Positive innovation

Online Marketplace Research – Summary Report

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Executive Summary

This research, conducted by Talan in collaboration with Electrical Safety First (ESF), investigates the prevalence of likely non-compliant electrical products sold through selected major UK online marketplaces. The largest generalist marketplaces in the UK are reported to be Amazon, eBay, AliExpress, Very, Tesco and Temu[1].

The analysis is based solely on the information presented to consumers at the point of purchase, including product descriptions, technical specifications, customer reviews and product images. Using publicly available listing information, the study assesses whether products advertised as meeting UK electrical safety standards are likely to meet those standards. Importantly, the analysis relies on basic product data and imagery that online marketplaces already collect and manage as part of their normal operations, rather than specialist testing or information unavailable to platforms.

The study highlights systemic safety risks and regulatory gaps in platform-based commerce, particularly concerning consumer assumptions about product safety and marketplace accountability. They show that consumers' reasonable assumptions about product safety are not being reliably met and that current marketplace practices and voluntary safeguards are insufficient to prevent likely non-compliant products from being listed, promoted and sold to UK consumers.

Independent testing and government data reveal alarmingly high failure rates among electrical items purchased online. In one study, 107 out of 116 counterfeit and look-alike chargers failed a critical safety test[2], and in an assessment by the Office for Product Safety and Standards, over 80% of items were non-compliant[3]. Despite this, over 90% of consumers (using Vinted, Etsy, eBay and Amazon) believe online purchases meet UK safety standards[4]. This creates a dangerous illusion of safety, leading consumers to reasonably assume that a product's presence on a major online marketplace indicates that basic safety checks have already been conducted.

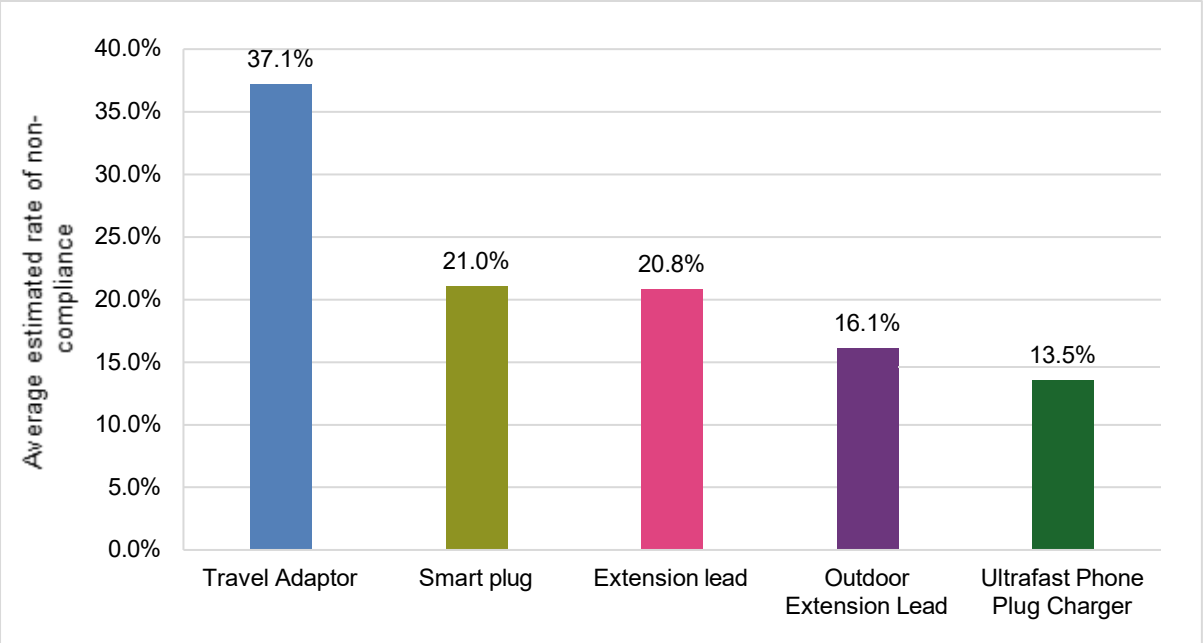
To quantify the scale of the issue, Talan developed a machine learning model to analyse approximately 24,000 electrical product listings across five categories: chargers, extension leads and smart plugs, household appliances, water-resistant products, and travel adapters and cable reels. The listings were drawn from top search results on major online marketplaces, meaning they are the products consumers are most likely to encounter when shopping online.

This represents one of the largest systematic assessments of electrical product listings on UK online marketplaces using information visible to consumers at the point of purchase. The model combines text and image analysis to identify indicators of likely non-compliance from product descriptions, specifications, reviews, and images. These are the same types of information that online marketplaces already require sellers to provide and host at scale.

[1] Marketplace Universe, 2025. *Top Marketplaces in the UK – Marketplace Country Quadrant 2025.* Available at: Top Marketplaces in the UK – Marketplace Country Quadrant 2025 - Marketplace Universe.
[2] Electrical Safety First, 2024. *Leading the Charge on Counterfeits*, Version 1.9. Available at: esf_leading_charge_report.pdf
[3] Office for Product Safety and Standards (OPSS), 2025. *Product Safety Testing Sampling Protocol Programme: April 2020 – March 2024.* Available at : Product Safety Testing Sampling Protocol Programme: April 2020 – March 2024 - GOV.UK.
[4] Office for Product Safety and Standards, 2025. *OPSS Research into Consumer Behaviour on Online Marketplaces.* Available at: OPSS Research into Consumer Behaviour on Online Marketplaces.

Key findings include:

- The analysis estimates that around **1 in 18 electrical products assessed** (5.42%) were likely non-compliant with UK safety standards. In the sample of listings analysed, this equates to more than 1,100 products showing indicators of likely non-compliance.
- When considered against the scale of online electrical product sales in the UK, these percentages translate into very large numbers of potentially unsafe products being offered to consumers, potentially amounting to **hundreds of thousands of listings across major online marketplaces**.
- Non-compliance rates were particularly high for several everyday electrical accessories commonly purchased by UK households. **Travel Adaptor** showed the highest non-compliance rate at **37.1%**, followed by **Smart Plug** and **Extension Lead** at **21.0%** and **20.8%**, respectively. This means that over **1 in 3** travel adaptors and over **1 in 5** extension leads and smart plugs showed likely non-compliance.



- These products are among the most widely used electrical accessories in UK homes, used to power everyday devices such as phones, appliances and home electronics. High levels of likely non-compliance in these categories are therefore particularly concerning, as they increase the likelihood that consumers will encounter and purchase unsafe products when shopping online.
- From a regulatory perspective, these percentages of non-compliant products are unacceptable where the potential consequences include fire, electric shock or serious injury, particularly when these products are widely available and actively promoted to consumers.
- The methodology used in this study is intentionally conservative. Where product listings lack sufficient technical detail, products are more likely to be classified as compliant rather than non-compliant. As a result, the 1 in 18 (5.42%) estimate should be regarded as a minimum bound rather than an upper limit.
- The algorithm demonstrated good accuracy (around 70%) in identifying both likely compliant and likely non-compliant products. The model is deliberately calibrated to avoid false positives, meaning it is more cautious when identifying non-compliance. This further supports the conclusion that the true prevalence of unsafe products is likely to be higher than estimated.

The findings highlight a fundamental weakness in the current self-regulatory approach to online marketplace regulation. The indicators used in this study, including voltage ratings, socket configurations, IP ratings and product imagery, are all data points that marketplaces already host, process and analyse at scale.

The fact that likely non-compliance can be identified using this information, yet unsafe products continue to be listed and sold, demonstrates that existing voluntary measures are insufficient. Different marketplaces use different tools and thresholds to assess product safety – in practice, this means the level of protection a consumer receives can depend on which marketplace they use, rather than on the product's inherent safety.

The findings also raise questions about the effectiveness of relying primarily on downstream enforcement to manage risk in online marketplaces. The volume, speed and cross-border nature of online sales mean that unsafe products can reach large numbers of consumers before enforcement action is possible. This limits the ability of traditional enforcement bodies to intervene effectively and highlights the importance of upstream, preventative controls at the point of listing.

What this means for regulation

This research demonstrates that indicators of likely non-compliant electrical products can be identified using information already visible on online marketplace listings, including product descriptions, technical specifications and images.

Online marketplaces already collect and process this information at scale as part of their normal operations.

Despite this, products that are likely not to meet UK safety standards continue to be listed and sold to consumers.

This suggests that voluntary measures alone may be insufficient to prevent unsafe products from reaching UK households, highlighting the importance of regulatory reforms that place clear duties on online marketplaces to identify and prevent the sale of non-compliant products.

This research can be refined and built upon in future for further insights.

1. Project Overview

The Case for Regulating Online Marketplaces

The rapid expansion of online marketplaces has transformed consumer behaviour and increased access to affordable goods. However, recent evidence highlights significant risks associated with electrical products purchased through these platforms, underscoring the urgent need for regulatory reform. The scale and consistency of these findings indicate a systemic issue in how online marketplaces govern product listings, rather than isolated failures by individual sellers.

Independent testing conducted by Electrical Safety First reveals consistently high failure rates in electrical items sourced from online marketplaces. In one study, 107 out of 116 counterfeit and look-alike chargers failed a critical safety test[5], while a previous sample of 15 everyday electrical goods revealed that 14 did not comply with UK safety standards[6]. Similar findings from the Office for Product Safety and Standards (OPSS) demonstrate that over 80% of items assessed were non-compliant[7], with over half featuring a physical safety non-compliance. These statistics point to systemic issues in product quality control and seller accountability within online environments.

A lack of consumer understanding of the risks associated with non-compliant products adds to the problem. Surveys indicate that more than 90% of buyers on major online marketplaces (Vinted, Etsy, eBay and Amazon) assume that goods purchased online meet UK safety requirements, and many believe platforms will intervene if items are recalled or deemed unsafe. This belief is not unreasonable, given that online marketplaces control listing standards, search visibility and product presentation, and are widely perceived as gatekeepers rather than neutral hosts. This misplaced trust creates an “illusion of safety”, placing households at greater risk of fire, electric shock, or property damage. Notably, case studies document severe consequences, including fatalities linked to defective products purchased online.

The existing regulatory framework is outdated, having been designed before the emergence of platform-based commerce. Online marketplaces are not currently recognised as actors in the supply chain and therefore do not have a statutory duty to verify sellers, prevent unsafe listings, or notify consumers of recalls. Enforcement responsibilities largely fall to local trading standards, whose resources and powers are insufficient to address the cross-border nature of online sales.

Identifying the scale of the problem

To identify the extent of electrical products sold into the UK market that do not meet UK Electrical Safety Standards, Talan selected an appropriate sample and applied data extraction techniques and machine learning to provide an indication of the scale of non-compliant electrical products on major online platforms.

Objectives of this project include:

- Demonstrate whether likely non-compliance is detectable using information already available to online marketplaces at the point of listing

[5] Electrical Safety First, 2024. *Leading the charge on counterfeits*, Version 1.9. Available at: esf_leading_charge_report.pdf

[6] Electrical Safety First, 2021. *Consumer Safety on Online Marketplaces: The Evidence and Impact*. Available at: online-marketplaces-the-evidence-and-impact.pdf.

[7] Office for Product Safety and Standards (OPSS), 2025. *Product Safety Testing Sampling Protocol Programme: April 2020 – March 2024.* Available at : Product Safety Testing Sampling Protocol Programme: April 2020 – March 2024 - GOV.UK.

[8] Office for Product Safety and Standards, 2025. *OPSS Research into consumer behaviour on online marketplaces.* Available at: OPSS Research into Consumer Behaviour on Online Marketplaces.

- Assess the scale of unsafe products: utilise innovative machine learning models to systematically identify likely non-compliant and potentially dangerous electrical products across key online UK marketplaces
- Enable effective communication: produce clear, accessible outputs to support ESF's outreach to stakeholders, media, and the public

Project approach

The approach has been developed following several constructive scoping conversations between ESF and Talan, and splits the project into 4 stages:

- Data collection: website scraping and identification of target products for model training.
- Methodology design: clarification of criteria with ESF and design of text-based and machine learning approach.
- Analysis completion: text analysis, machine learning training and parameter tuning.
- Output generation: a report summarising the results and completion of a detailed methodology note.

The team took the following approach to conducting the analysis:

1. Data Collection and Processing

Three online marketplaces were selected based on their prevalence among consumers and suitability for assessment using the methods within the scope of this study. Data was collected from these marketplaces between June and October 2025 for analysis.

Talan developed a bespoke data processing pipeline to collect and standardise product data from the three target marketplaces. The data collection process utilises a combination of commercial web-scraping tools (Oxylab) and bespoke HTML and JavaScript parsers, with the collected data reformatted to ensure consistent input across different target marketplaces. Irrelevant products were excluded based on listing text, such as products that included the term "USB" – since this would indicate a low-voltage, low-risk product.

2. Text-based and Machine Learning Classification

A text analysis and machine learning classification model has been designed and trained to distinguish between likely compliant and non-compliant products. The model uses both text and image data, with input from ESF to inform the compliance criteria. Information was extracted from product descriptions, specifications, and reviews to identify text-based non-compliance indicators, and image labelling was used to identify visual non-compliance indicators. The classification model has been applied to the first roughly 200 results for 42 product types across each of the major marketplaces reviewed. This results in a dataset and assessment of approximately 24,000 products.

Products are categorised into five groups, each with specific compliance criteria:

Group A: Chargers - Includes phone, e-bike, and laptop chargers.

Group B: Extension Leads and Smart Plugs - Includes extension leads and smart plugs.

Group C: Water-Resistant Products - Includes outdoor water-resistant products such as water heaters and outdoor extension leads.

Group D: Household Appliances - Includes a range of household appliances, such as electric blankets and air fryers.

Group E: Travel Adapters and Cable Reels - Includes travel adapters and cable reels.

The image training focused on identifying non-compliant features in plugs, sockets and rating plates. After testing, the image training was refined to focus on non-compliant sockets, since the identification of these features performed well and their occurrence in the dataset was much more prevalent than that of plug features such as half-insulated earth pins and clover-shaped plugs. As such, image compliance was tested only for product groups B and E.

Text-based criteria focused on voltage, current, and wattage ratings; IP ratings; review sentiment; brands with historical non-compliances; and recalled products.

Where information was incomplete or ambiguous, the methodology favoured classification as compliant rather than non-compliant, to avoid overstating risk.

3. Analysis Completion

After applying the criteria to the product dataset, the results were tested, and the criteria were refined to improve the identification of non-compliant products. Weightings were developed for the criteria to reflect the reliability of each indicator in indicating a non-compliant product. This enabled the calculation of a final non-compliance score for each product.

4. Output Development

Statistics were derived from the final analysed dataset, including predicted non-compliance rates and a measure of the model's accuracy. This final summary report has been produced alongside an accompanying methodology note detailing the full approach taken and a list of at-risk products identified across the marketplaces.

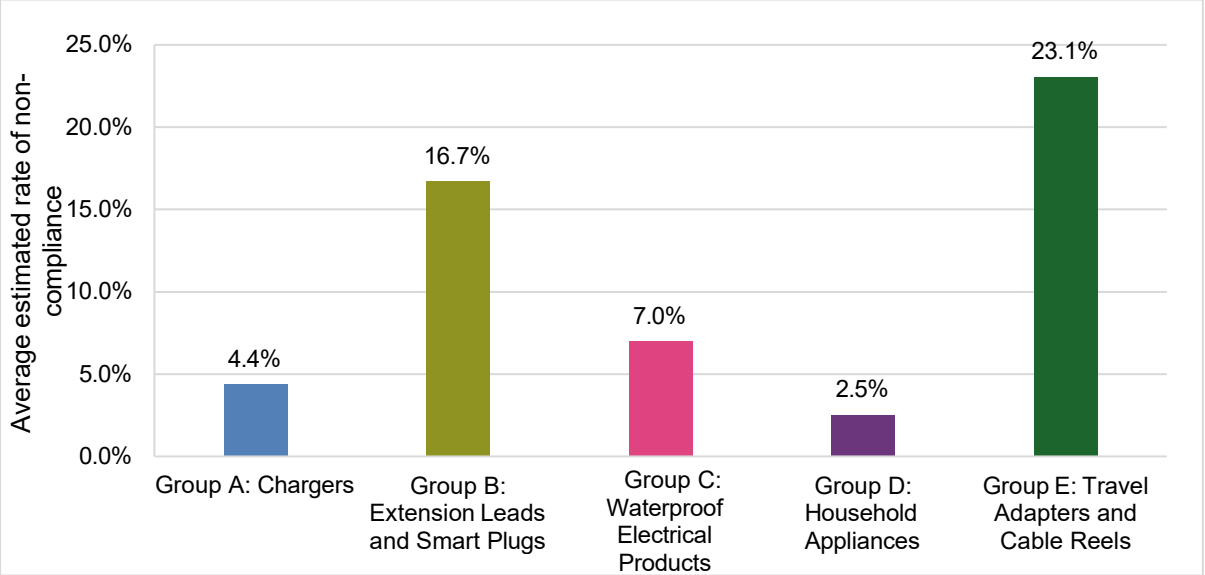
2. Key Findings

Outline of key findings of the analysis

Overall, the algorithm estimates a rate of 1 in 18 (5.42%) of products across the marketplaces and products assessed are likely non-compliant.

By product group, the estimated average non-compliance rate is highest for Travel Adapters and Cable Reels at 23.1%, and for Extension Leads and Smart Plugs at 16.7%. Figure 1 shows the results for each product group.

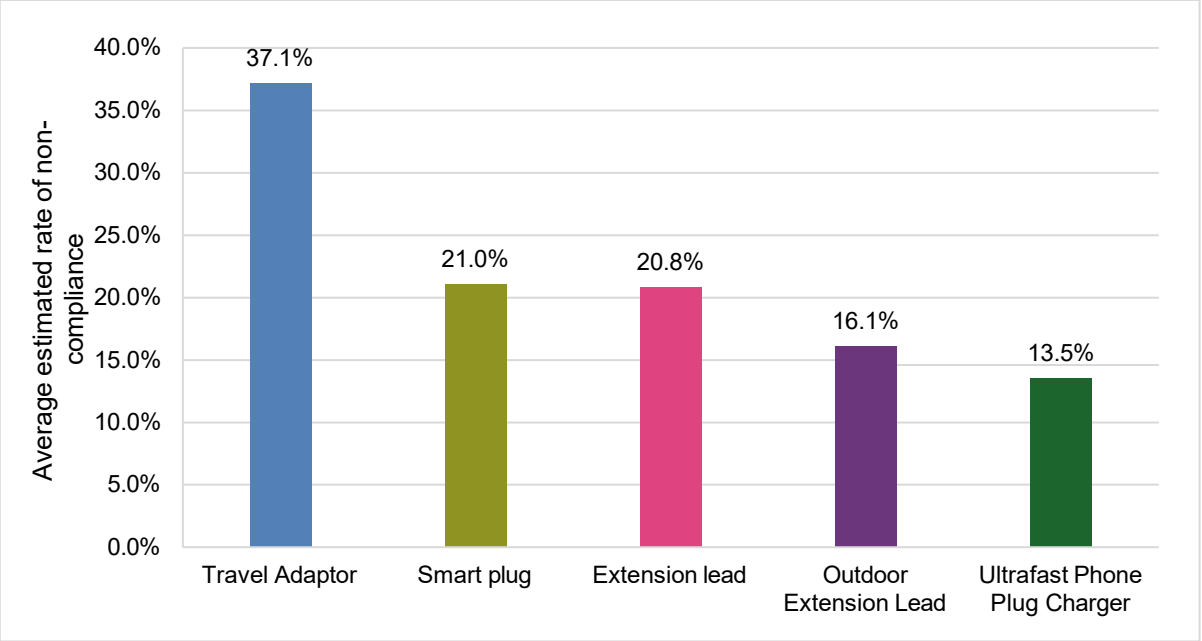
Figure 1: Average Rate of Non-Compliance by Product Group



These product categories represent some of the most commonly purchased electrical accessories in UK households – indicating a high likelihood that consumers will encounter and purchase non-compliant products.

Across the 42 specific query terms/product categories used to retrieve products from the marketplaces, travel adapters, smart plugs, and extension leads are the three most common non-compliant products, with estimated non-compliance rates of 37.1%, 21.0%, and 20.8%, respectively. This means that over 1 in 3 travel adaptors and around 1 in 5 extension leads and smart plugs showed non-compliance. The top five non-compliant products are shown in Figure 2.

Figure 2: Products with the Highest Rates of Non-Compliance



Given that the results are drawn from the first roughly 200 listings on the targeted online marketplaces, the high level of non-compliance across certain product types is particularly concerning, as consumers are likely to select a product from the first few pages of results.

The most common indicators of non-compliance of product groups are provided in Table 1. The "text" criteria include ratings, reviews and recalled brands. Non-compliant image features are particularly prevalent in group E, and non-compliant text is particularly prevalent in group B.

Table 1: Most Common Indicators of Non-Compliance by Product Group

	Group A: Chargers	Group B: Extension Leads and Smart Plugs	Group C: Water Resistant Products	Group D: Household Appliances	Group E: Travel Adapters and Cable Reels
Most common non-compliance indicators (% occurrence within total relevant products for each group)	text (4.33%)	text (12.5%) socket/image (3.90%)	text (6.30%)	text (2.47%)	socket/image (16.2%) text (7.88%)

As an indication of the relative performance of product groups according to the text criteria, Table 2 shows the average non-compliance scores assigned for each text criteria. A higher score indicates a higher estimated non-compliance for that group. Estimated non-compliant voltage values are highest for group C, while non-compliant amperage and wattage values are highest for group B. Reviews indicating dangerous products are most prevalent in group A, and group D has the highest rate of brands with historical non-compliances.

Note that the scoring scale differs across the text criteria.

Table 2: Average Non-Compliance Score

Product group	Voltage score	Amperage score	Wattage score	Danger score	Is recall brand (count)
Group A	0.0657	0.00825	0.00320	12.1	28
Group B	0.0698	0.113	0.168	3.41	20
Group C	0.125	0.0339	0.0414	2.51	47
Group D	0.0903	0.00685	0.0133	1.32	175
Group E	0.0901	0.0739	0.0645	4.32	12

The ESF technical team conducted an assessment of a sample of products identified by the model as likely compliant or non-compliant (84 products across marketplaces and product groups) to test its performance. ESF made their judgments using the online listings – utilising additional information beyond that used by the model. Among the products identified by the model as likely compliant, the ESF team agreed with the label in 72% of cases; among those identified as likely non-compliant, the ESF team agreed with the label in 69% of cases. Since there are more likely compliant products than non-compliant products in a random sample of listings, these accuracy rates indicate the algorithm is geared towards avoiding false positives – it is more conservative when labelling a product as non-compliant than as likely compliant.

Given that the non-compliance figures are likely to be suppressed under the current methodology, the high proportion of products identified as non-compliant across the product groups (just under 1 in 4 for group E and about 1 in 18 overall) signifies that a statistically significant issue is posed by non-compliant electronic products on UK online marketplaces.

Taken together, these findings indicate that non-compliant electrical products are not confined to obscure sellers or marginal listings. They appear regularly in common product categories and highly visible search results, increasing the likelihood that UK consumers will encounter and purchase them.

3. Approach

This section outlines an overview of the process undertaken for this study. More granular details are available in the accompanying methodology note.

Where: Three online marketplaces were selected according to their prevalence for consumer use and suitability for assessment via the methods employed within the scope of this study. Data was collected from these marketplaces between June and October 2025 for analysis.

How: Compliance criteria were used to train the model, to enable it to predict products that are more likely to be non-compliant. Text-based criteria were coded into an algorithm to apply to text extracted from product listings, and image-based criteria were used to train a separate image tool to apply to images within product listings.

What: The products in this study were grouped into 5 categories based on compliance assessment criteria. A full list of products in each category can be found in the annex and accompanying methodology note.

Table 3 gives an overview of the assessment process for each group.

Table 3: Overview of product group-specific assessment criteria

Product Group	Current Criteria	Voltage Criteria	Wattage Criteria	Other Criteria	Image Training
Group A: Chargers	≤13A unless industrial	x<=230>=y[9] unless industrial	<3000W unless industrial		No
Group B: Extension Leads and Smart Plugs	=13A	230 to 250	<3000W unless industrial	No overlap of UK-German or North American Australian sockets	Yes
Group C: Water-Resistant Products	≤13A unless industrial	x<=230>=y[9] unless industrial	<3000W unless industrial	Has a sufficiently high-water resistance rating (an IP rating 10 with moisture resistance of 4 or above)	No
Group D: Household Appliances	≤13A unless industrial	x<=230>=y[9] unless industrial	<3000W unless industrial		No
Group E: Travel Adapters and Cable Reels	≤13A unless industrial	230 to 250	<3000W unless industrial	No overlap of UK-German or North American-Australian sockets	Yes

[9] Where x and y represent upper and lower values of a given voltage range

[10] IP ratings are used as a measurement of resistance against dust and water ingress

Ratings Criteria

Assessing the current, voltage, and wattage of the products against the required standard was a key indicator of non-compliance, since in the majority of cases the relevant information could be extracted from the listing text, and ESF frequently uses this information to determine non-compliance.

Non-Compliant Sockets – Image Training

Because the image training focused on identifying non-compliant sockets, the non-compliance assessment was applied only to two of the five groups, as these groups are socket-oriented products.

Images were assessed to determine whether they showed the common areas of non-compliance depicted in Figure 3.

Figure 3: Non-compliant Socket Features Assessed

UK-German socket overlap	North American–Australian socket overlap
	

IP Ratings

If a product claims to be water-resistant for outdoor use (and there is a high enough risk of harm from water ingress), it must have an IP moisture rating of 4 or higher. If the product description included the term ‘water resistant’ or ‘waterproof’, then the description was also checked for a non-compliant IP rating.

Additional indicators of likely non-compliance

Other characteristics of non-compliance, rather than strict criteria, were utilised to support the identification of non-compliant products. This included:

- **If the product reviews contained terms indicating it is unsafe**: If product reviews consistently mentioned terms that indicated an electrical safety hazard, then the likelihood of non-compliance increased. The following keywords were fed into a mini language model (all-MiniLM-L6-v2), which then processes the full review text and provides a “danger score” based on the semantic similarity between the review's words and the hazard terms below. This study quantified negative sentiment words from reviews using NLTK’s sentiment indicator. Still, they were found to be insignificant for predicting compliance rate based on the training data, so they were not used for the final scoring.

"Defect"	"Hot"	"Arcing"	"Electrocute"
"Non-compliant"	"Spark"	"Arc"	"Short Circuit"
"Danger"	"Burn"	"Shock"	"Smoke"
"Injured"	"Melt"	"Electrocution"	"Toxic"
"Overheat"	"Exploded"	"Electric Shock"	"Harmful"
"Fire"			

- **If the product aligned with product recall data:** If the product code, model or serial number matched any information obtained from the UK Government's product recall list for "Electrical appliances and equipment" and "Adapters, Plugs and Sockets", then this was taken as an indication of possible non-compliance.
- **If the brand had appeared multiple times under historic non-compliant products:** If the brand name was the same as one that appeared more than once in the recall data above, and was not a well-known brand, this was used as an indicator of non-compliance.

Overall assessment

After removing all **irrelevant products**, the overall non-compliance assessment consists of three components: **text/description-based assessment, fixed lookup criteria** and **image-based socket assessment**.

