

Nemko Test Report:



Applicant:

Andrew Corporation
620 N. Greenfield Parkway
Garner, NC 27529
USA

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

TFAH-US6B

In Accordance With:

CFR 47, Part 22, Subpart H
Cellular Band Repeaters

FCC Identifier:

BCR-TFAHUS6

Tested By:

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

TESTED BY:

David Light, Senior Wireless Engineer

DATE: 28 August 2009

APPROVED BY:

Tom Tidwell, Telecom Direct

DATE: 31 August 2009

Number of Pages: 43

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EQUIPMENT: TFAH-US6BPROJECT NO.: 32513RUS1**Section 1. Summary of Test Results**

Manufacturer: Andrew Corporation

Model No.: TFAH-US6B

Serial No.: 7640480

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

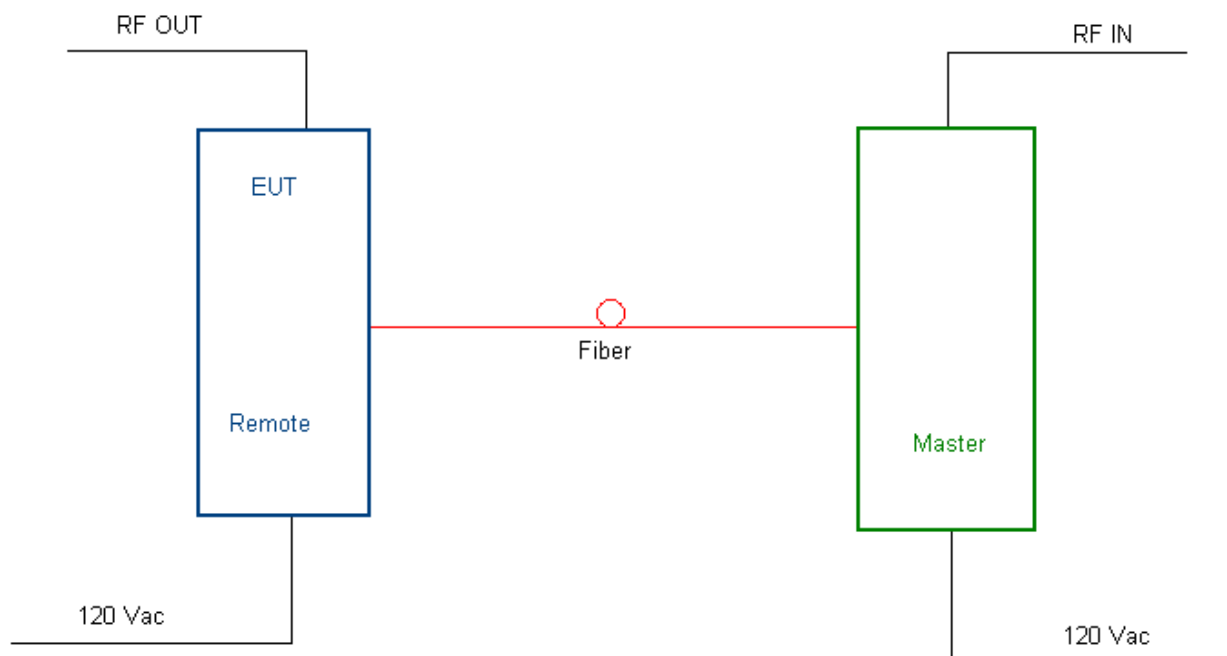
Footnotes: Frequency stability is not applicable because the device uses a common oscillator to down-convert and up-convert the rf signal.

Section 2. General Equipment Specification

Supply Voltage Input:	120 Vac		
Frequency Range:	Downlink:	869 to 894 MHz	
Frequency Range:	Uplink:	NA	
Type of Modulation and Designator:	CDMA (F9W)	GSM (GXW)	W-CDMA (F9W)
	☒	☒	☒
			EDGE (G7W)
			☒
Output Impedance:	50 ohms		
RF Output (Rated):	Downlink:	1.25 W	
		31.0 dBm	
	Uplink:	NA mW	
		NA dBm	
Frequency Translation:	F1-F1	F1-F2	N/A
	☒	☐	☐
Band Selection:	Software	Duplexer Change	Fullband Coverage
	☐	☐	☒

Description of EUT

The TFAH-US6B is a five band high power remote unit designed to distribute LMR700, LMR800, Cell850, LMR900, AWS and Extended PCS1900 band signals along the same fiber.

System Diagram

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 22.913
TESTED BY: David Light	DATE: 27 August 2009

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

Direction	Modulation	Output per Channel (dBm)	Composite Power (dBm)	Composite Power (W)
Uplink	CDMA	NA	NA	NA
Downlink	CDMA	28	31	1.25
Uplink	EDGE	NA	NA	NA
Downlink	EDGE	28	31	1.25
Uplink	GSM	NA	NA	NA
Downlink	GSM	28	31	1.25
Uplink	W-CDMA	NA	NA	NA
Downlink	W-CDMA	28	31	1.25

Equipment Used: 1036-1082-1472-1469**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 30 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: David Light	DATE: 27 August 2009

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1082-1472-1469

Measurement Uncertainty: 1X10⁻⁷ ppm

Temperature: 22 °C

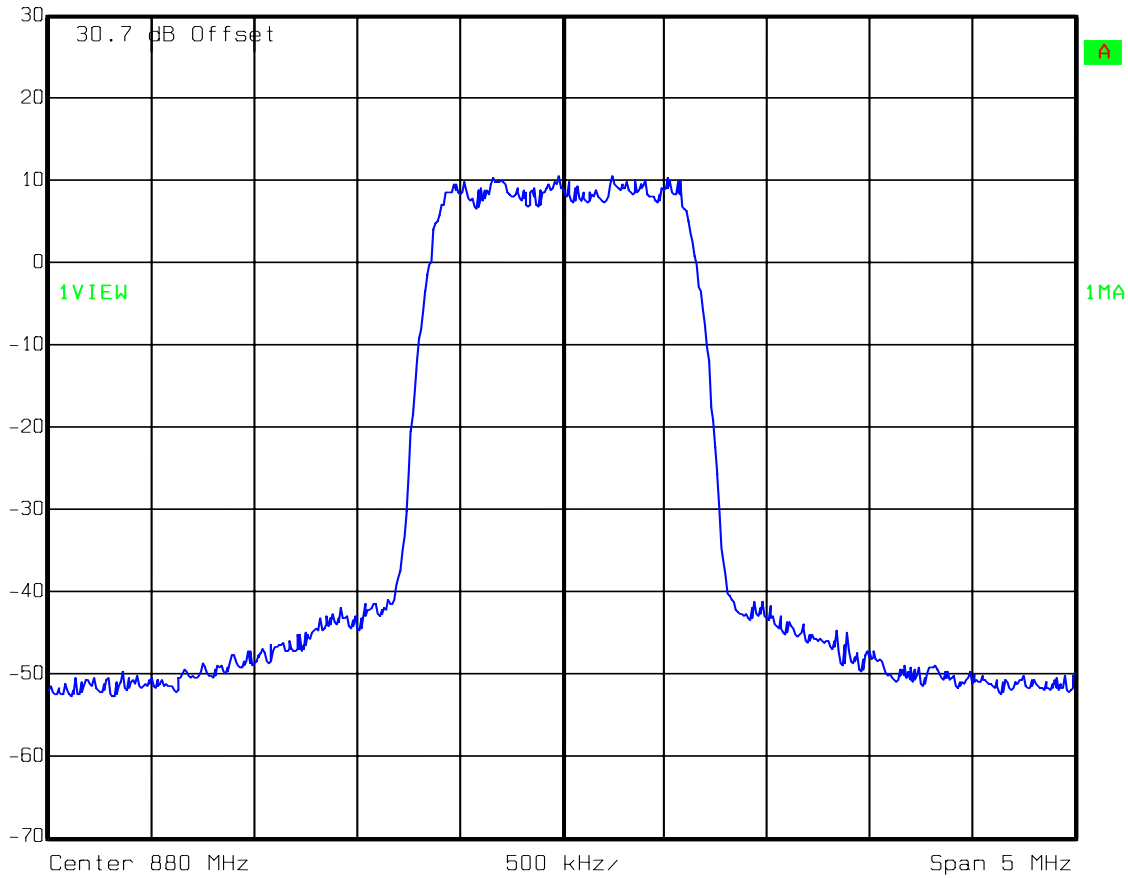
Relative Humidity: 30 %

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Occupied BandwidthCDMA - Output
DownlinkRef Lvl
30 dBm

RBW	30 kHz	RF Att	10 dB
VBW	30 kHz	Mixer	-10 dBm
SWT	14 ms	Unit	dBm



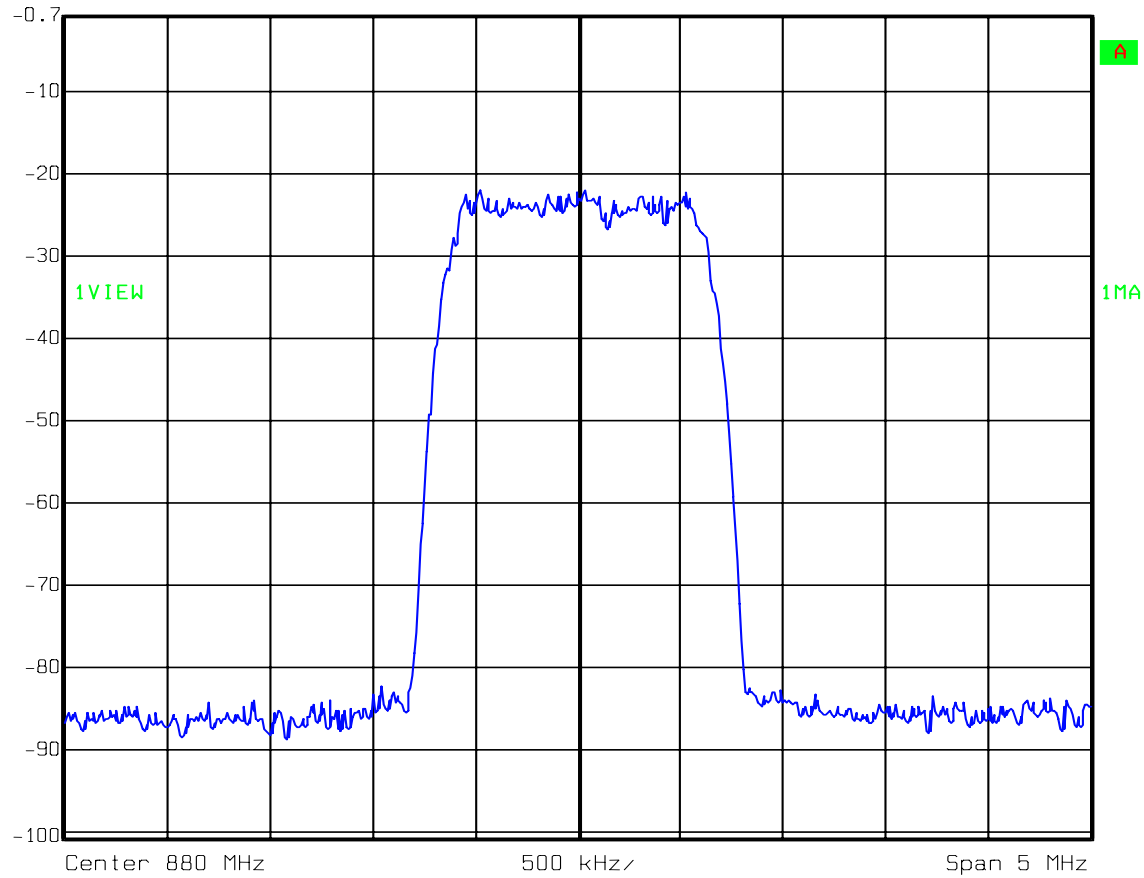
Date: 27.AUG.2009 09:43:31

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Occupied BandwidthCDMA - Input
DownlinkRef Lvl
-0.7 dBm

RBW	30 kHz	RF Att	10 dB
VBW	30 kHz	Mixer	-10 dBm
SWT	14 ms	Unit	dBm



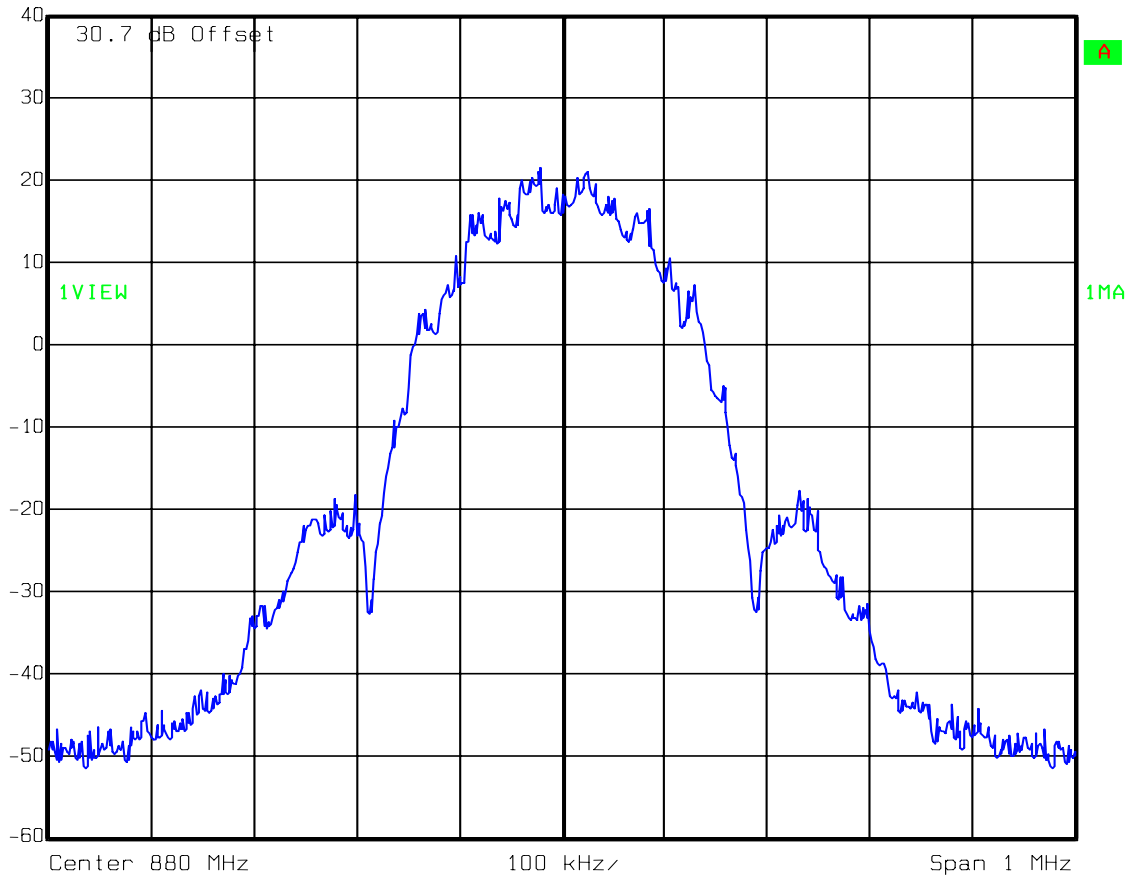
Date: 27.AUG.2009 09:44:16

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Occupied BandwidthEDGE - Output
DownlinkRef Lvl
40 dBm

RBW	3 kHz	RF Att	30 dB
VBW	3 kHz		
SWT	280 ms	Unit	dBm



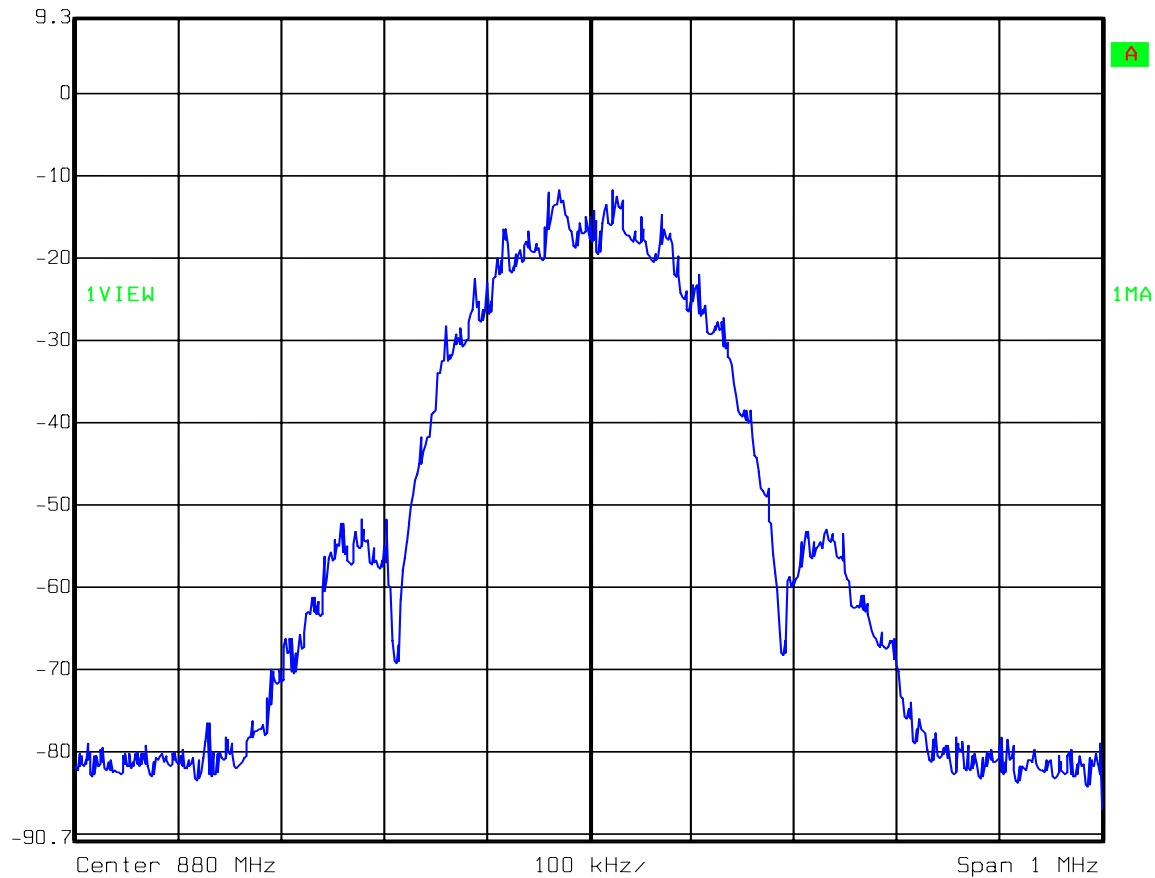
Date: 27.AUG.2009 09:24:08

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Occupied BandwidthEDGE - Input
DownlinkRef Lvl
9.3 dBm

