European spectrum regulation and the harmonised market of the European Union—An overview

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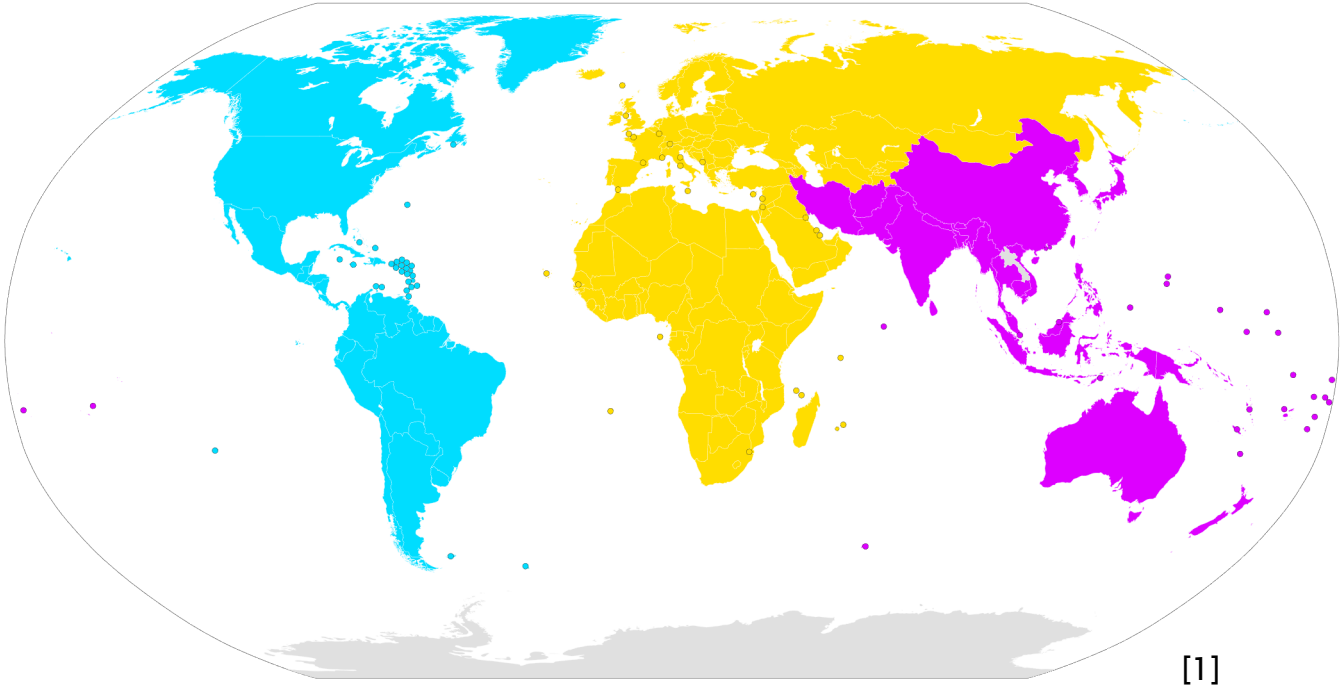
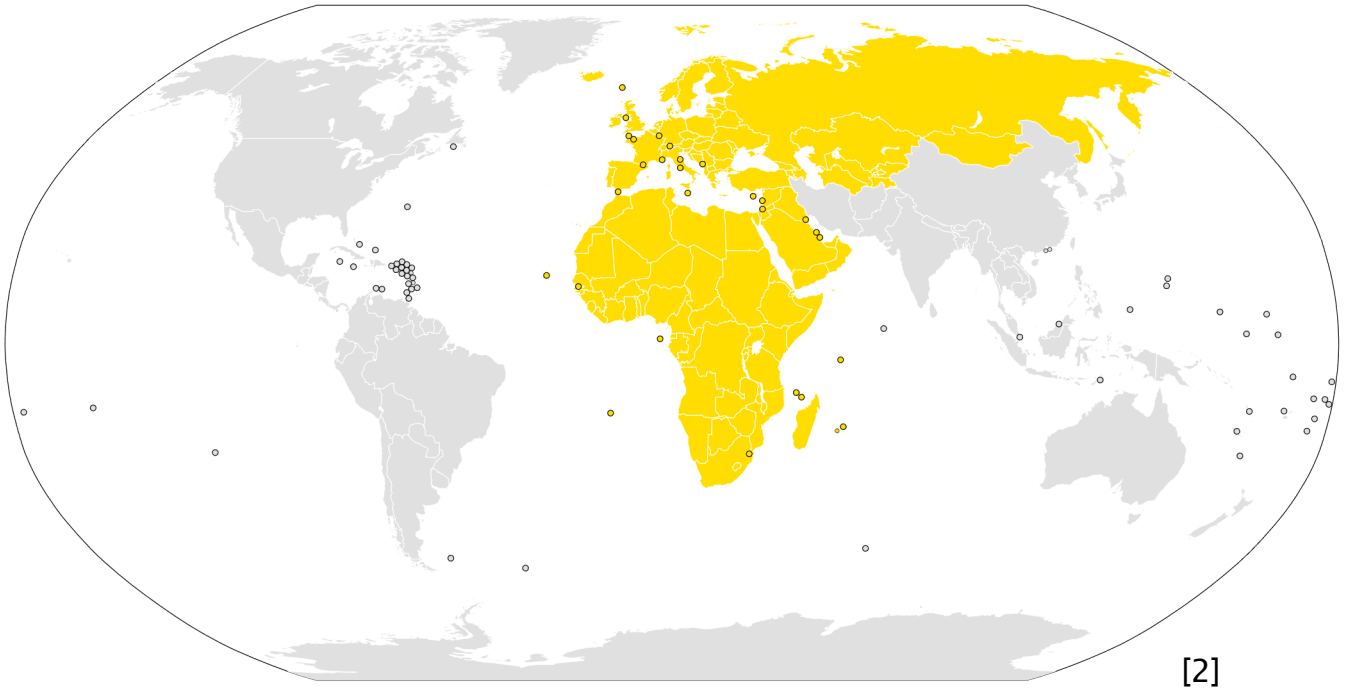
European Spectrum regulation

The three regions of the International Telecommunication Union (ITU)



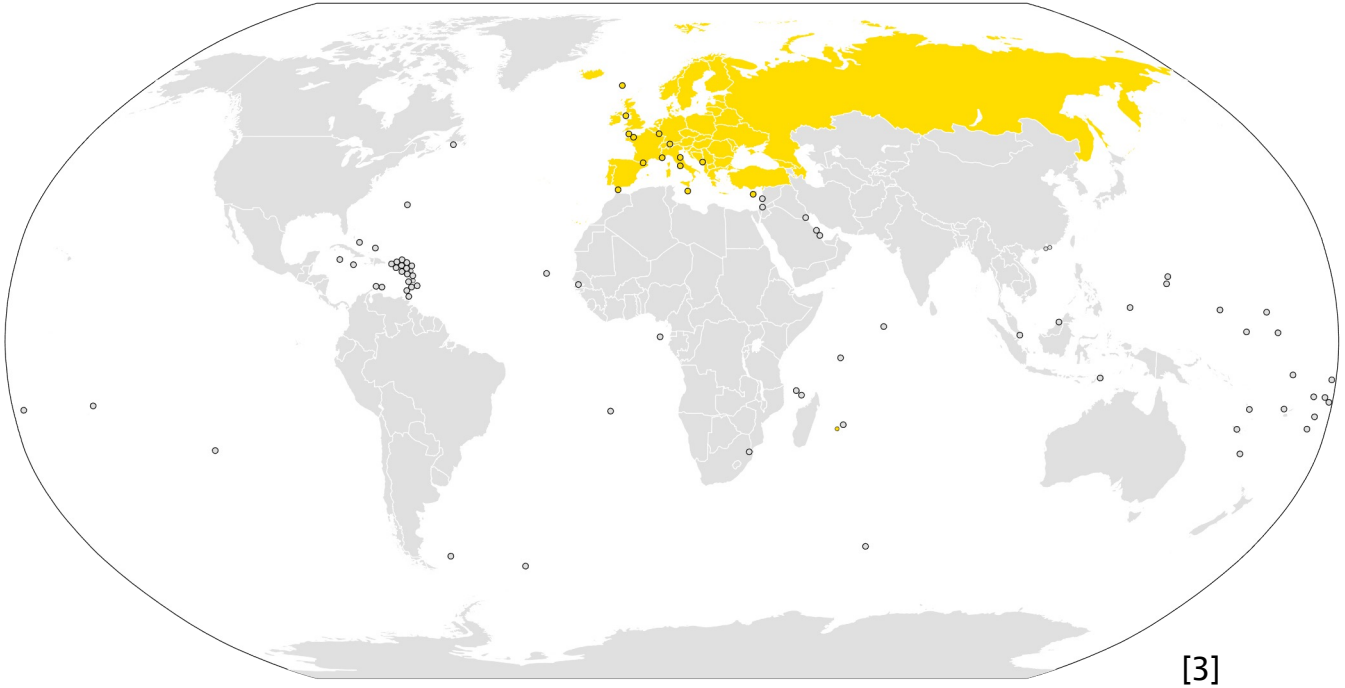
[1]

ITU region 1



ITU region 1 consists of Europe, Africa, Middle East (excluding Iran), Mongolia, all of the Russian federation

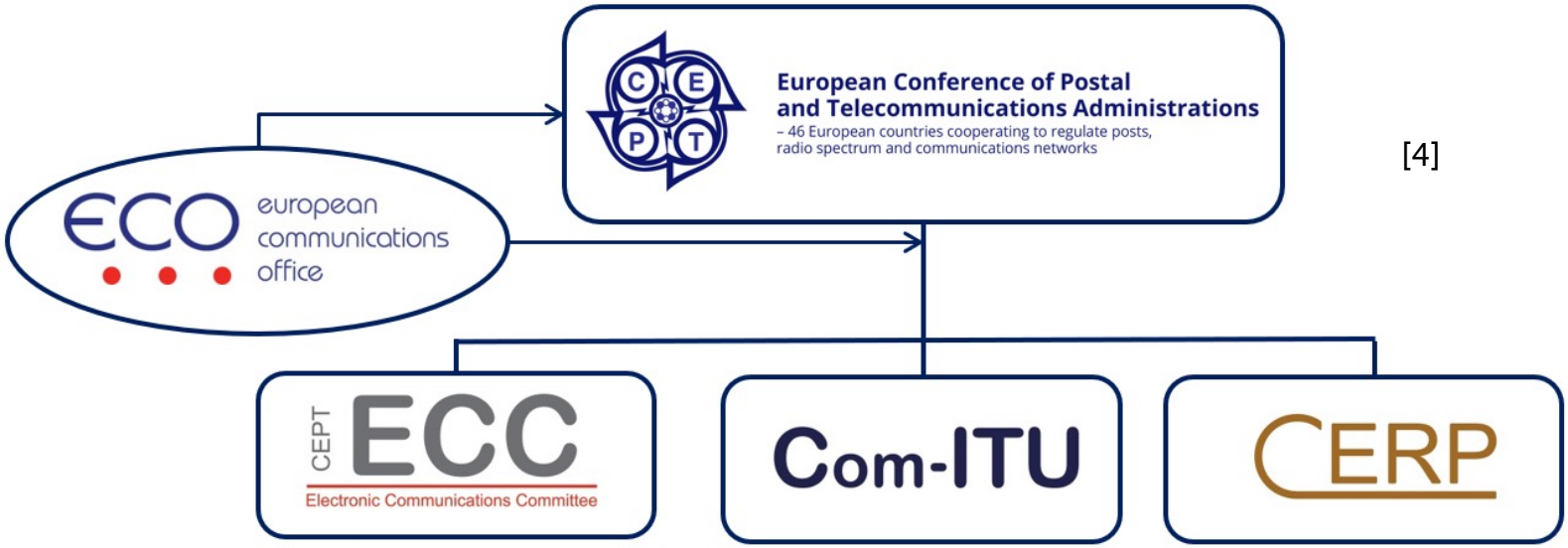
European Conference of Postal and Telecommunications Administrations (CEPT)



[3]

Albania, Andorra, Austria, Azerbaijan, Belarus (membership suspended) Belgium, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Russian Federation (membership suspended), San Marino, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye, Ukraine, United Kingdom, and Vatican City

CEPT and its bodies



[4]

CEPT consists of three business committees—ECC, Com-ITU, and CERP—and its permanent Office—ECO

CEPT membership

- **"Who can be a CEPT Member?**
  - In accordance with the CEPT 'Arrangement', Postal and Telecommunications Administrations of the European countries which are Members of the Universal Postal Union or Member States of the International Telecommunication Union may be Members of CEPT." [5]
- **CEPT consists of countries**
  - No entity or individual membership

Working areas of CEPT's bodies

- **Electronic Communications Committee (ECC)**
  - "The ECC considers and develops policies on electronic communications activities in European context, taking account of European and international legislations and regulations." [6]
- **Committee for ITU Policy**
  - "Com-ITU is responsible for organising the co-ordination of CEPT actions for the preparation for and during the course of the ITU activities of the Council, Plenipotentiary Conferences, WTDC, WTSA and other meetings as appropriate." [7]
- **European Committee for Postal Regulation**
  - "The European Committee for Postal Regulation (CERP) is responsible for postal regulation and European co-ordination and preparation for Universal Postal Union meetings." [8]
- **European Communications Office**
  - "ECO provides advice and support to CEPT to help it to develop and deliver its policies and decisions in an effective and transparent way." [9]

Electronic Communications Committee

Electronic Communications Committee (ECC)

- **ECC consists of …**
  - Steering Group (SG)
  - Conference Preparatory Group (CPG)
  - Numbering and Networks Working Group (WG NaN)
  - Working Group Frequency Management (WG FM)
  - Working Group Spectrum Engineering (WG SE)
  - Project Team 1 (PT1)

What does the ECC do?

CEPT ECC
Electronic Communications Committee

- "The Electronic Communications Committee (ECC) develops **common policies and regulations in electronic communications for Europe**, and is a focal point for information on spectrum use. Its **primary objective is to harmonise the efficient use of the radio spectrum**, satellite orbits and numbering resources across Europe. It also prepares common proposals to represent European interests in the ITU and other international organisations." [11]
- "The ECC's approach is strategic, open and forward-looking, and based on consensus between the member countries. It **works with** all stakeholders, the **European Commission**, and **ETSI** to facilitate the delivery of technologies and services for the benefit of society." [11]

ECC deliverables

- **ECC Decisions**
  - "These are measures to **harmonise the use of spectrum** and numbering **across the CEPT membership**. This is to make the use of spectrum more technically efficient to improve market efficiency across Europe. **Drafted by consensus, ECC Decisions are widely supported and adopted by individual countries, even though they are non-binding**. This provides a sound basis for manufacturers and service providers to prepare to address the European market confidently. The ECC ensures **compatibility between its own Decisions and the binding [European Commission] Decisions** on the same subjects made between the 27 member states of the European Union. This allows the benefits of harmonisation to be fully realised across all 48 CEPT member countries." [12]
- **ECC Recommendations**
  - "ECC Recommendations are measures that national Administrations are encouraged to apply. They are principally intended as harmonisation measures for those matters where ECC Decisions are not yet relevant, or as guidance to national Administrations." [12]
- **ECC Reports**
  - "ECC Reports are the result of studies by the ECC. They are developed in support of ECC Decisions, ECC Recommendations or European Common Positions (ECPs) adopted on a voluntary basis by European countries at World Radiocommunication Conferences." [12]
- **CEPT Reports**
  - "**CEPT Reports are technical studies** carried out by the ECC **under mandates from the European Commission [EC]**. These studies give results that are typically used as the technical basis of EC Decisions on spectrum policy matters." [12]

Spectrum regulation in Europe

- **Countries are sovereign over the use of the radio spectrum within their territory**
- **In Europe, ECC/CEPT harmonizes spectrum usage among its member countries**
  - However, ECC/CEPT decisions are not binding
- **ECC/CEPT member countries may voluntarily implement ECC/CEPT decisions and recommendations**
  - When using or providing devices etc. users and manufacturers need to consult national regulations
  - A partial (not necessarily up-to-date) overview is available from [13]

6 GHz as an example

- **ECC Decision (20)01 addresses license-exempt operation in the lower 6 GHz band (5945 MHz to 6425 MHz) [14], [15]**
  - Permits CEPT member countries to open the lower 6 GHz band
- **On 2021-09-01, the Federal Office of Communications (OFCOM) of the Swiss Confederation implemented ECC DEC(20)01 [16]**

CEPT ECC
Electronic Communications Committee

On the harmonised use of the frequency band 5945-6425 MHz for Wireless Access Systems including Radio Local Area Networks (WAS/RLAN)

approved 20 November 2020

The European Union

Europe

- **Europe is a continent**
  - Consists of ca. 73 countries
  - Ca. 750 million residents