Irrelevant Products

Since the data extraction process used in this project aims to reflect organic search results, which use selected keywords, the raw data scraped from the marketplaces will inevitably include products that are irrelevant to the scope of this assessment. For example, searching for electronic appliances such as laptops and portable chargers may return non-electronic accessories, such as cases and bags, related to those appliances. As such, keyword and listing-category-based strategies are devised to systematically remove products that are not relevant to the targeted product category.

Text or Description-based Assessment

Scoring Process: As outlined in the previous section, structural product attributes — such as voltage, amperage, and wattage — are evaluated based on the presence of likely non-compliant keywords or terms. Other qualitative signals are similarly quantified; these include repeated danger-related sentiments detected in review data using a mini-language model, as well as the presence of high-risk brands as suggested by the government's recall list. This approach enables qualitative information from product descriptions and user reviews to be converted into quantitative indicators. To effectively leverage these high-dimensional features, a logistic regression model has been employed to contextualise the influence of each indicator and estimate the odds of a product being non-compliant based on how its observed features align with each relevant criteria.

$$\text{logit}(p) = \beta_0 + \beta_1 \text{voltage score} + \beta_2 \text{amperage score} + \beta_3 \text{wattage score} + \beta_4 \text{recall brand} + \beta_5 \text{danger score}$$

$$odds(non\ compliant) = \frac{1}{1 + e^{-logit(p)}}$$

Scoring threshold: The logistic regression output is a binary odds ratio, with non-compliance as the positive indicator. If the odds ratio/score is > 50%, the product is more likely to be non-compliant than compliant; if it is < 50%, the opposite is true. In this study, any product with non-compliance odds> 50% will be deemed non-compliant.

Fixed Lookup Criteria

Beyond the probability-based predictors of non-compliance, the algorithm also identifies more definitive indicators that directly flag a product as non-compliant. In this study, two indicators serve as direct predictors of non-compliance:

1. **Moisture protection claims to be inconsistent with IP rating**: If a product claims to be water resistant but has an IP moisture rating (second digit) below 4.
2. **Government recall listing**: If the product code appears on the government's list of recalled products.

When either of these indicators is flagged, the product is automatically classified as non-compliant.

Image-based Socket Assessment

While the first two criteria are extracted directly from product descriptions and review text, this study also utilises product images for assessment. Among the five image labels analysed, socket compliance prediction demonstrated the highest consistency and is therefore the only characteristic tested in product images, serving as a direct indicator of non-compliance. If the image recognition model detects socket non-compliance with a confidence level of 90% or above, the product is flagged and classified as non-compliant.

Final Assessment Criteria

To sum up, a product will be classified as non-compliant if any **one** of the following is true:

- The text model suggests that, based on the product description and user reviews, the product has a higher chance of being non-compliant than likely to be compliant
- The product claims to be water-resistant but has an IP moisture rating of below 4
- The product is directly implicated in the government’s recall list
- The image recognition model suggests that the product’s socket section has a more than 90% chance of being non-compliant

4. Annex

Table 4: List of products assessed by the criteria group

Group A	Group B
• Apple Phone Plug Charger • Huawei Phone Plug Charger • Android Phone Plug Charger • Ultrafast Phone Plug Charger • E-Bike Charger • E-Scooter Charger • Plug-in chargers • Plug in Air Purifier • Laptop Charger	• Extension lead • Outdoor Extension lead • Smart plug • Drone • Hair Dryer • Electric Screwdriver • Blender • Mains Powered Alarm Clock • Floor Standing Electric Fan
Group C	**Group D**
• Portable plug-in immersion heater • Mini plug-in immersion heater • Mini portable plug-in immersion heater • Waterproof speakers • Outdoor Extension Lead	• E-Bike Conversion Kit • Desktop Electric Fan • Electric Blanket • Head Shaver • Kettle • Slow Cooker • Vacuum Cleaner • Food Processor • Electric Razor • Electronic Suitcase • Air Fryer • Folding Electric Treadmill • Steam Iron • Desk Monitor • Rice Cooker • Portable Charger • Hair Straighteners
Group E	
• Travel Adaptor	• Cable Reel

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