Supply of modems for ITS devices for DoT projects

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Purpose

This Technical Note outlines the minimum requirements for modems intended for use with ITS devices owned and operated by, or installed as part of, DoT projects.

Background

The Department of Transport (DoT) operates a large number of ITS systems that wirelessly communicate back to DoT network for remote monitoring and control purposes. These systems use wireless modems to route back to the network. Currently, there are various types of modems in use across the network which have different functionality, creating inconsistency. Some of the modems do not meet recently released cyber security requirements of DoT while some will be phased out due to technology change i.e. modems that only support 3G frequencies.

This technical note was created in order to address the above by standardising and future proofing the modems used across the DoT ITS network.

It has also been recognised that there are mains and solar powered modems in the network. A solar powered modem needs to have very low power consumption and as result will have different characteristics, size and functionalities from a mains powered modem, therefore the note will specify requirements for two types of the modems, mains and solar powered.

General and physical requirements

Modems shall be compatible with 3G and 4G (5G compatibility is desirable) cellular frequencies of all major carrier networks in Australia.

Mains powered modems shall incorporate ports and antenna connectors listed in Table 1.

<table>
<thead>
<tr>
<th>Interface</th>
<th>Requirement/Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>(2) RJ-45; 10/100 Mbps (auto-sensing)</td>
</tr>
<tr>
<td>Serial</td>
<td>(1) DB-9; DCE, RS-232/422/485</td>
</tr>
<tr>
<td>Antenna connector</td>
<td>50 Ω SMA (centre pin: female)</td>
</tr>
</tbody>
</table>

Table 1 – Port requirements for DoT supplied mains powered modem
Solar powered modems shall incorporate ports and antenna connectors listed 2.

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*Table 2 – Port requirements for DoT supplied solar powered modem*

Modems supplied for use with DoT ESLS can either have 1 Serial or 1 Ethernet port and must have an interface for configuration purpose.

All modems shall have external LED indicators for basic setup, management and functional needs.

These shall include:

- Power ON;
- WWAN/Mobile broadband connection status;
- Signal strength;
- Service mode;
- Data Tx and Rx.

Modems shall not exceed 0.5 kg in weight, and shall have the physical dimensions as detailed in Table 3.

<table>
<thead>
<tr>
<th>Modem Type</th>
<th>Maximum Dimensions (mm) (L X W X H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mains powered</td>
<td>200 x 150 x 50</td>
</tr>
<tr>
<td>Solar powered</td>
<td>150 x 120 x 40</td>
</tr>
</tbody>
</table>

*Table 3 – Dimension requirements for DoT supplied modem*

Modems shall provide support for DIN rail and wall mounting options to allow for easy installation in DoT cabinets and enclosures.

### Protocol support

Modems supplied to DoT shall provide an interactive browser-based user interface using HTTPS to provide monitoring, configuration and diagnostic related functions. They shall also comply with the following minimum protocol requirements:

<table>
<thead>
<tr>
<th>Item</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network and Comms</td>
<td>HTTPS, SFTP/SCP, SSH/TLS, DHCP (and static), NAT &amp; PAT, CIDR, NTP, 802.1X, IPv4, IPv6, L2TP VPN</td>
</tr>
<tr>
<td>Authentication</td>
<td>802.1X, RADIUS, TACACS+</td>
</tr>
<tr>
<td>Encryption</td>
<td>3DES, AES-256, IPSec (with IKEv1, IKEv2, NAT Traversal)</td>
</tr>
<tr>
<td>Monitoring</td>
<td>SYSLOG, SNMP v3</td>
</tr>
</tbody>
</table>

*Table 4 – Protocol requirements for DoT supplied modems*
Security, functional and monitoring requirements

Modems shall meet the DoT cyber security and functional requirements. As a minimum, modems shall have following features:

- Disable unused ports (ethernet, serial, USB)
- MAC address filtering
- Respond to ARP requests only from the local subnet
- SIM PIN lock
- Remote reboot
- Auto-reboot on hang
- Auto-reconnect on disconnect or “no data”
- Cabinet intrusion circuit
- Scripted and/or remote configuration
- On-prem (non-cloud) central management (remote config, firmware update, remote monitoring)
- Access to device must be authenticated with at least username and password
- Device must enforce DoT password complexity standard
- Passwords stored on the modem must be written using a 1-way hash using an approved algorithm (see above)
- Local DHCP server (with the ability to disable)
- DHCP forwarding (IP Helper)
- Disable insecure protocols (FTP, HTTP, telnet)
- Deny unauthenticated access
- Factory default settings must result in all passwords being removed from the device
- Factory default settings must result in cellular network access being unavailable
- Stateful firewall (desirable)
- Multiple levels of access to the modem (at least administrator and read-only) (desirable)

Modem system and audit events must be logged to a central server using the SYSLOG protocol. At a minimum the logging shall include:

- System start & stop
- Network port up/down
- Configuration changes (including factory reset)
- Critical errors
- Authentication events (success & failure)
- Cabinet intrusion circuit
- Any other security events

Modems shall be able to conduct monitoring and discovery of using SNMPv3. Minimum fields shall include:

- Make & model
- Serial number
- Firmware version
- Network & serial port enumeration
- Network & serial port status (up/down)
Electrical requirements

All modems shall be able to operate from a 12VDC power source whether mains or solar powered. For mains power operation, an external 230Vac/12Vdc power adapter shall be used to provide the modem with the required 12VDC power.

Modem power consumption shall not exceed the requirements detailed in Table 5.

<table>
<thead>
<tr>
<th>Modem Type</th>
<th>Modem Maximum Power Consumption (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mains powered</td>
<td>4 W Standby; 12 W Peak Tx/Rx;</td>
</tr>
<tr>
<td>Solar powered</td>
<td>1 W Standby; 4 W Peak Tx/Rx;</td>
</tr>
</tbody>
</table>

Table 5 – DoT modem power consumption requirements

Modems shall comply with all relevant requirements of AS/NZS CISPR 32, Electromagnetic compatibility of multimedia equipment – Emission requirements.

It shall also comply with the relevant requirements of the Australian Communication and Media Authority (ACMA) and shall be labelled with RCM label.

Environmental requirements

Modems shall be able to operate continuously at ambient temperatures ranging from -20°C to +70°C at 95% relative humidity (non-condensing). Consideration shall be also given to protection against the effects of high humidity, including condensation following a drop in ambient temperature.
Evaluation for acceptance for use

Modems intended for use on DoT projects must have ‘acceptance for use’ status by DoT.

To enable assessment for the purpose of granting acceptance for use, the supplier is to submit a formal request for acceptance accompanied by the following:

a) Documentation to demonstrate that the modem meets the requirements of this technical notice;
b) An outline drawing showing the general presentation and overall dimensions of the modem;
c) Details of the configuration requirements and user manuals for the modem.

The supplier shall provide evidence of compliance with the Electrical requirements and Environmental requirements sections of this document. Such evidence shall be as detailed in Table 6 below.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature and humidity</td>
<td>Test Report or other acceptable evidence</td>
</tr>
<tr>
<td>EMC Compliance</td>
<td>RCM mark</td>
</tr>
</tbody>
</table>

*Table 6 – Required test report and evidence*

A field trial of minimum 3 months may be required in order to fully test the modem in DoT environment. This will be solely at the discretion of the DoT representative assessing the modem for acceptance.

DoT may require additional information or testing to be carried out as part of its evaluation.