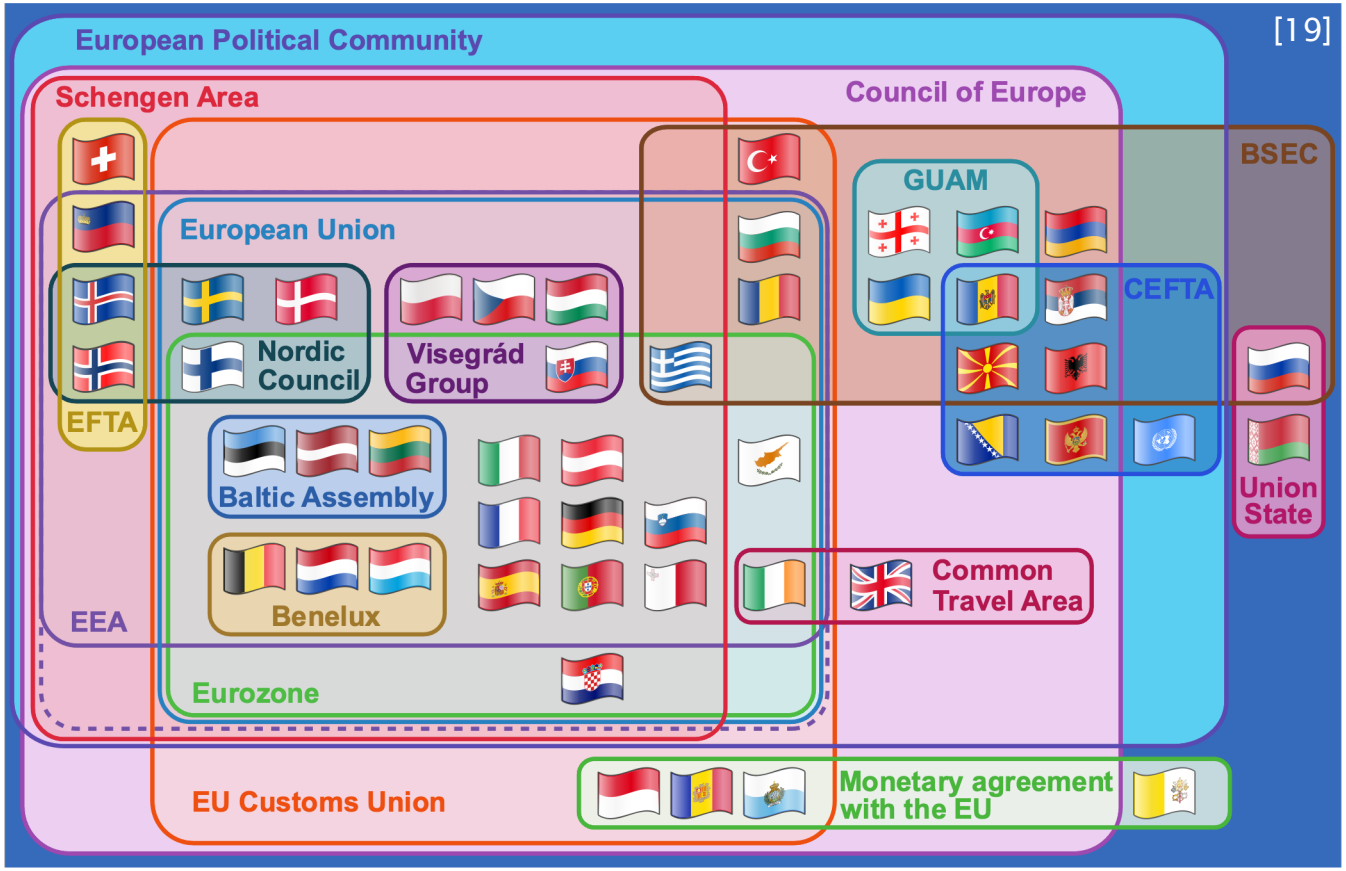
[17]

The European Union

- **Today, the European Union (EU) has 27 member countries**
  - Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden
- **Third largest economy after the US and China**

[18]

The European Union and related organizations



- EEA: European Economic Area (EEA)
- EFTA: European Free Trade Association
- GUAM: Organization for Democracy and Economic Development
- CEFTA: Central European Free Trade Agreement
- BSEC: Black Sea Economic Cooperation

What is the EU?

- **A voluntary union of independent countries**
  - Started as economic community
  - EU and member countries are bound by treaties between them
- **Follows principles of subsidiarity**
- **The EU has own institutions**
  - Member countries delegate power to the EU's bodies
- **EU develops EU legislation**
  - Member countries adopt this law

[20]

EU institutions

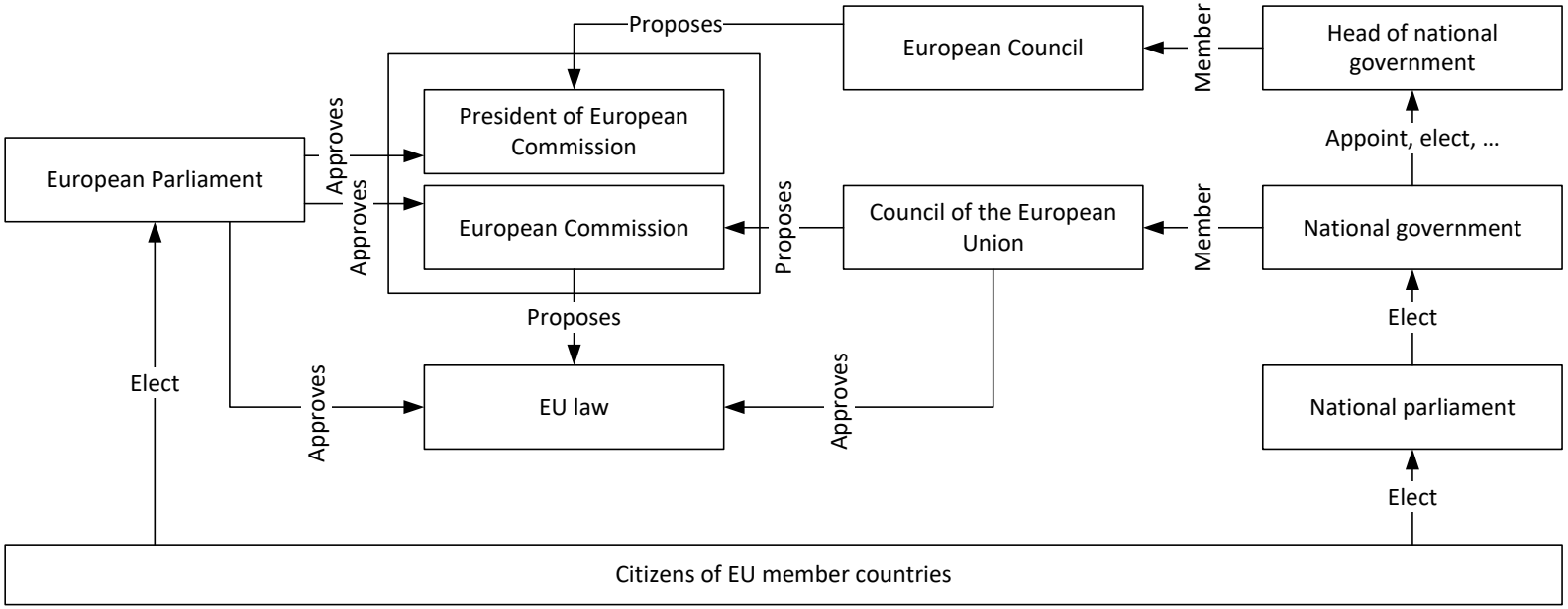
Decision making

- **European Council**
  - Defines general direction
- **European Commission**
  - "Government of the EU"
- **European Parliament**
  - Approves EU law
- **Council of the European Union**
  - Approves EU law

Controlling

- **Court of Justice of the European Union**
  - Reviews & interprets law, ensure EU members comply
- **European Central Bank**
  - Price stability, inflation
- **European Court of Auditors**
  - Assessment of EU actions

Organigram



- **The European Commission (EC) is the "government of the European Union (EU)"**
  - Proposed and appointed by the Council of the European Union
  - Approved and dismissed by the European Parliament
  - EC proposes and enforces EU law
- **The Council of the European Union consists of 27 ministers**
  - One per EU member country
- **EU citizens elect**
  - Their national governments, and
  - the European parliament

The European Commission

- **Consists of 27 commissioners**
- **Enforces EU law**
- **Proposes law**
  - Directives etc.
- **Proposes & supervises the EU's budget**
- **International representation of the EU**

6 GHz as an example

- **On 2021-06-30, the EC published decision 2021/1067 [21] in the Official Journal of the EU (OJEU)**
  - Forces all EU member countries to make available 5945 MHz to 6425 MHz for license-exempt use from 2021-12-01 at latest
- **On 2021-07-14, Bundesnetzagentur (BNetzA) [82], the regulatory authority of the Federal Republic of Germany, implemented decision (EU) 2021/1067 [22]**

30.6.2021 EN Official Journal of the European Union L 232/1

II [21]

(Non-legislative acts)

DECISIONS

COMMISSION IMPLEMENTING DECISION (EU) 2021/1067

of 17 June 2021

on the harmonised use of radio spectrum in the 5 945-6 425 MHz frequency band for the implementation of wireless access systems including radio local area networks (WAS/RLANs)

(notified under document C(2021) 4240)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) [1], and in particular Article 4(3) thereof,

Whereas:

(1) Because of the growing number and diversity of devices for wireless access systems including radio local area networks ('WAS/RLANs') and rising connection speeds and data traffic volumes, there is a need to harmonise new spectrum resources for the provision of wireless broadband via WAS/RLANs in addition to the spectrum already available on a non-exclusive basis in the 2,4 GHz (2 400-2 483,5 MHz) and 5 GHz (5 150-5 350 MHz and 5 470-5 725 MHz) frequency bands. Additional spectrum for WAS/RLANs should support the wide channels required for many applications (including videoconferencing, downloading media, telemedicine, online learning and gaming, augmented reality and virtual reality) which need a large bandwidth in order to achieve gigabit speeds. Such applications have also become increasingly important in the coronavirus crisis.

(2) In accordance with the Commission strategy on the European Gigabit Society [2], all main socio-economic drivers (including schools, transport hubs and main providers of public services) as well as digitally intensive enterprises should have access to internet connections with download or upload speeds of 1 gigabit of data per second (Gbit/s) by 2025. All households in the Union should have internet connections with a download speed of at least 100 Mbit/s which can be upgraded to 1 Gbit/s.

(3) The regulatory framework for WAS/RLANs operating in the 5 945-6 425 MHz frequency band, that is to say, the lower 6 GHz frequency band, should improve wireless connectivity in the Union and allow the internal market to benefit from a spectrum resource potentially available worldwide, thus generating large economies of scale for equipment manufacturers. The lower barriers to accessing spectrum resulting from a harmonised regulatory framework will facilitate large-scale deployment of interoperable WAS/RLANs-capable devices and access points, which should serve as an important connectivity infrastructure for services that complement mobile internet services provided by mobile network operators. The recommended framework identifies two WAS/RLANs use cases in the 5 945-6 425 MHz frequency band as follows: (i) low power indoor ('LPI') the use of which is restricted to and

[1] OJ L 108, 24.4.2002, p. 1.
[2] Communication Connectivity for a Competitive Digital Single Market - Towards a European Gigabit Society (COM(2016) 587 final).

EC based its decision on ECC's decision

EU 2021/1067 [21]

- "Techniques to access spectrum and mitigate interference that provide an appropriate level of performance to comply with the essential requirements of Directive 2014/53/EU of the European Parliament and of the Council shall be used. Where relevant techniques are described in harmonised standards or parts thereof the references of which have been published in the Official Journal of the European Union in accordance with Directive 2014/53/EU, performance at least equivalent to the performance level associated with those techniques shall be ensured."

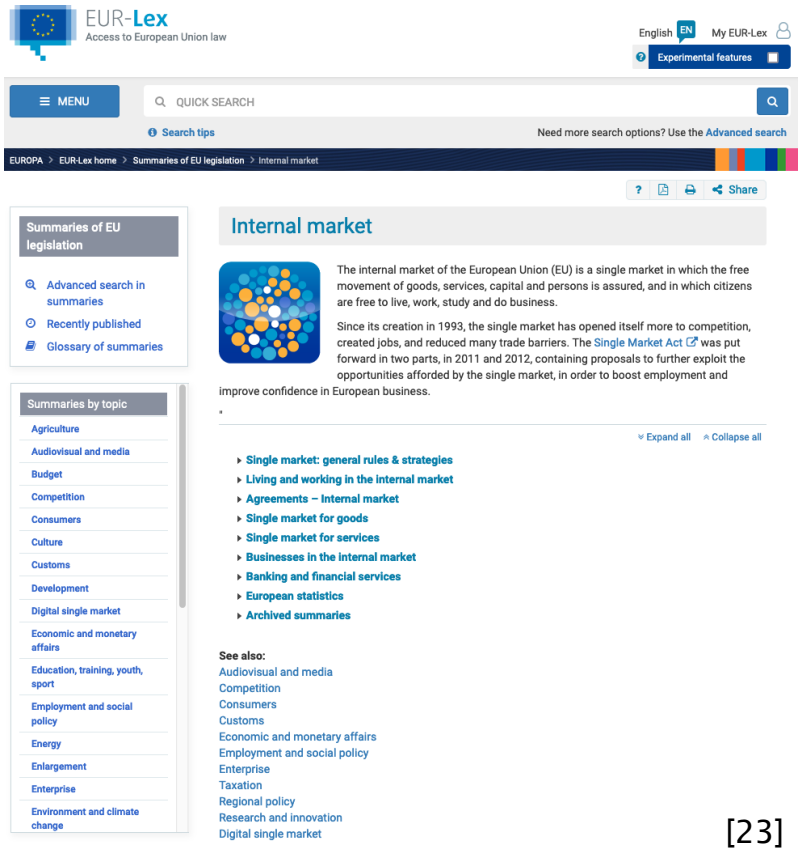
ECC DEC(20)01 [15]

- "An adequate spectrum sharing mechanism shall be implemented."

Placing products on the market of the EU

Single market

- **"EU countries may not prohibit the sale on their territory of goods which are lawfully marketed in another EU country." [23]**
  - Goods, services, money etc. move freely within EU
  - Free trade, no barriers
  - Once a product is put on the market of one EU member country the product cannot be blocked from entering other EU member countries



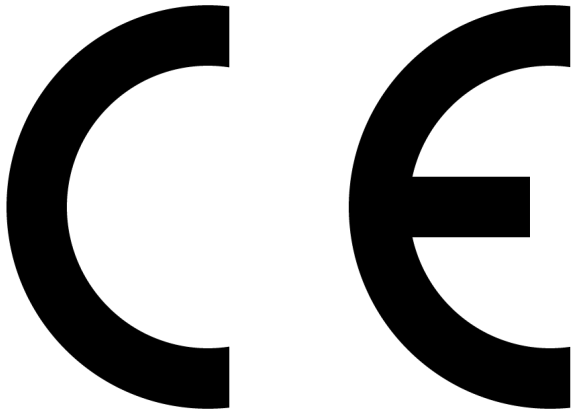
[23]

Harmonized requirements

- **Old, national approach posed many detailed requirements**
  - For example, few dial-up modems were approved for use in Germany
- **EU's New Approach covered by New Legislative Framework (NLF) [24]**
  - Restrict legislation to essential requirements
  - E. g., performance or functional requirements
- **Clause 4.1.1 of [25]**
  - "Essential requirements define the results to be attained, or the hazards to be dealt with, but do not specify the technical solutions for doing so."
  - "[…] Union harmonisation legislation is [limited] to the essential requirements that are of public interest. These requirements deal with the protection of health and safety of users (usually consumers and workers) but may also cover other fundamental requirements (for example protection of property, scarce resources or the environment)."

What is the CE marking?

- **CE marking [26]**
  - signifies that products "[…] have been assessed to meet high safety, health, and environmental protection requirements."
  - holds "[…] all companies accountable to the same rules."
  - of a product indicates that "[…] a manufacturer declares that the product meets all the legal requirements for CE marking and can be sold […]."



