



**Nemko Test Report:** 5L0403RUS1

**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:**   
Tom Tidwell, Frontline Group Manager

**Date:** 29 August, 2005

NVLAP LAB CODE: 100426-0



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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   |
| Occupied Bandwidth (WB Data & SAT)      | 2.1049    | Complies   |
| Occupied Bandwidth (ST)                 | 2.1049    | Complies   |
| Occupied Bandwidth (SAT)                | 2.1049    | Complies   |
| Occupied Bandwidth (SAT)                | 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  
40KF3E

Output Impedance: 50 ohms

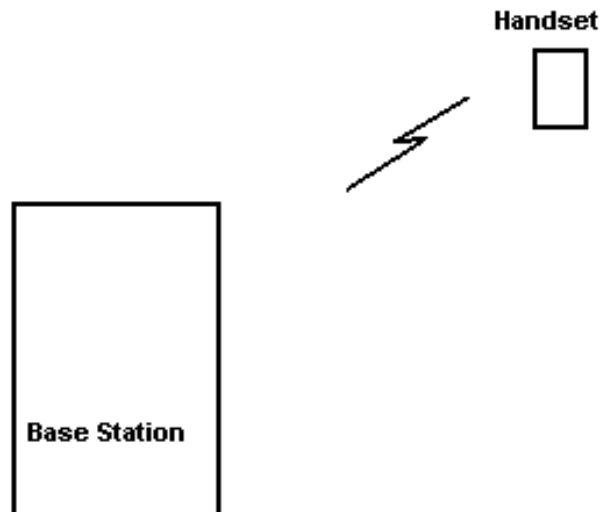
Operator Selection of Frequency: Software Controlled

|                                     |                     |
|-------------------------------------|---------------------|
| 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](#)

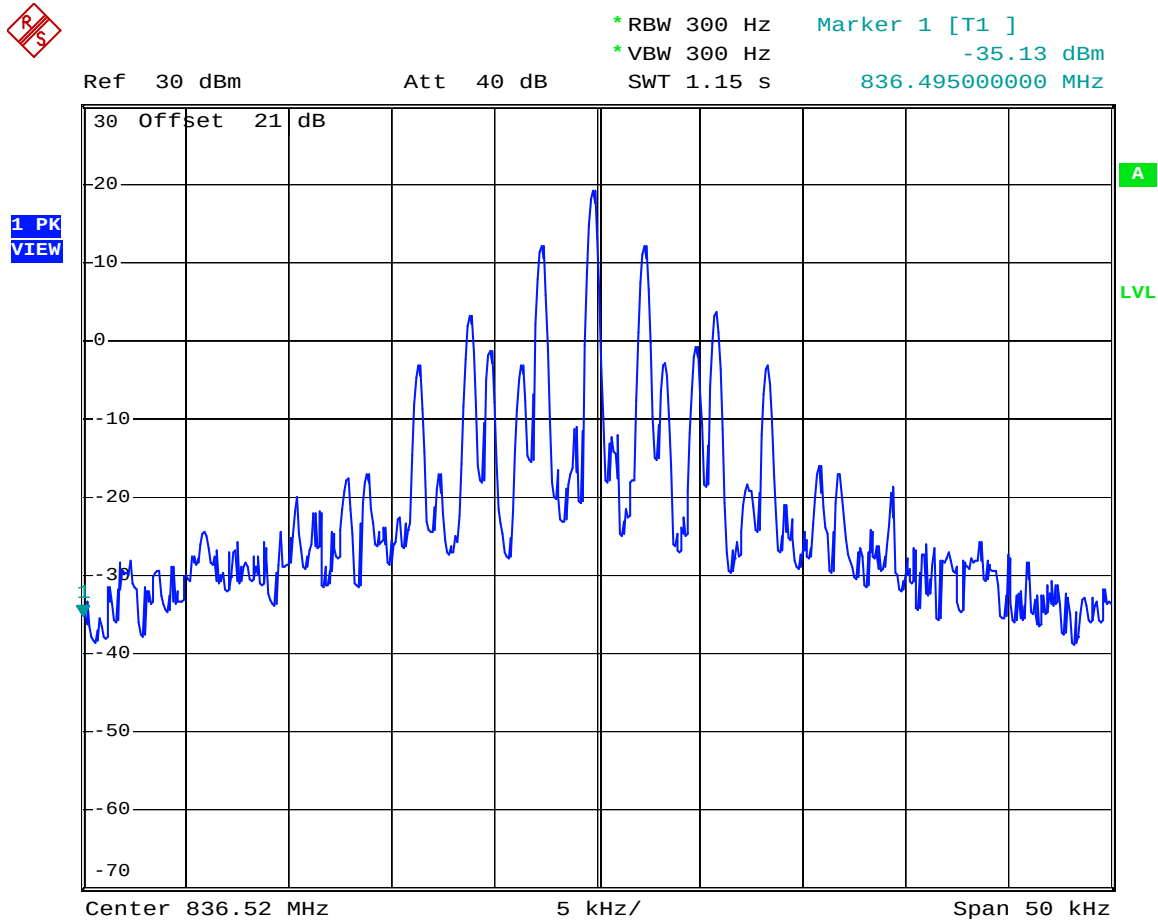
Equipment Used: [1082-1472-1659-1464](#)

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

Temperature: [22](#) °C

Relative Humidity: [45](#) %

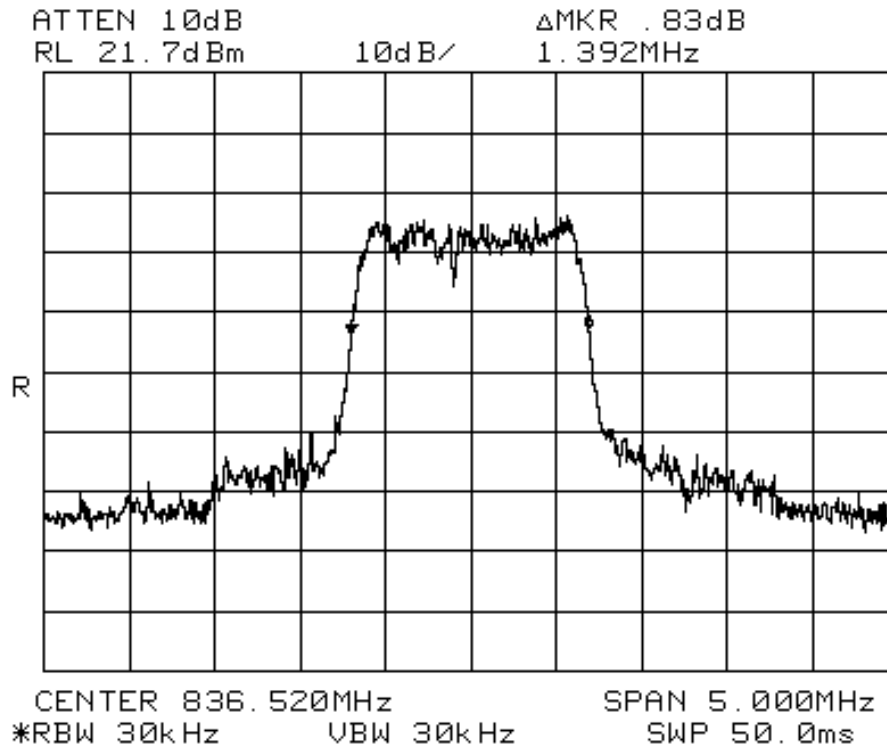
Test Data – Occupied Bandwidth (Voice & SAT)



Date: 5.AUG.2005 10:56:18



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](#)

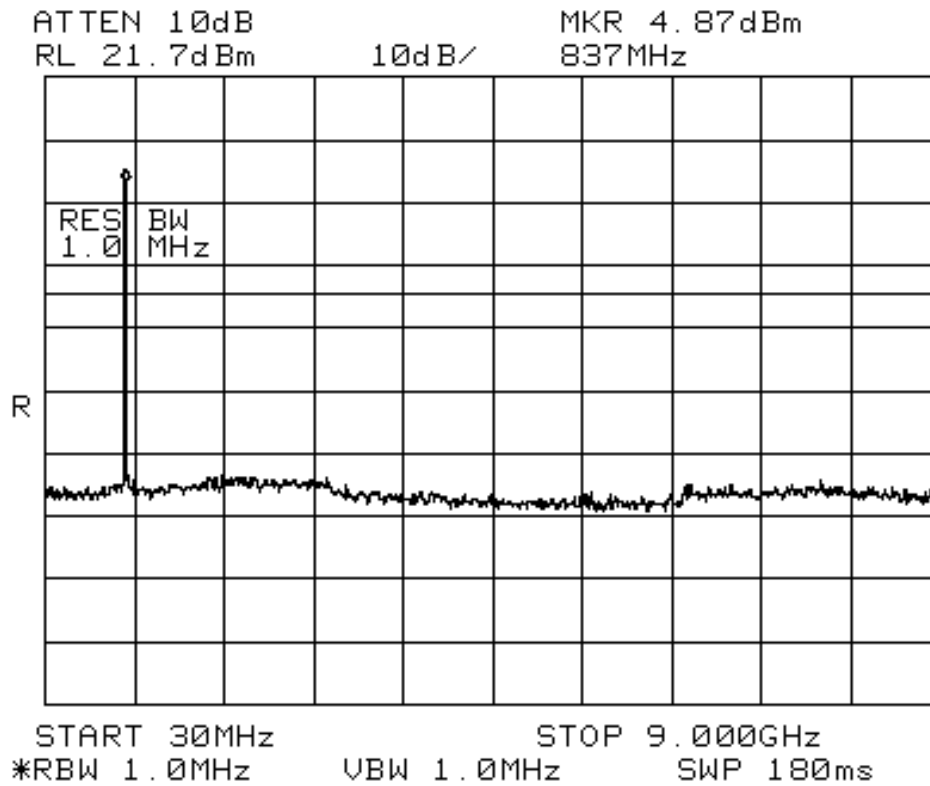
Equipment Used: [1082-1472-1464-1659](#)

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

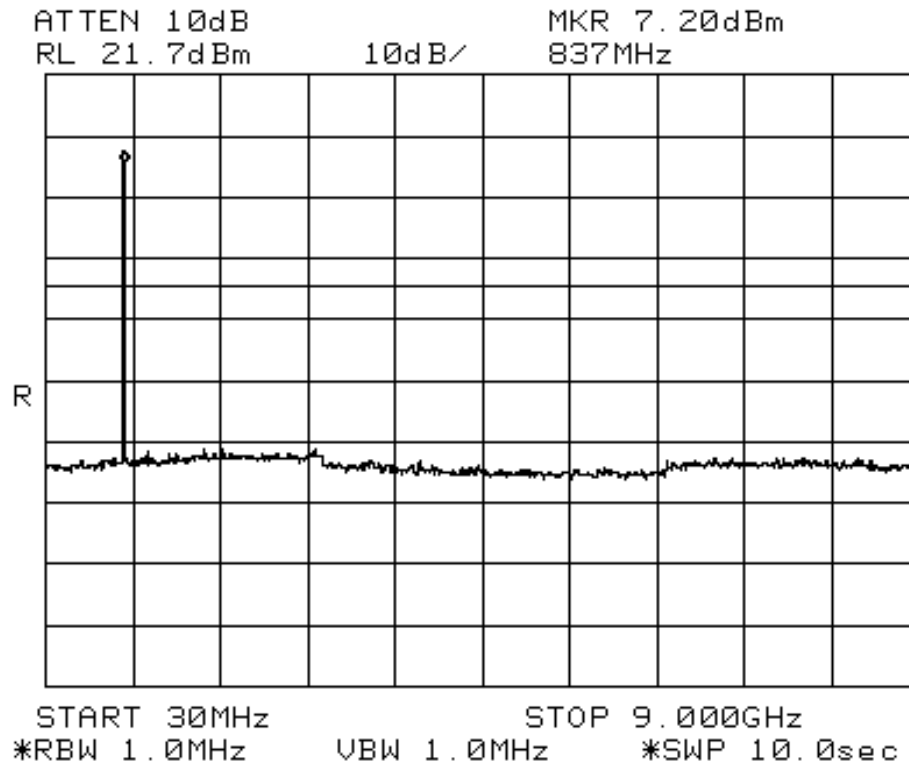
Temperature: [22](#) °C

Relative Humidity: [45](#) %

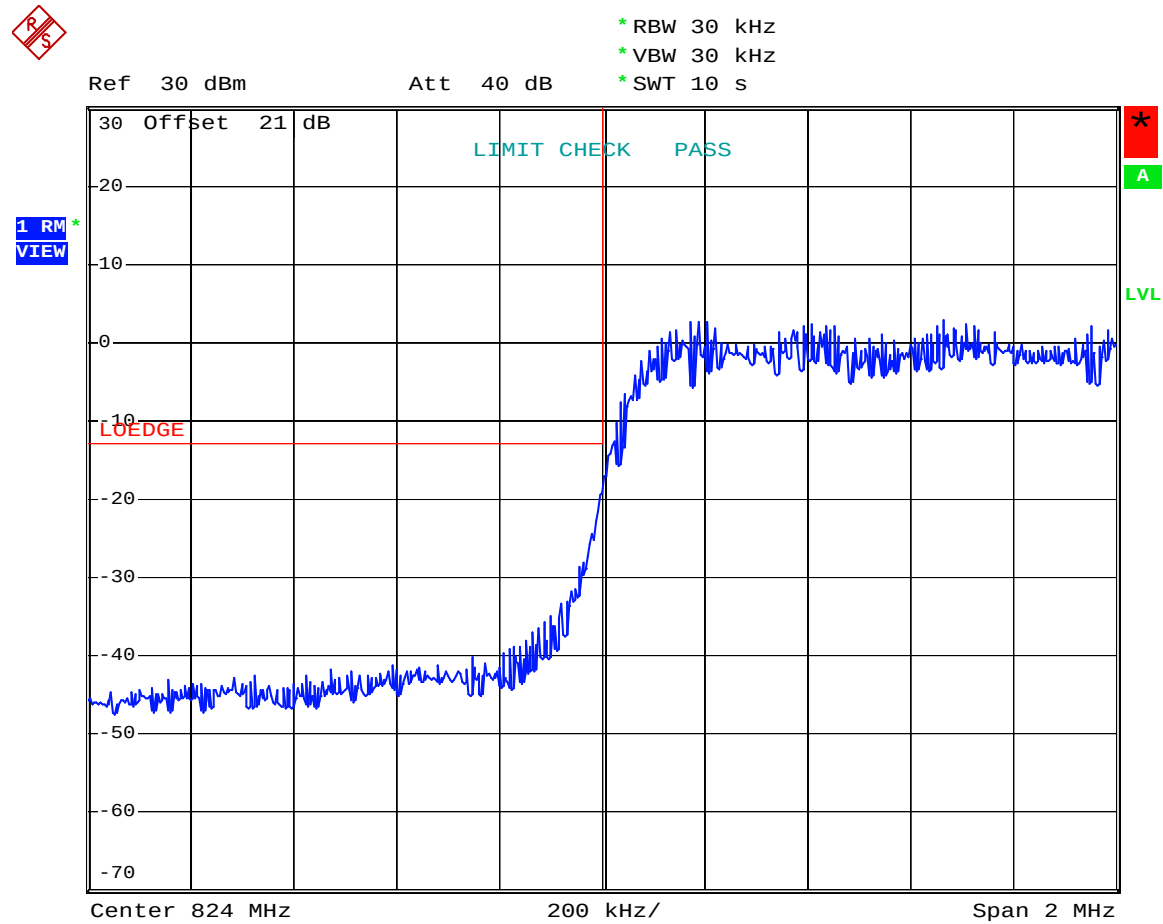
## Test Data – Spurious Emissions (Analog)



Test Data – Spurious Emissions (CDMA)

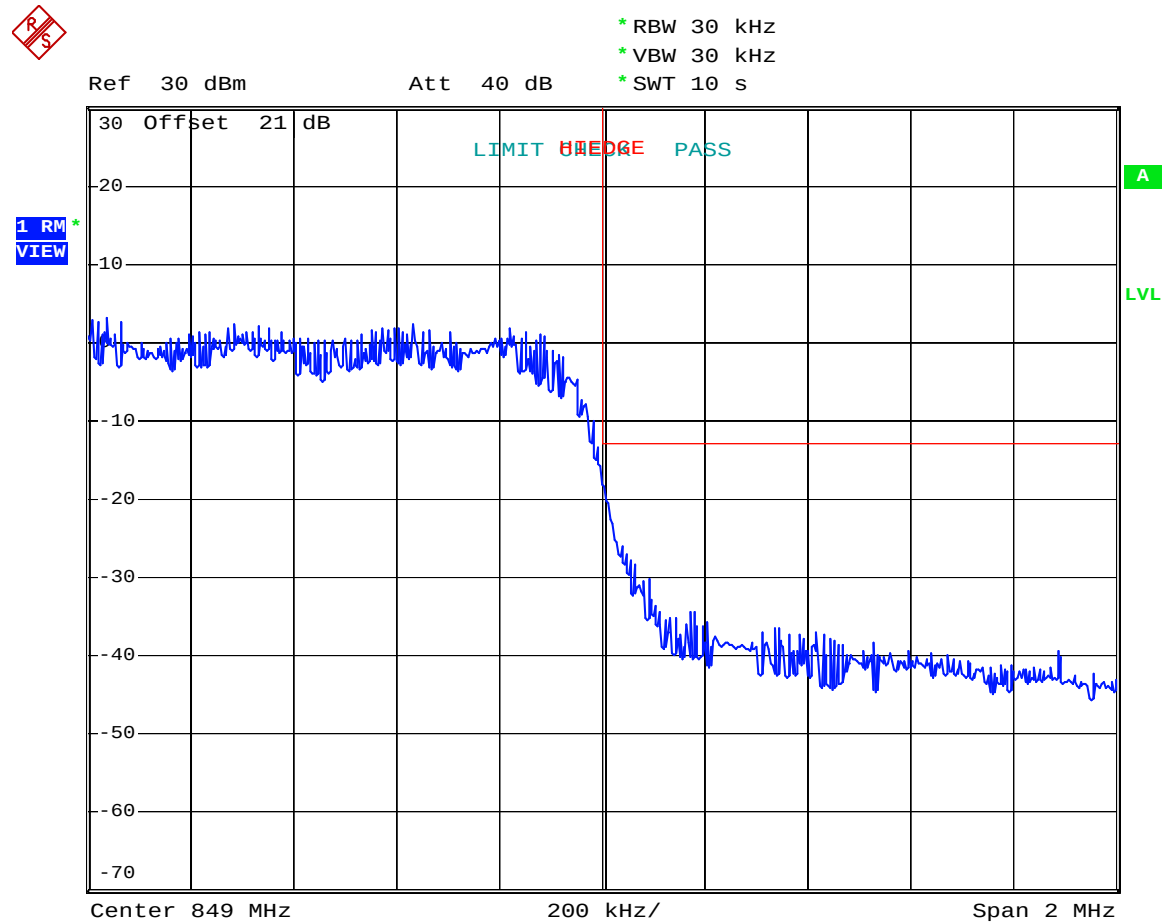


Test Data – Spurious Emissions (CDMA)



Date: 2.AUG.2005 14:45:01

Test Data – Spurious Emissions (CDMA)



Date: 2.AUG.2005 14:49:24

## 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.](#)

Test Data: [See attached table.](#)

Equipment Used: [1464-1484-1485-1304-1016-1481](#)

Measurement Uncertainty: [+/- 3.6](#) dB

Temperature: [24](#) °C

Relative Humidity: [45](#) %

## Test Data – Radiated Emissions

| <b>ERP</b>                                                                                                                              |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------|--|-------------------------|---------------------------------------|----------------|-------------------|-------------|----------|------------------|--|
| Page <u>1</u> of <u>1</u>                                                                                                               |                           |                              |  |                         |                                       |                | Complete <u>X</u> |             |          |                  |  |
| Job No.: 5L0403                                                                                                                         |                           | Date: 8/9/05                 |  |                         |                                       |                | Preliminary _____ |             |          |                  |  |
| Specification: PT22                                                                                                                     |                           | Temperature(°C): 22          |  |                         |                                       |                |                   |             |          |                  |  |
| Tested By: David Light                                                                                                                  |                           | Relative Humidity(%) 45      |  |                         |                                       |                |                   |             |          |                  |  |
| E.U.T.: Dual band/Tri mode CDMA HANDSET                                                                                                 |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
| Configuration: TX                                                                                                                       |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
| Sample No: 1                                                                                                                            |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
| Location: AC 3                                                                                                                          |                           | RBW: 1 MHz                   |  |                         |                                       |                | Measurement       |             |          |                  |  |
| Detector Type: Peak                                                                                                                     |                           | VBW: 1 MHz                   |  |                         |                                       |                | Distance: 3 m     |             |          |                  |  |
| <b>Test Equipment Used</b>                                                                                                              |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
| Antenna: 1304                                                                                                                           |                           | Directional Coupler: _____   |  |                         |                                       |                |                   |             |          |                  |  |
| Pre-Amp: 1016                                                                                                                           |                           | Cable #1: 1484               |  |                         |                                       |                |                   |             |          |                  |  |
| Filter: 1481                                                                                                                            |                           | Cable #2: 1485               |  |                         |                                       |                |                   |             |          |                  |  |
| Receiver: 1464                                                                                                                          |                           | Cable #3: _____              |  |                         |                                       |                |                   |             |          |                  |  |
| Attenuator #1: _____                                                                                                                    |                           | Cable #4: _____              |  |                         |                                       |                |                   |             |          |                  |  |
| Attenuator #2: _____                                                                                                                    |                           | Mixer: _____                 |  |                         |                                       |                |                   |             |          |                  |  |
| Additional equipment used: _____                                                                                                        |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
| Measurement Uncertainty: +/-1.7 dB                                                                                                      |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
| Frequency<br>(MHz)                                                                                                                      | Meter<br>Reading<br>(dBm) | Correction<br>Factor<br>(dB) |  | Pre-Amp<br>Gain<br>(dB) | Substitution<br>Antenna Gain<br>(dBd) | Limit<br>(dBm) | ERP<br>(dBm)      | ERP<br>(mW) | Polarity | Comments         |  |
|                                                                                                                                         |                           |                              |  |                         |                                       |                |                   |             |          | Tx 836.52 MHz    |  |
|                                                                                                                                         |                           |                              |  |                         |                                       |                |                   |             |          | Upright position |  |
|                                                                                                                                         |                           |                              |  |                         |                                       |                |                   |             |          | (Worst case)     |  |
|                                                                                                                                         |                           |                              |  |                         |                                       |                |                   |             |          | cdma             |  |
| 1673.04                                                                                                                                 | -65.0                     | 32.7                         |  | 0                       | 6.4                                   |                | -26.0             | 0.0025      | H        | Noise floor      |  |
| 1673.04                                                                                                                                 | -65.2                     | 29.9                         |  | 0                       | 6.4                                   |                | -29.0             | 0.0013      | V        | Noise floor      |  |
| 3346.08                                                                                                                                 | -63.0                     | 37.1                         |  | 32.6                    | 8.1                                   |                | -50.4             | 0.0000      | V        | Noise floor      |  |
|                                                                                                                                         |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
|                                                                                                                                         |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |
| <b>Notes:</b> Searched spectrum from 30 MHz to 9 GHz.<br>All emissions and noise floor readings within 20dB of spec limit are reported. |                           |                              |  |                         |                                       |                |                   |             |          |                  |  |



**Test Setup Photo**



## Section 6. Frequency Stability

|                                   |                   |
|-----------------------------------|-------------------|
| NAME OF TEST: Frequency Stability | PARA. NO.: 2.1055 |
| TESTED BY: David Light            | DATE: 8/3/2005    |

Test Results: [Complies.](#)

Test Data: [See attached table.](#)

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

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

Temperature: [22](#) °C

Relative Humidity: [45](#) %

## Test Data – Frequency Stability Analog

| <b><u>Frequency Stability</u></b>                                                       |                          |                                               |              |                      |               |             |         |
|-----------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------|--------------|----------------------|---------------|-------------|---------|
| 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>                                                                 |                          |                                               |              |                      |               |             |         |
| <b><u>Test Equipment Used</u></b>                                                       |                          |                                               |              |                      |               |             |         |
| Antenna: _____                                                                          |                          | Directional Coupler: _____                    |              |                      |               |             |         |
| Pre-Amp: _____                                                                          |                          | Cable #1: _____                               |              |                      |               |             |         |
| Filter: _____                                                                           |                          | Cable #2: _____                               |              |                      |               |             |         |
| Receiver: <u>HP8924C</u>                                                                |                          |                                               |              |                      |               |             |         |
| Attenuator #1: <u>1082</u>                                                              |                          |                                               |              |                      |               |             |         |
| Attenuator #2: _____                                                                    |                          |                                               |              |                      |               |             |         |
| <div style="border: 1px solid black; width: 80px; height: 20px; margin: 0 auto;"></div> |                          |                                               |              |                      |               |             |         |
| Measurement Uncertainty: <u>1x10<sup>-17</sup> 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

| <b><u>Frequency Stability</u></b>                                                       |                          |                                               |              |                      |               |             |                   |
|-----------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------|--------------|----------------------|---------------|-------------|-------------------|
| 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 - CDMA mode</u>                           |                          |                                               |              |                      |               |             |                   |
| Sample Number: <u>1</u>                                                                 |                          |                                               |              |                      |               |             |                   |
| <b><u>Test Equipment Used</u></b>                                                       |                          |                                               |              |                      |               |             |                   |
| Antenna: _____                                                                          |                          | Directional Coupler: _____                    |              |                      |               |             |                   |
| Pre-Amp: _____                                                                          |                          | Cable #1: _____                               |              |                      |               |             |                   |
| Filter: _____                                                                           |                          | Cable #2: _____                               |              |                      |               |             |                   |
| Receiver: <u>HP8924C</u>                                                                |                          |                                               |              |                      |               |             |                   |
| Attenuator #1: <u>1082</u>                                                              |                          |                                               |              |                      |               |             |                   |
| Attenuator #2: _____                                                                    |                          |                                               |              |                      |               |             |                   |
| <div style="border: 1px solid black; width: 80px; height: 20px; margin: 0 auto;"></div> |                          |                                               |              |                      |               |             |                   |
| Measurement Uncertainty: <u>1x10<sup>-17</sup> 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                                                                                      | 836.520002               | 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<br>Model Number       | Serial Number | Calibration<br>Date | Calibration<br>Due |
|----------|-------------------------------------------------|------------------------------------|---------------|---------------------|--------------------|
| 1304     | HORN ANTENNA                                    | ELECTRO METRICS<br>RGA-60          | 6151          | 09/22/03            | 09/22/05           |
| 1016     | Pre-Amp                                         | HEWLETT PACKARD<br>8449A           | 2749A00159    | 11/12/04            | 11/12/05           |
| 1482     | Band Pass Filter                                | K & L<br>11SH10-4000/T12000-0/0    | 2             | Cal B4 Use          | N/A                |
| 1464     | Spectrum analyzer                               | Hewlett Packard<br>8563E           | 3551A04428    | 01/14/05            | 01/15/07           |
| 1484     | Cable 2.0-18.0 Ghz                              | Storm<br>PR90-010-072              | N/A           | 08/26/04            | 08/26/05           |
| 1485     | Cable 2.0-18.0 Ghz                              | Storm<br>PR90-010-216              | N/A           | 08/02/04            | 08/02/05           |
| 1082     | CABLE 2m                                        | Astrolab<br>32027-2-29094-72TC     | N/A           | CBU                 | N/A                |
| 1472     | 20db Attenuator DC 18 Ghz                       | Omni Spectra<br>20600-20db         | NONE          | CBU                 | N/A                |
| Nokia    | Cell Site Simulator                             | HP<br>8924C                        | US38283285    | 07/18/05            | 07/18/07           |
| 283      | Environmental Chamber with controller # 1189006 | ENVIROTRONICS<br>SH27 & 2030-22844 | 129010083     | 09/16/04            | 09/16/05           |
| 619      | THERMOMETER                                     | FLUKE<br>51                        | 4520028       | 09/16/04            | 09/16/05           |

**ANNEX A - TEST DETAILS**

|                                                |                   |
|------------------------------------------------|-------------------|
| 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.

|                                                              |                          |
|--------------------------------------------------------------|--------------------------|
| <b>NAME OF TEST: Occupied Bandwidth (Digital Modulation)</b> | <b>PARA. NO.: 2.1049</b> |
|--------------------------------------------------------------|--------------------------|

**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



|                                                             |                          |
|-------------------------------------------------------------|--------------------------|
| <b>NAME OF TEST: Spurious Emission at Antenna Terminals</b> | <b>PARA. NO.: 2.1051</b> |
|-------------------------------------------------------------|--------------------------|

**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.

**Test Method:**

The maximum field strength of the spurious emission is measured at a distance of 3 meters. The device under test is then replaced with a substitution antenna of known gain with respect to a  $\frac{1}{4}$  wave dipole antenna. A calibrated signal source is used to feed the substitution antenna. The rf level to the substitution antenna is adjusted to repeat the previously measured field strength. The rf input level to the substitution antenna is the effective radiated power of the spurious emission after any correction for substitution antenna gain against a  $\frac{1}{4}$  wave dipole.

***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:

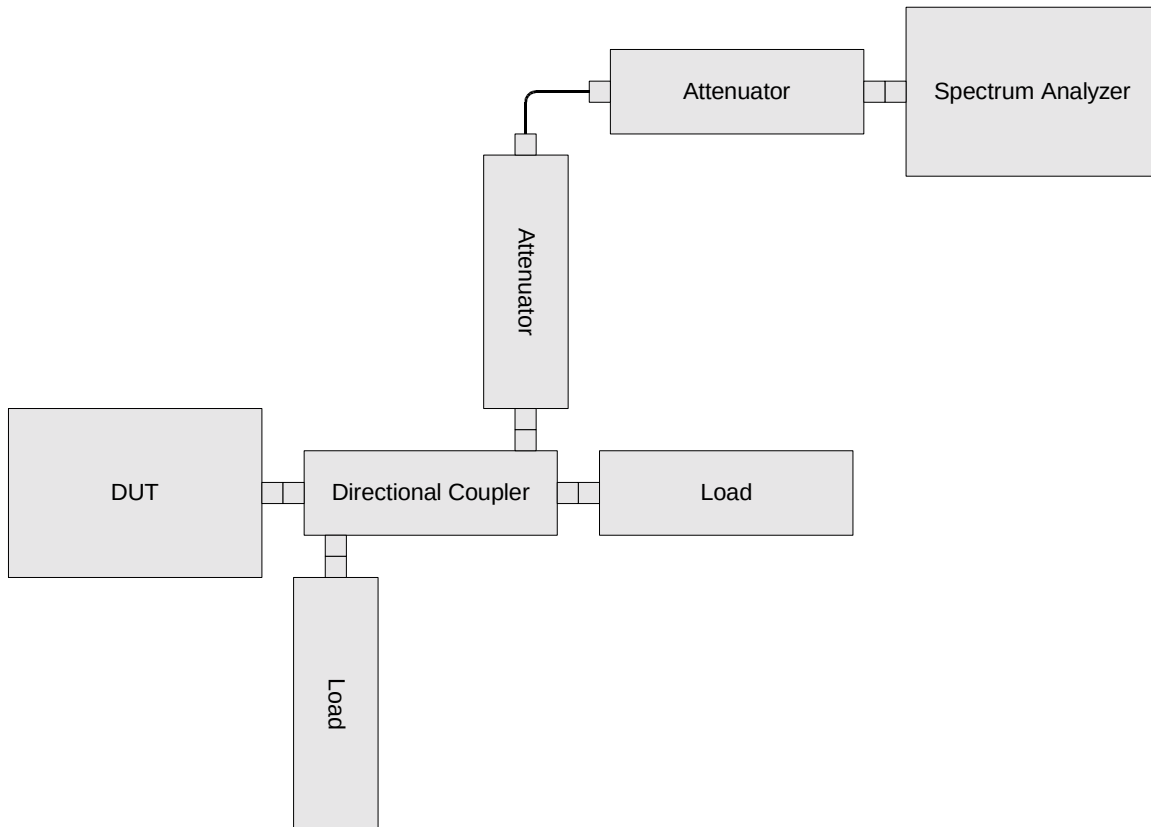
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the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

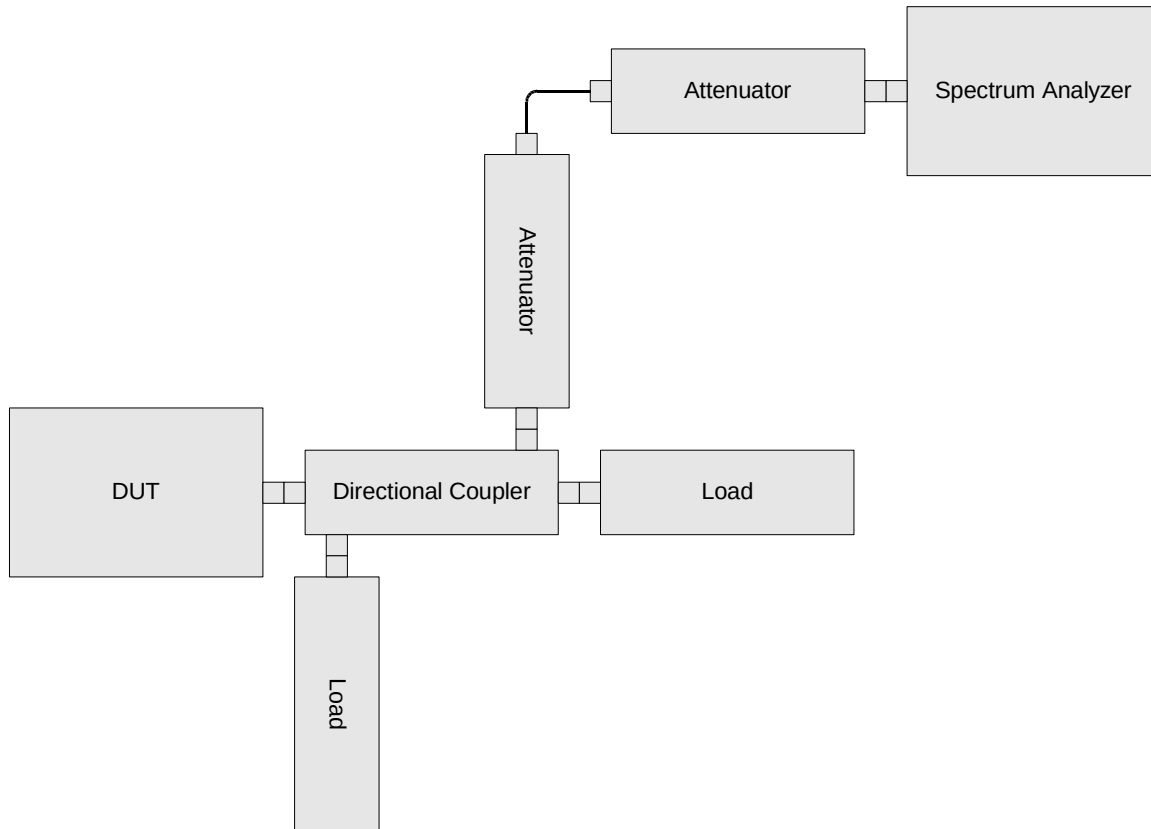
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

**ANNEX B - TEST DIAGRAMS**

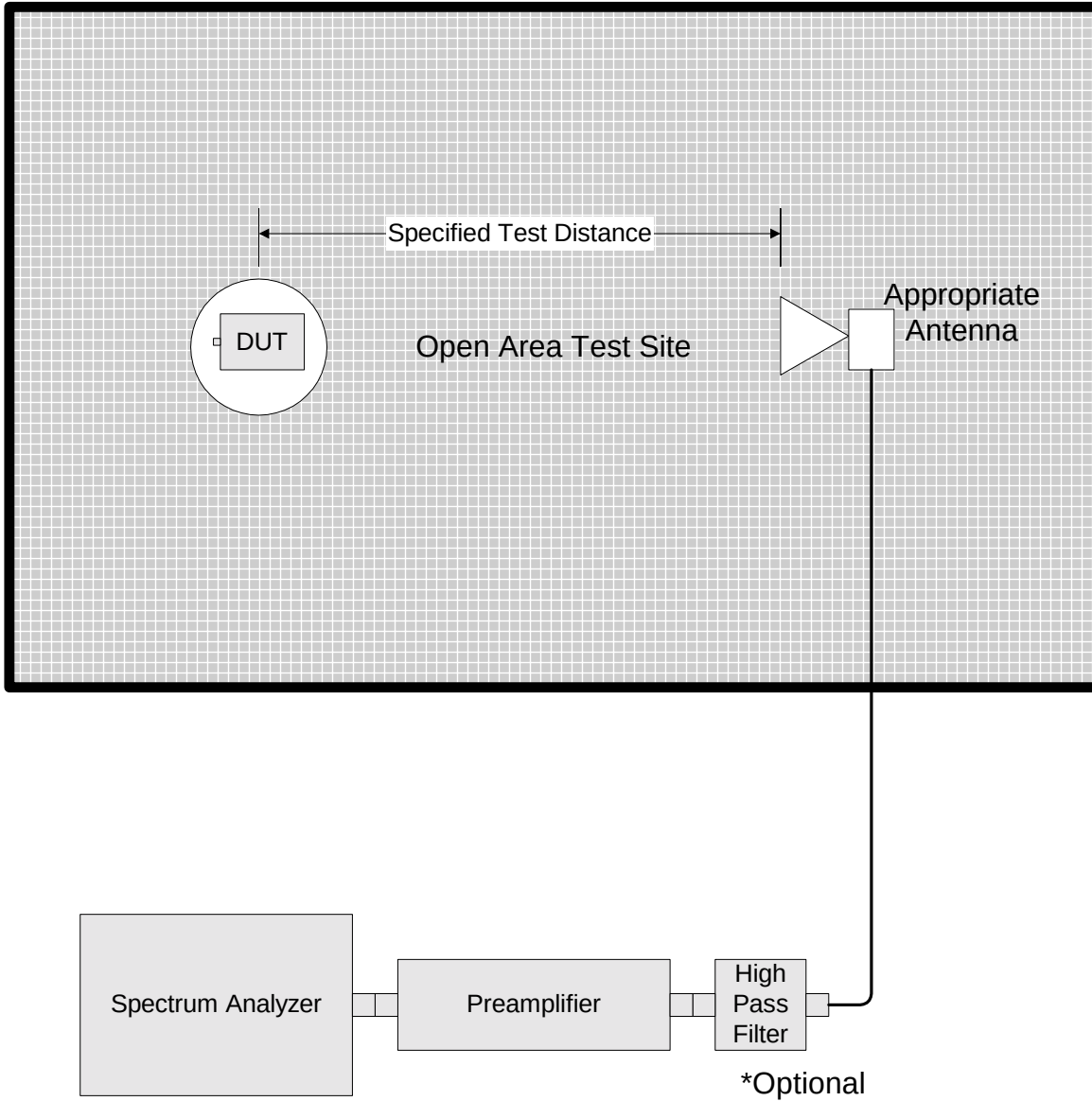
Para. No. 2.1049 - Occupied Bandwidth

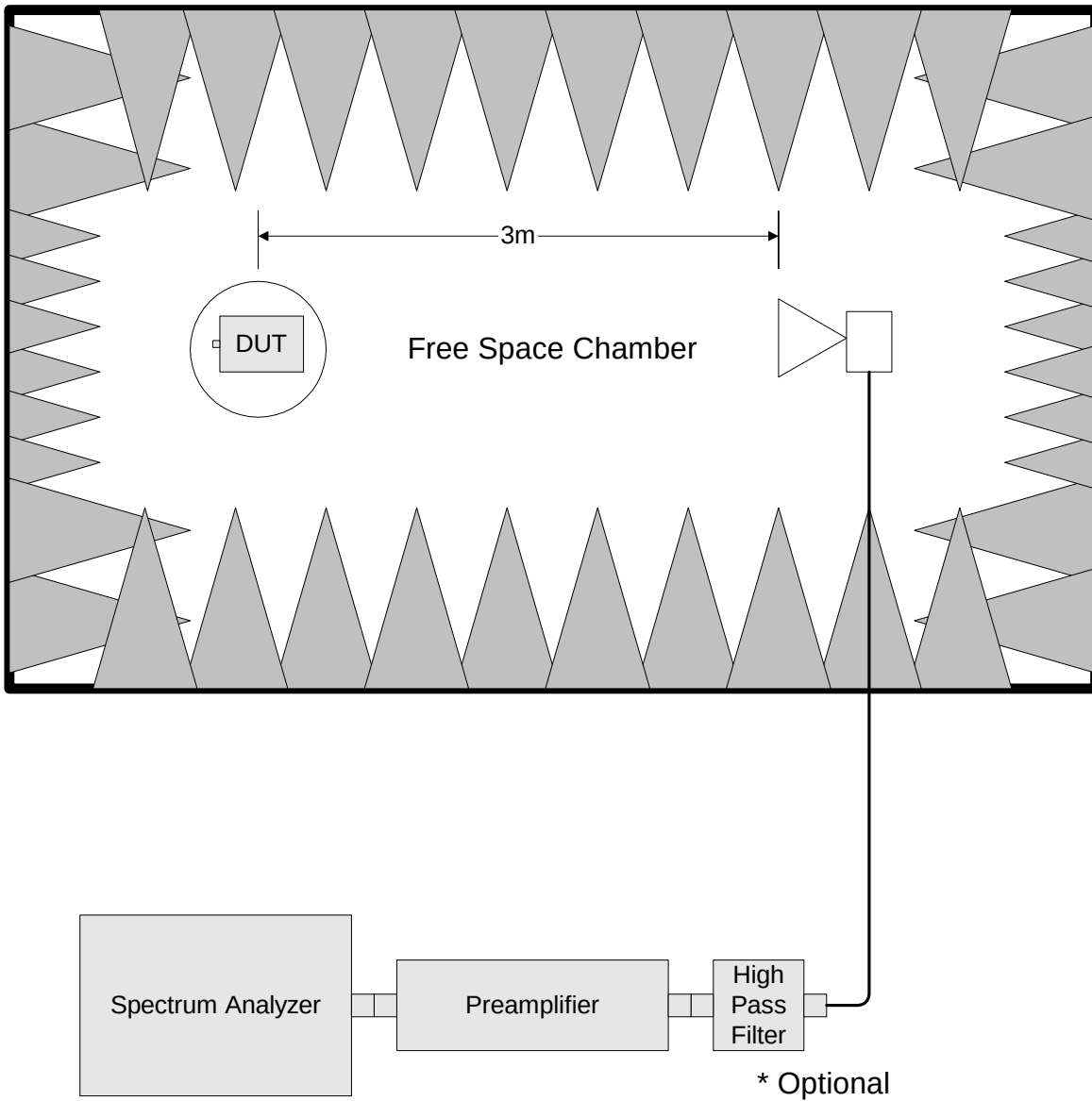


**Para. No. 2.1051 Spurious Emissions at Antenna Terminals**



Para. No. 2.1053 - Field Strength of Spurious Radiation







**Para. No. 2.1055 - Frequency Stability**

