

Nemko Test Report: 3L0324RUS2REV1

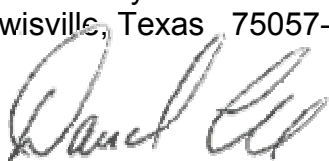
Applicant: Navini Networks

Equipment Under Test: Ripwave TTA Base Station
(E.U.T.)

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

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

Authorized By:

A handwritten signature in black ink, appearing to read "David Light", is positioned above the printed name of the authorized person.

David Light, Resource Manager

Date: 10/24/03

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Section 1. Summary of Test Results

Manufacturer: Navini Networks

Model No.: 2400-TTA-BTS
Omni Antenna: 2400-TTA-RFS-0

Serial No.: 00001

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, Paragraph 15.247 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992. 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.

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)	48 dB μ V	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:

General Equipment Information

User Frequency Adjustment:	Software controlled
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Theory of Operation

The EUT is part of a high speed wireless LAN system. Then transmitter uses Direct Sequence Spread Spectrum techniques.

The antenna for this product is mounted on a fixed outdoor structure. The antenna consists of multiple radiating elements fed by multiple transmitters. The antenna system uses beam-forming techniques to optimize the efficiency and coverage of the system.

The following points were agreed between the manufacturer and the FCC for the approval of this equipment under 15.247 rules.

1. The individual transmitters in the system will be subject to the technical requirements set forth in Section 15.247;
2. Section 15.31 will not apply;
3. The system will be considered "point to point" under Section 15.247(b)(3)(i) and (iii);
4. Total antenna gain per transmitter will be computed as the sum of (a) the actual gain of the antenna used, and (b) the beam-forming gain (18dBi) of the system determined by the formula $20\log_{10} N$, where N is the number of transmitters in the array; and
5. The peak output power for each transmitter will be reduced per Section 15.247(b)(3)(i) based on the total antenna gain, however, a "phase coherence loss" correction factor of 2dB for the 8 transmitter array will be subtracted from this reduction.

Example:

In accordance with the foregoing, the peak output power of each transmitter in the Navini beam-forming array will be reduced as follows for the 12 dBi antenna system:

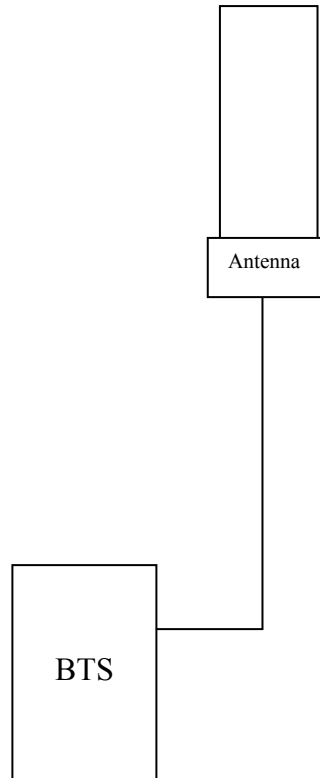
Total antenna gain(12 + 18)	30dB
Free gain per 15.247(b)(3)	- 6dB
Gain subject to power reduction	24dB

Power reduction per 15.247(b)(3)(i)	8dB
Correction for coherence loss	-2dB

Total reduction in transmitter power 6dB

This agreement is summarized in correspondence submitted with the application for equipment approval.

System Diagram



Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Dana Tassler	DATE: 9/30/03

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 1.7 dB

[illegible]

Test Data – Powerline Conducted Emissions

Conducted Emissions Powerline Voltage Measurement												
Complete	<u>X</u>		Job # : <u>3L0324</u>		Test # : <u>CEPV-01</u>							
Preliminary			Page <u>2</u>		of <u>2</u>							
Client Name :	<u>Navini Networks</u>											
EUT Name :	<u>Ripwave TTA Base Station</u>											
EUT Model # :	<u>2400-TTA-BTS</u>											
EUT Part # :												
EUT Serial # :	<u>00001</u>											
EUT Config. :												
Specification :	<u>FCC 15.207</u>					Reference : <u></u>						

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.			
0.6573	N	P	A	40.3	0.0	0.0	40.3	46.0	56.0	-15.7	Pass	

Date: 09/30/2003 Time: 16:42:25 WO#: 3L0324E
FCC Class B Average Limit Test Lead: White Sequence#: 2
FCC Class B Conducted Emissions, 2.4 GHz TTA BTS

dBuV/m

Frequency [MHz]

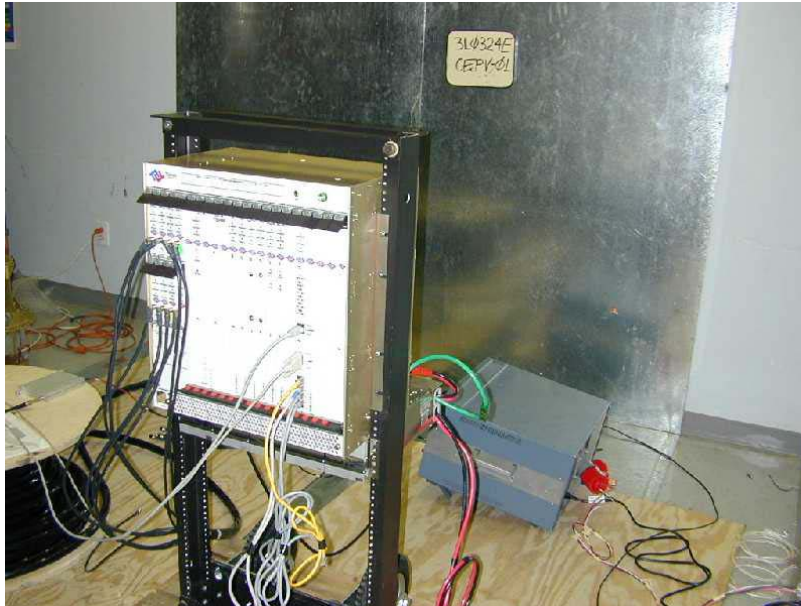
— Sweep Data
— 1 - FCC Class B Quasi-Peak Limit
— 2 - FCC Class B Average Limit

1
2

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Photos – Powerline Conducted Emissions

Front



Side



Section 4. Minimum 6 dB Bandwidth

NAME OF TEST: Minimum 6 dB Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Dustin Oaks	DATE: 09/29/03

Test Results: Complies.

Measurement Data: See 6 dB BW plot
Measured 6 dB bandwidth: 4.989MHz
Channel Separation: 250kHz

Equipment Used: 1629, 1478, 1467, 1036

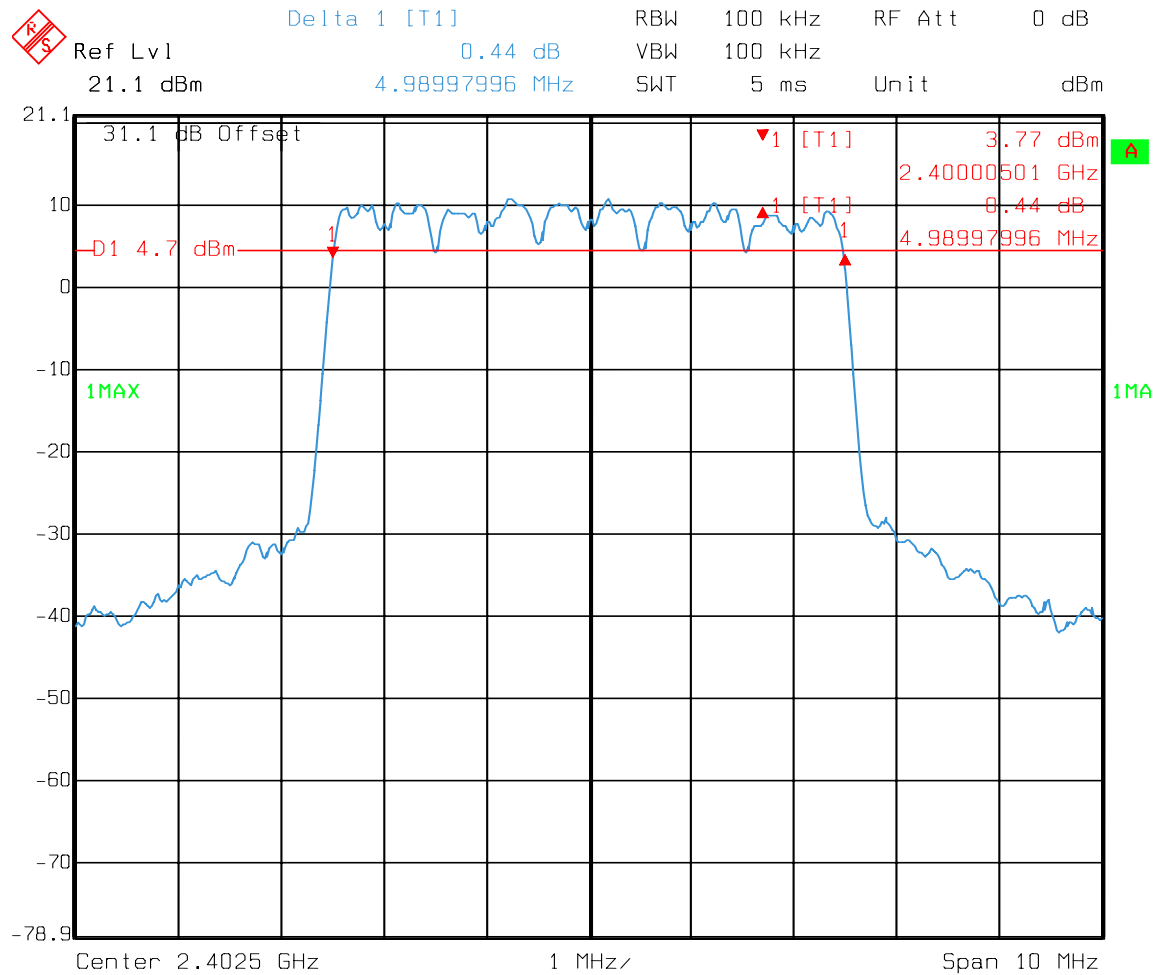
Measurement Uncertainty: +/- 0.7 dB

Temperature: 21 °C

Relative Humidity: 60 %

EQUIPMENT: Ripwave TTA Base Station

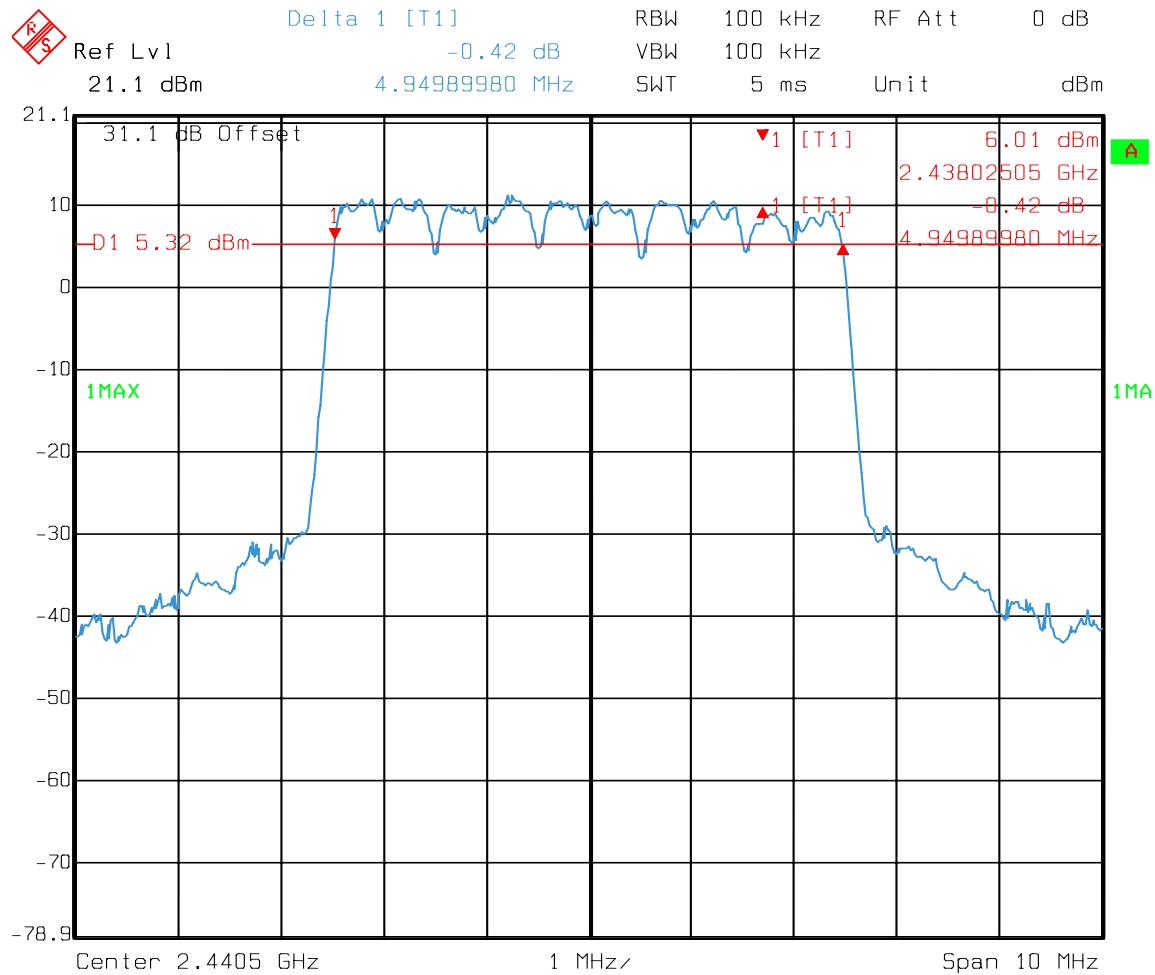
REPORT NO.: 3L0324RUS2



Date: 29.SEP.2003 09:51:57

EQUIPMENT: Ripwave TTA Base Station

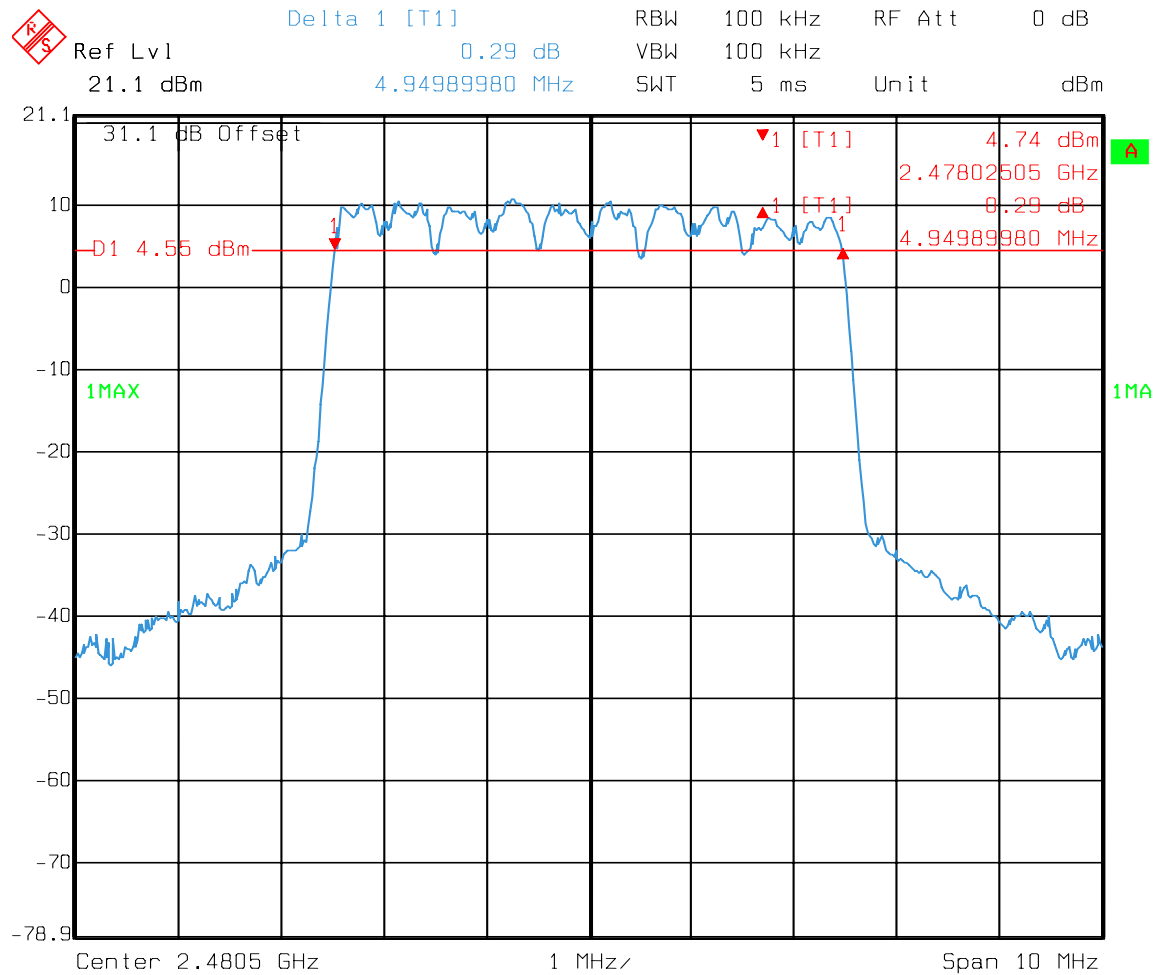
REPORT NO.: 3L0324RUS2



Date: 29.SEP.2003 09:56:50

EQUIPMENT: Ripwave TTA Base Station

REPORT NO.: 3L0324RUS2



Date: 29.SEP.2003 09:59:18

Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: Dustin Oaks	DATE: 09/27/03

Test Results: Complies.

Measurement Data:

Antenna Model and Type	Measured Power(watts)			Antenna Gain (dBi)	EIRP (watts)		
	2402.5 MHz	2440.5 MHz	2480.5 MHz		2402.5 MHz	2440.5 MHz	2480.5 MHz
2400-TTA-RFS-0	0.22	0.22	0.233	12	3.48677	3.48677	3.69280

EIRP is derived from the $10^{[(10 \log(P) + G) / 10]}$

where: P = Power at antenna terminal(W) and G = EUT antenna gain(dBi)

Equipment Used: 1625, 1604, 1036

Measurement Uncertainty: +/- 0.7 dB

Temperature: 21 °C

Relative Humidity: 60 %

Section 6. Spurious Emissions (conducted)

NAME OF TEST: Spurious Emissions (conducted)	PARA. NO.: 15.247(c)
TESTED BY: Dustin Oaks	DATE:09/29/03

Test Results: Complies.

Measurement Data: See attached plots.

Equipment Used: 1629, 1478, 1467, 1036

Measurement Uncertainty: +/- 0.7 dB

Temperature: 21 °C

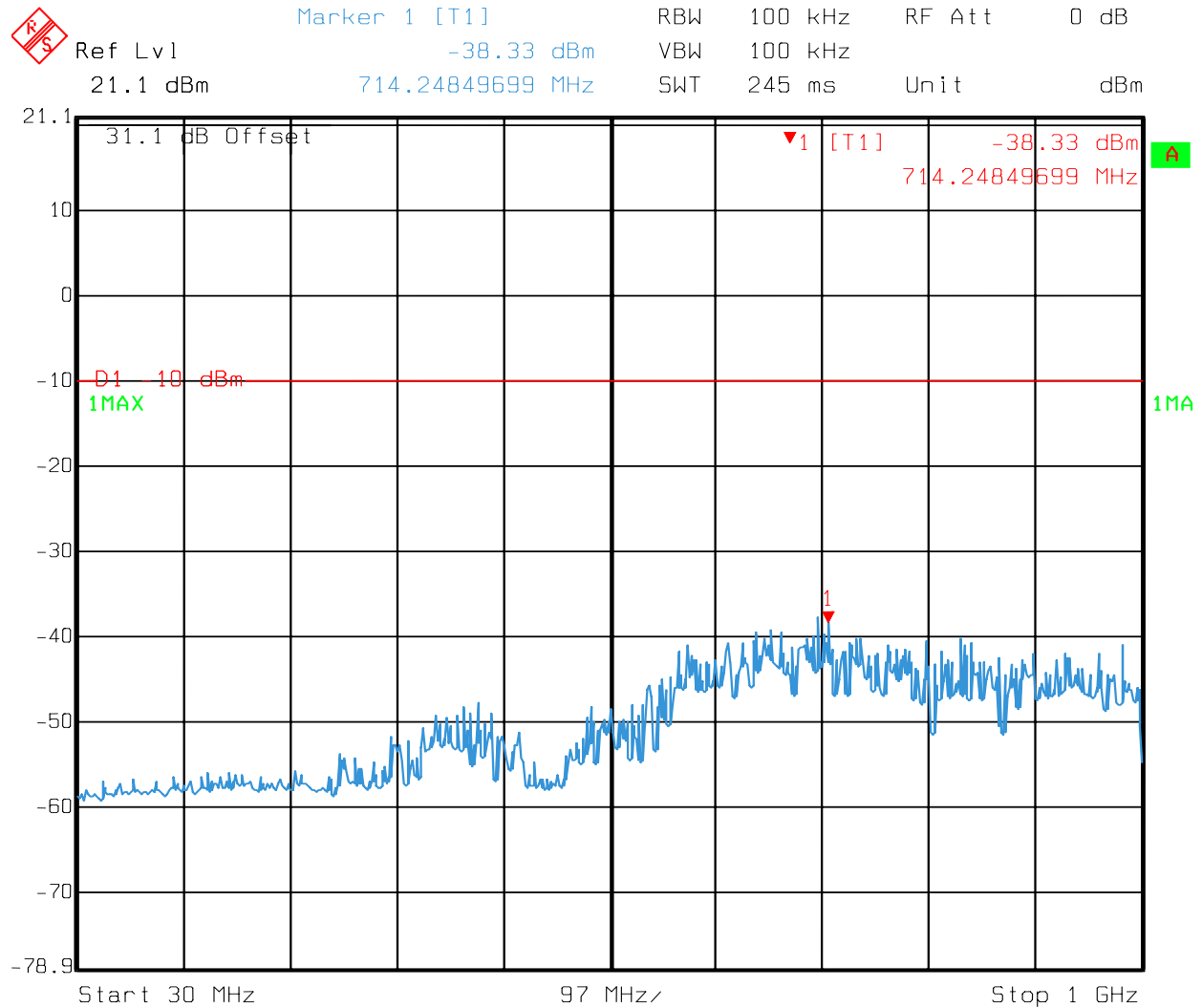
Relative Humidity: 60 %

Note:

Test was performed with transmitter power set for the Omni Antenna (highest setting).

EQUIPMENT: Ripwave TTA Base Station

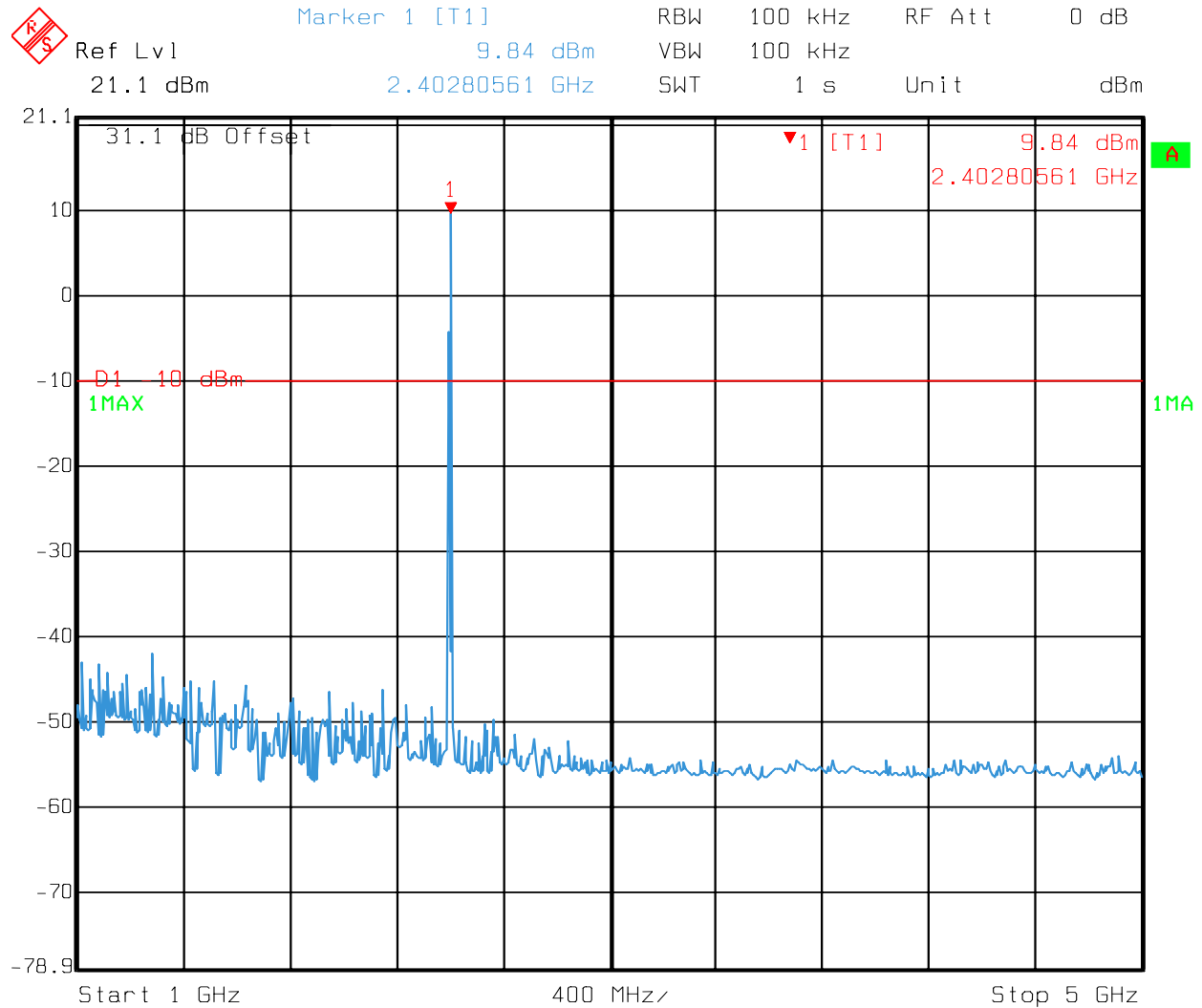
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Date: 29.SEP.2003 11:17:45

EQUIPMENT: Ripwave TTA Base Station

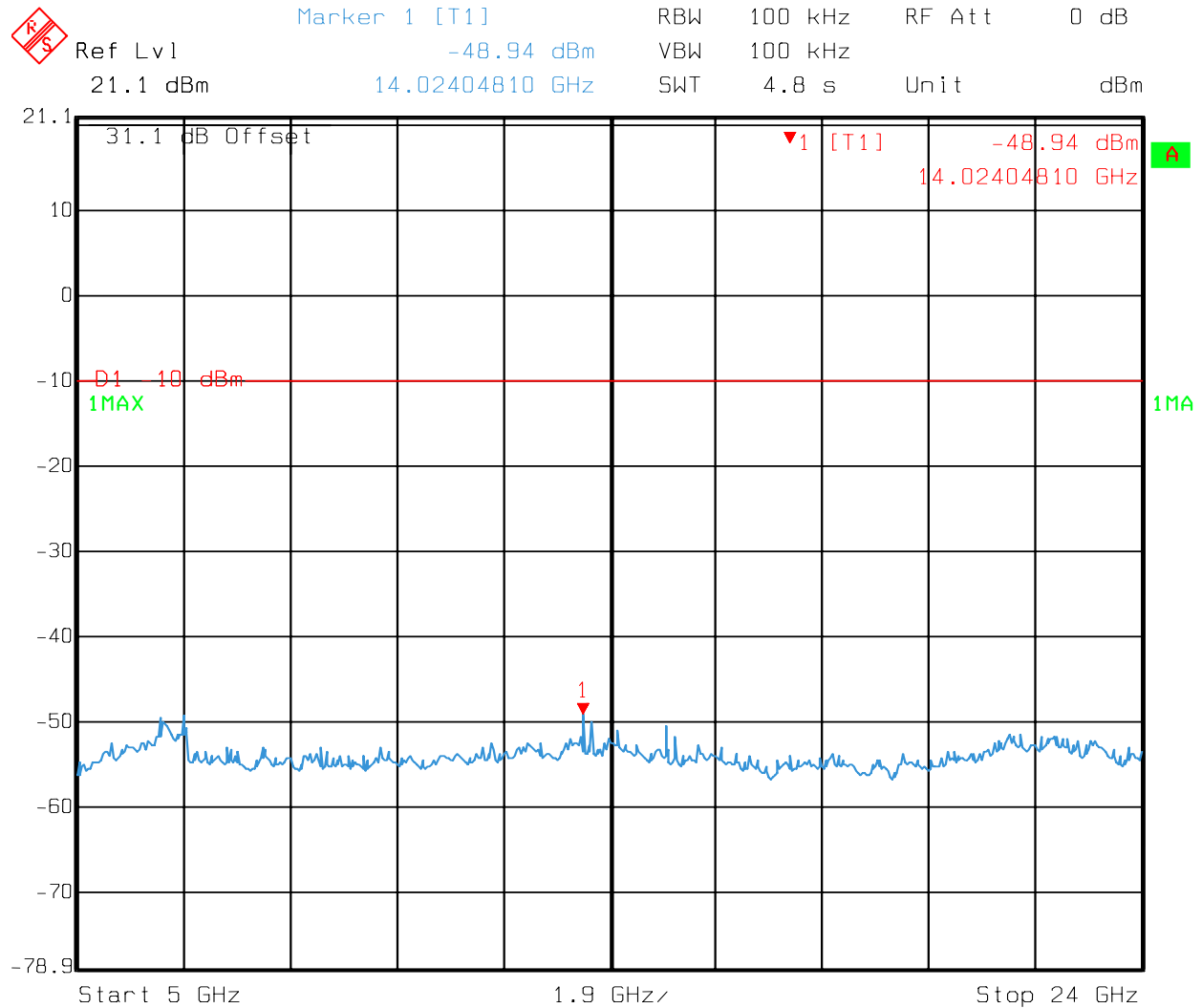
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EQUIPMENT: Ripwave TTA Base Station

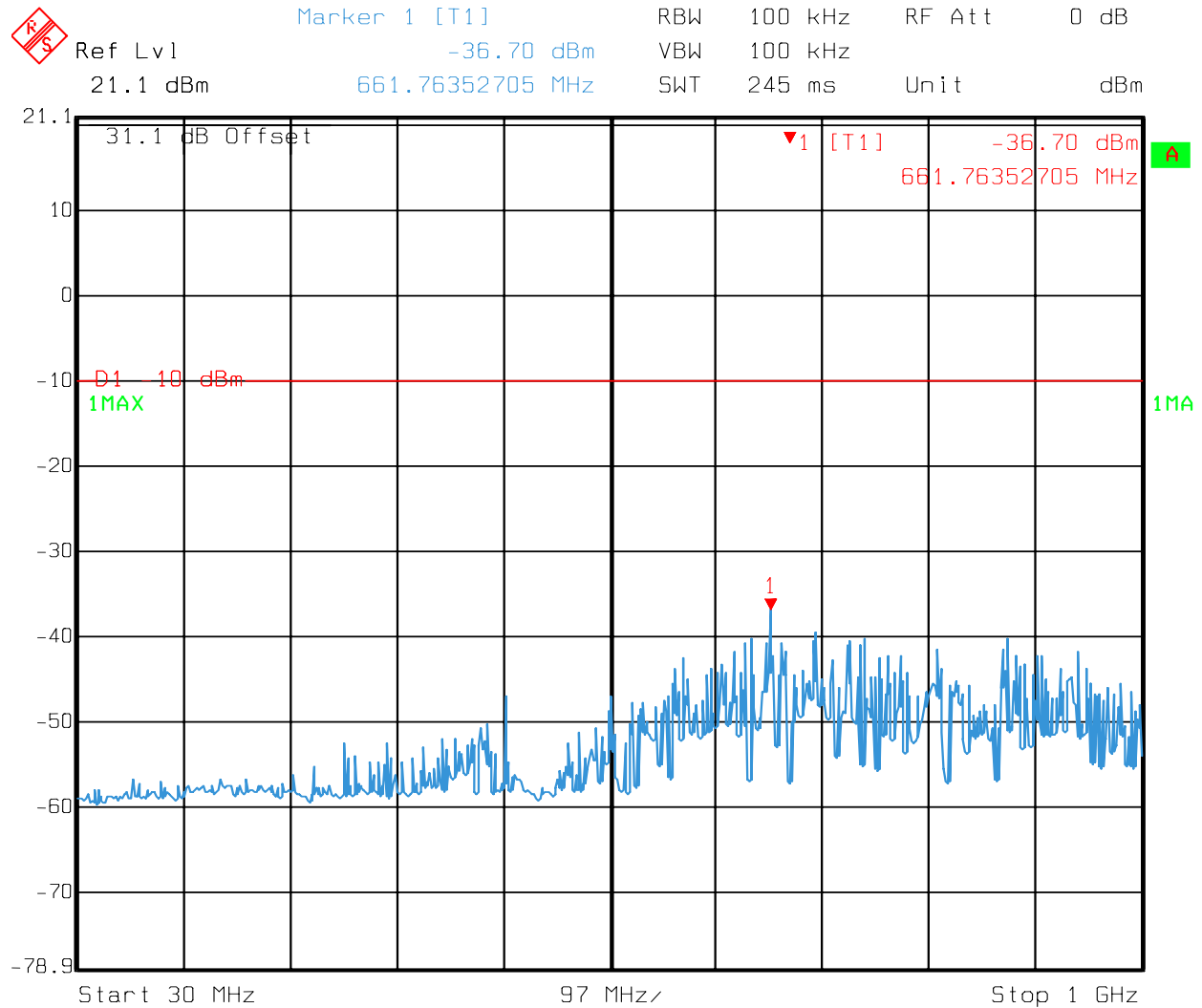
REPORT NO.: 3L0324RUS2



Date: 29.SEP.2003 11:20:07

EQUIPMENT: Ripwave TTA Base Station

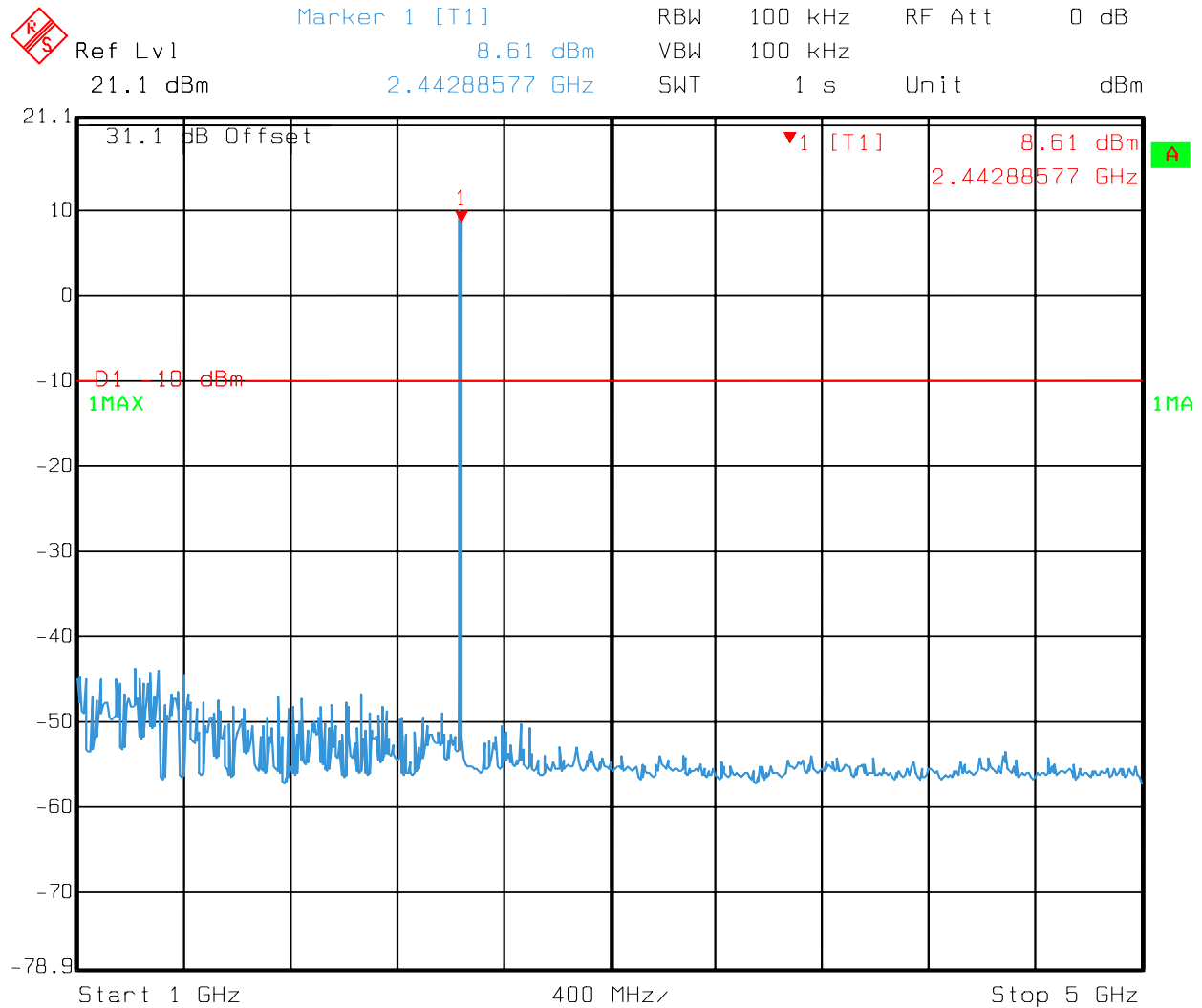
REPORT NO.: 3L0324RUS2



Date: 29.SEP.2003 11:21:07

EQUIPMENT: Ripwave TTA Base Station

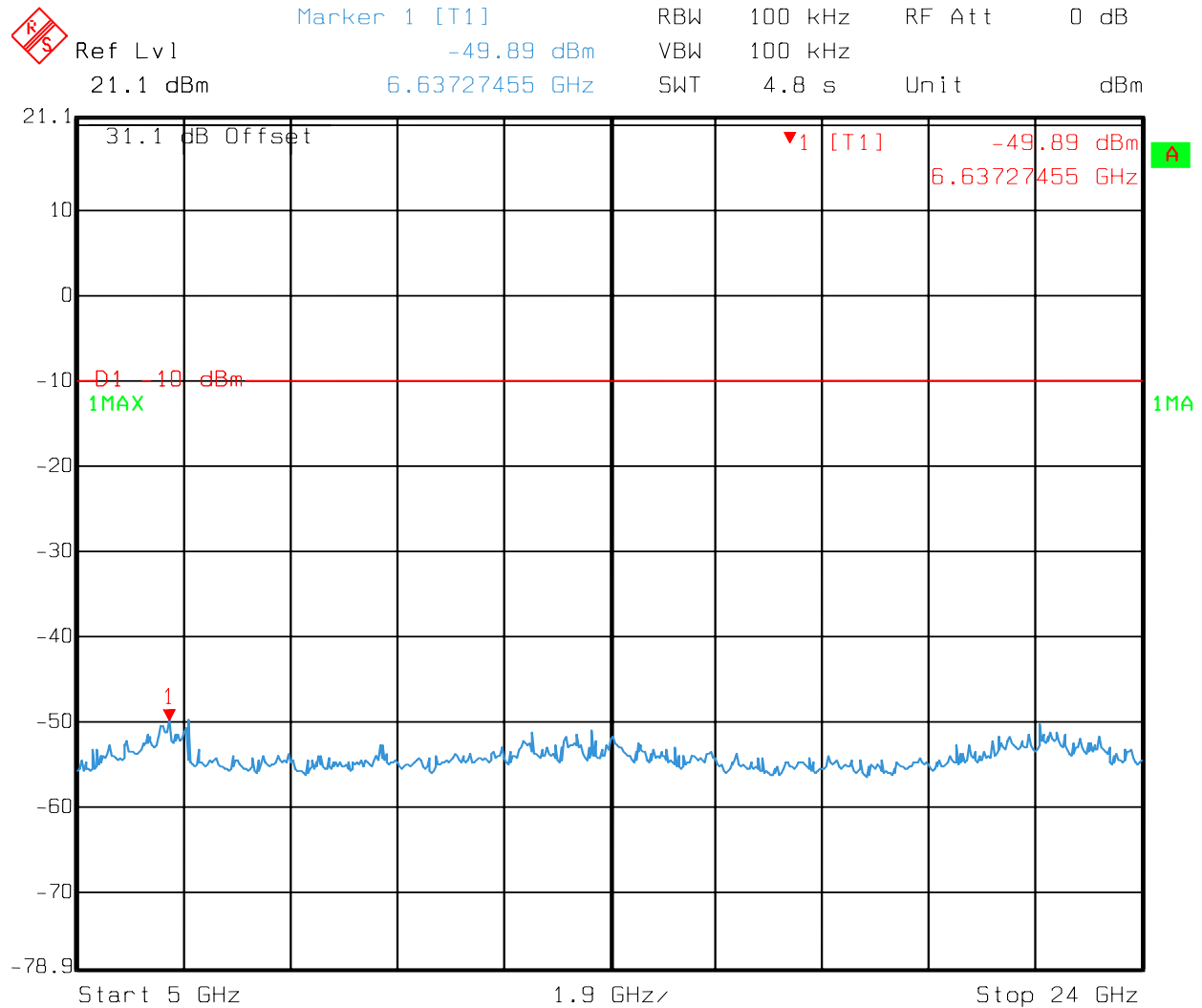
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Date: 29.SEP.2003 11:21:38

EQUIPMENT: **Ripwave TTA Base Station**

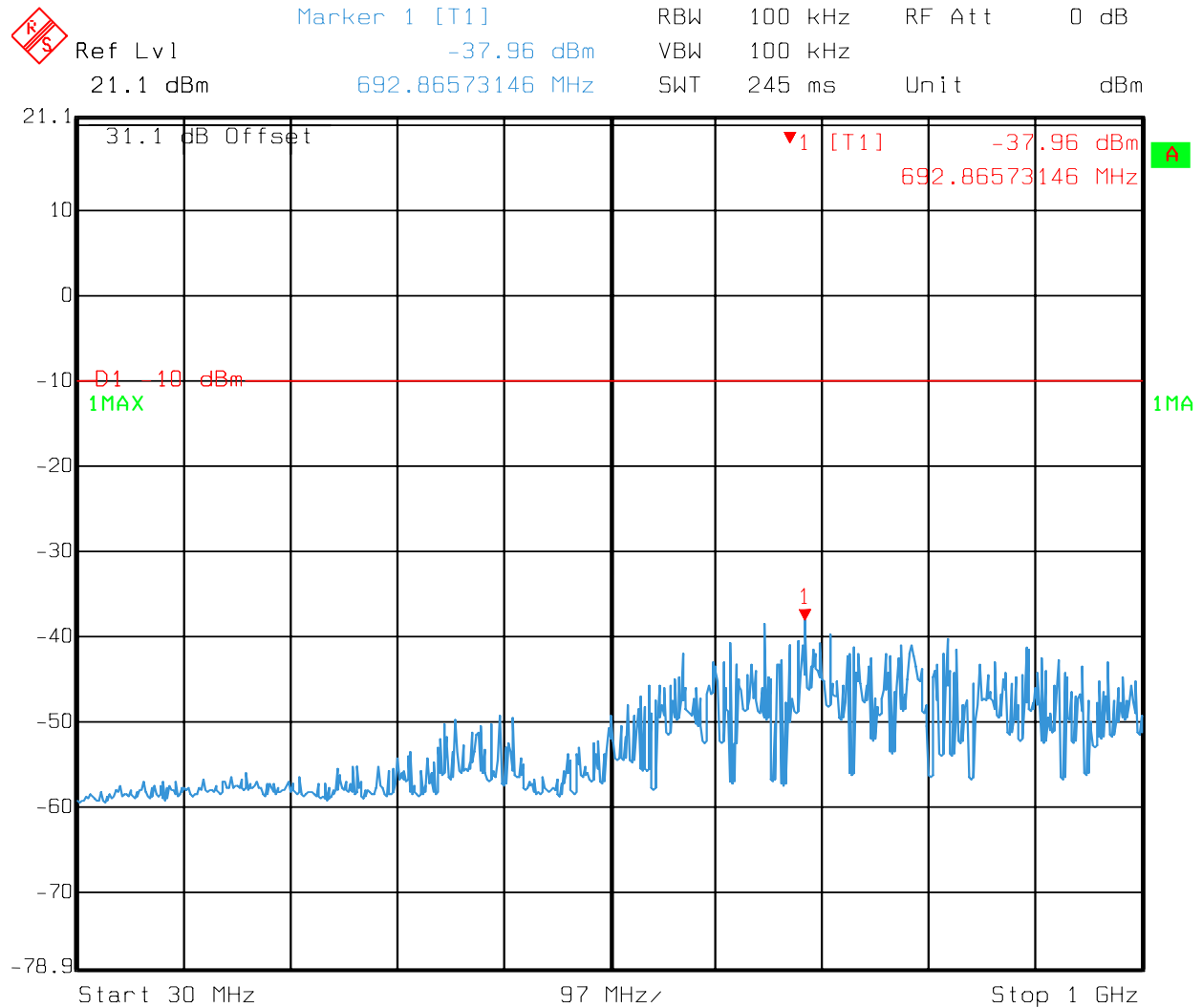
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Date: 29.SEP.2003 11:22:20

EQUIPMENT: Ripwave TTA Base Station

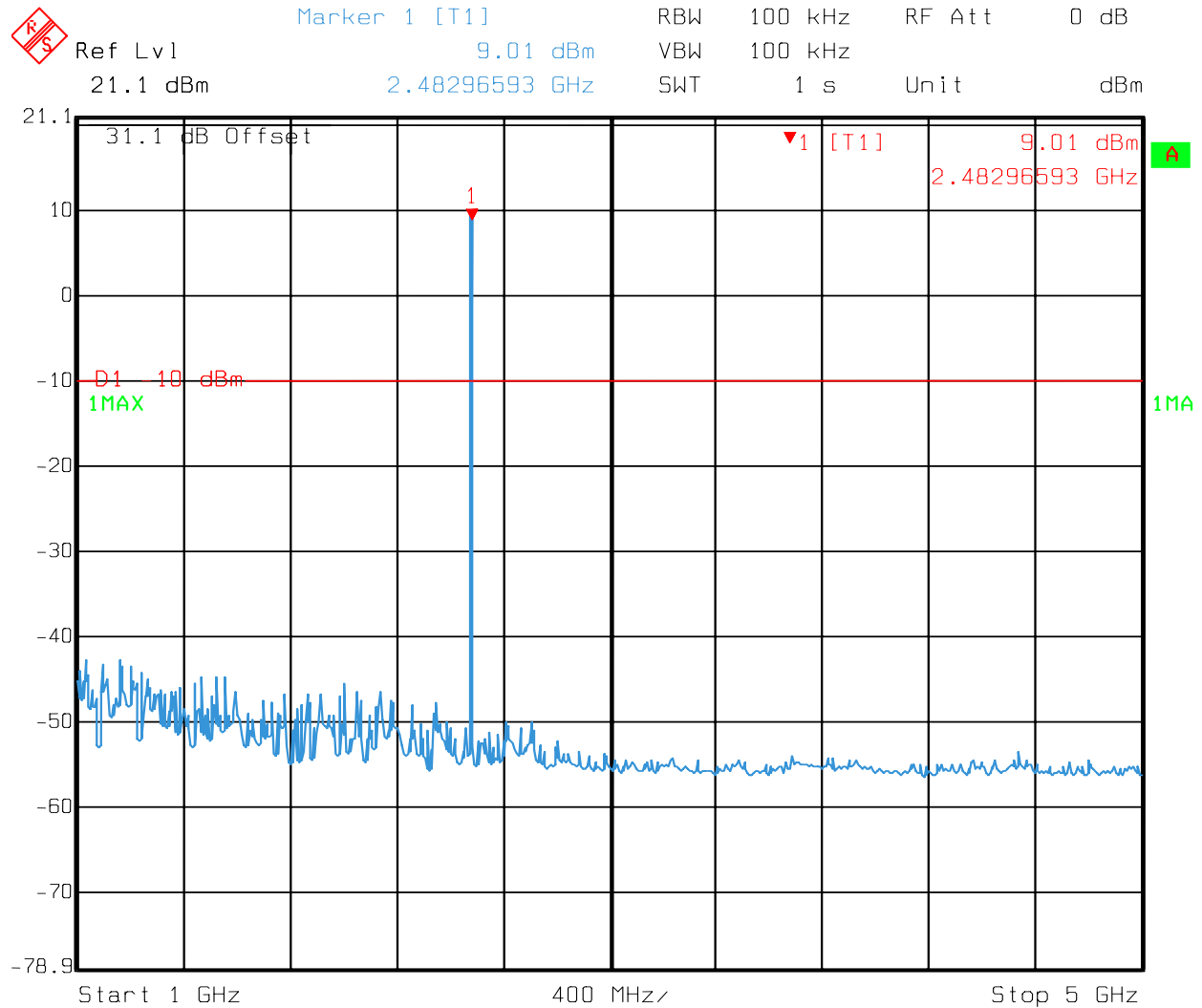
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Date: 29.SEP.2003 11:23:16

EQUIPMENT: Ripwave TTA Base Station

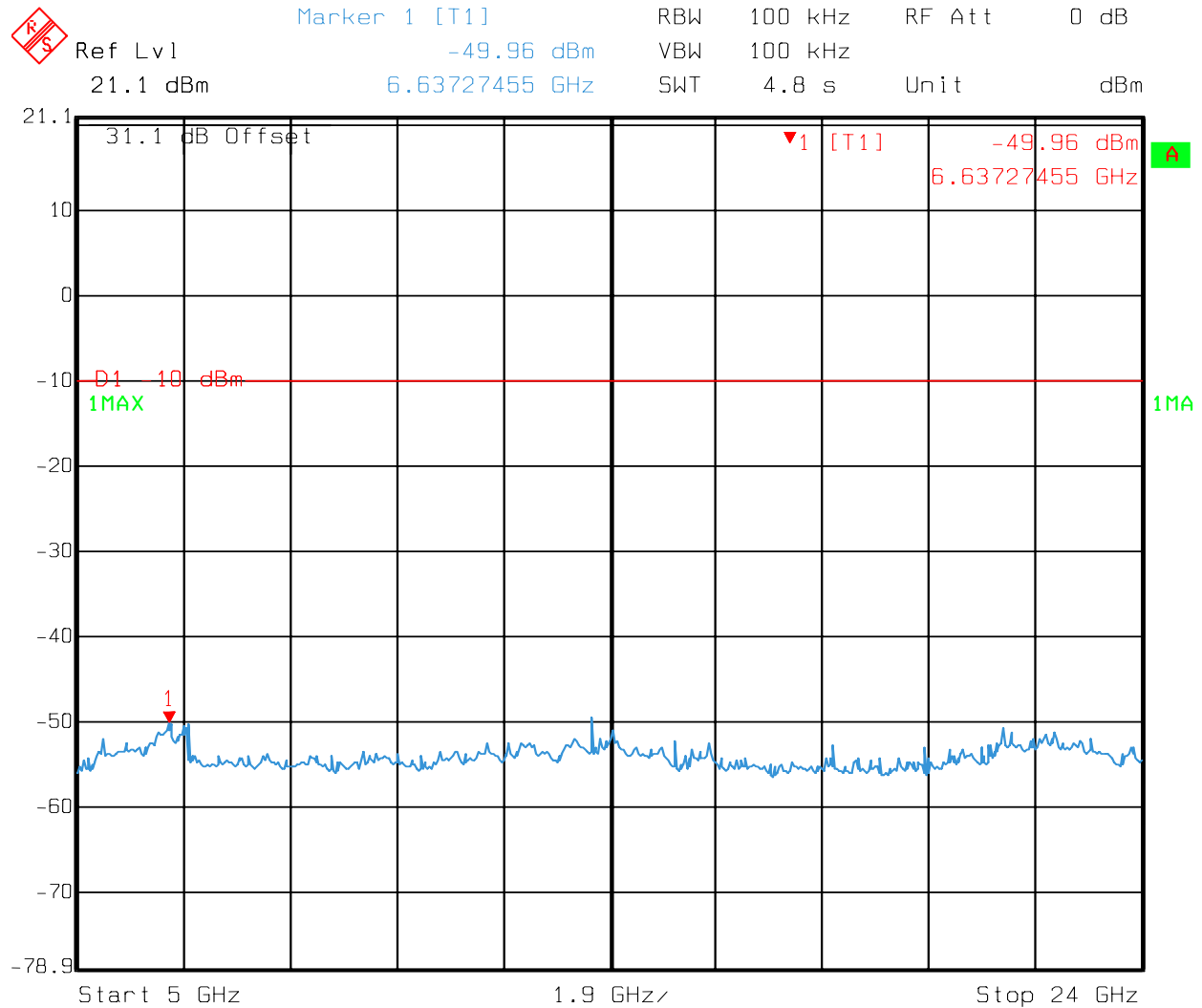
REPORT NO.: 3L0324RUS2



Date: 29.SEP.2003 11:24:02

EQUIPMENT: Ripwave TTA Base Station

REPORT NO.: 3L0324RUS2



Date: 29.SEP.2003 11:24:39

Section 7. Spurious Emissions (radiated)

NAME OF TEST: Radiated Spurious Emissions	PARA. NO.: 15.247 (c)
TESTED BY: Dustin Oaks	DATE: 09/27/03

Test Results: Complies.

Measurement Data: See attached table.

Equipment Used: 1036, 1484, 1485, 0993, 1016

Measurement Uncertainty: +/- 0.7 dB

Temperature: 21 °C

Relative Humidity: 60 %

Note: Test performed with Omni antenna (Highest Power).

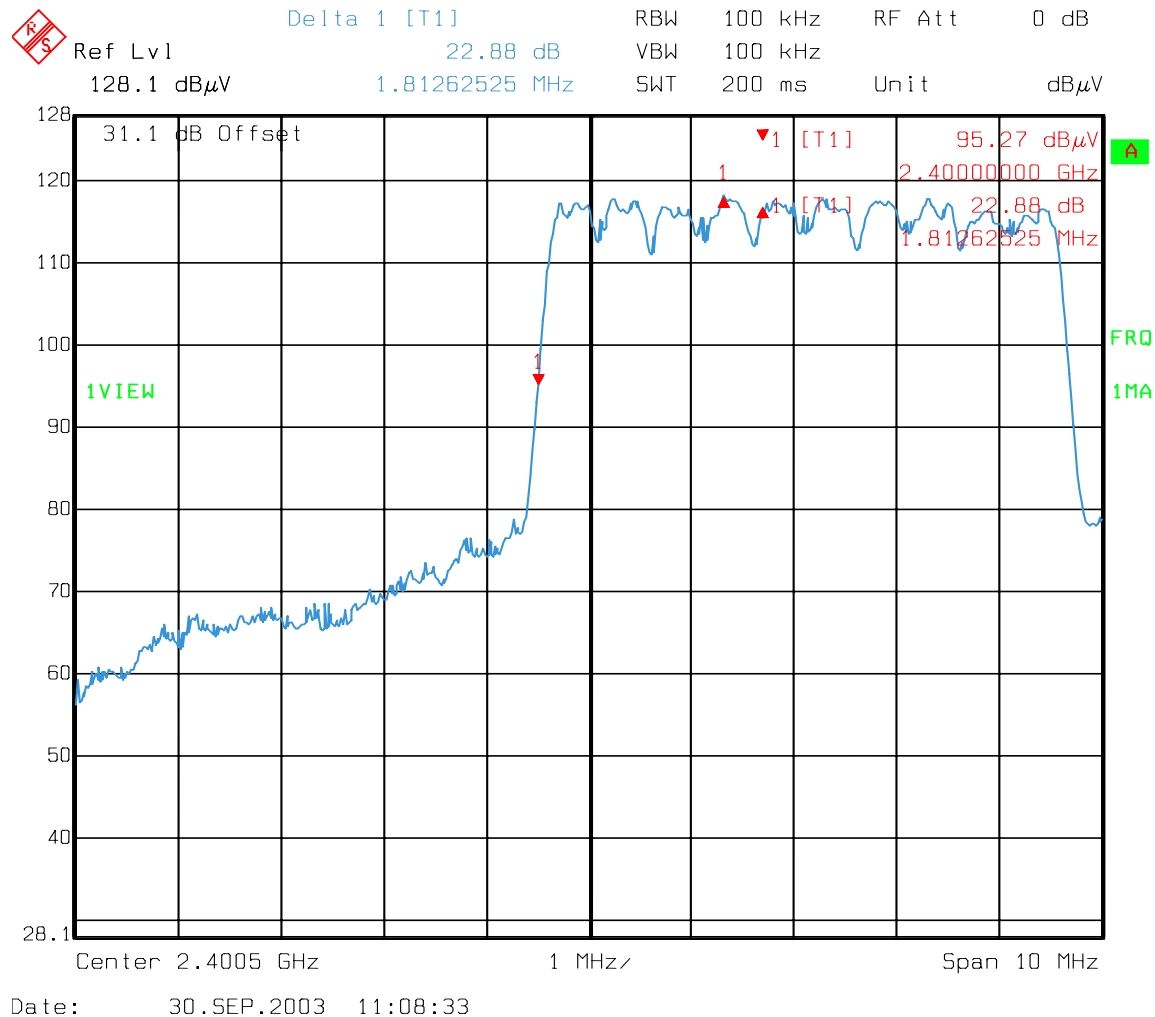
EQUIPMENT: [Ripwave TTA Base Station](#)REPORT NO.: [3L0324RUS2](#)

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
4805.875	29.6	33.1	4.2	30.1	36.8	54	-17.2	Vert
4805.875	29.1	33.1	4.2	30.1	36.3	54	-17.7	Horiz
7208.875	29.5	35.8	5.1	33.9	36.5	54	-17.5	Vert
7208.875	28.6	35.8	5.1	33.9	35.6	54	-18.4	Horiz
12014.88	30.6	39.6	7.3	33.5	44.0	54	-10.0	Vert
12014.88	31.2	39.6	7.3	33.5	44.6	54	-9.4	Horiz
14417.88	29.5	41.2	7.2	30.6	47.3	54	-6.7	Vert
14417.88	27.7	41.2	7.2	30.6	45.5	54	-8.5	Horiz
Notes: Device set on Low Channel, Highest power.								

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
4805.875	32.4	33.1	4.2	30.1	39.6	54	-14.4	Horiz
4805.875	31.4	33.1	4.2	30.1	38.6	54	-15.4	Vert
7208.875	29.9	35.8	5.1	33.9	36.9	54	-17.1	Horiz
7208.875	30.0	35.8	5.1	33.9	37.0	54	-17.0	Vert
12014.88	31.7	39.6	7.3	33.5	45.1	54	-8.9	Horiz
12014.88	32.7	39.6	7.3	33.5	46.1	54	-7.9	Vert
14417.88	30.7	41.2	7.2	30.6	48.5	54	-5.5	Horiz
14417.88	30.4	41.2	7.2	30.6	48.2	54	-5.8	Vert
Notes: Device set on Middle Channel, Highest power.								

EQUIPMENT: [Ripwave TTA Base Station](#)REPORT NO.: [3L0324RUS2](#)

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
4960.5	30.4	33.7	4.3	29.6	38.8	54	-15.2	Vert
4960.5	30.9	33.7	4.3	29.6	39.3	54	-14.7	Horiz
7441	30.2	35.9	5.3	34.1	37.3	54	-16.7	Vert
7441	29.7	35.9	5.3	34.1	36.8	54	-17.2	Horiz
12402	28.5	40.1	7.3	32.7	43.2	54	-10.8	Vert
12402	32.3	40.1	7.3	32.7	47.0	54	-7.0	Horiz
17363	28.7	42.6	8.7	31.0	49.0	54	-5.0	Vert
17363	29.6	42.6	8.7	31.0	49.9	54	-4.1	Horiz
Notes: Device set on highest Channel, Highest power.								

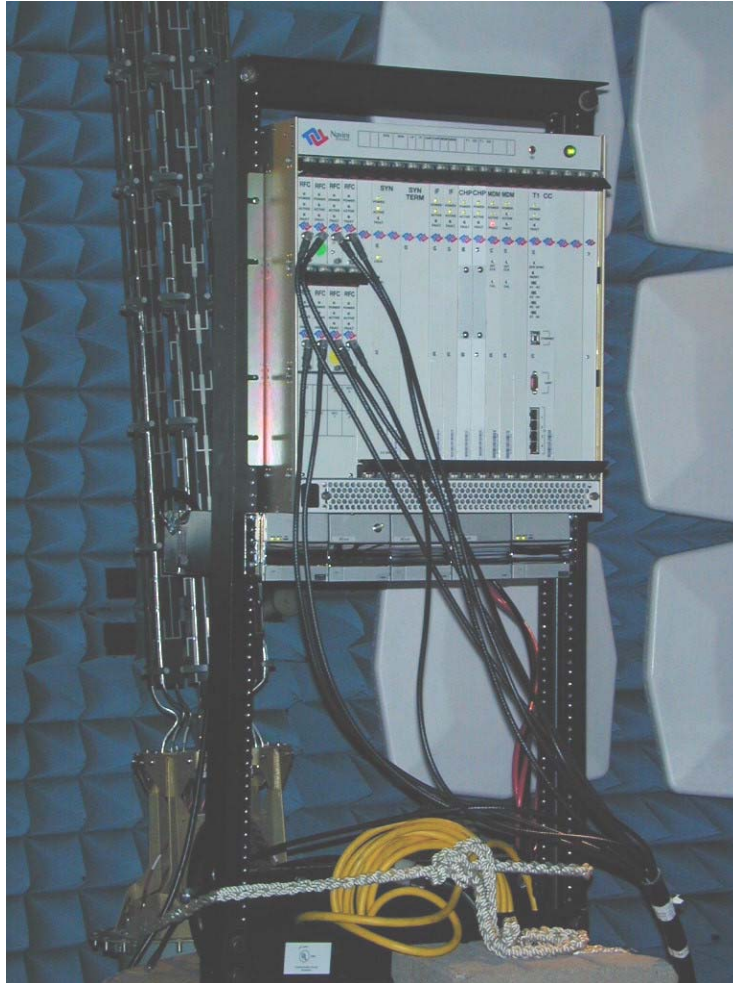
EQUIPMENT: **Ripwave TTA Base Station**REPORT NO.: **3L0324RUS2**

Lower Bandedge (2.402.75 MHz CF)
Worst case plot

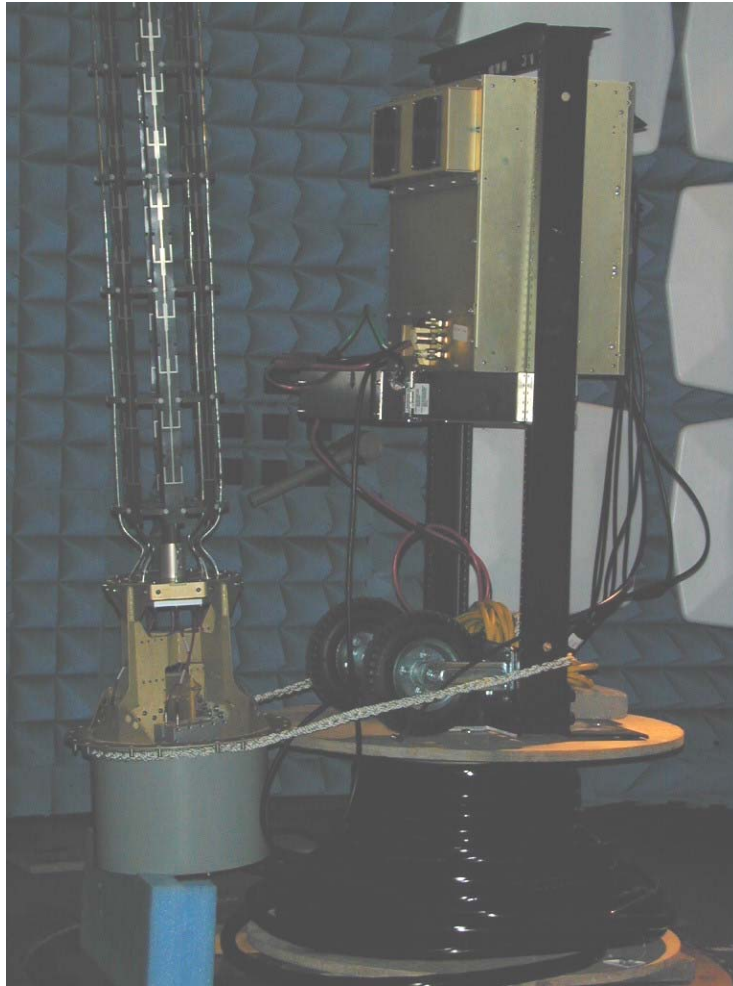
Freq in MHz	Meter dBμV/m	Factors	Corr	Spec	Margin	RType	Notes	
2483.5	25	31.3	56.3	74	-17.7	Peak	Omni Antenna	Horiz
2483.5	13.8	31.3	45.1	54	-8.9	Ave	Omni Antenna	Horiz
2483.5	35.5	31.3	66.8	74	-7.2	Peak	Omni Antenna	Vert
2483.5	19	31.3	50.3	54	-3.7	Ave	Omni Antenna	Vert

Upper Bandedge (2480.5MHz CF)

Radiated Photographs (Worst Case Configuration)



Omni Antenna: Radiated Emissions



Omni Antenna: Radiated Emissions

Section 8. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: Dustin Oaks	DATE: 09/29/03

Test Results: Complies.

Measurement Data: See attached plots.

Equipment Used: 1629, 1478, 1467, 1036

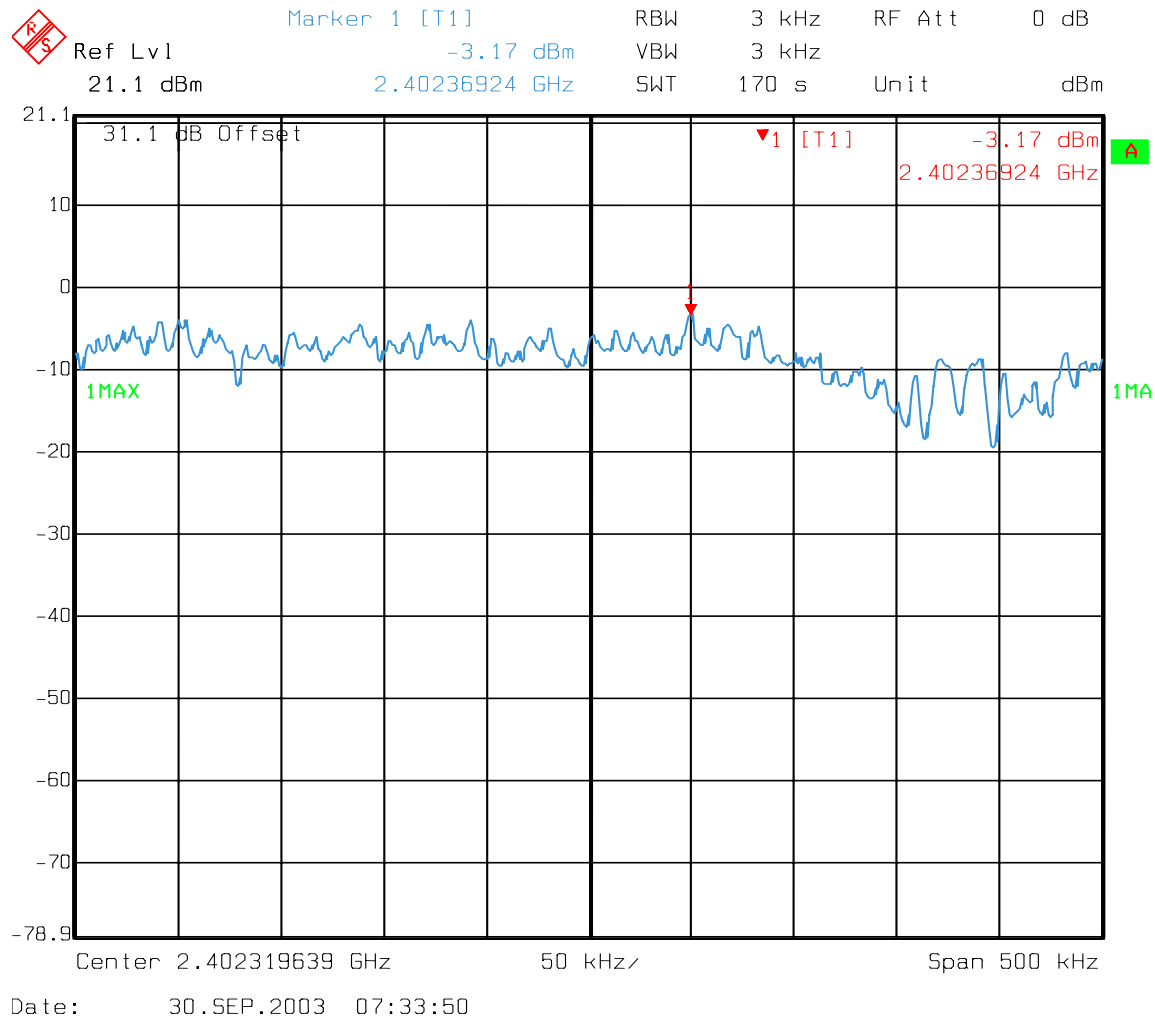
Measurement Uncertainty: +/- 0.7 dB

Temperature: 21 °C

Relative Humidity: 60 %

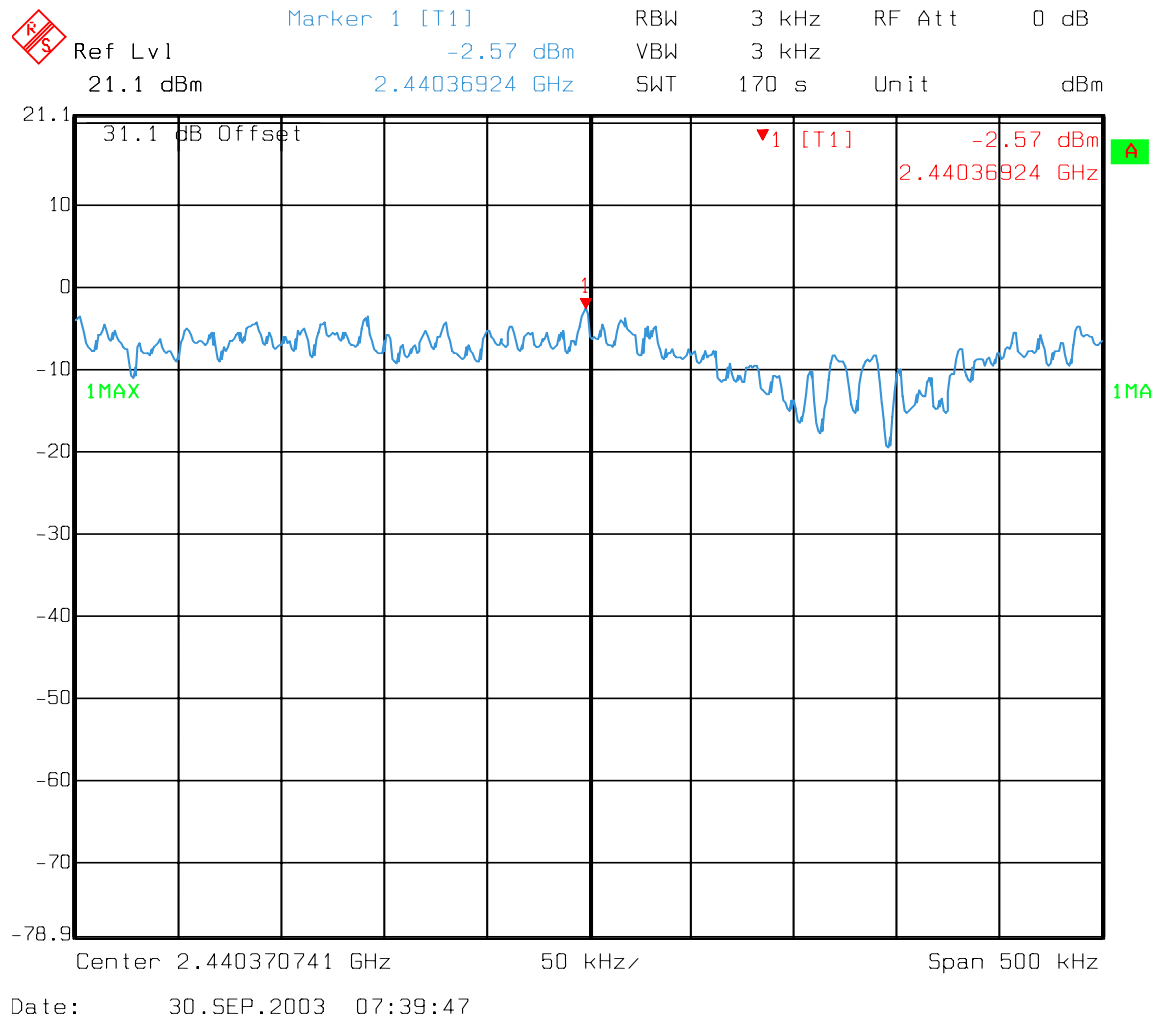
Notes:

Device tested on highest.

EQUIPMENT: **Ripwave TTA Base Station**REPORT NO.: **3L0324RUS2**

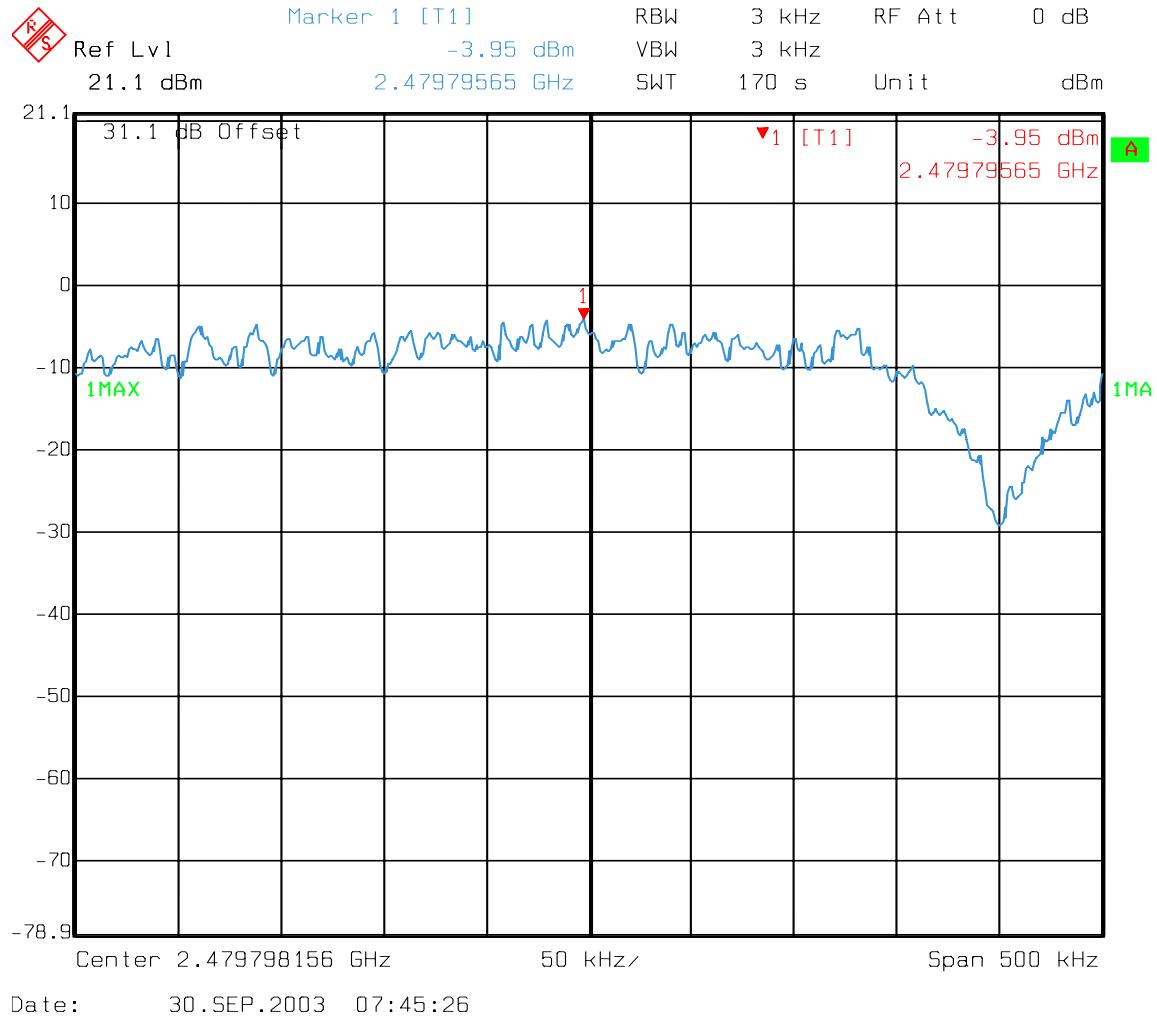
EQUIPMENT: Ripwave TTA Base Station

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EQUIPMENT: Ripwave TTA Base Station

REPORT NO.: 3L0324RUS2



EQUIPMENT: [Ripwave TTA Base Station](#)REPORT NO.: [3L0324RUS2](#)**Section 9. Test Equipment List**

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/11/03	02/11/05
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	08/28/03	08/23/04
993	Horn antenna	A.H. Systems SAS-200/571	XXX	01/08/02	01/09/04
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	02/11/03	02/11/05
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	07/24/03	07/23/04
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU	N/A
1478	20db Attenuator DC 18 Ghz	MCL Inc. BW-S20W6	NONE	CBU	N/A
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01	12/19/03
283	Environmental Chamber with controller # 1189006	ENVIROTRONICS SH27 & 2030-22844	129010083	04/22/03	04/21/04
599	POWER SUPPLY	XANTREX XFR 60-46	42669	CNR	
703	LISN	Schwarz Beck 8020	8020350	05/04/03	05/03/04
1433	High pass filter	Solar 7930-5.0	933142	02/24/03	02/24/04
1988	CABLE, 6.8m	KTL RG223	N/A	07/02/03	07/01/04
1547	CABLE .6m	KTL RG223	N/A	09/15/03	09/14/04
716	Receiver	Polorad ESH2	879342/005	01/03/03	01/03/04
761	3 module HP stack(Anal/Displ/Q-Peak Adapt)	Hewlett Packard 8567A/Disp/85650A	09/2542A10537/25	11/21/02	11/21/03
791	PREAMP, 25dB	ICC LNA25	398	09/30/02	09/30/03
1625	CABLE, 18 ft	MEGAPHASE 10311 1GVT4	N/A	03/05/03	03/04/04
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A

ANNEX A - TEST DETAILS

EQUIPMENT: [Ripwave TTA Base Station](#)

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NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
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Minimum Standard:

The R.F. that is conducted back onto the AC power line on any frequency within the band 0.45 to 30 MHz shall not exceed 250 μ V (48 dB μ V) across 50 ohms.

EQUIPMENT: [Ripwave TTA Base Station](#)

REPORT NO.: [3L0324RUS2](#)

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

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

EQUIPMENT: [Ripwave TTA Base Station](#)

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NAME OF TEST: RF Exposure	PARA. NO.: 15.247(b)(4)
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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)

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 band edge.

Sweep: Auto

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

Marker: Peak of fundamental emission

Marker Δ : 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 Δ : 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

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 ($\mu\text{V/m}$ @ 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 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)

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 a 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

NAME OF TEST: Processing Gain

PARA. NO.: 15.247(e)

Minimum Standard: The processing gain shall be at least 10 dB.

Method Of Measurement: The CW jamming margin method was used to determine the processing gain. A CW signal generator is stepped across the passband of the receiver in 50 kHz increments. At each point the signal generator level required to obtain the recommended bit error rate is recorded. The jammer to signal ratio (J/S) is then calculated. The worst 20% of the J/S points is discarded. The lowest remaining J/S ratio is used to calculate the processing gain.

Calculation Of Processing Gain:

The processing gain was determined by measuring the jamming margin of the E.U.T. and using the following formula:

$$\text{Jamming Margin} = G_p - (S/N)_{\text{out}} - L_{\text{sys}}$$

For a receiver using non-coherent detection the value $(S/N)_{\text{out}}$ is calculated using the formula:

$P_e = (1/2)\text{EXP}\{-E/2N_o\}$ where P_e is the probability of error (minimum Bit Error Rate required for proper operation).

E/N_o is $(S/N)_{\text{out}}$

for example, for a bit error rate of 10^{-4} a S/N ratio of 12.3 dB is required.

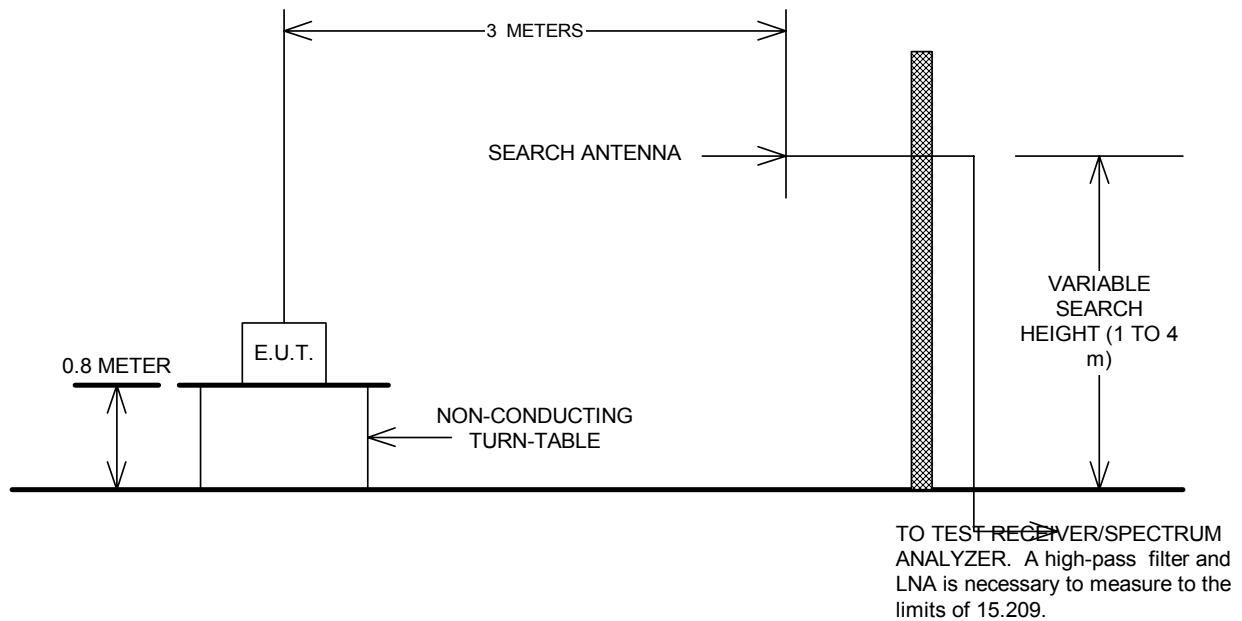
L_{sys} (system losses) is assumed to be 2 dB.

$$\text{Therefore } G_p = M_j + (S/N)_{\text{out}} + L_{\text{sys}}$$

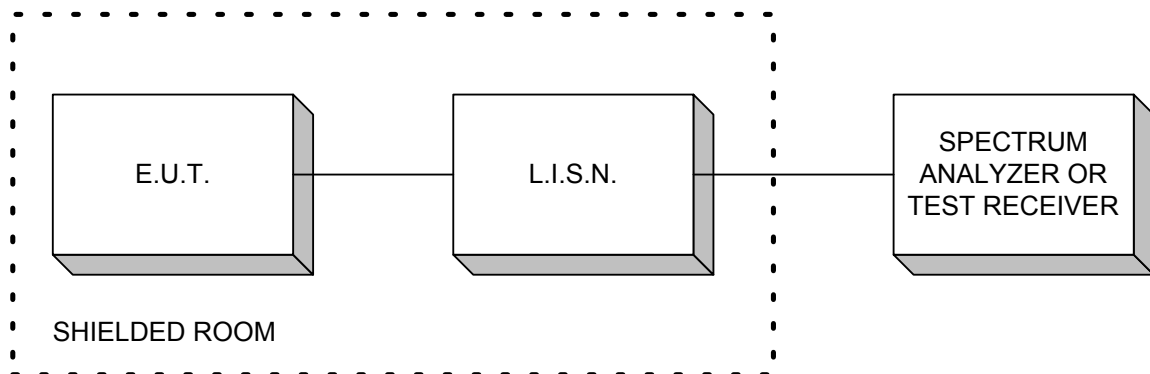
Measurement performed at a channel in the center of the operating band of the EUT.

ANNEX B - TEST DIAGRAMS

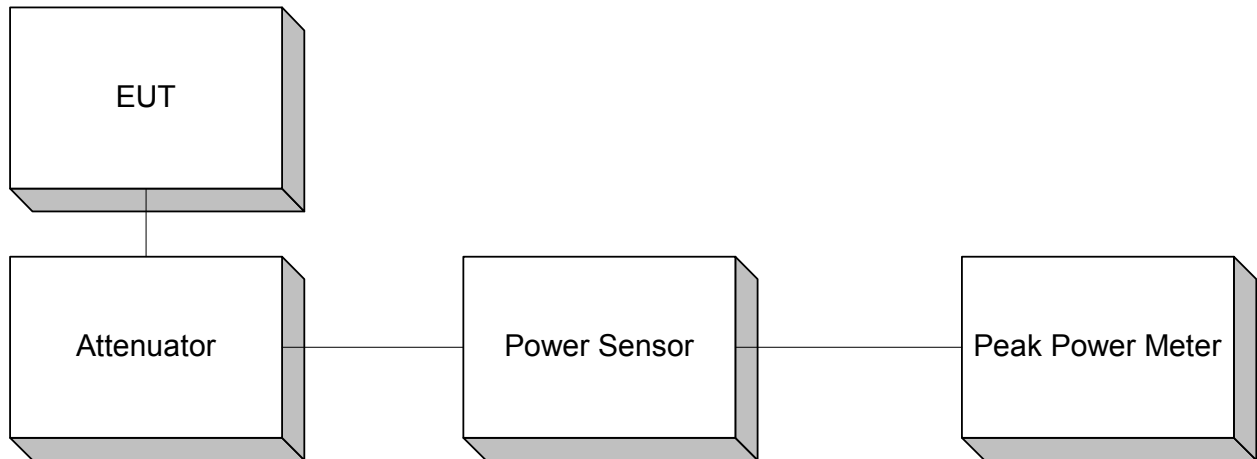
Test Site For Radiated Emissions



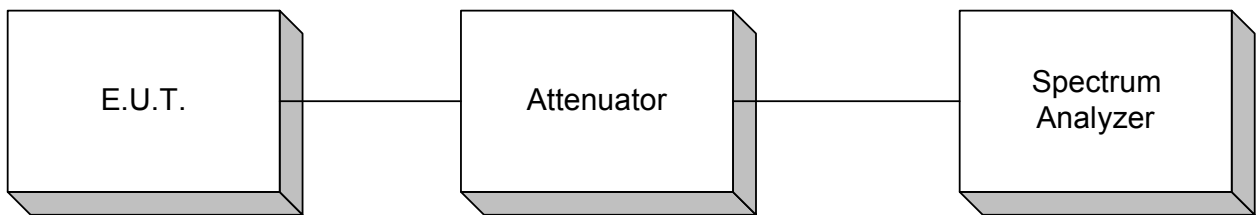
Conducted Emissions

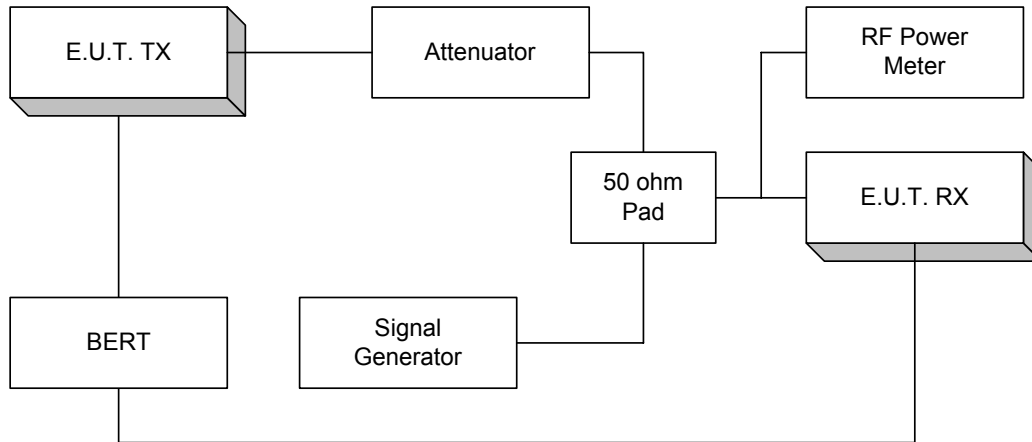


Peak Power At Antenna Terminals



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.