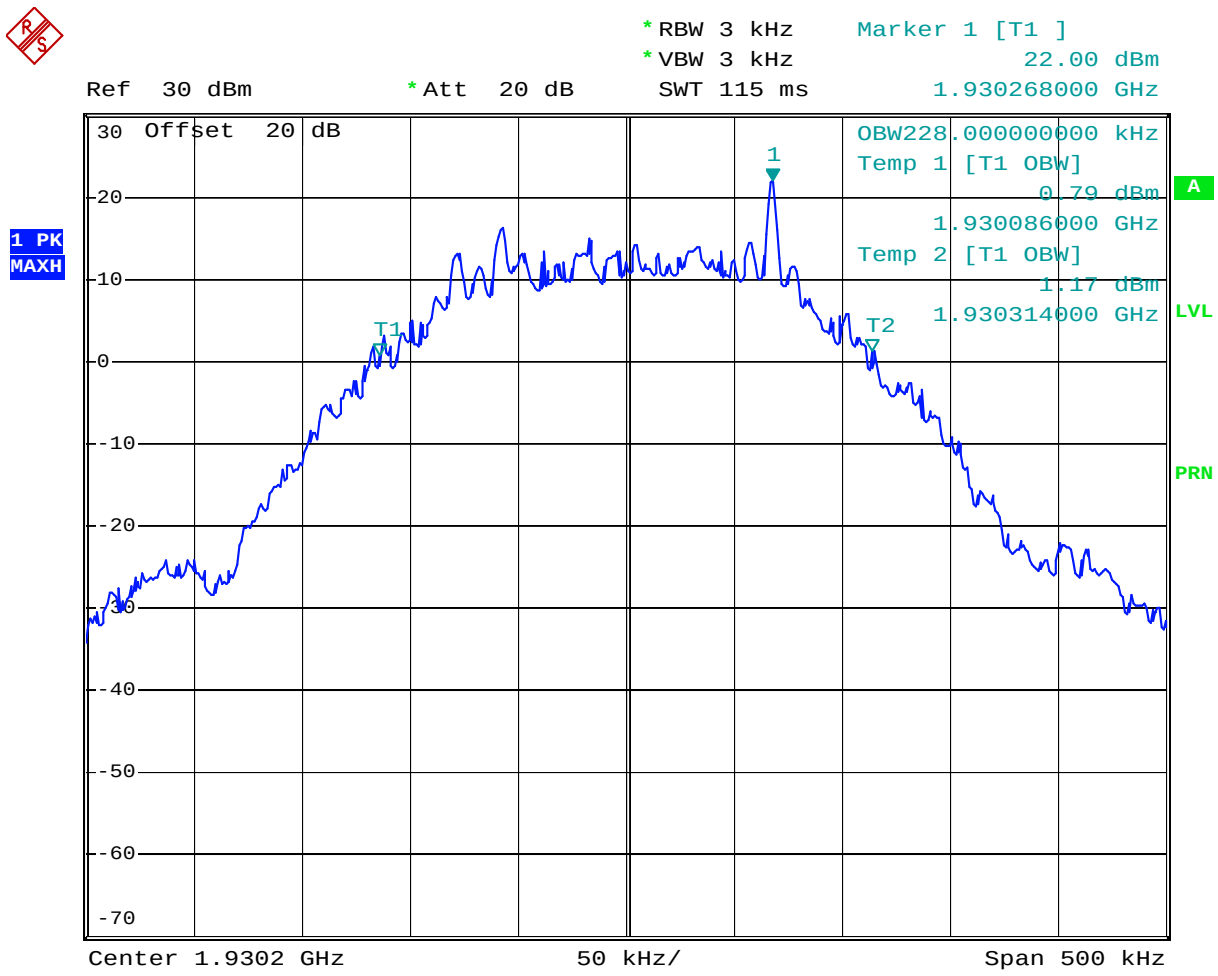


Comment: Occupied bandwidth, high power, ch 810
Date: 26.MAR.2008 17:08:17



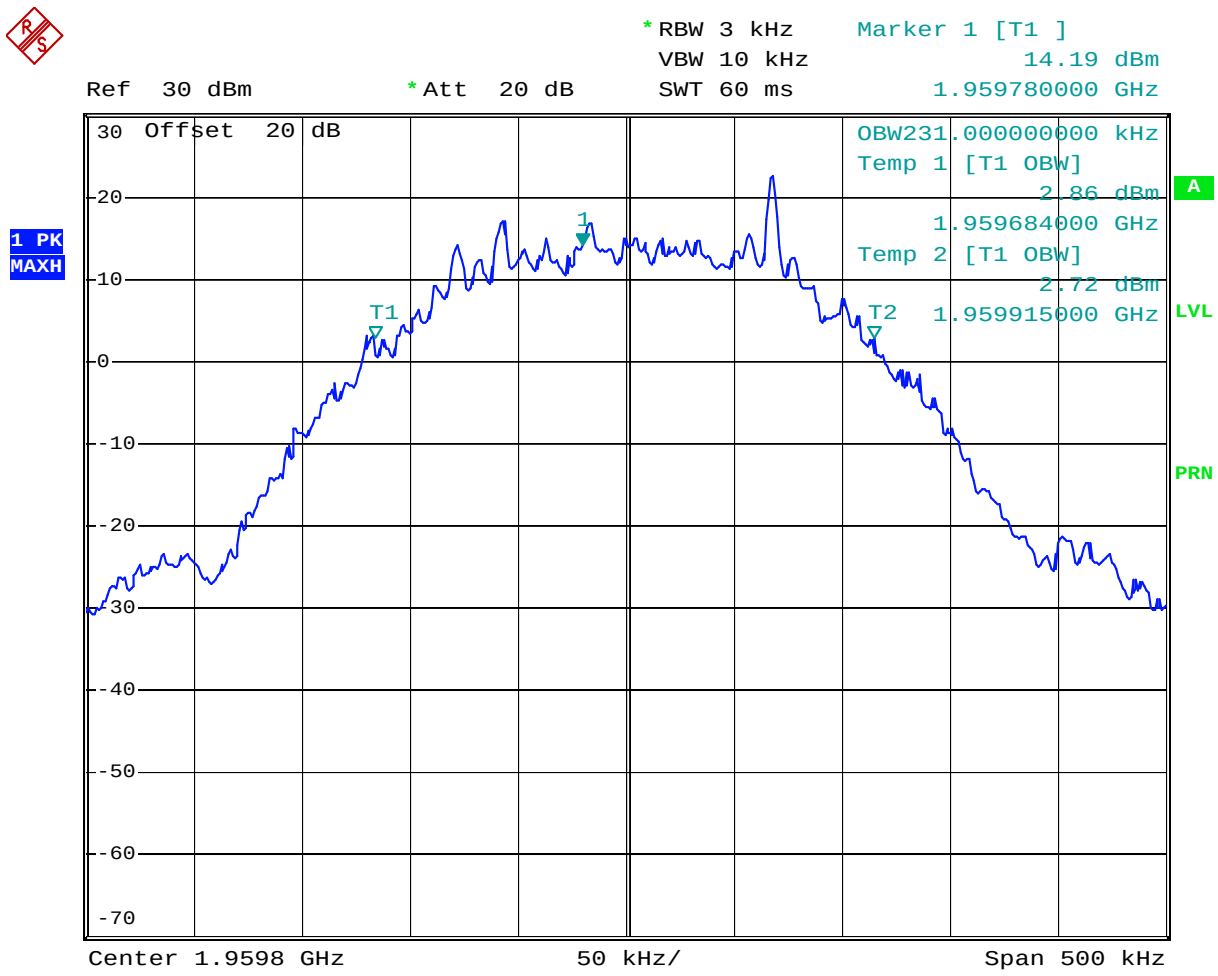
Comment: Occupied bandwidth, low power, ch 810
Date: 26.MAR.2008 17:10:50

Plot
Occupied Bandwidth, EDGE



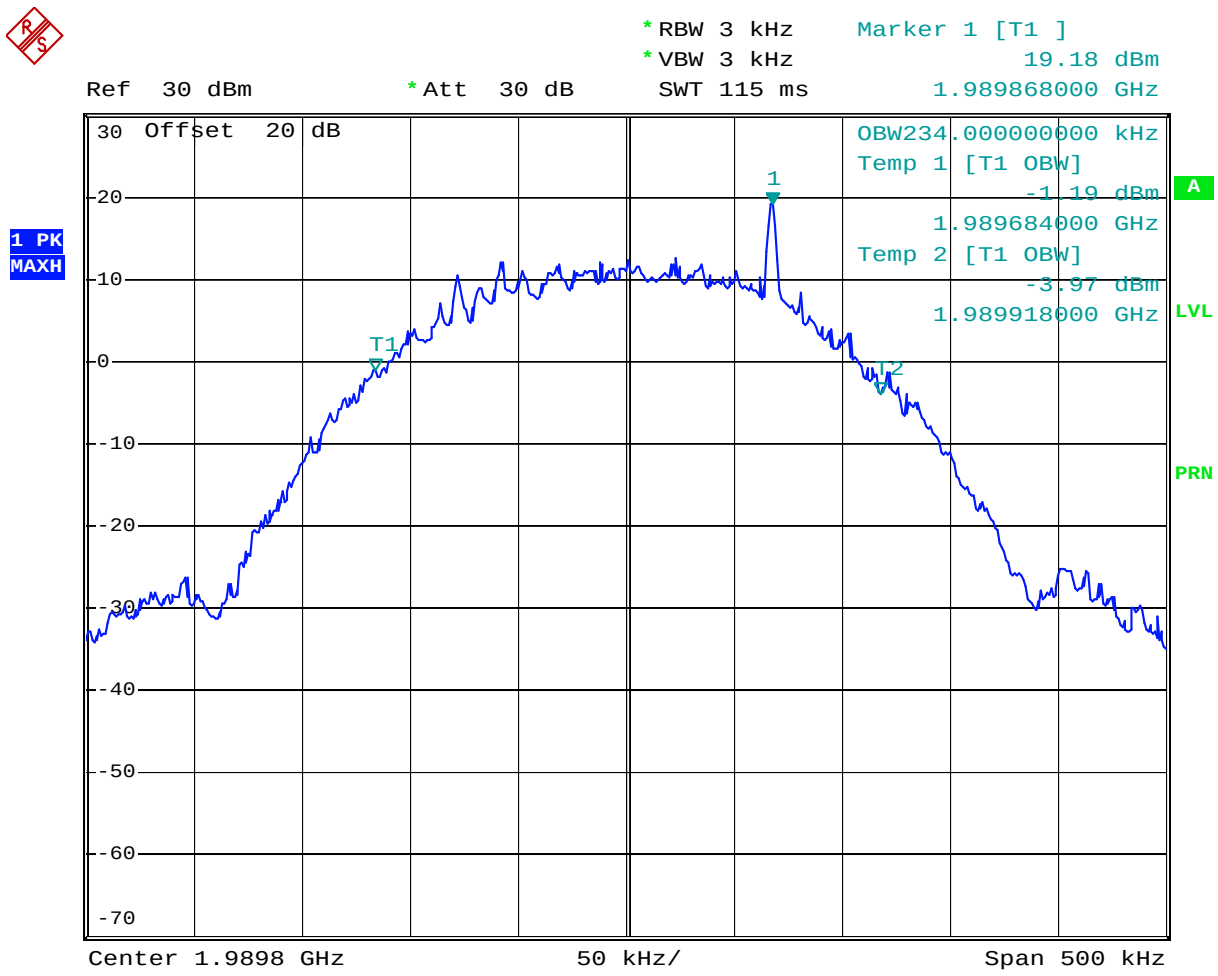
Comment: Occupied bandwidth, high power, EDGE, ch 512
Date: 1.APR.2008 20:08:02

Plot
Occupied Bandwidth, EDGE



Comment: Occupied bandwidth, high power, EDGE, ch 660
Date: 1.APR.2008 19:40:10

Plot
Occupied Bandwidth, EDGE



Comment: Occupied bandwidth, high power, EDGE, ch 810
Date: 1.APR.2008 20:45:13

5.0 Out-of-Band Emissions at antenna terminal

FCC 2.1051, 24.238

5.1 Requirement

The power of any emissions 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.

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 EUT was setup to transmit the maximum power.

For measurements, the spectrum analyzed resolution bandwidth (BW) was set to 1 MHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block, the BW was set to 3 kHz. If on frequencies more than 1 MHz away from the frequency block the BW < 1 MHz is used, the Bandwidth Correction Factor of $10\text{Log}(1_{\text{MHz}}/\text{BW}_{\text{MHz}})$ is added to the spectrum analyzed reading (included in the Reference Level OFFSET).

Measurements were performed at three frequencies (low, middle, and high channels).

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

5.3 Test Equipment

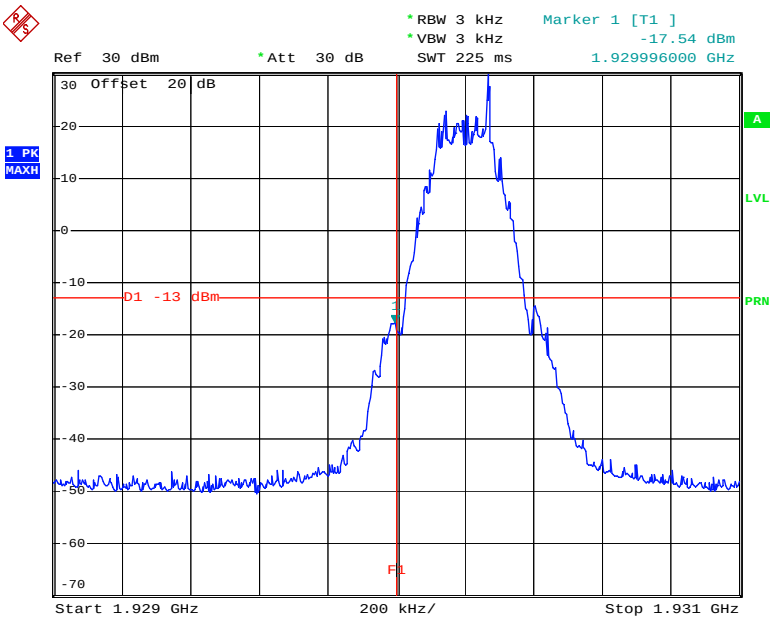
Rohde & Schwarz FSP40 Spectrum Analyzer

5.4 Test Results - band-edge frequencies

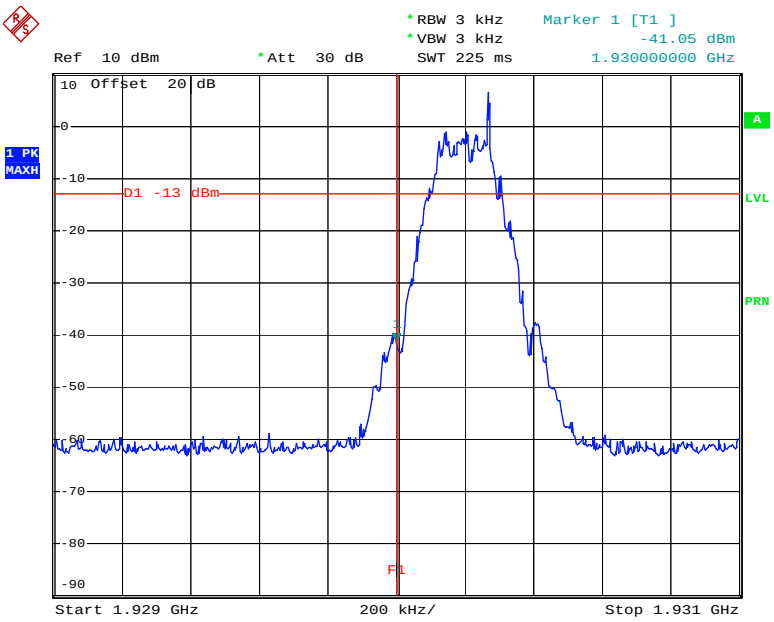
Result	**Complies** by: 1.3 dB – for GSM 11.7 dB – for EDGE

Refer to the following plots.

