



IoT Service Experience

Version 3.0

19 April 2022

This Industry Specification is a Non-binding Permanent Reference Document of the GSMA

Security Classification: Non-confidential

Access to and distribution of this document is restricted to the persons permitted by the security classification. This document is confidential to the Association and is subject to copyright protection. This document is to be used only for the purposes for which it has been supplied and information contained in it must not be disclosed or in any other way made available, in whole or in part, to persons other than those permitted under the security classification without the prior written approval of the Association.

Copyright Notice

Copyright © 2022 GSM Association

Disclaimer

The GSM Association ("Association") makes no representation, warranty or undertaking (express or implied) with respect to and does not accept any responsibility for, and hereby disclaims liability for the accuracy or completeness or timeliness of the information contained in this document. The information contained in this document may be subject to change without prior notice.

Antitrust Notice

The information contain herein is in full compliance with the GSM Association's antitrust compliance policy.

This GSMA Permanent Reference Document (PRD) is classified by GSMA as an Industry Specification, as such it has been developed and is maintained by GSMA in accordance with the provisions set out GSMA AA.35 - Procedures for Industry Specifications.

Table of Contents

1	Introduction	3
1.1	Overview	3
1.2	Scope	3
1.3	Relation with Other GSMA Specifications	3
1.4	Definitions	4
1.5	Abbreviations	4
1.6	References	4
1.7	Conventions	4
2	Requirements for IoT Devices and Services	5
2.1	Description of Features	5
2.1.1	Registration	5
2.1.2	Status Reporting	5
2.1.3	Alarm Reporting	5
2.1.4	Error Reporting	5
2.1.5	Remote Configuration	6
2.1.6	Remote Upgrade	6
2.1.7	Remote Control	6
2.2	Smart Smoke Detector	6
2.2.1	Service Description	6
2.2.2	Device Capability Requirements	7
2.3	Smart Meters	7
2.3.1	Service Description	7
2.3.2	Device Capability Requirements	8
2.4	Location Trackers	8
2.4.1	Service Description	8
2.4.2	Device Capability Requirements	9
2.5	Smart Parking	10
2.5.1	Service Description	10
2.5.2	Device Capability Requirements	10
2.6	Smart Watch	11
2.6.1	Service Description	11
2.6.2	Device Capability Requirements	11
2.7	Smart Air Conditioner	13
2.7.1	Service Description	13
2.7.2	Device Capability Requirements	14
Annex A	Document Management	16
A.1	Document History	16
A.2	Other Information	16

1 Introduction

1.1 Overview

IoT technologies have been deployed in various vertical markets to enable the intelligent connectivity. As the entrance of intelligent connectivity, devices play a key role in the development of IoT technologies. The quality of devices and its service experience affects the market acceptance and decides the market scale.

The 3GPP and GSMA technical specifications have defined basic requirements to ensure the performance of Mobile IoT platforms, modules and devices in the network, however it does not detail the requirements regarding service models and use cases of IoT devices. This leads to slightly different capabilities and inconsistent service experience between IoT devices of a specific type.

This document is intended to give guidance for device manufacturers and service providers when developing the IoT devices and services. It specifies requirements for IoT devices to ensure the service experience.

1.2 Scope

This document lists specific IoT devices and services in typical scenarios, which are deployed in the 3GPP-based IoT networks managed by MNOs.

It also identifies a minimum set of features which is necessary to be supported on the specific type of IoT devices. The requirements for IoT devices are specified accordingly.

These requirements shall provide guidelines for device manufacturers and service providers to implement IoT devices and services, and serve as a basis for testing and certification of IoT devices.

1.3 Relation with Other GSMA Specifications

The requirements in GSMA PRD MIoT Test Requirements TS.39 [3] ensure the proper support of 3GPP features on MIoT (Mobile IoT) platforms, modules and devices. This document does not replicate any requirements that are defined within GSMA TS.39 and assumes that devices supporting MIoT technologies conform to GSMA TS.39.

Other requirements and recommendations that are related to IoT devices can be found in GSMA PRDs below:

- IoT Device Connection Efficiency, see GSMA PRD TS.34 [4]
- IoT device security, see GSMA PRD CLP.13 [5]
- Remote provisioning and management of the eUICC, see GSMA PRD SGP.02 [6]
- On-Device Service Activation (ODSA) Entitlement and Configuration for eSIM-based devices, see GSMA PRD TS.43 [9]

1.4 Definitions

Term	Description
IoT Device	A device that is integrated with communication modules and allows objects to be accessed, sensed and/or controlled remotely across existing mobile networks.
IoT Service Platform	A service platform, hosted by the IoT service provider which communicates to an IoT device to provide an IoT service

1.5 Abbreviations

Term	Description
A-GNSS	Assisted Global Navigation Satellite System
APN	Access Point Name
BDS	BeiDou Navigation Satellite System
E-CID	Enhanced Cell-ID
GLONASS	GLObal'naya NAVigatsionnaya Sputnikovaya Sistema (Engl.: Global Navigation Satellite System)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
IoT	Internet of Things
OTDOA	Observed Time Difference Of Arrival
URL	Uniform Resource Locator

1.6 References

Ref	Doc Number	Title
[1]	RFC 2119	"Key words for use in RFCs to Indicate Requirement Levels", S. Bradner, March 1997. Available at http://www.ietf.org/rfc/rfc2119.txt
[2]	RFC 8174	Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words
[3]	GSMA TS.39	MIoT Test Requirements
[4]	GSMA TS.34	IoT Device Connection Efficiency Guidelines
[5]	GSMA CLP.13	IoT Security Guidelines for Endpoint Ecosystem
[6]	GSMA SGP.02	Remote Provisioning Architecture for Embedded UICC Technical Specification
[7]	GSMA PRD TS.26	NFC Handset Requirements
[8]	GSMA PRD TS.27	NFC Handset Test Book
[9]	GSMA PRD TS.43	Service Entitlement Configuration

1.7 Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 (RFC2119) [1] (RFC8174) [2] when, and only when, they appear in all capitals, as shown here.

2 Requirements for IoT Devices and Services

2.1 Description of Features

IoT devices with built-in communication modules enable real-time data collection from devices and command delivery, device status monitoring and additional remote operations (configuration/upgrade...). Lists of features that can be supported on the IoT devices are described as follows.

2.1.1 Registration

This feature is to register an IoT device on the network and then the IoT service platform when switching on the device to establish the IoT connection between the device and service platform.

Requirement ID	Requirement
TS50_2.1.1_REQ_1	The IoT device SHALL register on the network and service platform when switching on.

2.1.2 Status Reporting

This feature is to provide status information of IoT device and surroundings to the IoT service platform periodically or on enquiry. Status information can include but are not limited to:

- Status information of the IoT device, such as network signal strength, remaining battery power, location information, etc.
- Status information of its surroundings, such as temperature, humidity, etc.

Requirement ID	Requirement
TS50_2.1.2_REQ_1	The IoT device SHOULD provide status information of the IoT device and surroundings to the IoT service platform periodically or on enquiry.

2.1.3 Alarm Reporting

This feature is to automatically trigger an alarm to the IoT service platform on the detection of an emergency.

Requirement ID	Requirement
TS50_2.1.3_REQ_1	The IoT device SHALL automatically trigger an alarm to the IoT service platform on the detection of an emergency.

2.1.4 Error Reporting

This feature is to indicate an error to the IoT service platform on the detection of an abnormal working status of an IoT device, such as device failures, low battery, unexpected dismantling of the device, etc.

Requirement ID	Requirement
TS50_2.1.4_REQ_1	The IoT device SHOULD indicate errors to the IoT service platform on the detection of an abnormal working status of an IoT device.

2.1.5 Remote Configuration

This feature is to allow modification of the local pre-configuration on the IoT device and reconfiguration of the IoT device as commanded by the IoT service platform.

Requirement ID	Requirement
TS50_2.1.5_REQ_1	The IoT device SHOULD support modification on the local pre-configuration as commanded by the IoT service platform.

2.1.6 Remote Upgrade

This feature is to upgrade the firmware of the IoT device as commanded by the service platform.

Requirement ID	Requirement
TS50_2.1.6_REQ_1	The IoT device SHOULD upgrade the firmware of the IoT device as commanded by the service platform.

