

Nemko Test Report No.:

3L0496RUS1

Applicant:

Andrew Corporation

Equipment Under Test:

Node C 1943

FCC ID:

BCR-RPT-NODEC1943

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:

3/11/04

Total Number of Pages:

44

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

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EQUIPMENT: PCS Repeater

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: 3L0496

Section 1. Summary of Test Results

Manufacturer: Andrew Corporation

Model No.: Node C 1943

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**FCC ID: BCR-RPT-NODEC1943****PROJECT NO.: 3L0496**

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	24.232	100W	17.82W	Complies
Occupied Bandwidth (CDMA)	24.238	Input/Output	Complies	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	Complies	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	Complies	Complies
Frequency Stability	24.235		NA	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**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496****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 Range:	1930.75 – 1989.35 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		
Frequency Range:	1850.75 – 1909.35 MHz		
	CDMA (F9W) ☒	GSM (GXW) ☐	NADC (DXW) ☐
System Gain:	103dB Downlink 83dB Uplink		
Output Impedance:	50 ohms		
Max Input:	-60 dBm +23 dBm +43 dBm 1 CDMA Carrier +37 dBm 4 CDMA Carriers		
	F1-F1 ☐	F1-F2 ☐	N/A ☒
Band Selection:	Software	Duplexer	Fullband

Nemko Dallas

FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

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Modifications Made During Testing

No modifications made.

EQUIPMENT: **PCS Repeater***FCC ID:* BCR-RPT-NODEC1943PROJECT NO.: **3L0496**

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.

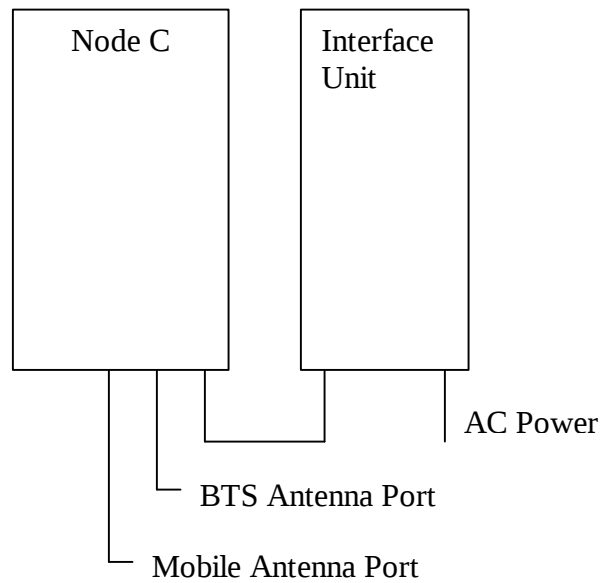
In the downlink path, a signal originating from the Base Transceiver Station is separated from the uplink signal in the DL IN duplexer. It is then amplified by an integrated low noise amplifier (LNA) and forwarded to the downlink digital channel module (DCM). The DCM down-converts the signal to base-band, 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**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

System Diagram



EQUIPMENT: PCS Repeater**FCC ID:** BCR-RPT-NODEC1943**PROJECT NO.:** 3L0496**Section 3. RF Power Output**

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

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

	Modulation Type	Measured Output Power (dBm)
Uplink	CDMA	22.97
Downlink	CDMA	42.51

Equipment Used: 1036, 1053, 1626, 1629, 1473, 1604**Measurement Uncertainty:** +/- 1.6 dB**Temperature:** 21 °C**Relative Humidity:** 51 %

EQUIPMENT: PCS Repeater

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: 3L0496

Section 4. Occupied Bandwidth

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

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036, 1053, 1626, 1629, 1473, 1604

Measurement Uncertainty: +/- 1.6 dB

Temperature: 21 °C

Relative Humidity: 51 %

EQUIPMENT: **PCS Repeater**

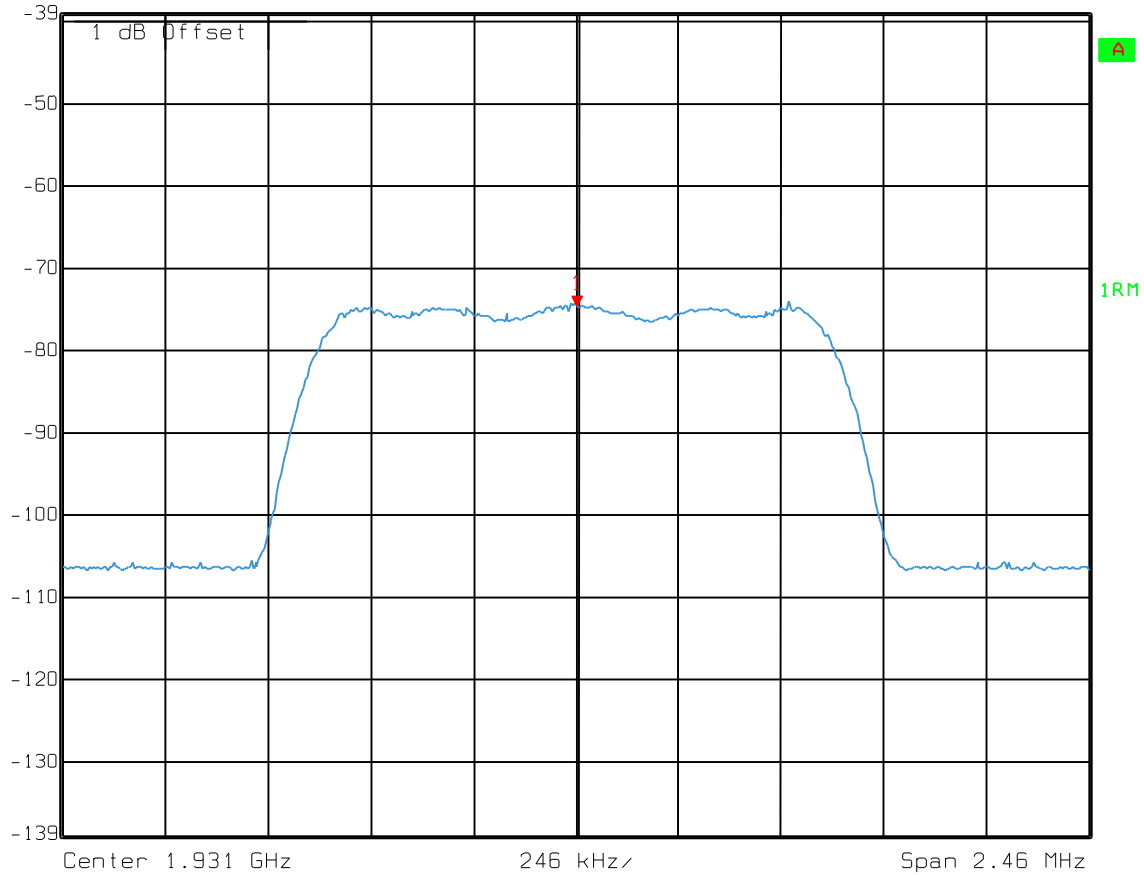
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Downlink Input



Marker 1 [T1] RBW 30 kHz RF Att 0 dB
Ref Lvl -74.72 dBm VBW 300 kHz Mixer -10 dBm
-39 dBm 1.93100000 GHz SWT 3 s Unit dBm



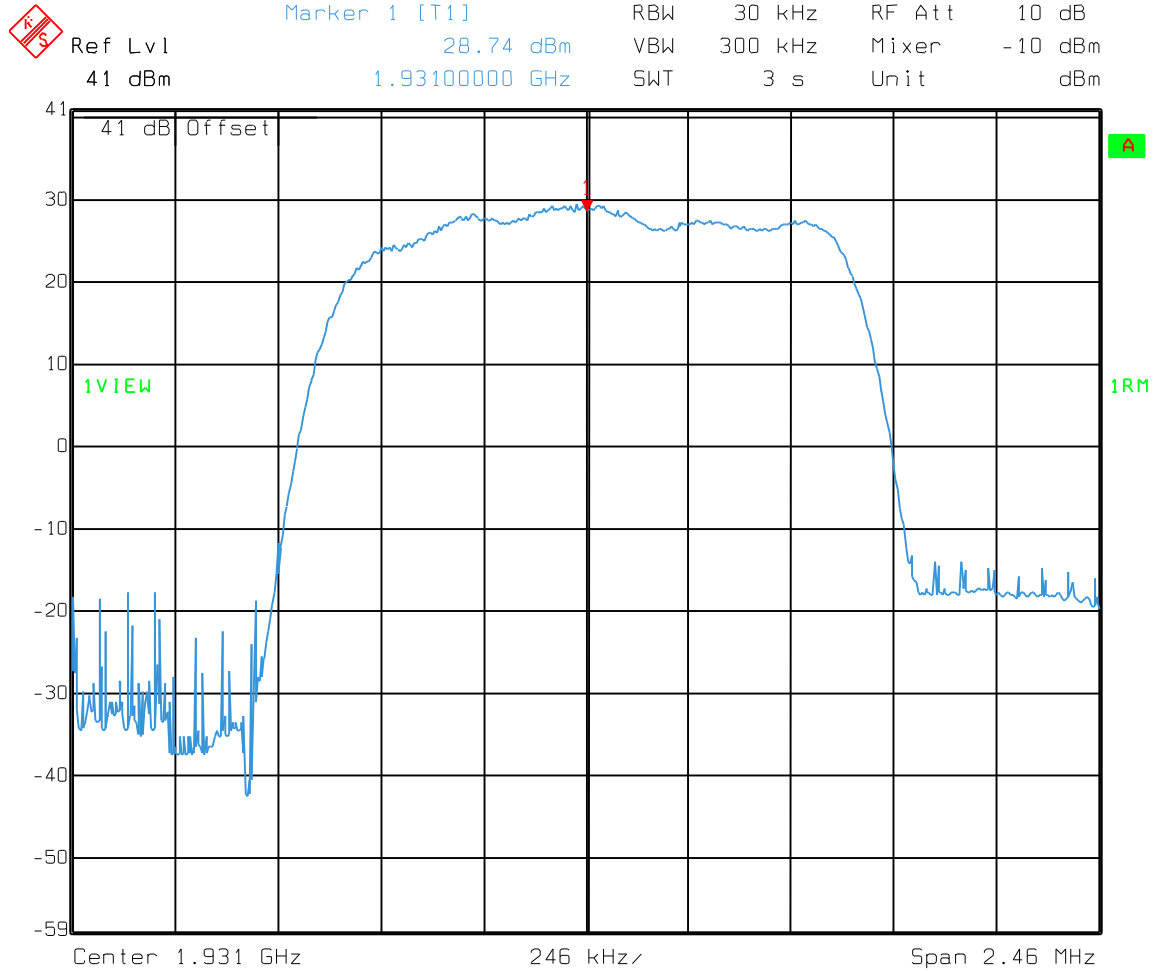
Date: 11.DEC.2003 16:31:13

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Downlink Output



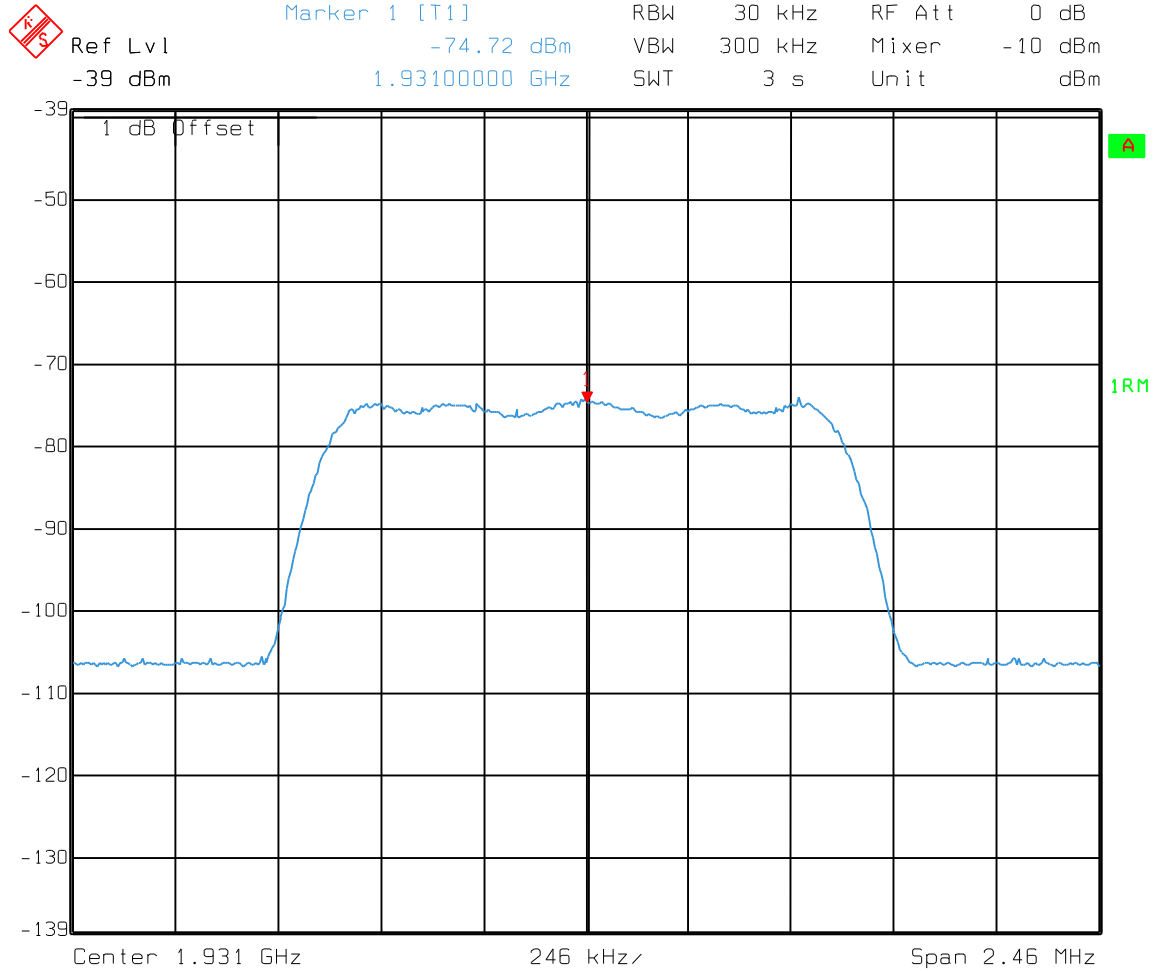
Date: 11.DEC.2003 16:29:19

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FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Uplink Input



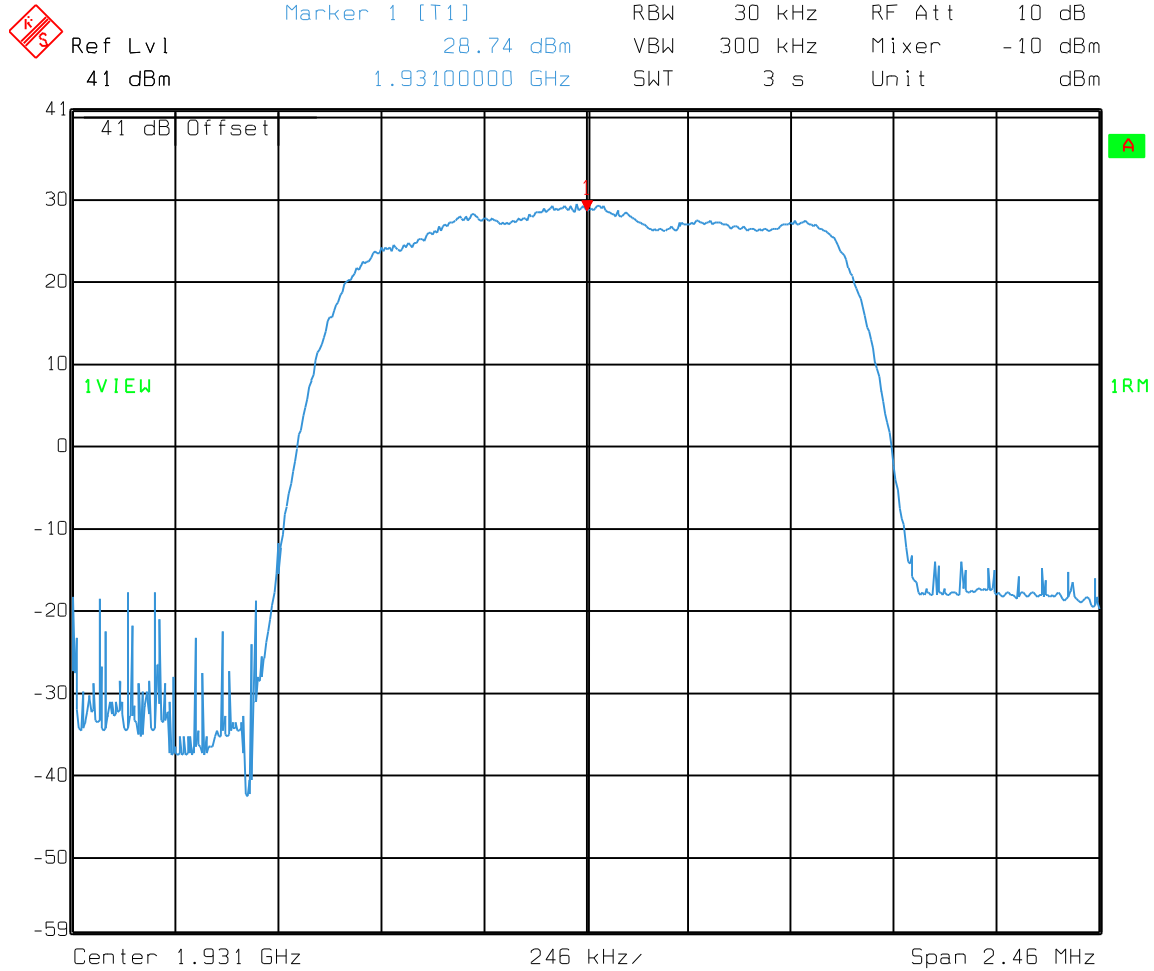
Date: 11.DEC.2003 16:31:13

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Uplink Output



Date: 11.DEC.2003 16:29:19

EQUIPMENT: PCS Repeater

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: 3L0496

Section 5. Spurious Emissions at Antenna Terminals

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

Test Results: Complies.

Test Data: See attached plot(s).

Equipment Used: 1036, 1053, 1626, 1629, 1473, 1604

Measurement Uncertainty: +/- 1.6 dB

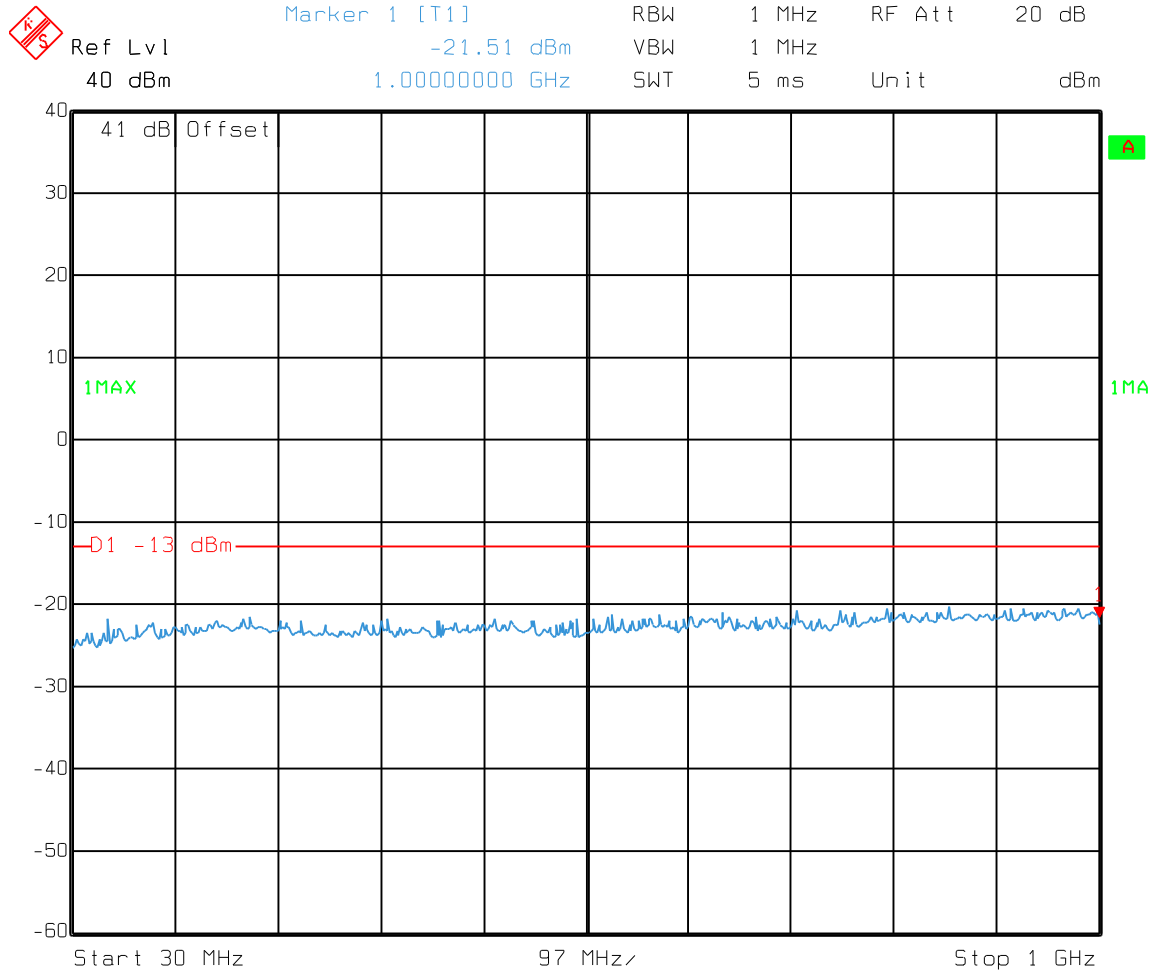
Temperature: 21 °C

Relative Humidity: 51 %

EQUIPMENT: **PCS Repeater**
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Downlink

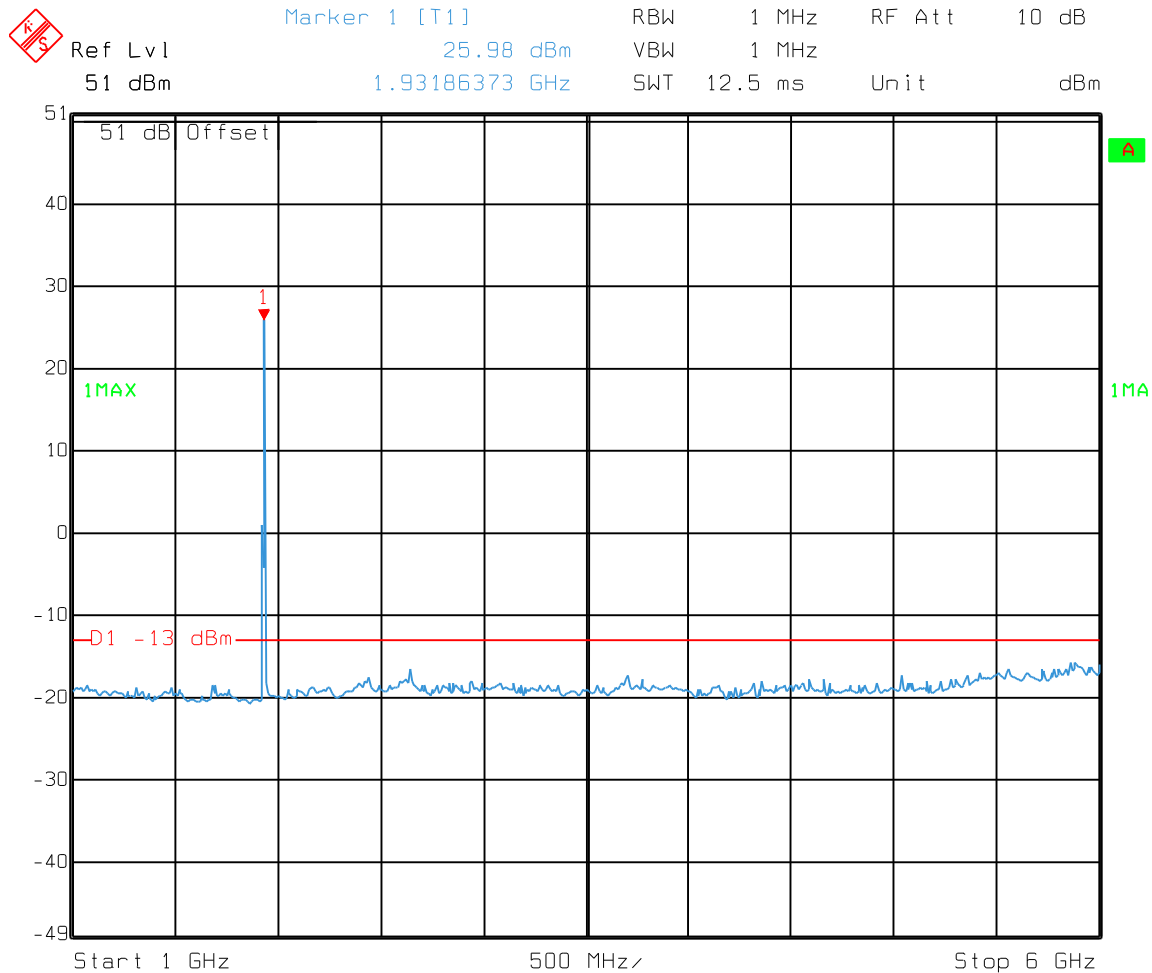


Date: 11.DEC.2003 16:39:45

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

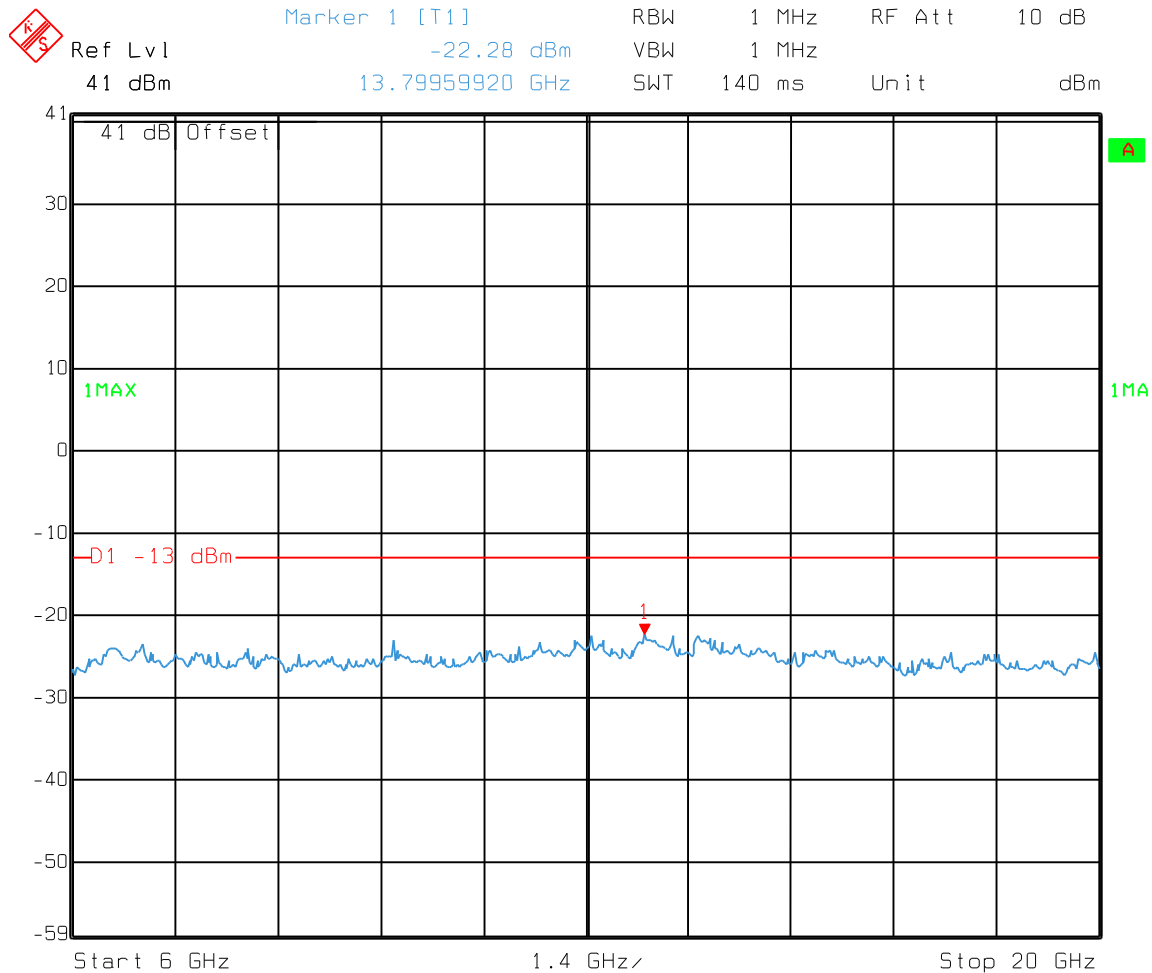


Date: 11.DEC.2003 16:57:14

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

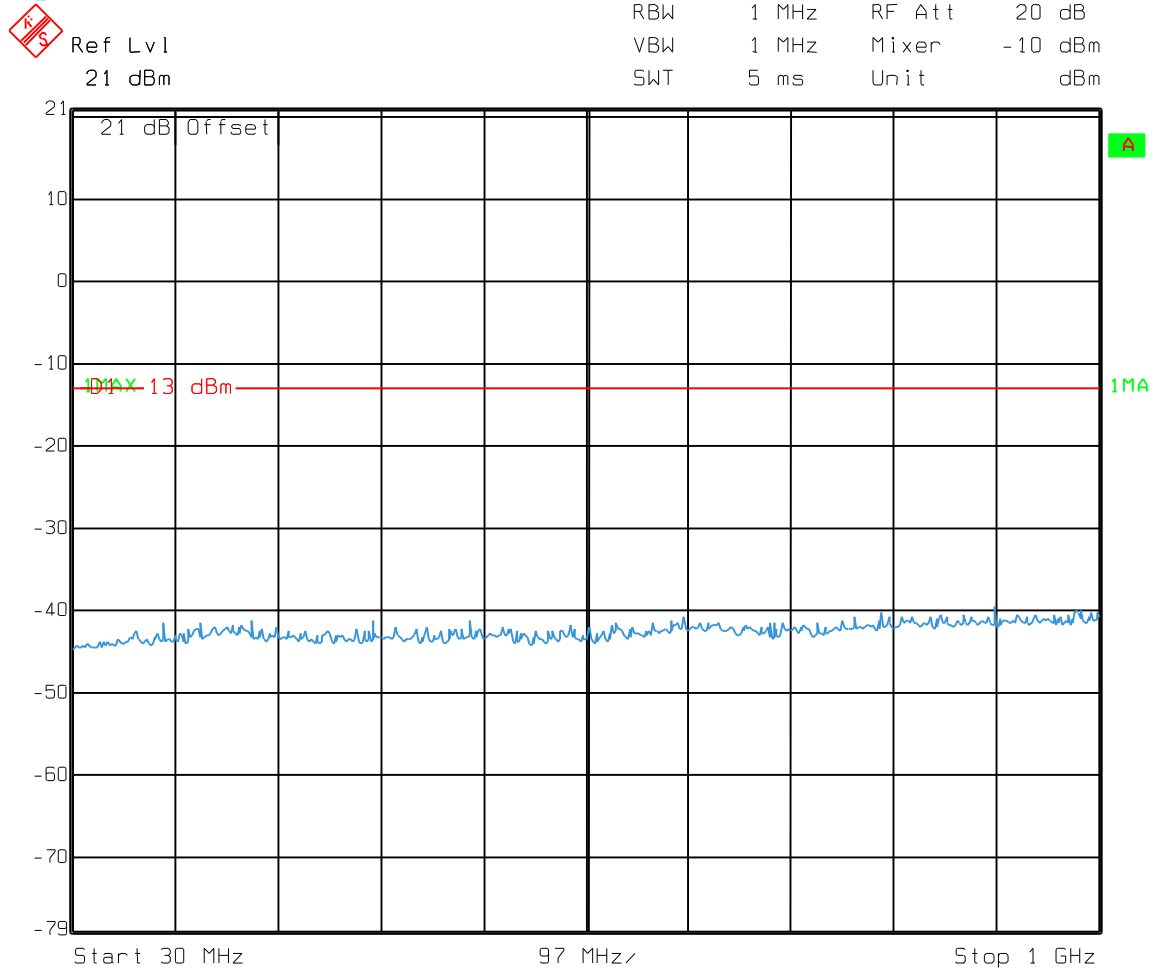


Date: 11.DEC.2003 16:58:47

EQUIPMENT: **PCS Repeater**
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Uplink

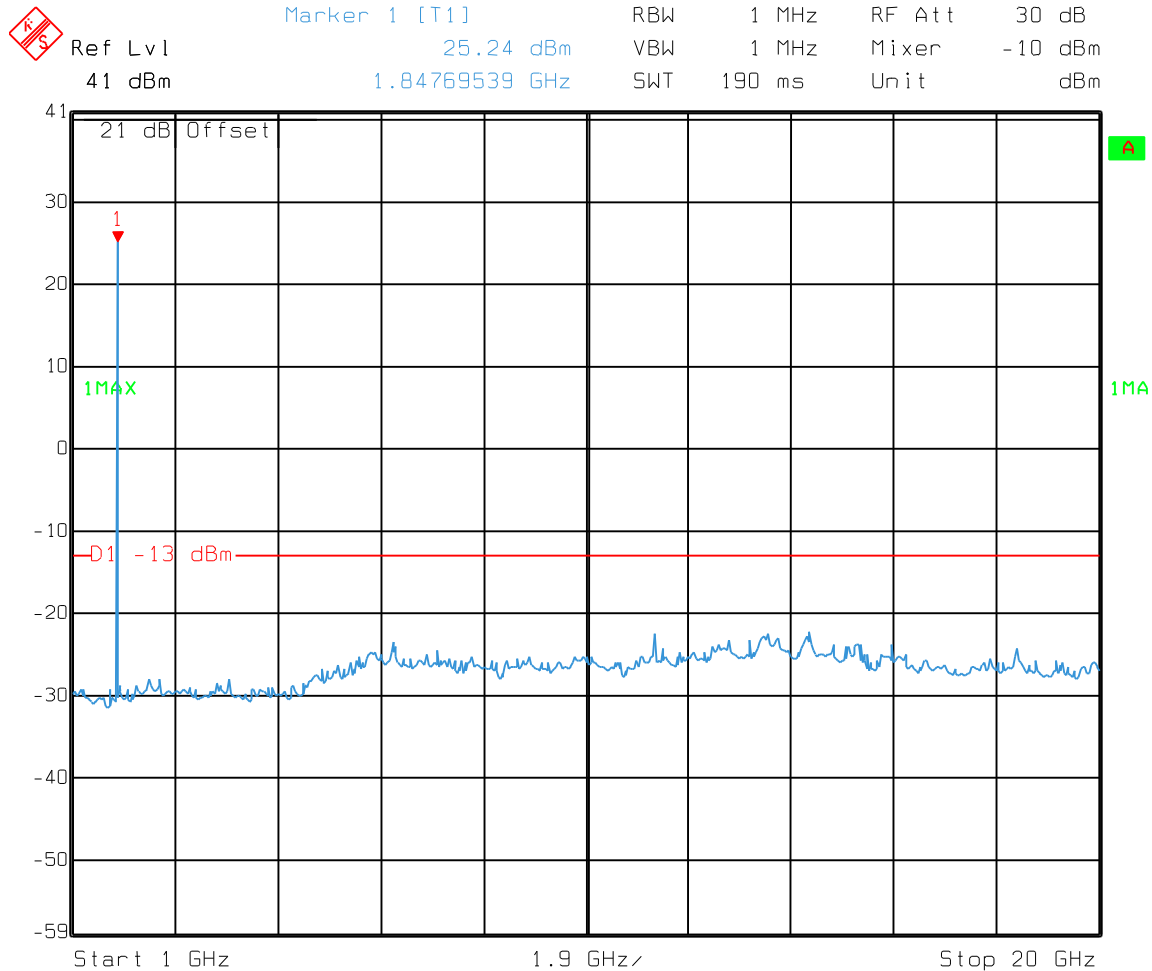


Date: 12.DEC.2003 15:35:28

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**



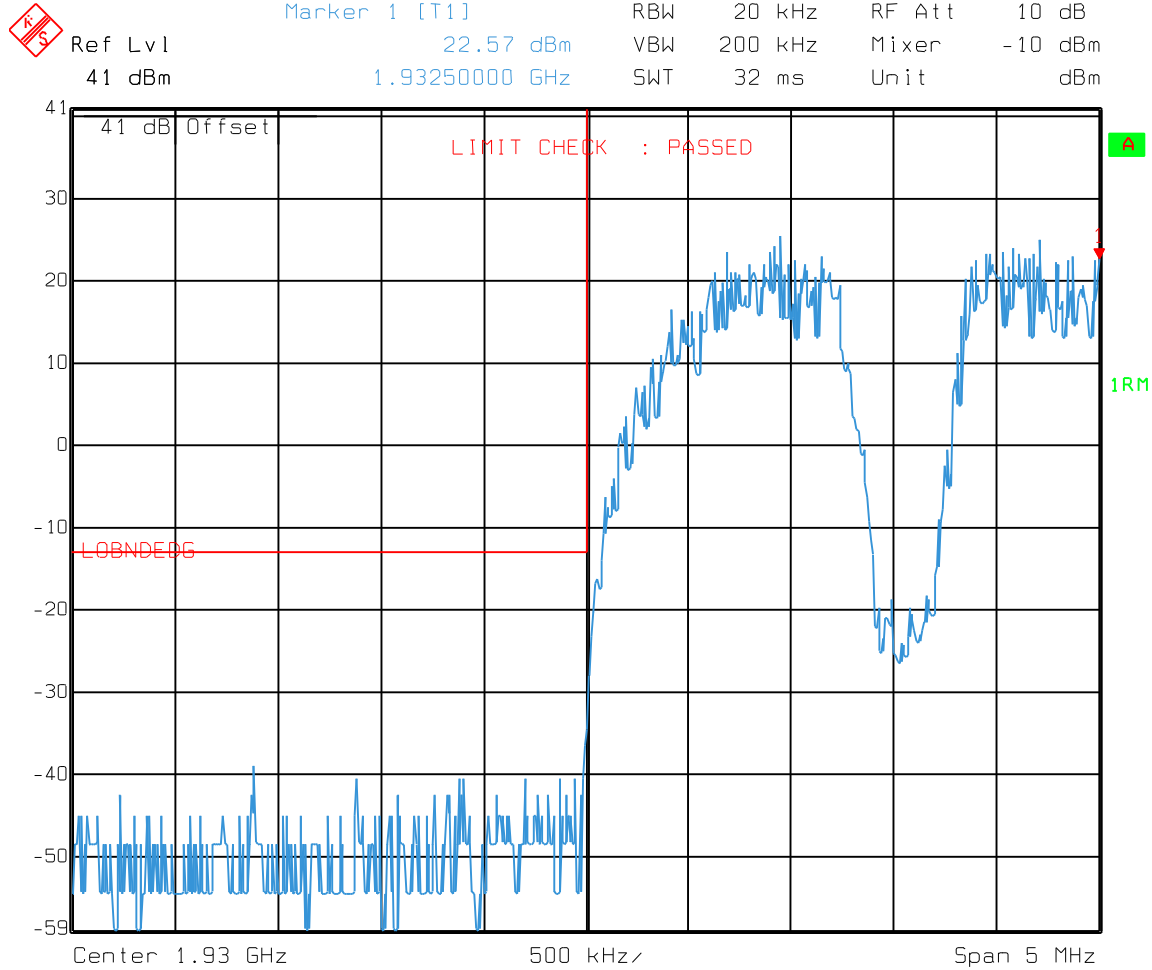
Date: 12.DEC.2003 15:36:46

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

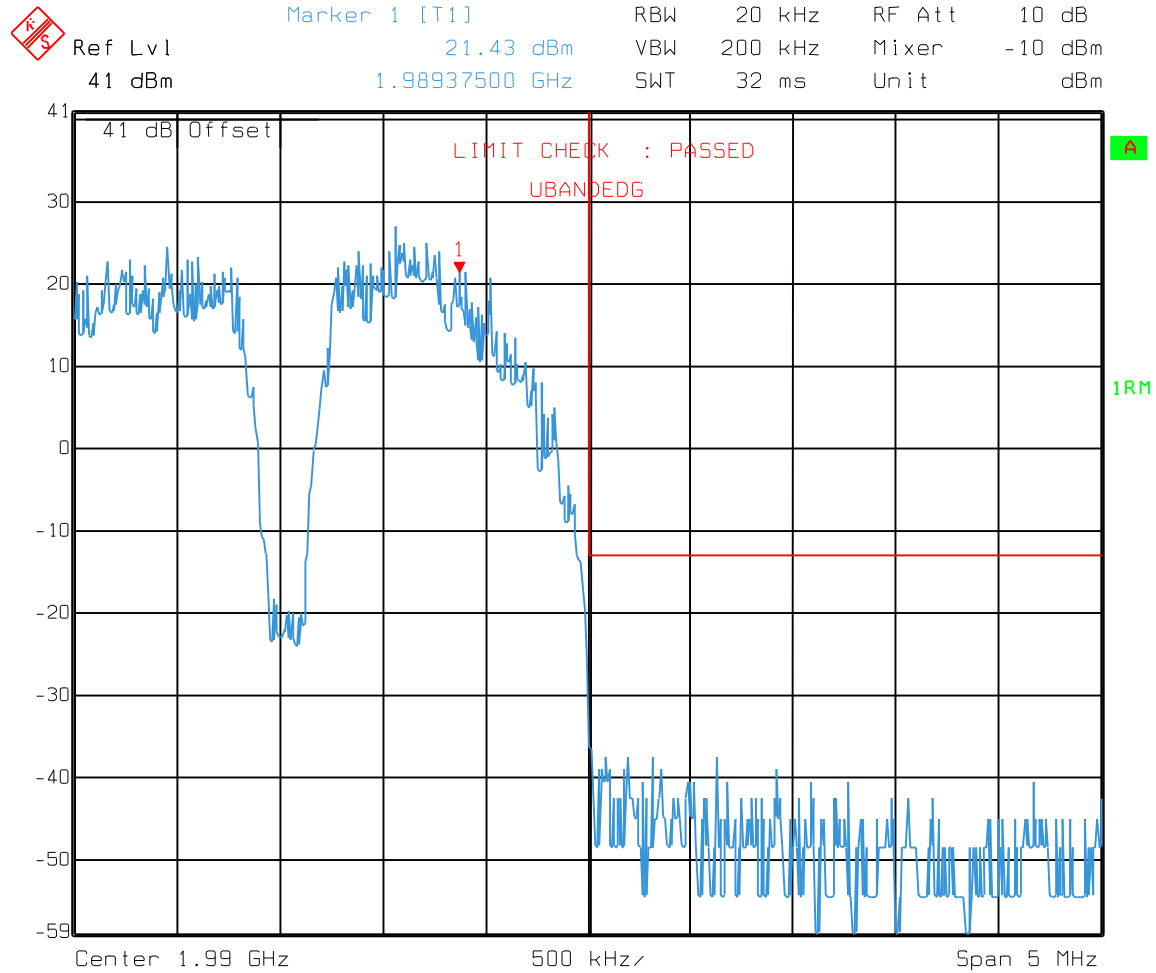
Downlink Intermodulation



Date: 11.DEC.2003 16:23:40

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

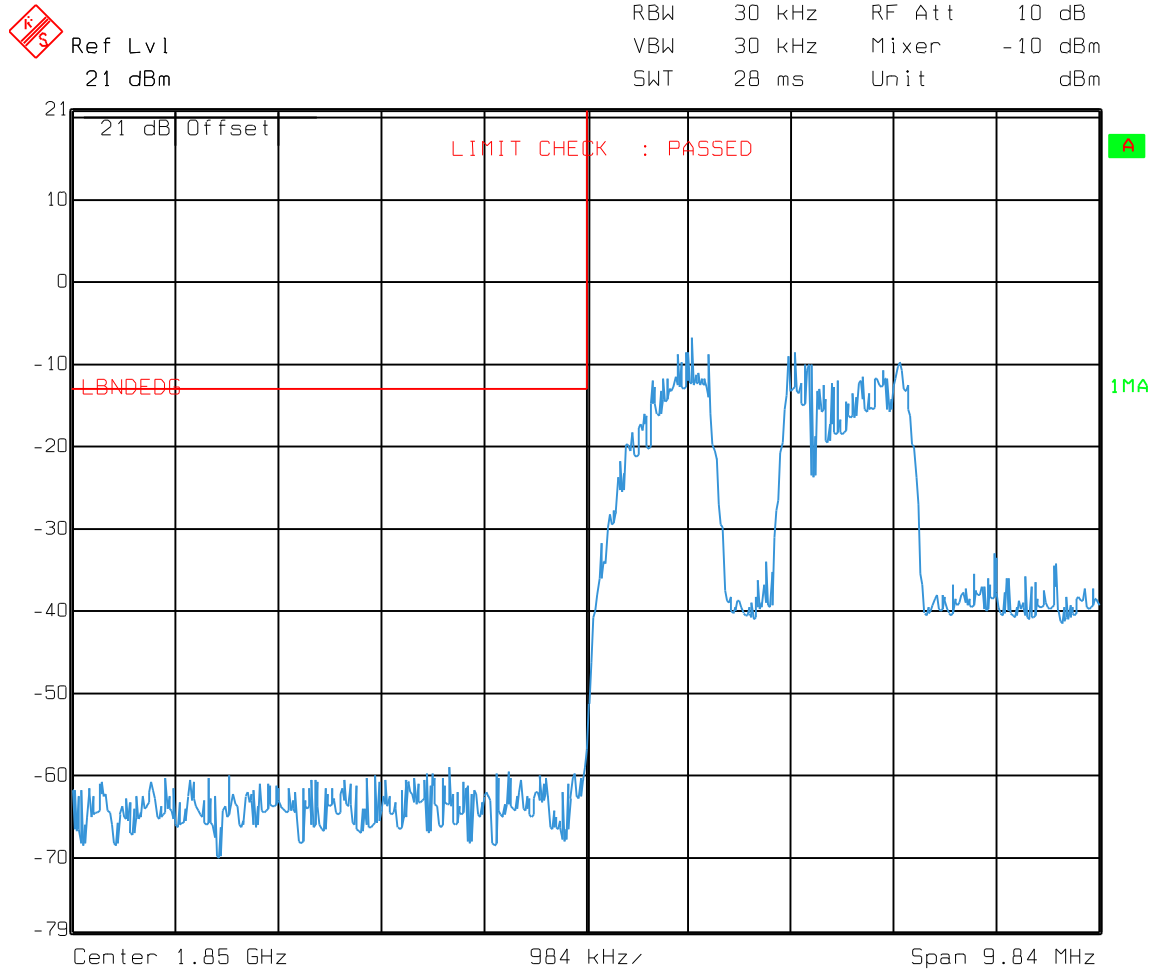
PROJECT NO.: **3L0496****Downlink Intermodulation**

Date: 11.DEC.2003 16:18:38

EQUIPMENT: **PCS Repeater**
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Uplink Intermodulation

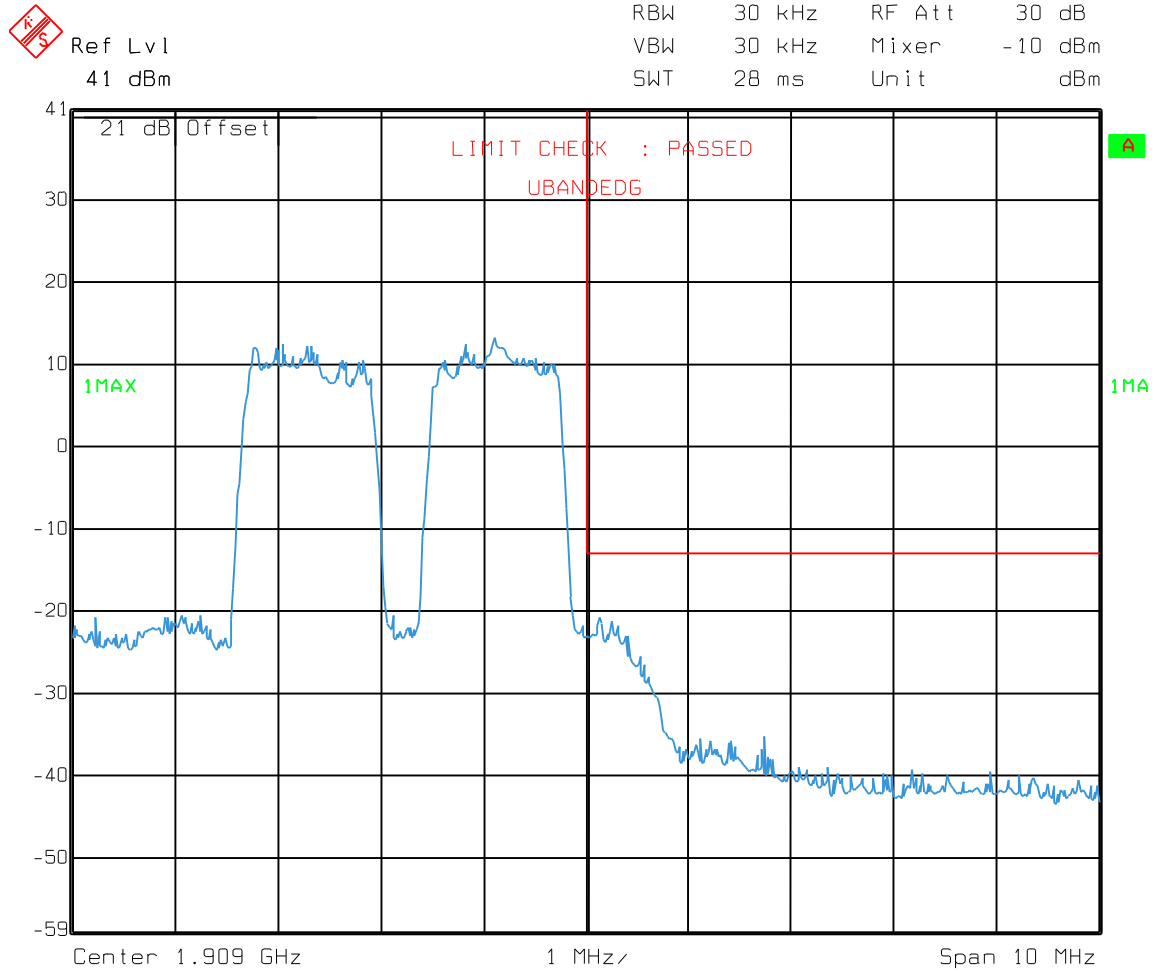


Date: 12.DEC.2003 15:25:30

EQUIPMENT: **PCS Repeater**
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Uplink Intermodulation

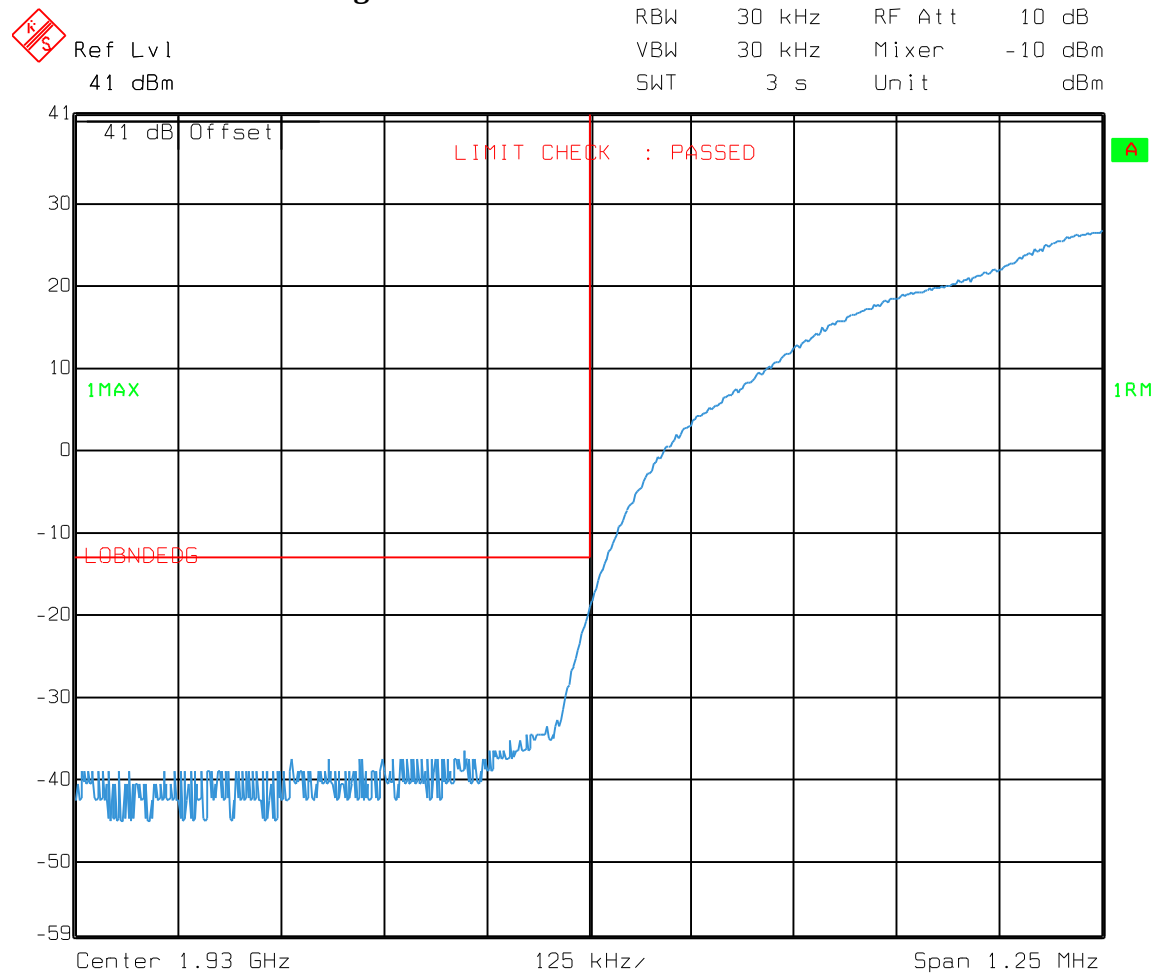


Date: 12.DEC.2003 15:47:30

EQUIPMENT: **PCS Repeater**
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Downlink Lower Bandedge: 1930MHz



Date: 11.DEC.2003 16:00:30

EQUIPMENT: **PCS Repeater**

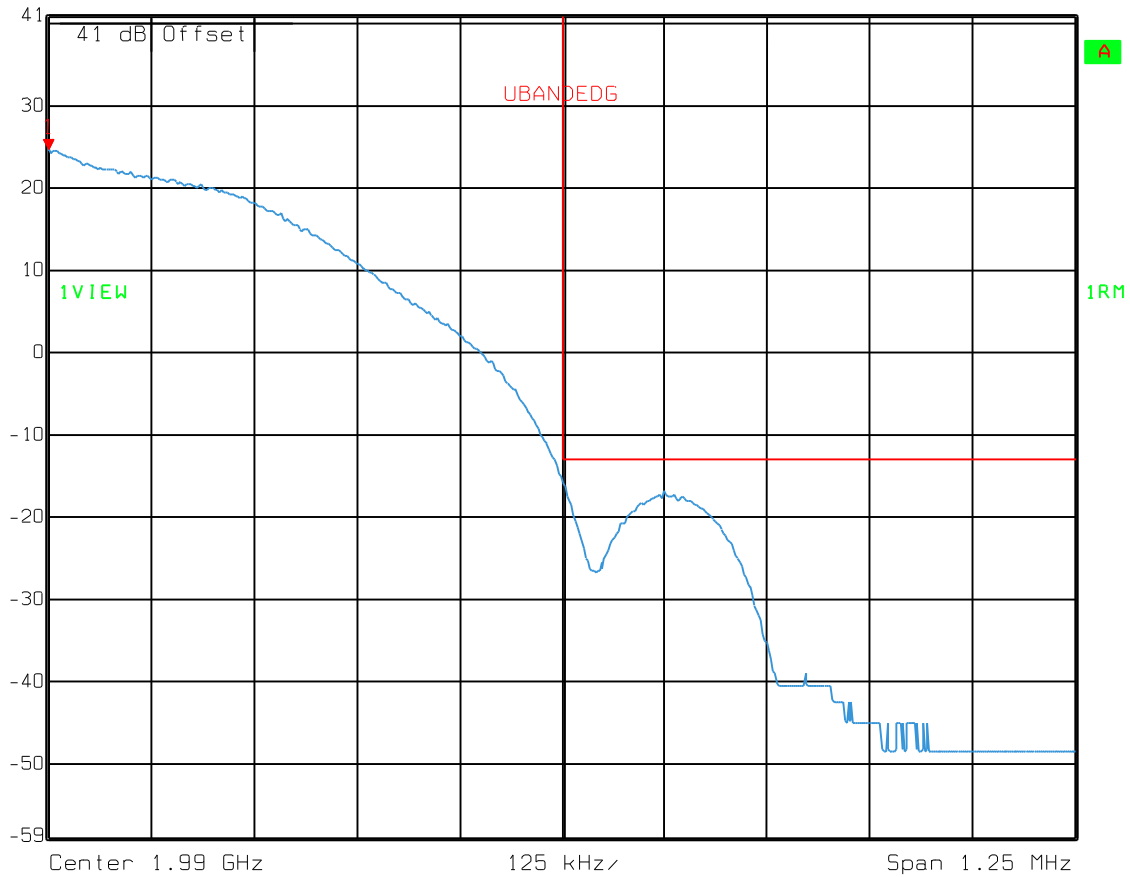
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Downlink Upper Bandedge: 1990MHz



Marker 1 [T1] RBW 30 kHz RF Att 10 dB
Ref Lvl 24.67 dBm VBW 30 kHz Mixer -10 dBm
41 dBm 1.98937500 GHz SWT 3 s Unit dBm



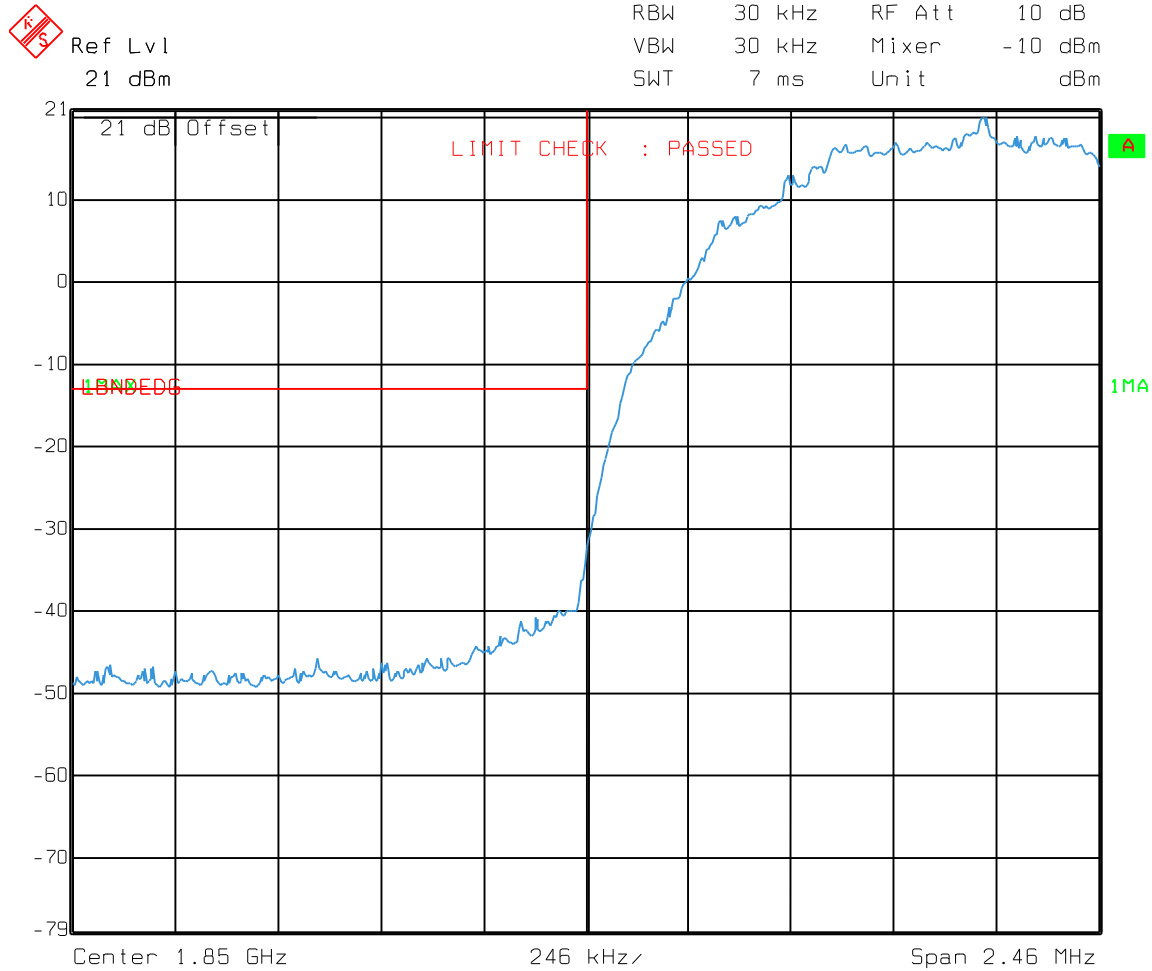
Date: 11.DEC.2003 16:04:00

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Uplink Lower Bandedge: 1850MHz

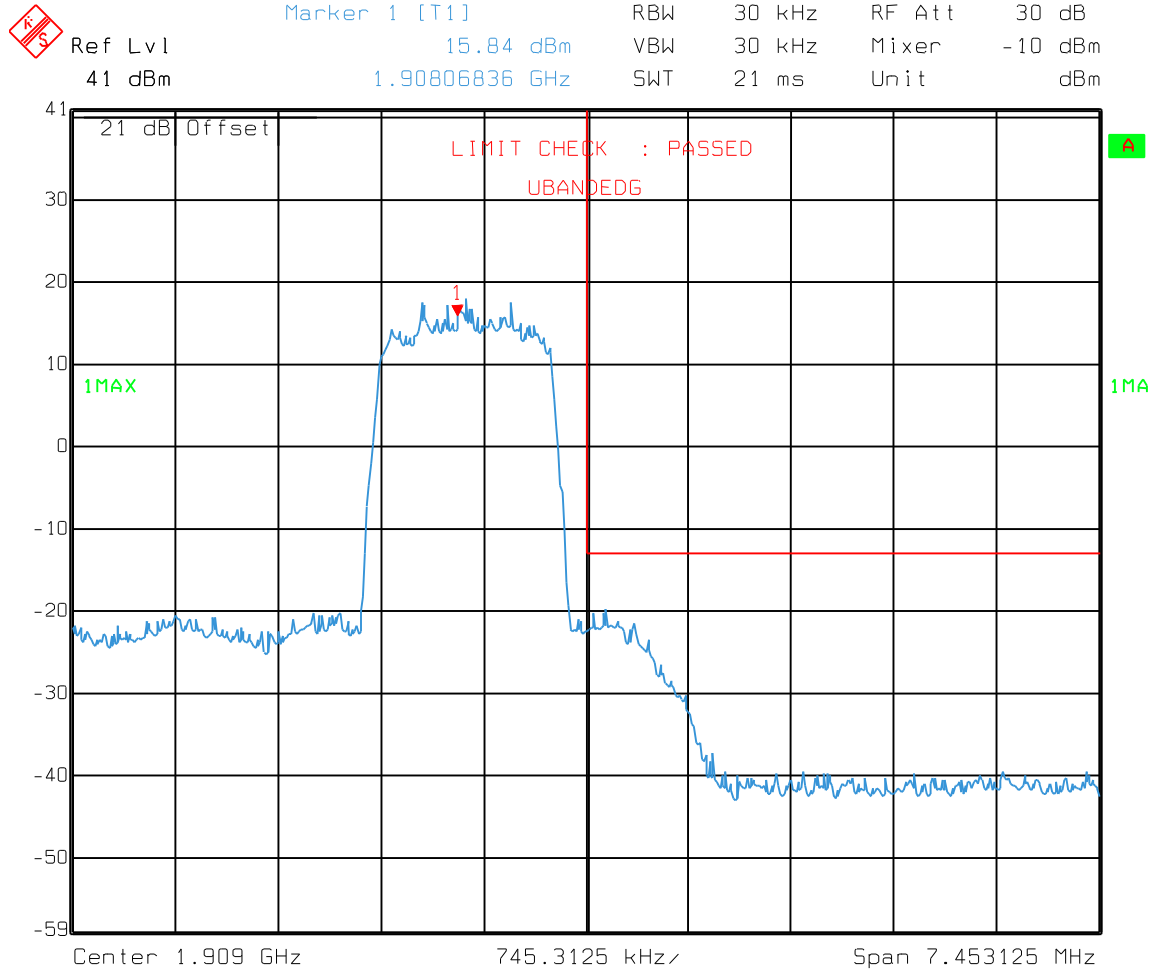


Date: 12.DEC.2003 15:21:38

EQUIPMENT: **PCS Repeater**
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Uplink Upper Bandedge: 1909MHz



Date: 12.DEC.2003 15:39:19

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

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, 1016, 1304

Measurement Uncertainty: +/- 6 dB

Temperature: 21 °C

Relative Humidity: 51 %

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496****Test Data - Radiated Emissions - Downlink and Uplink**

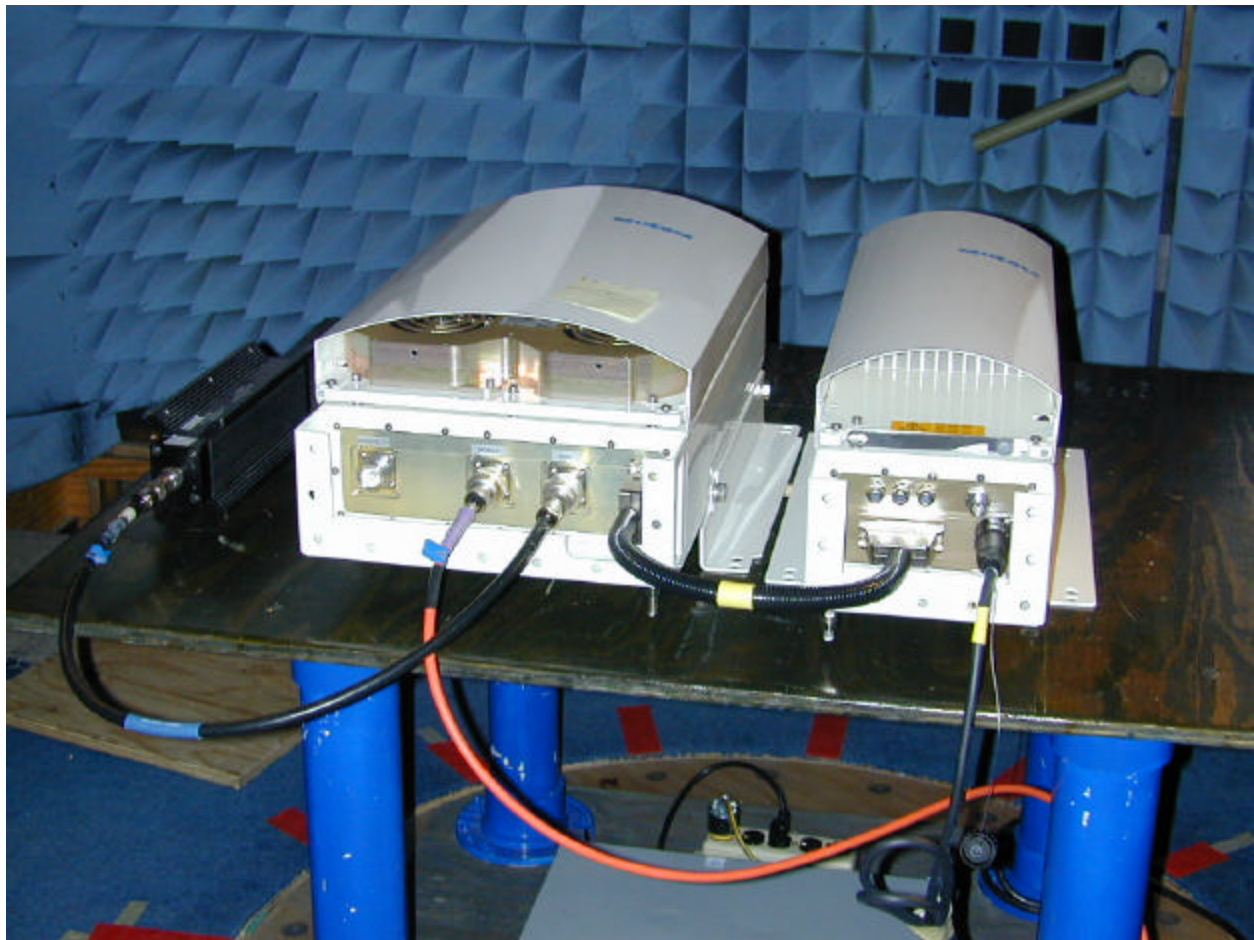
<u>EIRP Substitution Method</u>										
Page <u>1</u> of						Complete <u>X</u>				
Job No.: 3L0496R		Date: 12/12/2003				Preliminary _____				
Specification: FCC 24E		Temperature(°C): <u>21</u>								
Tested By: <u>Dustin Oaks</u>		Relative Humidity(%) <u>51</u>								
E.U.T.: <u>Node C 1943</u>										
Configuration: <u>EUT continuously Transmitting</u>										
Sample No: <u>13</u>										
Location: <u>Lab 3</u>		RBW: <u>1 MHz</u>		Measurement						
Detector Type: <u>Peak</u>		VBW: <u>1 MHz</u>		Distance: <u>3</u> m						
<u>Test Equipment Used</u>										
Antenna: <u>1304</u>		Directional Coupler: _____								
Pre-Amp: <u>1016</u>		Cable #1: <u>1484</u>								
Filter: _____		Cable #2: <u>1485</u>								
Receiver: <u>1036</u>		Cable #3: _____								
Attenuator #1: _____		Cable #4: _____								
Attenuator #2: _____		Mixer: _____								
Additional equipment used: _____										
Measurement Uncertainty: <u>+/-3.6 dB</u>										
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBi)		EIRP (dBm)	EIRP (mW)	Polarity	Comments
3870	-40.3	43.3		31.4	10.7		-17.7	0.02	v	EUT on 1935MHz
7740	-45.3	41.8		36.5	11.3		-28.7	0.001359	v	EUT on 1935MHz
1350	-50.8	31.5		31.1	7.0		-43.4	0.000045	v	EUT on 1935MHz
3870	-43.0	35.5		31.4	10.7		-28.2	0.001514	h	EUT on 1935MHz
1933	-47.8	33.0		31.9	9.4		-37.3	0.000185	h	EUT on 1855MHz
1941	-50.5	31.0		31.9	9.4		-42.0	0.00	v	EUT on 1855MHz
1349	-50.3	31.5		31.1	7.0		-42.9	0.00	v	EUT on 1855MHz
Notes: <u>Downlink and Uplink paths tested</u>										

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Photographs of Test Setup



EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Section 7. Frequency Stability

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

Test Results: Test Not Applicable

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496****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
1626	CABLE, 5 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1473	20db Attenuator DC 18 Ghz	Midwest Microwave 290-20db	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
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	08/28/03	08/28/04

Nemko Dallas

FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

ANNEX A - TEST DETAILS

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496****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.

Method Of Measurement:Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:

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

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

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

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

EQUIPMENT: PCS Repeater**FCC ID:** BCR-RPT-NODEC1943**PROJECT NO.:** 3L0496**NAME OF TEST: Occupied Bandwidth****PARA. NO.:** 2.1047

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**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

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**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496****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.

Calculation Of Field Strength Limit

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

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

For emissions ≤ 1 GHz:

$G = 1.64$ (Dipole Gain)

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

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

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

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

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

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

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

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

EQUIPMENT: **PCS Repeater***FCC ID:* BCR-RPT-NODEC1943*PROJECT NO.:* **3L0496****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

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: 3L0496

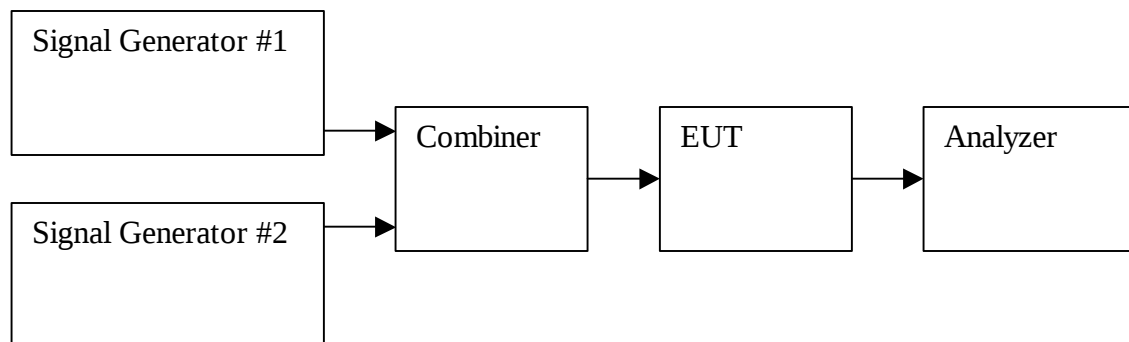
NAME OF TEST: Intermodulation

PARA. NO.:

Method of Measurement:

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

Test Setup:



Nemko Dallas

FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS

EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

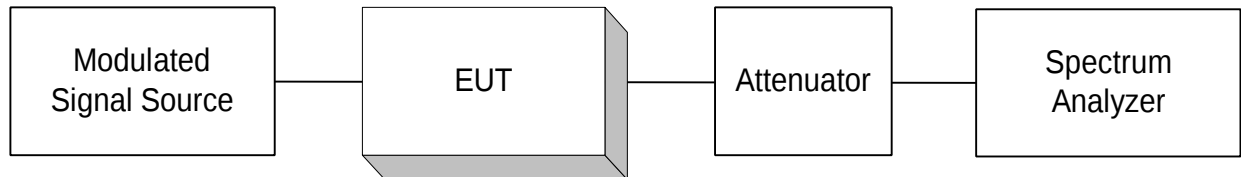
ANNEX B - TEST DIAGRAMS

EQUIPMENT: PCS Repeater

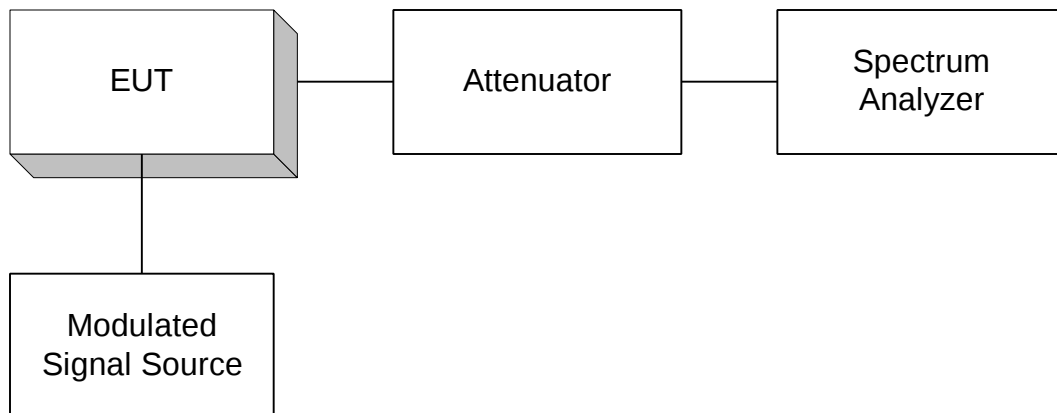
FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: 3L0496

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



Para. No. 2.989 - Occupied Bandwidth

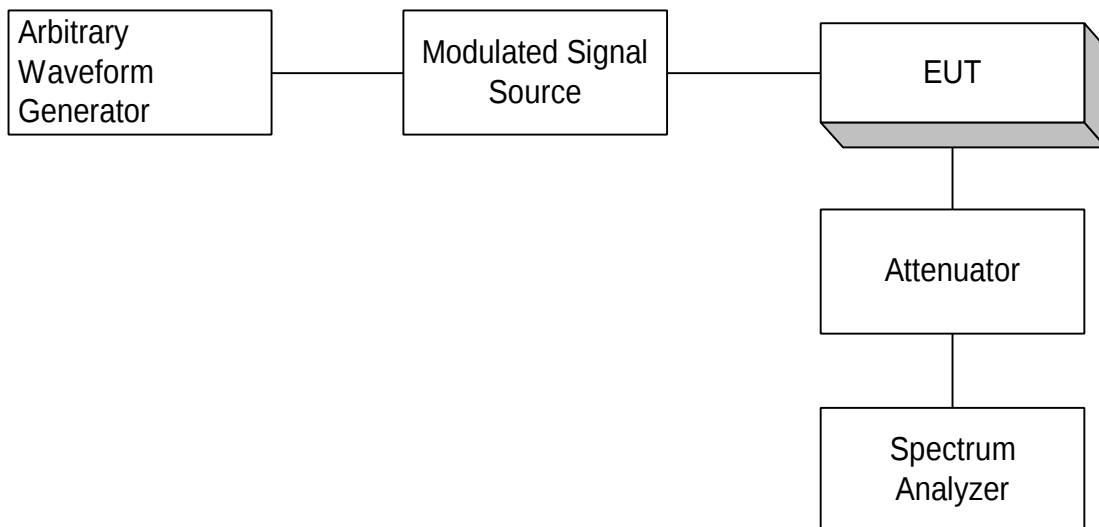
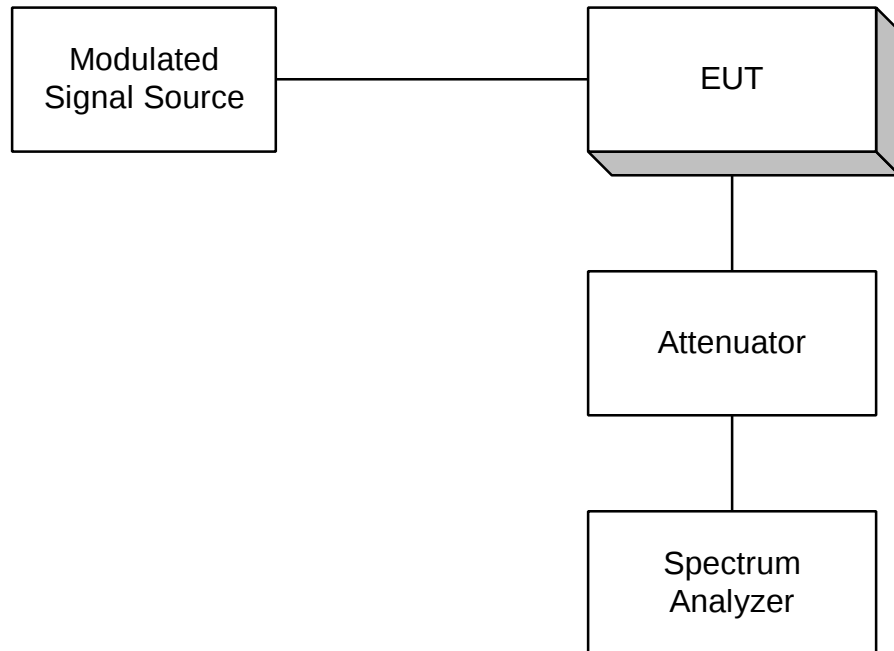


EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Para. No. 2.991 Spurious Emissions at Antenna Terminals

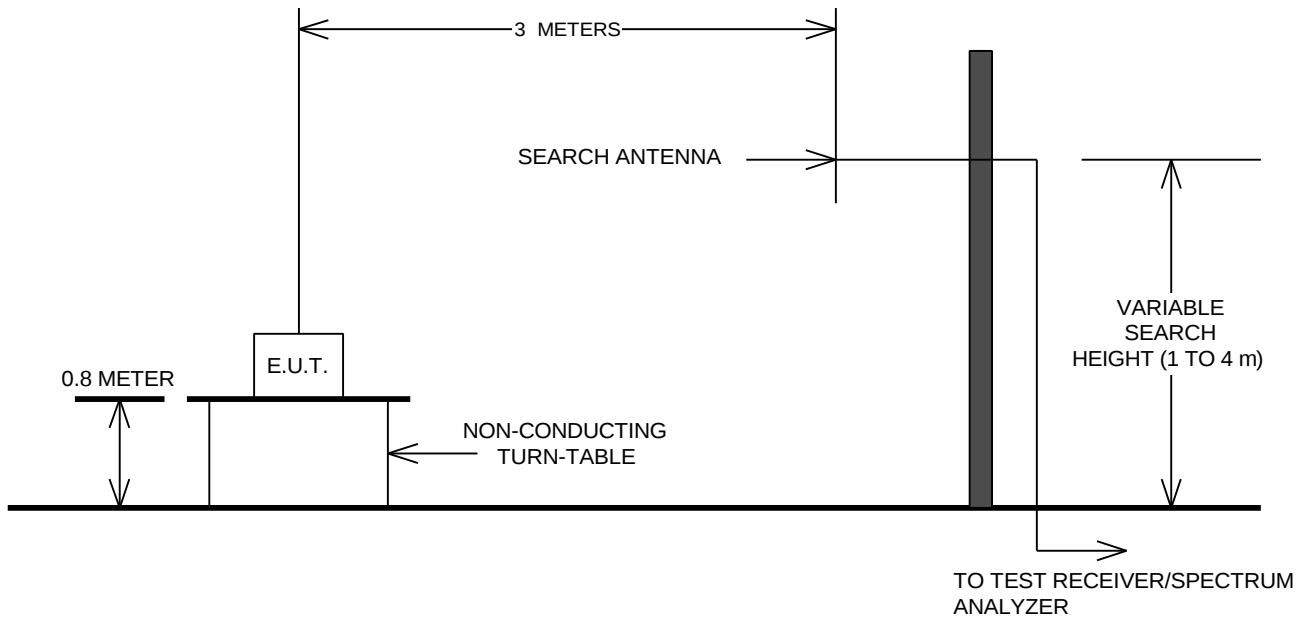


EQUIPMENT: **PCS Repeater**

FCC ID: BCR-RPT-NODEC1943

PROJECT NO.: **3L0496**

Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability

