Nemko Test Report No.:	3L0498RUS1
Applicant:	Andrew Corporation
Equipment Under Test:	Optical Repeater
In Accordance With:	**FCC Part 24, Subpart E** Broadband PCS Repeaters
Tested By:	Nemko USA Inc. 802 N. Kealy Lewisville, Texas 75057-3136
Authorized By:	Tom Tidwell, RF Group Manager
Date:	4/22/04
Total Number of Pages:	48

Table of Contents

Section 1. Summary of Test Results

Manufacturer:	Andrew Corporation		
Model No.:	MMR Optical Master	MMR 8A/19	MMR 8/19
Serial No.:	30	14	30

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 24, Subpart E.

☒	New Submission	☐	Production Unit
☐	Class II Permissive Change	☒	Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	24.232	100W	24.83W	Complies
Occupied Bandwidth (CDMA)	24.238	Input/Output	NA	Complies
Occupied Bandwidth (GSM)	24.238	Input/Output	NA	Complies
Occupied Bandwidth (NADC)	24.238	Input/Output	NA	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	Plots	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	E.I.R.P.	Complies
Frequency Stability	24.235			

Footnotes:

(1) Modulation characteristics were not tested since the E.U.T. processes but does not produce a modulated waveform.

Measurement uncertainty for each test configuration is expressed to 95% probability.

Section 2. General Equipment Specification

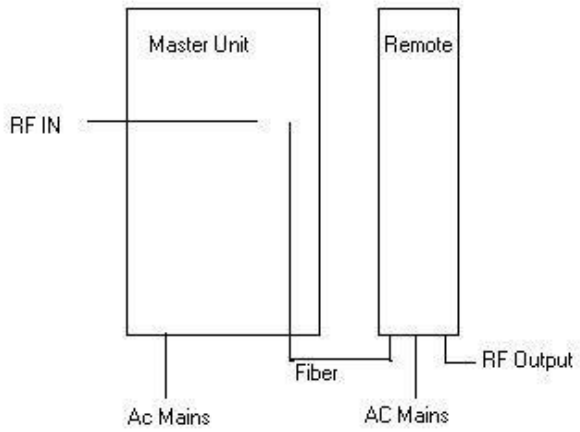
Supply Voltage Input:		115V AC
Frequency Bands:	**Downlink:**	☒ Block A : 1930 – 1945 MHz ☒ Block D : 1945 – 1950 MHz ☒ Block B : 1950 – 1965 MHz ☒ Block E : 1965 – 1970 MHz ☒ Block F : 1970 – 1975 MHz ☒ Block C : 1975 – 1990 MHz
Frequency Bands:	**Uplink:**	☐ Block A : 1850 – 1865 MHz ☐ Block B : 1865 – 1870 MHz ☐ Block C : 1870 – 1885 MHz ☐ Block D : 1885 – 1890 MHz ☐ Block E : 1890 – 1895 MHz ☐ Block F : 1895 – 1910 MHz
Type of Modulation and Designator:		**CDMA (F9W)** ☒ **GSM (GXW)** ☒ **NADC (DXW)** ☒
Output Impedance:		50 ohms
Max Input:		+20 dBm
RF Output (Rated):	**Uplink**	Per channel: NA W Total: NA W
RF Output (Rated): (Per Carrier)	**Downlink**	CDMA 33 dBm (2 Carrier) NADC 36 dBm (2 Carrier) GSM 39 dBm (2 Carrier)
Frequency Translation:		**F1-F1** ☐ **F1-F2** ☐ **N/A** ☒
Band Selection:		**Software** **Duplexer** **Fullband**

	☐	☐	☒

Modifications Made During Testing

No modifications made during testing.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: Dustin Oaks	DATE: 12/18/2003

Test Results: Complies.

Measurement Data:

	Modulation Type	Output Power (dBm)	
Uplink	CDMA	NA	
Downlink	CDMA	39.05	
Uplink	GSM	NA	
Downlink	GSM	43.95	
Uplink	NADC	NA	
Downlink	NADC	41.05	

Equipment Used: 1036, 1625, 1629, 1604, 1474, 1053

Measurement Uncertainty: +/- 1.6 dB

Temperature: 21 ?C

Relative Humidity: 51 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (CDMA)	PARA. NO.: 2.1049
TESTED BY: Dustin Oaks	DATE: 12/17/2003

Test Results: Complies.

Test Data: See attached plot(s).

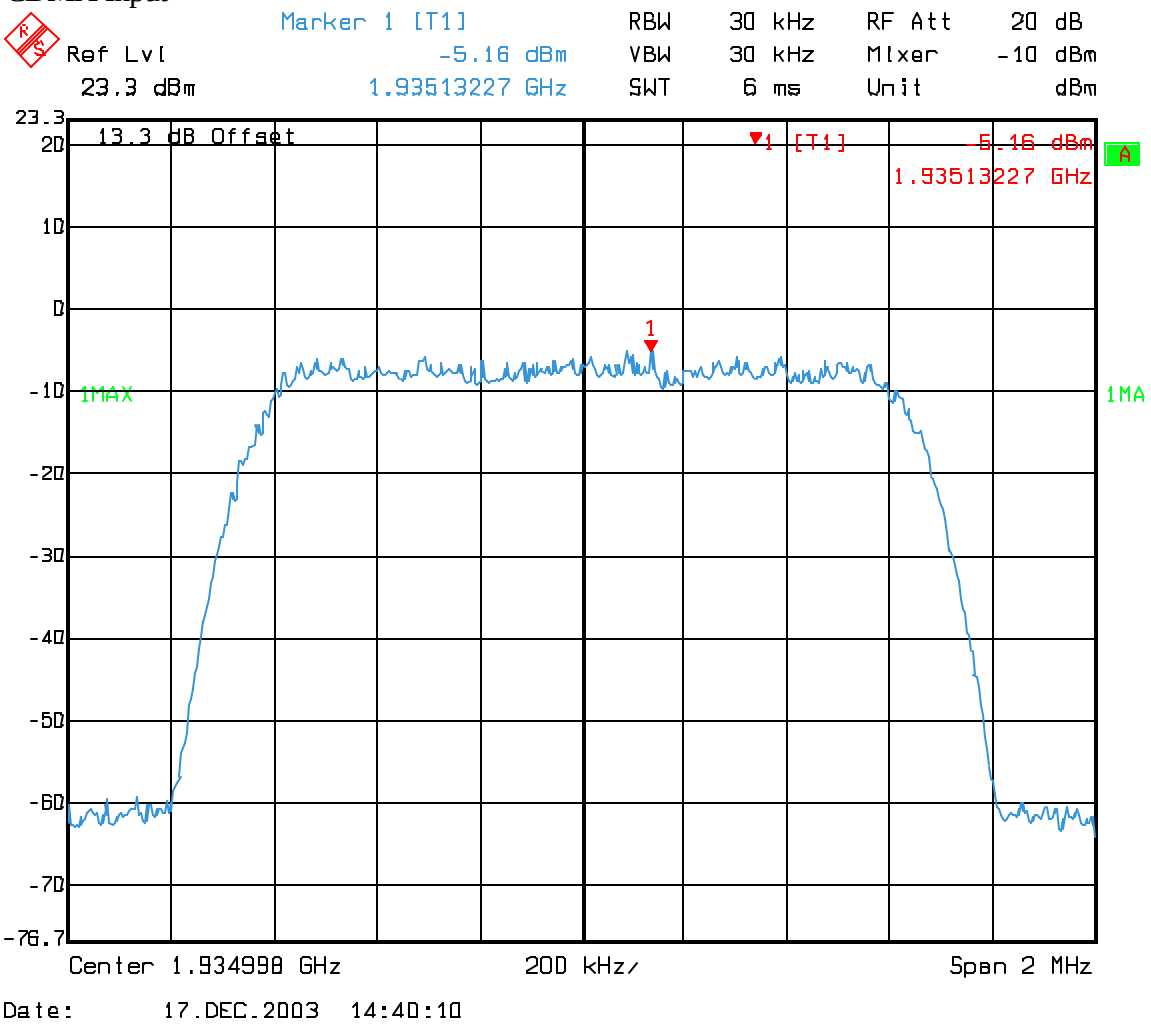
Equipment Used: 1036, 1625, 1629, 1604, 1474, 1053

