

Nemko Test Report: 6L0642RUS7

Applicant: Andrew Corporation
108 Rand Park Drive
Garner, NC 27529
USA

**Equipment Under Test:
(E.U.T.)** AMR8515

In Accordance With: **CFR 47, Part 22, Subpart H**
Cellular Band Repeaters

Tested By: Nemko USA Inc.
802 N. Kealy
Lewisville, TX
75057-3136

TESTED BY: 
David Light Wireless Engineer **DATE:** 25 September 2006

APPROVED BY: 
Kevin Rose Wireless Engineer **DATE:** 29 September 2006

Number of Pages: 60

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Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: AMR8515

Serial No.: None

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 CFR 47, Part 22, Subpart H.



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".



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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	22.913(a)	500W ERP	Complies
Occupied Bandwidth	Not defined	Input/Output	Complies
Spurious Emissions at Antenna Terminals	22.917	-13 dBm	Complies
Field Strength of Spurious Emissions	22.917	-13 dBm E.I.R.P.	Complies
Frequency Stability	22.355	1.5 ppm	NA

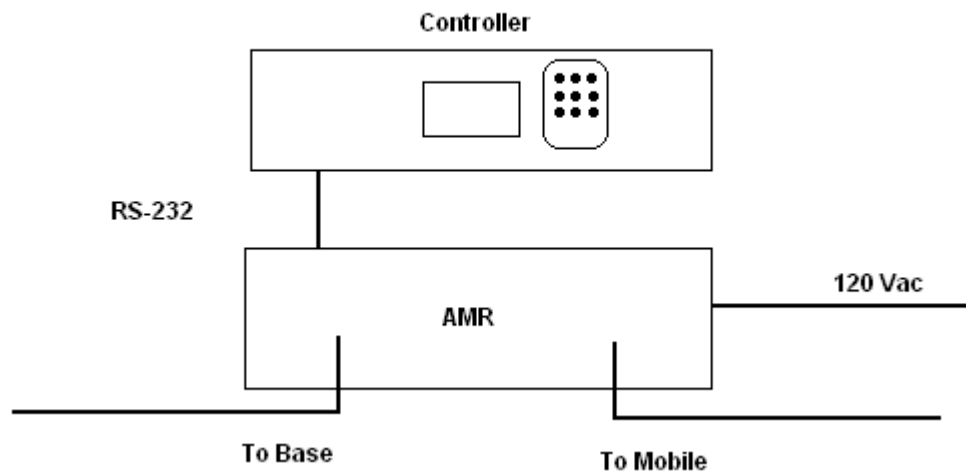
Footnotes: (1) Modulation characteristics were not tested since the E.U.T. processes but does not produce a modulated waveform.

Section 2. General Equipment Specification

Supply Voltage Input:	120 Vac				
Frequency Range:	Downlink:	869-894 MHz			
Frequency Range:	Uplink:	824-849 MHz			
Type of Modulation and Designator:	CDMA (F9W)	GSM (GXW)	TDMA (DXW)	EDGE (G7W)	W-CDMA (F9W)
	☒	☒	☒	☒	☐
Output Impedance:	50 ohms				
RF Output (Rated):	Downlink:	0.50 W 27 dBm			
	Uplink:	0.32 W 25 dBm			
Frequency Translation:	F1-F1	F1-F2	N/A		
	☒	☐	☐		
Band Selection:	Software	Duplexer Change	Fullband Coverage		
	☒	☐	☐		

Description of EUT

Bi-directional amplifier used to enhance signals between a mobile and a base station in a wireless network. Typical applications are coverage improvement in small and medium sized environments such as offices, store fronts, underground floors, and small manufacturing facilities. The AMR family will automatically set its gain to maximize performance. However, an alphanumeric interface allows the user to manually set the gain if desired. ALC, Automatic Level Control, is incorporated to prevent overdriving the amplifier.

System Diagram

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 22.913
TESTED BY: David Light	DATE: 08 September 2006

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

Direction	Modulation	Output per Channel (dBm)	Composite Power (dBm)	Composite Power (W)
Uplink	CDMA	24.03	27.03	0.50
Downlink	CDMA	22.01	25.01	0.32
Uplink	TDMA	24.06	27.06	0.50
Downlink	TDMA	22.02	25.02	0.32
Uplink	EDGE	24.02	27.02	0.50
Downlink	EDGE	22.00	25.00	0.32
Uplink	GSM	24.04	27.04	0.50
Downlink	GSM	22.01	25.01	0.32
Uplink	W-CDMA	22.03	25.03	0.50
Downlink	W-CDMA	20.00	23.00	0.32

Equipment Used: 1469-1472-1082-1659**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 25 °C**Relative Humidity:** 40 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: David Light	DATE: 08 September 2006

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1469-1472-1082-1659-1036

Measurement Uncertainty: 1X10⁻⁷ ppm

Temperature: 25 °C

Relative Humidity: 40 %

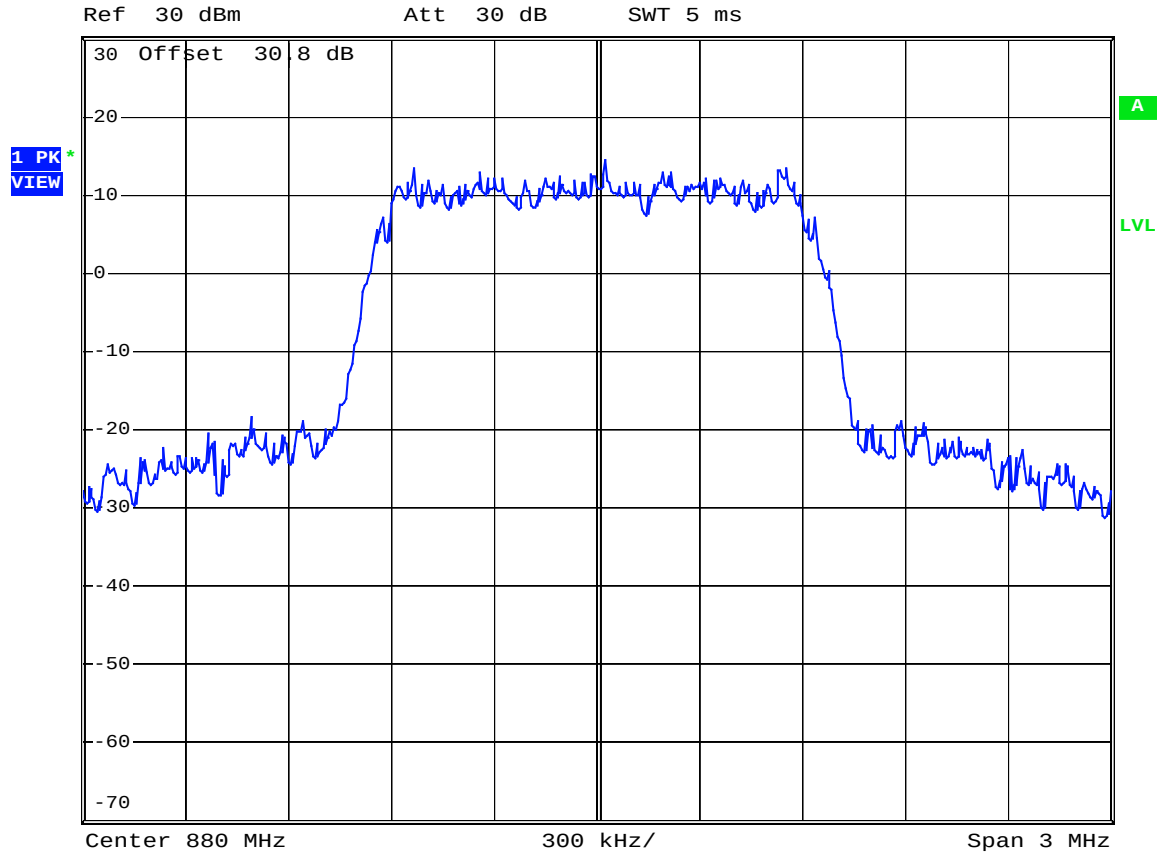
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

CDMA - Output
Downlink



* RBW 30 kHz
VBW 100 kHz
SWT 5 ms



Date: 11.SEP.2006 13:58:14

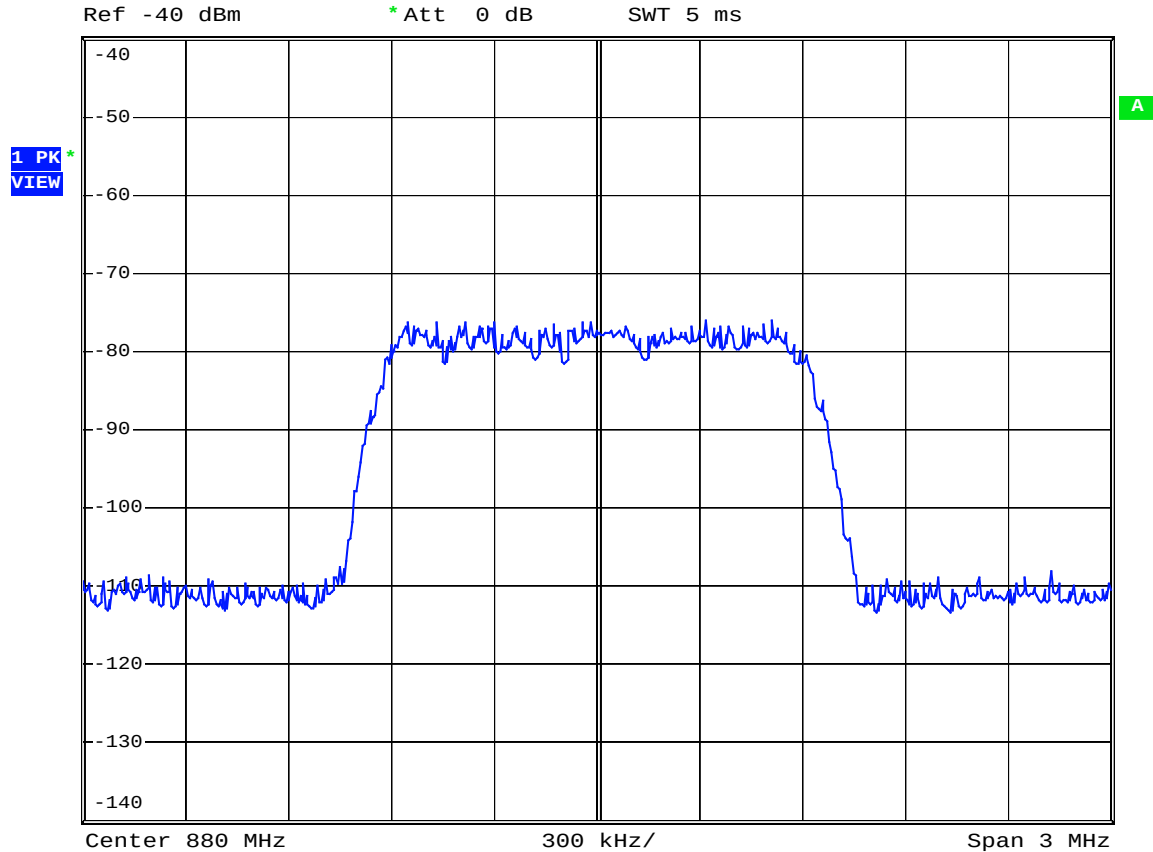
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

CDMA - Input
Downlink



* RBW 30 kHz
VBW 100 kHz
SWT 5 ms

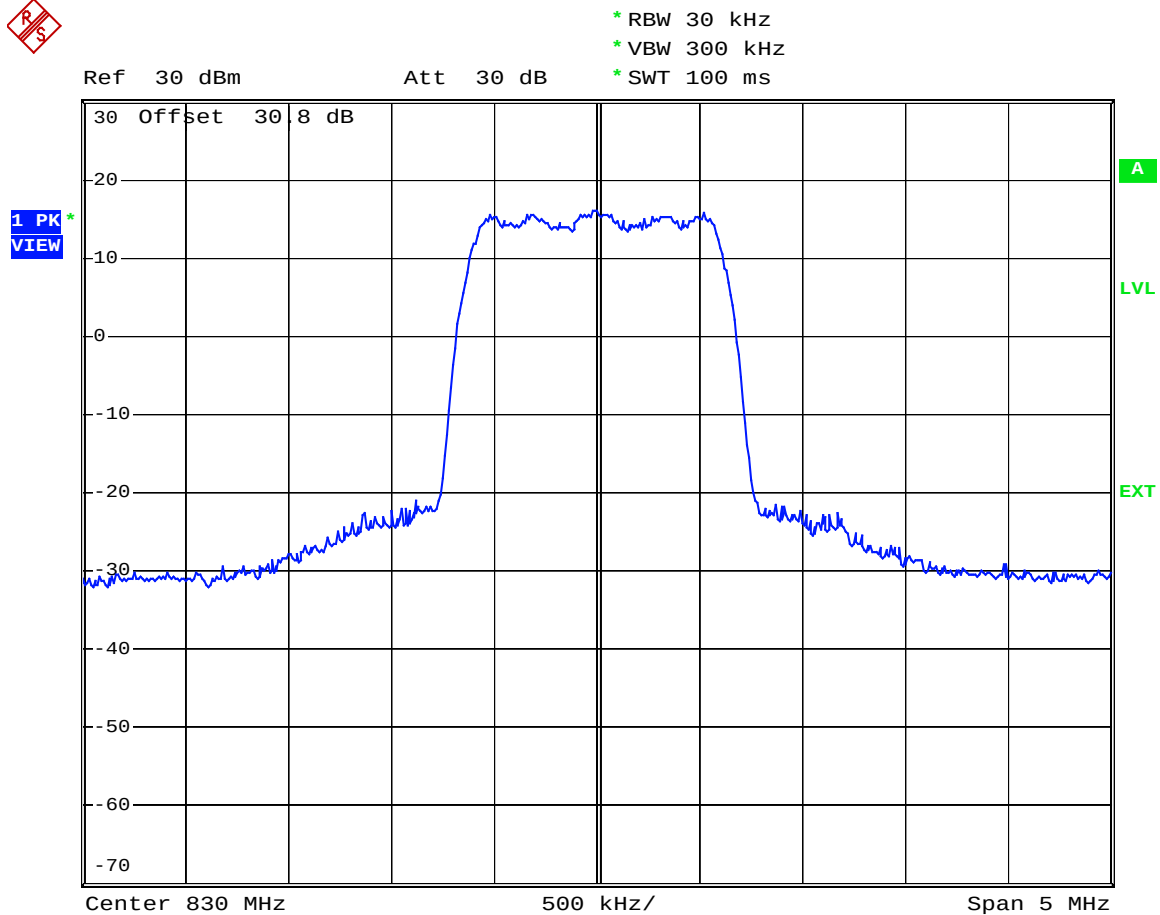


Date: 11.SEP.2006 13:56:54

EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

CDMA - Output
Uplink



Date: 8.SEP.2006 10:34:46

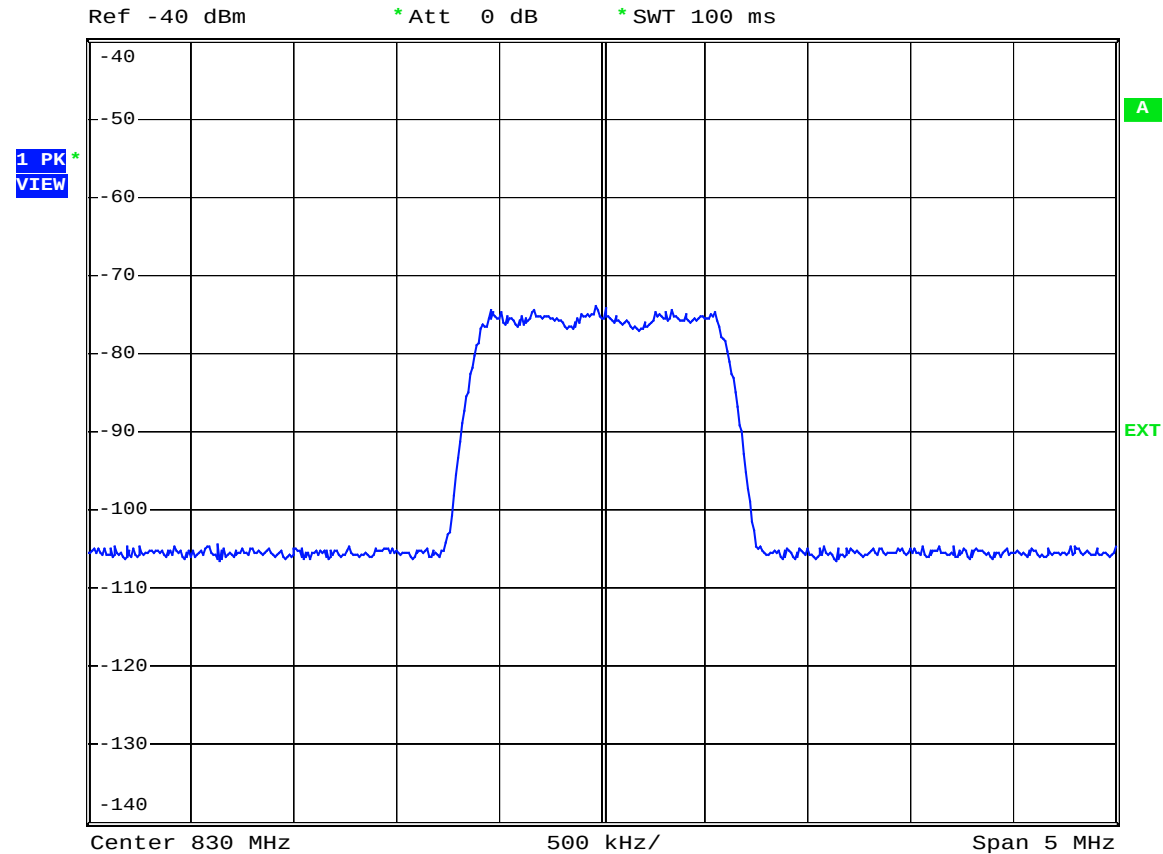
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

