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Industrijske brezžične komunikacije (WIA) - Oprema, ki deluje v frekvenčnem območju od 5725 MHz do 5875 MHz z močnostnimi nivoji do največ 400 mW - Harmonizirani standard za dostop do radijskega spektra

Wireless Industrial Applications (WIA) - Equipment operating in the 5 725 MHz to 5 875 MHz frequency range with power levels ranging up to 400 mW - Harmonised Standard for access to radio spectrum

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Contents

Intellectual Property Rights 7

Foreword 7

Modal verbs terminology 7

Introduction 8

1 Scope 9

2 References 9
2.1 Normative references 9
2.2 Informative references 9

3 Definition of terms, symbols and abbreviations 11
3.1 Terms 11
3.2 Symbols 12
3.3 Abbreviations 12

4 Technical requirements specifications 13
4.1 Environmental profile 13
4.2 Conformance requirements 13
4.2.1 RF output power and Adaptive Power Control 13
4.2.1.1 Definitions 13
4.2.1.1.1 RF Output Power 13
4.2.1.1.2 Adaptive Power Control 13
4.2.1.2 Limits 13
4.2.1.2.1 General requirements 13
4.2.1.2.2 Limits for RF output power and APC range 13
4.2.1.3 Conformance 13
4.2.2 Occupied channel bandwidth 14
4.2.2.1 Definition 14
4.2.2.2 Limits 14
4.2.2.3 Conformance 14
4.2.3 Transmitter unwanted emissions in the spurious domain 14
4.2.3.1 Definition 14
4.2.3.2 Limits 14
4.2.3.3 Conformance 14
4.2.4 Receiver spurious emissions 15
4.2.4.1 Definition 15
4.2.4.2 Limits 15
4.2.4.3 Conformance 15
4.2.5 Receiver Blocking 15
4.2.5.1 Applicability 15
4.2.5.2 Definition 15
4.2.5.3 Performance Criteria 15
4.2.5.4 Limits 15
4.2.5.5 Conformance 16
4.2.6 Dynamic Frequency Selection 16
4.2.6.1 General DFS operation 16
4.2.6.1.1 Applicability 16
4.2.6.1.2 General requirements 16
4.2.6.1.3 Applicable frequency range 16
4.2.6.1.4 DFS operational modes 16
4.2.6.1.5 DFS operation 17
4.2.6.2 DFS technical requirements specifications 17
4.2.6.2.1 Applicability 17
4.2.6.2.2 In-Service Monitoring 18
4.2.6.2.3 Channel Shutdown 18
4.2.6.2.4 Non-Occupancy Period 19
4.2.7 Adaptive Channel Access Mechanism 19

4.2.7.1 Overview 19
4.2.7.1.1 General requirements 19
4.2.7.1.2 Applicability 19
4.2.7.1.3 Applicable frequency range 19
4.2.7.2 DAA technical requirements specifications except ITS and TTT 20
4.2.7.2.1 Minimum Tx-off time 20
4.2.7.2.2 DAA minimum listening time 20
4.2.7.2.3 Maximum transmitter on-time (Tx on-time) 20
4.2.7.2.4 DAA threshold 21
4.2.7.3 DAA technical requirements specifications for ITS 21
4.2.7.3.1 General 21
4.2.7.3.2 Applicable frequency range 22
4.2.7.3.3 ITS Channel Availability Check time 22
4.2.7.3.4 *ITS Maximum TX_{on}-time* 22
4.2.7.3.5 *ITS Minimum TX_{off}-time* 22
4.2.7.3.6 *ITS DAA latency* 23
4.2.7.3.7 *ITS DAA Probability* 23
4.2.7.3.8 *ITS_Non-Occupancy Period* 23
4.2.7.3.9 *ITS DAA threshold* 24
4.2.7.4 DAA technical requirements specifications for TTT, general conditions and applicable frequency range 24
4.2.7.5 DAA using TTT signal detection 24
4.2.7.5.1 General 24
4.2.7.5.2 DAA threshold for TTT 24
4.2.7.5.3 TTT Channel Availability Check 25
4.2.7.5.4 *TTT Non-Occupancy Period* 25
4.2.7.5.5 *TTT DAA Latency* 25
4.2.7.5.6 *TTT In-Service Monitoring* 26
4.2.8 User Access Restrictions 26
4.2.8.1 Definition 26
4.2.8.2 Requirement 26
4.2.9 Geo-localization capability 27
4.2.9.1 Applicability 27
4.2.9.2 Definition 27
4.2.9.3 Requirements 27
4.2.10 TTT Detection and Avoidance using a Geolocation Database 27
4.2.10.1 Applicability 27
4.2.10.2 Definition 27
4.2.10.3 Requirements 28
4.2.10.4 Conformance 28

5 Testing for compliance with technical requirements 28
5.1 Environmental conditions for testing 28
5.1.1 General requirements 28
5.1.2 Normal and extreme test conditions 28
5.1.3 Test sequences and traffic load 28
5.1.3.1 General test transmission sequences 28
5.1.3.2 Test transmission sequences for DFS tests 29
5.1.4 Test channels 29
5.1.5 Antennas 30
5.1.5.1 Integrated and dedicated antennas 30
5.1.5.2 Transmit operating modes 30
5.1.5.2.1 Operating mode 1 (single antenna) 30
5.1.5.2.2 Operating mode 2 (multiple antennas, no beamforming) 30
5.1.5.2.3 Operating mode 3 (multiple antennas, with beamforming) 30
5.2 Void 30
5.3 Conformance tests 30
5.3.1 Product information 30
5.3.2 RF output power and Adaptive Power Control 32
5.3.2.1 Test conditions 32
5.3.2.2 Test method 32
5.3.2.2.1 Conducted measurement 32

5.3.2.2.2 Radiated measurement 34
5.3.3 Occupied Channel Bandwidth 34
5.3.3.1 Test conditions 34
5.3.3.2 Test method 35
5.3.3.2.1 Conducted measurement 35
5.3.3.2.2 Radiated measurement 35
5.3.4 Transmitter unwanted emissions in the spurious domain 36
5.3.4.1 Test conditions 36
5.3.4.2 Test method 36
5.3.4.2.1 Conducted measurement 36
5.3.4.2.2 Radiated measurement 38
5.3.5 Receiver spurious emissions 38
5.3.5.1 Test conditions 38
5.3.5.2 Test method 39
5.3.5.2.1 Conducted measurement 39
5.3.5.2.2 Radiated measurement 41
5.3.6 Receiver Blocking 41
5.3.6.1 Test frequencies 41
5.3.6.2 Test conditions 41
5.3.6.3 Test Method 41
5.3.6.3.1 Conducted measurements 41
5.3.6.3.2 Radiated measurements 42
5.3.7 Dynamic Frequency Selection 43
5.3.7.1 Test conditions 43
5.3.7.1.1 General requirements 43
5.3.7.1.2 Selection of radar test signals 43
5.3.7.1.3 Test set-ups 43
5.3.7.2 Test method 45
5.3.7.2.1 Conducted measurement 45
5.3.7.2.2 Radiated measurement 47
5.3.8 Adaptivity (channel access mechanism) except for ITS and TTT 47
5.3.8.1 Test conditions 47
5.3.8.2 Test method 47
5.3.8.2.1 Conducted measurements 47
5.3.8.2.2 Generic test procedure for measuring channel/frequency usage 49
5.3.8.2.3 Radiated measurements 49
5.3.8.2.4 DAA minimum listening time measurements 50
5.3.9 Adaptivity (channel access mechanism) for ITS 51
5.3.9.1 General requirements 51
5.3.9.2 ITS test signal 51
5.3.9.3 Initial start-up test 51
5.3.9.3.1 Start-up procedure 51
5.3.9.3.2 Test without an ITS victim test signal during the *ITS Channel Availability Check time*, $T_{ITS\_check\_time}$ 51
5.3.9.3.3 Test with an ITS victim test signal during the *ITS Channel Availability Check time*, $T_{ITS\_check\_time}$ 52
5.3.9.4 Test of ITS_Maximum_TX$_{on}$ and ITS_minimum_TX$_{off}$ 53
5.3.9.5 ITS in-service DAA test with continuous ITS test signal 53
5.3.9.6 ITS in-service DAA test with ITS test signal switched off after detection 54
5.3.10 Adaptivity (channel access mechanism) for TTT 55
5.3.10.1 General 55
5.3.10.2 TTT test signal 55
5.3.10.3 Initial start-up test 56
5.3.10.3.1 Start-up procedure 56
5.3.10.3.2 Test without a TTT victim test signal during the *TTT Channel Availability Check time*, $T_{TTT\_check\_time}$ 56
5.3.10.3.3 Test with a TTT victim test signal during the *TTT Channel Availability Check time* 56
5.3.10.4 TTT in-service DAA test with continuous TTT test signal 57
5.3.10.5 TTT in-service DAA test with TTT test signal switched off after detection 58
5.3.10.6 TTT DAA using a Geolocation Database 59

Annex A (informative): Relationship between the present document and the essential requirements of Directive 2014/53/EU 60

Annex B (normative): Test sites and arrangements for radiated measurements....62

B.1 General requirements 62

B.2 Radiation test sites....62
B.2.1 Open Area Test Site 62
B.2.2 Semi Anechoic Room....63
B.2.3 Fully Anechoic Room 64
B.2.4 Measurement Distance 65

B.3 Antennas....66
B.3.1 General requirements 66
B.3.2 Measurement antenna....66
B.3.3 Substitution antenna 66

B.4 Test fixture 66
B.4.1 General requirements 66
B.4.2 Description of the test fixture 67
B.4.3 Using the test fixture for relative measurements 67

B.5 Guidance on the use of radiation test sites 67
B.5.1 General requirements 67
B.5.2 Power supplies for the battery powered UUT 67
B.5.3 Site preparation 68

B.6 Coupling of signals....68
B.6.1 General requirements 68
B.6.2 Data Signals....68

B.7 Interference Signal used for Adaptivity Tests 69

Annex C (normative): Procedures for radiated measurements 70

C.1 General requirements 70

C.2 Radiated measurements in an OATS or SAR....70

C.3 Radiated measurements in a FAR 71

C.4 Substitution measurement 71

C.5 Guidance for testing technical requirements 71
C.5.1 Conformance tests and corresponding test sites 71
C.5.2 Guidance for testing Adaptivity (Channel Access Mechanism)....71
C.5.2.1 General requirements....71
C.5.2.2 Measurement Set-up 72
C.5.2.3 Calibration of the measurement Set-up....72
C.5.2.4 Test method 72

Annex D (normative): DFS parameters 73

D.1 Test signals....73

Annex E (informative): Receiver parameters....76

E.1 General 76

E.2 Receiver parameters 76

Annex F (informative): Bibliography....78

Annex G (informative): Change History 79

History 80

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Foreword

This Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.3] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC [i.2].

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

National transposition dates	
Date of adoption of this EN:	31 March 2020
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Date of withdrawal of any conflicting National Standard (dow):	31 December 2021

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

The market is in need of network solutions, each with different performance characteristics and functional capabilities, matching diverse application requirements. Industrial automation applications, covering different industrial application domains such as:

- process automation, covering for example the following industry branches:
  - oil and gas, refining;
  - chemical;
  - pharmaceutical;
  - mining;
  - pulp and paper;
  - water & wastewater;
  - steel;
- electric power like:
  - power generation, e.g. wind turbine;
  - power distribution (grid);
- factory automation, e.g. covering the following industry branches:
  - food and beverage;
  - automotive;
  - machinery;
  - semiconductor.

The technical characteristics and applications specific to radio spectrum requirements are identified in ETSI TR 102 889-2 [i.18].

In industrial automation, many different wireless communication networks may operate in the same premises. Examples of these networks are IEC 62591 (WirelessHART®, see note) [i.10], IEC 62601 (WIA-PA) [i.11] and IEC 62734 (ISA100.11a) [i.12]; all these networks use IEEE 802.15.4 [i.6] for the process automation applications. Other examples of wireless networks are specified in IEC 61784-1 [i.8] and IEC 61784-2 [i.9] CPs that use IEEE 802.11 [i.4] and IEEE 802.15.1 [i.5] for factory automation applications. Different to wired fieldbuses, the wireless communication interfaces can interfere with others on the same premises or environment, disturbing each other. Therefore, without a predictable assuredness of coexistence, it could be problematic to have multiple wireless communication networks in the same facility or environment, especially because the time-criticality, the safety and the security of the operation may not be ensured in such an environment.

NOTE: WirelessHART® is the registered trade name of the HART Communication Foundation. This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of the product named. Equivalent products may be used if they can be shown to lead to the same results.

The mitigation techniques which have to be implemented to protect primary radio services limit the applicability to non-real-time applications with relaxed latencies e.g. above 1 s and limits the probability to fulfil the demands on high reliability and high Quality of Services (non-critical links) of the wireless industrial applications. Thus, the 5,8 GHz WIA band may be appropriate for non-real time, non-critical purposes, e.g. monitoring in wireless industrial applications.

Equipment covered by the present document is operated in accordance with the CEPT ECC ERC Recommendation 70-03 [i.7], annex 2.

1 Scope

The present document specifies technical characteristics and methods of measurements for Wireless Industrial Applications equipment operating in the 5 725 MHz to 5 875 MHz frequency band. The present document also specifies spectrum sharing mechanisms to enable co-existence with other equipment operating in the 5 725 MHz to 5 875 MHz frequency band.

The present document covers the essential requirements of article 3.2 of Directive 2014/53/EU [i.2] under the conditions identified in annex A.

2 References

2.1 Normative references

References are specific, identified by date of publication and/or edition number or version number. Only the cited version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

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The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] IEC/EN 62657-1 (Edition 1): "Industrial communication networks - Wireless communication networks - Part 1: Wireless communication requirements and spectrum considerations".

[i.2] Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

[i.3] Commission Implementing Decision C(2015) 5376 final of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.

[i.4] IEEE Std. 802.11™-2016: "IEEE Standard for Information Technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

[i.5] IEEE Std. 802.15.1™: "IEEE Standard for Information technology - Wireless medium access control (MAC) and physical layer (PHY) specifications for wireless personal area networks (WPANs)".

[i.6] IEEE Std. 802.15.4™-2015: "IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements. Part 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs)".

[i.7] CEPT ECC ERC Recommendation 70-03: "Relating to the use of Short Range Devices (SRD)".

[i.8] IEC 61784-1: "Industrial communication networks - Profiles - Part 1: Fieldbus profiles".

[i.9] IEC 61784-2: "Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3".

[i.10] IEC 62591: "Industrial communication networks - Wireless communication network and communication profiles - WirelessHART®".

[i.11] IEC 62601: "Industrial communication networks - Fieldbus specifications - WIA-PA communication network and communication profile".

[i.12] IEC 62734: "Industrial communication networks - Fieldbus specifications - Wireless Systems for Industrial Automation: Process Control and Related Applications (based on ISA 100.11a)".

[i.13] ETSI TR 100 028-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1".

[i.14] ETSI TR 100 028-2 (V1.4.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2".

[i.15] ETSI TR 102 273-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 2: Anechoic chamber".

[i.16] ETSI TR 102 273-3: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 3: Anechoic chamber with a ground plane".

[i.17] ETSI TR 102 273-4: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Improvement on Radiated Methods of Measurement (using test site) and evaluation of the corresponding measurement uncertainties; Part 4: Open area test site".

[i.18] ETSI TR 102 889-2 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); System Reference Document; Short Range Devices (SRD); Part 2: Technical characteristics for SRD equipment for wireless industrial applications using technologies different from Ultra-Wide Band (UWB)".

[i.19] CEN EN 12253:2004: "Road transport and traffic telematics - Dedicated short-range communication - Physical layer using microwave at 5,8 GHz".

[i.20] CEN EN 12795:2003: "Road transport and traffic telematics - Dedicated Short Range Communication (DSRC) - DSRC data link layer: medium access and logical link control".

[i.21] CEPT ECC Report 206: "Compatibility studies in the band 5725-5875 MHz between SRD equipment for wireless industrial applications and other systems".

[i.22] ETSI EG 203 336 (V1.1.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in Directive 2014/53/EU [i.2], IEC/EN 62657-1 [i.1] and the following apply:

5,8 GHz WIA band: Wireless Industrial Applications (WIA) assigned total frequency range of 5 725 MHz to 5 875 MHz

available channel: channel identified as available for immediate use as an *Operating Channel*:

- Channel Move Time.
- Channel Shutdown.
- Channel Closing Transmission Time.

channel closing transmission time: limitation of the aggregate duration of all transmissions of the device on this channel during the *Channel Move Time*

channel move time: time difference between the instant when the UUT has ceased all transmissions on the channel and the end of the radar test signal

channel shutdown: process initiated by the WIA device on an *Operating Channel* after a radar signal has been detected during the *In-Service Monitoring* on that channel

frequency range: range of operating frequencies over which the equipment can be adjusted

nominal channel bandwidth: band of frequencies assigned to a single channel

operating frequency: nominal frequency at which the equipment can be operated; this is also referred to as the operating centre frequency

NOTE: Equipment may be adjustable for operation at more than one operating frequency.

outdoor: outside of a building

plant: complete set of technical equipment and facilities to accomplish a defined technical task for process automation and factory automation

NOTE: A plant includes apparatus, machines, instruments, devices, means of transportation, control equipment and other operating equipment.

spurious emissions: emissions on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information

NOTE: Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Tx-off time: period where a device remains off after a transmission or a polling sequence

Tx power: maximum RF output power; if the equipment is designed to operate with different power levels, the rated power for each level or range of levels, frequency or range of frequencies

unavailable channel: channel which cannot be considered by WIA device for a certain period of time *(Non Occupancy Period)* after a radar signal was detected on that channel

WIA device: radio equipment used for wireless industrial applications operating in the 5,8 GHz WIA band

wireless communication: communication in which electromagnetic radiations are used to transfer information

wireless industrial application: any use of electromagnetic waves with devices or equipment for the generation and use of radio frequency energy in a plant

3.2 Symbols

For the purposes of the present document, the following symbols apply:

A	power output A in dBm
ChS	Nominal occupied channel bandwidth
DAAthr	DAA threshold in dBm at the receiver input port
dBm	dB relative to 1 milliwatt
dBr	dB relative to peak power
dBW	dB relative to 1 Watt
G	Antenna gain in dBi
GHz	Gigahertz
Hz	Hertz
k	Total number of samples
kHz	kilohertz
MHz	Megahertz
mW	milliwatt
MS/s	Mega Samples per second
n	actual sample number or number of adjacent channels
P_{burst}	Power over the burst in dB
P_d	Detection probability
P_H	highest power level e.i.r.p. in dBm
P_{sample}	Power of the sample in dBm
Ptx	Transmit power e.i.r.p. for WIA device in dBm
t_F	Fixed listening time
t_L	Total listening time
t_{PS}	Pseudo random part of listening time
x	duty cycle
Y	Beamforming gain in dB

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

APC	Adaptive Power Control
ATT	Attenuator
BFWA	Broadband Fixed Wireless Access
BW	BandWidth
CEN	Comité Européen de Normalisation (European Committee for Standardization)
CEPT	European Conference of Postal and Telecommunications administrations
CON	Conformance test condition
CP	Communication Profile
CW	Continuous Wave
DAA	Detect And Avoid
DFS	Dynamic Frequency Selection
dow	date of withdrawal
DSRC	Dedicated Short Range Communication
DUT	Device Under Test
ECC	Electronic Communications Committee
e.i.r.p.	equivalent isotropically radiated power
EN	European Norm
e.r.p.	equivalent radiated power
ERC	European Radiocommunications Committee
FAR	Fully Anechoic Room
GNSS	Global Navigation Satellite System
IEC	International Electrotechnical Commission
ITS	Intelligent Transport Systems
LPDA	Logarithmic Periodic Dipole Antenna
OATS	Open Area Test Site

PER	Packet Error Rate
PPB	Pulses Per Burst
PPS	Pulses Per Second
PRF	Pulse Repetition Frequency
RBW	Resolution BandWidth
RF	Radio Frequency
RMS	Root Mean Square
SAR	Semi Anechoic Room
TP	Transmit Power
TTT	Transport and Traffic Telematics
Tx	Transmitter
UUT	Unit Under Test
VBW	Video BandWidth
VSWR	Voltage Standing Wave Ratio
WIA	Wireless Industrial Applications

4 Technical requirements specifications

4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment under intended use. The equipment shall comply with all the technical requirements of the present document which are identified as applicable in annex A at all times when operating within the boundary limits of the declared operational environmental profile.

4.2 Conformance requirements

4.2.1 RF output power and Adaptive Power Control

4.2.1.1 Definitions

4.2.1.1.1 RF Output Power

The RF Output Power is the mean equivalent isotropically radiated power (e.i.r.p.) during a transmission burst.

4.2.1.1.2 Adaptive Power Control

Adaptive Power Control (APC) is a mechanism to be used by the WIA device to adjust the RF Output Power to the minimum necessary in order to maintain a reliable link.

4.2.1.2 Limits

4.2.1.2.1 General requirements

The limits given in clause 4.2.1.2.2 shall be applicable to the system as a whole and in any possible configuration.

4.2.1.2.2 Limits for RF output power and APC range

Devices shall use APC. The maximum RF output power is 26 dBm e.i.r.p. The minimum APC range shall be 12 dB.

4.2.1.3 Conformance

Conformance tests as defined in clause 5.3.2 shall be carried out.