



A general consensus seems to have emerged in the computer and communications industry that universal connectivity will be a 'must have' feature in next generation voice and information terminals.

Universal connectivity implies a single standard working in a common frequency band. The ISM (industrial, scientific, medical) band at 2.45 GHz is proposed as a suitable frequency allocation given that it is available globally (though the amount of spectrum available in the band is not always the same in each country).

The ISM band is an unregulated band – anyone can use the band provided the maximum ERP of any device used does not exceed 100 mW (+ 20 dBm), with most devices operating at 1 mW (0 dBm).

There are two principal technology contenders for connectivity devices at 2.4 GHz, 'Bluetooth' and IEEE 802.11, both solutions use spread spectrum techniques to randomise the RF interference inherent in unregulated spectrum

Bluetooth uses frequency hopping with 79 hop frequencies 1 MHz apart, hopping at up to 1600 hops per second between 2.402 and 2.480 GHz (less in Japan, France and Spain).

Typical output power is 0 dBm (1 mW) with the option to increase to +20 dBm (100 mW) and decrease to -30 dBm (1 mW). The device uses simple FM modulation.

The assumption is that this will support synchronised data links of up to 432.6 kbs or unidirectional links up to 721 kbs and/or 64 kbs voice within a 10 metre radius (or 100 metres under favourable conditions). Single devices can support up to 7 simultaneous links to other devices.

Typical applications proposed include cell phones that can talk (ie exchange information) with PDA's, PDA's that can connect to local devices (printers for example), and the exchange of personal data. The increasing use of V Cards will likely be a major market driver here.

The IEEE 802.11 wireless LAN standard is the second contender (and pre-dates Bluetooth by several years). Technically this is a wireless LAN standard which evolved from the perceived need to provide wireless Ethernet access and recent iterations of the standard therefore include the capability to deliver up to 11 m/b/s (ie 10 Mb/S wired Ethernet substitution).

The Harris 'Prism' chip set was one of the first products to be introduced into this market – the chip set uses direct sequence spread spectrum, providing just over 10

dB of processing gain for higher bit rates (and more as the user bit rate decreases). The plan is to use two of IBM's SiGE IC's to shrink the platform into a PC card format (and reduce the component count and cost). Too complex to be a competitor to Bluetooth? I'm not so sure.

And then, there's the wireless LAN chip set solution from Philips Semiconductors using Lucent's 'WaveLAN' baseband and a Philips RF/IF front end which supports frequency hopping and direct sequence spreading. This is a perfectly well specified product, well executed using standard off-the-shelf Philips devices (silicon and GaAs front end, quadrature IF transceiver and synthesiser).

And then, there are the 'virtual cable' versions of DECT as additional future competition in the connectivity stakes. In the last 3 or 4 digital cordless design programmes that we have run we have noticed a considerable increase in interest from device manufacturers (ie manufacturers looking to connect devices with other devices in corporate and/or domestic applications) using DECT as the connectivity platform – DECT silicon platforms have the advantage of a rapidly reducing cost curve (as domestic digital cordless sales finally take off in Europe) and some really flexible data profiles (and relative to the ISM band, relatively clean spectrum in which to operate). The dynamic channel allocation and interface management implicit in the air interface also makes the protocol very friendly to implementing 'bandwidth on demand' type services – something that Bluetooth has not even started to address.

And then there's PHS. Don't write PHS off yet – the 'home RF working group' and the ARIB are busily working away on next generation PHS devices (1 mW and 10 mW) to provide device to device connectivity.

And then there's third generation cellular air interface developments, and this is where we have the biggest argument with Bluetooth – the 3G air interfaces will have enough flexibility (and bandwidth) to encompass pretty much any application you care to throw at them **including** local device to device connectivity.

Both W-CDMA and Cdma2000 have time division duplexed protocols as part of their 3G platforms and in most markets 20 MHz of non-paired frequency allocation from 1900 to 1920 MHz is available for TD-CDMA services (1910 to 1930 MHz in the US).

There is an obvious future development path for DECT and PHS to converge and develop together to evolve towards these integrated 3G air interface standards.

The connectivity issue (it seems to us) has to be addressed by qualifying how any add on technology (like Bluetooth) will co-exist with these standards and/or add value. In practice, there are any number of ways in which local connectivity can be addressed without needing to resort to additional add-on/add-in devices.

Bluetooth www.bluetooth.com

Philips Wireless LAN www.semiconductors.philips.com

'V' Cards www.imc.org/pdi/

www.pdi-info@imc.org

DECT Virtual Cables www.s3group.com

(Philips/Alps/S3)

Harris Prism Chipset www.harris.com

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