CDMA - Input
Uplink



* RBW 30 kHz
* VBW 300 kHz
* SWT 100 ms



Date: 8.SEP.2006 10:37:01

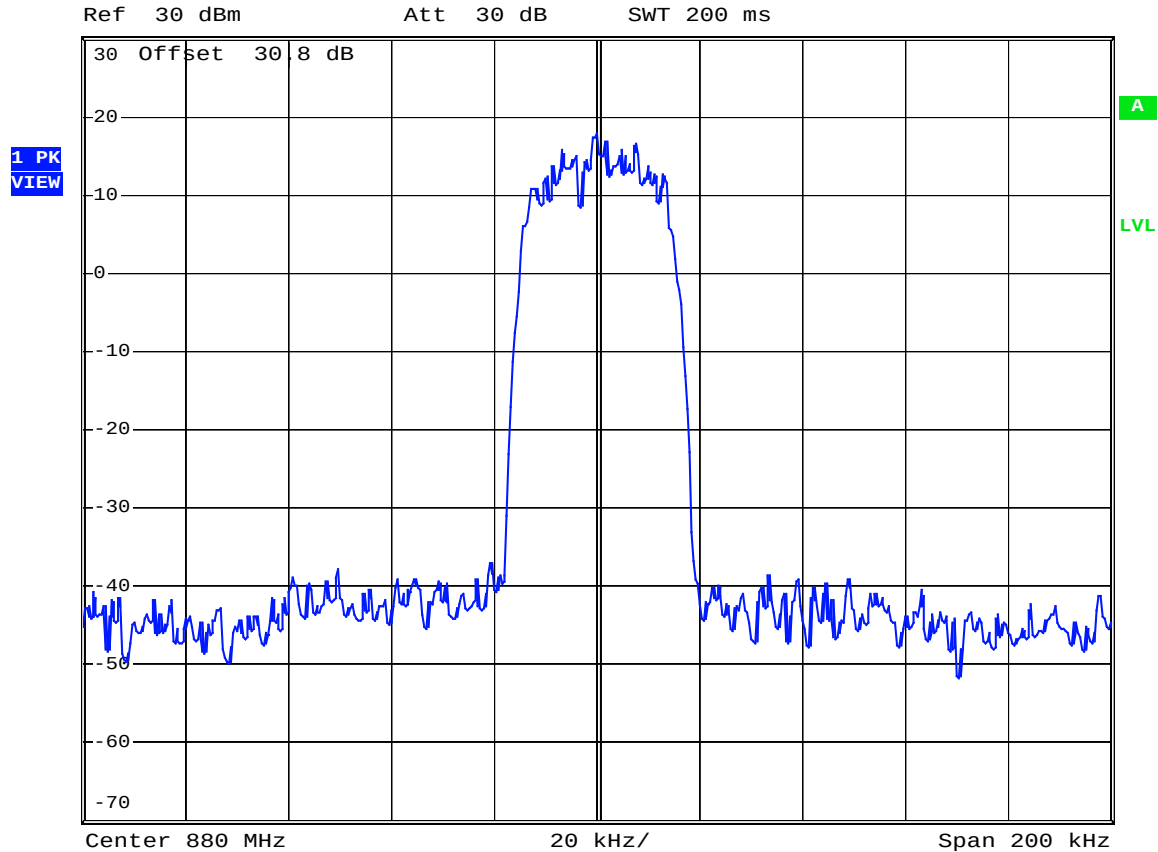
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

TDMA - Output
Downlink



* RBW 1 kHz
VBW 3 kHz
SWT 200 ms



Date: 11.SEP.2006 15:14:50

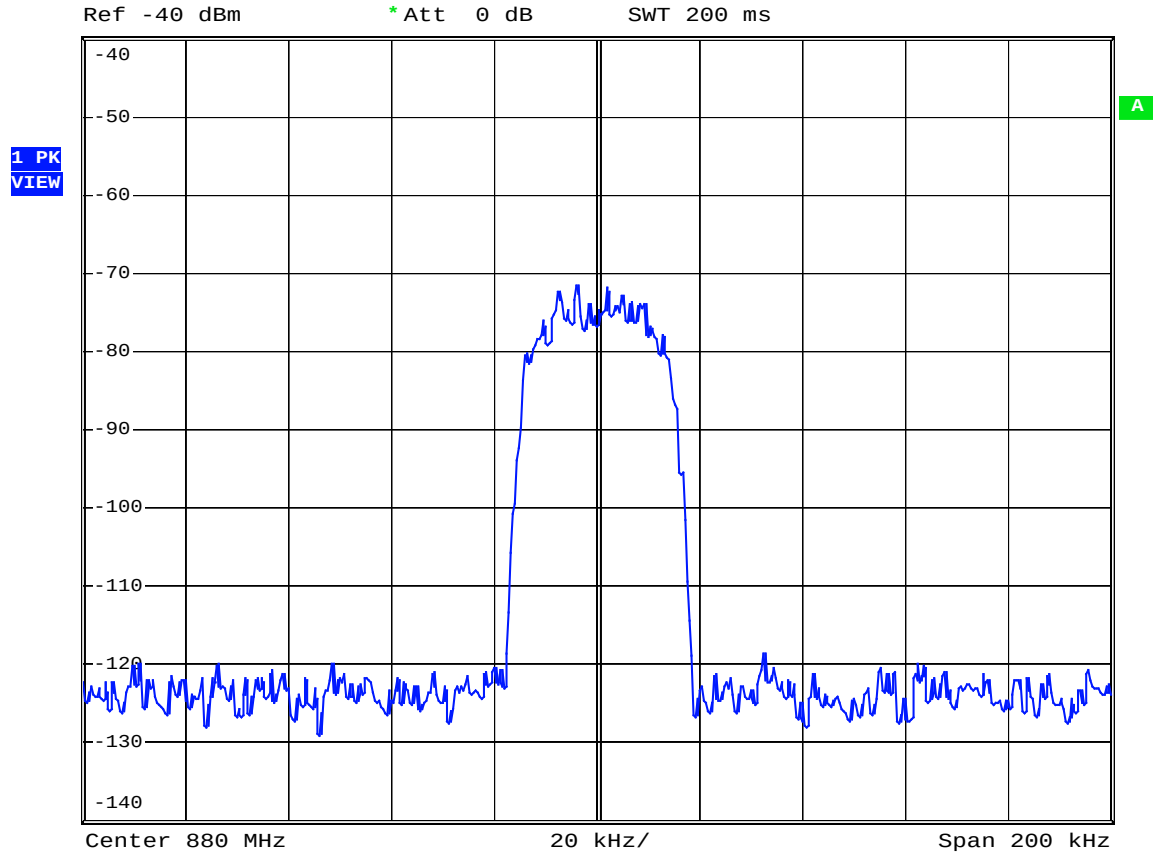
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

TDMA - Input
Downlink



* RBW 1 kHz
VBW 3 kHz
SWT 200 ms



Date: 11.SEP.2006 15:15:43

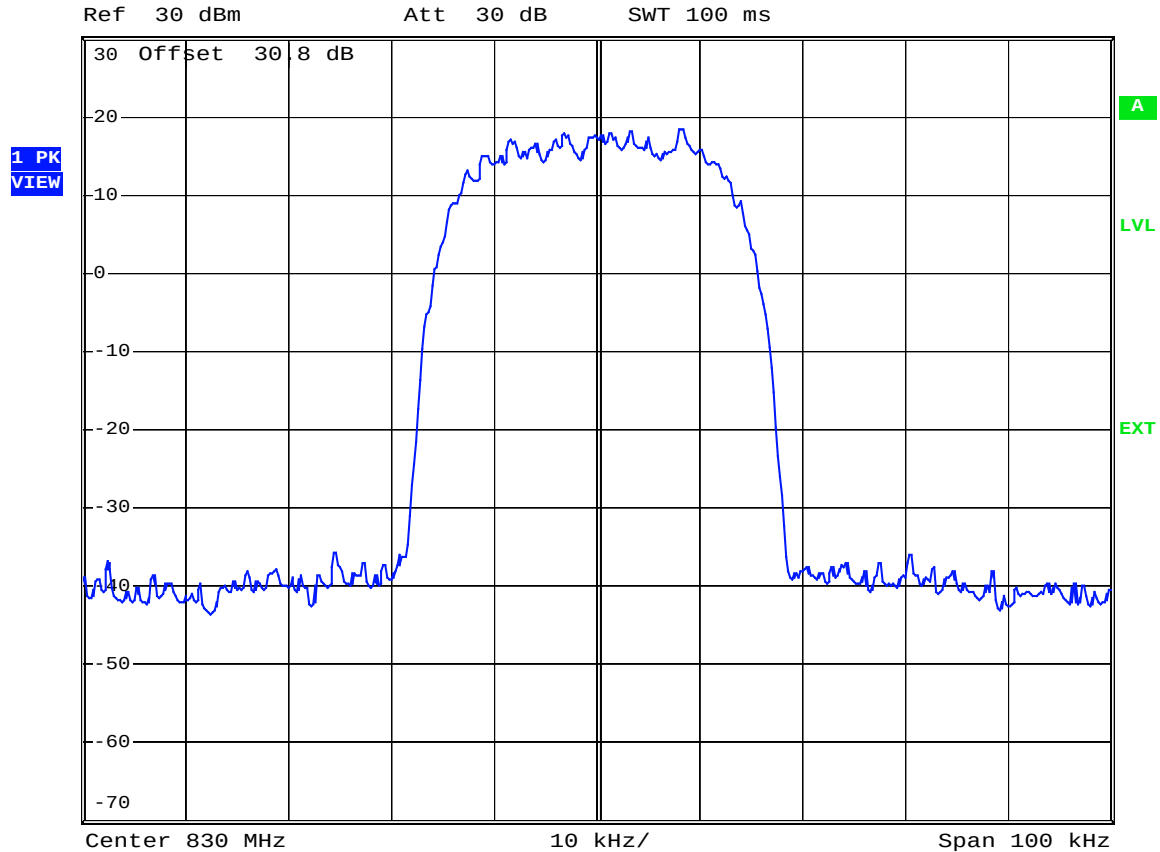
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

TDMA - Output
Uplink



* RBW 1 kHz
VBW 3 kHz
SWT 100 ms



Date: 8.SEP.2006 11:20:29

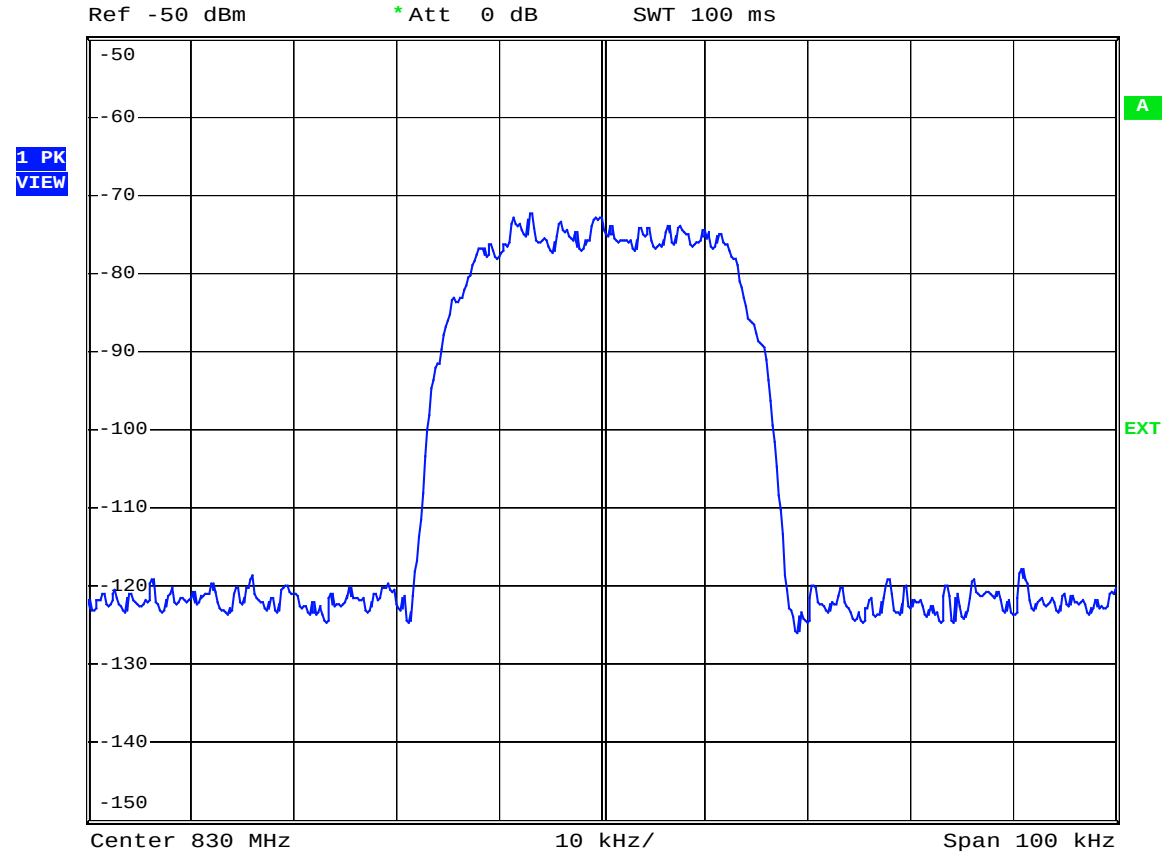
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

TDMA - Input
Uplink



* RBW 1 kHz
VBW 3 kHz
SWT 100 ms



Date: 8.SEP.2006 11:21:55

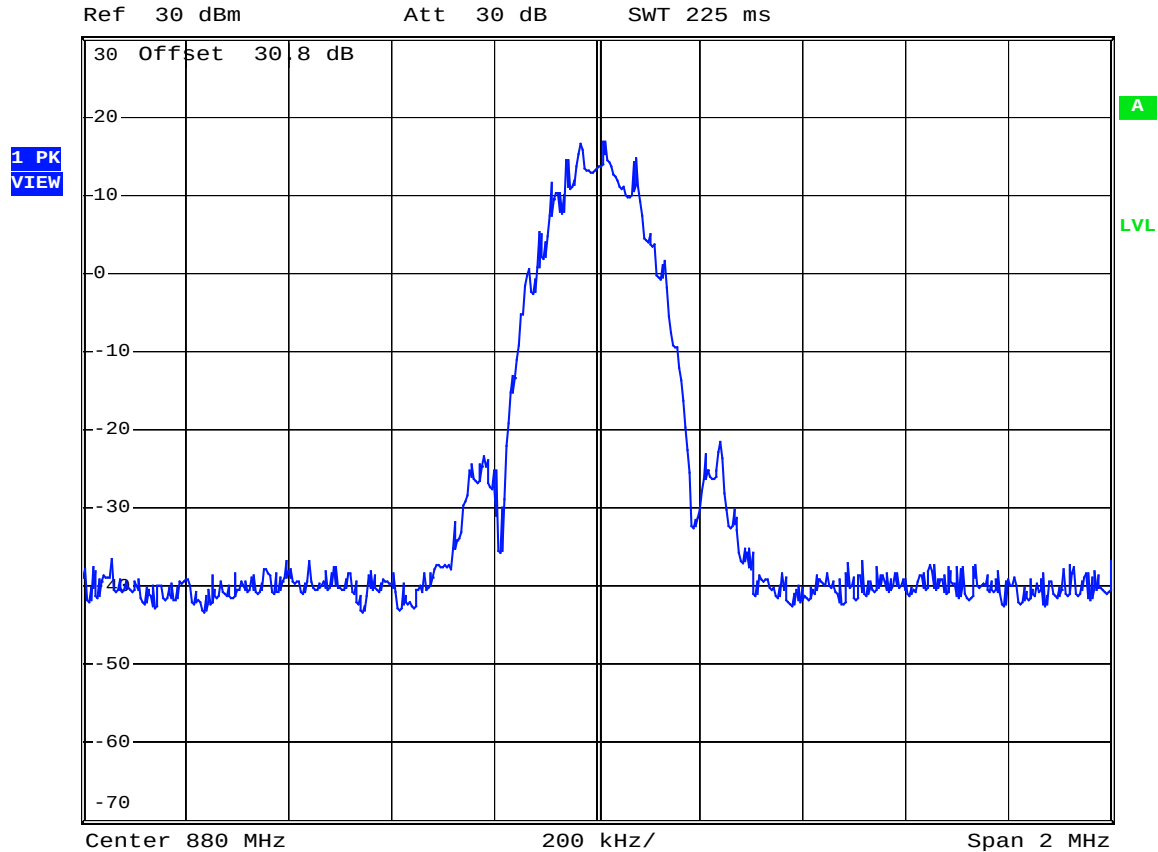
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

EDGE - Output
Downlink



* RBW 3 kHz
VBW 10 kHz
SWT 225 ms



Date: 11.SEP.2006 15:03:05

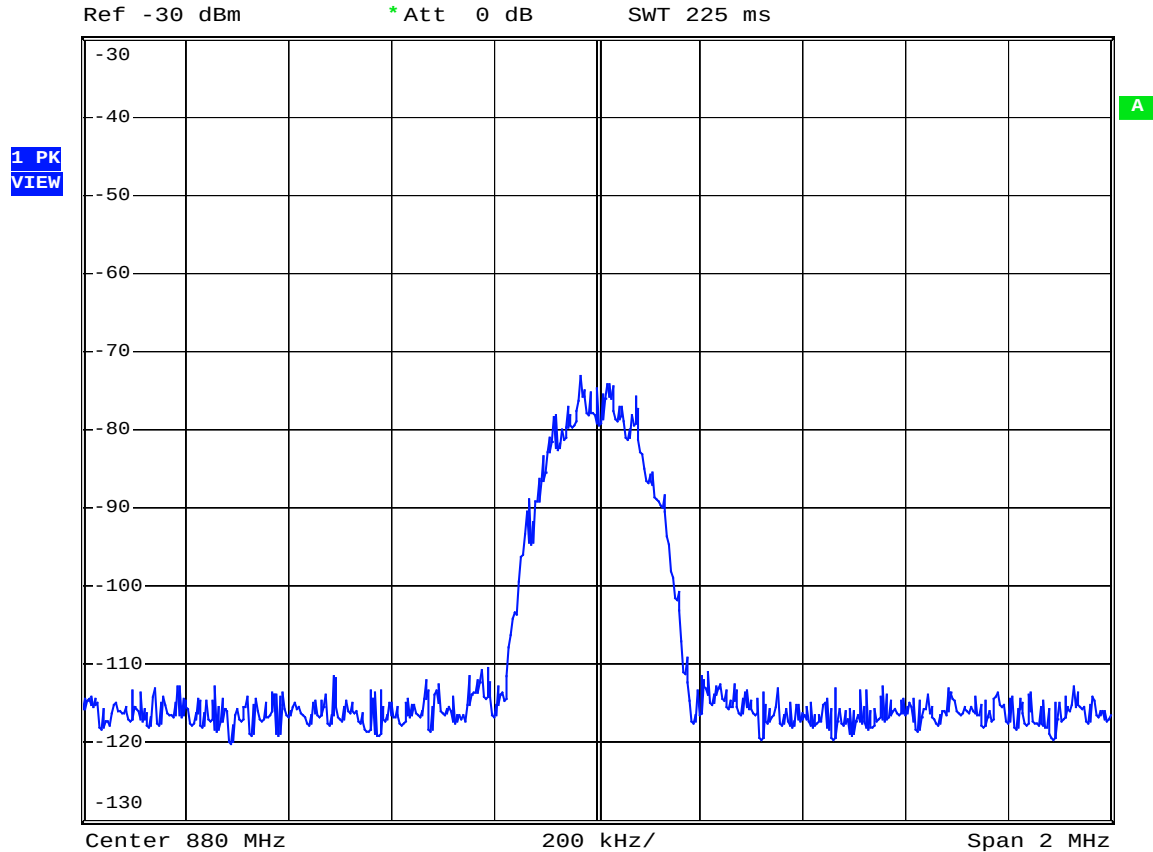
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

EDGE - Input
Downlink



* RBW 3 kHz
VBW 10 kHz
SWT 225 ms



Date: 11.SEP.2006 15:04:21

EQUIPMENT: AMR8515

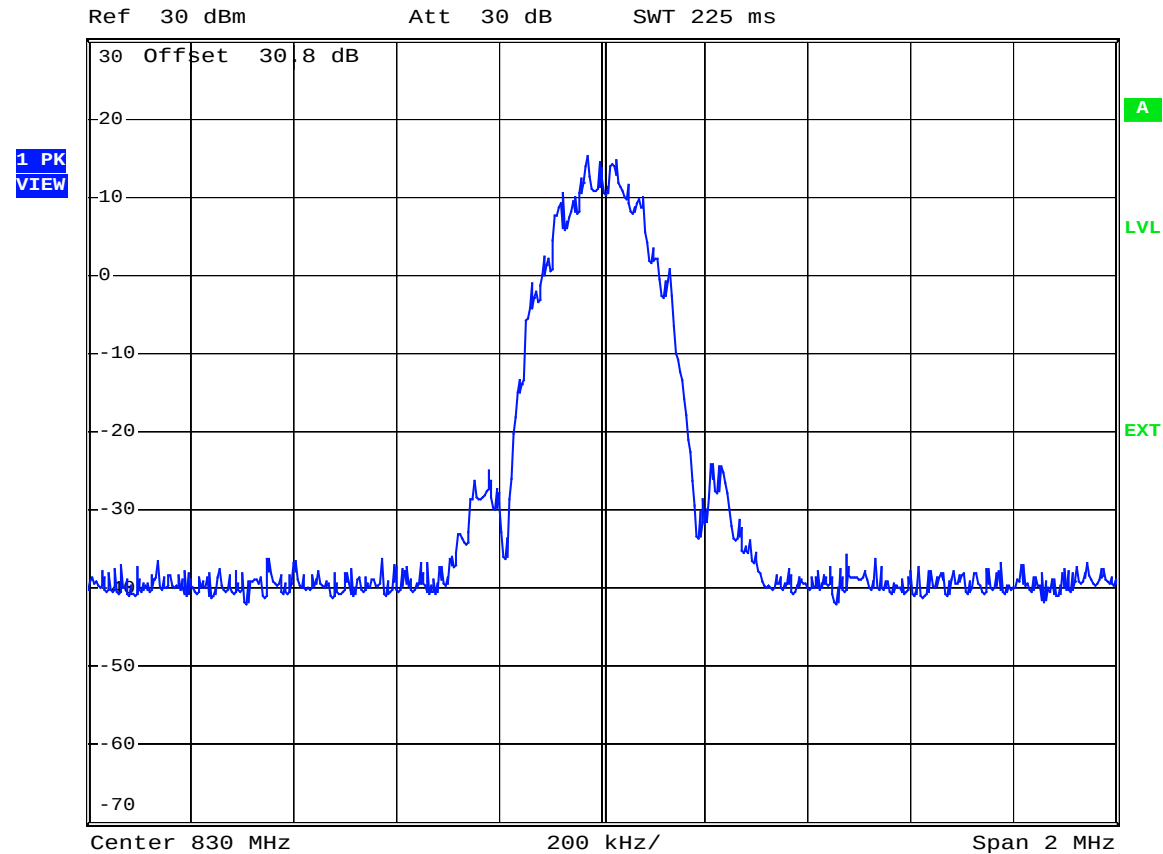
Test Data – Occupied Bandwidth

EDGE - Output

Uplink



* RBW 3 kHz
VBW 10 kHz
SWT 225 ms



Date: 8.SEP.2006 11:11:46

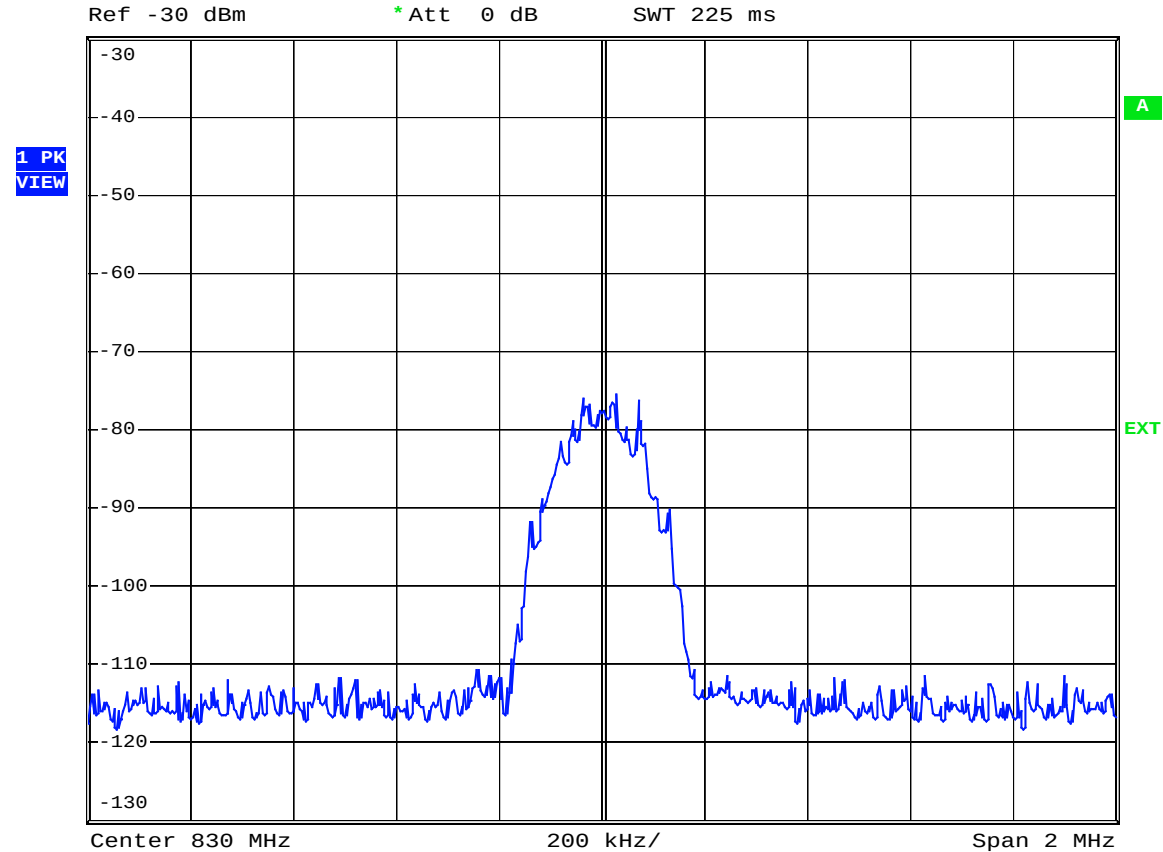
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

EDGE - Input
Uplink



* RBW 3 kHz
VBW 10 kHz
SWT 225 ms

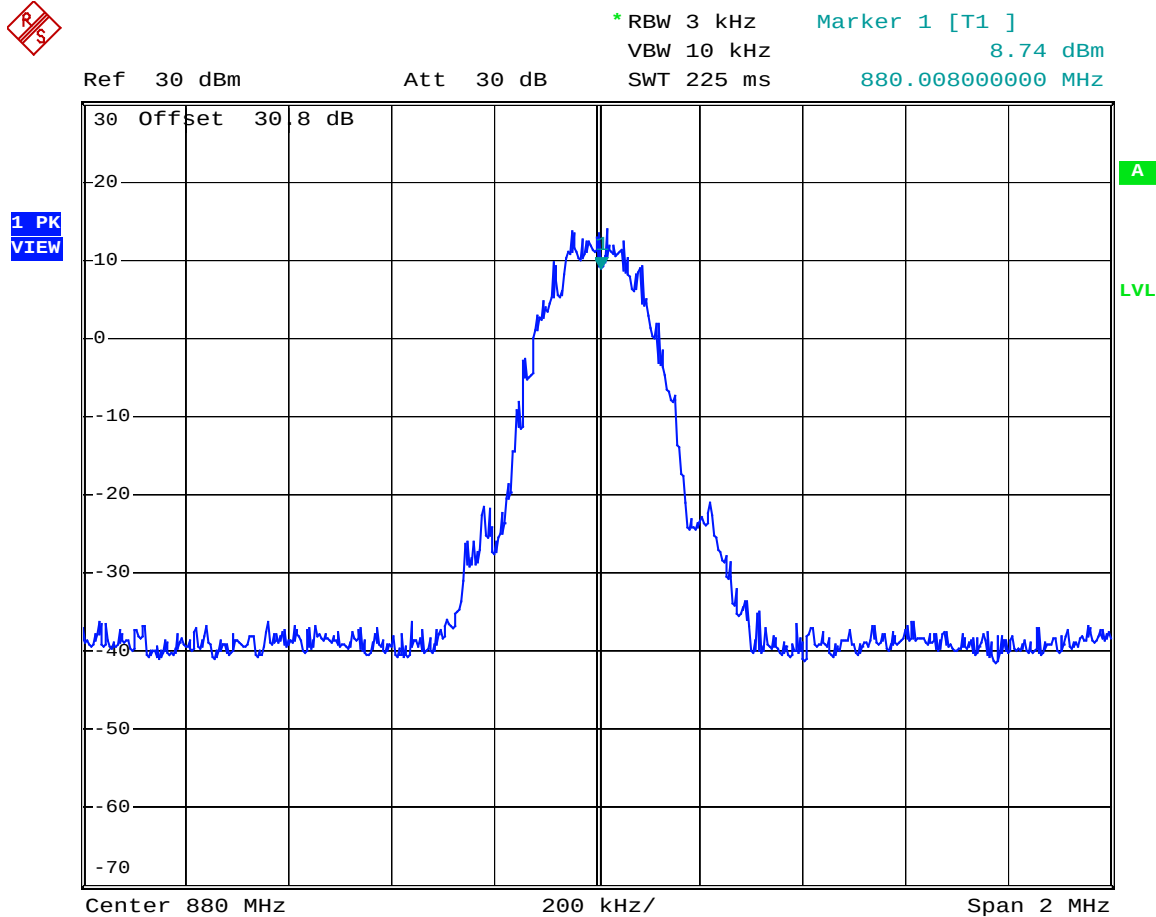


Date: 8.SEP.2006 11:12:59

EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

GSM - Output
Downlink



Date: 11.SEP.2006 15:07:29

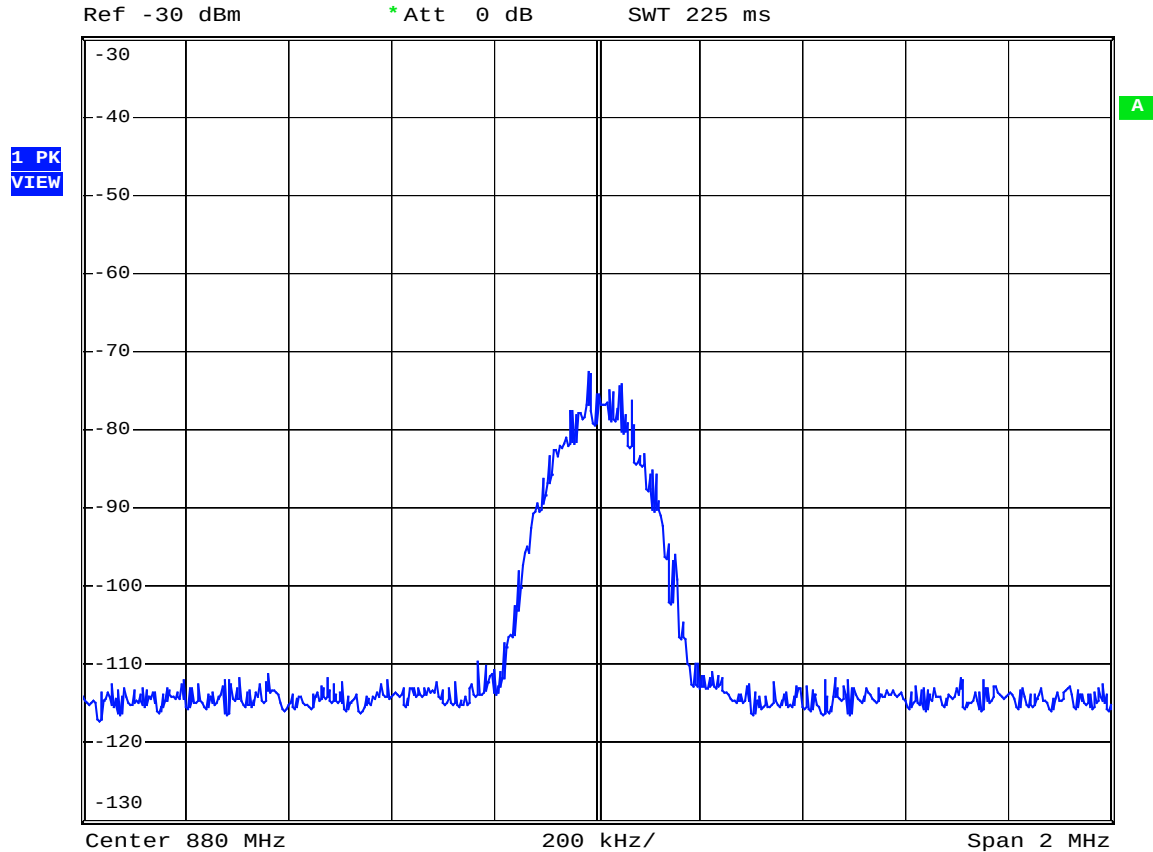
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

GSM - Input
Downlink



* RBW 3 kHz
VBW 10 kHz
SWT 225 ms



Date: 11.SEP.2006 15:05:27

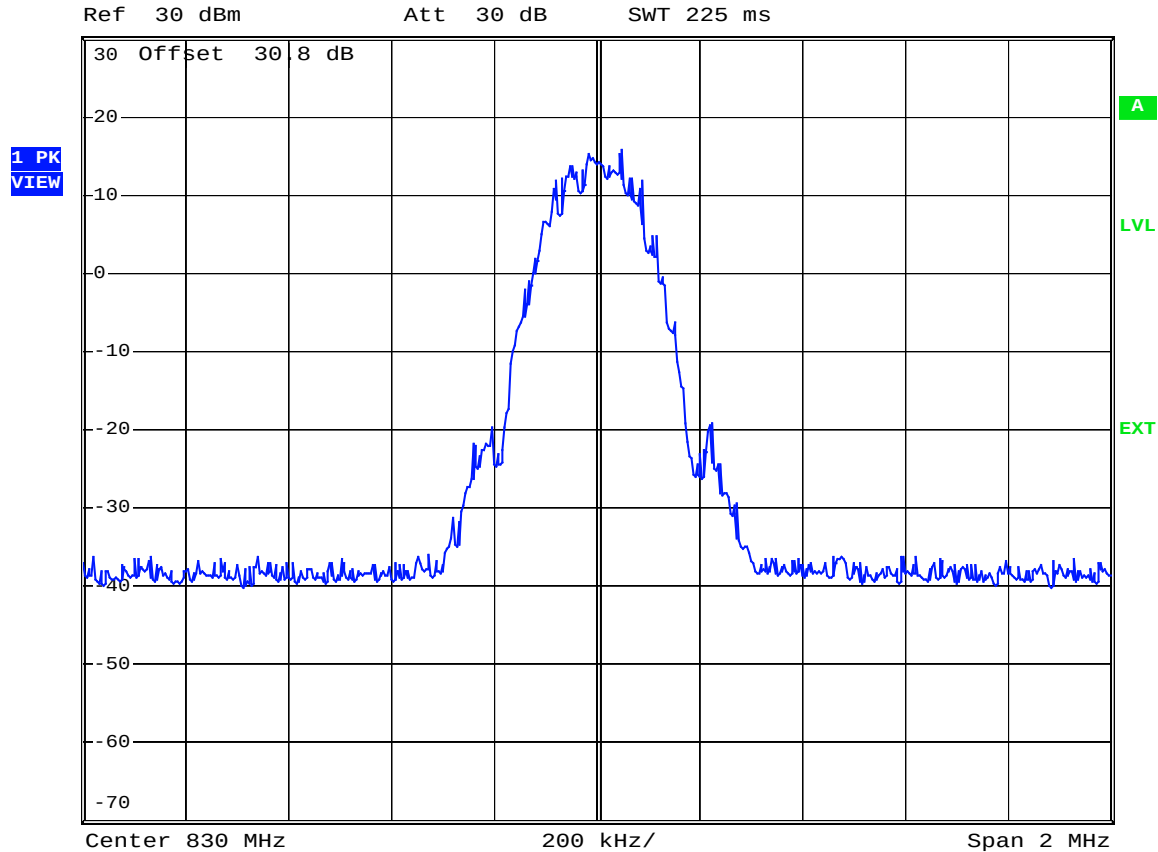
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

GSM - Output
Uplink



* RBW 3 kHz
VBW 10 kHz
SWT 225 ms



Date: 8.SEP.2006 10:54:15

EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

GSM - Input
Uplink



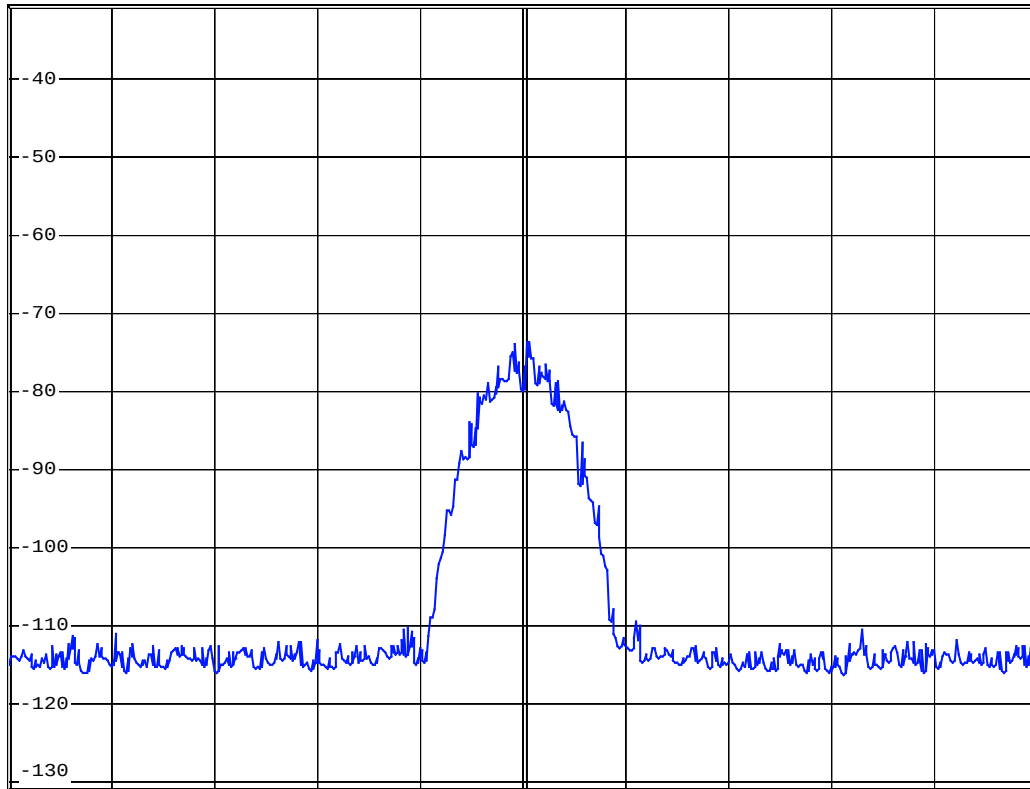
* RBW 3 kHz
VBW 10 kHz
SWT 225 ms

Ref -30.8 dBm

* Att 0 dB

SWT 225 ms

1 PK
VIEW



Center 830 MHz

200 kHz/

Span 2 MHz

Date: 8.SEP.2006 10:56:44

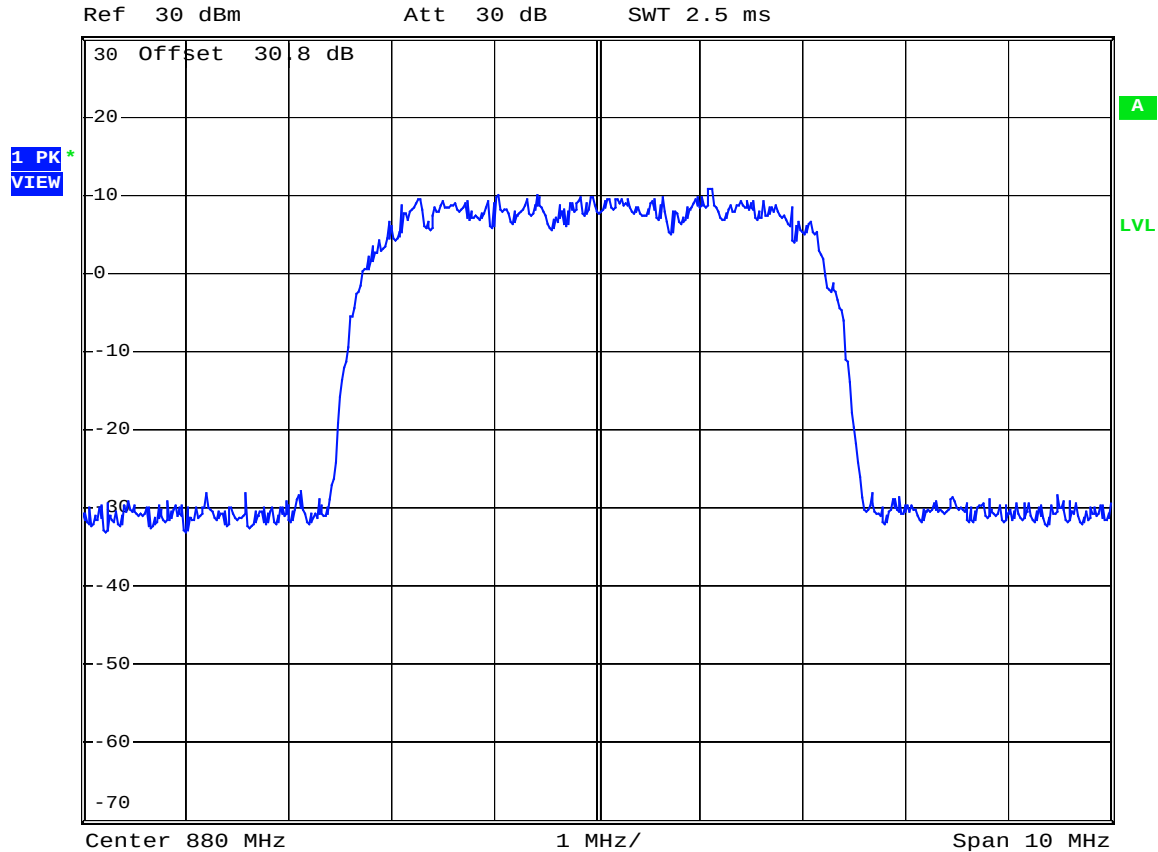
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

W-CDMA - Output
Downlink



* RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms



Date: 11.SEP.2006 14:25:59

EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

W-CDMA - Input
Downlink



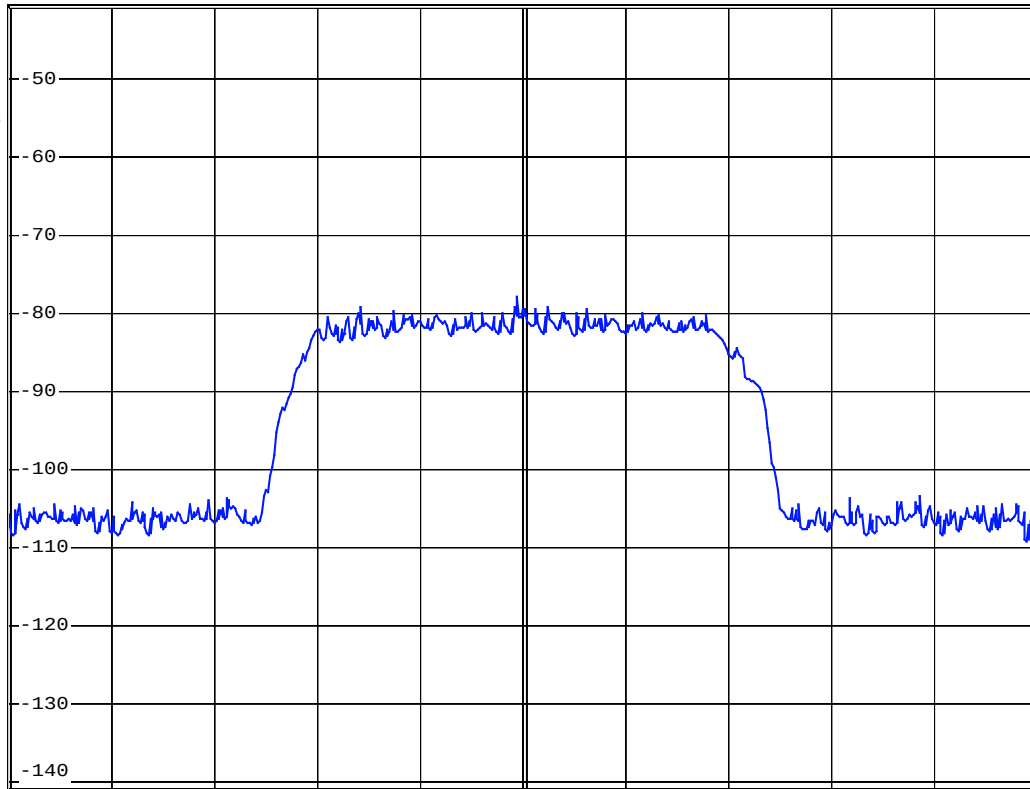
* RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms

Ref -40.8 dBm

* Att 0 dB

SWT 2.5 ms

1 PK
VIEW



Center 880 MHz

1 MHz/

Span 10 MHz

Date: 11.SEP.2006 14:28:39

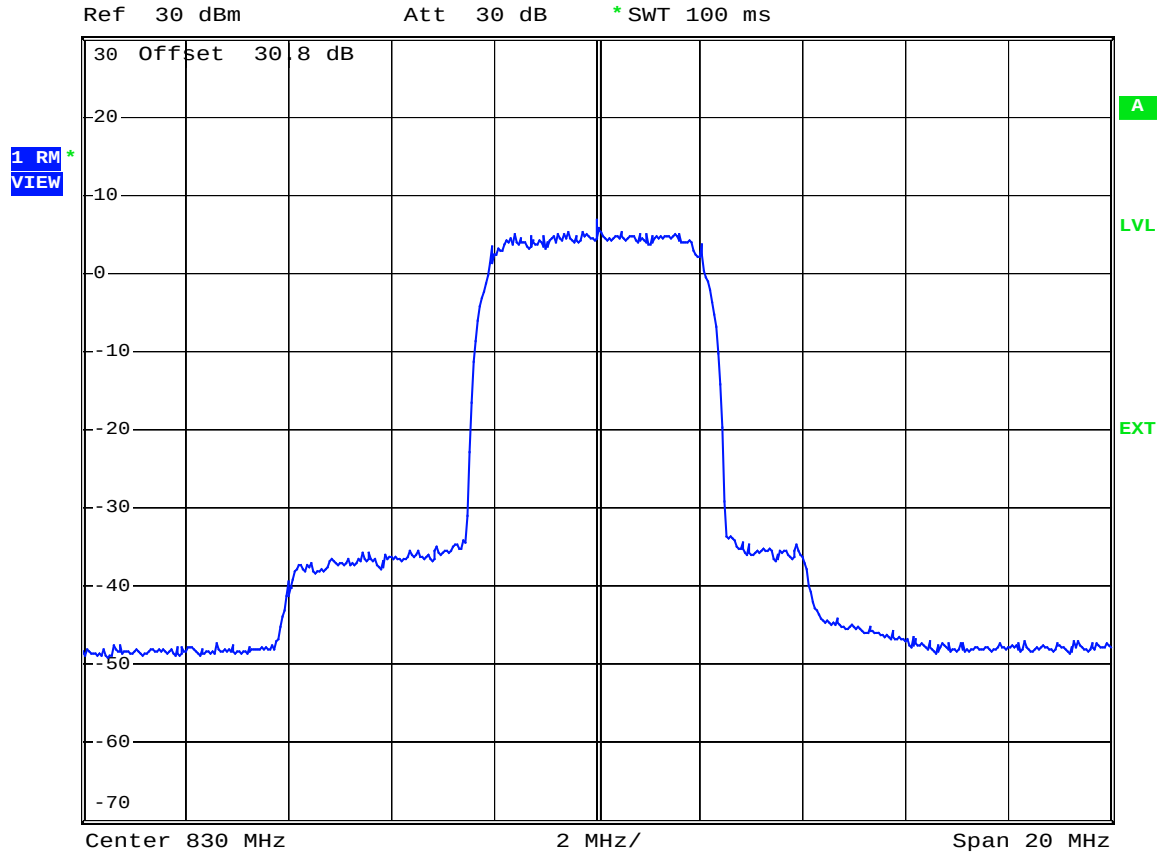
EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