Plot 5.1
Out-of-band emissions on the band-edge frequency, with duplexer, GSM

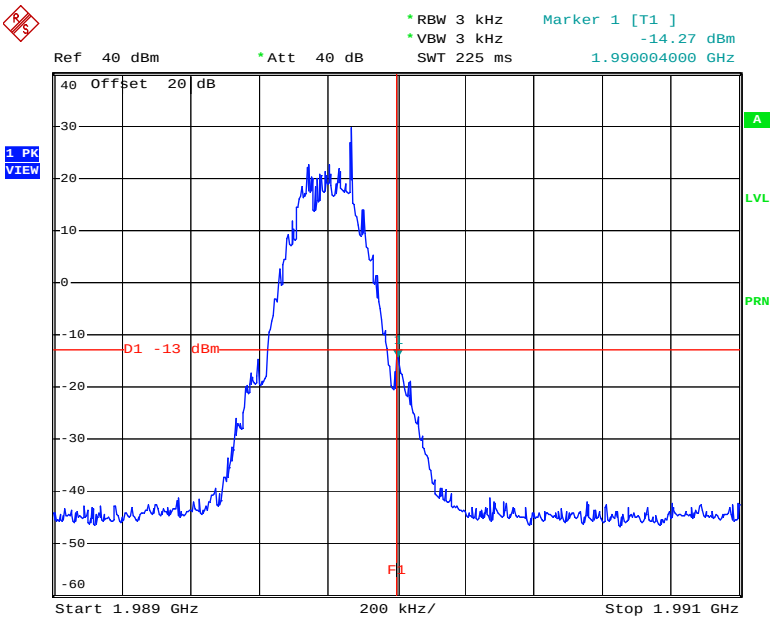


Comment: Conducted emissions on the band-edge fr., high power, ch 512
Comment:
Date: 20.MAR.2008 17:54:44

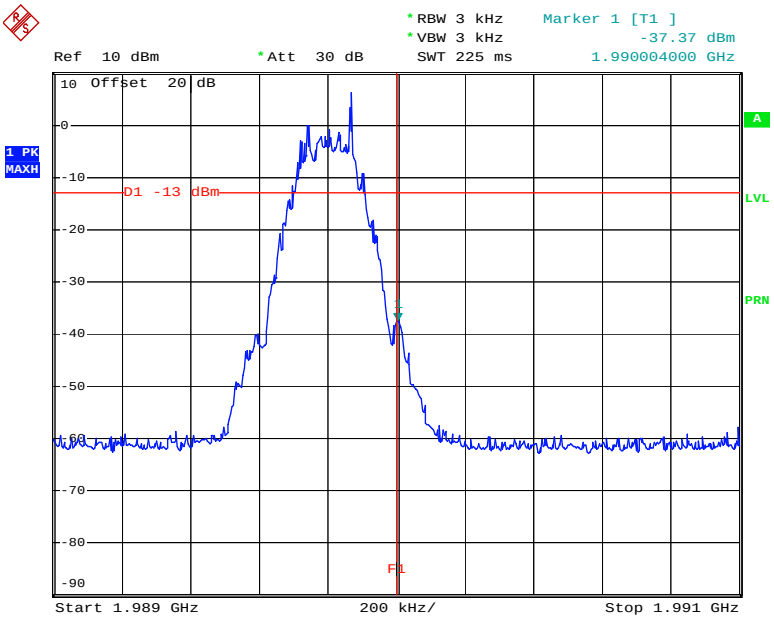


Comment: Conducted emissions on the band-edge fr., low power, ch 512
Date: 20.MAR.2008 17:52:08

Plot 5.2
Out-of-band emissions on the band-edge frequency, with duplexer, GSM

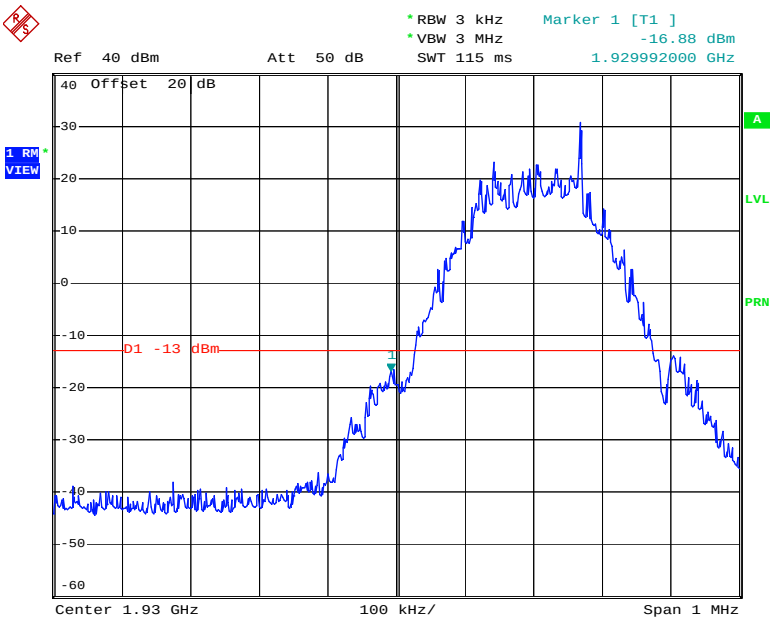


Comment: Conducted emissions on the band-edge fr., high power, ch 810
Comment:
Date: 20.MAR.2008 17:48:08

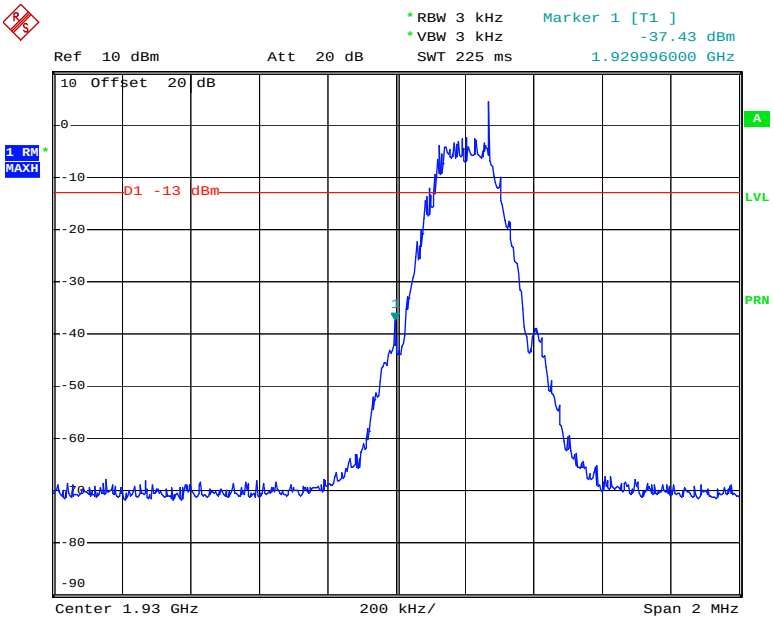


Comment: Conducted emissions on the band-edge fr., low power, ch 810
Date: 20.MAR.2008 17:50:20

Plot 5.3
Out-of-band emissions on the band-edge frequency, without duplexer, GSM

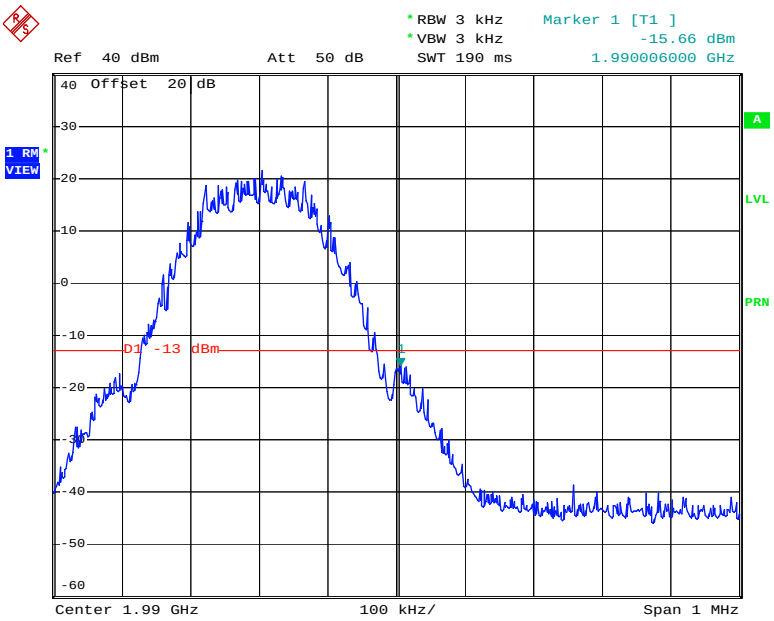


Comment: Conducted emissions on band-edge fr., high power, ch 512
Date: 28.MAR.2008 18:17:22

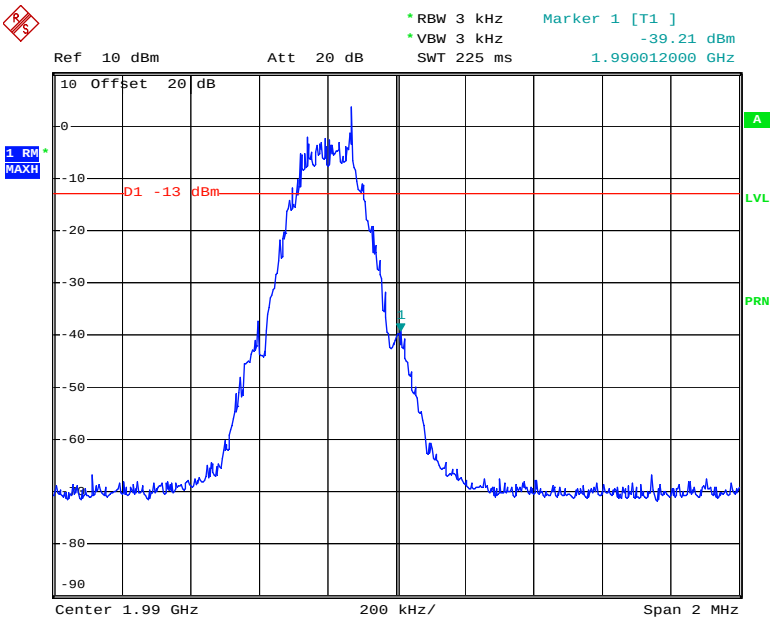


Comment: Conducted emissions on band-edge fr., low power, ch 512
Date: 28.MAR.2008 18:28:32

Plot 5.4
Out-of-band emissions on the band-edge frequency, without duplexer, GSM

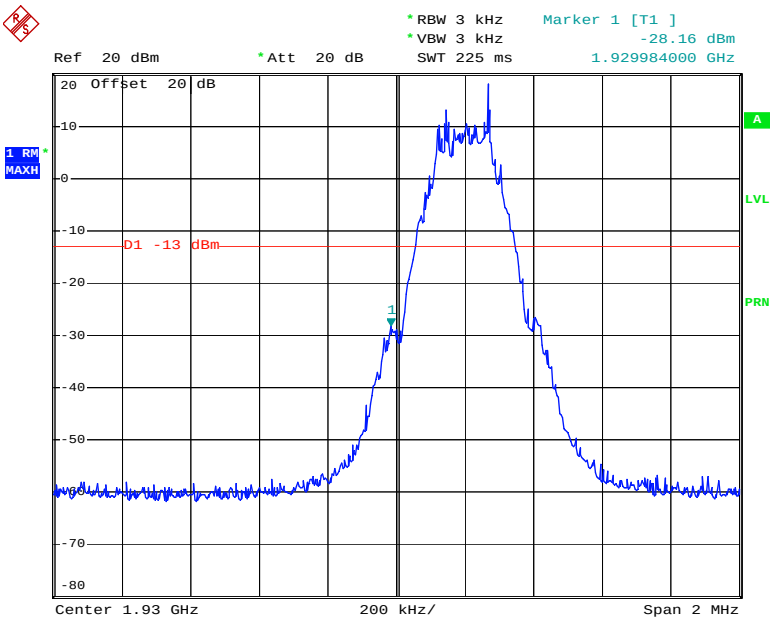


Comment: Conducted emissions on band-edge fr., high power, ch 810
Date: 28.MAR.2008 17:51:11

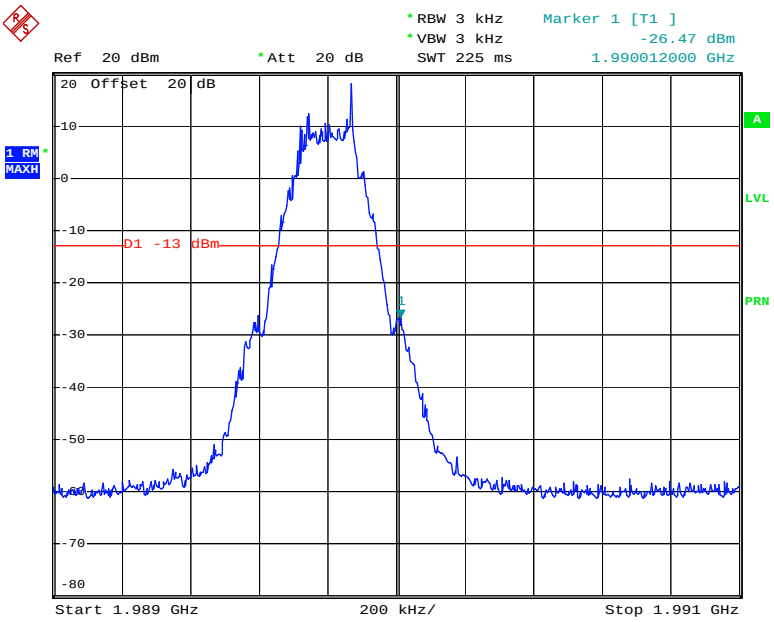


Comment: Conducted emissions on band-edge fr., low power, ch 810
Date: 28.MAR.2008 18:27:01

Plot 5.5
Out-of-band emissions on the band-edge frequency, with duplexer, EDGE

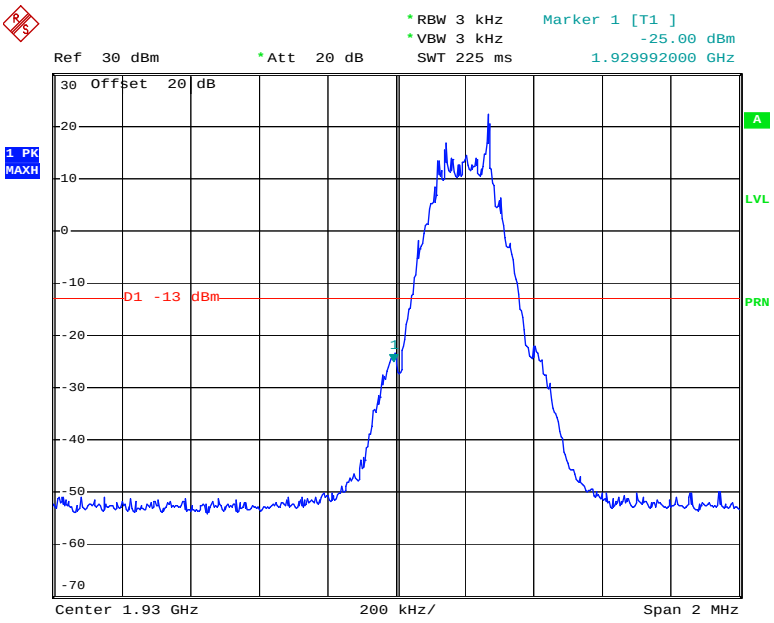


Comment: Conducted emissions on band-edge, EDGE, ch 512
Date: 2.APR.2008 14:13:31

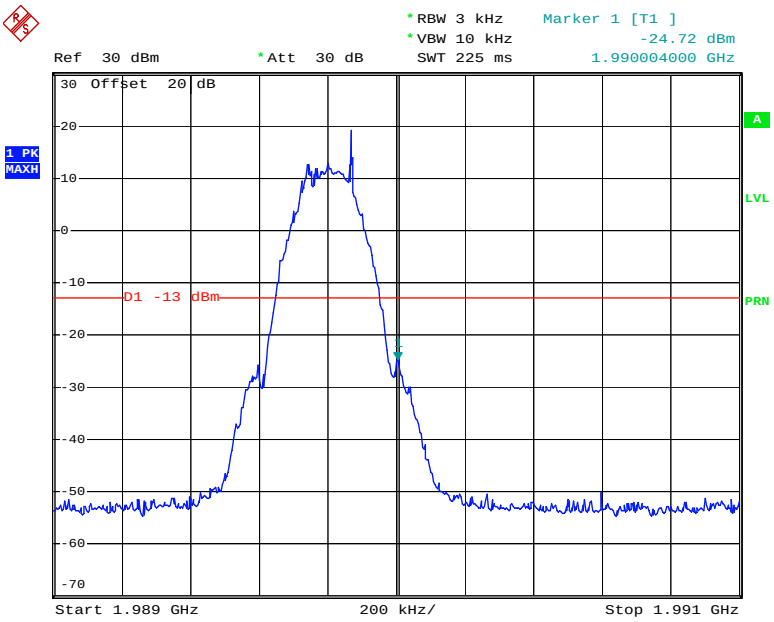


Comment: Conducted emission on band-edge, EDGE, ch 810
Date: 2.APR.2008 13:33:31

Plot 5.6
Out-of-band emissions on the band-edge frequency, without duplexer, EDGE



Comment: Conducted spurious emissions on band-edge, EDGE, ch 512
Date: 1.APR.2008 20:12:51



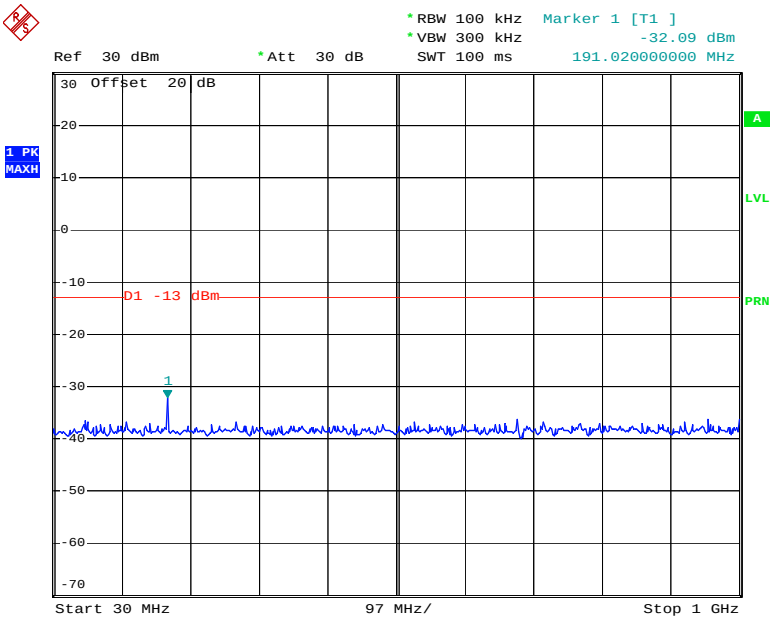
Comment: Conducted spurious emissions on band-edge, EDGE, ch 810
Date: 1.APR.2008 20:47:36

5.5 Test Results - other than band-edge frequencies

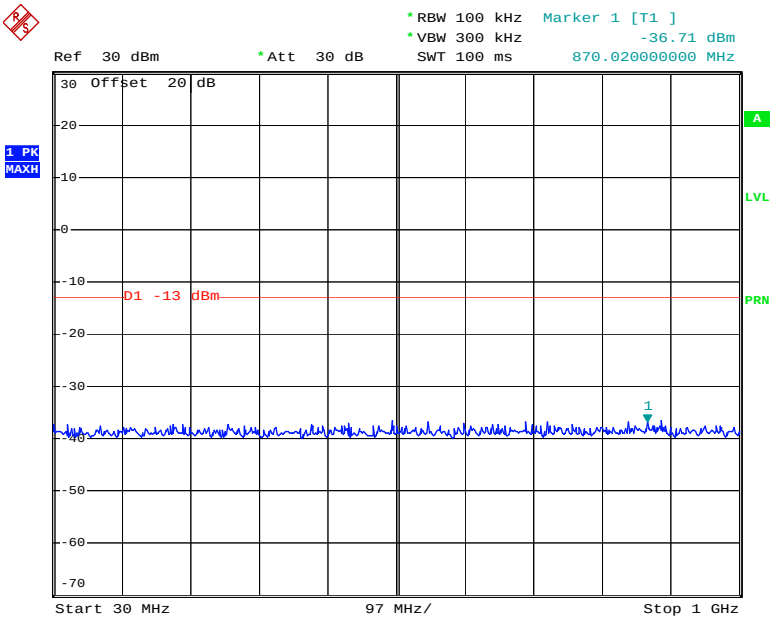
Result	**Complies** by 2.2 dB

Refer to the following plots.

Plot 5.7
Out-of-band and spurious emissions, with duplexer, GSM

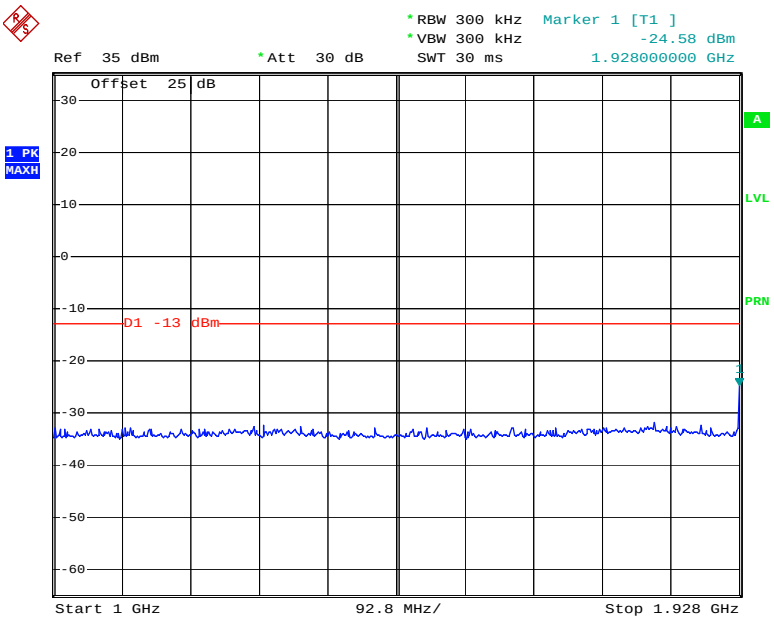


Comment: Conducted emissions, high power, ch 512
Date: 26.MAR.2008 16:41:26

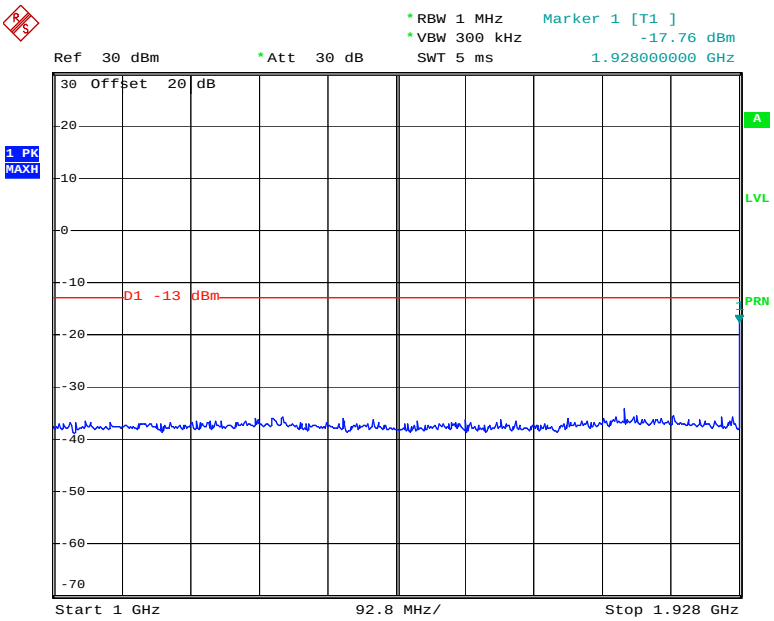


Comment: Conducted emissions, low power, ch 512
Date: 26.MAR.2008 16:40:30

Plot 5.8
Out-of-band and spurious emissions, with duplexer, GSM

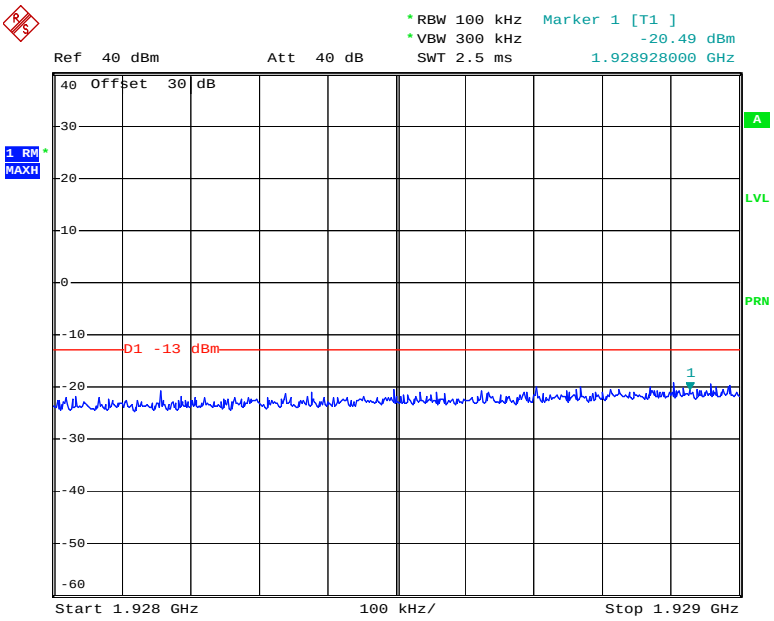


Comment: Conducted emissions, high power, ch 512, 5dB bandwidth corre
Comment: ction factor
Date: 26.MAR.2008 16:26:27



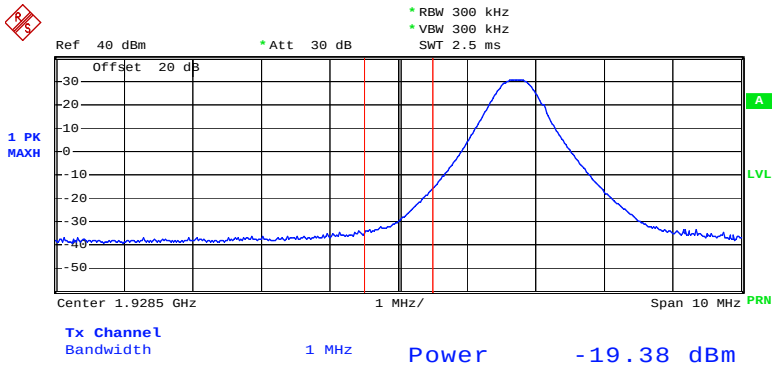
Comment: Conducted emissions, low power, ch 512
Date: 26.MAR.2008 16:39:30

Plot 5.9
Out-of-band and spurious emissions, with duplexer, GSM

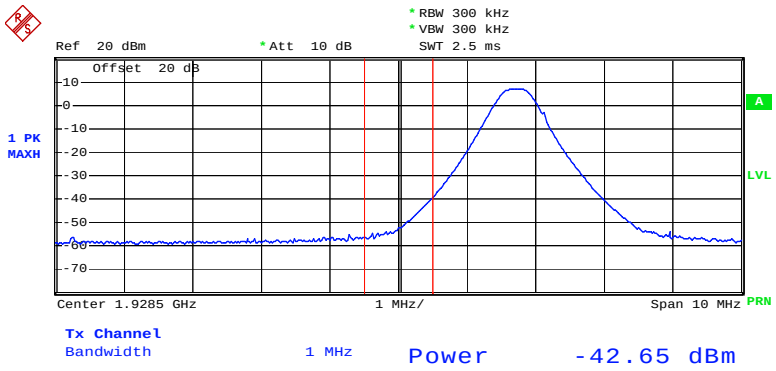


Comment: Conducted emissions, high power, ch 512, with 10dB BW corr.
Comment: factor
Date: 28.MAR.2008 18:41:07

Plot 5.10
Out-of-band and spurious emissions, with duplexer, GSM

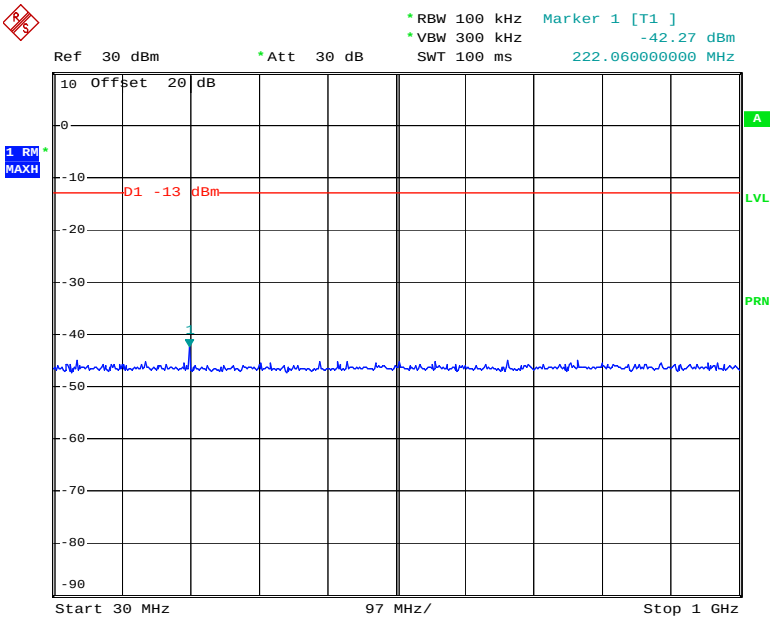


Comment: Conducted emissions on the band-edge fr., high power, ch 512
Comment:
Date: 26.MAR.2008 16:16:40

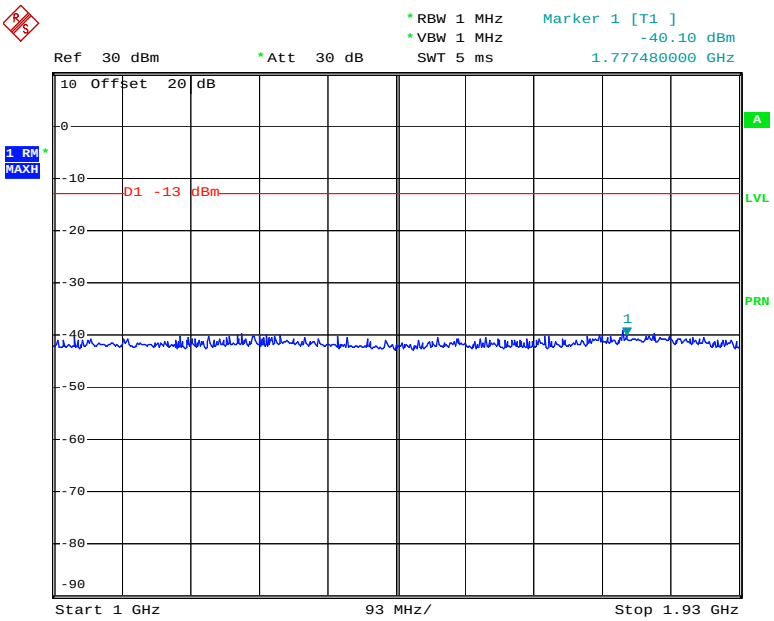


Comment: Conducted emissions on the band-edge fr., low power, ch 512
Date: 26.MAR.2008 16:15:31

Plot 5.11
Out-of-band and spurious emissions, with duplexer, GSM

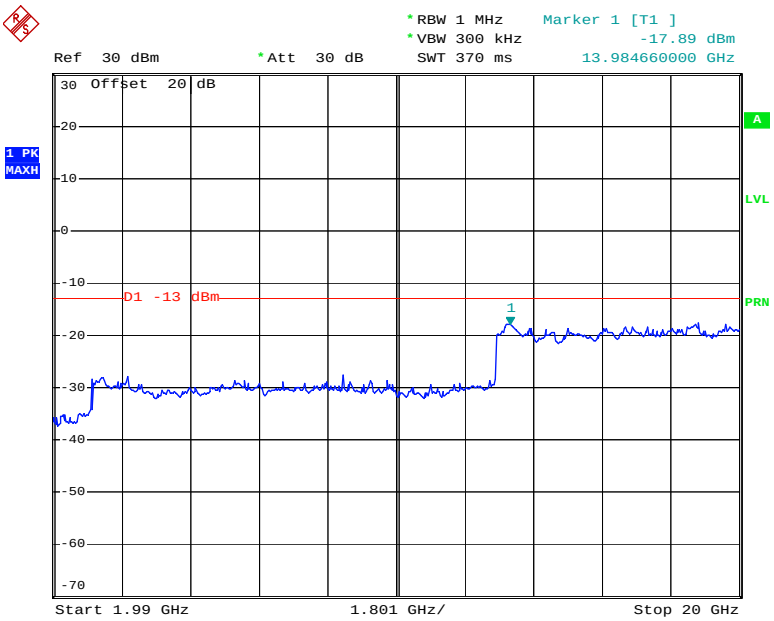


Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 19:03:20



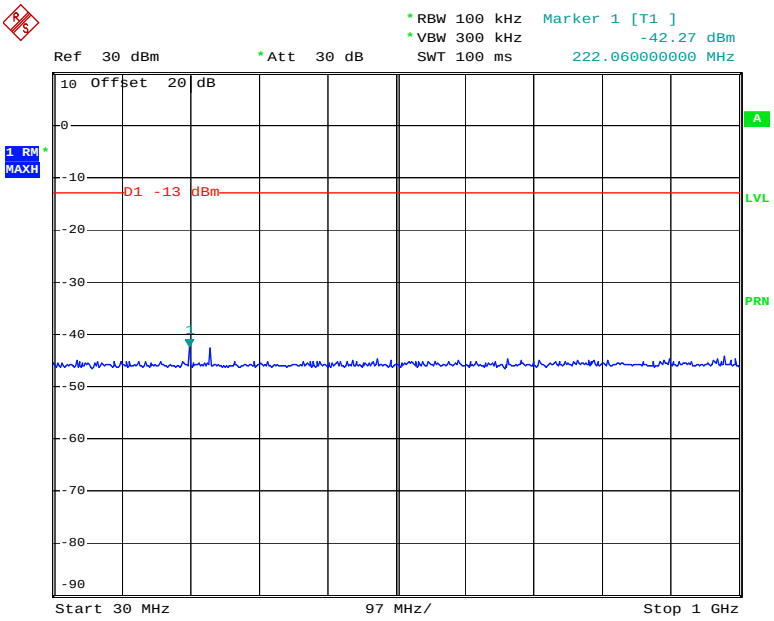
Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 19:02:36

Plot 5.12
Out-of-band and spurious emissions, with duplexer, GSM

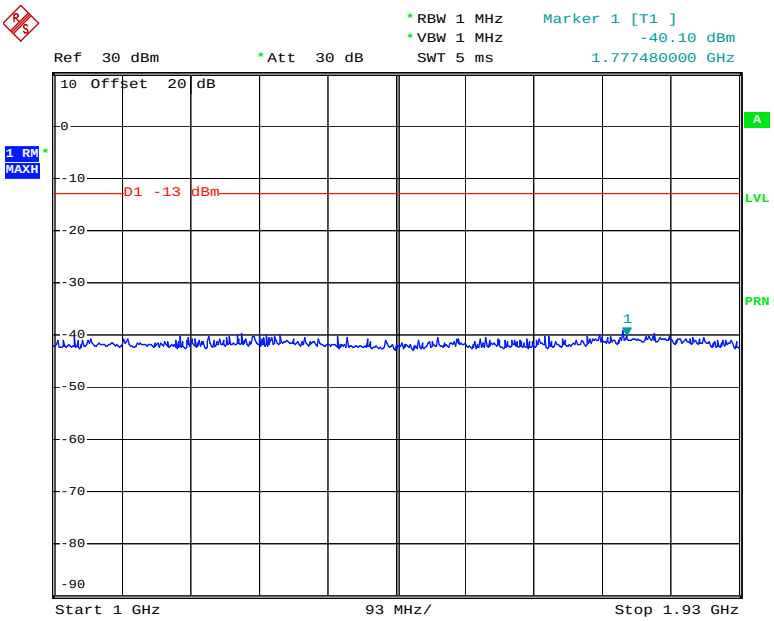


Comment: Conducted emissions, high power, ch 661
Date: 26.MAR.2008 16:44:11

Plot 5.13
Out-of-band and spurious emissions, with duplexer, GSM

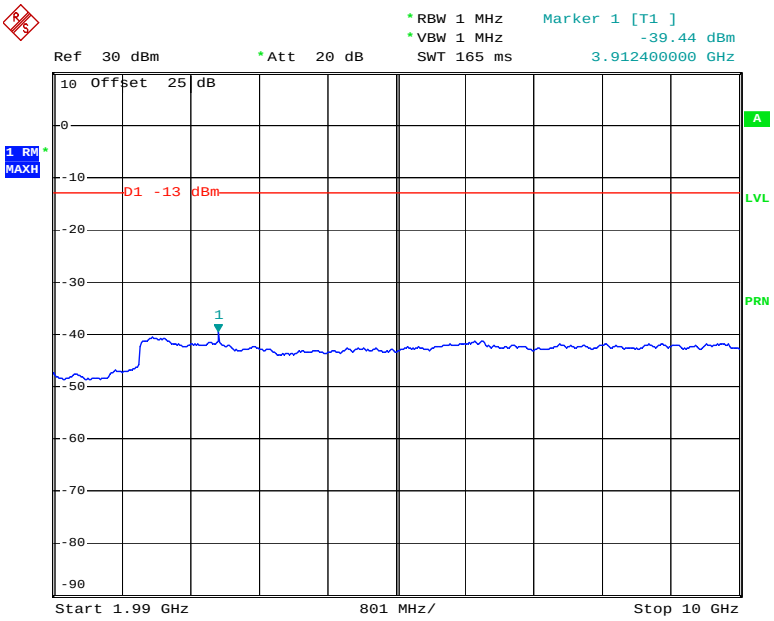


Comment: Conducted emissions, high power, ch 810,
Date: 28.MAR.2008 19:06:27

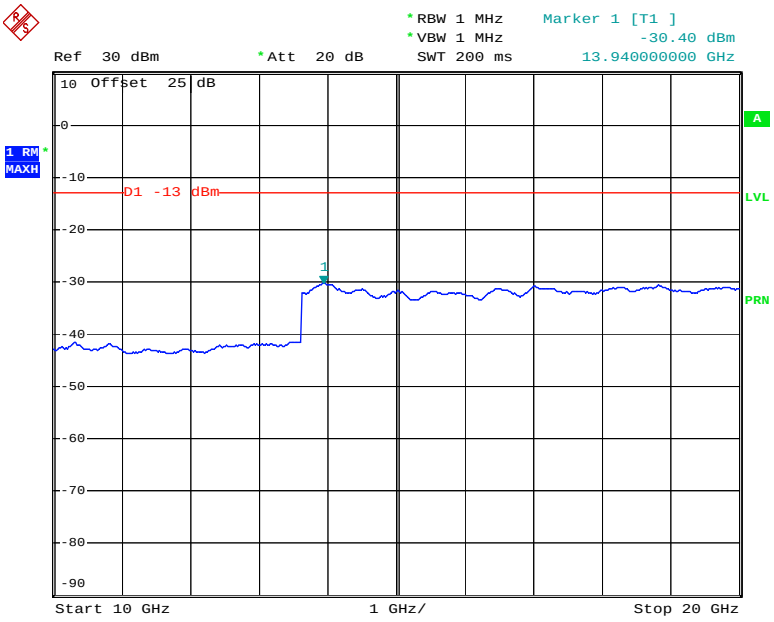


Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 19:02:36

Plot 5.14
Out-of-band and spurious emissions, with duplexer, GSM

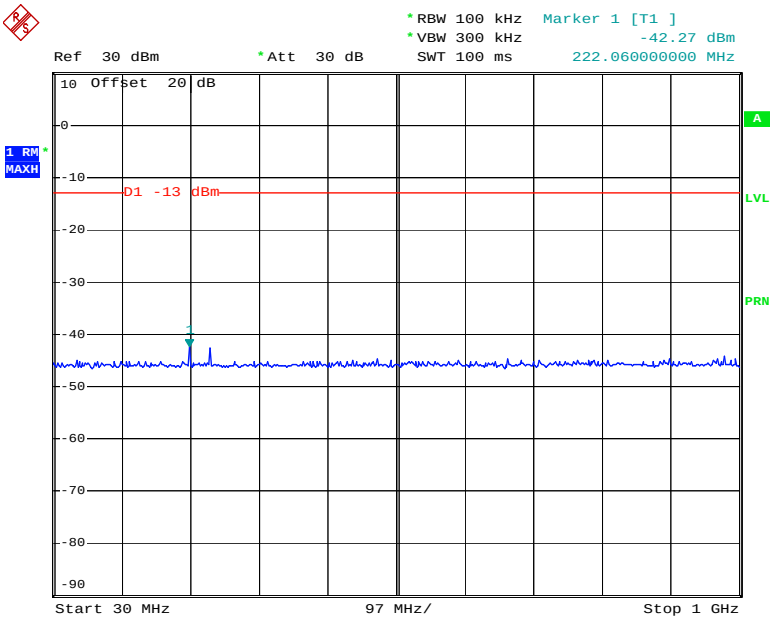


Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 18:59:32

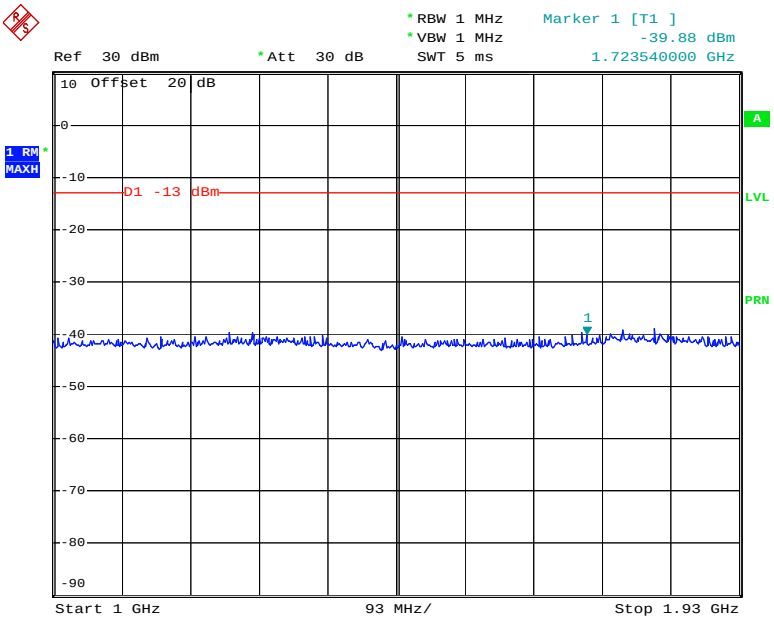


Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 18:58:41

Plot 5.15
Out-of-band and spurious emissions, with duplexer, GSM

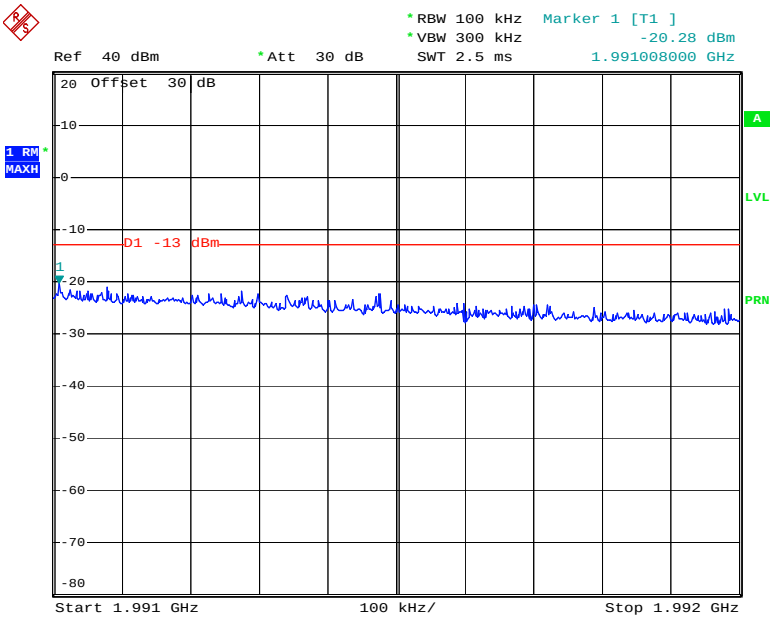


Comment: Conducted emissions, high power, ch 810,
Date: 28.MAR.2008 19:06:27



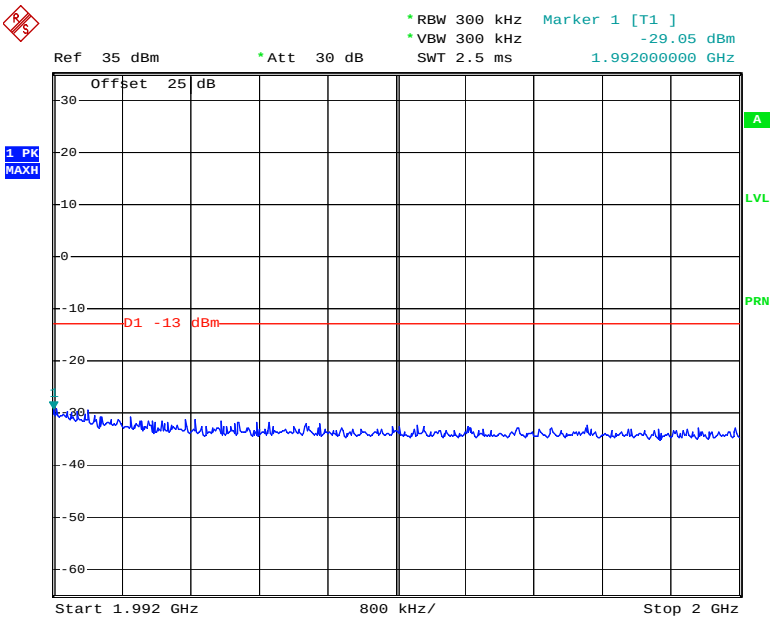
Comment: Conducted emissions, high power, ch 810,
Date: 28.MAR.2008 19:13:31

Plot 5.16
Out-of-band and spurious emissions, with duplexer, GSM

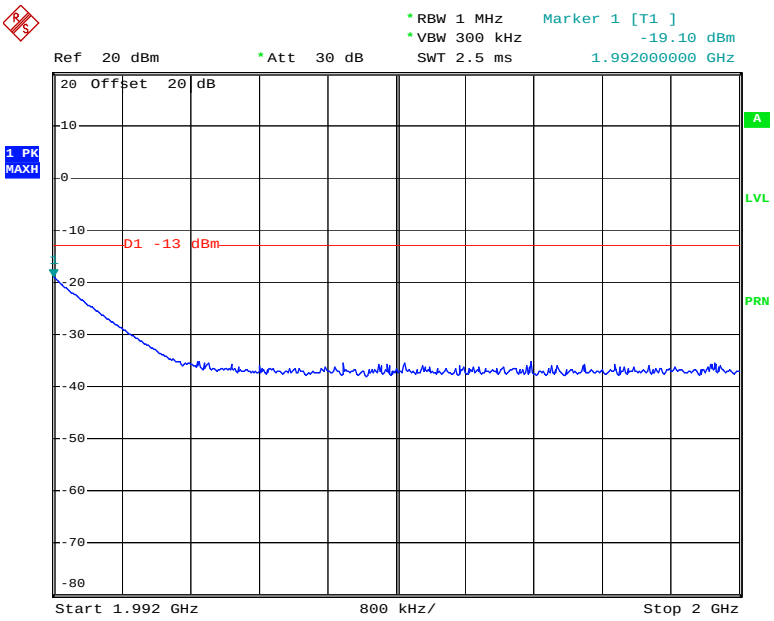


Comment: Conducted emissions, high power, ch 810, with 10 dB BW corr.
Comment: factor
Date: 28.MAR.2008 19:20:05

Plot 5.17
Out-of-band and spurious emissions, with duplexer, GSM

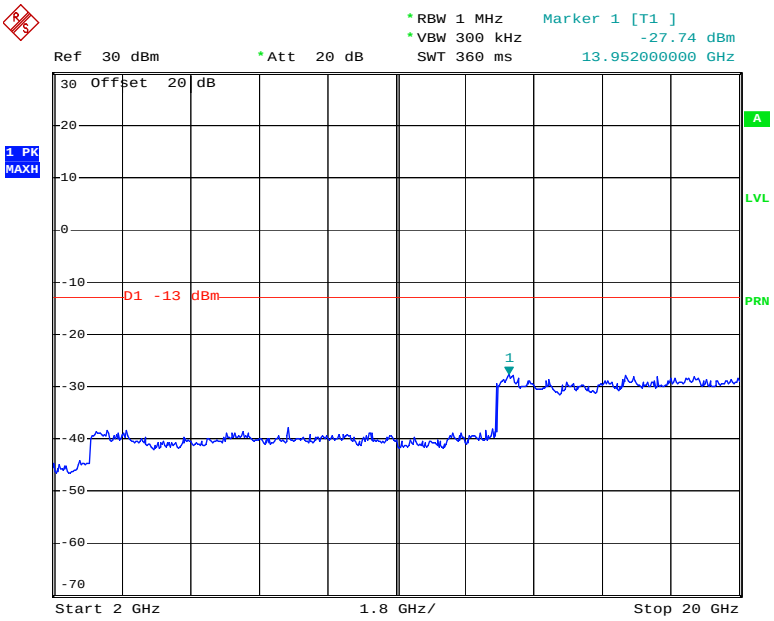


Comment: Conducted emissions, high power, ch 810, 5dB bandwidth corre
Comment: ction factor
Date: 26.MAR.2008 16:28:55

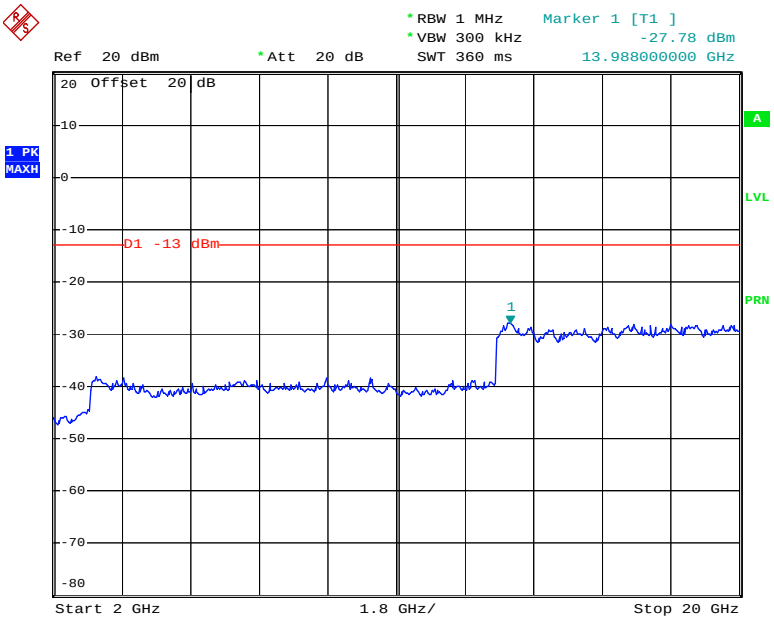


Comment: Conducted emissions, low power, ch 810
Date: 26.MAR.2008 16:33:22

Plot 5.18
Out-of-band and spurious emissions, with duplexer, GSM



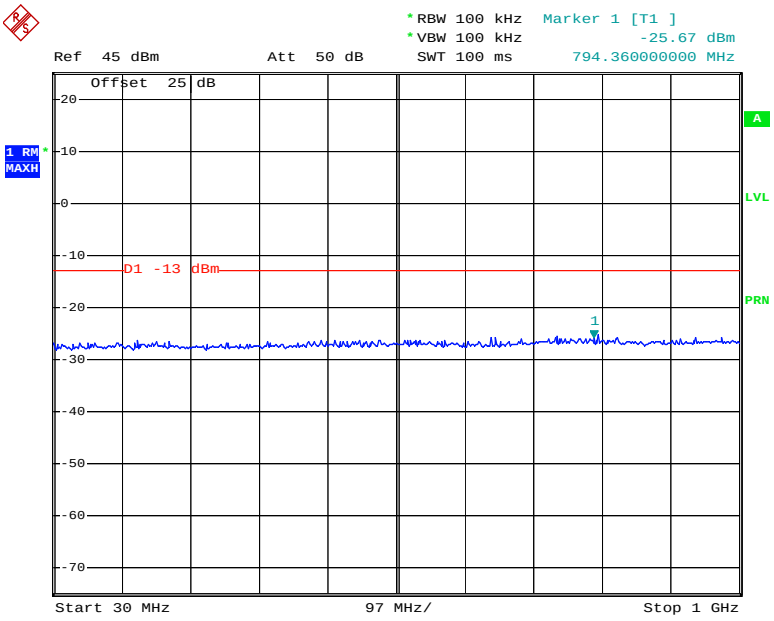
Comment: Conducted emissions, high power, ch 810
Date: 26.MAR.2008 16:35:51



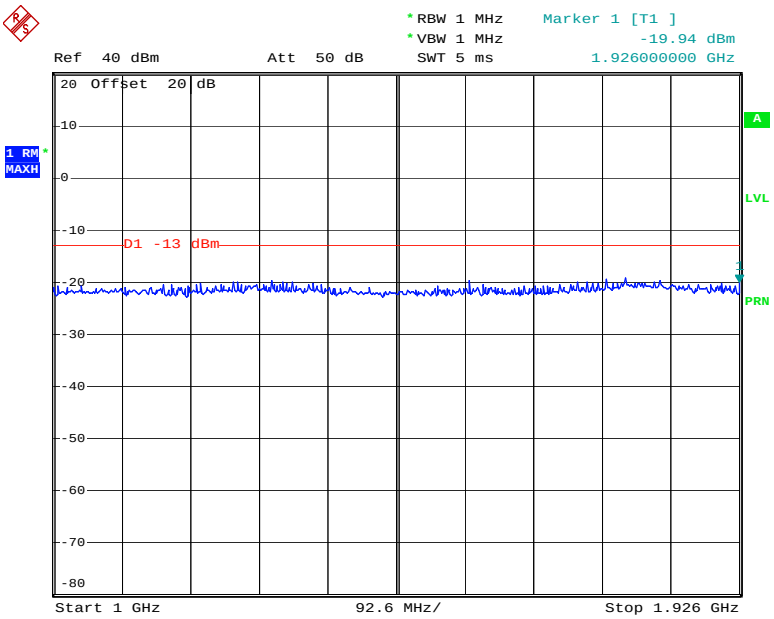
Comment: Conducted emissions, low power, ch 810
Date: 26.MAR.2008 16:34:38

