Nemko Test Report:	131640-2
Applicant:	TEKO Telecom S.p.A. Via Meucci, 24/a I-40024 Castel S. Pietro Terme (BO)
Equipment Under Test: **(E.U.T.)**	TRU8A19AWWL/AC-WS (+ Master Unit composed by: SUB-TRX+TPSU/AC+TPSU/48+TSPV-R+TTRC4W-S)
In Accordance With:	**CFR 47, Part 24, Subpart E** Broadband PCS Repeaters
Tested By:	Nemko Italy S.p.A.. Via Carroccio, 4 I-20046 Biassono (Italy)

G. Curioni

TESTED BY: _____ **DATE:** **18-25 September, 2009**

P. Barbieri

APPROVED BY: _____ **DATE:** **28 September, 2009**

Number of Pages: 79

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Section 1. Summary of Test Results

Manufacturer: TEKO Telecom
Model No.: TRU8A19AWWL/AC-WS
Serial No.: 090569002

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".

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 erp	Complies
Frequency Stability	24.235		NA

Footnotes For N/A's:
Frequency Stability testing was not performed since the E.U.T. does not contain modulation circuitry.

Section 2. General Equipment Specification

Supply Voltage Input:		120 Vac				
Frequency Range:	**Downlink:**	1930 to 1995 MHz				
Frequency Range:	**Uplink:**	1850 to 1915 MHz				
Type of Modulation and Designator:		**CDMA (G7W)** ☒	**GSM (GXW)** ☒	**EDGE (G7W)** ☒	**W-CDMA (G7W)** ☒	
Output Impedance:		50 ohms				
RF Output (Rated):	**Downlink:**	0.8 W 29 dBm				
	Uplink:	0.0025 W typical 4 dBm typical				
Gain:	**Downlink:**	34 dB				
	Uplink :	47 dB				
Frequency Translation:		**F1-F1** ☐	**F1-F2** ☐	**N/A** ☒		
Band Selection:		**Software** ☐	**Duplexer Change** ☐	**Fullband Coverage** ☒		

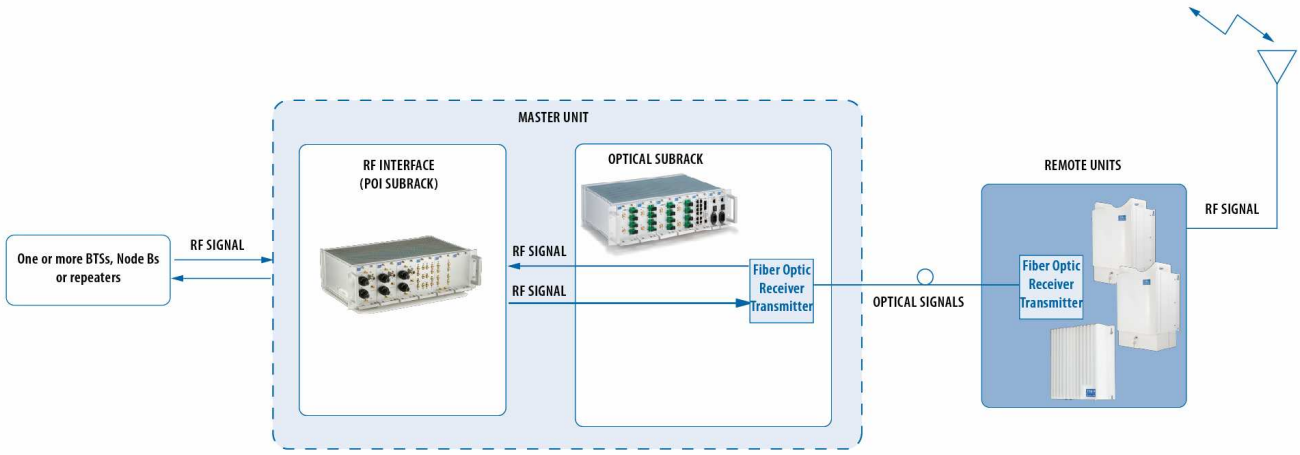
Description of EUT

The EUT is a low power multi-operator optical Remote Unit. It is used in conjunction with a Master Unit in the optical distribution system.
The EUT is a tri-band system; it is able to transport a wide frequency range simultaneously (AMPS, PCS and AWS bands). Single amplifier modules can be combined each other to obtain the following equipment:

Commercial name	*Description*	
REMOTE UNIT LOW POWER		
TRUxxxxxcL/zz-kkkj	**TRU**	Teko Telecom Remote Unit
	xxxxx =	**Operating band**: 7S: SMR700 (UL: 698-716+776-787MHz) DL: 728-757MHz) 7P: Public Safety 700 (DL: 763-775MHz; UL: 793-805MHz) 8S: SMR800 (DL: 851-869MHz; UL: 806-824MHz) 8A: AMPS (DL: 869-894MHz; UL: 824-849MHz) 9S: SMR900 (DL: 935-941MHz; UL: 896-902MHz) 19: PCS1900 (DL: 1930-1995MHz; UL: 1850-1915MHz) AW: AWS2100 (DL: 2110-2155MHz; UL: 1710-1755MHz) *and combination of these*
	c =	**RF Connector**: W: wideband D: duplexed B: bi duplexed N: no duplexed S: single connector
	L =	L: low power
	zz =	**Power supply**: AC: Power Supply: 85-264Vac, 50-60Hz 48: Power Supply: 36-72Vdc

	kkk =	**Laser version**: Without option: NO WDM Termocontrolled laser version: W21: λ = 1560,61nm W23: λ = 1558,98nm W25: λ = 1557,36nm W27: λ = 1555,75nm W29: λ = 1554,13nm W31: λ = 1552,52nm W: λ = 1550,92nm W35: λ = 1549,32nm W37: λ = 1547,72nm No termocontrolled laser version: M11: λ = 1470 ± 3 nm M12: λ = 1490 ± 3 nm M13: λ = 1510 ± 3 nm M14: λ = 1530 ± 3 nm W : λ = 1550 ± 3 nm (standard version) M16: λ = 1570 ± 3 nm M17: λ = 1590 ± 3 nm M18: λ = 1610 ± 3 nm
	j =	**Optical connector**: S: SC-APC E: E-2000

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 24.232
TESTED BY: G. Curioni	DATE: 22 September 2009

Test Results: Complies.

Measurement Data:

Direction	Modulation	Output per Channel (dBm)	Output per Channel Power (W)
Uplink	CDMA	4,34	0.0027
Downlink	CDMA	29,15	0.82
Uplink	EDGE	4,19	0.0026
Downlink	EDGE	29,20	0.82
Uplink	GSM	4,38	0.0027
Downlink	GSM	29,13	0.82
Uplink	W-CDMA	4,36	0.0027
Downlink	W-CDMA	29,18	0.82

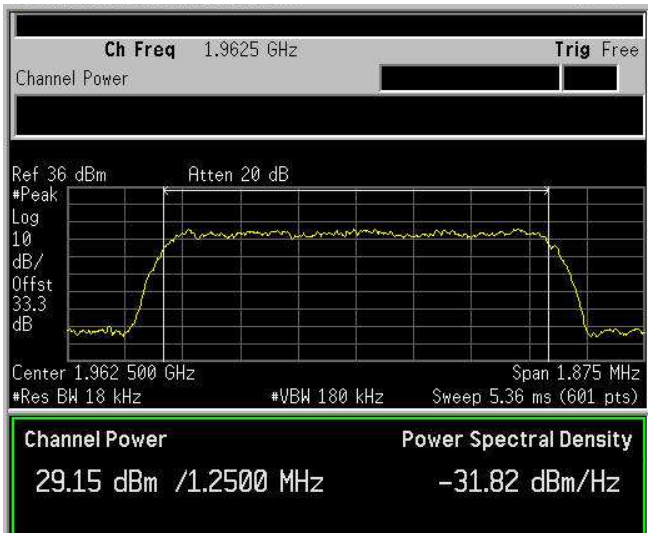
Equipment Used: 1 – 2 – 3b - 4

Measurement Uncertainty: +/- 1.9 dB

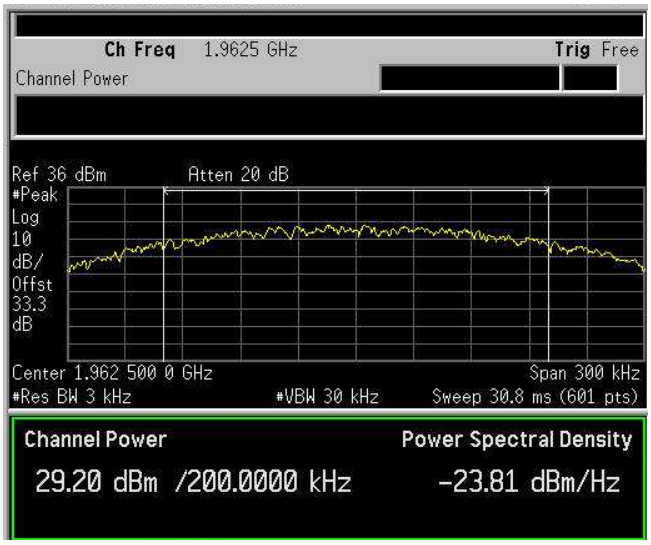
Temperature: 24 °C

Relative Humidity: 50 %

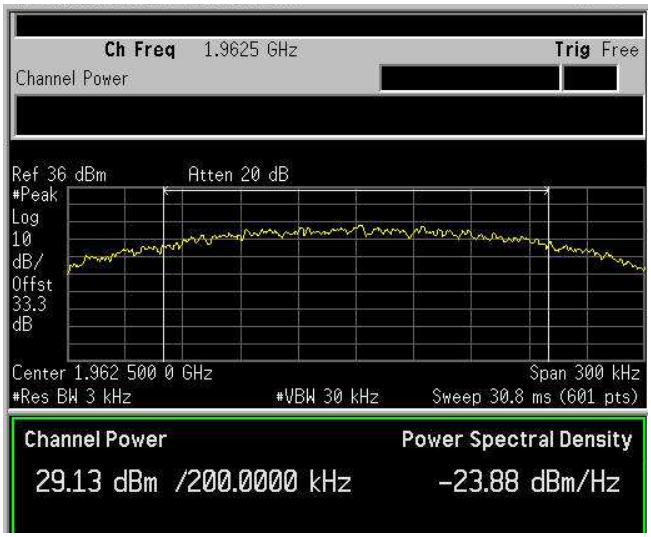
RF Power Output D.L. mod. CDMA



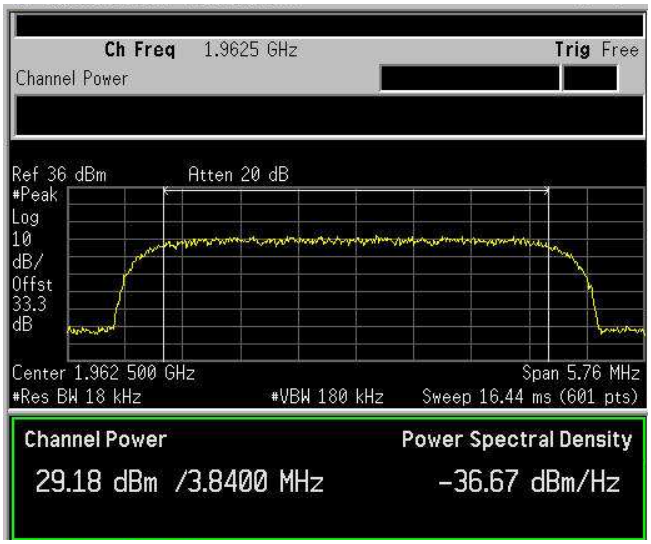
RF Power Output D.L. mod. EDGE



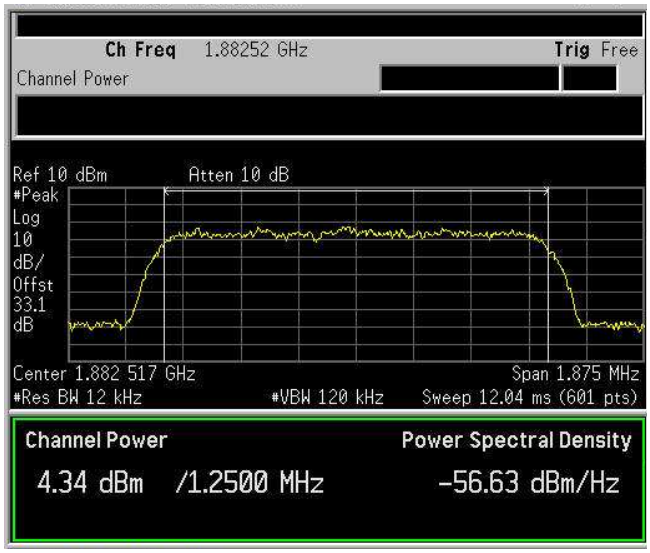
RF Power Output D.L. mod. GSM



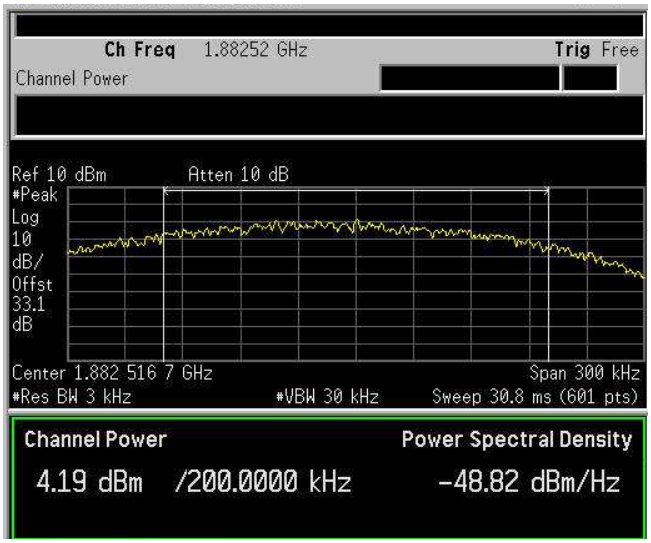
RF Power Output D.L. mod. WCDMA



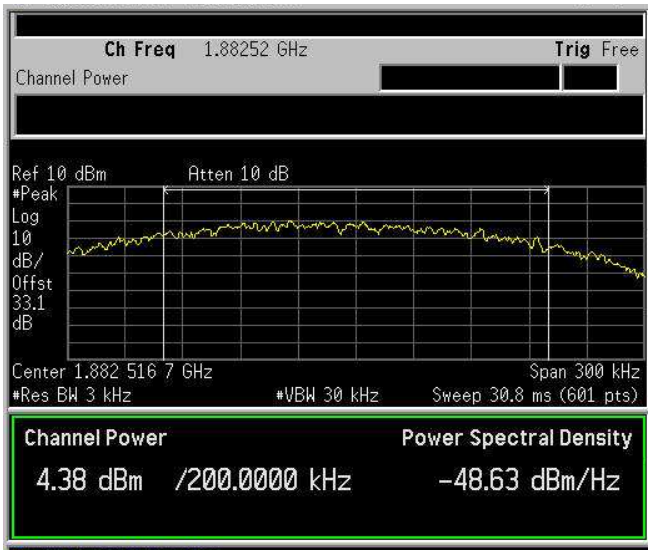
RF Power Output U.L. mod. CDMA



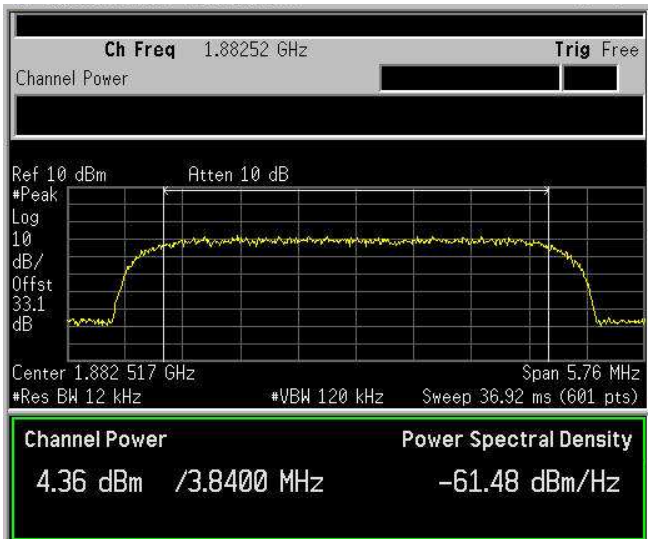
RF Power Output U.L. mod. EDGE



RF Power Output U.L. mod. GSM



RF Power Output U.L. mod. WCDMA



Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 24.238
TESTED BY: G. Curioni	DATE:22 September 2009

Test Results: Complies.

Test Data: See attached plot(s).

