

Nemko Test Report No.:

3L0497RUS1

Applicant:

Andrew Corporation

Equipment Under Test:

Node C 1937

FCC ID:

BCR-RPT-NODEC1937

In Accordance With:

FCC Part 24, Subpart E
Broadband PCS Repeaters

Tested By:

Nemko Dallas Inc.
802 N. Kealy
Lewisville, Texas 75057-3136



Authorized By:

Tom Tidwell, Frontline Manager

Date:

2/24/04

Total Number of Pages:

45

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EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: Node C 1937

Serial No.: 13

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 24, Subpart E.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See “ Summary of Test Data”.

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EQUIPMENT: **PCS Repeater**PROJECT NO.: **3L0497**

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
RF Power Output	24.232	Complies
Occupied Bandwidth (CDMA)	24.238	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	Complies
Field Strength of Spurious Emissions	24.238(a)	Complies
Frequency Stability	24.235	NA

Footnotes:

(1) Modulation characteristics were not tested since the E.U.T. processes but does not produce a modulated waveform.

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

EQUIPMENT: **PCS Repeater**PROJECT NO.: **3L0497****Section 2. General Equipment Specification**

Supply Voltage Input:	120 Vac		
Frequency Bands: Downlink:	☒ Block A : 1930 – 1945 MHz ☒ Block D : 1945 – 1950 MHz ☒ Block B : 1950 – 1965 MHz ☒ Block E : 1965 – 1970 MHz ☒ Block F : 1970 – 1975 MHz ☒ Block C : 1975 – 1990 MHz		
Frequency Bands: Uplink:	☒ Block A : 1850 – 1865 MHz ☒ Block B : 1865 – 1870 MHz ☒ Block C : 1870 – 1885 MHz ☒ Block D : 1885 – 1890 MHz ☒ Block E : 1890 – 1895 MHz ☒ Block F : 1895 – 1910 MHz		
	CDMA (F9W) ☒	GSM (GXW) ☐	NADC (DXW) ☐
System Gain:	93dB Downlink 80dB Uplink		
Output Impedance:	50 ohms		
Max Input:	-60 dBm		
	+23 dBm		
	+37 dBm	1 CDMA Carrier	
	+30 dBm	4 CDMA Carriers	
	F1-F1 ☐	F1-F2 ☐	N/A ☒
	Software ☒	Duplexer ☐	Fullband ☐

Nemko Dallas

FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Modifications Made During Testing

No modifications made.

Description of Operation

The Node C is designed to amplify signals between multiple UEs and a Base Transceiver Station in a CDMA system. The unit consists of a filter and amplifier chain in the downlink and one or two filters and amplifier chains in the uplink (primary and diversity). The uplink and downlink paths are connected via a duplexer on both ends of each path.

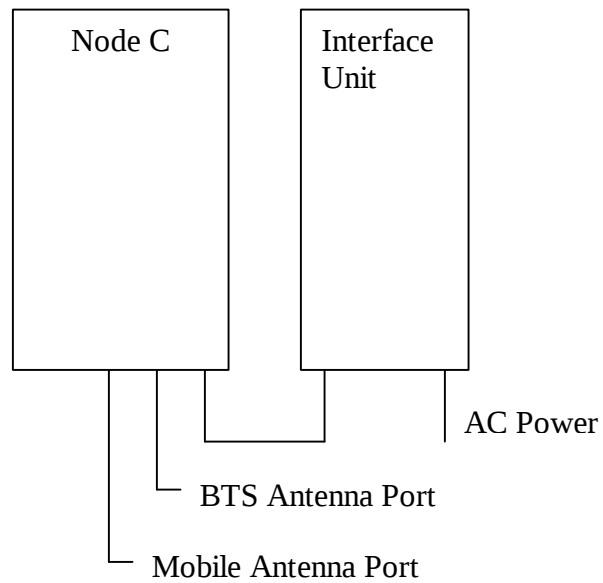
In the primary uplink path, a signal originating from the UE is separated from the downlink signal via the primary UL IN duplexer. It is then amplified by an integrated low noise amplifier (LNA) and forwarded to the uplink Digital Channel Module (DCM). The DCM down-converts the signal to base-band, digitally filters it, amplifies it and then up-converts it. In addition the interference cancellation technology is implemented in the DCM. Finally, the signal is sent to the final amplifier and combined with the downlink input signal in the DL IN duplexer. The optional diversity uplink path (via a second filter) is identical except signals enter via the diversity UL IN duplexer and are combined in the DCM with the primary path.

In the downlink path, a signal originating from the Base Transceiver Station is separated from the uplink signal in the DL IN duplexer. It is then amplified by an integrated low noise amplifier (LNA) and forwarded to the downlink digital channel module (DCM). The DCM down-converts the signal to base-band, digitally filters it amplifies it and then up-converts it. In addition the interference cancellation technology is implemented in the DCM. Finally, the signal is sent to the final amplifier and combined with the uplink input signal in the primary UL IN duplexer. The downlink DCM is also responsible for communication and control of the entire unit.

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

System Diagram



EQUIPMENT: **PCS Repeater**PROJECT NO.: **3L0497**

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: Dustin Oaks	DATE: 12/22/2003

Test Results: Complies.**Measurement Data:**

	Modulation Type	Measured Output Power (dBm)	
Uplink	CDMA	22.97	
Downlink	CDMA	36.99	

Equipment Used: 1036, 1053, 1626, 1629, 1478, 1604**Measurement Uncertainty:** +/- 1.6 dB**Temperature:** 21 °C**Relative Humidity:** 51 %

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (CDMA)	PARA. NO.: 2.1049
TESTED BY: Dustin Oaks	DATE: 12/22/2003

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036, 1053, 1626, 1629, 1478, 1604

Measurement Uncertainty: +/- 1.6 dB

Temperature: 21 °C

Relative Humidity: 51 %

EQUIPMENT: **PCS Repeater**

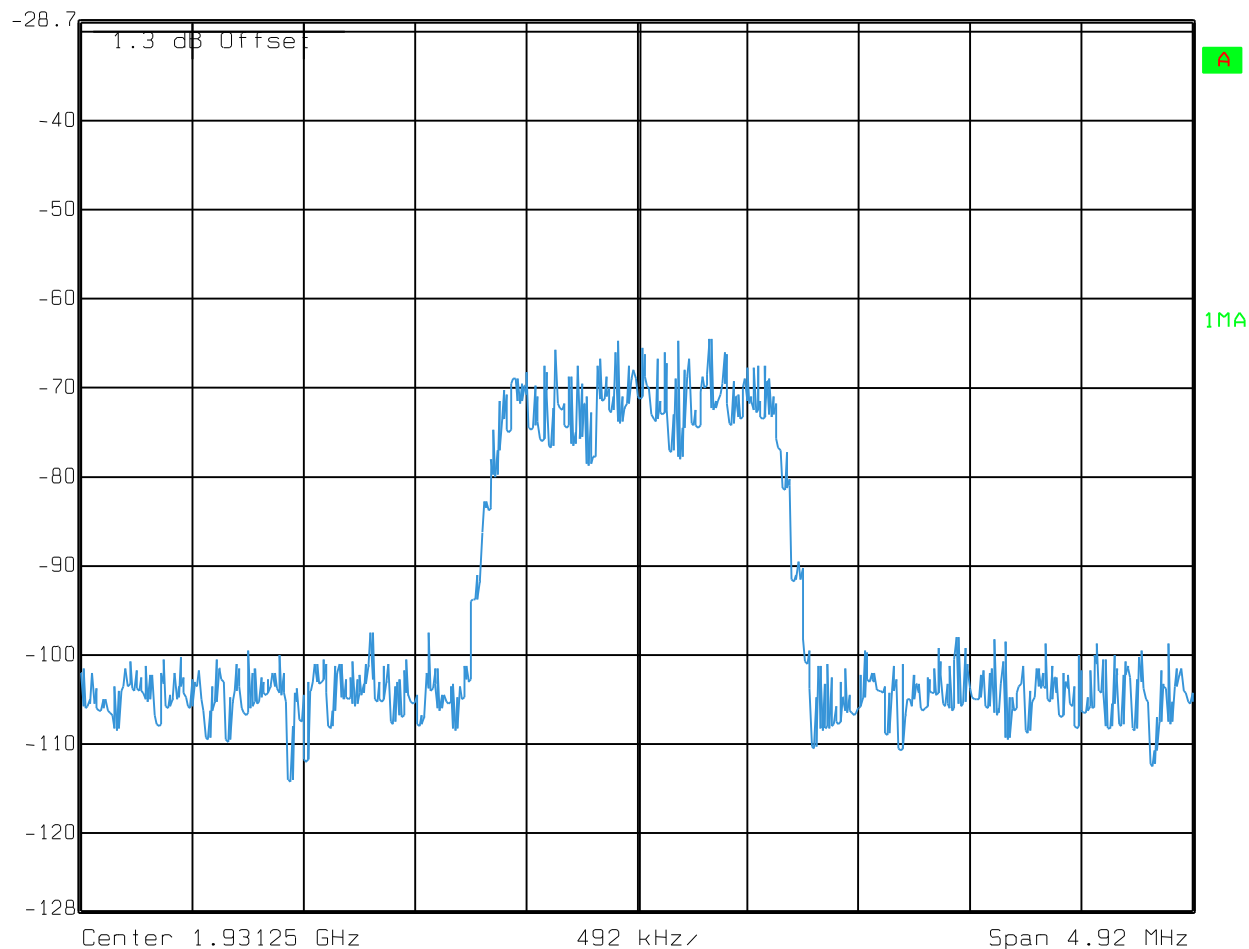
PROJECT NO.: **3L0497**

Downlink Input



Ref Lvl
-28.7 dBm

RBW	30 kHz	RF Att	0 dB
VBW	30 kHz	Mixer	-10 dBm
SWT	14 ms	Unit	dBm



Date: 22.DEC.2003 09:58:09

EQUIPMENT: PCS Repeater

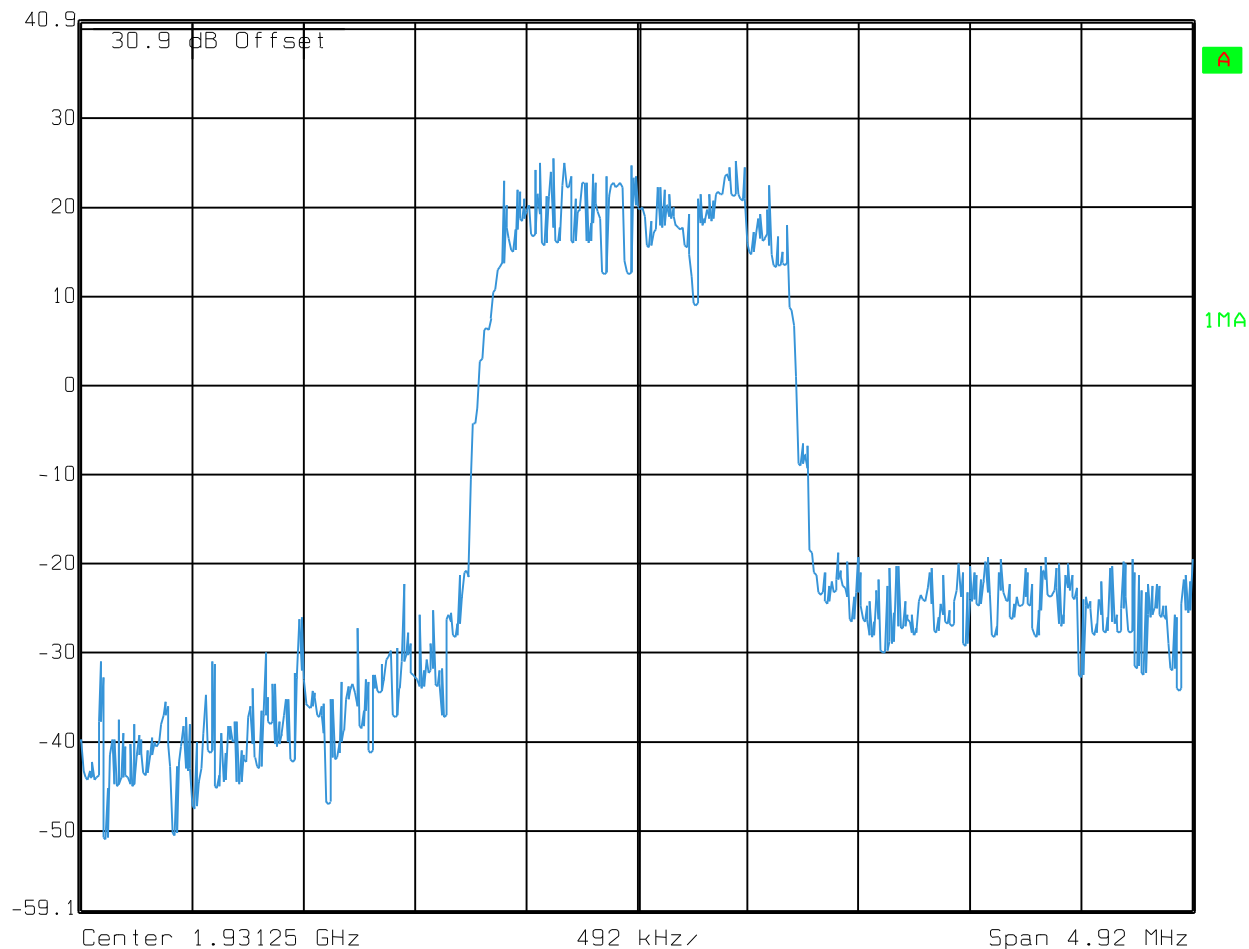
PROJECT NO.: 3L0497

Downlink Output



Ref Lvl
40.9 dBm

RBW	30 kHz	RF Att	20 dB
VBW	30 kHz	Mixer	-10 dBm
SWT	14 ms	Unit	dBm

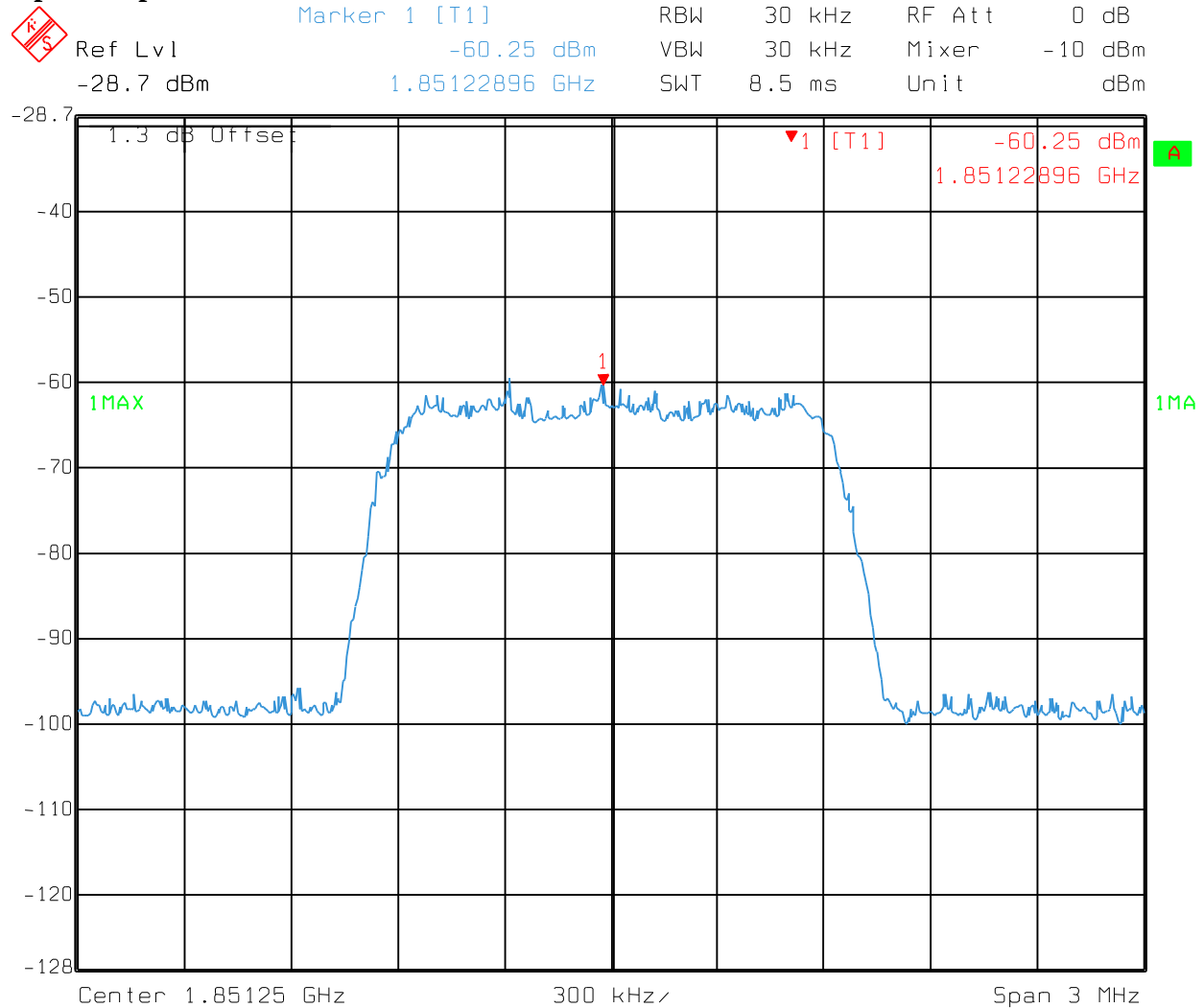


Date: 22.DEC.2003 10:02:38

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Uplink Input

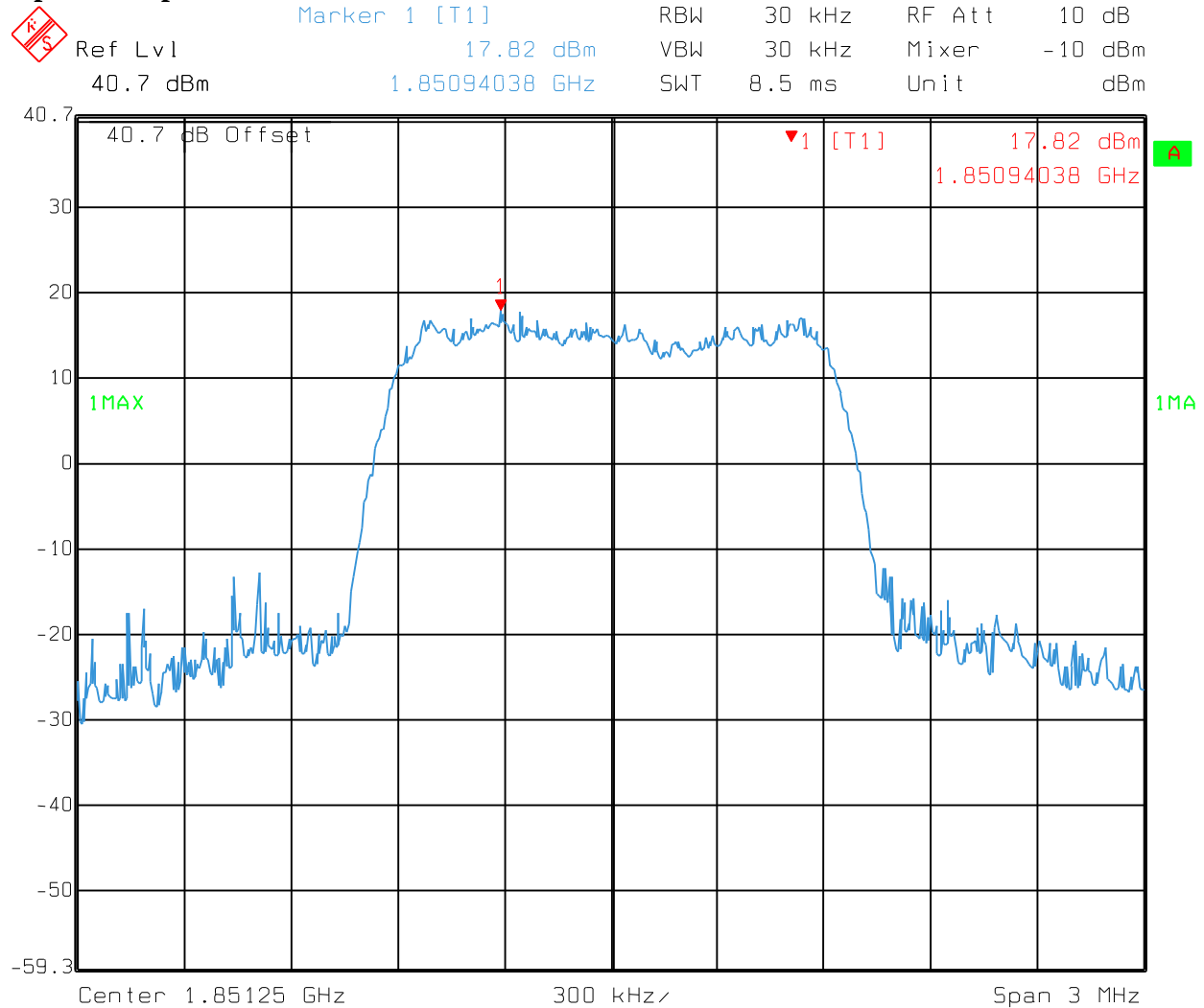


Date: 22.DEC.2003 11:03:45

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Uplink Output



Date: 22.DEC.2003 11:02:06

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: Dustin Oaks	DATE: 12/22/2003

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036, 1053, 1626, 1629, 1478, 1604

Measurement Uncertainty: +/- 1.6 dB

Temperature: 21 °C

Relative Humidity: 51 %

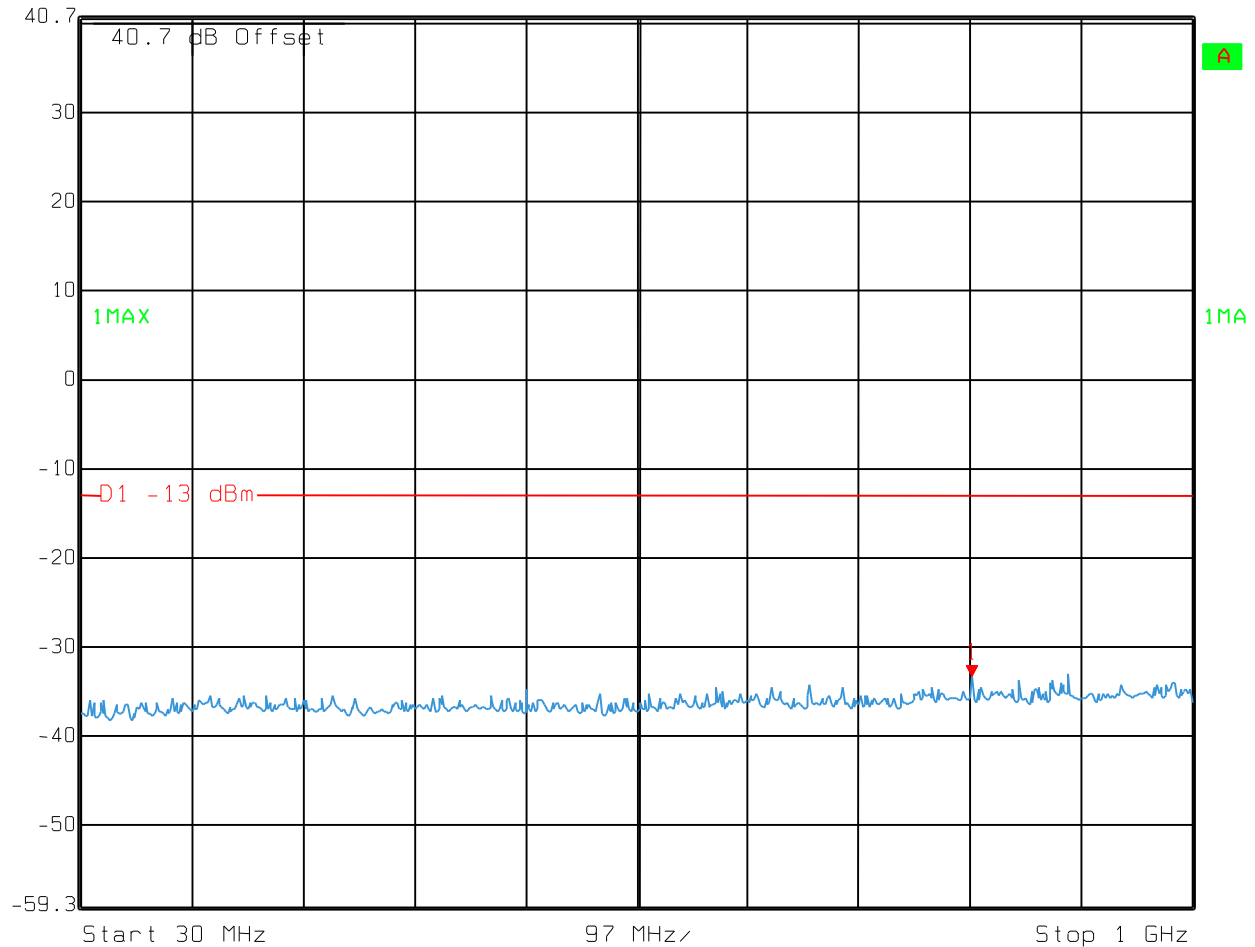
EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Downlink



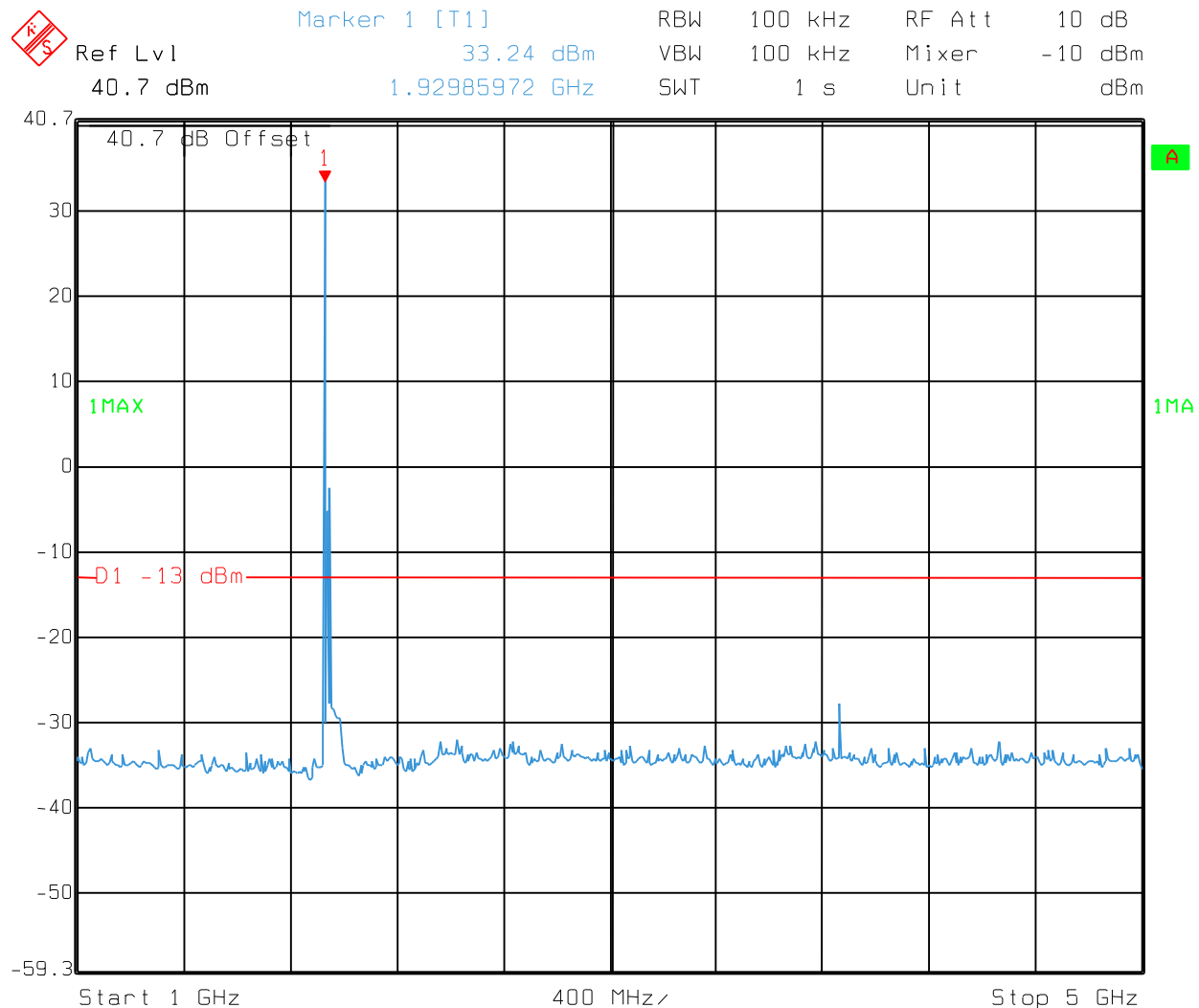
Ref Lvl	Marker 1 [T1]	RBW	100 kHz	RF Att	10 dB
40.7 dBm	-33.38 dBm	VBW	100 kHz	Mixer	-10 dBm
	807.55511022 MHz	SWT	245 ms	Unit	dBm



Date: 22.DEC.2003 10:12:56

EQUIPMENT: **PCS Repeater**

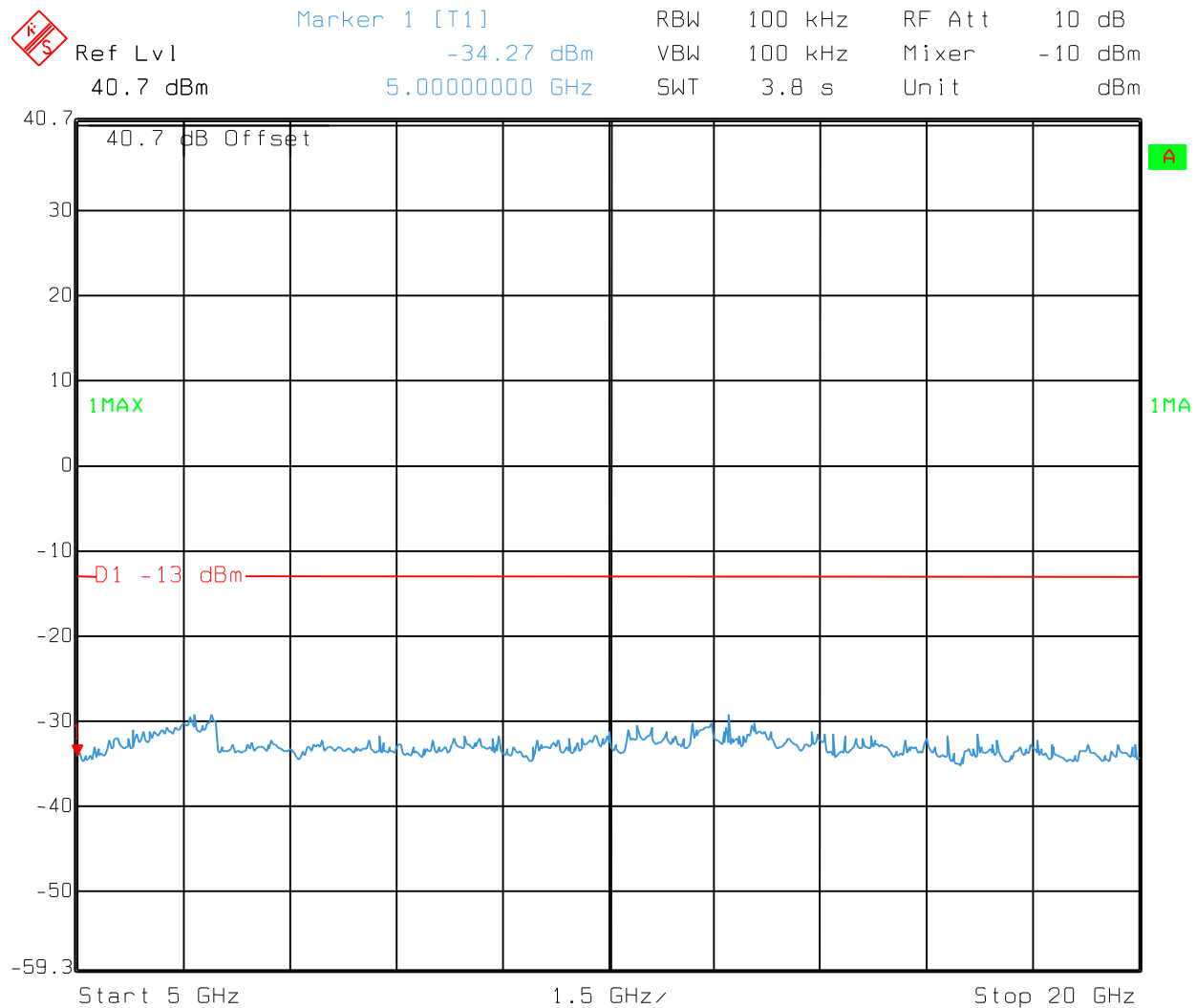
PROJECT NO.: **3L0497**



Date: 22.DEC.2003 10:11:52

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

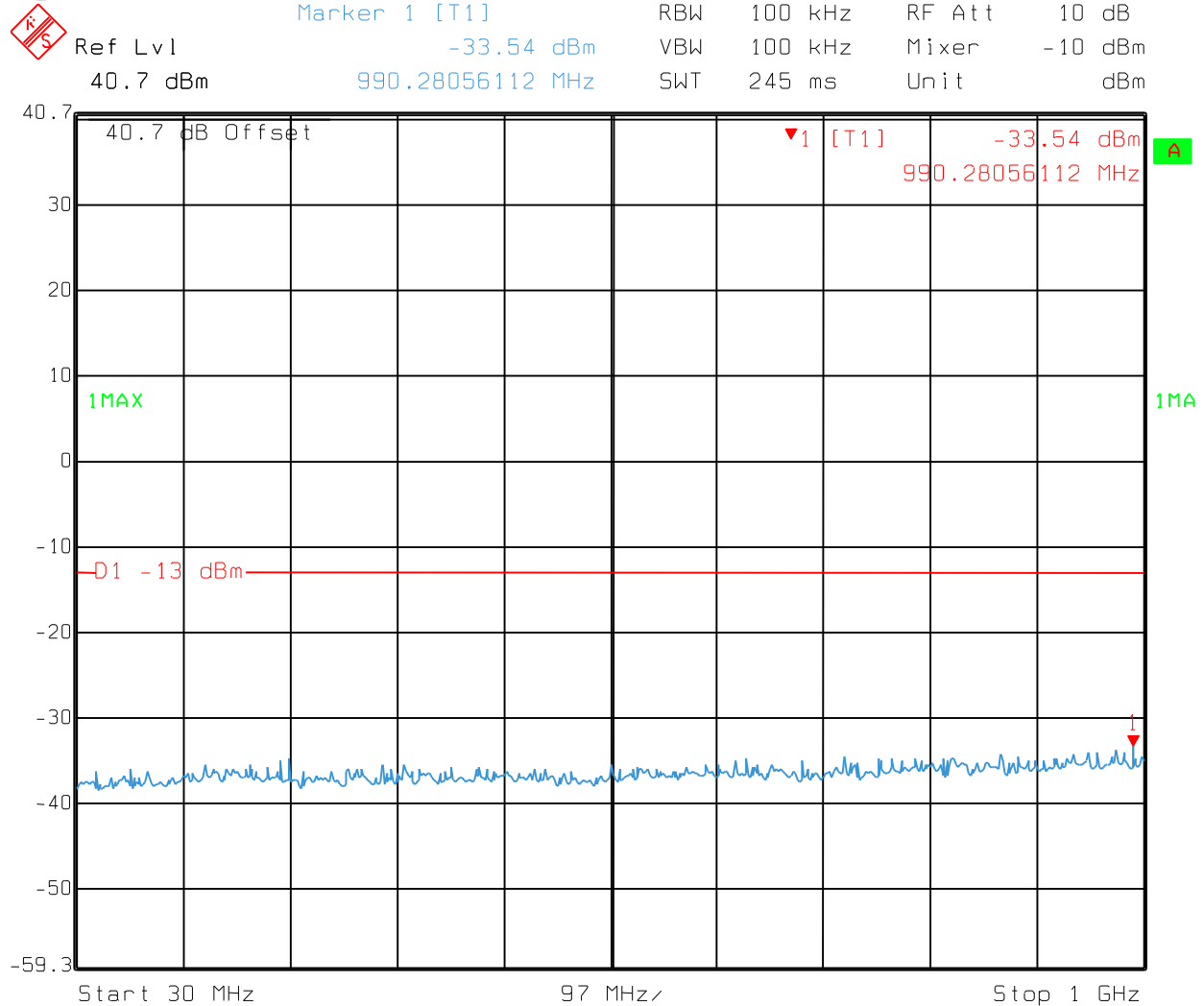


Date: 22.DEC.2003 10:12:28

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

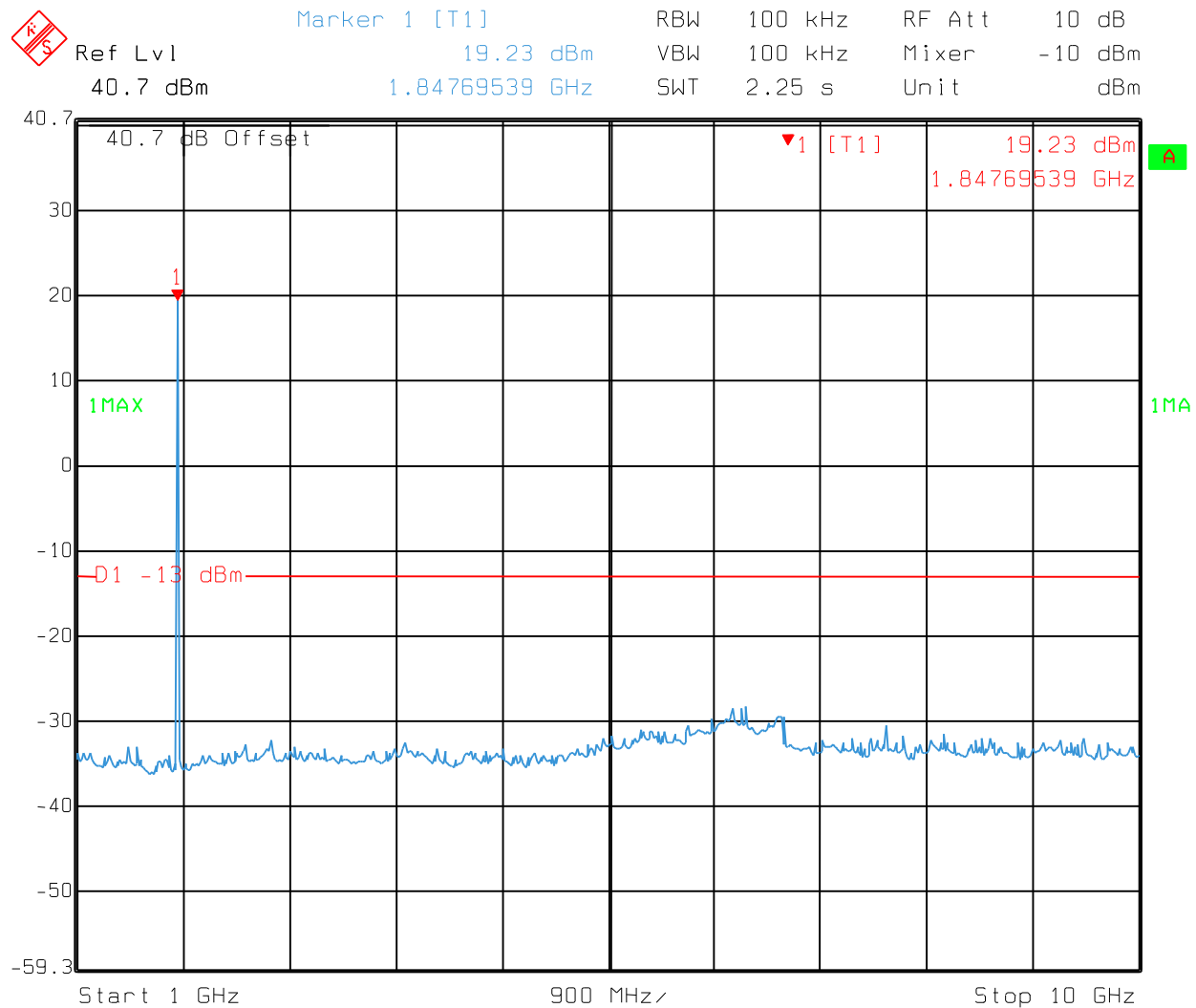
Uplink



Date: 22.DEC.2003 11:09:53

EQUIPMENT: **PCS Repeater**

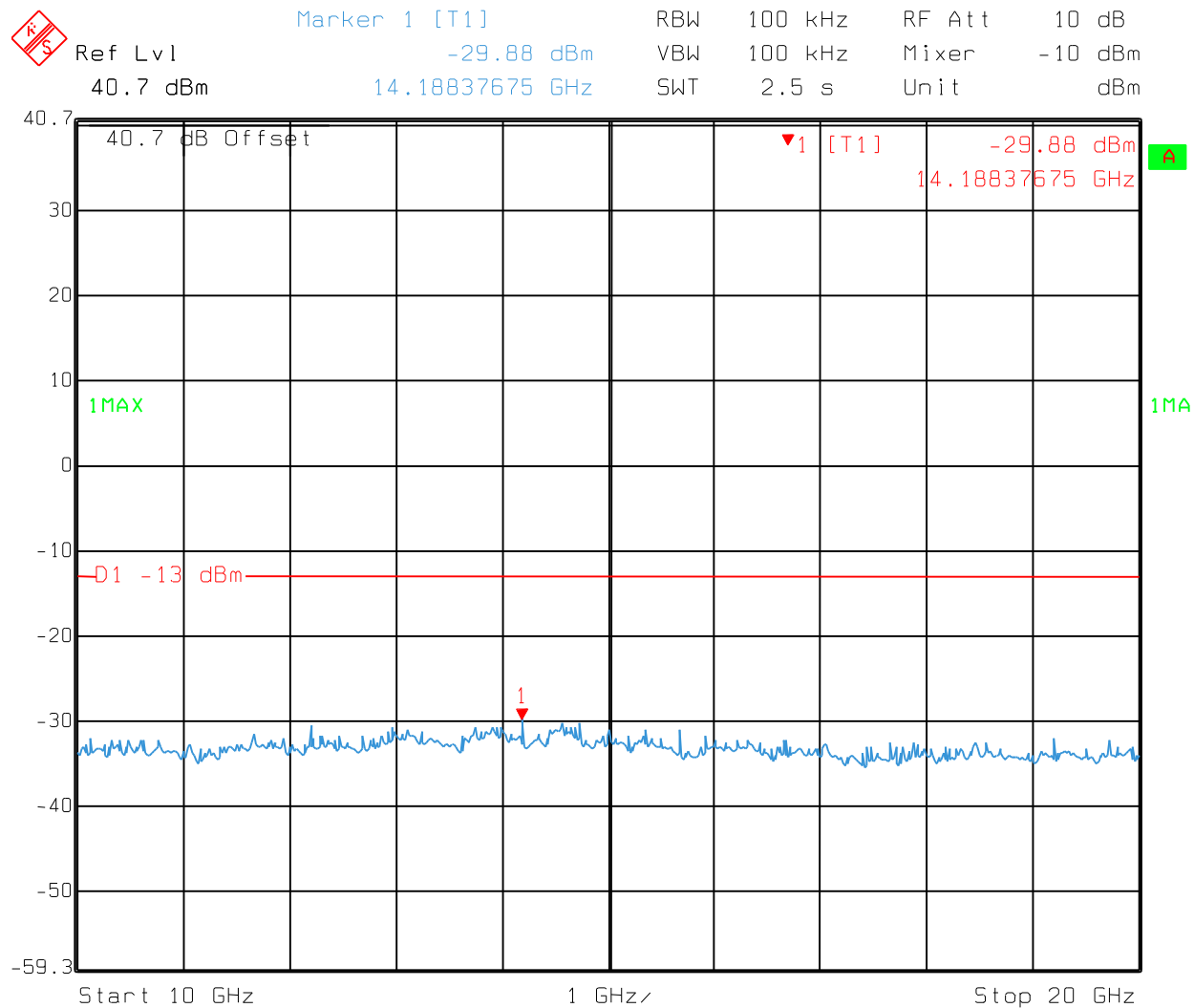
PROJECT NO.: **3L0497**



Date: 22.DEC.2003 11:10:27

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

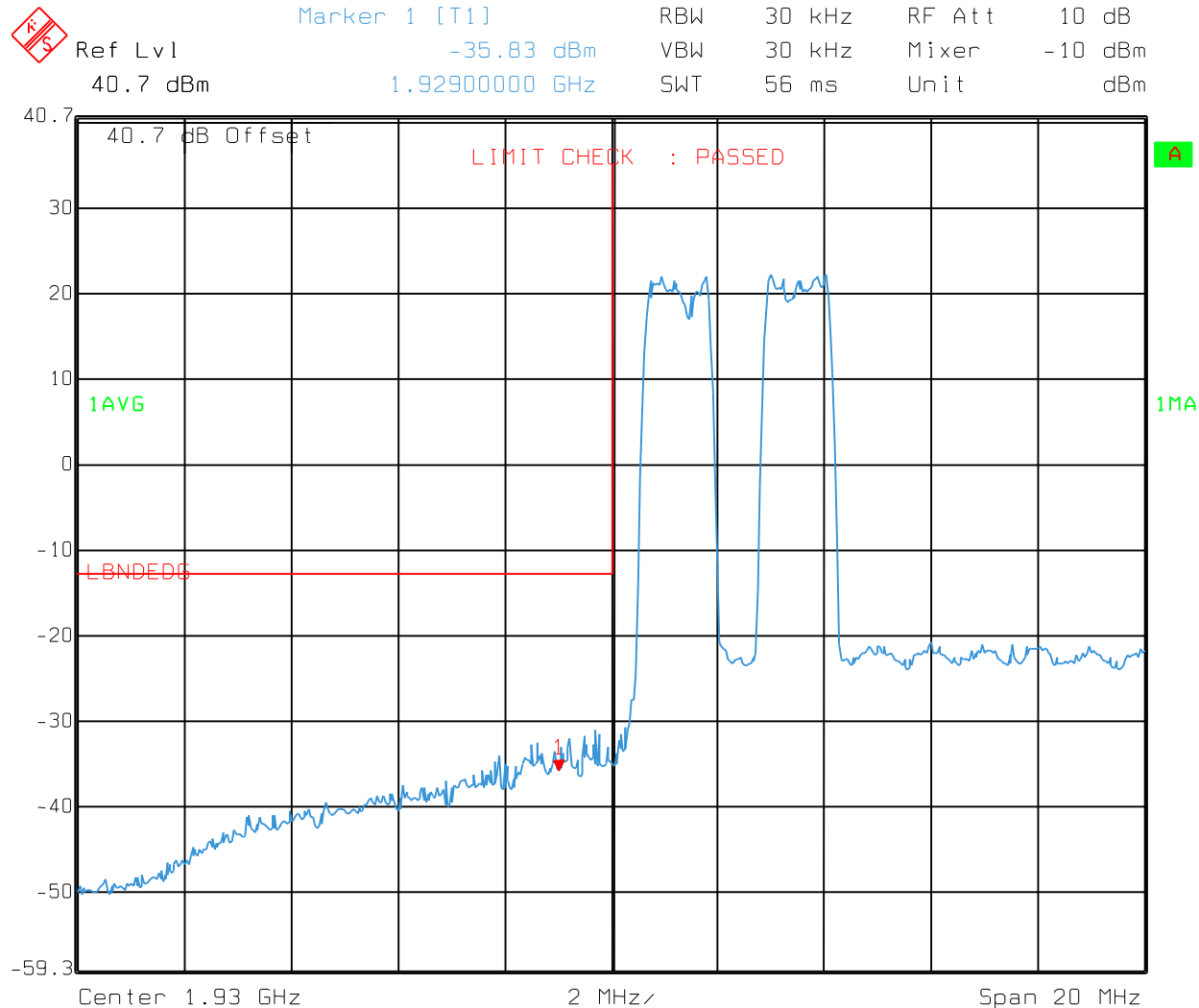


Date: 22.DEC.2003 11:10:55

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Downlink Intermodulation



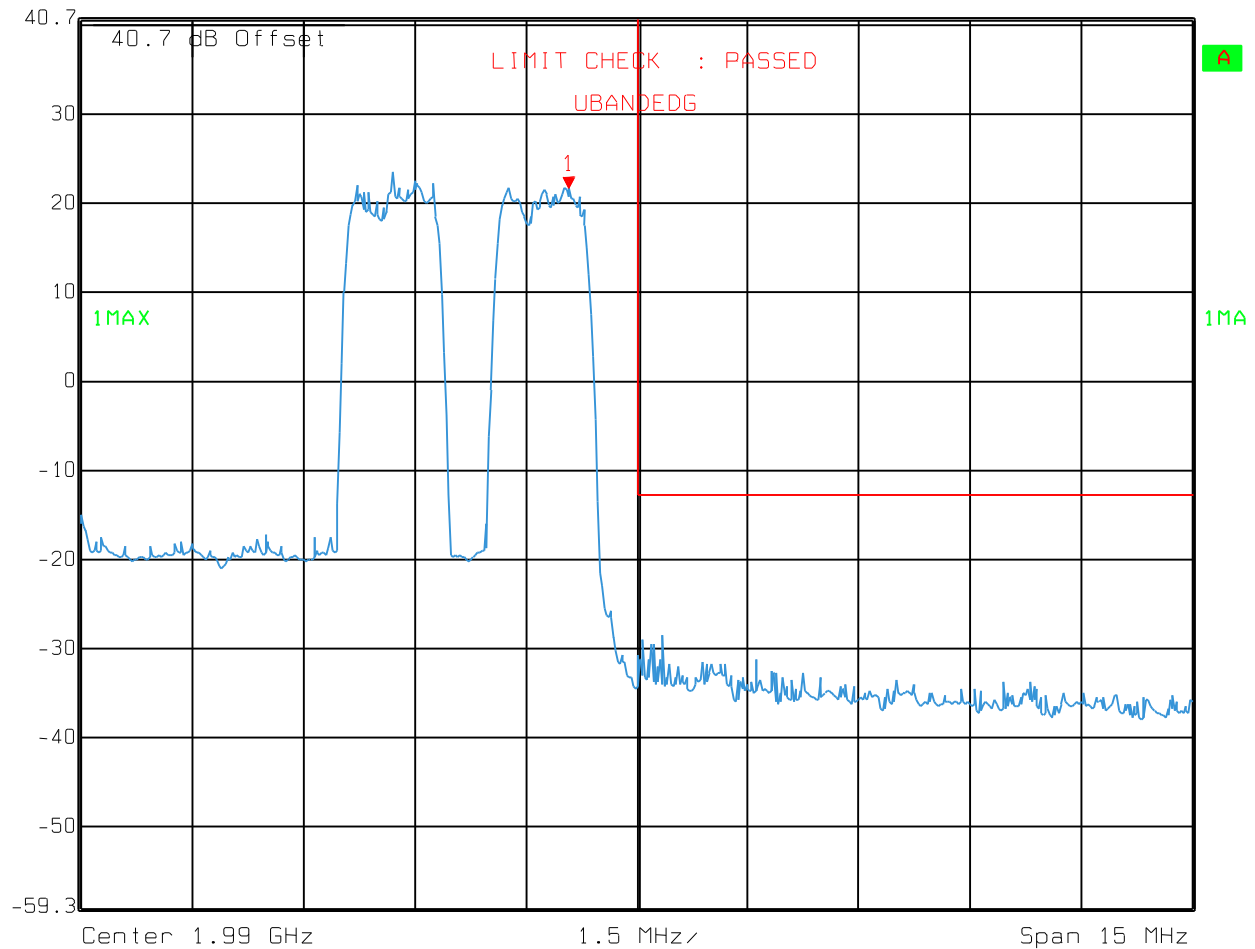
Date: 22.DEC.2003 10:21:44

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Downlink Intermodulation

 Marker 1 [T1] RBW 30 kHz RF Att 10 dB
Ref Lvl 21.46 dBm VBW 300 kHz Mixer -10 dBm
40.7 dBm 1.98908798 GHz SWT 42 ms Unit dBm

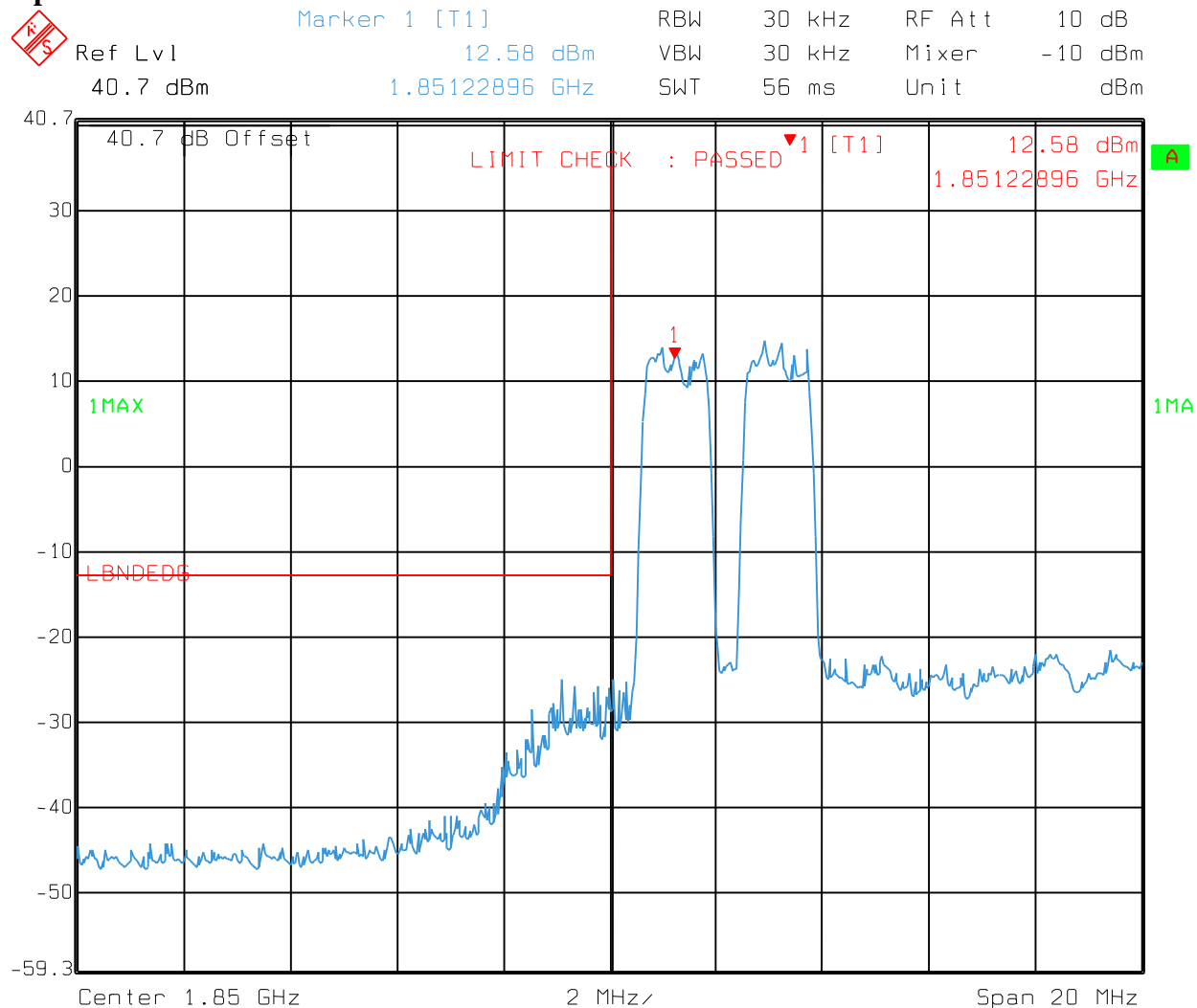


Date: 22.DEC.2003 10:44:44

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Uplink Intermodulation

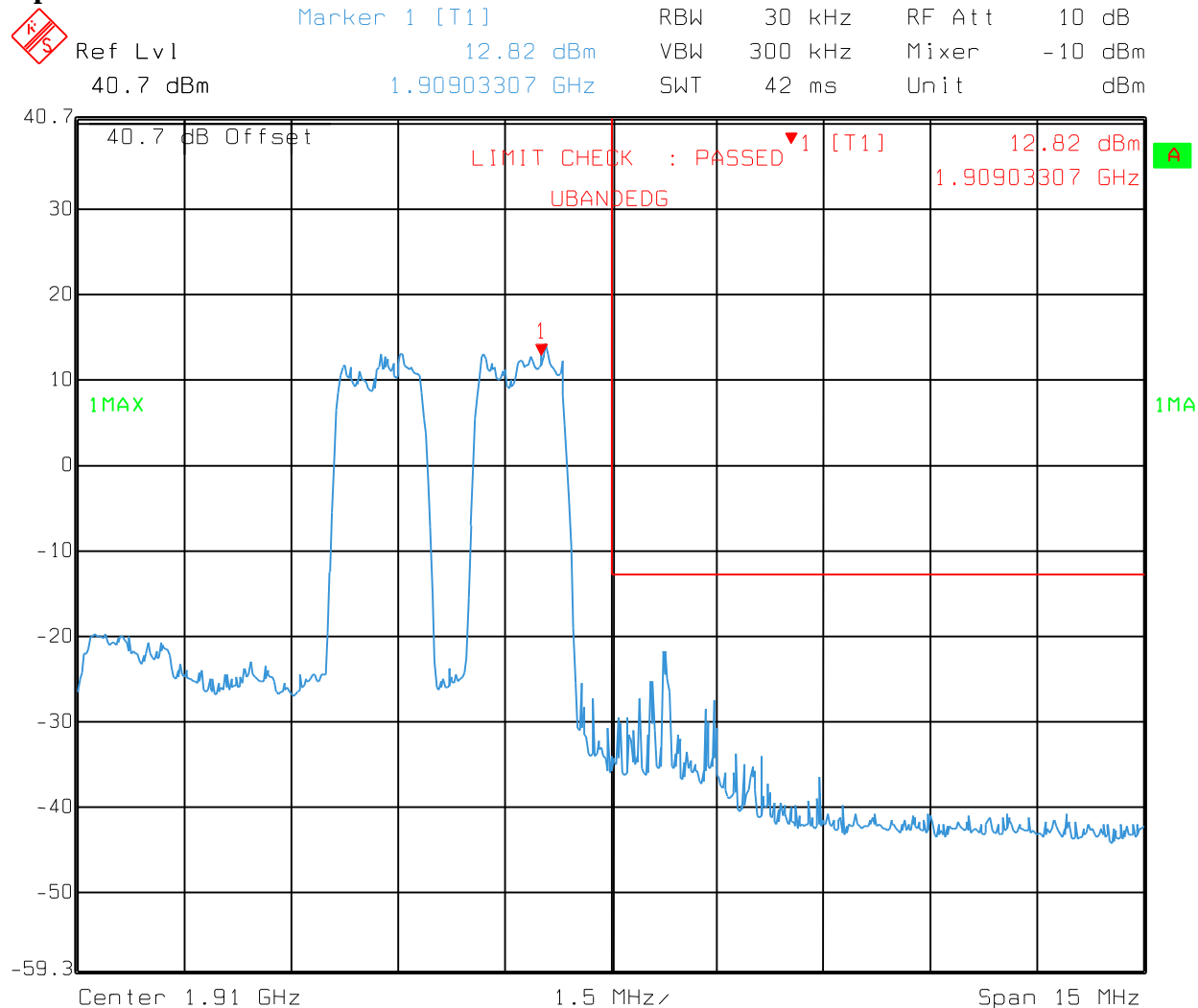


Date: 22.DEC.2003 11:07:04

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Uplink Intermodulation

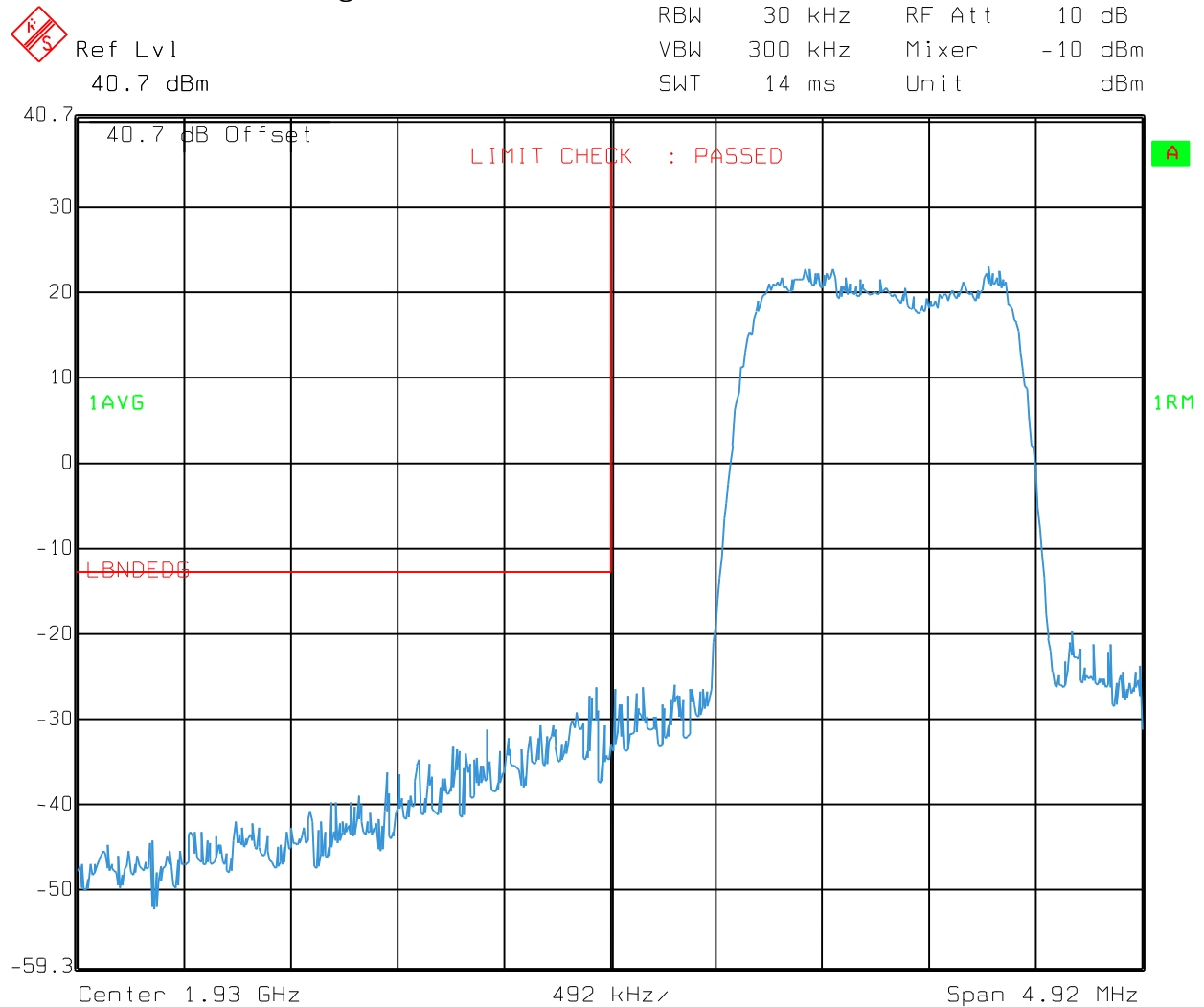


Date: 22.DEC.2003 11:29:24

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Downlink Lower Bandedge: 1930MHz

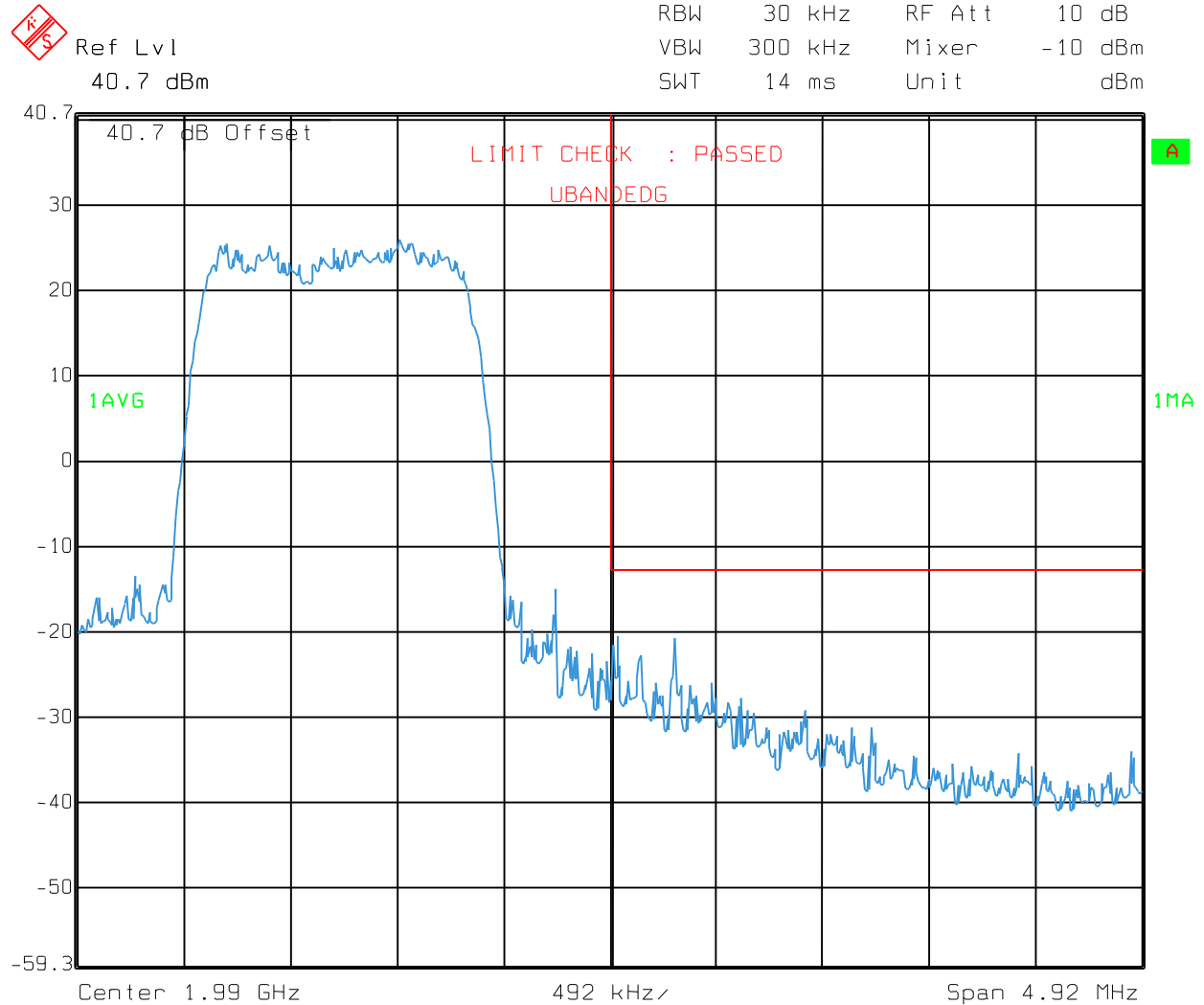


Date: 22.DEC.2003 09:52:37

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Downlink Upper Bandedge: 1990MHz

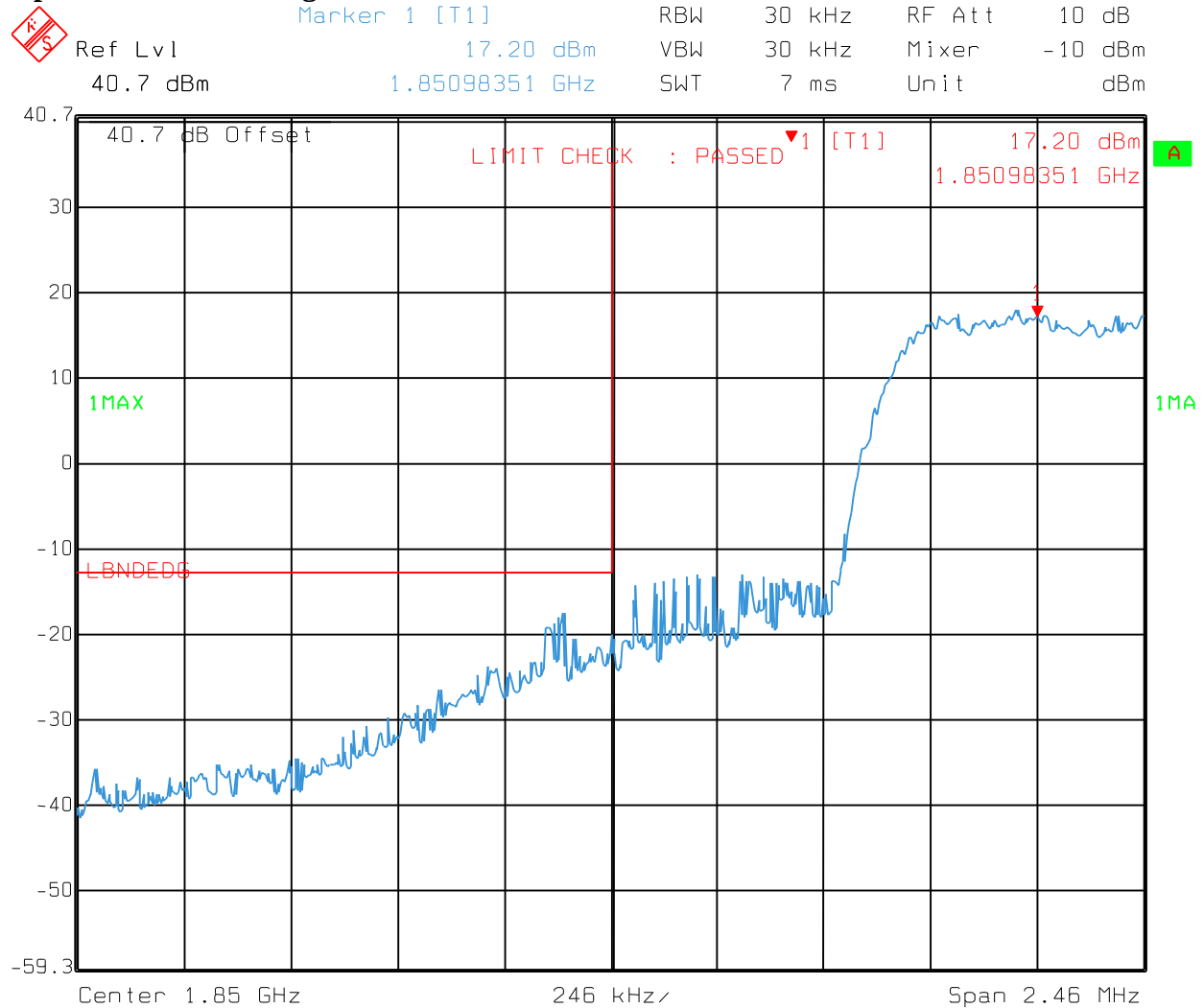


Date: 22.DEC.2003 10:40:31

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Uplink Lower Bandedge: 1850MHz

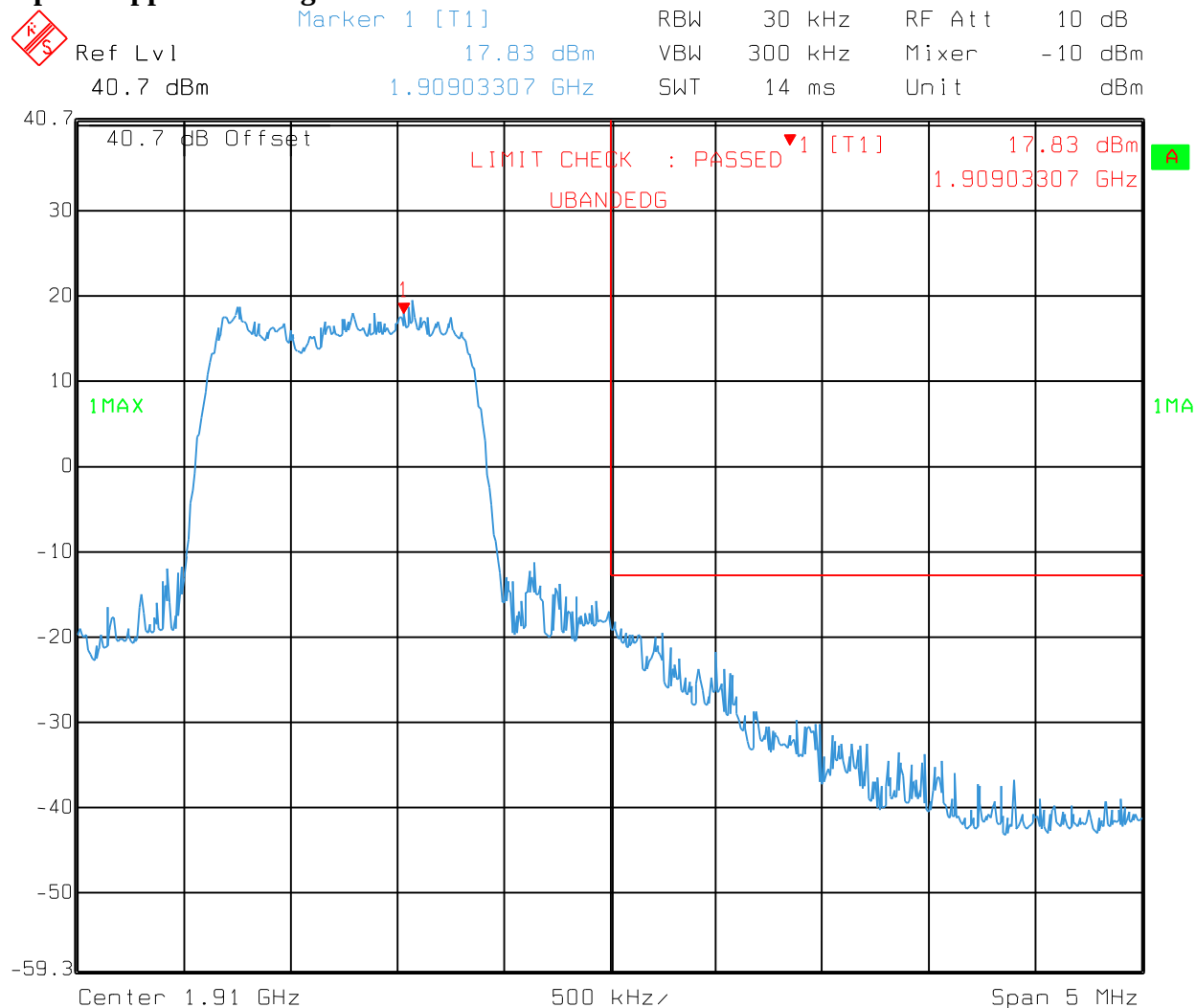


Date: 22.DEC.2003 11:01:11

EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Uplink Upper Bandedge: 1910MHz



Date: 22.DEC.2003 11:22:35

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1051
TESTED BY: Dustin Oaks	DATE: 12/12/2003

Test Results: Complies.

Test Data: See attached table.

Equipment Used: 1036, 1484, 1485, 1304, 791, 1480

Measurement Uncertainty: +/- 6 dB

Temperature: 21 °C

Relative Humidity: 51 %

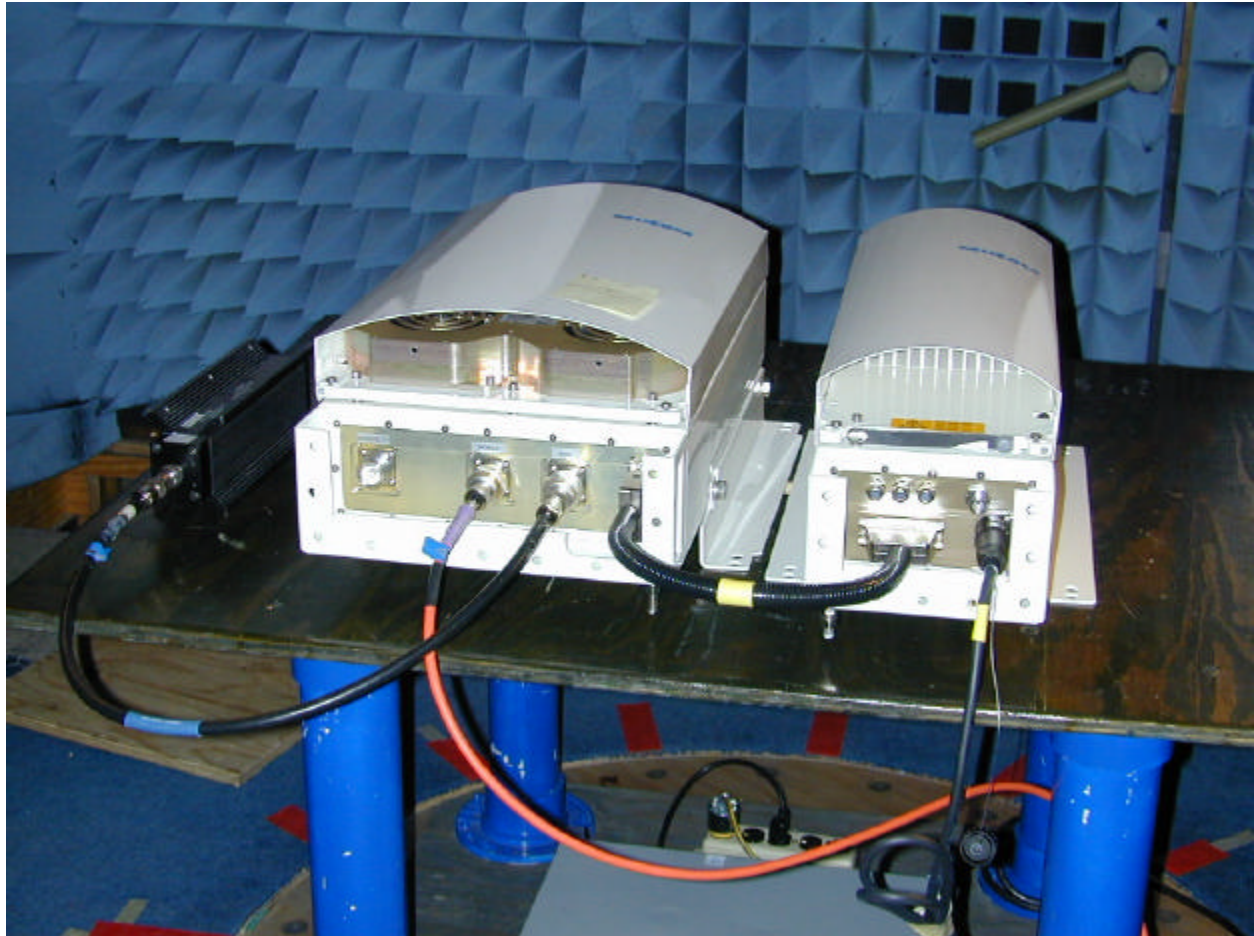
EQUIPMENT: PCS Repeater

PROJECT NO.: 3L0497

Test Data - Radiated Emissions - Downlink and Uplink

EIRP Substitution Method									
Page 1 of								Complete	X
Job No.:	3L0497R			Date:	12/23/2003			Preliminary	
Specification:	FCC 24E			Temperature(°C):	21				
Tested By:	Dustin Oaks			Relative Humidity(%)	51				
E.U.T.:	Node C 1937								
Configuration:	EUT continuously Transmitting								
Sample No:	13								
Location:	Lab 3					RBW:	1 MHz	Measurement	
Detector Type:	Peak					VBW:	1 MHz	Distance:	3
Test Equipment Used									
Antenna:	1304804			Directional Coupler:					
Pre-Amp:	101016			Cable #1:	14841484				
Filter:				Cable #2:	14851485				
Receiver:	103036			Cable #3:					
Attenuator #1				Cable #4:					
Attenuator #2:				Mixer:					
Additional equipment used:									
Measurement Uncertainty:	+/-3.6 dB								
Frequency	Meter Reading	Correction Factor		Pre-Amp Gain	Substitution Antenna Gain		EIRP	EIRP	Polarity
(MHz)	(dBm)	(dB)		(dB)	(dBi)		(dBm)	(mW)	
1350	-51.4	31.5		31.1	7.0		-44.0	0.000040	v
1350	-59.4	30.7		31.1	7.0		-52.9	0.000005	h
1350	-51.1	31.5		31.1	7.0		-43.7	0.000042	v
1305	-57.8	31.5		31.1	7.0		-50.4	0.000009	v
Notes: Downlink and Uplink paths tested									

Photographs of Test Setup



EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Section 7. Frequency Stability

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

Test Results: Test Not Applicable

EQUIPMENT: **PCS Repeater**PROJECT NO.: **3L0497****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	12/19/03
1053	SIGNAL GENERATOR	ROHDE & SCHWARZ SMIQ 03	DE22081	06/10/03	06/09/04
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1478	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W6	NONE	CBU	N/A
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	07/24/03	07/23/04
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/24/03	07/23/04
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	09/22/03	09/22/05
791	PREAMP, 25dB	ICC LNA25	398	10/27/03	10/26/04
1480	Bilog Antenna	Schaffner-Chase CBL6111C	2572	CalNotReq	N/A
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	10/27/03	10/26/04

ANNEX A - TEST DETAILS

EQUIPMENT: **PCS Repeater**PROJECT NO.: **3L0497**

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

Minimum Standard: Para. No.24.232. Base stations are limited to 1640 watts peak E.I.R.P. with an antenna height up to 300 meters HAAT. In no case may the peak output power of a base station transmitter exceed 100 watts.

Test Method for equipment with detachable antenna:

RF Power Output is measured using a rf power meter. The rf power meter is capable of correctly measuring a digitally modulated waveform.

Test Method for equipment with integral antenna: TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1047
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Minimum Standard: Para. No. 24.238(b). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB.

Method Of Measurement:

CDMA

Spectrum analyzer settings:

RBW: 30 kHz

VBW: $\geq$ RBW

Span: 5 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

GSM

RBW: 3 kHz

VBW: $\geq$ RBW

Span: 2 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

NADC

RBW: 1 kHz

VBW: $\geq$ RBW

Span: 1 MHz

Sweep: Auto

Mask: Set markers to -26 dB from peak of CW.

EQUIPMENT: **PCS Repeater**PROJECT NO.: **3L0497**

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.1051
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Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Method Of Measurement:

Spectrum analyzer settings:

CDMA

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 30 kHz (< 1 MHz from Band Edge)
VBW: $\geq$ RBW
Sweep: Auto
Video Avg: 6 Sweeps

GSM

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

NADC

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

To demonstrate compliance at band edges the frequency of the input signal is set to the lowest and highest assigned channel and the center frequency of the spectrum analyzer is set to the upper and lower edges of the appropriate frequency block.

EQUIPMENT: **PCS Repeater**PROJECT NO.: **3L0497**

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

Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Test Method: TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

EQUIPMENT: **PCS Repeater**PROJECT NO.: **3L0497**

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

Minimum Standard: Para. No. 24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Method Of Measurement:Frequency Stability With Voltage Variation

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

Frequency Stability With Temperature Variation

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

EQUIPMENT: **PCS Repeater**

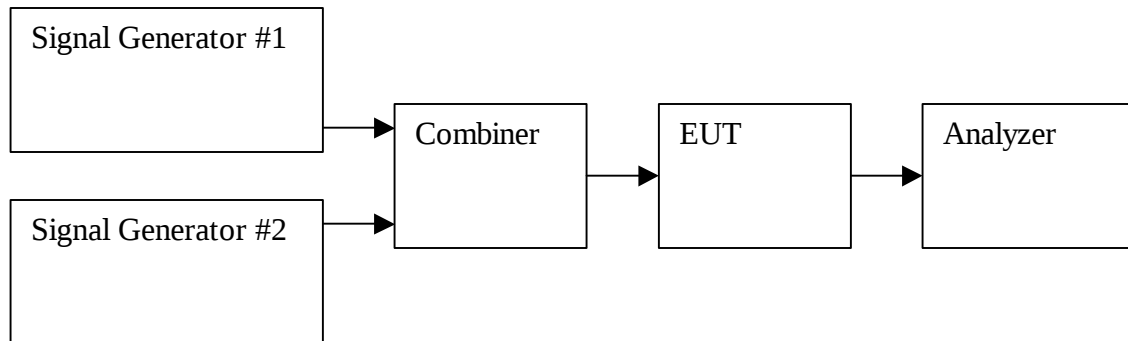
PROJECT NO.: **3L0497**

NAME OF TEST: Intermodulation	PARA. NO.:
--------------------------------------	-------------------

Method of Measurement:

Per EIA/TIA 603, the two signal generator method was utilized to perform the Intermodulation test.

Test Setup:

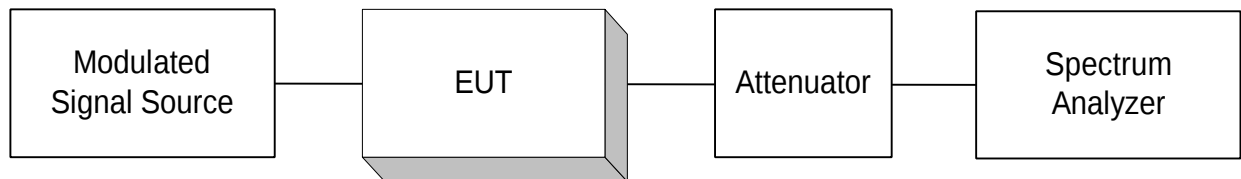


ANNEX B - TEST DIAGRAMS

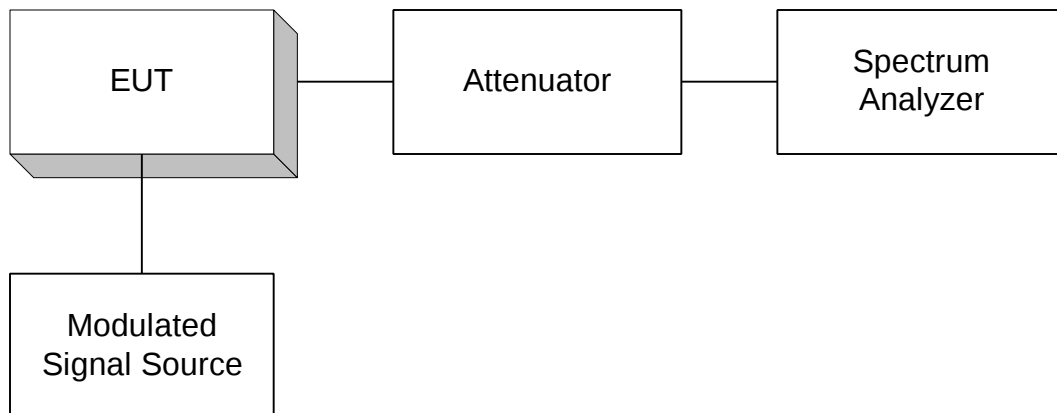
EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

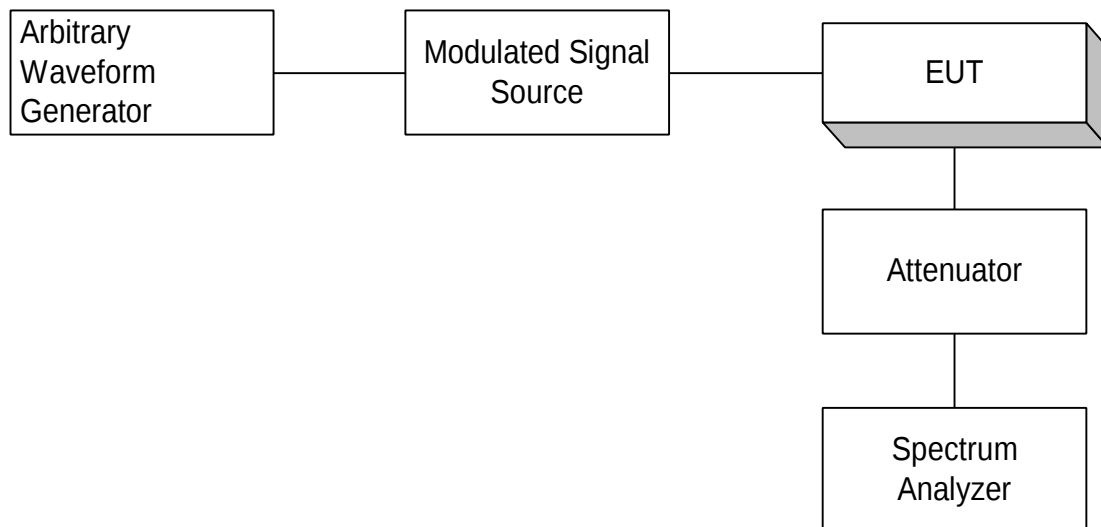
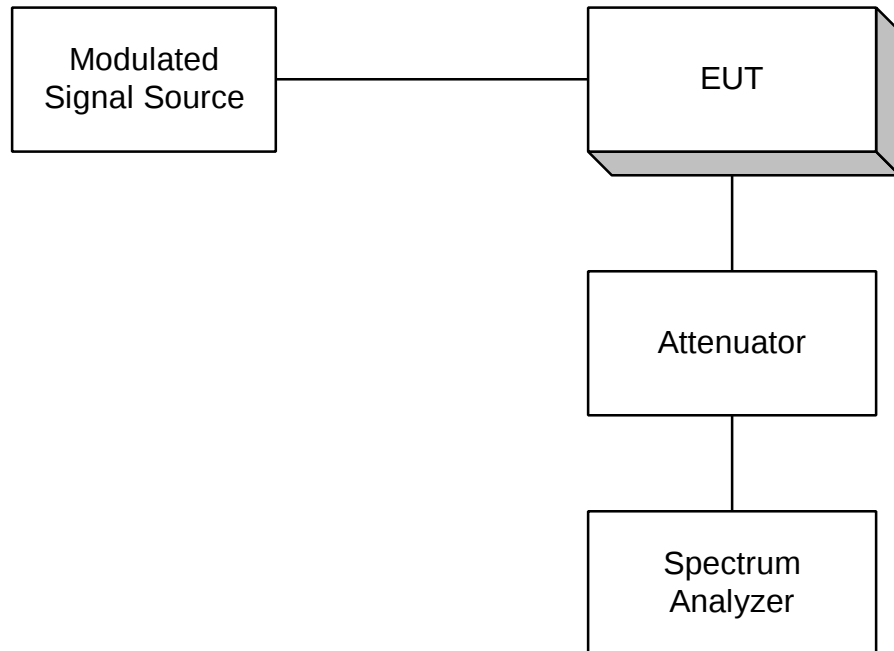
Para. No. 2.985 - R.F. Power Output



Para. No. 2.989 - Occupied Bandwidth



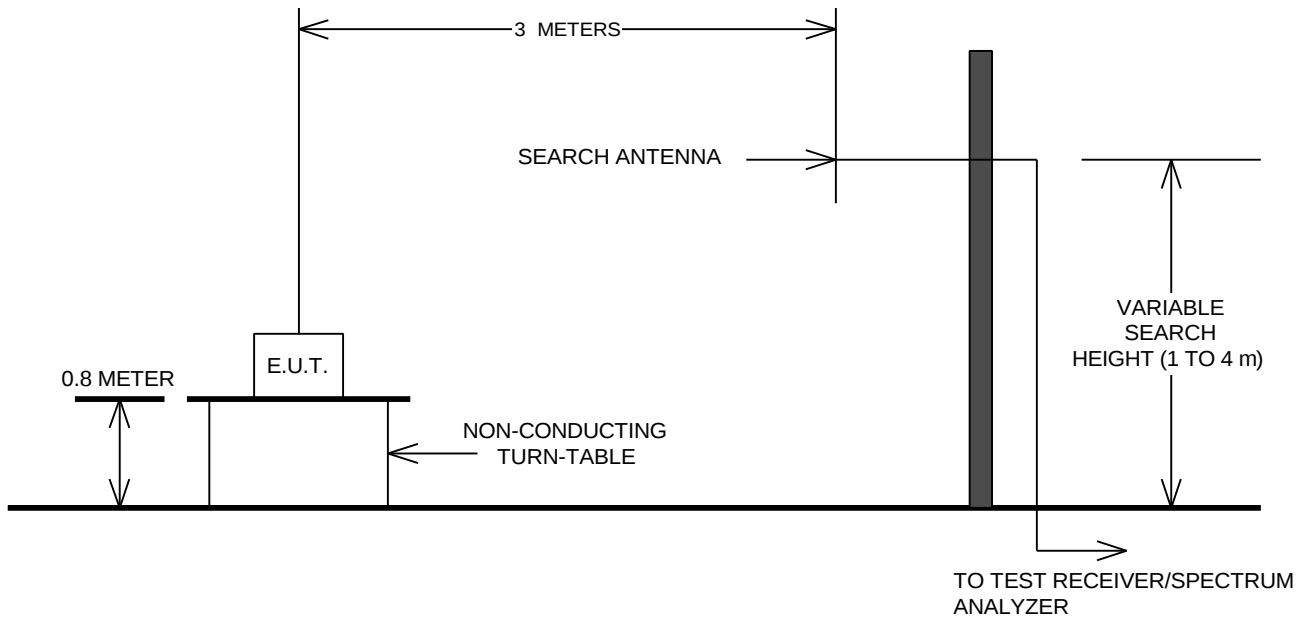
Para. No. 2.991 Spurious Emissions at Antenna Terminals



EQUIPMENT: **PCS Repeater**

PROJECT NO.: **3L0497**

Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

