# GTI

# Smart Home Interconnection Certification Test Specification



# *GTI Smart Home Interconnection Certification Test Specification*



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# 1 Executive Summary

This paper defines the certification test specification for the interconnection of Matter ecosystem devices with other protocol devices through the home smart protocol gateway. It covers 17 core test cases across six domains: device provisioning and authorization, device discovery and onboarding, device control and data reporting, device unbinding and recovery, interconnection compatibility, and scenario adaptability and stability. The specification is intended to establish a trusted, measurable and certifiable quality baseline for cross-protocol smart home interconnection, and will be continuously updated as technology evolves.

# 2 Abbreviations

| **Abbreviation** | **Explanation** |
|---|---|
| Matter | Unified smart home connectivity protocol developed by the CSA Connectivity Standards Alliance |
| APP | Home smart management APP client |
| Gateway | Home smart protocol gateway that enables cross-protocol device management and proxy control |
| IoT Platform | Home device cloud management platform |
| CASE | Certificate-authenticated Session Establishment; secure session during Matter operational phase |
| PASE | Passcode-authenticated Session Establishment; secure session during Matter commissioning phase |
| NOC | Node Operational Certificate |
| RCA | Root CA Certificate |
| IPK | Identity Protection Key |
| ACL | Access Control List |
| DCL | Distributed Compliance Ledger |
| Fabric | Matter Fabric/Network |
| DUT | Device Under Test |
| OTA | Over-the-Air update |

# 3 Introduction

With the rapid growth of Matter ecosystem devices and other multi-protocol smart home products, cross-protocol interconnection between devices from different vendors and ecosystems has become a key enabler for the smart home experience. This specification applies to the certification of interconnection between Matter ecosystem devices and other protocol devices, covering provisioning, discovery, control, data reporting, unbinding and recovery, compatibility, and scenario stability. The test environment, test equipment and test use cases defined herein provide the basis for consistent, repeatable and comparable certification testing.

# 4 Test Environment

## 4.1 Test Environment

The smart home interconnection test environment consists of the following four components:

(1) Home network environment: includes home Wi-Fi (2.4GHz/5GHz dual-band) and broadband access, simulating a real home network topology.

(2) Device under test set: devices from different protocol ecosystems, the home smart protocol gateway, and the home smart management APP.

(3) Cloud platform environment: home IoT cloud platform supporting device registration, online status, remote control, and message forwarding.

Basic test topology: Test terminal (APP) - Home Wi-Fi - Protocol Gateway - Home Broadband - IoT Cloud Platform. The test terminal may also directly connect to Matter devices for near-field communication.

## 4.2 Test Equipment

| **Equipment/Tool** | Description |
|---|---|
| **Matter DUTs (multi-vendor)** | Covering lighting, plugs, sensors and other categories from multiple vendors |
| **Home Smart Protocol Gateway** | Supports onboarding of Matter ecosystem devices |
| **Test Phone (Android)** | Installed with the home smart management APP |
| **Test Phone (iOS)** | Installed with the home smart management APP |
| **Home Wi-Fi Router** | Dual-band Wi-Fi supporting standard home networking |
| **Packet Capture Tool** | For CoAP/MQTT/HTTPS packet capture and analysis |
| **IoT Cloud Platform Test Environment** | Supports complete device onboarding and control workflows |

