Errata for "On-The-Go and Embedded Host Supplement to the USB Revision 2.0 Specification, Revision 2.0, May 8, 2009", as of May 25, 2010

Contributors

Add missing contributors

Background: Contributors to the supplement are missing from the list.

Add the following to the list of contributors:

Pat Crowe, MQP, Ken Helfrich, Maxim, Sebastian Capella, Broadcom

Chapter 1

Compliance plan includes Battery charging

Background: Reference to compliance plan does not include Battery Charging.

Changes to section 1.1:

Modify the following reference in Section 1.1:

[BC, OTG and EHCompliance2.0]	*USB Battery Charging, OTG and EH Compliance Plan, revision 2.0*

Clarify definition of A-Port

Background: Definition of an A-port is mentioned in section 2.1 but is missing from the definitions at the start of the document.

Changes to section 1.2:

Add the following definition in Section 1.2, page 2, immediately after the "A-Device" definition:

A-Port	*USB port with an A plug inserted into its receptacle. This port acts as an A-device.*

Clarify definition of ADP probing

Background: Definition indicates that ADP probing may be used to detect the current attachment status. Definition should be amended to show that ADP probing will only indicate changes in attachment status.

Changes to section 1.2:

Replace section 1.2, page 2, ADP probing definition:

ADP probing *This enables the local A-device or B-device to probe VBUS and determine whether a device is attached.*

with the following:

ADP probing *This enables the local A-device or B-device to probe VBUS and detect a change in attachment status.*

Chapter 2

Clarify use of ADP probing

Background: Descriptions of ADP probing indicate that it may be used to detect the current attachment status. Uses should be amended to show that ADP probing will only indicate changes in attachment status.

Changes to section 2.1.1:

Replace section 2.1.1, page 4, bullet 3:

3. If the Targeted Host has applications that will run automatically as soon as attachment to a particular device is detected, then it is required in this particular case that these hosts support the Attach Detection Protocol (ADP). As soon as the presence of a device is detected, the host starts providing power via the USB A-port, waits for connect, and then queries the device type, etc.

with the following:

3. *If the device has applications that will run automatically as soon as attachment to a particular device is detected, then it is required in this particular case that these devices support the Attach Detection Protocol (ADP). The device detects device attachment changes using ADP.*
    a. *When a change is detected, by an A-device it will start providing power via the USB A-port. If no device is connected, power is turned off again. If the presence of a device is detected, then the A-device queries the device type, etc.*
    b. *When a change is detected by a B-device it will issue a request for power to be turned on (SRP). If no device is connected power will not be provided. If power is detected then the B-device will respond to queries for device type etc.*

Changes to section 2.1.2:

Replace section 2.1.2, third paragraph on page 4:

A slightly more complicated example is a mobile device that supports HID devices. Since the power on the mobile device is at a premium, it does not continually provide power via the USB A-port even when a Micro-A plug is attached. However it is still able to detect device attachment to the Micro-B plug using ADP. As soon as the keyboard is attached the mobile device will start providing power via the USB A-port, and start an application that responds to keystrokes.

with the following:

A slightly more complicated example is a mobile device that supports HID devices. Since the power on the mobile device is at a premium, it does not continually provide power via the USB A-port even when a Micro-A plug is attached. However it is still able to detect device attachment changes to the Micro-B plug using ADP. When a change is detected, it powers the A-port. If the keyboard is detected, it will start an application that responds to keystrokes.

Changes to section 2.5:

Replace footnote 2 on page 5:

2 The A-device can use a variety of methods to determine that there is no device available: 1) Lack of A-plug insertion, 2) no connect in response to V_{BUS} assertion, or 3) ADP.

With the following:

2 The A-device can use a variety of methods to determine that there is no device available: 1) Lack of A-plug insertion, 2) no connect in response to V_{BUS} assertion.

Chapter 3

Clarify A-device remote wakeup behavior:

Background: Supplement is not clear enough that the use of suspend for power saving purposes is not recommended. In particular the use of suspend by the B-Host is more likely to result in HNP, since it has relinquished the bus. Therefore, the enabling of remote wakeup by B-devices shall not be permitted. In addition A-devices shall not perform remote wakeup signaling.

Changes to section 3.3.4:

Delete the following text:

"The A-device has the option to use the [USB2.0] mechanisms of suspend, resume and remote wakeup for power management including LPM. A-devices attached to other SRP-capable devices can also manage their power by ending the session. The OTG and EH supplement adds no new requirements for remote wakeup in addition to those in [USB2.0]."

Add the following text to the start of section:

"An Embedded Host, OTG A-host or OTG B-peripheral may use the [USB2.0] mechanisms of suspend, resume and remote wakeup, including LPM, for power mangement. In this case the OTG and EH supplement shall add no new requirements in addition to those in [USB2.0]. A-devices attached to other SRP-capable devices may also manage their power by ending the session.

OTG B-hosts and OTG A-peripherals should not use the [USB2.0] mechanisms of suspend, resume and remote wakeup for power management (suspend shall be used during HNP) including LPM since the resulting behavior is indeterminate."

Embedded Hosts are permitted to support only Low Speed:

Background: Supplement indicates that Full Speed support is mandatory. While this is the case for OTG devices, Embedded Hosts are permitted to provide only Low Speed capability.

Changes to section 3.4.9:

Modify section 3.4.9:

A Targeted Host shall be able to support full-speed peripherals. Support for low and high speeds is optional, and is dependant on the Targeted Hosts TPL. An OTG device shall be able to operate as a full-speed peripheral. Operation as a high-speed peripheral is optional. Operation as a low-speed peripheral is prohibited.

To the following:

An OTG device shall be able to support full-speed peripherals. Support for low and high speeds is optional, and is dependant on the OTG device's TPL. An OTG device shall be able to operate as a full-speed peripheral. Operation as a high-speed peripheral is optional. Operation as a low-speed peripheral is prohibited.

Add the following paragraph:

An Embedded Host shall support one of the following combinations of speeds based on its Targeted Peripherals List:

- *High-speed, full-speed and low-speed*
- *High-speed and full-speed*
- *Full-speed only*
- *Full-speed and low-speed*
- *Low-speed only*

Should a particular speed be not supported an appropriate message shall be displayed indicating the failure to the user.

Correct messaging text with respect to hubs

Background: Text refers to Embedded Host where Targeted Host was intended. It does not reflect the practice in compliance or the reality of stacks implemented for hub support

Changes to section 3.5:

Replace section 3.5, paragraph 3, page 10:

If hubs are supported different messages for hubs and non-hubs are required. If the attached peripheral is a hub, the embedded host shall be able to display a message indicating that the attached hub is not supported. Care should be taken to distinguish between standalone hubs and compound peripherals.

Examples of messages are:

- *Device not supported*
- *Device not responding*
- *Hubs not supported*
- *Invalid hub topology*

with the following text:

Different messages for hubs and non-hubs shall be displayed. If the attached peripheral is an unsupported hub, the Targeted Host shall be able to display a message indicating that the attached hub is not supported; this message shall be different from the message indicating an unsupported peripheral. When a supported hub is attached a Targeted Host shall also display a message indicating when:

- more than the maximum tier of supported hubs attached to the Targeted Host are attached or
- more than the maximum number of supported peripherals are attached to hub ports or
- more than the maximum instances of a given peripheral or device class is exceeded.

Messages shall distinguish between standalone hubs and compound peripherals.

Examples of messages where devices are attached without a hub are:

- Device not supported
- Device not responding

Examples of message relating to hubs and compound devices are:

- Max hub tier exceeded
- Too many peripherals attached
- Too many peripheral instances attached

Chapter 4

Incorrect section reference:

Background: The supplement refers to section 5.2.1 where section 5.1.1 would be a more relevant reference.

Changes to section 4.2.1:

Replace the 2nd^{t} paragraph, 2nd sentence:

This ensures an attached B-device has time to connect (see Section 5.2.1).

With the following

This ensures an attached B-device has time to connect (see Section 5.1.1).

Clarification of $I_{A\_VBUS\_RATED}$

Background: The supplement refers to currents less that the rated current of the A-device when it should also be possible to supply the rated current.

Changes to section 4.2.1:

Replace the 4th paragraph:

For a step change in load current with any amplitude less than the rated current of the A-device ($I_{A\_VBUS\_RATED}$), and an edge rate of less than 100mA/usec, the transient output voltage from an A-device shall remain within $V_{A\_VBUS\_TRNS\_LO}$ ($I_{A\_VBUS\_RATED} \leq 100mA$) or $V_{A\_VBUS\_TRNS\_HI}$ ($100mA < I_{A\_VBUS\_RATED}$).

With the following

For a step change in load current with any amplitude less than or equal to the rated current of the A-device ($I_{A\_VBUS\_RATED}$), and an edge rate of less than 100mA/usec, the transient output voltage from an A-device shall remain within $V_{A\_VBUS\_TRNS\_LO}$ ($I_{A\_VBUS\_RATED} \leq 100mA$) or $V_{A\_VBUS\_TRNS\_HI}$ ($100mA < I_{A\_VBUS\_RATED}$).

Changes to section 4.2.2:

Replace the 2nd paragraph:

If an attached B-device draws less current than $I_{A\_VBUS\_RATED}$ after $T_{A\_VBUS\_RISE}$, then V_{BUS} shall remain valid.

With the following

If an attached B-device draws less than or equal to $I_{A\_VBUS\_RATED}$ after $T_{A\_VBUS\_RISE}$, then V_{BUS} shall remain valid.

Clarification of $T_{A\_VBUS\_RISE}$

Background: In Section 4.2.2 and section 4.2.4, there are 2 timing constraints:
- $T_{A\_VBUS\_RISE}$ (100ms) for V_{BUS} to reach $V_{A\_VBUS\_AVG\_LO}$ (4.4V)
- $T_{A\_VBUS\_ATT}$ (200ms) for V_{BUS} to reach $V_{OTG\_SESS\_VLD}$ (4.0V)

$T_{A\_VBUS\_RISE}$ should not be linked to any attachment event but only to the rising of V_{BUS} as the attachment timing constraint is defined by $T_{A\_VBUS\_ATT}$. The proposal is to remove the condition "or after an attach event" in section 4.2.2.

Changes to section 4.2.2:

Replace the 1st paragraph 1st sentence:

After starting to drive V_{BUS}, or after an attach event, the output voltage from the A-device shall reach a voltage of $V_{A\_VBUS\_AVG\_LO}$ min (see Section 4.2.1) within a time of $T_{A\_VBUS\_RISE}$, providing the noninrush load current does not exceed the rated current of the A-device ($I_{A\_VBUS\_RATED}$).

With the following:

After starting to drive V_{BUS}, the output voltage from the A-device shall reach a voltage of $V_{A\_VBUS\_AVG\_LO}$ min (see Section 4.2.1) within a time of $T_{A\_VBUS\_RISE}$, providing the noninrush load current does not exceed the rated current of the A-device ($I_{A\_VBUS\_RATED}$).

Clarification of "other probing methods"

Background: Use of the term "other probing methods" may appear to allow non-ADP probing methods. Instead, the reference is changed to refer to other "implementations" of ADP.

Changes to section 4.2.3:

Replace the second paragraph:

For an ADP-capable A-device the V_{BUS} capacitance may be limited to C_{ADP_VBUS} by the ADP probing method described in Section 5.4. If other probing methods are used there must be a probe ramp that crosses VADP_SNS so detection will still work in the remote end.

With:

For an ADP-capable A-device the V_{BUS} capacitance may be limited to C_{ADP_VBUS} by the ADP probing implementation described in Section 5.4. If other ADP probing implementations are used there must be a probe ramp that crosses V_{ADP_SNS} so detection will still work in the remote end.

Clarification related to ADP-capable devices:

Background: The supplement indicates behavior relating to ID pin detection but does not state clearly enough that there are different requirements for ADP-capable devices.

Changes to section 4.2.4:

Replace the section:

When a Micro-A plug is attached the ID pin becomes FALSE as defined in [Micro-USB1.01]. When an OTG A-device is ready to act in host or peripheral roles, and VBUS is not present, it is required to reach $V_{OTG\_SESS\_VLD}$ max within $T_{A\_VBUS\_ATT}$ of the ID pin becoming FALSE unless an over-current condition is reached (see Section 4.2.2). The Standard-A plug does not contain an ID pin so this requirement is not applicable to an EH.

See also Section 5.4 for requirements relating to ADP-capable devices.

With the following

When a Micro-A plug is attached the ID pin becomes FALSE as defined in [Micro-USB1.01]. For a non-ADP-capable OTG A-device, whenever the application is ready to act in host or peripheral roles, VBUS is required to reach VOTG_SESS_VLD max within TA_VBUS_ATT of the ID pin becoming FALSE unless an over-current condition is reached (see Section 4.2.2). The Standard-A plug does not contain an ID pin so this requirement is not applicable to an EH.

Section 5.4 contains requirements relating to ADP-capable devices.

Incorrect term "norminal":

Background: The supplement uses the word "norminal" where "nominal" was intended

Changes to section 4.3.4:

Replace the 1st paragraph, 2nd sentence:

Capacitance of this capacitor, including its norminal tolerance, shall not go below the minimum value of CRPB min.

With the following

Capacitance of this capacitor, including its nominal tolerance, shall not go below the minimum value of CRPB min.

Clarification of ROTG_VBUS voltage range:

Background: We now have a min. 10kOhm input impedance requirement for OTG devices. This is needed just for the ADP operation, for which the voltage is always below 0.8V.Therefore the voltage range for the ROTG_VBUS conditions is: VBUS < VADP_PRB max. This allows lower input resistance at higher voltage levels..

Changes to section 4.4, Table 4-1:

Add the condition VBUS < VADP_PRB max to ROTG_VBUS.

Parameter	Symbol	Conditions	Min	Max	Units	Ref
Terminations:						
VBUS resistance	ROTG_VBUS	VBUS < VADP_PRB max	10		kΩ	4.1.1

Clarification of TAVG_VBUS timing:

Background: TAVG_VBUS is defined such that it can be any value less than 1 second. The intention of this value was that averaging should take place over about 1 second.

Changes to section 4.4, Table 4-1:

Add the condition VBUS < VADP_PRB max to ROTG_VBUS.

Parameter	Symbol	Conditions	Min	Max	Units	Ref
DC Electrical Timing:						
Period of measurement for VA_VBUS_AVG_LO and VA_VBUS_AVG_HI	TAVG_VBUS		0.9	1.1	sec	4.2.1 4.3.1

Clarification of IADP_SINK value:

Background: IADP_SINK is used to set the VBUS line to a predetermined level, a level that is repeatable for every measurement. The time measured by ADP is the time it takes the IADP_SRC current source to charge whatever capacitance there is at present from the voltage level IADP_SINK ends at to the level VADP_PRB. In order to make this measurement consistent, there is really only one requirement: it must be discharged to below 0.15v.

Changes to section 4.4, Table 4-1:

Add the following footnote to the IADP_SINK parameter:

IADP_SINK is specified to discharge VBUS below VADP_DSCHG within a time of TADP_DSCHG. The important parameter is that VBUS is discharged below VADP_DSCHG within a time of TADP_DSCHG. Other methods to discharge VBUS are allowed as long as they discharge to the same level in the same amount of time.

Clarification of IADP_SRC value:

Background: IADP_SRC current is only +/-20%, which is difficult to achieve with a poly resistor based current because some processes exceed +/-20% poly resistor variation. If this cannot be quite met, the overall ADP function can still be met, either by sampling faster than 32khz clock, with both edges, or tightening the ADP probe threshold voltage range.

Changes to section 4.4, Table 4-1:

Add the following footnote to the IADP_SRC parameter:

Other implementations or ranges are possible provided the system time constants are observed.

Modification of ADP probing voltage:

Background: When an A-device uses an ADP probe voltage of 0.8v this may trigger a session on the B-device due to noise (assumed to be max 50mV).in this case the B-device sees a session briefly at the ADP rate which then disappears. V_{ADP_PRB} max should be no more than 0.75v to allow for noise.

Changes to section 4.4, Table 4-1:

Modify the V_{ADP_PRB} max value to be 0.75v:

Parameter	Symbol	Conditions	Min	Max	Units	Ref
Thresholds:						
ADP probing voltage	V_{ADP_PRB}		0.6	~~0.8~~0.75	V	5.4.2

Modification of ADP change minimum threshold:

Background: C_{ADP_THR} min is currently defined as 1nF. After heavy use cases the temperature of the internal capacitor decreases and as the capacitance strongly depends on the temperature, there will be some capacitance change even after a couple of seconds. The local device should avoid detecting an ADP event when the capacitance on the remote device changes or by a short term change in temperature in the local device.

Changes to section 4.4, Table 4-1:

Parameter	Symbol	Conditions	Min	Max	Units	Ref
Capacitance:						
ADP threshold capacitance	C_{ADP_THR}		~~1~~200	900	nF	5.4.2

Chapter 5

Clarify HNP behavior when operating in HS mode:

Background: The supplement is ambiguous about when/whether the hardware switches to FS mode from HS mode.

Changes to section 5.2.1:

Delete footnote 11, page 19.

Replace Section 5.2.1, bullet F:

A-device detects lack of bus activity for more than $T_{A\_BIDL\_ADIS}$ min and turns off its D+ pull-up[11]. Alternatively, if the A-device has no further need to communicate with the B-device, the A-device may turn off V_{BUS} and end the session.

with the following text::

The A-device shall detect the lack of bus activity. If the bus is operating in HS mode, it shall first revert to FS suspend mode according to [USB2.0]. The A-device shall detect J-state (full-speed idle) for at least $T_{A\_BIDL\_ADIS}$ min and shall turn off its D+ pull-up. Alternatively, if the A-device has no further need to communicate with the B-device, the A-device may turn off V_{BUS} and end the session.

Clarify that A-device shall complete HNP:

Background: The normal mode of operation is for the A-Device to enable b_hnp_enable, suspend and then either wait for the B- device to perform HNP (by lowering its D+ resistor) or resume. The B-device then waits for the A-device to connect by asserting D+. Once the A-device has initiated the HNP process by enabling HNP and suspending the bus and sees that the B-device has become host it is not then allowed to terminate the process via reset or resume.

Changes to section 5.2.5.1:

Replace paragraph 2:

After the bus enters the Suspend state, the B-device will transition from acting as a peripheral to waiting for the A-device to indicate a connect event, which would complete the transfer of control to the B-device. While waiting for the A-device to indicate a connect event, the B-device may detect a K state on the bus. This indicates that the A-device is signaling a resume condition and is retaining control of the bus. In this case, the B-device will return to acting as a peripheral.

With the following:

After the bus enters the Suspend state, the B-device will transition from acting as a peripheral to waiting for the A-device to indicate a connect event, which would complete the transfer of control to the B-device. While waiting for the A-device to indicate a connect event, the B-device may detect a K state on the bus. This indicates that the A-device is signaling a resume condition, either because it commenced the resume before it saw the B-device lower its D+ resistor, or because it is exhibiting non-compliant behavior by retaining control of the bus after it saw the B-device disengage its D+ resistor. In this case, the B-device will return to acting as a peripheral.

Replace paragraph 4:

The A-device is not allowed to reset the bus during HNP in order to remain as host. The A-device is always required to complete HNP once it has been initiated.

With the following:

Once the A-device has initiated HNP (by enabling HNP and going to suspend) and detects SE0 (indicating that the B-device is requesting to become host) it shall complete the HNP process. The A-device shall not reset or resume the bus at this point in order to remain as host.

Remove incorrect reference to J-condition:

Background: The supplement indicates a J-condition (J-K transition) when neither device is pulling the data line high.

Changes to section 5.3.1:

Delete the 3rd paragraph first sentence:

However, if the B-device is waiting for the A-device to indicate a connect event (see Section5.2.5.1), then only a J-to-K transition is treated as a resume.

B-Device required to do ADP Sensing:

Background: A B-device, when attached to an A-device, and both are ADP capable, is required to do ADP-sensing. Modify text to require this.

Changes to section 5.4.1:

Replace the third paragraph:

If an A-device is attached to a B-device, and both support ADP, then the A-device is required to perform ADP probing, while the B-device is allowed to do ADP sensing. During ADP sensing, the B-device looks for ADP activity on the VBUS line. If ADP activity is detected, then the B-device knows that the A-device is still attached.

With:

If an A-device is attached to a B-device, and both are not in a session, and both support ADP, then the A-device shall perform ADP probing, while the B-device shall peform ADP sensing. During ADP sensing, the B-device looks for ADP activity on the VBUS line. If ADP activity is detected, then the B-device knows that the A-device is still attached.

