




Nemko Test Report: 11672RUS2rev2

Applicant: Cirronet
3079 Premiere Parkway
Duluth, Georgia 30097
USA

**Equipment Under Test:
(E.U.T.)** DNT500P

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Digital Transmission System Transmitter

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

TESTED BY: 

David Light, Senior Wireless Engineer **DATE:** 12 March 2008

APPROVED BY: 

Mike Cantwell, Frontline Manager **DATE:** 24 March, 2008

Number of Pages: 30

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Section 1. Summary of Test Results

Manufacturer: Cirronet

Model No.: DNT500P

Serial No.: 19

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 Digital Transmission Systems. 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.

See "Summary of Test Data".



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Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a)	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	Complies
Maximum Peak Power Output	15.247(b)(3)	Complies
Spurious Emissions (Antenna Conducted)	15.247(d)	Complies
Spurious Emissions (Restricted Bands)	15.247(d)/15.209(a)	Complies
Peak Power Spectral Density	15.247(e)	Complies

Footnotes:

The EUT is not powered off the AC mains. The module may be installed in any device that provides 3.3 to 5 Vdc via external means. The device is listed as “Modular Approval”

EQUIPMENT: DNT500P

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

General Equipment Information

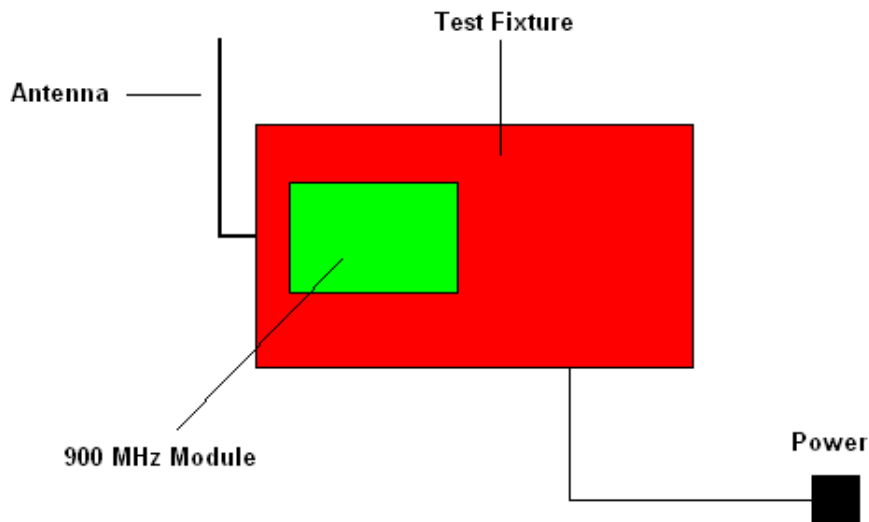
Frequency Band (MHz):	902-928	2400-2483.5	5725-5850
	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operating Frequency of Test Sample:	903.25 to 926.25		
Standard Input Voltage:	5 Vdc		
Data Rate:	500 kbps		
User Frequency Adjustment:	Software controlled		

EQUIPMENT: DNT500P

Description of EUT

900 MHz transceiver module utilizing either frequency hopping spread spectrum or digital transmission technology. Power Supply manufactured by PHIHONG, model number PSA05A-050, Input 100-240V~ 0.2A, 50-60 Hz, Max total output power 5W, Serial number M01313501A2.

System Diagram



EQUIPMENT: DNT500P

Section 3. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: David Light	DATE: 11 March 2008

Test Results: Complies.

