Technical Article

UNB (Ultra-narrow Band) Long Range Communication for a Smarter City

Terje Lassen

What problems could you solve if you had a connected smart city sensor that could live for over 10 years without maintenance? Innovation in RF connectivity now enables many new ways for cities to manage resources, making them greener, more efficient and more convenient. Myriads of sensors are finding their way into the everyday life of a city, managing energy consumption, routing traffic, monitoring air quality, improving waste management, monitoring and controlling street lighting, etc. Most of these sensors only have tiny amounts of data to send, hence the existing cellular system, optimized for high bandwidth, streaming smartphones, is often not a good fit. For smart city applications, a long range, ultra-narrow band network addresses the three key challenges for successful deployment of an autonomous sensor network: Ease of installation, communication robustness and long battery lifetime.

Ease of Installation

The installer is a person that typically has had very limited knowledge and training on the actual system and node functionality. First pass installation success must be very close to 100% to allow for a cost-effective deployment.

Communication Robustness

Maintaining information flow from a major deployment of sensor nodes require high communication success rate. Scrambling an RF savvy person to debug in-field communication issues is very expensive. For long term stability of the network, it is critical to use a robust communication link that also has the capacity and co-existence performance to support the projected growth of the connected devices. The network must run without issues both today and in 10 years from now!

Long Battery Life

Changing a battery is a very expensive operation. Therefore, the battery needs to last for the lifetime of the product. Although for some applications, energy harvesting can be an option, today this is typically a far more expensive solution than using a battery with sufficient capacity for the lifetime of the product.

The biggest smart city application today is smart metering. If you take for instance a gas meter, a typical requirement is between 10-20 years of battery lifetime. The cost of no communication is to send a person out to read the meter, so communication reliability is critical for the profitability of the installation. A large part of these meters today use narrowband and UNB (ultra-narrowband) communication to assure communication reliability, scalability and range to cover a whole city. UNB is the best choice to get robust, long range communication, and can achieve the best range in a real world environment. Check out this video where you can see TI demonstrating UNB achieving more than 100 km RF communication range using CC1120 and CC1190.

More than 100 km range with no data loss using long range narrowband

There is a push in the market to move to standards based solutions. Narrowband is defined in the key IEEE 802.15.4g spec, and narrowband is also selected for all new gas meter deployments in e.g. France and Italy (wM-Bus N-mode). Narrowband is the only technology that can offer the required network scalability, robust long-range communication and interoperability across multiple silicon providers. See also the white paper: Long-Range RF Communication: Why Narrowband is the de Facto Standard for more information on narrowband vs. other long-range communication technologies.

There is a definite trend for smart cities to move beyond only smart meter applications. The possibility to deploy low-cost sensor nodes with high communication reliability and years of battery lifetime opens for new application areas. Some examples of these applications are:

Street lighting: Remote monitoring and control of lighting reduces power consumption and make maintenance more efficient, which in turn gives more reliable streetlights for the communities.

Parking sensors: Route traffic to available parking spots gives city planners better insight into actual usage for better planning of future parking lots. In a city, automatic tracking of available parking spots can typically increase the usage of a parking spot. For spots with parking meters, the cost of a connected parking sensor can therefore often be justified, as it gives a positive return for the owner of the parking meter. The success of a smart city application usually depends on the return of investment calculation, to move beyond small scale trials and prototypes, someone needs to save substantial cost or increase revenue to justify the expense – with ease of use, robustness and longer battery life solutions from TI, we are pushing down the barrier for innovative smart city applications.

Air quality sensors: In many countries regulations mandate maximum levels for gases and pollution in cities. To assure compliance, sensors need to be placed around the city. Using narrowband technology with e.g. CC1120 in a dedicated sensor network will typically be a much more cost effective solution compared to e.g. using cellular connection. Please note that CC1125 has a slight better narrow band performance than CC1120 or CC1125, meaning you can reach longer distances.

In summary, for the smart city, using ultra-narrow band technology for long range communication will enable a robust, cost-effective network with longer battery lifetime. Narrowband is the best choice to assure capacity and reliability for innovative applications also in the years to come, with a projected dramatic increase of connected devices.

To read more posts related to connected living, check out these resources:

- Internet of Things
- How Wi-SUN FAN improves connected infrastructures
- Cities grow smarter through innovative semiconductor technologies

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265