

# A Technology Comparison

*Adopting Ultra-Wideband for Memsen's file sharing and wireless marketing platform*



What is Ultra-Wideband Technology?

- Ultra-Wideband is a proposed standard for short-range wireless communications that aims to replace Bluetooth technology in near future.
- It is an ideal solution for wireless connectivity in the range of 10 to 20 meters between consumer electronics (CE), mobile devices, and PC peripheral devices which provides very high data-rate while consuming very little battery power. It offers the best solution for bandwidth, cost, power consumption, and physical size requirements for next generation consumer electronic devices.
- UWB radios can use frequencies from 3.1 GHz to 10.6 GHz, a band more than 7 GHz wide. Each radio channel can have a bandwidth of more than 500 MHz depending upon its center frequency. Due to such a large signal bandwidth, FCC has put severe broadcast power restrictions. By doing so UWB devices can make use of extremely wide frequency band while emitting very less amount of energy to get detected by other narrower band devices. Hence, a UWB device signal can not interfere with other narrower band device signals and because of this reason a UWB device can co-exist with other wireless devices.
- UWB is considered as Wireless USB – replacement of standard USB and fire wire (IEEE 1394) solutions due to its higher data-rate compared to USB and fire wire.
- UWB signals can co-exists with other short/large range wireless communications signals due to its own nature of being detected as noise to other signals.
- Under current FCC regulations, UWB signals used for commercial communications are capable of delivering very high data rates within short-ranges.
- Intel, Panasonic, Motorola are few of the big players in wireless industry who are very much interested in making UWB a viable solution for short range wireless communications. They believe we can achieve data rate of as high as 480 Mbps within ranges of less than 15 meters.

### What is Bluetooth Technology?

- Bluetooth is a current industry standard for short-range wireless connectivity.
- Bluetooth technology is widely used in consumer electronics for short-range wireless data transfer, like printers and digital cameras. It operates efficiently within the range of 20-25 ft in the environment without WLAN equipments.
- Bluetooth signals operate in the same frequency range as WI-FI (802.11b, g) standard. This is the biggest disadvantage of it because of its interference with WI-FI signals. A Bluetooth enabled device is not being able to function efficiently in the vicinity of WI-FI signals.
- Bluetooth technology took many years to come into mass market but still is struggling to really prove its potentials.
- Bluetooth faces major challenges by upcoming Ultra-Wideband standard which has many advantages such as higher data-rate and capability to co-exist with other wireless standards.

### Why Memsen prefers UWB over Bluetooth for its wireless file sharing solutions?

- Memsen Corporation is building a complete wireless file-sharing platform which will benefit by Ultra-Wideband technology due to its many advantages over Bluetooth technology.
- UWB has the capacity to handle very high bandwidths required to transport multiple audio and video streams in “Real-time” between different UWB enabled devices, while Bluetooth lacks high data-rate - only 1Mbps maximum under ideal conditions, which is not enough for media rich content.

“Real-time” means almost zero time delay in transferring Mega bits of information - our products line includes a KEY-CHAIN type peer-to-peer file sharing device which will specifically focus on media rich file sharing and aims to take advantage of high data-range of about 450 Mbps (within short-range) provided by UWB technology. With the help of UWB, Memsen can offer “instant file-sharing solution” to millions of people and explore the whole new world of wireless connectivity. Obviously Bluetooth doesn’t have enough capabilities to handle instant transfer of huge information that UWB is very good at.

Memsen will be able to provide *low cost* solution to millions of people with the help of UWB implementation. This technology promises *very low battery power consumption* compared with Bluetooth which is critical aspect for Memsen’s peer-to-peer file sharing KEYCHAINS, users will be able to keep their devices live without battery replacement for days and enjoy freedom of information exchange with complete peace of mind.

- We at Memsen believe in next generation wireless marketing solutions which can provide “Real-time” connectivity & data-transfer for our wireless marketing products. “Real-time” means instant data transfer between our datavendor products irrespective of size of data. Only UWB technology has that potential to fulfill our dream of connecting advertising industry with millions of people instantly, and efficiently.

UWB provides capability of data-transfer with effective range of up to 25 meters compared with rival Bluetooth technology which offers effective range of only about 10 meters. Advertising industry can have a huge benefit using UWB enabled Memsen’s datavendor chain of products to reach millions of people efficiently, and with complete surety of reaching potential customers.

