Nemko Test Report:	1L0617RUS1rev2
Applicant:	Navini Networks 2240 Campbell Creek Blvd. Suite 110 Richardson, TX 75082
Equipment Under Test: (E.U.T.)	RipWave 2.4 GHz BTS, Release 1
FCC ID:	PL6-ISM-BTS-R1
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:	 David Light, Wireless Group Supervisor
Date:	11 June 2002
Total Number of Pages:	44

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Section 1. Summary of Test Results

Manufacturer: Navini Networks

Model No.: RipWave 2.4 GHz BTS, Release 1

Serial No.: Sample #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, Paragraph 15.247 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted is 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

Summary Of Test Data

NAME OF TEST	PARA. NO.	Limit	RESULT
Powerline Conducted Emissions	15.207(a)	48 dBµV	N/A
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
Processing Gain	15.247(e)	10 dB	Complies

Footnotes:

The equipment under test does not connect to the AC power mains network.

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

General Equipment Information

Frequency Band in which TX operates:

☐ 902 – 928 MHz
☒ 2400 – 2483.5 MHz
☐ 5725 – 5850 MHz

Frequency Range of Operation: 2.403 GHz – 2.4775 GHz

User Frequency Adjustment: Not adjustable by user

Description of Operation and Approval Notes

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 tranmitters. 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 20log10 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.

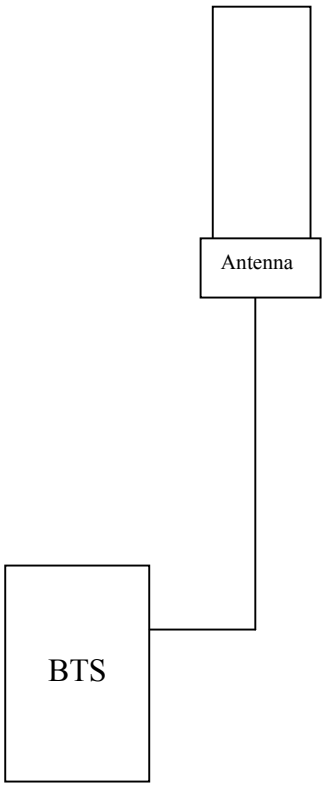
Example:

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:	DATE:

Test Results: NOT APPLICABLE. Does not connect to the AC power mains network.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 1.7 dB

Section 4. Minimum 6 dB Bandwidth

NAME OF TEST: Minimum 6 dB Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: T. Tidwell	DATE: 4/26/02

Test Results: Complies.

Measurement Data: See 6 dB BW plot
Measured 6 dB bandwidth: 4.93 MHz

Measurement Uncertainty: +/- 0.7 dB

EQUIPMENT: RipWave 2.4 GHz BTS PROJECT NO.: 1L0617RUS1rev2

~~Data Plot~~ **~~Occupied Bandwidth~~**

Page ~~1~~ of ~~3~~ Complete X

Job No.: 1L0617R Date: 4/26/2002 Preliminary:

Specification: 15.247 Temperature(°C): 23

Tested By: Tom Tidwell Relative Humidity(%) 57

E.U.T.: 2.4 GHz BTS

Configuration: Transmitting at +25.3 dBm measured at antenna port. 10 active traffic channels

Sample Number: S01

Location: Lab 1 RBW: Refer to plots

Detector Type: Peak VBW: Refer to plots

~~Test Equipment Used~~

Antenna: Directional Coupler:

Pre-Amp: Cable #1: 1629

Filter: Cable #2:

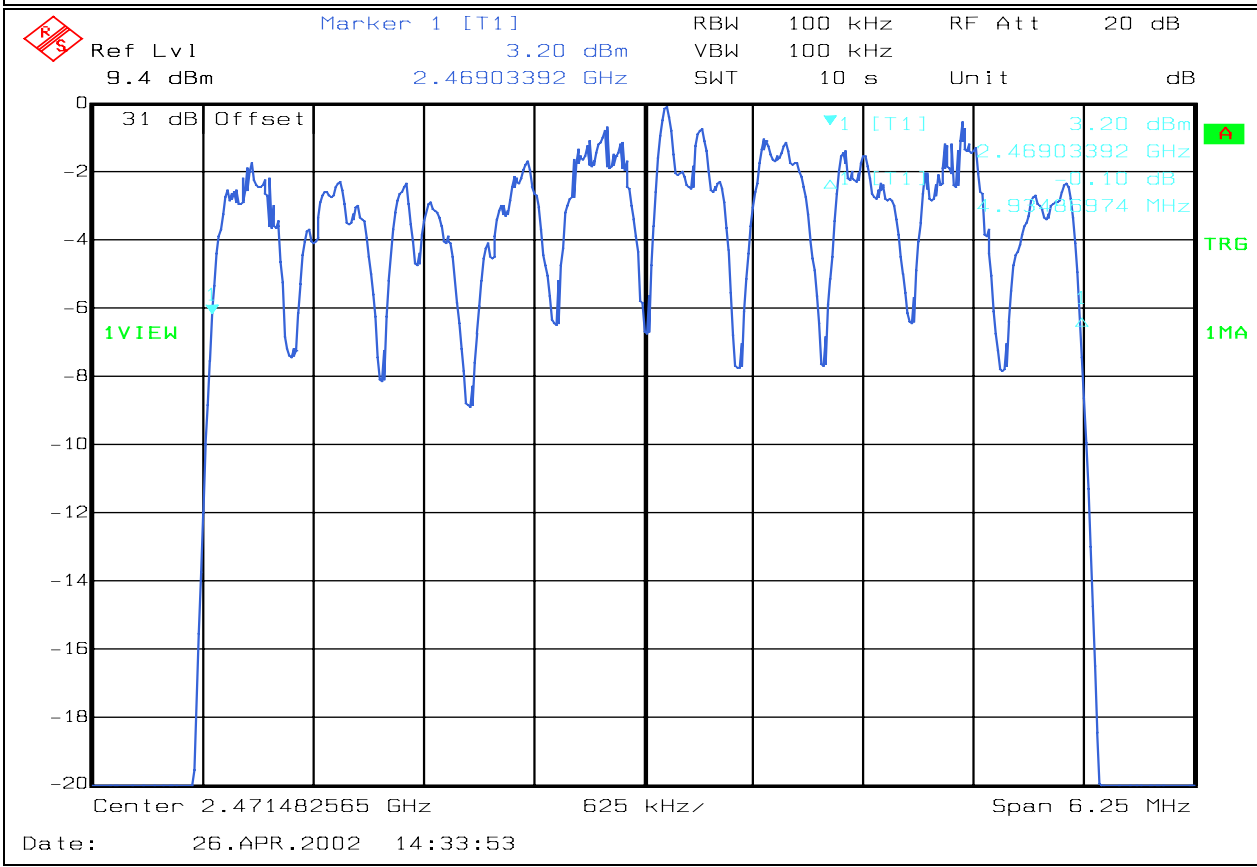
Receiver: 1036 Cable #3:

