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The Power of Linking Together

Abracon PTM
Introduction to AWCCA Series
Wireless Charging Coil Assemblies

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AWCCA Series
Wireless Charging Coil Assemblies

Purpose

To introduce AWCCA Series, Wireless Charging Coils.

Objective

Present the advantage, performance and applications of Abracon AWCCA Series.

Content

22 pages

Learning Time

25 minutes

Welcome to Abracon's AWCCA Series; Wireless Charging Coil Training Module. This training session will provide an overview of the key features and benefits; as well as, discuss the applications of this product series.

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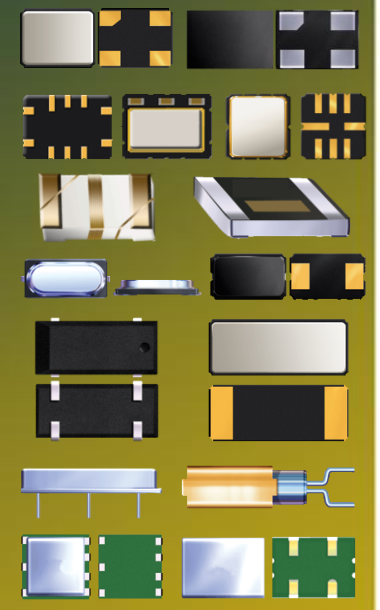

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An Introduction to Inductive Charging

What is Inductive Charging?

Inductive charging sometimes known as "Wireless Charging" uses an electro-magnetic field to transfer energy between two devices.

Energy is sent through the inductive couplings between a base unit and mobile device to charge a battery or power a d.c. electrical device.

This technology has been adopted for many years in electric toothbrushes, where the advantage of a "wireless" technology is paramount for safety.

It offers several advantages: No connections, safety, greener since less chargers are needed, and convenience (less leads and wired chargers).

But does it have some disadvantages: lower efficiency >> longer charge times, more costly. These cases are challenged by their manufacturers.

Inductive charging is designed to charge devices without having connecting wires. Magnetic energy from a coil in the base unit is induced into a coil in a mobile device to charge the mobile device.

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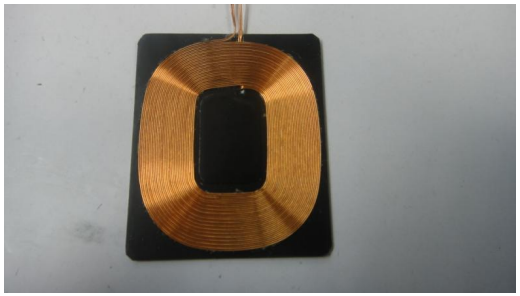
Product - AWCCA Series
Wireless Charging Coil Assemblies

AWCCA Series-Part Numbering



AWCCA	38R32H09	C	01	B
Part Series	Size (mm)	Feature	Design Code	Packaging Code
Wireless Charging Coil Assy	Example 38 L x 32 W x 0.9 H R = Receive	Coil	Design Code 01, 02	Blank = Box

The AWCCA Series offers a range of Wireless Charging Coils as described by their part number code

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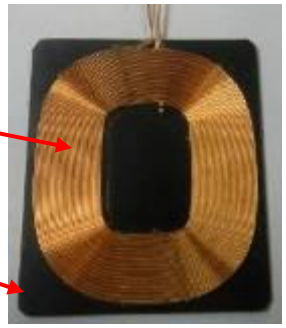
Abracon Wireless Charging Coils

LITZ WINDINGS

FERRITE BACKING

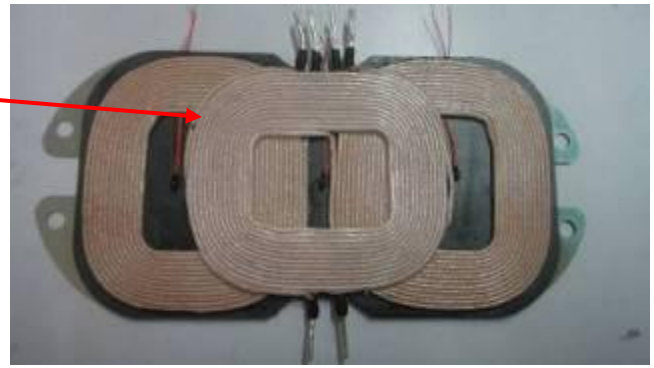


PN: AWCCA50N50H35C01B

PN: AWCCA38R32H09C01B

The AWCCA part number identifies its function Tx or Rx and size:
AWCCA-50N50H40-C01-B – N = Tx or Rx / 50N50H40 = 50x50x4.0mm
AWCCA-107T52H-40C01-B – T = Tx / 107T52H40 = 107x52x4.0mm
AWCCA-38R32H10-C01-B – R = Rx / 38R32H10 = 38.5x32.5x1.0mm

3 COIL ASSEMBLY



PN: AWCCA107T52H40C01B

The photographs above show examples of the AWCCA Series of charging coils.

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Abracon AWCCA Series - Part Numbering & Descriptions

Part No	Description / Inductance	Q-Factor @ 100KHz DC Resistance	Size
AWCCA-38R32H09-C01-B	Receiver, 1 Coil 1 Layer, 11.1uH,	22±30% 260m Ω±20%	38.5x32.5x1.0mm
AWCCA-48R32H11-C01-B	Receiver, 1 Coil 1 Layer,10.5uH,	28±30% 190m Ω±20%	48.5x32.5x1.1mm
AWCCA-50N50H35-C01-B	Transmitter or Receiver, 1 Coil 1 Layer, 24uH,	160±30% 72m Ω±20%	50x50x3.5mm
AWCCA-50N50H35-C02-B	Transmitter or Receiver, 1 Coil 1 Layer, 6.3uH,	72±30% 19m Ω±20%	50x50x3.5mm

The tables shown in these next three slides show the AWCCS part numbers, their attributes, and sizes.

This table starts by showing the receiver coils, continuing onto the 50mm square models suitable for transmit or receive.

Customization of the coils assemblies, e.g. adding permanent magnets is possible. Contact ABRACON

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Abracon AWCCA Series - Part Numbering & Descriptions

Part No	Description / Inductance	Q-Factor @ 100KHz DC Resistance	Size
AWCCA-50N50H40-C01-B	Transmitter or Receiver, 1 Coil 1 Layer, 24uH,	165±30% 72m Ω±20%	50x50x4.0mm
AWCCA-50N50H40-C02-B	Transmitter or Receiver, 1 Coil 1 Layer, 6.3uH,	72±30% 19m Ω±20%	50x50x4.0mm
AWCCA-50N50H50-C01-B	Transmitter or Receiver, 1 Coil 1 Layer, 24uH,	163±30% 72m ±20%	50x50x5.0mm
AWCCA-50N50H50-C02-B	Transmitter or Receiver, 1 Coil 1 Layer, 6.3uH,	75±30% 19m Ω±20%	50x50x5.0mm

The second table continues with the 50x50mm square models, highlighting the differences between parts, inductance value and thickness, shown by the H40 / H50 (4.0 & 5.0mm respectively) in the part numbers.
Customization of the coils assemblies, e.g. adding permanent magnets is possible. Contact ABRACON

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Abracon AWCCA Series - Part Numbering & Descriptions

Part No	Description / Inductance	Q-Factor @ 100KHz DC Resistance	Size
AWCCA-53N53H50-C01-B	Transmitter or Receiver, 1 Coil 1 Layer, 24uH,	170±30% 72m ±20%	53x53x5.0mm
AWCCA-53N53H50-C01-B	Transmitter or Receiver, 1 Coil 1 Layer, 6.3uH,	66±30% 19mΩ±20%	53x53x5.0mm
AWCCA-107T52H40-C01-B	Transmitter, 3 Coil 2 Layer, (Upper 11.5uH / Lower 12.0uH)	80±30% 56mΩ±20%	107x52x4.0mm

The **AWCCA-107T52H40-C01-B** is approved* with the **IDT9036A** wireless TX charging controller.
(* In conjunction with supply chain partner)

The last table adds 53mm square devices and the transmit coil AWCCA-107T52H40-C01-B, that is approved for the IDT9036A IC.

Wireless Charging – Standards Bodies

There are 3 standards bodies across the Wireless Charging Industry:

- **The Wireless Power Consortium – Qi Standard**
- **Power Matters Alliance (PMA)**
- **Alliance for Wireless Power (A4WP)**

- All three bodies have some significant followers. Their aim is to unify investors so the broadest number of companies are able to use a common standard.

- The **Wireless Power Consortium** won over technology company - Power by Proxi, which offers technology allowing multiple devices on one pad to be charged.

- **PMA** has seen interest from Starbucks, AT&T, Google, HTC, Samsung and LG.

- While **A4WP**, has backing from Samsung and Qualcomm.

Today Wireless Charging has 3 standards and interoperability testing groups; the Wireless Power Consortium, Power Matter Alliance (PMA) and Alliance for Wireless Power (A4WP).

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Qi (Chee) – The Wireless Charging Standard

The **Wireless Power Consortium** has developed the Qi Wireless Charging standard.

The purpose of Qi, is to standardize the interface and inter compatibility of wireless charging systems.

The Qi technology allows compatible electronic devices to be placed on the Qi charging surface, where they are charged inductively through tightly coupled magnetic currents.

Mobile device manufactures and automotive companies have adopted Qi.

Qi Hotspots in Coffee shops, Airports, and Sports Arenas, will offer a free charging service to attract customers.

The Wireless Power Consortium have developed a standard called Qi, allowing similarly equipped devices to be charged via a charging pad. These charging stations are becoming more common as businesses offer their customer charging time while they have a cup of coffee, or wait for a plane.

Other Wireless Charging Standards

Resonant Inductive Wireless Coupling:
Uses Resonant Inductive Power Coupling allowing charging over a wider distance. The **Power Matter Alliance (PMA)** have this technology.

The Alliance for Wireless Power (A4WP) also uses a resonant system, by using loosely coupled magnetic waves induced into coils (tuned circuits) operating at 6.78MHz.

The AWCCA coils are designed for closely coupled non-resonant inductive power transfer so are not suitable for the Resonant Wireless Coupling applications

Resonant Inductive charging uses capacitively loaded coils designed to operate at >5MHz. This technology has demonstrated power transfer between devices several meters apart. AWWCA coils are non-resonant coils, so not suitable for the resonant standards shown above.

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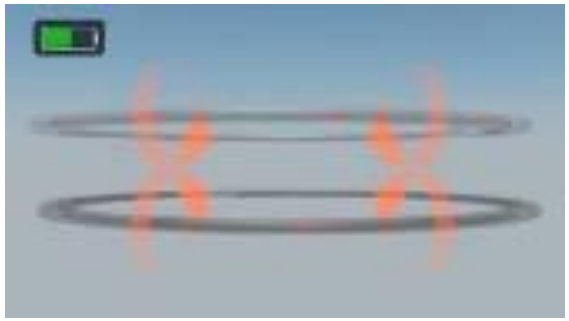
Wireless Charging Technology

The technology uses a **PRIMARY** and **SECONDARY** planar coils. The primary coils are described as **TRANSMITTER** coils and the secondary are **RECEIVER** coils.

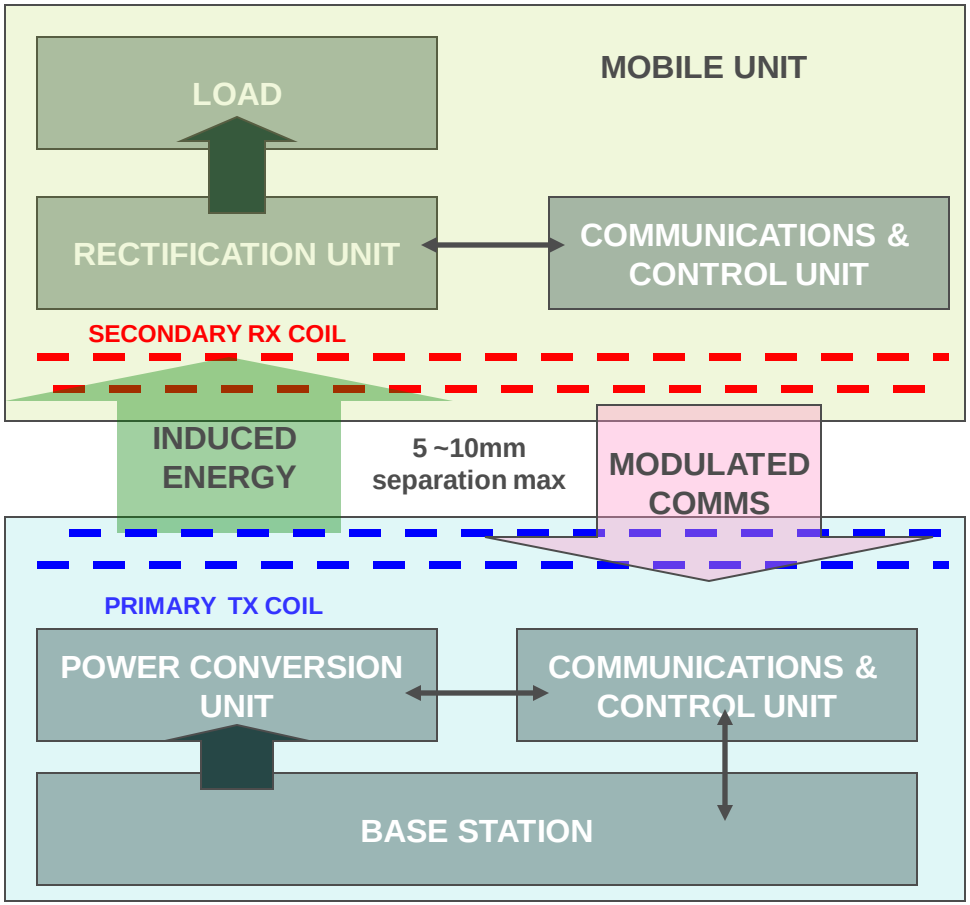
The Primary coil sits in the **BASE STATION**, and the Secondary in the **MOBILE** unit. Energy is induced from the base unit to the mobile by an alternating current in the primary coil causing a primary magnetic field, which induces a current in the secondary coil, that can charge a battery or power a mobile device after rectification.

Coils are identified as either **TX** or **RX** coils or either.



The Wireless Charging system uses closely coupled magnetic fields to transfer energy from the primary coil to the secondary in the mobile device. The primary is referred as the Tx coil and the secondary as the Rx. These functions are identified in the AWCCA part numbers.

Block Diagram:
Inductive Wireless Charging Coil Application



The Base Station power Conversion unit induces a magnetic field from its Primary coil to the Secondary coil in Mobile unit, which after rectification causes a charging current in the load of the mobile.

The Mobile Communications unit modulates a signal to the Base Station to control charging levels, and stop charging when the mobile device is removed.

Shown above is a simplified block diagram of a Wireless Charging system, showing how EMF is induced from primary to secondary coils and rectified back to a dc current. The mobile unit communicates a signal back to the Base Station to indicate charging level.

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AWCCA Charging Coils

The AWCCA Series offers a range of coils covering different sizes, inductance, and shielding requirements. If designers require alternative designs, please contact Abracon or an authorized Abracon Distributor or Agent.

ABRACON OFFERS CUSTOMIZATION OF WIRELESS CHARGING COILS TO MEET DIFFERENT CUSTOMER OR STANDARD REQUIREMENTS

Wireless Charging systems use a range of charging coils to meet system requirements. This impacts the design of the Primary coils used in the Base Station. Single or multiple coils arrays may be used in the Base Station, while smaller single secondary coils are fitted within mobile devices

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What Applications could benefit from Low Power Wireless Charging

- Mobile Charging Stations
- Charging Stations in Airports or Coffee Shops
- In Car Charging for Mobile Devices
- Hermitically sealed Medical Equipment

Mobile Phones have been the largest driver for wireless charging, seeing charging stations in coffee shops and airports. In car charging has started to adopt this as well and may be the largest application area. Personal Charging pads are likely to grow as well as users see the advantage and /or phone manufactures stop adding or charge extra $ for USB chargers. Other applications needing low power inductive charging across the medical or industrial fields are also likely to grow.

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Applications for Wireless Charging

- Wireless Charging is drawing in many companies wanting to take advantage of this technology directly through OEM designs or indirectly by offering wireless charging on their premises.

- Applications and Industries
  - Automotive Industry
  - Batteries and Battery Chargers
  - Consumer Electronics
  - Digital Cameras and Camcorders
  - Infrastructure and Furniture Manufacturers
  - Mobile Phone Companies and accessory manufactures like phone covers
  - Power Supply companies
  - Power Tool Manufacturers
  - Semiconductor manufacturers
  - System Engineering and Design companies
  - Wireless Power Product Manufactures.

An increasing number of companies are finding uses for the Wireless Charging Coil technology, adding to the range of industries and applications designing in this technology.

AWCCA Types & Performance

ABRACON	DESCRIPTION	Q-FACTOR	DC RESISTANCE
AWCCA-38R32H10-C01-B	Rx, Coil 11.1uH, 38.5x32.5x0.9mm	22±30%	260m Ω±20%
AWCCA-48R32H11-C01-B	Rx, Coil 10.5uH, 48.5x32.5x1.1mm	28±30%	190m Ω±20%
AWCCA-50N50H35-C01-B	Tx or Rx, Coil 24uH, 50x50x3.5mm	160±30%	72m Ω±20%
AWCCA-50N50H35-C02-B	Tx or Rx, Coil 6.3uH, 50x50x3.5mm	72±30%	19m Ω±20%
AWCCA-50N50H40-C01-B	Tx or Rx, Coil 24uH, 50x50x4.0mm	165±30%	72m Ω±20%
AWCCA-50N50H40-C02-B	Tx or Rx, Coil 6.3uH, 50x50x4.0mm	72±30%	19m Ω±20%

Q-Factor: $Q = \frac{\omega L}{R}$ with *with* $\omega = 2\pi f$:

Q-Factor is important; if it is too low then power losses in the coils will be excess leading to poor efficiency

The following two tables summarizes the description, type, distribution costs, and performance of the AWCCA series. The Q-Factor of the coil is merit of its quality, where a higher Q figure indicates a lower rate of energy loss relative to the stored energy of the resonator.

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AWCCA Types & Performance

ABRACON	DESCRIPTION	Q-FACTOR (1)	DC RESISTANCE
AWCCA-50N50H50-C01-B	Tx or Rx, Coil 24uH, 50x50x5.0mm	163±30%	72m Ω±20%
AWCCA-50N50H50-C02-B	Tx or Rx, Coil 6.3uH, 50x50x5.0mm	75±30%	19m Ω±20%
AWCCA-53N53H50-C01-B	Tx or Rx, Coil 24uH, 50x50x5.0mm	170±30%	72m Ω±20%
AWCCA-53N53H50-C02-B	Tx or Rx, Coil 6.3uH, 50x50x5.0mm	66±30%	19m Ω±20%
AWCCA-107T52H40-C01B	Tx, 3 Coils 11.5uH upper, 12uH lower 50x50x3.5mm	80±30%	56m Ω±20%

Efficiency of the Power Transfer is related to Q-Factor of the primary and secondary coils, their diameter & relative diameter, as well as the distance between the coils.

This is why you will see best power transfer when the mobile device is place flat on the charging pad and in the appropriate position.

Wireless Charging Stations will have alignment methods, either a logo indicating where to place the mobile, or auto alignment with a permanent magnet to co-locate the coils; while other types identify the relative position of the coils and modify the charging current to obtain best results.

Wireless charging coils need to be as efficient as possible. The Q-Factor and alignment of the Tx and Rx coils plays a significant factor here.

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Cross Reference Guide

ABRACON	DESCRIPTION	TDK	WURTH	VISHAY DALE
AWCCA-38R32H10-C01-B	Rx, Coil 11.1uH, 38.5x32.5x0.9mm	WR-383250-17M2-G		IWAS3827ECEB100J50
AWCCA-48R32H11-C01-B	Rx, Coil 10.5uH, 48.5x32.5x1.1mm	WR-383250-17M2-G		IWAS3827ECEB100J50
AWCCA-50N50H35-C01-B	Tx or Rx, Coil 24uH, 50x50x3.5mm	WT-525225-20K2-A1-G	760308110 & 760308101	
AWCCA-50N50H35-C02-B	Tx or Rx, Coil 6.3uH, 50x50x3.5mm	WT-505060-10K2-A11-G	760308111 & 760308105	
AWCCA-50N50H40-C01-B	Tx or Rx, Coil 24uH, 50x50x4.0mm	WT-525225-20K2-A1-G	760308110 & 760308101	
AWCCA-50N50H40-C02-B	Tx or Rx, Coil 6.3uH, 50x50x4.0mm	WT-505060-10K2-A11-G	760308111 & 760308105	

The table summarizes the cross references to the AWCCA Series of wireless charging coils

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Cross Reference Guide

ABRACON	DESCRIPTION	TDK	WURTH	VISHAY DALE
AWCCA-50N50H50-C01-B	Tx or Rx, Coil 24uH, 50x50x5.0mm	WT-525225-20K2-A1-G	760308110 & 760308101	
AWCCA-50N50H50-C02-B	Tx or Rx, Coil 6.3uH, 50x50x5.0mm	WT-505060-10K2-A11-G	760308111 & 760308105	
AWCCA-53N53H50-C01-B	Tx or Rx, Coil 24uH, 50x50x5.0mm	WT-525225-20K2-A1-G	760308110 & 760308101	
AWCCA-53N53H50-C02-B	Tx or Rx, Coil 6.3uH, 50x50x5.0mm	WT-505060-10K2-A11-G	760308111 & 760308105	
AWCCA-107T52H40-C01B	Tx 3 Coils 11.5uH upper, 12uH lower 50x50x3.5mm	WT-1005660-12K2-A6-G	710-760308106	

The table summarizes the cross references to the AWCCA Series of wireless charging coils

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Key Selling Points for AWCCA Series

- High Quality Litz windings
- Low dc resistance
- High Q-Factor values
- Competitive prices
- Broad range of sizes, thickness and inductance.

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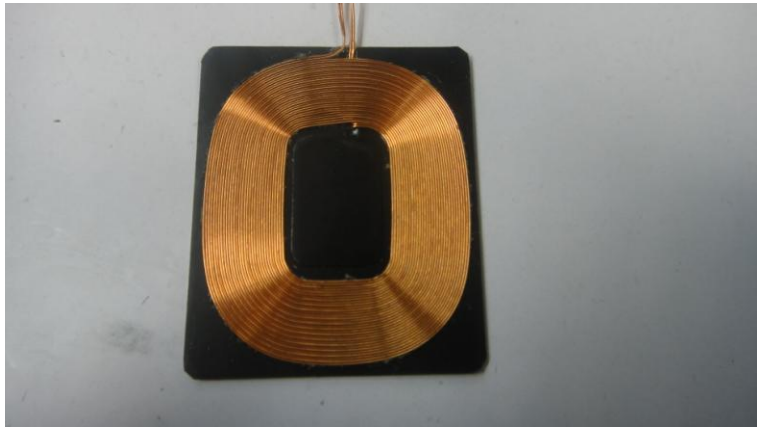

Thank You for your Kind Attention

Abracon Wireless Charging Coils