

Nemko Test Report: 3L0495RUS1REV1

Applicant: Andrew Corporation

**Equipment Under Test:
(E.U.T.)** Node C 843

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

Tested By: Nemko Dallas Inc.
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Date: 5/20/04

Total Number of Pages: 48

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

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EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

Section 1. Summary of Test ResultsManufacturer: **Andrew Corporation**Model No.: **Node C 843**Serial No.: **14**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.

See “ Summary of Test Data”.

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EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****Summary Of Test Data**

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	22.913(a)	500W	20W	Complies
Occupied Bandwidth	22.917(c)	Input/Output	Complies	Complies
Spurious Emissions at Antenna Terminals	22.917	-13 dBm	Complies	Complies
Field Strength of Spurious Emissions	22.917	-13 dBm E.I.R.P.	Complies	Complies
Frequency Stability	22.355	1.5 ppm		N/A

Footnotes:

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

.

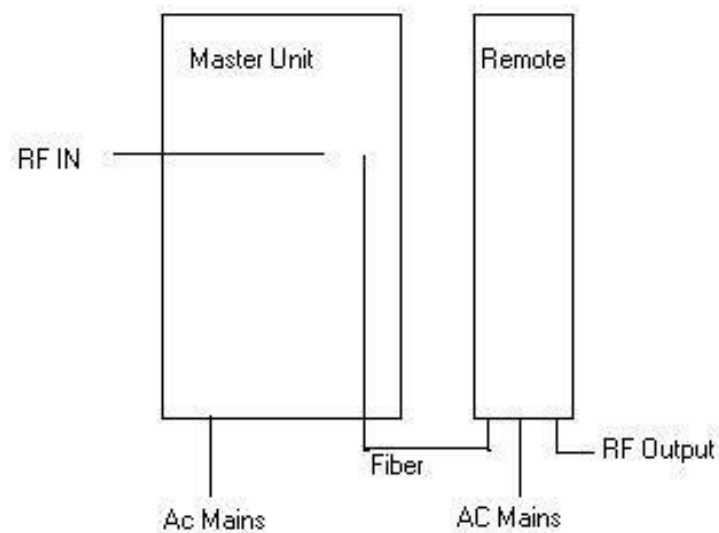
EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****Section 2. General Equipment Specification**

Supply Voltage Input:	115V AC				
Frequency Range:	Downlink:	869 – 894 MHz Device operates on Ch 37 to 630 (871.11 to 888.90MHz)			
Frequency Range:	Uplink:	824-849MHz Device operates on Ch 37 to 630 (826.11 to 843.90MHz)			
Type of Modulation and Designator:	CDMA (F9W) ☒	GSM (GXW) ☐	NADC (DXW) ☐	CDPD (F9W) ☐	AMPS (F8W, F1D) ☐
Output Impedance:	50 ohms				
RF Output (Rated): (Per Carrier)	Downlink:	43 dBm (1 Carrier)			
	Uplink:	23 dBm			
Frequency Translation:	F1-F1 ☐	F1-F2 ☐	N/A ☒		
Band Selection:	Software ☒	Duplexer Change ☐	Fullband Coverage ☐		

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

System Diagram



EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****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	23.08dBm	
Downlink	CDMA	43.05dBm	

Equipment Used: 1036, 1626, 1627, 1064, 1469, 1053**Measurement Uncertainty:** +/- 1.6 dB**Temperature:** 21 °C**Relative Humidity:** 51 %

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

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

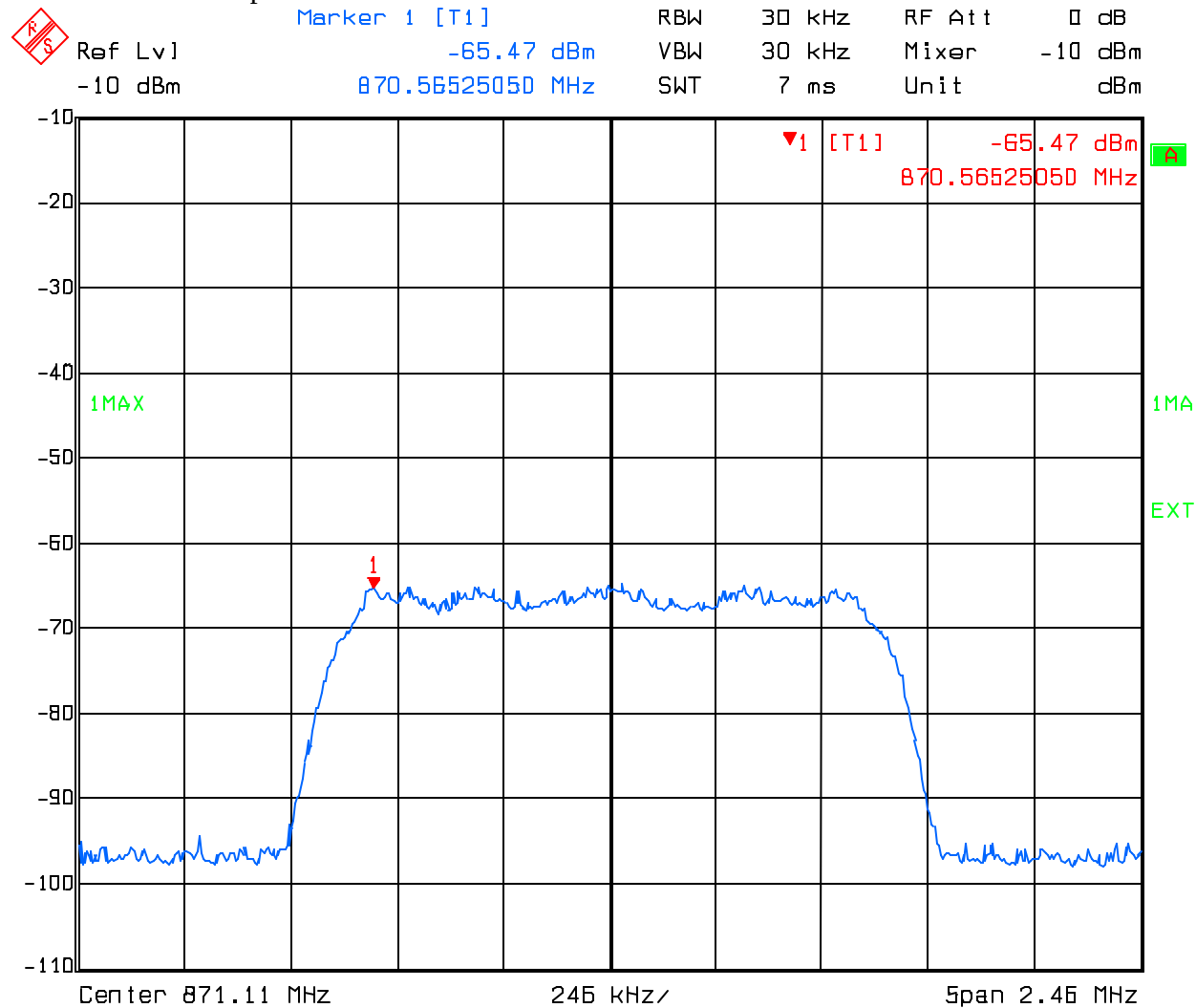
Measurement Uncertainty: +/- **1.6** dB

Temperature: **21** °C

Relative Humidity: **51** %

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****Occupied Band Width / Input Output Plots**

Downlink CDMA Input

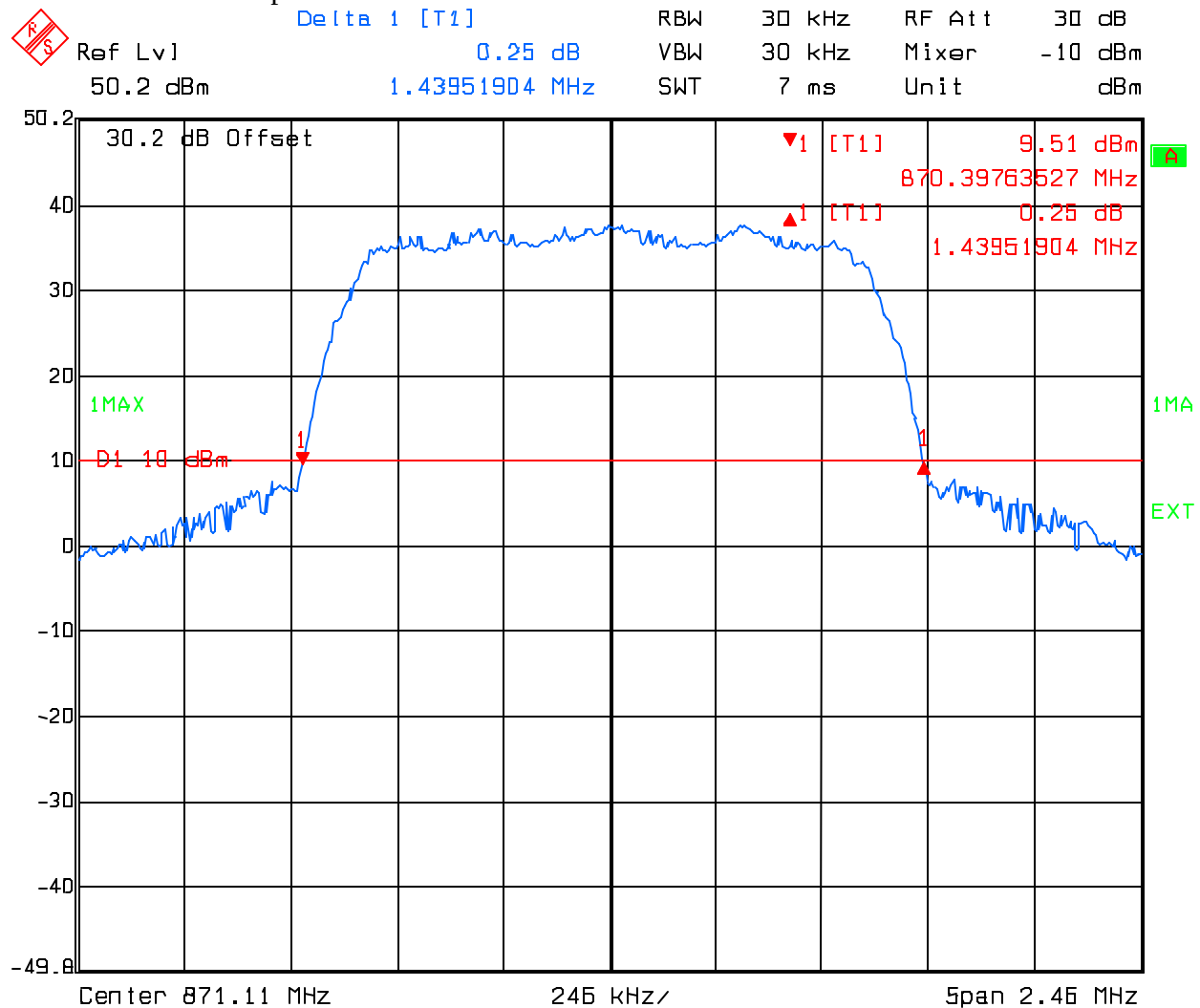


Date: 27.FEB.2004 16:55:30

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

Downlink CDMA Output

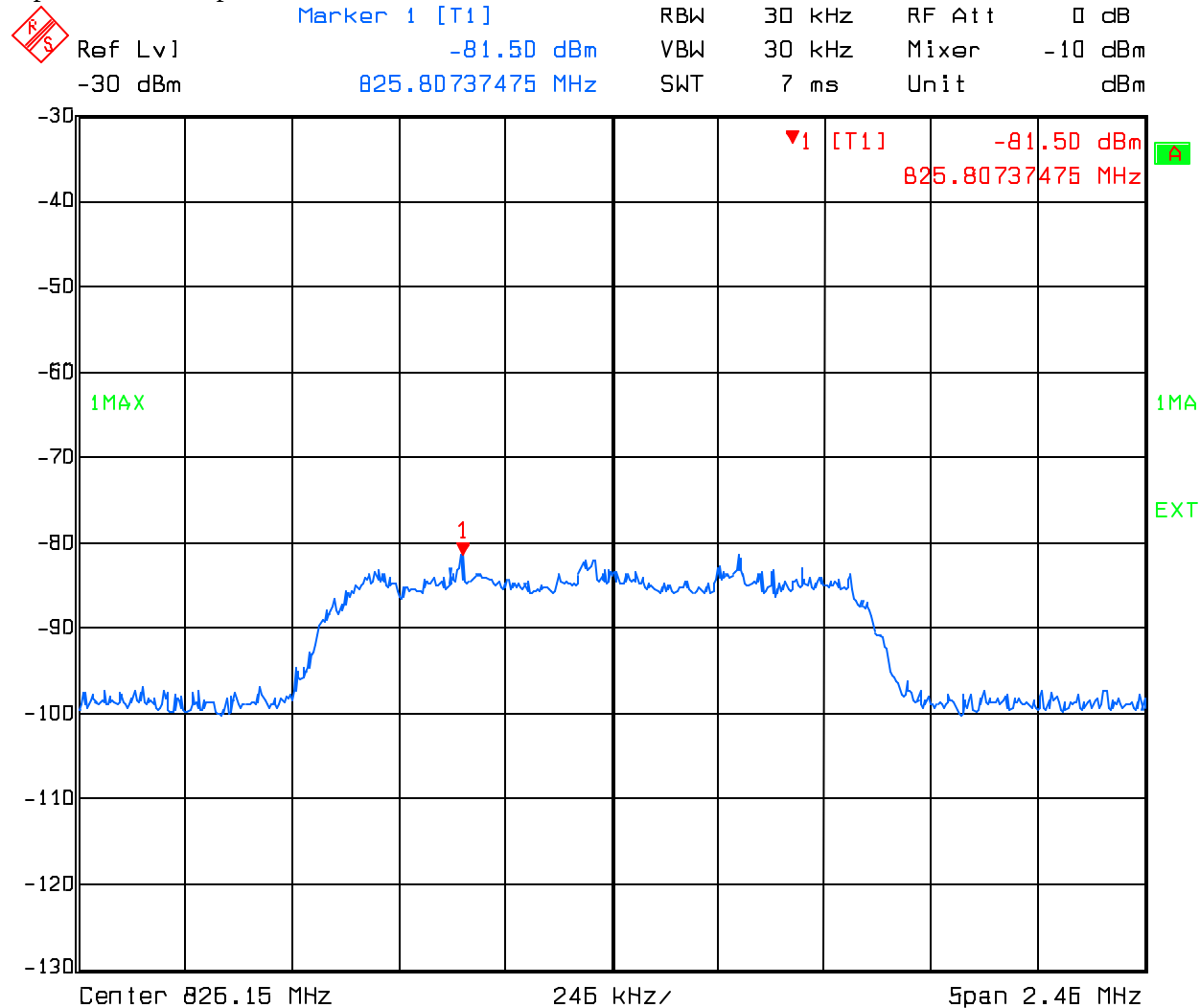


Date: 27.FEB.2004 16:52:07

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

Uplink CDMA Input



Date: 27.FEB.2004 12:36:20

PROJECT NO.: 3L0495

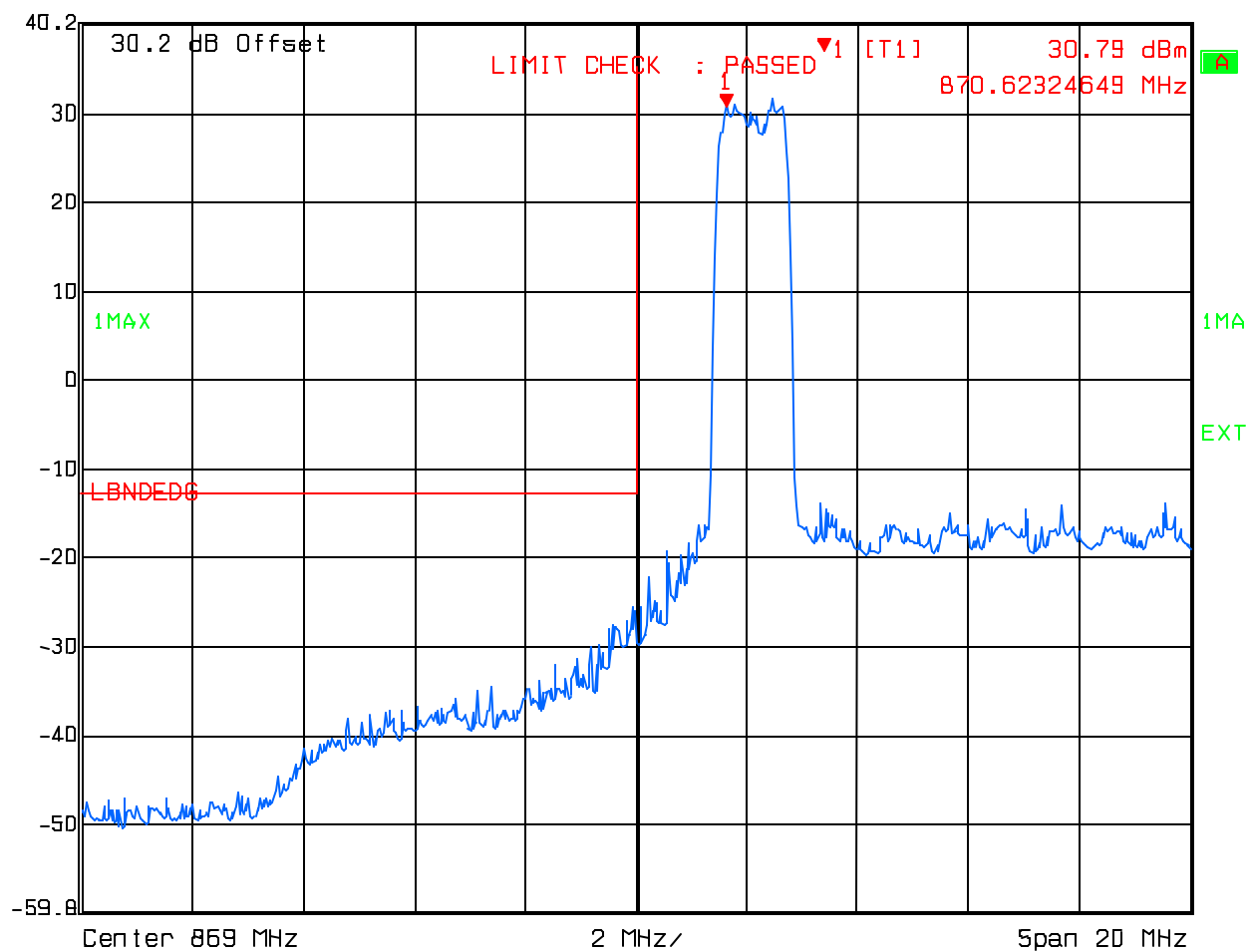
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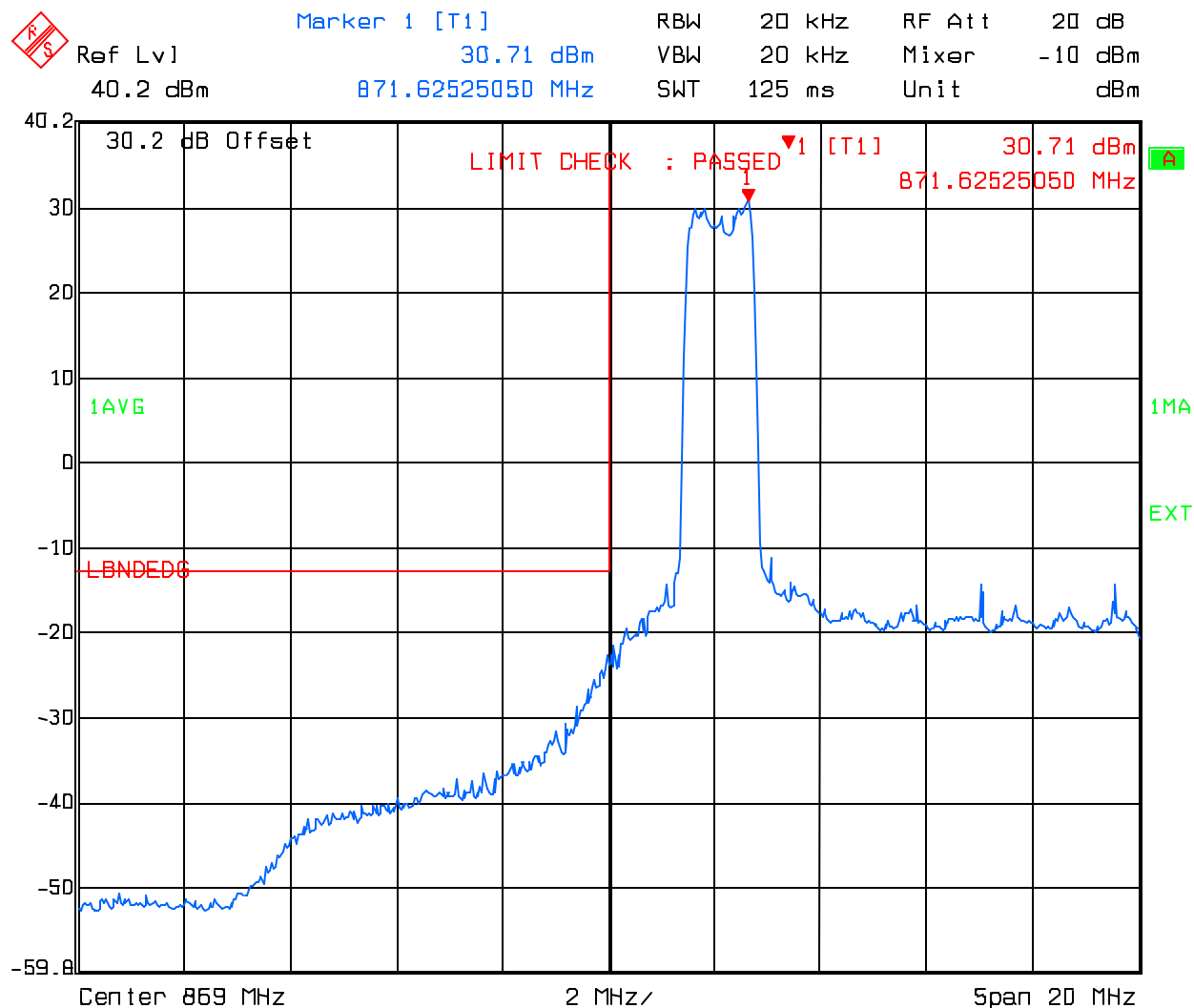
EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****Band Edge**

Down Link CDMA LOWER (Ch 871.11MHz)

	Ref Lvl	30.79 dBm	RBW	20 kHz	RF Att	20 dB
	40.2 dBm	870.62324649 MHz	VBW	20 kHz	Mixer	-10 dBm
			SWT	125 ms	Unit	dBm



