USB Capability Requirements

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1. At a Glance (Informative)

What this capability is	Operation of a USB peripheral across an IP network. The Host uses a peripheral that is attached to a distant device as if the peripheral were plugged into the Host.
What it accomplishes	An IPMX system can connect keyboards, mice, touch panels, cameras, storage, and control surfaces over the same network as its video and audio, with the same discovery and connection management.
Primary specification	VSF TR-10-14
Roles	The USB Receiver is attached to the USB Host. The USB Sender is attached to the USB peripherals. The names follow NMOS: a Sender is the end that publishes a stream on the network. The names do not follow the direction of USB data. See Section 3.
What a claiming device must do	Send USB traffic over TCP communication channels using the IPMX USB message set. Open and close those channels in the order TR-10-14 defines. Report the status of each transfer. Send and check heartbeats. Publish its connection information through SDP and NMOS. Section 6.
What is self-attested	Peripheral classes other than keyboard and mouse, remote wake, and cipher modes above the mandatory floor. The vendor declares that each feature works as Section 7 defines. The registry listing marks each feature as vendor attested. Self-attested features are not evaluated and do not affect the badge. TR-10-14 requires remote wake; it is attested because it is not evaluated.

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Where the bar differs from TR-10-14	TR-10-14 recommends encryption. This capability requires it: a device shall implement the Privacy Encryption Protocol, and evaluation runs with encryption enabled. Section 8.
What evaluation covers	A keyboard and a mouse attached at the same time, over an encrypted session, in each declared role. Evaluation includes teardown and the protocol events in Section 9.5. Section 9.
What evaluation does not cover	Self-attested features, compliance of the device's own USB implementation, peripherals other than the keyboard and mouse at the floor, latency and isochronous performance, and host operating system behavior. Section 10.
Requirement index	Annex A. Every normative statement in TR-10-14, with its clause, actor, class, and evaluation method.

2. Introduction (Informative)

A USB peripheral is normally connected directly to its Host. In an IPMX system the Host is often in a different place from the peripheral. For example, the operator sits at a desk and the workstation is in a rack on another floor. The keyboard, mouse, touch panel, and camera at the desk must reach the workstation over the network that also carries the video and audio.

TR-10-14 sends each USB transaction across the network as a USB transaction. Each peripheral has its own communication channel, so a busy peripheral does not block another peripheral.

This document is the requirements document and manual for the IPMX USB capability. VSF TR-10-14 is the specification and defines every behavior named here. This document does not restate TR-10-14. Annex A lists each normative statement in TR-10-14 and the behavior group in Section 6 that covers it.

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This capability is built on:

- The IPMX Product Qualification and Certification Requirements (PQCR), which defines the baseline requirements for every IPMX device.
- VSF TR-10-14, which defines the IPMX USB communication channels, message set, session behavior, and signaling.
- VSF TR-10-13, which defines the Privacy Encryption Protocol that protects the IPMX USB channels.

3. Roles and Channel Model (Informative)

Read this section before Section 6. The role names in TR-10-14 come from NMOS. They do not describe the direction of USB data. A reader who swaps the two roles will apply every requirement to the wrong device.

The gateway attached to the **USB Host** is the **USB Receiver**. The gateway attached to the **USB peripherals** is the **USB Sender**.

In NMOS, a Sender makes a stream available on the network and a Receiver consumes it (AMWA IS-04). A USB gateway registers like any other IPMX endpoint. The end that publishes is the Sender. In IPMX USB, that is the end with the peripherals attached. In point-to-point USB extension, the two ends are called local (Host) and remote (peripherals). Local maps to the USB Receiver. Remote maps to the USB Sender. This document uses the USB prefix because one device may have video, audio, and USB Senders and Receivers at the same time.

Each USB Receiver and USB Sender pair uses its own set of point-to-point TCP communication channels. Each pair has one Control Channel. The Control Channel is used for session and heartbeat messages. Each attached USB peripheral has one Data Channel. The Data Channel is used for that peripheral's transfers. The Sender opens a Data Channel when a peripheral is attached to one of its USB ports. The Sender closes the Data Channel when the peripheral is removed.

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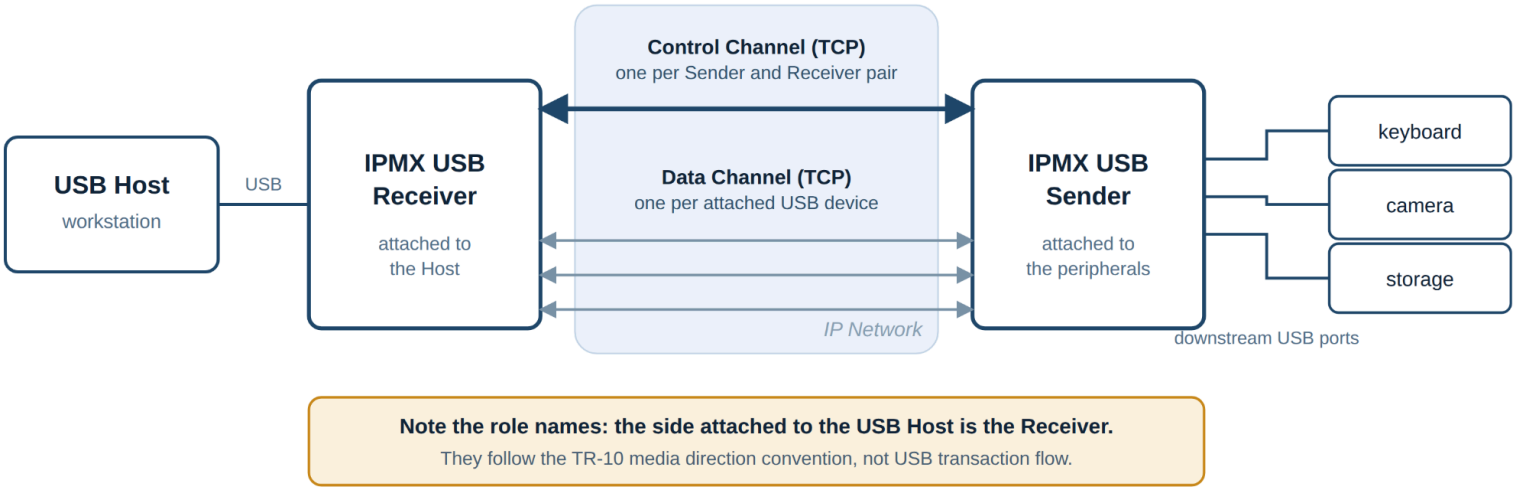


Figure 1: Role and channel topology

A session begins after NMOS delivers the Sender's connection information to the Receiver. The Receiver connects to the Sender on the Control Channel. The two devices complete a connection handshake before any other traffic is sent. The Sender then opens a Data Channel for each peripheral. Each Data Channel has its own handshake. Transfers on a Data Channel begin only after that handshake completes. The Sender sends a heartbeat on the Control Channel at a fixed period for the whole session. If the Receiver stops receiving the heartbeat, the Receiver treats the Sender as disconnected and closes the session.

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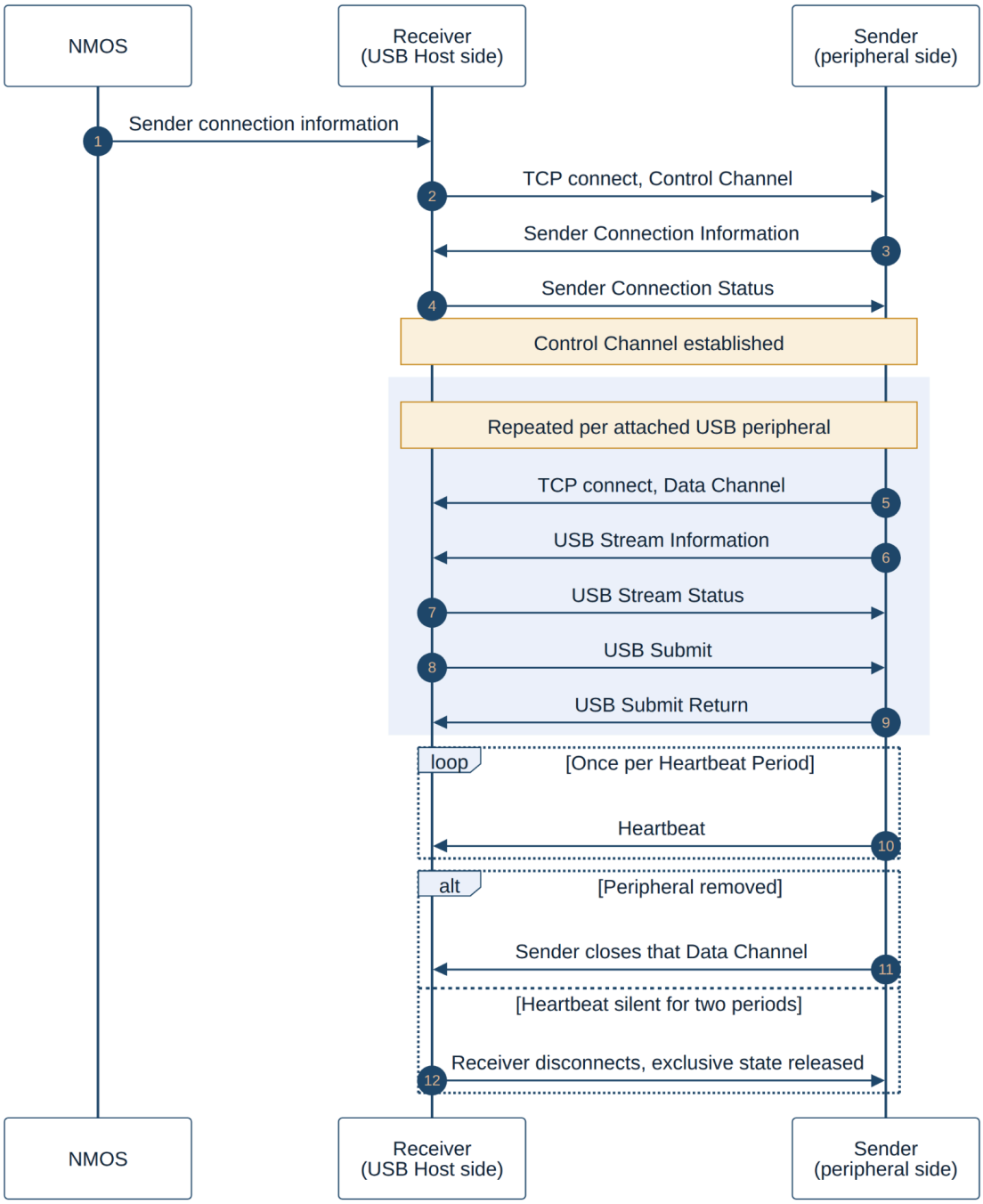


Figure 2: Session lifecycle sequence

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4. Normative References (Normative)

Devices conforming to this capability shall comply with:

- **VSF TR-10-14:** Internet Protocol Media Experience (IPMX): IPMX USB. The primary reference for this capability.
- **VSF TR-10-13:** Internet Protocol Media Experience (IPMX): Privacy Encryption Protocol (PEP). Referenced for the encryption and authentication of IPMX USB channels.
- **VSF TR-10-1:** Internet Protocol Media Experience (IPMX): System Timing and Definitions.
- **VSF TR-10-8:** Internet Protocol Media Experience (IPMX): NMOS Requirements.
- **IPMX Product Qualification and Certification Requirements (PQCR):** the baseline requirements for every IPMX device, and the governing document for certification scope, product families, and variants.
- **PEP Capability Requirements:** the AIMS capability document for the Privacy Encryption Protocol and its transport adaptations, including the USB adaptation.

This capability adds no normative reference outside the TR-10 series and AIMS documents. Where TR-10-14 references a document outside the AIMS and VSF family, that reference applies through TR-10-14.

5. Terms and Definitions (Informative)

The terms used in this document are as defined in VSF TR-10-14, VSF TR-10-1, and PQCR. This capability introduces no additional terms.

6. What This Capability Requires (Normative)

A device claiming this capability shall implement the behaviors TR-10-14 defines. The behaviors are grouped below. Each group states what it covers. TR-10-14 defines the requirements. Annex A lists them. Where this document and TR-10-14 differ, TR-10-14 governs.

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TR-10-14 Section 2 states that a conformant implementation includes all mandatory provisions. If the implementation includes a recommended provision, it implements that provision as TR-10-14 describes. Annex A marks the recommended provisions with class R.

6.1 Channel Architecture and Message Framing

References: TR-10-14 Section 8, Section 9.

Communication channels are point-to-point. Each message has a fixed header, an authenticated field set, and a payload. The meaning of the payload depends on the message type.

Requirements: USB-M-001 through USB-M-018, USB-R-001.

6.2 Session Establishment and Teardown

References: TR-10-14 Section 8.3.

This group covers the handshake order on the Control Channel and on each Data Channel, the rule that each Data Channel belongs to one attached peripheral, and the rule that the Data Channel closes when that peripheral is removed. TR-10-14 states, for each side, what it shall send and what it shall wait for before it continues. The Receiver shall not send transfers before it has sent the acknowledgement. Evaluation checks the order directly.

Requirements: USB-M-019 through USB-M-031.

6.3 Control Channel Message Set

References: TR-10-14 Section 8.1, Section 9.

This group covers the messages sent on the Control Channel and the direction each message travels: connection information and status, heartbeat, and the vendor-specific information and query exchanges. A message sent on the wrong channel or in the wrong direction is a conformance failure, even when its contents are correct.

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The vendor-specific exchanges are mandatory because TR-10-14 requires a Receiver to accept and answer them, whether or not the Receiver's vendor sends any. The content of the payload, and whether a vendor sends these messages at all, is not claimed and not evaluated. See Section 10.5.

Requirements: USB-M-032 through USB-M-050, USB-P-001.

6.4 Data Channel Message Set and Transfer Semantics

References: TR-10-14 Section 8.2, Section 9.

This group covers stream information and status, stream reset, the submit and submit-return exchanges for each USB transfer type, and transfer cancellation.

The control and interrupt exchanges are evaluated at the certification floor (Section 9.3). The bulk and isochronous exchanges are used only by the peripheral classes a vendor attests under Section 7.

Requirements: USB-M-051 through USB-M-082, USB-A-001 through USB-A-006, USB-P-002 through USB-P-003.

6.5 Transfer Status Reporting

References: TR-10-14 Section 9, Appendix A.

Every transfer ends with a status value from the set TR-10-14 defines. If the implementation meets a condition the set does not name, it reports the general unknown-error value. It does not report success and does not invent a code.

Requirements: USB-M-083 through USB-M-087, USB-A-007.

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6.6 Liveness and Non-Responsive Peer Handling

References: TR-10-14 Section 11.

The Sender shall send a heartbeat at the declared period. The Receiver shall treat the Sender as disconnected after the silence TR-10-14 defines, and shall release the session state.

Requirements: USB-M-088 through USB-M-092.

6.7 Encryption and Authentication

References: TR-10-14 Section 12, Section 9.

A device claiming this capability shall implement the Privacy Encryption Protocol. Evaluation is performed with encryption enabled. Unencrypted operation is not evaluated and is not part of the certified claim.

The PEP Capability Requirements document defines the USB transport adaptation and evaluates the Privacy Encryption Protocol itself. This document does not restate it.

Requirements: USB-M-097 through USB-M-106, USB-A-008 through USB-A-011.

6.8 Discovery and Connection Signaling

References: TR-10-14 Section 14, Section 15.

This group covers how a Sender publishes its connection information so that a Receiver can find it and connect: the transport file, the connection role the Sender takes, and the NMOS transport parameters a Controller uses to manage the connection.

Requirements: USB-M-107 through USB-M-114.

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7. Self-Attested Features (Normative)

TR-10-14 defines more features than the certification floor in Section 9.3 covers. The features in this section are not evaluated and do not affect the badge. A vendor may claim any of them on the product's registry listing by attesting that the feature works as this section defines. The registry listing shows each feature as vendor attested, separately from the tested floor. TR-10-14 requires remote wake (Section 7.3). Remote wake is in this section because it is attested and not evaluated.

A self-attested feature works when a peripheral of the named class, attached to the USB Sender, enumerates on the Host behind the USB Receiver and performs its ordinary function for the whole session, using the Host operating system's standard driver for that class. Section 7.1 lists the ordinary function for each class and the TR-10-14 exchanges the claim depends on.

7.1 Peripheral Classes

The class specification column is informative. The normative behavior for every row is TR-10-14.

Registry entry	TR-10-14 exchanges the claim depends on	Ordinary function the vendor attests	Class specification (informative)
Keyboards and mice (HID)	Control and interrupt: Sections 9.14, 9.16, 9.18, 9.20	Tested at the floor, Section 9.3. Not attested.	USB Device Class Definition for Human Interface Devices (HID) 1.11
Other human interface devices (HID+): multi-touch	Control and interrupt	Input from the device reaches the Host. Output from the Host, such as indicator lights or motorized	USB HID 1.11

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Registry entry	TR-10-14 exchanges the claim depends on	Ordinary function the vendor attests	Class specification (informative)
devices, control surfaces		controls, reaches the device.	
Storage drives (MSC)	Control and bulk: Sections 9.14, 9.15, 9.18, 9.19	The drive mounts on the Host. Files written to the drive are read back and match.	USB Mass Storage Class, Bulk-Only Transport 1.0
Webcams (UVC)	Control and isochronous: Sections 9.14, 9.17, 9.18, 9.21	Video from the camera plays on the Host, in a format the camera advertises, without stopping.	USB Video Class 1.5
Audio devices (UAC): headsets, microphones, speakers	Control and isochronous	Playback and capture run continuously without stopping.	USB Audio Class 2.0
Serial and network adapters (CDC)	Control, bulk, and interrupt	Data passes in both directions.	USB Communications Device Class 1.2
USB hubs attached to a USB Sender port	Control and interrupt for the hub, plus the attached peripherals' exchanges	Peripherals attached through the hub enumerate and operate. The hub counts toward the USB 2.0 tier limit, after the tiers	USB 2.0 Specification, Section 11

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Registry entry	TR-10-14 exchanges the claim depends on	Ordinary function the vendor attests	Class specification (informative)
		declared in Section 7.2.	

TR-10-14 Section 7.2 states that IPMX USB has no frame synchronization mechanism, that this affects isochronous transfers, and that the implementer must solve it. A webcam or audio attestation covers the implementer's solution.

Requirements: USB-A-001 through USB-A-007 (isochronous exchanges).

7.2 USB Tiers Consumed

A vendor shall declare the number of USB hub tiers between the Host's root hub and a peripheral port on the USB Sender. An IPMX USB Receiver appears to the Host as a hub (TR-10-14 Section 7), so the path uses at least one tier. A USB Sender whose ports are behind an internal hub uses two tiers. Evaluation at the floor confirms the declared value by inspecting the Host's device tree.

USB 2.0 allows seven tiers. The Host's root hub is the first tier and the peripheral is the seventh. The declared value tells an integrator how many hubs can be added between the USB Sender and the peripheral.

7.3 Remote Wake

TR-10-14 requires a Sender to send Enter Sleep when all of its ports sleep, to send Resume Operation when a port resumes, and to send a Wake-on-LAN packet when a port resumes while wake-on-LAN is enabled by the Receiver's Wake-up Control message (Sections 9.11 through 9.13 and Section 13). This capability does not evaluate that behavior. The vendor attests the following: after the wake path is enabled through the control messages, a wake-capable peripheral attached to the USB Sender wakes the sleeping Host behind the USB Receiver, and the Wake-on-LAN packet includes the payload supplied when the wake path was enabled. The

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registry listing shows remote wake as vendor attested. Whether the Host wakes depends on the Host and its power management. See Section 10.4.

Requirements: USB-M-115 through USB-M-117, USB-P-005.

7.4 Cipher Modes Above the Mandatory Floor

A device claiming a cipher mode above the floor attests that sessions complete with that mode selected. The PEP Capability Requirements document defines the modes. This document does not restate them.

Requirements: USB-A-008 through USB-A-011.

8. Differences from TR-10-14 (Normative)

This capability uses TR-10-14's conformance language with one exception, stated below. Every other requirement keeps the class TR-10-14 gives it: mandatory, recommended, or permitted. Annex A records the class of each requirement.

8.1 Privacy Encryption Protocol Implementation Is Mandatory

TR-10-14	Recommends that IPMX USB messages are encrypted and authenticated (Section 9), and defines the unprotected message layout. A device with no encryption conforms to TR-10-14.
This capability	A device shall implement the Privacy Encryption Protocol, and evaluation is performed with encryption enabled. Unencrypted operation is not evaluated and is not part of the certified claim.

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Unchanged	The Privacy Encryption Protocol is the mechanism. TR-10-14 Section 12 requires it wherever encryption is used, and limits the cipher mode to a defined set.

9. Evaluation Scope (Normative)

9.1 What Is Certified

PQCR Section 5.2 and Section 5.3 define the device under test, product families and variants, and the published version manifest. This capability does not change them.

9.2 What the Vendor Declares Before Evaluation

Before evaluation is scoped, a vendor shall declare:

- Which role or roles the device implements: Sender, Receiver, or both.
- Remote wake, as Section 7.3 defines. Remote wake is attested, not evaluated.

A vendor may attest, for the registry listing:

- The peripheral classes supported (Section 7.1).
- The number of USB tiers the IPMX USB path consumes (Section 7.2).
- Cipher modes above the mandatory floor (Section 7.4).

Attested items are not evaluated.

9.3 Certification Floor and Sampling Policy

The certification floor is a keyboard and a mouse attached to the USB Sender at the same time, working on the Host behind the USB Receiver over an encrypted session. A device that passes the floor in each declared role receives the USB capability on its badge. A device that does not

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pass the floor does not receive the USB capability. The device's certification for other capabilities is not affected.

Evaluation covers one instance of each behavior at the floor, including the protocol events in Section 9.5. **It does not cover every port, every peripheral, or every combination.**

Axis	Coverage
Device role	Each declared role evaluated separately.
Channel role	The Control Channel and two Data Channels, one per peripheral.
Session lifecycle	Establishment, peripheral removal, transfer cancellation, stream reset, heartbeat expiry, and reconnection.

9.4 Evidence Classes

Each requirement in Annex A has one of the following evaluation methods:

Method	Meaning
Tested	A specific procedure or automated check evaluates the behavior directly.
Inspection	Checked by examining the transport file, NMOS resources, or a packet capture. No dedicated procedure is needed.
Demonstrated	Observed indirectly through successful peripheral operation. The peripheral cannot work without the behavior, but the behavior is not tested on its own.

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Method	Meaning
Vendor attestation	The vendor's declaration is the evidence. Used where the behavior cannot be observed from outside the device, and for the self-attested features in Section 7.
Not currently evaluated	Normative in TR-10-14, with no current test procedure. Recorded so that the gap is visible.

A device that fails any Annex A requirement is non-conforming, whether or not the failure can be detected today. Closing the gaps marked in Annex A is the job of the test plan.

9.5 Protocol Event Coverage

Evaluation shall include, at minimum: a peripheral removed during a session, a transfer cancelled before it completes, a stream reset, and a heartbeat allowed to expire. TR-10-14 defines normative behavior for each of these events. The claim this capability makes includes recovery from these events.

10. Out of Scope (Informative)

10.1 Compliance of the Device's Own Peripheral Bus Implementation

TR-10-14 is built on the USB specification and does not change it. This capability evaluates the IPMX transport of USB. It does not evaluate the conformance of the device's own USB implementation. That remains the vendor's responsibility through the body that defines USB.

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10.2 Peripheral Function and Device Class Behavior

TR-10-14 supports any peripheral type and any use case. This capability evaluates only the keyboard and mouse at the certification floor. Other peripheral classes are self-attested under Section 7.

10.3 Latency, Effective Bandwidth, and Isochronous Viability

TR-10-14 Section 7 states that IPMX USB cannot meet the delay limit the USB specification sets for a hub, that IPMX USB has no frame synchronization mechanism, and that the implementer must solve this. This capability makes no claim about latency, bandwidth, responsiveness, or suitability for isochronous transfers.

10.4 Host Operating System and Driver Stack Behavior

Enumeration timing, driver behavior, and operating system power management are outside the IPMX boundary and are not evaluated.

10.5 Vendor-Specific Payload Semantics

TR-10-14 does not define the content or meaning of vendor-specific message payloads. They are not evaluated and are not recorded on the certification listing. The framing and identifier handling for these messages are mandatory and are evaluated under Section 6.3.

11. Conformance Statement (Normative)

Successful evaluation of this capability shows that the device implements the IPMX USB behaviors VSF TR-10-14 defines, within the scope of Section 9, and that a keyboard and a mouse work across the connection with encryption enabled, in the declared configurations.

Self-attested features under Section 7 are vendor claims and are not covered by this statement. No claim is made about latency, responsiveness, or suitability for isochronous transfers. See Section 10.3.

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Annex A: Requirement Index (Normative)

This index is a navigation aid. VSF TR-10-14 is authoritative for every entry. Where this index and TR-10-14 conflict, TR-10-14 governs. Handles name the subject of a requirement and do not restate it. Where the prose and the tables in TR-10-14 differ, TR-10-14 Section 2 states that the prose governs.

Identifier scheme: USB-<class>-<nnn>. The class is M (mandatory), A (attested), R (recommended), or P (permitted). Identifiers do not change between revisions of this document and are never reused.

A.1 Channel Architecture and Message Framing

ID	Clause	Actor	Handle	Class	Evaluation
USB-M-001	8	Both	Channels are point-to-point	M	Inspection
USB-M-002	8	Both	One control channel per pairing	M	Inspection
USB-M-003	8	Both	Channel transport protocol	M	Inspection
USB-M-004	8	Both	Payload carried as defined messages	M	Inspection
USB-M-005	9	Both	Message byte order	M	Inspection
USB-M-006	9	Both	Message field structure	M	Inspection
USB-M-009	9	Both	Message type field encoding	M	Inspection

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-010	9	Both	Reserved bit transmission value	M	Inspection
USB-M-011	9	Both	Message length bounds	M	Inspection
USB-M-012	9	Both	Authentication field coverage	M	Demonstrated
USB-M-014	9	Both	Counter field carries the AES-CTR counter	M	Demonstrated
USB-M-015	9	Both	Key version field carries the PEP key version	M	Demonstrated
USB-M-016	9	Both	Data field encrypted and authenticated	M	Demonstrated
USB-M-017	9	Both	MAC field is the 64 MSB of the CMAC, encrypted	M	Demonstrated
USB-M-018	12	Both	Message signed before encryption, MAC last	M	Demonstrated
USB-R-001	9	Both	Reserved bits ignored on reception	R	Not currently evaluated

A.2 Session Establishment and Teardown

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-019	8.3	Both	Control channel established from sender connection data	M	Demonstrated
USB-M-020	8.3	Both	Data channels established from receiver connection data	M	Demonstrated
USB-M-021	8.3.1.1	Receiver	Connection status sent on receipt of connection information	M	Tested
USB-M-022	8.3.1.1	Sender	Connection information sent after accept	M	Tested
USB-M-023	8.3.1.2	Sender	One data channel per occupied downstream port	M	Demonstrated
USB-M-024	8.3.1.2	Sender	Data channel closed on peripheral removal	M	Tested
USB-M-025	8.3.1.2	Sender	Sender initiates the data channel connection	M	Demonstrated
USB-M-026	8.3.1.2	Sender	Stream information sent, status awaited	M	Tested
USB-M-027	8.3.1.2	Sender	Readiness for submits follows status receipt	M	Demonstrated

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-028	8.3.1.2	Receiver	Stream status sent on stream information	M	Tested
USB-M-029	8.3.1.2	Receiver	No submits before status is sent	M	Tested
USB-M-030	8.1	Both	Control channel message set and directions	M	Tested
USB-M-031	8.2	Both	Data channel message set and directions	M	Tested

A.3 Control Channel Message Set

ID	Clause	Actor	Handle	Class	Evaluation
USB-M-032	9.1	Sender	Connection information layout per Table 2, 66 bytes	M	Tested
USB-M-033	9.1	Sender	Protocol version fields set to 0	M	Tested
USB-M-034	9.1	Sender	Serial number padded with zeros, unique per company ID	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-035	9.1	Both	Reserved bits in connection information	M	Tested
USB-M-036	9.2	Receiver	Connection status layout per Table 3, 68 bytes	M	Tested
USB-M-037	9.2	Receiver	Receiver version not above the sender version	M	Tested
USB-M-038	9.2	Receiver	Heartbeat index within 5 to 30	M	Tested
USB-M-039	9.2	Sender	Data channels connect to the receiver port in connection status	M	Demonstrated
USB-M-040	9.2	Receiver	Serial number padded with zeros, unique per company ID	M	Tested
USB-M-041	9.2	Both	Reserved bits in connection status	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
USB-P-001	9.4	Sender	Vendor specific information may be sent	P	Not currently evaluated
USB-M-042	9.4	Receiver	All vendor specific information accepted	M	Tested
USB-M-043	9.4	Receiver	Unrecognized vendor specific information ignored	M	Tested
USB-M-044	9.4	Sender	Vendor specific information layout per Table 4	M	Tested
USB-M-045	9.5	Receiver	Every vendor specific query answered	M	Tested
USB-M-046	9.5	Sender	Vendor specific query layout per Table 5, 4 bytes	M	Tested
USB-M-047	9.6	Receiver	Unknown query answered with status 255 and no data	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-048	9.6	Receiver	Query type 0 answered without error, string at most 256 bytes	M	Tested
USB-M-049	9.6	Receiver	Query return company ID matches the query	M	Tested
USB-M-050	9.6	Receiver	Query return layout per Table 6	M	Tested

Sentences in TR-10-14 Sections 9.1, 9.2, and 9.3 that repeat the Section 8.3 handshake and the Section 11 heartbeat requirements are indexed under A.2 and A.6.

A.4 Data Channel Message Set and Transfer Semantics

ID	Clause	Actor	Handle	Class	Evaluation
USB-M-051	9.7	Sender	Stream information layout per Table 7, 66 bytes	M	Tested
USB-M-052	9.7	Sender	Sub-stream identifier assignment	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
			and direction bit		
USB-M-053	9.7	Sender	Bus identifier padded, unique per sender and bus	M	Tested
USB-M-054	9.8	Receiver	Stream status layout per Table 8, 1 byte	M	Tested
USB-M-055	9.8	Receiver	Connection status value 0 OK, 255 error, others reserved	M	Tested
USB-P-002	9.9	Receiver	Stream reset may be sent after stream information	P	Not currently evaluated
USB-M-056	9.9	Receiver	No message to the port until stream reset return	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-057	9.10	Sender	Stream reset return sent when the reset is processed	M	Tested
USB-M-058	9.14	Receiver	Control submit only to control endpoints	M	Tested
USB-M-059	9.14	Receiver	Control submit layout per Table 10	M	Tested
USB-M-060	9.14	Receiver	Submit sequence number starts at 0 and increments by one	M	Tested
USB-M-061	9.14	Both	Reserved bits in submit messages	M	Tested
USB-M-062	9.14	Receiver	Direction bit encoding in submit messages	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-063	9.14	Receiver	Control transfer length equals wLength	M	Tested
USB-M-064	9.14	Receiver	Transfer length exact for OUT, maximum for IN	M	Tested
USB-M-065	9.15	Receiver	Bulk submit only to bulk endpoints	M	Vendor attestation
USB-M-066	9.15	Receiver	Bulk submit layout per Table 11	M	Vendor attestation
USB-M-067	9.15	Receiver	Bulk transfer data per USB 2.0 Section 4.7.2	M	Vendor attestation
USB-M-068	9.16	Receiver	Interrupt submit only to interrupt endpoints	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-069	9.16	Receiver	Interrupt submit layout per Table 11	M	Tested
USB-A-001	9.17	Receiver	Isochronous submit only to isochronous endpoints, layout per Table 12	A	Vendor attestation
USB-A-002	9.17	Receiver	Isochronous start frame and as-soon-as-possible flag	A	Vendor attestation
USB-A-003	9.17	Receiver	Isochronous packet lengths exact for OUT, maximum for IN, at most 1024	A	Vendor attestation
USB-M-070	9.18	Sender	Control submit return sent for every	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
			control submit		
USB-M-071	9.18	Sender	Submit return layout per Table 14	M	Tested
USB-M-072	9.18	Sender	Return sequence number, endpoint, and direction match the submit	M	Tested
USB-M-073	9.18	Both	Reserved bits in submit return messages	M	Tested
USB-M-074	9.18	Sender	Actual length 0 for OUT, never above transfer length for IN	M	Tested
USB-M-075	9.19	Sender	Bulk submit return sent for every bulk submit	M	Vendor attestation

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-076	9.19	Sender	Bulk return data per USB 2.0 Section 4.7.2	M	Vendor attestation
USB-M-077	9.20	Sender	Interrupt submit return sent for every interrupt submit	M	Tested
USB-A-004	9.21	Sender	Isochronous submit return sent for every isochronous submit, layout per Table 15	A	Vendor attestation
USB-A-005	9.21	Sender	Isochronous return packet count matches the submit	A	Vendor attestation
USB-A-006	9.21	Sender	Isochronous actual length within the submitted	A	Vendor attestation

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ID	Clause	Actor	Handle	Class	Evaluation
			length, 0 for OUT		
USB-P-003	9.22	Receiver	Cancel submit may be sent after a submit	P	Not currently evaluated
USB-M-078	9.22	Receiver	Cancel submit layout per Table 17	M	Tested
USB-M-079	9.22	Receiver	Cancel fields match the submit being cancelled	M	Tested
USB-M-080	9.23	Sender	Cancel submit return sent for every cancel submit	M	Tested
USB-M-081	9.23	Sender	Cancel submit return layout per Table 18, 7 bytes	M	Tested
USB-M-082	9.23	Sender	Cancel return fields match	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
			the cancel submit		

Sentences in TR-10-14 Sections 9.7 and 9.8 that repeat the Section 8.3.1.2 handshake are indexed under A.2. The sentences that permit submits after stream status are covered by USB-M-029.