2.1.7 Remote Control

This feature is to enable remote control of the IoT device by the service platform or by other devices, such as smartphones.

Requirement ID	Requirement
TS50_2.1.7_REQ_1	The IoT device SHOULD be remotely controlled by the service platform or by other devices to enable functions such as turn on/off, mode setting, etc.

2.2 Smart Smoke Detector

2.2.1 Service Description

A smart smoke detector is a wireless smoke detector that detects smoke concentration and sends an alarm message to the IoT service platform in real time. Apart from detecting smoke caused by fires, the smart smoke detectors can support remote operation and report device faults to the IoT service platform. The smart smoke detector features low power consumption, reliable and prompt report of potential issues and less-expensive maintenance costs compared to some traditional solutions. It is widely applied in scenarios like smart homes, and intelligent buildings for security purposes.

The smart smoke detector supports the following features:

- Registration to the network and service platform
- Periodic Status Reporting

- Alarm Reporting
- Error Reporting
- Remote Configuration
- Remote Upgrade

2.2.2 Device Capability Requirements

To ensure the operation of smart smoke detectors, the following requirements must be met:

Requirement ID	Requirement
TS50_2.2.2_REQ_1	The device SHALL register on the network and service platform when switching on.
TS50_2.2.2_REQ_2	The device SHOULD send a status report to the IoT service platform as per the configured frequency.
TS50_2.2.2_REQ_3	The device SHALL trigger an alarm report to the IoT service platform to indicate a potential fire when the device detects that the smoke concentration exceeds a pre-defined threshold
TS50_2.2.2_REQ_4	The device SHOULD trigger an error message to the IoT service platform and indicate the potential issue on detection of an abnormal working status of the device such as: <ul style="list-style-type: none"> • Remaining battery power is below a pre-defined threshold • Unexpected equipment dismantling • Device failure • Connection Errors
TS50_2.2.2_REQ_5	The device SHOULD support remote parameter configuration. The service parameter can be configured by the IoT service platform and should include but is not limited to: <ul style="list-style-type: none"> • APN • IP address/ Domain Name (URL) (Note: if Non-IP data delivery is used, IP address/Domain Name (URL) is not required) • Frequency of periodic status report
TS50_2.2.3_REQ_6	The device SHOULD support firmware upgrades as commanded by the IoT service platform.

2.3 Smart Meters

2.3.1 Service Description

A smart meter is a wireless device that automatically records energy (water, gas, heating, etc.) consumption and communicates the information to the energy supplier for real-time monitoring and accurate billing. Smart meters are deployed by utility companies and are usually installed in complex radio environments, such as in corridors, indoors, or underground.

Smart meters support the following basic features:

- Registration to the network and service platform

- Periodic status reporting

Advanced smart meters additionally support the following features:

- Error Reporting
- Remote Configuration
- Remote Upgrade

2.3.2 Device Capability Requirements

To ensure the operation of smart meters, the following requirements must be met:

Requirement ID	Requirement
TS50_2.3.2_REQ_1	The device SHALL register on the network and service platform when switching on.
TS50_2.3.2_REQ_2	The device SHALL send a status report to the IoT service platform as per the configured frequency. The status report should include but is not limited to the following information: <ul style="list-style-type: none"> • Current energy consumption
TS50_2.3.2_REQ_3	The device SHOULD trigger an error report to the IoT service platform and indicate the potential issue on detection of an abnormal working status of the device such as: <ul style="list-style-type: none"> • Remaining battery power is below a pre-defined threshold • Unexpected equipment dismantling • Device failure • Connection Errors
TS50_2.3.2_REQ_4	The device SHOULD support remote parameter configuration. The service parameter can be configured by the IoT service platform and should include but is not limited to: <ul style="list-style-type: none"> • APN • IP address/ Domain Name (URL) (Note: if Non-IP data delivery is used, IP address/Domain Name (URL) is not required) • Frequency of periodic status report
TS50_2.3.2_REQ_5	The device SHOULD support firmware upgrades as commanded by the IoT service platform.

2.4 Location Trackers

2.4.1 Service Description

A location tracker is a wireless device that automatically records the real-time location (latitude and longitude) and periodically reports the information to a service platform for real-time status monitoring and location tracking. Location trackers are usually installed in mobile devices with the capability of GNSS (GPS, BDS, Galileo, GLONASS, etc.), A-GNSS, OTDOA, CellID or eCID, such as cars, sharing bicycles, pet trackers, children’s watches, logistic boxes, shipping containers, etc.

According to the use cases, a location tracker could be used by an enterprise for business purposes which is commonly called ToB/2B such as GPS trackers for vehicles, or used by an individual for consumer purposes which is usually called ToC/2C like a pets whistle. Therefore the requirements and functionalities of location trackers may differ based on their specific using scenarios.

For both ToB/2B and ToC/2C usage, the location tracker supports the following basic features:

- Registration to the network and service platform
- Periodic location reporting

The advanced location tracker additionally supports the following features:

- Real-time location reporting triggered by event, e.g., out of geo-fence
- Real-time location reporting triggered by service platform
- Error reporting
- Indicator of alarm or warning notification
- Remote configuration
- Remote upgrading

2.4.2 Device Capability Requirements

To ensure the operation of the location tracker, the following requirements must be met:

Requirement ID	Requirement
TS50_2.4.2_REQ_1	The device SHALL register on the network and service platform when switching on.
TS50_2.4.2_REQ_2	The device SHALL send a status report to the IoT service platform periodically as per the configured frequency. The status report can include but is not limited to the following information: <ul style="list-style-type: none"> • Current location
TS50_2.4.2_REQ_3	The device SHOULD send a status report to the IoT service platform by the request from the IoT service platform. The status report should include but is not limited to the following information: <ul style="list-style-type: none"> • Current location
TS50_2.4.2_REQ_4	The device SHOULD send an alarm report to the IoT service platform to indicate a potential out of geo-fence, deviate from the route, etc. those which are pre-defined events. The alarm report shall include but is not limited to the following information: <ul style="list-style-type: none"> • Current location • Time when the device was last activated
TS50_2.4.2_REQ_5	The device SHOULD trigger an error report to the IoT service platform and indicate the potential issue on the detection of an abnormal working status of the device such as: <ul style="list-style-type: none"> • Remaining battery power is below a pre-defined threshold • Failure to locate the location

Requirement ID	Requirement
	<ul style="list-style-type: none"> • Connection Errors
TS50_2.4.2_REQ_6	The device SHOULD support remote parameter configuration. The service parameter can be configured by the IoT service platform and should include but are not limited to: <ul style="list-style-type: none"> • APN • IP address/Domain Name (URL) (Note: if Non-IP data delivery is used, IP address/Domain Name (URL) is not required) • Positioning method (GNSS, A-GNSS, CellID, OTDOA/eCID) • Frequency of periodic location report
TS50_2.4.2_REQ_7	The device SHOULD support firmware upgrades as commanded by the IoT service platform.

2.5 Smart Parking

2.5.1 Service Description

The aim of parking solutions is to charge for the usage of parking spaces and to make it easier for drivers to find available parking slots.

A smart parking solution should be aware of occupancy status of each parking space and should be able to guide the driver to it. The smart parking supports the following basic features:

- Registration to the network and service platform
- Periodic status reporting

Advanced smart parking additionally supports the following features:

- Adaptive periodic status reporting of peak and off peak hours

2.5.2 Device Capability Requirements

Requirement ID	Requirement
TS50_2.5.2_REQ_1	The device SHALL register on the network and service platform when switching on.
TS50_2.5.2_REQ_2	The device SHALL send a status report to the smart parking service platform as per the configured frequency. The status report can include but is not limited to the following information: <ul style="list-style-type: none"> • Serial number • Current battery status • Current status of the parking space – occupied/non-occupied
TS50_2.5.2_REQ_3	The device SHOULD trigger an error report to the IoT service platform and indicate the potential issue on detection of an abnormal working status of the device such as: <ul style="list-style-type: none"> • Remaining battery power is below a pre-defined threshold • Unexpected equipment dismantling

Requirement ID	Requirement
	<ul style="list-style-type: none"> Device failure Connection Errors
TS50_2.5.2_REQ_4	The device SHOULD support remote parameter configuration. The service parameter can be configured by the IoT service platform and can include but is not limited to: <ul style="list-style-type: none"> APN IP address/ Domain Name (URL) (Note: if Non-IP data delivery is used, IP address/Domain Name (URL) is not required) Frequency of periodic status report
TS50_2.5.2_REQ_5	The device SHOULD support firmware upgrades as commanded by the IoT service platform.

2.6 Smart Watch

2.6.1 Service Description

The Smart Watch is a kind of wearable device which is far beyond the conventional wristwatches which just record time. Cellular based Smart Watch is capable of working independently of your Smartphone being present. However, Smart Watches usually don't have much built-in storage, they can connect to personal devices (e.g. Smartphone) to enable the secure storage or synchronize with personal cloud account to record personal data.

According to different target users, Smart Watches could categorize into Kids' Smart Watch and Sports Smart Watch, etc.

Kids' Smart Watches support two-way communication (voice call, SMS), location tracking as the basic features, some advanced types can additionally support features of fitness and health tracker.

Sports Smart Watches support the activity tracking (e.g. step counting, sleep time, etc.), location tracking as the basic features, some advanced types additionally support the two-way communication (voice call, SMS), health monitor (e.g. heart rate, blood pressure, etc.) features.

In a word, Smart Watch provides an easy way to record valuable information and deliver to the user with notifications as required.

2.6.2 Device Capability Requirements

2.6.2.1 Kids' Smart Watch

Requirement ID	Requirement
TS50_2.6.2.1_REQ_1	The device SHALL register on the network and service platform when switching on.
TS50_2.6.2.1_REQ_2	The device SHALL provide time-related functions. Time-related functions can include but not limit to:

Requirement ID	Requirement
	<ul style="list-style-type: none"> • Time and calendar • Alarm clock • Timer, stopwatch
TS50_2.6.2.1_REQ_3	The device SHOULD monitor and records personal activities, which include but not limit to the following information: <ul style="list-style-type: none"> • Step counter • Distance travelled • Sleep time
TS50_2.6.2.1_REQ_4	The device SHOULD monitor and record physical health, which can include but not limit to following information: <ul style="list-style-type: none"> • Heart rate • Blood pressure
TS50_2.6.2.1_REQ_5	The device SHALL support data synchronization when authorized by the user. The personal data can be synchronized to a different device (e.g. Smartphone) or a cloud account.
TS50_2.6.2.1_REQ_6	The device SHALL support voice call to provide generic two-way communication service.
TS50_2.6.2.1_REQ_7	The device SHALL support text capability to provide generic SMS function.
TS50_2.6.2.1_REQ_8	The device SHALL support location tracking and provide location information to the IoT service platform as requested.
TS50_2.6.2.1_REQ_9	Emergency service supported by the device shall follow the local regulatory requirement.
TS50_2.6.2.1_REQ_9.1	The device SHOULD support emergency service to provide emergency call function. <ul style="list-style-type: none"> • Emergency voice communication • Emergency position indication • Emergency callback
TS50_2.6.2.1_REQ_10	The device SHALL support firmware upgrade function.

2.6.2.2 Sports Smart Watch

Requirement ID	Requirement
TS50_2.6.2.2_REQ_1	The device SHALL register on the network and service platform when switching on.
TS50_2.6.2.2_REQ_2	The device SHALL provide time-related functions. Time-related functions can include but not limit to: <ul style="list-style-type: none"> • Time and calendar • Alarm clock • Timer, stopwatch
TS50_2.6.2.2_REQ_3	The device SHALL monitor and records personal activities, which include but not limit to the following information: <ul style="list-style-type: none"> • Step counter • Sport route • Distance travelled

Requirement ID	Requirement
	<ul style="list-style-type: none"> • Sleep time
TS50_2.6.2.2_REQ_4	The device SHALL monitor and record personal activities which can include but not limit to the following information: <ul style="list-style-type: none"> • Calories burned • Floors climbed • Intensity minutes • Fitness age • Body energy
TS50_2.6.2.2_REQ_5	The device SHOULD monitor and record physical health, which can include but not limit to following information: <ul style="list-style-type: none"> • Heart rate • Blood Pressure
TS50_2.6.2.2_REQ_6	The device SHALL support data synchronization when authorized by the user. The personal data can be synchronized to a different device (e.g. Smartphone) or a cloud account.
TS50_2.6.2.2_REQ_7	The device MAY support voice call to provide generic two-way communication service.
TS50_2.6.2.2_REQ_8	The device MAY support text capability to provide generic SMS function.
TS50_2.6.2.2_REQ_9	Emergency service supported by the device shall follow the local regulatory requirement.
TS50_2.6.2.2_REQ_9.1	The device MAY support emergency service to provide emergency call function. <ul style="list-style-type: none"> • Emergency voice communication • Emergency position indication • Emergency callback
TS50_2.6.2.2_REQ_10	The device MAY support NFC (Near Field Communication) to provide contactless payment functions as defined in TS.26 [7] and TS.27 [8].
TS50_2.6.2.2_REQ_11	The device SHALL support firmware upgrade function.

2.7 Smart Air Conditioner

Note: This would be also applicable to devices including Air heaters, Air Purifiers and Air Coolers.

2.7.1 Service Description

A smart air conditioner enables wireless connection, which can be remotely controlled by devices such as smartphones and communicates the information to the service platform for enhanced functions, such as life cycle management, location-based features and billing. Smart air conditioner is deployed not only by personal users, but also by air conditioner

manufacturers in school dormitories, hotel rooms rented accommodation etc. based on sharing economy.

Smart air conditioners support the following basic features:

- Registration to the network and service platform
- Status reporting
- Remote control

Advanced air conditioners additionally support the following features:

- Error Reporting
- Remote Configuration
- Remote Upgrade
- Status enquiry
- Location reporting

2.7.2 Device Capability Requirements

To ensure the operation of devices, the following requirements must be met when the device is energized:

Requirement ID	Requirement
TS50_2.7.2_REQ_1	The device SHALL register on the network and service platform.
TS50_2.7.2_REQ_2	The device SHALL send a status report to the service platform periodically or triggered by event (i.e. power on/off) when energized. The status report can include but is not limited to the following information: <ul style="list-style-type: none"> • Serial number • Current operation status • Environment information, such as temperature, humidity
TS50_2.7.2_REQ_3	The device SHALL be able to remotely controlled by the service platform or by other devices to enable functions such as turn on/off, mode setting, temperature setting, etc.
TS50_2.7.2_REQ_4	The device SHOULD trigger an error report to the IoT service platform and indicate the potential issue on detection of an abnormal working status of the device such as: <ul style="list-style-type: none"> • Device failure • Connection Errors • Moved to an unauthorised location
TS50_2.7.2_REQ_5	The device SHOULD support remote parameter configuration. The service parameter can be configured by the IoT service platform and can include but is not limited to: <ul style="list-style-type: none"> • APN • IP address/ Domain Name (URL) (Note: if Non-IP data delivery is used, IP address/Domain Name (URL) is not required) • Status report policy

Requirement ID	Requirement
TS50_2.7.2_REQ_6	The device SHOULD support firmware upgrades as commanded by the IoT service platform.
TS50_2.7.2_REQ_7	The device SHOULD send a status report to the service platform on enquiry. The status report can include but is not limited to the following information: <ul data-bbox="555 456 1264 560" style="list-style-type: none">• Serial number• Current operation status• Environment information, such as temperature, humidity
TS50_2.7.2_REQ_8	The device MAY send a location report to the IoT service platform as commanded by the service platform.

Annex A Document Management

A.1 Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
1.0	March 2020	New PRD TS.50	TSG#38 TG#20	Ya Liu / China Mobile
2.0	Feb 2021	Implementing changes in TS.50 CR1002	TSG#42 ISAG#6	Ya Liu / China Mobile Indy Peng / Mediatek Kay Fritz / Vodafone
3.0	April 2022	Implementing changes in TS.50 CR1003	TSG#47 ISAG#19	Ya Liu / China Mobile

A.2 Other Information

Type	Description
Document Owner	Terminal Steering Group (TSG)
Editor / Company	Ya Liu / China Mobile

It is our intention to provide a quality product for your use. If you find any errors or omissions, please contact us with your comments. You may notify us at prd@gsma.com

Your comments or suggestions & questions are always welcome.