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REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

on market developments, market fragmentation and technological progress of wired charging for radio equipment

1 Introduction

The Radio Equipment Directive ([1]) (RED) sets out essential requirements for certain aspects of radio equipment that are of public interest in the EU. The RED was amended by Directive (EU) 2022/2380 ([2]) (the Common Charger Directive), which introduced five requirements, referred to as the 'common charger requirements' (CCRs):

- USB Type-C receptacles for charging on the device end;
- USB Power Delivery (USB PD) charging protocol for devices requiring more than 15 W;
- a label informing consumers about the charging characteristics of devices;
- unbundled sale of chargers and devices; and
- a pictogram showing whether a charger is included in the packaging or not.

Since 28 December 2024, the CCRs apply to mobile phones, tablets, e-readers, earbuds, digital cameras, headphones, headsets, handheld videogame consoles, portable speakers, keyboards, mice, and portable navigation systems ([3]). Since 28 April 2026, they also apply to laptops ([4]).

In addition, the European Commission adopted a Regulation laying down new ecodesign requirements for External Power Supplies (EPS) ([5]) complementing the RED. It will apply as of 14 December 2028, and will introduce the following main interoperability requirements to ensure the widespread use of the common charger:

- all radio equipment chargers on the EU market to be common chargers i.e. chargers with at least one USB Type-C port by default;
- all common chargers and cables on the EU market to meet USB Type-C standards;
- EPS placed on the EU market to be common changers, extending common chargers to a broader range of products beyond radio equipment to maximise interoperability. Exemptions from this obligation apply e.g. to EPS used in wet environments or with vacuum cleaners, certain power tools, toys and audio equipment;
- common chargers to operate only with detachable cables and be marked at each port with the power supported;
- a new EU common charger logo to be applied on common chargers.

The Council and Parliament have shown substantial interest in the possible future extension of the scope of application of the CCRs. Hence, under Article 3(4) of the amended RED, the Commission is obliged to

([1]) Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (OJ L 153, 22.5.2014, p. 62, ELI: http://data.europa.eu/eli/dir/2014/53/oj).

([2]) Directive (EU) 2022/2380 of the European Parliament and of the Council of 23 November 2022 amending Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment (OJ L 315, 7.12.2022, pp. 30-43, ELI: http://data.europa.eu/eli/dir/2022/2380/oj).

([3]) In so far as they can be recharged via wired charging.

([4]) In so far as they can be recharged via wired charging.

([5]) Commission Regulation (EU) 2025/2052 of 13 October 2025 laying down ecodesign requirements for external power supplies, wireless chargers, wireless charging pads, battery chargers for portable batteries of general use and USB Type-C cables, pursuant to Directive 2009/125/EC of the European Parliament and of the Council and repealing Commission Regulation (EU) 2019/1782 (*OJ L, 2025/2052, 24.11.2025, ELI: http://data.europa.eu/eli/reg/2025/2052/oj*).

regularly report on market developments, market fragmentation and technological progress of radio equipment. The aim is to identify new categories or classes of radio equipment that could be covered by the CCRs, which could improve consumer convenience, reduce environmental waste and avoid market fragmentation. As a follow-up to this reporting obligation, Article 3(4) also requires the Commission to adopt delegated acts modifying, adding or removing categories or classes of radio equipment. To support the analysis in the report, the Commission procured a study ([6]) (the study), and gathered data from other sources such as Statista.

In line with Article 3(4) of the amended RED, Section 2 of the report assesses market developments, beginning with an overall market analysis of the four main market segments covered by the RED. It then explains the criteria used for selecting potential subsegments or product categories to which the CCRs could be extended and provides an analysis of their market sizes and sales. Section 3 examines market fragmentation and technological progress, assessing whether there are technological barriers to extending the CCRs to such product categories. Section 4 looks at the possible environmental impact and savings for consumers. Section 5 concludes with a list of product categories to which the CCRs could apply based on this analysis.

2 Market developments

2.1 Evolution of the main market segments covered by the RED

There are **four main market segments** covered by the RED:

1) consumer electronics;
2) smart appliances;
3) plastic and other toys; and
4) wearable electronic devices (wearables).

The **consumer electronics segment** includes the following subsegments (i) telephony, including all mobile phones; (ii) TV, radio & multimedia, including digital cameras, e-readers, tablets, portable speakers, and earwear (headphones, headsets, earbuds); (iii) computing, including all IT equipment such as laptops, keyboards or mice; (iv) TV peripheral devices, including smart streaming devices, smart remotes, and video players; (v) drones, including unmanned aerial vehicles (UAVs) or unmanned aircraft systems (UASs) used for personal purposes; and (vi) gaming equipment, including augmented/virtual reality (AR/VR) headsets, handheld videogame consoles and videogame controllers.

Market revenues for all subsegments, except computing, have grown since 2019 and are expected to continue growing (some by more than 5% yearly until 2030). A substantial share of the consumer electronics segment, including some of the fastest growing subsegments (such as mobile phones or tablets), is already covered by the CCRs (see Figure 1). For example, earwear worldwide shipments are expected to grow steadily from 360 million (m) units in 2025 to 400m units in 2028 ([7]).

The **smart appliances segment** includes directly or indirectly internet-controllable (i) large smart household appliances such as fridges, washing machines, dishwashers, and ovens; (ii) personal care

([6]) *Study analysing the possible application of common charger requirements to radio equipment not covered by the Directive – Final report*, Publications Office of the European Union, 2025, https://data.europa.eu/doi/10.2873/628130.

([7]) Commission's calculations based on data from Statista.

devices; and (iii) small smart household appliances, such as coffee machines, vacuum and mowing robots, and microwaves. Revenues have grown at a steady rate since 2020 (to around EUR 8 billion (bn) in 2024) and are expected to increase by more than 50% between 2024 and 2029 ([8]).

The **plastic and other toys segment** covers (i) drawing and painting sets ([9]); (ii) craft kits ([10]); (iii) playground equipment ([11]); and (iv) remote-controlled toys ([12]). Market revenue from both online and offline sales has been decreasing slightly since 2022 (around EUR 5.3 bn) to reach around EUR 5bn in 2027, but is expected to grow again as of 2028 ([13]).

The **wearable electronic devices or wearables segment** is composed of (i) smartwatches; (ii) fitness trackers; (iii) smartglasses; (iv) wristbands; (v) smart clothes; and (vi) other modular devices ([14]). Shipments of smartwatches (a large subsegment) are forecast to grow steadily from 164m units in 2025 to 175m units in 2028, as are shipments of smart glasses (from 1.9m units in 2025 to 2.4m units in 2028 ([15])).

2.2 Assessment of market segments not covered by the CCRs

An in-depth market review[16] was undertaken to determine to which new categories of radio equipment the CCRs could be extended. The following approach (see Figure 1) was used to frame the scope of the in-depth market analysis. First, the radio equipment should (a) fall within the scope of the RED; (b) be equipped with a removable or embedded rechargeable battery; and (c) be rechargeable via wired charging. Second, three key, cumulative criteria should be met (1) the market size of the subsegment should be significant, with sales likely to remain constant or grow in the future; (2) the devices with RED features should represent a non-negligible portion of the subsegment; and (3) there should be no technical conditions concerning the devices that would rule out application of the CCRs.

The in-depth analysis identified nine categories of radio equipment listed below as meeting the criteria above to apply CCRs. All other categories examined were disregarded because they either already apply the CCRs or did not satisfy the two conditions above. For example, smart household appliances were excluded because most are not battery-operated, while smart clothing, modular devices and most personal care devices were disregarded due to limited market size and sales. Non-remote-controlled toys were excluded as they mostly use AA-type batteries, of which many are Ni batteries. Most electronic learning toys do not fall under the RED, and those that do are already covered by the CCRs under other categories like tablets.

Consumer electronics • **AR/VR headsets** • **drones intended for personal purposes** • **videogame controllers**	Wearables • **smart watches** • **fitness trackers** • **smart glasses** • **wristbands**
Smart appliances	Plastic and other toys

([8]) Ibidem.
([9]) For example, Crayola Inspiration Art Case and Melissa & Doug Deluxe Art Set.
([10]) For example, Klutz Make Clay Charms Kit and Alex Toys Simply Needlepoint Craft Kit.
([11]) For example, swings, slides, trampolines, climbing frames, and playhouses.
([12]) For example, Maisto RC cars and trucks.
([13]) Commission's calculations based on data from Statista.
([14]) Modular devices are devices that can be worn over the body and are composed of multiple elements. Examples of modular devices are bracelets composed of different segments.
([15]) Commission's calculations based on data from Statista.
([16]) The study including consultations (expert group, interviews with relevant stakeholders, and consumer survey).

