Nemko Test Report No.:	3L0496RUS1
Applicant:	Andrew Corporation
Equipment Under Test:	Node C 1943
FCC ID:	BCR-RPT-NODEC1943
In Accordance With:	**FCC Part 24, Subpart E** Broadband PCS Repeaters
Tested By:	Nemko Dallas Inc. 802 N. Kealy Lewisville, Texas 75057-3136
Authorized By:	Tom Tidwell, Frontline Manager
Date:	3/11/04
Total Number of Pages:	44

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Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: Node C 1943

Serial No.: 13

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	17.82W	Complies
Occupied Bandwidth (CDMA)	24.238	Input/Output	Complies	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	Complies	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	Complies	Complies
Frequency Stability	24.235		NA	NA

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:		120 VAC
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 Range:	**1930.75 – 1989.35 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
	Frequency Range:	1850.75 – 1909.35 MHz
		CDMA (F9W) ☒ **GSM (GXW)** ☐ **NADC (DXW)** ☐
System Gain:		103dB Downlink 83dB Uplink
Output Impedance:		50 ohms
Max Input:		-60 dBm +23 dBm
		+43 dBm 1 CDMA Carrier +37 dBm 4 CDMA Carriers
Band Selection:		**F1-F1** ☐ **F1-F2** ☐ **N/A** ☒ **Software** **Duplexer** **Fullband**

	☒	☐	☐

Modifications Made During Testing

No modifications made.

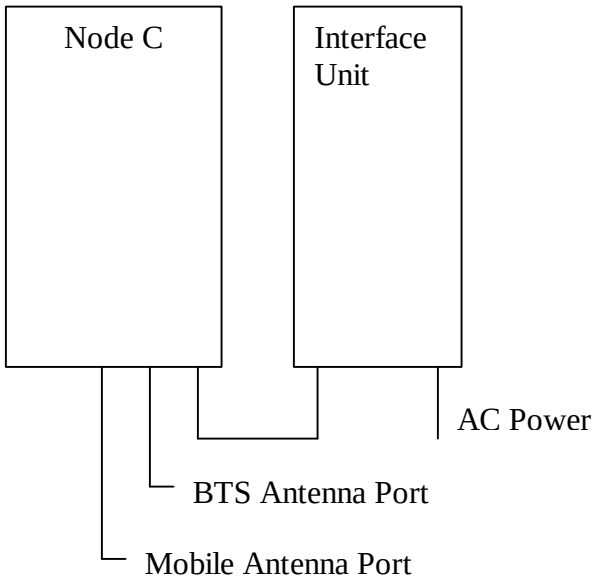
Description of Operation

The Node C is designed to amplify signals between multiple UEs and a Base Tranceiver Station in a CDMA system. The unit consists of a filter and amplifier chain in the downlink and one or two filters and amplifier chains in the uplink (primary and diversity). The uplink and downlink paths are connected via a duplexer on both ends of each path.

In the primary uplink path, a signal originating from the UE is separated from the downlink signal via the primary UL IN duplexer. It is then amplified by an integrated low noise amplifier (LNA) and forwarded to the uplink Digital Channel Module (DCM). The DCM down-converts the signal to base-band, digitally filters it, amplifies it and then up-converts it. In addition the interference cancellation technology is implemented in the DCM. Finally, the signal is sent to the final amplifier and combined with the downlink input signal in the DL IN duplexer. The optional diversity uplink path (via a second filter) is identical except signals enter via the diversity UL IN duplexer and are combined in the DCM with the primary path.

In the downlink path, a signal originating from the Base Tranceiver Station is separated from the uplink signal in the DL IN duplexer. It is then amplified by an integrated low noise amplifier (LNA) and forwarded to the downlink digital channel module (DCM). The DCM down-converts the signal to base-band, digitally filters it amplifies it and then up-converts it. In addition the interference cancellation technology is implemented in the DCM. Finally, the signal is sent to the final amplifier and combined with the uplink input signal in the primary UL IN duplexer. The downlink DCM is also responsible for communication and control of the entire unit.

System Diagram



Section 3. RF Power Output

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

Test Results: Complies.

Measurement Data:

	Modulation Type	Measured Output Power (dBm)
Uplink	CDMA	22.97
Downlink	CDMA	42.51

Equipment Used: 1036, 1053, 1626, 1629, 1473, 1604

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: 12/12/2003

Test Results: Complies.

Test Data: See attached plot(s).

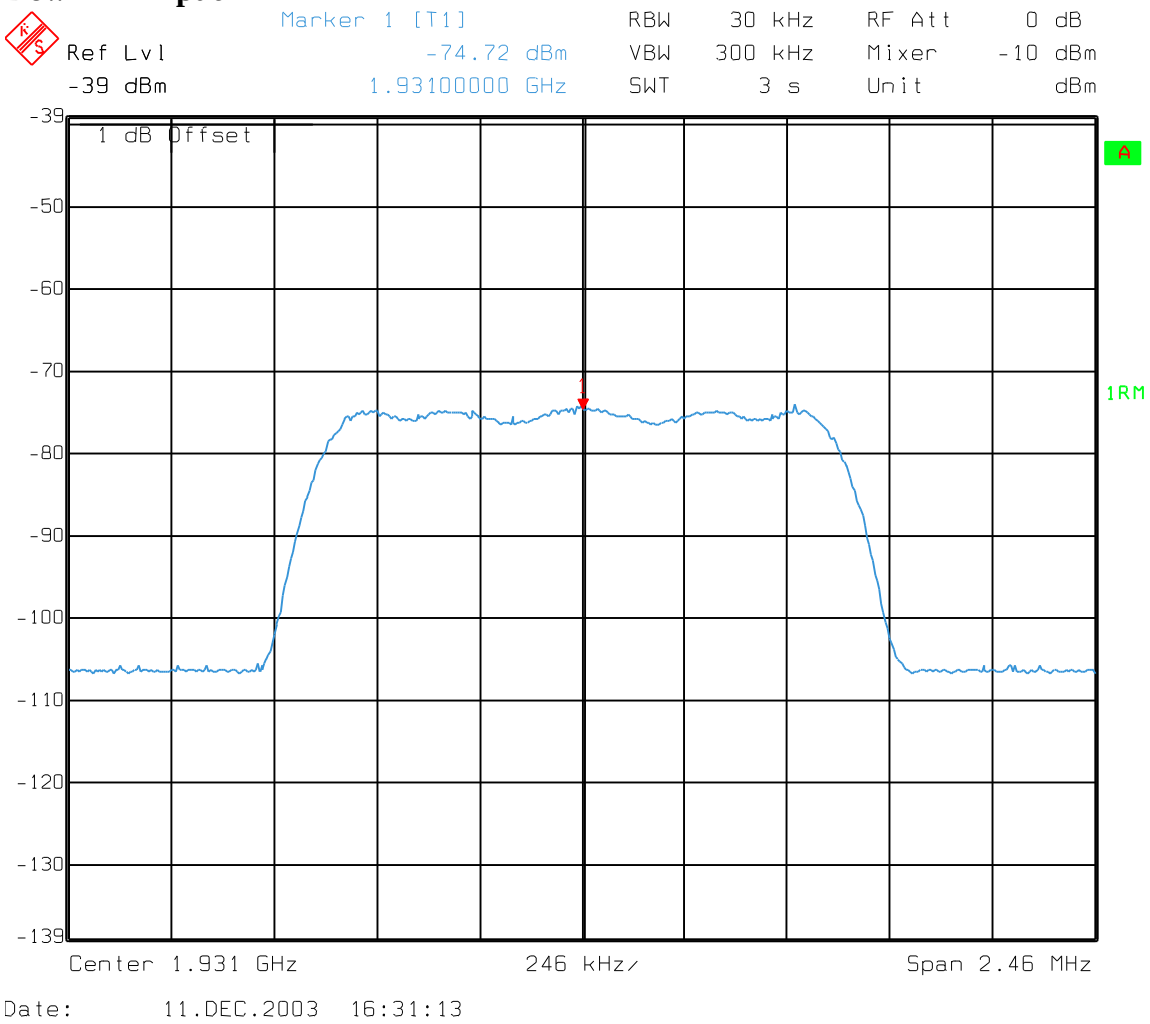
Equipment Used: 1036, 1053, 1626, 1629, 1473, 1604

Measurement Uncertainty: +/- 1.6 dB

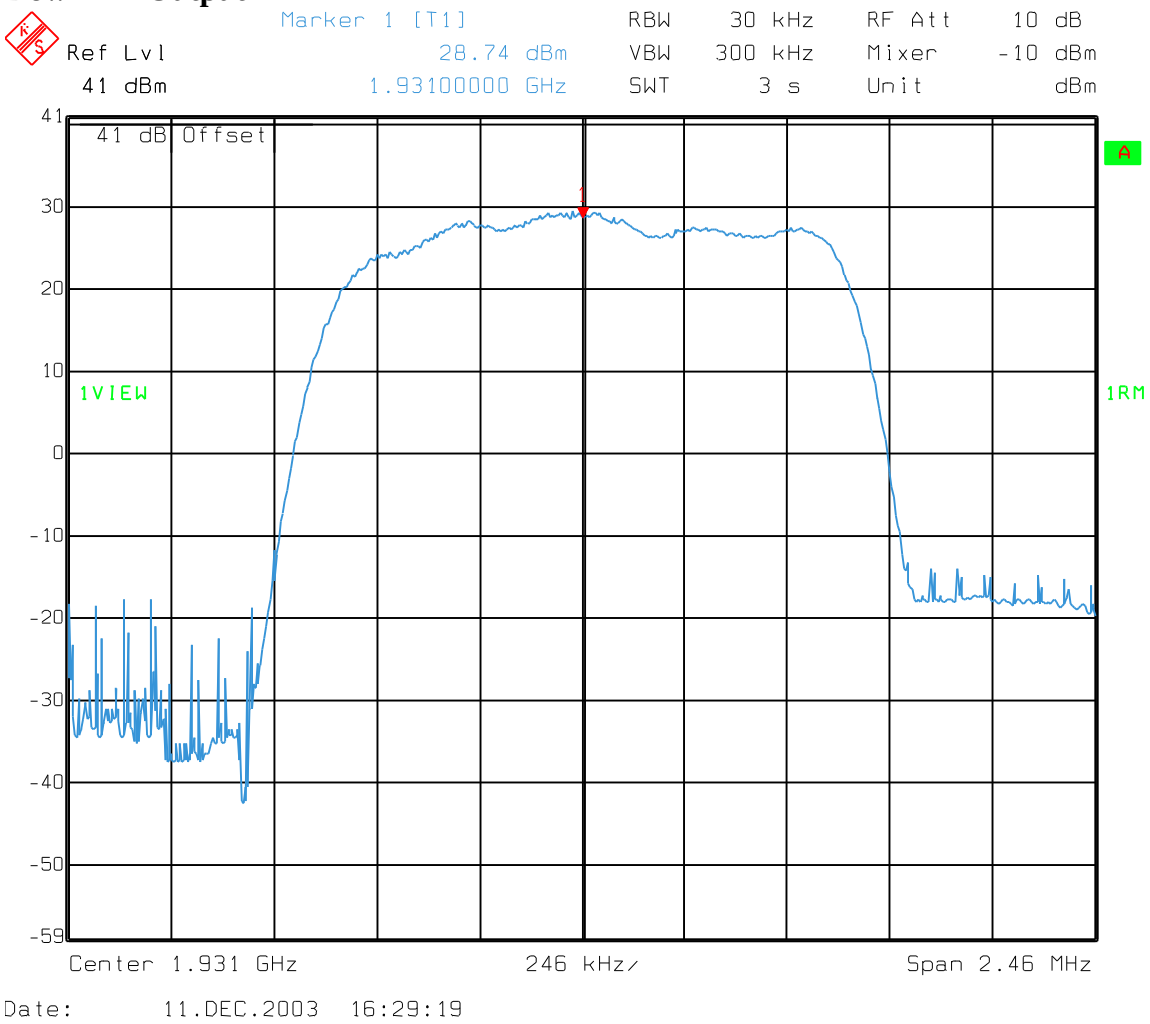
Temperature: 21 °C

Relative Humidity: 51 %

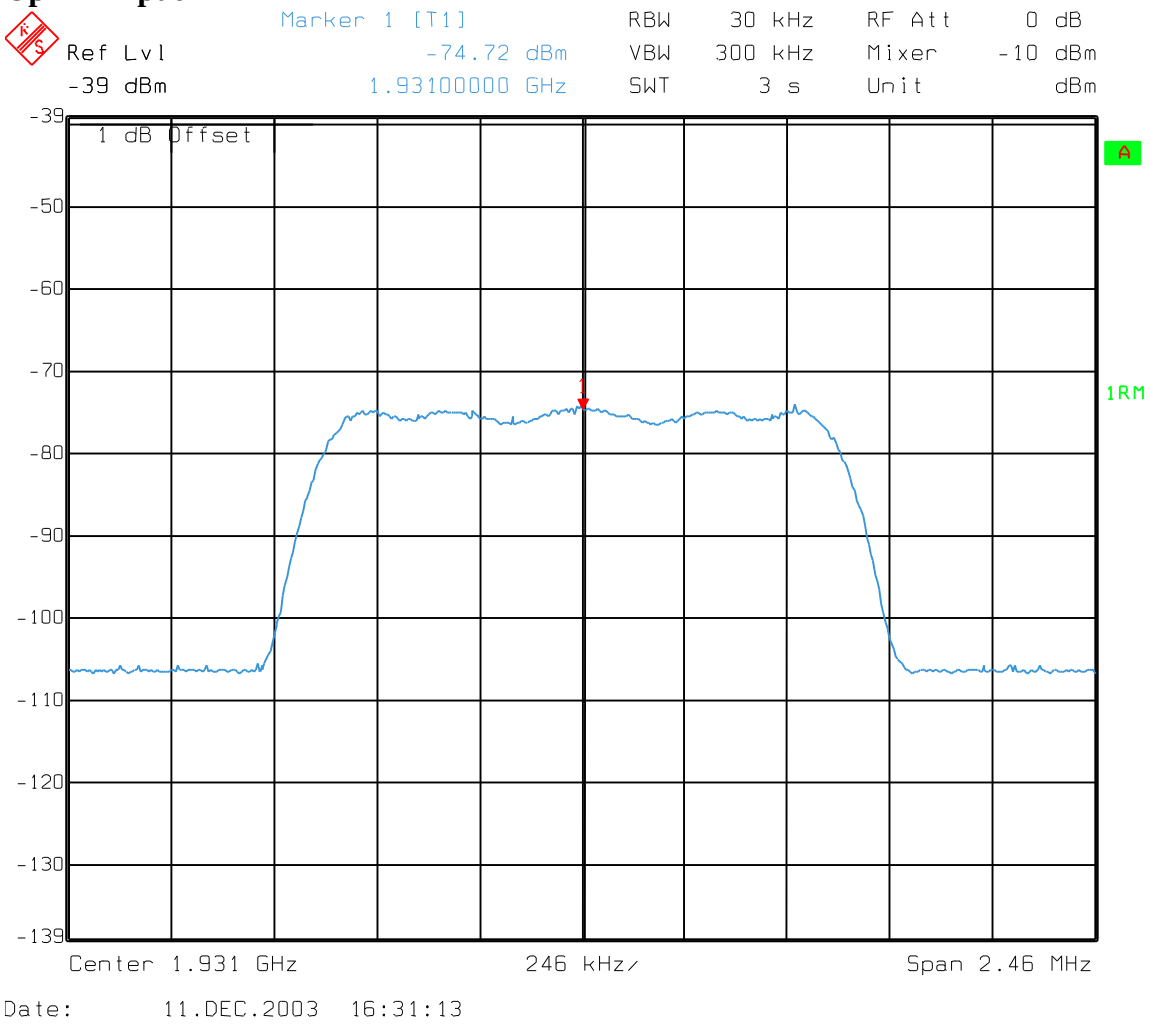
Downlink Input



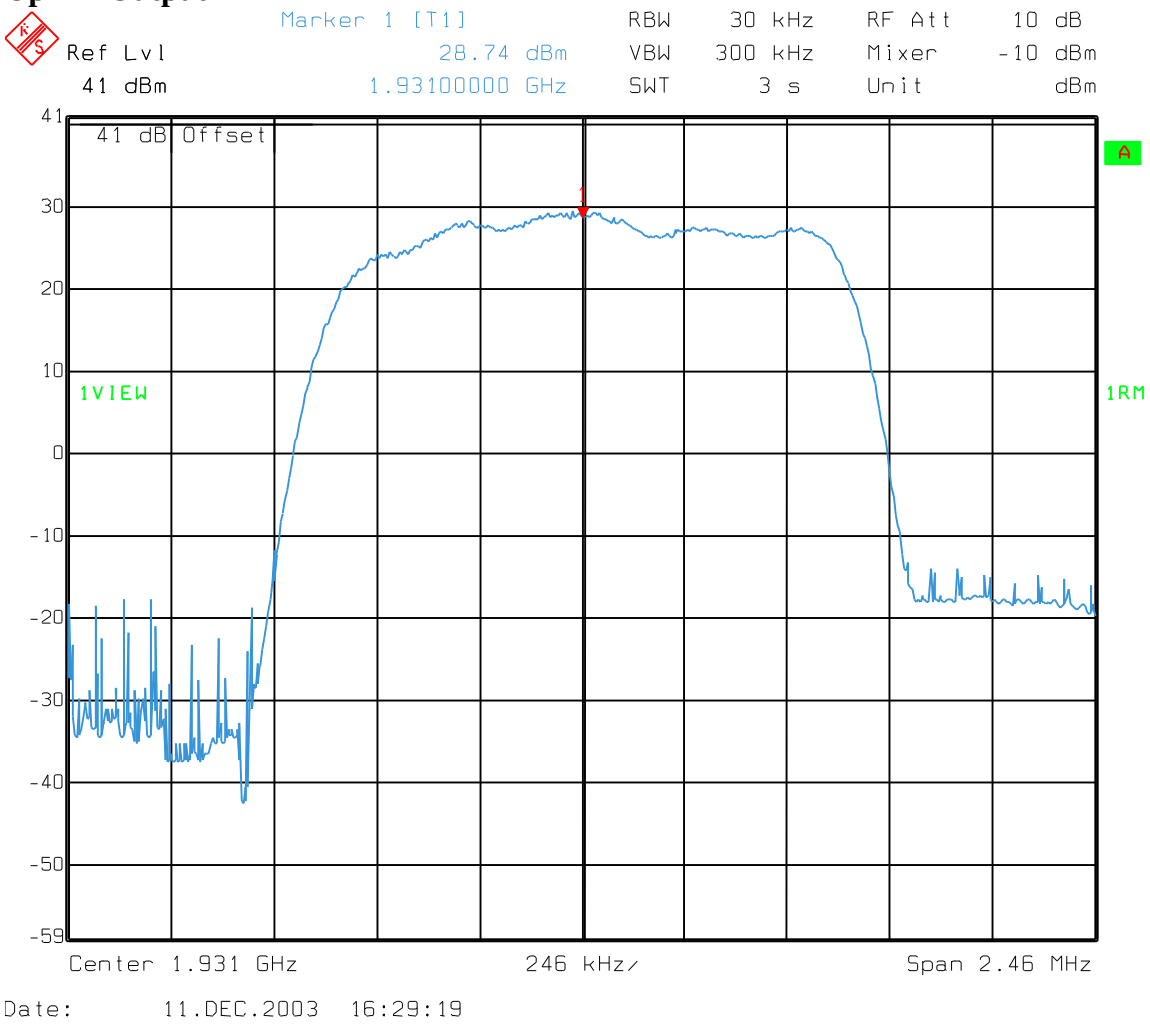
Downlink Output



Uplink Input



Uplink Output



Section 5. Spurious Emissions at Antenna Terminals

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

Test Results: Complies.

Test Data: See attached plot(s).

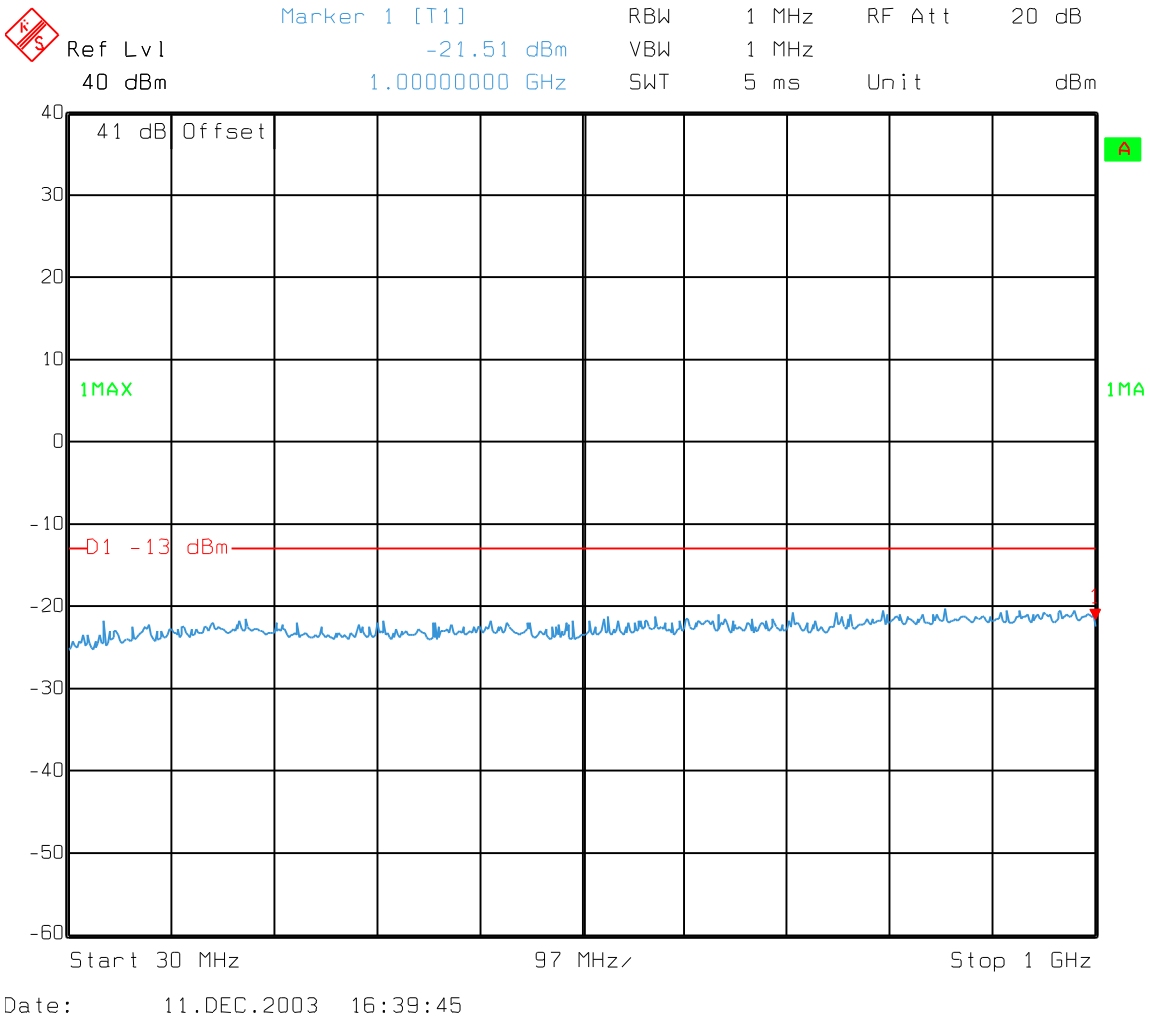
Equipment Used: 1036, 1053, 1626, 1629, 1473, 1604