Date: 27.FEB.2004 17:09:18

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

Date: 27.FEB.2004 17:11:17

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

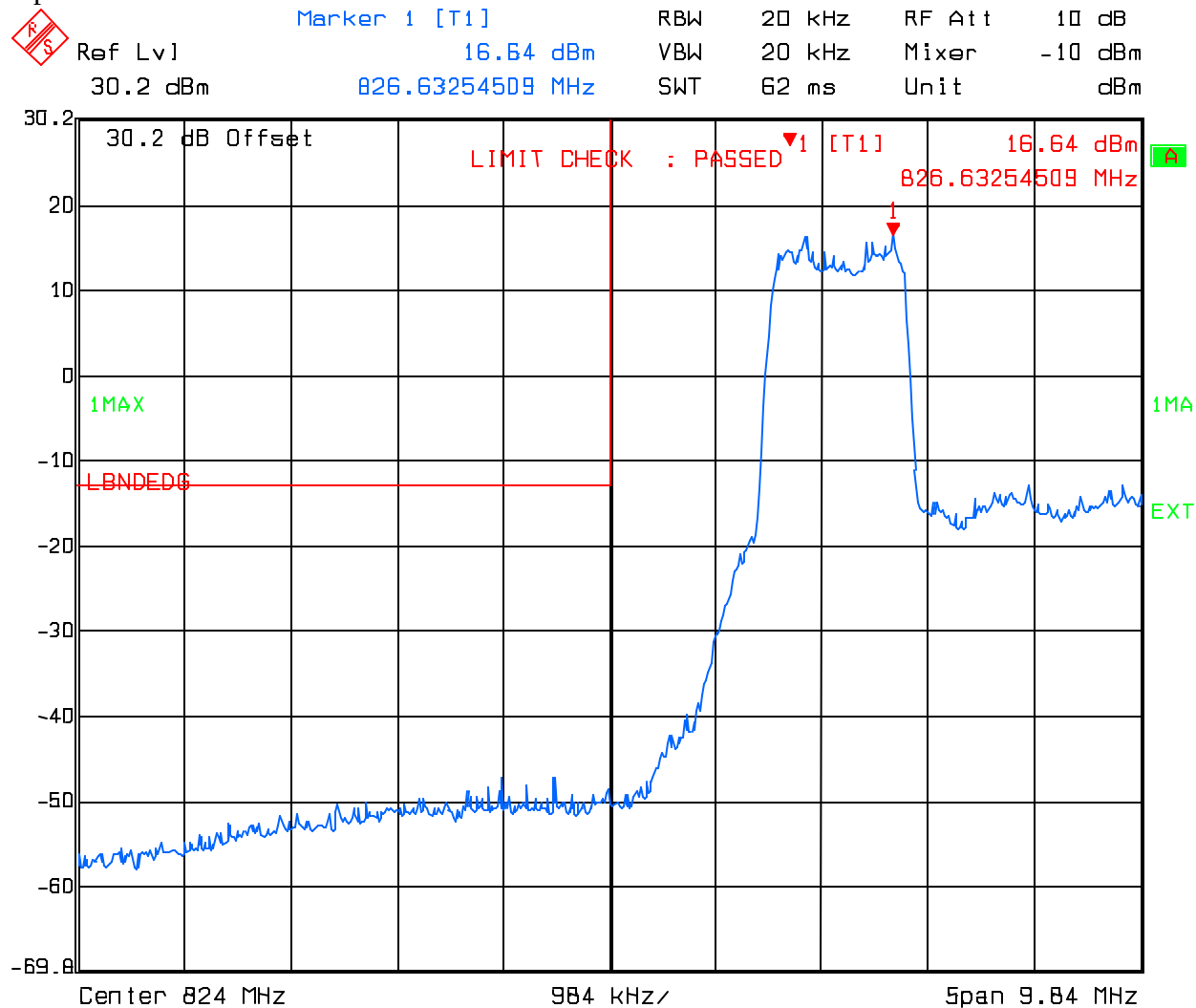
Downlink CDMA UPPER (888.9MHz)



Date: 27.FEB.2004 17:28:32

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

Uplink CDMA LOWER

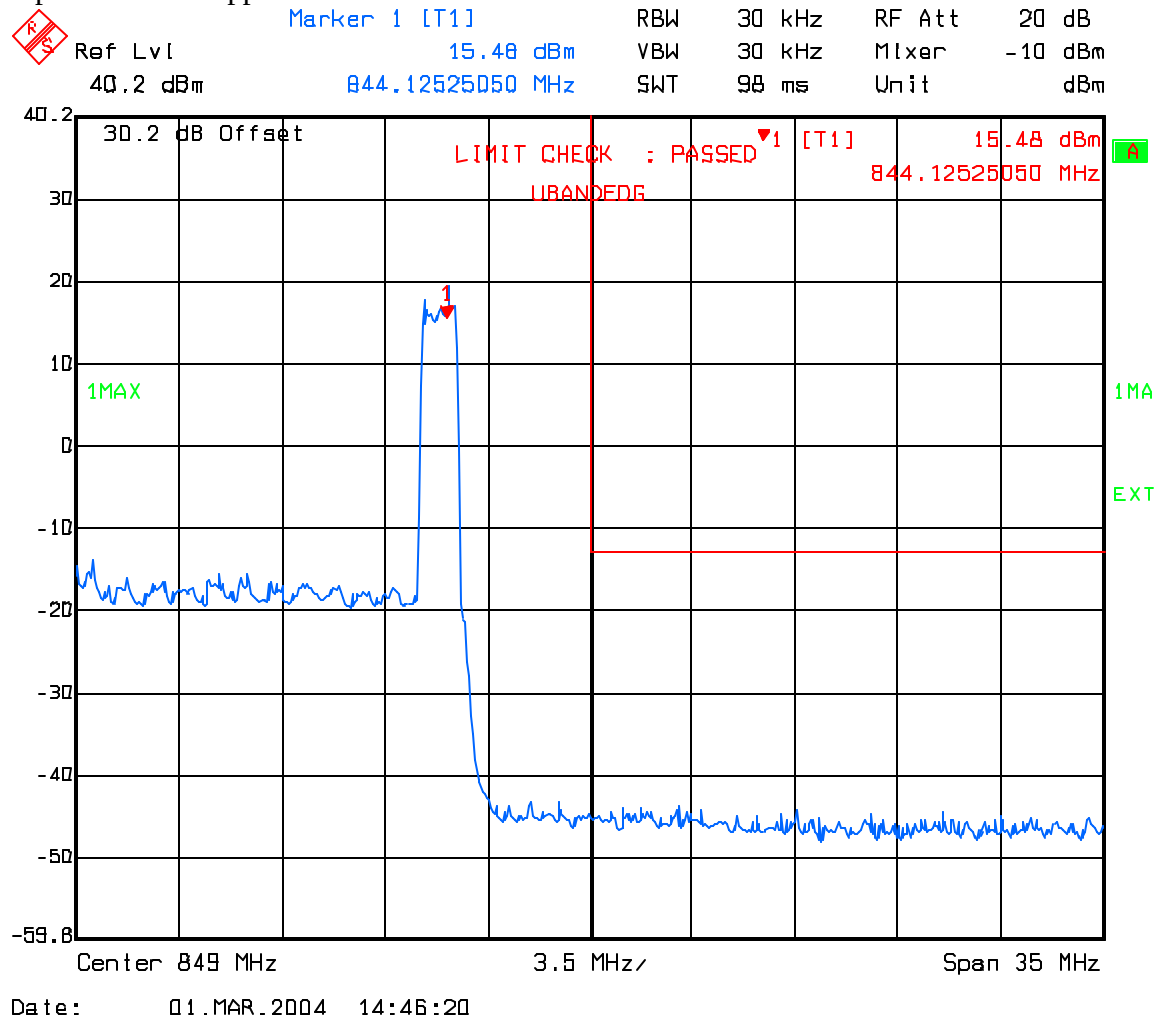


Date: 27.FEB.2004 11:45:00

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

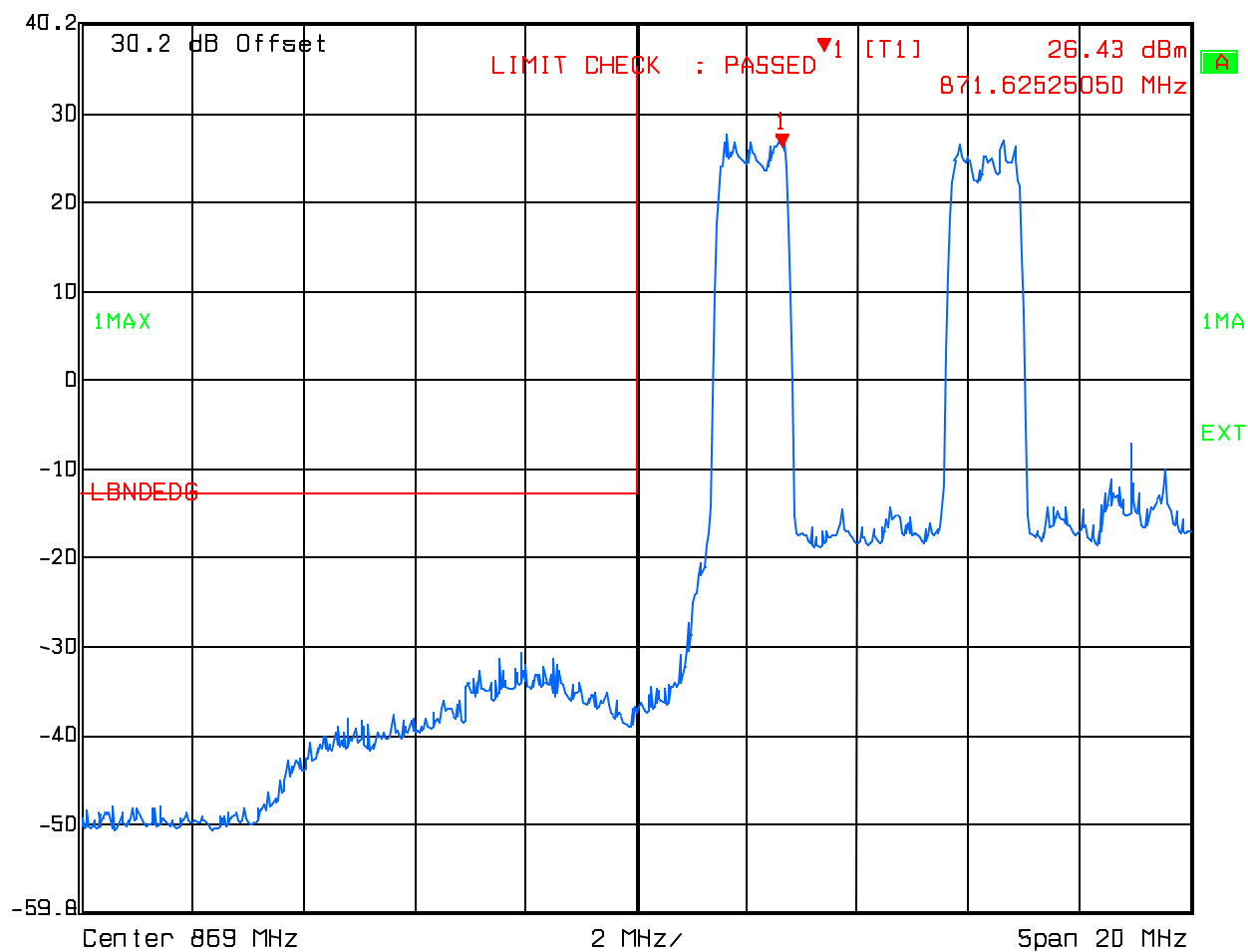
Uplink CDMA Upper



EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****Intermodulation**

Downlink 800 CDMA Lower (Ch 871.11MHz)

