

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Interoperability specifications of common external power supply (EPS) for use with data-enabled mobile telephones

Spécifications de l'interopérabilité de l'alimentation externe commune (EPS) pour téléphones mobiles avec service de données

<https://standards.iech.org/standards/sst/5/4/1/4abc-2c41-4596-a6ff-b696e360dde5/iec-62684-2011>



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INTEROPERABILITY SPECIFICATIONS
OF COMMON EXTERNAL POWER SUPPLY (EPS)
FOR USE WITH DATA-ENABLED MOBILE TELEPHONES**

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The text of this standard is based on the following documents:

CDV	Report on voting
100/1714/CDV	100/1771/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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INTEROPERABILITY SPECIFICATIONS OF COMMON EXTERNAL POWER SUPPLY (EPS) FOR USE WITH DATA-ENABLED MOBILE TELEPHONES

1 Scope

This International Standard specifies the interoperability of common external power supplies for use with data enabled mobile telephones. It defines the common charging capability and specifies interface requirements for the the external power supply.

Safety and EMC aspects are not covered by this International Standard. Safety is covered by IEC 60950-1 and EMC is covered by EN 301 489-34.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

EN 301 489-34 *Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services – Part 34: Specific conditions for External Power Supply (EPS) for mobile phones*

Universal Serial Bus Specification, *Cables and Connectors Class Document*, Revision 2.0, August 2007

(<http://www.usb.org/developers/docs>)

USB Battery Charging Specification, Revision 1.1

USB Micro-USB Cables and Connectors Specification, Revision 1.01

USB-IF Cable Assembly Test Requirements for Compliant Usage of Connectors and Cables in Micro-USB 1.01

USB-IF Connector Test Requirements

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

adaptor

device for connecting from a USB Micro-B receptacle/plug to a specific non Micro-USB connector

NOTE An adapter can also be a cable.

4 Abbreviations

For the purposes of this document, the following abbreviations apply:

AC	Alternating Current
DC	Direct Current
EPS	External Power Supply
ESR	Equivalent Series Resistance
EUT	Equipment Under Test
GND	GrouND
USB	Universal Serial Bus
Vbus	Virtual Bus

5 EPS specification

5.1 DC plug connector specification

The cable assembly supplied with the EPS shall terminate in a USB Micro-B plug. The cable assembly may be permanently connected to the EPS or may be a detachable cable. In either case, the terminating USB Micro-B plug

- shall meet the USB-IF connector test requirements,
- shall be compliant to the USB Micro-B cables and connectors specification, Rev 1.01 (Micro-USB 1.01) and
- shall be rated to meet all electrical specifications.

An EPS provided with a detachable cable shall be equipped with an USB standard A receptacle to connect to the EPS. The detachable cable assembly, supplied for use with the EPS, shall have Standard A and USB Micro-B plugs and meet the USB-IF cable assembly test requirements for compliant usage of connectors and cables in Micro-USB 1.01.

The above requirement also applies to cables used as an adaptor, i.e. when the USB Micro-B is connected to the mobile telephone by an adaptor where the mobile telephone does not have a Micro-USB interface.

5.2 AC input characteristic

The EPS shall meet Class II requirements of IEC 60950-1 with a maximum touch current not exceeding 90 μ A.

The EPS AC input shall operate over the following range:

- voltage range: the rated input voltage range should be at least 100 V to 230 V;
- frequency: 50 Hz to 60 Hz.

5.3 Environmental specification

The EPS operational environmental range over which the DC output characteristics defined in 5.4 shall be maintained, shall be

- temperature range: 0 °C to +45 °C,
- relative humidity: up to 90 %.

5.4 DC output characteristic

For EPS with permanently connected cables, the voltage at the USB Micro-B plug of the EPS shall be $5 \text{ V} \pm 0,25 \text{ V}$ with no load current to rated output current.