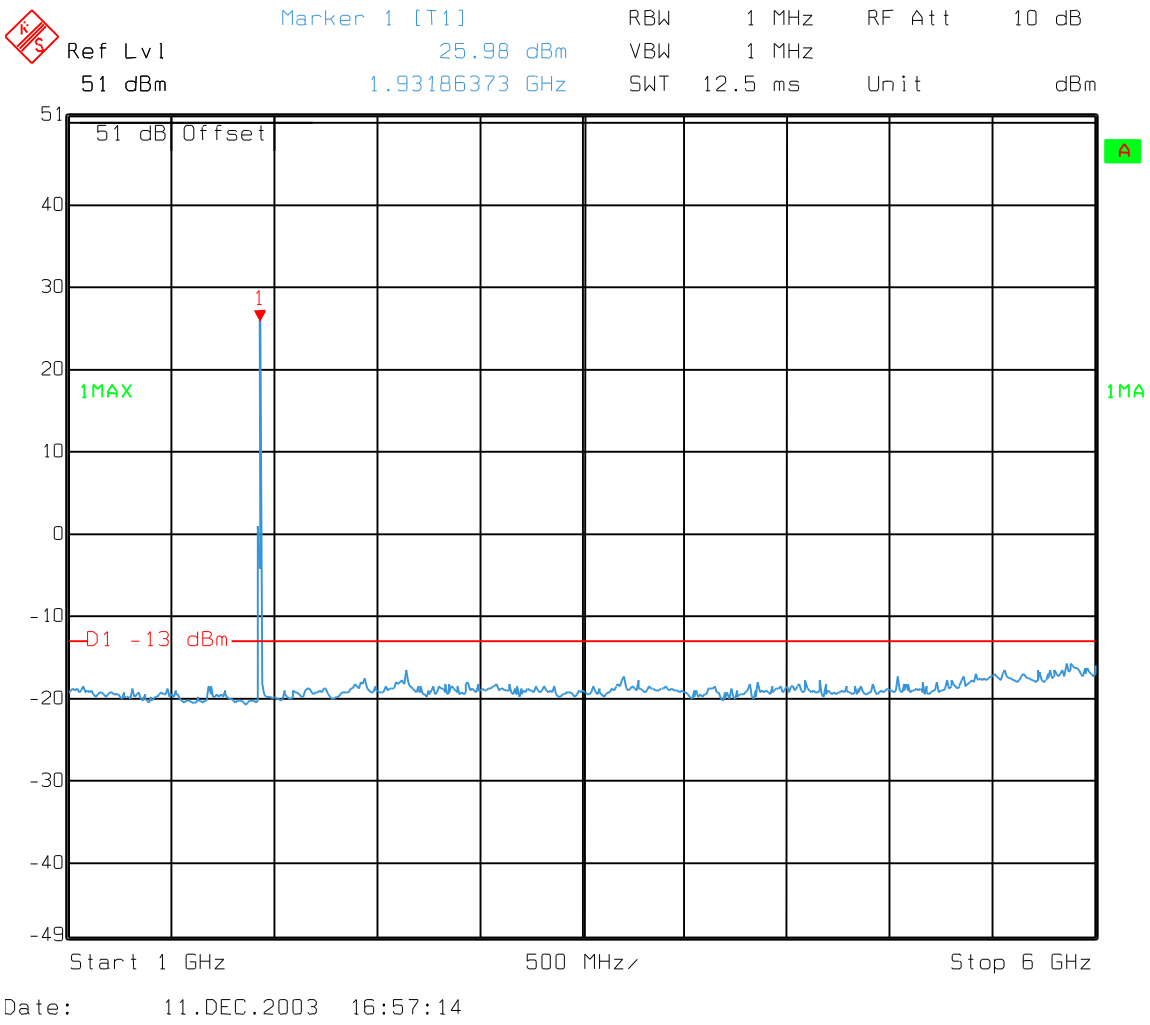
Measurement Uncertainty: +/- 1.6 dB

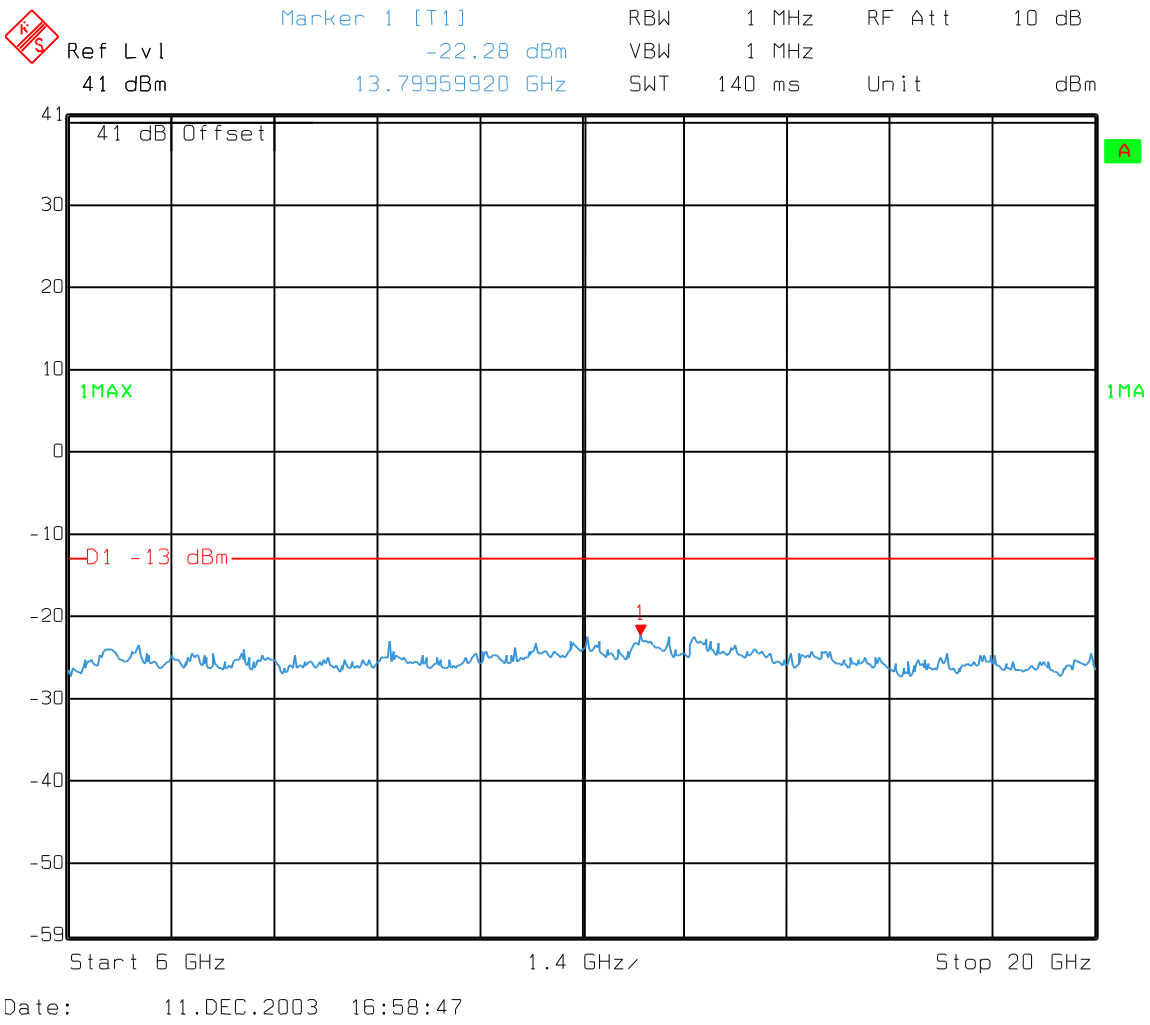
Temperature: 21 °C

Relative Humidity: 51 %

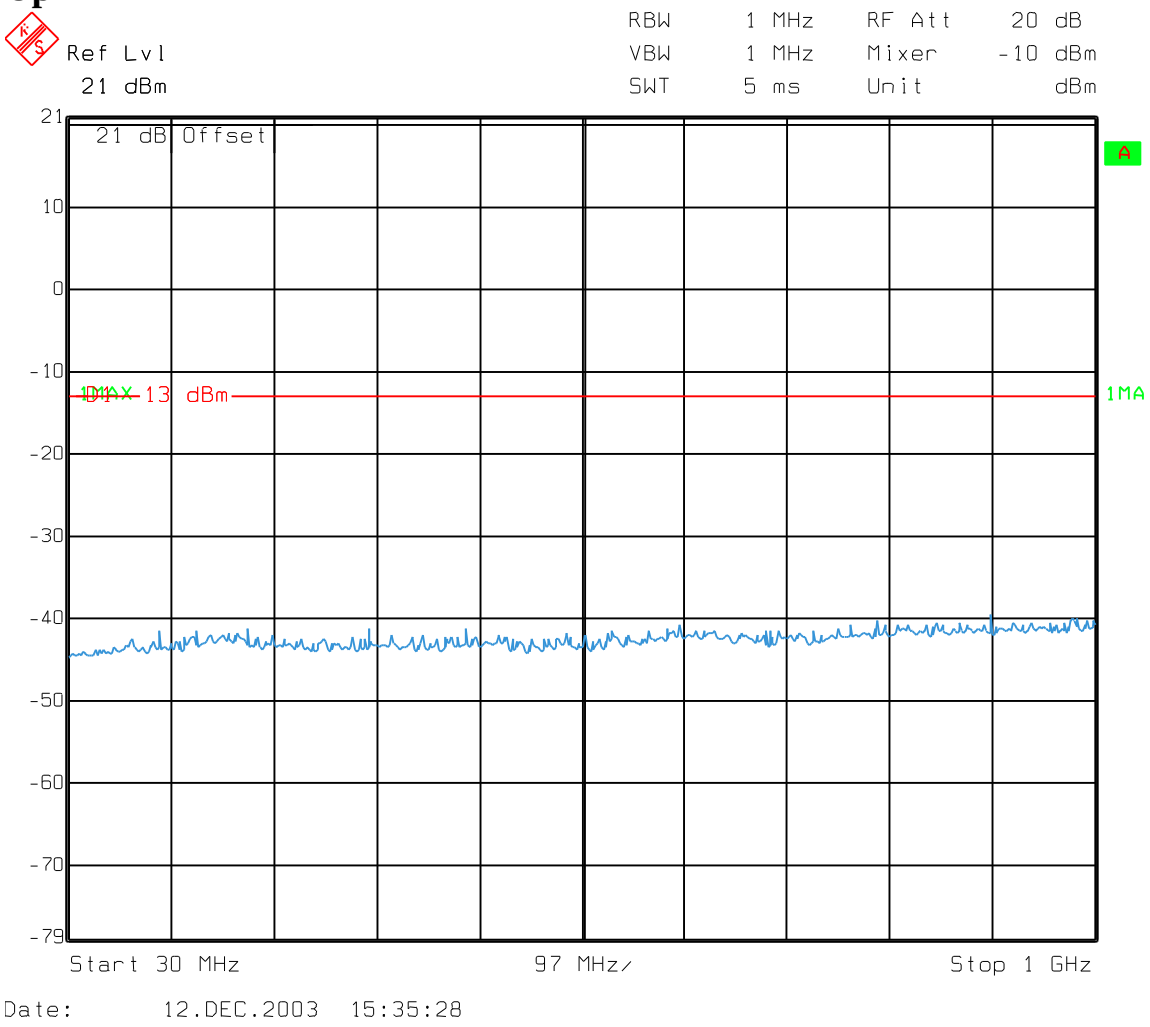
Downlink

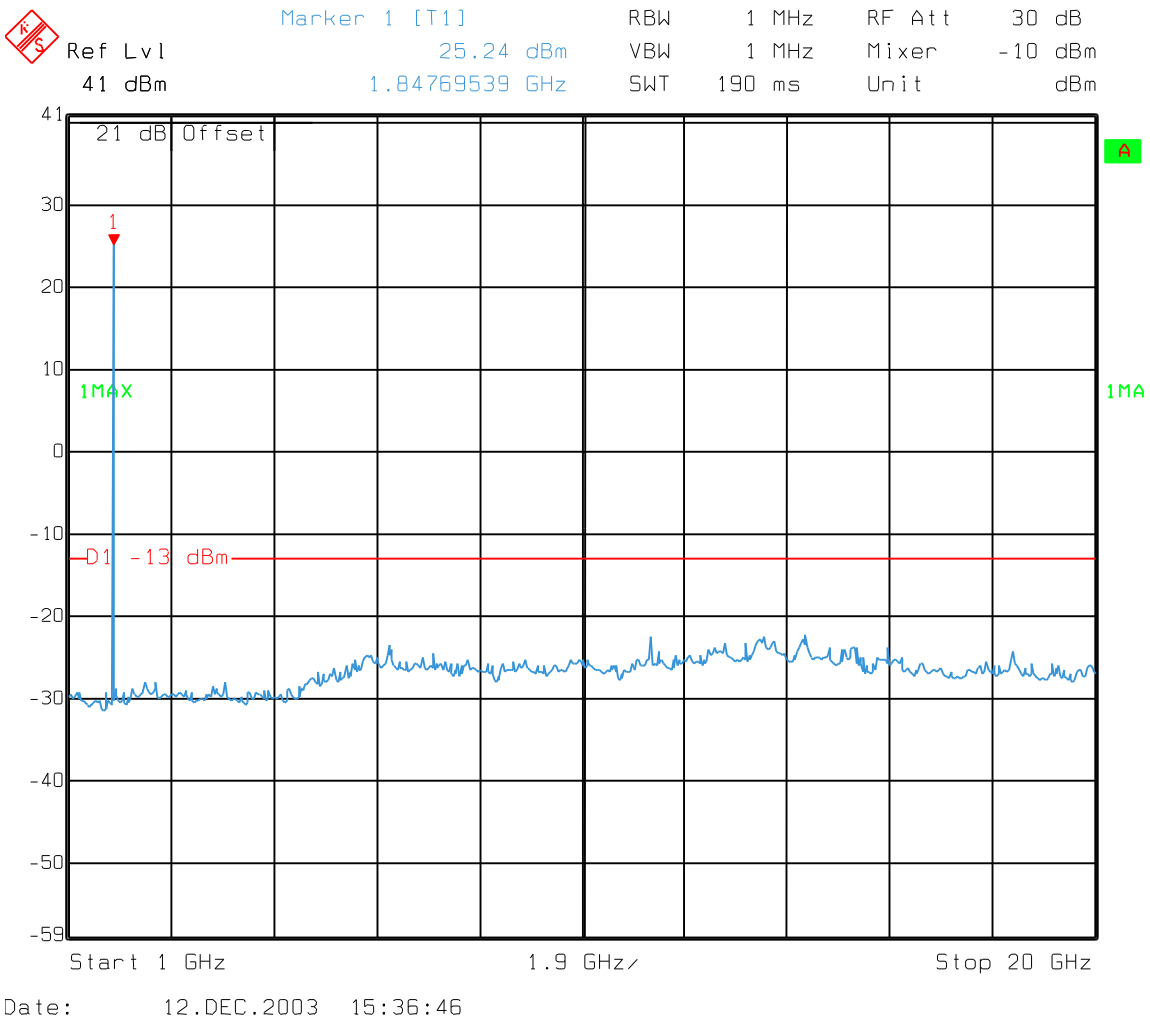

Marker 1 [T1]
-21.51 dBm
1.00000000 GHz
RBW 1 MHz
VBW 1 MHz
SWT 5 ms
RF Att 20 dB
Unit dBm
Ref Lvl
40 dBm
41 dB Offset
1MAX
1MA
A
D1 -13 dBm
40
30
20
10
0
-10
-20
-30
-40
-50
-60
Start 30 MHz
97 MHz/
Stop 1 GHz
Date: 11.DEC.2003 16:39:45


