Test Report

Report Number: 3082574MPK-002
Project Number: 3082574
Report Date: September 12, 2005

Testing performed on the
iCell CDMA 1X BTS Module - 1900 MHz
Model Number: iCell 1900 MHz BTS Pico

FCC ID: S52P1900-1

to

FCC Part 24

for
UTStarcom Canada Ltd.

A2LA Certificate Number: 1755-01

Test Performed by:	**Test Authorized by:**
Intertek Testing Services NA, Inc	4600 Jacombs Road
1365 Adams Court	Richmond, BC
Menlo Park, CA 94025	V6V3B1, Canada

Prepared by: **Date:** September 15, 2005

David Chernomordik, EMC Technical Manager

Reviewed by: **Date:** September 15, 2005

Ollie Moyrong, EMC Department Manager

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1.0 Introduction

1.1 Product Description

The Equipment under Test (EUT), model: iCell 1900 MHz BTS Pico is the CDMA2000 module which provides a one CDMA carrier support for one, two or three sector operation.

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

Whether quantity (>1) production is planned	Yes
Type	CDMA Base Station module
Rated RF Output Power	20 dBm
Frequency Ranges, MHz	1930 – 1990 MHz
Type of modulation	CDMA
Channel bandwidth	1.23 MHz
Antenna & Gain	Not specified
Detachable antenna?	yes
Operating temperature	-30^0C to $+55^0$C

EUT receive date: March 20, 2005
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 24, 2005
Test completion date: September 9, 2005

1.2 Summary of Test Results

FCC Rule	Description of Test	Result	Page
2.1046	RF Power Output	Complies	7
24.232	ERP	Complies	11
2.1047	Modulation characteristics	Not Applicable	
2.1049	Occupied Bandwidth	Complies	12
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2.1091	RF Exposure evaluation	Complies	41
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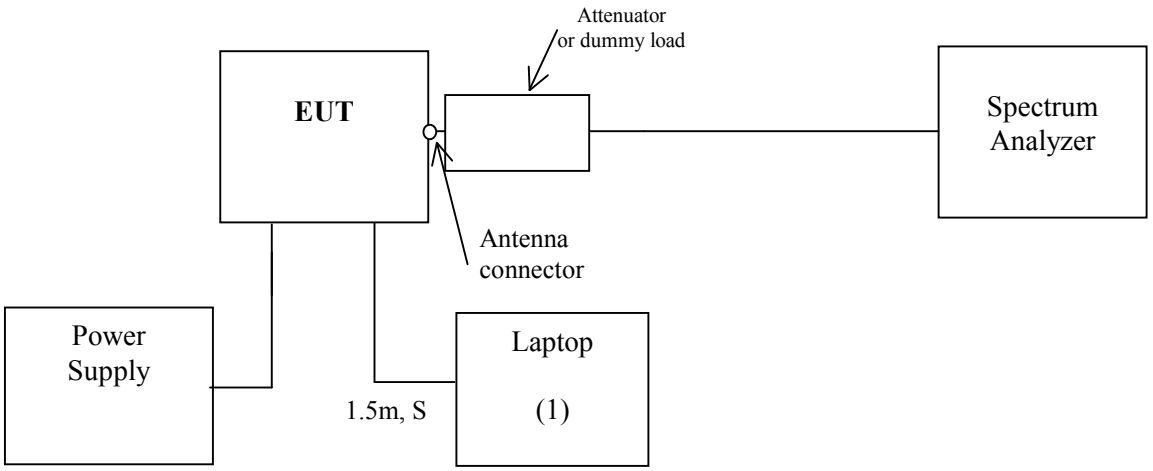
1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.	S/N or P/N
1	Compaq Laptop	Armada 7400	7933CY570119
2	Apx Technologies Power Supply	Switching Power Supply	SP60905M

1.3.2 Block diagram of Test Setup



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

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 "channel power" in the 1.2288 MHz bandwidth. 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

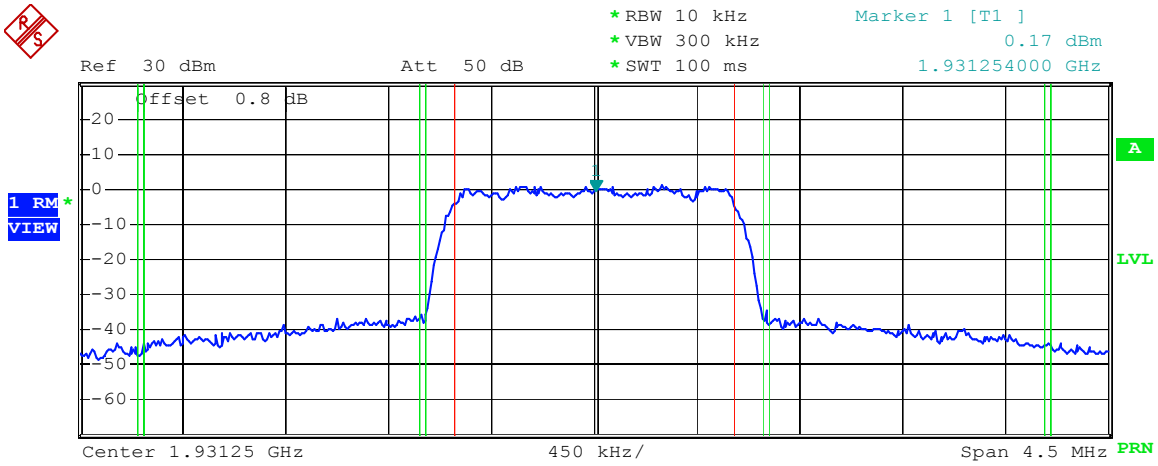
Rohde & Schwarz FSP40 Spectrum Analyzer

2.3 Test Results

Channel	Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (mWatt)	Plot
25	1931.25	19.7	93.3	2.1
600	1960.0	19.8	95.5	2.2
1175	1988.75	20.0	100.0	2.3

For more details refer to the attached plots.

Plot 2.1



Tx Channel
Bandwidth 1.2288 MHz

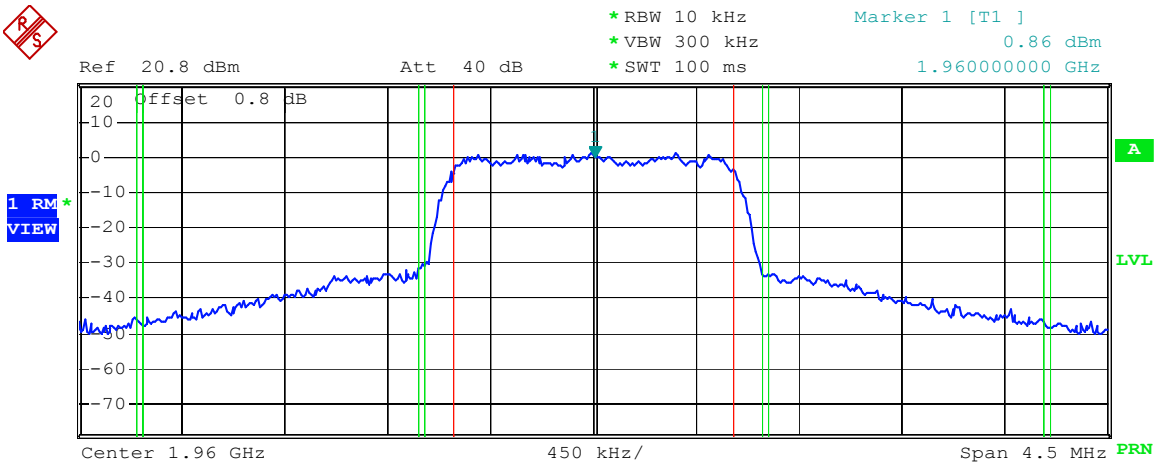
CDMA 2000 MC1
Power 19.73 dBm

Adjacent Channel
Bandwidth 30 kHz
Spacing 750 kHz
Lower -51.97 dB
Upper -51.12 dB

Alternate Channel
Bandwidth 30 kHz
Spacing 1.98 MHz
Lower -61.34 dB
Upper -59.63 dB

Comment: Output power, ch 25
Date: 24.MAR.2005 10:52:01

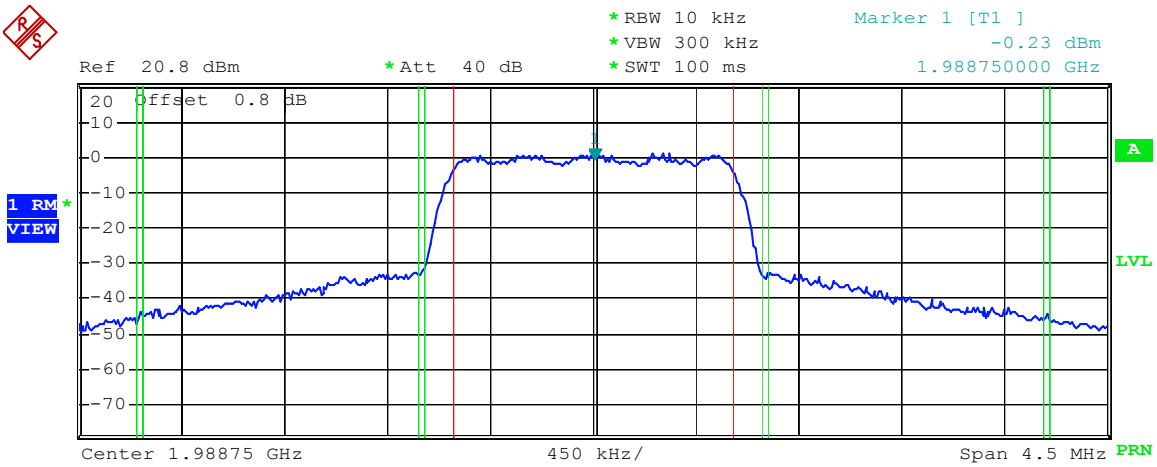
Plot 2.2



Tx Channel		**CDMA 2000 MC1**	
Bandwidth	1.2288 MHz	Power	19.80 dBm
Adjacent Channel			
Bandwidth	30 kHz	Lower	-46.39 dB
Spacing	750 kHz	Upper	-48.16 dB
Alternate Channel			
Bandwidth	30 kHz	Lower	-61.98 dB
Spacing	1.98 MHz	Upper	-62.89 dB

Comment: Output power, ch 600
Date: 23.MAR.2005 17:35:43

Plot 2.3



Tx Channel		**CDMA 2000 MC1**	
Bandwidth	1.2288 MHz	Power	20.04 dBm
Adjacent Channel			
Bandwidth	30 kHz	Lower	-48.09 dB
Spacing	750 kHz	Upper	-48.74 dB
Alternate Channel			
Bandwidth	30 kHz	Lower	-60.76 dB
Spacing	1.98 MHz	Upper	-60.73 dB

Comment: Output power, ch 1175
Date: 24.MAR.2005 11:45:22

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 ERP may be calculated by adding the antenna gain to the output power in dBm: $EIRP = P_{max} + G_{dBi}$ However, the antenna is not supplied with the EUT. Therefore, instead of calculation the EIRP, the maximum allowed antenna gain was calculated.

