

**Nemko Test Report:** 5L0390RUS1


**Applicant:** Navini Networks

**Equipment Under Test:  
(E.U.T.)** 2400 - 2483 LMX E

**In Accordance With:** **FCC Part 15, Subpart C, 15.247**  
Direct Sequence Spread Spectrum Transmitters

**Tested By:** Nemko USA Inc.  
802 N. Kealy  
Lewisville, Texas 75057-3136

**Authorized By:**

  
EMC Engineer

**Date:** 10/4/05

**Total Number of Pages:** 69

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**Section 1. Summary of Test Results**

Manufacturer: Navini Networks

Model No.: 2400 – 2483 LMX E

Serial No.: 01

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 Part 15, Subpart C, and Paragraph 15.247 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

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. NONE

See “ Summary of Test Data”.



**NVLAP LAB CODE: 100426-0**

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**Summary Of Test Data**

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Powerline Conducted Emissions	15.207(a)	0.15-0.5 66 to 56* QP 56 to 46* AVG *Decreases with Log(f) 0.5-5 56 QP 46 Ave  5-30 60 QP 50 Ave	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	>500 kHz	Complies
Maximum Peak Power Output	15.247(b)(1)	<1 Watt	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	-20 dBc/100kHz	Complies
Spurious Emissions (Restricted Bands)	15.247(c)	< 74 dBuV/m Peak < 54 dBuV/m Avg	Complies
Peak Power Spectral Density	15.247(d)	+8 dBm/3kHz	Complies

**Footnotes:**

## Section 2. Equipment Under Test (E.U.T.)

### General Equipment Information

**Frequency Band:**

- 902 – 928 MHz  
 2400 – 2483.5 MHz  
 5725 – 5850 MHz

**Frequency Band of operation:**

2402MHz to 2478MHz  
Center to Center

**User Frequency Adjustment:**

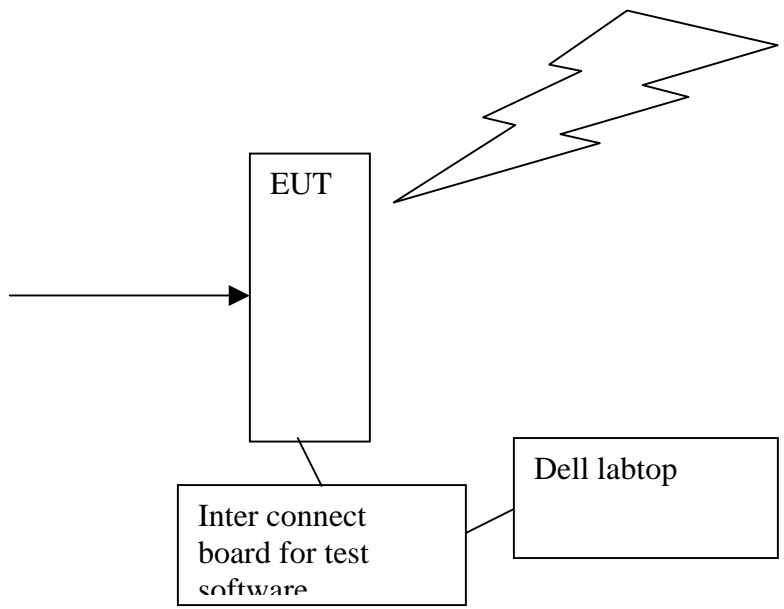
Software controlled

**Description of EUT**

Navini's Wireless Modem is a sleek end-user wireless terminal device used to give the user access to Navini's wireless broadband network

**System Diagram**

AC Pwr  
ACHIME CORP  
MODEL  
AM138B06S18  
S/N 0000014  
PN: 32-21300-00



### Section 3. Powerline Conducted Emissions

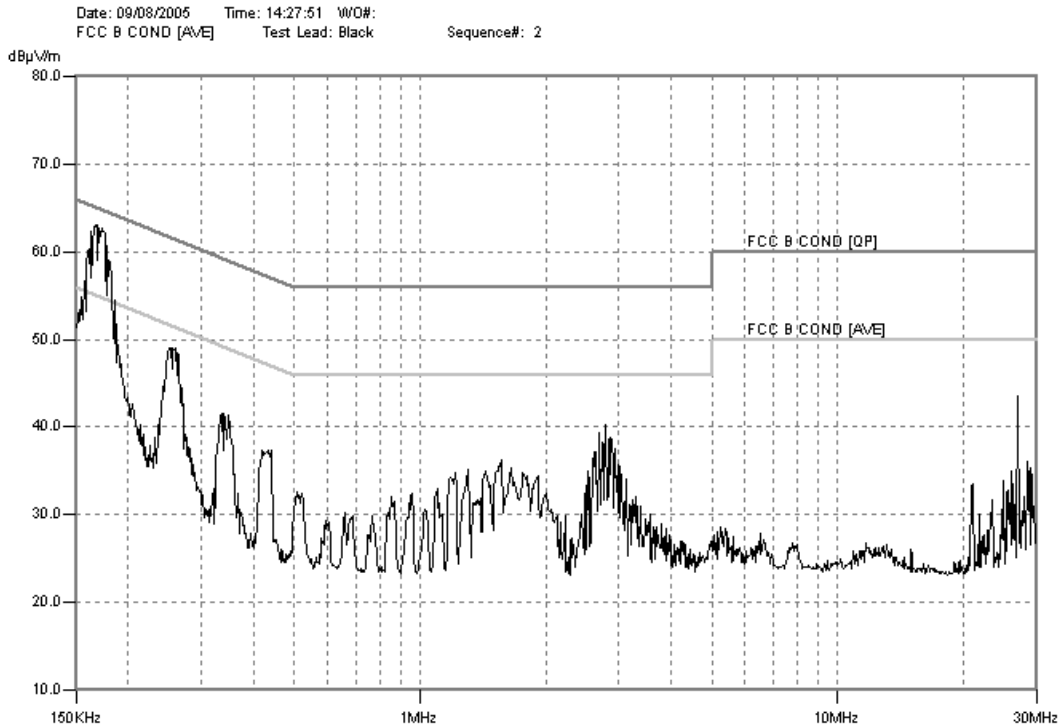
NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Kevin Rose	DATE: September 8, 2005

**Test Results:** Complies

**Measurement Data:** See attached plots.

**Measurement Uncertainty:** +/- 1.7 dB

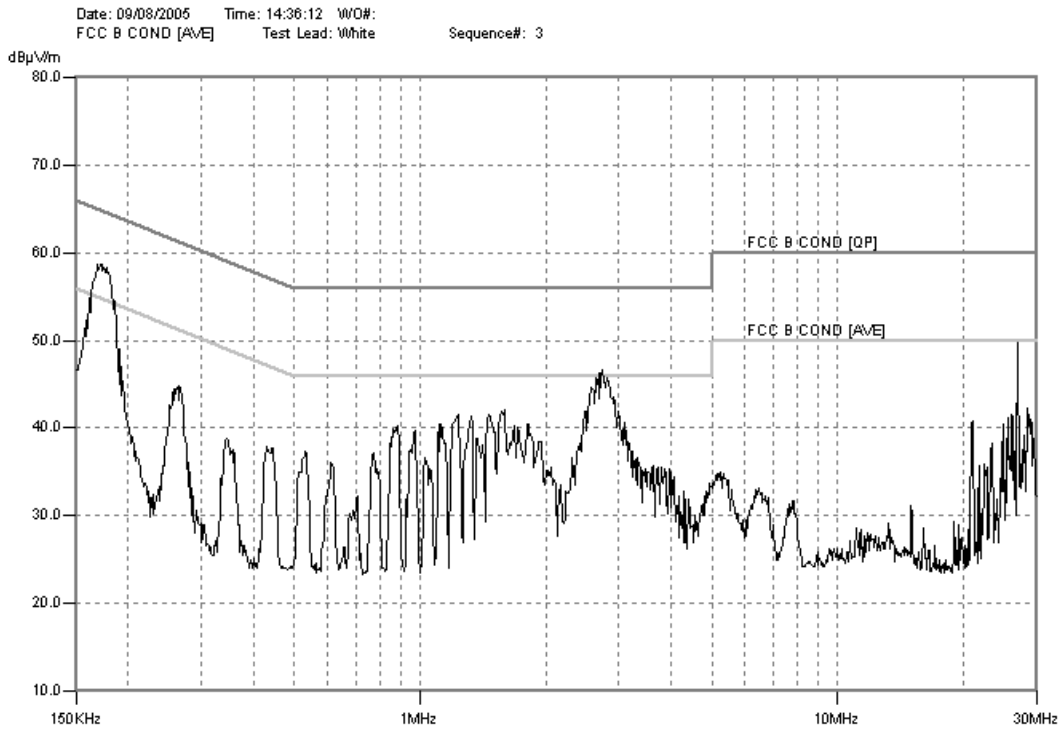
**Test Data – Powerline Conducted Emissions**  
**BLACK LEAD**



Meas. Freq. (MHz)	EUT Test Point	Detector Type (P,QP, A)	Limit Type (QP, A)	Meter Reading (dBuV)	Path Loss (dB)	Transducer Factor (dB)	Corrected Reading (dBuV)	Spec.limit (dBuV)		CR/SL Diff. (dB)	Pass Fail Unc.	Comment
								Q.P.	Avg.			
0.17	N	QP	QP	56	0.3	1.9	58.2	64.96	54.961	-6.8	Pass	
0.17	N	A	A	44	0.3	1.9	46.2	64.96	54.961	-8.8	Pass	



**Test Data – Powerline Conducted Emissions**  
**WHITE LEAD**



Meas. Freq. (MHz)	EUT Test Point	Detector Type (P,QP, A)	Limit Type (QP, A)	Meter Reading (dBuV)	Path Loss (dB)	Transducer Factor (dB)	Corrected Reading (dBuV)	Spec.limit (dBuV)		CR/SL Diff. (dB)	Pass Fail Unc.	Comment
								Q.P.	Avg.			
0.17	H	QP	QP	47.5	0.3	1.9	49.7	64.96	54.961	-15.3	Pass	
0.17	H	A	A	42.5	0.3	1.9	44.7	64.96	54.961	-10.3	Pass	
2.75	H	QP	QP	46.0	0.4	0.9	47.3	56	46	-8.7	Pass	
2.75	H	A	A	28.0	0.4	0.9	29.3	56	46	-16.7	Pass	
29.7	H	QP	QP	35.0	0.8	0.6	36.4	60	50	-23.6	Pass	
29.7	H	A	A	15.0	0.8	0.6	16.4	60	50	-33.6	Pass	

**Photos – Powerline Conducted Emissions**



**Section 4. Minimum 6 dB Bandwidth**

NAME OF TEST: Minimum 6 dB Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Kevin Rose	DATE: 8/25/05

**Test Results:** Complies.

**Measurement Data:** See 6 dB BW plot  
Measured 6 dB bandwidth: 1.93MHz  
Channel Separation:

**Equipment Used:** 1036, 1055, 1472 1562, 1561

**Measurement Uncertainty:** +/- 1.7 dB

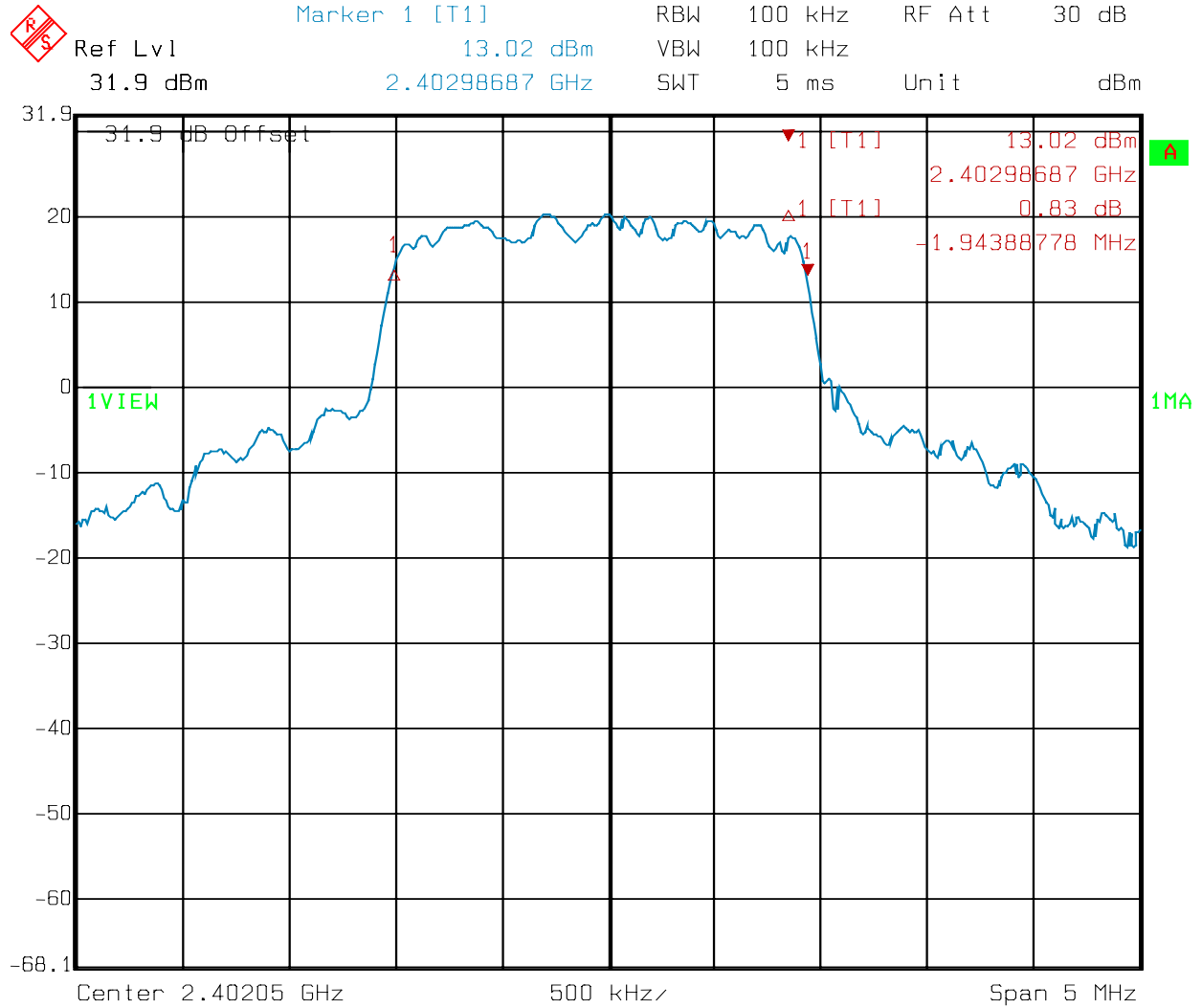
**Temperature:** 21°C

**Relative Humidity:** 40%

EQUIPMENT: 2400 – 2483 LMX E

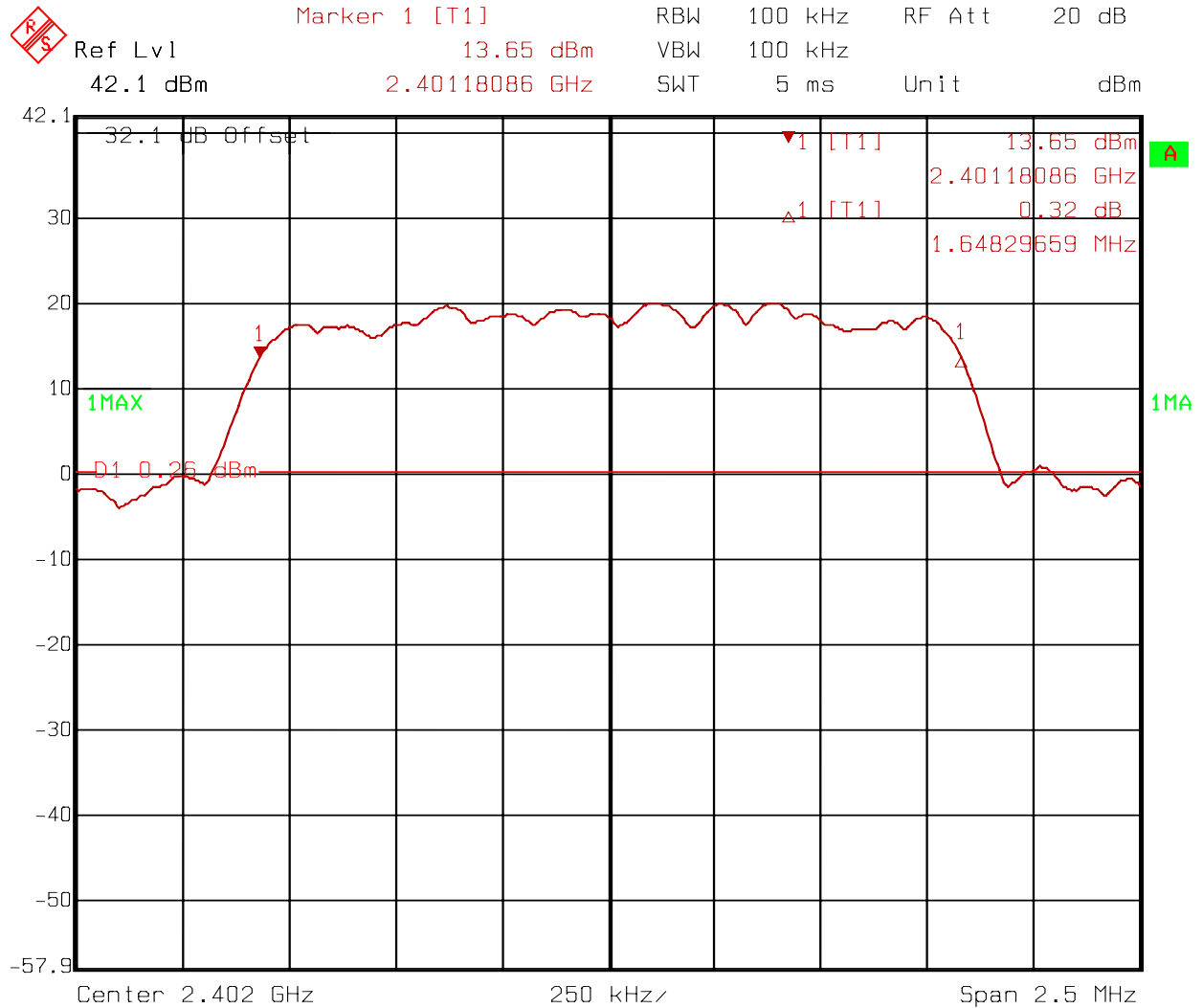
PROJECT NO.: 5L0390RUS1

LOW CHANNEL Navini (SCDMA)



Date: 02.SEP.2005 08:56:54

LOW CHANNEL Navini (802.16e)



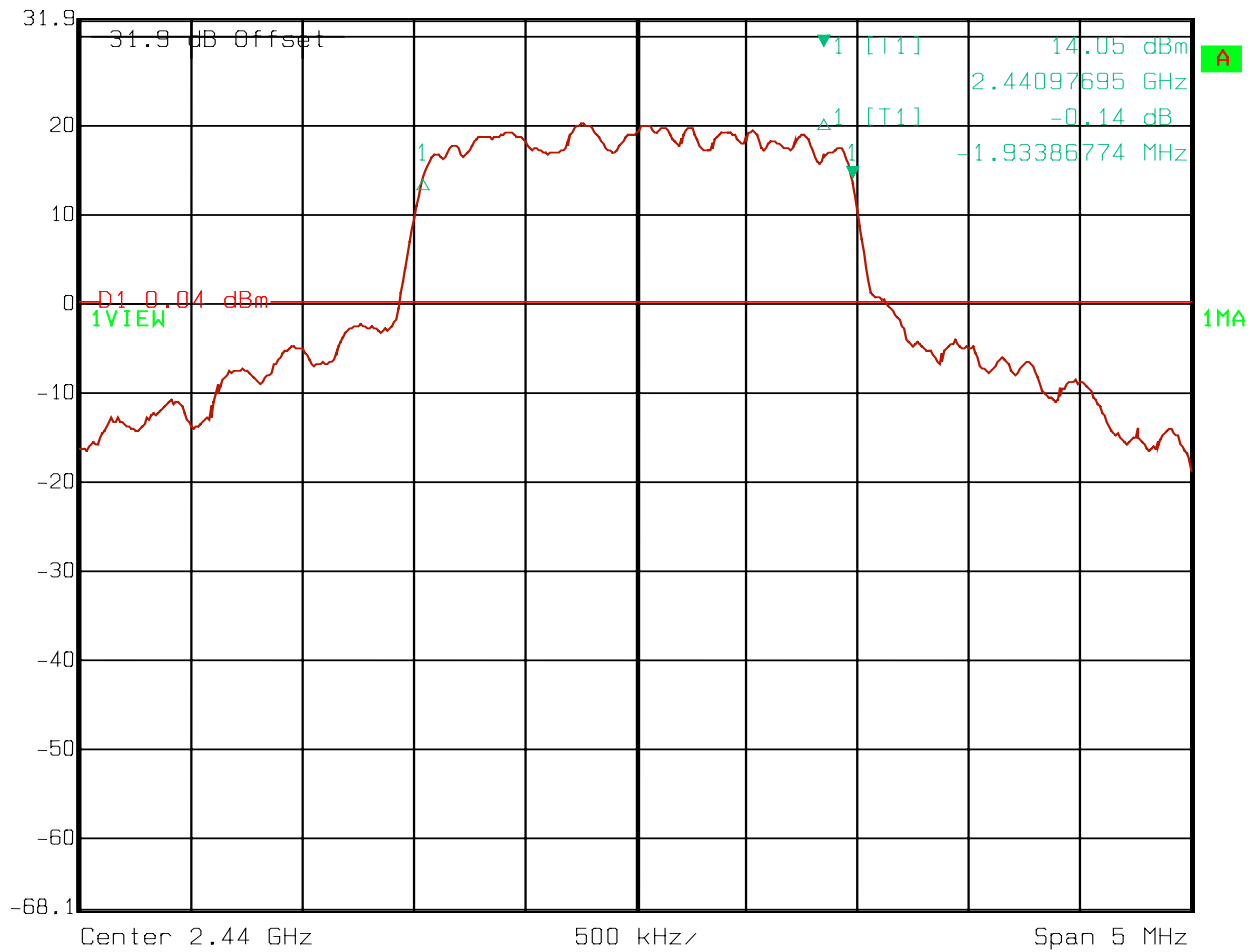
Date: 13.SEP.2005 14:04:02

EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

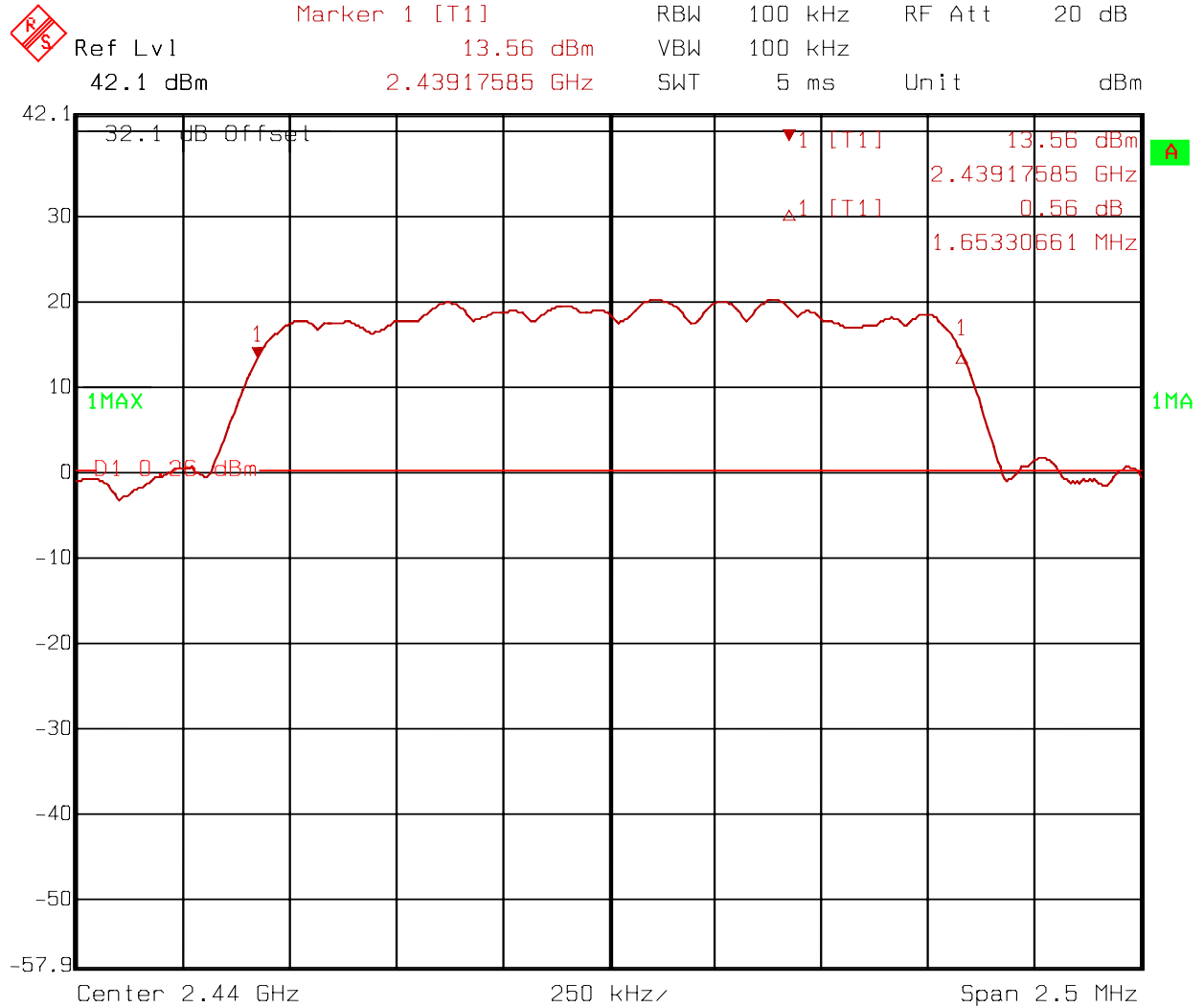
MID CHANNEL Navini (SCDMA)

 Ref Lvl 31.9 dBm  
Marker 1 [T1] 14.05 dBm  
RBW 100 kHz RF Att 30 dB  
VBW 100 kHz  
SWT 5 ms Unit dBm



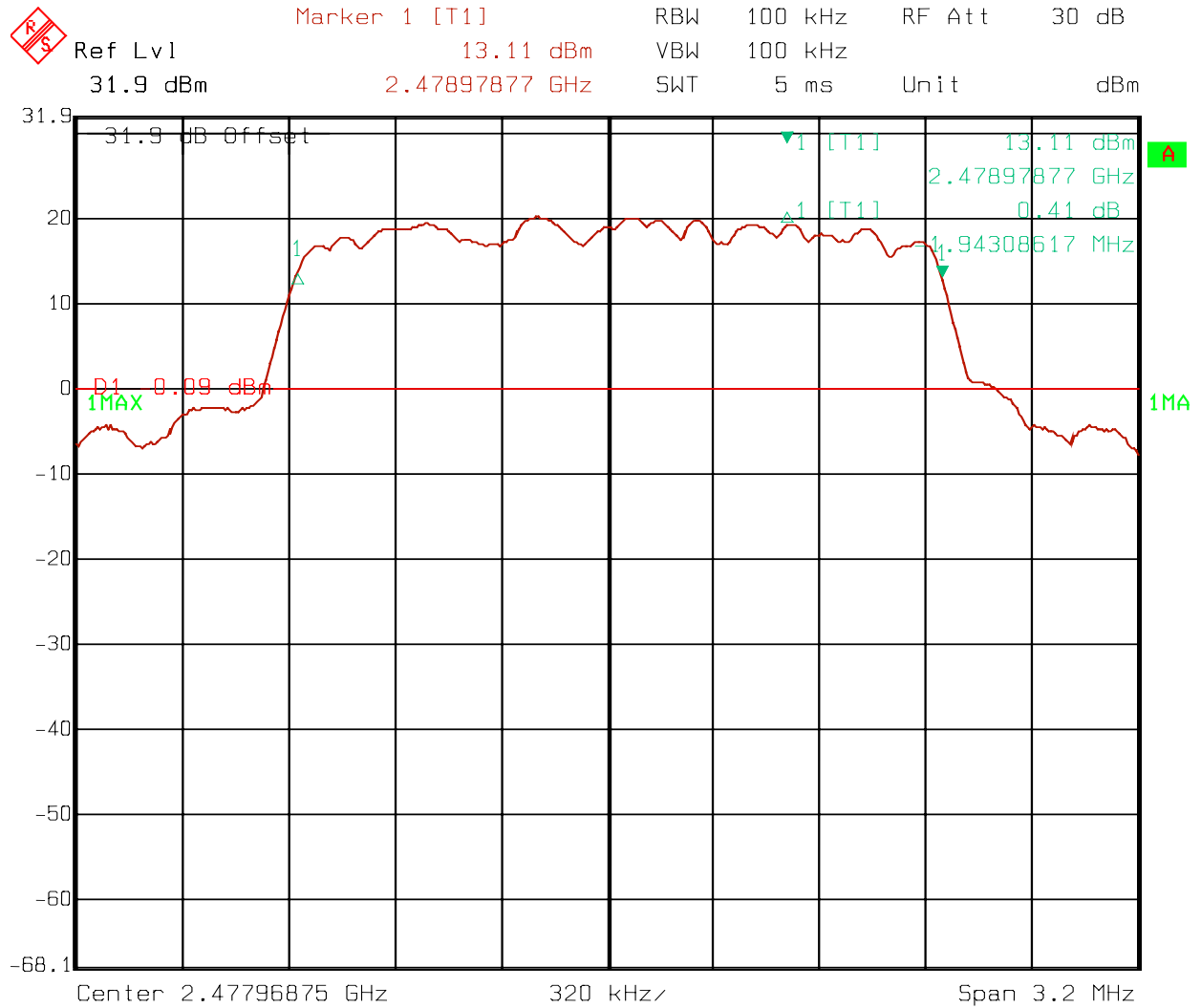
Date: 02.SEP.2005 09:12:46

MID CHANNEL Navini (802.16e)



Date: 13.SEP.2005 14:02:18

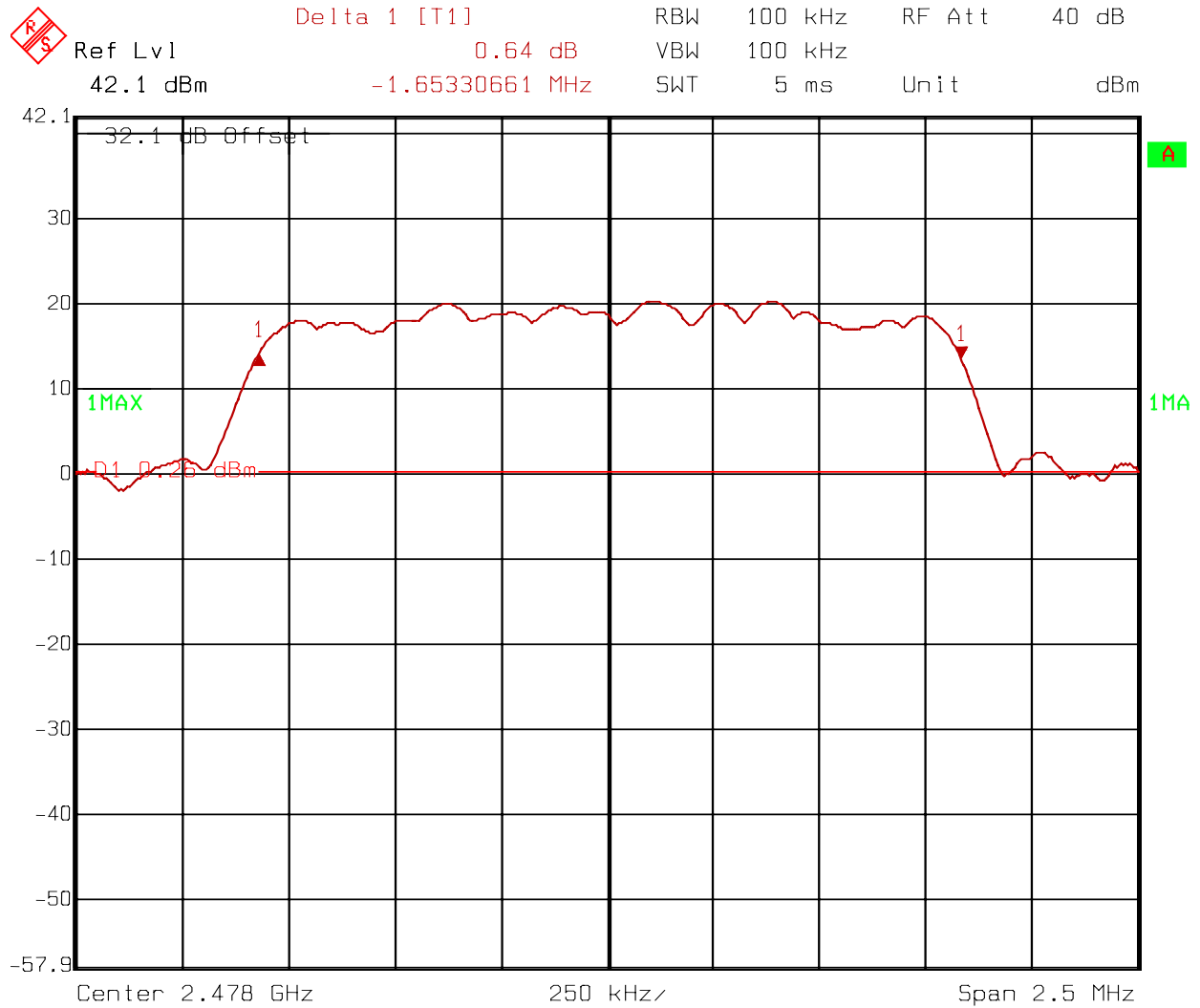
HIGH CHANNEL Navini (SCDMA)



Date: 02.SEP.2005 09:38:59



HIGH CHANNEL Navini (802.16e)



Date: 13.SEP.2005 13:55:18

### Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: Kevin Rose	DATE: 09/13/05

**Test Results:** Complies.

#### Antenna Terminal Measurements

**Note: Peak Power measurements were made with a Spectrum Analyzer (10MHz RBW 10MHz VBW).**

**Note: EUT Voltage was varied +/-15% and no variation in output power observed.**

**Equipment Used:** 1036, 1044, 1016, 1484, 1485, 1304, 1033

Measurement Uncertainty: +/- 1.7 dB

Temperature: 21°C

Relative Humidity: 42%

15.203 requirements

EUT uses a MMCX connector.



**Test data**

Channel Navini (SCDMA)	Average Conducted Power (dBm)	Peak Conducted Power (dBm)
Low	25.2	29.3
Mid	25.12	29.11
High	25.11	29.24

**EIRP Navini (SCDMA)**

Antenna	Antenna gain	EIRP dBm	EIRP (W)
Upright	1.5	30.8	1.2
Patch	6	35.3	3.4

Channel Navini (802.16e)	Average Conducted Power (dBm)	Peak Conducted Power (dBm)
Low	25.02	28.95
Mid	25.19	28.81
High	25.17	28.69

**EIRP Navini (802.16e)**

Antenna	Antenna gain	EIRP dBm	EIRP (W)
Upright	1.5	30.45	1.11
Patch	6	34.95	3.13

## Section 6      Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 15.247(c)
TESTED BY: Kevin Rose	DATE: 9/02/05

**Test Results:**                      Complies.

**Measurement Data:**      See attached plots.

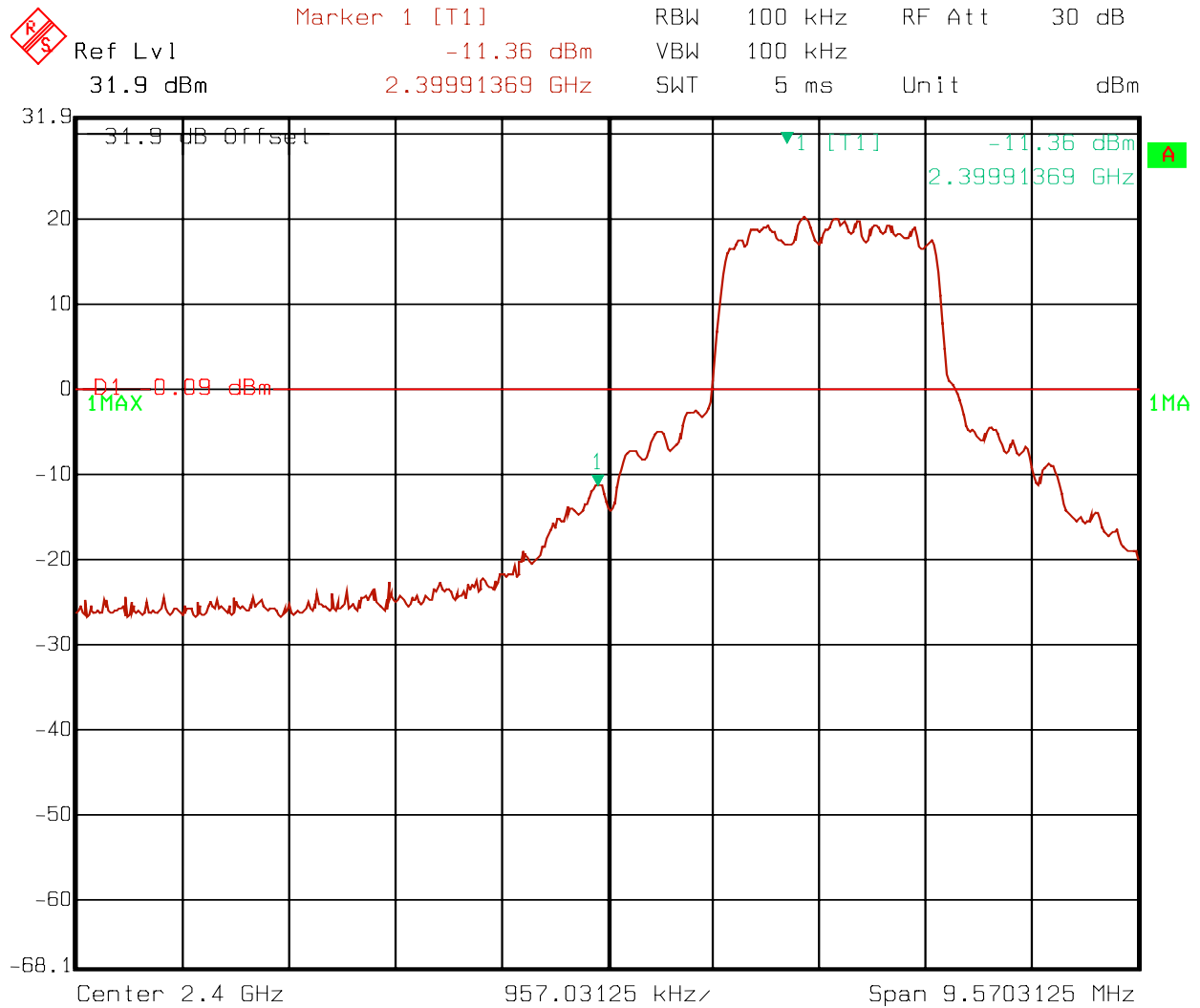
**Equipment Used:**    1036, 1472, 1055, 1081.1561,1562..

**Measurement Uncertainty:**   +/- 1.7 dB

**Temperature:**                      21°C

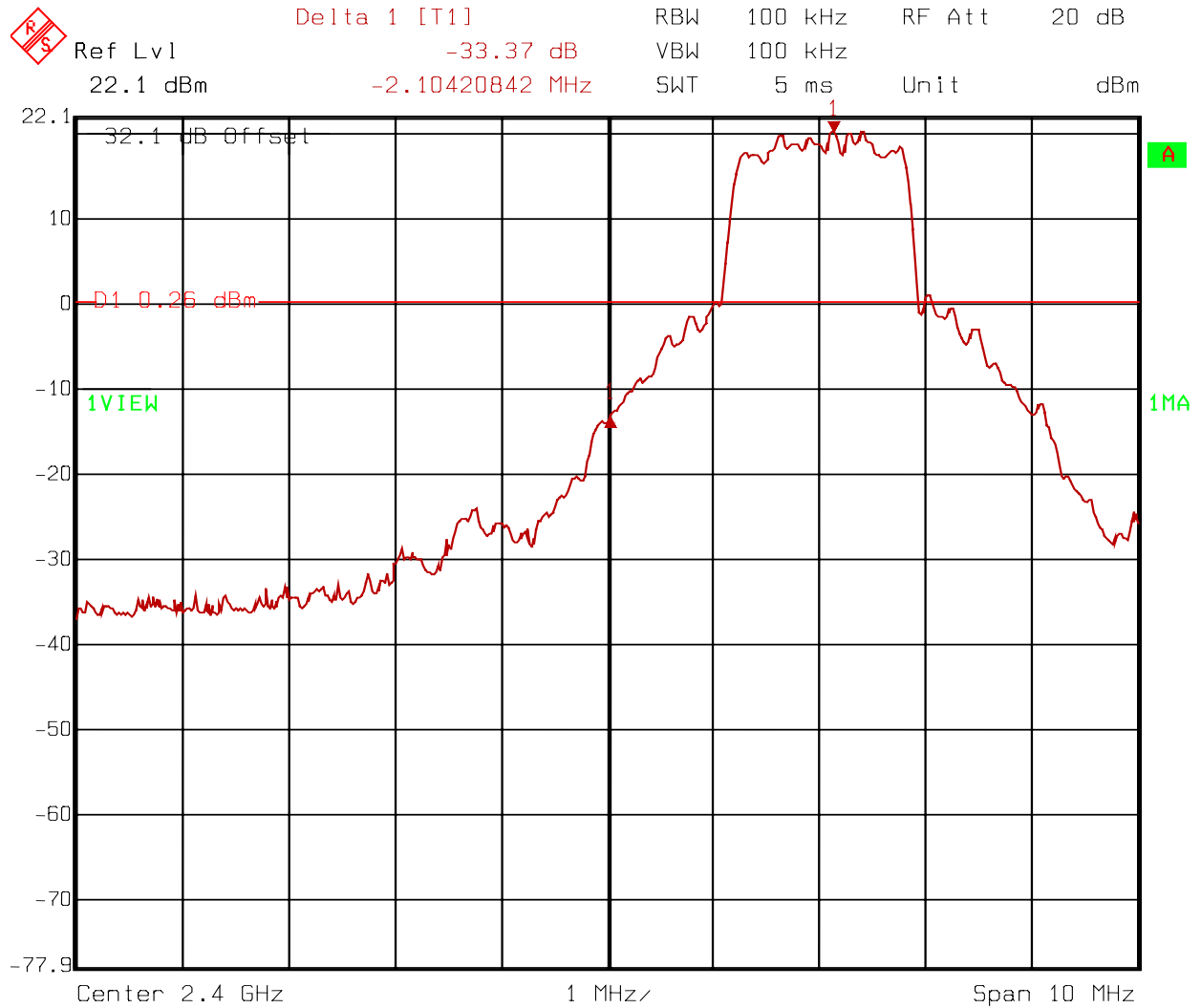
**Relative Humidity:**              46%

**Antenna Spurs: Low channel**  
**Band Edge, Lower Channel 2402.MHz Navini (SCDMA)**



Date: 02.SEP.2005 09:48:54

**Antenna Spurs: Low channel**  
**Band Edge, Lower Channel 2402.MHz Navini (802.16e)**



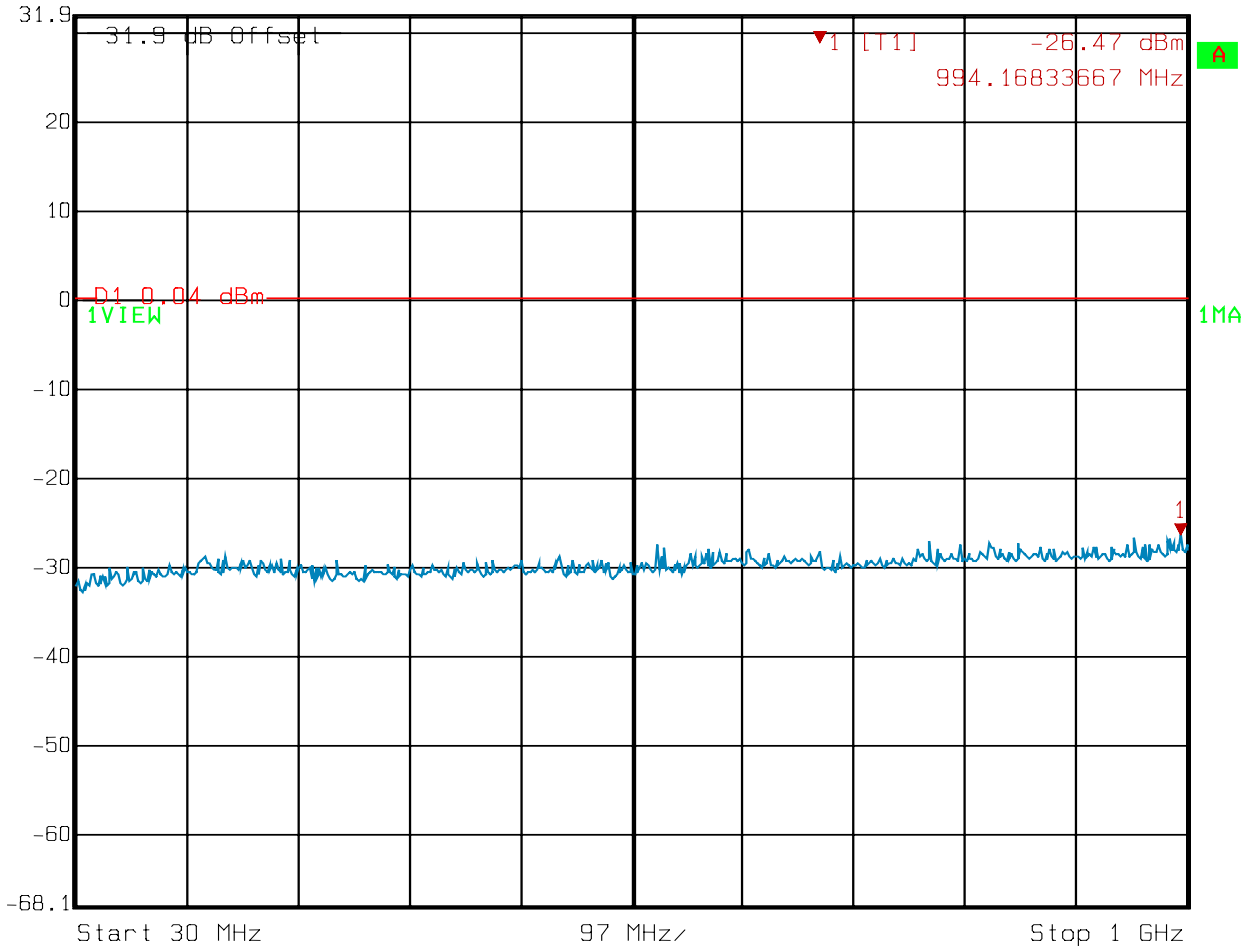
Date: 13.SEP.2005 13:23:03

EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

LOW CHANNEL Navini (SCDMA)

 Marker 1 [T1] RBW 100 kHz RF Att 30 dB  
Ref Lvl -26.47 dBm VBW 100 kHz  
31.9 dBm 994.16833667 MHz SWT 245 ms Unit dBm

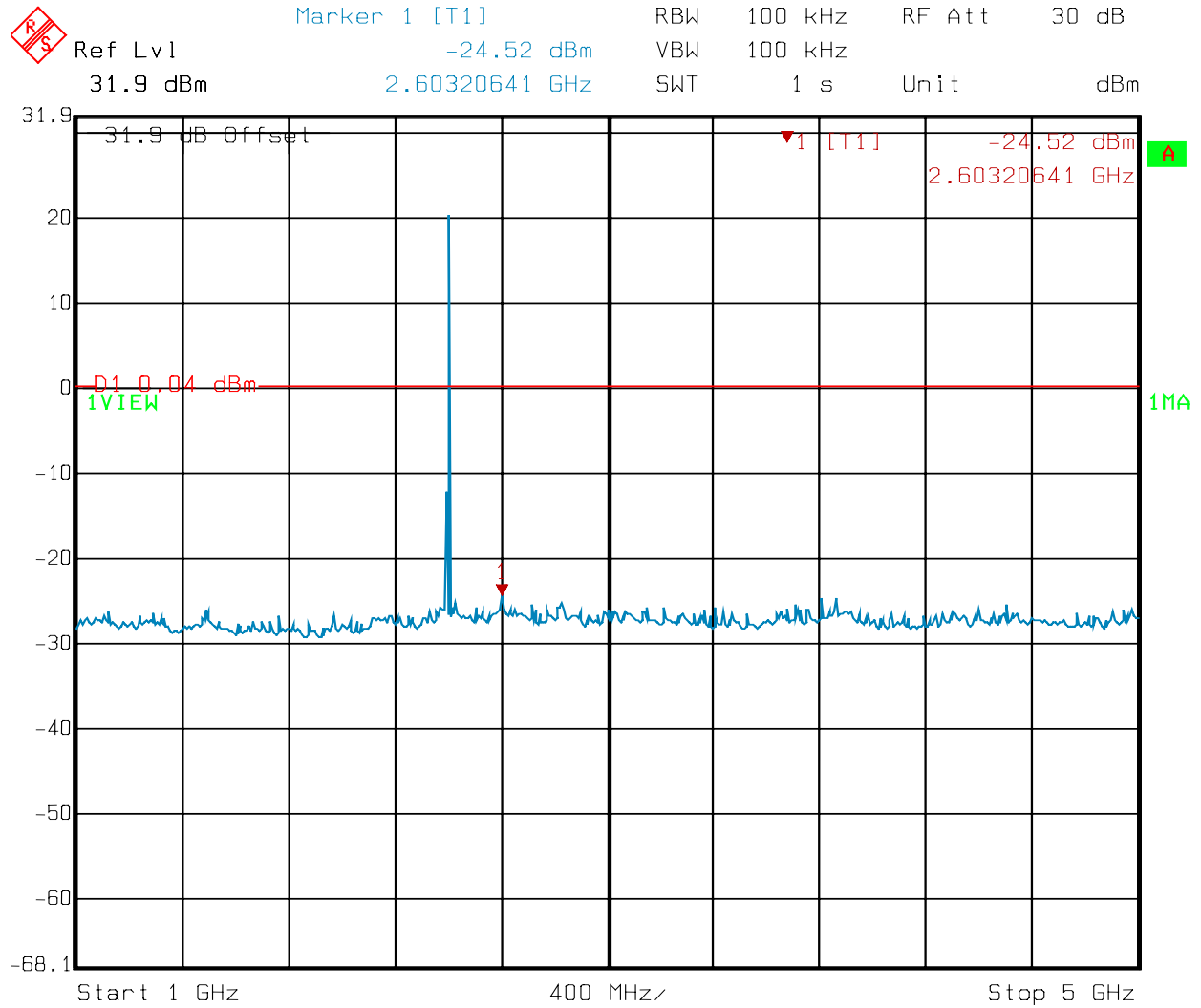


Date: 02.SEP.2005 09:00:26



EQUIPMENT: 2400 – 2483 LMX E

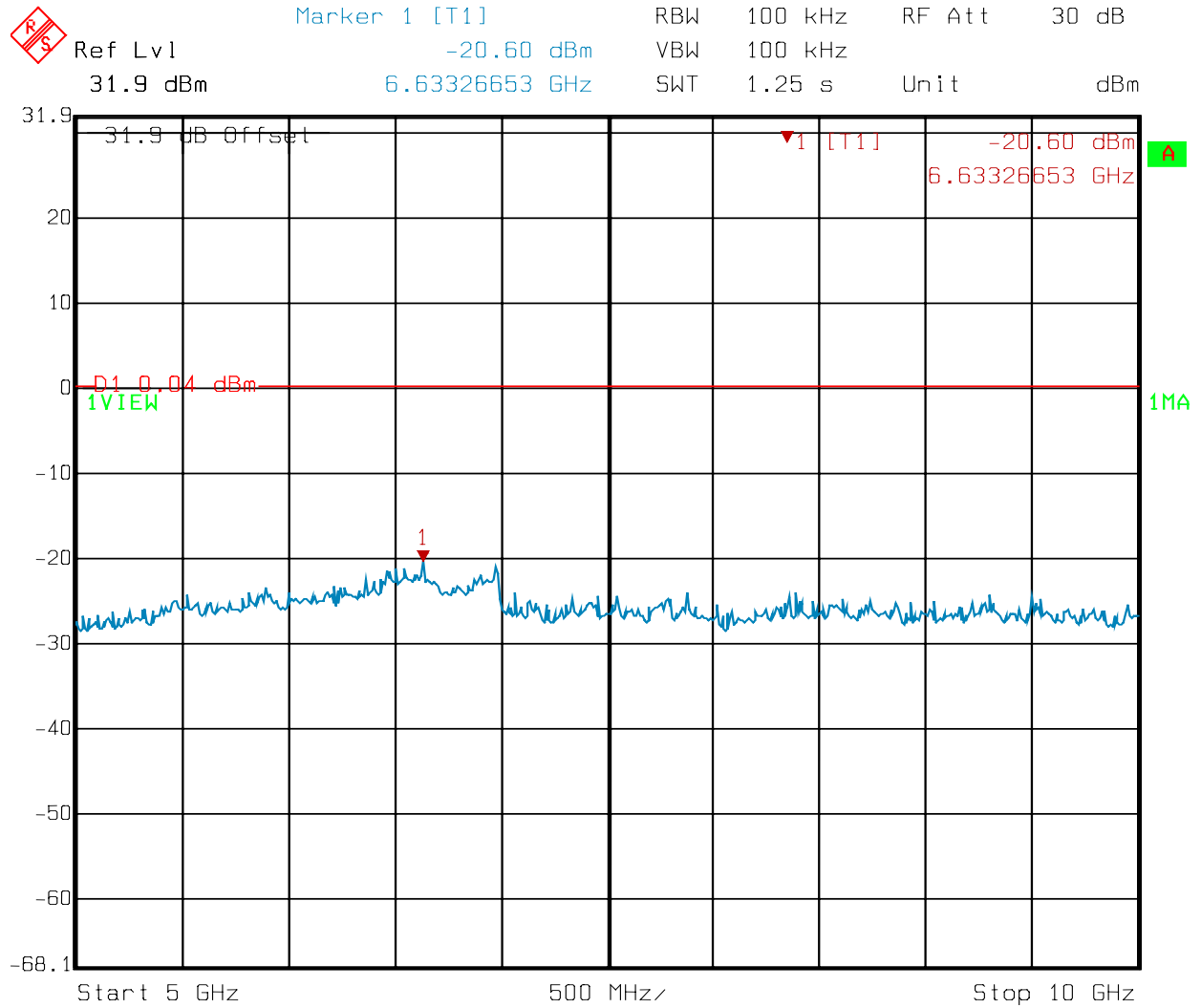
PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:02:15

EQUIPMENT: 2400 – 2483 LMX E

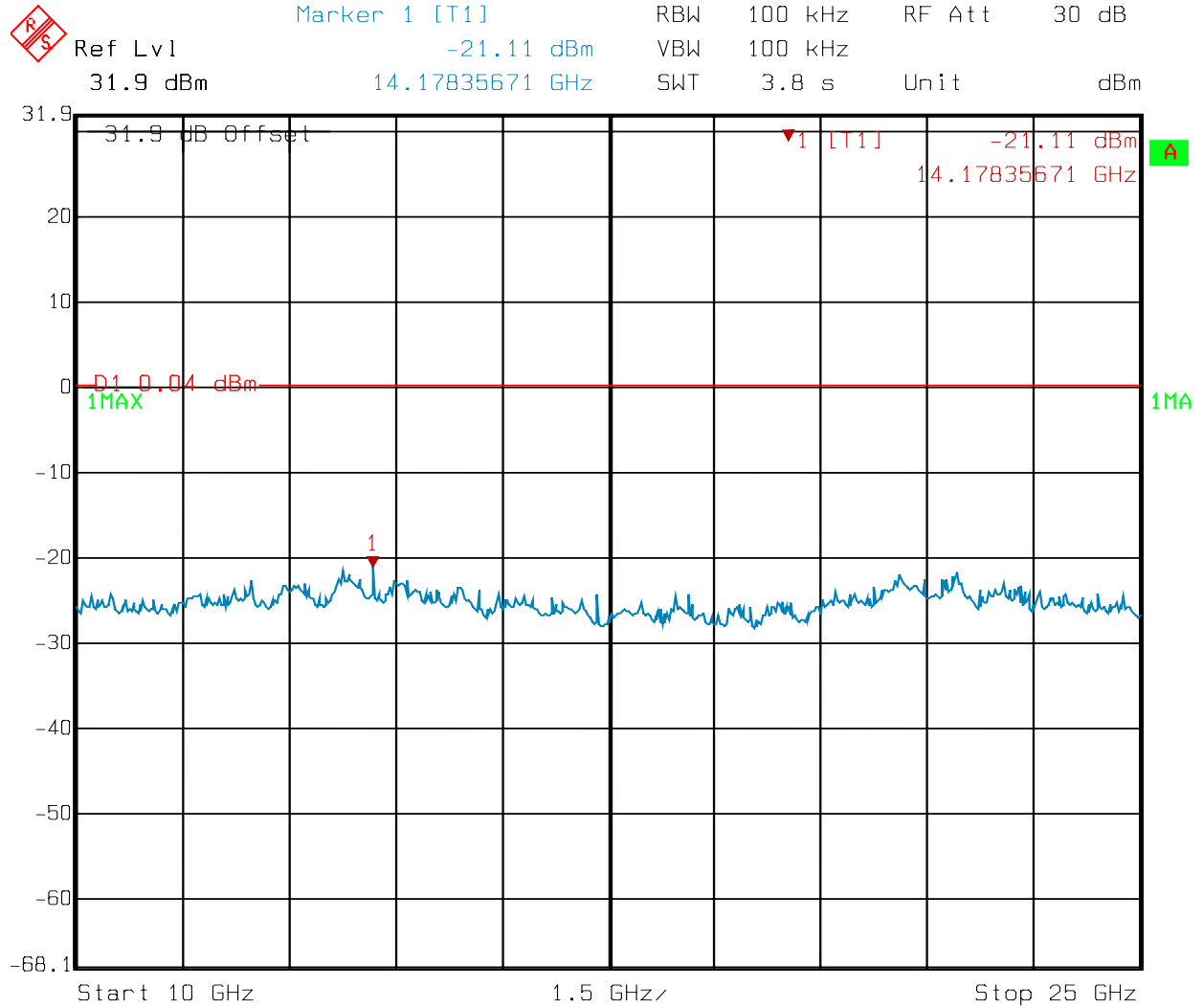
PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:03:24

EQUIPMENT: 2400 – 2483 LMX E

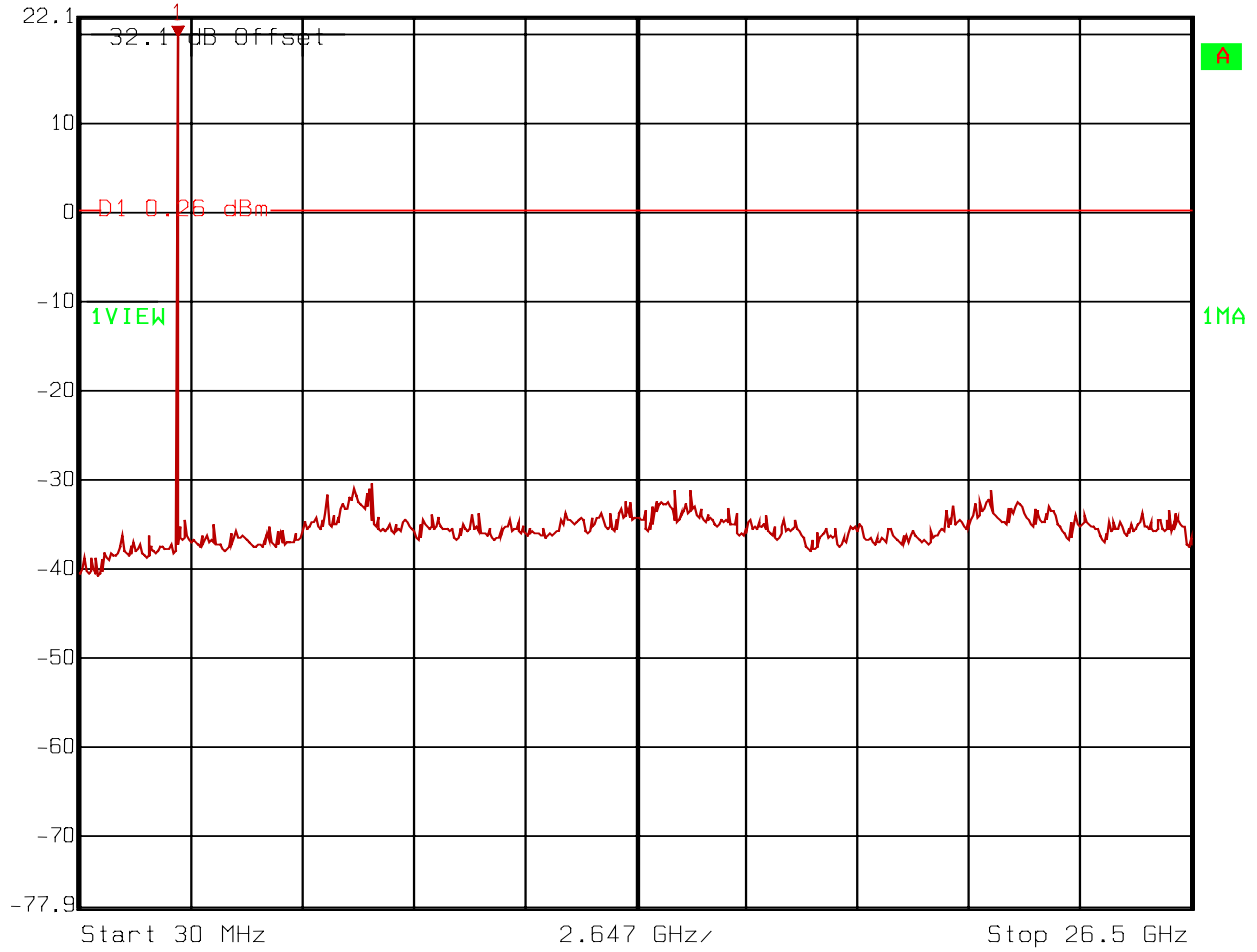
PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:04:20

LOW CHANNEL Navini (802.16e)

RS  
Marker 1 [T1] RBW 100 kHz RF Att 20 dB  
Ref Lvl 19.71 dBm VBW 100 kHz  
22.1 dBm 2.36402806 GHz SWT 6.8 s Unit dBm

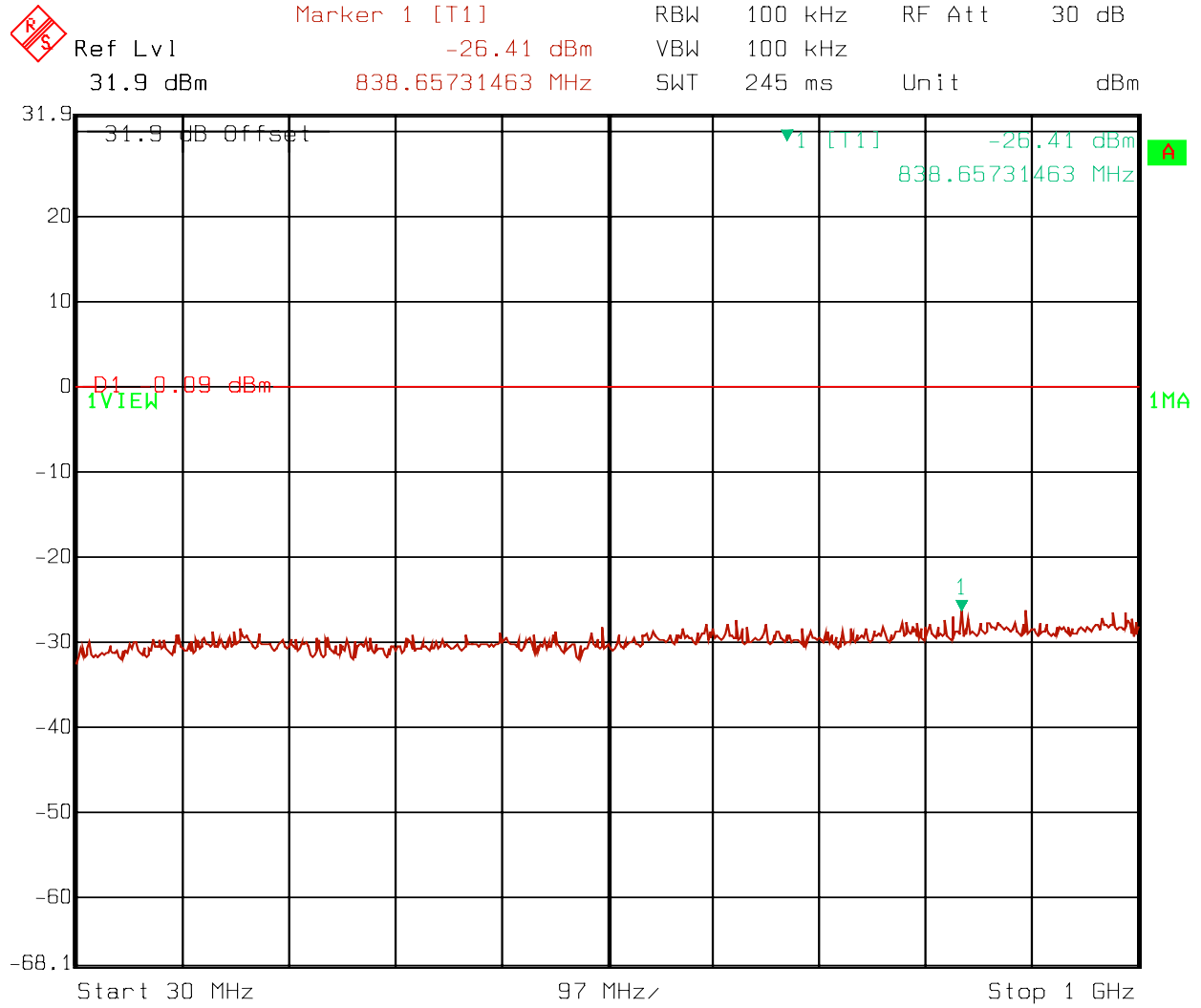


Date: 13.SEP.2005 13:12:01

EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

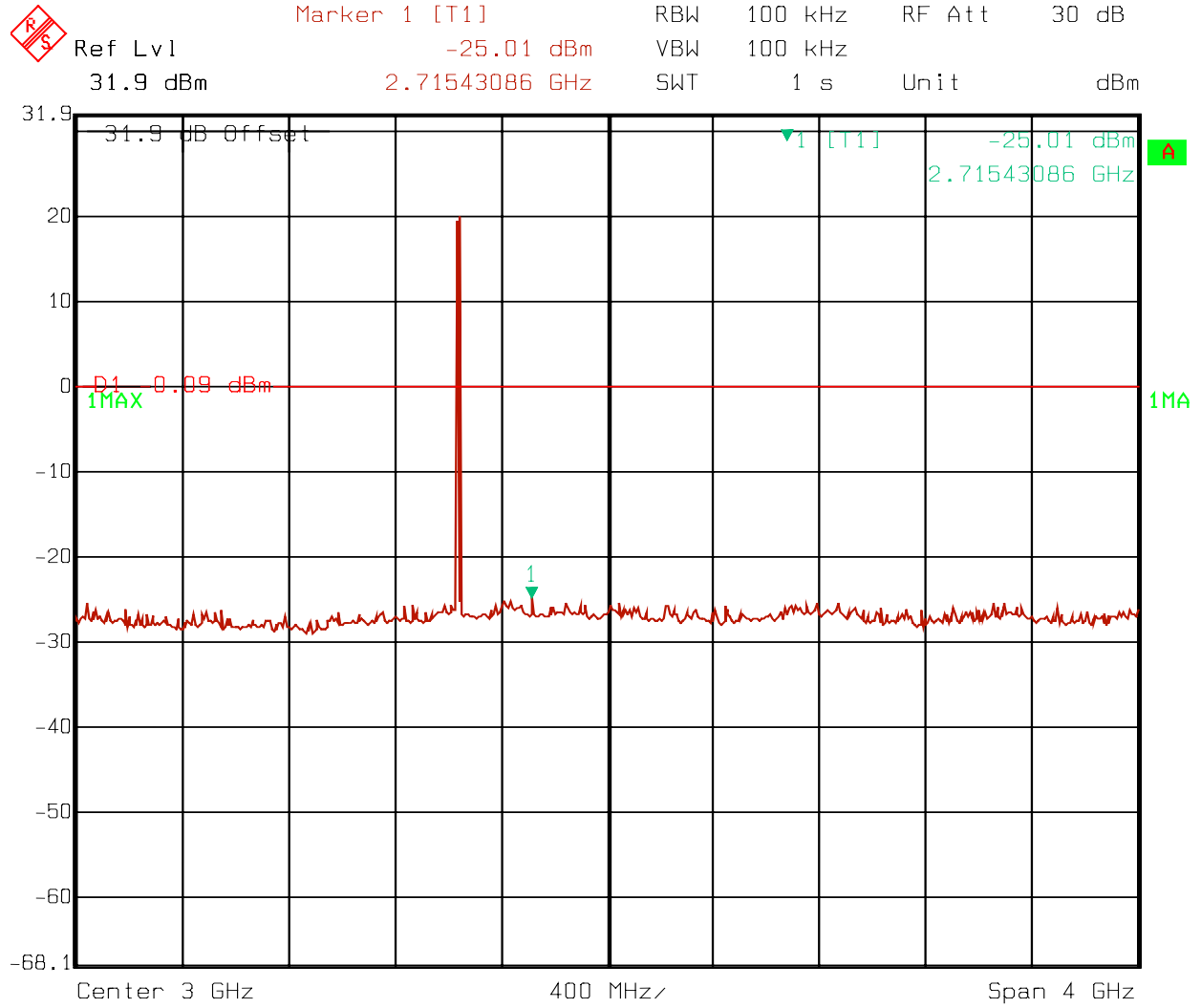
Antenna Spurs: Mid Channel Navini (SCDMA)



Date: 02.SEP.2005 09:15:19

EQUIPMENT: 2400 – 2483 LMX E

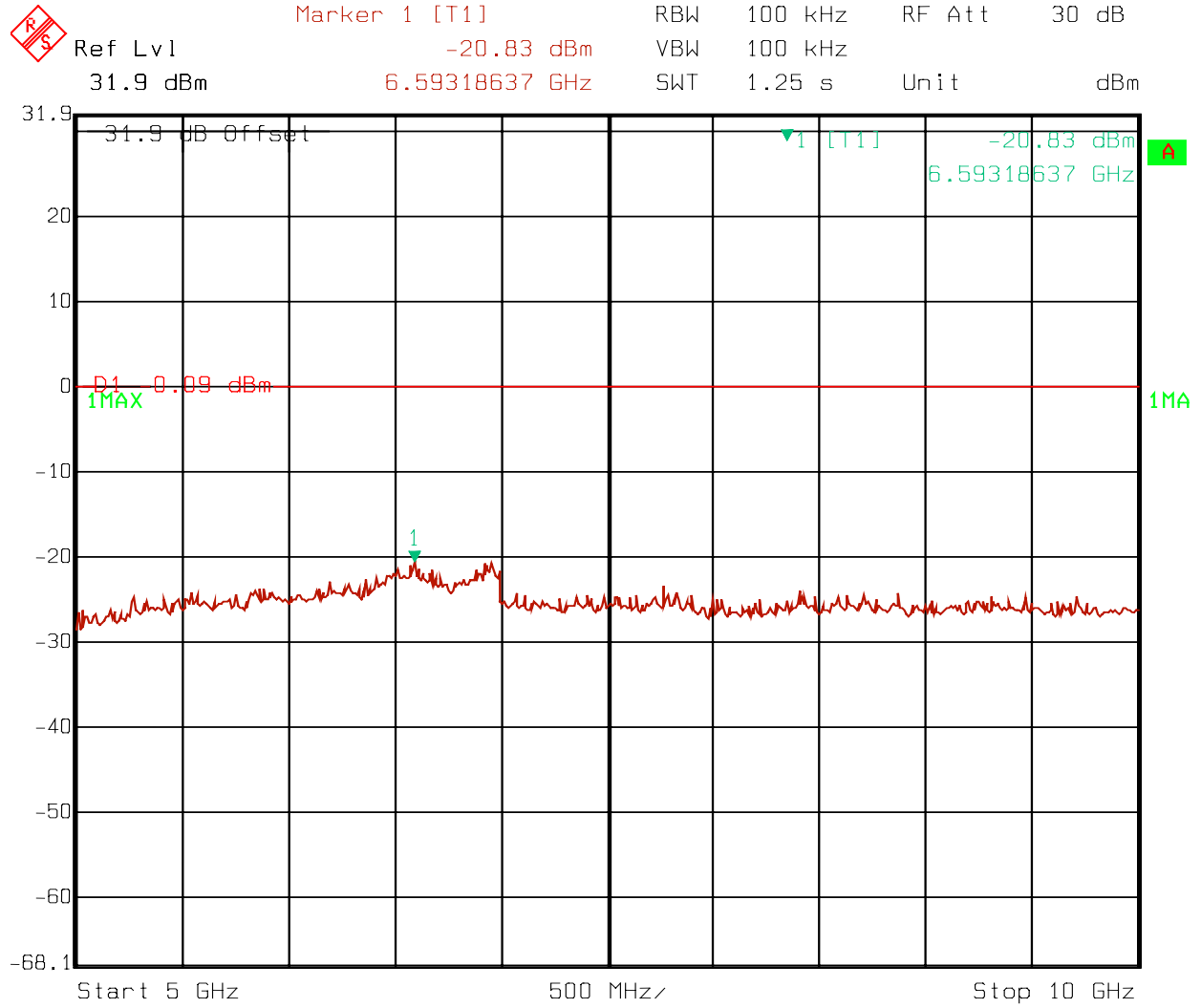
PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:20:28

EQUIPMENT: 2400 – 2483 LMX E

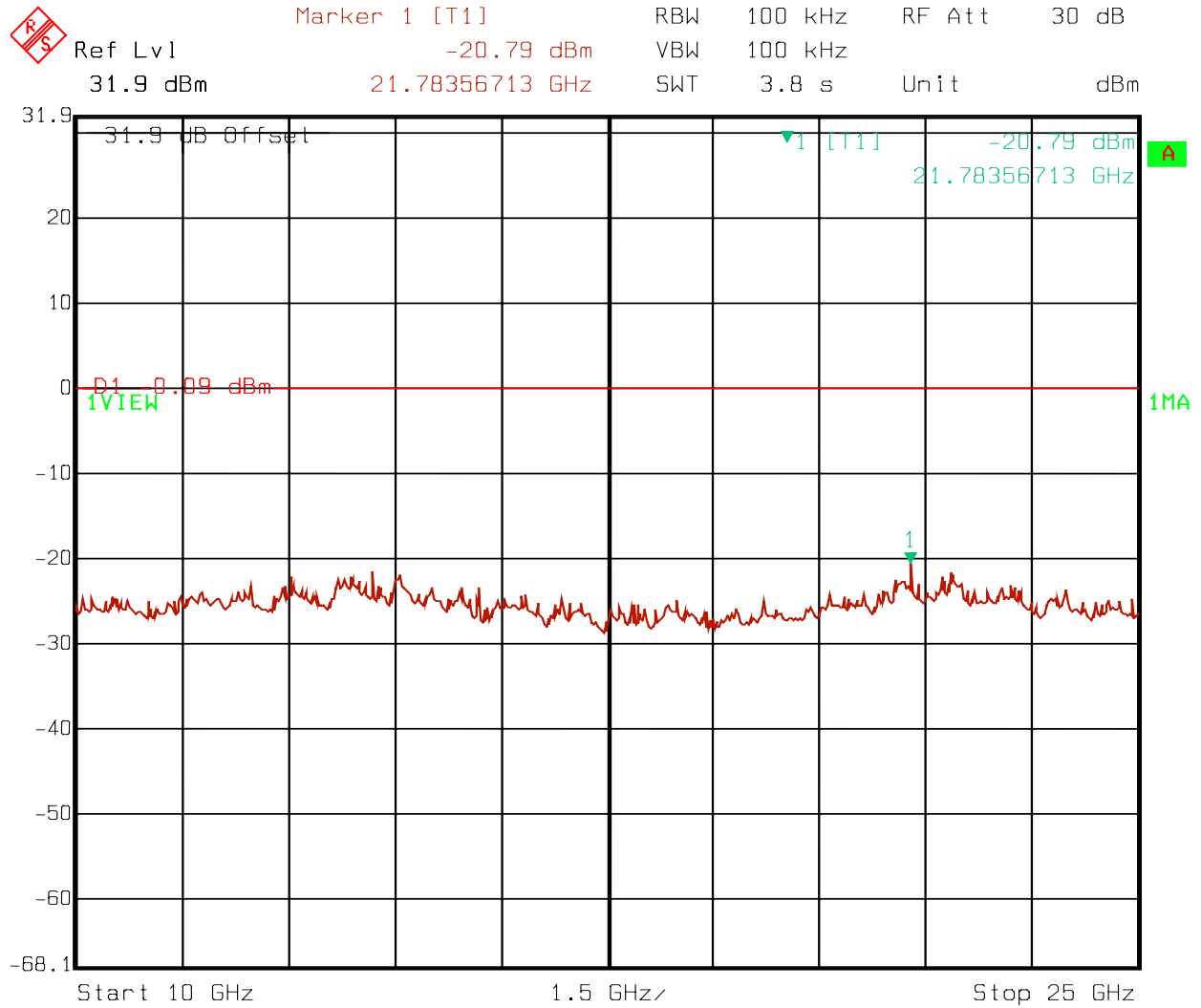
PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:21:15

EQUIPMENT: 2400 – 2483 LMX E

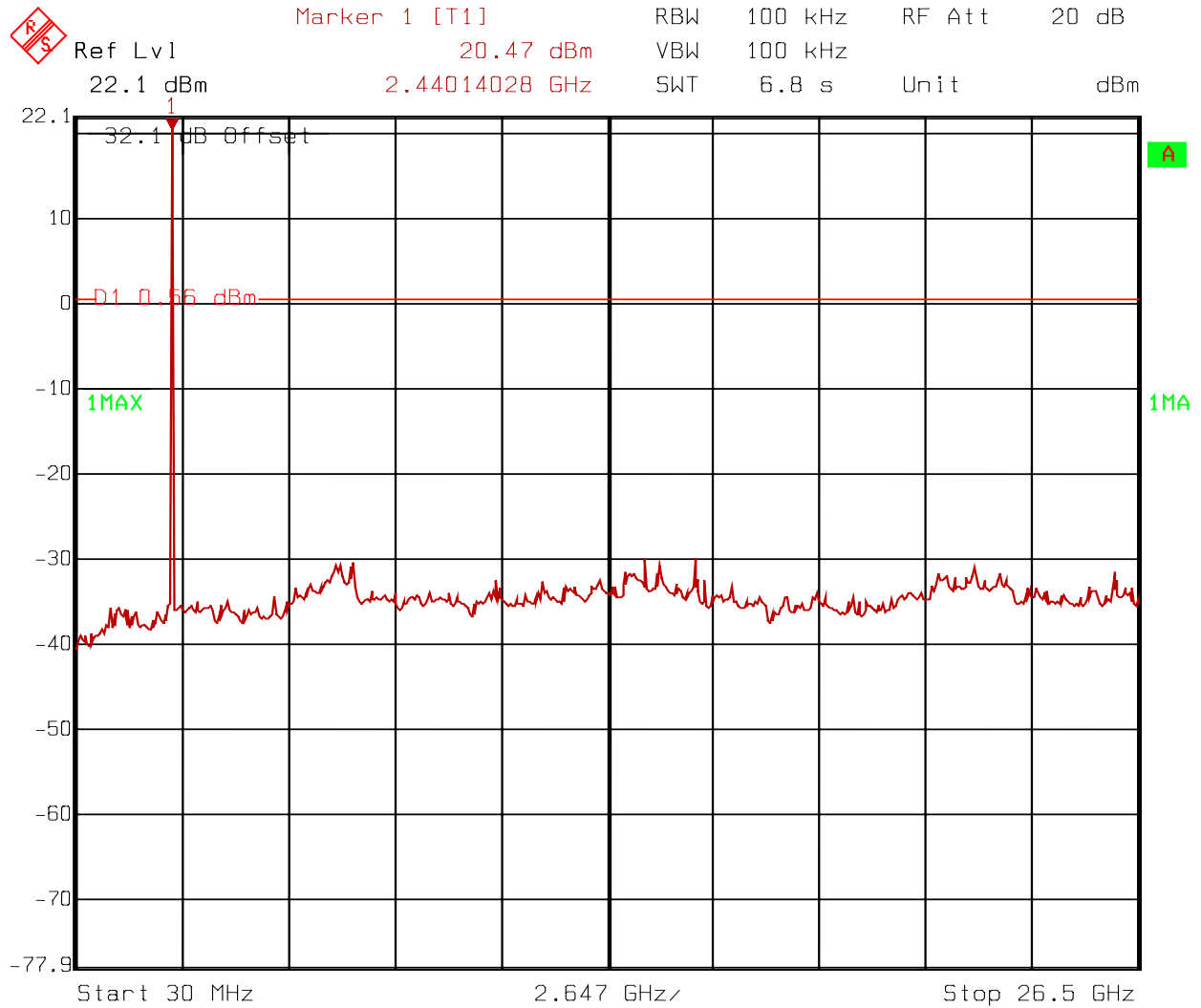
PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:23:13



MID CHANNEL Navini (802.16e)



Date: 13.SEP.2005 13:16:51

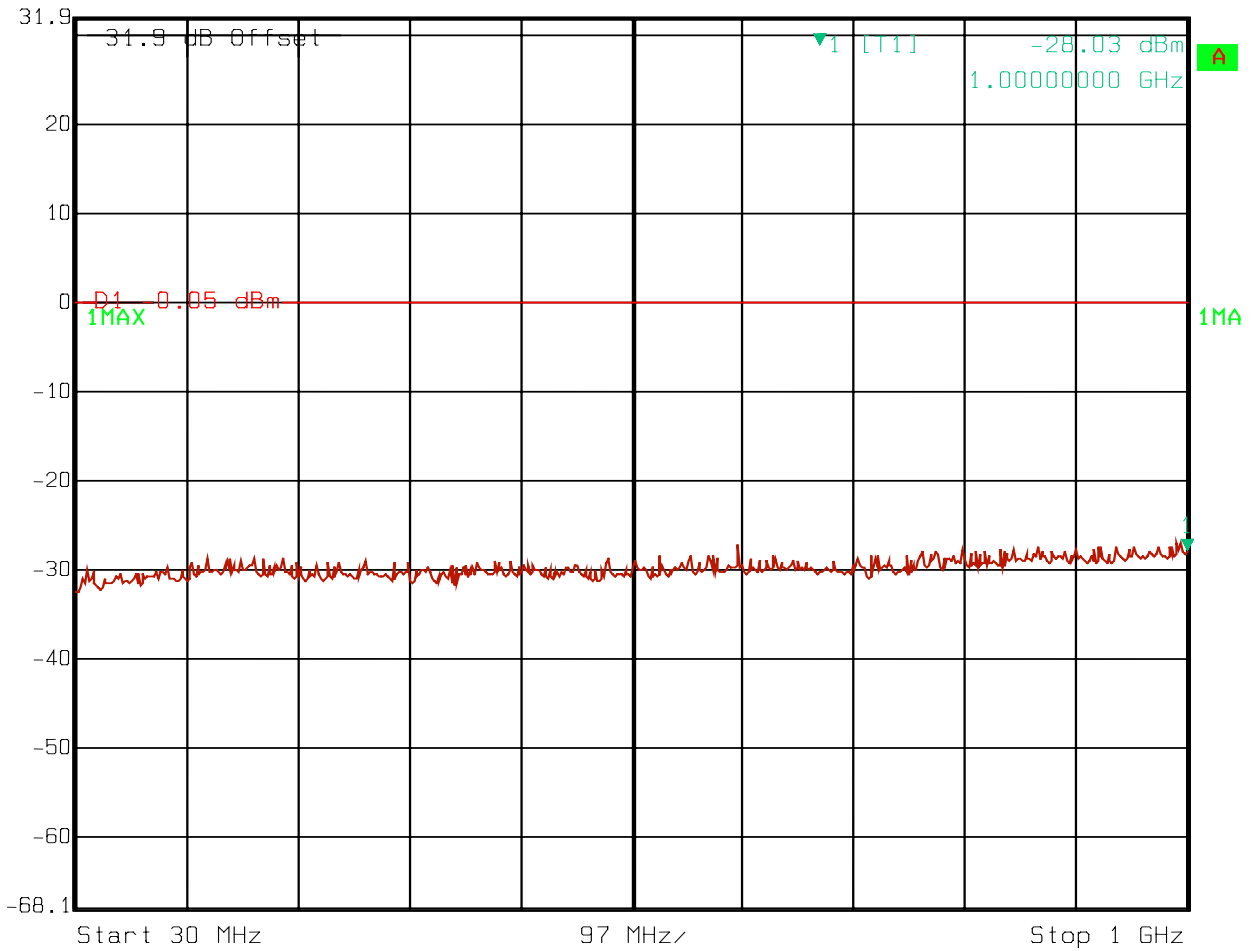
EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

Antenna Spurs: High Channel Navini (SCDMA)



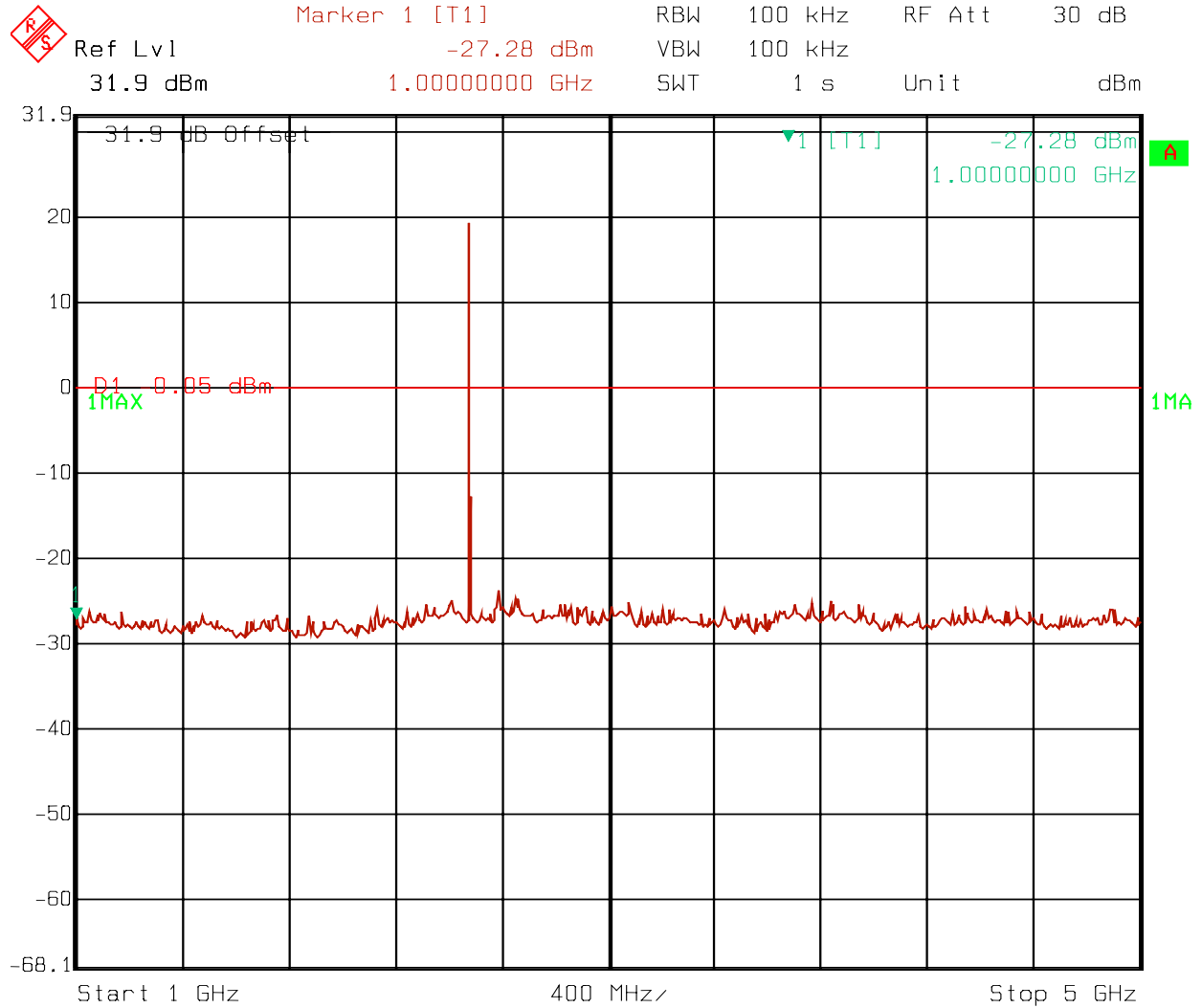
Ref Lvl 31.9 dBm  
Marker 1 [T1] -28.03 dBm  
1.00000000 GHz  
RBW 100 kHz RF Att 30 dB  
VBW 100 kHz  
SWT 245 ms Unit dBm



Date: 02.SEP.2005 09:41:48

EQUIPMENT: 2400 – 2483 LMX E

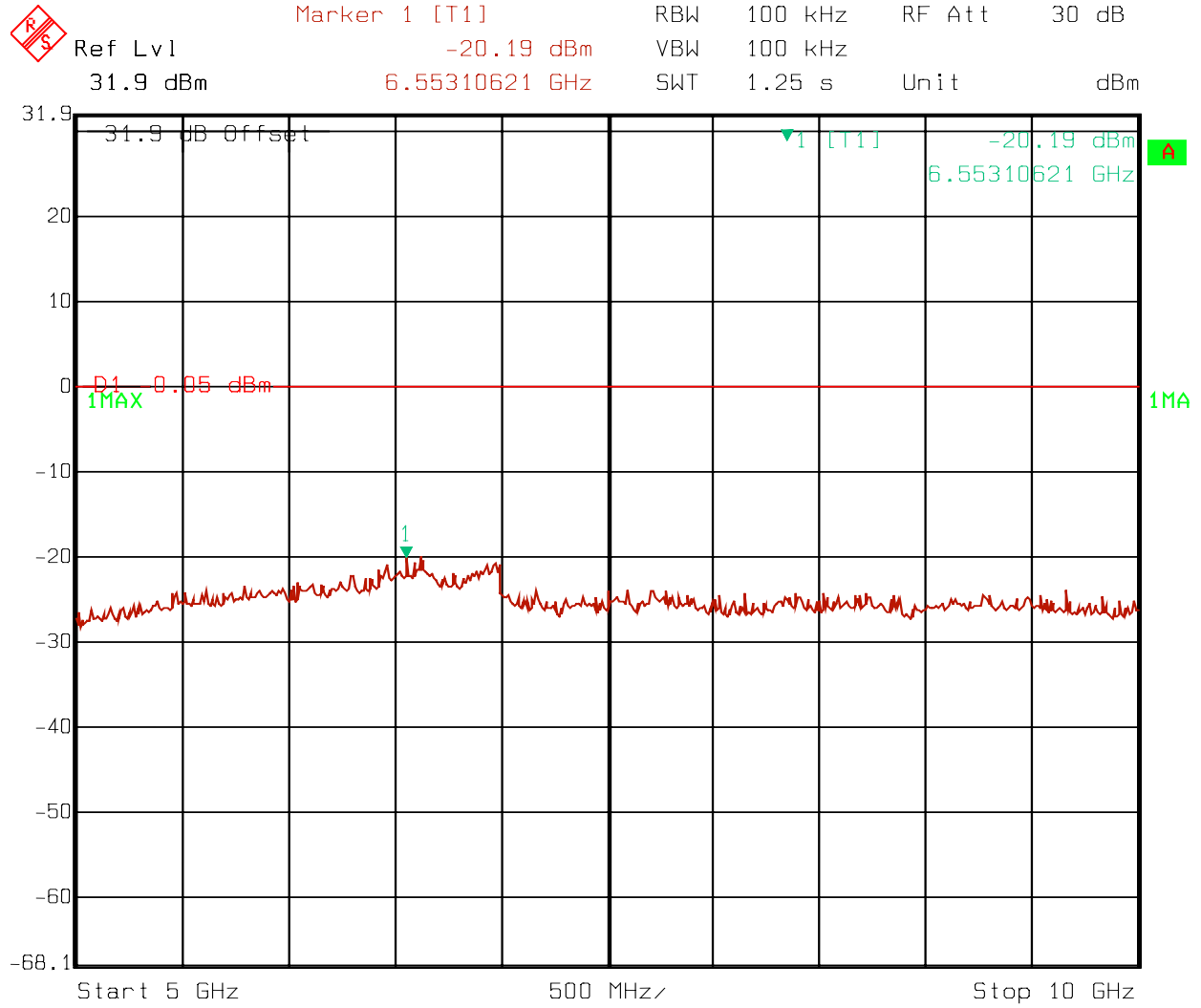
PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:42:31

EQUIPMENT: 2400 – 2483 LMX E

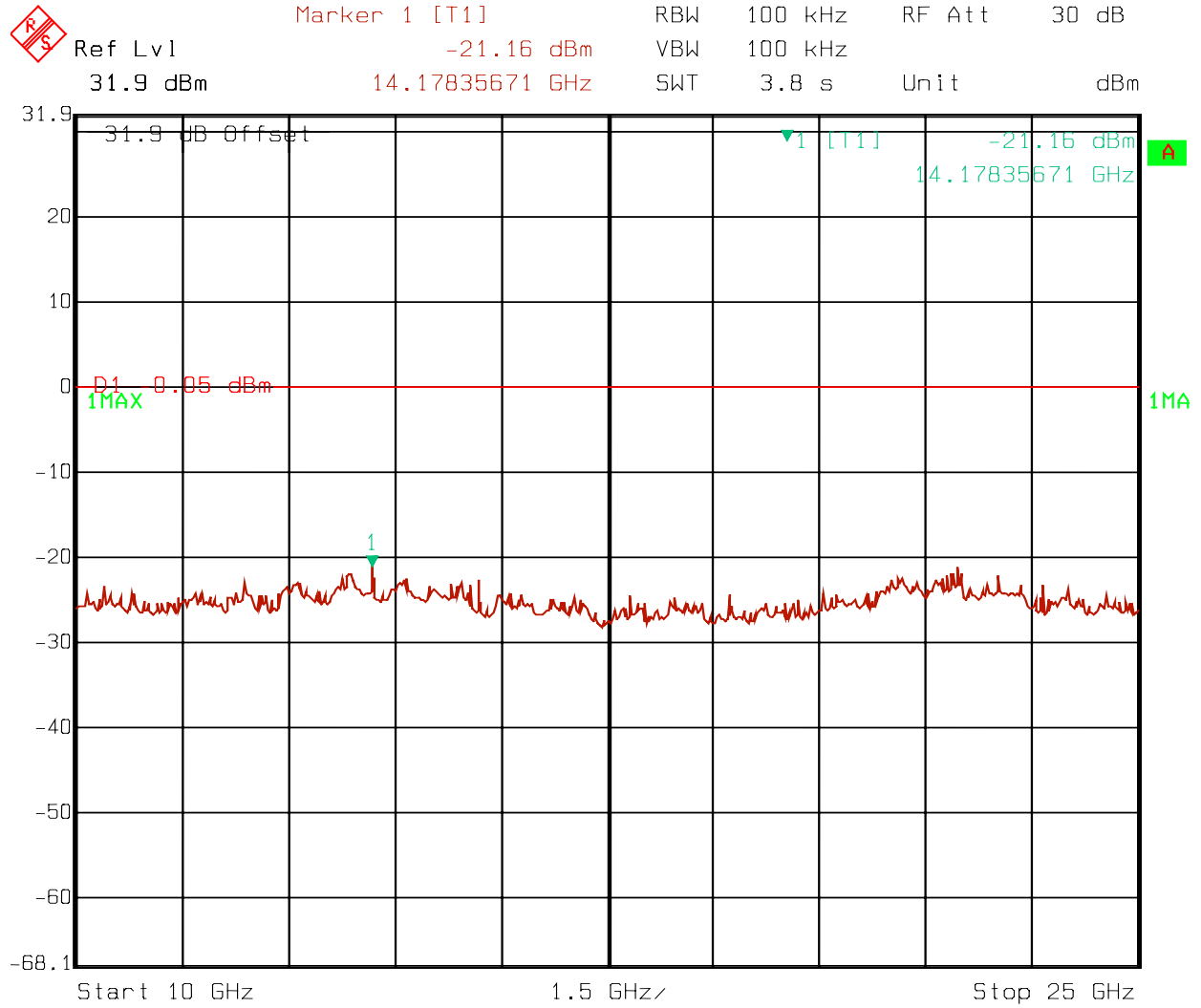
PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:43:10

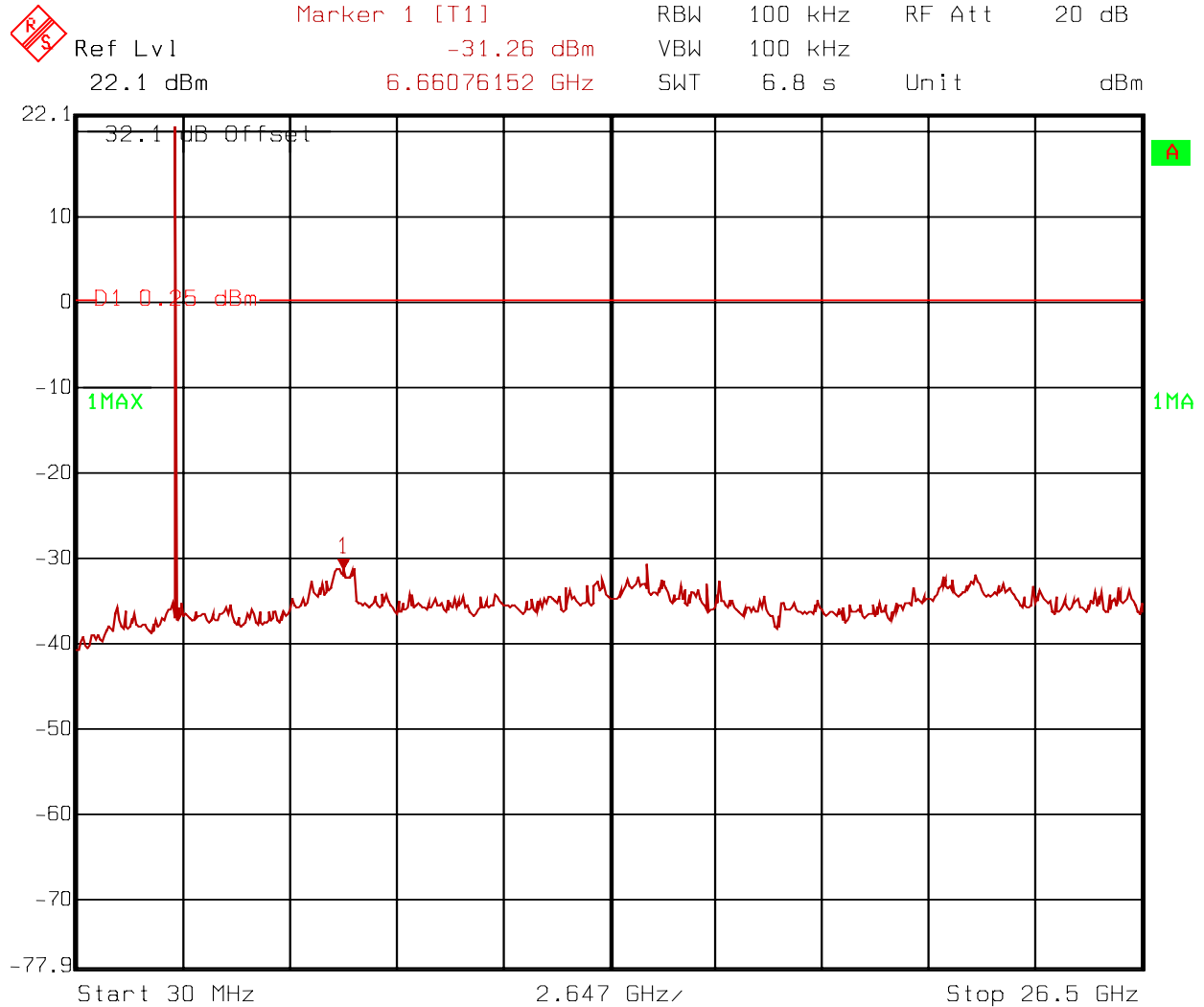
EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1



Date: 02.SEP.2005 09:43:42

Antenna Spurs: High Channel Navini (802.16e)



Date: 13.SEP.2005 13:19:22

## Section 7. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.247 (c)
TESTED BY: Kevin Rose	DATE: 08/25/05

**Test Results:** Complies.

**Measurement Data:** See attached table.

### Duty Cycle Calculation:

Duty Cycle correction factor (dB) =  $20 \log (rf_{ON} \text{ in ms}/100\text{ms})$

Duty cycle correction =  $20 \log (30.17/100) = -10.41$

**Equipment Used:** 1036, 1044, 1016, 1484, 1485, 1304

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

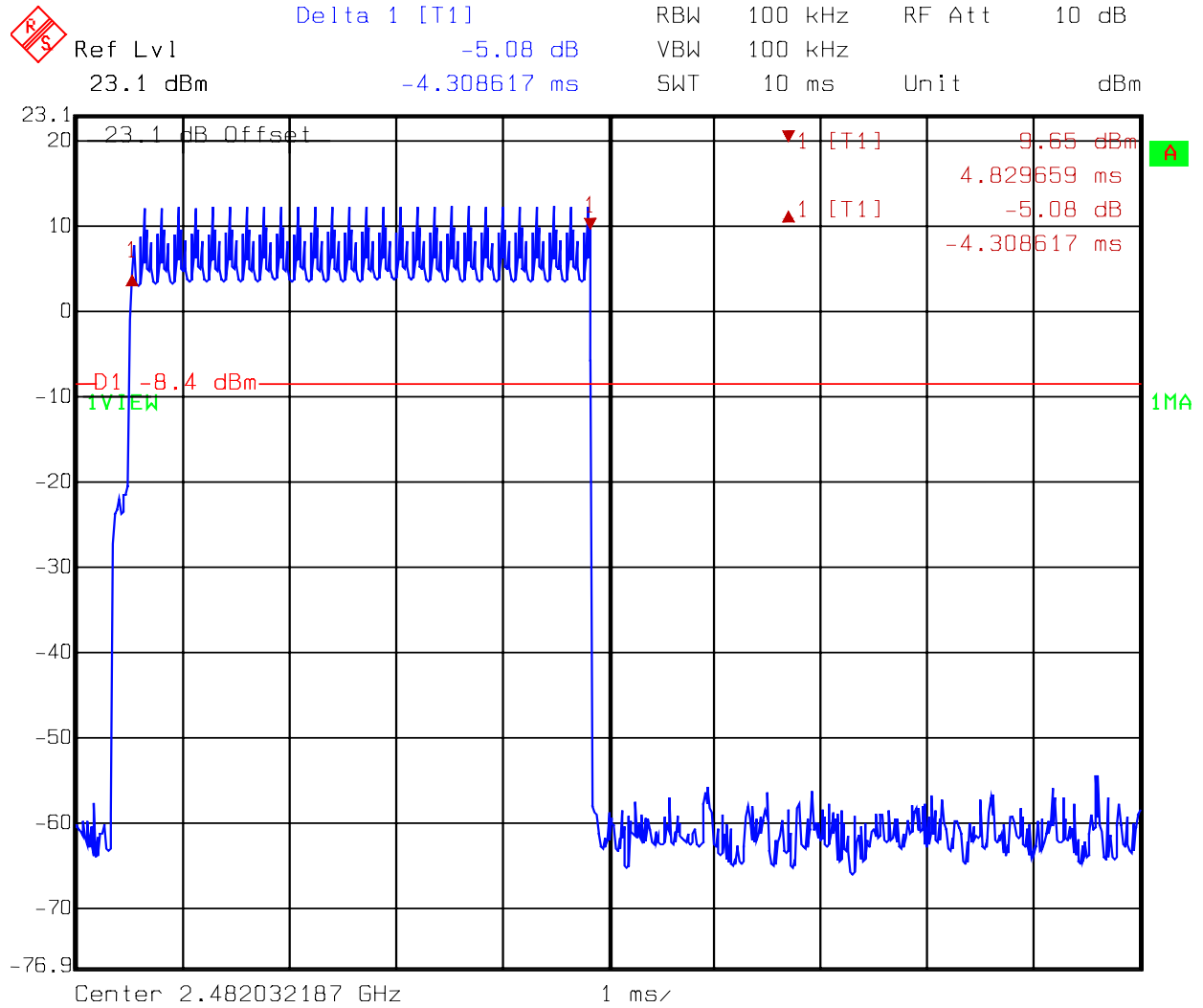
**Temperature:** 21°C

**Relative Humidity:** 48%

**Frequency Range Tested:** 30MHz to 25GHz

Note: Transmitter was at greater than 99% transmit. For averaging measurements 10hz VBW was used.

Duty Cycle Plots

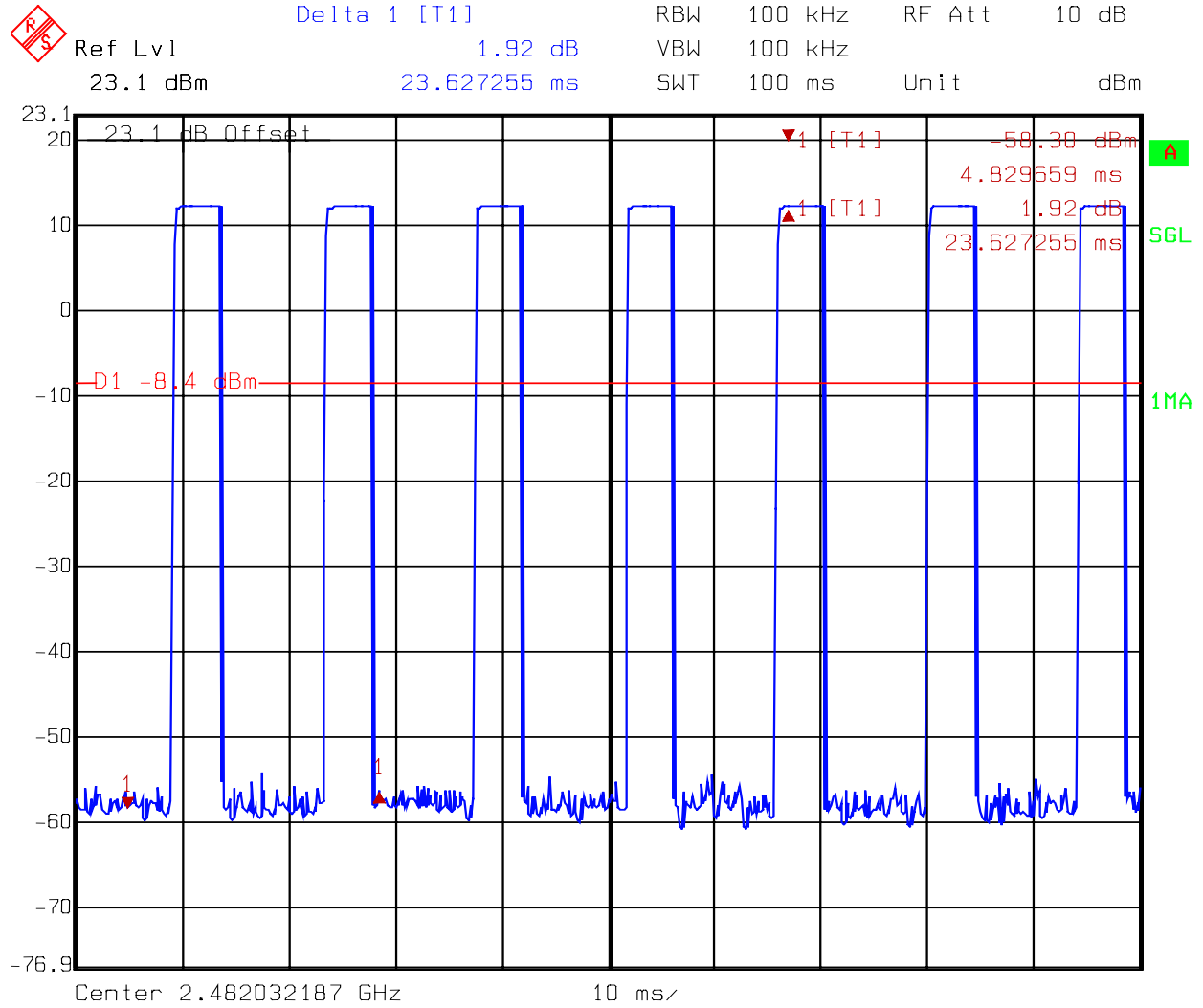


Date: 25.AUG.2005 13:09:04



EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1



Date: 25.AUG.2005 13:11:17

Navini (SCDMA)

<u>Radiated Emissions</u>								
Page <u>1</u> of <u>1</u>								
Job No.:	5L0390R			Date:	9/2/2005			
Specification:	15.247			Temperature(°C):	21			
Tested By:	Kevin Rose		Relative Humidity(%)	42				
E.U.T.:	2.4 cpe PATCH							
Configuration:	TX							
Sample Number:	1							
Location:	AC 3			RBW:	1 MHz			
Detector Type:	Peak			VBW:	1 MHz			
<u>Test Equipment Used</u>								
Antenna:	993			Directional Coupler:	#N/A			
Pre-Amp:	#N/A			Cable #1:	1484			
Filter:	#N/A			Cable #2:	1485			
Receiver:	1036			Cable #3:	1081			
Attenuator #1	1472			Cable #4:	#N/A			
Attenuator #2:	#N/A			Mixer:	#N/A			
Measurement Uncertainty: +/- 3.6 dB								
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Detector / Polarity
2.4835	57.7	28.2	3.1	22.6	66.4	74	54	Peak - / Vertical
2.4835	36.0	28.2	3.1	22.6	44.7	74	54	Average - / Vertical
2.4835	56.1	28.2	3.1	22.6	64.8	74	54	Peak - / Horizontal
2.4835	34.5	28.2	3.1	22.6	43.2	74	54	Average - NF / Horizontal
Notes:	The spectrum was searched from 30mhz toto 25 GHz							


EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

Navini (SCDMA)

<u>Radiated Emissions Upper band edge</u>								
Page <u>1</u> of <u>1</u>								
Job No.:	5L0390R			Date:	9/2/2005			
Specification:	15.247			Temperature(°C):	21			
Tested By:	Kevin Rose		Relative Humidity(%):	42				
E.U.T.:	2.4 cpe omni							
Configuration:	TX							
Sample Number:	1							
Location:	AC 3			RBW:	1 MHz			
Detector Type:	Peak			VBW:	1 MHz			
<u>Test Equipment Used</u>								
Antenna:	993			Directional Coupler:	#N/A			
Pre-Amp:	#N/A			Cable #1:	1484			
Filter:	#N/A			Cable #2:	1485			
Receiver:	1036			Cable #3:	1081			
Attenuator #1	1472			Cable #4:	#N/A			
Attenuator #2:	#N/A			Mixer:	#N/A			
Measurement Uncertainty:	+/- 3.6 dB							
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Detector / Polarity
2.4835	57.8	28.2	3.1	22.6	66.5	74	54	Peak - / Vertical
2.4835	36.3	28.2	3.1	22.6	45.0	74	54	Average - / Vertical
2.4835	54.8	28.2	3.1	22.6	63.5	74	54	Peak - / Horizontal
2.4835	38.9	28.2	3.1	22.6	47.6	74	54	Average - NF / Horizontal
Notes:	The spectrum was searched from 30MHz to 25 GHz							

Navini (SCDMA)

		<b>Dallas Headquarters:</b> 802 N. Kealy Lewisville, TX 75057 Tel: (972) 436-9600 Fax: (972) 436-2667						
<b>Nemko Dallas, Inc.</b>								
<b>Radiated Emissions</b>								
Page 1 of 1	Job No.: 5L0390R		Date: 9/6/2005					
Specification: 15.247	Temperature(°C): 23							
Tested By: Kevin Rose	Relative Humidity(%) 45							
E.U.T.: 2.4 CPE OMNI ANTENNA								
Configuration: MAX TX								
Sample Number: 1								
Location: AC 3	RBW: 1 MHz							
Detector Type: Peak	VBW: 1 MHz							
<b>Test Equipment Used</b>								
Antenna: 993	Directional Coupler: #N/A							
Pre-Amp: 1016	Cable #1: 1484							
Filter: 1482	Cable #2: 1485							
Receiver: 1464	Cable #3: #N/A							
Attenuator #1: #N/A	Cable #4: #N/A							
Attenuator #2: #N/A	Mixer: #N/A							
Additional equipment used: _____								
Measurement Uncertainty: +/- .7 dB								
Frequency (GHz)	Meter Reading (dBUV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBUV/m)	Limit (dBUV/m)	Delta (dB)	Comment
4.812	54.83	33.8	4.4	32.6	60.43	74	-13.6	V
4.812	35.17	33.8	4.4	32.6	40.77	54	-13.2	V
7.218	52.83	35.9	5.9	32.6	62.0	74	-12.0	V
7.218	32.8	35.9	5.9	32.6	42.0	54	-12.0	V
4.812	45.9	33.8	4.4	32.6	51.5	74	-22.5	H
4.812	30.6	33.8	4.4	32.6	36.2	54	-17.8	H
7.218	48.5	35.9	5.9	32.6	57.7	74	-16.3	H
7.218	29.3	35.9	5.9	32.6	38.5	54	-15.5	H
1.297	48.17	32.1	1.9	22.3	59.9	74	-14.1	V
1.297	36.56	32.1	1.9	22.3	48.3	54	-5.7	V
4.88	55.3	33.8	4.4	32.6	60.9	74	-13.1	V
4.88	38.5	33.8	4.4	32.6	44.1	54	-9.9	V
7.32	50	35.9	5.9	32.6	59.2	74	-14.8	V
7.32	33	35.9	5.9	32.6	42.2	54	-11.8	V
4.88	52.6	33.8	4.4	32.6	58.2	74	-15.8	H
4.88	36.3	33.8	4.4	32.6	41.9	54	-12.1	H
7.32	48	35.9	5.9	32.6	57.2	74	-16.8	H
7.32	31.3	35.9	5.9	32.6	40.5	54	-13.5	H
4.95	42.3	33.8	4.4	32.6	47.9	74	-26.1	V
4.95	24.3	33.8	4.4	32.6	29.9	54	-24.1	V
7.44	38.67	35.9	5.9	32.6	47.9	74	-26.1	V
7.44	26.3	35.9	5.9	32.6	35.5	54	-18.5	V
4.95	41.6	33.8	4.4	32.6	47.2	74	-26.8	H
4.95	22.3	33.8	4.4	32.6	27.9	54	-26.1	H

EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

Navini (SCDMA)

Radiated Emissions								
Page 1 of 1								
Job No.:	5L0390R			Date:	8/26/2005			
Specification:	15.247			Temperature(°C):	23			
Tested By:	Kevin Rose			Relative Humidity(%):	45			
E.U.T.:	2.4 CPE PATCH ANTENNA							
Configuration:	MAX TX							
Sample Number:	1							
Location:	AC 3			RBW:	1 MHz			
Detector Type:	Peak			VBW:	1 MHz			
<b>Test Equipment Used</b>								
Antenna:	993			Directional Coupler:	#N/A			
Pre-Amp:	1016			Cable #1:	1484			
Filter:	1482			Cable #2:	1485			
Receiver:	1464			Cable #3:	#N/A			
Attenuator #1:	#N/A			Cable #4:	#N/A			
Attenuator #2:	#N/A			Mixer:	#N/A			
Additional equipment used:								
Measurement Uncertainty:	+/- .7 dB							
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
4.812	40.2	33.8	4.4	32.6	45.8	74	-28.2	V
4.812	24.5	33.8	4.4	32.6	30.1	54	-23.9	V
7.218	43.5	35.9	5.9	32.6	52.7	74	-21.3	V
7.218	26.3	35.9	5.9	32.6	35.5	54	-18.5	V
4.812	41.2	33.8	4.4	32.6	46.8	74	-27.2	H
4.812	26.3	33.8	4.4	32.6	31.9	54	-22.1	H
7.218	41.6	35.9	5.9	32.6	50.8	74	-23.2	H
7.218	25.3	35.9	5.9	32.6	34.5	54	-19.5	H
4.88	45.5	33.8	4.4	32.6	51.1	74	-22.9	V
4.88	24.5	33.8	4.4	32.6	30.1	54	-23.9	V
7.32	42.6	35.9	5.9	32.6	51.8	74	-22.2	V
7.32	24.6	35.9	5.9	32.6	33.8	54	-20.2	V
4.88	44.5	33.8	4.4	32.6	50.1	74	-23.9	H
4.88	25.8	33.8	4.4	32.6	31.4	54	-22.6	H
7.32	43.1	35.9	5.9	32.6	52.3	74	-21.7	H
7.32	21.9	35.9	5.9	32.6	31.1	54	-22.9	H
4.95	42.3	33.8	4.4	32.6	47.9	74	-26.1	V
4.95	24.3	33.8	4.4	32.6	29.9	54	-24.1	V
7.44	38.67	35.9	5.9	32.6	47.9	74	-26.1	V
7.44	26.3	35.9	5.9	32.6	35.5	54	-18.5	V
4.95	40.9	33.8	4.4	32.6	46.5	74	-27.5	H
4.95	25.1	33.8	4.4	32.6	30.7	54	-23.3	H
7.44	43.9	35.9	5.9	32.6	53.1	74	-20.9	H
7.44	25.1	35.9	5.9	32.6	34.3	54	-19.7	H
Notes:								

EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

Navini (802.16e)

Radiated Emissions								
Page 1 of 1								
Job No.:	5L0390R	Date:		9/6/2005				
Specification:	15.247	Temperature(°C):		23				
Tested By:	Kevin Rose	Relative Humidity(%)		45				
E.U.T.:	2.4 CPE OMNI ANTENNA WIMAX MODE							
Configuration:	MAX TX							
Sample Number:	1							
Location:	AC 3	RBW:		1 MHz				
Detector Type:	Peak	VBW:		1 MHz				
Test Equipment Used								
Antenna:	993	Directional Coupler:		#N/A				
Pre-Amp:	1016	Cable #1:		1484				
Filter:	1482	Cable #2:		1485				
Receiver:	1464	Cable #3:		#N/A				
Attenuator #1:	#N/A	Cable #4:		#N/A				
Attenuator #2:	#N/A	Mixer:		#N/A				
Measurement Uncertainty:	+/- .7 dB							
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
2.4835	54.2	28.2	3.1	22.6	62.9	74	-11.1	Peak - / Vertical
2.4835	32.6	28.2	3.1	22.6	41.3	54	-12.7	Average - / Vertical
2.4835	53.9	28.2	3.1	22.6	62.6	74	-11.4	Peak - / Horizontal
2.4835	31.6	28.2	3.1	22.6	40.3	54	-13.7	Average - / Horizontal
4.812	53.6	33.8	4.4	32.6	59.2	74	-14.8	V
4.812	35.9	33.8	4.4	32.6	41.5	54	-12.5	V
7.218	51.9	35.9	5.9	32.6	61.1	74	-12.9	V
7.218	32.7	35.9	5.9	32.6	41.9	54	-12.1	V
4.812	44.2	33.8	4.4	32.6	49.8	74	-24.2	H
4.812	29.6	33.8	4.4	32.6	35.2	54	-18.8	H
7.218	47.8	35.9	5.9	32.6	57.0	74	-17.0	H
7.218	30	35.9	5.9	32.6	39.2	54	-14.8	H
1.297	48.9	32.1	1.9	22.3	60.6	74	-13.4	V
1.297	35.2	32.1	1.9	22.3	46.9	54	-7.1	V
4.88	54	33.8	4.4	32.6	59.6	74	-14.4	V
4.88	38.2	33.8	4.4	32.6	43.8	54	-10.2	V
7.32	49.8	35.9	5.9	32.6	59.0	74	-15.0	V
7.32	32	35.9	5.9	32.6	41.2	54	-12.8	V
4.88	52.8	33.8	4.4	32.6	58.4	74	-15.6	H
4.88	36.2	33.8	4.4	32.6	41.8	54	-12.2	H
7.32	47.9	35.9	5.9	32.6	57.1	74	-16.9	H
7.32	30	35.9	5.9	32.6	39.2	54	-14.8	H
4.95	41.9	33.8	4.4	32.6	47.5	74	-26.5	V
4.95	25	33.8	4.4	32.6	30.6	54	-23.4	V
7.44	37.4	35.9	5.9	32.6	46.6	74	-27.4	V
7.44	25.6	35.9	5.9	32.6	34.8	54	-19.2	V
4.95	40.9	33.8	4.4	32.6	46.5	74	-27.5	H
4.95	21.9	33.8	4.4	32.6	27.5	54	-26.5	H
7.44	35.6	35.9	5.9	32.6	44.8	74	-29.2	H
7.44	25	35.9	5.9	32.6	34.2	54	-19.8	H

EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

Navini (802.16e)

Radiated Emissions								
Page 1 of	1							
Job No.:	5L0390R			Date:	8/26/2005			
Specification:	15.247			Temperature(°)	23			
Tested By:	Kevin Rose			Relative Humidi	45			
E.U.T.:	2.4 CPE PATCH ANTENNA WIMAX							
Configuration:	MAX TX							
Sample Number:	1							
Location:	AC 3			RBW:	1 MHz			
Detector Type:	Peak			VBW:	1 MHz			
Test Equipment Used								
Antenna:	993			Directional Coup	#N/A			
Pre-Amp:	1016			Cable #1:	1484			
Filter:	1482			Cable #2:	1485			
Receiver:	1464			Cable #3:	#N/A			
Attenuator #1	#N/A			Cable #4:	#N/A			
Attenuator #2:	#N/A			Mixer:	#N/A			
Measurement Uncertainty:	+/- .7 dB							
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
2.4835	54.2	28.2	3.1	22.6	62.9	74	54	Peak - / Vertical
2.4835	33.0	28.2	3.1	22.6	41.7	74	54	Average - / Vertical
2.4835	53.2	28.2	3.1	22.6	61.9	74	54	Peak - / Horizontal
2.4835	32.9	28.2	3.1	22.6	41.6	74	54	Average - / Horizontal
4.812	23.9	33.8	4.4	32.6	29.5	54	-24.5	V
7.218	42.9	35.9	5.9	32.6	52.1	74	-21.9	V
7.218	25.2	35.9	5.9	32.6	34.4	54	-19.6	V
4.812	39.8	33.8	4.4	32.6	45.4	74	-28.6	H
4.812	25.6	33.8	4.4	32.6	31.2	54	-22.8	H
7.218	40.9	35.9	5.9	32.6	50.1	74	-23.9	H
7.218	24.6	35.9	5.9	32.6	33.8	54	-20.2	H
4.88	44.9	33.8	4.4	32.6	50.5	74	-23.5	V
4.88	23.5	33.8	4.4	32.6	29.1	54	-24.9	V
7.32	42.3	35.9	5.9	32.6	51.5	74	-22.5	V
7.32	23.6	35.9	5.9	32.6	32.8	54	-21.2	V
4.88	44.6	33.8	4.4	32.6	50.2	74	-23.8	H
4.88	24.6	33.8	4.4	32.6	30.2	54	-23.8	H
7.32	43	35.9	5.9	32.6	52.2	74	-21.8	H
7.32	22	35.9	5.9	32.6	31.2	54	-22.8	H
4.95	42.7	33.8	4.4	32.6	48.3	74	-25.7	V
4.95	23.7	33.8	4.4	32.6	29.3	54	-24.7	V
7.44	37.2	35.9	5.9	32.6	46.4	74	-27.6	V
7.44	26.3	35.9	5.9	32.6	35.5	54	-18.5	V
4.95	41.2	33.8	4.4	32.6	46.8	74	-27.2	H
4.95	24.9	33.8	4.4	32.6	30.5	54	-23.5	H
7.44	44	35.9	5.9	32.6	53.2	74	-20.8	H
7.44	26	35.9	5.9	32.6	35.2	54	-18.8	H

**Radiated Photographs**





## Section 8. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: Kevin Rose	DATE: 9/02/2005

**Test Results:** Complies.

**Measurement Data:** See attached plots.

**Equipment Used:** 1036 1472 1055 1629 1081, 1561, 1562

**Measurement Uncertainty:** +/- 1.7 dB

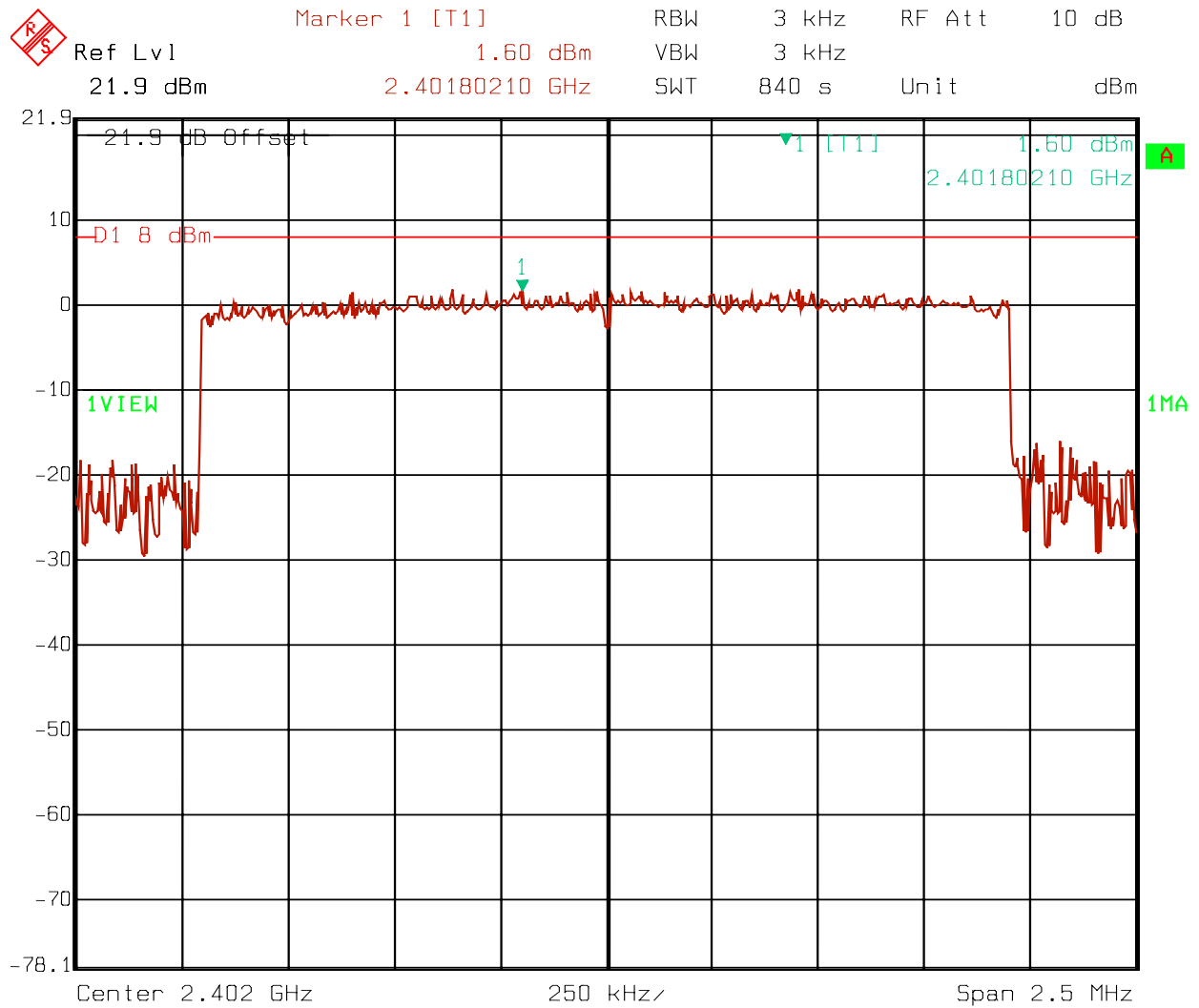
**Temperature:** 22°C

**Relative Humidity:** 49%

EQUIPMENT: 2400 – 2483 LMX E

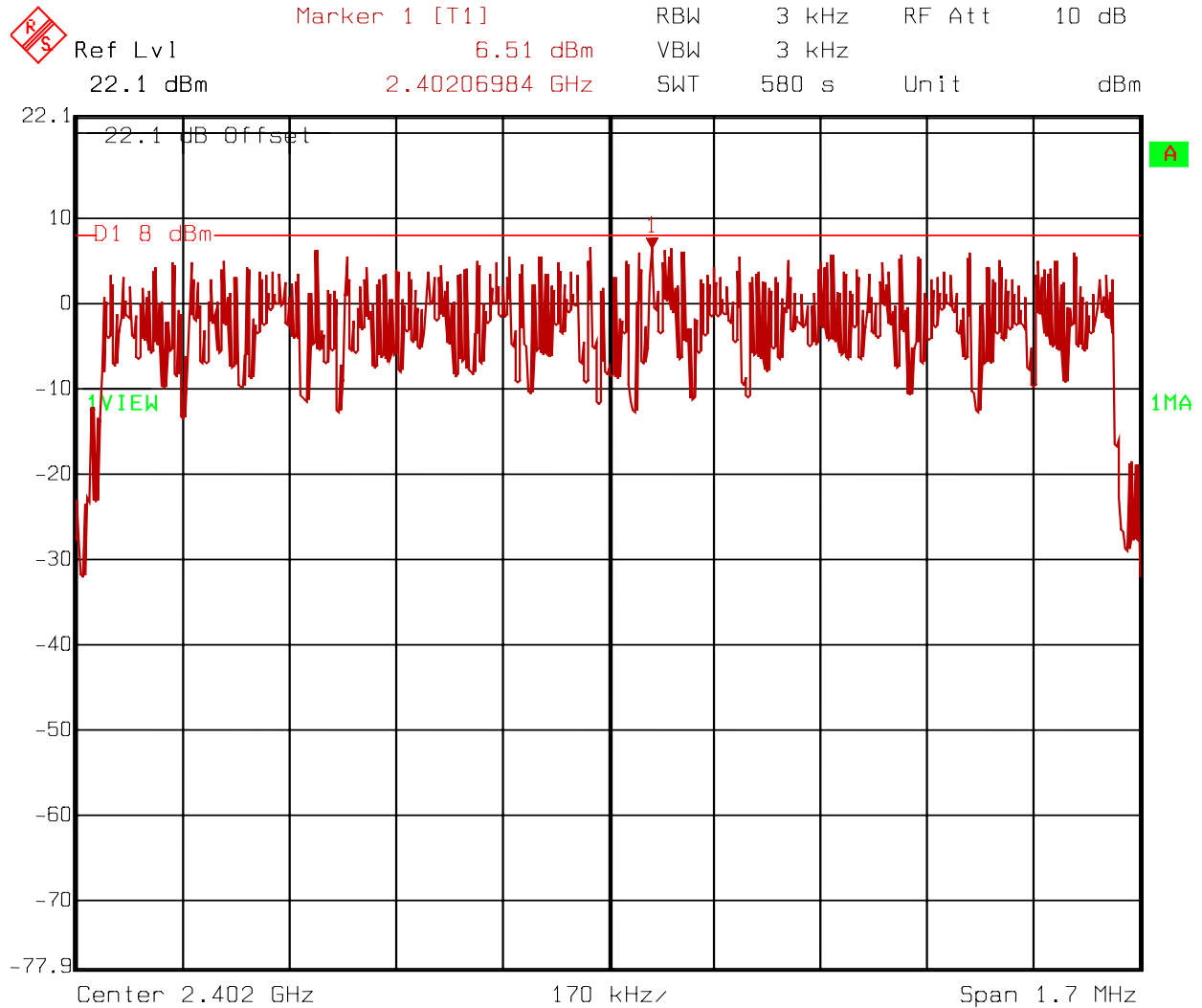
PROJECT NO.: 5L0390RUS1

LOW CHANNEL Navini (SCDMA)



Date: 02.SEP.2005 10:14:35

LOW CHANNEL Navini (802.16e)

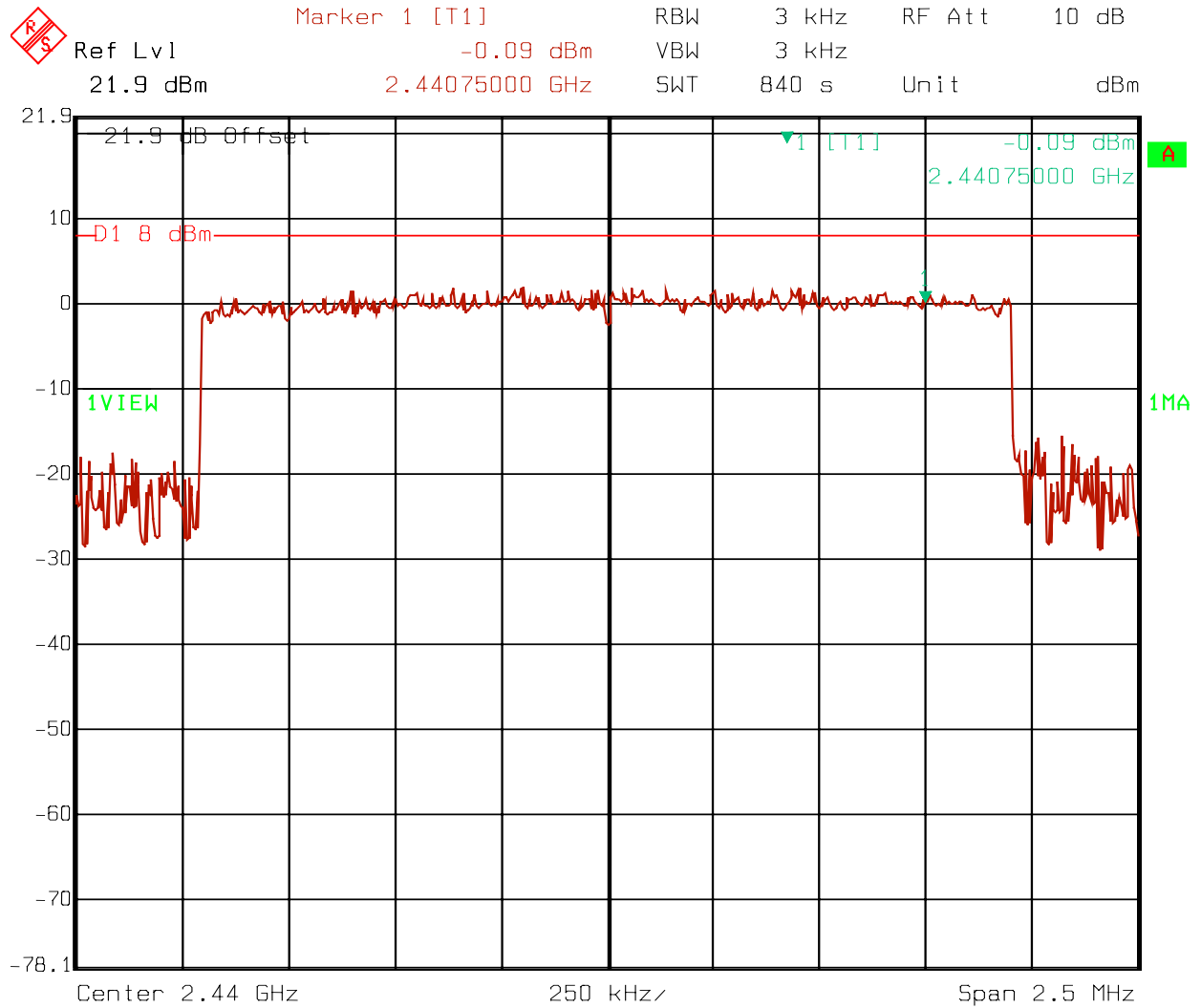


Date: 13.SEP.2005 10:57:18

EQUIPMENT: 2400 – 2483 LMX E

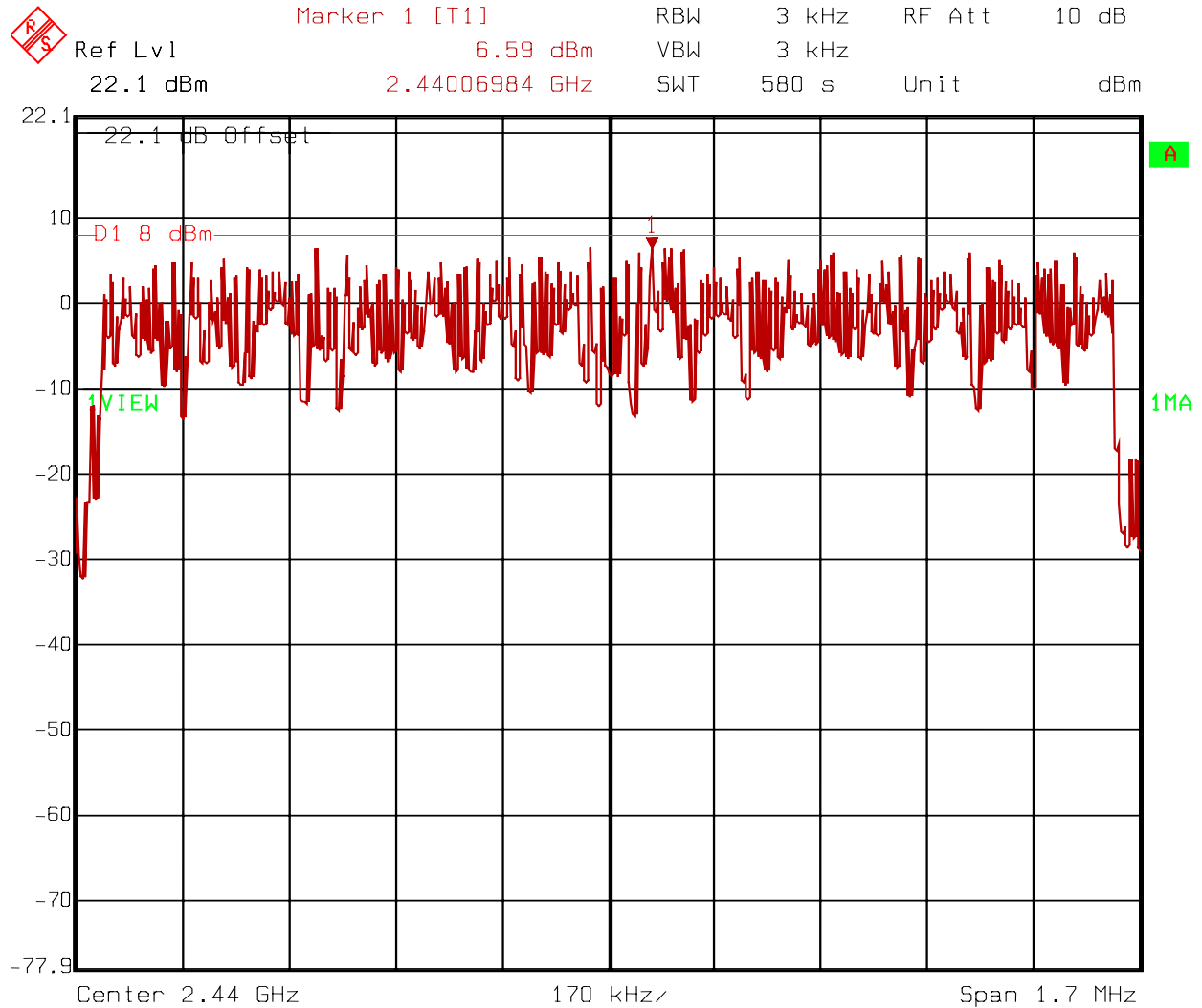
PROJECT NO.: 5L0390RUS1

MID CHANNEL Navini (SCDMA)



Date: 02.SEP.2005 10:34:38

MID CHANNEL Navini (802.16e)