W-CDMA - Output
Uplink



* RBW 30 kHz
* VBW 300 kHz
* SWT 100 ms

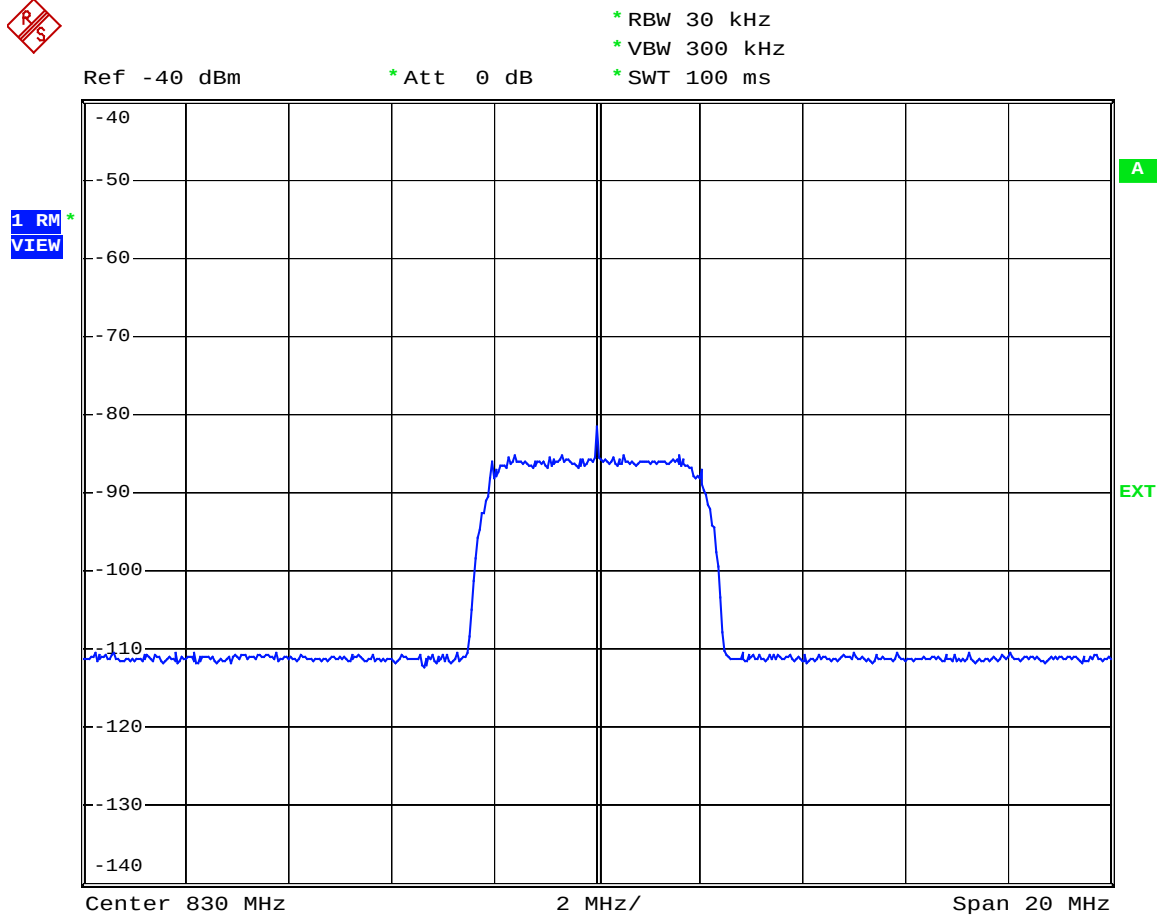


Date: 8.SEP.2006 11:37:39

EQUIPMENT: AMR8515

Test Data – Occupied Bandwidth

W-CDMA - Input
Uplink



Date: 8.SEP.2006 11:38:45

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals PARA. NO.: 22.917

TESTED BY: David Light

DATE: 08 September 06

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1472-1469-1082-1659-1464

Measurement Uncertainty: +/- 1.7 dB

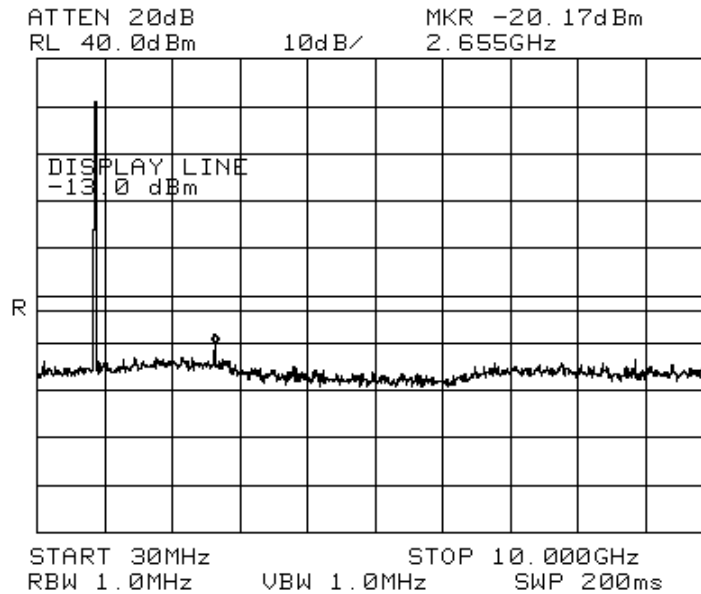
Temperature: 25 °C

Relative Humidity: 40 %

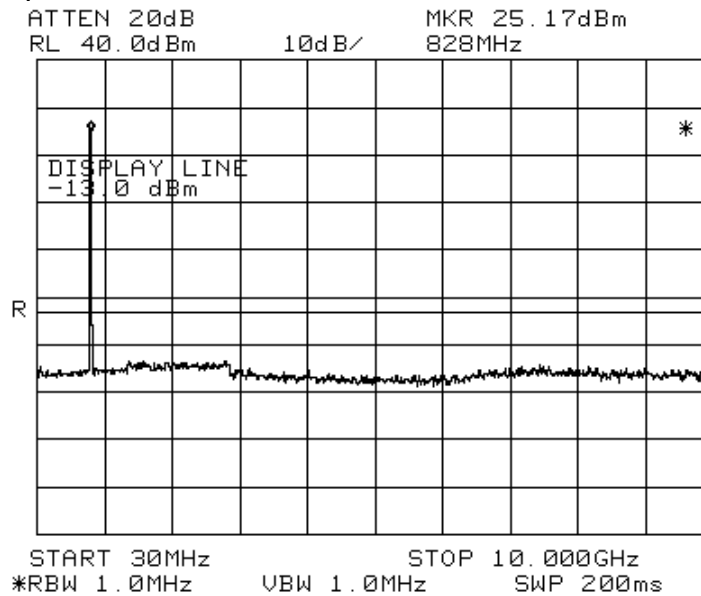
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Spurs – CDMA - Downlink



Spurs – CDMA - Uplink



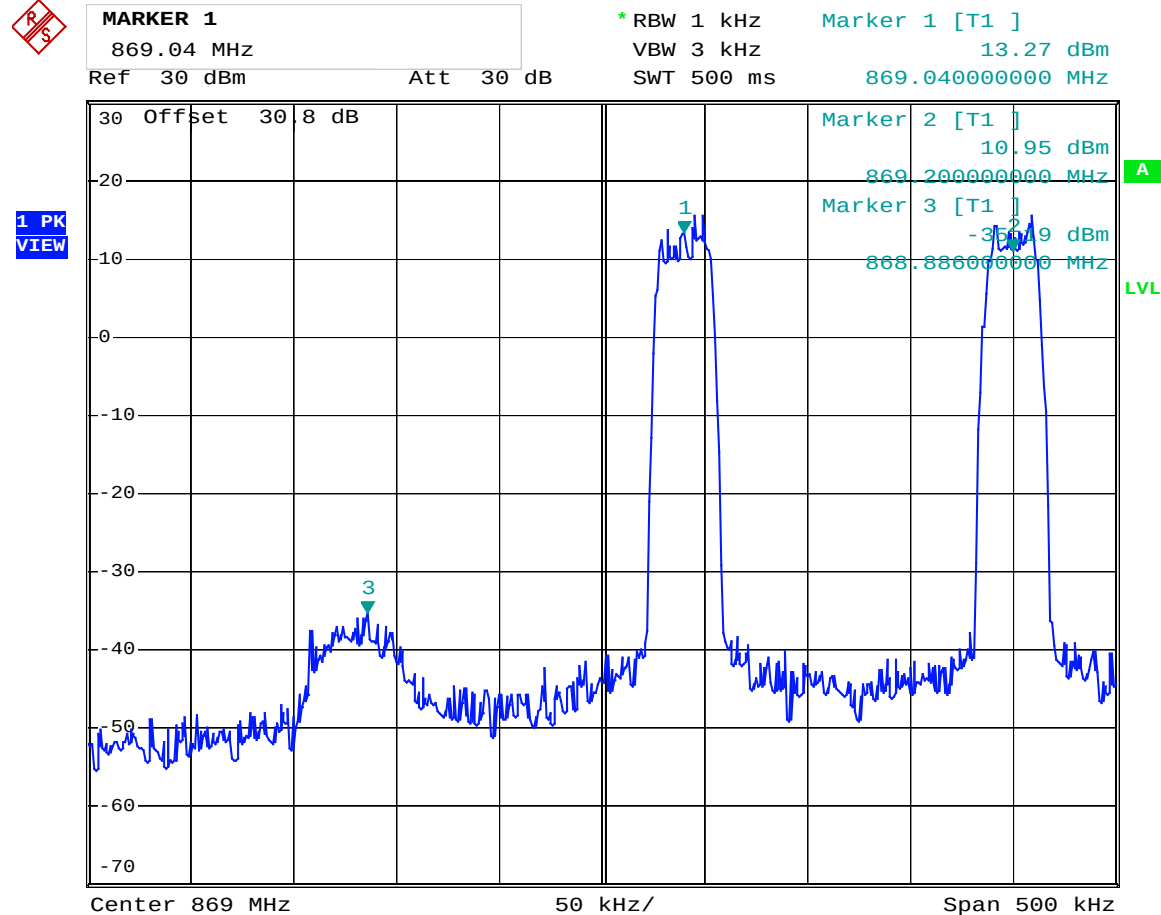
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

TDMA

Downlink



Date: 11.SEP.2006 10:33:05

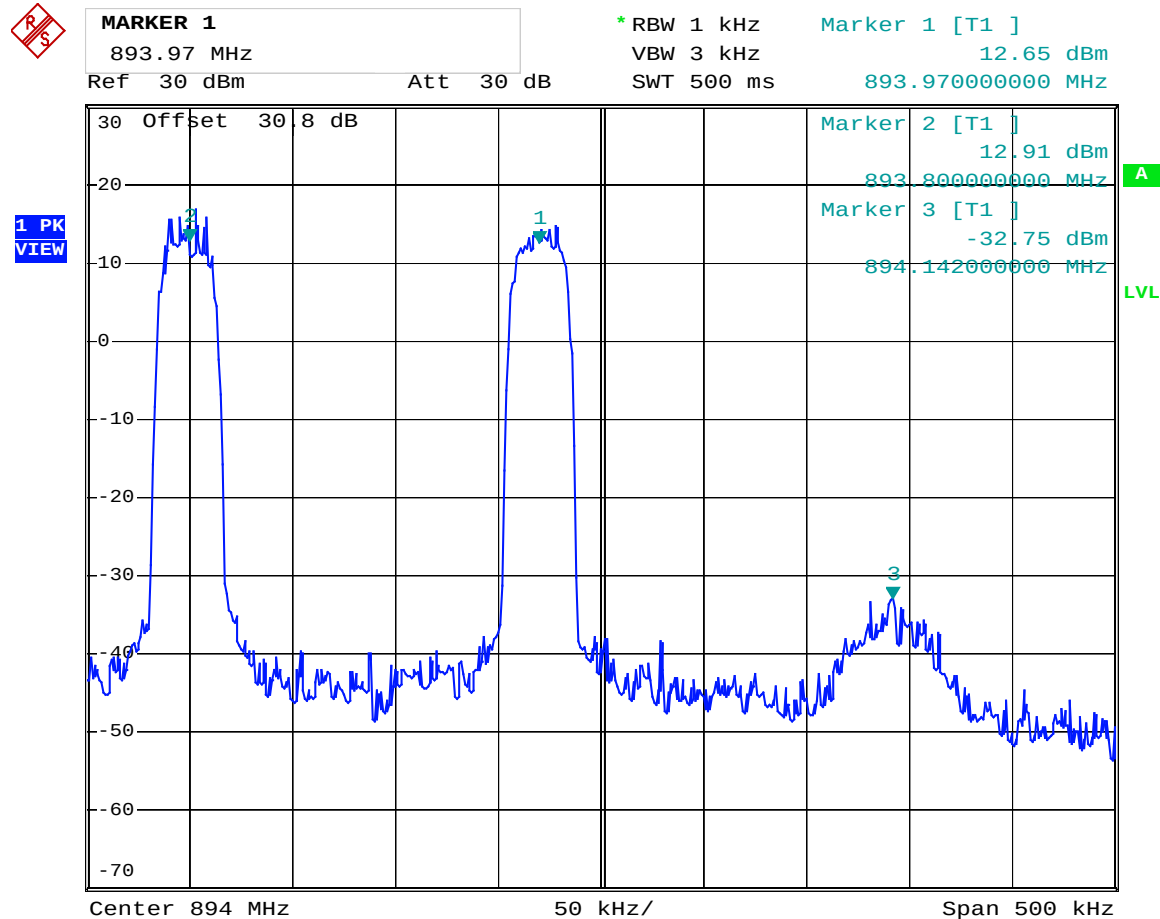
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

TDMA

Downlink



Date: 11.SEP.2006 10:31:24

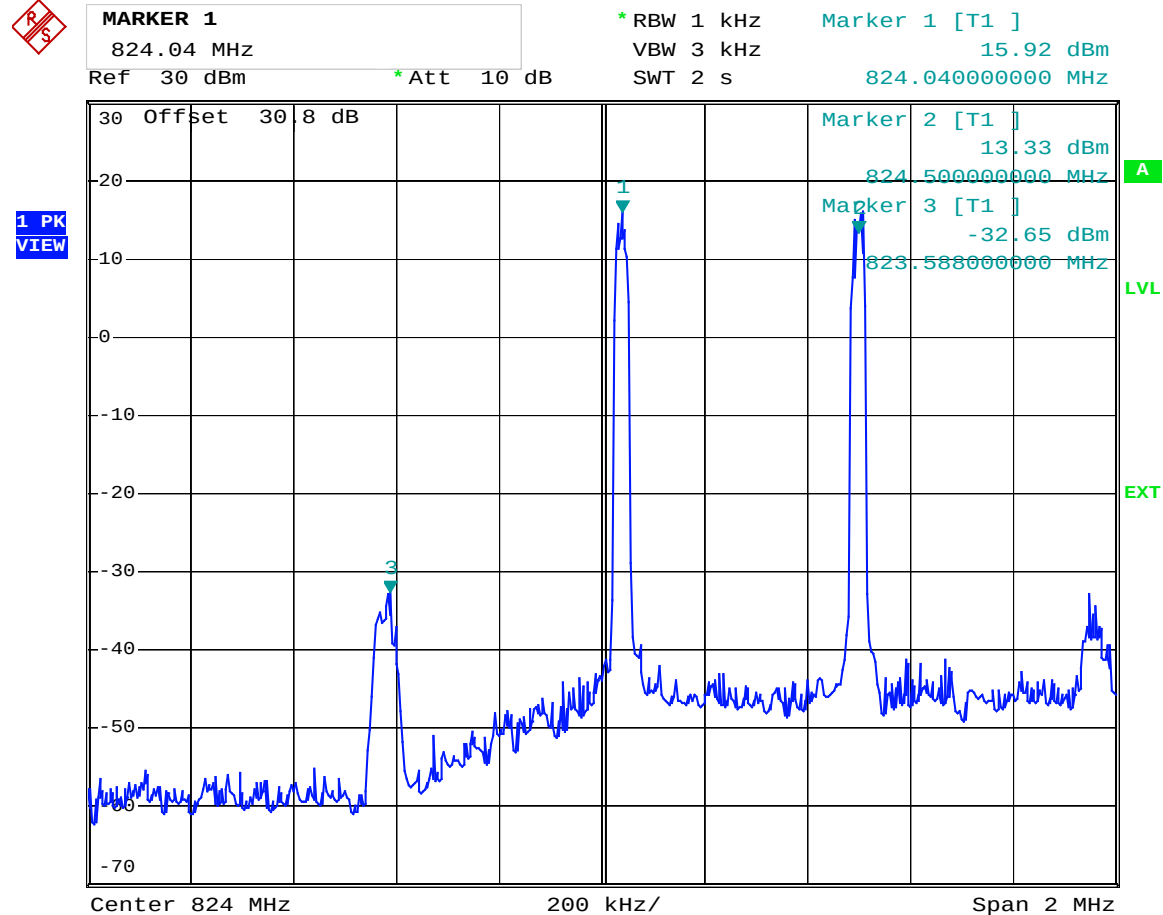
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

TDMA

Uplink



Date: 8.SEP.2006 14:37:23

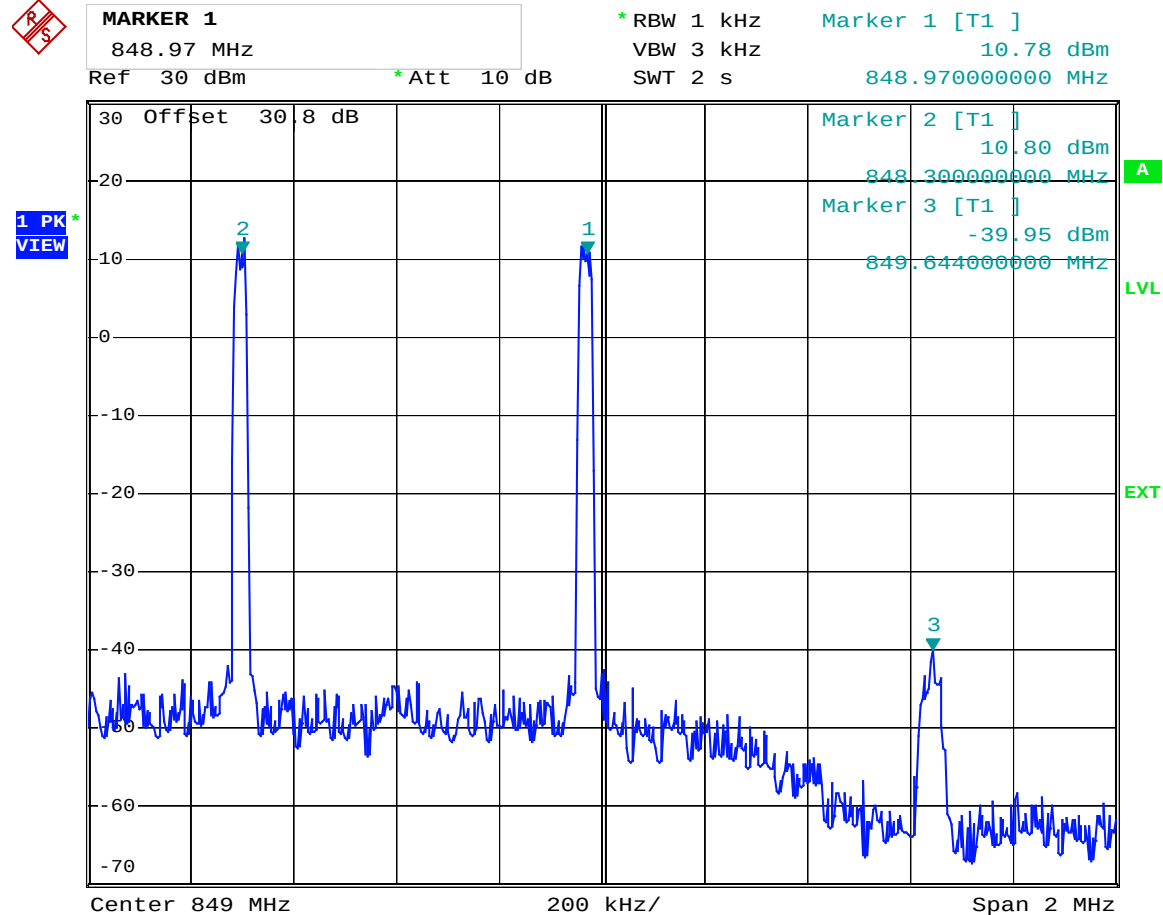
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

TDMA

Uplink

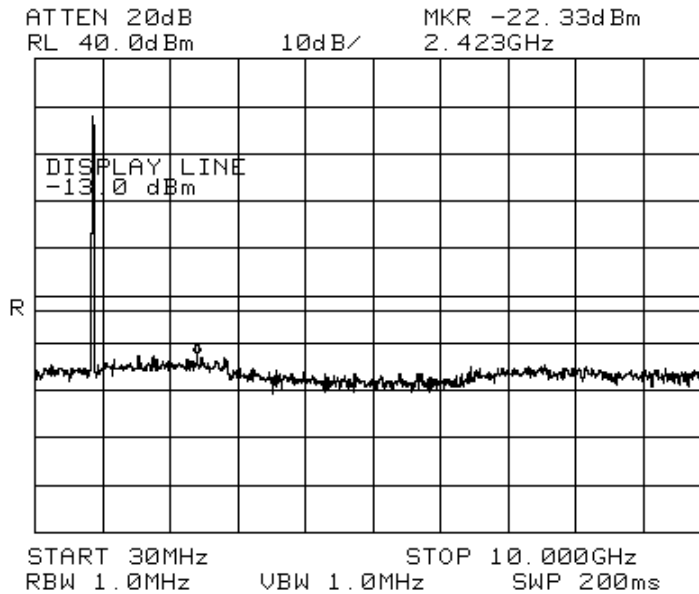


Date: 8.SEP.2006 14:35:22

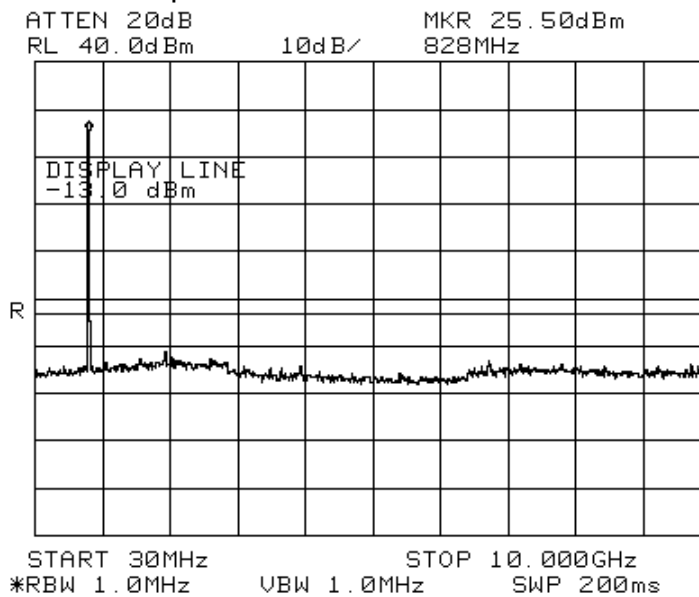
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Spurs – TDMA - Downlink



Spurs – TDMA - Uplink



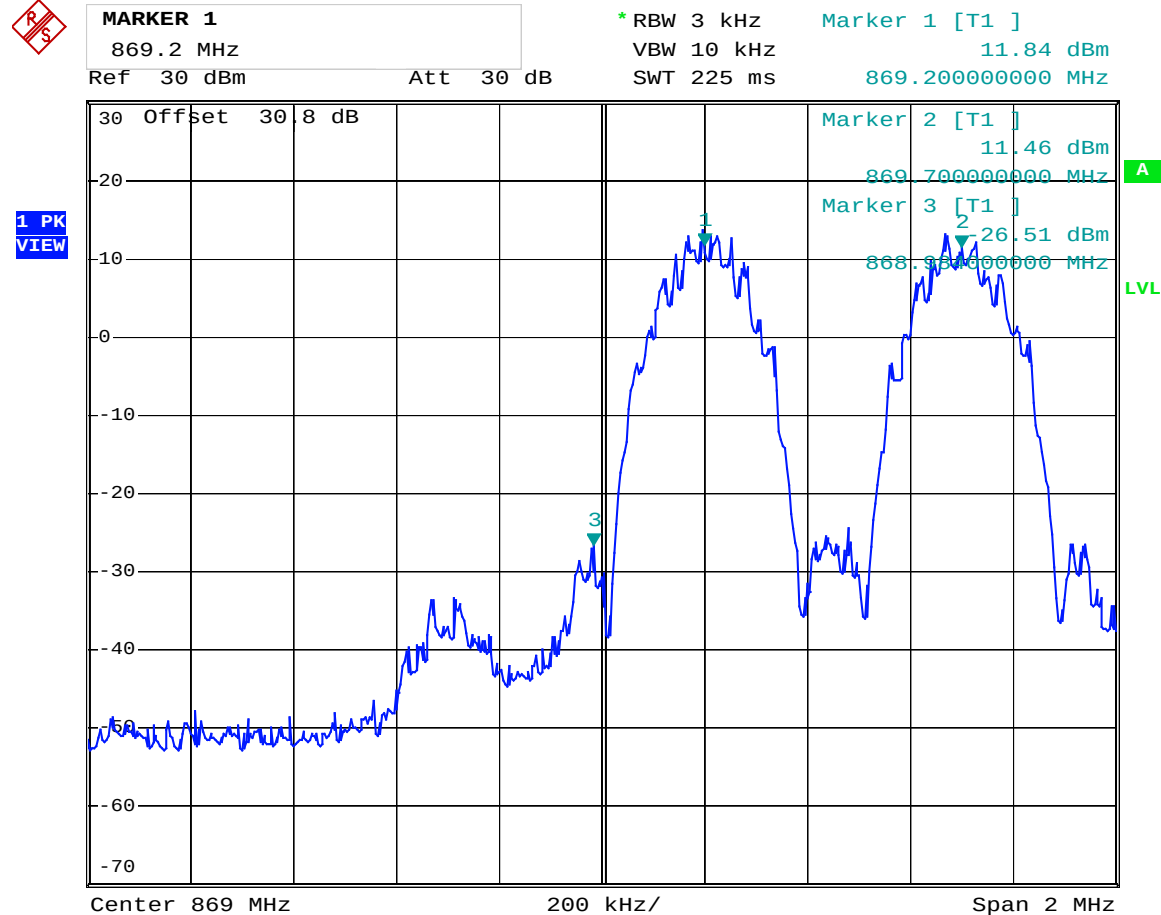
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

EDGE

Downlink



Date: 11.SEP.2006 10:44:06

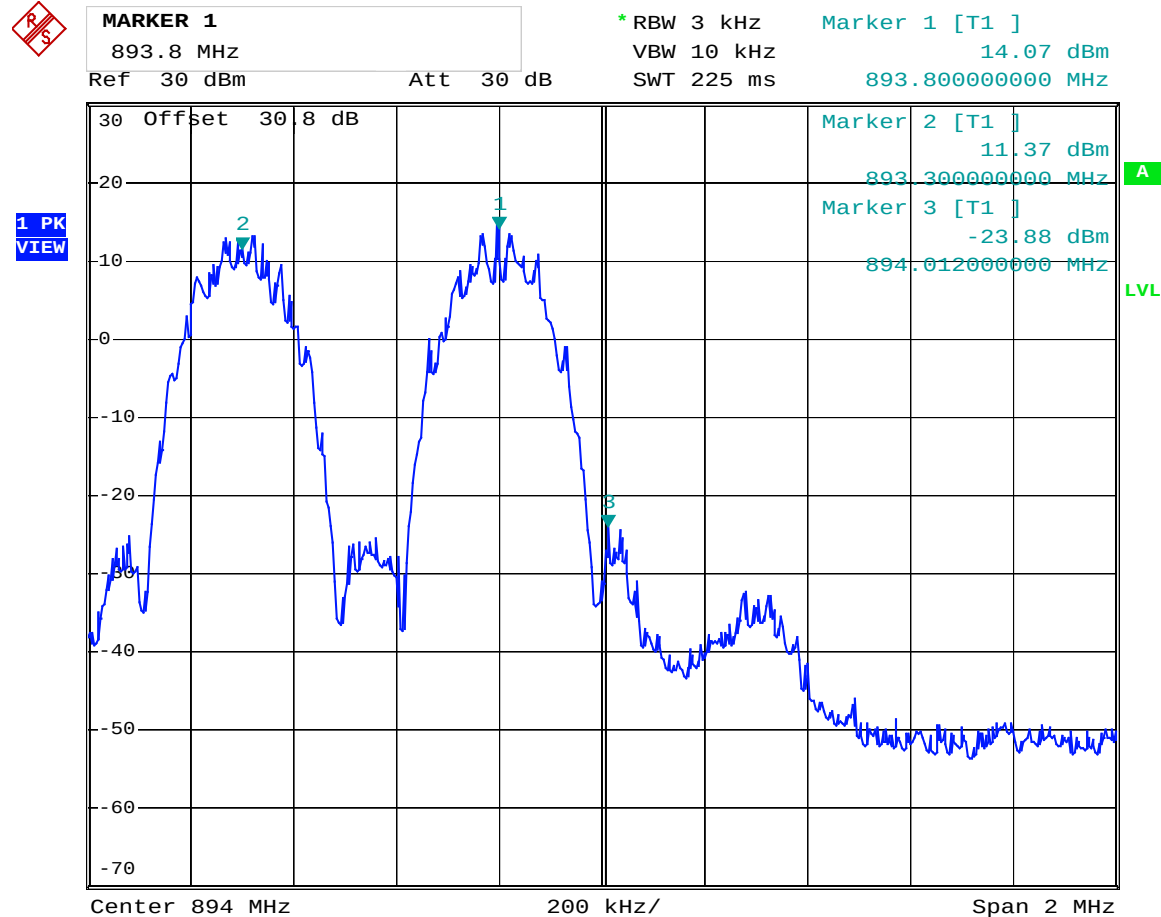
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

EDGE

Downlink



Date: 11.SEP.2006 10:42:46

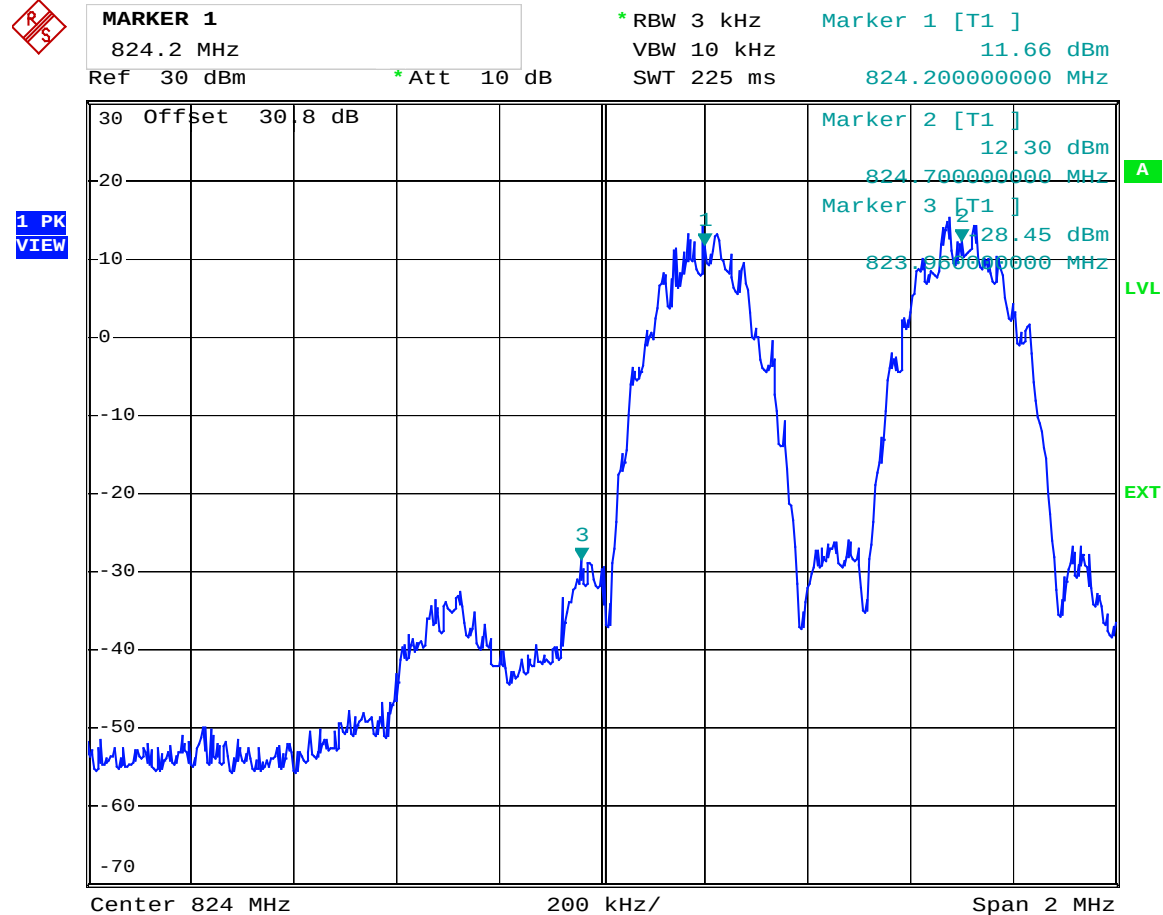
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

EDGE

Uplink



Date: 8.SEP.2006 14:45:59

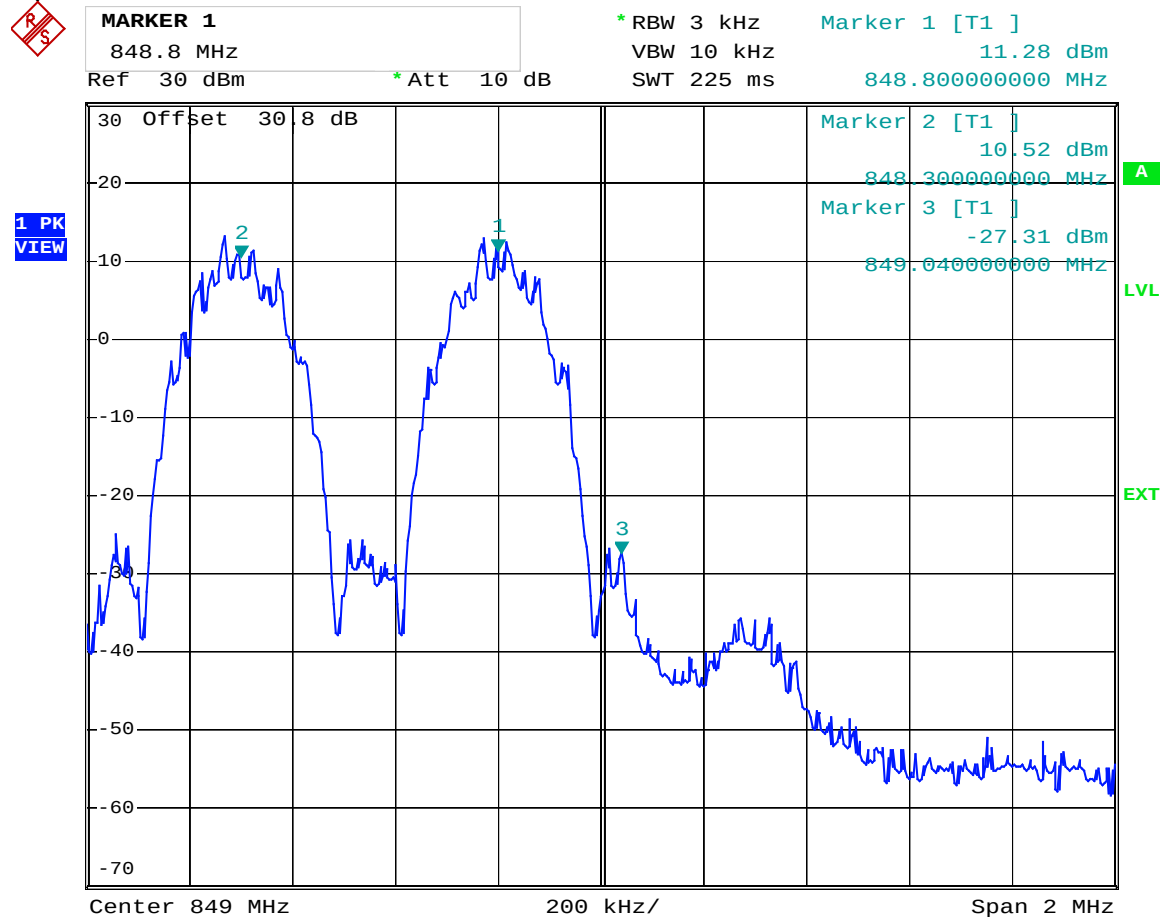
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

