# Measurement of RF Interference from a PASS P3 Transceiver

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| For | Continental Automotive<br>21440 West Lake Cook Road<br>Deer Park, IL 60010 |
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REVISION HISTORY

| Revision | Date | Description |
|---|---|---|
| — | November 5, 2010 | Initial release |
| | | |

**Measurement of RF Emissions from a PASS P3 Transceiver**

# 1 INTRODUCTION

## 1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Continental Automotive PASS P3, Serial No. FCC 1, transceiver (hereinafter referred to as the EUT). The EUT is a Bluetooth hybrid frequency hopping spread spectrum transceiver. The EUT was designed to transmit and receive in 2400-2483.5 MHz band using either an internal antenna or an A204 820 22 75 external antenna. The EUT contained a super-heterodyne type receiver which utilizes an intermediate frequency (IF) of 1.5 MHz below the receive frequency. The EUT was manufactured and submitted for testing by Continental Automotive located in Deer Park, IL.

## 1.2 Purpose

The test series was performed to determine if the EUT meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109, for receivers and Subpart C, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 2400-2483.5 MHz band.

The test series was also performed to determine if the EUT meets the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and Section 7.2.3 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.2 and RSS-210 Annex 2, section A2.9 for Transmitters.

Testing was performed in accordance with ANSI C63.4-2003.

## 1.3 Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series

## 1.4 EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

## 1.5 Laboratory Conditions

The temperature at the time of the test was 22°C and the relative humidity was 39%.

# 2 APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subparts B and C, dated 1 October 2009
- ANSI C63.4-2003, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000
- Measurement of Digital Transmission Systems Operating under Section 15.247, dated March 23, 2005
- Industry Canada RSS-210, Issue 7, June 2007, “Spectrum Management and Telecommunications Radio Standards Specification, Low-power License-exempt radio communication devices (All Frequency Bands): Category I Equipment”

- Industry Canada RSS-GEN, Issue 2, June 2007, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment”

# 3 EUT SET-UP AND OPERATION

## 3.1 General Description

The EUT is a PASS P3. A block diagram of the EUT setup is shown as Figure 1 and Figure 2.

### 3.1.1 Power Input

The EUT was powdered by 13.2VDC from an external power supply. Normally, the EUT is powered by the vehicle battery in which the EUT is installed.

### 3.1.2 Peripheral Equipment

No peripheral equipment was submitted with the EUT.

### 3.1.3 Interconnect Cables

A 1 meter long wiring harness was submitted with the EUT. The harness included 4 power wires (battery +, Ignition, and 2 battery negative leads).

### 3.1.4 Grounding

The EUT was ungrounded during the tests.

## 3.2 Operational Mode

For all tests, the EUT was placed on an 80cm high non-conductive stand. The EUT was energized. The unit was programmed to operate in one of the following modes:

- Transmit at 2402MHz
- Transmit at 2441MHHz
- Transmit at 2480MHHz
- Receive at 2441MHHz
- Frequency Hopping Enabled
- Inquiry Mode

## 3.3 EUT Modifications

No modifications were required for compliance.

# 4 TEST FACILITY AND TEST INSTRUMENTATION

## 4.1 Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

## 4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1.

The receiver allows measurements with the bandwidths specified by the FCC and with the quasi-peak and average detector functions.

### 4.3 Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

### 4.4 Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

The measurement uncertainty for these tests is presented below:

| Conducted Emission Measurements | | |
|---|---|---|
| Combined Standard Uncertainty | 1.07 | -1.07 |
| Expanded Uncertainty (95% confidence) | 2.1 | -2.1 |

| Radiated Emission Measurements | | |
|---|---|---|
| Combined Standard Uncertainty | 2.26 | -2.18 |
| Expanded Uncertainty (95% confidence) | 4.5 | -4.4 |

# 5 TEST PROCEDURES

## 5.1 Receiver

### 5.1.1 Powerline Conducted Emissions

#### 5.1.1.1 Requirements

Since the EUT is normally powered by a vehicle battery, conducted emission tests are not required.

### 5.1.2 Radiated Measurements

#### 5.1.2.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.101(b), receivers operating above 960MHz are exempt from complying with the technical provisions of Part 15.

Per Industry Canada RSS-Gen, Section 7.2.3, all radio frequency emissions from a receiver shall be below the limits shown on the following table:

RADIATION LIMITS FOR A RECEIVER

| Frequency MHz | Distance between EUT And Antenna in Meters | Field Strength uV/m | Field Strength dBuV/m |
|---|---|---|---|
| 30-88 | 3 | 100 | 40 |
| 88-216 | 3 | 150 | 43.5 |
| 216-960 | 3 | 200 | 46 |
| Above 960 | 3 | 500 | 54 |

Note: The tighter limit shall apply at the edge between the two frequency bands.

#### 5.1.2.2 Procedures

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.101(b), receivers operating above 960MHz are exempt from complying with the technical provisions of part 15.

For Industry Canada, testing was performed on a middle channel. The emissions in the frequency range of 30MHz to 3 times the highest tuneable or local oscillator frequency, whichever is the higher, were measured and plotted.

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Since a quasi-peak detector and an average detector require long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector.

The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 25GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted.

Final radiated emissions were performed on all significant broadband and narrowband emissions found in the preliminary sweeps using the following methods:

1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.

2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:

    a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

    b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

    c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

    d) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

#### 5.1.2.3 Results

The preliminary plots are presented on pages 23 through 30. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on pages 31 and 32. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level

closet to the limit (worst case) occurred at 7318.5MHz. The emissions level at this frequency was 11.8dB within the limit. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 3.

## 5.2 Transmitter

### 5.2.1 Powerline Conducted Emissions

#### 5.2.1.1 Requirements

Since the EUT is normally powered by a vehicle battery, no conducted emissions tests are required.

### 5.2.2 20dB Bandwidth

#### 5.2.2.1 Requirements

Per section 15.247(a)(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. Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate within an output power no greater than 125mW.

#### 5.2.2.2 Procedures

The output of the EUT was connected to the spectrum analyzer through 10dB of attenuation.

With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to ≥ 1% of the 20 dB BW. The span was set to approximately 2 to 3 times the 20 dB bandwidth.

The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

#### 5.2.2.3 Results

The plots on pages 33 through 35 show that the maximum 20 dB bandwidth was 837.68kHz. The 99% bandwidth was measured to be 825.65kHz.

### 5.2.3 Carrier Frequency Separation

#### 5.2.3.1 Requirements

Per section 15.247 (a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Per section 15.247(a)(1), alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate within an output power no greater than 125mW.

#### 5.2.3.2 Procedures

The output of the EUT was connected to the spectrum analyzer through 10dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to > to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the peaks of at least two adjacent channels.
When the trace had stabilized after multiple scans, the marker-delta function was used to determine the separation between the peaks of the adjacent channels. The analyzer's display was plotted using a 'screen dump' utility.

#### 5.2.3.3 Results

Page 36 shows the carrier frequency separation. As can be seen from this plot, the carrier frequency separation is 1MHz which is greater than the 20dB bandwidth of the hopping channel (825.65kHz).

### 5.2.4 Number of Hopping Frequencies

#### 5.2.4.1 Requirements

Per section 15.247(a)(1)(iii), frequency hopping systems operating in the 2400-2483.5MHz band that employ at least 15 hopping channels must have a maximum peak conducted output power that does not exceed 0.125W (21dBm). Per 15.247(b)(1), frequency hopping systems operating in the 2400- 2483.5MHz band that employ at least 75 non-overlapping hopping channels must have a maximum peak conducted output power that does not exceed 1W (30dBm).

#### 5.2.4.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to ≥ to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation.

The EUT's signal was allowed to stabilize after multiple scans. The number of hopping frequencies was counted. The analyzer's display was plotted using a 'screen dump' utility.

#### 5.2.4.3 Results

Page 37 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 79 which is greater than 75 which is the minimum number of required hopping frequencies for systems operating in the 2400-2483.5MHz band that have a maximum peak conducted output power that does not exceed 1W (30dBm).

### 5.2.5 Time of Occupancy

#### 5.2.5.1 Requirements

Per section 15.247(a)(1)(iii), for frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### 5.2.5.2 Procedures

The EUT was setup inside the chamber.
With the hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to 1 MHz. The peak detector and 'Max-Hold' function were engaged. With the span set to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. The analyzer's display was plotted using a 'screen dump' utility. Then, the sweep time was expanded to 0.4 seconds multiplied by the number of hopping channels employed (79 channels) to capture the number of hops in the appropriate sweep time. A single sweep was made. The analyzer's display was plotted using a 'screen dump' utility. The dwell time in the specified time period was then calculated from dwell time per hop multiplied by the number of hops in the specified time period.

#### 5.2.5.3 Results

Pages 38 through 40 show the plots for the time of occupancy (dwell time). As can be seen from the plots, the time of occupancy can be determined by (dwell time/hop) multiplied by (# of hops). This calculated value is equal to 0.231seconds which is less than the 0.4 seconds maximum allowed.

### 5.2.6 Antenna Conducted Peak Output Power

#### 5.2.6.1 Requirements

Per section 15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5MHz band and employing at least 75 non-overlapping hopping channels, the maximum peak output conducted power shall not be greater than 1W (30dBm).

#### 5.2.6.2 Procedures

The output of the EUT was connected to the spectrum analyzer through 20dB of attenuation. With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to greater than the 20dB bandwidth. The span was set to approximately 5 times the 20 dB bandwidth. The 'Max-Hold' function was engaged. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and high hopping frequencies.

#### 5.2.6.3 Results

The results are presented on pages 41 through 43. The maximum peak conducted output power from the transmitter was 4.46dBm (2.79mW) which is below the 30dBm (1 Watt) limit.

### 5.2.7 Effective Isotropic Radiated Power (EIRP)

#### 5.2.7.1 Requirements

Per section 15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5MHz band and employing at least 75 non-overlapping hopping channels, the maximum peak output conducted power shall not be greater than 1W (30dBm). Per section 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 4 Watt (36dBm). If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below 30dBm by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 5.2.7.2 Procedures

The EUT was placed on the non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 20dB bandwidth. The span was set to approximately 5 times the 20 dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle and high hopping frequencies.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a second double ridged waveguide antenna was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss and antenna gain, as required. The peak power output was calculated for low, middle, and high hopping frequencies.

#### 5.2.7.3 Results

The results are presented on pages 44. The maximum EIRP measured from the transmitter was 3.8dBm or 2.4mW which is below the 4 Watt limit.

### 5.2.8 Duty Cycle Factor Measurements

#### 5.2.8.1 Procedures

The duty cycle factor is used to correct meter readings to average readings. This factor is computed from the time

domain trace of the pulse modulation signal.

With the transmitter set up to transmit for maximum pulse density, the time domain trace is displayed on the spectrum analyzer. This trace is obtained by tuning center frequency to the transmitter frequency and then setting a zero span width with 500usec/div. The amplitude settings are adjusted so that the on/off transitions clear the 4th division from the bottom of the display. The markers are set at the beginning and end of the “on-time”. The trace is recorded.

Next the spectrum analyzer center frequency is set to the transmitter frequency with a zero span width and 10msec/div. This shows if the word is longer than 100msec or shorter than 100msec. If the word period is less than 100msec, the display is set to show at least one word. The on-time and off-time are then measured. The on-time is total time signal level exceeds the 4th division. Off-time is time under for the word period. The duty cycle is then computed as the (On-time/ word period) where the word period = (On-time + Off-time).

#### 5.2.8.2 Results

The plots of the duty cycle are shown on data pages 45 and 47. With maximum pulse density, the EUT transmits 3 each 360.7usec pulses in a 100msec interval. The duty cycle correction factor was calculated to be -39.3dB ( -39.3dB =20*log((3x360.7usec)/100msec).

### 5.2.9 Antenna Conducted Spurious Emissions

#### 5.2.9.1 Requirements

Per section 15.247(c), the spurious emissions in any 100 kHz BW outside the frequency band must be at least 20dB below the highest 100 kHz BW level measured within the band.

#### 5.2.9.2 Procedures

The output of the EUT was connected to the spectrum analyzer through 10dB of attenuation. The frequency hopping function was disabled. The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function were engaged. The emissions in the frequency range from 30MHz to 25GHz were observed and plotted separately with the EUT transmitting at low, middle and high hopping frequencies.

#### 5.2.9.3 Results

The results of the antenna conducted emissions levels were plotted. These plots are presented on pages 48 through 65. These plots show that the spurious emissions were at least 20 dB below the level of the fundamental.

### 5.2.10 Radiated Spurious Emissions Measurements

#### 5.2.10.1 Requirements

Per section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions 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 comply with the radiated emission limits specified in §15.209(a).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a). Paragraph 15.209(a) has the following radiated emission limits:

| Frequency MHz | Field Strength (microvolts/meter) | Measurement distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 3 |
| 30.0-88.0 | 100 | 3 |

| | | |
|---|---|---|
| 88.0-216.0 | 150 | 3 |
| 216.0-960.0 | 200 | 3 |
| Above 960 | 500 | 3 |

5.2.10.2 Procedures

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 25GHz was investigated using a peak detector function.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 25GHz.

1) For all harmonics not in the restricted bands, the following procedure was used:
   a) The field strength of the fundamental was measured using a double ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
   b) The field strengths of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
   c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
      i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
      ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
      iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
      iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
   d) All harmonics not in the restricted bands must be at least 20 dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
2) For all emissions in the restricted bands, the following procedure was used:
   a) The field strengths of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
   b) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.
   c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:
      i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
      ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.

d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.

e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken. If the emission is pulsed, the reading obtained with the 10 Hz video bandwidth may be further adjusted by a “duty cycle correction factor”, derived from 20*log(on time /100msec). These readings must be no greater than the limits specified in 15.209(a).

#### 5.2.10.3 Results

Preliminary radiated emissions plots with the EUT transmitting at 2402MHz, 2441MHz, and 2480MHz are shown on pages 66 through 113. Final radiated emissions data are presented on data pages 114 through 125. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closet to the limit (worst case) occurred at 4882MHz. The emissions level at this frequency was 6.2dB within the limit. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 3 and Figure 4.

### 5.2.11 Band Edge Compliance

#### 5.2.11.1 Requirements

Per section 15.247(d), the emissions at the band-edges must be at least 20dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required. In addition, the radiated emissions which fall in the restricted band beginning at 2483.5 MHz must meet the general limits of 15.209(a).

#### 5.2.11.2 Procedures

##### 5.2.11.2.1 Low Band Edge (external antenna)

1) The output of the EUT was connected to the spectrum analyzer through 20dB of attenuation.
2) The EUT was set to transmit continuously at the channel closest to the low band-edge (hopping function disabled).
3) To determine the band edge compliance, the following spectrum analyzer settings were used:

   a. Center frequency = low band-edge frequency.
   b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
   c. Resolution bandwidth (RBW) ≥ 1% of the span.
   d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
   e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the

authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)

f. The analyzer's display was plotted using a 'screen dump' utility.

4) Step 3) was repeated with the frequency hopping function enabled.

5.2.11.2.2 Low Band Edge (internal antenna)

1) The EUT was setup inside the test chamber on a non-conductive stand.
2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
3) The EUT was set to transmit continuously at the channel closest to the low band-edge (hopping function disabled).
4) The EUT was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded.
5) To determine the band edge compliance, the following spectrum analyzer settings were used:
   a. Center frequency = low band-edge frequency.
   b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
   c. Resolution bandwidth (RBW) ≥ 1% of the span.
   d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
   e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)
   f. The analyzer's display was plotted using a 'screen dump' utility.

6) Step 5) was repeated with the frequency hopping function enabled.

5.2.11.2.3 High Band Edge

1) The EUT was set to transmit continuously at the channel closest to the high band-edge (hopping function disabled).
2) A double ridged waveguide was placed 3 meters away from the EUT. The antenna was connected to the input of a spectrum analyzer.
3) The center frequency of the analyzer was set to the high band edge (2483.5MHz)
4) The resolution bandwidth was set to 1MHz.
5) To ensure that the maximum or worst case emission level was measured, the following steps were taken:

   a. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
   b. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
   c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

6) The highest measured peak reading was recorded.
7) The highest measured average reading was recorded.
8) Steps 1 through 7 were repeated with the hopping enabled.

5.2.11.3 Results

Pages 126 through 131 show the band-edge compliance results. As can be seen from these plots, the conducted emissions at the low end band edge are within the 20 dB down limits. The radiated emissions at the high end band edge are within the general limits.

### 5.2.12 Power Spectral Density

#### 5.2.12.1 Requirement

Per section 15.247(d), the peak power spectral density from the intentional radiator shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

#### 5.2.12.2 Procedures

##### 5.2.12.2.1 Radiated Method (internal antenna)

1) The EUT was placed on the non-conductive stand and set to transmit at a mid channel.
2) A broadband measuring antenna was placed near the EUT.
3) To determine the power spectral density, the following spectrum analyzer settings were used for Channel 1:
    a. Center frequency = transmit frequency
    b. Span = 1MHz or wider
    c. Resolution bandwidth (RBW) greater than the 6dB bandwidth.
    d. Sweep time = auto
    e. The peak detector and 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
    f. Channel 1 of the spectrum analyzer was placed in ‘View’ mode.
4) This reading corresponds to the peak output power measured for the mid channel.
5) Turn on the display line and place it at the corresponding +8dBm level. (e.g. if the peak output power is +18dBm then the +8dBm level will be 10dB down from the radiated level and if the peak output power is +6dBm then the +8dBm level will be 2dB above the radiated level.)
6) The EUT was then placed in the inquiry mode
7) To determine the power spectral density, the following spectrum analyzer settings were used for Channel 2:
    a. Center frequency = transmit frequency
    b. Span = 1MHz or wider
    c. Resolution bandwidth (RBW) = 3kHz
    d. Sweep time = span divided by RBW = ( for example :1MHz/3kHz = 333 seconds)
    e. The peak detector and 'Max-Hold' function was engaged.
    f. The display line represents the 8 dBm limit
    g. The analyzer's display was plotted using a 'screen dump' utility.

##### 5.2.12.2.2 Conducted Method (external antenna port)

1) The output of the EUT was connected to the spectrum analyzer through a 10dB pad and the
2) EUT was set to transmit at a mid channel.
3) To determine the power spectral density, the following spectrum analyzer settings were used for channel 1:
    a. Center frequency = transmit frequency
    b. Span = 1MHz
    c. Resolution bandwidth (RBW) = 1MHz
    d. Sweep time = auto
    e. The peak detector and 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
    f. Channel 1 of the spectrum analyzer was placed in ‘View’ mode.
4) This reading corresponds to the peak output power measured for the mid channel.
5) The EUT was then placed in the inquiry mode
6) To determine the power spectral density, the following spectrum analyzer settings were used for channel 2:
    a. Center frequency = transmit frequency
    b. Span = 1MHz
    c. Resolution bandwidth (RBW) = 3kHz

d. Sweep time = span divided by RBW = 1MHz/3kHz = 333 seconds
e. The peak detector and 'Max-Hold' function was engaged.
f. The display line represents the 8 dBm limit
g. The analyzer's display was plotted using a 'screen dump' utility.

#### 5.2.12.3 Results

Pages 132 and 133 show the power spectral density results. As can be seen from this plot, the peak power density is less than 8dBm in a 3kHz band during any time interval of continuous transmission.

## 6 CONCLUSIONS

It was determined that the Continental Automotive Product, Part No. PASS P3 Bluetooth hybrid frequency hopping transceiver, Serial No. FCC 1, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers and Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 2400-2483.5 MHz band, when tested per ANSI C63.4-2003.

It was also determined that the Continental Automotive Product, Part No. PASS P3 Bluetooth hybrid frequency hopping transceiver, Serial No. FCC 1, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.2 and Section 7.2.3 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 7.2.2 and RSS-210 Annex 2, section A2.9 for transmitters, when tested per ANSI C63.4-2003.

## 7 CERTIFICATION

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the EUT at the test date. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

## 8 ENDORSEMENT DISCLAIMER

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

# 9 EQUIPMENT LIST

**Table 9-1 Equipment List**

| Eq ID | Equipment Description | Manufacturer | Model No. | Serial No. | Frequency Range | Cal Date | Due Date |
|---|---|---|---|---|---|---|---|
| APW0 | PREAMPLIFIER | PLANAR ELECTRONICS | PE2-30-20G20R6G | PL2926/0646 | 20GHZ-26.5GHZ | 8/27/2010 | 8/27/2011 |
| APW3 | PREAMPLIFIER | PLANAR ELECTRONICS | PE2-35-120-5R0-10-12 | PL2924 | 1GHZ-20GHZ | 8/27/2010 | 8/27/2011 |
| GRE0 | SIGNAL GENERATOR | AGILENT TECHNOLOGIES | E4438C | MY42083127 | 250KHZ-6GHZ | 2/16/2010 | 2/16/2011 |
| NHG0 | STANDARD GAIN HORN ANTENNA | NARDA | 638 | --- | 18-26.5GHZ | NOTE 1 | |
| NTA2 | BILOG ANTENNA | TESEQ | 6112D | 28040 | 25-1000MHz | 6/7/2010 | 6/7/2011 |
| NWI0 | RIDGED WAVE GUIDE | AEL | H1498 | 153 | 2-18GHZ | 12/5/2009 | 12/5/2010 |
| NWI1 | RIDGED WAVE GUIDE | AEL | H1498 | 154 | 2-18GHZ | 12/5/2009 | 12/5/2010 |
| RBA0 | EMI TEST RECEIVER | ROHDE & SCHWARZ | ESIB26 | 100145 | 20HZ-26.5GHZ | 3/12/2010 | 3/12/2011 |
| RBB0 | EMI TEST RECEIVER 20HZ TO 40GHZ | ROHDE & SCHWARZ | ESIB40 | 100250 | 20 HZ TO 40GHZ | 3/16/2010 | 3/16/2011 |
| SES1 | 24VDC POWER SUPPLY | P TRANS | FS-32024-1M | 002 | 18-27VDC | NOTE 1 | |
| T1P0 | 10dB ATTENUATOR (40GHz) | WEINSCHEL | 89-10-12 | 254 | DC-40GHz | 11/6/2009 | 11/6/2010 |
| T2DM | 20DB, 25W ATTENUATOR | WEINSCHEL | 46-20-34 | BS2141 | DC-18GHZ | 8/9/2010 | 8/9/2011 |
| XPR0 | HIGH PASS FILTER | K&L MICROWAVE | 11SH10-4800/X20000 | 001 | 4.8-20GHZ | 7/19/2010 | 7/19/2011 |

I/O: Initial Only
N/A: Not Applicable
Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

