TCN 011
Supply of modems for ITS devices for DoT projects

V2.0 June 2021

Purpose

This Technical Note outlines the minimum requirements for modems intended for use with DoT (Roads) ITS devices.

The term 'ITS devices' within this notice shall include such things as:

- Active Advanced Warning Signs
- Bluetooth detectors
- CCTV Cameras
- Electronic Speed Limit Signs
- Freeway Data Stations
- Ice Warning Stations
- Over Height Detection systems
- Travel Time Signs
- Variable Message Signs

This technical note is not intended to cover the requirements of modems used for traffic signal sites. The requirements for these are outside the scope as they are supplied under a managed contract.

Background

DoT (Roads) operates a large number of ITS devices and systems that wirelessly communicate to DoT network for remote monitoring and control purposes.

These systems can use wireless modems to route back to the network. Currently, there are various types of wireless modems in use with different functionalities, creating inconsistency. Some of the modems do not meet recently released cyber security requirements of DoT (Roads) while some will be phased out due to technology change (e.g. modems that only support 3G frequencies).

The purpose of this Technical Note is to address the above, by standardising and future proofing modems used across the DoT (Roads) ITS network.

ITS devices can be mains or solar powered. Modems used for solar powered devices need to have very low power consumption in order not to compromise solar system design capacity on existing sites. Modems for solar powered sites will therefore typically require different characteristics and functionalities from modems used on mains powered devices. This Technical Note details the requirements for two types of the modems, mains and solar powered.

General and physical requirements

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

Modems shall have external LED indicators for basic setup, management and functional needs. As a minimum, modems shall have the following indicators:

- Power ON.

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

Modems shall not exceed 0.5 kg in weight.

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

Communications ports and antenna connectors

Modems may have different requirements for communications ports, depending on the intended application. Modems used for ESLS and Bluetooth detectors typically do not require the same communications ports as a standard ITS modem.

Details of typical modem communications port and antenna requirements are shown in Table 1.

Requirement	Standard ITS	ESLS	Bluetooth
Ethernet RJ-45; 10/100 Mbps (auto-sensing)	Required	Preferred (not mandatory)	Required
Serial DB-9; RJ45 serial socket; DCE, RS-232/422/485	Required	Required	Not required

Table 1 – Typical communications port requirements

Antenna requirements

With the exception of modems used for ESLS and Bluetooth detectors, antennas used for 3/4G modems shall be MIMO, with a minimum two LTE/Cellular cables to cater for both 3G/4G antenna connectors. The cables shall have male centre pin connectors.

The length of the antenna cables shall be minimum of 1 metre.

Modems may have different requirements for antenna connectors, depending on the intended application. Modems used for ESLS and Bluetooth detectors typically do not require the same antenna connectors as a standard ITS modem.

Details of typical antenna requirements are shown in Table 2.

Requirement	Standard ITS	ESLS	Bluetooth
2 X Antenna connector 50 Ω SMA (centre pin: female)	Required	Preferred (One antenna port is acceptable).	Preferred (One antenna port is acceptable).

Table 2 – Typical antenna connector requirements

Protocol support

Modems supplied to DoT shall have an interactive user interface used to provide monitoring, configuration and diagnostic related functions.

As a minimum, modems shall be capable of supporting the protocol requirements as specified in Table 3.

Item	Requirement	Port Type		
		Serial	**Ethernet**	**USB**
Network and Comms	HTTPS	N/A	Required	N/A
	SFTP/SC	N/A	Required	N/A
	SSH/TLS	N/A	Required	N/A
	DHCP (and static)	Required	Required	Required
	NAT & PAT	N/A	Required	N/A
	CIDR	N/A	Required	Required
	NTP	N/A	Required	Required
	802.1X	N/A	Required	N/A
	IPv4	N/A	Required	Required
	IPv6	N/A	Required	Required
	L2TP VPN	N/A	Required	Required
Authentication	802.1X	N/A	Required	N/A
	RADIUS	Required	Required	Required
	TACACS+	N/A	Required	N/A
Encryption	3DES	N/A	Required	Required
	AES-256	N/A	Required	Required
	IPSec (with IKEv1)	N/A	Required	Required
	IKEv2	N/A	Required	Required
	NAT	N/A	Required	N/A
Monitoring	SYSLOG	N/A	Required	Required
	SNMP v3	N/A	Required	N/A

Table 3 - Minimum modem protocol support

Security, functional and monitoring requirements

Minimum DoT cyber security and functional requirements that modems shall comply with are specified in Table 4.

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Requirement	Port Type		
	Serial Port	Ethernet Port	USB
Disable unused ports (ethernet, serial, USB) -	N/A	Required	Required
MAC address filtering	N/A	Required	Required
Respond to ARP requests only from the local subnet	N/A	Required	Required
SIM PIN lock	Required	Required	Required
Remote reboot	Required	Required	Required
Auto-reboot on hang (1)	Required	Required	Required
Auto-reconnect on disconnect or "no data" (1)	Required	Required	Required
Cabinet intrusion circuit (2)	Optional	Optional	Optional
Scripted and/or remote configuration	Required	Required	Required
On-prem (non-cloud) central management (remote config, firmware update, remote monitoring)	Required	Required	Required
Access to device must be authenticated with at least username and password	Required	Required	Required
Device must enforce DoT password complexity standard	Required	Required	Required
Passwords stored on the modem must be written using a 1-way hash using an approved algorithm (see above)	Required	Required	Required
Local DHCP server (with the ability to disable)	N/A	Required	N/A
DHCP forwarding (IP Helper)	N/A	Required	Required
Disable insecure protocols (FTP, HTTP, telnet)	N/A	Required	Required
Deny unauthenticated access	Required	Required	Required
Factory default settings must result in all passwords being removed from the device	Required	Required	Required
Factory default settings must result in cellular network access being unavailable	Required	Required	Required
Stateful firewall (desirable)	Required	Required	Required
Multiple levels of access to the modem (at least administrator and read-only) (desirable)	Required	Required	Required

Table 4: Minimum security and functional requirements

Notes: *(1) Not required for signs operating on NMS2 that are not permanently connected. (2) May be managed by other means.*

General ITS modems shall provide a log system and audit events 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

Standard ITS modems shall be able to conduct monitoring and discovery using SNMPv3. Minimum fields shall include:

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

NOTE: *Modems used for ESLS and Bluetooth detectors do not need to comply with the logging and SNMPv3 requirements above, however it is preferred that they have the functionalities.*

Electrical requirements

All modems shall operate from a nominal 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 in Table 4:

Modem Type	Modem Maximum Power Consumption (watts)
Mains powered sites	5 W Standby; 15 W Peak Tx/Rx;
Solar powered (1) Legacy ESLS	1 W Standby; 4 W Peak Tx/Rx This is recommended maximum unless solar system has capacity for higher load.
Solar Powered New ESLS	3 W Standby; 9 W Peak Tx/Rx
Bluetooth Detectors	1 W Standby; 6 W peak (power requirements are for both the integrated modem and the associated Bluetooth detector)

Table 4 –Modem power consumption requirements

Note: *(1) The above requirements are based on power consumption of modems presently installed in the field, to minimize impact to existing ITS systems as result of modem replacement.*

All modems shall comply with the EMC standard 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 an 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 for use on DoT projects are required to be 'accepted for use' by DoT.

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

  a) Compliance statement along with documentation to demonstrate that the modem complies with 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 5.

Requirements	Evidence
Temperature and humidity	Test report or other acceptable evidence
EMC Compliance	EMC test report or evidence of RCM mark
Security	Successful penetration test report

Table 5 – Environmental requirements

The evaluation process will include the steps shown in Table 6.

Requirement	Responsibility
Desktop review of submitted documentation	ITS Improvements and Standards Team
Penetration test	Modem Supplier ITS Design and Integration Team
Desktop operational test on DoT network	ITS Design and Integration Team
Field trial (if required)	ITS Improvements and Standards Team ITS Design and Integration Team

Table 6 – Evaluation process

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

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

Modems that are accepted for use shall be added to the list of accepted modems in TCG 018, Register of ITS Approved Products.