Clarify dependence on charge state of capacitors for discharge:

Background: When discharging the capacitors prior to ADP probing, the spec requires Tadp_dschg be long enough for all combinations of remote resistance, capacitance and leakage current, but doesn't specify initial capacitor charge which may be as high as $V_{OTG\_SESS\_VLD}$ max. Ensure this is added as a consideration:

Changes to section 5.4.2:

Replace top paragraph below Figure 5-6:

To measure the capacitance on the V_{BUS} line, the local device first discharges the V_{BUS} line below V_{ADP_DSCHG} by turning on the current sink (I_{ADP_SINK}) for a fixed amount of time. This time (T_{ADP_DSCHG}) must be long enough to ensure that V_{BUS} goes below V_{ADP_DSCHG} for all valid combinations of remote resistance, capacitance and leakage current. After the V_{BUS} voltage is below V_{ADP_DSCHG}, the current sink is turned off, and the current source (I_{ADP_SRC}) is turned on. When the V_{BUS} voltage reaches V_{ADP_PRB}, the current source is turned off. The time required for V_{BUS} to rise to V_{ADP_PRB} (T_{ADP_RISE}) is measured.

With:

To measure the capacitance on the VBUS line, the local device first discharges the VBUS line below VADP_DSCHG by turning on the current sink (IADP_SINK) for a fixed amount of time. This time (TADP_DSCHG) must be long enough to ensure that VBUS goes below VADP_DSCHG for all valid combinations of remote resistance, capacitance, initial voltage (up to VOTG_SESS_VLD MAX), and leakage current. After the VBUS voltage is below VADP_DSCHG, the current sink is turned off, and the current source (IADP_SRC) is turned on. When the VBUS voltage reaches VADP_PRB, the current source is turned off. The time required for VBUS to rise to VADP_PRB (TADP_RISE) is measured.

Clarify ADP behavior:

Background: It is unclear whether TA_VBUS_ATT refers to when the device powers up or when probing has been completed. The usage and intention of the CADP_THR value. Ensure that ADP is performed whenever possible and recommend that it starts as soon as possible after a session ends.

Changes to section 5.4.2:

Replace the 2nd to last paragraph:

When doing ADP probing, a device is required to ignore any changes in capacitance that are less than CADP_THR min. If the capacitance changes by more than CADP_THR, the device shall detect that as either an attach or detach event.

With the following:

When doing ADP probing, a device is required to ignore any changes in capacitance that are less than CADP_THR min. This ensures that cable attachment is ignored when the remote end of the cable is not attached to a device. For a series of "n" probes if the capacitance changes by more than CADP_THR between probe "n" and probe "n-2", the device shall detect that as an ADP change event. This ensures that it is possible to detect the attachment or detachment of a device presenting either CA_VBUS or *CADP_VBUS* as its VBUS bypass capacitance.

Replace last paragraph:

When an OTG A-device is ready to act in host or peripheral role or an EH is ready to act as host, and VBUS is not present, VBUS is required to reach VOTG_SESS_VLD within TA_VBUS_ATT of an attachment event being detected by ADP unless an over-current condition is reached (see also Section 4.2.4).

with the following:

When an OTG A-device is ready to act in host or peripheral role or an EH is ready to act as host, and VBUS is not present, VBUS is required to reach VOTG_SESS_VLD within TA_VBUS_ATT of an ADP change event being detected by ADP unless an over-current condition is reached (see also Section 4.2.4).

Add the following paragraphs to the end of section 5.4.2:

If a B-device starts doing ADP probing after a session and it has already measured the ramp time before the session, then it shall perform SRP, within $T_{B\_ADP\_PRB\_SRP}$ of the last ADP probe, if the two ramp times differ by more than C_{ADP_THR}. Otherwise, it shall continue probing and if any two ramp times, "n" and "n-2", differ by more than C_{ADP_THR}, it shall perform SRP within $T_{B\_ADP\_PRB\_SRP}$ of the last ADP probe.

If a B-device starts doing ADP probing after a session and it has not measured the ramp time before the session, then it shall perform SRP within $T_{B\_ADP\_PRB\_SRP}$ of the first ADP probe. If no session begins within $T_{B\_SRP\_FAIL}$, it shall continue ADP probing and shall perform another SRP within $T_{B\_ADP\_PRB\_SRP}$ of the last probe if the two ramp times differ by more than C_{ADP_THR}. Otherwise, it shall continue probing and if any two ramp times, "n" and "n-2", differ by more than C_{ADP_THR}, it shall perform SRP within $T_{B\_ADP\_PRB\_SRP}$ of the last ADP probe.

Changes to section 5.4.3:

Replace section 5.4.3:

After a session has ended, an ADP-capable A-device is required to issue its first ADP probe pulse within $T_{A\_SSEND\_PRB}$ of V_{BUS} going below $V_{OTG\_SESS\_VLD}$.

After a session has ended, an ADP-capable B-device is required to do ADP sensing until it detects that the remote device is not doing ADP probing. During ADP sensing, the B-device uses the sensing comparator to detect the ADP pulses applied to V_{BUS} by the A-device. If the B-device ADP sense comparator does not toggle for a time of $T_{B\_ADP\_DETACH}$, then the B-device is allowed to do ADP probing.

If a B-device starts doing ADP probing after a session, and it already measured the ramp time before the session, then it should do SRP if the two ramp times differ by more than C_{ADP_THR}.

If a B-device starts doing ADP probing after a session and it has not measured the ramp time before the session, then it should do SRP immediately after the first ADP probe pulse.

With the following:

After a session has ended, an ADP-capable A-device shall issue its first ADP probe pulse within $T_{A\_SSEND\_PRB}$ of V_{BUS} going below $V_{OTG\_SESS\_VLD}$ min. ADP-capable A-devices are recommended to implement small values of T_{SSEND_LKG} and $T_{A\_SSEND\_PRB}$ to minimize the potential for missing ADP changes at session end.

After a session has ended, an ADP-capable B-device shall perform ADP sensing until it detects that the remote device is not doing ADP probing. During ADP sensing, the B-device uses the sensing comparator to detect the ADP pulses applied to V_{BUS} by the A-device. The B-device shall determine the A-device is not doing ADP probing after $T_{B\_ADP\_DETACH}$ of the session end or of the last sense comparator toggle. The B-device shall issue an ADP probe within $T_{B\_SNSEND\_PRB}$ of detecting the A-device is not probing, and continue probing.

Changes to section 5.4.4:

Replace section 5.4.4:

When an ADP-capable A-device is first powered up, it shall perform at least one ADP probe cycle in order to obtain an initial value for T_{ADP_RISE}. The A-device shall then turn on V_{BUS} within $T_{A\_VBUS\_ATT}$ to see if a B-device is attached. If a B-device does not connect within $T_{A\_WAIT\_BCON}$, then the A-device is allowed to turn V_{BUS} off and start ADP probing.

If the ADP ramp time after dropping V_{BUS} differs from the ADP ramp time before asserting V_{BUS} by a time proportional to C_{ADP_THR} or more, then the A-device shall again assert V_{BUS}.

When an ADP-capable B-device is first powered up, and V_{BUS} is not present, it shall perform at least one ADP probe cycle in order to obtain an initial value for T_{ADP_RISE}. The B-device shall then perform SRP to see if an A-device is attached. If an A-device does not assert V_{BUS} within $T_{B\_SRP\_FAIL}$, then the B-device is allowed to do ADP probing.

If the ADP rise time after SRP differs from the ADP rise time before SRP by a time proportional to C_{ADP_THR} or more, then the B-device shall issue another SRP pulse.

With the following:

When an ADP-capable A-device is first powered up, it shall perform at least one ADP probe cycle in order to obtain an initial value for T_{ADP_RISE}. After this probe the A-device shall then turn on V_{BUS} within TA_VBUS_ATT to see if a B-device is attached. The delay from first power-up until V_{BUS} is turned on shall not exceed T_{PWRUP_RDY}. If a B-device does not connect within $T_{A\_WAIT\_BCON}$ min, then the A-device shall turn V_{BUS} off within $T_{A\_WAIT\_BCON}$ max and shall then start ADP probing within $T_{A\_SSEND\_PRB}$ max of VBUS going below $V_{OTG\_SESS\_VLD}$.

If the ADP ramp time after dropping V_{BUS} differs from the ADP ramp time before asserting V_{BUS} by a time proportional to C_{ADP_THR} or more, then the A-device shall again assert V_{BUS}.

When an ADP-capable B-device is first powered up, and V_{BUS} is not present, it shall perform at least one ADP probe cycle in order to obtain an initial value for TADP_RISE. The B-device shall then perform SRP to see if an A-device is attached. The delay from first power-up until this SRP pulse shall not exceed T_{PWRUP_RDY}. If an A-device does not assert VBUS within TB_SRP_FAIL, then the B-device shall commence ADP probing within a further $T_{B\_ADP\_PRB}$ max.

If the ADP rise time after SRP differs from the ADP rise time before SRP by a time proportional to CADP_THR or more, then the B-device shall issue another SRP pulse.

Add the following common parameter to Table 5-1:

Power on until ready for USB (not mandatory see reference)	T_{PWRUP_RDY}		30	sec	A3.5

Add and modify the following A-device parameters in Table 5-1:

Wait for B-Connect	TA_WAIT_BCON	1.1	30	sec	4.2.1, 5.2.1, 5.4.4

Add a footnote to the maximum value of the TA_WAIT_BCON value in Table 5-1:

This maximum value is required for testing of products which support sessions and therefore do not leave VBUS on all the time an A-plug is inserted. Manufacturers shall specify when entering compliance if they require a larger maximum value.

Add the following B-device parameters to Table 5-1:

Time from stopping ADP probing to SRP generation	TB_ADP_PRB_SRP		5	sec	5.4.2
B-device ADP detach time, sensing mode	TB_ADP_DETACH	3.0	3.1	sec	5.4.3
Sensing end to first ADP probe	TB_SNSEND_PRB		100	msec	5.4.3

ADP probing ranges for A-device and B-device overlap:

Background: The tolerances on TA_ADP_PRB and TB_ADP_PRB are defined so that it is impossible to guarantee that even 2 successive probes will produce the same value. For example the A-device could use a period of 1.3sec and the B-device a period of 2.6sec. If they start together and both produced an invalid probe reading on the first attempt, then the second attempt by the B-device would be the same as the first value, but incorrect, and the A-device probe would alternate between incorrect and correct readings.

Changes to section 5.5:

In Table 5-1 replace:

A-device ADP probing period, (Typical = 1.75 sec)[14]	TA_ADP_PRB	1.25	1.85	sec	5.4.2

With the following:

A-device ADP probing period, (Typical = 1.75 sec)[14]	TA_ADP_PRB	1.35	1.85	sec	5.4.2

Replace footnote 14:

An A-device is also allowed to use a probing period of .625sec to .925sec.

With the following:

An A-device is also allowed to use a probing period of .675sec to .925sec.

Replace footnote 16:

A B-device is also allowed to use a probing period of .85sec to 1.3sec

With the following:

A B-device is also allowed to use a probing period of .95 sec to 1.3sec

Chapter 6

Clarification of HNP polling mechanism and suspend:

Background: The supplement is contradictory; you can't simultaneously poll AND be suspended..

Changes to section 6.3:

Replace the first paragraph last sentence:

Unless an A-device enables b_hnp_enable before entering suspend it shall also continue polling while the bus is suspended

With the following text:

'Unless an A-device enables b_hnp_enable before entering suspend, then after suspend it shall resume with a frequency of THOST_REQ_POLL, poll the status, and return to suspend. Polling shall not be required if the b_hnp_enable is set before entering suspend, since the B-device indicates its intention by commencing the HNP procedure.

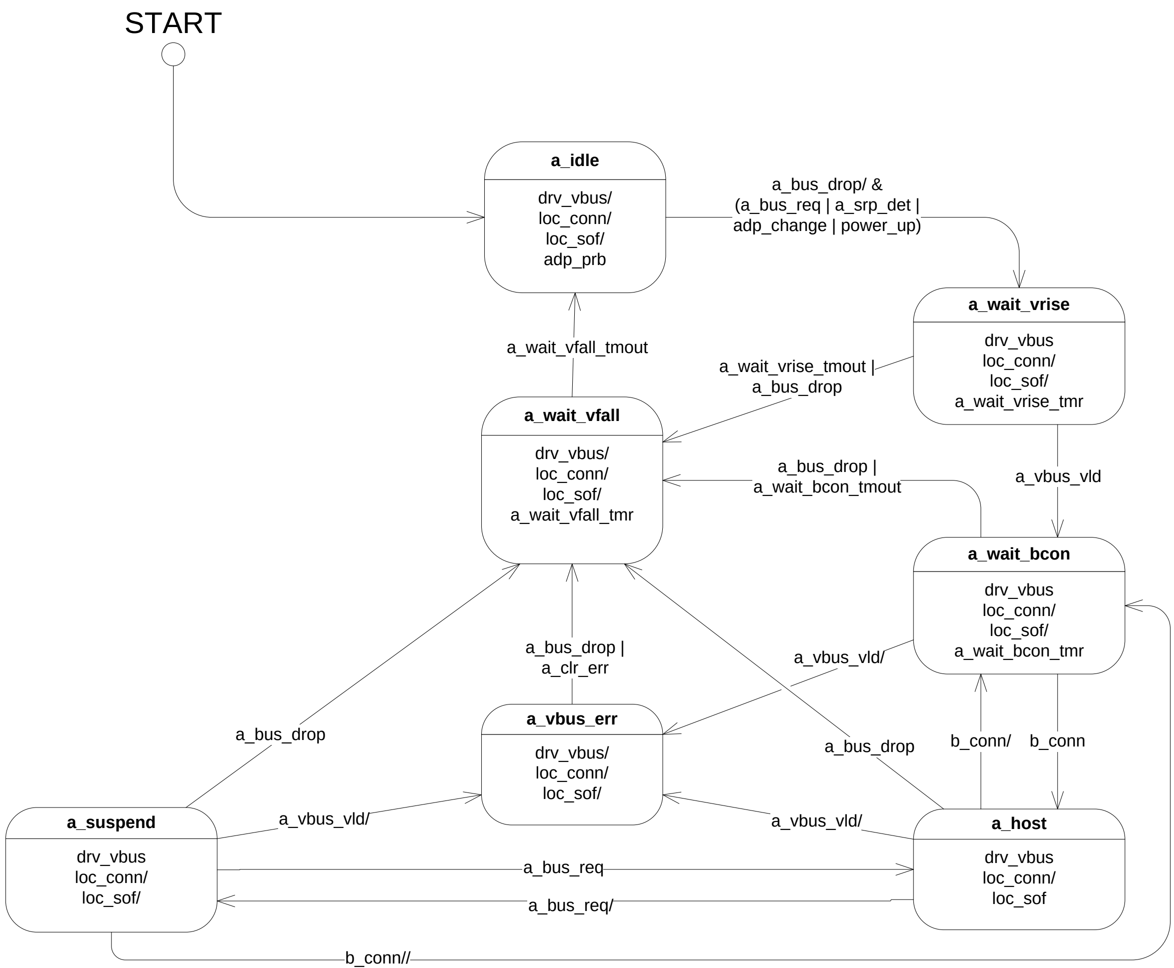
Chapter 7

Embedded Host state diagram uses ID/:

Background: The state diagram includes a reference to ID/ which is not applicable for Embedded Hosts.

Changes to section 7.1, Figure 7-2:

Replace Figure 7-2 with the following:



Clarify A-device state diagrams with respect to ADP:

Background: Supplement is not clear enough on the behavior of ADP immediately after power up. In addition ADP may not be necessary for certain use cases. Clarification is required of the state machine.

Changes to section 7.1.1, 5th bullet:

Replace 2nd paragraph, 5th bullet from:

- *the A-device has only just powered up its USB system (power_up = TRUE)*.

With the following:

- *the A-device has only just powered up its USB system (power_up = TRUE). Note: for an ADP-capable A-device ADP probing takes place immediately after power up in order to calibrate the measurement (see Section 5.4.4). In this case the power_up transition shall only be triggered after a reliable ADP measurement value has been obtained.*

Changes to section 7.1.1, last paragraph:

Replace last paragraph:

OTG devices are configured such that a change in id from TRUE to FALSE causes a_bus_req to be asserted unless doing ADP probing (see Section 4.2.4) and that a change in id from FALSE to TRUE causes a transition to the b_idle state. This does not apply to an EH since there is no ID pin in the Standard-A plug.

With

OTG devices are configured such that a change in id from TRUE to FALSE causes a_bus_req to be asserted unless the device is ADP capable (see Section 4.2.4) and that a change in id from FALSE to TRUE causes a transition to the b_idle state. This does not apply to an EH since there is no ID pin in the Standard-A plug.

Changes to section 7.2.1:

Change 2nd paragraph, 3rd bullet from:

- the B-device has only just powered up its USB system (*power_up* = TRUE).

To the following:

- the B-device has only just powered up its USB system (*power_up* = TRUE). *Note: for an ADP-capable B-device ADP probing takes place immediately after power up in order to calibrate the measurement (see Section 5.4.4). In this case the power_up transition shall only be triggered after a reliable ADP measurement value has been obtained.*

Changes to section 7.3.1:

Change 2nd paragraph, 3rd bullet from:

- the B-device has only just powered up its USB system (*power_up* = TRUE).

To the following:

- the B-device has only just powered up its USB system (*power_up* = TRUE). *Note: for an ADP-capable B-device ADP probing takes place immediately after power up in order to calibrate the measurement (see Section 5.4.4). In this case the power_up transition shall only be triggered after a reliable ADP measurement value has been obtained.*

Changes to section 7.4.2.5:

Change 1st paragraph:

The ADP probe variable (adp_prb) is TRUE when the local device is doing ADP probing (see section 5.4.2).

To the following:

The ADP probe variable (adp_prb) is TRUE when the local device is doing ADP probing (see section 5.4.2). Implementation of the ADP feature depends on the supported use cases so for a particular implementation this variable may not be required.

Clarify Definition of ADP Change:

Background: ADP Change definition does not clearly indicate that ADP probes can only be compared between sessions. Add text indicating this. Also, update definition to describe N v. N-1 and N v. N-2 probe comparison.

Changes to Table 7.2, page 36, Table 7.4, page 41 and Table 7.6, page 44 definition of adp_change:

Replace the definition of adp_change in Table 7-2 and 7-4:

adp_change TRUE when two successive ADP measurement values are different by more than C_{ADP_THR}

and the definition of adp_change in Table 7-6:

adp_change The ADP change value is TRUE when two successive ADP measurement values are significantly different.

With the following text:

adp_change TRUE when current ADP measurement (n) value, compared to the ADP measurement taken at n-2, differs by more than C_{ADP_THR}.

Require B-device ADP sensing:

Background: Require ADP sensing for B-device.

Changes to section 7.4.2.5:

Replace 2nd paragraph:

A B-device also has the option of doing ADP sensing if the remote A-device is doing ADP probing (see Section 5.4.3).

With

An ADP capable B-device shall first perform ADP sensing (adp_sns = TRUE). If the B-device ADP sense comparator does not toggle for a time of TB_ADP_DETACH, the B-device shall then perform ADP probing and adp_prb will be TRUE. (see Section 5.4.3).

Changes to section 7.4.2.6:

Replace 1st paragraph (definition of adp_sns):

The ADP sense variable (adp_sns) is TRUE when the local device is doing ADP sensing. This output is used in preference to adp_prb when the B-device detects that the A-device is doing ADP probing (see Section 5.4.3).

With

The ADP sense variable (adp_sns) is TRUE when the local device is doing ADP sensing.
(see Section 5.4.3).

Clarify A-device remote wakeup behavior:

Background: Supplement is not clear enough that the use of suspend for power saving purposes is not recommended. In particular the use of suspend by the B-Host is more likely to result in HNP, since it has relinquished the bus. Therefore, the enabling of remote wakeup by B-devices shall not be permitted. In addition A-devices shall not perform remote wakeup signaling. The footnote previously implied that the use of suspend/resume by a B-host was recommended behavior.

