Applicant:	Andrew Corporation
Equipment Under Test: (E.U.T.)	Node C 837
In Accordance With:	FCC Part 22, Subpart H Cellular Band Repeaters
Tested By:	Nemko Dallas Inc. 802 N. Kealy Lewisville, TX 75057-3136
Authorized By:	Tom Tidwell, Frontline Manager
Date:	5/20/04
Total Number of Pages:	52

3L0494RUS1REV1

Nemko Test Report:

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EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

Section 1.	Summary of Tes	t Results	
Manufacturer:	Andrew Corporation		
Model No.:	Node C 837		
Serial No.:	12		
General:	All measurements are traceal	ole to national stand	dards.
These tests were with FCC Part	•	quipment for the purp	pose of demonstrating compliance
$\boxtimes$	New Submission		Production Unit
	Class II Permissive Change		Pre-Production Unit
	THIS TEST REPORT RELATE	S ONLY TO THE I	ΓΕΜ(S) TESTED.
THE FOLLOW	SPECIFICATION	DITIONS TO, OR E S HAVE BEEN MA nary of Test Data".	EXCLUSIONS FROM THE TEST .DE.
	See Sunin	iary or Test Data.	
Nemko USA Inc. au the company's empl		oduce this report provided	it is reproduced in its entirety and for use by
	1 . 1 . 0.11		

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# **Summary Of Test Data**

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	22.913(a)	500W	Complies
Occupied Bandwidth	22.917(c)	Input/Output	Complies
Spurious Emissions at Antenna Terminals	22.917	-13 dBm	Complies
Field Strength of Spurious Emissions	22.917	-13 dBm E.I.R.P.	Complies
Frequency Stability	22.355	1.5 ppm	N/A

#### **Footnotes:**

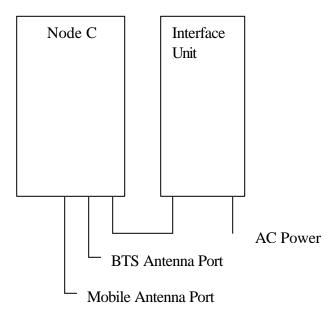
Measurement uncertainty for each test configuration is expressed to 95% probability.

.

# Section 2. General Equipment Specification

<b>Supply Voltage Input:</b>		115V AC		
Frequency Range:	Downlink:	869 – 894 MHz Band Device operates on C 888.90MHz)		( 871.11 to
Frequency Range:	Uplink:	824-849MHz Band Device operates on C	Ch 37 to 630	( to 843.90MHz)
Type of Modulation and Designator:		CDMA GSM (F9W) (GXW)	NADC (DXW)	CDPD AMPS (F9W) (F8W, F1D)
Output Impedance:		50 ohms		
RF Output (Rated): (Per Carrier)	Downlink:		37 dBm (1	Carrier)
	Uplink:		23 dBm	
Frequency Translation:		F1-F1	F1-F2	N/A
Band Selection:		Software	Duplexer Change	Fullband Coverage

# **System Diagram**



EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

# Section 3. RF Power Output

NAME OF TEST: RF Power Output PARA. NO.: 2.1046

TESTED BY: Dustin Oaks DATE: 2/26/2004

**Test Results:** Complies.

**Test Data:** 

	Modulation Type	Power Output (dBm)	
Uplink	CDMA	23.01dBm	
Downlink	CDMA	37.51dBm	

**Equipment Used:** 1036, 1626, 1627, 1064, 1469, 1053

**Measurement Uncertainty:** +/- 1.6 dB

Temperature: 21 ?C

**Relative Humidity:** 51 %

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

### Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth PARA. NO.: 2.1049

TESTED BY: Dustin Oaks DATE: 2/26/2004

**Test Results:** Complies.

**Test Data:** See attached plots

**Equipment Used:** 1036, 1626, 1627, 1064, 1469, 1053

**Measurement Uncertainty:** +/- 1.6 dB

**Temperature:** 21 ?C

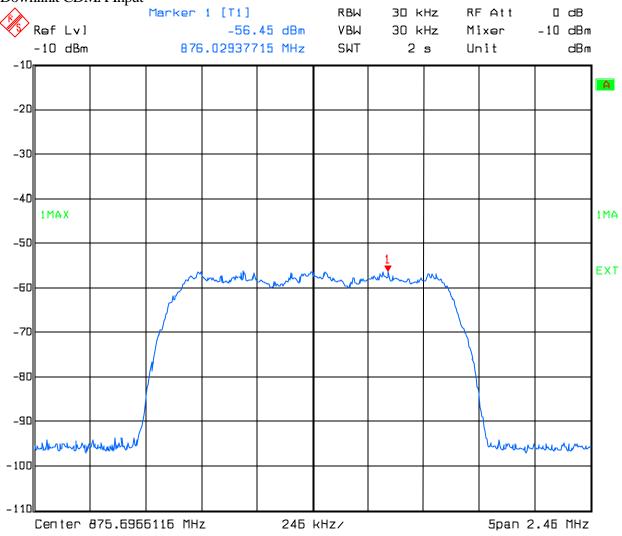
**Relative Humidity:** 51 %

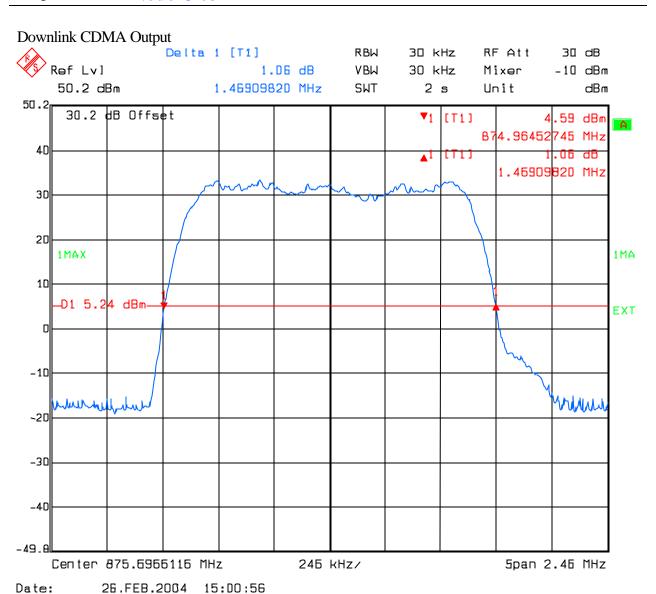
# Occupied Band Width / Input Output Plots

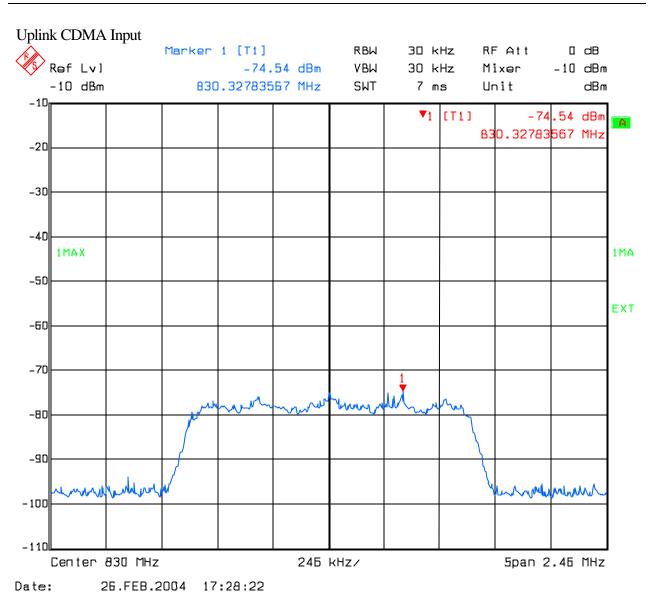
26.FEB.2004 15:D3:34

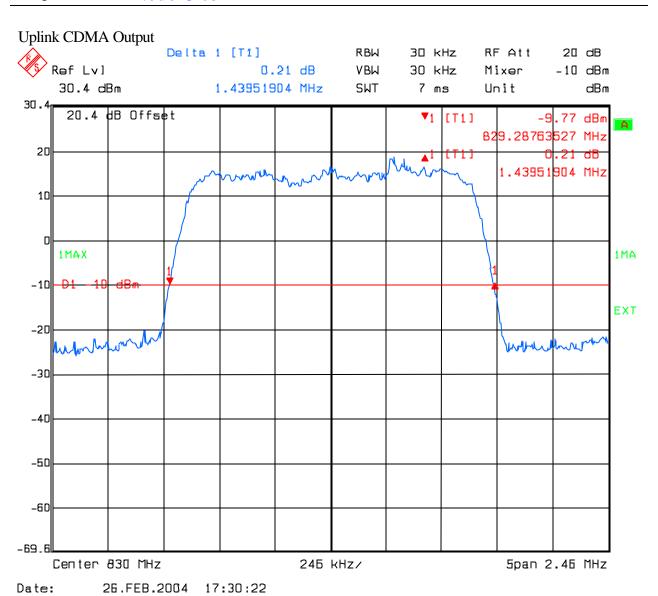
Downlink CDMA Input

Date:





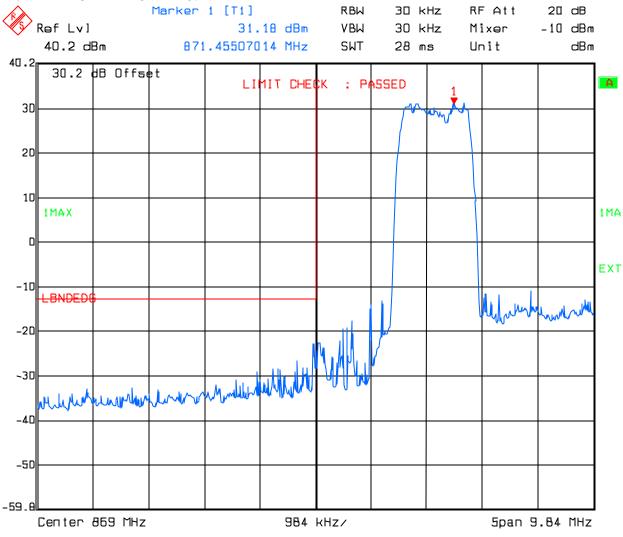




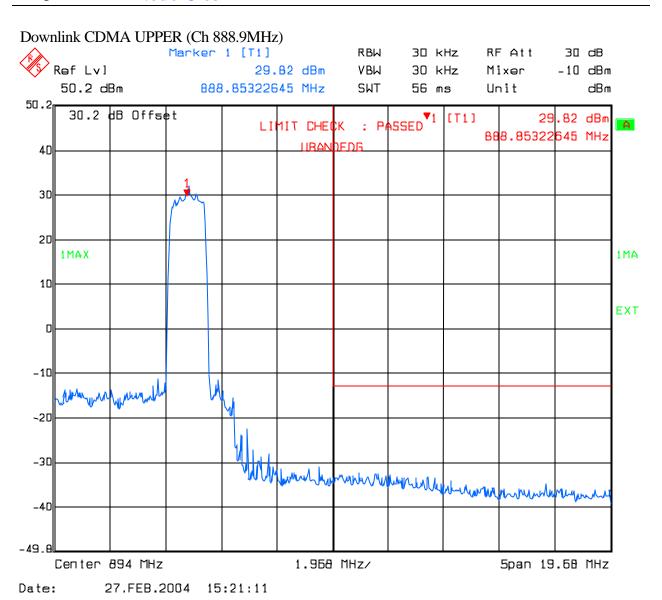
Page 12 of 52

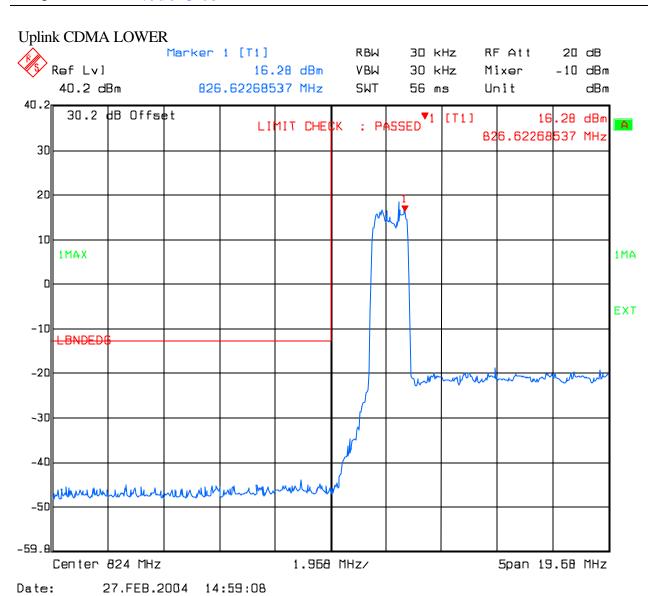
#### **Band Edge**

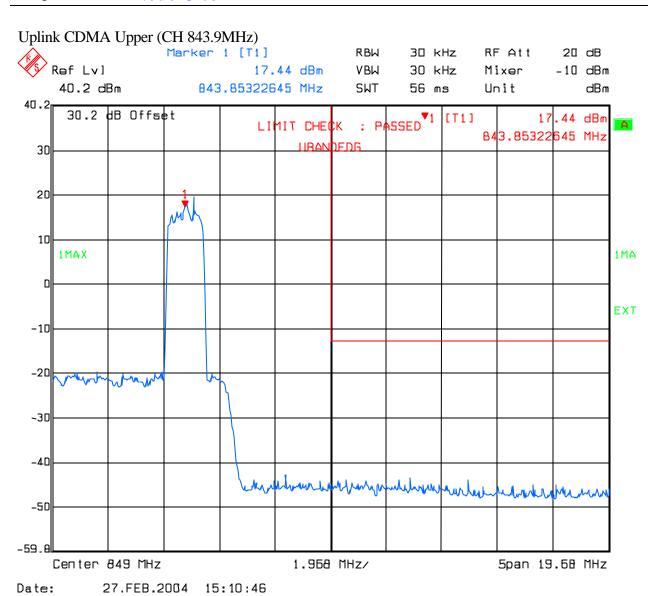
Down Link CDMA LOWER 871.11Mhz



Date: 27.FEB.2004 14:47:56

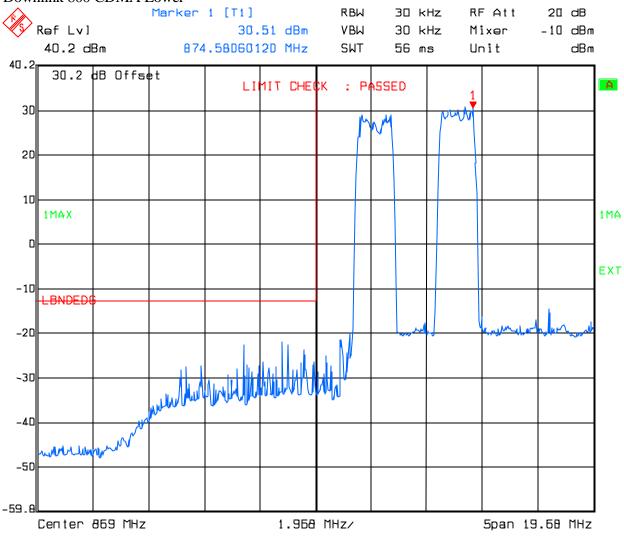


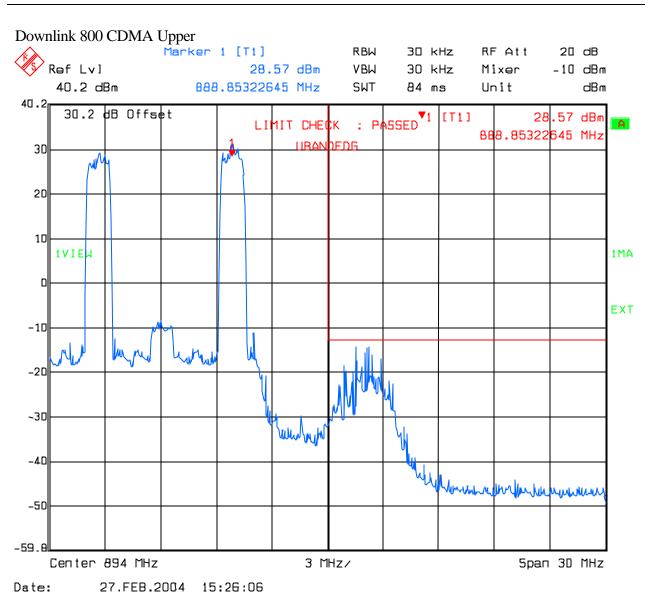


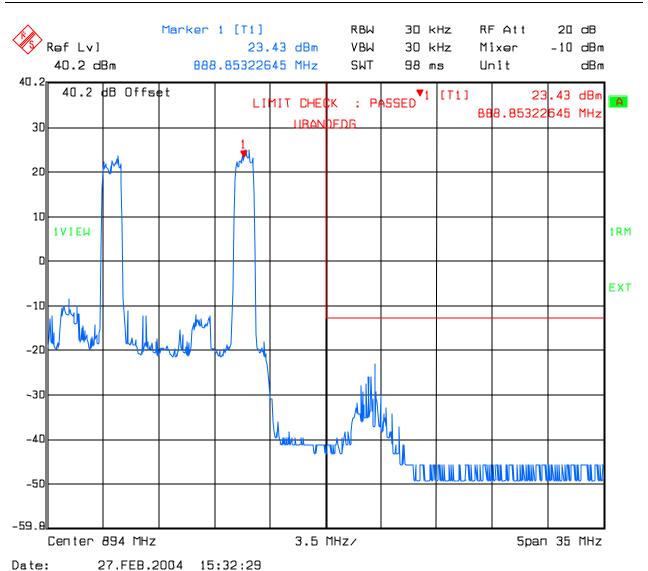


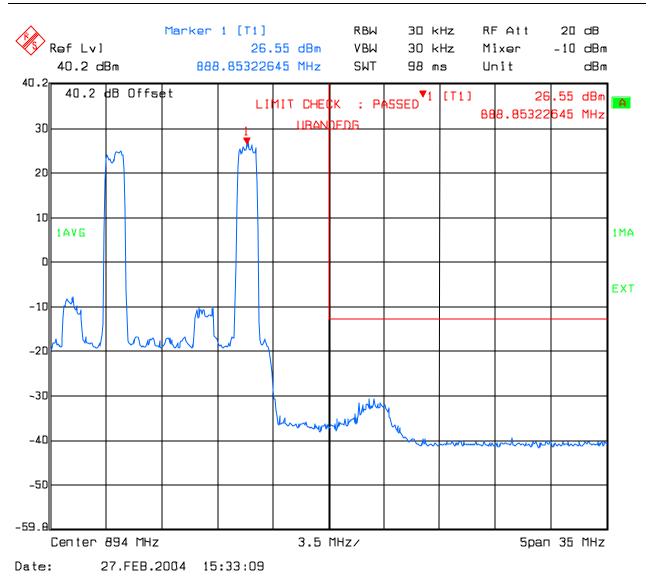
#### Intermodulation

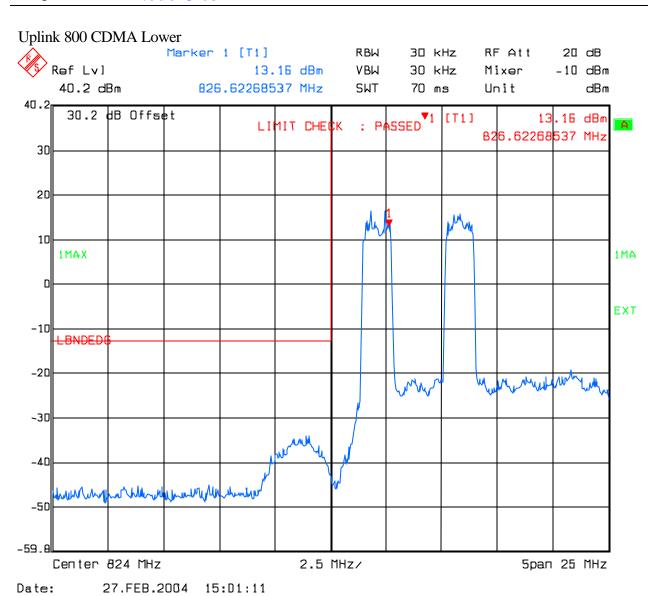
Downlink 800 CDMA Lower

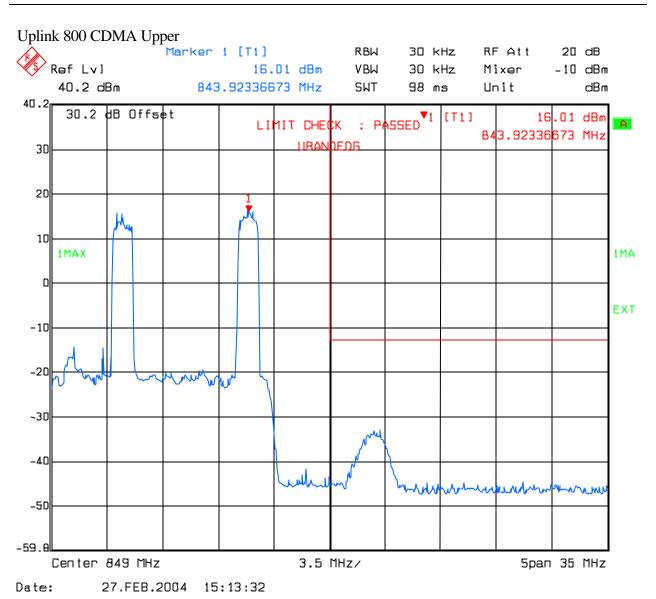












EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

# Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals PARA. NO.: 2.1051

TESTED BY: Dustin Oaks DATE: 12/18/2003

**Test Results:** Complies.

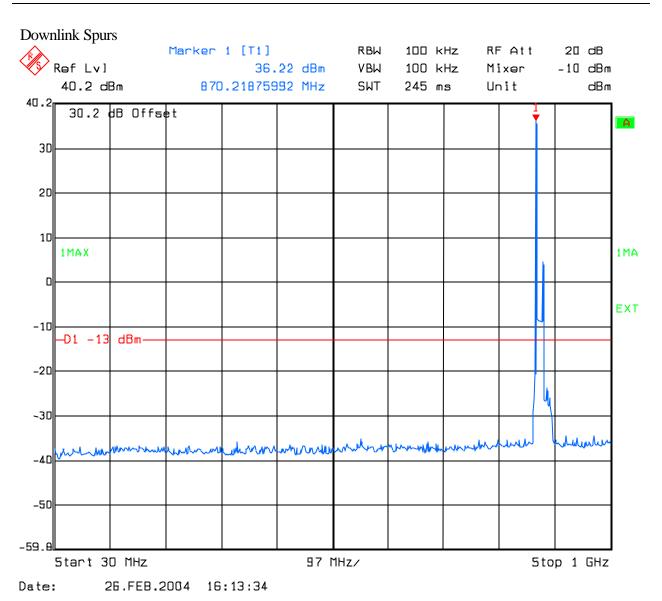
**Test Data:** See attached plots

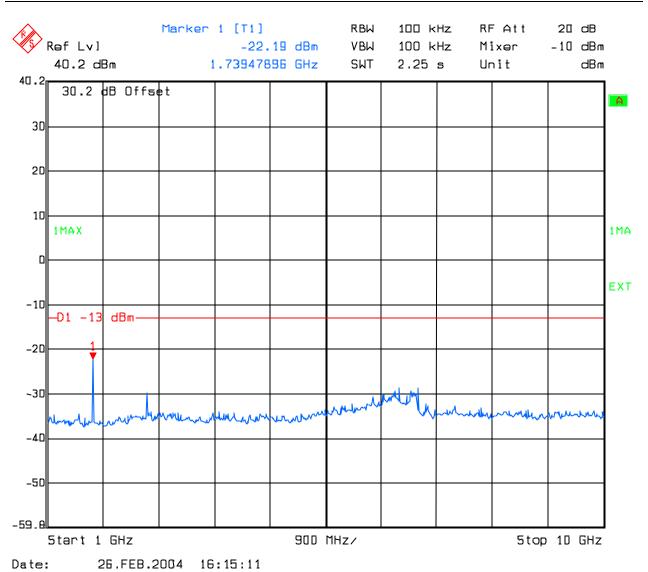
**Equipment Used:** 1036, 1625, 1629, 1604, 1474, 1053

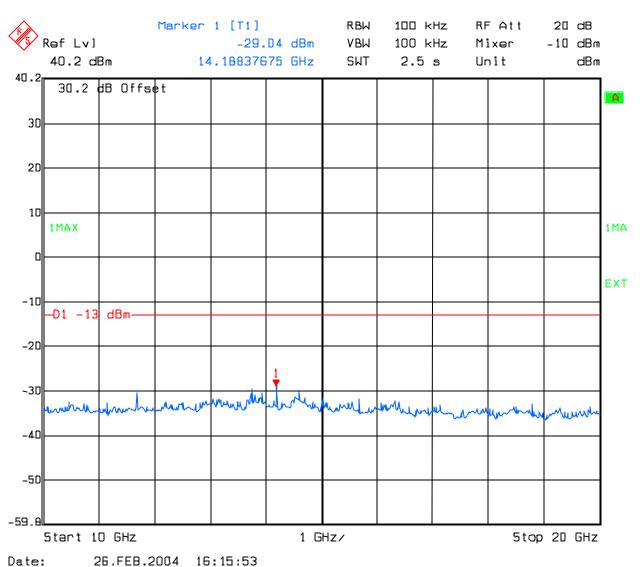
**Measurement Uncertainty:** +/- 1.6 dB

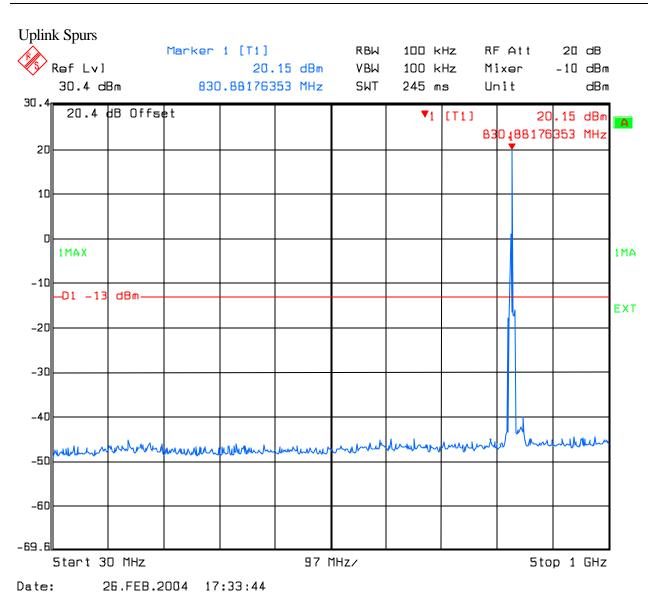
**Temperature:** 21 ?C

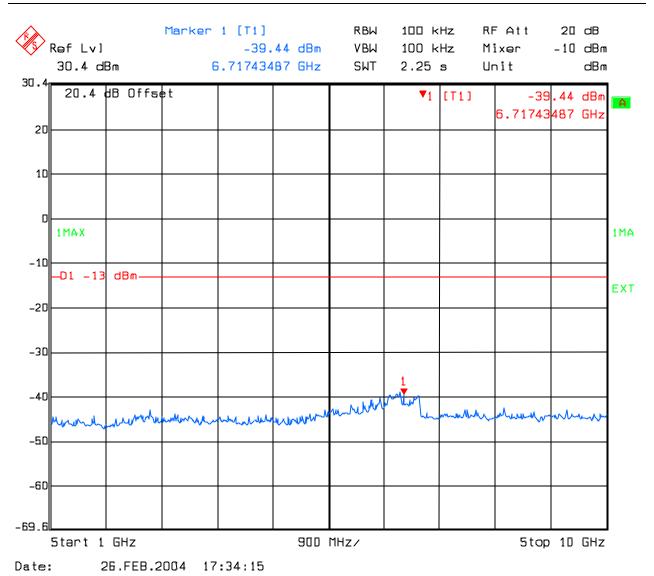
**Relative Humidity:** 51 %

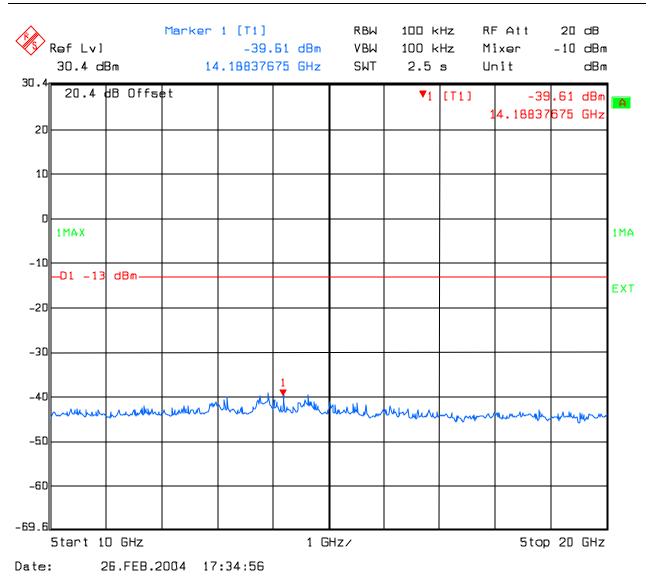












EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

### Section 6. Field Strength of Spurious

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

TESTED BY: David Light DATE: 2/27/2004

**Test Results:** Complies.

**Test Data:** No Emissions found within 20dB of Limit. Noise from was greater

than 20dB below limit. Frequency range scanned from 30MHz to

20GHz

**Equipment Used:** 1464, 1016, 1464, 1485, 1484, 1304

**Measurement Uncertainty:** +/- 3.6 dB

Temperature: 21 ?C

**Relative Humidity:** 51 %

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

ERP Substitution Method										
Page 1 of	f 2							Complete	X	_
Job No.:	3L0494			Date:	2/27/04			Preliminary		_
Specification:	PT 22		Tempera	ature(°C):	22					
Tested By:	David Light		Relative Hun	nidity(%)	40					
E.U.T.:	Nnode c 937	7	-		-					
Configuration:	UPRIGHT (	ON TABLE - TX I	FULL POWER	INTO LC	AD		-			
Sample No:	1						·			
Location:	AC 3				RBW:	1 MHz		Measurement		
Detector Type:	Peak				VBW:	1 MHz	•	Distance:	3	m
Test Equipme	ent Used									
Antenna:	1304			D	irectional Coupler:					
Pre-Amp:	1016	•			Cable #1:	1484	•			
Filter:		•			Cable #2:	1485	•			
Receiver:	1464	•					•			
Attenuator #1		•					•			
Attenuator #2:		•			Mixer:		•			
Additional equip	ment used:				•		•			
Measurement Un		+/-1.7 dB					•			
			•							
Frequency	Meter	Substitution	Pi	re-Amp	Substitution	ERP	Limit	Margin	Polarity	Comments
	Reading	Level		Gain	Antenna Gain					
0.00	(ID.)	(ID.)		(dB)	(ID.1)	(ID.)	(ID.)	(10)		
(MHz)	(dBm)	(dBm)		(ub)	(dBd)	(dBm)	(dBm)	(dB)		
										UL-Tx @ 830 MHz
1660	-60.3	-61.7		32.4	7.3	-61.7	-13	-48.7000	V	Noise floor
2490	-60.0	-58.8		33.0	6.8	-58.8	-13	-45.8333	V	Noise floor
3320	-61.0	-53.8		32.6	8.0	-53.8	-13	-40.7667	V	Noise floor
4150	-61.5	-49.2		33.0	8.2	-49.2	-13	-36.1667	V	Noise floor
4980	-62.0	-51.1		33.1	8.7	-51.1	-13	-38.1000	V	Noise floor
5810	-62.1	-54.2		31.9	9.3	-54.2	-13	-41.1667	V	Noise floor
6640	-62.3	-52.5		31.5	9.4	-52.5	-13	-39.4667	V	Noise floor
7470	-62.5	-54.2		32.5	8.8	-54.2	-13	-41.1667	V	Noise floor
8300	-62.1	-52.3		33.0	9.1	-52.3	-13	-39.2667	V	Noise floor
1660	-60.3	-59.7		32.4	7.3	-59.7	-13	-46.7000	Н	Noise floor
2490	-60.0	-56.0		33.0	6.8	-56.0	-13	-43.0000	Н	Noise floor
3320	-61.0	-57.3		32.6	8.0	-57.3	-13	-44.2667	Н	Noise floor
4150	-61.5	-59.7		33.0	8.2	-59.7	-13	-46.6667	Н	Noise floor
4980	-62.0	-59.6		33.1	8.7	-59.6	-13	-46.6000	Н	Noise floor
5810	-62.1	-56.2		31.9	9.3	-56.2	-13	-43.1667	Н	Noise floor
6640	-62.3	-54.6		31.5	9.4	-54.6	-13	-41.6333	Н	Noise floor
7470	-62.5	-54.7		32.5	8.8	-54.7	-13	-41.6667	Н	Noise floor
8300										
0000	-62.1	-52.6		33.0	9.1	-52.6	-13	-39.6000	H	Noise floor

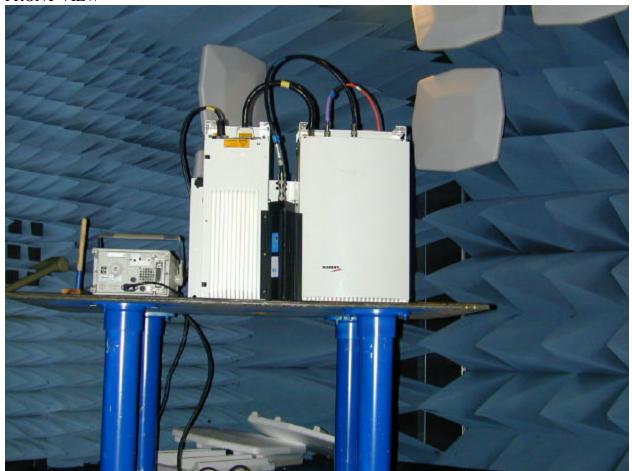
Notes: Searched spectrum to the 10th harmonic of carrier

	Field Strength of Spurious Emissions							
Page 1 of	2		Complete X					
Job No.:	3L0494	Date: 2/27/04	Preliminary					
Specification:	PT 22	Temperature(°C): 22						
Tested By:	David Light	Relative Humidity(%) 40						
E.U.T.:	Nnode c 937							
Configuration:	UPRIGHT ON TABI	E - TX FULL POWER INTO LOAD						
Sample No:	1							

