ENGINEERING TEST REPORT

ON:
2600E/2600U CPE MDS Response Station Transceiver

IN ACCORDANCE WITH:

FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE

PROJECT NO.: 2L0042RUS1

FCC ID.: PL6-MMDS-CPE-R1

TESTED FOR:

Navini Networks
2240 Campbell Creek Blvd. Suite 110
Richardson, TX 75082

TESTED BY:

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

APPROVED BY:

Tom Tidwell, EMC/Wireless Manager

DATE: 3/14/02

This document contains 54 pages.

Table of Contents

Section 1. Summary of Test Results

MODEL NO.: 2600E/2600U

SERIAL NO.: None

GENERAL:

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 21, Subpart K.

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

SUMMARY OF TEST DATA

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Modulation Characteristics		Digitally Modulated Spread Spectrum	N/A
RF Power Output	2.985	33 dBW + 10log(X/6) dBW (21.904)	Complies
Occupied Bandwidth	2.989	Mask (21.101)	Complies
Spurious Emissions at Antenna Terminals	2.991	Mask (-60 dBc) 21.905	Complies
Field Strength of Spurious Radiation	2.993	Mask (-60 dBc) 21.905	Complies
Frequency Stability	2.995	Mask (21.101)	Complies

Footnotes:

GENERAL EQUIPMENT SPECIFICATION

Power Input:	115 Vac
Frequency Range:	2596 MHz to 2644 MHz
Type of Modulation:	Digital
Emission Designator:	2M00F9W
Output Impedance:	50 ohms
RF Power Output (rated):	24 dBm @ Patch antenna 22.5 dBm @ Broadbeam antenna
Duty Cycle:	50% TDD
Selection of Operating Frequency:	Not selectable by operator

Power Output Adjustment Capability: Not selectable by operator

Description of Operation

The EUT is a CPE (Customer Premise Equipment) transceiver operating in the MMDS band. The transceiver serves as a wireless link between a BTS and a customer site. The transceiver is not intended to be a mobile device. The EUT uses a multi-antenna system for improved coverage and diversity. **Only one antenna transmits at any time.** The transmitter is digitally modulated and produces a spread spectrum waveform.

System Diagram

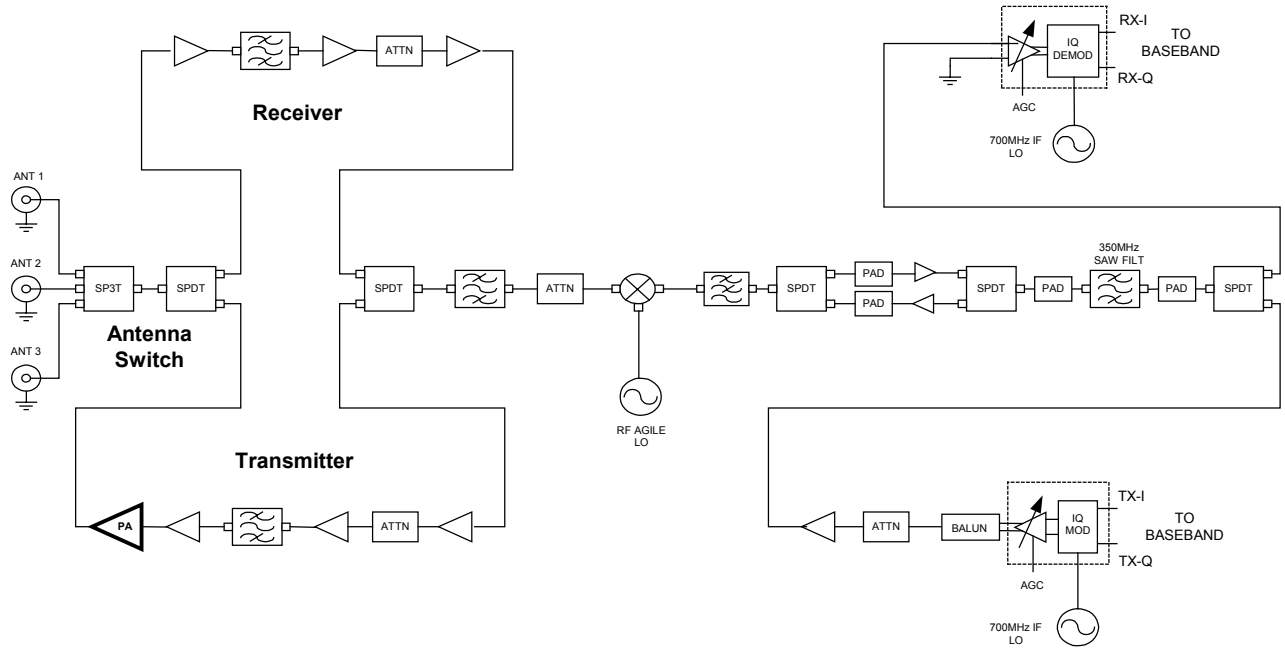


Figure 1 2.6GHz CPE BLOCK DIAGRAM

Section 2. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: David Light	DATE: 2/20/02

TEST RESULTS: Complies

MEASUREMENT DATA: .

Antenna Port	Measured Output Power (dBm)	Measured Output Power (W)
Broadbeam	22.5	0.178
Patch	24.0	0.251

Power was varied +/- 15% with no change in power output.
Temperature: 20 deg Celsius, RH: 50%

Test equipment used:	1036-1629-1477

Section 3. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.989
TESTED BY: David Light	DATE: 2/20/02

TEST RESULTS: Complies

MEASUREMENT DATA: See attached data sheets

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

Nemko Dallas, Inc.

Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Data Plot — **20 dB Bandwidth**

Page 1 of 2 — Complete: X — Preliminary: ____

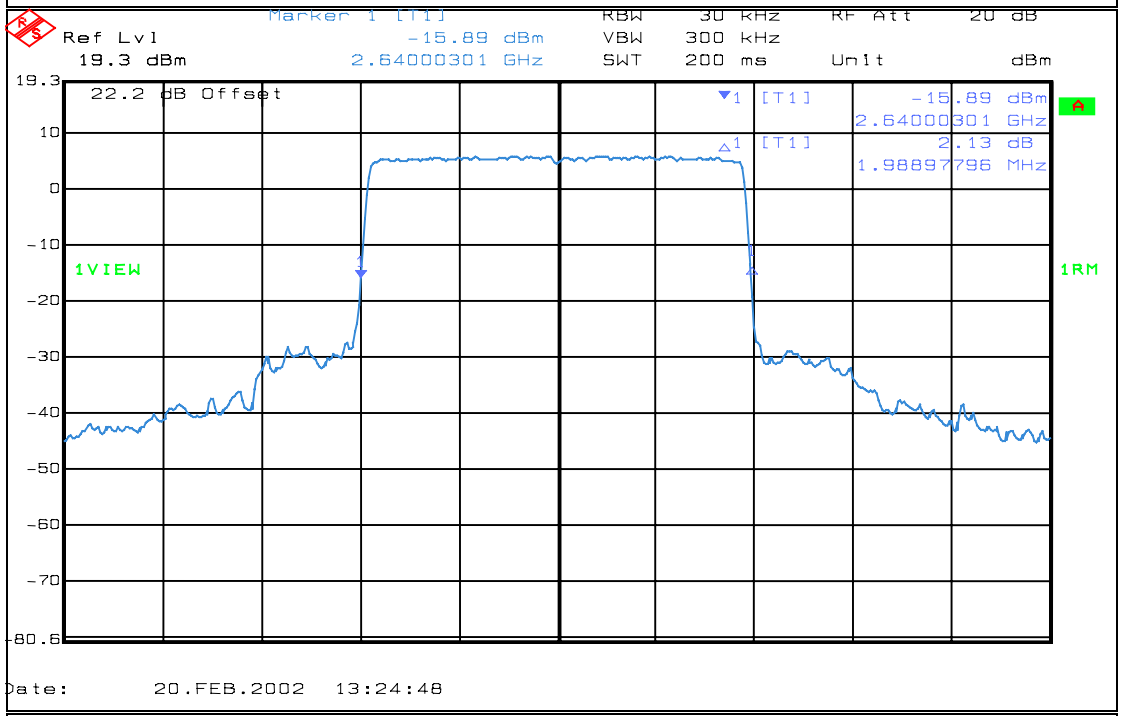
Job No.:	PT 21	Date:	2/20/2002
Specification:	2L0042R	Temperature(°C):	20
Tested By:	Tom Tidwell	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA - TEST FIXTURE		
Sample Number:	1		
Location:	Lab 1	RBW:	30 kHz
Detector Type:	Rms	VBW:	300 kHz

Measurement Distance: ____ m

Test Equipment Used

Antenna:		Directional Coupler:	1056
Pre-Amp:		Cable #1:	1628
Filter:		Cable #2:	1629
Receiver:	1036	Cable #3:	1046
Attenuator #1	1477	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:
Measurement Uncertainty: +/-1.7 dB



Notes: BROADBEAM PORT - 22.5 DBM

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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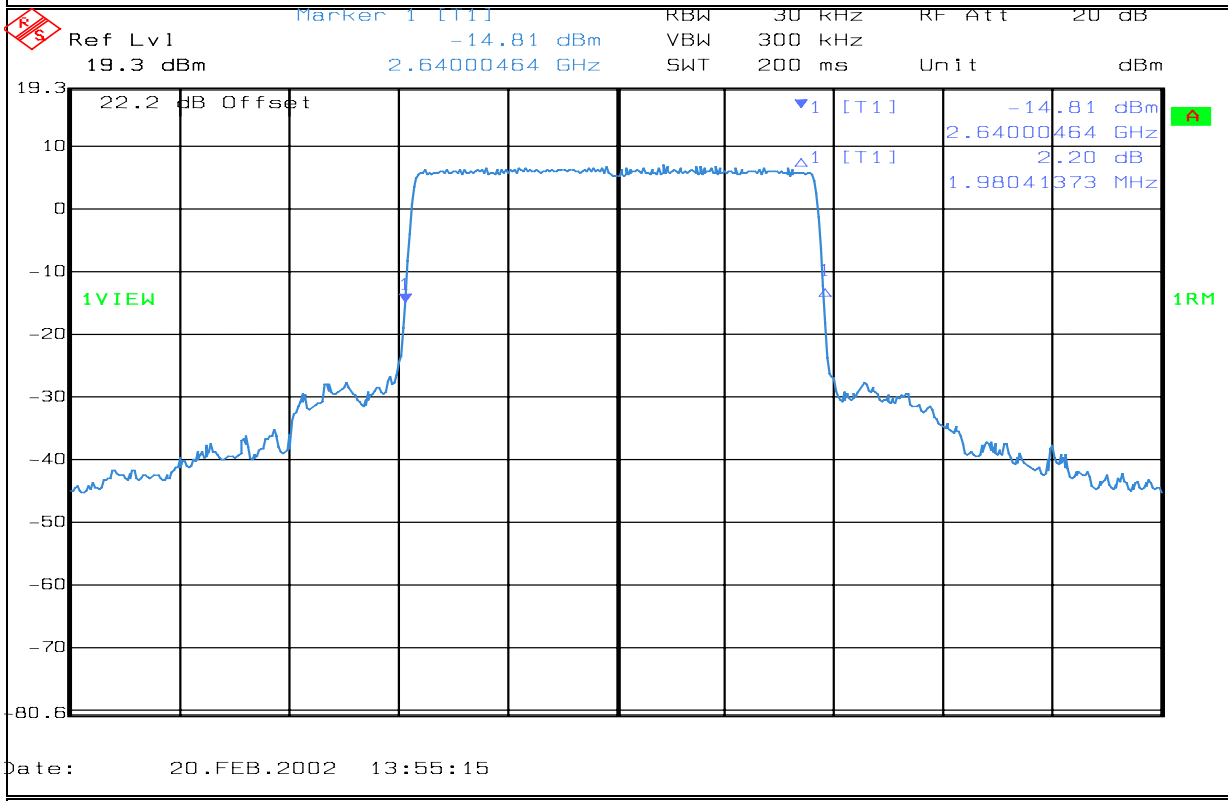
Nemko Dallas, Inc.

Data Plot **20 dB Bandwidth**

Page 2 of 2

Job No.:	PT 21	Date:	2/20/2002
Specification:	2L0042R	Temperature(°C):	20
Tested By:	Tom Tidwell	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA - TEST FIXTURE		



Notes: PATCH ANYENNA PORT - 24 DBM OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Data Plot — Bandwidth Mask

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Complete X
Preliminary:

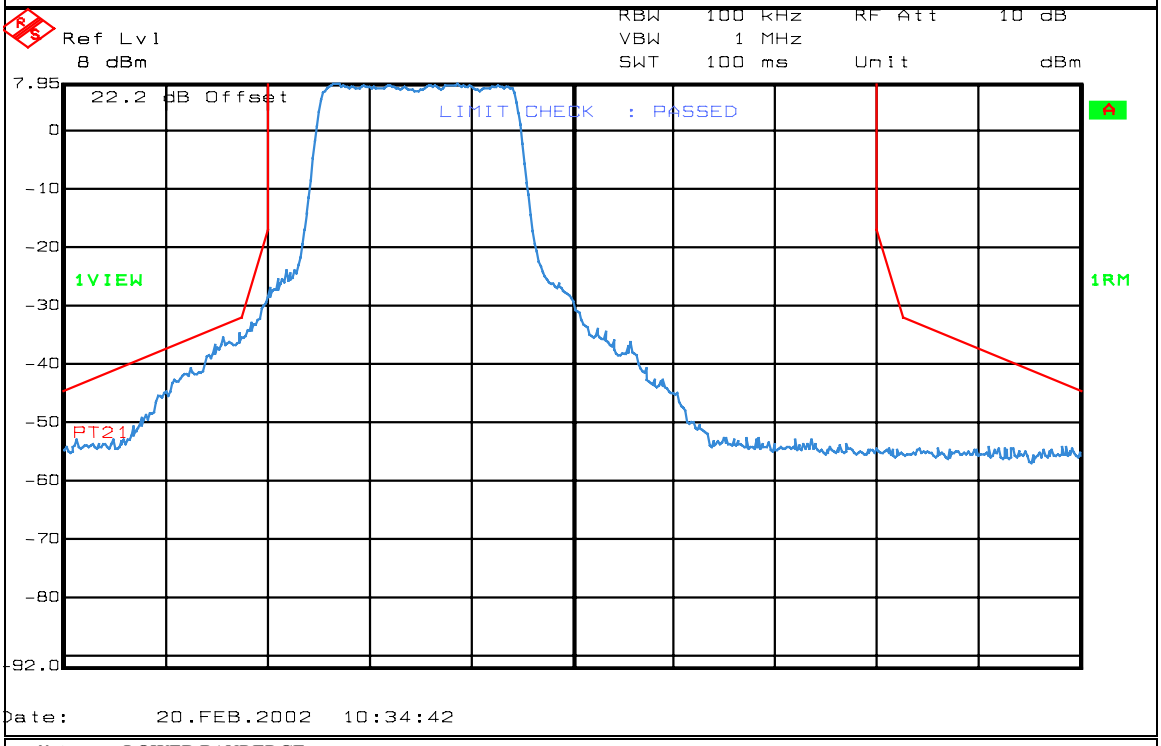
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		
Sample Number:	1		
Location:	Lab 1	RBW:	100 kHz
Detector Type:	Rms	VBW:	1 MHz

Measurement Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	1056
Pre-Amp:		Cable #1:	1628
Filter:		Cable #2:	1629
Receiver:	1036	Cable #3:	1046
Attenuator #1	1477	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:
Measurement Uncertainty: +/-1.7 dB



Notes: LOWER BANDEDGE
CHANNEL E1
LOWEST OPERATING FREQUENCY IN BAND (2597.5 MHz) - BROADBEAM ANTENNA PORT @ 22.5 dBm

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Data Plot — **Bandwidth Mask**

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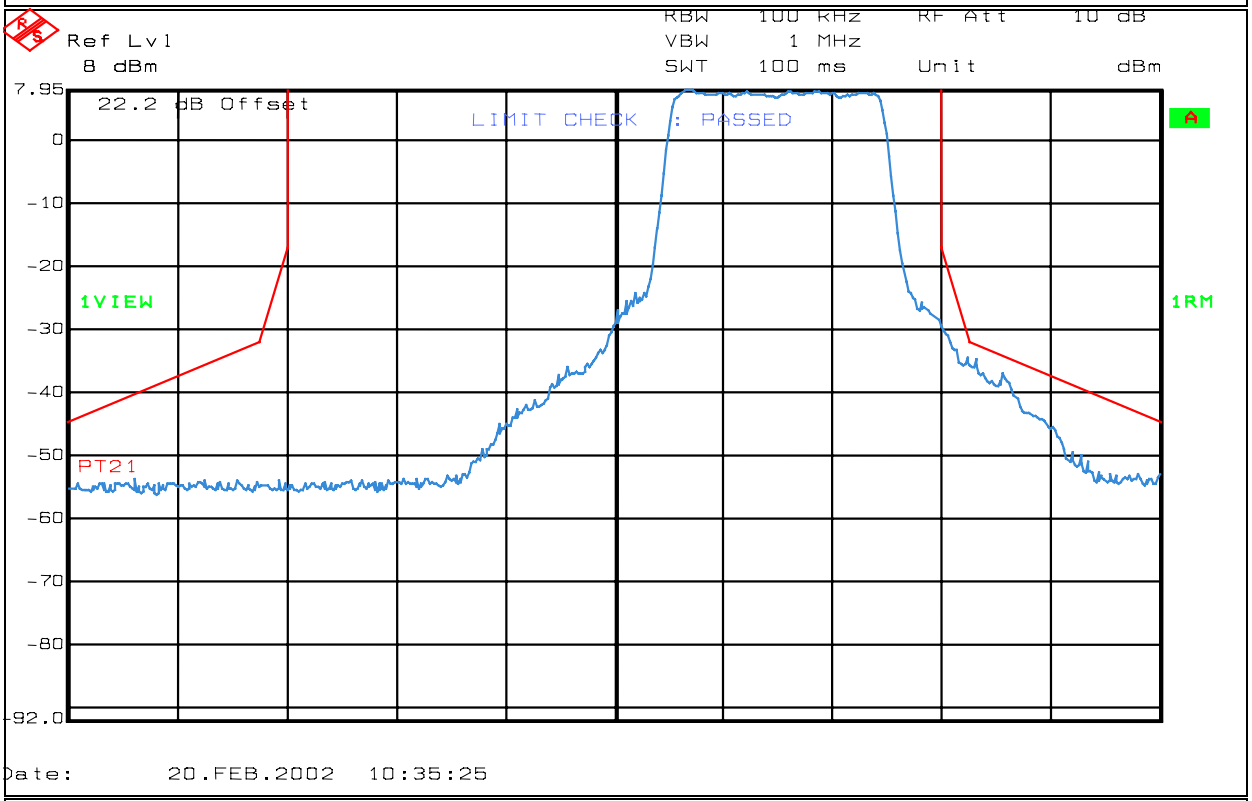
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:	
	LOWER BANDEDGE
	CHANNEL E1
	LOWEST OPERATING FREQUENCY IN BAND (2600.5 MHz) - BROADBEAM ANTENNA PORT @ 22.5 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

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Data Plot **Bandwidth Mask**

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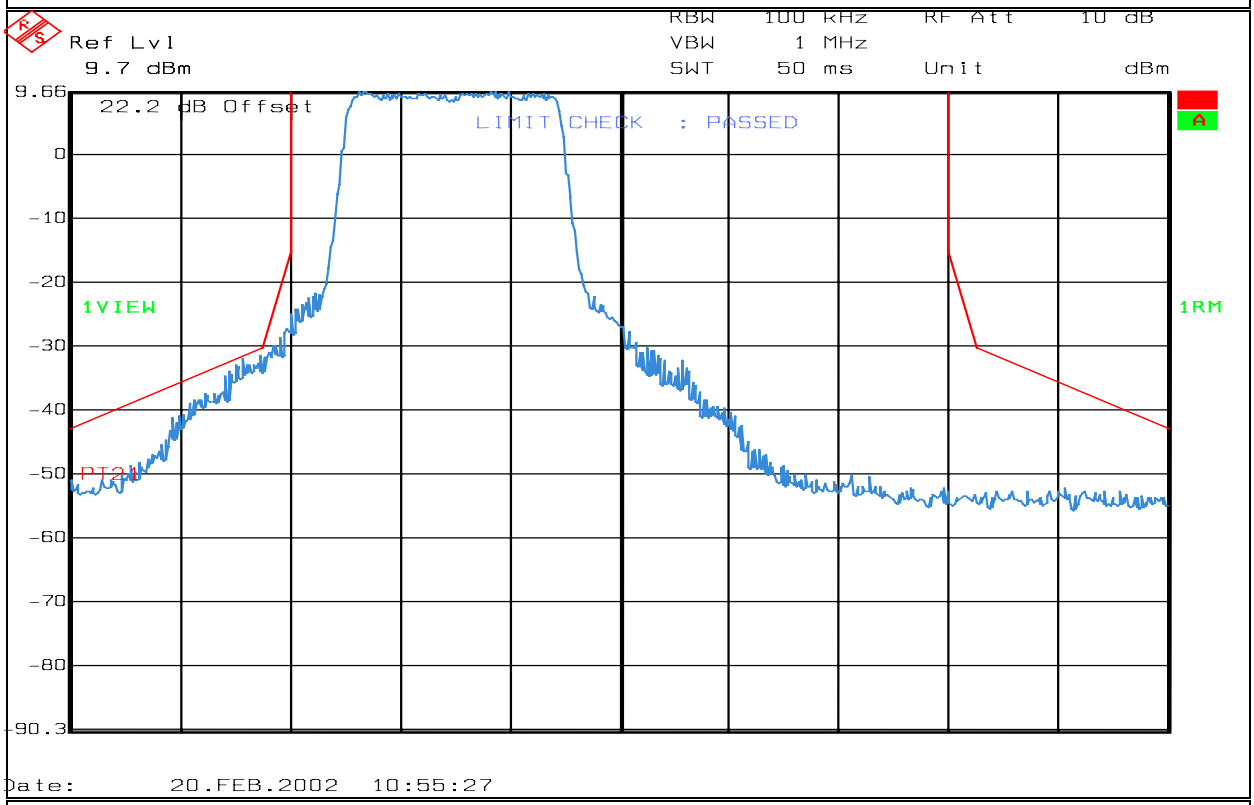
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:
LOWER BANDEDGE
CHANNEL E1
LOWEST OPERATING FREQUENCY IN BAND (2597.5 MHz) - PATCH ANTENNA PORT @ 24 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Test Plot: **Bandwidth Mask**

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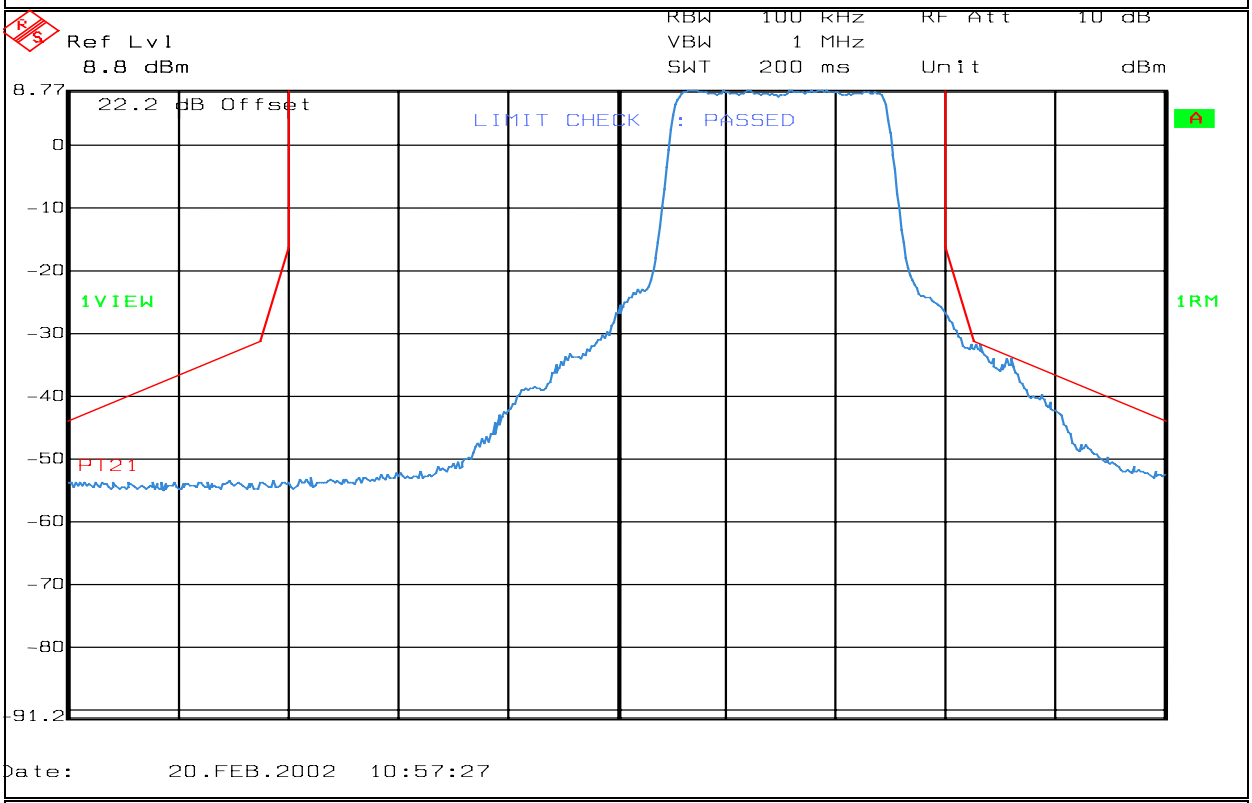
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:	**UPPER BANDEDGE**
	CHANNEL E1
	HIGHEST OPERATING FREQUENCY IN BAND (2600.5 MHz) - PATCH ANTENNA PORT @ 24 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Test Plot: **Bandwidth Mask**

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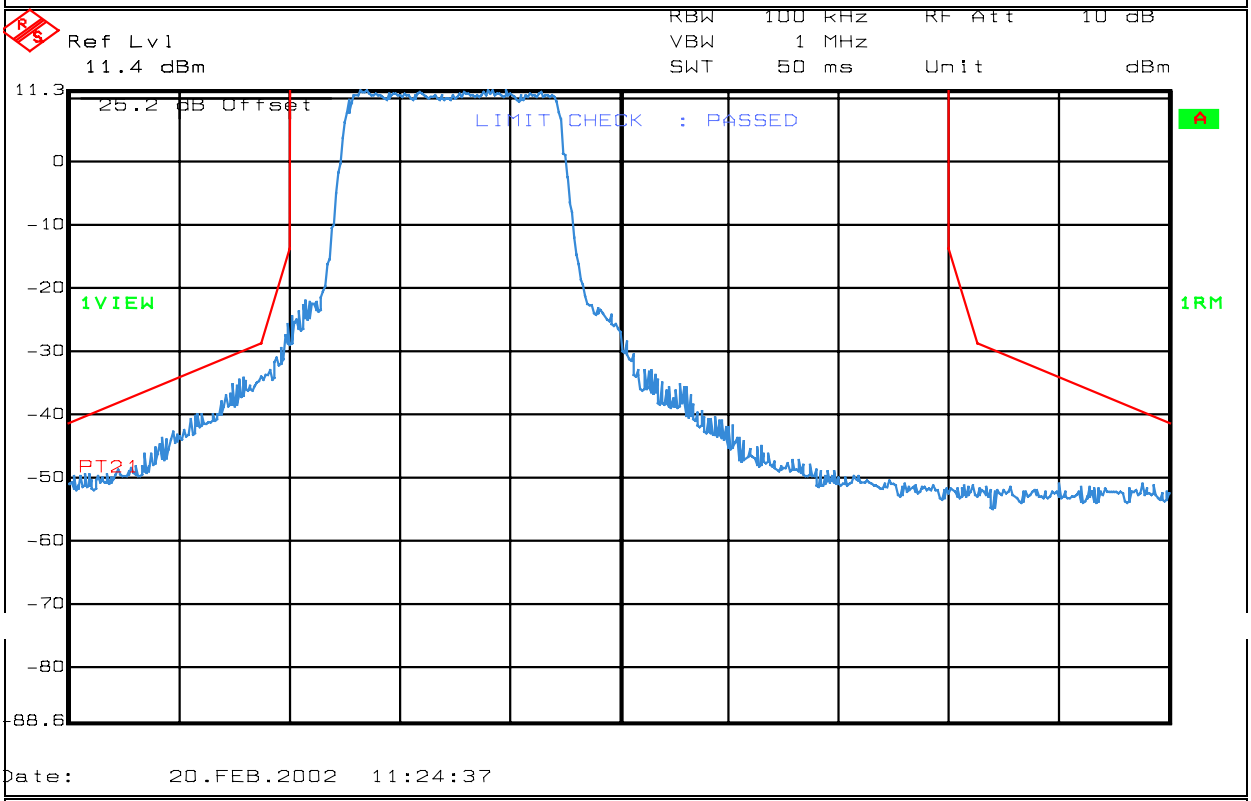
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:
LOWER BANDEDGE
CHANNEL E3
LOWEST OPERATING FREQUENCY IN BAND (2621.5 MHz) - BROADBEAM ANTENNA PORT @ 22.5 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Test Plot: **Bandwidth Mask**

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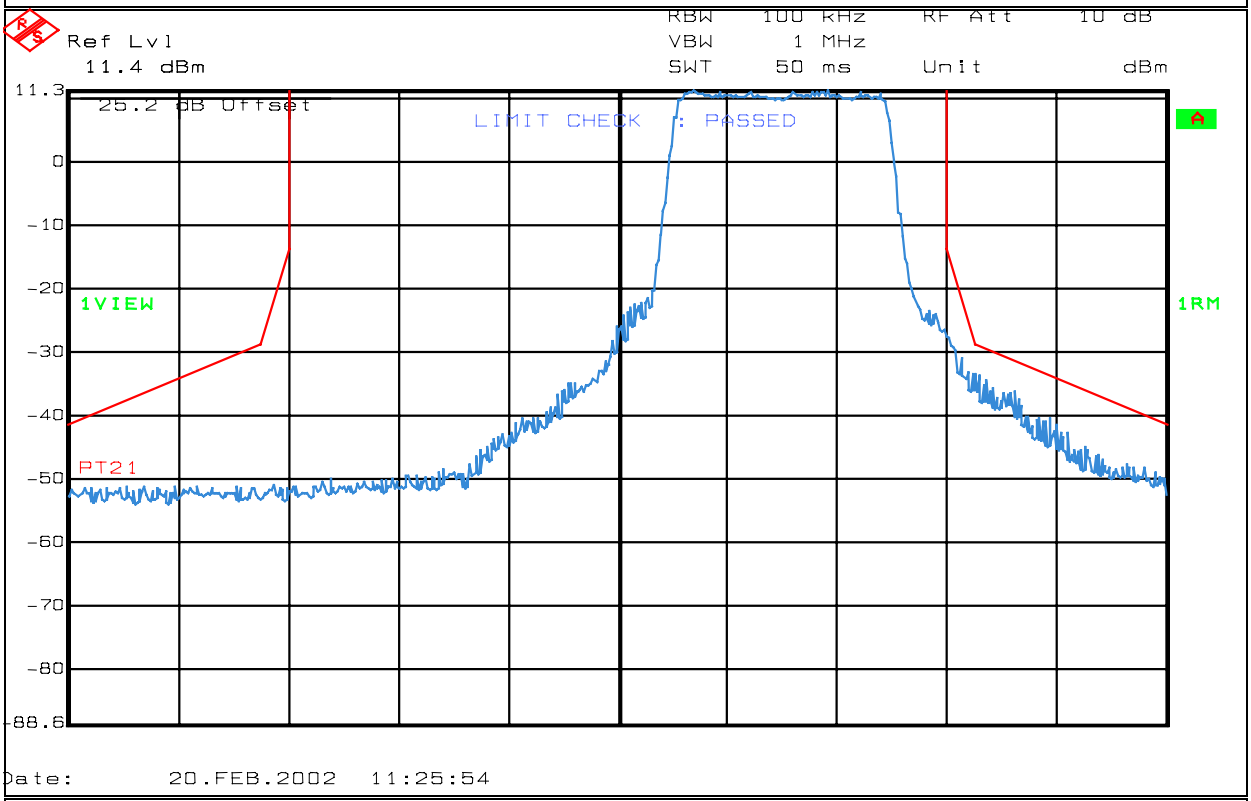
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:	
	UPPER BANDEDGE
	CHANNEL E3
	HIGHEST OPERATING FREQUENCY IN BAND (2624.5 MHz) - BROADBEAM ANTENNA PORT @ 22.5 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Test Plot: **Bandwidth Mask**

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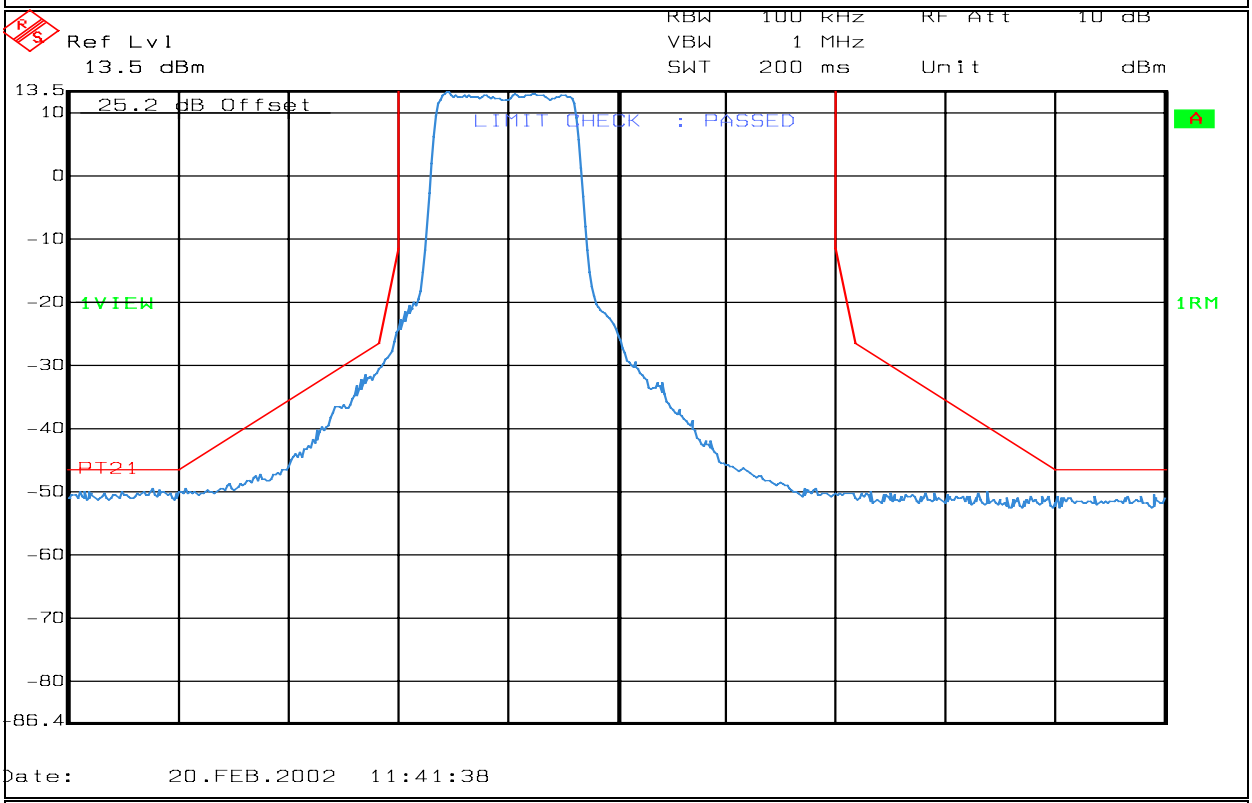
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:	
	LOWER BANDEDGE
	CHANNEL E3
	LOWEST OPERATING FREQUENCY IN BAND (2621.5 MHz) - PATCH ANTENNA PORT @ 24 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Test Plot: **Bandwidth Mask**

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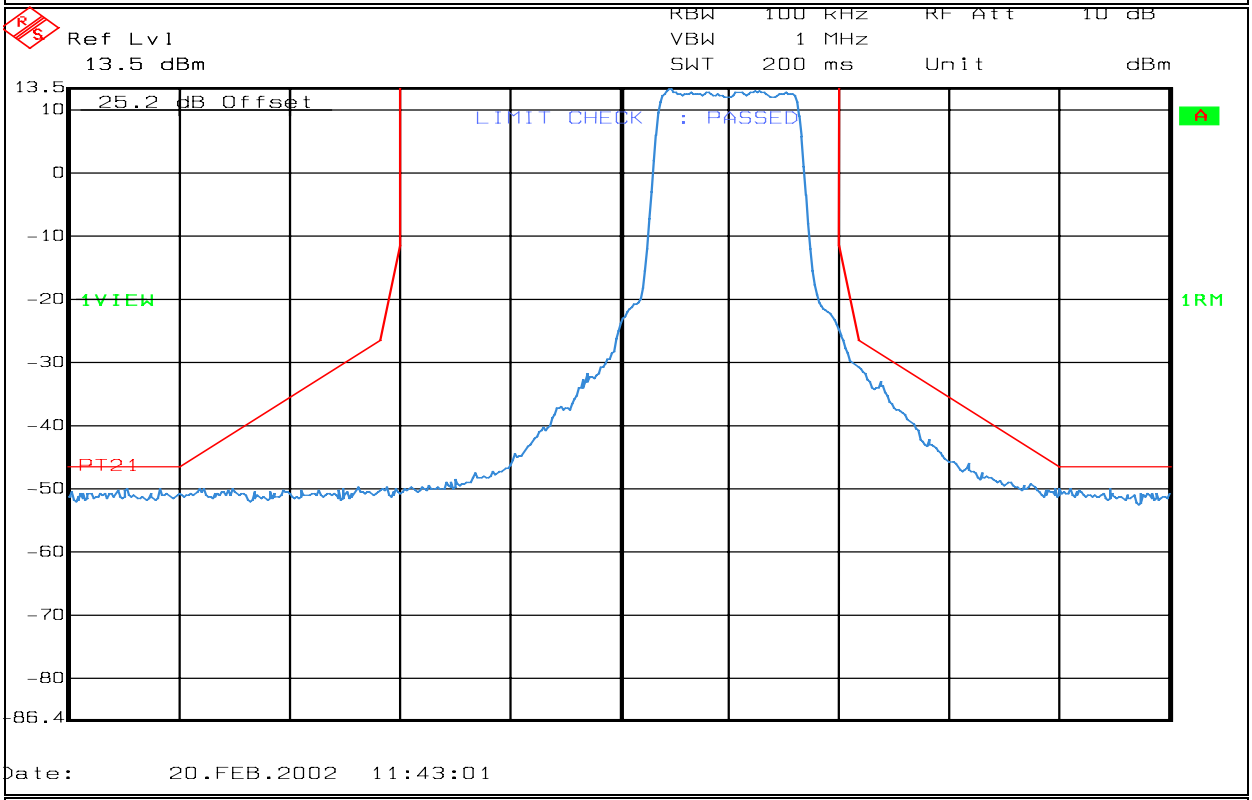
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:	**UPPER BANDEDGE**
	CHANNEL E3
	HIGHEST OPERATING FREQUENCY IN BAND (2624.5 MHz) - PATCH ANTENNA PORT @ 24 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Test Plot: **Bandwidth Mask**

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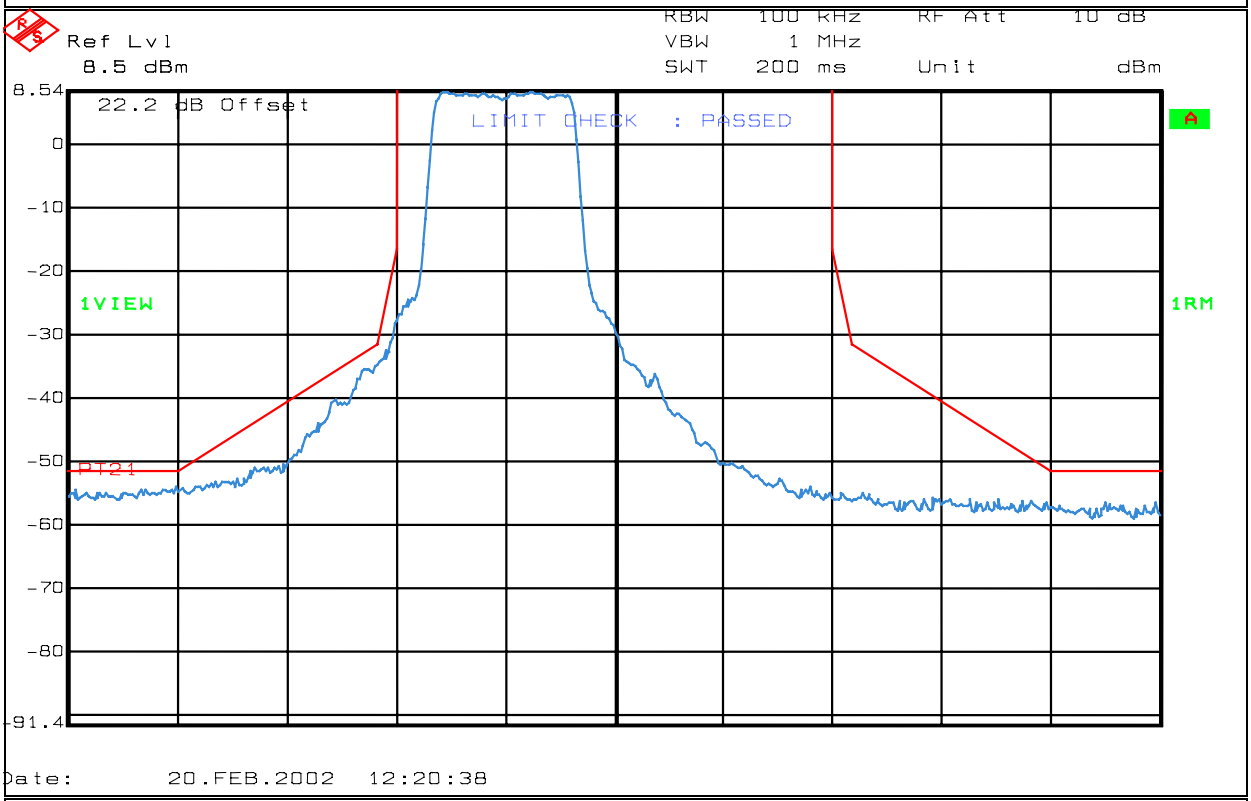
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:	**LOWER BANDEDGE**
	CHANNEL F4
	LOWEST OPERATING FREQUENCY IN BAND (2639.5 MHz) - BROADBEAM ANTENNA PORT @ 22.5 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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Test Plot: **Bandwidth Mask**

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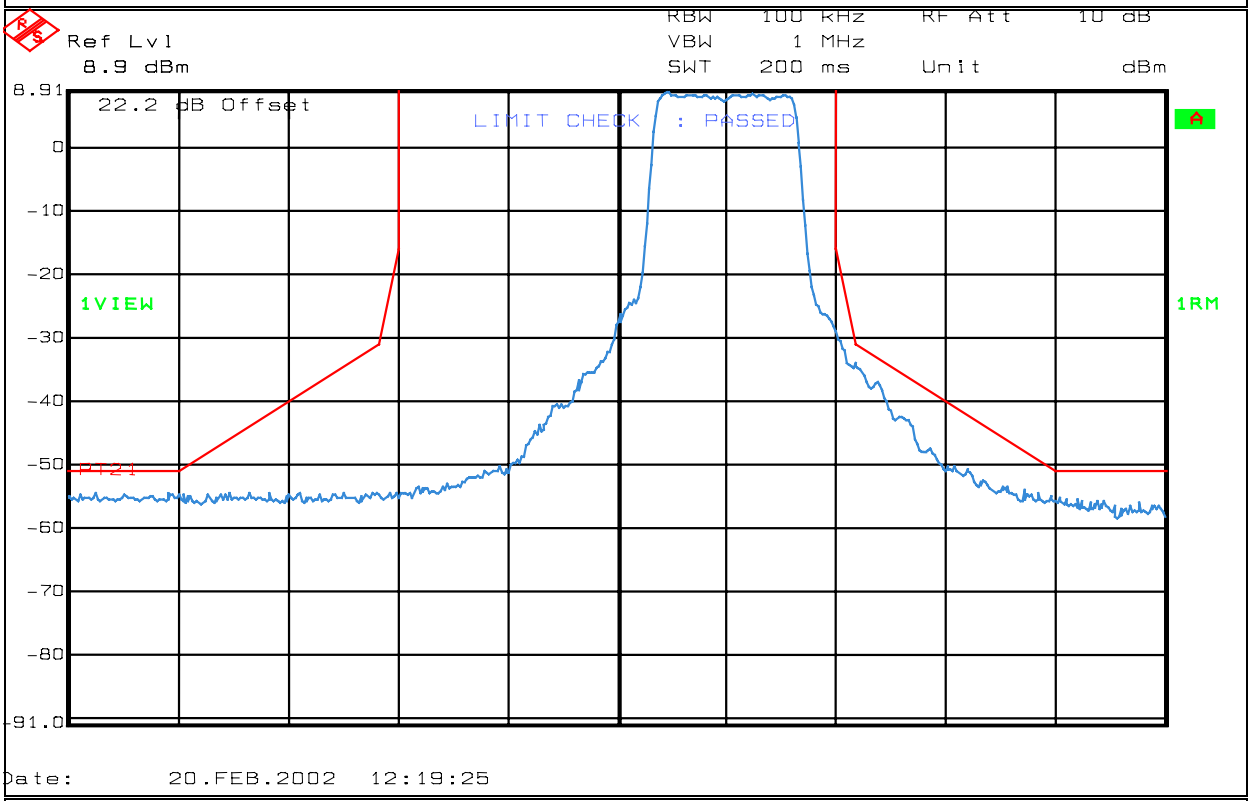
Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:
UPPER BANDEDGE
CHANNEL F4
HIGHEST OPERATING FREQUENCY IN BAND (2642.5 MHz) - BROADBEAM ANTENNA PORT @ 22.5 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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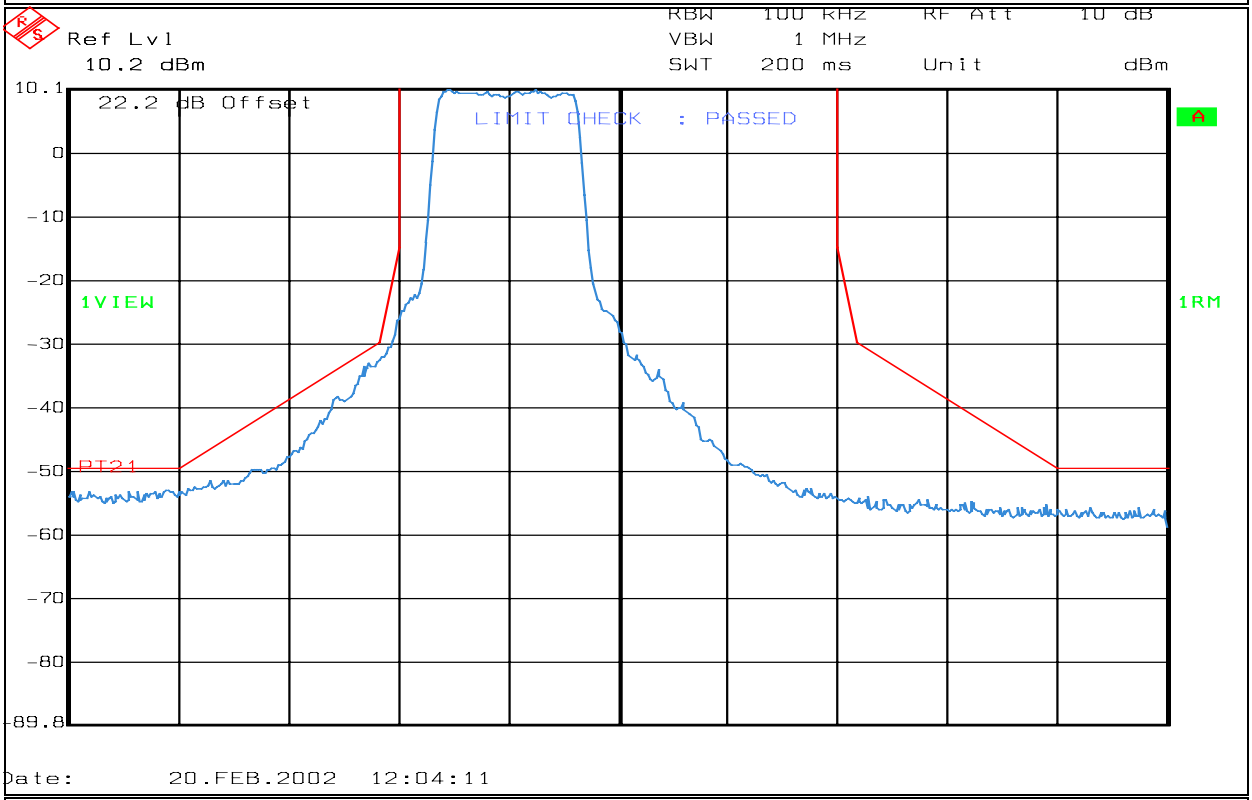
Test Plot: **Bandwidth Mask**

Page 11 of 12

Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:	
	LOWER BANDEDGE
	CHANNEL F4
	LOWEST OPERATING FREQUENCY IN BAND (2639.5 MHz) - PATCH ANTENNA PORT @ 24 dBm OUTPUT

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

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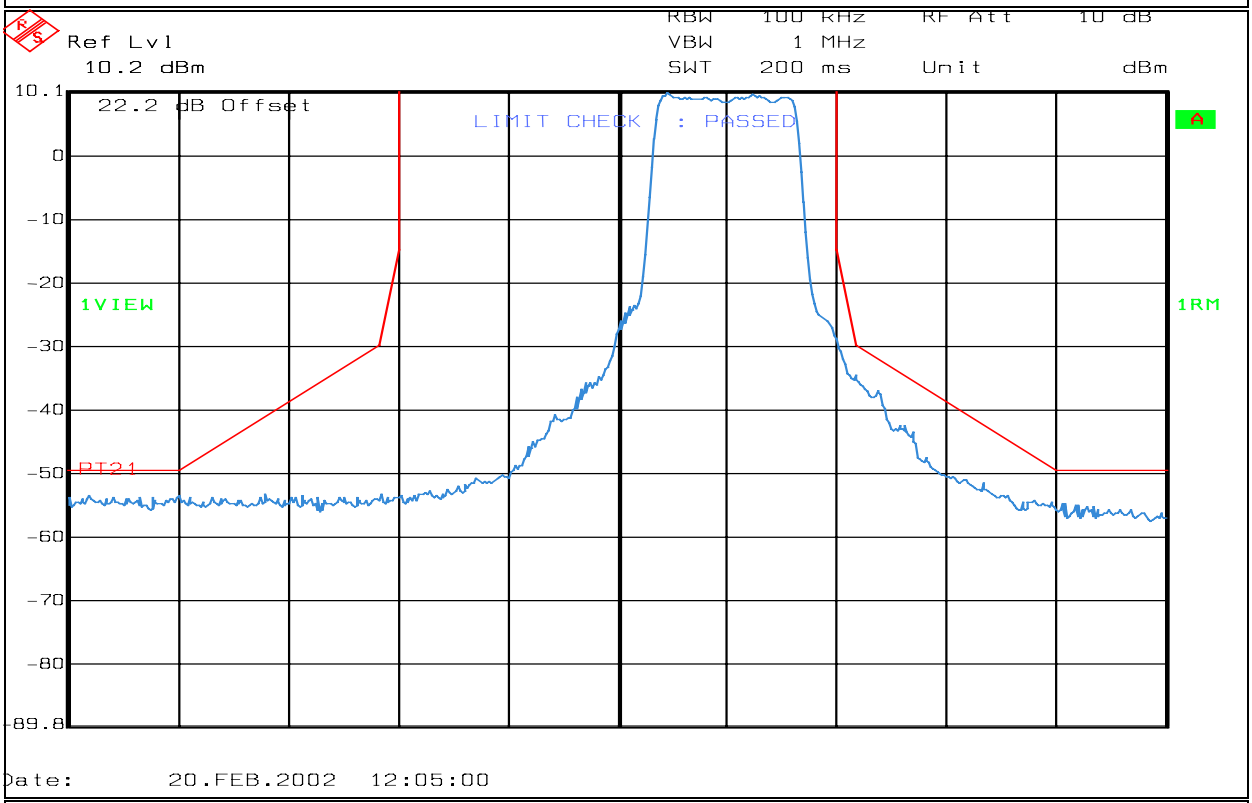
Test Plot: **Bandwidth Mask**

Page 7 of 12

Job No.:	2L0042R	Date:	2/20/2002
Specification:	PART 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA SIGNAL - TEST FIXTURE		



Notes:	**UPPER BANDEDGE**
	CHANNEL F4
	HIGHEST OPERATING FREQUENCY IN BAND (2642.5 MHz) - PATCH ANTENNA PORT @ 24 dBm OUTPUT

Section 4. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 2.991
TESTED BY: David Light	DATE: 2/20/2002

TEST RESULTS: Complies

MEASUREMENT DATA: See attached data sheets.

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

Nemko Dallas, Inc.

Dallas Headquarters:
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Lewisville, TX 75057
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Data Plot — **Spurious Emmisions at Antenna Terminals**

Page 1 of 2 — Complete: X — Preliminary:

Job No.:	2L0042R	Date:	2/20/2002
Specification:	PT 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA - TEST FIXTURE		
Sample Number:	1		
Location:	Lab 1	RBW:	1 MHz
Detector Type:	Average	VBW:	10 MHz

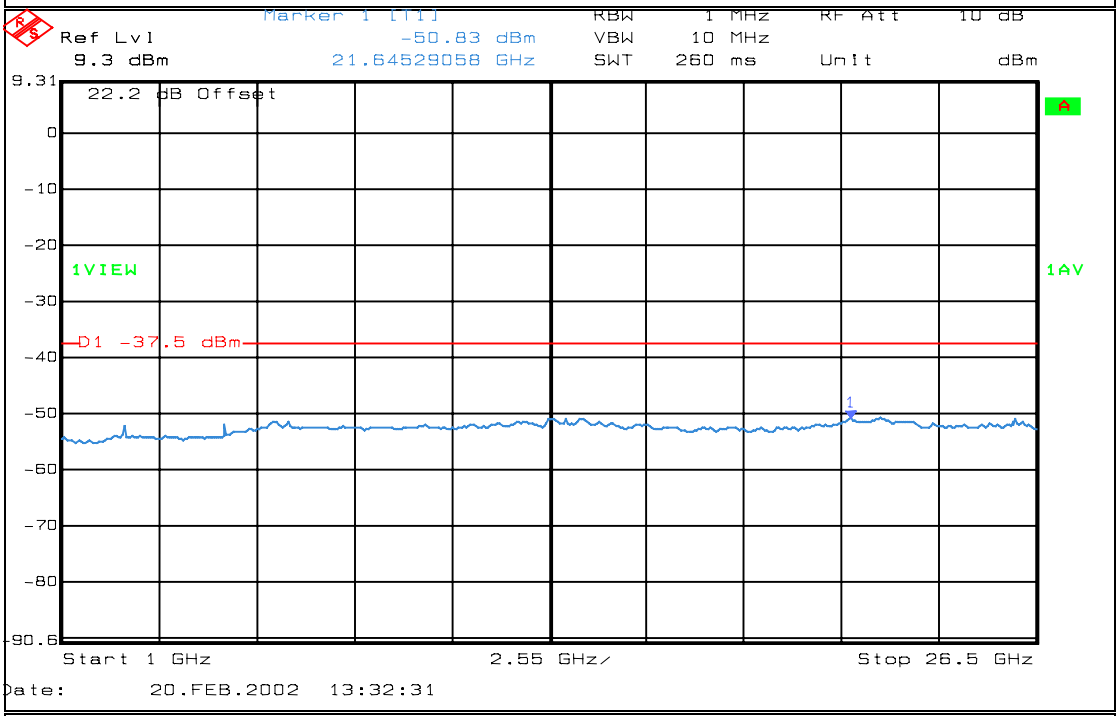
Measurement Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	1056
Pre-Amp:		Cable #1:	1628
Filter:	1482	Cable #2:	1629
Receiver:	1036	Cable #3:	1046
Attenuator #1	1477	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:

Measurement Uncertainty: +/-1.7 dB



Notes: **BROADBEAM PORT - 22.5 dBm OUTPUT**
Carrier Notched

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data

Nemko

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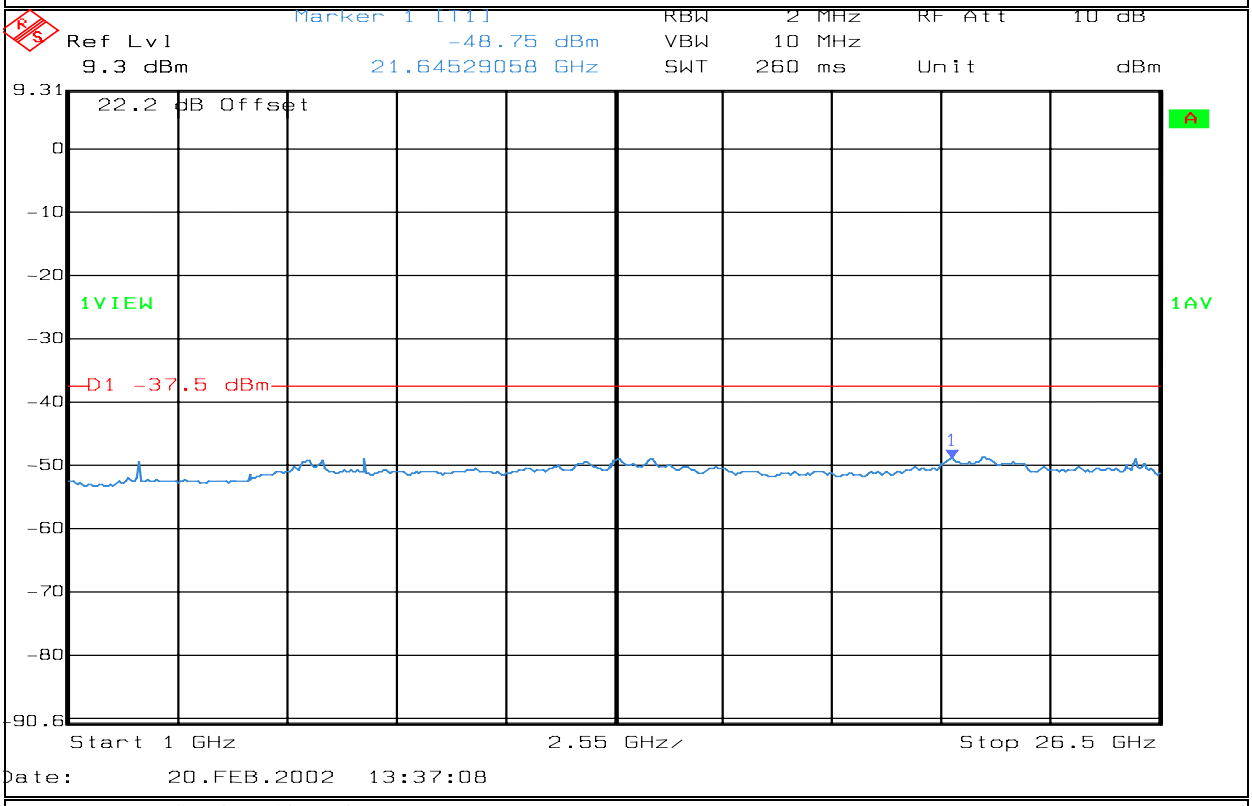
Nemko Dallas, Inc.

Data Plot — **Spurious Emmisions at Antenna Terminals**

Page 2 of 2

Job No.:	2L0042R	Date:	2/20/2002
Specification:	PT 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	2.6 GHz CPE		
Configuration:	TX CDMA - TEST FIXTURE		



Notes: **PATCH PORT - 24 dBm OUTPUT**
Carrier Notched

Test Data

FREQUENCY (GHz)	Level (dBm)	Detector	RBW	VBW	Port	Limit (dBm)	Delta (dB)	
2.616	24	Peak	2 MHz	1 kHz	Patch	N/A		Carrier
5.232	-40.1	Peak	2 MHz	1 kHz	Patch	-36	-4.1	2nd Harmonic
7.848	-39.7	Peak	2 MHz	1 kHz	Patch	-36	-3.7	3rd Harmonic
10.464	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	4th Harmonic
13.08	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	5th Harmonic
15.696	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	6th Harmonic
18.312	-56	Peak	2 MHz	1 kHz	Patch	-36	-20	7th Harmonic
20.928	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	8th Harmonic
23.544	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	9th Harmonic
26.16	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	10th Harmonic
2.626	24	Peak	2 MHz	1 kHz	Patch	N/A		Carrier
5.252	-41.7	Peak	2 MHz	1 kHz	Patch	-36	-5.7	2nd Harmonic
7.878	-37	Peak	2 MHz	1 kHz	Patch	-36	-1	3rd Harmonic
10.504	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	4th Harmonic
13.13	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	5th Harmonic
15.756	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	6th Harmonic
18.382	-56	Peak	2 MHz	1 kHz	Patch	-36	-20	7th Harmonic
21.008	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	8th Harmonic
23.634	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	9th Harmonic
26.26	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	10th Harmonic
2.644	24	Peak	2 MHz	1 kHz	Patch	N/A		Carrier
5.288	-44.4	Peak	2 MHz	1 kHz	Patch	-36	-8.4	2nd Harmonic
7.932	-37	Peak	2 MHz	1 kHz	Patch	-36	-1	3rd Harmonic
10.576	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	4th Harmonic
13.22	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	5th Harmonic
15.864	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	6th Harmonic
18.508	-56	Peak	2 MHz	1 kHz	Patch	-36	-20	7th Harmonic
21.152	-54	Peak	2 MHz	1 kHz	Patch	-36	-18	8th Harmonic
23.796	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	9th Harmonic
26.44	-55	Peak	2 MHz	1 kHz	Patch	-36	-19	10th Harmonic

Test Data

FREQUENCY (GHz)	Level (dBm)	Detector	RBW	VBW	Port	Limit (dBm)	Delta (dB)	
2.616	22.5	Peak	2 MHz	1 kHz	Broadbeam	N/A		Carrier
5.232	-41.2	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-3.7	2nd Harmonic
7.848	-48.2	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-10.7	3rd Harmonic
10.464	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	4th Harmonic
13.08	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	5th Harmonic
15.696	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	6th Harmonic
18.312	-56	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-18.5	7th Harmonic
20.928	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	8th Harmonic
23.544	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	9th Harmonic
26.16	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	10th Harmonic
2.626	22.5	Peak	2 MHz	1 kHz	Broadbeam	N/A		Carrier
5.252	-40.2	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-2.7	2nd Harmonic
7.878	-47.9	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-10.4	3rd Harmonic
10.504	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	4th Harmonic
13.13	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	5th Harmonic
15.756	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	6th Harmonic
18.382	-56	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-18.5	7th Harmonic
21.008	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	8th Harmonic
23.634	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	9th Harmonic
26.26	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	10th Harmonic
2.644	22.5	Peak	2 MHz	1 kHz	Broadbeam	N/A		Carrier
5.288	-39.7	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-2.2	2nd Harmonic
7.932	-46.5	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-9	3rd Harmonic
10.576	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	4th Harmonic
13.22	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	5th Harmonic
15.864	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	6th Harmonic
18.508	-56	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-18.5	7th Harmonic
21.152	-54	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-16.5	8th Harmonic
23.796	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	9th Harmonic
26.44	-55	Peak	2 MHz	1 kHz	Broadbeam	-37.5	-17.5	10th Harmonic

Section 5. Field Strength of Spurious Radiation

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.993
TESTED BY: David Light	DATE: 2/20/2002

TEST RESULTS: Complies

MEASUREMENT DATA: See attached data sheets.

NOTE: This testing was performed using the substitution antenna method as prescribed in EIA/TIA 603-1992, Section 2.2.12. The correction factor on the following tables is the correction factor that results from a calibration of the test site for a given frequency.

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.

Test Data – Field Strength of Spurious Radiation

Nemko Dallas, Inc.

Dallas Headquarters:
802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Field Strength of Spurious Emissions

Page 1 of 1 — Complete X

Job No.: 2L0042R — Date: 2/20/2002 — Preliminary

Specification: PT 21 — Temperature(°C): 20

Tested By: David Light — Relative Humidity(%) 50

E.U.T.: 2.6 GHz CPE

Configuration: TX CDMA - TEST FIXTURE

Sample No: 1

Location: AC 3 — RBW: 1 MHz — Measurement

Detector Type: Average — VBW: 10 kHz — Distance: 3 m

Test Equipment Used

Antenna: 1304 — Directional Coupler:

Pre-Amp: 1016 — Cable #1: 1484

Filter: — Cable #2: 1485

Receiver: 1464 — Cable #3:

Attenuator #1 — Cable #4:

Attenuator #2: — Mixer:

Additional equipment used:

Measurement Uncertainty: +/-3.6 dB

Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	Limit (dBm)	ERP (dBm)	ERP (mW)	Polarity	Comments
										Omni port @ 22.5 dBm
										Output
5240	-75.3	38.3		33.3	8.2	-37.5	-62.1	0.0000	H	-24.6
7860	-70.8	41.5		33.3	9.2	-37.5	-53.5	0.0000	H	-16.0
10480	-74.0	44.5		35.7	10.1	-37.5	-55.2	0.0000	H	-17.7
13100	-75.2	47.8		34.5	9.8	-37.5	-52.1	0.0000	H	-14.6
15720	-75.5	45.5		33.2	12.9	-37.5	-50.3	0.0000	H	-12.8
5240	-75.3	41.3		33.3	8.2	-37.5	-59.1	0.0000	V	-21.6
7860	-74.2	41.8		33.3	9.2	-37.5	-56.5	0.0000	V	-19.0
10480	-74.0	42.0		35.7	10.1	-37.5	-57.7	0.0000	V	-20.2
13100	-75.2	45.8		34.5	9.8	-37.5	-54.1	0.0000	V	-16.6
15720	-75.5	44.3		33.2	12.9	-37.5	-51.5	0.0000	V	-14.0
										Patch port
										@ 24 dBm Output
5240	-74.2	38.3		33.3	8.2	-36.0	-61.0	0.0000	H	-25.0
7860	-74.5	41.5		33.3	9.2	-36.0	-57.2	0.0000	H	-21.2
10480	-74.0	44.5		35.7	10.1	-36.0	-55.2	0.0000	H	-19.2
13100	-75.2	47.8		34.5	9.8	-36.0	-52.1	0.0000	H	-16.1
15720	-75.5	45.5		33.2	12.9	-36.0	-50.3	0.0000	H	-14.3
5240	-73.8	41.3		33.3	8.2	-36.0	-57.6	0.0000	V	-21.6
7860	-75.0	41.8		33.3	9.2	-36.0	-57.3	0.0000	V	-21.3
10480	-74.0	42.0		35.7	10.1	-36.0	-57.7	0.0000	V	-21.7
13100	-75.2	45.8		34.5	9.8	-36.0	-54.1	0.0000	V	-18.1
15720	-75.5	44.3		33.2	12.9	-36.0	-51.5	0.0000	V	-15.5

Notes:

Section 6. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.995
TESTED BY: David Light	DATE:

TEST RESULTS: Complies.

MEASUREMENT DATA: See attached data sheets..

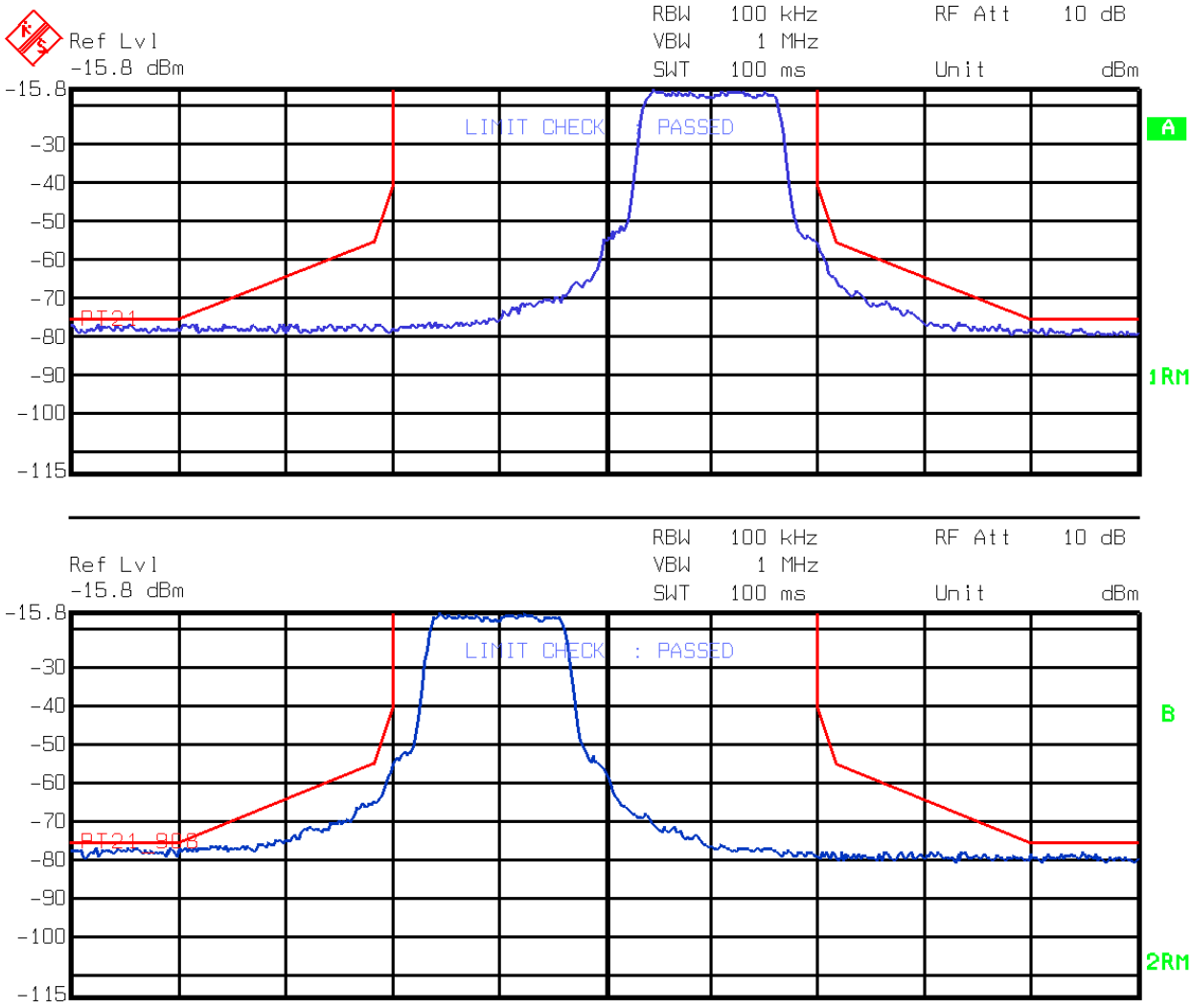
Test equipment used:	1036-1629-1477-278

NOTE: The EUT is an MDS Response Station and is subject to 21.101(a), note 2 below.

Note 2: Beginning January 21, 2000, the equipment authorized to be used at all MDS main stations, and at all MDS booster stations authorized pursuant to §21.913(b) of this part, shall maintain a frequency tolerance of 0.001**%. MDS booster stations authorized pursuant to §21.913(e) of this part and MDS response stations authorized pursuant to §21.909 of this part shall employ transmitters with sufficient frequency stability to ensure that the emission is, at all times, within the required emission mask.**

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

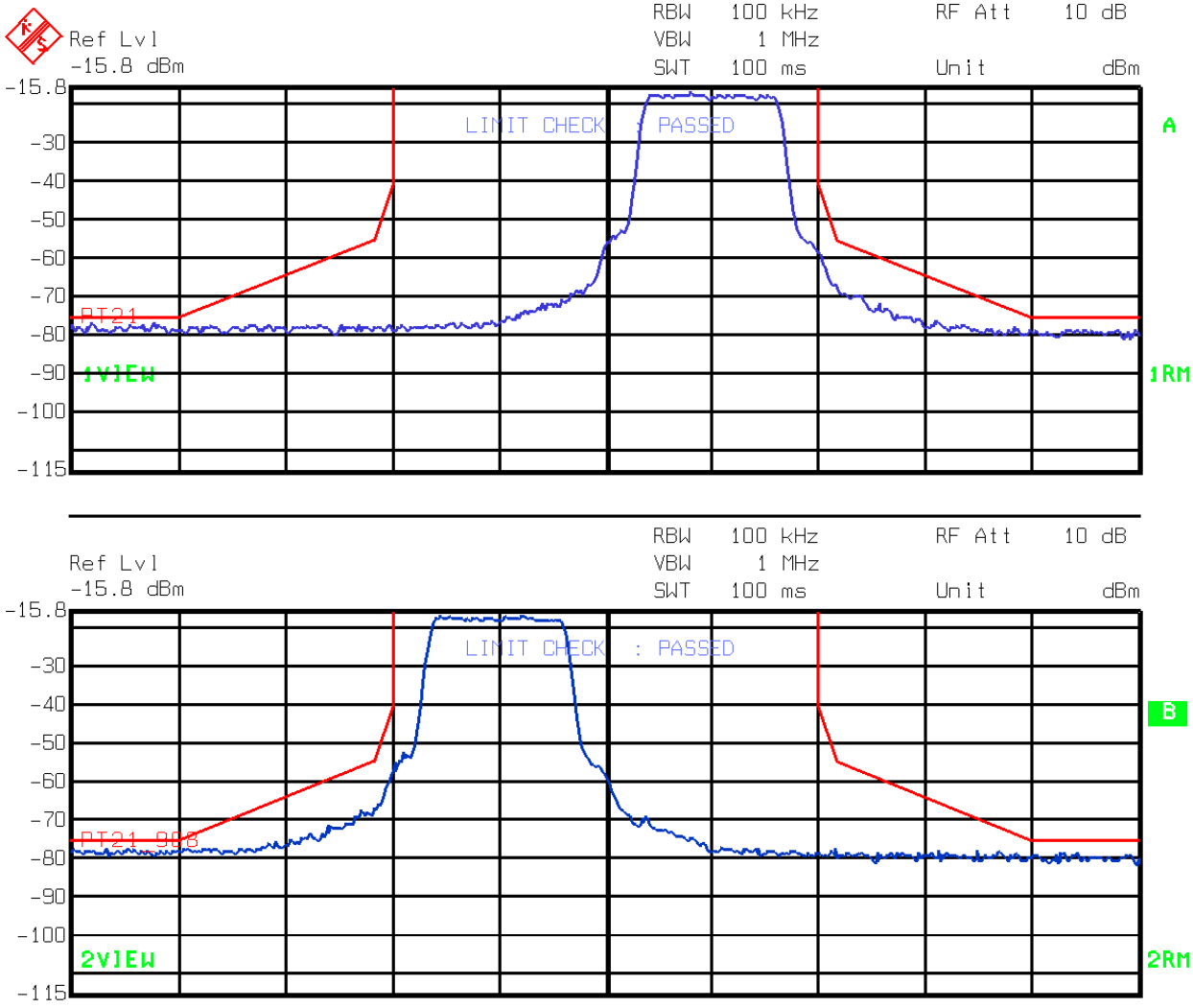
Test Data



Title: FREQ ERROR
Comment A: -30°C
Comment B: -30°C
Date: 22.FEB.2002 13:43:06

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

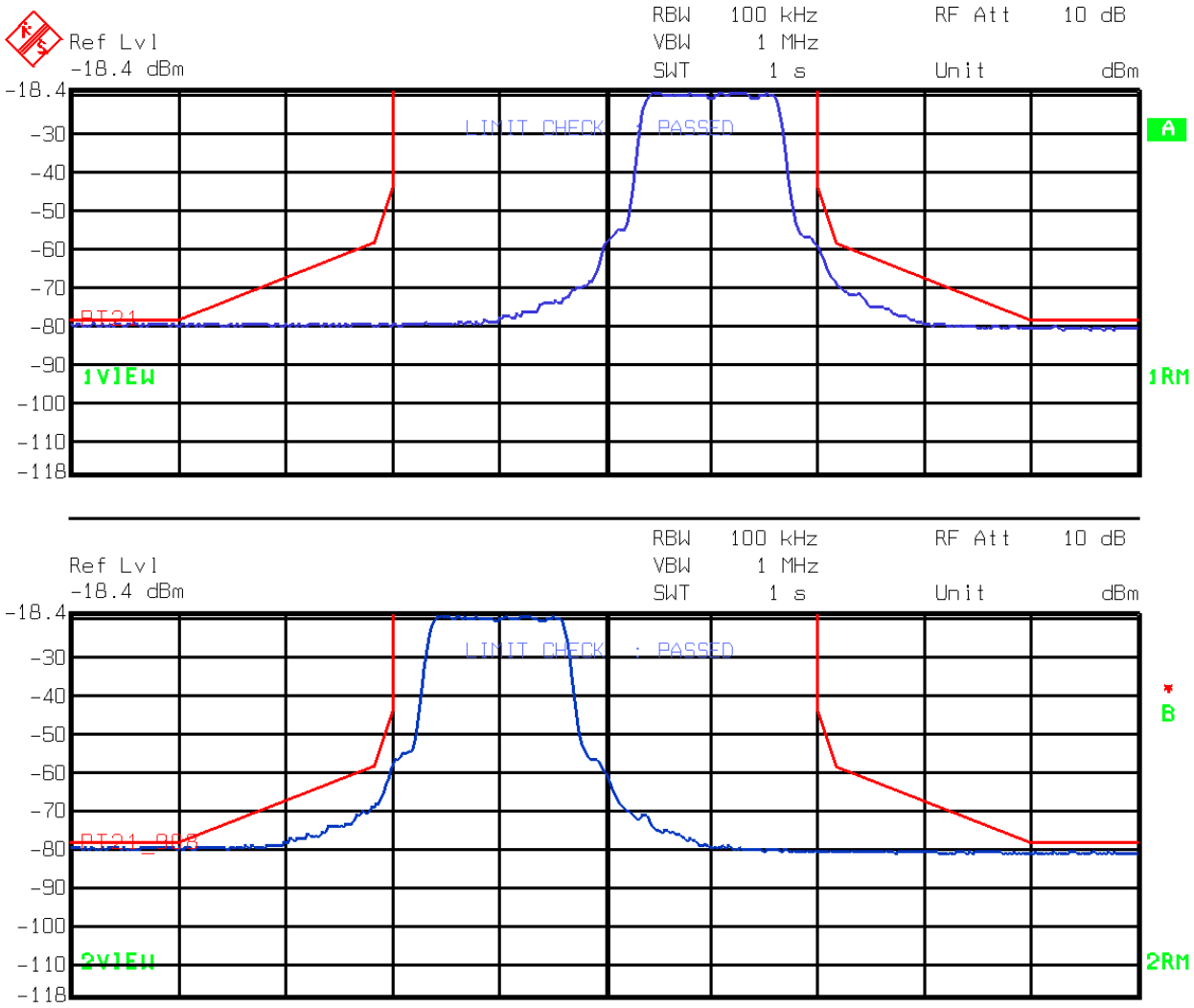
Test Data



Title: FREQ ERROR
Comment A: -20°C
Date: 22.FEB.2002 14:15:46

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

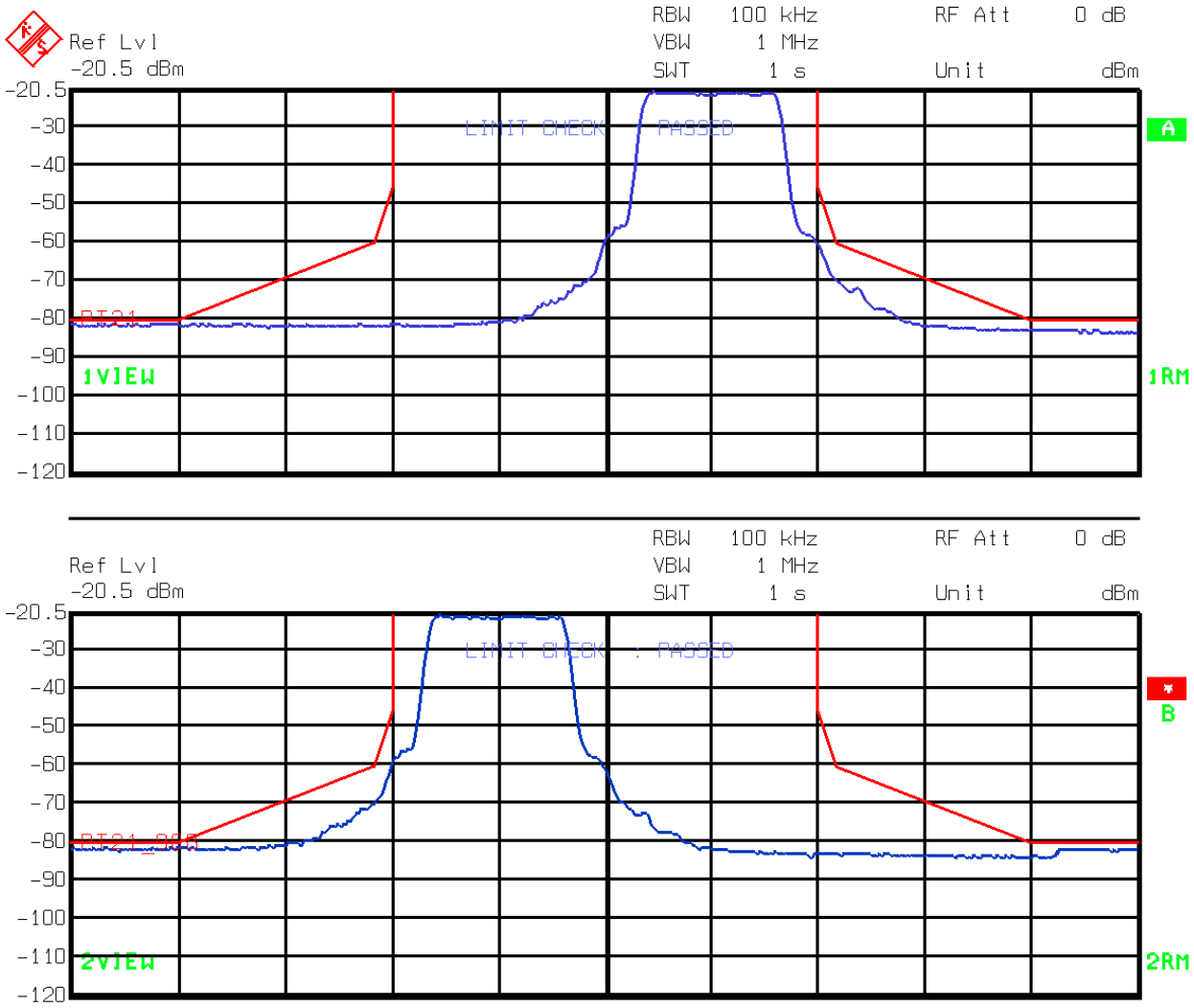
Test Data



Title: FREQ ERROR
Comment A: -10°C
Date: 22.FEB.2002 14:32:01

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

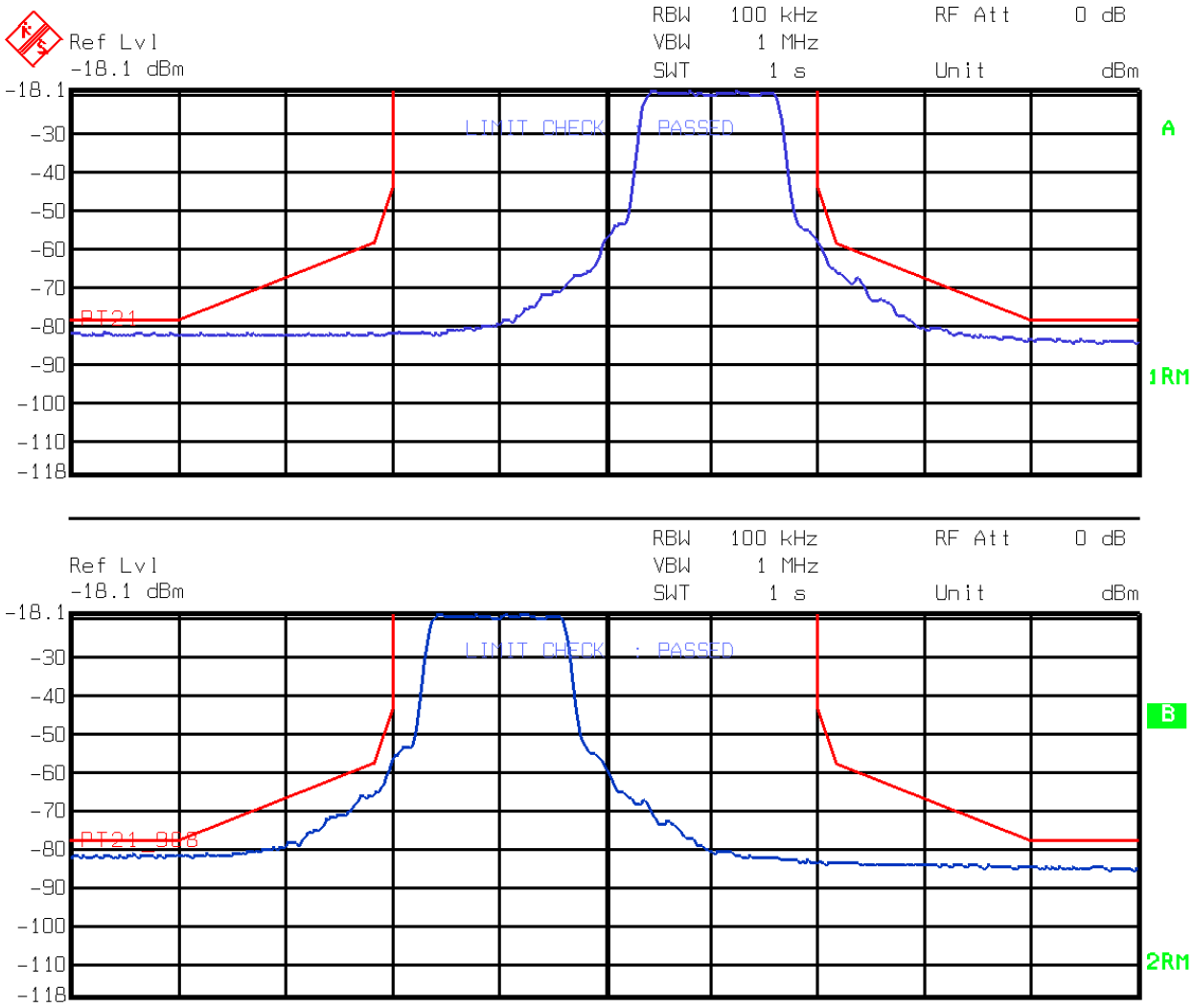
Test Data



Title: FREQ ERROR
Comment A: 0°C
Date: 22.FEB.2002 14:54:28

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

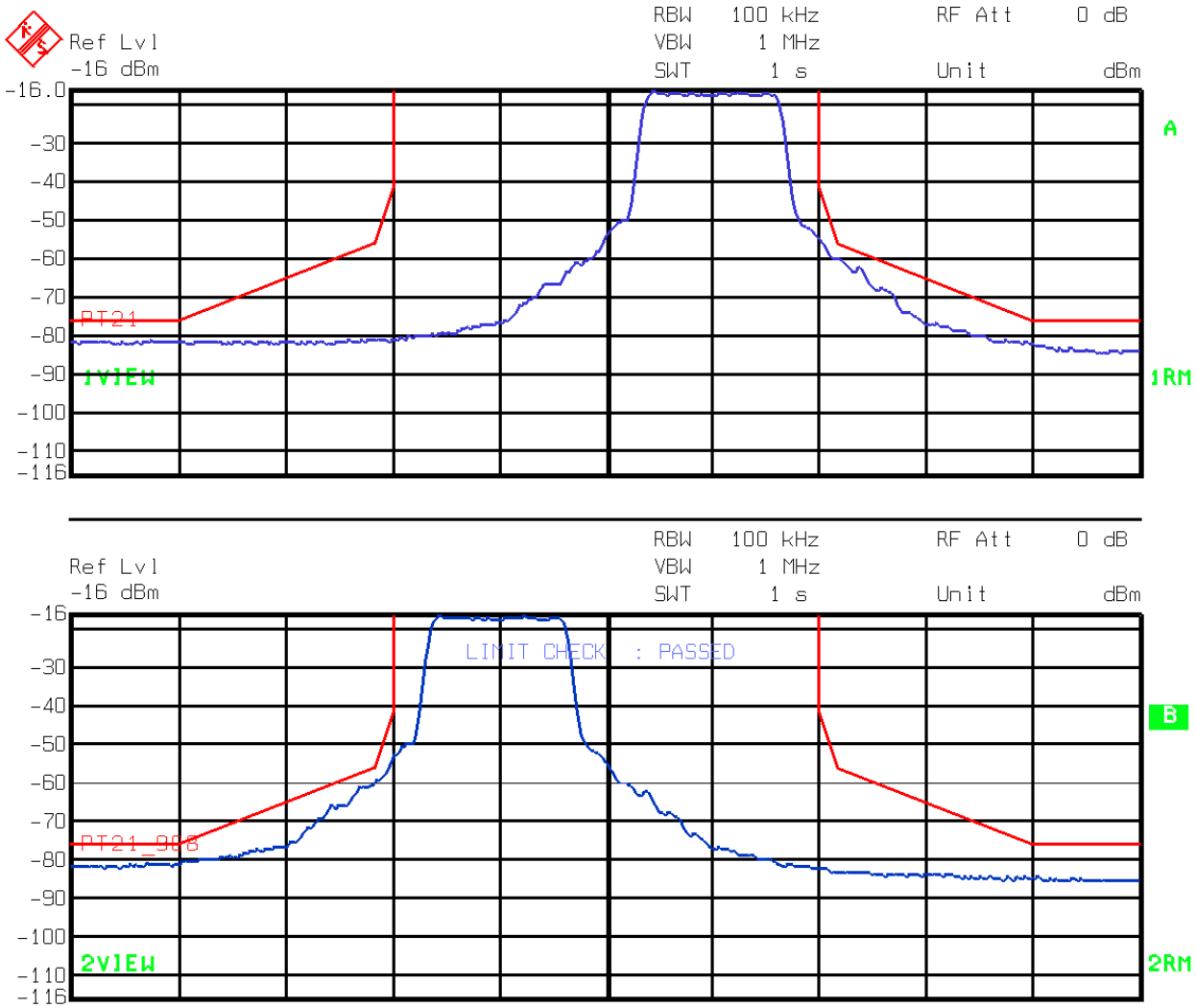
Test Data



Title: FREQ ERROR
Comment A: +10°C
Date: 22.FEB.2002 15:18:47

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

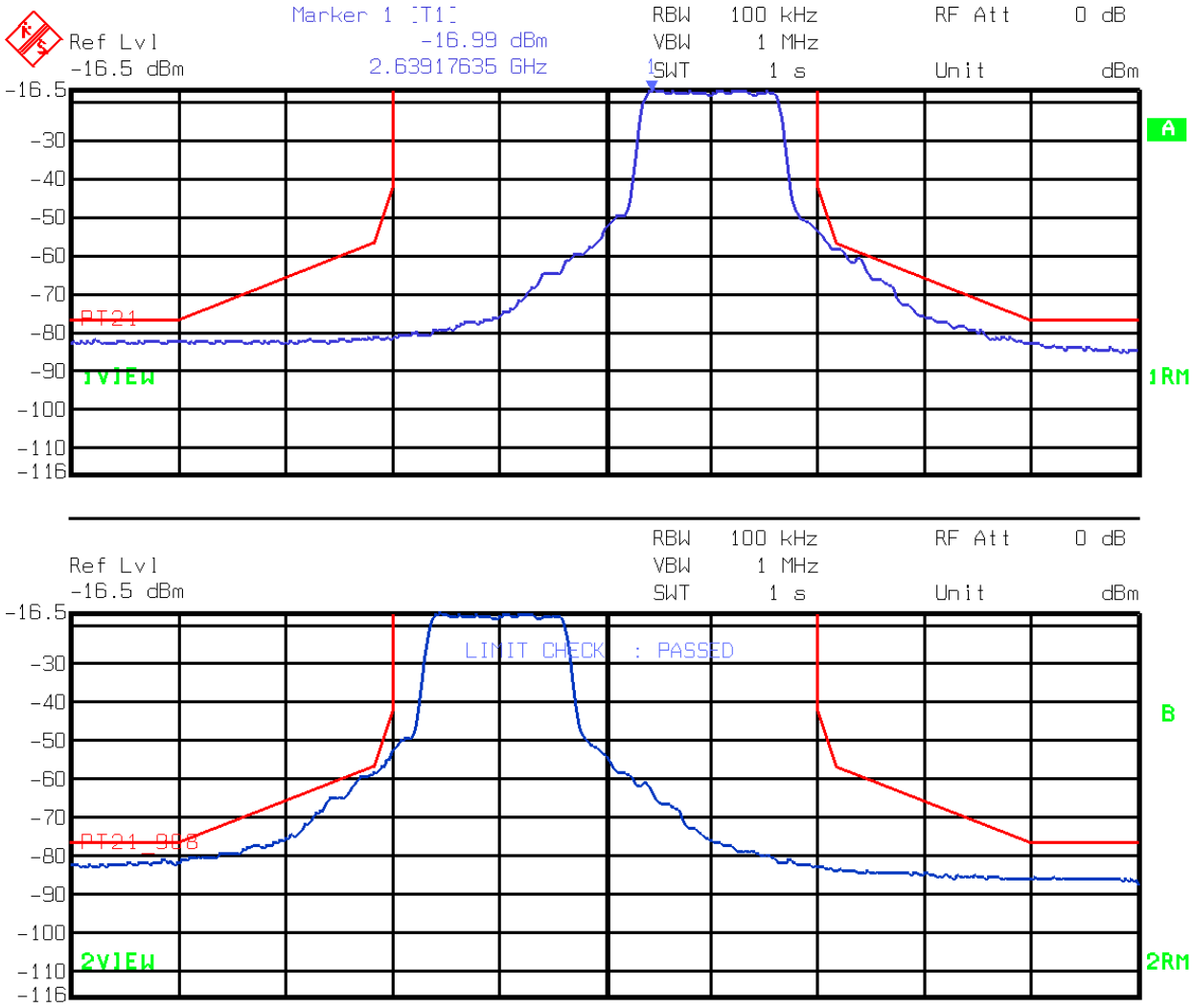
Test Data



Title: FREQ ERROR
Comment A: +20°C
Date: 22.FEB.2002 15:58:39

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

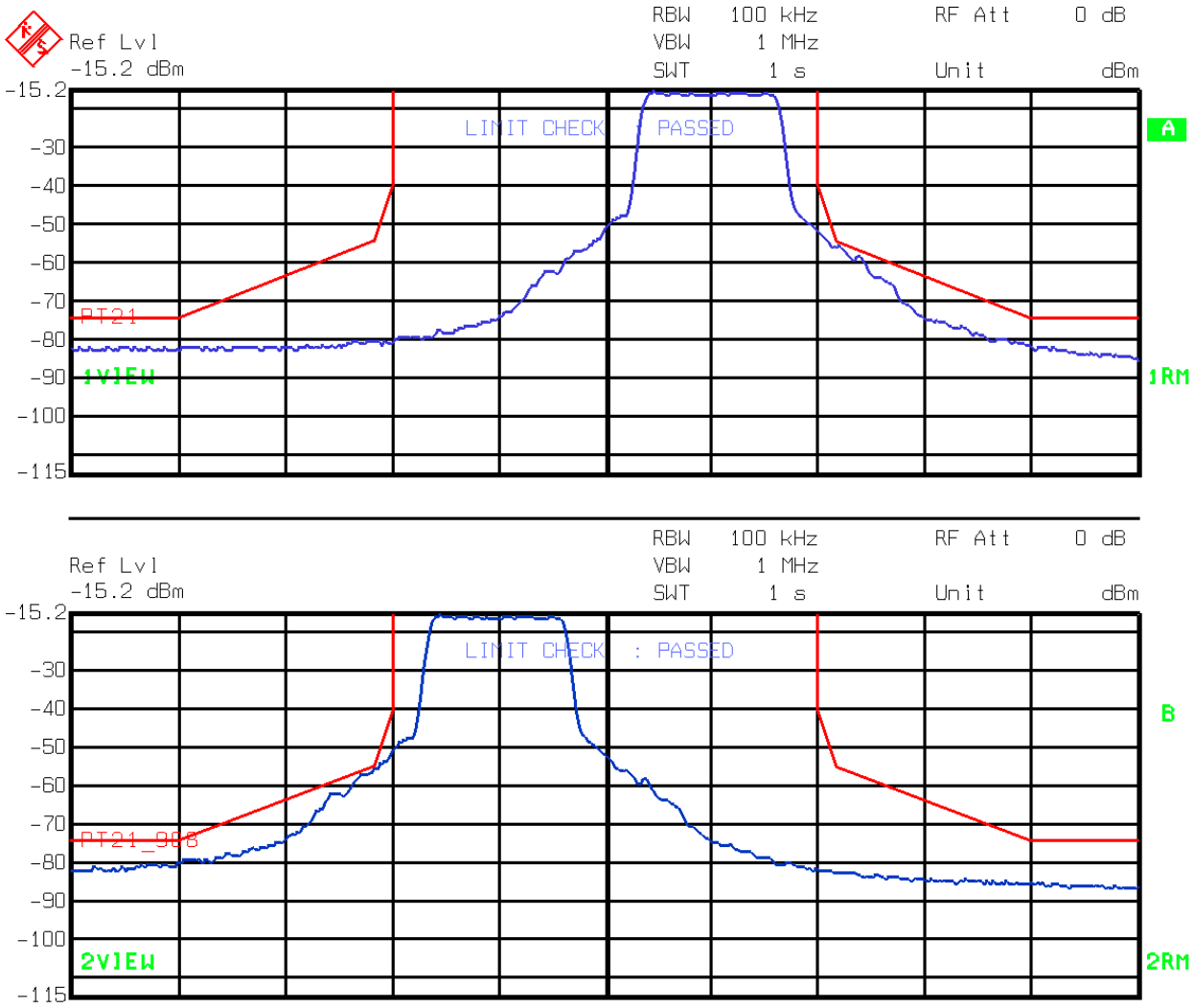
Test Data



Title: FREQ ERROR
Comment A: +30°C
Date: 22.FEB.2002 16:12:26

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

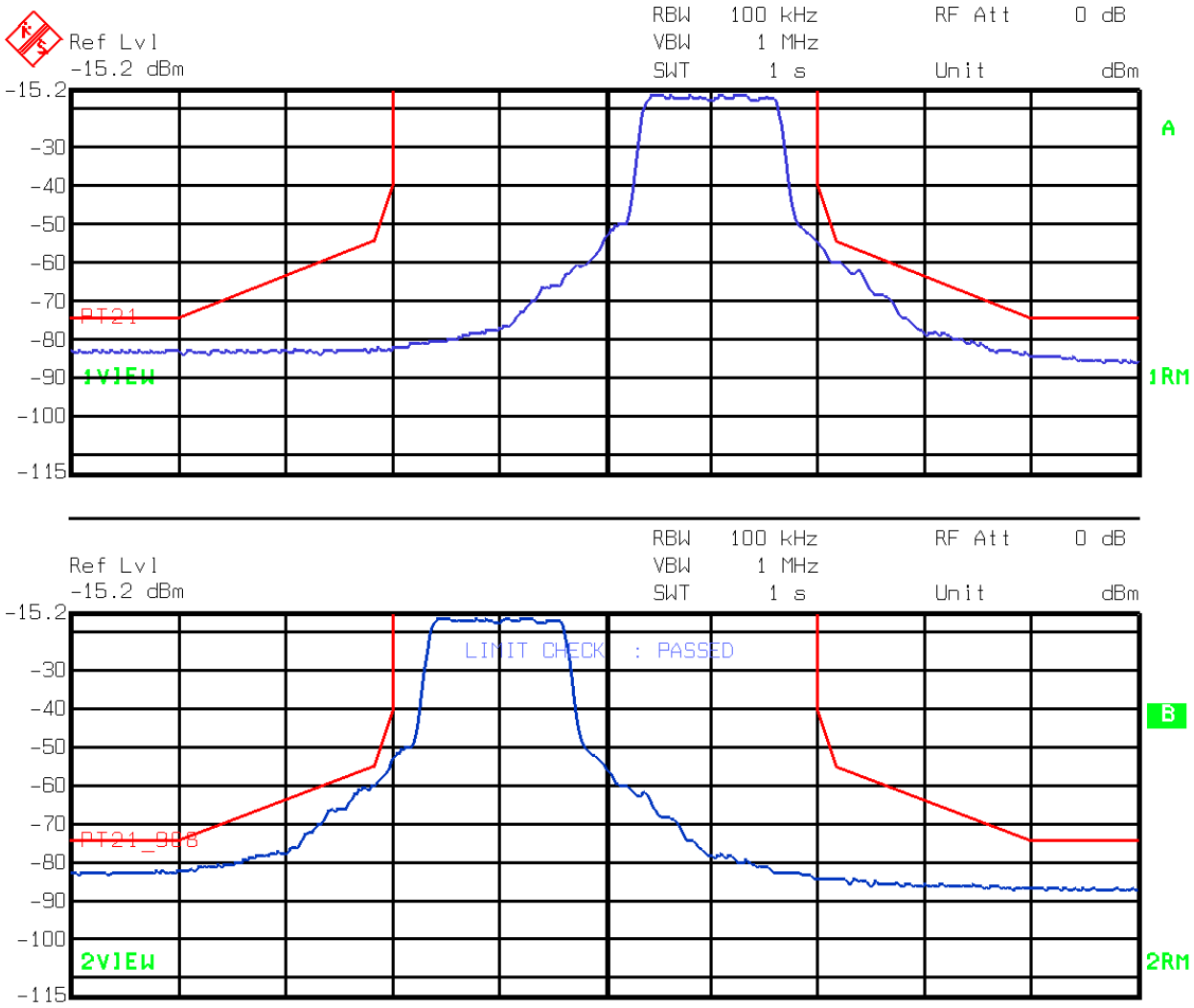
Test Data



Title: FREQ ERROR
Comment A: +40°C
Date: 22.FEB.2002 16:22:21

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

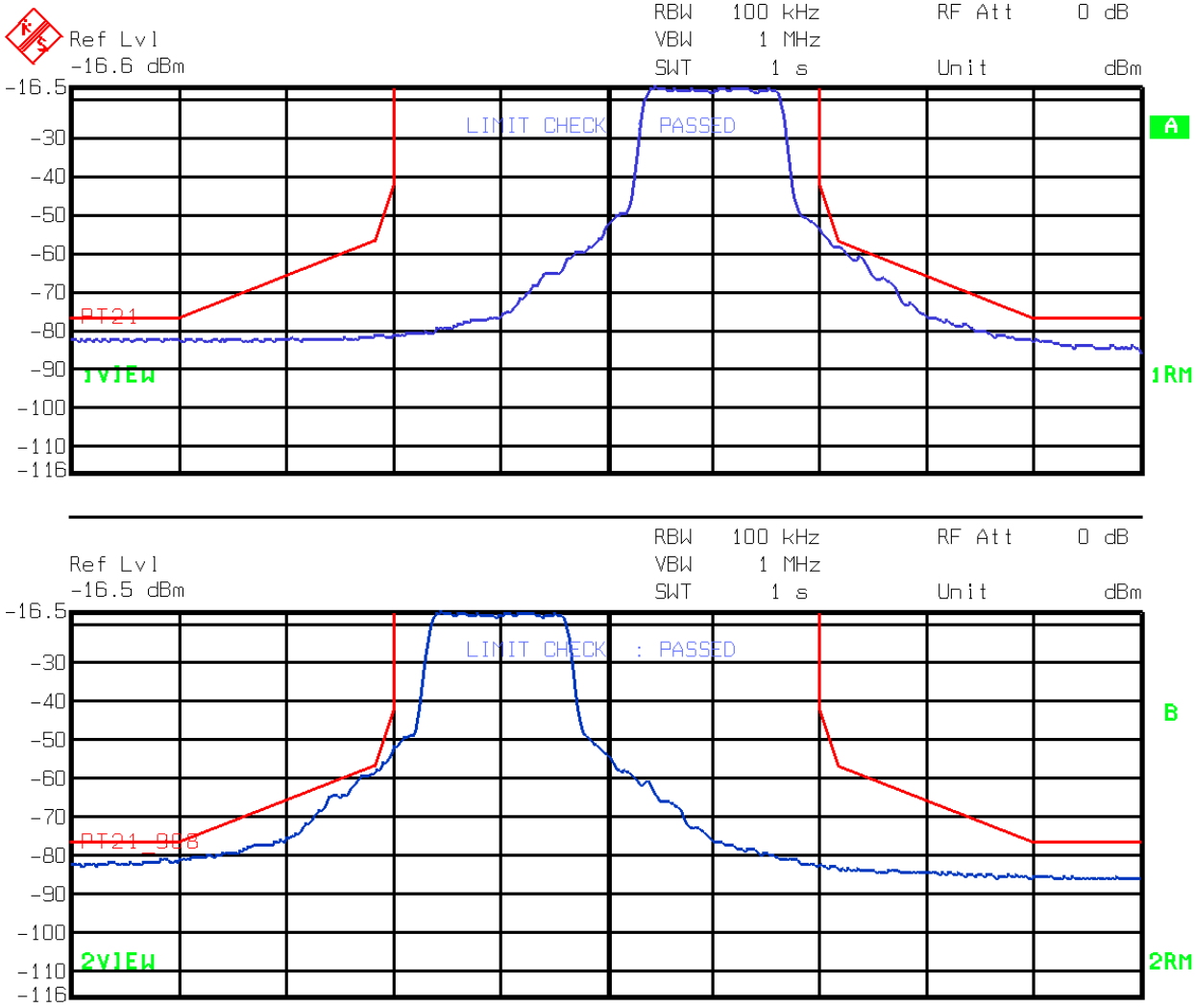
Test Data



Title: FREQ ERROR
Comment A: +50°C
Date: 22.FEB.2002 16:33:16

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

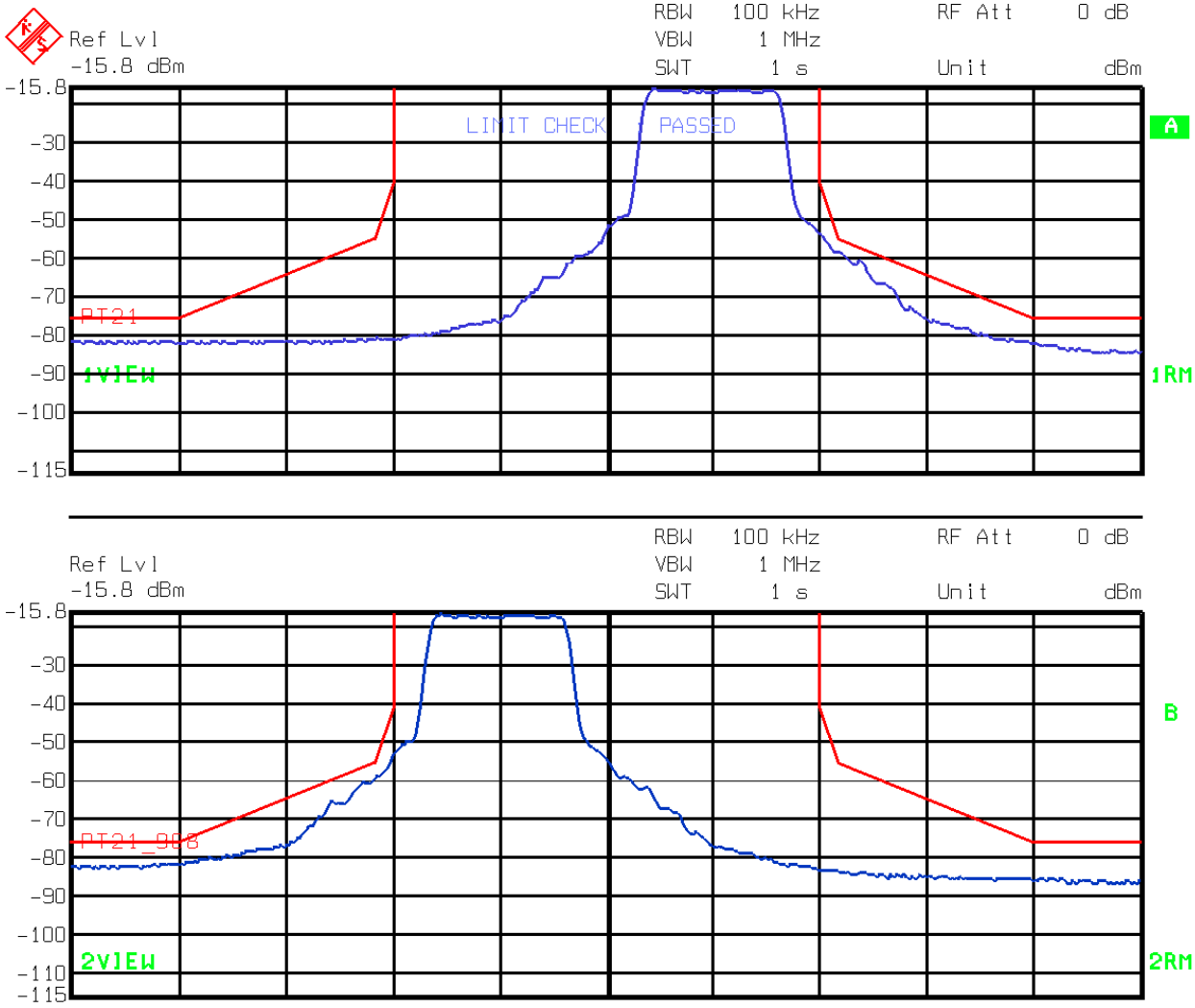
Test Data



Title: FREQ ERROR
Comment A: 132UAC
Date: 22.FEB.2002 16:43:11

EQUIPMENT: 2600E/2600U CPE MDS Response Station Transceiver
FCC ID: PL6-MMDS-CPE-R1

Test Data



Title: FREQ ERROR
Comment A: 98UAC
Date: 22.FEB.2002 16:41:39

Section 7. Test Details

NAME OF TEST:	RF Power Output	PARA. NO.: 2.985

MINIMUM STANDARD:
EIRP limitations.

(a) The maximum EIRP of a main or booster station shall not exceed 33 dBW + 10log(X/6) dBW, where X is the actual bandwidth if other than 6 MHz, except as provided in paragraph (b) of this section.

(b)(i) If a main or booster station sectorizes or otherwise uses one or more transmitting antennas with a non-omnidirectional horizontal plane radiation pattern, the maximum EIRP in a given direction shall be determined by the following formula:

EIRP = 33 dBW + 10 log(X/6) dBW + 10 log(360/beamwidth) dBW, where X is the channel width in MHz and 10 log(360/beamwidth) £ 6 dB.
(ii) Beamwidth is the total horizontal plane beamwidth of the individual transmitting antenna for the station or any sector measured at the half-power points.

(c) An increase in station EIRP, above currently-authorized or previously-proposed values, to the maximum values provided in paragraphs (a) and (b) of this section may be authorized, if the requested increase would not cause harmful interference to any authorized or previously-proposed, cochannel or adjacent channel station entitled to interference protection under the Commission's rules, or if an applicant demonstrates that:

(1) A station that must be protected from interference could compensate for interference by increasing its EIRP; and

(2) The interfered-with station may increase its own EIRP consistent with the rules and without causing harmful interference to any cochannel or adjacent channel main or booster station protected service area, response station hub or BTA/PSA, for which consent for the increased interference has not been obtained; and

(3) The applicant requesting authorization of an EIRP increase agrees to pay all expenses associated with the increase in EIRP by the interfered-with station.

(d) For television transmission if the authorized bandwidth is 4.0 MHz or more for the visual and accompanying aural signal, the peak power of the accompanying aural signal must not exceed 10 percent of the peak visual power of the transmitter. The Commission may order a reduction in aural signal power to diminish the potential for harmful interference.

(e) For main, booster and response stations utilizing digital emissions with non-uniform power spectral density (e.g. unfiltered QPSK), the power measured within any 100 kHz resolution bandwidth within the 6 MHz channel occupied by the non-uniform emission cannot exceed the power permitted within any 100 kHz resolution bandwidth within the 6 MHz channel if it were occupied by an emission with uniform power spectral density, i.e., if the maximum permissible power of a station utilizing a perfectly uniform power spectral density across a 6 MHz channel were 2000 watts EIRP, this would result in a maximum permissible power flux density for the station of 2000/60 = 33.3 watts EIRP per 100 kHz bandwidth. If a non-uniform emission were substituted at the station, station power would still be limited to a maximum of 33.3 watts EIRP within any 100 kHz segment of the 6 MHz channel, irrespective of the fact that this would result in a total 6 MHz channel power of less than 2000 watts EIRP.

NAME OF TEST:	Occupied Bandwidth	PARA. NO.: 2.989

MINIMUM STANDARD:

(a) The maximum out-of-band power of an MDS station transmitter or booster transmitting on a single 6 MHz channel with an EIRP in excess of -9 dBW employing analog modulation shall be attenuated at the channel edges by at least 38 dB relative to the peak visual carrier, then linearly sloping from that level to at least 60 dB of attenuation at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge, and attenuated at least 60 dB at all other frequencies. The maximum out-of-band power of an MDS station transmitter or booster transmitting on a single 6 MHz channel or a portion thereof with an EIRP in excess of -9 dBW (or, when subchannels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths) employing digital modulation shall be attenuated at the 6 MHz channel edges at least 25 dB relative to the licensed average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies. Notwithstanding the foregoing, in situations where an MDS station or booster station transmits, or where adjacent channel licensees jointly transmit, a single signal over more than one contiguous 6 MHz channel utilizing digital modulation with an EIRP in excess of -9 dBW (or, when subchannels or superchannels are used, the appropriately adjusted value based upon the ratio of 6 MHz to the subchannel or superchannel bandwidth), the maximum out-of-band power shall be attenuated at the channel edges of those combined channels at least 25 dB relative to the power level of each channel, then attenuated along a linear slope from that level to at least 40 dB at 250 kHz above or below the channel edges of those combined channels, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower edges of those combined channels, and attenuated at least 60 dB at all other frequencies. However, should harmful interference occur as a result of emissions outside the assigned channel, additional attenuation may be required. A transmitter licensed prior to November 1, 1991, that remains at the station site initially licensed, and does not comply with this paragraph, may continue to be used for its life if it does not cause harmful interference to the operation of any other licensee. Any non-conforming transmitter replaced after November 1, 1991, must be replaced by a transmitter meeting the requirements of this paragraph.

(b) A booster transmitting on multiple contiguous or non-contiguous channels carrying separate signals (a “broadband” booster) with an EIRP in excess of -9 dBW per 6 MHz

channel and employing analog, digital or a combination of these modulations shall have the following characteristics:

(1) For broadband boosters operating in the frequency range of 2.150-2.160/2 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges forming the band edges by at least 25 dB relative to the licensed analog peak visual carrier or digital average power level (or, when subchannels are used, the appropriately adjusted value based on upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the band edges, then linearly sloping from that level to at least 60 dB of attenuation at 3.0 MHz above and below the band edges, and attenuated at least 60 dB at all other frequencies.

(2) For broadband boosters operating in the frequency range of 2.500-2.690 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges forming the band edges by at least 25 dB relative to the licensed analog peak visual carrier or digital average power level (or, when subchannels are used, the appropriately adjusted value based on upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the band edges, then linearly sloping from that level to at least 50 dB of attenuation at 3.0 MHz above and below the band edges, then linearly sloping from that level to at least 60 dB of attenuation at 20 MHz above and below the band edges, and attenuated at least 60 dB at all other frequencies.

(3) Within unoccupied channels in the frequency range of 2.500-2.690 GHz, the maximum out-of-band power shall be attenuated at the upper and lower channel edges of an unoccupied channel by at least 25 dB relative to the licensed analog peak visual carrier power level or digital average power level of the occupied channels (or, when subchannels or 125 kHz channels are used, the appropriately adjusted value based upon the ratio of the channel-to-subchannel bandwidths), then linearly sloping from that level to at least 40 dB of attenuation at 0.25 MHz above and below the occupied channel edges, then linearly sloping from that level to at least 50 dB of attenuation at 3.0 MHz above and below the occupied channel edges, and attenuated at least 50 dB at all other unoccupied frequencies.

(c) Boosters operating with an EIRP less than -9 dBW per 6 MHz channel shall have no particular out-of-band power attenuation requirement, except that if they cause harmful interference, their operation shall be terminated within 2 hours of notification by the Commission until the interference can be cured.

(d) The maximum out-of-band power of an MDS response station using all or part of a 6 MHz channel, employing digital modulation and transmitting with an EIRP greater than -6 dBW per 6 MHz channel shall be attenuated (as measured in accordance with paragraph (e) of this section) at the 6 MHz channel edges at least 25 dB relative to the average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz

beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies. The maximum out-of-band power of an MDS response station using all or part of a 6 MHz channel, employing digital modulation and transmitting with an EIRP no greater than -6 dBW per 6 MHz channel shall be attenuated (as measured in accordance with paragraph (e) of this section) at the channel edges at least 25 dB relative to the average 6 MHz channel transmitter output power level (P), then attenuated along a linear slope to at least 40 dB or 33+10log(P) dB, whichever is the lesser attenuation, at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB or 43+10log(P) dB, whichever is the lesser attenuation, at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB or 43+10log(P) dB, whichever is the lesser attenuation, at all other frequencies. Where MDS response stations with digital modulation utilize all or part of more than one contiguous 6 MHz channel to form a larger channel (e.g., a channel of width 12 MHz), the above-specified attenuations shall be applied only at the upper and lower edges of the overall combined channel. Notwithstanding these provisions, should harmful interference occur as a result of emissions outside the assigned channel(s), additional attenuation may be required by the Commission.

(e) In measuring compliance with the out-of-band emissions limitations, the licensee shall employ one of two methods in each instance: (1) absolute power measurement of the average signal power with one instrument, with measurement of the spectral attenuation on a separate instrument; or (2) relative measurement of both the average power and the spectral attenuation on a single instrument. The formula for absolute power measurements is to be used when the average signal power is found using a separate instrument, such as a power meter; the formula gives the amount by which the measured power value is to be attenuated to find the absolute power value to be used on the spectrum analyzer or equivalent instrument at the spectral point of concern. The formula for relative power measurements is to be used when the average signal power is found using the same instrument as used to measure the attenuation at the specified spectral points, and allows different resolution bandwidths to be applied to the two parts of the measurement; the formula gives the required amplitude separation (in dB) between the flat top of the (digital) signal and the point of concern.

NAME OF TEST:	Spurious Emissions at Antenna Terminals	PARA. NO.: 2.991

MINIMUM STANDARD:

-60 dBc – Refer to previous section “Occupied Bandwidth”

NAME OF TEST:	Field Strength of Spurious Radiation	PARA. NO.: 2.993

MINIMUM STANDARD:

-60 dBc. Refer to previous section "Occupied Bandwidth

TEST METHOD:

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.

NAME OF TEST:	Frequency Stability	PARA. NO.: 2.995

MINIMUM STANDARD: .

§21.101 Frequency tolerance.

(a) The carrier frequency of each transmitter authorized in these services shall be maintained within the following percentage of the reference frequency except as otherwise provided in paragraph (b) of this section or in the applicable subpart of this part (unless otherwise specified in the instrument of station authorization the reference frequency shall be deemed to be the assigned frequency):

Frequency tolerance (percent)

Frequency range (MHz)	Frequency tolerance for fixed stations (percent)
2,150 to 2,162 Note1 Note2	0.001
2,596 to 2,680 Note1	0.005

(b) As an additional requirement in any band where the Commission makes assignments according to a specified channel plan, provisions shall be made to prevent the emission included within the occupied bandwidth from radiating outside the assigned channel at a level greater than that specified in §21.106.

Note 1: Beginning August 9, 1975, this tolerance will govern the marketing of equipment pursuant to §§2.803 and 2.805 of this chapter and the issuance of all authorizations for new radio equipment. Until that date new equipment may be authorized with a frequency tolerance of 0.03 percent in the frequency range 2,200 to 10,500 MHz and equipment so authorized may continue to be used for its life provided that it does not cause interference to the operation of any other licensee. Equipment authorized in the frequency range 2,450 to 10,500 MHz prior to June 23, 1969, at a tolerance of 0.05 percent may continue to be used until February 1, 1976 provided it does not cause interference to the operation of any other licensee.

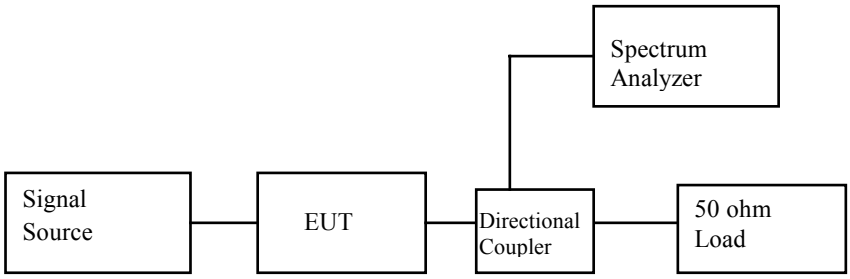
Note 2: Beginning January 21, 2000, the equipment authorized to be used at all MDS main stations, and at all MDS booster stations authorized pursuant to §21.913(b) of this part, shall maintain a frequency tolerance of 0.001**%. MDS booster stations authorized pursuant to §21.913(e) of this part and MDS response stations authorized pursuant to §21.909 of this part shall employ transmitters with sufficient frequency stability to ensure that the emission is, at all times, within the required emission mask.**

Section 8. Test Equipment

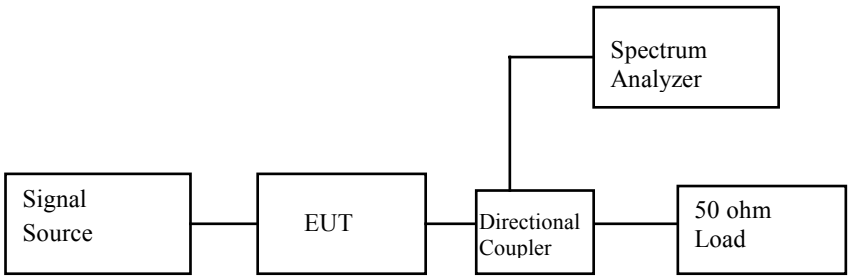
Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01
1304	HORN ANTENNA	ELECTRO METRICS RGA-60	6151	07/30/01
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU
1477	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W5	NONE	CBU
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	06/01/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	06/01/01
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	01/10/02

Section 9. Test Diagrams

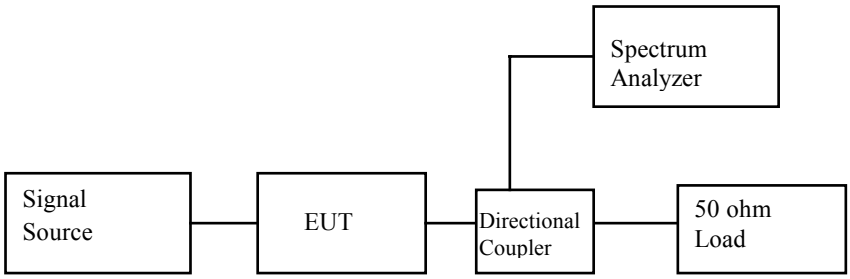
PARA. NO. 2.985 RF POWER OUTPUT



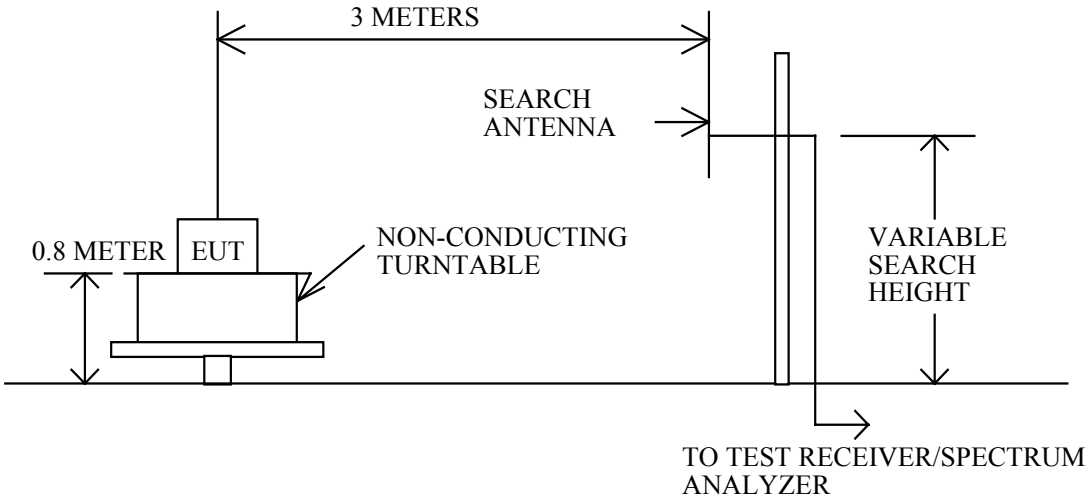
PARA. NO. 2.989 OCCUPIED BANDWIDTH



PARA. NO. 2.991 SPURIOUS EMISSIONS AT ANTENNA TERMINALS



PARA. NO. 2.993 FIELD STRENGTH OF SPURIOUS RADIATION



PARA. NO. 2.995 FREQUENCY STABILITY