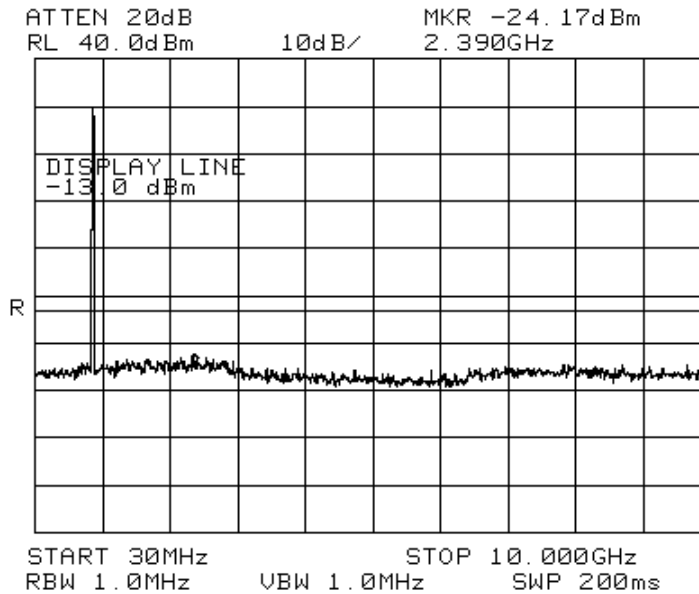
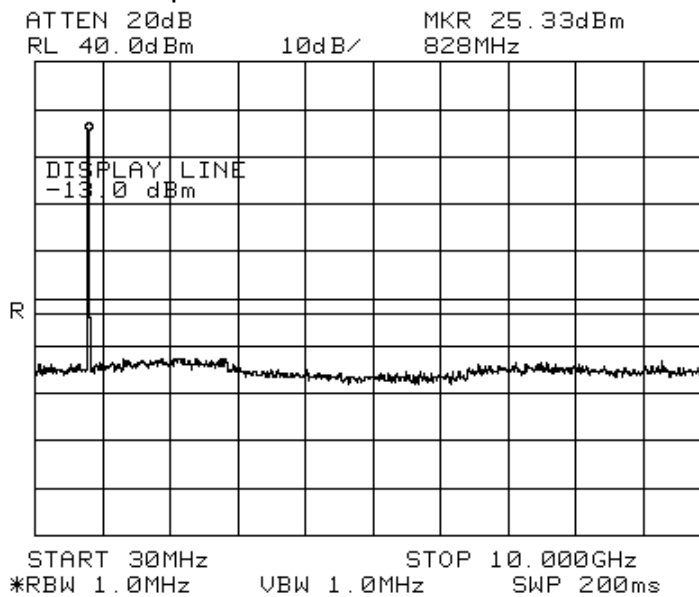
Upper Bandedge Intermodulation

EDGE

Uplink



Date: 8.SEP.2006 14:44:36

EQUIPMENT: AMR8515**Test Data – Spurious Emissions at Antenna Terminals****Spurs – EDGE - Downlink****Spurs – EDGE - Uplink**

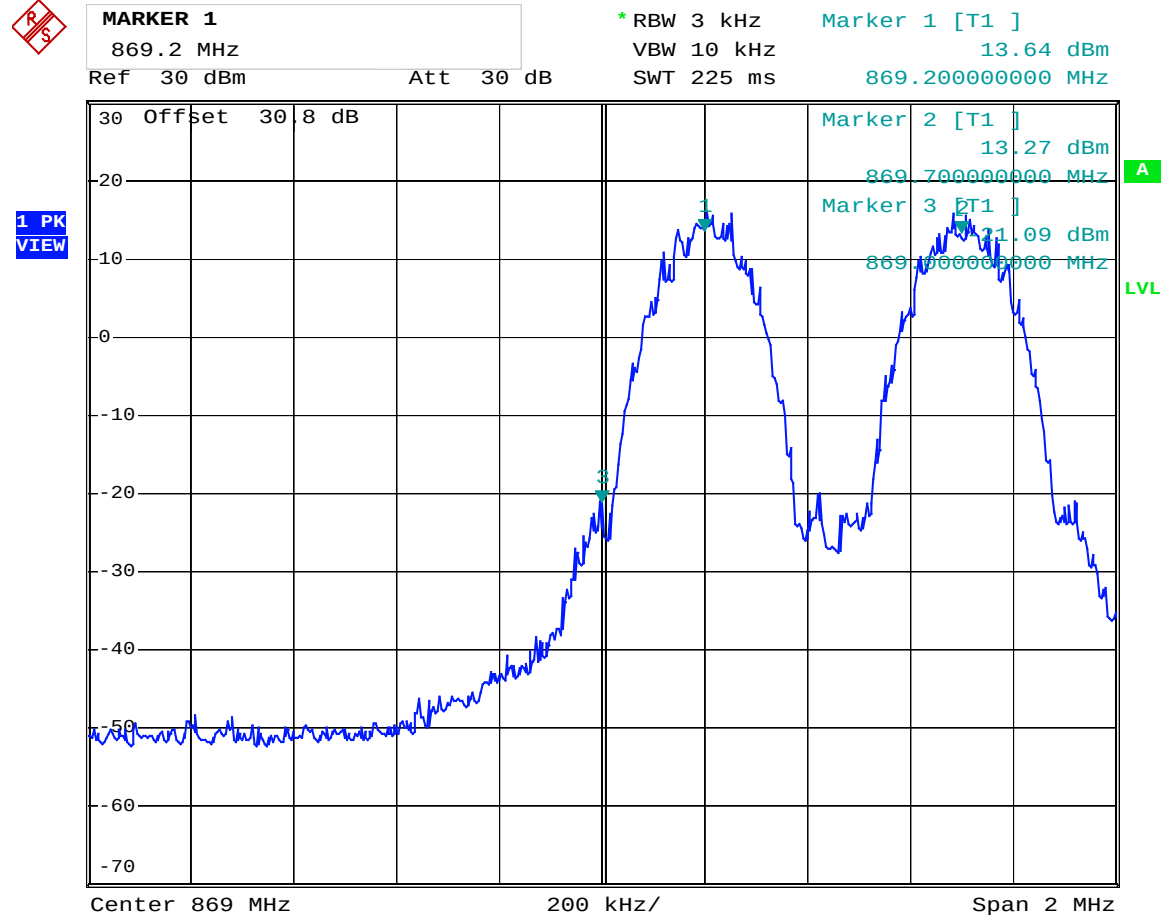
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

GSM

Downlink



Date: 11.SEP.2006 10:36:55

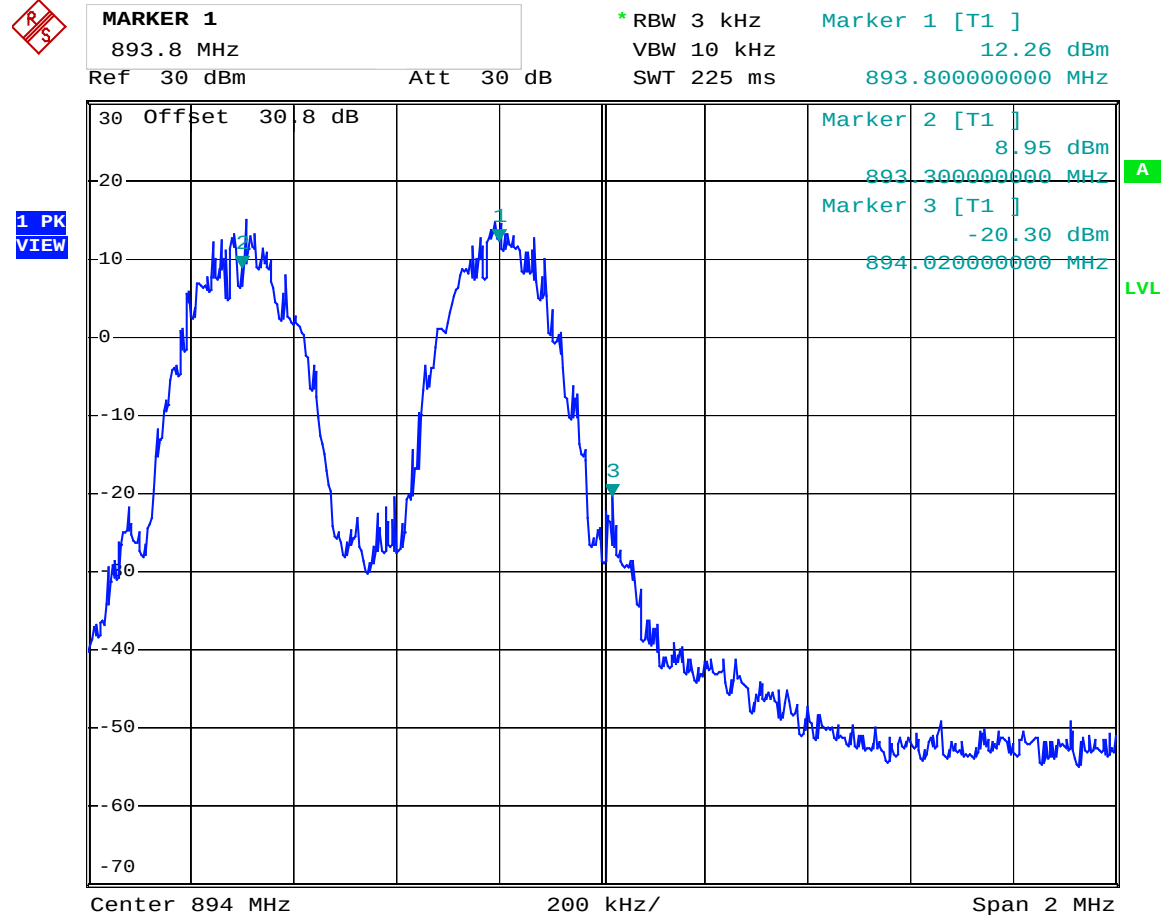
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

GSM

Downlink



Date: 11.SEP.2006 10:39:21

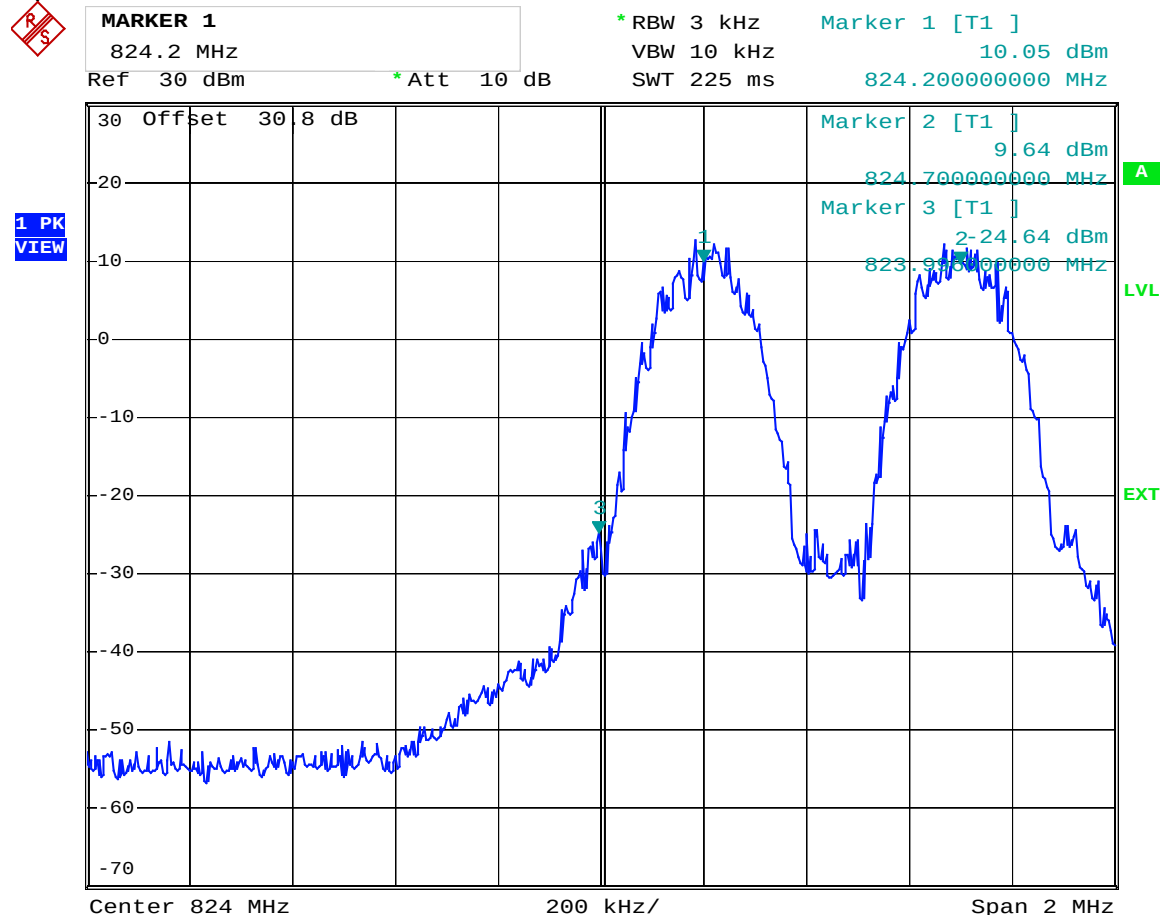
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

GSM

Uplink



Date: 8.SEP.2006 14:41:08

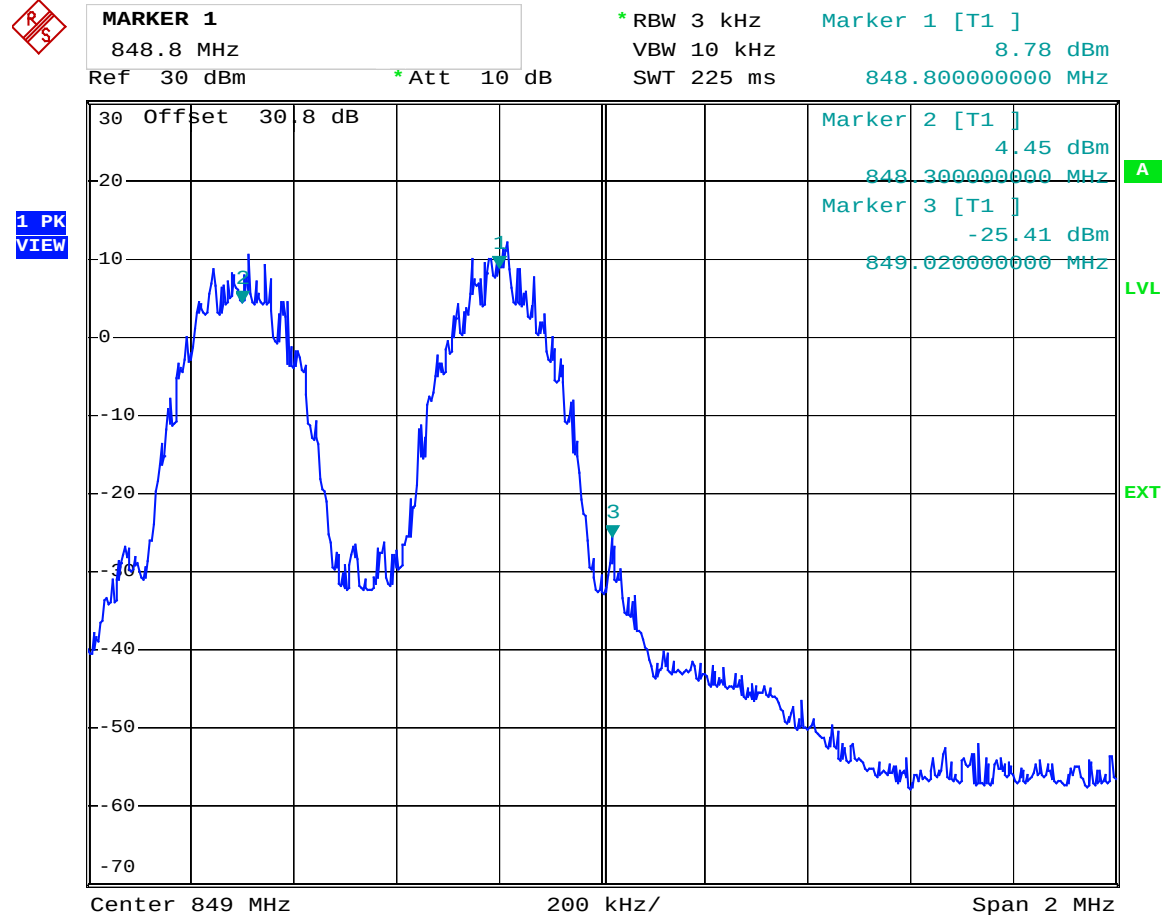
EQUIPMENT: AMR8515

Test Data – Spurious Emissions at Antenna Terminals

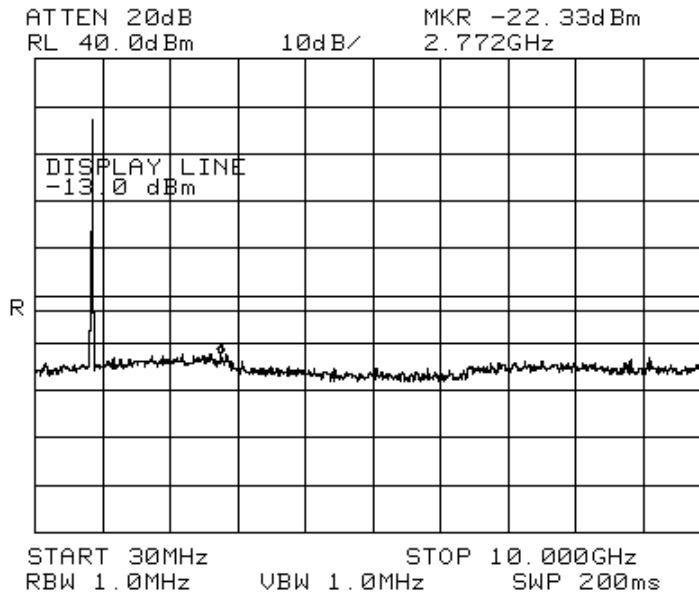
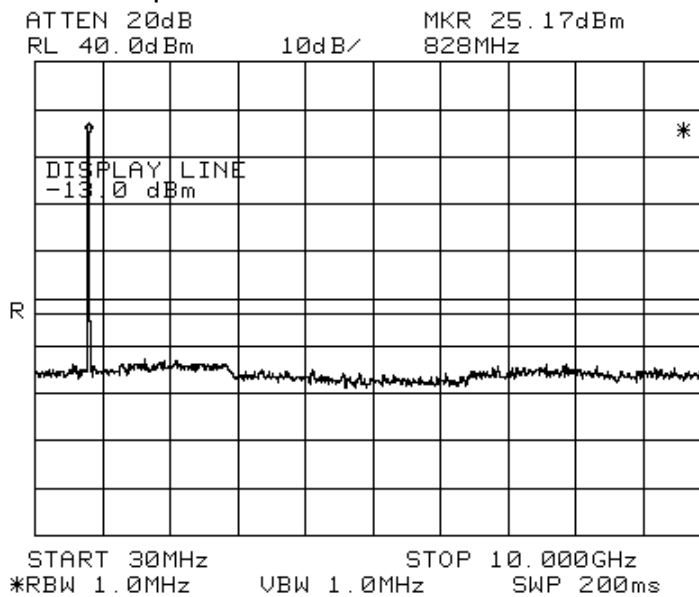
Upper Bandedge Intermodulation

GSM

Uplink



Date: 8.SEP.2006 14:42:29

EQUIPMENT: AMR8515**Test Data – Spurious Emissions at Antenna Terminals****Spurs – GSM - Downlink****Spurs – GSM - Uplink**

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 22.917
TESTED BY: David Light	DATE: 31 August 2006

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.

