Environmental Product Declaration

THE INTERNATIONAL EPD® SYSTEM

In accordance with ISO 14025 and EN 50693 for:

i4880 Series Wi-Fi 6 router

Icotera

This EPD covers multiple products:
i4882 and i4883 from *Icotera*
Based on worst-case results

Programme:	The International EPD® System, www.environdec.com
Programme operator:	EPD International AB
EPD registration number:	S-P-EPD-IES-0007354
Publication date:	2025-04-29
Valid until:	2030-04-28

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
PCR: *PCR 2024:06 Electronic and electric equipment, and electronic components (non-construction) (EN 50693) (1.0.1)> <UN CPC: 47223*
Life Cycle Assessment (LCA)
LCA accountability: *Tasos Lizos, Icotera*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: *Vladimír Kocí, LCAstudio* Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third-party verifier: ☐ Yes   ☒ No

Comparability of EPDs, adapted from ISO 14025

EPDs within the same product category but from different programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison.

Company information

Owner of the EPD: Icotera

Contact*: Tasos Lizos, +4581912262, tlizos@icotera.com

Description of the organisation: Icotera is a leading European developer and manufacturer of standard-setting fiber-to-the-home (FTTH) CPE solutions. Our intelligent FTTH gateways, managed ethernet routers, and access points feature high-end Wi-Fi and are optimized with end-to-end real time in-home network and Wi-Fi monitoring. As a technology leader in this field, the company develops and delivers products with unique design and superior quality and performance. Icotera is committed to providing fiber-optic network operators and ISPs with tailor-made, flexible and cost-effective solutions that meet individual requirements.

Name and location of production site: MitraStar production sites in Taiwan, China, and Vietnam.

The EPD owner has the sole ownership, liability, and responsibility of the EPD.

Product information

Product name: The i4880 Series Wi-Fi 6 covers i4882 and i4883.

Product description: The i4880 Series Wi-Fi 6 ethernet gateways take performance to the next level. Full backward compatibility for WAN/LAN, VoIP, and Wi-Fi makes the i4880 Series Wi-Fi 6 gateways the obvious choice for a high-end residential router for internet service providers.

The reference service life of an i4880 Series Wi-Fi 6 router is 5 years.

Wi-Fi 6
• 802.11ax 8x8:8 5 GHz + 4x4:4 2.4 GHz
• BW support: 20 MHz, 40 MHz, 80 MHz
• Modulation support: MCS 0-11
• Downlink MU-MIMO and OFDMA

• Up to 1024-QAM modulation
• Support for unequal MCS
• Support for LDPC, STBC
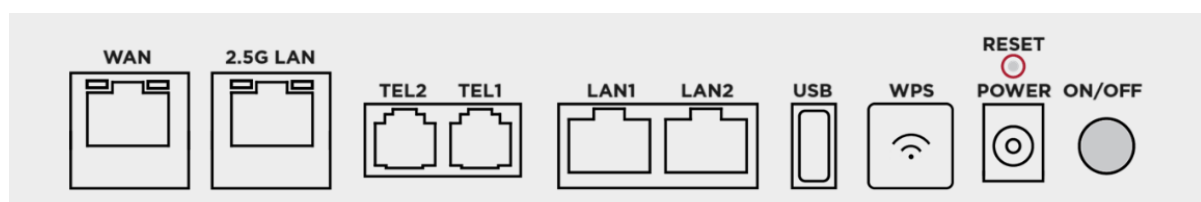• Support for target wake time (TWT)

Features
• Enterprise 8x8+4x4 Wi-Fi 6 configuration
• Non-blocking 2.5 Gbps architecture
• Wi-Fi link rate up to 9.8 Gbps
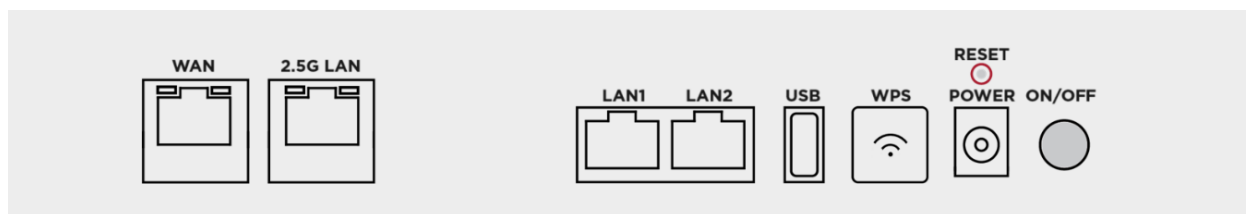• Optional operator branding
• Customized firmware
• VoIP (i4883)

