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**DATE: 28 February 2016**

# I.T.L. (PRODUCT TESTING) LTD.

# Test Report According to EN 301 908-1 V6.2.1: 2013

**for**

## Pointer Telocation

### Equipment under test:

## Self Powered Smart Hub

## CelloTrack Nano 20 3G, P/N: GC9771004-000
## CelloTrack Nano 10 3G, P/N: GC9771003-000*

*See customer's declaration on page 4.

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

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# 1. General Information

## *1.1 Administrative Information*

| | |
|---|---|
| Manufacturer: | Pointer Telocation |
| Manufacturer's Address: | 14 Hamelacha St.,<br>Rosh Ha'ayin,48091<br>Israel<br>Tel: +972-3-572-3111<br>Fax: +972-3-572-3100 |
| Manufacturer's Representative: | Itamar Gohary |
| Equipment Under Test (E.U.T): | Self Powered Smart Hub |
| Equipment Model No.: | CelloTrack Nano 20 3G, P/N: GC9771004-000<br>CelloTrack Nano 10 3G, P/N: GC9771003-000* |
| Equipment Serial No.: | 982968 |
| Date of Receipt of E.U.T: | 20.12.2015 |
| Start of Test: | 21.12.2015 |
| End of Test: | 21.12.2015 |
| Test Laboratory Location: | I.T.L (Product Testing) Ltd.<br>1 Batsheva St.,<br>Lod<br>ISRAEL 7120101 |
| Test Specifications: | EN 301 908-1 V6.2.1: 2013 |

*See customer's declaration on following page.

POINTER

# DECLARATION

**Date: 14/2/2016**

I HEREBY DECLARE THE FOLLOWING REGARDING THE BELOW MODELS:

| # | Product name | P/N |
|---|---|---|
| 1 | CelloTrack Nano 20 | GC9770001-000 |
| 2 | CelloTrack Nano 20 3G | GC9771004-000 |
| 3 | CelloTrack Nano 10 | GC9770002-000 |
| 4 | CelloTrack Nano 10 3G | GC9771003-000 |

All of the above models use the same PCB.

These models are all identical except:

1. That P/N GC9770001-000 has the Cinterion BGS2-W 2G GSM cellular modem while P/N GC9771004-000 has the Cinterion EHS6A 3G cellular modem.
2. That in P/N GC9770002-000 and P/N GC9771003-000 the 2.4GHz transmitter is deactivated by firmware.
3. That in both P/N GC9770001-000 and P/N GC9770002-000 have the Cinterion BGS2-W 2G GSM cellular modem while P/N GC9771003-000 and P/N GC9771004-000 both have the Cinterion EHS6A 3G cellular modem.

Please relate to them (from an EMC/RADIO point of view) as the same product.

IGOR ROGOV
16-02-2016
VP R&D

Signature
Igor Rogov
VP R&D
Pointer Telocation Inc.

## 1.2 Abbreviations and Symbols

The following abbreviations and symbols are applicable to this test report:

| | |
|---|---|
| A/m | ampere per meter |
| AC | alternating current |
| AM | amplitude modulation |
| ARA | Antenna Research Associates |
| Aux | auxiliary |
| Avg | average |
| CDN | coupling-decoupling network |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dbµV | decibel referred to one microvolt |
| dbµV/m | decibel referred to one microvolt per meter |
| DC | direct current |
| EFT/B | electrical fast transient/burst |
| EMC | electromagnetic compatibility |
| ESD | electrostatic discharge |
| E.U.T. | equipment under test |
| GHz | gigahertz |
| HP | Hewlitt Packard |
| Hz | Hertz |
| kHz | kilohertz |
| kV | kilovolt |
| LED | light emitting diode |
| LISN | line impedance stabilization network |
| m | meter |
| mHn | millihenry |
| MHz | megahertz |
| msec | millisecond |
| N/A | not applicable |
| per | period |
| QP | quasi-peak |
| PC | personal computer |
| RF | radio frequency |
| RE | radiated emission |
| sec | second |
| V | volt |
| V/m | volt per meter |
| VRMS | volts root mean square |

