Technical Article

Wireless M-Bus 101: Demystifying Modes and Regional Application Profiles

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One of the top worldwide trends in metering is to add connectivity to the meter. This allows for efficient readouts, over the air updates, and quick connectivity to your phone. In large buildings with various tenants, you have multiple meters that need to be read monthly. If all these meters are connected, pulling data from them is as simple as walking up to a data collector and performing a quick readout. This saves time and money for the electricity companies.

However, designing wireless connectivity into your flow or electricity meter, can be a bit overwhelming. If you just want to wirelessly read data off your meter and you perform a quick web search on how to implement this, you are immediately flooded with several options of range, throughput, and protocols. Where do you start?

In order to choose amongst the various protocols, you need an understanding of where your meter will be installed. Will it be in a basement or alleyway? Do you need coverage for a house or an apartment building? Where will you place the data collector or gateway? If the meter needs to connect to a data collector or gateway, that means transmitting through obstacles such as concrete walls and multiple floors over long distances – a harsh environment for wireless connectivity. One technology is specifically designed for this challenge: Sub-1 GHz.

Another challenge when designing a meter (depending on its deployment) is that it will most likely be read by multiple energy companies, in multiple cities, in multiple countries, all with their own rules and regulations. It can be confusing for a designer who is trying to determine the frequency needed for their region in Europe, what standards are available for their application and even where to start. Wireless M-Bus helps alleviate this confusion by creating a Sub-1 GHz standard for European countries.

What Is Wireless M-Bus?

Wireless M-Bus (wM-Bus) is the only European standard for wireless meter reading. Widely adopted by major metering companies across the continent, if there is a wireless meter or heat cost allocator currently installed in Europe, chances are it is using this standard. wM-Bus is based on European standard (EN) 13757-4, covering the specification of communication between meters and data collectors, also known as gateways.

wM-Bus is a low-cost, low-power star network running on license-free industrial -scientific-medical bands. Because it is based on Sub-1 GHz, wM-Bus networks it can penetrate concrete walls and long distances, with networks of as many as 1,000 nodes per collector. There are modes for the 868MHz, 433MHz and 169MHz bands, enabling coverage over several kilometres.

Various Modes

To help determine which frequency to choose for your meter, let’s start with the wM-Bus modes.

There are eight modes covering the three frequency bands mentioned here; however, only four modes have been widely adopted. Modes define how the meter operates. Stationary (S) mode is appropriate for meters that only need to only send data a few times a day. Frequent transmit (T) mode is applicable when sending greater amounts of data per day. Compact (C) mode can handle even higher data rates. These three modes operate on 868MHz.

If you don’t need a high data rate, but your network is spread over a wide area, then the solution is a narrowband network on 169MHz. Narrowband (N) mode is known for long range, tripling the areas covered by S, T and C modes. The other four modes – R, F, P and Q – are less common.

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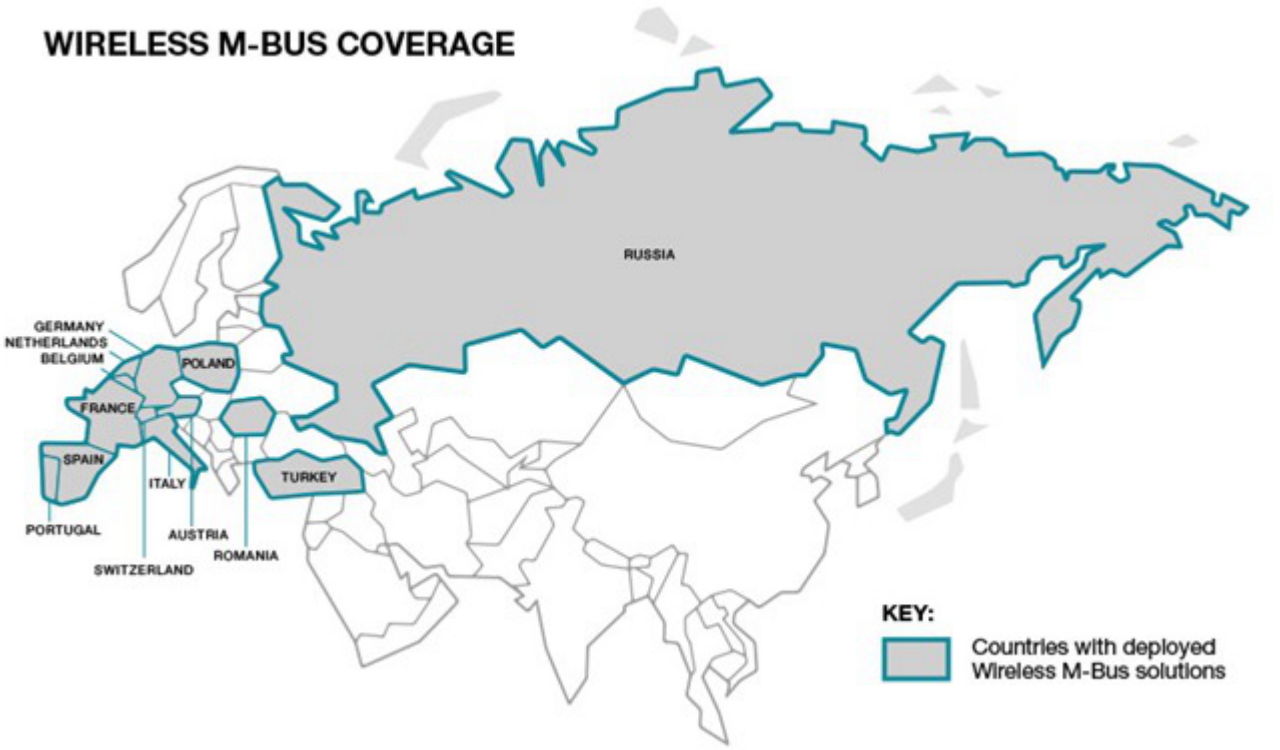

Available Application Profiles

To tackle the vast differences in deployment requirements throughout European countries, wM-Bus has multiple application profiles driven by various working groups, each with specific priorities.

One of the larger working groups, with over 50 members, is the Open Metering System (OMS)-Group. OMS started as a group of German companies that wanted a standard communication interface. To accomplish this, they focused on the application layer of the wM-Bus stack. OMS is based on 868 MHz, with several implementations in and around Germany. More recently, OMS has also been writing specifications for non-European regions such as Russia, India, Australia, the Middle East, and North and South America.

Dutch Smart Meter Requirements (DSMR) is another application layer-focused standard. DSMR also operates in the 868-MHz band and has several focused companion guides for various flow and electricity meters. DSMR is typically deployed in meters in the Netherlands.

Not all profiles are based on 868 MHz: Committee Italian Gaz (CIG) and Gaz Reseau Distribution France (GrDF) use N mode on 169 MHz. The CIG profile is focused in Italy, allows for +27 dBm of output power, and follows Ente Nazionale Italiano di Unificazione (UNI) technical specification (TS) 11291. The French-based GrDF has set the toughest wM-Bus requirements, requiring sensitivity and blocking beyond what EN 13757-4 specifies.

An interesting adaption of the GrDF profile is within the Wize Alliance, which uses the 169-MHz profile to go beyond meters and target smart city applications throughout Europe and Africa.

wM-Bus Brings History to Sub-1 GHz

In the fast-paced world of wireless standards, not many can outlast the competition. With over 15 years of history, wM-Bus is one of the oldest and most constant. This is important for smart grids, where deployments live in the market for +10 years. By choosing wM-Bus, you can be confident in choosing a standard with clear profiles and various modes to fit your needs.

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Where Should You Start with wM-Bus?

After reading up on the standards and determining which profile your region is covering, your next step is to find a technology adaptable to your target frequency and market.

From a hardware perspective, TI has designed wireless MCUs with a flexible radio that allows for the same chip to cover all of wM-Bus' different frequencies, modes and profiles. The CC1310 Sub-1 GHz wireless MCU comes in flash options of 32, 64 and 128 kB. If you need more memory for your end application, the same CC1310 family offers larger flash sizes with pin-to-pin compatibility. This helps future-proof your meter and enables the addition of other standards such as the Wireless Smart Utility Network (WiSUN) or mioty for smart city applications. The CC1310 family also comes in a dual-band flavor, the CC1352, if you would like to add *Bluetooth*® Low Energy connectivity to your meter.

To get a head start on software, TI provides a royalty-free software stack based on the CC1310 platform. TI's wM-Bus stack is deployed in over 10 countries throughout Europe. For stack support, TI has an application team in Oslo, Norway, that works closely with Stackforce GmBH for stack customization and porting to specific hardware platforms.

While TI has many Sub-1 GHz TI designs for smart grid applications, a great place to start is the Ultra-Low-Power Water-Flow Measurement for AMR Reference Design, which demonstrates a fully tested single-chip solution based on the CC1312.

wM-Bus Is a Known Sub-1 GHz Standard

wM-Bus is one of the oldest standards in smart grid. It has been deployed in the market for over 15 years and has been adapted by several European metering companies. When it comes to the metering market, this longevity is extremely important because meters are typically deployed for 10+ years. If you are looking to add a well tried and trusted protocol to your meter, this is it.

Additional Resources

Download these application notes:

- "Wireless M-Bus Implementation with CC112x/CC120x High Performance Transceiver Family."
- "CC13xx Combined wM-Bus C-Mode and T-Mode."
- "CC13xx wM-Bus S-Mode."
- "Ultra-Low-Power OMSv4.1.2 Compliant wM-Bus Stack Implementation with CC1310 and CC1350."
- "Complete Wireless M-Bus Solution"

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