Attenuator #1 Cable #4:

Attenuator #2: Mixer:

Additional equipment used: 30 dB attenuator

Measurement Uncertainty: +/-1.7 dB



Notes: **High Channel**

EQUIPMENT: RipWave 2.4 GHz BTS PROJECT NO.: 1L0617RUS1rev2

~~Data Plot~~ **~~Occupied Bandwidth~~**

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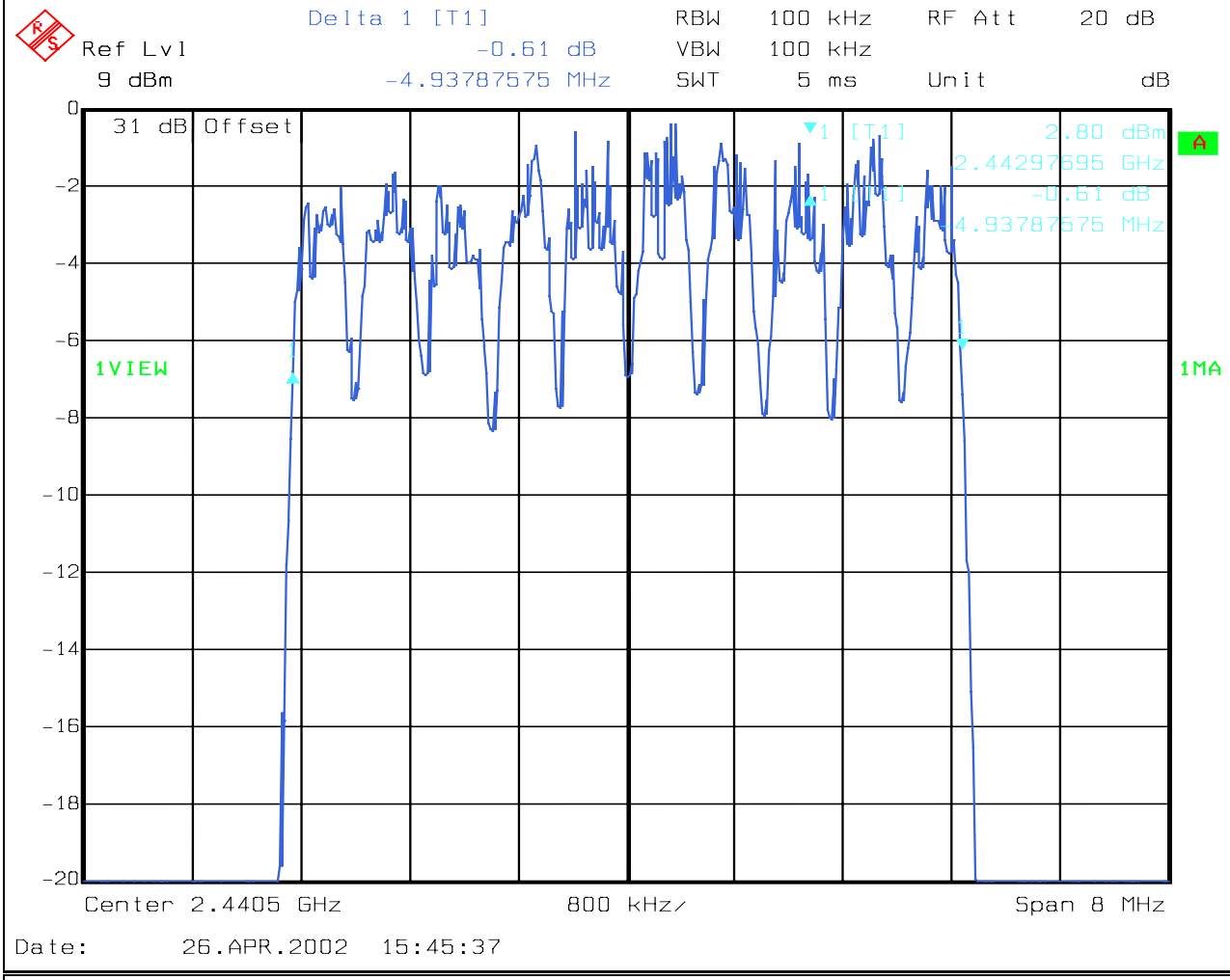
Job No.: 1L0617R Date: 4/26/2002
Specification: 15.2 Temperature(°C): 23
Tested By: Tom Tidwell Relative Humidity(%) 57
E.U.T.: 2.4 GHz BTS
Configuration: Transmitting at +25.3 dBm measured at antenna port. 10 active traffic channels



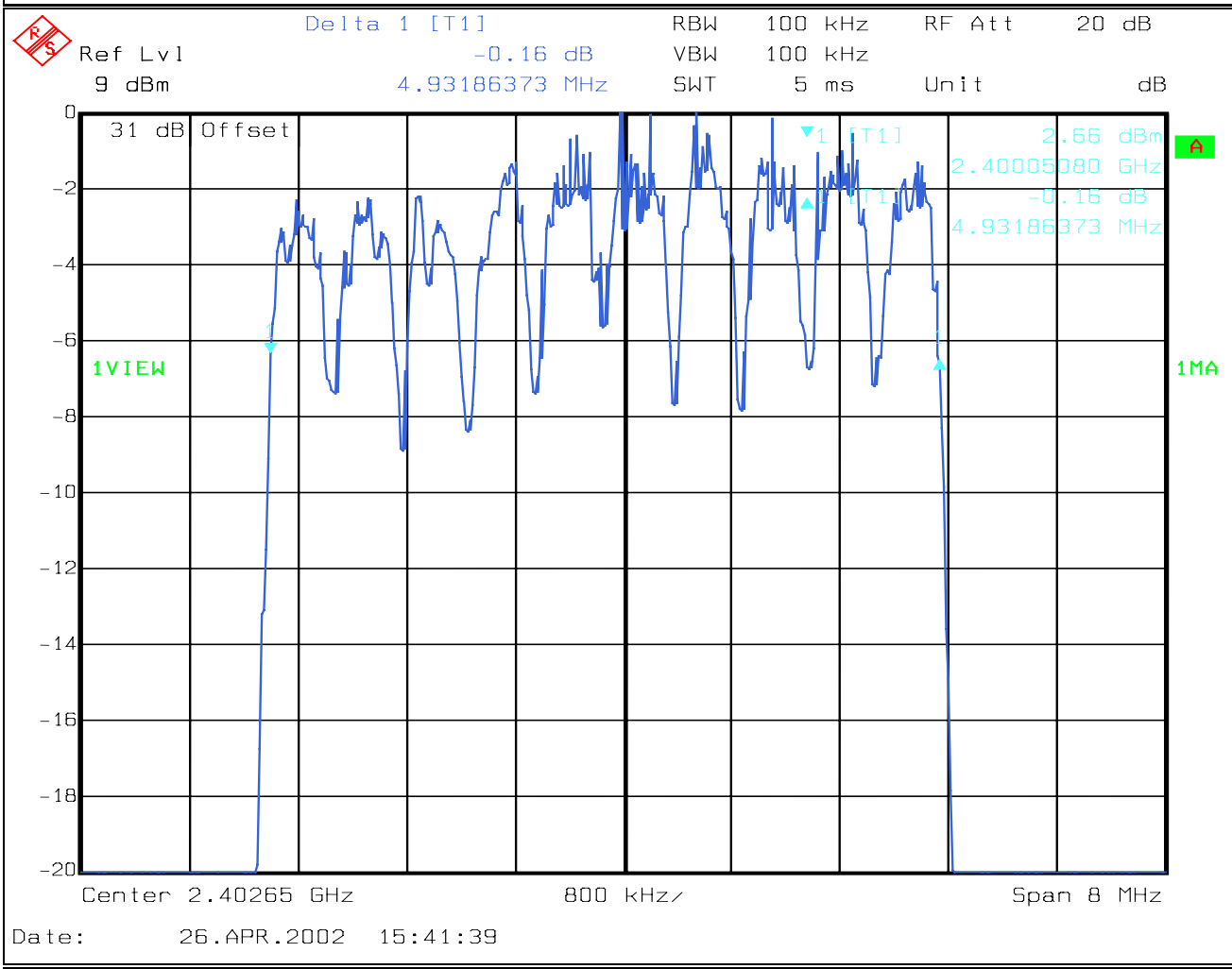
Notes: Mid Channel

EQUIPMENT: RipWave 2.4 GHz BTS PROJECT NO.: 1L0617RUS1rev2

~~Data Plot~~ **~~Occupied Bandwidth~~**

Page ~~3~~ of 3

Job No.: 1L0617R Date: 4/26/2002
Specification: 15.247 Temperature(°C): 23
Tested By: Tom Tidwell Relative Humidity(%) 57
E.U.T.: 2.4 GHz BTS
Configuration: Transmitting at +25.3 dBm measured at antenna port. 10 active traffic channels



Notes: **Low Channel**

Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: T. Tidwell	DATE: 4/26/02

Test Results: Complies.

Measurement Data:

Equipment Used: 1016, 1046

Gain (dBi)	Power @ Antenna Port	E.I.R.P. (dBm)
12	24.0	36.0
Note-The device was tested at +/- 15% variation with no effect on output power.		

Measurement Uncertainty: +/- 0.7 dB

Section 6. RF Exposure

NAME OF TEST: RF Exposure	PARA. NO.: 15.247(b)(4)
TESTED BY: D. Light	DATE: 6/11/2002

Test Results: Complies.

Measurement Data: See next page

Prediction of MPE Limit
OET Bulletin 65, Edition 97-01

Navini NETWORKS
Internet at the speed of thought

Equation from page 18

$$S = \frac{PG}{4\pi R^2}$$

$$R = \sqrt{\frac{PG}{4\pi S}}$$

S= power density
P= power input to the antenna
G= power gain of the antenna in the direction of interest relative to an isotropic radiator
R= distance to the center of radiation of the antenna

	Choose	ENTER	
Occupational/Controlled -(BTS)	○		
General Population/Uncontrolled -(CPE)	◉		
Tx Frequency:		2400.00	(MHz)
Maximum Peak Power at Antenna Input Terminal:		24.00	(dBm)
Antenna gain (typical)+ 8-element Beamforming gain:		30.00	(dBi)

S=	1.00	(mW/cm^2)
P=	251.19	(mW)
G=	1000.00	(numeric)

R = 141.38 (cm)

NOTE: The following warning must appear in the installation manual.

WARNING: This device is intended to be used with an antenna professionally installed on a fixed, outdoor structure. A minimum separation distance of 1.5 meters should be maintained in order to ensure compliance with the FCC rules for Radio Frequency Exposure. Installation where this minimum distance cannot be maintained may result in exposure to RF levels that exceed the FCC limits and is discouraged.

Section 7. Spurious Emissions (conducted)

NAME OF TEST: Spurious Emissions (conducted)	PARA. NO.: 15.247(c)
TESTED BY: T. Tidwell	DATE: 4/26/02

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 1.7 dB

EQUIPMENT: RipWave 2.4 GHz BTS PROJECT NO.: 1L0617RUS1rev2

Data Plot **Spurious Emissions at Antenna Terminals**

Page 1 of 5 Complete X

Job No.: 1L0617R Date: 4/26/2002 Preliminary:

Specification: 15.247 Temperature(°C): 23

Tested By: Tom Tidwell Relative Humidity(%) 57

E.U.T.: 2.4 GHz BTS

Configuration: Full TX power

Sample Number:

Location: Lab 1 RBW: Refer to plots

Detector Type: Peak VBW: Refer to plots

Test Equipment Used

Antenna: Directional Coupler:

Pre-Amp: Cable #1: 1046

Filter: Cable #2:

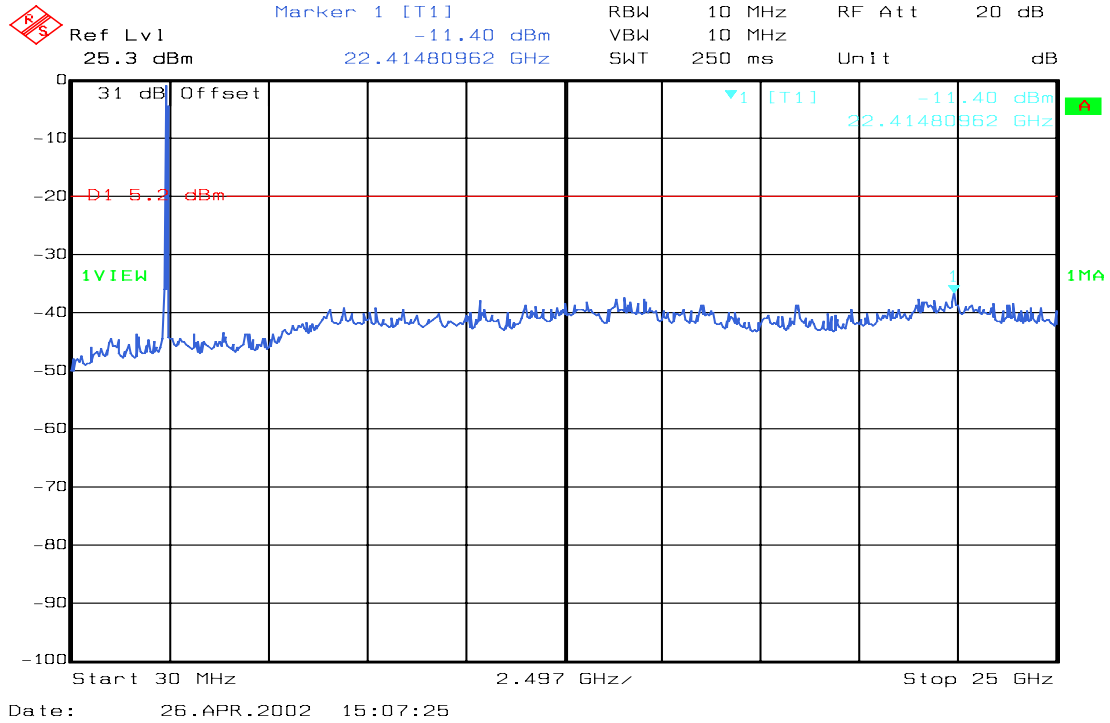
Receiver: 1036 Cable #3:

Attenuator #1 Cable #4:

Attenuator #2: Mixer:

Additional equipment used: 30 dB attenuator

Measurement Uncertainty: +/-1.7 dB



Notes: **High Channel**

~~Data Plot~~ **~~Spurious Emissions at Antenna Terminals~~**

Page ~~2~~ of 5

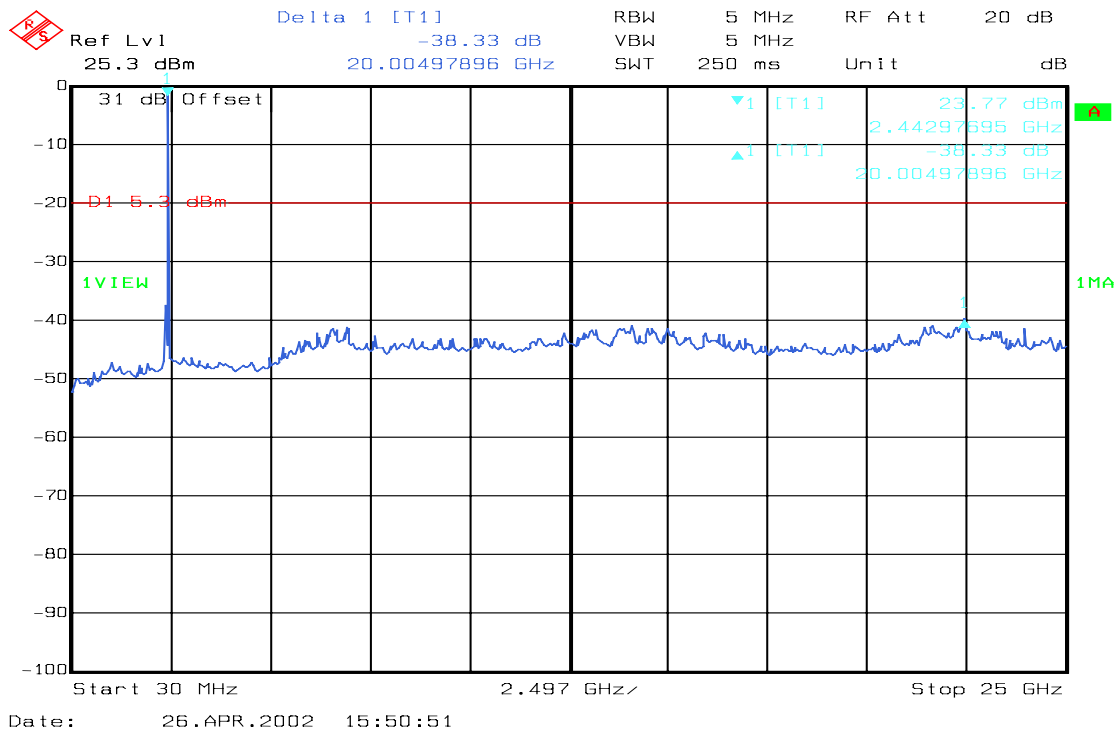
Job No.: 1L0617R Date: 4/26/2002

Specification: 15.2 Temperature(°C): 23

Tested By: Tom Tidwell Relative Humidity(%) 57

E.U.T.: 2.4 GHz BTS

Configuration: Full TX power



Notes: **Mid Channel**

~~Data Plot~~ **~~Spurious Emissions at Antenna Terminals~~**

Page ~~3~~ of 5

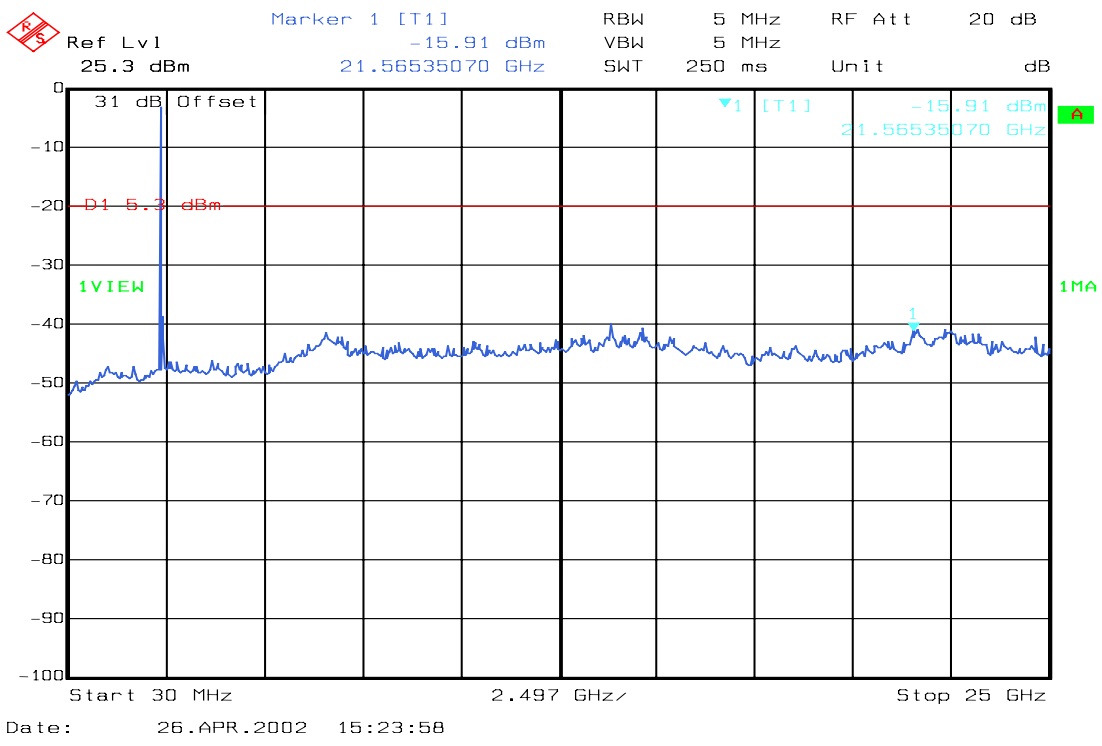
Job No.: 1L0617R Date: 4/26/2002

Specification: 15.247 Temperature(°C): 23

Tested By: Tom Tidwell Relative Humidity(%) 57

E.U.T.: 2.4 GHz BTS

Configuration: Full TX power



Notes: **Low Channel**

Section 8. Spurious Emissions (radiated)

NAME OF TEST: Restricted Bands	PARA. NO.: 15.247 (c)
TESTED BY: D. Light	DATE: 6/10/2002

Test Results: Complies.

Measurement Data: See attached table.

Duty Cycle Calculation:

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

Measurement Uncertainty: +/- 0.7 dB

Note: During testing, the input to each antenna was verified to be +24 dBm at each channel tested.

EQUIPMENT: RipWave 2.4 GHz BTS PROJECT NO.: 1L0617RUS1rev2

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Radiated Emissions

Page 1 of 2

Job No.:	1L0617R	Date:	6/10/02
Specification:	15.205	Temperature(°C):	24
Tested By:	David Light	Relative Humidity(%)	40
E.U.T.:	2.4 GHz BTS		
Configuration:	All transmitters active, all antennas active, 24 dBm output per transmitter		
Sample Number:	1		
Location:	Lab 6	RBW:	1 MHz
Detector Type:	Peak	VBW:	1 MHz

Test Equipment Used

Antenna:	1304	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
								Tx at 2.4775 GHz
								Highest channel
2.4835	33.7	28.2	3.1	0.0	65.0	74	-9.0	Peak - Vertical
2.4835	18.2	28.2	3.1	0.0	49.5	54	-4.5	Average - Vertical
4.955	44	33.8	4.3	29.6	52.5	54	-1.5	Peak - Vertical
7.4325	43	36.2	5.3	34.1	50.4	54	-3.6	Peak - Vertical
12.3875	44	39.9	7.3	32.7	58.5	74	-15.5	Peak - Vertical
12.3875	33	39.9	7.3	32.7	47.5	54	-6.5	Average - Vertical
2.4835	31.5	28.2	3.1	0.0	62.8	74	-11.2	Peak - Horizontal
2.4835	15.8	28.2	3.1	0.0	47.1	54	-6.9	Average - Horizontal
4.955	44.2	33.8	4.3	29.6	52.7	54	-1.3	Peak - Horizontal
7.4325	43	36.2	5.3	34.1	50.4	54	-3.6	Peak - Horizontal
12.3875	44	39.9	7.3	32.7	58.5	74	-15.5	Peak - Horizontal
12.3875	33	39.9	7.3	32.7	47.5	54	-6.5	Average - Horizontal
								Tx at 2.4425 GHz
								Mid Channel
4.8850	42.8	33.8	4.3	29.6	51.3	54	-2.7	Peak - Vertical
7.3725	42.5	36.2	5.3	34.1	49.9	54	-4.1	Peak - Vertical
4.8850	37.7	33.8	4.3	29.6	46.2	54	-7.8	Peak - Horizontal
7.3725	37.2	36.2	5.3	34.1	44.6	54	-9.4	Peak - Horizontal

Notes: **Peak readings 1 MHz RBW / 1 MHz VBW - Average readings 1 MHz RBW / 10 Hz VBW**
Average readings include -6 dB correction for TDD modulation

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Radiated Spurious Emissions

Page 1 of 2 **Continuation Page**

Job No.: 1L0617R Date: 6/11/02

Specification: 15.205 Temperature(°F): 24

Tested By: #N/A Relative Humidity(%) 40

E.U.T.: 2.4 GHz BTS

Configuration: All transmitters active, all antennas active, 24 dBm output per transmitter

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
								Tx at 2.4025 GHz
								Lowest channel
4.805	44	33.8	4.3	29.6	52.5	54	-1.5	Peak - Vertical
12.0125	43.3	39.9	7.3	32.7	57.8	74	-16.2	Peak - Vertical
12.0125	27.5	39.9	7.3	32.7	42.0	54	-12.0	Average - Vertical
4.805	42.7	33.8	4.3	29.6	51.2	54	-2.8	Peak - Horizontal
12.0125	43.7	39.9	7.3	32.7	58.2	74	-15.8	Peak - Horizontal
12.0125	28	39.9	7.3	32.7	42.5	54	-11.5	Average - Horizontal

Notes:	**Peak readings 1 MHz RBW / 1 MHz VBW - Average readings 1 MHz RBW / 10 Hz VBW**
	Average readings include -6 dB correction for TDD modulation

Radiated Photographs (Worst Case Configuration)

Section 9. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: T. Tidwell	DATE: 4/26/02

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 0.7 dB

EQUIPMENT: RipWave 2.4 GHz BTS PROJECT NO.: 1L0617RUS1rev2

~~Data Plot~~ **~~Peak Power Spectral Density~~**

Page ~~1~~ of ~~3~~ Complete X

Job No.: 1L0617R Date: 4/26/2002 Preliminary:

Specification: 15.247 Temperature(°C): 23

Tested By: Tom Tidwell Relative Humidity(%) 57

E.U.T.: 2.4 GHz BTS

Configuration: Transmit full power

Sample Number:

Location: RBW: Refer to plots

Detector Type: Peak VBW: Refer to plots

~~Test Equipment Used~~

Antenna: Directional Coupler:

Pre-Amp: Cable #1:

Filter: Cable #2:

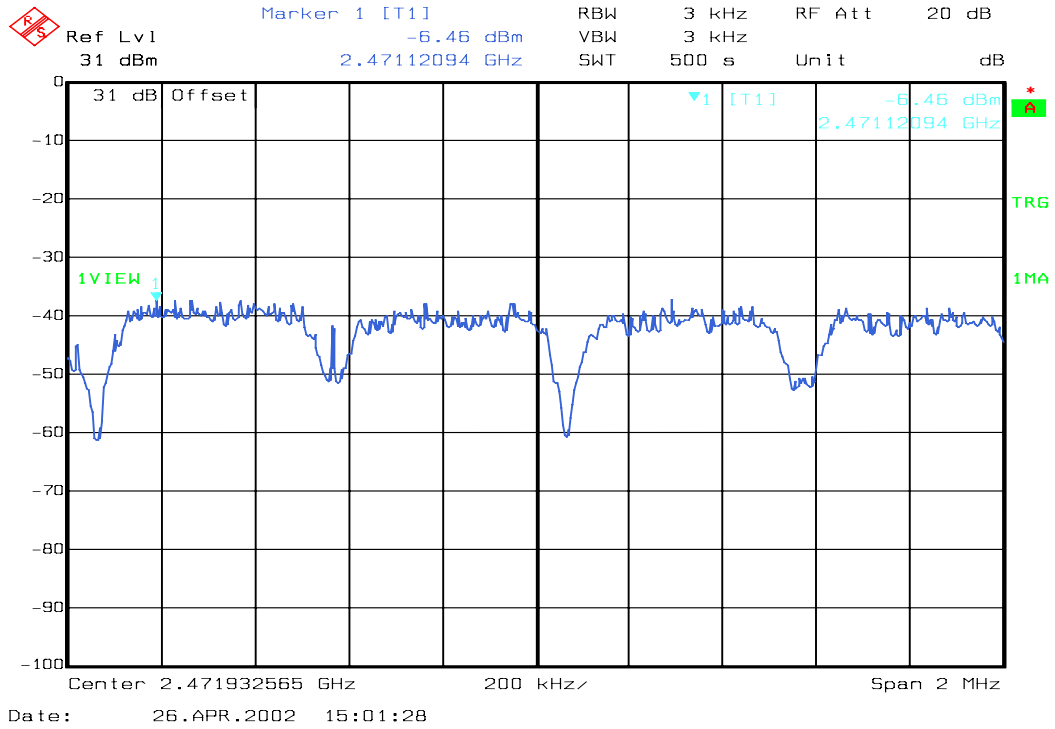
Receiver: 1036 Cable #3:

Attenuator #1 Cable #4:

Attenuator #2: Mixer:

Additional equipment used: 30 dB attenuator

Measurement Uncertainty: +/-1.7 dB

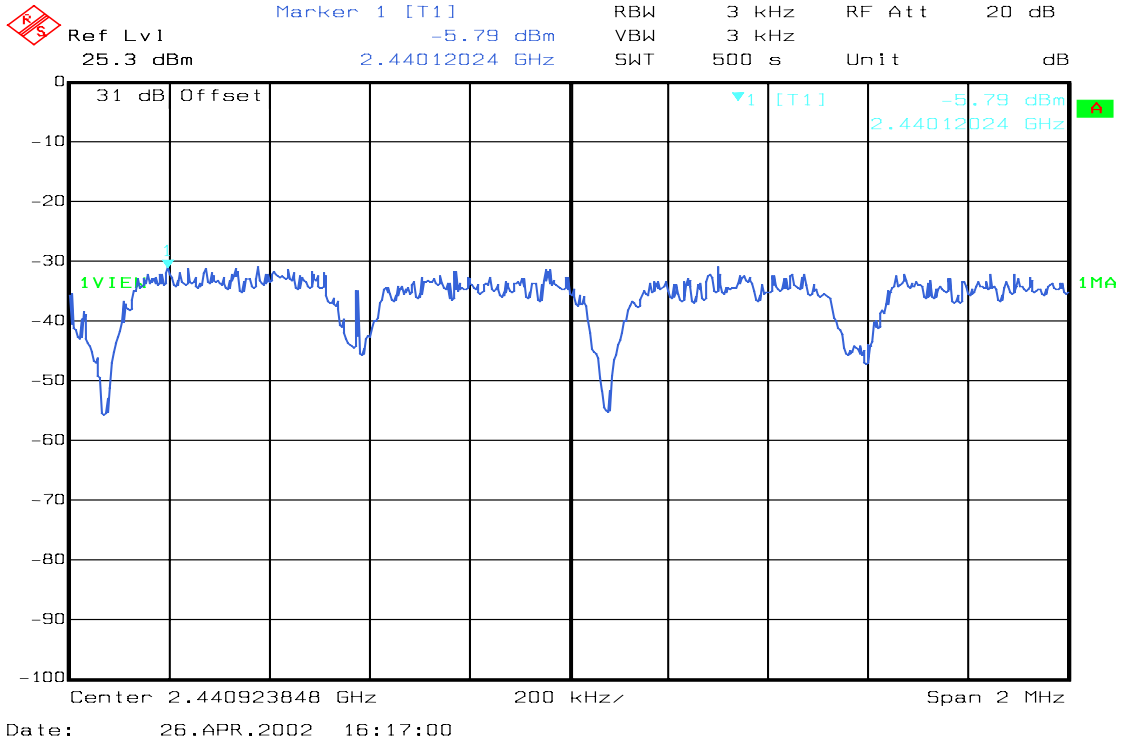


Notes: **High Channel**

~~Data Plot~~ **~~Peak Power Spectral Density~~**

Page ~~2~~ of 3

Job No.: 1L0617R Date: 4/26/2002
Specification: 15.2 Temperature(°C): 23
Tested By: Tom Tidwell Relative Humidity(%) 57
E.U.T.: 2.4 GHz BTS
Configuration: Transmit full power

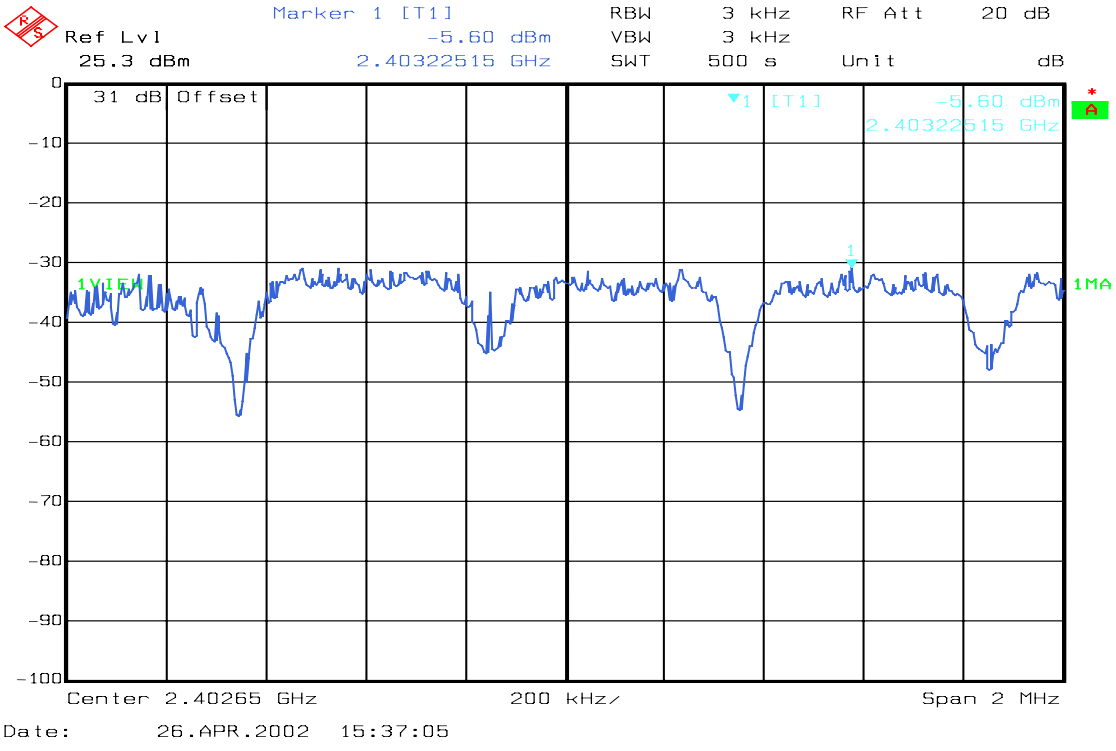


Notes: Mid Channel

~~Data Plot~~ **~~Peak Power Spectral Density~~**

Page ~~3~~ of 3

Job No.: 1L0617R Date: 4/26/2002
Specification: 15.247 Temperature(°C): 23
Tested By: Tom Tidwell Relative Humidity(%) 57
E.U.T.: 2.4 GHz BTS
Configuration: Transmit full power



Notes: **Low Channel**

Section 10. Minimum Processing Gain

NAME OF TEST: Minimum Processing Gain	PARA. NO.: 15.247(e)

Test Results: Complies. The processing gain of the system is 15 dB.

Measurement Data: See data and information in separate exhibit.

Section 11. Test Equipment List

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	01/02/02
1625	CABLE, 18 ft	MEGAPHASE 10311 1GVT4	N/A	10/23/01
1046	Flex cable 1m	Astrolab Inc. 32022-2-29094K-1M	N/A	01/18/02
1482	Band Pass Filter	K & L 11SH10-4000/T12000-0/0	2	Cal B4 Use
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/30/01

ANNEX A - TEST DETAILS

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

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 250µV (48 dBµV) across 50 ohms.

NAME OF TEST: Minimum 6 dB bandwidth	PARA. NO.: 15.247(a)(2)

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 2.4 GHz BTS PROJECT NO.: 1L0617RUS1rev2

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)

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 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 (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)

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:

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

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

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

E/N_o is $(S/N)_{out}$
for example, for a bit error rate of 10^{-4} a S/N ratio of 12.3 dB is required.

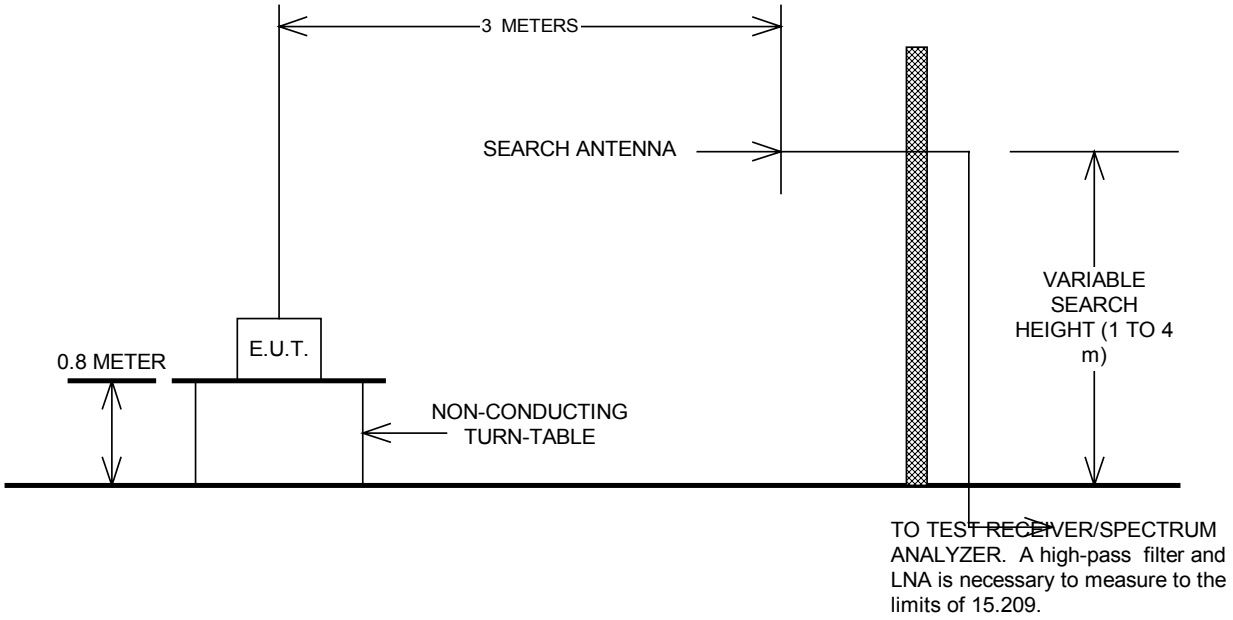
$L_{sys\ (system\ losses)}$ is assumed to be 2 dB.

