Oven-Stabilized Ultra Low Noise S-Band DRO for 3.900GHz (±50MHz)

Developed for extremely jitter sensitive applications like electron beam accelerators, this voltage-controlled Dielectric-Resonator Oscillator delivers ultimate phase noise performance at 3.900GHz, comparable to quartz crystal oscillators.

While developed for 3.900GHz, the design can be factory tuned to any frequency within a ±50MHz range with the same guaranteed and comparable typical performance.

With a high performance dielectric resonator at its heart, phase noise typically reaches -125dBc/Hz at 1kHz, -155dBc/Hz at 10kHz offset and -180dBc/Hz in the noise floor, yielding attosecond jitter performance when integrated from 1kHz to 30MHz.

Double buffering on the output keeps pulling below 1ppm (typically) and a two tier voltage stabilization scheme virtually eliminates pushing.

The tuning port accepts 0..10V for a ±100kHz tuning range and easy integration into phase-locked loops.

The DRO runs off a single +5.7V supply voltage. In addition a +15V supply, drawing a maximum current of 1100mA, is required to keep the unit at a stable temperature of +35°C, ensuring frequency accuracy.

Available option:

ALC: Amplitude stabilization to ±0.1dB
Data Sheet: Ultra Low Noise 3.900GHz ±50MHz S-Band DRO

Technical Data:

**Operating Frequency:** 3.900GHz (±50MHz factory set, ±1.0 MHz mechanical tuning)

**Output Power:** +17dBm

**Output Power Variation:** < ±1.5dB (typ. < ±0.75dB)

**Return Loss:** > 20dB, VSWR < 1.22 (typ. < 25dB, VSWR < 1.12)

**Harmonic Distortion:** > -40dBc (typ. > 50dB)

**Discrete Spurious Tones:** > -20dBc - 20log(Offset[Hz]) dB for Offsets < 100kHz
> -120dBc for Offsets > 100kHz

**Phase Noise:**
- @ 100Hz: < - 80 dBc/Hz - 90 dBc/Hz
- @ 1kHz: < - 115 dBc/Hz - 125 dBc/Hz
- @ 10kHz: < - 145 dBc/Hz - 155 dBc/Hz
- @ 100kHz: < - 170 dBc/Hz - 175 dBc/Hz
- @ 1MHz: < - 175 dBc/Hz - 180 dBc/Hz
- @ 10MHz: < - 175 dBc/Hz - 180 dBc/Hz

**Electronic Tuning:** 0 .. +10V (-100kHz .. +100kHz)

**Tuning Slope:** 20kHz/V

**Modulation Bandwidth:** 160 kHz

**Power Supply:** +5.7V/450mA +15V/1100mA max. (Heater)

**Dimensions:** Milled Aluminum Case 125mm x 130mm x 56mm

**Connectors:** 2 x SMA (RF-Output, VCO-Tuning Port), Feed-Through for +5.7V and +15V, 2 x Ground Solder Pins

**Temperatur Range:** 23°C ±10°C operating (-40°C..+71°C storage, non Condensing)

**Oven warm-up Time:** < 5min for <50kHz frequency error

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**Option ALC:**

**Output Power:** +17dBm

**Output Power Variation:** < ±0.1dB
**Data Sheet:**

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**Typical Phase Noise Plot:**

- **Signal Frequency:** 3.900GHz  
- **Signal Level:** 15.38 dBm  
- **Noise Level:** 0.48 dB  
- **Uneven Time:** 67 h

### Phase Noise

<table>
<thead>
<tr>
<th>Frequency Offset (Hz)</th>
<th>Phase Noise (dBc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz</td>
<td>-102 dBc</td>
</tr>
<tr>
<td>1000 Hz</td>
<td>-117 dBc</td>
</tr>
<tr>
<td>10 kHz</td>
<td>-165 dBc</td>
</tr>
<tr>
<td>100 kHz</td>
<td>-165 dBc</td>
</tr>
<tr>
<td>1 MHz</td>
<td>-165 dBc</td>
</tr>
<tr>
<td>10 MHz</td>
<td>-165 dBc</td>
</tr>
<tr>
<td>100 MHz</td>
<td>-165 dBc</td>
</tr>
</tbody>
</table>

### Integrated Measurements

<table>
<thead>
<tr>
<th>Range</th>
<th>Trace</th>
<th>Start Offset</th>
<th>Step Offset</th>
<th>Weighting</th>
<th>Int Noise (dBc)</th>
<th>PM (dBc)</th>
<th>FM (Hz)</th>
<th>Jitter (μs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>30,000 Hz</td>
<td></td>
<td>-22.70 dBc</td>
<td>5.90 *102/89 mrad</td>
<td>115.752 Hz</td>
<td>4.199 μs</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>100,000 Hz</td>
<td>30,000 Hz</td>
<td></td>
<td>-77.03 dBc</td>
<td>11.41 mrad</td>
<td>115.752 Hz</td>
<td>8.124 μs</td>
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<tr>
<td>3</td>
<td>1</td>
<td>1,000 kHz</td>
<td>30,000 Hz</td>
<td></td>
<td>-88.52 dBc</td>
<td>926.54 μrad</td>
<td>115.752 Hz</td>
<td>660.213 μs</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>10,000 kHz</td>
<td>30,000 Hz</td>
<td></td>
<td>-105.98 dBc</td>
<td>406.82 μrad</td>
<td>115.752 Hz</td>
<td>289.755 μs</td>
</tr>
</tbody>
</table>
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Mechanical Drawings: