

DIGITAL WE DAYS

2024



THE OVERVIEW OF THE WIRELESS POWER TECHNOLOGY MARKET

Dinesh Kithany
Founder and Chief Analyst | **WAWT (Wired & Wireless Technologies)**



WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

Contents of this presentation

- About WAWT
- Wireless power technology evolution and landscape
- Adoption of wireless power across applications
- Wireless power market drivers and barriers
- How BIG is the wireless power market opportunity?
- Q&A Session



About WAWT and its Wireless Power Research

About Wired & Wireless Technologies (WAWT)

- **Wired & Wireless Technologies (WAWT)** is a strategic technology analyst and consultancy firm.
 - We deliver **Research, Insights** and **Strategy**
 - **WAWT** was founded and supported by **Our Believers** (our clients)
 - Our **thorough research and analysis practice** help us to drive our client's business strategy and growth.
 - Our **SMEs** operate as '**Trusted Advisors**' and act as '**Strategic Business Partners**' to our clients.
- Our **3i Approach** helps us to offer tailor-made solutions specific to client's needs: ***To Inform, To Intellect, To Interact***
- Our SMEs (**Subject Matter Experts**) have extensive **knowledge and experience** and are **well-networked** in the industry.
 - Our **SMEs are the most sought-after industry analysts**, invited to speak at key industry events and webinars.
- Our Mission: **"To grow when our clients grow and succeed"**.
- Our Vision: **"To be the Most Trustworthy and Sought-After Analyst Firm in the areas we excel"**.

Our area of *Expertise* and *Tailormade Solutions*

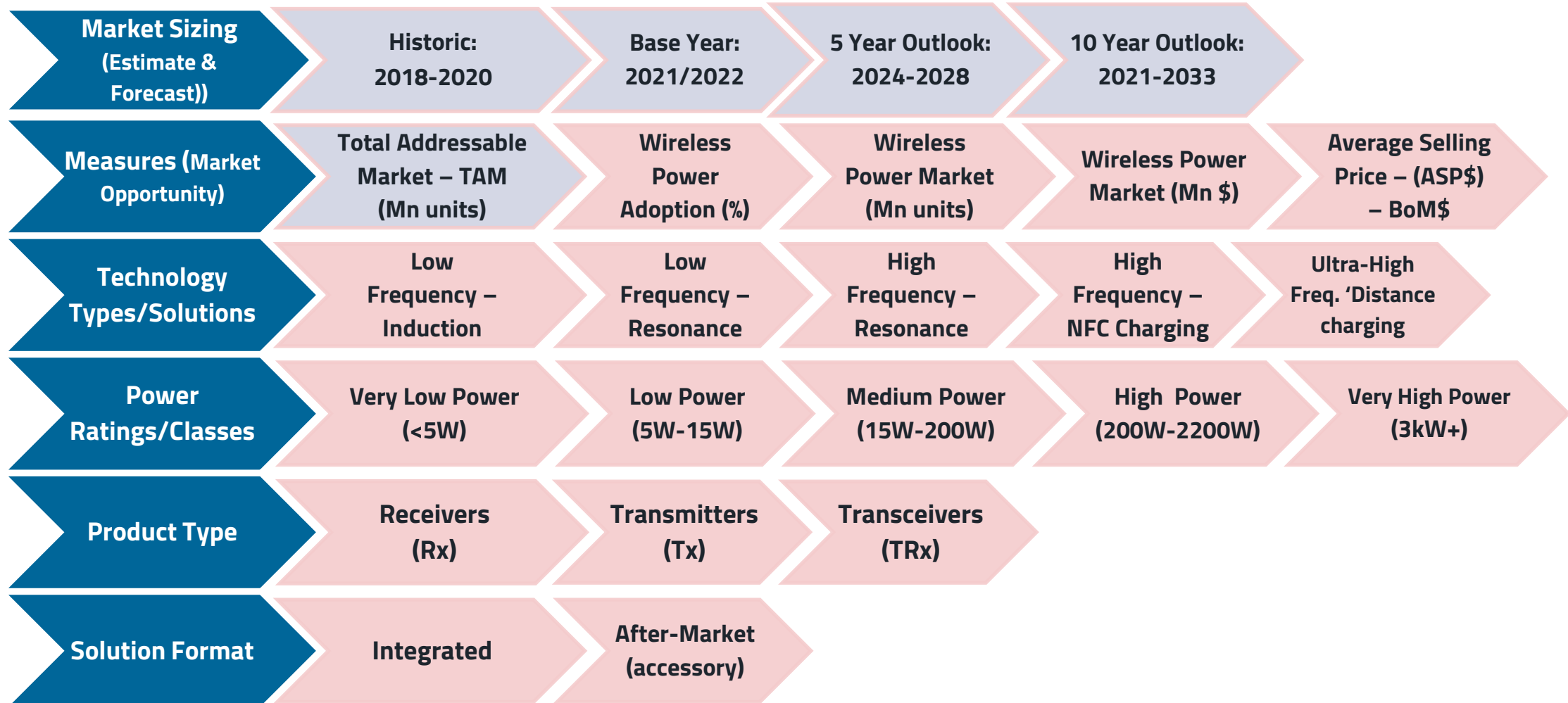
- Our current **Core Expertise** areas where we provide strategic directions through critical data and market intelligence are:
 - **Wireless Power**
 - **Power Supplies**
- We offer the following **Tailormade Solutions**, moving data, insights, and market intelligence into action.
 - **Research Data & Analysis**
 - **Intelligence Service** - The most comprehensive research solution on the respective technology markets
 - **Strategic Consultancy & Bespoke Solutions**
 - **Thought Leadership Interactive Services** - Digital Events, Webinars, Whitepaper, Workshops
- Visit www.wawt.tech to know more about us and Follow ([WAWT](#)) our LinkedIn Page to get the latest news, insights, and updates on the technology sectors we cover.

