



Nemko Test Report: 5L0546RUS3

Applicant: Nokia, Inc.

Equipment Under Test: 6265i
(E.U.T.)

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Frequency Hopping Transmitters

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

Authorized By: *Brian Boyea*

Brian Boyea, Resource Manager

Date: November 30, 2005

Table of Contents

Section 1.	Summary of Test Results.....	3
Section 2.	Equipment Under Test (E.U.T.)	5
Section 3.	Powerline Conducted Emissions.....	6
Section 4.	Spurious Emissions (Radiated).....	10
Section 5.	Channel Separation.....	13
Section 6.	Occupied Bandwidth	15
Section 7.	Peak Power Output	18
Section 8.	Time of Occupancy	19
Section 9.	Test Equipment List.....	22
ANNEX A - TEST DETAILS.....		23
ANNEX B - TEST DIAGRAMS		33

Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Section 1. Summary of Test Results

Manufacturer: Nokia, Inc.

Model No.: 6265i

Type: RM-66

Serial No.: ESN:033/07776604

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 Frequency Hopping 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.

See "Summary of Test Data".

NVLAP[®]

NVLAP LAB CODE: 100426-0

Nemko USA Inc. authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko USA Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report applies only to the items tested.

Summary Of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a)	Complies
Channel Separation	15.247(a)(1)	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	Complies
Time of Occupancy	15.247(a)(1)(ii)	Complies
20 dB Occupied Bandwidth	15.247(a)(1)	Complies
Peak Power Output	15.247(b)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	Complies
Spurious Emissions (Radiated)	15.247(c)	Complies

Footnotes:

- 1) All tests were performed radiated.

Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

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

General Equipment Information

Frequency Band: 2402 to 2480 MHz

Number of Channels: 79

Channel Spacing: 1 MHz

User Frequency Adjustment: Software controlled

Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: David Light	DATE: 11/29/05

Test Results: Complies.

Measurement Data: See attached plots.

Equipment Used: 1258-1433-1534-1036

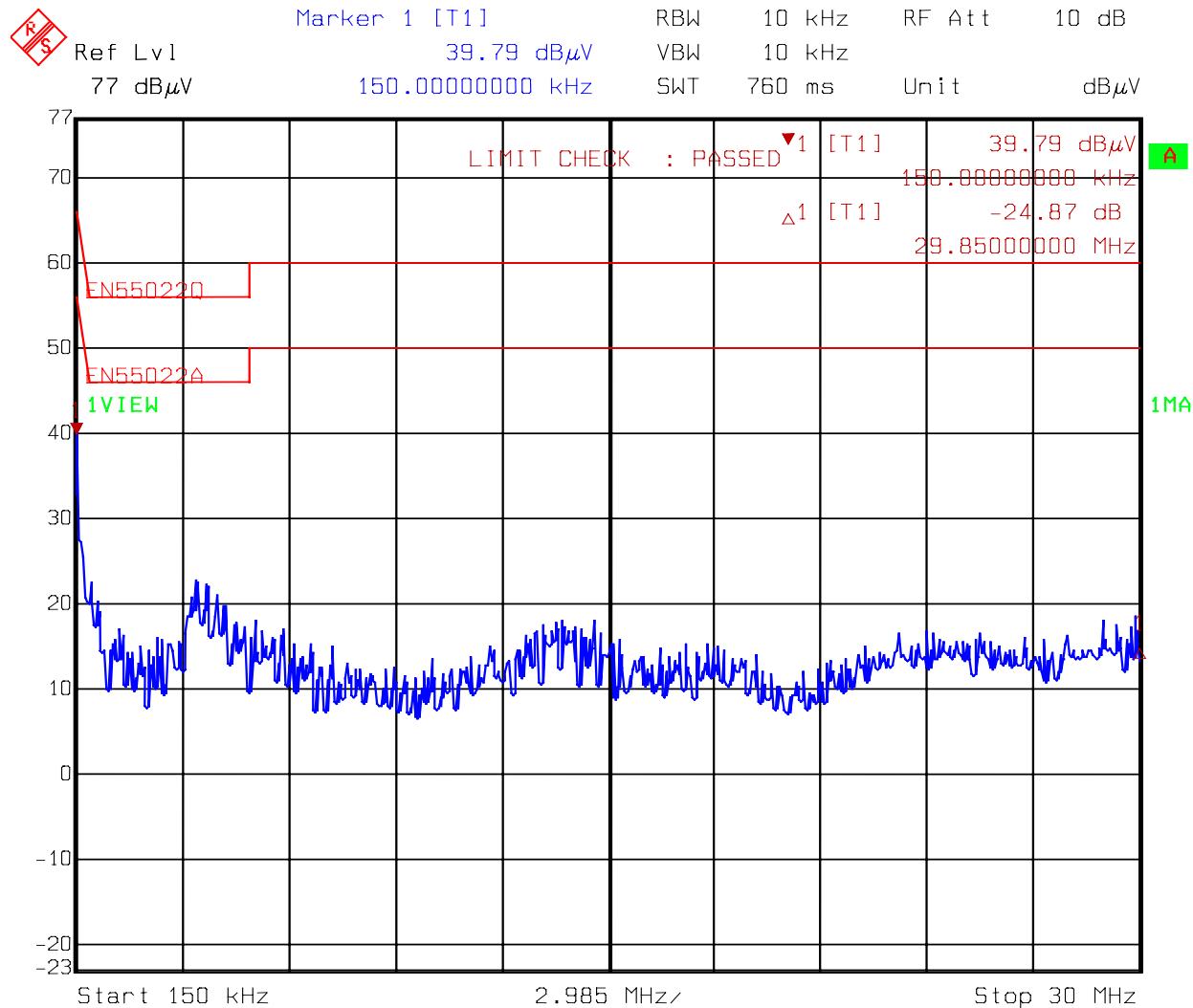
Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 45 %