For EPS with detachable cables the voltage at the USB standard A receptacle shall be $(5 \pm 0,25) \text{ V}$ with no load current to rated output current. The maximum voltage drop caused by the detachable cable shall be 125 mV when measured across the power pair pins of the USB Micro-B plug, while drawing 500 mA from a nominal 5 V source.

The minimum rated output current shall be 500 mA.

The maximum rated output current shall be 1 500 mA.

The maximum output current at any voltage shall not be greater than 1 500 mA.

The ripple voltage on the output with a no load current to maximum rated output current shall be no more than 80 mV peak-to-peak measured at 20 MHz bandwidth using the test method as defined in Clause 6.

The common mode noise at the DC output when measured in accordance with Clause 6 shall be

- AC voltage frequency component: 95 V peak-to-peak maximum,
- EPS switching frequency component:
 - a) the peak-to-peak voltage measured in the frequency range of 1 kHz to 100 kHz shall not exceed 1 V peak-to-peak;
 - b) the peak-to-peak voltage measured in the frequency range of 100 kHz to 400 kHz shall not exceed 200 mV peak-to-peak;
 - c) the peak-to-peak voltage measured in the frequency range of 400 kHz to 1 MHz shall not exceed 39 mV peak-to-peak;
 - d) the peak-to-peak voltage measured in the frequency range of 1 MHz to 100 MHz shall not exceed 20 mV peak-to-peak;
 - e) the occupied bandwidth of the fundamental measured with peak hold shall not exceed $\pm 10 \%$ of the EPS switching frequency;
 - f) the maximum amount of slew within any 100 ns window is 1,25 V peak-to-peak.

NOTE Noise in the FM and TV bands from the EPS should be minimized as it may cause interference to any FM radio and/or TV function of the mobile telephone to which the EPS is connected. At the time of writing, no suitable method of measurement has been defined and is the subject of ongoing work.

5.5 Protection

The maximum output voltage under Single Fault Condition shall not exceed 9 V.

The maximum output current under Single Fault Condition shall not exceed 3 A.

The EPS shall not be damaged as a result of either any over-temperature condition of the EPS circuitry components which is not due to a fault of the EPS, or any output short circuit condition. If shut down occurs, the unit shall not resume operation until AC power is cycled or the failure condition causing the shut down has been removed.

5.6 EPS detection

To enable the mobile telephone to detect that it is connected to an EPS, the EPS shall meet the USB-IF charging port test requirements for a dedicated charging port as defined in USB Battery Charging Specification, Revision 1.1 (BC 1.1), Section 4.1 'Charging Port'.

The top level requirements are

- the EPS shall short the D+ and D- lines with a resistance not greater than 200 Ω ,
- the resistance between the D+ or D- lines of the EPS and either Vbus or GND shall be greater than 2 M Ω ,
- the capacitance between the D+ or D- lines of the EPS and either Vbus or GND shall be less than 1 nF.

5.7 Reliability

Durability of the plug and receptacles shall, as a minimum, meet the performance as given in Table 3-1 of Universal Serial Bus, Cables and Connectors Class Document, Revision 2.0 August 2007:

- USB Micro-B plug: 10 000 cycles;
- Standard-A receptacle and plug: 10 000 cycles (ruggedized Standard-A).

6 Testing requirements

6.1 General

The requirements in Clause 5 have been developed to try to ensure that common EPS perform correctly with any data enabled mobile phone to which they may be connected. Most of the requirements can be verified using existing and well understood measurement techniques which do not need defining in this International Standard.

The common mode voltage and ripple voltage at the DC output can be affected by the load on the output of the EPS. For these parameters, the following test procedures shall be used.

6.2 Common mode voltage of the DC output

- a) The EPS shall be connected to an AC power source wherein one or the other of the AC mains is a neutral conductor, bonded to earth either at the upstream service transformer, or locally in the laboratory environment.

Rationale

- 1) In most installations, it is required that one or the other of the AC mains is bonded to earth at the upstream service transformer, and is termed the “neutral” or “return” conductor; and
- 2) common-mode noise is manifested to the greatest extent when one or the other of AC mains is bonded as such.

NOTE Many synthesized AC power supplies produce isolated AC outputs with no connection to earth. Common-mode noise measurements are reduced in such situations, since the EPS common-mode noise source has no real ground reference. Therefore, isolated AC outputs should have one or the other of the output lines bonded to local ground or neutral. Similar considerations exist when using variable autotransformers to produce the required AC line voltage.

- b) The EPS shall be powered by 253 V AC - 1 % / + 0 % at 50 Hz \pm 1 %.

Rationale

- 1) Common-mode noise amplitude is greater at higher AC mains voltage, and
- 2) AC mains voltages that may be seen by the EPS and its associated mobile terminal are permitted to range up to 230 V AC + 10 %;

- c) The EPS shall be loaded with a (10 \pm 0,01) Ω resistive load, between the Vbus and GND terminals of the USB Micro-B plug. For an EPS with a detachable cable, a 1 m cable length shall be used during testing. To provide the equivalent capacitive load of a generic mobile terminal, a conductive metal box measuring (100 \pm 1) mm \times (60 \pm 1) mm \times (12 \pm 1) mm shall be connected to the GND terminal of the USB Micro-B plug. The EPS cable, resistor, and simulated mobile terminal shall be kept at

least 30 cm from nearby metal structures and shall be supported upon a low-dielectric material, such as Styrofoam or corrugated cardboard box.

Rationale

While the amplitude and frequency of common-mode noise produced by a given EPS will dynamically change over the operational modes and battery charging cycle, it is necessary to create a common test load which will give repeatable measurements. The resistive portion of the load will cause a certain frequency and amplitude of common-mode noise from a given EPS, while the USB cable and simulated mobile terminal contribute a distributed shunt capacitance to earth, which in normal use, serves to attenuate the common mode noise, as in a capacitive AC voltage divider. Without this latter provision, any common mode noise test is generally too restrictive, and is not realistic.

- d) The common-mode noise waveform shall be measured at the GND terminal of the USB Micro-B plug. The sampling probe shall have an input impedance of 10 M Ω in parallel with 8 pF.

Rationale

Common-mode noise is that electrical signal present at the output negative conductor with respect to earth. The probe impedance, as well as shunt capacitance to the test bench, does artificially load, and therefore attenuate, the measured common-mode noise.

6.3 Ripple voltage at the DC output

- a) The USB Micro-B plug of the EPS shall be connected to a load representative of a mobile phone with the following characteristics:
- USB Micro-B receptacle connection;
 - a capacitance of $(1 \pm 0,1) \mu\text{F}$ between the Vbus and GND terminals of the USB Micro-B receptacle. This capacitance shall have a typical ESR of 0,01 Ω at 1 MHz and 0,6 Ω at 10 kHz;
 - a variable or switchable resistance between the Vbus and GND terminals of the USB Micro-B receptacle. It shall be possible to select a resistance of 10 k Ω to simulate a no load condition and other resistances suitable to draw 25 %, 50 %, 75 % and 100 % of the rated current of the EPS.
- b) Place EUT into an environmental chamber.
- c) Connect an oscilloscope to the Vbus and GND terminals. Set the oscilloscope to 20 mV/div, 1 s/div and 20 MHz bandwidth.
- d) Allow the temperature of the EPS to stabilize for at least 10 min.
- e) Turn on the AC power to the EPS and allow it to operate for at least 10 min before making any measurements.
- f) Measure the peak-to-peak voltage of the signal on the oscilloscope under each possible combination of the following parameters:
- AC frequency: 47 Hz, 50 Hz, 60 Hz and 63 Hz;
 - AC voltage: 90 V, 120 V, 207 V and 253 V;
 - load: 0 %, 25 %, 50 %, 75 % and 100 % of the rated output current;
 - temperature: 0 °C, 25 °C and 45 °C.