



Nemko Test Report: 42432RUS1

Applicant: SkyeTek Inc.
1525 Market St., Ste 200
Denver, CO 80202

**Equipment Under Test:
(E.U.T.)** SR100

FCC Identifier: WZ4010A0001

In Accordance With: FCC Part 15, Subpart C, 15.247 and RSS 210,
Issue 7 - Frequency Hopping Transmitters

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

TESTED BY:



David Light, Wireless Engineer

DATE:

19 February 2010

APPROVED BY:



Tom Tidwell, Telecom Direct

DATE:

26 February 2010

Total Number of Pages: 42

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Section 1. Summary of Test Results

Manufacturer: SkyeTek Inc.

Model No.: SR100

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.



New Submission



Production Unit



Class II Permissive Change



Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.

See "Summary of Test Data".



NVLAP Lab Code 100426-0

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Summary of Test Data

NAME OF TEST	PARA. NO.	RESULT
Powerline Conducted Emissions	15.207(a), RSS GEN. 7.2.2	Complies
Channel Separation	15.247(a)(1), A8.1(c)	Complies
Time of Occupancy and No. of Channels	15.247(a)(1), A8.1(c)	Complies
20 dB Occupied Bandwidth	15.247(a)(1), A8.1(c)	Complies
Peak Power Output	15.247(b), A8.4(1)	Complies
Spurious Emissions (Antenna Conducted)	15.247(d), A8.5	Complies
Spurious Emissions (Radiated)	15.247(d), 2.2, 2.7, Table 2	Complies
Receiver Spurious Emissions	RSS GEN. (6)(b) and 7.2.3.1	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:

128

Channel Spacing:

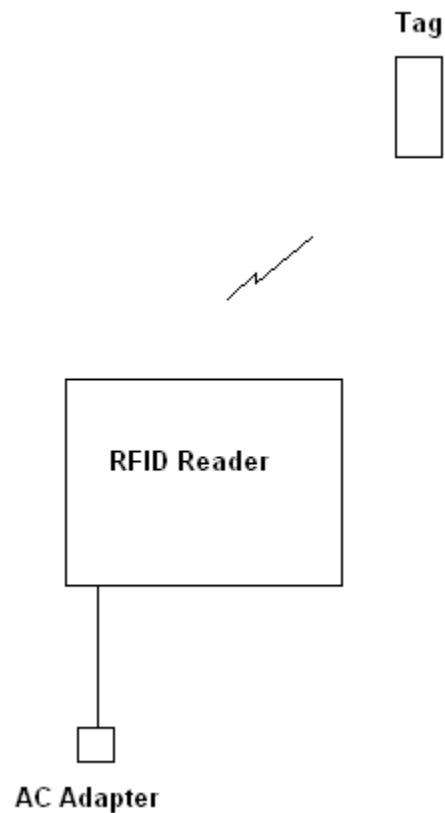
200 kHz

User Frequency Adjustment:

Software controlled

Description of EUT

The SR100 is a multi-protocol UHF RFID reader platform that supports a variety of UHF RFID tags.

System Diagram

Section 3. Channel Separation

NAME OF TEST: Channel Separation	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE: 19 February 2010

Test Results: Complies.