Operational Specifications
• DC 12 V input
• Power consumption maximum: 31.7 W
• Power consumption in idle state: 17.8 W
• Operating temperature: 5°C – 45°C
• Storage temperature: -20°C – 85°C
• Humidity: 5% – 95% (noncondensing)

i4883 configuration:

i4882 configuration:

Gateway Interface Configurations:

Model	Uplink	LAN	USB	POTS	Wi-Fi	Antennas
i4882	2.5G WAN (RJ45)	1x 2.5G LAN 2x 1G LAN	1 x USB 2.0	-	Wi-Fi 6	8x8 + 4x4
i4883	2.5G WAN (RJ45)	1x 2.5G LAN 2x 1G LAN	2 x USB 2.0	2x	Wi-Fi 6	8x8 + 4x5

UN CPC code

47223. Other telephone sets and apparatus for transmission or reception of voice, images or other data, including apparatus for communication in a wired or wireless network (such as a local or wide area network)

Geographical scope

Europe

LCA information

Declared unit

The Declared Unit (DU) is "One i4880 Series Wi-Fi 6 router". The product aligns with the IEEE 802.11ax standard. The following properties apply: Total mass of the product (including packaging in DU) is 1.61 kg. Casing size: 234x177x53 mm. Wi-Fi link rate up to 9.8 Gbps. Input: 12 V. Power consumption: 17.8 – 31.7 W.

Time representativeness

2023

Database(s) and LCA software used

Ecoinvent 3.10 and SimaPro 10.1

Description of system boundaries

A full life cycle, cradle to grave approach has been followed, to cover most aspects of the overall environmental impacts of i4880 Series Wi-Fi 6 routers.

Allocation and cut-off rules

No allocation nor cut-off rules have been applied.

Excluded lifecycle stages

The excluded lifecycle stages comprise of A5 – Installation at point of use, B1 – Use, B2 - Maintenance, B3-Repair, B4-Reuse, B7 Operational water use, C1-De-installation from point of use, C2-Transport to end of life processing, C3-Waste processing. For A5 and C1, the installation/ de-installation respectively involves minimal infrastructure or energy use that can´t be easily quantified, no resource inputs are needed for these stages. The use phase emissions from router operation are attributed to energy consumption, which is accounted for in module B6, and thus B1 is out of scope. B2, B3 and B4 are not typically performed and thus these are out of scope. For

B7 routers do not use or interact with water during operation and therefore direct water consumption during use is zero. For C2, transport impacts from users sending routers to end of life management is very uncertain to allow for meaningful impact modelling and thus it has not been considered. C3 is not performed and thus it has been left out of scope. End of life management is captured in module C4 instead.
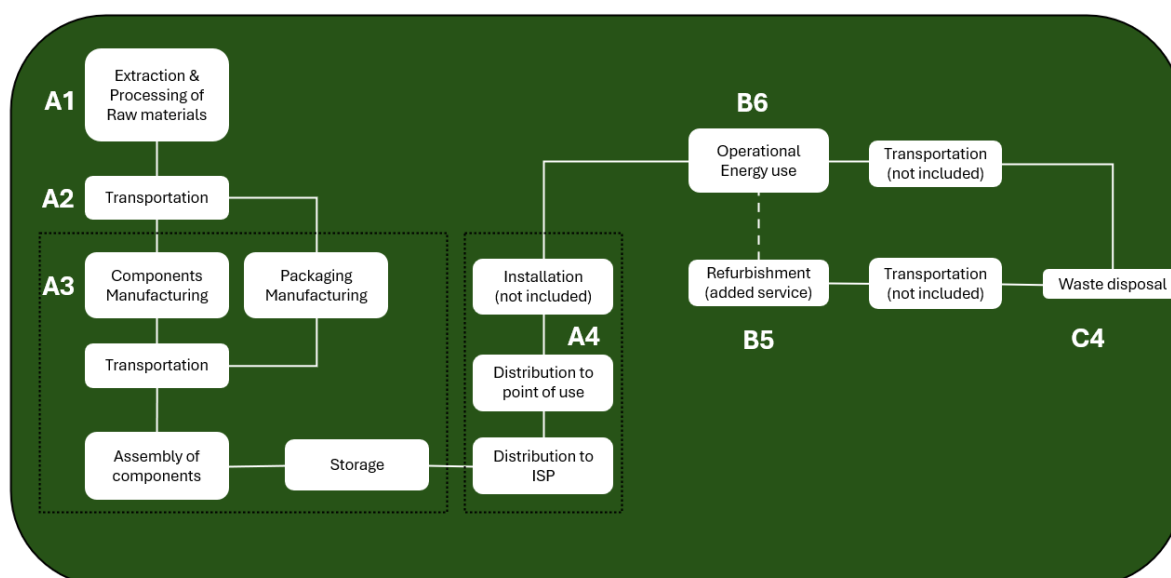
Data quality declaration

Process	Source Type	Source	Data Type	Primary data in GWP
Components manufacturing	**Collected data**	**Manufacturer**	**Specific**	**>90%**
Product manufacturing	**Collected data**	**Manufacturer**	**Specific**	**0.8%**
Transport of raw materials	**Database**	**Ecoinvent**	**Generic**	**1.9%**
Total share of primary data, of GWP-GHG results for A1-A3				**>90%**

Disclaimer: The share of specific data is calculated based on GWP-GHG results. It is a simplified indicator for data quality that supports the use of more specific data, to increase the representativeness of and comparability between EPDs. Note that the indicator does not capture all relevant aspects of data quality and is not comparable across product categories.

Included lifecycle stages

The environmental impact indicators as well as the resource use indicators have been calculated for the EPD International corresponding stages A1-Material and components supply, A2-Transport, A3-Manufacturing, A4-Transport from gate to site/point of sale, B5-Refurbishment, B6-Operational energy use, C4-Disposal.

Chemical safety and content declaration

According to PCR 2024:06 the EPD should declare the presence of substances in the product/packaging that can be found on the European Chemicals Agency (ECA) list of substances of very high concern (SVHC). Icotera products comply with the RoHS Directive (Restriction of Hazardous Substances in Electrical and Electronic Equipment) that currently restricts the use of ten substances: lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE), bis(2-ethylhexyl) phthalate (DEHP), butyl benzyl phthalate (BBP), dibutyl phthalate (DBP) and diisobutyl phthalate (DIBP). The product content declaration and the consumer packaging content declaration specify which of these substances can be found on the ECA-SVHC list.

It is declared that i4880 Series Wi-Fi 6 routers and its packaging contain no added bromine or chlorine compound which represents a higher proportion than 0.1% by weight of the homogeneous material of a printed circuit board, except for the components of the card, or a plastic part which weighs more than 25 grams.

The products do not contain:

1. any additive phosphorus compound which constitutes a higher proportion than 0.1% by weight of the homogeneous material in:
a) a circuit board, except for the components of the card or
b) a plastic part weighing more than 25 grams, or

2. any reactive added bromine or chlorine compound which represents a higher proportion than 0.1% by weight of the homogeneous material of:
a) a circuit board, except for the components of the card or
b) a plastic part weighing more than 25 grams

Compliance to the Swedish chemical tax: The i4880 Series Wi-Fi 6 router comply with requirements of the following Directive: Swedish Constitution, 2016:1067, Amendment through: SFS 2022:1774

The content declaration refers to the i4883 component list, which is the most extensive of the series to ensure a conservative estimation of the environmental impacts for all i4880 Wi-Fi 6 series products. This means that the product content declaration represents the "worst case" scenario in terms of environmental impacts.

Product Content Declaration	Value	Unit
Product mass	1.31	kg
PCB	0.1	kg
Metals	0.3	kg
Plastics	0.38	kg
Passive electronic components	0.28	kg
Active electronic components	0.19	kg
Ceramics	0.04	kg
Biogenic content in product mass	0	% w/w
Pb (SVHC)	<0.1	% w/w
Hg	<0.1	% w/w
Cr(VI)	<0.1	% w/w
Cd (SVHC)	<0.1	% w/w
PBB, PBDE (SVHC)	<0.1	% w/w
DEHP, BBP, DBP, DIBP(SVHC)	<0.1	% w/w

The packaging components for i4882 and i4883 are identical and thus the consumer packaging declaration represents actual values for both products packaging.

Consumer Packaging Content Declaration	Value	Unit
Packaging mass	0.3	kg
Cellulose Pulp	86-92	% w/w
Starch	2-4	% w/w
Water	6-10	% w/w
Pb (SVHC)	<0.1	% w/w
Hg	<0.1	% w/w
Cr(VI)	<0.1	% w/w
Cd (SVHC)	<0.1	% w/w
PBB, PBDE (SVHC)	<0.1	% w/w
DEHP, BBP, DBP, DIBP (SVHC)	<0.1	% w/w
Share of Biogenic content	88	% w/w
Share of Carbon in Biogenic content	44	% w/w
Total Biogenic Carbon	0.11	kg C
Total Biogenic CO2	0.40	kg

Packaging: plastic-free, PE bag-free, 86-92% recycled cardboard.

Cradle-to-Gate (A1-A2-A3)

Cradle to gate refers to the A1-Material and components supply, A2-Transportation of materials/ components to the manufacturing site and A3-Manufacturing. For A1 and A2, impacts have been calculated based on the component list of i4883. Regarding manufacturing (A3), the energy use is 0.31 kWh per declared unit based on an electricity mix comprised of natural gas (41.8%), hard coal (28.2%), lignite (10.6%), nuclear (13.3%), other (6.1%).

Transportation Gate-to-Customer (A4)

Transportation (Gate-to-Customer) is calculated based on sea transportation (21000 km) from manufacturing site to storage facilities and land transportation (via freight lorries), from warehouse to the point of sale (1500 km - Europe). Considering that the total mass of the product including packaging is 1.61 kg, the mass*distance relation is 1.61*21000/1000 = 33.8 tkm for sea transportation and 1.61*1500/1000 = 2.42 tkm for land transportation.

Operational Energy Use (B6)

The power consumption complies with the Ecodesign Related Product Directive 2009/125/EC.
The estimation of energy consumption during the use phase of the product has been calculated according to the guidance of PCR 2024:06 as shown below:

$$TEC = (Pidle * Tidle + Pactive * Tactive) * RSL$$
$$= \left(17.8\,W * \frac{12h}{d} + 23.78W * \frac{12h}{d}\right) * 365\frac{d}{y} * 5y = 910.6\,kWh$$

Active state corresponds to 75% of the Maximum obtained power, where 75% is the Typical Power Consumption Factor based on empirical estimations.

The carbon footprint from operational energy use (B6) is directly related to the Greenhouse Gas Protocol (GHG) category 3.11- use of sold products where CO2 emissions are calculated for the total number of sold products during the use phase and comprises an integral part of Icotera GHG accounting. While in GHG accounting the carbon intensity of electricity mix (kgCO2/kWh) in given geographies is used, however for the scope of the EPD the ecoinvent database has been used to calculate additional environmental indicators. The ecoinvent datasets correspond to electricity mix of 2020.

Based on the sales market share of 2023, a weighted electricity mix between different geographies (markets) has been applied to calculate environmental indicators. The primary sources forming the electricity mix are wind (37.5%), natural gas (22.2%), biomass (8.8%), nuclear (8.2%), hard coal (5.4%), hydro (5%), lignite (1.2%), biogas (0.5%), other (11.2%).

It is important to highlight that the impact of the use phase will change depending on the energy production sources and geography.

Refurbishment (B5)

Refurbishment (B5) is an additional service. In the scope of the EPD, the environmental impacts are calculated by considering the electricity consumption (1.27 kWh/DU).

Disposal (C4)

Regarding disposal (C4), since there is no direct control of the end of life handling of the product by Icotera, two options were considered to maintain a conservative estimation of the environmental impacts, incineration and landfilling. A 50% w/w landfilling – 50% w/w incineration principle has been followed.

Carbon Footprint (numeric values in kg CO2-eq)

Carbon footprint during life cycle	i4883		i4882	
Total	190	Percentage	190	Percentage
Cradle-to-Gate (A1-A2-A3)	29.3	15.4%	29.1	15.3%
Transportation Gate-to-Customer (A4)	0.71	0.37%	0.71	0.37%
Operational energy use (B6)	157	82.8%	157	82.84%
Refurbishment (B5)	1.15	0.6%	1.15	0.6%
Disposal (C4)	1.52	0.8%	1.52	0.8%

Results of the environmental performance indicators

According to PCR 2024:06 for multiple products EPD the highest environmental impact results should be disclosed for each indicator and life cycle stage as shown below.

Impact category indicators

Environmental impact indicator	Unit (EN)	Manufacturing			Distribution	Installation	Use				De-installation	End of life		Total
		A1	A2	A3	A4	A5	B1-B4	B5	B6	B7	C1	C2-C3	C4	
GWP-total	kg CO2 eq.	2.9E+01	5.3E-01	2.4E-01	7.1E-01	ND	ND	1.2E+00	1.6E+02	ND	ND	ND	1.5E+00	1.9E+02
GWP-fossil	kg CO2 eq.	2.9E+01	5.3E-01	2.4E-01	7.1E-01	ND	ND	1.2E+00	1.6E+02	ND	ND	ND	1.1E+00	1.9E+02
GWP-biogenic	kg CO2 eq.	-4.0E-01	0.0E+00	0.0E+00	0.0E+00	ND	ND	0.0E+00	0.0E+00	ND	ND	ND	4.0E-01	0.0E+00
GWP-luluc	kg CO2 eq.	4.1E-02	0.0E+00	1.9E-04	1.4E-03	ND	ND	4.0E-04	5.2E-01	ND	ND	ND	5.1E-05	5.7E-01
GWP-GHG	kg CO2 eq.	2.9E+01	5.3E-01	2.4E-01	7.1E-01	ND	ND	1.2E+00	1.6E+02	ND	ND	ND	1.1E+00	1.9E+02
ODP	kg CFC-11 eq.	1.7E-06	0.0E+00	3.4E-09	1.1E-08	ND	ND	5.2E-09	4.7E-06	ND	ND	ND	7.9E-10	6.5E-06
AP	mol H+ eq.	2.3E-01	8.3E-03	9.0E-04	1.2E-02	ND	ND	8.2E-03	6.1E-01	ND	ND	ND	4.9E-04	8.6E-01
EP-freshwater	kg P eq.	2.5E-02	0.0E+00	1.7E-04	4.1E-05	ND	ND	1.4E-03	7.1E-02	ND	ND	ND	4.9E-05	9.7E-02
EP-marine	kg N eq.	3.3E-02	2.8E-03	1.9E-04	3.2E-03	ND	ND	1.2E-03	1.5E-01	ND	ND	ND	9.1E-04	1.9E-01
EP-terrestrial	mol N eq.	3.5E-01	3.1E-02	1.7E-03	3.5E-02	ND	ND	1.0E-02	1.7E+00	ND	ND	ND	2.2E-03	2.2E+00
POCP	kg NMVOC eq.	1.2E-01	7.7E-03	5.4E-04	1.0E-02	ND	ND	3.0E-03	4.3E-01	ND	ND	ND	7.1E-04	5.7E-01
ADPE	kg Sb eq.	4.7E-03	0.0E+00	2.2E-07	1.5E-06	ND	ND	9.0E-07	1.1E-03	ND	ND	ND	1.1E-07	5.8E-03
ADPF	MJ, net calorific value	3.9E+02	0.0E+00	3.4E+00	9.5E+00	ND	ND	1.3E+01	3.2E+03	ND	ND	ND	6.0E-01	3.6E+03
WDP	m3 world eq. deprived	7.7E+00	0.0E+00	3.2E-02	3.5E-02	ND	ND	1.6E-01	2.4E+01	ND	ND	ND	-7.8E-02	3.2E+01

Abbreviations: 1. GWP-total: Global warming potential – total, 2. GWP-fossil: Global warming potential - fossil fuels, 3. GWP biogenic Global warming potential – biogenic, 4. GWP-luluc: Global warming potential - land use and land use change, 5. GWP-GHG: Global warming potential, 6. ODP: Depletion potential of the stratospheric ozone layer, 7. AP: Acidification potential, accumulated exceedance, 8. EP-freshwater: Eutrophication potential – freshwater, 9. EP-marine: Eutrophication potential – marine, 10. EP-terrestrial: Eutrophication potential – terrestrial, 11. POCP: Photochemical ozone creation potential, 12. ADPE: Abiotic depletion potential - non-fossil resources, 13. ADPF: Abiotic depletion potential - fossil resources, 14.WDP: Water (user) deprivation potential.

For every life cycle stage and environmental indicator the difference between i4882 and i4883 is less than 3%.

Resource use indicators

Resource use indicator	Unit (EN)	Manufacturing			Distribution	Installation	Use				De-installation	End of life		Total
		A1	A2	A3	A4	A5	B1-B4	B5	B6	B7	C1	C2-C3	C4	
PERE	MJ, net calorific value	5.0E+01	0.0E+00	4.7E-02	1.0E-01	ND	ND	1.4E+00	2.9E+03	ND	ND	ND	5.2E-01	3.0E+03
PERM	MJ, net calorific value	4.0E+00	0.0E+00	0.0E+00	0.0E+00	ND	ND	0.0E+00	0.0E+00	ND	ND	ND	-4.0E+00	0.0E+00
PERT	MJ, net calorific value	5.4E+01	0.0E+00	4.7E-02	1.0E-01	ND	ND	1.4E+00	2.9E+03	ND	ND	ND	-3.4E+00	3.0E+03
PENRE	MJ, net calorific value	3.9E+02	4.5E+00	3.4E+00	9.5E+00	ND	ND	1.3E+01	3.2E+03	ND	ND	ND	9.4E+00	3.6E+03
PENRM	MJ, net calorific value	2.8E+01	0.0E+00	0.0E+00	0.0E+00	ND	ND	0.0E+00	0.0E+00	ND	ND	ND	-2.8E+01	0.0E+00
PENRT	MJ, net calorific value	4.2E+02	4.5E+00	3.4E+00	9.5E+00	ND	ND	1.3E+01	3.2E+03	ND	ND	ND	-1.9E+01	3.6E+03

Abbreviations: 1. PERE: Use of renewable primary energy as energy carrier, 2. PERM: Use of renewable primary energy resources used as raw materials, 3. PERT: Total use of renewable primary energy, 4. PENRE: Use of non renewable primary energy as energy carrier, 5. PENRM: Use of non renewable primary energy resources used as raw materials, 6. PENRT: Total use of non renewable primary energy resource
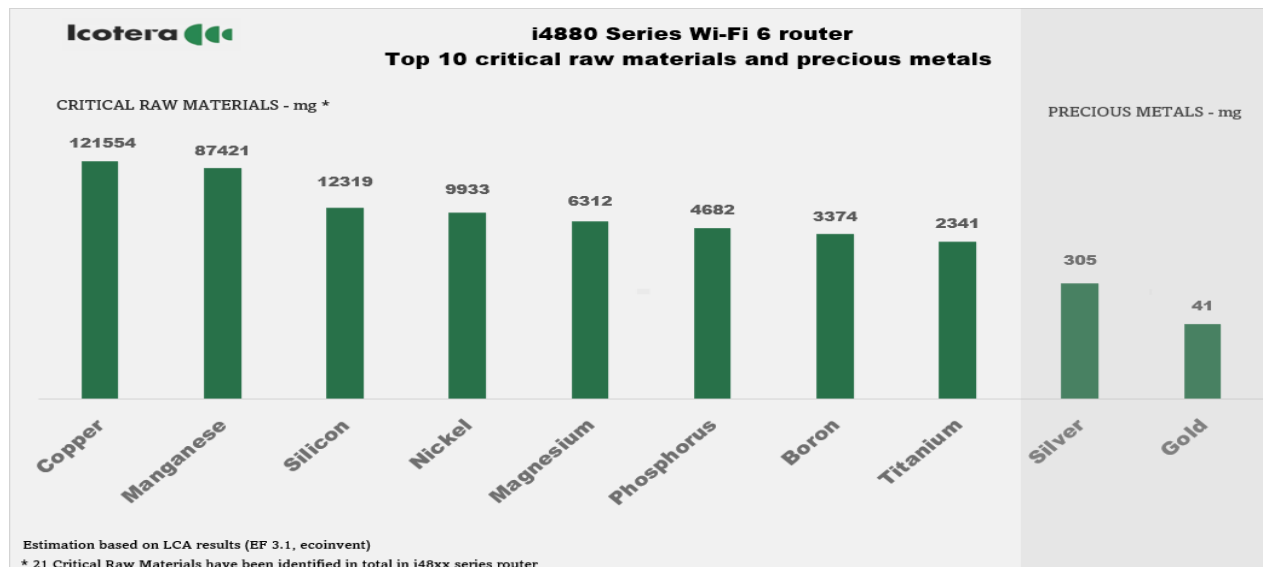
Additional environmental information

Additional product environmental information

- Available in up to 95% post-consumer recycled (PCR) materials.
- Space-saving packaging, pallet optimization, and sea shipping to reduce CO2 emissions in A4 transportation.
- All suppliers signed the Icotera Supplier Code of Conduct on E, S and G.
- Manufactured at an ISO14001 certified factory.

Circular economy and raw materials

Critical raw materials, rare earth elements, platinum group and precious metals can all be found in a router. Life cycle assessment (LCA) is estimating that an i4880 Series Wi-Fi 6 router contains 21 different critical raw materials with a total mass of 250 g, including copper, manganese, silicon and nickel among others. Around 41 mg gold and 305 mg silver are contained in a router, mostly present in the PCB. The unique collection of high value metals and minerals in the router highlights the necessity for responsible end-of-life management and circular economy initiatives.

How to prolong the product lifetime

Built of long-lasting components for a minimum of 5 years' expected lifetime. Icotera recommends ISPs to prolong product lifetime by systematically reclaiming units when they come to an end-of-use and do a refurbishment service before returning to a new user. Icotera offers a high-quality refurbishment service including a visual inspection, technical tests, cleaning, and repack. The service includes ESG data.

How to handle the product at the end-of-life

The unit must be responsibly handled as e-waste. It is designed for easy disassembly to sort in fractions after use. Icotera offers a responsible e-waste handling service, documenting the amounts of fractions like aluminum, plastics, PCB, and PSU brought into recirculation, minimising the end-of-life impacts. Icotera complies to the EU extended producer responsibilities as a member of El-retur, ensuring more and better reuse and recycling of electric and electronic waste, and Emballage-retur, ensuring the responsible recycling, use, and management of packaging waste.

ESG vision

Icotera's ESG vision is to empower ISPs and network operators to differentiate with green offerings and reduce their overall footprint, via long-lasting products that maximize performance and minimize environmental

Icotera commits to the Science Based Targets initiative (SBTi) to reduce our absolute scope 1 and scope 2 GHG emissions 42% by 2030 from a 2023 base year, and to measure and reduce our scope 3 emissions. Read more https://icotera.com/about/esg.

References

1. General Programme Instructions of the International EPD® System Version 5.01.
2. General Programme Instructions of the International EPD® System Version 4.0
3. PCR 2024:06. *Electronic and electric equipment, and electronic components (non-construction) (EN 50693)* Version 1.01
4. ISO 14040: *Environmental Management – Life Cycle Assessment – Principles and Framework*.
5. ISO 14044: *Environmental Management – Life Cycle Assessment – Requirements and Guidelines.*
6. ISO 14025: *Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.*
7. ISO 14020: Environmental statements and programmes for products – Principles and general requirement