Plot 5.18

Out-of-band and spurious emissions, without duplexer, GSM

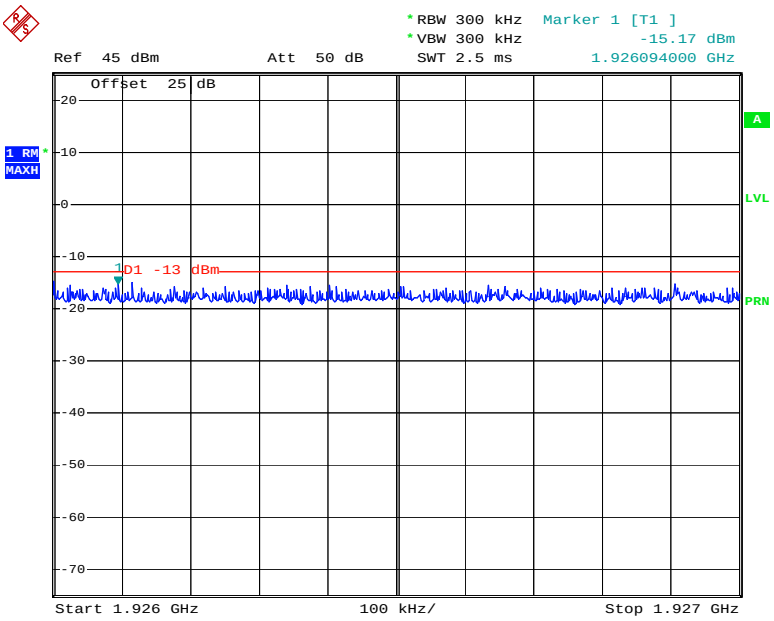


Comment: Conducted emissions, high power, ch 512,
Date: 28.MAR.2008 18:53:16

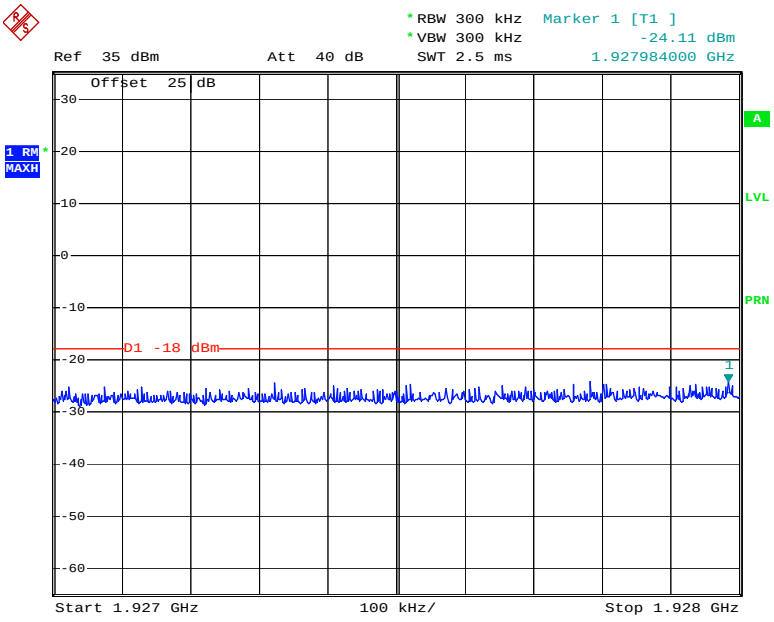


Comment: Conducted emissions, high power, ch 512,
Date: 28.MAR.2008 18:50:01

Plot 5.19
Out-of-band and spurious emissions, without duplexer, GSM



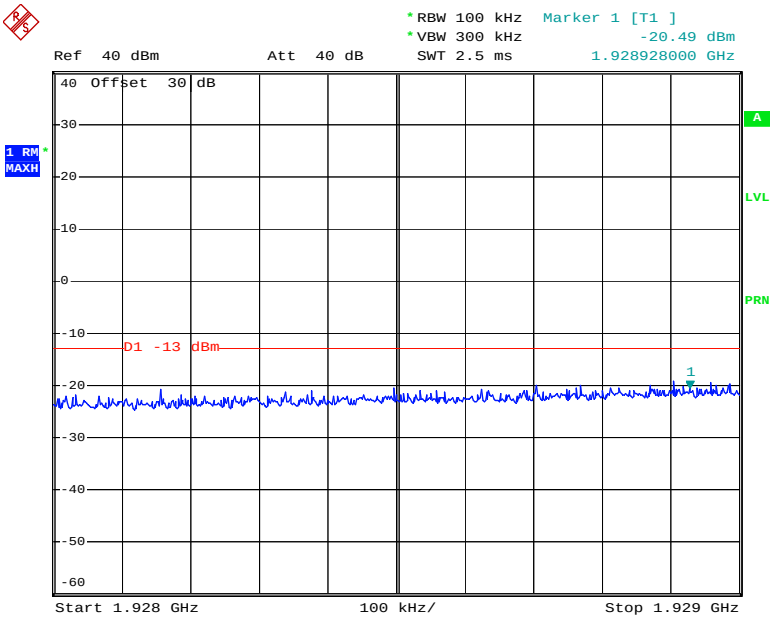
Comment: Conducted emissions, high power, ch 512, with 5 dB BW corr.
Comment: factor
Date: 28.MAR.2008 18:51:45



Comment: Conducted emissions, high power, ch 512, with 5 dB BW corr.
Comment: factor
Date: 28.MAR.2008 18:43:26

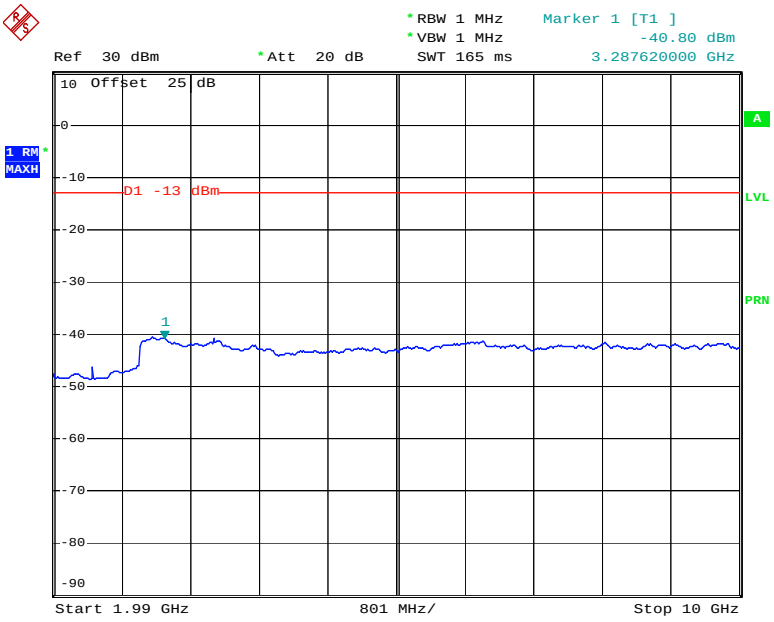
Plot 5.20

Out-of-band and spurious emissions, without duplexer, GSM

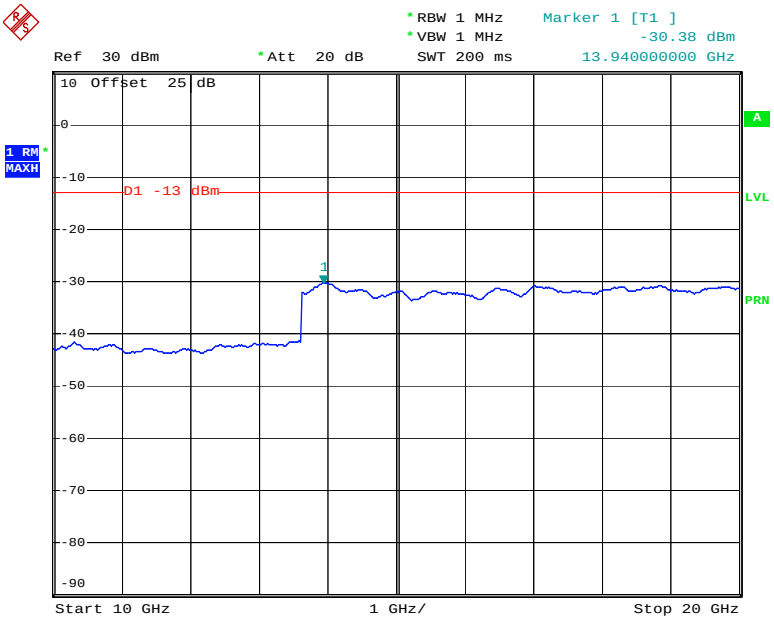


Comment: Conducted emissions, high power, ch 512, with 10dB BW corr.
Comment: factor
Date: 28.MAR.2008 18:41:07

