



**Short Range Devices (SRD);  
Ultra Low Power (ULP) wireless medical capsule endoscopy  
devices operating in the band 430 MHz to 440 MHz;  
Harmonised Standard for access to radio spectrum**

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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 standards EN Approval Procedure.

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.1] 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.

| Proposed national transposition dates  |                                 |
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| Date of latest announcement of this EN (doa):  | 3 months after ETSI publication |
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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).

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## Introduction

The present document is aiming to cover radio and telecommunications terminal equipment within the scope of the EU's Radio Equipment Directive (RED) [i.2].

The present document specifies conformance requirements for the Ultra Low Power Wireless Medical Capsule Endoscopy SRD application, which includes Capsule Camera (CCam) acting as transmitter and associated Data Recorder (DR) receiver devices, as meant by ETSI TR 103 451 [i.3]. The CCam is designed to wirelessly transmit recorded images from inside patient's gastrointestinal tract to the DR receiver, utilizing a single wideband radio channel occupying the entire designated band 430 MHz to 440 MHz. It is intended that this band will be harmonised for European-wide usage by Ultra Low Power Wireless Medical Endoscopy application through relevant CEPT and EU normative documents in the field of SRD spectrum regulation, such as CEPT/ERC/REC 70-03 [i.4].

CCam transmitters will utilize miniature integral antenna encapsulated within its pill-shaped enclosure. The intended use of the CCam transmitter is inside the human body.

DR receivers will use either integral antenna or dedicated external antenna implemented in the form of skin patch or belt. Such dedicated external antenna would ensure optimal reception of weak radio signals by keeping antenna in direct proximity to the patient's body in the area closest to internal passage of CCam.

These devices would offer opportunity of performing medical endoscopy-type examination of the entire human gastrointestinal tract including the small intestine and colon. Thanks to simple application with minimized risks and side effects, while providing the unique ability to visualize the complete gastrointestinal tract, its use would be highly beneficial and attractive to patients and doctors.

The present document is structured as follows:

- Clauses 1 through 3 provide a general description of the types of equipment covered by the present document and the definitions of terms, symbols and abbreviations used.
- Clause 4 specifies the requirements and limits applicable to CCam transmitter and DR receiver.
- Clauses 5.1 and 5.2 specify the test and general conditions for testing of the equipment.
- Clause 5.3 specifies the methods of measurement for the parameters specified in clause 4.
- Annex A (informative) provides an overview of the relationship between the present document and the essential requirements of the RED [i.2].
- Annex B (normative) describes a human torso simulator test fixture to be used for radiated measurements.
- Annex C (normative) describes the Full Anechoic Room test site configuration for radiated measurements.

---

# 1 Scope

The present document specifies technical characteristics and methods of measurements for Ultra Low Power Wireless Medical Capsule Endoscopy application (CCam transmitters and associated DR receivers) operating in the designated frequency band 430 MHz to 440 MHz, as meant by ETSI TR 103 451 [i.3].

A possible return (downlink) RF transmission channel from DR to CCam for command and control signalling, if and when implemented, will be outside the scope of the present document.

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

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.

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] 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.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 (RED).
- [i.3] ETSI TR 103 451: "System Reference document (SRdoc); Short Range Devices (SRD); Technical characteristics for UHF wideband Ultra Low Power Wireless Medical Capsule Endoscopy".
- [i.4] CEPT/ERC/REC 70-03: "Relating to the use of Short Range Devices (SRD)".
- [i.5] Body Tissue Dielectric Parameters provided by the Federal Communications Commission: "Reference Calculation Tool".

NOTE: Available online at <https://www.fcc.gov/general/body-tissue-dielectric-parameters>.

- [i.6] Bioelectromagnetics (1987): "Simulated biological materials for electromagnetic radiation absorption studies", Hartsgrove G., Kraszewski A. & Surowiec A. 8(1), 29-36.

## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

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

**Capsule Camera (CCam):** miniature disposable capsule-shaped optical imaging camera with integrated ultra low RF power SRD transmitter, intended to be swallowed

**Data Recorder (DR):** device worn by the patient in order to record the stream of images received from CCam and store it

NOTE: At the end of diagnostic procedure the stream of images may be downloaded to doctor's PC for examination.

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

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

**unwanted emissions in the spurious domain:** components at any frequency, generated and radiated by active DR receiver or CCam transmitter outside the defined operating frequency band of 430 MHz to 440 MHz

### 3.2 Symbols

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

|     |  |
|-----|--|
| dB  | decibel  |
| dBm | absolute power level referred to one milliwatt |
| f   | frequency                                      |

### 3.3 Abbreviations

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

|      |  |
|------|--|
| CCam | Capsule Camera   |
| CEPT | European Conference of Postal and Telecommunications administrations |
| DR   | Data Recorder  |
| EC   | European Commission  |
| EFTA | European Free Trade Association                                      |
| EU   | European Union   |
| EUT  | Equipment Under Test   |
| FAR  | Fully Anechoic Room  |
| RF   | Radio Frequency  |
| RMS  | Root Mean Square   |
| SRD  | Short Range Device   |
| TX   | Transmitter  |
| VSWR | Voltage Standing Wave Ratio  |



## 4 Technical requirements specifications

### 4.1 Environmental profile

Tests defined in the present document shall be carried out at representative points within the boundary limits of the declared operational environmental profile.

Where technical performance varies subject to environmental conditions, tests shall be carried out under a sufficient variety of environmental conditions (within the boundary limits of the declared operational environmental profile) to give confidence of compliance for the affected technical requirements.

### 4.2 Conformance requirements

#### 4.2.1 Transmitter requirements

##### 4.2.1.1 Effective radiated power

###### 4.2.1.1.1 Definition

The effective radiated power is the total power of CCam TX wanted emissions measured outside test patient's (phantom) body within the designated band 430 MHz to 440 MHz, in the direction of the maximum radiated power under specified conditions of measurements.

###### 4.2.1.1.2 Limit

The effective radiated power of CCam TX shall not exceed -40 dBm/10 MHz total power, -50 dBm/100 kHz e.r.p. density within the designated 430 MHz to 440 MHz band.

###### 4.2.1.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.4.1.1 of the present document.

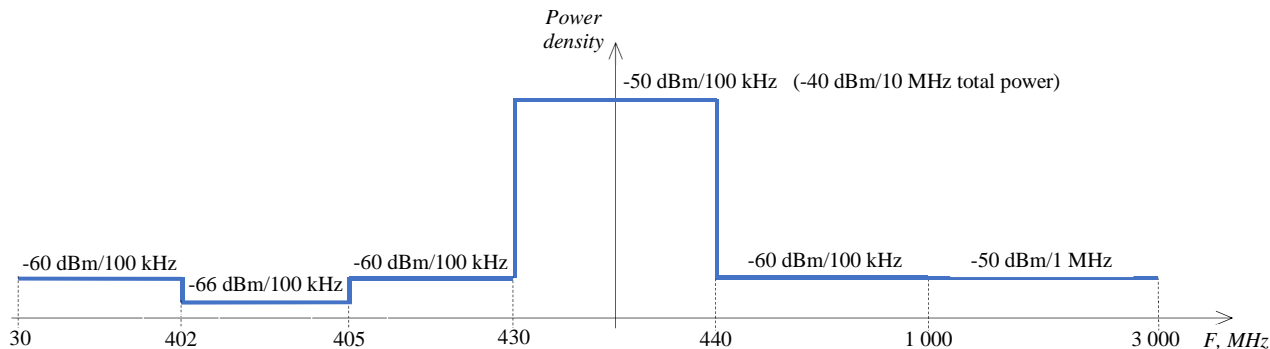
##### 4.2.1.2 Transmitter emissions mask

###### 4.2.1.2.1 Definition

The transmitter emissions mask envelope shall contain all constituent wanted and unwanted (including the unwanted emissions in the spurious domain) RF emissions of CCam TX as measured outside test patient's (phantom) body in the direction of maximum radiated power under specified conditions of measurements.

###### 4.2.1.2.2 Limits

The transmitter emissions mask limits shall be as given in Figure 1.



**Figure 1: CCam TX emissions mask (not to scale)**

The power density limit given in this clause for in-channel portion of the mask is meant to constrain any small-scale power density fluctuations across the transmission bandwidth and as such should not be compared directly or bandwidth-converted to the aggregate effective radiated power limit for the entire useful signal given in the clause 4.2.1.1.2.

#### 4.2.1.2.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.4.1.2 of the present document.

## 4.2.2 Receiver requirements

### 4.2.2.1 Unwanted Emissions in the Spurious Domain

#### 4.2.2.1.1 Definition

Unwanted emissions in the spurious domain from the DR receiver are RF emission components at any frequency, generated and radiated by active receiver circuitry and the antenna.

#### 4.2.2.1.2 Limit

The power of any unwanted emissions in the spurious domain by the DR receiver shall not exceed:

- -60 dBm/100 kHz between 30 MHz and 402 MHz;
- -66 dBm/100 kHz between 402 MHz and 405 MHz;
- -60 dBm/100 kHz between 405 MHz and 1 000 MHz;
- -50 dBm/1 MHz between 1 000 MHz and 3 000 MHz.

#### 4.2.2.1.3 Conformance

The conformance tests for this requirement shall be as defined in clause 5.4.2.1 of the present document.

### 4.2.2.2 Receiver blocking

#### 4.2.2.2.1 Definition

Blocking is a measure of the capability of the DR receiver to receive a wanted modulated signal from CCam without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or the adjacent channels or bands.