RBW	3 kHz	RF Att	30 dB
VBW	3 kHz		
SWT	280 ms	Unit	dBm



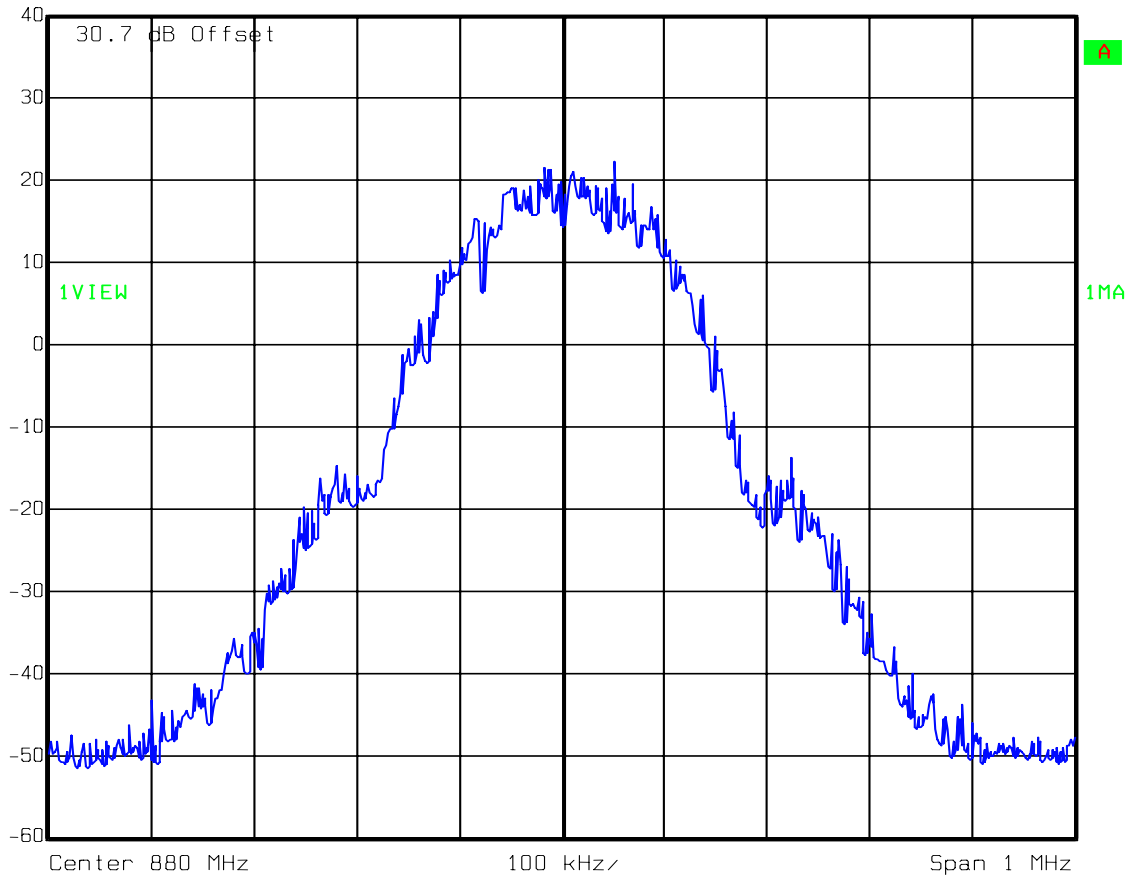
Date: 27.AUG.2009 09:25:22

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Occupied BandwidthGSM - Output
DownlinkRef Lvl
40 dBm

RBW	3 kHz	RF Att	30 dB
VBW	3 kHz		
SWT	280 ms	Unit	dBm



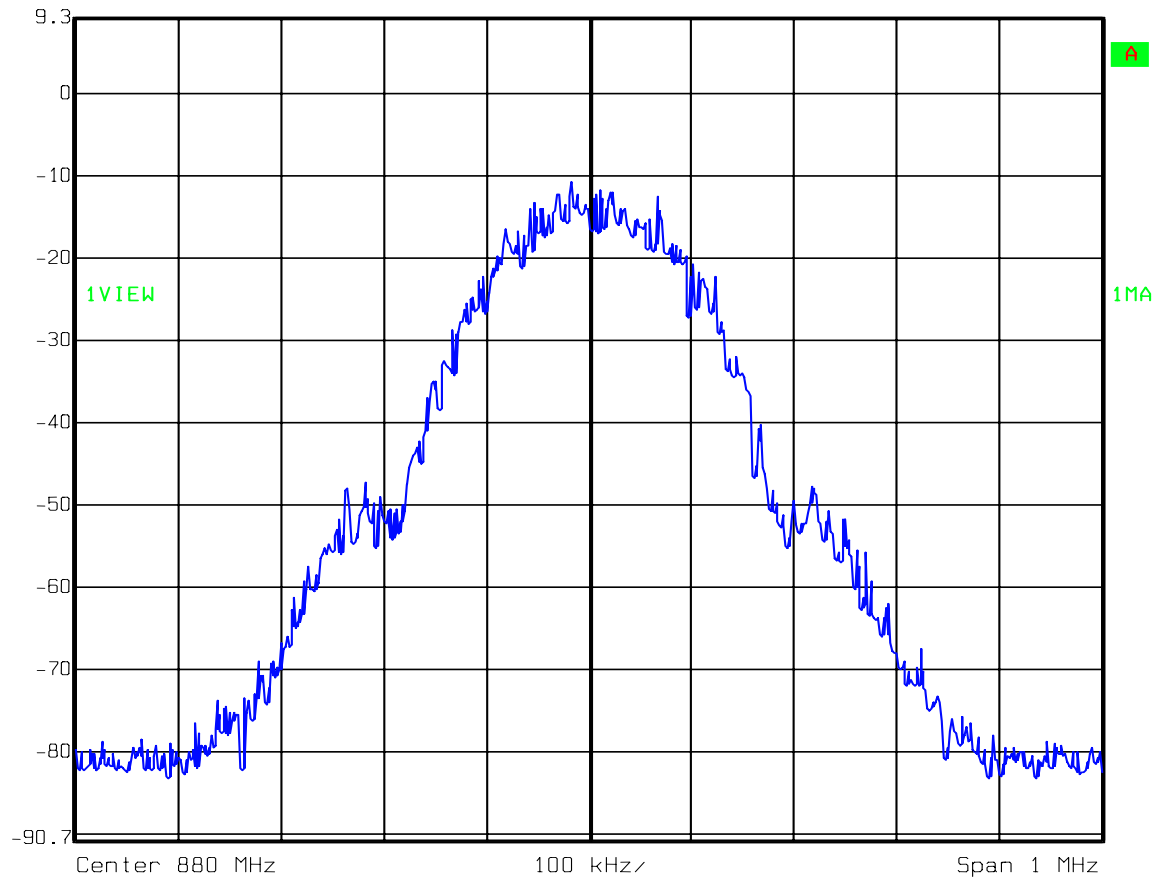
Date: 27.AUG.2009 09:12:32

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Occupied BandwidthGSM - Input
DownlinkRef Lvl
9.3 dBm

RBW	3 kHz	RF Att	30 dB
VBW	3 kHz		
SWT	280 ms	Unit	dBm



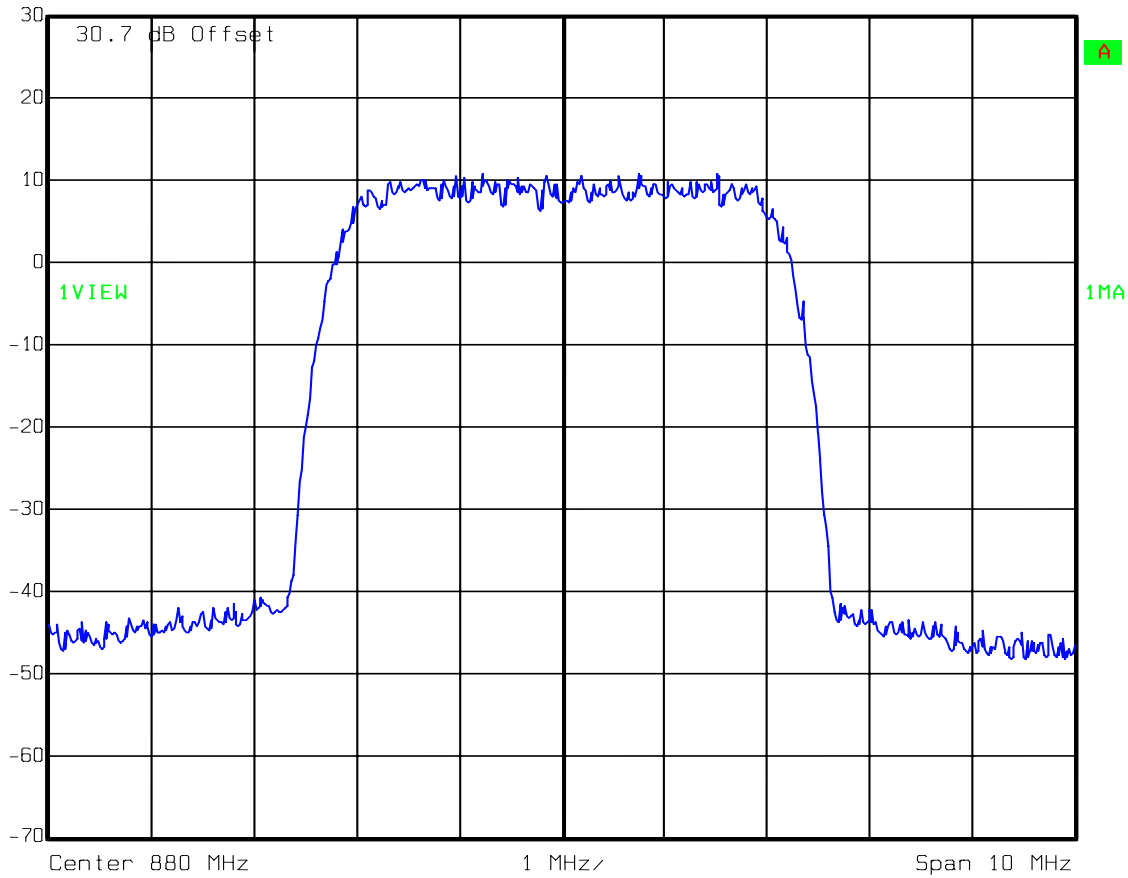
Date: 27.AUG.2009 09:13:26

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Occupied BandwidthWCDMA - Output
DownlinkRef Lvl
30 dBm

