



BSI Standards Publication

**Activities and considerations
related to wireless power
transfer (WPT) for audio,
video and multimedia
systems and equipment**

National foreword

This Published Document is the UK implementation of IEC/TR 62869:2013.

The UK participation in its preparation was entrusted to Technical Committee EPL/100, Audio, video and multimedia systems and equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2014.
Published by BSI Standards Limited 2014

ISBN 978 0 580 86523 7
ICS 29.240.99; 33.160.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 10 November 2014.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------



TECHNICAL REPORT



Activities and considerations related to wireless power transfer (WPT) for audio, video and multimedia systems and equipment

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XA**

ICS 29.240.99; 33.160.01

ISBN 978-2-8322-0926-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Executive summary	9
2.1 Market.....	9
2.2 Technology.....	9
2.3 Regulation.....	9
2.4 Standards development.....	10
2.5 IEC TC 100 WPT technical standards development.....	10
3 Terms and definitions	10
3.1 Terms and definitions	10
3.2 Abbreviations	11
4 Market.....	13
4.1 Use cases	13
4.1.1 General	13
4.1.2 Vehicle	13
4.1.3 Commercial, institutional, retail.....	13
4.1.4 Residential	13
4.1.5 Professional office	14
4.1.6 Transportation and public spaces	14
4.1.7 Beyond mobile CE.....	14
4.2 Public benefit, including reduction in e-waste.....	14
4.3 Overview of products and services	16
4.3.1 Overview	16
4.3.2 Market segmentation	16
4.3.3 Market size.....	16
4.3.4 Geographic extension.....	16
4.3.5 Market participation	16
4.3.6 Current market technologies.....	16
4.3.7 Global industry engagement.....	17
4.3.8 By underlying technology.....	17
4.3.9 By product and use case	17
4.4 Research activities	20
4.4.1 Academic research	20
4.4.2 Market research and analysis	21
5 Technology.....	22
5.1 System reference model.....	22
5.2 The wireless power transfer layer	24
5.2.1 General	24
5.2.2 Electromagnetic induction.....	24
5.2.3 Magnetic resonance	25
5.2.4 Capacitive coupling	26
5.2.5 Microwave power transfer.....	26
5.2.6 Microwave energy harvesting	26
6 Regulation	27
6.1 Spectrum.....	27

6.2	RF emissions	28
6.3	Safety.....	28
6.3.1	General	28
6.3.2	RF exposure.....	28
6.3.3	Heating.....	30
6.3.4	Electrical safety	30
6.4	Compliance	30
6.4.1	Identified regulations and standards	30
6.4.2	Measurement methods	32
6.5	Impact of regulation.....	32
7	Technical standards development.....	32
7.1	General.....	32
7.2	Global survey industrial consortia.....	33
7.2.1	General	33
7.2.2	A4WP – Alliance for Wireless Power.....	33
7.2.3	CE4A – Consumer Electronics for Automotive	33
7.2.4	DE – Digital Europe	33
7.2.5	KWPF – Korea Wireless Power Forum.....	33
7.2.6	MFAN – Magnetic Field Area Network Forum	34
7.2.7	NFC Forum.....	34
7.2.8	PMA – Power Matters Alliance.....	34
7.2.9	WPC – Wireless Power Consortium.....	34
7.3	Global survey governmental and standards development organizations.....	35
7.3.1	General	35
7.3.2	APT – Asia Pacific Telecommunity	36
7.3.3	ARIB – Association of Radio Industries and Businesses	37
7.3.4	BWF – Broadband Wireless Forum	37
7.3.5	CCSA – China Communications Standards Association	39
7.3.6	CEA – Consumer Electronics Association.....	40
7.3.7	CJK – China, Japan and Korea Standards Coordination	40
7.3.8	ETSI – European Telecommunications Standards Institute	40
7.3.9	GSC – Global Standards Collaboration	41
7.3.10	IEC TC 100.....	41
7.3.11	ISO/IEC JTC 1.....	42
7.3.12	ITU-.....	42
7.3.13	TTA – Telecommunications Technology Association.....	42
7.3.14	UL – Underwriters Laboratories	43
8	Review of WPT opportunities and challenges	43
8.1	General	43
8.2	Market.....	43
8.2.1	Interoperability	43
8.2.2	Use cases	44
8.3	Technology and technical standards development.....	44
8.3.1	Competing WPT technologies.....	44
8.3.2	Parallel efforts	44
8.3.3	Interoperability and multi-protocol support	44
9	Role for IEC TC 100	44
9.1	General	44
9.2	Market.....	44

9.2.1	Increase awareness and impact.....	44
9.2.2	Nomenclature harmonization	45
9.3	Technology.....	45
9.3.1	Technology taxonomy, use case and use case category harmonization.....	45
9.3.2	WPT classification	45
9.4	Regulation.....	45
9.4.1	General	45
9.4.2	Product categorization.....	45
9.4.3	Spectrum.....	45
9.4.4	RF emissions (EMI/EMC), RF exposure and regulatory engineering	45
9.5	Technical standards development	46
9.5.1	Framework of WPT standards.....	46
9.5.2	Interoperability	46
9.5.3	Minimum performance testing and certification	47
10	Summary and conclusions.....	47
	Bibliography.....	49
	Figure 1 – Automotive CE WPT products and concepts.....	18
	Figure 2 – CE WPT products and concepts	19
	Figure 3 – Professional office WPT products and concepts	19
	Figure 4 – Embedded WPT concepts for public space	20
	Figure 5 – WPT system reference model for single source, single device.....	23
	Figure 6 – Electromagnetic induction	25
	Figure 7 – Magnetic resonance.....	25
	Figure 8 – Electric field inductive coupling	26
	Figure 9 – Microwave power transfer	26
	Figure 10 – Radio-exposure protection guidelines details (Japan).....	30
	Figure 11 – Regulatory, technical standards and implementation pipelines	36
	Figure 12 – Relationship between key Japan WPT technical standards stakeholders	38
	Table 1 – Academic type research	20
	Table 2 – Market planning and analysis	21
	Table 3 – Operating frequencies and power limits.....	27
	Table 4 – GB 2702-88 (China) basic restrictions	29
	Table 5 – GB 9175-88 (China) maximum permitted exposure.....	29
	Table 6 – Identified regulations and standards.....	31
	Table 7 – Alliance for Wireless Power (A4WP).....	33
	Table 8 – Consumer Electronics for Automotive (CE4A).....	33
	Table 9 – Digital Europe (DE)	33
	Table 10 – Korea Wireless Power Forum (KWPF).....	34
	Table 11 – Magnetic Field Area Network Forum (MFAN).....	34
	Table 12 – NFC Forum	34
	Table 13 – Power Matters Alliance (PMA)	34
	Table 14 – Wireless Power Consortium (WPC)	35

Table 15 – Asia Pacific Telecommunity (APT).....	37
Table 16 – Association of Radio Industries and Businesses (ARIB).....	37
Table 17 – Broadband Wireless Forum (BWF)	39
Table 18 – China Communications Standards Association (CCSA)	39
Table 19 – Consumer Electronics Association (CEA)	40
Table 20 – China, Japan and Korea Standards Coordination (CJK).....	40
Table 21 – European Telecommunications Standards Institute (ETSI).....	41
Table 22 – Global Standards Collaboration (GSC)	41
Table 23 – IEC TC 100	41
Table 24 – ISO/IEC JTC 1.....	42
Table 25 – ITU-R	42
Table 26 – Telecommunications Technologies Association (TTA)	43
Table 27 – Underwriters Laboratories (UL).....	43

Currently in preview, click buy full version

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ACTIVITIES AND CONSIDERATIONS RELATED
TO WIRELESS POWER TRANSFER (WPT) FOR AUDIO,
VIDEO AND MULTIMEDIA SYSTEMS AND EQUIPMENT**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC 62869, which is a technical report, has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
100/2134/DTR	100/2166/RVC

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

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

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

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

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC TC 100 established a Stage 0 project on wireless power transfer (WPT) to develop a technical report on WPT technical standardization in relation to audio, video and multimedia systems and equipment. A survey was developed to investigate the global positioning of the technology and its uptake. Twelve National Committees provided responses. Four National Committees (China, Japan, Korea, USA) provided responses to all questions. The key research undertaken and information gathered from the survey responses included: a) terms and definitions used for WPT by IEC TC 100 members; b) regulations, national laws, public policies and industry practices related to WPT; c) status of activities and discussions in various organizations relating to regulatory activities, standards projects, and market research; d) potential topics to be addressed in IEC TC 100 TR; and e) potential role for IEC TC 100 in the domain of WPT technical standards development.

This Technical Report combines survey results with Stage 0 project expert group contributions and extensive public information to develop and present a holistic understanding of WPT and, in so doing, respond to the Stage 0 TR objectives. This understanding is developed through a progression of four interrelated topics.

- Clause 4 considers the overall WPT market, including use cases, public benefit, academic research activities, and an overview of WPT products and services.
- Clause 5 discusses leading commercial WPT technical approaches and briefly surveys additional WPT technologies by reviewing a system reference model. The system reference model can be understood at a very high level as consisting of the lowest layer of a power handling layer, where upper layers implement signaling and systems interfaces.
- Clause 6 presents the major elements of the comparable international and regional regulatory frameworks, one of whose key outputs is product categorization. Product categorization, in turn, is closely related to the topic of spectrum. Key regulatory drivers for WPT products and services as well as technical standards development include RF emissions, RF exposure and compliance.
- Clause 7 reviews global industrial consortium and standards development organization (SDO) activities, and critically discusses WPT technical standard development challenges and opportunities.

With market, technology, regulatory and standards development foundations established, the TR concludes in Clauses 8-10 with observations and recommendations about the potential for future WPT technical standards development within the scope of IEC TC 100.

ACTIVITIES AND CONSIDERATIONS RELATED TO WIRELESS POWER TRANSFER (WPT) FOR AUDIO, VIDEO AND MULTIMEDIA SYSTEMS AND EQUIPMENT

1 Scope

This technical report addresses activities and considerations related to wireless power transfer for audio, video and multimedia systems and equipment. It combines public information, contributions by experts and completed IEC TC 100 WPT survey responses and reviews global market conditions. The TR describes a range of WPT technical approaches with the aid of a system reference model, outlines the impacts on WPT of applicable regulation and surveys standards development organization (SDO) and private industry consortium-led activities in support of WPT technical standards development. The TR concludes with observations and recommendations for potential future technical standards development activities that lie within scope of IEC TC 100.

2 Executive summary

2.1 Market

A variety of metrics indicate that the commercial market is in its early phases. Annual revenue projections range from a current level of a few hundred millions to some billions of dollars (US) by the 2016-2018 timeframe. Geographic coverage spans major markets in Asia, Europe and North America, and is expected to mirror the larger CE market. Market participants range from small, focused start-ups to the largest integrated global CE market leaders. Currently, market share, or market “excitement” may be characterized as being split amongst a few small companies, each with a proprietary solution, and a broader range of companies who have coalesced around private industry consortia, each of which is seeking to promote a particular technical approach.

2.2 Technology

Commercial application of WPT technology has its origins in the pioneering work of Nikola Tesla in the early 1900s and is already well-established in several industrial and specialized application areas, such as power supply to “people mover” systems in airports, material handling systems in manufacturing and warehousing, and “mission critical” control systems that isolate power supply from environmental disruption. Within the scope of IEC TC 100, a system reference model consists of one or more WPT “sources” and one or more WPT “sinks” that interact through a “coil subsystem.” This reference model captures commonalities and differences across the wide range of approaches already in the market, those expected to come to market in the near term and long-term prospective market entrants. The WPT technology environment today consists of multiple, largely non-interoperable approaches.

2.3 Regulation

The development of the WPT market is subject to applicable regulations. These serve the purpose of protecting people and services in the areas of safety, efficient use of spectrum, harmful interference and electromagnetic compatibility and immunity. WPT regulatory categorization sets the overall framework. Designs are subject to different regulations depending at least on WPT spectrum selection and signalling method. Categorization, in turn, drives RF exposure limits and highlights the importance of methods for demonstration of compliance. Currently, individual markets and regions have similar, but not uniform approaches. Policy development opportunities and challenges relate primarily to global harmonization as a means to promote technology innovation and market development.