Changes to section 7.4.5.6:

Replace footnote 23, page 51

[23] In Section 7.1.7.6 of [USB2.0] the downstream device (in this case the A-device) interprets more than 3 ms of idle as an indication that the upstream device has suspended the bus. $T_{A\_BIDL\_ADIS}$ min is much larger than this value. This means that it is possible for the B-device to suspend and resume the bus provided that this is for less than $T_{A\_BIDL\_ADIS}$ min. Suspending the bus for more than $T_{A\_BIDL\_ADIS}$ max indicates that the B-device no longer wants to act as host.

with the following text:

"[23] In Section 7.1.7.6 of [USB2.0] the downstream device (in this case the A-device) interprets more than 3 ms of idle as an indication that the upstream device has suspended the bus. $T_{A\_BIDL\_ADIS}$ min is much larger than this value. This means that the B-device shall suspend the bus for more than $T_{A\_BIDL\_ADIS}$ max in order to indicate that the B-device no longer wants to act as host.

Chapter 8

Clarify Embedded Host Support:

Background:

Changes to section 8: text is incorrect since it links 2 alternative implementations with "and".

Replace paragraph 2, 2nd sentence:

EHs are at liberty to choose whether they leave V_{BUS} always powered, and whether they support SRP or ADP.

With the following:

EHs are at liberty to choose whether they leave V_{BUS} always powered, or whether they support SRP or ADP.

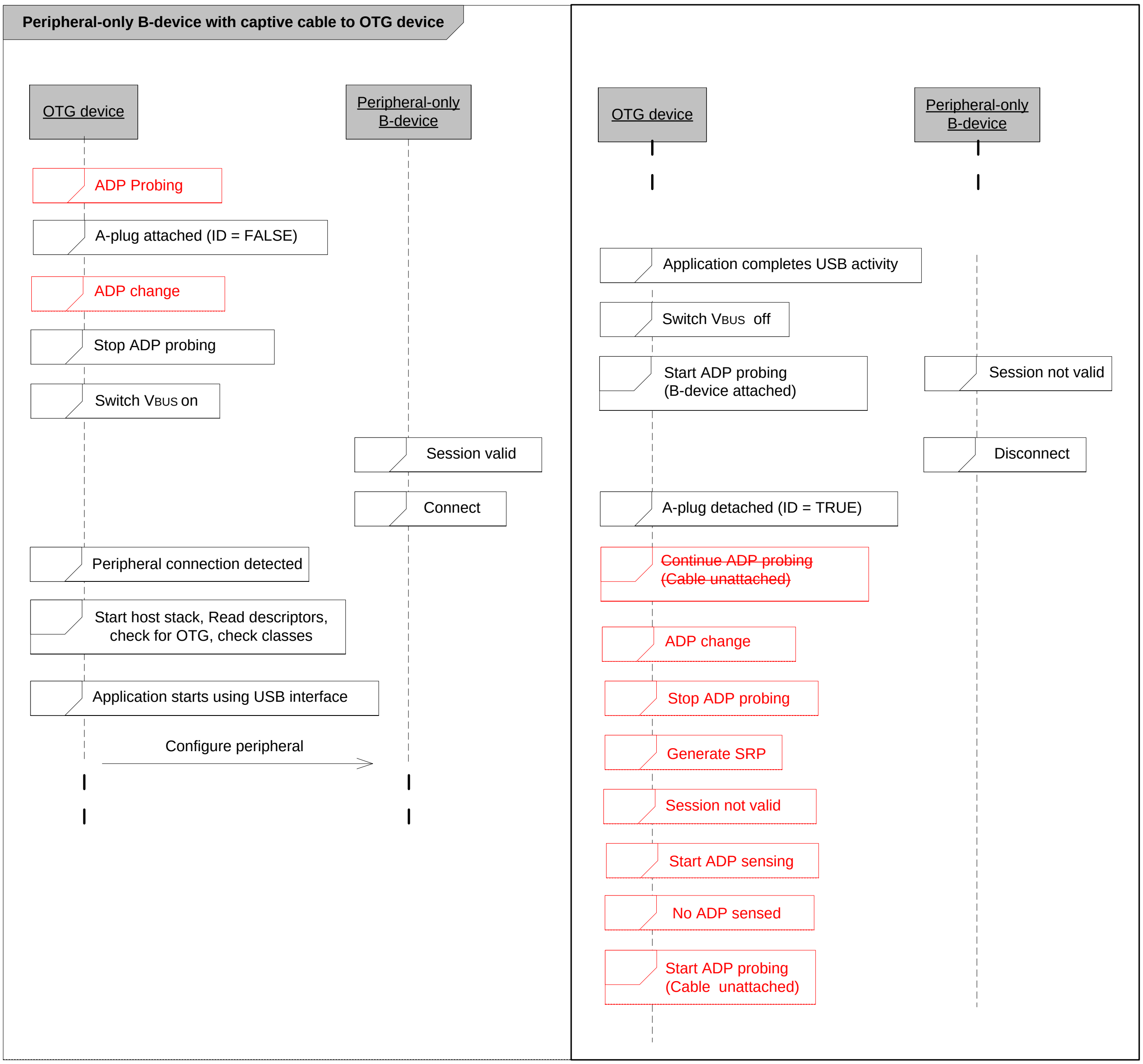
Appendix A

Correct diagram with respect to ADP:

Background: Figures A-1, A-2, A-3, A-4, A-5, A-6, A-8, A-9, A-10, need to be updated to reflect current expected ADP behavior. There are 2 changes which have been applied to several of the diagrams:
Initial ADP State: Add box showing initial ADP state: A-1, A-2, A-3, A-4, A-5, A-6, A-8, A-9 and A-10
A-plug Ignore: Remove incorrect responses to A-plug attach for ADP devices: A-3, A-5 and A-8.
These changes will just be referred to by name in the descriptions in the diagrams below. Additionally, there are corrections unique to some of the diagrams which are described in the text for each individual diagram.

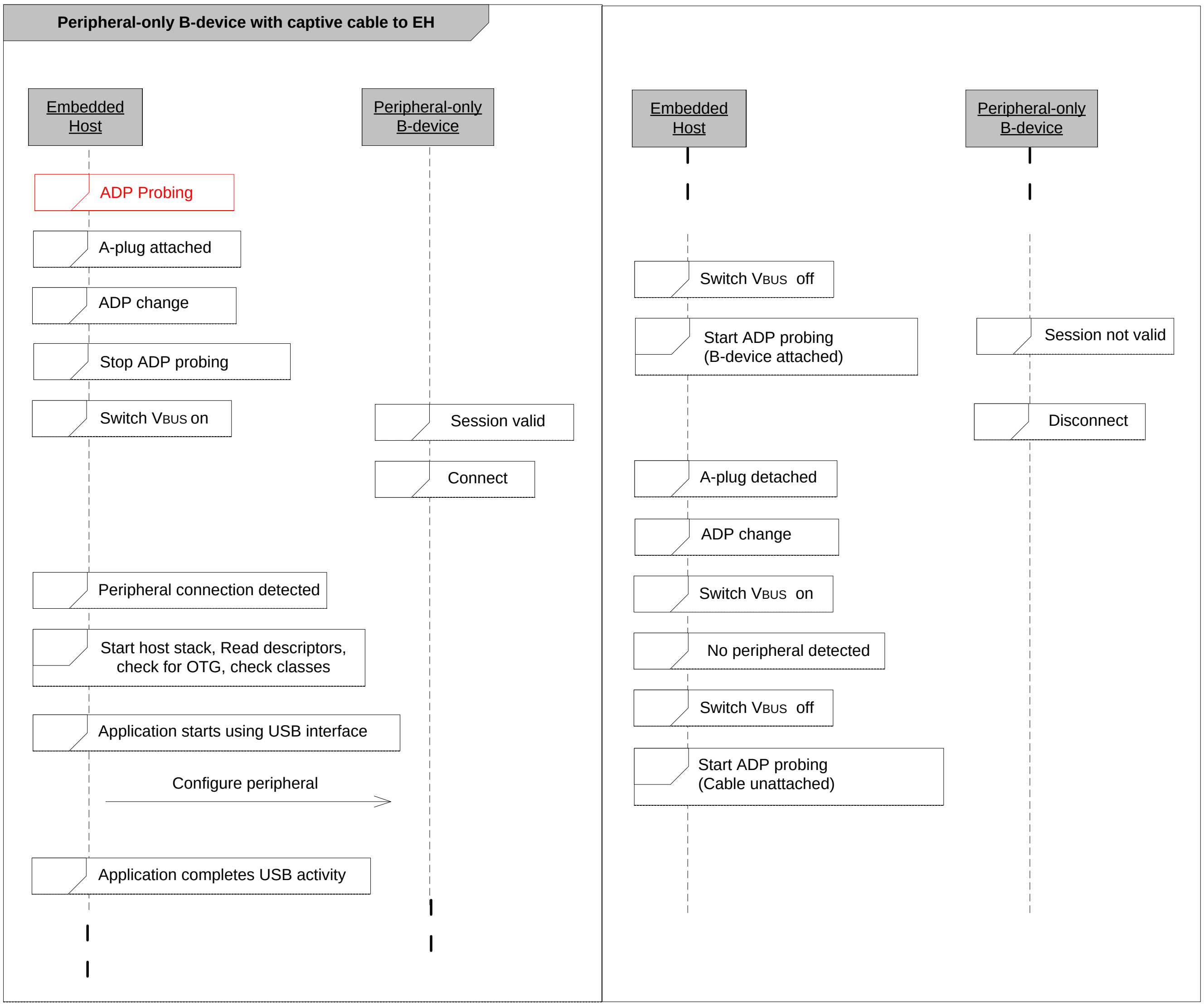
Changes to Figure A-1:

Edit Figure A-1 as shown in the diagram below. This adds Initial ADP state, adds missing ADP change after A-plug attached and adds the correct behavior when the A-plug is detached.



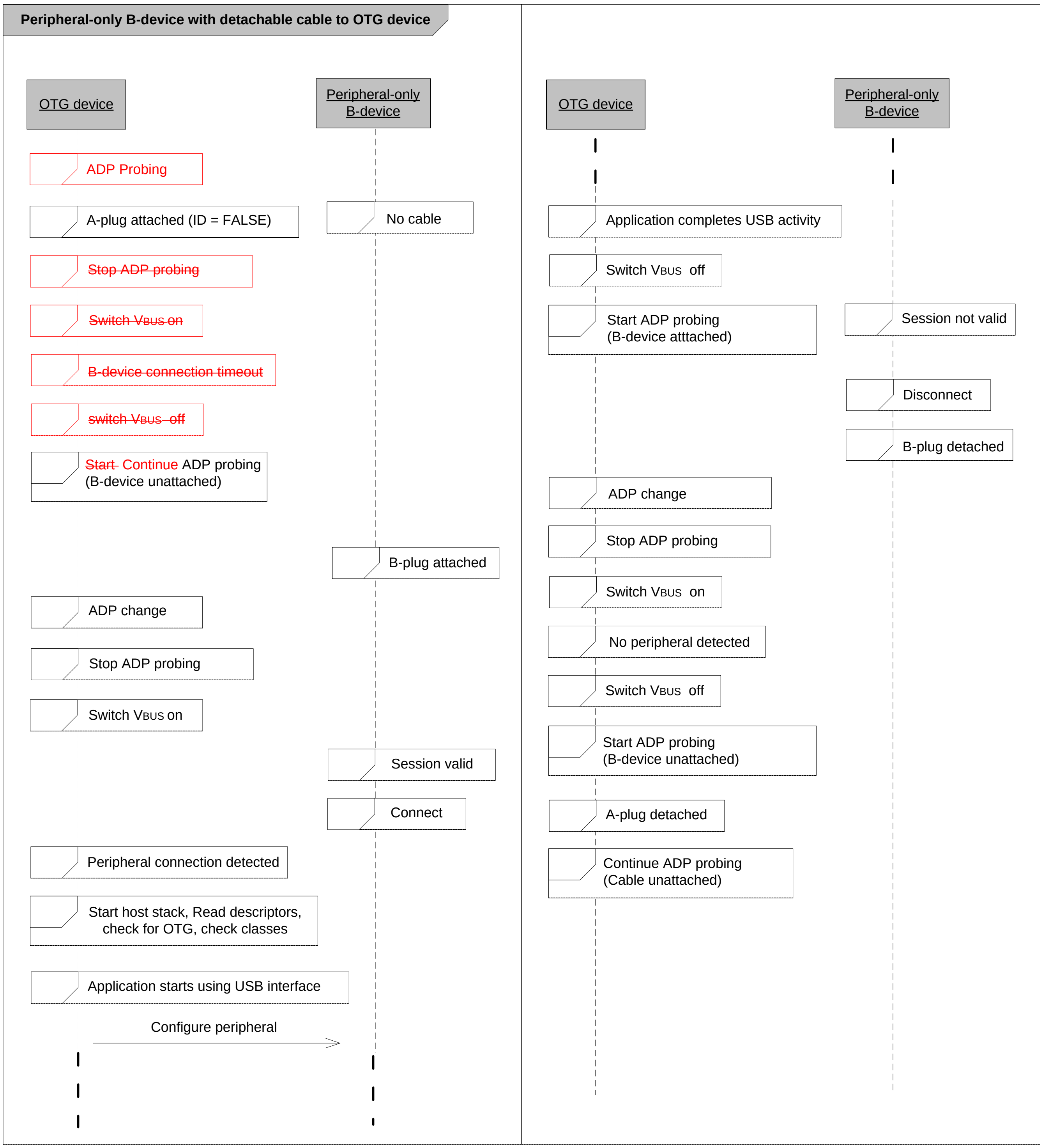
Changes to Figure A-2:

Edit Figure A-2 as shown in the diagram below. This adds the Initial ADP state.



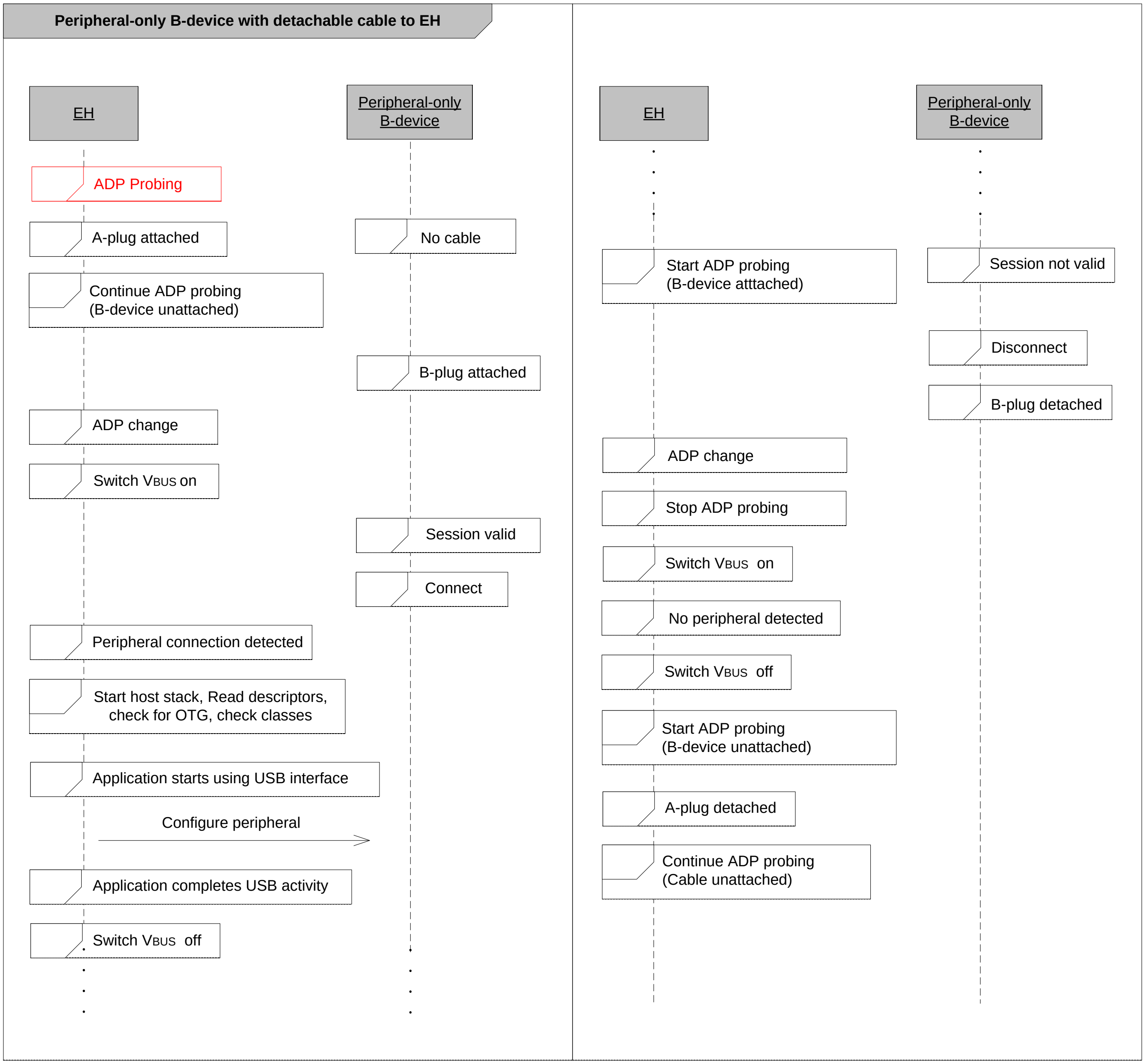
Changes to Figure A-3:

Edit Figure A-3 as shown in the diagram below. This adds Initial ADP state, removes incorrect behavior when the A-plug is attached to an ADP capable device and adds "continue probing" after A-plug attached with no ADP change.



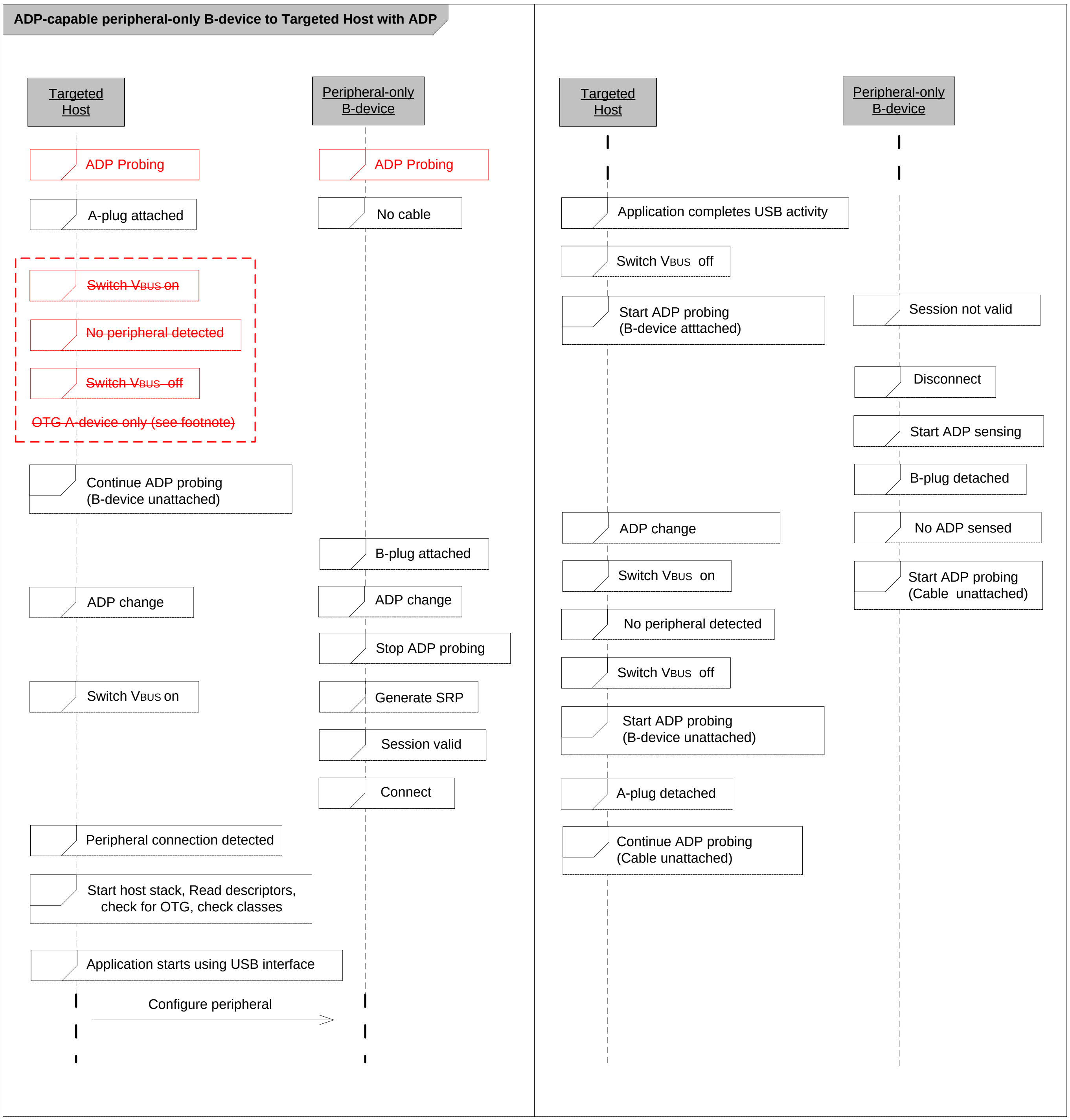
Changes to Figure A-4:

Edit Figure A-4 as shown in the diagram below. This adds the Initial ADP state.



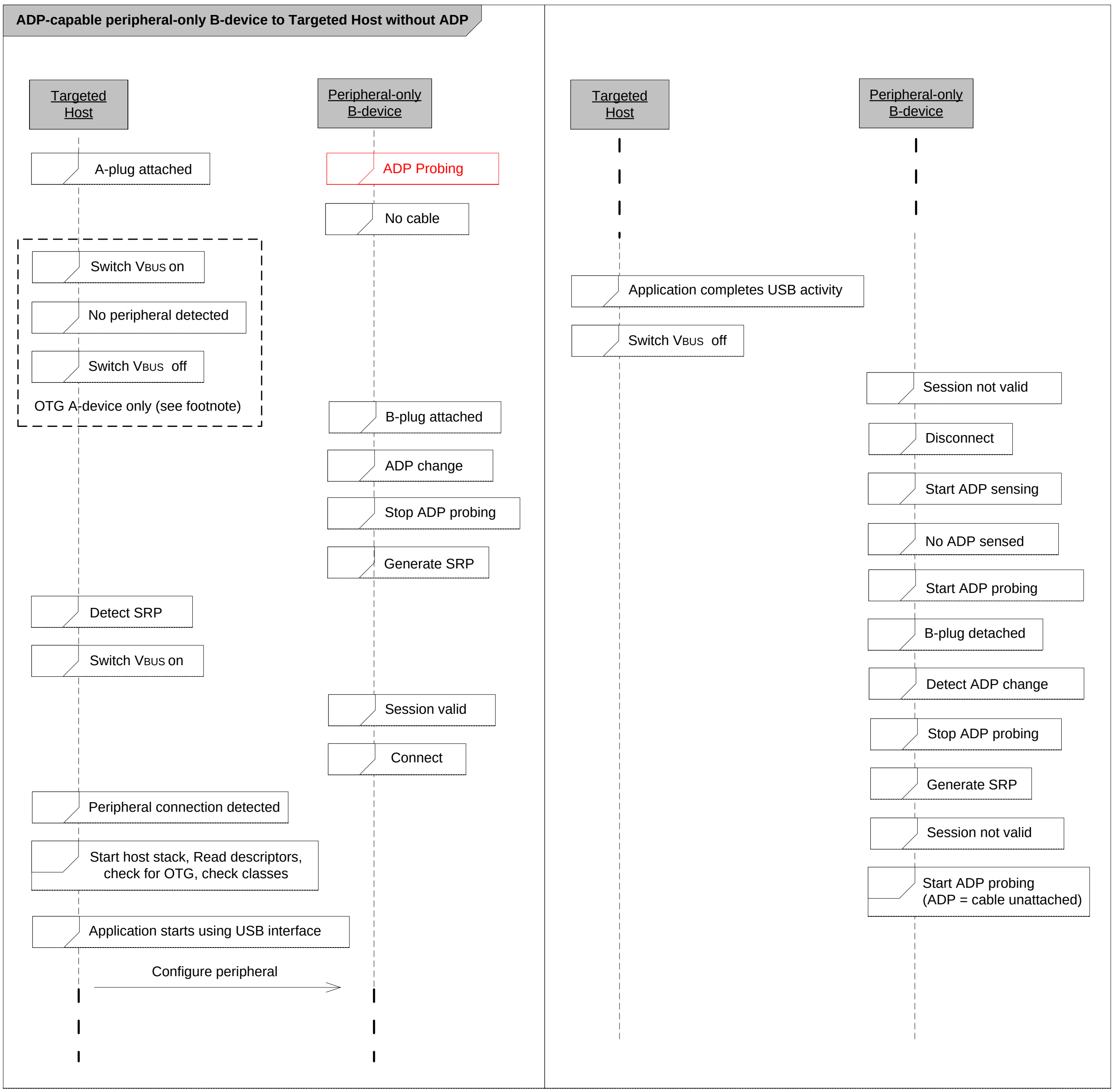
Changes to Figure A-5:

Edit Figure A-5 as shown in the diagram below. This adds Initial ADP state and removes incorrect behavior when the A-plug is attached to an ADP capable device.



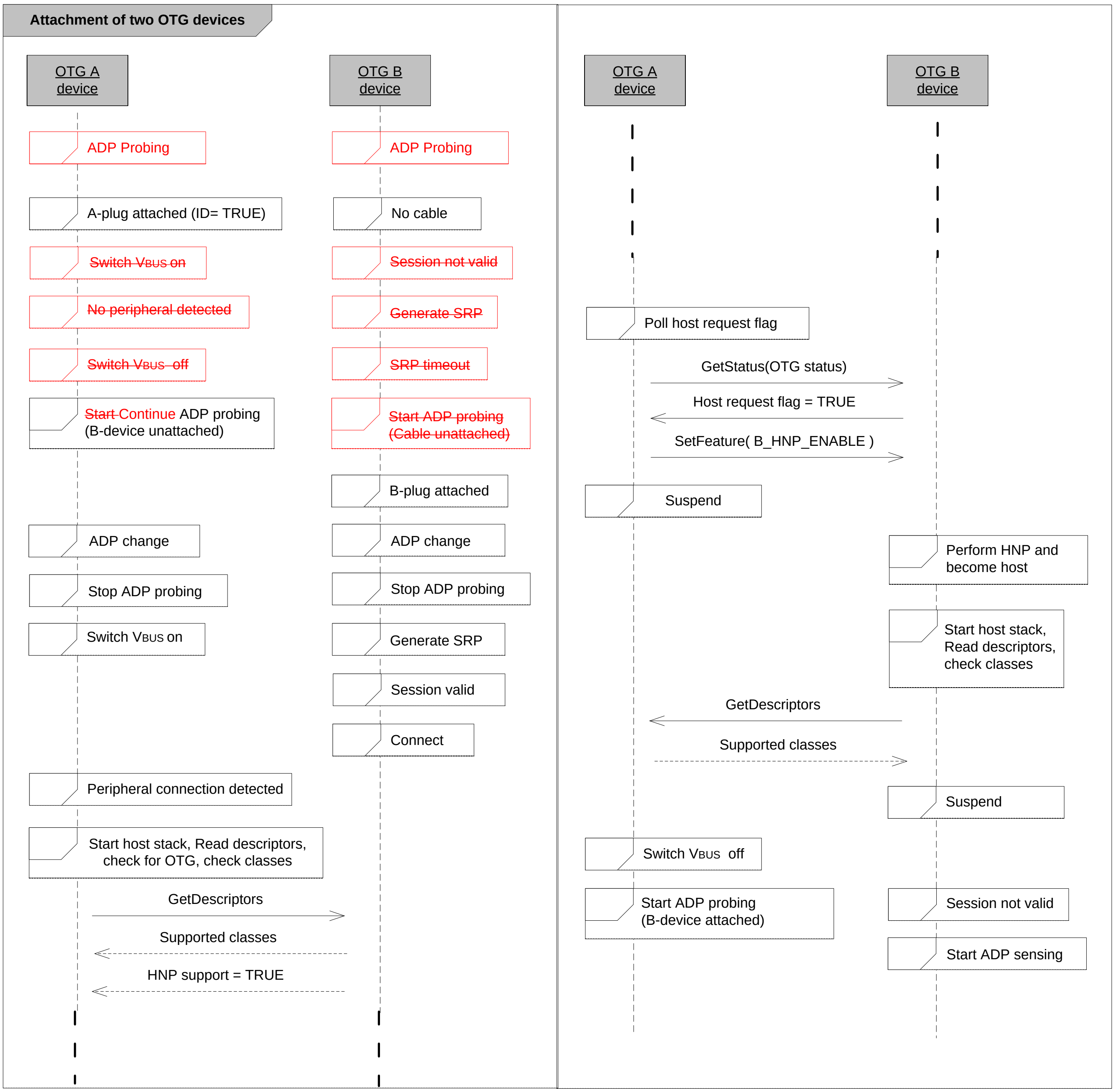
Changes to Figure A-6:

Edit Figure A-6 as shown in the diagram below. This adds the Initial ADP state.



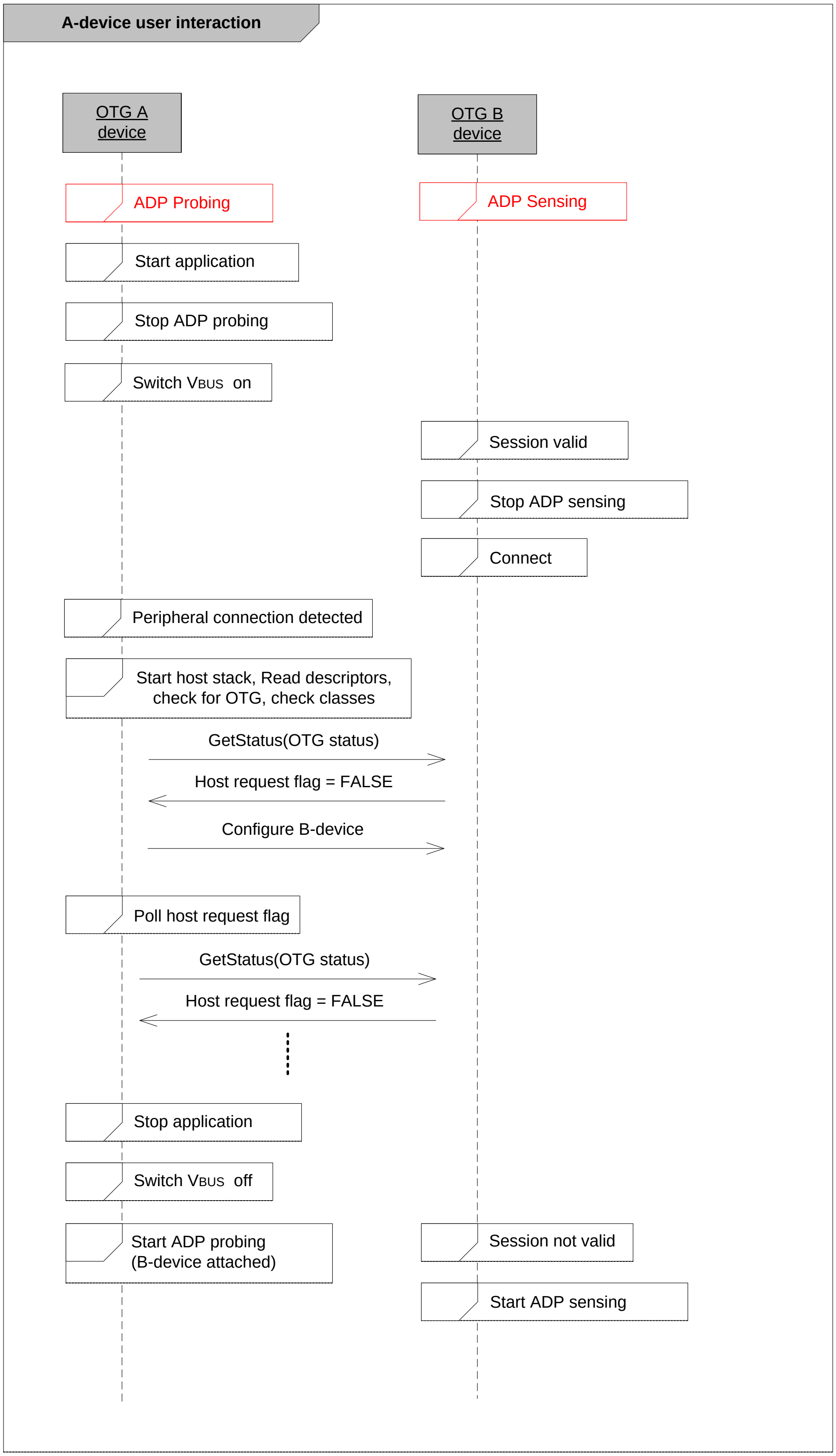
Changes to Figure A-8:

Edit Figure A-8 as shown in the diagram below. This adds Initial ADP state and removes incorrect behavior when the A-plug is attached to an ADP capable device.



Changes to Figure A-9:

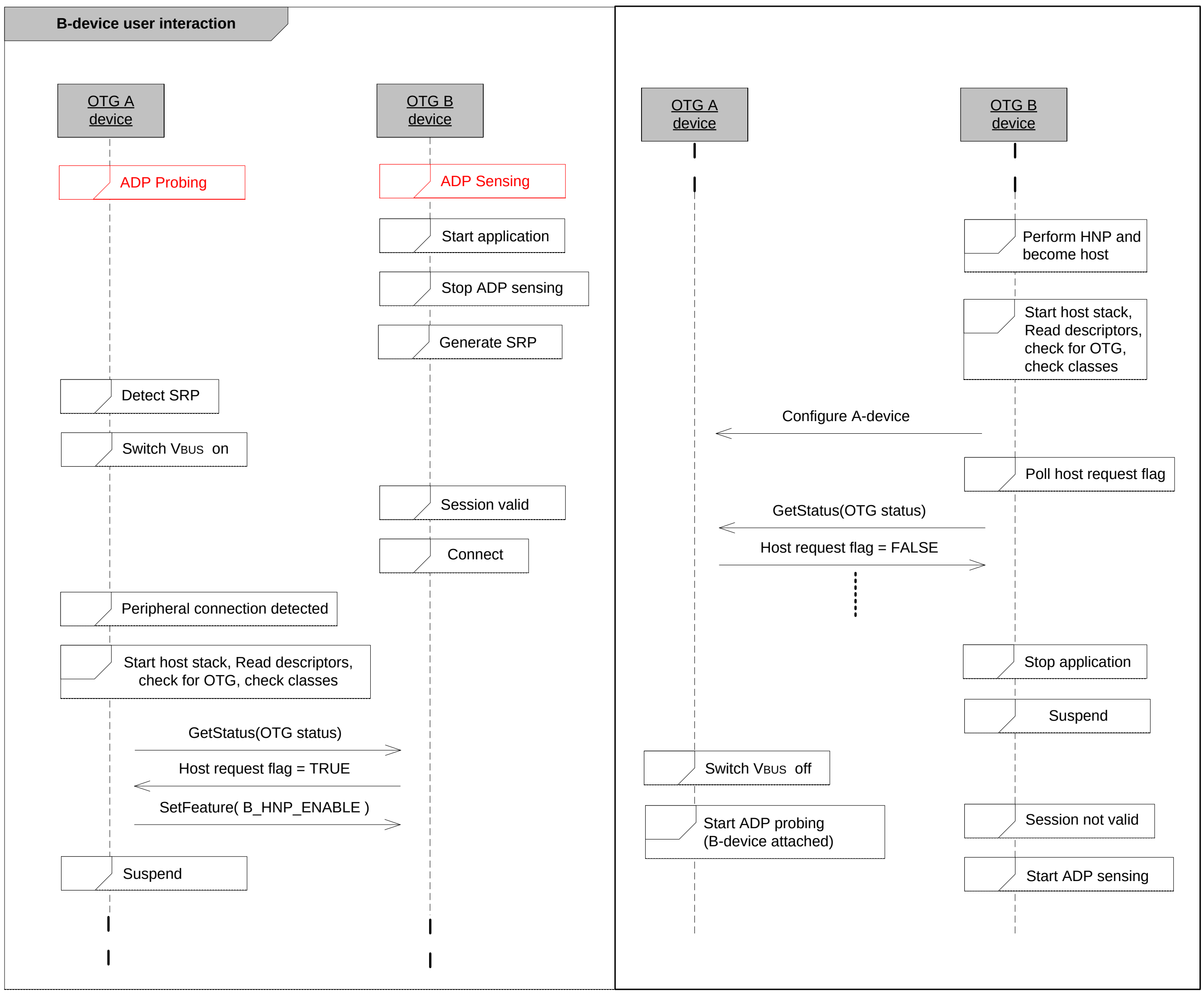
Edit Figure A-9 as shown in the diagram below. This adds the Initial ADP state.



A-device user interaction
OTG A device
OTG B device
ADP Probing
ADP Sensing
Start application
Stop ADP probing
Switch VBUS on
Session valid
Stop ADP sensing
Connect
Peripheral connection detected
Start host stack, Read descriptors, check for OTG, check classes
GetStatus(OTG status)
Host request flag = FALSE
Configure B-device
Poll host request flag
GetStatus(OTG status)
Host request flag = FALSE
Stop application
Switch VBUS off
Start ADP probing (B-device attached)
Session not valid
Start ADP sensing

Changes to Figure A-10:

Edit Figure A-10 as shown in the diagram below. This adds the Initial ADP state.



Correction to A3.1/A3.2 paragraphs:

Background:

ADP is used to detect the attachment of a B-device (capacitance) not A-plug necessarily. An A-plug alone will not be detectable

Replace first paragraph of A3.1:

Figure A-13 shows the operation of an A-device after powering up its USB function when it is unattached, and assumes support for ADP. An EH needs ADP support in order to detect A-plug attachment when VBUS is not powered.

With

Figure A-13 shows the operation of an A-device after powering up its USB function when it is unattached, and assumes support for ADP. An EH needs ADP support in order to detect B-device attachment when VBUS is not powered.

Replace first paragraph of A3.2:

Figure A-14 shows the operation of an A-device after powering up its USB function when it is attached, and assumes support for ADP. An EH needs ADP support in order to detect A-plug attachment when VBUS is not powered.

With

Figure A-14 shows the operation of an A-device after powering up its USB function when it is attached, and assumes support for ADP. An EH needs ADP support in order to detect B-device attachment when VBUS is not powered.

Proposed change to errata to improve testability:

Background:

a.) The Protocol Tester needs to know when to fail a UUT in the case that it does not respond to tests within a reasonable time after being switched on. We need a parameter to refer to this delay so that it can be modified in the tester setup dialog. The parameter does not have a mandatory maximum value, but is needed so that we can start an automated test sequence with as little wasted time as possible in the case of failure. The parameter starts at switch-on but ends with a condition dependent on the UUT-type, so that we can re-use the same parameter for each UUT-type.

b.) Initial ADP pulse which has been re-introduced leads to the situation that it is not possible to guarantee to detect it, as it is indistinguishable from a combination of doing an ADP probe then immediately turning on VBUS. So rather than specifying TADP_PWR_UP, we should use the new parameter, which is satisfied by VBUS rising.

Add the following paragraph as section A3.5:

A.3.5 Timing requirements when powering up (for testability)

To allow compliance testing, an OTG device or EH shall be ready to perform USB activity at a time no longer than TPWRUP_RDY from an identifiable powering on action or sequence of actions (e.g. switching on).

TPWRUP_RDY is not mandatory, as a given value may not always be achievable. However the vendor shall be able to specify the maximum value of this parameter in order to allow the compliance tester to be aware of the power up delay.

The phase ‘Ready to perform USB activity’ shall be as defined in Table A-1.

Table A-1: Definition of “Ready to perform USB activity”

Type of unit	**Definition of ‘Ready to perform USB activity’**
OTG-A or EH, ADP-capable	VBUS has been turned on after initial ADP probing
OTG-A, not ADP-capable	VBUS has been turned on, and OTG-A is ready to respond

	to a connect event.
EH supporting sessions, but not ADP-capable	VBUS has been turned on, and EH is ready to respond to a connect event, or VBUS is off and EH is ready to respond to an SRP pulse
EH not supporting sessions	VBUS is on, and EH is ready to respond to a connect event
OTG-B, ADP-capable	If VBUS is on, OTG-B connects (data line pull-up). If VBUS is off, OTG-B performs SRP pulse after initial ADP probing.
OTG-B, not ADP-capable	If VBUS is on, OTG-B connects (data line pull-up). If VBUS is off, OTG-B performs SRP pulse.