Marker 1 [T1]
Ref Lvl
51 dBm
25.98 dBm
1.93186373 GHz
RBW 1 MHz
VBW 1 MHz
SWT 12.5 ms
RF Att 10 dB
Unit dBm
51 dB Offset
1MAX
1MA
D1 -13 dBm
Start 1 GHz
500 MHz/
Stop 6 GHz
Date: 11.DEC.2003 16:57:14

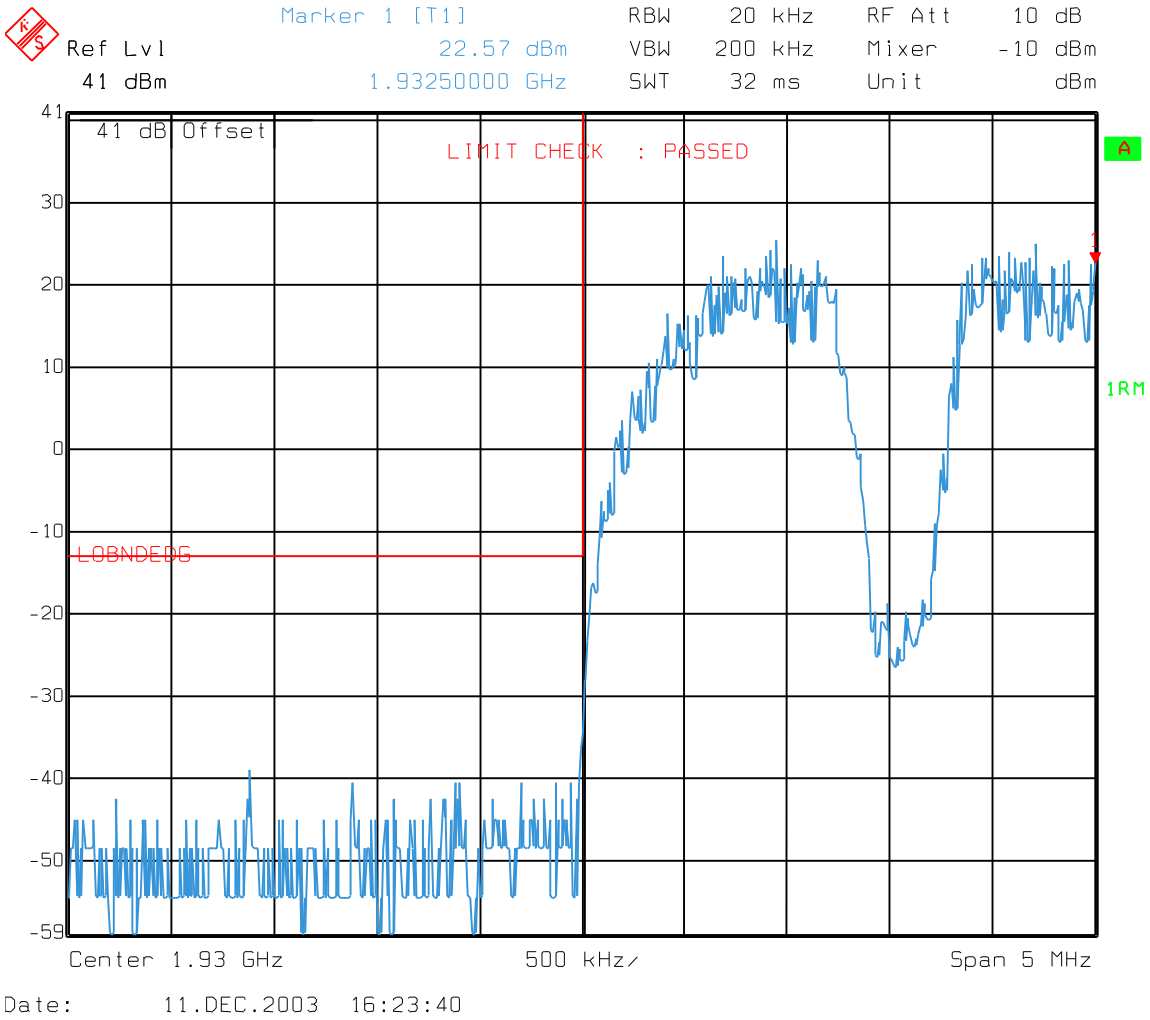

Marker 1 [T1]
Ref Lvl
41 dBm
-22.28 dBm
13.79959920 GHz
RBW 1 MHz
VBW 1 MHz
SWT 140 ms
RF Att 10 dB
Unit dBm
41 dB Offset
1MAX
1MA
D1 -13 dBm
41
30
20
10
0
-10
-20
-30
-40
-50
-59
Start 6 GHz
1.4 GHz/
Stop 20 GHz
Date: 11.DEC.2003 16:58:47

