



Nemko Test Report: 9372RUS1

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

**Equipment Under Test:
(E.U.T.)** TFAH-US5B

In Accordance With: **CFR 47, Part 24, Subpart E**
Broadband PCS Repeaters

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

TESTED BY:

A handwritten signature in black ink, appearing to read 'David Light', is written over a horizontal line.

David Light, Senior Wireless Engineer

DATE: 09 January, 2008

APPROVED BY:

A handwritten signature in blue ink, appearing to read 'Jon Fink', is written over a horizontal line.

DATE: 11 January, 2008

Number of Pages: 41

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EQUIPMENT: **TFAH-US5B**

Section 1. Summary of Test Results

Manufacturer Andrew Corporation

Model No.: TFAH-US5B

Serial No.: 074405615

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 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".



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EQUIPMENT: TFAH-US5B

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	24.232	100W	Complies
Occupied Bandwidth	2.1049	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) Modulation characteristics were not tested since the E.U.T. processes but does not produce a modulated waveform.
- (2) Frequency stability was not tested since the device does not translate the rf input frequency.

EQUIPMENT: **TFAH-US5B****Section 2. General Equipment Specification**

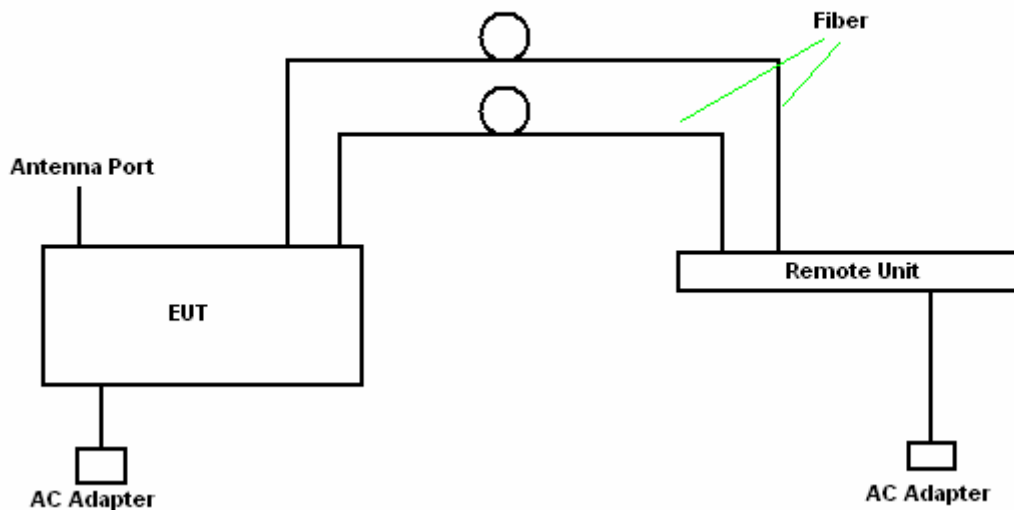
Supply Voltage Input:	120 Vac		
Frequency Bands: Downlink:	1930 to 1995 MHz		
Frequency Bands: Uplink:	NA		
Type of Modulation and Designator:	CDMA (F9W)	GSM (GXW)	W-CDMA (F9W) EDGE (G7W)
Output Impedance:	50 ohms		
RF Output (Rated): Downlink	$\frac{1.25}{31} \text{ W (max)}$ dBm (max)		
RF Output (Rated): Uplink	$\frac{\text{NA}}{\text{NA}} \text{ W}$ dBm		
Frequency Translation:	F1-F1 <input type="checkbox"/>	F1-F2 <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Band Selection:	Software <input type="checkbox"/>	Duplexer <input type="checkbox"/>	Fullband <input checked="" type="checkbox"/>

EQUIPMENT: **TFAH-US5B**

Description of EUT

The TFAH-US5B is a five band high power remote unit designed to distribute LMR800, Cellular850, LMR900, AWS1700, and Extended PCS1900 band signals along the same fiber.

System Diagram



EQUIPMENT: TFAH-US5B**Section 3. RF Power Output**

NAME OF TEST: RF Power Output	PARA. NO.: 24.232
TESTED BY: David Light	DATE: 08 January 2008

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

Direction	Modulation	Output per Channel (dBm)	Composite Power (dBm)	Composite Power (W)
Downlink	CDMA	26*	29	0.8
Downlink	EDGE	28*	31	1.25
Downlink	GSM	28*	31	1.25
Downlink	W-CDMA	24*	27	0.5

- Based on two carriers

RBW: 10 MHz

VBW: 10 MHz

Equipment Used: 1036-1082-1471-1472**Measurement Uncertainty:** +/- 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 35 %

EQUIPMENT: **TFAH-US5B**

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 24.238
TESTED BY: David Light	DATE: 08 January 2008

