21 September 2023

Common Charger FAQ Document

Part I: DIGITALEUROPE Response to the remaining open FAQ items

1. Maximum charging power harmonisation and USB PD full functionality

1.1 Additional charging protocols

1.1.1 Related Q&As in Common Charger FAQ (31 Jan 2023)

Q13: Are other charging protocols over USB-C® allowed in addition to the mandatory requirement to support USB PD?

A: Yes. The objective is not to restrict innovation and the continued use of other charging protocols, as long as they allow the radio equipment to be charged by USB PD chargers as well.

Note: Backwards compatibility with other charging protocols increases the consumer convenience and reduces environmental waste as consumers can use their existing chargers (supporting such other charging protocols) to charge their new radio equipment.

Q15: Is >5A charging current allowed when using the additional charging protocol?

A: Yes. There is an upper limit for charging current (5A) in the USB PD standard (EN IEC 62680-1-2:2021) and USB-C standard (EN IEC 62680-1-3:2021) referenced by Annex Ia, but if there is no such upper charging current limit in the additional charging protocol, >5A charging current may be used.

Q16: Is the radio equipment allowed to support higher charging power (e.g. ≥ 40W) when using the manufacturer’s own charging protocol than when using USB PD (e.g. ≤ 30W)?

A: Yes. The objective of common charger initiative is to enhance consumer convenience and improve the interoperability between device and charger, not to regulate the charging performance of the existing or future innovative charging solutions.

Note: Manufacturers are able to assure higher safety and charging performance when the radio equipment uses the manufacturer’s own, thoroughly tested and verified charging solution (including the charging protocol) than any unknown, untested and unverified 3rd party charger.

1.1.2 EC Feedback

The EC agreed on Q13 and Q15, as long as the full functionality of USB PD is ensured, and disagreed on Q16, saying that the maximum charging power provided by additional charging protocols shall not exceed that of the USB PD since otherwise the full functionality of USB PD is not ensured. And what is more, the same principle shall apply for the maximum charging...
power over USB BC 1.2 (less than 15W charging) and other charging receptacles than USB-C (e.g. the popular barrel type connector of laptops) in the radio equipment.

Later, the EC confirmed its stance in an email to DIGITALEUROPE as follows:

“If the radio equipment is allowed to support a certain charging power, it shall support it across all communication protocols that the radio equipment incorporates/uses. Two (2) chargers with same maximum power but with a different communication protocol (one with harmonised solution USB PD and the other with a proprietary solution) cannot provide a different speed of charge which depends on a limitation of the power accepted by the radio equipment for a specific communication protocol. This principle is also applicable for devices with power levels lower or equal to 15W.”

DIGITALEUROPE understood that the underlying EC assumption behind this requirement is that the radio equipment would have a certain maximum charging power level, independent from the charging protocol and charging connector used, and whether the connected charger is the device manufacturer’s own or any 3rd party charger. DIGITALEUROPE strongly disagrees with this assertion, with the following arguments.

1.1.3 Our perspective

DIGITALEUROPE thinks that the focus of Directive 2022/2380 should be interoperability while ensuring the maximum safety of charging and embracing the continued charging innovation.

As stated in DIGITALEUROPE Common Charger FAQ proposal in January 2023, the manufacturers are able to assure higher safety and charging performance when the radio equipment uses the manufacturer’s own, thoroughly tested and verified charging solution (including the charging protocol) than any unknown, untested and unverified 3rd party charger. This is a widely recognised paradigm which applies also to other technologies than charging.

End-to-end compatibility and coherent design of radio equipment, cable and charger is a key factor for a great user experience in charging. A number of radio equipment manufacturers have developed their own charging solutions to this end, while the USB standards were lagging behind, and have ensured that their customers get the optimal charging solution by including the manufacturer’s own charger and charging cable in the product box for the consumer.

The new Directive 2022/2380 will improve the interoperability of different manufacturers’ chargers and radio equipment by mandating the USB-C receptacle and USB PD or basic USB BC 1.2 charging protocols. Thus, the consumer will be able to charge his/her radio equipment equally with any USB PD or USB BC 1.2 charger.

Furthermore, for environmental reasons, vendors are obliged to make the radio equipment available also without the optimally matched charger in the product box. This makes it more difficult for the manufacturers to ensure that the user gets the optimal charger for the specific radio equipment when purchasing the radio equipment. On the other hand, this is expected to reduce eWaste in the long term.