A.5 Transfer Status Reporting

ID	Clause	Actor	Handle	Class	Evaluation
USB-M-083	9.18	Sender	Request status carried in every submit return	M	Tested
USB-M-084	9.23	Sender	Request status carried in every cancel submit return	M	Tested
USB-M-085	A.1	Sender	Success status on completed transfer	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-086	A.1	Sender	Failure reported with a status code from Table 20	M	Tested
USB-M-087	A.1	Sender	Unmatched conditions reported as unknown error	M	Tested
USB-A-007	9.21	Sender	Per-packet isochronous status from Table 20	A	Vendor attestation

A.6 Liveness and Non-Responsive Peer Handling

ID	Clause	Actor	Handle	Class	Evaluation
USB-M-088	11	Sender	Heartbeat sent once per heartbeat period	M	Tested
USB-M-089	11	Both	Heartbeat period computed	M	Tested

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ID	Clause	Actor	Handle	Class	Evaluation
			from the heartbeat index		
USB-M-090	11	Receiver	Sender non-responsive after two periods without heartbeat	M	Tested
USB-M-091	11	Receiver	Non-responsive sender disconnected	M	Tested
USB-M-092	11	Sender	Exclusive state released on disconnect	M	Tested

A.7 Multi-Peer Access and Connection Limits

ID	Clause	Actor	Handle	Class	Evaluation
USB-M-093	10	Both	Each sender and receiver pair uses its	M	Not currently evaluated

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ID	Clause	Actor	Handle	Class	Evaluation
			own channel set		
USB-M-094	10	Receiver	Receiver connects to each sender individually	M	Not currently evaluated
USB-R-002	10	Sender	Sender accepts each receiver individually	R	Not currently evaluated
USB-P-004	10	Both	Simultaneous connection limit permitted	P	Not currently evaluated
USB-M-095	10	Receiver	No new sender connection at the limit	M	Not currently evaluated
USB-M-096	10	Sender	Receiver connection refused at the limit	M	Not currently evaluated

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A.8 Encryption and Authentication

ID	Clause	Actor	Handle	Class	Evaluation
USB-M-097	12	Both	Privacy Encryption Protocol implemented (Section 8.1)	M	Demonstrated
USB-M-098	12	Both	Privacy attribute present in the SDP transport file	M	Inspection
USB-M-099	12	Both	Privacy parameters present in NMOS transport parameters	M	Inspection
USB-M-100	12	Both	AES-128-CTR_CMAC-64-AAD mode supported	M	Demonstrated
USB-M-101	12	Both	Mode parameter from the defined set	M	Inspection

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ID	Clause	Actor	Handle	Class	Evaluation
USB-M-102	12	Both	CMAC keyed with the privacy cipher key	M	Demonstrated
USB-M-103	12	Both	Encrypted portion sliced in 16 bytes, padding discarded	M	Demonstrated
USB-M-104	12	Both	Encryption key is the PEP privacy key	M	Demonstrated
USB-M-105	12	Both	Sub-stream identifiers per Table 19, unique at any time	M	Demonstrated
USB-M-106	12	Sender	Key version incremented and counter reset per TCP session	M	Demonstrated

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ID	Clause	Actor	Handle	Class	Evaluation
USB-A-008	12	Both	AES-256-CTR_CMAC-64-AAD mode	A	Vendor attestation
USB-A-009	12	Both	ECDH_AES-128-CTR_CMAC-64-AAD mode	A	Vendor attestation
USB-A-010	12	Both	ECDH_AES-256-CTR_CMAC-64-AAD mode	A	Vendor attestation
USB-A-011	12	Both	CMAC block cipher follows the key length	A	Vendor attestation

Statements that apply only to unencrypted operation are not indexed, because unencrypted operation is not part of the certified claim (Section 6.7). The rows marked Demonstrated are exercised by the encrypted session at the floor. The Privacy Encryption Protocol itself is evaluated under the PEP Capability Requirements.

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A.9 Power and Wake Behavior

ID	Clause	Actor	Handle	Class	Evaluation
USB-P-005	9.11	Receiver	Wake-up control message, 1 to 7 bytes, per Table 9	P	Not currently evaluated
USB-M-115	9.12	Both	Enter sleep sent when all ports sleep; connections closed	M	Vendor attestation
USB-M-116	9.13	Sender	Resume operation sent when a port resumes with wake disabled	M	Vendor attestation
USB-M-117	13	Sender	Wake-on-LAN packet sent on resume with the supplied password	M	Vendor attestation

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A.10 Discovery and Connection Signaling

ID	Clause	Actor	Handle	Class	Evaluation
USB-M-107	8.1	Sender	Sender connection data delivered by NMOS	M	Inspection
USB-M-108	14	Sender	SDP follows RFC 4145	M	Inspection
USB-M-109	14	Sender	Media line application/usb over TCP with the sender port	M	Inspection
USB-M-110	14	Sender	Privacy attribute with protocol USB_KV and a valid mode	M	Inspection
USB-M-111	14	Sender	Setup attribute role passive	M	Inspection
USB-M-112	15.1	Sender	Sender transport parameters source_ip	M	Inspection

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ID	Clause	Actor	Handle	Class	Evaluation
			and source_port		
USB-M-113	15.2	Receiver	Receiver transport parameters source_ip, interface_ip, source_port	M	Inspection
USB-M-114	15	Both	PEP privacy transport parameters when PEP is used	M	Inspection

Appendix B: Change Log (Informative)

Version	Date	Summary of Changes
1.0	2026-10-27	First release.
0.1 DRAFT	2026-07	Initial draft.

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