UMTS Base Station Timing with OCXOs

Introduction

Universal Mobile Telecommunications System (UMTS) is a third-generation (3G) wireless communications standard that is capable of delivering voice and high-speed data using Wideband CDMA (WCDMA) radio access technology.

UMTS Reference Challenges

UMTS Base Stations must hold minimum carrier frequency accuracies as per Table 1 below, taken from 3GPP TS 25.104 V7.4.0 (2006-06).

<table>
<thead>
<tr>
<th>Base station class</th>
<th>Accuracy (life)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide Area (macrocell)</td>
<td>±50 ppb</td>
</tr>
<tr>
<td>Medium Range</td>
<td>±100 ppb</td>
</tr>
<tr>
<td>Local Area (picocell)</td>
<td>±100 ppb</td>
</tr>
</tbody>
</table>

Table 1.

To meet these challenging requirements, CTS has developed extensive UMTS OCXO product platforms for the infrastructure industry. The compelling attributes of CTS' UMTS OCXOs include:

- Superior aging characteristics
- Performance versus cost
- No factory calibration required
- Excellent reliability

UMTS Reference OCXOs

CTS’ UMTS OCXOs are designed to be placed in base stations (“Node B”) and to be used as stand-alone clocks, although external disciplining, either analog or digital, is an option (e.g., GPS, E1/T1, etc.).

Brief descriptions of the UMTS OCXO platforms are listed below:

- Model 125 – High performance reference
- Model 127 – High performance reference, 36 mm x 27 mm size
- Model 196 – Low phase noise base station reference (UMTS picocell)

The Model 125 and 127 platforms offer performance comparable to traditional double-oven OCXOs at 40% less cost. This tradeoff allows infrastructure equipment manufacturers the ability to meet the stringent UMTS requirements while remaining sensitive to budgetary needs.
Table 2 shows CTS’ UMTS OCXO platforms and their corresponding specifications:

<table>
<thead>
<tr>
<th>Platform</th>
<th>Frequencies (MHz)</th>
<th>Temperature stability</th>
<th>Temperature range</th>
<th>Aging</th>
<th>Package size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 125</td>
<td>5.0, 10.0, 15.0</td>
<td>0.8 ppb, p-p (standard)</td>
<td>-10°C to 75°C (standard)</td>
<td>Less than 0.1 ppb/day at time of ship, decaying to less than 0.05 ppb/day within the first year (5 MHz crystal)</td>
<td>51 x 51 x 25 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.4 ppb, p-p (precision)</td>
<td>-10°C to 70°C (precision)</td>
<td></td>
<td>51 x 51 x 15.5 mm (&gt; 7MHz resonator)</td>
</tr>
<tr>
<td>Model 127</td>
<td>5.0, 10.0, 15.0</td>
<td>1.0 ppb p-p (standard)</td>
<td>-10°C to 75°C (standard)</td>
<td>Less than 0.1 ppb/day at time of ship, decaying to less than 0.05 ppb/day within the first year (5 MHz crystal)</td>
<td>36 x 27 x 20 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5 ppb p-p (precision)</td>
<td>-10°C to 70°C (precision)</td>
<td></td>
<td>36 x 27 x 18 mm (&gt;9MHz resonator)</td>
</tr>
<tr>
<td>Model 196</td>
<td>10.0, 10.24, 12.8, 13.0, 15.0, 16.384, 20.0, 26.0, 32.768</td>
<td>± 10 ppb (standard)</td>
<td>-20°C to 70°C</td>
<td>Less than 0.05 ppb/day at time of ship (10 MHz crystal)</td>
<td>36 x 27 x 13.5 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>± 5 ppb (precision)</td>
<td></td>
<td></td>
<td></td>
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</table>
A photo of a typical Model 125 UMTS OCXO is shown in Figure 1.

![Image of Model 125 UMTS OCXO]

**Figure 1.**

All of CTS’ UMTS OCXOs use SC-cut crystals. SC-cut crystals are doubly-rotated quartz crystals that produce excellent aging and temperature characteristics. Furthermore, CTS subjects the crystals to a rigorous pre-conditioning process. This combination of superior crystal and pre-conditioning process eliminates the need for any additional aging compensation. Moreover, these factors allow CTS to provide 100% characterized (predicted) aging rates for the crystal.

For more information on CTS’ UMTS OCXO platforms, please visit [http://www.ctscorp.com/](http://www.ctscorp.com/) or call one of the contacts below.

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