Plot 5.21
Out-of-band and spurious emissions, without duplexer, GSM

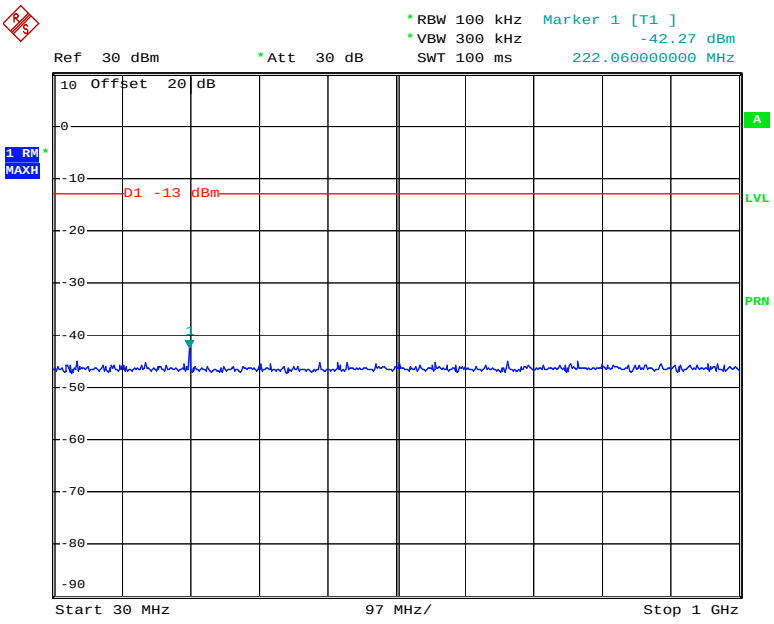


Comment: Conducted emissions, high power, ch 512,
Date: 28.MAR.2008 18:56:59

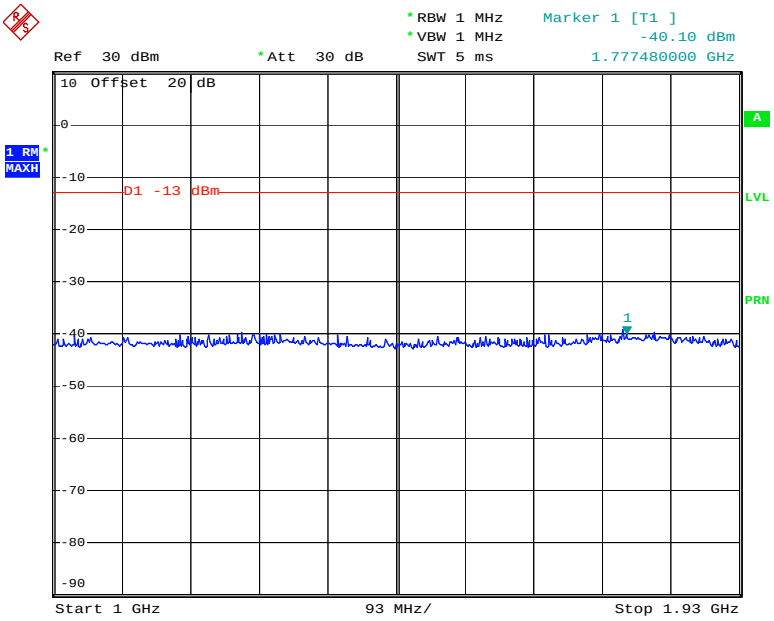


Comment: Conducted emissions, high power, ch 512,
Date: 28.MAR.2008 18:57:32

Plot 5.22
Out-of-band and spurious emissions, without duplexer, GSM

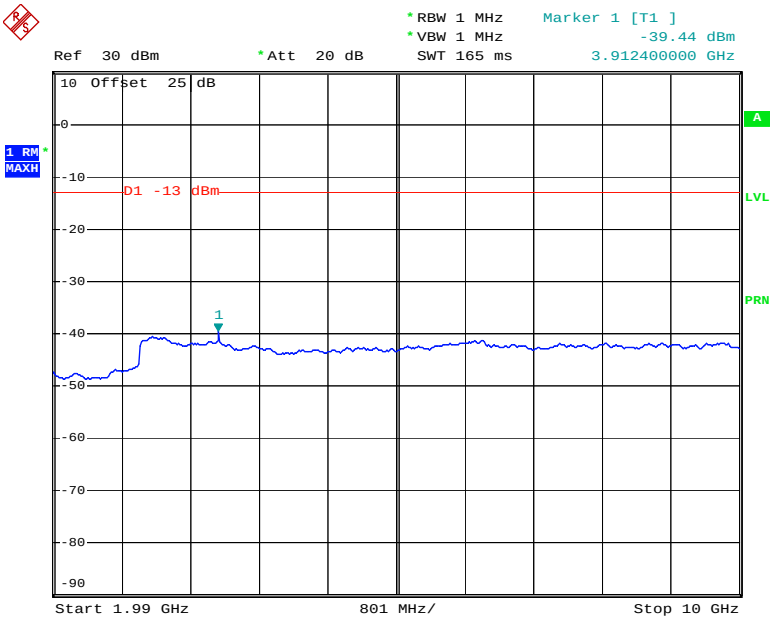


Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 19:03:20

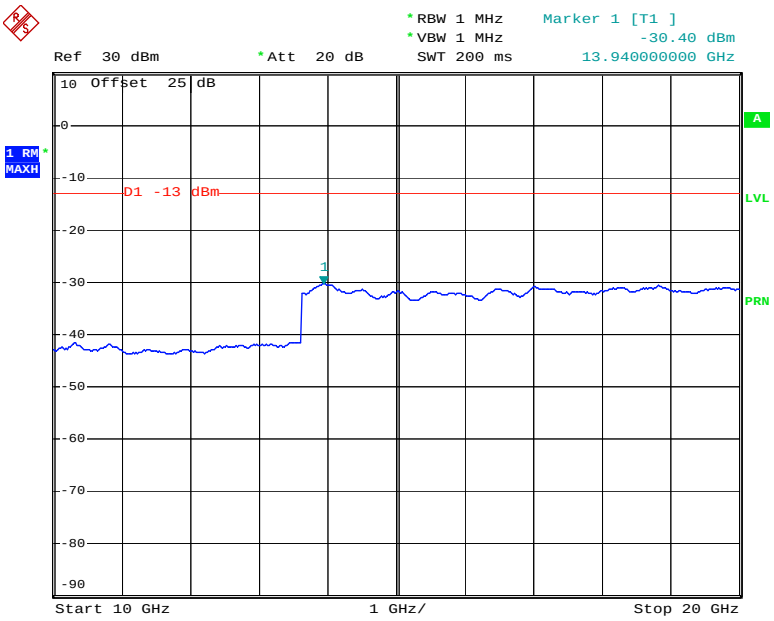


Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 19:02:36

Plot 5.23
Out-of-band and spurious emissions, without duplexer, GSM

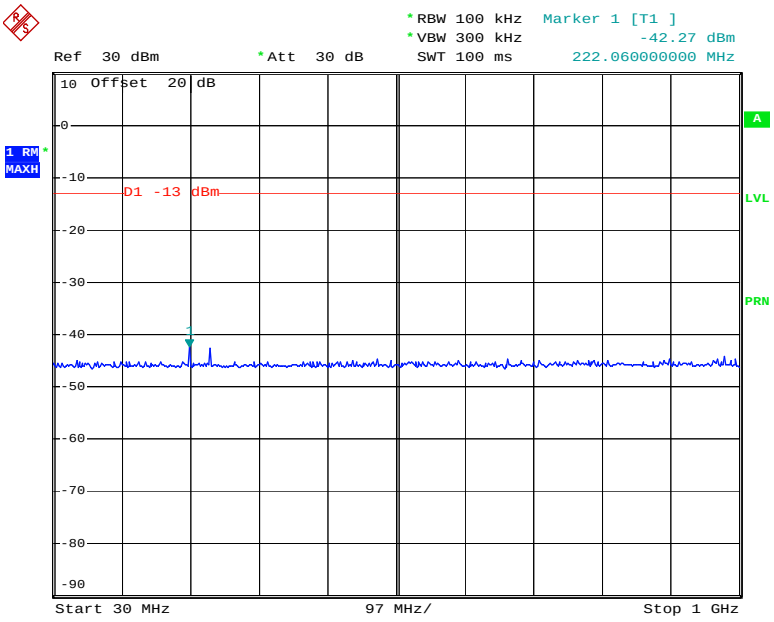


Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 18:59:32

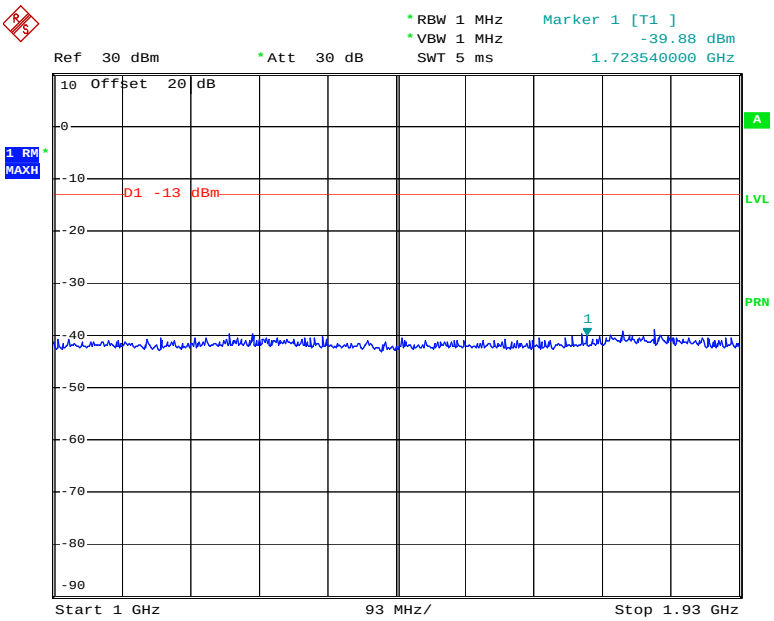


Comment: Conducted emissions, high power, ch 661,
Date: 28.MAR.2008 18:58:41

Plot 5.24
Out-of-band and spurious emissions, without duplexer, GSM

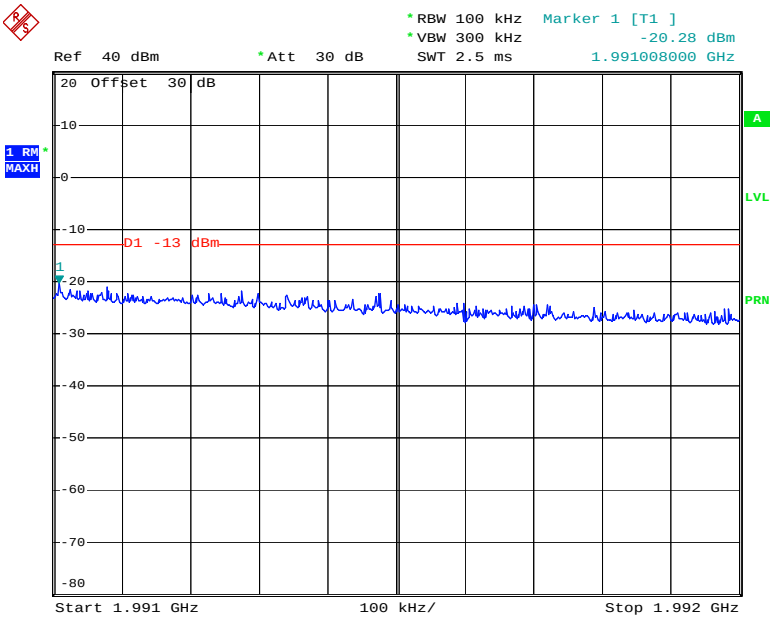


Comment: Conducted emissions, high power, ch 810,
Date: 28.MAR.2008 19:06:27

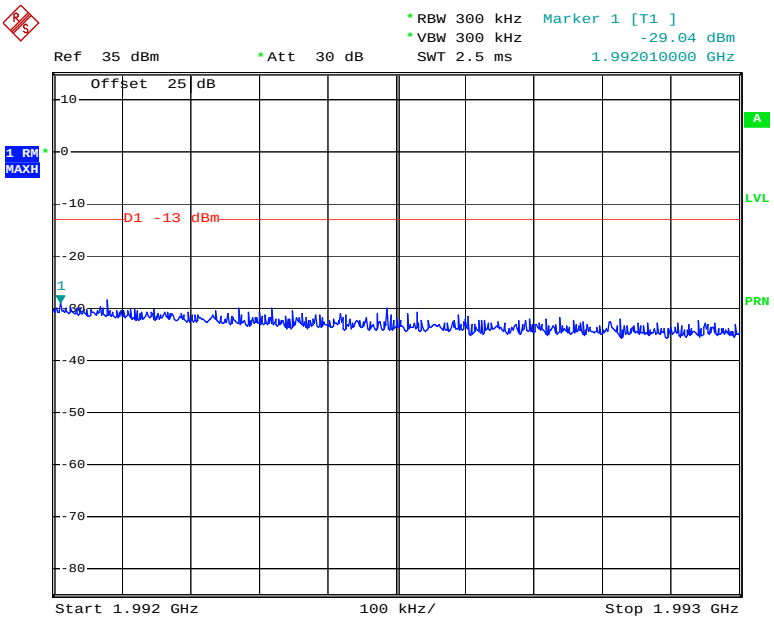


Comment: Conducted emissions, high power, ch 810,
Date: 28.MAR.2008 19:13:31

Plot 5.25
Out-of-band and spurious emissions, without duplexer, GSM

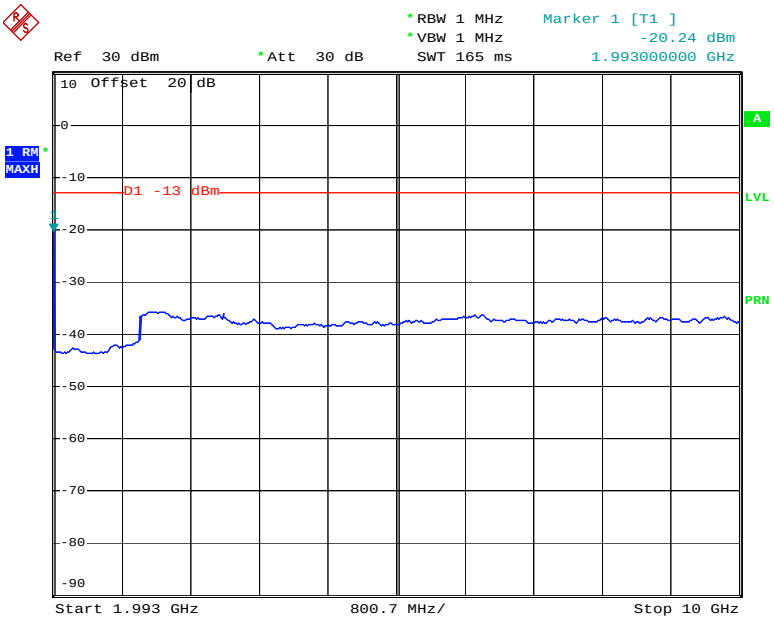


Comment: Conducted emissions, high power, ch 810, with 10 dB BW corr.
Comment: factor
Date: 28.MAR.2008 19:20:05

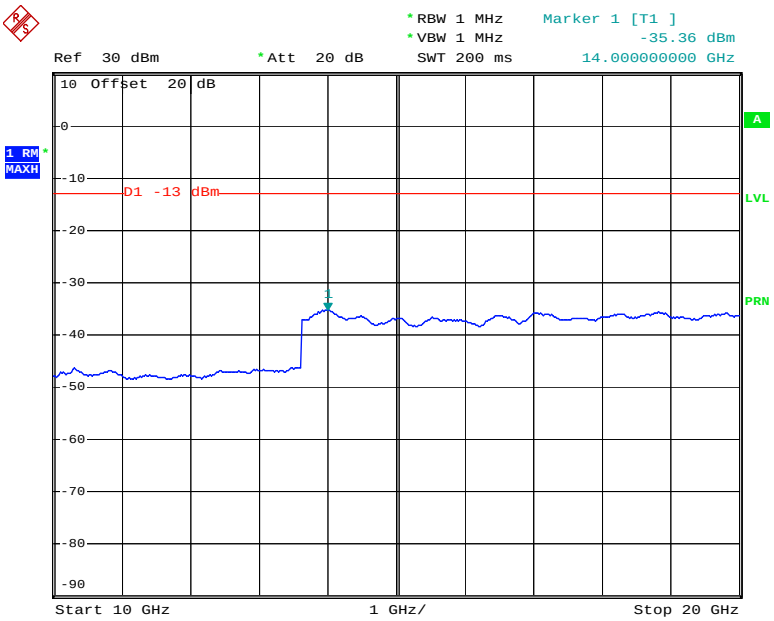


Comment: Conducted emissions, high power, ch 810, with 5 dB BW corr.
Comment: factor
Date: 28.MAR.2008 19:21:43

Plot 5.26
Out-of-band and spurious emissions, without duplexer, GSM

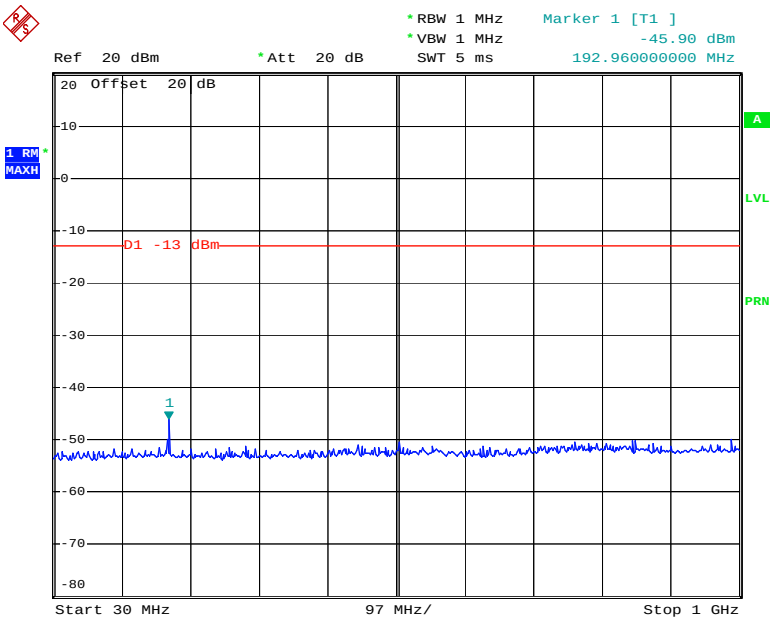


Comment: Conducted emissions, high power, ch 810
Date: 28.MAR.2008 19:24:52

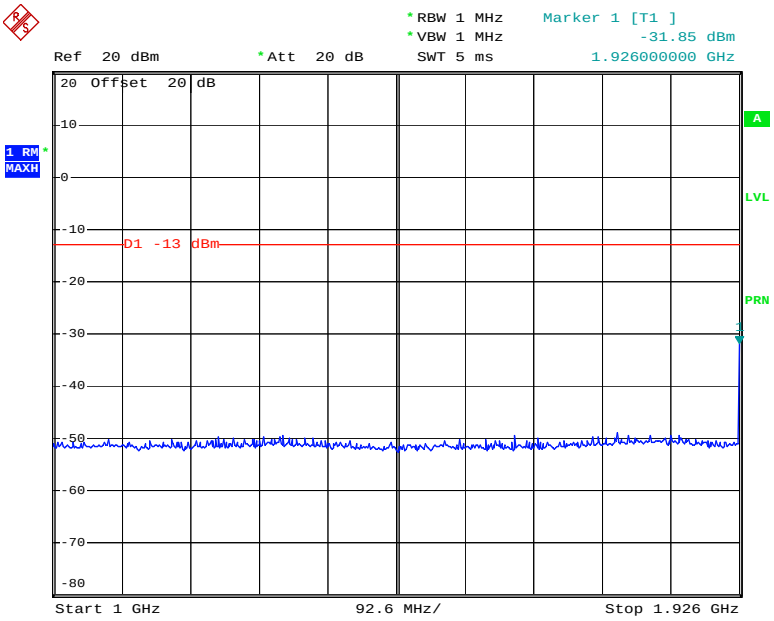


Comment: Conducted emissions, high power, ch 810
Date: 28.MAR.2008 19:26:21

Plot 5.27
Out-of-band and spurious emissions, with duplexer, EDGE

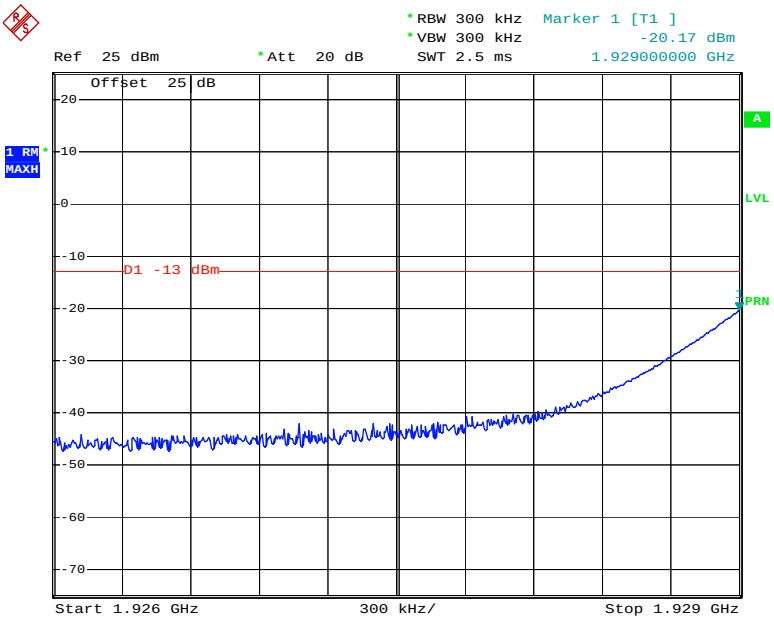


Comment: Conducted emissions, EDGE, ch 512
Date: 2.APR.2008 14:19:50



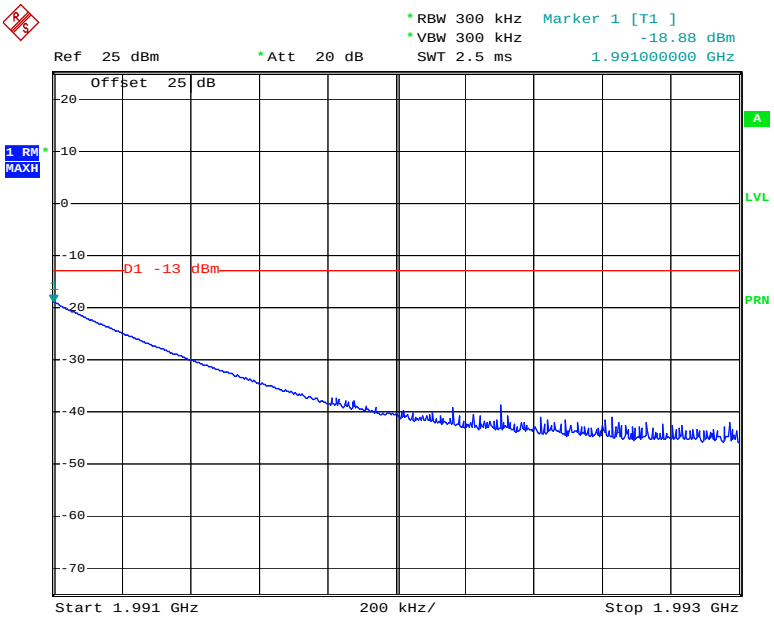
Comment: Conducted emissions, EDGE, ch 512
Date: 2.APR.2008 14:19:05

Plot 5.28
Out-of-band and spurious emissions, with duplexer, EDGE

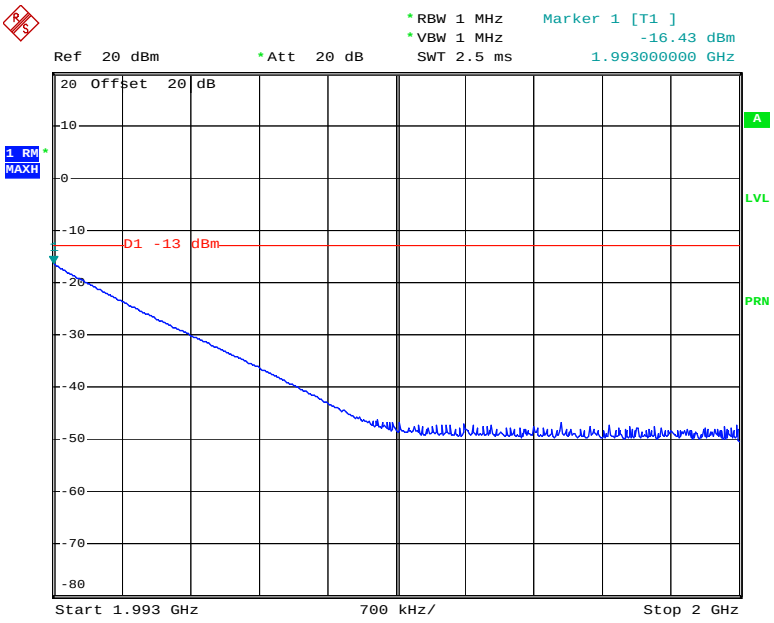


Comment: Conducted emissions, EDGE, ch 512 with 5dB BW correction
Date: 2.APR.2008 14:17:42

Plot 5.29
Out-of-band and spurious emissions, with duplexer, EDGE



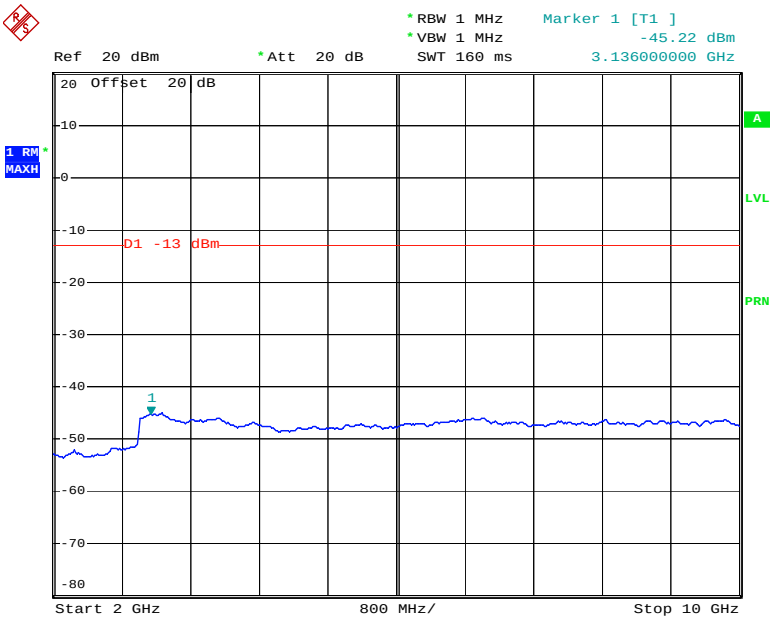
Comment: Conducted emission on band-edge, EDGE, ch 810 with 5dB BW co
Comment: rrection
Date: 2.APR.2008 13:36:11



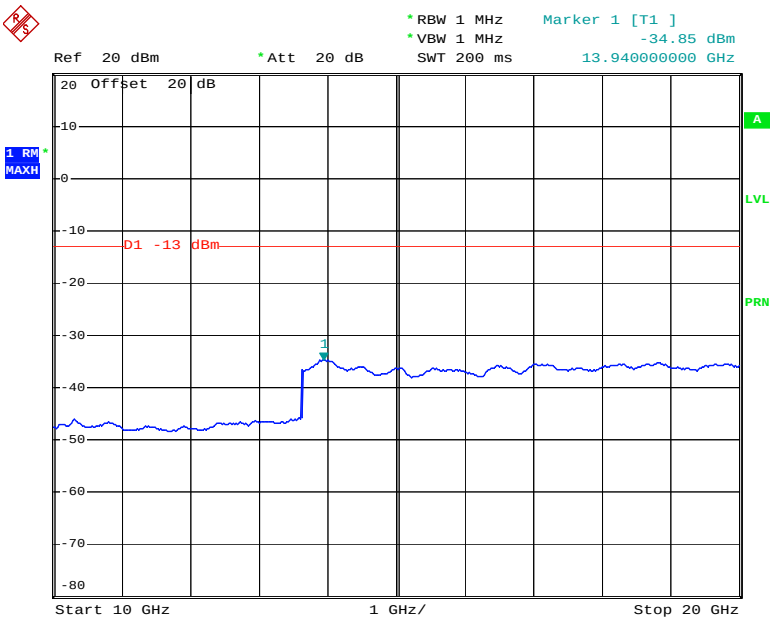
Comment: Conducted emission, EDGE, ch 810
Date: 2.APR.2008 13:39:16

Plot 5.30

Out-of-band and spurious emissions, with duplexer, EDGE



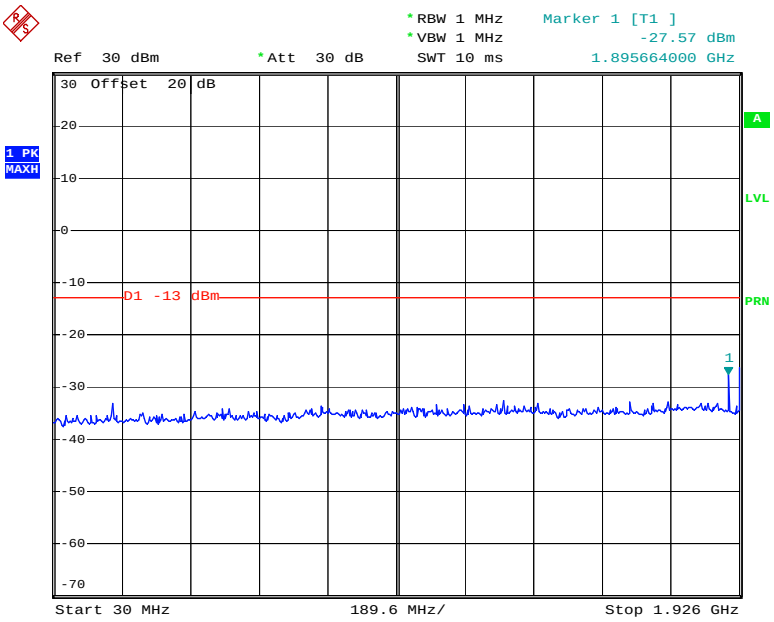
Comment: Conducted emission, EDGE, ch 810
Date: 2.APR.2008 13:40:20



Comment: Conducted emission, EDGE, ch 810
Date: 2.APR.2008 13:40:54

Plot 5.31

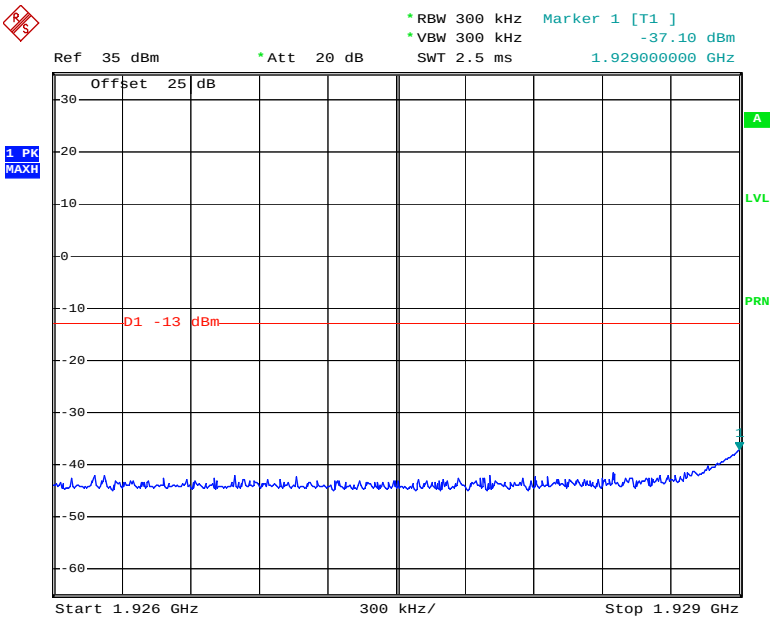
Out-of-band and spurious emissions, without duplexer, EDGE



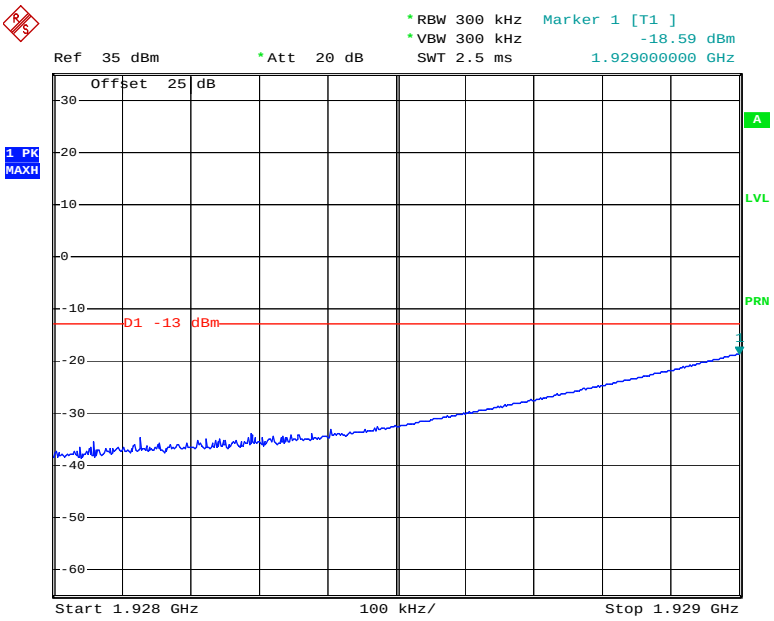
Comment: Conducted spurious emissions on band-edge, EDGE, ch 512
Date: 1.APR.2008 20:29:30

Plot 5.32

Out-of-band and spurious emissions, without duplexer, EDGE



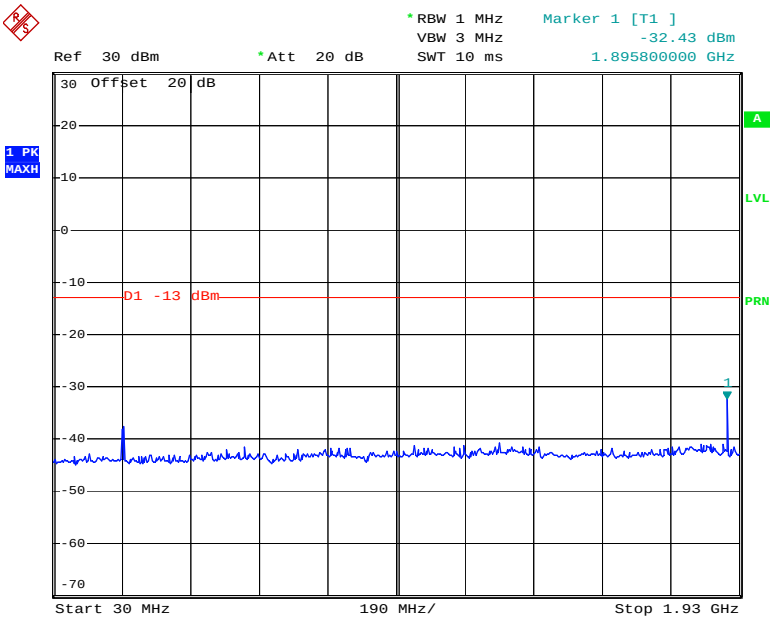
Comment: Conducted spurious emissions on band-edge, EDGE, ch 512 with
Comment: 5dB BW correction
Date: 1.APR.2008 20:26:53



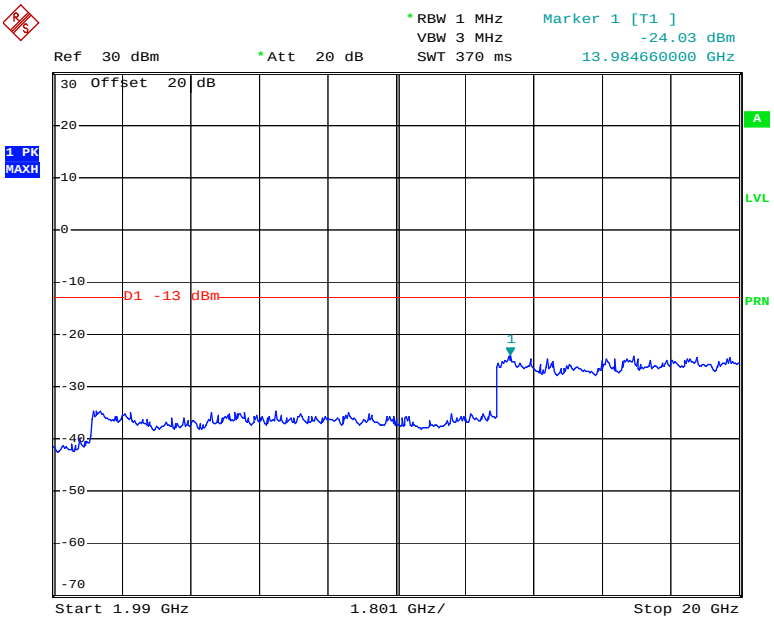
Comment: Conducted spurious emissions on band-edge, EDGE, ch 512 with
Comment: 5dB BW correction
Date: 1.APR.2008 20:16:40

Plot 5.33

Out-of-band and spurious emissions, without duplexer, EDGE



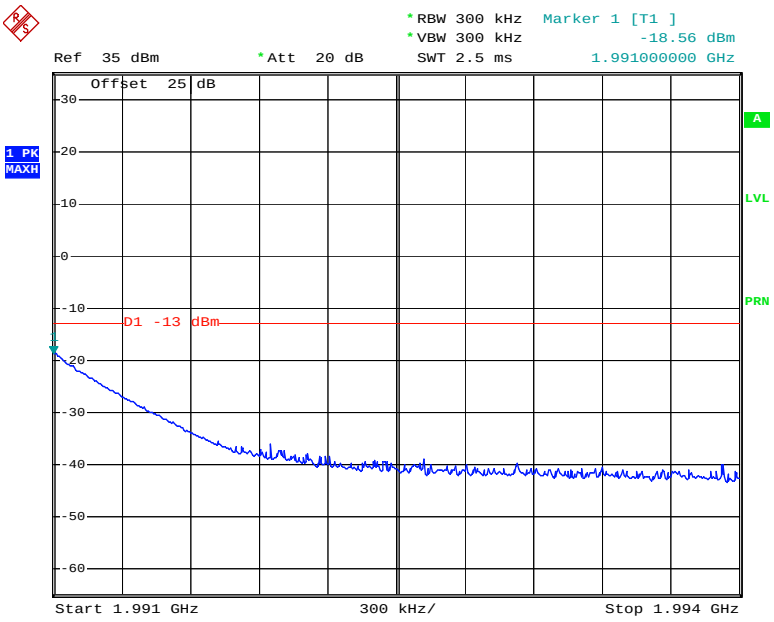
Comment: Conducted spurious emissions, high power, EDGE, ch 660
Date: 1.APR.2008 19:43:39



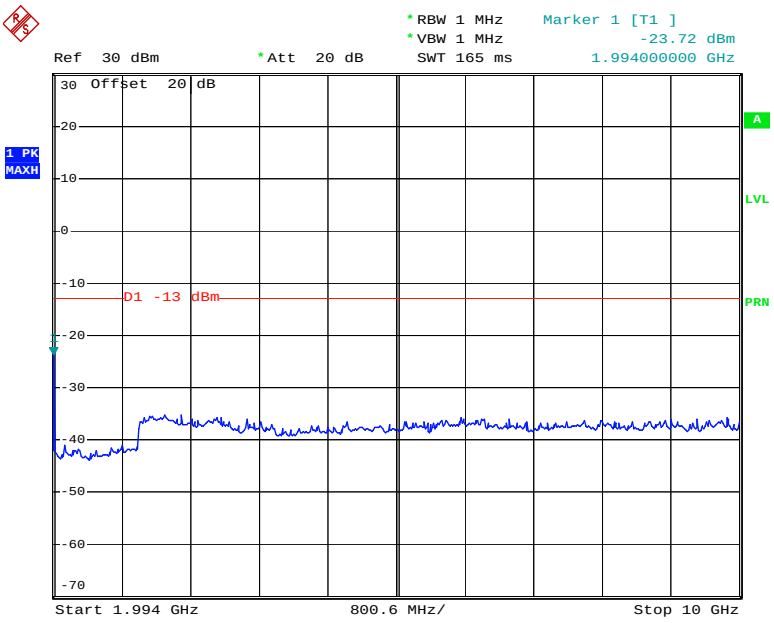
Comment: Conducted spurious emissions, high power, EDGE, ch 660
Date: 1.APR.2008 19:44:33

Plot 5.34

Out-of-band and spurious emissions, without duplexer, EDGE



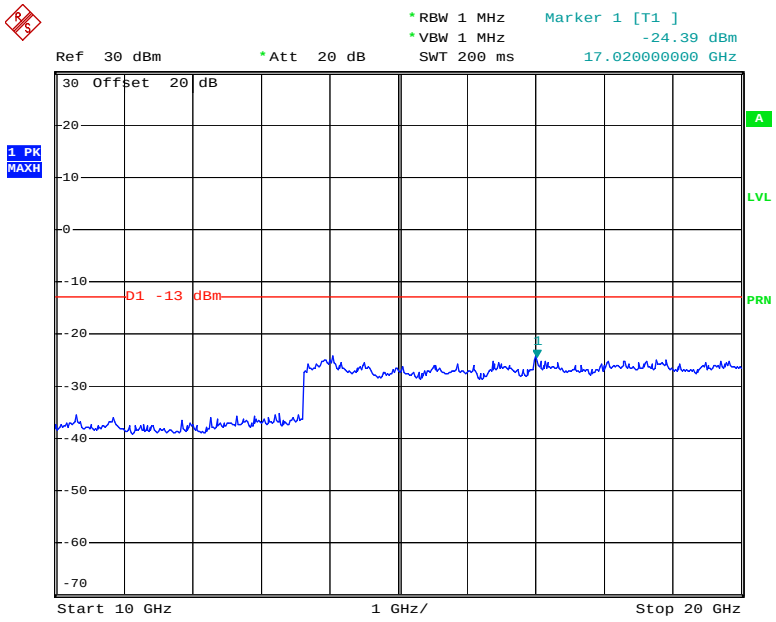
Comment: Conducted emissions on band-edge, EDGE, ch 810 with 5dB BW c
Comment: orrection
Date: 1.APR.2008 20:56:35



Comment: Conducted spurious emissions on band-edge, EDGE, ch 810
Date: 1.APR.2008 20:54:03

Plot 5.35

Out-of-band and spurious emissions, without duplexer, EDGE



Comment: Conducted spurious emissions on band-edge, EDGE, ch 810
Date: 1.APR.2008 20:54:53

6.0 Transmitter Spurious Radiation

FCC 2.1053, 24.238

6.1 Requirement

The power of any emissions 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.

Note: That corresponds to the level of -13 dBm for any radiated 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 10-th harmonic of each of the three fundamental frequencies (low, middle, and high channels) was investigated. 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 EIRP at the spurious emissions frequency was calculated as follows.

$$EIRP_{(dBm)} = \mathbf{V_g + G_{(dBi)}}$$

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

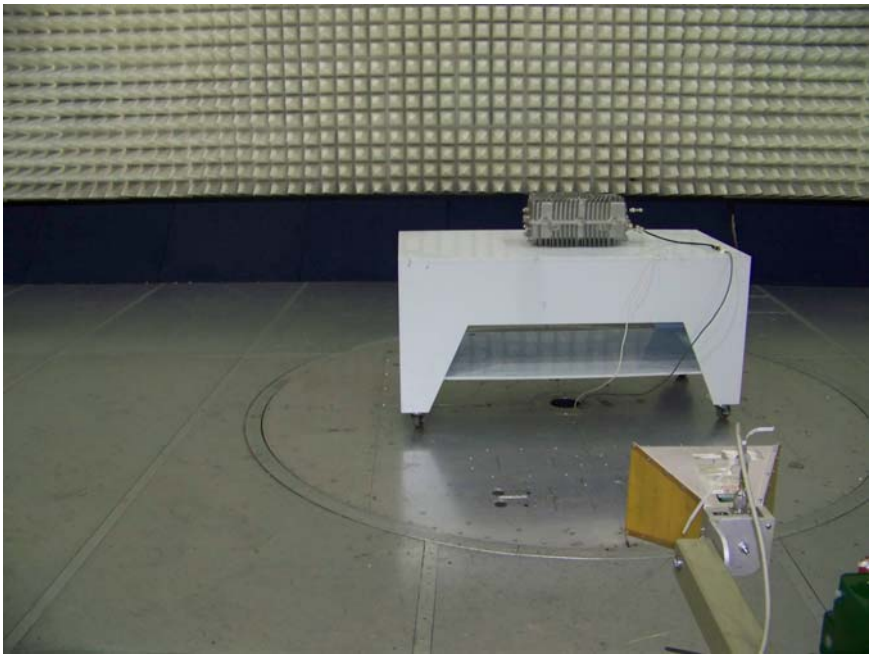
Test was performed with 50 Ω dummy load.

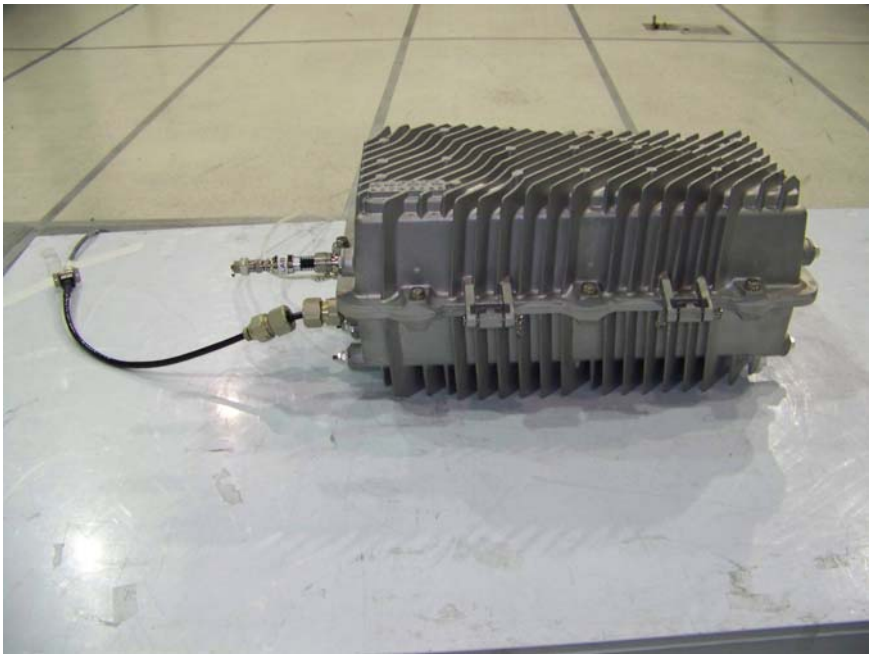
6.3 Test Equipment

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

6.4 Configuration Photographs

Radiated Emission Test Setup





6.5 Test Results

Transmitter Spurious Radiated Emissions

Frequency	SA Reading (from 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**
Low Channel: 1930.2 MHz					
1247.0	43.3	-66.3	-60.2	-13.0	-47.2
1853.6	44.3	-63.9	-56.7	-13.0	-43.7
3860.4	45.8	-54.3	-46.0	-13.0	-33.0
5790.6	31.0	-66.6	-57.4	-13.0	-44.4
7720.8	28.5	-65.4	-56.3	-13.0	-43.3
9651.0	30.6	-59.6	-50.1	-13.0	-37.1
Mid Channel: 1960.0 MHz					
1247.0	43.6	-66.1	-60.0	-13.0	-47.0
1853.6	44.3	-63.9	-56.7	-13.0	-43.7
3920.0	47.1	-52.8	-44.5	-13.0	-31.5
5880.0	32.9	-64.0	-54.7	-13.0	-41.7
7840.0	25.3	-68.7	-59.5	-13.0	-46.5
9800.0	28.6	-61.5	-52.1	-13.0	-39.1
High Channel: 1989.8 MHz					
1247.0	38.2	-71.4	-65.3	-13.0	-52.3
3979.6	45.1	-54.7	-46.4	-30.0	-16.4
5969.4	32.6	-64.4	-54.9	-30.0	-24.9
7959.2	25.8	-67.9	-58.7	-30.0	-28.7
9949.0	26.3	-63.7	-54.3	-30.0	-24.3

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

* Noise Floor

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

Result	**Complies by more than 20 dB**

7.0 Receiver Radiated emissions

FCC 15.109

7.1 Radiated Emission Limits

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

Radiated Emissions Limits, Section 15.109(b)

Frequency **(MHz)**	**Class A at 10m (μV/m)**	**Class A at 10m (dBμV/m)**
30-88	90	39
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 (dBμV), and microvolts (μV). To convert between them, use the following formulas: 20 LOG_{10} (μV) = dBμV, dBm = dBμV-107.