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1082-1471-1472

Measurement Uncertainty: 1X10⁻⁷ ppm

Temperature: 22 °C

Relative Humidity: 35 %

EQUIPMENT: **TFAH-US5B**

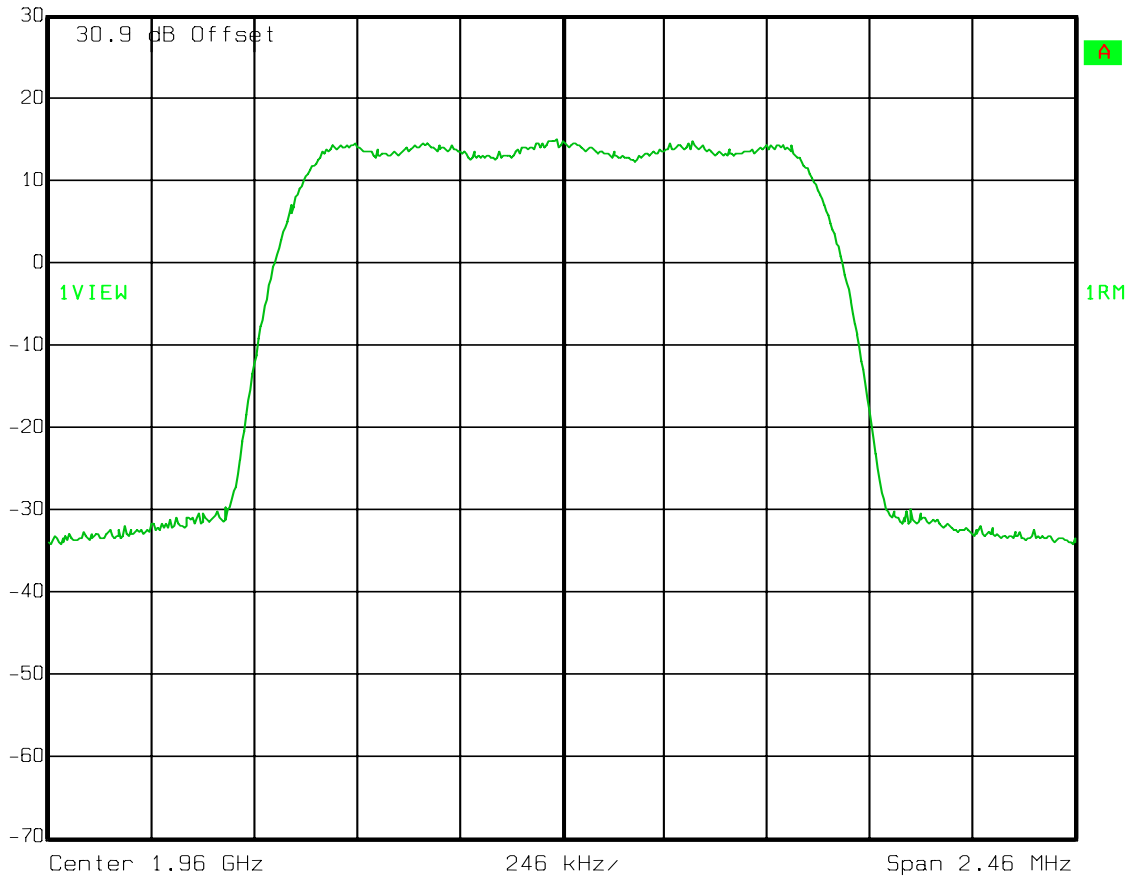
Test Data – Occupied Bandwidth

CDMA - Output



Ref Lvl
30 dBm

RBW	30 kHz	RF Att	10 dB
VBW	300 kHz	Mixer	-10 dBm
SWT	3 s	Unit	dBm



Date: 07.JAN.2008 11:15:05

EQUIPMENT: **TFAH-US5B**

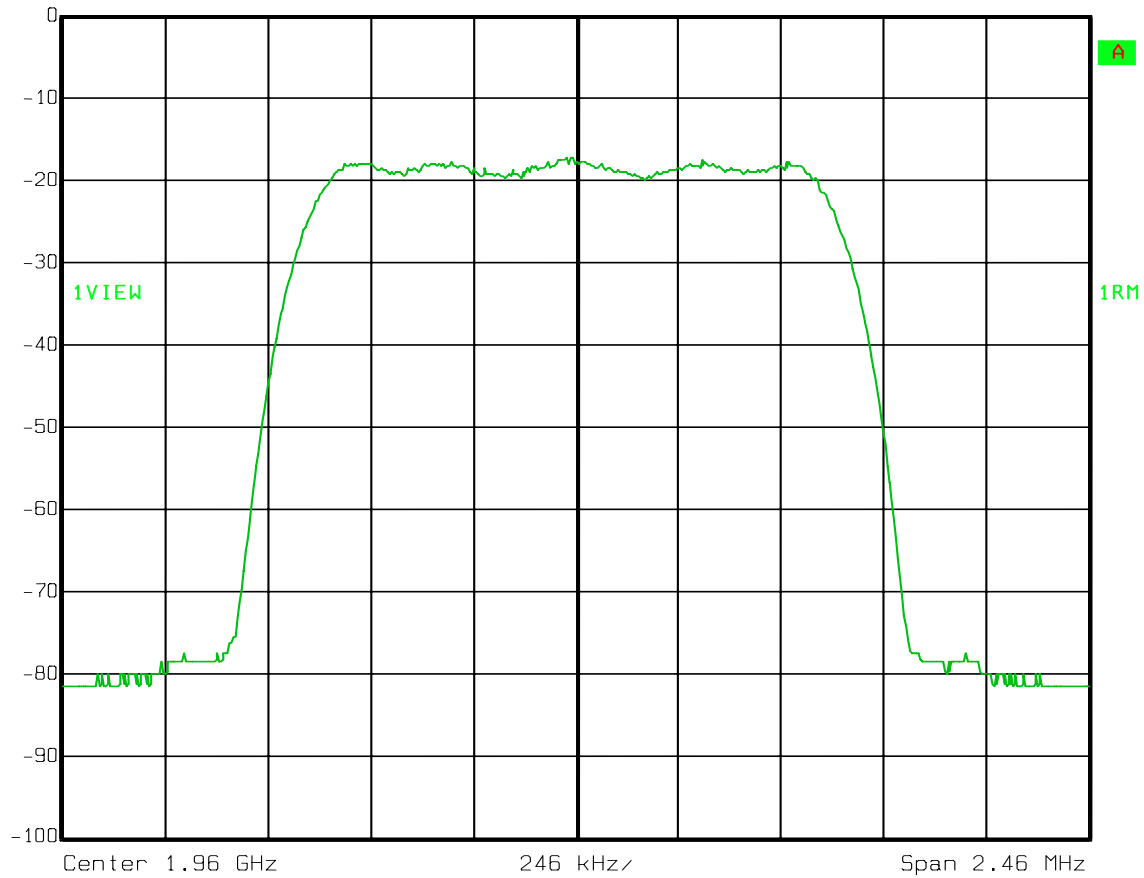
Test Data – Occupied Bandwidth

CDMA - Input



Ref Lvl
0 dBm

RBW	30 kHz	RF Att	10 dB
VBW	300 kHz	Mixer	-10 dBm
SWT	3 s	Unit	dBm



Date: 07.JAN.2008 11:16:53

EQUIPMENT: **TFAH-US5B**

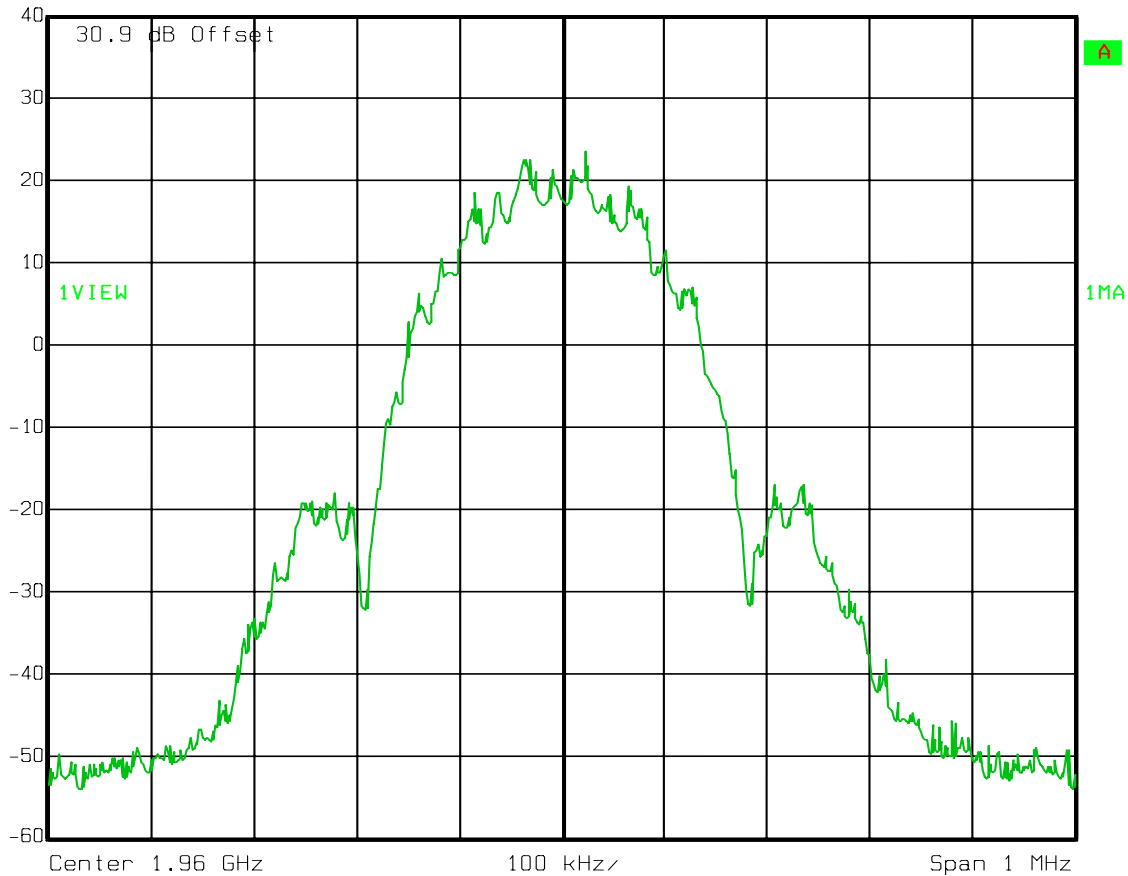
Test Data – Occupied Bandwidth

EDGE - Output



Ref Lvl
40 dBm

RBW	3 kHz	RF Att	20 dB
VBW	3 kHz	Mixer	-10 dBm
SWT	280 ms	Unit	dBm



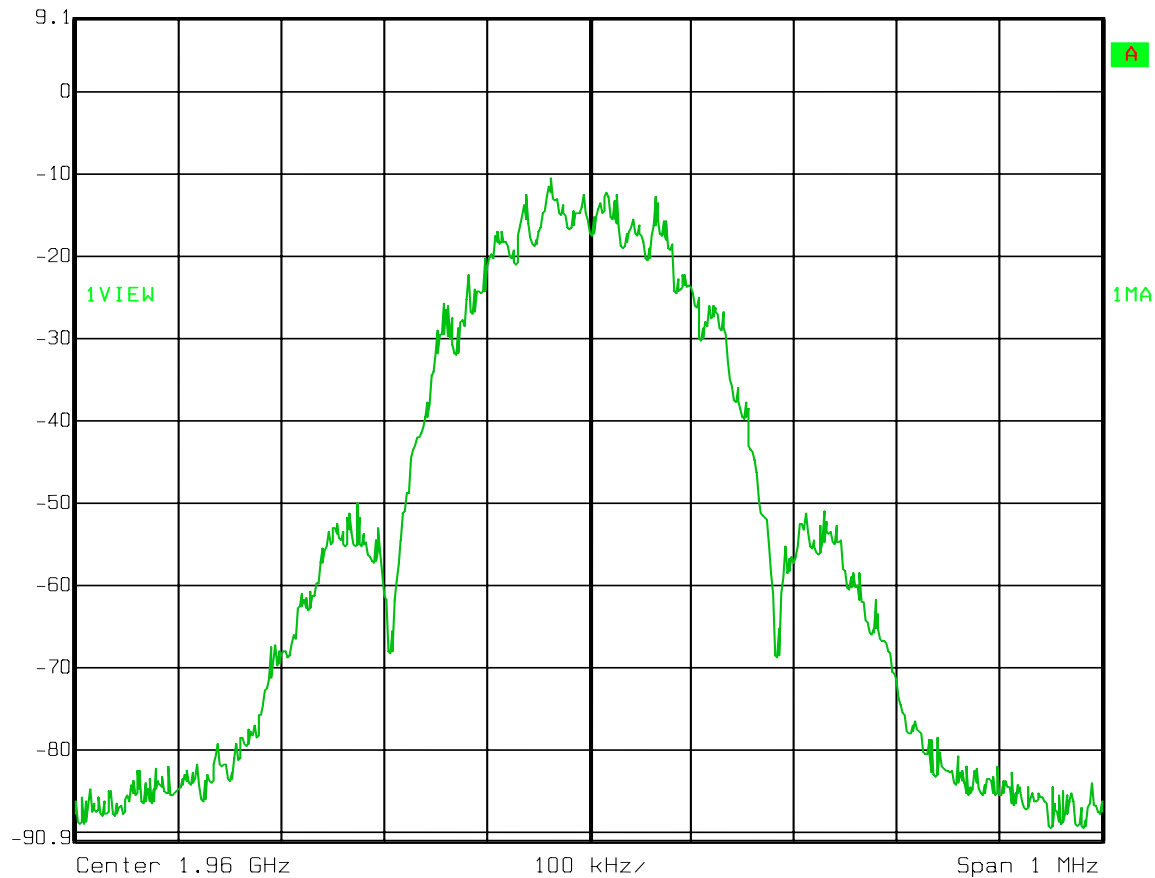
Date: 07.JAN.2008 14:15:21

EQUIPMENT: **TFAH-US5B****Test Data – Occupied Bandwidth**

EDGE - Input

Ref Lvl
9.1 dBm

RBW	3 kHz	RF Att	20 dB
VBW	3 kHz	Mixer	-10 dBm
SWT	280 ms	Unit	dBm



Date: 07.JAN.2008 14:16:20

EQUIPMENT: **TFAH-US5B**

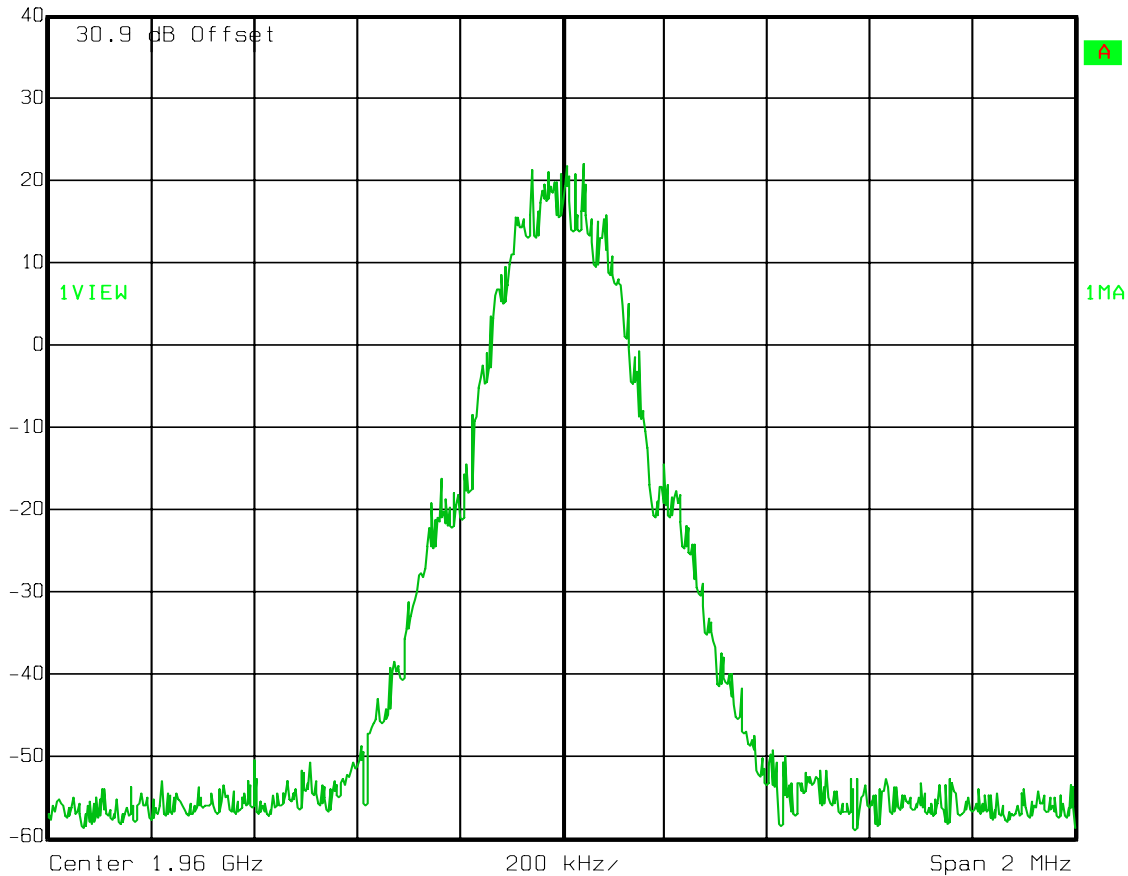
Test Data – Occupied Bandwidth

GSM - Output



Ref Lvl
40 dBm

RBW	3 kHz	RF Att	20 dB
VBW	3 kHz	Mixer	-10 dBm
SWT	560 ms	Unit	dBm



Date: 07.JAN.2008 14:10:01

EQUIPMENT: **TFAH-US5B**

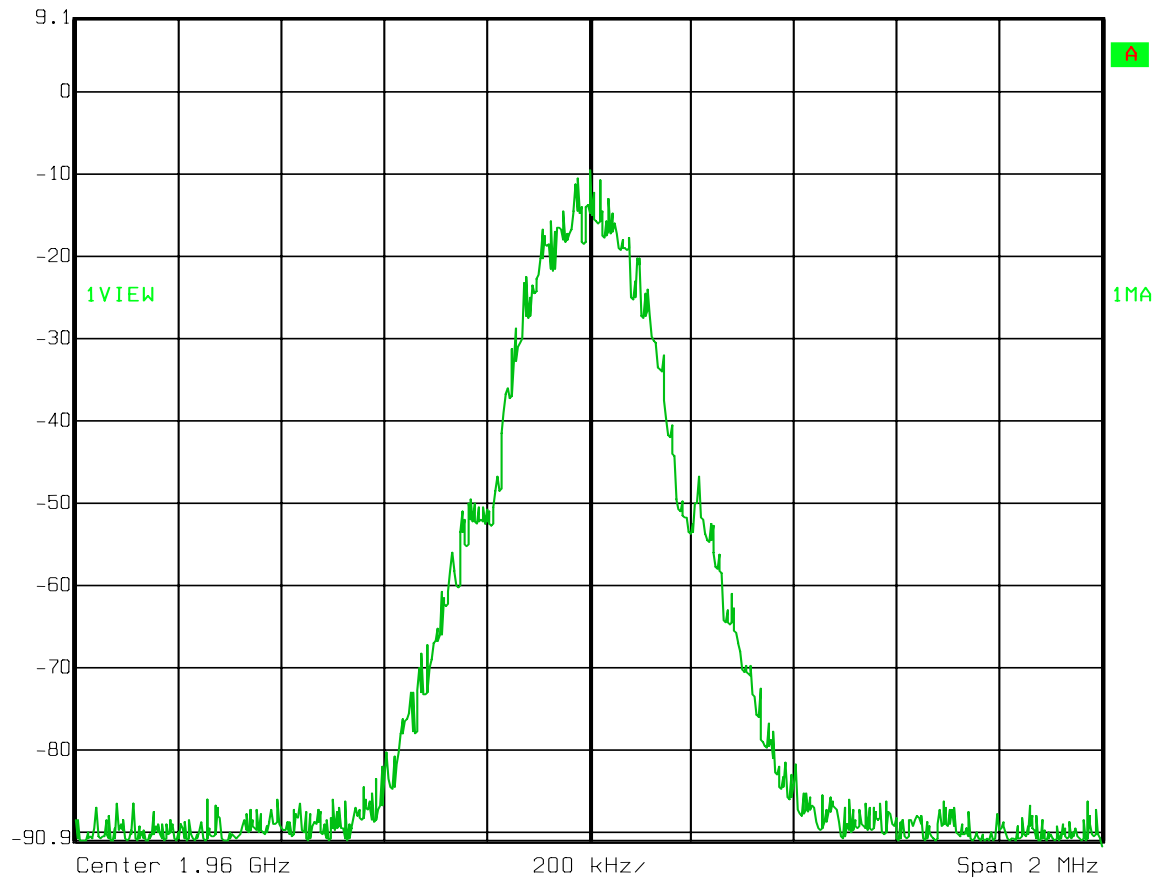
Test Data – Occupied Bandwidth

GSM - Input



Ref Lvl
9.1 dBm

RBW	3 kHz	RF Att	20 dB
VBW	3 kHz	Mixer	-10 dBm
SWT	560 ms	Unit	dBm



Date: 07.JAN.2008 14:11:37

EQUIPMENT: **TFAH-US5B**

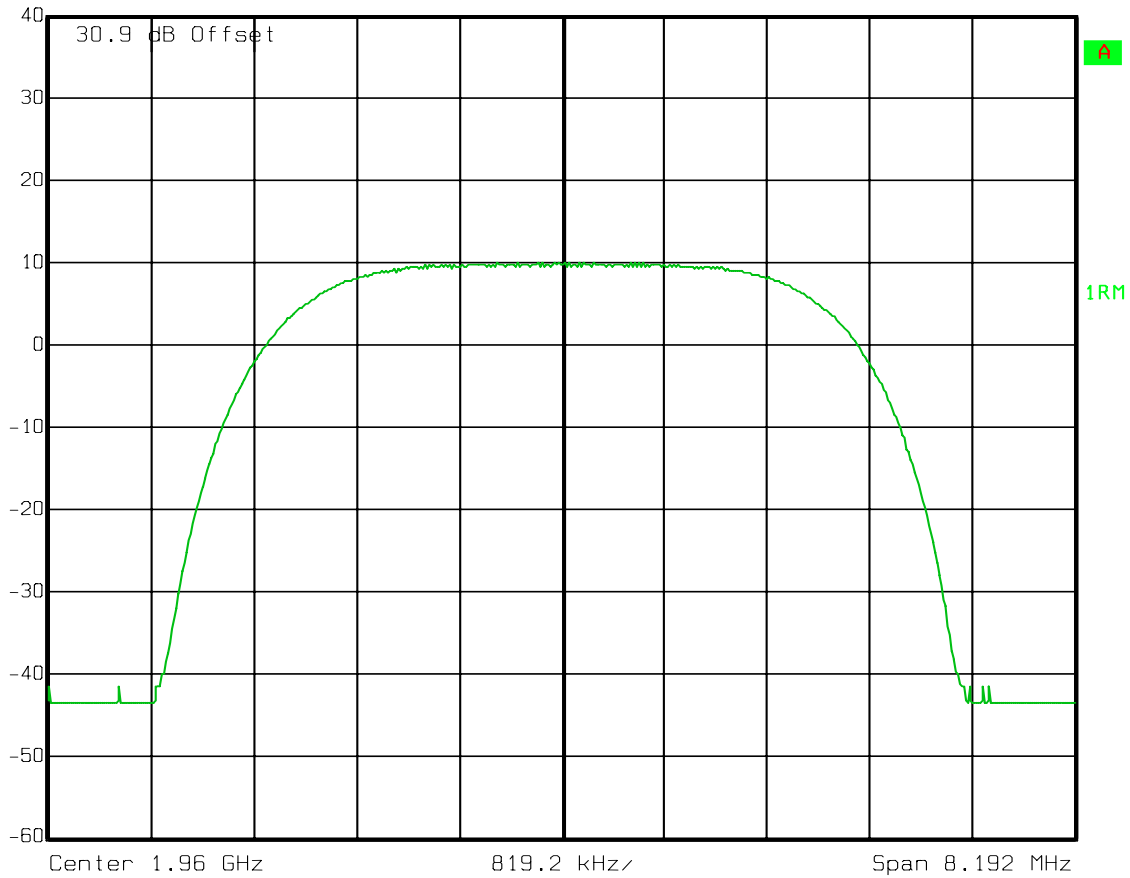
Test Data – Occupied Bandwidth

W-CDMA - Output



Ref Lvl
40 dBm

RBW	50 kHz	RF Att	20 dB
VBW	500 kHz	Mixer	-10 dBm
SWT	2 s	Unit	dBm



Date: 08.JAN.2008 13:21:56

EQUIPMENT: TFAH-US5B

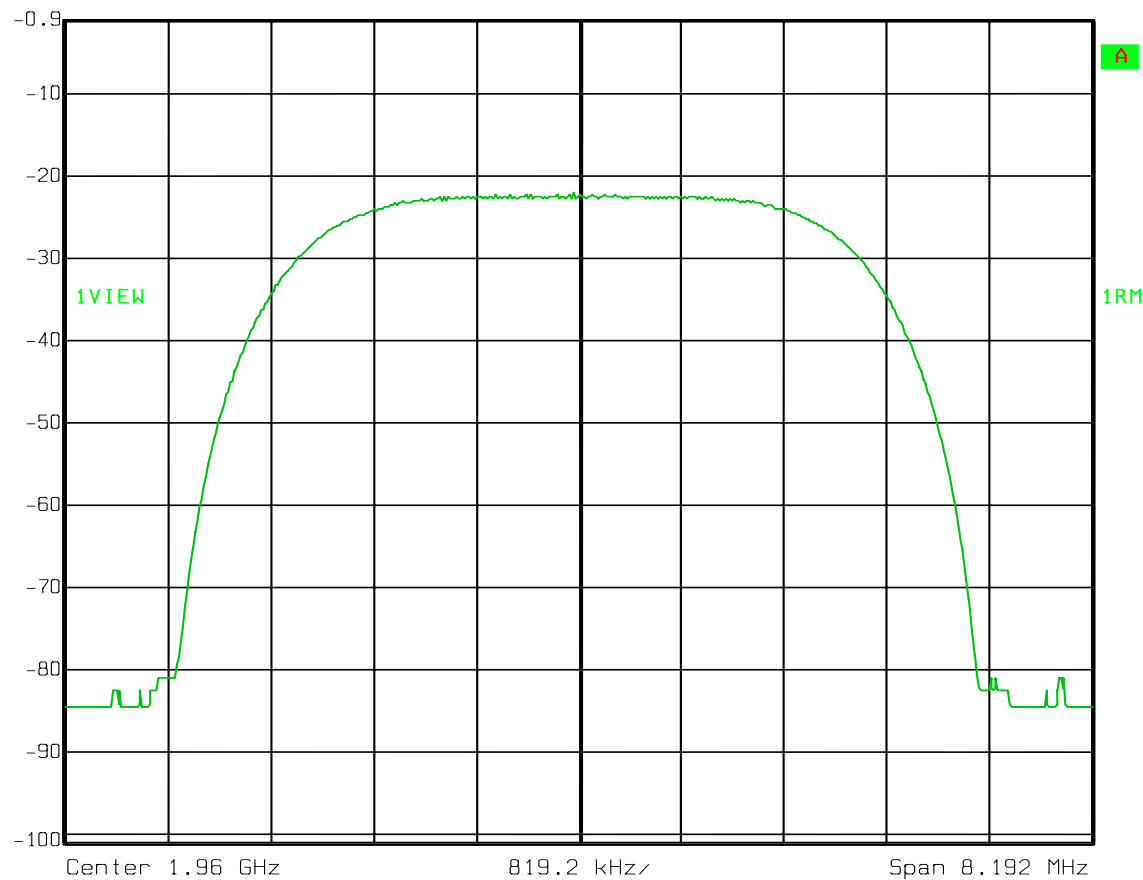
Test Data – Occupied Bandwidth

W-CDMA - Input



Ref Lvl
-0.9 dBm

RBW	50 kHz	RF Att	10 dB
VBW	500 kHz	Mixer	-10 dBm
SWT	2 s	Unit	dBm



Date: 08.JAN.2008 13:23:21

EQUIPMENT: **TFAH-US5B**

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Port	PARA. NO.: 24.238
TESTED BY: David Light	DATE: 08 January 2008