RBW	50 kHz	RF Att	10 dB
VBW	50 kHz	Mixer	-10 dBm
SWT	10 ms	Unit	dBm



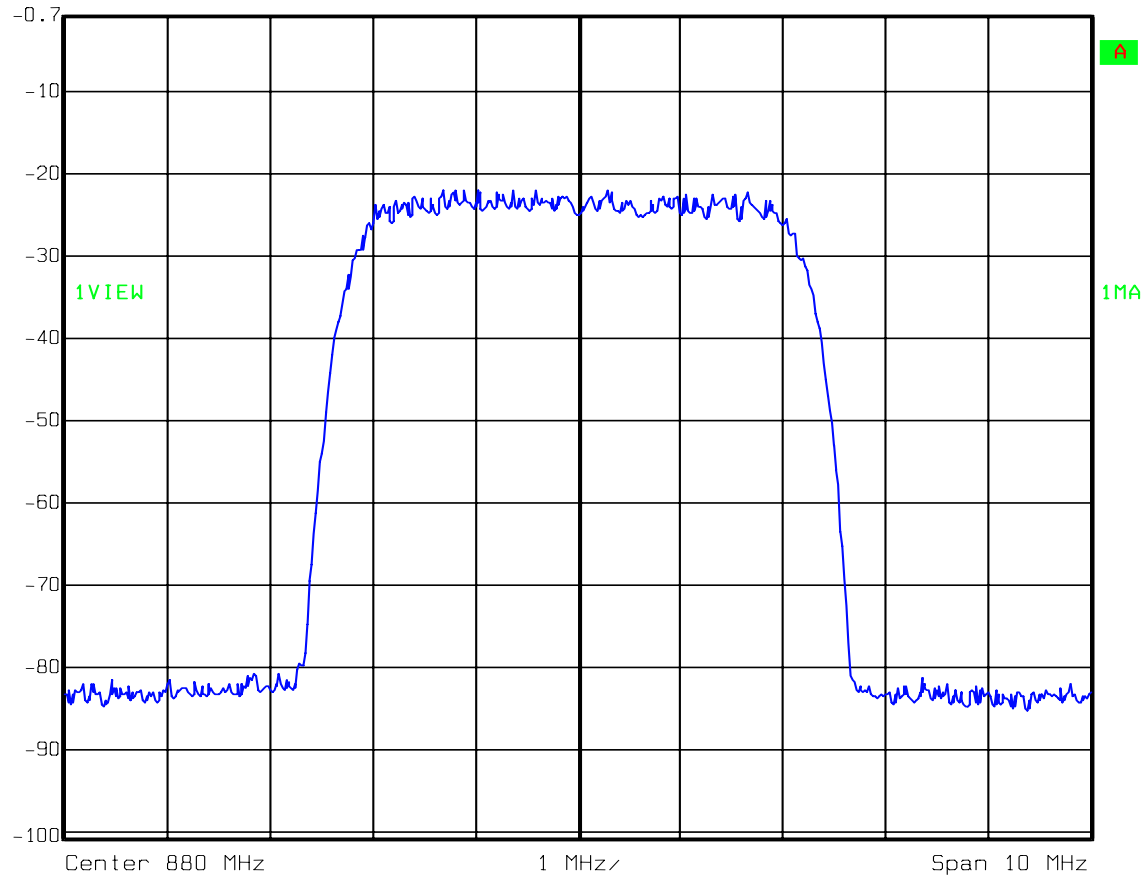
Date: 27.AUG.2009 09:56:12

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Occupied BandwidthWCDMA - Input
DownlinkRef Lvl
-0.7 dBm

RBW	50 kHz	RF Att	10 dB
VBW	50 kHz	Mixer	-10 dBm
SWT	10 ms	Unit	dBm



Date: 27.AUG.2009 09:57:09

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 22.917
TESTED BY: David Light	DATE: 27 August 09

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1472-1082-1469

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 35 %

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

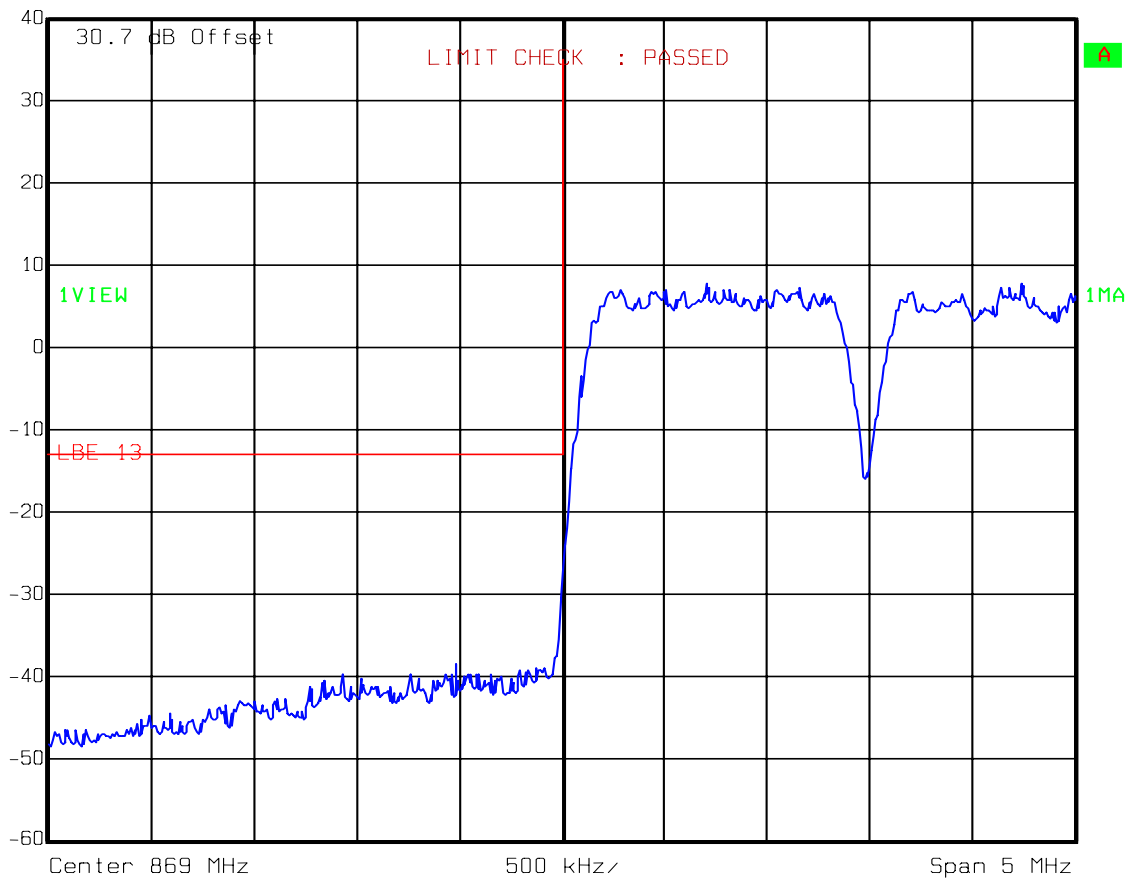
Lower Bandedge Intermodulation

CDMA

Downlink

Ref Lvl
40 dBm

RBW	30 kHz	RF Att	20 dB
VBW	30 kHz	Mixer	-10 dBm
SWT	14 ms	Unit	dBm



Date: 27.AUG.2009 09:39:38

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

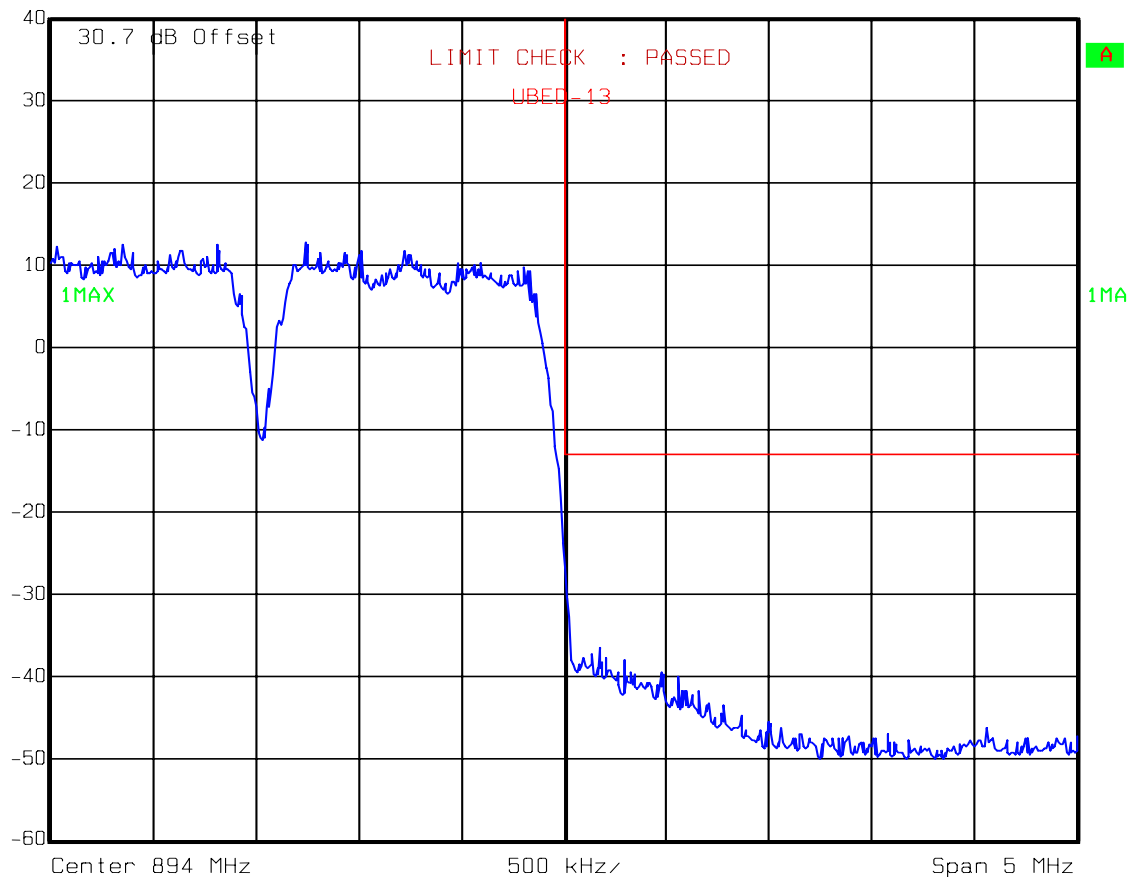
Upper Bandedge Intermodulation

CDMA

Downlink

Ref Lvl
40 dBm

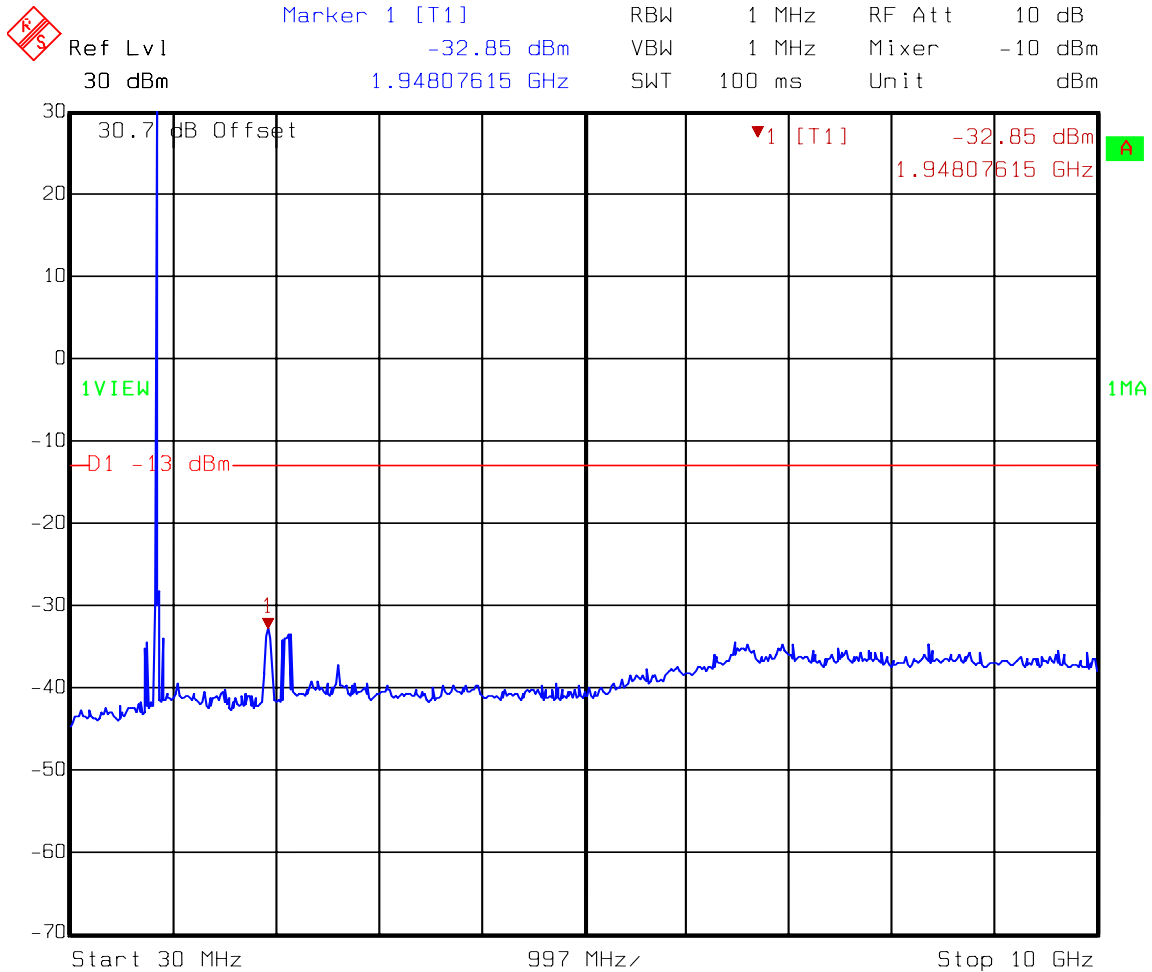
RBW	30 kHz	RF Att	20 dB
VBW	30 kHz	Mixer	-10 dBm
SWT	14 ms	Unit	dBm



Date: 27.AUG.2009 09:40:55

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals**Spurs – CDMA - Downlink**

Date: 27.AUG.2009 09:42:59

EQUIPMENT: TFAH-US6B

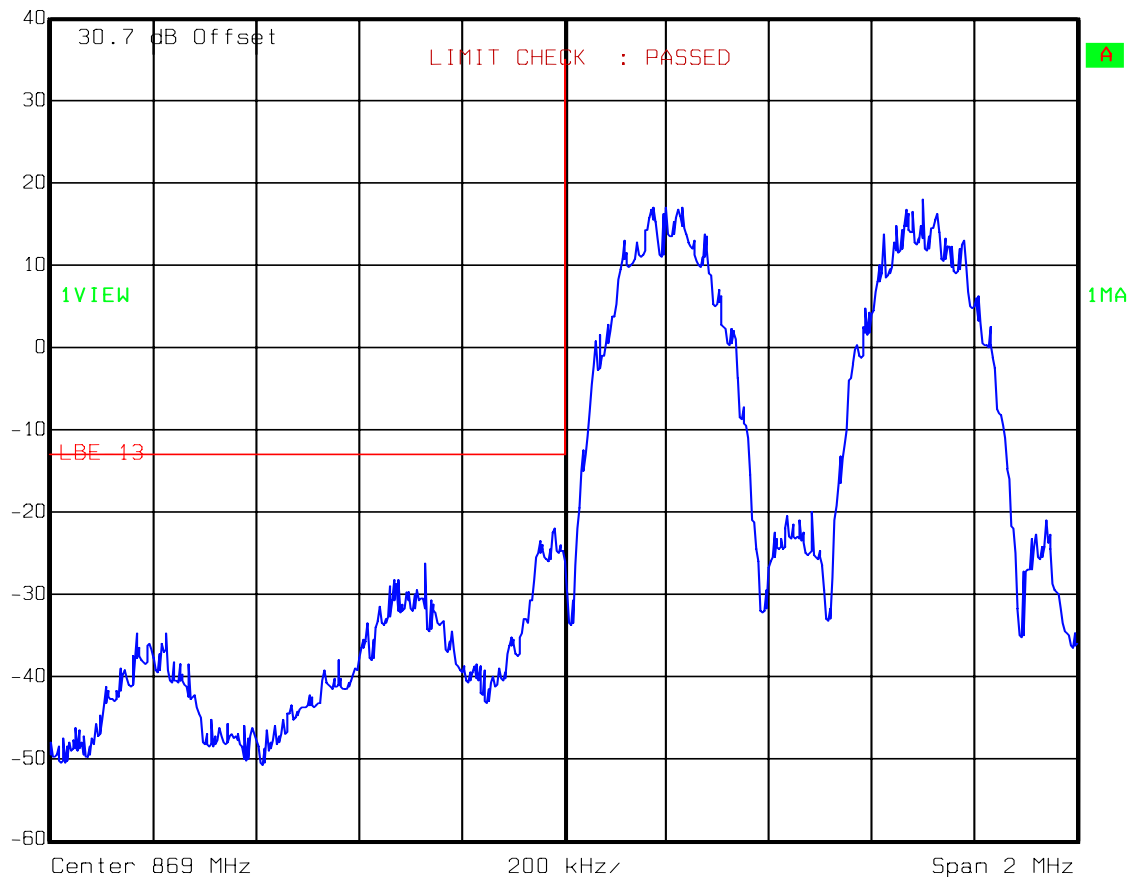
PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

EDGE

Downlink

Ref Lvl
40 dBmRBW 3 kHz RF Att 30 dB
VBW 3 kHz
SWT 560 ms Unit dBm

Date: 27.AUG.2009 09:16:23

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

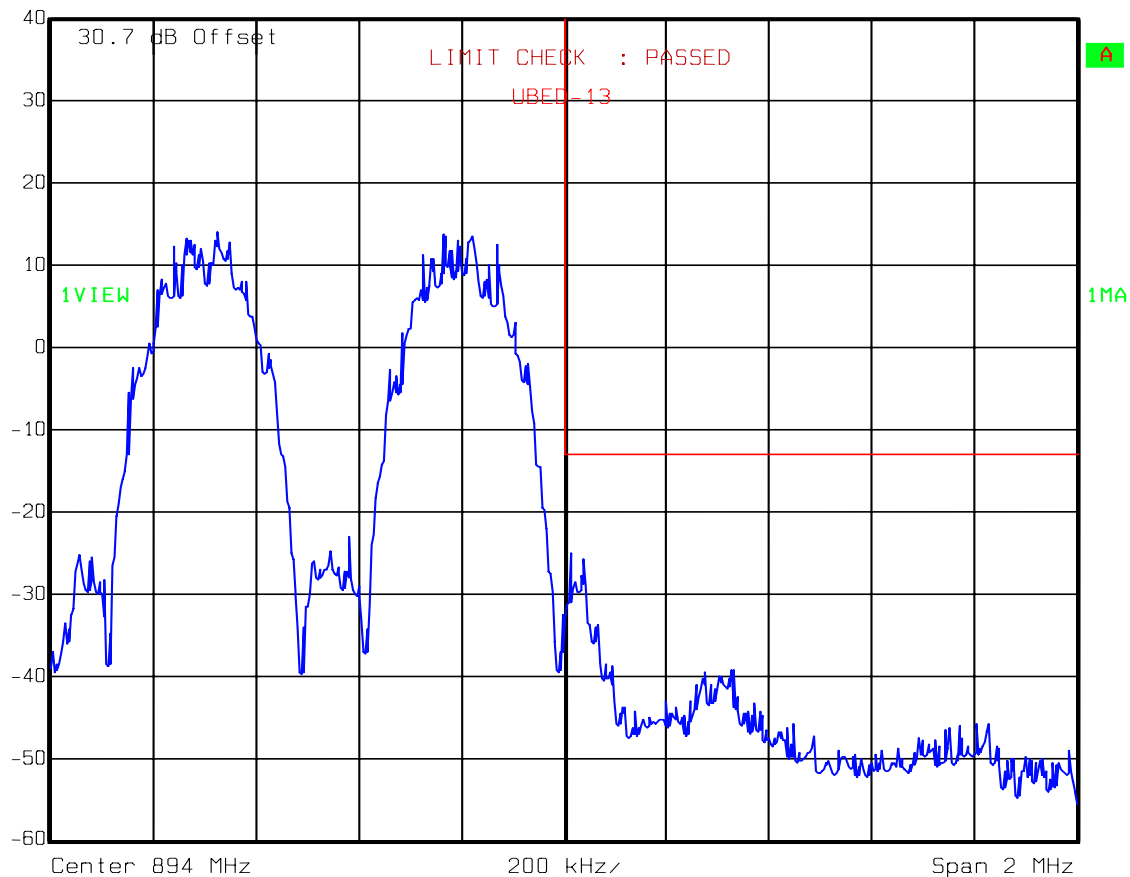
Upper Bandedge Intermodulation

EDGE

Downlink

Ref Lvl
40 dBm

RBW	3 kHz	RF Att	30 dB
VBW	3 kHz		
SWT	560 ms	Unit	dBm



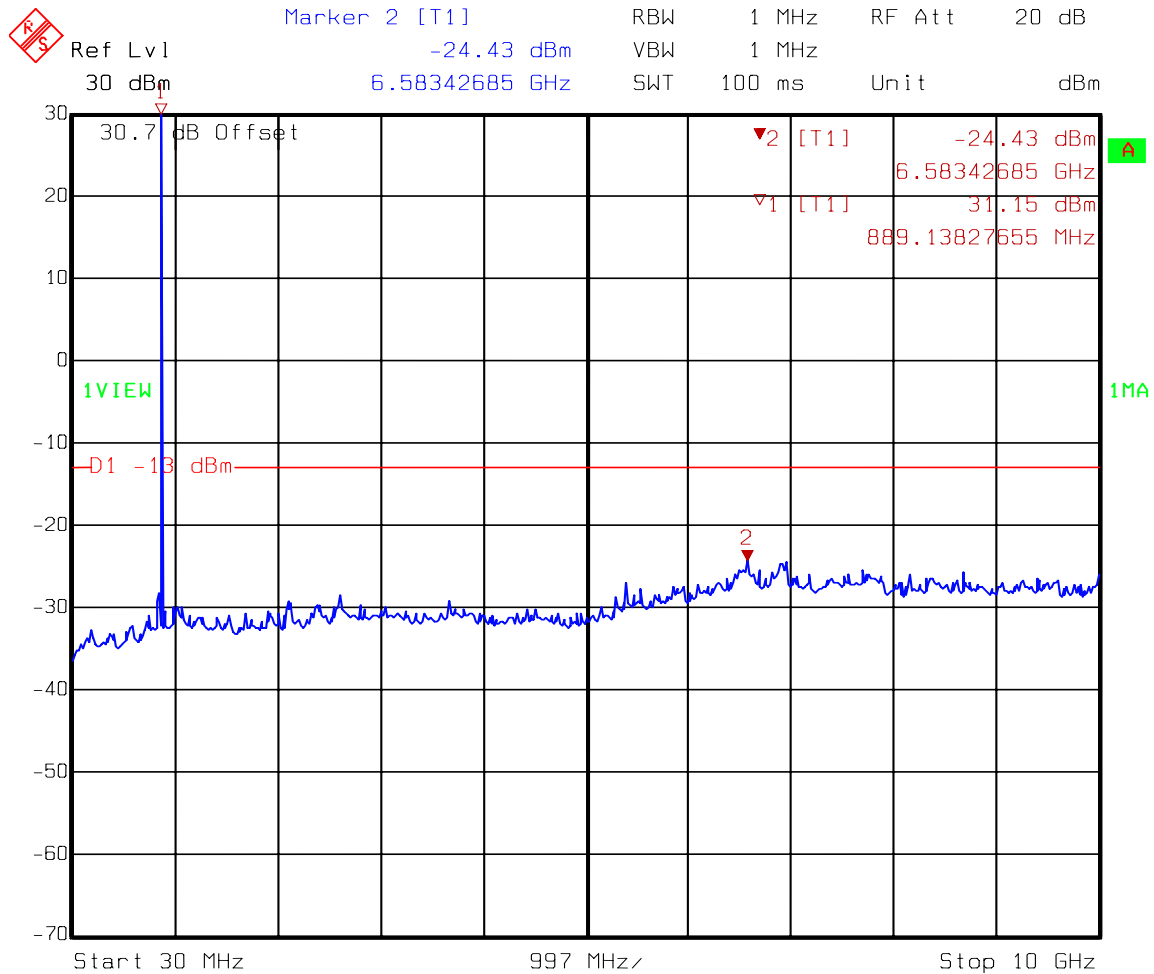
Date: 27.AUG.2009 09:19:58

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

Spurs – EDGE - Downlink



Date: 27.AUG.2009 09:21:58

EQUIPMENT: TFAH-US6B

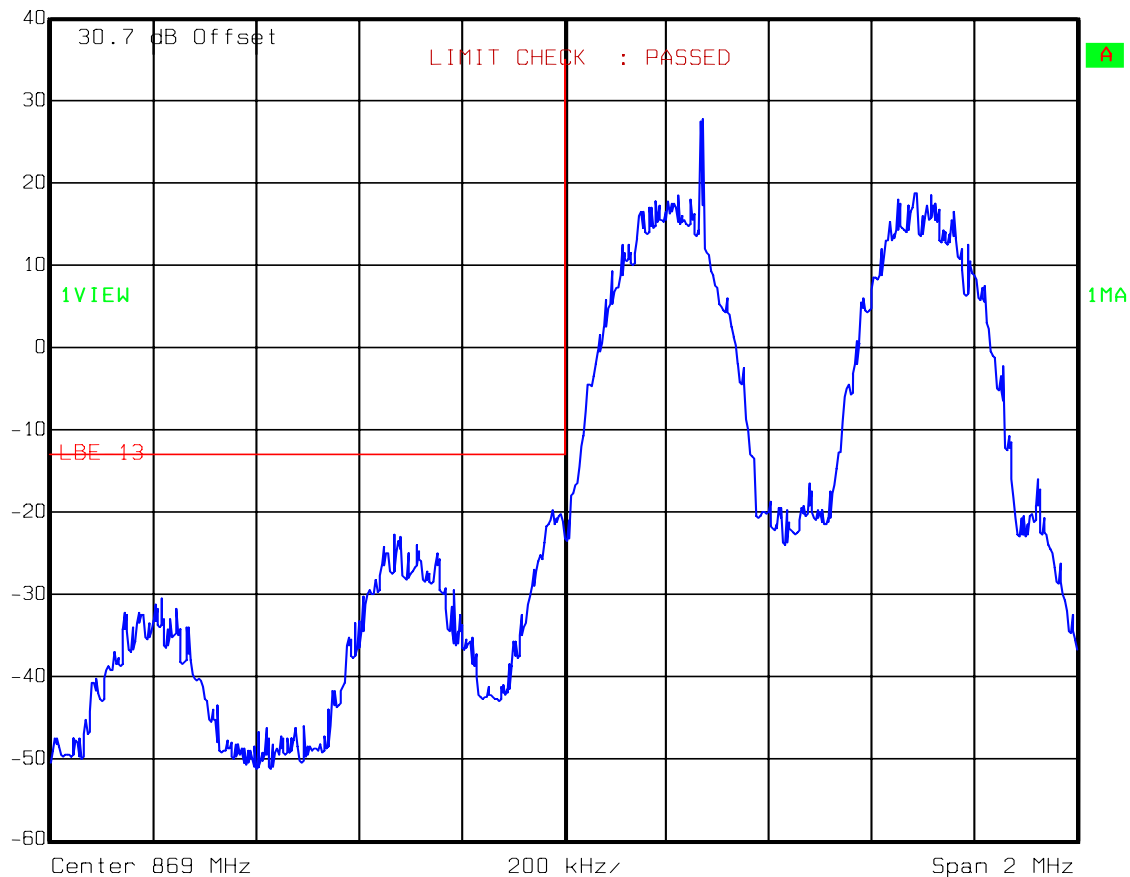
PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

GSM

Downlink

Ref Lvl
40 dBmRBW 3 kHz RF Att 30 dB
VBW 3 kHz
SWT 560 ms Unit dBm

Date: 27.AUG.2009 09:06:51

EQUIPMENT: TFAH-US6B

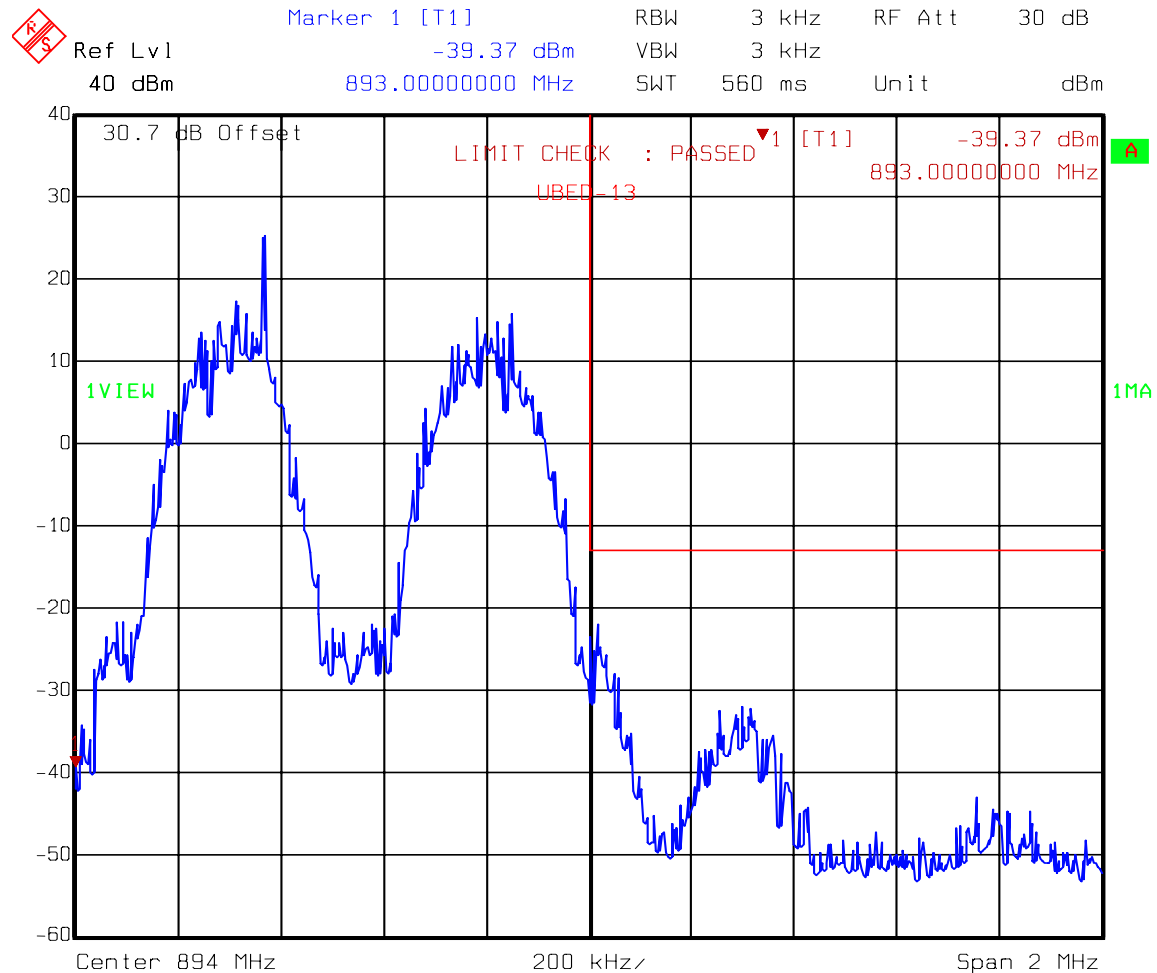
PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

GSM

Downlink



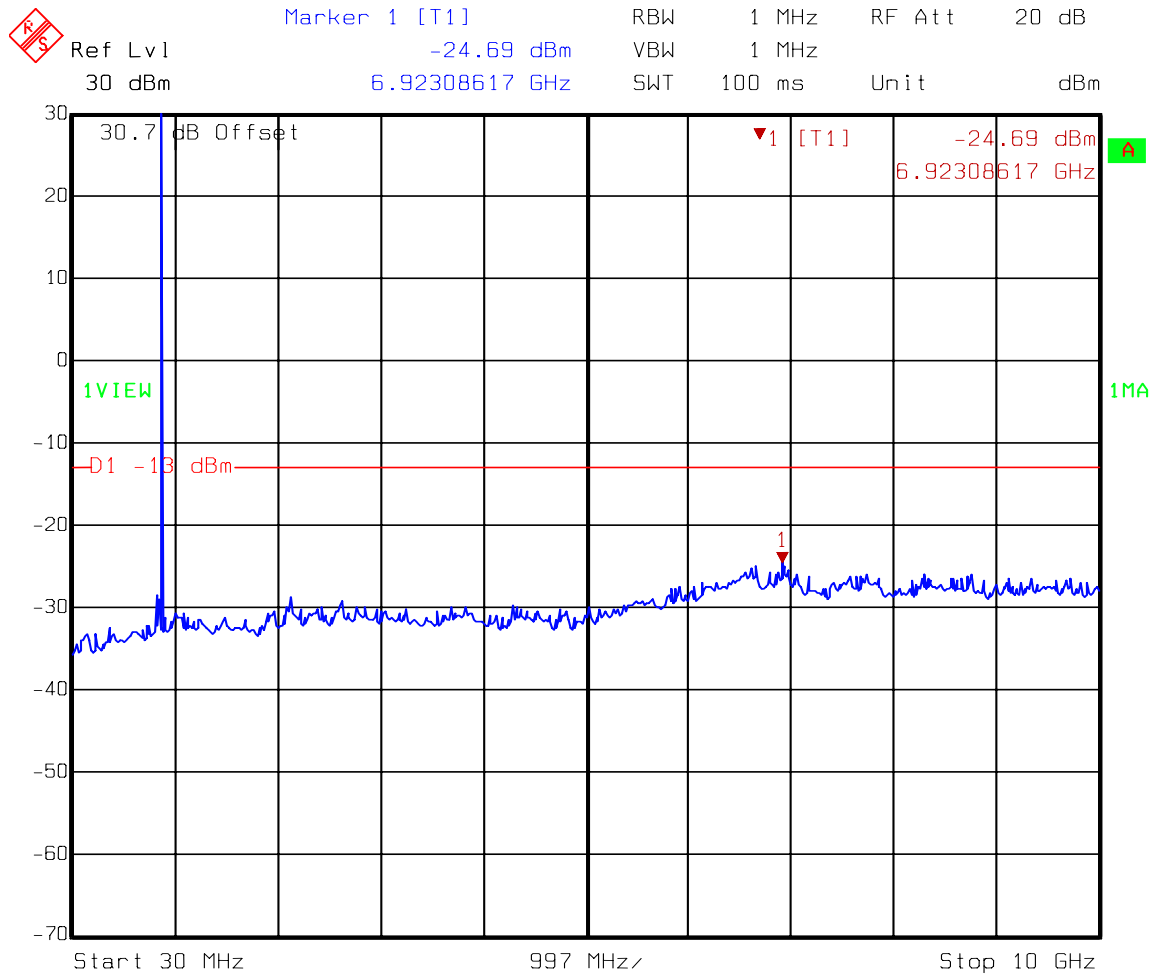
Date: 27.AUG.2009 09:08:41

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

Spurs – GSM - Downlink



Date: 27.AUG.2009 09:22:55

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

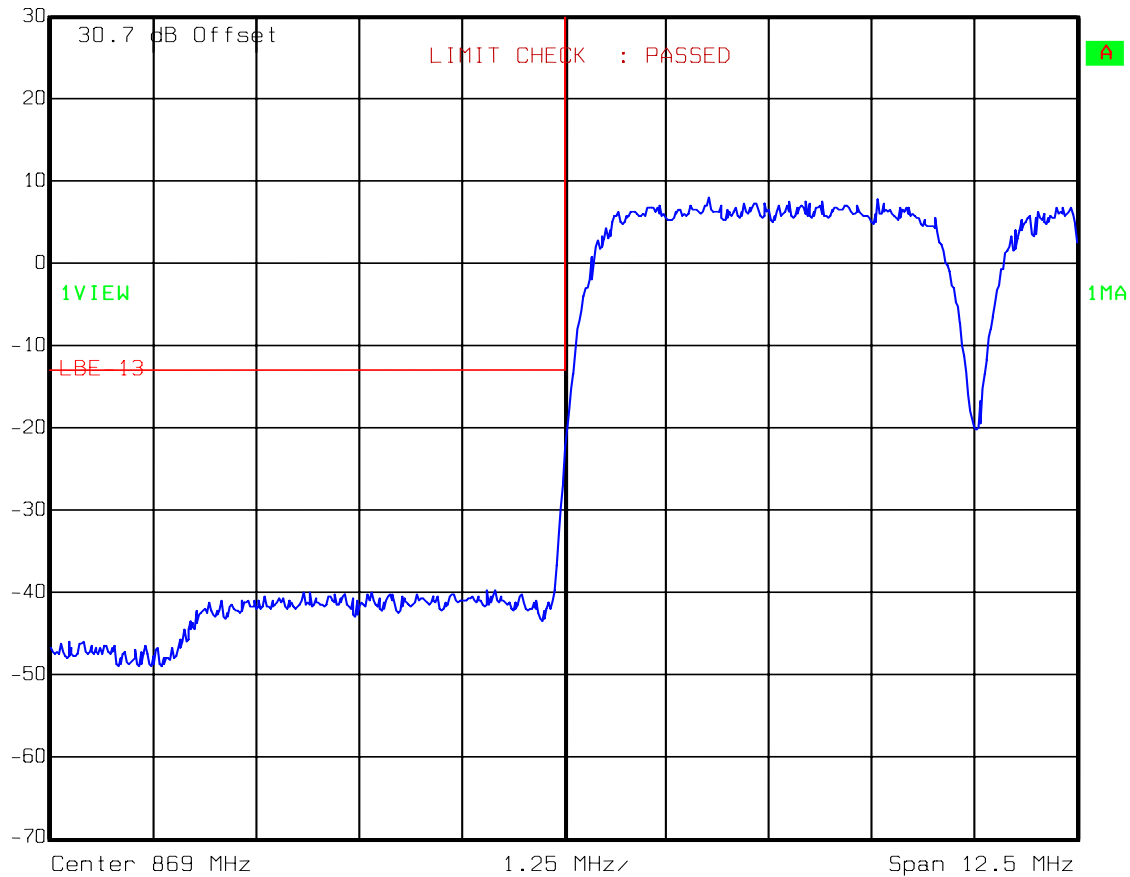
Lower Bandedge Intermodulation

W-CDMA

Downlink

Ref Lvl
30 dBm

RBW	50 kHz	RF Att	10 dB
VBW	50 kHz	Mixer	-10 dBm
SWT	12.5 ms	Unit	dBm



Date: 27.AUG.2009 09:50:29

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals

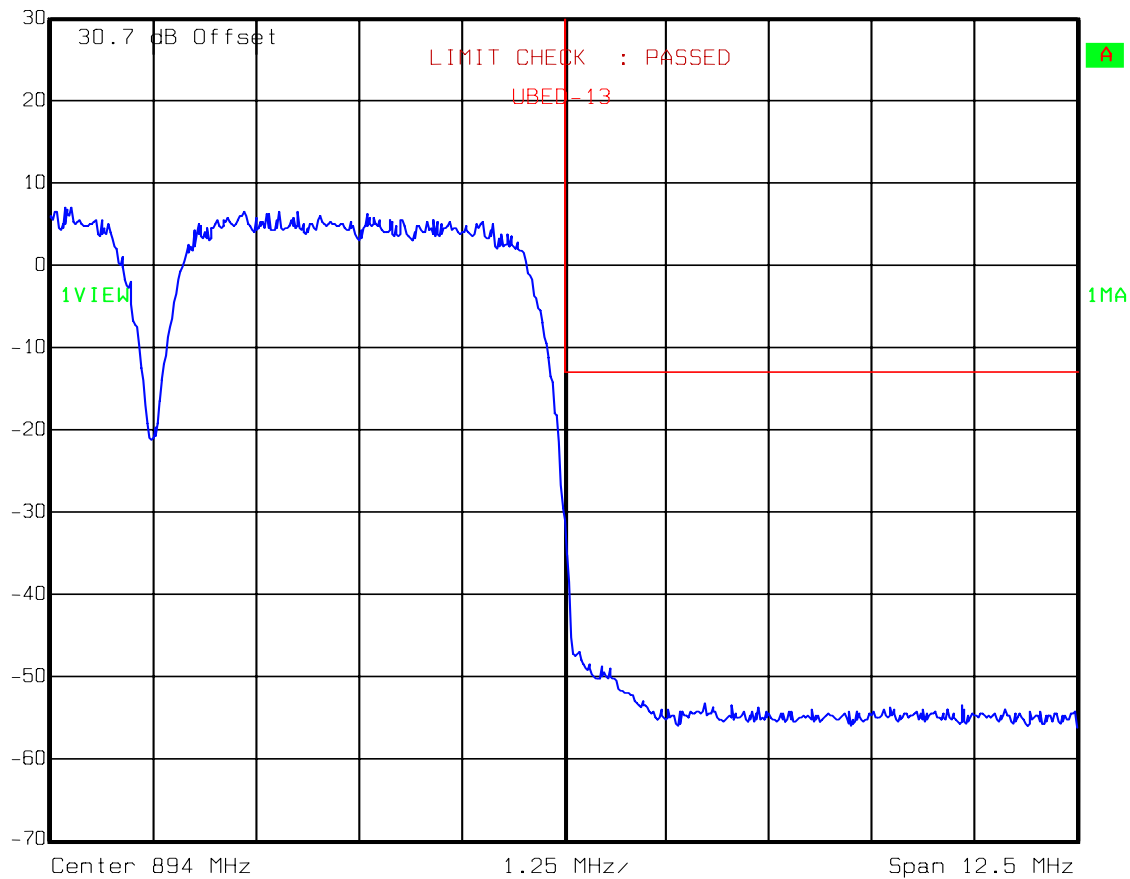
Upper Bandedge Intermodulation

W-CDMA

Downlink

Ref Lvl
30 dBm

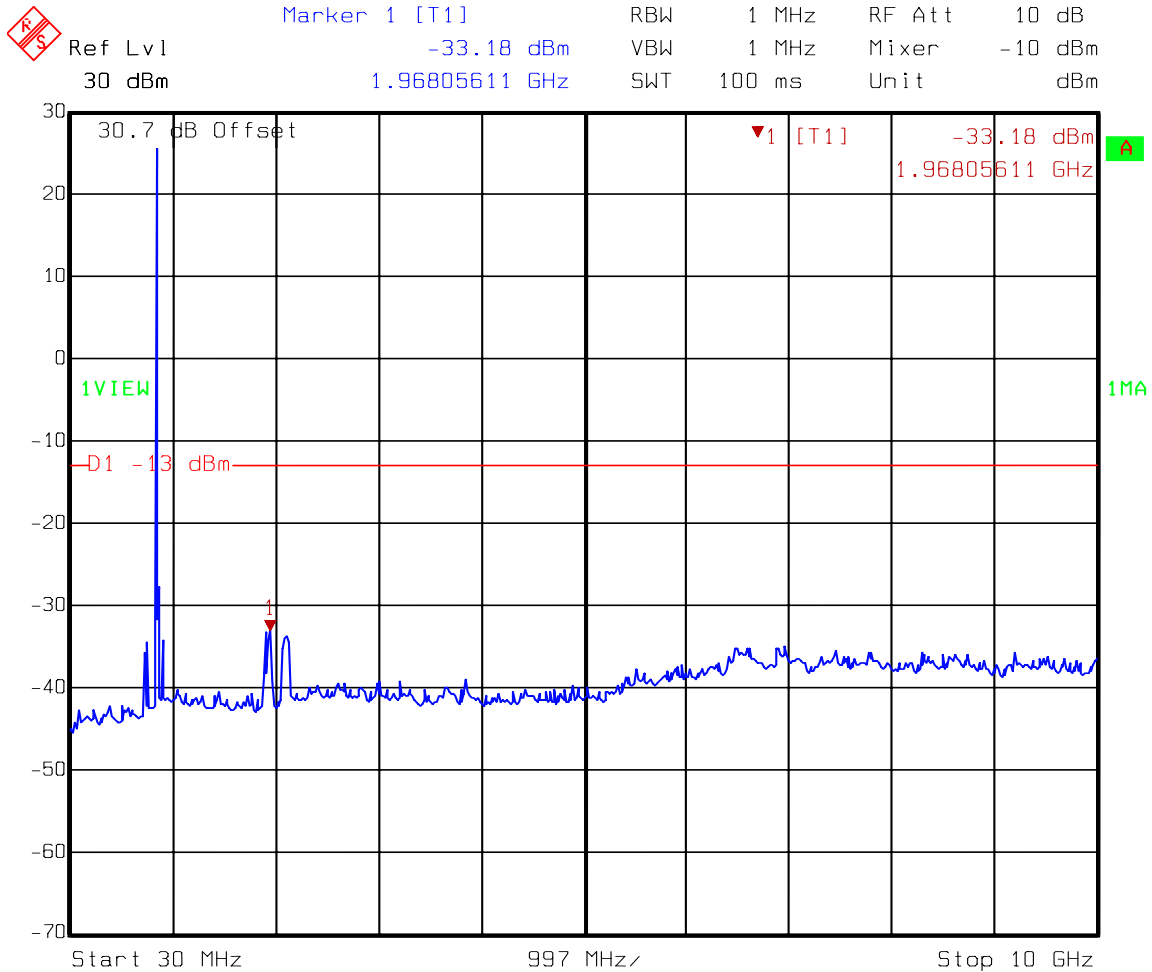
RBW	50 kHz	RF Att	10 dB
VBW	50 kHz	Mixer	-10 dBm
SWT	12.5 ms	Unit	dBm



Date: 27.AUG.2009 09:51:43

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

Test Data – Spurious Emissions at Antenna Terminals**Spurs – W-CDMA - Downlink**

Date: 27.AUG.2009 09:53:37

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 22.917
TESTED BY: David Light	DATE: 27 August 2009

Test Results: Complies.

Test Data: The spectrum was searched from 30 MHz to the tenth harmonic of the carrier. There were no emissions detected above the noise floor, which was at least 20 dB below the specification limit of -13 dBm.

Equipment Used: 1464-1484-1485-1016-993-791-1763**Measurement Uncertainty:** +/-1.7 dB**Temperature:** 22 °C**Relative Humidity:** 30 %

Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	01/19/09	01/20/11
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/27/09	02/28/11
1484	Cable	Storm PR90-010-072	N/A	06/23/09	06/23/10
1485	Cable	Storm PR90-010-216	N/A	06/23/09	06/23/10
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	06/23/09	06/23/10
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	05/28/09	05/28/10
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/31/09
1763	Bilog Antenna	Schaffner CBL 6111D	22926	11/04/08	11/04/09

ANNEX A - TEST DETAILS

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

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.

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

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

EQUIPMENT: TFAH-US6B

PROJECT NO.: 32513RUS1

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.1051
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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:**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 ≤ 3 W
821 to 896	1.5	2.5	2.5

Method Of Measurement:Frequency Stability With Voltage Variation:

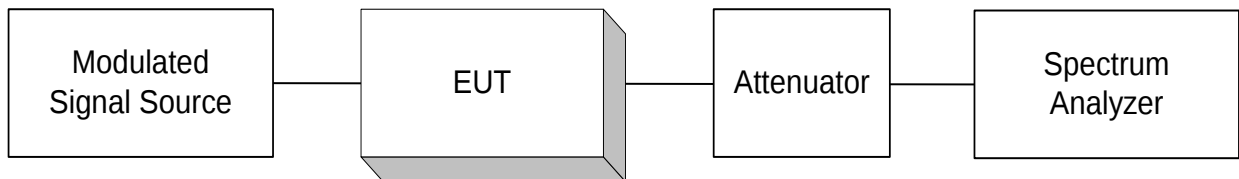
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the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

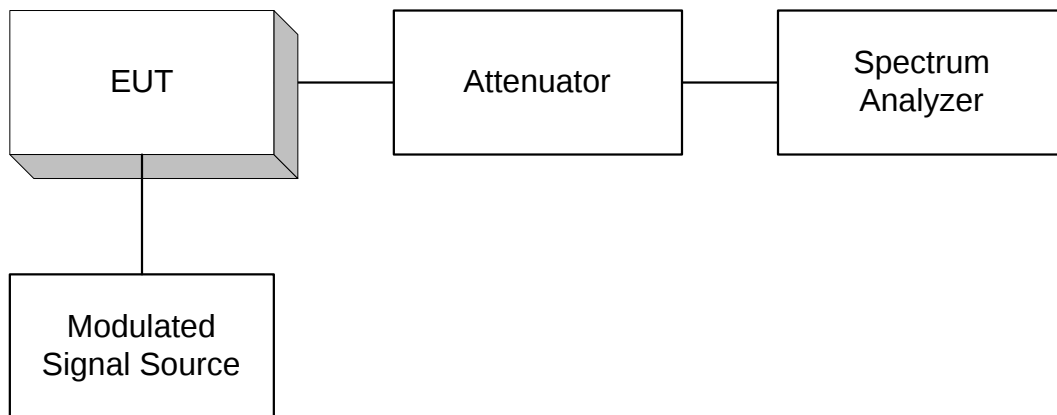
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

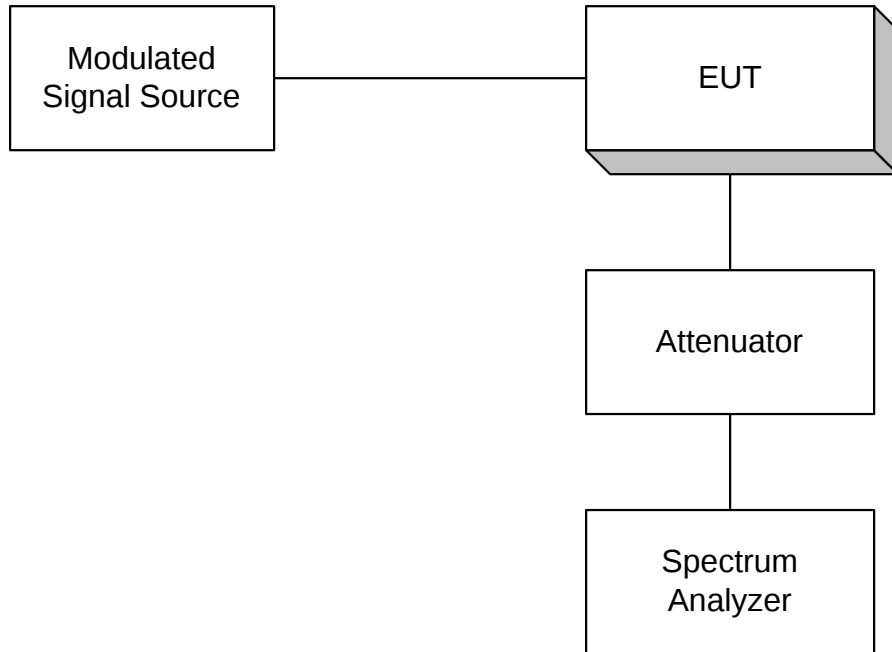
Para. No. 2.1046 - R.F. Power Output



Para. No. 2.1049 - Occupied Bandwidth



Para. No. 2.1051 Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Spurious Radiation

