**Nemko Test Report:** 7896RUS1

**Applicant:** Alanco Technologies, Inc.
15575 N. 83rd Way, Suite 3
Scottsdale, AZ 85260
USA

**Equipment Under Test: (E.U.T.)** PSD3G

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

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

**TESTED BY:** _____ **DATE:** **29 November 2007**
David Light, Senior Wireless Engineer

**APPROVED BY:** _____ **DATE:** **05 December, 2007**
Michael Cantwell, Frontline Manager

**Number of Pages: 27**

## Table of Contents

## Section 1. Summary of Test Results

Manufacturer: Alanco Technologies, Inc

Model No.: PSD3G

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 Digital Transmission Systems. 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) | NA |
| Minimum 6 dB Bandwidth | 15.247(a)(2) | Complies |
| Maximum Peak Power Output | 15.247(b)(3) | Complies |
| Spurious Emissions (Restricted Bands) | 15.247(d)/15.209(a) | Complies |
| Peak Power Spectral Density | 15.247(e) | Complies |

**Footnotes:**

1) The device is battery powered
2) All measurements were made radiated due to integral antenna.

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

### General Equipment Information

| | | | |
|---|---|---|---|
| **Frequency Band (MHz):** | 902-928 | 2400-2483.5 | 5725-5850 |
| | ☐ | ☒ | ☐ |

**Operating Frequency of Test Sample:** 2412 to 2462 MHz

**Supply Voltage:** 3.6 Vdc rechargeable battery

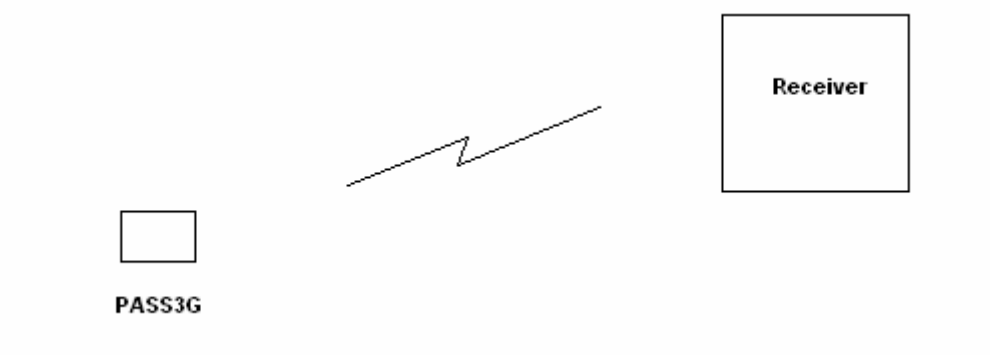
**Channel Spacing:** 5 MHz

**User Frequency Adjustment:** Software controlled

**Description of EUT**

RFID transmitter for real time tracking.

**System Diagram**



## Section 3. Occupied Bandwidth

| | |
|---|---|
| NAME OF TEST: Occupied Bandwidth | PARA. NO.: 15.247(a)(2) |
| TESTED BY: David Light | DATE: 28 November 2007 |