Measurement Uncertainty: +/- 1.6 dB

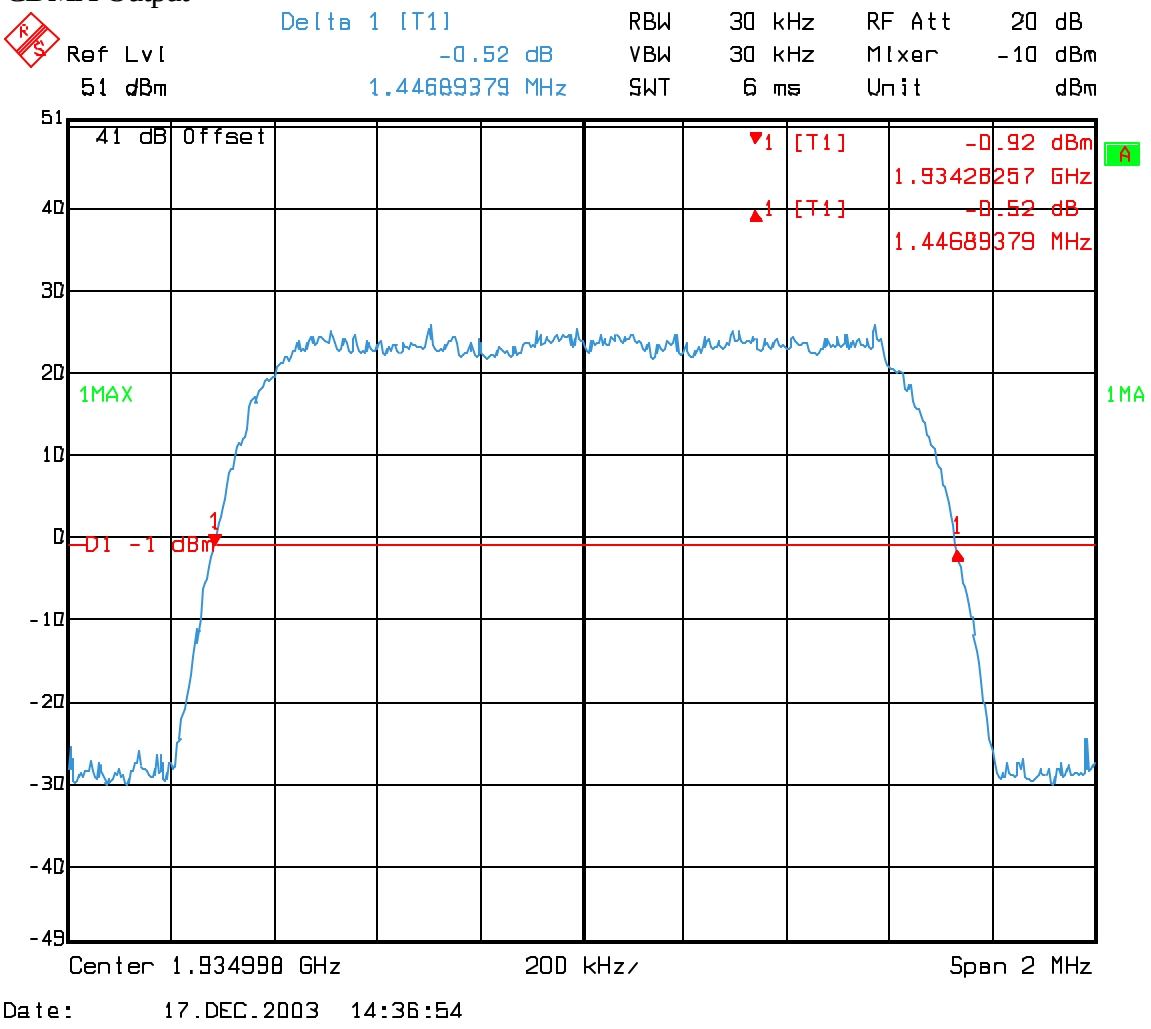
Temperature: 21 ?C

Relative Humidity: 51 %

CDMA Input

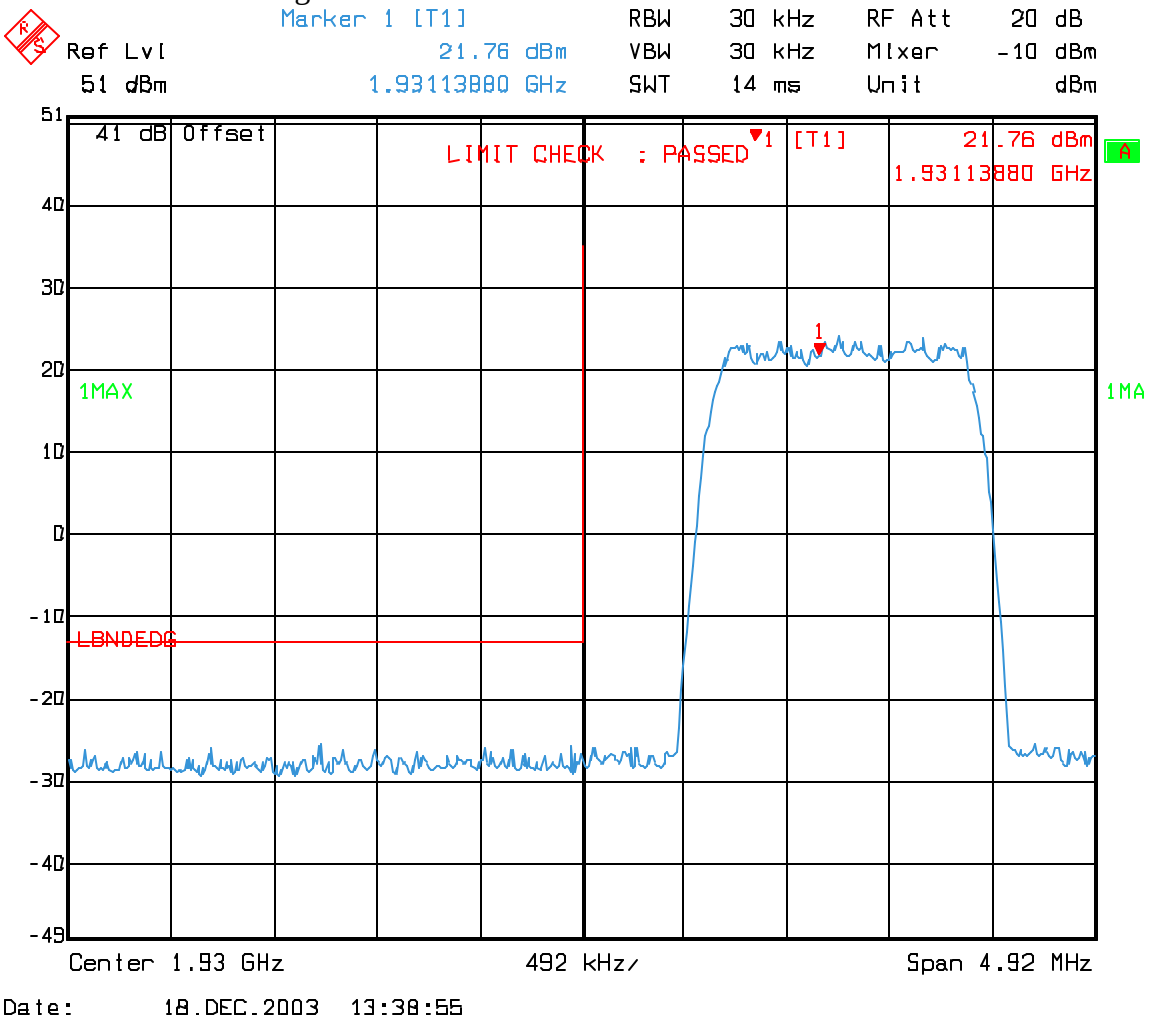

Marker 1 [T1]
Ref Lvl
23.3 dBm
-5.16 dBm
1.93513227 GHz
RBW 30 kHz
VBW 30 kHz
SWT 6 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
13.3 dB Offset
1 [T1]
-5.16 dBm
1.93513227 GHz
1MAX
1MA
Center 1.934998 GHz
200 kHz/
Span 2 MHz
Date: 17.DEC.2003 14:40:10

CDMA Output

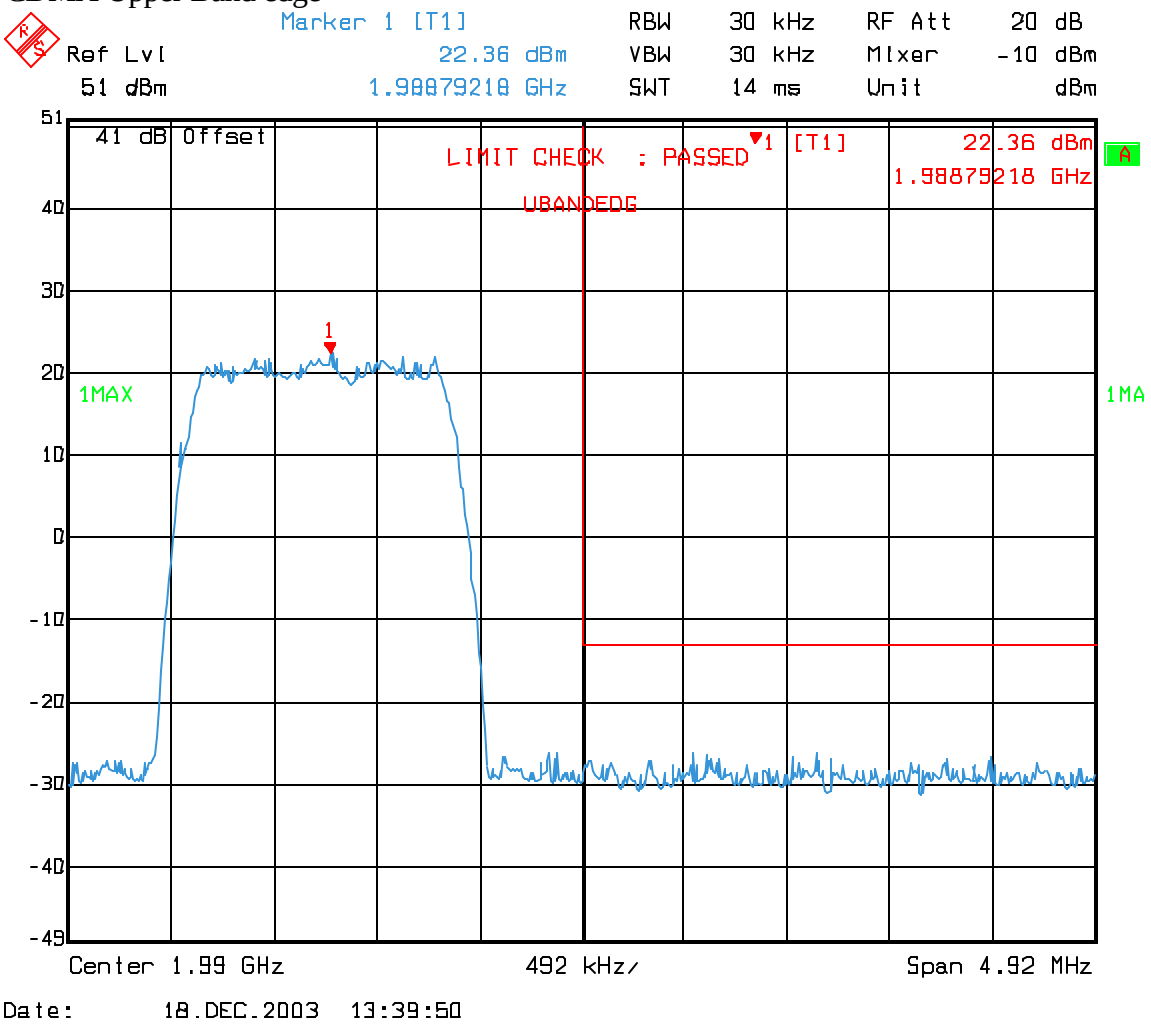

Delta 1 [T1]
-0.52 dB
1.44689379 MHz
RBW 30 kHz
VBW 30 kHz
SWT 6 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
Ref Lvl
51 dBm
41 dB Offset
1 [T1] -0.92 dBm
1.93428257 GHz
1 [T1] -0.52 dB
1.44689379 MHz
1MAX
1MA
D1 -1 dBm
Center 1.934998 GHz
200 kHz/
Span 2 MHz
Date: 17.DEC.2003 14:36:54

Band Edge

CDMA Lower Band edge

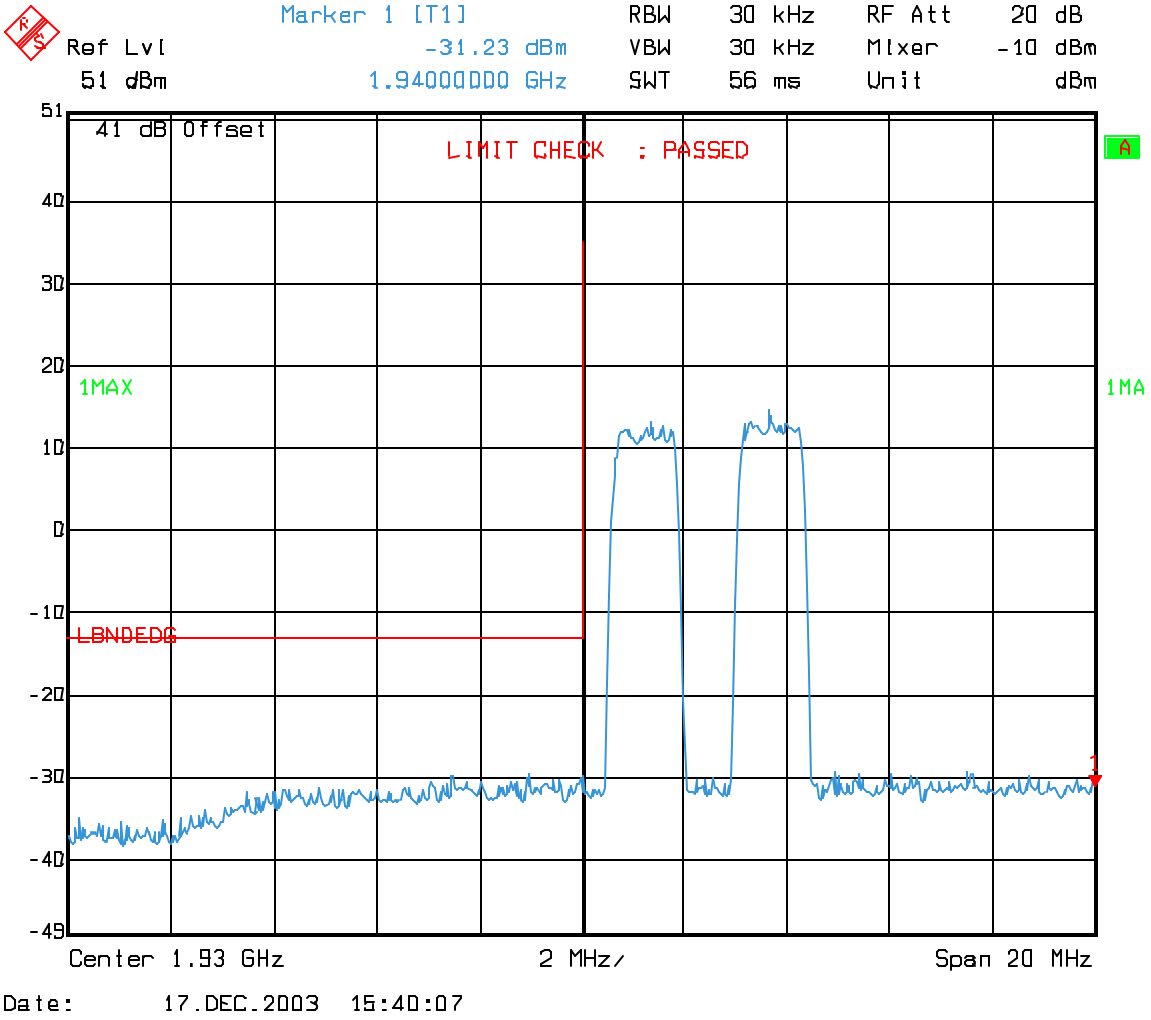


CDMA Upper Band edge

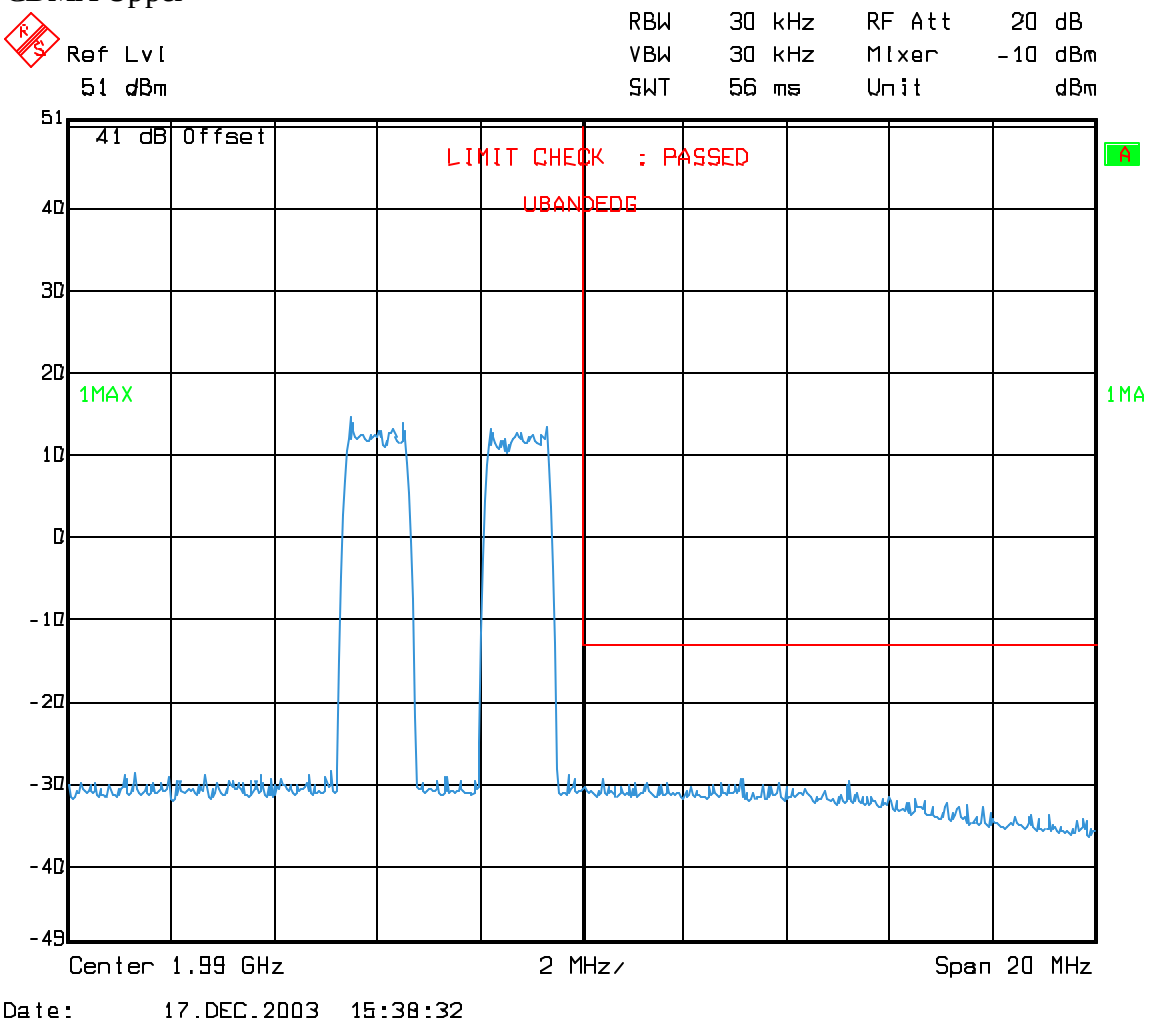


Intermodulation

CDMA Lower



CDMA Upper


Ref Lvl
51 dBm
RBW 30 kHz
VBW 30 kHz
SWT 56 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
41 dB Offset
LIMIT CHECK : PASSED
UBANDEDG
1MAX
1MA
A
51
40
30
20
10
0
-10
-20
-30
-40
-49
Center 1.99 GHz
2 MHz/
Span 20 MHz
Date: 17.DEC.2003 15:38:32

NAME OF TEST: Occupied Bandwidth (GSM)	PARA. NO.: 2.1049
TESTED BY: Dustin Oaks	DATE: 12/17/2003

Test Results: Complies.

Test Data: See attached plot(s).

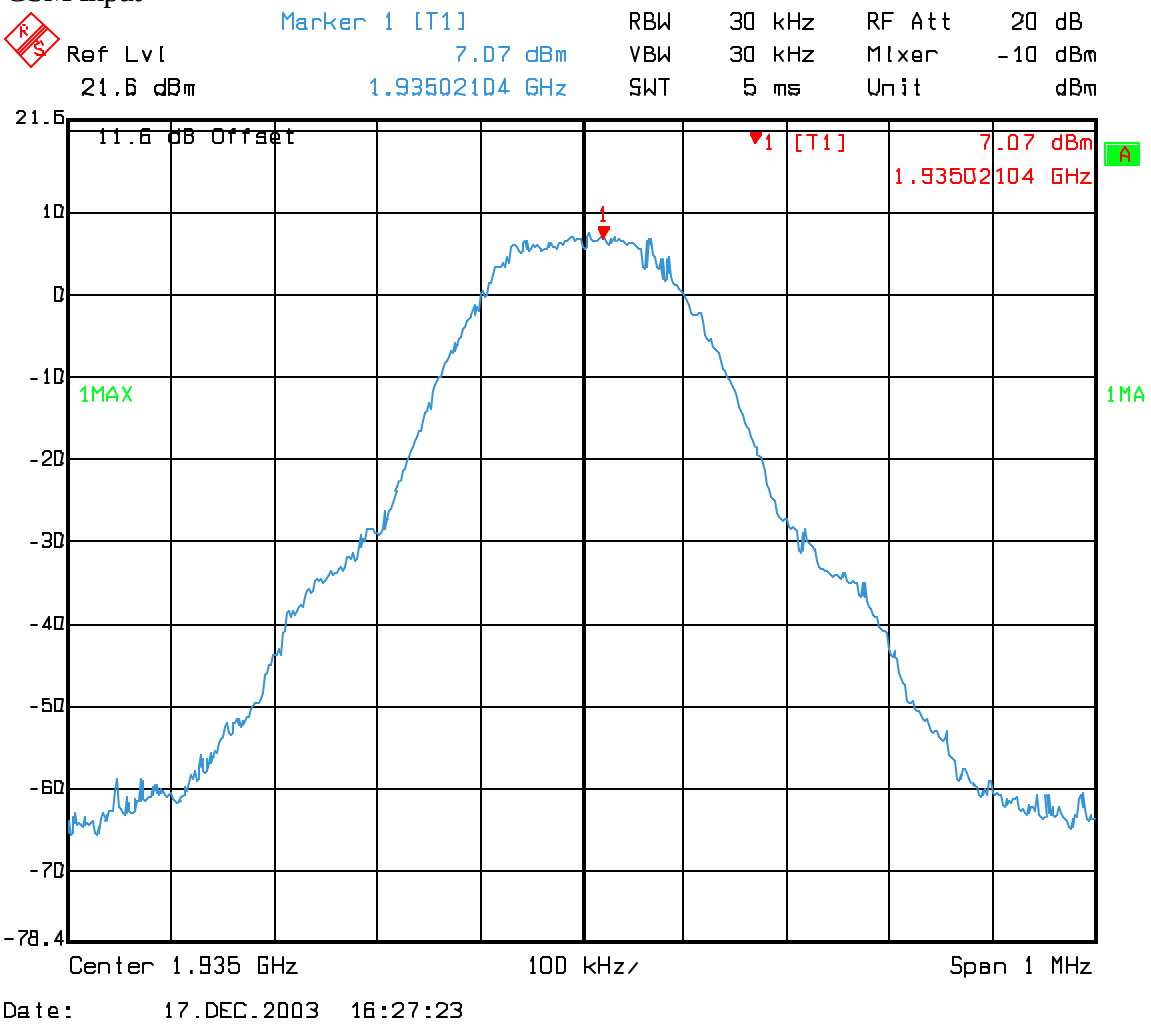
Equipment Used: 1036, 1625, 1629, 1604, 1474, 1053

Measurement Uncertainty: +/- 1.6 dB

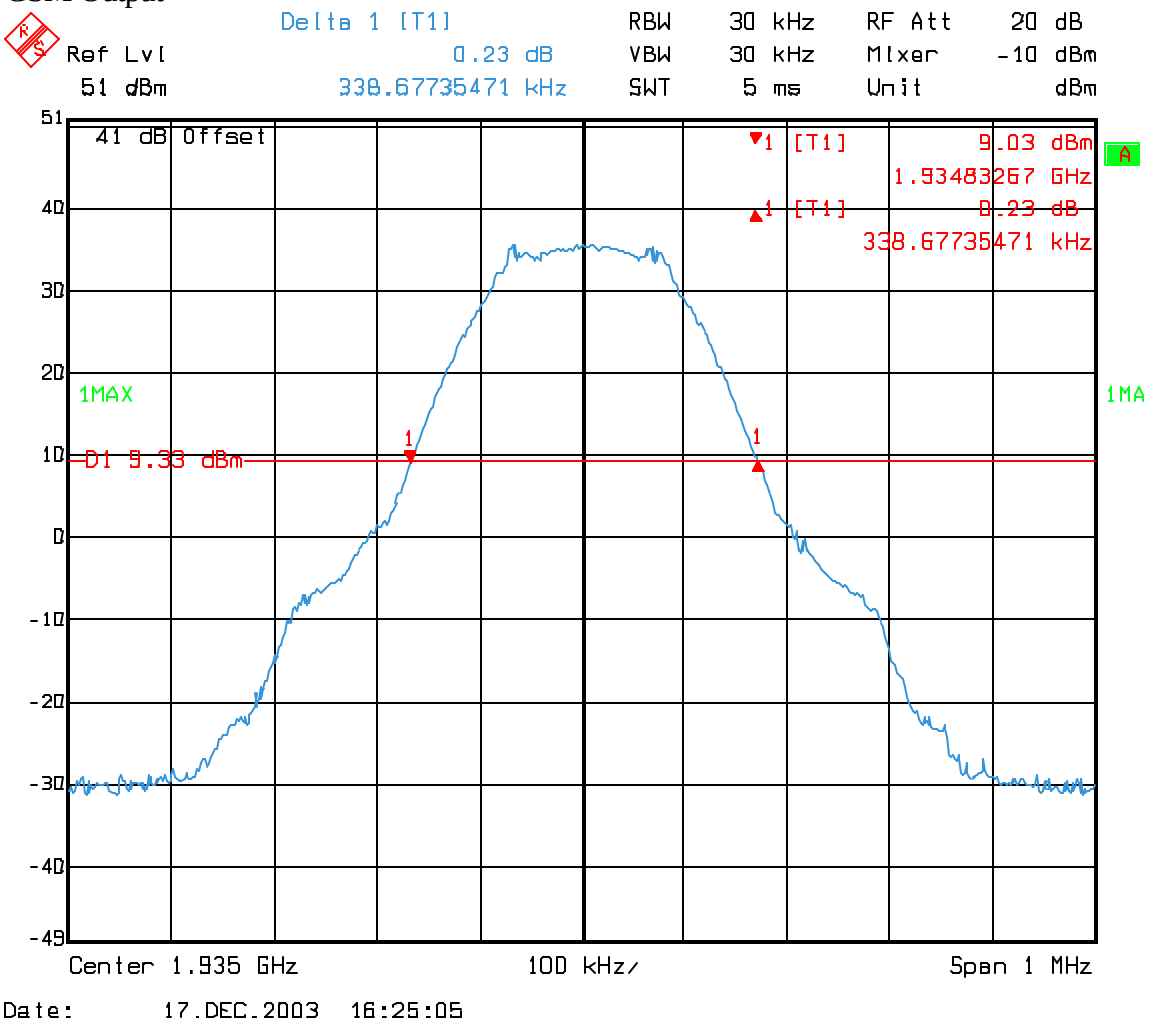
Temperature: 21 ?C

Relative Humidity: 51 %

GSM Input

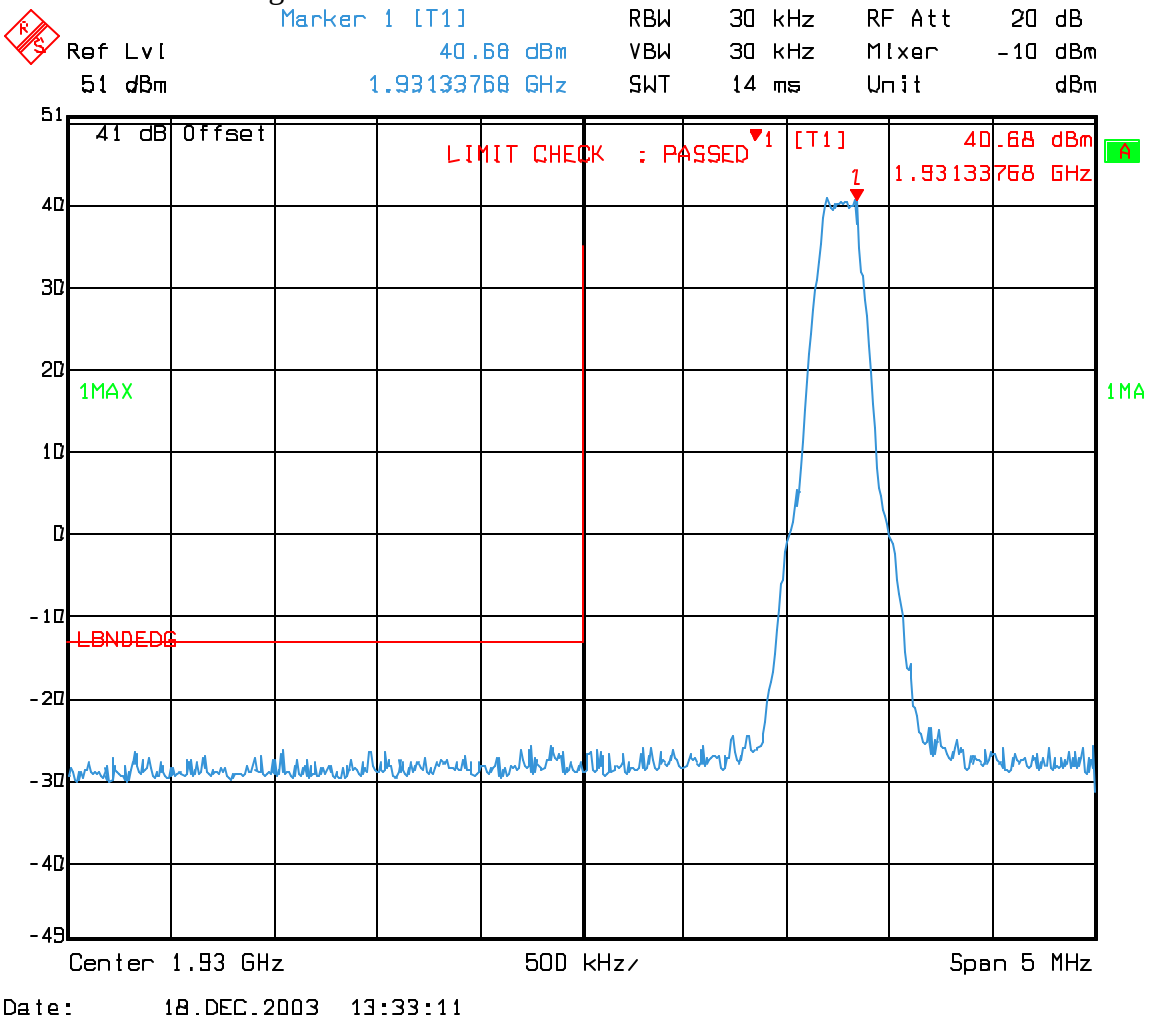

Marker 1 [T1]
7.07 dBm
1.93502104 GHz
RBW 30 kHz
VBW 30 kHz
SWT 5 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
Ref Lvl
21.6 dBm
11.6 dB Offset
1 [T1]
7.07 dBm
1.93502104 GHz
1MAX
1MA
A
21.6
10
0
-10
-20
-30
-40
-50
-60
-70
-78.4
Center 1.935 GHz
100 kHz/
Span 1 MHz
Date: 17.DEC.2003 16:27:23

GSM Output

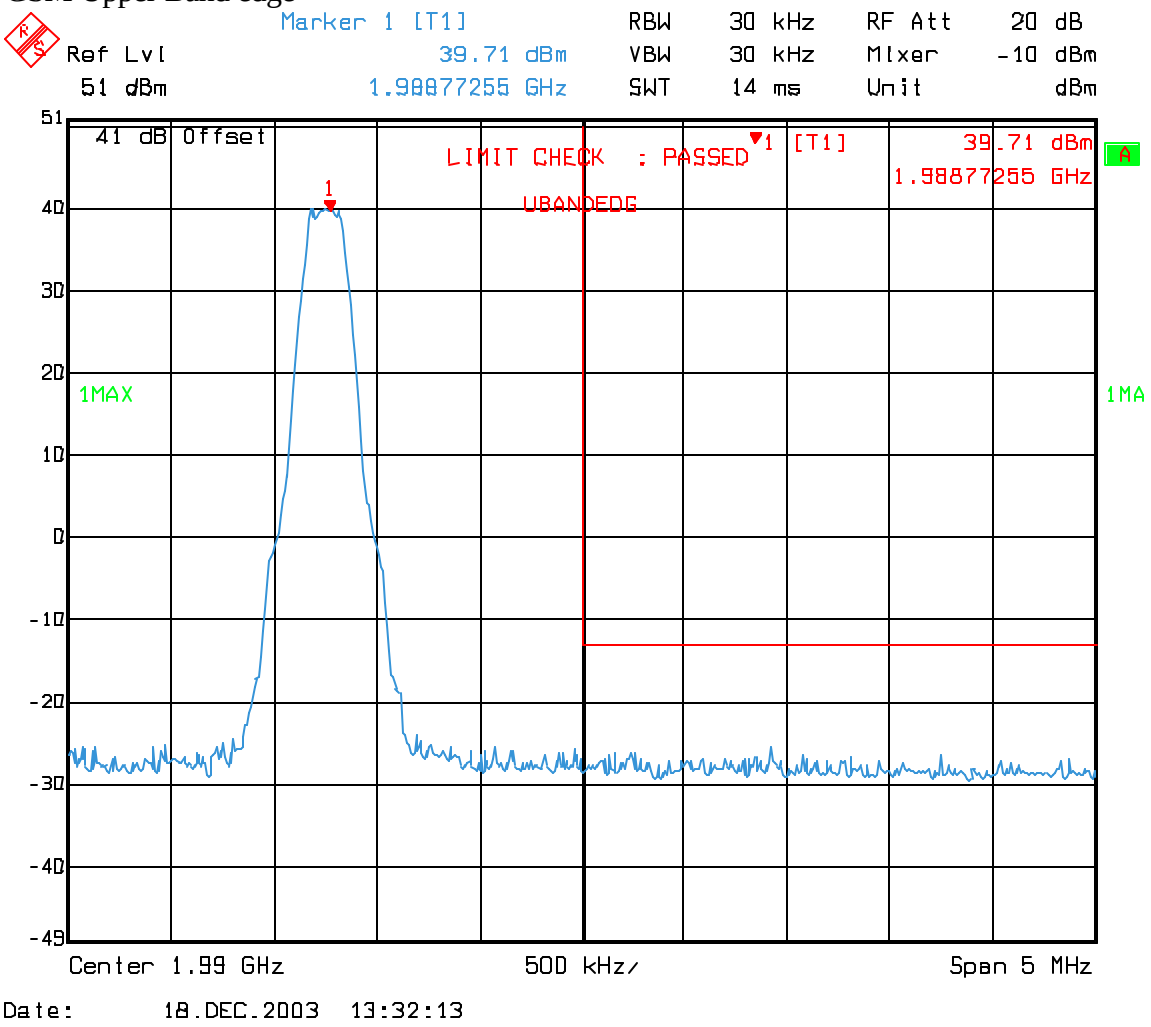

Delta 1 [T1]
0.23 dB
338.67735471 kHz
RBW 30 kHz
VBW 30 kHz
SWT 5 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
Ref Lvl
51 dBm
41 dB Offset
1 [T1] 9.03 dBm
1.93483267 GHz
1 [T1] 0.23 dB
338.67735471 kHz
1MAX
D1 9.33 dBm
1MA
A
51
40
30
20
10
0
-10
-20
-30
-40
-49
Center 1.935 GHz
100 kHz/
Span 1 MHz
Date: 17.DEC.2003 16:25:05

Band Edge

GSM Lower Band edge

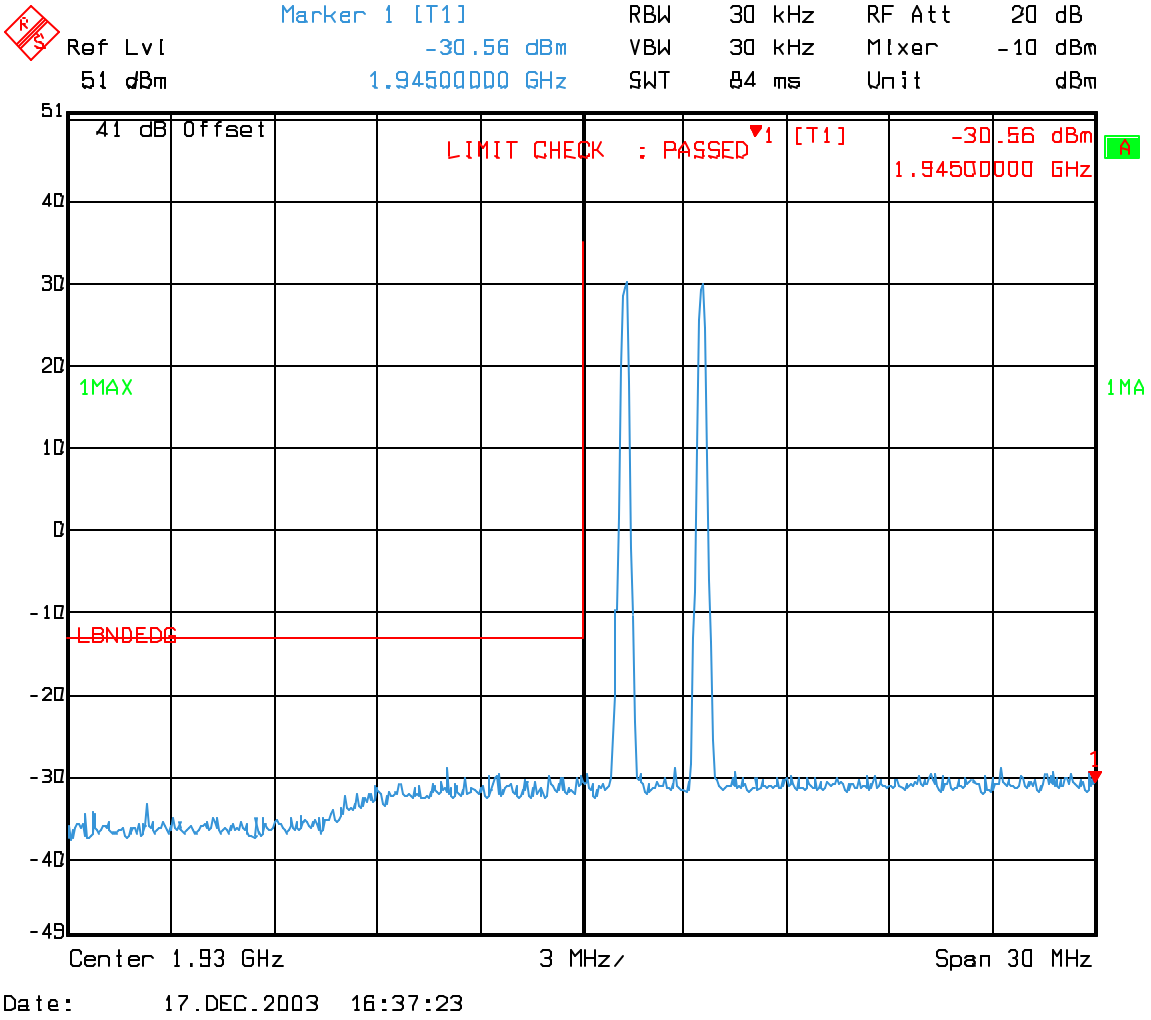


GSM Upper Band edge

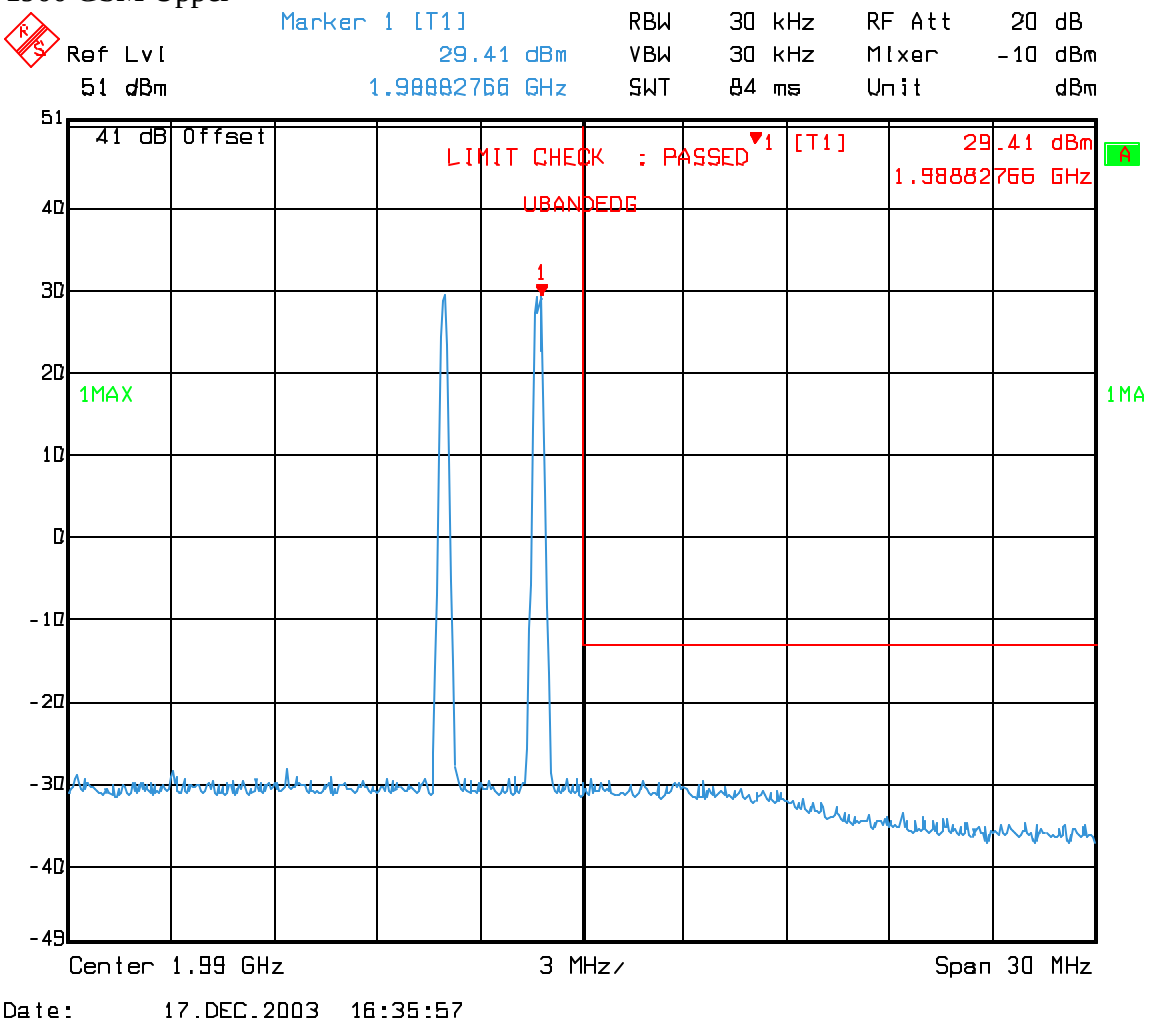


Intermodulation

GSM Lower



1900 GSM Upper



NAME OF TEST: Occupied Bandwidth (NADC)	PARA. NO.: 2.1049
TESTED BY: Dustin Oaks	DATE: 12/17/2003

Test Results: Complies.

Test Data: See attached plot(s).

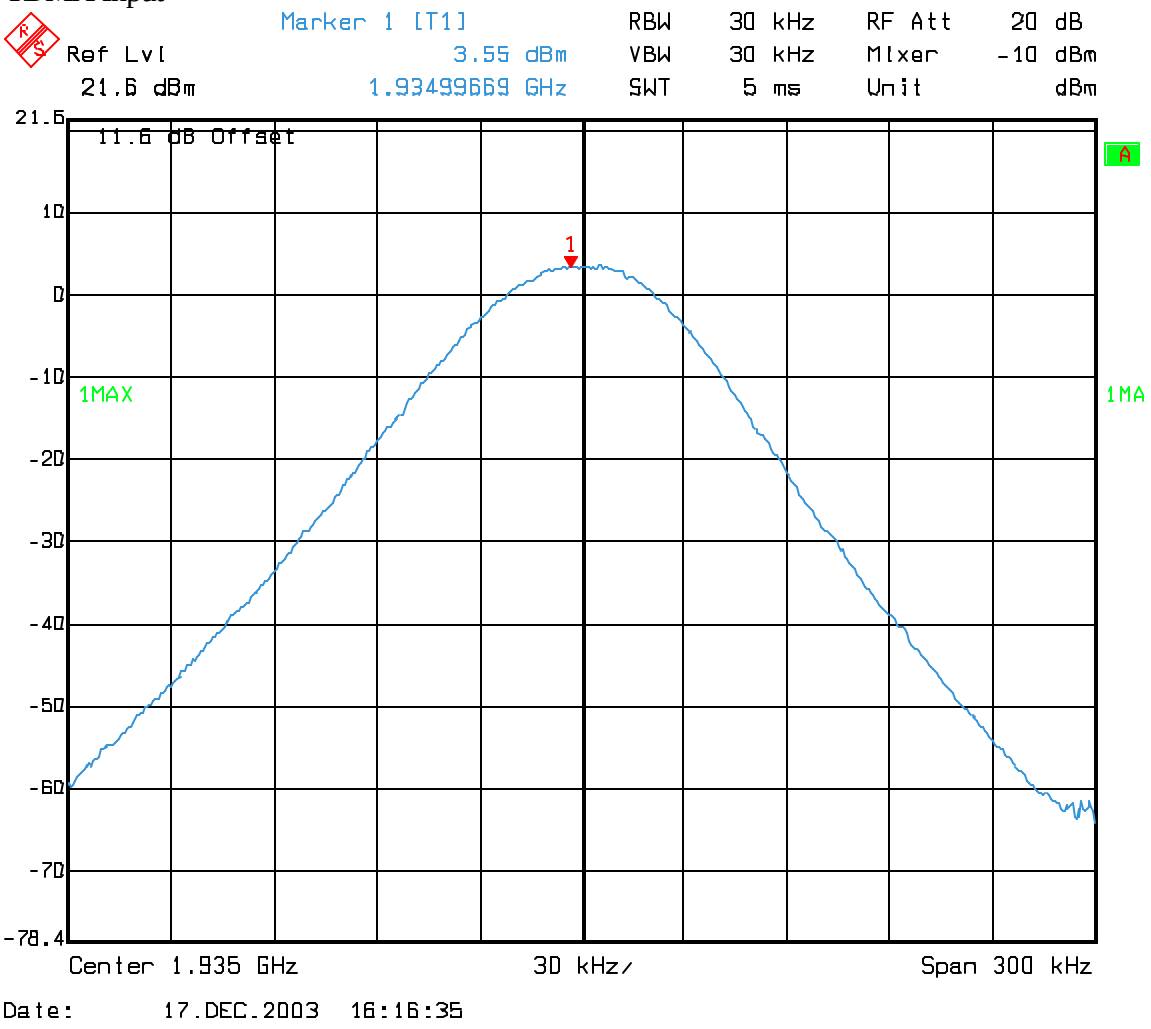
Equipment Used: 1036, 1625, 1629, 1604, 1474, 1053

Measurement Uncertainty: +/- 1.6 dB

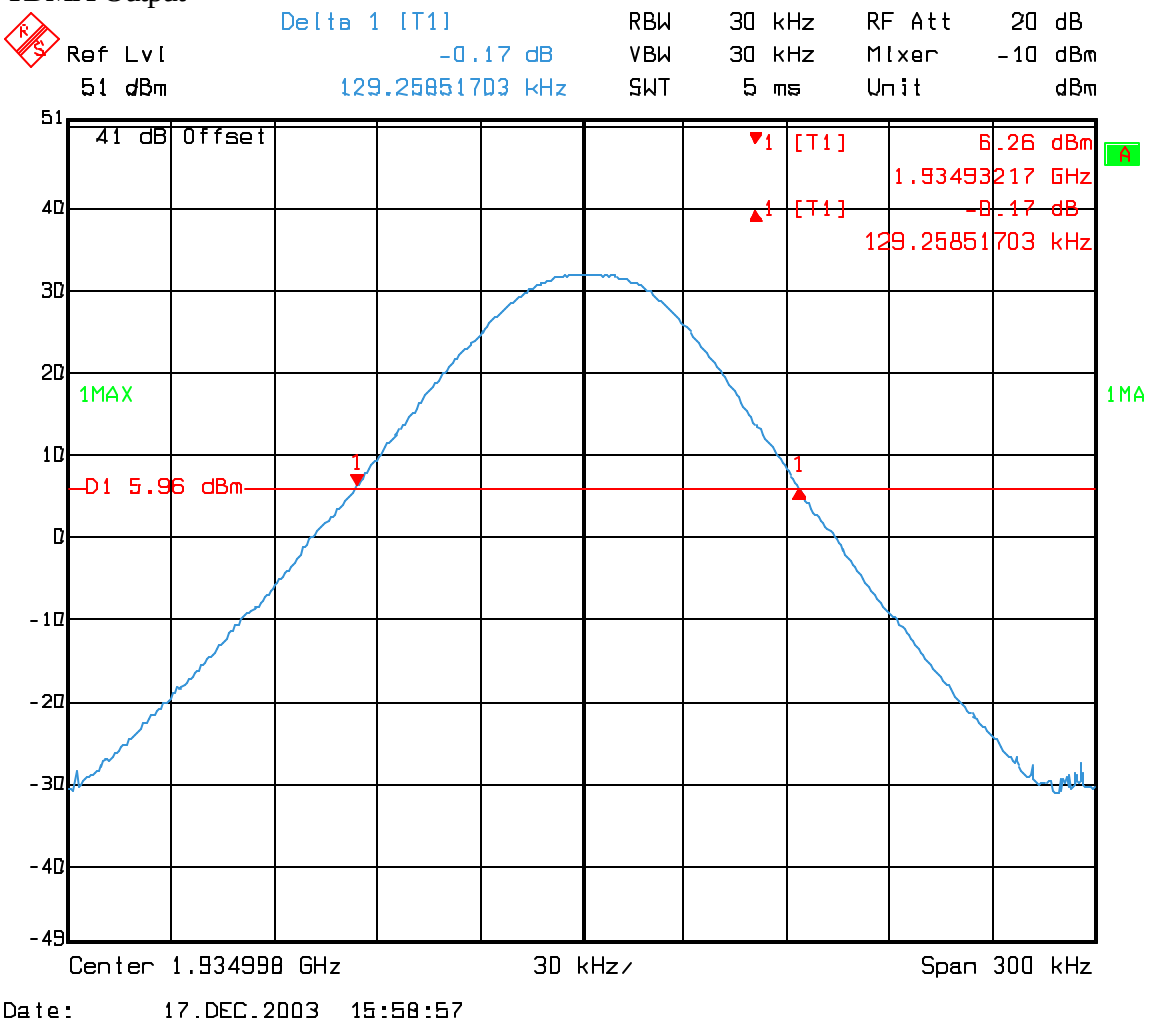
Temperature: 21 ?C

Relative Humidity: 51 %

TDMA Input

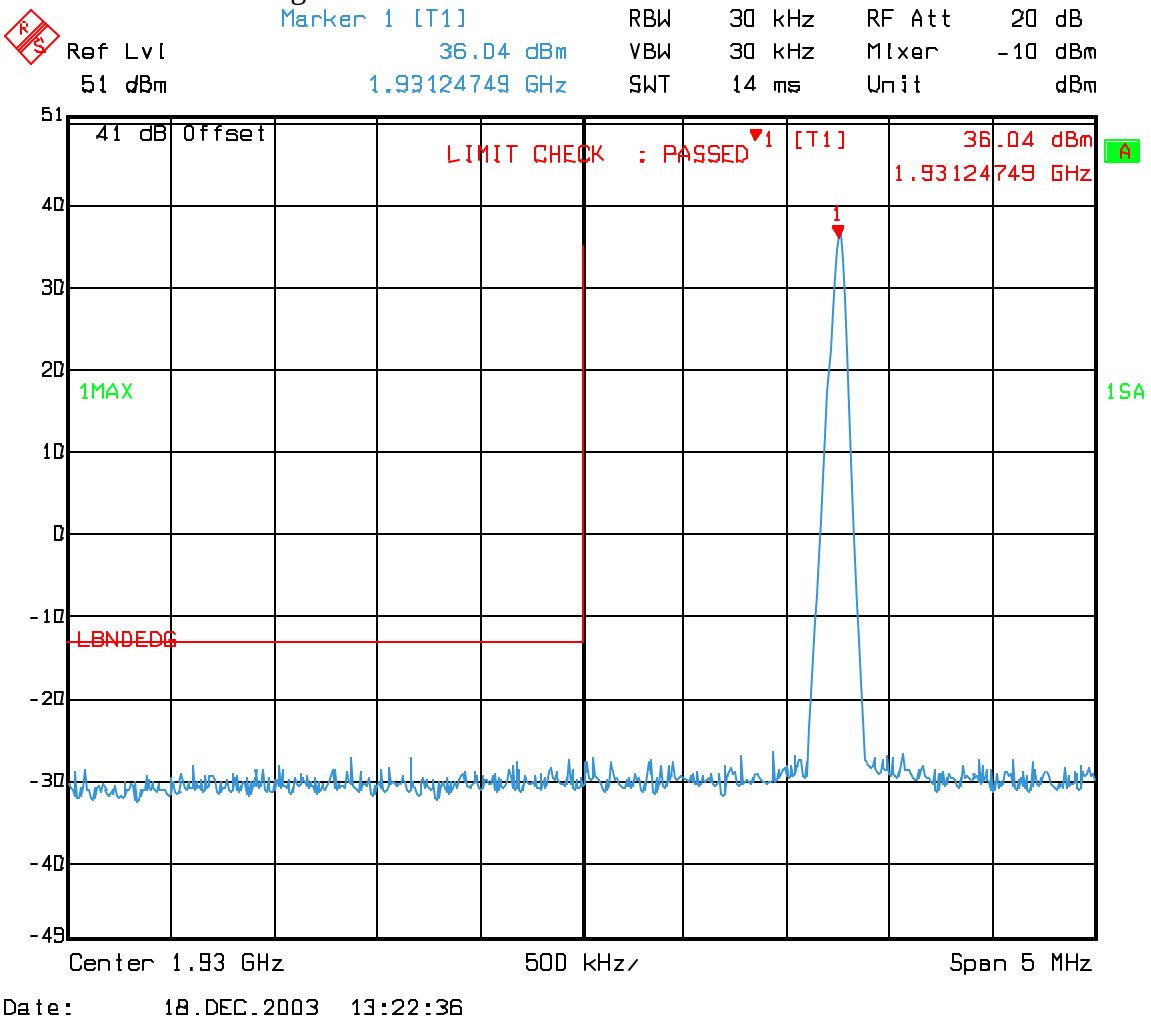

Marker 1 [T1]
3.55 dBm
1.93499669 GHz
RBW 30 kHz
VBW 30 kHz
SWT 5 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
Ref Lvl
21.6 dBm
11.6 dB Offset
1MAX
1MA
A
Center 1.935 GHz
30 kHz/
Span 300 kHz
Date: 17.DEC.2003 16:16:35

TDMA Output

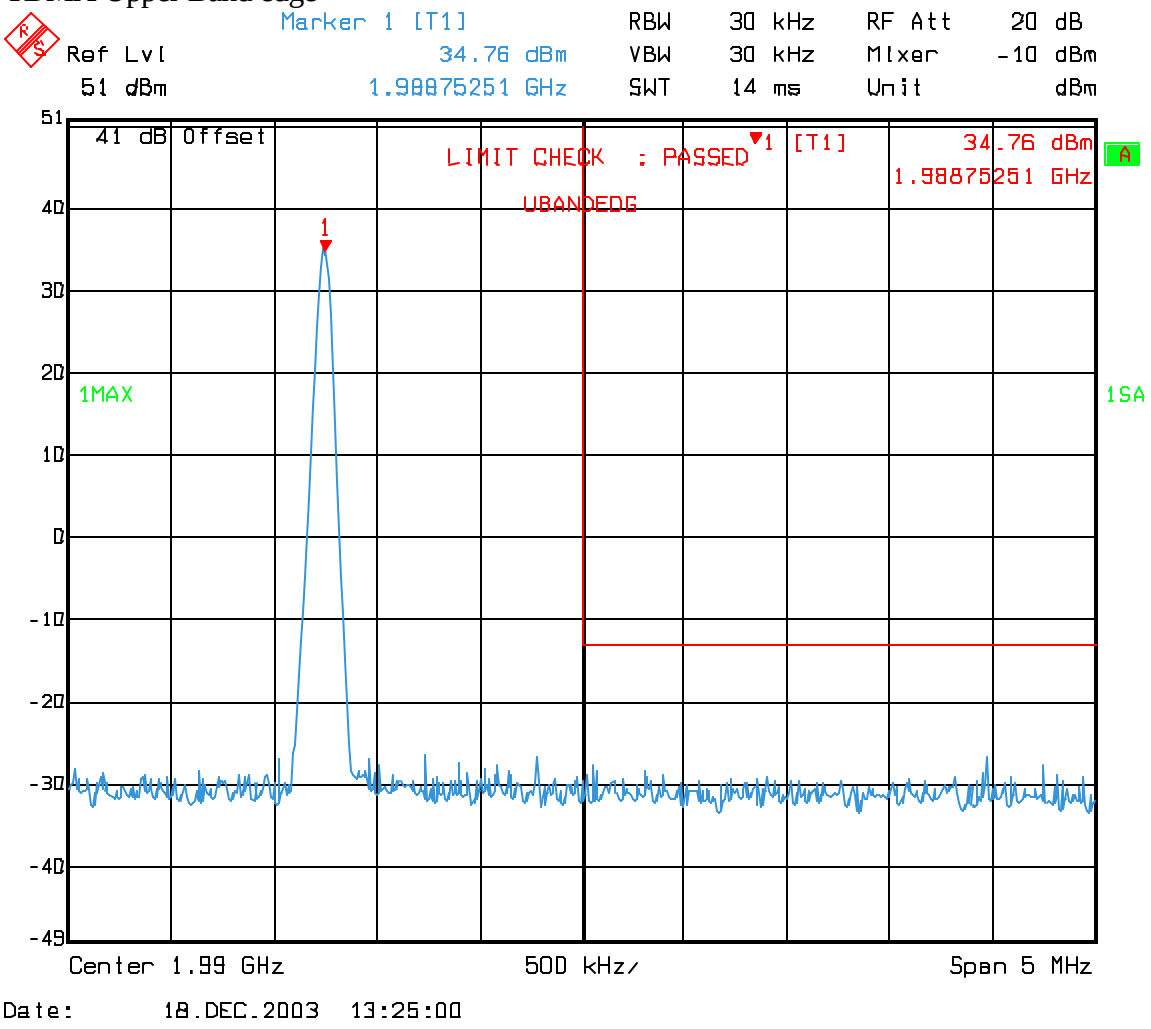

Delta 1 [T1]
-0.17 dB
129.25851703 kHz
RBW 30 kHz
VBW 30 kHz
SWT 5 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
Ref Lvl
51 dBm
41 dB Offset
1 [T1] 6.26 dBm
1.93493217 GHz
1 [T1] -0.17 dB
129.25851703 kHz
1MAX
1MA
D1 5.96 dBm
51
40
30
20
10
0
-10
-20
-30
-40
-49
Center 1.934998 GHz
30 kHz/
Span 300 kHz
Date: 17.DEC.2003 15:58:57

Band Edge

TDMA Lower Band edge

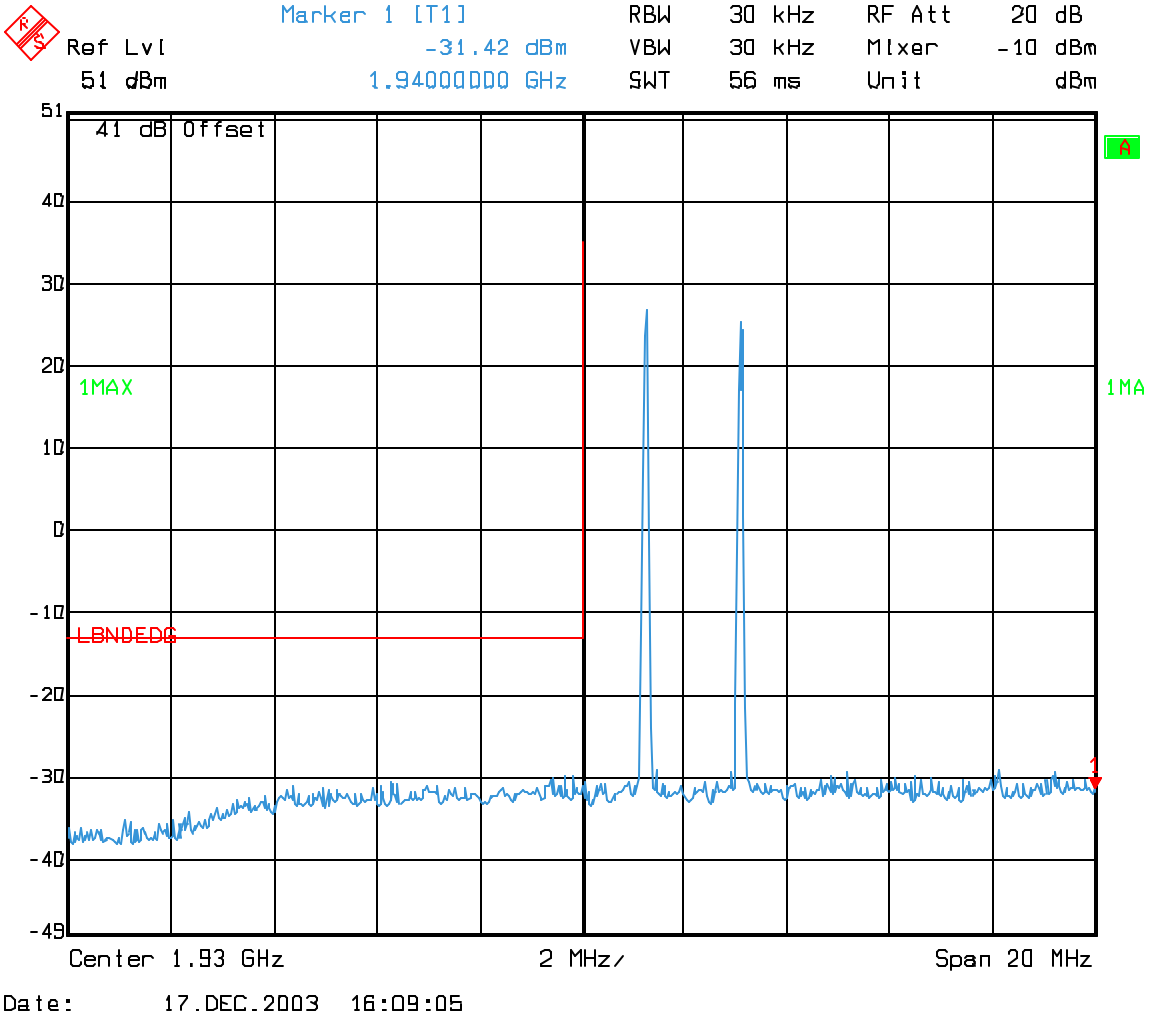


TDMA Upper Band edge

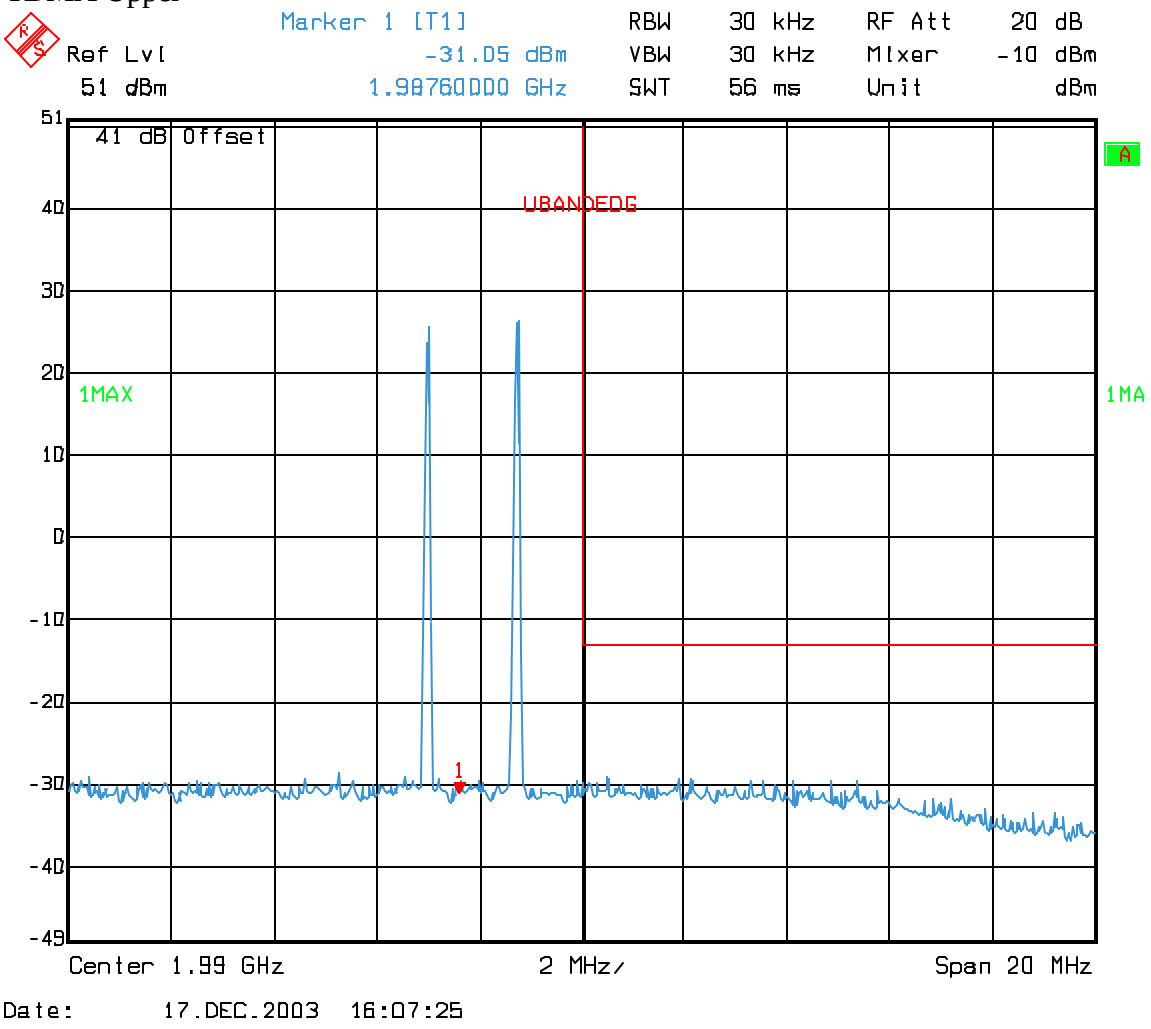


Intermodulation

TDMA Lower



TDMA Upper


Marker 1 [T1]
-31.05 dBm
1.98760000 GHz
RBW 30 kHz
VBW 30 kHz
SWT 56 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
Ref Lvl
51 dBm
41 dB Offset
UBANDEDG
1MAX
1MA
A
51
40
30
20
10
0
-10
-20
-30
-40
-49
Center 1.99 GHz
2 MHz/
Span 20 MHz
Date: 17.DEC.2003 16:07:25

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: Dustin Oaks	DATE: 12/17/2003

Test Results: Complies.

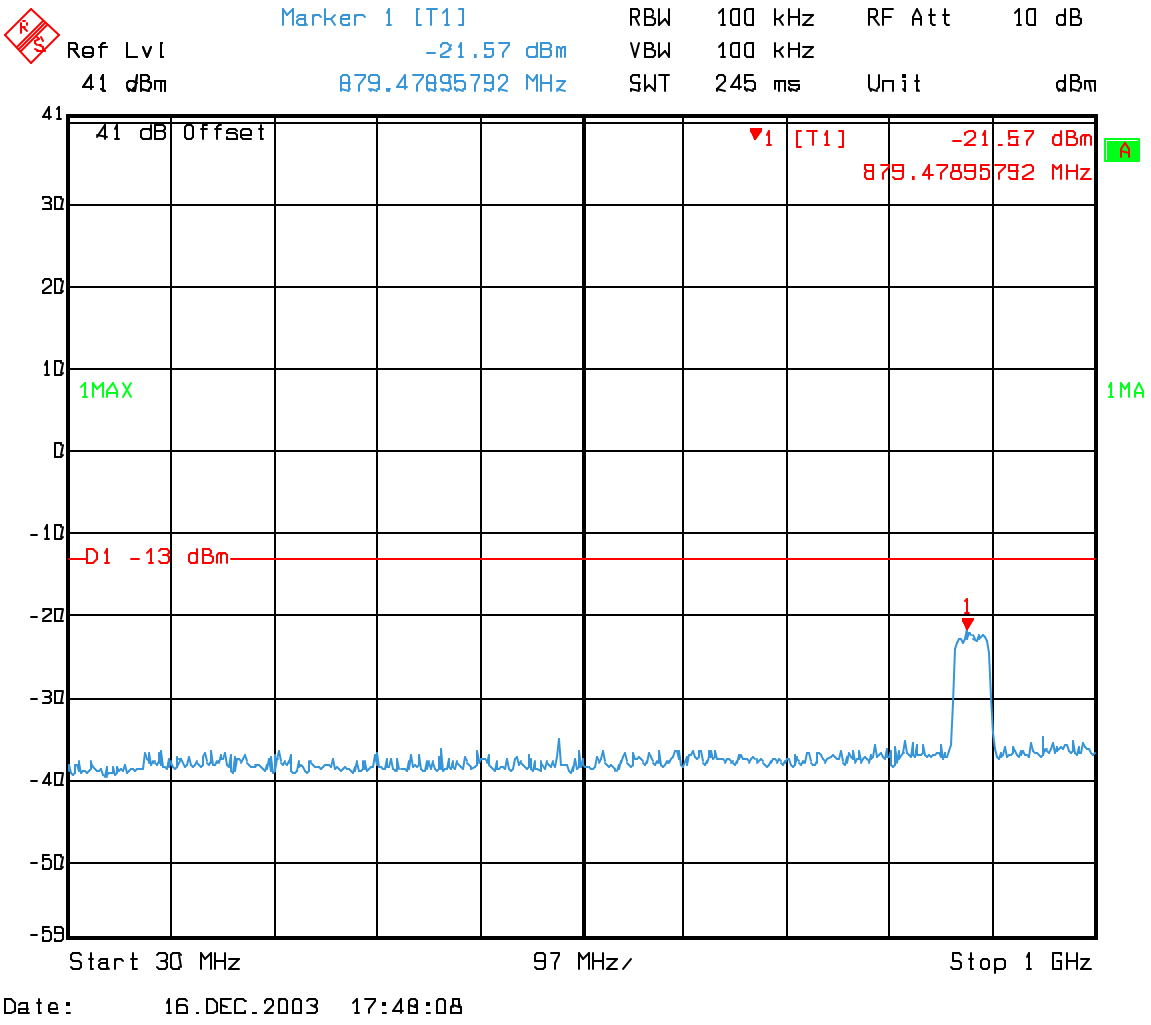
Test Data: See attached plot(s).

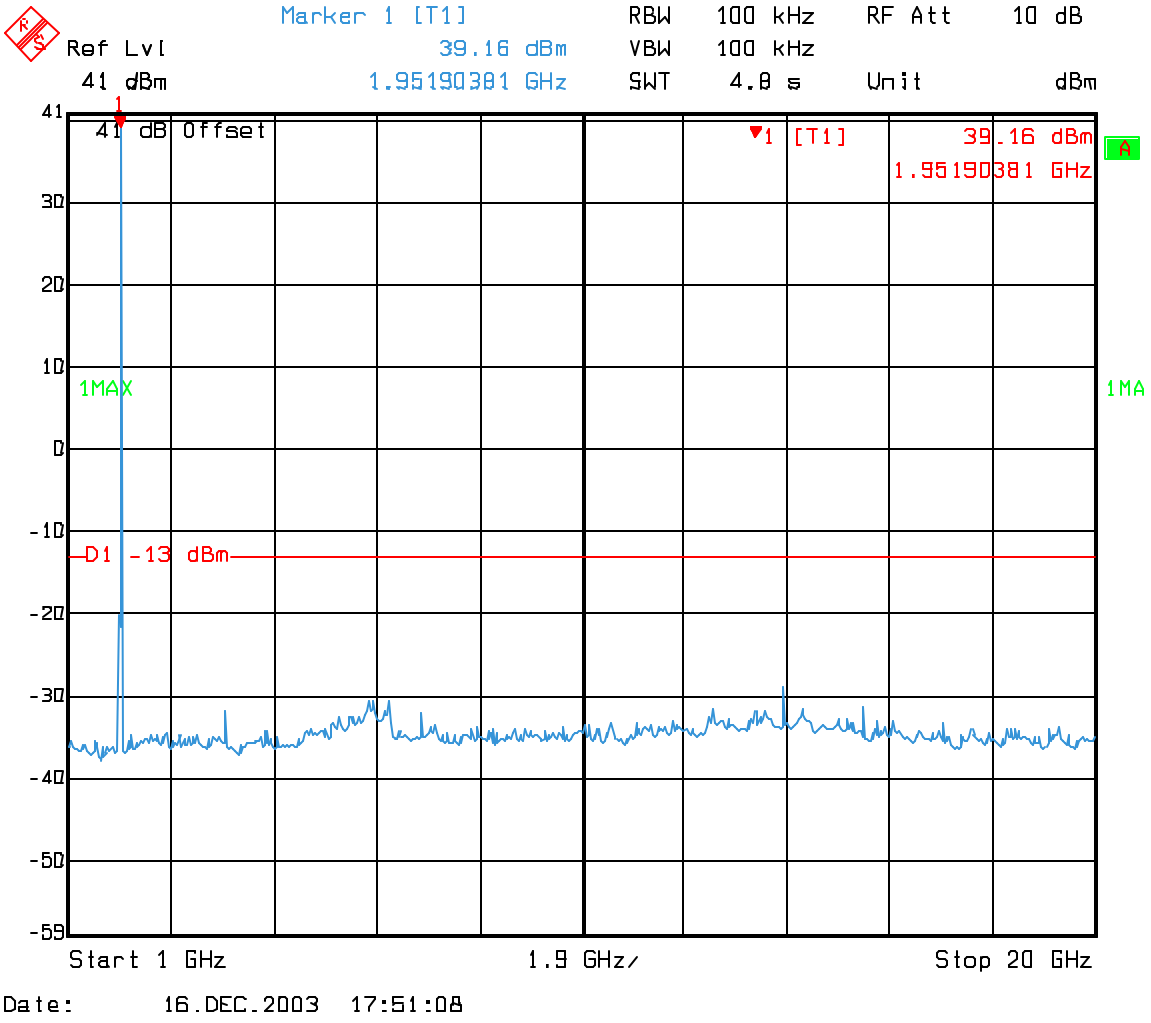
Equipment Used: 1036, 1625, 1629, 1604, 1474, 1053

Measurement Uncertainty: +/- 1.6 dB

Temperature: 21 ?C

Relative Humidity: 51 %


Marker 1 [T1]
Ref Lvl
41 dBm
-21.57 dBm
879.47895792 MHz
RBW 100 kHz
VBW 100 kHz
SWT 245 ms
RF Att 10 dB
Unit dBm
41 dB Offset
1 [T1]
-21.57 dBm
879.47895792 MHz
1MAX
1MA
D1 -13 dBm
Start 30 MHz
97 MHz/
Stop 1 GHz
Date: 16.DEC.2003 17:48:08


Marker 1 [T1]
RBW 100 kHz
RF Att 10 dB
Ref Lvl
39.16 dBm
VBW 100 kHz
41 dBm
1.95190381 GHz
SWT 4.8 s
Unit dBm
41 dB Offset
1 [T1]
39.16 dBm
1.95190381 GHz
1MAX
1MA
D1 -13 dBm
Start 1 GHz
1.9 GHz/
Stop 20 GHz
Date: 16.DEC.2003 17:51:08

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1051
TESTED BY: Dustin Oaks	DATE: 12/18/2003

Test Results: Complies.

Test Data:

No Emissions found within 20dB of Limit. Noise from was greater than 20dB below limit. Frequency range scanned from 30MHz to 20GHz

Equipment Used: 1016, 1484, 1485, 1304, 791, 1480

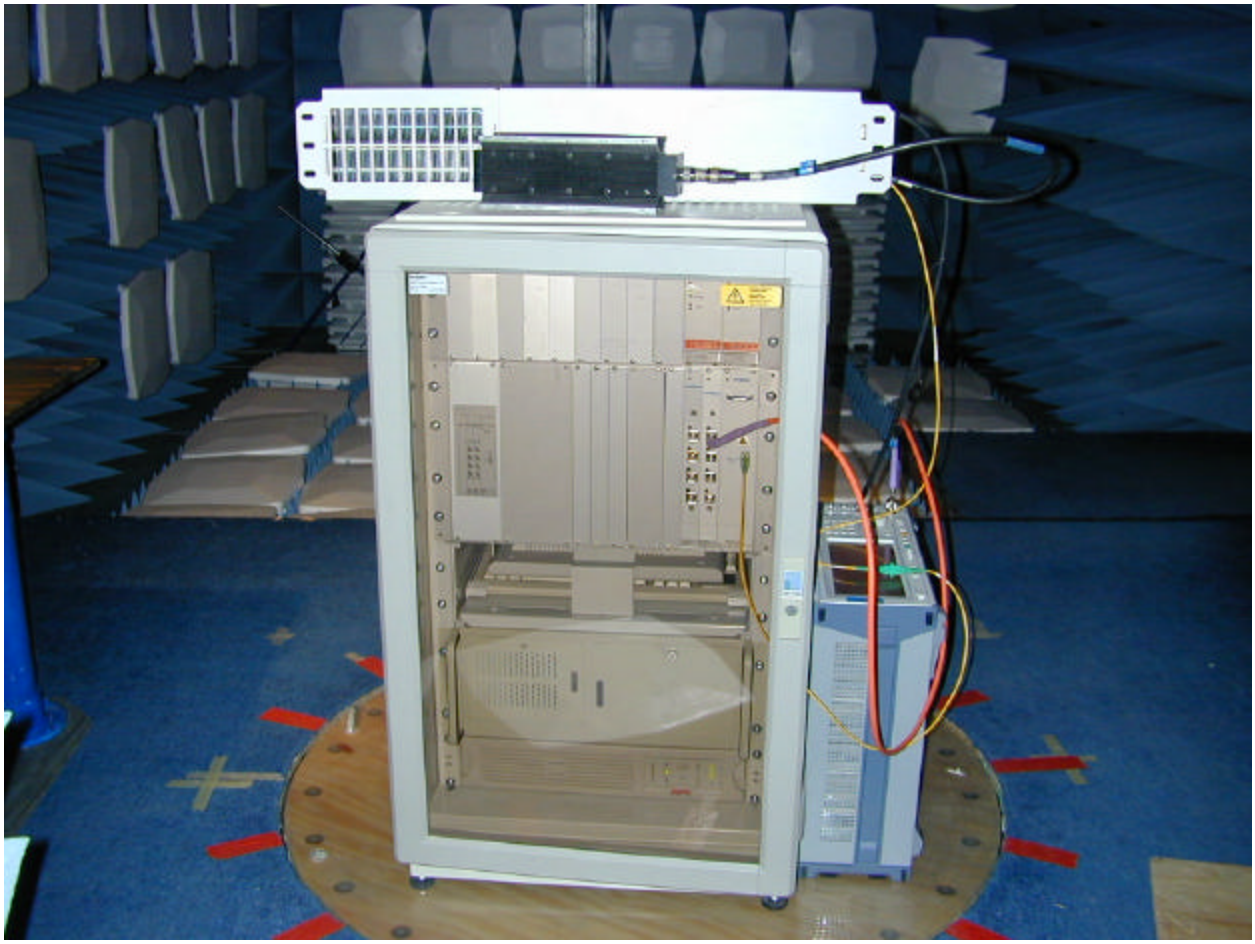
Measurement Uncertainty: +/- 6 dB

Temperature: 21 ?C

Relative Humidity: 51 %

Photographs of Test Setup

FRONT VIEW



REAR VIEW

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY:	DATE:

Test Results: Not Applicable

Measurement Data: See attached table.

Standard Test Frequency: MHz
Standard Test Voltage:

Equipment Used:

Measurement Uncertainty: +/- 1.6 dB

Lab Temperature: ?C

Relative Humidity: %

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01	12/19/03
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/11/03	02/11/05
1625	CABLE, 18 ft	MEGAPHASE 10311 1GVT4	N/A	03/05/03	03/04/04
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A
1474	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W2	NONE	CBU	N/A
1053	SIGNAL GENERATOR	ROHDE & SCHWARZ SMIQ 03	DE22081	06/10/03	06/09/04
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	08/28/03	08/28/04
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/24/03	07/23/04
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/24/03	07/23/04
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
791	PREAMP, 25dB	ICC LNA25	398	10/27/03	10/26/04
1480	Bilog Antenna	Schaffner-Chase CBL6111C	2572	CalNotReq	N/A

Section 8. Test Equipment List

ANNEX A - TEST DETAILS

NAME OF TEST: RF Power Output	**PARA. NO.: 2.1046**

Minimum Standard: Para. No.24.232. Base stations are limited to 1640 watts peak E.I.R.P. with an antenna height up to 300 meters HAAT. In no case may the peak output power of a base station transmitter exceed 100 watts.

Method Of Measurement:

Detachable Antenna:
The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:
If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation GP/4? $R^2 = E^2/120$? and proceeding as follows:

$$P ? \frac{E^2 R^2}{30G} ? \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts
E = the maximum measured field strength in V/m
R = the measurement range (3 meters)
G = the numeric gain of the transmit antenna in relation to an isotropic radiator

NAME OF TEST: Occupied Bandwidth	**PARA. NO.: 2.1047**

Minimum Standard: Para. No. 24.238(b). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB.

Method Of Measurement:

CDMA

Spectrum analyzer settings:
RBW: 30 kHz
VBW: ? RBW
Span: 5 MHz
Sweep: Auto
Mask: Set markers to -26 dB from peak of CW.

GSM

RBW: 3 kHz
VBW: ? RBW
Span: 2 MHz
Sweep: Auto
Mask: Set markers to -26 dB from peak of CW.

NADC

RBW: 1 kHz
VBW: ? RBW
Span: 1 MHz
Sweep: Auto
Mask: Set markers to -26 dB from peak of CW.

NAME OF TEST: Spurious Emission at Antenna Terminals PARA. NO.: 2.1051

Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least 43 + 10 log (P) dB.

Method Of Measurement:

Spectrum analyzer settings:

CDMA

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 30 kHz (< 1MHz from Band Edge)
VBW: ? RBW
Sweep: Auto
Video Avg: 6 Sweeps

GSM

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: ? RBW
Sweep: Auto
Video Avg: Disabled

NADC

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: ? RBW
Sweep: Auto
Video Avg: Disabled

To demonstrate compliance at band edges the frequency of the input signal is set to the bwest and highest assigned channel and the center frequency of the spectrum analyzer is set to the upper and lower edges of the appropriate frequency block.

NAME OF TEST: Field Strength of Spurious Radiation	**PARA. NO.: 2.1053**

Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least 43 + 10 log (P) dB.

Calculation Of Field Strength Limit

An example of attenuation requirement of 43 + 10 Log P is equivalent to -13 dBm (5×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$GP/4?R^2 = E^2/120?$

For emissions ? 1 GHz:

G = 1.64 (Dipole Gain)
$P = 10^{-5}$ Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E ? \frac{\sqrt{30GP}}{R}$$

$$E ? \frac{\sqrt{30 \times 1.64 \times 5 \times 10^{?5}}}{3} ? \ 0.016533 \text{ V / m} ? 84.4 \text{ dB?V / m}$$

For emissions > 1 GHz:

G = 1 (Isotropic Gain)
$P = 1 \times 10^{-5}$ Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E ? 84.4 ? 20Log\sqrt{1.64} ? 82.3dB?V / m@3m$$

NAME OF TEST: Frequency Stability	**PARA. NO.: 2.1055**

Minimum Standard: Para. No. 24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Method Of Measurement:

Frequency Stability With Voltage Variation

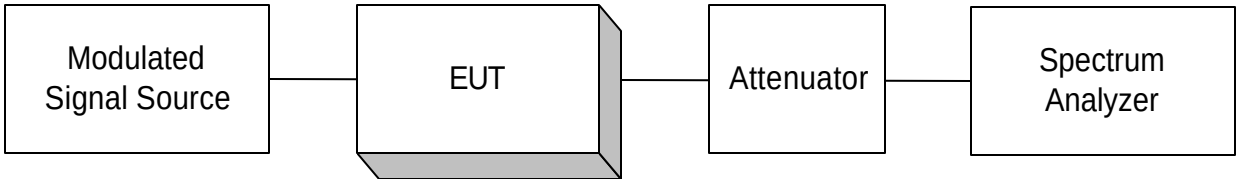
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the signal generator. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation

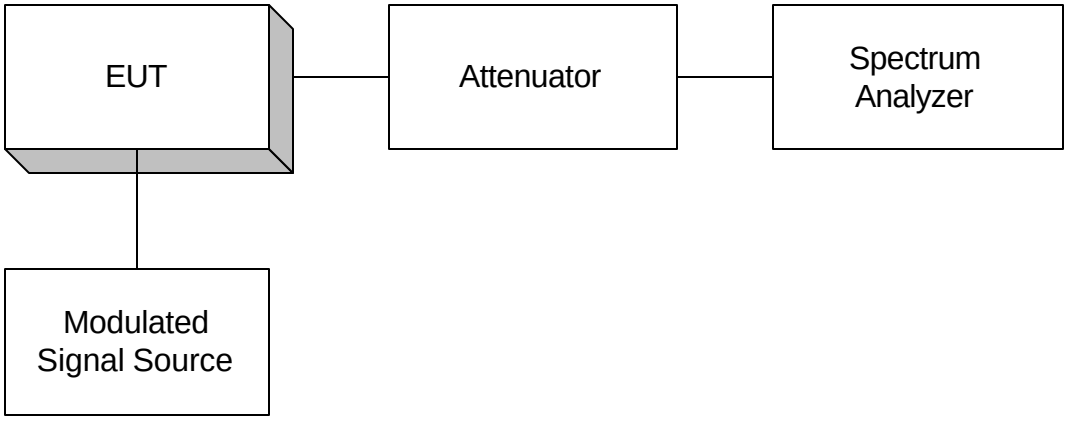
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

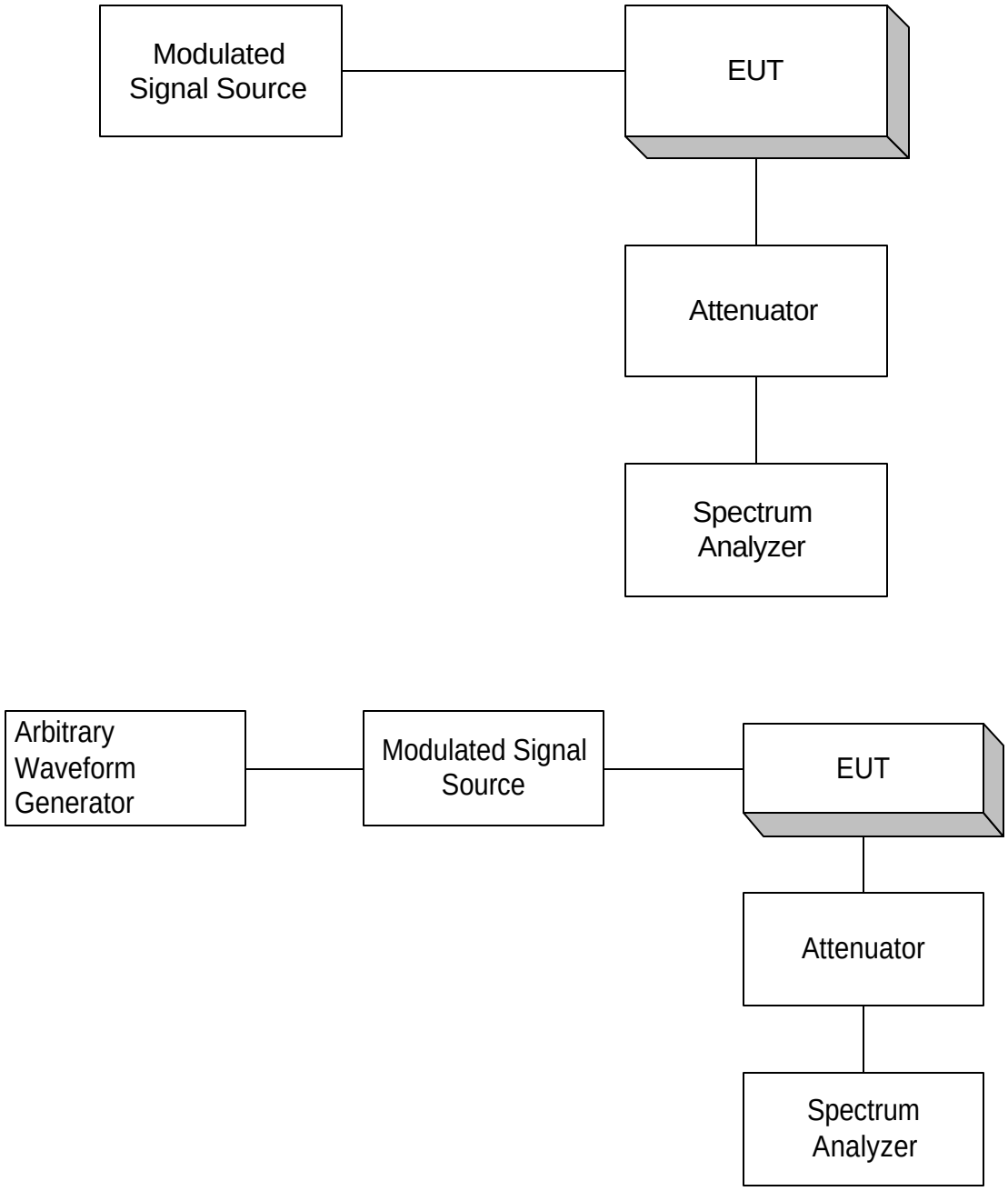
Para. No. 2.985 - R.F. Power Output



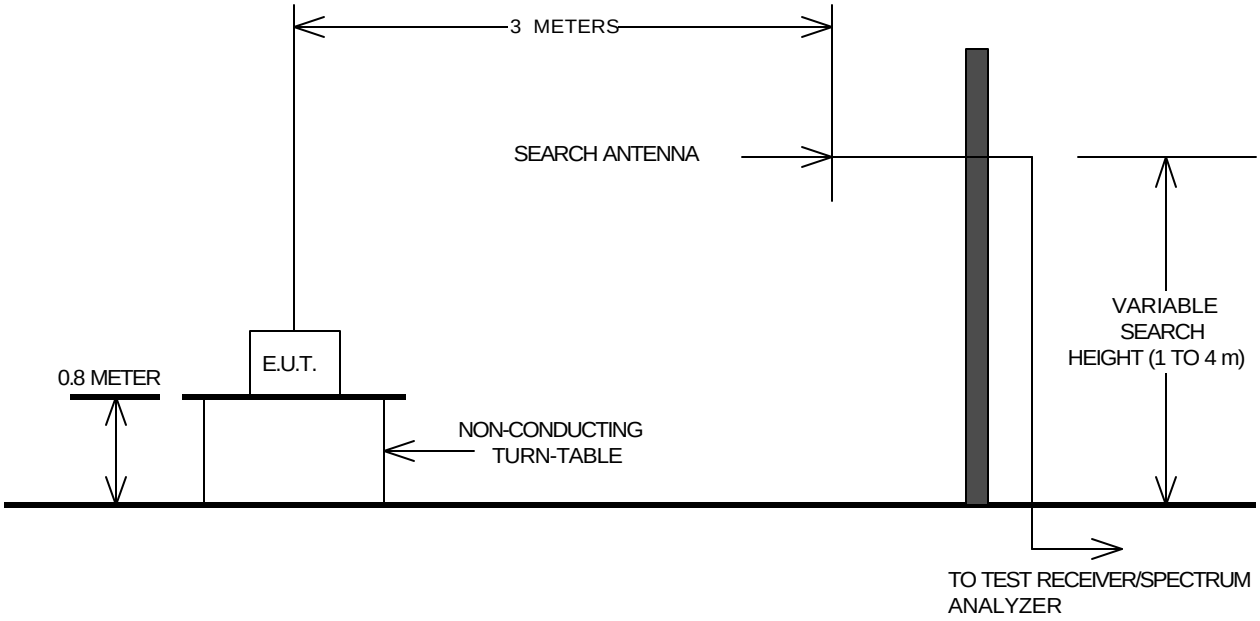
Para. No. 2.989 - Occupied Bandwidth



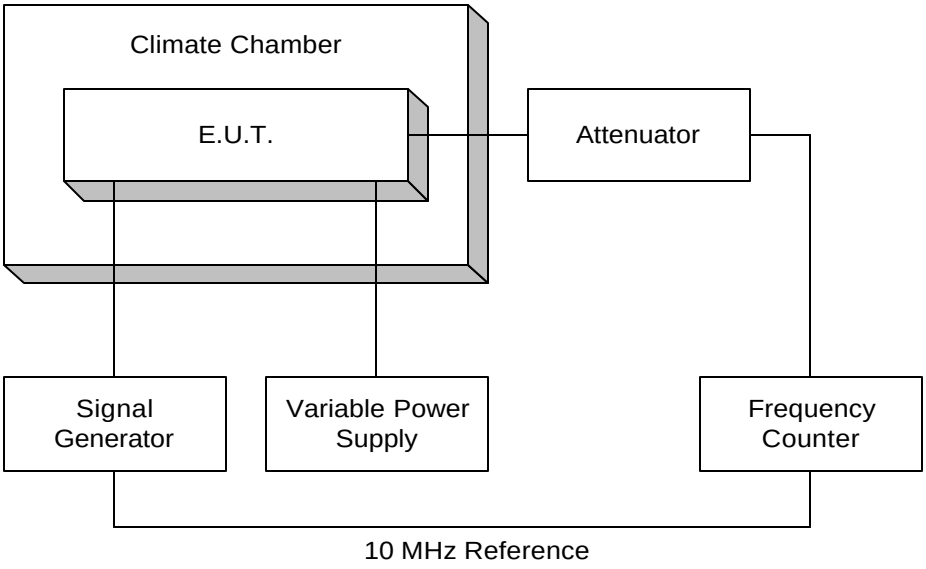
Para. No. 2.991 Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability


Climate Chamber
E.U.T.
Attenuator
Signal Generator
Variable Power Supply
Frequency Counter
10 MHz Reference