

Application Note
CableFree Infrastructure for Internet of Things (IoT) Connectivity
10 Gigabit Wireless Networks



About Wireless Excellence

Founded in 1996 and with headquarters in Oxford UK, Wireless Excellence Limited is a leading designer and supplier of outdoor and indoor Broadband Wireless communication products.

With a complete range of solutions including Radio, Microwave, Millimeter-Wave, Free Space Optics, WiFi and 4G/5G/LTE, customers in over 80 countries have chosen Wireless Excellence as the “one stop shop” solution of choice for dependable wireless networking.

CableFree Infrastructure for Internet of Things (IoT) Connectivity

CableFree LTE and WiFi Infrastructure is ideal for creating public, private and "closed" networks for a wide range of IoT applications.

The IoT (Internet of Things) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and network connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure. Experts estimate that the Internet of Things will consist of about 30 billion objects by 2020. It is also estimated that the global market value of Internet of Things will reach \$7.1 trillion by 2020

The CableFree product range is ideal to implement and connect an Internet of Things network using either 4G/LTE or WiFi solutions to connect IoT devices:

- Cellular Wide Area Network: CableFree LTE using NB-IoT
- Closed/Private Network: CableFree WiFi

This paper will concentrate on LTE as an IoT infrastructure, but it is worth noting the complimentary capabilities of CableFree WiFi AP devices for short-range IoT as well as the longer-range capabilities of LTE.

The underlying technology of LTE can be used for connecting IoT as well as mobile customers to rural, suburban and urban customers, using Narrowband IoT devices. 4G was launched as LTE with 3GPP Release 8 onwards. The latest version (release 13) offers specific IoT support, and is available in current-generation CableFree LTE Base Station products: 3GPP Release 13 (LTE Advanced Pro). These more recent LTE releases offer greater feature set as well as higher capacities (256 QAM modulation, 4x4 MIMO, Carrier Aggregation, and more) and upgradable up to 5G.

Cellular Internet of Things using NB-IoT LTE

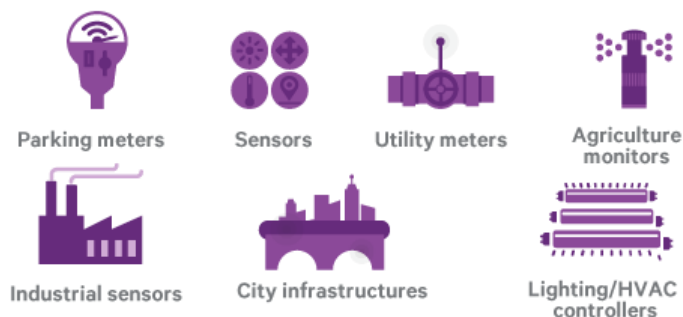
LTE Internet of Things is a suite of two complementary narrowband technologies – eMTC1 & NB-IoT2 – defined starting in 3GPP Release 13. Together, they deliver optimized performance and efficiency for a wide range of low-power, wide-area Internet of Things



CableFree LTE Supports Internet of Things

CableFree 4G LTE base stations support NB-IoT release 13 compliant standards, to enable connection of Internet of Things devices to a CableFree LTE base station.

- Single-tone and multi-tone category NB1 UE support
- 15 kHz and 3.75 kHz subcarrier spacing are supported
- All operation modes (in-band, guard band and standalone) are supported
- Multiple NB-IoT and LTE cells can be used at the same time in the same eNodeB



What is NB-IoT ?

NB-IoT is a narrowband radio technology designed for the Internet of Things and is one of a range of Mobile (M)IoT technologies standardized by the 3rd Generation Partnership Project (3GPP). This standard focuses specifically on indoor coverage, low cost, long battery life, and enabling a large number of connected devices. The NB-IoT technology is deployed “in-band” in spectrum allocated to Long Term Evolution (LTE), using resource blocks within a normal LTE carrier (or in the unused resource blocks within a LTE carrier’s guard-band) or “standalone” for deployments in dedicated spectrum. It is also suitable for the re-farming of GSM spectrum.

	LTE Cat 1	LTE Cat 0	LTE Cat M1(eMTC)	LTE Cat NB1(NB-IoT)	EC-GSM-IoT
3GPP Release	Release 8	Release 12	Release 13	Release 13	Release 13
Downlink Peak Rate	10 Mbit/s	1 Mbit/s	1 Mbit/s	250 kbit/s	474 kbit/s (EDGE) 2 Mbit/s (EGPRS2B)
Uplink Peak Rate	5 Mbit/s	1 Mbit/s	1 Mbit/s	250 kbit/s (multi-tone) 20 kbit/s (single-tone)	474 kbit/s (EDGE) 2 Mbit/s (EGPRS2B)
Latency	50-100ms	not deployed	10ms-15ms	1.6s-10s	700ms-2s
Number of Antennas	2	1	1	1	1-2
Duplex Mode	Full Duplex	Full or Half Duplex	Full or Half Duplex	Half Duplex	Half Duplex
Device Receive Bandwidth	1.08 – 18 MHz	1.08 – 18 MHz	1.08 MHz	180 kHz	200 kHz
Receiver Chains	2 (MIMO)	1 (SISO)	1 (SISO)	1 (SISO)	1-2
Device Transmit Power	23 dBm	23 dBm	20 / 23 dBm	20 / 23 dBm	23 / 33 dBm

Example: LTE-Advanced Tower for LTE 4G service

One or more LTE towers are installed in a region to give Internet access to fixed subscribers. Customers within several km of the tower can have IoT devices installed (indoor or outdoor) to enable internet access and connection to cloud based servers for IoT applications.

An example of a CableFree LTE-Advanced installation in the Middle East: shown is an LTE Macro-site tower with 3 Sector Antennas, LTE Remote Radio Heads (RRH), which connect down to the LTE Baseband Controller.



Connect Fixed or Mobile IoT devices and locations

A CableFree IoT Wireless solution can connect any of:

- Fixed IoT devices to centralised monitoring facilities
- Mobile or temporary IoT devices to core infrastructure
- Home, Residential, Business, Corporate, Government IoT applications
- Moving vehicles to centralised monitoring stations using CableFree Mobility.

Secure & Reliable high capacity wireless technology

A CableFree IoT Wireless solutions is Scalable and Future-proof and use the latest generation wireless technologies. Using the latest wireless technology, solutions can be made ultra-secure to avoid leakage of sensitive data.

Wireless networks can be designed to be self-healing and avoid single-point-of-failure to ensure maximum uptime and availability

For Further Information

At CableFree we have over 20 years experience with fixed wireless and deployments in over 80 countries. Contact our team of experts for free advice on creating Wireless IoT networks for your application. We offer free advice and additional design consultancy services.

For More Information on CableFree IoT Applications, please Contact Us and our team will be delighted to advise on a precise solution to match your exact requirements.

CableFree products are field-proven, with thousands of deployments in over 80 countries since 1997. Excellence in performance and reliability are not sacrificed in providing highly competitive priced solutions together with a comprehensive range of support services.

For More Information

Please contact Wireless Excellence Ltd for information on the complete range of CableFree products and services

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