	Ref Lvl	26.43 dBm	RBW	20 kHz	RF Att	20 dB
	40.2 dBm	871.62525050 MHz	VBW	20 kHz	Mixer	-10 dBm
			SWT	125 ms	Unit	dBm



Date: 27.FEB.2004 17:15:50

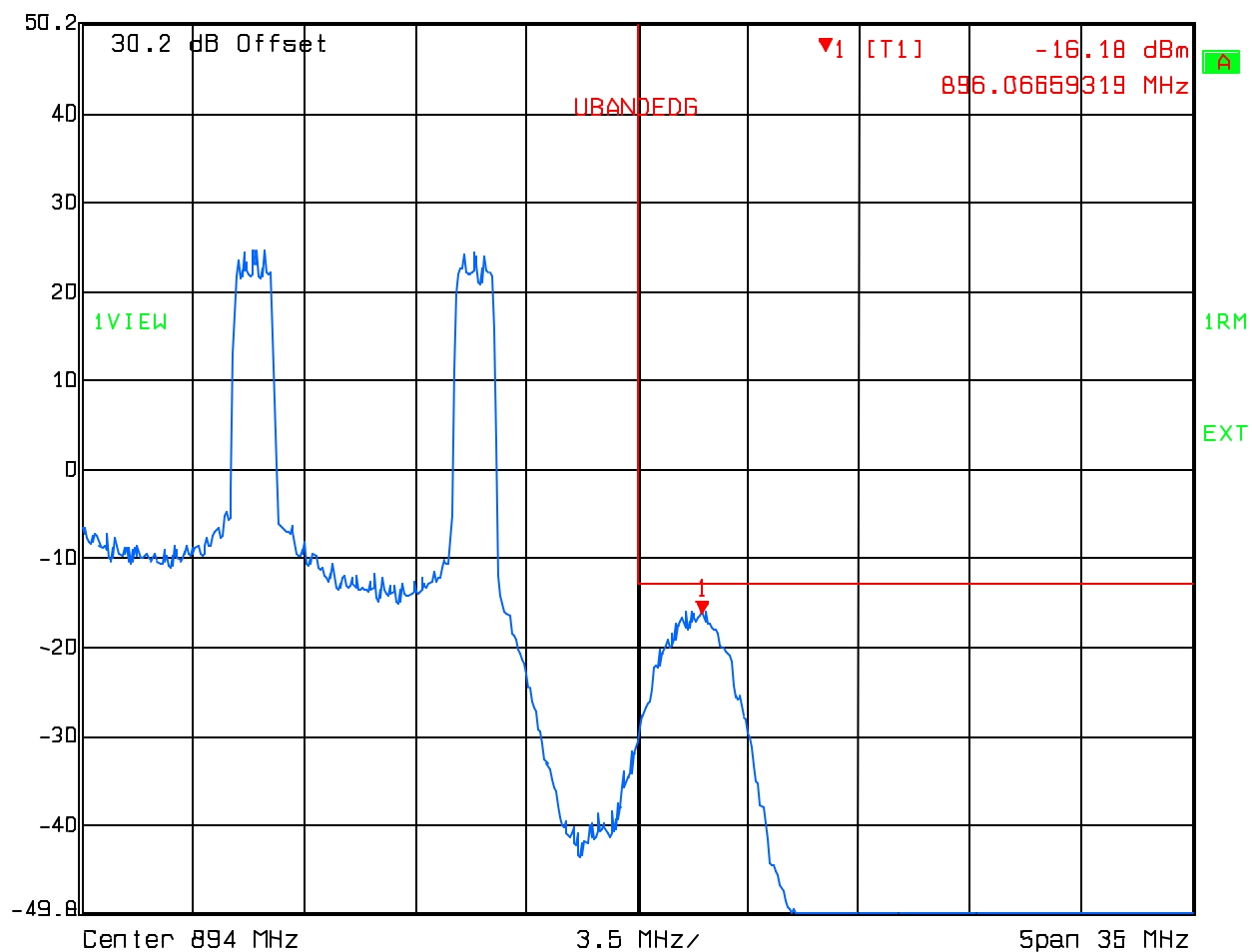
EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

Downlink 800 CDMA Upper

 Ref Lvl 50.2 dBm
 Marker 1 [T1] -16.18 dBm
 896.06659319 MHz

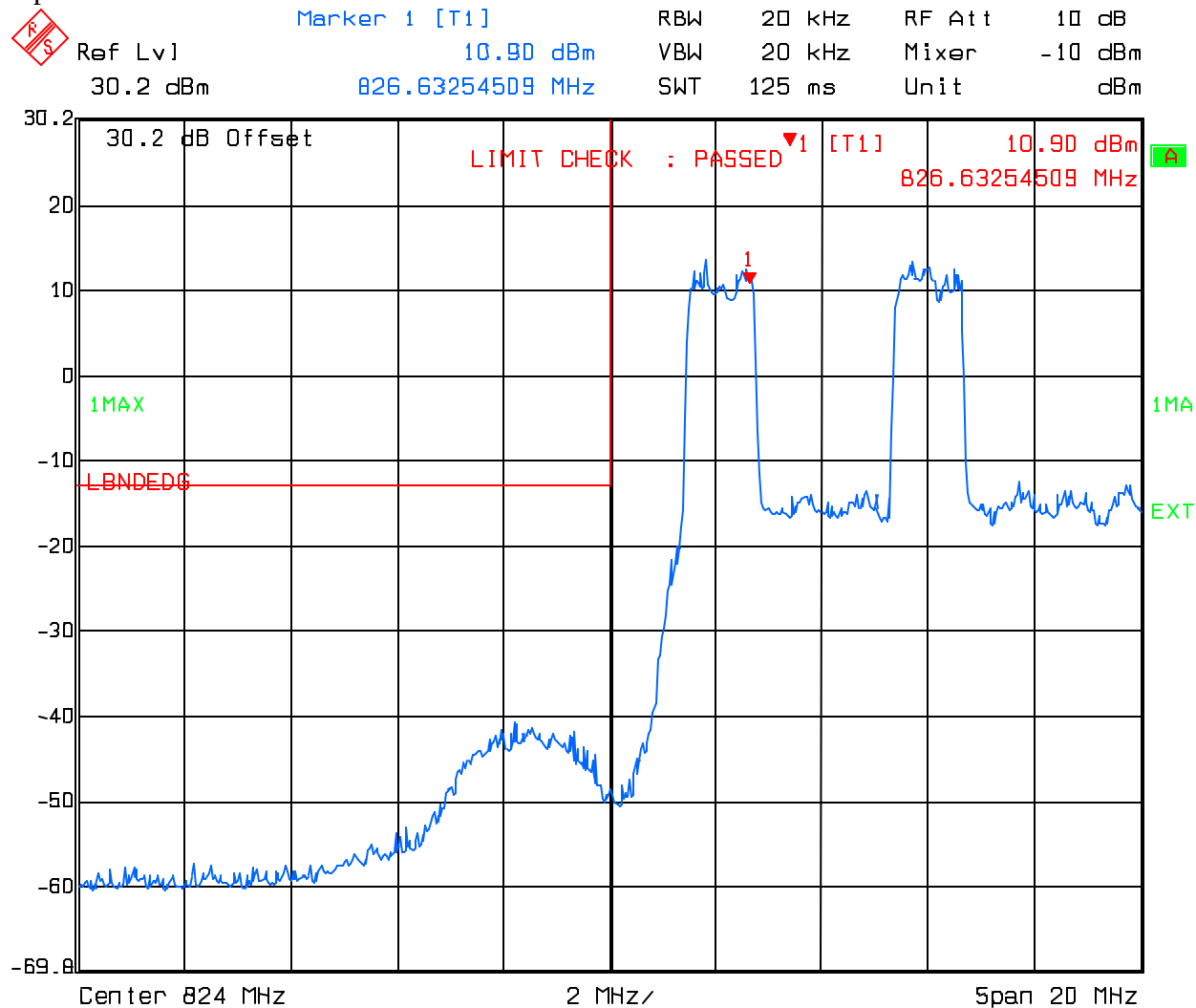
RBW 20 kHz RF Att 30 dB
 VBW 20 kHz Mixer -10 dBm
 SWT 220 ms Unit dBm



Date: 01.MAR.2004 10:29:03

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

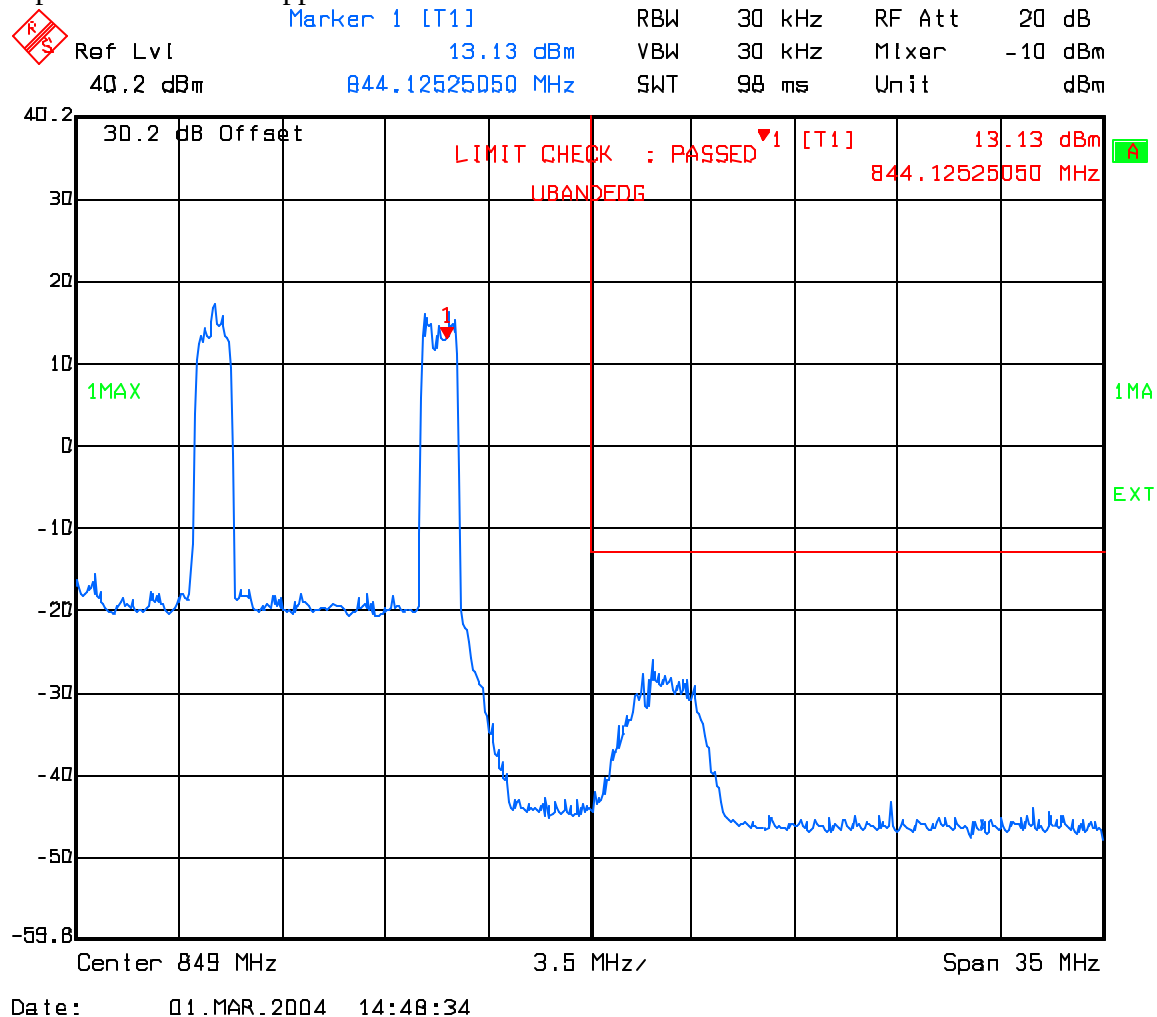
Uplink 800 CDMA Lower



Date: 27.FEB.2004 11:58:04

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

Uplink 800 CDMA Upper



EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

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, 1626, 1627, 1064, 1469, 1053

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

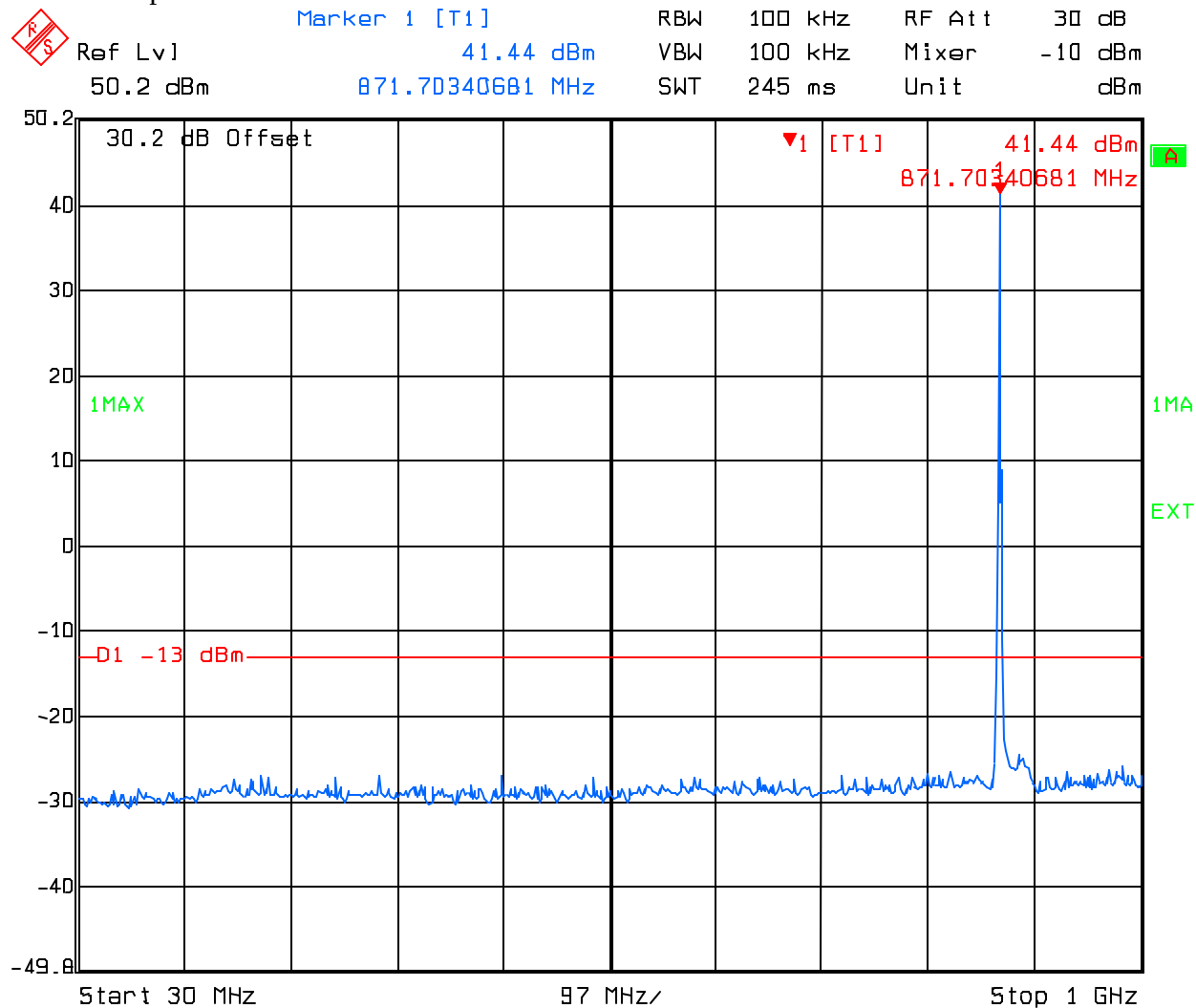
Temperature: **21** °C

Relative Humidity: **51** %

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

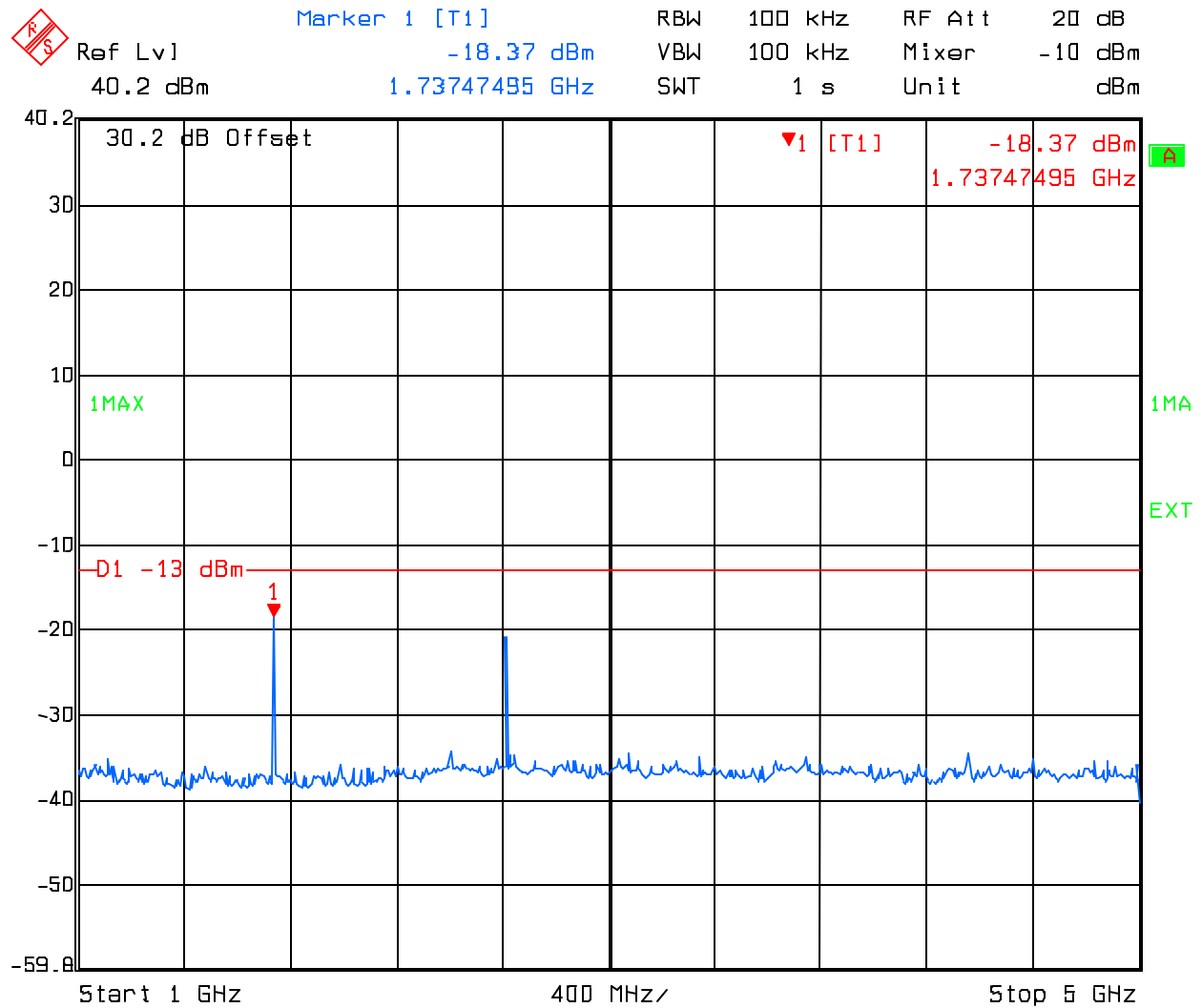
Downlink Spurs

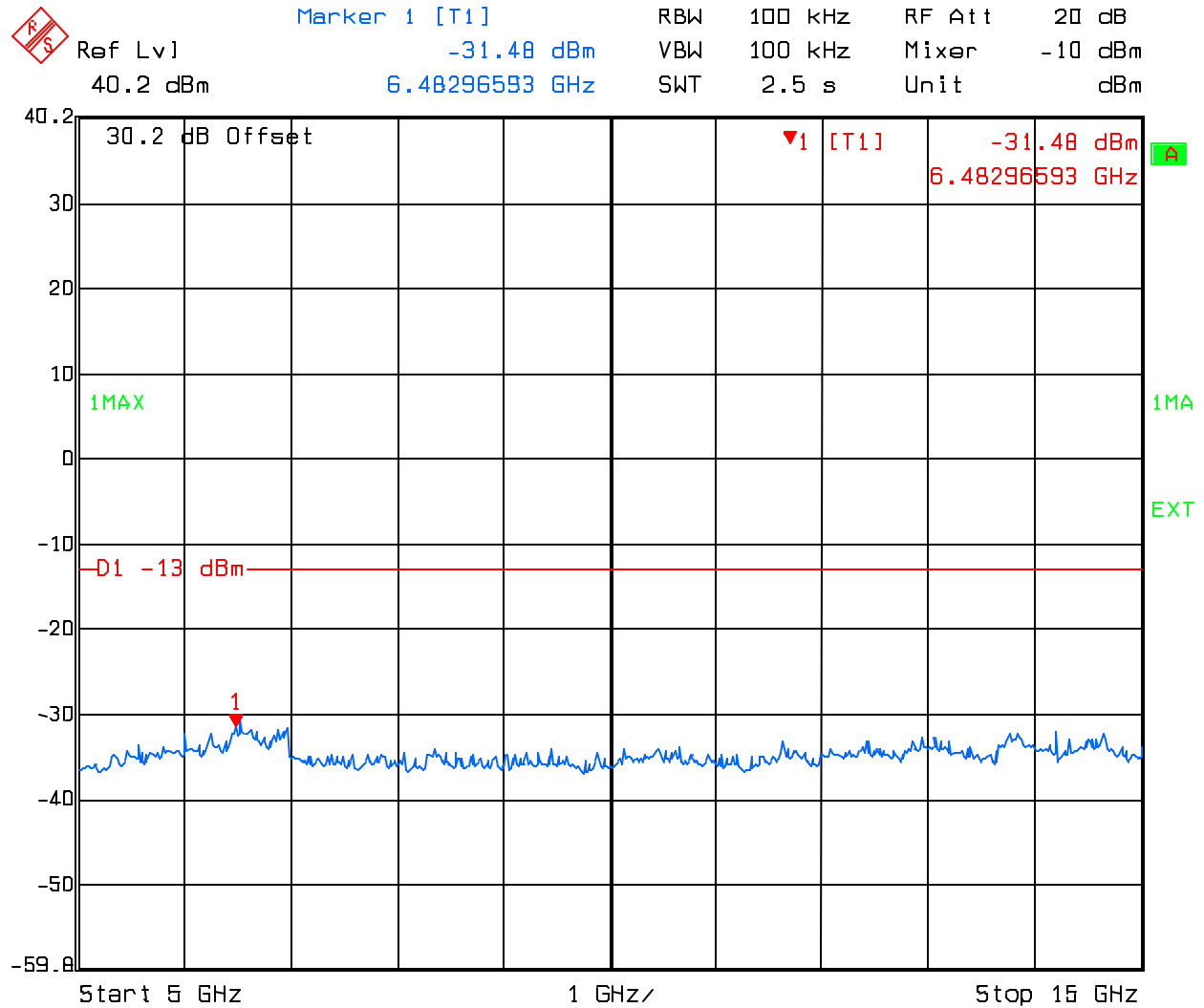


Date: 27.FEB.2004 16:57:50

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

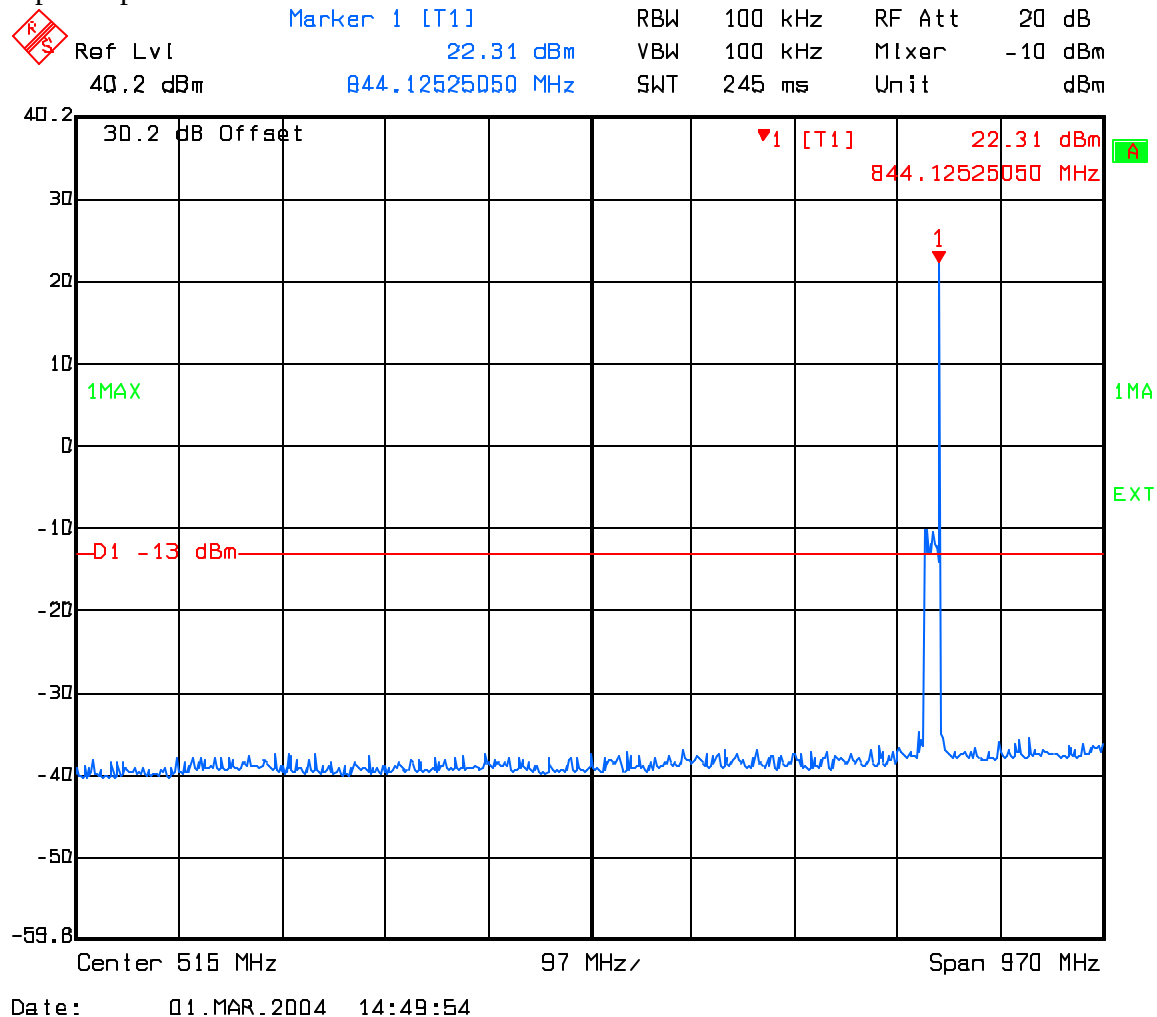


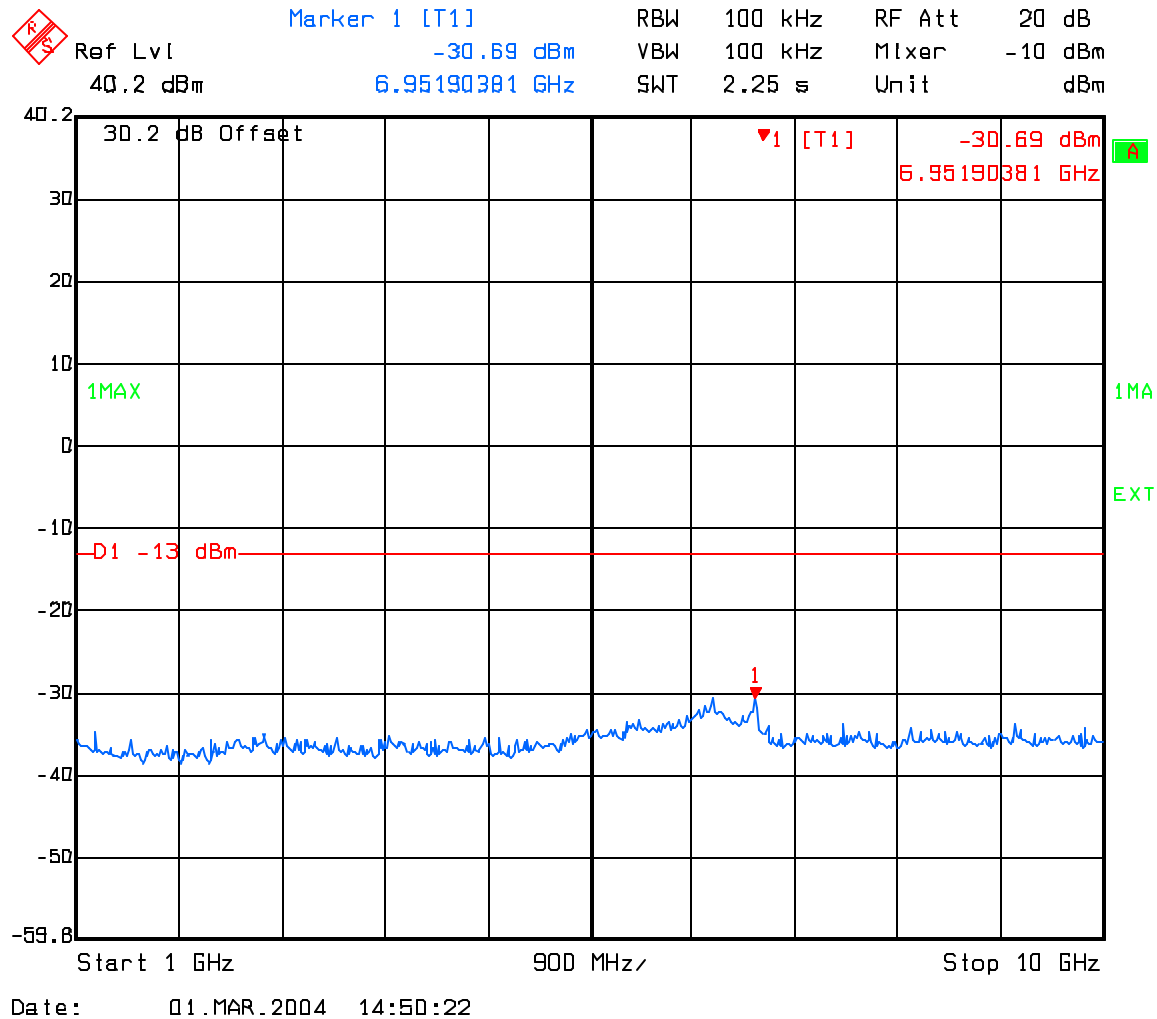
EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

Uplink Spurs



EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

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

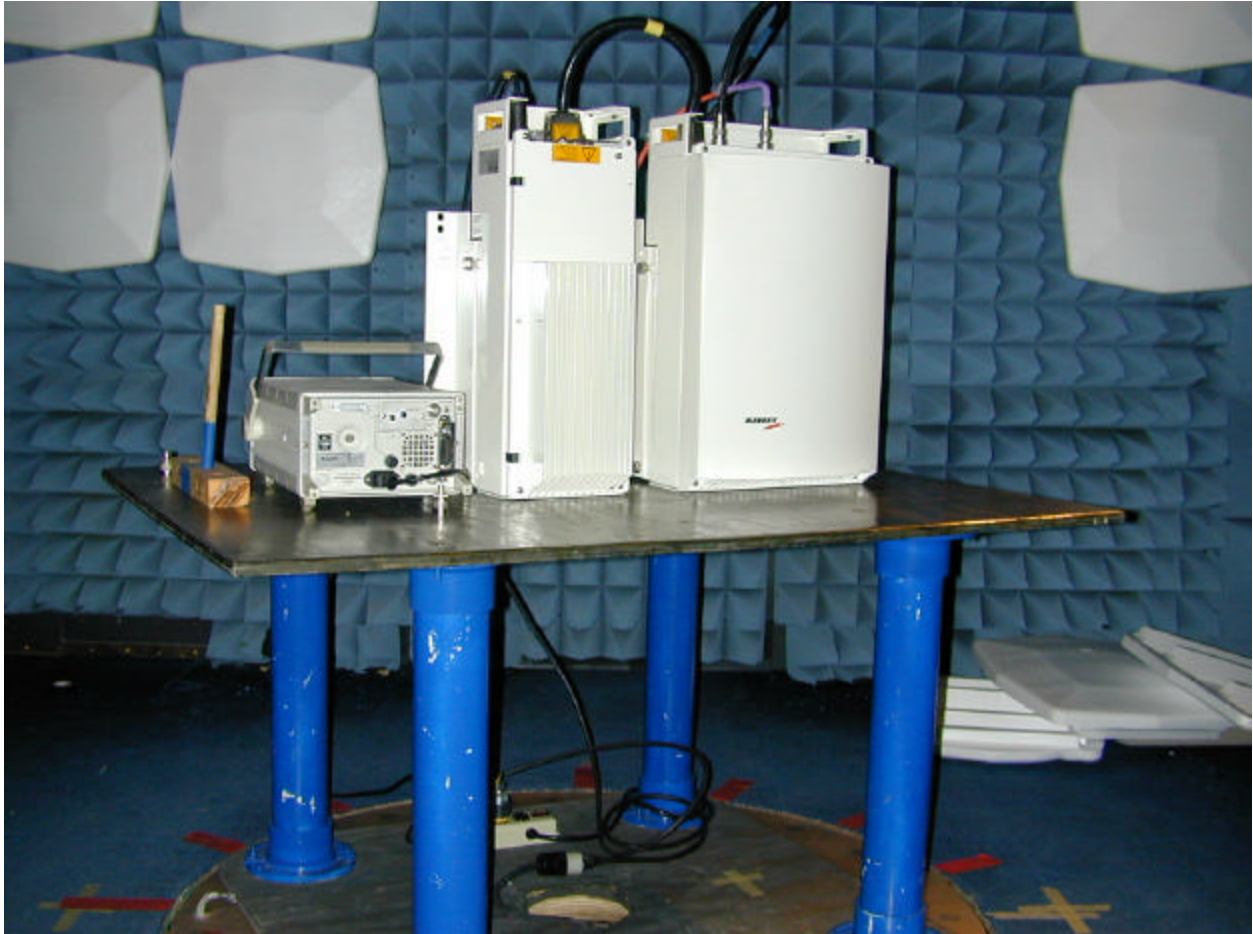
Equipment Used: 1464, 1016, 1464, 1485, 1484, 1304**Measurement Uncertainty:** +/- **3.6** dB**Temperature:** **21** °C**Relative Humidity:** **51** %

