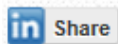


DecaWave DWM1000 Module: Precise Indoor Location

Steve Taranovich -July 09, 2014



A **recent report** said that the indoor location market will be worth \$2.60 Billion by 2018.

Invensense just acquired Movea, a motion-sensing algorithm developer. So suffice it to say that the location market, especially the indoor location market, is about to explode. The following Product review will introduce another key company in this volatile market. I'm so excited to see what these and more events will bring. **RFID Journal** says:

.....the DWM1000, designed to be easily built into an active RFID tag, transceiver, machine or electronic shelf for unique, low-cost real-time location system (RTLS) applications.

Fabless Ireland semiconductor company, **DecaWave**, announced their first module, DWM1000, based on what the company claims is the industry's most precise indoor location and communication CMOS chip, the DW1000 (See **EDN Product article on the DW1000 IC** from November 2013). See Figure 1.

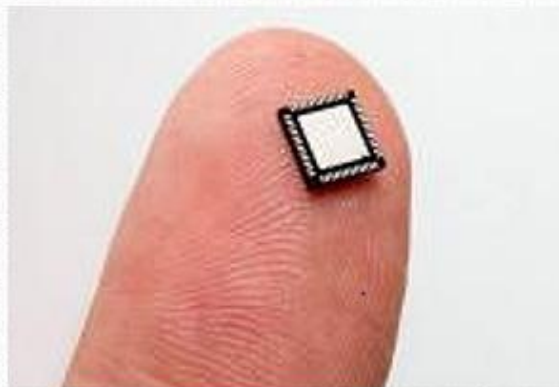


Figure 1: The tiny DW1000 indoor location communication chip at the heart of the DWM1000 module (Image courtesy of DecaWave)

The module will allow designers to simply and quickly integrate the technology as a plug and play solution, reducing the cost of development and the risks associated with radio frequency (RF) design.

I spoke to Mickael Viot, Marketing manager, from DecaWave recently and we discussed this new innovation. Viot commented that their device brings location capability down to the “object” level. This apparently had not been done in the past to this level of accuracy, plus Ultra-wideband (UWB) transceivers have traditionally been larger with more components and too bulky for many applications.

Viot told me that their design uses UWB with Time of Flight (Time of flight or Time of Arrival in this case describes a variety of methods that measure the time that it takes for an electromagnetic or other wave to travel a distance through a medium). UWB has a very short pulse duration and a fast rising edge which makes it ideal for this application because it brings with it features of ultra-low power and the capability of giving precise ranging and positioning in an indoor environment.

Sampling a received signal

Since UWB has such a large bandwidth, it is very difficult to sample the received signal in real time with the ADCs we have today. So the technique of equivalent time sampling (Also known as stroboscopic sampling) is performed on a repetitive pulse train. (I did something like this in the 80s when we designed a Microwave Pulse Power Meter to look at 10 ns pulse trains and larger modulating a microwave frequency. We would delay sampling with ECL delay lines as the pulse train would be sampled and then incrementally delayed to create a composite pulse with which one could extract the rise and fall time, pulse width and duty cycle). See Figure 2.

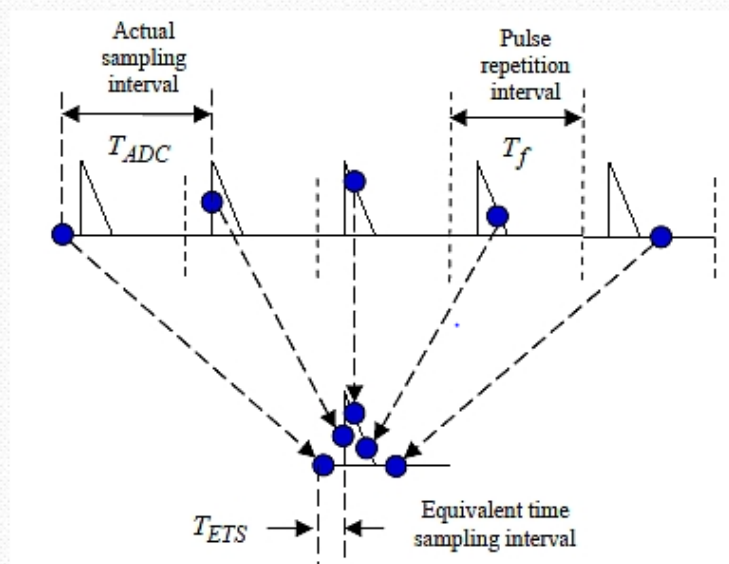


Figure 2: Equivalent time sampling method on a pulse train (Image courtesy of Reference 1)

Frequency ranges

Past designs in the industry had used a frequency of 2.4 GHz with a 20 MHz bandwidth and this technique yielded a skewed time of arrival. DecaWave's technology yields an almost perfectly shaped RF pulse with ps time accuracy.

Six frequency bands are supported with center frequencies of 3.5 GHz to 6.5 GHz. Data rates are 110 kbit/s, 850 kbit/s and 6.8 kbit/s.

Transmit power density is programmable from -35 dBm/MHz to -62 dBm/MHz using a modulation scheme of Burst Position Modulation (BPM) with Binary Phase Shift Keying (BPSK) to support both coherent and non-coherent receivers using a common signaling scheme adhering to the IEEE802.15.4-2011 UWB standard..

Package size

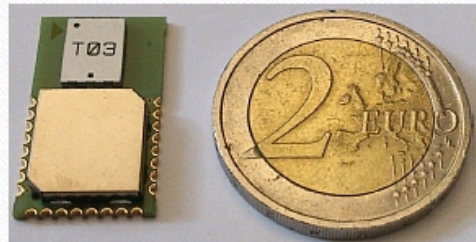


Figure 3: Small size as compared to a 2 Euro coin (Image courtesy of DecaWave)

The device integrates everything necessary for RF design. A chip, antenna, balun, crystal and passive components are all fitted on a 23 mm x 13 mm x 2.9 mm 24-pin side-castellation package. See Figure 4.

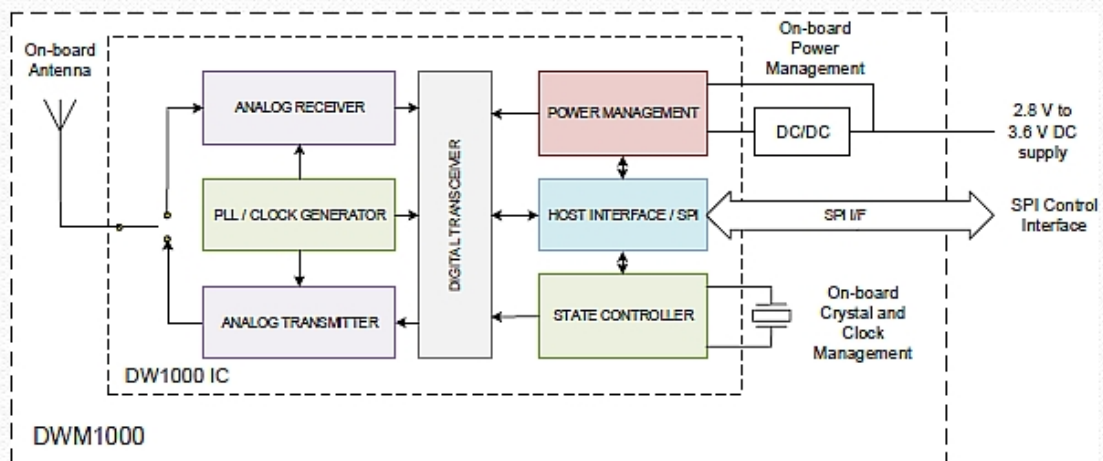


Figure 4: The DWM1000 block diagram shows the high level of integration including the antenna, DC/DC power converter and crystal for clock management. (Image courtesy of DecaWave)

Applications

This level of integration has been made possible thanks to the close collaboration between DecaWave and [LG Innotek](#), the world leader in module and sub-system manufacturing. Great for portable equipment. Innotek already builds the DW1000 chip into lighting-control and building-automation systems. This application gives the ability to identify when a badged individual enters a room to adjust lighting; other companies use the DW1000 for tracking patron locations and traffic within museums.

Check out this [brief video](#) ---this happened to me at an airport years ago and I wish I had a device like the DWM1000.

Accuracy

The module is an IEEE802.15.4-2011 UWB compliant wireless transceiver. It allows the location of objects in real time location systems (RTLS) to a precision of 10 cm. Now that's pretty amazing.

Data rate

It is capable of high data rate communications, up to 6.8 Mb/s, and it is also a perfect fit in wireless sensor network (WSN) applications. Based on an excellent communications range of up to 290 m in Line of Sight and up to 35m in Non-Line of Sight, it also reduces the system cost and the need for additional infrastructure.

Power

All of this would not be practical in a design unless there were low power consumption so that battery operation would last for long periods. The single supply 2.8 V to 3.6 V with current draw of 31 mA in transmit mode; 64 mA in receive mode and 2 uA in watchdog timer mode make the design realistic in portable applications. It has 100 nA in deep sleep mode as well.

Technology

DecaWave's Applications Engineering Manager, Gerry O'Grady best explains the DW1000 chip technology and function, which is the single chip IC in the DWM1000 module, in this [video](#).

Pricing

The DWM1000 is priced from \$30 for smaller quantities or \$15 for quantities of 5,000 to 10,000 parts.

For more information please visit the DecaWave [website](#).