| | |
|---|---|
| **Nemko Test Report:** | 25136RUS1 |
| **Applicant:** | Sirit Corporation<br>1321 Valwood Parkway<br>Carrollton, TX 75006<br>USA |
| **Equipment Under Test: (E.U.T.)** | IDENTITY 4100 |
| **In Accordance With:** | **FCC Part 15, Subpart C, 15.247**<br>Frequency Hopping Transmitters |
| **Tested By:** | Nemko USA Inc.<br>802 N. Kealy<br>Lewisville, Texas 75057-3136 |

**TESTED BY:** _____ **DATE:** **20 February 2009**

David Light, Senior Wireless Engineer

**APPROVED BY:** _____ **DATE:** **1 June, 2009**

Tom Tidwell, Telecom Direct

**Total Number of Pages:** 45

# Table of Contents

## Section 1. Summary of Test Results

Manufacturer: Sirit Corporation

Model No.: IDENTITY 4100

Serial No.: ID4100000029

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 is 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

**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<br>☐ 2400 – 2483.5 MHz<br>☐ 5725 – 5850 MHz |
| **Operating Frequency Range:** | 902.3 – 912.1 MHz*<br>910.1 – 919.9 MHz*<br>917.9 – 927.7 MHz*<br>902.75 – 927.25 MHz* |
| **Number of Channels:** | 50 |
| **Channel Spacing:** | 200 kHz or 500 kHz* |
| **User Frequency Adjustment:** | Software controlled |

* See explanation on next page.

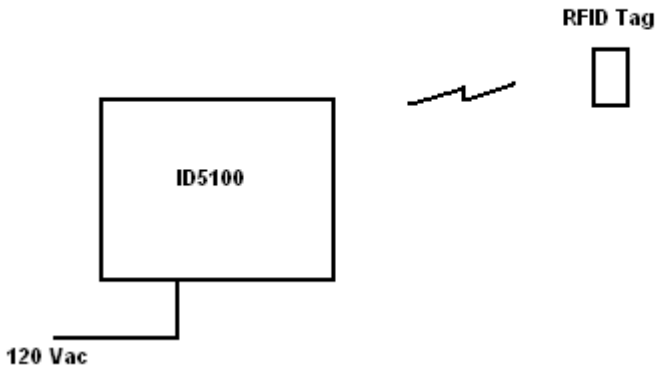
**Description of EUT**

IDENTITY 4100 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 IDENTY 4100 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. 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**



## Section 3. Powerline Conducted Emissions

| | |
|---|---|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207(a) |
| TESTED BY: David Light | DATE: 20 February 2009 |

**Test Results:** Complies. The worst case emission was 49.8 dBµV at 292.4 kHz. This is 0.7 dB below the average specification limit of 50.5 dBµV.

**Test Data:** Refer to attached plots

**Equipment Used:** 1663-1188-1120

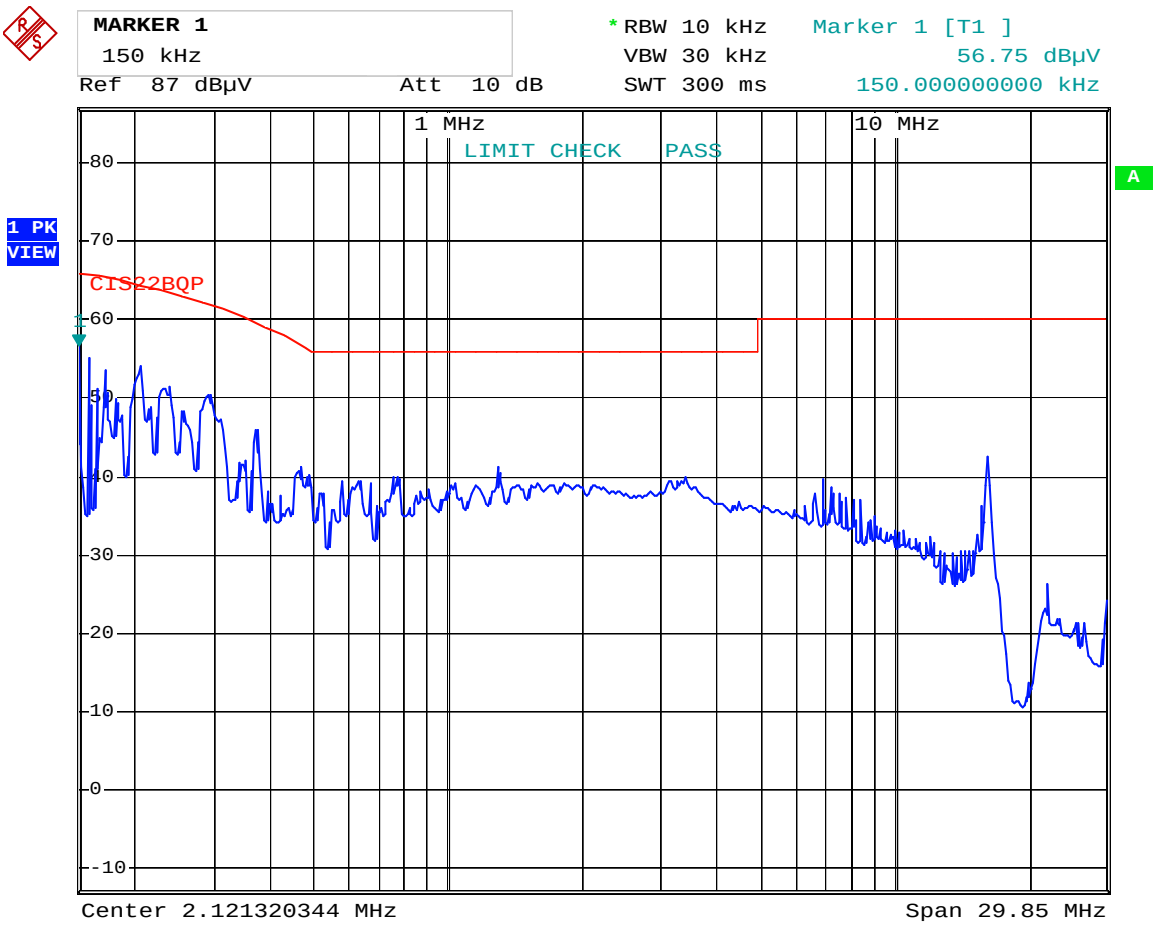
**Measurement Uncertainty:** +/- 1.7 dB

**Temperature:** 22 °C

**Relative Humidity:** 30 %

## Test Data – Powerline Conducted Emissions

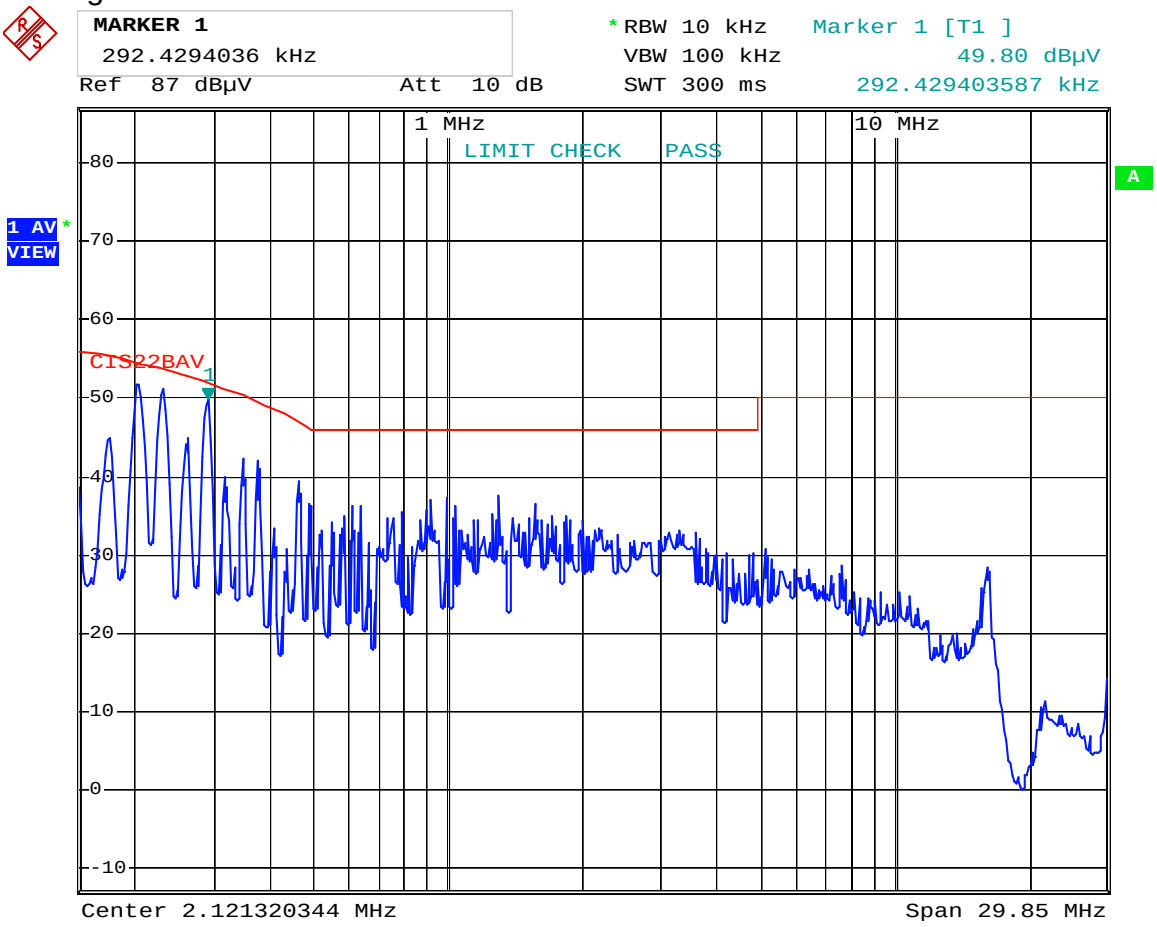
Line side
Peak




Date: 20.FEB.2009 10:48:55

## Test Data – Powerline Conducted Emissions

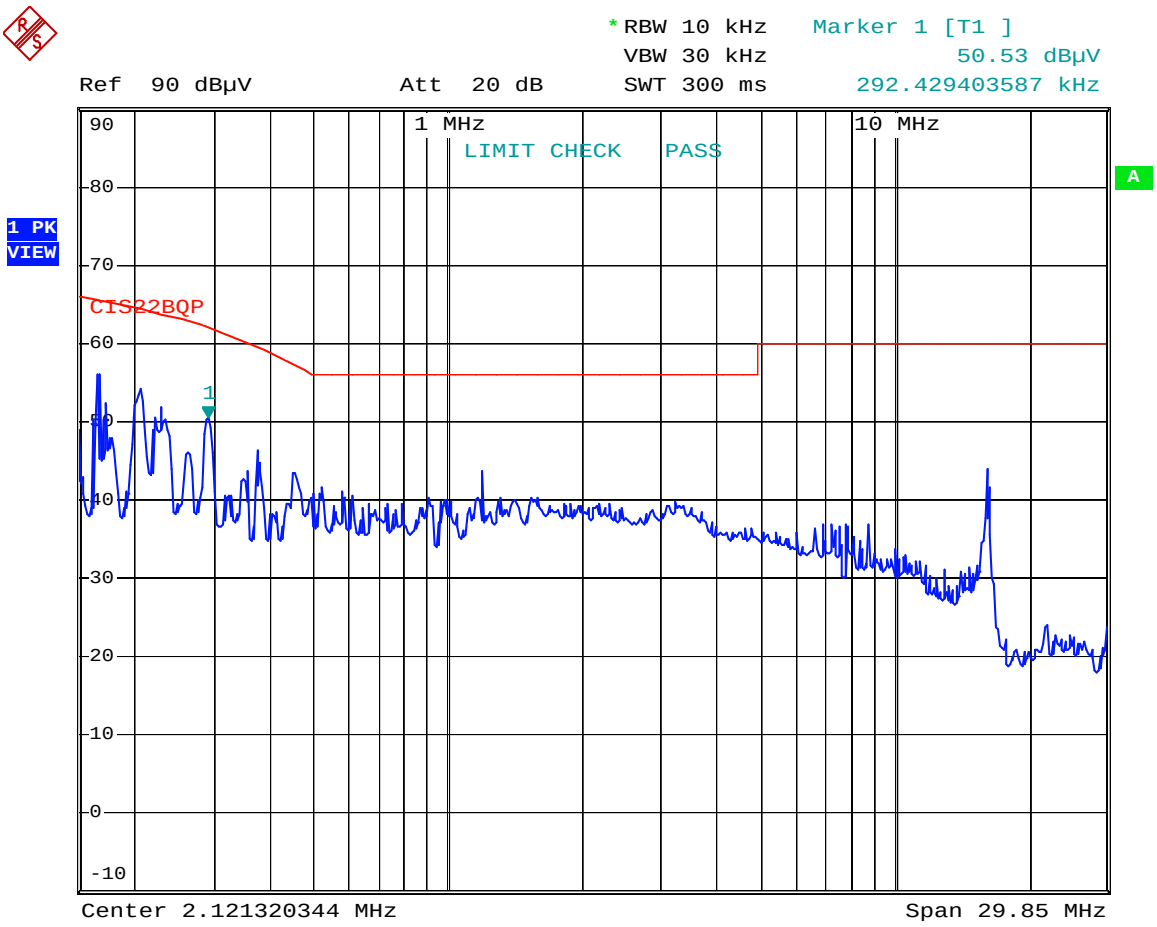
Line side
Average




Date: 20.FEB.2009 10:50:14

## Test Data – Powerline Conducted Emissions

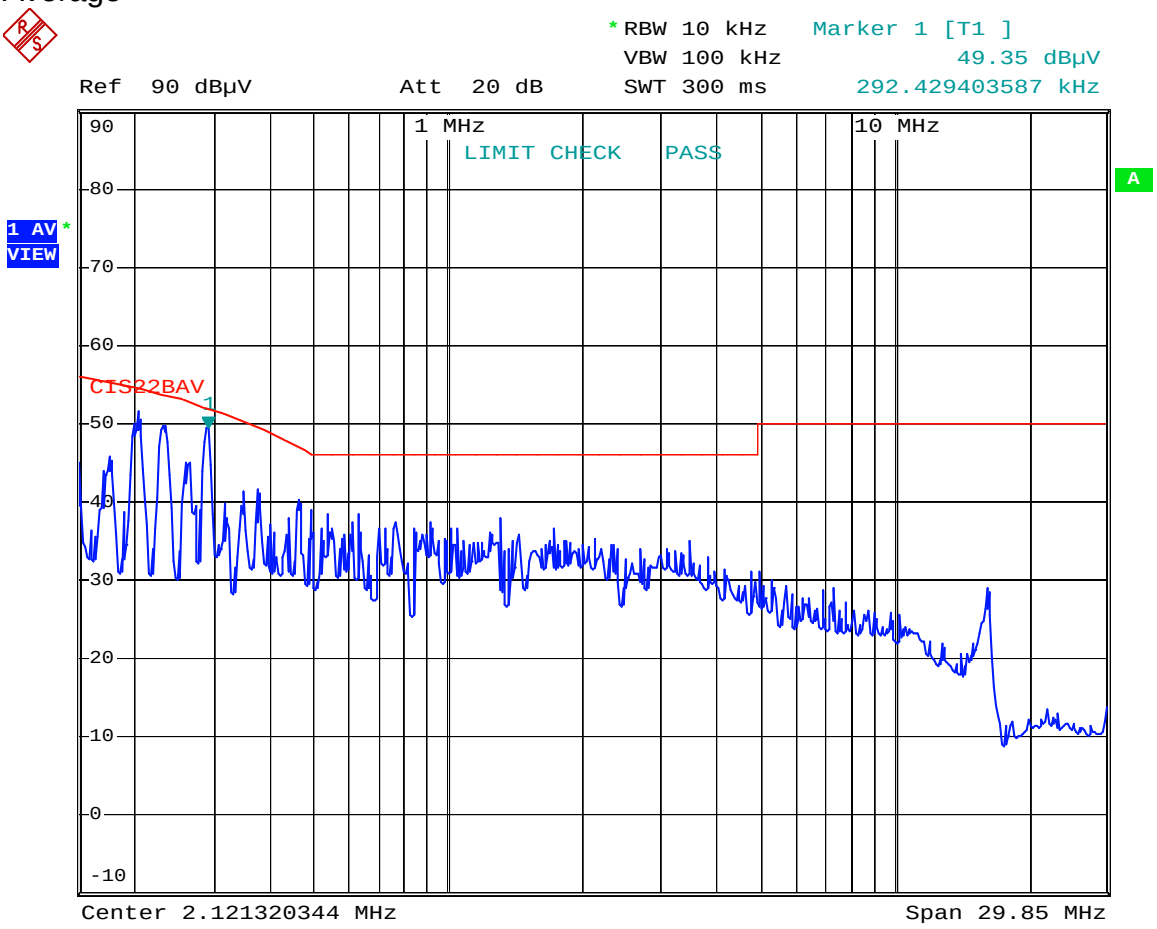
Neutral side
Peak




Date: 20.FEB.2009 10:52:15

## Test Data – Powerline Conducted Emissions

Neutral side
Average




Date: 20.FEB.2009 10:51:42

## Section 4. Channel Separation

| | |
|---|---|
| NAME OF TEST: Channel Separation | PARA. NO.: 15.247(a)(1) |
| TESTED BY: David Light | DATE: 19 February 2009 |

**Test Results:** Complies.

**Measurement Data:** See 20 dB BW plot

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

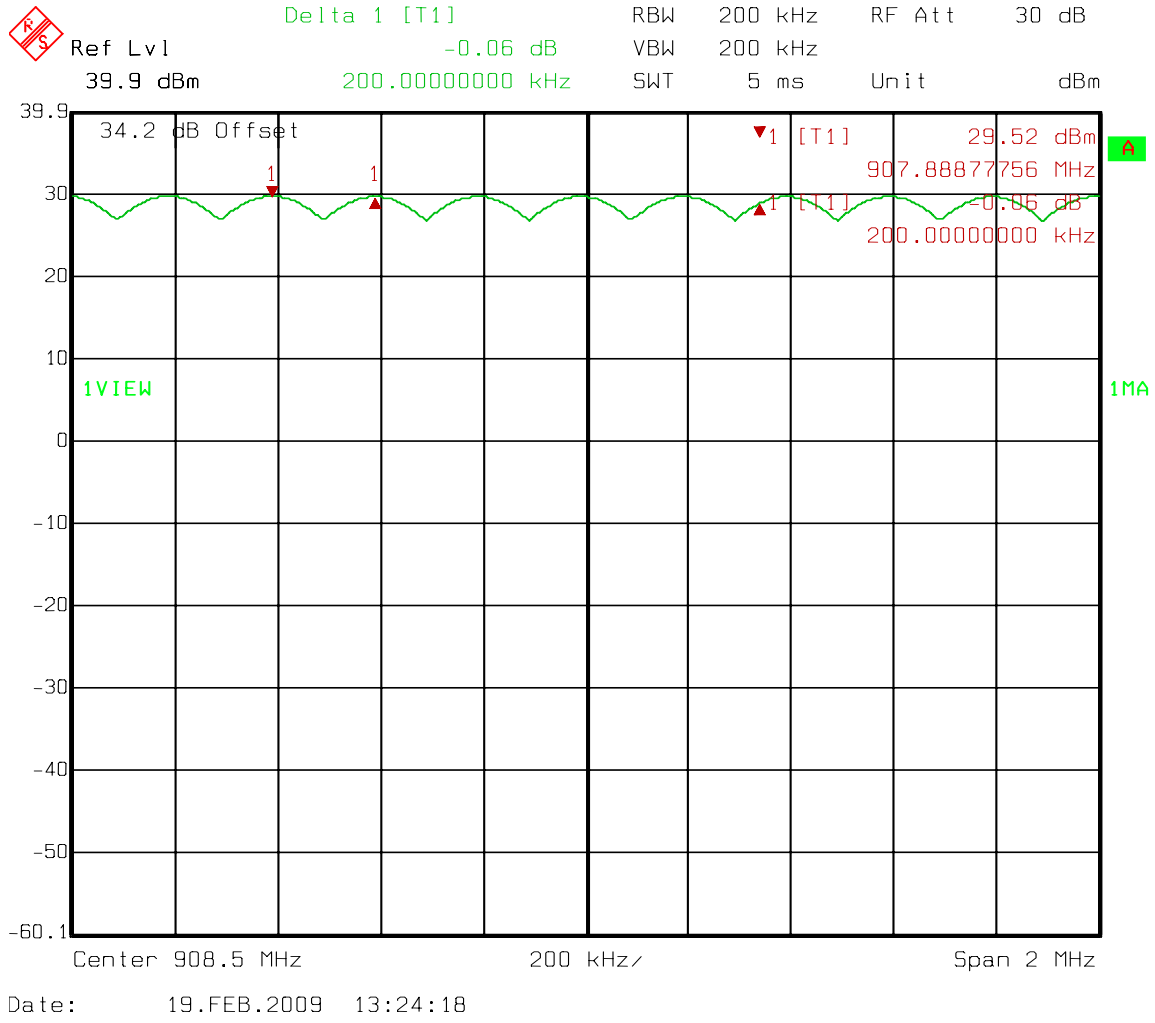
**Equipment Used:** 1472-1469-1082-1036

**Measurement Uncertainty:** $1X10^{-7}$ppm

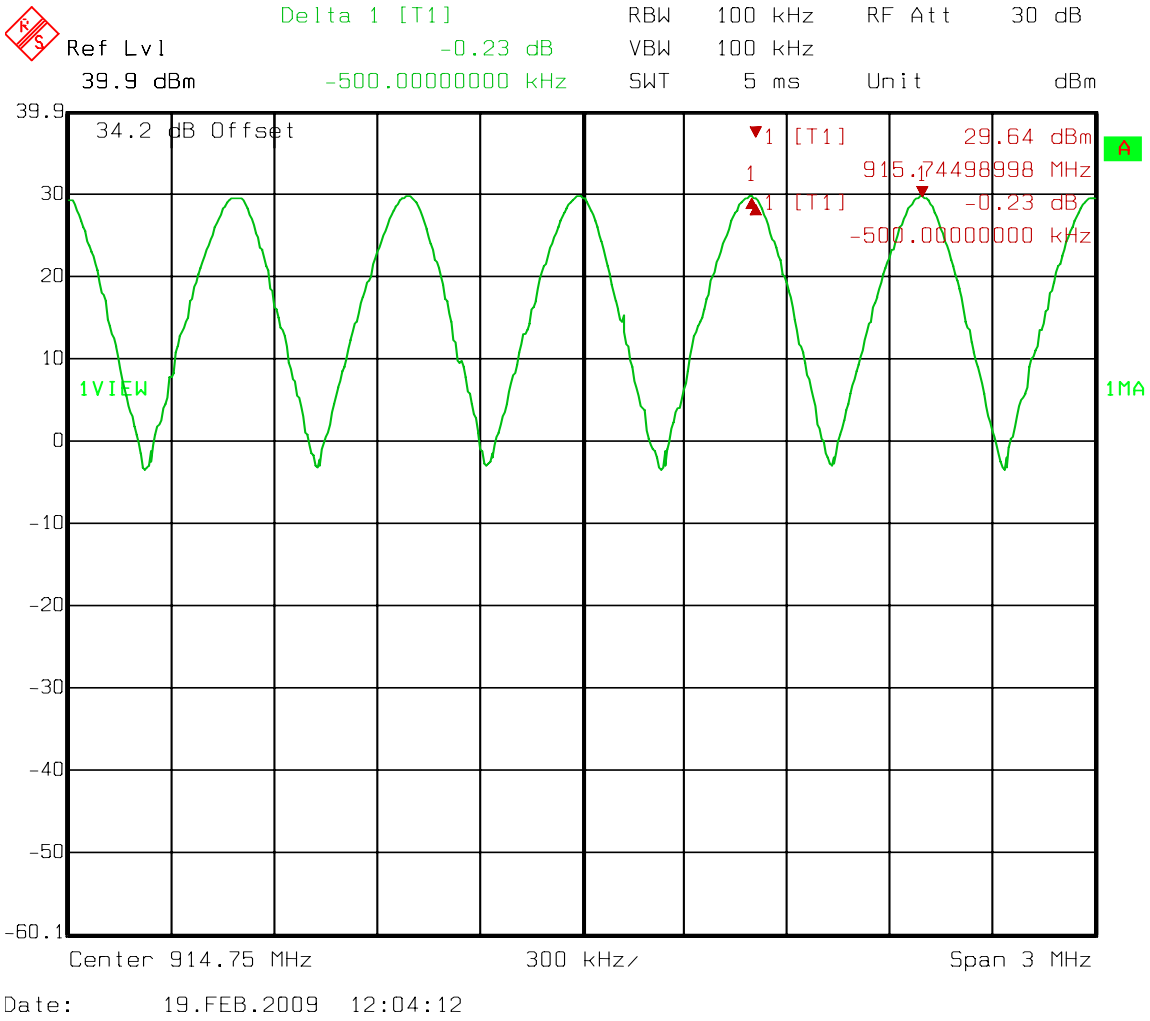
**Temperature:** 22 °C

**Relative Humidity:** 35 %

## Test Data – Channel Separation

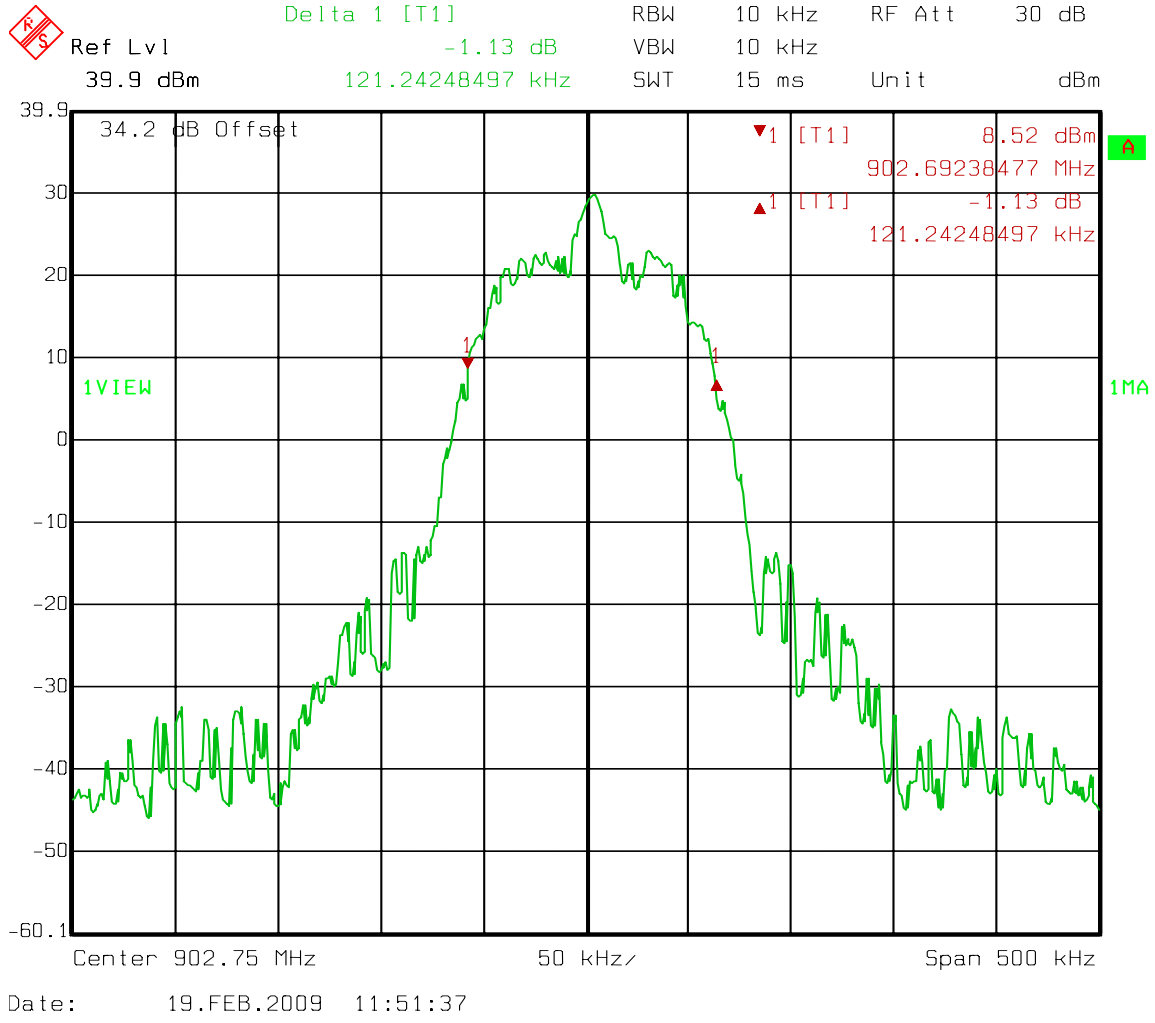


## Test Data – Channel Separation



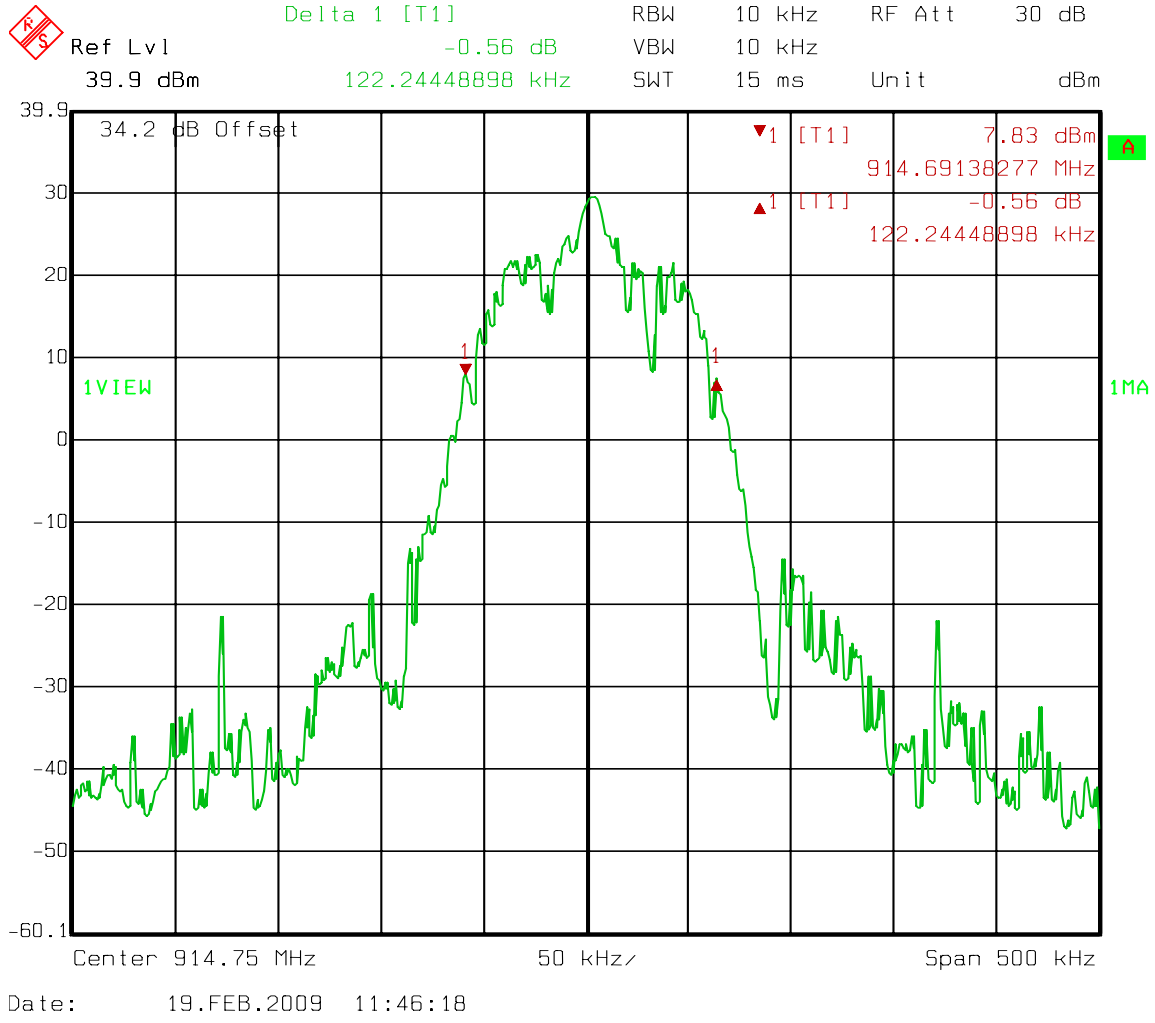
**Test Data – 20 dB Bandwidth**

Low Channel



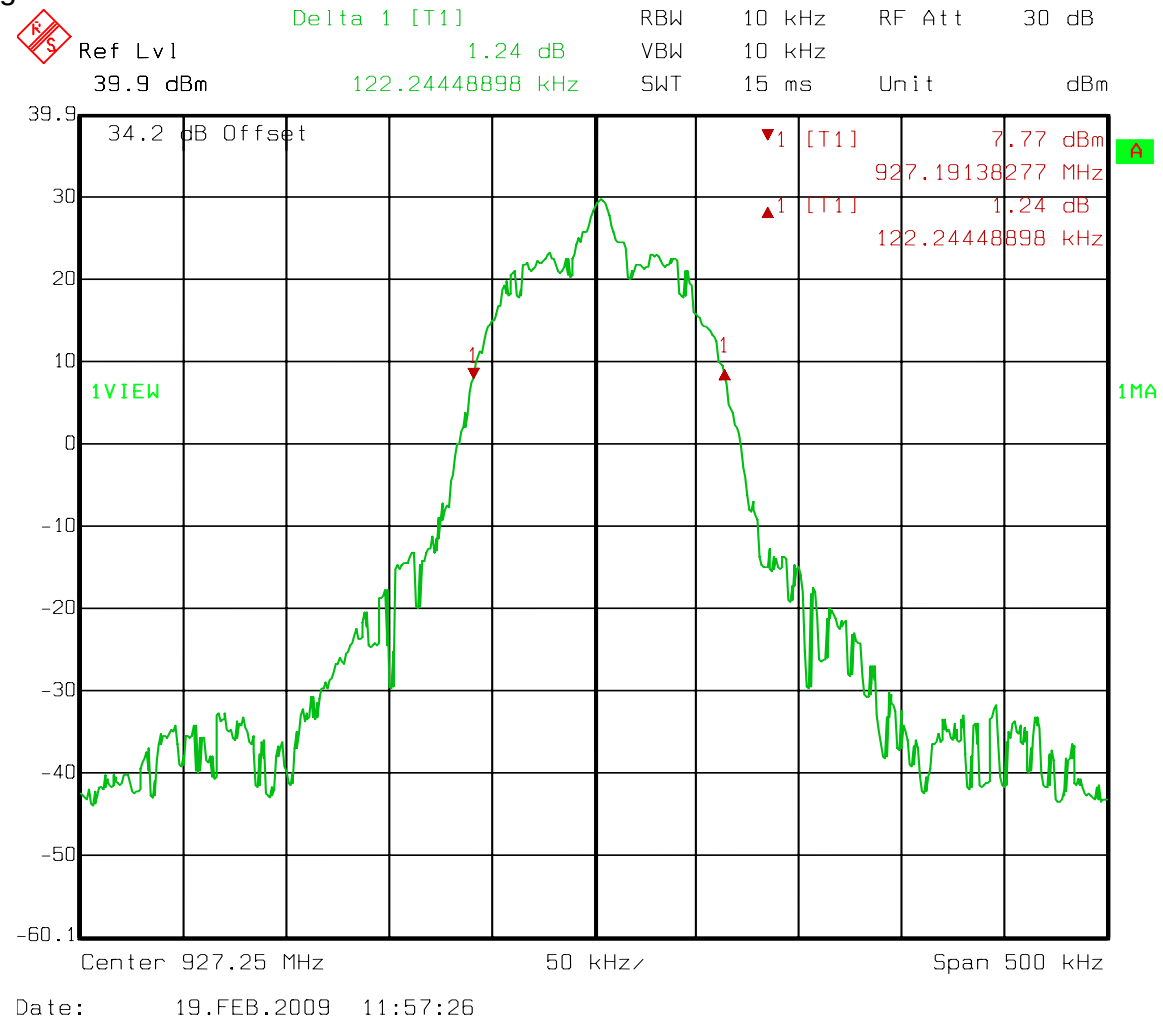
**Test Data – 20 dB Bandwidth**

Mid Channel



**Test Data – 20 dB Bandwidth**

High Channel



## Section 5. Time of Occupancy

| | |
|---|---|
| NAME OF TEST: Time of Occupancy | PARA. NO.: 15.247(a)(1) |
| TESTED BY: David Light | DATE: 19 February 2009 |

**Test Results:** Complies.

**Measurement Data:**

Maximum Dwell Time On Any Channel: 2%

**Equipment Used:** 1036-1472-1469-1082

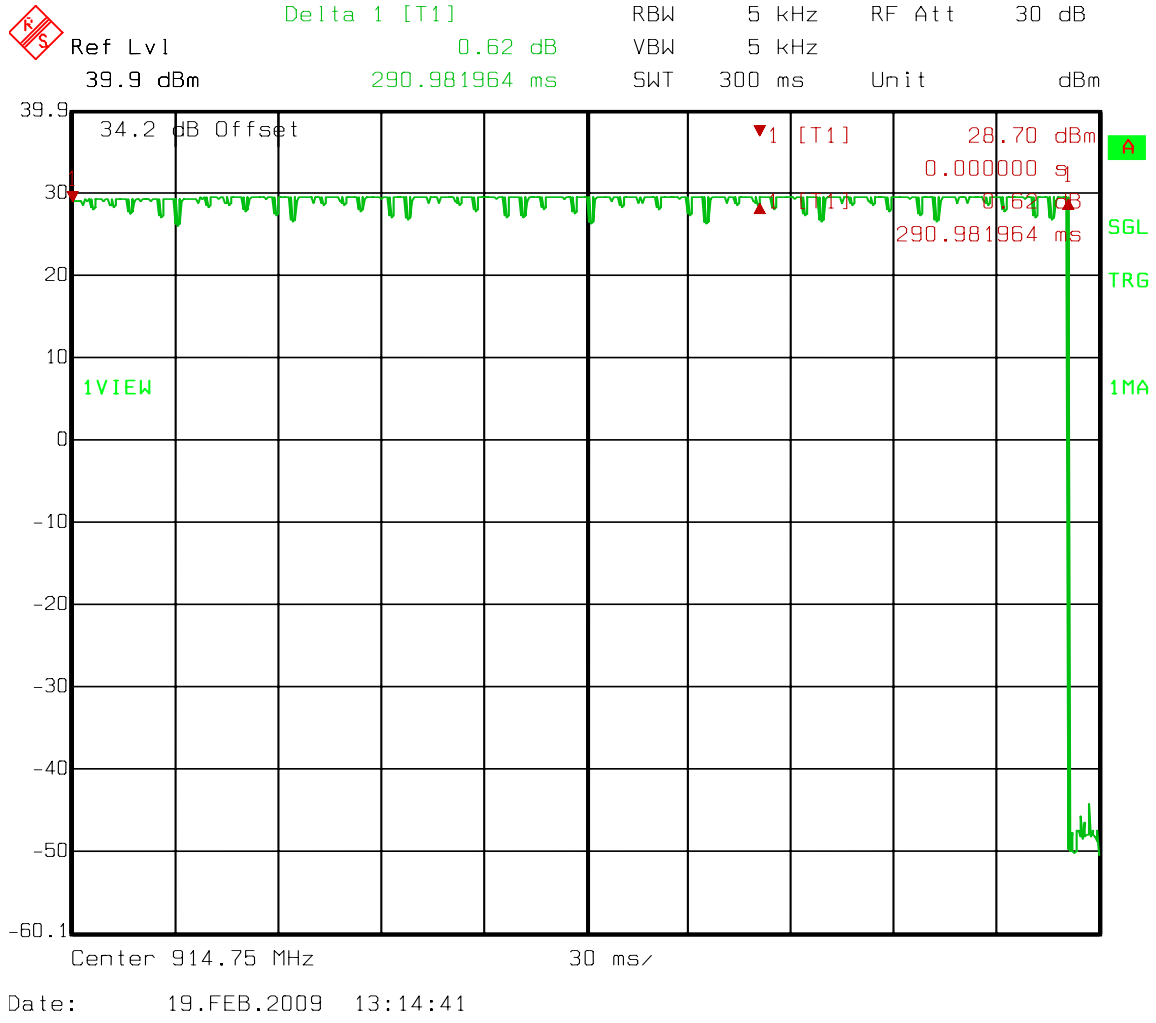
**Measurement Uncertainty:** $1X10^{-7}$ppm

**Temperature:** 22 °C

**Relative Humidity:** 35 %

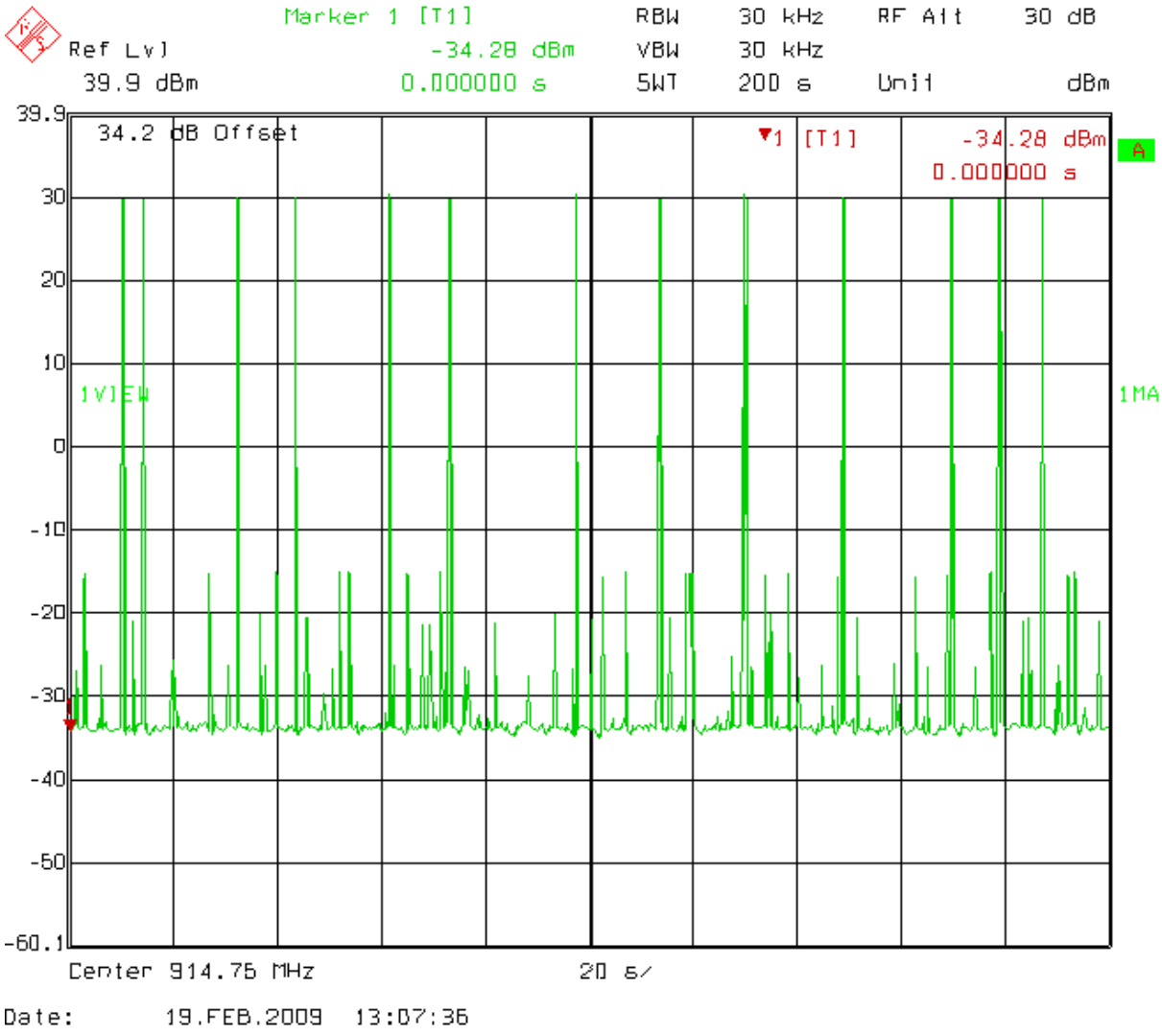
**Test Data – Time of Occupancy**

Pulse Width



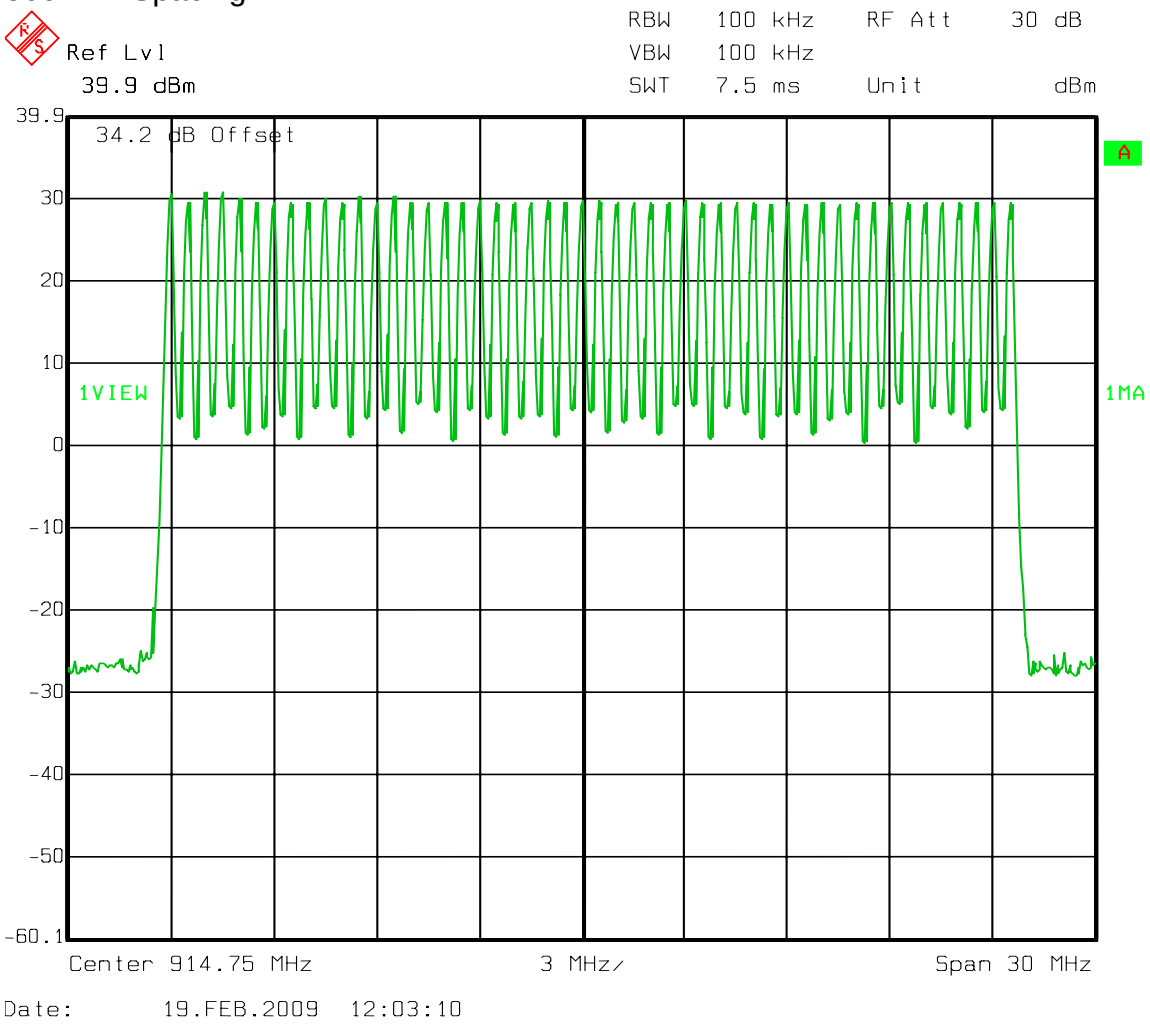
**Test Data – Time of Occupancy**

Time ON = 13 x .291 = 3.783 S in 200 seconds
1.9% ON time



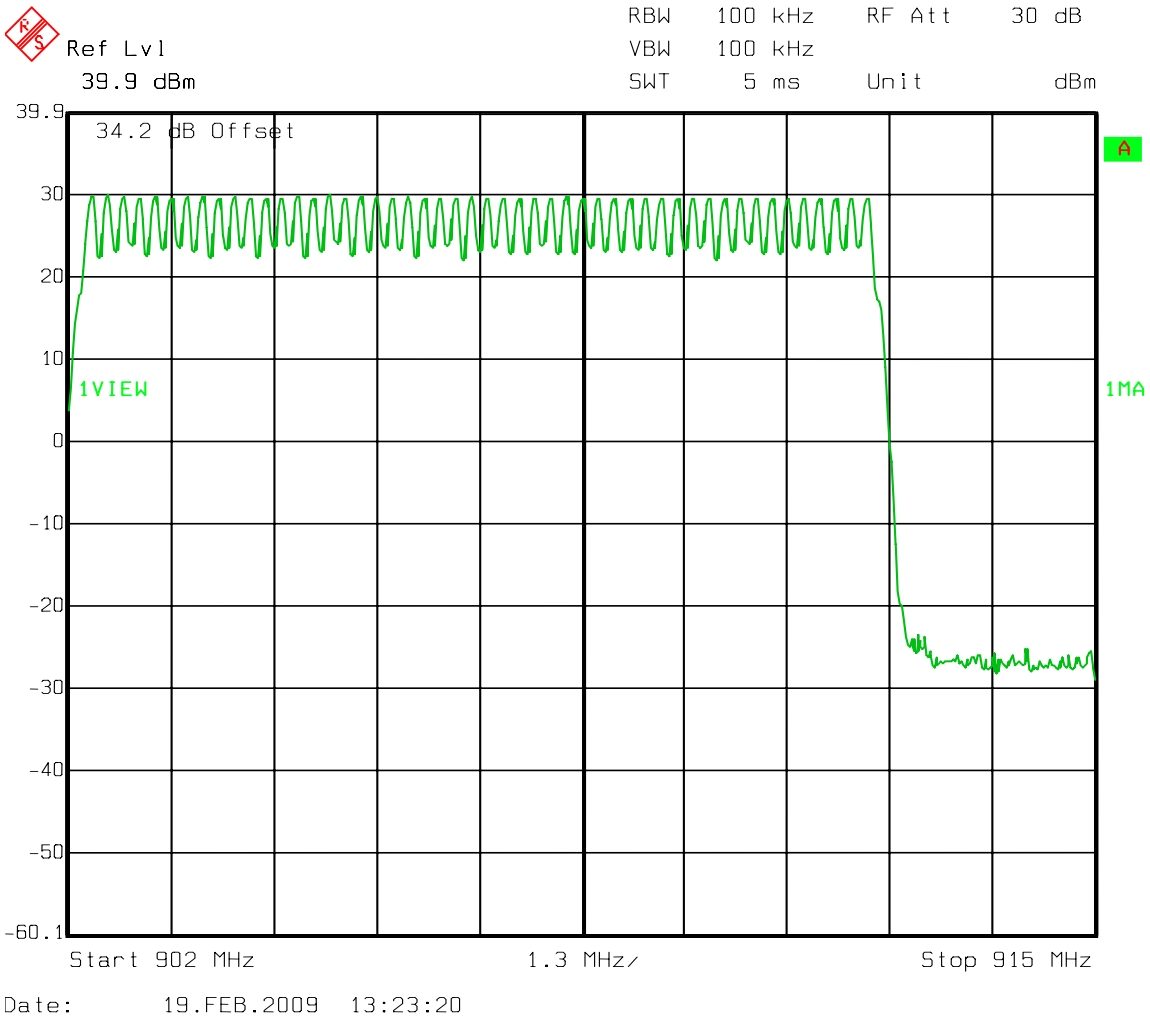
**Test Data – Time of Occupancy**

Number of hopping channels
50 Channels
500 kHz Spacing



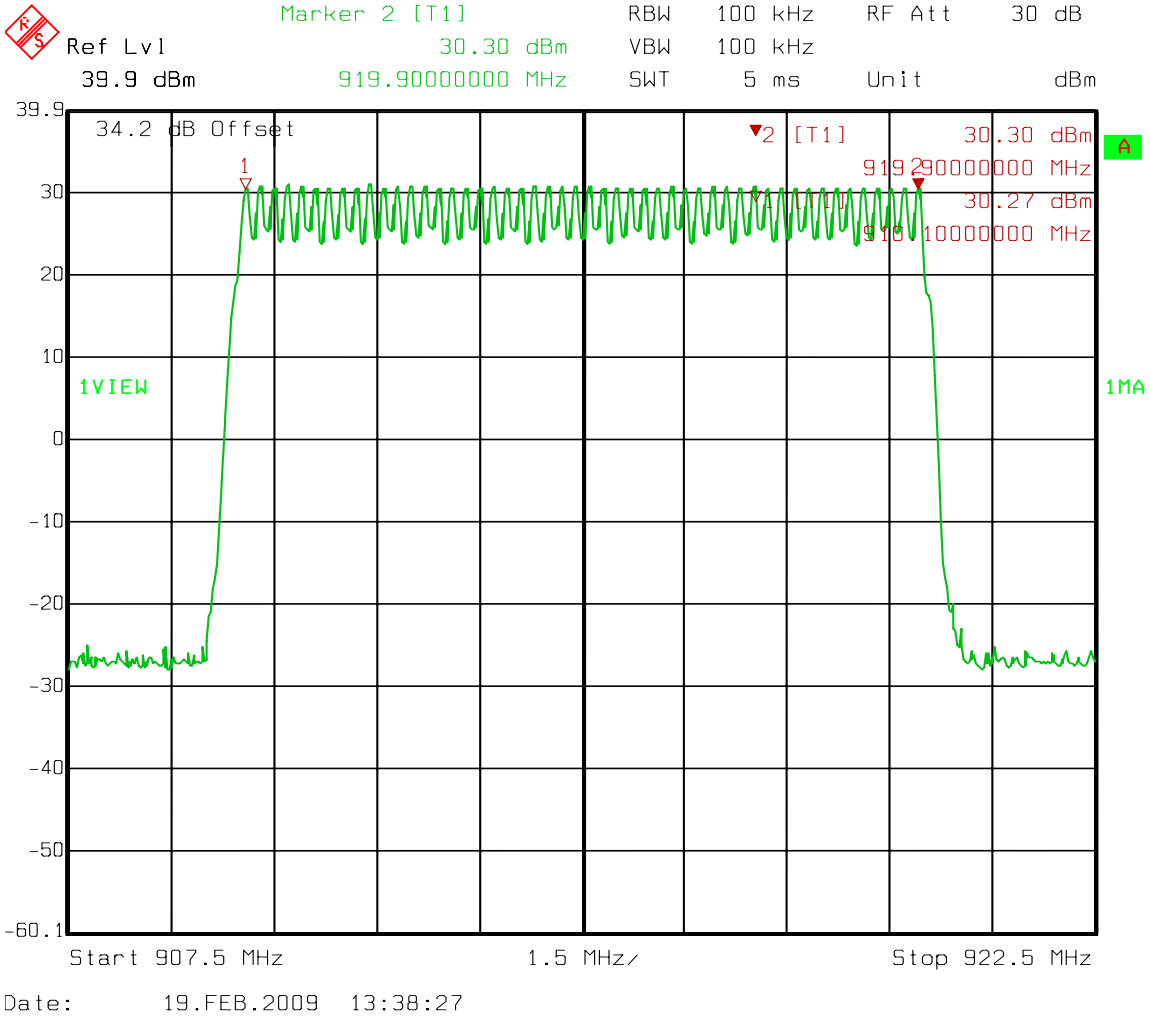
**Test Data – Time of Occupancy**

Number of hopping channels
Band A
50 Channels



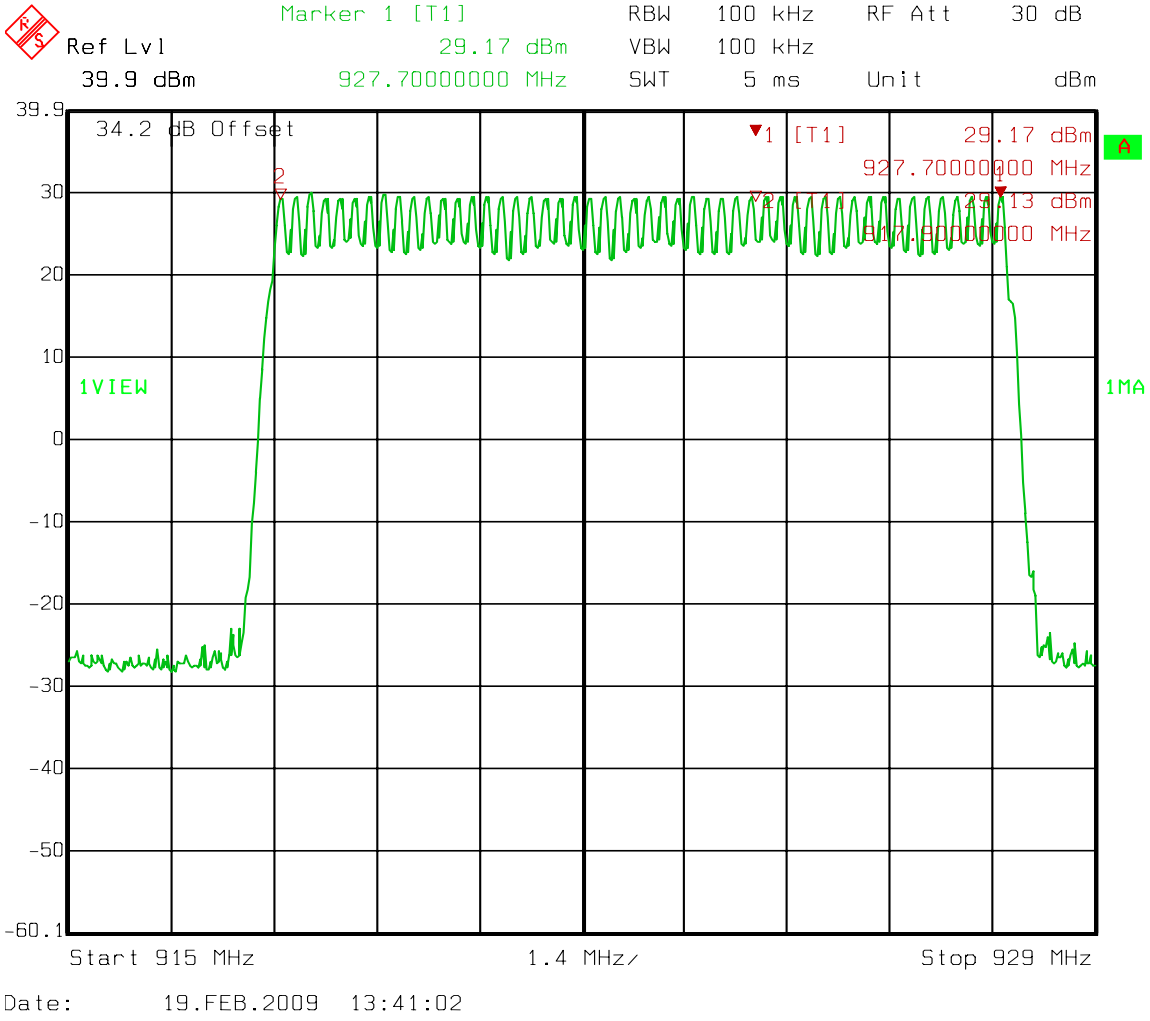
**Test Data – Time of Occupancy**

Number of hopping channels
Band B
50 Channels



**Test Data – Time of Occupancy**

Number of hopping channels
Band C
50 Channels



## Section 6. Peak Power Output

| | |
|---|---|
| NAME OF TEST: Peak Power Output | PARA. NO.: 15.247 (b) |
| TESTED BY: David Light | DATE: 15 February 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 | 29.4 | 0.871 | Circular | 6.5 | 35.9 | 3.89 |
| 915.25 | 29.4 | 0.871 | Circular | 6.5 | 35.9 | 3.89 |
| 927.25 | 29.4 | 0.871 | Circular | 6.5 | 35.9 | 3.89 |
| Maximum EIRP (W): 3.89 | | | | | | |

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

**Analyzer Settings:** RBW=VBW=1 MHz, Peak detector

**Equipment Used:** 1036-1082-1469-1472

**Measurement Uncertainty:** 1.7 dB

**Temperature:** 22 °C

**Relative Humidity:** 35 %

## Section 7. Spurious Emissions (Antenna Conducted)

| | |
|---|---|
| NAME OF TEST: Spurious Emissions (Antenna Conducted) | PARA. NO.: 15.247(d) |
| TESTED BY: David Light | DATE: 19 February 2009 |

**Test Results:** Complies.

**Measurement Data:** See attached plots.

**Equipment Used:** 1036-1082-1472-1469

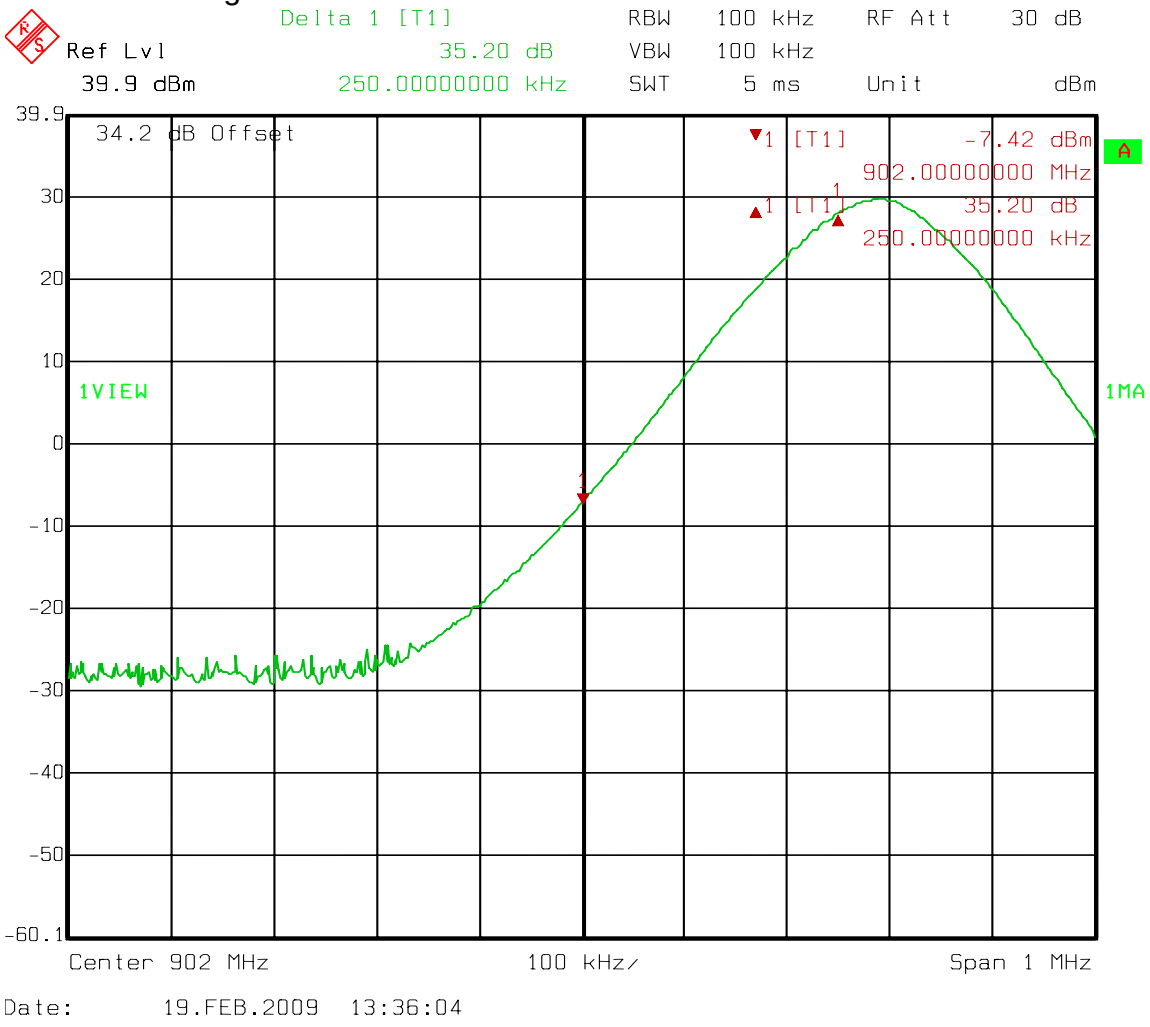
**Measurement Uncertainty:** $1X10^{-7}$ppm

**Temperature:** 22 °C

**Relative Humidity:** 35 %

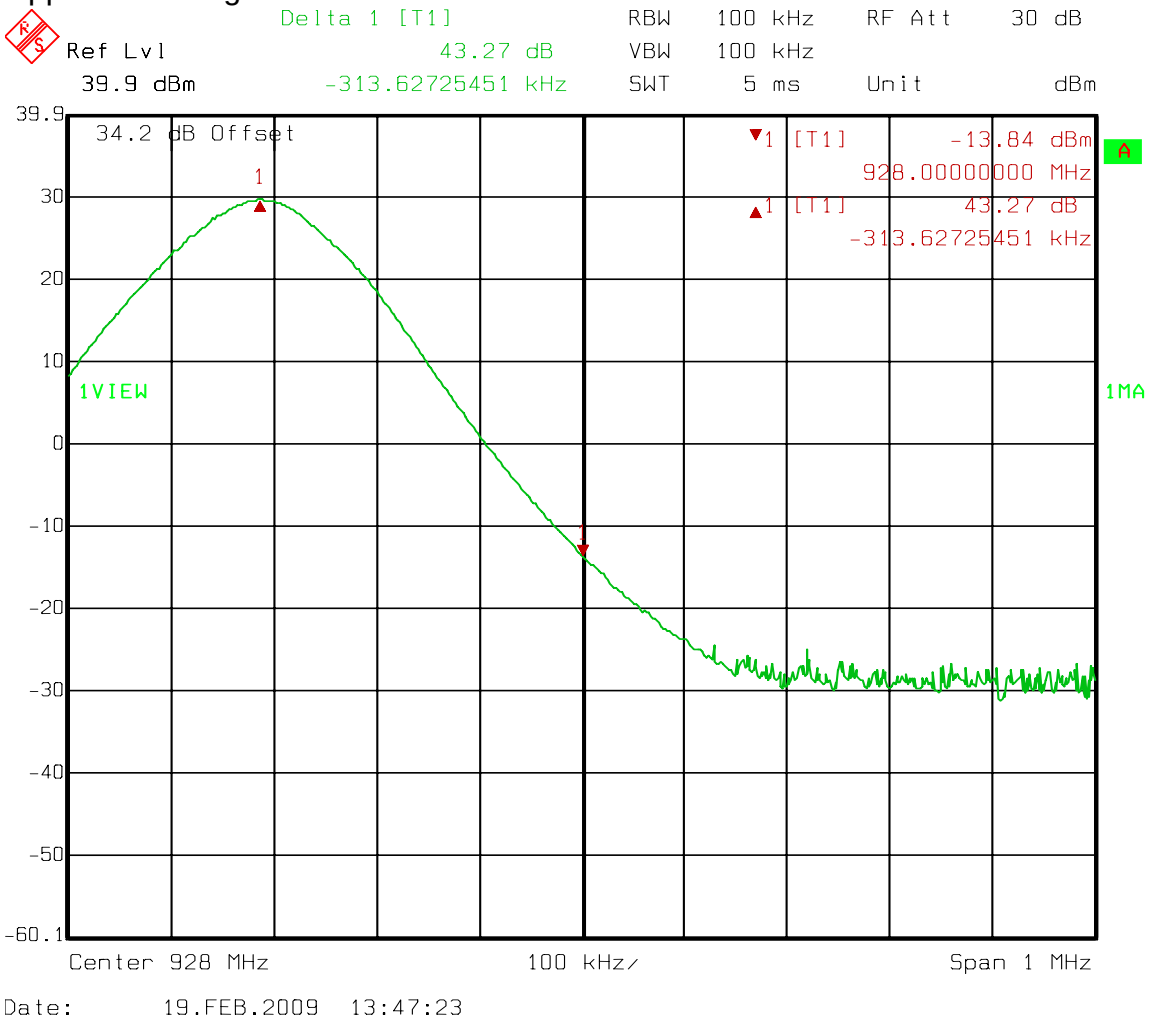
## Test Data – Spurious Emissions at Antenna Terminals

Lower Band Edge



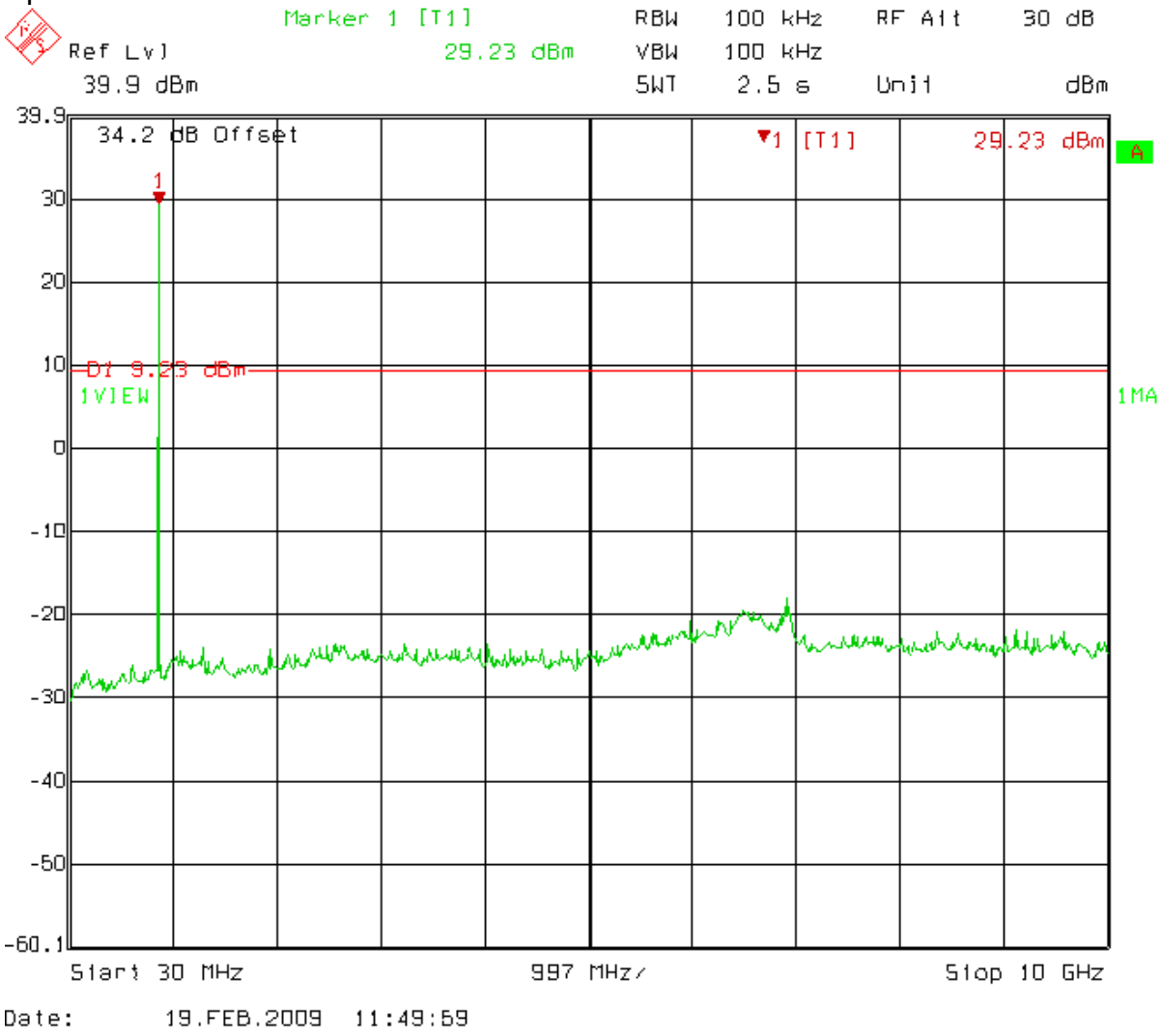
## Test Data – Spurious Emissions at Antenna Terminals

Upper Band Edge



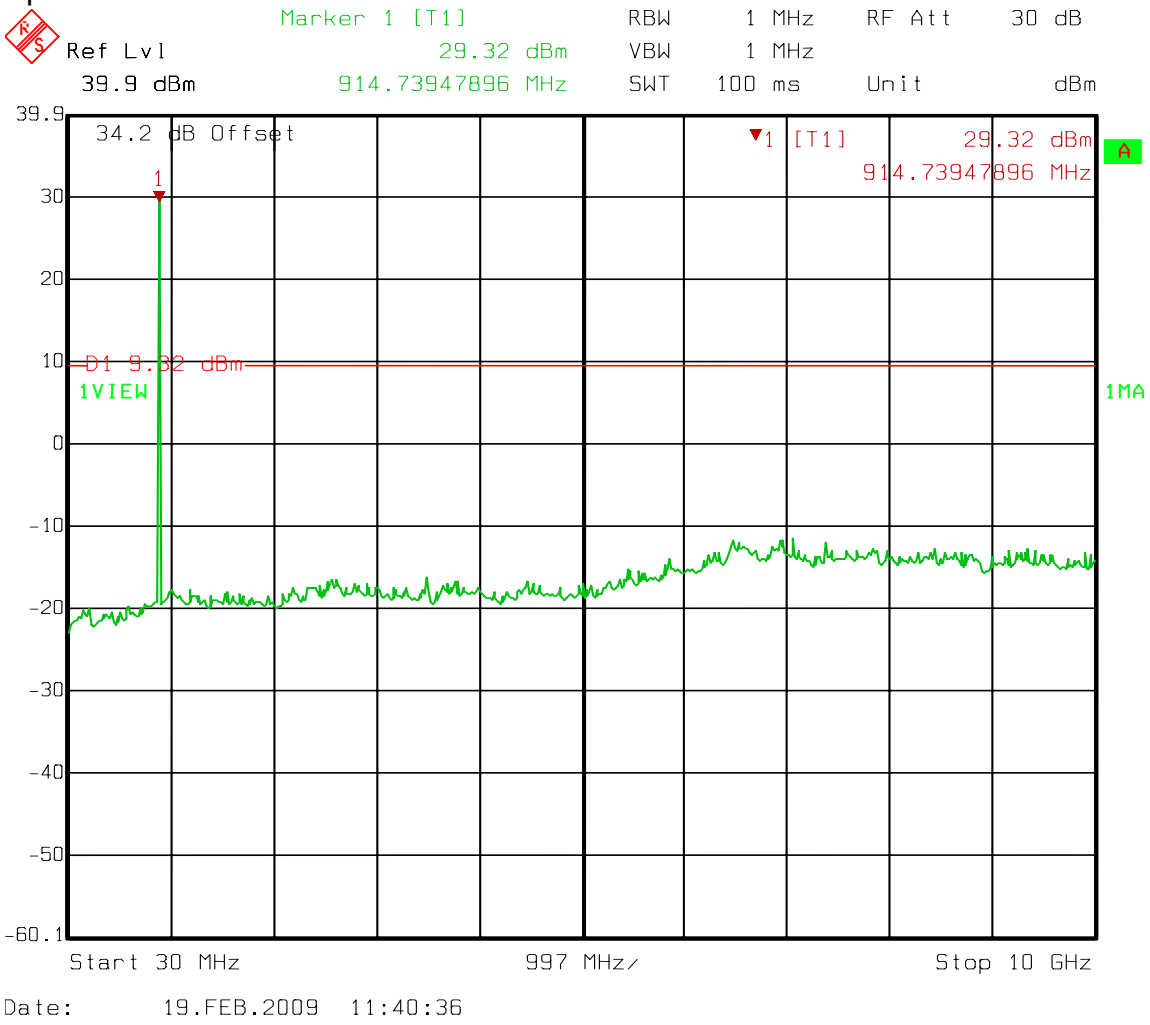
**Test Data – Spurious Emissions at Antenna Terminals**

Spurs – Low Channel



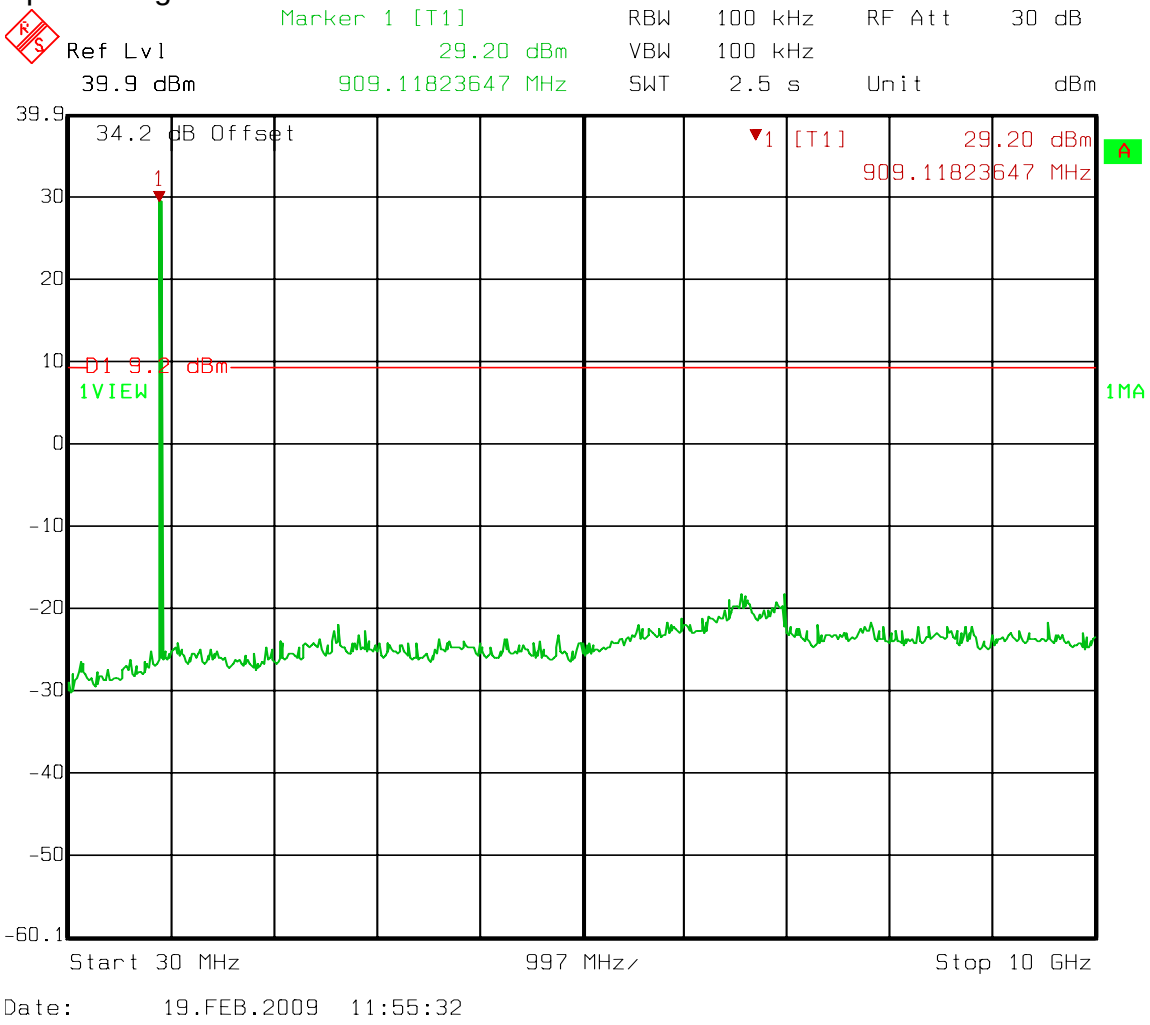
## Test Data – Spurious Emissions at Antenna Terminals

Spurs – Mid Channel



## Test Data – Spurious Emissions at Antenna Terminals

Spurs – High Channel



## Section 8. Spurious Emissions (Radiated)

| | |
|---|---|
| NAME OF TEST: Spurious Emissions (Radiated) | PARA. NO.: 15.247(d) |
| TESTED BY: David Light | DATE: 19 February 2009 |

**Test Results:** Complies.

**Measurement Data:** No emissions were detected within 20 dB of the specification limit of 54 dBµV/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:** 1304-1783-1763-1785-1767

**Analyzer Settings:** <1000 MHz: RBW=VBW=100 kHz
>1000 MHz: RBW=VBW=1 MHz
Peak Detector

**Measurement Uncertainty:** +/-3.6 dB

**Temperature:** 20 °C

**Relative Humidity:** 30 %

## Section 9. Test Equipment List

| Nemko ID | Description | Manufacturer Model Number | Serial Number | Calibration Date | Calibration Due |
|---|---|---|---|---|---|
| 1304 | HORN ANTENNA | ELECTRO METRICS RGA-60 | 6151 | 09/09/08 | 09/10/10 |
| 1783 | Cable | Nemko? 0 | 0 | 06/12/08 | 06/12/09 |
| 1763 | Bilog Antenna | Schaffner CBL 6111D | 22926 | 11/04/08 | 11/04/09 |
| 1785 | Preamplifier | A.H. SYSTEMS PAM-0126 | 143 | 07/25/08 | 07/25/09 |
| 1767 | EMI Test Receiver | ROHDE & SCHWARZ ESIB26 | 837491/0002 | 09/20/07 | 09/19/08 |
| 1036 | SPECTRUM ANALYZER | ROHDE & SCHWARZ FSEK30 | 830844/006 | 12/18/08 | 12/19/10 |
| 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 |
| 1663 | Spectrum Analyzer | Rhode & Schwarz FSP3 | 100073 | 06/03/08 | 06/03/09 |
| 1188 | LISN | EMCO 3825/2 | 1214 | 07/22/08 | 07/22/09 |
| 1120 | CABLE | Nemko USA, Inc. 0 | N/A | 06/10/08 | 06/10/09 |

# 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.

| 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. 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 mS x 14 hops)/200 sec. = 0.02 = 2%

| 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)

**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**

**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 (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**

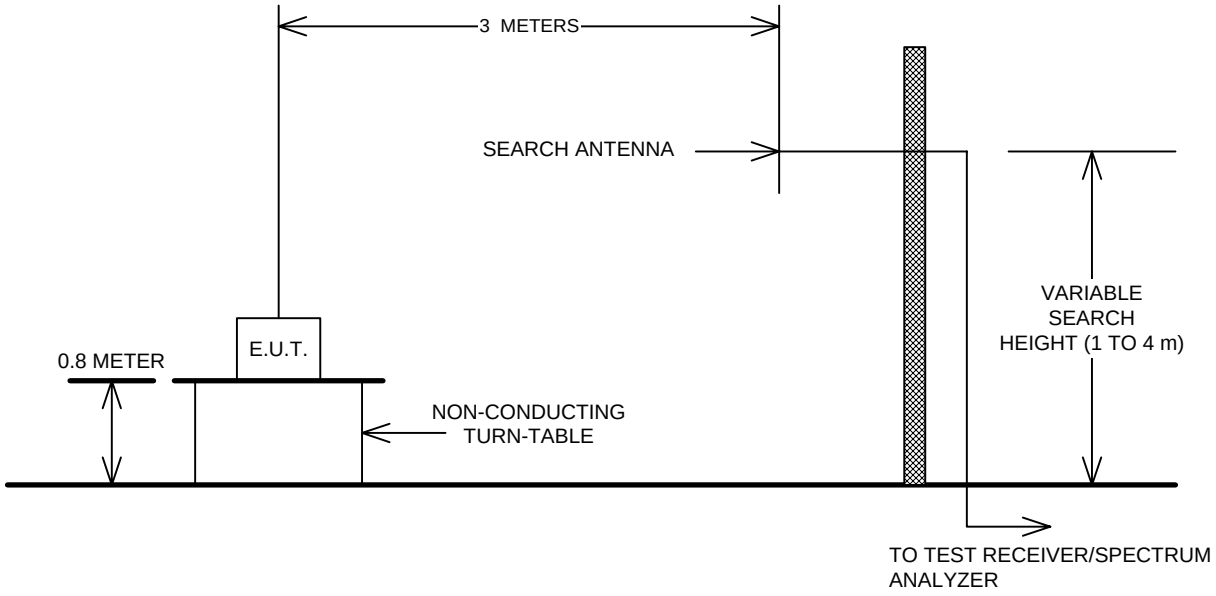
| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.09-0.11 | 16.42-16.423 | 399.9-410 | 4.5-5.25 |
| 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 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:

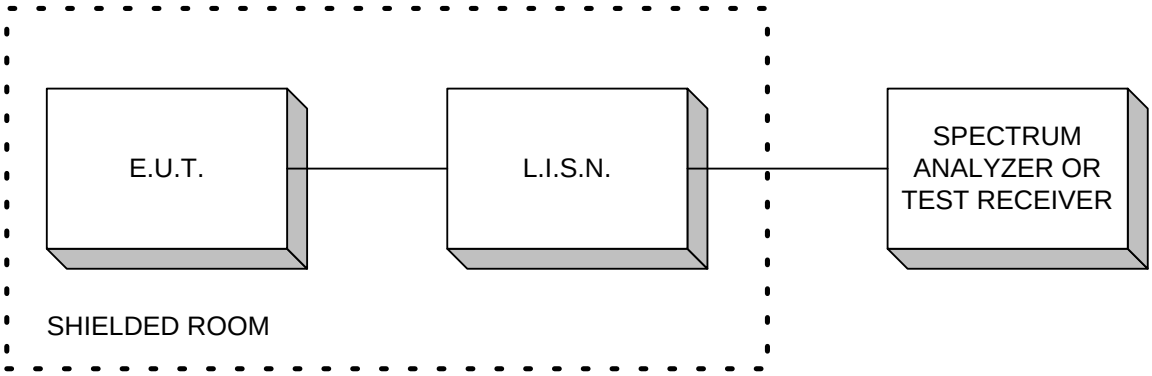
| Tuning range | Number of channels tested | Channel location in band |
|---|---|---|
| 1 MHz or less | 1 | middle |
| 1 to 10 MHz | 2 | top and bottom |
| more than 10 MHz | 3 | top, middle, bottom |

# ANNEX B - TEST DIAGRAMS

**Test Site For Radiated Emissions**




**Conducted Emissions**



**Peak Power at Antenna Terminals**