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

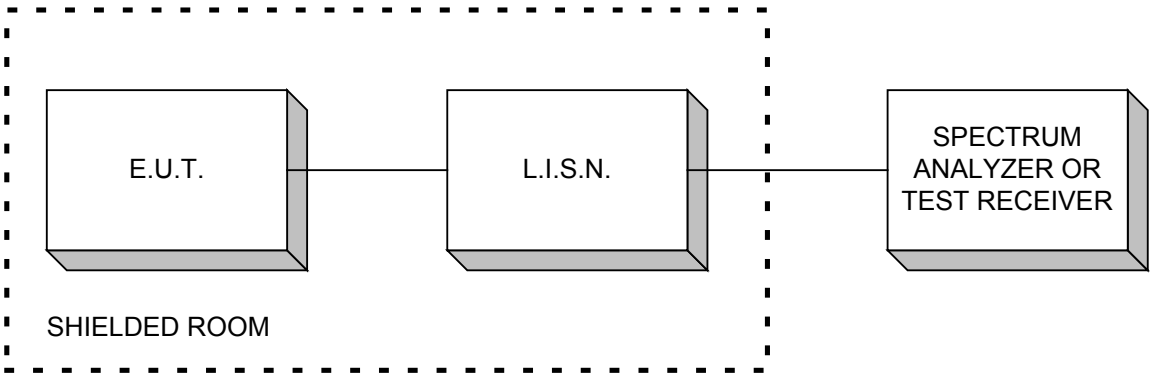
Measurement performed at a channel in the center of the operating band of the EUT.

ANNEX B - TEST DIAGRAMS

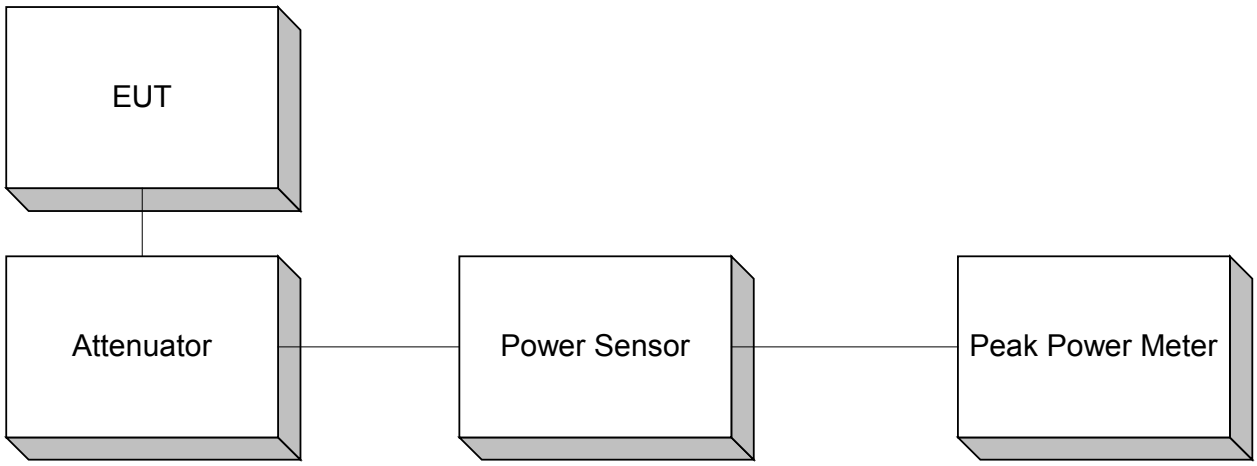
Test Site For Radiated Emissions



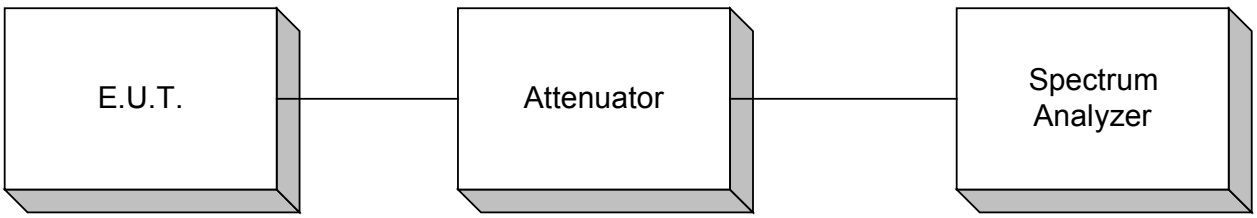
Conducted Emissions



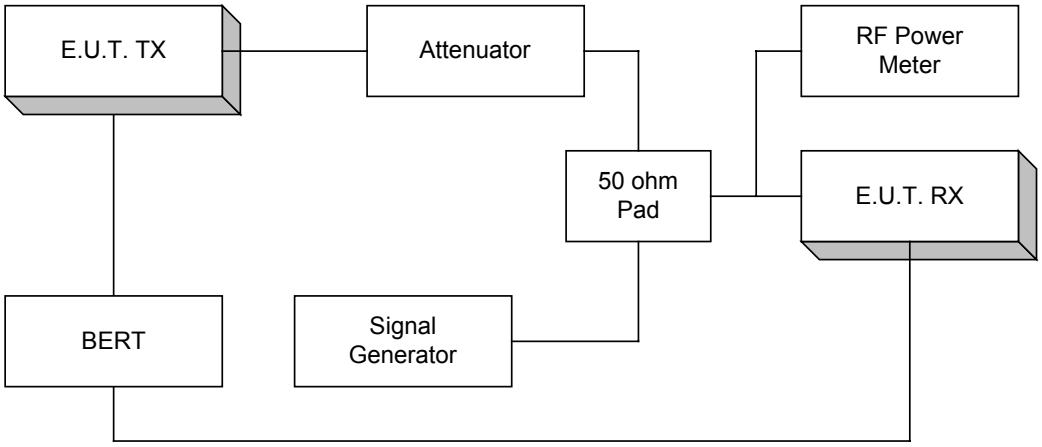
Peak Power At Antenna Terminals



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.