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036-1082-1471-1472

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 35 %

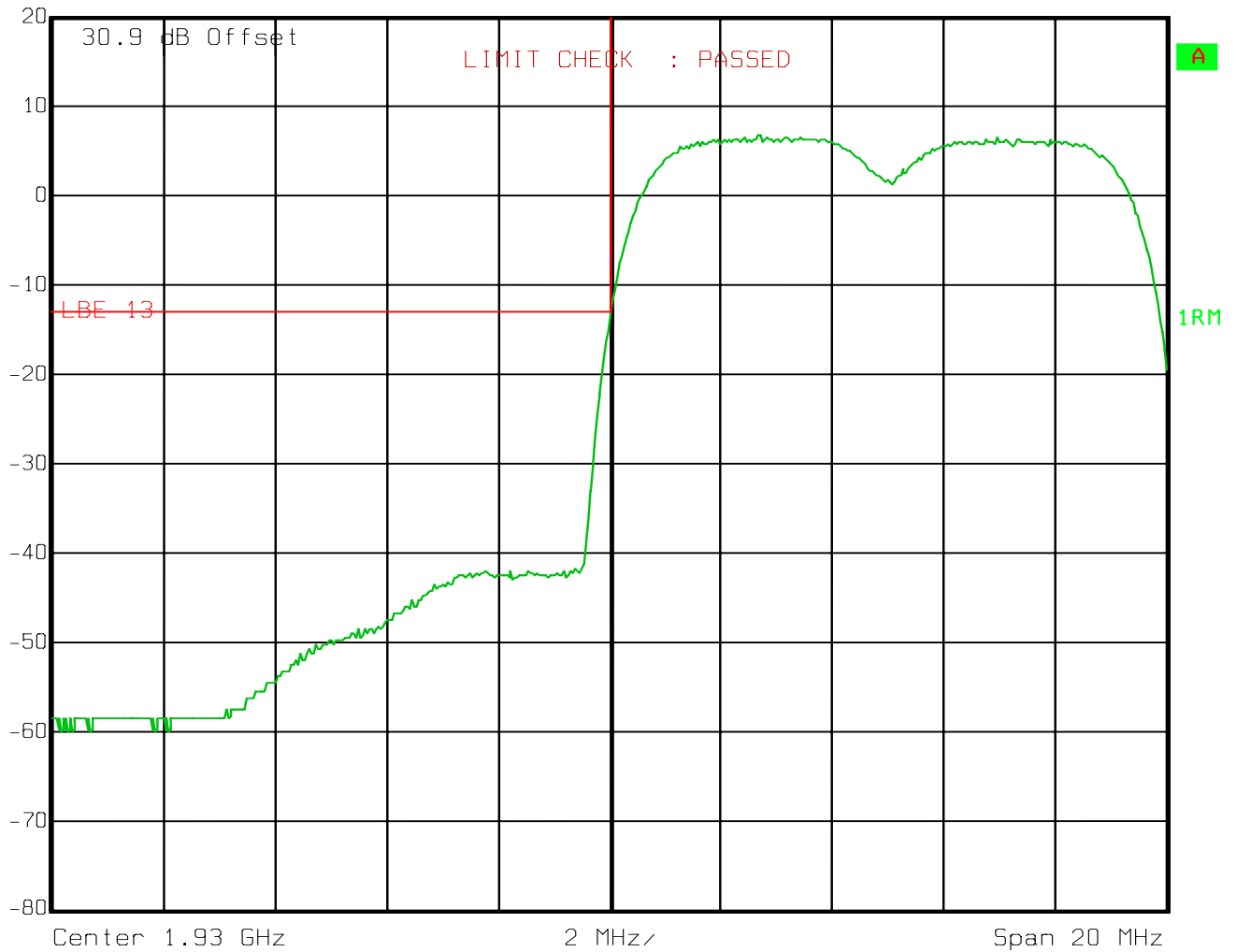
EQUIPMENT: **TFAH-US5B****Test Data – Spurious Emissions at Antenna Terminals**

Lower Bandedge Intermodulation

CDMA

Ref Lvl
20 dBm

RBW	50 kHz	RF Att	10 dB
VBW	500 kHz	Mixer	-10 dBm
SWT	2 s	Unit	dBm



Date: 08.JAN.2008 13:28:53

EQUIPMENT: **TFAH-US5B**

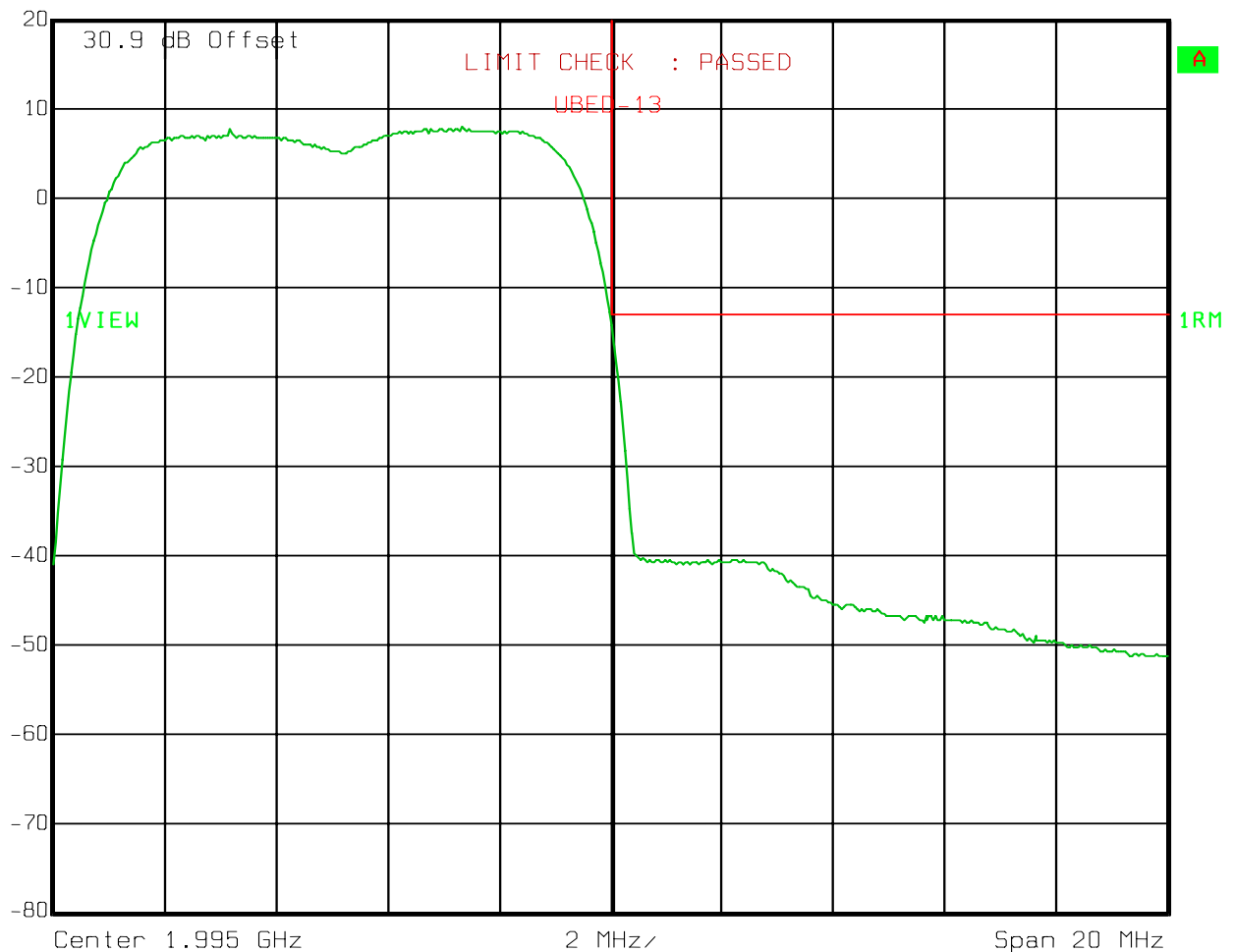
Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation
CDMA



Ref Lvl
20 dBm

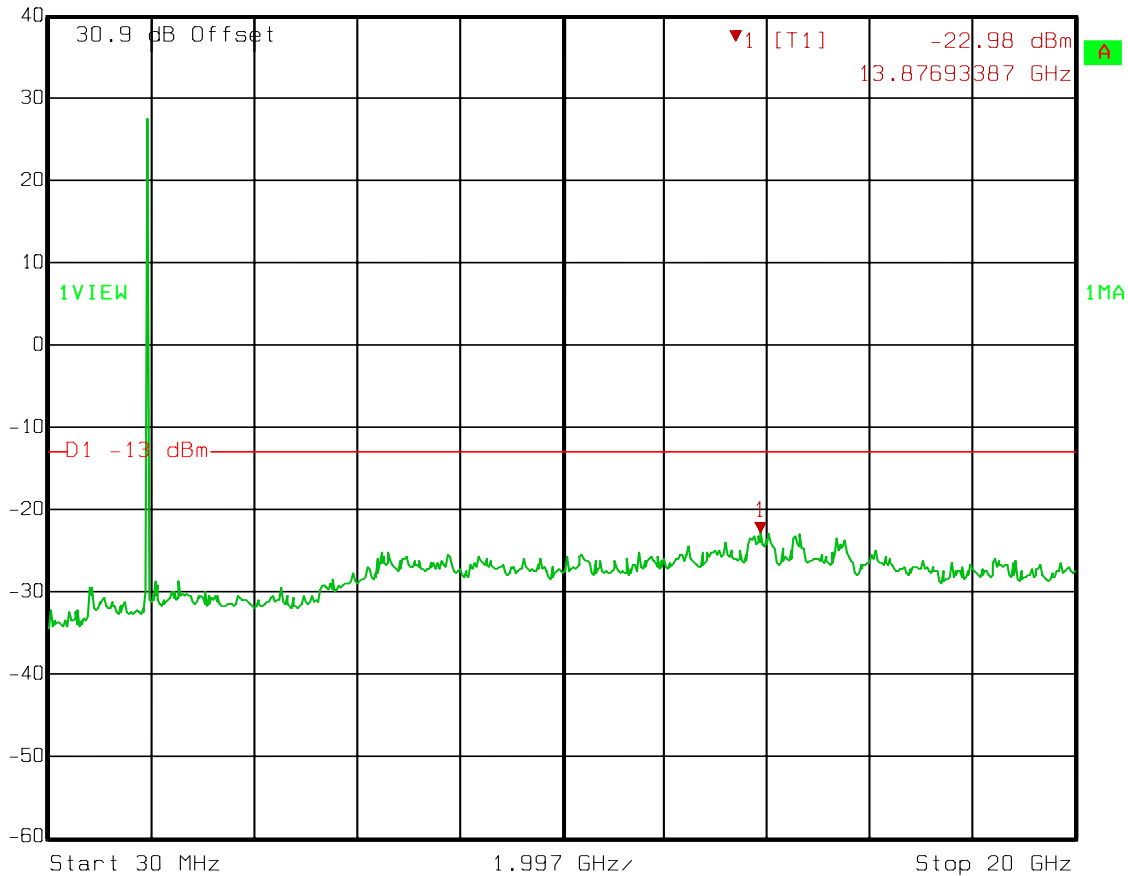
RBW	50 kHz	RF Att	10 dB
VBW	500 kHz	Mixer	-10 dBm
SWT	2 s	Unit	dBm



Date: 08.JAN.2008 13:31:34

EQUIPMENT: **TFAH-US5B****Test Data – Spurious Emissions at Antenna Terminals****Spurs – CDMA - Downlink**

Ref Lvl 40 dBm
Marker 1 [T1] -22.98 dBm
13.87693387 GHz
RBW 1 MHz
VBW 1 MHz
SWT 200 ms
RF Att 20 dB
Mixer -10 dBm
Unit dBm



Date: 08.JAN.2008 13:24:51

EQUIPMENT: **TFAH-US5B****Test Data – Spurious Emissions at Antenna Terminals**

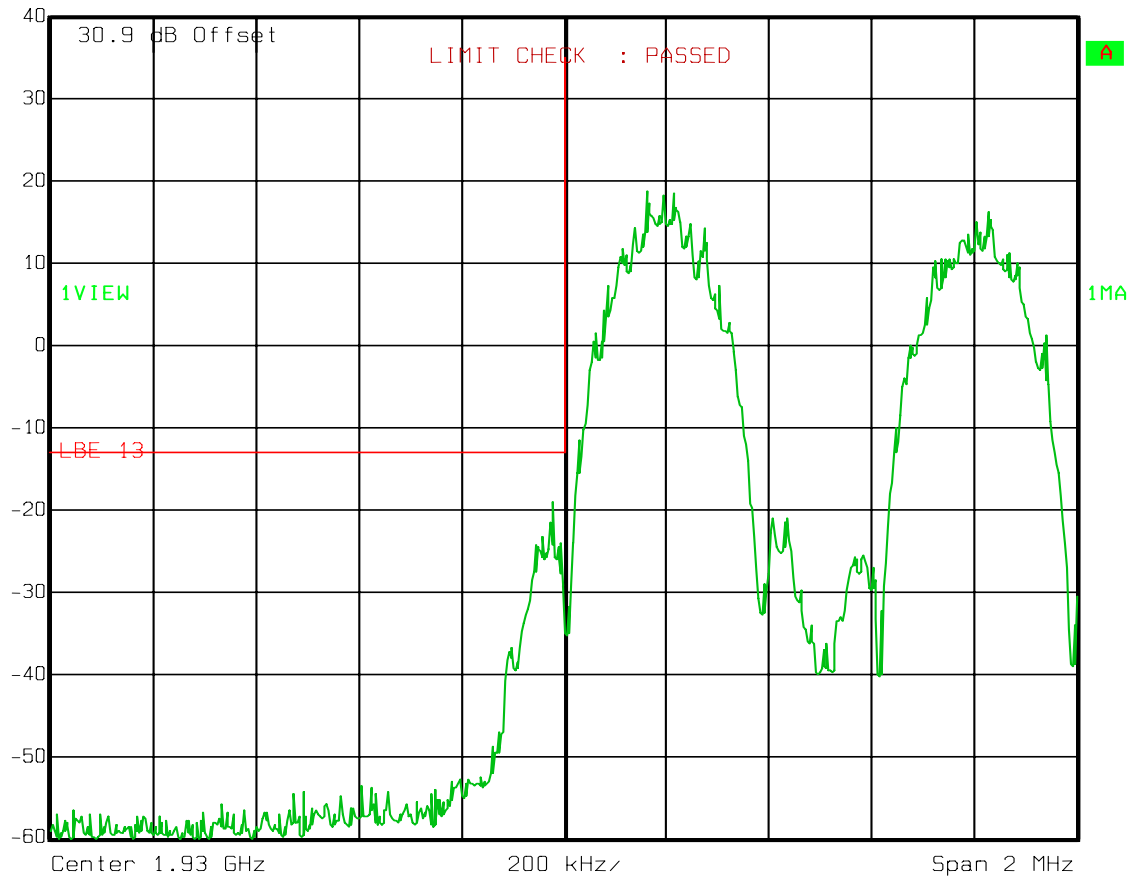
Lower Bandedge Intermodulation

EDGE

Downlink

Ref Lvl
40 dBm

RBW	3 kHz	RF Att	20 dB
VBW	3 kHz	Mixer	-10 dBm
SWT	560 ms	Unit	dBm



Date: 07.JAN.2008 14:20:20

EQUIPMENT: **TFAH-US5B**

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

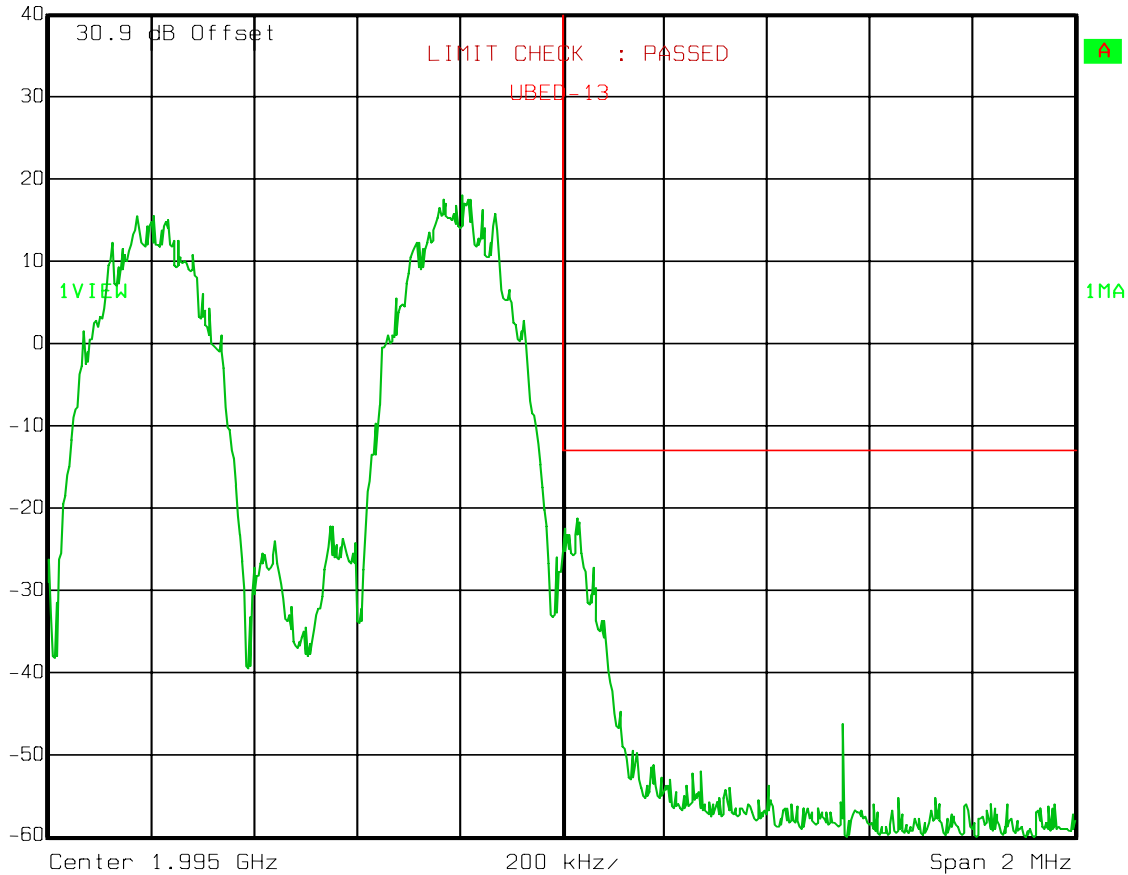
EDGE

Downlink

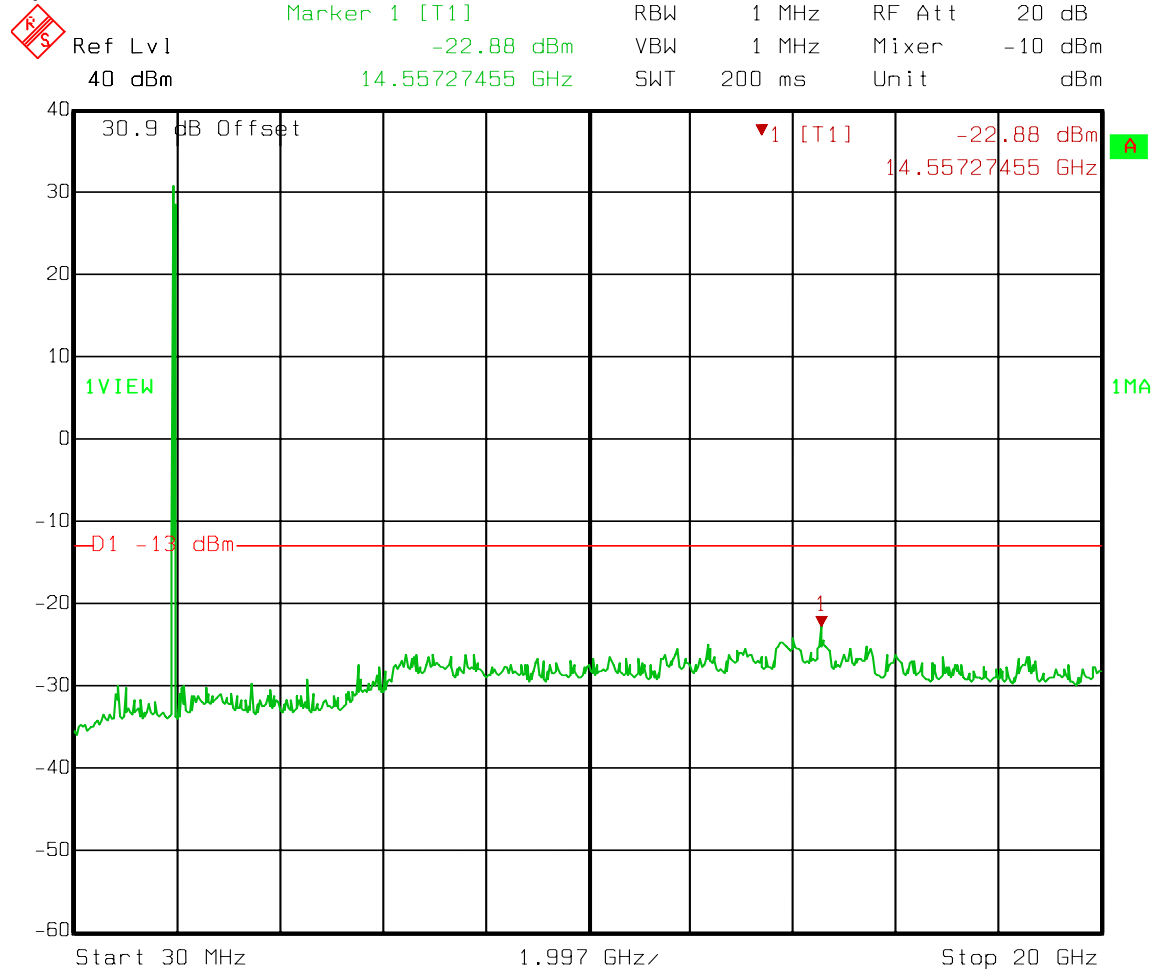


Ref Lvl
40 dBm

RBW	3 kHz	RF Att	20 dB
VBW	3 kHz	Mixer	-10 dBm
SWT	560 ms	Unit	dBm



Date: 07.JAN.2008 14:21:40

EQUIPMENT: **TFAH-US5B****Test Data – Spurious Emissions at Antenna Terminals****Spurs – EDGE - Downlink**

Date: 07.JAN.2008 14:14:13

EQUIPMENT: **TFAH-US5B**

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

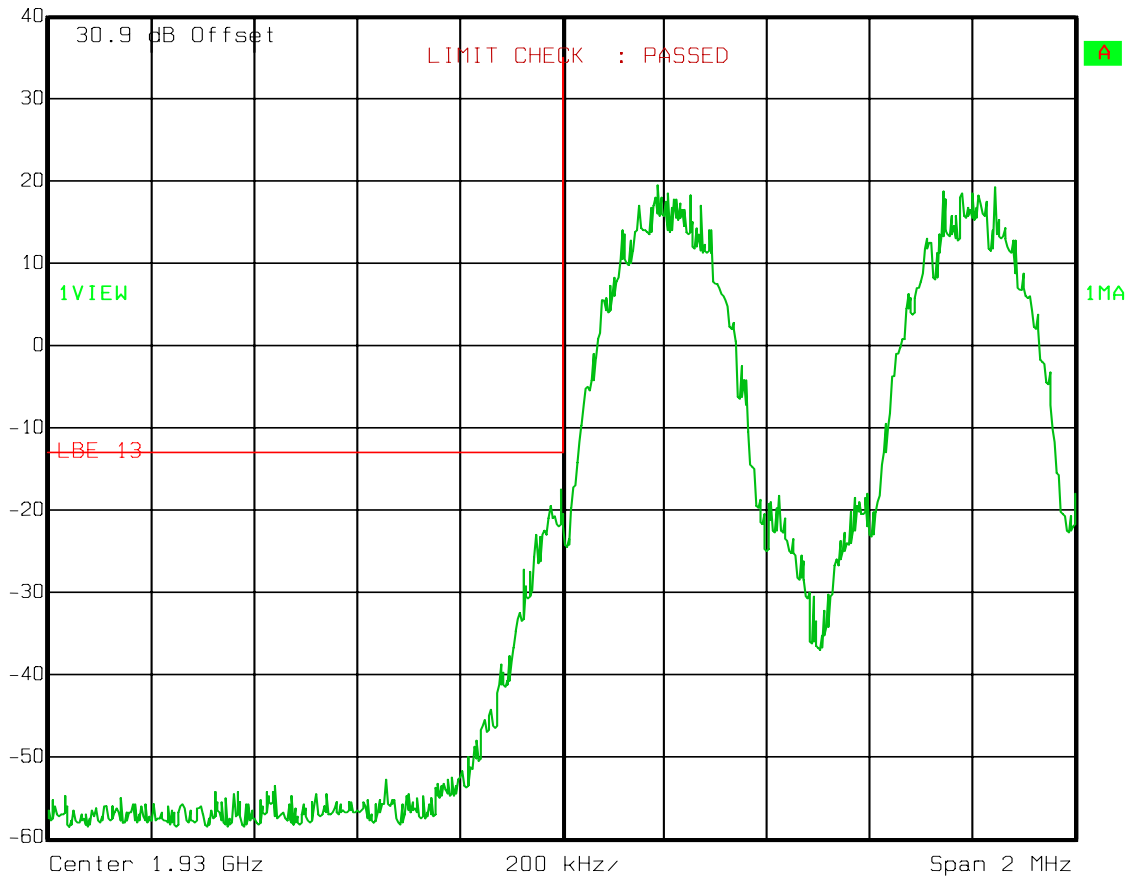
GSM

Downlink



Ref Lvl
40 dBm

RBW	3 kHz	RF Att	20 dB
VBW	3 kHz	Mixer	-10 dBm
SWT	560 ms	Unit	dBm



Date: 07.JAN.2008 14:06:33

EQUIPMENT: **TFAH-US5B****Test Data – Spurious Emissions at Antenna Terminals**

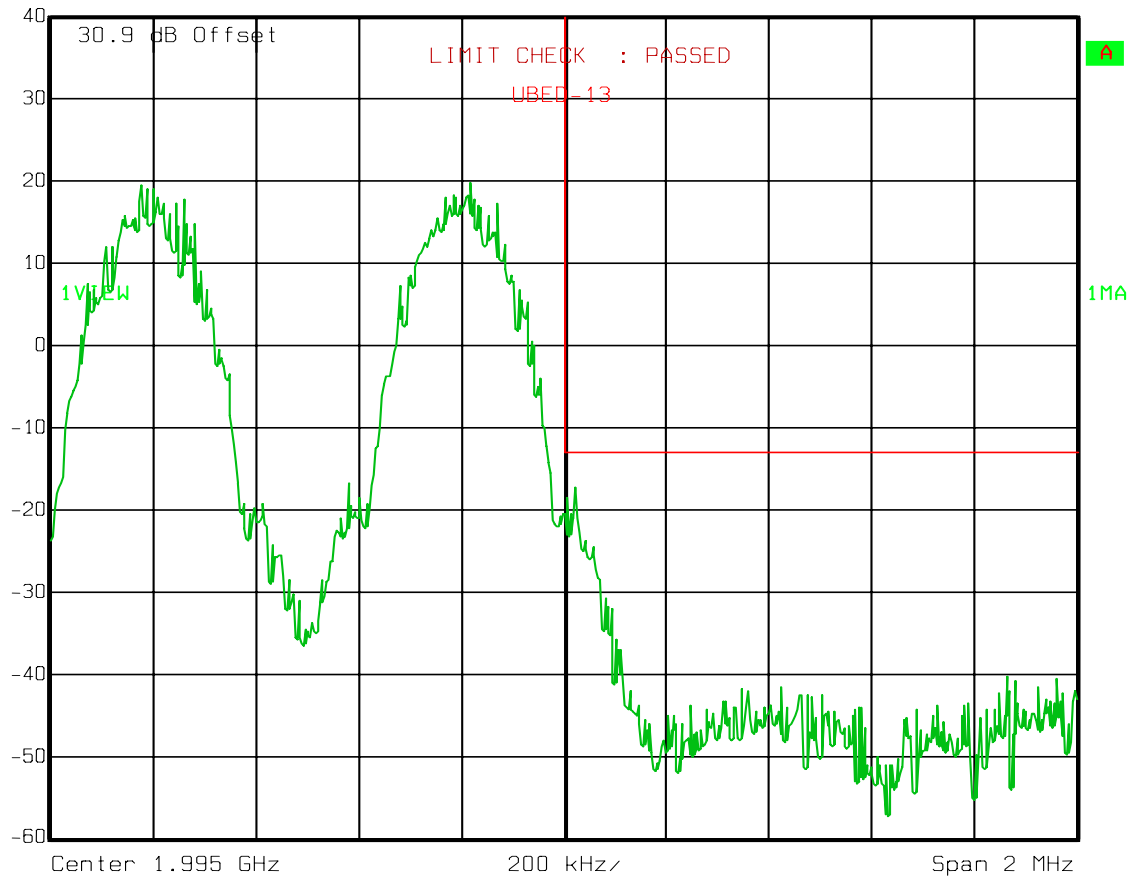
Upper Bandedge Intermodulation

GSM

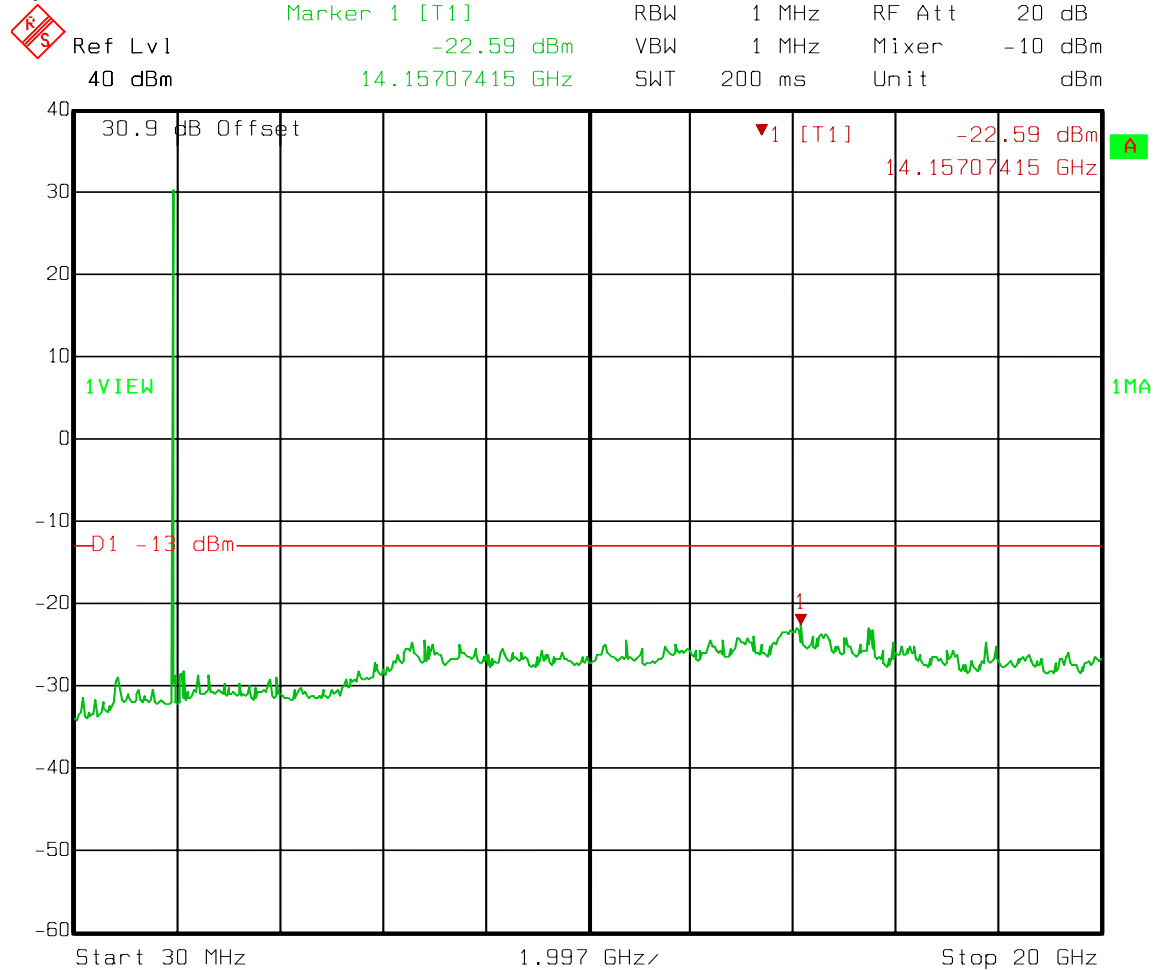
Downlink

Ref Lvl
40 dBm

RBW	3 kHz	RF Att	20 dB
VBW	3 kHz	Mixer	-10 dBm
SWT	560 ms	Unit	dBm



Date: 07.JAN.2008 14:08:46

EQUIPMENT: **TFAH-US5B****Test Data – Spurious Emissions at Antenna Terminals****Spurs – GSM - Downlink**

Date: 07.JAN.2008 14:12:58

EQUIPMENT: **TFAH-US5B**

Test Data – Spurious Emissions at Antenna Terminals

Lower Bandedge Intermodulation

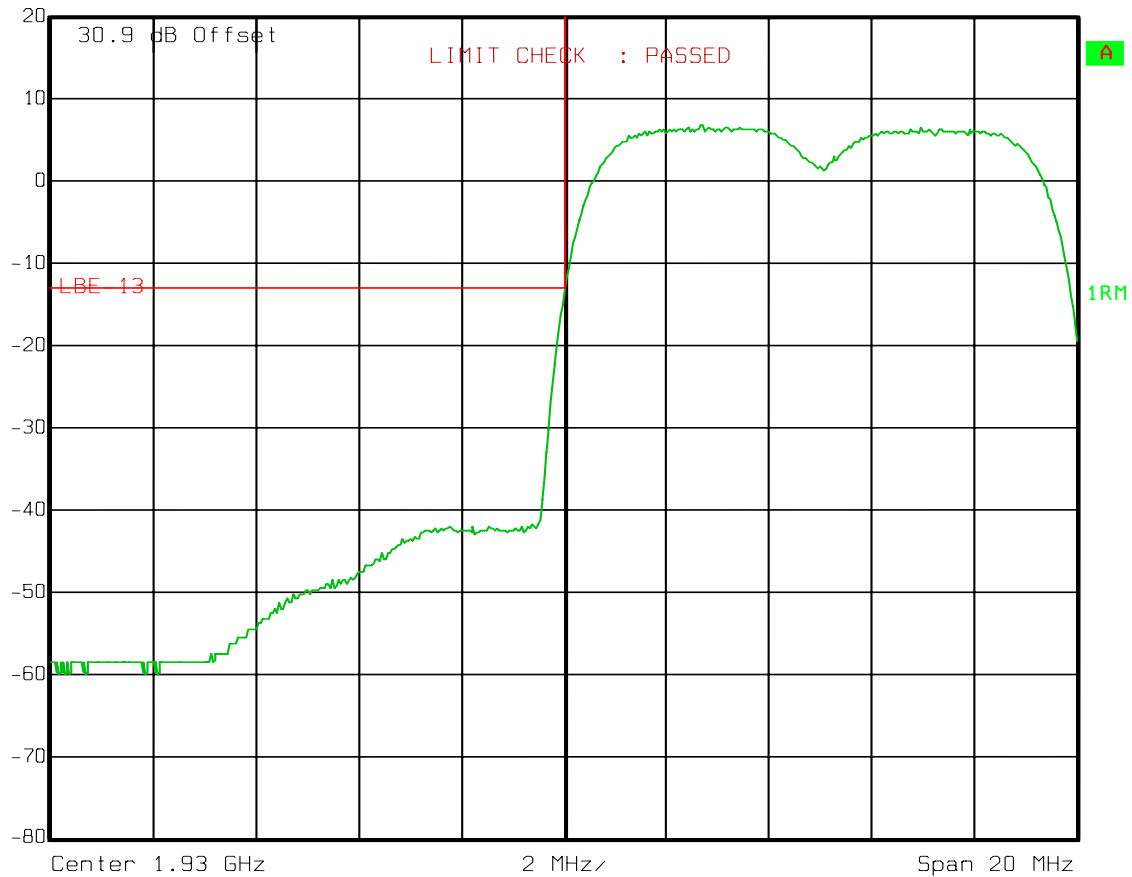
W-CDMA

Downlink



Ref Lvl
20 dBm

RBW	50 kHz	RF Att	10 dB
VBW	500 kHz	Mixer	-10 dBm
SWT	2 s	Unit	dBm



Date: 08.JAN.2008 13:28:53

EQUIPMENT: **TFAH-US5B**

Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

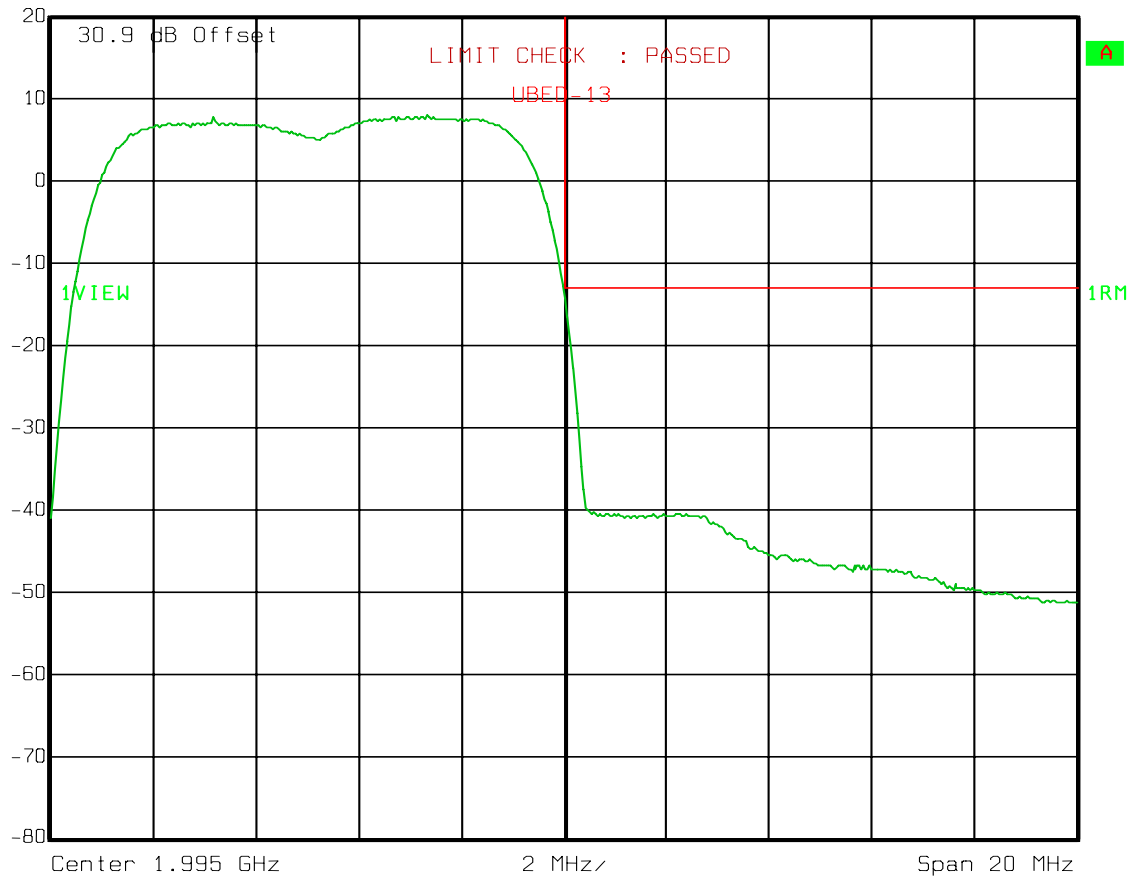
W-CDMA

Downlink



Ref Lvl
20 dBm

RBW	50 kHz	RF Att	10 dB
VBW	500 kHz	Mixer	-10 dBm
SWT	2 s	Unit	dBm

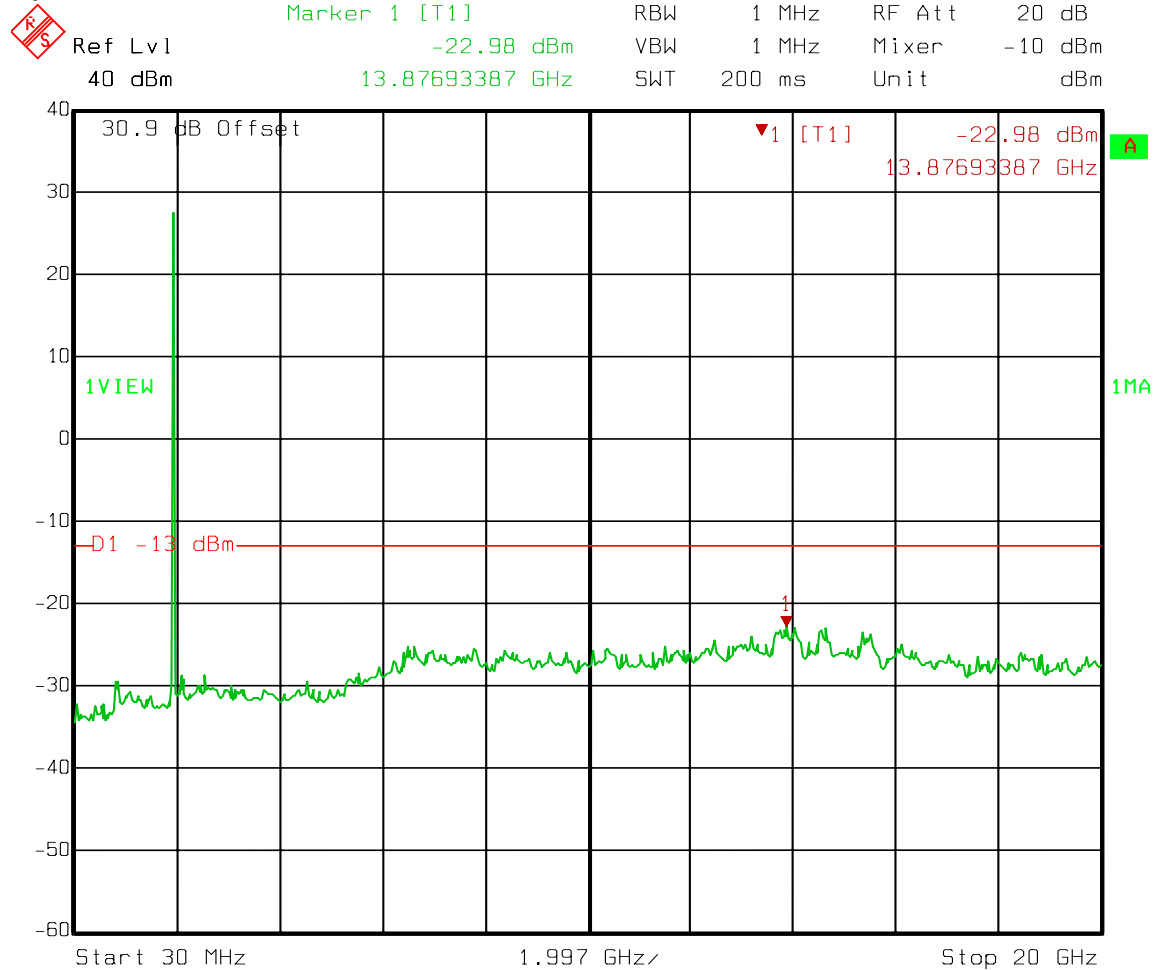


Date: 08.JAN.2008 13:31:34

EQUIPMENT: **TFAH-US5B**

Test Data – Spurious Emissions at Antenna Terminals

Spurs – W-CDMA - Downlink



EQUIPMENT: **TFAH-US5B**

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 24.238
TESTED BY: David Light	DATE: 08 January 2008

Test Results: Complies.

Test Data: There were no emissions detected above the noise floor which was at least 20 dB below the specification limit.

Equipment Used: 1476-1484-1485-791-1016-759-760-993

Measurement Uncertainty: +/-1.7 dB

Temperature: 22 °C

Relative Humidity: 35 %

EQUIPMENT: **TFAH-US5B****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	05/26/06	05/26/08
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1471	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
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/24/07	01/24/09
1484	Cable	Storm PR90-010-072	N/A	05/02/07	05/01/08
1485	Cable	Storm PR90-010-216	N/A	05/02/07	05/01/08
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	05/01/07	04/30/08
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/01/07	04/30/08
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	03/30/07	03/29/08
760	Antenna biconical	Electro Metrics MFC-25	477	01/19/07	01/19/08
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/30/08

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 or spectrum analyzer. Power output is measured with the maximum rated input level. If a spectrum analyzer is used for this measurement, the RBW is set to a value greater than the 20 dB bandwidth of the measured waveform. If the 20 dB bandwidth of the rf waveform is greater than the highest RBW setting on the spectrum analyzer, then the channel power measurement function on the spectrum analyzer is used. This function integrates the measured rf power values over the width of the channel and presents the total power in the channel.

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 an isotropic radiator. 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 eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic radiator.

EQUIPMENT: **TFAH-US5B**

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 2.1049

Minimum Standard: 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= 50 kHz

Span: 10 MHz

Sweep: Auto

EQUIPMENT: **TFAH-US5B****NAME OF TEST: Spurious Emission at Antenna Terminals PARA. NO.: 24.238****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: \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: 50 kHz (< 1MHz from Band Edge)
VBW: \geq RBW
Sweep: Auto
Video Avg: 6 Sweeps

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.: 24.238
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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 TIA/EIA-603

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 an isotropic radiator. 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 eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic radiator.

EQUIPMENT: TFAH-US5B**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

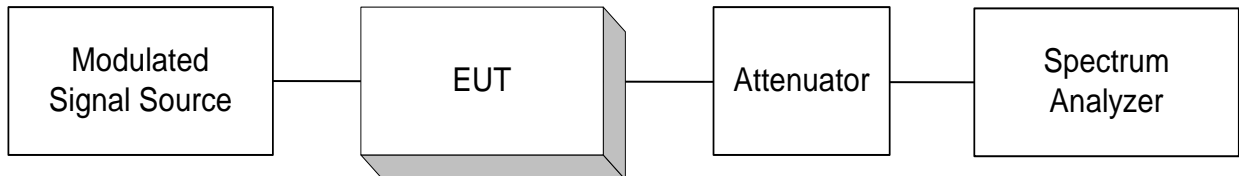
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the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

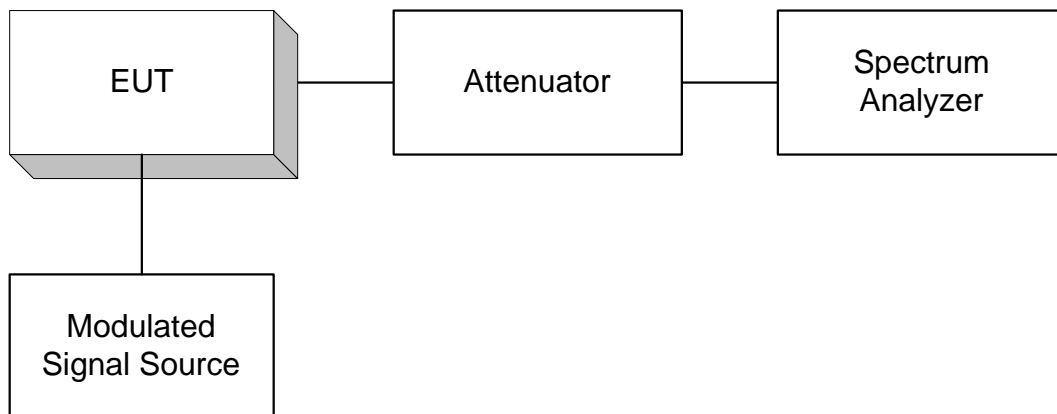
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

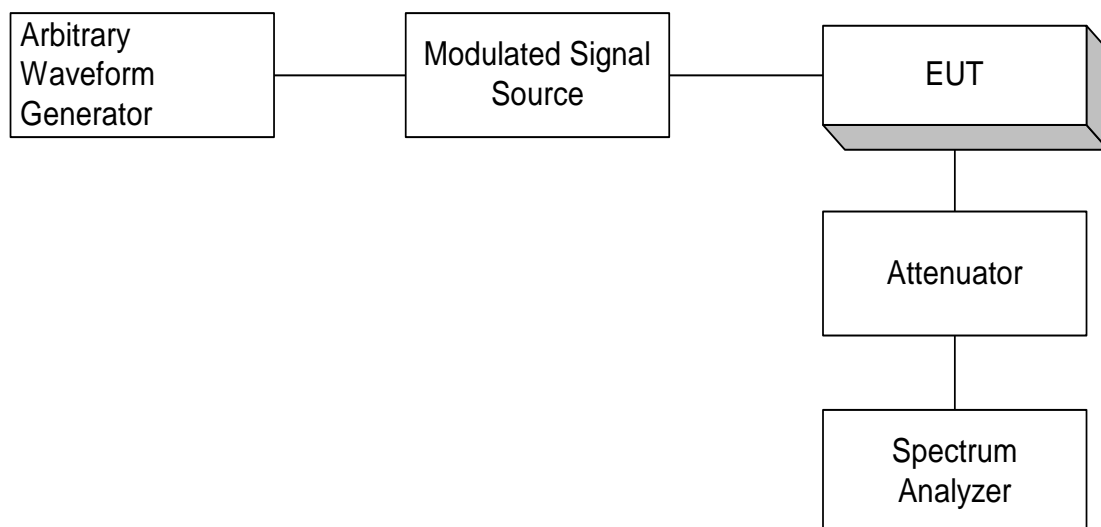
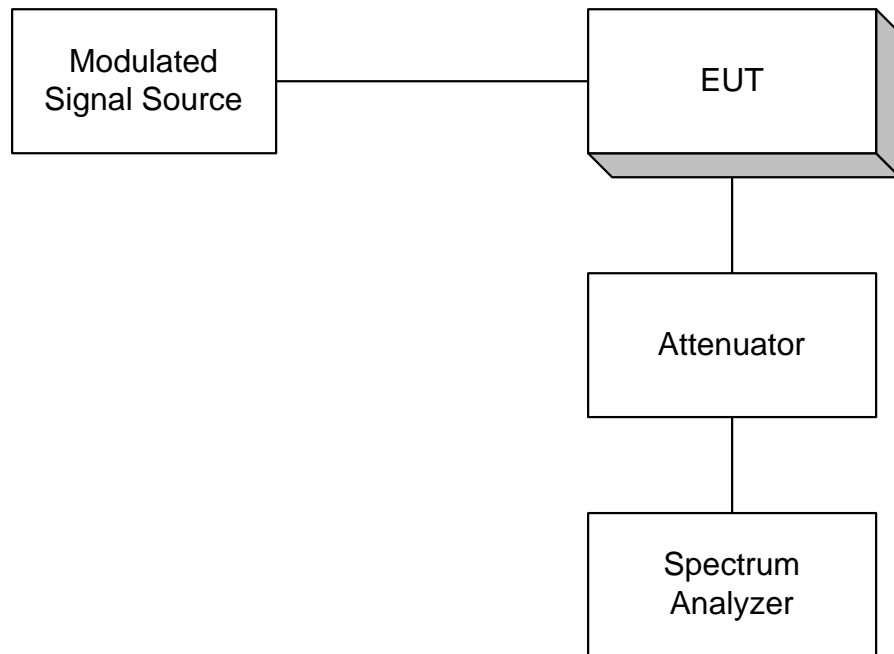
Para. No. 2.985 - R.F. Power Output



Para. No. 2.989 - Occupied Bandwidth

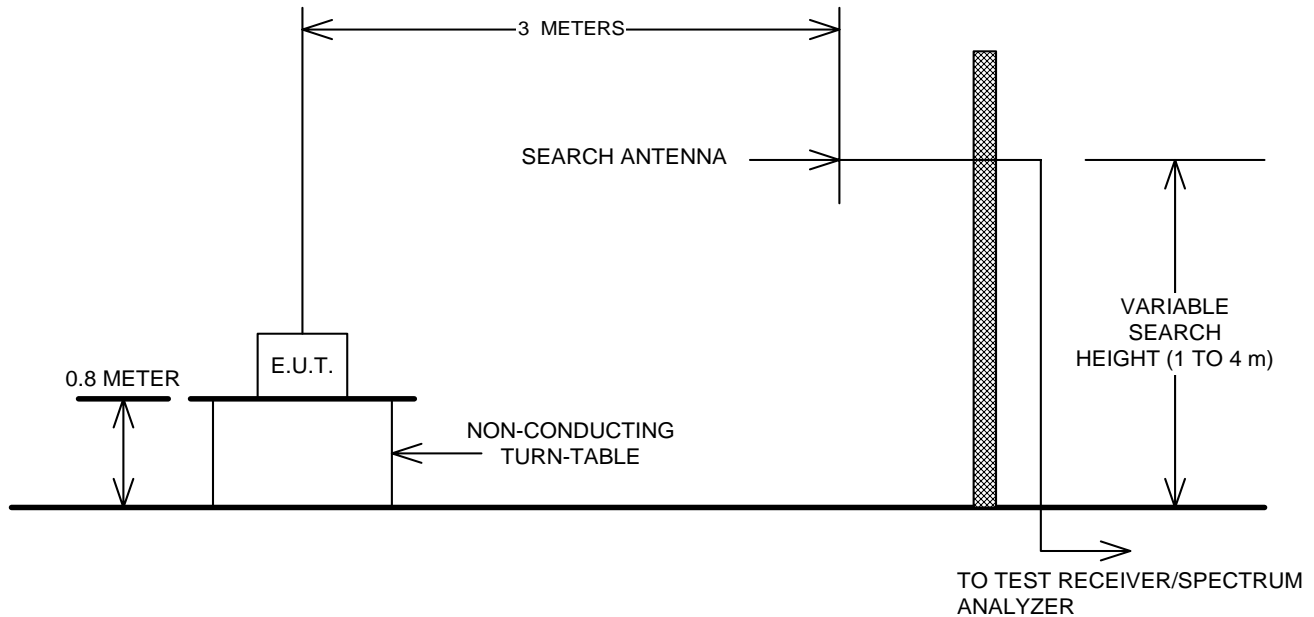


Para. No. 2.991 Spurious Emissions at Antenna Terminals



EQUIPMENT: **TFAH-US5B**

Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