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

Photographs of Test Setup

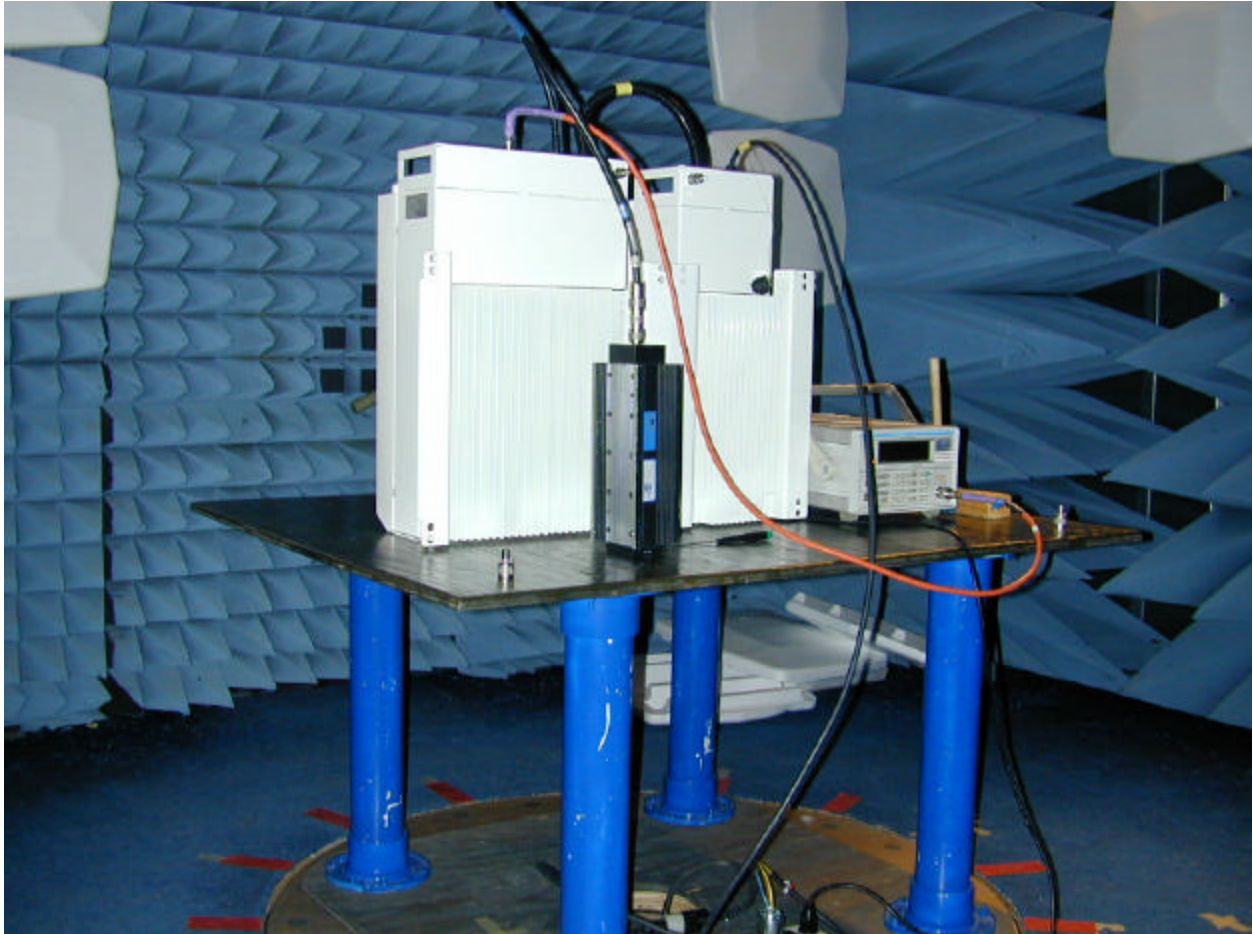
FRONT VIEW



EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

REAR VIEW



EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495**

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability

PARA. NO.: 2.1055

TESTED BY:

DATE:

Test Results: **Not Applicable****Test Data:**

Standard Test Frequency:

MHz

Standard Test Voltage:

Equipment Used:**Measurement Uncertainty:** ppm**Temperature:** °C**Relative Humidity:** %

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****Section 8. Test Equipment List**

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

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

ANNEX A - TEST DETAILS

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****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 $GP/4\pi R^2 = E^2/120$ 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

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****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

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.

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****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 843**PROJECT NO.: **3L0495****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

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

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

EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

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

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****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)

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

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

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

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

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

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

The spectrum is searched to 10 GHz.

EQUIPMENT: **Node C 843**PROJECT NO.: **3L0495****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:

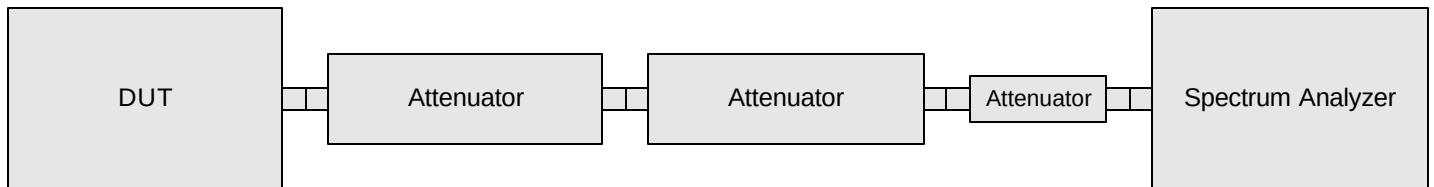
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

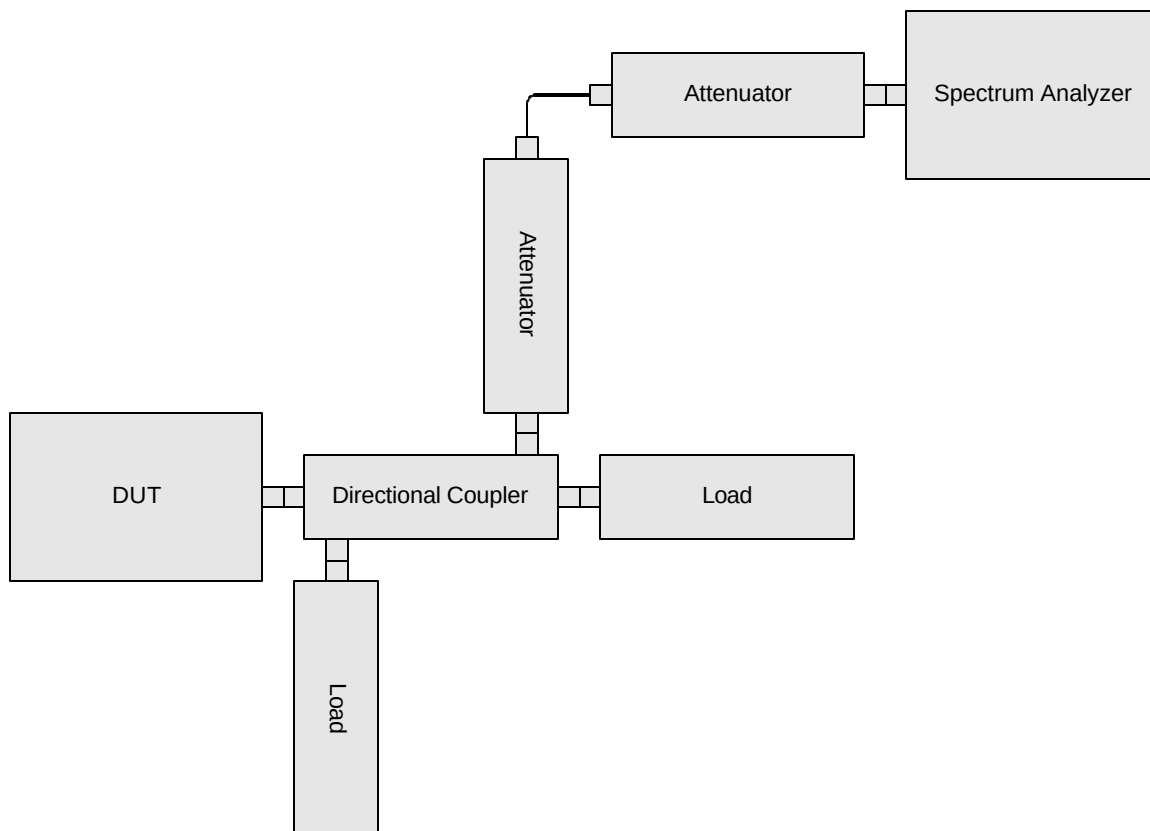
EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

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



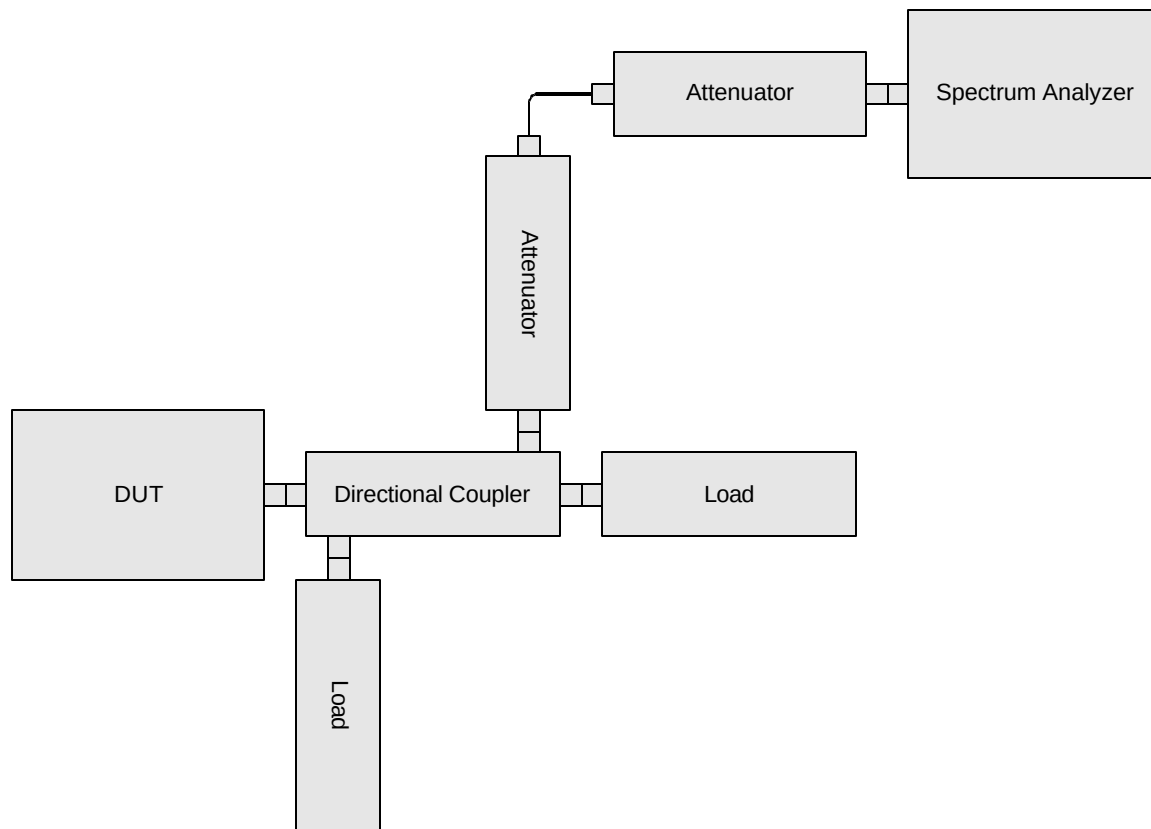
Para. No. 2.1049 - Occupied Bandwidth



EQUIPMENT: **Node C 843**

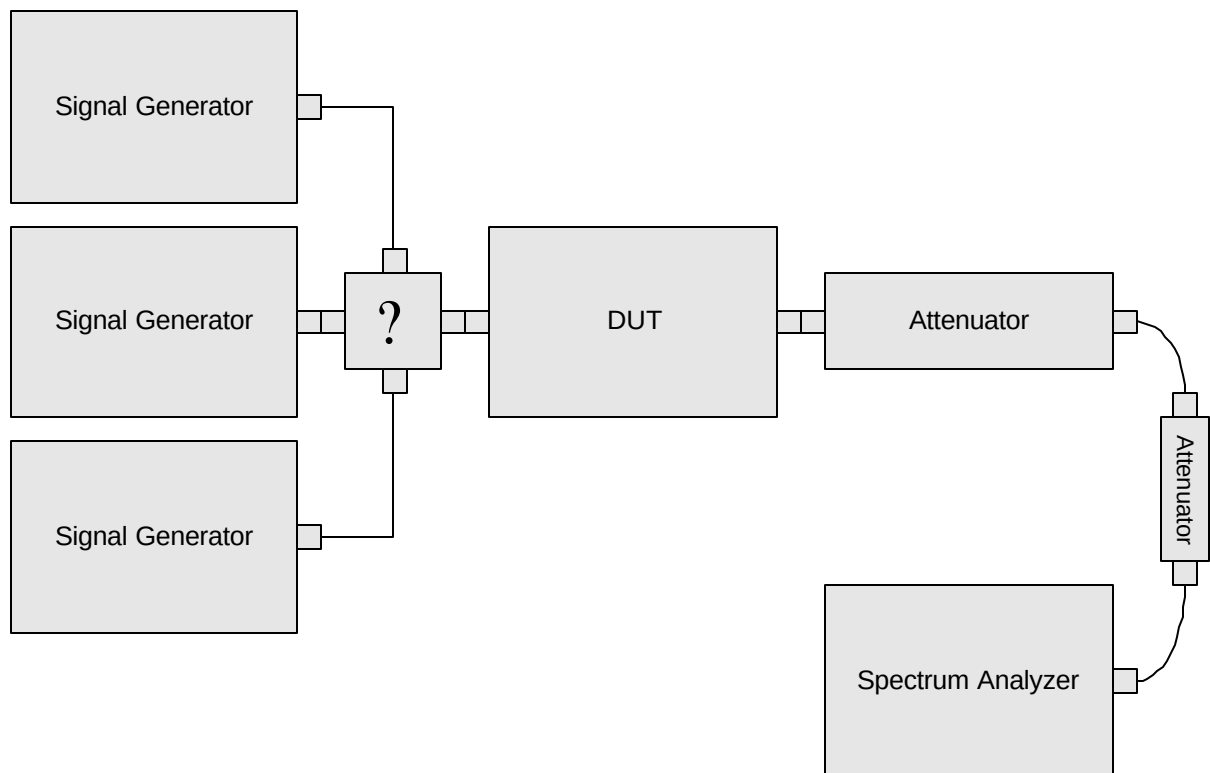
PROJECT NO.: **3L0495**

Para. No. 2.1051 Spurious Emissions at Antenna Terminals



EQUIPMENT: **Node C 843**

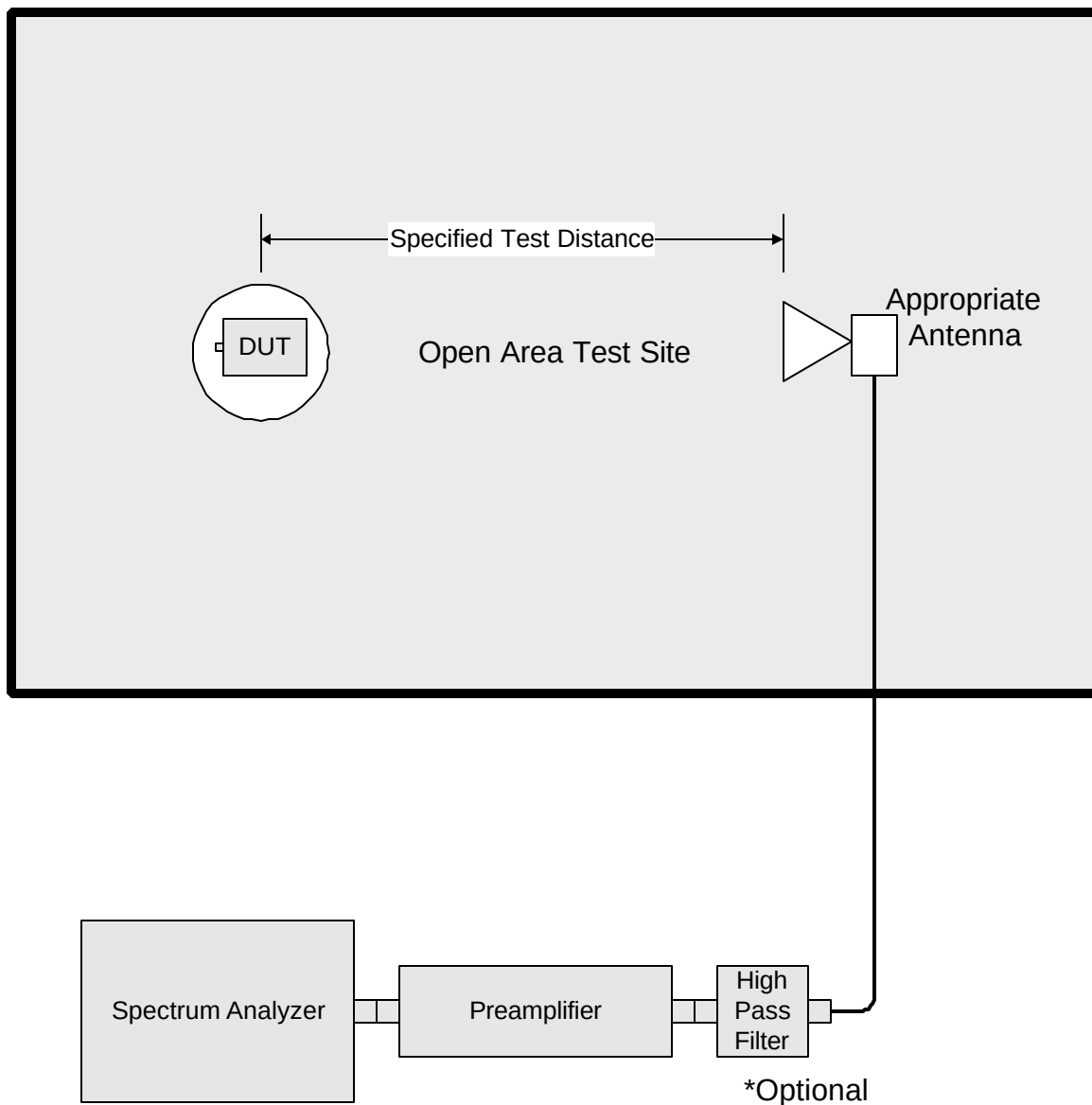
PROJECT NO.: **3L0495**



EQUIPMENT: **Node C 843**

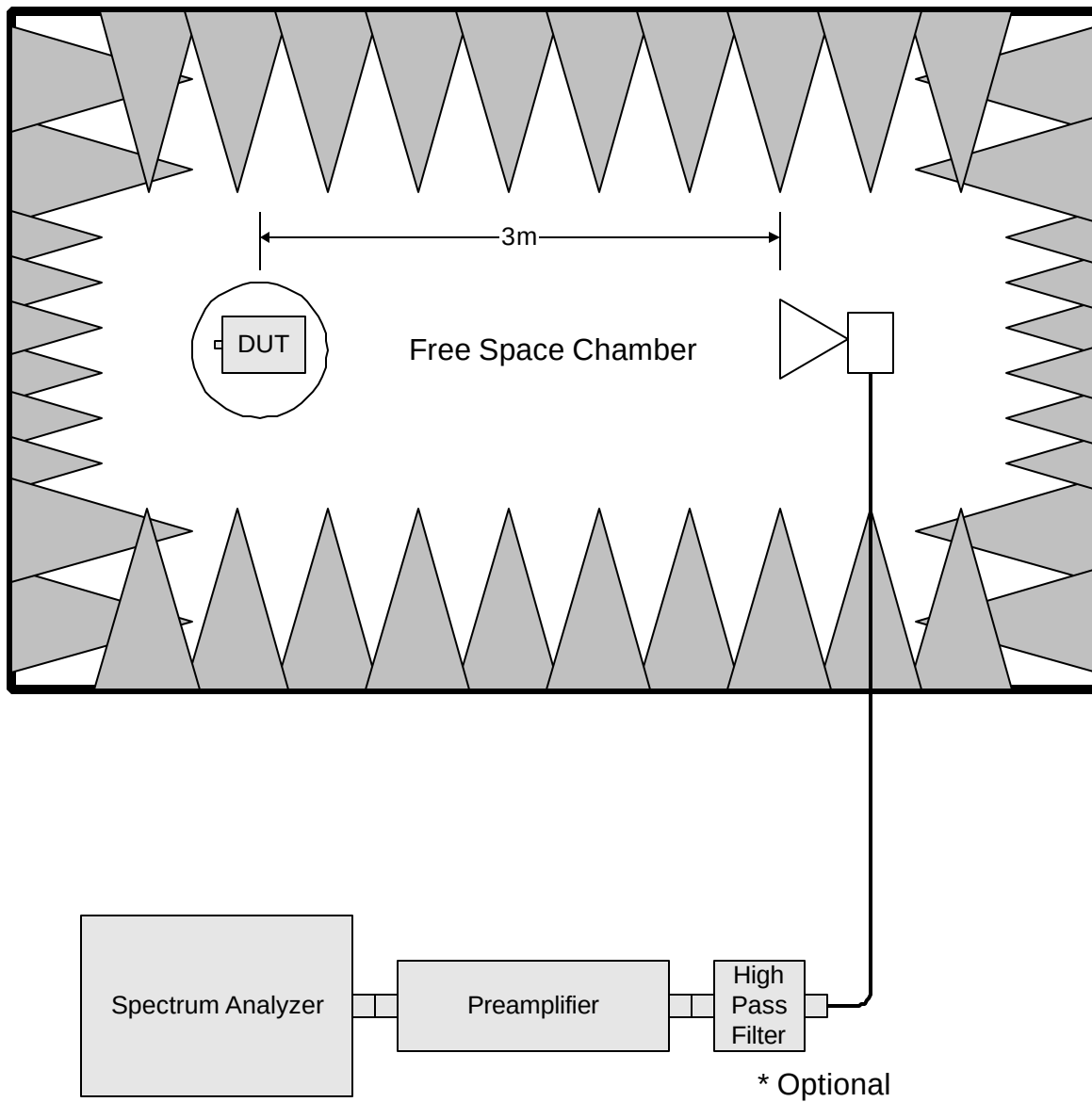
PROJECT NO.: **3L0495**

Para. No. 2.1053 - Field Strength of Spurious Radiation



EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**



EQUIPMENT: **Node C 843**

PROJECT NO.: **3L0495**

Para. No. 2.1055 - Frequency Stability