### 1.3 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), FCC Designation Number IL1005.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site Nos. IC 4025A-1, 4025A-2.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

# 2. Applicable Documents

| | | |
|---|---|---|
| 2.1 | **R&TTE Directive: 1999** | *DIRECTIVE 1999/5/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity* |
| 2.2 | **EN 301 908-1 V6.2.1 (2013-04)** | *IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 1: Introduction and common requirements* |

# 3. Test Site Description

## 3.1 Location:

The Electromagnetic Compatibility Test Facility of I.T.L. (Product testing) Ltd. Is located at
Telrad Industrial Park, Lod, 7120101 Israel.

Telephone: +972-8-9153100

Fax: +972-8-9153101

## 3.2 Shielded Room:

A Modular Shielded Room, Type 20 SpaceSaver, manufactured by ETS, consisting of a Main Room and a Control Room.

The dimensions of the Main Room are: length: 7.0 m, width: 3.0 m, height: 3.0 m.

The shielding performance is:

magnetic field: 60 dB at 10 kHz rising linearly to 100 dB at 100 kHz,

electric field: better than 110 dB between 50 MHz and 1 GHz,

plane wave: 110 dB between 50 MHz and 1 GHz.

All the power lines entering the shielded room are filtered.

## 3.3 Open Site:

The OATS is located on a one floor-building roof. The OATS consists of 3 meter and 10 meter ranges, using a 21.5m X 8.5m solid metal ground plane, a remote controlled turntable and an antenna mast.

## 3.4 Ground Plane:

The ground plane is made from steel plates, which are welded continuously together. The Ground plane is lies and welded on welded steel construction with vias to allow for water drainage. All the power, control, and signal lines to the turntable and the 3 m and 10m antenna mast outlets are routed in shielded conduits under the plane to the control building.

## 3.5 Antenna Mast:

ETS model 2070-2. The antenna position and polarization are remote controlled via Fiber Optical Link using ETS/EMCO Dual Controller Type 2090. The antenna position is adjustable between 1-4 meters. Pressurized air is used to power changing the polarity of the antenna.

## 3.6 Turntable:

ETS model 2087 series. The position of the turntable is remote-controlled via Fiber Optic Link, using ETS/EMCO Dual Controller Type 2090. The turntable is mounted in a pit and its surface is flush with the Open Site Ground Plane. Brushes near the periphery of the turntable ensure good conductive connection to the ground plane. The Turntable maximum load is 1250 Kg.

### 3.7 EMI Receiver:

Type ESCI7, manufactured by Rohde & Schwarz, being in full compliance with CISPR 16 requirements.

### 3.8 E.U.T. Support:

Table mounted E.U.T.s are supported during testing on 150 cm high all plastic table.

### 3.9 Test Equipment

See details in Section 6.

# 4. Summary of Test Results

| Test | Results |
|---|---|
| **Radiated Emissions (UE)**<br>EN 301 908-1 V6.2.1 (2013)<br>Sections 4.2.2.2, 5.3.1 | The E.U.T met the performance requirements of the specification.<br>The margin between the spurious emission level and the specification limit is 0.7 dB in the worst case at the frequency of 12740.1MHz, horizontal polarization. |

# 5. Equipment Under Test (E.U.T.) Description

Self- powered Smart Hub for asset and cargo management Iot applications with universal 3G cellular communication, GNSS, short range RF and wide sensing capabilities.
The E.U.T. contains a Cinterion EHS6 Wirelss 3G module.

