

Test Report for Unlicensed Low Power Transmitter

Description of device: Glucose Monitor Transmitter Unit

Applicable Rule Parts: 15.205, 15.209, 15.231

Applicant: Therasense Inc.
1360 South Loop Road
Alameda, CA 94502

Model No.: M-TX HRS
FCC ID: QXS-TX030301

TEST REQUIREMENTS

The referenced device is subject to certification under Part 2 of FCC Rules. The specific emissions limits and test requirements are found in Part 15 of FCC Rules. In addition to the device specific requirements listed in 15.231 (re-printed below), the following Part 15 requirements are universal to all unlicensed transmitters and would also apply:

15.19 Labeling requirements

The FCC ID label will be placed on the product as shown in the photograph that accompanies the FCC certification application (separate attachment).

15.20 Accessories

A separate receiver is associated with this product. The receiver meets all applicable requirements under Part 15. A separate verification report for the receiver has been forwarded to the manufacturer.

15.21 Information to user

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Such a statement will be included in the user manual for the referenced equipment and in the user manual for its companion receiver.

15.31 Measurement standards

American National Standards Institute (ANSI) C63.4-1992, entitled "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz," was followed in performing all transmitter and receiver tests.

15.32 Frequency range of radiated emissions measurements

Measurements were made from the lowest frequency generated by the device up to 3.15 GHz, the 10th harmonic of the fundamental emission

15.35 Measurement detector functions and bandwidths

As specified in ANSI C63.4 for the various tests required. When average radiated emission measurements are specified in this part, including emission measurements below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated.

Where average reading measurements are specified, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

15.109 Radiated Emissions (unintentional radiators)

Radiated emissions testing was performed for the companion receiver. Emissions levels did not exceed measurement equipment noise floor (at least 15 dB below limits).

15.203 Antenna requirement

The transmitter antenna is internal and permanently attached, and complies with this requirement.

15.204 External radio frequency power amplifiers and antenna modifications

NOT APPLICABLE

15.205 Restricted bands of operation

Several transmitter harmonic frequencies fall into restricted bands. Measurement results indicate all restricted band emissions were more than 21 dB below 15.209 limits.

15.206 Conducted Emissions

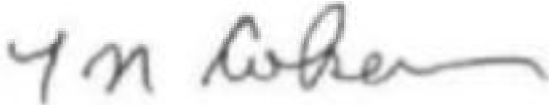
NOT APPLICABLE. Transmitter is battery operated only.

Emissions limits and test data are found below.

The Therasense transmitter model M-TX HRS meets all relevant requirements.

THOMAS N. COKENIAS

24 February 2003



EMC and Radio Regulatory Consultant
Agent for Therasense Inc.

15.205 Restricted bands of operation.

Only spurious emissions are permitted in any of the frequency bands listed below: The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209.

| MHz | MHz | MHz | GHz |
|---------------------|-----------------------|-----------------|---------------|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| 10.495 - 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 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 - 335.4 | 3600 - 4400 | |
| 13.36 - 13.41 | | | |

15.109 Radiated emission limits, general requirements.

Except as provided elsewhere in this paragraph the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength uV/m | Measurement distance, m |
|-----------------|---------------------|-------------------------|
| 0.009 - 0.490 | 2400/F(kHz) | 300 |
| 0.490 - 1.705 | 24000/F(| 30 |
| 1.705 - 30.0 | 30 | 30 |
| 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.

Section 15.231

Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz.

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

(e) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following table.:

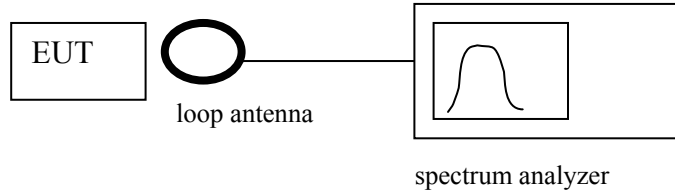
| | | |
|---------------|------------------|--------------|
| 40.66 - 40.70 | 1,000 | 100 |
| 70 - 130 | 500 | 50 |
| 130 - 174 | 500 to 1,500** | 50 to 150** |
| 174 - 260 | 1,500 | 150 |
| 260 - 470 | 1,500 to 5,000** | 150 to 500** |
| Above 470 | 5,000 | 500 |

** linear interpolation

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

OCCUPIED BANDWIDTH FCC Specification: 15.231 (c)

TEST SET-UP



Test Equipment

HP 8566 Spectrum Analyzer
Small loop antenna

Test Procedure

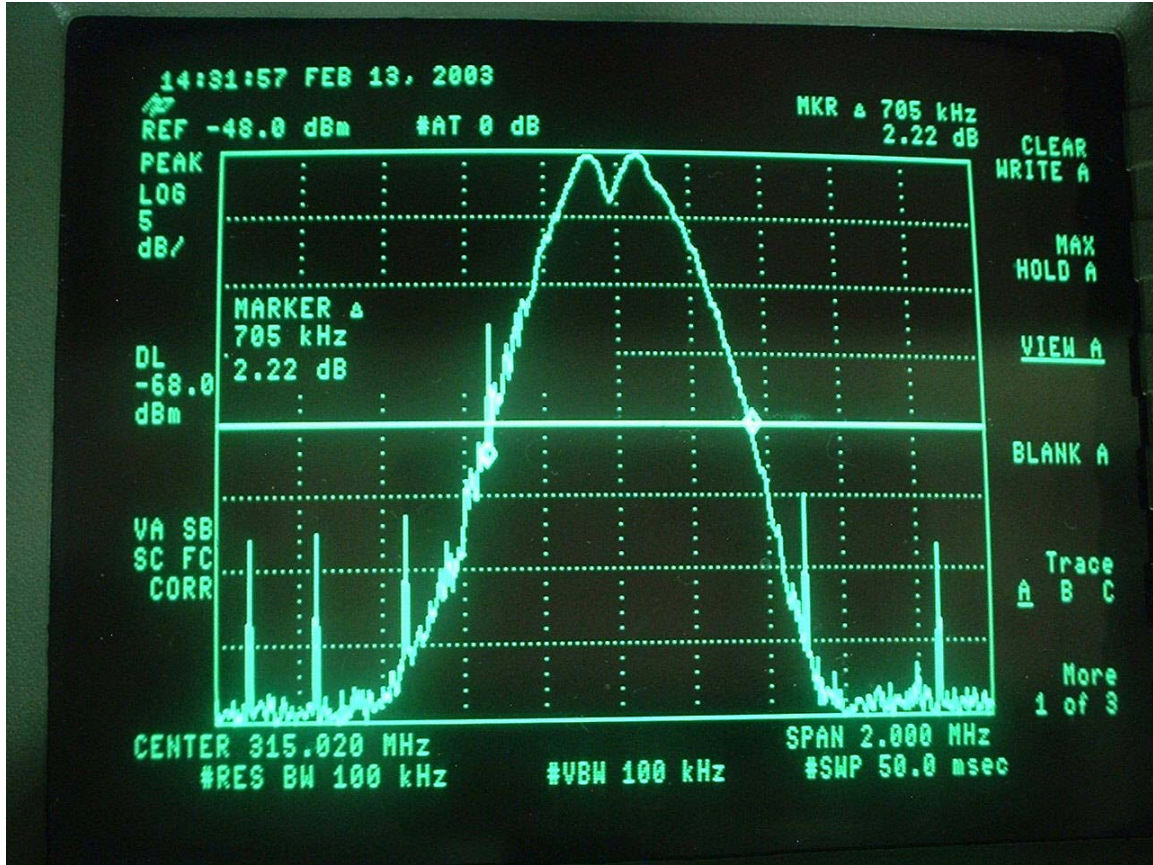
The spectrum analyzer bandwidth settings were adjusted per the requirements of the standard. A small loop antenna was placed beside the transmitter to sample a modulated signal for display on the spectrum analyzer. Photographs of the spectrum analyzer plots are presented below.

20 dB occupied bandwidth limit: 0.25% of fundamental frequency = $.0025 * 315 \text{ MHz} = 787.5 \text{ kHz}$

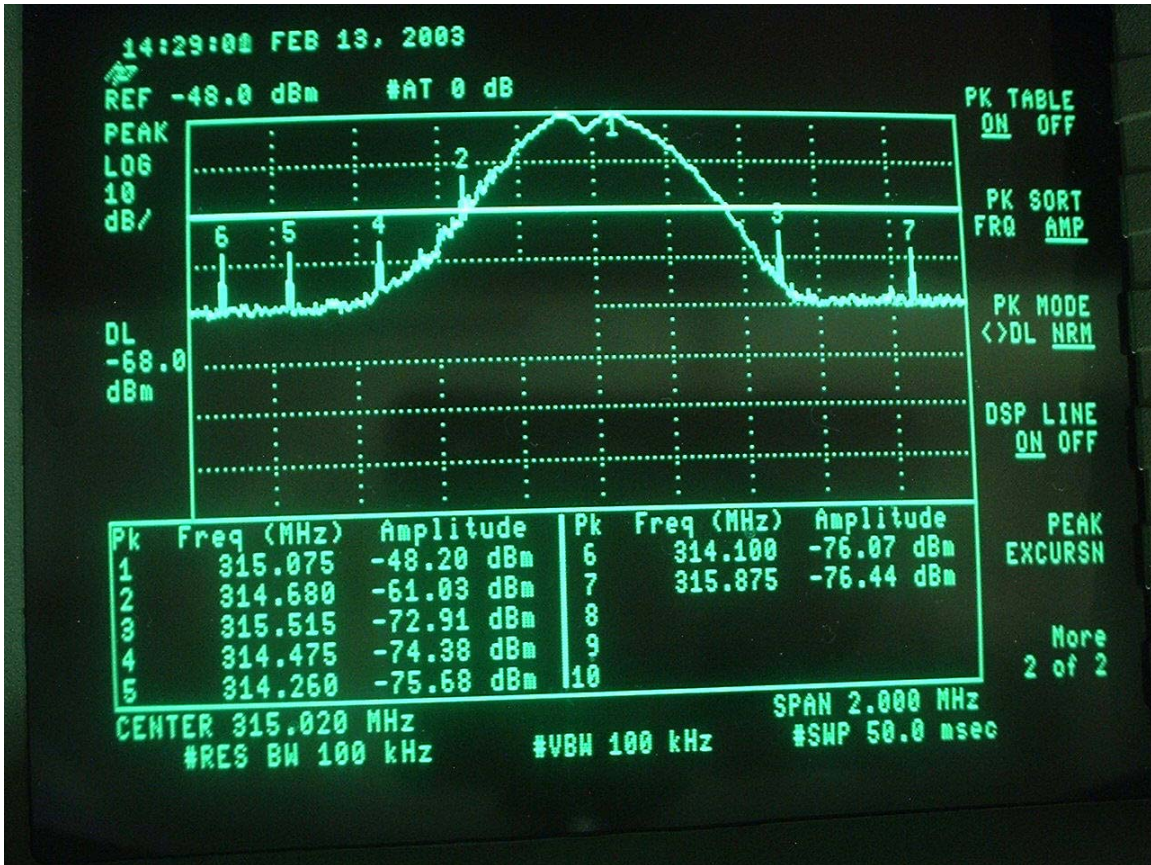
Test Results

Data indicates maximum 20 dB occupied bandwidth is 705 kHz.

Occupied Bandwidth

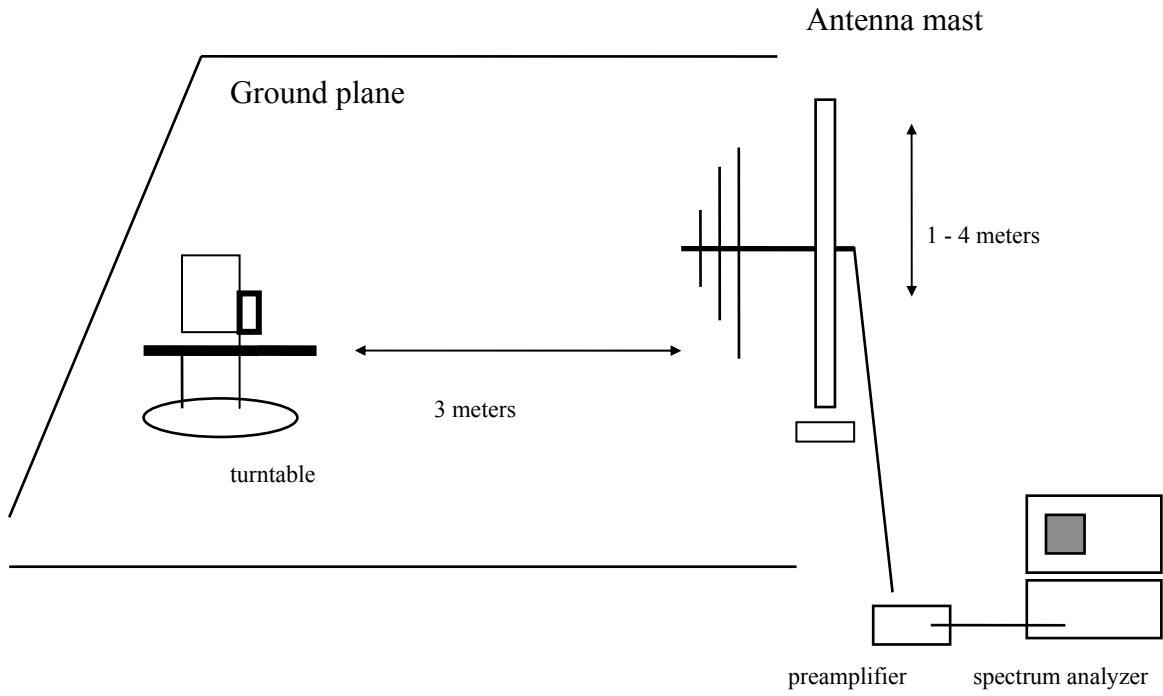


Occupied Bandwidth



TEST SET UP: RADIATED EMISSIONS BELOW 1 GHZ
FCC Specification: 15.205, 15.209, 15.231(e)

Test Set-up, 30 - 1000 MHz



TEST SET UP: RADIATED EMISSIONS ABOVE 1 GHZ
FCC Specification: 15.205, 15.209, 15.231(e)

Test Set-up, 1-3.15 GHz

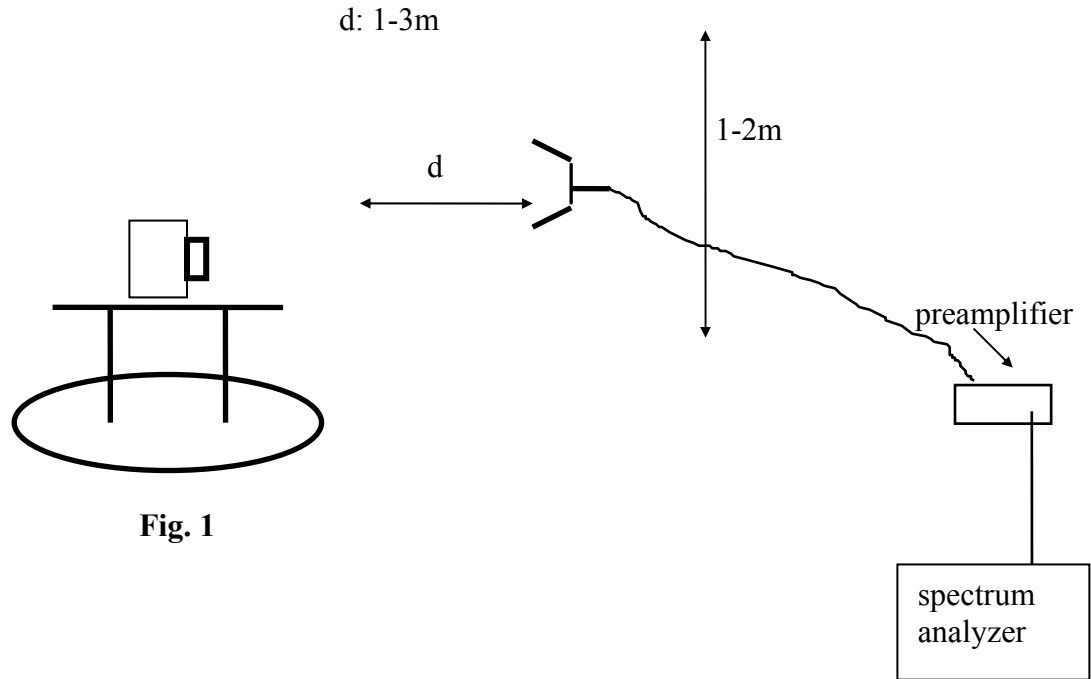


Fig. 1

Test Equipment

| TEST EQUIPMENT LIST | | | | |
|--------------------------------------|--------------|-------------|------------|-----------|
| Name of Equipment | Manufacturer | Model No. | Serial No. | Due Date |
| Antenna, Log Periodic 200 ~ 1000 MHz | EMCO | 3146 | 9107-3163 | 3/29/2003 |
| Preamplifier, 1 ~ 26 GHz | Miteq | NSP10023988 | 646456 | 4/26/2003 |
| SA Display Section 3 | HP | 8560A | 2314A02604 | 4/16/2003 |
| SA RF Section, 1.5 GHz | HP | 85680A | 101236 | 4/16/2003 |
| Quasi-Peak Detector | HP | 85650A | 2521A01038 | 4/16/2003 |
| Preamplifier, 1300 MHz | HP | 8447D | 2944A06550 | 8/22/2003 |
| spectrum Analyzer | HP | 8593EM | 3710A00205 | 6/11/2003 |
| Horn | EMCO | 3115 | 6717 | 1/30/2004 |

Test Procedure

The EUT was taped to a plastic milk carton and was oriented along the X axis (EUT on its back), on a wooden turntable located 3m from the search antenna. The EUT was activated to transmit continuously. Radiated emissions from fundamental operating frequency to the 10th harmonic, for search antenna in both vertical and horizontal polarities.

The test was repeated for the EUT oriented along the Y axis (EUT vertical) and the Z axis (EUT on its edge).

Duty Cycle Measurements

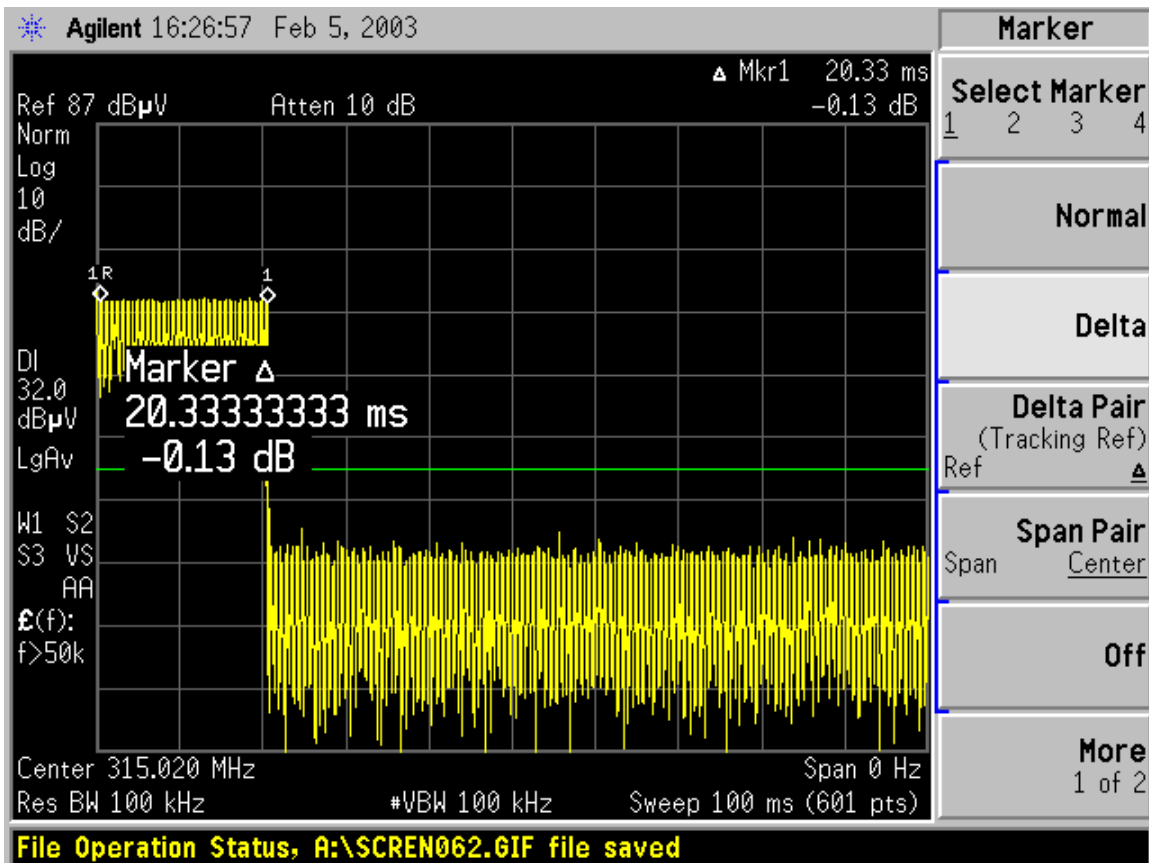
Duty cycle is defined as $20 \log(\text{Ton} / 100\text{msec})$. The duty cycle is added to PEAK radiated emissions and the result is compared against the AVERAGE limits called out in the specification.

Duty cycle is 20.33 %, or -13.8 dB. Refer to attached spectrum analyzer screen photograph for duty cycle test results.

Test Results

Data shows the EUT meets all radiated requirements specified in 15.205 and 15.231. Above 1 GHz there were no emissions detected, data shown is noise floor level of the measurement equipment. Noise floor is at least 20 dB below the limit.

Duty Cycle



| 02/05/03 High Frequency Measurement | | | | | | | | | | | | | | | | |
|--|-----------------------|---------|----------|------|-----|--------|--|----------------------------|--------|--------|--------|---------|------------------------------|---------|--------------------------------------|--|
| Compliance Certification Services, Morgan Hill Open Field Site | | | | | | | | | | | | | | | | |
| Test Engr: Chin Pang | | | | | | | | | | | | | | | | |
| Company: Therasense Inc. | | | | | | | | | | | | | | | | |
| EUT Descrip.: Transmitter | | | | | | | | | | | | | | | | |
| EUT M/N: M-TX HRS | | | | | | | | | | | | | | | | |
| Test Target: FCC 15.231 | | | | | | | | | | | | | | | | |
| Mode Oper: Transmitting | | | | | | | | | | | | | | | | |
| Peak Measurements: | | | | | | | | Average Measurements: | | | | | | | | |
| 1 MHz Resolution Bandwidth | | | | | | | | 1 MHz Resolution Bandwidth | | | | | | | | |
| 1MHz Video Bandwidth | | | | | | | | 10Hz Video Bandwidth | | | | | | | | |
| 315MHz Transmitter | | | | | | | | | | | | | | | | |
| f | Dist | Read Pk | Duty, dB | AF | CL | Amp | D Corr | HPF | Peak | Avg | Pk Lim | Avg Lim | Pk Mar | Avg Mar | Notes | |
| GHz | feet | dBuV | | dB/m | dB | dB | dB | | dBuV/m | dBuV/m | dBuV/m | dBuV/m | dB | dB | | |
| 0.315 | 10.0 | 64.5 | -13.8 | 14.8 | 3.1 | -26.5 | 0.0 | 0.0 | 55.9 | 42.1 | 87.7 | 67.7 | -31.8 | -25.6 | V -EUT X axis (on back) | |
| 0.315 | 10.0 | 56.9 | -13.8 | 14.8 | 3.1 | -26.5 | 0.0 | 0.0 | 48.3 | 34.5 | 87.7 | 67.7 | -39.4 | -33.2 | V - EUT Yaxis (upright) | |
| 0.315 | 10.0 | 48.3 | -13.8 | 14.8 | 3.1 | -26.5 | 0.0 | 0.0 | 39.7 | 25.9 | 87.7 | 67.7 | -48.0 | -41.8 | EUT Z axis (on edge) | |
| 0.315 | 10.0 | 76.5 | -13.8 | 14.8 | 3.1 | -26.5 | 0.0 | 0.0 | 67.9 | 54.1 | 87.7 | 67.7 | -19.8 | -13.6 | V - On person, reference only | |
| 0.630 | 10.0 | 42.4 | -13.8 | 19.6 | 4.7 | -27.8 | 0.0 | 0.0 | 38.9 | 25.1 | 67.7 | 47.7 | -28.8 | -22.6 | worst case 2fo, V EUT X | |
| 0.945 | 10.0 | 42.1 | -13.8 | 23.2 | 5.9 | -27.2 | 0.0 | 0.0 | 44.1 | 30.3 | 67.7 | 47.7 | -23.7 | -17.5 | worst case 3fo, H EUT Z | |
| 1.260 | 3.3 | 54.4 | -13.8 | 25.2 | 2.5 | -36.5 | -9.5 | 0.0 | 36.2 | 22.4 | 67.7 | 47.7 | -31.5 | -25.3 | V | |
| 1.575 | 3.3 | 60.0 | -13.8 | 26.1 | 2.9 | -36.4 | -9.5 | 0.0 | 43.1 | 29.3 | 74.0 | 54.0 | -30.9 | -24.7 | 15.205 restricted V | |
| 1.890 | 3.3 | 50.7 | -13.8 | 27.5 | 3.2 | -36.4 | -9.5 | 1.0 | 36.6 | 22.8 | 67.7 | 47.7 | -31.1 | -24.9 | V | |
| 2.205 | 3.3 | 57.0 | -13.8 | 28.5 | 3.5 | -36.4 | -9.5 | 1.0 | 44.1 | 30.3 | 74.0 | 54.0 | -29.9 | -23.7 | 15.205 restricted V | |
| 2.520 | 3.3 | 57.0 | -13.8 | 29.2 | 3.7 | -36.3 | -9.5 | 1.0 | 45.0 | 31.2 | 67.7 | 47.7 | -22.7 | -16.5 | V | |
| 2.835 | 3.3 | 50.5 | -13.8 | 30.4 | 3.8 | -36.3 | -9.5 | 1.0 | 40.0 | 26.2 | 74.0 | 54.0 | -34.0 | -27.8 | 15.205 restricted V | |
| 3.150 | 3.3 | 45.8 | -13.8 | 31.4 | 4.0 | -36.2 | -9.5 | 1.0 | 36.5 | 22.7 | 67.7 | 47.7 | -31.2 | -25.0 | V | |
| 1.260 | 3.3 | 54.6 | -13.8 | 25.2 | 2.5 | -36.5 | -9.5 | 1.0 | 37.4 | 23.6 | 67.7 | 47.7 | -30.3 | -24.1 | H | |
| 1.575 | 3.3 | 53.3 | -13.8 | 26.1 | 2.9 | -36.4 | -9.5 | 1.0 | 37.4 | 23.6 | 74.0 | 54.0 | -36.6 | -30.4 | 15.205 restricted H | |
| 1.890 | 3.3 | 54.7 | -13.8 | 27.5 | 3.2 | -36.4 | -9.5 | 1.0 | 40.6 | 26.8 | 67.7 | 47.7 | -27.1 | -20.9 | H | |
| 2.205 | 3.3 | 57.9 | -13.8 | 28.5 | 3.5 | -36.4 | -9.5 | 1.0 | 45.0 | 31.2 | 74.0 | 54.0 | -29.0 | -22.8 | 15.205 restricted H | |
| 2.520 | 3.3 | 59.9 | -13.8 | 29.2 | 3.7 | -36.3 | -9.5 | 1.0 | 47.9 | 34.1 | 67.7 | 47.7 | -19.8 | -13.6 | H | |
| 2.835 | 3.3 | 50.9 | -13.8 | 30.4 | 3.8 | -36.3 | -9.5 | 1.0 | 40.4 | 26.6 | 67.7 | 47.7 | -27.3 | -21.1 | 15.205 restricted H | |
| 3.150 | 3.3 | 44.8 | -13.8 | 31.4 | 4.0 | -36.2 | -9.5 | 1.0 | 35.5 | 21.7 | 67.7 | 47.7 | -32.2 | -26.0 | H | |
| f | Measurement Frequency | | | | | Amp | Preamp Gain | | | | | HPF | High Pass Filter | | | |
| Dist | Distance to Antenna | | | | | D Corr | Distance Correct to 3 meters | | | | | Avg Lim | Average Field Strength Limit | | | |
| Read | Analyzer Reading | | | | | Duty | Duty Cycle correction, 20log(20.4/100) | | | | | Pk Lim | Peak Field Strength Limit | | | |
| AF | Antenna Factor | | | | | Peak | Calculated Peak Field Strength | | | | | Avg Mar | Margin vs. Average Limit | | | |
| CL | Cable Loss | | | | | Avg | Calculated Average Field Strength | | | | | Pk Mar | Margin vs. Peak Limit | | | |
| | | | | | | | | | | | | | | | V,H | Test antenna polarity Vertical, Horizontal |