# 5 Test Use Cases

## 5.1 Device Provisioning and Authorization

| | |
|---|---|
| **TC NO.** | 5.1.1 |
| **Test Case** | Matter Device Standard Provisioning Verification |
| **Test Purpose** | Verify that the APP can guide the user through the standard Matter provisioning flow and successfully add the device to the home network. |
| **Initial Configuration** | 1. Device is in factory unprovisioned state; 2. Test phone and device are on the same home Wi-Fi network; 3. APP is logged into the home account. |
| **Test Procedure** | 1. Reset the device to provisioning mode; 2. Initiate device addition in the APP; 3. Follow APP guidance to complete device discovery, setup code entry, and network configuration; 4. Verify that the APP successfully creates a device card showing online status. |
| **Check Point** | 1. Provisioning flow guidance is clear and unambiguous; 2. Device completes provisioning within 60 seconds; 3. Device card correctly displays name, type, and online status; 4. Provisioning success rate ≥98% over 10 consecutive attempts. |
| **Remarks** | |
| **TC NO.** | 5.1.2 |
| **Test Case** | Gateway Authorization and Credential Persistence Verification |
| **Test Purpose** | Verify that the APP can securely deliver Matter network management credentials to the protocol gateway, and that the gateway independently manages Matter devices in the same network after persistent storage. |
| **Initial Configuration** | 1. Protocol gateway is deployed and bound to the same home account; 2. At least one Matter device has been provisioned; 3. APP and gateway are on the same LAN. |
| **Test Procedure** | 1. Trigger gateway authorization in the APP; 2. Confirm the APP discovers the gateway on the LAN; 3. Complete the authorization flow; 4. Restart the gateway after closing the APP; 5. Verify that the gateway automatically discovers and joins provisioned Matter devices. |
| **Check Point** | 1. Authorization flow completes smoothly without errors; 2. After gateway restart, devices in the same Matter network are automatically discovered without re-authorization. |
| **Remarks** | |
| **TC NO.** | 5.1.3 |
| **Test Case** | Provisioning Failure Fault Tolerance and Recovery Verification |
| **Test Purpose** | Verify that when an exception occurs during provisioning, the APP provides clear prompts and supports recovery without residual state. |
| **Initial Configuration** | A provisioning failure scenario may be constructed by disconnecting Wi-Fi during the process. |
| **Test Procedure** | 1. Construct a provisioning failure scenario; 2. Observe APP error prompts; 3. Re-initiate provisioning following the prompts; 4. Verify provisioning ultimately succeeds; 5. Check that no "zombie devices" remain in the device list. |
| **Check Point** | 1. APP provides specific, understandable failure reasons and operational guidance, with no meaningless error codes or crashes; 2. Re-provisioning succeeds; 3. Device state fully recovers after failure. |
| **Remarks** | |

## 5.2 Device Discovery and Onboarding

| | |
|---|---|
| **TC NO.** | 5.2.1 |
| **Test Case** | Gateway Automatic Discovery of Same-Network Devices Verification |
| **Test Purpose** | Verify that after receiving management credentials, the protocol gateway automatically discovers devices within the same Matter network without manual intervention. |
| **Initial Configuration** | 1. Gateway has completed authorization; 2. Matter devices are provisioned and on the same home network. |
| **Test Procedure** | 1. Restart the gateway or add a newly provisioned Matter device; 2. Observe the automatic discovery process. |
| **Check Point** | 1. Gateway automatically discovers devices within 5 minutes. |
| **Remarks** | |
| **TC NO.** | 5.2.2 |
| **Test Case** | Device Information Reading and Cloud Registration Verification |
| **Test Purpose** | Verify that the gateway reads basic Matter device information and completes cloud registration, establishing the device-to-gateway association. |
| **Initial Configuration** | Gateway has discovered the Matter device; cloud platform service is normal. |
| **Test Procedure** | 1. Observe the automatic registration process after gateway discovers the device; 2. View device information in the APP or cloud platform; 3. Verify vendor, product model, hardware/software version, and other information. |
| **Check Point** | 1. Device automatically completes cloud registration; 2. Registration information is complete and accurate, matching the actual device; 3. Cloud platform correctly establishes the parent-child (gateway-device) association. |
| **Remarks** | |
| **TC NO.** | 5.2.3 |
| **Test Case** | Device Online Status Synchronization Verification |
| **Test Purpose** | Verify that device online/offline status is synchronized in a timely and accurate manner. |
| **Initial Configuration** | Device is onboarded; device power can be controlled. |
| **Test Procedure** | 1. Cut device power and observe offline status updates across all three ends; 2. Restore device power and observe online recovery. |
| **Check Point** | 1. APP shows device offline within 30 seconds after power loss; 2. Device recovers online status within 60 seconds after power restoration. |
| **Remarks** | |
| **TC NO.** | 5.2.4 |
| **Test Case** | Device List Merging and Display Verification |
| **Test Purpose** | Verify that the APP correctly merges locally connected and cloud-onboarded device information, displaying a unified list without duplicates. |
| **Initial Configuration** | Device is onboarded to the cloud via the gateway; APP can also directly connect to the device locally. |
| **Test Procedure** | 1. Refresh the APP device list; 2. Observe device card display; 3. Check whether associated gateway information is shown on the device. |
| **Check Point** | 1. Only one device card appears in the APP list without duplication; 2. Card correctly displays name, type, and online status; 3. Associated gateway information is correctly shown. |
| **Remarks** | |

## 5.3 Device Control and Data Reporting

| | |
|---|---|
| **TC NO.** | 5.3.1 |
| **Test Case** | Near-Field Direct Control Verification |
| **Test Purpose** | Verify that the APP directly communicates with Matter devices over the home network for low-latency control. |
| **Initial Configuration** | APP is connected to home Wi-Fi; device is online; APP and device can establish a direct session. |
| **Test Procedure** | 1. Perform control operations on the APP device card page; 2. Observe device response and APP status update; 3. Perform query operations to verify status reading. |
| **Check Point** | 1. Device correctly responds after control command is issued; 2. APP UI updates synchronously, matching the actual device state. |
| **Remarks** | |
| **TC NO.** | 5.3.2 |
| **Test Case** | Remote Proxy Control Verification |
| **Test Purpose** | Verify that the APP remotely controls Matter devices via the cloud platform and gateway proxy link when on an external network. |
| **Initial Configuration** | APP is on a cellular network; protocol gateway is online; device is online. |
| **Test Procedure** | 1. Switch APP to an external network; 2. Perform control operations in the APP; 3. Observe whether the device executes; 4. Observe whether the APP receives the execution result. |
| **Check Point** | 1. Device correctly responds after control command is issued; 2. APP UI updates synchronously, matching the actual device state. |
| **Remarks** | |
| **TC NO.** | 5.3.3 |
| **Test Case** | Near-Field/Remote Control Auto-Switching Verification |
| **Test Purpose** | Verify that the APP automatically selects the control mode based on network environment, with seamless switching that is transparent to the user. |
| **Initial Configuration** | The network can be switched between home Wi-Fi and external network. |
| **Test Procedure** | 1. Perform control over Wi-Fi (near-field mode); 2. Switch to external network and perform control (remote mode); 3. Switch back to Wi-Fi and perform control; 4. Verify that each control operation works correctly. |
| **Check Point** | 1. Control mode adapts automatically after network switching without manual setting; 2. Device correctly responds after control command is issued; 3. APP UI updates synchronously, matching the actual device state. |
| **Remarks** | |
| **TC NO.** | 5.3.4 |
| **Test Case** | Real-Time Device Status Change Reporting Verification |
| **Test Purpose** | Verify that device status changes are reported to the APP in a timely and accurate manner. |
| **Initial Configuration** | Device is onboarded; APP is on the device card page or list page. |
| **Test Procedure** | 1. Change device status via physical button or external trigger; 2. Observe APP UI status update; 3. Repeat verification in remote mode. |
| **Check Point** | 1. APP updates display within 3 seconds after status change; 2. Reported data accurately reflects the actual device state; 3. Proxy reporting link is equally timely in remote mode; 4. No missing reports over 10 consecutive status changes. |
| **Remarks** | |

