



**Radio Frequency Identification;  
Equipment operating in the band 2 446 MHz to 2 454 MHz  
with power levels up to a maximum of 500 mW e.i.r.p.  
and up to a maximum of 4 W e.i.r.p.;  
Harmonised Standard for access to radio spectrum**

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# Contents

|                                                                                            |    |
|--------------------------------------------------------------------------------------------|----|
| Intellectual Property Rights .....                                                         | 8  |
| Foreword.....                                                                              | 8  |
| Modal verbs terminology.....                                                               | 9  |
| 1 Scope .....                                                                              | 10 |
| 2 References .....                                                                         | 10 |
| 2.1 Normative references .....                                                             | 10 |
| 2.2 Informative references.....                                                            | 10 |
| 3 Definition of terms, symbols and abbreviations.....                                      | 11 |
| 3.1 Terms.....                                                                             | 11 |
| 3.2 Symbols.....                                                                           | 13 |
| 3.3 Abbreviations .....                                                                    | 13 |
| 4 Technical requirements specifications .....                                              | 14 |
| 4.0 General .....                                                                          | 14 |
| 4.1 Environmental profile.....                                                             | 14 |
| 4.2 General conditions for operating .....                                                 | 14 |
| 4.2.1 Conformance requirements.....                                                        | 14 |
| 4.2.2 Designated frequencies .....                                                         | 14 |
| 4.2.2.1 EU wide harmonised national radio interface 2 446 MHz to 2 454 MHz.....            | 14 |
| 4.2.2.2 National Radio Interfaces not EU wide harmonised from 2 446 MHz to 2 454 MHz ..... | 15 |
| 4.2.3 Operating conditions.....                                                            | 15 |
| 4.3 Transmitter requirements .....                                                         | 16 |
| 4.3.1 Transmitter measurement requirements.....                                            | 16 |
| 4.3.1.1 Applicability.....                                                                 | 16 |
| 4.3.1.2 Methods of measurement and limits for transmitter parameters .....                 | 16 |
| 4.3.2 Equivalent isotropically radiated power (e.i.r.p.).....                              | 16 |
| 4.3.2.1 Indoor and outdoor transmitters of 500 mW or less.....                             | 16 |
| 4.3.2.1.1 Applicability .....                                                              | 16 |
| 4.3.2.1.2 Definition.....                                                                  | 16 |
| 4.3.2.1.3 Limits .....                                                                     | 17 |
| 4.3.2.1.4 Conformance.....                                                                 | 17 |
| 4.3.2.2 Indoor transmitters of 4 W or less .....                                           | 17 |
| 4.3.2.2.1 Applicability .....                                                              | 17 |
| 4.3.2.2.2 Definition.....                                                                  | 17 |
| 4.3.2.2.3 Limits .....                                                                     | 18 |
| 4.3.2.2.4 Conformance .....                                                                | 18 |
| 4.3.3 Permitted range of operating frequencies .....                                       | 18 |
| 4.3.3.1 Applicability.....                                                                 | 18 |
| 4.3.3.2 Definition .....                                                                   | 18 |
| 4.3.3.3 Limits .....                                                                       | 18 |
| 4.3.3.4 Conformance.....                                                                   | 18 |
| 4.3.4 Transmitter spectrum masks .....                                                     | 18 |
| 4.3.4.1 Applicability.....                                                                 | 18 |
| 4.3.4.2 Definition .....                                                                   | 19 |
| 4.3.4.3 Limits .....                                                                       | 19 |
| 4.3.4.4 Conformance.....                                                                   | 19 |
| 4.3.5 Unwanted emissions in the spurious domain .....                                      | 19 |
| 4.3.5.1 Applicability.....                                                                 | 19 |
| 4.3.5.2 Definition .....                                                                   | 19 |
| 4.3.5.3 Limits .....                                                                       | 19 |
| 4.3.5.4 Conformance.....                                                                   | 20 |
| 4.3.6 Duty cycle.....                                                                      | 20 |
| 4.3.6.1 Applicability.....                                                                 | 20 |
| 4.3.6.2 Definition .....                                                                   | 20 |
| 4.3.6.3 Limits .....                                                                       | 20 |

|         |                                                                                                                 |    |
|---------|-----------------------------------------------------------------------------------------------------------------|----|
| 4.3.6.4 | Conformance.....                                                                                                | 20 |
| 4.3.7   | Additional requirements for FHSS equipment.....                                                                 | 21 |
| 4.3.7.1 | Applicability.....                                                                                              | 21 |
| 4.3.7.2 | Definition .....                                                                                                | 21 |
| 4.3.7.3 | Limits .....                                                                                                    | 21 |
| 4.3.7.4 | Conformance.....                                                                                                | 21 |
| 4.4     | Receiver requirements .....                                                                                     | 21 |
| 4.4.1   | General performance criteria .....                                                                              | 21 |
| 4.4.2   | Blocking or desensitization.....                                                                                | 21 |
| 4.4.2.1 | Applicability.....                                                                                              | 21 |
| 4.4.2.2 | Definition .....                                                                                                | 21 |
| 4.4.2.3 | Limits .....                                                                                                    | 21 |
| 4.4.2.4 | Conformance.....                                                                                                | 22 |
| 4.4.3   | Spurious radiations .....                                                                                       | 22 |
| 4.4.3.1 | Applicability.....                                                                                              | 22 |
| 4.4.3.2 | Definition .....                                                                                                | 22 |
| 4.4.3.3 | Limits .....                                                                                                    | 22 |
| 4.4.3.4 | Conformance.....                                                                                                | 22 |
| 4.4.4   | Receiver sensitivity.....                                                                                       | 22 |
| 4.4.4.1 | Applicability.....                                                                                              | 22 |
| 4.4.4.2 | Definition .....                                                                                                | 22 |
| 4.4.4.3 | Limits .....                                                                                                    | 22 |
| 4.4.4.4 | Conformance.....                                                                                                | 22 |
| 4.4.5   | Adjacent channel selectivity .....                                                                              | 23 |
| 4.4.5.1 | Applicability.....                                                                                              | 23 |
| 4.4.5.2 | Definition .....                                                                                                | 23 |
| 4.4.5.3 | Limits .....                                                                                                    | 23 |
| 4.4.5.4 | Conformance.....                                                                                                | 23 |
| 4.4.6   | Receiver spurious response rejection.....                                                                       | 23 |
| 4.4.6.1 | Applicability.....                                                                                              | 23 |
| 4.4.6.2 | Definition .....                                                                                                | 23 |
| 4.4.6.3 | Limits .....                                                                                                    | 23 |
| 4.4.6.4 | Conformance.....                                                                                                | 23 |
| 4.4.7   | Receiver maximum input signal level.....                                                                        | 23 |
| 4.4.7.1 | Applicability.....                                                                                              | 23 |
| 4.4.7.2 | Definition .....                                                                                                | 23 |
| 4.4.7.3 | Limits .....                                                                                                    | 24 |
| 4.4.7.4 | Conformance.....                                                                                                | 24 |
| 5       | Testing for compliance with technical requirements.....                                                         | 24 |
| 5.0     | General .....                                                                                                   | 24 |
| 5.1     | Environmental conditions for testing .....                                                                      | 24 |
| 5.2     | Presentation of equipment for testing purposes.....                                                             | 24 |
| 5.2.1   | General.....                                                                                                    | 24 |
| 5.2.2   | Choice of model for testing .....                                                                               | 24 |
| 5.2.3   | Testing of equipment with alternative power levels .....                                                        | 25 |
| 5.2.4   | Testing of equipment that does not have an external 50 $\Omega$ RF connector (integral antenna equipment) ..... | 25 |
| 5.2.4.1 | Equipment with an internal permanent or temporary antenna connector or using a dedicated test fixture .....     | 25 |
| 5.2.4.2 | Equipment with a temporary antenna connector .....                                                              | 25 |
| 5.2.5   | Testing of devices using duty cycle .....                                                                       | 25 |
| 5.3     | Mechanical and electrical design.....                                                                           | 25 |
| 5.3.1   | General.....                                                                                                    | 25 |
| 5.3.2   | Transmitter shut-off facility .....                                                                             | 26 |
| 5.3.3   | Receiver mute or squelch.....                                                                                   | 26 |
| 5.4     | Auxiliary test equipment .....                                                                                  | 26 |
| 5.5     | Test power source.....                                                                                          | 26 |
| 5.5.1   | General.....                                                                                                    | 26 |
| 5.5.2   | External test power source .....                                                                                | 26 |
| 5.5.3   | Internal test power source .....                                                                                | 26 |
| 5.6     | Normal test conditions.....                                                                                     | 27 |

|           |                                                                                                                                                      |    |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 5.6.1     | Normal temperature and humidity .....                                                                                                                | 27 |
| 5.6.2     | Normal test power source .....                                                                                                                       | 27 |
| 5.6.2.1   | Mains voltage .....                                                                                                                                  | 27 |
| 5.6.2.2   | Battery power sources .....                                                                                                                          | 27 |
| 5.6.2.3   | Other power sources .....                                                                                                                            | 27 |
| 5.7       | Extreme test conditions .....                                                                                                                        | 27 |
| 5.7.1     | Extreme temperatures .....                                                                                                                           | 27 |
| 5.7.1.1   | Procedure for tests at extreme temperatures .....                                                                                                    | 27 |
| 5.7.1.1.1 | General .....                                                                                                                                        | 27 |
| 5.7.1.1.2 | Procedure for equipment designed for continuous operation .....                                                                                      | 28 |
| 5.7.1.1.3 | Procedure for equipment designed for intermittent operation .....                                                                                    | 28 |
| 5.7.1.2   | Extreme temperature ranges .....                                                                                                                     | 28 |
| 5.7.2     | Extreme test source voltages .....                                                                                                                   | 28 |
| 5.7.2.1   | Mains voltage .....                                                                                                                                  | 28 |
| 5.7.2.2   | Battery power sources .....                                                                                                                          | 28 |
| 5.7.2.3   | Power sources using other types of batteries .....                                                                                                   | 29 |
| 5.7.2.4   | Other power sources .....                                                                                                                            | 29 |
| 5.8       | General conditions .....                                                                                                                             | 29 |
| 5.8.1     | Normal test signals and test modulation .....                                                                                                        | 29 |
| 5.8.1.1   | General .....                                                                                                                                        | 29 |
| 5.8.1.2   | Normal test signals for data .....                                                                                                                   | 30 |
| 5.8.2     | Artificial antenna .....                                                                                                                             | 30 |
| 5.8.3     | Test fixture .....                                                                                                                                   | 30 |
| 5.8.3.1   | General .....                                                                                                                                        | 30 |
| 5.8.3.2   | Validation of the test-fixture in the temperature chamber .....                                                                                      | 31 |
| 5.8.3.3   | Mode of use .....                                                                                                                                    | 33 |
| 5.8.4     | Test sites and general arrangements for radiated measurements .....                                                                                  | 33 |
| 5.8.5     | Measuring receiver .....                                                                                                                             | 33 |
| 5.9       | Transmitter requirements .....                                                                                                                       | 33 |
| 5.9.1     | Transmitter measurement requirements .....                                                                                                           | 33 |
| 5.9.1.1   | Methods of measurement and limits for transmitter parameters .....                                                                                   | 33 |
| 5.9.2     | Equivalent isotropically radiated power (e.i.r.p.) .....                                                                                             | 34 |
| 5.9.2.1   | Method of measurement .....                                                                                                                          | 34 |
| 5.9.2.1.1 | General requirements .....                                                                                                                           | 34 |
| 5.9.2.1.2 | Non spread spectrum transmitters with a -6 dB bandwidth of up to 20 MHz and spread spectrum transmitters with channel bandwidth of up to 1 MHz ..... | 34 |
| 5.9.2.1.3 | Transmitters other than those defined in clause 5.9.2.1.2 .....                                                                                      | 35 |
| 5.9.2.1.4 | Tests for indoor transmitters of 4 W .....                                                                                                           | 36 |
| 5.9.3     | Permitted range of operating frequencies .....                                                                                                       | 36 |
| 5.9.3.1   | Method of measurement .....                                                                                                                          | 36 |
| 5.9.3.2   | Method of measurement for equipment using FHSS modulation .....                                                                                      | 37 |
| 5.9.4     | Transmitter spectrum mask .....                                                                                                                      | 37 |
| 5.9.4.1   | Method of measurement .....                                                                                                                          | 37 |
| 5.9.5     | Unwanted emissions in the spurious domain .....                                                                                                      | 38 |
| 5.9.5.1   | Method of measurement .....                                                                                                                          | 38 |
| 5.9.5.1.1 | General Requirements .....                                                                                                                           | 38 |
| 5.9.5.1.2 | Conducted spurious emission .....                                                                                                                    | 39 |
| 5.9.5.1.3 | Method of measurement - cabinet spurious radiation .....                                                                                             | 39 |
| 5.9.5.1.4 | Method of measurement - radiated spurious emission .....                                                                                             | 40 |
| 5.9.5.1.5 | Additional requirements for equipment employing FHSS modulation .....                                                                                | 41 |
| 5.9.6     | Duty cycle .....                                                                                                                                     | 41 |
| 5.9.6.1   | Method of measurement .....                                                                                                                          | 41 |
| 5.9.7     | Additional requirements for FHSS equipment .....                                                                                                     | 41 |
| 5.9.7.1   | Method of measurement .....                                                                                                                          | 41 |
| 5.9.7.1.0 | General .....                                                                                                                                        | 41 |
| 5.9.7.1.1 | Total number of hops and maximum separation of hops .....                                                                                            | 41 |
| 5.9.7.1.2 | Dwell time .....                                                                                                                                     | 42 |
| 5.10      | Receiver requirements .....                                                                                                                          | 42 |
| 5.10.1    | General performance criteria .....                                                                                                                   | 42 |
| 5.10.2    | Blocking or desensitization .....                                                                                                                    | 42 |
| 5.10.2.1  | Method of measurement .....                                                                                                                          | 42 |
| 5.10.2.2  | Method of measurement for blocking or desensitization .....                                                                                          | 42 |

|            |                                                                      |    |
|------------|----------------------------------------------------------------------|----|
| 5.10.2.2.1 | Test Conditions.....                                                 | 42 |
| 5.10.2.2.2 | Conducted measurement.....                                           | 42 |
| 5.10.2.2.3 | Radiated measurement.....                                            | 43 |
| 5.10.2.2.4 | Measurement procedure .....                                          | 43 |
| 5.10.3     | Spurious radiations .....                                            | 43 |
| 5.10.3.1   | Method of measurement for spurious radiation.....                    | 43 |
| 5.10.3.1.1 | General Requirements .....                                           | 43 |
| 5.10.3.1.2 | Method of measurement conducted spurious components .....            | 44 |
| 5.10.3.1.3 | Method of measurement cabinet radiation.....                         | 44 |
| 5.10.3.1.4 | Method of measurement radiated spurious components.....              | 45 |
| 5.10.4     | Receiver sensitivity.....                                            | 45 |
| 5.10.4.1   | Method of measurement for receiver sensitivity .....                 | 45 |
| 5.10.4.1.1 | Test Conditions.....                                                 | 45 |
| 5.10.4.1.2 | Method of measurement conducted receiver sensitivity.....            | 45 |
| 5.10.4.1.3 | Method of measurement radiated receiver sensitivity .....            | 45 |
| 5.10.4.1.4 | Measurement procedure .....                                          | 45 |
| 5.10.5     | Adjacent channel selectivity .....                                   | 46 |
| 5.10.5.1   | Method of measurement for adjacent channel selectivity .....         | 46 |
| 5.10.5.1.1 | Test conditions .....                                                | 46 |
| 5.10.5.1.2 | Conducted measurement.....                                           | 46 |
| 5.10.5.1.3 | Radiated measurement.....                                            | 46 |
| 5.10.5.1.4 | Measurement procedure .....                                          | 46 |
| 5.10.6     | Receiver spurious response rejection.....                            | 47 |
| 5.10.6.1   | Method of measurement for receiver spurious response rejection ..... | 47 |
| 5.10.6.1.1 | Test conditions .....                                                | 47 |
| 5.10.6.1.2 | Conducted measurement.....                                           | 47 |
| 5.10.6.1.3 | Radiated measurement.....                                            | 47 |
| 5.10.6.1.4 | Measurement procedure .....                                          | 48 |
| 5.10.7     | Receiver maximum input signal level.....                             | 48 |
| 5.10.7.1   | Method of measurement for receiver maximum input signal level.....   | 48 |
| 5.10.7.1.1 | Test conditions .....                                                | 48 |
| 5.10.7.1.2 | Conducted measurement.....                                           | 48 |
| 5.10.7.1.3 | Radiated measurement.....                                            | 48 |
| 5.10.7.1.4 | Measurement procedure .....                                          | 49 |

|                               |                                                                                                               |           |
|-------------------------------|---------------------------------------------------------------------------------------------------------------|-----------|
| <b>Annex A (informative):</b> | <b>Relationship between the present document and the essential requirements of Directive 2014/53/EU .....</b> | <b>50</b> |
|-------------------------------|---------------------------------------------------------------------------------------------------------------|-----------|

|                               |                                                |           |
|-------------------------------|------------------------------------------------|-----------|
| <b>Annex B (informative):</b> | <b>Selection of technical parameters .....</b> | <b>52</b> |
|-------------------------------|------------------------------------------------|-----------|

|     |                    |    |
|-----|--------------------|----|
| B.1 | Introduction ..... | 52 |
|-----|--------------------|----|

|                             |                                    |           |
|-----------------------------|------------------------------------|-----------|
| <b>Annex C (normative):</b> | <b>Radiated measurements .....</b> | <b>53</b> |
|-----------------------------|------------------------------------|-----------|

|     |                                                                                 |    |
|-----|---------------------------------------------------------------------------------|----|
| C.1 | General requirements for measurements involving the use of radiated fields..... | 53 |
|-----|---------------------------------------------------------------------------------|----|

|     |                  |    |
|-----|------------------|----|
| C.2 | Test Sites ..... | 53 |
|-----|------------------|----|

|       |               |    |
|-------|---------------|----|
| C.2.0 | General ..... | 53 |
|-------|---------------|----|

|       |                        |    |
|-------|------------------------|----|
| C.2.1 | Indoor test site ..... | 54 |
|-------|------------------------|----|

|       |                                  |    |
|-------|----------------------------------|----|
| C.2.2 | Shielded anechoic test site..... | 55 |
|-------|----------------------------------|----|

|         |              |    |
|---------|--------------|----|
| C.2.2.0 | General..... | 55 |
|---------|--------------|----|

|         |                                                               |    |
|---------|---------------------------------------------------------------|----|
| C.2.2.1 | Influence of parasitic reflections in anechoic chambers ..... | 55 |
|---------|---------------------------------------------------------------|----|

|         |                                                       |    |
|---------|-------------------------------------------------------|----|
| C.2.2.2 | Calibration of the shielded RF anechoic chamber ..... | 55 |
|---------|-------------------------------------------------------|----|

|     |               |    |
|-----|---------------|----|
| C.3 | Antennas..... | 58 |
|-----|---------------|----|

|       |                   |    |
|-------|-------------------|----|
| C.3.1 | Test antenna..... | 58 |
|-------|-------------------|----|

|       |                            |    |
|-------|----------------------------|----|
| C.3.2 | Substitution antenna ..... | 58 |
|-------|----------------------------|----|

|       |                         |    |
|-------|-------------------------|----|
| C.3.3 | Artificial antenna..... | 58 |
|-------|-------------------------|----|

|     |                                                 |    |
|-----|-------------------------------------------------|----|
| C.4 | Test Practice and Auxiliary Test Equipment..... | 59 |
|-----|-------------------------------------------------|----|

|     |                         |    |
|-----|-------------------------|----|
| C.5 | Measuring distance..... | 59 |
|-----|-------------------------|----|

|       |               |    |
|-------|---------------|----|
| C.5.0 | General ..... | 59 |
|-------|---------------|----|

|       |                        |    |
|-------|------------------------|----|
| C.5.1 | Standard position..... | 59 |
|-------|------------------------|----|

|                               |                                                                                           |           |
|-------------------------------|-------------------------------------------------------------------------------------------|-----------|
| C.5.2                         | Auxiliary cables.....                                                                     | 59        |
| <b>Annex D (normative):</b>   | <b>General description of measurement methods.....</b>                                    | <b>60</b> |
| D.0                           | General .....                                                                             | 60        |
| D.1                           | Conducted measurements.....                                                               | 60        |
| D.2                           | Radiated measurements.....                                                                | 60        |
| D.3                           | Radiated measurement for receivers .....                                                  | 61        |
| <b>Annex E (informative):</b> | <b>Example of implementation for restriction of 4 W RFID to in-building use only.....</b> | <b>62</b> |
| <b>Annex F (informative):</b> | <b>Selection of receiver parameters.....</b>                                              | <b>64</b> |
| F.0                           | Introduction .....                                                                        | 64        |
| F.1                           | Receiver sensitivity .....                                                                | 64        |
| F.2                           | Receiver co-channel rejection .....                                                       | 64        |
| F.3                           | Receiver adjacent signal selectivity .....                                                | 64        |
| F.4                           | Receiver spurious response rejection .....                                                | 64        |
| F.5                           | Receiver blocking.....                                                                    | 64        |
| F.6                           | Receiver radio-frequency intermodulation.....                                             | 65        |
| F.7                           | Receiver dynamic range .....                                                              | 65        |
| F.8                           | Desensitization .....                                                                     | 65        |
| F.9                           | Receiver unwanted emissions in the spurious domain .....                                  | 65        |
| <b>Annex G (informative):</b> | <b>Interpretation of the measurement results.....</b>                                     | <b>66</b> |
| <b>Annex H (informative):</b> | <b>Change history .....</b>                                                               | <b>67</b> |
| History .....                 |                                                                                           | 68        |



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# Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Electromagnetic compatibility and Radio spectrum Matters (ERM), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI Standardisation Request deliverable Approval Procedure (SRdAP).

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.7].

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.

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## 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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

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# 1 Scope

The present document specifies technical characteristics and methods of measurements for Radio Frequency IDentification (RFID) devices operating in the frequency range 2 446 MHz to 2 454 MHz with power levels up to a maximum of 500 mW e.i.r.p. and up to a maximum of 4 W e.i.r.p.

The frequency usage conditions for RFID are EU wide harmonised in the band 2 446 MHz to 2 454 MHz with a power up 500 mW e.i.r.p. according to [i.1].

NOTE 1: It should be noted that RFID systems in this frequency band with a power of 4 W e.i.r.p. have only a limited implementation status within the European Union and the CEPT countries. CEPT/ERC/REC 70-03 [i.4] provides in Appendix 1 an overview of countries where the band is implemented.

The present document contains requirements to demonstrate that the specified radio equipment both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference.

NOTE 2: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.7] is given in Annex A.

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# 2 References

## 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found in the [ETSI docbox](#).

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 necessary for the application of the present document.

- [1] [EN IEC 55016-1-1:2019](#): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".
- [2] [EN IEC 55016-1-4:2019/A1:2020](#) + [A2 \(2023\)](#): "Specification for radio disturbance and immunity measuring apparatus and methods; Part 1-4: Radio disturbance and immunity measuring apparatus - Antennas and test sites for radiated disturbance measurements".

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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] [Commission Implementing Decision \(EU\) 2019/1345](#) of 2 August 2019 amending Decision 2006/771/EC updating harmonised technical conditions in the area of radio spectrum use for short-range devices.

- [i.2] ETSI EG 203 336 (V1.2.1): "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".
- [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] [CEPT/ERC/Recommendation 70-03 \(2022\)](#): "Relating to the use of Short Range Devices (SRD)".
- [i.5] Recommendation ITU-R SM.329-13 (09/2024): "Unwanted emissions in the spurious domain".
- [i.6] [CEPT/ERC/Recommendation 74-01 \(2022\)](#): "Unwanted emissions in the spurious domain".
- [i.7] [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 (RE-Directive).
- [i.8] Recommendation ITU-T O.153 (10/1992): "Basic parameters for the measurement of error performance at bit rates below the primary rate".

## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

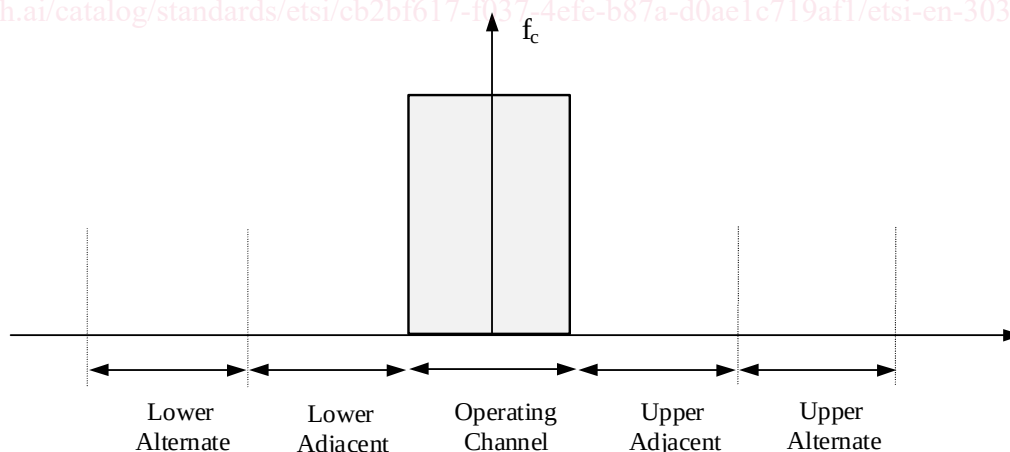
For the purposes of the present document, the following terms apply:

**adjacent channels:** two channels offset from the nominal channel by the nominal channel bandwidth

NOTE: See Figure 1.

**alternate adjacent channels:** two channels offset from the nominal channel by double the channel bandwidth

NOTE: See Figure 1.



**Figure 1: Adjacent and alternate adjacent channel definitions**

**artificial antenna:** non-radiating dummy load

**assigned frequency band:** frequency band within which the device is authorized to operate and to perform the intended function of the equipment

**chip:** unit of modulation used in Direct Sequence Spread Spectrum (DSSS) modulation

**chip rate:** number of chips per second in DSSS

**conducted measurements:** measurements which are made using a direct connection to the equipment under test

**cumulative on-time ( $T_{on\_cum}$ ):** sum of  $T_{on}$ , within  $T_{obs}$

**dedicated antenna:** removable antenna supplied and tested with the radio equipment, designed as an indispensable part of the equipment

**Direct Sequence Spread Spectrum (DSSS):** form of modulation where a combination of data to be transmitted and a code sequence (chip sequence) is used to directly modulate a carrier, e.g. by phase shift keying

NOTE: The chip rate determines the occupied bandwidth.

**Duty Cycle (DC):** ratio expressed as a percentage, of the cumulative duration of transmissions  $T_{on\_cum}$  within an observation interval  $T_{obs}$ .  $DC = \left( \frac{T_{on\_cum}}{T_{obs}} \right)_{F_{obs}}$  on an observation bandwidth  $F_{obs}$

**equivalent isotropically radiated power:** maximum radiated power of the transmitter and its antenna

**fixed station:** equipment intended for use in a fixed location

**Frequency Hopping Spread Spectrum (FHSS):** spread spectrum technique in which the transmitter signal occupies a number of frequencies in time, each for some period of time, referred to as the dwell time

NOTE: Transmitter and receiver follow the same frequency hop pattern. The number of hop positions and the bandwidth per hop position determine the occupied bandwidth.

**identification system:** equipment consisting of a transmitter(s), receiver(s) (or a combination of the two) and an antenna(s) to identify objects by means of a transponder

**integral antenna:** permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment

**mobile station:** equipment normally fixed in a vehicle or used as a transportable station

**observation bandwidth ( $F_{obs}$ ):** bandwidth in which the energy of an equipment is considered for the purposes of assessing transmission timings

**observation period ( $T_{obs}$ ):** reference interval of time

**occupied bandwidth:** width of a frequency band such that, below the lower and above the upper frequency limits the mean powers emitted are each equal to 0,5 % of the total mean power of a given emission

**off-time ( $T_{off}$ ):** time duration between two successive transmissions

**on-time ( $T_{on}$ ):** duration on a Transmission Operating Channel (OC)

**Operating Channel (OC):** frequency range in which the transmission from the equipment occurs; defined by two frequency edges values:  $F_{low}$  and  $F_{high}$

**Operating Channel Width (OCW):** bandwidth between the two frequencies  $F_{low}$  and  $F_{high}$  channel

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

NOTE: Equipment may be able to operate at more than one operating frequency.

**operating frequency range:** range of operating frequencies over which the equipment can be adjusted through tuning, switching or reprogramming

**out-of-band emissions:** emission on a frequency or frequencies outside the occupied bandwidth which results from the modulation process, but excluding spurious emissions

**portable station:** equipment intended to be carried, attached or implanted

**radiated measurements:** measurements which involve the absolute measurement of a radiated field

**radiodetermination:** determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves

**spread spectrum:** modulation technique in which the energy of a transmitted signal is spread throughout a large portion of the frequency spectrum

**spurious emissions:** emission on a frequency or frequencies which are outside the occupied 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.

**telecommand:** use of radio communication for the transmission of signals to initiate, modify or terminate functions of equipment at a distance

**telemetry:** use of radio communication for indicating or recording data at a distance

**transponder:** device which responds to an interrogation signal

## 3.2 Symbols

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

|           |                                                   |
|-----------|---------------------------------------------------|
| $D_{ant}$ | Aperture dimension of the radiating antenna       |
| dB        | decibel                                           |
| dBi       | gain in decibels relative to an isotropic antenna |
| dBm       | decibel-milliwatts                                |
| E         | Electrical field strength                         |
| f         | Frequency                                         |
| $f_c$     | Carrier frequency                                 |
| P         | Power                                             |
| R         | Distance                                          |
| t         | Time                                              |
| $\lambda$ | wavelength                                        |

## 3.3 Abbreviations

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

|          |                                                                   |
|----------|-------------------------------------------------------------------|
| ac       | alternating current                                               |
| ACS      | Adjacent Channel Selectivity                                      |
| ARQ      | Automatic Repeat Request                                          |
| BER      | Bit Error Rate                                                    |
| BW       | Band Width                                                        |
| CW       | Continuous Wave (transmission)                                    |
| dc       | direct current                                                    |
| DC       | Duty Cycle                                                        |
| DSSS     | Direct Sequence Spread Spectrum                                   |
| e.i.r.p. | equivalent isotropically radiated power                           |
| ERC      | European Radiocommunication Committee                             |
| EUT      | Equipment Under Test                                              |
| FAR      | Fully Anechoic Room                                               |
| FEC      | Forward Error Correction                                          |
| FH       | Frequency High                                                    |
| FHSS     | Frequency Hopping Spread Spectrum                                 |
| FL       | Frequency Low                                                     |
| FOC      | Frequency Operating Channel                                       |
| ITU-R    | International Telecommunications Union, Radio sector              |
| ITU-T    | International Telecommunications Union, Telecommunications sector |
| MSR      | Message Success Ratio                                             |
| NRI      | National Radio Interfaces                                         |
| NSA      | Normal Site Attenuation                                           |
| OC       | Operating Channel                                                 |
| OCW      | Operating Channel Width                                           |

|      |                                          |
|------|------------------------------------------|
| OFDM | Orthogonal Frequency Division Modulation |
| PFB  | Permitted Frequency Band                 |
| RBW  | Reference BandWidth                      |
| RF   | Radio Frequency                          |
| RFID | Radio Frequency IDentification           |
| RMS  | Root Mean Square                         |
| SCU  | System Control Unit                      |
| SRD  | Short Range Device                       |
| Tx   | Transmitter                              |
| VSWR | Voltage Standing Wave Ratio              |

## 4 Technical requirements specifications

### 4.0 General

All limits mentioned in clause 4 assume testing under normal test conditions unless otherwise mentioned.

### 4.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its 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 operational environmental profile defined by its intended use.

### 4.2 General conditions for operating

#### 4.2.1 Conformance requirements

For the purpose of the receiver performance tests, the receiver shall produce:

- after demodulation, a raw data signal with a Bit Error Ratio  $\leq 10^{-3}$  without correction; or
- after demodulation, a message success ratio equivalent to the above Bit Error Ratio.

The message success ratio (MSR) can be computed by the expression:

$$\text{MSR} = (1-p)^n \quad (1)$$

where  $p$  is the probability of a single bit error ( $10^{-3}$ ) and  $n$  is the number of bits in the message.

Some designs may include permanent channel coding as an integral part of information transmission. Such designs may not be able to operate without correction inherent in the channel coding. For the purposes of receiver test suites in the present document, the wanted performance criteria are specified with optional FEC &/or ARQ mechanisms disabled.

#### 4.2.2 Designated frequencies

##### 4.2.2.1 EU wide harmonised national radio interface 2 446 MHz to 2 454 MHz

In the Permitted Frequency Band the equipment shall comply with all parameters, exclusions and notes from the corresponding row in Table 1.