Bluetooth solution for our datavendor chain of products is not feasible due to its connection time delay, interference issues, higher battery power consumption and poor communication range compared with UWB. We at Memsen believe in user satisfaction and it can only be achieved using UWB technology in our products.

UWB provides spatial capacity of  $>1000 \text{ Kbps/m}^2$  compared with about  $30 \text{ Kbps/m}^2$  with Bluetooth technology. Higher spatial capacity means capability to allocate higher bandwidth in given area, which is one of the main aspects of datavendor chain of products. With higher spatial capacity, advertising company can reach more number of people simultaneously without increasing cost and amount of time spent.

- UWB technology is also considered as replacement of USB and fire wire standards. USB is a high speed PC connectivity solution where as fire wire (IEEE 1394) is high speed consumer connectivity solution. UWB is considered as a technology that can bridge the divide between these two standards and hence can be used as replacement of USB and fire wire. Memsen’s vision is to develop wireless file sharing platform based on UWB technology which can enhance users’ experience with wireless connectivity solutions and provide complete freedom of having the very new technology in their own pocket.

### A quick overview of other WPAN/WLAN technologies

- WI-FI (802.11a, b, g) – Wireless LAN technology is not new to us. It is been in the market for some years and now it is seen as mature wireless LAN solution that replaced Ethernet cables in many office and home networks. Ethernet provides 100 Mbps connection while Gigabit Ethernet is much more. Not comparable with Ethernet data-rate, WI-FI struggles to provide good data-rate for bandwidth hungry applications in LAN environment. Memsen envisions providing WPAN solution which can deliver instant sharing of multimedia content. WLAN technologies are much better for LAN environment where network connectivity is more important than peer-to-peer file sharing. With maximum data-rate of 11 Mbps (802.11b), 22 Mbps (802.11a) and 54 Mbps (802.11g), WLAN is still not capable enough to handle major requirements of Memsen’s Click N’ Share KEYCHAINS and Datavendor – provide high data rate with instant connectivity.
- Zigbee – With effective Communication range of 20 meters and data-rate of about 40-240 Kbps, Zigbee is a new upcoming technology for short-range wireless communications. With low power consumption and less cost compared with Bluetooth and WI-FI, Zigbee is a promising technology for applications which are NOT too much bandwidth hungry. Memsen’s products will be designed for multimedia file sharing and instant connectivity which Zigbee can not promise. Range will be an issue for Memsen’s datavendor products with Zigbee technology, whereas data-rate will be the main issue with Click N’ Share KEYCHAINS. Hence Memsen can not use Zigbee as a replacement for UWB; however UWB is the only viable solution for Memsen’s products, with such a wonderful technology Memsen can reach millions of people instantly and efficiently.

### Different industrial viewpoints in standardization of UWB technology

## **Multiband-OFDM Alliance (MBOA)**

- Initially led by Intel, later on many big players like Microsoft, Panasonic, Samsung, Texas Instruments formed alliance to propose Multiband-OFDM based UWB standard. The multiband approach takes 7.5 GHz of unlicensed UWB spectrum and divides it into 15 non-overlapping frequency bands. It complies with the FCC regulation by ensuring that the individual bands occupy between 500MHz and 700MHz. The Multiband approach based on OFDM is supported by a QPSK modulation pushed by Texas Instruments.
- The multi-band approach adds technical complexity, requires more power and increase upfront costs. Also, the aggregate power of all the different pulse streams would have to fall within strict FCC regulations, meaning the tradeoff with range/data transfer will be an issue.
- Multiband systems have improved multi-path energy collection that increases the potential range of transmissions however this introduces increased receiver complexity (i.e. multiple RF receive chains), power consumption, analog die size and increased design time. The multi-band system using orthogonal frequency division multiplexing (OFDM) proposed by the MBOA has several advantages. Transmitting information on each of the sub-bands increases the high spectral efficiency, inherent resilience to RF interference, robustness to multi-path, and the ability to efficiently capture multi-path energy.

## **DS-CDMA UWB**

- Led by XtremeSpectrum/Motorola, nine companies formed the Alliance. The founding member companies include Appairant Technologies, Inc., Eastman Kodak Company, Hewlett Packard, Motorola, Inc., Royal Philips Electronics, Samsung Electronics Co. Ltd., Sharp Laboratories of America, Inc., Time Domain Corporation and XtremeSpectrum, Inc.
- These companies are proposing direct sequence based CDMA modulation for UWB signals which is very different from the MBOA proposal. The International Telecommunications Union's radio branch is likely to endorse the XtremeSpectrum/Motorola direct-sequence CDMA ultra-wideband proposal now before the IEEE 802.15.3a study group.

## Technical comparison of UWB with Bluetooth and other wireless standards

**Table 1** describes advantages of UWB technology over other short range wireless communications standards.

**Figure 1** shows effective data rate comparisons between UWB and other technologies. UWB provides more than 100 Mb/s effective transfer rate compared with Bluetooth (1Mb/s max.) and 802.11b (11Mb/s).

**Figure 2** shows power dissipation for UWB chip which is less than 10 mw (much less than 802.11b and Bluetooth technologies).

**Figure 3** shows energy efficiency comparisons. UWB provides maximum efficiency among other technologies. Hence it is the best match for energy sensitive applications.

**Figure 4** compares effective communication range. UWB technology is meant for short range communications – personal area networks, while 802.11a, b, g are meant for broader range - local area networks.

**Figure 5** shows cost comparison with other technologies. Ultra Wideband transceivers are cheaper than 802.11 group transceivers and also are expected to be cheaper than Bluetooth in near future once mass production starts.

**Table 1 Comparison between UWB and other short range wireless standards.**

Technology	Data Rate	Range	Cost	Power	Spectrum	Issues
UWB	50-100Mb/s, >500Mb/s expected in future	500 ft	Low	Low	3.1–10.7 GHz	High data rate for short range only – about 300- 500 ft, technology still not ratified
Bluetooth	0.8 - 1.0 Mb/s	30 ft	Low	Low	2.4 GHz	Speed and Interference issues
802.11a	54 Mb/s	90-100 ft	High	High	5.0 GHz	High power consumption, High cost, Bulky chipsets
802.11b	11 Mb/s	250– 300ft	Medium	Medium	2.4 GHz	Speed and signal strength issues for more range.
802.11g	54 Mb/s	100 ft	High	High	2.4 GHz	Connectivity and range problems, High cost
HyperLan	25 Mb/s	100 ft	High	High	2.4 GHz	Only European standard, High cost
Home RF	11 Mb/s	150 ft	Medium	Medium	2.4 GHz	Speed Issues, doesn't have big players' support
Zigbee	0.02 – 0.2 Mb/s	20 – 25 ft	Low	Low	2.4 GHz	Standard still under consideration, very less communication range, low data-rate

**Figure 1 Data Rate Comparisons**

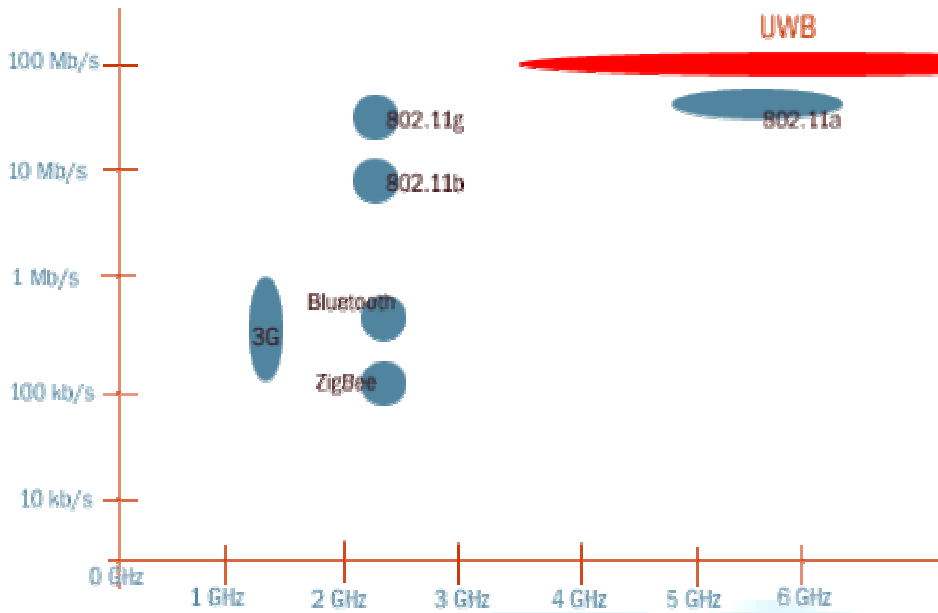


Figure 2 Power Dissipation Comparisons

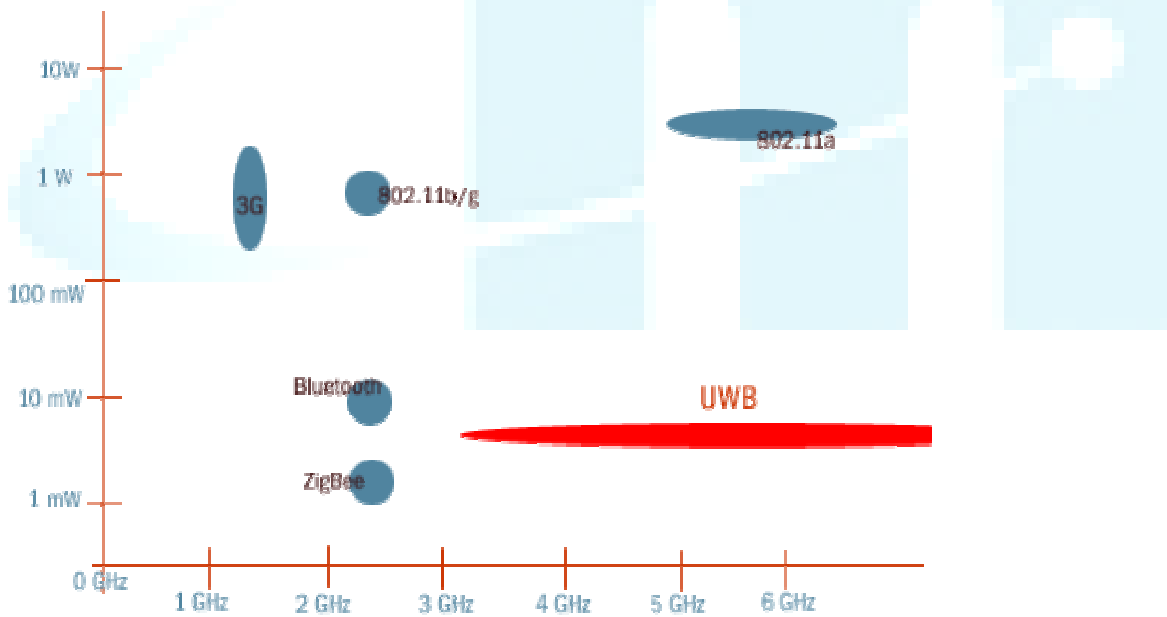


Figure 3 Energy Efficiency Comparisons

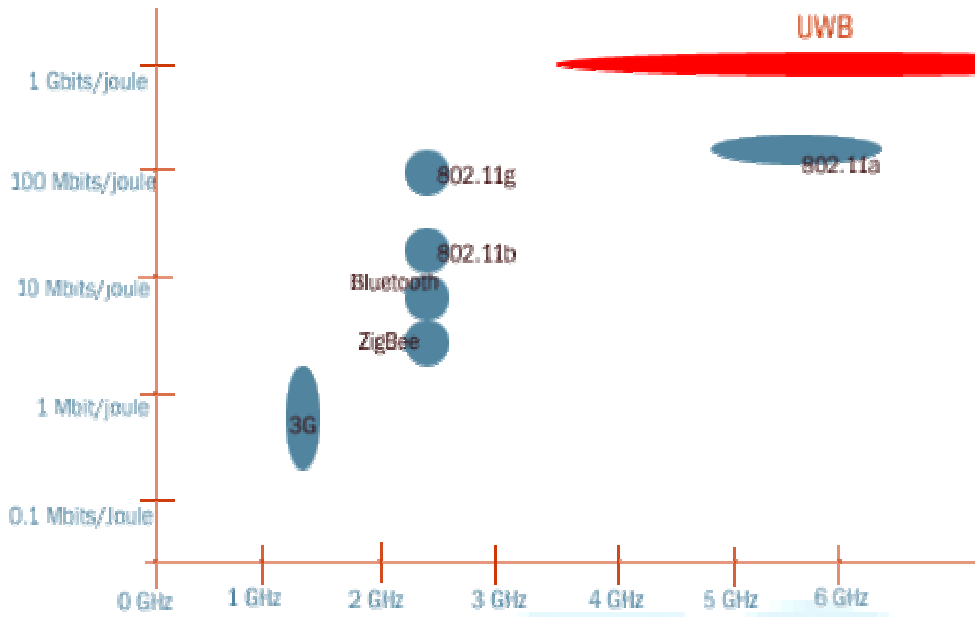


Figure 4 Effective Communication Range Comparisons

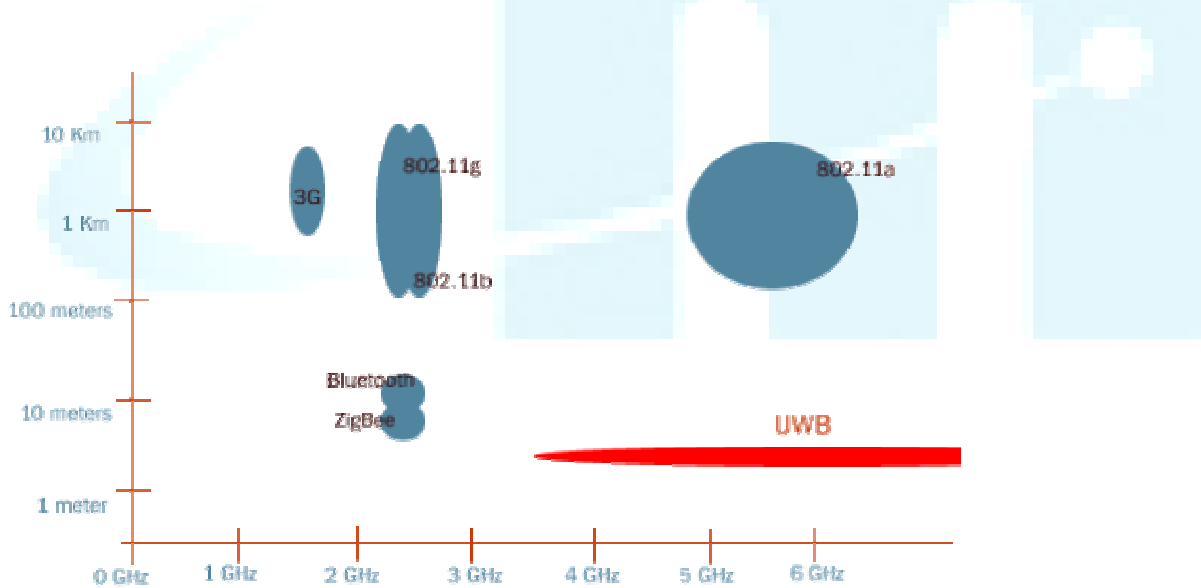
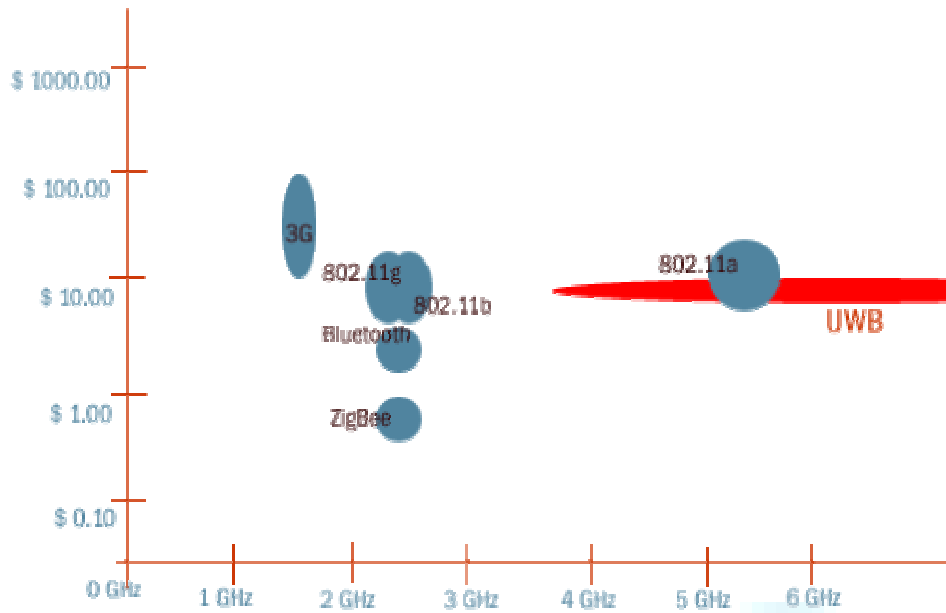


Figure 5 Cost Comparisons



Reference:

1. [Ultra Wideband: Poised to transform wireless industry - by On world](#)
2. [UWB – Intel’s Perspective](#)
3. [ITU said to favor Motorola UWB proposal](#)
4. [UWB beats up Bluetooth by 2007](#)
5. [Will UWB usurp Bluetooth?](#)