DECT ULE – A Technology Overview
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What is DECT ULE?

Digital Enhanced Cordless Telecommunications (DECT) was launched in 1987 and is the standard for cordless phone communications worldwide. Available in over 110 countries and operating is some 600 million households. DECT has been a continuously evolving technology and new versions of the core technology such as Cordless Advanced Technology – Internet & Quality (CAT-iq) have already surfaced. The latest version is DECT Ultra Low Energy (ULE).

With the introduction of the Ultra Low Energy (ULE) standard extension, DECT has become the ideal technology for home automation and security, as well. DECT ULE features extremely low cost, low power consumption, long range (full house coverage with simple star technology), interference free, highly-stable bit-rates, and value –added complementary voice and video capabilities.

Why DECT ULE?

DECT ULE utilizes a star topology, taking advantage of an extended indoor (over 70 meters/230 feet) and outdoor (over 600 meters/2000 feet) range to provide full coverage without deployment of a costly mesh network.

DECT ULE is a SW protocol extension of the standard DECT, already deployed in millions of DECT gateways and standard (PSTN) base stations. These devices can be easily upgraded to support DECT ULE for Home Automation and Security/Monitoring, while continuing to support legacy telephony.

Figure 1 - DECT ULE Topology
Source: DSP Group
Target Market Applications

ULE positions DECT in new and rapidly growing market segments beyond the traditional DECT telephony market, such as the wireless Machine-to Machine (M2M) market. In addition, DECT ULE is ideal for Smart Home and Home Area Network (HAN) sensor applications such as home automation, security, monitoring, metering and healthcare.

Home Automation

- **Smart Plugs**: provides intelligent monitoring and control of electrical appliances connected to standard electrical sockets
- **Consumption Display & Awareness**: provides home user the display of the monitored power consumption
- **Lighting Controls**: provides the user the ability to control lighting in the home from remote control
- **White Goods/Appliance Control**: provides the user the ability to control appliances from remote control, including setting operation timing in off-peak tariff periods
- **Climate Control**: Thermostat, HVAC, ventilation, remote sensing blinds

Home Security & Life Safety

- **Doorbell w/ Voice and Video**: allows home user to visually inspect who is at the door
- **Security Systems**: Cameras, Motion Detectors, Glass Breakage Detectors, Door/Window Sensors

Figure 2 - Home Automation and Security Ecosystem

Source: DSP Group
• Access Control, Surveillance Systems w/ Voice and Video
• Smoke, CO and Flood Detectors
• Voice Enabled Panic Buttons
• Baby Monitors:

**Healthcare**
• Distress “Panic Button” Pendants
• Assisted Living
• Remote Healthcare & Patient Monitoring

**Energy Management**
• Remote Metering: allows transmission of consumption information of metered energy sources such as gas, electricity from the home to the energy provider
• Remote (Cloud) Energy Management

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**Figure 3 - Smart Home Application**

Source: DSP Group
DECT ULE Advantages

Perfect for smart home sensor applications

- Superior Transmission Range: 70 m Indoor, 600 m outdoor
- Interference Free with dedicated/protected spectrum
- No contention with Wi-Fi, Bluetooth or other ISM band radios
- Long Battery Lifetime – up to 10 years
- World Wide Spectrum
- Low System Cost
- Single Chip Solution
- Open Standard
- Built in security and authentication
- Low Latency

Sample Applications

Home Healthcare: Distress Pendant

Figure 4 - Distress Pendant

Source: DECT Forum
Home Security and Safety: Smoke Detector

Figure 5 - Fire Alert Application

Source: DECT Forum

Technical Specifications

DECT ULE: the perfect combination of long battery lifetime, high data rate, low cost and long transmission range.

RF Specifications

- Carrier Frequency: 1.8 GHz Europe, 1.9 GHz US
- RX Sensitivity: -98 dBm
- TX Power: +25.5 dBm (20 dBm US FCC Limit)
- Link Budget: up to 123 dB (BT = 92 dB, Zigbee = 106 dB)
- Channels: 5-10 RF channels
- Uses dynamic channel selection to avoid interference
- High Data Rate: 1Mb/s
- Capable of supporting repeaters for enhanced transmission range

Current Consumption

- Very Low Duty Cycle: 100 mS sensor transmission every 20 seconds
- Low average current: <20 uA

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Regulatory Requirements

The DECT standard was developed by ETSI but has been adopted by many countries all over the world.

Figure 6 - DECT World Coverage Map

Source: DECT Forum

Regulatory Standards:

- CE Requirement: ETSI EN 300-175
- FCC Requirement: Subpart D – Unlicensed PCS Devices (FCC Part 15.3xx)
- Industry Canada: RSS-213 Issue 2

Key Note for FCC Certification: DECT is generally considered a license exempt personal communication service but in the US, in order to free up dedicated spectrum, the FCC had to relocate other devices (primarily point-to-point microwave links). Consequently, the cost of clearing the band of incumbent devices is currently being recovered from DECT users and is called a UTAM Clearing Fee.

Each DECT product manufacturer or distributor must pay an upfront $50,000 one-time licensing fee and a UTAM certificate must be presented as part of the FCC filing. This fee is not required if a “FCC certified module” is used as the fees would have been paid by the module manufacturer. This fee is in effect until such a time as when all financial obligations are met.
Frequency Allocations:
- Europe: 1880-1900 MHz
- China: 1900-1920 MHz
- Japan: 1893-1906 MHz
- Latin America: 1910-1930 MHz
- US & Canada: 1920-1930 MHz

Technical Note: a common radio chipset, design or module can typically cover all frequency bands so only a single design is needed.

Key Differences:
- Channel Plan:
  - Europe: 10 channels (1.728 MHz spacing)
  - US: 5 channels (1.728 MHz spacing)
- Average TX Power:
  - Europe: 10 mW (250 mW peak)
  - US: 4 mW (100 mW peak)

Battery Lifetime

The ULE power consumption depends on the operational mode of the ULE device. The synchronous mode (DECT calls this “locked mode”) consists of a predetermined sleep time (between 1-20 seconds). In the synchronous mode the ULE node autonomously communicates with the base every x seconds (x = 1-20 seconds)

In the asynchronous mode (DECT calls this “unlocked mode”); a sleep period of seconds to days is possible.

The following table, provided by the DECT Forum, provides an indication of expected battery lifetime. Chipsets such as the DHX91 system on a chip (SoC) from DSP Group are able to exceed these lifetime estimates.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Sleep time</th>
<th>Battery Lasts*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asynchronous (unlocked)</td>
<td>5-6 mins.</td>
<td>~ 10 yrs</td>
</tr>
<tr>
<td>Asynchronous (unlocked)</td>
<td>2½ mins.</td>
<td>~ 5 yrs</td>
</tr>
<tr>
<td>Synchronous (locked)</td>
<td>20 second</td>
<td>~ 4 yrs</td>
</tr>
</tbody>
</table>

*Note: Battery lifetime is for 2 x AA alkaline cells. 2 x AAA or coin cells will also be applicable for certain applications.
Summary

The ULE addition to DECT provides new marketing opportunities where low cost, long battery lifetime and interference free, long range coverage is desired. DECT ULE can be considered as both a competing and complimentary technology to other ISM based alternatives such as Zigbee, WiFi and Bluetooth. Based upon a standards based technology; DECT ULE can provide a cost effective, low risk, quick time-to market solution for a variety of M2M and Home Area Network sensor node applications.

I would like to thank both the DECT Forum website and DSP Group for providing significant technical input that was leveraged in the development of this white paper.

LS Research and DSP Group Alliance

DSP Group®, Inc. (NASDAQ: DSPG), a leading global provider of wireless chipset solutions for converged communications, and LS Research (LSR), a leading provider of wireless modules and design services for Smart Home, Smart Energy and healthcare, announced have jointly developed a DECT Ultra Low Energy (ULE) system on module aimed at the Home Control, home automation, healthcare, and other vertical markets. The solution will dramatically reduce time to market and ease integration for OEM’s planning to add DECT/ULE support to their product portfolio.