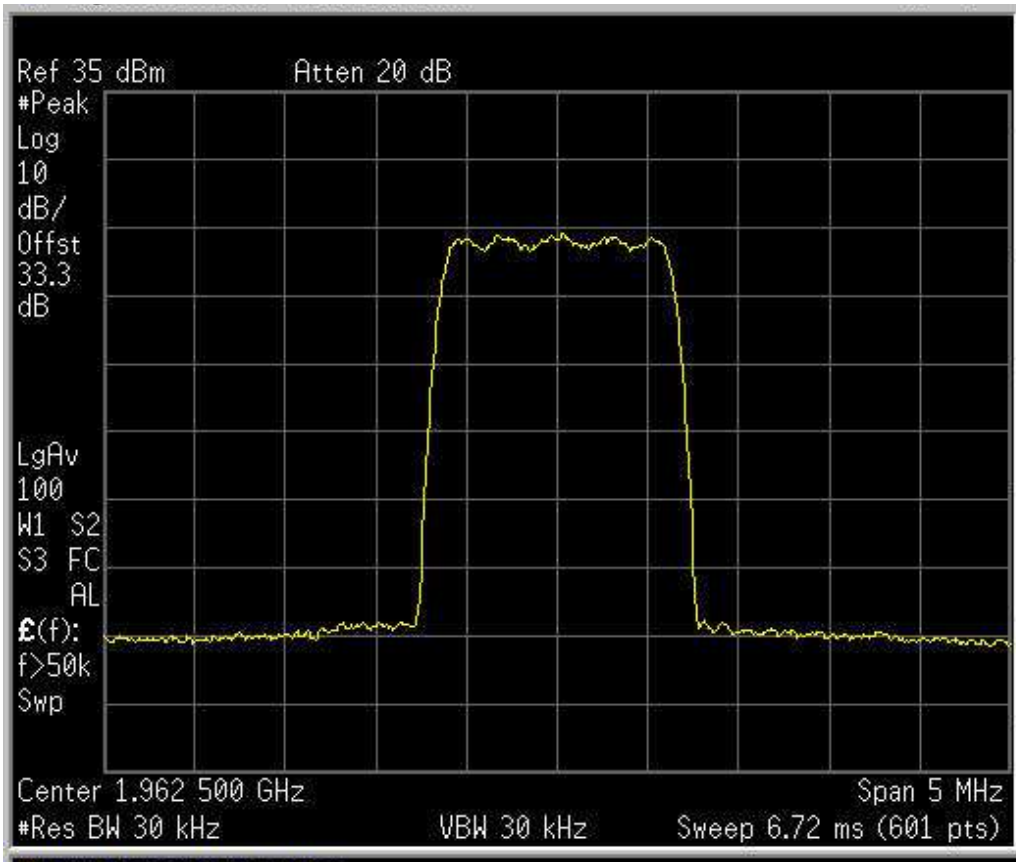
Equipment Used: 1 – 2 – 3b - 4

Measurement Uncertainty: $1X10^{-7}$

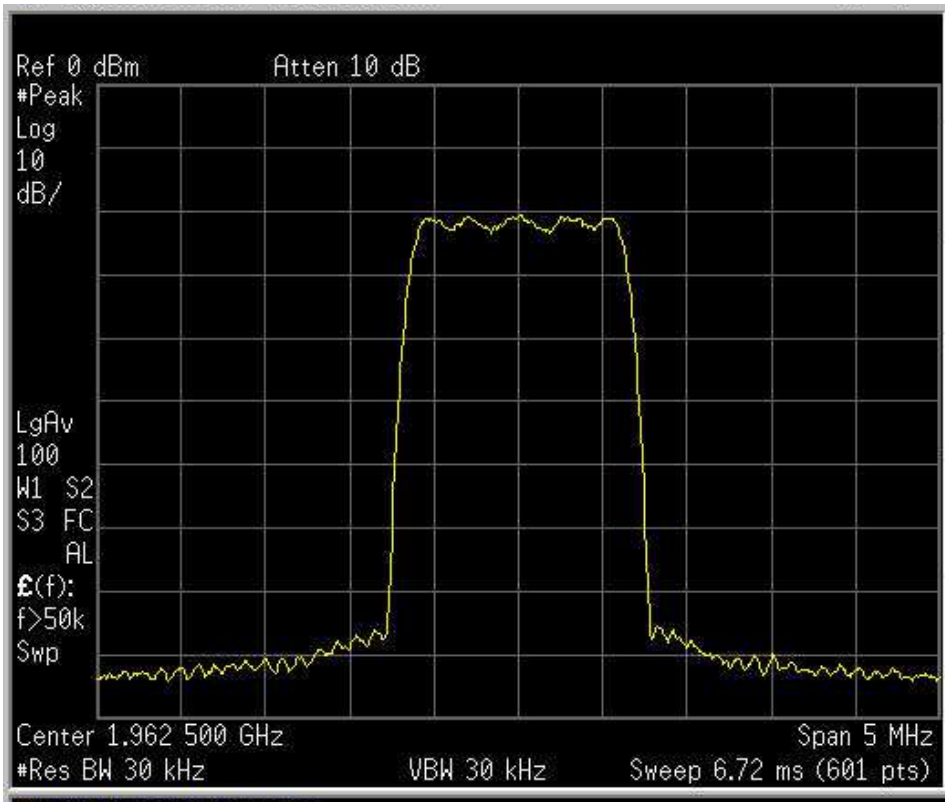
Temperature: 24 °C

Relative Humidity: 50 %

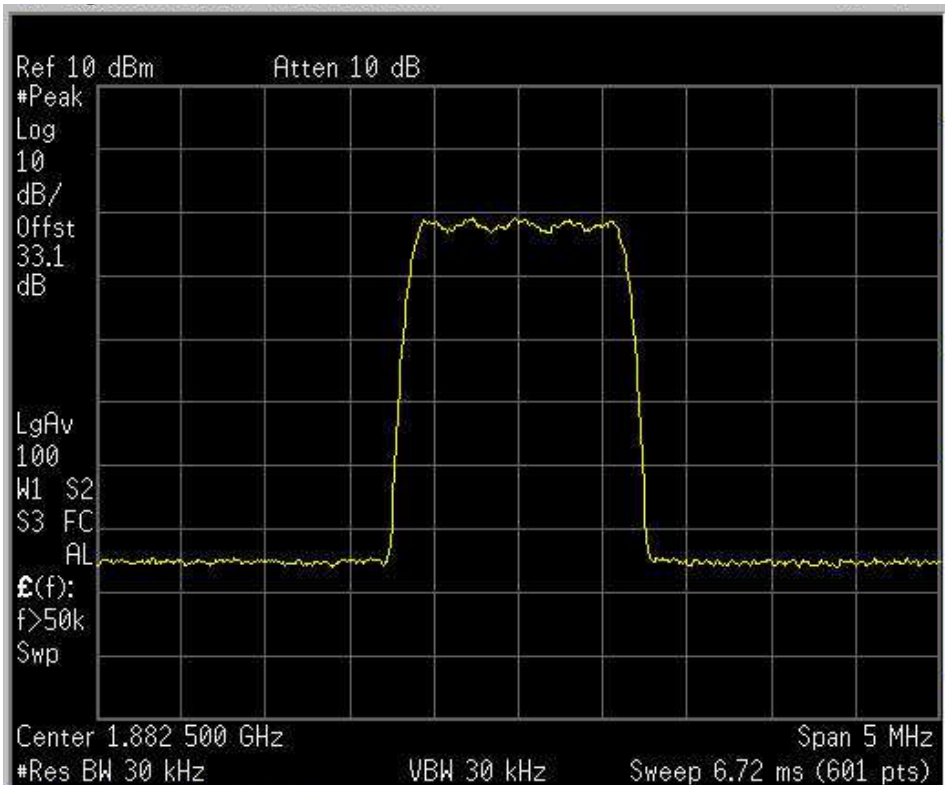
Test Data – Occupied Bandwidth
CDMA – Output
Downlink



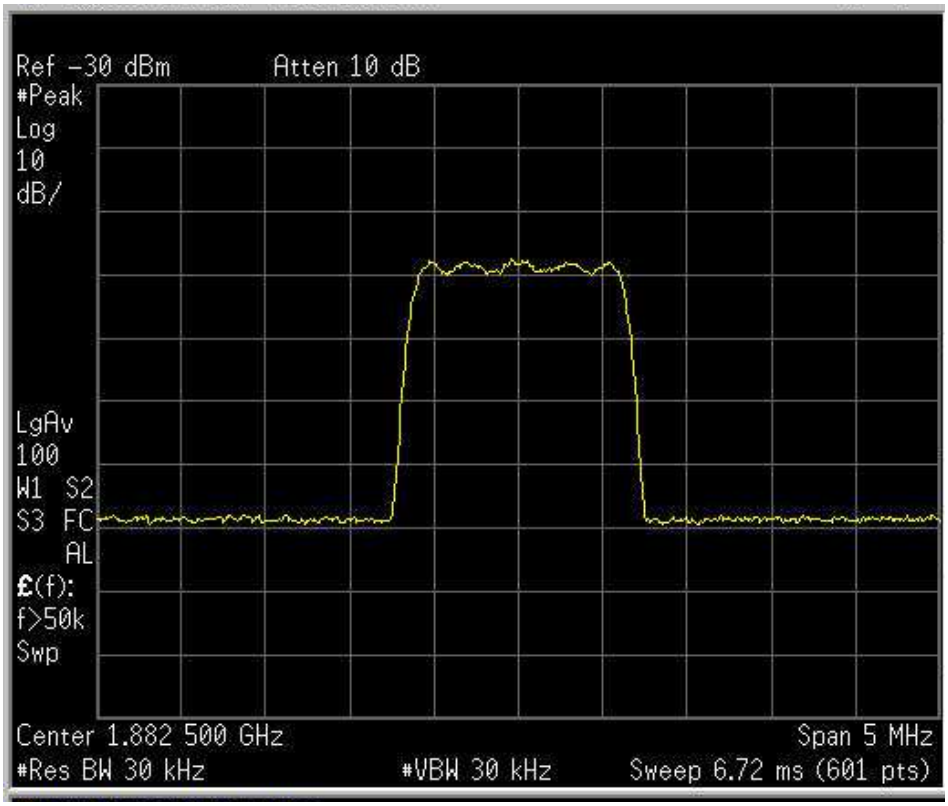
Test Data – Occupied Bandwidth
CDMA – Input
Downlink



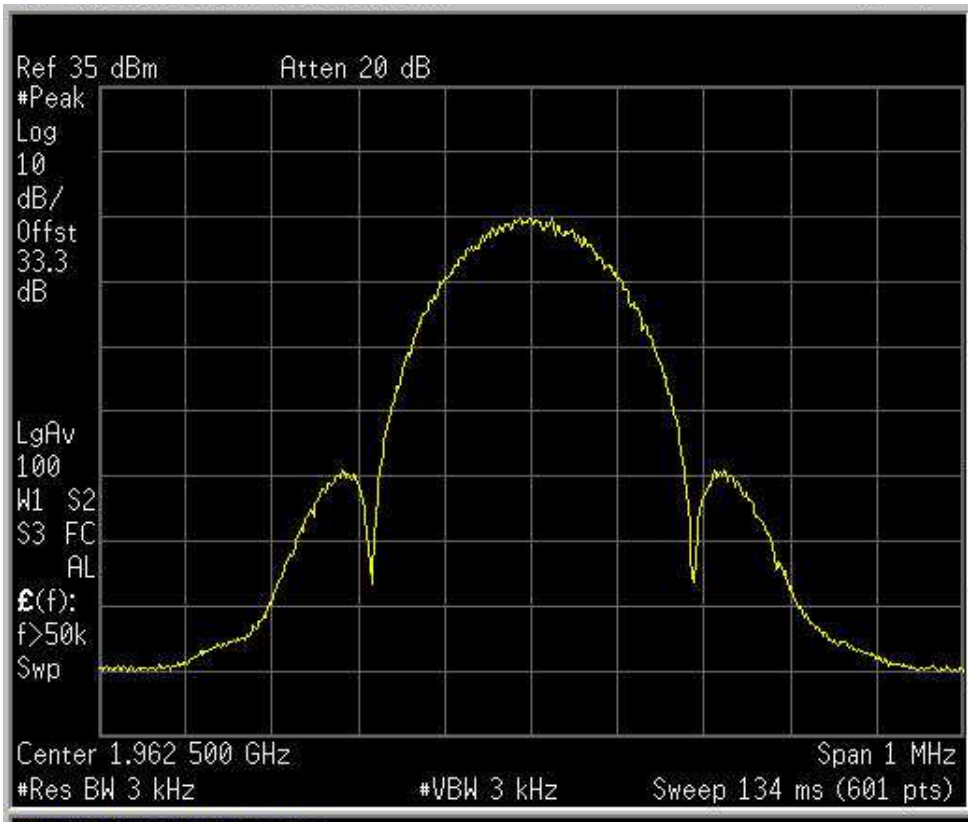
Test Data – Occupied Bandwidth
CDMA – Output
Uplink



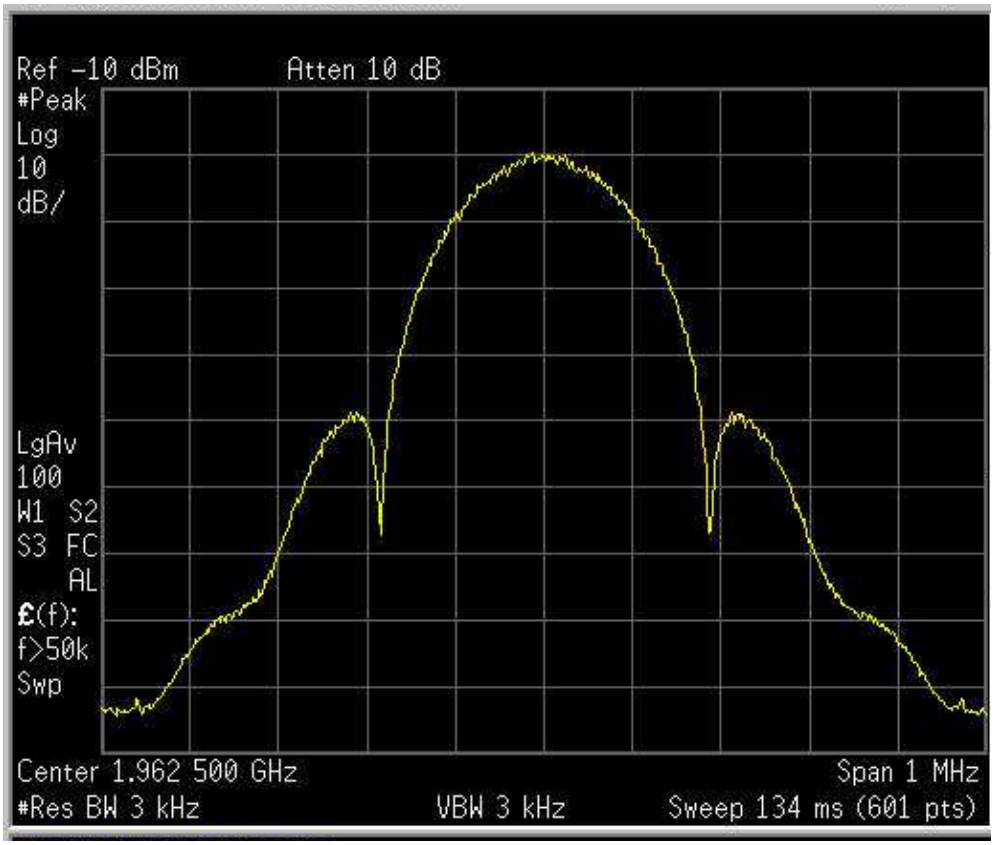
Test Data – Occupied Bandwidth
CDMA – Input
Uplink



Test Data – Occupied Bandwidth
EDGE – Output
Downlink

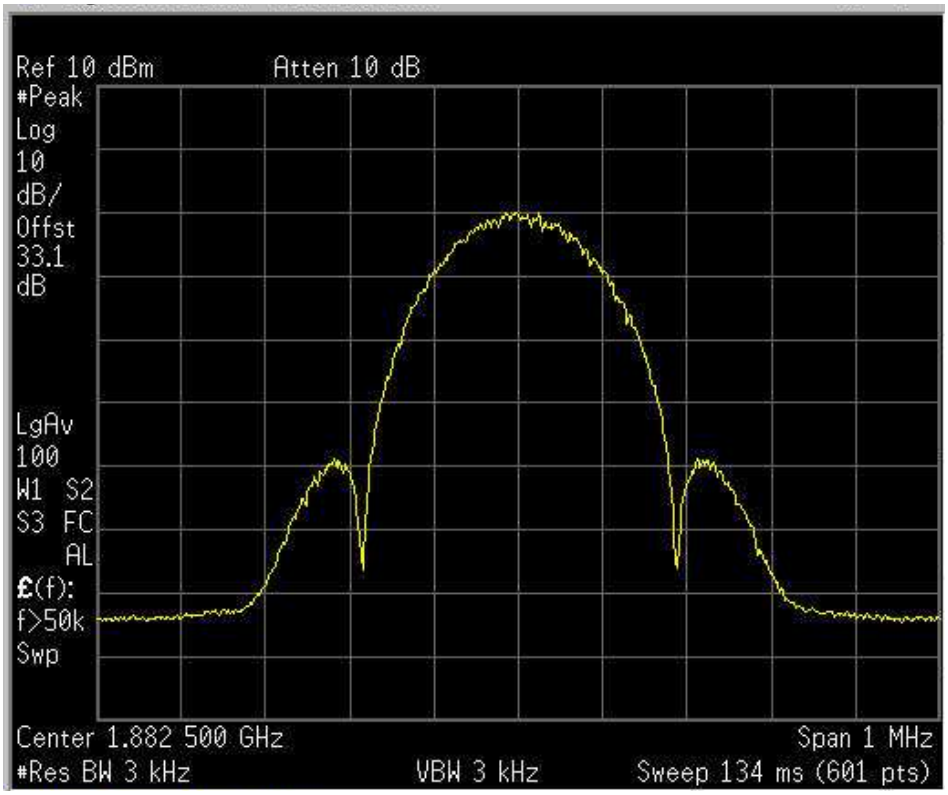


Test Data – Occupied Bandwidth
EDGE – Input
Downlink

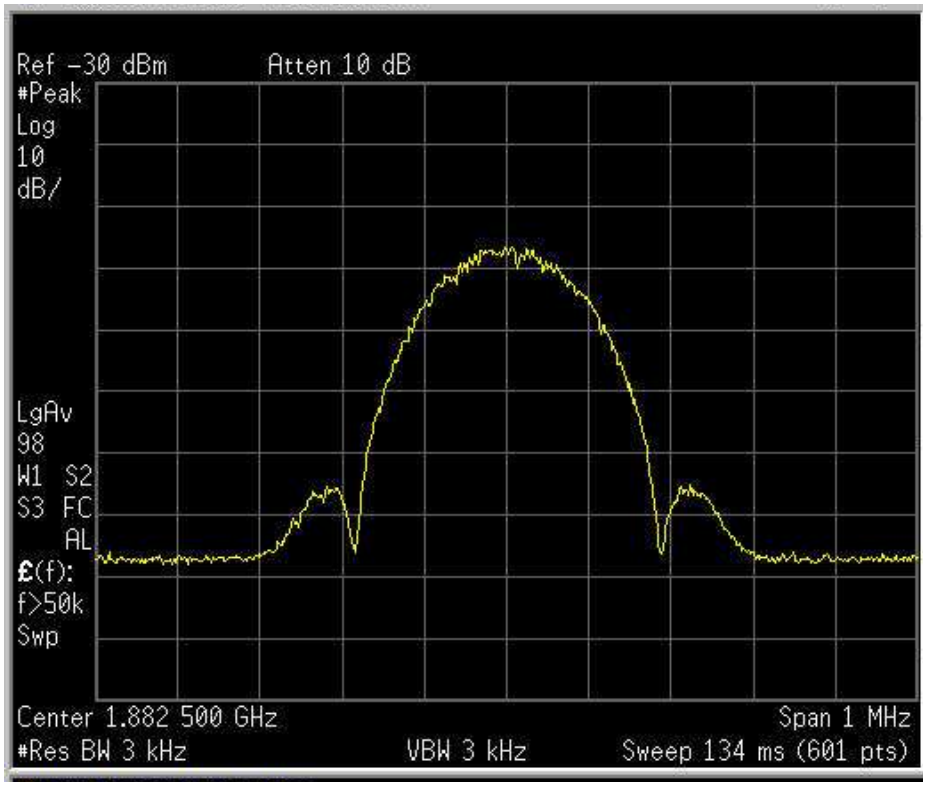


Test Data – Occupied Bandwidth

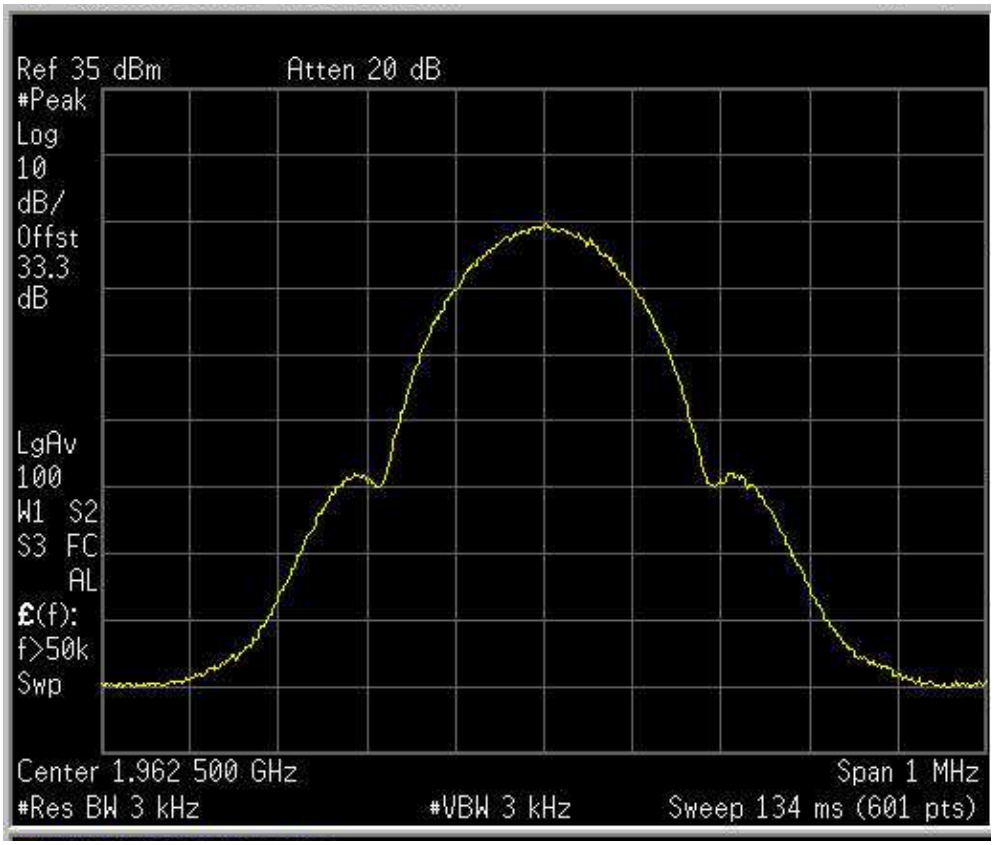
EDGE – Output
Uplink



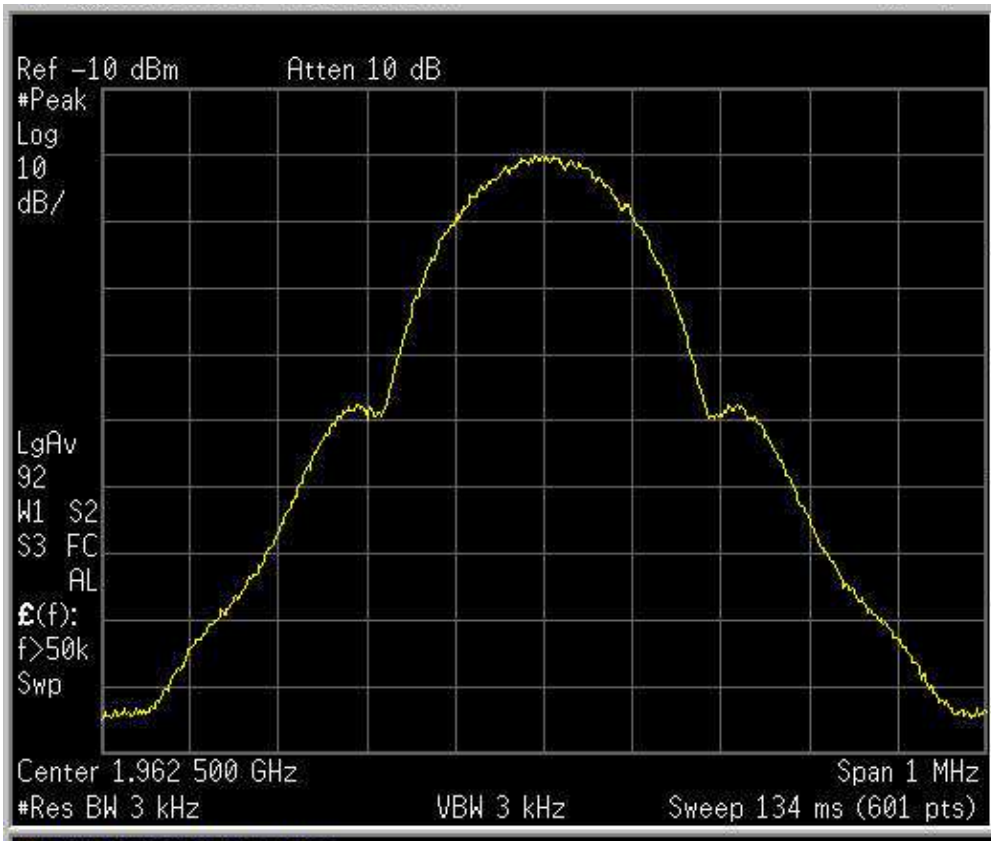
Test Data – Occupied Bandwidth
EDGE – Input
Uplink



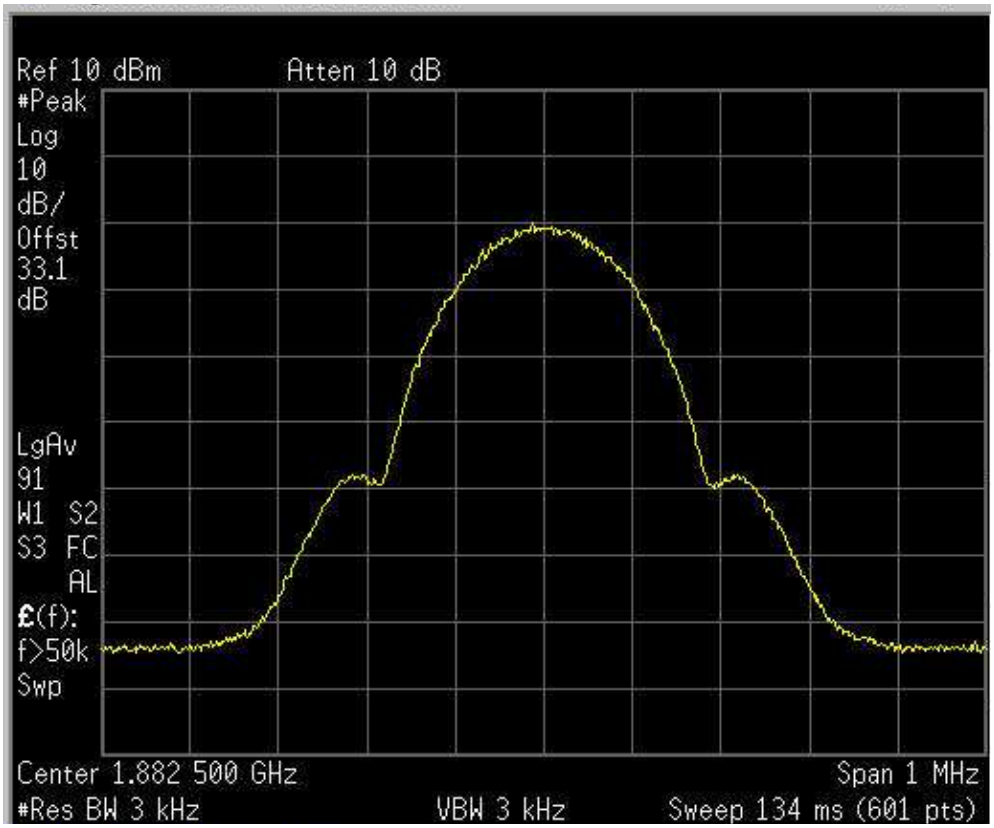
Test Data – Occupied Bandwidth
GSM – Output
Downlink



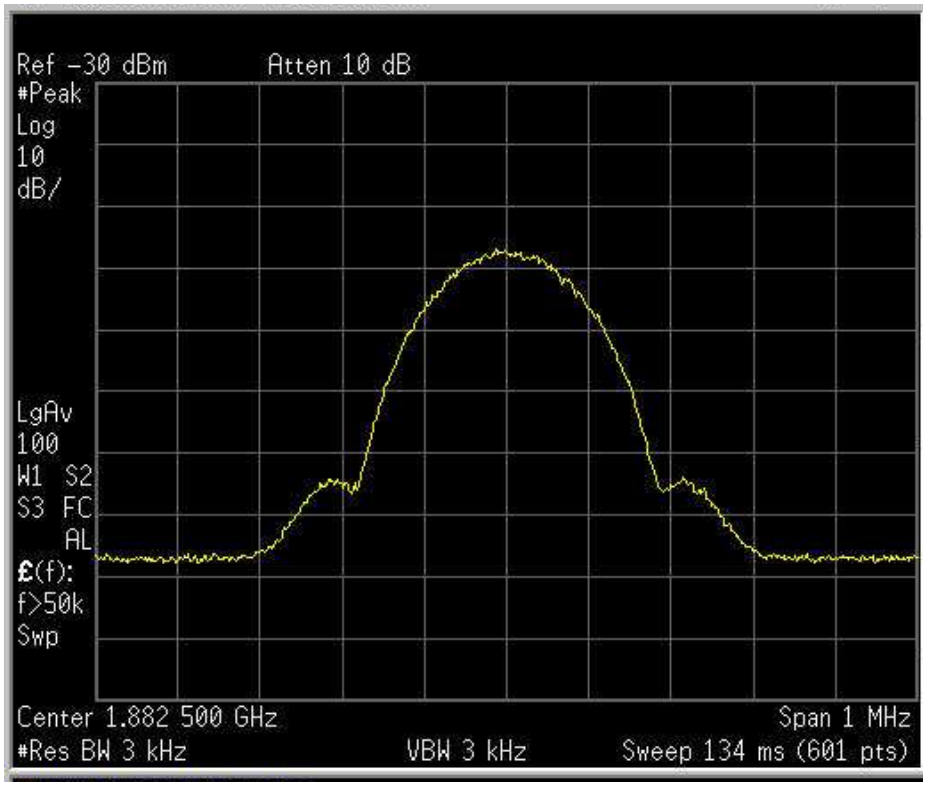
Test Data – Occupied Bandwidth
GSM – Input
Downlink



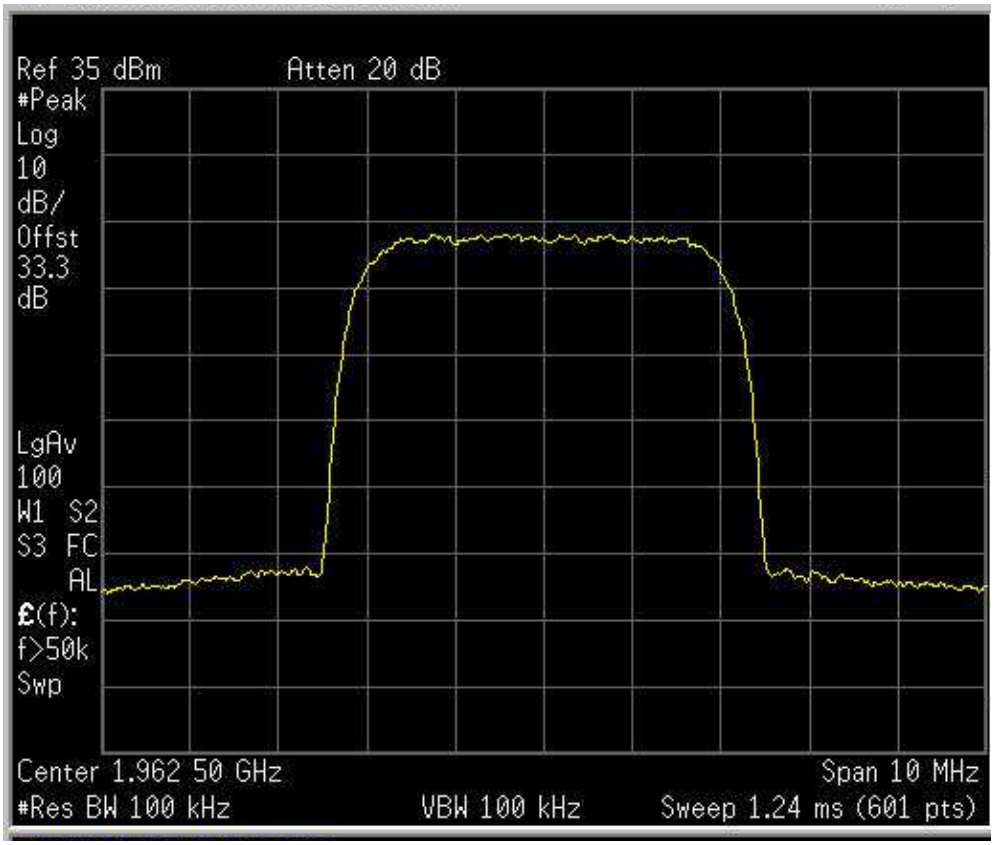
Test Data – Occupied Bandwidth
GSM – Output
Uplink



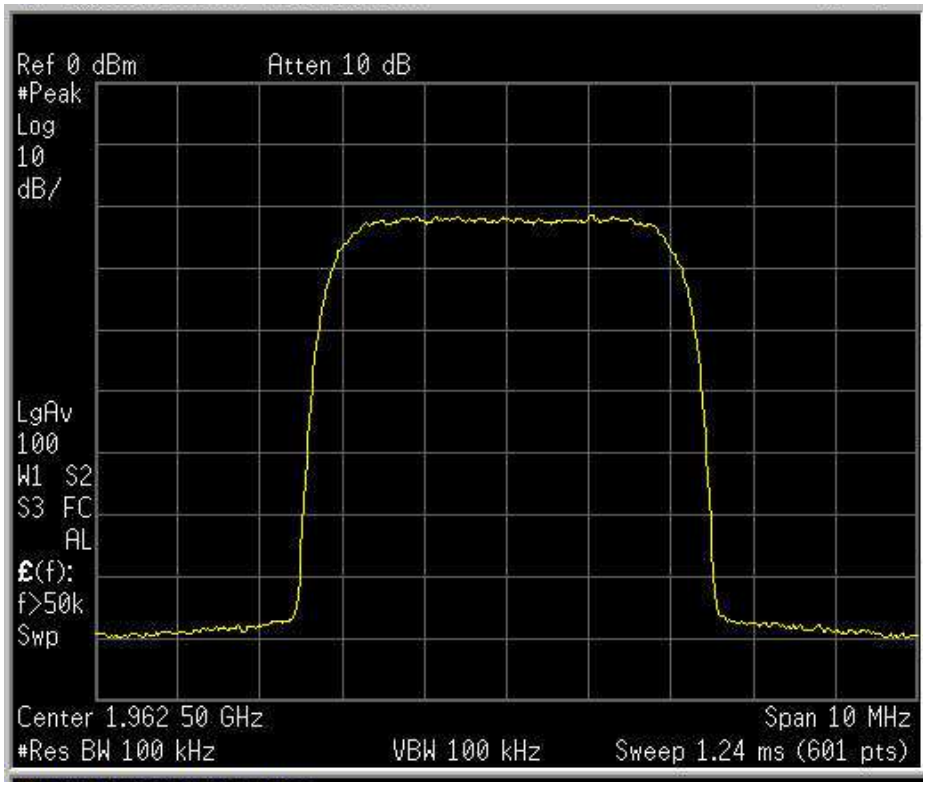
Test Data – Occupied Bandwidth
GSM – Input
Uplink



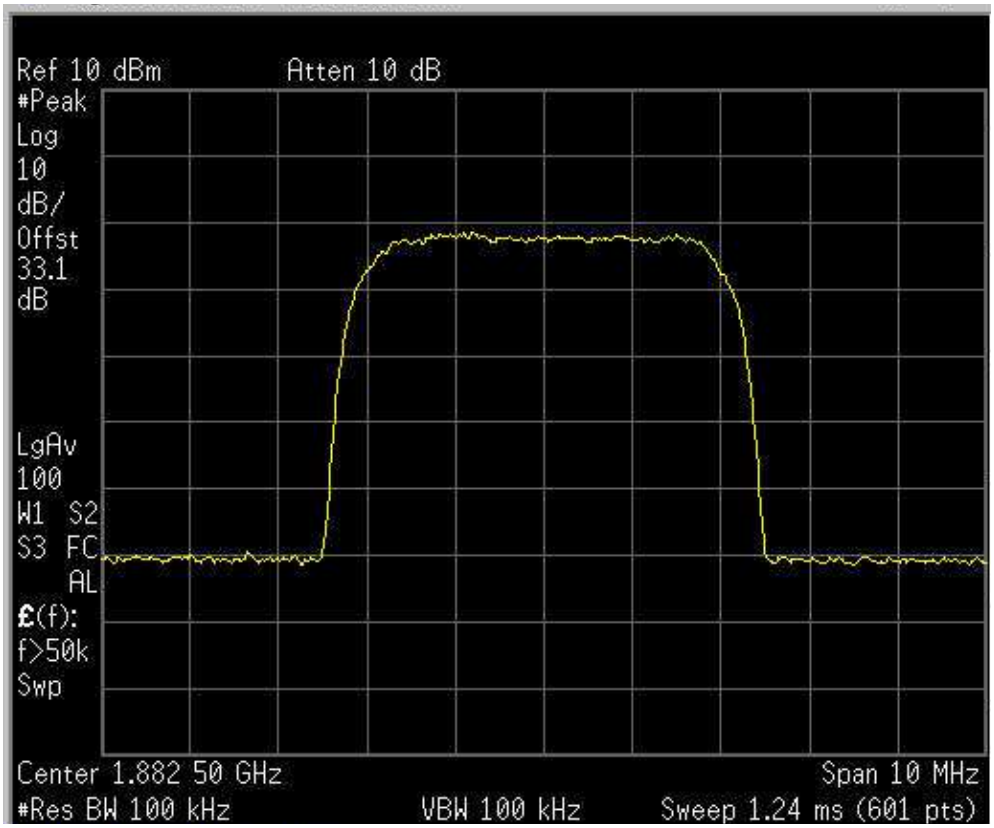
Test Data – Occupied Bandwidth
W-CDMA – Output
Downlink



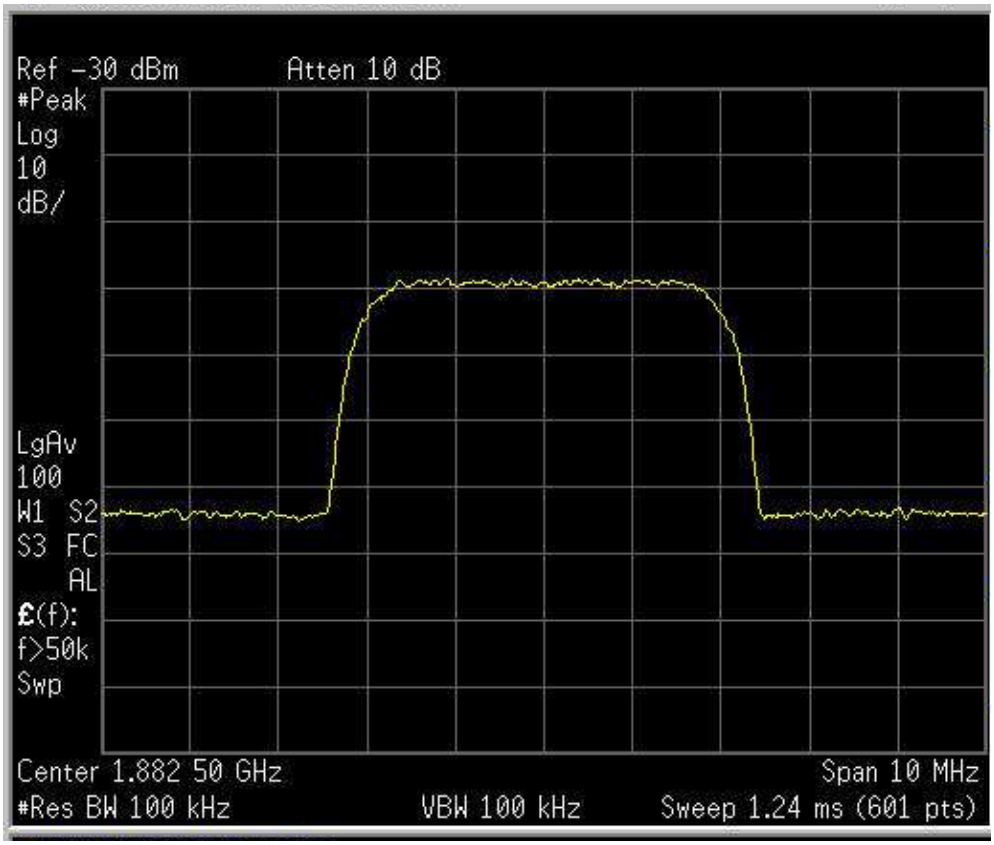
Test Data – Occupied Bandwidth
W-CDMA – Input
Downlink



Test Data – Occupied Bandwidth
W-CDMA – Output
Uplink



Test Data – Occupied Bandwidth
W-CDMA – Input
Uplink



Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 24.238
TESTED BY: G. Curioni	DATE: 22 September 09

Test Results: Complies.

Test Data: See attached plot(s).

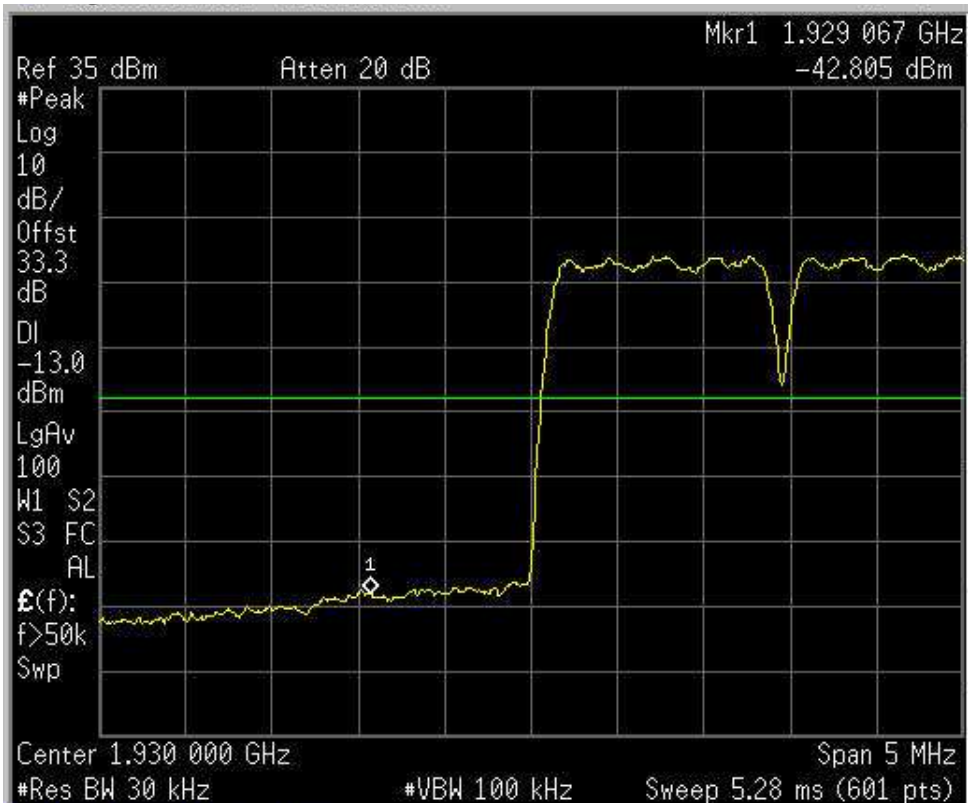
Equipment Used: 1 – 2 – 3b - 4

Measurement Uncertainty: +/- 1.9 dB

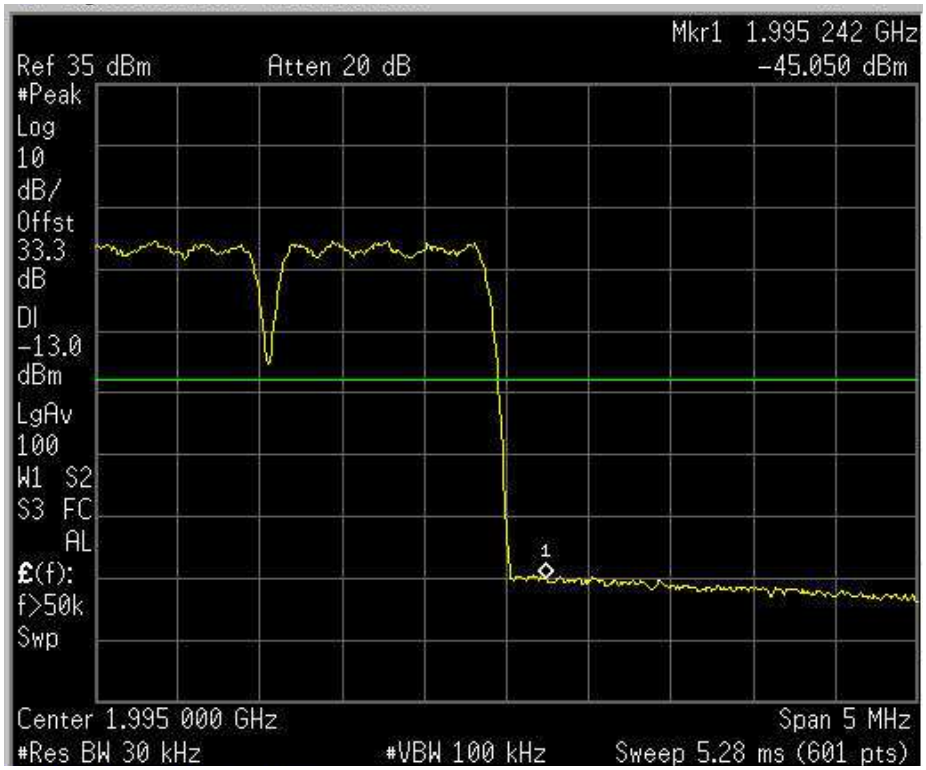
Temperature: 24 °C

Relative Humidity: 50 %

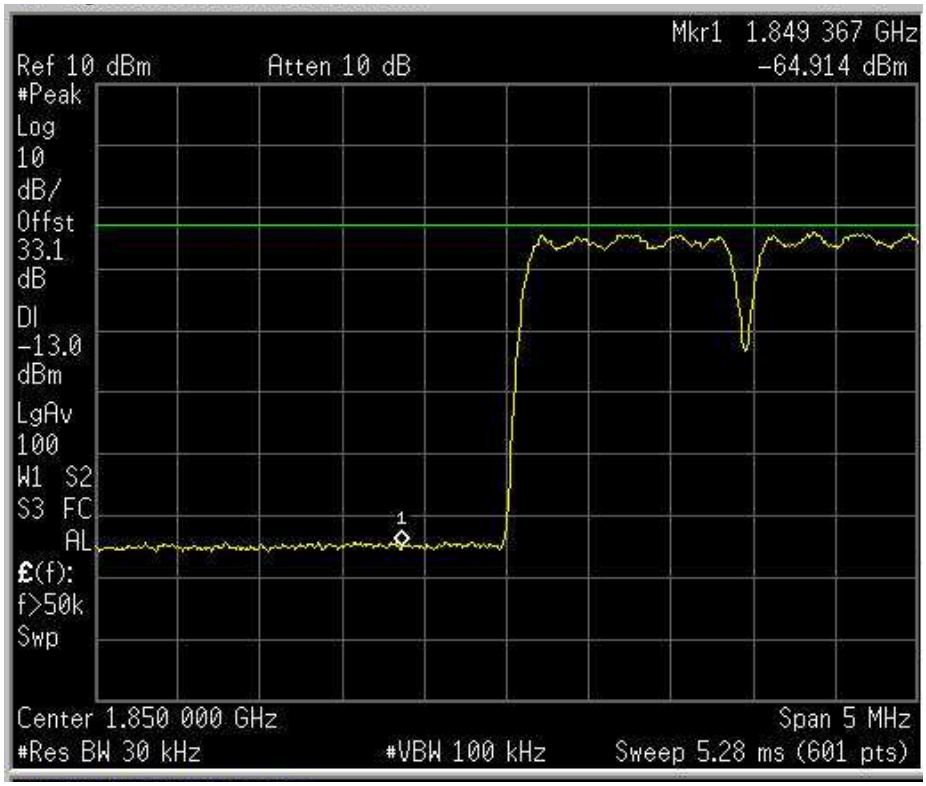
Test Data – Spurious Emissions at Antenna Terminals
Lower Bandedge Intermodulation
CDMA
Downlink



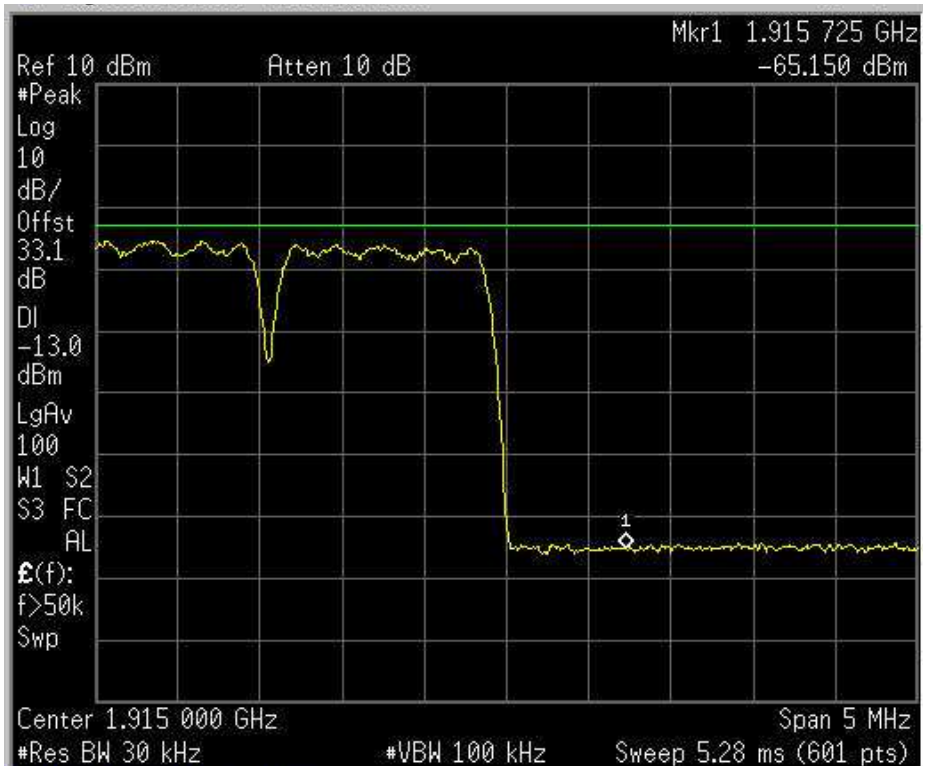
Test Data – Spurious Emissions at Antenna Terminals
Upper Bandedge Intermodulation
CDMA
Downlink



Test Data – Spurious Emissions at Antenna Terminals
Lower Bandedge Intermodulation
CDMA
Uplink

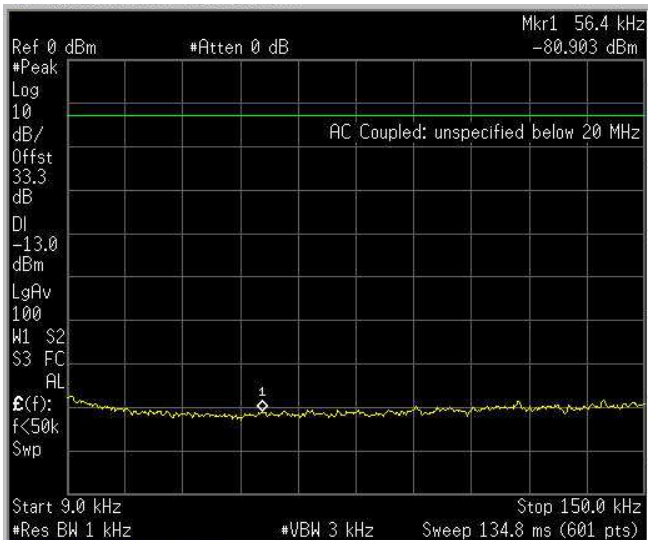


Test Data – Spurious Emissions at Antenna Terminals
Upper Bandedge Intermodulation
CDMA
Uplink

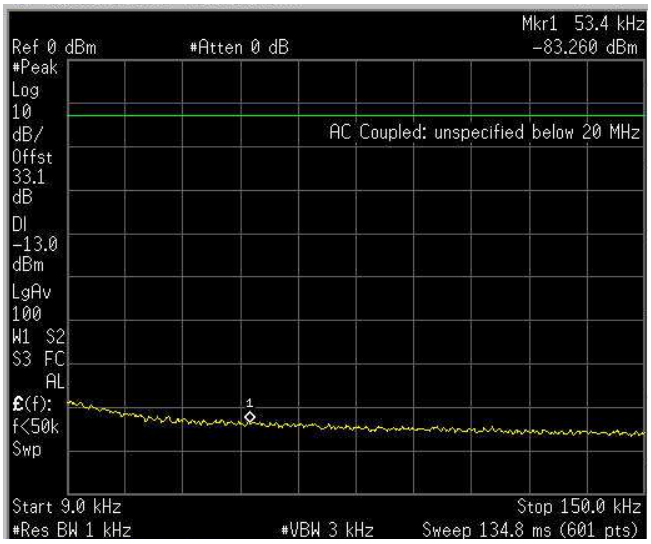


Test Data – Spurious Emissions at Antenna Terminals

Spurs – CDMA – Downlink 9 -150 kHz

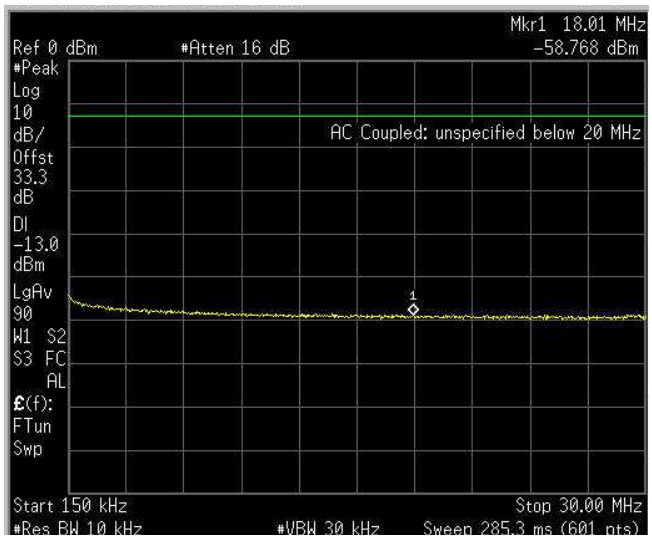


Spurs – CDMA – Uplink 9 -150 kHz

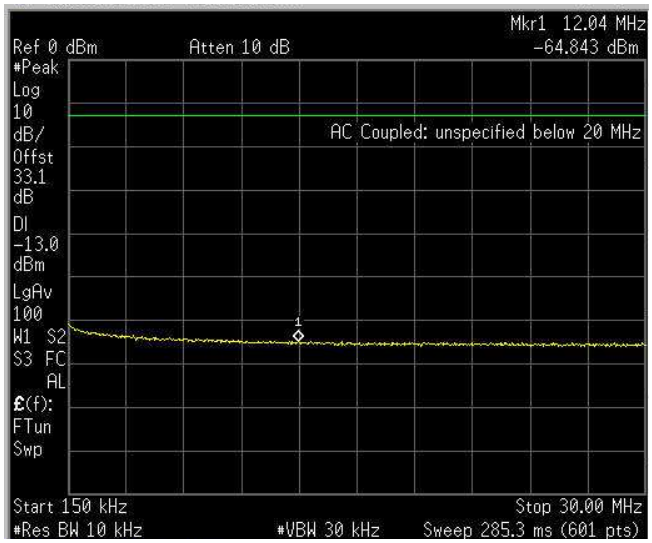


Test Data – Spurious Emissions at Antenna Terminals

Spurs – CDMA – Downlink 150 kHz – 30 MHz

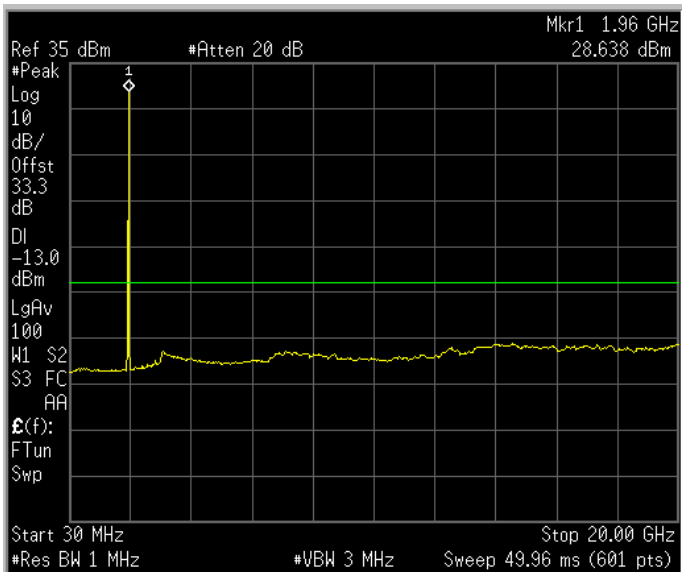


Spurs – CDMA – Uplink 150 kHz – 30 MHz

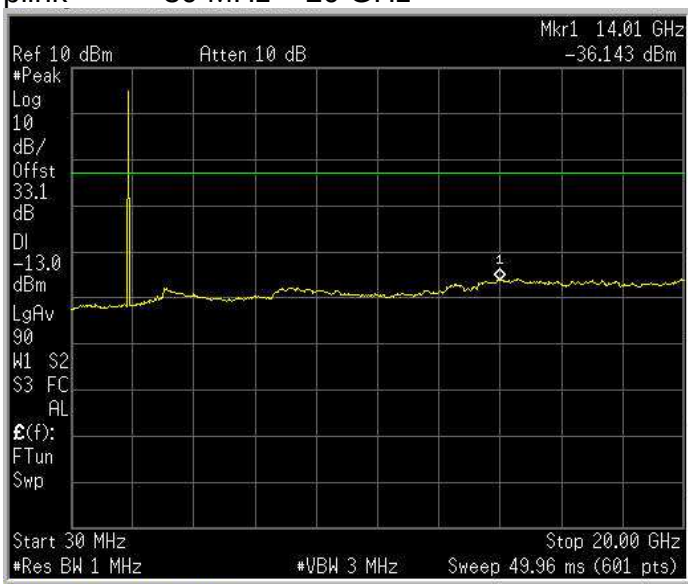


Test Data – Spurious Emissions at Antenna Terminals

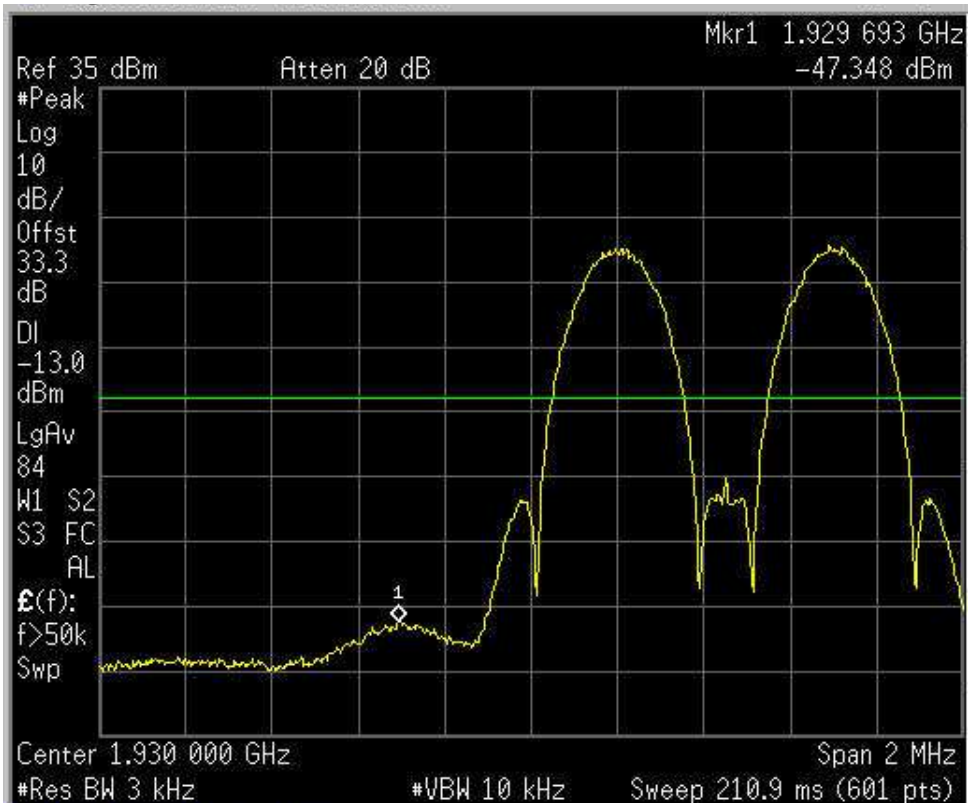
Spurs – CDMA – Downlink 30 MHz – 20 GHz



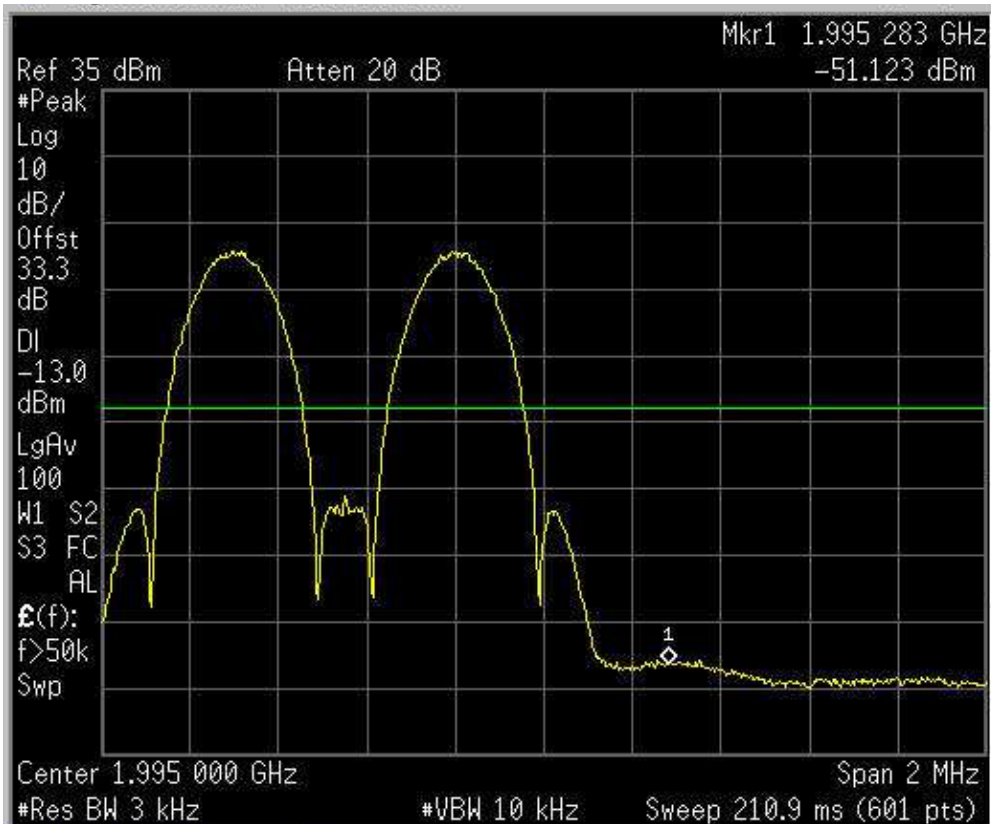
Spurs – CDMA – Uplink 30 MHz – 20 GHz



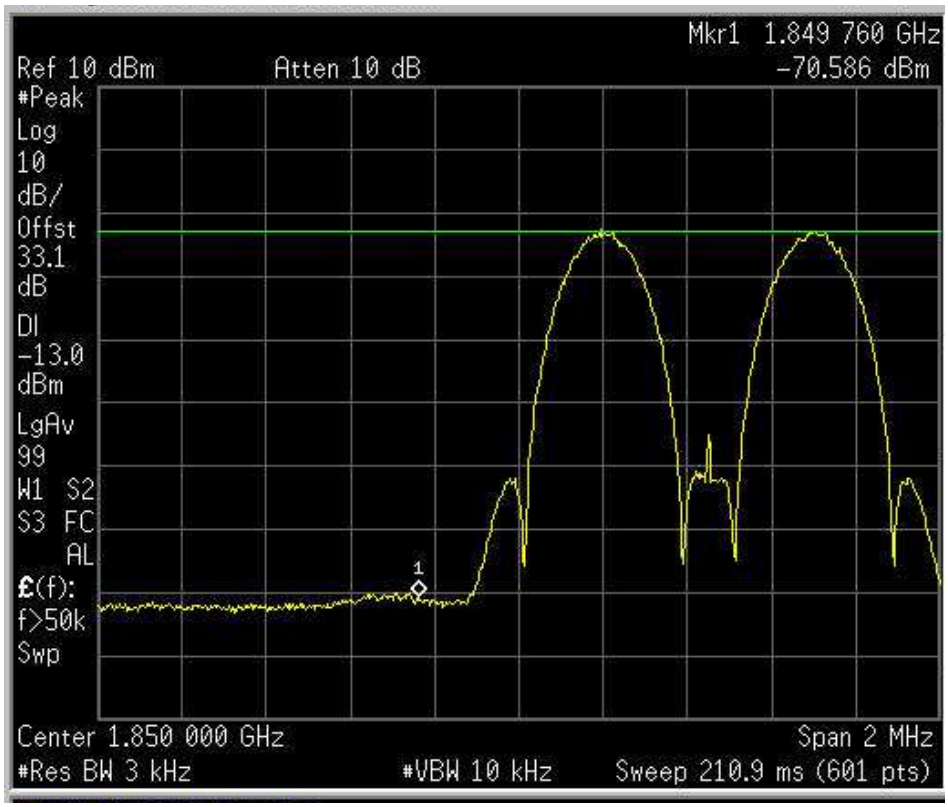
Test Data – Spurious Emissions at Antenna Terminals
Lower Bandedge Intermodulation
EDGE
Downlink



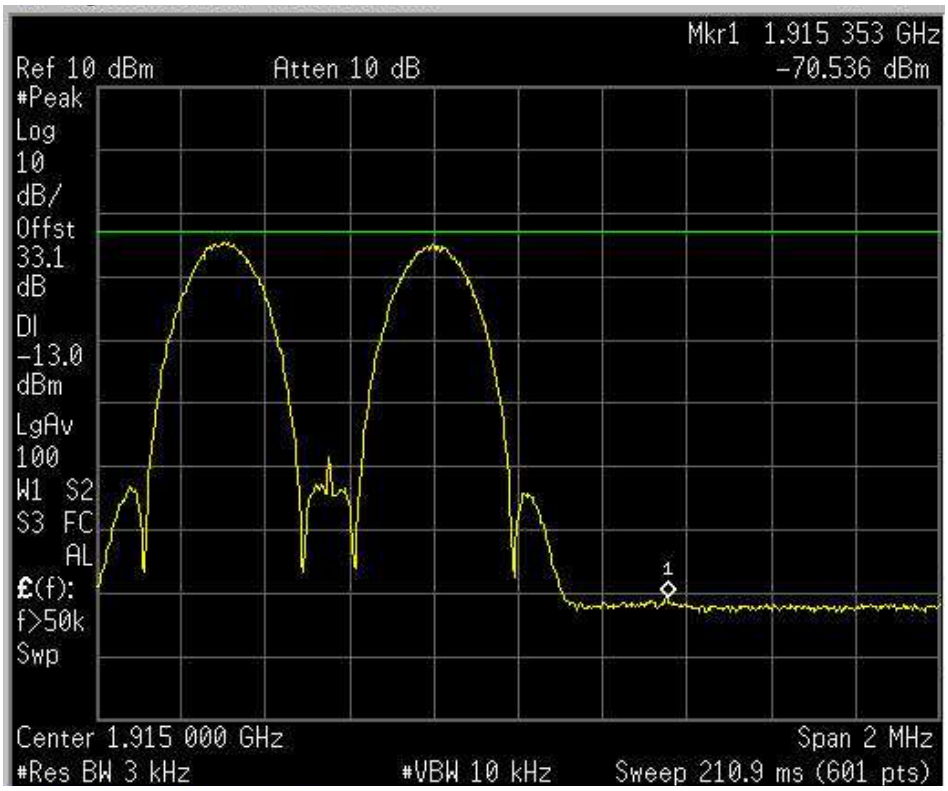
Test Data – Spurious Emissions at Antenna Terminals
Upper Bandedge Intermodulation
EDGE
Downlink



Test Data – Spurious Emissions at Antenna Terminals
Lower Bandedge Intermodulation
EDGE
Uplink

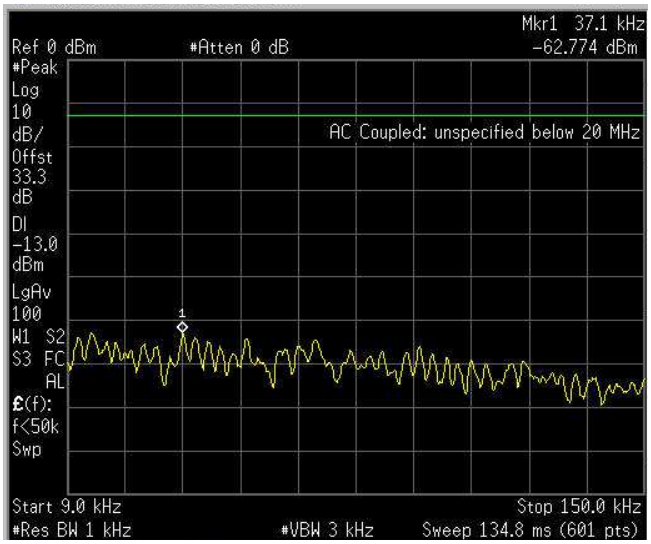


Test Data – Spurious Emissions at Antenna Terminals
Upper Bandedge Intermodulation
EDGE
Uplink

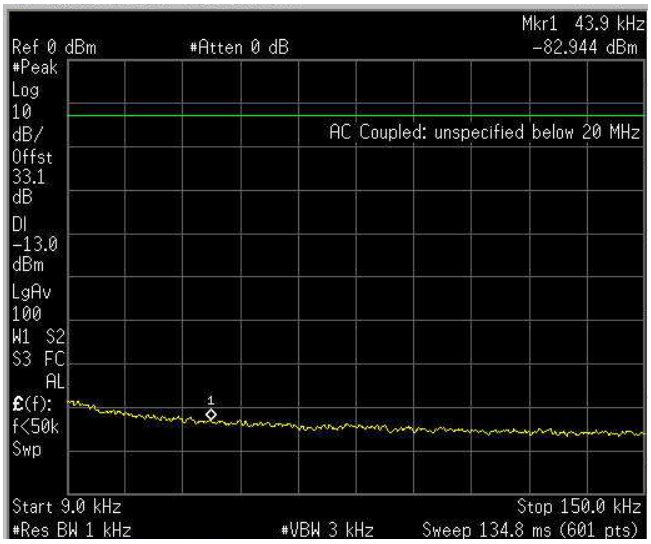


Test Data – Spurious Emissions at Antenna Terminals

Spurs – EDGE – Downlink 9 – 150 kHz

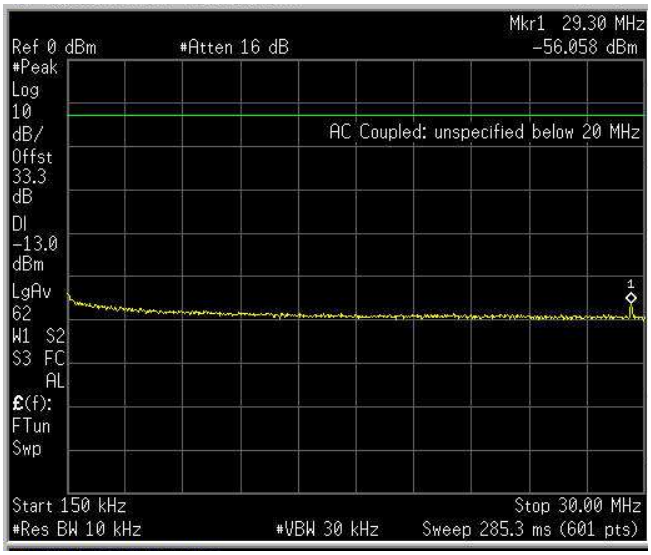


Spurs – EDGE – Uplink 9 – 150 kHz

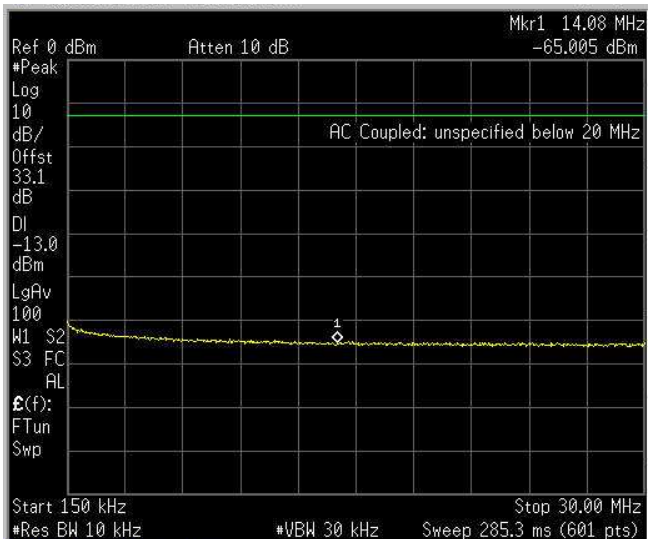


Test Data – Spurious Emissions at Antenna Terminals

Spurs – EDGE – Downlink 150 kHz – 30 MHz

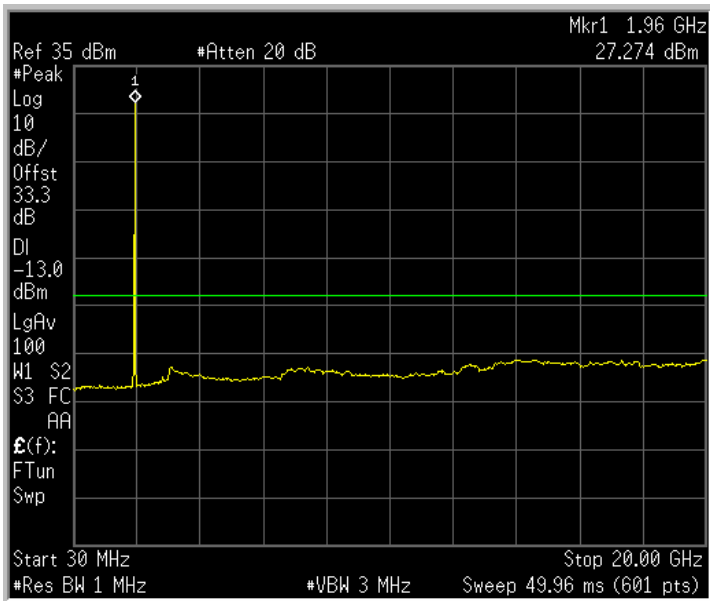


Spurs – EDGE – Uplink 150 kHz – 30 MHz

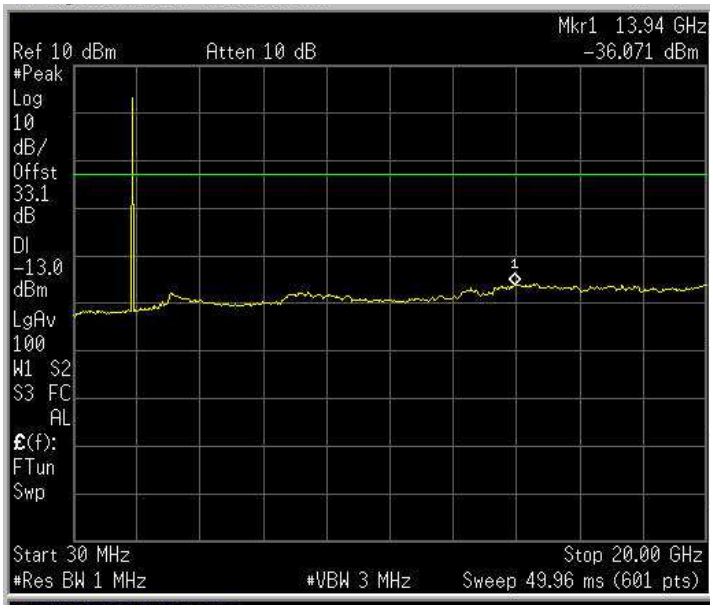


Test Data – Spurious Emissions at Antenna Terminals

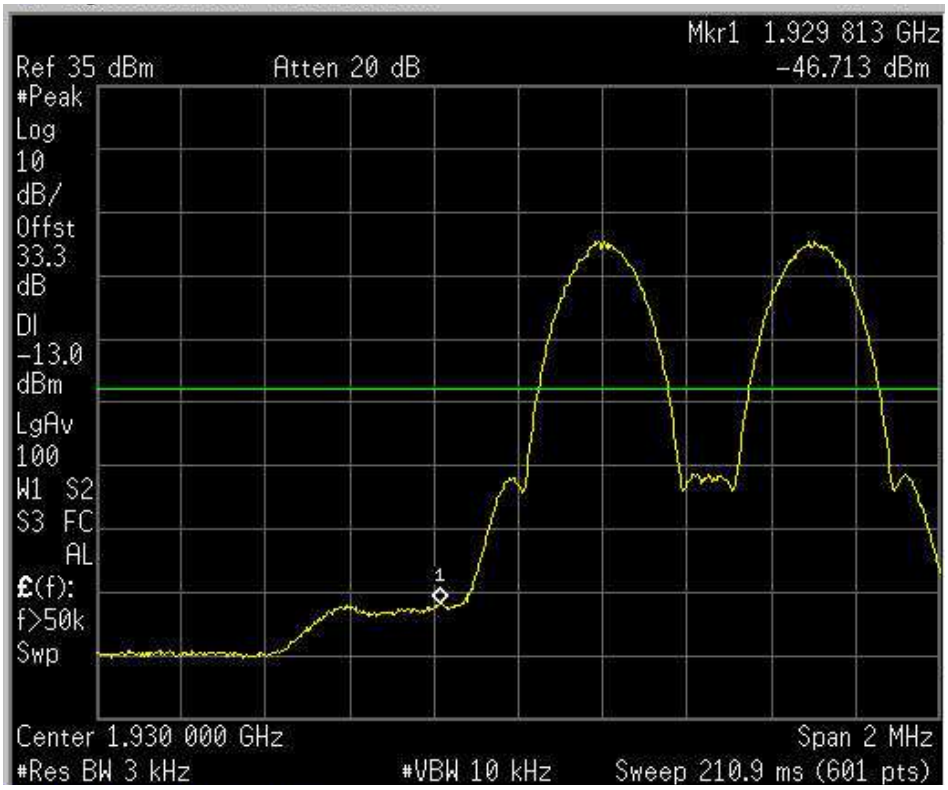
Spurs – EDGE – Downlink 30 MHz – 20 GHz



Spurs – EDGE – Uplink 30 MHz – 20 GHz



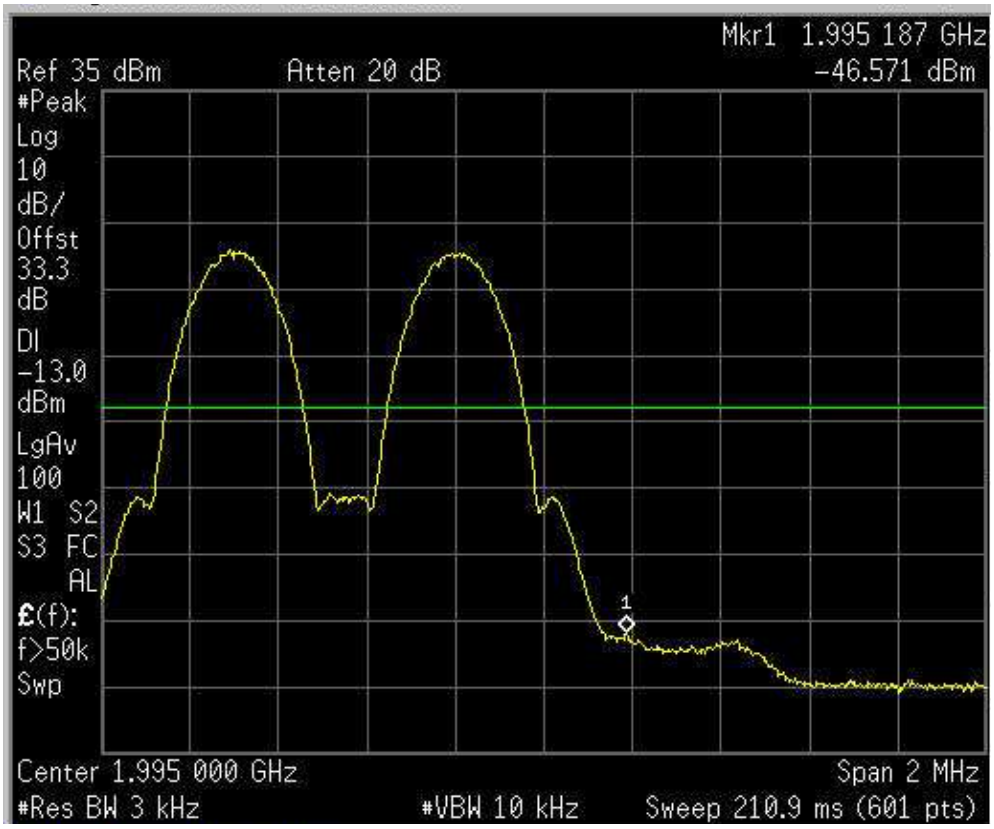
Test Data – Spurious Emissions at Antenna Terminals
Lower Bandedge Intermodulation
GSM
Downlink



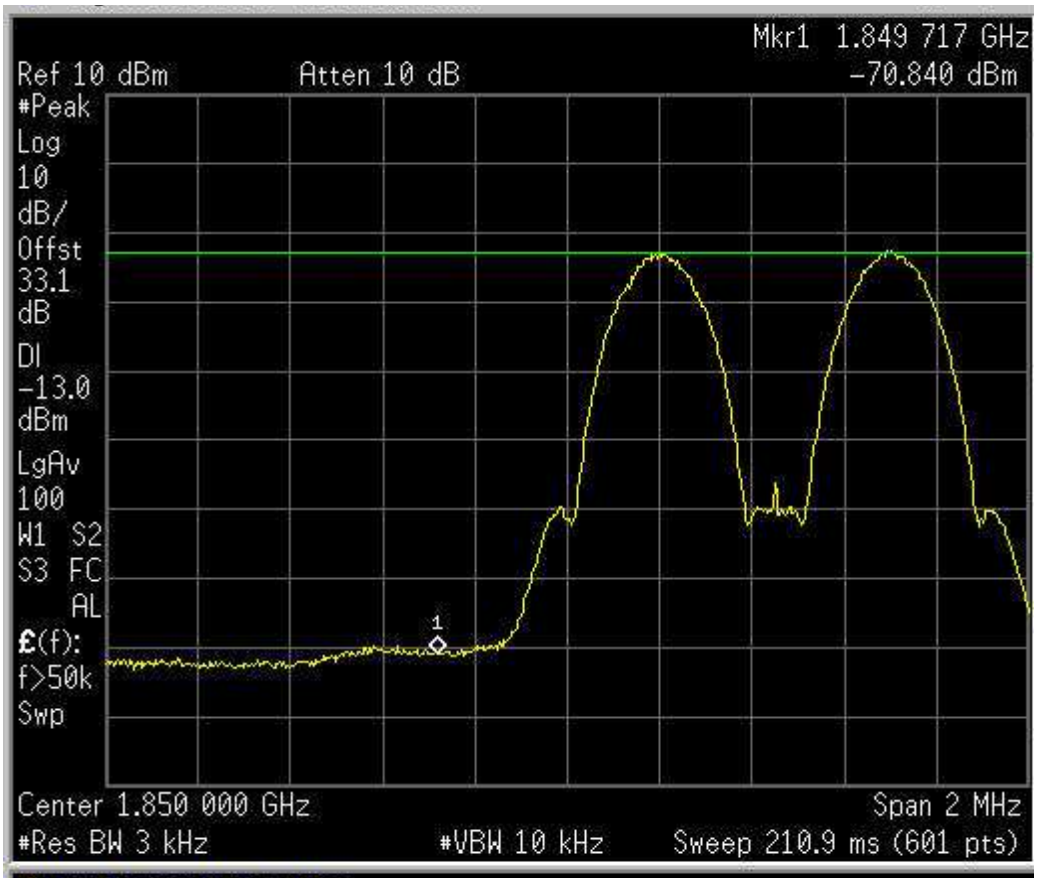
Test Data – Spurious Emissions at Antenna Terminals

Upper Bandedge Intermodulation

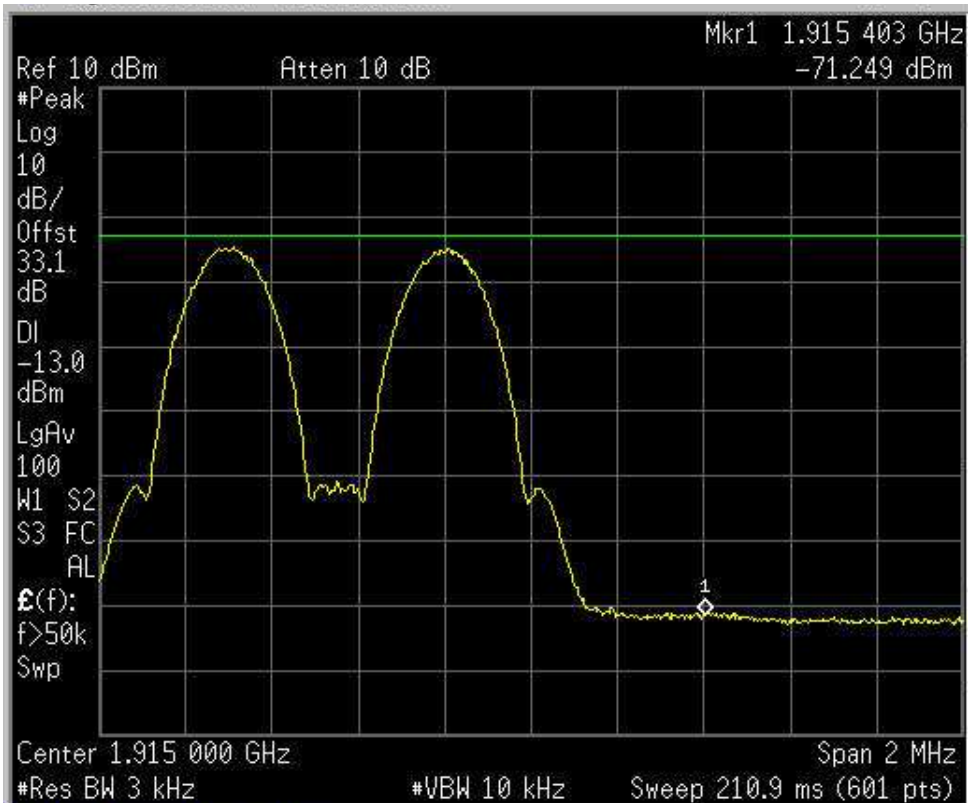
GSM
Downlink



Test Data – Spurious Emissions at Antenna Terminals
Lower Bandedge Intermodulation
GSM
Uplink

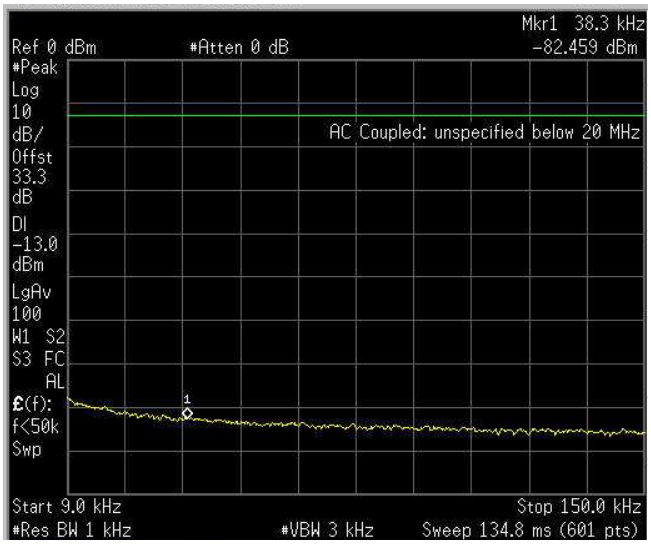


Test Data – Spurious Emissions at Antenna Terminals
Upper Bandedge Intermodulation
GSM
Uplink

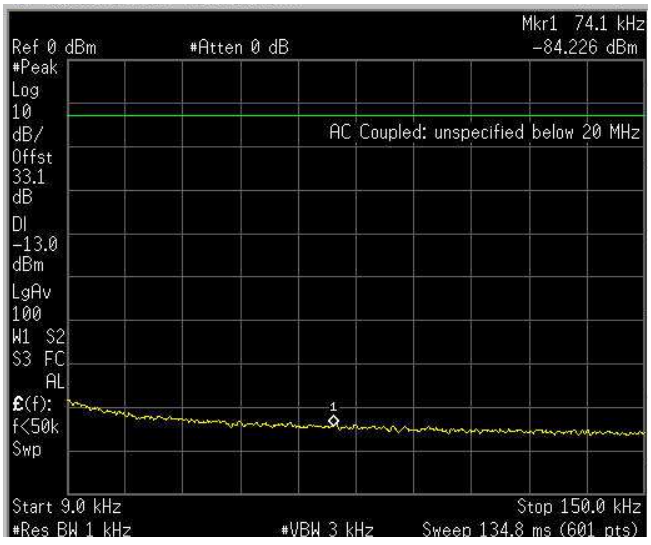


Test Data – Spurious Emissions at Antenna Terminals

Spurs – GSM – Downlink 9 – 150 kHz

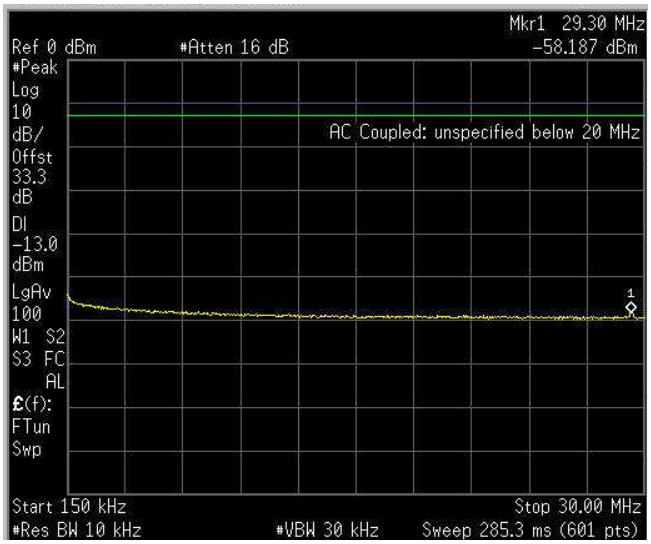


Spurs – GSM – Uplink 9 – 150 kHz

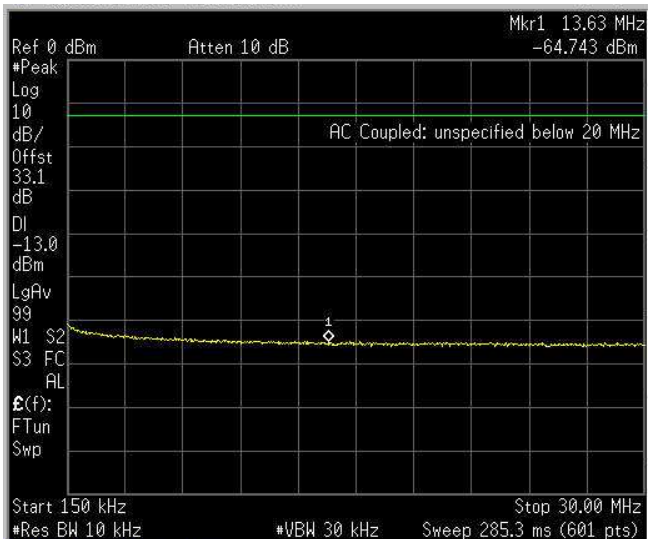


Test Data – Spurious Emissions at Antenna Terminals

Spurs – GSM – Downlink 150 kHz – 30 MHz

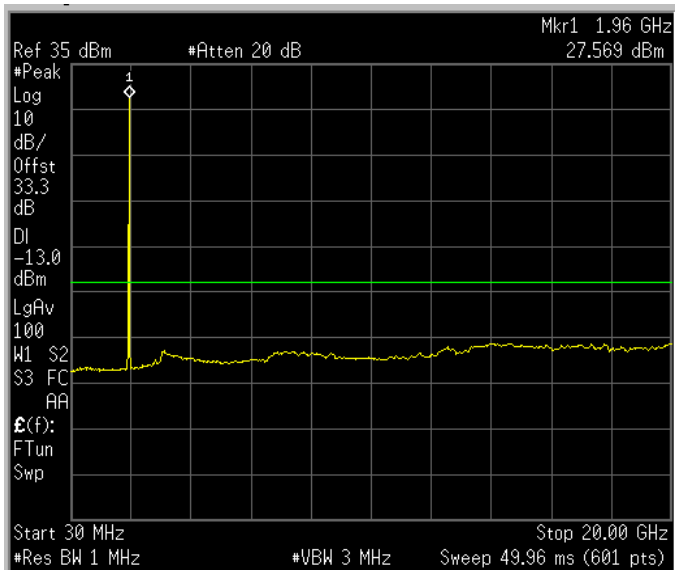


Spurs – GSM – Uplink 150 kHz – 30 MHz



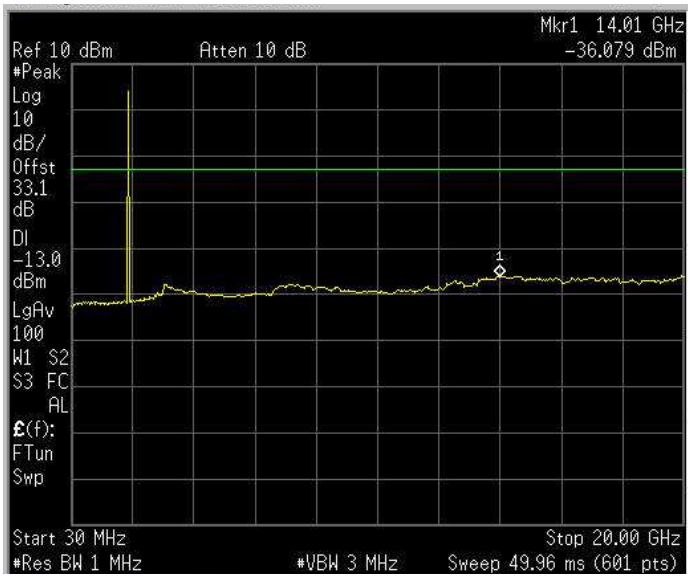
Test Data – Spurious Emissions at Antenna Terminals

Spurs – GSM – Downlink 30 MHz – 20 GHz

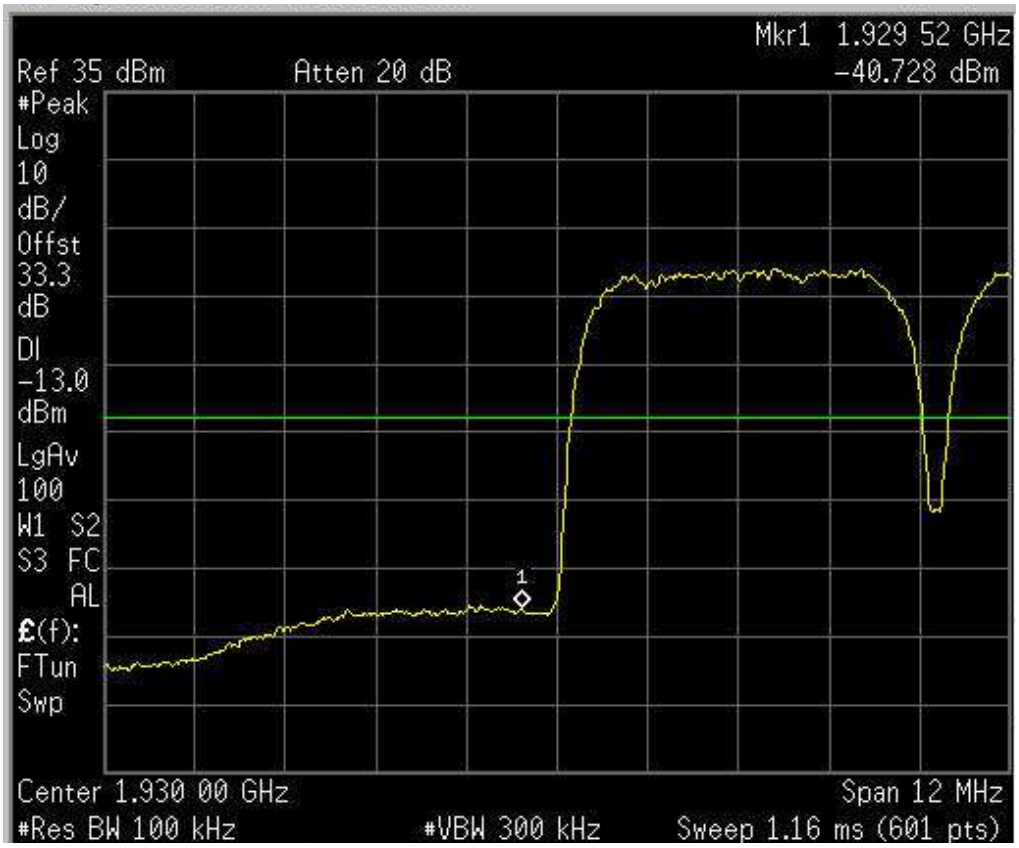


Test Data – Spurious Emissions at Antenna Terminals

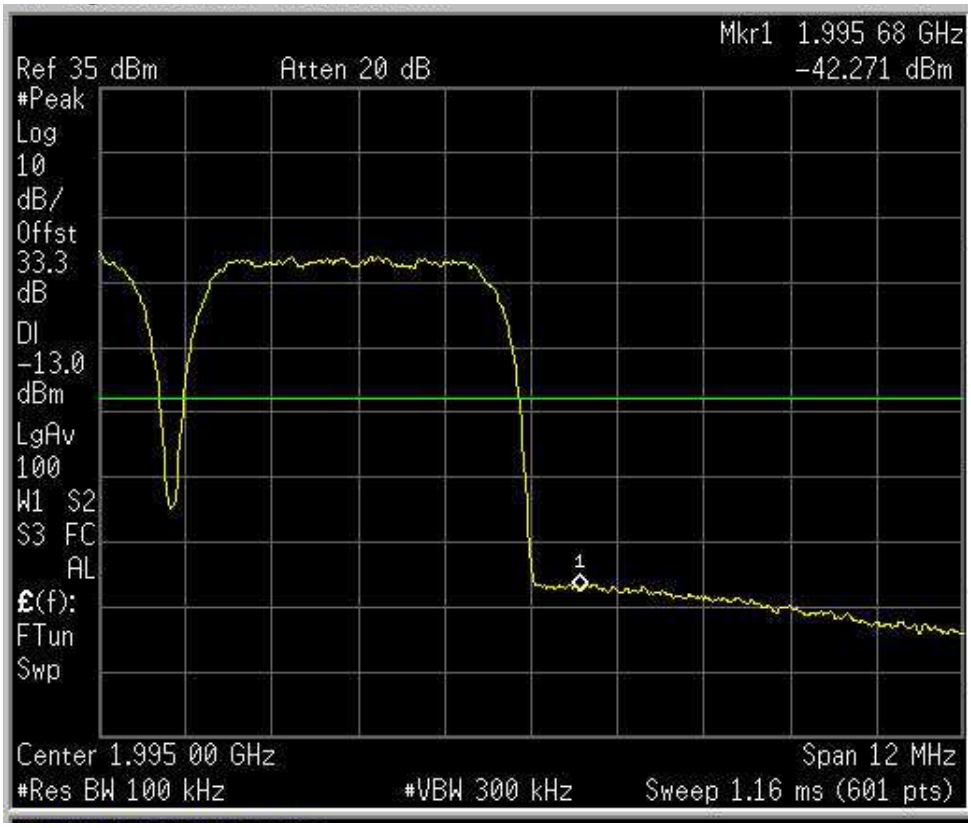
Spurs – GSM – Uplink 30 MHz – 20 GHz



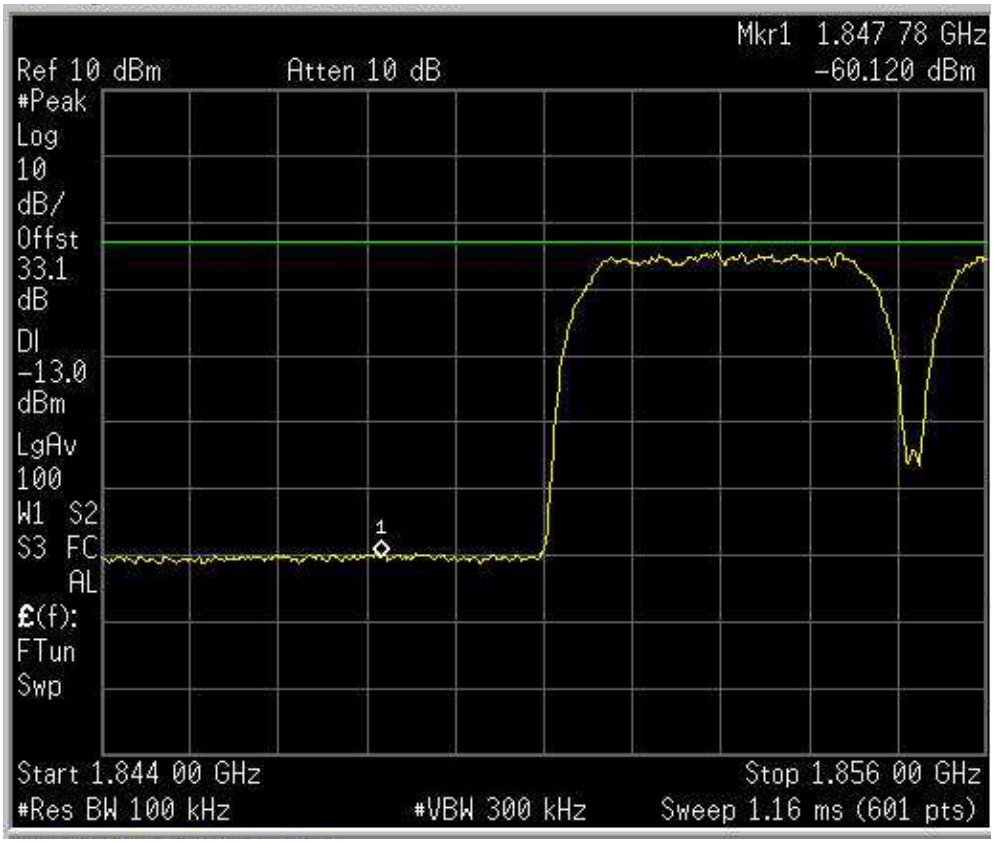
Test Data – Spurious Emissions at Antenna Terminals
Lower Bandedge Intermodulation
W-CDMA
Downlink



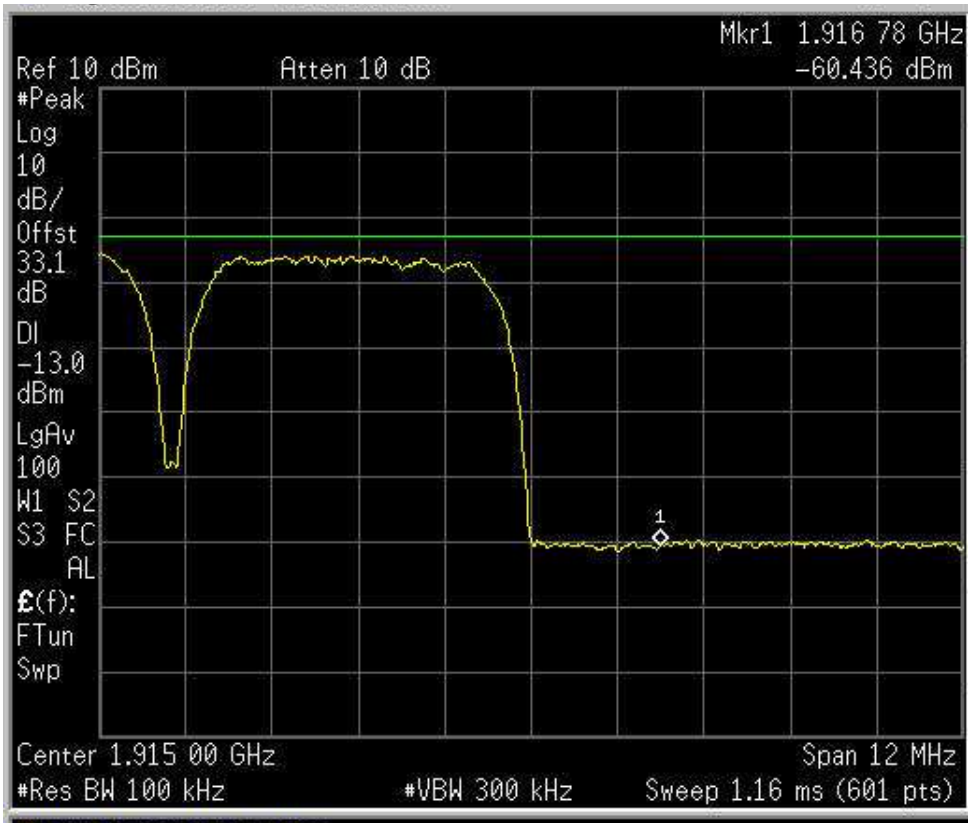
Test Data – Spurious Emissions at Antenna Terminals
Upper Bandedge Intermodulation
W-CDMA
Downlink



Test Data – Spurious Emissions at Antenna Terminals
Lower Bandedge Intermodulation
W-CDMA
Uplink

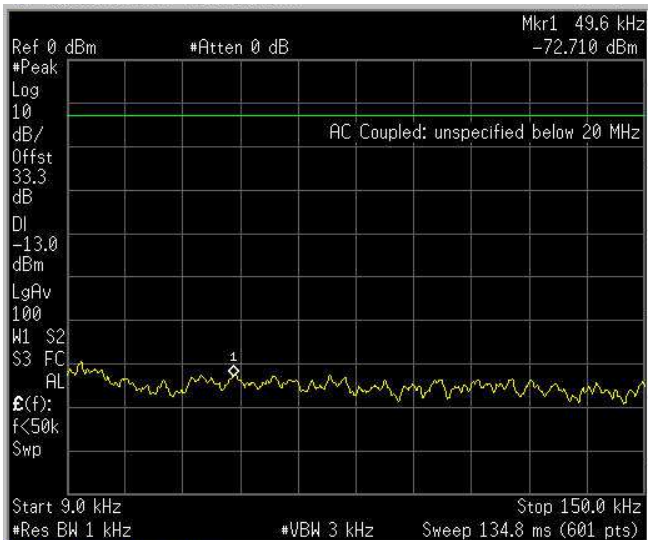


Test Data – Spurious Emissions at Antenna Terminals
Upper Bandedge Intermodulation
W-CDMA
Uplink

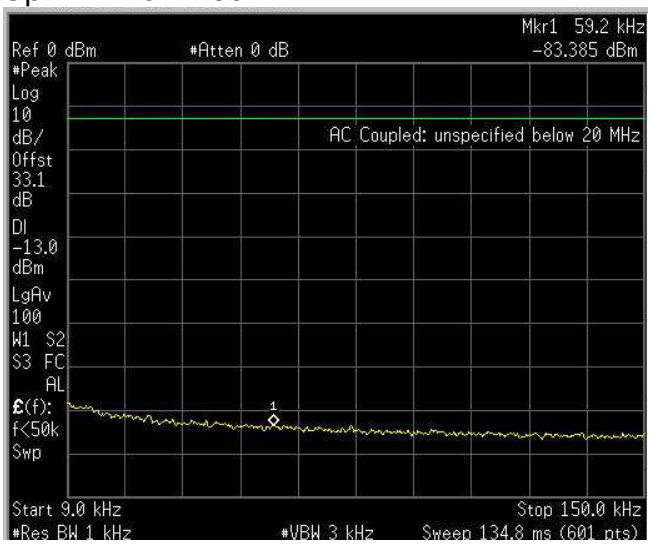


Test Data – Spurious Emissions at Antenna Terminals

Spurs – W-CDMA – Downlink 9 – 150 kHz

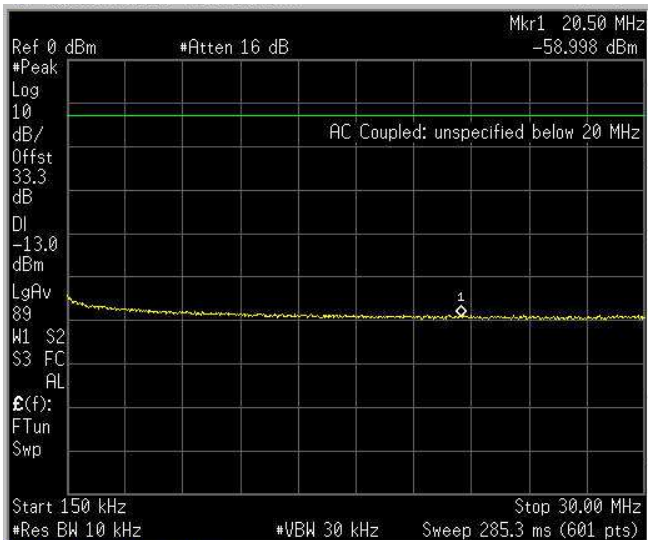


Spurs – W-CDMA – Uplink 9 – 150 kHz

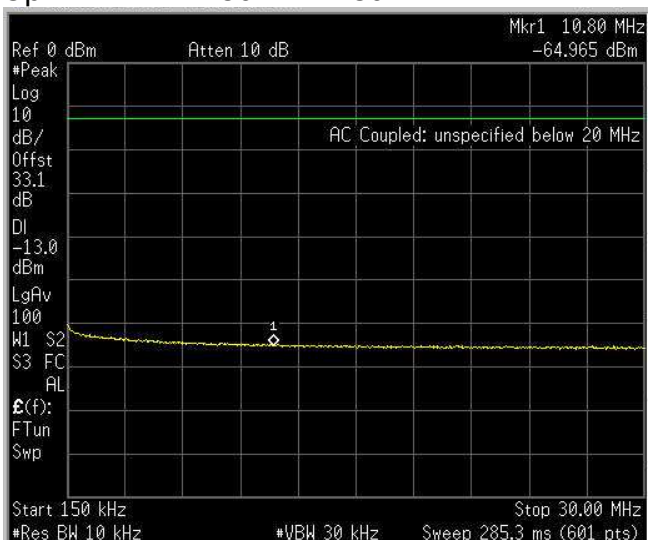


Test Data – Spurious Emissions at Antenna Terminals

Spurs – W-CDMA – Downlink 150 kHz – 30 MHz

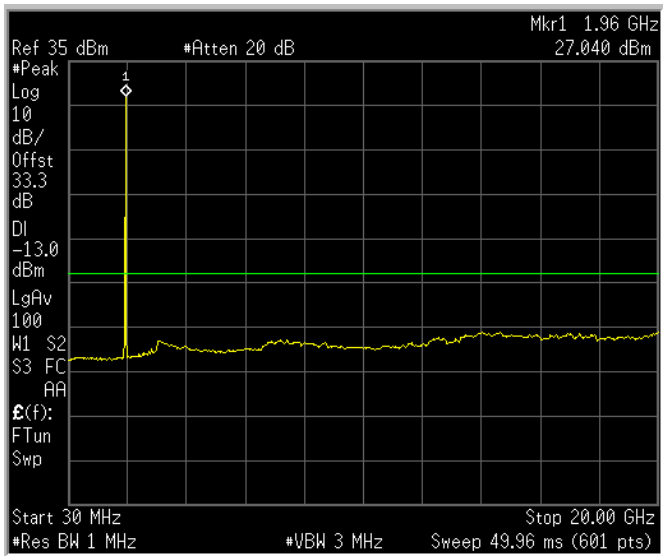


Spurs – W-CDMA – Uplink 150 kHz – 30 Mhz

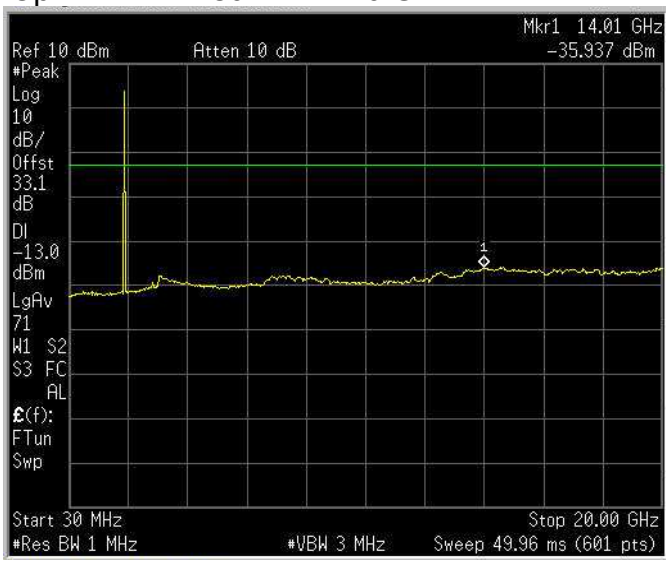


Test Data – Spurious Emissions at Antenna Terminals

Spurs – W-CDMA – Downlink 30 MHz – 20 GHz



Spurs – W-CDMA – Uplink 30 Mhz – 20 GHz



Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 24.238
TESTED BY: G. Curioni	DATE: 22 September 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.

PCS band - Master/remote 120/120 Vac			
Frequency range	D.L. & U.L.	Result [dBm] Max. field strength pol. V/H	Limit
30 – 1000 MHz	78.6 MHz	-69.4 dBm H	-13 dBm
1 – 20 GHz		negligible	-13dBm

PCS band - Master/remote 48 Vdc/120 Vac			
Frequency range	D.L. & U.L.	Result [dBm] Max. field strength pol. V/H	Limit
30 – 1000 MHz	33.9 MHz 92.2 MHz 98.0 MHz 152.5 MHz	-51.1 dBm H -63.6 dBm H -64.7 dBm V -53.6 dBm V	Limit: -13 dbm
1 – 20 GHz		negligible	Limit: -13 dBm

Equipment Used: 5 – 6 – 7 – 8 – 9 -10 – 11 – 12 - 13

Measurement Uncertainty: +/-5 dB

Temperature: 24 °C

Relative Humidity: 50 %

RBW=VBW=100 kHz below 1000 MHz
RBW=VBW=1 MHz above 1000 MHz
Peak detector

Section 7. Filter Frequency Response

NAME OF TEST: Filter Frequency Response	PARA. NO.: 2-11-04/EAB/RF
TESTED BY: G. Curioni	DATE: 23 January 2010

Test Results: Complies.

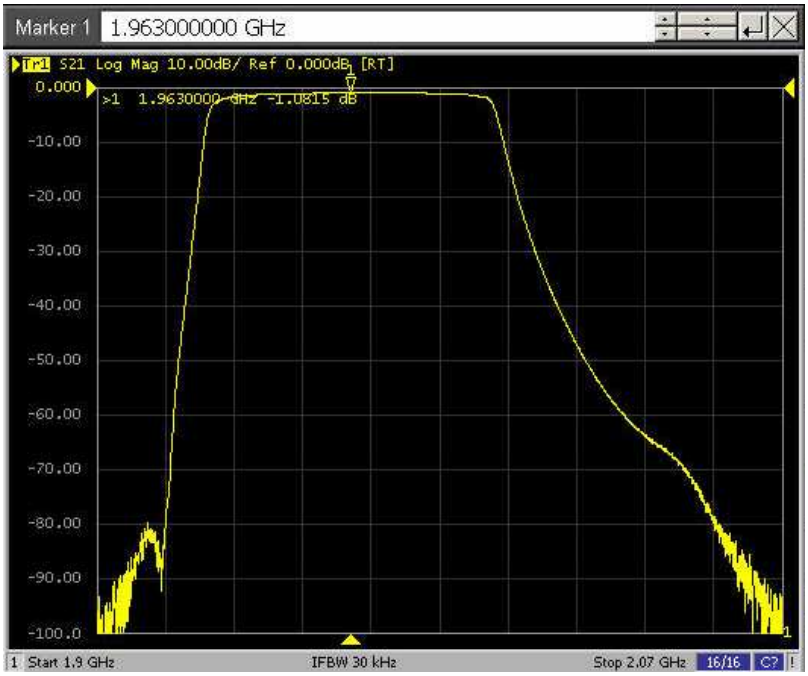
Test Data: See attached plot(s).

Equipment Used: 3a

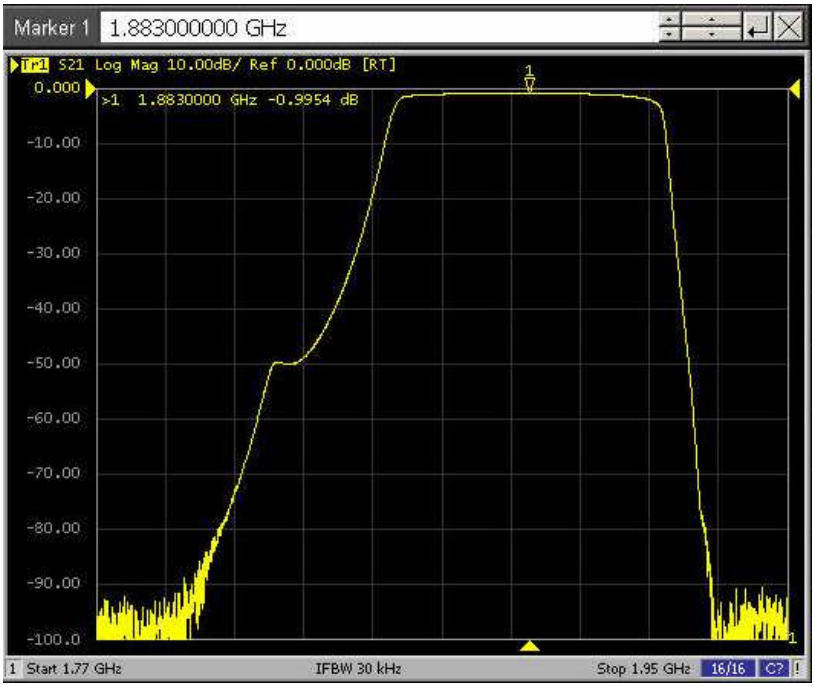
Measurement Uncertainty: +/-1,9 dB

Temperature: 24 °C

Relative Humidity: 55 %



Down-link



Up-link

Section 8. Test Equipment List

Identification number	*Description*	*Manufacturer model*	*s/n*	*Cal. Due*
1	Vector Signal Generator	Agilent H.P. E4438C	MY45094485	July 2010
2	Spectrum Analyzer	Agilent H.P. E4440A	US40420470	December 2009
3a	Network Analyzer	Agilent H.P E5062A	MY44101829	November 2012
3b	Network Analyzer	Hewlett Packard 8753D	3410A04850	March 2010
4	2xcables+directional coupler+dummyload			

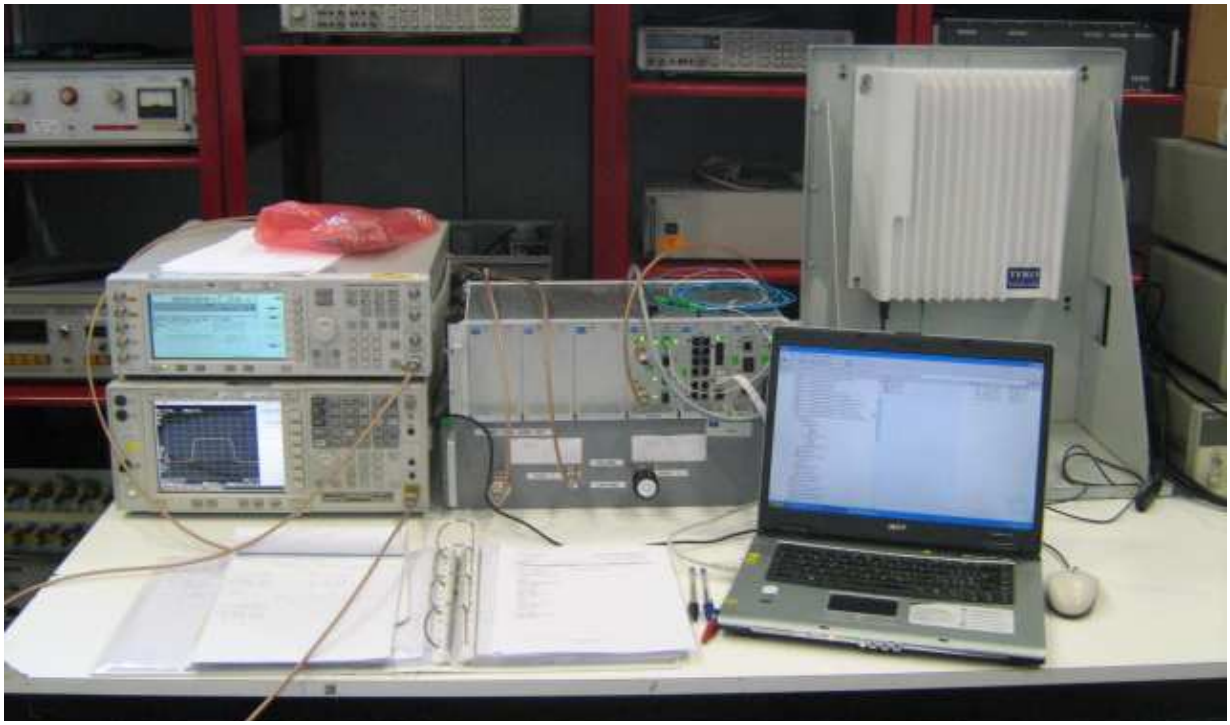
Client's property

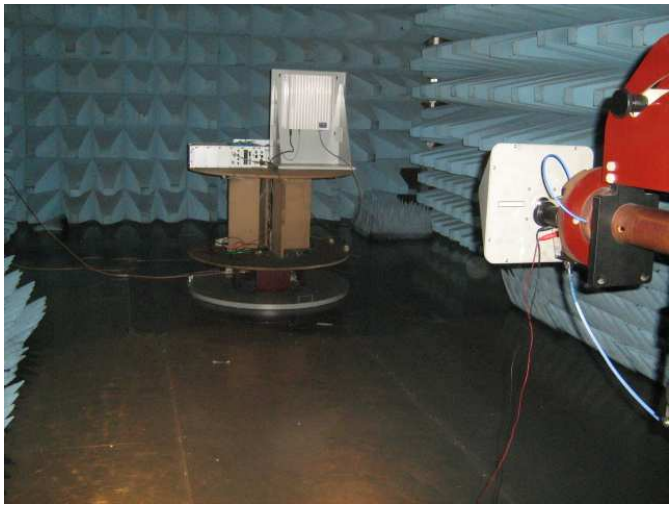
Coupling Factor 2xcables+directional coupler+dummyload	PCS	UL 1882.5 DL 1962.5	33.1 dB 33.3 dB	

Identification number	***Equipment***	***Manufacturer***	***Model***	***Serial N°***	***Cal. due***
5	Trilog Broadband Antenna	Schwarzbeck	VULB 9163	VULB 9163-286	04/2010
6	Bilog antenna	Schwarzbeck	STLP 9148-123	123	09/2011
7	Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	05/2011
8	Spectrum Analyzer 9kHz-40GHz	R&S	FSEK	848255/005	09/2010
9	Controller	EMCO	2090	9511-1099	NSC
10	Antenna Tower	EMCO	2071-2	9601-1940	NSC
11	Turning table Controller	EMCO	1061-1.521	9012-1508	NSC
12	Semi-anechoic chamber	Nemko	3m semi-anechoic chamber	70	04/2010
13	Trilog Broadband Antenna	Siemens	3m control room	3	NSC

Section 9. PHOTOS

SETUP





REMOTE

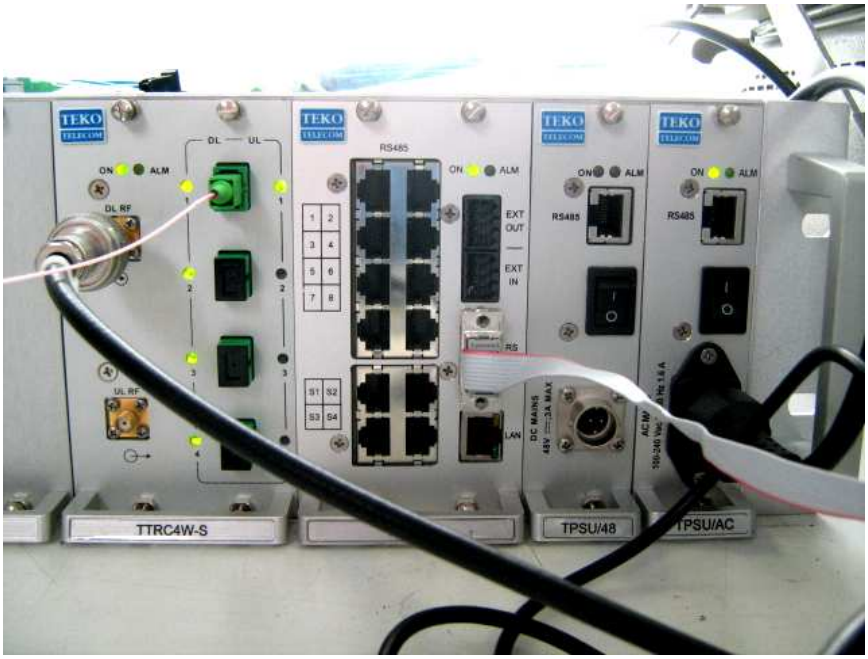

TEKO
TELECOM


TEKO
TELECOM
MADE IN ITALY
Model: TRU8A19AWWL/AC-WS
Frequency 824 ÷ 894MHz
Range: 1850 ÷ 1995MHz
1710 ÷ 2155MHz


CLASS 1
LASER PRODUCT
AC MAINS
(100-240V~; 50-60Hz; 1.5A)

MASTER


28V ⎓ ; 10A MAX
+ −
RS485


TEKO TELECOM
DL
UL
ON
ALM
DL RF
UL RF
RS485
EXT OUT
EXT IN
LAN
TTRC4W-S
TPSU/48
TPSU/AC

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.

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.

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= 100 kHz
Span: 10 MHz
Sweep: Auto

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: ≥ 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: ≥ RBW
Sweep: Auto
Video Avg: Disabled

TDMA

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

W-CDMA

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 100 kHz (< 1MHz from Band Edge)
VBW: ≥ 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

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-603-1992

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 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.

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

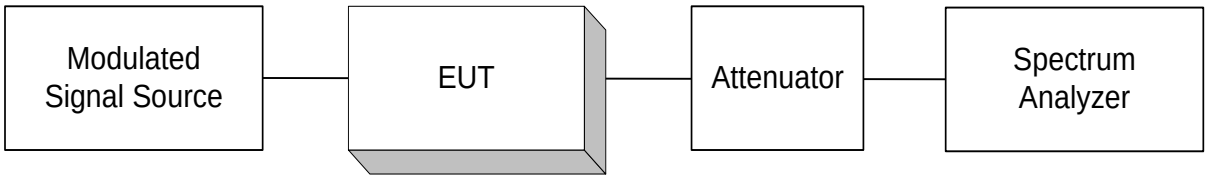
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the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

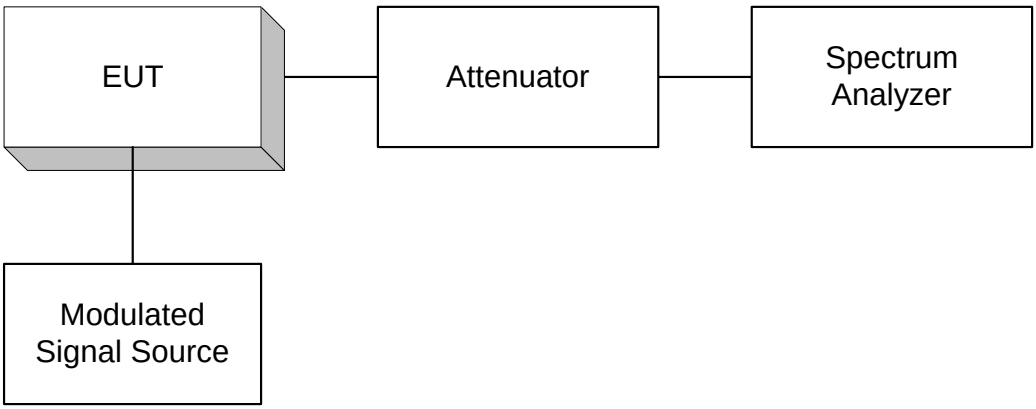
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

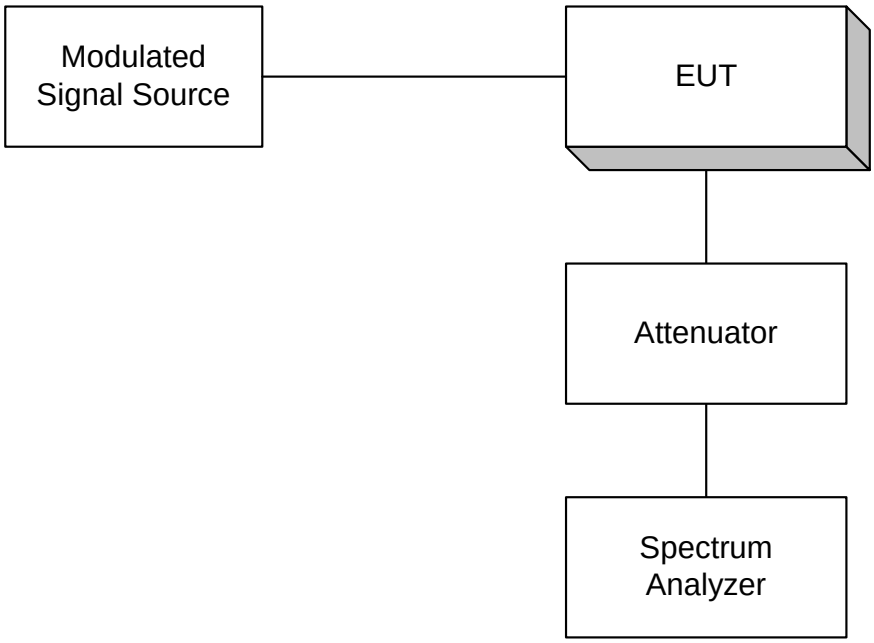
Para. No. 2.985 - R.F. Power Output



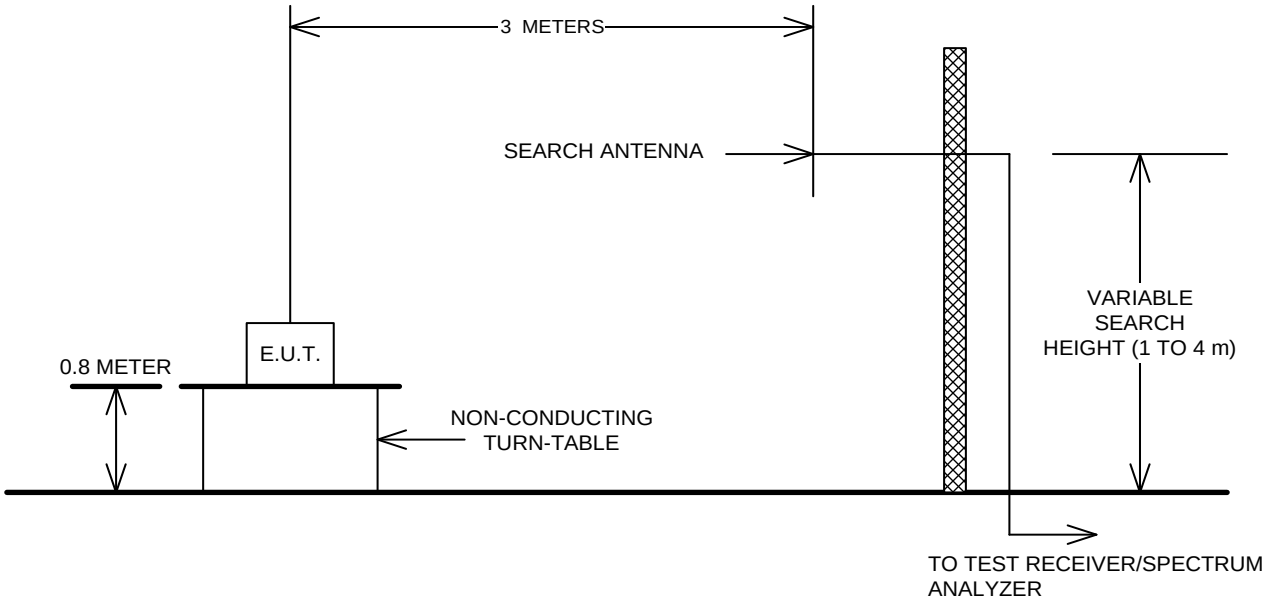
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability