



FCC CFR47 PART 15 CERTIFICATION

TEST REPORT

FOR

2.4GHZ BLUETOOTH HAND-HELD UNIT

MODEL:Tungsten T (aka Palm m550)

FCC ID: O3W550000

REPORT NUMBER: 02U1357-1

ISSUE DATE: JULY 29, 2002

Prepared for
Palm Solutions Group
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USA

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1. TEST RESULT CERTIFICATION

COMPANY NAME: PALM SOLUTIONS GROUP
400 N. McCarthy Blvd
Milpitas, CA 95035 USA

EUT DESCRIPTION: 2.4GHZ BLUETOOTH HAND-HELD UNIT

MODEL NAME: Tungsten T

DATE TESTED: JUNE 14 – 21, 2002

| | |
|-----------------------|-------------------------------|
| TYPE OF EQUIPMENT | INTENTIONAL RADIATOR |
| EQUIPMENT TYPE | 2.4GHz TRANSCEIVER |
| MEASUREMENT PROCEDURE | ANSI 63.4 / 1992, TIA/EIA 603 |
| PROCEDURE | CERTIFICATION |
| FCC RULE | CFR 47 PART 15 Subpart C |

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirement set forth in CFR 47, PART 15 Subpart C. The equipment in the configuration described in this report, shows the measured emission levels emanating from the equipment do not exceed the specified limit.

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Tested By:



Approved & Released For CCS By:



THU CHAN
SENIOR EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

STEVE CHENG
EMC ENGINEERING MANAGER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

Tungsten T is a hand-held PDA utilizing 2.4GHz Bluetooth technology. This transceiver is designed to transmit & receive over the frequency range of 2402 MHz to 2480 MHz, with a maximum power output of 0.551mW and a built-in antenna.

3. TEST METHODOLOGY

Both conducted and radiated testing were performed according to the procedures documented on chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057.

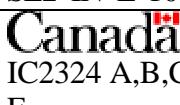
4. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2))

5.1 Laboratory Accreditations and Listings

| Country | Agency | Scope of Accreditation | Logo |
|---------|-----------------|---|--|
| USA | NVLAP* | FCC Part 15, CISPR 22, AS/NZS 3548, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11, CNS 13438 |  200065-0 |
| USA | FCC | 3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements |  1300 |
| Japan | VCCI | CISPR 22 Two OATS and one conducted Site |  R-1014, R-619, C-640 |
| Norway | NEMKO | EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1 |  ELA 117 |
| Norway | NEMKO | EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC |  ELA-171 |
| Taiwan | BSMI | CNS 13438 |  SL2-IN-E-1012 |
| Canada | Industry Canada | RSS210 Low Power Transmitter and Receiver |  IC2324 A,B,C, and F |

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

6. CALIBRATION AND UNCERTAINTY

6.1 Measuring 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.

6.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Radiated Emission | |
|--------------------------------------|-------------|
| 30MHz – 200 MHz | +/- 3.3dB |
| 200MHz – 1000MHz | +4.5/-2.9dB |
| 1000MHz – 2000MHz | +4.6/-2.2dB |
| Power Line Conducted Emission | |
| 150kHz – 30MHz | +/-2.9 |

Any results falling within the above values are deemed to be marginal.

6.3 Test and Measurement Equipment

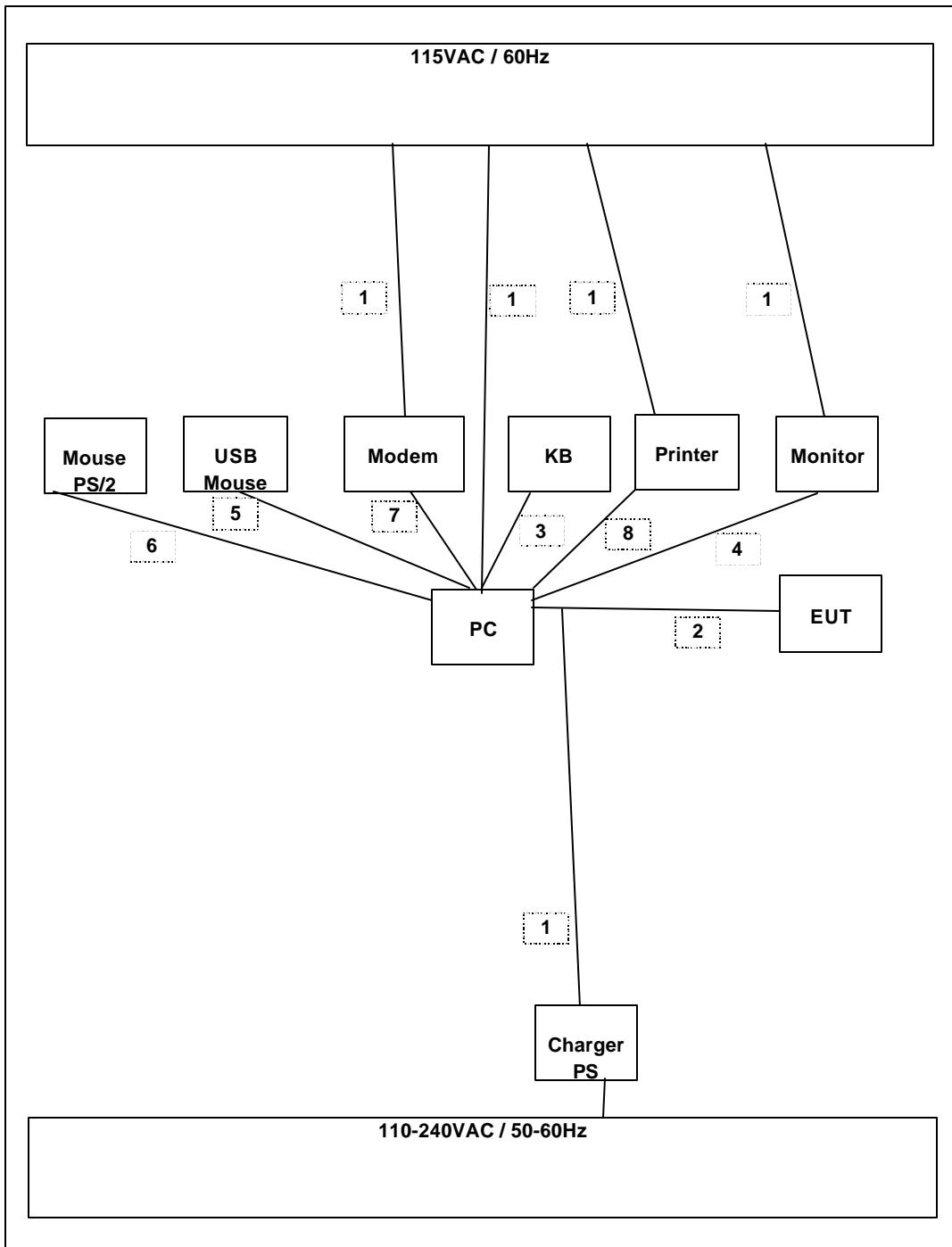
The following test and measurement equipment was utilized for the tests documented in this report:

| TEST AND MEASUREMENT EQUIPMENT LIST | | | | |
|-------------------------------------|-----------------------------|------------------|---------------|----------------------|
| Name of Equipment | Manufacturer | Model | Serial Number | Calibration Due Date |
| Spectrum Analyzer | HP | 8566B | 2140A01296 | 5/23/03 |
| Spectrum Display | HP | 85662A | 3026A19146 | 5/23/03 |
| Quasi-Peak Detector | HP | 85650A | 2811A01335 | 5/23/03 |
| Pre-Amplifier | HP | 8447D (P5) | 2944A06550 | 8/10/02 |
| Antenna, Bicon | Eaton | 94455-1 | 1214 | 3/30/03 |
| Antenna, LP | EMCO | 3146 | 9107-3163 | 3/30/03 |
| Line Filter | Lindgren | LMF-3489 | 497 | N.C.R. |
| LISN | Fisher Custom Communication | LISN-50/250-25-2 | 114 | 4/23/03 |
| EMI Test Receiver | Rohde & Schwarz | ESHS 20 | 827129/006 | 4/23/03 |
| Spectrum Analyzer | HP | 8593EM | 3710A00205 | 6/14/03 |
| Preamplifier (1 - 26.5GHz) | MITEQ | NSP2600-44 | 646456 | 4/26/03 |
| Horn Antenna (1 - 18GHz) | EMCO | 3115 | 6717 | 1/31/03 |
| Horn Antenna (18 - 26GHz) | Antenna Research Associates | MWH 1826/B | 1013 | 7/26/02 |
| High Pass Filter (4.57GHz) | FSY Microwave | FM-4570-9SS | 003 | N.C.R. |

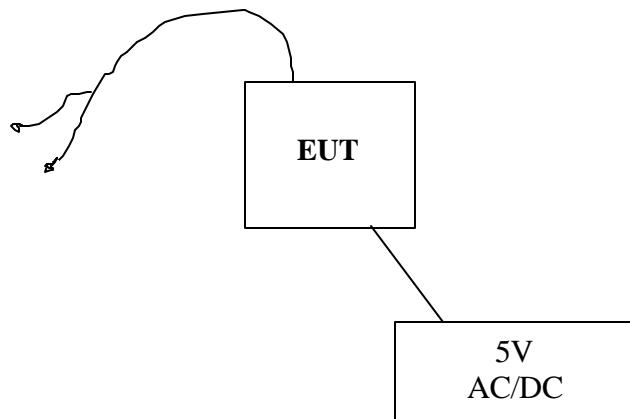
7. SUPPORT EQUIPMENT / EUT SETUP

The following peripheral support equipment was utilized to operate the equipment under test:

Test Diagram for 15.207 & 15.209 (Below 1GHz)



Test Diagram for Fundamental, Harmonic & Spurious Measurements



I/O CABLES

| Cable No | I/O Port | # of I/O Port | Connector Type | Type of Cable | Cable Length | Data Traffic | Bundled | Remark |
|----------|----------|---------------|----------------|---------------|--------------|--------------|---------|------------------|
| 1 | AC | 1 | US 115VAC | Un-shielded | 2m | No | No | Bundle - LC Test |
| 2 | USB/IO | 1 | USB | Shielded | 2m | Yes | No | |
| 3 | KB | 1 | PS/2 | Shielded | 2m | Yes | No | |
| 4 | Video | 1 | DB15 | Shielded | 2m | Yes | Yes | |
| 5 | Mouse | 1 | USB | Shielded | 2m | Yes | No | |
| 6 | Mouse | 1 | PS/2 | Shielded | 2m | Yes | No | |
| 7 | Modem | 1 | DB9 | Shielded | 2m | Yes | No | |
| 8 | Printer | 1 | DB25 | Shielded | 2m | Yes | Yes | |

8. APPLICABLE RULES

§15.247 (b) (1) - POWER OUTPUT

(b) The maximum peak output power of the intentional radiator shall not exceed the following:

- (1) For frequency hopping systems operating in the 2400-2483.5 MHz or 5725-5850 MHz band, and all direct sequence systems: 1 watt (30dBm)

§15.247 (a) (1) – HOPPING FREQUENCY SEPERATION

- (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

§15.247 (a) (1) (ii) – NUMBER OF HOPPING FREQUENCIES

- (ii) Frequency hopping systems operating in the 2400 – 2483.5 MHz and 5725 – 5850 MHz bands shall use at least 75 hopping frequencies.

§15.247 (a) (1) (ii) - BANDWIDTH LIMITATION

- (a) (1) (ii) The maximum 20 dB bandwidth of the hopping channel is 1 MHz.

§15.247 (c) – SPURIOUS EMISSION

(c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

§15.247 (d) and §15.247 (f) - PEAK POWER SPECTRAL DENSITY

(d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

(f) The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

§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.

§15.207- CONDUCTED LIMITS

(a) For an intentional radiator which 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 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

FCC 15.207

| FREQUENCY RANGE | FIELD STRENGTH (Microvolts) | FIELD STRENGTH (dBuV)/QP |
|-----------------|--------------------------------|-----------------------------|
| 450kHz-30MHz | 250 | 48 |

§15.209- RADIATED EMISSION LIMITS; GENERAL REQUIREMENTS

(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 (micro volts/meter) | Measurement Distance (meters) |
|--------------------|---------------------------------------|----------------------------------|
| 30 - 88 | 100 ** | 3 |
| 88 - 216 | 150 ** | 3 |
| 216 - 960 | 200 ** | 3 |
| Above 960 | 500 | 3 |

** 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.

(b) In the emission table above, the tighter limit applies at the band edges.

FCC PART 15.209

| MEASURING DISTANCE OF 3 METER | | |
|-------------------------------|----------------------------------|----------------------------|
| FREQUENCY RANGE (MHz) | FIELD STRENGTH (Microvolts/m) | FIELD STRENGTH (dBuV/m) |
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

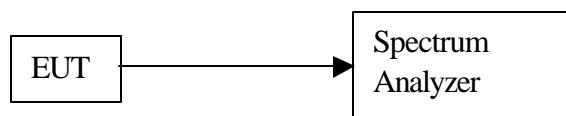
9. TEST SETUP, PROCEDURE AND RESULT

9.1 PEAK POWER OUTPUT

TEST SETUP

Detector Function Setting of Test Receiver

| Frequency Range (MHz) | Detector Function | Resolution Bandwidth | Video Bandwidth |
|-----------------------|--|---|---|
| Above 1000 | <input checked="" type="checkbox"/> Peak | <input checked="" type="checkbox"/> 3 MHz | <input checked="" type="checkbox"/> 3 MHz |



TEST PROCEDURE

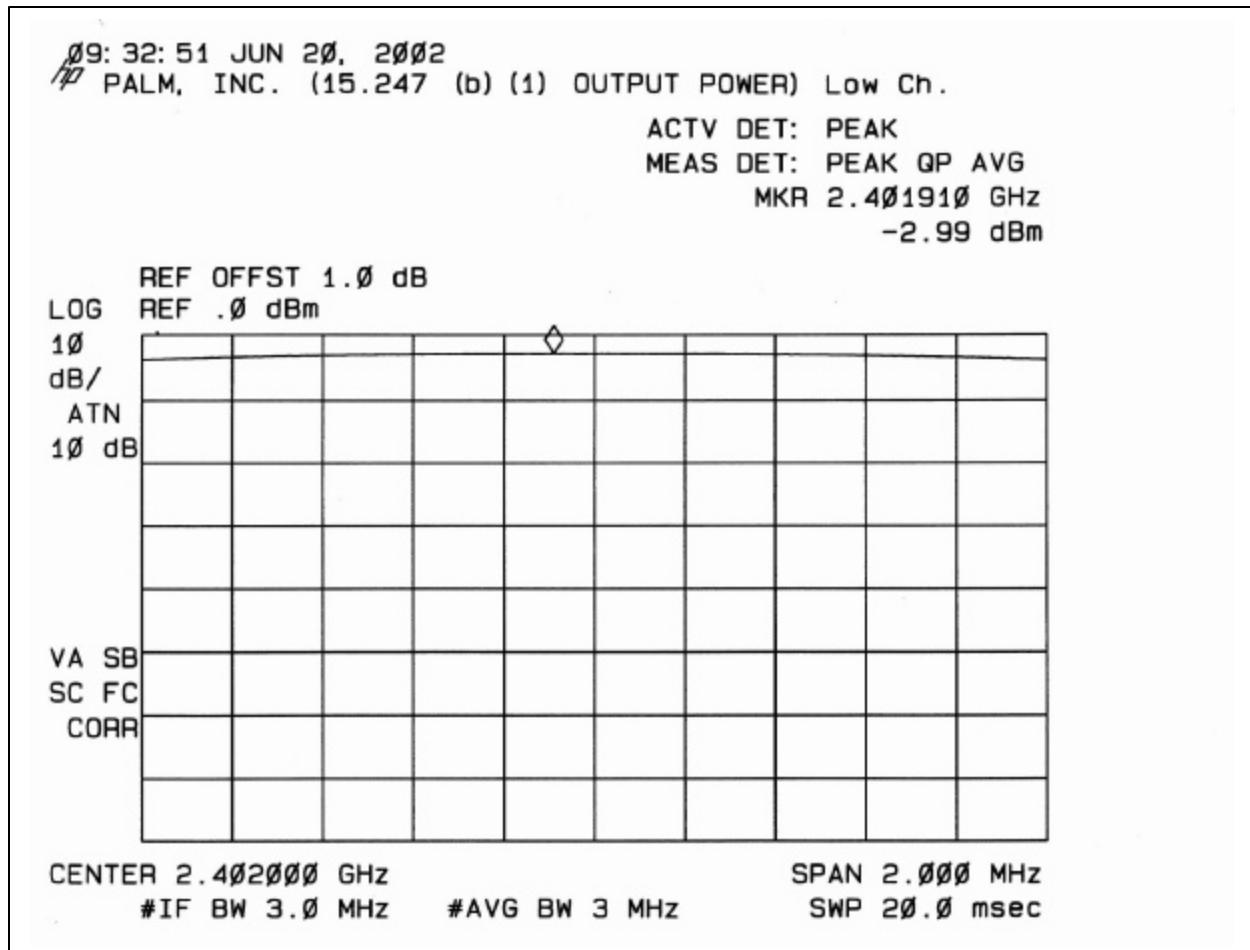
The EUT is configured on a test bench as shown above in a continuously transmitting / receiving mode, with hopping stopped on assigned channel.

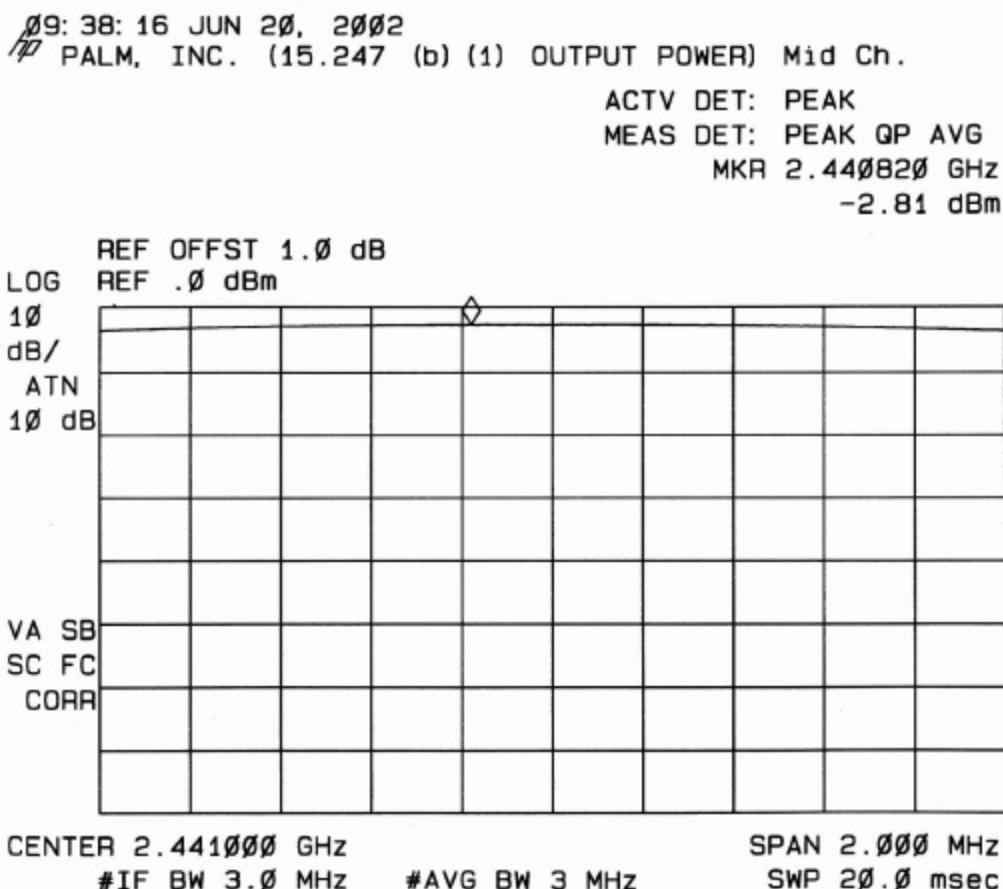
While the transceiver started, the analyzer MAX HOLD function is used to capture the emissions and a plot is made with the marker at the peak emission.

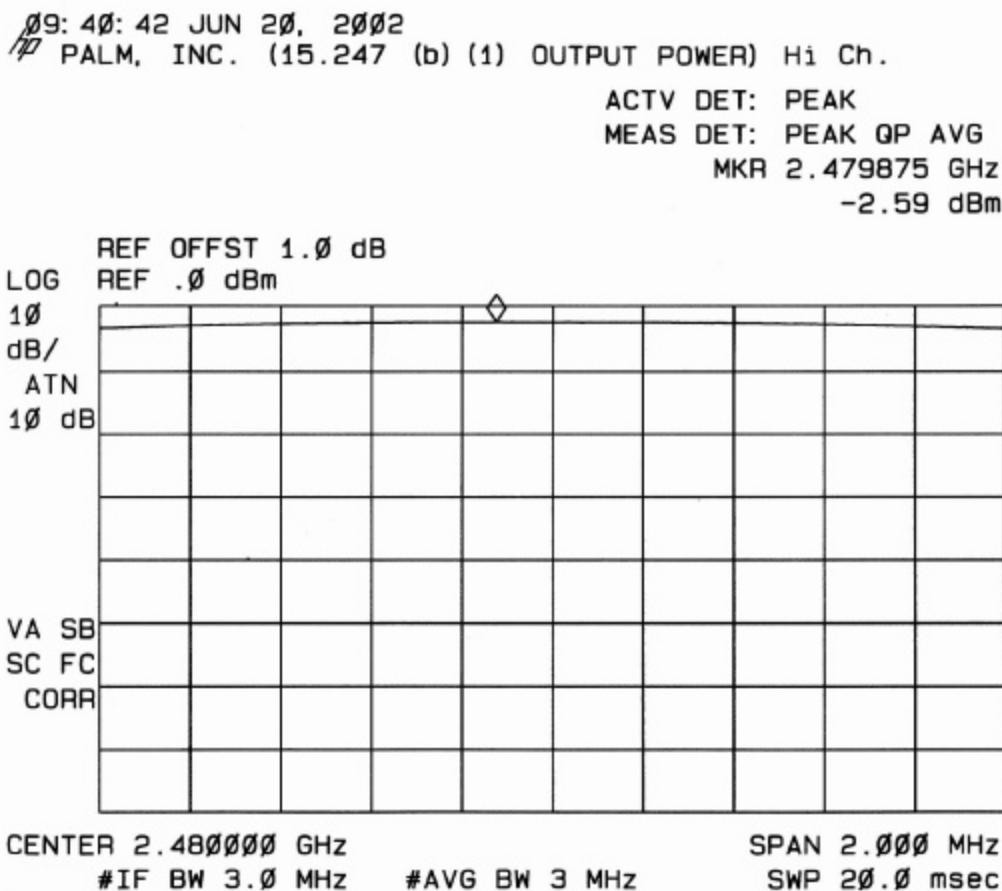
| Channel | Frequency (MHz) | EUT Reading (mW) / (dBm) |
|---------|-----------------|--------------------------|
| LOW | 2402 | 0.502 (mW) / -2.99 (dBm) |
| MID | 2441 | 0.524 (mW) / -2.81 (dBm) |
| HIGH | 2480 | 0.551 (mW) / -2.59 (dBm) |

See plot below:

POWER OUTPUT PLOT





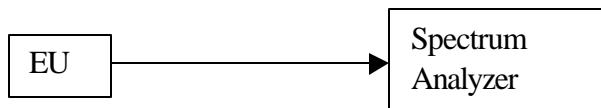


9.2 HOPPING FREQUENCY SEPARATION

TEST SETUP

Detector Function Setting of Test Receiver

| Center Frequency (MHz) | Detector Function | Resolution Bandwidth | Video Bandwidth |
|------------------------|--|---|---|
| 2441 | <input checked="" type="checkbox"/> Peak | <input checked="" type="checkbox"/> 100 kHz | <input checked="" type="checkbox"/> 100 kHz |



TEST PROCEDURE

Connect the Eut's antenna port to the Spectrum Analyzer's input port.

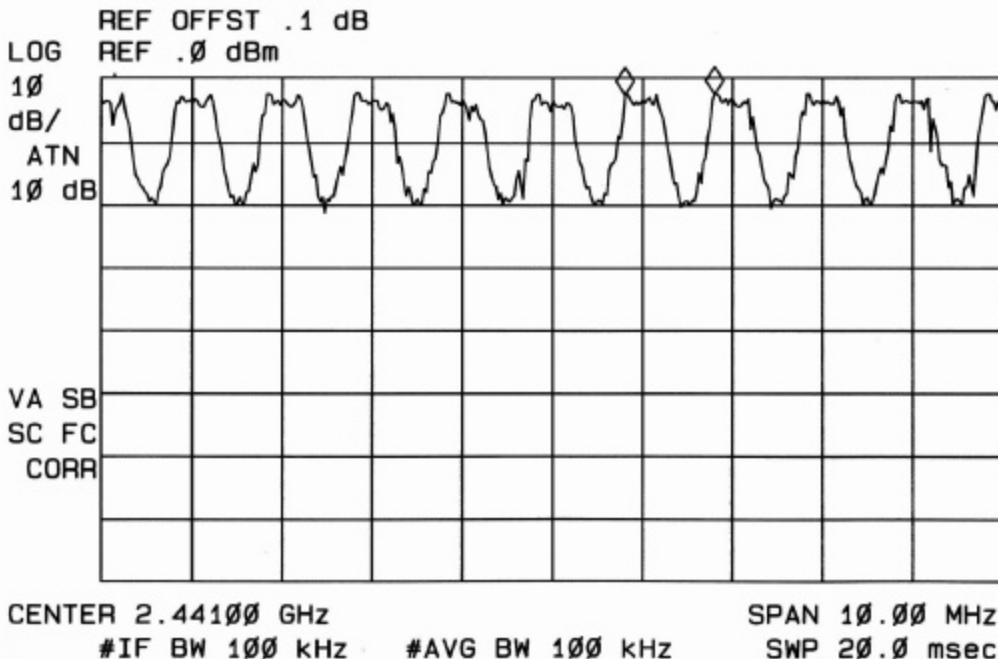
Set frequency span to at least 10 MHz. Let EUT to complete the pseudorandom hopping, then set marker delta to measure the separation between two hops.

RESULT

No non-compliance noted. See plot below.

09:04:42 JUN 18, 2002
P ALM, INC. (15.247 (a) (1) Hopping Freq. Separation)

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKA 1.00 MHz
.12 dB

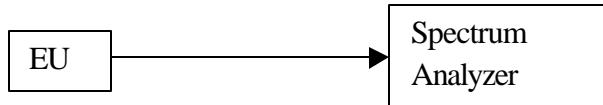


9.3 NUMBER OF HOPPING FREQUENCIES

TEST SETUP

Detector Function Setting of Test Receiver

| Center Frequency (MHz) | Detector Function | Resolution Bandwidth | Video Bandwidth |
|------------------------|--|---|---|
| 2441 | <input checked="" type="checkbox"/> Peak | <input checked="" type="checkbox"/> 100 kHz | <input checked="" type="checkbox"/> 100 kHz |



TEST PROCEDURE

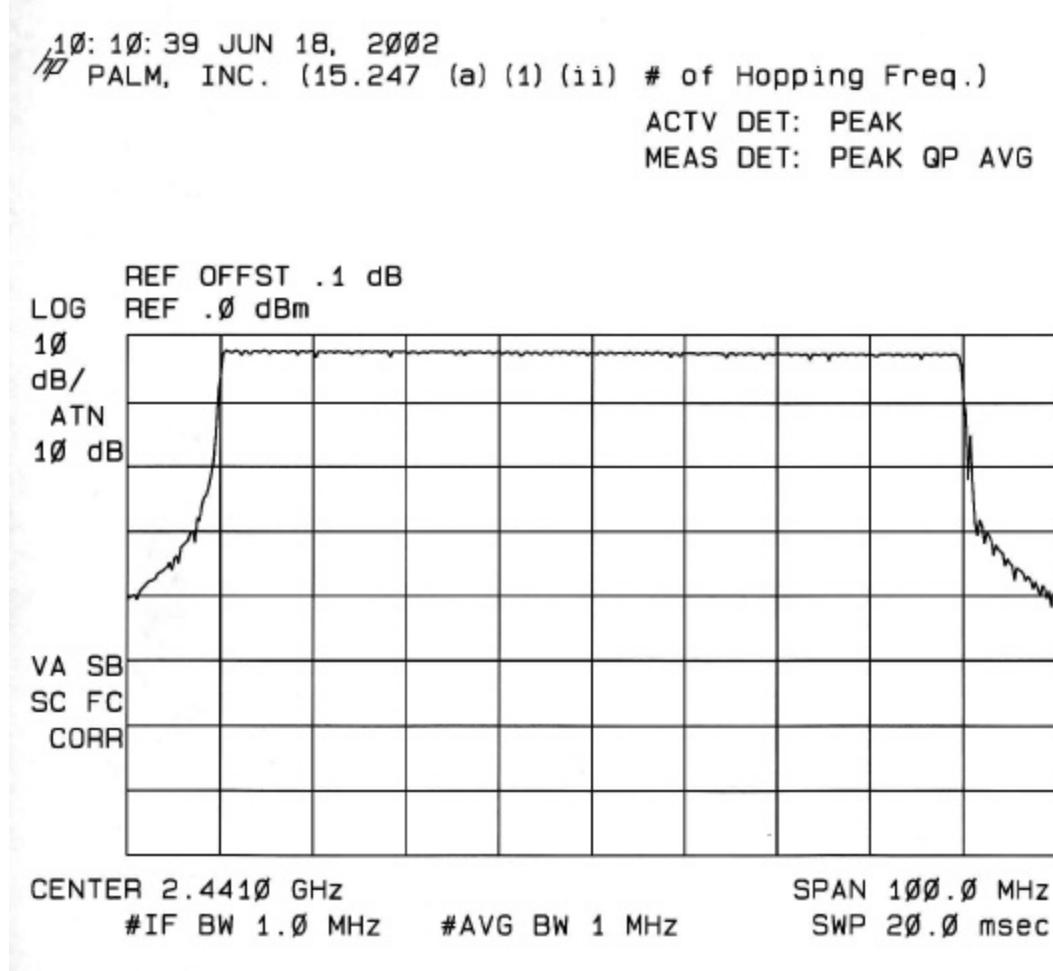
Connect the Eut's antenna port to the Spectrum Analyzer's input port.

Set frequency span to at least 100 MHz. Let EUT to complete the pseudorandom hopping frequency then set trace A to maximum hold. Record data by plotting graph.

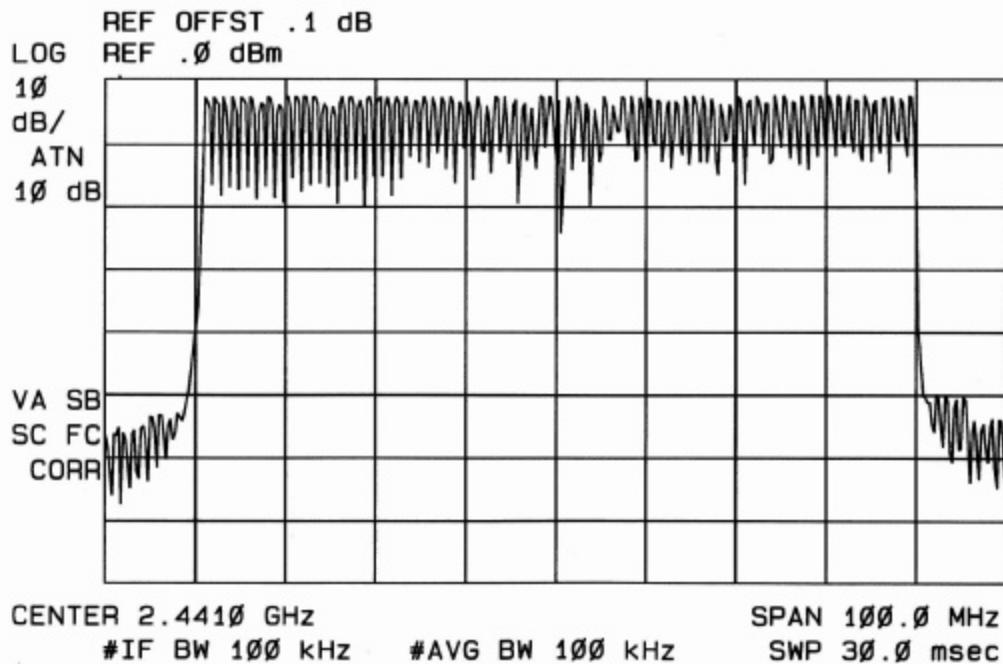
RESULT

No non-compliance noted. See plot below.

79 Hopping Frequency:

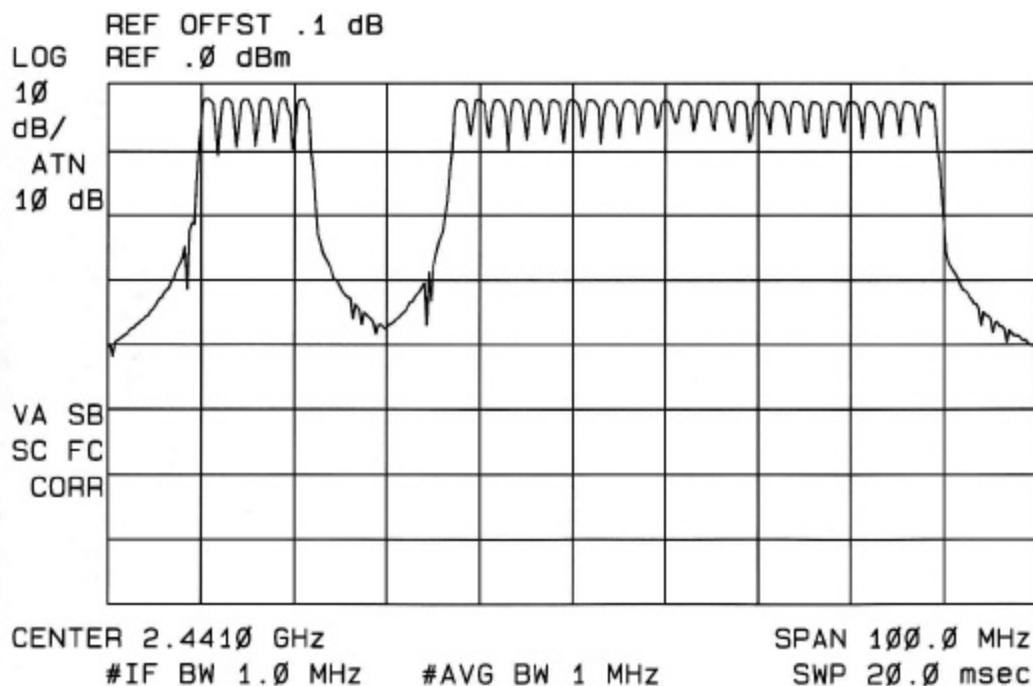


09: 12: 23 JUN 18, 2002
PALM, INC. (15.247 (a) (1) (ii) # of Hopping Freq.)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG



32 Hopping Frequency:

10:23:09 JUN 18, 2002
PALM, INC. (15.247 (a) (1) (ii) # of Hopping) Inquiry
ACTV DET: PEAK
MEAS DET: PEAK QP AVG

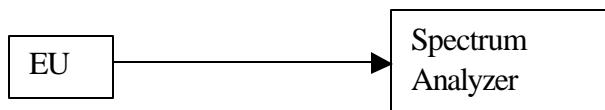


9.4 20 dB BANDWIDTH MEASUREMENT

TEST SETUP

Detector Function Setting of Test Receiver

| Frequency Range (MHz) | Detector Function | Resolution Bandwidth | Video Bandwidth |
|--------------------------|--|--|--|
| Above 1000 | <input checked="" type="checkbox"/> Peak | <input checked="" type="checkbox"/> 10 kHz | <input checked="" type="checkbox"/> 10 kHz |

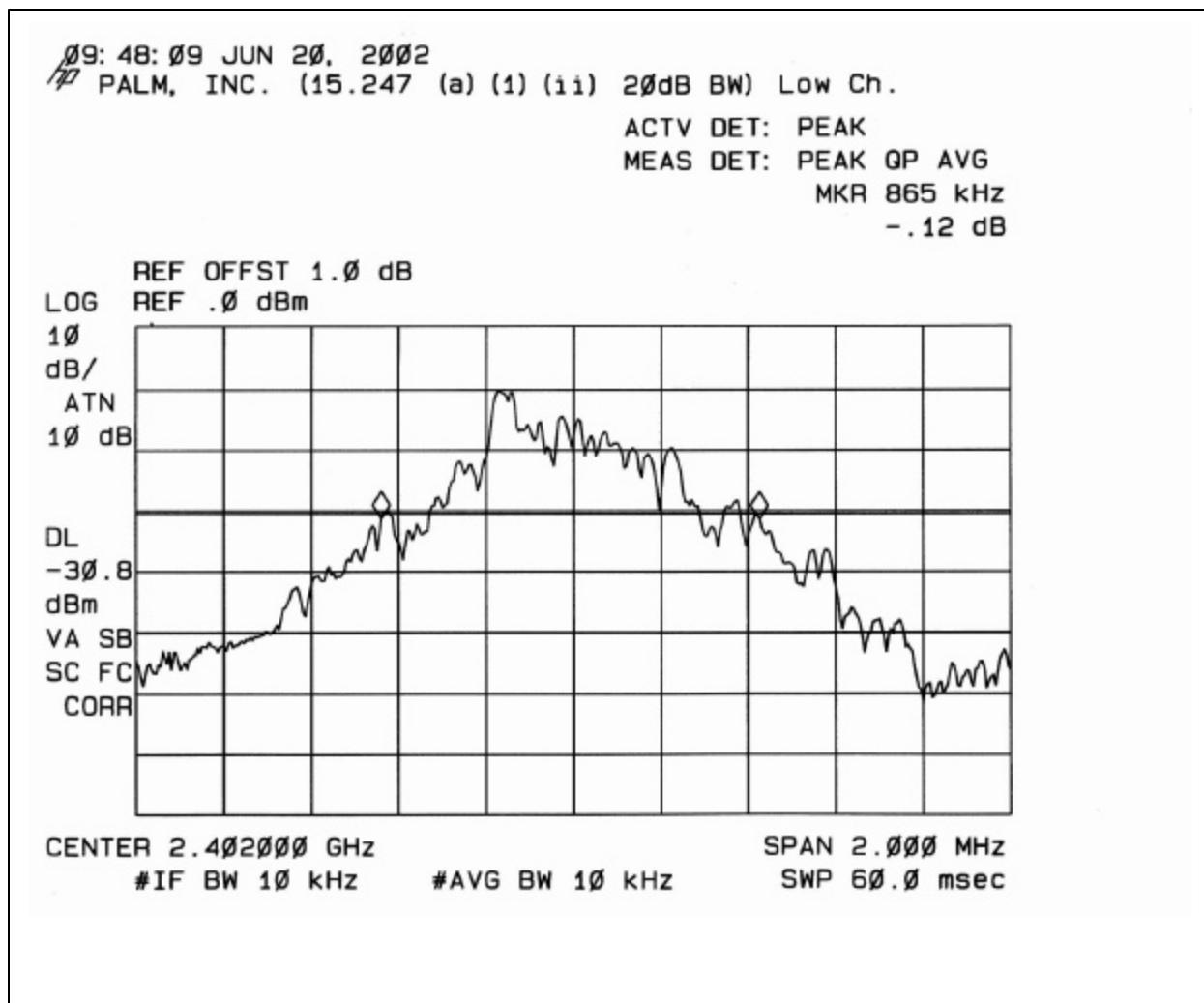


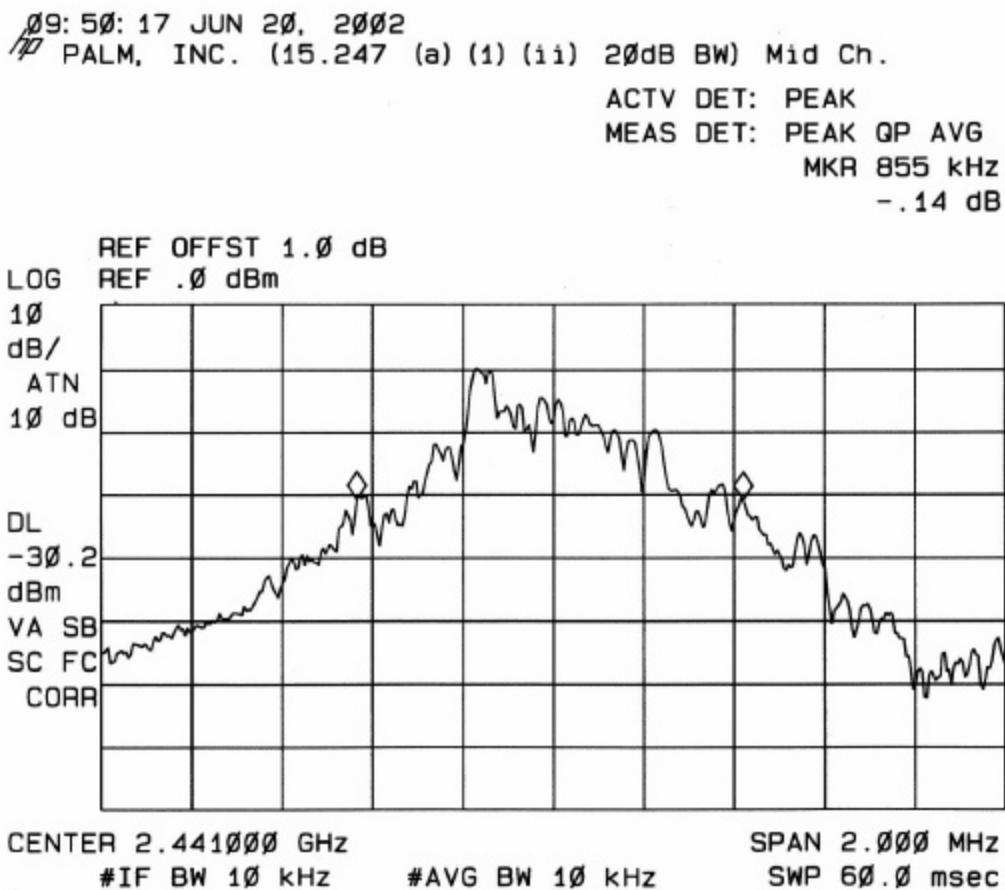
TEST PROCEDURE

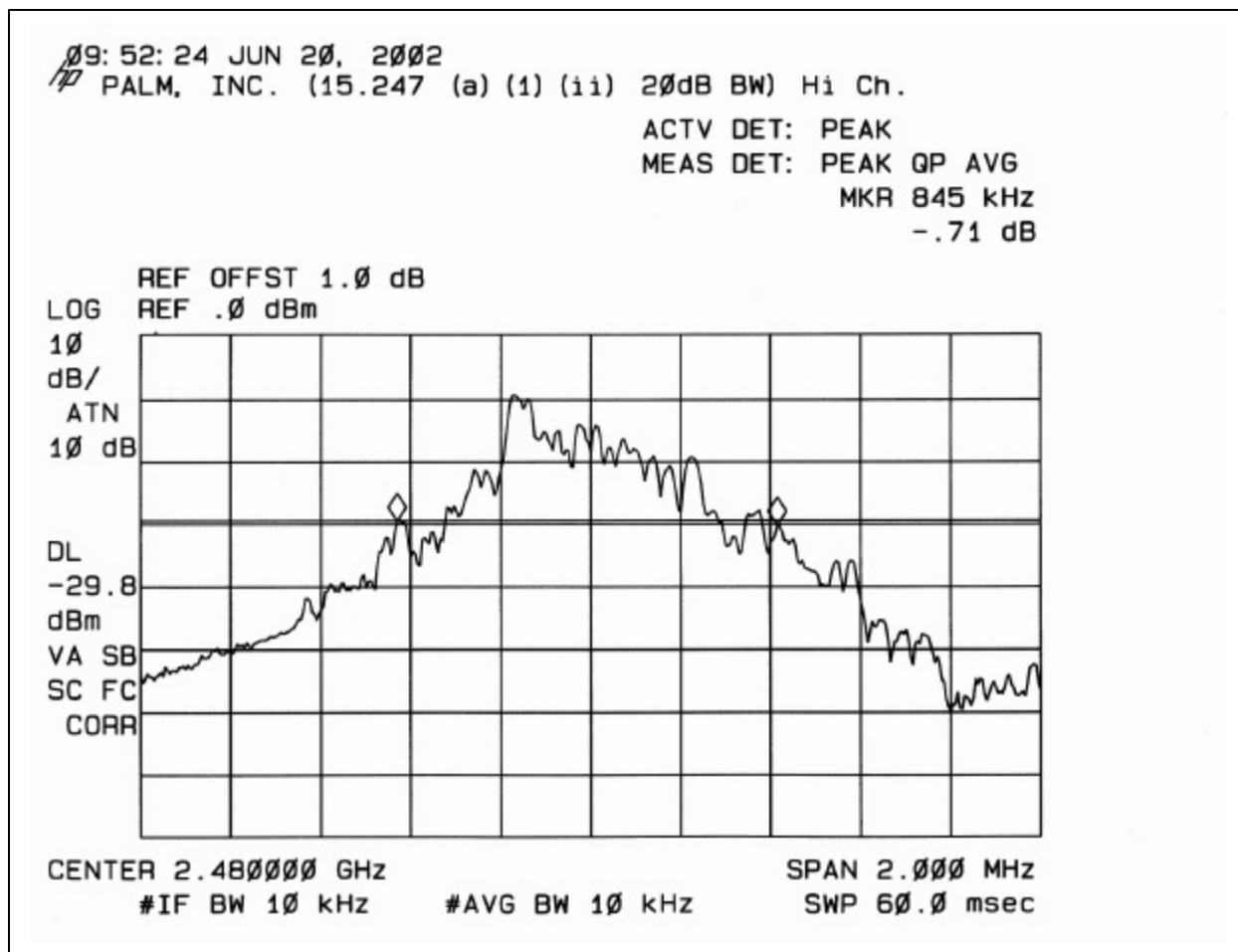
The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10 kHz RBW and 10 kHz VBW.

RESULT

No non-compliance noted. See plots below.





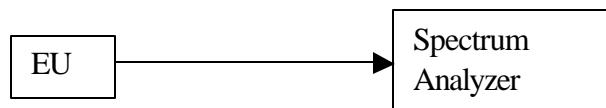


9.5 CONDUCTED SPURIOUS EMISSION

TEST SETUP

Detector Function Setting of Test Receiver

| Frequency Range (MHz) | Detector Function | Resolution Bandwidth | Video Bandwidth |
|-----------------------|--|---|---|
| 15 - 25000 | <input checked="" type="checkbox"/> Peak | <input checked="" type="checkbox"/> 100 kHz | <input checked="" type="checkbox"/> 100 kHz |



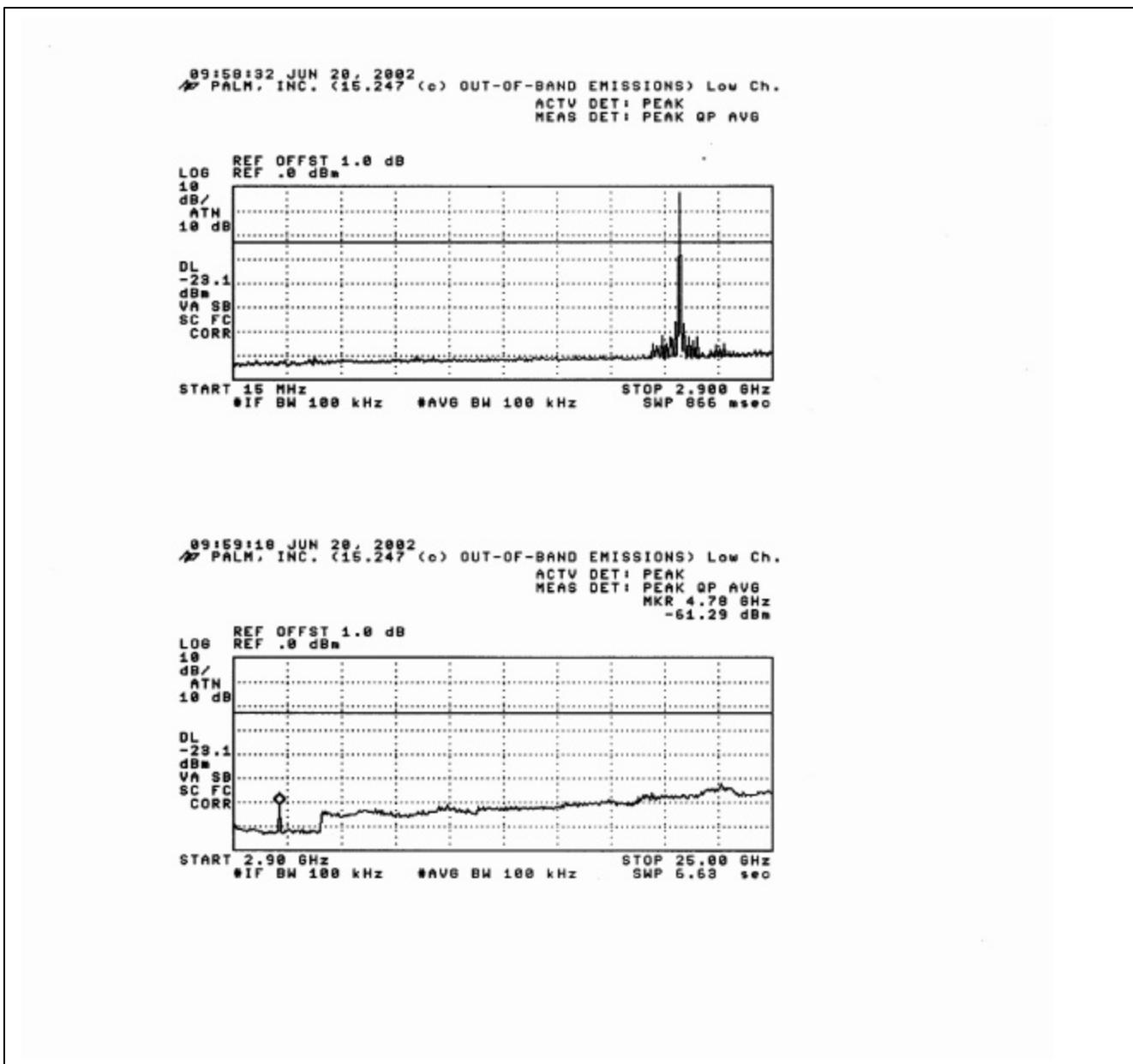
TEST PROCEDURE

Connect the Eut's antenna port to the Spectrum Analyzer's input port.
Investigate the entire frequency of the carrier frequency, up to the tenth harmonic.

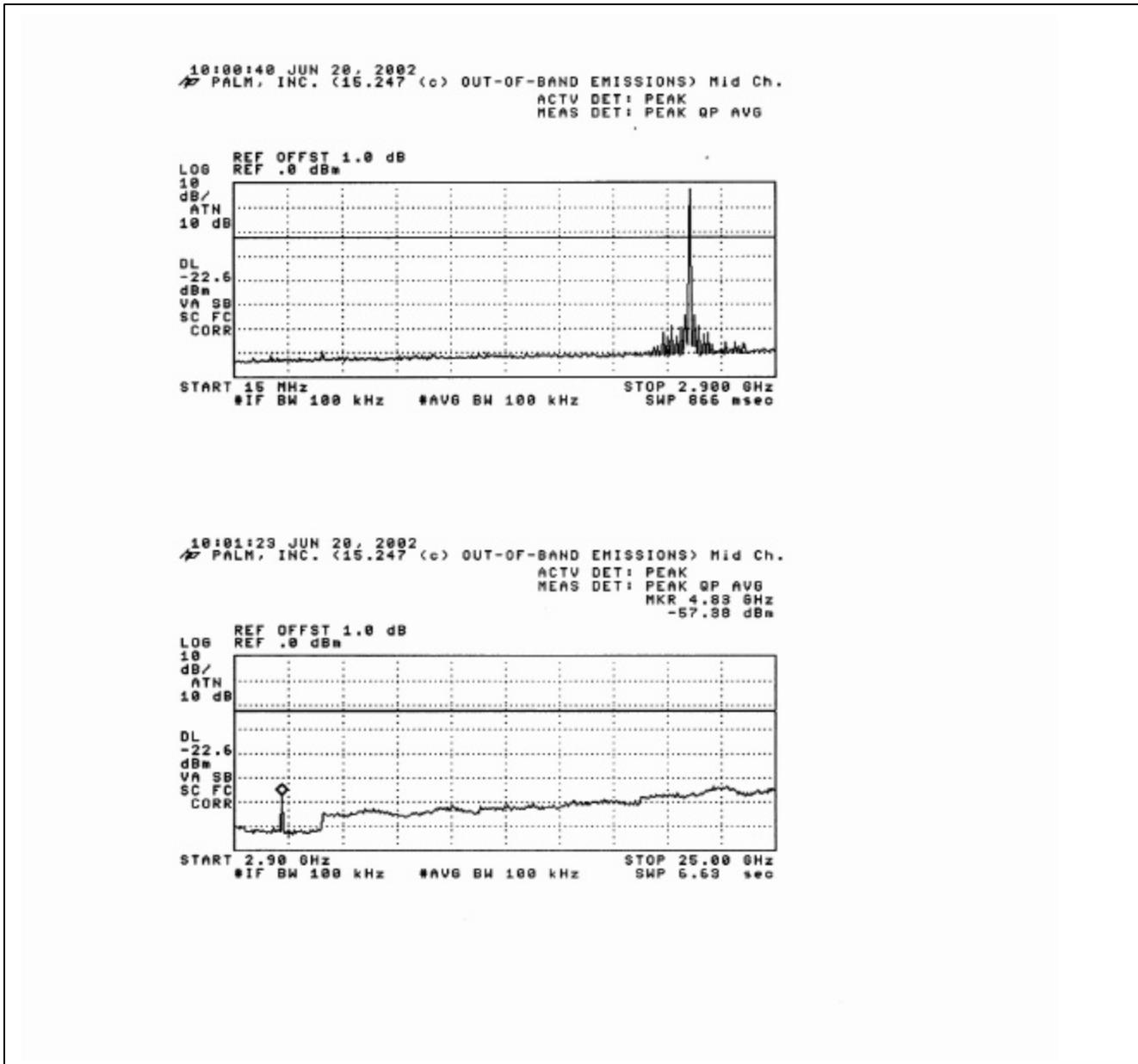
RESULT

No non-compliance noted. See below plots.

Low Channel:



Mid Channel:



High Channel:

