



Nemko Test Report: 5L0403RUS1rev2

Applicant: Nokia, Inc.

**Equipment Under Test:
(E.U.T.)** 6155i

In Accordance With: **FCC Part 22, Subpart H**
Cellular Band Subscriber Services

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

Authorized By:

A handwritten signature in blue ink, appearing to read 'Tom Tidwell', is positioned above the printed name.

Tom Tidwell, Frontline Group Manager

Date: 22 September, 2005

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Section 1. Summary of Test Results

Manufacturer: Nokia, Inc.

Model No.: 6155i

Type: B3.0

Serial No.: 044/13202978

General: All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 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. None.

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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	2.1046	Not Tested
Audio Frequency Response	2.1047	Not Tested
Audio Low Pass Filter Response	2.1047	Not Tested
Modulation Limiting	2.1047	Not Tested
Occupied Bandwidth	2.1049	Complies
Spurious Emissions at Antenna Terminals	2.1051	Complies
Field Strength of Spurious Emissions	2.1053	Complies
Frequency Stability	2.1055	Complies

Footnotes

:

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

.

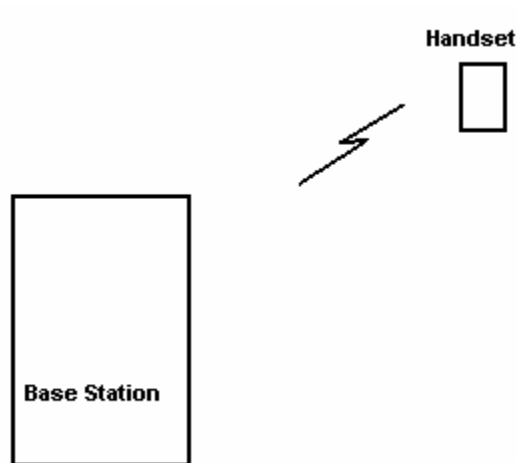
Section 2. General Equipment Specification

Frequency Range:	824.04 to 848.97 MHz
Tunable Bands:	824.04 to 849.97 MHz
Necessary Bandwidth:	1.25 MHz CDMA 40 kHz Analog
Emission Designator:	1M25F9W 40KF8W \ 40K0F1D
Output Impedance:	50 ohms
Operator Selection of Frequency:	Software Controlled
Power Output Adjustment Capability:	Software Controlled

Operational Description

The phone is a dual band CDMA phone operating in the 800 MHz cellular band and 1900 PCS band. It also supports analog operation in the 800 MHz Band

System Diagram



Section 3. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: David Light	DATE: 7/25/2005

Test Results: [Complies.](#)

Test Data: [See attached plots](#)

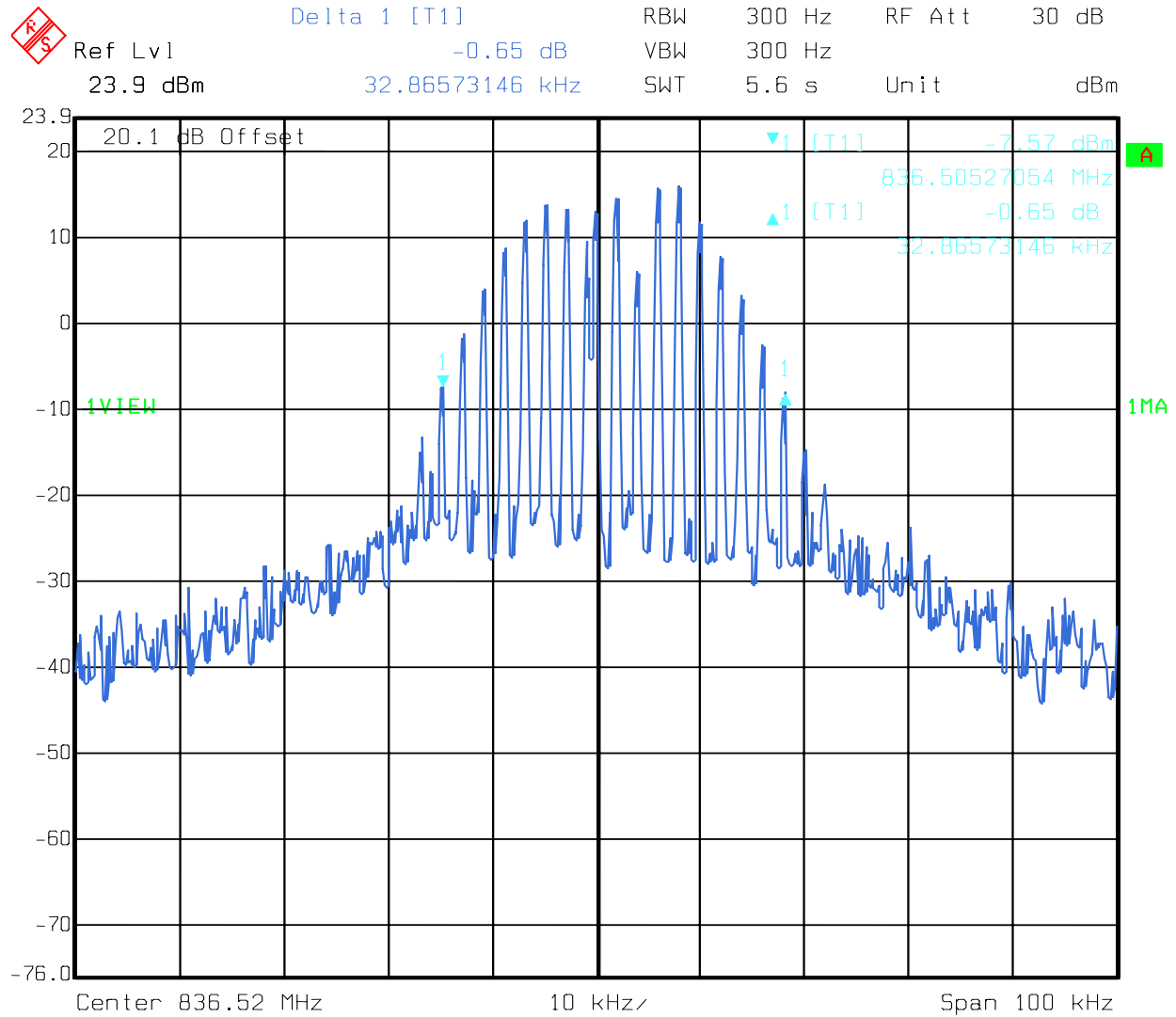
Equipment Used: [1082-1472-1659-1464](#)

Measurement Uncertainty: [+/- 1.6](#) dB

Temperature: [22](#) °C

Relative Humidity: [45](#) %

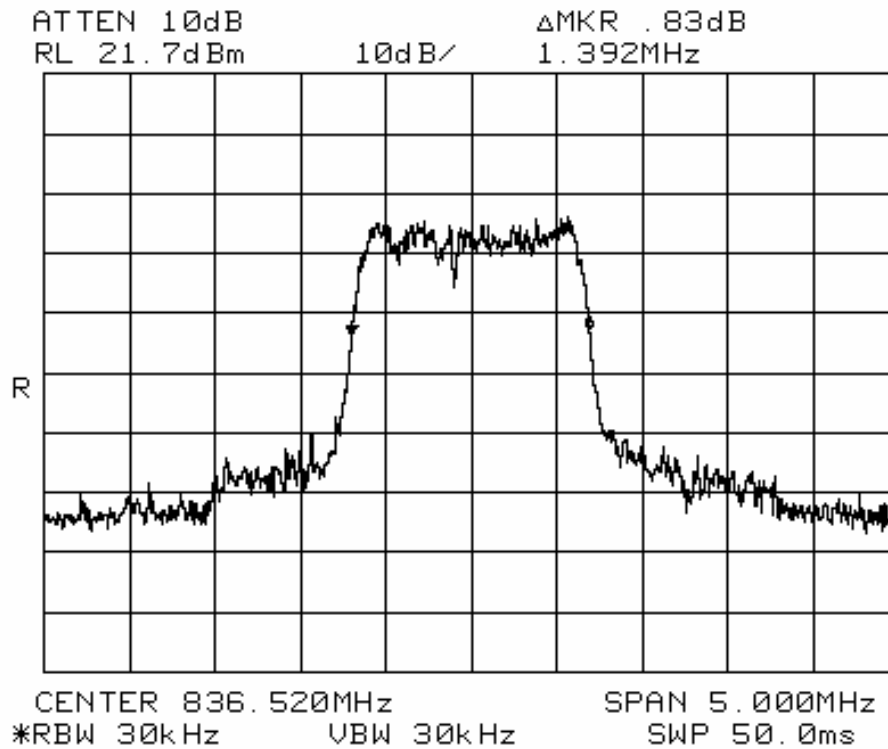
Test Data – Occupied Bandwidth (Voice & SAT)



Date: 26.SEP.2005 10:57:15

2 kHz AF + 6 kHz SAT

Test Data – Occupied Bandwidth (CDMA)



Section 4. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 8/2/2005

Test Results: [Complies.](#)

Test Data: [See attached plots](#)

