



Nemko Test Report No.:

50849RUS1rev2

Applicant:

Andrew Corporation

Equipment Under Test:

MR1903D

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, Frontline Group Manager

Date:

18 November, 2005

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EQUIPMENT: MR1903D

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: MR1903D

Serial No.: 7164217

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. NONE

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Summary Of Test Data

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

Footnotes:

(1) The device is an F1 to F1 repeater.

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

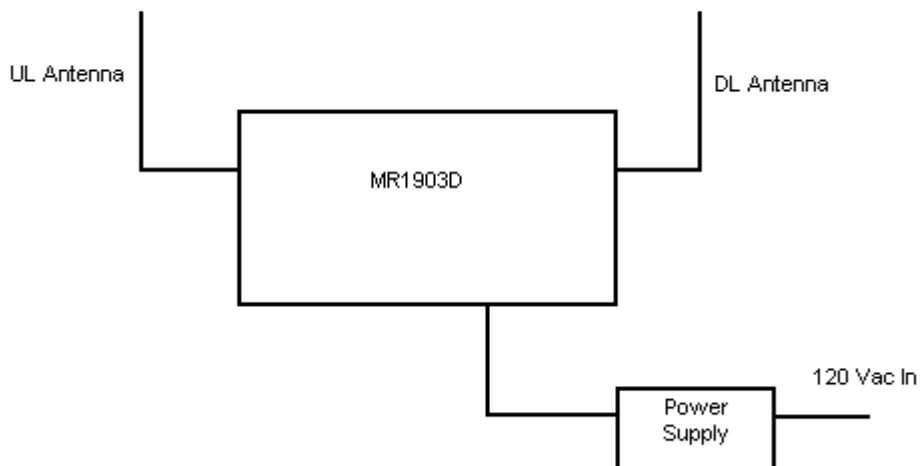
Section 2. General Equipment Specification

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 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/W-CDMA (F9W)	GSM/EDGE (G7W)	NADC (DXW)	
		☒	☒	☐	
System Gain:		60 dB			
Output Impedance:		50 ohms			
RF Output (Rated):	Technology	Output Power per Carrier, dBm			
		1	2	4	8
	CDMA	15	11	7	9
	EDGE	17	13	11	7
	GSM	17	14	11	7
	W-CDMA	11	8	5	2
Frequency Translation:		F1-F1	F1-F2	N/A	
		☒	☐	☐	
Band Selection:		Software	Selector Switch	Fullband	
		☐	☒	☐	

Theory of Operation

The MR1903D band selective mini repeater is a bi-directional amplifier used to enhance signals between a mobile and base station in a wireless network. The MR1903D is available in 5, 10 or 15 MHz wide options.

System Diagram



EQUIPMENT: **MR1903D****Section 3. RF Power Output**

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David Light	DATE: 07 August 2005

Test Results: Complies.**Measurement Data:**

	Modulation Type	Output Power (dBm)	Output Power (mW)
Uplink	CDMA	15.2	33.11
Downlink	CDMA	14.6	28.84
Uplink	W-CDMA	11.18	13.12
Downlink	W-CDMA	11.09	12.85
Uplink	GSM	17.23	52.84
Downlink	GSM	17.03	50.46
Uplink	EDGE	17.23	52.84
Downlink	EDGE	17.03	50.46

Equipment Used: 1659-1626-1472**Measurement Uncertainty:** +/- 1.6 dB**Temperature:** 22 °C**Relative Humidity:** 45 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: David Light	DATE: 07 August 2005