Test Data – Powerline Conducted Emissions

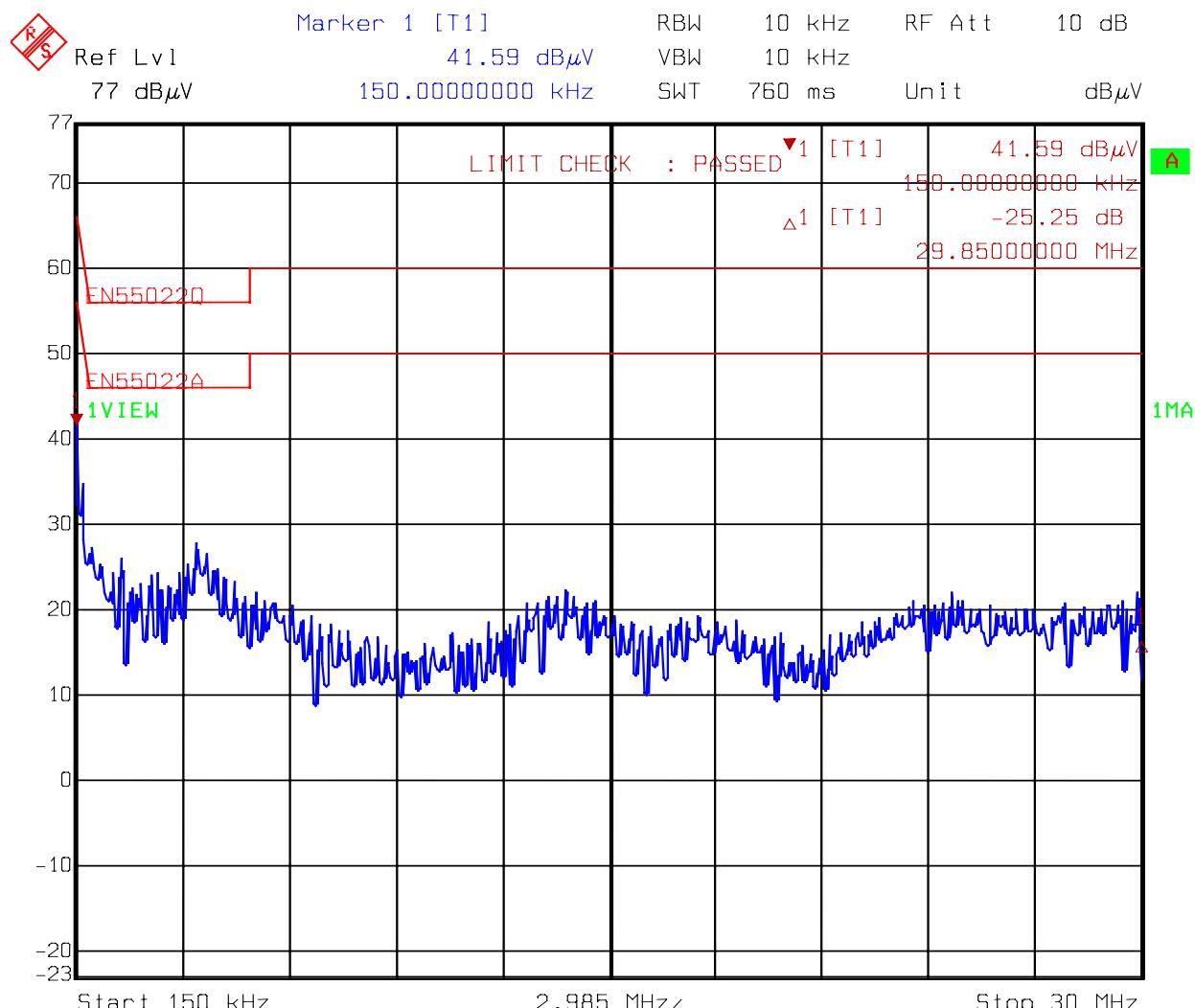
Line



Date: 29.NOV.2005 11:16:50

Test Data – Powerline Conducted Emissions

Neutral



Date: 29.NOV.2005 11:17:30

Nemko USA, Inc.

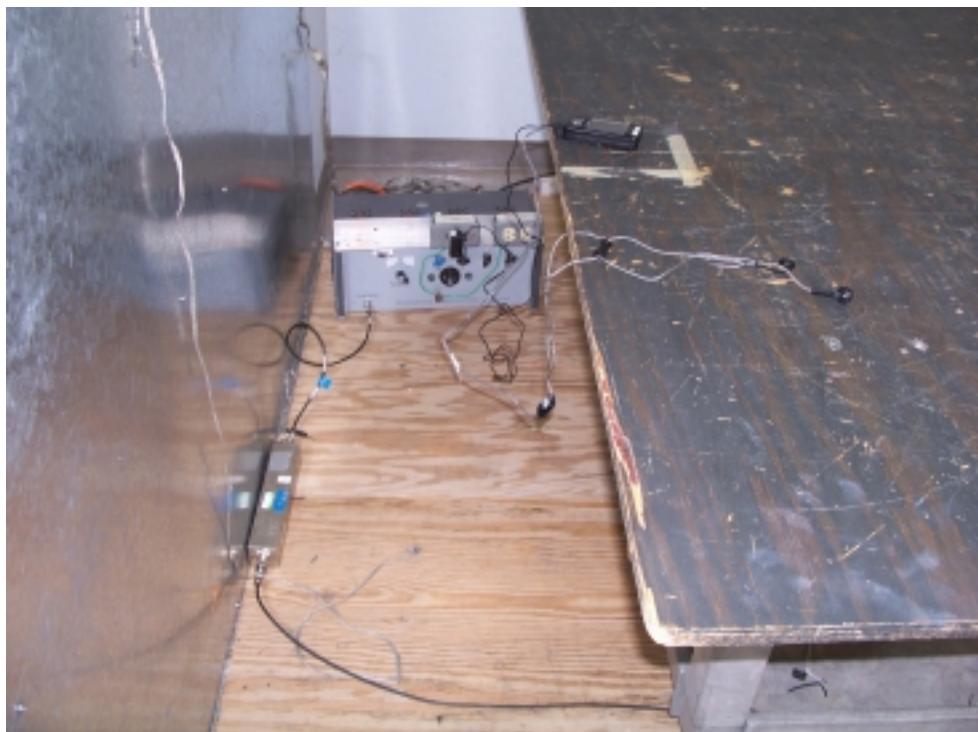
FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Test Setup Photos



Section 4. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
TESTED BY: David Light	DATE: 11/16/05

Test Results: Complies.**Measurement Data:** There were no harmonic emissions detected above the noise floor which is at least 20 dB below the specification limit of 74 dB μ V/m. Peak or 54 dB μ V/m Average. 1 MHz RBW/VBW for peak readings, 1 MHz RBW/1 MHz VBW with duty cycle correction was used for average measurement.

The worst case emission was 57.6 dB μ V/m. peak at 2483.5 MHz in the vertical polarity with the handset transmitting at 2480 MHz. This is 16.4 dB below the peak limit of 74 dB μ V/m at 3 meters

Duty Cycle Calculation:Duty Cycle correction factor(dB) = $20 \log (rf_{ON} \text{ in ms} / 100\text{ms})$ **Equipment Used:** 1484-1485-1464-1016-993**Measurement Uncertainty:** +/- 3.7 dB**Temperature:** 22 °C**Relative Humidity:** 45 %

The handset was tested on three orthogonal axis'.

Nemko USA, Inc.

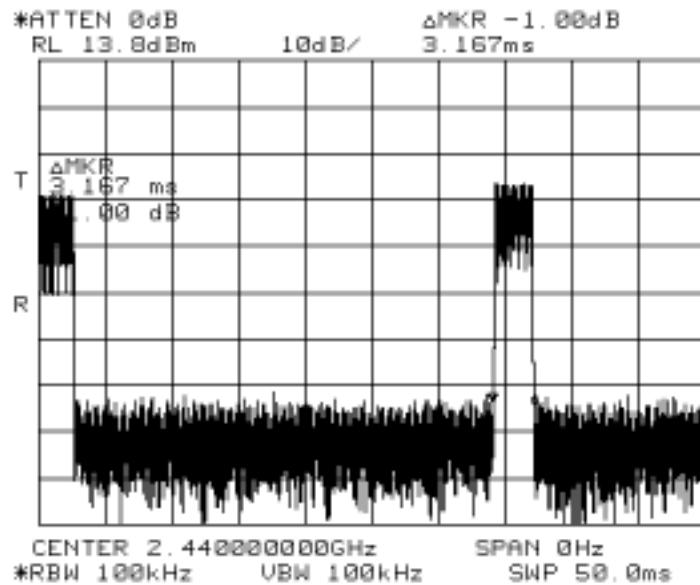
FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Test Data – Duty Cycle (Normal Hop Mode)



Duty cycle correction = $20 \log_{10} (\text{Time On mS}/100 \text{ mS})$

$20 \log_{10} (6.334/100) = -24 \text{ dB}$

Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Radiated Photographs



Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Section 5. Channel Separation

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE:11/16/05

Test Results: Complies.

Measurement Data: See 20 dB BW plot
Measured 20 dB bandwidth: 942 kHz max
Channel Separation: 1 MHz

Equipment Used:

Measurement Uncertainty: +/- 0.7 dB

Temperature: 22 °C

Relative Humidity: 45 %

Nemko USA, Inc.

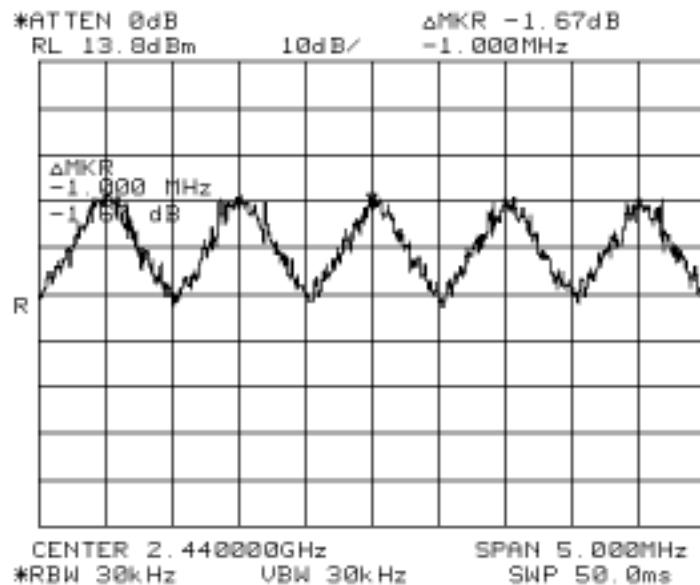
FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Test Data – Channel Separation



Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Section 6. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(1)(i)
TESTED BY: David Light	DATE: 11/15/05

Test Results: Complies.

Measurement Data: See attached plots.

Equipment Used:

Measurement Uncertainty: +/- 0.7 dB

Temperature: 20 °C

Relative Humidity: 45 %

Nemko USA, Inc.

FCC PART 15, SUBPART C

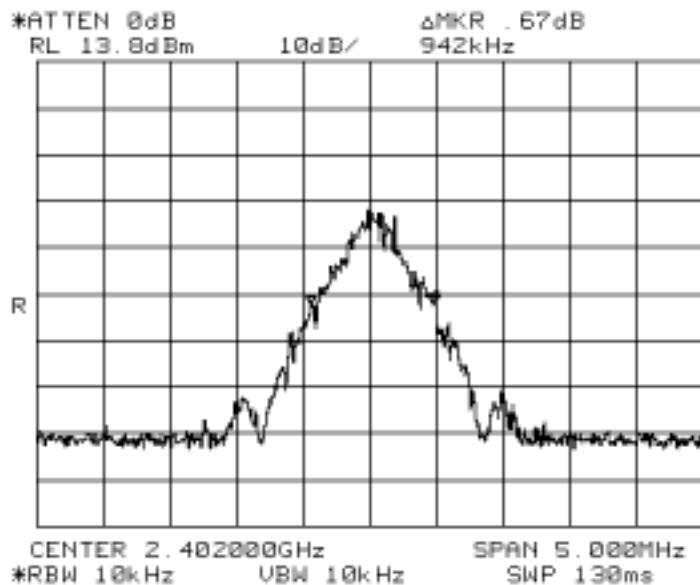
FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

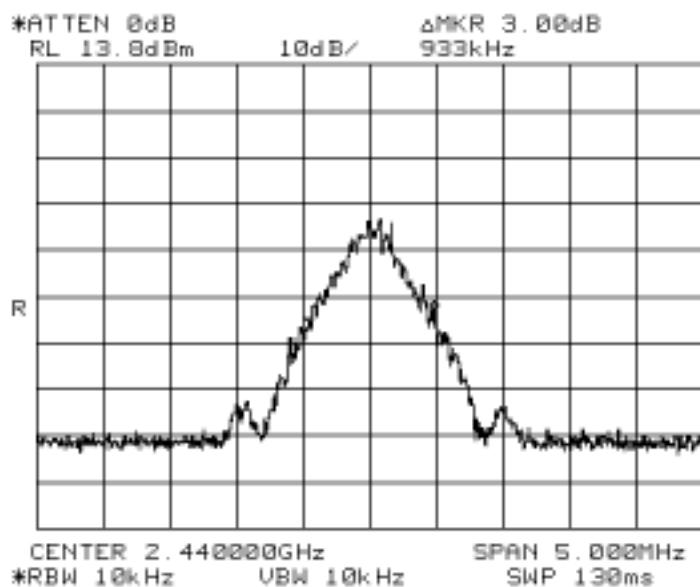
Test Report No.: 5L0546RUS3

Test Data – Occupied Bandwidth

Channel 0



Channel 38



Nemko USA, Inc.

FCC PART 15, SUBPART C

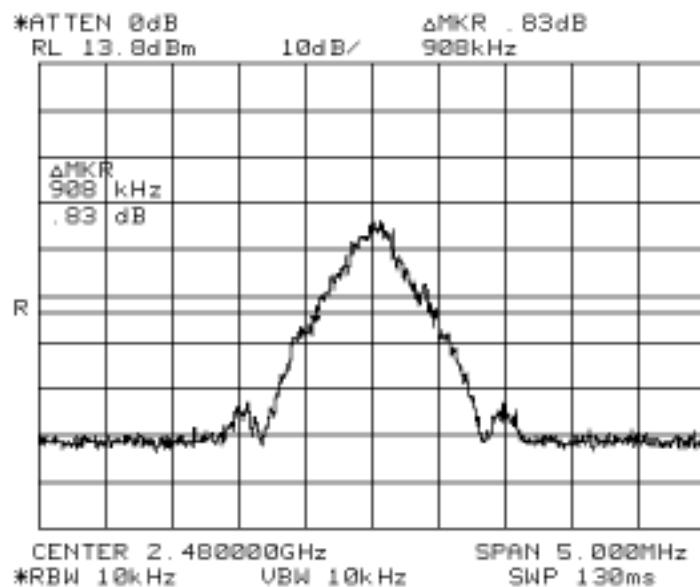
FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Test Data – Occupied Bandwidth

Channel 78



Section 7. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: David Light	DATE: 11/15/05

Test Results: Complies.**Measurement Data:** See attached plots.
Detachable antenna? Yes No
If yes, state the type of non-standard connector used:**Antennas:**

Frequency (MHz)	Peak Power (dBm)	Peak Power (mW)
2402	2.1	1.6
2440	2.0	1.6
2480	2.1	1.6
Peak power output at antenna port(dBm):		

This measurement was made radiated.**Equipment Used:** 1464-1484-1485-993**Measurement Uncertainty:** +/- 1.7. dB7**Temperature:** 22 °C**Relative Humidity:** 45 %

Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

Section 8. Time of Occupancy

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247 (a)(1)(iii)
TESTED BY: David Light	DATE: 11/15/05

Test Results: Complies.

This measurement was made radiated.

Equipment Used: 1464-1484-1485-993

Measurement Uncertainty: +/- 1.7. dB

7

Temperature: 22 °C

Relative Humidity: 45 %

Nemko USA, Inc.

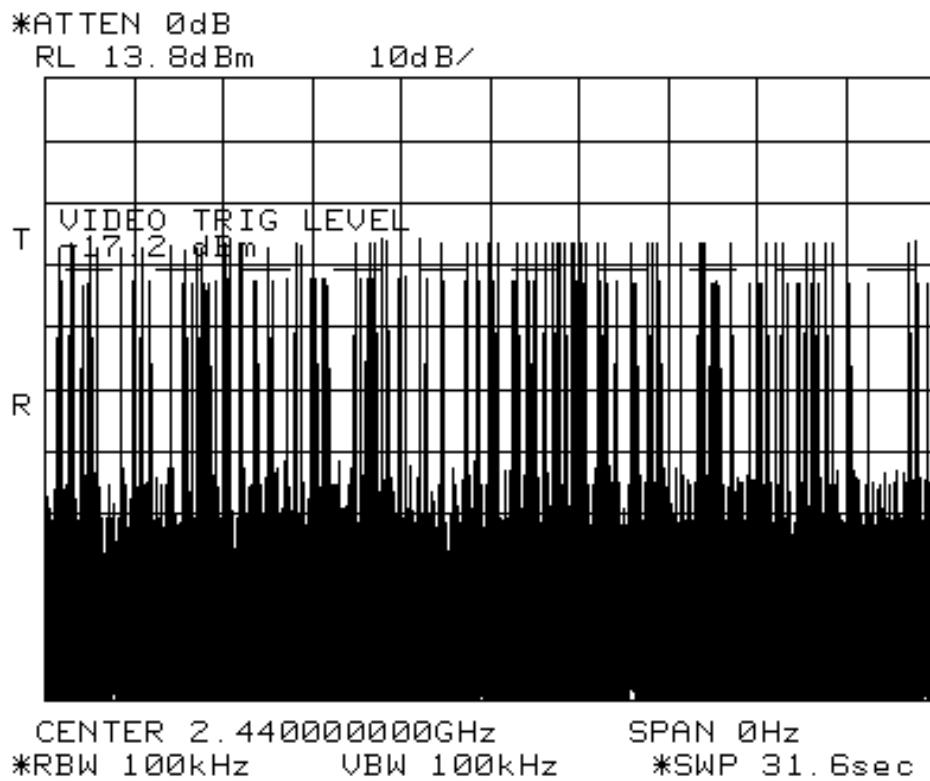
FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