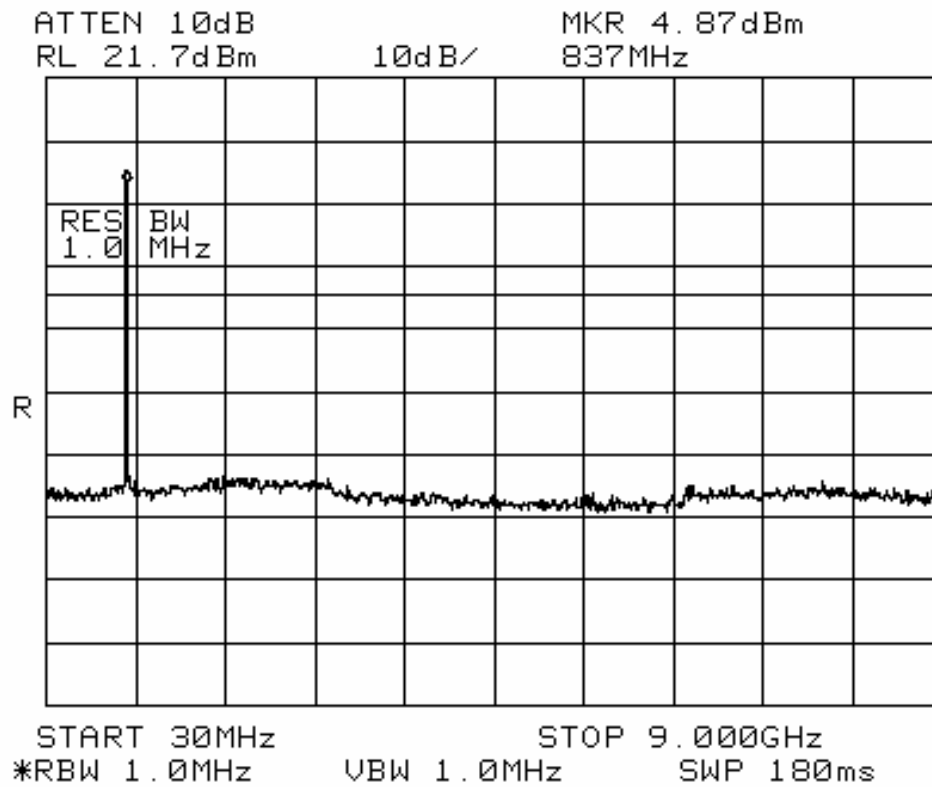
Equipment Used: [1082-1472-1464-1659](#)

Measurement Uncertainty: [+/- 1.6](#) dB

Temperature: [22](#) °C

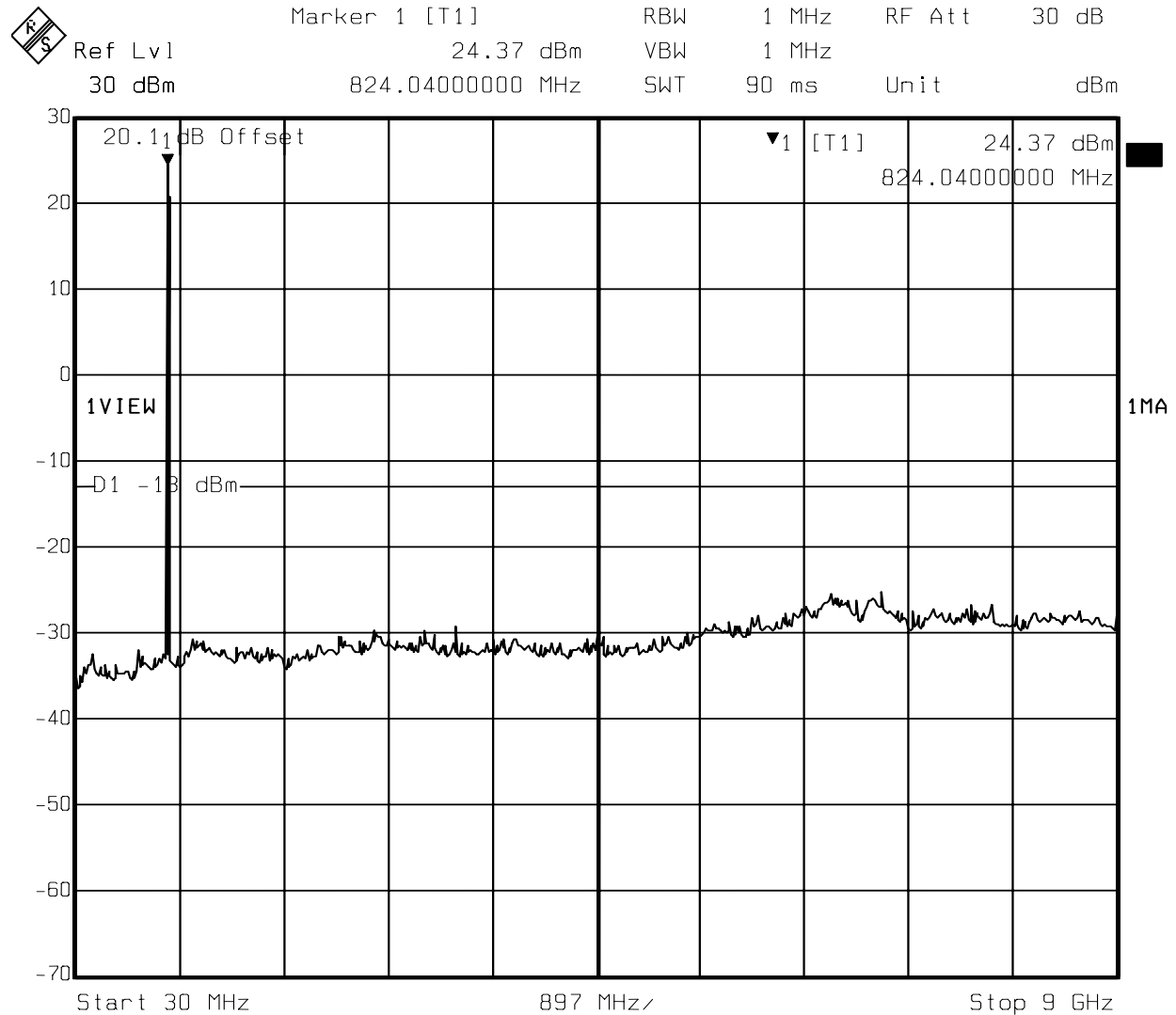
Relative Humidity: [45](#) %

Test Data – Spurious Emissions (Analog)



Channel 384

Test Data – Spurious Emissions (Analog)



Date: 26.SEP.2005 09:50:28

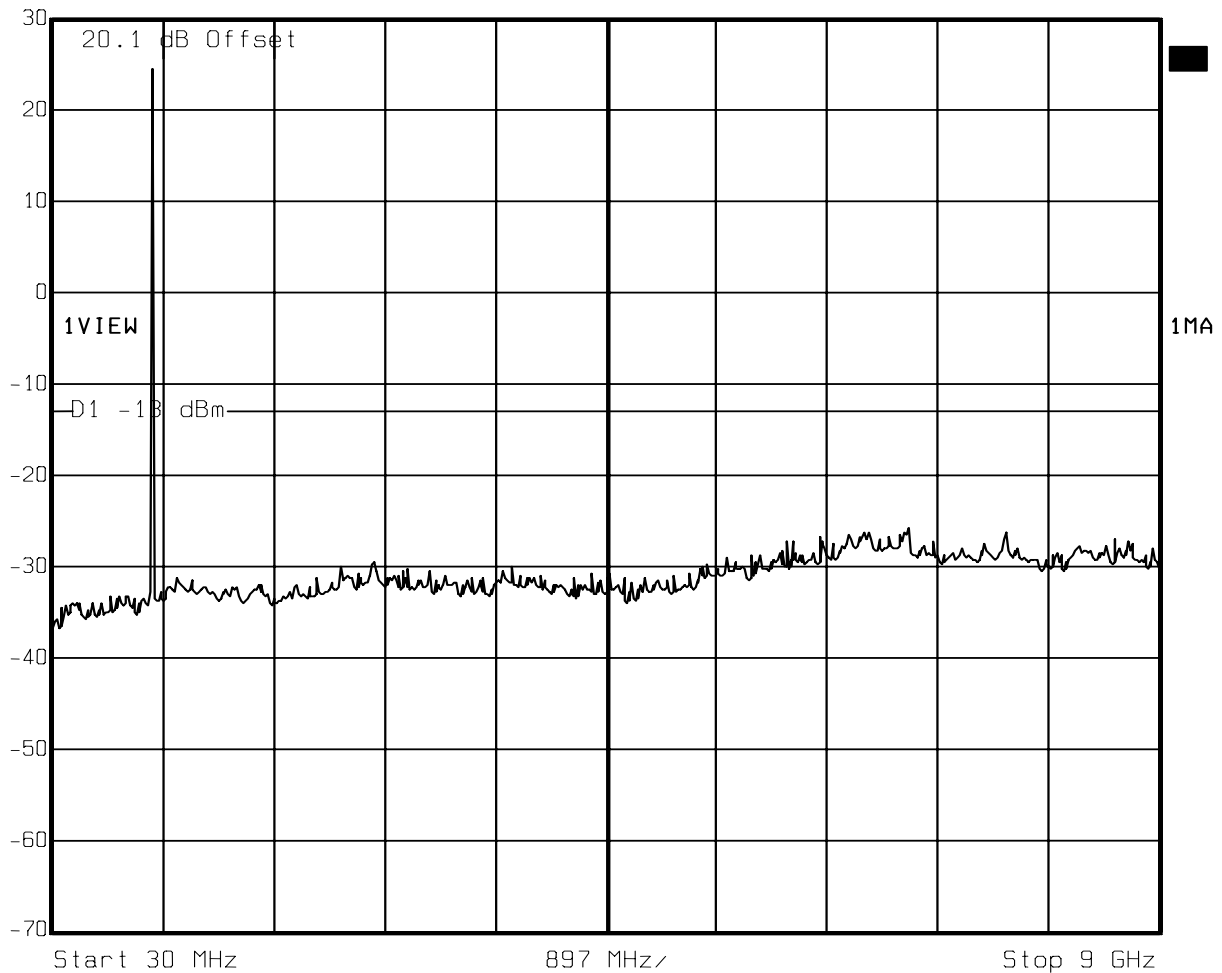
Channel 991

Test Data – Spurious Emissions (Analog)



Ref Lvl
30 dBm

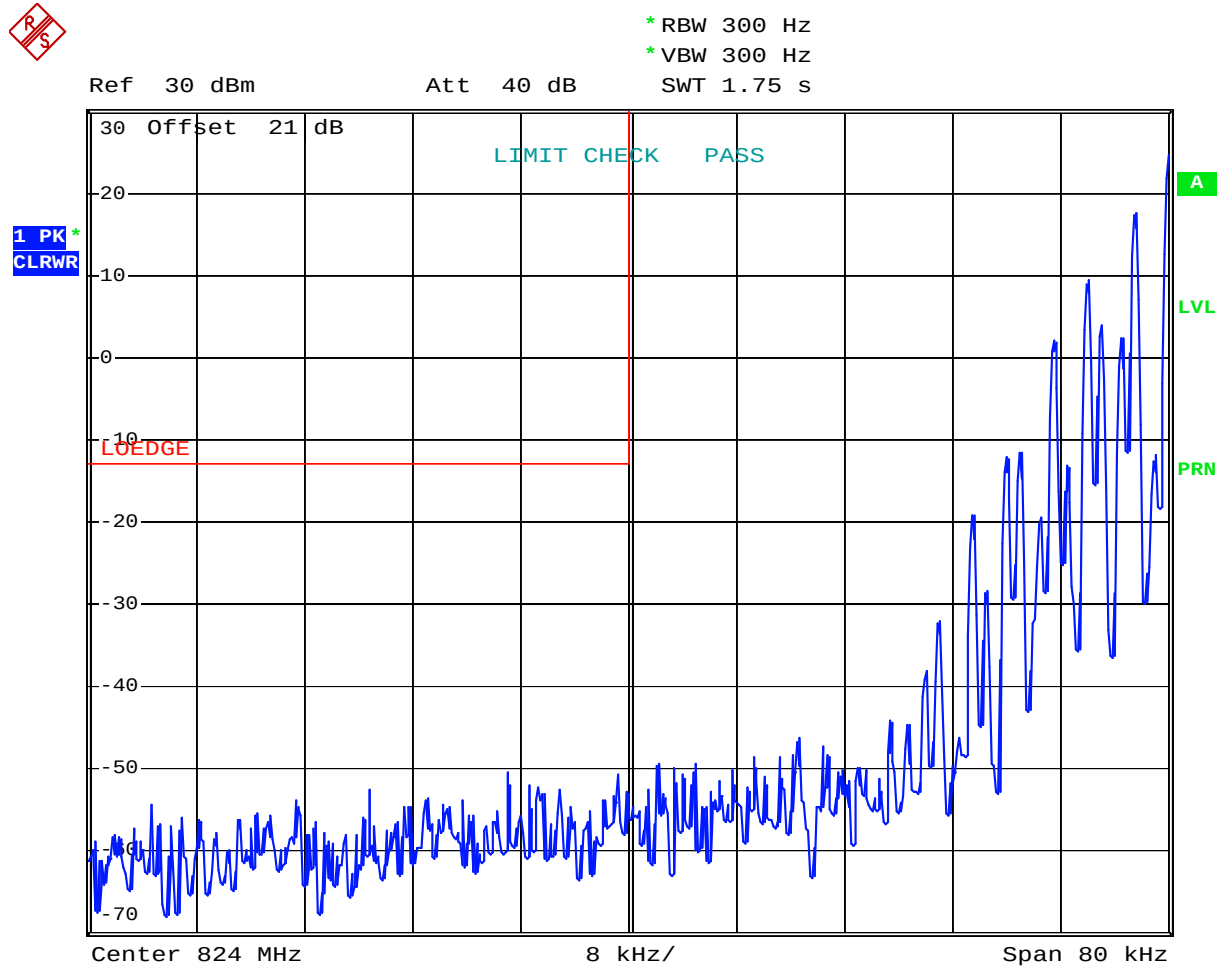
RBW 1 MHz RF Att 30 dB
VBW 1 MHz
SWT 90 ms Unit dBm



Date: 26.SEP.2005 10:03:49

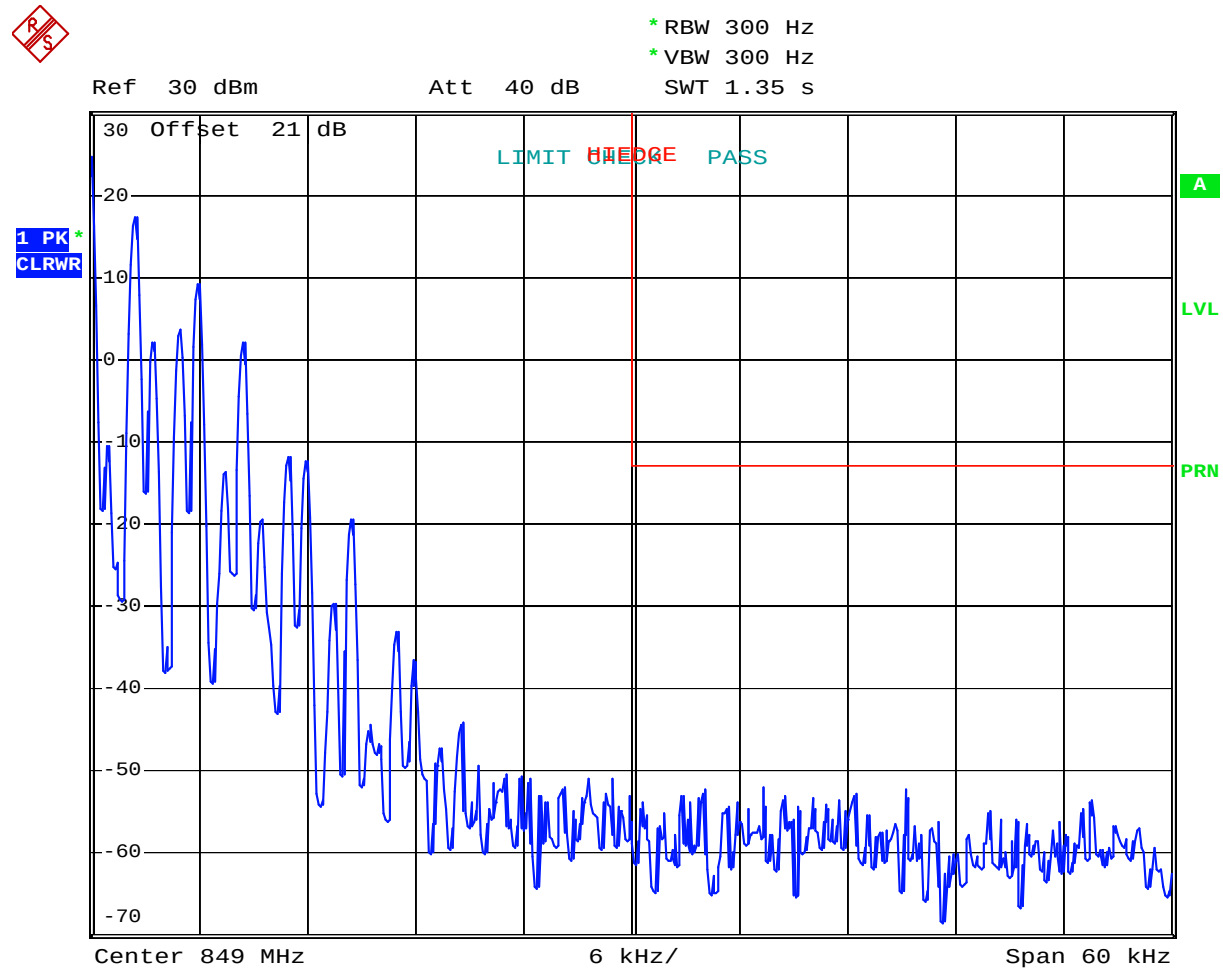
Channel 799

Test Data – Spurious Emissions (Analog)



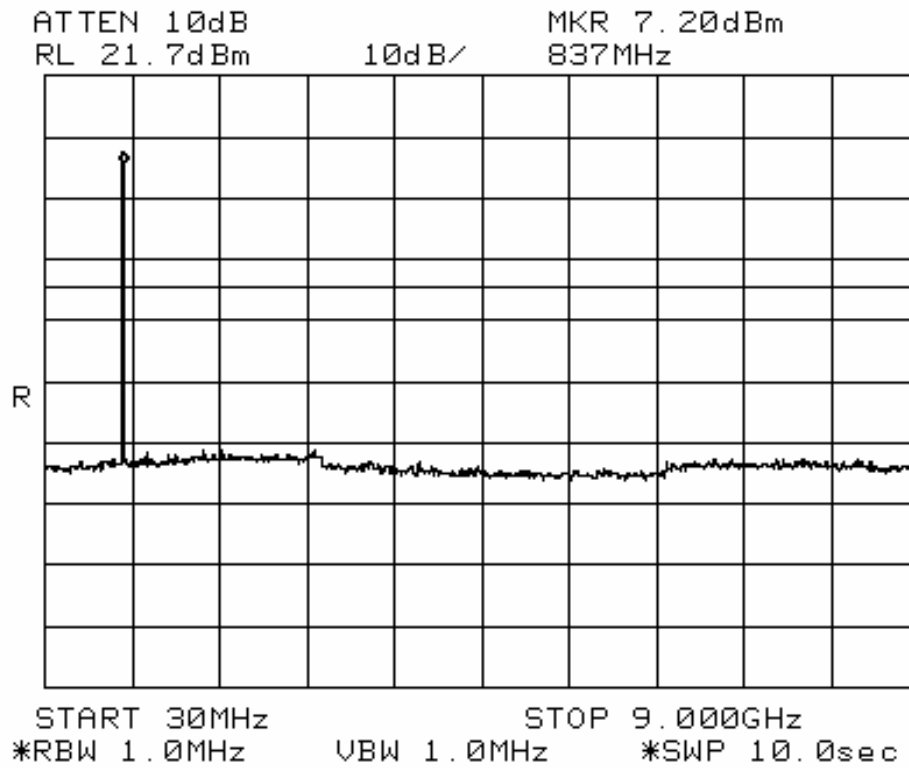
Date: 2.AUG.2005 15:51:14
Channel 991

Test Data – Spurious Emissions (Analog)



Date: 2.AUG.2005 15:48:39
Channel 799

Test Data – Spurious Emissions (CDMA)



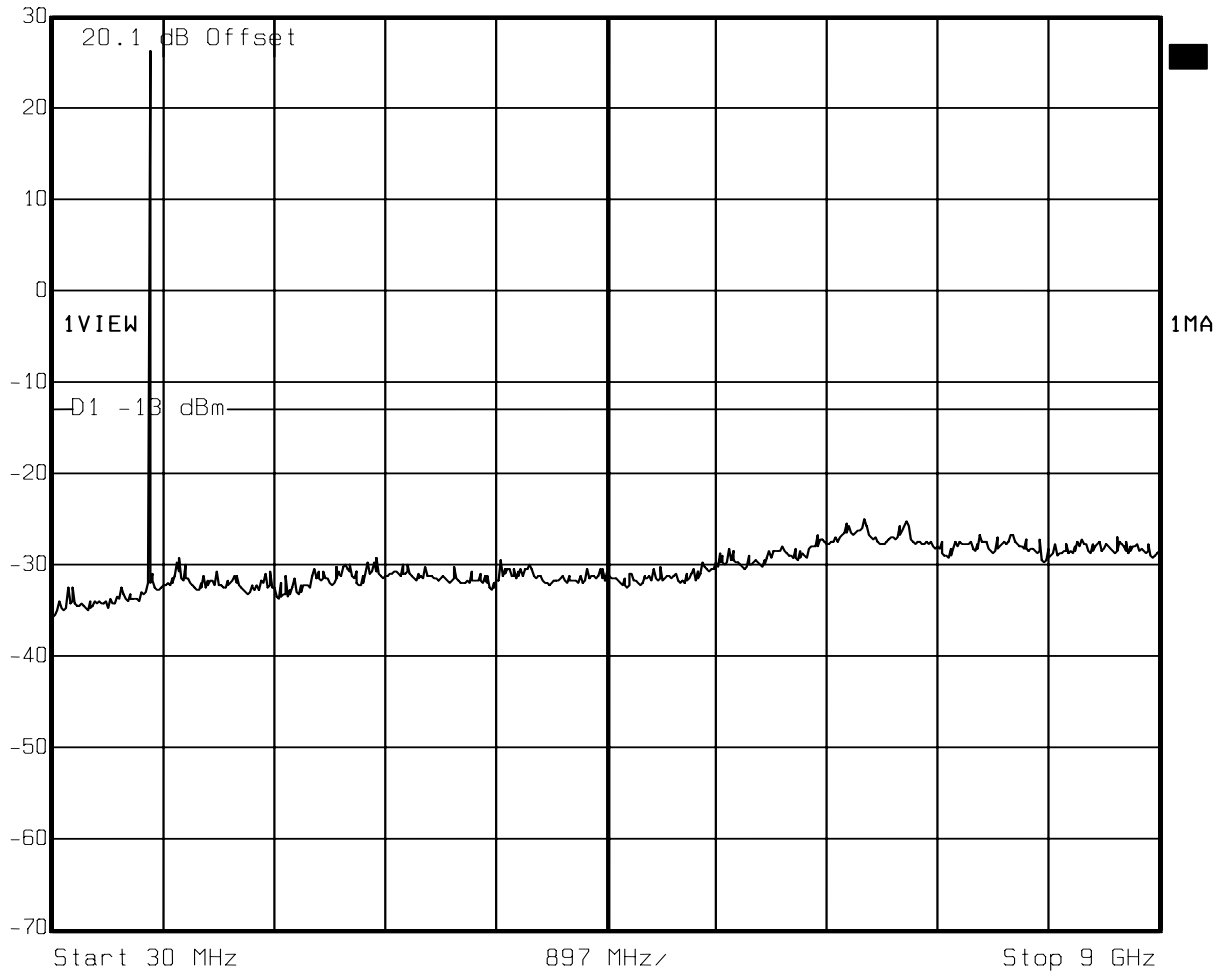
Channel 384

Test Data – Spurious Emissions (CDMA)



Ref Lvl
30 dBm

RBW 1 MHz RF Att 30 dB
VBW 1 MHz
SWT 90 ms Unit dBm



Date: 26.SEP.2005 10:07:14

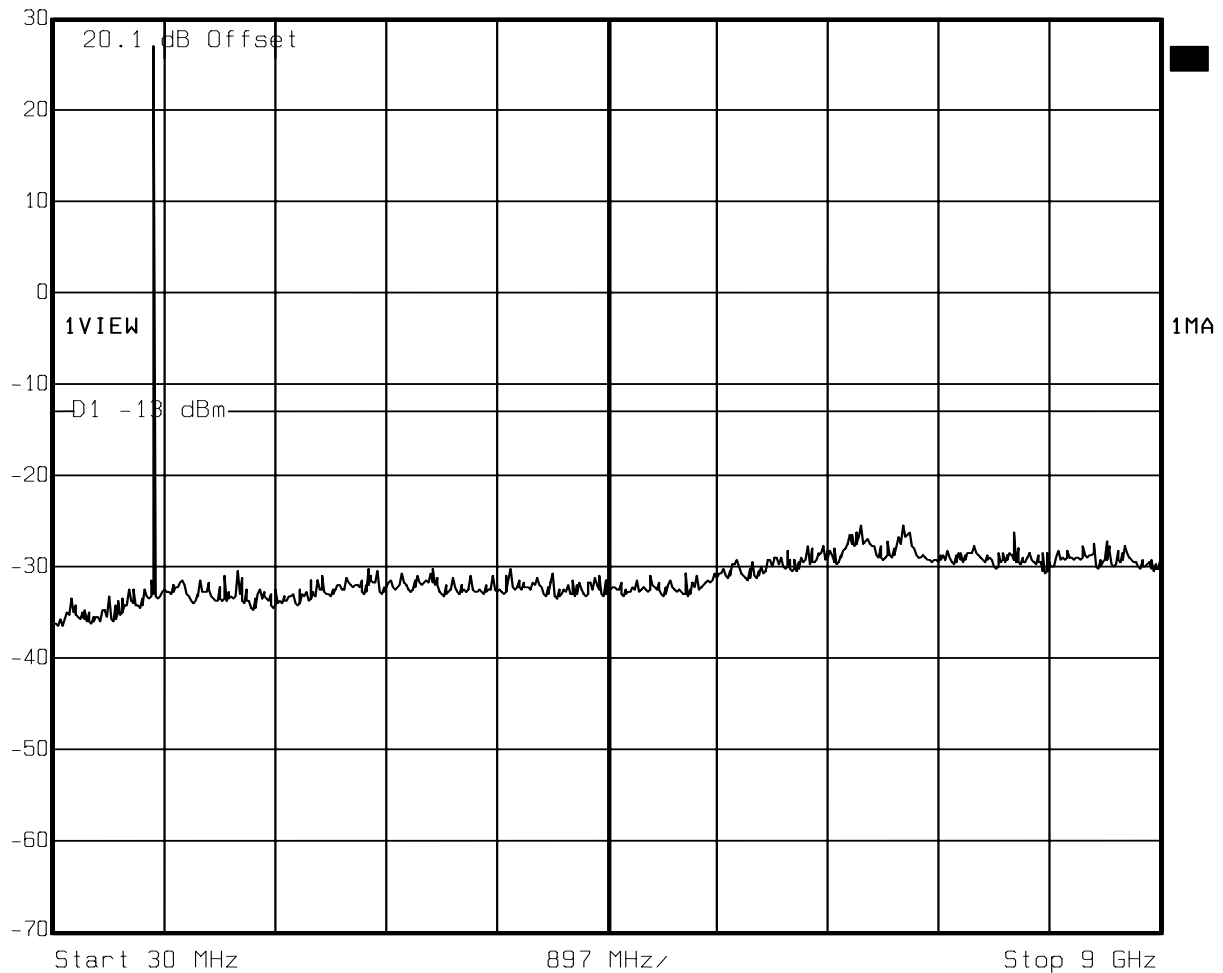
Channel 1013

Test Data – Spurious Emissions (CDMA)



Ref Lvl
30 dBm

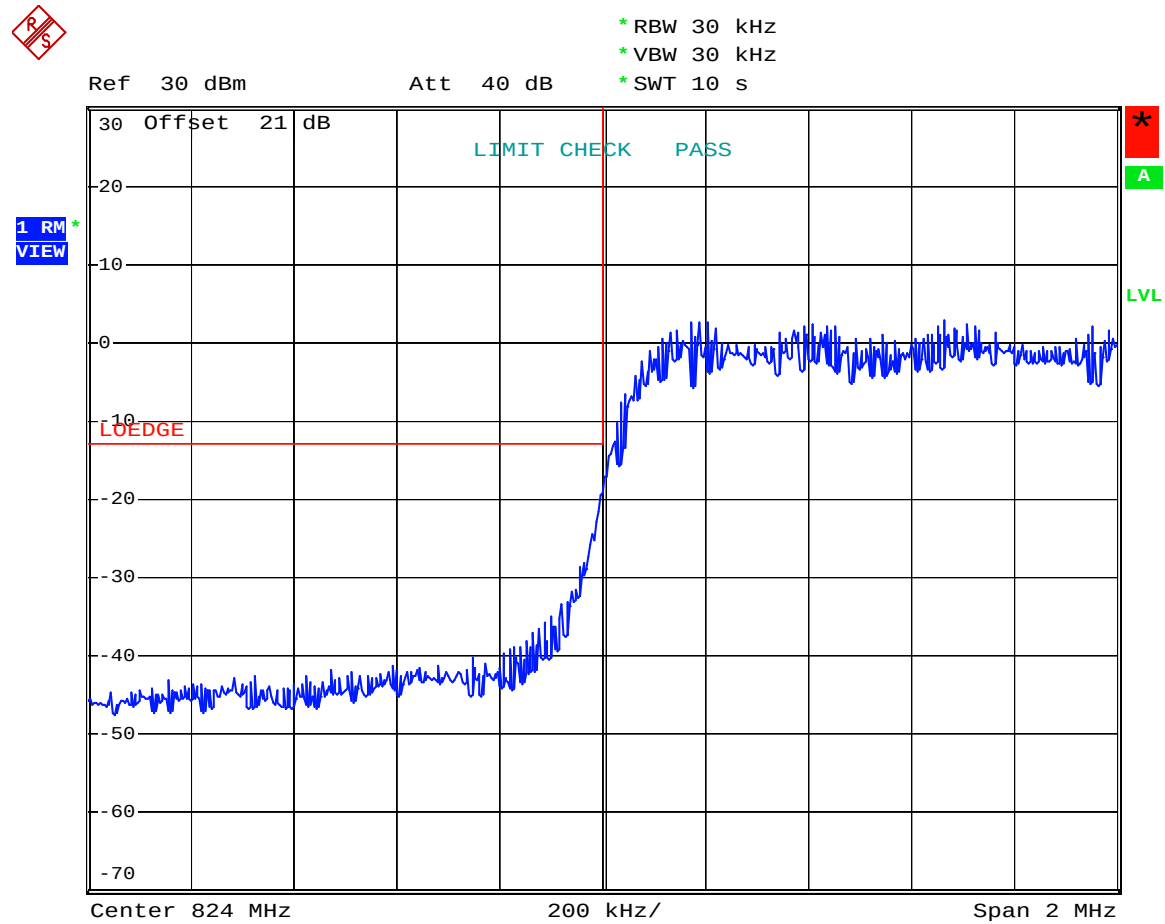
RBW 1 MHz RF Att 30 dB
VBW 1 MHz
SWT 90 ms Unit dBm



Date: 26.SEP.2005 10:18:54

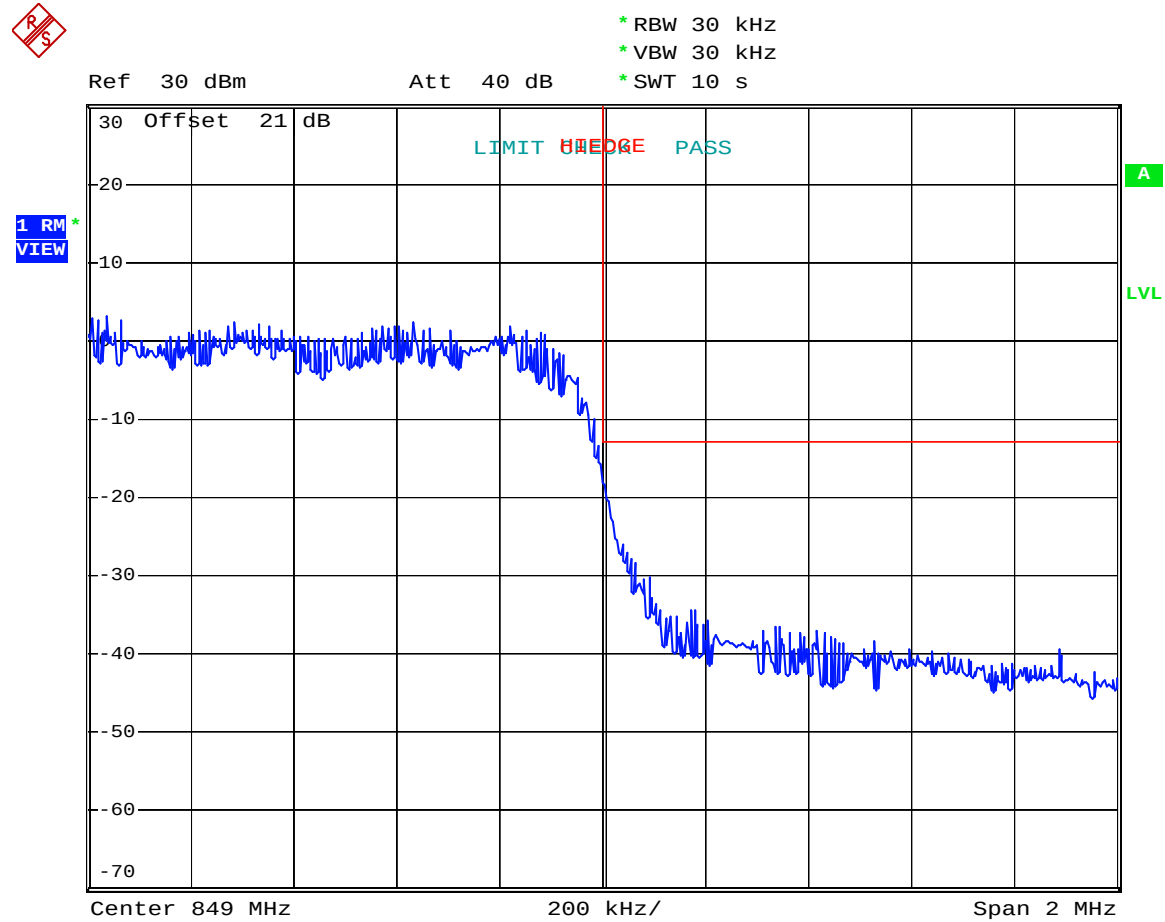
Channel 777

Test Data – Spurious Emissions (CDMA)



Channel 1013

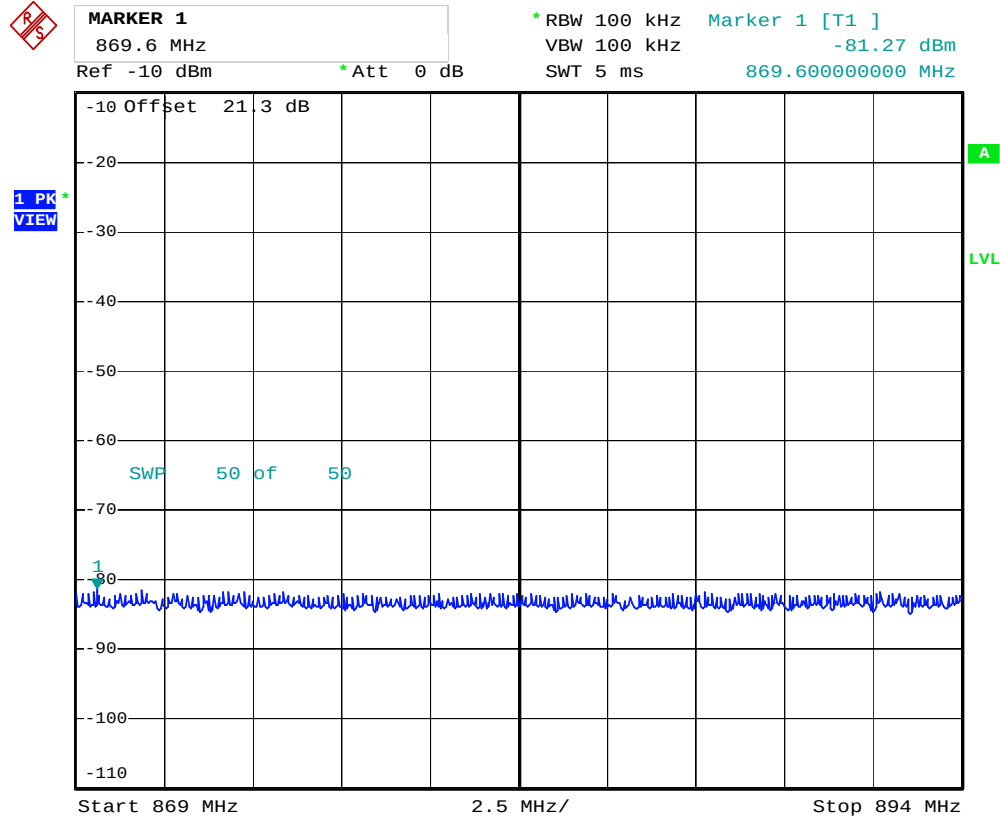
Test Data – Spurious Emissions (CDMA)



Channel 777

Test Data – Spurious Emissions in Rx Band

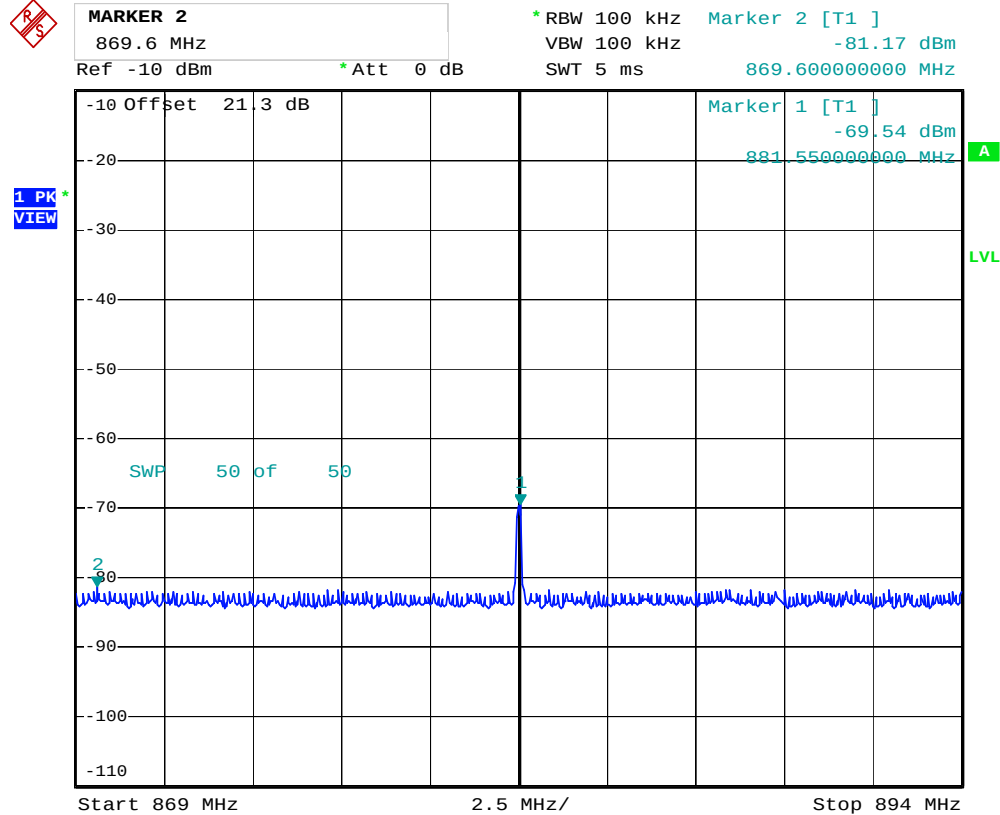
CDMA Mode



22.917
Channel 384

Test Data – Spurious Emissions in Rx Band

Analog mode



22.917

Marker 1 is from base station simulator

Marker 2 is highest emission

Channel 384

Section 5. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious	PARA. NO.: 2.1053
TESTED BY: David Light	DATE: 8/9/2005

Test Results: Complies. There were no emissions detected above the noise floor. The spectrum was searched from 30 MHz to 9 GHz.

Test Data: There were no emissions detected above the noise floor. The spectrum was searched from 30 MHz to 9 GHz. The highest noise floor reading was -26 dBm @ 1673.04 MHz. All other noise floor readings were greater than 20 dBc below the specification limit of -13 dBm ERP

The handset was tested on three orthogonal axis'. The upright position pictured was determined to be worse case.

Equipment Used: 1304-1016-1481-1464-1484-1485

Measurement Uncertainty: +/- 1.7 dB

RBW=VBW=1 MHz: CDMA Mode
RBW=VBW= 1 kHz Analog Mode

Temperature: 22 °C

Relative Humidity: 45 %

Test Setup Photo



Section 6. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY:	DATE:

Test Results: [Complies.](#)

Test Data: [See attached table.](#)
Standard Test Frequency: [836.52](#) MHz
Standard Test Voltage: [3.7](#) Vdc

Equipment Used: [1082-619-283-HP8924C](#)

Measurement Uncertainty: [+/- 1 x 10⁻⁷](#) ppm

Temperature: [22](#) °C

Relative Humidity: [45](#) %

Test Data – Frequency Stability Analog

<u>Frequency Stability</u>							
Page <u>1</u> of <u>1</u>							
Job No.: 5L0403		Date: 8/3/2005					
Specification: PT22		Temperature(°C): <u>22</u>					
Tested By: <u>David Light</u>		Relative Humidity(%) <u>45</u>					
E.U.T.: <u>6155i</u>							
Configuration: <u>Tx - Linked to base station - Analog mode</u>							
Sample Number: <u>1</u>							
<u>Test Equipment Used</u>							
Antenna: _____		Directional Coupler: _____					
Pre-Amp: _____		Cable #1: _____					
Filter: _____		Cable #2: _____					
Receiver: <u>HP8924C</u>							
Attenuator #1: <u>1082</u>							
Attenuator #2: _____							
Measurement Uncertainty: <u>1x10⁻¹⁷ ppm</u>		Standard Test Frequency <u>836.520000</u> MHz					
Temp (°C)	Measured Frequency (MHz)	Rho	Test Voltage	Frequency Error (Hz)	Limit (+/-Hz)	Error (ppm)	Comment
20	836.520130		3.7	130	836.5	0.2	
20	836.520130		4.3	130	836.5	0.2	
20	836.520129		2.9	129	836.5	0.2	
50	836.520200		3.7	200	836.5	0.2	
40	836.520185		3.7	185	836.5	0.2	
30	836.520200		3.7	200	836.5	0.2	
10	836.520212		3.7	212	836.5	0.3	
0	836.520205		3.7	205	836.5	0.2	
-10	836.520200		3.7	200	836.5	0.2	
-20	836.520215		3.7	215	836.5	0.3	
-30					836.5		
Notes: The handset ceased operation at -20 degrees C.							

Test Data – Frequency Stability CDMA

<u>Frequency Stability</u>							
Page <u>1</u> of <u>1</u>							
Job No.: 5L0403		Date: 8/3/2005					
Specification: PT22		Temperature(°C): <u>22</u>					
Tested By: David Light		Relative Humidity(%) <u>45</u>					
E.U.T.: 6155i							
Configuration:		Tx - Linked to base station - CDMA mode					
Sample Number: 1							
<u>Test Equipment Used</u>							
Antenna: _____		Directional Coupler: _____					
Pre-Amp: _____		Cable #1: _____					
Filter: _____		Cable #2: _____					
Receiver: HP8924C							
Attenuator #1: 1082							
Attenuator #2: _____							
Measurement Uncertainty: 1×10^{-17} ppm		Standard Test Frequency <u>836.520000</u> MHz					
Temp (°C)	Measured Frequency (MHz)	Rho	Test Voltage	Frequency Error (Hz)	Limit (+/-Hz)	Error (ppm)	Comment
20	836.520002	0.994	3.7	2	836.5	0.0	
20	836.520002	0.990	4.3	2	836.5	0.0	
20	836.520002	0.995	2.9	2	836.5	0.0	Battery end point
50	836.520003	0.995	3.7	3	836.5	0.0	
40	836.520002	0.995	3.7	2	836.5	0.0	
30	836.520002	0.992	3.7	2	836.5	0.0	
10	836.520004	0.994	3.7	4	836.5	0.0	
0	836.520003	0.996	3.7	3	836.5	0.0	
-10	836.520004	0.996	3.7	4	836.5	0.0	
-20	836.520002	0.995	3.7	2	836.5	0.0	
-30					836.5		
Notes: The handset ceased operation at -20 degrees C.							

Section 7. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/04	11/12/05
1482	Band Pass Filter	K & L 11SH10-4000/T12000-0/0	2	Cal B4 Use	N/A
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/14/05	01/15/07
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	08/26/04	08/26/05
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	08/02/04	08/02/05
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
Nokia	Cell Site Simulator	HP 8924C	US38283285	07/18/05	07/18/07
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	09/16/04	09/16/05
619	THERMOMETER	FLUKE 51	4520028	09/16/04	09/16/05

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:

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

NAME OF TEST: Occupied Bandwidth (Voice & SAT)

PARA. NO.: 2.1049

Minimum Standard: 22.917(c) The mean power of any emission removed from the carrier frequency by a displacement frequency (f_d in kHz) must be attenuated below the mean power of the unmodulated carrier (P) as follows:

- (i) On any frequency removed from the carrier frequency by more than 12 kHz but not more than 20 kHz:

at least $117 \log(f_d/12)$

- (ii) On any frequency removed from the carrier frequency by more than 20 kHz, up to the first multiple of the carrier frequency:

at least $100 \log(f_d/11)$ dB or $43 + 10 \log(P)$ dB, whichever is the lesser attenuation.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: 300 Hz

VBW: $\geq$ RBW

Span: 100 kHz

Sweep: Auto

Input Signal Characteristics (F3E/F3D):

RF level: Maximum recommended by manufacturer

AF1 frequency: 6 kHz

AF1 level: sufficient to produce 2 kHz deviation

AF2 frequency: 2.5 kHz

AF2 level: sufficient to produce 12 kHz deviation.

NAME OF TEST: Occupied Bandwidth (WB Data)

PARA. NO.: 2.1049

Minimum Standard: 22.917(c) The mean power of any emission removed from the carrier frequency by a displacement frequency (f_d in kHz) must be attenuated below the mean power of the unmodulated carrier (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but not more than 45 kHz:

at least 26 dB

(2) On any frequency removed from the carrier frequency by more than 45 kHz but not more than 90 kHz:

at least 45 dB

(3) On any frequency removed from the carrier frequency by more than 90 kHz, up to the first multiple of the carrier frequency:

at least 60 dB or $43 + 10 \log (P)$ dB, whichever is the lesser attenuation.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: 300 Hz

VBW: $\geq$ RBW

Span: 200 kHz

Sweep: Auto

Input Signal Characteristics:

RF level: Maximum recommended by manufacturer

AF1 frequency: 10 kHz, random bit sequence

AF1 level: sufficient to produce 8 kHz deviation

NAME OF TEST: Occupied Bandwidth (ST)

PARA. NO.: 2.1049

Minimum Standard: 22.917(c) The mean power of any emission removed from the carrier frequency by a displacement frequency (f_d in kHz) must be attenuated below the mean power of the unmodulated carrier (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but not more than 45 kHz:

at least 26 dB

(2) On any frequency removed from the carrier frequency by more than 45 kHz but not more than 90 kHz:

at least 45 dB

(3) On any frequency removed from the carrier frequency by more than 90 kHz, up to the first multiple of the carrier frequency:

at least 60 dB or $43 + 10 \log (P)$ dB, whichever is the lesser attenuation.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: 300 Hz

VBW: $\geq$ RBW

Span: 200 kHz

Sweep: Auto

Input Signal Characteristics:

RF level: Maximum recommended by manufacturer

AF1 frequency: 10 kHz tone

AF1 level: sufficient to produce 8 kHz deviation

NAME OF TEST: Occupied Bandwidth (Digital Modulation) PARA. NO.: 2.1049

Minimum Standard: Not defined by FCC. Input vs. Output.

Method Of Measurement:

Spectrum Analyzer Settings:

RBW: CDMA (30 kHz), GSM (30 kHz), NADC (1 kHz) and CDPD (1 kHz)

VBW: $\geq$ RBW

Span: As required

Sweep: Auto

Input Signal Characteristics:

RF level: Maximum recommended by manufacturer

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:

Spectrum Analyzer Settings:

RBW: 30 kHz (AMPS). As required for digital modulations.

VBW: $\geq$ RBW

Start Frequency: 0 MHz

Stop Frequency: 10 GHz

Sweep: Auto

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

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.

Calculation Of Field Strength Limit:

An example of attenuation requirement of $43 + 10 \log P$ is equivalent to -13 dBm (5×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi$$

For emissions ≤ 1 GHz:

$G = 1.64$ (Dipole Gain)

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

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

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

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

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

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

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

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

The spectrum is searched to 10 GHz.

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:

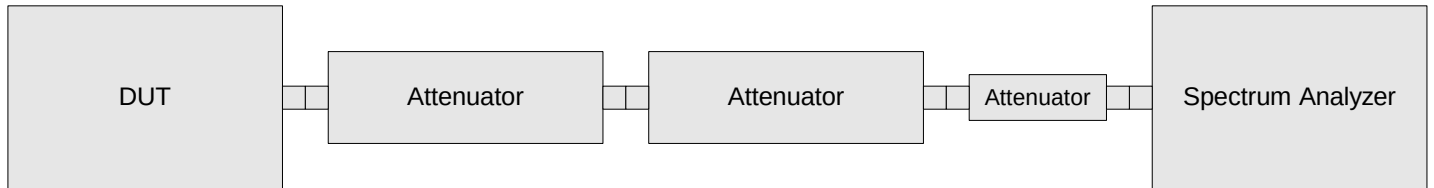
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref. in of the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

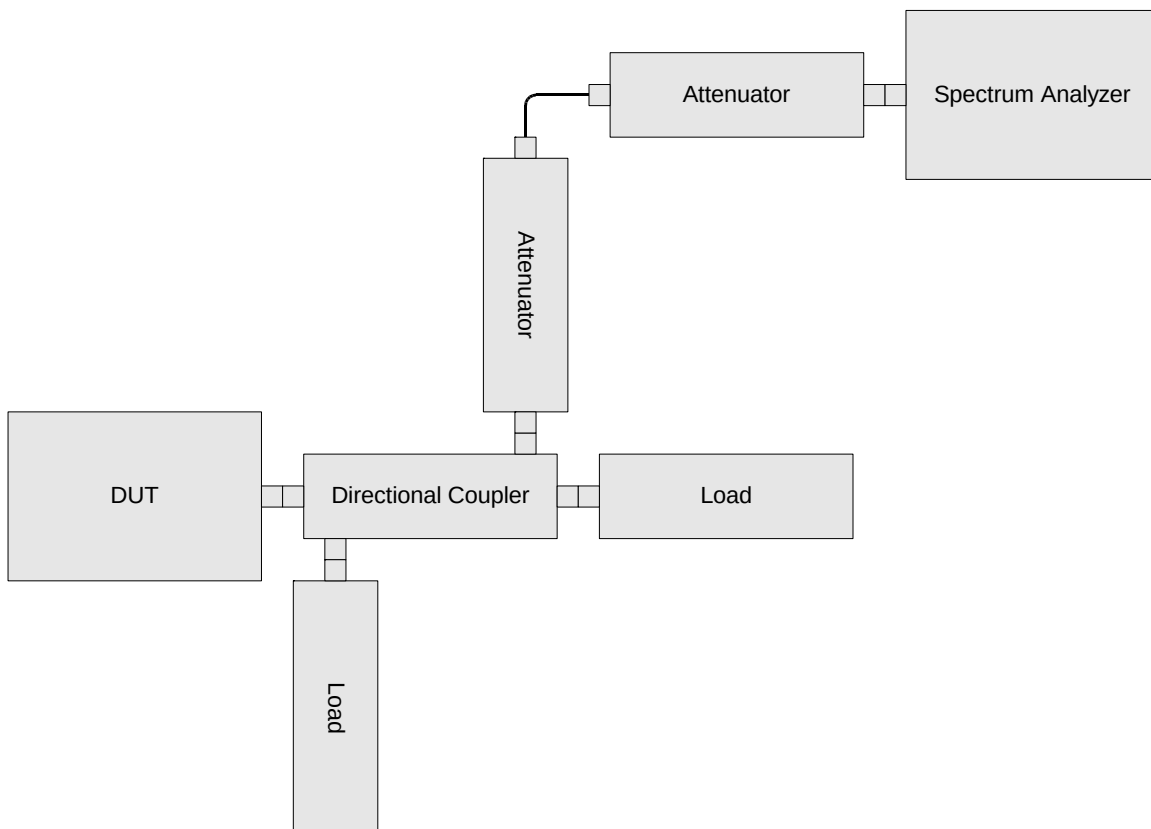
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

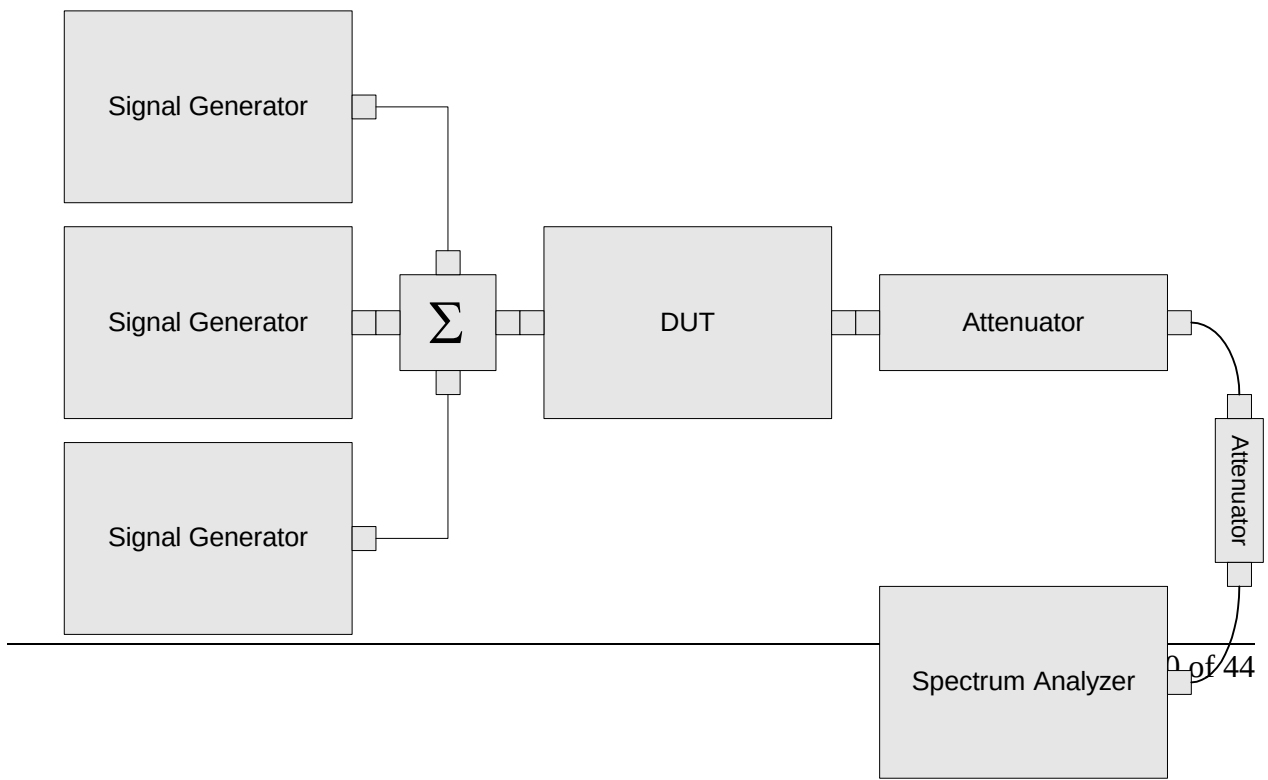
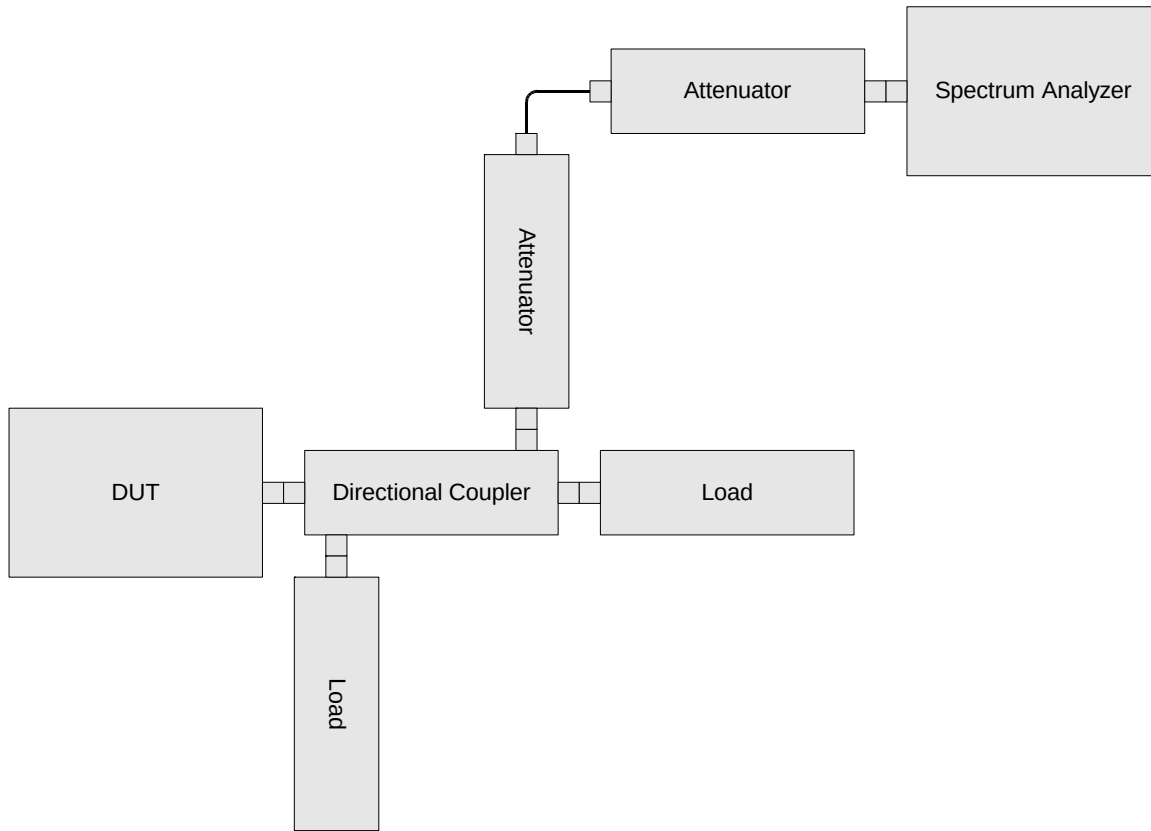
Para. No. 2.1046 - R.F. Power Output



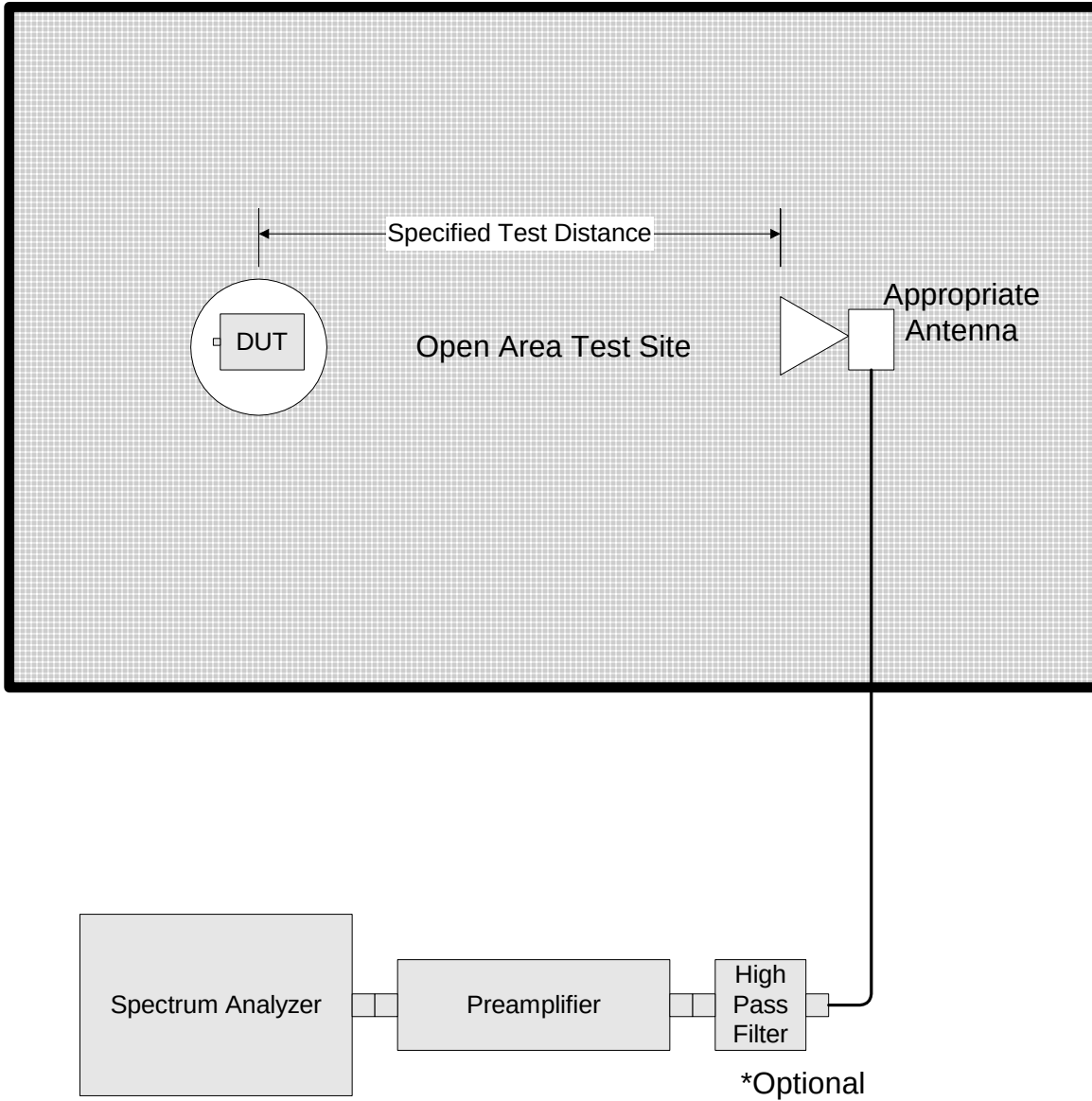
Para. No. 2.1049 - Occupied Bandwidth

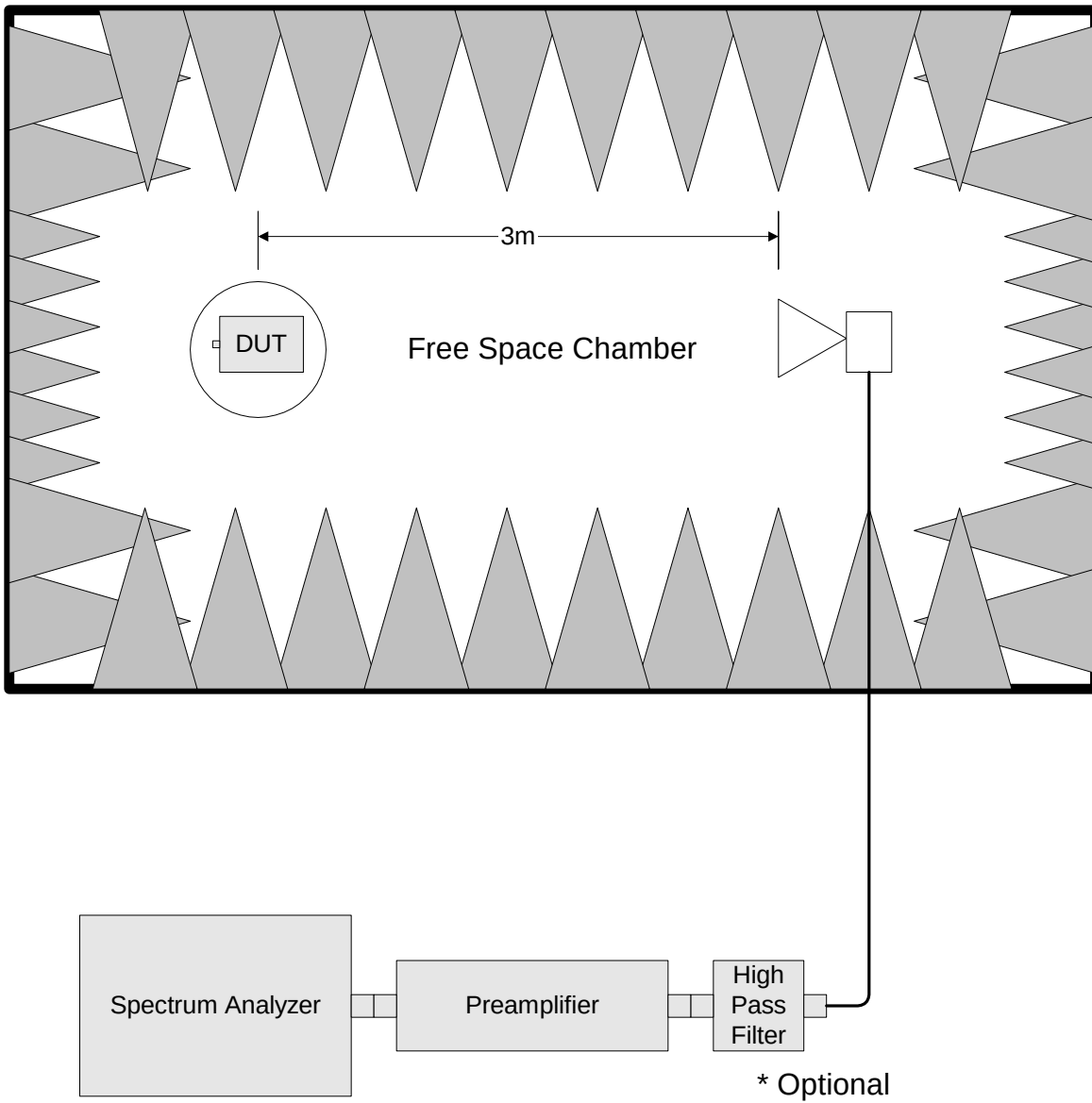


Para. No. 2.1051 Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Spurious Radiation





Para. No. 2.1055 - Frequency Stability