The calculation was performed on the base of the limit (3 W or 34.8 dBm) of the ERP for exclusion from routine environmental evaluation for RF exposure according to FCC 2.1091(c).

The maximum gain $G_{max} = 34.8 – 20.0 = 14.8$ dBd = 16.9 dBi

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

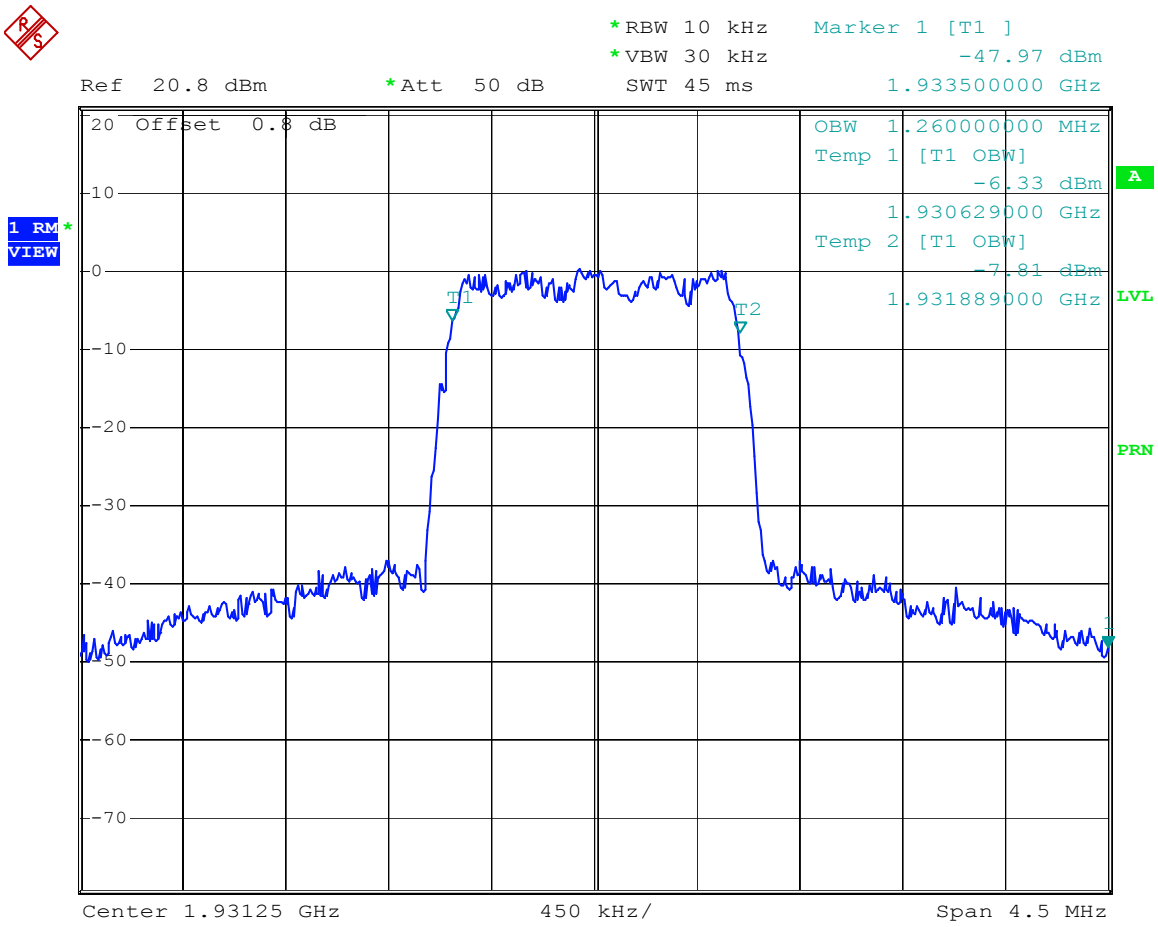
4.3 Test Results

Channel	Frequency (MHz)	Measured Occupied Bandwidth (MHz)	Plot
25	1931.25	1.26	4.1
600	1960.0	1.27	4.2
1175	1988.75	1.27	4.3

For more details refer to the attached plots.

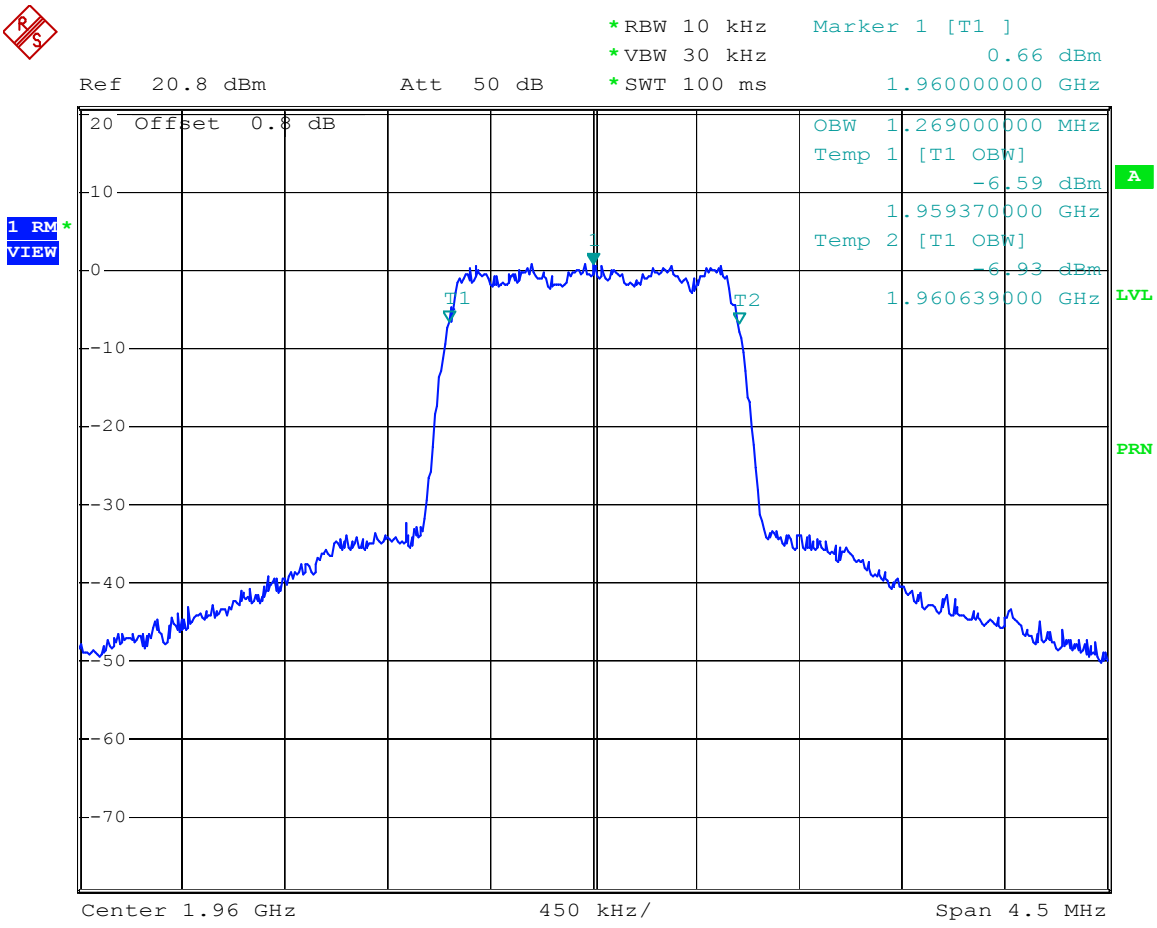
Emission Designator is 1M25F9W

Plot 4.1



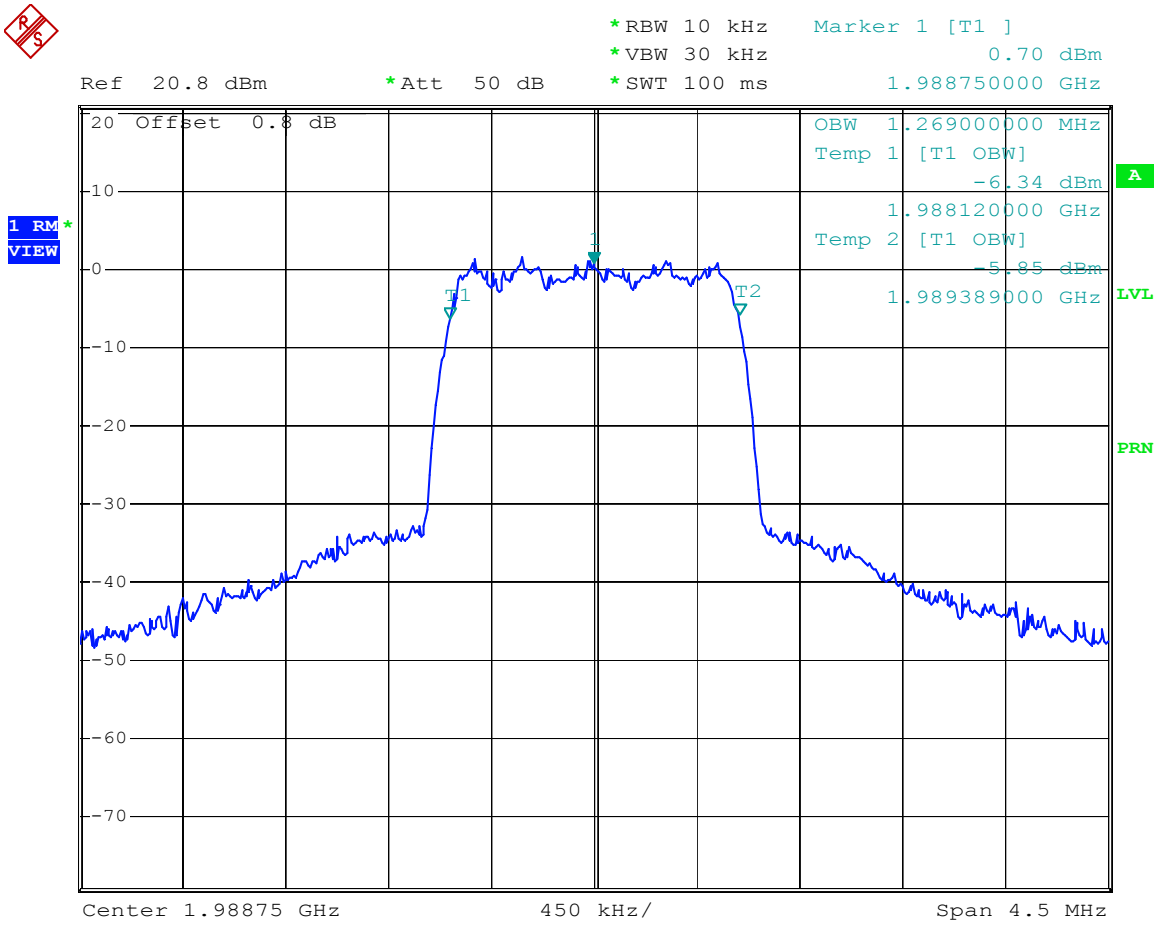
Comment: Occupied bandwidth, ch 25
Date: 24.MAR.2005 14:31:42

Plot 4.2



Comment: Occupied bandwidth, ch 600
Date: 23.MAR.2005 17:39:13

Plot 4.3



Comment: Occupied bandwidth, ch 1175
Date: 24.MAR.2005 11:48:51

5.0 Out of Band Emissions at Antenna Terminals

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 was set to 1 MHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block, the spectrum analyzed resolution bandwidth was set to 30 kHz.

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

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

5.3 Test Equipment

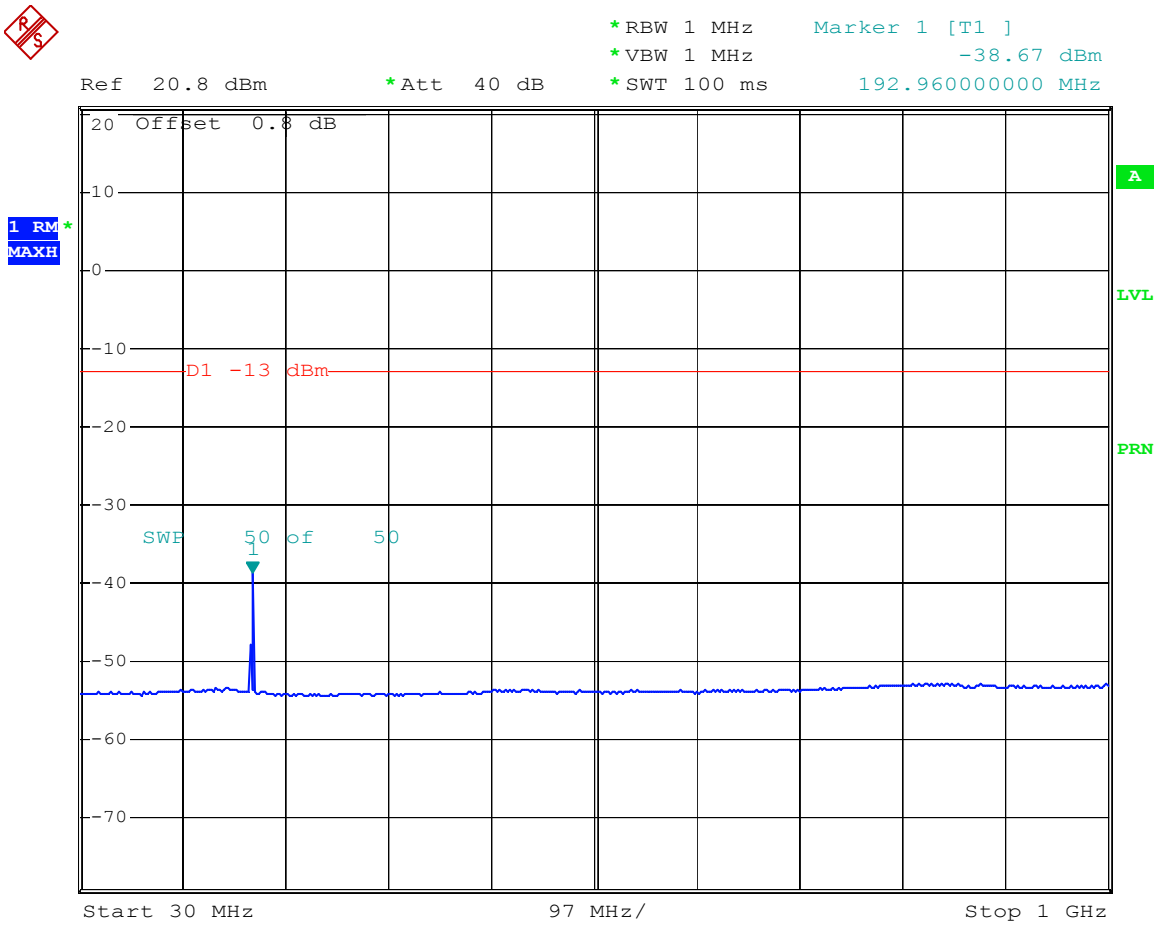
Rohde & Schwarz FSP40 Spectrum Analyzer

5.4 Test Results

Result	**Complies** by 14 dB

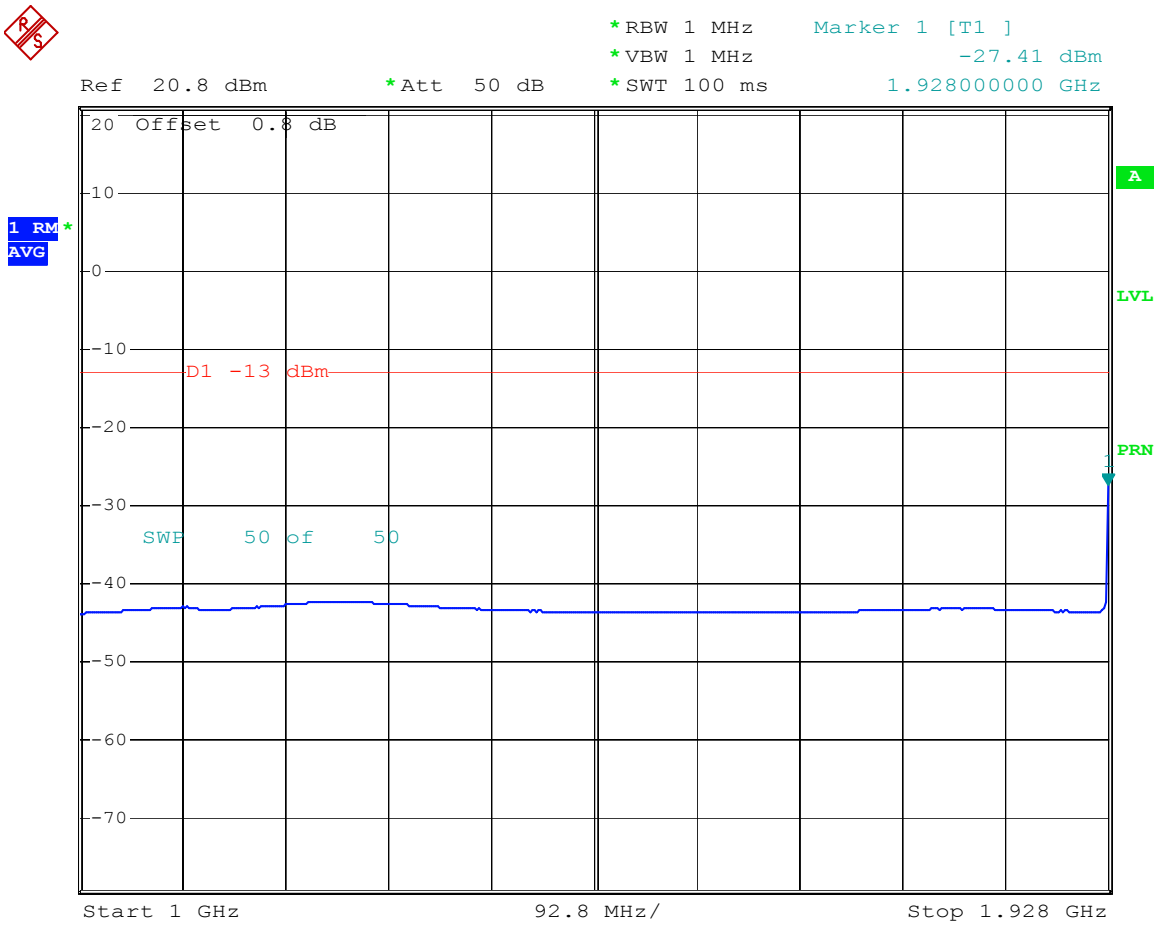
Refer to the following plots.

Plot 5.1



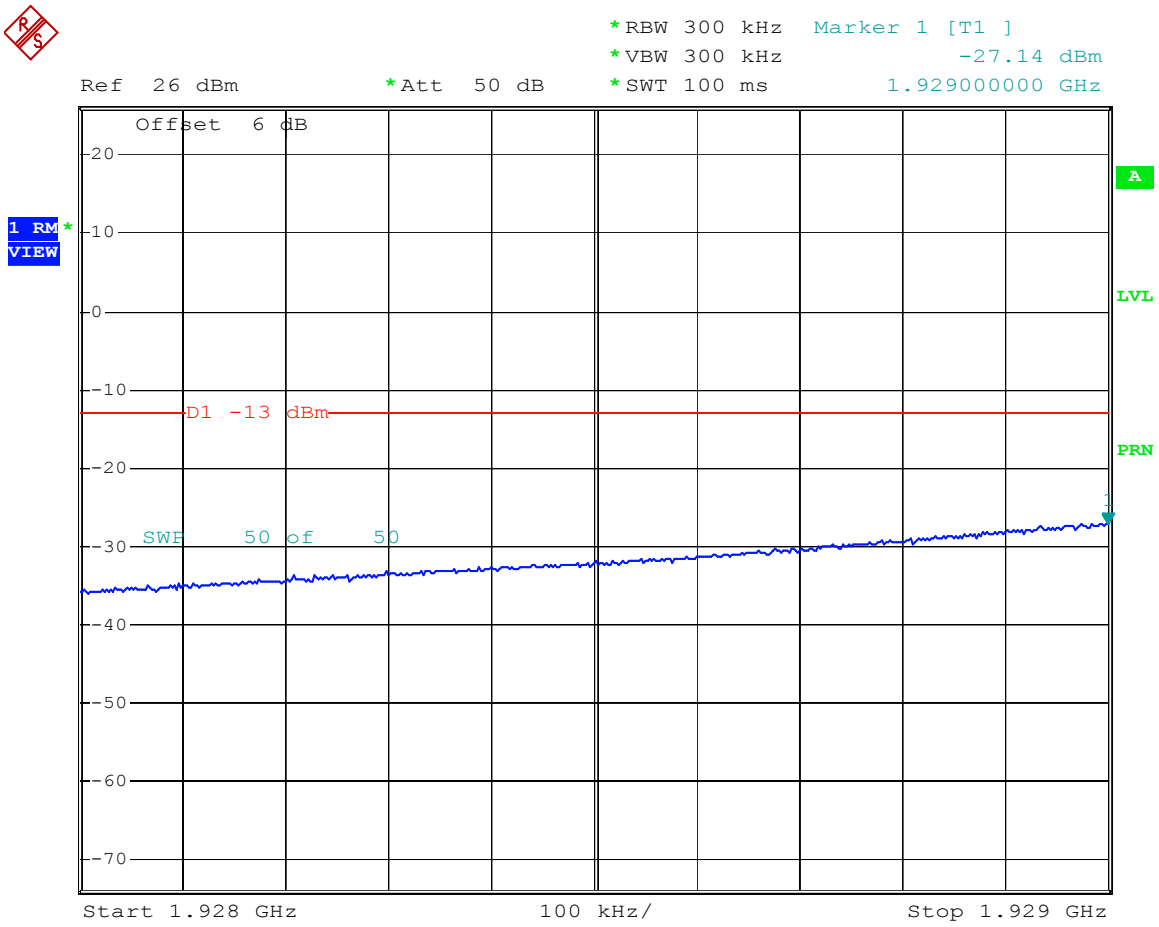
Comment: Out-of-band emissions, ch 25
Date: 24.MAR.2005 11:16:44

Plot 5.2



Comment: Out-of-band emissions, ch 25
Date: 24.MAR.2005 11:05:49

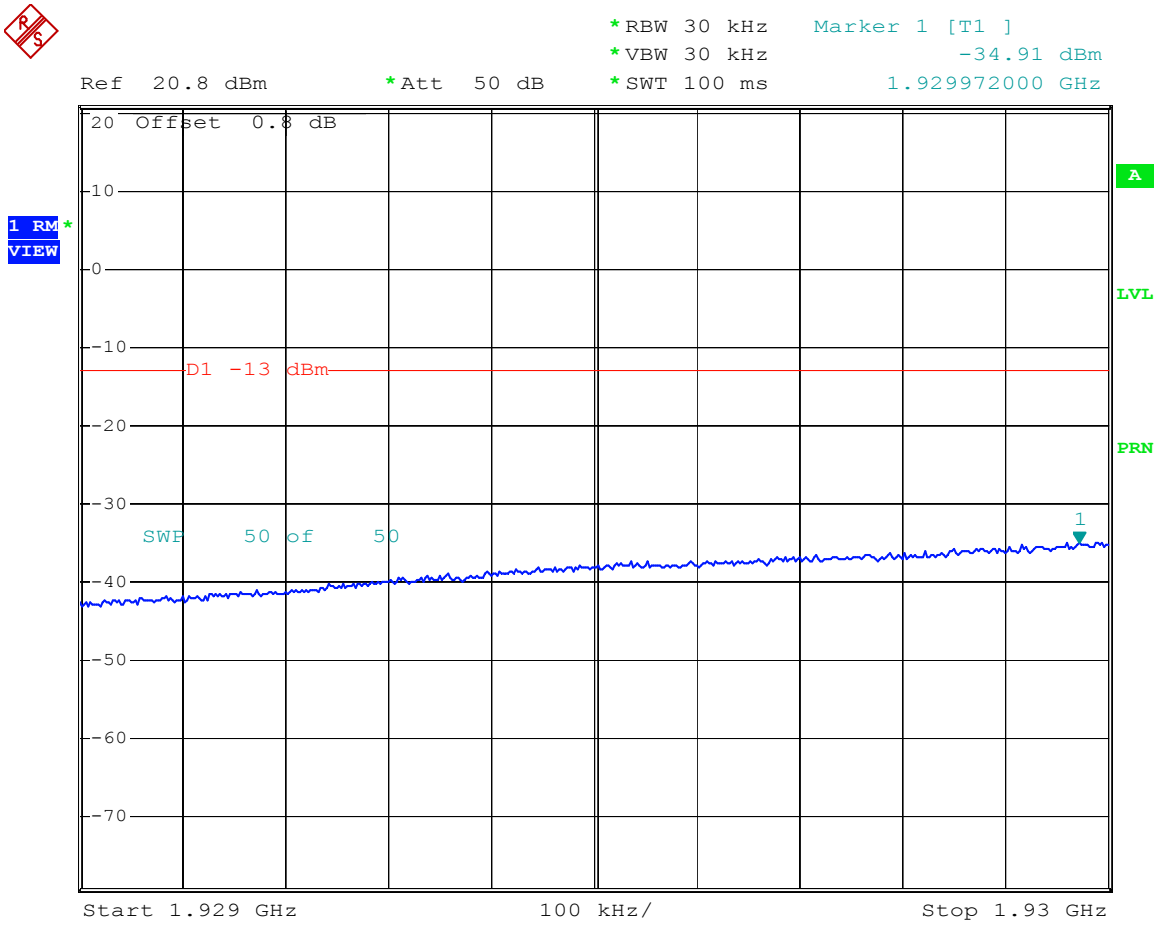
Plot 5.3



Comment: Out-of-band emissions, ch 25, BCF=5.2 dB added
Date: 24.MAR.2005 11:09:30

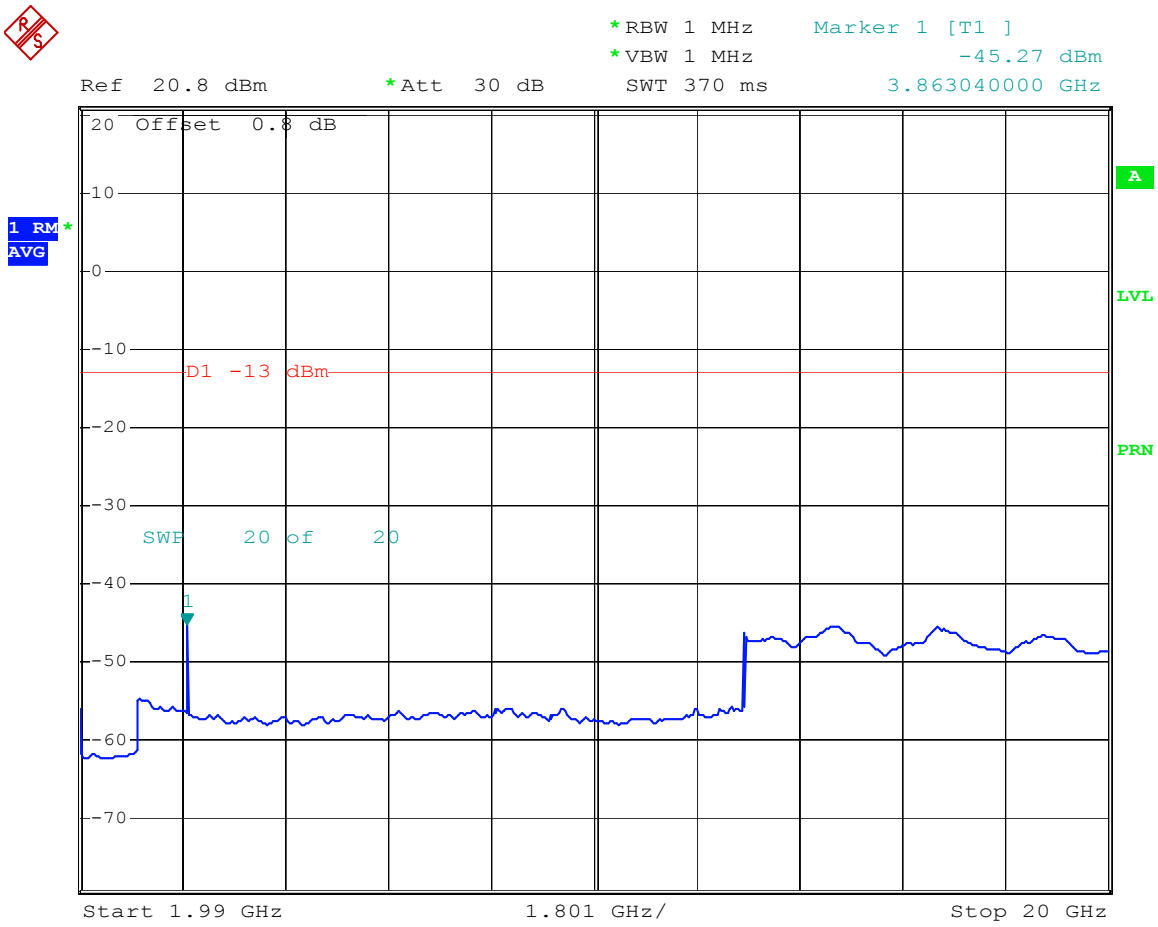
Note: Since the resolution bandwidth (RBW) of less than 1 MHz is used, the bandwidth correction factor (BCF) of 10Log(1/RBW) = 5.2 dB was added to the Spectrum analyzer reading (as OFFSET).

Plot 5.4



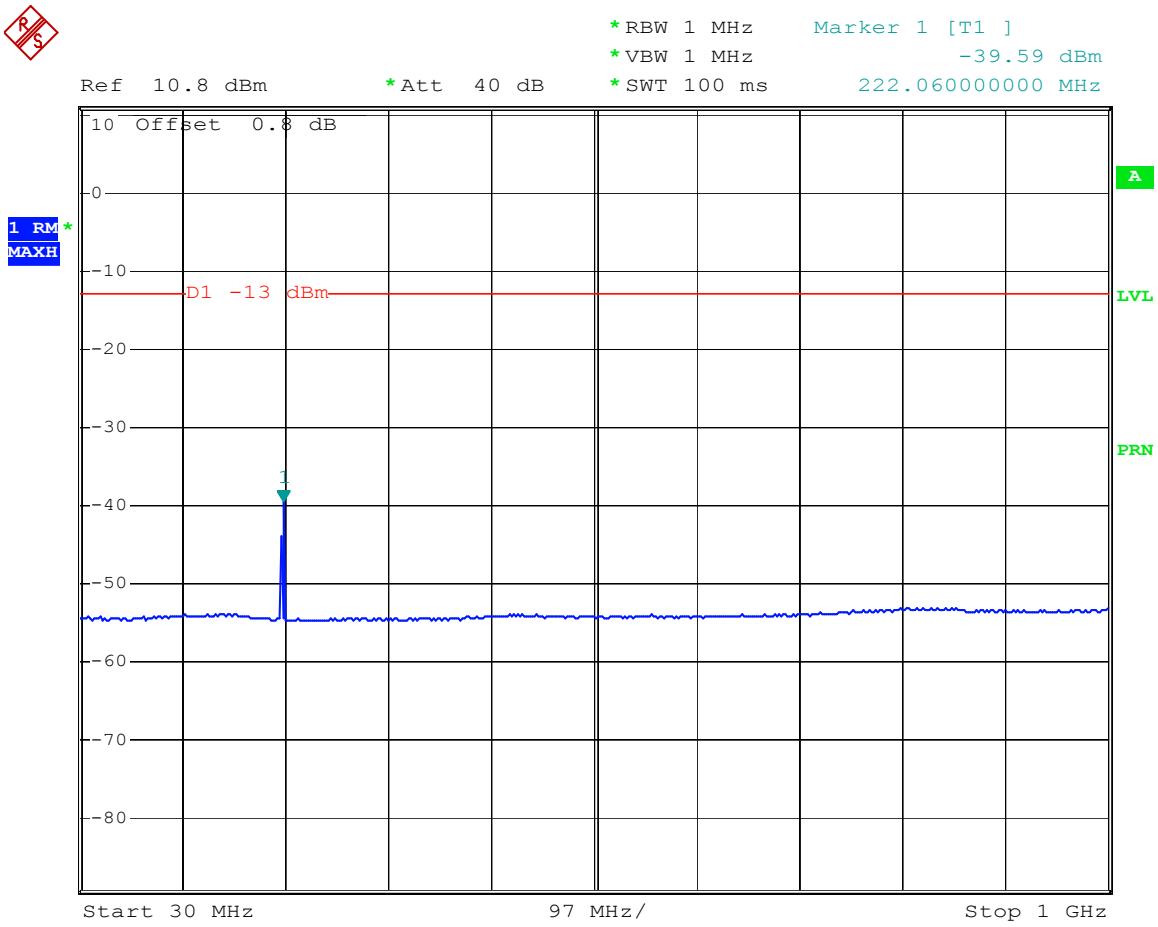
Comment: Out-of-band emissions, ch 25
Date: 24.MAR.2005 11:02:42

Plot 5.5



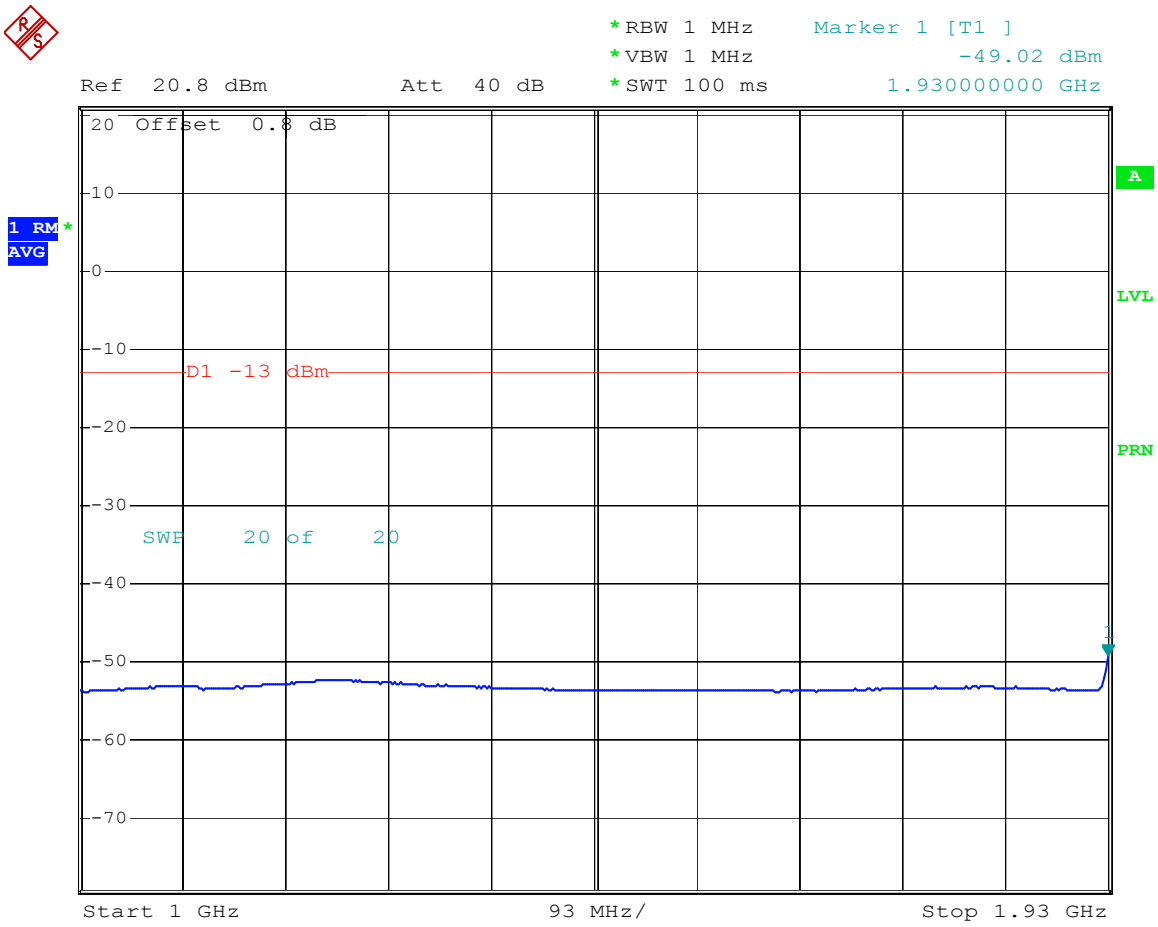
Comment: Out-of-band emissions, ch 25
Date: 24.MAR.2005 14:26:52

Plot 5.6



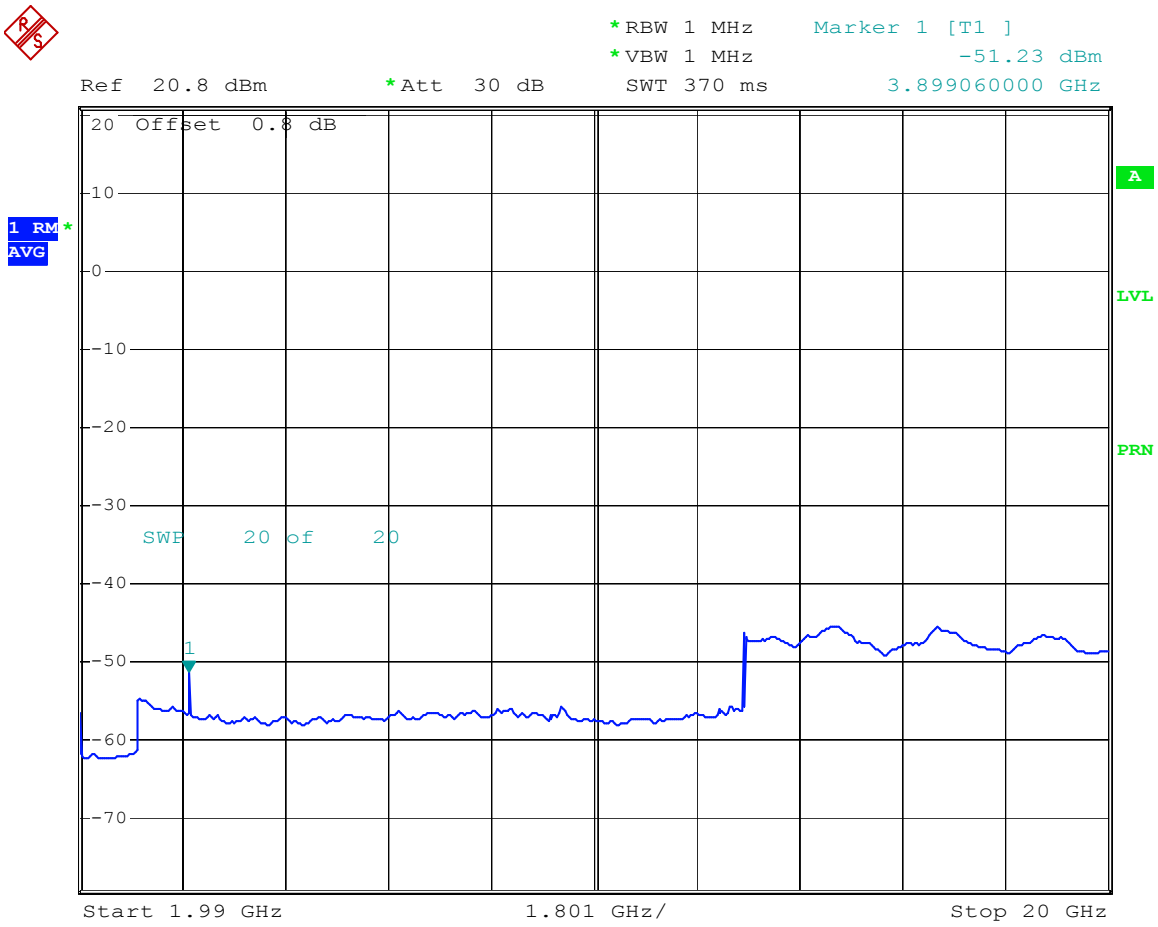
Comment: Out-of-band emissions, ch 600
Date: 23.MAR.2005 17:50:29

Plot 5.7



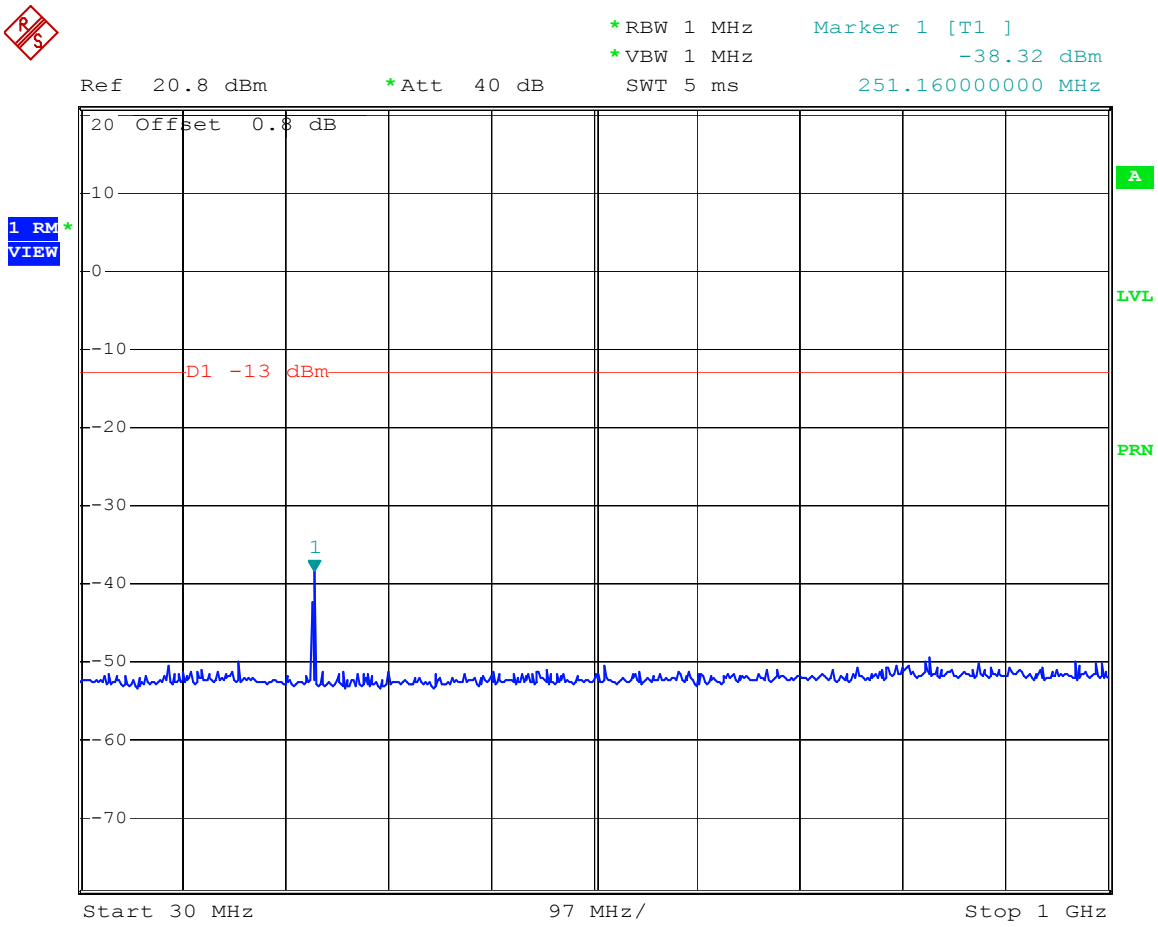
Comment: Out-of-band emissions, ch 600
Date: 23.MAR.2005 17:45:40

Plot 5.8



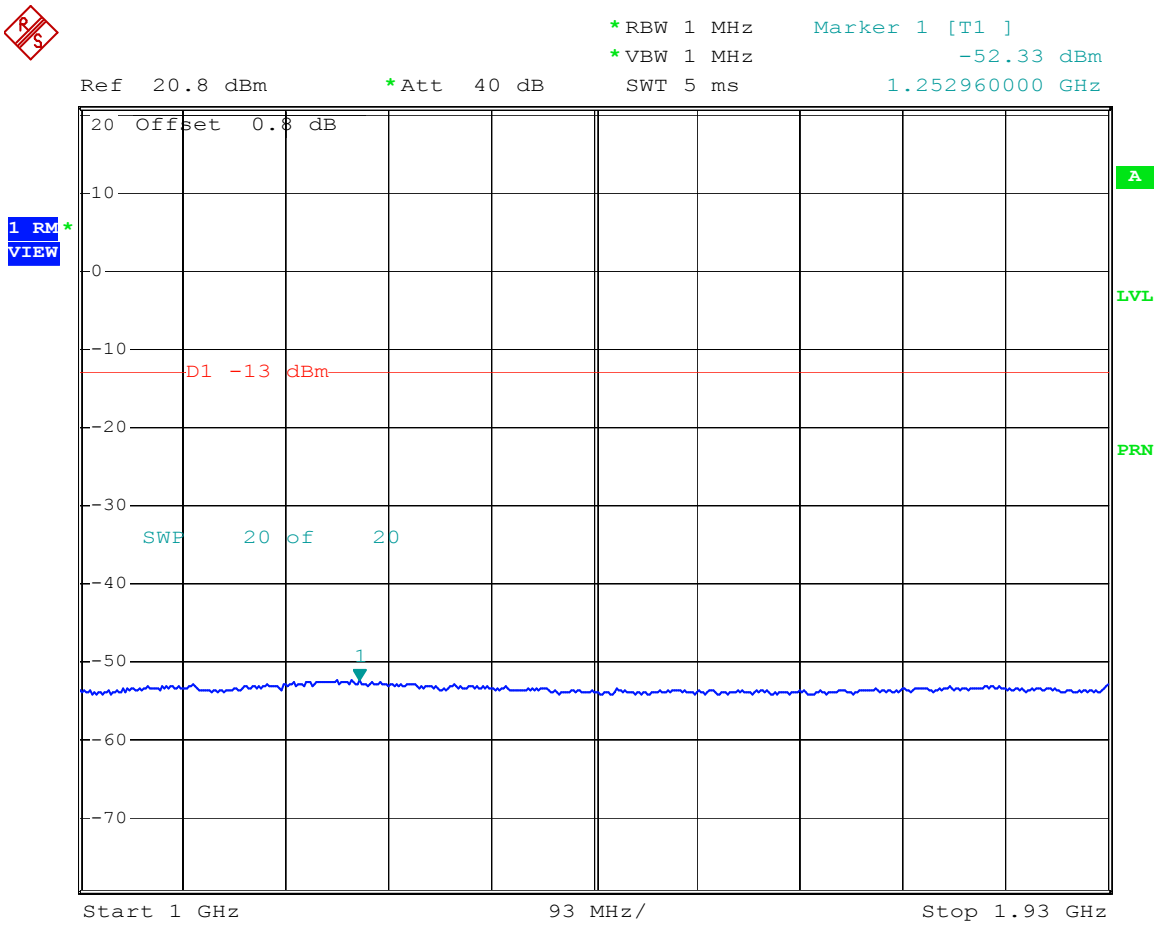
Comment: Out-of-band emissions, ch 600
Date: 24.MAR.2005 14:41:16

Plot 5.9



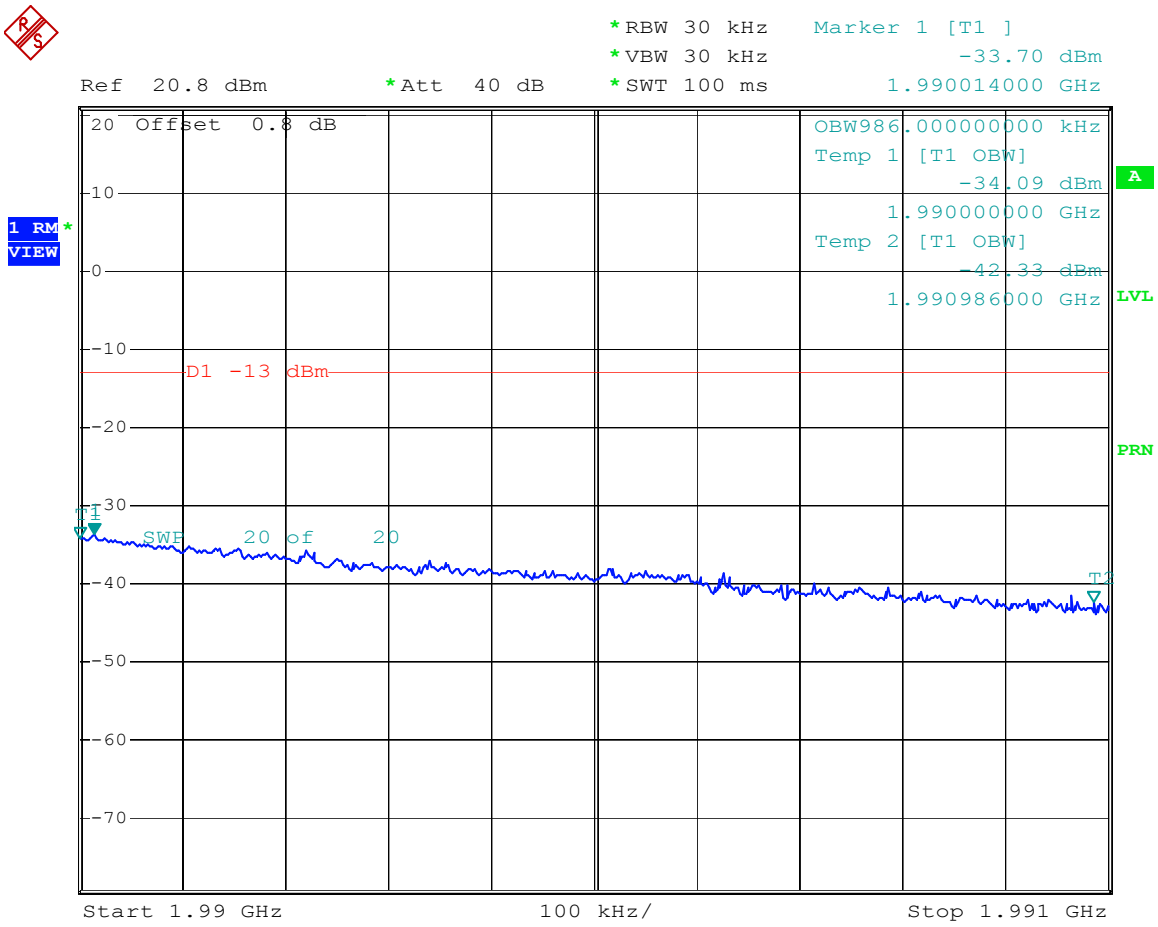
Comment: Out-of-band emissions, ch 1175
Date: 24.MAR.2005 13:19:41

Plot 5.10



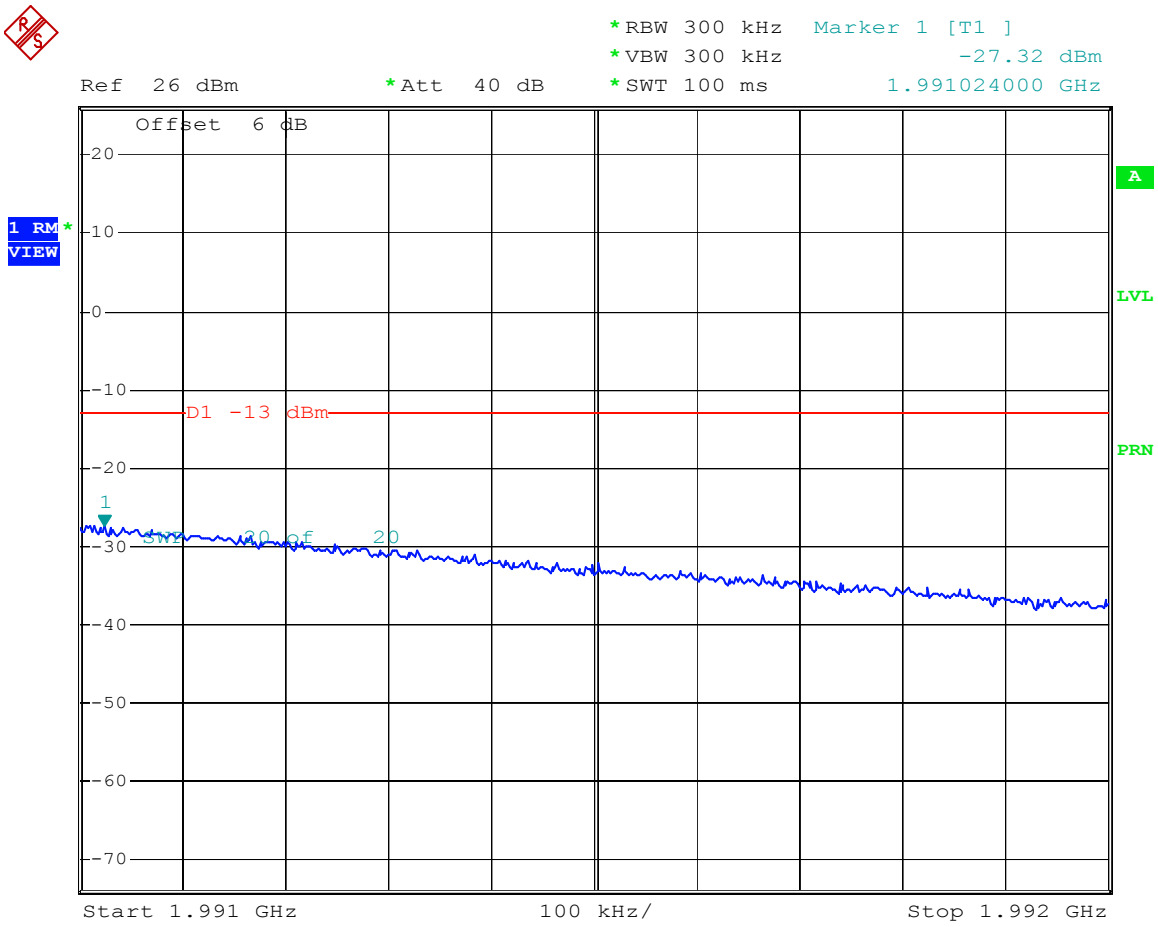
Comment: Out-of-band emissions, ch 1175
Date: 24.MAR.2005 14:06:15

Plot 5.11



Comment: Out-of-band emissions, ch 1175
Date: 24.MAR.2005 11:53:18

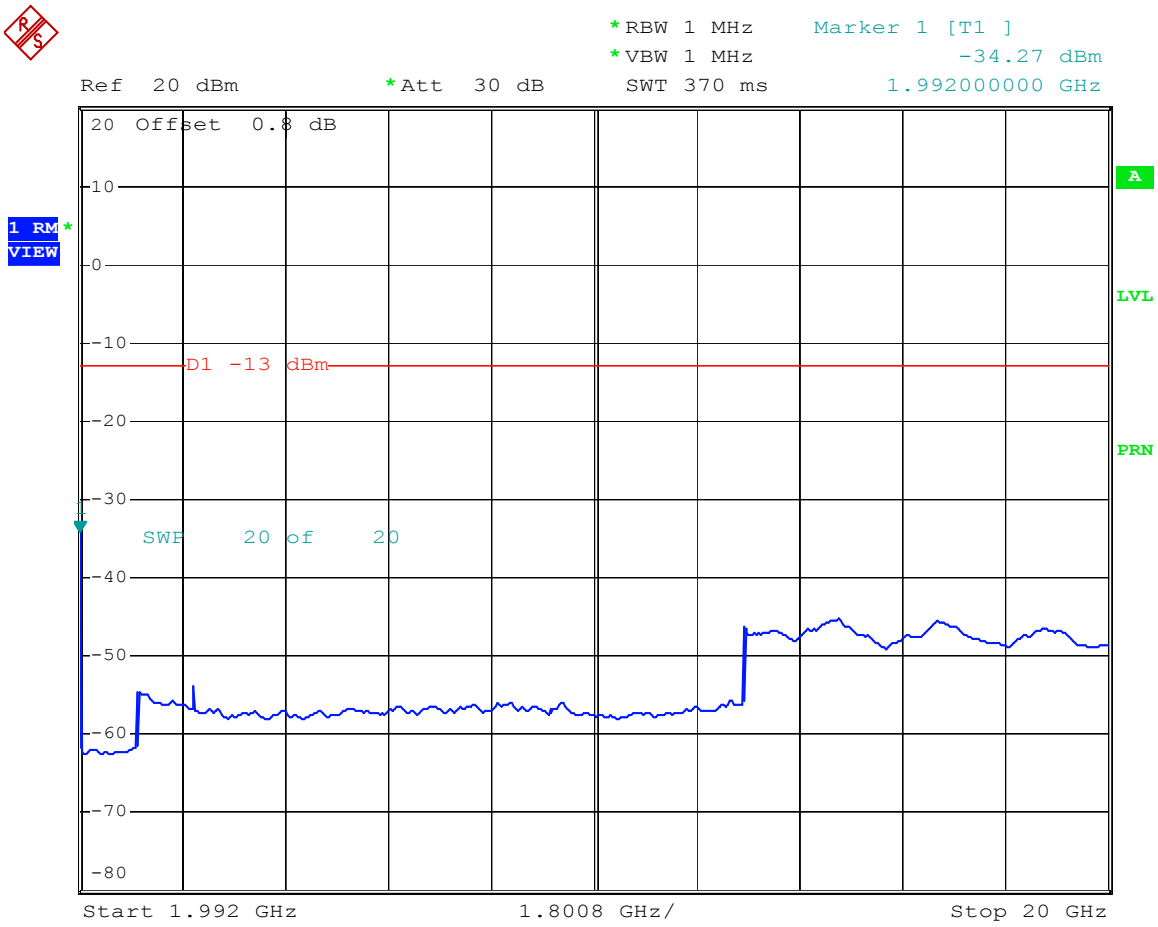
Plot 5.12



Comment: Out-of-band emissions, ch 1175, BCF=5.2 dB added
Date: 24.MAR.2005 11:59:56

Note: Since the resolution bandwidth (RBW) of less than 1 MHz is used, the bandwidth correction factor (BCF) of 10Log(1/RBW) = 5.2 dB was added to the Spectrum analyzer reading (as OFFSET).

Plot 5.13



Comment: Out-of-band emissions, ch 1175
Date: 24.MAR.2005 13:18:03

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 frequency (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.

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

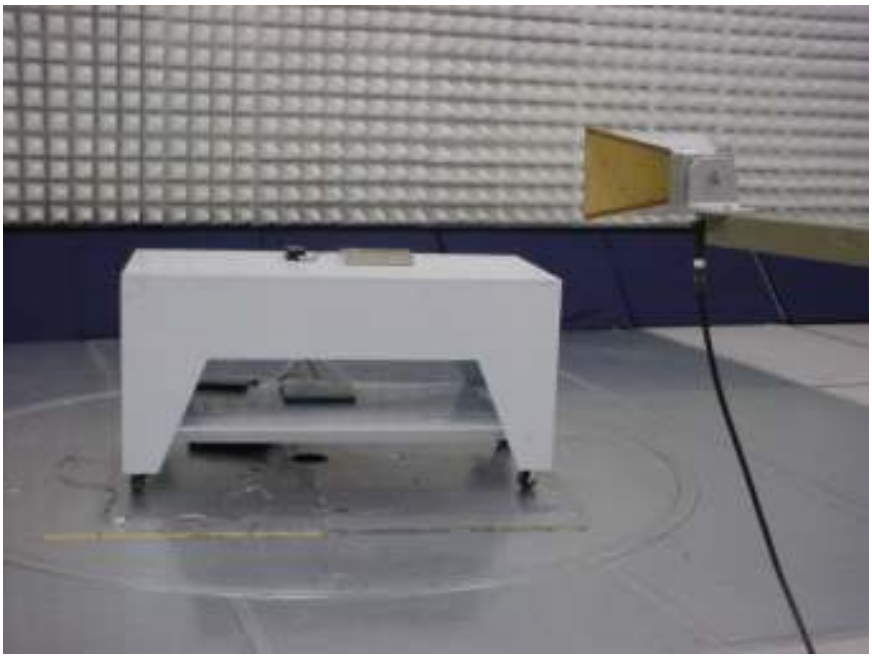
The spurious emissions attenuation is the difference between EIRP at the fundamental frequency (see section 3) and at the spurious emissions frequency.