# 6. List of Test Equipment

## 6.1 Emission Tests

The equipment indicated below by an “X” was used for testing Spurious Radiated Emissions, EN 301 908-1 V6.2.1: 2013, Section 5.3.1

Test equipment calibration is in accordance with ITL Q.A. Procedure PM 110 "Calibration Control Procedure", which complies with ISO 9002 and ISO/IEC Guide 17025.

| Instrument | Manufacturer | Model | Serial No. | Used in Test |
|---|---|---|---|---|
| Spectrum Analyzer | HP | 8592L | 3826A01204 | X |
| Base Station * | Agilent | E5515B | GB41400124 | X |
| EMI Receiver | Rohde & Schwarz | ESCI7 | 100724 | X |
| EMI Receiver | HP | 8542E | 3906A00276 | X |
| RF Filter section | HP | 85420E | 3705A00248 | X |
| Biconical Antenna | EMCO | 3104 | 2606 | X |
| Log Periodic Antenna | EMCO | 3146 | 9505-4081 | X |
| Horn Antenna | ETS | 3115 | 29845 | X |
| Spectrum Analyzer | HP | 8593EM | 3536A00120ADI | X |
| Semi Anechoic Civil Chamber | ETS | S81 | SL 11643 | X |
| Low Noise Amplifier | Narda | DBS-0411N313 | 13 | X |
| Low Noise Amplifier | Sophia Wireless | LNA28-B | 232 | X |

* Supplied by the customer.

# 7. Mode of Operation

The E.U.T. was operated, transmitting to, and receiving information from the operator, through the UMTS Cinterion EHS6 Wireless 3G module. Using a base station, a link was achieved with the E.U.T that transmitted in UL.

The evaluation was performed in 2 modes (traffic mode and idle mode) and in 2 channels: (Low and High in 2 operational bands):

1. E-GSM900 (Low: 880.0MHz, High: 915.0MHz)
2. IMT2100 (Low: 1920.0MHz, High: 1980.0MHz)

The E.U.T. was tested while transmitting continuously on each channel with modulation.

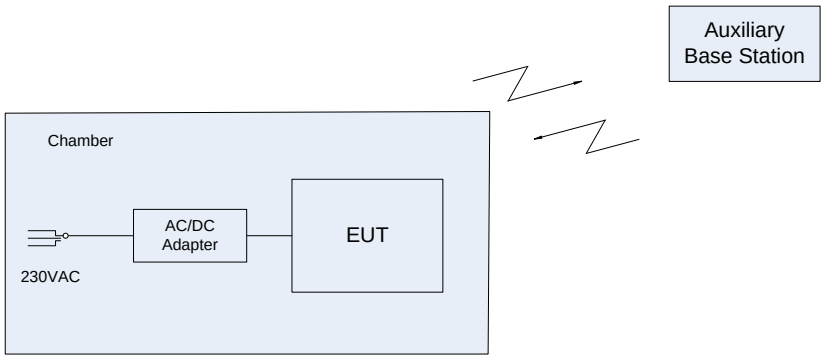


**Figure 1. Test Set-up**

# 8. Radiated Emissions (UE) GSM-900/IMT2100

## 8.1 Test Specification

EN 301 908-1 V6.2.1: 2013, Clause 4.2.2, 5.3.1

## 8.2 Test Procedure

The test was performed in the cellular frequency bands.

Scanning the frequency range of 30 MHz to 12,750 MHz was performed. The spurious signals were recorded.

The EMI receiver was operated with 120kHz resolution bandwidth and 300kHz video bandwidth.

The E.U.T. was replaced by the substitution antenna and a signal generator.

The signal generator was adjusted to the same level at the substitution antenna as the level measured with the E.U.T. This level was recorded.

The above tests were performed in both horizontal and vertical polarizations.

The maximum signal generator levels were recorded as the test results.

A RMS detector was used.

## 8.3 Test Results

The E.U.T met the requirements of EN 301 908-1 V6.2.1: 2013, Clauses 4.2.2, 5.3.1

Additional details are given in *Figure 2* to *Figure 5*.

The margin between the spurious emission level and the specification limit is 0.7 dB in the worst case at the frequency of 12740.1MHz, horizontal polarization.

# Radiated Emissions (UE) GSM-900 Band

| | |
|---|---|
| E.U.T Description | Self Powered Smart Hub |
| Type | CelloTrack Nano 20 3G, P/N: GC9771004-000 |
| Serial Number: | 982968 |

Specification: EN 301 908-1 V6.2.1:2013, Clauses 4.2.2, 5.3.1

| Operating Frequency | Frequency (MHz) | E (dBµV/m) | Antenna Pol. (H/V) | Power Output Generator (dBm) | Cable Loss (dB) | Antenna Gain (dBi) | ERP (dBm) | Spec. (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| Low | 1760.0 | 60.4 | V | -40.3 | 0.5 | 4.8 | -36.0 | -30.0 | -6.0 |
| | 1760.0 | 59.0 | H | -41.0 | 0.5 | 4.8 | -36.7 | -30.0 | -6.7 |
| High | 1830.0 | 60.1 | V | -40.6 | 0.5 | 4.8 | -36.3 | -30.0 | -6.3 |
| | 1830.0 | 56.0 | H | -44.0 | 0.5 | 4.8 | -39.7 | -30.0 | -9.7 |

**Figure 2. Spurious Emissions GSM-900 Traffic Mode**

| Operating Frequency | Frequency (MHz) | E (dBµV/m) | Antenna Pol. (H/V) | Power Output Generator (dBm) | Cable Loss (dB) | Antenna Gain (dBi) | ERP (dBm) | Spec. (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| Low | 12740.1 | 46.6 | V | -60.8 | 1.5 | 11.9 | -50.4 | -47.0 | -3.4 |
| | 12740.1 | 45.0 | H | -55.8 | 1.5 | 9.9 | -47.7 | -47.0 | -7.7 |
| High | 12750.0 | 46.0 | V | -61.4 | 1.5 | 11.9 | -51.0 | -47.0 | -4.0 |
| | 12750.0 | 44.8 | H | -56.0 | 1.5 | 9.9 | -47.9 | -47.0 | -0.9 |

**Figure 3. Spurious Emissions GSM-900 Idle Mode**

*Note:*

*Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*

# Radiated Emissions (UE) IMT2100 Band

| | |
|---|---|
| E.U.T Description | Self Powered Smart Hub |
| Type | CelloTrack Nano 20 3G, P/N: GC9771004-000 |
| Serial Number: | 982968 |

Specification: EN 301 908-1 V6.2.1:2013, Clauses 4.2.2, 5.3.1

| Operating Frequency | Frequency (MHz) | E (dBµV/m) | Antenna Pol. (H/V) | Power Output Generator (dBm) | Cable Loss (dB) | Antenna Gain (dBi) | ERP (dBm) | Spec. (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| Low | 38443.3 | 59.8 | V | -39.3 | 0.5 | 7.4 | -32.4 | -30.0 | -2.4 |
| | 3843.3 | 52.5 | H | -46.2 | 0.5 | 7.4 | -39.3 | -30.0 | -9.3 |
| High | 3964.4 | 57.1 | V | -42.0 | 0.5 | 7.4 | -35.1 | -30.0 | -5.1 |
| | 3964.4 | 57.1 | H | -42.0 | 0.5 | 7.4 | -35.1 | -30.0 | -5.1 |

**Figure 4. Spurious Emissions IMT2100 Traffic Mode**

| Operating Frequency | Frequency (MHz) | E (dBµV/m) | Antenna Pol. (H/V) | Power Output Generator (dBm) | Cable Loss (dB) | Antenna Gain (dBi) | ERP (dBm) | Spec. (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| Low | 12740.1 | 46.6 | V | -60.8 | 1.5 | 11.9 | -50.4 | -47.0 | -3.4 |
| | 12740.1 | 45.0 | H | -55.8 | 1.5 | 9.9 | -47.7 | -47.0 | -0.7 |
| High | 12740.1 | 45.1 | V | -62.2 | 1.5 | 11.9 | -51.8 | -47.0 | -4.8 |
| | 12740.1 | 44.8 | H | -56.0 | 1.5 | 9.9 | -47.9 | -47.0 | -0.9 |

