UltraWideBand - UWB

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UltraWideBand - UWB

- **UltraWideband is . . .**
- **Low power short range data links potentially over all of 3.1-10.6GHz**
- **Essentially UWB = Wireless USB or Firewire**
- **UWB allows a high data rate to be achieved with relatively simple equipment but results in transmissions spread across large parts of the spectrum used by others.**
- **UWB might be used to deliver wireless connections between DVD players, displays and speakers, for example, simplifying installation and removing the need for unsightly wires. It might provide a wireless high data rate link between digital cameras and computers or link computers, PDAs and other computing devices in a local area.**
- **Intel expects UWB to be integrated into PC Motherboards in 2006**
- **Likely to be popular for high speed Video streaming etc**

UltraWideBand - UWB Standards

- **Brief Intro to Ultrawideband Spectrum follows, but this is dependent of which standard is used**

- **Two Camps with incompatible standards**
  - Freescale (Motorola) Direct Sequencing
  - Intel OFDM Alliance

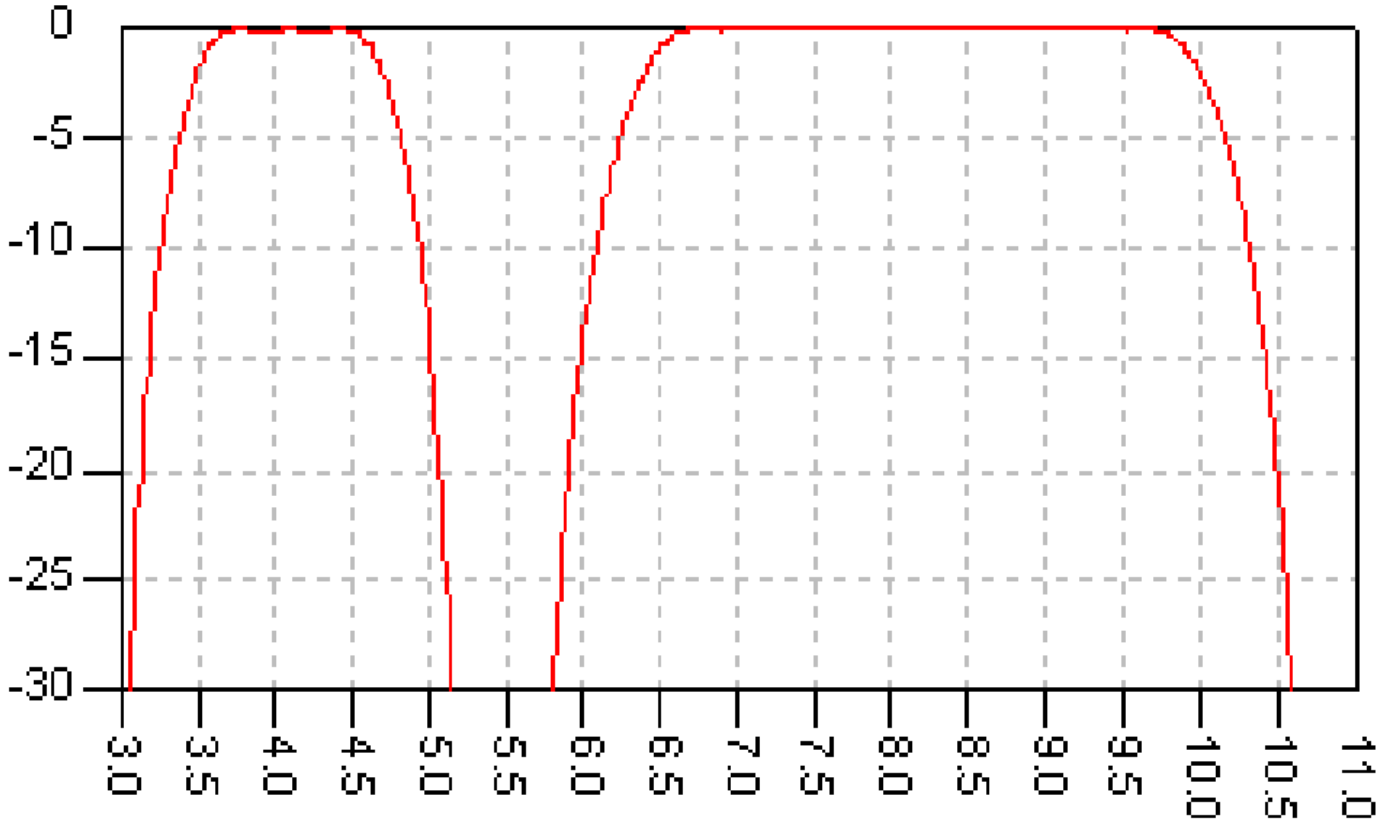
- **IEEE 802.15 trying to resolve battle**
  - http://www.ieee802.org/15/
  - NB Fierce debate in latest minutes at http://grouper.ieee.org/groups/802/15/pub/Minutes.html

- **Both camps will only use lower bands for now due to chipset availability and costs**

Direct-Sequence UWB

http://www.uwbforum.org/

- **DS UWB - Two bands only**
- **Largely a Motorola (Freescale) Initiative**
- Lower band occupies 3.1 GHz to 4.85 GHz and the
- Upper band occupies 6.2 GHz to 9.7 GHz.
- NB - The upper end seems to be rather higher than 9.7 and hit 10GHz+



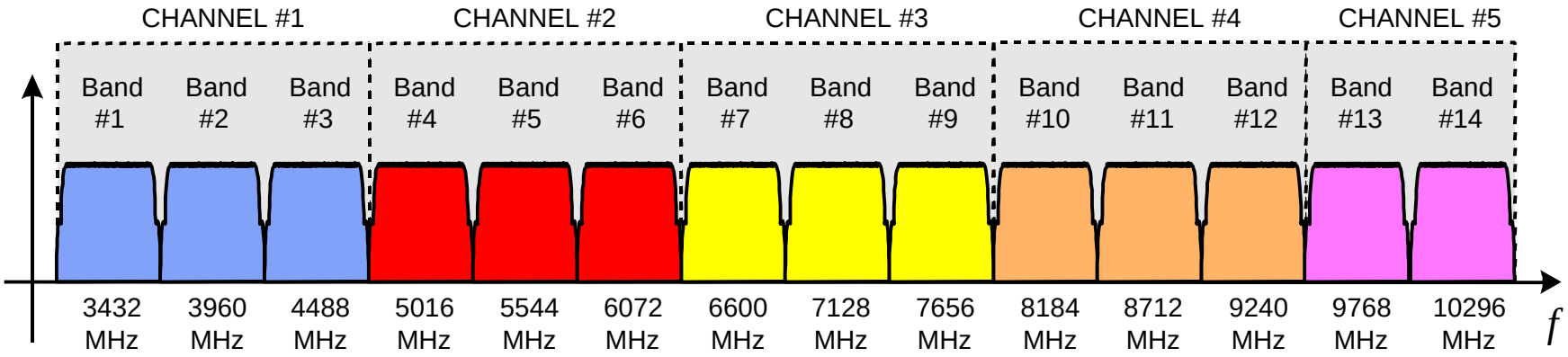
DS UWB Channels

Piconet Channel	Centre Frequency
• 1	3939 MHz
• 2	3978 MHz
• 3	4017 MHz
• 4	4056 MHz
• 5	3900 MHz
• 6	4094 MHz
• 7	7878 MHz
• 8	7956 MHz
• 9	8034 MHz
• 10	8112 MHz
• 11	7800 MHz
• 12	8190 MHz

NB No Scope within a spectral band for selective channel notching

OFDM UWB

http://www.multibandofdm.org/



- **OFDM uses sub-bands with more scope for notches/spectral sculpting**
- **Mode-1 uses Group-1 only**
- **Broad Industry Alliance led by Intel and PC Companies**

Band Group	BAND_ID	Lower frequency	Center frequency	Upper frequency
1	1	3168 MHz	3432 MHz	3696 MHz
	2	3696 MHz	3960 MHz	4224 MHz
	3	4224 MHz	4488 MHz	4752 MHz
2	4	4752 MHz	5016 MHz	5280 MHz
	5	5280 MHz	5544 MHz	5808 MHz
	6	5808 MHz	6072 MHz	6336 MHz
3	7	6336 MHz	6600 MHz	6864 MHz
	8	6864 MHz	7128 MHz	7392 MHz
	9	7392 MHz	7656 MHz	7920 MHz
4	10	7920 MHz	8184 MHz	8448 MHz
	11	8448 MHz	8712 MHz	8976 MHz
	12	8976 MHz	9240 MHz	9504 MHz
5	13	9504 MHz	9768 MHz	10032 MHz
	14	10032 MHz	10296 MHz	10560 MHz

OFDM continued…

- **The relationship between centre frequency and band number is given by the following equation:**
  - Band centre frequency = 2904+528x n_b MHz, where n_b=1…14
- **This definition provides a unique numbering system for all channels that have a spacing of 528 MHz and lie within the band 3.1–10.6GHz.**
- **Based on this, five band groups are defined, consisting of four groups of three bands each and one group of two bands.**
- **Band group 1 is used for Mode 1 devices (mandatory mode).**

- **122 Subcarriers are used out of 128 (100 data, 12 pilots, 10 guard)**
- **Subcarriers at 4.125MHz spacing (128x4.125=528MHz multiplex)**

- **Default Spectral shaping is to drop Ch-2 or Band-5 to protect 5.7GHz LANs, but smarter notching theoretically possible at subcarrier level by software only - a great attraction**
- See http://www.multibandofdm.org/papers/Spectral_Sculpting_and_Future_Ready_UWB_Sept_04.ppt

OFDM Modes

- **Initial Chipsets will use Mode-1 only**
- **Mode-2 likely to be next with other channels reserved for future expansion**
- **Other than the 3.4GHz band - looks very Amateur friendly**