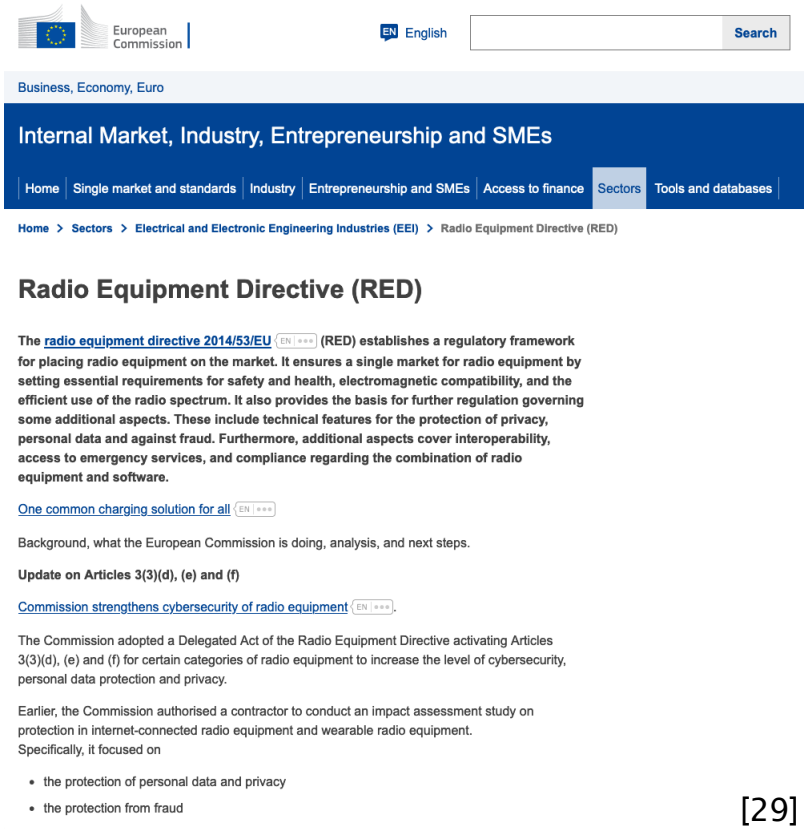
[27]

- **CE marking applies to the European Economic Area (EEA)**
  - EEA > EU, see page 16

Radio Equipment Directive

Directive 2014/53/EU

- **Radio Equipment Directive (RED) addresses traditional aspects (transmitters, electromagnetic compatibility etc.) and new aspects (receivers) [28]**
  - Consists of several articles
- **The EC activates RED articles over time**
  - Latest activation targets a common power supply/charger
  - Also recently, protection of privacy and against fraud
- **RED is highly important for all products operating according to IEEE 802.11 or IEEE 802.15 standards**



[29]

Traditional RED aspects

"1. Radio equipment shall be constructed so as to ensure:

a) the protection of health and safety of persons and of domestic animals and the protection of property, including the objectives with respect to safety requirements set out in Directive 2014/35/EU […]

b) an adequate level of electromagnetic compatibility as set out in Directive 2014/30/EU." [28]

- **Similar requirements set out under previous "Radio and Telecommunications Terminal Equipment" (R&TTE) directive**
- **RED replaced the R&TTE directive**

Receiver oriented aspects of the RED

2) "Radio equipment shall be so constructed that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference." [28]

- **Interference issues not limited to transmitters**
  - Avoid complaints about interference caused by bad receiver designs
- **Improving the quality of receivers improves spectrum efficiency**
  - Better receivers reduce the need for guard bands etc.
- **Therefore, RED not limited to transceivers, also addressing receiving devices**
  - Frequency Modulation (FM) and Digital Audio Broadcast (DAB+) radios, DVB-T/S/C, and Global Navigation Satellite Service (GNSS) receivers, …

New aspects addressed by RED

- **2019-02-25, EC activated & detailed g) [30]**
  - Mandatory support of Galileo GNSS in smartphones
- **2022-01-12, EC activated d), e), and f) [31]**
  - Addresses cybersecurity
    - Privacy
    - Network resilience
    - …
- **2022-12-07, EC mandates the use of a common charging solution [32]**
  - USB-C

3) "Radio equipment within certain categories or classes shall be so constructed that it complies with the following essential requirements: [radio equipment]

a) […] interworks with accessories, in particular with common chargers;

b) […] interworks via networks with other radio equipment;

c) […] can be connected to interfaces of the appropriate type throughout the Union;

d) […] does not harm the network or its functioning nor misuse network resources, thereby causing an unacceptable degradation of service;

e) […] incorporates safeguards to ensure that the personal data and privacy of the user and of the subscriber are protected;

f) […] supports certain features ensuring protection from fraud;

g) […] supports certain features ensuring access to emergency services;

h) […] supports certain features in order to facilitate its use by users with a disability;

i) […] supports certain features in order to ensure that software can only be loaded into the radio equipment where the compliance of the combination of the radio equipment and software has been demonstrated." [28]

Radio Equipment Directive Compliance Association (REDCA)

- **REDCA [33] brings together**
  - Manufacturers
  - Notified bodies
    - Test labs
  - Regulatory authorities
  - Consulting companies
  - …

The Radio Equipment Directive Compliance Association (REDCA)

The REDCA was formed under the requirements of the Radio Equipment Directive 2014/53/EU specifically for Article 26.11 and Article 38 for Notified Bodies. Membership of this association as listed on the Notified Body member's page is deemed to demonstrate compliance with these articles. * *See Note.* In this context REDCA publishes Technical Guidance Notes – TGN that can be accessed by following the "Documents" menu tab above.

The REDCA provides a forum for people concerned with the compliance of radio equipment with regulations and technical standards in the European Economic Area, as well as in the Countries that have a Mutual Recognition Agreement with the EU, such as the USA and Japan.

The annual fee for REDCA Membership is €600.

The Association meets twice a year in a location within the EEA. All meetings are open for members only. These meetings are ideal to discuss matters with important players in the field such as representatives of the EU Commission, ECC, ETSI, ADCO RED and authorities from MRA countries.

The REDCA operates a mail server where only members can ask questions that will trigger answers and comments from the experts within the Association. These discussions provide material to be stored on the protected database for future reference by the members. Furthermore the Association has a specific protected area on the CIRCABC website, operated by the EU Commission, where all working documents are stored for access by the members only.

For further information about the Association or its activities, please send a message to the REDCA Secretary.

*Note: For the information of accreditation bodies:

For accreditation assessments of Radio Equipment Directive Notified Bodies; the Notified Body membership can be verified on this website. If a Notified Body is not on this list then they are not a member. Membership of the REDCA specifically enables the Notified bodies for the Radio Equipment Directive to demonstrate their compliance with Article 26.11 and Article 38.

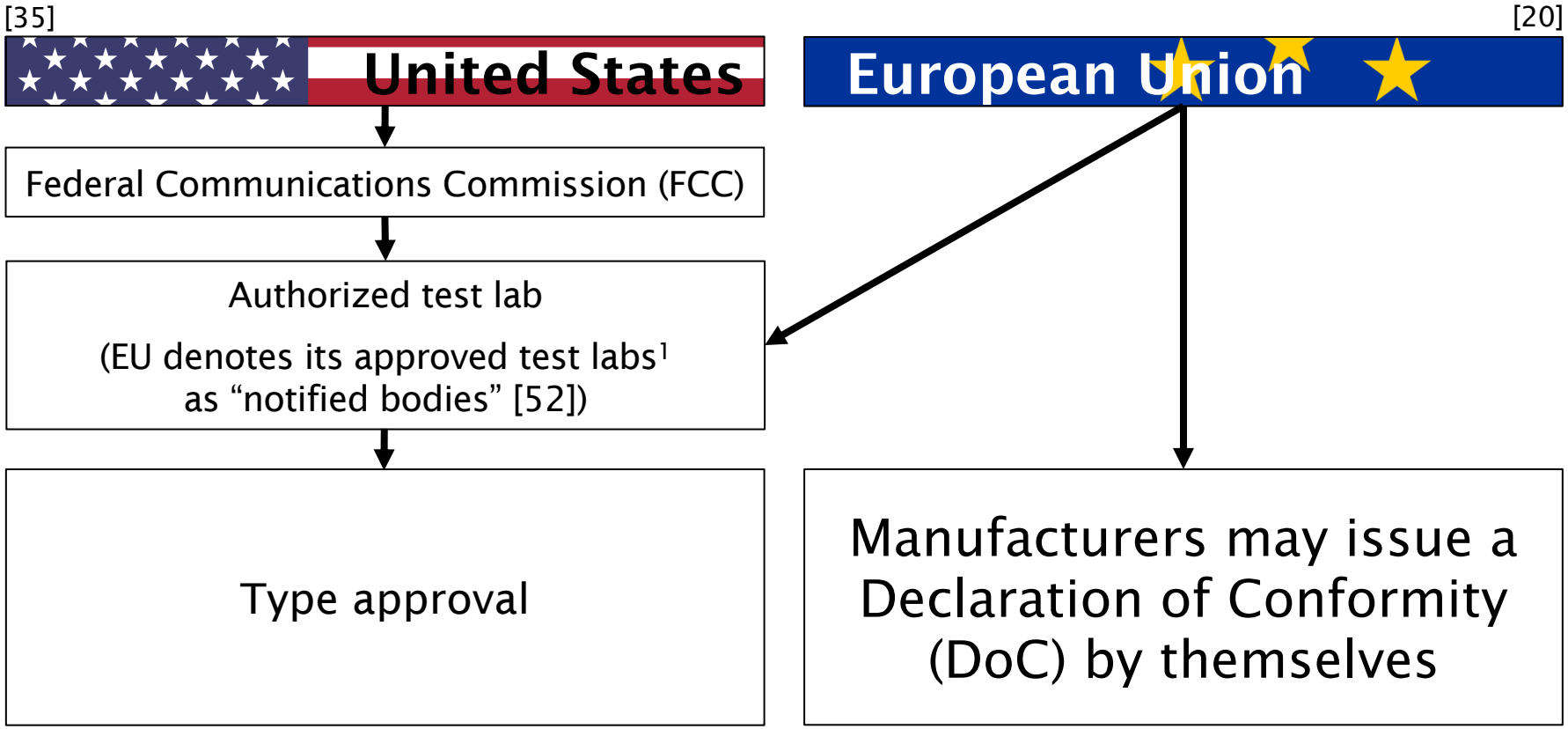
REDCA's goals

- "[…] formed under the requirements of the Radio Equipment Directive 2014/53/EU specifically for Article 26.11 and Article 38 for Notified Bodies (sectorial group of notified bodies) […]"

- "[…] REDCA publishes Technical Guidance Notes – TGN that can be accessed by members and in some case the general public." [34]

How to sell a (radio) product?

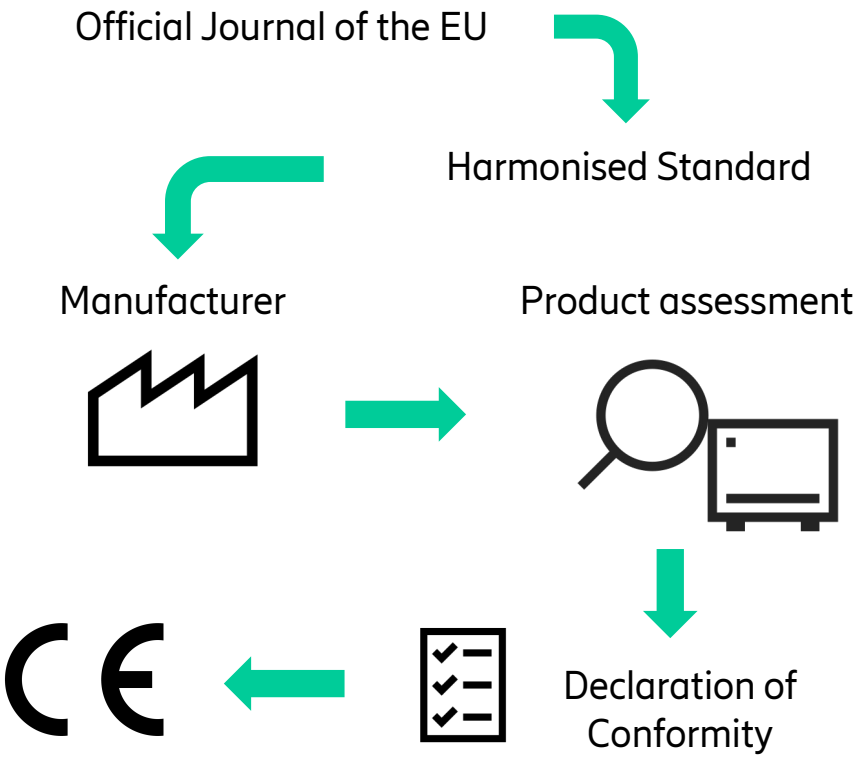
Placing radio products on the market



[1]This is a simplification resp. generalization. To ensure independence, notified bodies are expert entities separate of the EU. Many notified bodies incorporate test labs or are affiliated with a test lab. However, a notified body is not required to have test lab capabilities.

From the Official Journal of the EU (OJEU) to Declarations of Conformity (DoCs) by self-assessment

- **OJEU contains a Harmonized Standard (HS) applicable to a product?**
  - Then, HS may be used to assess a product's compliance with EU law
  - Avoids the need to consult a notified body
- **Notified bodies are independent experts that have knowledge and experience to admit a product to the EU market**
  - For their decisions, however, notified bodies might consider requirements in HSs
- **DoC by self-assessments saves cost and time**
  - In this case, the content of an HSs determines a vendor's options
- **HSs determine vendors' options & influence notified bodies**



Self-assessment depends on Harmonized Standards (HSs)—What is an HS?

- "'harmonised standard' means **a European standard adopted on the basis of a request made by the Commission** for the application of Union harmonisation legislation" [48]

- **An HS defines requirements for products targeting certain EU markets**
  - HS shall be limited to essential requirements
  - An HS neither provides nor targets technical interoperability
- **Examples: An HS may require …**
  - that the out-of-band emissions of a product must not exceed certain levels
  - that a product must stop transmitting after a certain duration
  - that a product must detect certain radar patterns and upon detection must cease transmitting

Example DoC

- **Issuing a DoC depends on testing and finding a products to comply with all requirements in Harmonised Standards (HS) relevant to the product**
  - Because of the product's Wi-Fi modules, HSs EN 300 328 [53] (2,4 GHz) and EN 301 893 [54] (5 GHz) are referred to
  - In the present example, the manufacturer got support from a Notified Body [51]

cradlepoint

CE

Declaration of Conformity CE

Cradlepoint, Inc.
1111 W Jefferson St, Suite 400
Boise, ID 83702

EU Authorized Representative:
Jan Willeke, Area Director Central Europe, Cradlepoint EMEA. Beim Riesenstein 21, 22393 Hamburg, Germany

Declare that this DoC is issued under our own responsibility and that for the following product:

Model: **S5A111A**
Description: **E3000-5GB Cellular Router**
Trademark: **Cradlepoint**

The object of the declaration described above is in conformity with the with the relevant Union harmonization legislation:
Radio Equipment Directive 2014/53/EU, Eco-Design Directive 2009/125/EC, RoHS Directive 2011/65/EU + Amendment 2015/863/EU.

Standards applied:
EN 300 328 V2.2.2
EN 301 908-1 V13.1.1
EN 301 908-13 V11.1.2
EN 303 413 V1.1.1
EN 301 893 V2.1.1
EN 301 908-2 V11.1.2
(Draft) EN 301 908-25 V15.1.1
EN 62368-1:2014/+A11:2017

Other Standards Used:
EN 55032:2015/A11:2020
EN 55035:2017/A11:2020
Draft EN 301 489-17 V3.2.0 (2017-03)
Draft EN 301 489-52 V 1.1.2
EN 50665:2017
EN 55024: 2010/A1:2015
EN 301 489-1 V2.2.3
EN 301 908-19 V2.1.1 (2019-04)
EN 62311:2008
EN 50385:2017

The Notified Body TIMCO Engineering Inc. with Notified Body number 1177 performed: Modules: B+C.
Issued Type Examination Certificate: E1177-210436

The equipment was tested with
Power Adapters

Model / Part Number	Input Rating	Output Rating
FSP180-AWAN3	100-240Vac	54Vdc, 3.34A

Antennas

Part Number	703-915 MHz	1700-2000 MHz	2000-2025 MHz	2300-2400 MHz	2496-2690 MHz	3300-4200 MHz	2400-2500 MHz	5150-5250 MHz	5250-5350 MHz	5470-5735 MHz	5725-5900 MHz
170801-000	1.42 dBi	1.34 dBi	1.34 dBi	2.67 dBi	2.69 dBi	4.13 dBi	--	--	--	--	--
170628-000	--	--	--	--	--	--	2.47 dBi	2.47 dBi	2.47 dBi	2.47 dBi	--

Software Version: 7.21

Signed for, and on behalf of Cradlepoint, Inc.

Date: 2021-09-01

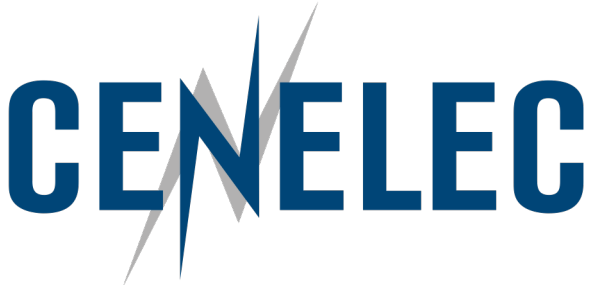
DocuSigned by:
Pankaj Malhotra
5B81E8826BD2E417...
Pankaj Malhotra, SVP Engineering

1111 W Jefferson St, Boise, ID 83702
Toll Free: 855.813.3385
Local: 208.424.5054
Fax: 208.429.6852

cradlepoint.com

Who develops Harmonized Standards?

– **"Harmonised standards are developed by recognised European Standards Organisations: CEN, CENELEC, or ETSI." [36]**

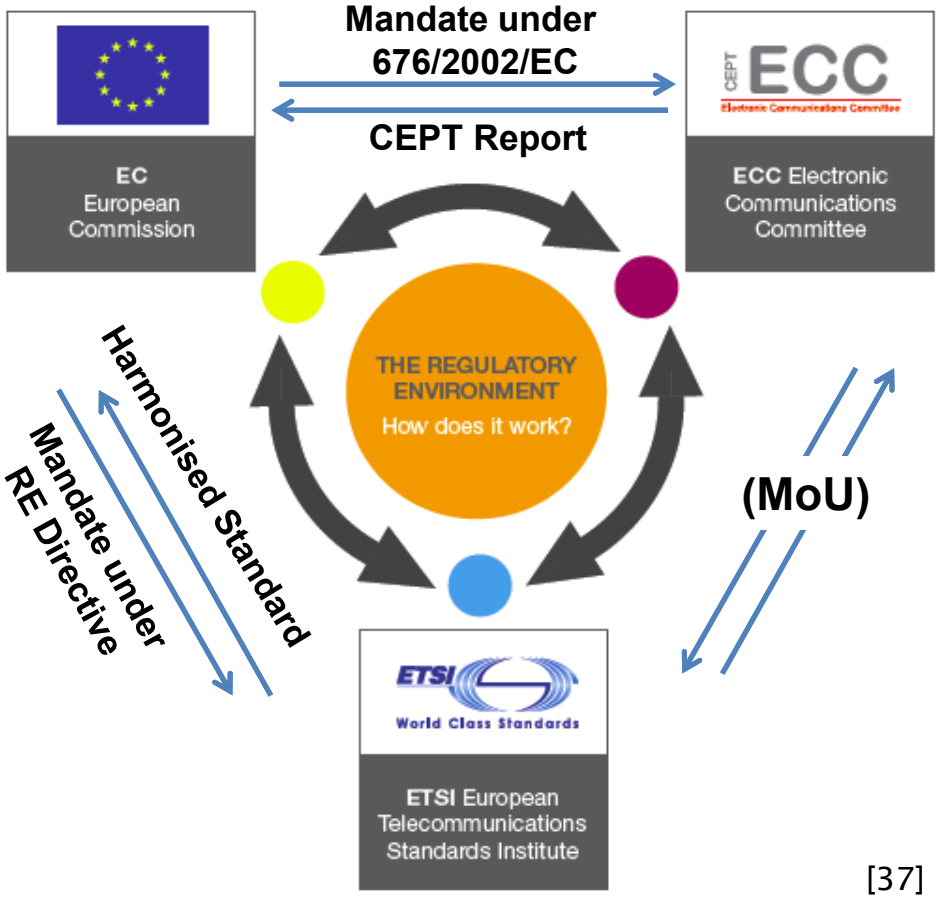


What is the relevance of Harmonized Standards?

- "**Following harmonised standards** in the design and manufacture of your products will ensure your products are in line with corresponding EU rules; this **is known as 'presumption of conformity'**." [36]
- "[…] the **use of harmonised standards remains voluntary**. You are **free to choose another technical solution to demonstrate compliance with the mandatory legal requirements**." [36]

Relationship between EC, CEPT, and ETSI

- MoU: Memorandum of Understanding



[37]

Relationship between EC and ETSI

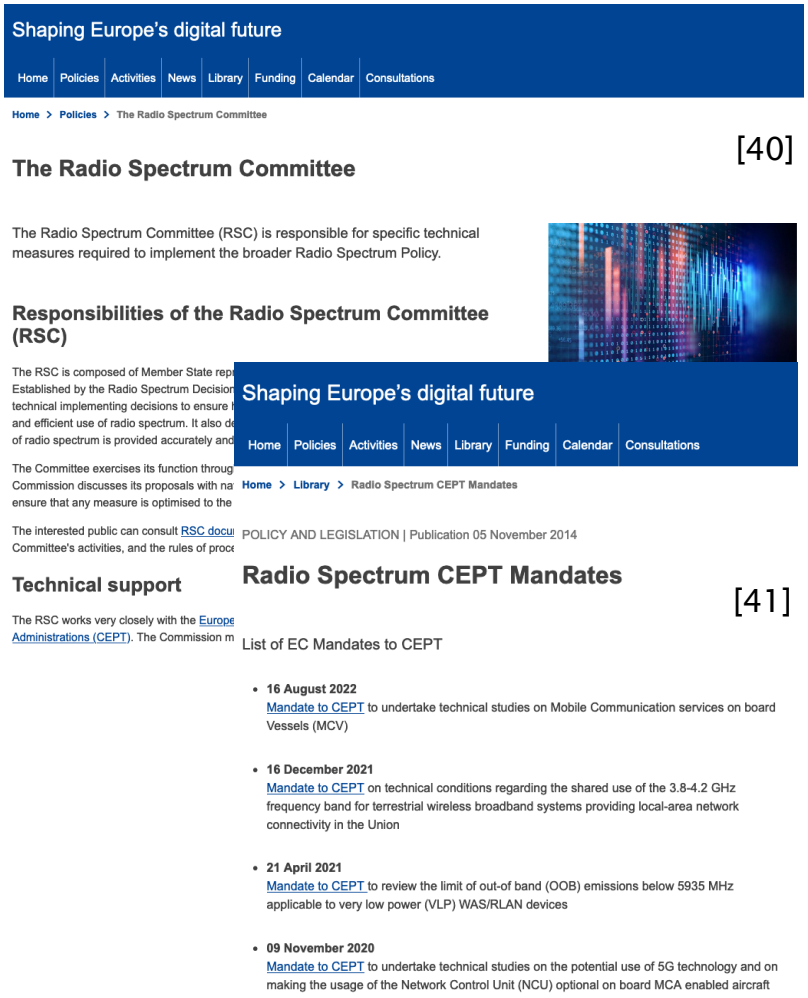
- **"ETSI was set up in 1988 by the European Conference of Postal and Telecommunications Administrations (CEPT) in response to proposals from the European Commission." [38]**

- **ETSI cooperates with EC and EFTA[1]**
  - ETSI supports EU regulations and **legislation**
- **EC/EFTA issue standardization requests to ETSI**
  - Targeting development of Harmonized Standards
  - ETSI may reject requests
- **The EC provides 15 % to 20 % of ETSI's budget**

[1]See page 18

Relationship between EC and ECC

- **EC collaborates with ECC through its Radio Spectrum Committee (RSC)**
  - Memorandum of Understanding signed in 2004 [39]
  - ECC provides expertise to EC
- **EC may issue mandates to ECC**
  - To "[…] ensure harmonised conditions for the availability and efficient use of radio spectrum." [40]



Relationship between ECC and ETSI

- **Ensure "that ECC and ETSI deliverables do not contradict each other" [42]**
- **Normally, new system/services are studied/proposed at ETSI**
  - Results in an ETSI System Reference Document (SRDoc)
- **If regulatory changes or spectrum are needed, ECC's Working Group FM[1] analyzes SRDoc**
  - May create new Work Item leading to new regulation (Decision)
  - Sharing/compatibility studies are conducted in WG SE[1]

ECC and ETSI [43]

The ECC works in partnership with ETSI to ensure new radio equipment entering the market uses the spectrum efficiently.

This page provides information on the various ways in which ETSI (European Telecommunications Standards Institute) and the ECC work together.

CEPT ECC Electronic Communications Committee

ETSI World Class Standards

The ECC develops regulations for the effective use and Europe-wide harmonization of the radio frequency spectrum, and the efficient use of satellite orbits and, therefore, provides for decisions regarding the allocation/designation of frequencies for radio communications services and applications within the CEPT countries, as well as for related requirements relevant to the use of spectrum by radio equipment.

ETSI develops standards for radiocommunication systems and equipment. Radio standards, and in particular those under article 3.2 of the Radio Equipment Directive, contain various requirements which relate to the efficient use of the spectrum, including compatibility between different radio services.

A Memorandum of Understanding (MoU) has been agreed between ETSI and the CEPT Electronic Communications Committee (ECC) to formalise our co-operation. The provisions of the ETSI-CEPT MoU are applied in the development of harmonised standards for radio equipment, as well as in relevant ECC deliverables.

ECC and ETSI representatives meet at ECC-ETSI meetings on a yearly basis in order to a maintain a strong relationship between the two organizations, to discuss strategic issues and to report on the ongoing activities in each of the organizations.

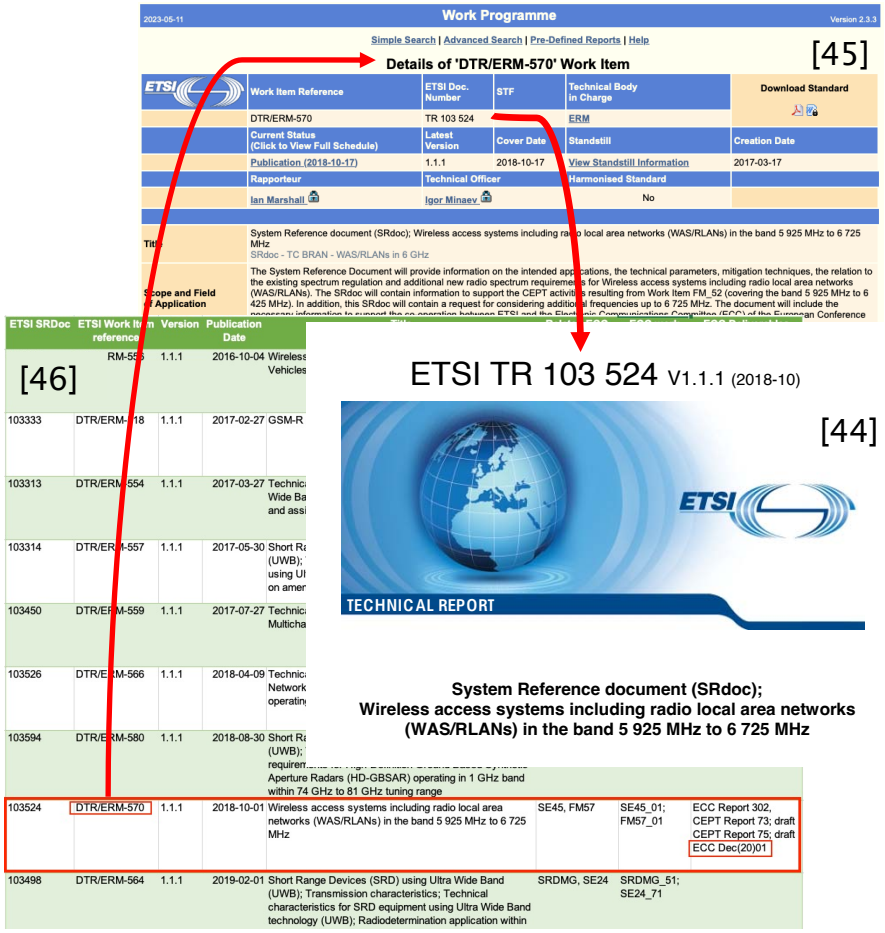
ECC-ETSI brochure
The European regulatory environment for radio equipment and spectrum - An introduction

The ECC and the ETSI with support from the European Commission have jointly produced a brochure which provides an introduction to the regulatory environment in Europe for radio equipment and spectrum and some key information for newcomers. The initial version of the brochure has been published in April 2011. The brochure has been revised in 2016 in order to reflect the update of the relevant European regulatory framework. The latest version (November 2017) includes additional minor update.

[1]See page 10

6 GHz license-exempt operation—example collaboration between ECC and ETSI

- **Under Work Item DTR/ERM-570, ETSI TC BRAN developed TR 103 524**
  - "Wireless access systems including radio local area networks (WAS/RLANs) in the band 5 925 MHz to 6 725 MHz"
- **TR 103 524 served as input for ECC's WGs SE 45 and FM 57**
  - Resulted in ECC DEC(20)01 [15]



European Telecommunications Standards Institute

What is ETSI?

- **The European Telecommunications Standards Institute (ETSI) is an internationally recognized Standards Development Organization (SDO)**
  - One of three European Standardisation Organisations (ESOs)
- **ETSI develops standards for information and communication technology**
  - Technical standards that provide interoperability
    - TETRA, DECT, GSM, 3G, 4G, 5G …
  - Harmonized Standards that describe requirements for the EU's/EFTA's harmonized market

Quick facts

- **ETSI has >900 members**
  - Entity-based membership
  - Full, associate, and observer membership
  - Membership fees depend on size of entity
- **ETSI's headquarter is located in Sophia Antipolis in France**
  - It is a not-for-profit association under French law
- **ETSI does <u>not</u> certify products**

[47]

ETSI's development process

[49]

- **ETSI Directives [49] detail process**
  - Equivalent to combed IEEE SA bylaws, operations manual, IEEE 802 policies & procedures etc.
- **Contribution driven**
  - Documents may be for information, discussion, or decision

www.etsi.org
ETSI | 650 Route des Lucioles | 06921 Sophia Antipolis CEDEX | France | +33 (0)4 92 94 42 00 | info@etsi.org
Institut Européen des Normes de Télécommunication | Association à but non lucratif enregistrée à la Sous-Préfecture de Grasse (06) N° W061004871 | SIRET N° 348 623 562 00017 | APE 7112B | N° TVA : FR 14 348 623 562

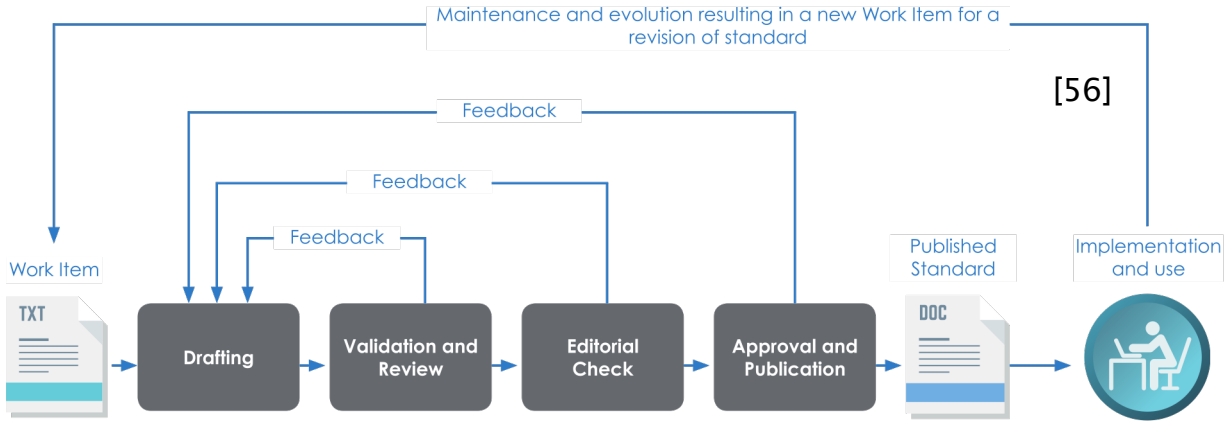
Committees, projects & other groups [50]

- Access, Terminals, Transmission and Multiplexing (ATTM)
- Broadband Radio Access Networks (BRAN)
- EBU/CENELEC/ETSI on Broadcasting (BROADCAST)
- Integrated broadband cable telecommunication networks (CABLE)
- Cyber Security (CYBER)
- Digital Enhanced Cordless Telecommunications (DECT)
- Environmental Engineering (EE)
- eHEALTH
- Emergency Communications (EMTEL)
- EMC and Radio Spectrum Matters (ERM)
- Electronic Signatures and Infrastructures (ESI)
- Human Factors (HF)
- Core Network and Interoperability Testing (INT)
- Intelligent Transport Systems (ITS)
- Lawful Interception (LI)
- Mobile Standards Group (MSG)
- Methods for Testing & Specification (MTS)
- OpenSource MANO (OSM)
- Reconfigurable Radio Systems (RRS)
- Railway telecommunications (RT)
- Safety
- Satellite Earth Stations & Systems (SES)
- Secure Element Technologies (SET)
- Smart Body Area Network (SmartBAN)
- SmartM2M
- Speech and multimedia Transmission Quality (STQ)
- TETRA and Critical Communications Evolution (TCCE)
- TeraFlowSDN (TFS)
- User Group

Industry Specification Groups [50]

- Augmented Reality Framework (ARF)
- european Common information sharing environment service and Data Model (CDM)
- cross-cutting Context Information Management (CIM)
- Experiential Networked Intelligence (ENI)
- Encrypted Traffic Integration (ETI)
- 5th Generation Fixed Network (FSG)
- Multi-access Edge Computing (MEC)
- millimetre Wave Transmission (mWT)
- Network Functions Virtualisation (NFV)
- Non-IP Networking (NIN)
- Operational energy Efficiency for Users (OEU)
- Permissioned Distributed Ledger (PDL)
- Quantum Key Distribution (QKD)
- Reconfigurable Intelligent Surfaces (RIS)
- Securing Artificial Intelligence (SAI)
- TeraHertz technology (THz)
- Zero-touch network and Service Management (ZSM)

Development process



[56]

2023-05-12 **Work Programme** Version 2.3.3

Simple Search | Advanced Search | Pre-Defined Reports | Help

[55]

Details of 'REN/BRAN-230016' Work Item

	Work Item Reference	ETSI Doc. Number	STF	Technical Body in Charge	Standard Not Ready For Download
	REN/BRAN-230016	EN 301 893		BRAN	
	Current Status (Click to View Full Schedule)	**Latest Version**	**Cover Date**	**Standstill**	**Creation Date**
	Stable draft (2023-03-02)	2.1.51 Draft		View Standstill Information	2017-06-22
	Rapporteur	**Technical Officer**		**Harmonised Standard**	
	Volker Leisse	Igor Minaev		Yes	

Title	5 GHz RLAN; Harmonised Standard for access to radio spectrum HS for 5 GHz RLANs
Scope and Field of Application	(1) To consider the possible inclusion of the band 5 725 MHz to 5 850 MHz together with appropriate mitigation techniques for operation in this band; (2) To revise clause 4.2.7.3.2.5 on Energy Detection Threshold (ED) and other sections of Adaptivity related to detection; (3) To revise clause 4.2.8 on Receiver Blocking and to consider the need to include additional receiver requirements; (4) To consider improving existing text throughout the entire document without changing requirements other than those identified in (1) to (3) above; (5) To revise/improve existing test methods where appropriate.
Supporting Organizations	Ofcom (U.K.), Cisco Systems Belgium, Sony Europe Limited, CableLabs, Microsoft Ltd, Intel Corporation (UK) Ltd, ZES BVBA; Hewlett-Packard Enterprise; Ruckus Wireless Inc.

ETSI Work Item (WI) = IEEE SA Project Authorization Request (PAR)

- Scope description

Two decision events

- WI adoption
- Approval

Interim (draft) stages

- Early
- Stable
- For approval

Development process—Decision making

- **Decision making defined in ETSI Directives [49]**
- **Consensus driven**
  - Consensus is defined as the lack of objection
  - Follows EC's regulation [48]
- **Nothing less than 100 % approval is sufficient**
  - No need to provide reasons
  - No interpretations
- **At the discretion of the chair, a vote may be conducted**
  - Very rare because of high hurdles to conduct a vote
- **Remote consensus (RC) for taking decisions independent of meetings**
  - RC must be open for 30 d

ETSI process—EN 303 687 as example (1)

- **Work Item creation period**
  - Initiates standstill period
  - EU member states informed to discontinue developing related national standards
- **Drafting stage**
  - Member contributions
  - Discussions etc.
- **Harmonized Standard Technical Advisory Consultant (HASTAC) review**
  - Consultants to EC
  - Currently from EY [60]
- **EN - Approval Procedure (ENAP)**
  - Review, commenting, voting by National Standard Organizations (NSOs)

Work Programme

Simple search Advanced search Pre-Defined Reports Help

Details of 'DEN/BRAN-230021' Work Item Schedule [59]

Code	Milestone	Action	Action Nb	Target	Achieved	Version
0	Creation of WI by WG/TB			2019-06-03	2019-06-03	
0 p	WI proposed to TB				2019-06-26	
0 a	TB adoption of WI			2019-06-20	2019-06-26	
0 E	EC informed of mandated WI			2020-04-17	2020-04-17	
0 Er	EC mandate confirmed			2020-05-22		
1	Start of work			2019-10-07	2019-09-27	
2	Early draft			2019-12-02	2019-10-01	0.0.1
2	Early draft				2020-02-16	0.0.2
2	Early draft				2020-02-20	0.0.3
2	Early draft				2020-06-27	0.0.4
2	Early draft				2020-06-30	0.0.5
2	Early draft				2020-08-02	0.0.6
2	Early draft				2020-09-07	0.0.7
2	Early draft				2020-09-28	0.0.8
2	Early draft				2020-10-01	0.0.9
4	Stable draft			2020-09-15	2020-11-09	0.0.10
4	Stable draft				2020-12-10	0.0.11
4	Stable draft				2021-03-12	0.0.12
4	Stable draft				2021-06-24	0.0.13
4	Stable draft				2021-10-01	0.0.14
4	Stable draft				2021-12-17	0.0.15
4	Stable draft				2022-02-04	0.0.16
4	Stable draft				2022-02-06	0.0.17
4	Stable draft				2022-02-10	0.0.18
4	Stable draft				2022-02-14	0.0.19
5 V	Mature draft sent to EC and/or recog.Org			2022-03-10	2022-03-10	0.0.19
5 Vr	EC Assessment Received					
6	Final draft for approval			2022-04-10	2022-03-21	0.0.20
8	TB approval			2022-03-30	2022-03-21	1.0.0
8 A	Draft receipt by ETSI Secretariat			2022-04-04	2023-03-10	
9 B	Start of EN Approval Procedure Access the e-approval application	AP	20220726	2022-04-27	2022-04-27	1.0.0
9 C	End of EN Approval Procedure			2022-07-26	2022-07-26	
9 CA	Start of comments categ. Assessment					
9 CB	End of comments categ. Assessment					

ETSI process—EN 303 687 as example (2)

[59]

5 Vr	EC Assessment Received					
6	Final draft for approval			2022-04-10	2022-03-21	0.0.20
8	TB approval			2022-03-30	2022-03-21	1.0.0
8 A	Draft receipt by ETSI Secretariat			2022-04-04	2023-03-10	
9 B	Start of EN Approval Procedure Access the e-approval application	AP	20220726	2022-04-27	2022-04-27	1.0.0
9 C	End of EN Approval Procedure			2022-07-26	2022-07-26	
9 CA	Start of comments categ. Assessment					
9 CB	End of comments categ. Assessment					
9 CC	Start of TB review after AP comments			2022-07-26	2022-09-08	
9 Dr	Draft Review after PE			2022-09-08	2022-09-08	
9 Dr	Draft Review after PE			2022-09-09	2022-09-09	0.0.21
9 Dr	Draft Review after PE			2022-09-09	2022-09-09	0.0.22
9 Dr	Draft Review after PE			2022-10-21	2022-10-21	0.0.23
9 Dr	Draft Review after PE			2022-10-21	2022-10-21	0.0.24
9 Cv	EC assessment before WNV requested			2022-11-08	2022-11-08	
9 Cvr	EC assessment before WNV received			2022-12-14	2022-12-21	
8	TB approval			2023-03-02	2023-03-02	1.1.0
8 A	Draft receipt by ETSI Secretariat			2023-03-16	2023-03-10	
9 B	Start of EN Approval Procedure Access the e-approval application	AP	20230627	2023-03-29	2023-03-29	1.1.0
9 C	End of EN Approval Procedure			2023-06-27		
9 CA	Start of comments categ. Assessment					
9 CB	End of comments categ. Assessment					
9 CC	Start of TB review after AP comments			2023-06-27		
9 Cv	EC assessment before WNV requested					
9 Cvr	EC assessment before WNV received					
9 Cw	Draft after EC comments					
9 Cx	Resolution of EC comments					
9 DaA	Start of TB approval process			2023-08-22		
9 DaB	End of TB approval process			2023-09-19		
9 Da	TB approval for WNV			2023-09-26		
9 E	Draft receipt by ETSI Secretariat			2023-10-03		
10 F	Start of Vote	V		2023-10-17		
10 G	End of Vote			2023-12-16		
11	Vote result determination (adopted)			2023-12-16		
12	Publication	PU		2023-12-30		
12 V	Delivery to the EC			2024-01-20		
12 W	Citation in the OJ			2024-04-13		

- **2nd HASTAC review**
- **ENAP recirculation (here, 2nd ENAP)**
  - Review, commenting, voting by NSOs
- **Immediate publication if no ENAP comments**
  - Submission to EC
  - Request to publish in Official Journal of the EU

The role of the EC

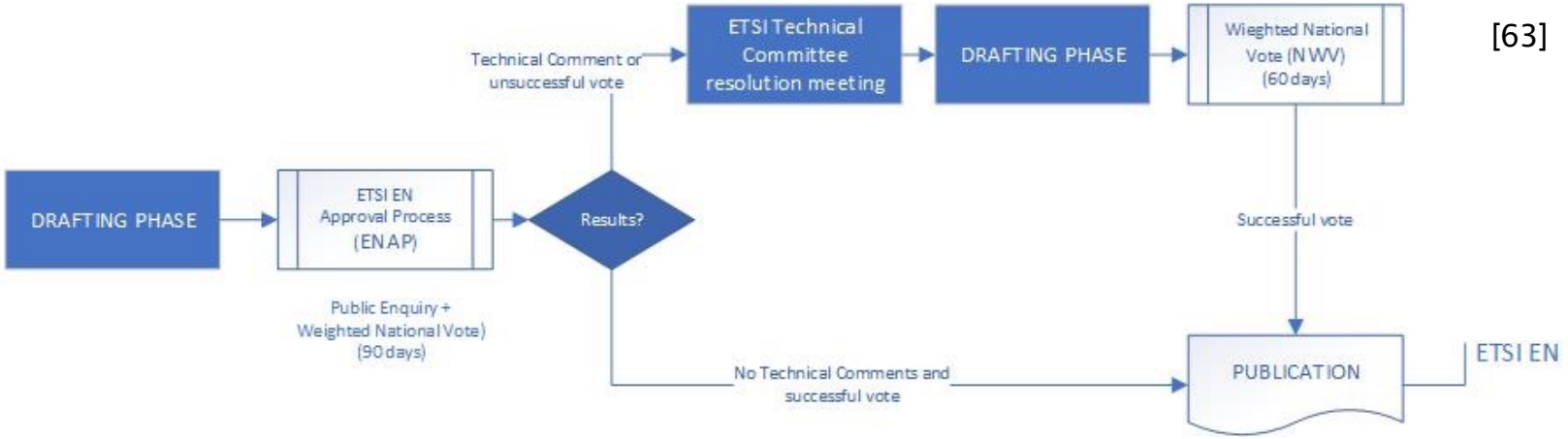
- **ETSI is sovereign over the content of its standards**
  - The EC is an ETSI member
  - However, does not influence ETSI process
- **In the past, the EC would list published HSs immediately in the Official Journal of the EU (OJEU)**
  - Since several years, however, HSs are considered part of EU legislation (see Appendix for background information)
- **The EC expects "legal certainty" of HSs**
- **Thus, HSs need to contain tests that**
  - lead to binary results (pass/fail criteria)
  - are reproducible
- **EC mandates to HASTAC reviews during HS development**
- **EC conducts legal review after publication**
  - May bring further comments and questions
  - EC reserves the right to not publish an HS in the OJEU

HASTAC

- **EC has budget for Harmonized Standard Technical Advisory Consultants (HASTAC)**
  - Two mandatory reviews
  - When HS becomes mature (stable)
  - Before ENAP
- **HASTAC provides suggestions, recommendations, and comments to ETSI groups**
  - ETSI not required to concur with comments
  - However, comment resolution is mandatory → "Similar to IEEE SA ballot"

- **Comments address various aspects**
  - State of the art of technical solutions
  - Sufficient consideration of receiver requirements
  - Unambiguous tests leaving no choice to manufacturer
  - Absence of manufacturer declarations
  - …

European Norm Approval Process (ENAP)



[63]

- **First ENAP stage (Public Enquiry) takes 90 d**
- **If comments are received they must be resolved**
  - Afterwards, a "recirculation" of revised HS occurs
  - Takes 60 d
- **If modifications beyond ENAP comments occurred, a new ENAP might be initiated**
- **In case the HS is approved, ETSI must publish the unmodified HS within 10 d**

National Standardization Organizations (NSOs)

- **During ENAP, NSOs vote on HSs [67]**
  - NSOs undertake national consultations [63]
  - Weighted voting, see [49]
  - Country dependent number of votes (number or residents etc.)
    - Germany, UK, France, Italy: 29
    - Spain, Poland: 27
    - …
- **Disapproval must be accompanied by comments**
- **Example: Deutsche Kommission Elektrotechnik Elektronik Informationstechnik (DKE) [62] represents Germany**
  - Technical experts review HS
  - Agree on vote
  - Collect comments

[ENAP] CLOSED Public Enquiry / Weighted National Voting procedure **VIEW RESULTS**

[61]

ETSI Document number: ETSI EN 303 687 V1.0.0 (2022-04)
Work Item Reference: DEN/BRAN-230021
Technical Body: BRAN Broadband Radio Access Networks
Title: 6 GHz WAS/RLAN Harmonised Standard for access to radio spectrum

Harmonised Standard

Current Detailed Results

	Date	Comments	Organisation	Country	Voting Weight	Vote Cast	Voter
1	[redacted]		DPS	AL	4	-	[redacted]
2	[redacted]		OVE	AT (E.U.)	10	-	[redacted]
3	[redacted]		CRC	BG (E.U.)	10	-	[redacted]
4	[redacted]		asut	CH (EFTA)	10	-	[redacted]

- **1st ENAP on HS EN 303 687 as example**
  - Here, voting details redacted
    - Accessible to ETSI members, only
  - Because of comments, ENAP failed

From Work Item (WI) to Official Journal of the EU (OJEU)

Milestones

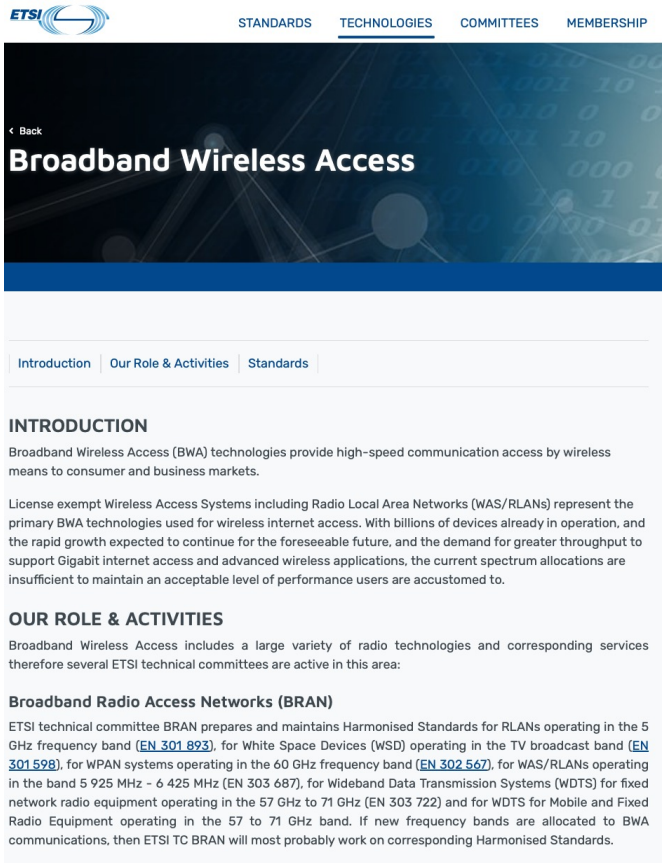
- **WI adoption**
- **HS drafting**
- **1st HASTAC review**
  - Comment resolution
- **HS completion**
- **2nd HASTAC review**
  - Comment resolution
- **Approval for ENAP**
  - Comment resolution
- **ENAP recirculation**
  - Comment resolution
- **HS publication**
  - EC review
  - Resolution of EC comments

- **The EC's review of the final HS targets "legal certainty"**
  - At this time, the HS cannot be modified anymore
  - If EC comments cannot be satisfied, the EC may deny listing the HS in the OJEU or the HS may be listed with comments

ETSI TC BRAN

Technical Committee (TC) Broadband Radio Access Networks (BRAN)

- **WAS/RLAN related Harmonized Standards developed by TC BRAN**
  - EN 301 893, 5 GHz
  - EN 303 687, 6 GHz
  - EN 302 567, 60 GHz
  - EN 303 722, 60 GHz
  - EN 303 753, 60 GHz
  - EN 301 598, TV Whitespace
  - …
- **Several other documents**
  - Mesh Access Point performance testing
  - Coexistence in 5.8 GHz band
  - …



Current status of EN 303 687

Background

- **During development of the HS, TC BRAN requested HASTAC review**
  - Was not conducted because of a lack of EC budget
- **1st ENAP did not pass**
  - Meanwhile, HASTAC program had restarted
  - TC BRAN requested HASTAC review
  - This brought comments in addition to ENAP comments
  - Hence, TC BRAN modified the HS beyond ENAP resolution
  - Therefore, ENAP restarted (90 d)
- **Second ENAP will end on 2023-06-27**
  - TC BRAN currently considering an initial ENAP comment review meeting on 2023-07-06
    - To be cancelled if no comments will be received
  - Next TC BRAN plenary meeting after IEEE 802.11 September 2023 interim

Current status of EN 301 893

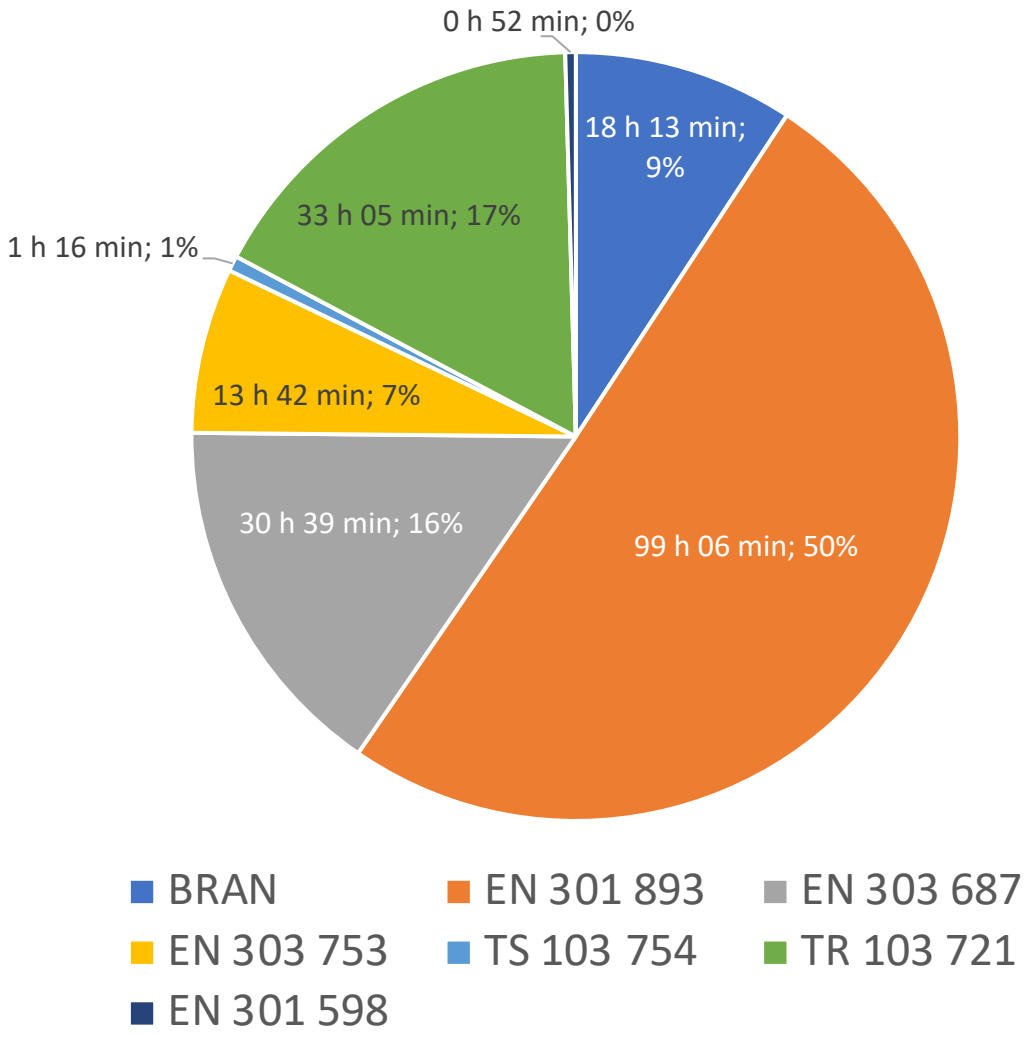
- **Considerations for WAS/RLAN operation in 5.8 GHz band included**
  - Available in Czech Republic [64]
- **HASTAC review conducted & comments addressed**
  - Draft at version 51, now
- **2nd HASTAC review and initial ENAP outstanding**
- **TC BRAN members are discussing about a technical aspect considered highly important by many members**
  - Some members are concerned about a certain relaxation that is assumed to cause unfair advantages, loophole
  - Other members are concerned about certain modes of operation being negatively impacted by stricter settings
- **Hopefully, a compromise may be established at ETSI TC BRAN plenary meeting #119 [65]**

Expectations for remainder of 2023

- **Various ETSI TC BRAN members expressed their interest in developing a revision of EN 303 687**
  - ETSI TBs/TCs cannot adopt a new WI until ETSI published the related HS
  - There is an interest in better consideration of several technical features
- **It is hoped that HS EN 301 893 will enter 1st ENAP**
- **1st ENAP and potential publication of HS EN 303 753**
  - So far, this HS seemed to be uncontroversial to many TC BRAN members

2022 session distribution

Committee	Duration in session	Percentage
BRAN	18 h 13 min	9,29%
EN 301 893	99 h 06 min	50,56%
EN 303 687	30 h 39 min	15,64%
EN 303 753	13 h 42 min	6,99%
TS 103 754	1 h 16 min	0,65%
TR 103 721	33 h 05 min	16,88%
EN 301 598	0 h 52 min	0,44%
Total	196 h 01 min	100,00%



License-exempt operation in the 5.8 GHz band in the Czech Republic

- **The Czech Republic made available 5725 MHz to 5850 MHz at high power for license-exempt use**
  - With minimal technical requirements, this band is available for non-specific Short Range Devices (SRD) in the EU
    - Limited to 25 mW EIRP
- **Because of the harmonized market, products placed on the market in the Czech Republic cannot be denied entry into other EU countries**
- **Because of concerns, that WAS/RLAN products sold in the Czech Republic could operate at high power in the 5.8 GHz band in other EU countries, TC BRAN added a geolocation requirement for 5.8 GHz in HS EN 301 893**
- **The Czech Republic's decision is an example for the sovereignty of countries over their spectrum**
  - Nevertheless, the EU's harmonized market may impact other countries etc.

Conclusion

In a nutshell …

- **For Europe, ECC/CEPT develops spectrum regulation**
  - Neither the European Commission (EC) nor ETSI define spectrum regulation
- **For the EU, the EC issues directives forcing EU member countries to implement certain spectrum regulation**
  - ETSI develops Harmonized Standards (HSs) based on a mandate by the EC
- **HSs define requirements for placing products on the market of the European Economic Area (= EU & additional countries)**
  - HSs do not define regulatory requirements
- **If, and only if an HS is listed in the OJEU a manufacturer may use the HS to demonstrate compliance of its product with legal requirements**
  - Thus, HSs are part of EU law

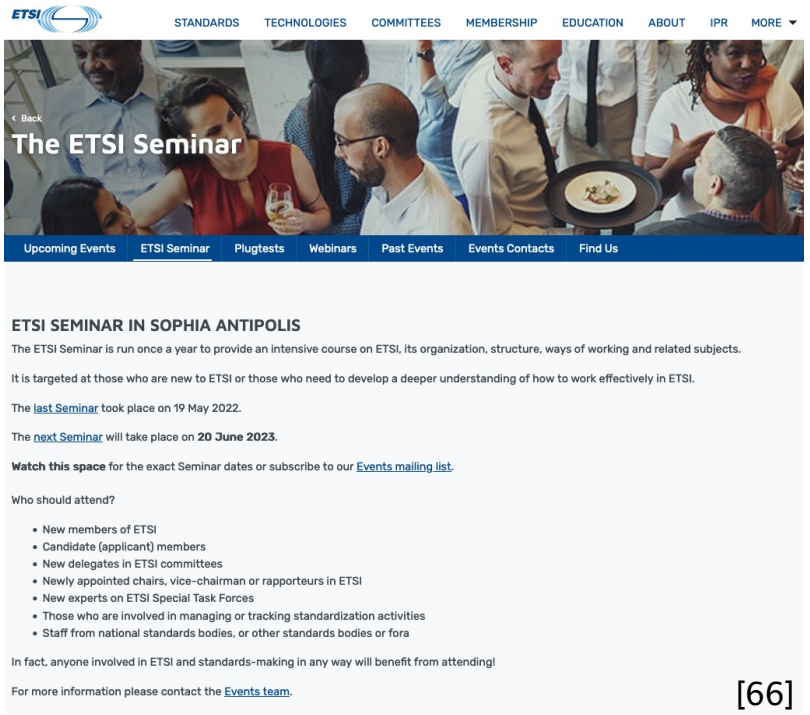
Appendix

Appendix A

Further information related to ETSI

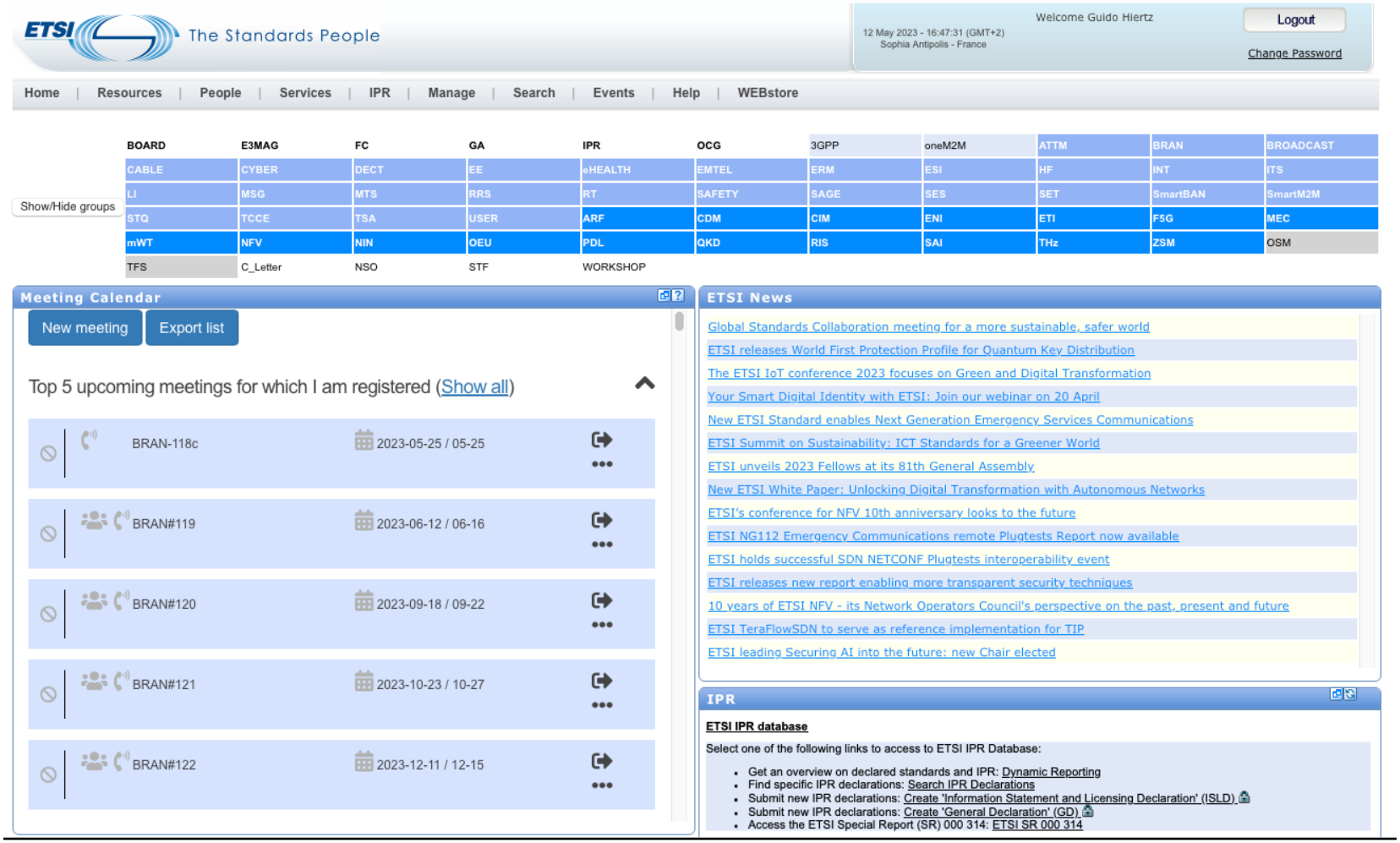
Helpful insights—ETSI Seminars

- ETSI Strategy
- Discover the ETSI Environment
- Research, Innovation & Standards
- ETSI Membership
- Legal & Governance
- Standards and Regulation (Part 1)
- Standards and Regulation (Part 2)
- Standards and Regulation (Part 3)
- Technical Organization
- 3GPP Essentials
- Introduction to oneM2M
- Testing & Interoperability
- Specialist Task Forces
- ETSI Seminar Online Modules

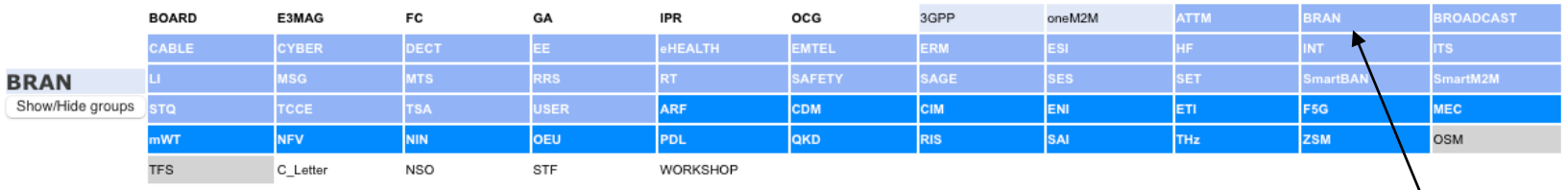


[66]

The ETSI portal [55]

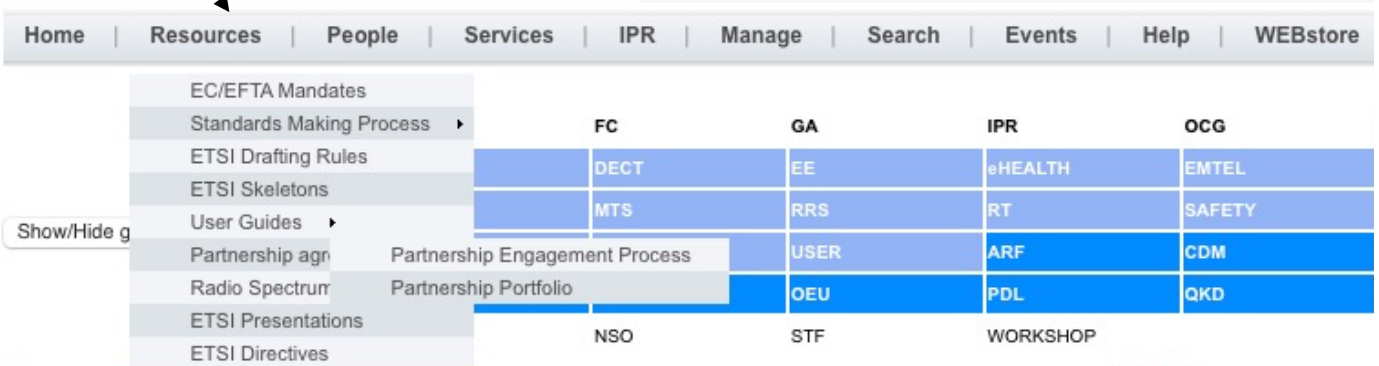


ETSI portal features (1)



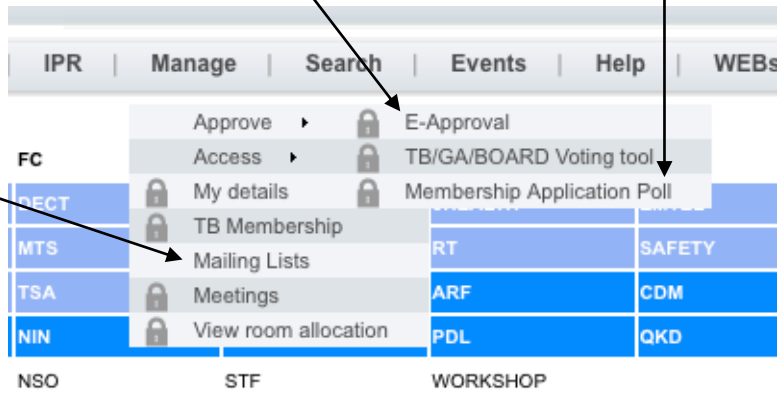
- **Access to partnership agreements, user & drafting guides, directives, templates**

- **Selection of different Technical Bodies/Committees (TCs/TBs)**
  - E. g. TC BRAN