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: 1931.25MHz					
3862.5	49.1	-55.5	-45.9	-13	-32.9
5793.7	36.2	-69.4	-58.8	-13	-45.8
7725.0	22.8 *	-83.5	-72.3	-13	-59.3
Mid Channel: 1960.10MHz					
3920.2	49.6	-55.0	-45.4	-13	-32.4
5880.3	35.4	-70.5	-59.6	-13	-46.6
7840.4	22.6 *	-83.3	-72.1	-13	-59.1
High Channel: 1988.75 MHz					
3977.5	45.8	-58.8	-49.2	-13	-36.2
5966.2	35.6	-70.3	-59.4	-13	-46.5
7955.0	22.8 *	-83.5	-72.3	-13	-59.3

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

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

FS = RR + LF
Where FS = Field Strength in dBμV/m
RR = RA - AG in dBμV
LF = CF + AF in dB

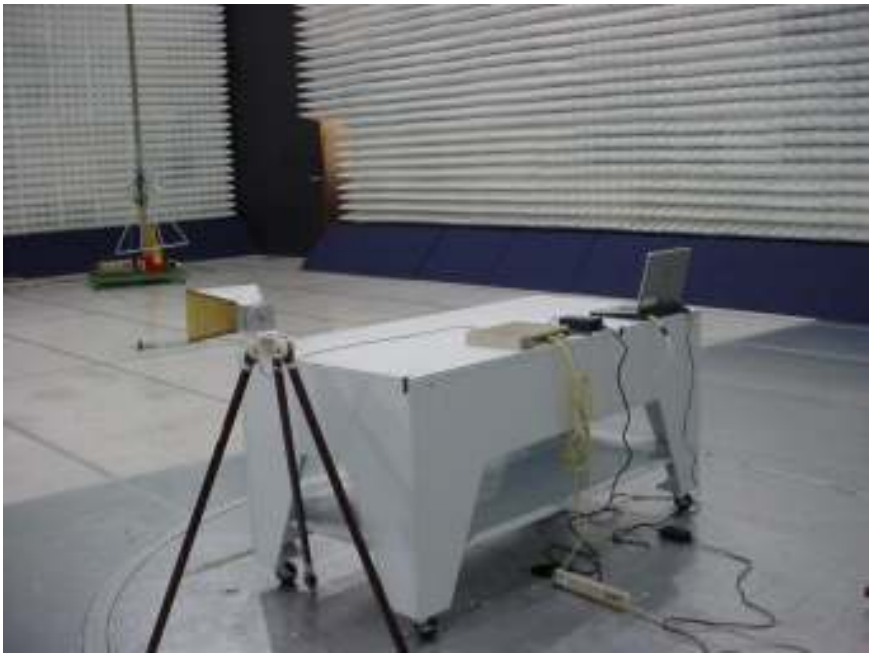
Assume a receiver reading of 52.0 dBμV is obtained. The antennas factor of -7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB RR = 23.0 dBμV
CF = 1.6 dB LF = 9.0 dB
AG = 29.0 dB
FS = RR + LF
FS = 23 + 9 = 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



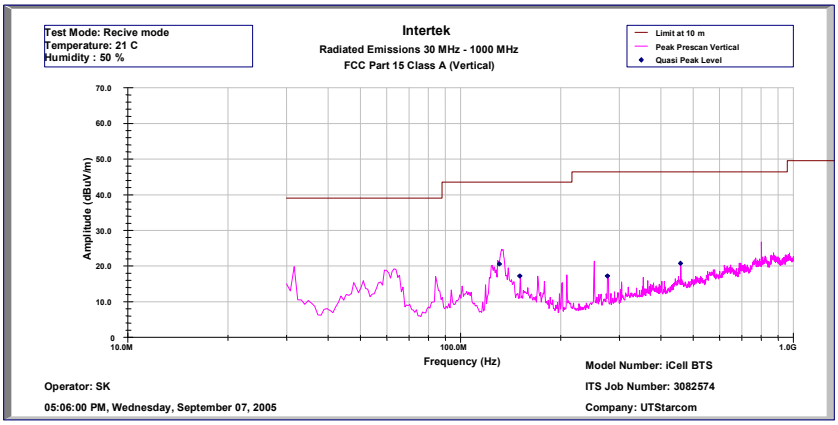
7.4 Test Results

Tested By:	Suresh Kondapalli
Test Date:	September 7, 2005

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

Note: A complete scan was made from 30 MHz – 1000 MHz.
The six highest emissions are reported.

Result	**Complies by more than 20 dB**



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

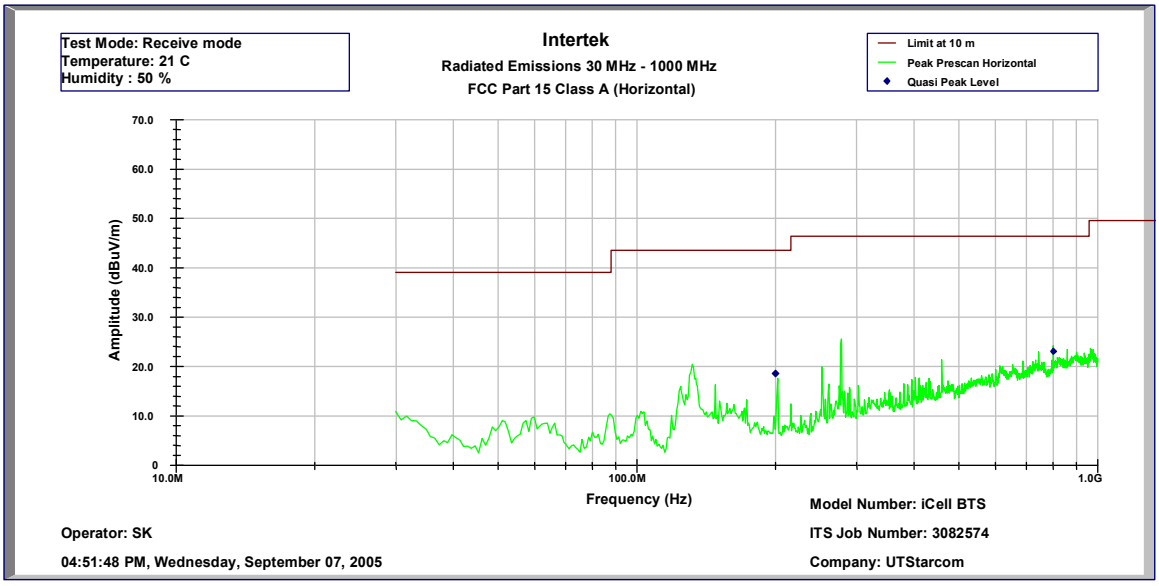
Operator: SK

05:05:57 PM, Wednesday, September 07, 2005

Model Number: iCell BTS
ITS Job Number: 3082574
Company: UTStarcom

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)
131.0	20.6	43.5	-22.9	41.4	4.6	32.9	7.5
150.0	16.7	43.5	-26.8	34.0	4.7	32.9	10.8
281.0	14.6	46.4	-31.8	28.9	5.5	32.8	13.0
458.0	20.7	46.4	-25.7	28.9	6.2	32.8	18.4

Test Mode: Receive mode
Temperature: 21 C
Humidity : 50 %



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

Operator: SK
Model Number: iCell BTS
ITS Job Number: 3082574

04:51:45 PM, Wednesday, September 07, 2005
Company: UTStarcom

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)
200.0	18.6	43.5	-24.9	36.5	5	32.8	9.9
802.0	23.1	46.4	-23.3	26.3	7.3	32.7	22.1

Test Mode: Receive mode
Temperature: 21 C
Humidity : 50 %

)

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 frequency counter. The EUT was setup to transmit the maximum power.

After the temperature stabilized for approximately 20 minutes, the transmitting frequency was measured by the frequency counter 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 (Hz)

Frequency Deviation (Hz)								
Temperature (°C)								
-30	-20	-10	0	10	20	30	40	50
85% Supply 5.2 x 0.85 = 4.4V								
-20.5	-19.8	-19.8	-20.0	-19.3	-20.5	-20.1	-19.3	-20.3
100% Supply 5.2V								
-20.6	-19.7	-19.8	-19.6	-20.4	-20.1	-19.8	-20.3	-19.9
115% Supply 5.2 x 1.15 = 6.0V								
-20.3	-20.8	-20.6	-20.3	-20.6	-20.4	-19.8	-19.7	-20.3

Maximum frequency deviation is 20.8 Hz

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 allowed antenna gain of 16.9 dBi (see sec. 3.2), the maximum EIRP is 36.9 dBm or 4.9 W.

Using the formula for the Power Density $S = EIRP/ 4\pi D^2$, the distance D, where the Maximum Permissible Exposure (MPE) satisfies the FCC 1.1310 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, $D \geq 0.197$ 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
BI-Log Antenna	EMCO	3143	9509-1160	12	10/28/05
Double-ridged Horn Antenna	EMCO	3115	8812-3049	12	04/29/06
Dipole Antenna	CDI	Roberts	331	12	09/19/05
Double-ridged Horn Antenna	EMCO	3115	9170-3712	12	06/08/06
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	09/10/05
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	09/10/05
Spectrum Analyzer	Rohde & Schwarz	FSP40	036612004	12	09/15/05
Signal Generator	Hewlett Packard	83732A	322A00119	12	03/21/06
Power Meter	Booton	4300	62003DU	12	10/19/06
Pre-Amplifier	Sonoma Inst.	310	185634	12	07/05/06
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	03/29/06

11.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3082574	DC	September 12, 2005	Original document