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1464-1659-1472-1626

Measurement Uncertainty: +/- 1.6 dB

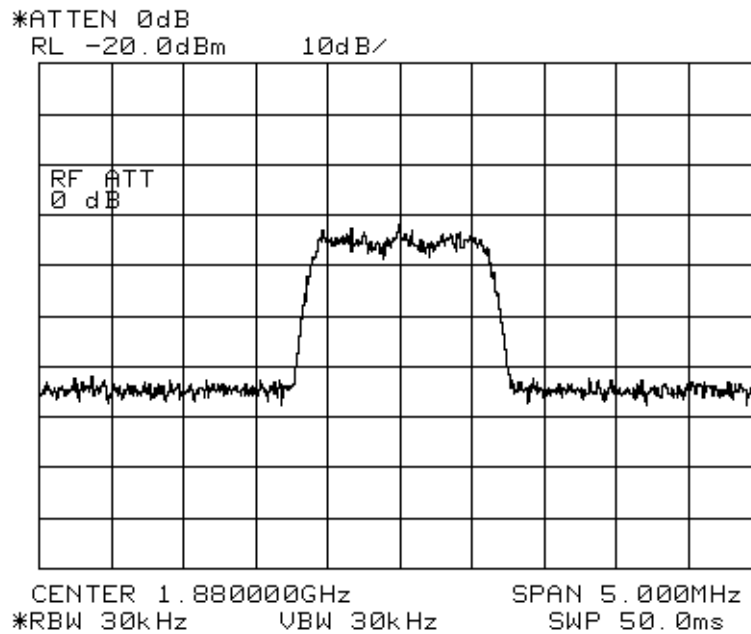
Temperature: 22 °C

Relative Humidity: 45 %

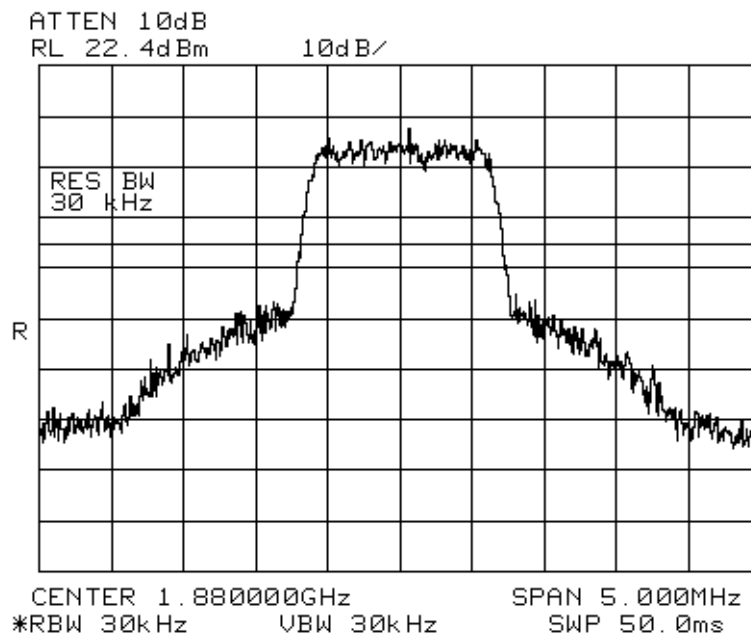
EQUIPMENT: MR1903D

Test Data – Occupied Bandwidth

CDMA – Uplink - Input



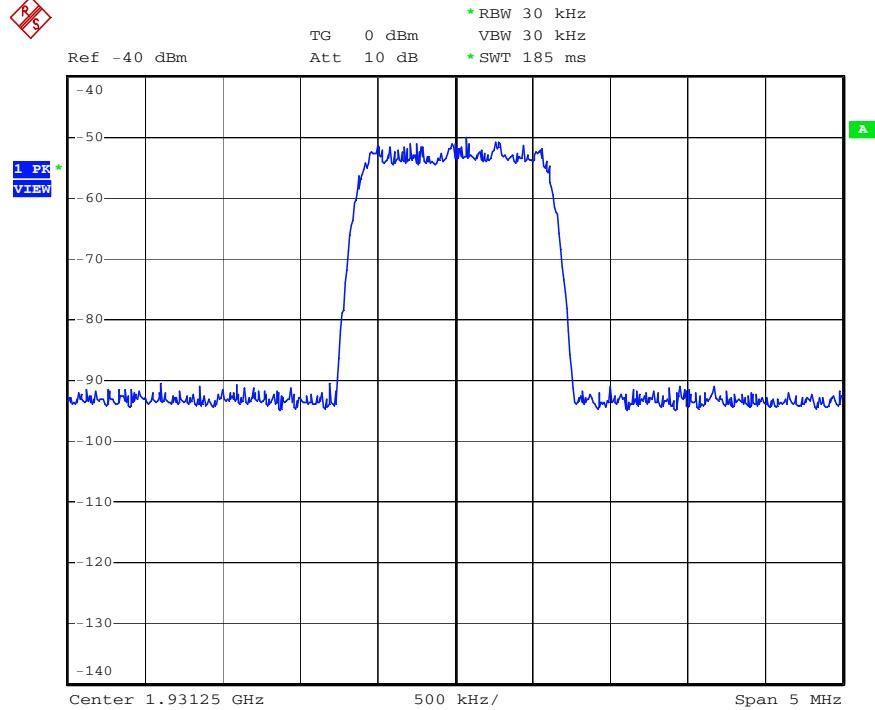
CDMA Uplink - Output



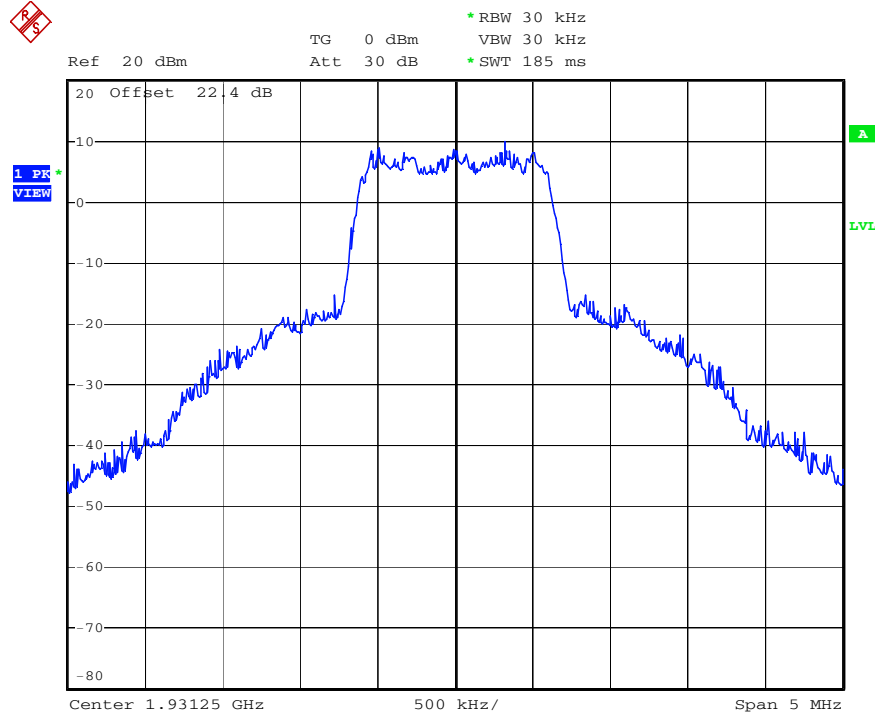
EQUIPMENT: MR1903D

Test Data – Occupied Bandwidth

CDMA – DL - Input



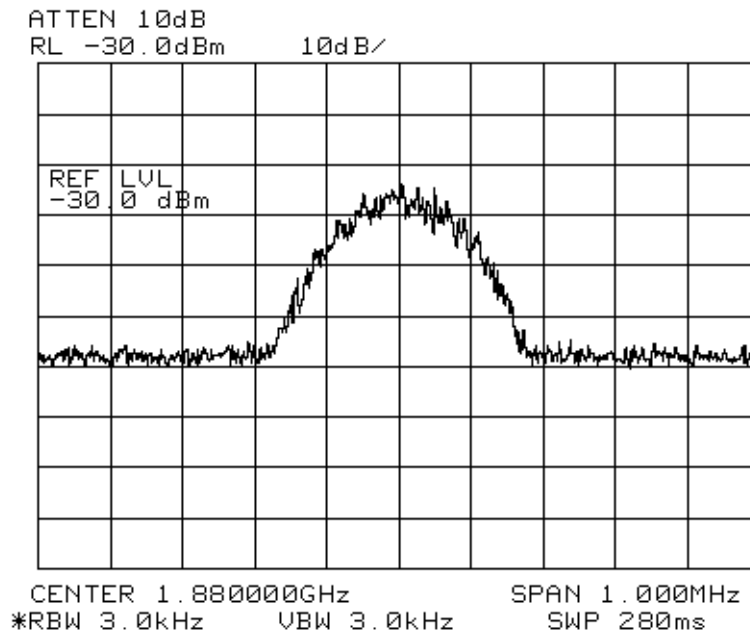
CDMA – DL - Output



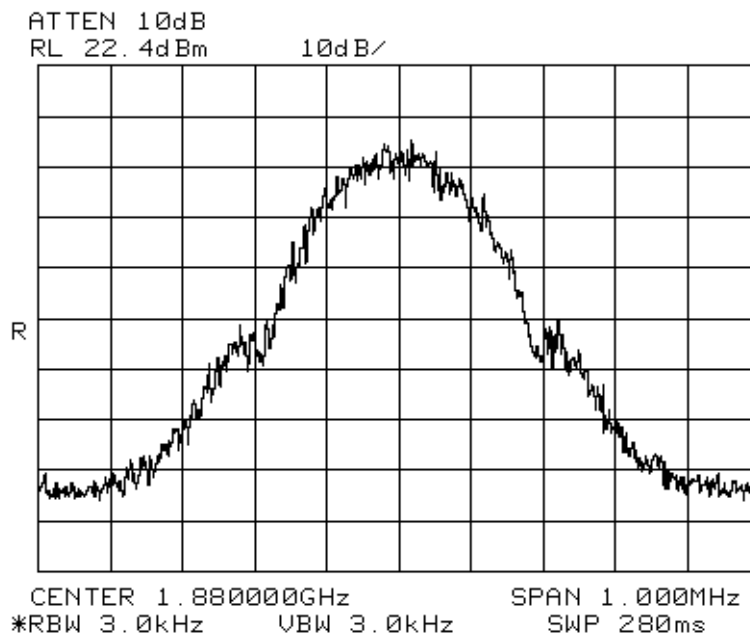
EQUIPMENT: MR1903D

Test Data – Occupied Bandwidth

GSM – UL - Input



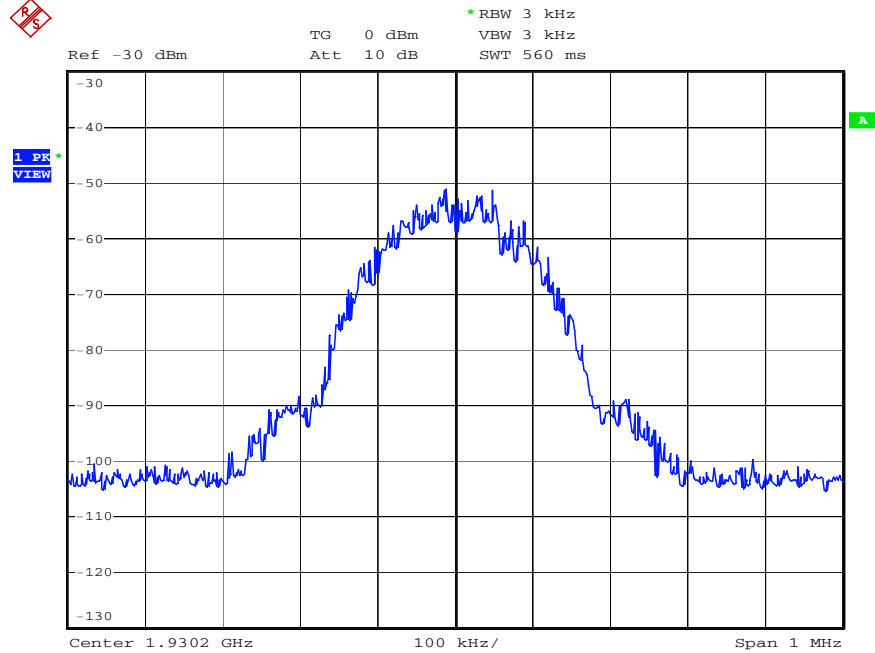
GSM – UL - Output



EQUIPMENT: MR1903D

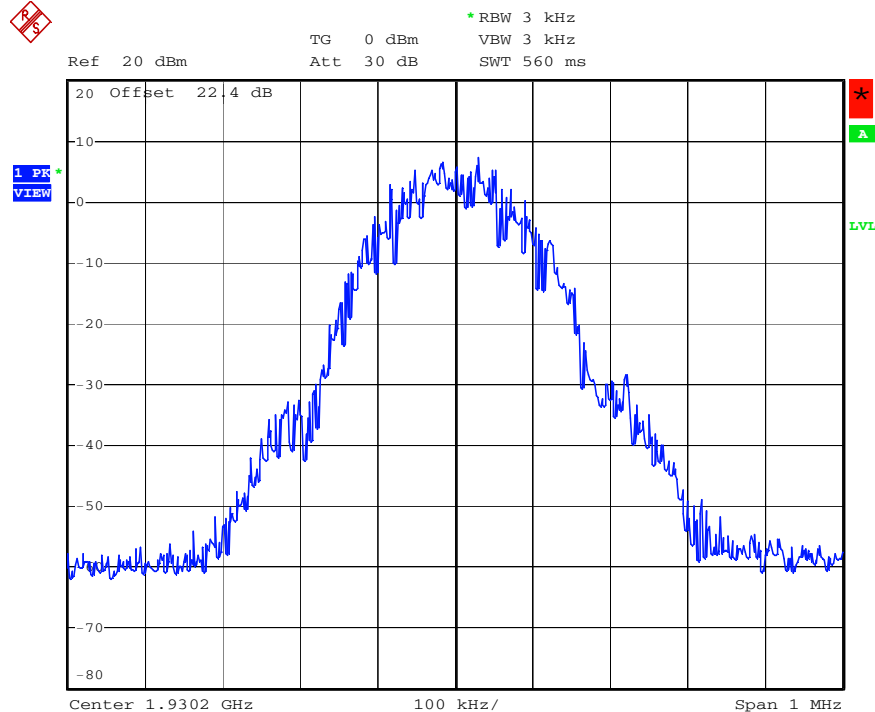
Test Data – Occupied Bandwidth

GSM – DL - Input



Date: 6.SEP.2005 12:07:24

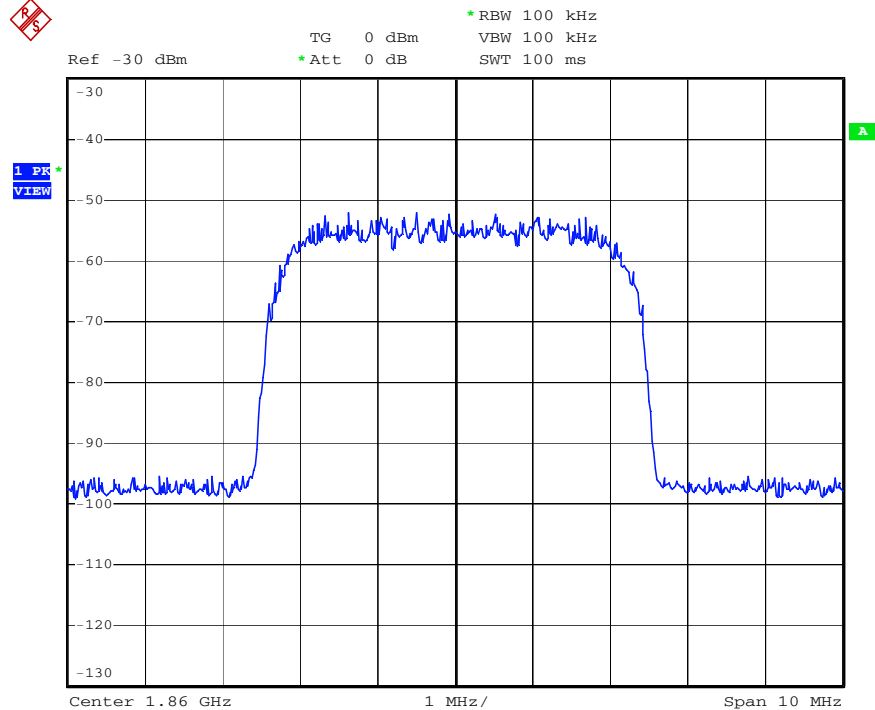
GSM – DL - Output



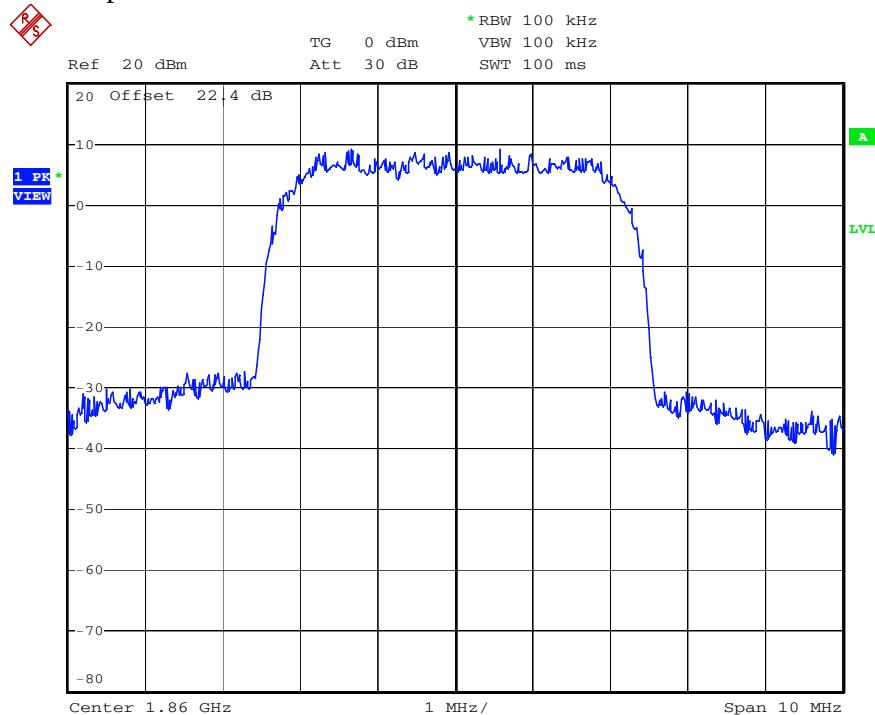
EQUIPMENT: MR1903D

Test Data – Occupied Bandwidth

W-CDMA – UL - Input



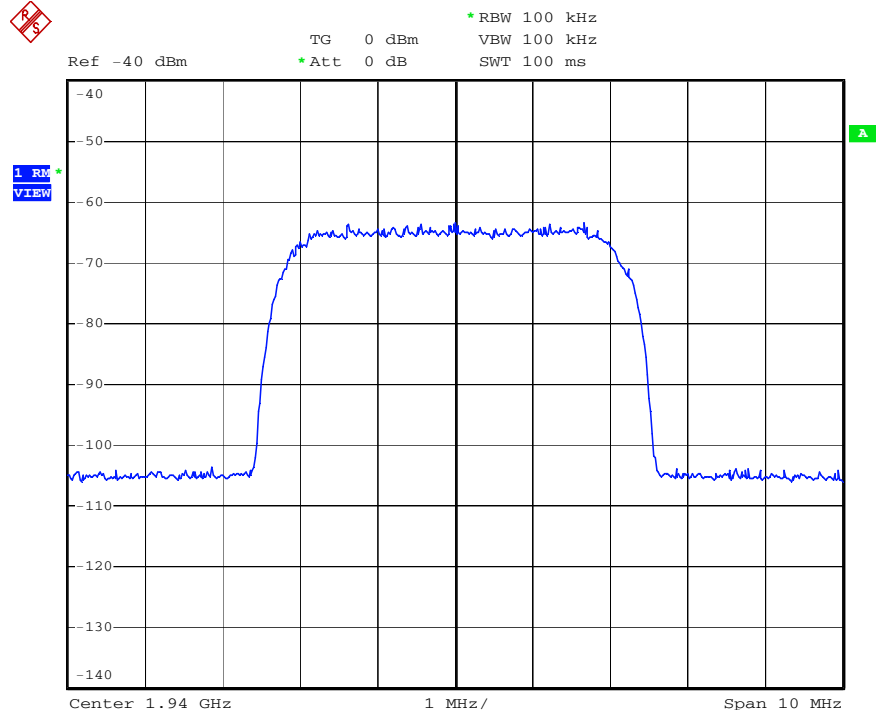
W-CDMA – UL - Output



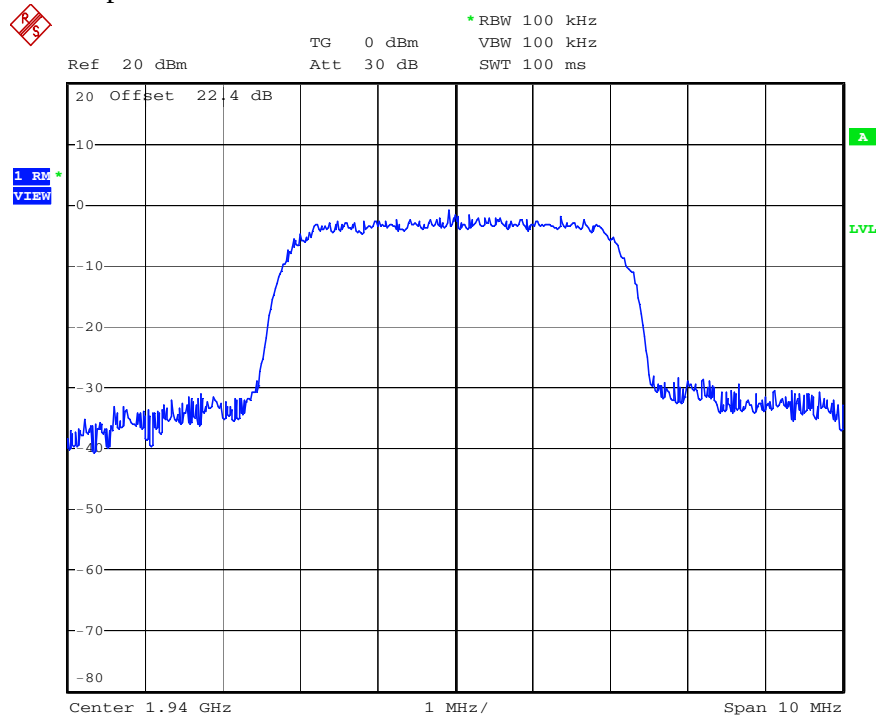
EQUIPMENT: MR1903D

Test Data – Occupied Bandwidth

W-CDMA – DL - Input



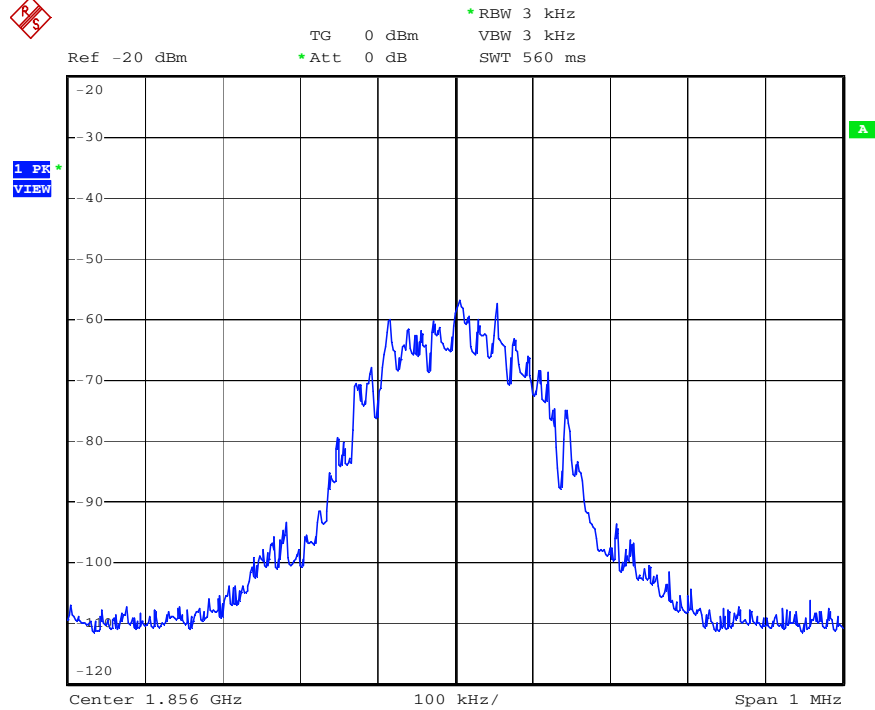
W-CDMA – DL - Output



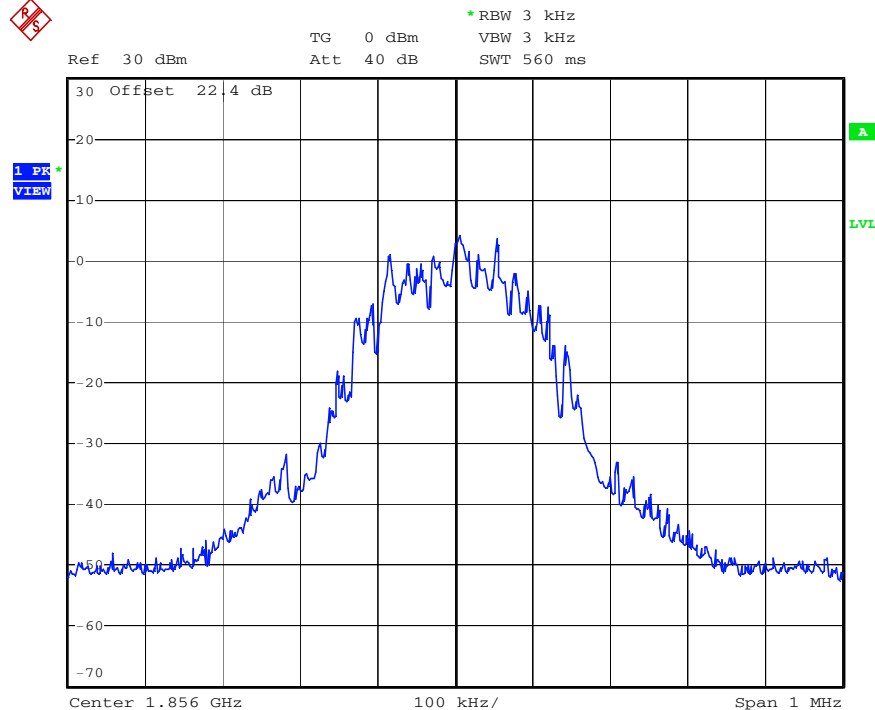
EQUIPMENT: MR1903D

Test Data – Occupied Bandwidth

EDGE – UL - Input



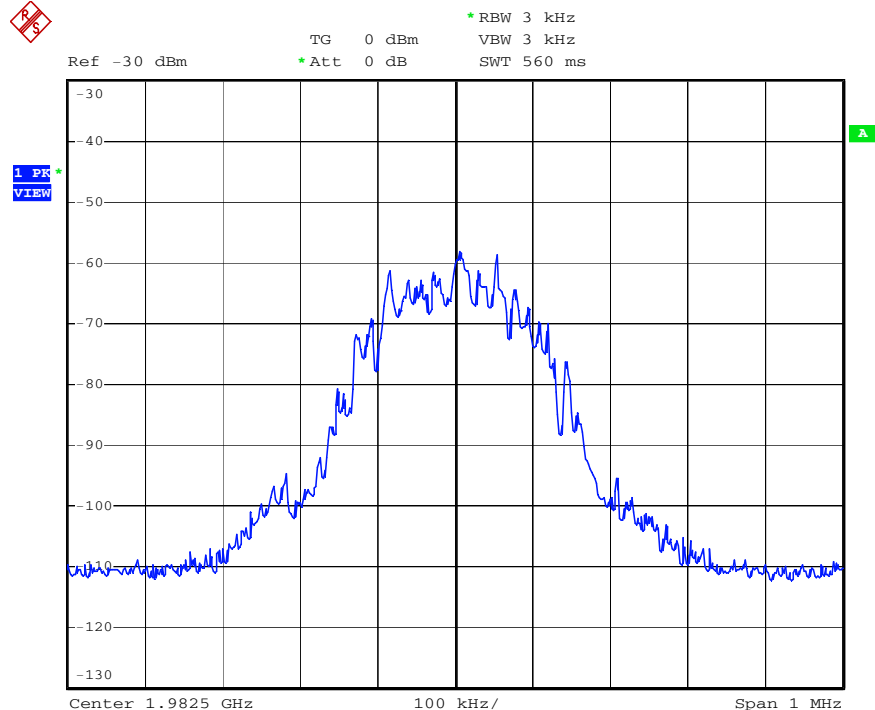
EDGE – UL - Output



EQUIPMENT: MR1903D

Test Data – Occupied Bandwidth

EDGE – DL - Input



EDGE – DL - Output



Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 07 August 2005

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1464-1659-1472-1626

Measurement Uncertainty: +/- 1.6 dB

Temperature: 22 °C

Relative Humidity: 45 %

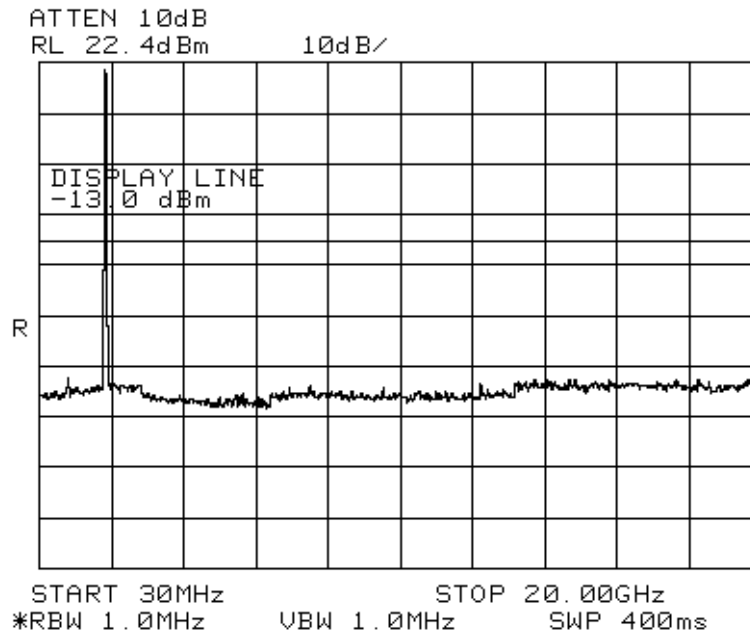
Measurements on three channels (Highest , Middle and Lowest) utilizing all modulations. Data presented is representative of all channels tested.

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – CDMA

Single carrier +15 dBm

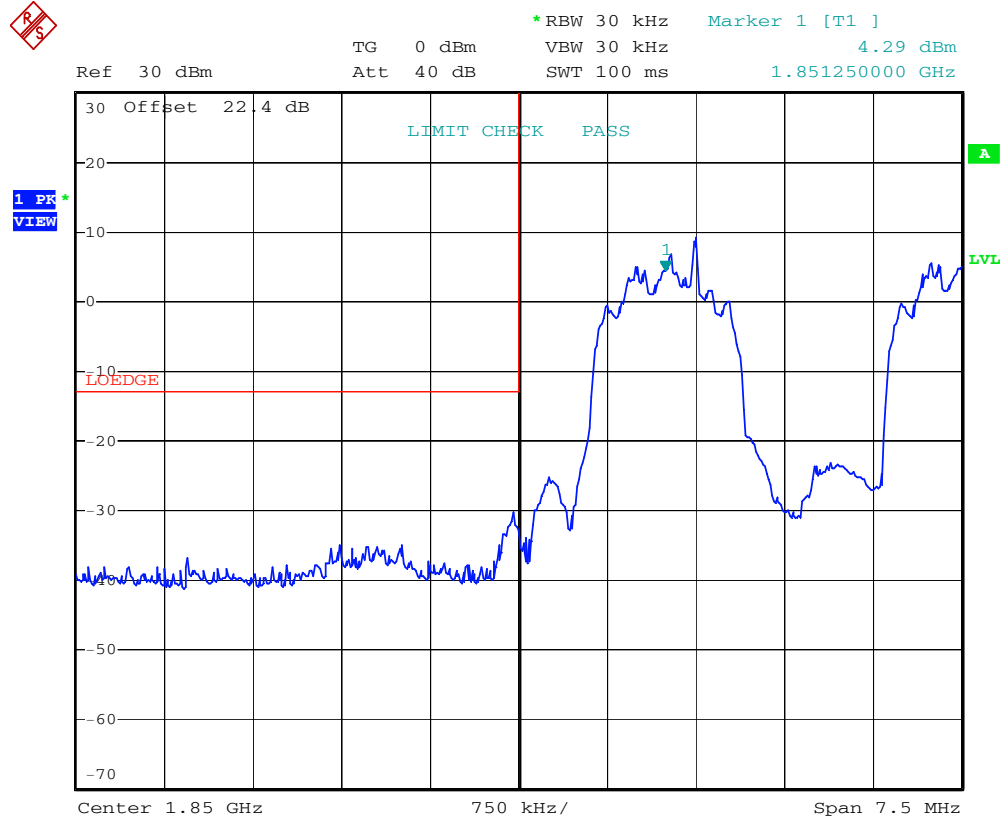


EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – CDMA – Lowest operating channel

11 dBm each



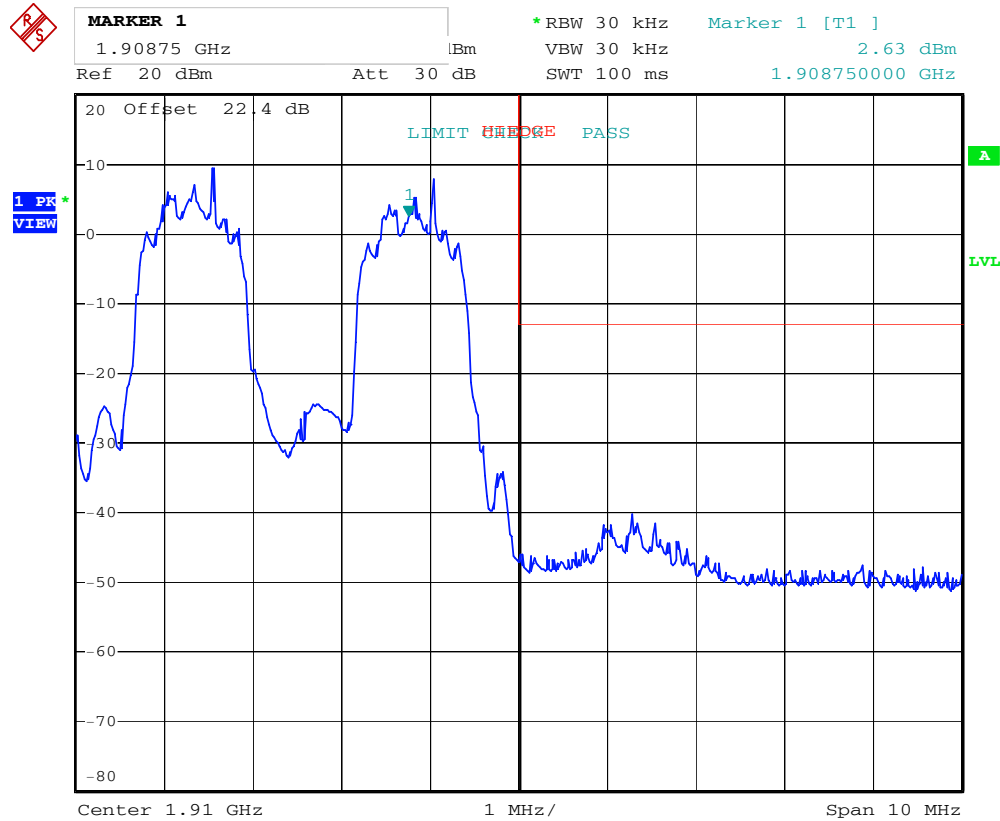
Date: 7.SEP.2005 10:54:52

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – CDMA – Highest operating channel

11 dBm each



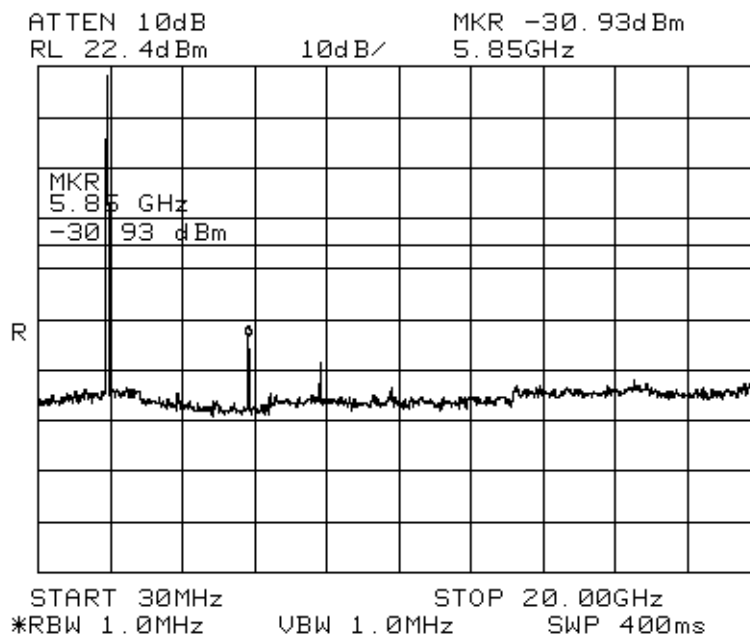
Date: 6.SEP.2005 17:37:36

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – CDMA

Single carrier +15 dBm



EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – CDMA – Lowest operating channel

11 dBm each



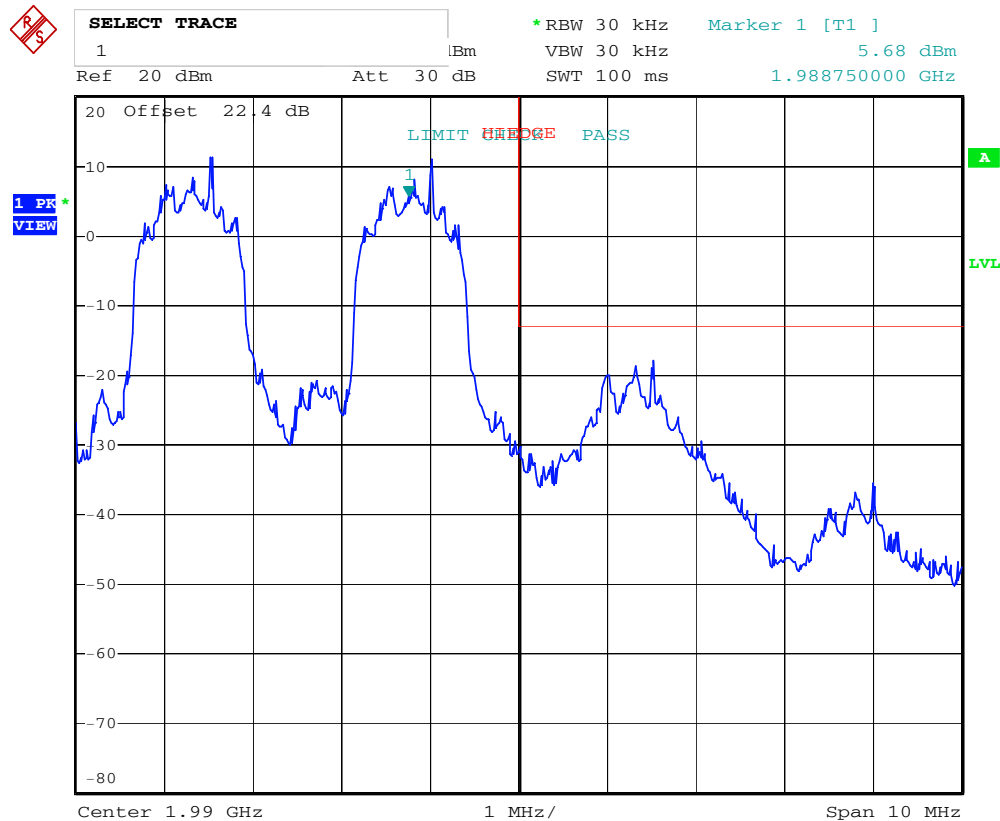
Date: 6.SEP.2005 17:43:27

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – CDMA – Highest operating channel

11 dBm each



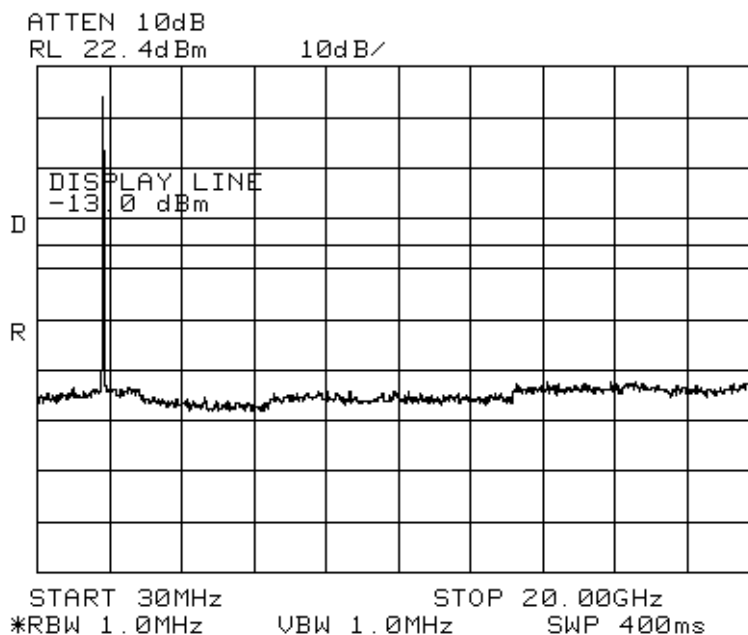
Date: 6.SEP.2005 17:41:19

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – GSM

Single carrier +17 dBm

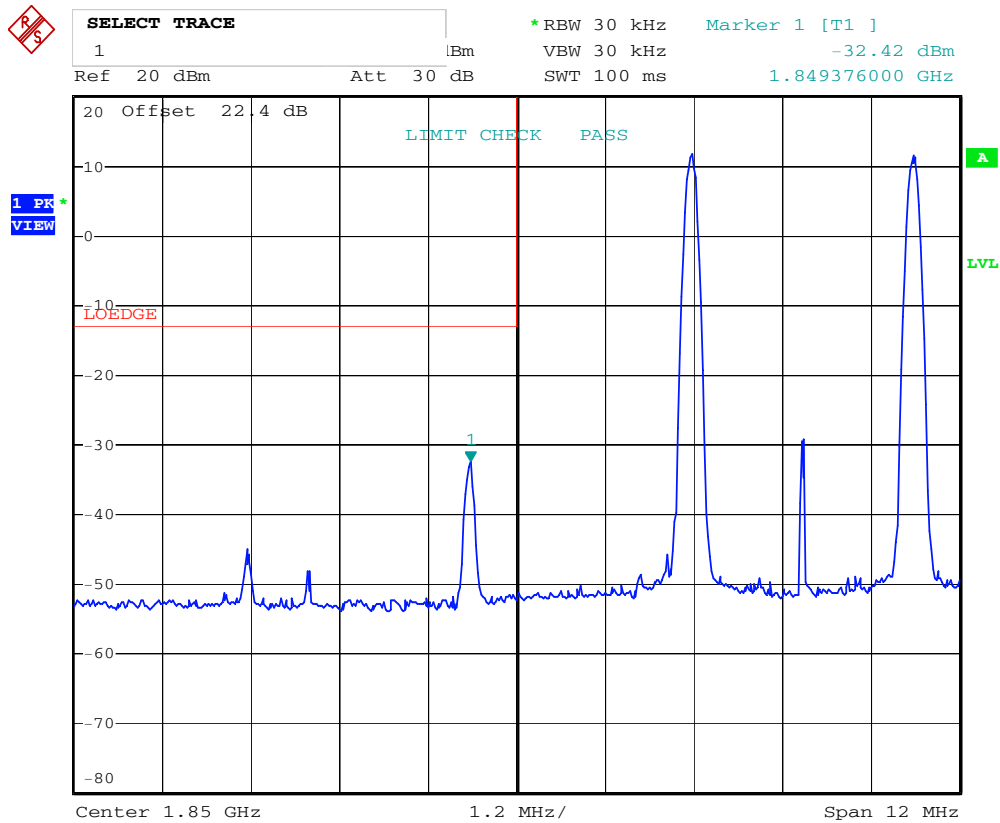


EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – GSM

14 dBm per carrier



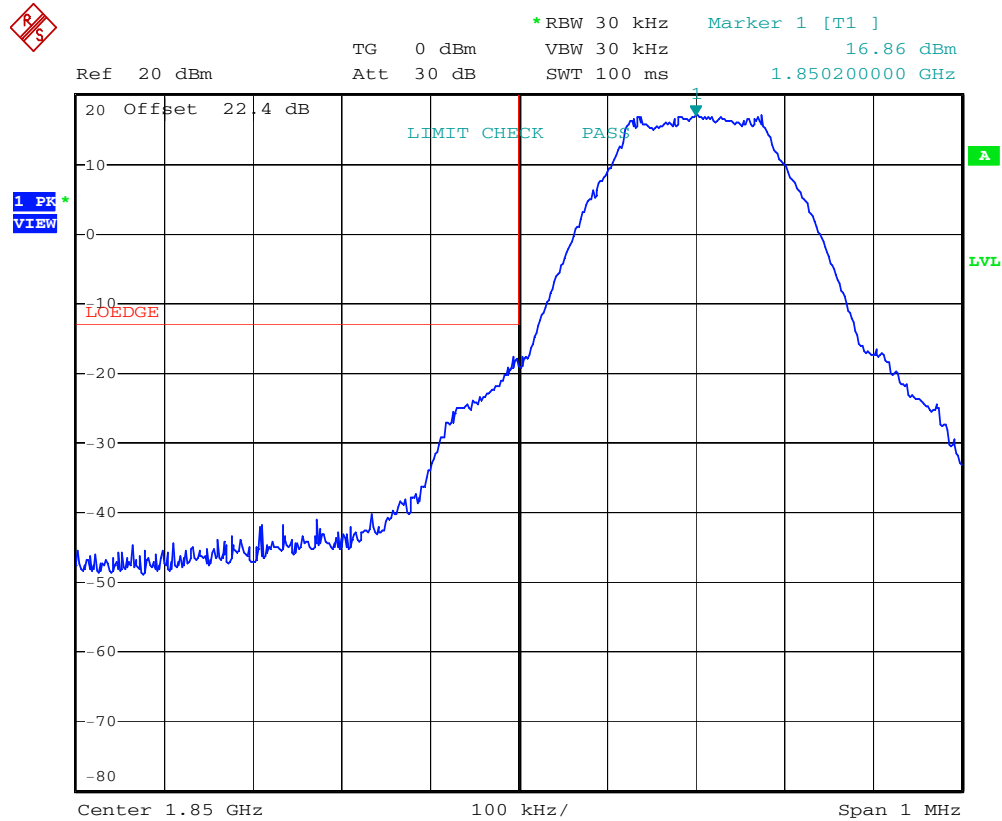
Date: 6.SEP.2005 17:58:08

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – GSM – Lowest operating channel

17 dBm



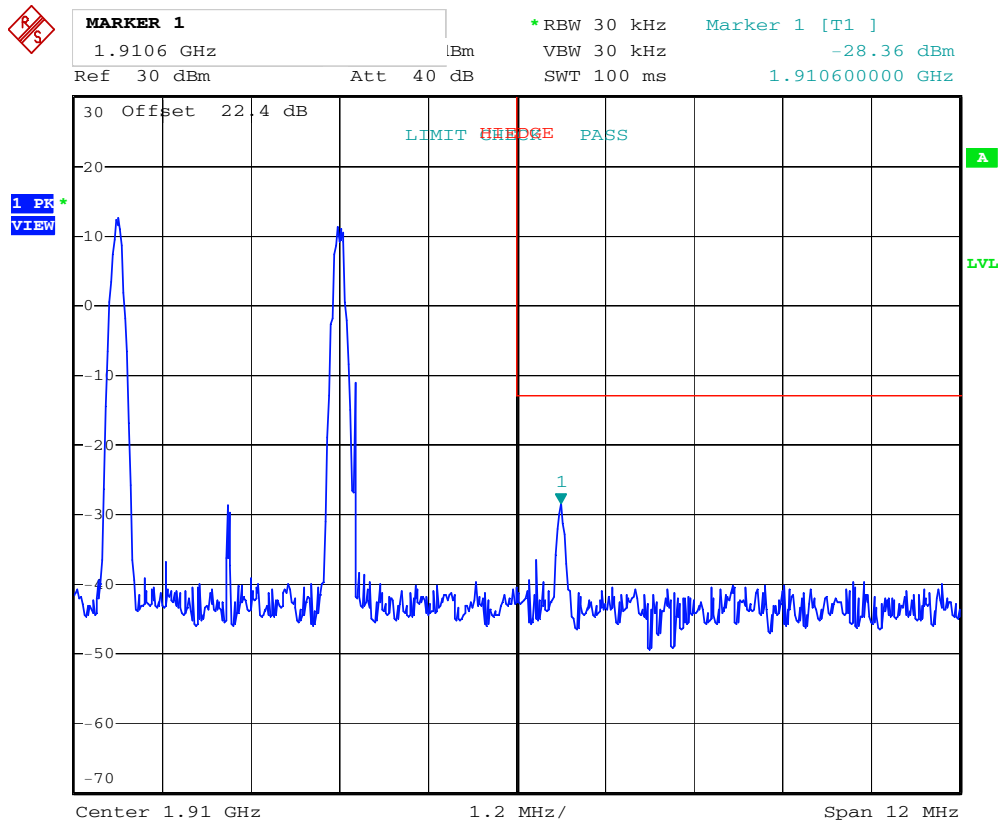
Date: 6.SEP.2005 17:59:56

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – GSM

14 dBm per carrier



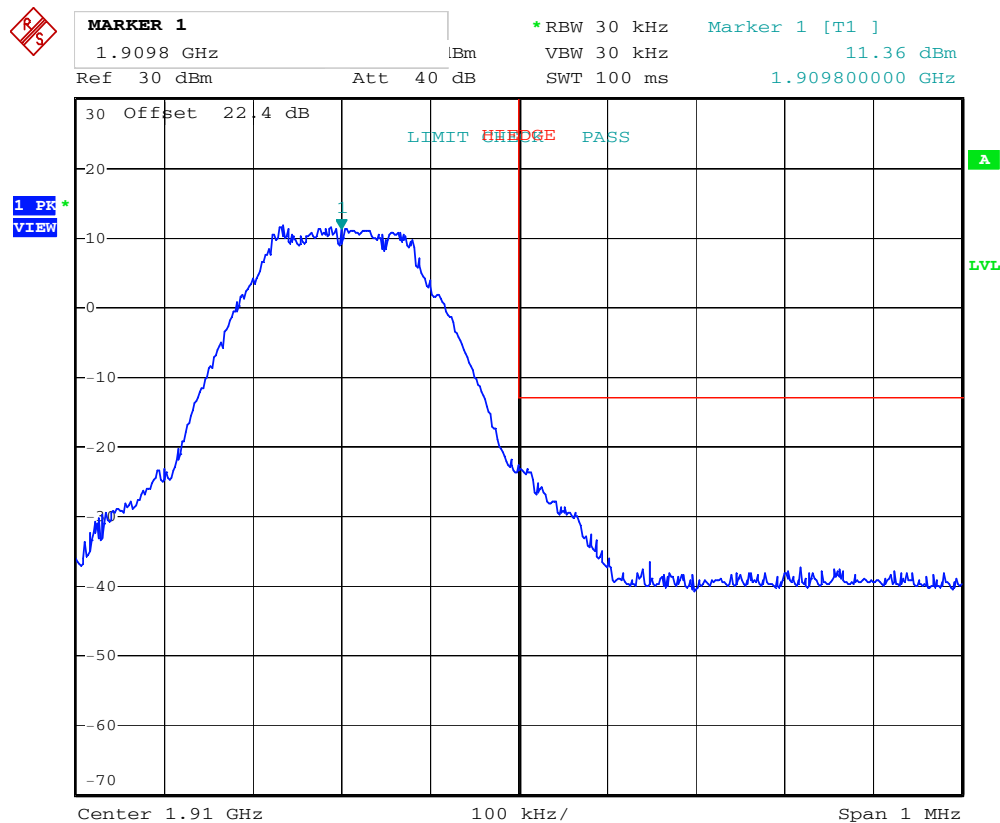
Date: 7.SEP.2005 10:46:22

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – GSM – Highest operating Channel

17 dBm



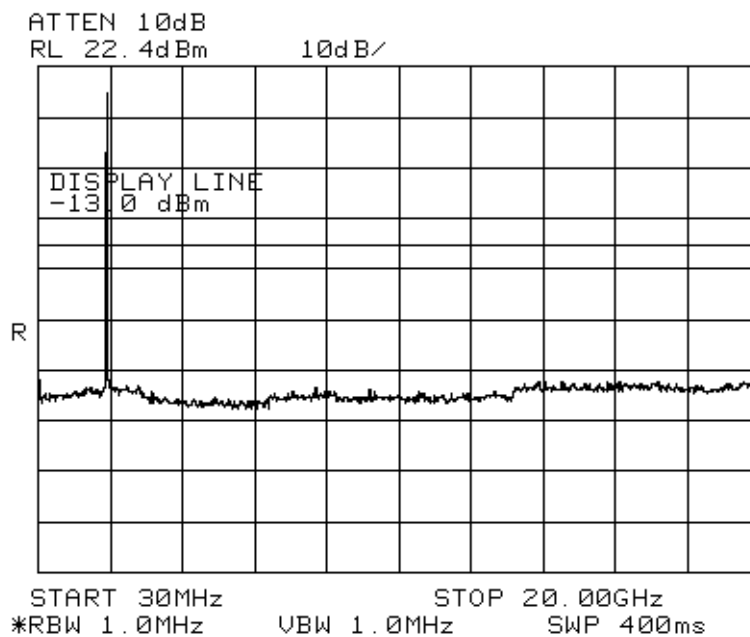
Date: 7.SEP.2005 10:42:10

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – GSM

Single carrier +17 dBm

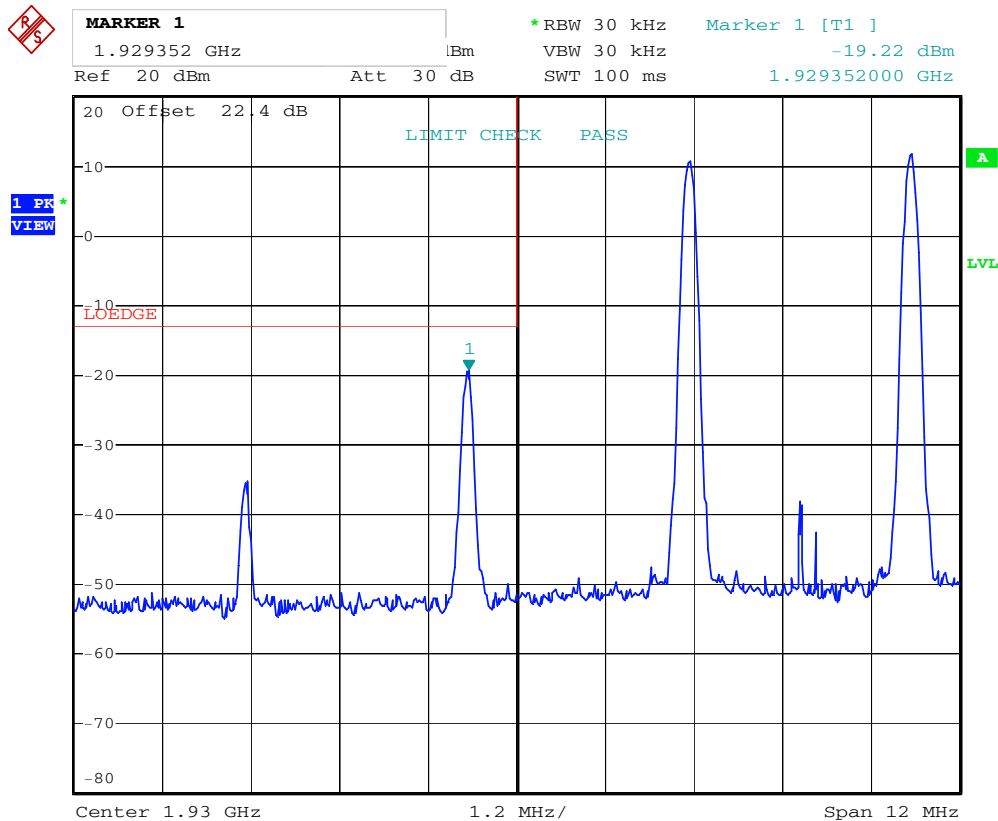


EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – GSM

14 dBm per carrier



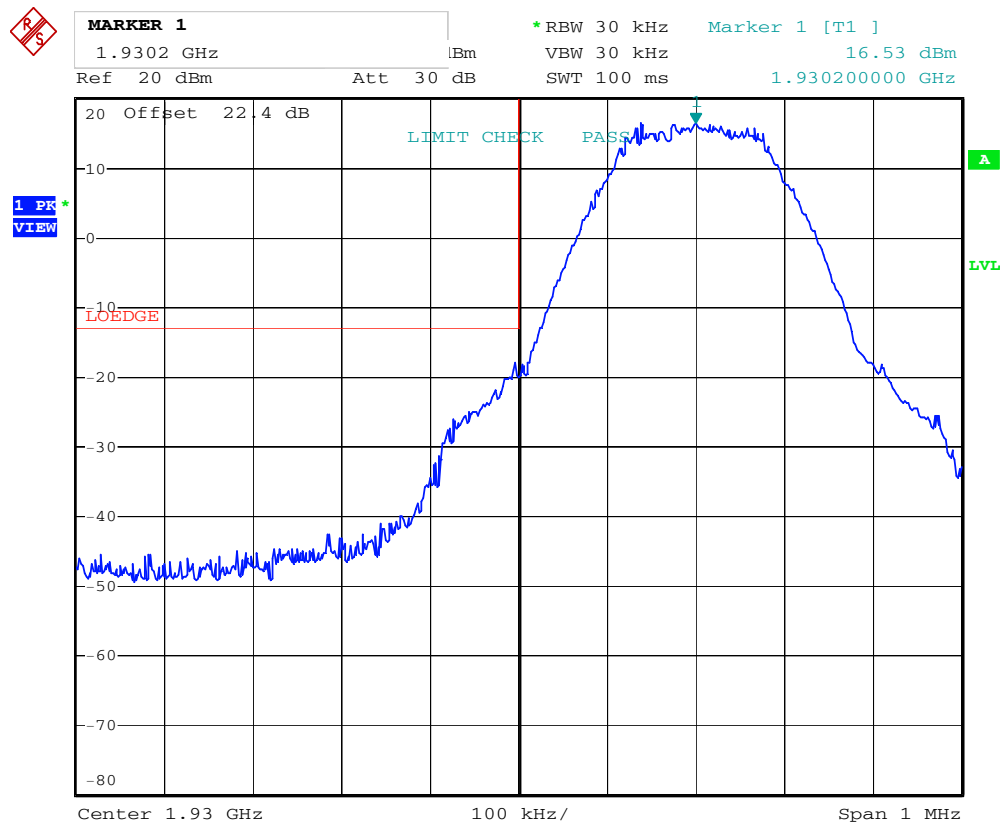
Date: 6.SEP.2005 18:10:12

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – GSM – Highest operating channel

17 dBm



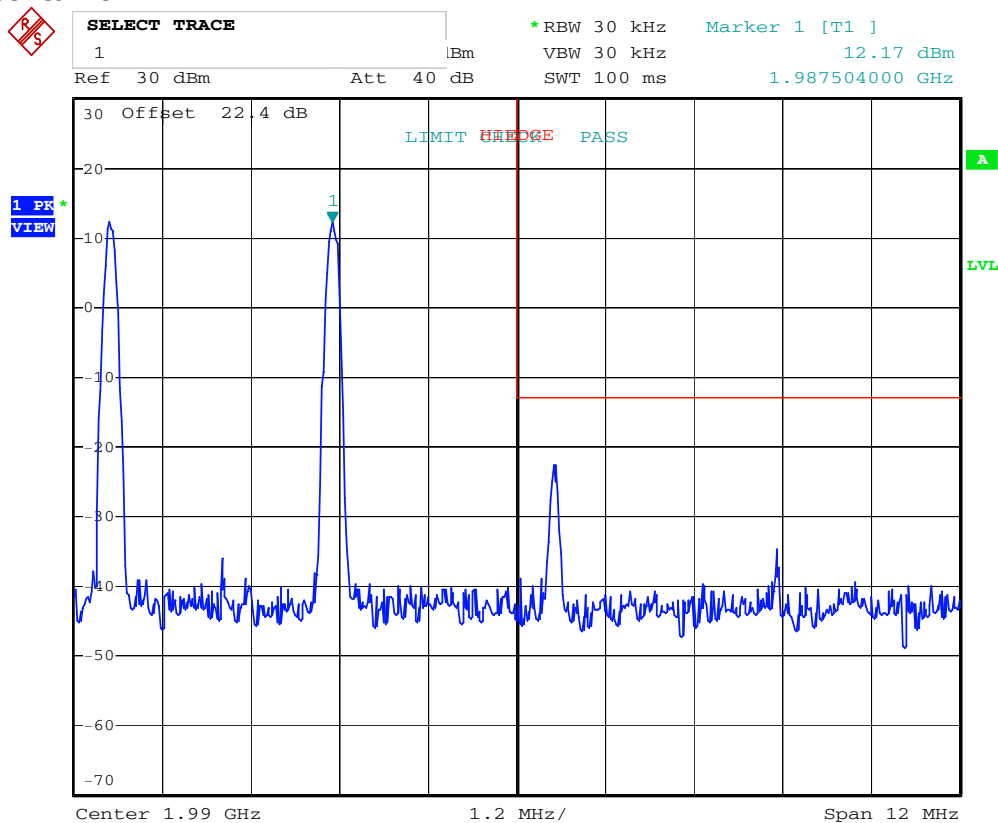
Date: 6.SEP.2005 18:08:20

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – GSM

14 dBm per carrier



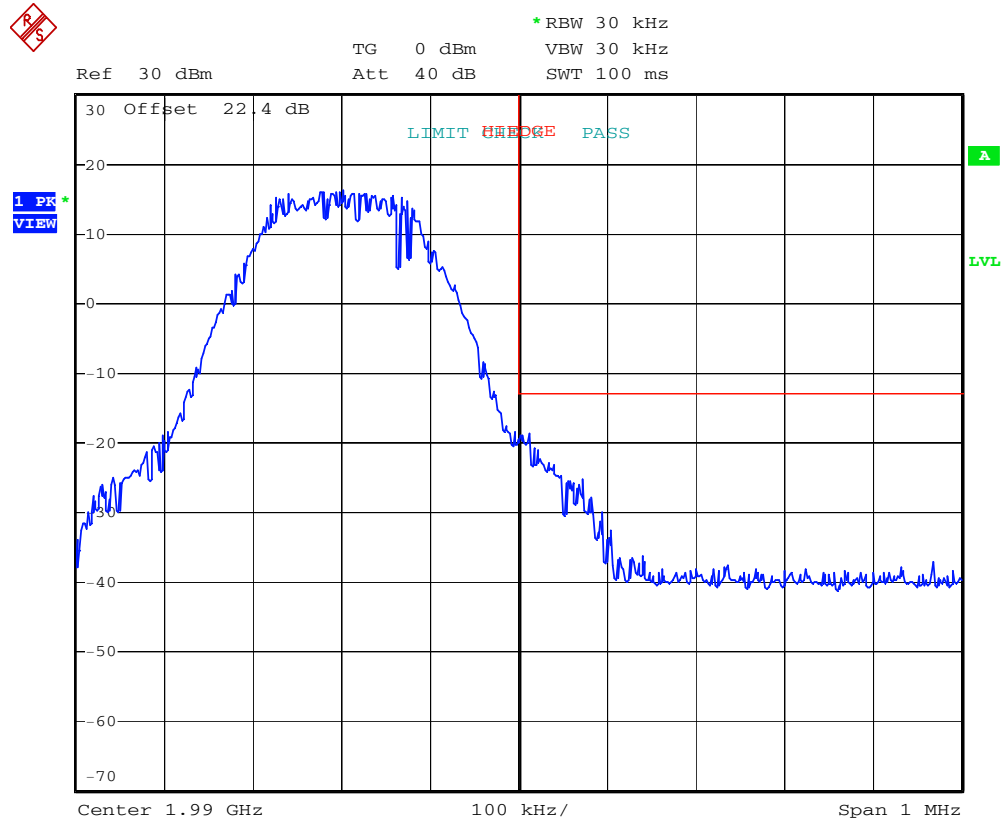
Date: 7.SEP.2005 10:15:26

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – GSM – Highest operating channel

17 dBm



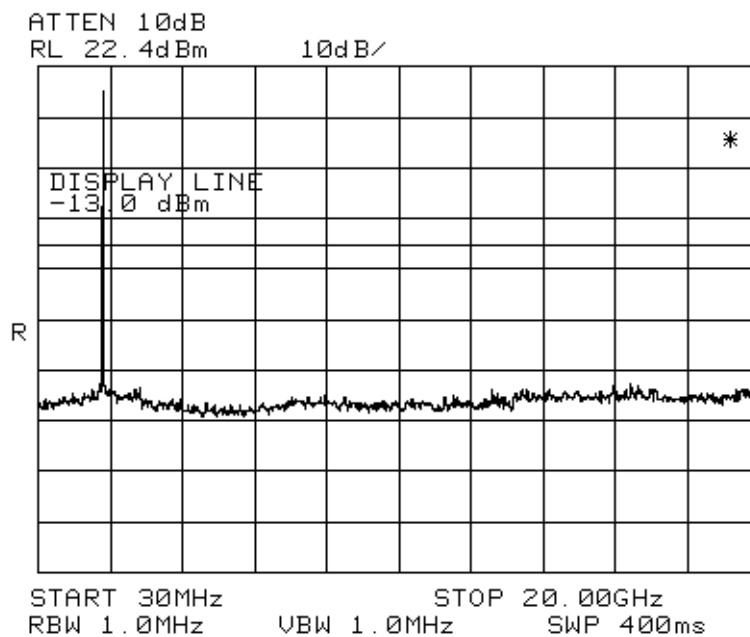
Date: 7.SEP.2005 10:38:58

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – W-CDMA

Single carrier +11 dBm

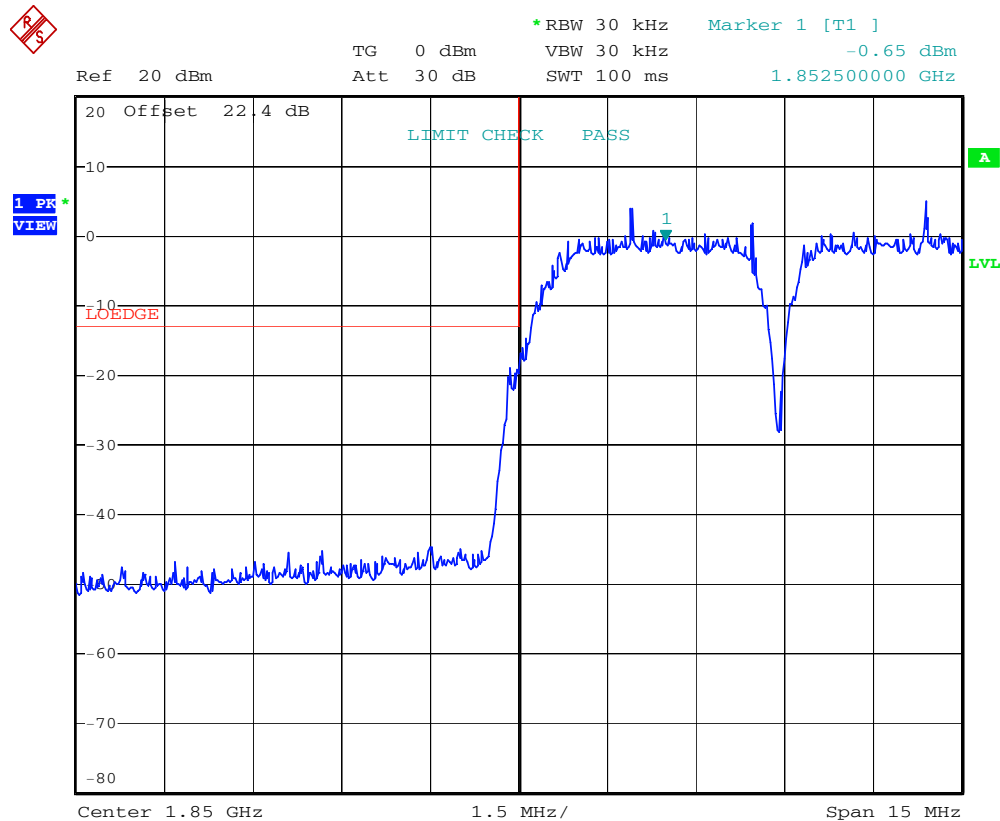


EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – W-CDMA – Lowest operating channel

Two carriers at 8 dBm each



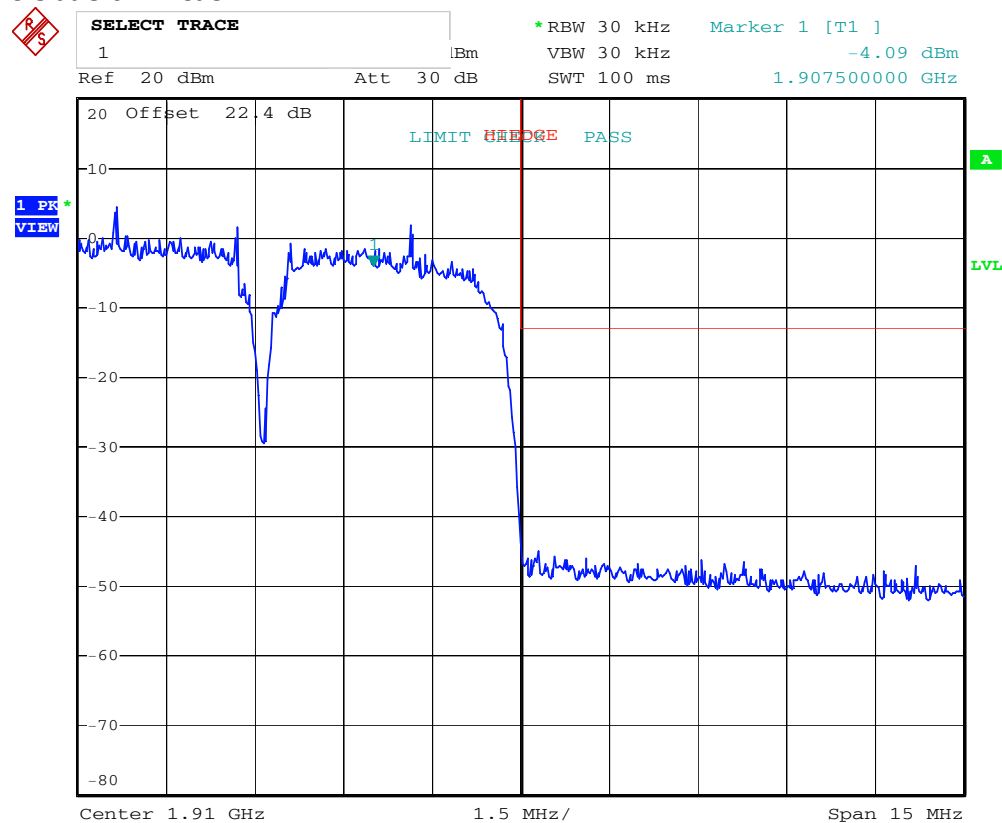
Date: 6.SEP.2005 17:26:44

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – W-CDMA – Highest operating channel

Two carriers at 8 dBm each



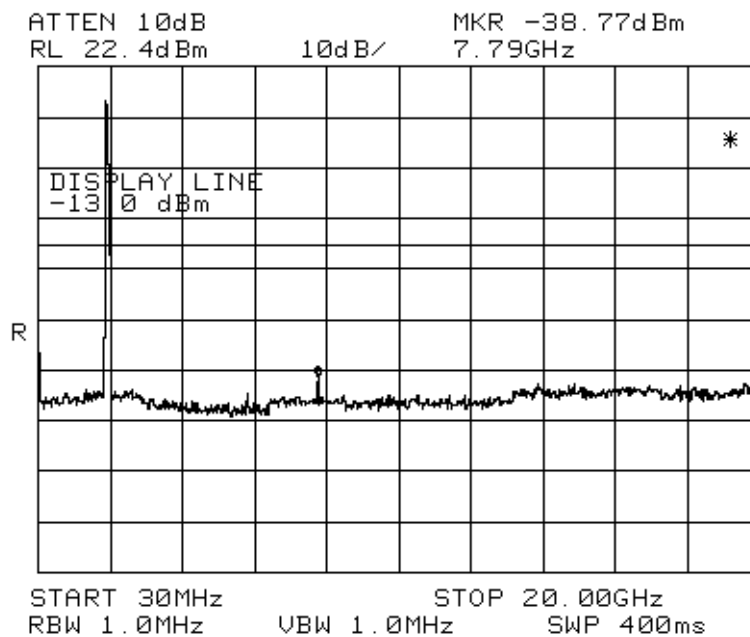
Date: 6.SEP.2005 17:28:26

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – W-CDMA

Single carrier +11 dBm

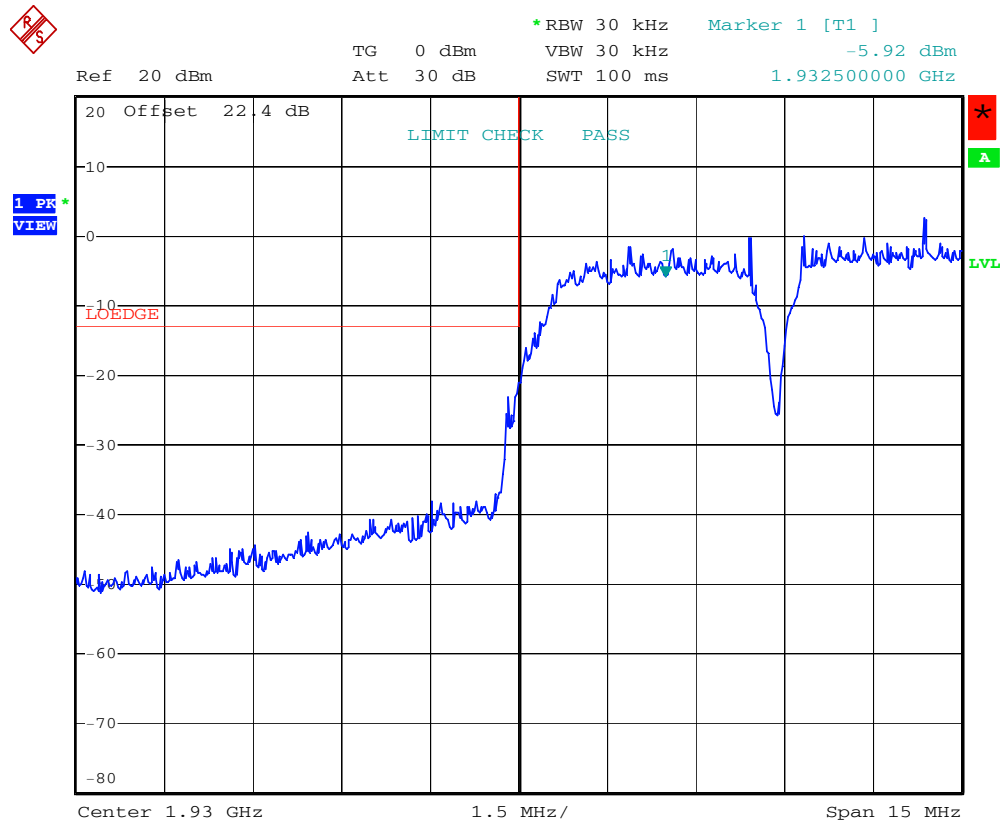


EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – W-CDMA – Lowest operating channel

Two carriers at 8 dBm each



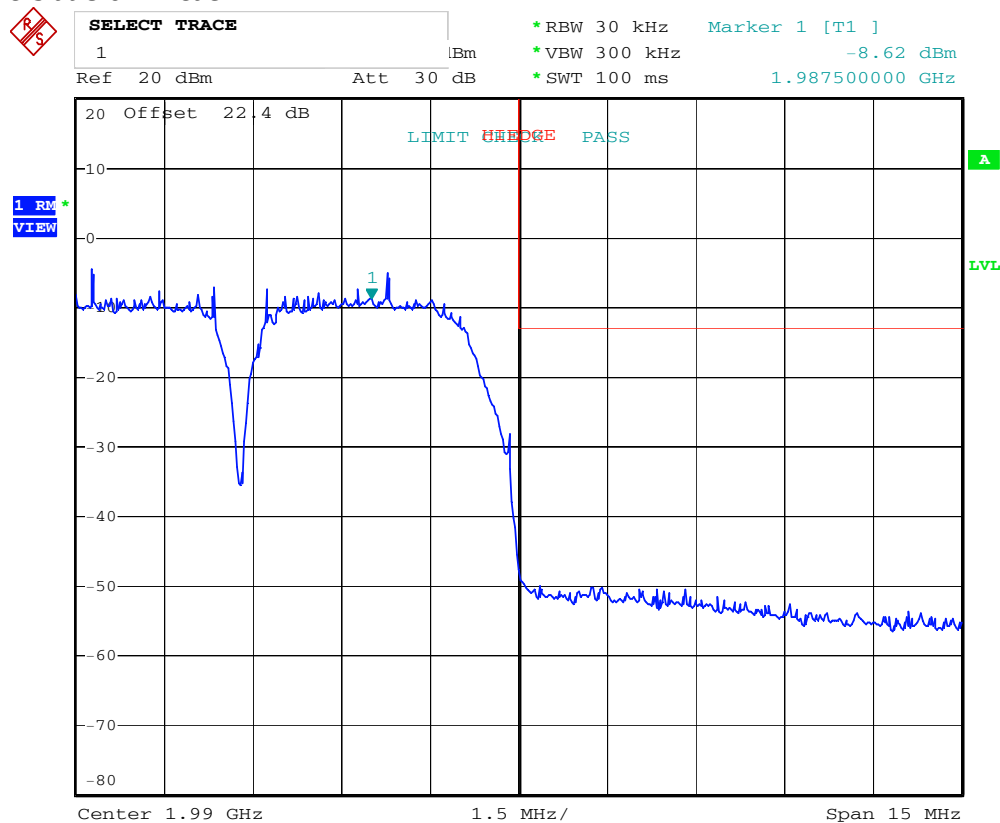
Date: 6.SEP.2005 17:23:52

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – W-CDMA – Highest operating channel

Two carriers at 8 dBm each



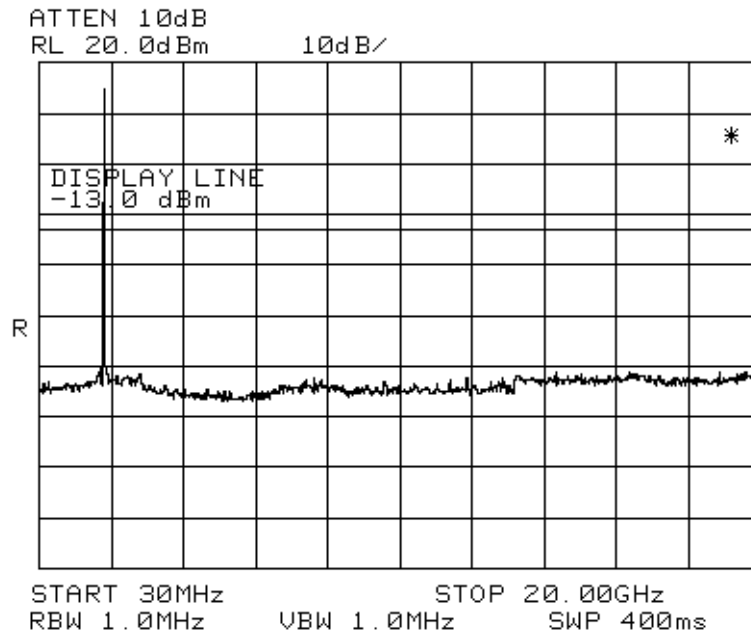
Date: 6.SEP.2005 17:19:25

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – EDGE

Single carrier +17 dBm

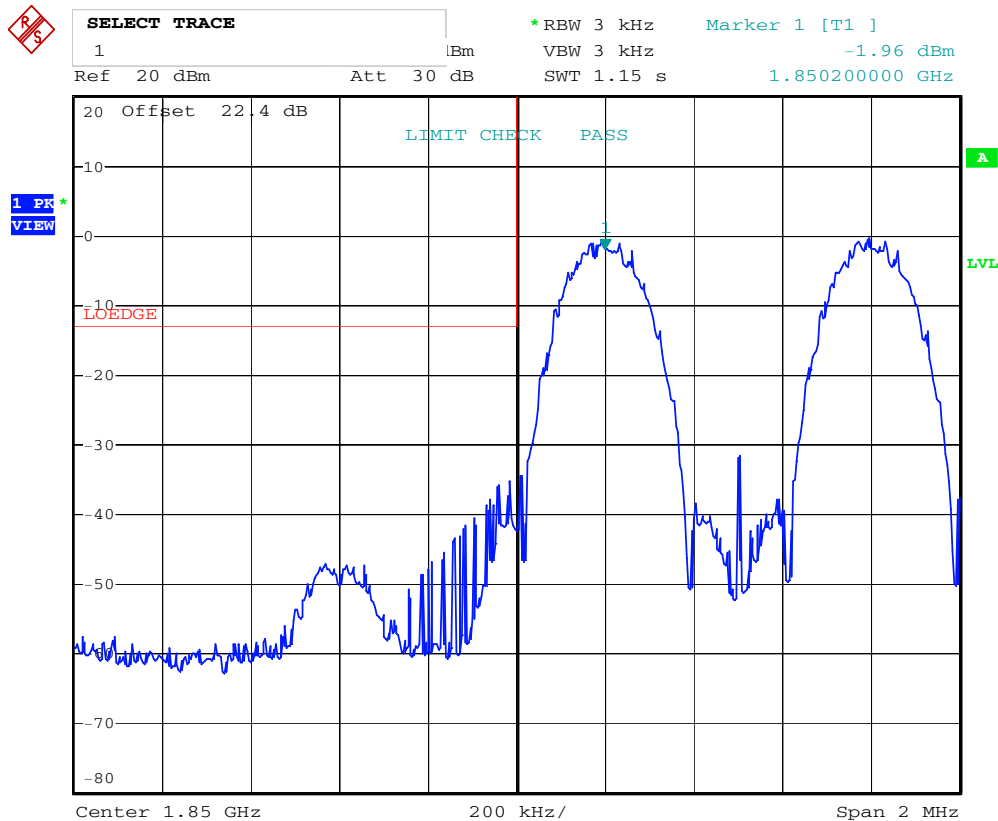


EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – EDGE

13 dBm per carrier



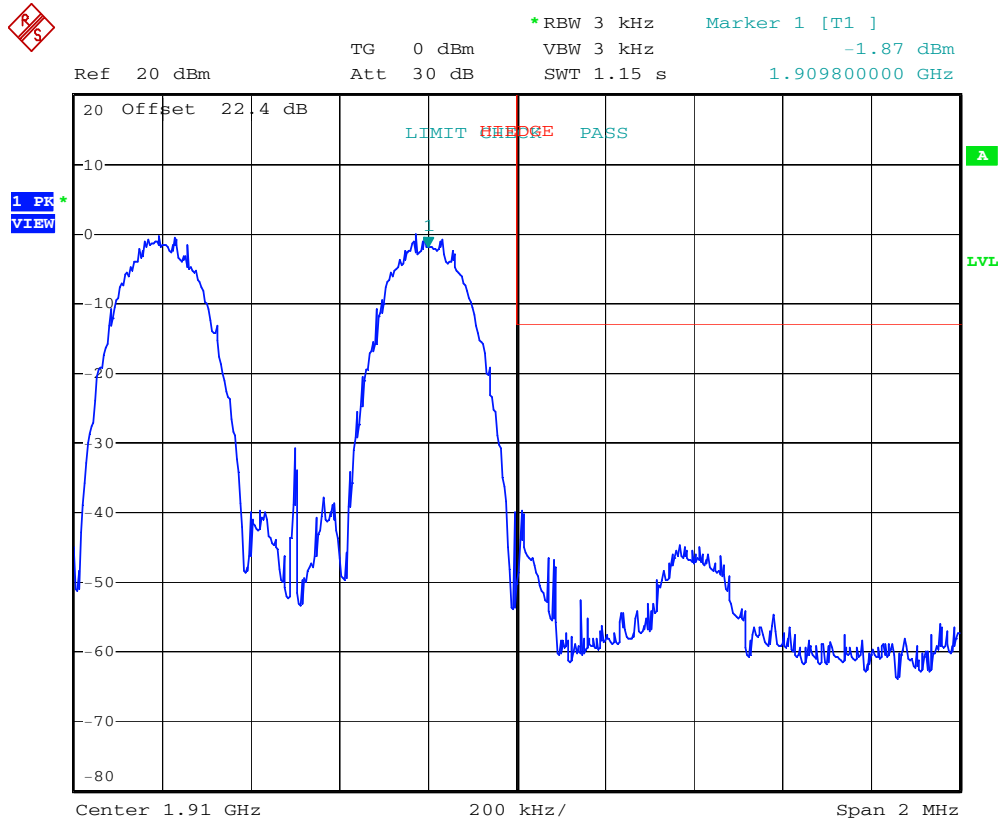
Date: 7.SEP.2005 12:44:38

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

UL – EDGE

13 dBm per carrier



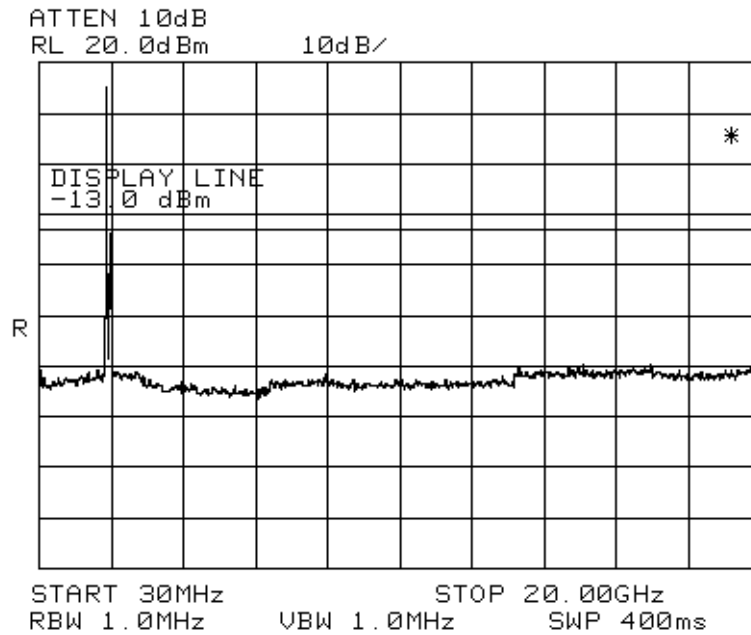
Date: 7.SEP.2005 12:47:20

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – EDGE

Single carrier +17 dBm

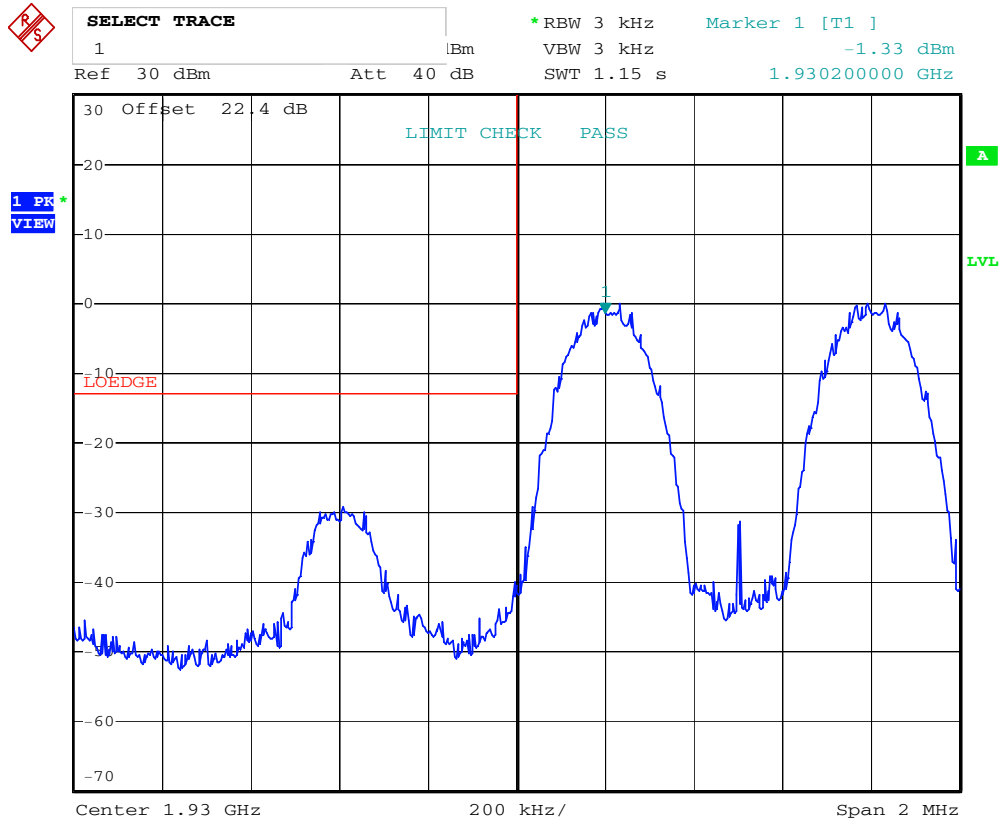


EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – EDGE

13 dBm per carrier



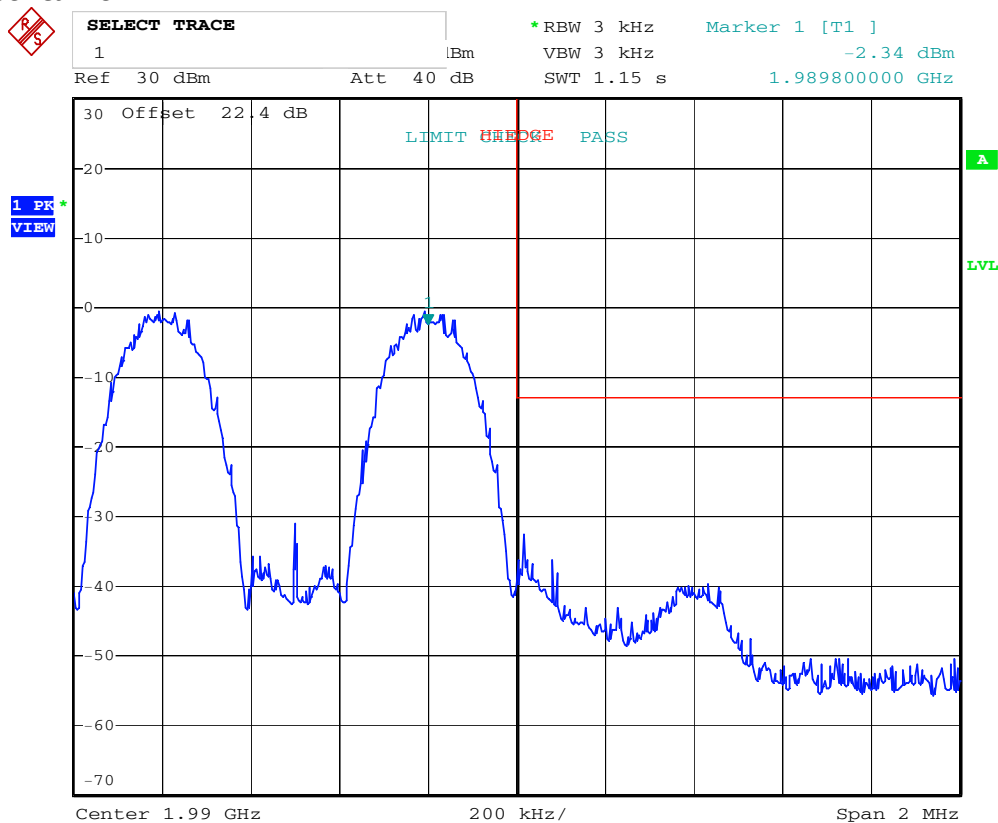
Date: 7.SEP.2005 13:01:15

EQUIPMENT: MR1903D

Test Data – Spurious Emissions at Antenna Terminals

DL – EDGE

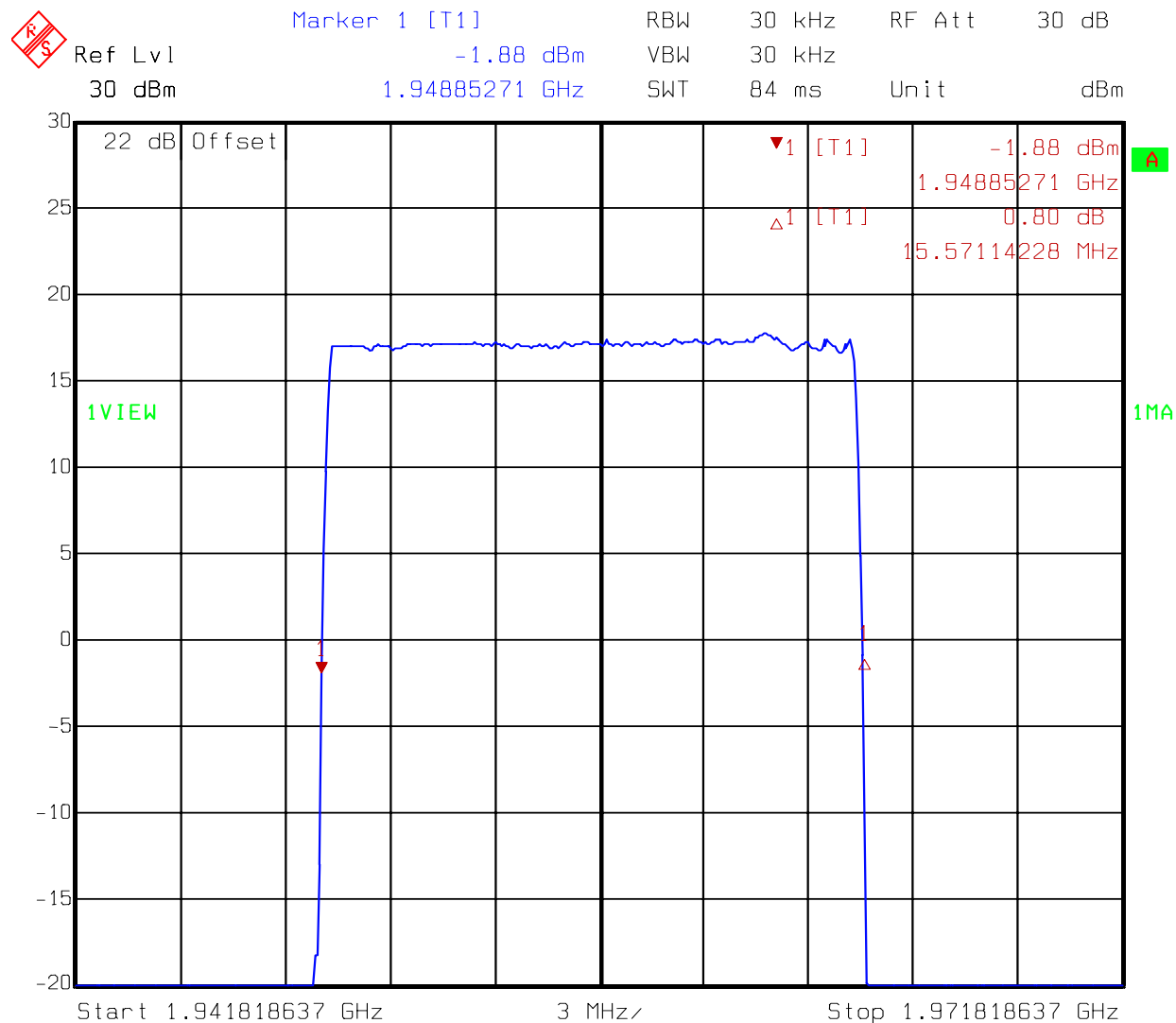
13 dBm per carrier



Date: 7.SEP.2005 12:58:50

EQUIPMENT: MR1903D

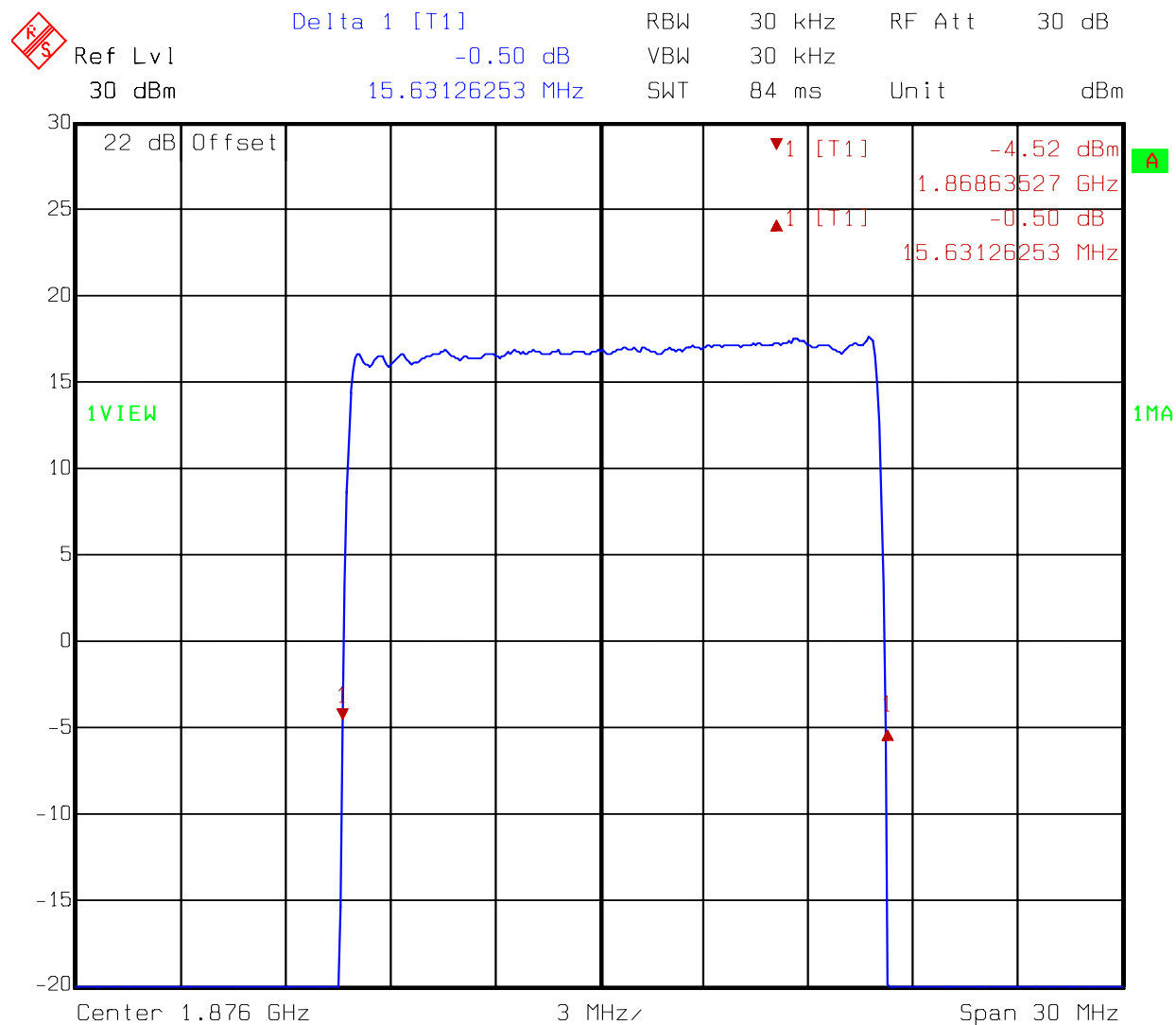
20 dB Pass band 15 MHz Module - DL



Date: 31.AUG.2005 14:06:43

EQUIPMENT: MR1903D

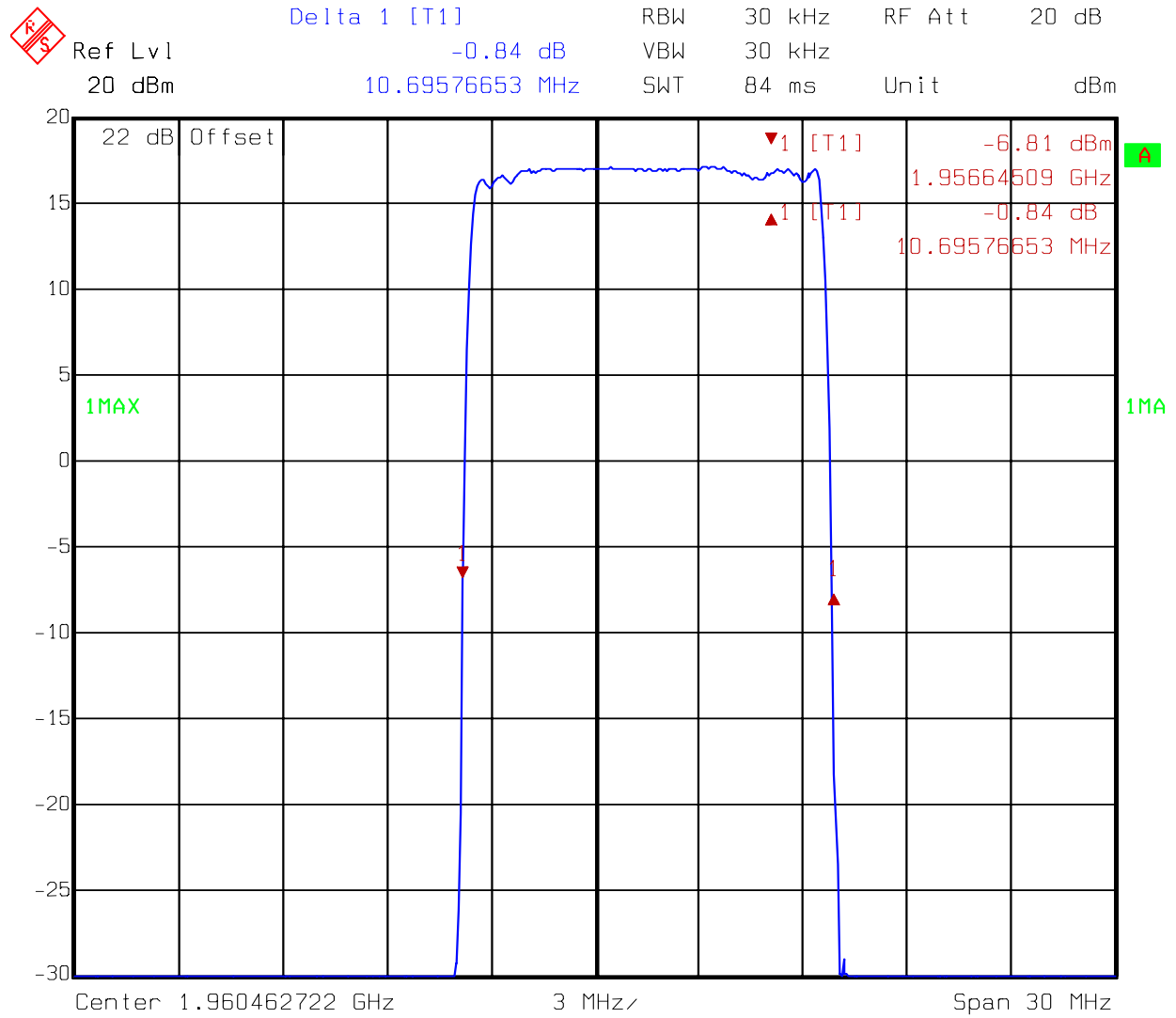
20 dB Passband 15 MHz Module – UL



Date: 31.AUG.2005 14:41:52

EQUIPMENT: MR1903D

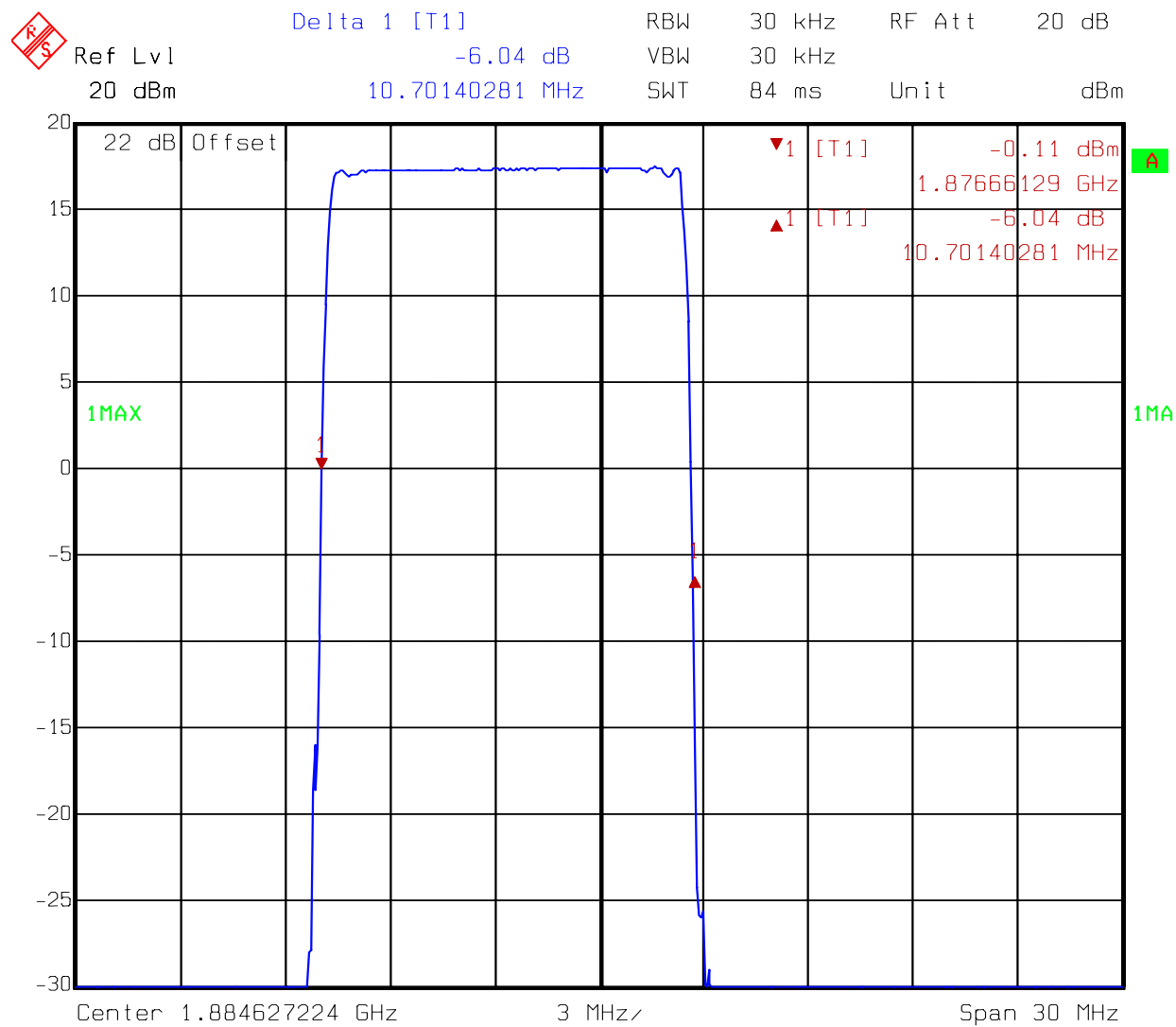
20 dB passband 10 MHz module DL



Date: 31.AUG.2005 15:13:27

EQUIPMENT: MR1903D

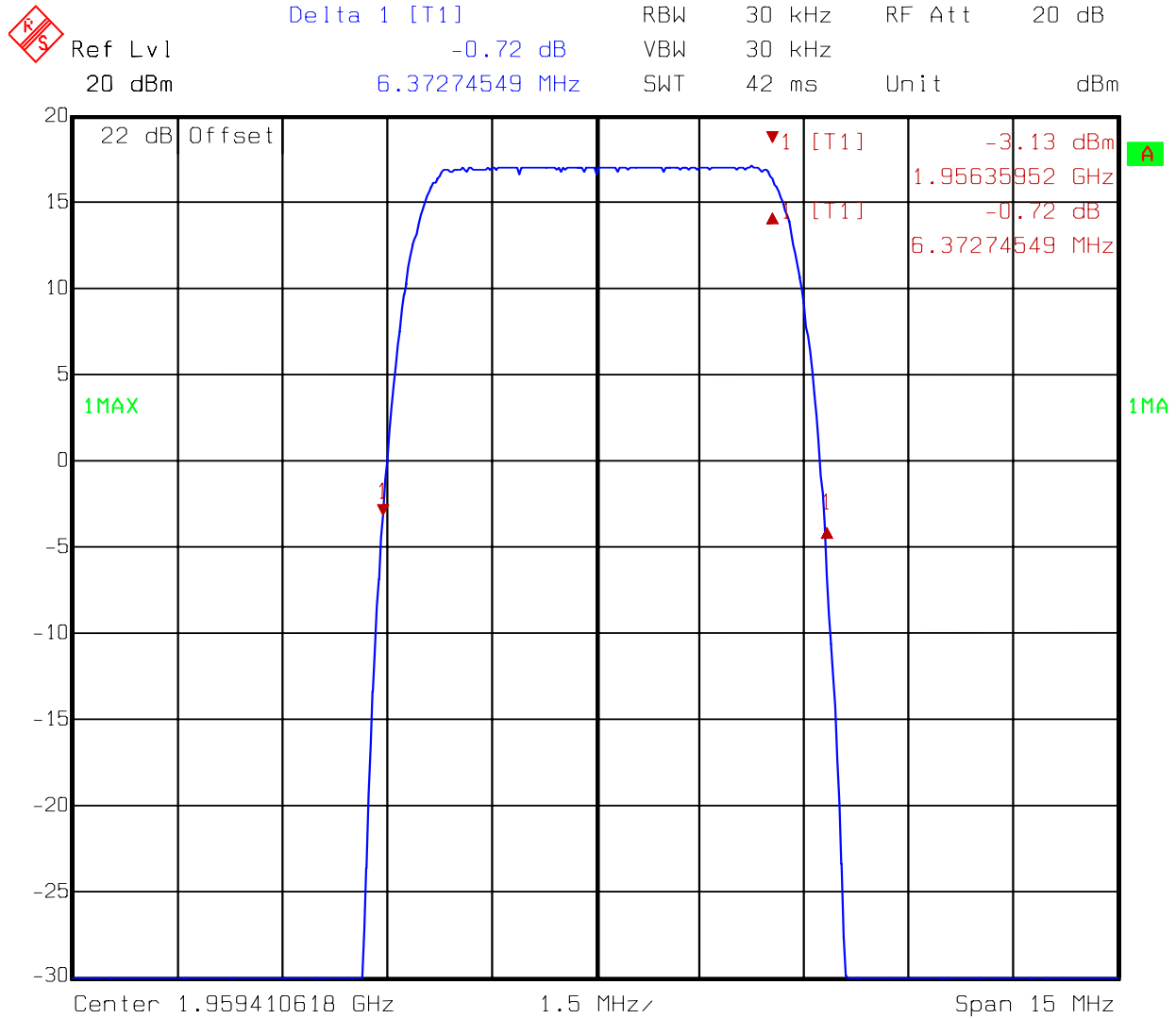
20 dB passband 10 MHz module – UL



Date: 31.AUG.2005 15:08:29

EQUIPMENT: MR1903D

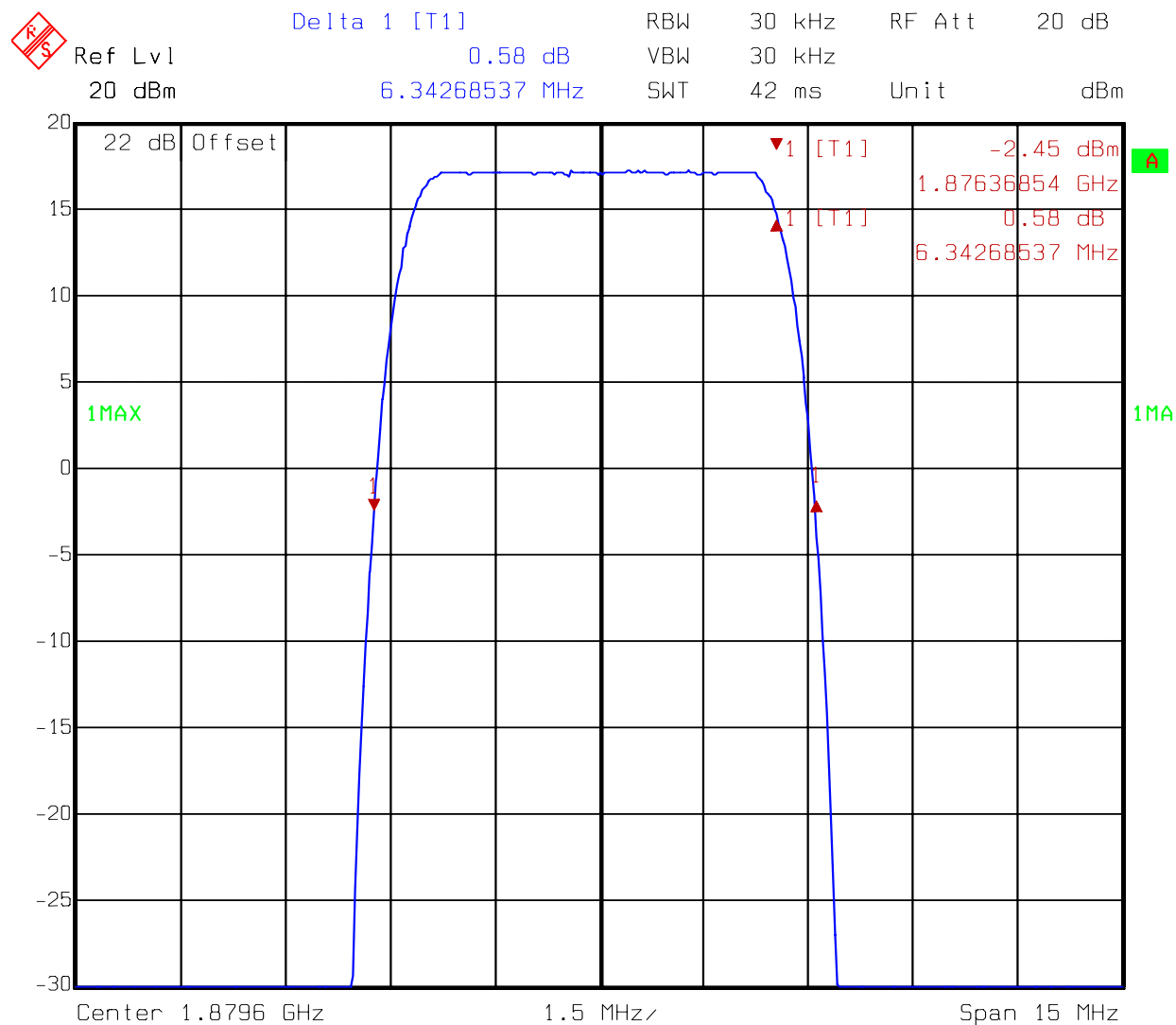
20 dB passband 5 MHz module DL



Date: 31.AUG.2005 15:20:03

EQUIPMENT: MR1903D

20 dB passband 5 MHz module UL



Date: 31.AUG.2005 15:23:15

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 07 August 2005

Test Results: Complies.

Test Data: There were no emissions detected above the noise floor which was at least 20 dB below the specification limit of -13 dBm EIRP. The EUT was tested in both Uplink and Downlink modes at the highest rated output power of +17 dBm. The highest noise floor reading was -39.4 dBm EIRP at 15.5 GHz in the vertical polarity.

The spectrum was searched from 30 MHz to 20 GHz.

Measurements on three channels (Highest , Middle and Lowest) utilizing all modulations. Data presented is representative of all channels tested.

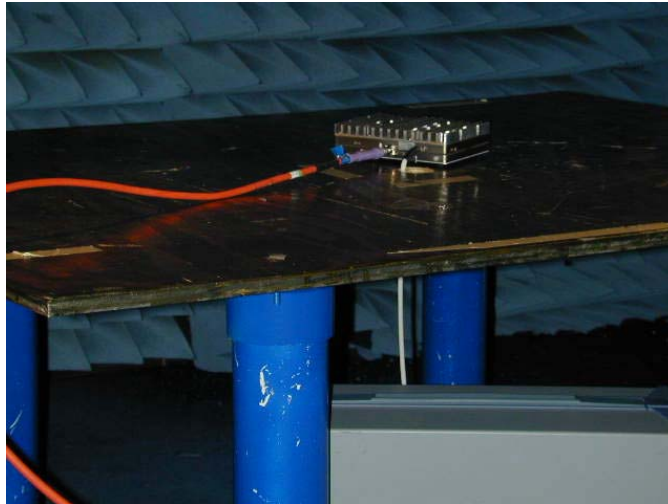
Equipment Used: 1480-1484-1485-1464-993-1311-760-791-991

Measurement Uncertainty: +/- 1.6 dB

Temperature: 22 °C

Relative Humidity: 45 %

Photographs of Test Setup



Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
1659	Spectrum Analyzer	Rhode & Schwarz FSP	973353	10/02/03	10/02/05
1626	CABLE, 5 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/04	11/12/05
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/05	08/26/06
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/26/05	08/26/06
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/01/05	08/02/07
991	Horn antenna	EMCO 3160-10	9704-1049	CNR	N/A
1311	ANTENNA, LOG PERIODIC	EMCO 3146	1753	08/02/05	08/02/06
760	Antenna biconical	Electro Metrics MFC-25	477	08/04/05	08/04/06
791	PREAMP, 25dB	ICC LNA25	398	11/12/04	11/12/05
1052	I/Q MODULATION GENERATOR	Rhode & Schwarz AMIQ	DE30619	CBU	NA
1053	SIGNAL GENERATOR	ROHDE & SCHWARZ SMIQ 03	DE22081	CBU	NA

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 spectrum analyzer. 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: $\geq$ RBW

Span: 5 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

GSM

RBW: 3 kHz

VBW: $\geq$ RBW

Span: 2 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

NADC

RBW: 1 kHz

VBW: $\geq$ 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
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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 (< 1 MHz from Band Edge)
VBW: $\geq$ 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: $\geq$ RBW
Sweep: Auto
Video Avg: Disabled

NADC