7.2 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 dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

An example for the calculations in the following table is as follows:

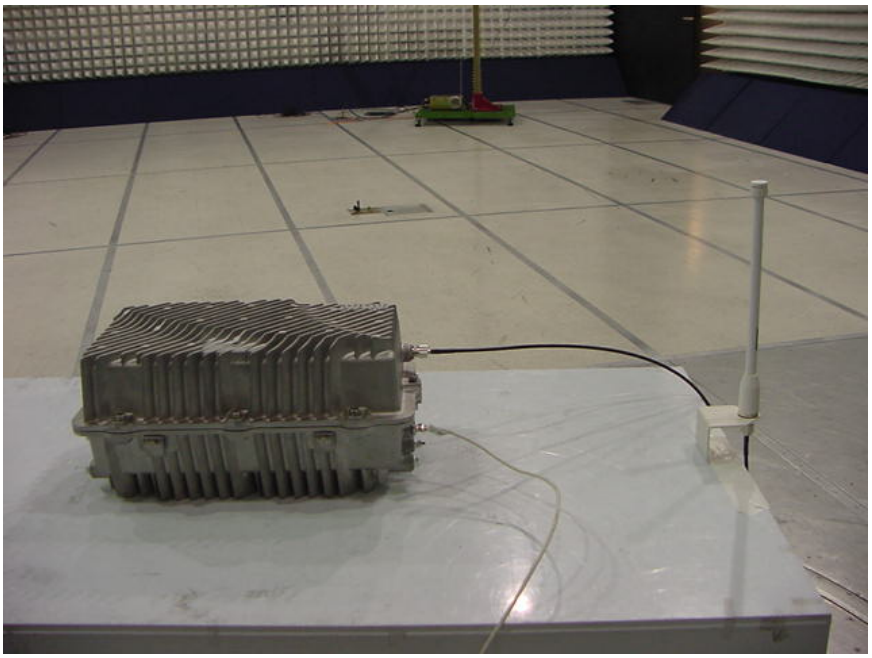
Assume a receiver reading of 52.0 dBμV is obtained. The antennas factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29.0 dB is subtracted, giving field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0 + 7.4 + 1.6 – 29.0 = 32 dBμV/m

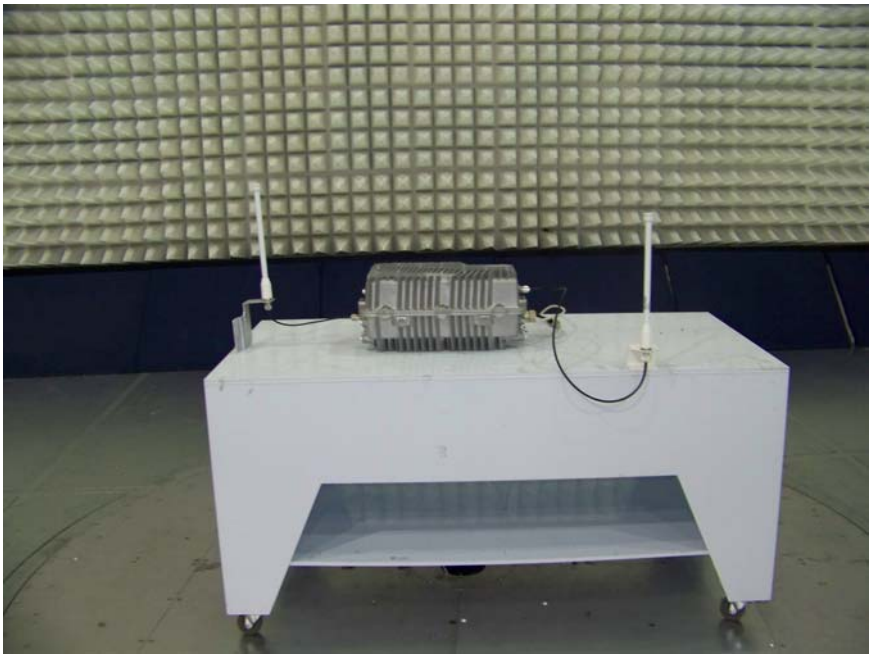
Level in μV/m = Common Antilogarithm [(32 dBμV/m)/20] = 39.8 μV/m

7.3 Configuration Photographs

Radiated Emission Test Setup
(with duplexer)



(without duplexer)



7.4 Test Results

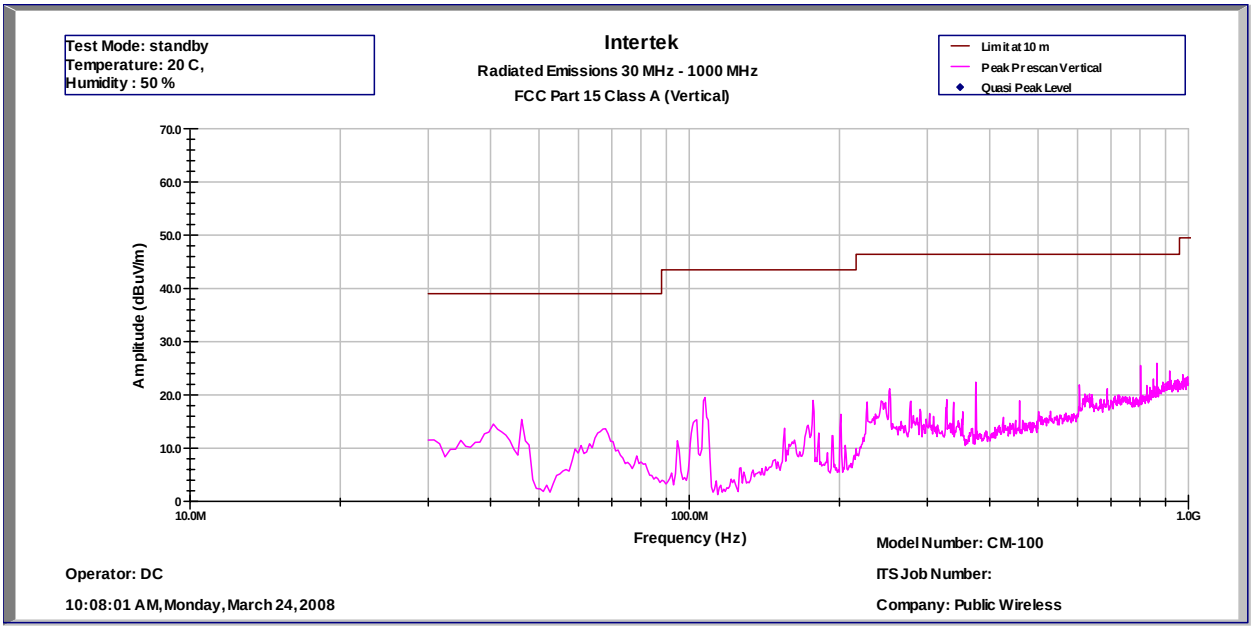
Tested By:	David Chernomordik
Test Date:	March 24, 2008

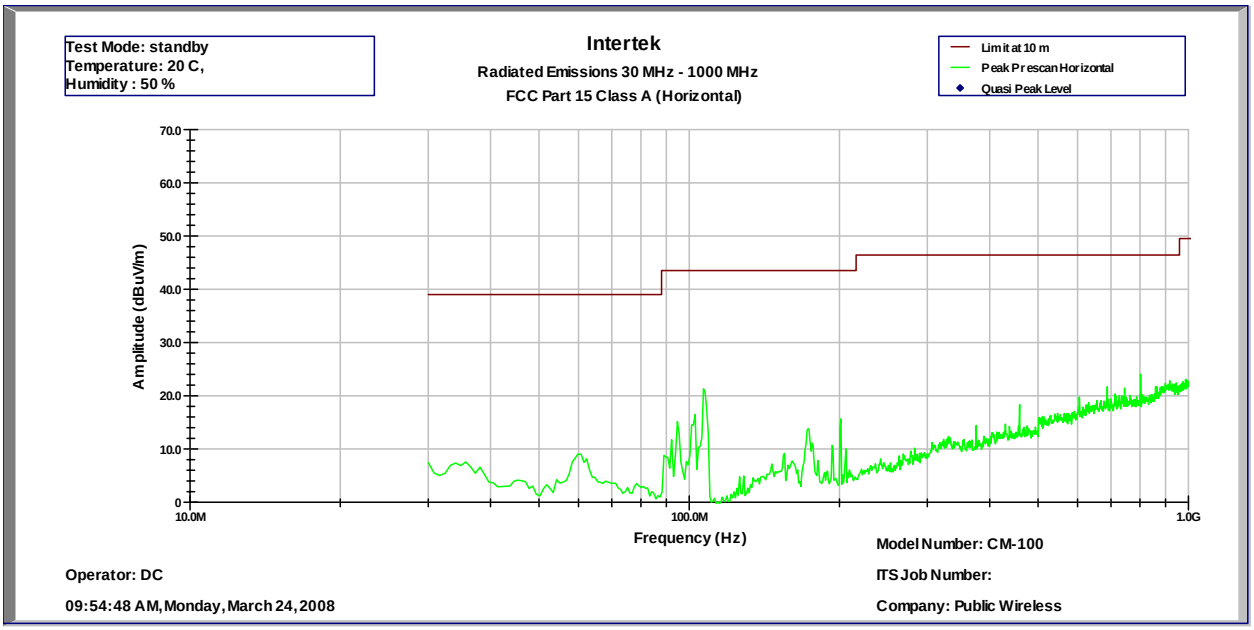
The results on the following page(s) were obtained when the device was tested in the standby/receiving mode

Note: A complete scan was made from 30 MHz – 20 GHz.
All other emissions, not reported, are at least 10 dB below the limit

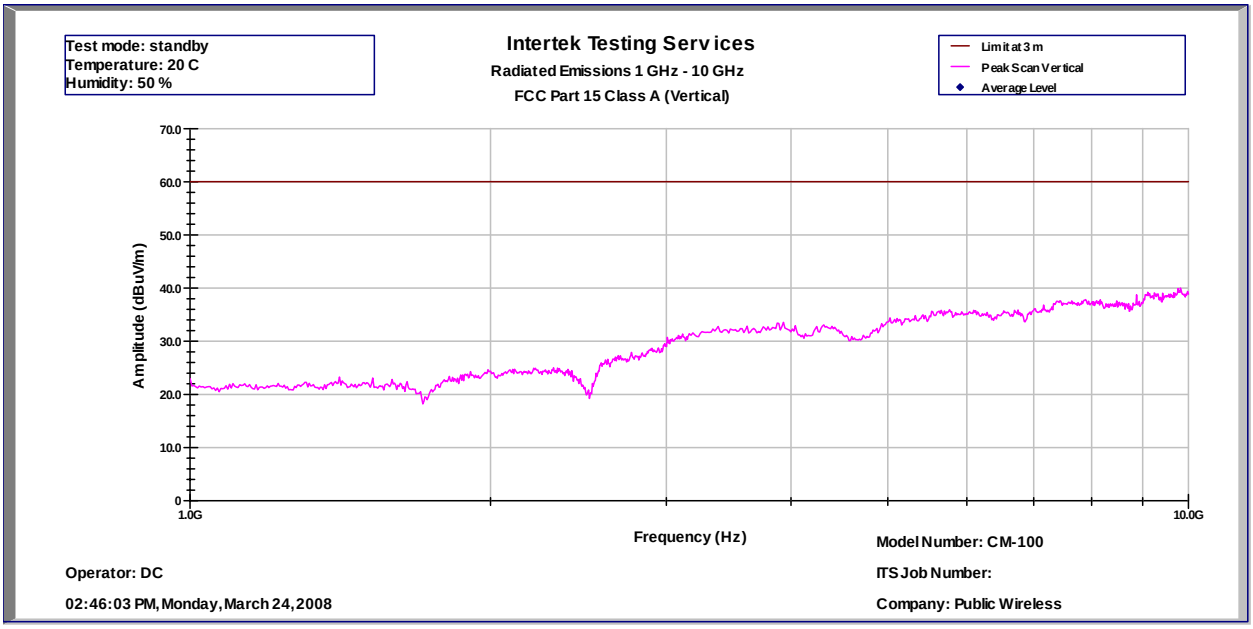
Result	**Complies by more than 10 dB**

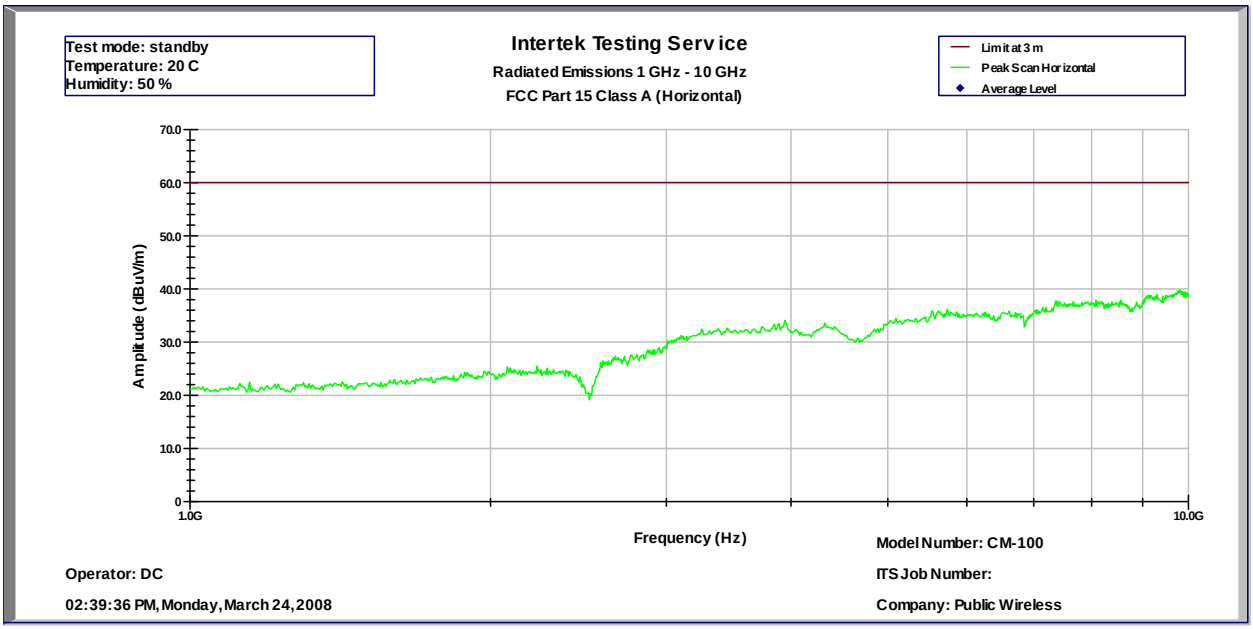
Radiated Emissions below 1 GHz





Radiated Emissions above 1 GHz





No emissions above the noise floor were found above 10 GHz

8.0 Frequency Stability vs Temperature and Voltage

FCC 2.1055, 24.235

8.1 Requirement

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

8.2 Test Procedure

The EUT was placed inside the temperature chamber. The RF power output was connected to a spectrum analyzer. The EUT was setup to transmit the maximum power.

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

At the room temperature, the frequency was measured when the EUT was powered with the nominal voltage and with 85% and 115% of the nominal voltage.

8.3 Test Results

Nominal frequency: 1960 MHz

Frequency Stability Test Data

Frequency Deviation (kHz)								
Temperature (°C)								
-30	-20	-10	0	10	20	30	40	50
Voltage: 120 VAC					2.80			
2.90	2.85	2.85	2.85	2.8	2.80	2.8	2.83	2.86
Voltage: 138 VAC					2.80			
2.90	2.85	2.85	2.85	2.8	2.80	2.8	2.83	2.86
Voltage: 102 VAC					2.80			
2.90	2.85	2.85	2.85	2.8	2.80	2.8	2.83	2.86

Maximum frequency deviation is 2.9 kHz or 1.5 ppm

Result	Complies

9.0 RF Exposure evaluation

FCC 2.1091, 24.52

The EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons.

Considering the maximum antenna gain of 6 dBi, the maximum EIRP is 32.1 dBm or 1.62 W.

Using the formula for the Power Density $S = EIRP/ 4\pi D^2$, the distance D, where the Power Density (S) satisfies the FCC 1.1310 Maximum Permissible Exposure (MPE) Limit for General Population/Uncontrolled Exposure, can be calculated as:

$$D \geq \sqrt{(EIRP/ 4\pi S)}$$

The MPE Limit at 1960 MHz is 1.0 mW/cm^2 (or 10 W/m^2), therefore, $D \geq 0.11$ m

The Statement that a minimum separation distance of 20 cm between the antenna and persons must be maintained is included in the User's Manual.

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
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	10/02/08
Spectrum Analyzer	R & S	FSP40	036612004	12	10/01/08
BI-Log Antenna	EMCO	3143	9509-1160	12	09/05/08
Signal Generator	Hewlett Packard	83732A	322A00119	12	04/21/08
Horn Antenna	EMCO	3115	8812-3049	12	07/16/08
Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Pre-Amplifier	Sonoma Inst.	310	185634	12	09/26/08
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	07/13/08

No Calibration required

11.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3148514 & 3149417	DC	March 31, 2008	Original document