rakon

Base Station Solutions

Introduction

The evolution of mobile phones as Smart Wireless Devices and the explosion of devices such as tablets have created a capacity challenge for mobile networks, starting from the Base Station to the Mobile Backhaul. New initiatives such as Small Cells reduce the pressure of capacity crunch and coverage limitations, but the importance of Macro Base Stations remains high. With the transition to packet-based backhaul mechanisms, the synchronisation implementations of the Macro Base Stations have become extremely challenging. Rakon offers a unique range of OCXOs ideal for Base Station application requirements.

Synchronisation Challenges

The challenges in Macro Base Station Synchronisation are many. GPS or other GNSS methods are currently the primary source of network timing, but there is increasing risk of loss of synchronisation because of signal loss (urban canyons or weather conditions for example) or jamming in various situations.

Secondly, circuit switch networks are transitioning to packet switched networks allowing Base Stations to use Synchronous Ethernet and packet-based synchronisation techniques. Unlike traditional synchronisation techniques, packet-based solutions transfer frequency and time, complementing the GNSS based synchronisation solutions.

Synchronisation Requirements

Radio Technology	Base Station Type	Frequency Accuracy	Phase Error
GMS	Macro BTS	±50 ppb	
CDMA 2000	Macro Pico / Femto	±50 ppb ±100 ppb	±3 µs
WCDMA	Wide Area Local Area Home	±50 ppb ±100 ppb ±250 ppb	±3 µs (TDD)
LTE (FDD &TDD)	Wide Area Local Area Home	±50 ppb ±100 ppb ±250 ppb	±1.5 µs (TDD)

In most base station synchronisation implementations, GNSS is used as the primary reference source. When GNSS signals fail, the system may switch to packet-based network synchronisation, which in turn may be supported by SyncE or traditional synchronisation. When all synchronisation sources fail, systems fall back to local clock source to provide holdover. Depending on the system requirements, clock source need certain stability to achieve target holdover specifications.

Rakon OCXO Key Specifications

	Oscillators	Frequency	Stability (FvsT -40 to 85°C)	Ageing	Holdover	Supported Stability Level
ASIC OCXO 14 x 9 mm 	**ROM1490PS**	10 to 40 MHz	±10 ppb	< ±0.5 ppb/day	1.5 µs /1 hour	Stratum 3E
Discrete OCXO 25 x 22 mm 	**ROX2522S4**	5 to 40 MHz	±5 ppb	≤ ±0.5 ppb/day	1.5 µs /2 hours	Stratum 3E
	ROX2522S3	10 to 40 MHz	2 ppb pk-pk	≤ ±0.3 ppb/day	< 8 µs/12 hours	Stratum 3E
38 x 27 mm 	**ROX5242T2** **ROX3827T2**	10 to 40 MHz	0.5 ppb pk-pk	≤ ±0.2 ppb/day	≤ 8 µs/day	Stratum 2
52 x 52 mm 	**ROX5252T1**	10 to 20 MHz	0.05 ppb pk-pk	≤ ±0.1 ppb/day	< 8 µs/1 to 3 days	Stratum 2

Base Station Solutions

Rakon Oscillators for Base Station Timing Applications

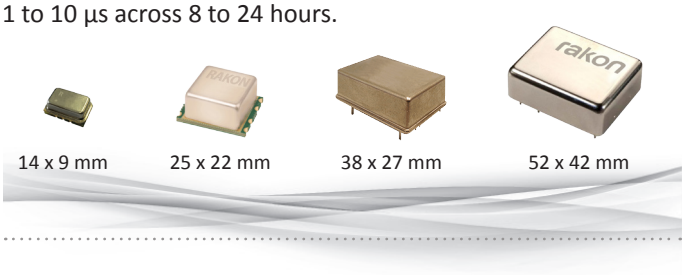
Two main aspects of oscillators are considered for Base Station synchronisation designs. The holdover requirement is one of the primary objectives. Holdover time for Base Stations is required by the Service Operator so that the system remains operational for a specified time limit after the network synchronisation sources fail. Depending on the air interface requirements, constraints may be placed on frequency only, or frequency and phase to achieve certain holdover time periods.

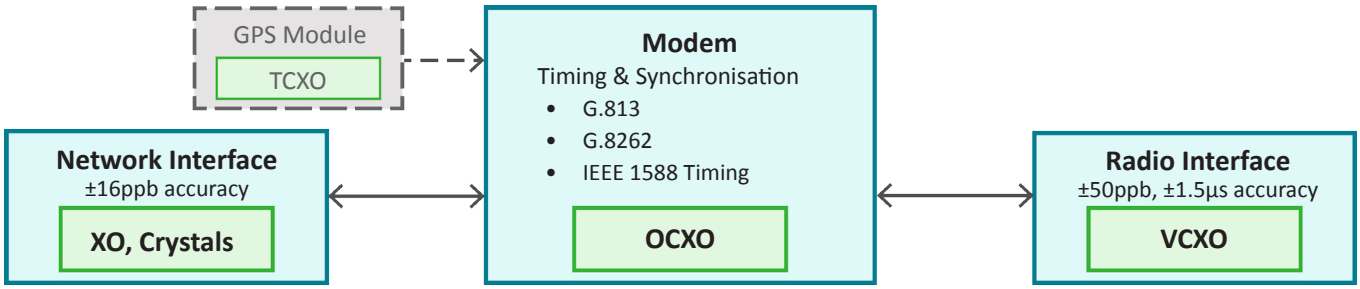
In a synchronisation design, the holdover time depends on the oscillator, specifically on the frequency versus temperature characteristics, ageing and the slope performances of frequency with temperature.

Secondly, packet based networks impose extremely low bandwidths on clock recovery PLLs, due to the varying nature of Packet Delay Variation (PDV). Macro Base station synchronisation PLLs generally employ very low loop bandwidths (in the order of mHz), and thus very stable oscillators are required for implementations of such PLLs. Oscillator selection is carefully done identifying the holdover and loop bandwidth requirements, along with other considerations such as phase noise.

At Rakon we have the expertise to help determine the best oscillator solution for our customers' system requirements. Oscillator solutions require knowledge of the differential in frequency versus the differential in temperature. Rakon has characterized various types of oscillators under changing environmental conditions for the loop time periods relevant to Packet Networks.

Rakon has also performed extended tests on the holdover phase movement performance of the OCXOs and features devices that have holdover performances of a few µs over the temperature range over a 24 hour period. Rakon has a complete range of OCXOs that support a wide range of holdover requirements of 1 to 10 µs across 8 to 24 hours.





Rakon's OCXO Holdover Performance

‹ Better than 3 µs for 24 hours in stable conditions, and better than 5 µs for 24 hours including temperature changes.