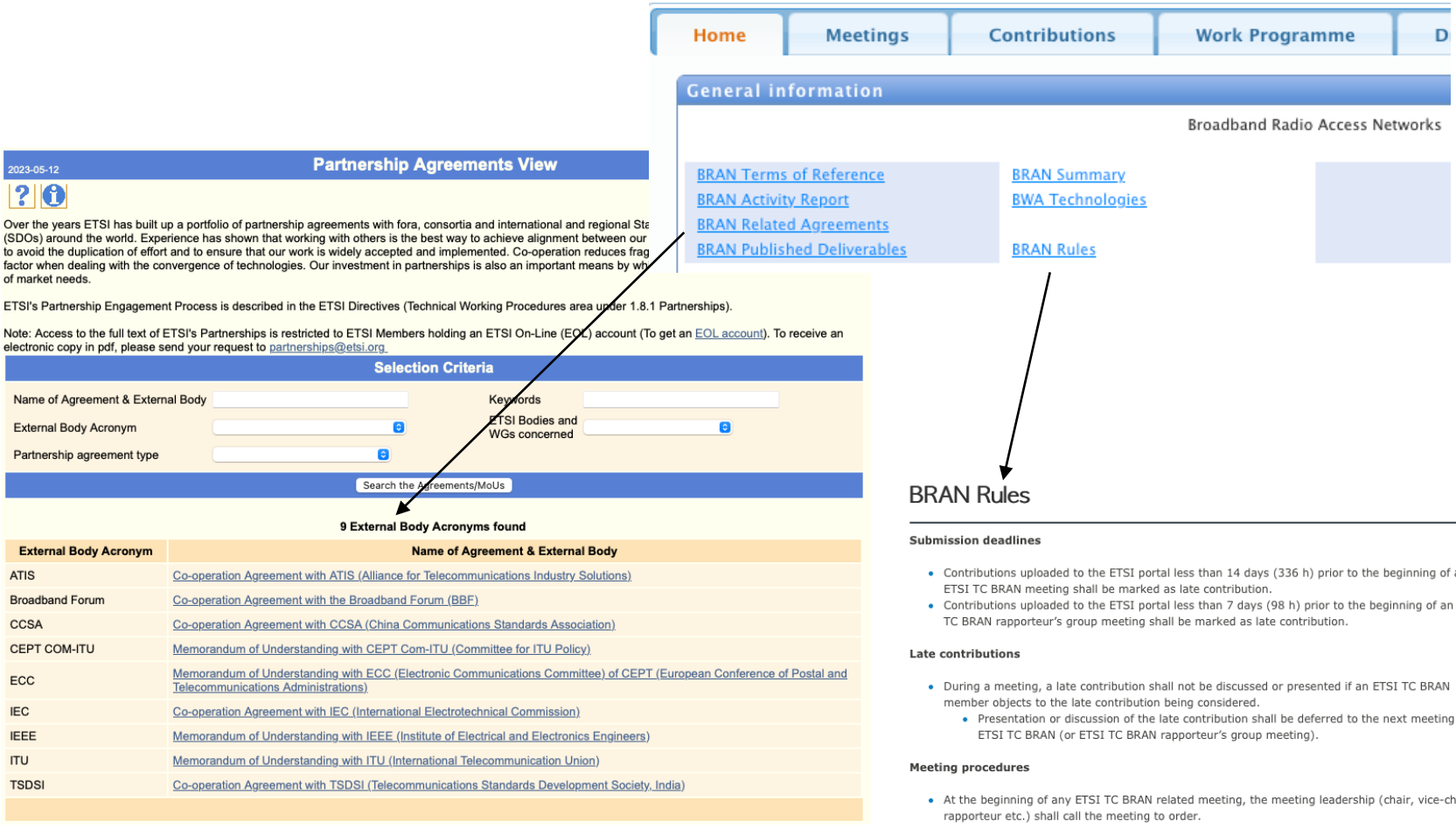


ETSI portal features (2)

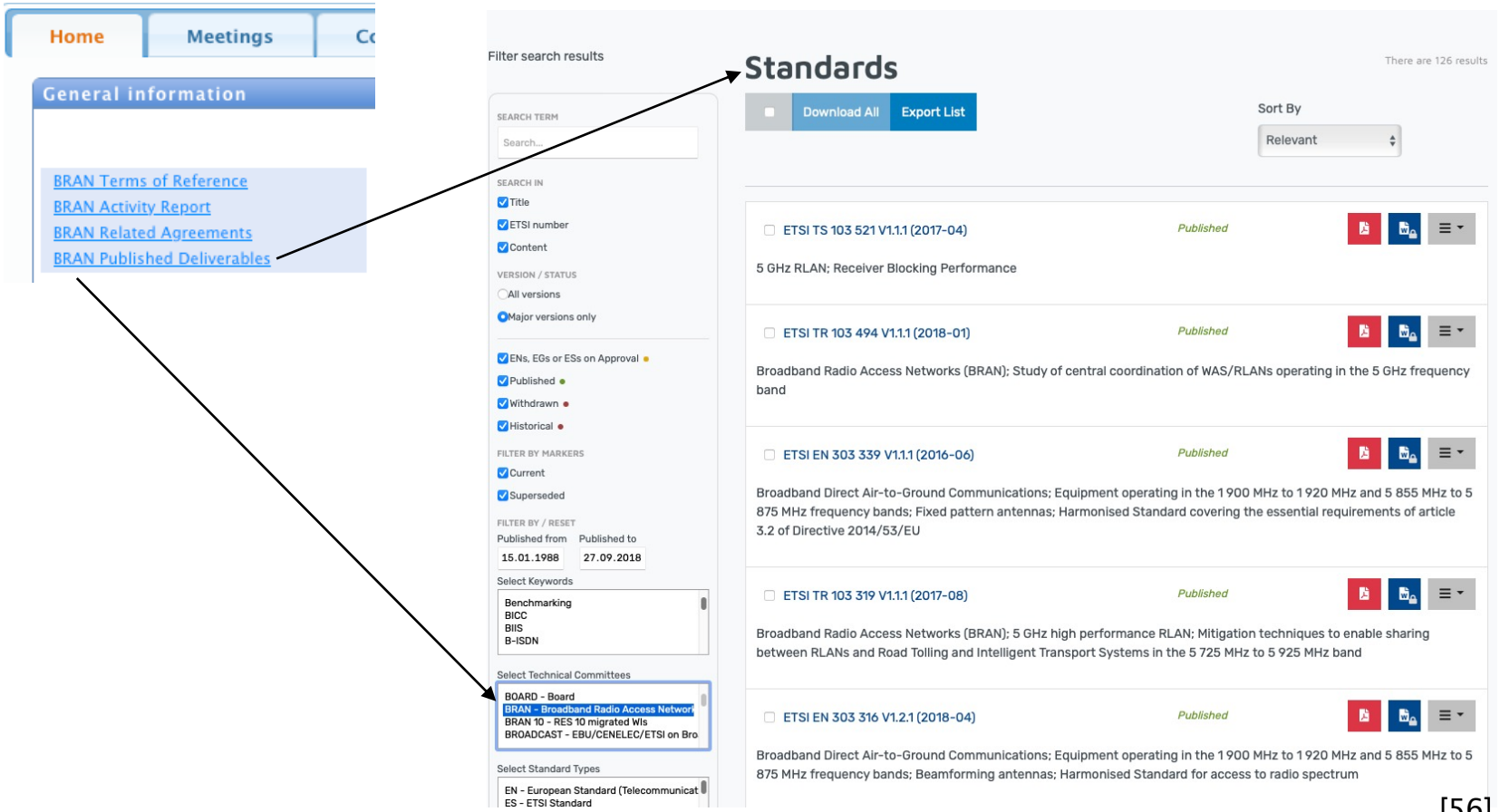
- **Member information**
  - Contact data etc.
- **E-mail list membership management, access, and archives**
- **ETSI voting tool**
- **Admission of new ETSI members**



ETSI portal features (3)

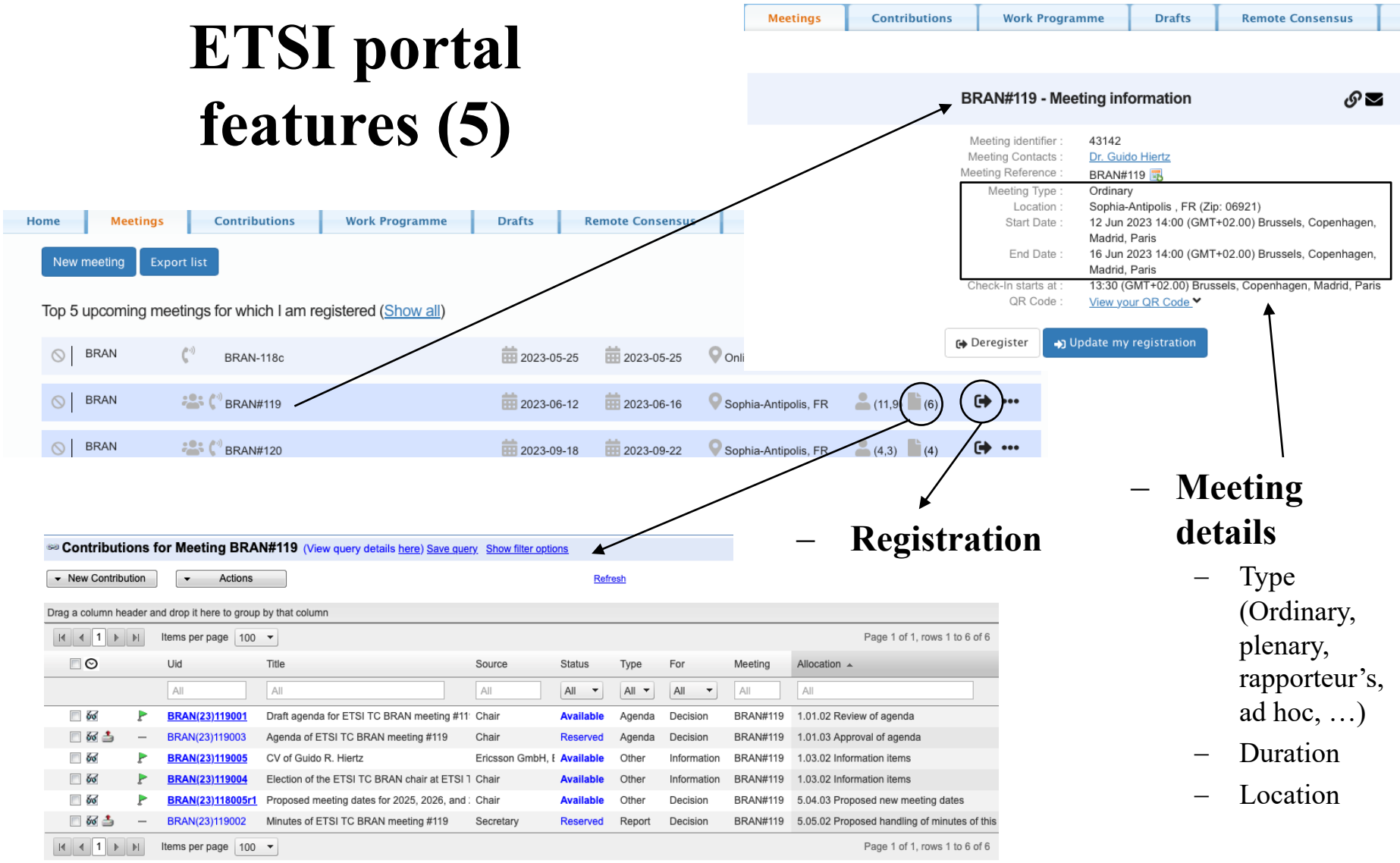


ETSI portal features (4)



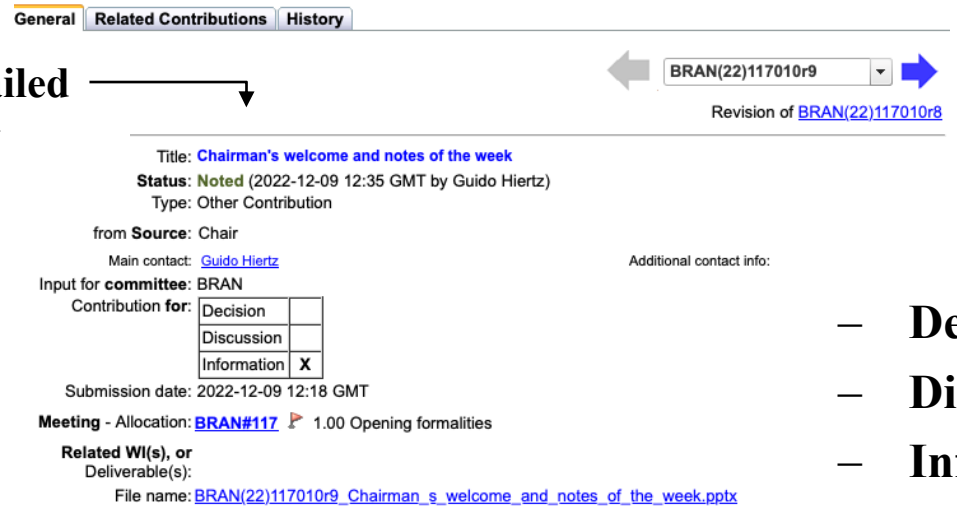
[56]

ETSI portal features (5)



- **Registration**
- **Meeting details**
  - Type (Ordinary, plenary, rapporteur's, ad hoc, …)
  - Duration
  - Location

ETSI portal features (6)



- Decision
- Discussion
- Information

Uid	Title	Source	Status	Type	For	Meeting
	All	All	All	All	All	All
BRAN(22)117002	Minutes of ETSI TC BRAN meeting #117	Secretary	Accepted	Report	Decision	BRAN#117
BRAN(22)115010	EC comments on EN 303 722	Chair	Noted	Other	Discussion	BRAN#117
BRAN(22)117010r9	Chairman's welcome and notes of the week	Chair	Noted	Other	Information	BRAN#117

Part of remote consensus

Submitted after deadline

BRAN(22)115010
- Submitted 2022
- For meeting 115
- Document number 010 at meeting #115
- Reassigned to meeting #117

Submitter

- Accepted (green)
- Rejected (red)
- Noted (olive)
- Available (blue)

- Agenda
- Report
- LSin
- LSout
- Other
- Change Request (CR)
- …

Appendix B

Essential requirements—HS EN 301 893 as an example

Major aspects in EN 301 893 (1)

- **Requirements for radar detection**
  - Definition of pulse patterns
  - Rules for vacating radar channels
- **Adaptivity (Medium Access)**
  - Load Based Equipment (LBE)
    - Similar to IEEE 802.11
  - Frame Based Equipment (FBE)
    - May access medium at discrete times
    - Sensing but no backoff process

4.2.7.3.2.6 Initiating Device Channel Access Mechanism

Before a transmission or a burst of transmissions on an *Operating Channel*, the *Initiating Device* shall operate at least one *Channel Access Engine* that executes the procedure described in step 1) to step 8) below. This *Channel Access Engine* makes use of the parameters defined in table 7 or table 8 in clause 4.2.7.3.2.4.

A single *Observation Slot* as defined in clause 3.1 and as referenced by the procedure in the present clause shall have a duration of not less than 9 µs.

An *Initiating Device* shall operate at least one and no more than four different *Channel Access Engines* each with a different *Priority Class* as defined in clause 4.2.7.3.2.4:

1) The *Channel Access Engine* shall set CW to CW_{min}.
2) The *Channel Access Engine* shall select a random number q from a uniform distribution over the range 0 to CW. Note 2 in table 7 defines an alternative range for q when the previous or next *Channel Occupancy Time* is greater than the maximum *Channel Occupancy Time* specified in table 7.
3) The *Channel Access Engine* shall initiate a *Prioritization Period* as described in step 3) a) to step 3) c):
   a) The *Channel Access Engine* shall set p according to the *Priority Class* associated with this *Channel Access Engine*. See clause 4.2.7.3.2.4.
   b) The *Channel Access Engine* shall wait for a period of 16 µs.
   c) The *Channel Access Engine* shall perform a *Clear Channel Assessment (CCA)* on the *Operating Channel* during a single *Observation Slot*:
      i) The *Operating Channel* shall be considered occupied if other transmissions within this channel are detected with a level above the *ED threshold* defined in clause 4.2.7.3.2.5. In this case, the *Channel Access Engine* shall initiate a new *Prioritization Period* starting with step 3) a) after the energy within the channel has dropped below the *ED threshold* defined in clause 4.2.7.3.2.5.
      ii) In case no energy within the *Operating Channel* is detected with a level above the *ED threshold* defined in clause 4.2.7.3.2.5, p may be decremented by not more than 1. If p is equal to 0, the *Channel Access Engine* shall proceed with step 4), otherwise the *Channel Access Engine* shall proceed with step 3) c).
4) The *Channel Access Engine* shall perform a *Backoff Procedure* as described in step 4) a) to step 4) d):
   a) This step verifies if the *Channel Access Engine* satisfies the *Post Backoff* condition. If q < 0 and the *Channel Access Engine* is ready for a transmission, the *Channel Access Engine* shall set CW equal to CW_{min} and shall select a random number q from a uniform distribution over the range 0 to CW before proceeding with step 4) b). Note 2 in table 7 defines an alternative range for q when the previous or next *Channel Occupancy Time* is greater than the maximum *Channel Occupancy Time* specified in table 7.

[79]

Major aspects in EN 301 893 (2)

- **Rules for channel bonding**
- **Maximum transmit power**
- **Spectral masks**
- **Detection thresholds for Listen-before-Talk (LBT)**
- **Description of various tests**
  - Adaptivity, radar detection, sensing thresholds, channel bonding, …

4.2.4.2 Transmitter unwanted emissions within the 5 GHz RLAN bands

4.2.4.2.1 Definition

Transmitter unwanted emissions within the 5 GHz RLAN bands are radio frequency emissions within the 5 GHz RLAN bands defined in clause 3.1.

4.2.4.2.2 Limits

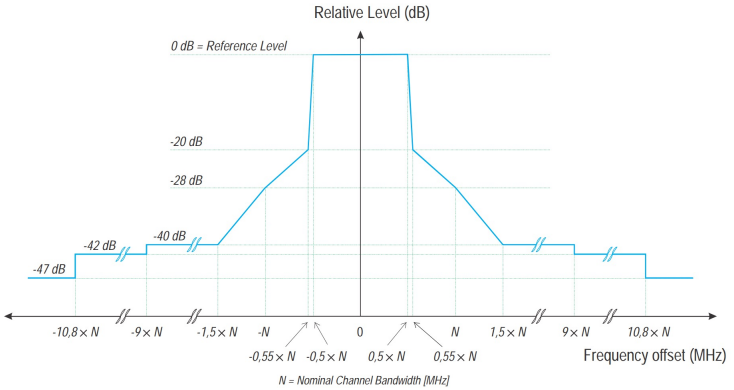


Figure 1: Transmit spectral power mask

[79]

What is is new in version 2.1.1?

- **Until version 1.8.1**
  - Requirements focusing on device
  - Generic concept defining maximum transmit duration dependent on random medium access deferral
  - Simple tests measuring duty cycle etc.

- **From version 2.1.1**
  - Fixed channel raster
    - Temporal minimal bandwidth of 2 MHz
  - Testing system behavior
    - Channel access behavior of device under test (DUT) and companion
    - Duration of DUT and companion device transmissions not to exceed TXOP (Channel Occupancy Time, COT) threshold
  - Very detailed LBE requirements
    - Testing backoff behavior, measuring statistics etc.
  - Restricting user access to software and device behavior
    - Must not disable radar detection
  - Deferral to different modulated signals
    - Not only testing gaussian noise

[79]

Important terminology

- **HSs must be technology-neutral**
  - No technology specific exceptions or assignments
  - Therefore, EN 301 893 introduces some generic terms
- **A selection of terms most important to Load Based Equipment (IEEE 802.11) on the right →**

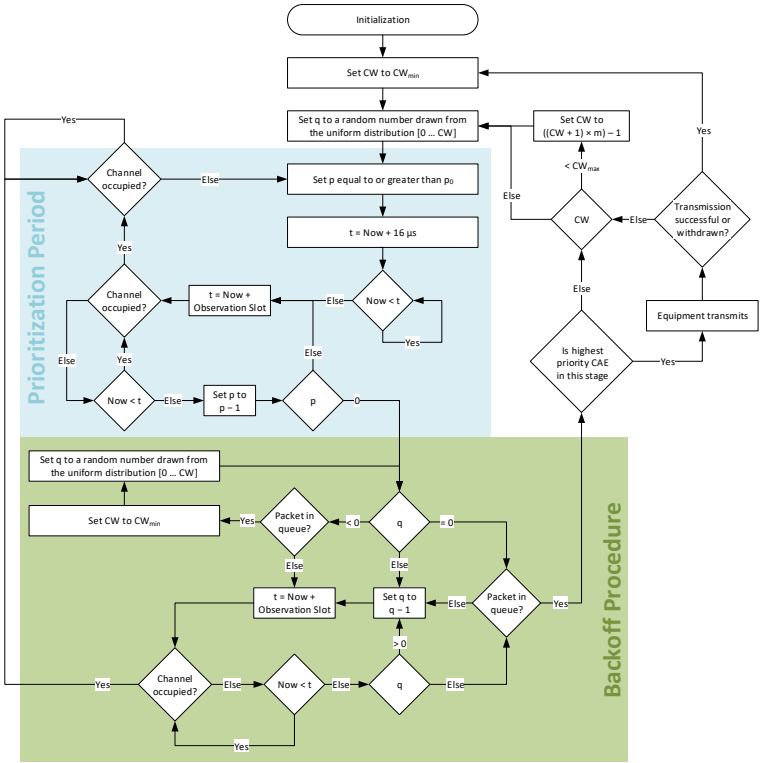
- **Terms important to IEEE 802.11**
  - Initiating Device
    - TXOP owner
  - Responding Device
    - Device addressed by TXOP owner
  - Supervising Device
    - AP STA
  - Supervised Device
    - Non-AP STA
  - Channel Occupancy Time (COT)
    - TXOP
  - p_0
    - AIFSN
  - q
    - Backoff counter

[79]

Remark: The statement in this 2019 presentation requires clarification. The EC does not mandate that HSs must be technology-neutral. However, "[…] European standards and European standardisation deliverables shall be market-driven, take into account the public interest as well as the policy objectives clearly stated in the Commission's request and based on consensus. […]" so that
- "[…] technical specifications have market acceptance and their implementations do not hamper interoperability with the implementations of existing European or international standards. […]
- the technical specifications were developed on the basis of open decision-making accessible to all interested parties in the market or markets affected by those technical specifications; […]
- specifications need to respond to market needs and regulatory requirements; […]
- specifications whenever possible are performance oriented rather than based on design or descriptive characteristics; […]
- specifications do not distort the market or limit the possibilities for implementers to develop competition and innovation based upon them; […]
- specifications are based on advanced scientific and technological developments […]." [48]

LBE adaptivity

- **Emulating EDCA**
  - Prioritization period ≡ AIFS[AC]
  - Backoff procedure ≡ CW[AC] dependent random waiting
  - Virtual collisions etc.
- **DCF & "Post-backoff" behavior are permitted**



[79]

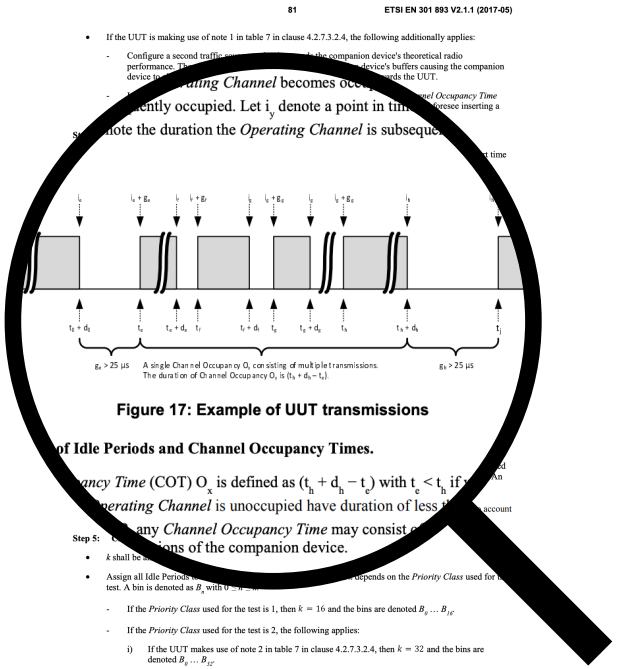
What are essential requirements?

- **Basically, all "shall" statements**
- **Examples**
  - Radar detection
  - Unwanted emissions
    - Inside band
    - Outside band
  - Receiver blocking
  - Channel bonding, spectral masks
  - Power density
    - Max transmit power
  - LBT thresholds
    - Deferral to modulated signals & noise
  - Backoff behavior
    - Slot distribution
  - Maximum TXOP duration

[79]

Example: Backoff test (1)

- **EN 301 893 defines a Channel Occupancy Time (COT = TXOP) as sequence of transmissions having no gaps of more than 25 µs duration**
  - Defined by occupied and unoccupied periods
  - Used to classify measurements



81 ETSI EN 301 893 V2.1.1 (2017-05)

- If the UUT is making use of note 1 in table 7 in clause 4.2.7.3.2.4, the following additionally applies:
  - Configure a second traffic ... the companion device's theoretical radio performance. Th... device's buffers causing the companion device to ... wards the UUT.
  - ... *Operating Channel* becomes occ... *Channel Occupancy Time* ... ently occupied. Let i_y denote a point in tim... foresee inserting a ... note the duration the *Operating Channel* is subsequ... ur time

i_x $i_x + g_x$ i_y $i_y + g_y$ i_z $i_z + g_z$ i_y $i_y + g_y$ i_k

$t_g + d_g$ t_x $t_x + d_x$ t_y $t_y + d_y$ t_z $t_z + d_z$ t_k $t_k + d_k$ t_j

$g_x > 25$ µs A single Channel Occupancy O_x consisting of multiple transmissions. The duration of Channel Occupancy O_x is $(t_k + d_k - t_x)$. $g_k > 25$ µs

Figure 17: Example of UUT transmissions

...of Idle Periods and Channel Occupancy Times.

...*ancy Time* (COT) O_x is defined as $(t_h + d_h - t_e)$ with $t_e < t_h$ if ... ed ... An ... *perating Channel* is unoccupied have duration of less t... account ... any *Channel Occupancy Time* may consist ... ions of the companion device.

Step 5: ...

- k shall be ...
- Assign all Idle Periods ... depends on the *Priority Class* used for t... test. A bin is denoted as B_n with $0 \le n \le ...$
  - If the *Priority Class* used for the test is 1, then $k = 16$ and the bins are denoted $B_0 \dots B_{15}$.
  - If the *Priority Class* used for the test is 2, the following applies:
    - i) If the UUT makes use of note 2 in table 7 in clause 4.2.7.3.2.4, then $k = 32$ and the bins are denoted $B_0 \dots B_{31}$.

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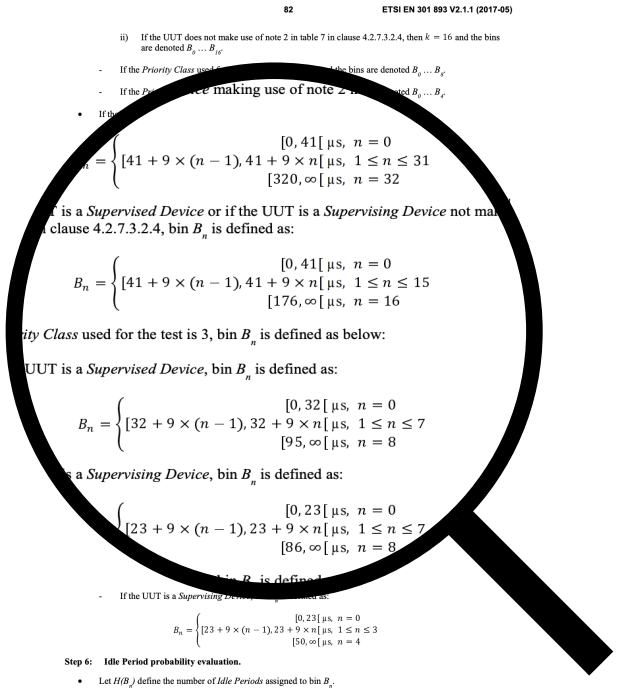
[79]

Example: Backoff test (2)

- **EN 301 893 translates the adaptivity requirements on the truncated exponential backoff into discrete bins of certain duration**
  - Depends on priority and device category (e.g. non-AP STA or AP STA)



82 ETSI EN 301 893 V2.1.1 (2017-05)

ii) If the UUT does not make use of note 2 in table 7 in clause 4.2.7.3.2.4, then $k = 16$ and the bins are denoted $B_0 \dots B_{16}$.

- If the *Priority Class* used for the test is 3, bin B_n is defined as below:
- If the UUT is a *Supervised Device*, bin B_n is defined as:

$$B_n = \begin{cases} [0, 41[\ \mu s, & n = 0 \\ [41 + 9 \times (n-1), 41 + 9 \times n[\ \mu s, & 1 \le n \le 15 \\ [176, \infty[\ \mu s, & n = 16 \end{cases}$$

- If the UUT is a *Supervising Device*, bin B_n is defined as:

$$B_n = \begin{cases} [0, 23[\ \mu s, & n = 0 \\ [23 + 9 \times (n-1), 23 + 9 \times n[\ \mu s, & 1 \le n \le 3 \\ [50, \infty[\ \mu s, & n = 4 \end{cases}$$

Step 6: Idle Period probability evaluation.

- Let $H(B_n)$ define the number of *Idle Periods* assigned to bin B_n.

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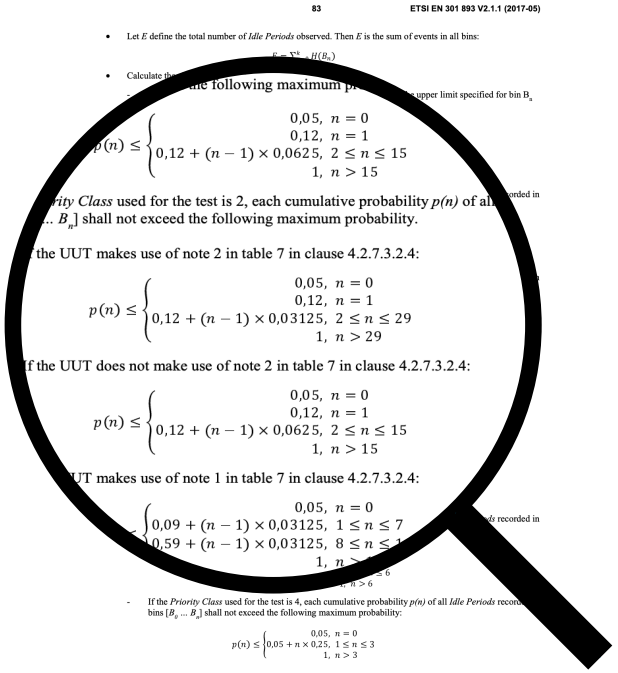
[79]

Example: Backoff test (3)

- **A Cumulative Distribution Function (CDF) describes a tolerable probability per bin**
  - Devices fail if probability of bins are exceeded
  - Devices may always wait longer than permitted
    - Less aggressive behavior



83 ETSI EN 301 893 V2.1.1 (2017-05)

- Let E define the total number of *Idle Periods* observed. Then E is the sum of events in all bins:

$$E = \sum_{n=0}^{k} H(B_n)$$

- Calculate the following maximum p

- B_n upper limit specified for bin B_n

$$p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}12, & n = 1 \\ 0{,}12 + (n-1) \times 0{,}0625, & 2 \leq n \leq 15 \\ 1, & n > 15 \end{cases}$$

rity Class used for the test is 2, each cumulative probability *p(n)* of all ... B_n] shall not exceed the following maximum probability.

the UUT makes use of note 2 in table 7 in clause 4.2.7.3.2.4:

$$p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}12, & n = 1 \\ 0{,}12 + (n-1) \times 0{,}03125, & 2 \leq n \leq 29 \\ 1, & n > 29 \end{cases}$$

f the UUT does not make use of note 2 in table 7 in clause 4.2.7.3.2.4:

$$p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}12, & n = 1 \\ 0{,}12 + (n-1) \times 0{,}0625, & 2 \leq n \leq 15 \\ 1, & n > 15 \end{cases}$$

UT makes use of note 1 in table 7 in clause 4.2.7.3.2.4:

$$\begin{cases} 0{,}05, & n = 0 \\ 0{,}09 + (n-1) \times 0{,}03125, & 1 \leq n \leq 7 \\ 0{,}59 + (n-1) \times 0{,}03125, & 8 \leq n \leq \\ 1, & n > 6 \end{cases}$$

ds recorded in

- If the *Priority Class* used for the test is 4, each cumulative probability *p(n)* of all *Idle Periods* record... bins [B_0 ... B_n] shall not exceed the following maximum probability:

$$p(n) \leq \begin{cases} 0{,}05, & n = 0 \\ 0{,}05 + n \times 0{,}25, & 1 \leq n \leq 3 \\ 1, & n > 3 \end{cases}$$

ETSI

[79]

Do these requirements matter to IEEE 802.11 implementations?

- **[80] finds many devices violating requirements defined in HS EN 301 893**
  - A vendor must not place these products on the market of the EU by self-assessment
  - Should vendors intend to place these products on the market of the EU, a notified body permission is required
- **Without notified body approval, EU market surveillance may remove non-compliant products from the EU market**
- **Independently, [81] finds the same issues in current product implementations**
  - Thus, confirming the results in [80]

Appendix C

Guides by the European Commission

The EC's Blue & RED guides, and the EC's Vademecum

Blue Guide [69]

- Guide to New Legislative Framework (NLF)
- Discusses legislation for non-food products
- Review of making available and placing products on the market
- Modules and conformity assessments

RED Guide [70]

- Guide to Radio Equipment Directive (RED) [28]
- What is a radio equipment?
- Which devices apply to RED?
- Antennas, receivers etc.
- Fixed and vehicle installations, …

Vademecum [71]-[74]

- The role of the EC in requesting standards
- Standards request as an implementing act
- Roles of ESOs and stakeholders
- Preparation of standards & legal requirements to be covered
- Guidelines on executing standardization requests
- Development of standards
- Selection of normative references
- Compliance of standard with request

Appendix D

Background related to Harmonized Standards being part of EU legislation

The search for legal certainty

- **In 2016, the European Court of Justice concluded [78] that HSs "form 'part of Union law'" [77]**
  - This decision has major consequences
- **Thus, is the EC liable for HS developed based on its mandates?**
  - See discussion [76]
- **Because of the court's decision, the EC lists HSs in the OJEU's legislation series**
  - In the past, EC listed HSs in the communication series of the OJEU
- **From the court's decision, EC concluded that it has special responsibility for HSs**
  - Therefore, there is a push for "legal certainty" in HSs

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