**Figure 5. Spurious Emissions IMT2100 Idle Mode**

*Note:*

*Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.*

# 9. Set Up Photographs

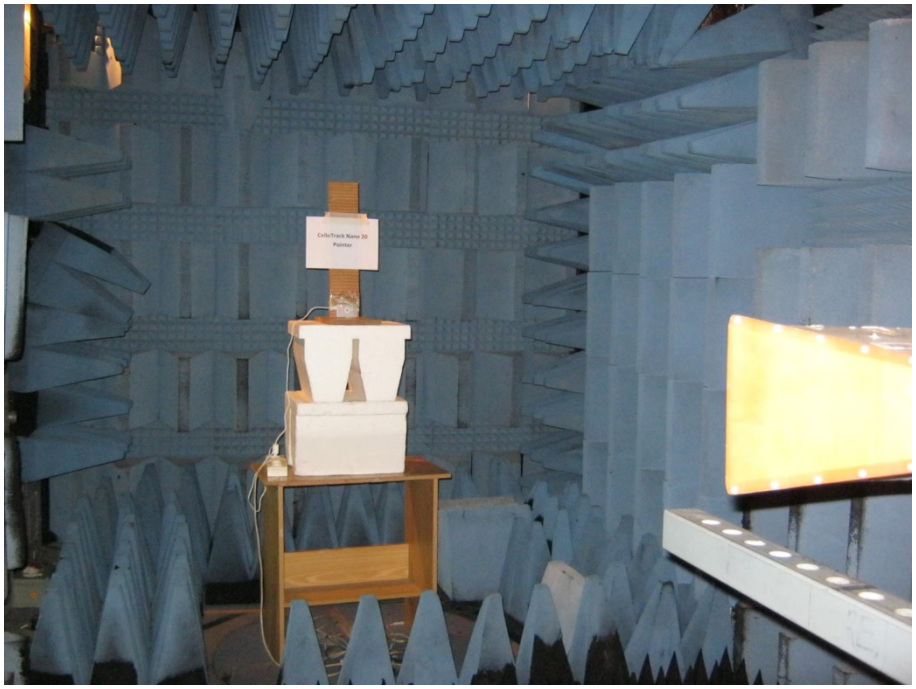

**Figure 6 Spurious Emission Test**

# 10. Signatures of the E.U.T's Test Engineers

| Test | Test Engineer Name | Signature |
|---|---|---|
| Spurious Emission | M. Zohar |  |

# 11. APPENDIX A - CORRECTION FACTORS

## *11.1 Correction factors for CABLE RE Chamber 1M*

***Manufacturer Suhner***
***Model: 104A***

| Frequency ( MHz) | Ref. (dBm) | Tested ( dBm) | Cable loss (dB) |
|---|---|---|---|
| 0.15 | -20.11 | -20.14 | 0.03 |
| 0.5 | -20.1 | -20.14 | 0.04 |
| 1 | -20.08 | -20.12 | 0.04 |
| 2 | -19.96 | -20.02 | 0.06 |
| 5 | -19.94 | -20 | 0.06 |
| 10 | -19.97 | -20.04 | 0.07 |
| 20 | -19.94 | -20.01 | 0.07 |
| 30 | -19.8 | -19.96 | 0.16 |
| 40 | -19.92 | -20.01 | 0.09 |
| 50 | -19.91 | -20.01 | 0.1 |
| 60 | -19.93 | -20.02 | 0.09 |
| 70 | -19.95 | -20.05 | 0.1 |
| 80 | -19.98 | -20.05 | 0.07 |
| 90 | -20.01 | -20.08 | 0.07 |
| 100 | -20.04 | -20.11 | 0.07 |
| 200 | -20.11 | -20.2 | 0.09 |
| 300 | -19.98 | -20.11 | 0.13 |
| 400 | -20.17 | -20.27 | 0.1 |
| 500 | -20.13 | -20.28 | 0.15 |
| 600 | -20.18 | -20.36 | 0.18 |
| 700 | -20.11 | -20.32 | 0.21 |
| 800 | -20.08 | -20.31 | 0.23 |
| 900 | -20.04 | -20.3 | 0.26 |
| 1000 | -20.15 | -20.45 | 0.3 |
| 1200 | -20.28 | -20.63 | 0.35 |
| 1400 | -20.28 | -20.6 | 0.32 |
| 1600 | -20.2 | -20.53 | 0.33 |
| 1800 | -20.2 | -20.54 | 0.34 |
| 2000 | -20.24 | -20.61 | 0.37 |
| 2300 | -20.29 | -20.7 | 0.41 |
| 2600 | -20.5 | -20.99 | 0.49 |
| 2900 | -20.51 | -21.01 | 0.5 |

## *11.2 Correction factors for Amplifiers 83006A and 50-8P*

| FREQUENCY (GHz) | GAIN (dB) |
|---|---|
| 1.0 | 49.3 |
| 2.0 | 51.5 |
| 3.0 | 52.7 |
| 4.0 | 53.8 |
| 5.0 | 51.7 |
| 6.0 | 51.8 |
| 7.0 | 50.1 |
| 8.0 | 47.4 |
| 9.0 | 47.3 |
| 10.0 | 46.2 |
| 11.0 | 47.6 |
| 12.0 | 47.1 |
| 13.0 | 48.4 |

## *11.3 Correction factors for Log Periodic Antenna*

**Model: 3146**
**Serial #: 9505-4081**

**CALIBRATION DATA**

| Frequency, MHz | Antenna factor, dB/m [1] |
|---|---|
| 200 | 11.55 |
| 250 | 11.60 |
| 300 | 14.43 |
| 400 | 15.38 |
| 500 | 17.98 |
| 600 | 18.78 |
| 700 | 21.17 |
| 800 | 21.16 |
| 900 | 22.67 |
| 1000 | 24.09 |

[1] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.

## *11.4 Correction factors for Biconical Antenna*

**Model: 3104**
**Serial #: 2606**

**CALIBRATION DATA**

| Frequency, MHz | Near free space antenna factor, dB/m | Geometry specific correction factor, dB | Free space antenna factor, dB/m [1)] |
|---|---|---|---|
| 30 | 12.97 | 0.13 | 12.84 |
| 35 | 12.34 | 0.09 | 12.25 |
| 40 | 12.03 | 0.06 | 11.97 |
| 45 | 11.42 | 0.02 | 11.40 |
| 50 | 11.91 | 0.03 | 11.88 |
| 60 | 11.92 | 0.37 | 11.55 |
| 70 | 9.60 | 0.25 | 9.35 |
| 80 | 6.99 | -0.45 | 7.44 |
| 90 | 10.87 | -0.34 | 11.21 |
| 100 | 11.51 | -0.06 | 11.57 |
| 120 | 13.30 | 0.20 | 13.10 |
| 140 | 12.56 | -0.01 | 12.57 |
| 160 | 14.49 | -0.12 | 14.61 |
| 180 | 16.53 | 0.05 | 16.48 |
| 200 | 15.30 | 0.15 | 15.15 |

[1)] The antenna factor shall be added to receiver reading in dBµV to obtain field strength in dBµV/m.

## *11.5 Correction factors for Double-Ridged Waveguide Horn*

**Model: 3115**
**Serial # 29845**
**At 10 meter range.**

| FREQUENCY (MHz) | AFE (dB/m) | FREQUENCY (MHz) | AFE (dB/m) |
|---|---|---|---|
| 1000 | 22.4 | 10000 | 36.1 |
| 2000 | 25.2 | 11000 | 37.0 |
| 3000 | 31.1 | 12000 | 41.3 |
| 4000 | 30.2 | 13000 | 38.1 |
| 5000 | 34.2 | 14000 | 41.7 |
| 6000 | 31.6 | 15000 | 39.0 |
| 7000 | 34.7 | 16000 | 38.8 |
| 8000 | 34.8 | 17000 | 43.2 |
| 9000 | 36.2 | 18000 | 43.7 |