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)	Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	ERP (dBm)	Limit (dBm)	Margin (dB)	Polarity	Comments
									DL-Tx @ 875 MHz
1750	-61.2	31.0	32.4	7.3	31.0	-13	44.0000	V	Noise floor
2625	-60.8	35.5	33.0	8.0	35.5	-13	48.5000	V	Noise floor
3500	-61.7	43.3	32.6	8.6	43.3	-13	56.3333	V	Noise floor
4375	-63.3	45.3	33.0	8.2	45.3	-13	58.3333	V	Noise floor
5250	-63.3	41.3	33.1	8.2	41.3	-13	54.3333	V	Noise floor
6125	-62.8	40.5	31.9	9.6	40.5	-13	53.5000	V	Noise floor
7000	-62.5	40.8	31.5	8.8	40.8	-13	53.8333	V	Noise floor
7875	-62.3	41.8	32.5	9.2	41.8	-13	54.8333	V	Noise floor
8750	-63.2	44.8	33.0	9.4	44.8	-13	57.8333	V	Noise floor
1750	-61.2	33.0	32.4	7.3	33.0	-13	46.0000	Н	Noise floor
2625	-60.8	35.5	33.0	8.0	35.5	-13	48.5000	Н	Noise floor
3500	-61.7	35.5	32.6	8.6	35.5	-13	48.5000	Н	Noise floor
4375	-63.3	34.8	33.0	8.2	34.8	-13	47.8333	Н	Noise floor
5250	-63.3	38.3	33.1	8.2	38.3	-13	51.3333	Н	Noise floor
6125	-62.8	38.7	31.9	9.6	38.7	-13	51.6667	Н	Noise floor
7000	-62.5	40.3	31.5	8.8	40.3	-13	53.3333	Н	Noise floor
7875	-62.3	41.5	32.5	9.2	41.5	-13	54.5000	Н	Noise floor
8750	-63.2	42.2	33.0	9.4	42.2	-13	55.1667	Н	Noise floor
Notes									

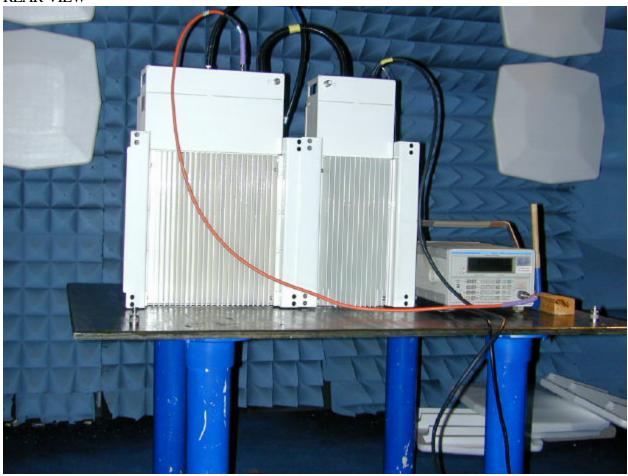
# **Photographs of Test Setup**

#### FRONT VIEW



EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

#### **REAR VIEW**



occion i i cquency otability	Section	7.	Frequency	<b>Stability</b>
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NAME OF TEST: Frequency S	Stability	PARA. NO.: 2.1055
TESTED BY:		DATE:
Test Results:	Not Applicable	
Test Data:	Standard Test Frequency: Standard Test Voltage:	MHz
Equipment Used:		
Measurement Uncertainty:	ppm	

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01	03/31/04
1626	CABLE, 5 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1627	CABLE, 5 ft	MEGAPHASE 10312 1GVT4	N/A	07/29/03	07/28/04
1064	ATTENUATOR	NARDA 776B-20	NONE	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1053	SIGNAL GENERATOR	ROHDE & SCHWARZ SMIQ 03	DE22081	06/10/03	06/09/04
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/11/03	02/11/05
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	10/27/03	10/26/04
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/24/03	07/23/04
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/24/03	07/23/04
1301	Torque wrench	Maury Microwave 8799D1	0	CNR	N/A

# Section 8. Test Equipment List

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

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?  $R^2 = E^2/120$ ? and proceeding as follows:

$$P ? \frac{E^2R^2}{30G} ? \frac{E^23^2}{30G}$$

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

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

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: ? RBW Span: 100 kHz Sweep: Auto

### <u>Input Signal Characteristics (F3E/F3D):</u>

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.

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

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: ? 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

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

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: ? 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

### Nemko USA

# FCC PART 22, SUBPART H CELLULAR BAND REPEATERS

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

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: ? RBW Span: As required Sweep: Auto

### Input Signal Characteristics:

RF level: Maximum recommended by manufacturer

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EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

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: ? 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 x  $10^{-5}$  Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4? R^2 = E^2/120?$$

For emissions? 1 GHz:

G = 1.64 (Dipole Gain)

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

R = 3m (Measurement Distance)

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

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

For emissions > 1 GHz:

G = 1 (Isotropic Gain)

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

R = 3m (Measurement Distance)

$$E$$
 ? 84.4 ?  $20 Log \sqrt{1.64}$  ? 82.3 $dB$ ? $V / m@3m$ 

The spectrum is searched to 10 GHz.

EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

NAME OF TEST: Frequency Stability PARA. NO.: 2.1055

**Minimum Standard:** Para. No. 22.355. The transmitter carrier frequency shall remain

within the tolerances given in Table C-1.

#### Table C-1

Freq. Range (MHz)	Base, fixed	Mobile > 3 W	Mobile ? 3 W
821 to 896	1.5	2.5	2.5

#### **Method Of Measurement:**

### Frequency Stability With Voltage Variation:

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the signal generator. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

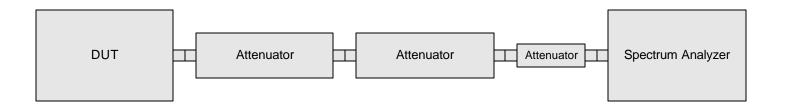
#### Frequency Stability With Temperature Variation:

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

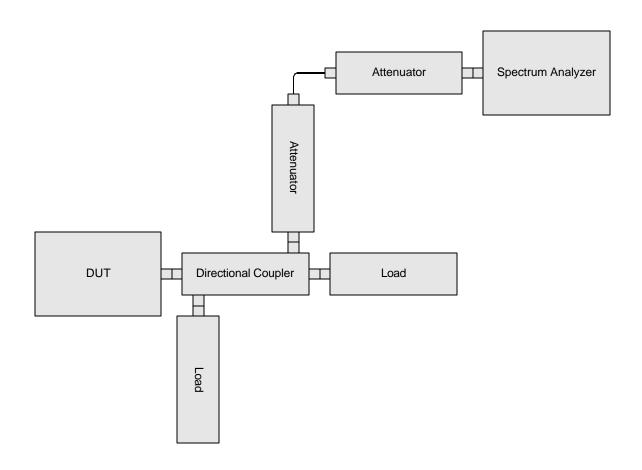
EQUIPMENT: Node C 837 PROJECT NO.: 3L0494R

**ANNEX B - TEST DIAGRAMS** 

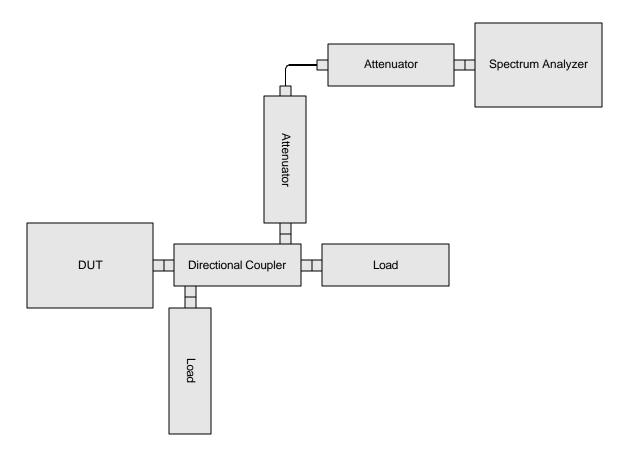
### Para. No. 2.1046 - R.F. Power Output

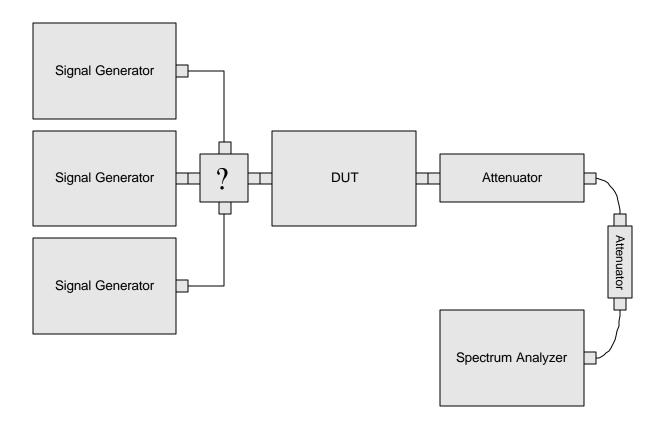


## Para. No. 2.1049 - Occupied Bandwidth

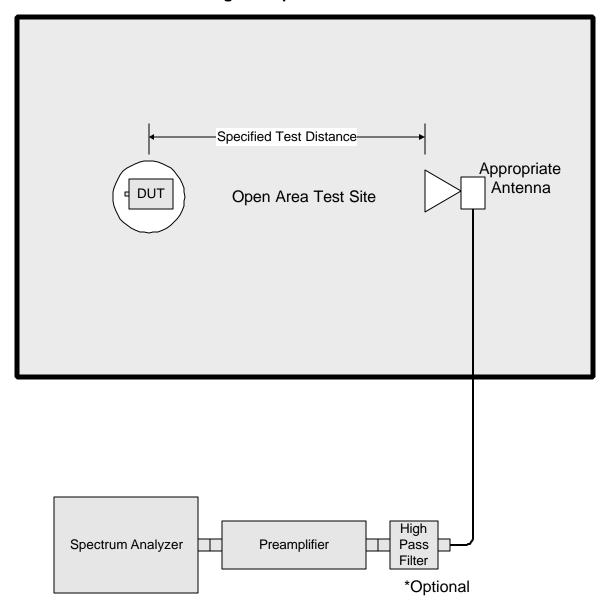


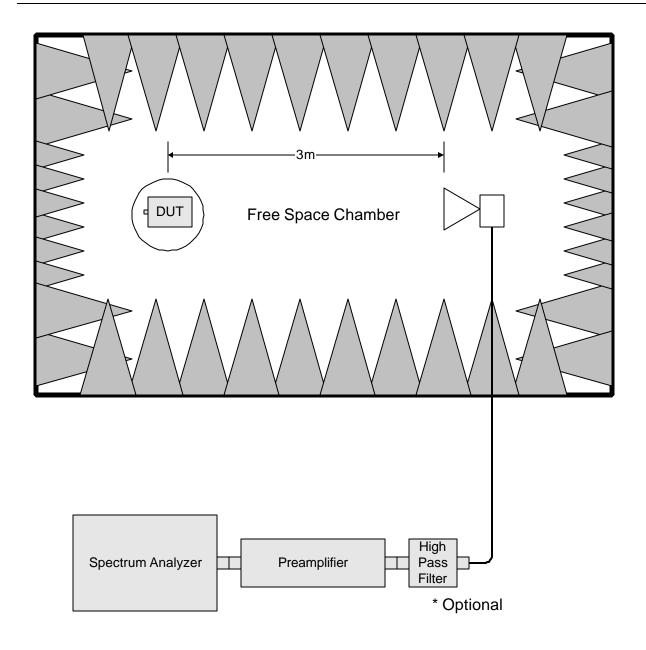
Para. No. 2.1051 Spurious Emissions at Antenna Terminals





Para. No. 2.1053 - Field Strength of Spurious Radiation





Para. No. 2.1055 - Frequency Stability