So, the harmonised USB-C/PD charging solution and the proprietary charging solutions do positively complement each other, and the legislation ensures that they will also not conflict or interfere with each other. However, this is not the case if the charging performance of the proprietary charging solutions is dramatically restricted in favour of the harmonised charging
solution. Such restriction may even lead to the ultimate exit of those charging solutions from the European market which is not in the interest of the European consumers as it will stifle innovation, reduce competition and reduce the backwards compatibility with existing solutions.

A healthy, competitive marketplace is needed to continue to drive the technology innovation forward. The innovative, proprietary charging solutions and competition have pushed the fast charging technologies significantly ahead in the last decade. Now, following through the latest new EC requirement for the harmonisation of the maximum charging power across different charging solutions would contradict to the cherished principles of healthy competition and technology innovation in Europe. This would likely lead to the global fragmentation of charging technologies as other regions would be able to continue on the free innovation path while Europe would ultimately lag behind in these developments.

It would be important to let the manufacturers continue to innovate, excel and differentiate with their own charging solutions or other charging standards while ensuring interoperability of radio equipment and chargers through the harmonised common charging solution. This should be a win-win situation where the other charging solutions can co-exist with the harmonised charging solution.

**1.1.3.1 Safety of Charging**

When the end-to-end (charger, cable, device) charging solution is from the same device manufacturer, then the device manufacturer is more confident about increasing the charging power since the manufacturer knows what the design and safety mechanisms are end-to-end.

When a 3rd party EPS and cable are connected to the device, they advertise themselves as USB PD compatible but device manufacturers cannot ensure that the 3rd party EPS and cable have gone through compliance testing and are of high quality. Even worse, a 3rd party EPS/cable may not even have undergone basic safety/EMI testing according to industry guidelines. These situations are much too risky for a device manufacturer to support the highest charging power levels towards 3rd party chargers and cables. If something goes wrong, it will be the OEM brand name that will get damaged and not the brand of the 3rd party EPS vendor.

The safety of each charger depends greatly on the design of the charger manufacturer and varies a lot in the market. Therefore, limiting the output power of the charger that is not approved by the device manufacturer will maximize the safety of the user and protect the device, charger and cable, especially at high power.

If device is charged at high power by a low-quality charger not approved by the device manufacturer, the following hazards may occur:

- Radio equipment
  - During fast charging, the output voltage and current of the charger are high. If the voltage output precision of the third-party charger is poor, the radio equipment being recharged triggers over-voltage or over-current protection, and charging is interrupted. In severe cases, the radio equipment may be damaged due to over-voltage or over-current. In extreme scenarios, batteries are directly exposed to high voltages, causing safety risks. Also, the internal components of the radio equipment may be damaged, leading to various safety risks and/or need to repair or replace the radio equipment.
If the advertised power of the charger does not match the actual power it provides, it may cause the radio equipment being charged to disconnect from the charger when charging at higher power. For example, a VBUS voltage drop can cause such bad user experience and poses certain safety risks. Furthermore, if a mobile phone requests 10V@3A and the maximum power of the charger only supports 10V@2A, the charger may experience OCP protection or VBUS voltage drop, or the charger Reject may cause a disconnection from the radio equipment, leading to bad user experience.

Arcing may occur when the charging current is high and the 3rd party charger may not be protected for quick removal and insertion, resulting in safety risks for both the user and the products involved.

Port melting: In high-voltage applications, if the 3rd party cable connector is not fully protected, the port will be corroded and short-circuited. As a result, the port will be melted.

Charger

High charging current can cause high temperature. If the cooling and over-heating protection mechanism of the 3rd party charger are not perfect, the device will heat up too much, causing flammable materials to catch fire and possible scalds for the user. In milder case, the radio equipment may be disconnected from the charger, resulting bad user experience.

Electrolytic capacitor related safety risks include temperature rise, large charging ripple current and high voltage. If the electrolytic capacitor of 3rd party charger is not well protected, a slurry burst occurs, lighting up the charging line which spreads to the port and results in fire.

Cable

Cables may also be of low quality and may not advertise their capability correctly.

In summary, the manufacturer cannot guarantee that no safety hazards will occur when the radio equipment is connected to a 3rd party USB PD charger and cable e.g. caused by the poor high current sustainability, heat dissipation capacity, and various other quality issues. Therefore, the charging power of 3rd party USB PD chargers and cables are limited to safe levels – in order to protect the user, the radio equipment, the charger and the cable.

Following the new EC requirement “Two (2) chargers with same maximum power but with a different communication protocol (one with harmonised solution USB PD and the other with a proprietary solution) cannot provide a different speed of charge” will put the radio equipment, charger and cable at risk and potentially cause physical damage to consumers.

1.1.3.2 Different power levels of USB PD and proprietary charging protocols

The different power levels of USB PD and proprietary charging protocols are partly due to the different current and voltage levels these protocols use, and even for this reason alone, the maximum charging power of USB PD and proprietary charging protocols cannot be the same.
The maximum allowed USB PD current is 5A, but the proprietary charging protocols are not limited to this value. Thus, the power levels and ranges corresponding to different VBUS voltages are different in USB PD and proprietary protocols. For example, in USB PD, when VBUS voltage is 20V, the corresponding max power is 100W, and 100-240W power levels are achieved only by >20V VBUS voltage. But the current maximum VBUS voltage in mobile phone designs is 20V. As result, by >5A current, proprietary charging protocols can achieve >100W charging power at the max 20V VBUS voltage which is a common feature in current mobile phone designs.

Rather than the high-voltage charging which USB PD has adopted, various other charging protocols could leverage high-current charging exceeding the upper limit of 5A defined in the USB PD standard (EN IEC 62680-1-2:2022) when the radio equipment has confirmed that the connected cable and charger support > 5A. Thus, many non-PD charging protocols can deliver higher power than USB PD, even if they use the same charging voltage and the same hardware.

If the device, cable and charger can all support >5A (note: the capability identification mechanism is provided by the manufacturer), the device should be allowed to run the proprietary charging protocol with >5A charging current to avoid artificially affecting the charging speed.

A simple example illustrated by the following table:

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Current (A)</th>
<th>Maximum Charging Power (W) at 11V</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB PD</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>Other charging protocol (example)</td>
<td>11</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Table 1: An example of the different power levels of USB PD and another charging protocol at a certain voltage level due to the different maximum current levels supported by these charging protocols.

In Table 1 example above, the charging power of the non-PD charging protocol is 67W (= 11V x 6.1A). Even if the radio equipment can support 11V charging via USB PD, it can only be charged at a maximum of 55W (= 11V x 5A) because of USB PD restricts the maximum charging current to 5A. This is the reason why many non-PD charging solutions can deliver higher power than USB PD at the same charging voltage level.

This example illustrates that it is the upper limit for charging current (5A) which is restricting the maximum charging power of USB PD. In this case, the other charging protocol is neither limiting the charging power of USB PD nor impeding the full functionality of USB PD.

In other words, USB PD cannot fully leverage the capability of common hardware designs, but major other charging protocols can. Without dramatic technology innovation, USB PD is no longer the best fast charging technology. It is actually the USB PD protocol limiting the full use of existing hardware, and not the other charging protocols limiting USB PD.
Furthermore, some phone designs may not be designed to accept higher voltages from the EPS, but they are designed to accept higher currents. For example, they may not be able to accommodate voltage higher than 9V (theoretical max power via USB PD: 9V x 5A = 45W if a 5A cable is used), but the same phone can accept 6A or 7A via the non-PD protocol i.e. 9V x 7A = 63W which is much higher achievable via USB PD.

Note: 5A USB PD / USB-C cables are very uncommon. On the other hand, proprietary cables can always support charging current higher than 3A.

Accepting higher voltages means also that all charging chips and other components in direct contact with the connector will be subject to higher cost which is ultimately reflected in a higher cost of the radio equipment to consumers. For example, there are several ways to support 100W charging. USB PD supports a higher cost path as all the components need to support higher voltage which implies higher cost and thermal challenges. Other methods do not require high voltage support and are therefore more cost-efficient and thermally sustainable and safer. This applies particularly to smartphones which have a lot of electronics cramped into a small form factor where heat dissipation is demanding to achieve.

With USB PD Extended Power Range (EPR), the power efficiency inside the different radio equipment will suffer (higher voltage to lower voltage conversion) which may contradict other EU initiatives in the area of energy efficiency and power conservation. The lower the power efficiency, the more power the radio equipment will need to draw from the charger in order to meet its power needs and also the more thermal solutions will need to be implemented in the radio equipment (i.e. more e-waste instead of less).

To sum up, interpreting the “full functionality of USB PD” as (quoting the new EC requirement) “If the radio equipment is allowed to support a certain charging power, it shall support it across all communication protocols that the radio equipment incorporates/uses.” will definitely stifle innovation on fast charging, prevent EU consumers from benefiting from the more advanced fast charging technologies, and cause market fragmentation.

1.1.3.3 Power harmonisation of basic charging

Paragraph “2.1.2 EC feedback” in this document addresses also the harmonization of basic charging: “...This principle is also applicable for devices with power levels lower or equal to 15W.” DIGITALEUROPE strongly disagree with the interpretation that such charging power harmonization should also apply to basic charging, based on the USB PD full functionality which is different from basic USB charging.

Directive 2022/2380 Annex 1a Part I Clause 3.2 does require the full functionality of USB Power Delivery for charging >15W, but the Directive does not have any explicit or separate requirement on the full functionality of the basic charging protocol USB BC 1.2 below 15W.

1.1.3.4 Proposed new Q&A on USB PD PPS feature

Q28: USB PD standard includes the Programmable Power Supply (PPS) as an optional feature. Once the radio equipment incorporates USB Power Delivery (PD), ensuring its full functionality, as described in the standard EN IEC 62680-1-2:2022, may it also include the optional PPS feature to enable higher charging power levels?
A: Yes, it may. Optional features of the standard referenced by the Directive can be implemented upon manufacturer choice.

1.2 Alternative charging receptacles

This section comprises one new individual Q&A proposed by DIGITALEUROPE for the Directive 2022/2380 Guide and elaborates on Q18 from the original FAQ.

1.2.1 Proposed new Q&A

Q29: Are alternative charging receptacles permitted in addition to the USB-C receptacle specified in Directive 2022/2380?

A: Yes. Products in scope of Directive 2022/2380 must meet all the requirements including full support for USB-C receptacle and USB PD protocol where required. Alternative charging connectors – e.g. barrel type connectors frequently used in high-power laptops – may be applied if they do not interfere with or detract from the functioning of the mandated USB connectors and protocols.

Such dual-charging solutions can arise, for example, with products require higher power than that foreseen in the USB PD protocols for optimal functionality or for products that may – due to foreseeable environmental conditions - benefit from an alternative type of charging connector.

Examples of such products include (but are not limited to) very high-end laptop computers that can consume more than 240W or portable products designed for operation in certain ‘rugged’ environments.

Dual-charging solutions may arise also for dual use i.e. consumer and industrial applications, and to facilitate the widest deployment globally, where other countries utilise other primary methods of charging. Directive 2022/2380 is not intended to limit product versatility, and the decision whether a product needs to support additional charging ports and/or protocols, above and beyond USB-C, is at the choice of the manufacturer.

Note: DG GROW interpretation of “full functionality” as meaning the maximum power (at least relative to the maximum power of the system) is effectively a new requirement and one with profound implications. The Directive itself requires only that the Powered Radio Equipment be “capable of being recharged” and does not say anything about the power ratings of the USB Type-C circuit. Also the referenced USB standard does not say anything in this regard. Requiring the same charging power to be supported over the standard USB Type-C port using USB PD charging protocol as the primary charging solution using the alternative charging connector (e.g. barrel type connector in laptops) will lead to huge design changes, impact on circuits ratings in the context of EN 62368-1 and will not necessarily bring any benefits to the user.

On the contrary, it is likely to mean increased cost ultimately paid by the end-user, reduced performance and thermal inefficiency.

1.2.2 Unbundling of charger using a cable with alternative charging connector

1.2.2.1 Related Q&A in the original Q&A (31 Jan 2023)

Q18: In case the radio equipment has an alternative charging receptacle (e.g. barrel style) in addition to USB Type-C receptacle, do the requirements of Article 3a of
Directive 2380/2022 regarding the supply of radio equipment without a charger, apply to the alternative charger?

A: No. The requirements of Article 3a apply only to chargers compatible with USB Type-C receptacle as described in Annex Ia Part I of Directive 2380/2022. Alternative chargers may use proprietary charging protocols or connectors and it cannot be assumed that the end user will have a compatible charger available prior to the purchase of the radio equipment. Thus, it is a decision for the manufacturer whether to include such a charger with the radio equipment (in box) or not.

1.2.2.2 EC feedback on the proposed Q&A 18

Based on Directive 2022/2380 text, it should be the default that devices with two charging receptacles (e.g. USB Type-C, barrel) must be unbundled for both receptacles. E.g. a laptop with a barrel receptacle must also be sold without the barrel charger and this should be the default, in addition to making the laptop available as a bundled offering.

1.2.2.3 Our perspective

There is no “default” requirement in Directive 2022/2380. Manufacturers are required to “also” offer the “possibility” of acquiring the radio equipment without a charger. The specifics of the product offerings and marketing strategy are determined by the manufacturer.

The objective of Directive 2022/2380 is to ensure interoperability of the radio equipment in scope with a common charger, as well as increasing the convenience for consumers and reducing the electronic waste by not having to acquire a new common charger with every product. However, as several categories of products were added by the co-legislators late in the process, an impact assessment of unbundling chargers for those categories of products was not performed and care should be taken in order not to decrease the consumer convenience because consumers would not have access to such alternative charger at the time of purchase. Additionally, from discussions with certain market surveillance/Member State representatives, the understanding seems to be that the unbundling only applies to the USB Type-C charger itself.

The Commission should provide guidance and clarifications to EU Member States and ADCO to avoid inconsistent interpretation of the unbundling principle, and thus risk harming legal certainty and market harmonization.

1.3 Rated power v Maximum charging power

1.3.1 Directive 2022/2380 definitions

Recital 6 of Directive 2022/2380 states that “The maximum power should express the sum of the power required by the radio equipment to maintain operation and the power required to achieve the maximum charging speed.” This however conflicts with the meaning of Part II: “maximum power required by the radio equipment to achieve the maximum charging speed”.

The same inconsistency exists for the minimum charging power.

1.3.2 Proposed new Q&A

Q30: What is the difference between rated power and maximum charging power?

A: The rated power and maximum charging power of the radio equipment are not always the same thing. For example, a radio equipment rated e.g. at 300W (e.g. high-end gaming laptop)
may use only around 100W at maximum for charging its battery as most of the power is used to power heavy system loads (e.g. GPUs, CPUs, particularly gaming). In the maximum power consumption case, this could mean that 200W from the mains supply would be used for operating the device while charging the radio equipment’s battery at 100W. Even when the radio equipment is in idle mode or completely switched off, the charging power would be lower than power adapter’s rated power and would not use the full rated power in any case. There are also regulations which limit the maximum battery capacity e.g. to 100Wh which impacts the charging time.

Directive 2022/2380 only regulates the charging of the radio equipment and does not regulate the rated power of the radio equipment. Thus, it is important to make the distinction between the rated power and the maximum charging power of the radio equipment.

In the case of a system using an alternative, proprietary power solution to enable a higher power than that foreseen by the USB PD specifications, the actual power rating of both the proprietary and USB Type-C power solutions are determined by the manufacturer. In any case, the power rating of the USB Type-C circuit shall be such that it offers a viable* charging alternative to the user with due regard to energy efficiency, impact on system design/footprint and customer expectations.

* For example, a viable charging solution in high-power laptops would typically allow for charging of a 100Whr battery from 0% to 100% within 2 hours.

![Figure 1: Example of the use of mains power for basic operation and charging of high-power laptop.](image)

It is important that the user will use the correctly rated power adapter as recommended by the manufacturer. If a user connects a power adapter with too low power rating to a high-power radio equipment (e.g. laptop), the insufficient power supply will result bad user experience. Although the laptop manufacturer can provide a warning statement on laptop screen about a too weak power supply connected to the laptop and advise the user how to select and use a charger, some users will still use an unsuitable charger. For example, when the user connects a low power charger to the laptop, the laptop battery will not be charged but the battery will discharge gradually to zero as all the mains power provided is needed for the basic operation of the radio equipment. After the battery discharges to a certain level, the laptop will start working at a low performance mode which will impact the efficiency, and the user may doubt the battery, or the charging or laptop performance.
Part II: 2 new proposed Q&As on USB-C receptacle not previously reviewed/approved by our working group

Q25: The standard EN IEC 62680-1-3:2022, clause 3.2.1, mentions the physical size of the USB-C receptacle, but all the dimensions are provided for reference only. Does this mean that there are no hard requirements for the physical USB-C receptacle size?

A: Yes, no hard requirements as stated in the standard:

3.2.1 Interface Definition

Figure 3-1 and Figure 3-3 show, respectively, the USB Type-C receptacle and USB Full-Featured Type-C plug interface dimensions.

Figure 3-11 shows the USB 2.0 Type-C plug interface dimensions. The dimensions that govern the mating interoperability are specified. All the REF dimensions are provided for reference only, not hard requirements.

Q26: Are the 6-pin USB-C receptacles common in Bluetooth mice and keyboards allowed to be used for charging, even if they are not specified in IEC EN 62680-1-3?

A: No. Only 12, 16 and 24 pin USB-C receptacles are specified in this standard and they must be used.

![USB-C receptacles](image)

Figure 2: Different USB-C pin configurations.