# FCC 47 CFR PART 15 SUBPART E

# TEST REPORT

## For

## Notebook Computer

## Model: RK886EX

## Trade Name: CReTE

*Issued to*

**CRETE SYSTEMS INC.**
**7F, No. 250, Sec. 3, Pei Shen Rd., Shen Keng Hsiang,**
**Taipei County,Taiwan.**

*Issued by*

**Compliance Certification Services Inc.**
**No. 81-1, Lane 210, Bade Rd. 2, Luchu Hsiang,**
**Taoyuan Hsien, (338) Taiwan, R.O.C.**
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ACCREDITED
No. 0824-01

TAF
Testing Laboratory
0363

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# 1. TEST RESULT CERTIFICATION

**Applicant:** CRETE SYSTEMS INC.
7F, No. 250, Sec. 3, Pei Shen Rd., Shen Keng Hsiang,
Taipei County,Taiwan.

**Equipment Under Test:** Notebook Computer

**Trade Name:** CReTE

**Model:** RK886EX

**Date of Test:** May 7 ~ June 15, 2007

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULT** |
| FCC 47 CFR Part 15 Subpart E | No non-compliance noted |

## We hereby certify that:

Compliance Certification Services Inc. tested the above equipment. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.407.

The test results of this report relate only to the tested sample identified in this report.

*Approved by:* *Reviewed by:*

Johnny Liu
Section Manager
Compliance Certification Services Inc.

Amanda Wu
Section Manager
Compliance Certification Services Inc.

# 2. EUT DESCRIPTION

| | |
|---|---|
| **Product** | Notebook Computer |
| **Trade Name** | CReTE |
| **Model Number** | RK886EX |
| **Model Discrepancy** | N/A |
| **Housing Type** | Magnesium-aluminum |
| **Power Supply** | 1. Power Adapter:<br>Trade Name / Model Number:<br>EPS / F10903-A<br>I/P: 100-240V, 50-60Hz, 1.2A<br>FUSE RATING: T3.15A, 250V<br>O/P: 19V, 4.75A<br>2. Rechargeable Lithium-lon Battery:<br>Model Number: BR83A<br>11.1V, 6600mAH |
| **Frequency Range** | IEEE 802.11a mode: 5150 MHz ~ 5350 MHz |
| **Transmit Power** | IEEE 802.11a mode: 14.69 dBm |
| **Modulation Technique** | OFDM (QPSK, BPSK, 16-QAM, 64-QAM) |
| **Transmit Data Rate** | 54, 48, 36, 24, 18, 12, 9, 6 Mbps |
| **Number of Channels** | IEEE 802.11a mode: 8 Channels |
| **Antenna Specification** | Gain: -2.53 dBi |
| **Antenna Designation** | PIFA Antenna |

**Operation Frequency:**

| UNLICENSED NATIONAL INFORMATION INFRASTRUCTURE (U-NII) | |
|---|---|
| **CHANNEL** | **MHz** |
| 36 | 5180 |
| 40 | 5200 |
| 44 | 5220 |
| 48 | 5240 |
| 52 | 5260 |
| 56 | 5280 |
| 60 | 5300 |
| 64 | 5320 |

***Remark:***

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: **IR5RK886EX** filing to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.*

# 3. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 Radiated testing was performed at an antenna to EUT distance 3 meters.

## 3.1EUT CONFIGURATION

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

## 3.2EUT EXERCISE

The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement.

According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

## 3.3GENERAL TEST PROCEDURES

**Conducted Emissions**

The EUT is placed on the turntable, which is positioned at 0.8 m above the ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4, the conducted emission from the EUT is measured in the frequency range between 0.15 MHz and 30MHz, using the CISPR Quasi-Peak detector mode.

**Radiated Emissions**

The EUT is placed on the turntable, which is 0.8 m above the ground plane. The turntable is then rotated for 360 degrees to determine the proper orientation for the maximum emission level. The EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission level. And, each emission is to be maximized by changing the horizontal and vertical polarization of the receiving antenna. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.

## 3.4FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]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 |
| 6.215 - 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 - | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.52525 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 156.7 - 156.9 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 162.0125 - 167.17 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 167.72 - 173.2 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 240 - 285 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | 322 - 335.4 | | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## 3.5DESCRIPTION OF TEST MODES

The EUT (model: RK886EX) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

Channel Low (5180MHz), Channel Mid (5260MHz) and Channel High (5320MHz) with 6Mbps data rate were chosen for full testing.

# 4. INSTRUMENT CALIBRATION

## 4.1MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

## 4.2MEASUREMENT EQUIPMENT USED

**Equipment Used for Emissions Measurement**

***Remark:*** *Each piece of equipment is scheduled for calibration once a year.*

| Conducted Emissions Test Site | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Spectrum Analyzer | Agilent | E4446A | MY43360131 | 01/30/2008 |

| 3M Semi Anechoic Chamber | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Spectrum Analyzer | Agilent | E4446A | US42510252 | 08/02/2007 |
| Test Receiver | Rohde&Schwarz | ESCI | 100064 | 11/13/2007 |
| Switch Controller | TRC | Switch Controller | SC94050010 | 05/04/2008 |
| 4 Port Switch | TRC | 4 Port Switch | SC94050020 | 05/04/2008 |
| Horn-Antenna | TRC | HA-0502 | 06 | 06/05/2008 |
| Horn-Antenna | TRC | HA-0801 | 04 | 05/04/2008 |
| Horn-Antenna | TRC | HA-1201A | 01 | 07/10/2007 |
| Horn-Antenna | TRC | HA-1301A | 01 | 07/18/2007 |
| Bilog- Antenna | Sunol Sciences | JB3 | A030205 | 03/09/2008 |
| Turn Table | Max-Full | MFT-120S | T120S940302 | N.C.R. |
| Antenna Tower | Max-Full | MFA-430 | A440940302 | N.C.R. |
| Controller | Max-Full | MF-CM886 | CC-C-1F-13 | N.C.R. |
| Site NSA | CCS | N/A | FCC: 965860<br>IC: IC 6106 | 09/25/2008 |
| Test S/W | LABVIEW (V 6.1) | | | |

***Remark:*** *The measurement uncertainty is less than +/-2.0065dB (30MHz ~ 1GHz), +/-3.0958dB (Above 1GHz) which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

| Powerline Conducted Emissions Test Site | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| EMI Test Receiver 9kHz-30MHz | Rohde & Schwarz | ESHS30 | 828144/003 | 10/31/2007 |
| Two-Line V-Network 9kHz-30MHz | Schaffner | NNB41 | 03/10013 | 06/12/2008 |
| LISN 10kHz-100MHz | EMCO | 3825/2 | 9106-1809 | 04/01s/2008 |
| Test S/W | LABVIEW (V 6.1) | | | |

***Remark:*** *The measurement uncertainty is less than +/- 2.81dB, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

| Dynamic Frequency Selection Test Site | | | | |
|---|---|---|---|---|
| **Name of Equipment** | **Manufacturer** | **Model** | **Serial Number** | **Calibration Due** |
| Spectrum Analyzer | Agilent | E4446A | MY43360131 | 01/30/2008 |
| Signal Generator | Agilent | E8267C | US42340162 | 12/05/2007 |

***Remark:*** *The measurement uncertainty is less than +/-2.0065dB (30MHz ~ 1GHz), +/-3.0958dB (Above 1GHz) which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.*

# 5. FACILITIES AND ACCREDITATIONS

## 5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No. 11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

## 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

## 5.3TABLE OF ACCREDITATIONS AND LISTINGS

| Country | Agency | Scope of Accreditation | Logo |
|---|---|---|---|
| USA | A2LA | EN 55011, EN 55014-1/2, CISPR 11, CISPR 14-1/2, EN 55022, EN 55015, CISPR 22, CISPR 15, AS/NZS 3548, VCCI V3 (2001), CFR 47, FCC Part 15/18, CNS 13783-1, CNS 13439, CNS 13438, CNS 13803, CNS 14115, EN 55024, IEC 801-2, IEC 801-3, IEC 801-4, IEC/EN 61000-3-2, EIC/EN 61000-3-3, IEC/EN 61000-4-2/3/4/5/6/8/11, EN 50081-1/ EN 61000-6-3, EN 50081-2/EN 61000-6-4, EN 50081-2/EN 61000-6-1: 2001 | ACCREDITED<br>0824-01 |
| USA | FCC | 3/10 meter Open Area Test Sites (93105, 90471) / 3M Semi Anechoic Chamber (965860) to perform FCC Part 15/18 measurements | 93105, 90471<br>965860 |
| Japan | VCCI | 3/10 meter Open Area Test Sites to perform conducted/radiated measurements | R-393/1066/725/879<br>C-402/747/912 |
| Norway | NEMKO | EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2, EN 300 328, EN 300 422-2, EN 301 419-1, EN 301 489-01/03/07/08/09/17, EN 301 419-2/3, EN 300 454-2, EN 301 357-2 | ELA 124a<br>ELA 124b<br>ELA 124c |
| Taiwan | TAF | EN 300 328, EN 300 220-1, EN 300 220-2, EN 300 220-3, 47 CFR FCC Part 15 Subpart C, EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1, CNS 14115, CNS 13438, AS/NZS CISPR 22, CNS 13022-1, IEC 61000-4-2/3/4/5/6/8/11, CNS 13022-2/3 | Testing Laboratory<br>0363 |
| Taiwan | BSMI | CNS 13438, CNS 13783-1, CNS 13439, CNS 14115 | SL2-IS-E-0014<br>SL2-IN-E-0014<br>SL2-A1-E-0014<br>SL2-R1-E-0014<br>SL2-R2-E-0014<br>SL2-L1-E-0014 |
| Canada | Industry Canada | 3/10 meter Open Area Test Sites (IC 2324C-3, IC 2324C-5) / 3M Semi Anechoic Chamber (IC 6106) to perform RSS 212 Issue 1 | IC 2324C-3<br>IC 2324C-5<br>IC 6106 |

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

# 6. SETUP OF EQUIPMENT UNDER TEST

## 6.1SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix I for the actual connections between EUT and support equipment.

## 6.2SUPPORT EQUIPMENT

| No. | Device Type | Brand | Model | Series No. | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|---|
| 1. | LCD Monitor | Samsung | 173P | DI17H4JXB04968Y | IFAXDM1414 | Shielded, 1.8m with 2 cores | AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core |
| 2. | LCD Monitor | HP | L1740 | CNK5220VH8 | FCC DoC | Shielded, 1.8m with 2 cores | AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core |
| 3. | Printer | EPSON | STYLUS C60 | DR3K039633 | FCC DoC | Shielded, 1.8m | Unshielded, 1.8m |
| 4. | Modem | ACEEX | DM-1414 | 304012269 | IFAXDM1414 | Shielded, 1.8m | Unshielded, 1.8m |
| 5. | Modem | ACEEX | DM-1414 | 0304012261 | IFAXDM1414 | Shielded, 1.8m | Unshielded, 1.8m |
| 6. | USB 2.0 External HDD | TeraSyS | F12-U | A0100214-31d0014 | FCC DoC | Shielded, 1.8m | N/A |
| 7. | USB 2.0 External HDD | TeraSyS | F12-U | A0100214-31d0028 | FCC DoC | Shielded, 1.8m | N/A |
| 8. | USB 2.0 External HDD | TeraSyS | F12-U | A0100214-2Bq0039 | FCC DoC | Shielded, 1.8m | N/A |
| 9. | Earphone | LABTEC | 980180-0121 | N/A | FCC DoC | Shielded, 1.8m | N/A |
| 10. | Multimedia Earphone | LABTEC | Axis-301 | N/A | FCC DoC | Shielded, 1.8m | N/A |
| 11. | Walkman | Panasonic | RQ-L10 | HB004471 | FCC DoC | Shielded, 1.8m | N/A |
| 12. | USB Mouse | HP | MO19UCA | 20440964 | FCC DoC | Shielded, 1.8m | N/A |
| 13. | USB Keyboard | Compaq | KU-9978 | B463AOAGALT097 | FCC DoC | Shielded, 1.8m | N/A |
| 14. | Power Adaptor | N/A | A602-12 15U41 | N/A | FCC DoC | N/A | Unshielded, 1.8m |
| 15. | Wireless Lan USB2.0 Adapter | Senao | NUB-862 | 057208325 | NI3-UB86005001* | N/A | Unshielded, 1.8m |
| 16. | Wireless PCI Card | ZCOM | AG-621 | AG62145NE00032 | FCC DoC | N/A | N/A |

***Remark:***

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

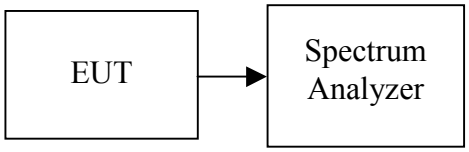
# 7. FCC PART 15 REQUIREMENTS

## 7.126 dB EMISSION BANDWIDTH

## LIMIT

According to §15.303(c), for purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

**Test Configuration**




## TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low-loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW > 1%EBW, VBW > RBW, Span >26dB bandwidth, and Sweep = auto.
4. Mark the peak frequency and –26dB (upper and lower) frequency.
5. Repeat until all the rest channels were investigated.

## TEST RESULTS

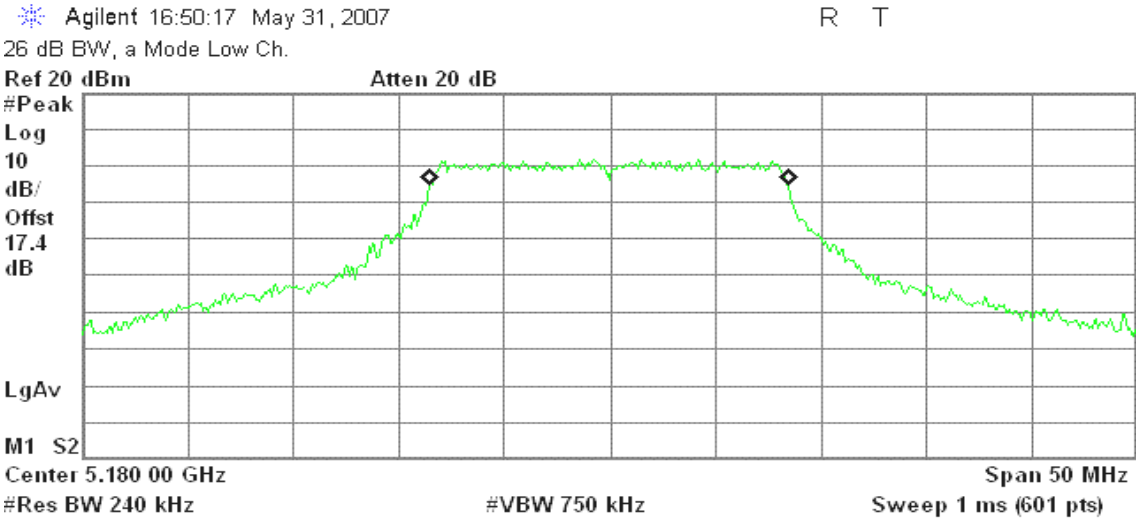
*No non-compliance noted*

**Test Data**

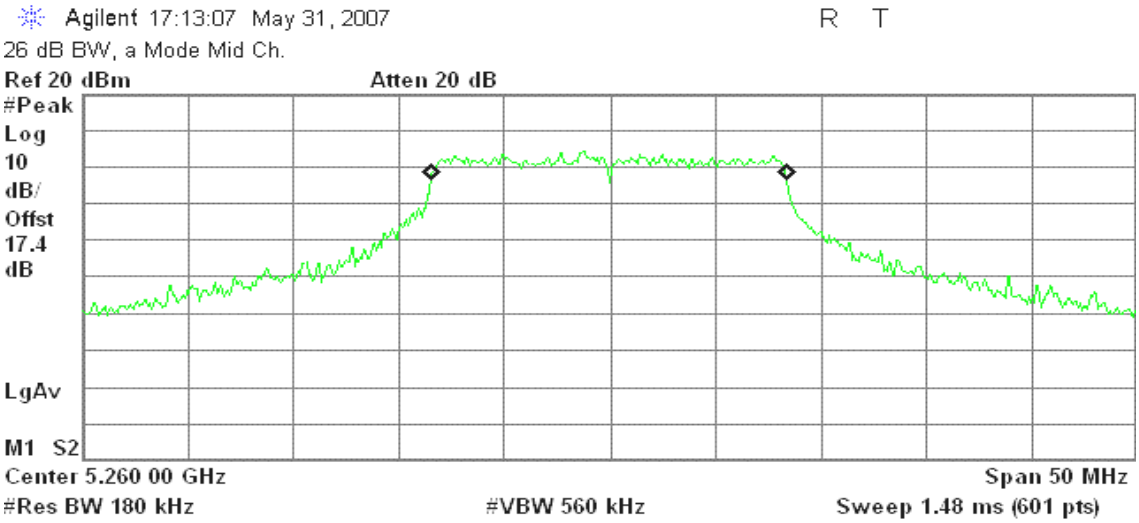
| Channel | Frequency (MHz) | Bandwidth (B) (MHz) |
|---|---|---|
| Low | 5180 | 22.595 |
| Mid | 5260 | 22.703 |
| High | 5320 | 24.205 |

## Test Plot

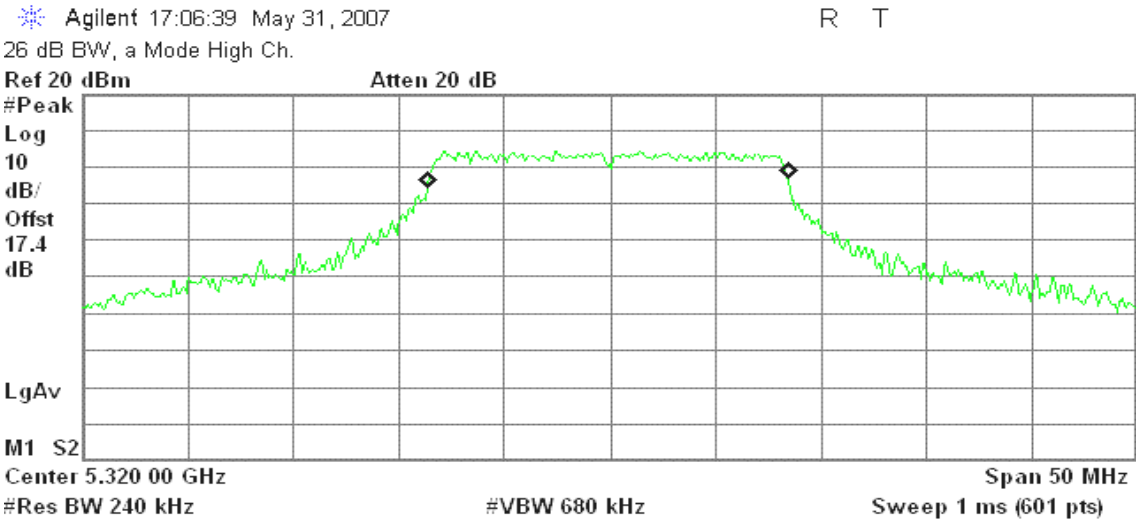
### CH Low




### CH Mid



## CH High




Occupied Bandwidth
16.9790 MHz

Occ BW % Pwr 99.00 %
x dB -26.00 dB

| | |
|---|---|
| Transmit Freq Error | -103.029 kHz |
| x dB Bandwidth | 24.205 MHz |

# 7.2MAXIMUM CONDUCTED OUTPUT POWER

## LIMIT

According to §15.407(a),

(1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10log B, where B is the 26 dB emission bandwidth in MHz.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in MHz.

*If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.*

The peak power shall not exceed the limit as follow:

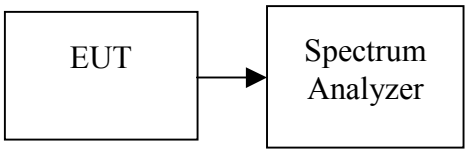
**Specified Limit of the Peak Power**

| Channel | Frequency (MHz) | 26 dB Bandwidth (B) (MHz) | 10 Log B (dB) | 4 + 10 Log B or 11 + 10 Log B (dBm) | Maximum Conducted Output Power Limit (dBm) |
|---|---|---|---|---|---|
| Low | 5180 | 22.595 | 13.54 | 17.54 | 17.00 |
| Mid | 5260 | 22.703 | 13.56 | 24.56 | 24.00 |
| High | 5320 | 24.205 | 13.83 | 24.83 | 24.00 |

*(**Remark:** Maximum antenna gain = -2.53dBi, therefore there is no reduction due to antenna gain.)*

**Test Configuration**

*The EUT was connected to a spectrum analyzer through a 50Ω RF cable.*




## TEST PROCEDURE

Set span to encompass the entire emission bandwidth (EBW) of the signal.

Set RBW = 1 MHz / Set VBW = 3 MHz.

Use sample detector mode if bin width (i.e., span/number of points in spectrum display) < 0.5 RBW. Otherwise use peak detector mode. Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to "free run".·Trace average 100 traces in power averaging mode. Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges or by summing power levels in each 1 MHz band in linear power terms. The 1 MHz band power levels to be summed can be obtained by averaging, in linear power terms, power levels in each frequency bin across the 1 MHz.

## TEST RESULTS

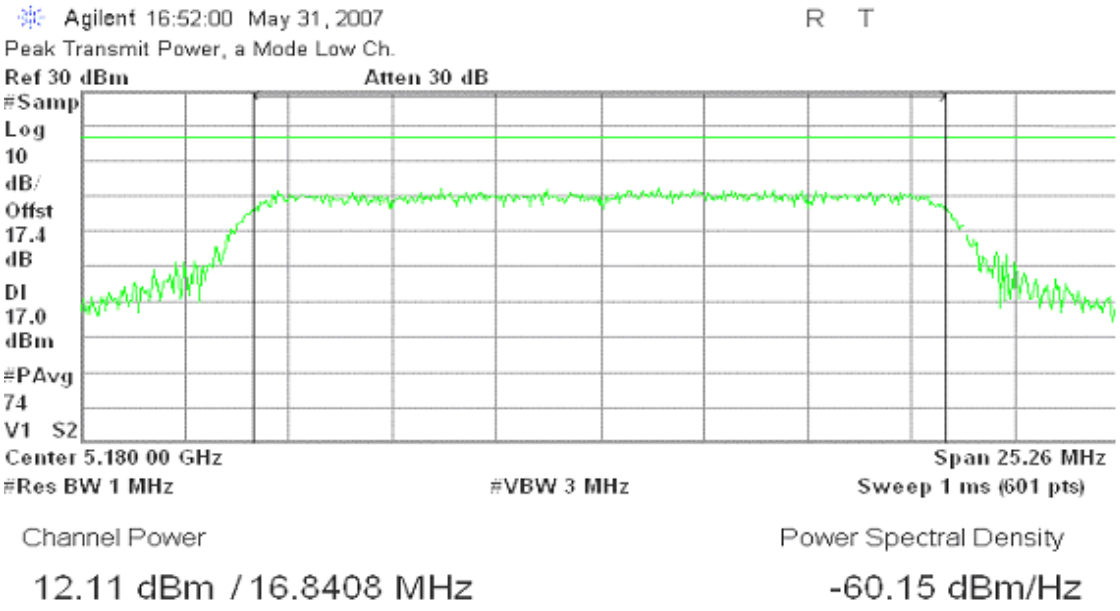
*No non-compliance noted*

**Test Data**

| Channel | Frequency (MHz) | Maximum Conducted Output Power (dBm) | Limit (dBm) |
|---|---|---|---|
| Low | 5180 | 12.11 | 17.00 |
| Mid | 5260 | 14.05 | 24.00 |
| High | 5320 | 14.69 | 24.00 |

## Test Plot

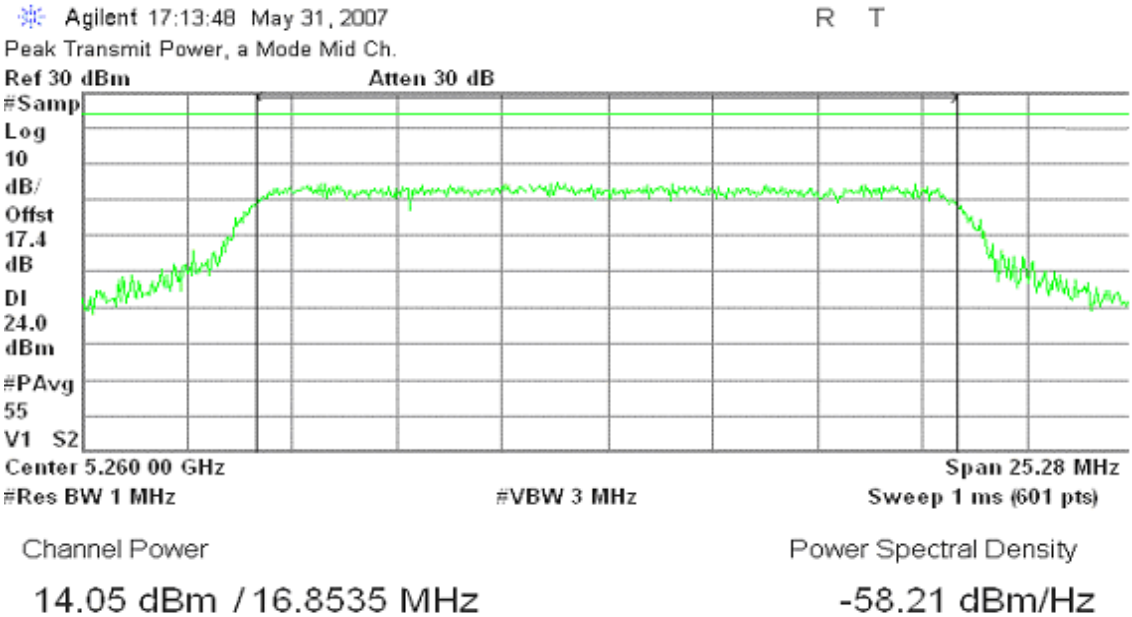
### CH Low




Channel Power
12.11 dBm / 16.8408 MHz

Power Spectral Density
-60.15 dBm/Hz

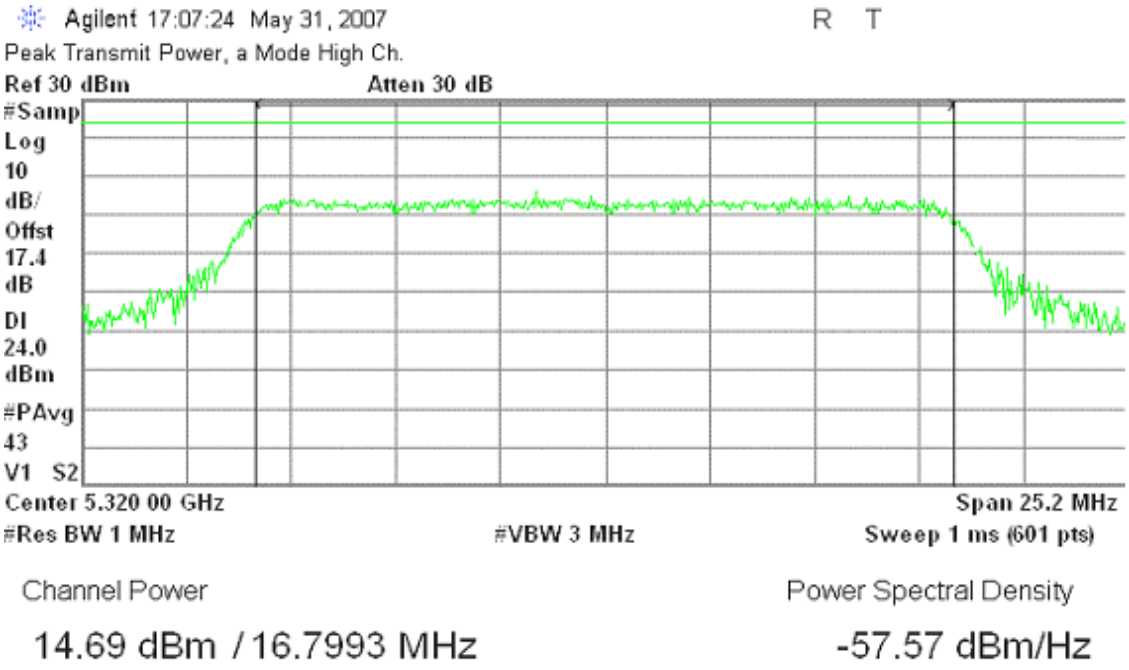
### CH Mid




Channel Power
14.05 dBm / 16.8535 MHz

Power Spectral Density
-58.21 dBm/Hz

## CH High



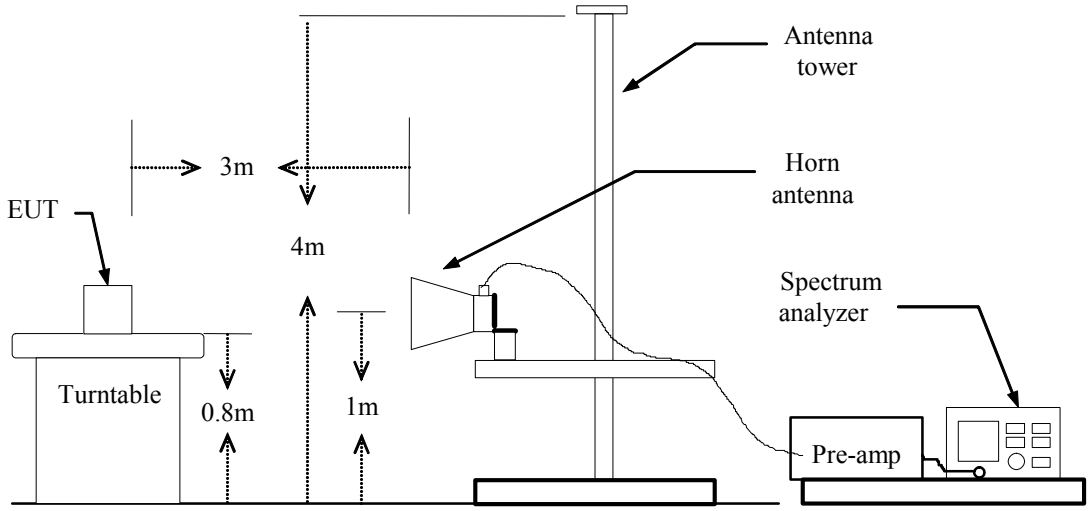

| Channel Power | Power Spectral Density |
|---|---|
| 14.69 dBm / 16.7993 MHz | -57.57 dBm/Hz |

# 7.3BAND EDGES MEASUREMENT

## LIMIT

According to §15.407(b),
(1) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

**Test Configuration**




## TEST PROCEDURE

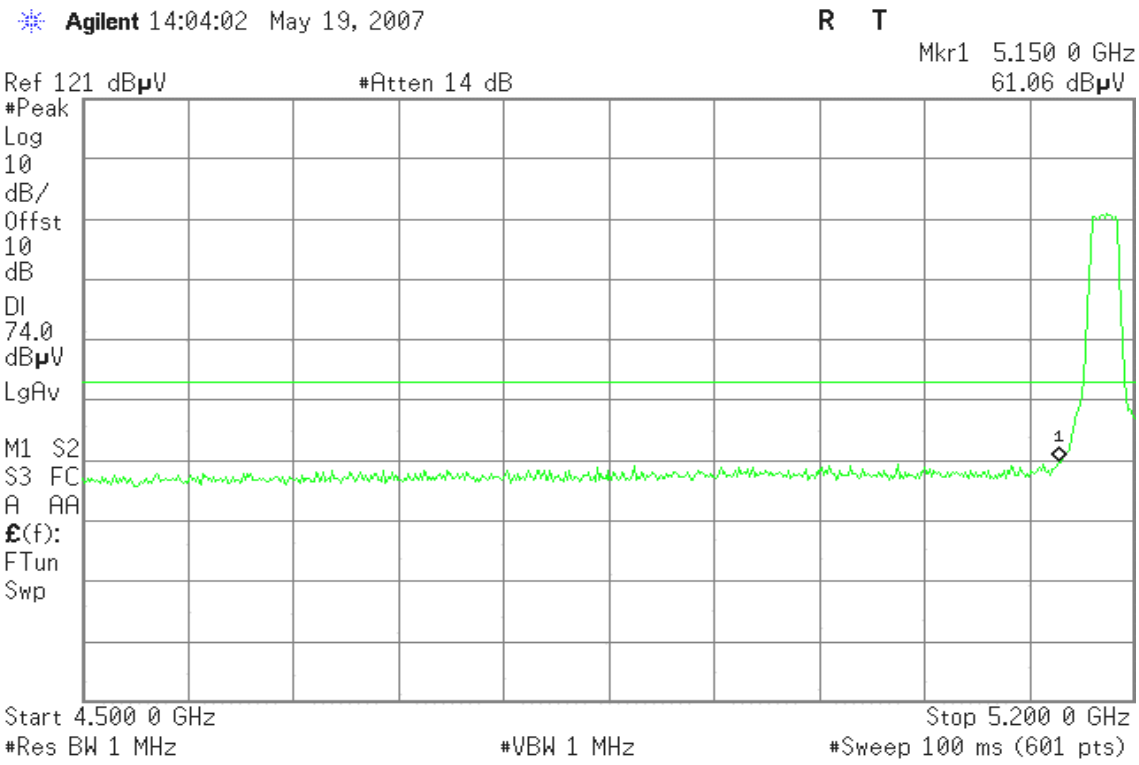
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

## TEST RESULTS

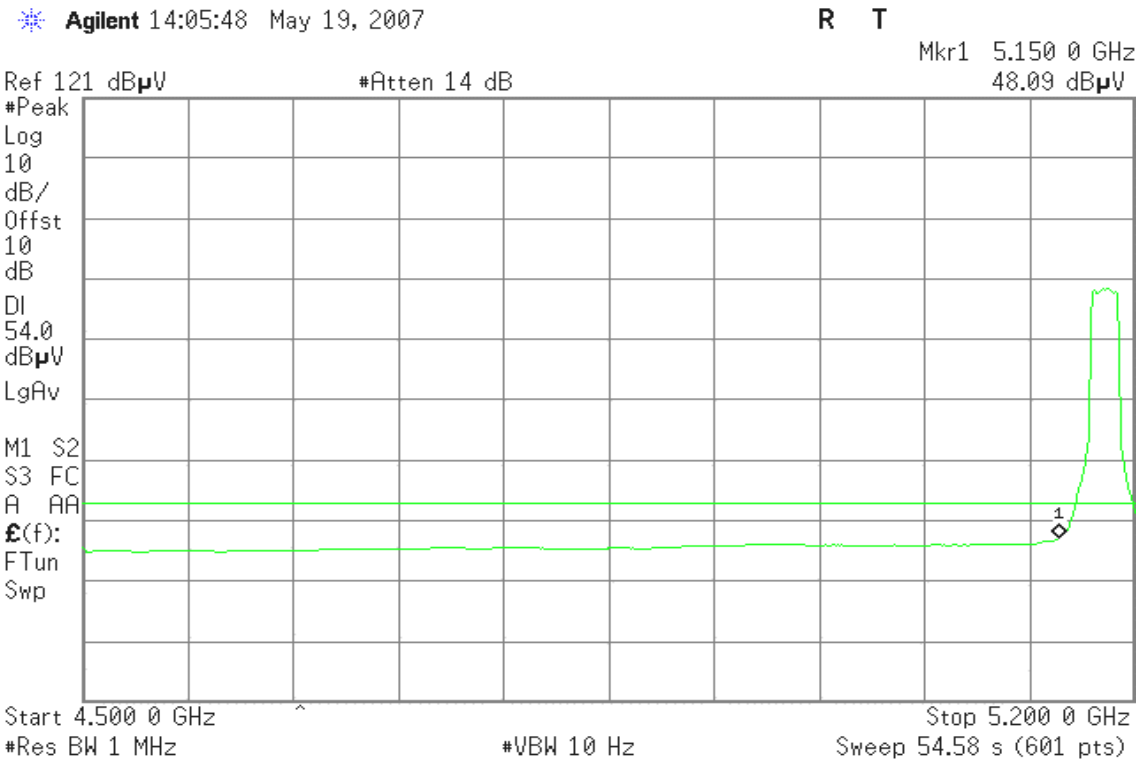
Refer to attach spectrum analyzer data chart.

## Band Edges (CH Low)

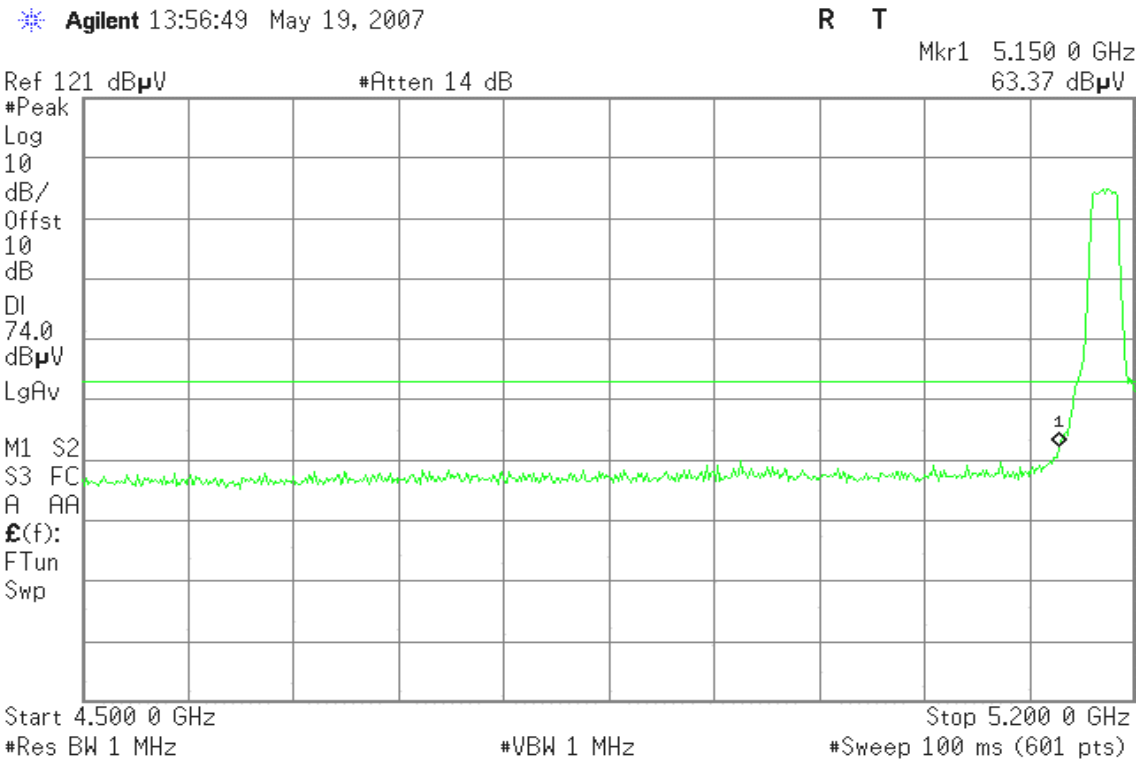
### Detector mode: Peak Polarity: Vertical



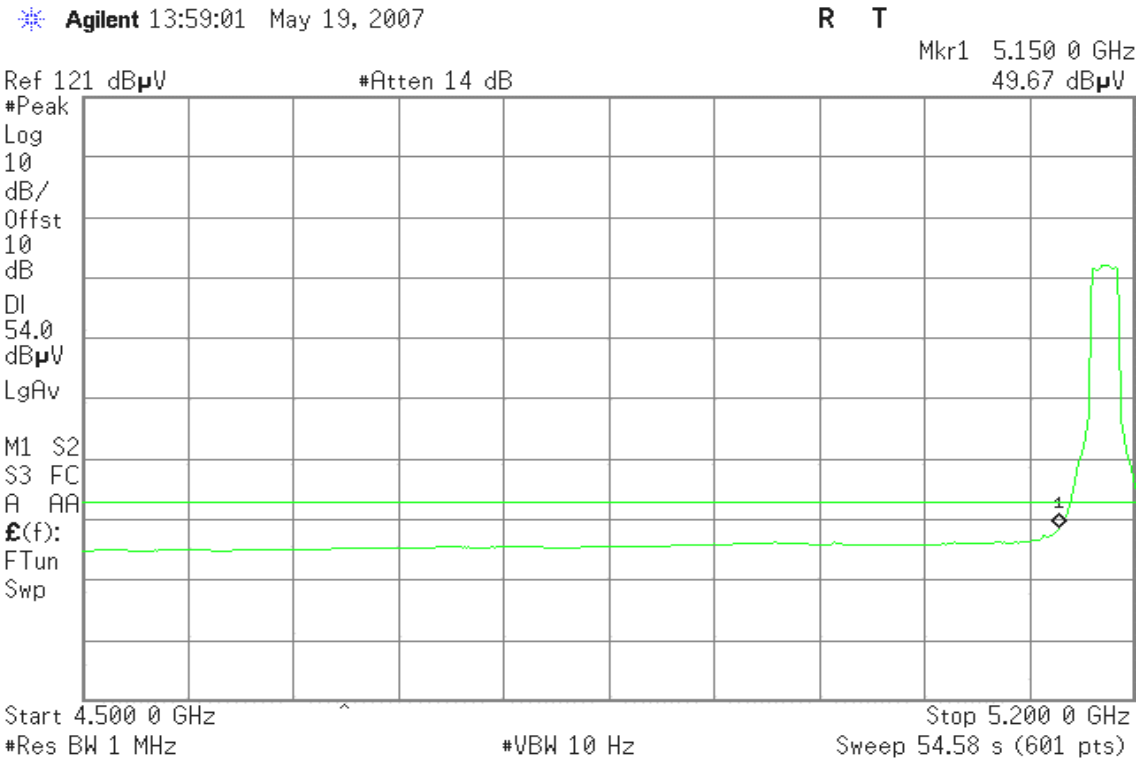

### Detector mode: Average Polarity: Vertical



**Detector mode: Peak** **Polarity: Horizontal**

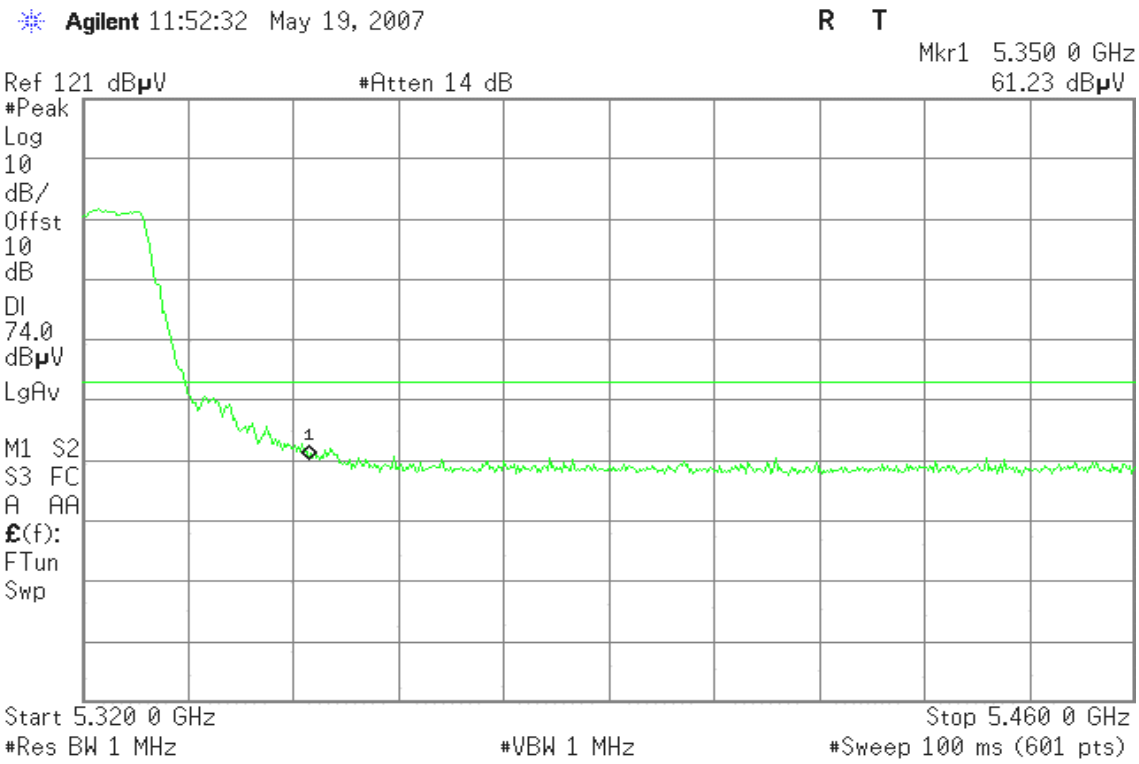



**Detector mode: Average** **Polarity: Horizontal**

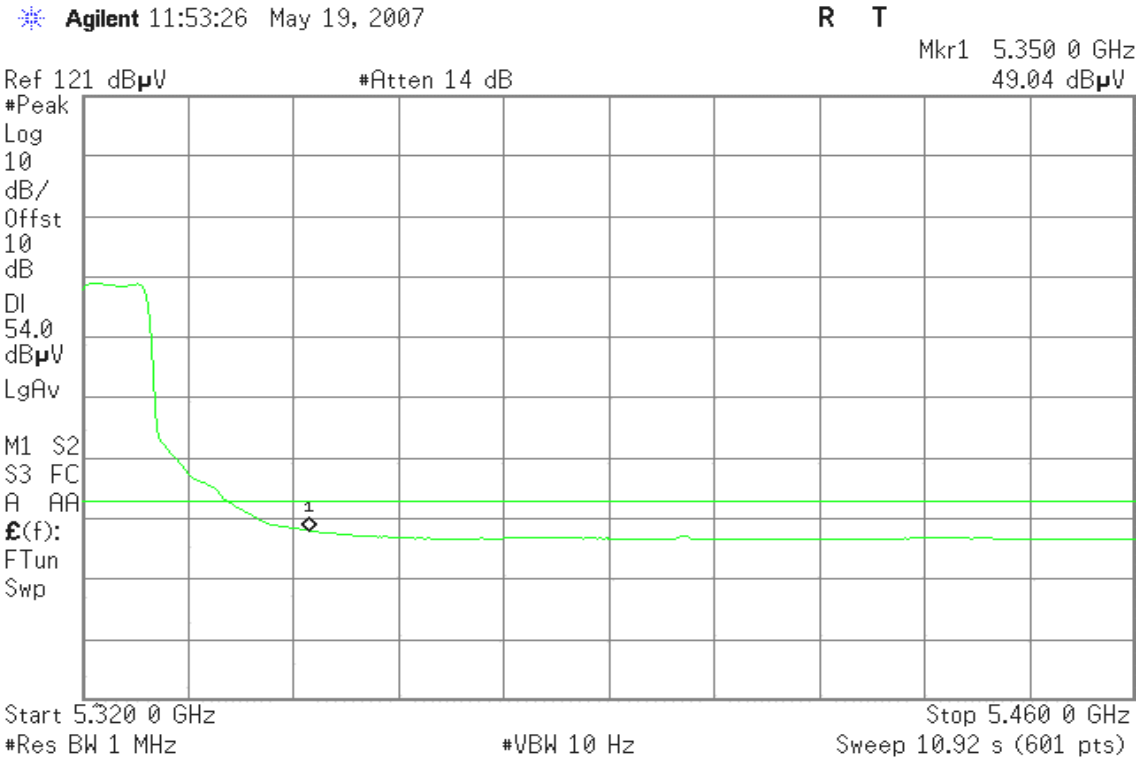


## Band Edges (CH High)

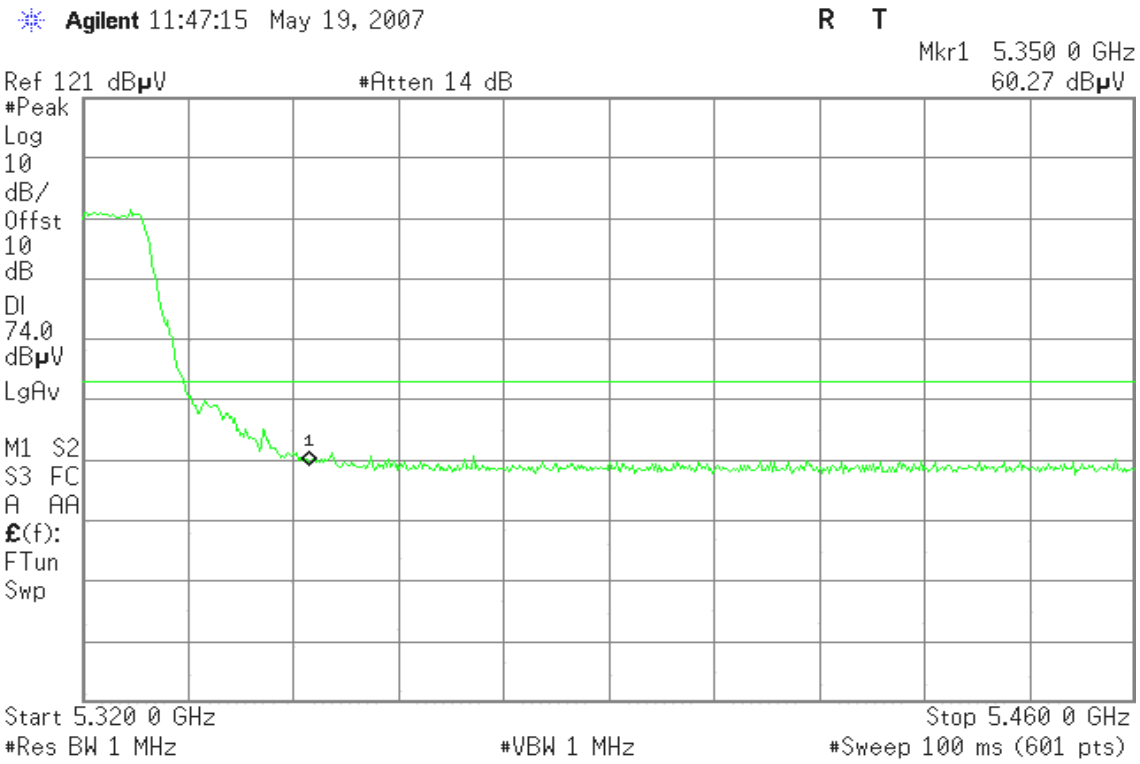
### Detector mode: Peak Polarity: Vertical



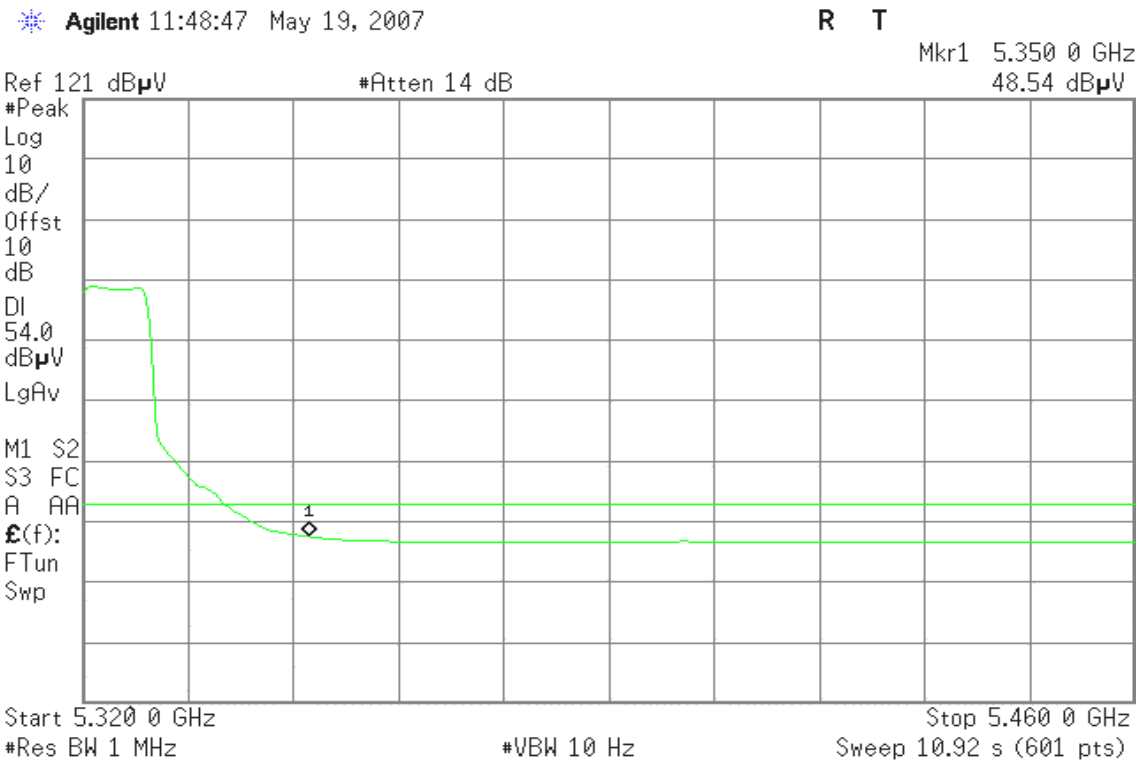

### Detector mode: Average Polarity: Vertical



**Detector mode: Peak** **Polarity: Horizontal**




**Detector mode: Average** **Polarity: Horizontal**



# 7.4PEAK POWER SPECTRAL DENSITY

## LIMIT

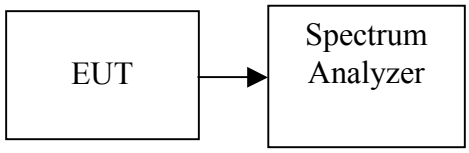
According to §15.407(a),

(1) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4dBm in any 1MHz band.

(2) For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11dBm in any 1MHz band.

*If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.*

**Test Configuration**




## TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 1MHz, VBW = 3MHz, Span = 25MHz, Sweep=1ms
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed

## TEST RESULTS

*No non-compliance noted*

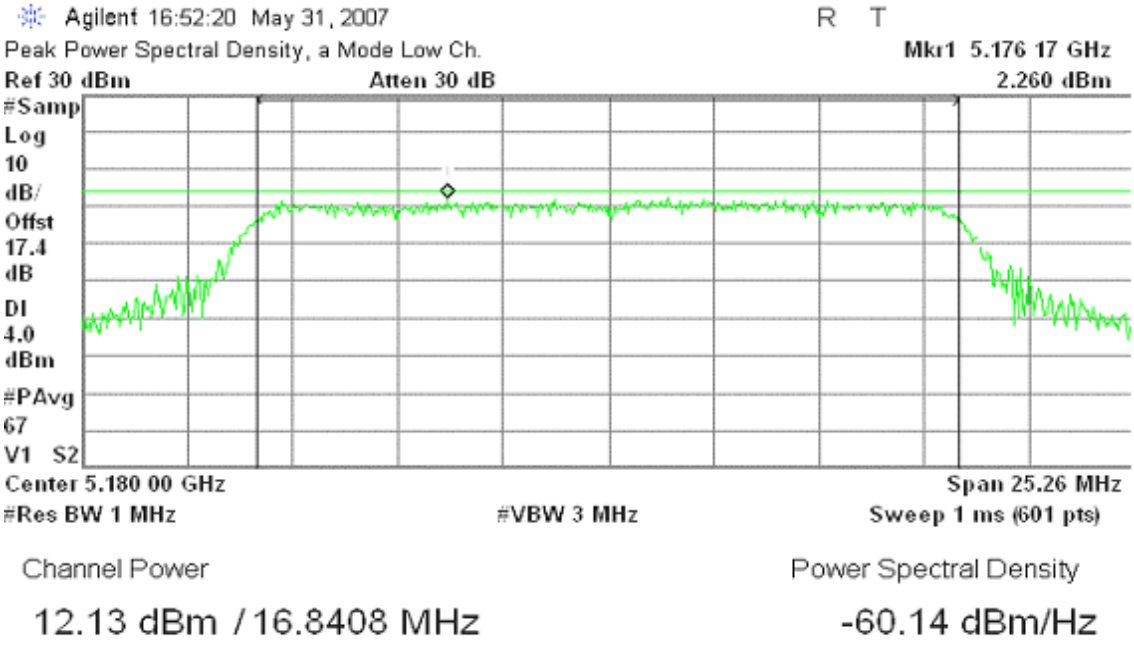
**Test Data**

| Channel | Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|
| Low | 5180 | 2.260 | 4.00 | -1.74 | PASS |
| Mid | 5260 | 4.888 | 11.00 | -6.11 | PASS |
| High | 5320 | 6.009 | 11.00 | -4.99 | PASS |

*(**Remark:** Maximum antenna gain =-2.53dBi, therefore there is no reduction due to antenna gain.)*

## Test Plot

### CH Low



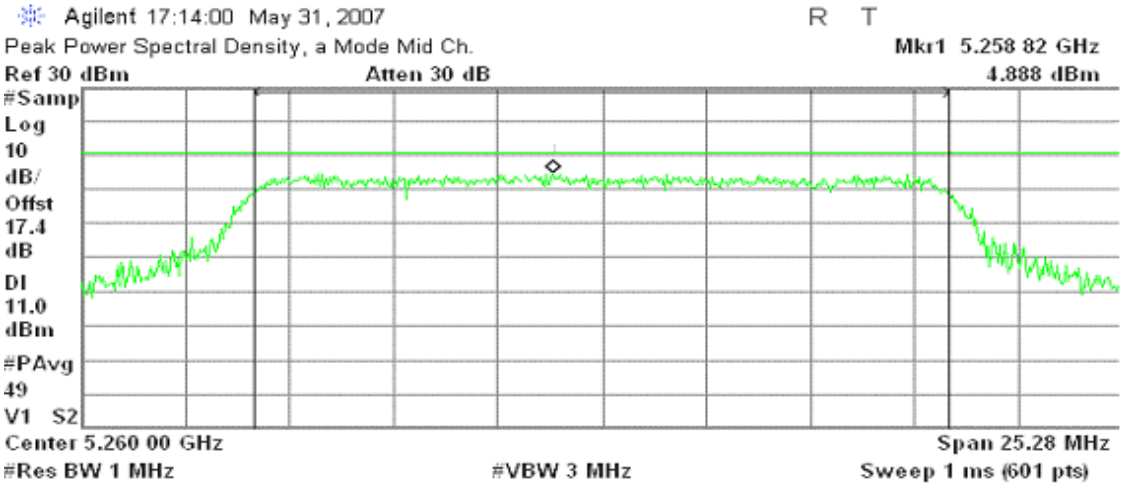

Channel Power

12.13 dBm / 16.8408 MHz

Power Spectral Density

-60.14 dBm/Hz

### CH Mid



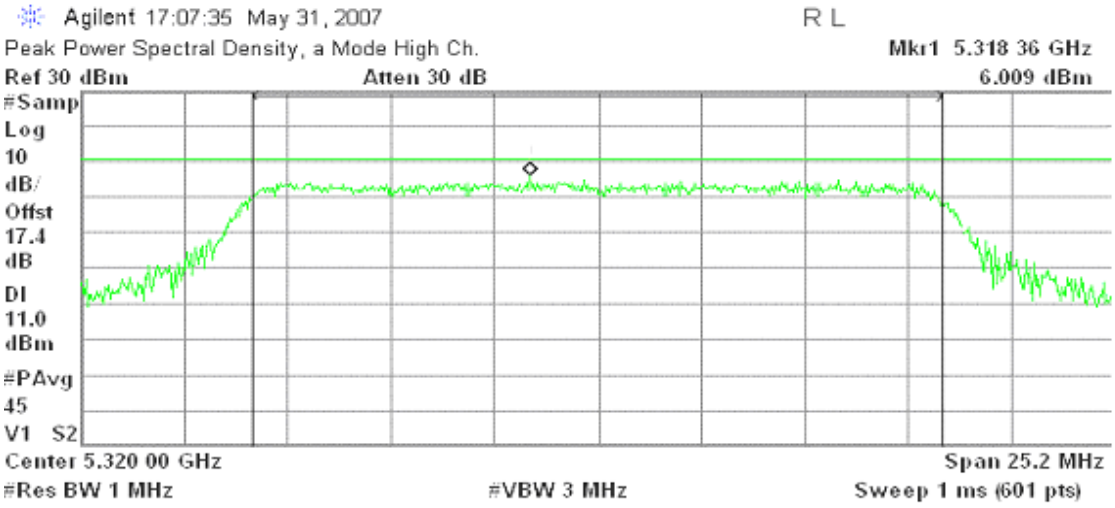

Channel Power

13.03 dBm / 16.8535 MHz

Power Spectral Density

-59.23 dBm/Hz

## CH High




Channel Power

15.22 dBm / 16.7993 MHz

Power Spectral Density

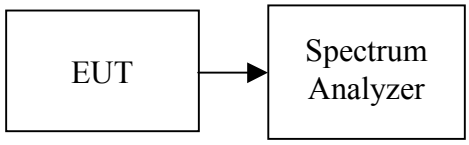
-57.03 dBm/Hz

## 7.5PEAK EXCURSION

## LIMIT

According to §15.407(a)(6), the ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**Test Configuration**




## TEST PROCEDURE

The test is performed in accordance with <FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices> – Part 15, Subpart E, August 2002.

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to spectrum.
3. Trace A, Set RBW =1MHz, VBW = 3MHz, Span >26dB bandwidth, Max. hold.
4. Delta Mark trace A Maximum frequency and trace B same frequency.
5. Repeat the above procedure until measurements for all frequencies were complete.

## TEST RESULTS

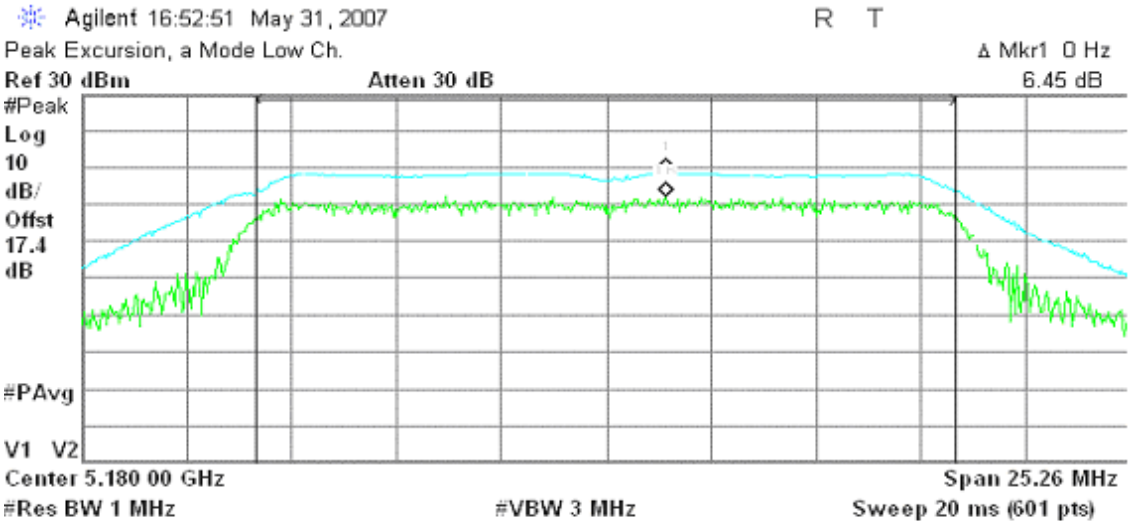
*No non-compliance noted*

**Test Data**

| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) | Result |
|---|---|---|---|---|---|
| Low | 5180 | 6.45 | 13.00 | -6.55 | PASS |
| Mid | 5260 | 9.21 | 13.00 | -3.79 | PASS |
| High | 5320 | 11.03 | 13.00 | -1.97 | PASS |

## Test Plot

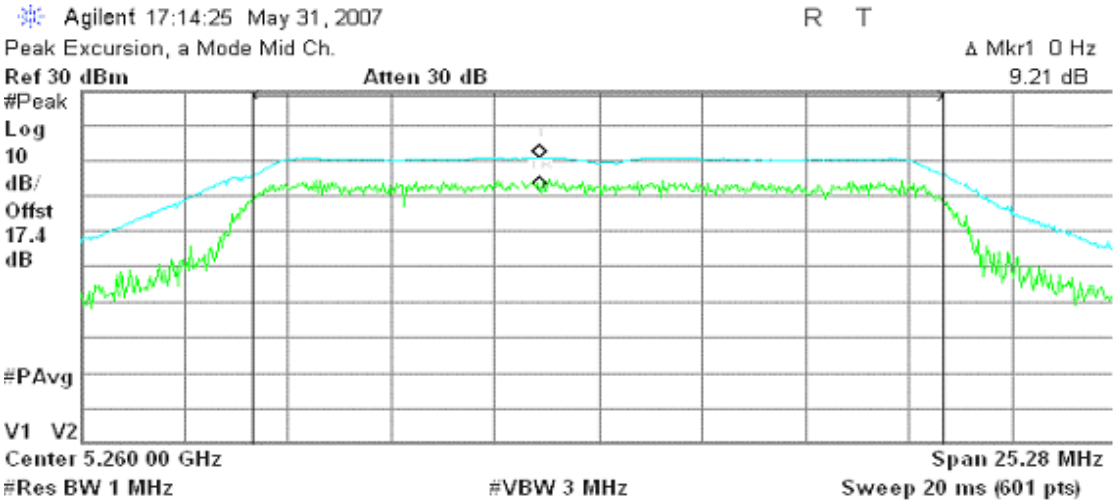
### CH Low




Channel Power
18.02 dBm / 16.8408 MHz

Power Spectral Density
-54.24 dBm/Hz

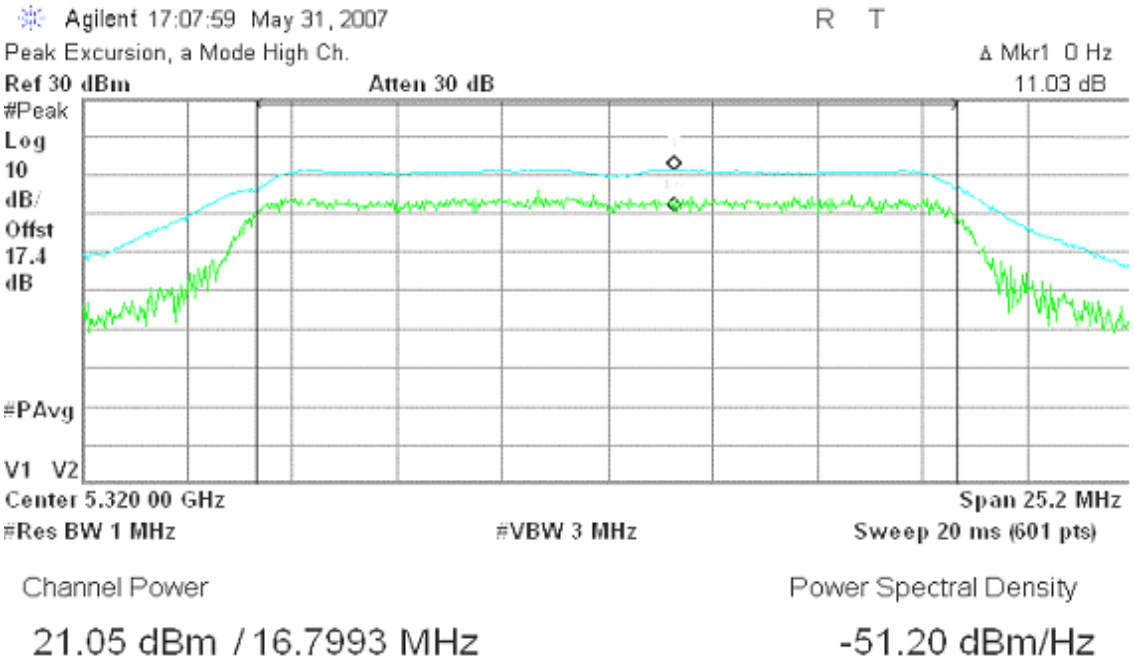
### CH Mid




Channel Power
20.58 dBm / 16.8535 MHz

Power Spectral Density
-51.69 dBm/Hz

**CH High**




Channel Power

21.05 dBm / 16.7993 MHz

Power Spectral Density

-51.20 dBm/Hz

## 7.6RADIATED UNDESIRABLE EMISSION

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (μV/m) | Measurement Distance (m) |
|---|---|---|
| 30-88 | 100* | 3 |
| 88-216 | 150* | 3 |
| 216-960 | 200* | 3 |
| Above 960 | 500 | 3 |

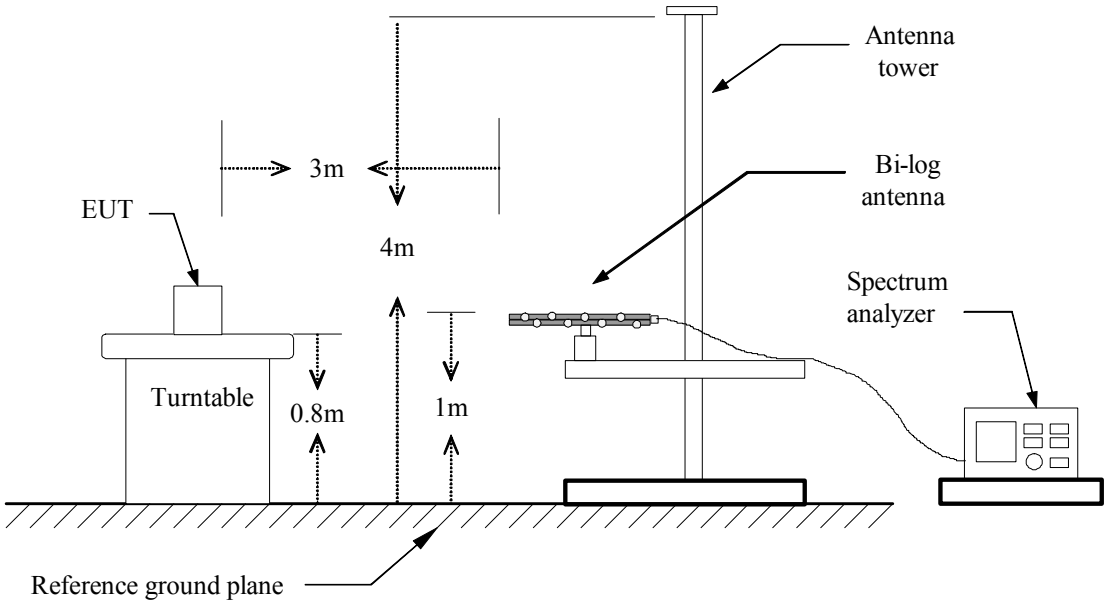
***Remark:*** *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.*

2. In the emission table above, the tighter limit applies at the band edges.

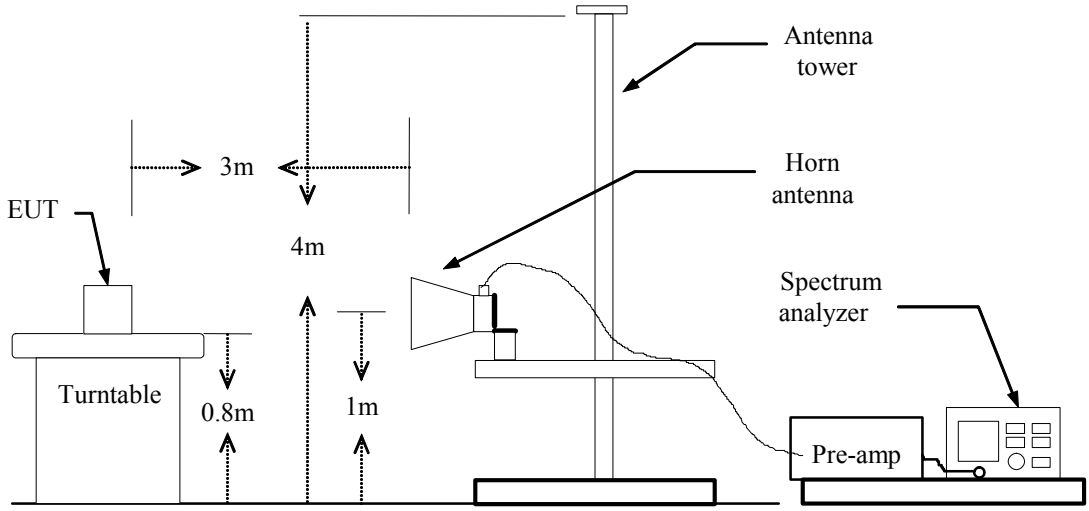
| Frequency (MHz) | Field Strength (μV/m at 3-meter) | Field Strength (dBμV/m at 3-meter) |
|---|---|---|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

## Test Configuration

### Below 1 GHz




### Above 1 GHz



## TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

# TEST RESULTS

## Below 1 GHz

**Operation Mode:** Normal Link **Test Date:** May 18, 2007

**Temperature:** 20°C **Tested by:** Wolf Huang

**Humidity:** 55% RH **Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 227.23 | V | 53.24 | -14.83 | 38.42 | 46.00 | -7.58 | Peak |
| 261.18 | V | 54.61 | -13.84 | 40.77 | 46.00 | -5.23 | Peak |
| 422.85 | V | 44.77 | -9.16 | 35.61 | 46.00 | -10.39 | Peak |
| 553.80 | V | 42.85 | -6.80 | 36.05 | 46.00 | -9.95 | Peak |
| 799.53 | V | 41.25 | -3.16 | 38.08 | 46.00 | -7.92 | Peak |
| 912.70 | V | 38.43 | -1.80 | 36.63 | 46.00 | -9.37 | Peak |
| 227.23 | H | 51.82 | -14.83 | 37.00 | 46.00 | -9.00 | Peak |
| 261.18 | H | 54.43 | -13.84 | 40.59 | 46.00 | -5.41 | Peak |
| 422.85 | H | 42.64 | -9.16 | 33.48 | 46.00 | -12.52 | Peak |
| 618.47 | H | 42.29 | -5.60 | 36.69 | 46.00 | -9.31 | Peak |
| 814.08 | H | 41.82 | -2.82 | 39.00 | 46.00 | -7.00 | Peak |
| 912.70 | H | 40.81 | -1.80 | 39.01 | 46.00 | -6.99 | Peak |

***Remark:***

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

**Above 1 GHz**

**Operation Mode:** Tx / IEEE 802.11a mode / CH Low **Test Date:** May 19, 2007

**Temperature:** 23°C **Tested by:** Ivan Tsai

**Humidity:** 52% RH **Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Peak) (dBuV) | Reading (Average) (dBuV) | Correction Factor (dB/m) | Result (Peak) (dBuV/m) | Result (Average) (dBuV/m) | Limit (Peak) (dBuV/m) | Limit (Average) (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1070.00 | V | 55.75 | --- | -10.68 | 45.07 | --- | 74.00 | 54.00 | -8.93 | Peak |
| 2120.00 | V | 47.85 | --- | -4.70 | 43.14 | --- | 74.00 | 54.00 | -10.86 | Peak |
| 2995.00 | V | 47.11 | --- | -2.46 | 44.65 | --- | 74.00 | 54.00 | -9.35 | Peak |
| 4966.67 | V | 46.63 | --- | 0.69 | 47.33 | --- | 74.00 | 54.00 | -6.67 | Peak |
| 5188.33 | V | 48.70 | --- | 0.98 | 49.68 | --- | 74.00 | 54.00 | -4.32 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| 1175.00 | H | 50.74 | --- | -10.51 | 40.23 | --- | 74.00 | 54.00 | -13.77 | Peak |
| 1758.33 | H | 48.39 | --- | -7.41 | 40.98 | --- | 74.00 | 54.00 | -13.02 | Peak |
| 4955.00 | H | 47.05 | --- | 0.68 | 47.73 | --- | 74.00 | 54.00 | -6.27 | Peak |
| 5176.67 | H | 51.12 | --- | 0.97 | 52.09 | --- | 74.00 | 54.00 | -1.91 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |

***Remark:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

**Operation Mode:** Tx / IEEE 802.11a mode / CH Mid **Test Date:** May 19, 2007

**Temperature:** 23°C **Tested by:** Ivan Tsai

**Humidity:** 52% RH **Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Peak) (dBuV) | Reading (Average) (dBuV) | Correction Factor (dB/m) | Result (Peak) (dBuV/m) | Result (Average) (dBuV/m) | Limit (Peak) (dBuV/m) | Limit (Average) (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1070.00 | V | 54.24 | --- | -10.68 | 43.56 | --- | 74.00 | 54.00 | -10.44 | Peak |
| 1431.67 | V | 50.42 | --- | -10.09 | 40.33 | --- | 74.00 | 54.00 | -13.67 | Peak |
| 2178.33 | V | 46.95 | --- | -4.56 | 42.39 | --- | 74.00 | 54.00 | -11.61 | Peak |
| 2995.00 | V | 47.45 | --- | -2.46 | 44.99 | --- | 74.00 | 54.00 | -9.01 | Peak |
| 5270.00 | V | 46.20 | --- | 1.09 | 47.29 | --- | 74.00 | 54.00 | -6.71 | Peak |
| 6133.33 | V | 45.67 | --- | 2.33 | 48.00 | --- | 74.00 | 54.00 | -6.00 | Peak |
| | | | | | | | | | | |
| 1175.00 | H | 50.74 | --- | -10.51 | 40.23 | --- | 74.00 | 54.00 | -13.77 | Peak |
| 1758.33 | H | 47.94 | --- | -7.41 | 40.54 | --- | 74.00 | 54.00 | -13.46 | Peak |
| 5258.33 | H | 48.34 | --- | 1.08 | 49.42 | --- | 74.00 | 54.00 | -4.58 | Peak |
| 7113.33 | H | 44.53 | --- | 3.78 | 48.31 | --- | 74.00 | 54.00 | -5.69 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |

***Remark:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

**Operation Mode:** Tx / IEEE 802.11a mode / CH High **Test Date:** May 19, 2007

**Temperature:** 23°C **Tested by:** Ivan Tsai

**Humidity:** 52% RH **Polarity:** Ver. / Hor.

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Peak) (dBuV) | Reading (Average) (dBuV) | Correction Factor (dB/m) | Result (Peak) (dBuV/m) | Result (Average) (dBuV/m) | Limit (Peak) (dBuV/m) | Limit (Average) (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1070.00 | V | 53.47 | --- | -10.68 | 42.79 | --- | 74.00 | 54.00 | -11.21 | Peak |
| 1431.67 | V | 51.41 | --- | -10.09 | 41.33 | --- | 74.00 | 54.00 | -12.67 | Peak |
| 2995.00 | V | 46.83 | --- | -2.46 | 44.37 | --- | 74.00 | 54.00 | -9.63 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| 1175.00 | H | 51.07 | --- | -10.51 | 40.57 | --- | 74.00 | 54.00 | -13.43 | Peak |
| 1758.33 | H | 50.13 | --- | -7.41 | 42.72 | --- | 74.00 | 54.00 | -11.28 | Peak |
| N/A | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

***Remark:***

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

# 7.7CONDUCTED UNDESIRABLE EMISSION

## LIMIT

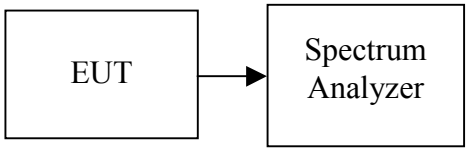
According to 15.407(b),

(1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

The provisions of §15.205 apply to intentional radiators operating under this section.

**Test Configuration**




## TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

Measurements are made over the 20G Hz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

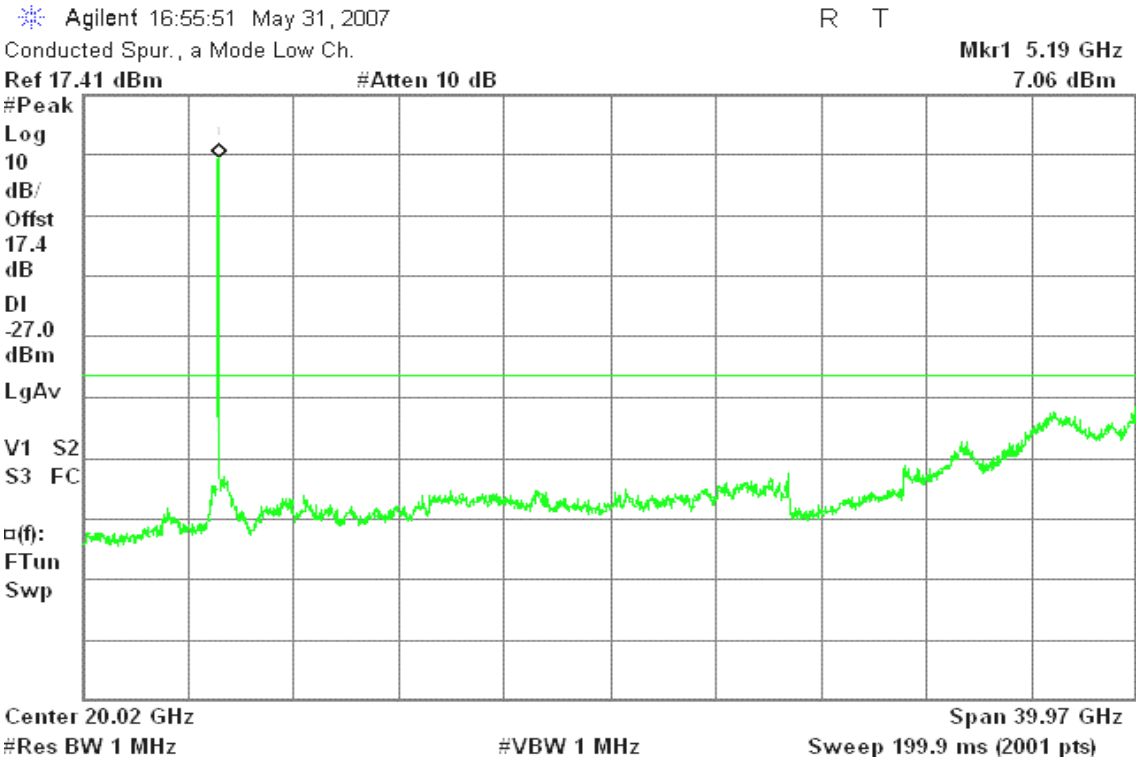
## TEST RESULTS

*No non-compliance noted*

## Test Plot

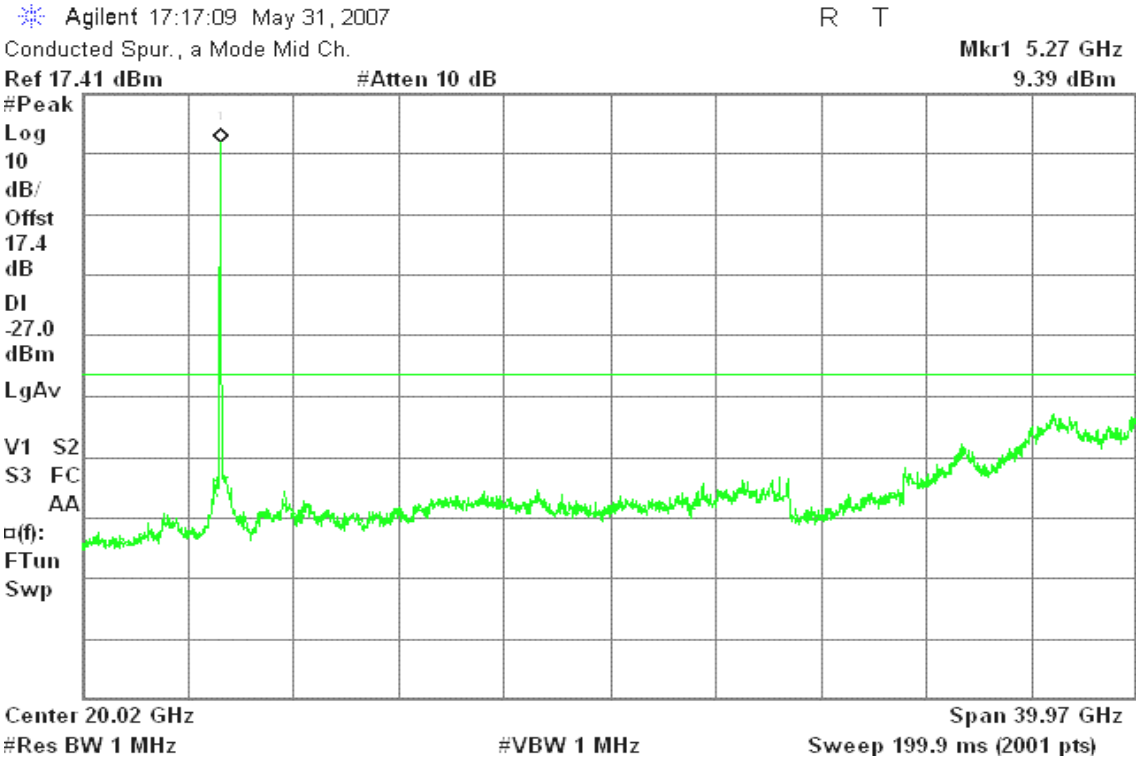
### CH Low

### 20GHz ~ 40GHz



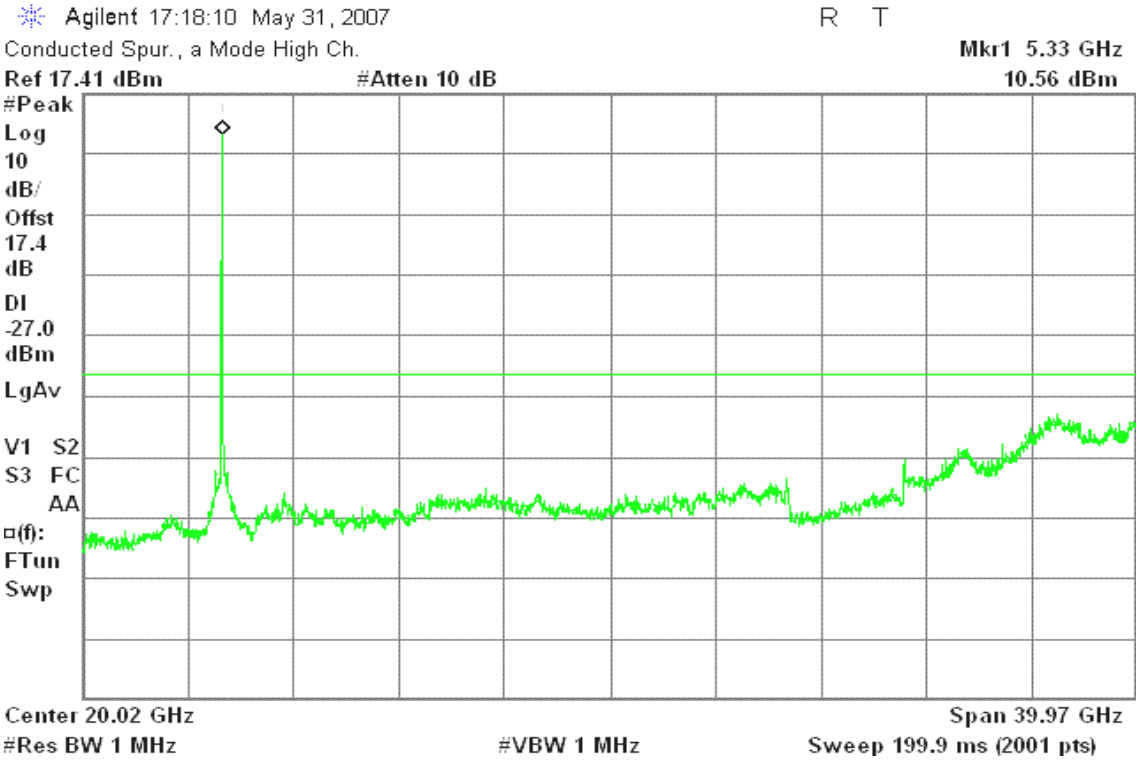

### CH Mid

### 20GHz ~ 40GHz



**CH High**

**30MHz ~ 40GHz**



# 7.8POWERLINE CONDUCTED EMISSIONS

## LIMIT

According to §15.207(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 μH/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 Range (MHz) | Limits (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56* | 56 to 46* |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

** Decreases with the logarithm of the frequency.*

## TEST CONFIGURATION

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

## TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

## TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

### Test Data

| | | | |
|---|---|---|---|
| **Operation Mode:** | Normal Link | **Test Date:** | May 7, 2007 |
| **Temperature:** | 25°C | **Tested by:** | Snake Shan |
| **Humidity:** | 55% RH | | |

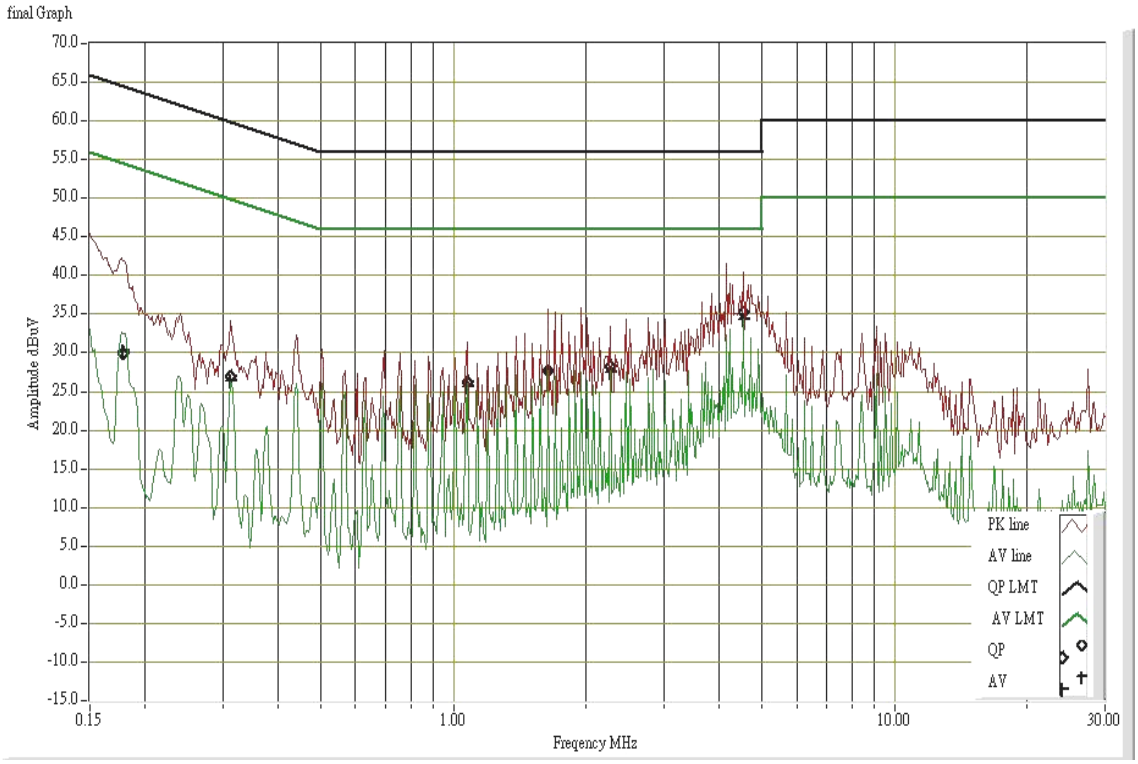
| Freq. (MHz) | QP Reading (dBuV) | AV Reading (dBuV) | Corr. factor (dB) | QP Result (dBuV) | AV Result (dBuV) | QP Limit (dBuV) | AV Limit (dBuV) | QP Margin (dB) | AV Margin (dB) | Note |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.178 | 30.400 | 30.320 | 0.143 | 30.543 | 30.463 | 64.564 | 54.564 | -34.020 | -24.100 | L1 |
| 0.313 | 26.980 | 26.400 | 0.100 | 27.080 | 26.500 | 59.889 | 49.889 | -32.809 | -23.389 | L1 |
| 1.074 | 26.120 | 25.620 | 0.100 | 26.220 | 25.720 | 56.000 | 46.000 | -29.780 | -20.280 | L1 |
| 1.638 | 27.630 | 27.440 | 0.100 | 27.730 | 27.540 | 56.000 | 46.000 | -28.270 | -18.460 | L1 |
| 2.271 | 28.190 | 27.530 | 0.100 | 28.290 | 27.630 | 56.000 | 46.000 | -27.710 | -18.370 | L1 |
| 4.541 | 35.250 | 34.330 | 0.154 | 35.404 | 34.484 | 56.000 | 46.000 | -20.596 | -11.516 | L1 |
| | | | | | | | | | | |
| 0.443 | 30.100 | 28.480 | 0.100 | 30.200 | 28.580 | 57.004 | 47.004 | -26.804 | -18.424 | L2 |
| 0.893 | 29.720 | 29.660 | 0.100 | 29.820 | 29.760 | 56.000 | 46.000 | -26.180 | -16.240 | L2 |
| 1.338 | 23.680 | 22.760 | 0.100 | 23.780 | 22.860 | 56.000 | 46.000 | -32.220 | -23.140 | L2 |
| 2.064 | 31.480 | 31.190 | 0.100 | 31.580 | 31.290 | 56.000 | 46.000 | -24.420 | -14.710 | L2 |
| 2.930 | 32.250 | 29.880 | 0.100 | 32.350 | 29.980 | 56.000 | 46.000 | -23.650 | -16.020 | L2 |
| 4.799 | 26.960 | 24.330 | 0.180 | 27.140 | 24.510 | 56.000 | 46.000 | -28.860 | -21.490 | L2 |

***Remark:***

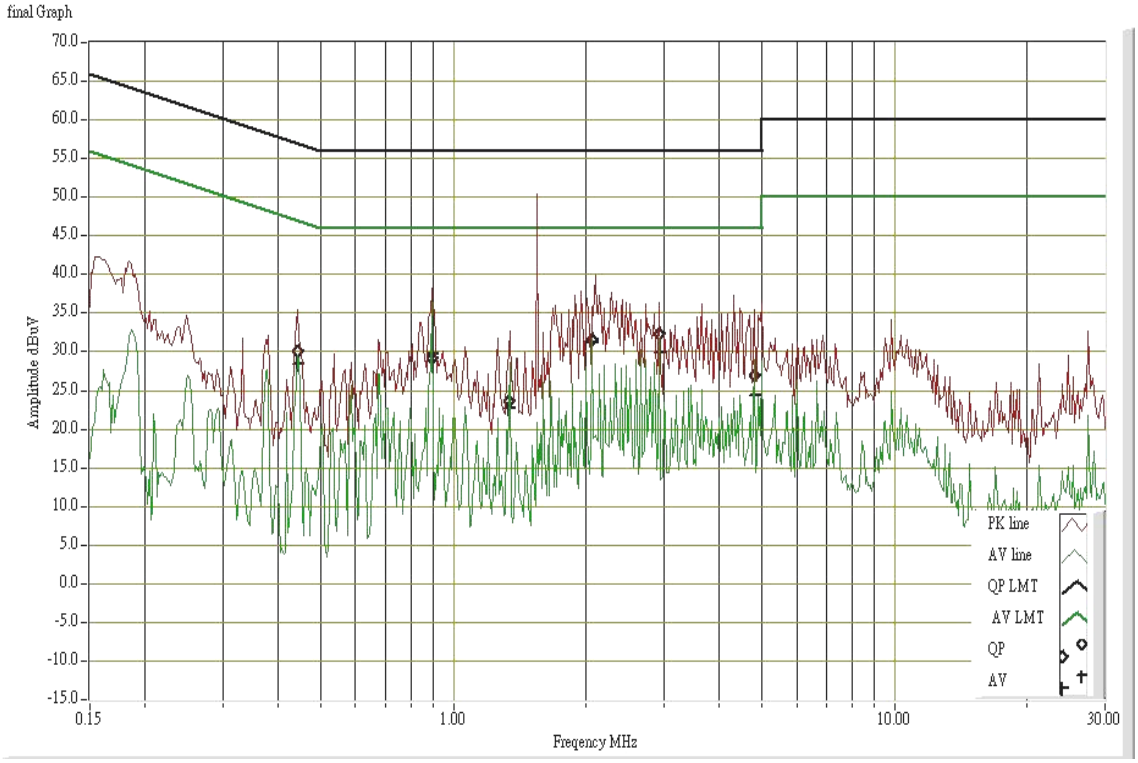
1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*

## Test Plots

### *Conducted emissions (Line 1)*




### *Conducted emissions (Line 2)*



## 7.9TRANSMISSION IN ABSENCE OF DATA

### LIMIT

According to §15.319(f), the device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

Applicants shall include in their application for equipment authorization a description of how this requirement is met.

### TEST RESULTS

*Please refer to the operational description for details.*

***Remark:*** *For the details, please refer to the operational description.*

## 7.10 FREQUENCY STABILITY

### LIMIT

According to §15.407(g), manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the operational description.

### TEST RESULTS

*Please refer to the* operational description *for further details.*

***Remark:*** *An examination of the band-edge plots shows that the emission will stay within the authorized band over the entire temperature range.*

## 7.11 DYNAMIC FREQUENCY SELECTION

## LIMIT

According to §15.407 (h) and FCC 06-96 appendix "compliance measurement procedures for unlicensed-national information infrastructure devices operating in the 5250-5350 MHz and 5470-5725 MHz bands incorporating dynamic frequency selection".

**Table 1: Applicability of DFS requirements prior to use of a channel**

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client (without radar detection) | Client(with radar detection) |
| Non-Occupancy Period | Yes | Not required | Yes |
| DFS Detection Threshold | Yes | Not required | Yes |
| Channel Availability Check Time | Yes | Not required | Not required |
| Uniform Spreading | Yes | Not required | Not required |

**Table 2: Applicability of DFS requirements during normal operation**

| Requirement | Operational Mode | | |
|---|---|---|---|
| | Master | Client (without radar detection) | Client(with radar detection) |
| DFS Detection Threshold | Yes | Not required | Yes |
| Channel Closing Transmission Time | Yes | Yes | Yes |
| Channel Move Time | Yes | Yes | Yes |

**Table 3: Interference Threshold values, Master or Client incorporating In-Service**

| Maximum Transmit Power | Value (see note) |
|---|---|
| >=200 Milliwatt | -64 dBm |
| < 200 Milliwatt | -62 dBm |

Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna.
Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.

**Table 4: DFS Response requirement values**

| Parameter | Value |
|---|---|
| Non-occupancy period | 30 minutes |
| Channel Availability Check Time | 60 seconds |
| Channel Move Time | 10 seconds |
| Channel Closing Transmission Time | 200 milliseconds + approx. 60 milliseconds over remaining 10 second period |

The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows:

- For the Short pulse radar Test Signals this instant is the end of the Burst.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated.
- For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

**Table 5 – Short Pulse Radar Test Waveforms**

| Radar Type | Pulse Width (Microseconds) | PRI (Microseconds) | Pulses | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|
| 1 | 1 | 1428 | 18 | 60% | 30 |
| 2 | 1-5 | 150-230 | 23-29 | 60% | 30 |
| 3 | 6-10 | 200-500 | 16-18 | 60% | 30 |
| 4 | 11-20 | 200-500 | 12-16 | 60% | 30 |
| Aggregate (Radar Types 1-4) | | | | 80% | 120 |

**Table 6 – Long Pulse Radar Test Signal**

| Radar Waveform | Bursts | Pulses per Burst | Pulse Width (µsec) | Chirp Width (µsec) | PRI (µsec) | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|---|---|
| 5 | 8-20 | 1-3 | 50-100 | 5-20 | 1000-2000 | 80% | 30 |

**Table 7 – Frequency Hopping Radar Test Signal**

| Radar Waveform | Pulse Width (µsec) | PRI (µsec) | Burst Length (ms) | Pulses Per Hop | Hopping Rate (kHz) | Minimum Percentage of Successful Detection | Minimum Trials |
|---|---|---|---|---|---|---|---|
| 6 | 1 | 333 | 300 | 9 | 0.33 | 70% | 30 |

# DESCRIPTION OF EUT

## Overview Of EUT With Respect To §15.407 (H) Requirements

The firmware installed in the EUT during testing was:
Firmware Rev: 10.5.1.75

The EUT operates over the 5250-5350 MHz range as a Client Device that does not have radar detection capability.

The antenna assembly utilized with the EUT has a gain of –2.53 dBi.

The highest power level is 14.69 dBm EIRP in the 5250-5350 MHz band.

The EUT uses one transmitter connected to two 50-ohm coaxial antenna ports via a diversity switch. Only one antenna port is connected to the test system since the EUT has one antenna only.

The Slave device associated with the EUT during these tests does not have radar detection capability.

The EUT utilizes an 802.11a IP based architecture.One normal channel bandwidth,is implemented on the channels subject to DFS requirements.

WLAN traffic is generated by streaming the video file TestFile.mp2 “6 ½ Magic Hours” from the Master to the Slave in full motion video mode using the media player with the V2.61 Codec package.

TPC is not required since the maximum EIRP is less than 500 mW (27 dBm).

The EUT utilizes the 802.11a architecture, with a nominal channel bandwidth of 20 MHz.

The Master Device is a Cisco Aironet 802.11a/b/g Access Point, FCC ID: LDK102056.

The rated output power of the Master unit is < 23dBm (EIRP). Therefore the required interference threshold level is -62 dBm. After correction for antenna gain and procedural adjustments, the required conducted threshold at the antenna port is –62 + -2.53 = -64.53 dBm.

The calibrated conducted DFS Detection Threshold level is set to -62 dBm. The tested level is lower than the required level hence it provides margin to the limit.

## Manufacturer’s Statement Regarding Uniform Channel Spreading

The end product implements an automatic channel selection feature at startup such that operation commences on channels distributed across the entire set of allowed 5GHz channels. This feature will ensure uniform spreading is achieved while avoiding non-allowed channels due to prior radar events.

# TEST AND MEASUREMENT SYSTEM

## System Overview

The measurement system is based on a conducted test method.

The short pulse and long pulse signal generating system utilizes the NTIA software. The Vector Signal Generator has been validated by the NTIA. The hopping signal generating system utilizes the CCS simulated hopping method and system, which has been validated by the DoD, FCC and NTIA. The software selects waveform parameters from within the bounds of the signal type on a random basis using uniform distribution.

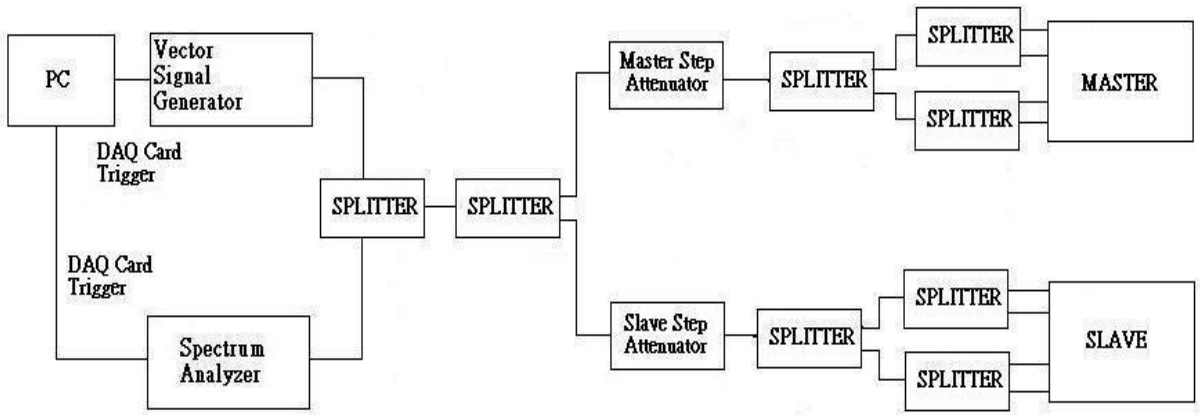
The short pulse types 2, 3 and 4, and the long pulse type 5 parameters are randomized at run-time.

The hopping type 6 pulse parameters are fixed while the hopping sequence is based on the August 2005 NTIA Hopping Frequency List. The initial starting point randomized at run-time and each subsequent starting point is incremented by 475. Each frequency in the 100-length segment is compared to the boundaries of the EUT Detection Bandwidth and the software creates a hopping burst pattern in accordance with Section 7.4.1.3 Method #2 Simulated Frequency Hopping Radar Waveform Generating Subsystem of FCC 06-96 APPENDIX. The frequency of the signal generator is incremented in 1 MHz steps from FL to FH for each successive trial. This incremental sequence is repeated as required to generate a minimum of 30 total trials and to maintain a uniform frequency distribution over the entire Detection Bandwidth.

The signal monitoring equipment consists of a spectrum analyzer set to display 8001 bins on the horizontal axis. The time-domain resolution is 2 msec / bin with a 16 second sweep time, meeting the 10 second short pulse reporting criteria. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold. The time-domain resolution is 3 msec / bin with a 24 second sweep time, meeting the 22 second long pulse reporting criteria and allowing a minimum of 10 seconds after the end of the long pulse waveform.

Should multiple RF ports be utilized for the Master and/or Slave devices (for example, for diversity or MIMO implementations), 50 ohm termination would be removed from the splitter so that connection can be established between splitter and the Master and/or Slave devices.

## Conducted Method System Block Diagram



**System Calibration**

Connect the spectrum analyzer to the test system in place of the master device. Set the signal generator to CW mode. Adjust the amplitude of the signal generator to yield a measured level of –62 dBm on the spectrum analyzer.

Without changing any of the instrument settings, reconnect the spectrum analyzer to the Common port of the Spectrum Analyzer Combiner/Divider and connect a 50 ohm load to the Master Device port of the test system.

Measure the amplitude and calculate the difference from –62 dBm. Adjust the Reference Level Offset of the spectrum analyzer to this difference. Confirm that the signal is displayed at –62 dBm. Readjust the RBW and VBW to 3 MHz, set the span to 10 MHz, and confirm that the signal is still displayed at –62 dBm.

The spectrum analyzer displays the level of the signal generator as received at the antenna ports of the Master Device. The interference detection threshold may be varied from the calibrated value of –62 dBm and the spectrum analyzer will still indicate the level as received by the Master Device.

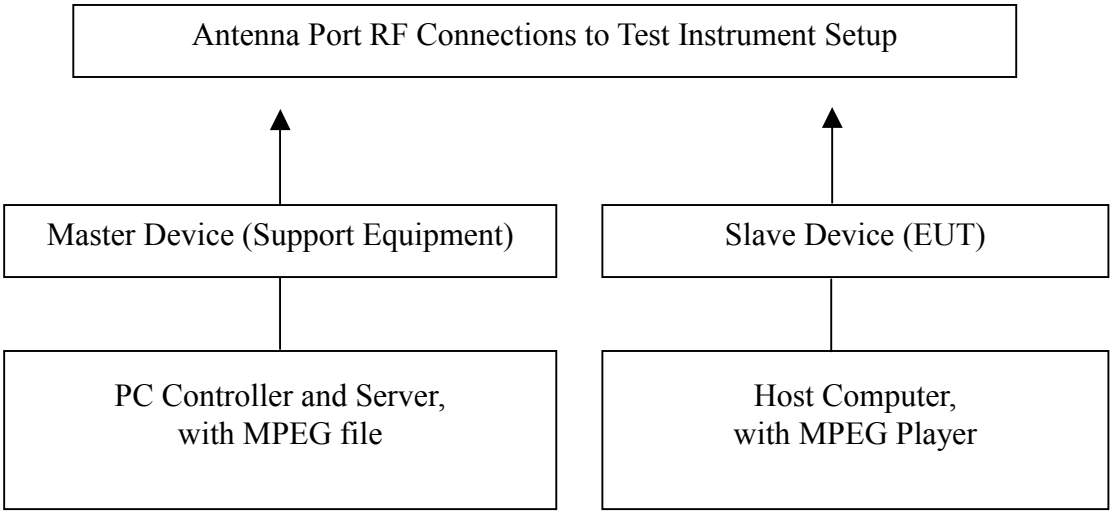
Set the signal generator to produce a radar waveform, trigger a burst manually and measure the level on the spectrum analyzer. Readjust the amplitude of the signal generator as required so that the peak level of the waveform is at a displayed level equal to the required or desired interference detection threshold. Separate signal generator amplitude settings are determined as required for each radar type.

**Adjustment Of Displayed Traffic Level**

Establish a link between the Master and Slave, adjusting the Link Step Attenuator as needed to provide a suitable received level at the Master and Slave devices. Stream the video test file to generate WLAN traffic. Confirm that the WLAN traffic level, as displayed on the spectrum analyzer, is at lower amplitude than the radar detection threshold. Confirm that the displayed traffic is from the Master Device. For Master Device testing confirm that the displayed traffic does not include Slave Device traffic. For Slave Device testing confirm that the displayed traffic does not include Master Device traffic.

If a different setting of the Master Step Attenuator is required to meet the above conditions, perform a new System Calibration for the new Master Step Attenuator setting.

**Test Setup**



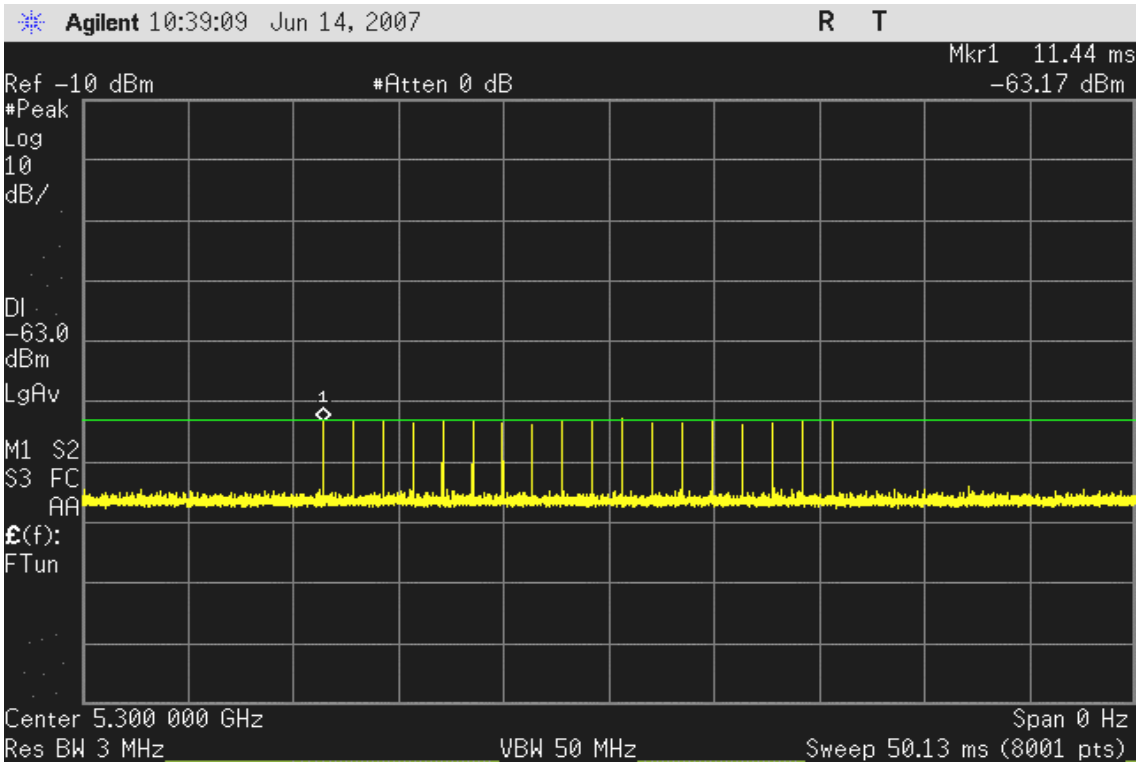

## TEST RESULTS

*No non-compliance noted*

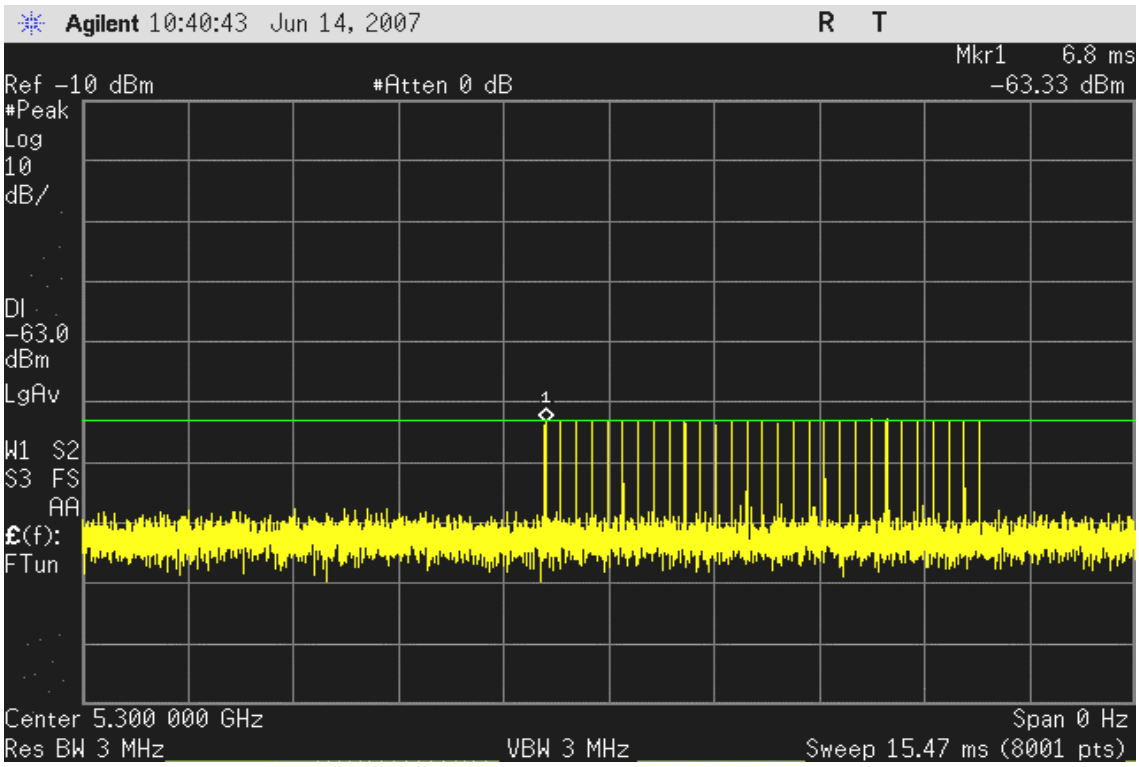
## Test Plot

### PLOTS OF RADAR WAVEFORMS

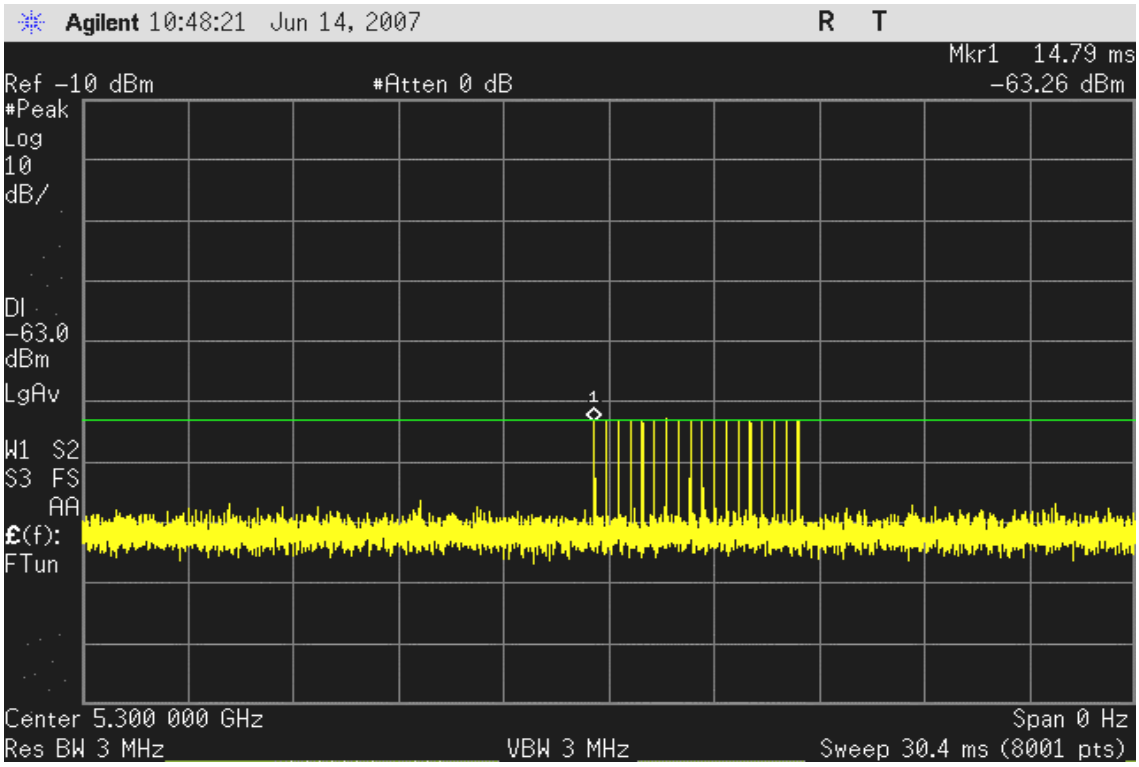
### Sample of Short Pulse Radar Type 1



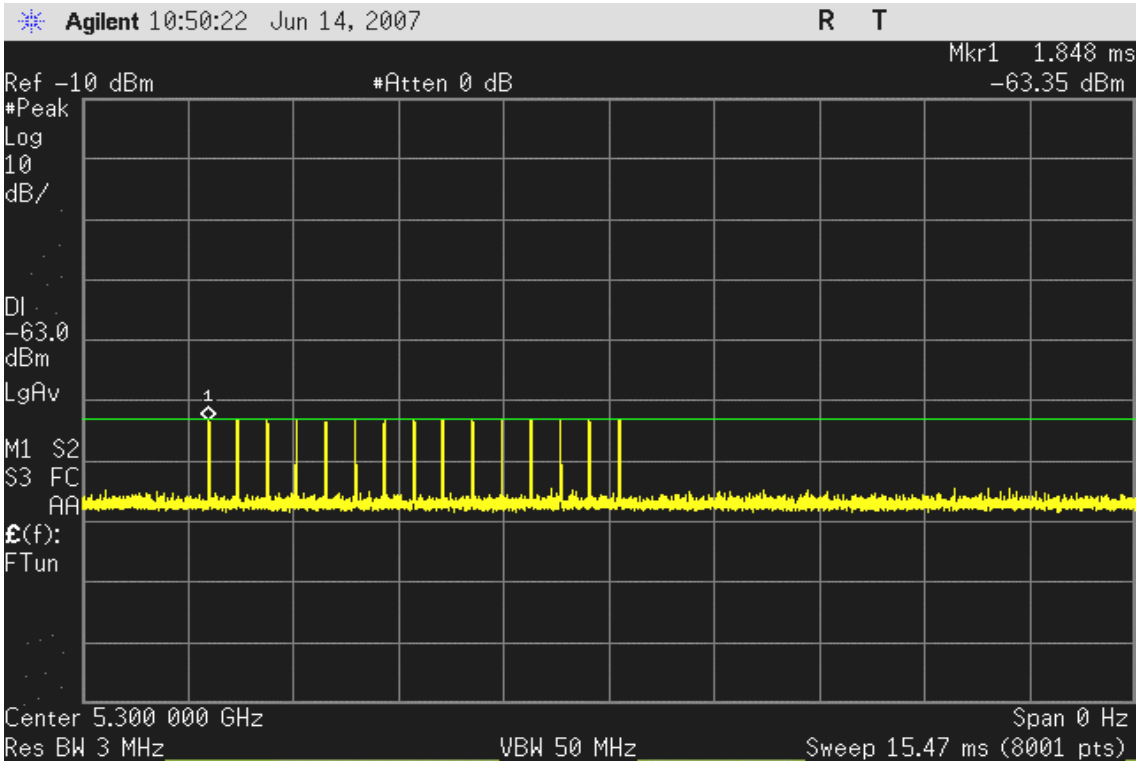

### Sample of Short Pulse Radar Type 2



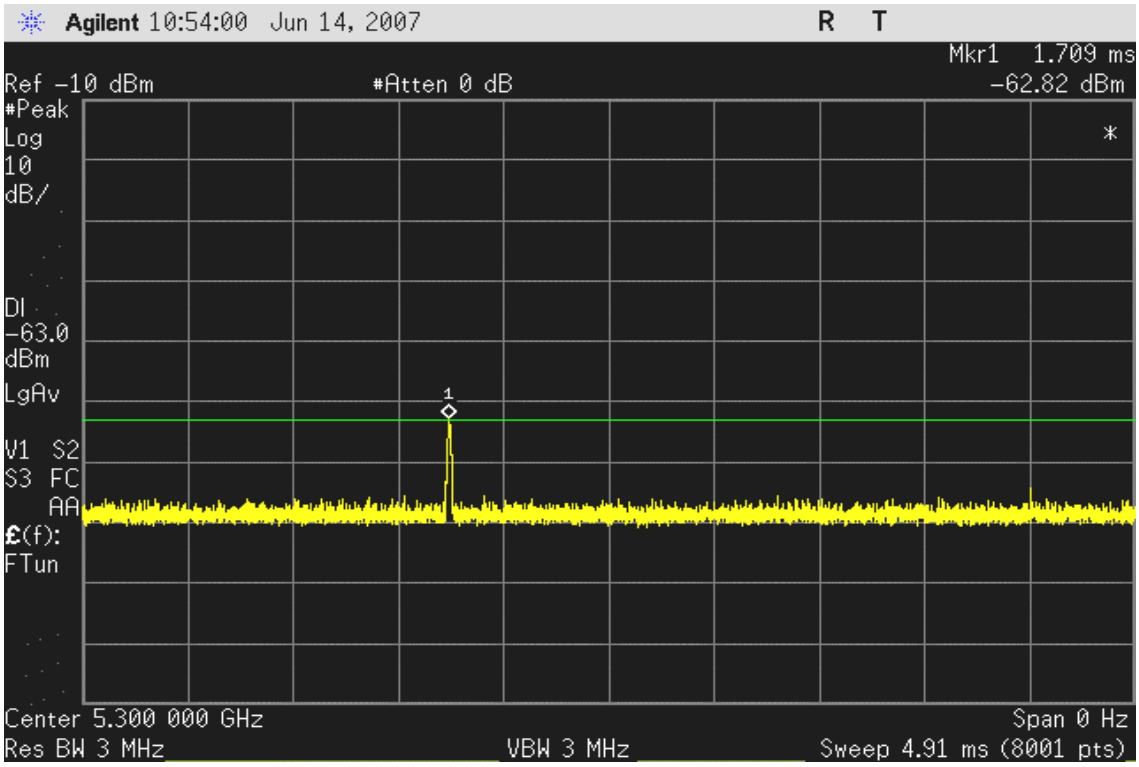
## Sample of Short Pulse Radar Type 3



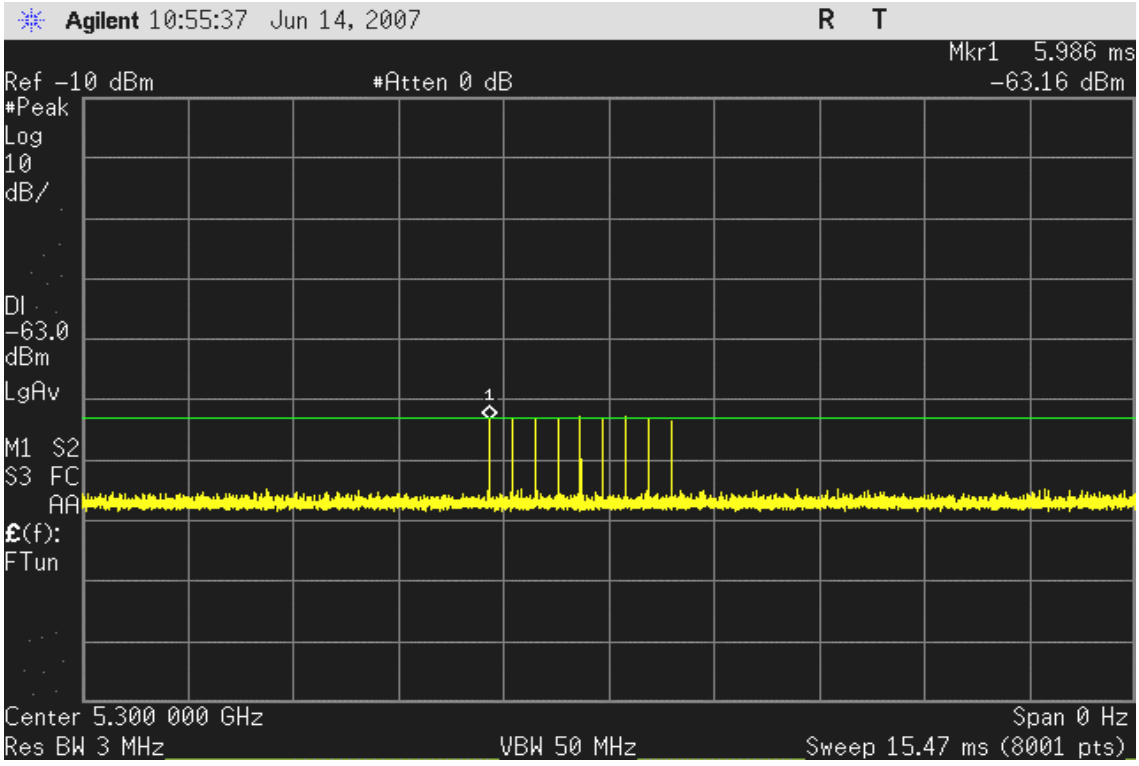

## Sample of Short Pulse Radar Type 4



## Sample of Long Pulse Radar Type 5




## Sample of Frequency Hopping Radar Type 6



# TEST CHANNEL AND METHOD

All tests were performed at a channel center frequency of 5300 MHz utilizing a conducted test method.

## CHANNEL MOVE TIME AND CHANNEL CLOSING TRANSMISSION TIME

### GENERAL REPORTING NOTES

The reference marker is set at the end of last radar pulse.

The delta marker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time =

(Number of analyzer bins showing transmission) * (dwell time per bin)

The observation period over which the aggregate time is calculated

Begins at (Reference Marker + 200 msec) and

Ends no earlier than (Reference Marker + 10 sec).

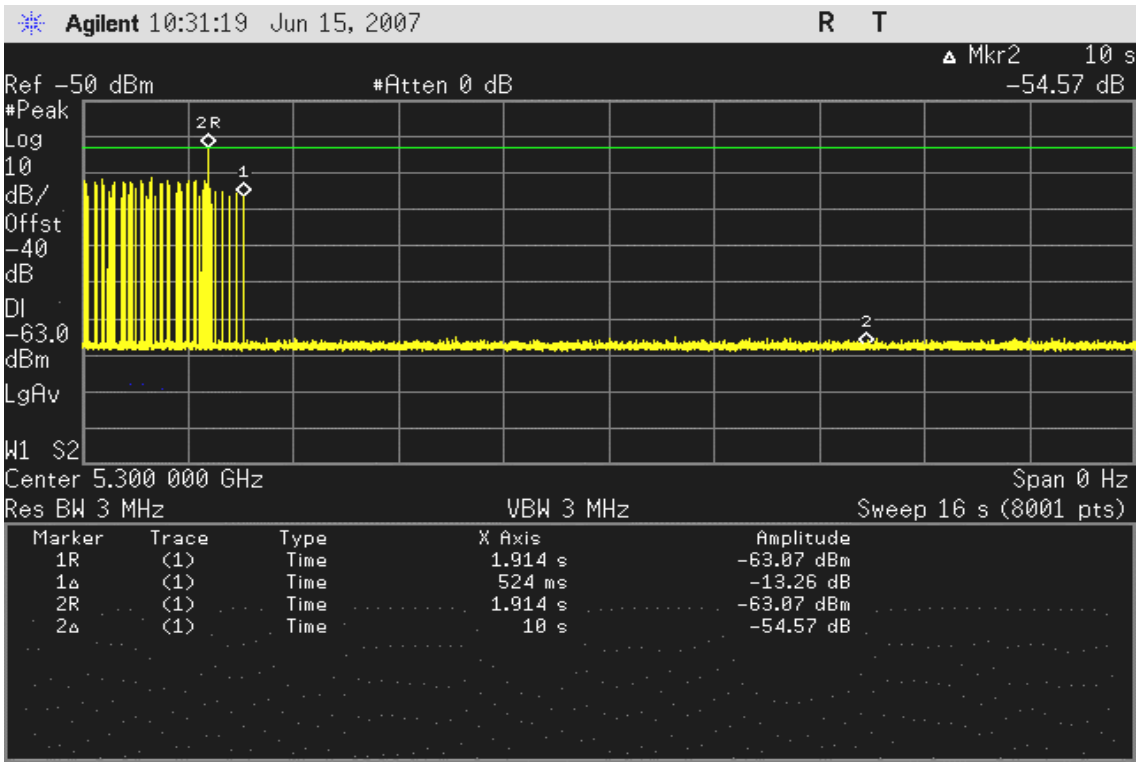
### Type 5 Radar Reporting Notes

The delta marker is set to 10 seconds after the end of the radar pulse.

## Type 1 Channel Move Time Results

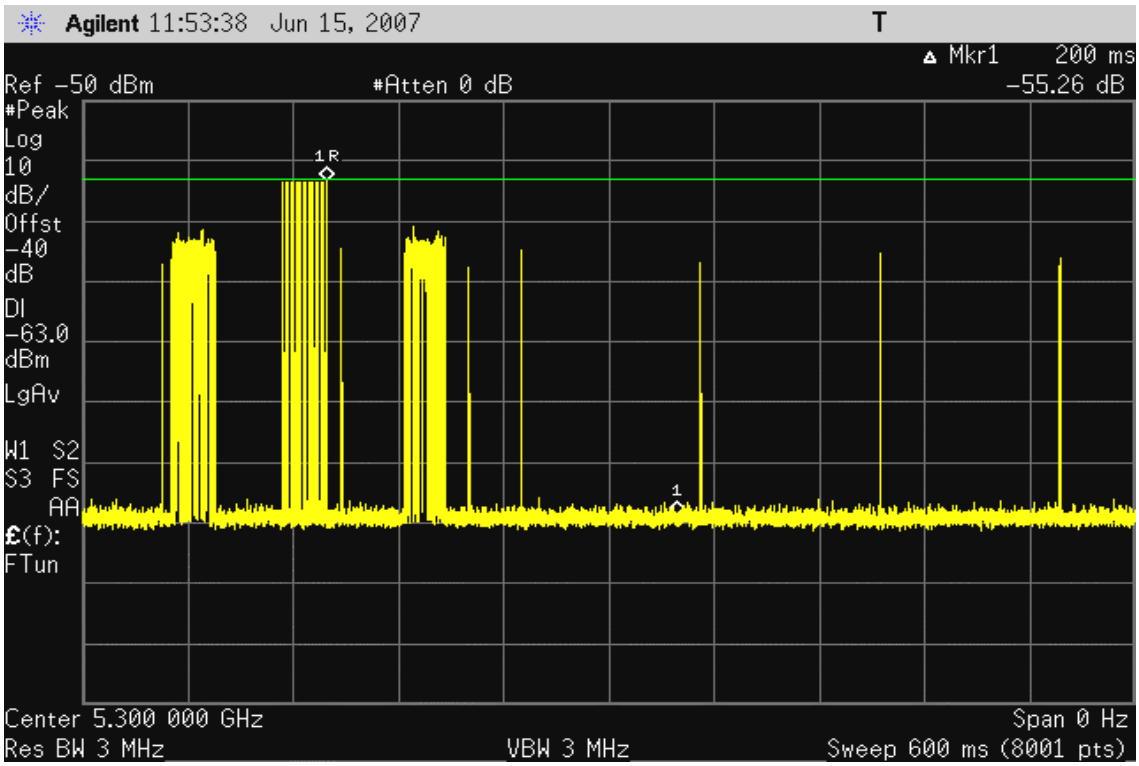
*No non-compliance noted.*

| Channel Move Time (s) | Limit (s) |
|---|---|
| 10 | 10 |



## Type 1 Channel Closing Time Results

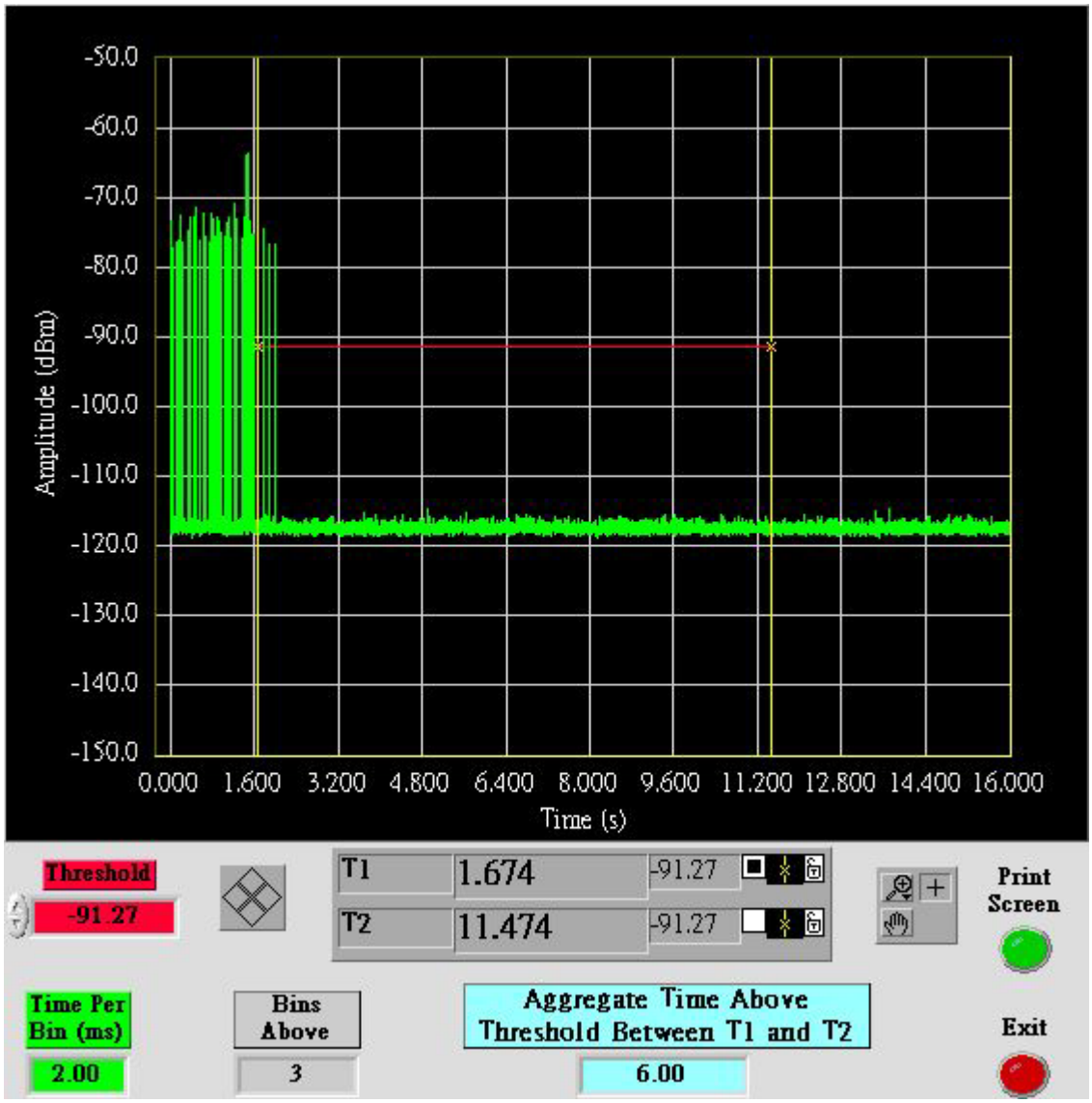
*No non-compliance noted.*



## Type 1 Channel Closing Transmission Time Results

*No non-compliance noted.*

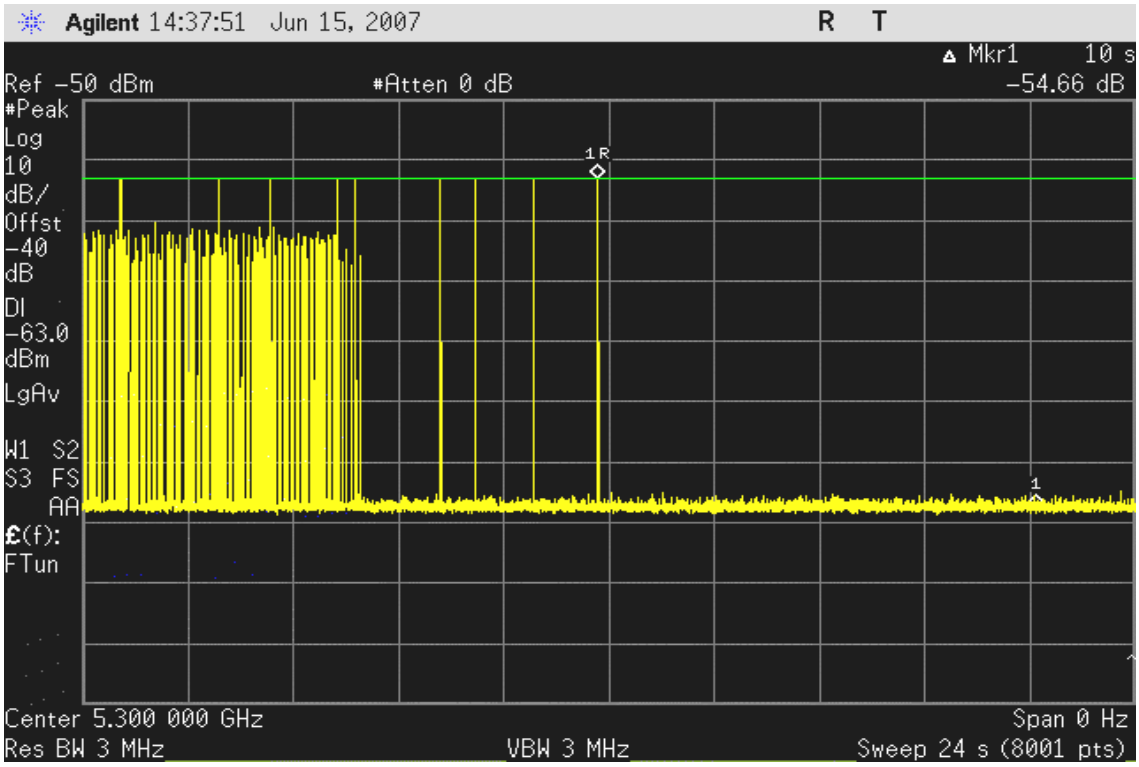
| Aggregate Transmission Time (ms) | Limit (ms) | Margin (ms) |
|---|---|---|
| 6 | 60 | -54 |




Only intermittent transmissions are observed during the aggregate monitoring period.

## Type 5 Channel Move Time Results

No non-compliance noted: The traffic ceases prior to the end of the radar waveform, therefore it also ceases prior to 10 seconds after the end of the radar waveform.



# IN-SERVICE MONITORING

## Test Results

*No non-compliance noted:*

SUMMARY OF DETECTION PROBABILITY

Summary of Detection Probability

| Radar Type | Number of Trials | Detection (%) | Limit (%) | Pass / Fail |
|---|---|---|---|---|
| Short 1 | 30 | 100 | 60 | Pass |
| Short 2 | 30 | 100 | 60 | Pass |
| Short 3 | 30 | 100 | 60 | Pass |
| Short 4 | 30 | 100 | 60 | Pass |
| Aggregate of 1 to 4 | 30 | 100 | 80 | Pass |
| Long 5 | 30 | 100 | 70 | Pass |
| Hopping 6 | 30 | 100 | 80 | Pass |

**Type 1 Detection Probability**

| Table 1: Data Sheet for Fixed Radar Signal 1 | |
|---|---|
| **Trial No.** | **Successful Detection (Yes/No)** |
| 1 | Yes |
| 2 | Yes |
| 3 | Yes |
| 4 | Yes |
| 5 | Yes |
| 6 | Yes |
| 7 | Yes |
| 8 | Yes |
| 9 | Yes |
| 10 | Yes |
| 11 | Yes |
| 12 | Yes |
| 13 | Yes |
| 14 | Yes |
| 15 | Yes |
| 16 | Yes |
| 17 | Yes |
| 18 | Yes |
| 19 | Yes |
| 20 | Yes |
| 21 | Yes |
| 22 | Yes |
| 23 | Yes |
| 24 | Yes |
| 25 | Yes |
| 26 | Yes |
| 27 | Yes |
| 28 | Yes |
| 29 | Yes |
| 30 | Yes |

**Type 2 Detection Probability**

| Table 2: Data Sheet for Fixed Radar Test Signal 2 | | | | |
|---|---|---|---|---|
| **Waveform No.** | **# Pulses per burst** | **Pulse Width (us)** | **Pulse repetition Interval (us)** | **Successful Detection (Yes/No)** |
| 1 | 23 | 1.60 | 168 | Yes |
| 2 | 28 | 4.50 | 154 | Yes |
| 3 | 23 | 2.80 | 228 | Yes |
| 4 | 23 | 5.00 | 213 | Yes |
| 5 | 25 | 1.70 | 184 | Yes |
| 6 | 29 | 2.50 | 157 | Yes |
| 7 | 28 | 1.00 | 196 | Yes |
| 8 | 24 | 1.60 | 202 | Yes |
| 9 | 26 | 3.10 | 200 | Yes |
| 10 | 27 | 1.70 | 217 | Yes |
| 11 | 23 | 1.50 | 198 | Yes |
| 12 | 26 | 3.50 | 188 | Yes |
| 13 | 27 | 2.10 | 223 | Yes |
| 14 | 25 | 1.00 | 186 | Yes |
| 15 | 26 | 3.30 | 207 | Yes |
| 16 | 28 | 3.40 | 178 | Yes |
| 17 | 26 | 2.00 | 202 | Yes |
| 18 | 24 | 1.10 | 195 | Yes |
| 19 | 27 | 3.50 | 195 | Yes |
| 20 | 27 | 4.20 | 179 | Yes |
| 21 | 25 | 2.30 | 229 | Yes |
| 22 | 26 | 3.90 | 215 | Yes |
| 23 | 23 | 2.40 | 206 | Yes |
| 24 | 25 | 4.40 | 219 | Yes |
| 25 | 26 | 4.00 | 184 | Yes |
| 26 | 29 | 3.60 | 222 | Yes |
| 27 | 28 | 2.20 | 151 | Yes |
| 28 | 29 | 2.90 | 226 | Yes |
| 29 | 24 | 2.10 | 210 | Yes |
| 30 | 24 | 1.40 | 175 | Yes |

Note: Type 2 randomized parameters are shown in a separate document.

**Type 3 Detection Probability**

| Table 3: Data Sheet for Fixed Radar Test Signal 3 | | | | |
|---|---|---|---|---|
| **Waveform No.** | **# Pulses per burst** | **Pulse Width (us)** | **Pulse repetition Interval (us)** | **Successful Detection (Yes/No)** |
| 1 | 16 | 8.70 | 318 | Yes |
| 2 | 18 | 8.50 | 470 | Yes |
| 3 | 18 | 7.00 | 338 | Yes |
| 4 | 17 | 6.10 | 256 | Yes |
| 5 | 17 | 5.30 | 315 | Yes |
| 6 | 16 | 6.80 | 453 | Yes |
| 7 | 16 | 5.80 | 425 | Yes |
| 8 | 17 | 7.70 | 288 | Yes |
| 9 | 18 | 5.10 | 286 | Yes |
| 10 | 16 | 8.10 | 433 | Yes |
| 11 | 17 | 7.50 | 385 | Yes |
| 12 | 17 | 7.30 | 468 | Yes |
| 13 | 17 | 7.80 | 271 | Yes |
| 14 | 18 | 8.50 | 306 | Yes |
| 15 | 17 | 8.70 | 394 | Yes |
| 16 | 17 | 7.40 | 297 | Yes |
| 17 | 18 | 9.10 | 488 | Yes |
| 18 | 18 | 8.70 | 273 | Yes |
| 19 | 17 | 6.30 | 284 | Yes |
| 20 | 16 | 7.60 | 322 | Yes |
| 21 | 16 | 7.00 | 272 | Yes |
| 22 | 18 | 8.10 | 496 | Yes |
| 23 | 18 | 9.30 | 409 | Yes |
| 24 | 17 | 9.60 | 458 | Yes |
| 25 | 17 | 6.80 | 408 | Yes |
| 26 | 18 | 10.00 | 256 | Yes |
| 27 | 18 | 6.60 | 446 | Yes |
| 28 | 17 | 10.00 | 326 | Yes |
| 29 | 17 | 6.00 | 486 | Yes |
| 30 | 17 | 6.60 | 385 | Yes |

Note: Type 3 randomized parameters are shown in a separate document.

**Type 4 Detection Probability**

| Table 4: Data Sheet for Fixed Radar Test Signal 4 | | | | |
|---|---|---|---|---|
| **Waveform No.** | **# Pulses per burst** | **Pulse Width (us)** | **Pulse repetition Interval (us)** | **Successful Detection (Yes/No)** |
| 1 | 12 | 17.60 | 398 | Yes |
| 2 | 12 | 17.90 | 368 | Yes |
| 3 | 16 | 14.50 | 386 | Yes |
| 4 | 15 | 14.00 | 462 | Yes |
| 5 | 13 | 15.20 | 487 | Yes |
| 6 | 13 | 17.20 | 414 | Yes |
| 7 | 14 | 19.40 | 437 | Yes |
| 8 | 12 | 11.00 | 315 | Yes |
| 9 | 15 | 11.40 | 482 | Yes |
| 10 | 13 | 10.20 | 396 | Yes |
| 11 | 13 | 16.30 | 304 | Yes |
| 12 | 13 | 20.00 | 317 | Yes |
| 13 | 14 | 15.80 | 396 | Yes |
| 14 | 15 | 12.60 | 464 | Yes |
| 15 | 15 | 12.30 | 466 | Yes |
| 16 | 12 | 12.40 | 418 | Yes |
| 17 | 15 | 16.20 | 382 | Yes |
| 18 | 13 | 11.20 | 412 | Yes |
| 19 | 14 | 12.00 | 380 | Yes |
| 20 | 16 | 14.90 | 423 | Yes |
| 21 | 14 | 10.10 | 276 | Yes |
| 22 | 13 | 11.50 | 469 | Yes |
| 23 | 14 | 17.90 | 274 | Yes |
| 24 | 12 | 10.70 | 279 | Yes |
| 25 | 12 | 16.20 | 314 | Yes |
| 26 | 16 | 13.30 | 361 | Yes |
| 27 | 14 | 17.80 | 305 | Yes |
| 28 | 13 | 16.20 | 283 | Yes |
| 29 | 14 | 18.30 | 393 | Yes |
| 30 | 12 | 12.60 | 322 | Yes |

Note: Type 4 randomized parameters are shown in a separate document.

**Type 5 Detection Probability**

| Table 5: Data Sheet for Long Pulse Radar Test Signal 5 | |
|---|---|
| **Waveform No.** | **Successful Detection (Yes/No)** |
| 1 | Yes |
| 2 | Yes |
| 3 | Yes |
| 4 | Yes |
| 5 | Yes |
| 6 | Yes |
| 7 | Yes |
| 8 | Yes |
| 9 | Yes |
| 10 | Yes |
| 11 | Yes |
| 12 | Yes |
| 13 | Yes |
| 14 | Yes |
| 15 | Yes |
| 16 | Yes |
| 17 | Yes |
| 18 | Yes |
| 19 | Yes |
| 20 | Yes |
| 21 | Yes |
| 22 | Yes |
| 23 | Yes |
| 24 | Yes |
| 25 | Yes |
| 26 | Yes |
| 27 | Yes |
| 28 | Yes |
| 29 | Yes |
| 30 | Yes |

**Type 6 Detection Probability**

| Table 6: Data Sheet for Hopping Signal | |
|---|---|
| **Trial No.** | **Successful Detection (Yes/No)** |
| 1 | Yes |
| 2 | Yes |
| 3 | Yes |
| 4 | Yes |
| 5 | Yes |
| 6 | Yes |
| 7 | Yes |
| 8 | Yes |
| 9 | Yes |
| 10 | Yes |
| 11 | Yes |
| 12 | Yes |
| 13 | Yes |
| 14 | Yes |
| 15 | Yes |
| 16 | Yes |
| 17 | Yes |
| 18 | Yes |
| 19 | Yes |
| 20 | Yes |
| 21 | Yes |
| 22 | Yes |
| 23 | Yes |
| 24 | Yes |
| 25 | Yes |
| 26 | Yes |
| 27 | Yes |
| 28 | Yes |
| 29 | Yes |
| 30 | Yes |