WAWT's Wireless Power Intelligence Service

- **Wireless Power Intelligence Service (WPIS)** is the **most comprehensive research** on the wireless power technology market consisting of data, insights, and market intelligence. This annual subscription consists of:
 - **Market Sizing Database files (Excel)** – One for every tracker report
 - **Analysis & Insights Report (PDF)** – One for every tracker report
 - **Direct Access with our SME throughout the year** to discuss the market estimates, trends, insights, and strategic inputs.
- The intelligence service covers **tracker reports published every 4 months**, covering:
 - **Critical market data, analyst insights, market intelligence, latest market trends, and strategic inputs**
 - Key wireless power **technology types; power classes; wide range of applications** (30+)
 - Vital measures include TAM (total addressable market), wireless power adoption rates, unit shipments, BoM\$, revenues, share by technology/power class, Rx-Tx split...) and qualitative analysis – **refer following slides.**
- Be free to request the **sample output tables** and **sample report copy.**

Wireless Power Market Research:

- Market segmentation and key measures

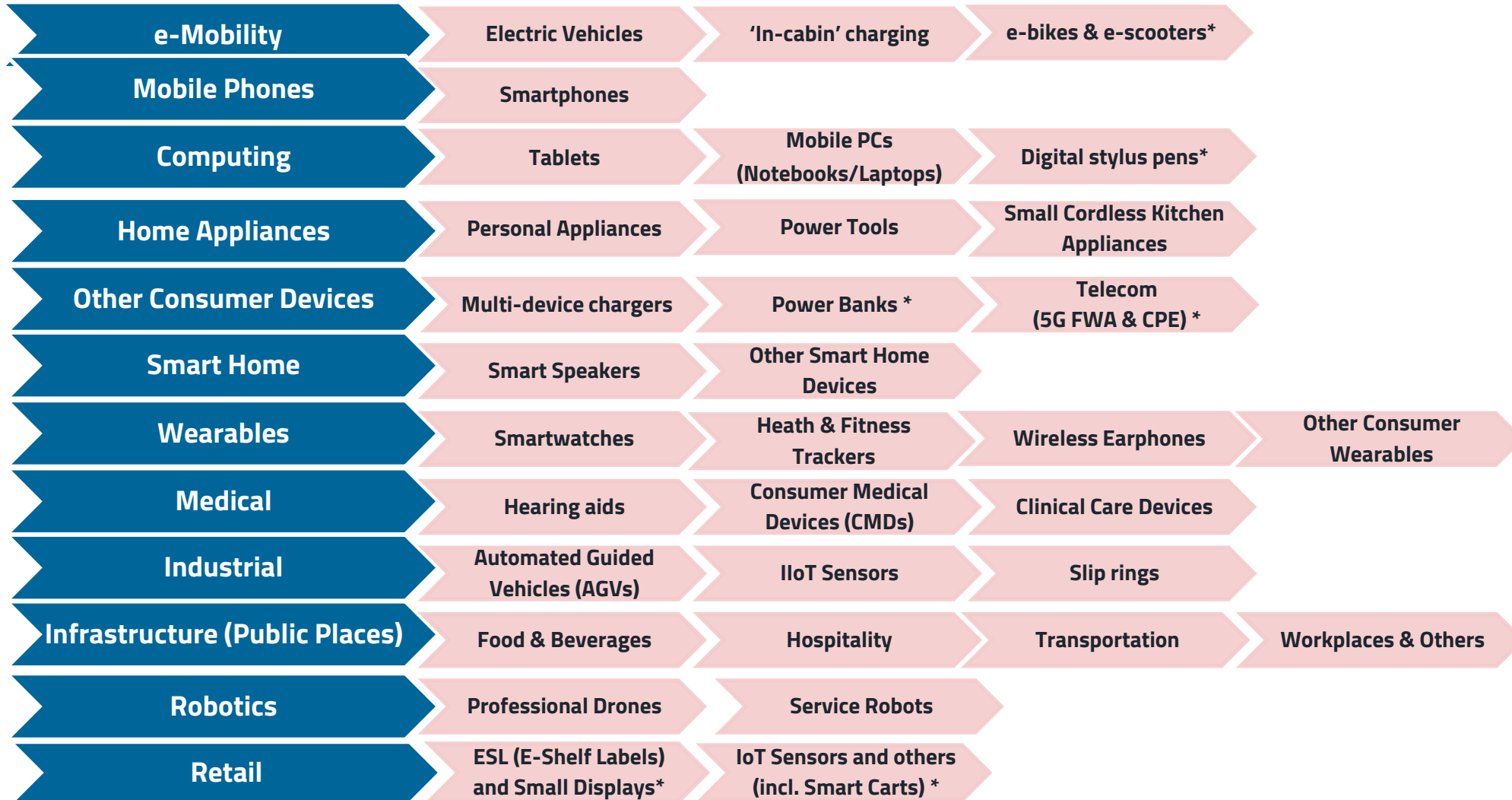


Source: WAWT

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WAWT's Wireless Power Research:

- Application coverage (30+ devices)



Source: WAWT


* New emerging applications added

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Wireless power technology landscape

Wireless power technology continues to evolve rapidly as adoption expands across a wide range of applications, catering to specific needs (use cases)

(Scenario: End 2018)



Frequency class	Low frequency
Technology type	Magnetic Induction
Coupling	"Tightly coupled"
Frequency band	100 kHz-200 kHz (330 kHz)
Regulatory / Standard Body	
Standard name/type	Qi + Other Proprietary

Source: WAWT

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Wireless power technology continues to evolve rapidly as adoption expands across a wide range of applications, catering to specific needs (use cases)

(Scenario: End 2018)




Frequency class	Low frequency	
Technology type	Magnetic Induction	Magnetic Resonance
Coupling	"Tightly coupled"	'Loosely coupled'
Frequency band	100 kHz-200 kHz (330 kHz)	79-90 kHz (85 kHz) (3 kHz-25 kHz)
Regulatory / Standard Body		
Standard name/type	Qi + Other Proprietary	SAE and other specification for EVs

Source: WAWT

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Wireless power technology continues to evolve rapidly as adoption expands across a wide range of applications, catering to specific needs (use cases)

(Scenario: End 2018)





Frequency class	Low frequency		High frequency
Technology type	Magnetic Induction	Magnetic Resonance	Magnetic Resonance
Coupling	"Tightly coupled"	'Loosely coupled'	"Loosely coupled"
Frequency band	100 kHz-200 kHz (330 kHz)	79-90 kHz (85 kHz) (3 kHz-25 kHz)	6.78 MHz
Regulatory / Standard Body			
Standard name/type	Qi + Other Proprietary	SAE and other specification for EVs	AirFuel Resonance (AFA) + Other Proprietary

Source: WAWT

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Wireless power technology continues to evolve rapidly as adoption expands across a wide range of applications, catering to specific needs (use cases)

(Scenario: End 2018)





Frequency class	Low frequency		High frequency	Ultra-High-Frequency
Technology type	Magnetic Induction	Magnetic Resonance	Magnetic Resonance	'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)
Coupling	"Tightly coupled"	'Loosely coupled'	"Loosely coupled"	'Uncoupled' No coupling needed
Frequency band	100 kHz-200 kHz (330 kHz)	79-90 kHz (85 kHz) (3 kHz-25 kHz)	6.78 MHz	<ul style="list-style-type: none"> RF: 900 MHz, 2.4GHz-5.8GHz US: 45 kHz-75 kHz/145-155 dB
Regulatory / Standard Body				
Standard name/type	Qi + Other Proprietary	SAE and other specification for EVs	AirFuel Resonance (AFA) + Other Proprietary	AirFuel RF + Other Proprietary

Source: WAWT

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Wireless power technology continues to evolve rapidly as adoption expands across a wide range of applications, catering to specific needs (use cases)

(Scenario: End 2018)






Frequency class	Low frequency		High frequency	Ultra High-Frequency
Technology type	Magnetic Induction	Magnetic Resonance	Magnetic Resonance	'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)
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Regulatory / Standard Body				
Standard name/type	Qi + Other Proprietary	SAE and other specification for EVs	AirFuel Resonance (AFA) + Other Proprietary	AirFuel RF + Other Proprietary
Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging	Light-duty Electric vehicles (EVs) And possibly other consumer applications	Public places, laptops, wearables, robots, drones, AGVs/AMRs, 5G FWA/CPE, e-bikes/e-scooters	Infrastructure (public places), IIoT sensors, wearables, hearables, smart home and gaming devices, smart clothing, retail ESLs, other consumer, medical and industrial devices, Multi-mode systems.

Source: WAWT

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Emergence of new NFC charging solution for small battery-powered devices.

(Scenario: Early 2019)

Frequency class	Low frequency		High frequency		Ultra High-Frequency
Technology type	Magnetic Induction	Magnetic Resonance	Magnetic Resonance	NFC Charging	'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)
Coupling	"Tightly coupled"	'Loosely coupled'	"Loosely coupled"	"Loosely coupled"	'Uncoupled' No coupling needed
Frequency band	100 kHz-200 kHz (330 kHz)	79-90 kHz (85 kHz) (3 kHz-25 kHz)	6.78 MHz	13.56 MHz	<ul style="list-style-type: none"> RF: 900 MHz, 2.4GHz-5.8GHz US: 45 kHz-75 kHz/145-155 dB
Regulatory / Standard Body					
Standard name/type	Qi + Other Proprietary	SAE and other specification for EVs	AirFuel Resonance (AFA) + Other Proprietary	NFC Charging	AirFuel RF + Other Proprietary
Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging	Light-duty Electric vehicles (EVs) And possibly other consumer applications	Public places, laptops, wearables, robots, drones, AGVs/AMRs, 5G FWA/CPE, e-bikes/e-scooters	Small battery-powered devices. Smart glasses, fitness trackers, hearing aids, wireless earphones, wearables, digital stylus pens, key-fobs	Infrastructure (public places), IIoT sensors, wearables, hearables, smart home and gaming devices, smart clothing, retail ESLs. other consumer, medical and industrial devices, Multi-mode systems.

Emerging technology

Emergence of new NFC charging solution for small battery-powered devices. And further segmentation of the market based on power classes and distance (Scenario: Early 2019)







Frequency class	Low frequency					High frequency					Ultra High-Frequency						
Technology type	Magnetic Induction		Magnetic Resonance			Magnetic Resonance			NFC Charging		'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)						
Coupling	"Tightly coupled"		'Loosely coupled'			"Loosely coupled"			"Loosely coupled"		'Uncoupled' No coupling needed						
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Regulatory / Standard Body																	
Standard name/type	Qi + Other Proprietary		SAE and other specification for EVs			AirFuel Resonance (AFA) + Other Proprietary			NFC Charging		AirFuel RF + Other Proprietary						
Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging		Light-duty Electric vehicles (EVs) And possibly other consumer applications			Public places, laptops, wearables, robots, drones, AGVs/AMRs, 5G FWA/CPE, e-bikes/e-scooters			Small battery-powered devices. Smart glasses, fitness trackers, hearing aids, wireless earphones, wearables, digital stylus pens, key-fobs		Infrastructure (public places), IIoT sensors, wearables, hearables, smart home and gaming devices, smart clothing, retail ESLs. other consumer, medical and industrial devices, Multi-mode systems.						
Power Classes	(Low-PC0) 5W-15W	(Med-PC1) 30W-200W	(High-PC2) 200W-2200W	(WPT1) 3.7kW	(WPT2) 7.7kW	(WPT3) 11.1kW	(WPT4) 22kW (WPT5) 60kW	0W-50W (AFA)	50W-100W (AFA)	100W-3000W (AFA Custom + Proprietary)	250 mW	500 mW	750 mW	1W-2W	Near-Field (4 inches)	Medium-Field (4 feet)	Far-Field (4 meters)

Source: WAWT

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New (Ki) standard launched by WPC for small cordless kitchen appliances.

(Scenario: End 2019)

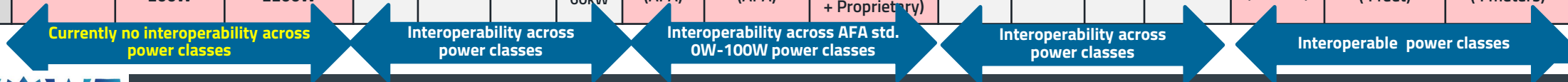
Frequency class	Low frequency				High frequency				Ultra High-Frequency								
Technology type	Magnetic Induction		Magnetic Resonance		Magnetic Resonance		NFC Charging		'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)								
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Frequency band	100 kHz-200 kHz (330 kHz)		79-90 kHz (85 kHz) (3 kHz-25 kHz)		6.78 MHz		13.56 MHz		<ul style="list-style-type: none"> RF: 900 MHz, 2.4GHz-5.8GHz US:45 kHz-75 kHz/145-155 dB 								
Regulatory / Standard Body																	
Standard	Qi & Ki  + Other Proprietary		SAE and other specification for EVs		AirFuel Resonance (AFA) + Other Proprietary		NFC Charging		AirFuel RF + Other Proprietary								
Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging		Light-duty Electric vehicles (EVs) And possibly other consumer applications		Public places, laptops, wearables, robots, drones, AGVs/AMRs, 5G FWA/CPE, e-bikes/e-scooters		Small battery-powered devices. Smart glasses, fitness trackers, hearing aids, wireless earphones, wearables, digital stylus pens, key-fobs		Infrastructure (public places), IIoT sensors, wearables, hearables, smart home and gaming devices, smart clothing, retail ESLs. other consumer, medical and industrial devices, Multi-mode systems.								
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Source: WAWT

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As power classes evolve, frequency bands expand, and proprietary solutions increase (MagSafe launched), there appears to be less/no interoperability across adjacent power classes, mainly within low-frequency-based inductive solutions (Scenario: 2020)

Frequency class	Low frequency				High frequency				Ultra High-Frequency								
Technology type	Magnetic Induction		Magnetic Resonance		Magnetic Resonance		NFC Charging		'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)								
Coupling	"Tightly coupled"		'Loosely coupled'		"Loosely coupled"		"Loosely coupled"		'Uncoupled' No coupling needed								
Frequency band	100 kHz-200 kHz (330 kHz)		79-90 kHz (85 kHz) (3 kHz-25 kHz)		6.78 MHz		13.56 MHz		<ul style="list-style-type: none"> RF: 900 MHz, 2.4GHz-5.8GHz US: 45 kHz-75 kHz/145-155 dB 								
Regulatory / Standard Body																	
Standard name/type	Qi & Ki + MagSafe Other Proprietary		SAE and other specification for EVs		AirFuel Resonance (AFA) + Other Proprietary		NFC Charging		AirFuel RF + Other Proprietary								
Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging		Light-duty Electric vehicles (EVs) And possibly other consumer applications		Public places, laptops, wearables, robots, drones, AGVs/AMRs, 5G FWA/CPE, e-bikes/e-scooters		Small battery-powered devices. Smart glasses, fitness trackers, hearing aids, wireless earphones, wearables, digital stylus pens, key-fobs		Infrastructure (public places), IIoT sensors, wearables, hearables, smart home and gaming devices, smart clothing, retail ESLs. other consumer, medical and industrial devices, Multi-mode systems.								
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Source: WAWT

While 'distance' wireless charging gained traction amongst existing players, with entry of few new players in 2021, other complimenting solutions like RFID, Energy Harvesting, and Hybrid (multi-freq.) solutions start to emerge.

(Scenario: 2021-2022)

Frequency class	Low frequency							High frequency							Ultra High-Frequency		
Technology type	Magnetic Induction			Magnetic Resonance				Magnetic Resonance			NFC Charging				'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)		
Coupling	"Tightly coupled"			'Loosely coupled'				"Loosely coupled"			"Loosely coupled"				'Uncoupled' No coupling needed		
Frequency band	100 kHz-200 kHz (330 kHz)			79-90 kHz (85 kHz) (3 kHz-25 kHz)				6.78 MHz			13.56 MHz				<ul style="list-style-type: none"> • RF: 900 MHz, 2.4GHz-5.8GHz • US: 45 kHz-75 kHz/145-155 dB 		
Regulatory / Standard Body																	
Standard name/type	Qi & Ki + MagSafe + Other Proprietary			SAE and other specification for EVs				AirFuel Resonance (AFA) + Other Proprietary			NFC Charging				AirFuel RF + Other Proprietary		
Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging			Light-duty Electric vehicles (EVs) and possibly other consumer applications				Public places, laptops, wearables, robots, drones, AGVs/AMRs, 5G FWA/CPE, e-bikes/e-scooters			Small battery-powered devices. Smart glasses, fitness trackers, hearing aids, wireless earphones, wearables, digital stylus pens, key-fobs				Infrastructure (public places), IIoT sensors, wearables, hearables, smart home and gaming devices, smart clothing, retail ESLs. other consumer, medical and industrial devices, Multi-mode systems.		
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Hybrid 'multi-frequency' start to emerge








Source: WAWT

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WPC announces development of advanced Qi2 standard based on Magnetic Power Profile (MPP = EPP + MagSafe compactible).

(Scenario: Year 2023, so far)

Frequency class	Low frequency							High frequency							Ultra High-Frequency		
Technology type	Magnetic Induction			Magnetic Resonance				Magnetic Resonance			NFC Charging				'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)		
Coupling	"Tightly coupled"			'Loosely coupled'				"Loosely coupled"			"Loosely coupled"				'Uncoupled' No coupling needed		
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Regulatory / Standard Body																	
Standard	Qi & Ki + Qi2 + MagSafe + Other Proprietary			SAE and other specification for EVs				AirFuel Resonance (AFA) + Other Proprietary			NFC Charging				AirFuel RF + Other Proprietary		
Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging			Light-duty Electric vehicles (EVs) And possibly other consumer applications				Public places, laptops, wearables, robots, drones, AGVs/AMRs, 5G FWA/CPE, e-bikes/e-scooters			Small battery-powered devices. Smart glasses, fitness trackers, hearing aids, wireless earphones, wearables, digital stylus pens, key-fobs				Infrastructure (public places), IIoT sensors, wearables, hearables, smart home and gaming devices, smart clothing, retail ESLs. other consumer, medical and industrial devices, Multi-mode systems.		
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Source: WAWT

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To summarise, the wireless power technology market continues to evolve

- In the last few years, we witnessed advancement of existing technology, new standard, new wireless power technology, evolving power classes, hybrid (multi-freq.) solutions.

Frequency class	Low frequency							High frequency							Ultra High-Frequency		
Technology type	Magnetic Induction			Magnetic Resonance				Magnetic Resonance			NFC Charging				'Distance' Charging (RF, ultrasound, infrared, 5G, etc.)		
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Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging			Light-duty Electric vehicles (EVs) and possibly other consumer applications				Public places, laptops, wearables, robots, drones, AGVs/AMRs, 5G FWA/CPE, e-bikes/e-scooters,			Small battery-powered devices. Smart glasses, fitness trackers, hearing aids, wireless earphones, wearables, digital stylus pens, key-fobs				Infrastructure (public places), IIoT sensors, wearables, hearables, smart home and gaming devices, smart clothing, retail ESLs. other consumer, medical and industrial devices, Multi-mode systems.		
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Hybrid 'multi-frequency' start to emerge

Emerging technology

New standards

Emerging applications


Evolving power classes

Source: WAWT

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Low frequency inductive based solution holds the largest share of the wireless power technology market, with installed based on more than billion devices

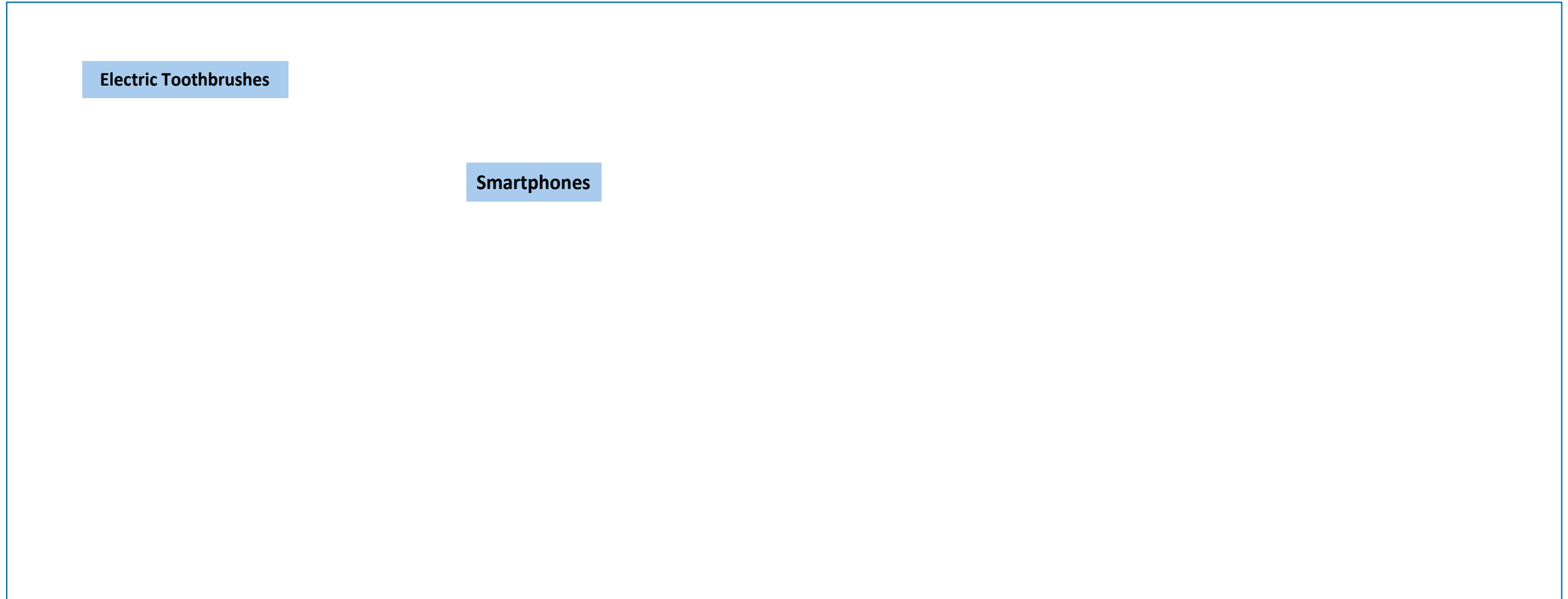
- This technology segment continues to advance and grow
- This is where **Würth Electronics** focuses on and excels, with its standard and custom-based solutions

Frequency class	Low frequency		
Technology type	Magnetic Induction		
Coupling	"Tightly coupled"		
Frequency band	100 kHz-200 kHz (330 kHz)		
Regulatory / Standard Body			
Standard name/type	Qi & Ki + Qi2 (EPP + MPP) + Apple MagSafe + Other Proprietary		
Key Applications (examples)	Smartphones, smartwatches, wireless earphones, power tools, cordless kitchen appliances, 5G FWA/CPE, automotive 'in-cabin', AGVs/AMRs, electric toothbrushes, e-bikes/e-scooters, reverse charging		
Power Classes	(Low-PC0) 5W-15W	(Med-PC1) 30W-200W	(High-PC2) 200W-2200W

Source: WAWT

Wireless power technology adoption expands beyond electric toothbrushes and smartphones

From electric toothbrushes and smartphones 2016-2017 (Past scenario)



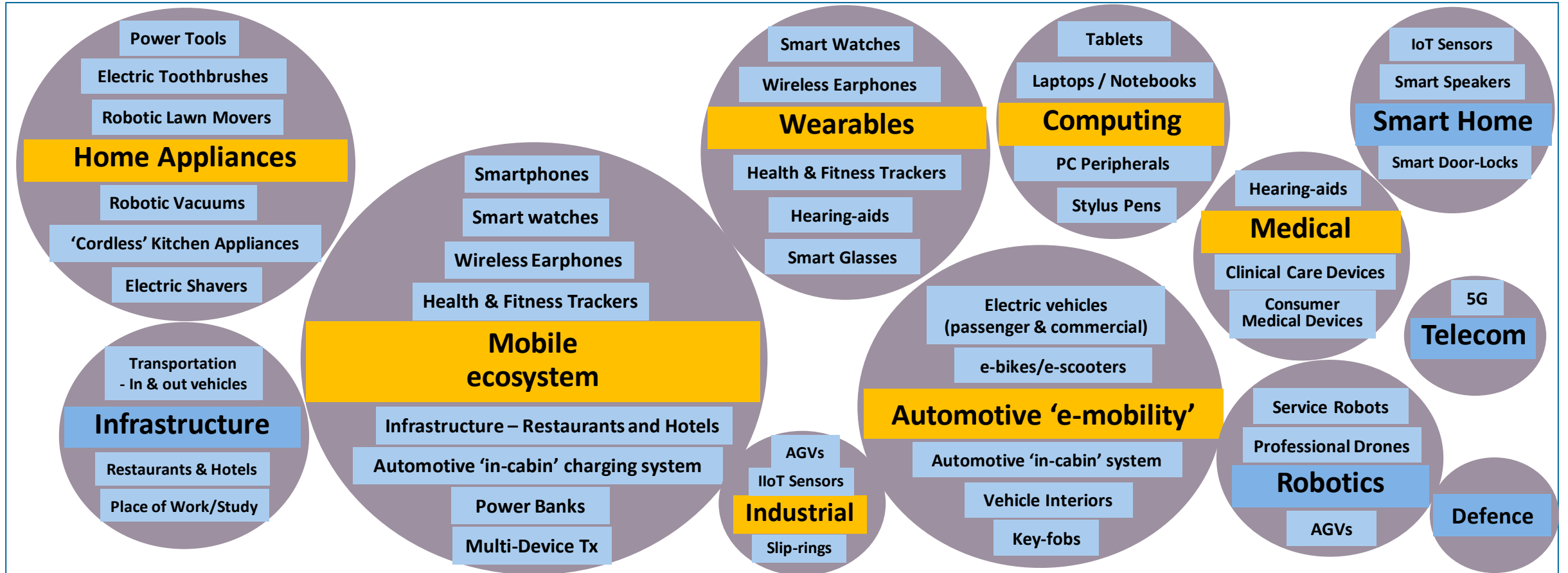
Source: WAWT

Source: WAWT's Wireless Power Intelligence Service

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... to wider application markets across sectors

2023-2024 (Current scenario)



Source: WAWT

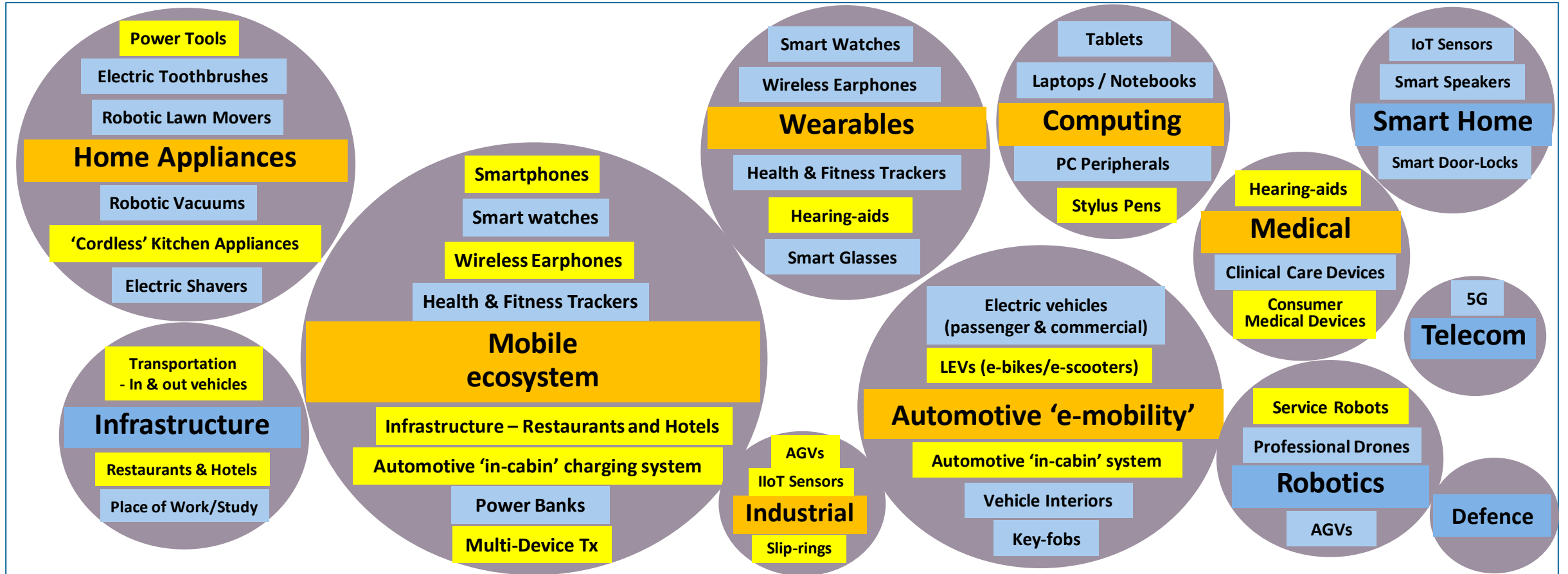
Source: WAWT's Wireless Power Intelligence Service

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AGVs: Automated Guided Vehicles

... to wider application markets across sectors

2023-2024 (Current scenario)



Source: WAWT

Source: WAWT's Wireless Power Intelligence Service

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AGVs: Automated Guided Vehicles

Wireless power market drivers and barriers

- An overall summary

Wireless power market drivers and barriers

- An overall summary



Market Drivers

- Convenience
- Favourable customer demand (enhances user experience)
- Sealed device (facilitates enclosed design)
- Green benefits (use of no or less batteries).
- Safety benefits (Eliminates contacts with wired cables)
- More reliable (Few moving parts, less wear & tear, low down-time.
- Infrastructure and data capture (Integration with data/comm.)
- Market differentiation (Competitive advantage)
- Monetization (Increase revenues, footprints, business opportunities)

- Costs
- Health and safety concerns
- Design constraints and better performance
- Standards, certification, interoperability process
- High-capacity batteries being used (less need)
- High unrealistic expectations set
- Battery and heat management 'thermal' issues
- Low awareness and lack of understanding of the benefits
- Mind-set change (Complements, not competes with wired technology)
- Commoditization of market (Deteriorating/lower margins)
- Infrastructure challenges (costs/set-up/Tx deployment)
- Not enough or costly Tx
- Other competing technologies



Market Barriers

Source: WAWT

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How BIG is the wireless power market opportunity?

- Market size estimation and forecast

How BIG is the WPT market opportunity?

- The size of the wireless power market

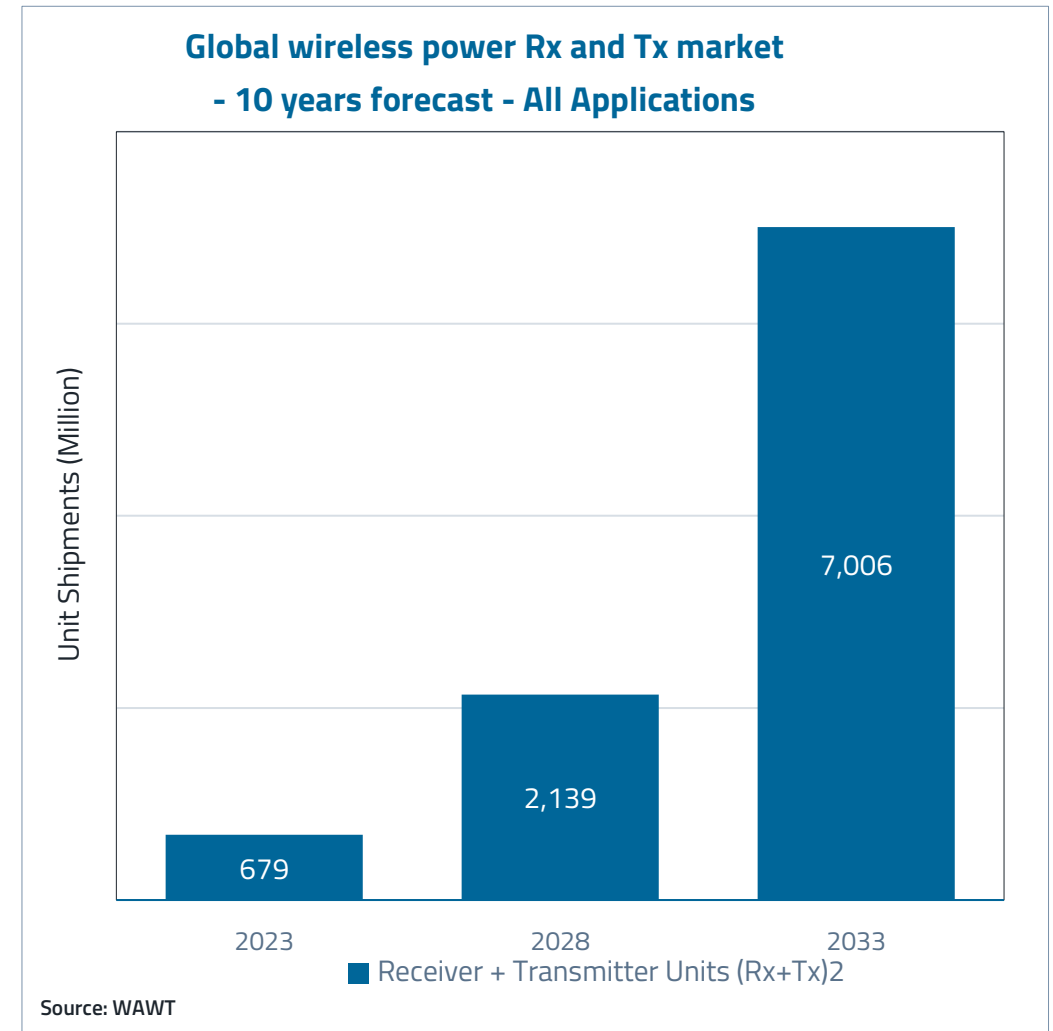
- 1) What was the **size of wireless power market in 2023**, in terms of unit shipments, considering wireless power receivers and transmitters, all application markets and all WPT technology types?
- 2) Currently, which are the **top three application markets**, in terms of unit shipments?
- 3) How many wireless power receiver (Rx) and transmitter (Tx) units in total are expected to be **shipped in the next 5 years**?

Source: WAWT's Wireless Power Intelligence Service

With more than 1 billion installed base, the wireless power market opportunity is still HUGH

- The total wireless power receivers and transmitters (Rx+Tx) market is expected to grow from around **679 million units** in 2023 to **2.1 billion units** in 2028, to **7.0 billion units** in 2033
- **Smartphones, electric toothbrushes and smart watches** are currently the top three application markets, in terms of unit shipments
- In total there we expect around **8.1 billion units** of wireless power **Rx+Tx units to be shipped in the next 5 years**

Source: WAWT's Wireless Power Intelligence Service – 2023 Report Edition



THE OVERVIEW OF THE WIRELESS POWER TECHNOLOGY MARKET

- BY WAWT

Questions & Answers



We are here for you now!
Ask us directly via our chat or via e-mail
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