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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Wireless power transfer – AirFuel Alliance resonant baseline system specification (BSS)

Transfert d'énergie sans fil – Spécification du système de référence (BSS) pour le système résonant d'AirFuel Alliance

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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WIRELESS POWER TRANSFER – AIRFUEL ALLIANCE RESONANT BASELINE SYSTEM SPECIFICATION (BSS)

FOREWORD

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International Standard IEC 63028 has been prepared by technical area 15: Wireless power transfer, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
100/2901/FDIS	100/2941/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

In today's world, mainstream consumer mobile devices are ubiquitously supported by wireless technologies for data communication and connectivity functions while charging function is primarily supported by wired technologies. The development of wireless power transfer technologies offers increased user convenience for charging mobile devices; technologies include inductive, resonant, uncoupled (RF, ultrasonic, laser) methods.

IEC 63028 defines a specific wireless charging approach based on resonant technology and specifies technical requirements for the AirFuel™[1] resonant wireless power transfer (WPT) systems.

1 AirFuel™ is the trade name of a product supplied by AirFuel Alliance. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named.

WIRELESS POWER TRANSFER – AIRFUEL ALLIANCE RESONANT BASELINE SYSTEM SPECIFICATION (BSS)

1 Scope

This document defines technical requirements, behaviors and interfaces used for ensuring interoperability for flexibly coupled wireless power transfer (WPT) systems for AirFuel Resonant WPT. This document is based on AirFuel Wireless Power Transfer System Baseline System Specification (BSS) v1.3.

Products implementing this document are expected to follow applicable regulations and global standards.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

AirFuel Wireless Power Transfer System Baseline System Specification (BSS) v1.3 [viewed 2017-03-13]. Available at: http://www.airfuel.org/technologies/specification-download

AirFuel Wireless Power Transfer System Baseline System Specification (BSS) v1.2.1 [viewed 2017-03-13]. Available at: http://www.airfuel.org/technologies/specification-download

Bluetooth core specification v4.0, or later versions as they are available [viewed 2017-03-13]. Available at: https://www.bluetooth.org/docman/handlers/downloaddoc.ashx?doc_id=229737

CSA4, or later versions as they are available [viewed 2017-03-13]. Available at: https://www.bluetooth.org/docman/handlers/DownloadDoc.ashx?doc_id=269452

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
advertisement
connectable, undirected advertising event where the device transmits three WPT service specific ADV_IND packets and accepts both scan requests and connect requests

Note 1 to entry: There is one ADV_IND packet transmitted on each of the advertising channels.

Note 2 to entry: Receipt of an advertisement is defined to be receipt of one of the three advertisement packets.

3.1.2
category
type of power receiving unit (PRU)

Note 1 to entry: Refer also to the definition of power receiving unit (3.1.17).

3.1.3
charge area
<PRU larger than the test area> region of maximum overlap between the PTU charge area and the PRU resonator

Note 1 to entry: The charge area is provided by the vendor, the PRU is the entire device, and the test area is the charge area in tests.

3.1.4
charge area
<PRU smaller than the test area> region of maximum overlap between the PTU charge area and the PRU

Note 1 to entry: The charge area is provided by the vendor, and the test area is the charge area in tests.

Note 2 to entry: This does not preclude the PRU resonator being larger than the PTU resonator.

Note 3 to entry: Additionally, "within the charge area" is equated to mean "within the test area".

Note 4 to entry: The charge area includes the specification of the Z heights intended for the final product, from the surface of resonator coil.

3.1.5
class
type of power transmitting unit (PTU)

Note 1 to entry: Refer also to the definition of power transmitting unit (3.1.18).

3.1.6
concurrent multiple charging
transmission of power from one transmitting resonator to multiple receiving resonators

Note 1 to entry: Magnetic resonant coupling can occur among one transmitting resonator and many receiving resonators, while tight coupling is restricted to only one transmitting coil and one receiving coil. Thus, tightly coupled technology only allows one-to-one power transmission.

3.1.7
delta R1
change in a PTU resonator's measured resistance when a PRU is placed at the center of PTU's charge area as compared to the resistance when no objects are in the charge area

Note 1 to entry: This measurement refers to the use of a PRU with an open-circuit resonator.

3.1.8
device registry
list of active PRU's maintained by the PTU

3.1.9
dominant PRU
PRU consuming the highest percentage of its rated output power (V_{RECT} x I_{RECT} / $P_{\text{RECT\_MAX}}$)

3.1.10
flexibly coupled wireless power transfer
power transfer system that provides power through magnetic induction between a transmitter coil and a receiver coil, where the coupling factor (k) between the coils can be within a range between large and very small (e.g., less than 0,025)

Note 1 to entry: Also, in a flexibly coupled system, the transmitter (i.e., the primary) coil can be of the same size, or much larger than the receiver (i.e., secondary) coil. The allowable difference in coil size enables concurrent charging of multiple devices as well as more flexible placement of receiver coils within the charge area.

3.1.11
high voltage region
PRU region in which V_{RECT} levels result in high power dissipation without damaging the PRU

3.1.12
keep-out volume
volume outside of the charge area in which no testing is performed

Note 1 to entry: This parameter is defined by the PTU vendor.

3.1.13
low voltage region
V_{RECT} voltages below the operational range

3.1.14
normal operation
range of all specified WPT states other than PRU System Error state for over-voltage

3.1.15
over-voltage
V_{RECT} voltages greater than $V_{\mathrm{RECT\_MAX}}$

Note 1 to entry: Over-voltage can permanently damage PRU components if the PRU does not correct the condition (see 8.3.6).

3.1.16
OVP switch
switch in the PRU that opens or closes to protect the PRU

3.1.17
power receiving unit
unit receiving electrical power wirelessly from a power transmitting unit

3.1.18
power transmitting unit
unit transferring electrical power wirelessly to each power receiving unit

3.1.19
rectifier efficiency
ratio of rectified power to PRU received power (P_{RECT} / $P_{\mathrm{RX\_OUT}}$)

3.1.20
resonance
condition of a body or system when it is subjected to a periodic disturbance of the same frequency as the natural frequency of the body or system

Note 1 to entry: At this frequency, the system displays an enhanced oscillation or vibration.

3.1.21
resonator
magnetic field generator that satisfies the resonance condition for efficiently transferring electrical power from a PTU to a PRU

Note 1 to entry: Both a coil and an electrical conducting wire are examples of a resonator.

3.1.22
wireless power transfer
processes and methods that take place in any system where electrical power is transmitted from a power source to an electrical load without interconnecting wires

3.2 Symbols and abbreviated terms

3.2.1 Symbols

For the purposes of this document, the following symbols for variable parameters apply.

3.2.1.1
η_{RECT}
rectifier efficiency (P_{RECT} / $P_{\mathrm{RX\_OUT}}$)

3.2.1.2
I_{RECT}
DC current out of the PRU's rectifier

3.2.1.3
$I_{\mathrm{RECT\_REPORT}}$
I_{RECT} value reported by a PRU to a PTU

3.2.1.4
$I_{\mathrm{RX\_IN}}$
RMS current out of the resonator/into the rectifier, while in the PRU on state

3.2.1.5
I_{TX}
RMS current into the PTU resonator coil

3.2.1.6
$I_{\mathrm{TX\_LONG\_BEACON}}$
RMS current into the PTU resonator during the long beacon period in the PTU power save state

Note 1 to entry: This current is used to provide minimum power for waking up a PRU signaling module and MCU, and to initiate communication.

3.2.1.7
$I_{\mathrm{TX\_SHORT\_BEACON}}$
RMS current into the PTU resonator while in the PTU power save state

Note 1 to entry: This current is used to detect the PTU impedance change caused by the placement of an object in the charge area.

3.2.1.8
$I_{\mathrm{TX\_START}}$
RMS current into the PTU resonator that provides minimum power for waking up a PRU signaling module and MCU

Note 1 to entry: This current is also used to initiate communication and registration.

3.2.1.9
P_{IN}
DC power into the PTU