**Test Results:** Complies.

**Measurement Data:** See 6 dB BW plot

Measured 6 dB bandwidth: 12 MHz

Channel Separation: 5 MHz

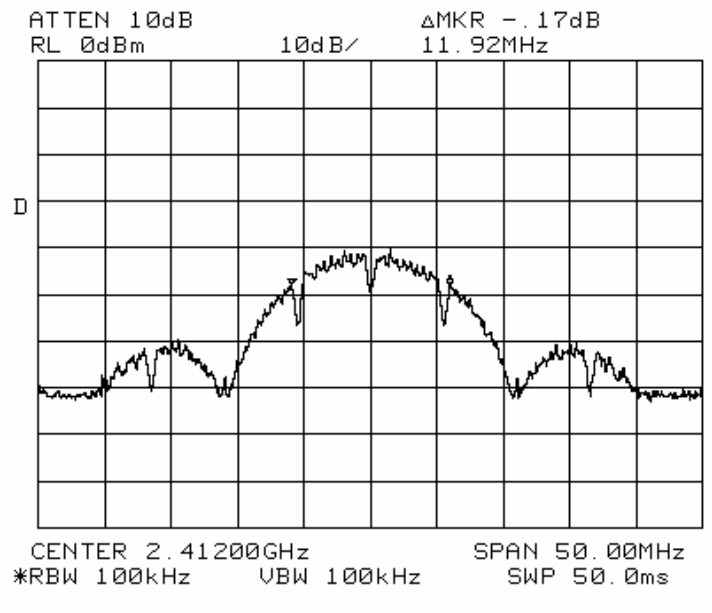
**Test Conditions:** 22 %RH
45 °C

**Measurement Uncertainty:** +/-1x$10^{-7}$ ppm

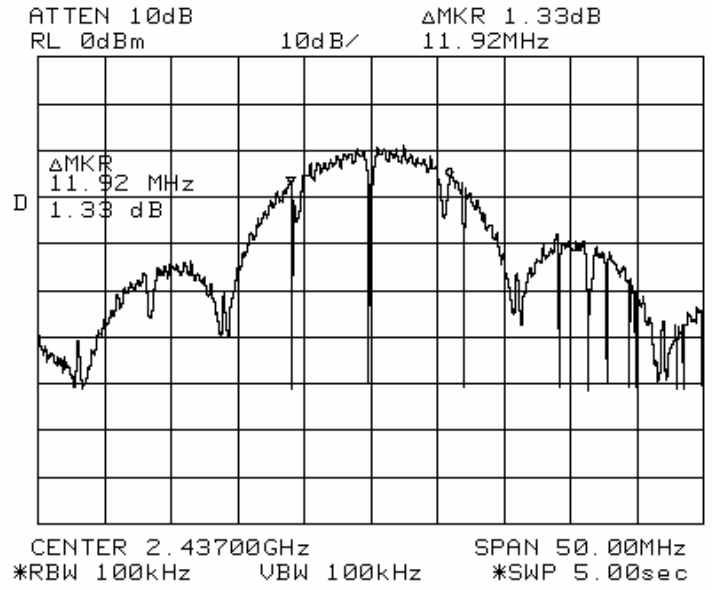
**Test Equipment Used:** 1464-1484-1485-993-1016

