

General Requirements of EMSD GWIN Sensor Devices

Version 3

1. General Requirements for LoRaWAN equipment

1.1 Technical Requirements

- 1.1.1. The LoRaWAN equipment shall comply with the following requirements, as a minimum:-
- (a) 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 (OFCA), HKSARG; and
 - (b) LoRaWAN specification v1.0.2 or latest version issued by LoRa Alliance™.
- 1.1.2. This supply and installation of low power wireless network system shall base on LoRaWAN specification v1.0.2 or latest version issued by LoRa Alliance™ for the Government in Hong Kong Special Administrative Region (HKSAR).
- 1.1.3. The LoRaWAN sensor devices shall be manufactured and configured to support and capable of communicating with the existing LoRaWAN compatible equipment in LoRaWAN specification v1.0.2 or latest.
- 1.1.4. All equipment that emits radiowaves shall have been type-approved by the Office of the Communications Authority (OFCA) or shall fall within the licensing exemption(s) provided for by legislation, including (but not be limited to) the Telecommunications (Telecommunications Apparatus) (Exemption from Licensing) Order (Cap 106Z).
- 1.1.5. The LoRaWAN equipment shall comply with LoRaWAN specification v1.0.2 or latest standard, Chapter 106 of the Telecommunications Ordinance, HKCA 1078, and other subsidiary legislations of Hong Kong.
- 1.1.6. All LoRaWAN equipment shall operate with the parameters as specified below:
- (a) Frequency range: 920MHz – 925MHz;
 - (b) Regulation: Radio Equipment Specifications (HKCA 1078) issued by OFCA; and
 - (c) Standard: Compliant with LoRaWAN specification v1.0.2 or latest version issued by LoRa Alliance™.
- 1.1.7. All LoRaWAN sensor devices shall comply with the requirements below as a minimum:
- (a) Over-the-Air Activation (OTAA) activation mode;
 - (b) Support Adaptive Data Rate (ADR);
 - (c) Support random LoRaWAN frequency channel selection;
 - (d) With battery level in payload, if applicable; and
 - (e) Support heartbeat message at least once a day.

- 1.1.8. The use of frequency bands and transmission powers shall comply with the requirements set by OFCA and LoRa Alliance on LoRaWAN equipment and applications.
- 1.1.9. The LoRaWAN equipment shall be capable of operating in the full band of the frequency range as mentioned in Clause 1.1.6. Exact operating frequencies in the aforementioned frequency band may be altered and finalized after the contract award.
- 1.1.10. In case downlink command and/or confirmed uplink function will be adopted, the proposed LoRaWAN sensor devices shall support a reasonable receiver sensitivity by-design for ensuring the stable connection with EMSD's LoRa network.
- 1.1.11. The maximum transmission duty cycle of LoRaWAN sensor devices shall be 1%, and the maximum dwell time per frequency channel shall be 400 millisecond, unless otherwise approved by Engineers' Representative(s).
- 1.1.12. For battery-powered LoRaWAN sensor devices, its battery shall be able to last for at least one year without battery replacement under normal operation condition and with the data transmission frequency of at least one uplink message per hour, unless otherwise approved by Engineers' Representative(s). The Contractor shall provide supporting calculation and/or test report regarding the battery life of the proposed LoRaWAN sensor devices upon requested by Engineers' Representative(s).
- 1.1.13. The LoRaWAN equipment shall be interoperable with major LoRaWAN network servers in the market such as Actility, ChirpStack, Loriot, The Things Network, Orbiwise, etc.
- 1.1.14. Unless otherwise approved by Engineers' Representative(s), data and/or signals from deployed equipment, including sensors, actuators and convertors shall be transmitted to the EMSD's GWIN Server through EMSD designated gateways and shall be able to be decoded to human-interpretable content without intervention of any third-party proprietary system.

1.2 Contractor's Responsibilities

- 1.2.1. The Contractor shall be responsible for the registration, decoding and configuration for sensor devices supplied under this Contract to EMSD designated LNS as well as the associated testing and troubleshooting works.
- 1.2.2. The Contractor shall liaise with the Engineer's Representative(s) to obtain the user manual, login ID and password for the use of EMSD's LNS web-based platform after contract award.
- 1.2.3. The Contractor shall provide competent and experienced personnel for the satisfactory completion of sensor device registration, decoding and configuration to EMSD's LNS as well as the associated testing and troubleshooting works.
- 1.2.4. The Contractor shall follow the instructions for sensor device registration (i.e. join request & accept using OTAA) and decoding standard, if applicable which will be provided by the Engineer's Representative(s) after the contract award.

- 1.2.5. The Contractor shall make his own arrangement to visit the below websites of major LNSs in the market to obtain the user manuals and / or guidelines for his own reference purpose to complete his work satisfactorily.
- (a) Actility (resources available after free registration): <https://partners.thingpark.com/>;
 - (b) ChirpStack: <https://www.chirpstack.io/guides/first-gateway-device/>;
 - (c) Loriot: <https://docs.loriot.io/>; and
 - (d) The Things Network: <https://www.thethingsnetwork.org/docs/>.
- 1.2.6. Upon the request by the Engineer's Representative, the Contractor shall co-operate and co-ordinate with EMSD's team and relevant contractors for the smooth progress and satisfactory completion of his work.
- 1.2.7. As an interim solution, the Contractor is allowed to install his own gateway connecting to EMSD's LNS to test and fine tune the system as a turn-key solution. The Contractor shall remove the gateway upon successful migration to the EMSD-owned production gateway as an ultimate deliverable upon Engineer Representative's request. The migration should demonstrate the required features without performance deterioration. The Contractor shall, at his own cost, to perform necessary on-site troubleshooting and configuration services, including but not limited to, re-joining of sensor devices, sensor device parameters updates, sensor device parts replacement and firmware updates, to ensure the connectivity to EMSD's LoRa network and proper configuration of deployed sensor devices so that the equipment can function normally under the requested scope of works.
- 1.2.8. The Contractor shall ensure the firmware of the LoRaWAN equipment to be the latest version available in the market. The Contractor shall be responsible to update and provide patches to all software and / or firmware so that the equipment can function normally under the requested scope of works.
- 1.2.9. The Contractor shall submit the material submission for approval by the Engineer's Representative(s). In case the proposed LoRaWAN equipment is not compatible with EMSD's LoRa network, the Contractor shall provide alternative proposals or substitutions on the material submission at his own cost and obtain in writing an explicit approval from the Engineer's Representative(s).
- 1.2.10. Upon request of the Engineer's Representative(s), the Contractor shall implement a payload decoder, on EMSD's LNS in JSON or other protocols to be agreed by EMSD, to decode the sensor payload to a meaningful human comprehensible format, and no mapping table,

data dictionary nor codebook shall be required to interpret the meaning of the decoded payload.

- 1.2.11. The Contractor shall take lead to resolve any technical issues and ensure all the required works as stipulated under Section 1.2 are completed on time, regardless of the root cause(s) without any additional cost to the Employer.
- 1.2.12. The Contractor shall provide all technical documents including the payload format and configuration specification for LoRaWAN equipment supplied under this Contract.
- 1.2.13. The Contractor may be required to arrange samples of equipment and conduct bench test with EMSD's LoRa network before the approval of material submission. The Contractor shall, at his own cost, arrange the required sensor device samples, necessary gateways, tools and accessories and complete the test within 1 week at the request of the Engineer's Representative(s).
- 1.2.14. The Contractor may be required to submit samples of equipment for the Engineer's Representative's evaluation during the course of the Contract if they elect to offer equipment which has not been approved by the Engineer's Representative(s) due to equipment offered becoming obsolete or due to other causes. The Contractor shall, at his own cost, submit the required samples for evaluation within 1 week at the request of the Engineer's Representative(s).
- 1.2.15. During the Nursing Period and Defect Liability Period, the Contractor is responsible for remote monitoring the health status of the sensor devices deployed under this contract through system provided as stipulated in Clause 1.2.2. Upon request by the Engineer's Representative(s), the Contractor shall submit regular health reports or on-demand of the sensor devices to keep-track of the wellbeing and rectification progress of the end-devices.

1.3 Testing and Commissioning

- 1.3.1 The Contractor shall submit the Site Acceptance Test (SAT) plan, schedule, procedures, forms and testing methodology to the Engineer's Representative(s) for prior approval before the tests.
- 1.3.2 Unless otherwise specified, any test instrument or field tester for the tests should be provided by the Contractor. Should any transportation of these equipment to test site be required, the Contractor is also responsible for the delivery.
- 1.3.3 The Contractor shall ensure the sensor device installation and documentation to meet the following minimum pre-requisite before the commencement of SAT.
 - (a) Sensor's baseline information should be recorded in the test form, i.e. brand, model, serial number, device ID, device name, device EUI, installed location with geospatial data;
 - (b) Sensor's baseline configuration should be recorded in the test form, i.e.

- heartbeat, frequency, reporting interval, triggering event;
- (c) The parameters for test environment should be recorded including but not limited to the RSSI, package loss rate taken on site with field tester as the reference value for the sensor under test;
- (d) The latest activity for the sensor from the LNS should be recorded i.e. the sensor activity for last 7 days before the SAT; and
- (e) The sensor device should be alive for at least 7 days before the SAT.

- 1.3.4 The Contractor shall perform signal test for the sensor devices under this Contract during the SAT recording the parameters including, but limited to uplink Received Signal Strength Indicator (RSSI), uplink Signal to Noise Ratio (SNR), Spreading Factor (SF), Data Rate (DR) of acceptable level as stipulated in the approved test plan.
- 1.3.5 Upon the completion of SAT, the Contractor shall submit the sensor device inventory list recording the information including, but not limited to brand, model, serial number, device ID, device name, device EUI, installed location with geospatial data based on the template as required by the Engineer's Representative(s).

2. Application Interfacing Requirements with EMSD's LoRaWAN Network Server (LNS)

- 2.1.1 The Contractor shall develop interfaces on the system applications or data platform for data exchange with API (i.e. via MQTT and/or HTTP call-back with SSL) with the EMSD's LNS in accordance to the associated EMSD standards which will be provided by the Engineer's Representative(s) after the contract award.
- 2.1.2 The Contractor shall, at his own cost, retain data collected by sensor devices deployed under this Contract to meet the system functional requirements under the requested scope of works. Data exchange methods stipulated in 2.1.1 shall be means of data transfer between EMSD's LNS and the systems and/or applications deployed by the Contractor under this Contract. EMSD's LoRa network is not obligated to retain any data collected by the sensor devices and/or applications deployed under this Contract.
- 2.1.3 The Contractor shall liaise with the Engineer's Representative(s) to obtain the user manual, login ID and password for the use of EMSD's LNS web-based platform after the contract award.
- 2.1.4 The Contractor shall be responsible for the provision, upkeep and troubleshoot of servers, applications and/or connectivity that integrate with the data exchange methods.

Annex 1 – System Hierarchy

