



Nemko Test Report: 10230RUS1

Applicant: Sirit Corporation
1321 Valwood Parkway
Carrollton, TX 75006
USA

Equipment Under Test: ID5100
(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

TESTED BY:

A handwritten signature in black ink that appears to read "David Light".

David Light, Senior Wireless Engineer

DATE: 18 January 2008

APPROVED BY:

A handwritten signature in black ink that appears to read "Mike Cantwell".

Mike Cantwell, Frontline Manager

DATE: 25 January 2008

Total Number of Pages: 47

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Section 1. Summary of Test Results

Manufacturer: Sirit Corporation

Model No.: ID5100

Serial No.: None

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.

<input checked="" type="checkbox"/>	New Submission	<input type="checkbox"/>	Production Unit
<input type="checkbox"/>	Class II Permissive Change	<input checked="" type="checkbox"/>	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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FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: ID5100

PROJECT NO.: 10230RUS1

Summary Of Test Data

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

Footnotes:

Section 2. Equipment Under Test (E.U.T.)**General Equipment Information**

Frequency Band: 902 – 928 MHz
 2400 – 2483.5 MHz
 5725 – 5850 MHz

Operating Frequency Range: 902.3 to 927.7 MHz

Number of Channels: 50

Channel Spacing: 200 kHz or 500 kHz

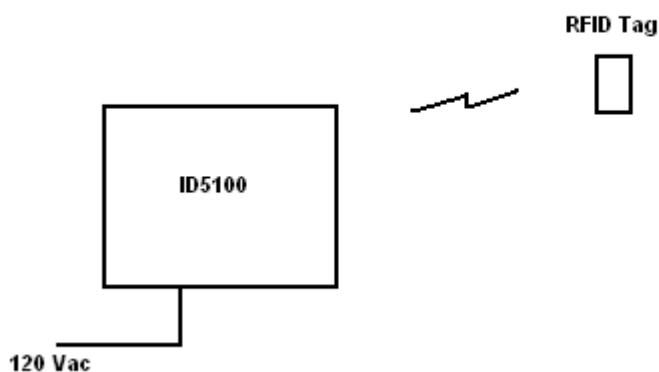
User Frequency Adjustment: Software controlled

Description of EUT

ID5100 is a 900 MHz RFID reader. The reader can be configured to operate in one of four frequency band sets, as shown in the table below.

Frequency Band Set	Frequency Range (MHz, inclusive)	Channel Spacing (kHz)	Number of Channels
FCC_A	902.3 – 912.1	200	50
FCC_B	910.1 – 919.9	200	50
FCC_C	917.9 – 927.7	200	50
FCC_DENSE	902.75 – 927.25	500	50

The IDentity 5100 is equipped with two RFID antenna ports: One port dedicated to the integrated patch antenna and the second is for an optional external antenna. The 2 TX/RX ports are multiplexed, i.e. only one port is active at any given time. Conducted output power is adjustable up to 2 Watts maximum for FCC Part 90 Licensed operation, but is further restricted to a 1 watt maximum output for FCC Part 15 operation. In addition to flexibility in power level, the transmitter has been optimized to handle the demanding requirements of dense reader modes. These optimizations include the use of phase reversal keying and substantial filtering to reduce out-of-band emissions to well below industry standards.

System Diagram

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

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Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: David Light	DATE: 16 January 08

Test Results: Complies. The worst case emission was 53.81 dB μ V at 158.1 kHz. This is 1.8 dB below the average specification limit of 55.6 dB μ V.

Test Data: Refer to attached plots

Equipment Used: 1659-1188-1120-674

Measurement Uncertainty: +/- 1.7 dB

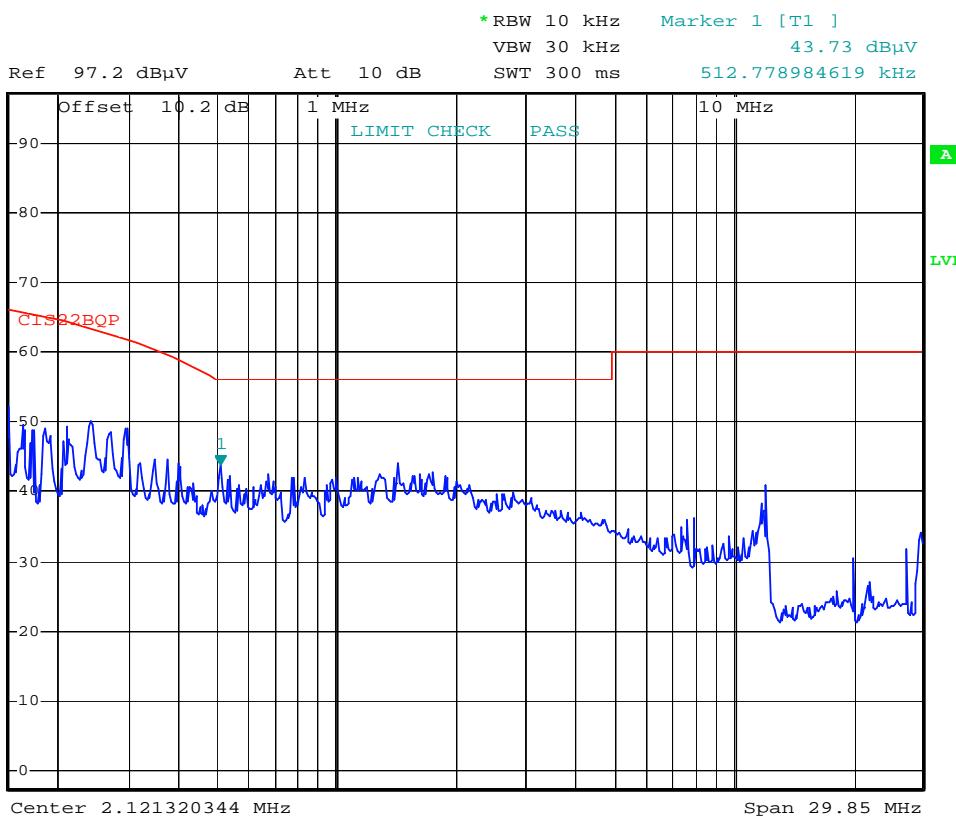
Temperature: 22 °C

Relative Humidity: 30 %

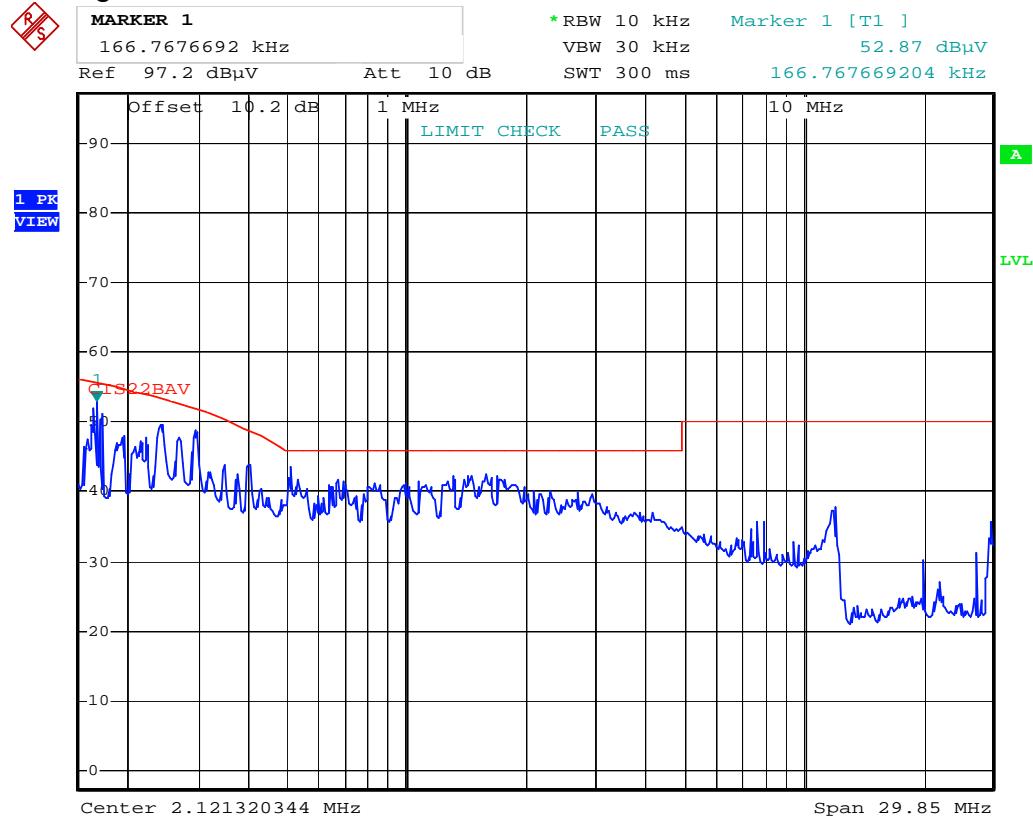
Test Data – Powerline Conducted Emissions

Line side

Peak



Date: 16.JAN.2008 11:17:50

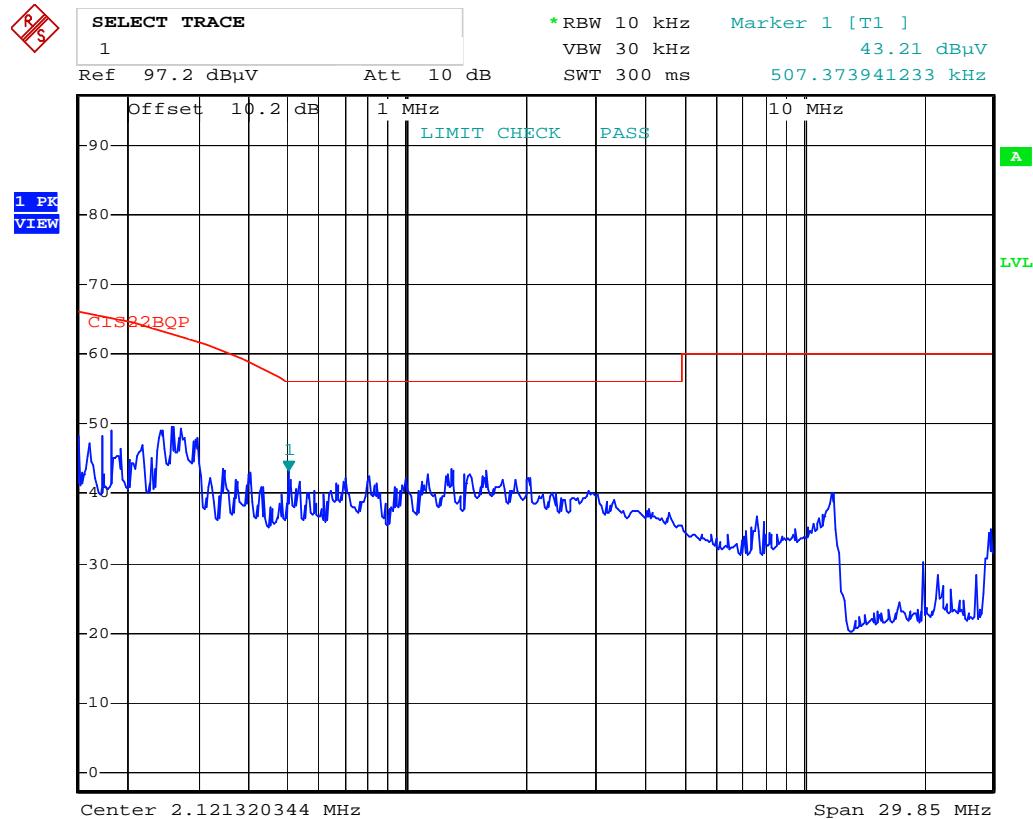
Test Data – Powerline Conducted EmissionsLine side
Average

Date: 16.JAN.2008 11:19:26

Test Data – Powerline Conducted Emissions

Neutral side

Peak

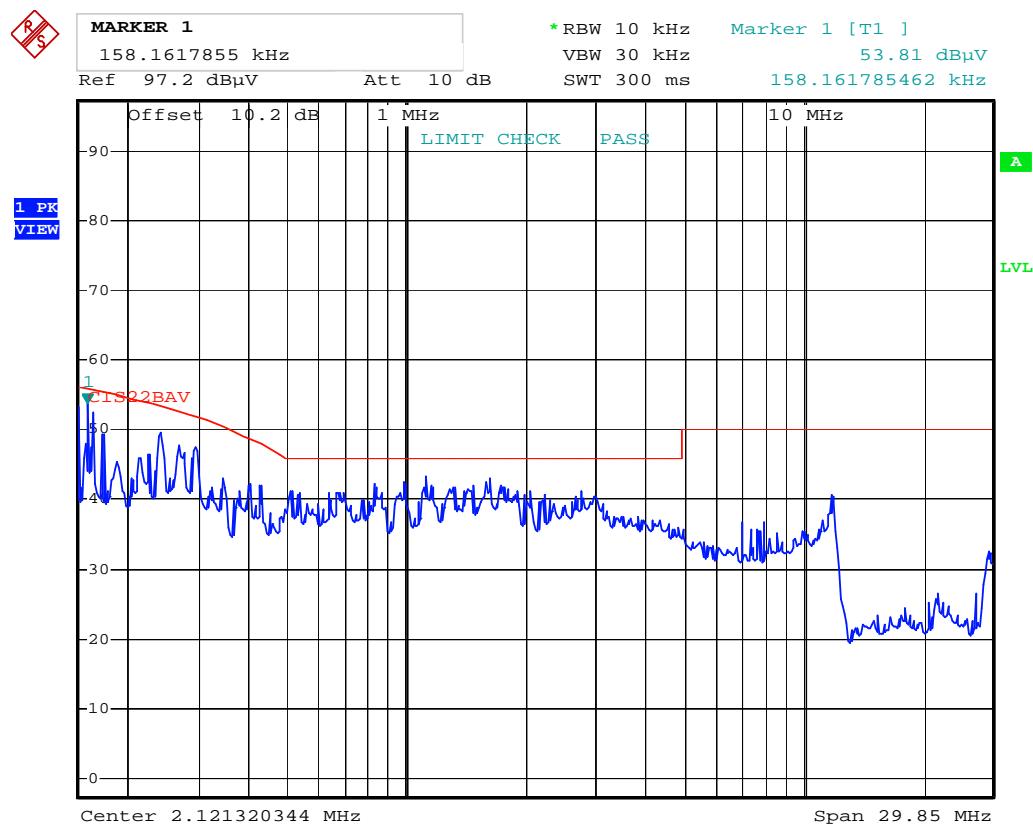


Date: 16.JAN.2008 11:23:23

Test Data – Powerline Conducted Emissions

Neutral side

Average



Date: 16.JAN.2008 11:21:14

Test Setup Photos – Powerline Conducted Emissions



Section 4. Channel Separation

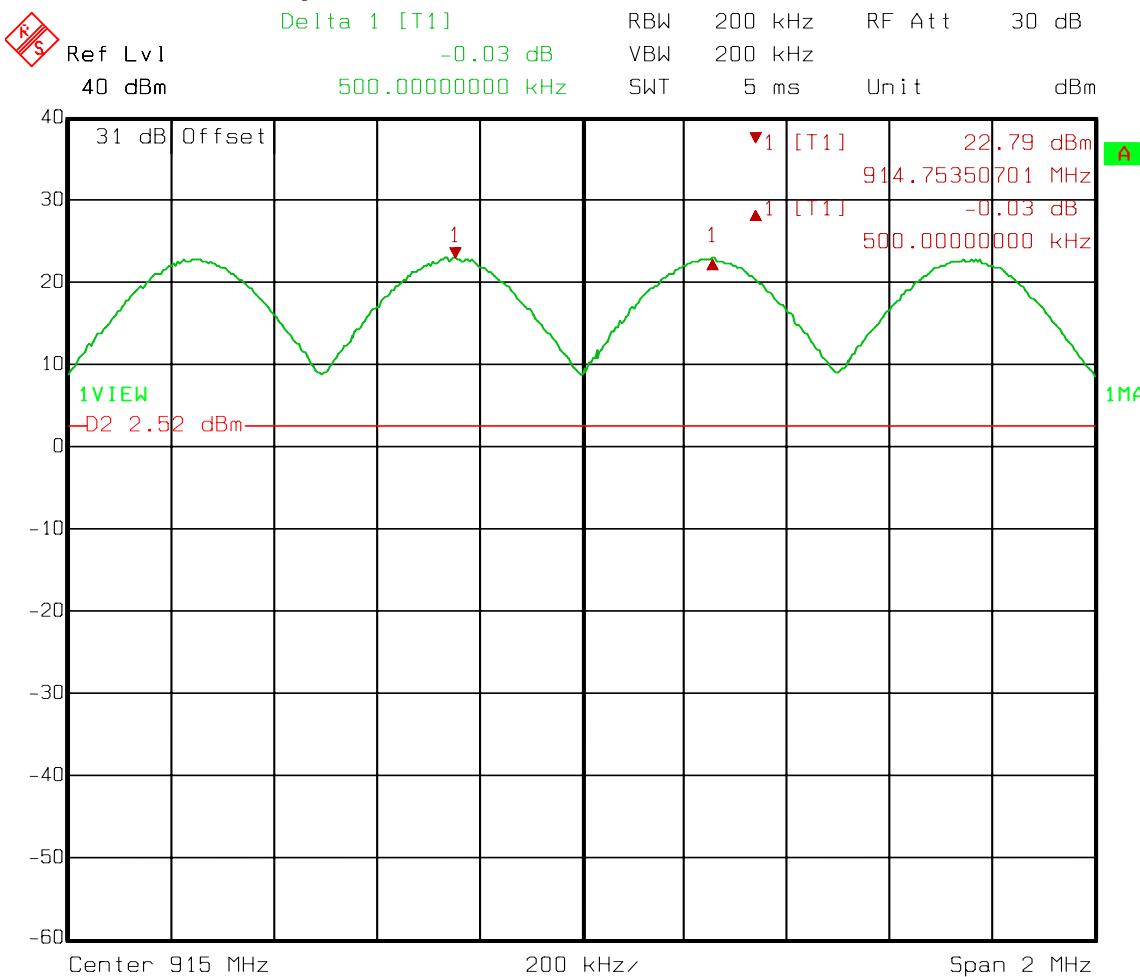
NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE: 15 January 08

Test Results: Complies.**Measurement Data:** See 20 dB BW plot

Measured 20 dB bandwidth: 122 kHz max
Channel Separation: 200 kHz or 500 kHz

Equipment Used: 1604-1065-1082-1036**Measurement Uncertainty:** 1X10⁻⁷ppm**Temperature:** 22 °C**Relative Humidity:** 35 %

Test Data – Channel Separation



Date: 15.JAN.2008 11:34:04

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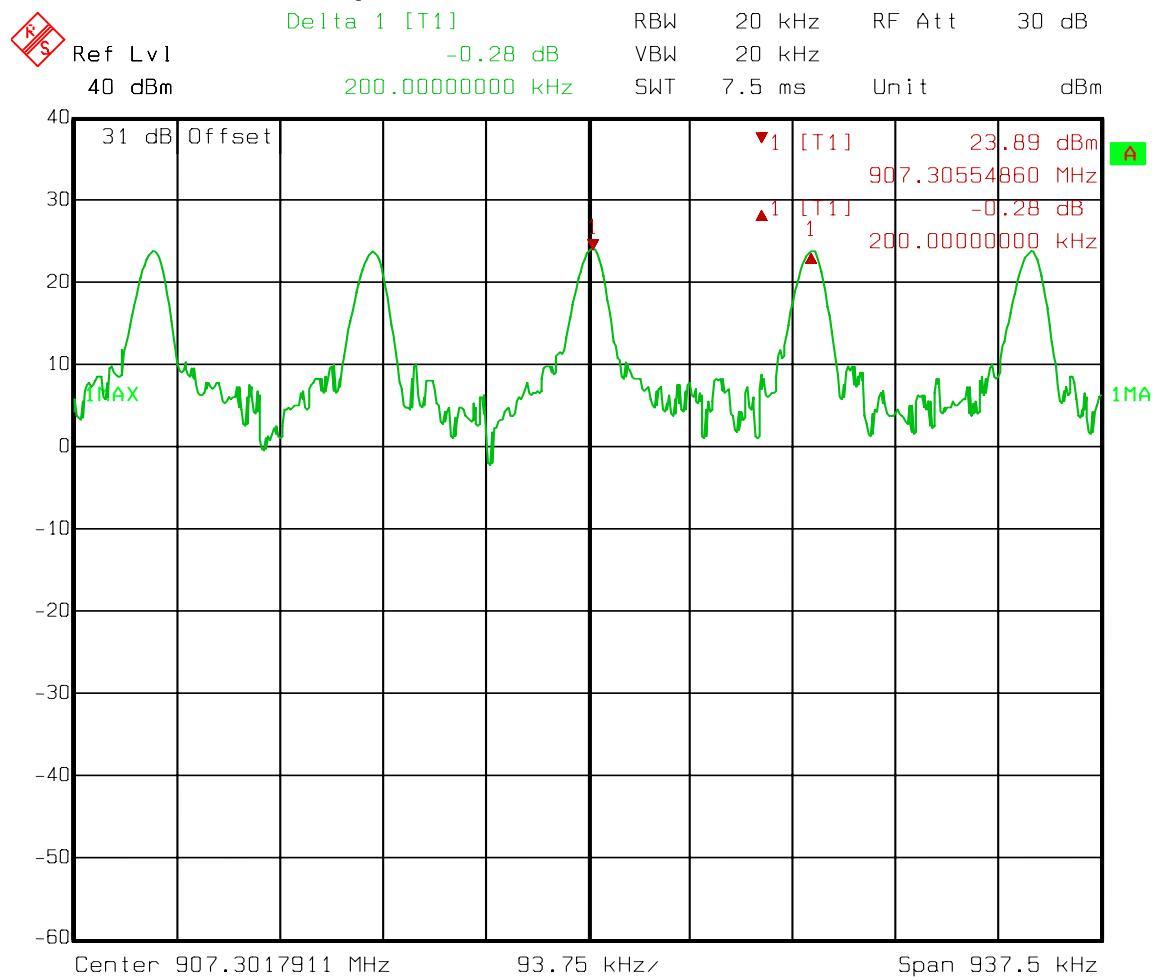
FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: ID5100

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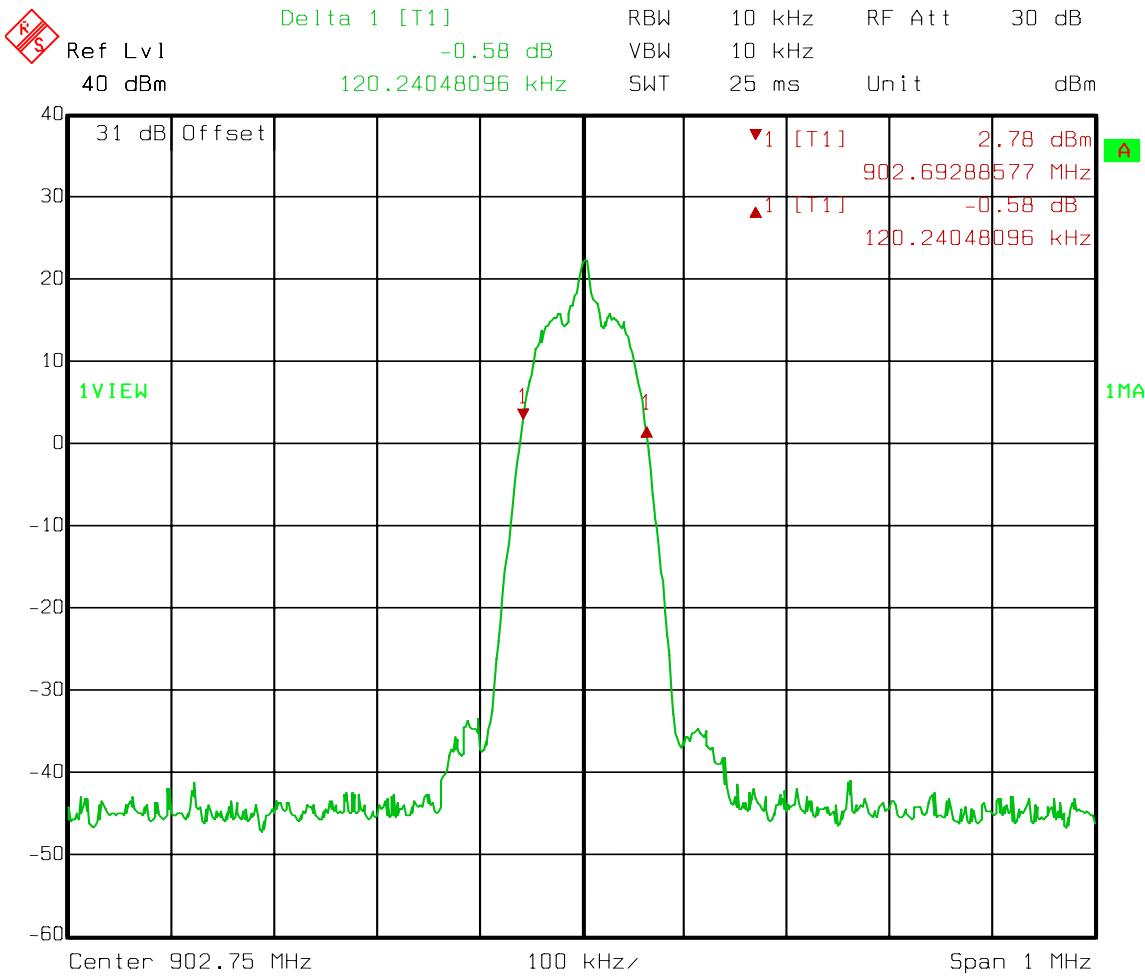
Test Data – Channel Separation

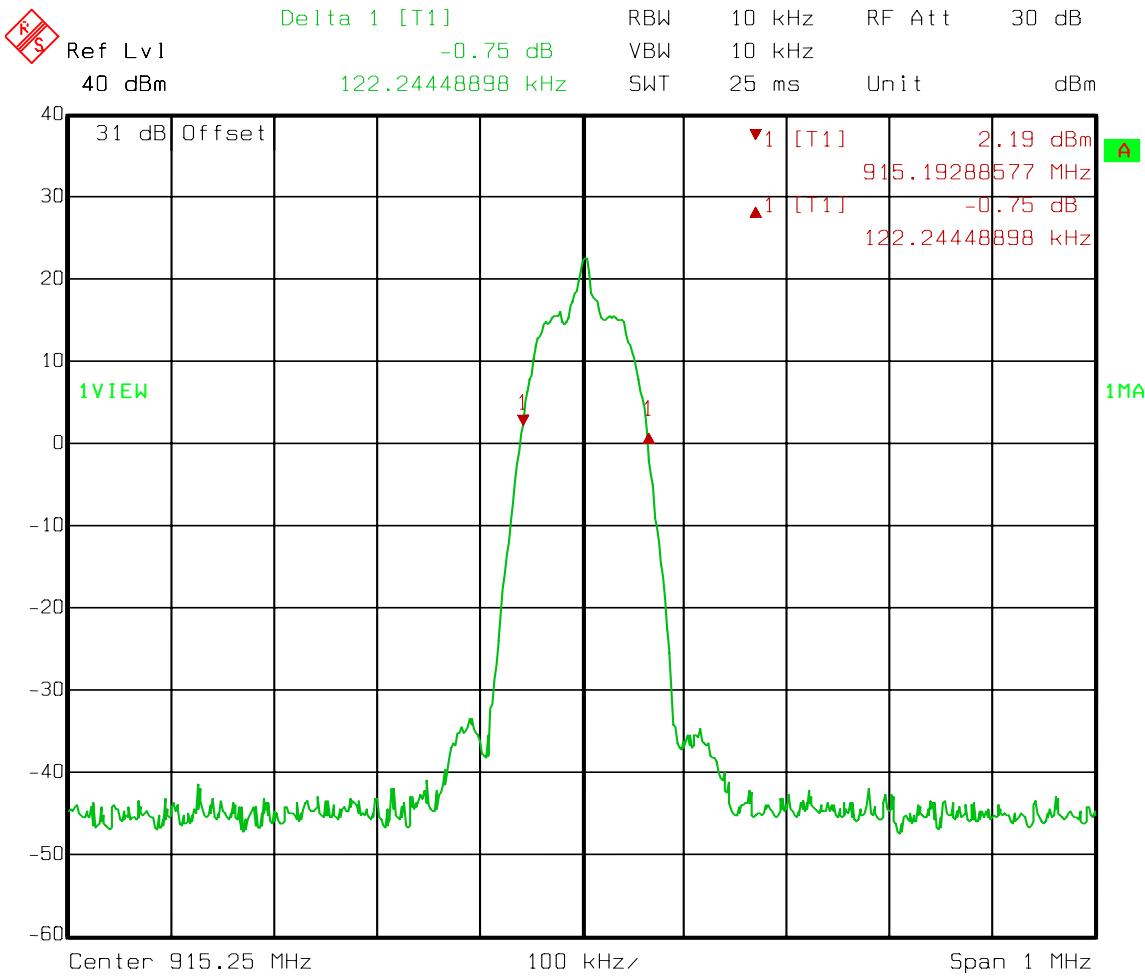


Date: 15.JAN.2008 17:09:49

Test Data – 20 dB Bandwidth

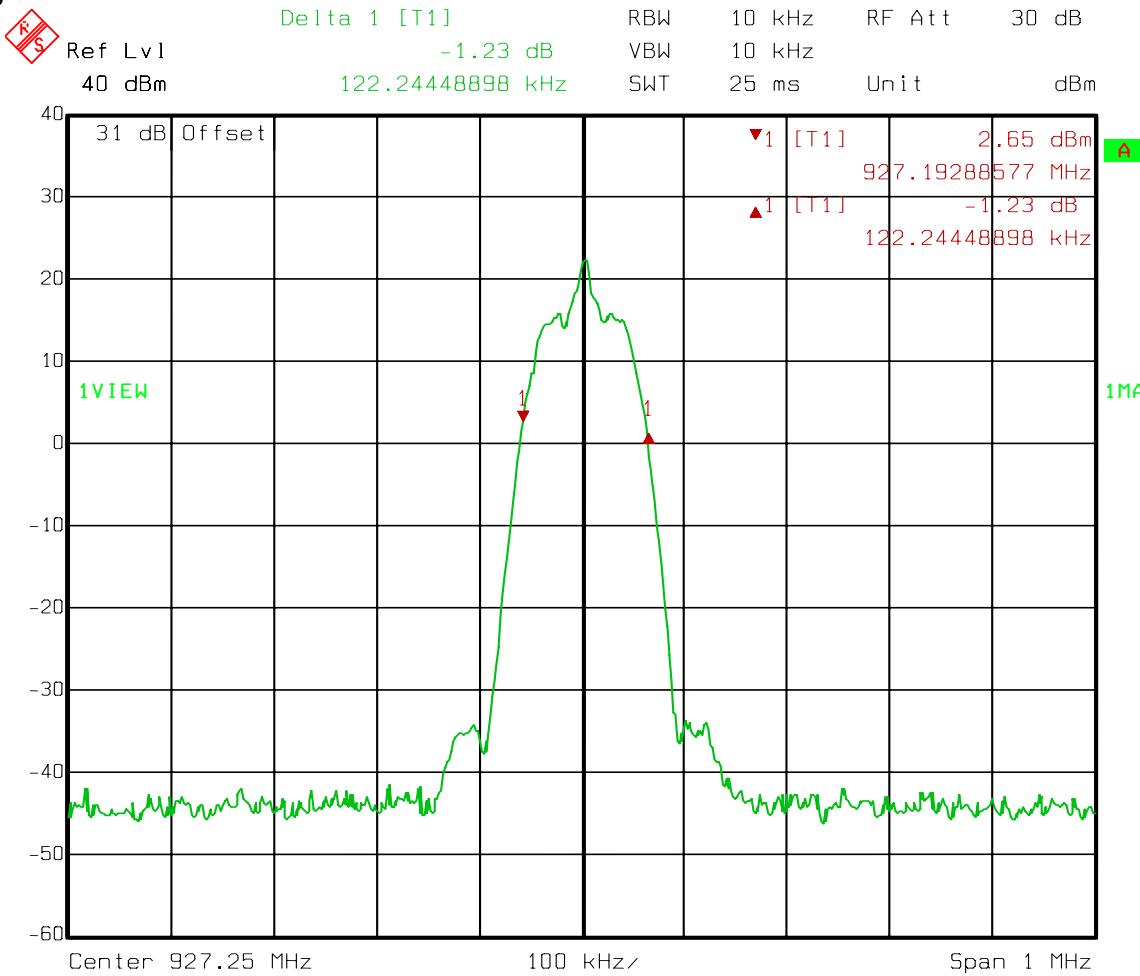
Low Channel



Test Data – 20 dB Bandwidth**Mid Channel**

Test Data – 20 dB Bandwidth

High Channel



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EQUIPMENT: ID5100

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Section 5. Time of Occupancy

NAME OF TEST: Time of Occupancy	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE: 15 January 2008

Test Results: Complies.

Measurement Data:

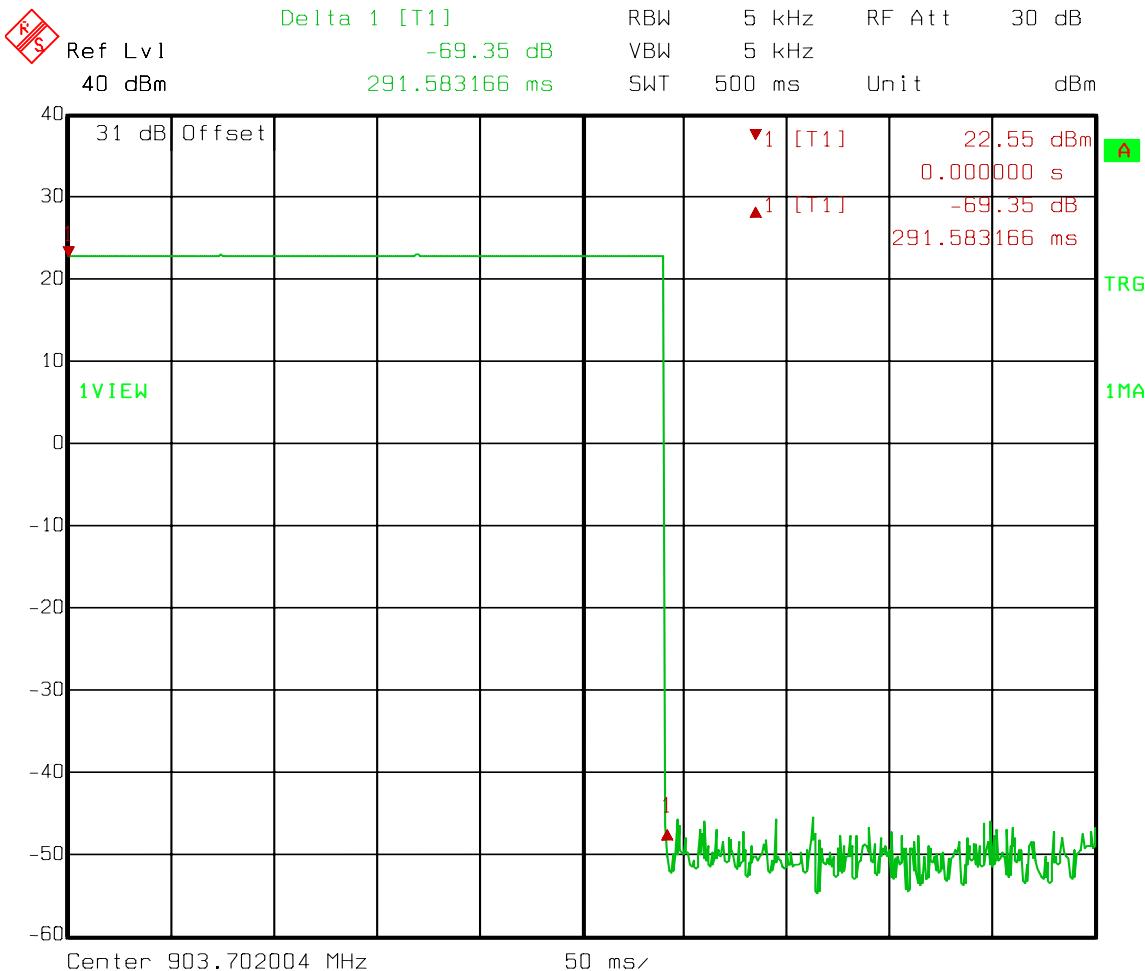
Maximum Dwell Time On Any Channel: 2%

Equipment Used: 1036-1604-1065-1082

Measurement Uncertainty: 1X10⁻⁷ppm

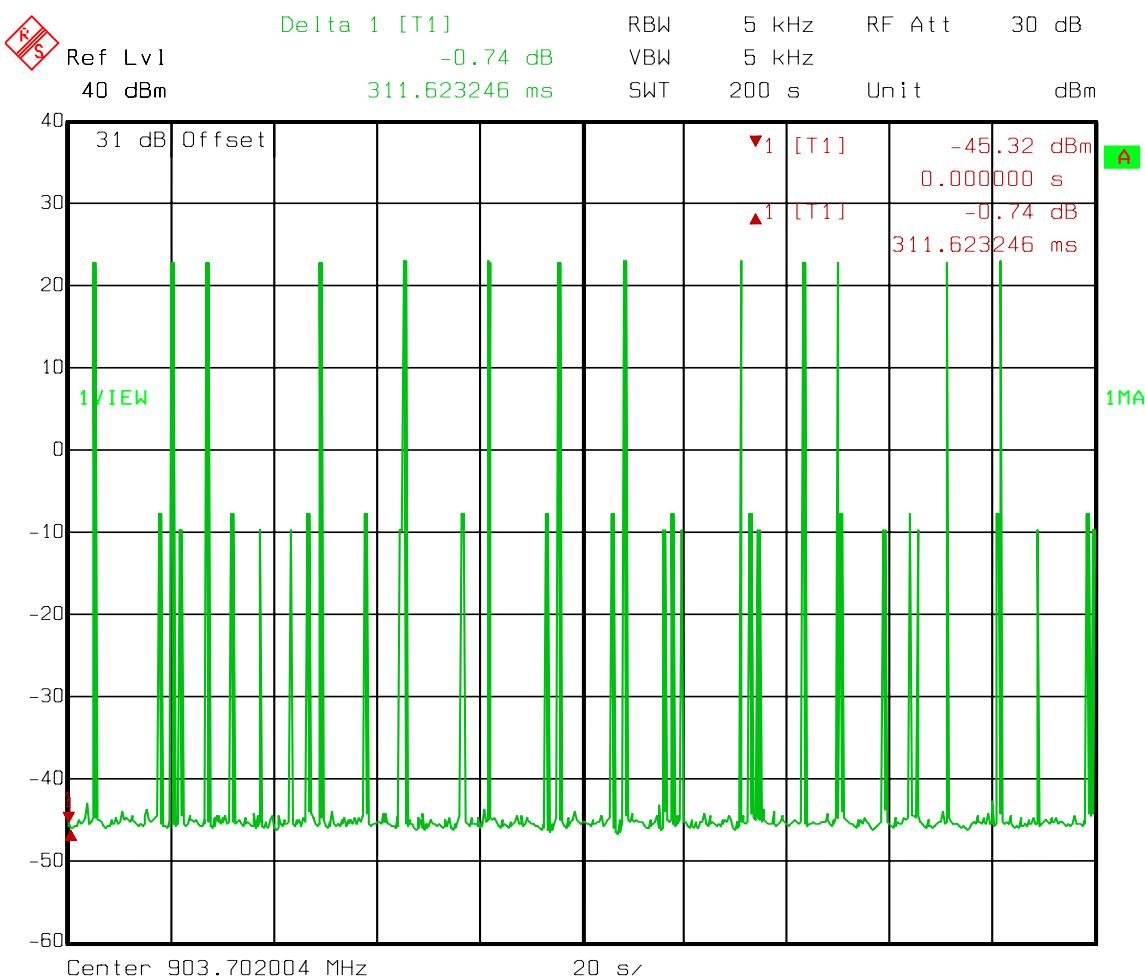
Temperature: 22 °C

Relative Humidity: 35 %

Test Data – Time of Occupancy**Pulse Width**

Test Data – Time of OccupancyTime ON = $13 \times .2916 = 3.7908$ S in 200 seconds

1.9% ON time



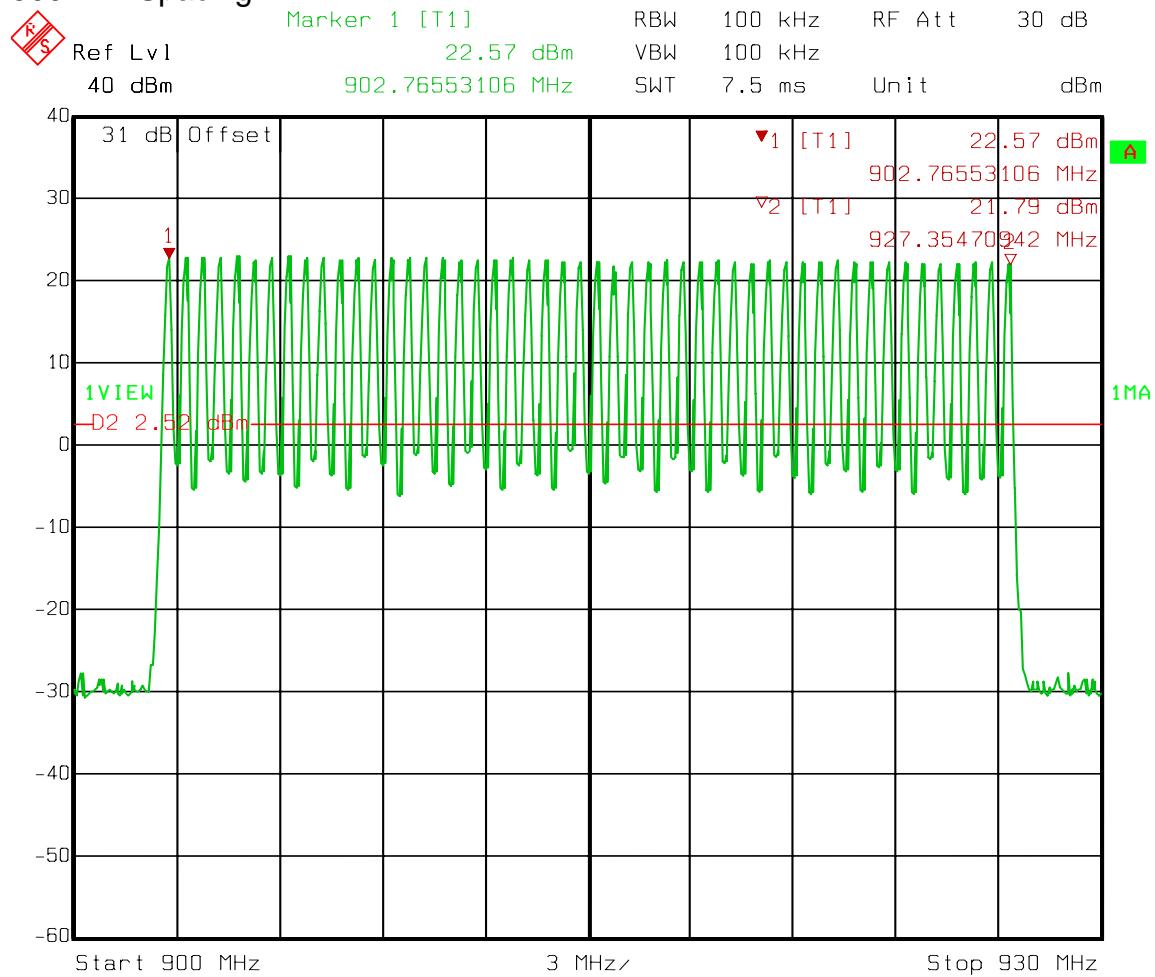
Date: 17.JAN.2008 15:48:31

Test Data – Time of Occupancy

Number of hopping channels

50 Channels

500 kHz Spacing



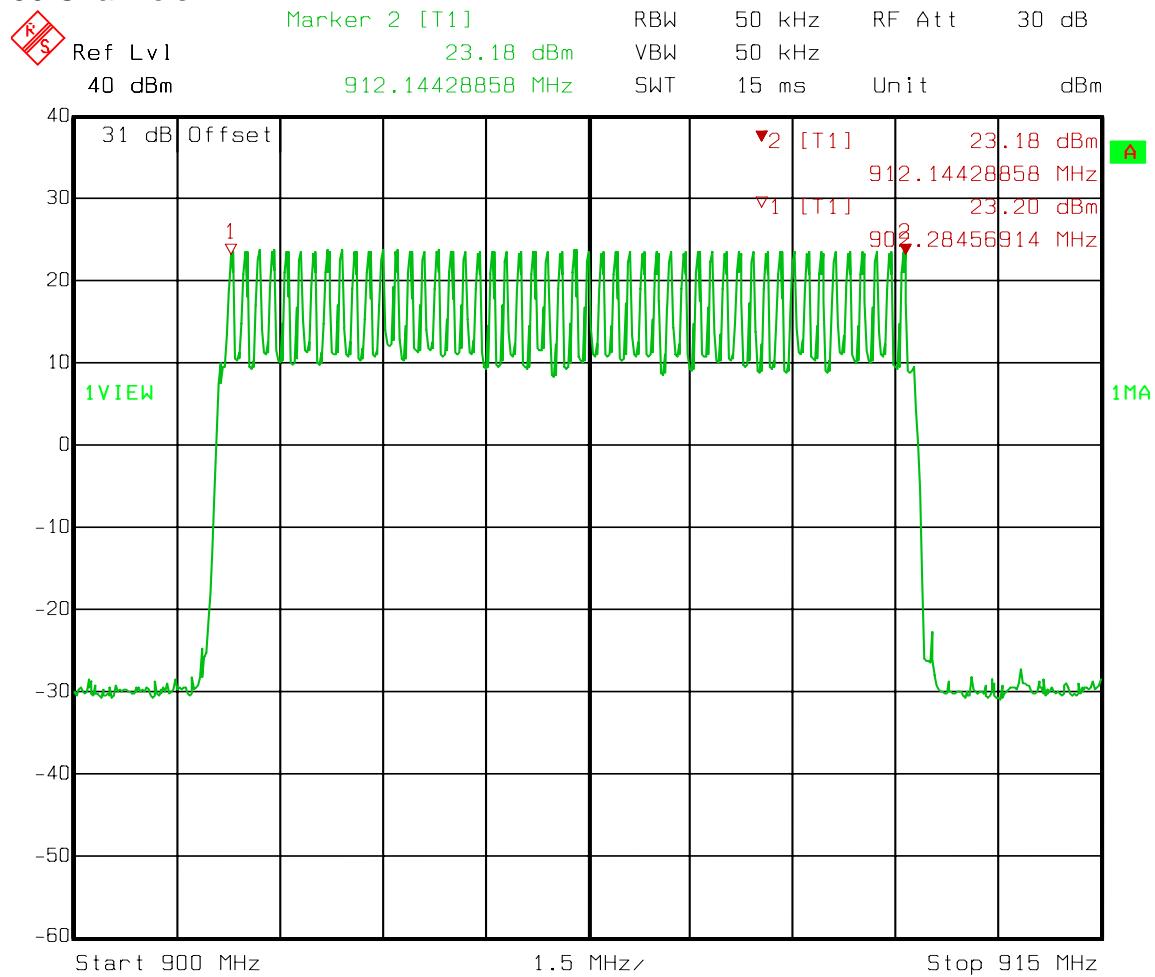
Date: 15.JAN.2008 11:30:55

Test Data – Time of Occupancy

Number of hopping channels

Band A

50 Channels



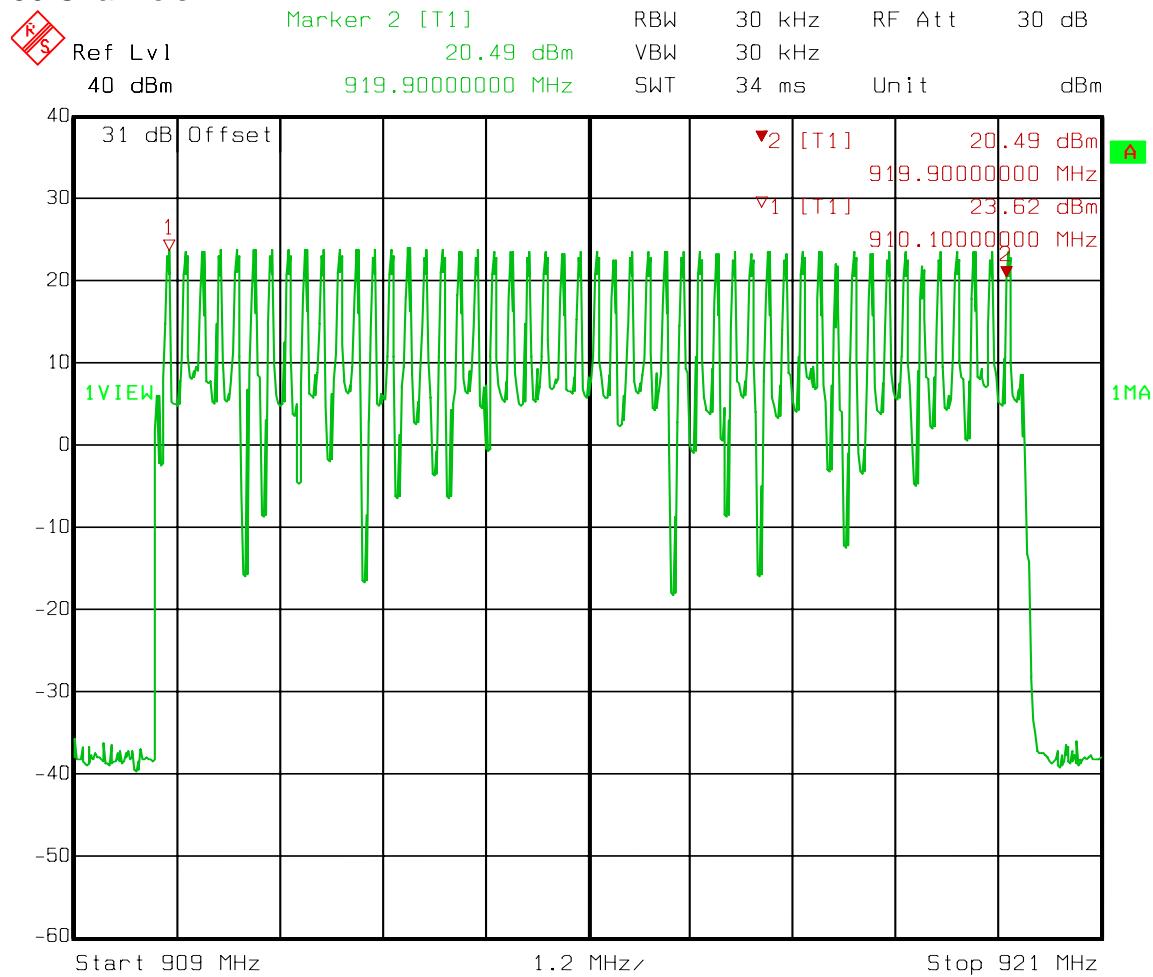
Date: 15.JAN.2008 17:08:43

Test Data – Time of Occupancy

Number of hopping channels

Band B

50 Channels



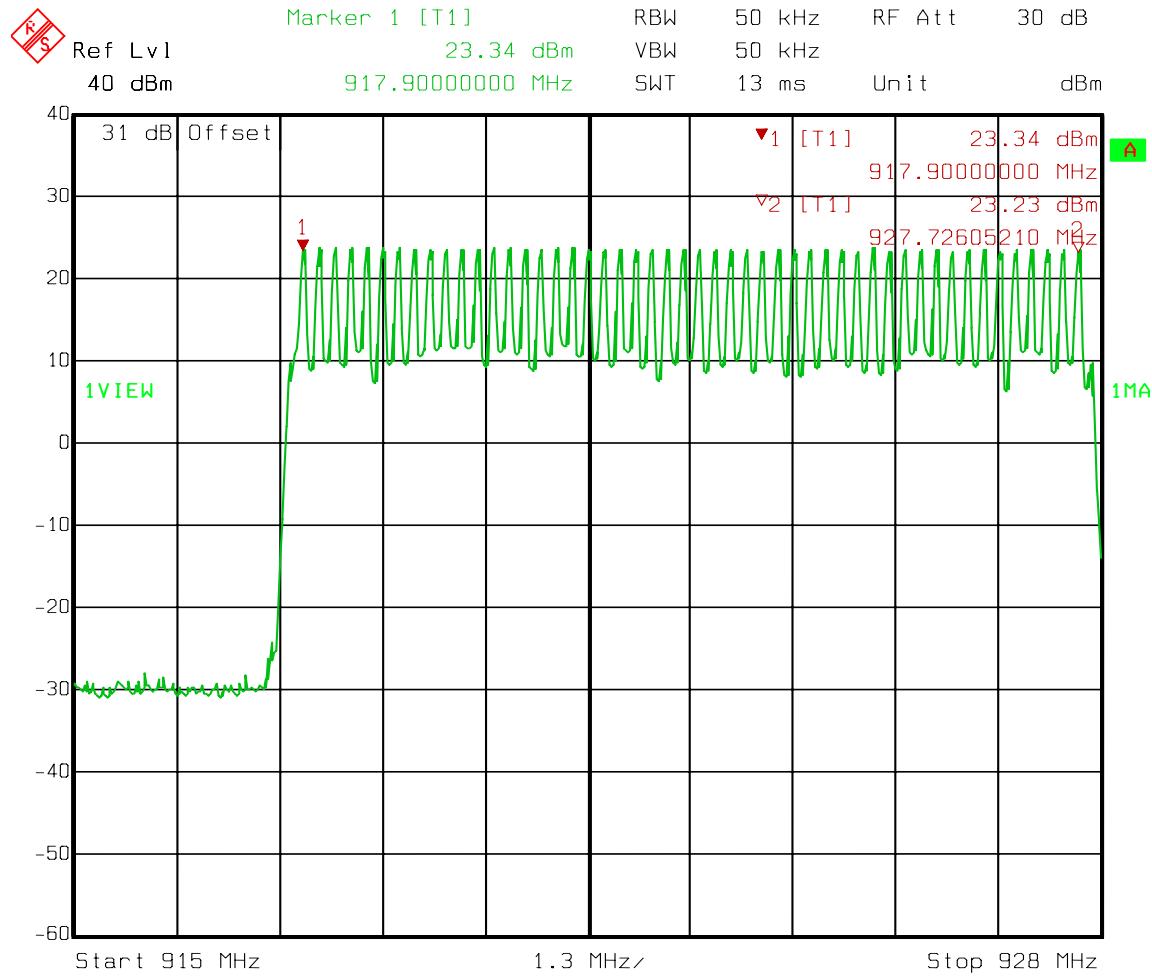
Date: 15.JAN.2008 17:13:23

Test Data – Time of Occupancy

Number of hopping channels

Band C

50 Channels



Date: 15.JAN.2008 17:20:36

Section 6. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: David Light	DATE: 15 January 2008

Test Results: Complies.**Measurement Data:** See attached plots.

Detachable antenna? Yes No Both
If yes, state the type of non-standard connector used: Reverse
TNC

Frequency (MHz)	Peak Power (dBm)	Peak Power (W)	Antenna Type	Gain (dBi)	E.I.R.P. (dBm)	E.I.R.P. (W)
902.75	22.6	0.182	Patch	13	35.6	3.63
915.25	22.8	0.191	Patch	13	35.8	3.80
927.25	22.7	0.187	Patch	13	35.7	3.72
Maximum EIRP (W): 3.80						

- This device was tested at +/- 15% input power per 15.31(e), with no variation in output power.
- For battery powered equipment, the device was tested with a fresh battery per 15.31(e).
- The device was tested on three channels per 15.31(l).
- This test was performed radiated.

Equipment Used: 1036-1082-1066-1604**Measurement Uncertainty:** 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 35 %

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EQUIPMENT: ID5100

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Section 7. Spurious Emissions (Antenna Conducted)

NAME OF TEST: Spurious Emissions (Antenna Conducted)	PARA. NO.: 15.247(d)
TESTED BY: David Light	DATE: 15 January 08

Test Results: Complies.

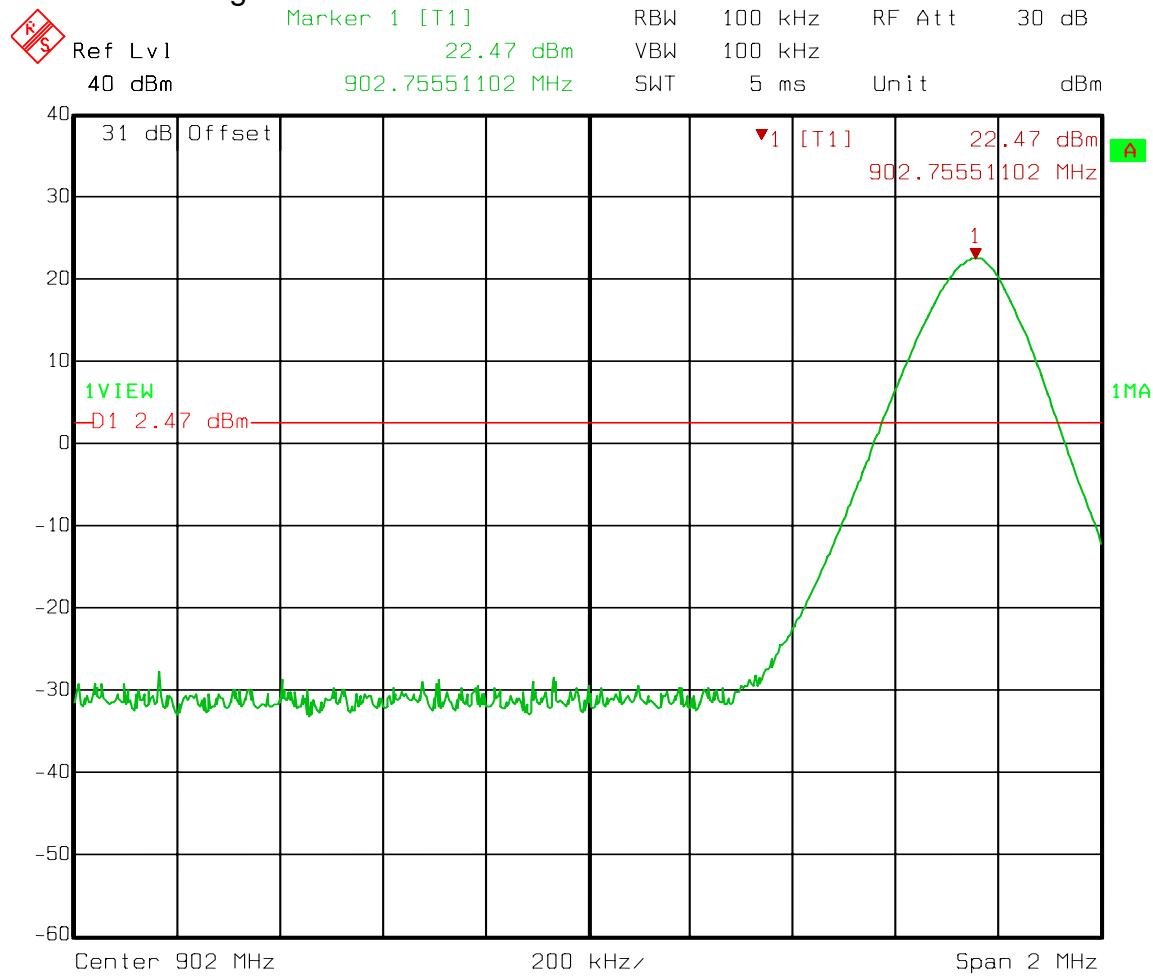
Measurement Data: See attached plots.

Equipment Used: 1036-1082-1065-1604

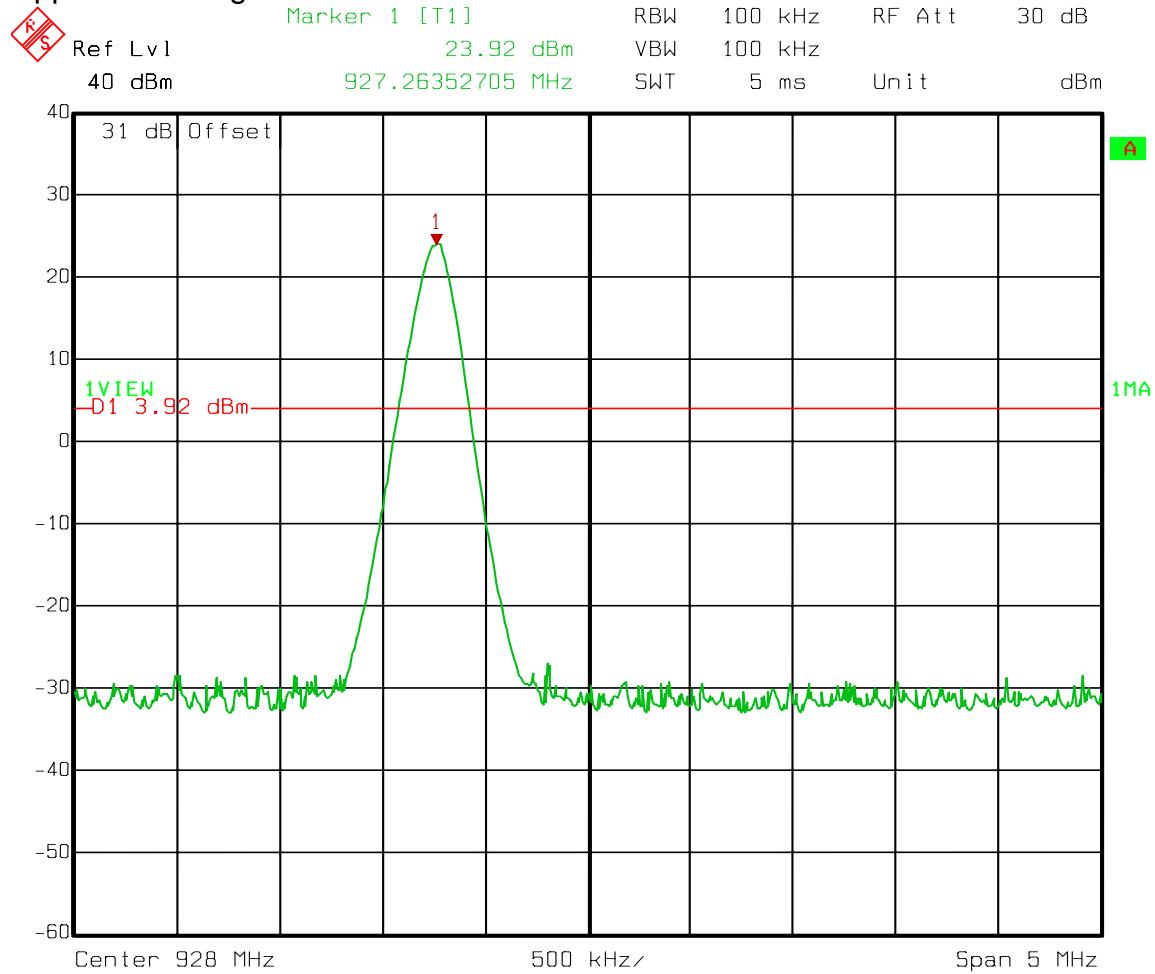
Measurement Uncertainty: 1X10⁻⁷ppm

Temperature: 22 °C

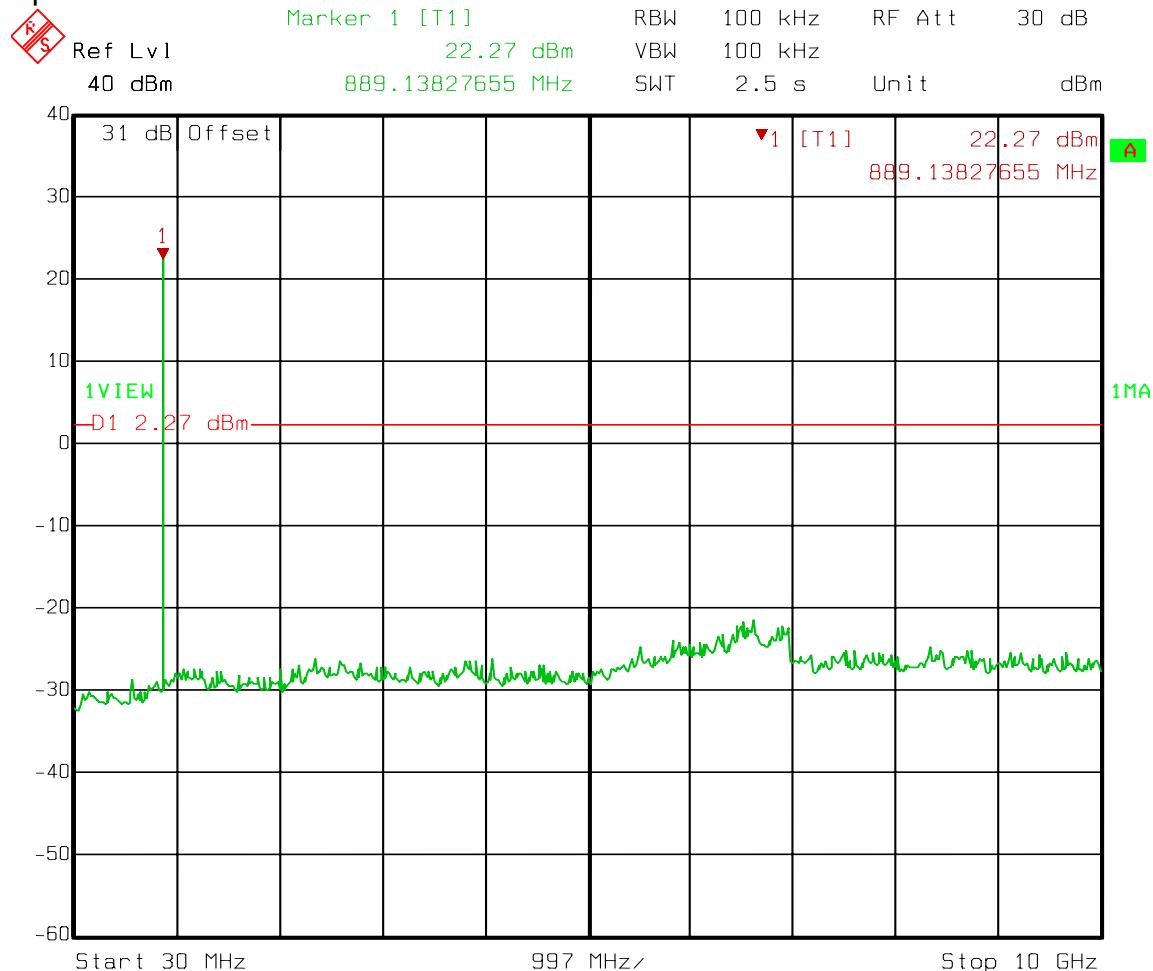
Relative Humidity: 35 %

Test Data – Spurious Emissions at Antenna Terminals**Lower Band Edge**

Date: 15.JAN.2008 11:44:21

Test Data – Spurious Emissions at Antenna Terminals**Upper Band Edge**

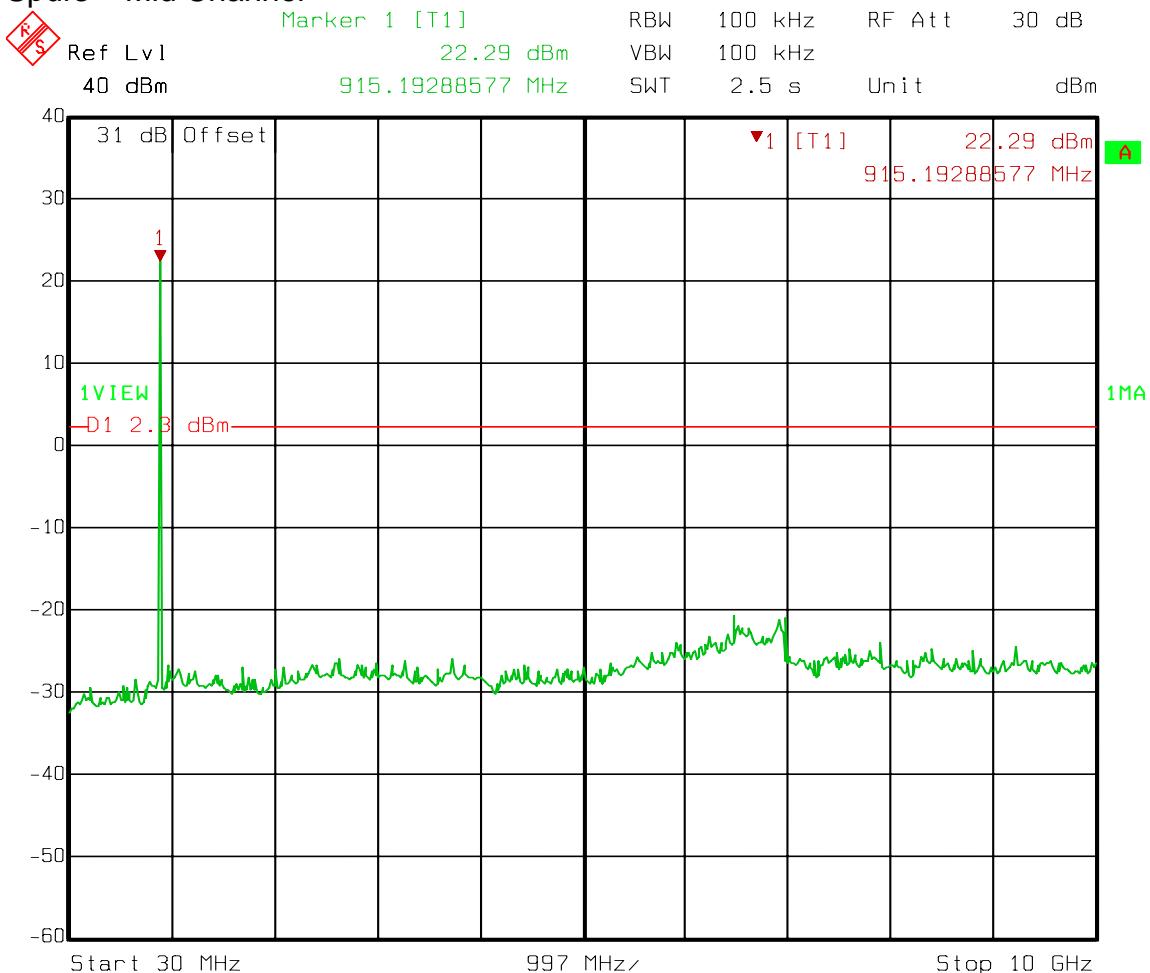
Date: 16.JAN.2008 09:23:25

Test Data – Spurious Emissions at Antenna Terminals**Spurs – Low Channel**

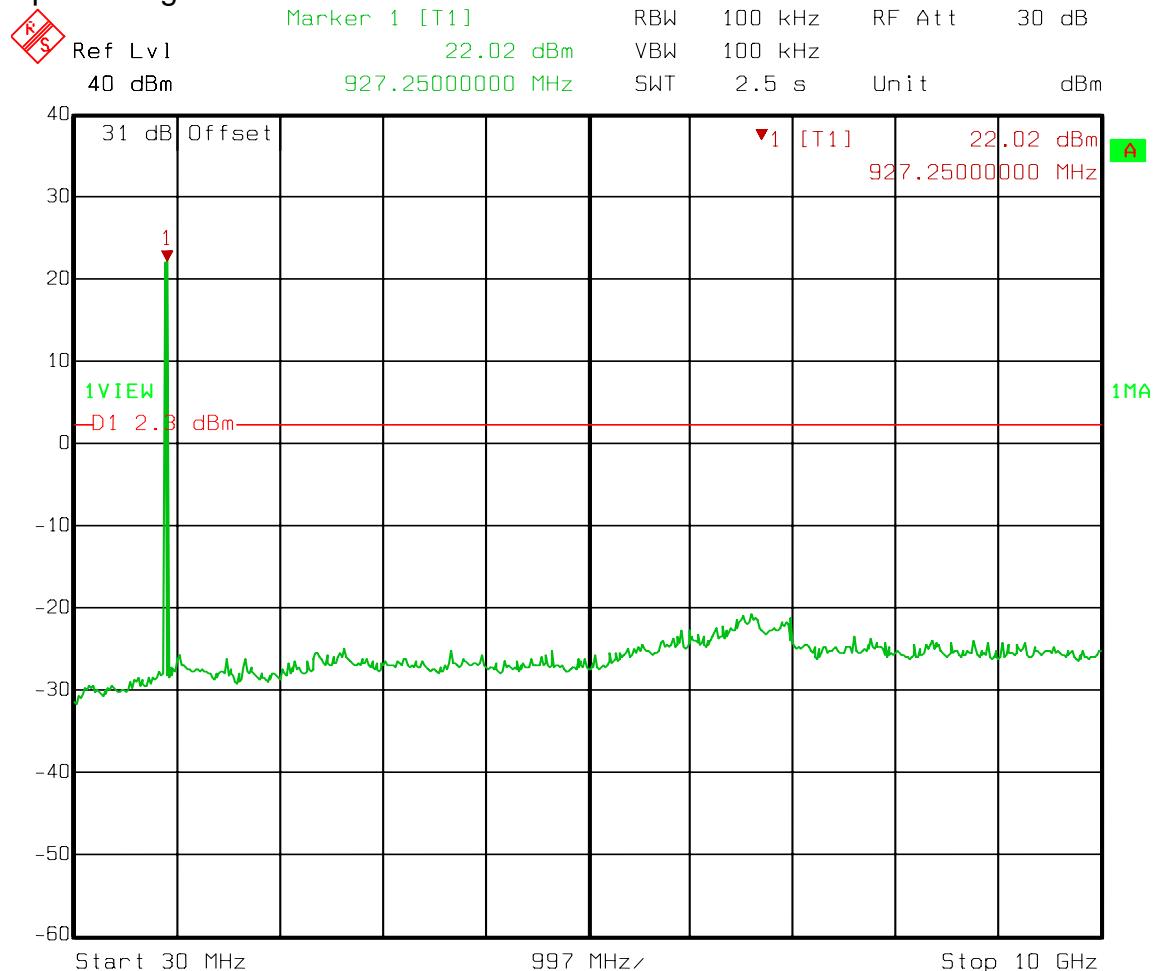
Date: 15.JAN.2008 16:47:02

Test Data – Spurious Emissions at Antenna Terminals

Spurs – Mid Channel



Date: 15.JAN.2008 16:57:20

Test Data – Spurious Emissions at Antenna Terminals**Spurs – High Channel**

Date: 15.JAN.2008 17:00:54

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: ID5100

PROJECT NO.: 10230RUS1

Section 8. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(d)
TESTED BY: David Light	DATE: 16 January 2008

Test Results: Complies.

Measurement Data: No emissions were detected within 20 dB of the specification limit of 54 dB μ V/m.

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).

Equipment Used: 759-760-993-1484-1485-791-1016

Measurement Uncertainty: +/-3.6 dB

Temperature: 20 °C

Relative Humidity: 30 %

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: ID5100

PROJECT NO.: 10230RUS1

Radiated Photographs



Section 9. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date	Calibration Due
1659	Spectrum Analyzer	Rhode & Schwarz FSP	973353	01/24/07	01/24/09
1188	LISN	EMCO 3825/2	1214	06/20/07	06/19/08
674	LIMITER	HP 11947A	3107A02200	CBU	NA
1120	CABLE	Nemko USA, Inc. 0	N/A	09/19/17	09/19/08
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	05/26/06	05/26/08
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	CBU	N/A
1065	ATTENUATOR	NARDA 776B-10	NONE	CBU	N/A
1604	ATTENUATOR	NARDA 776B-20	NONE	N/A	N/A
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	03/30/07	03/29/08
760	Antenna biconical	Electro Metrics MFC-25	477	01/19/07	01/19/08
993	Horn antenna	A.H. Systems SAS-200/571	XXX	08/31/07	08/30/08
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
791	PREAMP, 25dB	Nemko USA, Inc. LNA25	398	05/01/07	04/30/08
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/01/07	04/30/08

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: ID5100 PROJECT NO.: 10230RUS1

ANNEX A - TEST DETAILS

NAME OF TEST: Powerline Conducted Emissions

PARA. NO.: 15.207(a)

Minimum Standard: §15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Conducted Emission (MHz)	Limit (dBmV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 mV within the frequency band 535-1705 kHz, as measured using a 50 mH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as provided in §15.205 and §§15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

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EQUIPMENT: ID5100

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NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
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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. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

NAME OF TEST: Time of Occupancy

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

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 0.4 seconds multiplied by the number of hopping channels employed.
5725 - 5850	-----	75	=<0.4 sec. in 30 sec.

Method Of Measurement:

The spectrum analyzer is set as follows:

RBW: 5 kHz

VBW: = RBW

Span: 0 Hz

LOG dB/div.: 10 dB

Sweep: Sufficient to see 10 hop time sequences.

Trigger: Video

The occupancy time of ten hops is measured as above. The average time of occupancy is calculated over the appropriate period of time from above table

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 900 MHz system has a measured hop duration time of 20 msec. and uses 50 channels, then the average time of occupancy would be:

$$(0.4 \text{ mS} \times 14 \text{ hops})/200 \text{ sec.} = 0.02 = 2\%$$

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EQUIPMENT: ID5100

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NAME OF TEST: Occupied Bandwidth

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

Minimum Standard:

Frequency Band (MHz)	Maximum 20 dB Bandwidth
902 - 928	500 kHz
2400 – 2483.5	Not defined
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

NAME OF TEST: Spurious Emissions at Antenna Terminals	PARA. NO.: 15.247(d)
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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 (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(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 (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:

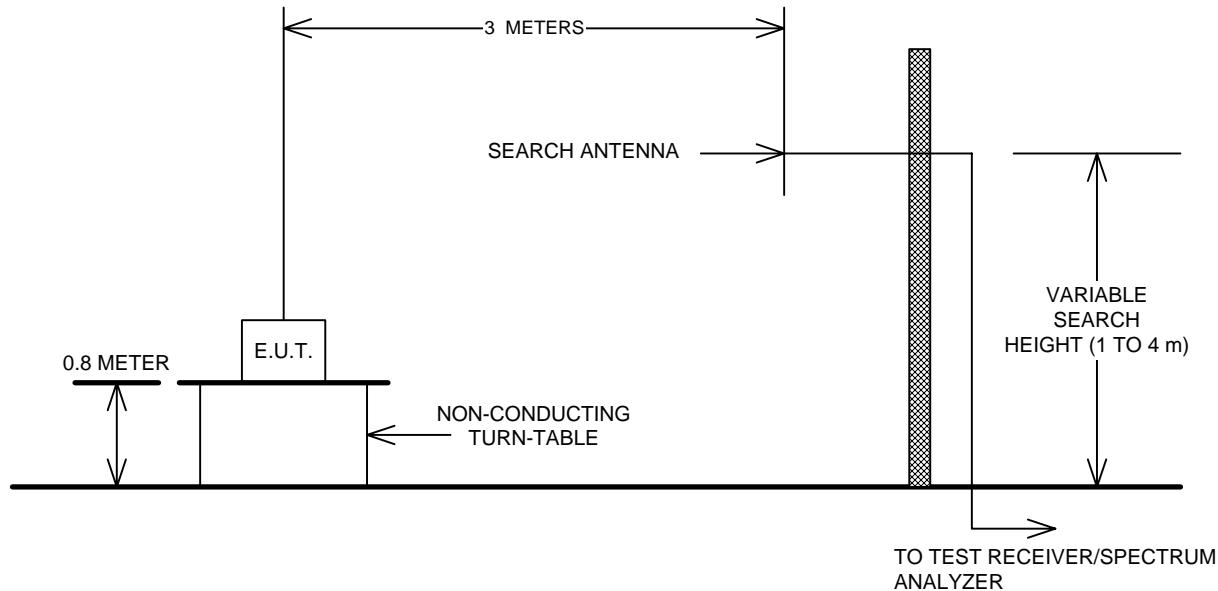
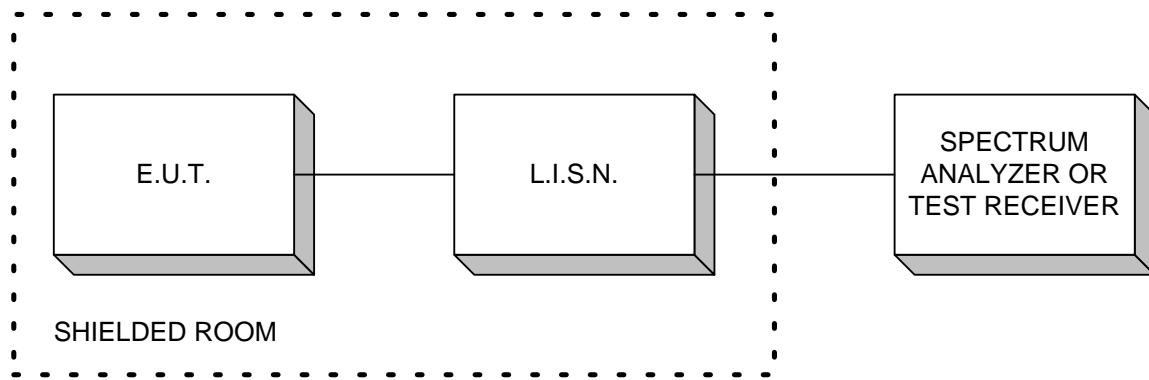
Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

Nemko USA, Inc.

FCC PART 15, SUBPART C

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER
EQUIPMENT: ID5100 PROJECT NO.: 10230RUS1

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions**Conducted Emissions**

Peak Power at Antenna Terminals