**Test Data – Occupied Bandwidth**

Low Channel

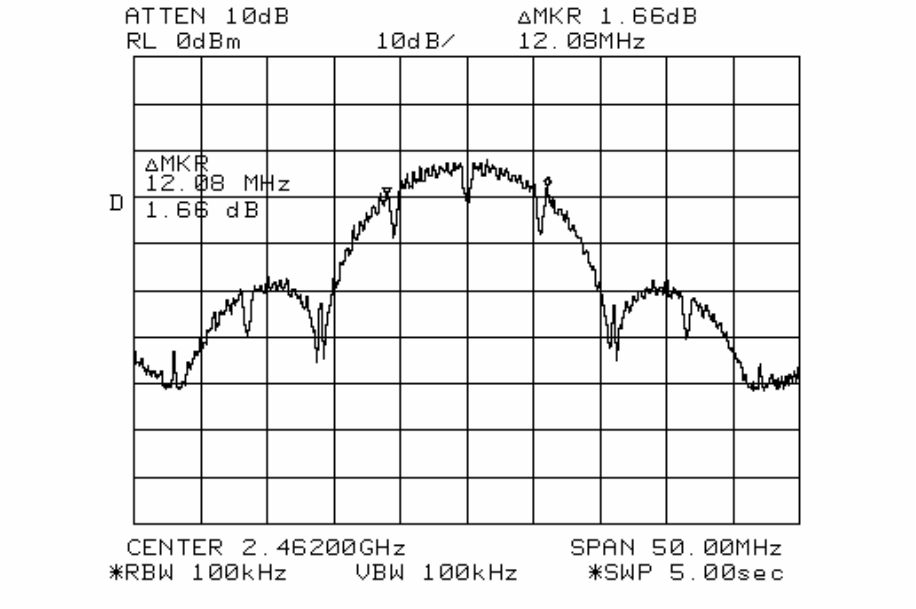



Mid Channel

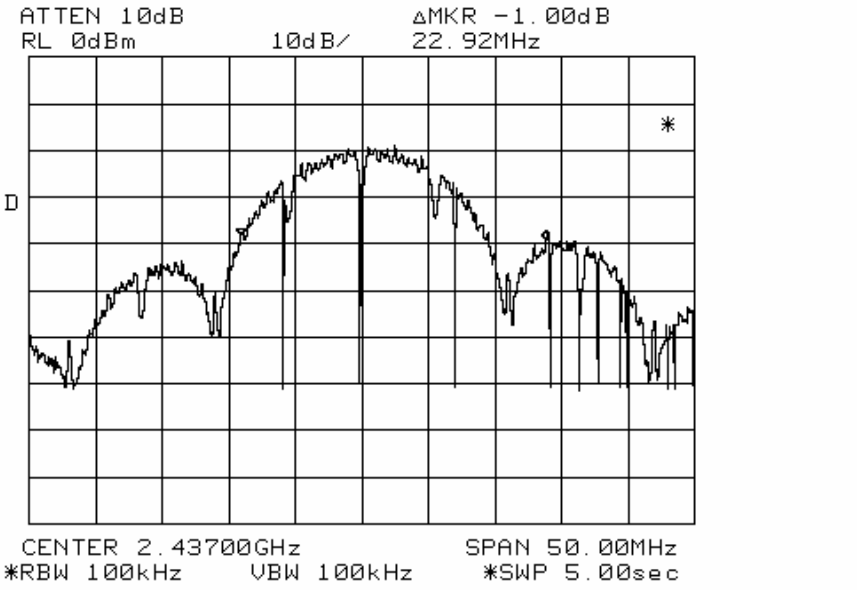


**Test Data – Occupied Bandwidth**

High Channel




20 dB plot for Industry Canada



## Section 4. Maximum Peak Output Power

| | |
|---|---|
| NAME OF TEST: Maximum Peak Output power | PARA. NO.: 15.247(b)(3) |
| TESTED BY: David Light | DATE: 28 November 2007 |

**Test Results:** Complies.

**Measurement Data:**

| Frequency (MHz) | EIRP (dBm) | Antenna Gain (dBi) | Calculated Output Power (dBm) | Calculated Output Power (Watts) |
|---|---|---|---|---|
| 2412 | 12.6 | 0 | 12.6 | 0.018 |
| 2437 | 10.8 | 0 | 10.8 | 0.012 |
| 2462 | 11.5 | 0 | 11.5 | 0.014 |

Manufacturers stated maximum antenna gain = 0 dBi

**Test Conditions:** 22 %RH
45 °C

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

**Test Equipment Used:** 1464-1484-1485-993

☒ 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.

## Section 5. Spurious Emissions

| | |
|---|---|
| NAME OF TEST: Spurious Emissions | PARA. NO.: 15.247 (d) 15.209 |
| TESTED BY: David Light | DATE: 28 November 2007 |

**Test Results:** Complies.

**Measurement Data:** See attached table.

**Test Conditions:** 22 %RH
45 °C

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

**Test Equipment Used:** 1464-1484-1485-993-759-760-1016-791

Notes:

☒ For handheld devices, the EUT was tested on three orthogonal axis'

☒ The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33

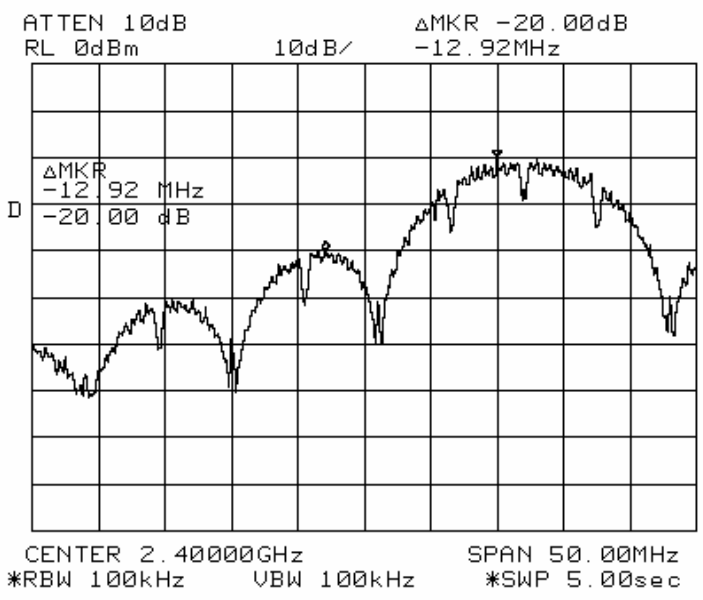
☒ The device was tested on three channels per 15.31(l).

☐ No emissions were detected within 20 dB of the specification limit therefore none are reported per 15.31(o). Band edge data is presented below.

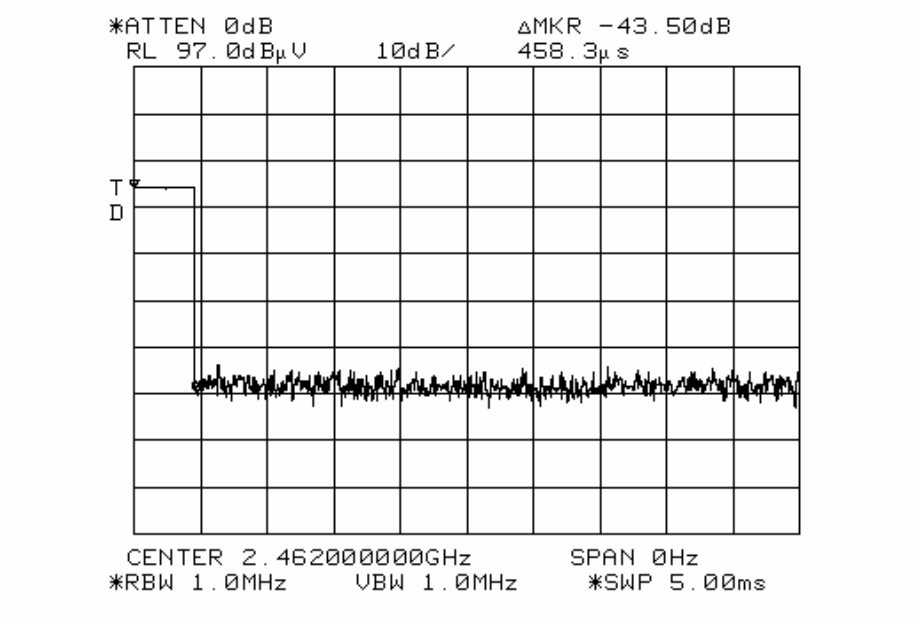
RBW=VBW=100 kHz below 1000 MHz
RBW=VBW=1 MHz above 1000 MHz (Peak)
RBW= 1 MHz VBW=1 MHz (Average)

**Duty Cycle Correction:** -40.5 dB

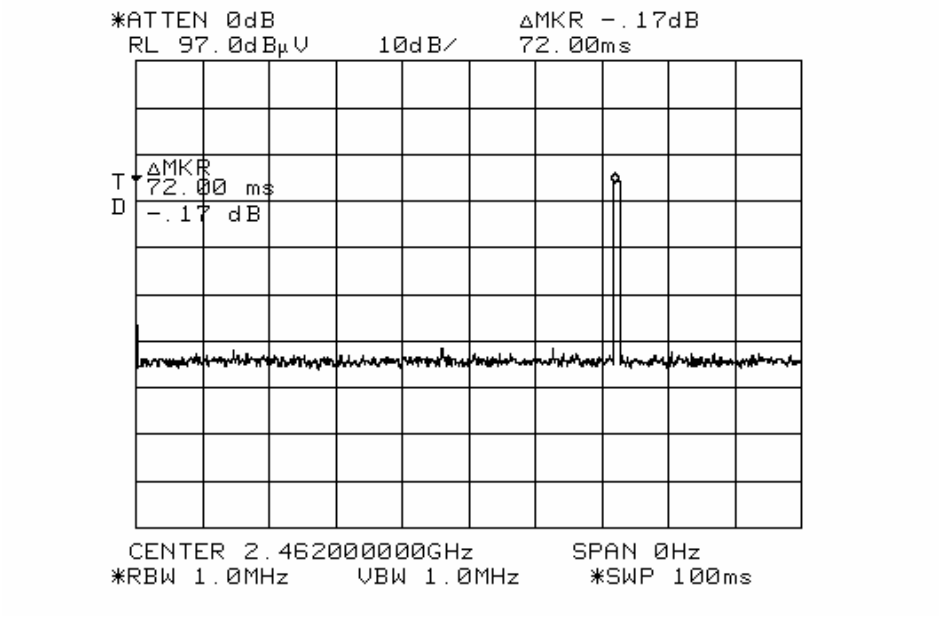
**Lower Bandedge**



**Duty Cycle**
One Pulse




100 mS




0.4583*2=0.9166 mS

Duty Cycle Correction = 20 log (0.9166/100) = -40.7 dB

## Radiated Emissions

***Measurement Data:*** Reading listed by order taken. Test Distance: 3 Meters

| # | Freq MHz | Rdng dBµV | Cable dB | Cable dB | Horn Duty dB | Pre-A dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4824.000 Peak | 60.0 | +1.0 | +3.2 | +33.2 +0.0 | -32.5 | +0.0 | 64.9 | 74.0 Channel 1 | -9.1 | Vert |
| 2 | 4824.000 Ave | 60.0 | +1.0 | +3.2 | +33.2 -40.7 | -32.5 | +0.0 | 24.2 | 54.0 Channel 1 | -29.8 | Vert |
| 3 | 7236.000 Peak | 47.5 | +1.2 | +3.9 | +35.8 +0.0 | -32.2 | +0.0 | 56.2 | 74.0 Channel 1 | -17.8 | Vert |
| 4 | 7236.000 Ave | 47.5 | +1.2 | +3.9 | +35.8 -40.7 | -32.2 | +0.0 | 15.5 | 54.0 Channel 1 | -38.5 | Vert |
| 5 | 4824.000 Peak | 52.2 | +1.0 | +3.2 | +33.2 +0.0 | -32.5 | +0.0 | 57.1 | 74.0 Channel 1 | -16.9 | Horiz |
| 6 | 4824.000 Ave | 52.2 | +1.0 | +3.2 | +33.2 -40.7 | -32.5 | +0.0 | 16.4 | 54.0 Channel 1 | -37.6 | Horiz |
| 7 | 4874.000 Peak | 59.7 | +1.0 | +3.3 | +33.4 +0.0 | -32.6 | +0.0 | 64.8 | 74.0 Channel 6 | -9.2 | Vert |
| 8 | 4874.000 Ave | 59.7 | +1.0 | +3.3 | +33.4 -40.7 | -32.6 | +0.0 | 24.1 | 54.0 Channel 6 | -29.9 | Vert |
| 9 | 7311.000 Peak | 49.7 | +1.2 | +4.0 | +35.8 +0.0 | -32.3 | +0.0 | 58.4 | 74.0 Channel 6 | -15.6 | Vert |
| 10 | 7311.000 Ave | 49.7 | +1.2 | +4.0 | +35.8 -40.7 | -32.3 | +0.0 | 17.7 | 54.0 Channel 6 | -36.3 | Vert |
| 11 | 4874.000 Peak | 51.5 | +1.0 | +3.3 | +33.4 +0.0 | -32.6 | +0.0 | 56.6 | 74.0 Channel 6 | -17.4 | Horiz |
| 12 | 4874.000 Ave | 51.5 | +1.0 | +3.3 | +33.4 -40.7 | -32.6 | +0.0 | 15.9 | 54.0 Channel 6 | -38.1 | Horiz |
| 13 | 2483.500 Peak | 55.0 | +0.8 | +2.3 | +29.0 +0.0 | -32.8 | +0.0 | 54.3 | 74.0 Channel 11 | -19.7 | Vert |
| 14 | 2483.500 Ave | 55.0 | +0.8 | +2.3 | +29.0 -40.7 | -32.8 | +0.0 | 13.6 | 54.0 Channel 11 | -40.4 | Vert |
| 15 | 4924.000 Peak | 51.7 | +1.0 | +3.3 | +33.5 +0.0 | -32.6 | +0.0 | 56.9 | 74.0 Channel 11 | -17.1 | Vert |
| 16 | 4924.000 Ave | 51.7 | +1.0 | +3.3 | +33.5 -40.7 | -32.6 | +0.0 | 16.2 | 54.0 Channel 11 | -37.8 | Vert |
| 17 | 7386.000 Peak | 43.8 | +1.2 | +4.0 | +35.9 +0.0 | -32.4 | +0.0 | 52.5 | 54.0 Channel 11 | -1.5 | Vert |
| 18 | 2483.500 | 44.5 | +0.8 | +2.3 | +29.0 +0.0 | -32.8 | +0.0 | 43.8 | 54.0 Channel 11 | -10.2 | Horiz |
| 19 | 4924.000 Peak | 48.2 | +1.0 | +3.3 | +33.5 +0.0 | -32.6 | +0.0 | 53.4 | 74.0 Channel 11 | -20.6 | Horiz |
| 20 | 4924.000 Ave | 48.2 | +1.0 | +3.3 | +33.5 -40.7 | -32.6 | +0.0 | 12.7 | 54.0 Channel 11 | -41.3 | Horiz |

## Section 6. Peak Power Spectral Density

| | |
|---|---|
| NAME OF TEST: Peak Power Spectral Density | PARA. NO.: 15.247(e) |
| TESTED BY: David Light | DATE: 28 November 2007 |

**Test Results:** Complies.

**Measurement Data:** See attached data..

| Frequency (MHz) | EIRP (dBm) | Antenna Gain (dBi) | Calculated Density (dBm) |
|---|---|---|---|
| 2412 | -14.5 | 0 | -14.5 |
| 2437 | -16.5 | 0 | -16.5 |
| 2462 | -16.3 | 0 | -16.3 |

Note: Manufacturers stated maximum antenna gain = 0 dBi

Note: This test was performed radiated

**Test Conditions:** 22 %RH
45 °C

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

**Test Equipment Used:** 1464-1484-1485-993

## Section 7. Test Equipment List

| Nemko ID | Description | Manufacturer Model Number | Serial Number | Calibration Date | Calibration Due |
|---|---|---|---|---|---|
| 1464 | Spectrum analyzer | Hewlett Packard 8563E | 3551A04428 | 01/24/07 | 01/24/09 |
| 1484 | Cable | Storm PR90-010-072 | N/A | 05/02/07 | 05/01/08 |
| 1485 | Cable | Storm PR90-010-216 | N/A | 05/02/07 | 05/01/08 |
| 1016 | Pre-Amp | HEWLETT PACKARD 8449A | 2749A00159 | 05/01/07 | 04/30/08 |
| 993 | Horn antenna | A.H. Systems SAS-200/571 | XXX | 08/31/07 | 08/30/08 |
| 791 | PREAMP, 25dB | Nemko USA, Inc. LNA25 | 398 | 05/01/07 | 04/30/08 |
| 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 |

# 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: Occupied Bandwidth | PARA. NO.: 15.247(a)(2) |
|---|---|

**Minimum Standard:** The minimum 6 dB bandwidth shall be at least 500 kHz

| NAME OF TEST: Maximum Peak Output Power | PARA. NO.: 15.247(b)(3) |
|---|---|

**Minimum Standard:** The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

**Direct Measurement Method For Detachable Antennas:**
If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load. The dBi gain of the antenna(s) employed shall be reported.

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

The RBW of the spectrum analyzer shall be set to a value greater than the measured 6 dB occupied bandwidth of the E.U.T.

Number of channels tested:

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

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

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

**Method Of Measurement:**

The spectrum analyzer is set as follows:

RBW = VBW = 100 kHz.
Span: Sufficient to display 6 dB bandwidth
LOG dB/div.: 10 dB
Sweep: Auto

## Number of channels tested:

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

NAME OF TEST: Spurious Emissions(conducted) PARA. NO.: 15.247(d)

**Minimum Standard:** In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

| Frequency (MHz) | Field Strength (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 IS SEARCHED TO THE 10th HARMONIC OF THE HIGHEST FREQUENCY GENERATED IN THE EUT.**

**Method Of Measurement:**

30 MHz - 10th harmonic plot
RBW: 100 kHz
VBW: 300 kHz
Sweep: Auto
Display line: -20 dBc

Lower Band Edge
RBW: At least 1% of span/div.
VBW: >RBW
Span: As necessary to display any spurious at band edge.
Sweep: Auto
Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz
Marker: Peak of fundamental emission
Marker Δ: Peak of highest spurious level below center frequency.

Upper Band Edge
RBW: At least 1% of span/div.
VBW: >RBW
Span: As necessary to display any spurious at band edge.
Sweep: Auto
Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz
Marker: Peak of fundamental emission
Marker Δ: Peak of highest spurious level above center frequency.

Number of channels tested:

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

NAME OF TEST: Radiated Spurious Emissions PARA. NO.: 15.247(c)

**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 |

| NAME OF TEST: Transmitter Power Density | PARA. NO.: 15.247(d) |
|---|---|

**Minimum Standard:** The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

**Method Of Measurement:** The spectrum analyzer is set as follows:

RBW: 3 kHz
VBW: >3 kHz
Span: => measured 6 dB bandwidth
Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.
LOG dB/div.: 2 dB

**Note:** For devices with spectrum line spacing =< 3 kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

**For Devices With Integral Antenna:**

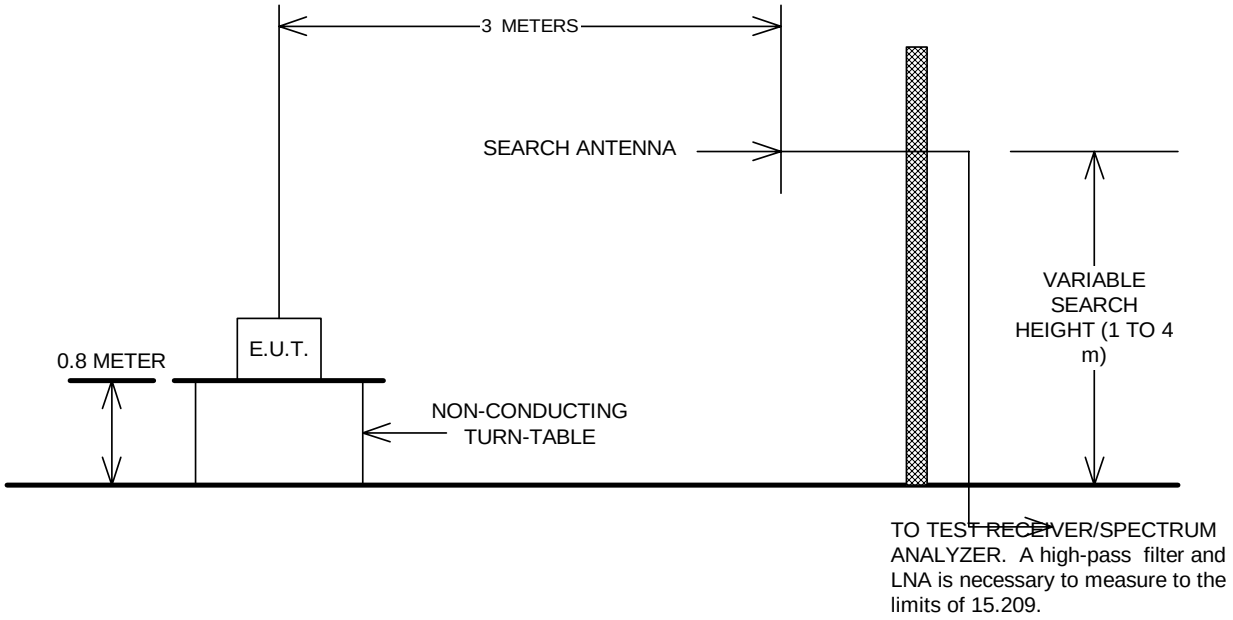
For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent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

Number of channels tested:

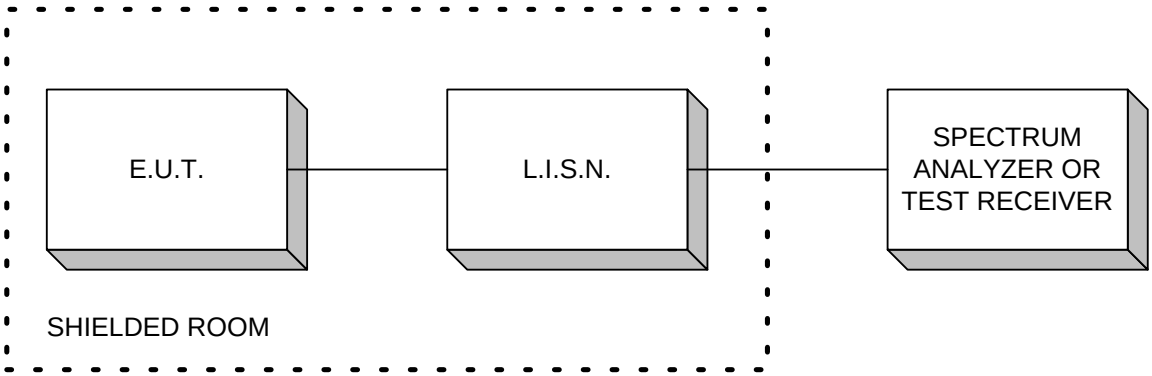
| Tuning Range | Number Of Channels Tested | Channel Location In Band |
|---|---|---|
| 1 MHz or Less | 1 | Middle |
| 1 to 10 MHz | 2 | Top And Bottom |
| More Than 10 MHz | 3 | Top, Middle, Bottom |

# ANNEX B - TEST DIAGRAMS

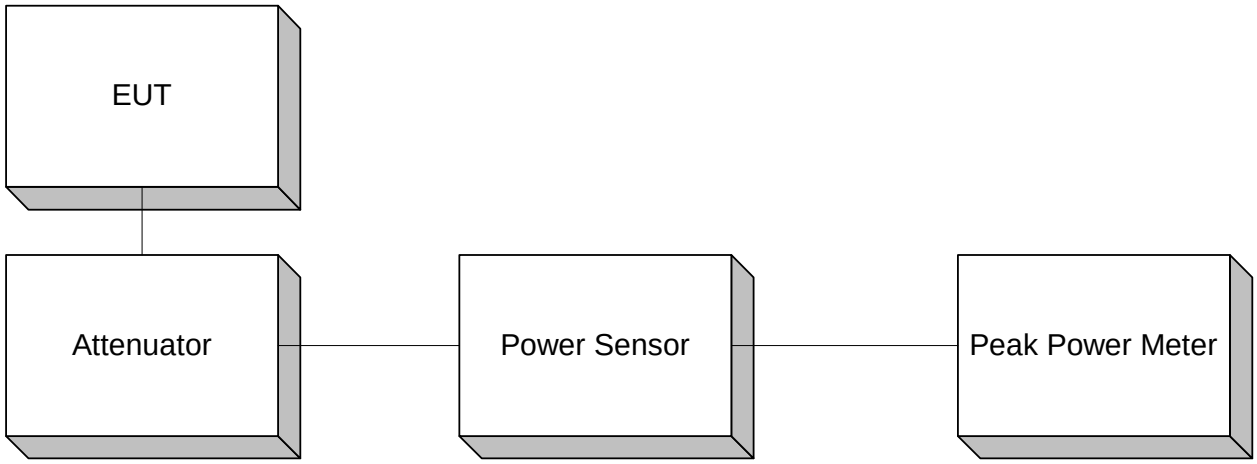
## Test Site For Radiated Emissions




## Conducted Emissions



**Peak Power At Antenna Terminals**




Note: A spectrum analyzer may be substituted for Peak Power Meter given that the measurement bandwidth is sufficient to capture the 6 dB bandwidth of the transmitter.

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