

Title:

Basic Technical Specifications of Asset Tracking LoRaWAN Network

Purpose: General Reference

Version: v1

1. General

- 1.1. The Contractor shall take up the responsibility for the liaison with the users and other related parties for the design and installation of the System.
- 1.2. The Gateway and key accessories shall be manufactured by an established factory with at least 3-years business history. DIY type of assemble products are not accepted.
- 1.3. All equipment supplied by this Contract shall have 36-month warranty period, with free maintenance services excluding malfunctions caused by misuse. The warranty and maintenance services shall be commenced after the acceptance of the deliverables.
- 1.4. In case of conflict between the technical requirements of this Specification and other requirements, the order of precedence shall be:-
 - 1.4.1. HKSAR Ordinances, Regulations and Codes of Practices;
 - 1.4.2. Radio Equipment Specifications (HKCA 1078) - Performance Specification for Radio Equipment Operating in the 920 – 925 MHz Band for the Provision of Public Telecommunications Services issued by Office of the Communications Authority, HKSARG;
 - 1.4.3. This Part of Specification;
 - 1.4.4. LoRaWAN Specification v1.0.2 or latest version defined by LoRa Alliance;

2. Scope

The Contractor shall supply all deliverables under this specification including:

- 2.1. Deployment of LoRaWAN network server (LNS) data platform based on cloud infrastructure (Software-as-a-Service (SaaS)) instance;
- 2.2. Supply of X (x) nos. of gateways with functionality of Wi-Fi communication, antenna (8 dBi for outdoor, 1.5 dBi for indoor), Power over Ethernet (PoE), and on AS923 MHz frequency band;
- 2.3. 4G LTE modem is preferably built-in in sub-clause 2.2;
- 2.4. The gateway should be equipped with at least one of the GNSS service (GPS, Glonass, Beidou, Galileo) for highest compatibility of edge devices and local practice in sub-clause 2.2;
- 2.5. Installation of LoRa Relay (LRR) software in each gateway, i.e., LRR staging, and provision of the software, or equivalent, and instruction document;
- 2.6. License of use for all the above with maximum edge device quality be 500 and number of data platform user 100;
- 2.7. Supply of Y (y) nos. of asset tracker with functionality of selectable GPS/Wi-Fi/BLE communication, internal antennas, battery, and on AS923 MHz frequency band;
- 2.8. Seamless data flow connection from asset trackers to their positioning and meta information be visualized and managed from its data platform;
- 2.9. Two (2) days on-site training to end-user's technical team at their office in Hong Kong;
- 2.10. Provision of standard product/solution documentation, system user guide and training materials.

3. Technical Specification

The LoRaWAN Outdoor Gateway to be supplied shall fully complies below technical specifications:

LoRaWAN Gateway Hardware Specifications	
CPU	Quad-core 1.5 GHz, 64-bit ARM Cortex-A53 or better
RAM/Flash	512 MB DDR4 RAM, 8 GB eMMC
Power	PoE (802.3 AF, 47-57 VDC), max 40W
4G LTE	Can adopt SIM card from any LTE operator in Hong Kong with automatic configuration function, optional internal/external antenna
Ethernet	At least one IEEE 802.3 RJ45 port (6 kV surge protection is required for outdoor gateway, 1.5 kV RMS protection is required for both indoor & outdoor)
Wi-Fi	IEEE 802.11 b/g/n 2.4GHz, selectable AP or Client mode, WPA/WPA2 authentication, WEP/TKIP/AES encryption
USB port	Optional
GPS	GNSS class with GPS, GLONASS, Beidou, and Galileo module, internal/external antenna (position accuracy <2.5m CEP)
IP Rating	IP67 (Outdoor), IP63 (Indoor)
LoRa Frequency & Antenna	AS923 Class; Peak Gain: 8 dBi for outdoor, 1.5 dBi for indoor, N-Type connector; VSWR: < 1.5;
Mounting	Wall- and Pole-mounting accessories be included
Operating Temperature	-20°C to +60°C
Operating Humidity	0% to 95% non-condensing at 25°C
Weight	Less than 2.5kg
Certifications	FCC/EC/NCC/IC/TELEC

LoRaWAN Gateway Communication Specifications	
Man-machine Interface	Webpage or command line
Backhaul WAN Failover	Selection among 4G LTE, ETH and WLAN
LoRaWAN Channel	8 or 16 channels
LoRaWAN Protocol	V1.0.2 Class A/B/C or higher
Transmit RF Power	0.5W (up to 27 dBm)
Receive Sensitivity	Down to -140 dBm
Data Security	AES128
Geo-Location	Options to identify end-device location base on TDOA or GNSS technologies

4. LoRaWAN Network Server (LNS)

- 4.1. The LoRaWAN Network Server is the brain and the controller of a LoRaWAN network. It should be provided as a managed cloud service (SaaS model).
- 4.2. The LNS connects sensors, gateways and end-user applications and ensures reliable and secure data routing all along the LoRaWAN network. Along with the Operation Support System (or OSS), they are the brain that controls the complete LoRaWAN network.
- 4.3. The OSS should have **Network Control & Supervision** functions including but not limited to:
 - 4.3.1. MAC Layer management of uplinks & downlinks
 - 4.3.2. Double – automatic deduplication of packets whenever needed
 - 4.3.3. Best Gateway – automatic selection of best gateway from gateway fleet based on availability and radio performance
 - 4.3.4. ADR – Adaptive Data Rate optimization automated
 - 4.3.5. Class Control – All operator to define Class A/B/C per device in according to use case for best power consumption in edge devices
 - 4.3.6. Multi-cast – Configurable grouping of devices for any downlink broadcasting
 - 4.3.7. Firmware – Upgradable via Multi-cast over-the-air to selected group of devices
- 4.4. The OSS should have **Device & Gateway Management** functions including but not limited to:
 - 4.4.1. Device management – Allow provisioning, management of RF profile and class; ability to bulk import of devices registration details is a must-have feature
 - 4.4.2. Gateway management - Allow provisioning, RF monitoring, configurable alarms (by both SMS and email), and reverse-SSH for remote control
 - 4.4.3. Multi-RF – Multiple RF profiles for gateways to manage multiple regions (e.g., Hong Kong AS923 and China CN477)

- 4.4.4. Packet Routing – Each device can be assigned one or more end-user applications URLs for data routing
- 4.4.5. Decode – Capable to apply decoder to individual devices
- 4.4.6. Data Logging - Resource browser, logs, and download
- 4.4.7. API – Data exchange be available on every network management function through a set of open & documented APIs to pre-authorized users; both HTTPS and MQTT connectivity should be available
- 4.4.8. Connect – Out-of-the-box cloud connectors for third-party IoT clouds such as AWS, Azure or IBM Watson
- 4.4.9. Multi-tenant – Fine access control and privilege management for each user over multiple instances of management
- 4.5. The OSS should have **Data Security** functions including but not limited to:
 - 4.5.1. AES128 - Network and application layer symmetric AES 128-bit encryption ensuring optimal and integrated security
 - 4.5.2. Join Servers - Integrated or external Join Servers for secure device activation and Key storage & management
 - 4.5.3. IPSEC - IPSEC tunnels are used to mount VPN between Gateways and the Network server to ensure a higher-level security at IP layer.
- 4.6. The contractor shall keep all the data for at least 3 years or more upon agreement by the Project Owner or its representative.

5. Asset Tracker

- 5.1. Asset trackers should be able to communicate with LoRaWAN Specification v1.0.2 or latest version defined by LoRa Alliance.
- 5.2. Each tracker should be embedded with sensors combining multi-constellation GNSS, Wi-Fi Sniffer or BLE, and LoRaWAN TDoA geolocation technologies, for seamless outdoor and indoor geolocation.
- 5.3. Each tracker should be embedded with a 3D accelerometer sensor for motion tracking as a power saving options.
- 5.4. Tracker battery life should be longer than 100-day on rechargeable battery, and 1500-day on non-rechargeable, both on hourly indoor and outdoor position reporting mode (at TX Power 14 dBm, SF9, triple-send/message).
- 5.5. Battery status and alert should be available in the system.
- 5.6. A temperature sensor should be embedded monitor any battery and electronic malfunctioning, status and alert functions should be available in the system.
- 5.7. Tracker enclosure should be of at least IP64 (on rechargeable battery), or IP68 (on non-rechargeable battery)
- 5.8. Trackers should have edge computing capability for fast proximity detection and exposure assessment
- 5.9. Selectable operating modes
 - 5.9.1. Standby: With configurable heartbeat frequency
 - 5.9.2. Motion tracking: Get tracker position only when motion is detected
 - 5.9.3. Permanent tracking: Get tracker on configurable frequency
 - 5.9.4. Start/End motion tracking: Get position logs during motion start and end events
 - 5.9.5. Activity tracking: Monitor activity rate with adjustable sensitivity
 - 5.9.6. Position on-demand
 - 5.9.7. SOS tracking
 - 5.9.8. Bump detection
 - 5.9.9. Geofencing zone detection

- 5.10. Device management tools should be available for all online tracking devices with functionality including but not limited to:
 - 5.10.1. Tracker positioning visualization on maps (indoor and outdoor) with date range selector and CSV export
 - 5.10.2. Performance monitoring on battery, packets lost, RSSI, SNR, activity counter and payload length.
 - 5.10.3. Device configuration
 - 5.10.4. Uplinks data log
 - 5.10.5. Contact tracking for proximity events
- 5.11. Operating temperature: -10°C to 55°C (on rechargeable battery), or -15°C to 65°C (on non-rechargeable battery)
- 5.12. Operating humidity: < 95% non-condensing
- 5.13. Certifications: FCC/EC/IC/TELEC, optionally ATEX