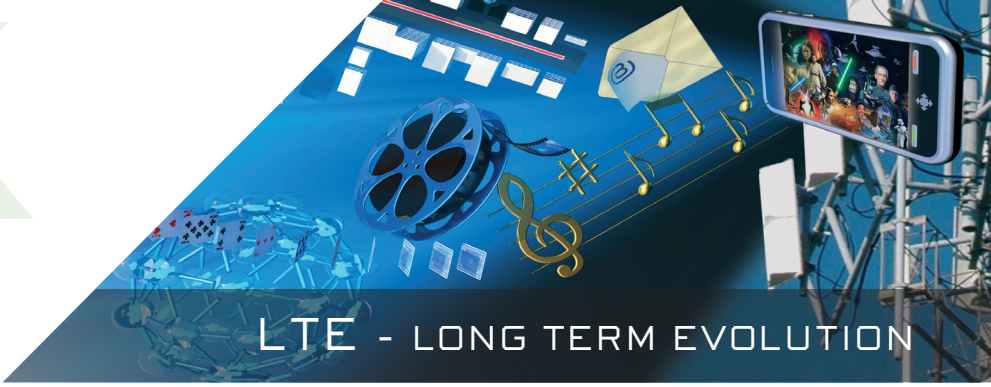
rakon



LTE - LONG TERM EVOLUTION

Long Term Evolution (LTE) is the latest standard in the mobile network technology tree. It can evolve directly from the GSM/EDGE and UMTS/HSxPA network technologies that now account for over 85% of all mobile subscribers.

The number of LTE subscribers is forecast by Infonetics to top 290 million by 2015.

LTE deployment challenges

LTE as a whole was designed with heavy reliance on excellent frequency references.

LTE has been set aggressive performance requirements that rely on physical layer technologies, such as, Orthogonal Frequency Division Multiplexing (OFDM), Multiple-Input Multiple-Output (MIMO) systems and smart antennae to achieve these targets. The main objectives of LTE are to minimize the system and User Equipment (UE) complexities, allow flexible spectrum deployment in existing or new frequency spectra and to enable co-existence with other 3GPP Radio Access Technologies (RATs).

Backhaul poses a serious challenge for the cost effectiveness of LTE deployment. Today's 3G networks are already facing major backhaul issues with the increased data transfer requirement of LTE. Operators are pushing vigorously for new techniques and technologies (e.g wireless solutions) that will optimize their backhaul, to ensure significant investment in running fiber to existing cell sites is not required.

When deploying LTE infrastructure, it has been recognized that LTE small cells will play a critical role in maximizing bandwidth and enabling effective indoor operation.

The tight subcarrier structure of the OFDM modulation is likely to create two big issues for LTE radio designers compared to single carrier systems like W-CDMA and makes the frequency reference more relevant and even more important. For example subcarrier spacing for LTE is 15 kHz. In contrast, W-CDMA has 5 MHz channel spacing.

With OFDM, symbol lengths are longer to make up for the spectral efficiency lost by the special code (i.e. cyclical prefix) inserted to cope with intersymbol interference.

One subcarrier's symbol energy interferes with the other causing loss of data. But then this leaves little spacing between information tagged on subcarriers hence making data highly dependent on frequency accuracy as well as phase noise. Phase noise on the frequency reference can cause subcarrier interference resulting in phase instability on the received signal. Further, to avoid distortion of the time domain signals due to close channel spacing in frequency space, a beefed up amplifier is required, meaning more heat is generated. This in turn leads to the need for a reference oscillator with considerably better frequency stability over temperature gradients.

LTE performance requirements

Metric	Requirement
Peak data rate	DL: 100 Mbps, UL:50 Mbps (for 20 MHz spectrum)
Mobility support	Up to 500 kmph but optimized for low speeds from 0 to 15 kmph
Control plane latency (transition time to active state)	<100 ms (for idle to active)
User plane latency	<5 ms
Control plane capacity	>200 users per cell (for 5 MHz spectrum)
Coverage (cell sizes)	5 km – 100 km with slight degradation after 30 km
Spectrum flexibility	1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz, 15 MHz and 20 MHz

The main advantages with LTE are high throughput, low latency, plug and play, FDD and TDD deployments in the same platform, an improved end-user experience and a simple architecture resulting in low operating costs. The next step for LTE evolution is LTE Advanced which is currently being standardized in 3GPP Release 10.

LTE FREQUENCY CONTROL SOLUTIONS

TCXOs

High Stability TCXOs

Rakon is the world leader in the design and manufacture of miniature TCXOs for high volume high performance applications. Rakon's High Stability TCXOs have ASIC based compensation with extremely high resolution testing resulting in the highest quality TCXOs with ±0.5 ppm stability over -40 °C to 85 °C and ±0.28 ppm over a narrower temperature range. Other features include stable frequency vs. time on start up and low hysteresis. Special options are available such as low voltage, power down mode, temperature sensing, voltage control, dual output and extended frequency range. Available in packages down to 2.0 mm x 1.6 mm. Suitable for LTE enabled mobile applications.

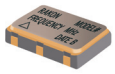
Ultra Stable TCXOs

Rakon's Ultra Stable TCXOs are the yardstick by which all other ultra stable TCXOs are measured. Suitable for LTE applications where excellent frequency accuracies are required over a wide temperature range. Phase noise as low as -153 dBc/Hz at 20 MHz is achievable. Available in small standard footprints (either 7.0 mm x 5.0 mm or 5.0 mm x 3.2 mm) and with low power consumption.

Mercury

When tighter stabilities are required than even the best TCXO can meet, Rakon's Mercury OCXO comes into its own. At a mere 9.7 mm x 7.5 mm in footprint, it is the world's smallest OCXO. Frequency stabilities and phase noise are superb and it will support many of the most stringent LTE frequency reference requirements for femtocell base stations. The heart of Mercury is an in-house developed ASIC. Mercury's performance is further enhanced by it consuming only 350 mW at room temperature – an important attribute when designers need to reduce the overall power consumption of a system.

VCXOs and XOs



Rakon's ultra low noise VCXOs and XOs are well suited to basestations and telecom infrastructure including LTE networks. Offering integrated RMS phase jitter as low as 0.1 ps (integrated 12 kHz to 20 MHz) and frequencies up to 1.5 GHz (including 30.72, 122.88 and 491.52 MHz). Standard package sizes: 14.0 mm x 9.0 mm, 7.0 mm x 5.0 mm and smaller are available.

OCXOs

Rakon's OCXO product portfolio covers the full range of performance attributes required for LTE (FDD & TDD), WCDMA, CDMA and GSM base stations. The range is available in a multitude of package sizes with frequency stabilities as low as ±0.1 ppb (parts per billion) over wide temperature ranges and with aging performance as low as 0.05 ppb/day.

Why Rakon for LTE

Rakon offers an exceptionally wide range of products unmatched in the frequency control industry, to address the stringent requirements of LTE and LTE-Advanced applications. Consult Rakon to discuss your next LTE requirement.

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