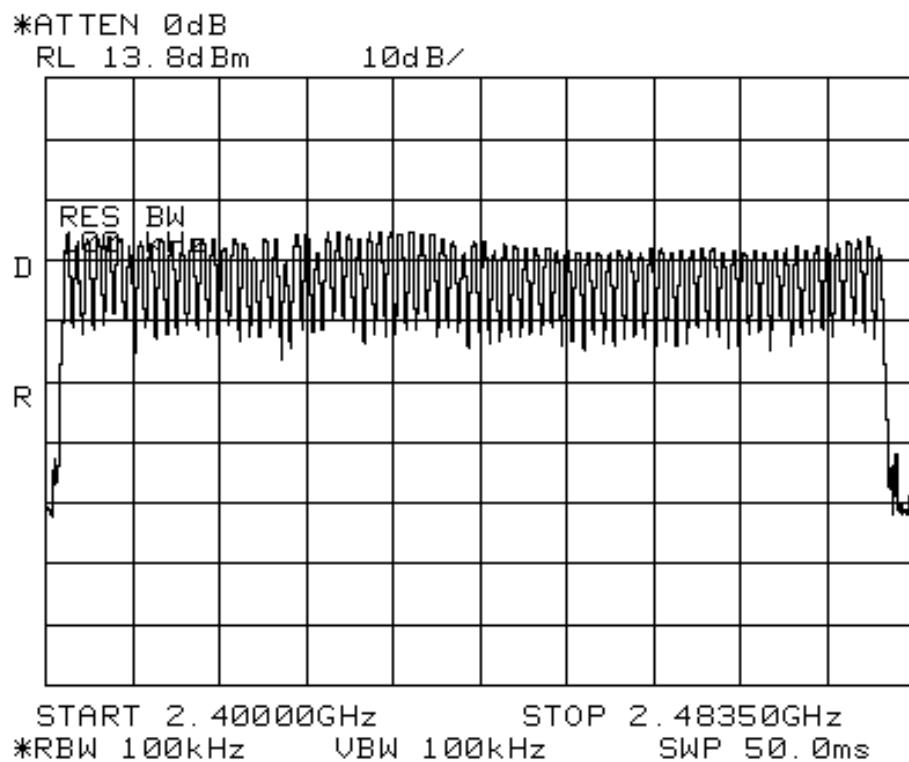
Test Report No.: 5L0546RUS3

Test Data – Time of Occupancy



58 hops @ 3.167 each = 0.183 seconds in 31.6 seconds

0.4*79 channels = 31.6

Test Data – Number of Hopping Channels

79 Channels

Section 9. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1484	Cable	Storm PR90-010-072	N/A	08/26/05	08/26/06
1485	Cable	Storm PR90-010-216	N/A	08/02/05	08/02/06
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	11/12/05	11/12/06
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/01/05	08/02/07
760	Antenna biconical	Electro Metrics MFC-25	477	09/04/05	09/04/06
1034	ANTENNA,LP	A.H. SYSTEMS SAS-200/510	121	09/04/05	09/04/06
791	PREAMP, 25dB	ICC LNA25	398	11/12/05	11/12/06
	Bluetooth Tester	R&S CMU200	1100.0008.02	06/28/05	06/28/06
969	lisn	Schwarzbeck 8120	8120281	11/01/05	11/01/06
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	03/22/04	03/23/06
1652	CABLE	KTL RG223	NA	CBU	NA
1433	High pass filter	Solar 7930-5.0	933142	09/07/05	09/07/06
1977	CABLE, .8m	KTL RG223	N/A	CBU	NA

Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

ANNEX A - TEST DETAILS

NAME OF TEST: Powerline Conducted Emissions

PARA. NO.: 15.207(a)

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

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
----------------------------------	-------------------------

Minimum Standard: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

NAME OF TEST: Pseudorandom Hopping Algorithm	PARA. NO.: 15.247(a)(1)
--	-------------------------

Minimum Standard:

The system shall hop to channel frequencies that are selected from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

NAME OF TEST: Time of Occupancy

PARA. NO.: 15.247(a)(1)(ii)

Minimum Standard:

Frequency Band (MHz)	20 dB Bandwidth	No. of Hopping Channels	Average Time of Occupancy
902 - 928	<250 kHz	50	=<0.4 sec. in 20 sec.
902 - 928	=>250 kHz	25	=<0.4 sec. in 10 sec.
2400 - 2483.5	-----	75	=<0.4 sec. in 30 sec.
5725 - 5850	-----	75	=<0.4 sec. in 30 sec.

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: 1 MHz

VBW: = RBW

Span: 0 Hz

LOG dB/div.: 10 dB

Sweep: Sufficient to see one hop time sequence.

Trigger: Video

The occupancy time of one hop is measured as above. The average time of occupancy is calculated over the appropriate period of time from above table (10, 20, or 30 seconds).

Avg. time of occupancy = (period from table/duration of one hop)/no. of channels multiplied by the duration of one hop.

For instance:

If a 2.4 GHz system has a measured hop duration time of 1 msec. and uses 75 channels, then the average time of occupancy would be:

(30 sec./.001 sec.)/75 chan. = 400 x 1 msec. = 400 msec. or 0.4 sec. in 30 sec.

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 15.247(a)(2)

Minimum Standard:

Frequency Band (MHz)	Maximum 20 dB Bandwidth
902 - 928	500 kHz
2400 – 2483.5	1 MHz
5725 – 5850	1 MHz

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: At least 1% of span/div.

VBW: >RBW

Span: Sufficient to display 20 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: Peak Power Output

PARA. NO.: 15.247(b)

Minimum Standard:

Frequency Band (MHz)	No. of Hopping Channels	Maximum Peak Power Output at Antenna Port
902 - 928	at least 50	1 watt
902 - 928	25 - 49	0.25 watts
2400 - 2483.5	75	1 watt
5725 - 5850	75	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 20 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

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

NAME OF TEST: Spurious Emissions at Antenna Terminals **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 (μ 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

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 (μ 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

Nemko USA, Inc.

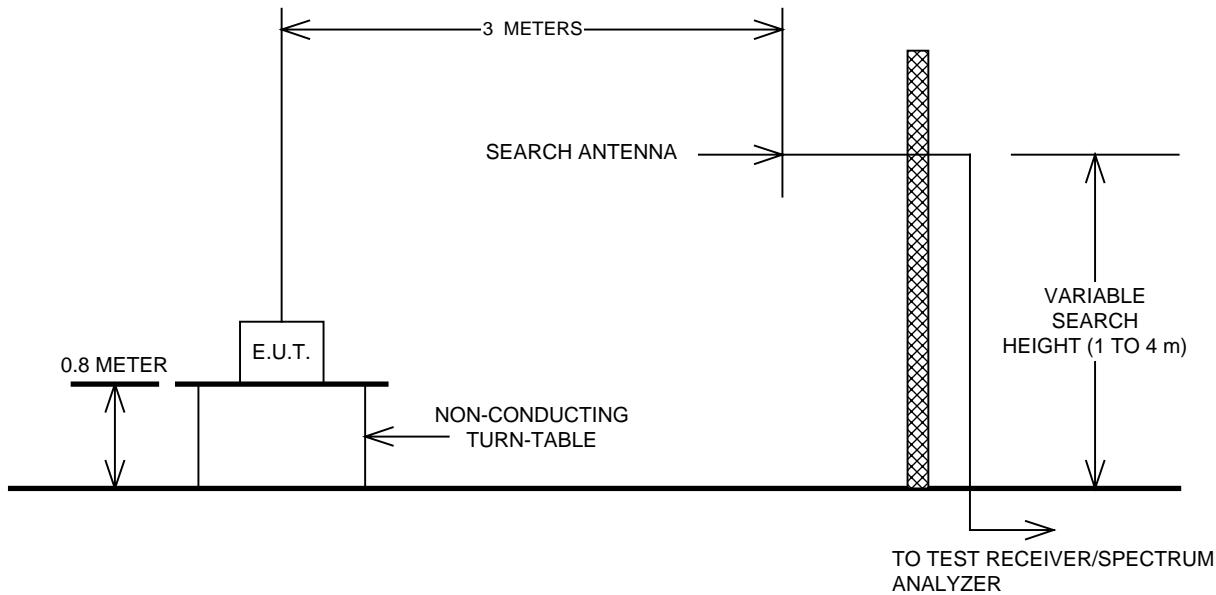
FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: 6265i

Test Report No.: 5L0546RUS3

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions**Conducted Emissions**