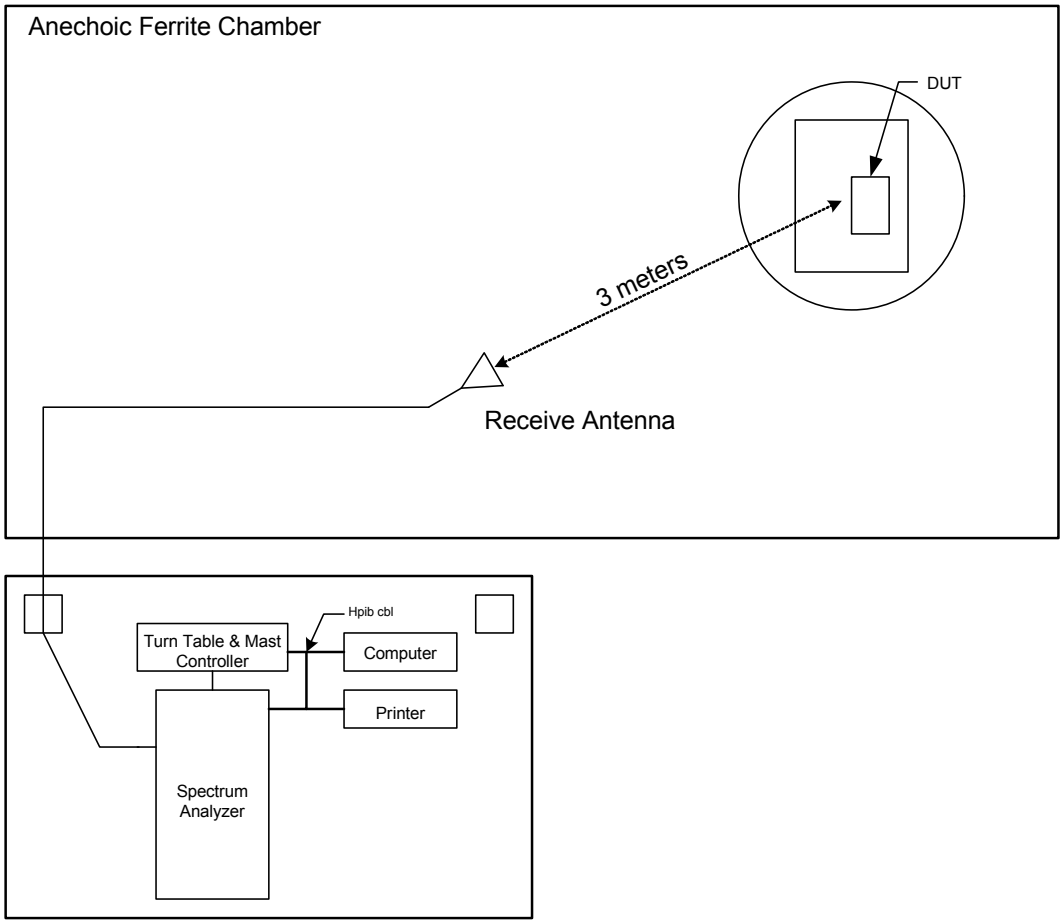



FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

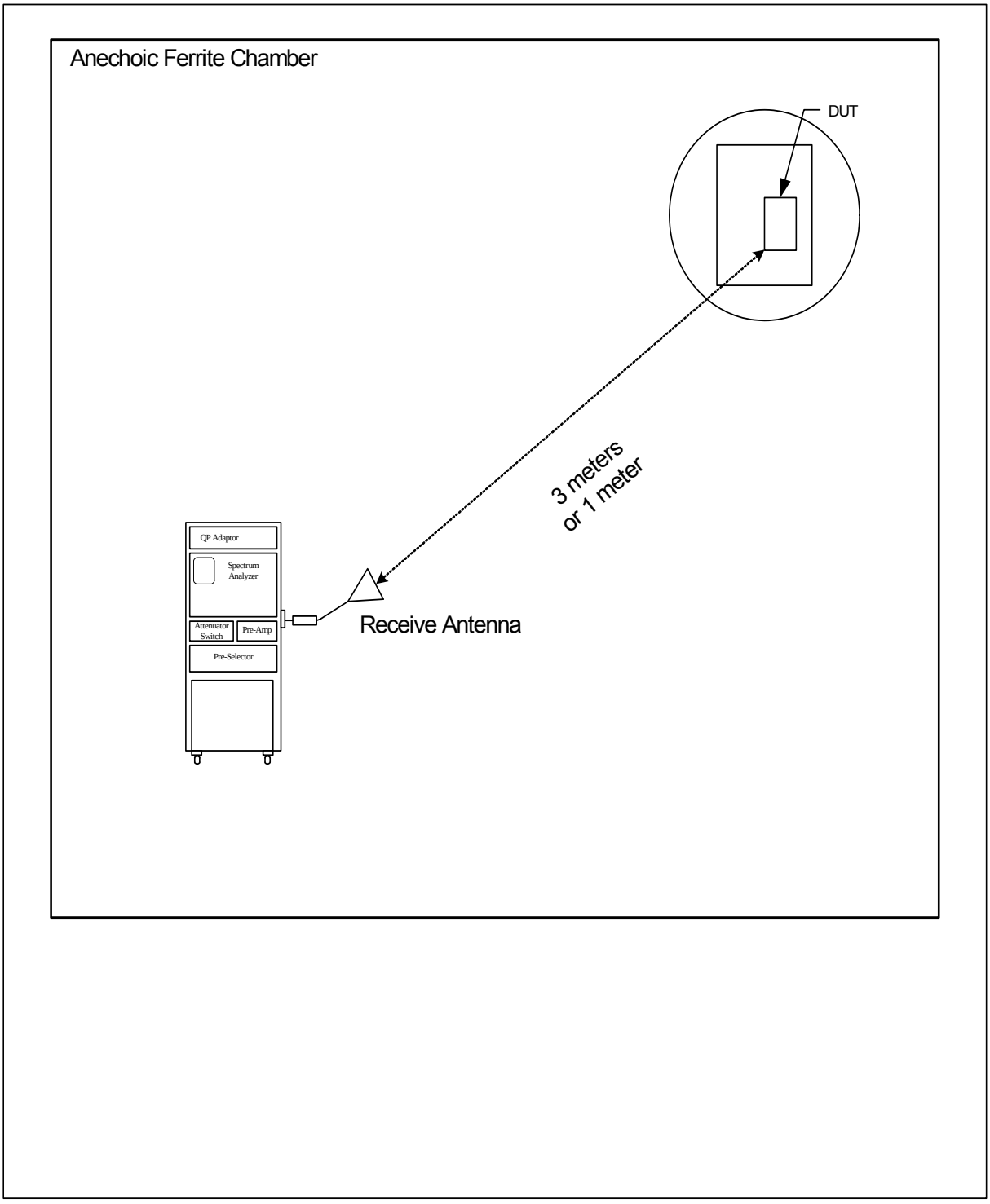


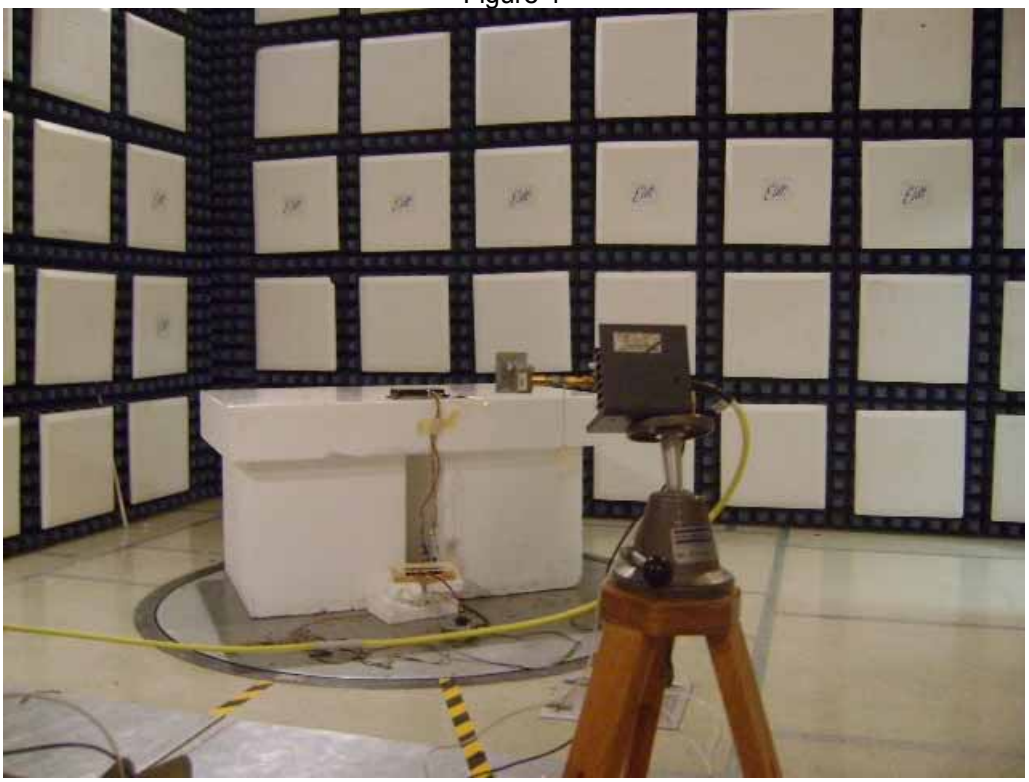

Figure 2: BLOCK DIAGRAM OF TEST SETUP FOR RADIATED EMISSIONS ABOVE 18GHZ

Figure 3

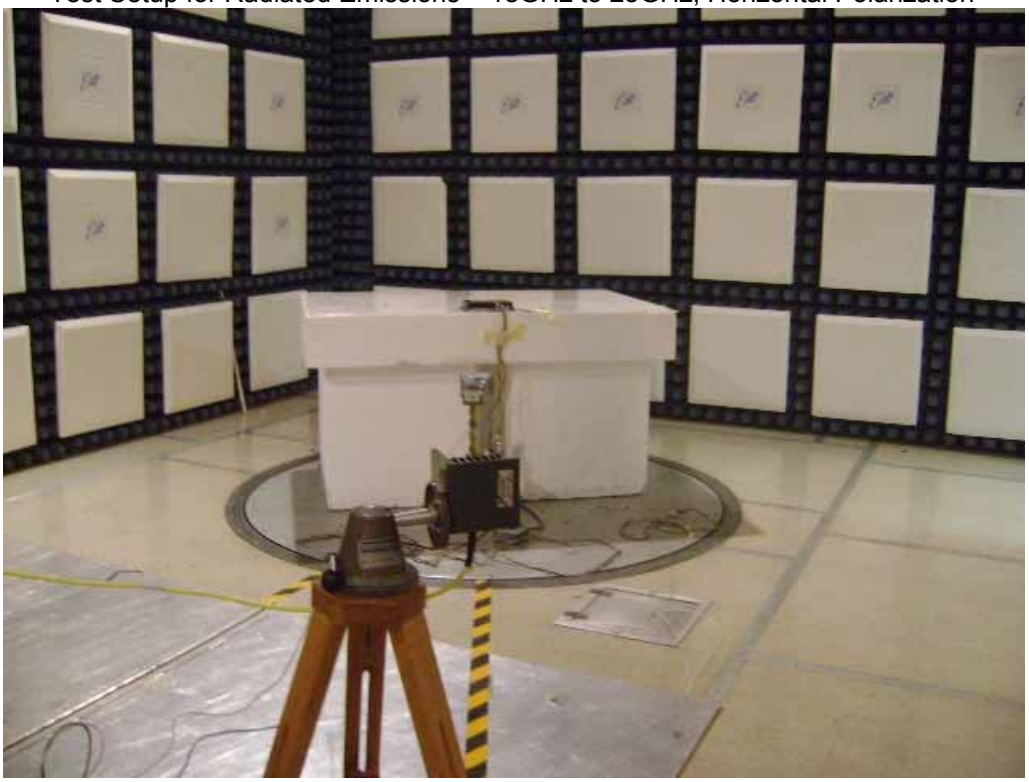
Test Setup for Radiated Emissions – 2GHz to 18GHz, Horizontal Polarization

Test Setup for Radiated Emissions – 2GHz to 18GHz, Vertical Polarization

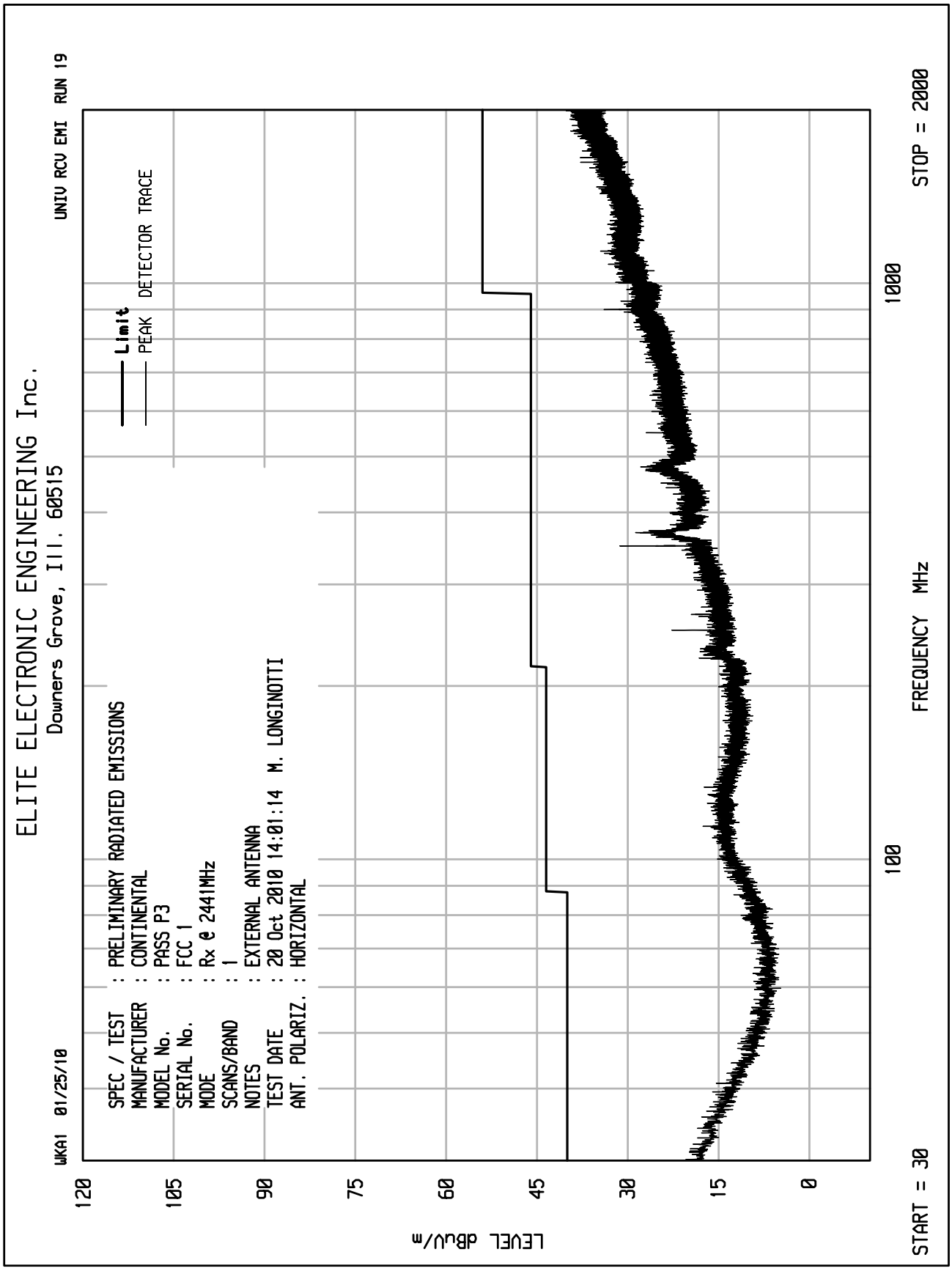
Figure 4

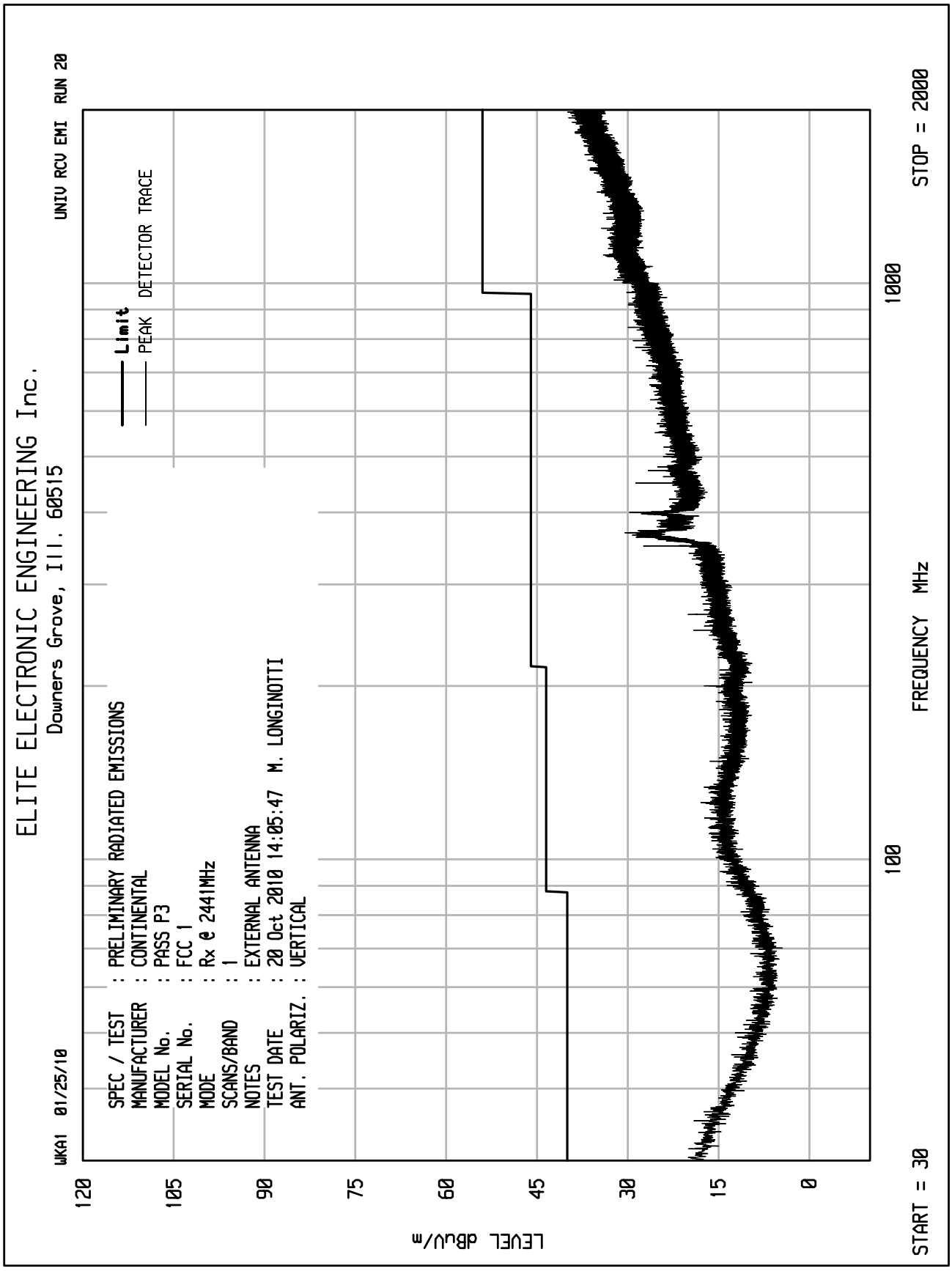


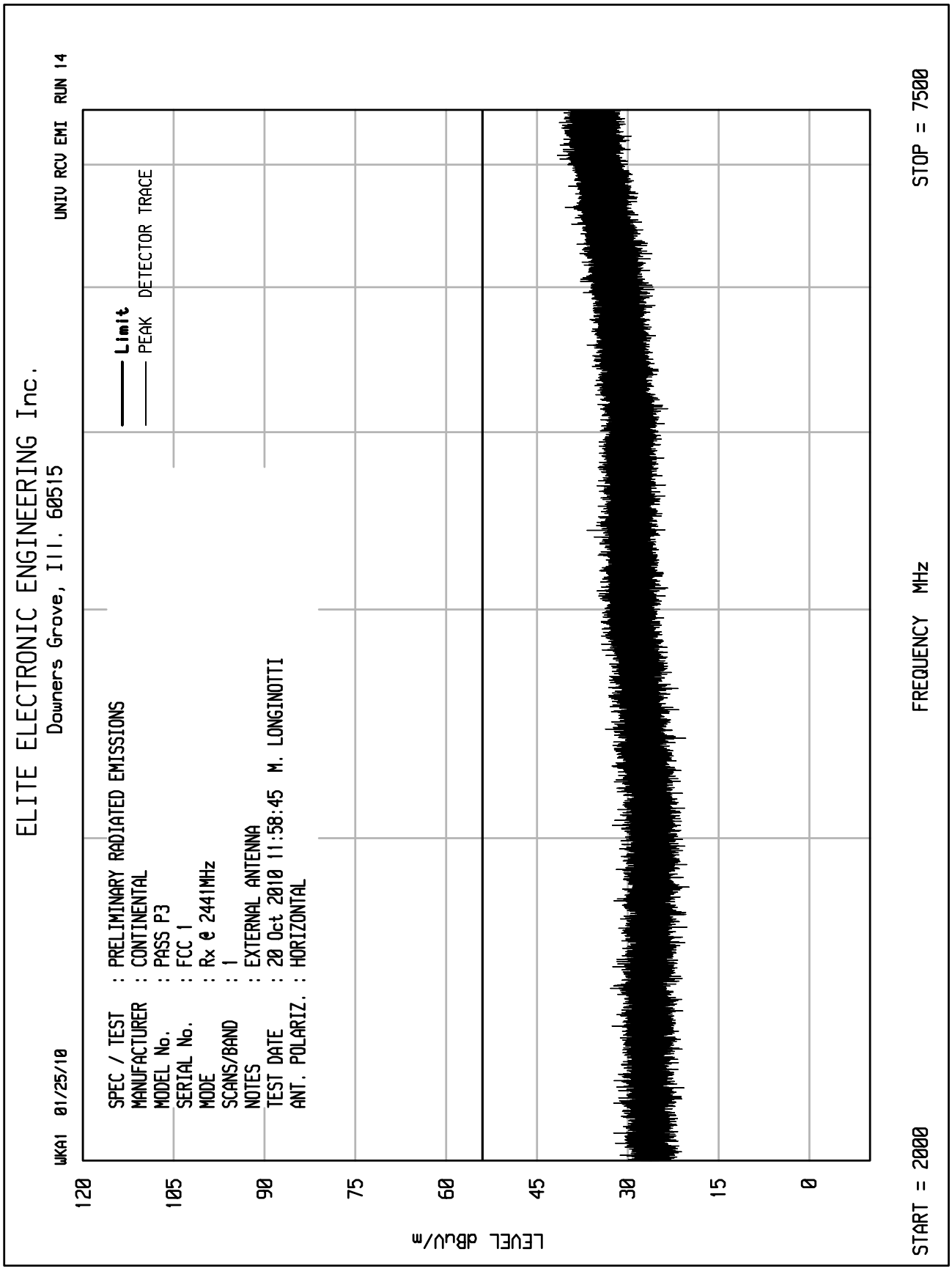
Test Setup for Radiated Emissions – 18GHz to 25GHz, Horizontal Polarization

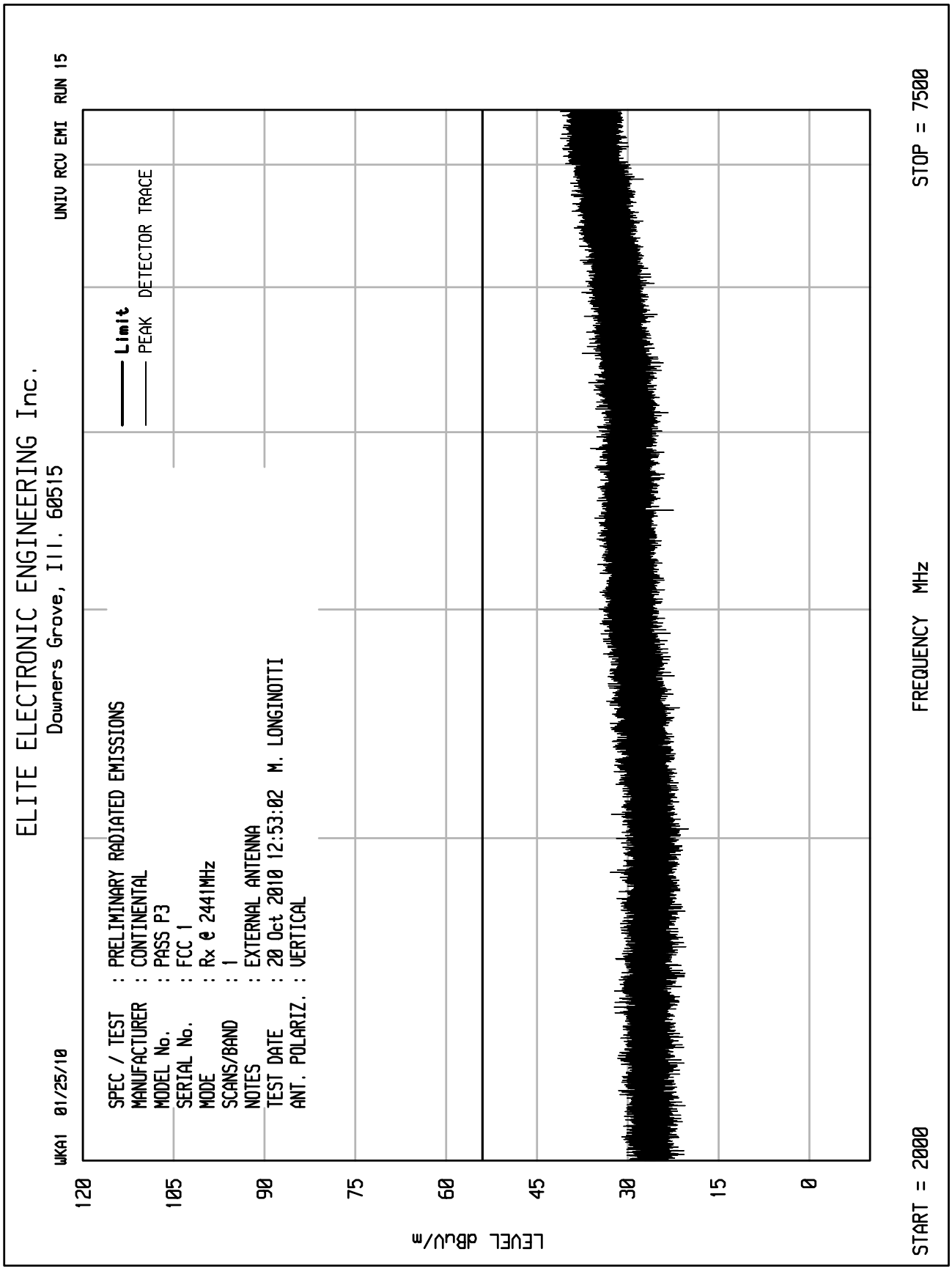


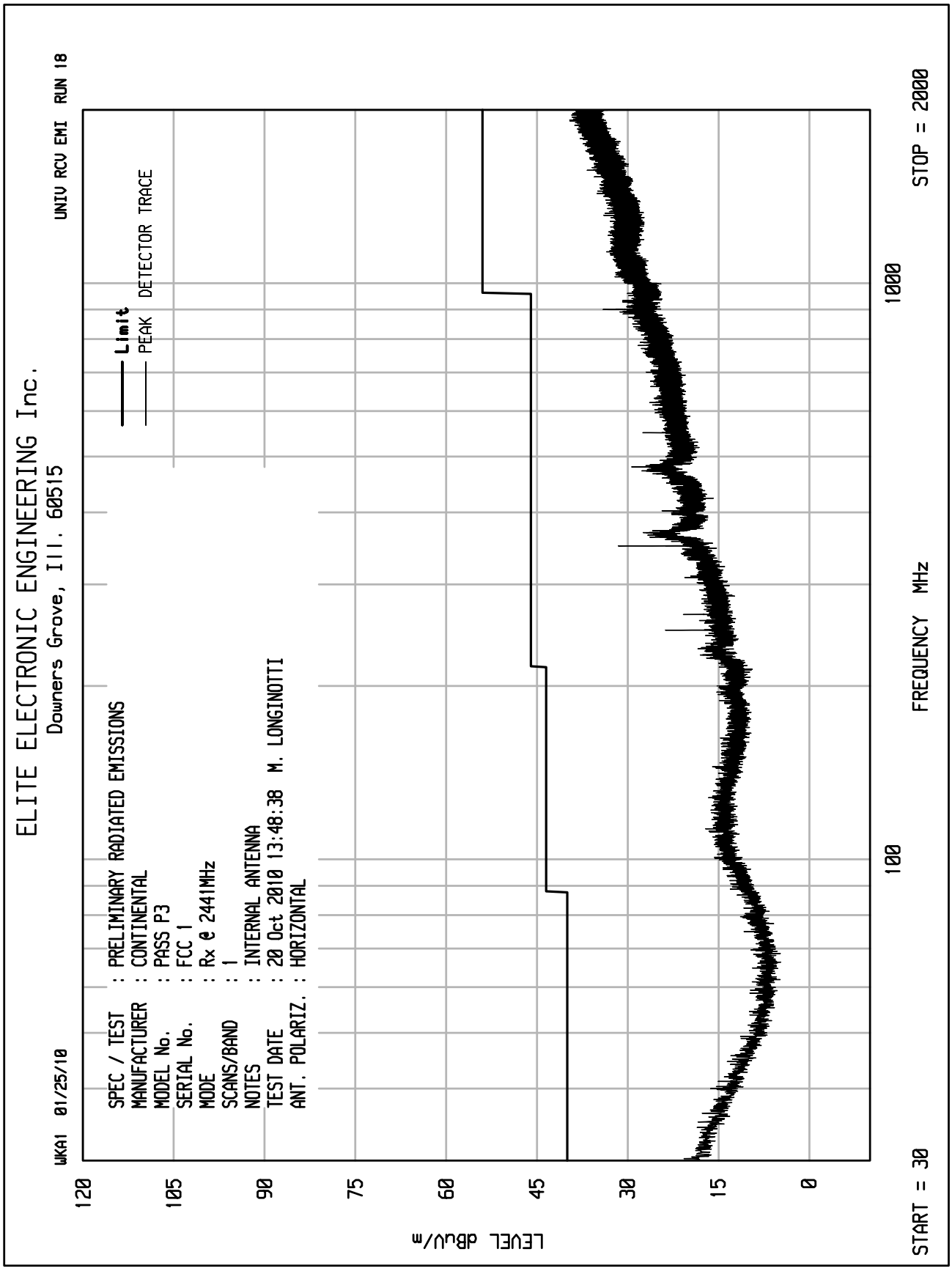
Test Setup for Radiated Emissions – 18GHz to 25GHz, Vertical Polarization

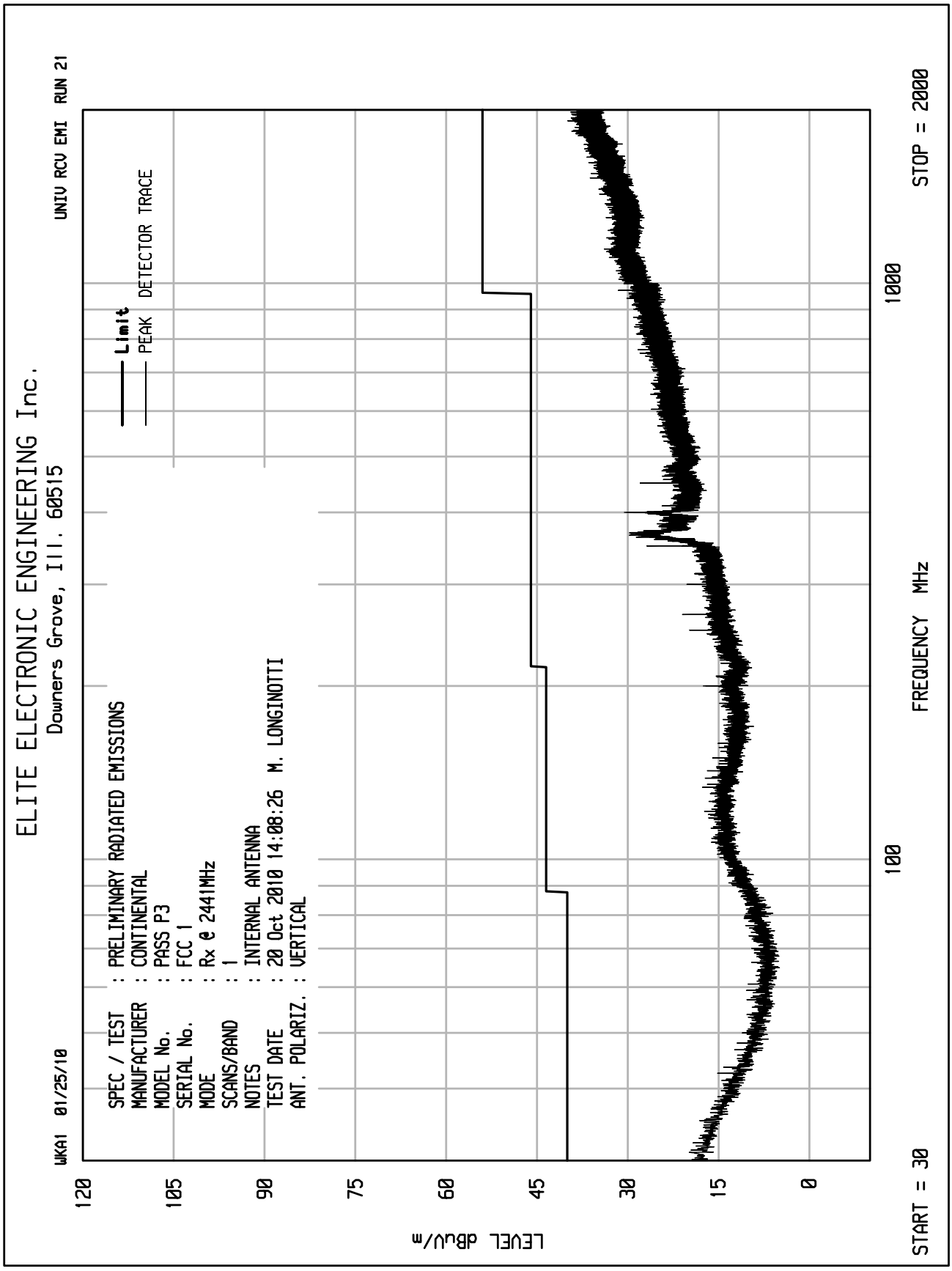

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 19
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CONTINENTAL
MODEL No. : PASS P3
SERIAL No. : FCC 1
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES : EXTERNAL ANTENNA
TEST DATE : 20 Oct 2010 14:01:14 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz

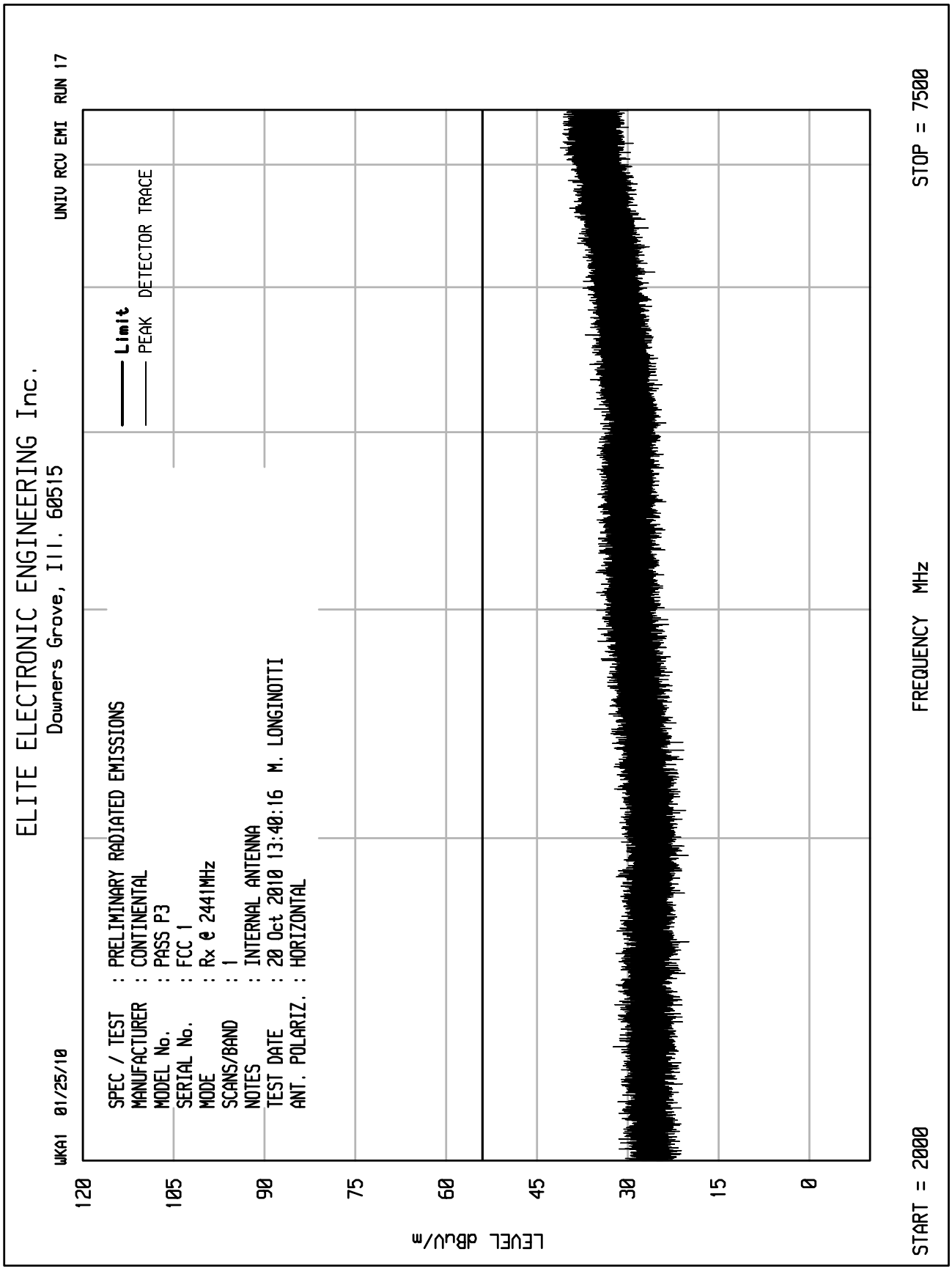

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 20
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CONTINENTAL
MODEL No. : PASS P3
SERIAL No. : FCC 1
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES : EXTERNAL ANTENNA
TEST DATE : 20 Oct 2010 14:05:47 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz

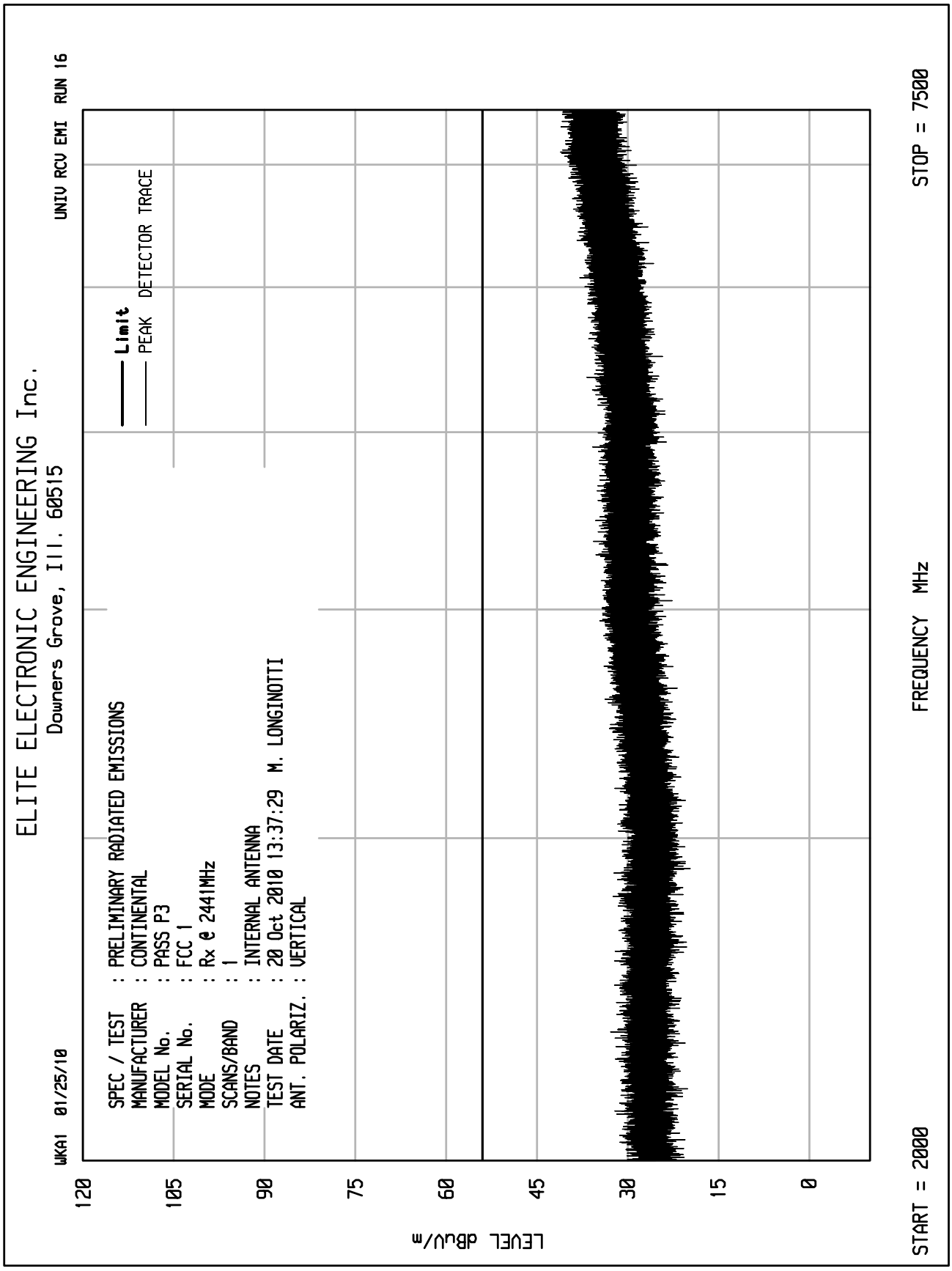

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 14
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CONTINENTAL
MODEL No. : PASS P3
SERIAL No. : FCC 1
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES : EXTERNAL ANTENNA
TEST DATE : 20 Oct 2010 11:58:45 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 2000
FREQUENCY MHz
STOP = 7500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 15
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CONTINENTAL
MODEL No. : PASS P3
SERIAL No. : FCC 1
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES : EXTERNAL ANTENNA
TEST DATE : 20 Oct 2010 12:53:02 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 2000
FREQUENCY MHz
STOP = 7500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 18
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CONTINENTAL
MODEL No. : PASS P3
SERIAL No. : FCC 1
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES : INTERNAL ANTENNA
TEST DATE : 20 Oct 2010 13:48:38 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 21
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CONTINENTAL
MODEL No. : PASS P3
SERIAL No. : FCC 1
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES : INTERNAL ANTENNA
TEST DATE : 20 Oct 2010 14:08:26 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 17
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CONTINENTAL
MODEL No. : PASS P3
SERIAL No. : FCC 1
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES : INTERNAL ANTENNA
TEST DATE : 20 Oct 2010 13:40:16 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 2000
FREQUENCY MHz
STOP = 7500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 16
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CONTINENTAL
MODEL No. : PASS P3
SERIAL No. : FCC 1
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES : INTERNAL ANTENNA
TEST DATE : 20 Oct 2010 13:37:29 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 2000
FREQUENCY MHz
STOP = 7500

Manufacturer : Continental
Model No. : Pass P3
Serial No. : FCC1
Specification : FCC-15.109 Spurious Radiated Emissions
Date : October 21, 2010
Mode : Rx @ 2441MHz
Equipment Used : RBB0, NTA2, NWI0, APW3, SES1
Notes : Test Distance is 3 meters
Notes : External Antenna

| Freq (MHz) | Ant Pol | Meter Reading (dBuV) | Ambient | CBL Fac (dB) | Ant Fac (dB) | Pre Amp (dB) | Total dBuV/m at 3 M | Total uV/m at 3M | Limit uV/m at 3M | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2439.500 | H | 35.9 | Ambient | 3.8 | 31.3 | -39.7 | 31.3 | 36.9 | 500.0 | -22.6 |
| 2439.500 | V | 36.1 | Ambient | 3.8 | 31.3 | -39.7 | 31.5 | 37.7 | 500.0 | -22.4 |
| 4879.000 | H | 33.9 | Ambient | 5.7 | 34.9 | -38.3 | 36.2 | 64.8 | 500.0 | -17.8 |
| 4879.000 | V | 33.8 | Ambient | 5.7 | 34.9 | -38.3 | 36.1 | 64.0 | 500.0 | -17.9 |
| 7318.500 | H | 34.8 | Ambient | 7.7 | 38.2 | -38.4 | 42.2 | 129.1 | 500.0 | -11.8 |
| 7318.500 | V | 34.8 | Ambient | 7.7 | 38.2 | -38.4 | 42.2 | 129.1 | 500.0 | -11.8 |

H – Horizontal V – Vertical

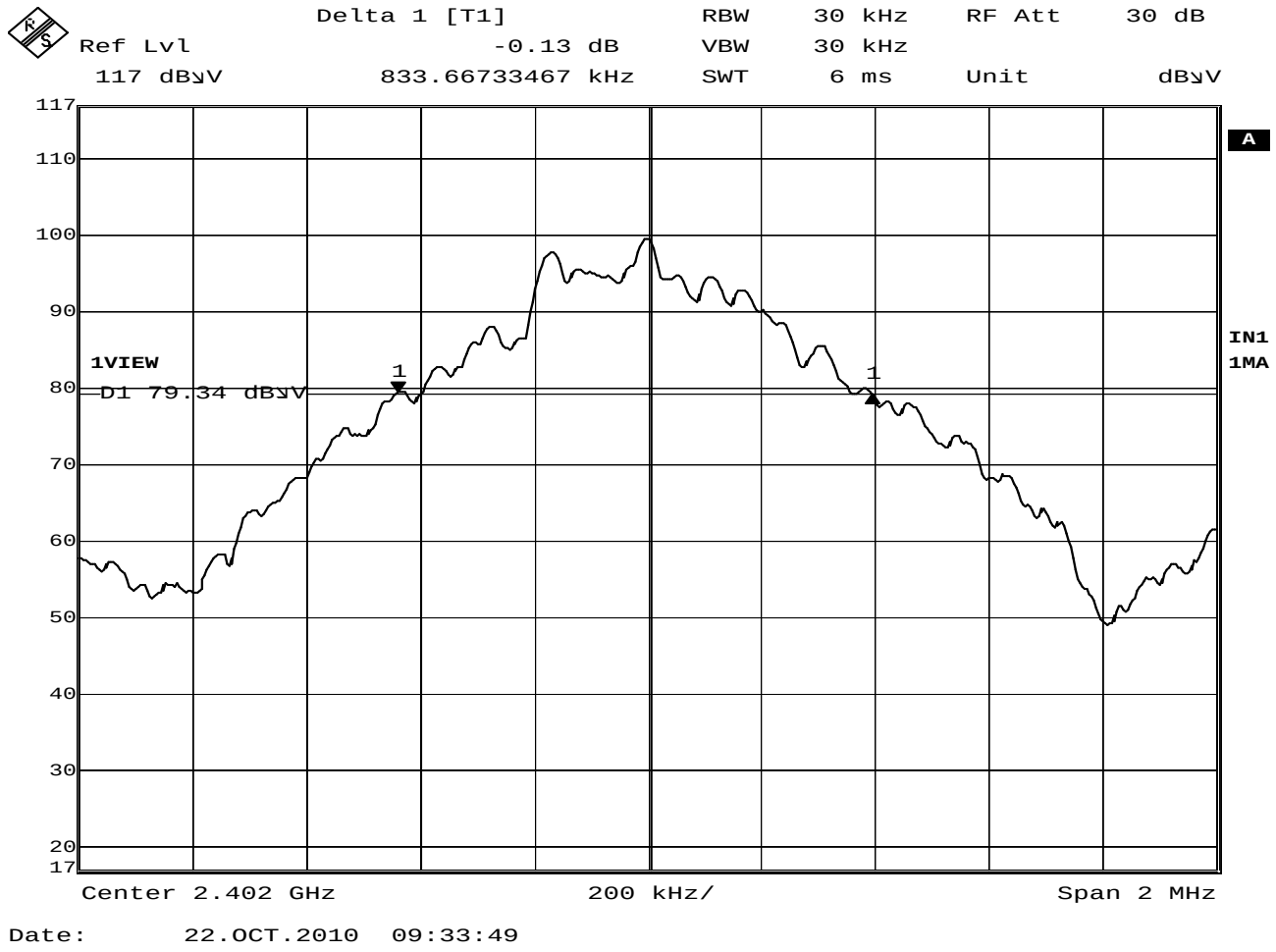
Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)

Manufacturer : Continental
Model No. : Pass P3
Serial No. : FCC1
Specification : FCC-15.109 Spurious Radiated Emissions
Date : October 21, 2010
Mode : Rx @ 2441MHz
Equipment Used : RBB0, NTA2, NWI0, APW3, SES1
Notes : Test Distance is 3 meters
Notes : Internal Antenna

| Freq (MHz) | Ant Pol | Meter Reading (dBuV) | Ambient | CBL Fac (dB) | Ant Fac (dB) | Pre Amp (dB) | Total dBuV/m at 3 M | Total uV/m at 3M | Limit uV/m at 3M | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 2439.500 | H | 35.9 | Ambient | 3.8 | 31.3 | -39.7 | 31.3 | 36.9 | 500.0 | -22.6 |
| 2439.500 | V | 36.1 | Ambient | 3.8 | 31.3 | -39.7 | 31.5 | 37.7 | 500.0 | -22.4 |
| 4879.000 | H | 33.9 | Ambient | 5.7 | 34.9 | -38.3 | 36.2 | 64.8 | 500.0 | -17.8 |
| 4879.000 | V | 33.8 | Ambient | 5.7 | 34.9 | -38.3 | 36.1 | 64.0 | 500.0 | -17.9 |
| 7318.500 | H | 34.8 | Ambient | 7.7 | 38.2 | -38.4 | 42.2 | 129.1 | 500.0 | -11.8 |
| 7318.500 | V | 34.8 | Ambient | 7.7 | 38.2 | -38.4 | 42.2 | 129.1 | 500.0 | -11.8 |

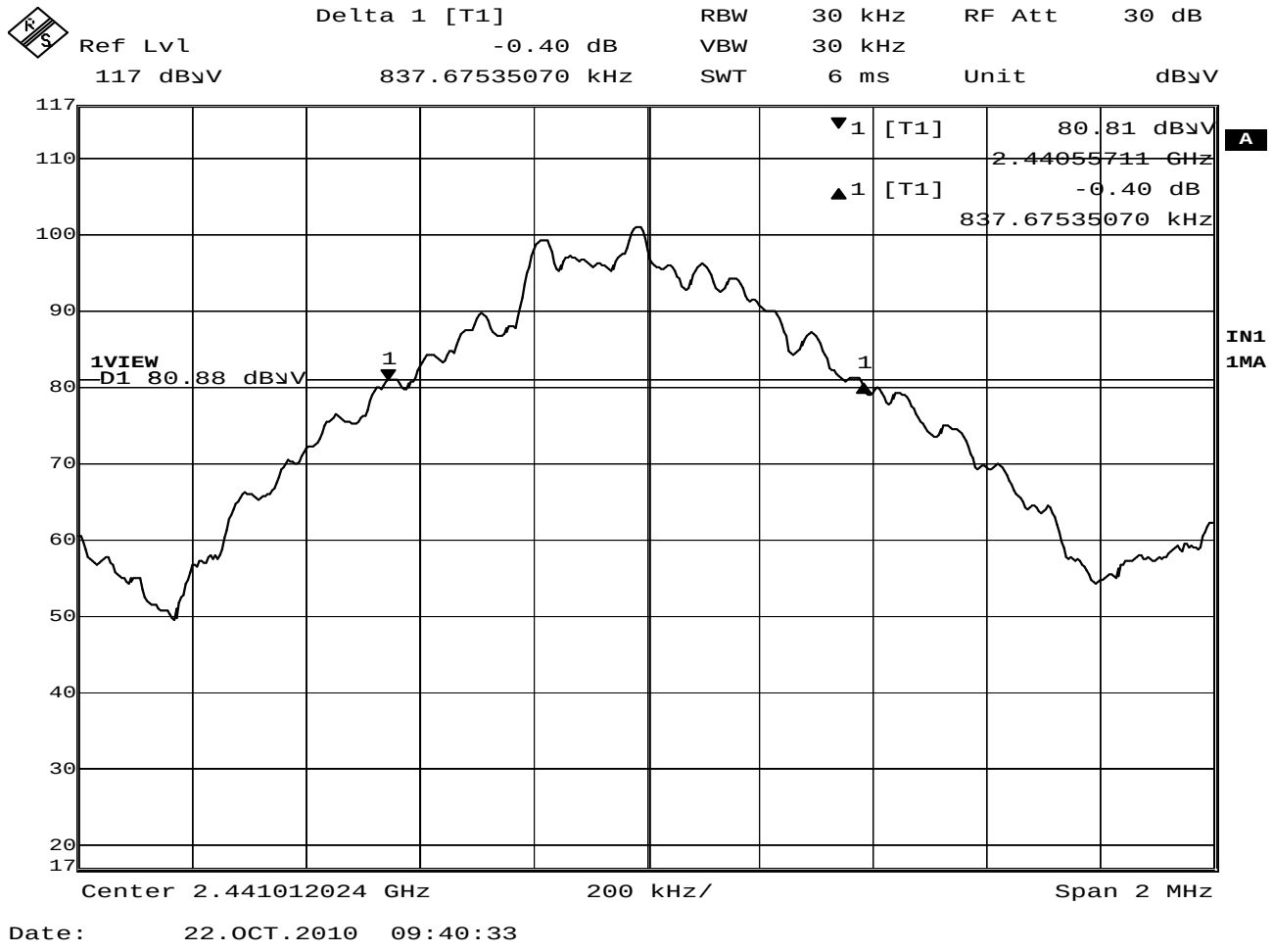
H – Horizontal V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cable Factor (dB) + Antenna Factor (dB) + Pre Amp (dB)



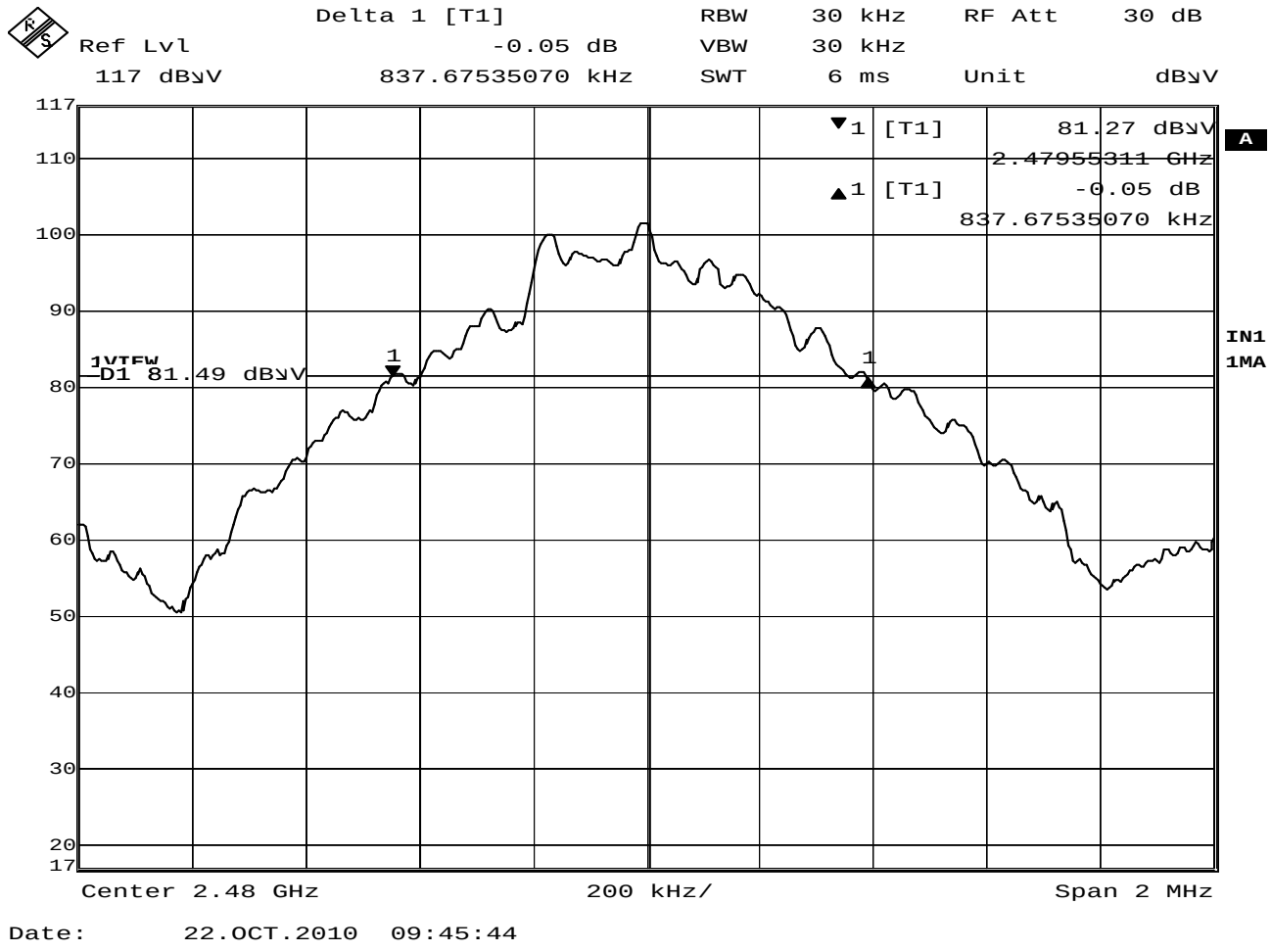

**15.247(a) 20dB Band Width**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2402MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | 20dB Band Width |
| NOTES | : | 20dB band width = 833.67kHz |
| EQUIPMENT USED | : | RBA0, T1P0 |



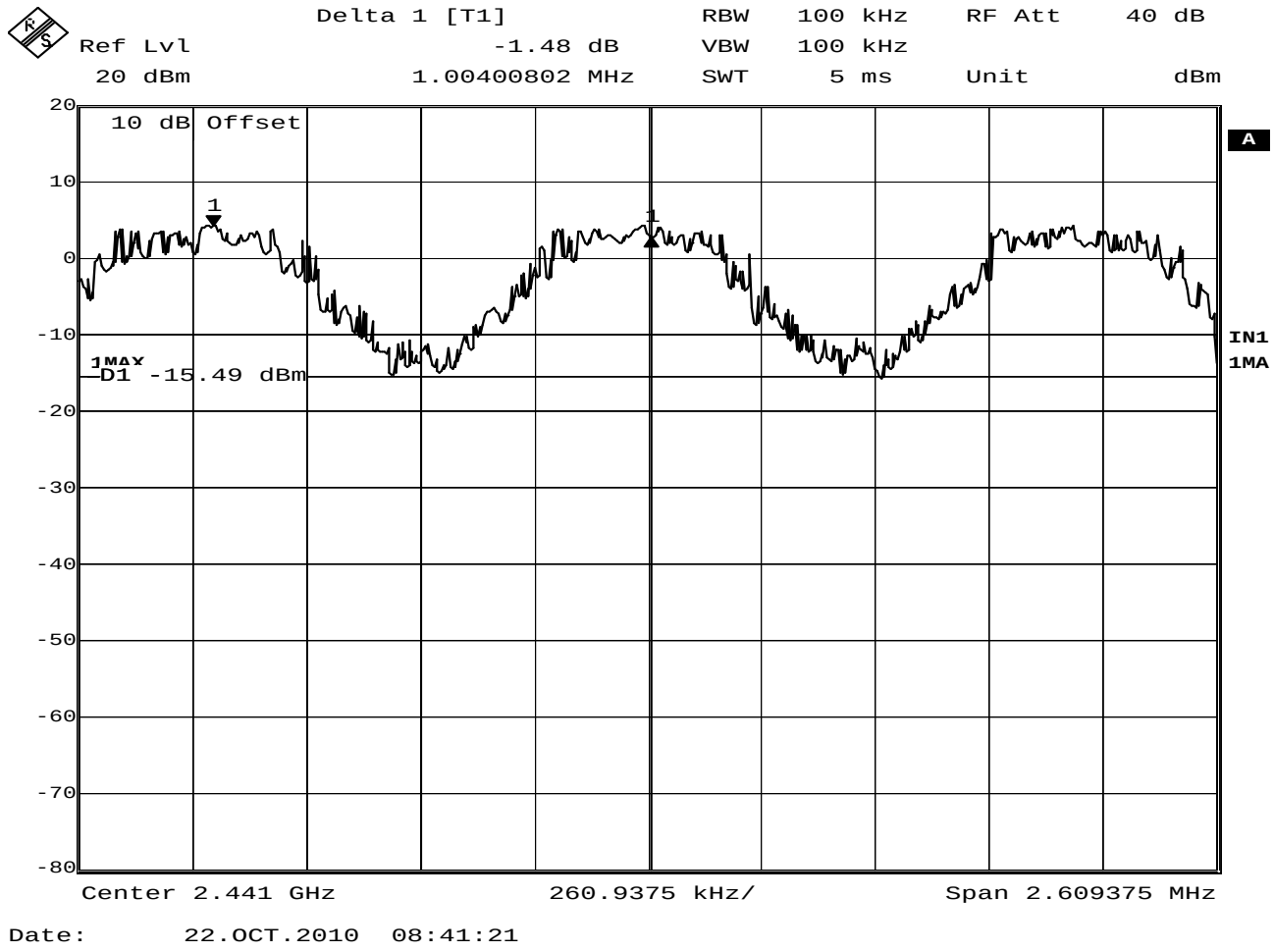

**15.247(a) 20dB Band Width**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2442MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | 20dB Band Width |
| NOTES | : | 20dB band width = 837.68kHz |
| EQUIPMENT USED | : | RBA0, T1P0 |



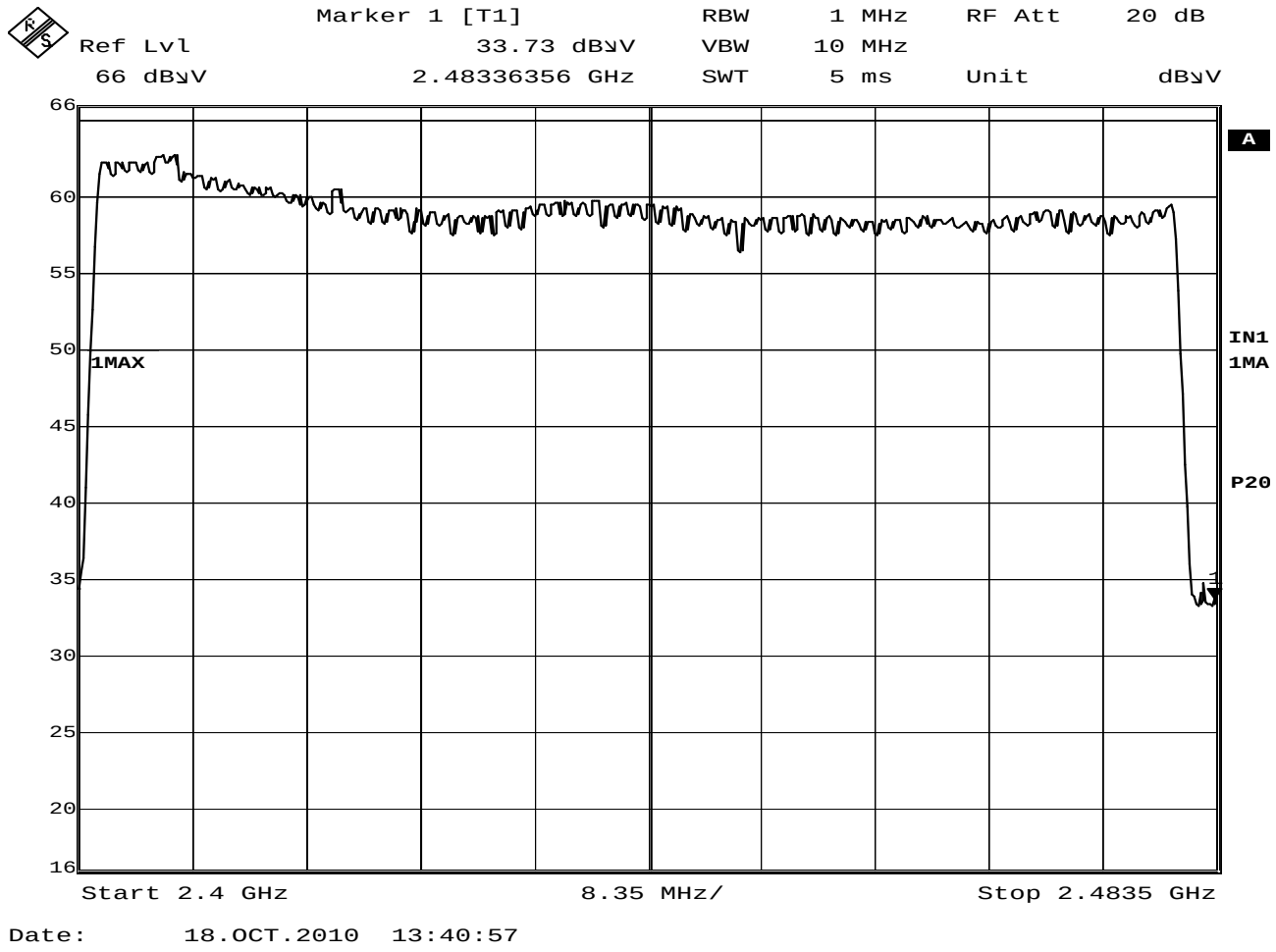

**15.247(a) 20dB Band Width**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2480MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | 20dB Band Width |
| NOTES | : | 20dB band width = 837.68kHz |
| EQUIPMENT USED | : | RBA0, T1P0 |



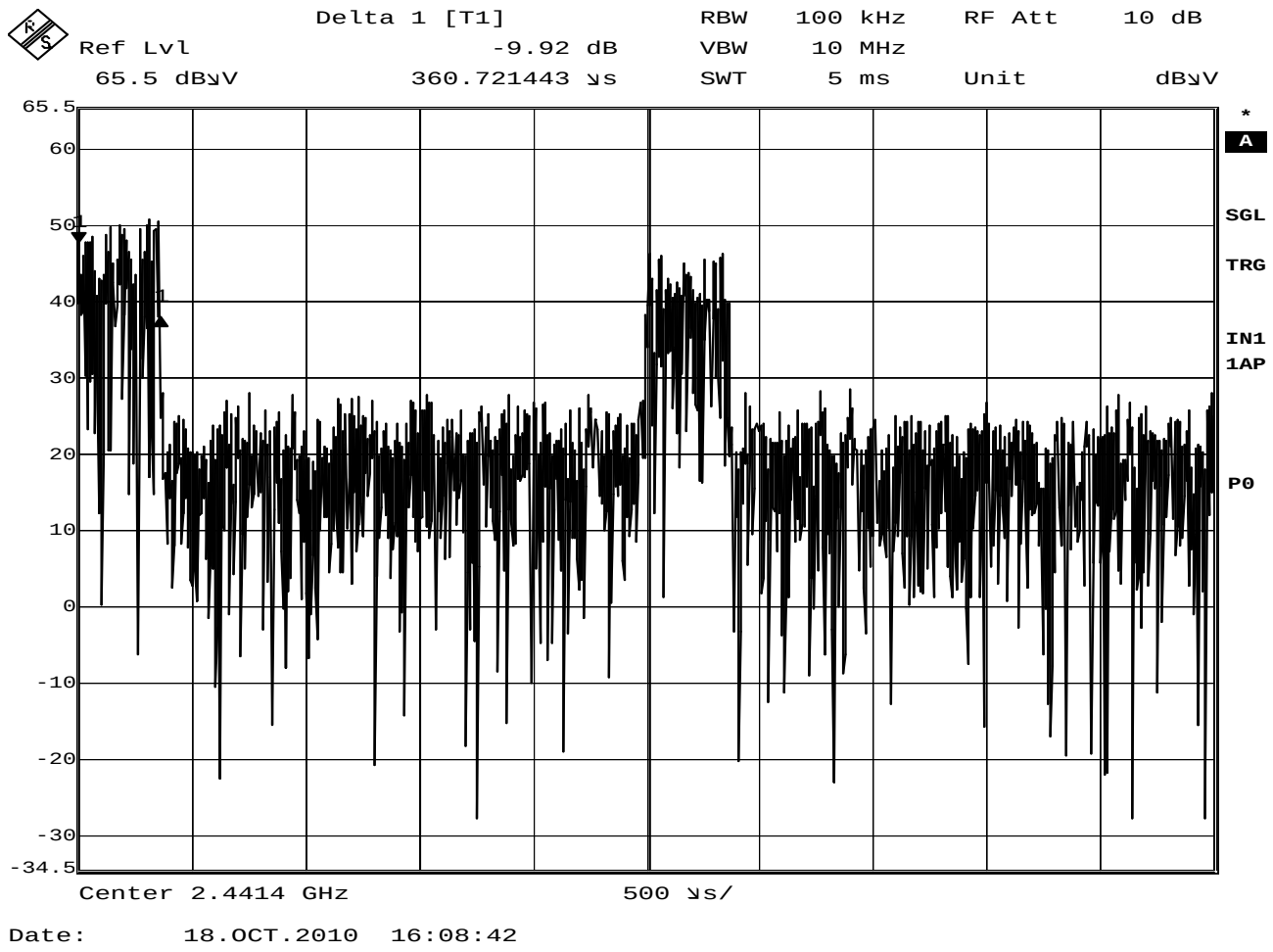

**15.247(a) Carrier Frequency Separation**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Hopping Enabled |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Carrier Frequency Separation |
| NOTES | : | Carrier Frequency Separation = 1MHz |
| EQUIPMENT USED | : | RBA0, T1P0 |



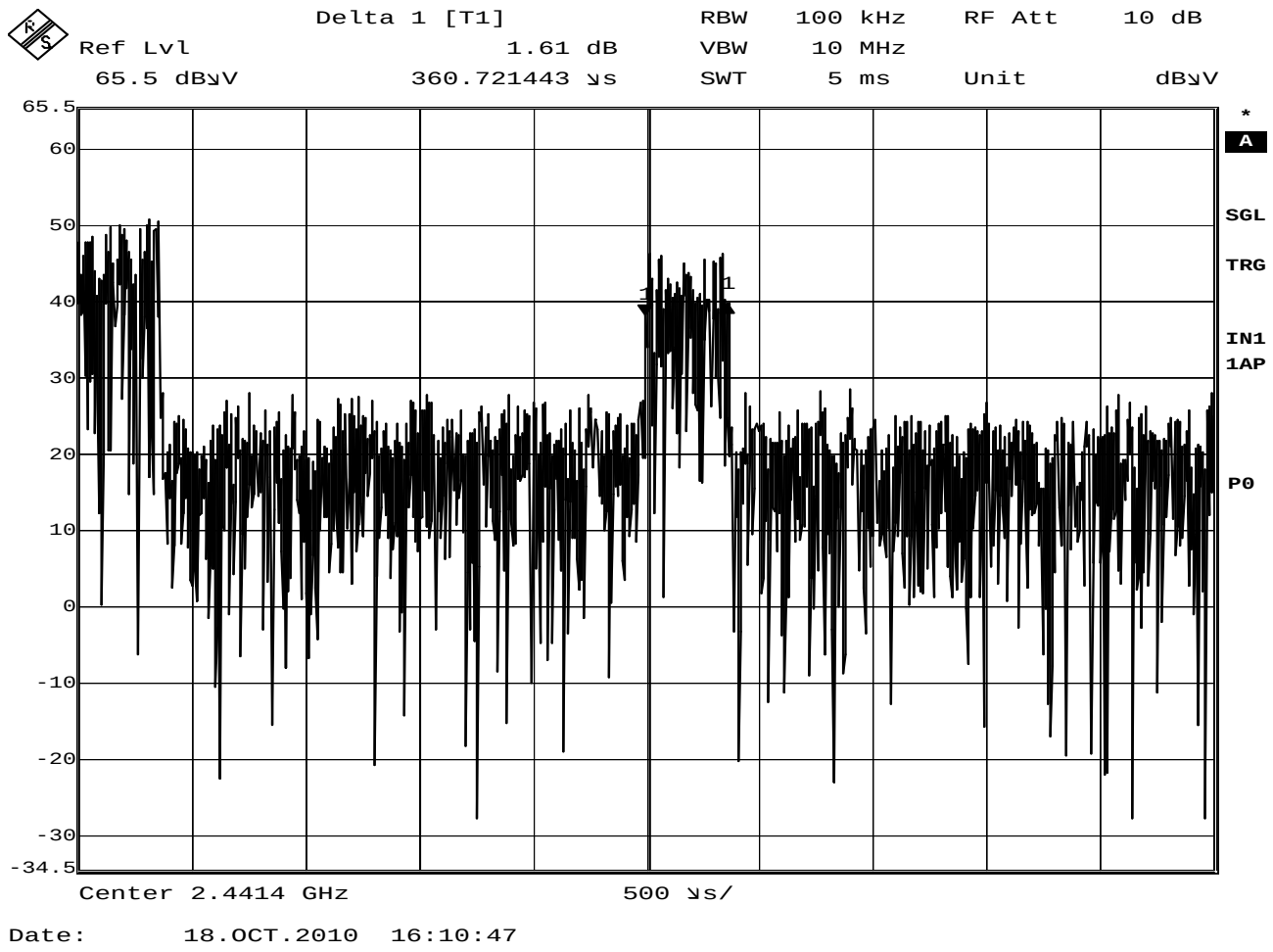

**15.247(a) Number of Hopping Channels**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Hopping Enabled |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Number of Hopping Channels |
| NOTES | : | Number of Hopping Channels = 79 |
| EQUIPMENT USED | : | RBB0, NWI0 |



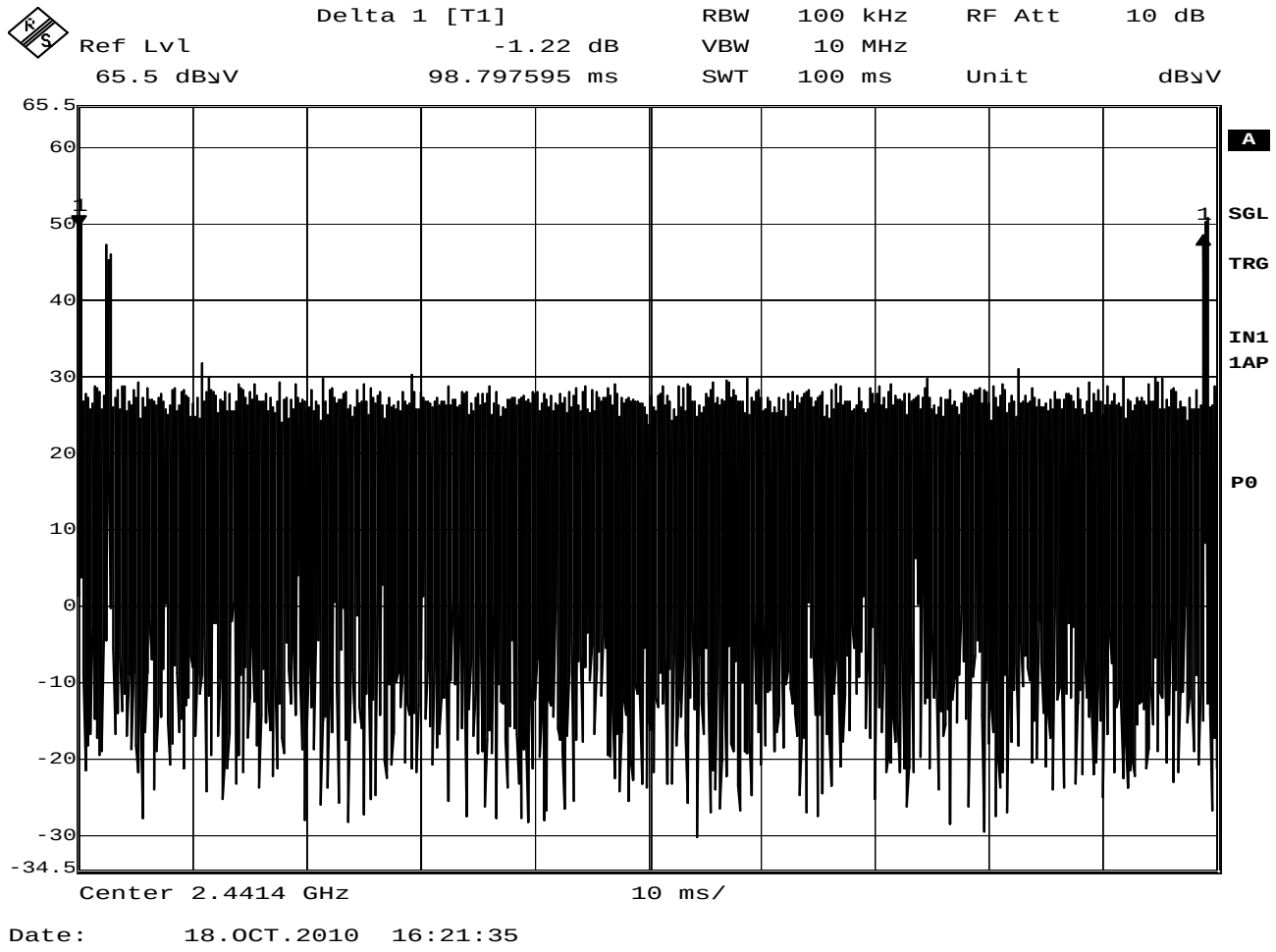

**15.247(a) Time of Occupancy**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Hopping Enabled |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Time of Occupancy |
| NOTES | : | Duration of Pulse 1 = 360.7usec |
| EQUIPMENT USED | : | RBB0, NWI0 |



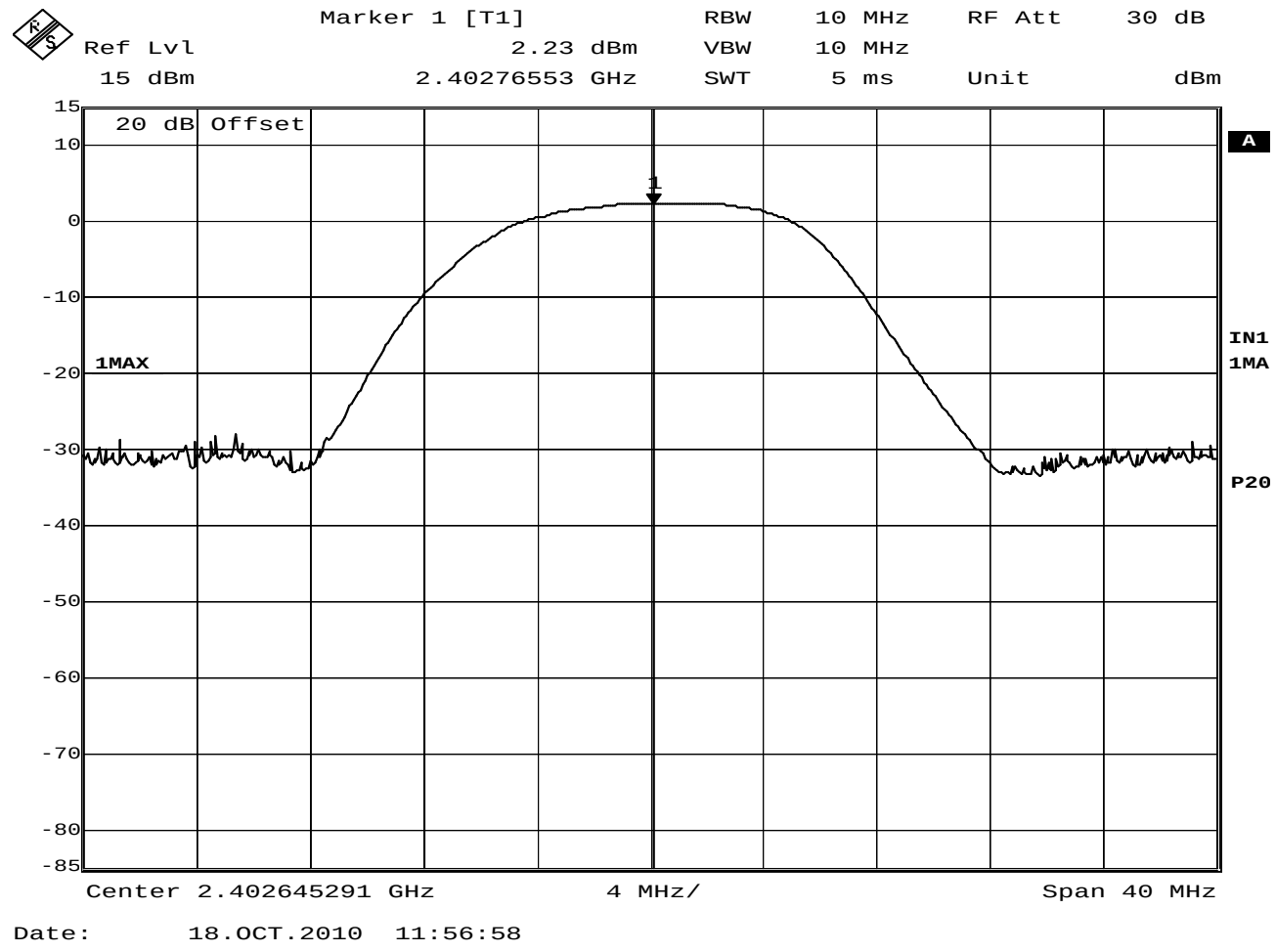

**15.247(a) Time of Occupancy**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Hopping Enabled |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Time of Occupancy |
| NOTES | : | Duration of Pulse 2 = 360.7usec |
| EQUIPMENT USED | : | RBB0, NWI0 |



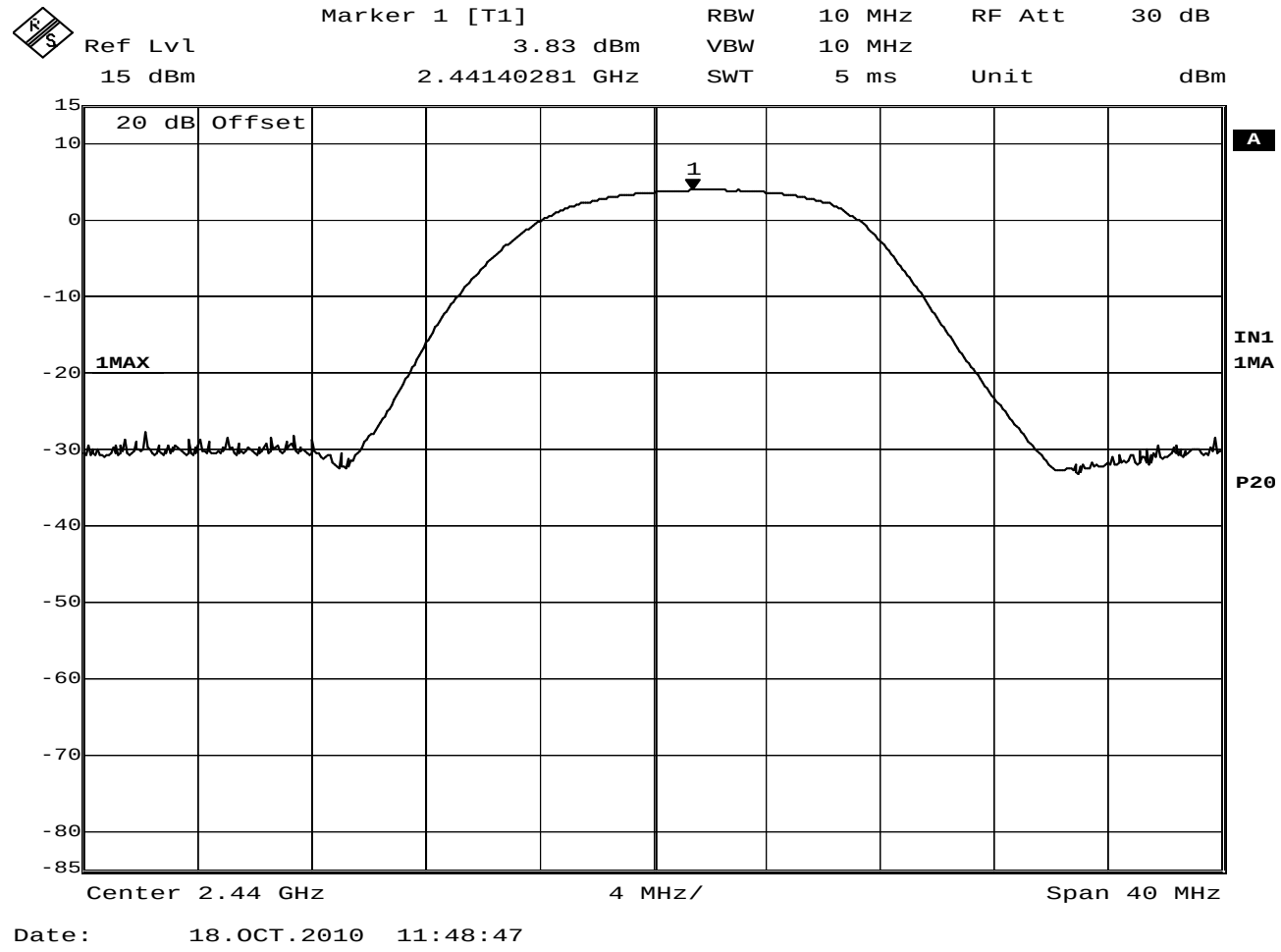

**15.247(a) Time of Occupancy**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Hopping Enabled |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Time of Occupancy |
| NOTES | : | A hop occurs at this frequency once every 98.8msec or 0.0988sec. Since there are 79 hopping channels, the time of occupancy must be measured over a time of 0.4sec x (number of hopping channels) = 0.4 x 79 = 31.6 seconds. The hopping sequence hits 1 channel every 98.8msec. To measure time of occupancy: (on time per hop)x( number of hops in a 31.6 second period) = ((pulse 1 on time) + (pulse 2 on time))x((1 hop/0.0988sec) x 31.6 sec) = (360.7usec + 360.7usec)*(319.8) = 230,731.2usec = 230.7msec = .231sec |
| EQUIPMENT USED | : | RBB0, NWI0 |



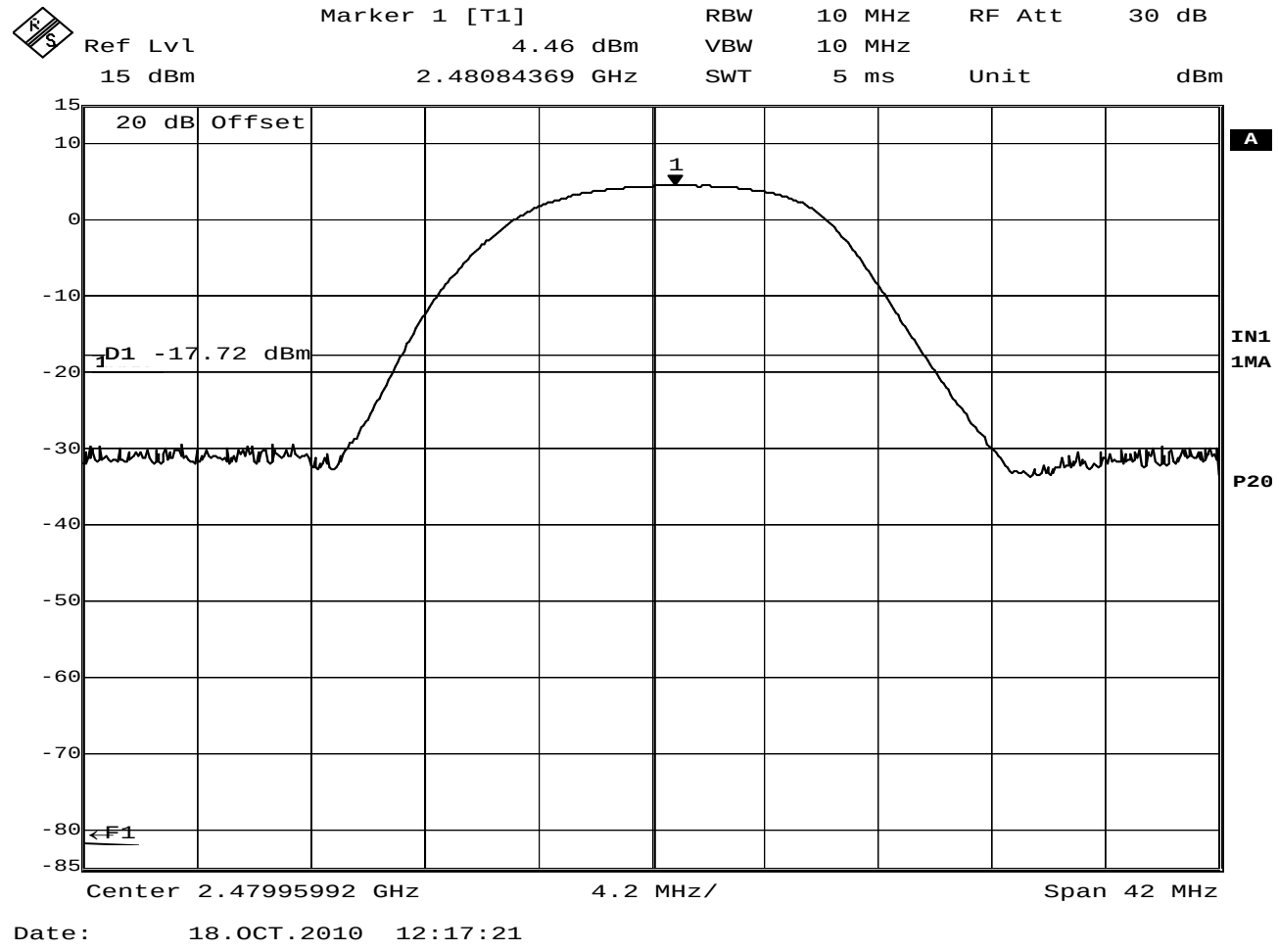

**15.247(b) Peak Output Power (conducted)**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2402.7MHz |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Peak Output Power |
| NOTES | : | Peak Output Power = 2.23dBm = 1.67mW |
| EQUIPMENT USED | : | RBB0, T2DM |




**15.247(b) Peak Output Power (conducted)**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2441.4MHz |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Peak Output Power |
| NOTES | : | Peak Output Power = 3.83dBm = 2.42mW |
| EQUIPMENT USED | : | RBB0, T2DM |



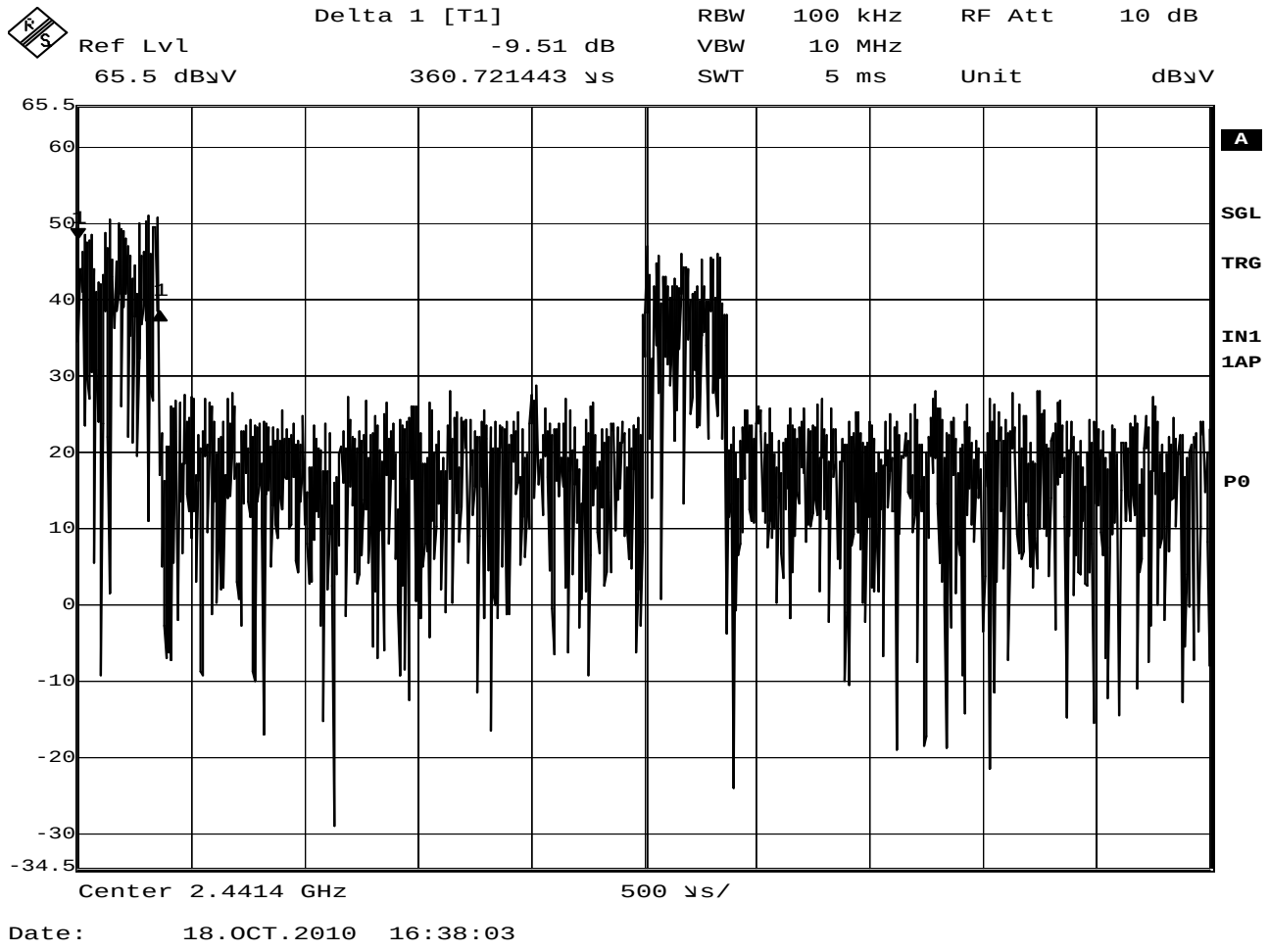

**15.247(b) Peak Output Power (conducted)**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2480.84MHz |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Peak Output Power |
| NOTES | : | Peak Output Power = 4.46dBm = 2.79mW |
| EQUIPMENT USED | : | RBB0, T2DM |

Manufacturer : Continental Automotive
Model No. : Pass P3
Serial No. : FCC1
Specification : FCC-15.247 Effective Isotropic Radiated Power (EIRP)
Date : October 20, 2010
Mode : See Below
Equipment Used : RBB0, NWI0, NWI1, GRE0
Notes : Test Distance is 3 meters

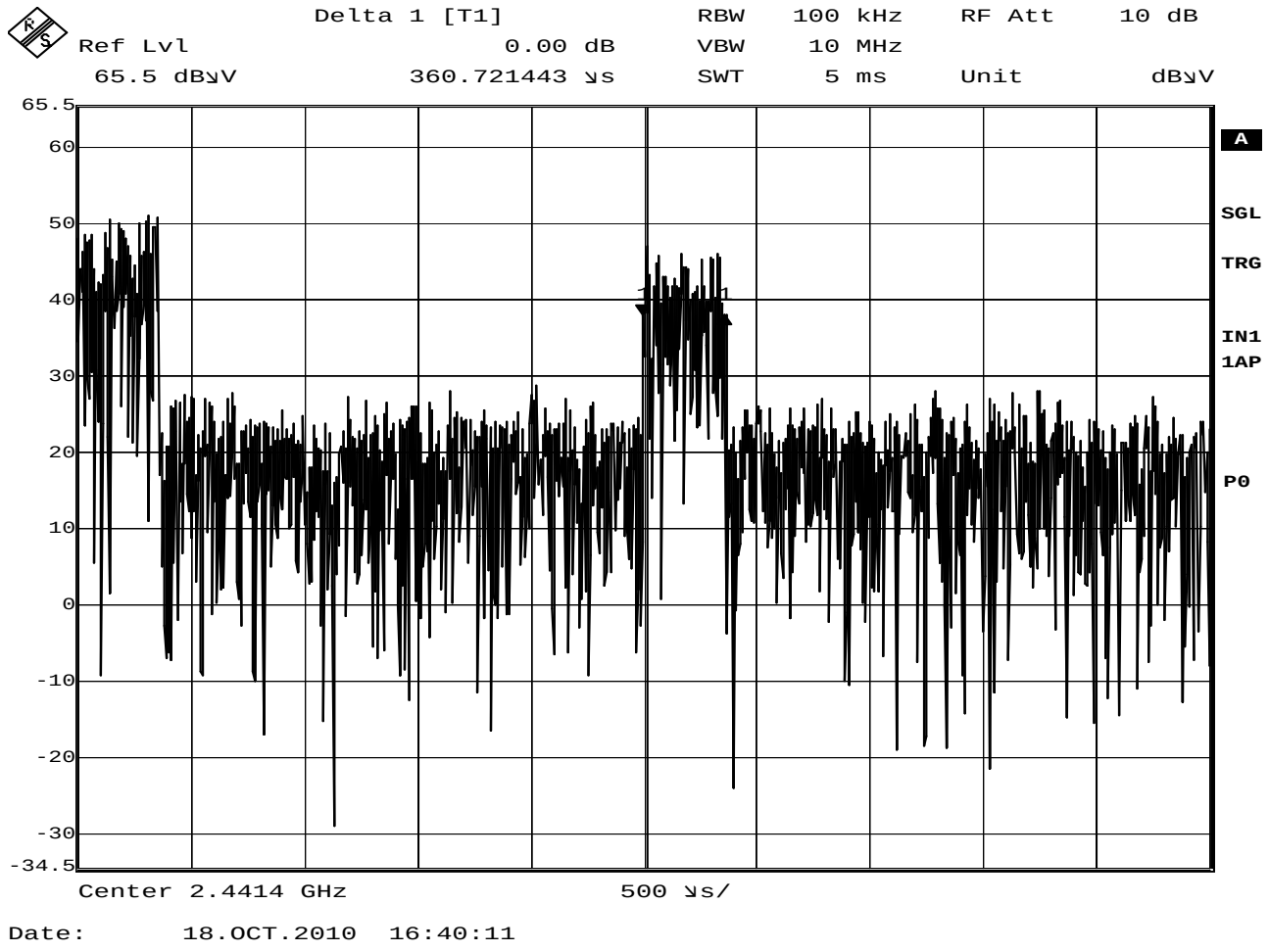
| Freq (MHz) | Ant Pol | Meter Reading (dBuV) | Ambient | Matched SIG. GEN. (dBm) | Ant Gain (dB) | CBL (dB) | EIRP Total (dBm) | Limit dBm |
|---|---|---|---|---|---|---|---|---|
| Transmit at 2402MHz, External Antenna | | | | | | | | |
| 2401.9 | H | 59.2 | | -8.4 | 4.3 | 3.0 | -7.1 | 36.0 |
| 2401.9 | V | 66.9 | | -0.8 | 4.3 | 3.0 | 0.5 | 36.0 |
| Transmit at 2402MHz, Internal Antenna | | | | | | | | |
| 2401.9 | H | 61.2 | | -6.3 | 4.3 | 3.0 | -5.0 | 36.0 |
| 2401.9 | V | 68.0 | | -0.1 | 4.3 | 3.0 | 1.2 | 36.0 |
| Transmit at 2441MHz, External Antenna | | | | | | | | |
| 2439.5 | H | 35.9 | | -10.6 | 4.4 | 3.1 | -9.2 | 36.0 |
| 2439.5 | V | 36.1 | | -6.6 | 4.4 | 3.1 | -5.2 | 36.0 |
| Transmit at 2441MHz, Internal Antenna | | | | | | | | |
| 2439.5 | H | 36.1 | | -10.6 | 4.4 | 3.1 | -9.2 | 36.0 |
| 2439.5 | V | 36.3 | | -6.6 | 4.4 | 3.1 | -5.2 | 36.0 |
| Transmit at 2480MHz, External Antenna | | | | | | | | |
| 2479.9 | H | 60.8 | | -6.1 | 4.6 | 3.1 | -4.6 | 36.0 |
| 2479.9 | V | 69.9 | | 2.3 | 4.6 | 3.1 | 3.8 | 36.0 |
| Transmit at 2480MHz, Internal Antenna | | | | | | | | |
| 2479.9 | H | 61.0 | | -5.8 | 4.6 | 3.1 | -4.3 | 36.0 |
| 2479.9 | V | 63.7 | | -3.7 | 4.6 | 3.1 | -2.2 | 36.0 |

EIRP (dBm) = Matched Signal Generator (dBm) + Antenna Gain (dB) – Antenna Gain (dB)



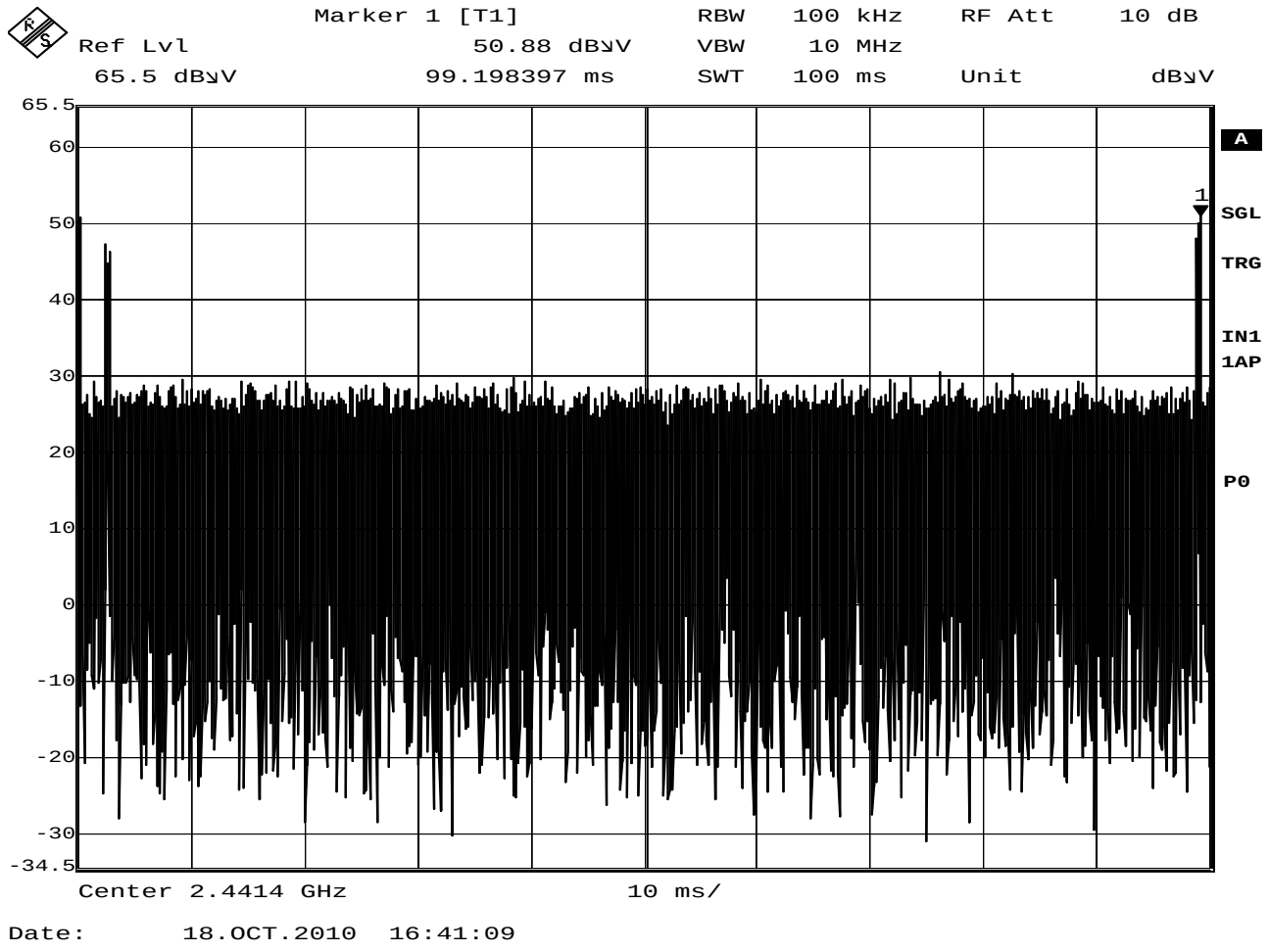

**15.247 Duty Cycle Factor**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Hopping Enabled |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Duty Cycle Factor |
| NOTES | : | Duration of Pulse 1 = 360.7usec |
| EQUIPMENT USED | : | RBB0, NWI0 |



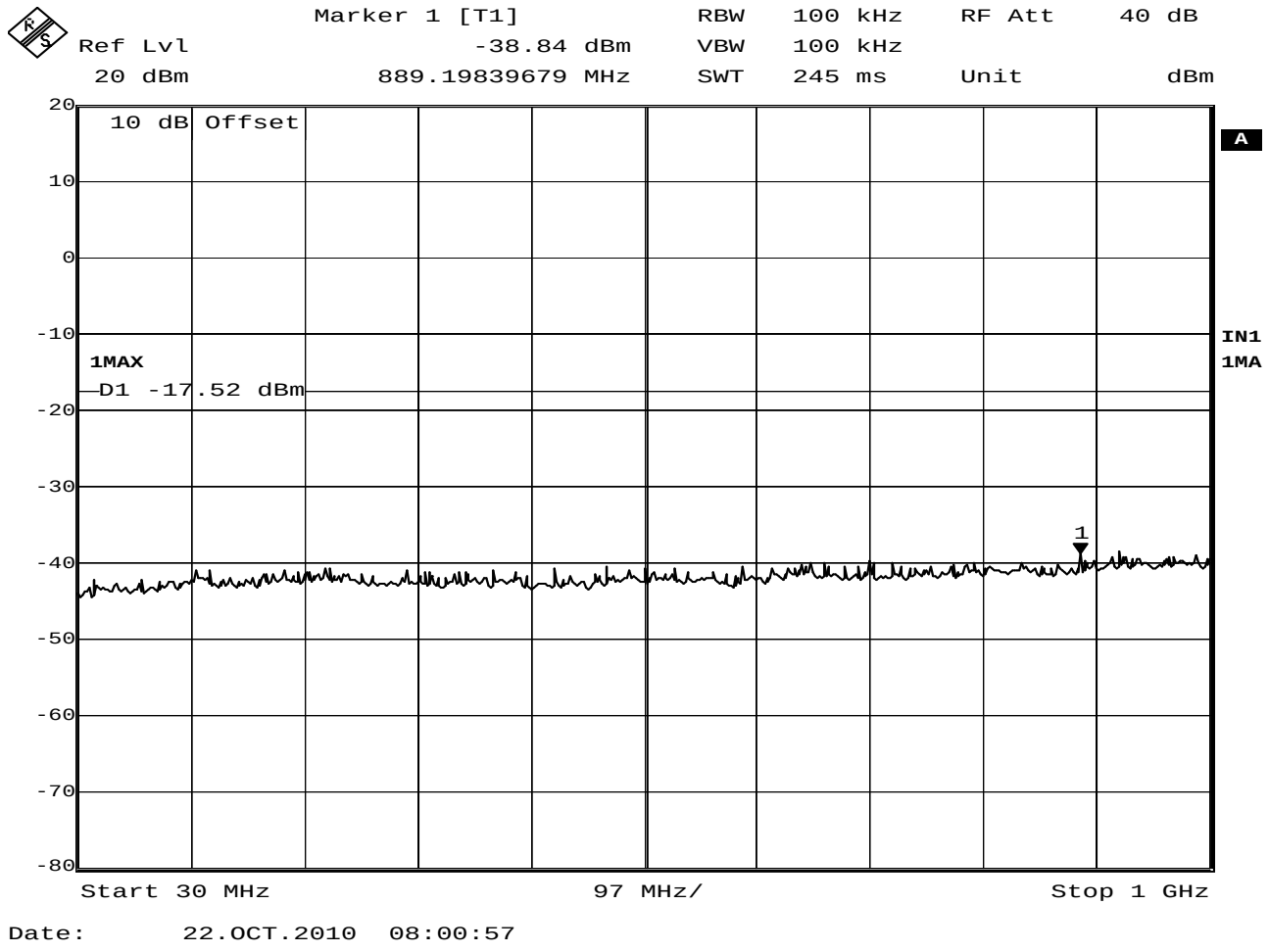

**15.247 Duty Cycle Factor**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Hopping Enabled |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Duty Cycle Factor |
| NOTES | : | Duration of Pulse 2 = 360.7usec |
| EQUIPMENT USED | : | RBB0, NWI0 |



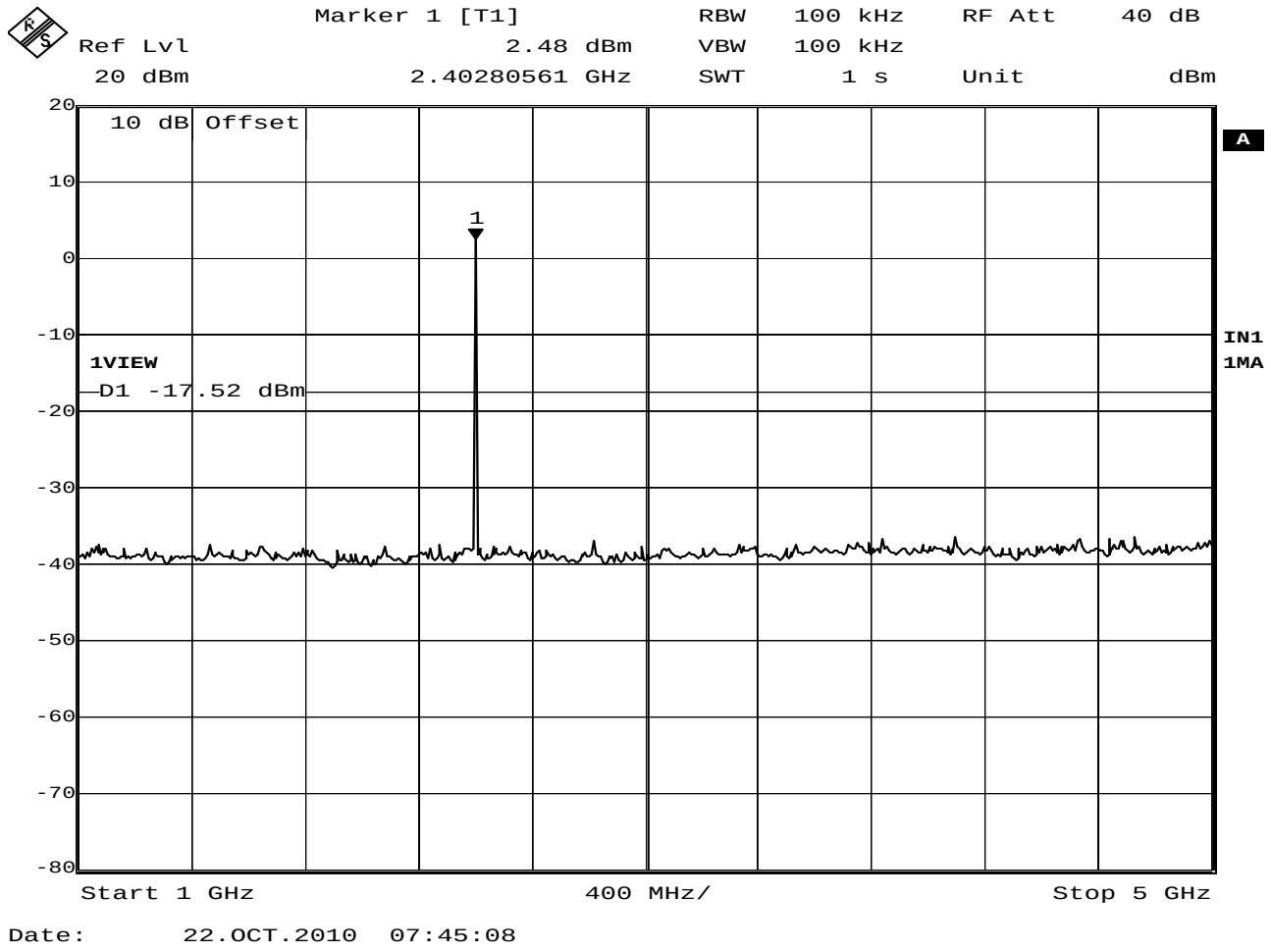

**15.247 Duty Cycle Factor**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Hopping Enabled |
| NOTES | : | |
| TEST DATE | : | October 18, 2010 |
| TEST PARAMETERS | : | Duty Cycle Factor |
| NOTES | : | The worst case in any 100msec period, is pulse 1 on 2 times and pulse 2 on 1 time = (2 x360.7usec) + (1 x 360.7usec) = 1.082msec on-time in a 100msec period. |
| | : | Duty Cycle Correction Factor = 20xlog(on-time/100msec) = 20xlog(1.082msec/100msec) = 20xlog(0.01082) = -39.3dB |
| EQUIPMENT USED | : | RBB0, NWI0 |



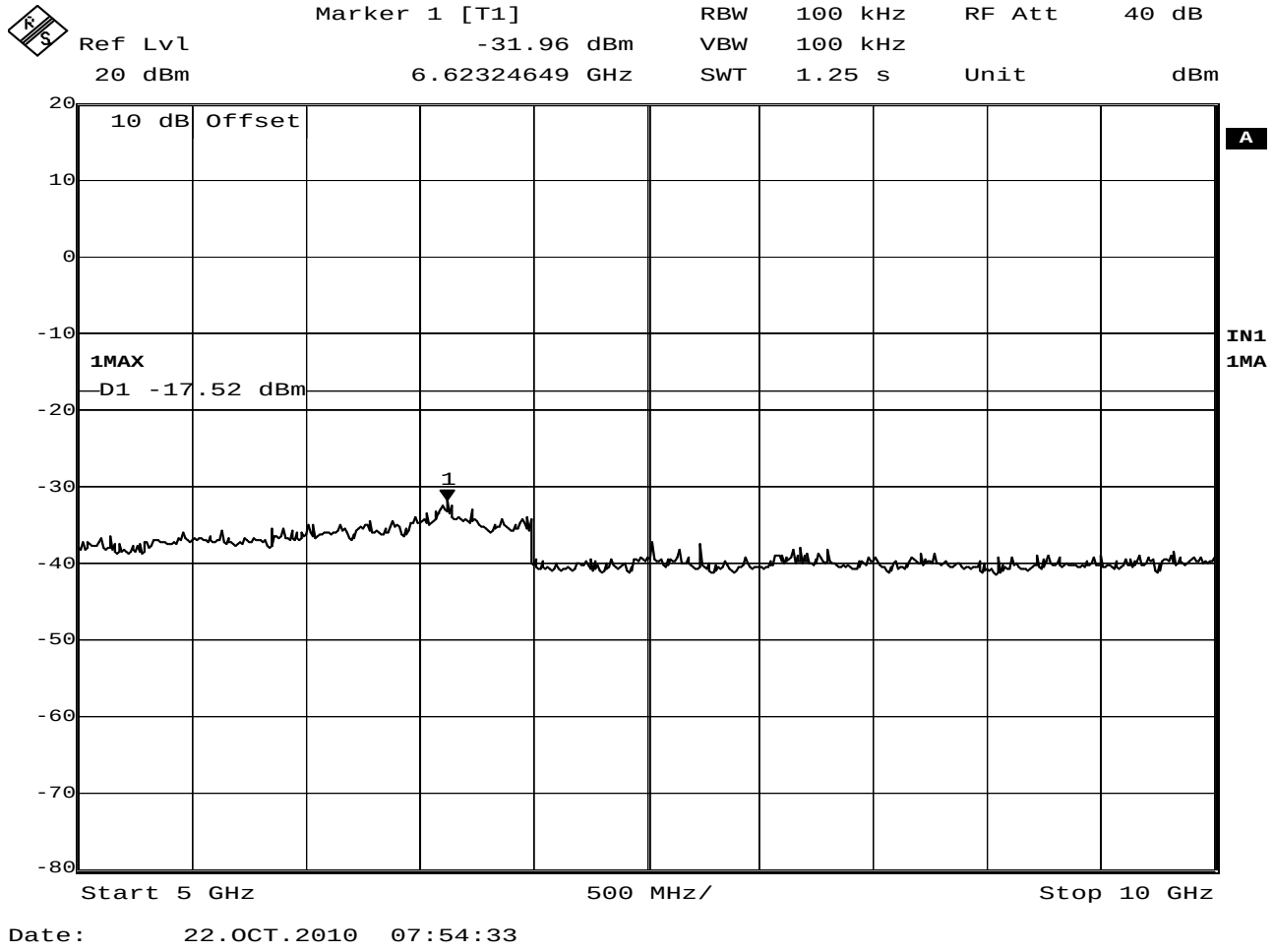

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2402 |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



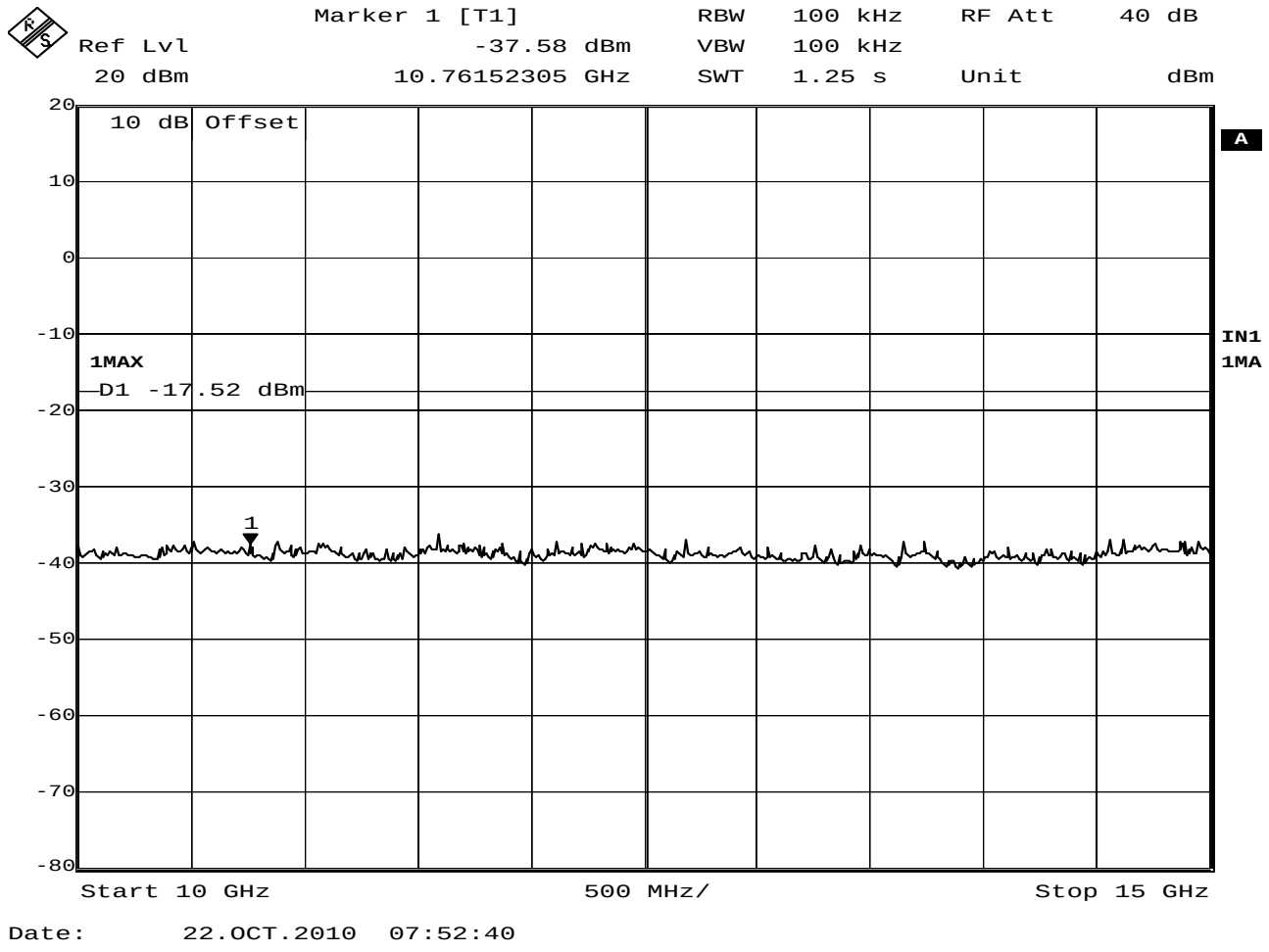

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2402 |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



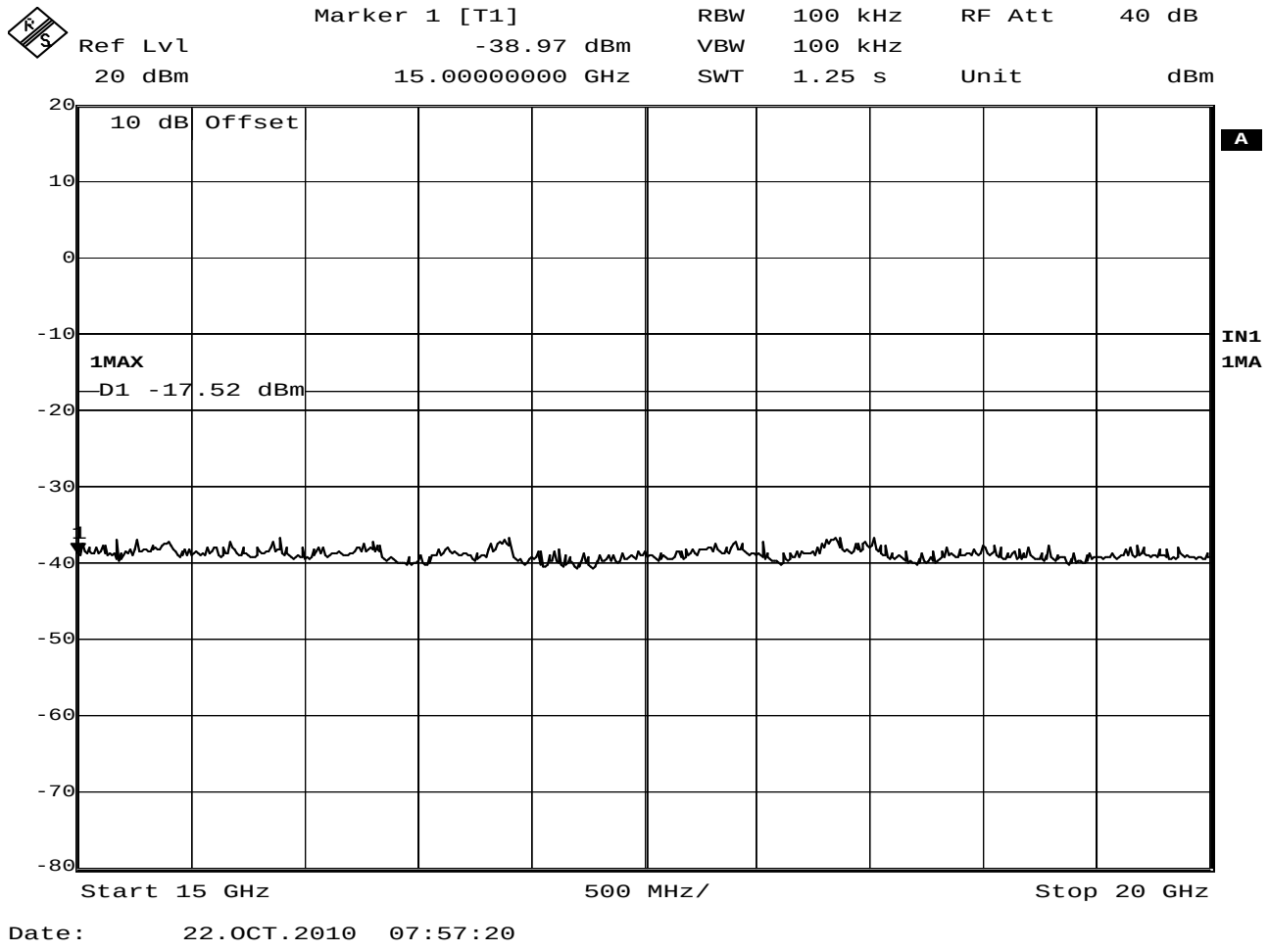

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2402 |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



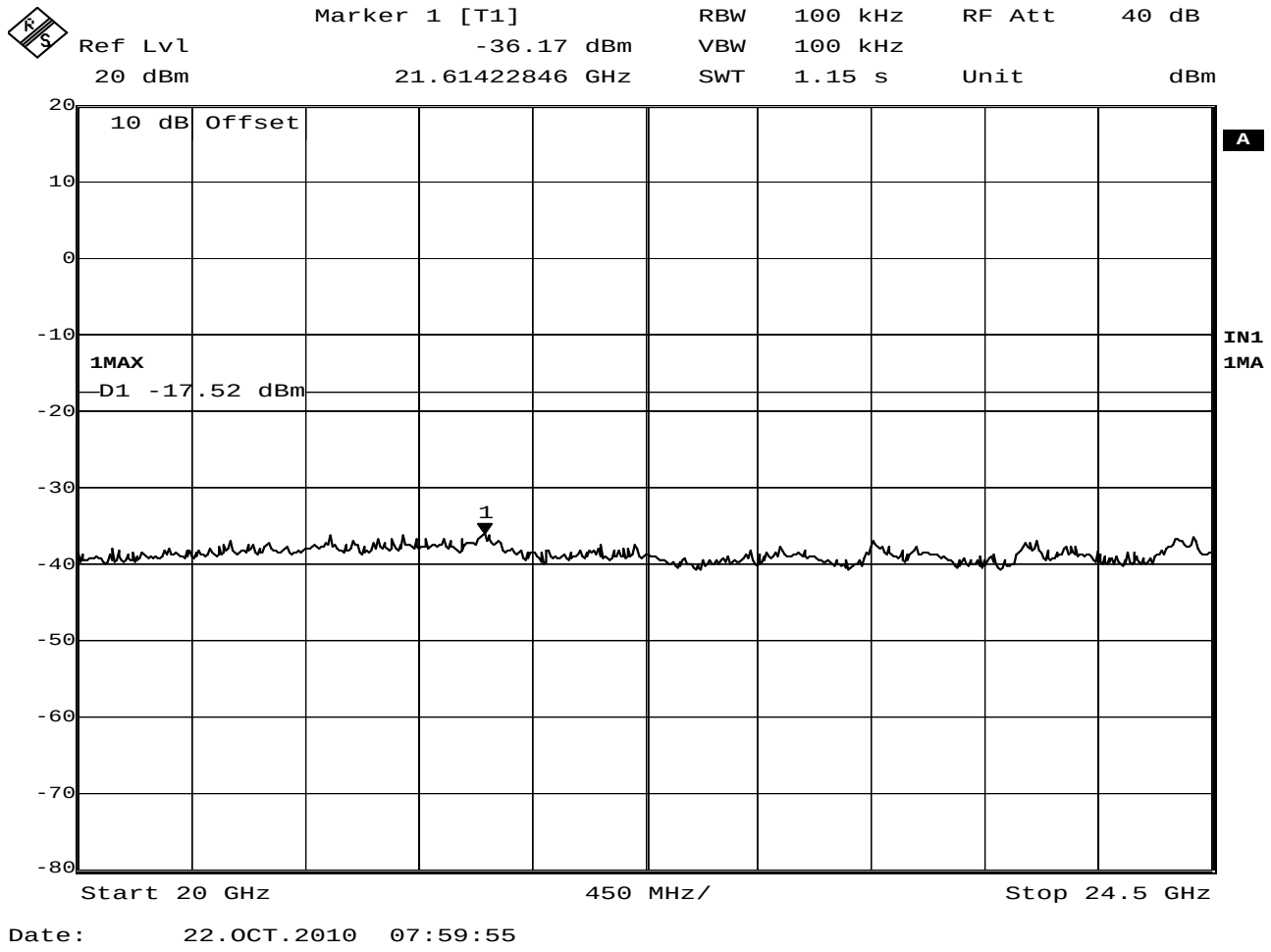

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2402 |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



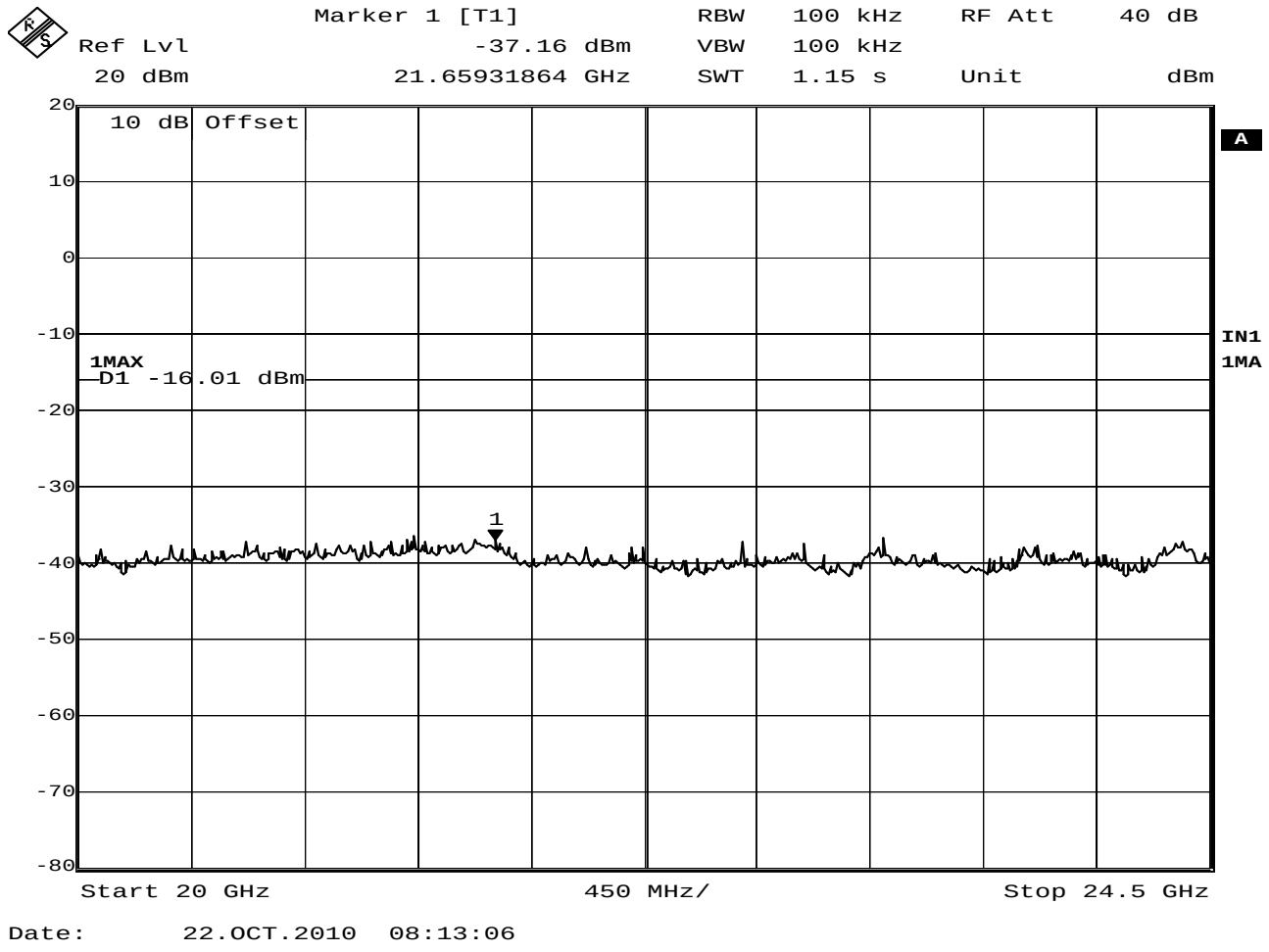

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2402 |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



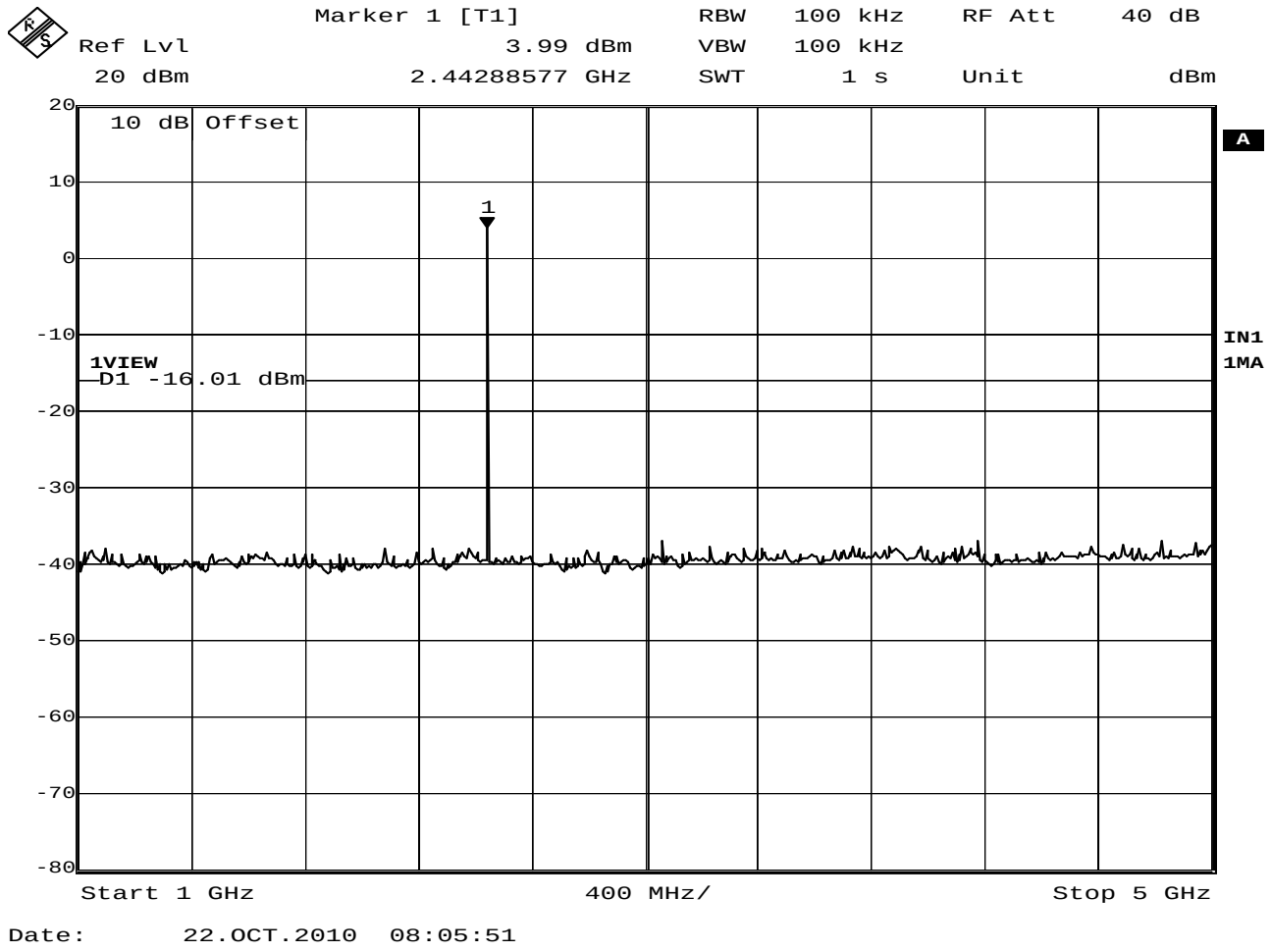

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2402 |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



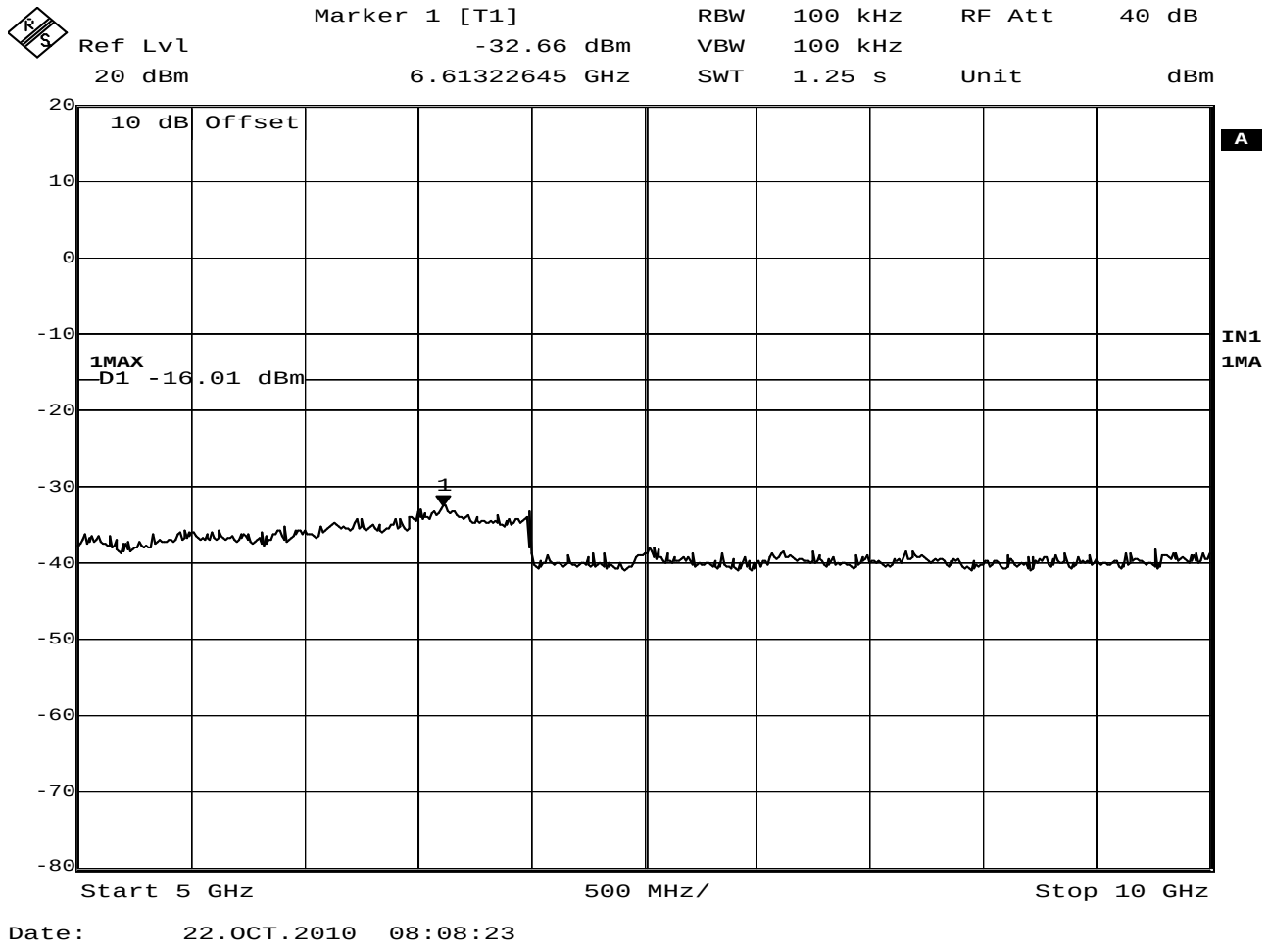

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2441MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



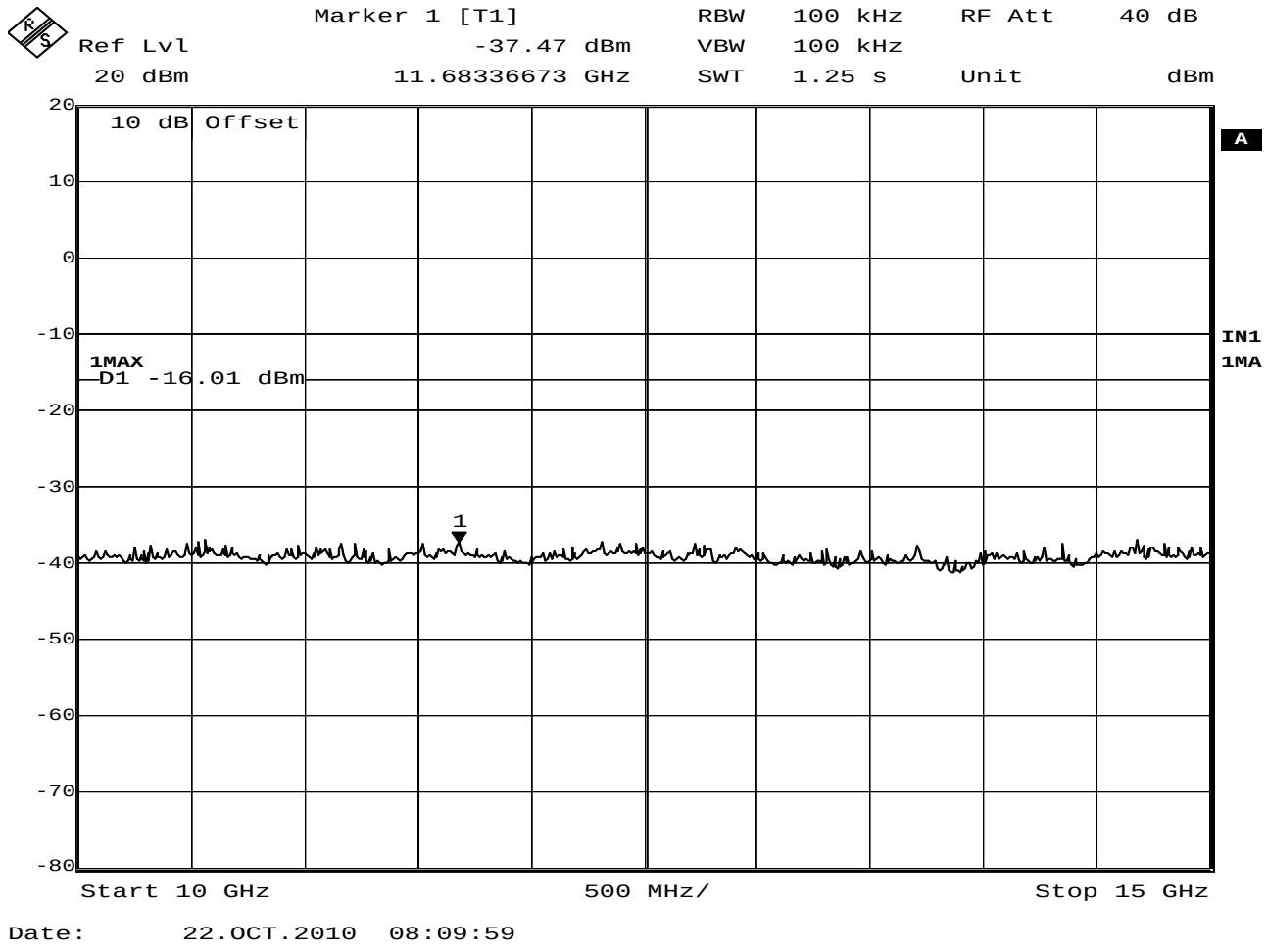

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2441MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



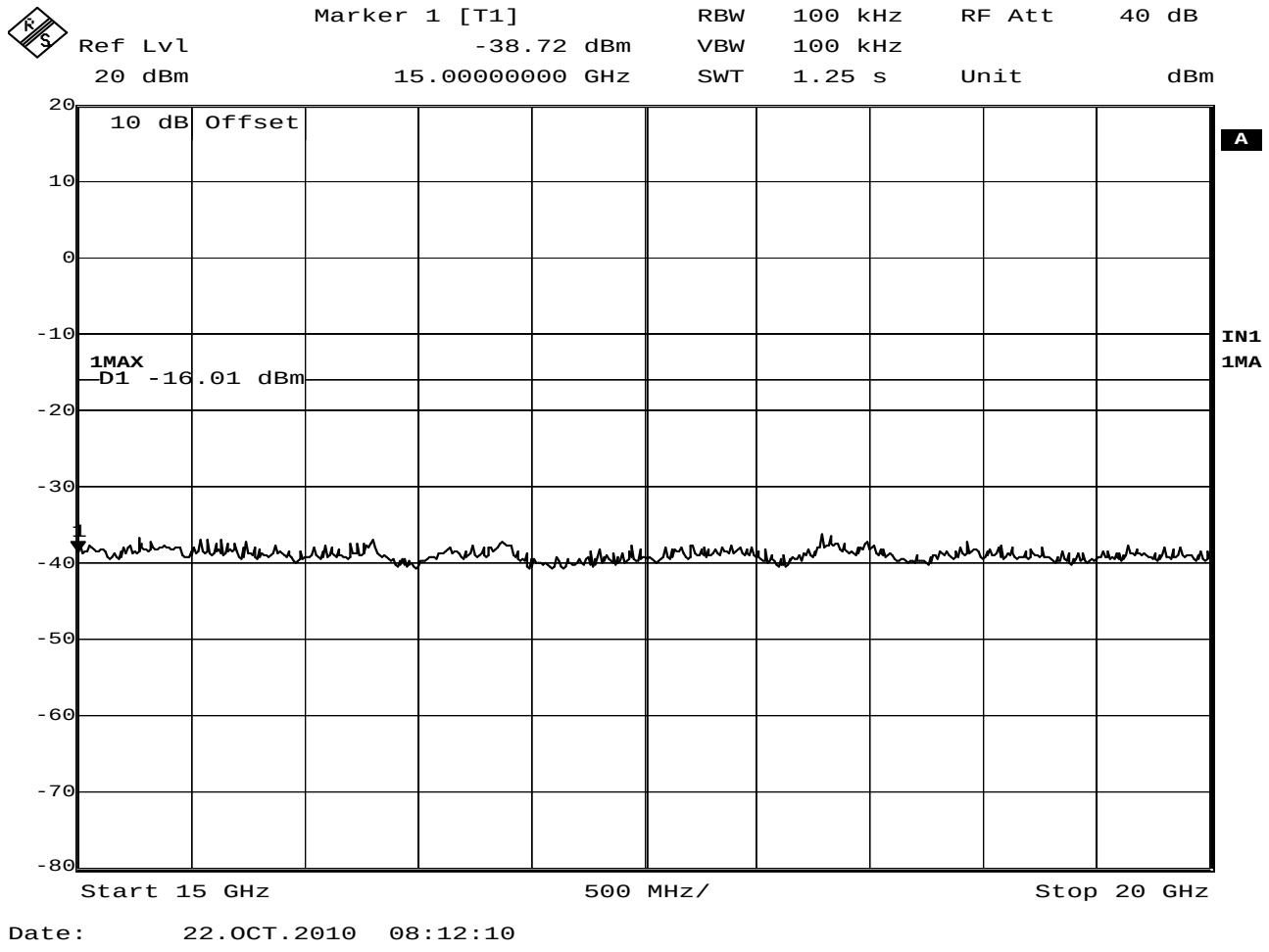

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2441MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



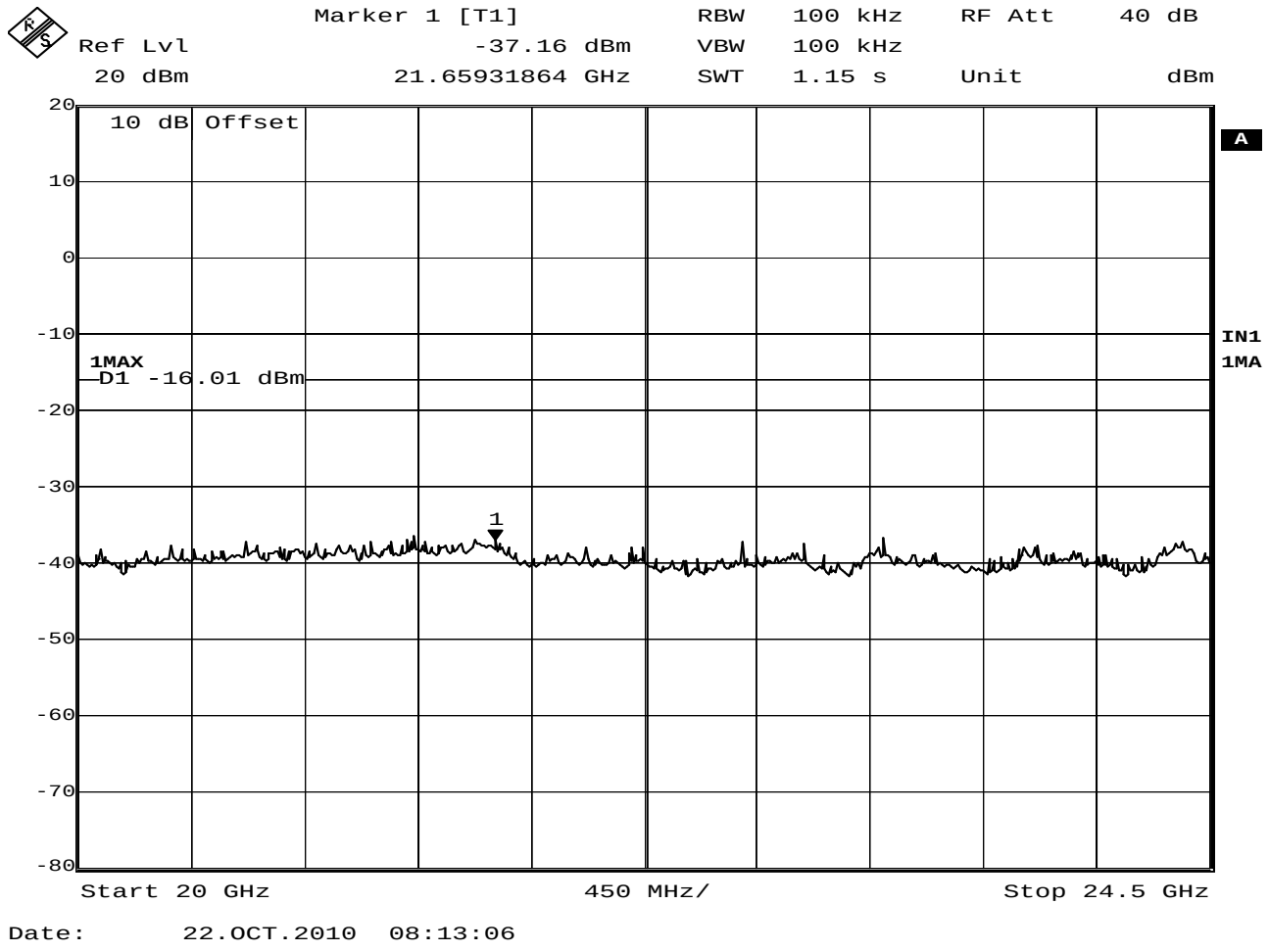

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2441MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



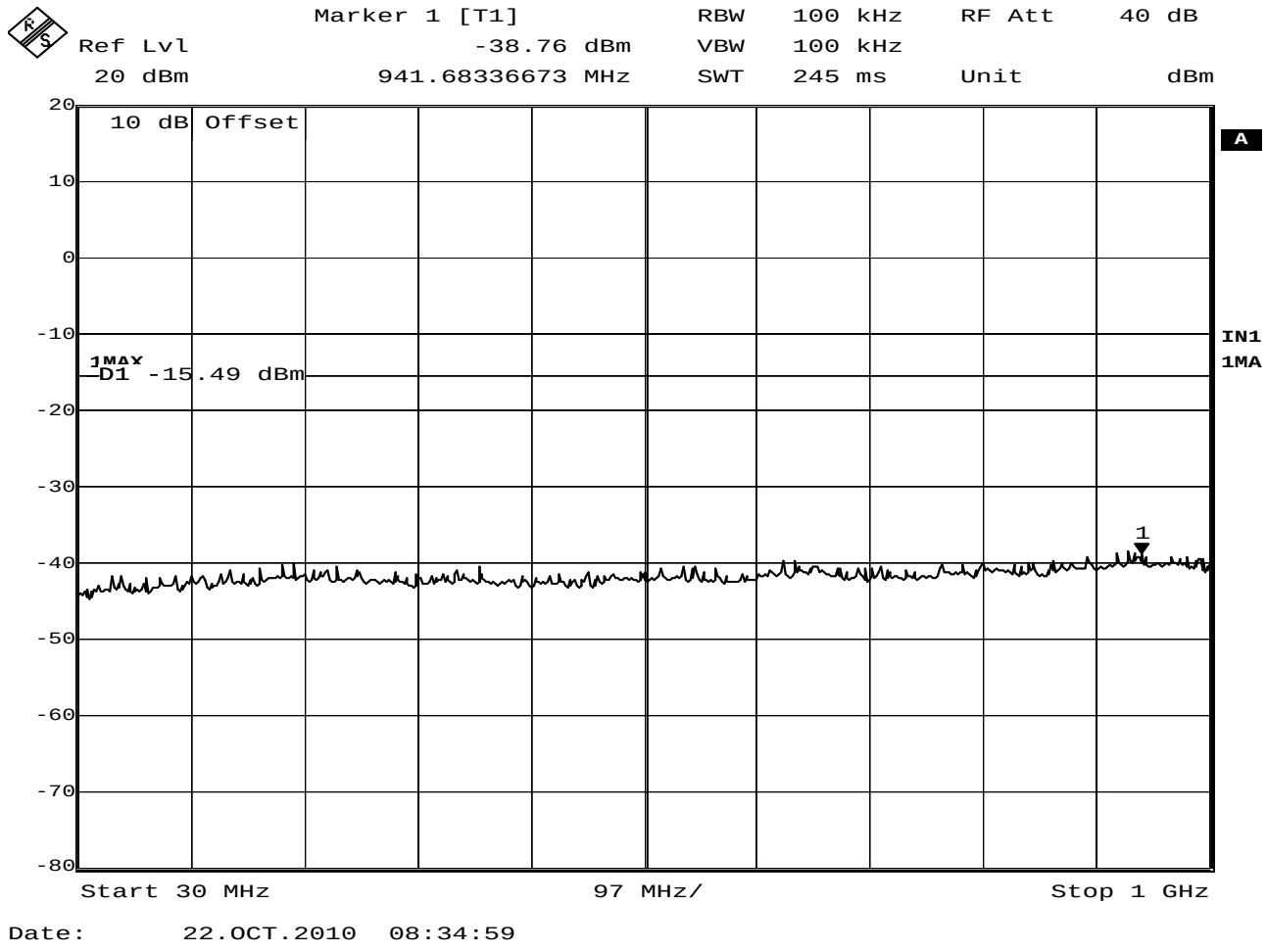

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2441MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



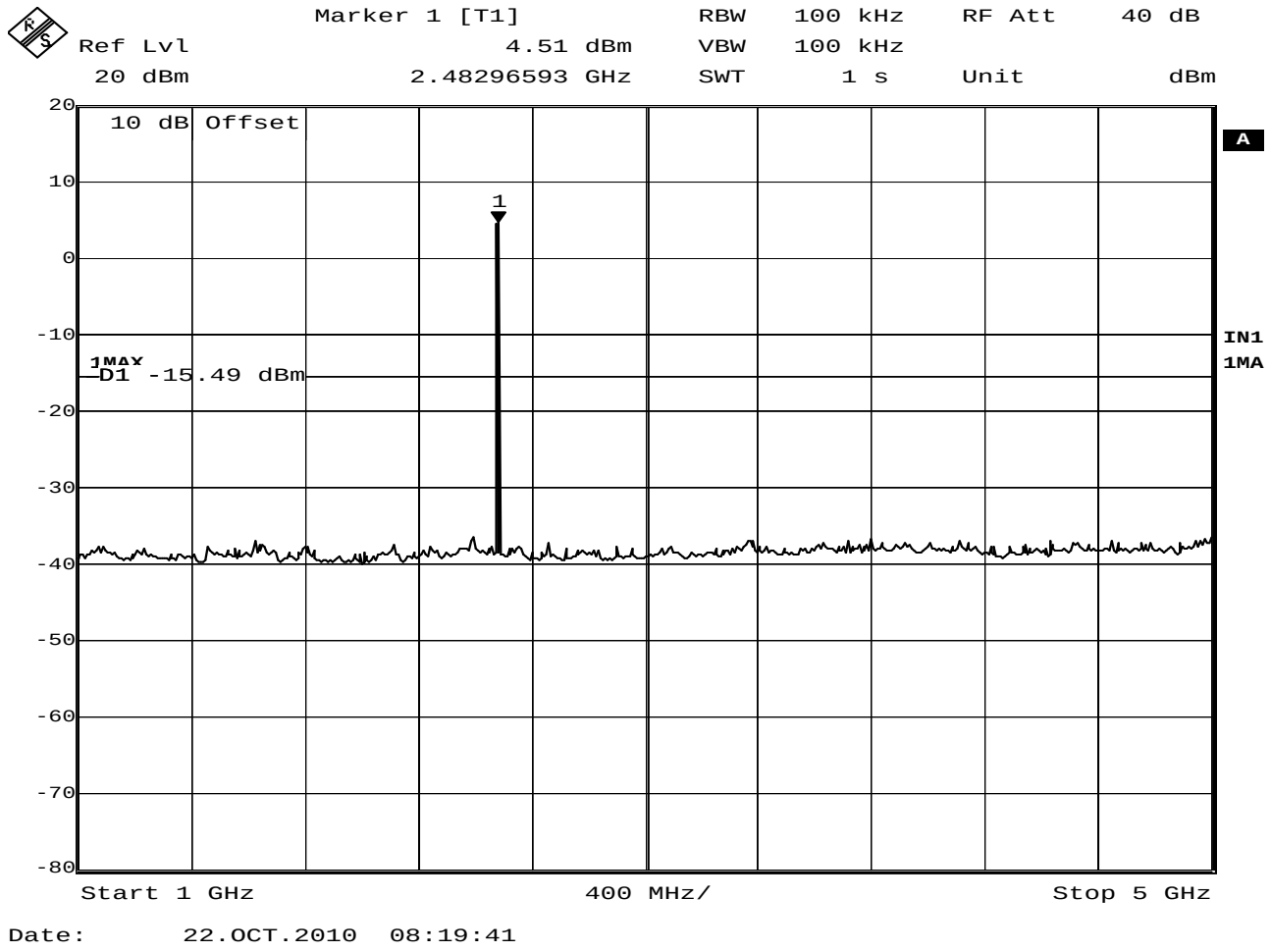

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2441MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



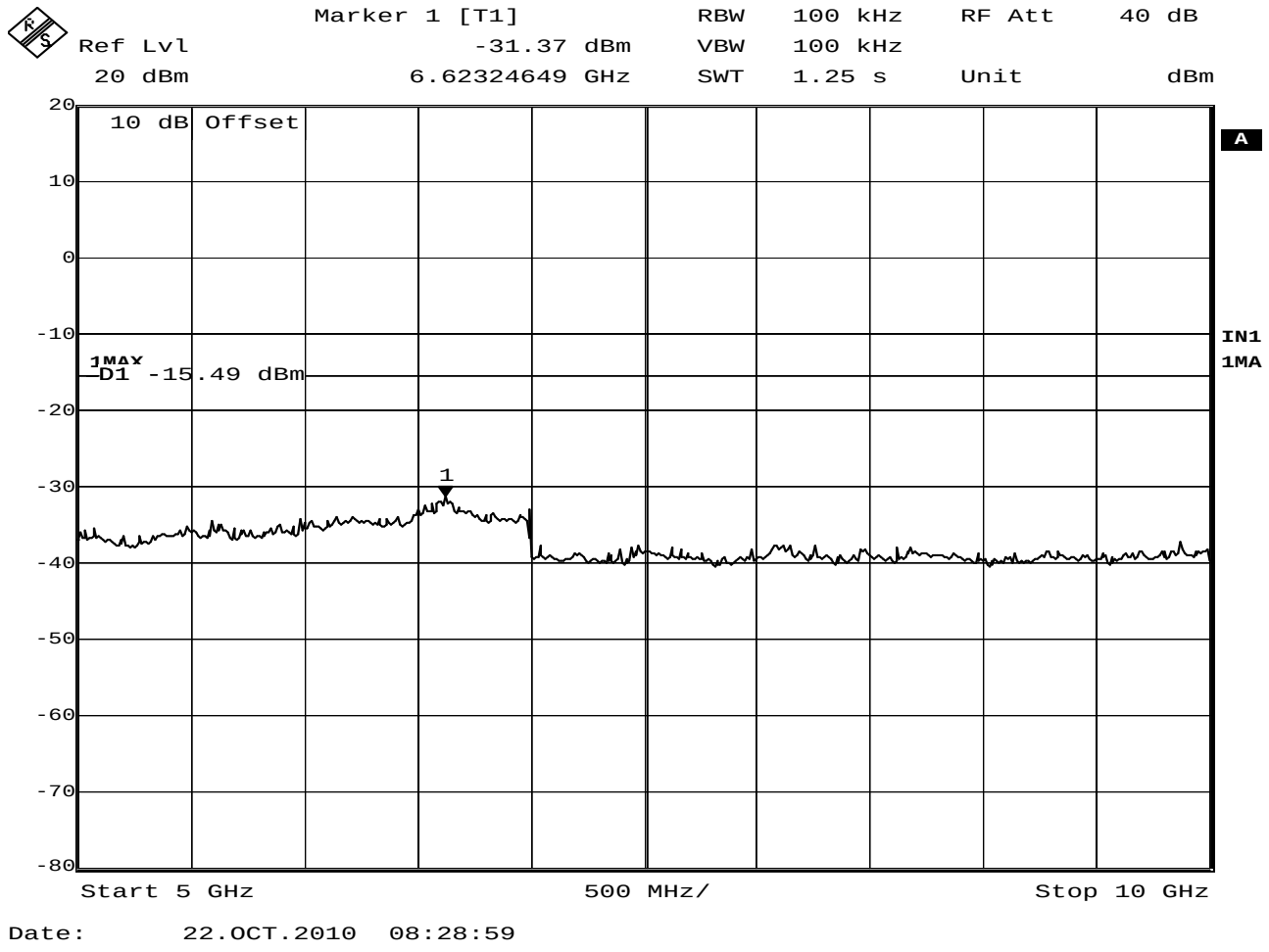

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2480MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |



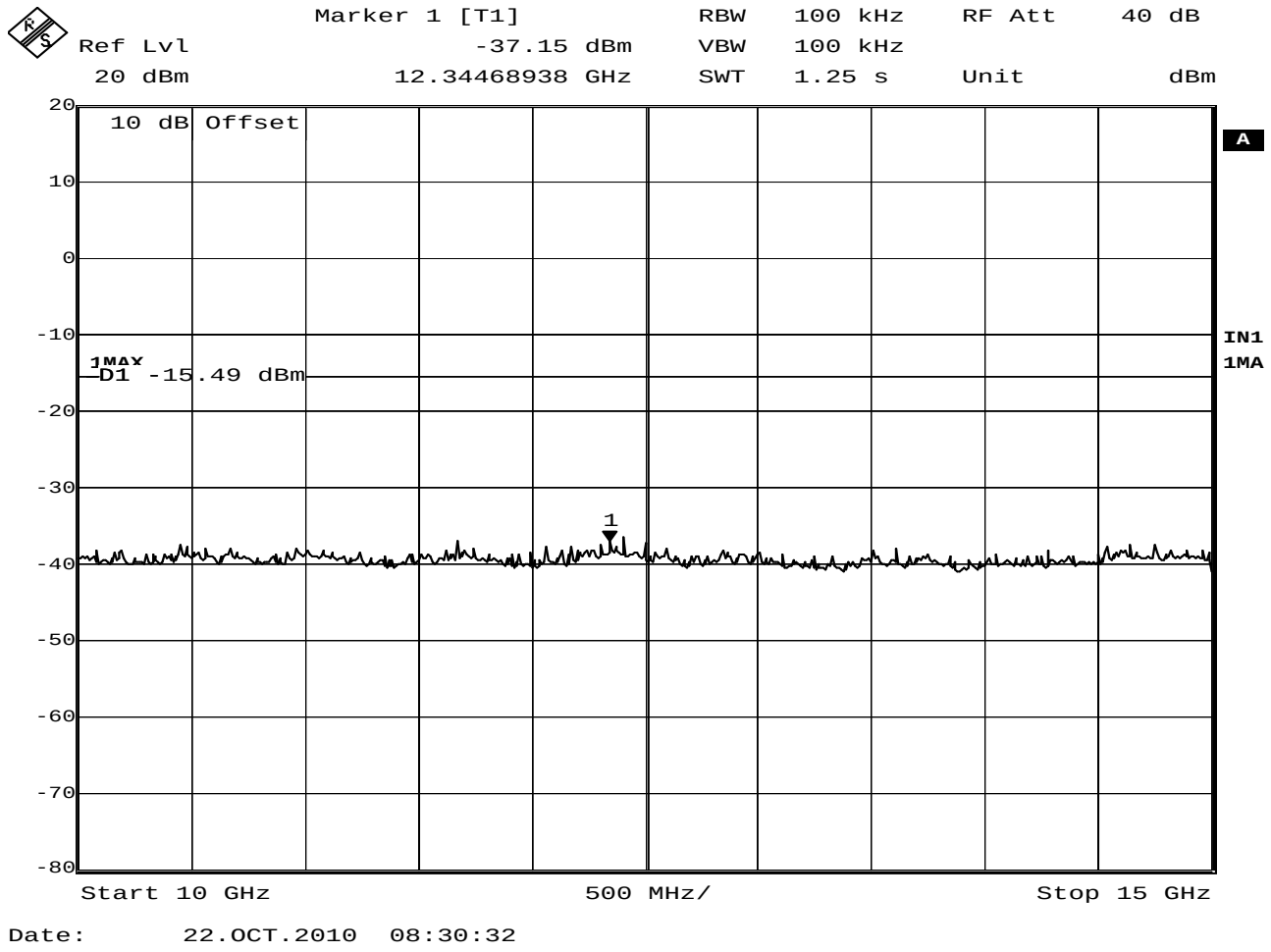

**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2480MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |




**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
| SERIAL NUMBER | : | FCC 1 |
| TEST MODE | : | Tx @ 2480MHz |
| NOTES | : | |
| TEST DATE | : | October 22, 2010 |
| TEST PARAMETERS | : | Antenna Conducted Spurious Emissions |
| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
| EQUIPMENT USED | : | RBA0, T1P0 |




**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
| MODEL NUMBER | : | Pass P3 |
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| TEST DATE | : | October 22, 2010 |
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| NOTES | : | Display Line D1 Represents the level that is 20dB below the highest level in the band when measured with a 100kHz bandwidth. |
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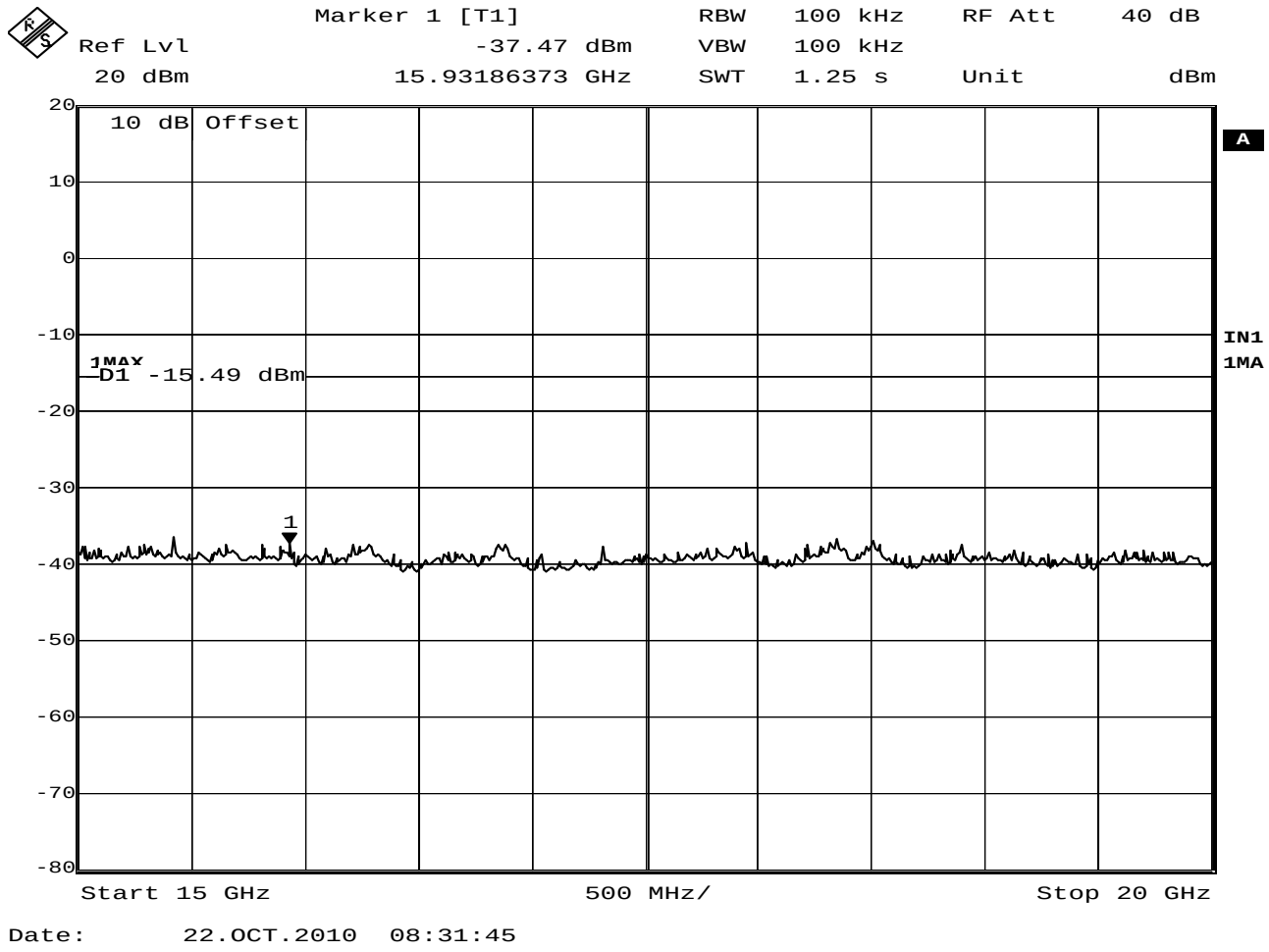


**15.247(c) Antenna Conducted Spurious Emissions**

| | | |
|---|---|---|
| MANUFACTURER | : | Continental Automotive |
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