Uplink

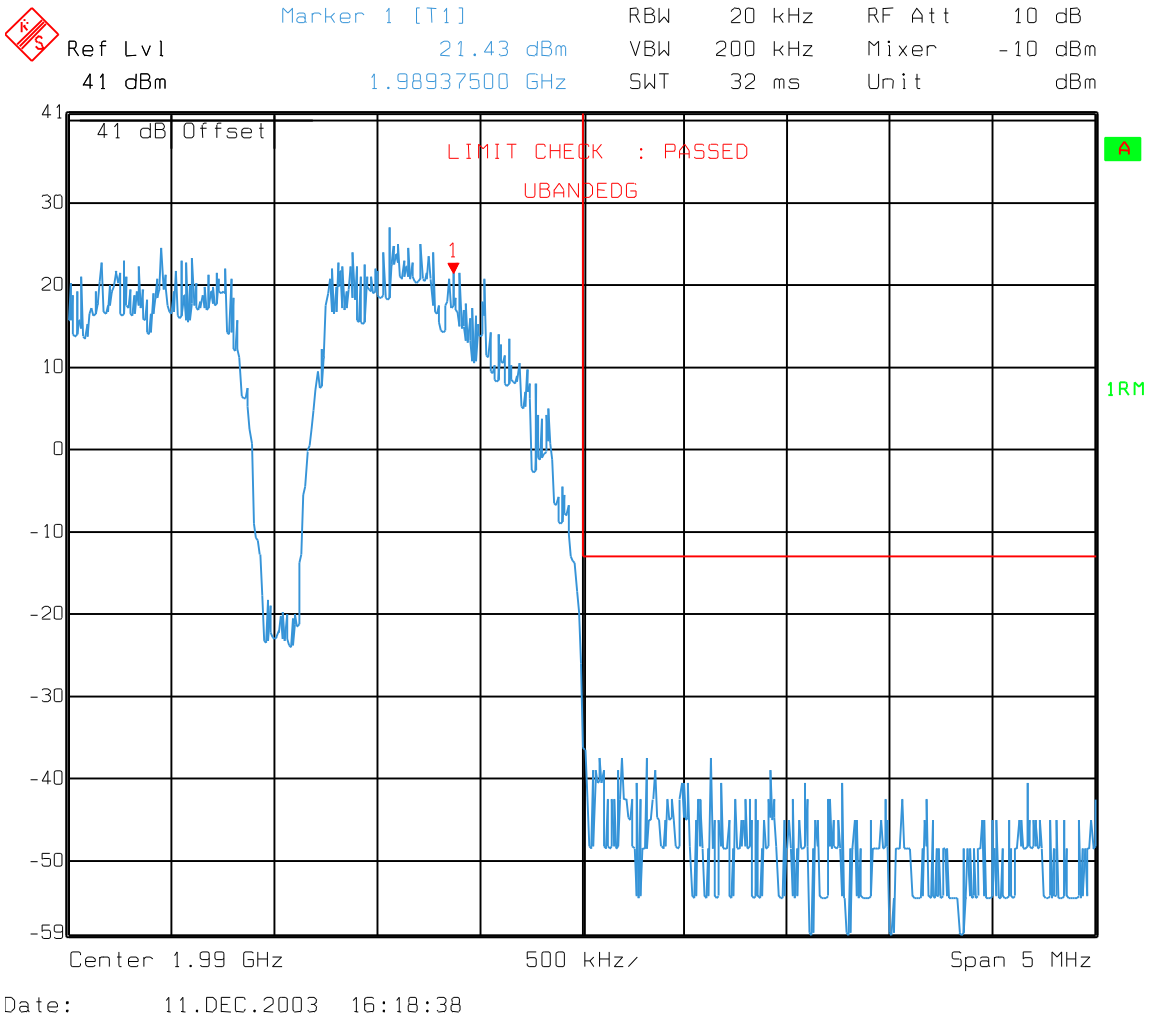

RBW 1 MHz
VBW 1 MHz
SWT 5 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm
Ref Lvl
21 dBm
21 dB Offset
1MAX 13 dBm
1MA
A
21
10
0
-10
-20
-30
-40
-50
-60
-70
-79
Start 30 MHz
97 MHz/
Stop 1 GHz
Date: 12.DEC.2003 15:35:28


Marker 1 [T1]
25.24 dBm
1.84769539 GHz
RBW 1 MHz
VBW 1 MHz
SWT 190 ms
RF Att 30 dB
Mixer -10 dBm
Unit dBm
Ref Lvl
41 dBm
21 dB Offset
1MAX
1MA
D1 -13 dBm
41
30
20
10
0
-10
-20
-30
-40
-50
-59
Start 1 GHz
1.9 GHz/
Stop 20 GHz
Date: 12.DEC.2003 15:36:46