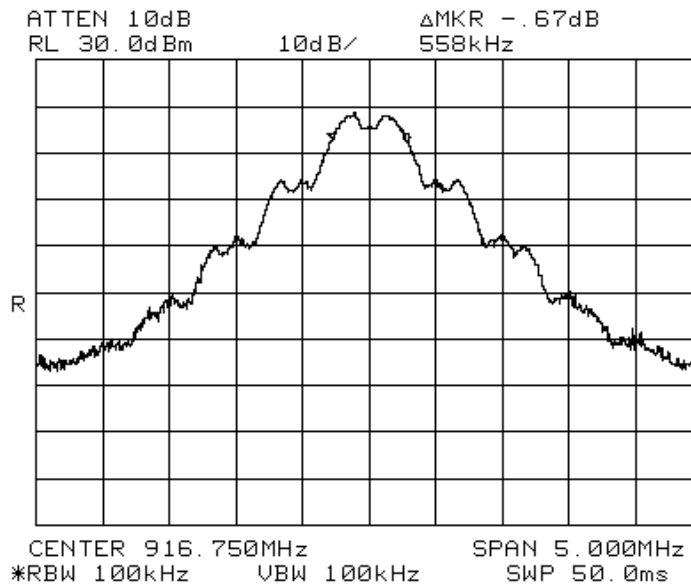
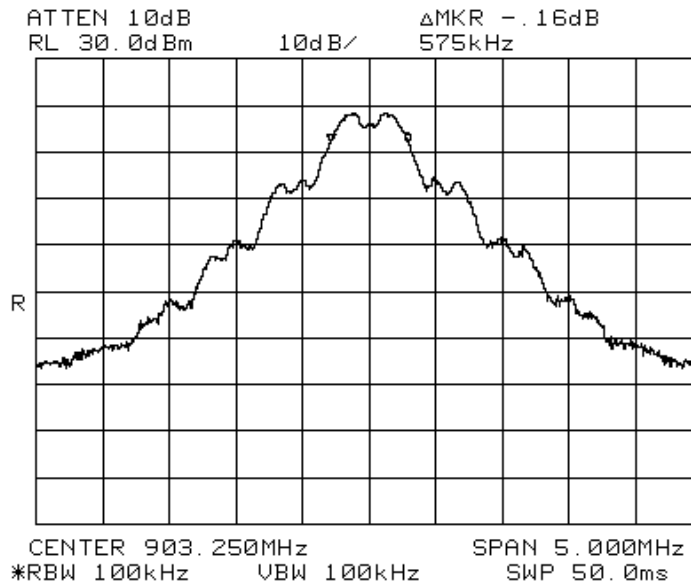
Measurement Data: See 6 dB BW plot
Measured 6 dB bandwidth: 583 kHz max
Measured 20 dB bandwidth: 1533 kHz max

Test Conditions: 20 %RH
30 °C

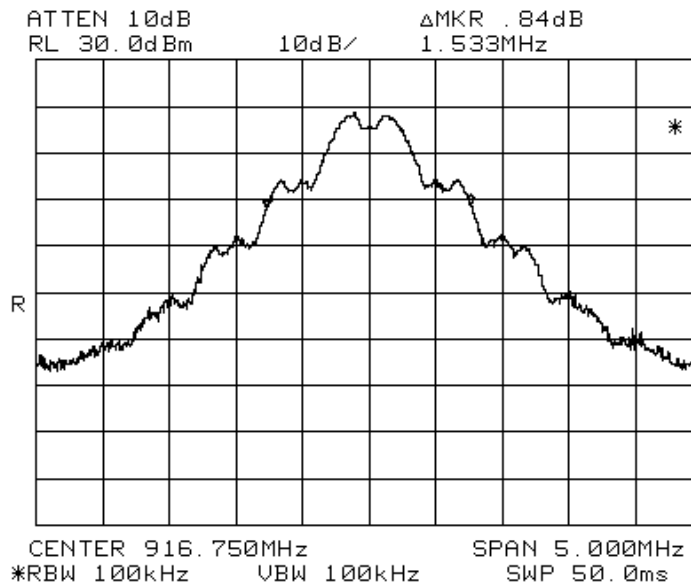
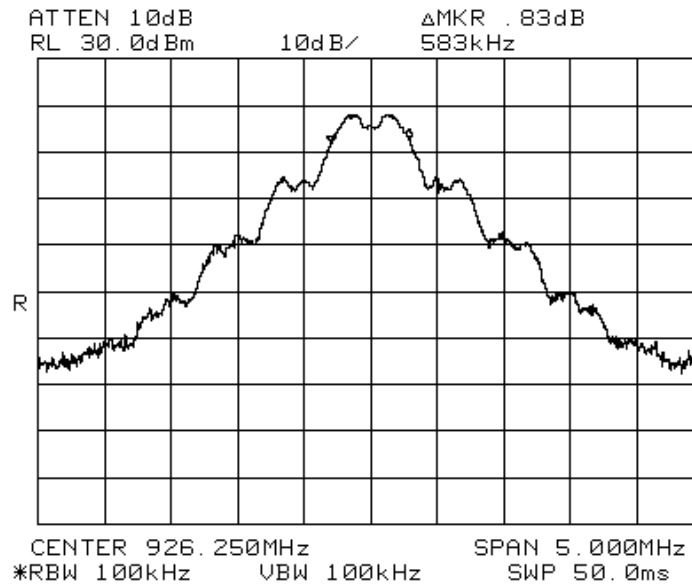
Measurement Uncertainty: +/-1x10⁻⁷ ppm

Test Equipment Used: 1082-1464-1472-1469

Test Data – Occupied Bandwidth



Test Data – Occupied Bandwidth



Section 4. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(3)
TESTED BY: David Light	DATE: 11 March 2008

Test Results: Complies.

Measurement Data:

Detachable antenna? Yes No
 If yes, state the type of non-standard connector used: R-SMA

Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)	Antenna Type	Gain (dBi)	E.I.R.P. (dBm)	E.I.R.P. (mW)
903.25	19.3	85.1	Dipole	2	21.3	134.9
916.75	19.2	83.2	Dipole	2	21.2	131.8
926.25	19.2	83.2	Dipole	2	21.2	131.8
Maximum EIRP (mW): 169.8						

RBW =VBW = 1 MHz Peak detector

Test Conditions: 20 %RH
 30 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 1464-1472-1469-1082

This device was tested at 3.3 and 5.75 Vdc input power per 15.31(e), with no variation in output power.

The device was tested on three channels per 15.31(l).

Section 5 Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 15.247 (d)
TESTED BY: David Light	DATE: 11 March 2008

Test Results: Complies.

Measurement Data: See attached plots.

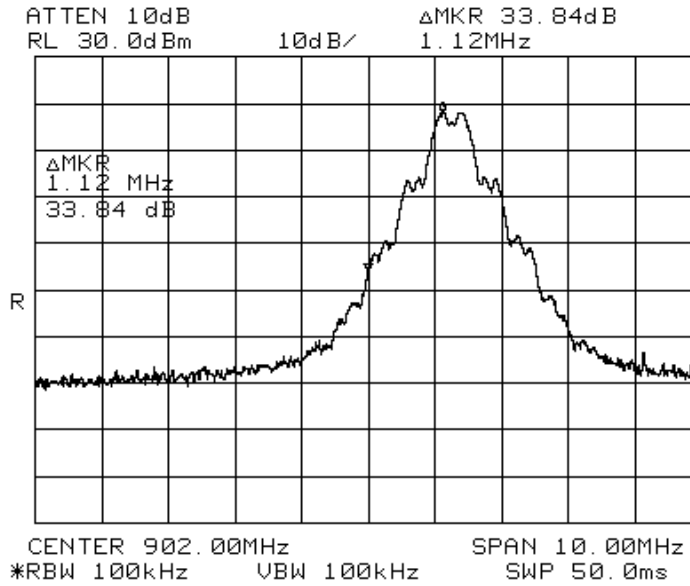
Test Conditions: 20 %RH
 30 °C

Measurement Uncertainty: +/-1.7 dB

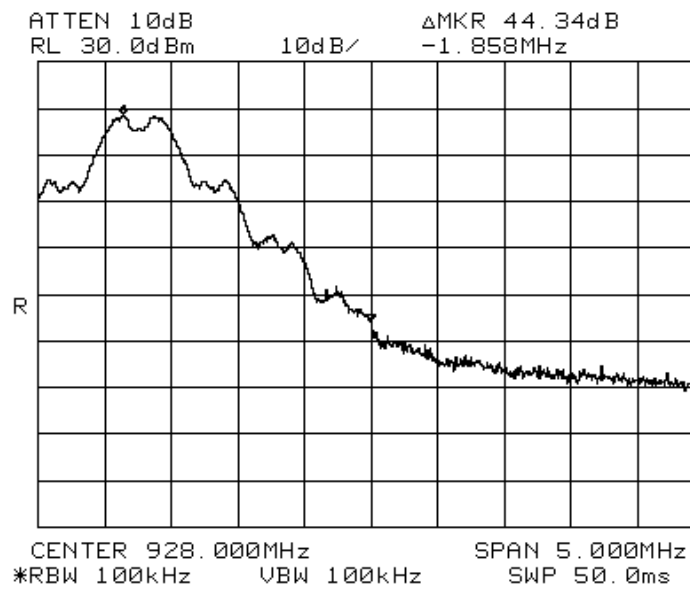
Test Equipment Used: 1464-1472-1469-1082

Test Data – Spurious Emissions at Antenna Terminals

Lower Band Edge

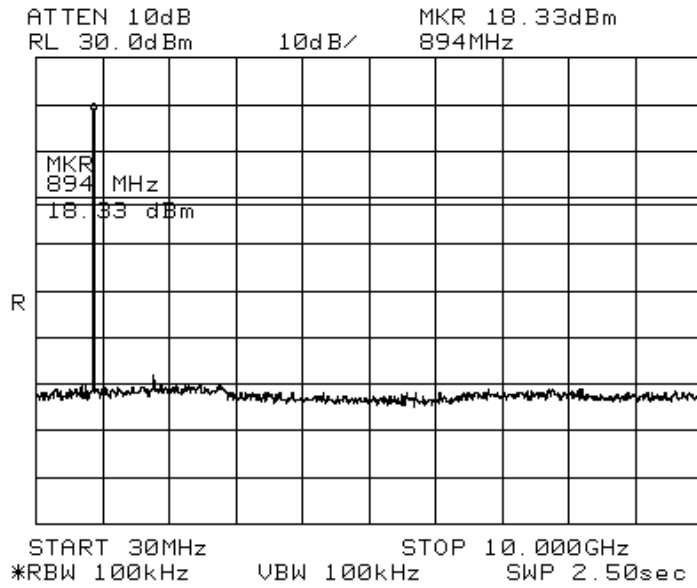


Upper Band Edge

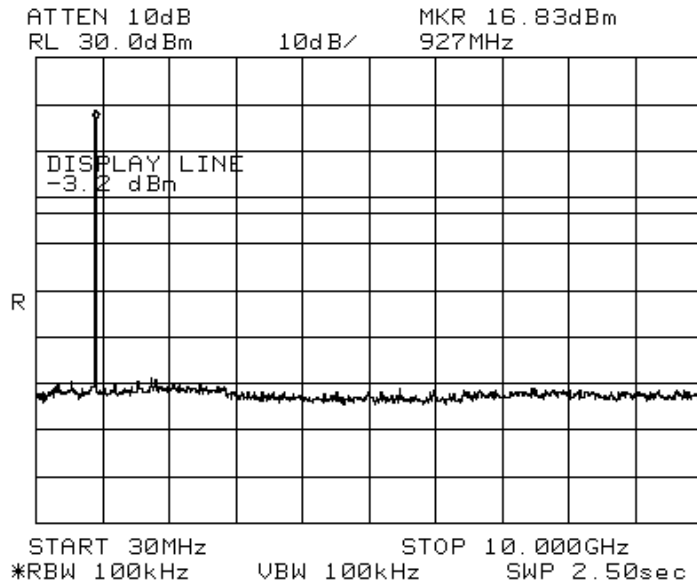


Test Data – Spurious Emissions at Antenna Terminals

Low Channel
Spurs

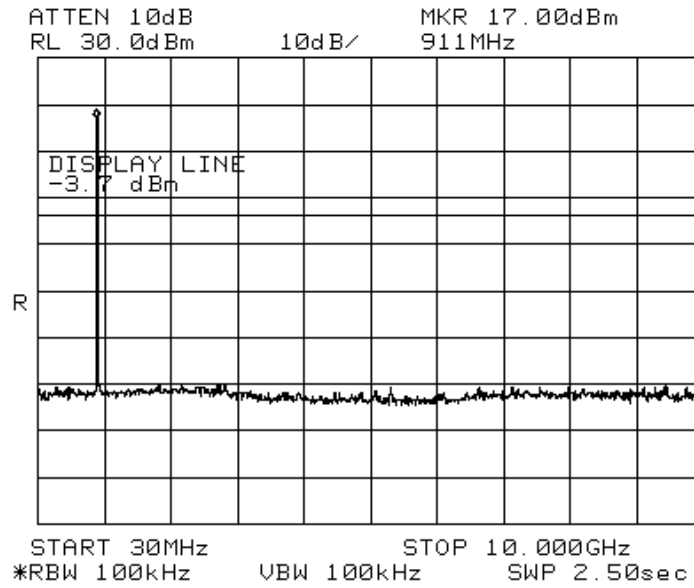


Mid Channel Spurs



Test Data – Spurious Emissions at Antenna Terminals

High Channel
Spurs



EQUIPMENT: DNT500P

Section 6. Radiated Emissions

NAME OF TEST: Radiated Emissions	PARA. NO.: 15.247 (d)
TESTED BY: David Light	DATE: 11 March 2008

Test Results: Complies. The worst case emission was 52.1 dBµV/m at 2781.75 MHz. This is 1.9 dB below the average specification limit of 54.0 dBµV/m.

Measurement Data: See attached table.

Test Conditions: 20 %RH
30 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 1464-1484-1485-1016-791-993-759-1195

Notes:

- For handheld devices, the EUT was tested on three orthogonal axis'
- The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33
- The device was tested on three channels per 15.31(l).
- No emissions were detected within 20 dB of the specification limit therefore none are reported per 15.31(o). Band edge data is presented below.

RBW=VBW=100 kHz below 1000 MHz
RBW=VBW=1 MHz above 1000 MHz (Peak)
RBW= 1 MHz VBW=10Hz (Average)

Radiated Emissions

Freq MHz	Rdng dBµV	Cable dB	Cable dB	Horn dB	Pre-A dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
2708.25 Low Channel	48.0	+0.8	+2.8	+29.3	-32.7	+0.0	48.2	54.0	-5.8	Horiz
2708.25 Low Channel	50.5	+0.8	+2.8	+29.3	-32.7	+0.0	50.7	54.0	-3.3	Vert
3611.00 Low Channel	47.5	+0.8	+2.8	+30.3	-32.4	+0.0	49.0	54.0	-5.0	Vert
4513.75 Low Channel	44.8	+1.0	+3.1	+32.1	-31.6	+0.0	49.4	54.0	-4.6	Vert
2750.25 Mid Channel	51.5	+0.8	+2.9	+29.4	-32.7	+0.0	51.9	54.0	-2.1	Vert
3667.00 Mid Channel	48.5	+0.8	+2.8	+30.5	-32.3	+0.0	50.3	54.0	-3.7	Vert
4583.75 Mid Channel	44.7	+1.0	+3.1	+32.3	-31.8	+0.0	49.3	54.0	-4.7	Vert
2750.25 Mid Channel	48.8	+0.8	+2.9	+29.4	-32.7	+0.0	49.2	54.0	-4.8	Horiz
2781.75 High Channel	48.5	+0.8	+2.9	+29.4	-32.7	+0.0	48.9	54.0	-5.1	Horiz
2781.75 High Channel	51.7	+0.8	+2.9	+29.4	-32.7	+0.0	52.1	54.0	-1.9	Vert
3709.00 High Channel	48.5	+0.8	+2.8	+30.6	-32.2	+0.0	50.5	54.0	-3.5	Vert
4636.25 High Channel	44.0	+1.0	+3.2	+32.5	-32.1	+0.0	48.6	54.0	-5.4	Vert

All measurements are PEAK unless otherwise indicated.

EQUIPMENT: DNT500P

Section 7. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(e)
TESTED BY: David Light	DATE: 11 March 2008

Test Results: Complies.

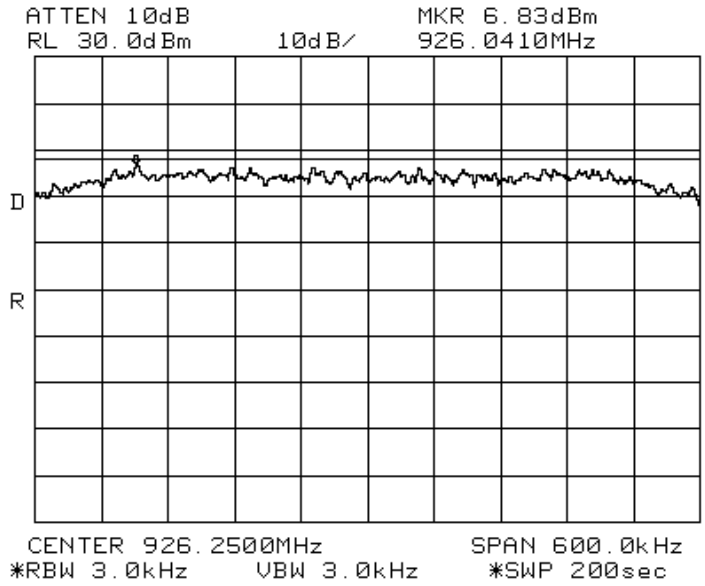
Measurement Data: See attached data..

Test Conditions: 20 %RH
30 °C

Measurement Uncertainty: +/-1.7 dB

Test Equipment Used: 1464-1472-1469-1082

Peak Power Spectral Density



Section 8. Powerline Conducted Emissions

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

Test Results: Complies. The worst case emission was 50.52 dB μ V at 197.6 kHz. This is 3.2 dB below the quasi-peak specification limit of 53.7 dB μ V. This is a peak measurement.

Test Data: Refer to attached plots

Equipment Used: 674-1663-1548-1555-1258

Measurement Uncertainty: +/- 1.7 dB

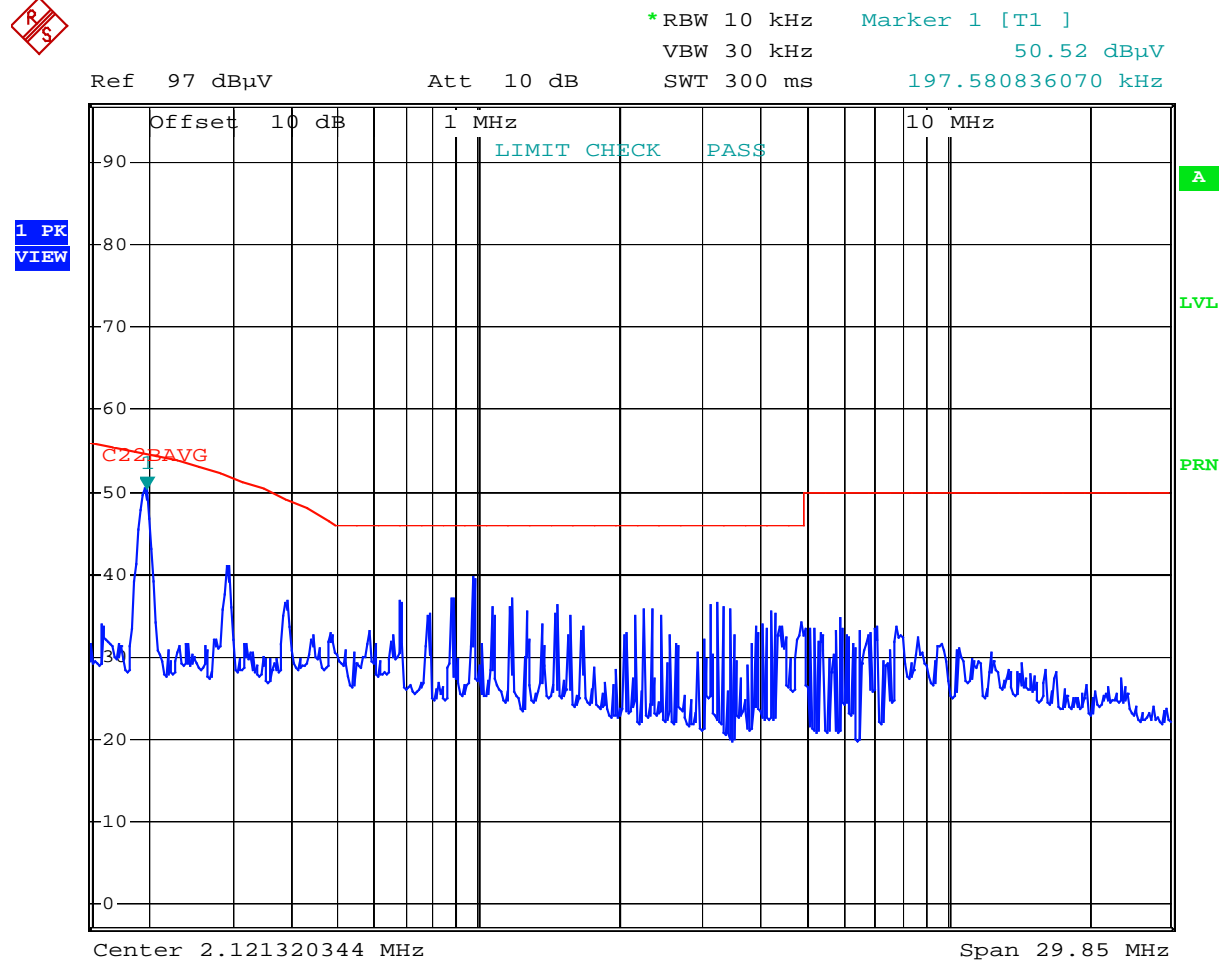
Temperature: 22 °C

Relative Humidity: 35 %

EQUIPMENT: DNT500P

Test Data – Powerline Conducted Emissions

L1



Date: 10.JUN.2008 11:27:13

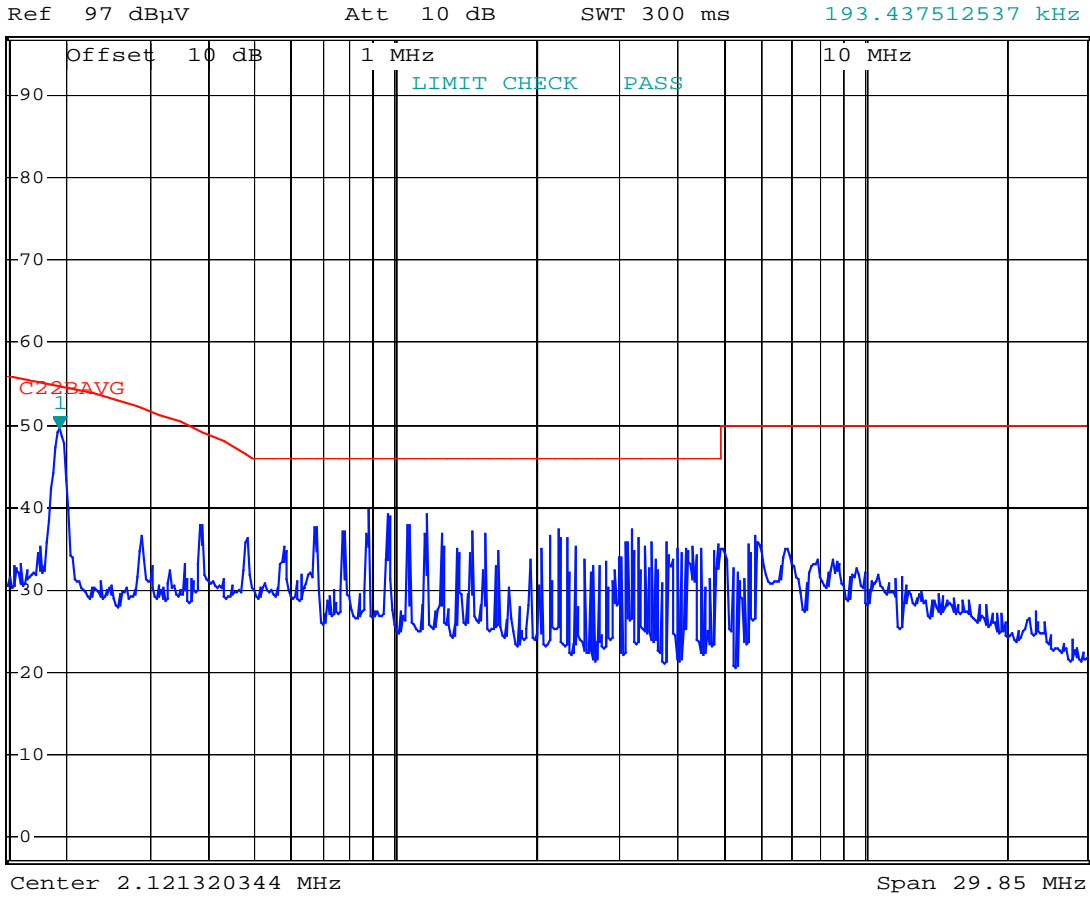
EQUIPMENT: DNT500P

Test Data – Powerline Conducted Emissions

L2



*RBW 10 kHz Marker 1 [T1]
VBW 30 kHz 49.54 dBμV
SWT 300 ms 193.437512537 kHz



Date: 10.JUN.2008 11:26:20

Section 9. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/24/07	01/24/09
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1472	20db Attenuator DC 18 Ghz	Omni Spectra 20600-20db	NONE	CBU	N/A
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
1484	Cable	Storm PR90-010-072	N/A	05/02/07	05/01/08
1485	Cable	Storm PR90-010-216	N/A	05/02/07	05/01/08
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/01/07	04/30/08
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	05/01/07	04/30/08
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/30/08
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	03/30/07	03/29/08
1195	ANTENNA,BICONICAL	A.H. SYSTEMS SAS-200/542	235	03/30/07	03/29/08
674	LIMITER	HP 11947A	3107A02200	CBU	NA
1663	Spectrum Analyzer	Rhode & Schwarz FSP3	100073	07/23/07	07/22/08
1548	CABLE .8m	Nemko USA, Inc. RG214	N/A	12/13/07	12/12/08
1555	Filter high pass 5KHz	Solar Electronics 7930-5.0	933125	01/14/08	01/14/09
1258	LISN .15mhz-30mhz	EMCO 3825/2	1305	06/20/07	06/19/08

ANNEX A - TEST DETAILS

Nemko USA, Inc.

FCC PART 15, SUBPART C

Digital Transmission Systems

EQUIPMENT: DNT500P

Test Report No.: 11672RUS2rev2

NAME OF TEST: Occupied 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)(3)
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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.

Substitution Antenna Method for Integral Antennas:

The peak field strength of the carrier is measured in a worst-case configuration with a RBW > 5 times the occupied bandwidth of the transmitted waveform. For cases where the RBW of the test instrument is not sufficient, the power is measured using a peak power meter instead of the spectrum analyzer.

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

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
----------------------------------	-------------------------

Minimum Standard:

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW = VBW = 100 kHz.

Span: Sufficient to display 6 dB bandwidth

LOG dB/div.: 10 dB

Sweep: Auto

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: Spurious Emissions(conducted)	PARA. NO.: 15.247(d)
---	----------------------

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)
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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 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:

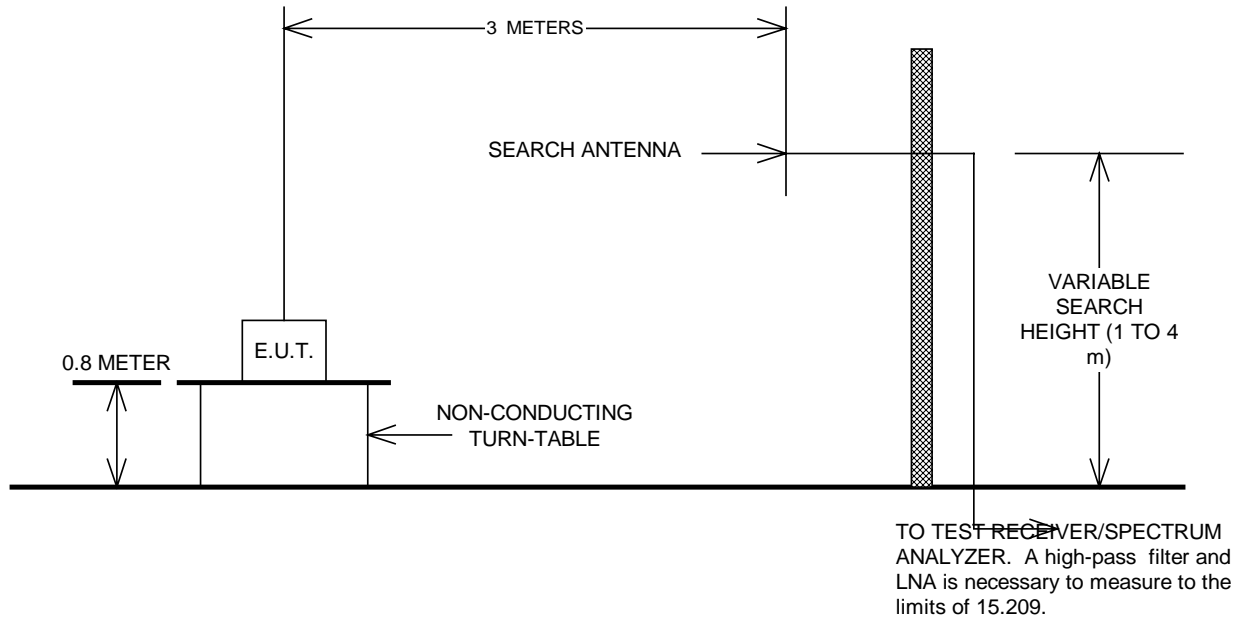
For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent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

Number of channels tested:

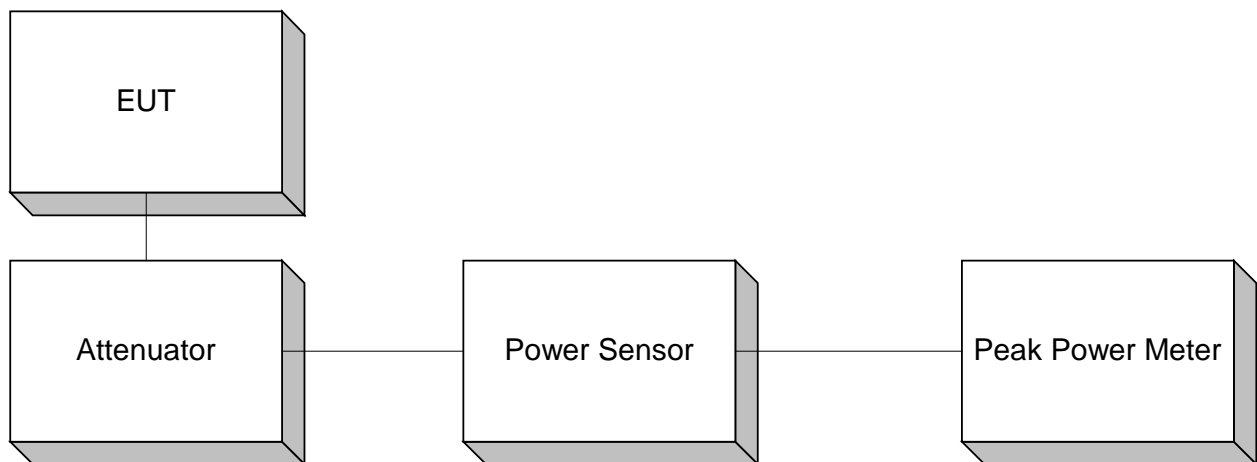
Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions



Peak Power At Antenna Terminals



Note: A spectrum analyzer may be substituted for Peak Power Meter given that the measurement bandwidth is sufficient to capture the 60 dB bandwidth of the transmitter.

EQUIPMENT: DNT500P

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