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ 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 (5×10^{-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)

$R = 3\text{m}$ (Measurement Distance)

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

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

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

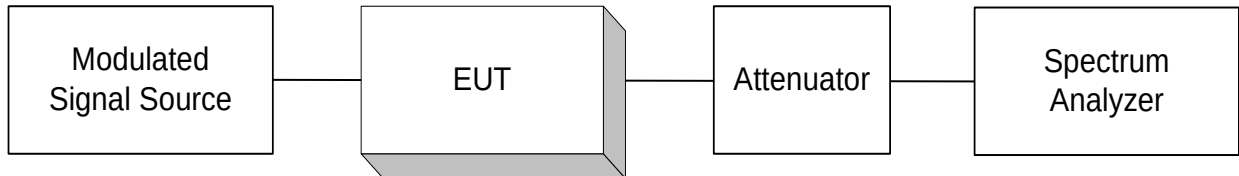
$P = 1 \times 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

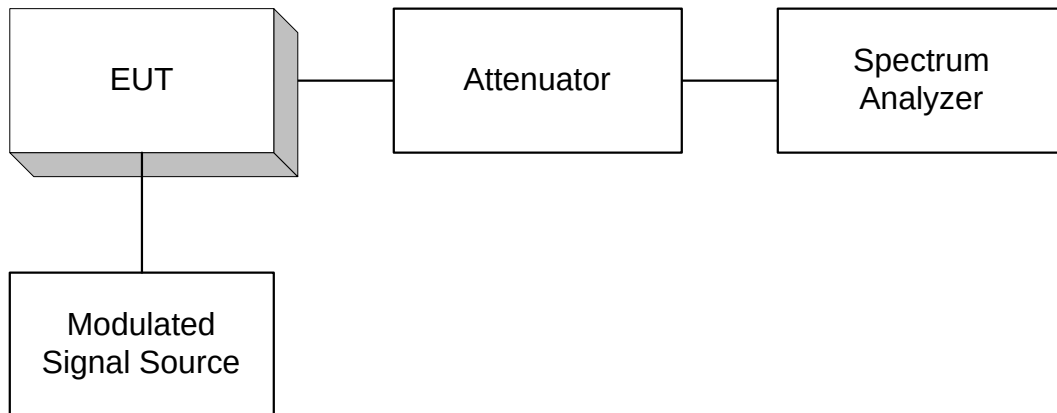
$$E = 84.4 - 20 \log \sqrt{1.64} = 82.3 \text{ dB}\mu\text{V / m} @ 3\text{m}$$

ANNEX B - TEST DIAGRAMS

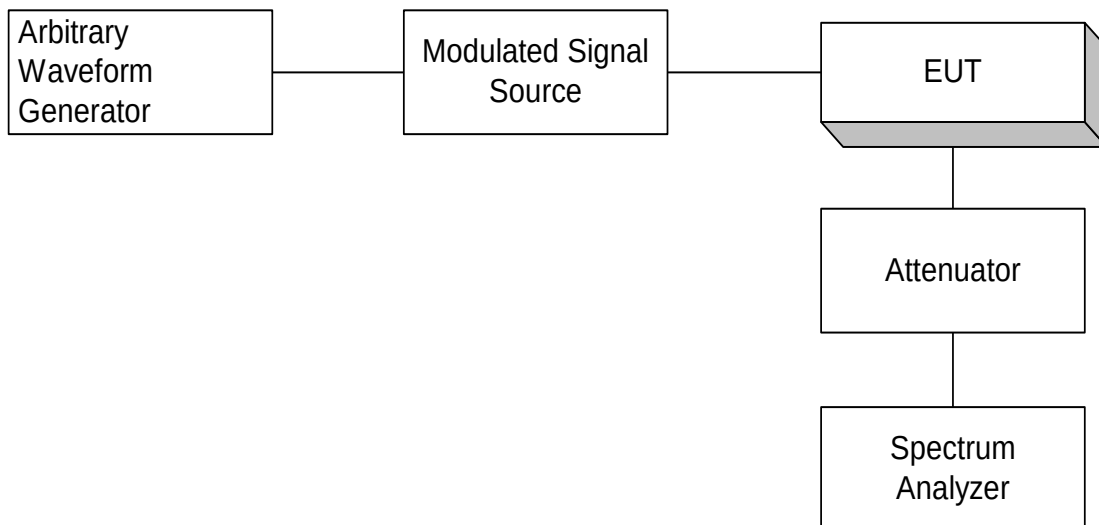
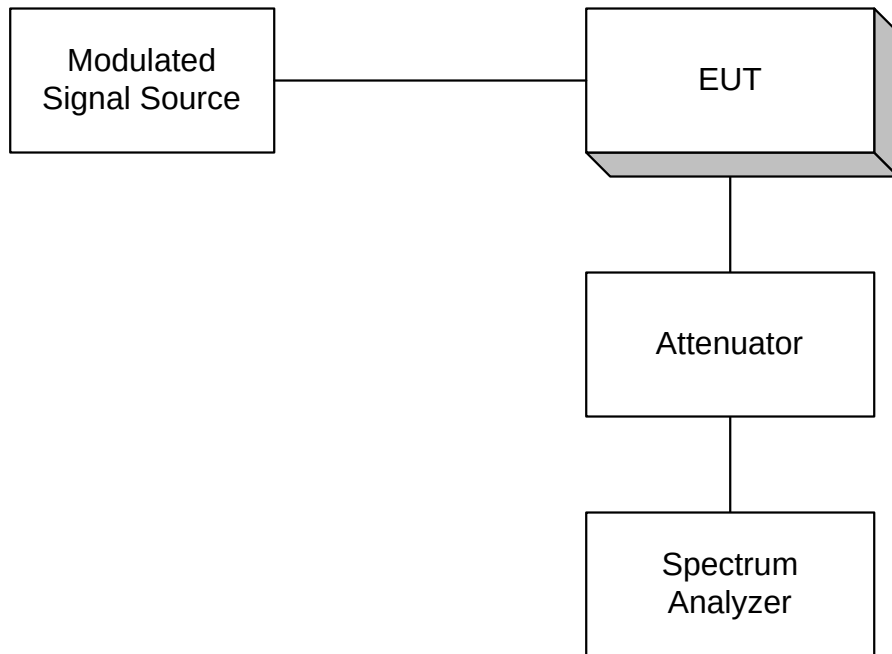
Para. No. 2.985 - R.F. Power Output



Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 Spurious Emissions at Antenna Terminals



The diagram illustrates the test setup for measuring the radiation pattern of an E.U.T. (Equivalent Under Test). The setup is as follows:

- A horizontal line represents the ground plane.
- A vertical line represents the turn-table axis.
- A rectangular block labeled "E.U.T." is mounted on a "NON-CONDUCTING TURN-TABLE".
- The height of the turn-table is indicated as "0.8 METER".
- A horizontal line extends from the E.U.T. to a vertical screen, labeled "SEARCH ANTENNA".
- The distance from the turn-table axis to the search antenna is indicated as "3 METERS".
- The vertical screen is labeled "VARIABLE SEARCH HEIGHT (1 TO 4 m)".
- A cable connects the search antenna to a "TO TEST RECEIVER/SPECTRUM ANALYZER".

The diagram illustrates the experimental setup. A **Climate Chamber** contains an **E.U.T.** (Equivalent Uncertainty Test). The **E.U.T.** is connected to an **Attenuator**, which is in turn connected to a **Frequency Counter**. A **Signal Generator** and a **Variable Power Supply** are connected to the **E.U.T.**. A **10 MHz Reference** signal is provided to the **Signal Generator** and the **Frequency Counter**.