• **battery-operated electric toothbrushes**	• **remote-controlled toys**

Further analysis focused on trends in sales of the selected radio equipment categories. The following key trends were identified.

- Approximately 1.5m **AR/VR headsets** were sold across 20 EU Member States in 2022, up from 0.8m in 2018 and 0.7m in 2020. This doubling of sales came with the launches of Meta's VR headset and of Oculus Quest 2. Online reports indicate that sales are expected to continue growing ([17]).
- In 2020, 700 000 **drones intended for personal purposes** were sold in the EU, and 1m units in 2022. Sales are expected to continue to increase to 1.2m in 2028. Some drones are already covered by the CCRs due to their main function (e.g. cameras).
- Sales of **wireless videogame controllers** increased from 4.5m in 2020 to 4.6m in 2022 and are expected to increase to around 4.8m units in 2028.
- The market for **electric toothbrushes** falling under the scope of the RED was estimated at 11.2m units in 2022. Sales are expected to remain stable.
- The market for **remote-controlled toys** is estimated at around 1.5m units. Online reports also show that this market is steadily growing ([18]). As for drones, some toys are already covered by the CCRs due to their main function (e.g. cameras, tablets).
- In 2022, over 26m **wearable devices** were shipped to the EU, up from 14m in 2018 and 24m in 2020. Smartwatches accounted for almost 80% of the shipments, followed by wristbands, fitness trackers and smartglasses. Online reports ([19]) and feedback from industry stakeholders indicate that the market is expected to grow in the next 5-10 years for all subsegments as innovation advances quickly.

In sum, the identified categories fall within the scope of the RED, are equipped with a rechargeable battery, and can be recharged via wired charging. In addition, RED devices represent a significant share of each category, their market size is significant, sales are expected to remain constant or grow, and no technical limitations to the application of the CCRs were observed in the study.

3 Market fragmentation and technological progress

In the **third stage**, the Commission assessed market fragmentation and technological progress. The assessment covered **potential limitations** of USB Type-C, **safety concerns and existing applicable legislation**, for different categories of radio equipment. The following elements were considered:

- use of a USB Type-C charging receptacle or, alternatively, use of a charging pad, case or box with a captive cable;
- use of USB PD fast charging protocol; and
- unbundling of charger or charging cable.

The results are summarised in Table 1.

([17]) https://www.statista.com/outlook/amo/ar-vr/worldwide#revenue.
([18]) https://www.datainsightsmarket.com/reports/remote-control-toys-1917195.
([19]) https://www.grandviewresearch.com/industry-analysis/wearable-technology-market.

Table 1 – Market fragmentation of charging characteristics, receptacle, protocol, and unbundling (Source: The study)							
Categories of devices	**Number of devices analysed**	**Charging characteristics**	**USB Type-C charging receptacles**	**Captive cable in wireless / pin charging pad, case or box**	**USB PD charging protocol**	**Sold with a charger**	**Sold with a charging cable**
Wearables	63	I = 0.15 … 2 A U = 3.7 … 5 V P = 0.75 … 20 W	4 6%	32 51%	7 11%	3 5%	59 94%
AR/VR headsets	20	I = 0.9 … 3 A U = 5 … 12 V P = 4.5 … 45 W	8 40%	2 10%	3 15%	7 65%	20 100%
Drones	17	I = 0.5 … 5 A U = 4.7 … 52.8 V P = 12.9 … 77 W	11 65%	0 0%	1 6%	1 6%	16 100%
Videogame controllers	23	I = 0.48 … 2 A U = 3.65 … 5 V P = 2.4 … 10 W	18 65%	0 0%	1 4%	2 9%	23 100%
Remote-controlled toys	31	I = 0.1 … 2 A U = 3.2 … 11.1 V P = 0.45 … 10 W	0 0%	0 0%	0 0%	6 19%	31 100%
Electric toothbrushes	15	I = 0.7 … 3.9 A U = 3.6 … 5 V P = 2.5 … 3.5 W	1 7%	9 60%	0	10 19%	15 100%

3.1 Charging receptacle

Table 1 shows that, of the products assessed in 2023, 65% of **drones and videogame controllers** and 40% of **AR/VR headsets** had a USB Type-C receptacle. This shows that manufacturers have to a large extent adjusted to the requirement to use this receptacle in these categories, and that further expansion is technologically feasible for products that do not yet have a USB Type-C receptacle.

For **electric toothbrushes**, adoption of USB Type-C was low, at 7% in 2023. Manufacturers explained that since toothbrushes are used and charged in wet environments, USB Type-C receptacles consistently failed to meet safety and performance requirements at the testing stage. Because of its small size, the USB Type-C connector has a reduced space between pins. The presence of liquids or moisture in the receptacle can cause a shortening of the power pins. USB Type-C receptacles are therefore not currently suitable for use in wet environments.

97% of **remote-controlled toys** used proprietary receptacle in 2023. While the analysis found no specific technological barriers to changing to USB Type-C, manufacturers indicated that providing a charger together with toys ensures optimal charging and minimises safety risks (users are mostly children) (Section 3.3). In addition, existing standardisation requirements for toys require them to be equipped with a charger and have specific technical characteristics.

For **wearables**, the rate of adoption of USB Type-C was low at the time of the study (6% in 2023). The small size and form of these devices may have influenced the choice of proprietary connectors and dedicated charging pads, cases or boxes. However, recent exchanges with industry suggest that the adoption of the Common Charger Directive in 2022, enhanced the adaptation of the charging method. Moreover, the study suggests that adapting wearables to the USB Type-C receptacle would affect only the charging pad, case or box (e.g. most smartwatches use a pad which would need to be adapted) and no technological constraints or safety implications to the change were identified. On that basis it would appear that the technological adaptation would be easy to achieve

For **videogame controllers**, the same reasoning applies to attachments to a main device, such as Joy-Con controllers for the Nintendo Switch. These controllers must be considered together with their handheld consoles. The CCRs would therefore apply only to the main device.

It should be noted that, even for products already using the USB Type-C receptacle, there may still be interoperability issues with a common charger. This is because some products do not fully comply with the USB specifications. The study found that over 60% of device owners still experienced difficulties charging them with a charger other than the included one on at least one occasion.

The study found that manufacturers use proprietary charging solutions because of the size of the equipment (e.g. wearables), the environment in which it is used (e.g. electric toothbrushes) or specific legislative and standardisation considerations (e.g. toys) rather than for commercial reasons.

Regarding technological progress in the field, the USB Type-C specification was revised several times to accommodate developments in the USB PD specification (see below).

The analysis suggests that the **application of the CCRs is not suitable for electric toothbrushes and remote-controlled toys**, which are also excluded from the EPS Regulation, **respectively because of safety concerns and regulatory requirements largely based on safety grounds. .**

3.2 Fast charging

Table 1 shows that only a few devices are equipped with USB PD. This can be explained by the fact that most devices (e.g. wearables) charge at low power and thus do not need an USB PD. In addition, under the CCRs USB PD is not required below 15 W. According to the study, manufacturers of devices where USB PD would be enforced (e.g. certain drones or AR/VR headsets) are either already using it or see its use as technically possible.

As for the receptacle, products declared compatible with USB PD may still have interoperability issues with the common charger if the USB specifications are not applied in full.

Some key developments in technological progress have been made in the field.

- In 2022, the USB PD ([20]) specification was revised, increasing power from 100 W to 240 W, with voltage restricted to 48 V. USB PD supports high power and enables 'fast charging' over a USB Type-C connection. In 2025, the specification was updated again, consolidating support for a maximum of 240 W and for adjustable voltage supply. USB PD delivers a minimum of 1 W (though it is mostly used above 15 W).
- In 2021, four Chinese manufacturers – Huawei, OPPO, Vivo, and Xiaomi – released the Universal Fast Charging Specification (UFCS), which reaches up to 36 V and delivers between 20 W and 200 W. The study shows no evidence of UFCS-supporting devices sold in the EU market among those analysed in this report. However, a charger made by Huawei ([21]) was found. This charger integrates a USB A and a USB Type-C receptacle and is compatible with USB PD and UFCS.

3.3 Unbundling of the charger

Table 1 shows variations between device categories. For example, most wearables, drones and videogame controllers are sold without a charger, while AR/VR headsets are mostly sold with one. In the study, some manufacturers reported that end users in certain sectors (e.g. industrial or high-end products) expect to find a complete product in the box, and that providing a charger ensures optimal charging and minimises safety risks. This is the case for toys which are sold with a charger due to standardisation requirements (e.g. EN IEC 62115:2020 supporting Directive 2009/48/EC on the safety of toys).

4 Cost-benefit considerations

The analysis above shows that for several categories of radio equipment (drones, videogame controllers and AR/VR headsets), the switch to USB Type-C receptacles is under way, with the study identifying no technical constraints or possible safety concerns. Since many devices from these categories already comply fully or partially with the CCRs, manufacturers' adaptation costs have been at least partially absorbed.

For wearables (including smartwatches – the largest subsegment), some recent models already use USB Type-C on their charging pads, cases, or boxes. However, several models still require adaptation. It is also reasonable to expect that the share of products complying with certain CCRs has increased since the study as a spillover effect of the amended RED, in turn limiting adaptation costs. Some adaptation costs may alsolikely be partially absorbed as an effect of the Ecodesign EPS Regulation which which is assumed to lead indirectly to further adoption of the USB Type-C receptacles on the analysed categories of devices.

([20]) The USB PD specification is detailed in standard EN IEC 62680-1-2 (currently referred to in the CCRs).
([21]) SuperPower Wall Charger (max. 88 W).

For each identified category of devices, the impact of application of the CCRs on the environment, consumers and businesses is summarised in Table 2.

Table 2 – Yearly average impacts of CCR application for 2026-2035 compared to the baseline (source: the study)

	Green House Gases (GHG) emissions [ktCO2]	**Material use [tonnes]**	**E-waste [tonnes]**	**Spendings for consumers [NPV million EUR]**	**Costs for manufacturers [NPV million EUR]**
AR/VR headsets	-10	-149	-85	-23	10
Drones	-0.3	-3	-2	-2	-1
Videogame controllers	-0.5	-3	3	-1	1
Wearables	8	233	116	-52	23
Baseline for smartphones, tablets, earwear, digital cameras, standalone chargers, and the 4 categories above ([22])	1 110	25 654	23 667	6 926	1 492

For all categories but wearables, positive environmental benefits are identified. These benefits come mostly from unbundling the charger. Wearables are already sold without a charger, hence the needed technical adaptations would result in additional GHG emission, material use and e-waste.

For the four categories, CCRs would result in monetary savings for consumers. These outweigh the monetary costs for manufacturers, notably for AR/VR headsets and wearables.

The impacts of CCRs application to the identified categories (Table 2) are limited and represent less than 1.5 % of the overall GHG emissions, material use, e-waste generation, consumer spendings and costs for manufacturers of the market (without new regulatory intervention) of smartphones, tablets, earwear, digital cameras, standalone chargers and the 4 categories identified.

Beyond the expected impacts, the following considerations could justify mandating the application of CCRs to the above categories.

- In the absence of legislative action, uptake would be left to the goodwill of manufacturers, which could result in slower adoption or even increased market fragmentation, as nothing would prevent manufacturers from relying only on proprietary solutions.
- The application of CCRs would complement the EPS Regulation to ensure that only USB Type-C receptacles would be used on the device side, thus encouraging a full uptake of the common charger solution.
- Although some products already incorporate the USB Type-C receptacle or USB PD fast charging protocol, they do not necessarily strictly apply the USB specifications (as these are not mandatory), therefore they may not be interoperable with common chargers.

([22]) The study (raw data).

- Although the unbundling of the charger is already taking place for certain categories, consumers are not given simple and harmonised information on the device's charging requirements, which is one of the CCRs (see Section 1).

5 Conclusions

This report assessed several categories of products currently not covered by CCRs in line with Article 3(4) of the amended RED. Based on the criteria for inclusion presented in section 2, it identifies several product categories of radio equipment capable of being recharged by means of wired charging for which the inclusion in Part I of Annex Ia of the RED could lead overall to improved consumer convenience and savings and environmental benefits.

For all product categories, consumer savings outweigh manufacturing costs and for all categories but wearables the impact on the environment is positive. The categories are:

Consumer electronics	Wearables
• AR/VR headsets	• smartwatches
• drones intended for personal purposes	• fitness trackers
• videogame controllers, excluding attachments to handheld consoles	• smart glasses
	• wristbands

The impacts to apply the CCRs to those categories are limited, compared to the overall GHG emissions, material use, e-waste generation, consumer spendings and costs for manufacturers of the market ([23]) without new regulatory intervention.

These categories represent a smaller market size (63.1 m units) than some of the categories already covered by the CCRs (183.5 m units) ([24]). However, since sales have been increasing, consumers savings and convenience resulting from application of the CCRs to these categories could be further amplified. Moreover, the report did not discover technological barriers or safety issues related to extending the CCRs to the above categories.

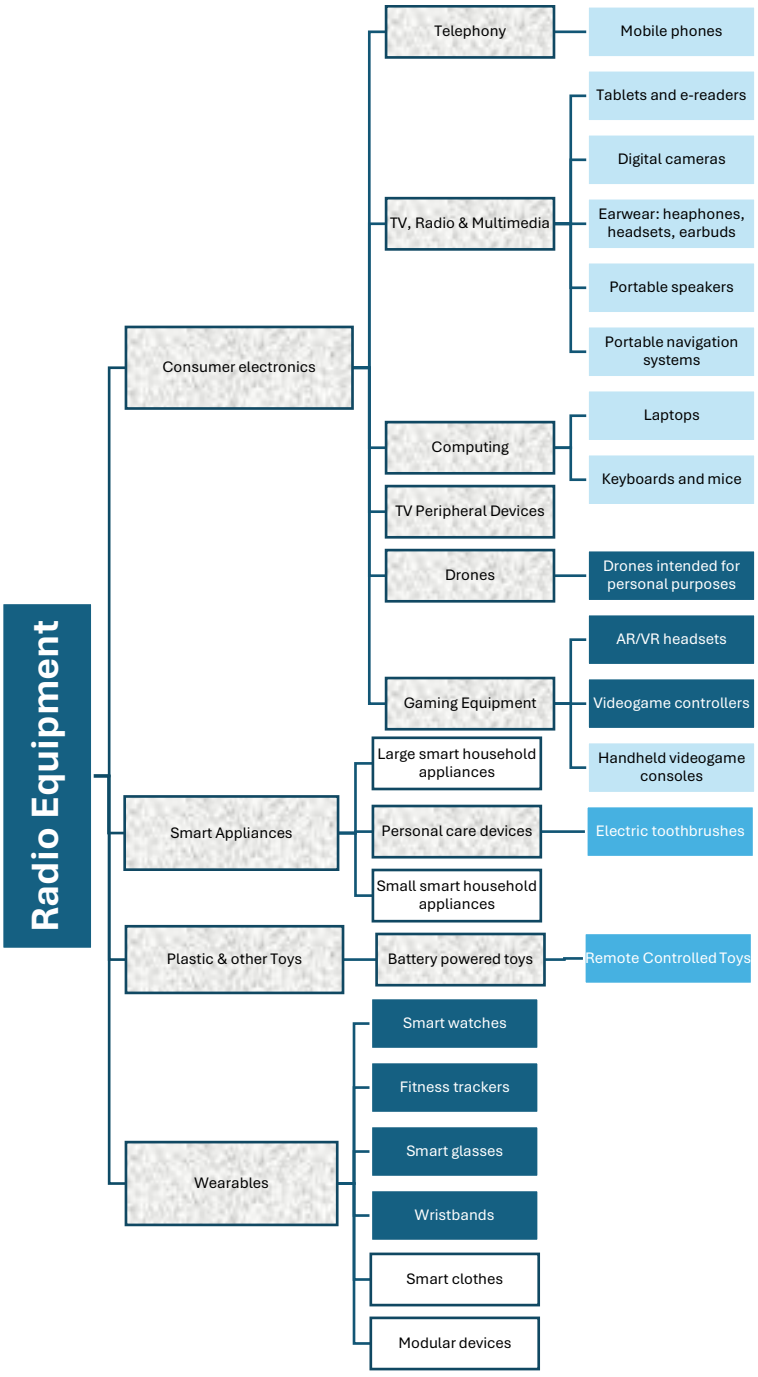
Extending the scope of the CCRs to these categories could remove market fragmentation, while entailing limited adaptation costs for manufacturers. It would also complement the implementation of the EPS Regulation which will extend the use of the common charger by ensuring a more extensive adoption of USB Type-C receptacles.

For general context, it is worth noting that EU consumers generally support a possible extension of the scope of the CCRs. According to the support study, 84% of Europeans expressed a positive view of the Common Charger Directive and most respondents (between 55% and 65%) were in favour of extending its scope for reasons of safety and cost.

([23]) Ibidem.
([24]) Market size in 2022 according to the study for smartphones, tablets, earwear, digital cameras, and standalone chargers.

6 Annex

Figure 1 – Graphical representation of candidate categories for application of the CCRs



Categories already covered by the CCRs
Categories not fulfilling criteria 1 and 2
Categories fulfilling criteria 1 and 2, but not suited to application of the CCRs
Categories fulfilling the criteria laid out in this report