## 5.4 Device Unbinding and Recovery

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|---|---|
| **TC NO.** | 5.4.1 |
| **Test Case** | Online Device Unbinding Verification |
| **Test Purpose** | Verify that when the APP triggers unbinding while the device is online, the device, gateway, and cloud platform correctly complete unbinding and data cleanup. |
| **Initial Configuration** | Device is online; gateway is online; APP can normally control the device. |
| **Test Procedure** | 1. Trigger unbinding on the APP device details page; 2. Confirm unbinding; 3. Observe the APP device list; 4. Check whether gateway and cloud platform device information is cleaned up; 5. Check whether the device leaves the current Matter network. |
| **Check Point** | 1. Device is removed from the APP list after unbinding; 2. Gateway cleans up local information and credentials; 3. Cloud platform deletes device information and associations; 4. Device leaves the current Matter network and can be re-provisioned. |
| **Remarks** | |
| **TC NO.** | 5.4.2 |
| **Test Case** | Offline Device Unbinding and Status Synchronization Verification |
| **Test Purpose** | Verify that when unbinding is triggered while the device or gateway is offline, status is correctly synchronized after recovery, with no zombie devices. |
| **Initial Configuration** | Device or gateway offline status can be controlled. |
| **Test Procedure** | Scenario A (device offline): Cut device power -> APP unbind -> Restore device power -> Observe device state. Scenario B (gateway offline): Cut gateway power -> APP unbind -> Restore gateway power -> Observe whether the gateway synchronizes the unbinding state. |
| **Check Point** | 1. Scenario A: After device recovery, unbinding or credential cleanup is executed with no residual in the APP; 2. Scenario B: After gateway recovery, it automatically synchronizes the device list and cleans up local information for unbound devices; 3. No zombie devices in either scenario. |
| **Remarks** | |
| **TC NO.** | 5.4.3 |
| **Test Case** | Re-Onboarding After Unbinding Verification |
| **Test Purpose** | Verify that after unbinding, the device can re-enter provisioning mode and be added again. |
| **Initial Configuration** | Device has completed unbinding. |
| **Test Procedure** | 1. Confirm the device has left the original Matter network; 2. Re-initiate provisioning in the APP; 3. Complete provisioning and gateway authorization; 4. Verify that the device can be normally controlled. |
| **Check Point** | 1. Device can be rediscovered and provisioned by the APP; 2. Provisioning flow is identical to the first time; 3. Control functions work normally after re-onboarding. |
| **Remarks** | |

## 5.5 Interconnection and Compatibility

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|---|---|
| **TC NO.** | 5.5.1 |
| **Test Case** | Multi-Protocol Device Compatibility Verification |

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|---|---|
| **TC NO.** | 5.5.1 |
| **Test Purpose** | Verify that devices from different vendors and protocols can be stably onboarded and controlled through the protocol gateway. |
| **Initial Configuration** | Prepare at least 2 devices from different protocols. |
| **Test Procedure** | 1. Provision devices from each vendor in sequence; 2. Perform control operations on each device; 3. Verify status reporting; 4. Run continuously for 24 hours to observe stability. |
| **Check Point** | 1. All vendor devices are successfully provisioned and onboarded; 2. Control commands are correctly executed; 3. Status reporting is accurate; 4. No disconnections or anomalies during continuous operation; 5. Devices from different vendors do not interfere with each other. |
| **Remarks** | |

## 5.6 Scenario Adaptability and Stability

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|---|---|
| **TC NO.** | 5.6.1 |
| **Test Case** | Interconnection Reliability Under Weak Network Conditions Verification |
| **Test Purpose** | Verify that cross-protocol interconnection functions reliably under poor home network quality. |
| **Initial Configuration** | Wi-Fi RSSI between -70dB and -65dB |
| **Test Procedure** | 1. Simulate weak network conditions; 2. Perform device provisioning; 3. Perform near-field and remote control; 4. Verify device status reporting. |
| **Check Point** | 1. Provisioning succeeds normally under weak network; 2. Remote control succeeds; 3. No data loss in status reporting. |
| **Remarks** | |
| **TC NO.** | 5.6.2 |
| **Test Case** | Long-Run Stability Verification |
| **Test Purpose** | Verify that after extended continuous operation, the device and gateway maintain stable interconnection performance without degradation. |
| **Initial Configuration** | Device and gateway are onboarded, and all functions are normal. |
| **Test Procedure** | 1. System runs continuously for 7 days without restart; 2. Perform one control operation and status check daily; 3. Record any exceptions during the period. |
| **Check Point** | 1. No abnormal restarts or functional failures within 7 days; 2. Control operations function normally. |
| **Remarks** | |

# 6 References

[1]CSA Specification: "Matter Core Specification", Version 1.5, Connectivity Standards Alliance.
[2]IETF RFC 7252: "The Constrained Application Protocol (CoAP)"
[3]Wi-Fi Alliance Specification: "Wi-Fi EasyMesh Specification"