

## Wireless Extension to DALI

VEmesh D2D Node Module is a member of the VEmesh family of network devices for *Wireless Extension to DALI* (D2D). Such networks combine the widely-used DALI standard for lighting control with the high-performance VEmesh wireless technology. Adding wireless capability to lighting control enables to reach places that otherwise would be difficult or impossible to access, or to lower the deployment cost and time - or both.

VEmesh D2D Networks are high performance wireless mesh networks designed to replace part of all the wiring in a DALI network. A VEmesh D2D Network has two types of network elements: a D2D Gateway that connects to the DALI loop, typically next to the DALI Master and 1 to 64 D2D Nodes that connect each to 1 to 8 DALI devices - drivers, switches or sensors. Together, they form the VEmesh D2D network with up to 64 DALI addresses, with high performance and cost-effective wireless connectivity.

VEmesh D2D Nodes can be of two main types: Bridge Nodes, in own housing and Node Modules, as OEM electronic circuits. This document describes the Node Modules.

VEmesh D2D Node Modules are designed to reside in the luminaire, or in the LED driver housing, or in sensor, to interface with the DALI device and to be powered by it. The interface uses the DALI protocol format - addressing, commands and replies, but instead of the DALI physical layer it uses UART interface, for drastically lowering the interface and the power supplies' costs.

The high performance VEmesh technology enables the use of internal antenna in most cases, for further lowering the system cost.

### VEmesh high performance networks

All VEmesh network units act as relays, in addition to their own activity, by re-transmitting other unit's data to create a modular solution with a highly robust bi-directional communication.

VEmesh is optimized for wireless mesh topology in the ISM/SRD unlicensed frequency bands, by using the innovative synchronized-flooding technology: after an initiating node transmitting its message, all nodes within range simultaneously retransmit it, repeating the process until all the nodes have received the message.



Figure 1 - VEmesh D2D Node Module

VEmesh D2D supports simultaneous operation of up to 250 Networks in same or adjacent location, for large lighting systems. The configuration of multi-network systems is by VEmesh D2D Toolkit.

### Node Modules Main Features

- Standard DALI full wireless extension
- Uses VEmesh mesh network technology for utmost wireless performance
- Antenna can be in the enclosure for higher cost-effectiveness
- Space diversity and time diversity for highest propagation robustness
- Instant addition, removal and location change of nodes with no network downtime
- No-knowledge, no-training installation and maintenance
- Frequency Hopping according to local regulations and following polite spectrum access CCA requirements by implementing LBT+AFA
- Full ownership - operates in ISM/SRD unlicensed frequency bands.

### Standards and regulations

VEmesh D2D Node Module is designed to operate in lighting control networks of DALI devices complying with IEC 62386 DALI1 and with the available parts of DALI2 as they become available.

The supported Wireless regulations are of Europe, North America, South America, Australia and Israel, depending on the model; for an updated list or additional availability and models please inquire with us.

## VEmesh D2D Node Module - Main Specifications

Description	Remarks
DALI standard support <sup>1</sup>	IEC 62386 Parts 102 and 207
DALI addresses per Node Module	1÷8
UART Interface	3÷5 VDC - replaces DALI physical interface
Frequency range	902÷928 MHz, 863÷870 MHz, 915÷917 MHz
Regulatory standards' compliance	FCC/Parts 15.247 & 15.249, ETSI/EN 300-220 V2.1.1, Israel/MOC ISM 0.9 GHz regulations <sup>2</sup>
Range (typical) - between adjacent Node Modules	Outdoor / Line-of-sight: 150m÷300m
	Indoor: 30m÷50m / 2÷3 walls / 2 floors
Indicators	LED - power and synchronization
Input Voltage	3.7÷6VDC
Peak Current (Rx/Tx)	35 mA / 160 mA
Lifetime at Tc 71 °C	100,000 hours / min. 90% survivals MTBF modelling
Outer dimensions	1294 x 1295 mil (32.87 x 32.89 millimeters)

## Additional VEmesh Lighting Control lines of products

Virtual Extension offers 2 additional types of lighting control system, both belonging to VEmesh IoT (Internet of Things) families and enabling cloud management. These are

1. *VEmesh IoT Extension to DALI*, and
2. *VEmesh IoT for Lighting*.

Both networks use an identical concept of Nodes and Gateways, with the Gateway connects to an Internet backbone by Wi-Fi or by cellular Internet (rather than to a DALI Master), and from it to a central *VEhub Management* System of single or multiple networks - the later for city-wide coverage.

The protocol for VEhub connection is open, for enabling the use of any management system complying with it. The Gateways can also use USB interface for local management.

Each *VEmesh IoT Extension to DALI* system connects to up to 16,000 standard DALI devices, such as DALI luminaires, for easy replaceability and interchangeability of the largest portion of the system.

*VEmesh IoT for Lighting* system connects to an unlimited number of devices - luminaires or sensors.

<sup>1</sup> The support is only for DALI data and network layers only; DALI physical layer is replaced by UART

<sup>2</sup> For additional availability please inquire with Virtual Extension