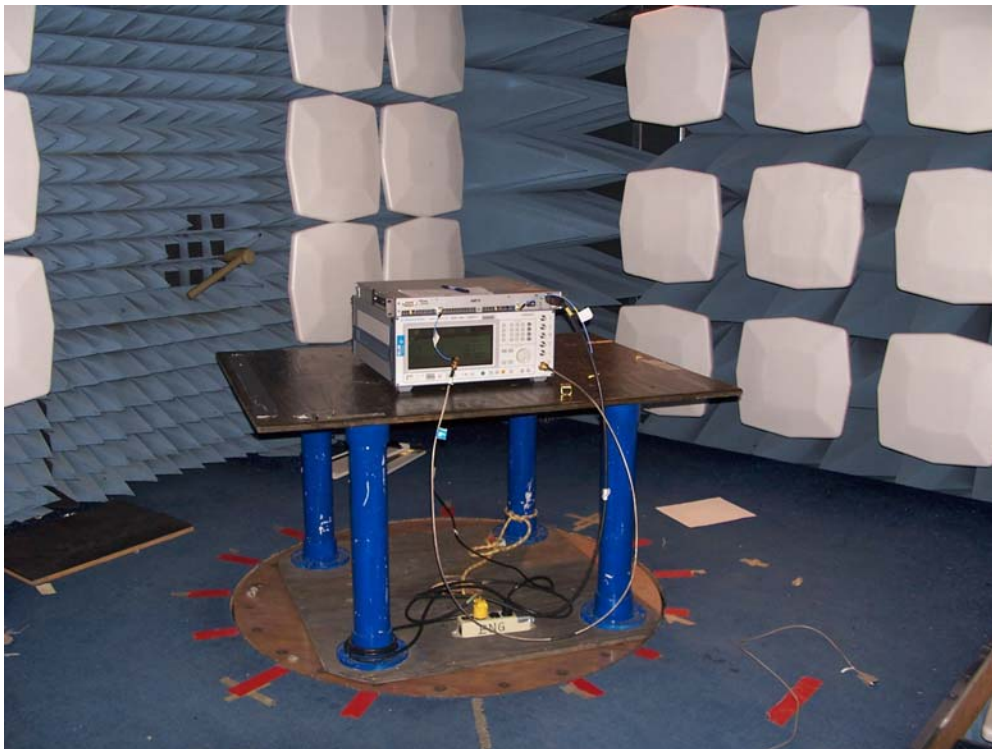
Equipment Used: 1484-1485-1464-1016-791-1306-759

Measurement Uncertainty: +/-1.7 dB

Temperature: 23 °C

Relative Humidity: 40 %

Photographs of Test Setup



Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1659	Spectrum Analyzer	Rhode & Schwarz FSP	973353	01/10/06	01/10/07
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	05/26/06	05/26/08
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
1484	Cable	Storm PR90-010-072	N/A	08/26/05	08/26/06
1485	Cable	Storm PR90-010-216	N/A	08/26/05	08/26/06
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	04/20/06	04/20/07
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	04/20/06	04/20/07
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/13/06	02/13/07
1306	Antenna biconical	Nemko USA, Inc. BCON 30300	212	02/10/06	02/10/07

ANNEX A - TEST DETAILS

NAME OF TEST: RF Power Output

PARA. NO.: 2.1046

Minimum Standard: Para. No. 22.913(a). The maximum effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 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:

The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 2.1049

Minimum Standard: Not defined (Input/Output)

Method Of Measurement:

CDMA

Spectrum analyzer settings:

RBW=VBW=30 kHz

Span: 5 MHz

Sweep: Auto

GSM / EDGE

RBW=VBW= 3 kHz

Span: 1 MHz

Sweep: Auto

TDMA

RBW=VBW= 1 kHz

Span: 1 MHz

Sweep: Auto

W-CDMA

RBW=VBW= 100 kHz

Span: 10 MHz

Sweep: Auto

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

Para. No. 22.917(e). The mean power of emissions must be attenuated below the mean power of the unmodulated carrier on any frequency twice or more than twice the fundamental emission by at least $43 + 10 \log P$. This is equivalent to -13 dBm absolute power.

Method Of Measurement:**Method Of Measurement:**

Spectrum analyzer settings:

CDMA

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

GSM / EDGE

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

TDMA

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

W-CDMA

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 100 kHz (< 1MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: 6 Sweeps

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

Para. No. 22.917(e). The mean power of emissions must be attenuated below the mean power of the unmodulated carrier on any frequency twice or more than twice the fundamental emission by at least $43 + 10 \log P$. This is equivalent to -13 dBm absolute power.

Method of Measurement

TIA/EIA-603-1992

The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

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

Para. No. 22.355. The transmitter carrier frequency shall remain within the tolerances given in Table C-1.

Table C-1

Freq. Range (MHz)	Base, fixed	Mobile > 3 W	Mobile $\leq$ 3 W
821 to 896	1.5	2.5	2.5

Method Of Measurement:Frequency Stability With Voltage Variation:

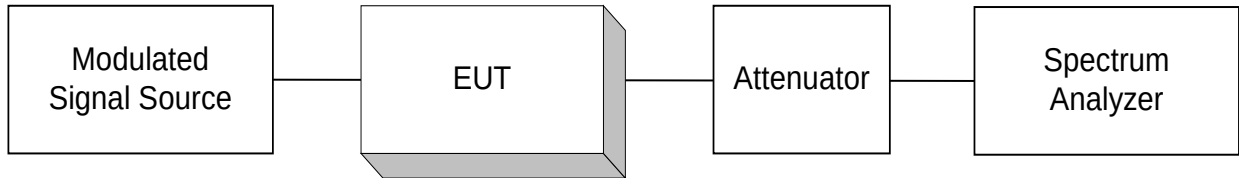
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the 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:

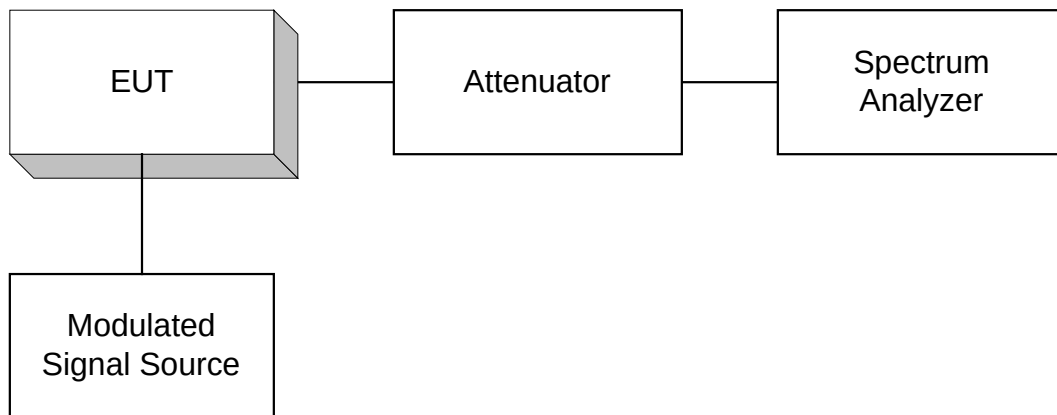
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

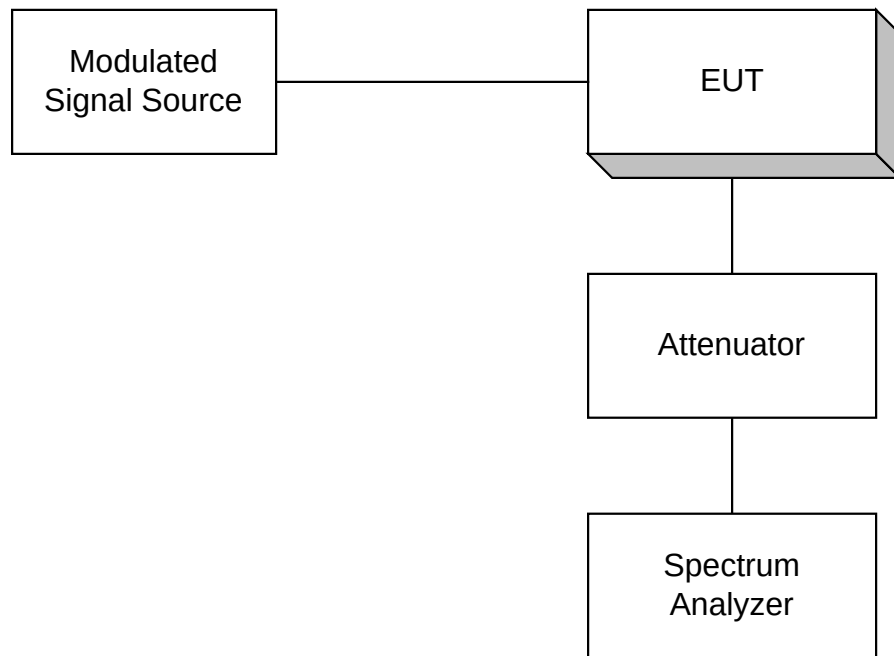
Para. No. 2.1046 - R.F. Power Output



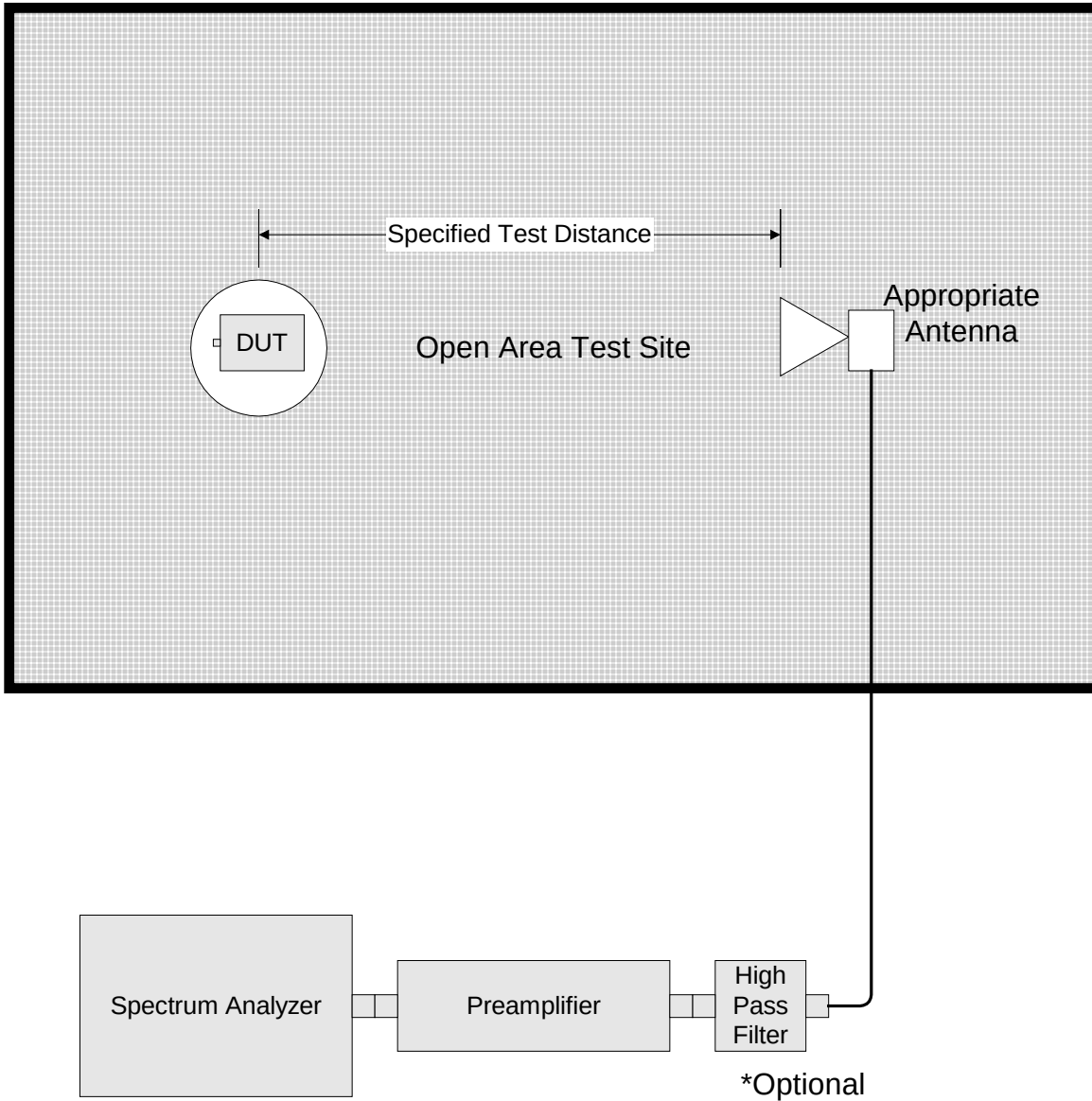
Para. No. 2.1049 - Occupied Bandwidth

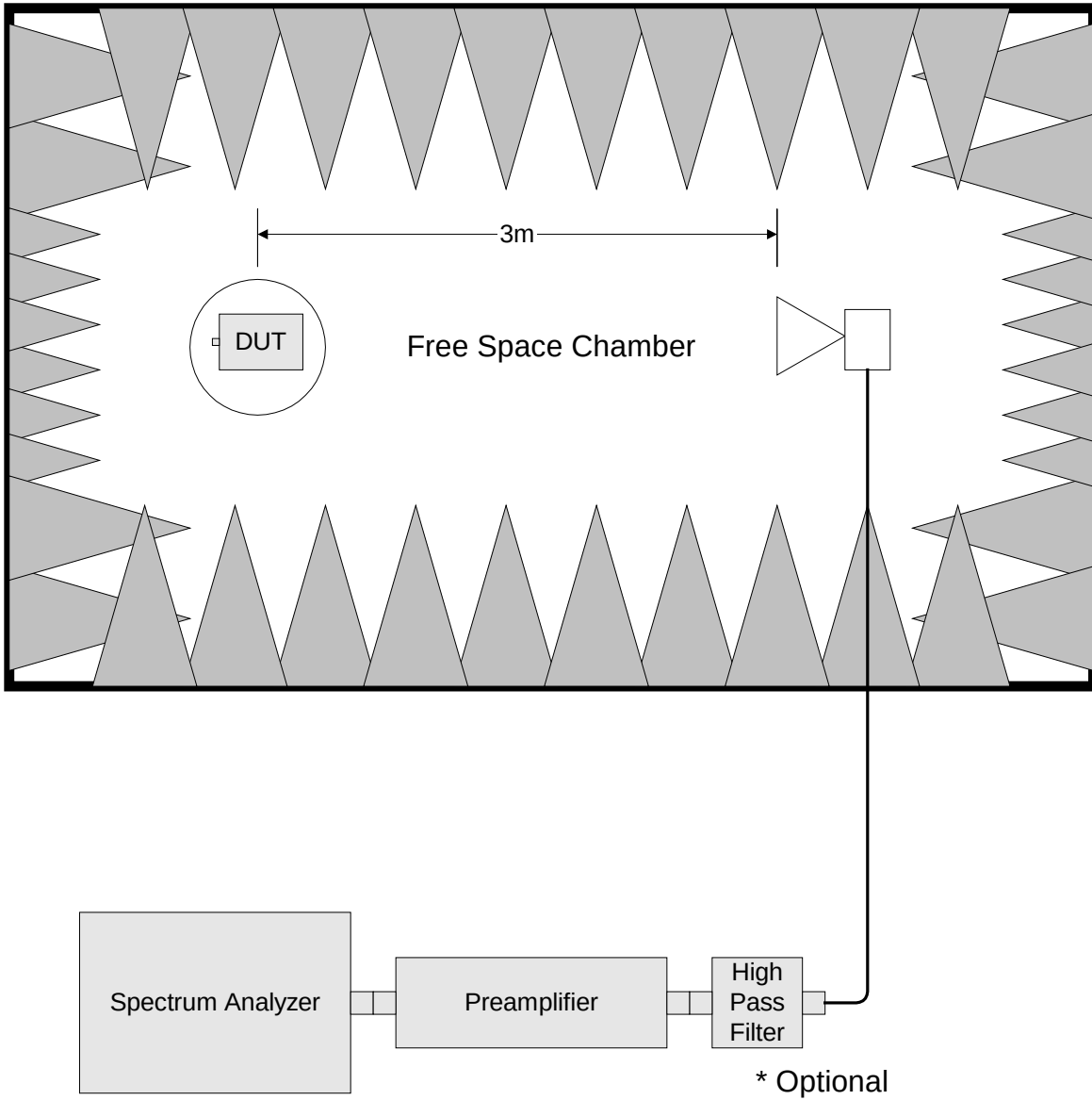


Para. No. 2.1051 Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Spurious Radiation





Para. No. 2.1055 - Frequency Stability