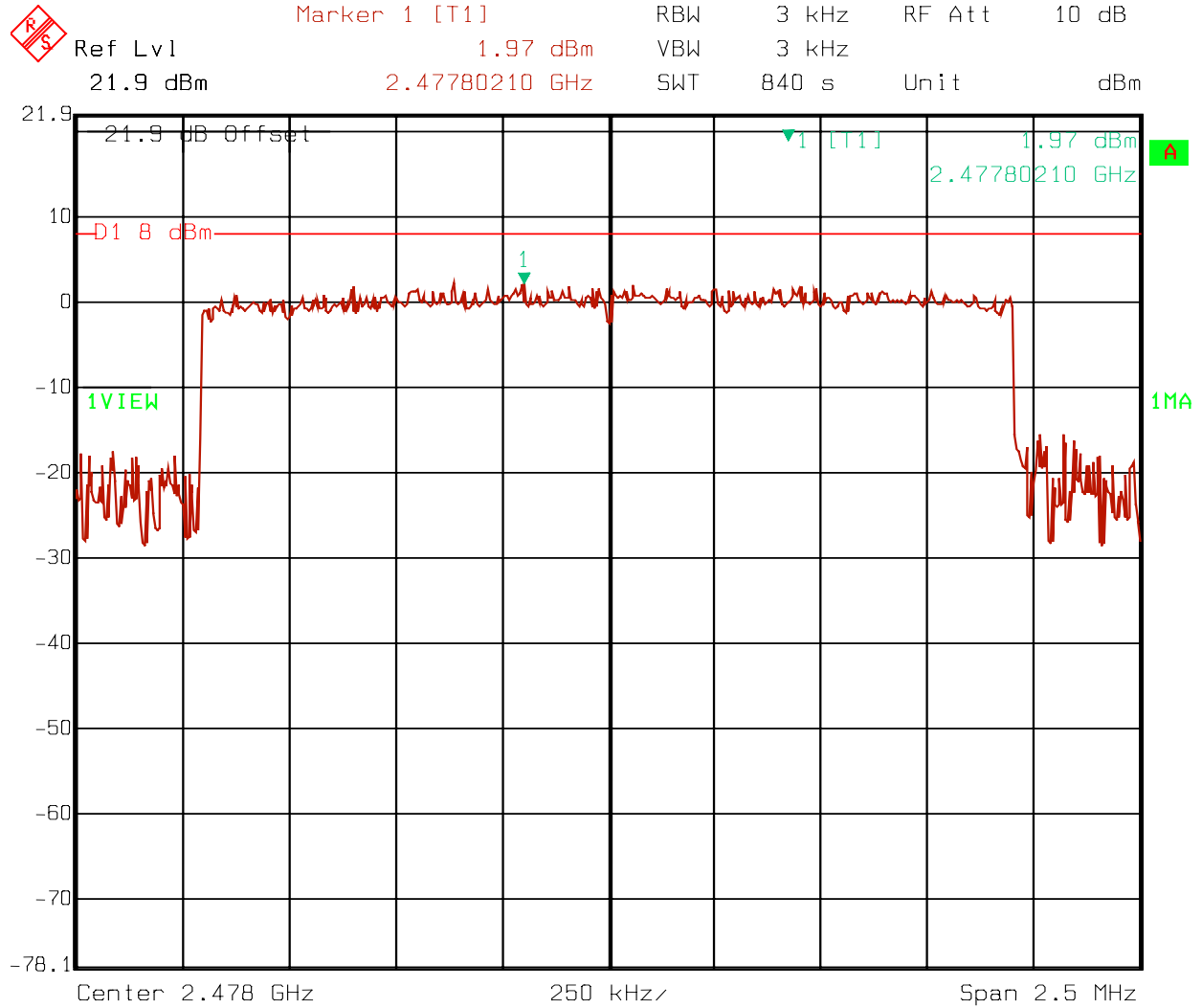


Date: 13.SEP.2005 11:11:30

EQUIPMENT: 2400 – 2483 LMX E

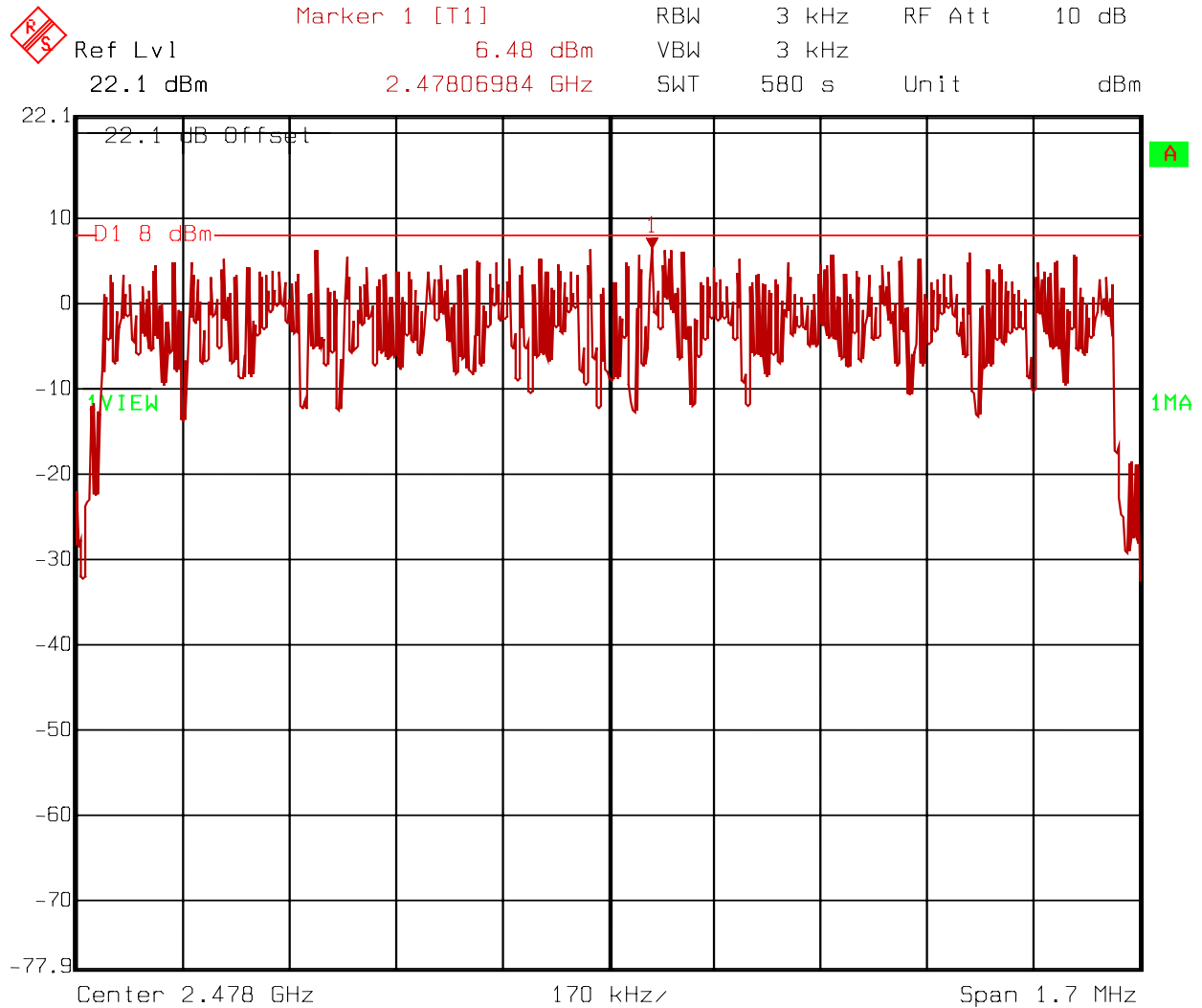
PROJECT NO.: 5L0390RUS1

HIGH CHANNEL Navini (SCDMA)



Date: 02.SEP.2005 12:22:12

HIGH CHANNEL WIMAX MODE



Date: 13.SEP.2005 13:04:54

**Section 9. Test Equipment List**

Nemko ID	Description	Manufacturer		Serial Number	Calibration Date	Calibration Due
		Model Number				
1484	Cable 2.0-18.0 Ghz	Storm		N/A	08/26/04	02/26/06
		PR90-010-072				
1485	Cable 2.0-18.0 Ghz	Storm		N/A	08/02/04	02/26/06
		PR90-010-216				
993	Horn antenna	A.H. Systems		XXX	08/01/05	08/01/07
		SAS-200/571				
1480	Bilog Antenna	Schaffner-Chase		2572	CalNotReq	N/A
		CBL6111C				
1081	CABLE 2m	Astrolab		N/A	CBU	NA
		32027-2-29094-72TC				
1472	20db Attenuator DC 18 Ghz	Omni Spectra		NONE	CBU	N/A
		20600-20db				
1055	DUAL DIRECTIONAL COUPLER	NARDA		73393	Cal Not Req	N/A
		3022				
1471	10 db Attenuator DC 18 Ghz	MCL Inc.		NONE	CBU	N/A
		BW-S10W2 10db-2WDC				
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ		830844/006	03/22/04	03/23/06
		FSEK30				
1464	Spectrum analyzer	Hewlett Packard		3551A04428	01/14/05	01/15/07
		8563E				
966	Receiver	Rohde & Schwartz		880370/029	09/20/04	09/20/05
		ESH2				
718	HP SPECTRUM ANALYZER	HEWLETT PACKARD		3639A00980	04/06/05	04/06/06
		8591EM				
1258	LISN .15mhz-30mhz	EMCO		1305	09/17/04	09/17/05
		#REF!				
1433	High pass filter	Solar		933142	09/07/05	09/07/06
		7930-5.0				
674	LIMITER	HP		3107A02200	01/29/05	01/29/06
		11947A				
1079	CABLE, 1m	KTL		N/A	04/28/05	04/28/06
		RG223				
2076	Cable	Nemko		None	04/28/06	04/28/06
		None				
1561	Attenuator 10db	Midwest Microwave		NONE	CBU	N/A
		392-10				
1562	Attenuator 10db	Midwest Microwave		NONE	CBU	N/A
		392-11				



## **ANNEX A - TEST DETAILS**

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
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**Purpose:**

The test is intended to demonstrate the compliance of the Equipment Under Test (E.U.T.) to the limits for conducted disturbance as defined by CFR 47, Part 15, Subpart B, Class B, Paragraph Number 15.107.

**Specification Limits:**

Limits for conducted disturbance at the mains ports

Frequency Range (MHz)	Quasi-peak Limits (dBuV)	Average Limits (dBuV)
0.15 to 0.50	66-56	56-46
0.50 to 5.00	56	46
5.00-30.0	60	50
The limit decreases with the logarithm of the frequency in the range 0.15MHz to 0.5 MHz		

**Method of Measurement (Procedure ANSI C63.4-2003):**

Measurements were made using a spectrum analyzer with 10 kHz RBW, Peak detector. Any emissions that are close to the limit are measured using a test receiver with 9 or 10 kHz bandwidth, CISPR Quasi-Peak detector.

**Nemko USA, Inc.**

FCC PART 15, SUBPART C  
DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT:* 2400 – 2483 LMX E

PROJECT NO.: [5L0390RUS1](#)

NAME OF TEST: Minimum 6 dB bandwidth	PARA. NO.: 15.247(a)(2)
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**Minimum Standard:** The minimum 6 dB bandwidth shall be at least 500 kHz

EQUIPMENT: 2400 – 2483 LMX EPROJECT NO.: 5L0390RUS1

NAME OF TEST: Maximum Peak Output Power

PARA. NO.: 15.247(b)(1)

**Minimum Standard:**

The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

**Direct Measurement Method For Detachable Antennas:**

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50-ohm load. The dBi gain of the antenna(s) employed shall be reported.

**Calculation Of EIRP For 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

The RBW of the spectrum analyzer shall be set to a value greater than the measured 6 dB occupied bandwidth of the E.U.T.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

**Nemko USA, Inc.**

FCC PART 15, SUBPART C  
DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT:* 2400 – 2483 LMX E

PROJECT NO.: [5L0390RUS1](#)

NAME OF TEST: RF Exposure

PARA. NO.: 15.247(b)(4)

**Minimum Standard:**

Systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines stipulated in 1.1307(b)(1) of CFR 47.

NAME OF TEST: Spurious Emissions(conducted)	PARA. NO.: 15.247(c)
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**Minimum Standard:** In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength ( $\mu\text{V/m}$ @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

**THE SPECTRUM IS SEARCHED TO THE 10th HARMONIC OF THE HIGHEST FREQUENCY GENERATED IN THE EUT.**

**Method Of Measurement:**

30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Lower Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at bandedge.

Sweep: Auto

Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz

Marker: Peak of fundamental emission

Marker  $\Delta$ : Peak of highest spurious level below center frequency.

Upper Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz

Marker: Peak of fundamental emission

Marker  $\Delta$ : Peak of highest spurious level above center frequency.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: 2400 – 2483 LMX E

PROJECT NO.: 5L0390RUS1

NAME OF TEST: Radiated Spurious Emissions

PARA. NO.: 15.247(c)

**Minimum Standard:** In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

**Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:**

Frequency (MHz)	Field Strength (µV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

*THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC*

**15.205 Restricted Bands**

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom



NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
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**Minimum Standard:** The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

**Method Of Measurement:** The spectrum analyzer is set as follows:

- RBW: 3 kHz
- VBW: >3 kHz
- Span: => measured 6 dB bandwidth
- Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.
- LOG dB/div.: 2 dB

**Note:** For devices with spectrum line spacing =< 3 kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

**For Devices With Integral Antenna:**

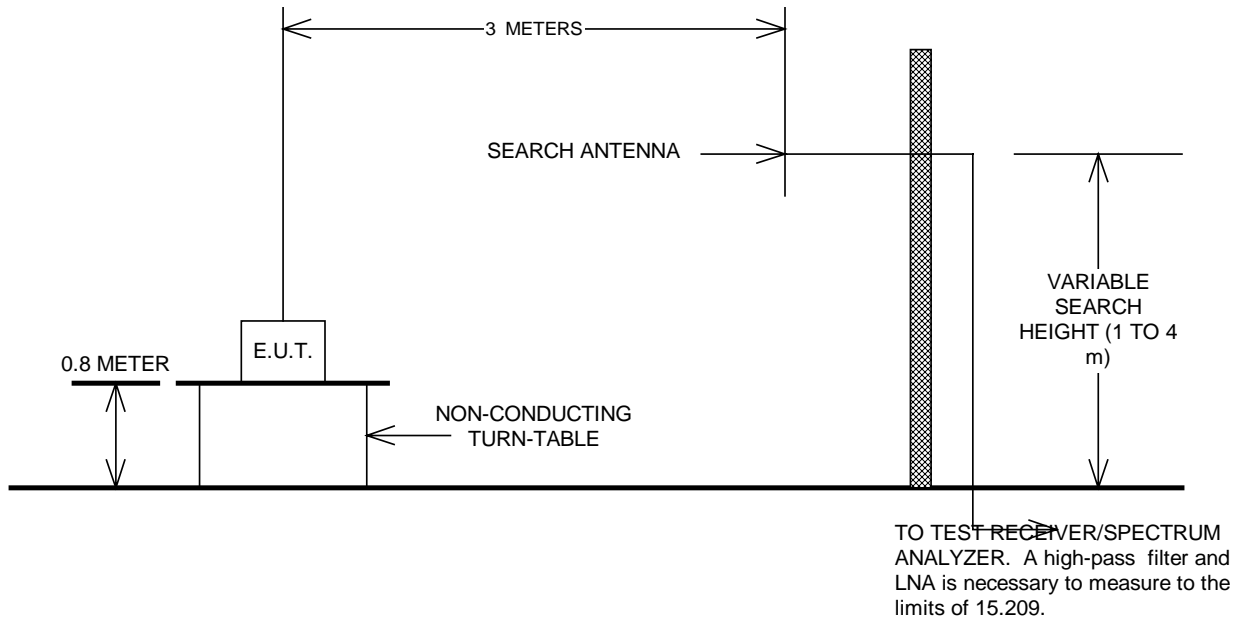
For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent isotropic radiated power using the same method as described for Peak Power output.

Number of channels tested:

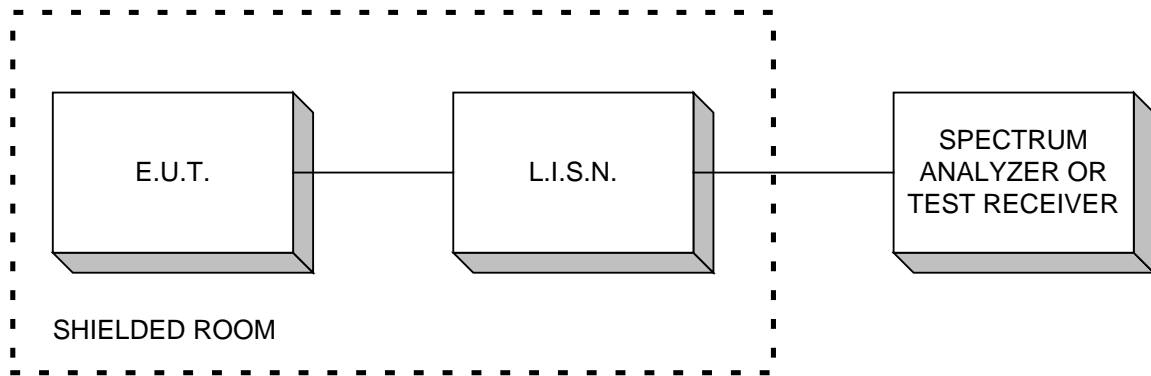
Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

## **ANNEX B - TEST DIAGRAMS**

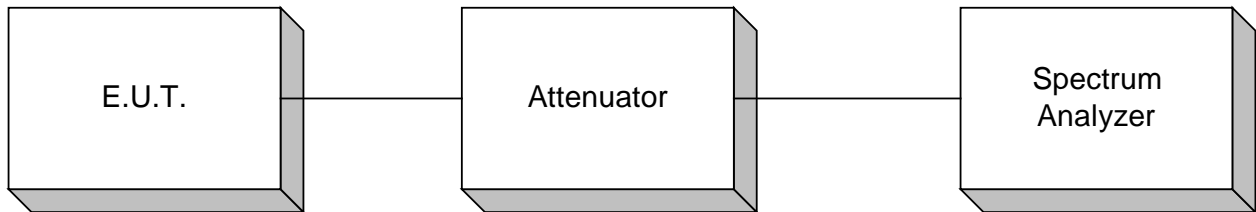
**Test Site For Radiated Emissions**



**Conducted Emissions**



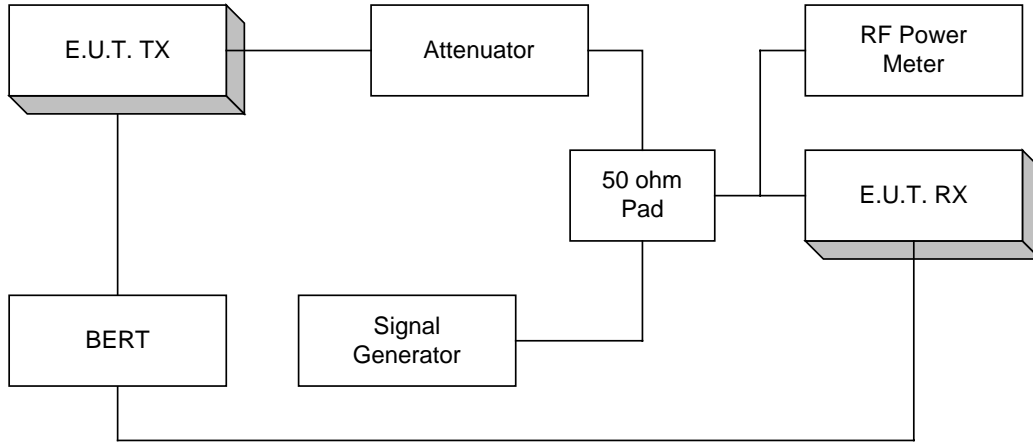
**Peak Power At Antenna Terminals**



**Minimum 6 dB Bandwidth  
Peak Power Spectral Density  
Spurious Emissions (conducted)**



**Processing Gain**



NOTE: This is a typical setup. The setup may vary slightly since many devices have BER test functions built into the device.