Measurement Data: See 20 dB BW plot

Measured 20 dB bandwidth: 200 kHz

Channel Separation: 200 kHz

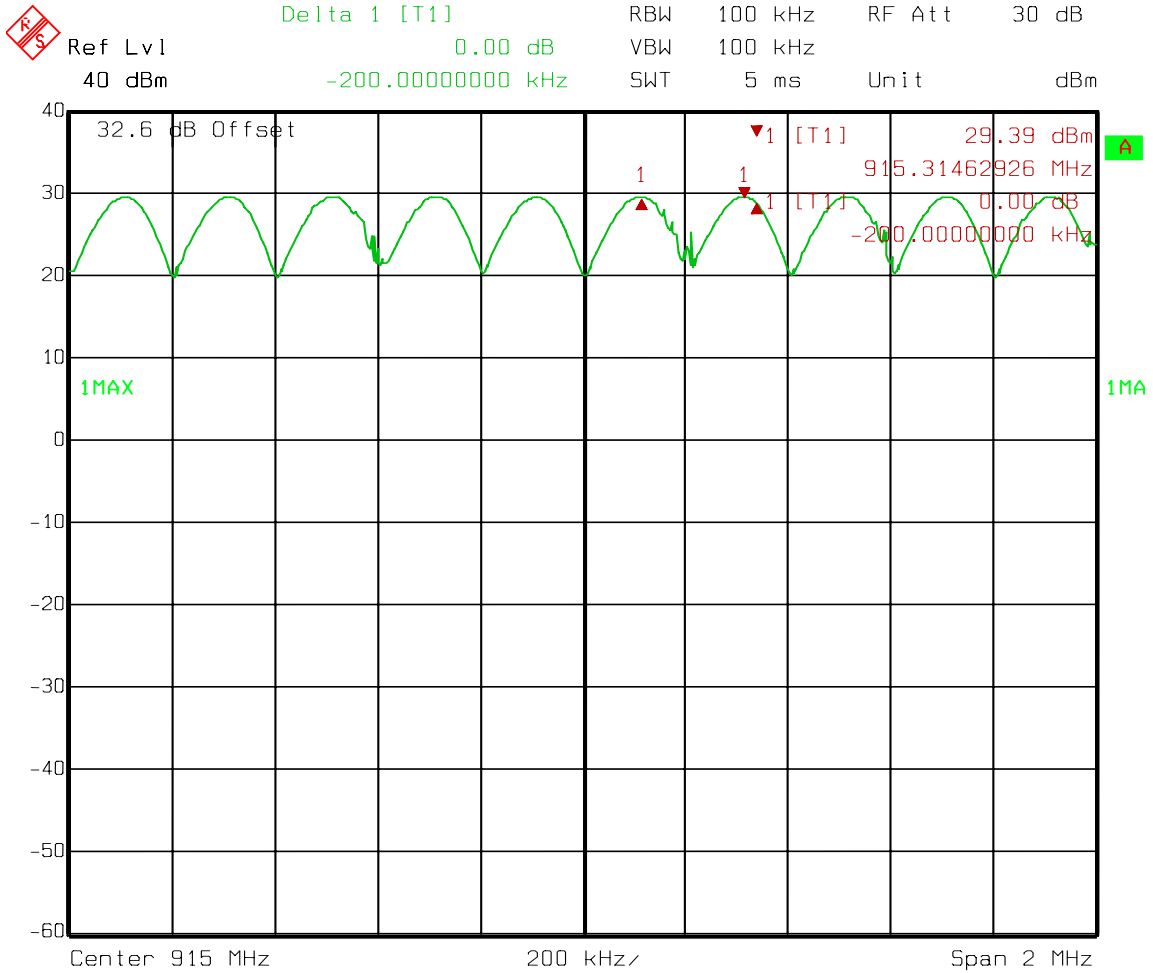
Equipment Used: 1036-1082-1472-1469

Measurement Uncertainty: 1×10^{-7} ppm

Temperature: 22°C

Relative Humidity: 40%

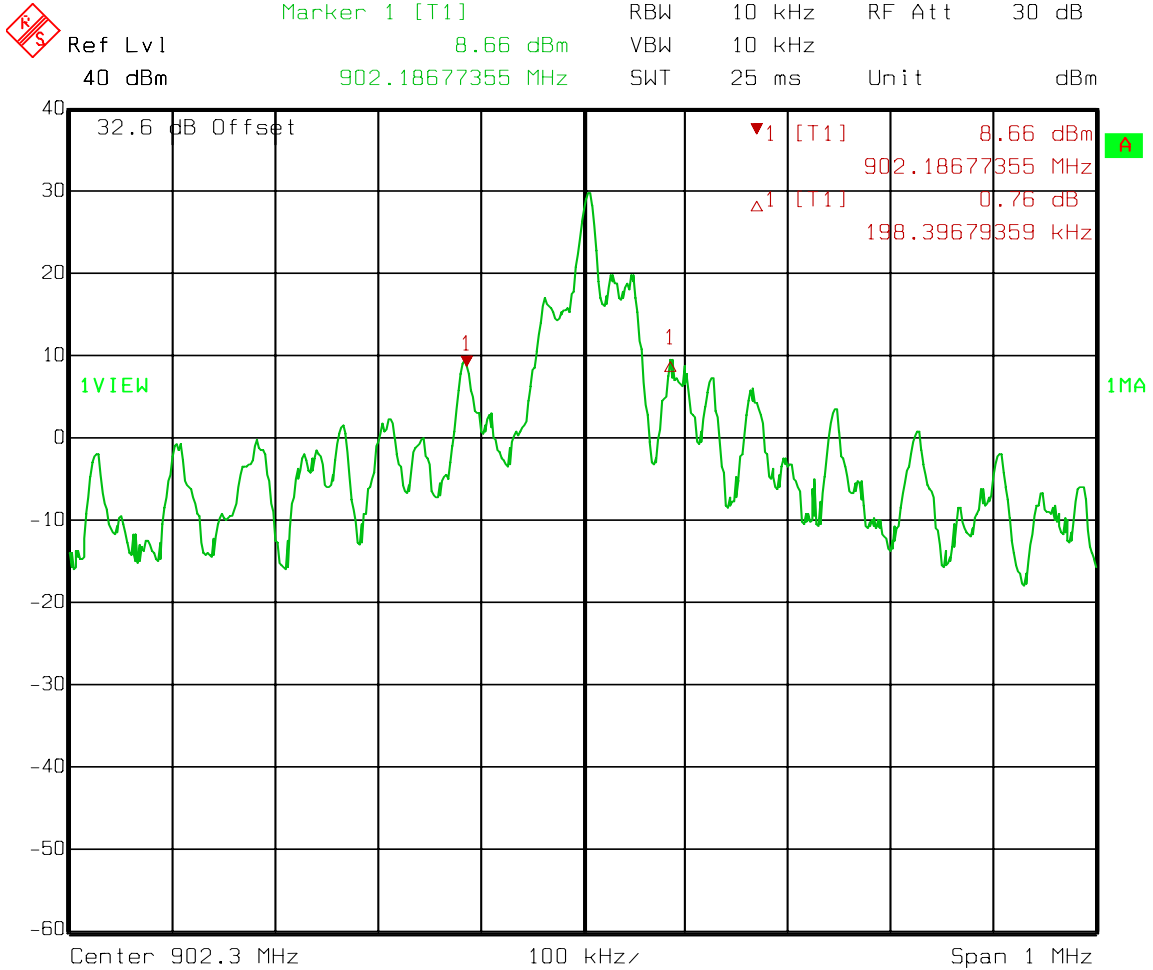
Test Data – Channel Separation



Date: 19.FEB.2010 13:40:53

Test Data – 20 dB Bandwidth

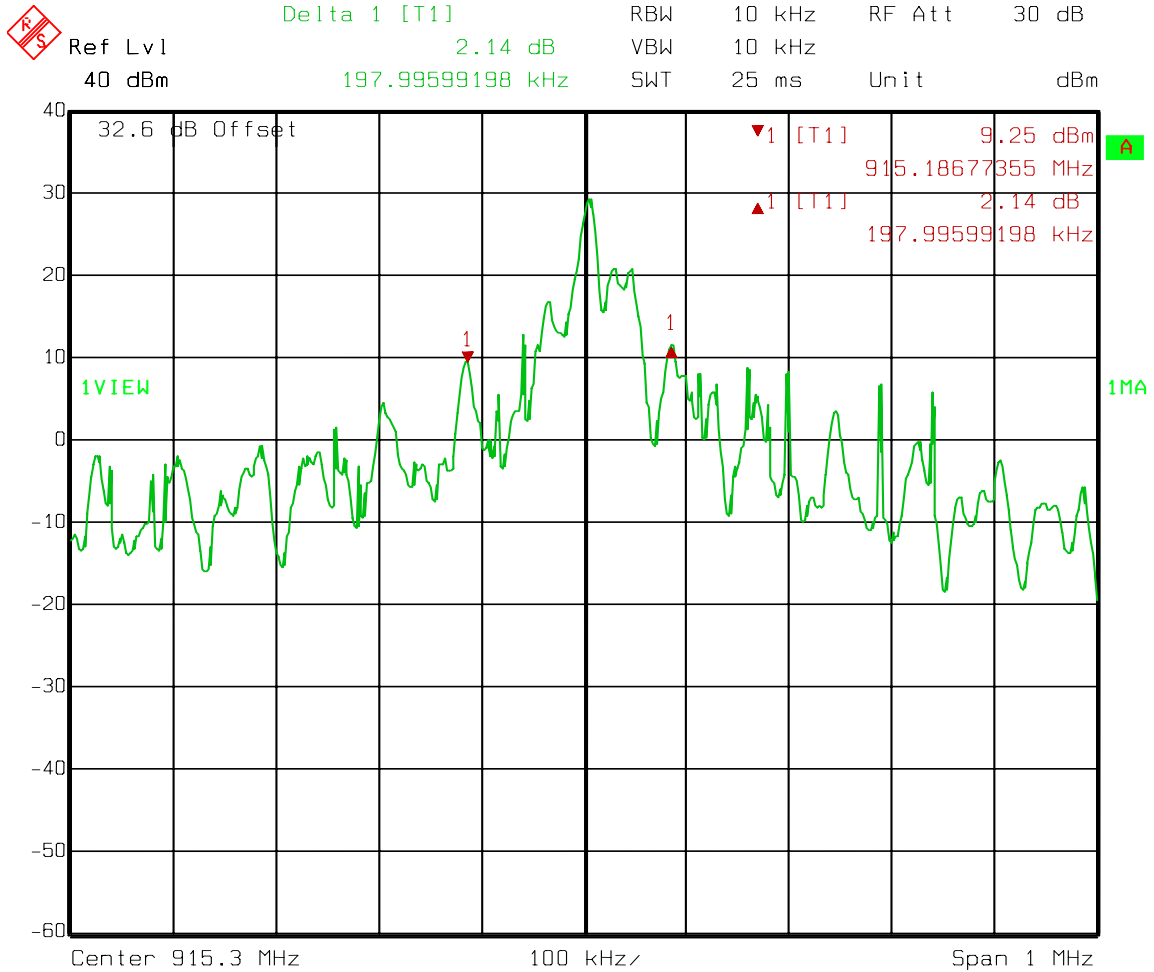
Low Channel



Date: 19.FEB.2010 13:43:09

Test Data – 20 dB Bandwidth

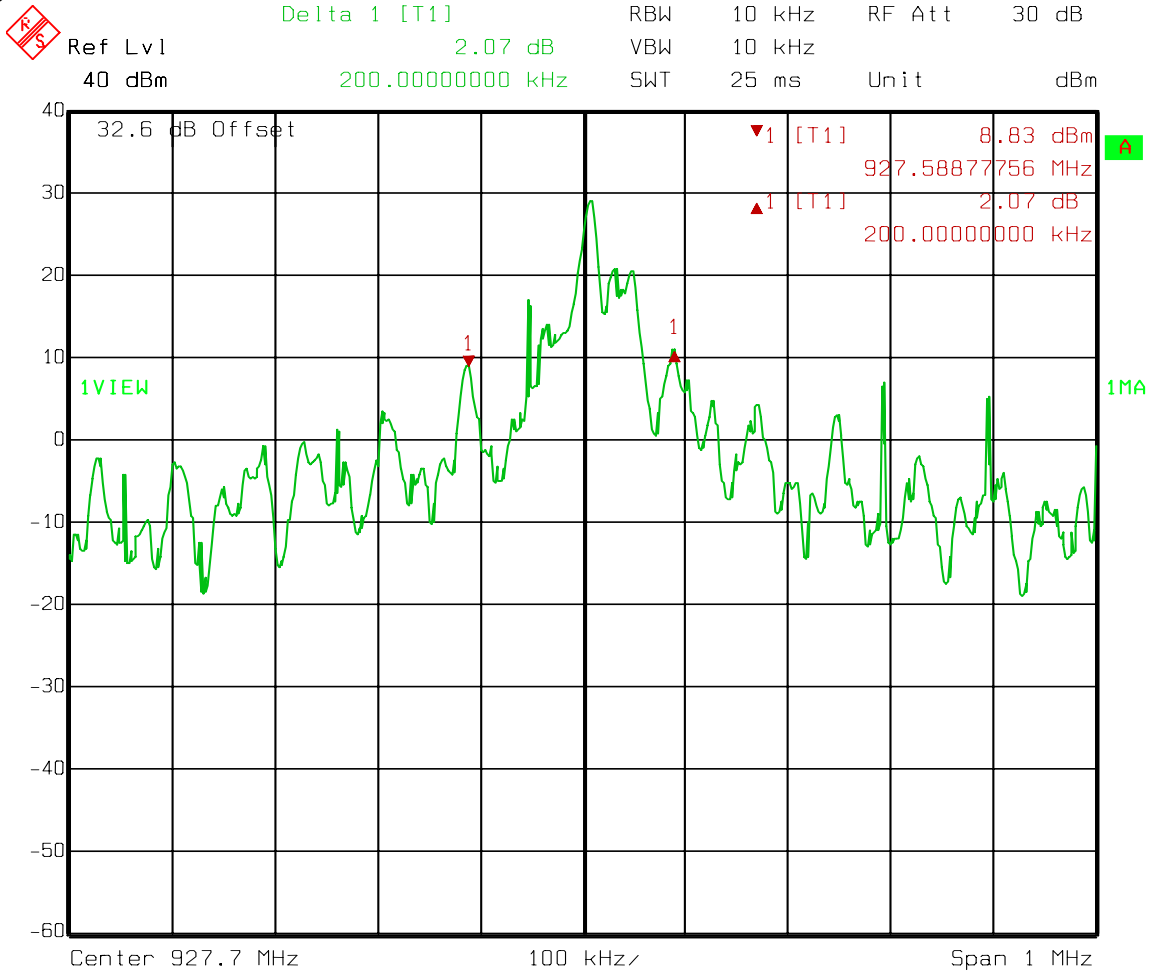
Mid Channel



Date: 19.FEB.2010 13:45:58

Test Data – 20 dB Bandwidth

High Channel



Date: 19.FEB.2010 13:48:50

Section 4. Time of Occupancy and No. of Channels

NAME OF TEST: Time of Occupancy and No. of Channels	PARA. NO.: 15.247(a)(1)
TESTED BY: David Light	DATE: 19 February 2010

Test Results: Complies.

Measurement Data: Attached

Maximum Dwell Time On Any Channel: 41.2 mS in 20 seconds

Number of Hopping Channels: 128

Equipment Used: 1036-1082-1472-1469

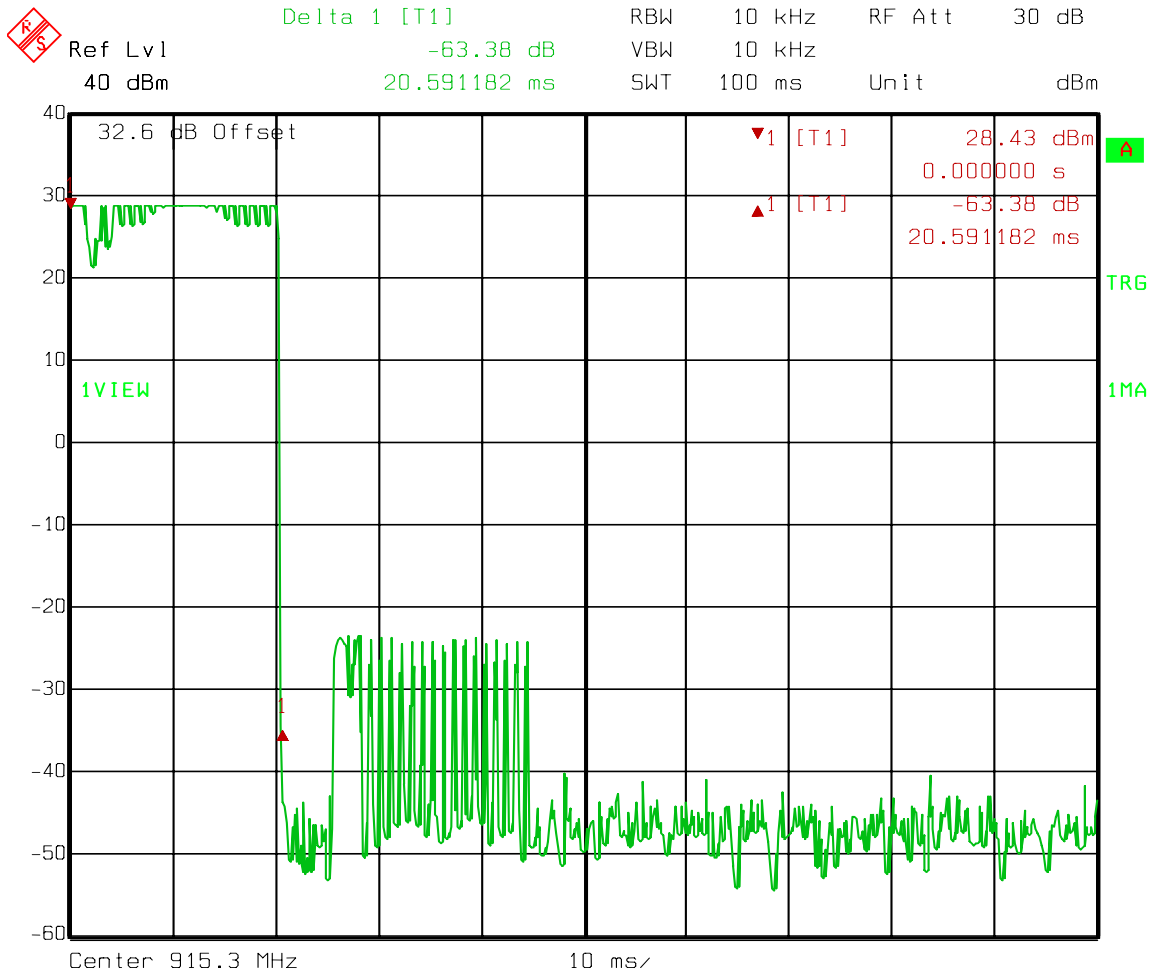
Measurement Uncertainty: 1×10^{-7} ppm

Temperature: 22 °C

Relative Humidity: 40 %

Test Data – Time of Occupancy

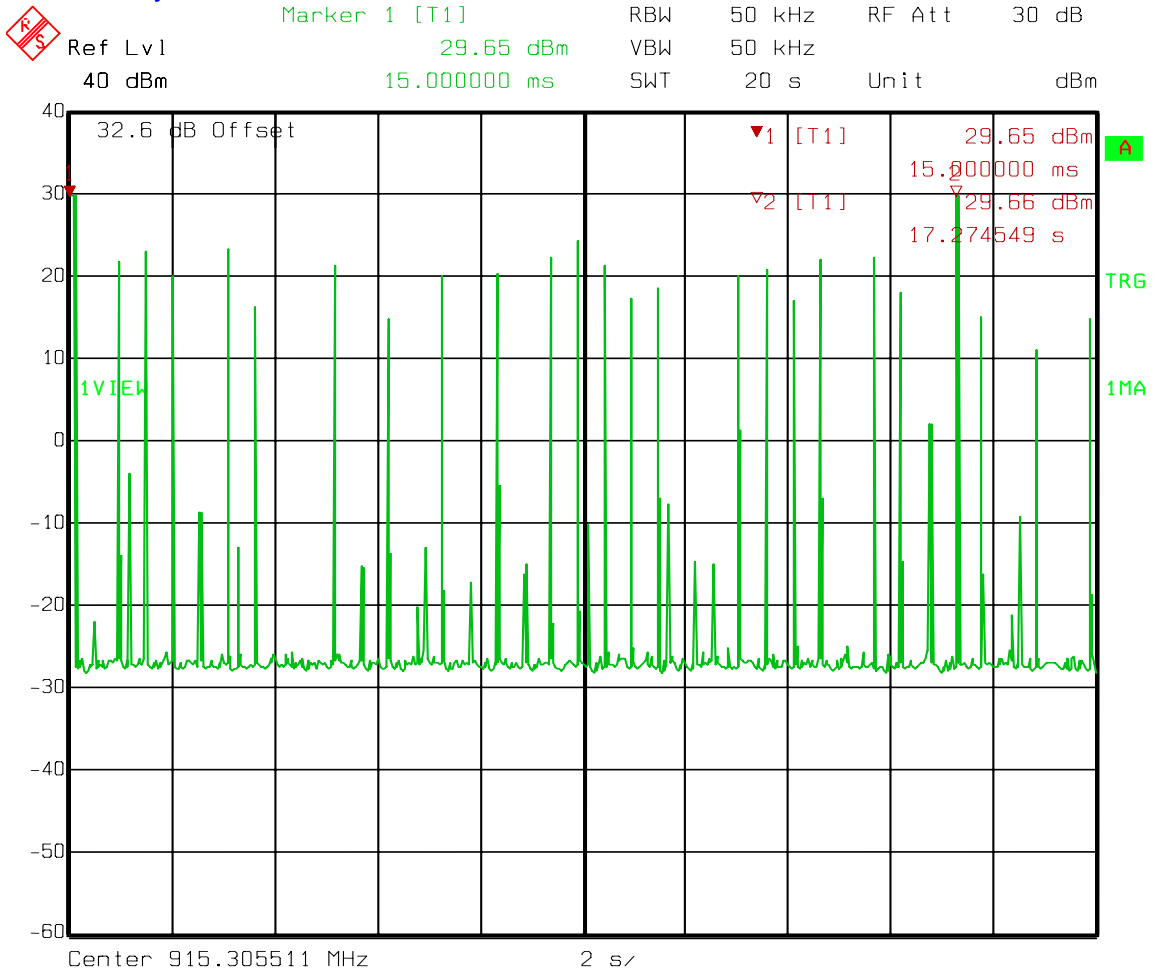
Time of occupancy for one hop



Date: 19.FEB.2010 13:51:00

Test Data – Time of Occupancy

A channel may be used a maximum of two times in 20 seconds

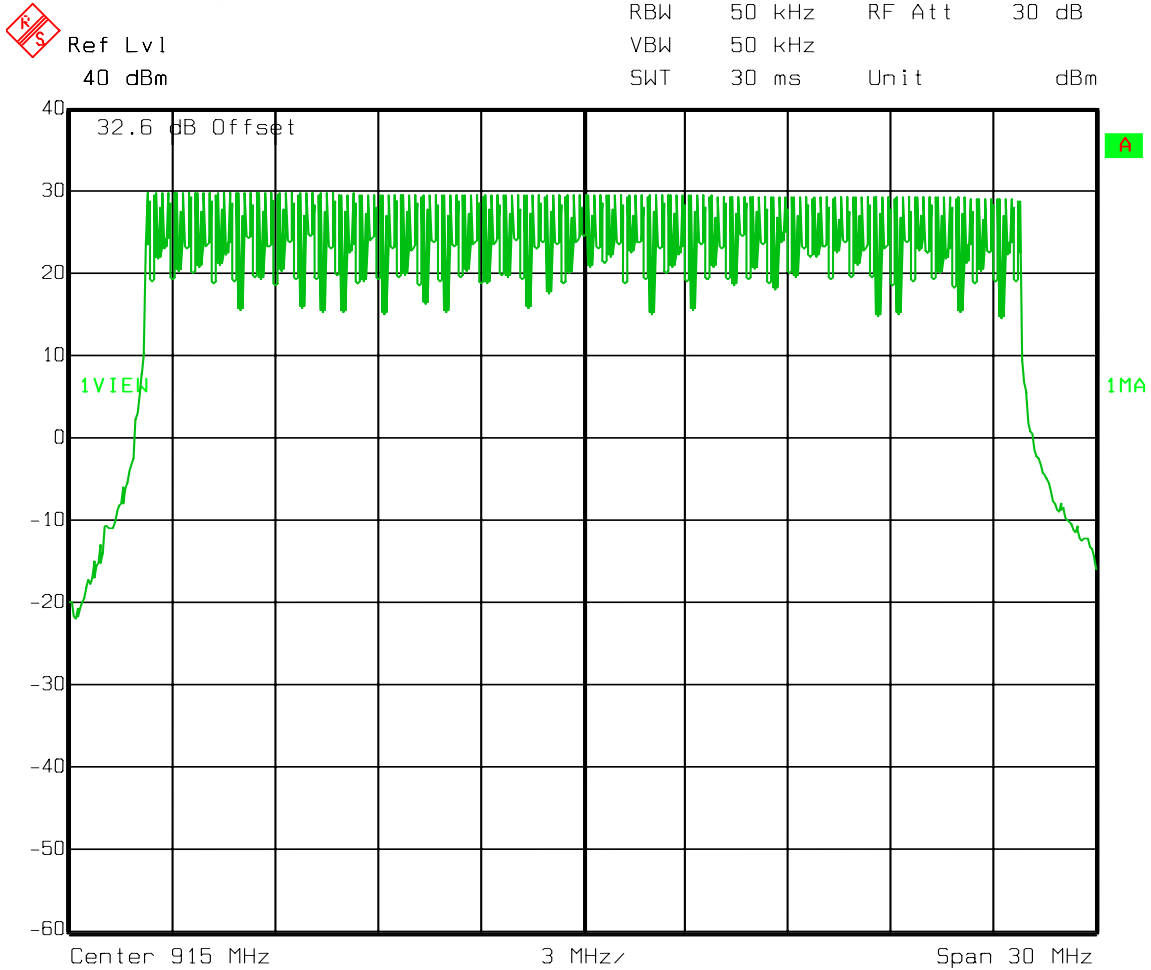


Date: 19.FEB.2010 13:56:14

2 x 20.59 msec. = 41.18 msec. in 20 sec.

Test Data – Number of Hopping Channels

Number of hopping channels = 128



Date: 19.FEB.2010 14:01:47

Section 5. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: David Light	DATE: 18 February 2010

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. (W)
902.3	29.7	933.3	Patch	5	34.7	3.0
915.3	29.4	871.0	Patch	5	34.4	2.6
927.7	29.0	794.3	Patch	5	34.0	2.5
Maximum EIRP (W): 3.0						

RBW: 1 MHz**VBW: 1 MHz****Detector: Max Peak**

Note: This device can be used with either an internal or external patch antenna, the antenna is identical in both cases.

☒ This device was tested at +/- 15% input power per 15.31(e), with no variation in output power.

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

Equipment Used: 1036-1082-1472-1469**Measurement Uncertainty:** 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 40 %

Section 6. Spurious Emissions (Conducted)

NAME OF TEST: Spurious Emissions (Conducted)	PARA. NO.: 15.247(d)
TESTED BY: David Light	DATE: 19 February 2010

Test Results: Complies.

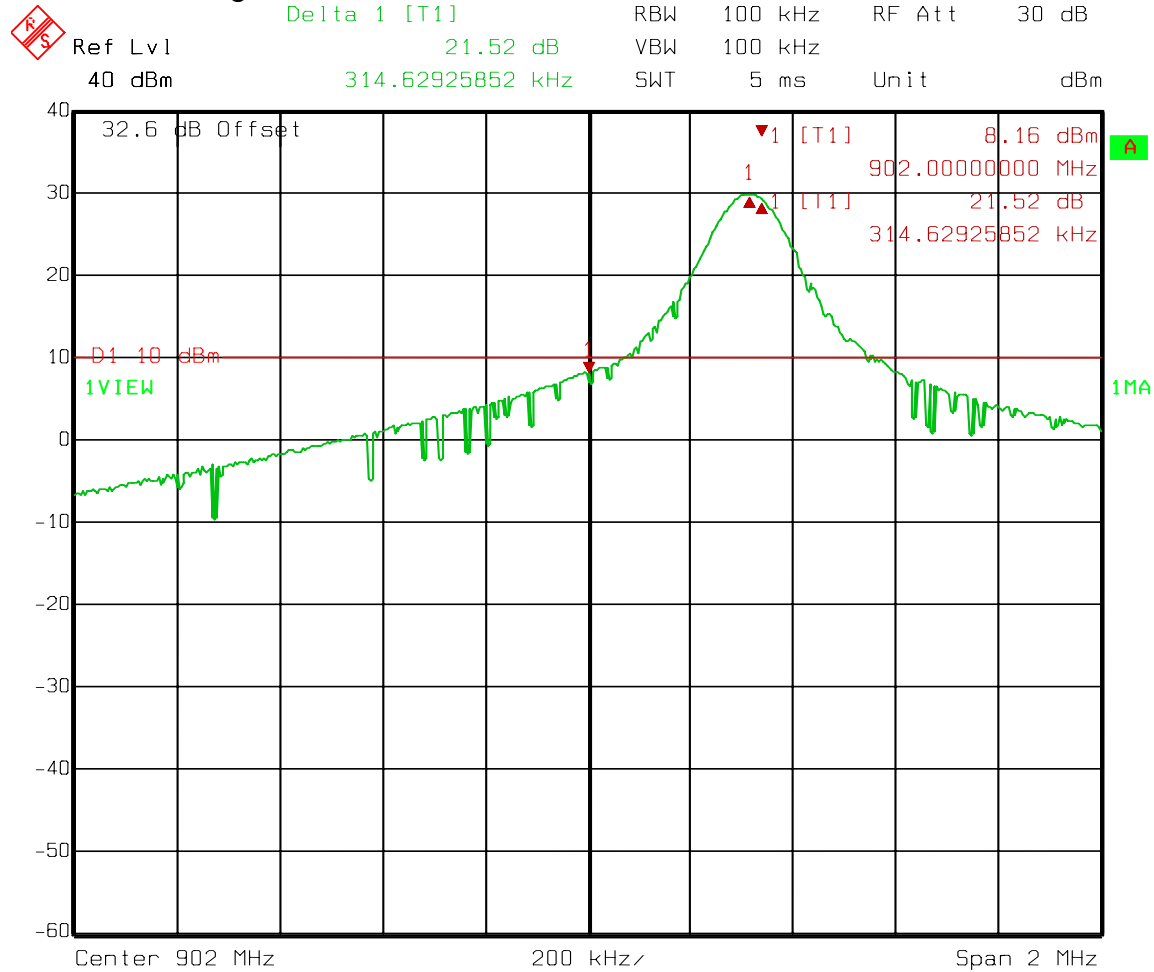
Measurement Data: See attached plots.

Equipment Used: 1036-1082-1472-1469

Measurement Uncertainty: 1X10⁻⁷ppm

Temperature: 22 °C

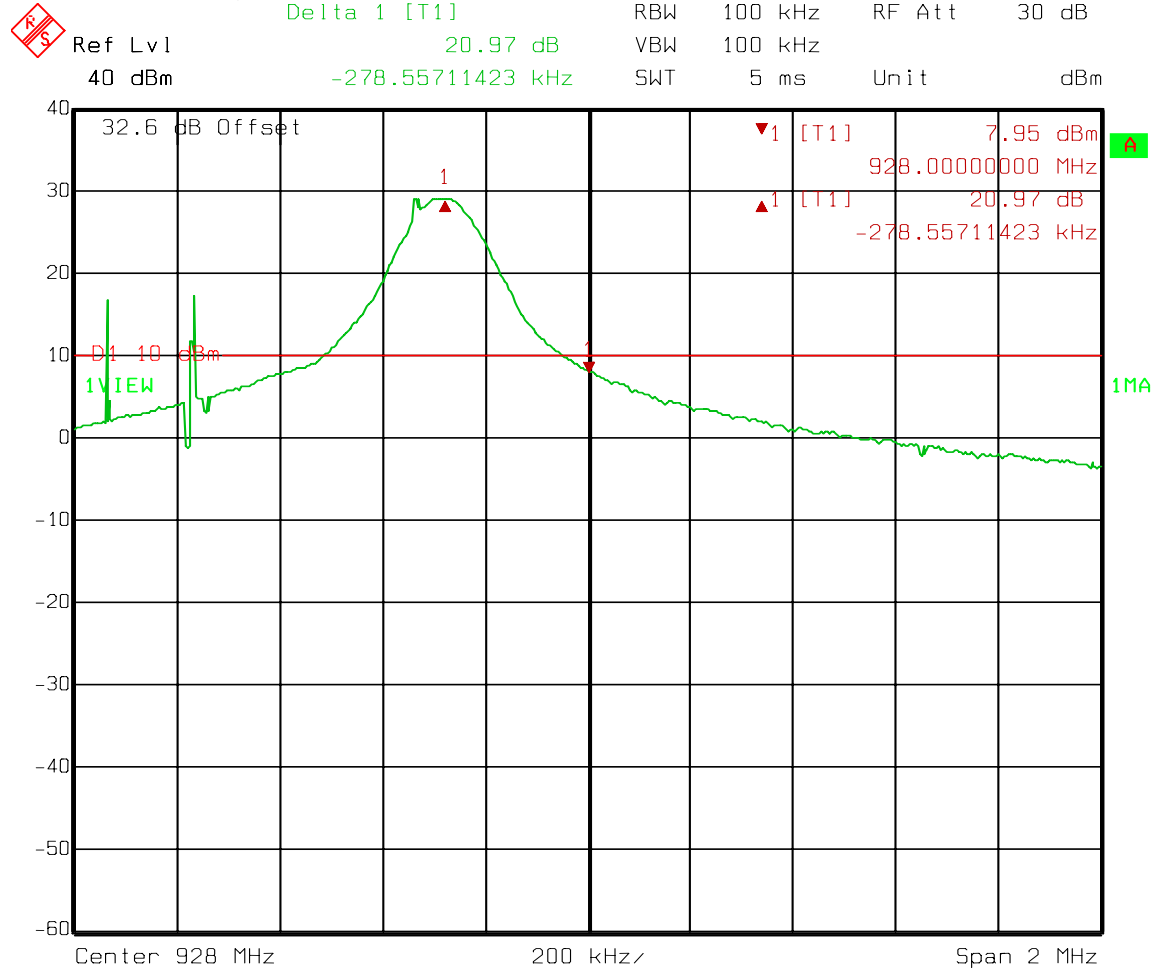
Relative Humidity: 40 %

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

Date: 19.FEB.2010 13:37:38

Test Data – Spurious Emissions at Antenna Terminals

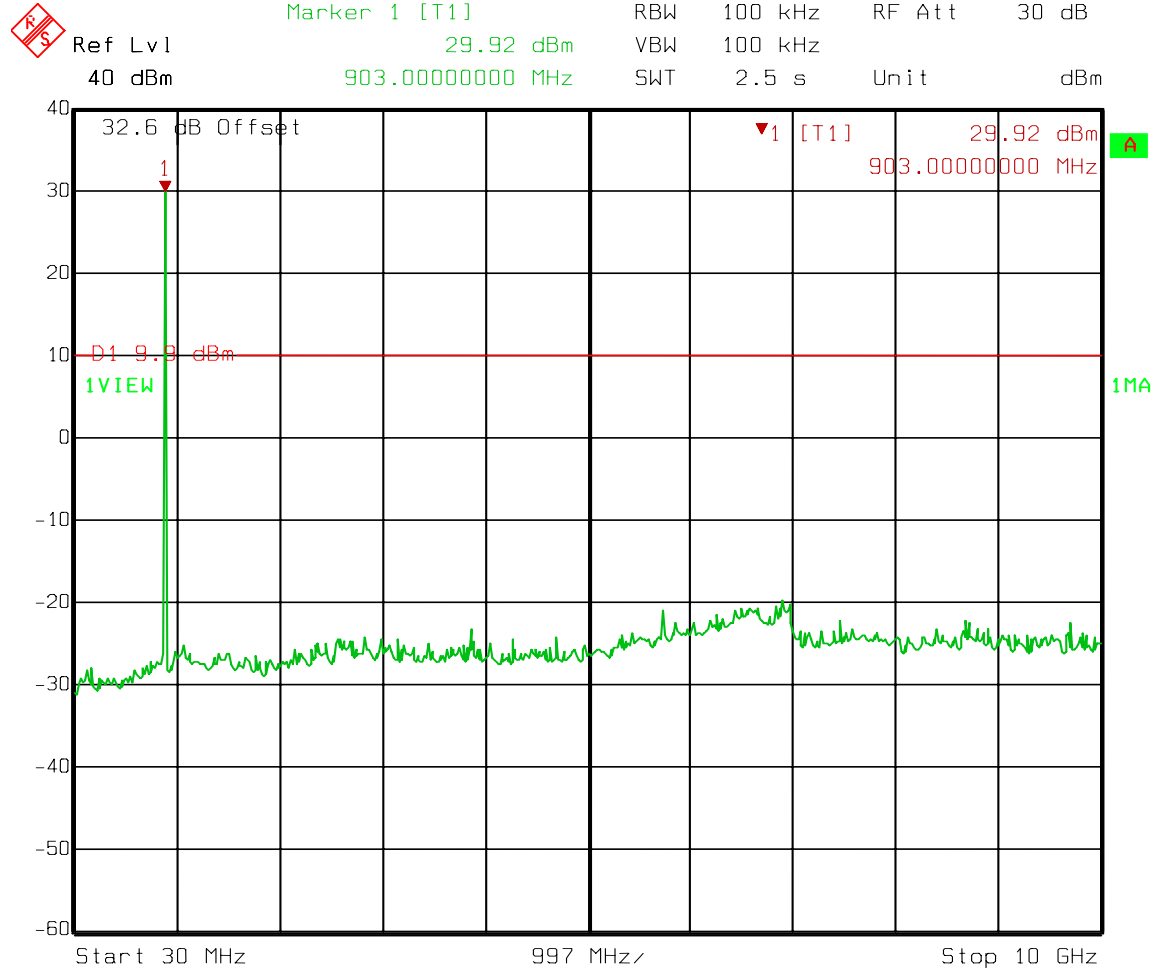
Upper Band Edge



Date: 19.FEB.2010 13:38:53

Test Data – Spurious Emissions at Antenna Terminals

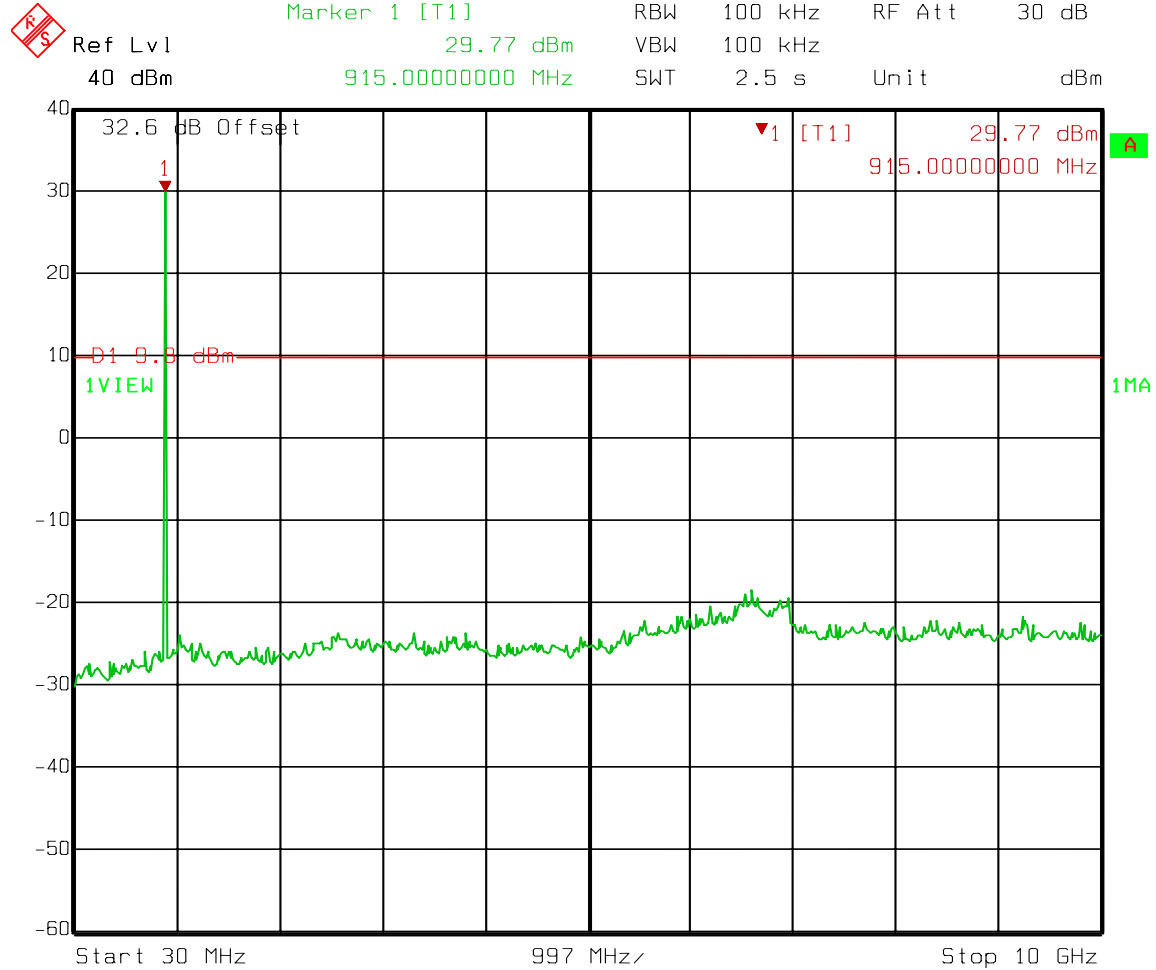
Spurs – Low Channel (902.3 MHz)



Date: 19.FEB.2010 09:46:59

Test Data – Spurious Emissions at Antenna Terminals

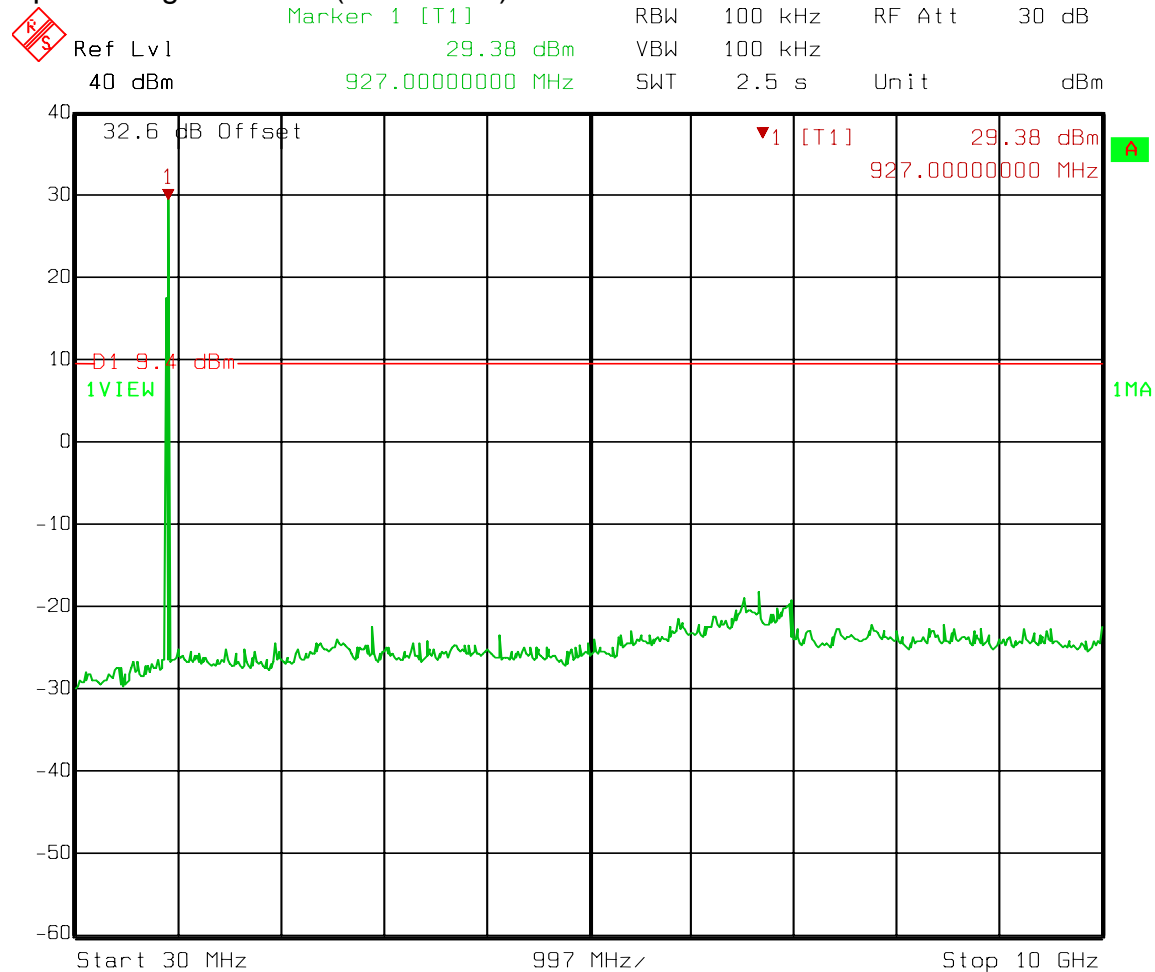
Spurs – Mid Channel (915.3 MHz)



Date: 19.FEB.2010 09:45:42

Test Data – Spurious Emissions at Antenna Terminals

Spurs – High Channel (927.7 MHz)



Date: 19.FEB.2010 09:49:40

Section 7. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(d)
TESTED BY: David Light	DATE: 19 February 2010

Test Results: Complies. No emissions were detected within 20 dB of the specification limit therefore none are reported per 15.31(o).

Testing was performed with the internal antenna.

Measurement Data: None

Notes:

- ☒ The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33 (902.3 MHz, 915.3 MHz, 927.7 MHz)
- ☒ The device was tested on three channels per 15.31(l).

Equipment Used: 1464-1484-1485-791-1016-1480-993

Measurement Uncertainty: +/-3.6 dB

Temperature: 22 °C

Relative Humidity: 40 %

Analyzer Settings: RBW/VBW = 1 MHz Peak detector.

Section 8. Receiver Spurious Emissions (Conducted)

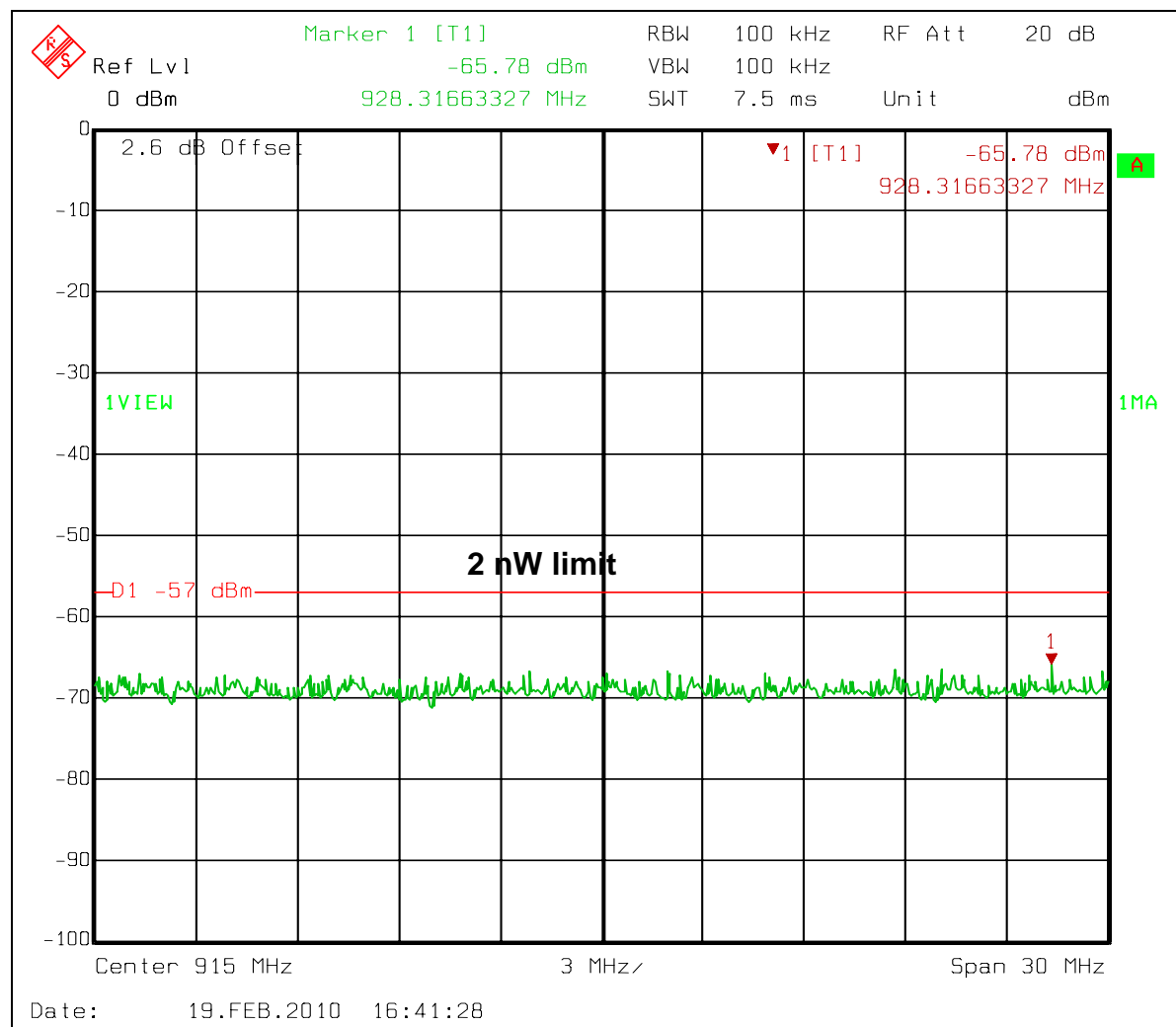
NAME OF TEST: Receiver Spurious Emissions (Conducted)	PARA. NO.: RSS-GEN 6(b)
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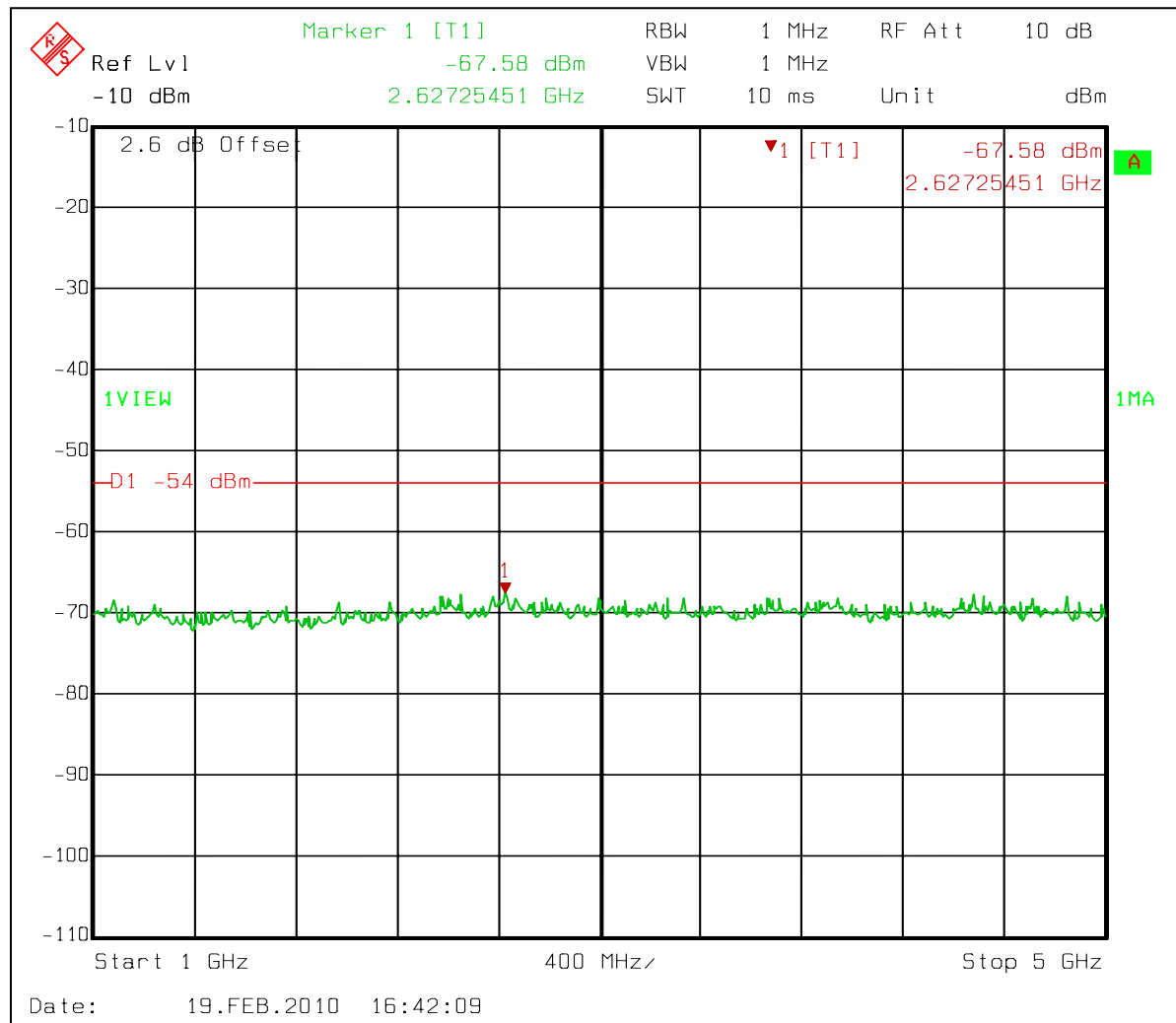
TESTED BY: David Light	DATE: 19 February 2010
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Test Results: Complies..**Measurement Data:** None

Notes:

☒ The device was tested from 30 MHz to 5 GHz. Worst-case emission levels are shown.☒ The device was tested on center channel (915 MHz).**Equipment Used:** 1036, 1484**Measurement Uncertainty:** +/-3.6 dB**Temperature:** 22 °C**Relative Humidity:** 40 %**Analyzer Settings:** RBW/VBW = 1 MHz Peak detector.





Section 9. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: David Light	DATE: 19 February 2010

Test Results: Complies. The worst case emission was 49.8 dB μ V at 174 kHz. This is 4.8 dB below the average specification limit of 54.8 dB μ V. This was a peak measurement. Since the measured peak emission level complies with the average limit, the device complies.

Test Data: Refer to attached plots

Equipment Used: 1989-1663-188

Measurement Uncertainty: +/- 1.7 dB

Temperature: 22 °C

Relative Humidity: 40 %

Test Data – Powerline Conducted Emissions

Line side



*RBW 10 kHz

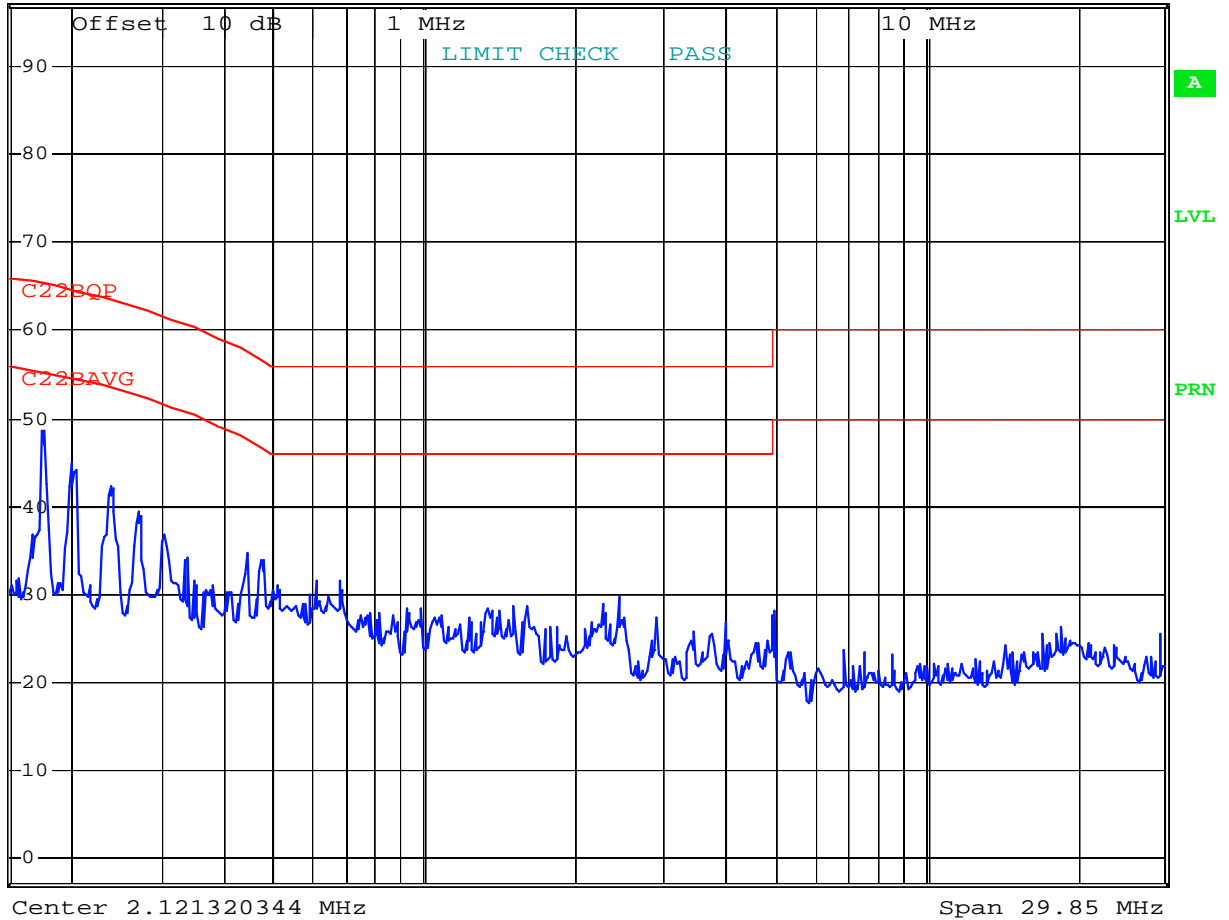
VBW 30 kHz

SWT 300 ms

Ref 97 dBμV

Att 10 dB

1 PK
VIEW



Date: 19.FEB.2010 17:34:28

Test Data – Powerline Conducted Emissions

Neutral side



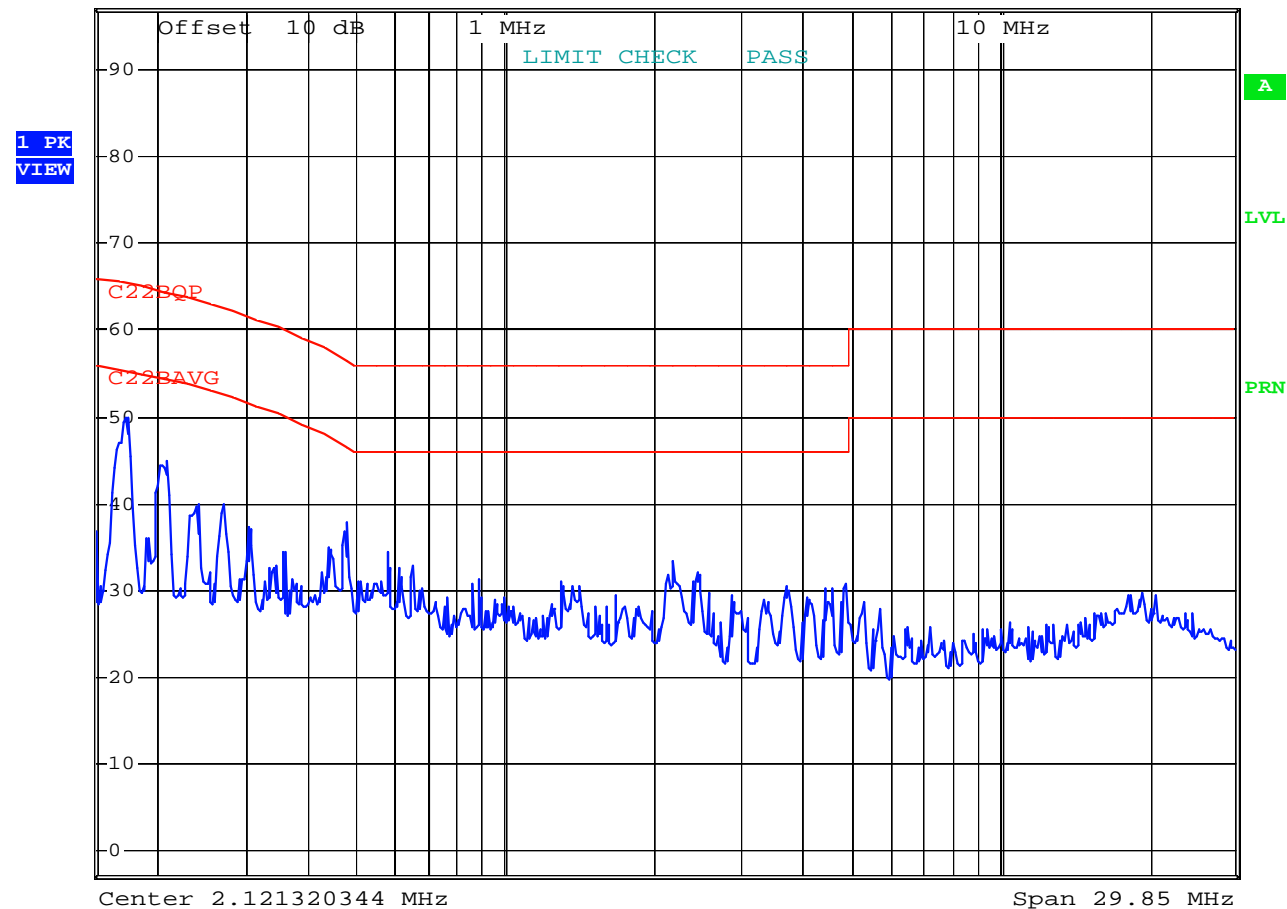
*RBW 10 kHz

VBW 30 kHz

SWT 300 ms

Ref 97 dBμV

Att 10 dB



Date: 19.FEB.2010 17:35:19

Section 9. Test Equipment List

Asset Tag	Manufacturer	Model	Serial #	Last Cal	Next Cal
993	A.H. Systems	SAS-200/571	162	09-Sep-2009	09-Sep-2011
1016	Hewlett Packard	8449A	2749A00159	23-Jun-2009	23-Jun-2010
1036	Rohde&Schwarz	FSEK30	830844/006	10-Jan-2009	10-Jan-2011
1082	Astrolab	32027-2-29094-72TC		CBU	NA
1188	EMCO	3825/2	1214	23-Sep-2009	23-Sep-2010
1464	Hewlett Packard	8563E	3551A04428	27-Feb-2009	27-Feb-2011
1469	MCL Inc.	BW-S10W2 10db-2WDC		CBU	NA
1472	Omni Spectra	20600-20db		CBU	NA
1480	Schaffner-Chase	CBL6111C	2572	18-Jan-2010	18-Jan-2011
1484	Storm	PR90-010-072		23-Jun-2009	23-Jun-2010
1485	Storm	PR90-010-216		23-Jun-2009	23-Jun-2010
1663	Rohde&Schwarz	FSP3	100073	20-Apr-2009	20-Apr-2011
1989	Nemko USA	RG213		10-Jun-2009	10-Jun-2010

ANNEX A - TEST DETAILS

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

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: 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

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:

$(30 \text{ sec.} / .001 \text{ sec.}) / 75 \text{ chan.} = 400 \times 1 \text{ msec.} = 400 \text{ msec. or } 0.4 \text{ sec. in } 30 \text{ sec.}$

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

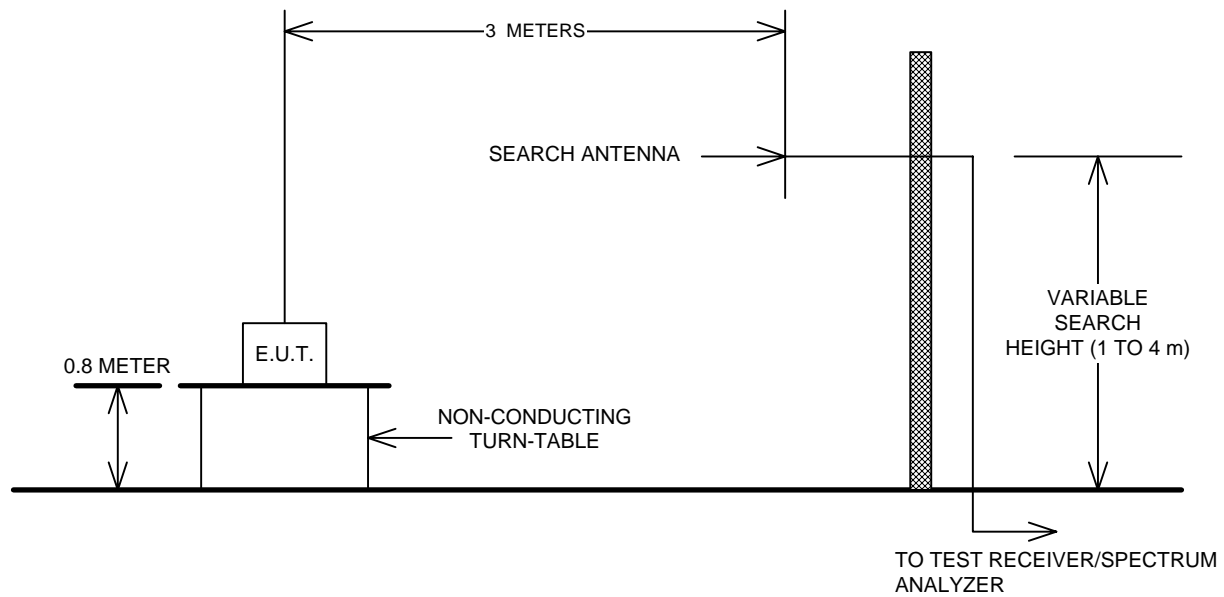
MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	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

ANNEX B - TEST DIAGRAMS

Test Site For Radiated Emissions



Conducted Emissions



Peak Power at Antenna Terminals

