

Battery Charging Specification

(Including errata and ECNs through March 15, 2012)

Revision 1.2

March 15, 2012

Copyright © 2012, USB Implementers Forum, Inc.
All rights reserved.

A LICENSE IS HEREBY GRANTED TO REPRODUCE THIS SPECIFICATION FOR INTERNAL USE ONLY. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, IS GRANTED OR INTENDED HEREBY.

USB-IF AND THE AUTHORS OF THIS SPECIFICATION EXPRESSLY DISCLAIM ALL LIABILITY FOR INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS, RELATING TO IMPLEMENTATION OF INFORMATION IN THIS SPECIFICATION. USB-IF AND THE AUTHORS OF THIS SPECIFICATION ALSO DO NOT WARRANT OR REPRESENT THAT SUCH IMPLEMENTATION(S) WILL NOT INFRINGE THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS.

THIS SPECIFICATION IS PROVIDED "AS IS" AND WITH NO WARRANTIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE. ALL WARRANTIES ARE EXPRESSLY DISCLAIMED. NO WARRANTY OF MERCHANTABILITY, NO WARRANTY OF NON-INFRINGEMENT, NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, AND NO WARRANTY ARISING OUT OF ANY PROPOSAL, SPECIFICATION, OR SAMPLE.

IN NO EVENT WILL USB-IF OR USB-IF MEMBERS BE LIABLE TO ANOTHER FOR THE COST OF PROCURING SUBSTITUTE GOODS OR SERVICES, LOST PROFITS, LOSS OF USE, LOSS OF DATA OR ANY INCIDENTAL, CONSEQUENTIAL, INDIRECT, OR SPECIAL DAMAGES, WHETHER UNDER CONTRACT, TORT, WARRANTY, OR OTHERWISE, ARISING IN ANY WAY OUT OF THE USE OF THIS SPECIFICATION, WHETHER OR NOT SUCH PARTY HAD ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

Contributors

Mark Lai	Allion Test Labs
Sammy Mbanta	Astec Power
Abel Astley	Broadcom
Kenneth Ma	Broadcom
Shimon Elkayam	Broadcom
Gaurav Singh	Cypress
Dan Ellis	DisplayLink
Graham Connolly	Fairchild
Oscar Freitas	Fairchild
Joel Silverman	Kawasaki
Pat Crowe	MQP Electronics
Juha Heikkila	Nokia
Richard Petrie	Nokia
Sten Carlsen	Nokia
Jeroen Kleinpenning	NXP Semiconductors
Terry Remple, Chair	Qualcomm
Dave Haglan	SMSC
Mark Bohm	SMSC
Morgan Monks	SMSC
Tim Knowlton	SMSC
Morten Christiansen	ST Ericsson
Nicolas Florenchie	ST Ericsson
Shaun Reemeyer	ST Ericsson
George Paparrizos	Summit Microelectronics
Adam Burns	Synopsys
Wei Ming	Telecommunication Metrology Center of MII
Jean Picard	Texas Instruments
Ivo Huber	Texas Instruments
Pasi Palojarvi	Texas Instruments
Steven Tom	Texas Instruments
Ed Beeman	USB-IF
Mark Paxson	USB-IF

Revision History

Revision	Date	Author	Description
BC1.0	Mar 8, 2007	Terry Remple	First release
BC1.1	April 15, 2009	Terry Remple	Major updates to all sections. Added Data Contact Detect protocol, and Accessory Charger Adapter.
BC1.2	Oct 5, 2010	Terry Remple Adam Burns	<p>Following items indicate changes from BC1.1 to BC1.2. References below to Section, Figures and Tables refer to BC1.2, unless BC1.1 is specifically indicated.</p> <ol style="list-style-type: none"> 1. Allow DCPs to output more than 1.5A. Allows Portable Devices (PDs) with switch mode chargers to draw more power. Section 4.4.1. 2. Increase minimum CDP current to 1.5A. Without change, PDs had to draw less than 500mA, to avoid CDP shutdown. Table 5-2. 3. Indicate that ICDP max and IDCP max limits of 5A come from USB 2.0, and are safety limits. Table 5-2 note 1. 4. Allow PDs to draw up to 1.5A during HS chirp and traffic. Remove previous limits of 560mA and 900mA which was based on HS common mode ranges. Section 3.5. 5. Require CDPs to support 1.5A during HS chirp and traffic. Affects CDP common mode range. Section 3.5. 6. Reduce maximum PD current from 1.8A to 1.5A, to avoid shutdown when attached to CDP. Table 5-2. 7. Rename Docking Station to ACA-Dock, to avoid confusion with other types of Docking Stations. 8. Require ACA-Dock to differentiate itself from an ACA, by enabling VDM_SRC during no activity. Section 3.2.4.4. 9. Allow CDP to leave VDM_SRC enabled while peripheral not connected. Section 3.2.4.2. 10. Remove ICHG_SHTDWN. This was a recommended max output current for Charging Ports with VBUS grounded. BC1.1 Section 4.1. 11. Require VDP_SRC to not pull D+ below 2.2V when D+ is being pulled to VDP_UP through RDP_UP. Require VDM_SRC to not pull D- below 2.2V when D- is being pulled high. Required for ACA-Dock support. Table 5-1 notes 1 and 2.

			<p>12. Make DCD current source optional for PDs. Section 3.2.3.</p> <p>13. Make DCD timeout required for PDs. Section 3.2.3.</p> <p>14. Make Secondary Detection optional for PDs. Section 4.6.2.</p> <p>15. Make Good Battery Algorithm required behavior for PDs. Section 3.2.4.</p> <p>16. Remove resistive detection. BC1.1 Section 3.9.</p> <p>17. Change PD Required Operating Range to include 4.5V at 500mA. Figure 4-3.</p> <p>18. Allow any downstream port to act as a DCP. Section 4.1.3.</p> <p>19. Require PDs to enable VDP_SRC or RDP_PU when charging from a DCP. Section 3.3.2.</p> <p>20. Allow chargers to renegotiate current with PD by dropping and reasserting VBUS. Section 4.1.3.</p> <p>21. Require PDs to discharge their own VBUS input after VBUS drops to support charger port renegotiation request. Section 4.6.3.</p> <p>22. Allow PDs to disconnect and repeat Charger Detection multiple times while attached, with specified timing. Section 4.6.3.</p> <p>23. Reduce DCP input impedance between D+, D- to VBUS and ground from 1MΩ to 300kΩ. Section 4.4.3.</p> <p>24. Require CDPs to recover after over-current condition. Section 4.2.2.</p> <p>25. Allow greater DCP undershoot for large load current steps, to enable low quiescent current chargers required by Europe. Section 4.4.2.</p> <p>26. Define ACAs and ACA-Docks as types of Charging Ports. Section 1.4.5.</p> <p>27. Use session valid voltage range defined in EH and OTG Supplement rev 2.0. Section 3.2.2.</p> <p>28. Only devices that can operate stand-alone from internal battery power are allowed to use the Dead Battery Provision. Section 2.2.</p> <p>29. Allow compound PDs to draw ISUSP plus an</p>
--	--	--	---

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.