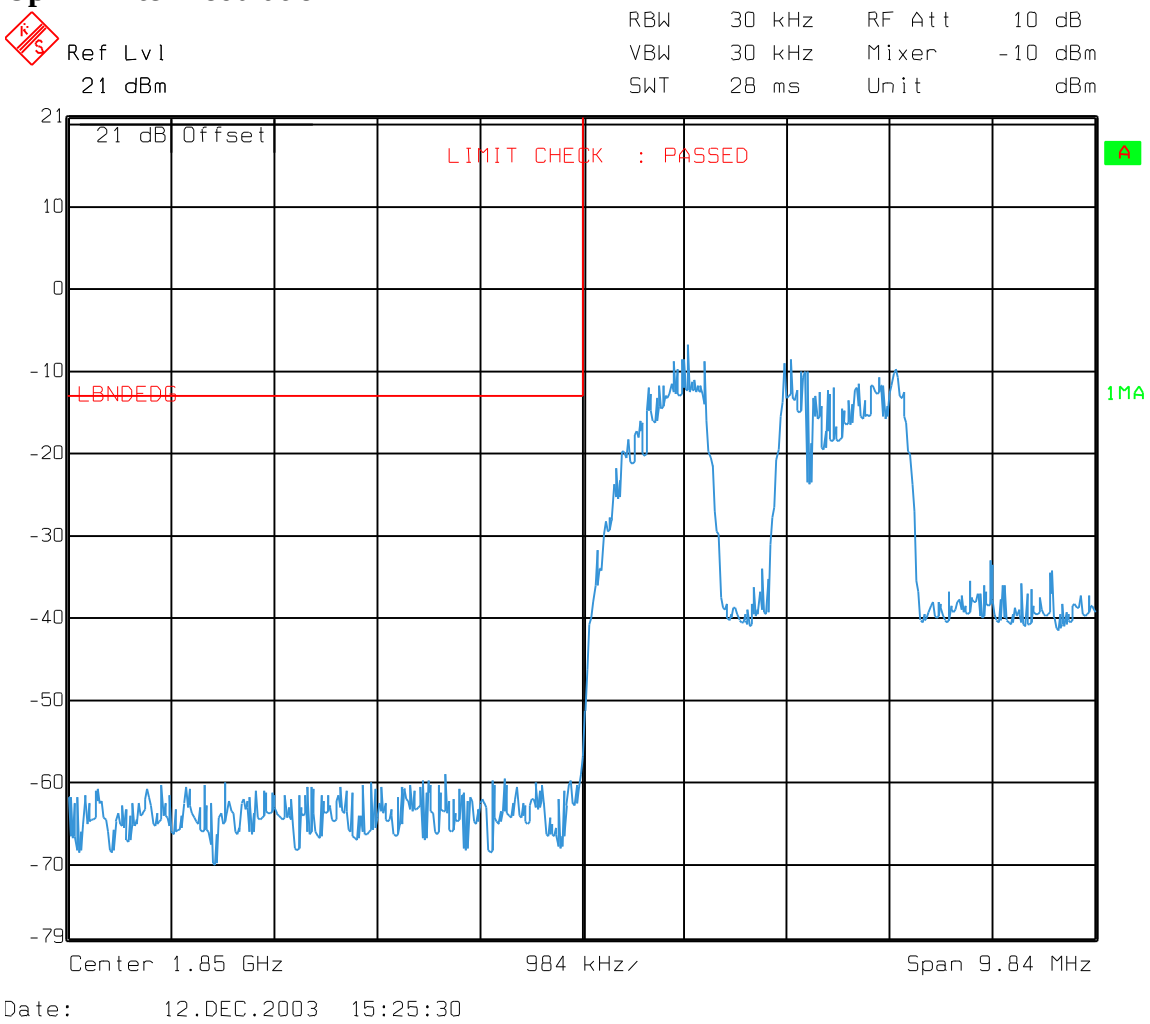
Downlink Intermodulation



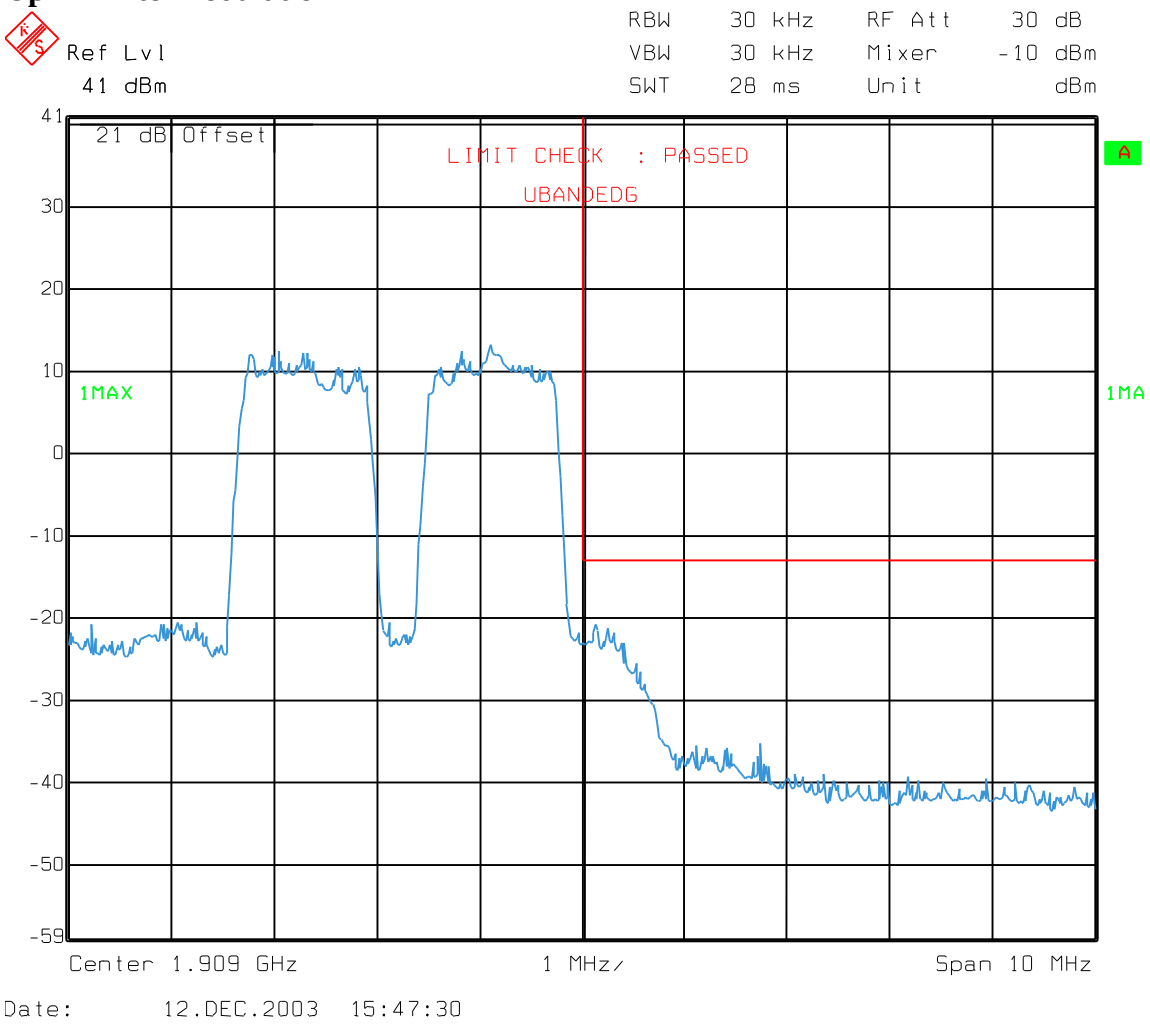
Downlink Intermodulation



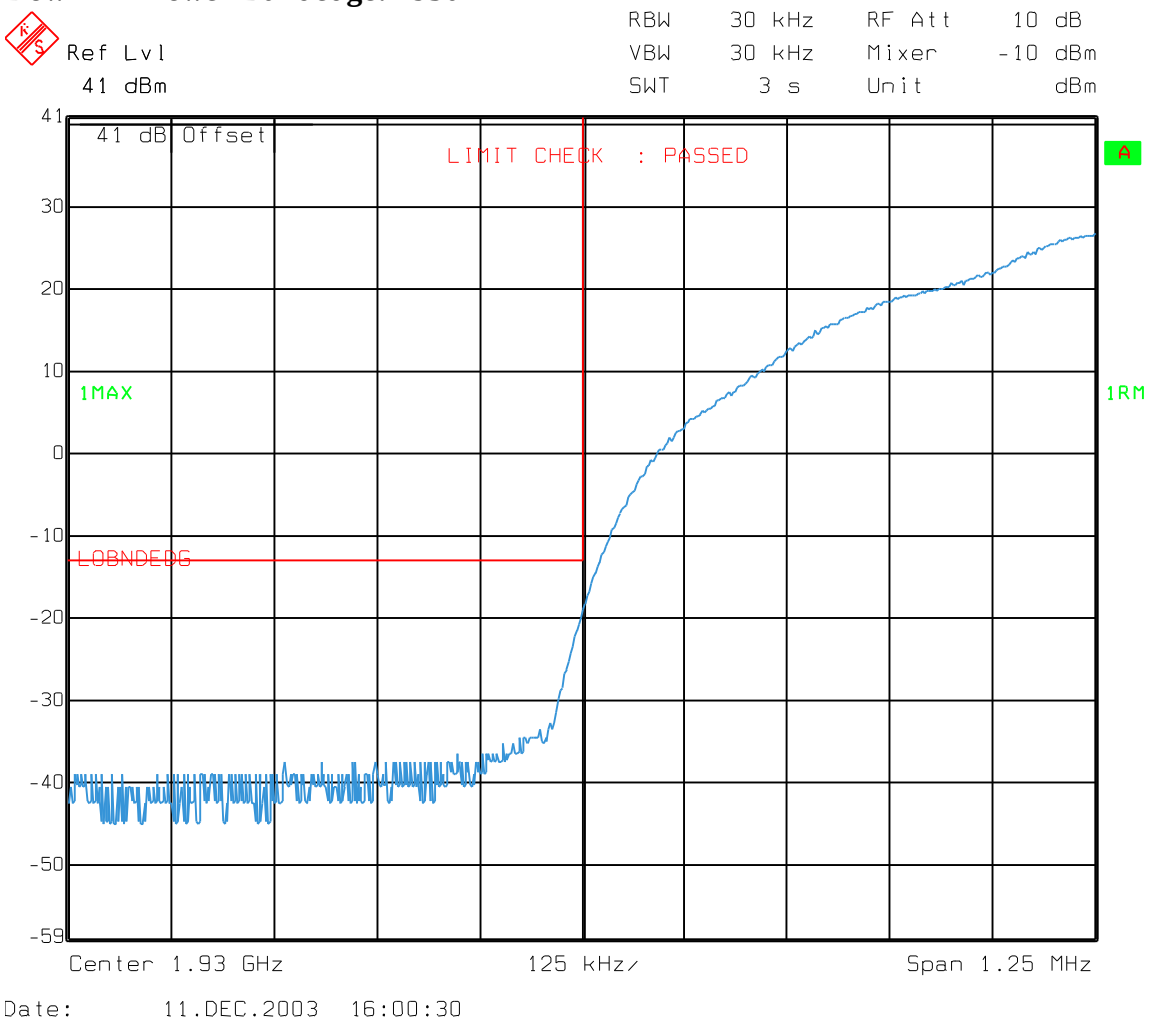
Uplink Intermodulation



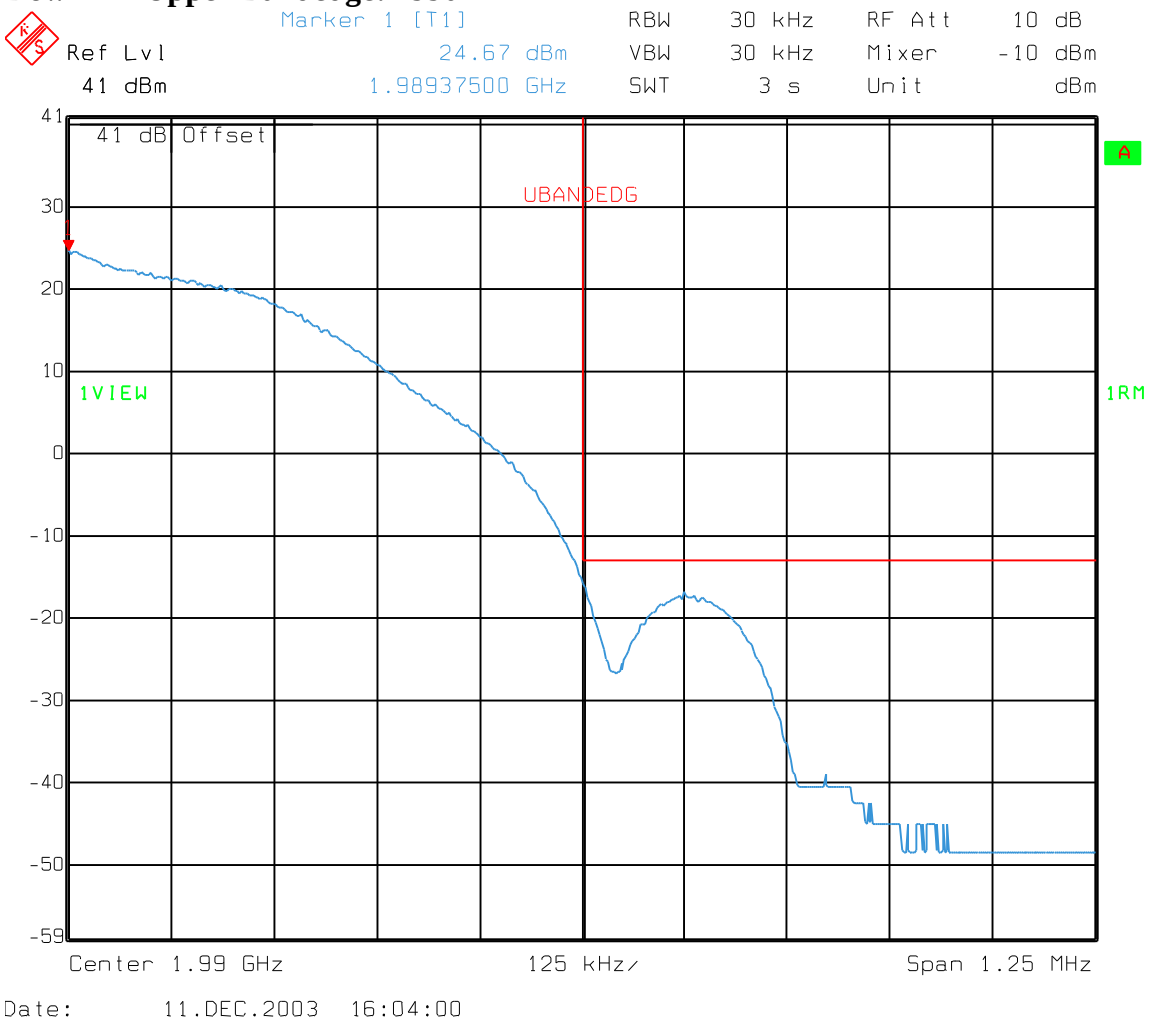
Uplink Intermodulation



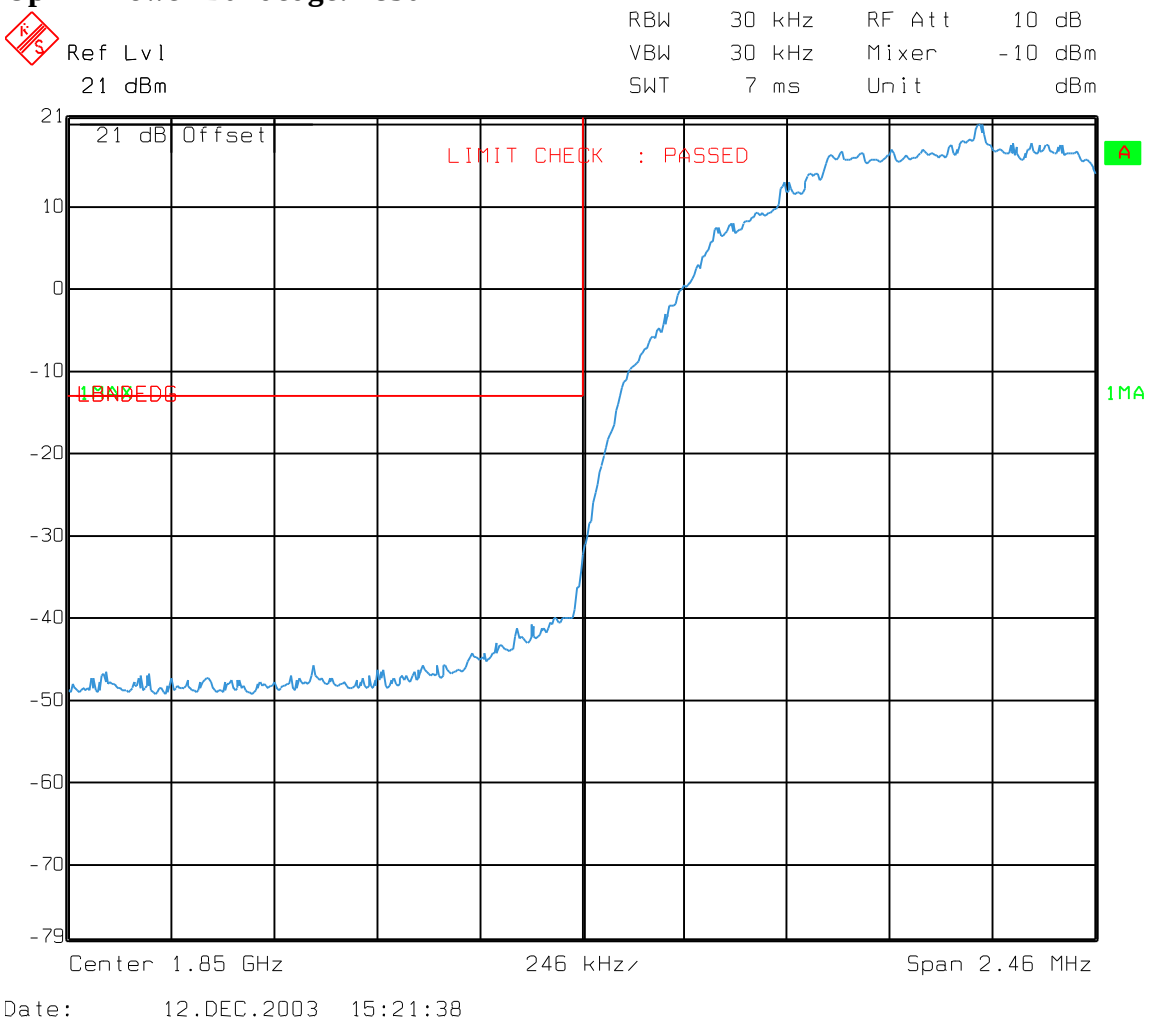
Downlink Lower Bandedge: 1930MHz



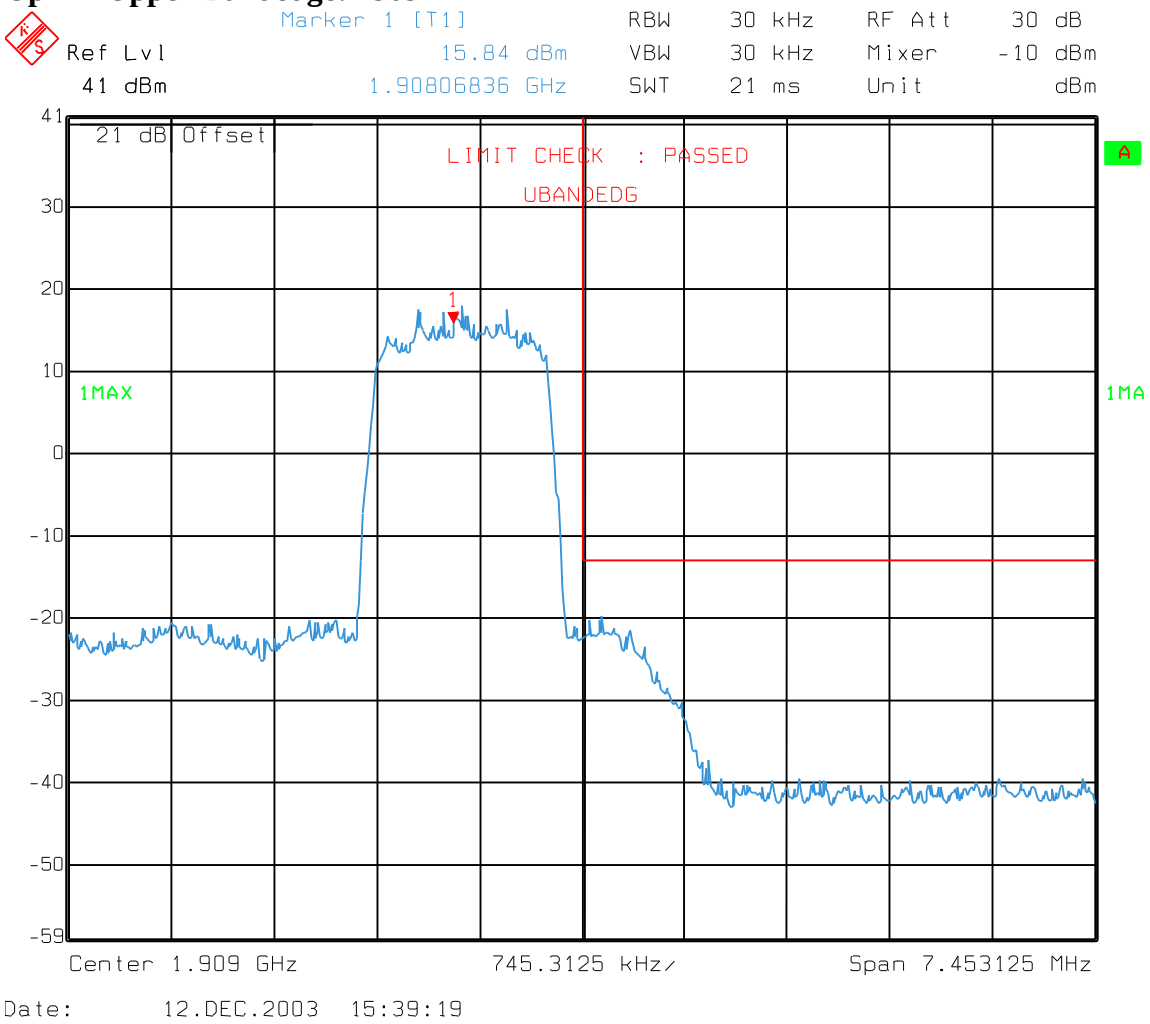
Downlink Upper Bandedge: 1990MHz



Uplink Lower Bandedge: 1850MHz



Uplink Upper Bandedge: 1909MHz



Section 6. Field Strength of Spurious

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

Test Results: Complies.

Test Data: See attached table.

Equipment Used: 1036, 1484, 1485, 1016, 1304

Measurement Uncertainty: +/- 6 dB

Temperature: 21 °C

Relative Humidity: 51 %

Test Data - Radiated Emissions - Downlink and Uplink

EIRP Substitution Method

Page 1 of

Complete X
Preliminary

Job No.: 3L0496R Date: 12/12/2003
Specification: FCC 24E Temperature(°C): 21
Tested By: Dustin Oaks Relative Humidity(%) 51
E.U.T.: Node C 1943
Configuration: EUT continuously Transmitting
Sample No: 13
Location: Lab 3 RBW: 1 MHz Measurement
Detector Type: Peak VBW: 1 MHz Distance: 3 m

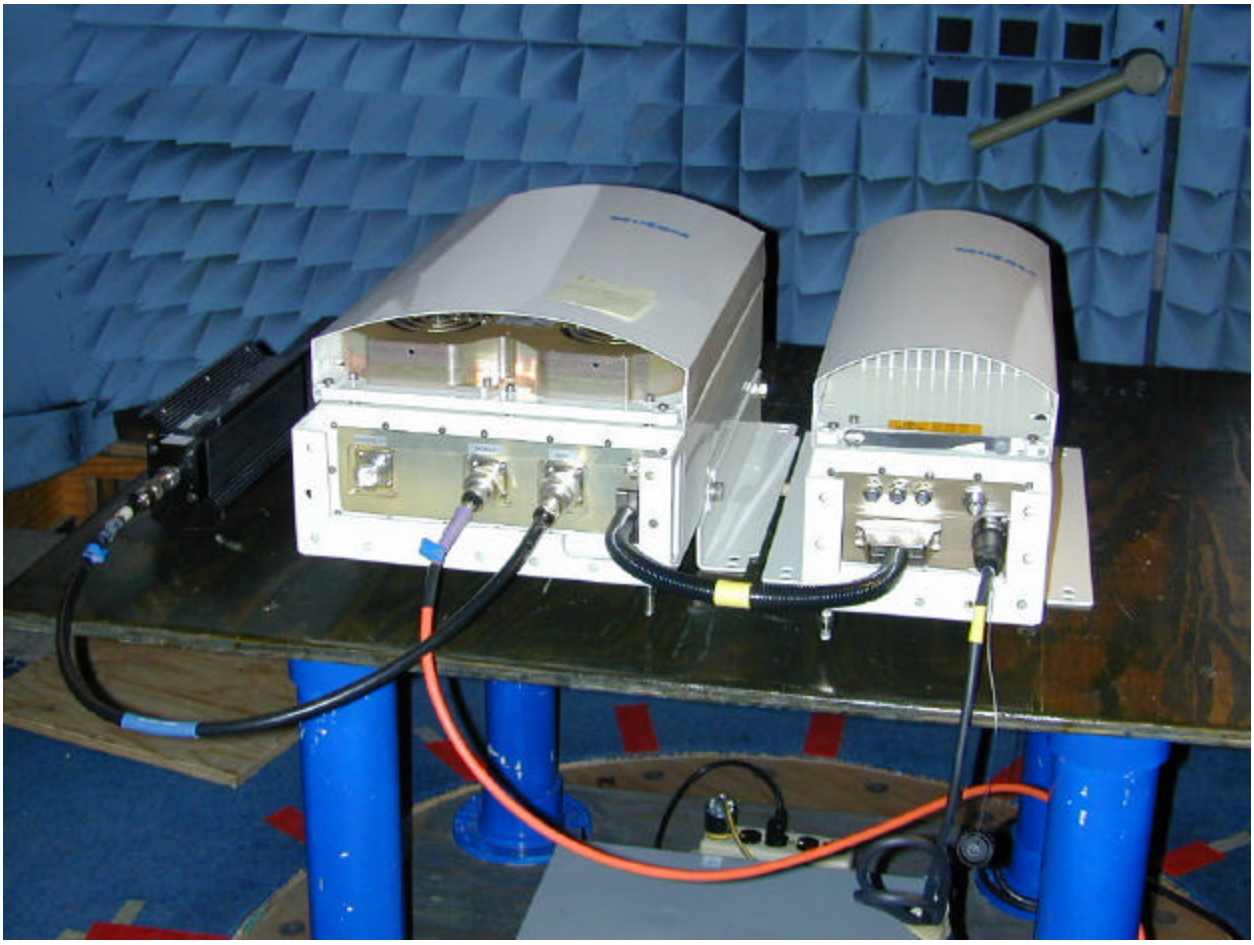
Test Equipment Used

Antenna: 1304 Directional Coupler:
Pre-Amp: 1016 Cable #1: 1484
Filter: Cable #2: 1485
Receiver: 1036 Cable #3:
Attenuator #1 Cable #4:
Attenuator #2: Mixer:
Additional equipment used:
Measurement Uncertainty: +/-3.6 dB

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments
3870	-40.3	43.3		31.4	10.7		-17.7	0.02	v	EUT on 1935MHz
7740	-45.3	41.8		36.5	11.3		-28.7	0.001359	v	EUT on 1935MHz
1350	-50.8	31.5		31.1	7.0		-43.4	0.000045	v	EUT on 1935MHz
3870	-43.0	35.5		31.4	10.7		-28.2	0.001514	h	EUT on 1935MHz
1933	-47.8	33.0		31.9	9.4		-37.3	0.000185	h	EUT on 1855MHz
1941	-50.5	31.0		31.9	9.4		-42.0	0.00	v	EUT on 1855MHz
1349	-50.3	31.5		31.1	7.0		-42.9	0.00	v	EUT on 1855MHz

Notes: **Downlink and Uplink paths tested**

Photographs of Test Setup



Section 7. Frequency Stability

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

Test Results: Test Not Applicable

Section 8. Test Equipment List

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
1053	SIGNAL GENERATOR	ROHDE & SCHWARZ SMIQ 03	DE22081	06/10/03	06/09/04
1626	CABLE, 5 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1473	20db Attenuator DC 18 Ghz	Midwest Microwave 290-20db	NONE	CBU	N/A
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A
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
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	08/28/03	08/28/04

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 $GP/4\pi R^2 = E^2/120\pi$ 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 lowest 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 x 10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$GP/4\pi R^2 = E^2/120\pi$

For emissions ≤ 1 GHz:

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

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

$$\mathrm{E} = \frac{\sqrt{30 \text{ x } 1.64 \text{ x } 5 \text{ x } 10^{-5}}}{3} = 0.016533 \text{ V / m} = 84.4 \text{ dB}\mu\text{V / m}$$

For emissions > 1 GHz:

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

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

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

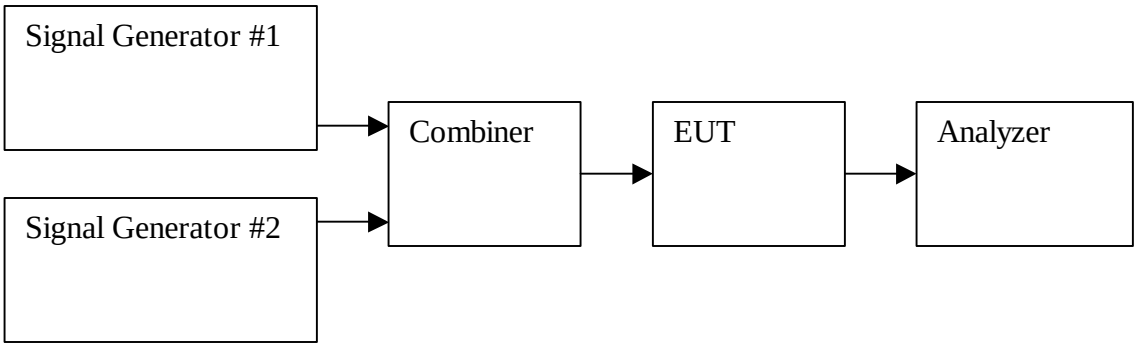
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

NAME OF TEST: Intermodulation	**PARA. NO.:**

Method of Measurement:

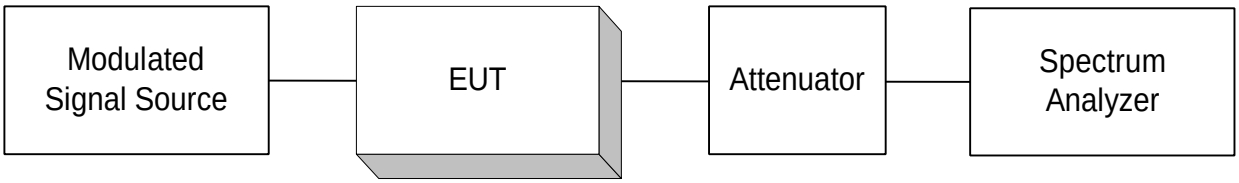
Per EIA/TIA 603, the two signal generator method was utilized to perform the Intermodulation test.

Test Setup:

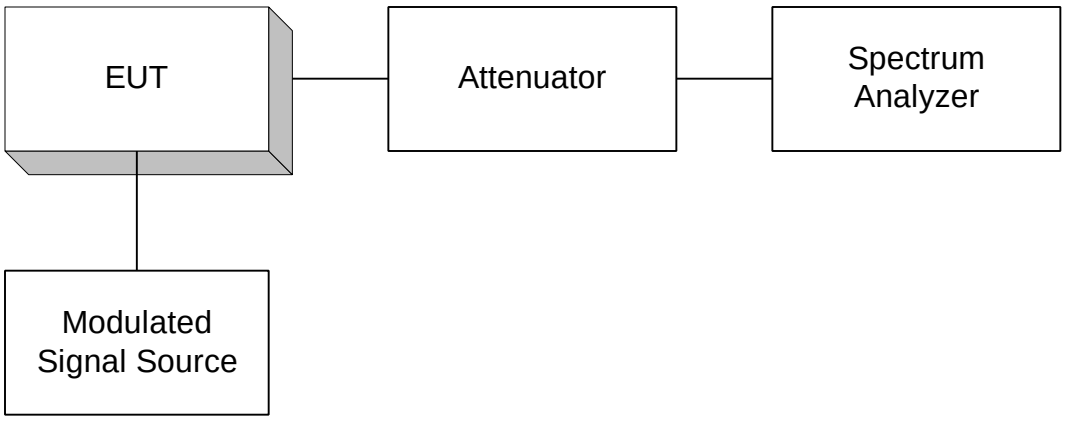


ANNEX B - TEST DIAGRAMS

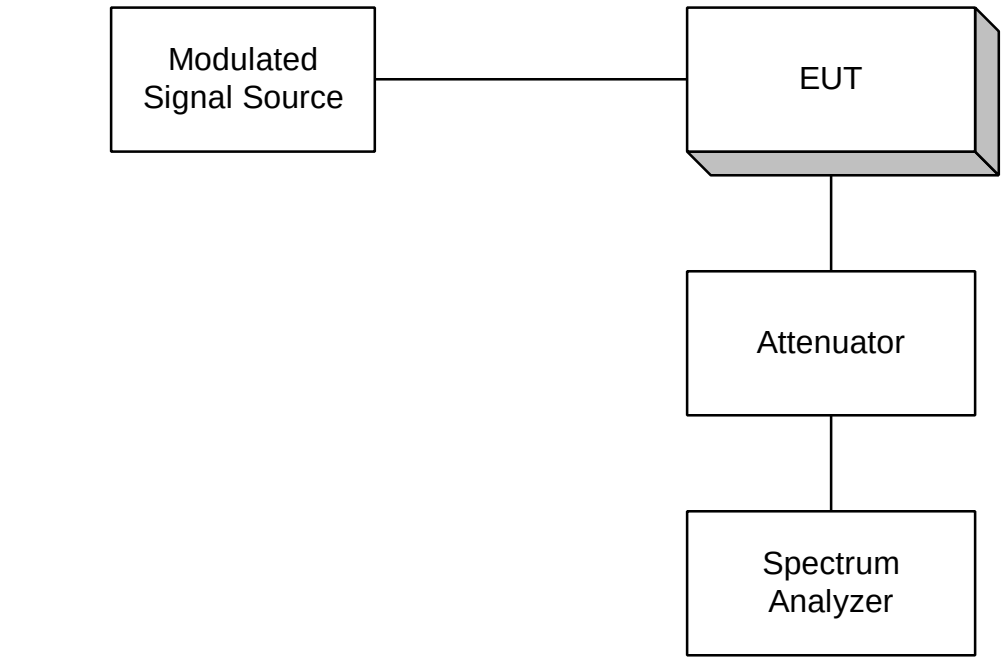
Para. No. 2.985 - R.F. Power Output

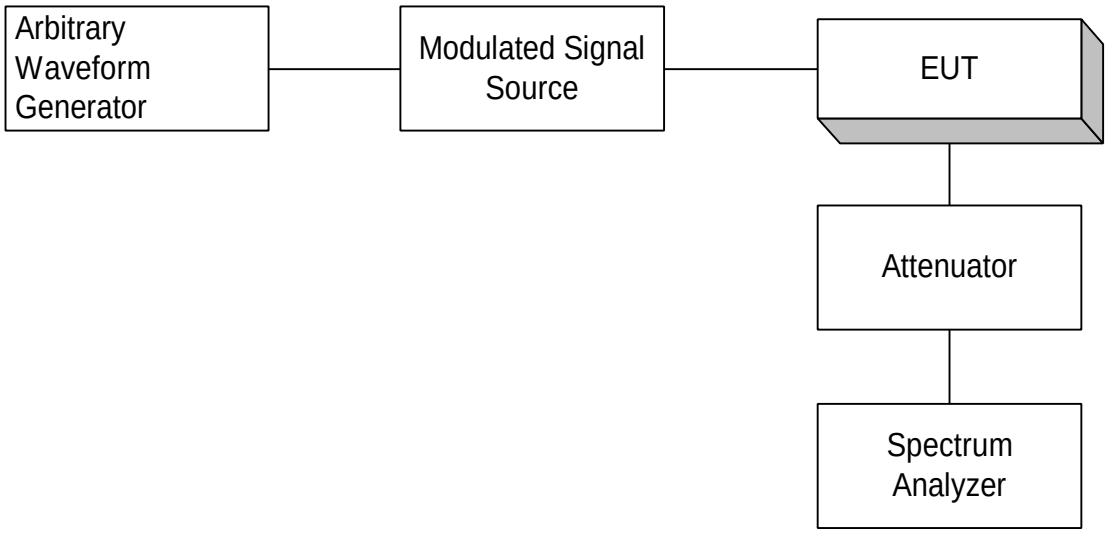


Para. No. 2.989 - Occupied Bandwidth

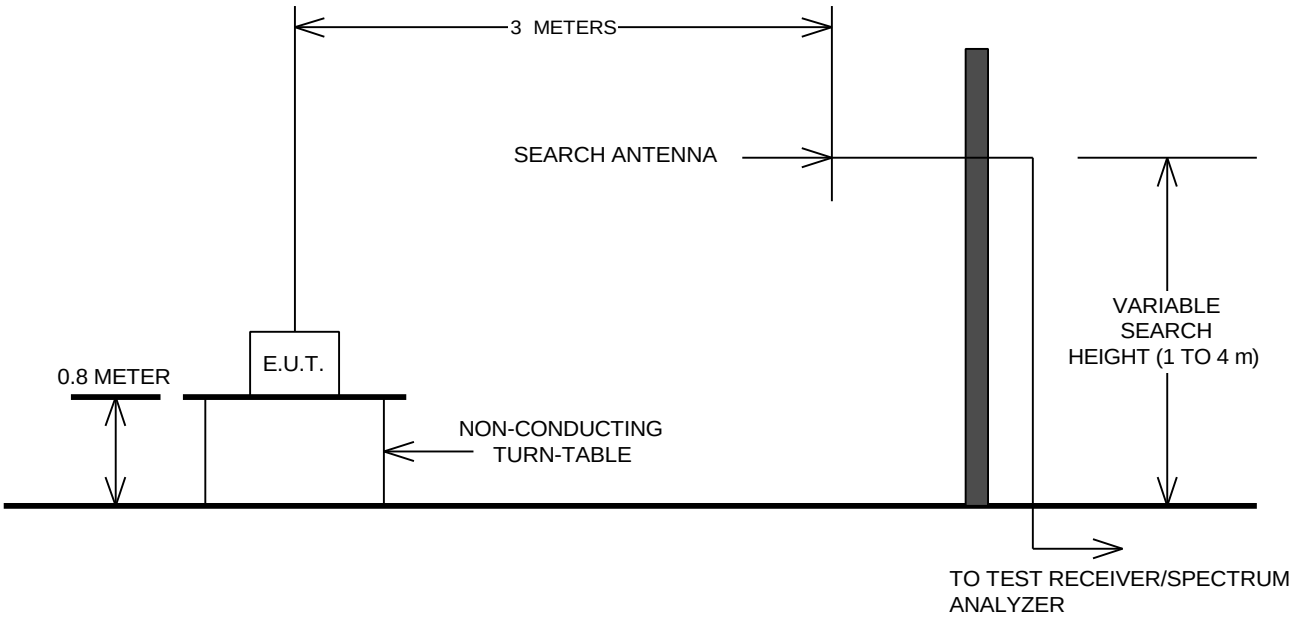


Para. No. 2.991 Spurious Emissions at Antenna Terminals





Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability