UPAMDTM/P1823TM
Potential Goals

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UPAMD™ Goals

• General Goals
• Connector Goals
  – Connector Options
• Communications Goals
  – Communications Options
• Power Goals
  – Power Options
UPAMD™ General Goals

• Life expectancy of 10 years
• First adapter must work with last device and last adapter must work with first device, possibly with reduced capability.
  • Adapter<->Mobile Device communications required for safety.
  • Continuous communications growth to support growth of UPAMD.
• Must support non-battery powered devices
• Connector must not mate with any current designs – product Safety issue
• Consider future mobile device design options
  – Smaller profiles, headed for 10mm now 5mm later?
  – Different shapes: may not be on edge
• Must support changing battery storage technology.
  – Multiple battery technologies currently used and need to be considered.
  – Consider future power storage technologies
• Should UPAMD consider Adapter supply side issues
  – (input voltage/frequency safety standards, country specific issues?) – suggested as not being needed at this meeting.
UPAMD™ Connector Goals

- Not compatible with any existing connector design
  - Equipment safety - Prevent damage
- Easy disconnect to prevent tripping – safety issue
  - What disconnect force as a function of angle?
- Capable of 10W to 130W
  - Contacts rated for currents to 9A?. Voltage Rated SELV?.
- Floating electrical connection, electrically isolated – Safety
  - No shock hazard under any conditions
- Very high connect – disconnect cycle capability – Many year usage
- Aesthetically pleasing
- Support lower profile devices
  - 10mm or less? iPad=13.4mm (to start with) 5mm goal?
  - other shapes and possibly flat surface connect
- Retention mechanism - Magnetic or Mechanical
  - Magnetic possibly good choice, Apple Patent 7,311,526 Needs LOA.
  - Several clip possibilities exist. New Ideas clearly welcome
- Positive and Negative connection with communication AC coupled
  - Assume multiple contacts for reliability and current sharing?
- Blind mate friendly - it possible
  - think of mating adapters and device alignment by feel in the dark
  - Easy docking station or charging station
UPAMD™ Connector Options

- **Barrel Connector – TC100 proposed style**
  - Advantages
    - Exists, History, IEC 61076-2-102 spec, cost?
  - Disadvantages
    - Big, not Aesthetically pleasing, No sources found, Safety trip hazard, moisture seal

- **Spring Loaded Contact Style – Adapter side**
  - Advantages
    - Small Footprint, flat contact surface, good usage models, low cost to device, possible Flush mount on device, aesthetically pleasing, contact life >1,000,000 operations
  - Disadvantages
    - Latching mechanism, require pressure 300-500+ grams

- **Edge Connector**
  - Advantage
    - Direct extension of pc board, low cost edge connector
  - Disadvantages
    - Direct access to pcb, moisture seal, contact life

- **Multi-pin Connector**
  - Advantages
    - Separate power from control on different wires
  - Disadvantages
    - Cost, single orientation.

- **Magnetic Induction coupling**
  - Advantages
    - No contact coupling, no penetration of casing, cleanest design.
  - Disadvantages
    - Size of coil, position for good coupling. Field effect on surrounding parts at 130W, power transfer efficiency, modulation for communications. Interfere with other radio traffic from device.
UPAMD™ Communication Goals

• Use existing standards if possible.
  – CAN bus, RS422/RS485, USB, others?
• Differential signal communications
  – AC coupled on positive and negative power leads
  – Robust system – EMI, EMC, ESD
• Other communication schema?
• No Communications – No Power
  – Connector safe when disconnected – only communications signal present
  – No shock hazard, no possible damage to adapter
• Communications messages needed (starting thoughts)
  • “Any adapter present?” (probably connector pin)
  • “Who are you?”: To adapter
  • “I am ___ and my capability is ___”: to device
  • “Supply power XX Volts YY mA max”: to adapter
  • “Ready” or “not capable”: to device
  • “Start power”: to adapter
  • “Status?”: to adapter
  • “Status is ____”: to device
  • “STOP power supply”: to adapter
UPAMDTM Communications Options

• Signaling
  – Extra wires with transformer coupling
  – Differential signals AC coupled to positive and negative power leads

• Protocols
  – CAN Bus
    • Advantages
      – Known protocol, very flexible, designed for control structures
      – Most small embedded controllers have it built in
      – High growth potential
    • Disadvantages
      – Less well known
  – UART – RS422/RS485
    • Advantages
      – Low cost. Easy implementation, can support needed communications.
    • Disadvantages
      – Needs UART from host
      – Protocol development needed.
  – USB
    • Advantages
      – Ubiquitous, well known, many ports available.
    • Disadvantages
      – USB certification for modified protocols
      – Requires cooperation with USB-IF committee
      – Operation over differential power lines needs to be verified.
  – Ethernet – Ethernet over-power-line method
    • Advantages
      – Proven to work, also can connect for other communications
    • Disadvantages
      – Needs additional Ethernet port
      – Most expensive.
  – I2C/SMB; SPI; 1-Wire – probably difficult to implement
  – X-10 – not designed for DC
UPAMDTM Power Goals

• One connector fits all power needs
• Power Range 10W – 130W
• New Connector – Not inter-mateable with existing connectors – Safety issue for equipment
• Smart interconnect.
  – No power enabled without communications to adapter.
UPAMDTM Power Options

• 10 year Life Expectancy
  – Think ahead
  – Consider both as a battery charging and as a fixed power source

• Adjustable power Source
  – Adapter sets output voltage based on communications with device
  – Adapter sets maximum current limit based on communications with device
  – Good match for each user
  – Specify range from 5V to 45V. Power limited by connector current capacity.
    • Choice of 9A rated 0.050 spring loaded contacts with 2 per rail provides good margin 130W above 15V.
    • Possible options 5V, 12V, 13.75V, 20V, 24V, 36V, 42V, 48V.
    • Possible current limits: 1A, 3A, 5A, 10A. Or at specified mA rating 0-10000.

• Well regulated Fixed voltage
  – Tight regulation +/- 1-5% DC @ fixed voltage
    • consider cable losses and feedback loop
    • Battery chemistry driven?
    • No common voltage used.
      – 12V, 13.75V, 15V, 19V, 19.5V, 24V
      – Battery chemistry – NiCad, NiMH, Li-ion, Li-PO other exotics. New technology will probably be different
      – All devices seem to have internal regulators.
    • Battery voltages – laptops
      – 11.1, 10.8, 14.8, 9.6, 14.4, 12, …

• Semi-regulated bulk power
  – Bulk power ie 24V +/- 10% (6A) or 45V +/- 10% (3A) @ 130W
    • Power delivery vehicle with point of use regulation
    • Regulator efficiency works
    • Lower Cost
    • Smaller wire size needed
    • Longer power cable allowed.
    • Higher voltage more efficient transfer.
    • Higher voltage smaller contacts.
Backup Slides