ECC(14)008 Annex 03

Interim Report

Interim Report from CEPT to the European Commission in response to the Mandate

To study and identify harmonised compatibility and sharing conditions for Wireless Access Systems including Radio Local Area Networks in the bands 5350-5470 MHz and 5725-5925 MHz ('WAS/RLAN extension bands') for the provision of wireless broadband services

**Interim Report approved on DD March 2014 by the ECC**

# Executive summary

This Interim report has been developed within European Conference of Postal and Telecommunications Administrations (CEPT) in the framework of the EC Mandate on the 5GHz WAS/RLAN extension bands (see Annex 1).

CEPT was mandated to undertake the following tasks:

**Task 1 – Identification of compatibility and sharing scenarios**

Taking into account the relevant developments since the completion of the original studies carried out prior to WRC-03 for the bands 5150-5350 MHz and 5470-5725 MHz, to study and identify harmonised compatibility and sharing scenarios for WAS/RLANs in the bands 5350-5470 MHz and 5725-5925 MHz based on the latest generation of WAS/RLAN equipment (EN 301 893 v. 1.6.1. or 1.7.1. [30]) and to define relevant protection parameters and conditions in close cooperation with all concerned stakeholders for:

1.1. Ensuring the planned operation of GMES/Copernicus (such as availability of proper satellite data based on SAR imaging systems) within the band 5350-5470 MHz.

1.2. Ensuring safety-related operation of ground-based ITS systems in the band 5875-5905 MHz in line with the provisions of Decision 2008/671/EC [1]

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1.3. Facilitating coexistence between RLAN systems and other existing usage in various Member States in and adjacent to the bands 5350-5470 MHz and 5725- 5925 MHz as listed in the annex, including FSS in the band 5725-5925 MHz and radiolocation applications in the bands 5350-5470 MHz and 5725-5850 MHz.

1.4. Assessing the impact, if any, of the future use of WAS/RLAN systems in the WAS/RLAN extension bands on SRDs operating in the bands 4500-7000 MHz, 5725-5875 MHz and 5795-5805 MHz according to the parameters harmonised in Decision 2006/771/EC [2].

For each compatibility and sharing scenario, the risk of interference, the deployment assumptions of all applications and the operational footprint of the actual use of the protected services/applications should be identified. In addition, it should also be assessed whether and how coexistence can be ensured between the future WAS/RLAN usage, as an essential element of the wireless broadband EU priority, and other uses of the 5 GHz band that are currently considered on a shared basis, taking into account studies on-going in CEPT.

**Task 2 – Development of compatibility and sharing conditions**

Taking into account the expected development of WAS/RLAN technology and of the relevant standards until 2020, in particular the use of larger channel bandwidths, as well as the outcome of Task 1, appropriate mitigation techniques and/or operational compatibility and sharing conditions should be developed in close cooperation with all concerned stakeholders.

Based on the working assumption that WAS/RLANs would operate on a co-primary basis under an appropriate mobile allocation in the whole 5150 MHz to 5925 MHz band, and in the light of experience, the compatibility and sharing conditions should in particular identify the technical parameters that would be needed to ensure in the internal market consistent harmonised conditions and requirements for WAS/RLANs operating on a shared basis across the entire 5 GHz band.

To enable WAS/RLANs to operate on the basis of a general authorisation only those requirements should be implementable on the basis of harmonised standards and foster economies of scale in order to meet EU spectrum policy objectives, in particular taking into account sharing technologies and mitigation approaches implemented for existing WAS/RLAN equipment. These requirements should also take into account the regulatory and enforcement context of general authorisation. The compatibility and sharing conditions should also define the coexistence criteria that need to be taken into account by any other potential future use of the 5 GHz band in order to avoid interference with WAS/RLAN usage of the 5 GHz band.

**Task 3 – Review of compatibility and sharing conditions after WRC-15**

Taking utmost account of the possibility of international harmonisation, to assess the need to review and/or reconfirm the compatibility and sharing conditions developed under task 2 for the Final report based on the result of WRC-15, in the event that this would have a material effect on the parameters chosen for completion of tasks 1 and 2.

In addition CEPT has also noted the following from the mandate:

“In the work carried out under the Mandate, the overall policy objectives of the RSPP, such as effective and efficient spectrum use and the support for specific Union policies shall be given utmost consideration. In implementing this mandate, the CEPT shall, where relevant, take utmost account of EU law applicable and support the principles of service and technological neutrality, non-discrimination and proportionality insofar as technically possible.

CEPT is also requested to collaborate actively with all concerned stakeholders and the European Telecommunications Standardisation Institute (ETSI) which develops harmonised standards for conformity under Directive 1999/5/EC [35]”.

The status of the CEPT work in response to the tasks of the Mandate is presented in the relevant sections of this report.

This is the Interim Report from CEPT to the Commission including the description of work undertaken and interim results under tasks (1) and (2) of the Mandate. CEPT ECC confirmed that currently the work is progressing according the time schedule of the mandate.

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**LIST OF ABBREVIATIONS**

|  |  |
| --- | --- |
| **Abbreviation** | **Explanation** |
| **AM(R)S** | Aeronautical Mobile (Route) Service |
| **AMS(R)S** | Aeronautical Mobile Satellite (Route) Service |
| **AS** | Aircraft Station |
| **BFWA** | Broadband Fixed Wireless Access |
| **CEN** | Committee for European Normalisation |
| **CEPT** | European Conference of Postal and Telecommunications Administrations |
| **CPE** | Customer Premises Equipment |
| **DA2GC** | Direct Air To Ground Communications |
| **DAA** | Detect And Avoid |
| **DFS** | Dynamic Frequency Selection |
| **DSRC** | Dedicated Short Range Communication |
| **EBU** | European Broadcasting Union |
| **EC** | European Commission |
| **ECC** | Electronic Communications Committee |
| **ECCM** | Electronic-Counter-Counter-Measures |
| **ECO** | European Communications Office |
| **EESS** | Earth Exploration Satellite Service |
| **EFIS** | ECO Frequency Information System |
| **EME** | Earth-Moon-Earth |
| **ERC** | European Radiocommunications Committee |
| **ESA** | European Space Agency |
| **ETSI** | European Telecommunications Standards Institute |
| **EU** | European Union |
| **FCC** | Federal Communications Commission |
| **FSS** | Fixed Satellite Service |
| **GDDN** | Ground Data Dissemination Network |
| **GMDSS** | Global Maritime Distress and Safety System |
| **GMES** | Global Monitoring for Environment and Security |
| **GS** | Ground Station |
| **GSO** | Geostationary |
| **ISM** | Industrial, scientific and medical |
| **ITS** | Intelligent Transport Systems |
| **ITU** | **International Telecommunication Union** |
| **LEO** | Low Earth Orbit |
| **LBT** | Listen Before Transmit |
| **MCL** | Minimum Coupling Loss |
| **OBU** | On-Board Units |
| **P-MP** | Point-to-Multipoint |
| **RSCOM** | Radio Spectrum Committee |
| **RSU** | Road Side Units |
| **RTTT** | Road Transport Telematics Systems |
| **SAR** | Synthetic Aperture Radar |
| **SRD** | Short Range Devices |
| **TPC** | Transmit Power control |
| **TR** | Technical Report |
| **TTT** | Transport Telematics Systems |
| **UNHCR** | United Nations High Commissioner for Refugees |
| **UNII** | Unlicensed National Information Infrastructure |
| **WAIC** | Wireless Avionics Intra-Communications |
| **WAS/RLAN** | Wireless Access Systems including Radio Local Area Networks |
| **WG FM** | Working Group Frequency Management |
| **WG SE** | Working Group Spectrum Engineering |
| **WIA** | Wireless Industrial Applications |
| **WIFI** | Wireless Fidelity |
| **WMO** | World Meteorological Organisation |
| **WRC** | World Radio Conference |

# Introduction

ECC considered the various tasks (1, 2 & 3) as described in the EC Mandate on 5 GHz Extension Bands in order to respond to the mandate according to the time schedule of the mandate.

This interim report is providing an overview of the current on-going ECC activities on:

**Task 1 – Identification of compatibility and sharing scenarios for possible introduction of WAS/RLANs in the bands 5350-5470 MHz and 5725-5925 MHz**

* 1. Ensuring the planned operation of GMES/Copernicus (such as availability of proper satellite data based on SAR imaging systems) within the band 5350- 5470 MHz.
  2. Ensuring safety-related operation of ground-based ITS systems in the band 5875-5905 MHz in line with the provisions of Decision 2008/671/EC [1]
  3. Facilitating coexistence between RLAN systems and other existing usage in various Member States in and adjacent to the bands 5350-5470 MHz and 5725- 5925 MHz as listed in the annex, including FSS in the band 5725-5925 MHz and radiolocation applications in the bands 5350-5470 MHz and 5725-5850 MHz.
  4. Assessing the impact, if any, of the future use of WAS/RLAN systems in the WAS/RLAN extension bands on SRDs operating in the bands 4500-7000 MHz, 5725-5875 MHz and 5795-5805 MHz according to the parameters harmonised in Decision 2006/771/EC [2].

**Task 2 – Development of compatibility and sharing conditions**

* 1. Taking into account the expected development of WAS/RLAN technology and of the relevant standards until 2020, in particular the use of larger channel bandwidths, as well as the outcome of Task 1,
  2. Appropriate mitigation techniques and/or operational compatibility and sharing conditions should be developed in close cooperation with all concerned stakeholders.
  3. Based on the working assumption that WAS/RLANs would operate on a co-primary basis under an appropriate mobile allocation in the whole 5150 MHz to 5925 MHz band,

# Information on services/applications in the Bands under study

CEPT ECC have made an assessment of the services to be studied in the possible extension bands that have been identified for WAS/RLANs 5350-5470 MHz, 5725-5850 MHz and 5850-5925 MHz.

The excerpt of the latest edition of ERC Report 25 [3] the European Common Allocation is provided in ANNEX 2: of this interim report.

## 5350 - 5470 MHz

1. Allocations in 5350-5470 MHz

| **Region 1** | **Region 2** | **Region 3** |
| --- | --- | --- |
| **5 350-5460 MHz**  AERONAUTICAL RADIONAVIGATION (5.449)  RADIOLOCATION (5.448D)  EARTH EXPLORATION-SATELLITE (ACTIVE) (5.448B)  SPACE RESEARCH (ACTIVE) (5.448C) | | |
| **5460-5470 MHz** 5.448B  SPACE RESEARCH (ACTIVE)  RADIOLOCATION (5.448D)  RADIONAVIGATION (5.449)  EARTH EXPLORATION-SATELLITE (ACTIVE) | | |

**Relevant RR Article 5 footnotes:**

**5.448B** The Earth exploration-satellite service (active) operating in the band 5 350-5 570 MHz and space research service (active) operating in the band 5 460-5 570 MHz shall not cause harmful interference to the aeronautical radionavigation service in the band 5 350-5 460 MHz, the radionavigation service in the band 5 460-5 470 MHz and the maritime radionavigation service in the band 5 470-5 570 MHz. (WRC-03)

**5.448C** The space research service (active) operating in the band 5 350-5 460 MHz shall not cause harmful interference to nor claim protection from other services to which this band is allocated. (WRC-03)

**5.448D** In the frequency band 5 350-5 470 MHz, stations in the radiolocation service shall not cause harmful interference to, nor claim protection from, radar systems in the aeronautical radionavigation service operating in accordance with No. **5.449**. (WRC-03)

**5.449** The use of the band 5 350-5 470 MHz by the aeronautical radionavigation service is limited to airborne radars and associated airborne beacons.

### Existing users

#### Radiolocation and Radiodetermination applications

The band is utilised for a variety of radiodetermination applications falling within the radionavigation and radiolocation services. This includes defence systems including tactical and weapon system radars, position fixing, ship borne and vessel traffic and coastal surveillance radars, ground based and airborne weather radars. The band is also used by tank level probing radars as specified in ETSI EN 302 372 [4] and ERC/REC 70-03 [5].

#### Active sensors (Earth Exploration satellites)

The band is used by the Global monitoring for environment and security (GMES) / Copernicus system, that is carried out in partnership with the Member States and the European Space Agency (ESA) for which COM(2012)218 [6] was agreed (not a regulatory text but an Intergovernmental Agreement for the operation of the European Earth monitoring programme (GMES) from 2014 to 2020).

Regulation No 911/2010 [7] of the European Parliament and of the Council of 22 September 2010 on the European Earth monitoring programme (GMES) and its initial operations (2011 to 2013) applies.

The possible expansion of RLAN in the 5 GHz range concerns the band 5350-5470 MHz which is used by Sentinel-1 and Sentinel-3 for observation purposes. The space component is using this band on-board the series of SENTINEL satellites, such as for Synthetic Aperture Radar (SAR) (central frequency: 5405 MHz, with a bandwidth of 90 MHz) on Sentinel-1 satellites and Altimeter (central frequency 5410 MHz with a bandwidth of 320 MHz) on Sentinel-3 satellites.

The band is also used by EESS (active) instruments from other countries such as the Canadian constellation Radarsat.

### Proposals for new additional use

Wireless Avionics Intra-Communications (WAIC) WRC-15 AI 1.17

The band 5350-5460 MHz has been considered during preparation to the WRC-15 AI 1.17 and is not considered by CEPT as suitable for WAIC.

## 5725 - 5850 MHz

1. Allocations in 5725-5850 MHz

| **Region 1** | **Region 2** | **Region 3** |
| --- | --- | --- |
| 5 725-5 830  FIXED-SATELLITE (Earth-to-space)  RADIOLOCATION  Amateur  5.150 5.451 5.453 5.455 5.456 | 5 725-5 830  RADIOLOCATION  Amateur  5.150 5.453 5.455 | |
| 5 830-5 850  FIXED-SATELLITE (Earth-to-space)  RADIOLOCATION  Amateur  Amateur-satellite (space-to-Earth)  5.150 5.451 5.453 5.455 5.456 | 5 830-5 850  RADIOLOCATION  Amateur  Amateur-satellite (space-to-Earth)  5.150 5.453 5.455 | |

**Relevant RR Article 5 footnotes:**

5.150 The following bands: 5 725-5 875 MHz (centre frequency 5 800 MHz), and are also designated for industrial, scientific and medical (ISM) applications. Radio communication services operating within these bands must accept harmful interference which may be caused by these applications. ISM equipment operating in these bands is subject to the provisions of No. 15.13.

5.451 Additional allocation: in the United Kingdom, the band 5 470-5 850 MHz is also allocated to the land mobile service on a secondary basis. The power limits specified in Nos. 21.2, 21.3, 21.4 and 21.5 shall apply in the band 5 725-5 850 MHz.

5.455 Additional allocation: in Armenia, Azerbaijan, Belarus, Cuba, the Russian Federation, Georgia, Hungary, Kazakhstan, Latvia, Moldova, Mongolia, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the band 5 670-5 850 MHz is also allocated to the fixed service on a primary basis. (WRC-03)

1. Applications in 5725-5850 MHz

| **Frequency range** | **European Common Allocation** | **ECC/ERC**  **harmonisation**  **measures** | **Application** | **European**  **footnotes** | **Standard** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| 5725-5830 MHz | FIXED-SATELLITE (E/S)  RADIOLOCATION  Amateur  Mobile  5.150 EU2  EU22 |  | Amateur |  | EN 301 783 |  |
| ECC/REC/(06)04 | BFWA |  | EN 302 502 | Within the band 5725-5875 MHz |
|  | Defence systems |  |  | Tactical and weapon system radars |
|  | ISM |  | EN 300 440 | Within the band 5725-5875 MHz |
| ERC/REC 70-03 | Non-Specific SRD |  | EN 302 372 | Within the band 5725-5875 MHz |
| ERC/REC 70-03 | Radiodetermination applications |  |  | Within the band 4500-7000 MHz for  TLPR application |
| ERC/REC 70-03 | TTT |  |  | Within the band 5795-5805 MHz.  TTT in the band 5805-5815 MHz  on a national basis |
|  | Weather Radars |  |  | Ground based and airborne |
| 5830-5850 MHz | FIXED-SATELLITE (E/S)  RADIOLOCATION  Amateur  Amateur Satellite (S/E)  Mobile  5.150 EU2  EU22 |  | Amateur Satellite (S/E) | EU23 |  | Within the band 5830-5850 MHz |
| ECC/REC/(06)04 | BFWA |  | EN 302 502 | Within the band 5725-5875 MHz |
|  | Defence systems |  |  | Tactical and weapon system radars |
|  | ISM |  |  | Within the band 5725-5875 MHz |
| ERC/REC 70-03 | Non-Specifics SRDs |  | EN 300 440 | Within the band 5725-5875 MHz |
| ERC/REC 70-03 | Radiodetermination applications |  | EN 302 372 | Within the band 4500-7000 MHz for  TLPR application |
|  | Weather radars |  |  | Ground based and airborne |

**Relevant EU footnote from the European Allocation Table (ECA Table):**

EU2: Civil-military sharing.

EU22: The band 5250-5850 MHz is utilised for a variety of radiodetermination applications falling within the radionavigation and radiolocation services. This band will be subject to further detailed consideration.

EU23 In the sub-bands 5660-5670 MHz (earth to space), 5830-5850 MHz (space to earth) and 10.45-10.50 GHz the amateur-satellite additionally operates on a secondary and non-interference basis to other services. In making assignments to other services, CEPT administrations are requested wherever possible to maintain these allocations in such a way as to facilitate the reception of amateur emissions with minimal power flux densities.

### Existing users

#### Radiolocation and Radiodetermination applications

The band 5250-5850 MHz is utilised for a variety of radiodetermination applications falling within the radionavigation and radiolocation services. This also includes defence systems such as tactical and weapon radars as well as weather radars (ground based and airborne).

Recommendation ITU-R M.1638 [8] provides characteristics of radars operating under the Radiolocation services in the frequency range 5250-5850 MHz. Within this range, the band between 5725 MHz and 5850 MHz is used by many different types of radars on fixed land-based, ship borne and transportable platforms. It should be noted that most of these radars are designed to operate not only in the 5725-5850 MHz band but in a larger portion of the band 5250-5850 MHz.

The following table contains technical characteristics of representative systems deployed in this band. This includes a subset of the radars contained in Recommendation ITU-R M.1638 [8], which are relevant for the frequency band 5725-5850 MHz (radars L, M, N, O and Q) and three additional radars operated by administrations within CEPT (X, Y and Z). This information is generally sufficient for calculation to assess the compatibility between these radars and other systems.

Frequency hopping is one of the most common Electronic-Counter-Counter-Measures (ECCM). Radar systems that are designed to operate in hostile electronic attack environments use frequency hopping as one of its ECCM techniques. This type of radar typically divides its allocated frequency band into channels. The radar then randomly selects a channel from all available channels for transmission. This random occupation of a channel can occur on a per beam position basis where many pulses on the same channel are transmitted or on a per pulse basis. This important aspect of radar systems should be considered and the potential impact of frequency hopping radar should be taken into account in sharing studies.

There are numerous radar types, accomplishing various missions, operating within the Radiolocation service throughout the whole range 5250-5850 MHz, and specifically within the 5725-5850 MHz band. Test range instrumentation radars are used to provide highly accurate position data on space launch vehicles and aeronautical vehicles undergoing developmental and operational testing. These radars are typified by high transmitter powers and large aperture parabolic reflector antennas with very narrow pencil beams. The radars have auto-tracking antennas which either skin-track or beacon-track the object of interest. Periods of operation can last from minutes up to 4-5 hours, depending upon the test program. Operations are conducted at scheduled times 24 hours/day, 7 days/week.

Shipboard sea and air surveillance radars are used for ship protection and operate continuously while the ship is underway as well as entering and leaving port areas. These surveillance radars usually employ moderately high transmitter powers and antennas which scan electronically in elevation and mechanically a full 360 degrees in azimuth. Operations can be such that multiple ships are operating these radars simultaneously in a given geographical area. Other special-purpose radars are also operated in the band 5250-5850 MHz.

Also, in this band operate tactical radar mounted on mobile vehicles used for providing airspace surveillance.

#### FSS (Earth to space 5725 - 5925 MHz)

FSS deployments use the whole band 5725-5875 MHz and it is used by transmitting earth stations in the Earth-to-space direction operating only to satellites in geostationary orbits. In the 125 MHz portion of the band up to 5850 MHz, this is a Region 1 allocation only (i.e. only Europe, Africa, and some of the northernmost countries in Asia). Above 5850 MHz the band is part of the heavily utilised FSS global uplink band and most of the currently operating satellites (INTELSAT & New Skies for instance) have receive transponders in this upper portion of the band. More than 55 satellites with C-band payloads operate over Europe; another 7 are under procurement (status: end of 2013). In Europe, the C-band supports a number of critical services such as aviation (AMS(R)S), emergency (emergency.lu, UNHCR), navigation (GDDN), maritime (GMDSS), meteorology (WMO) and public (e.g. EBU) services.

1. Sample Satellite Data taken from ITU filings for the band 5725-5875MHz

| **Satellite** | **Sub-satellite longitude** | **Part of frequency range 5725-5875 MHz used** |
| --- | --- | --- |
| A | 5o West | Whole band |
| B | 14o West | Whole band |
| C | 31.5o West | > 5850 MHz |
| D | 3o East | Whole band |
| E | 18o West | >5850MHz |
| F | 53o East | Whole band |
| G | 59.5o East | Whole band |
| H | 66o East | >5850 MHz |
| I | 359o East | >5850 MHz |

#### Amateur and Amateur-satellite

The amateur and amateur-satellite (s-E) services have harmonised allocations in all three ITU Regions in the frequency range 5725-5850 MHz with secondary status as follows:

1. Allocations for Amateur Services

| **Frequency** | **Service** |
| --- | --- |
| 5725-5830 MHz | Amateur |
| 5830-5850 MHz | Amateur  Amateur Satellite (space-to-Earth) |

The operational characteristics of amateur stations and amateur-satellite stations vary significantly. However based on the IARU Region-1 VHF Managers Handbook they can be categorised as:

* + Weak signal reception of Narrowband Terrestrial and EME (Earth-Moon-Earth- Moonbounce) operation in the sub-band 5760-5762 MHz, including propagation beacons;
  + Data and multimedia systems (point to-point links and area repeaters) in other parts of the band;
  + Low-power satellite downlinks within 5830-5850 MHz (typically from LEO Cubesat satellites).

EU footnote 17 of the European Common Allocation Table states that in the sub-band 5660-5670 MHz, the amateur service operates on a secondary basis. In making assignments to other services, CEPT administrations are requested wherever possible to maintain the sub-band in such a way as to facilitate the reception of amateur emissions with minimal power flux densities.

#### Non-specific SRDs

The frequency band 5725 MHz to 5875 MHz (25 mW e.i.r.p.) is designated for generic SRDs for a very long time (some decades, i.e. even before the ERC/REC 70-03 [5]) and is the only SRD band having a quite large bandwidth capability, no duty cycle restriction and a reasonably transmit power of 25 mW e.i.r.p. vs. propagation for the foreseen operations.

Within the last ten years the 5 GHz band became highly attractive for SRDs due to various reasons such as 2,4 GHz high use (i.e. WLAN), the generation of pico-cells, thus having an higher frequency re-use ratio but still below 10 GHz highly propagation critical and the availability of electronic components at low cost such as:

1. A very widespread 5 GHz band usage of SRDs became progressively popular especially within the last years for outdoor/indoor alarm-security microwave sensors;
2. Also a widespread 5 GHz band usage of SRDs happened for outdoor/indoor security wireless TVCC cameras, and in general for video wireless professional use;
3. Similar use to b) above became popular for consumer video electronics too.

The 5725 to 5875 MHz band is a fully harmonised spectrum especially within the EU being implemented by the Decision 2006/771/EC [2] for non-specific SRDs by the original edition in 2006 and kept since without amendments for this band.

The band is also included in Recommendation ITU-R SM.1896 [9] on SRD global and regional harmonisation.

#### TTT (below 5830 MHz, former RTTT)

ERC/REC 70-03 [5] designates the frequency bands 5795-5805 MHz, with possible extension to 5815 MHz, for TTT. The band 5795-5805 MHz is for use by initial road-to-vehicle systems, in particular road toll systems, with an additional sub-band, 5805-5815 MHz, to be used on a national basis to meet the requirements of multi-lane road junctions. The regulatory parameters (maximum power levels) for TTT are given in Annex 5 of ERC/REC 70-03 [5]. The TTT parameters are also specified in EN 300 674 [10] developed by ETSI and the EN 12253 [33] developed by CEN. It should be noted that the EN 300 674 [10] deals with both Road Side Units (RSU) and On-Board Units (OBU).

Directive 2004/52/EC [11] lays down the conditions for the interoperability of electronic road toll systems in the European Union. The Directive requires that all new electronic toll systems brought into service shall use one or more of the following technologies: satellite positioning (GNSS); mobile communications (GSM-GPRS); microwave technology (DSRC). This equipment on-board of lorries shall therefore at least be interoperable and capable of communicating with all the systems operating in the Member States using one or more of the technologies named in this Directive. The on-board units installed in lorries have therefore bands 5a and 5b included.

It should be noted that the frequency usage for TTT DSRC was identified in the early 1990´s and that no compatibility studies exist for this frequency identification. Therefore, CEPT has begun conducting compatibility studies between TTT applications using the additional sub-band 5805-5815 MHz and primary services recently.

Around 28 million DSRC OBUs are in use today, communicating with more than 20.000 Transceivers (beacons) in Europe for tolling purposes. The majority of European countries have practical implementations of TTT DSRC systems either as nationwide road tolling systems or local road tolling systems (major bridges, individual toll roads or city toll system). The majority of such installations comply with ETSI EN 300 674 [10] and use all four 5 MHz wide channels up to 2 watts e.i.r.p. per channel for the road site units. Some implementations only use the 5795-5805 MHz range such as the French national road tolling system. The use of 8 W road side unit systems is seldom and is an almost historic implementation option but maybe still in use at individual systems. State-of-the-art technology does not use higher power for multiple lane management. The Harmonised European Standard ETSI EN 300 674 [10] only identifies the frequency range 5795-5805 MHz as pan-European service frequencies.

There are also more than 1 000 small systems implemented throughout Europe over the last 15-20 years which are operated in individual buildings, pre-dominantly in parking garages, which are not strictly speaking “road tolling” systems. Other known implementations outside of pure road tolling are found at ferry operators. These applications operate under a more relaxed national regulatory regime.

#### BFWA

ECC Report 101 [12] indicated that Broadband Fixed Wireless Access (BFWA) is used here to refer to wireless systems that provide local connectivity for a variety of applications and using a variety of architectures, including combinations of access as well as interconnection. ECC Report 068 [13] depicts the different architectures of BFWA and provides the relevant information on these different kinds of networks including technical parameters to ensure compatibility with other systems. These reports also provide the main parameters for two BFWA architectures, Point to Multipoint (P-MP) and Mesh.

A CEPT questionnaire regarding the implementation of BFWA according to ECC/REC/(06)04 [14] (Use of the band 5725-5875 MHz for Broadband Fixed Wireless Access (BFWA)) had been sent out by the ECO in 2012. The responses to the questionnaire were discussed during the 75th WG FM meeting in Minsk in September 2012. According to the summary, 38 CEPT administrations had submitted a response. Until that point in time 14 countries had implemented BFWA in the whole frequency range from 5725-5875 MHz, whereas some other countries had implemented BFWA in parts of this frequency range, 14 countries had not at all implemented BFWA until that point in time. However, 4 of the latter planned the implementation of BFWA. The main reasons for not implementing BFWA, partly or completely, were given by the required protection of other radio applications. With that regard, TTT, ITS, FSS uplinks and radars were mentioned in the responses. According to the implementation status in the ECO document database as well as information in EFIS, three countries which did not submit an answer to the questionnaire had also implemented ECC/REC/(06)04 [14] (BFWA). Altogether 27 countries had implemented BFWA in the whole frequency range 5725-5875 MHz or in parts of it until that point in time. Also the regulatory status of BFWA at 5.8 GHz was discussed. On national level, BFWA is considered as a radio application under the scope of a radio service, e. g. the Fixed Service in some countries, but in other countries, as a de facto non-protected radio application as it is the case for other radio applications which are exempted from individual licences. All except four countries which had implemented BFWA follow the ECC/REC/(06)04 [14] which recommends that administrations should consider applying simplified authorisation procedures for BFWA in this band, e.g. licence-exempt or light licensing regime. Several countries had already made use of registration/notification procedures (light licensing) which also make it necessary to provide location details about the central station or even clients. The majority which had implemented BFWA in that point in time, had done this based on ECC/REC/(06)04[14] and using exemption from individual licensing.

The questionnaire collected also data about the quantity of deployment (some country examples):

**Germany**: The district or self-governing town in which a BFWA system is operated is known because of the light licensing procedure. So far Germany got notifications from 69 BFWA operators for 202 different districts / self-governing towns. Assuming that there is only 1 central station in every district / self-governing town, there are (at least) 202 central stations currently in operation in Germany. BFWA was operated in 11 districts / self-governing towns in the year 2008;

**Ireland**: about 90 central stations.

**Ukraine**: around 100 central stations notified all over the Ukraine.

**Russian Federation**: From ECC Report 173 (2011) [15] (under the scope of Fixed Service):

From 5 850 to 5 950 MHz, some use is indicated, mostly for P-MP (Point-to-Multipoint). The licensing regime appears to be mostly link-based, including 1400 Point-to-Point (P-P) links, 600 PMP Base Stations, infrastructure and broadcasting).

**United Kingdom**: Information is available on the topologies used, e.g. P-P, P-MP, repeater, mesh. But not on which end of the link is the central station and which is CPE. Any number of “terminals” (a terminal being a generic term for any type of transmitting station) can be deployed under a single light licence. So the number of licences is not a precise indicator of numbers of equipment deployed.

However, the estimate is that about 10000 terminals have been registered in total in the UK. The most popular use tends to be for P-P links (so no central station as such).

Compared with figures provided in RSCOM 07-06 (2007): UK: about 350 CSs (Central Stations) (P-MP), 4500 TSs (Terminal Stations), 420 P-P stations, this shows that the market for BFWA in the UK is not growing. This is in line with one recent market study has been found in the public domain from, 2010 Senza Fili Consulting)

### Proposals for new additional use

Wireless Industrial Applications

Wireless Industrial Applications (WIA) is used for wireless links in industrial environments including monitoring and worker communications, wireless sensors and actuators.

ETSI described in TR 102 889-2 [16] the technical characteristics for SRD equipment for wireless industrial applications (WIA) and requested ECC/WGFM to conduct studies. The results of these studies have been published in ECC Report 206 [17]. WIA is currently considered in ECC/WGFM for inclusion in ANNEX 2: of ERC/REC 70-03 [5].

1. Preliminary parameters for WIA applications under consideration

| **Frequency Band** | | **Power / Magnetic Field** | **Spectrum access and mitigation requirements** | **Channel spacing** | **ECC/ERC Decision** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **e** | 5725-5875 MHz | ≤ 400 mW e.i.r.p. | APC required  Adequate spectrum sharing mechanisms (e.g. DFS and DAA) shall be implemented by the equipment (see note below). | ≥ 1 MHz and  ≤ 20 MHz |  | Wireless Industrial Applications (WIA)  The Adaptive Power Control is able to reduce the e.i.r.p. to  ≤ 25 mW. |

Note: DFS is required in frequency range 5725-5850 MHz for the protection of the radiolocation service, DAA is required in frequency range 5855-5875 MHz for the protection of ITS in frequency range 5725-5875 MHz for the protection of BFWA, and in the frequency range 5795-5815 MHz for the protection of TTT applications.

A Harmonised European Standard for WIA systems is under development.

## 5850 - 5925 MHz

The band 5725-5875 MHz is also designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within these bands must accept harmful interference which may be caused by these applications.

1. Allocations in 5850 - 5925 MHz

| **Region 1** | **Region 2** | **Region 3** |
| --- | --- | --- |
| 5 850-5 925  FIXED  FIXED-SATELLITE (Earth-to-space)  MOBILE  5.150 | 5 850-5 925  FIXED  FIXED-SATELLITE (Earth-to-space)  MOBILE  Amateur  Radiolocation  5.150 | 5 850-5 925  FIXED  FIXED-SATELLITE (Earth-to-space)  MOBILE  Radiolocation  5.150 |

**Relevant RR Article 5 footnotes:**

5.150 The following bands: 5 725-5 875 MHz (centre frequency 5 800 MHz), and are also designated for industrial, scientific and medical (ISM) applications. Radio communication services operating within these bands must accept harmful interference which may be caused by these applications. ISM equipment operating in these bands is subject to the provisions of No. 15.13.

1. Applications in 5850-5925 MHz

| **Frequency range** | **European Common Allocation** | **ECC/ERC**  **harmonisation**  **measures** | **Application** | **European footnotes** | **Standard** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| 5850-5925 MHz | FIXED  FIXED-SATELLITE (E/S)  MOBILE  5.250 | ECC/REC/(06)04 | BFWA |  | EN 302 502 | Within the band 5725-5875 MHz |
|  | FSS |  | EN 301 443 | Priority for civil networks |
|  | ISM |  |  | Within the band 5725-5875 MHz |
| ECC/DEC/(08)01 | ITS |  | EN 302 571 | Within the band 5875-5925 MHz.  Within the band 5855-5875 MHz |
| ERC/REC 70-03 | Non-Specific SRDs |  | EN 300 440 | Within the band 5725-5875 MHz |
| ERC/REC 70-03 | Radiodetermination applications |  | EN 302 372 | Within the band 4500-7000 MHz for TLPR application |

### Existing users

#### Non-specific SRDs (up to 5875 MHz)

See section 2.2.1.4

#### BFWA (up to 5875 MHz)

See section 2.2.1.6

#### FSS (Earth to space, 5725-5925 MHz)

See section 2.2.1.2

#### Intelligent Transport Services (ITS)

ITS means systems in which information and communication technologies are applied in the field of transport and traffic telematics, including infrastructure, vehicles and users, and in traffic management and mobility management.

Safety related applications have high requirements on robustness and latency, and may need to operate in a predictable interference environment. Non-safety related applications usually have lower requirements on robustness and latency. Decision 2008/671/EC [1] and ECC/DEC/(08)01 [18] harmonise 30 MHz of spectrum band for ITS applications in the 5875-5905 MHz band (possible expansion in 5905-5925 MHz). This spectrum is for primarily for road-safety related features.

The general framework for the deployment of Intelligent Transport Systems is set out in Directive 2010/40/EU [19]. The standardisation mandate M/453 [36] on corporative ITS let to a set of standards and specifications to be used for ITS applications.

ETSI has also prepared a new ETSI systems reference document TR 103 083 [34] in support of the scheduled update of the ITS spectrum regulation in ECC/DEC/(08)01 [18] and ECC/REC/(08)01 [20]. Two main topics will be addressed by the ETSI systems reference document:

1. the inclusion of addition ITS station roles in the regulation in order to complement the existing role as mobile station only with infrastructure ITS stations and portable ITS stations. These ITS stations will be handled under the same ETSI harmonised standard EN 302 571 [21].

2. Update of the spectrum mask in order to allow for technical implementation of ITS stations by taking into account the fixed 10MHz channel bandwidth. This may allow a clarification of the spurious emission limits and CEPT may need to consider the involvement of ECC/WGSE for additional investigations. In this context, it should be noted that the ITS community is working together with the TTT community on road tolling applications to solve the potential interference issues based on passive an active mitigation techniques described in ETSI TS 102 792 [22], i.e. co-existence specifications are available.

Cooperative ITS systems based on the ETSI ITS standard will be deployed from 2015 onwards in vehicles with initial infrastructure installation will appear in the course of 2014. 12 major car manufacturers recently signed a Memorandum of Understanding to signal their intentions to provide cooperative systems from 2015 on.

### Proposals for new additional use

#### Broadband Direct Air to Ground (BDA2G) (5855 - 5875MHz)

Two options have been considered for BDA2G systems in the frequency range 5855-5875 MHz:

1. A TDD system according to ETSI TR 101 599 [24];
2. A TDD system according to ETSI TR 103 108 [25].

The results of the compatibility studies for the 5.8 GHz band can be found in ECC Report 210 [23] on compatibility/sharing studies related to Broadband Direct-Air-to-Ground Communications (DA2GC) in the frequency bands 5855-5875 MHz, 2400-2483.5 MHz and 3400-3600 MHz.

Sharing and compatibility studies were conducted between DA2GC and the following services/systems in the band 5855-5875 MHz:

1. Broadband Fixed Wireless Access (BFWA);
2. Fixed Satellite Service (E-s);
3. Non-specific Short Range Devices (SRD);
4. Intelligent Transport Systems / Transport and Traffic Telematics (ITS/TTT);
5. Radiolocation Systems.

The studies carried out in ECC Report 210 [23] show that operation of Broadband DA2GC according to ETSI TR 101 599 [24] and ETSI TR 103 108 [25] is possible in the 5.855-5.875 MHz band based on specific system parameters and if appropriate mitigation measures are applied. However, ECC Report 210 [23] has not considered in detail that other applications will also use mitigation techniques in this frequency band. For example, the harmonised European Standard for Intelligent Transportation systems, EN 302 571 [21], includes a mandatory technical requirement for Listen-Before-Talk (LBT) to improve co-existence with BFWA as indicated in ECC Report 101 [12]. When the ITS LBT is triggered the ITS radio is not allowed to transmit.

Most probably the ITS LBT is not able to distinguish between DA2GC and other non-ITS signals and therefore it is important that the DA2GC transmissions will not exceed the LBT threshold. However, it is shown in ECC Report 210 that the ITS receiver interference threshold is lower than the trigger threshold for the ITS LBT and therefore there was no need to study further the impact from DA2GCS on the ITS LBT.

Also the detect-and-avoid (DAA) mitigation feature as described in ECC Report 210 [23] at the Aircraft Station for the system according to TR 101 599 is not able to differentiate between signal characteristics coming from different applications because the DAA mechanism reacts on the received power level (above the threshold) and not on the signal characteristics. The situation may be improved in the future by considering more complex mitigation techniques which allow differentiating between different applications. False triggering of the DAA cannot cause interferences, but it may lead to system performance degradation. Such an impact, e.g. caused by BFWA transmissions, could be avoided by switching off DAA at the AS and - instead - by applying a greater minimum elevation angle for the beam between AS and GS which would lead to a higher number of GS. It is also assumed that received signals from ITS stations will typically be at lower power levels than signals from BFWA and by optimising the trigger power level, false triggers from ITS could be minimised. However, this possibility to avoid false triggering of DAA was not part of the studies carried out within the scope of ECC Report 210 [23].

Network investment and deployment costs as well as aircraft equipment costs are high for Broadband DA2GCS, especially when considering the first roll-out of DA2GCS. The implementation of such a system is only reasonable if a gap-free and continental-wide coverage is achieved, thus a CEPT wide harmonised radio spectrum designation and harmonised licensing conditions would be highly beneficial. In addition, a European harmonised authorisation framework is considered necessary to provide the regulatory certainty that network operators and airlines require to invest in a Broadband DA2GCS.

Given the need for substantial financial investment, together with the requirement to protect other spectrum users, it is reasonable to envisage some form of light or individual licensing in Europe. However, it is important that the chosen forms of regulation and licensing do not impose unreasonable restrictions on competition. Aircraft stations under the control of the DA2GC network could be dealt with by means of exemption from individual licensing and free circulation and use, under the umbrella of an ECC Decision.

The considerations on DA2GCS in the CEPT have not been finalised yet and several frequency ranges are under investigations.

#### Wireless Industrial Applications (5725 - 5875 MHz)

See section 2.2.2

# Proposed WAS/RLAN characteristics for study

CEPT ECC have made a preliminary assessment, taking account of the services to be studied and sharing environments, discussions taking place with the ITU under WRC-15 Agenda Item 1.1 and liaison with the WAS/RLAN industry, on the proposed harmonized conditions that would be suitable for WAS/RLAN in each of the bands identified.

## Current WAS/RLAN characteristics and use in 5 GHz bands in EU, CEPT and elsewhere in the world

EC Decision 2005/513/EC [26] complemented by EC Decision 2007/90/EC [27] addresses the designation of the frequency bands 5150-5350 MHz and 5470-5725 MHz for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) in EU members states and ECC/DEC/(04)08 [28] addresses their designation within CEPT. At World level these frequency bands have been allocated to the *mobile service except aeronautical mobile service* on a primary basis in all three regions by World Radiocommunication Conference 2003 (WRC-03). Furthermore ITU-R Resolution 229 [29] limits the use of this allocation to WAS/RLANs. ITU-R Resolution 229 [29] also requires that WAS/RLAN need to protect other specific primary services in these frequency bands.

In the EU/CEPT the following bands were identified for use by RLANs under prescribed conditions in the both the ECC and EC Spectrum Decisions:

* 5 150-5 350 MHz   
  Only indoor use, mean e.i.r.p. limited to 200 mW, and above 5250 MHz; the use of mitigation techniques such as dynamic frequency selection (DFS) and transmitter power control (TPC)
* 5 470-5 725 MHz  
  Indoor as well as outdoor use allowed, mean e.i.r.p. limited to 1 W, and use of mitigation techniques such as dynamic frequency selection (DFS) and transmitter power control (TPC).

The World Radiocommunication Conference 2003 (WRC-03) agreed on a new frequency allocation on a co-primary basis to the mobile service for the implementation of “wireless access systems including radio local area networks” (WAS/RLANs) in the bands 5150-5350 MHz and 5470-5725 MHz. This was subject to technical and regulatory provisions included in the radio regulations, given in Resolution 229 [29] (WRC-03) that makes the Annex 1 of Recommendation ITU-R M.1652 mandatory. This decision noted however that in these bands the stations in the mobile service shall not claim protection from radiodetermination services. The decision includes specific provisions to protect the incumbent systems; including military and meteorological radars. China MIIT expanded allowed channels as of Dec 31 2012 to add UNII-1, 5150 - 5250 MHz, UNII-2, 5250 - 5350 MHz (DFS/TPC), similar to European standards EN 301.893 V1.7.1.

1. Existing WAS/RLAN regulations/use

| **Frequency Band** | **CEPT** | **USA** | **Japan** | **Notes** |
| --- | --- | --- | --- | --- |
| 5150-5250 MHz | Indoor | No restrictions | No restrictions | Additional regional variations for countries including Australia, Brazil, China, Israel, Korea, Singapore, South Africa, Turkey, etc. Additionally Japan has access to some channels below 5180 MHz. China expanded in 2012 to add 5150-5250, 5250-5350, similar to European regulation |
| 5250-5350 MHz | Indoor/ DFS / TPC | DFS | DFS/TPC |
| 5470-5725 MHz | DFS/TPC | DFS | DFS/TPC | It should be noted that some administrations (notably Australia & Canada) do not allow WAS/RLAN to use the band 5600-5650 MHz with the objective to protect meteorological radar operations  The FCC encouraged users of U-NII devices near the aeronautical meteorological radars to register in a voluntary database system as discussed in the guidance DA 12-459 [3] and took action in 2012 against operating devices that caused interference to meteorological radars maintained by the Federal Aviation Administration (FAA) operating in the 5600-5650 MHz band.  CEPT investigated the issue of  5 GHz DFS and published ECC Report 192 in 02/2014 |
| 5725-5850 MHz | Not available | No restrictions | Not available |  |

## Current Mitigation Techniques used in 5 GHz WAS/RLAN

CEPT ECC have made a preliminary assessment, taking account of the services to be studied and sharing environments, discussions taking place with the ITU under WRC-15 Agenda Item 1.1 and liaison with the WAS/RLAN industry, on possible mitigation techniques that may need to be applied to WAS/RLAN to enable compatibility with existing services in the band.

### Dynamic Frequency Selection (DFS)

Dynamic Frequency Selection (DFS) is a mechanism to allow 5 GHz Wireless Access Systems including radio local area networks (WAS/RLANs) to operate without causing undue interference to terrestrial radars operating in the 5250-5350 MHz and 5470-5725 MHz bands. The same mechanism also enables 5.8 GHz BFWA systems to operate in the 5725-5850 MHz band, at least in those countries that have implemented the ECC/REC/(06)04 [14]. DFS is a politeness mitigation technique, intended to sense the presence of radar signals in a given channel and prevent any WAS/RLAN or BFWA device from transmitting on that channel.

The allocation of the 5150-5350 MHz and 5470-5725 MHz to the mobile service for the implementation of WAS/RLANs was made on a co-primary basis at the International Telecommunication Union (ITU) World Radiocommunication Conference 2003 (WRC-03), under the conditions of the Radio Regulations Footnote N° **5.446A**:

**“**The use of the bands 5150-5350 MHz and 5470-5725 MHz by the stations in the mobile service shall be in accordance with Resolution **229 (WRC‑03) [29]**.”

This Resolution 229 (WRC-03) [29] (see Annex 1) specifies the conditions under which this allocation was made.

* Considering j) highlights the need for using mitigation techniques such as DFS in order to enable sharing with Radiodetermination / Radiolocation services (i.e. radars);
* DFS is further specified in Resolves 8 that refers to Annex 1 of Recommendation ITU-R M.1652 [31] for the details of the DFS requirements;
* Resolves 6 and 7 contain other requirements that contribute to the protection of radars;
* Recognizing a) also states *‘that in the band 5 600-5 650 MHz, ground-based meteorological radars are extensively deployed and support critical national weather services, according to footnote No. 5.452”.*

The DFS principle is recognisant of the fact that WAS/RLAN operating co-channel with a radar may interfere with the radar and therefore there is a need to avoid co-channel operation. To do so, the WAS/RLAN DFS mechanism has to perform radar signal detection on the channel it intends to use prior to have any transmissions on that channel. If a radar signal is identified, then this channel becomes unavailable for use by the WAS/RLAN. .

Following WRC-03, both the ECC and the European Commission translated this International regulation into European regulations, adopting respectively ECC Decision ECC/DEC/(04)08 (9 July 2004) [28] and EC Decision 2005/513/EC (11 July 2005) [26] on “*the harmonised use of the 5 GHz frequency bands for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs)*“. ECC/DEC/(04)08 [28] has been implemented by 41 CEPT administrations in May 2013.

The implementation of EC Decision 2005/513/EC [26] into national regulation has been mandatory and therefore has resulted in a general authorisation status for WAS/RLANs across the EU. Without derogation, Member States cannot impose additional requirements in their national regulations beyond those specified in the EC Decisions.

Within the context of the operation of the DFS function, a WAS/RLAN device shall operate as either a master or a slave. RLAN devices operating as a slave shall only operate in a network controlled by an RLAN device operating as a master. A device which is capable of operating as either a master or a slave shall comply with the requirements applicable to the mode in which it operates.

The master/slave concept, where the master performs the radar detection on behalf of the slaves, was accepted with the assumption that the slave devices were in close vicinity to the master (e.g. an office type of indoor application, or an outdoor public hotspot application, where ‘slave’ devices like PCs, notebooks, tablets and WIFI equipment smart phones are just a few meters away from the Access Point that operates as a ‘master’. This is also reflected in the requirement for slave devices with more than 200 mW e.i.r.p. to perform their own DFS operation.

The master/slave concept cannot be applied in cases where the slave is further away from the master, e.g. outdoor point to point or point to multipoint applications where the master and slave devices can be separated by up to a few kilometres. In such a scenario, both devices should perform their own radar detection, even if the maximum power of the client is below 200 mW e.i.r.p.

A brief overview of the DFS related requirements associated with master and slave devices are provided below. Please see EN 301 893 [30] [1][[1]](#footnote-1) for more details.

**Master devices:**

* The master device shall use a radar detection function to:
  + Before normal operation: perform an initial check of the channel on which it intends to operate, to verify no radar is operating on that channel. This is a contiguous check for a certain period during which no transmissions are allowed;
  + During normal operation: continuous monitoring of the channel to verify no radar is operating on the channel.
* If a radar is detected on the channel, the master device shall stop normal operation on this channel and shall also instruct all its associated slave devices to stop transmitting on this channel. The channel shall be blocked for 30 minutes. After that a new initial check (check without transmissions) is required before it may consider this channel again for normal operation.

**Slave devices:**

* Slave devices shall not transmit unless being authorised by the master;
* Slave devices shall stop transmitting whenever instructed by the master;
* Slave devices with an e.i.r.p. of 200 mW or above, shall perform their own radar detection.

### Transmit Power Control (TPC)

TPC is a technique in which the transmitter output power is controlled so that it is adjusted to the desirable signal level, thus avoiding unnecessary battery consumption. It also results in reduced interference to other systems.

In the previous sharing studies on 5 GHz WAS/RLAN, TPC was introduced as a technique to mitigate by 3 dB the interference from an aggregation of devices.

Resolution 229 (Rec. WRC-12) [29] state that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB.

This provision has been included in the European regulations as per ECC Decision ECC/DEC/(04)08 [28] and EC Decision 2005/513/EC [26].

This requirement is also translated in the standardization framework through ETSI EN 301 893 [30]. The 3 dB mitigation factor for aggregate interference requires the RLAN device to have a TPC range from which the lowest value is at least 6 dB below the regulated values for mean e.i.r.p. for devices with TPC.

In the band 5725-5875 MHz, studies performed in Europe on Broadband Fixed Wireless Access (see ECC Report 68) also lead to the consideration of TPC as mitigation technique. ECC/REC/(06)04 [14] recommends a TPC range of 12 dB with respect to the maximum permitted radiated output power of the station, to provide on average a mitigation factor of approximately 5 dB on the aggregate interference effect into the Fixed-Satellite Service (Earth-to-space). This is implemented in the corresponding EN 302 502 [32].

### Antenna discrimination

Studies performed in the ITU-R in preparation to WRC-03 introduced antenna discrimination as a possible technique to mitigate interference into EESS in the 5250-5350 MHz band. This was supported by North-American countries.

Resolution 229 (Rec. WRC-12) [29] provides the option of WAS/RLAN use in the 5250-5350 MHz band with a maximum mean e.i.r.p. of 1 W under the condition that, when operating above a mean e.i.r.p. of 200 mW, these stations shall comply with the following e.i.r.p. elevation angle mask where θ is the angle above the local horizontal plane (of the Earth):

* −13 dB(W/MHz) for 0° ≤ θ < 8°
* −13 − 0.716(θ − 8) dB(W/MHz) for 8° ≤ θ < 40°
* −35.9 − 1.22(θ − 40) dB(W/MHz) for 40° ≤ θ ≤ 45°
* −42 dB(W/MHz) for 45° < θ;

This option has not been implemented in the European regulations as justified in CEPT Report 006.

In the band 5725-5875 MHz, studies performed in Europe on Broadband Fixed Wireless Access (see ECC Report 68 [13]) lead to the consideration of e.i.r.p. spectral density limits in the elevation plane for BFWA installations to protect GSO satellite receivers in the fixed satellite service. Recommended limits are contained in the ECC/REC/(06)04 [14], Annex 3, depending upon the BFWA topology.

## Assumed WAS/RLAN characteristics

These assumed characteristics are a result of discussions in CEPT with the WAS/RLAN community.

### 5350-5470 MHz

Similar to current CEPT & EU regulations for 5150 – 5350 MHz

Only indoor use, mean e.i.r.p. limited to 200 mW, and use of mitigation techniques such as dynamic frequency selection (DFS) and transmitter power control (TPC);

### 5725-5850 MHz

Similar to current CEPT & EU regulations for 5470 – 5725 MHz

Indoor as well as outdoor use allowed, mean e.i.r.p. limited to 1 W, and use of mitigation techniques such as dynamic frequency selection (DFS) and transmitter power control (TPC).

### 5850-5925 MHz

Similar to current CEPT & EU regulations for 5470 – 5725 MHz

Indoor as well as outdoor use allowed, mean e.i.r.p. limited to 1 W, and use of mitigation techniques such as dynamic frequency selection (DFS) and transmitter power control (TPC).

# Initial Results of sharing and compatibility analysis

CEPT ECC have made a preliminary assessment, taking account of the services to be studied and sharing environments, discussions taking place with the ITU under WRC-15 Agenda Item 1.1 and liaison with the WAS/RLAN industry, on possible mitigation techniques that may need to be applied to WAS/RLAN to enable compatibility with existing services in the band.

## 5350 - 5470 MHz

Various sharing studies between RLANs and Incumbent services (radar and EESS (active)) in the 5350-5470 MHz band which have been submitted to CEPT so far.

These studies use different parameters and assumptions and, consequently, any comparison of the results is difficult as there is a need to take into account these differences. The compilation of the studies is aimed to support activities in the relation to the proposal to include RLAN use in the 5350 5470 MHz band.

These studies contain the technical and operational parameters of RLAN systems being used in sharing studies in the 5350-5470 MHz frequency range. These parameters are a result of lengthy discussions in the ITU-R JTG 4-5-6-7 and consequently in CEPT and aim to provide a common set of parameters to be used in studies. Specific parameters for antenna gain/discrimination, body/additional losses and RLAN device density still present a number of options. A common agreement has also been reached on how to present the status of each of these parameters.

With regards to sharing studies between RLAN and Radar, CEPT have also considered the compatibility between RLAN and terrestrial radiolocation systems in the 5350-5470 MHz and 5725-5850 MHz bands and it currently appears that the DFS function as described in the current version of the ETSI harmonised European standard EN 301 893 is not tested for their ability to detect frequency hopping radar signals.

Relevant studies will have to be performed to determine how coexistence between RLAN and frequency hopping radars can be achieved and if coexistence is feasible.

## 5725 - 5925 MHz

CEPT have carried out some preliminary studies between RLANs and the following radio services or applications:

* Fixed Service (Broadband Fixed Wireless Access (BFWA) in the band 5725-5925 MHz;
* Mobile Service (Intelligent Transport Systems, ITS) in the band 5855-5925 MHz;
* Road Transport and Traffic Telematics Systems (TTT) in the bands 5795-5805 and 5805-5815 MHz;
* Wireless Industrial Application[[2]](#footnote-2) (WIA) in the band 5725-5875 MHz;
* FSS (Earth to space) in the frequency range 5725-5925 MHz;
* Broadband Direct Air to Ground communication[[3]](#footnote-3) (DA2GC) in the band 5855-5875 MHz.

Using the set of WAS/RLAN parameters shown in Annex 4, the preliminary studies were conducted based on the following approach:

* As an initial step, perform MCL calculations were performed for potentially worst case scenarios between RLAN and other systems.

A short summary of the results for the existing incumbent services/ applications can be seen below:

**RLAN-BFWA**

Different RLAN scenarios (urban, rural, indoor, and outdoor) were considered. The RLAN bandwidth was chosen by 80 MHz, the e.i.r.p. was 200 mW (23 dBm) for indoor and 1 W (30 dBm) for outdoor. Applying MCL and depending on the selected propagation model (3 slope model and Recommendation ITU-R P.452-14) and RLAN parameters the separation distance varied between 50 m and about 3 km. The case LOS results in 5 to 23 km separation and should be avoided by mitigation or coordination.

**RLAN - ITS**

For this case the RLAN were located indoor as well as outdoor. The RLAN bandwidth was 20 MHz, the e.i.r.p. was 200 mW (23 dBm). For ITS different deployment scenarios were assumed, e.g. ITS antenna mounted on the roof of the vehicle, integrated inside of the vehicle passenger compartment or mounted on the road side as on a traffic light. Applying a 3 slope propagation model and assuming urban, suburban or rural environment, the MCL calculations lead to separation distances between 200 and 1800 m. Initial consideration has also been made on the potential application of interference avoidance techniques for the protection of ITS.

**RLAN - TTT**

For this case the RLAN were located indoor as well as outdoor. The RLAN bandwidth was, the e.i.r.p. was 200 mW (23 dBm).

For TTT two different deployment scenarios were assumed: TTT antenna is situated inside and outside of a building. Applying the same 3 slope propagation model and assuming urban, suburban or rural environment, the MCL calculations lead to separation distances between 140 and 970 m.

**RLAN – FSS**

SE40 has addressed the compatibility between RLANs and FSS (Earth to space) operating in the frequency range 5725-5925 MHz. This working document provides some preliminary considerations regarding

* FSS parameters and protection criteria;
* RLAN parameters and deployment scenarios;
* Methodology.

Compatibility studies have not been initiated because no agreement was reached particularly on the following parameters:

* Ratio between indoor and outdoor applications relevant for FSS/RLAN studies;
* maximum RLAN power to be used in the calculations.

Further guidance is expected from WG SE in order to ensure consistency between the RLAN parameters used by the different groups of CEPT in their studies.

A short summary of the results for the new proposed services/ applications can be seen below:

**RLAN – WIA**

For this case the RLAN were located indoor. The RLAN bandwidth was varied between] 20 and 160 MHz, the e.i.r.p. was 200 mW (23 dBm). For WIA two different deployment scenarios were assumed: WIA is placed inside a factory and at the border/fence of a plant. Applying the same 3 slope propagation model and assuming urban, suburban or rural environment, the MCL calculations lead to separation distances between 50 and 1900 m.

**RLAN – BDA2G**

Two DA2GC system proposals were considered:

*ETSI TR 101 599 [24]*

* Worst-case MCL calculations shown in separate studies come to the conclusion that coexistence between outdoor RLANs (Access Points) and the DA2GC system described in ETSI TR 101 599 [24] is not possible. Further studies taking into account possible mitigation techniques and other factors need to be considered.
* Further studies need to be conducted on the coexistence between DA2GC according to ETSI TR101 599 [24] and indoor RLANs. Differences between the initial studies need to be investigated further before agreeing any conclusions.

*ETSI TR 103 108 [25]*

* Aggregate interference from RLAN into the DA2GC AS is operationally acceptable.
* Interference from DA2GC AS into RLAN is operationally acceptable for indoor RLANs and operationally acceptable in the majority of outdoor cases.
* Interference from RLAN into the DA2GC GS is operationally acceptable with appropriate site planning and reasonable separation distances.
* Interference from DA2GC GS into RLAN is operationally acceptable given the preferred DA2GC GS urban site locations and a separation distance less than 200 metres.

RLAN industry indicated that they would like to investigate this study further before validating any conclusions.

# Candidate Mitigation Techniques

Depending upon the results of sharing analysis, CEPT ECC will consider the requirement and assess efficiency of possible mitigation techniques to enable compatibility with existing services in the bands. Candidate mitigation techniques could be considered among techniques already in used by WAS/RLAN (DFS, TPC, antenna discrimination, see section 4.1) or any other mitigation techniques (e.g; geo-location databases).

# Initial Assessment of appropriate compatibility and sharing conditions

Although no conclusions have been made on the appropriate compatibility and sharing conditions CEPT have received the preliminary proposals from the WAS/RLAN industry which have been used as a starting point for the studies. These studies are still ongoing but are limited to the WAS/RLAN parameters that can be seen in section 3.3.

# Results

It should be noted that the studies being carried out in CEPT and ITU are at a preliminary stage and that some of the parameters to be used in the studies are still under discussion within CEPT. Having said this significant progress has been made with respect to agreeing most of the parameters and there are options available for those parameters that are still under discussion.

In addition relevant studies will have to be performed to determine the effectiveness of the proposed mitigation techniques to ensure relevant protection of the incumbent radiocommunication services and applications.

**Future Studies**

Further more comprehensive studies are proposed to be carried out in the future based on an approach which, as a second step, will consider additional scenarios, analyse potential mitigation techniques, define sharing conditions and/or conduct statistical simulations.

1. EC mandate TO CEPT



1. Excerpt of the European Common allocation Table

***RR Region 1 Allocation and RR*** ***ECC/ERC***  ***European***

***footnotes applicable to CEPT*** ***European Common Allocation*** ***harmonisation*** ***Applications footnotes*** ***Standard*** ***Notes***

***measure***

**5150 - 5250 MHz**

AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (E/S) 5.447A Aeronautical telemetry

MOBILE except aeronautical mobile

FIXED-SATELLITE (E/S) 5.447A 5.446A 5.446B Feeder links Feeder links for MSS.

Aeronautical Radionavigation and

FSS envisaged in some countries

MOBILE except aeronautical mobile

5.446A 5.446B ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

TLPR application

5.446 5.446

5.446C 5.446C ECC/DEC/(04)08 Radio LANs EN 301 893 WAS/RLANs within the bands 5150- 5350

5.447 5.447 MHz and 5470-5725 MHz

5.447B 5.447B

5.447C 5.447C ECC/REC/(08)04 BBDR EN 302 625 Temporary use by PPDR users

**5250 - 5255 MHz**

EARTH EXPLORATION-SATELLITE EARTH EXPLORATION-SATELLITE Active sensors (satellite)

(active) (active)

MOBILE except aeronautical mobile MOBILE except aeronautical mobile Defence systems Tactical and weapon system radars

5.446A 5.447F 5.446A 5.447F

RADIOLOCATION RADIOLOCATION - Position fixing

SPACE RESEARCH 5.447D SPACE RESEARCH 5.447D ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

TLPR application

5.447E 5.448A EU2 Maritime radar Shipborne and VTS radar

5.448 EU22

5.448A ECC/DEC/(04)08 Radio LANs EN 301 893 WAS/RLANs within the bands 5150- 5350

MHz and 5470-5725 MHz

Weather radar Ground based and airborne

**5255 - 5350 MHz**

EARTH EXPLORATION-SATELLITE EARTH EXPLORATION-SATELLITE Active sensors (satellite)

(active) (active)

MOBILE except aeronautical mobile MOBILE except aeronautical mobile Defence systems Tactical and weapon system radars

5.446A 5.447F 5.446A 5.447F

RADIOLOCATION RADIOLOCATION - Position fixing

SPACE RESEARCH (active) SPACE RESEARCH (active) ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

TLPR application

5.447E 5.448A EU2

5.448 EU22 Maritime radar Shipborne and VTS radar

5.448A

ECC/DEC/(04)08 Radio LANs EN 301 893 WAS/RLANs within the bands 5150-

5350 MHz and 5470-5725 MHz

Weather radar Ground based and airborne

**5350 - 5450 MHz**

* 1. AERONAUTICAL RADIONAVIGATION AERONAUTICAL RADIONAVIGATION Active sensors (satellite)

5.449 5.449

EARTH EXPLORATION-SATELLITE EARTH EXPLORATION-SATELLITE Defence systems Tactical and weapon system radars

(active) 5.448B (active) 5.448B

RADIOLOCATION 5.448D RADIOLOCATION 5.448D - Position fixing

SPACE RESEARCH (active) 5.448C SPACE RESEARCH (active) 5.448C ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

Fixed TLPR application

EU2 Maritime radar Shipborne and VTS radar

EU22

Weather radar Ground based and airborne

**5450 - 5460 MHz**

* 1. AERONAUTICAL RADIONAVIGATION AERONAUTICAL RADIONAVIGATION Active sensors (satellite)

5.449 5.449

EARTH EXPLORATION-SATELLITE EARTH EXPLORATION-SATELLITE Defence systems Tactical and weapon system radars

(active) 5.448B (active) 5.448B

RADIOLOCATION 5.448D RADIOLOCATION 5.448D - Position fixing

SPACE RESEARCH (active) 5.448C SPACE RESEARCH (active) 5.448C ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

TLPR application

EU2

EU22 Maritime radar Shipborne and VTS radar

Weather radar Ground based and airborne

**5460 - 5470 MHz**

EARTH EXPLORATION-SATELLITE EARTH EXPLORATION-SATELLITE Active sensors (satellite)

(active) (active)

RADIOLOCATION 5.448D RADIOLOCATION 5.448D Defence systems Tactical and weapon system radars

RADIONAVIGATION 5.449 RADIONAVIGATION 5.449 - Position fixing

SPACE RESEARCH (active) SPACE RESEARCH (active)

5.448B 5.448B EU2 ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

TLPR application

EU22 Maritime radar Shipborne and VTS radar

Weather radar Ground based and airborne

**5470 - 5570 MHz**

EARTH EXPLORATION-SATELLITE EARTH EXPLORATION-SATELLITE Active sensors (satellite)

(active) (active)

MARITIME RADIONAVIGATION MARITIME RADIONAVIGATION Defence systems Tactical and weapon system radars

MOBILE except aeronautical mobile MOBILE except aeronautical mobile - Position fixing

5.446A 5.450A 5.446A 5.450A

RADIOLOCATION 5.450B RADIOLOCATION 5.450B ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

SPACE RESEARCH (active) SPACE RESEARCH (active) TLPR application

5.448B 5.448B EU2 Maritime radar Shipborne and VTS radar

5.450 EU22

5.451 ECC/DEC/(04)08 Radio LANs EN 301 893 WAS/RLANs within the bands 5150-

5350 MHz and 5470-5725 MHz

Weather radars Ground based and airborne

**5570 - 5650 MHz**

MARITIME RADIONAVIGATION MARITIME RADIONAVIGATION Defence systems Tactical and weapon system radars

MOBILE except aeronautical mobile MOBILE except aeronautical mobile

5.446A 5.450A 5.446A 5.450A - Position fixing

RADIOLOCATION 5.450B RADIOLOCATION 5.450B ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

5.450 5.452 EU2 TLPR application

5.451 EU22 Maritime radar Shipborne and VTS radar

5.452

ECC/DEC/(04)08 Radio LANs EN 301 893 WAS/RLANs within the bands 5150-

5350 MHz and 5470-5725 MHz

Weather radars Ground based

**5650 - 5725 MHz**

MOBILE except aeronautical mobile MOBILE except aeronautical mobile Amateur EU17 EN 301 783 Within the band 5660-5670 MHz

5.446A 5.450A 5.446A 5.450A

RADIOLOCATION RADIOLOCATION Amateur-satellite EU23 Within the band 5660-5670 MHz

Amateur Amateur Defence systems Tactical and weapon system radars

Space research (deep space) Amateur-satellite (E/S)

5.282 5.282 EU2 - Position fixing

5.451 EU17 ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

5.453 EU22 TLPR application

5.454 Maritime radar Shipborne and VTS radar

5.455

ECC/DEC/(04)08 Radio LANs EN 301 893 WAS/RLANs within the bands 5150-

5350 MHz and 5470-5725 MHz

Weather radars Ground based and airborne

**5725 - 5830 MHz**

FIXED-SATELLITE (E/S) FIXED-SATELLITE (E/S) Amateur EN 301 783

RADIOLOCATION RADIOLOCATION

Fixed ECC/REC/(06)04 BFWA EN 302 502 Within the band 5725-5875 MHz

Amateur Amateur

Mobile Defence systems Tactical and weapon system radars

5.150 5.150 EU2 ISM Within the band 5725-5875 MHz

5.451 EU22

5.453 ERC/REC 70-03 Non-Specific SRDs EN 300 440 Within the band 5725-5875 MHz

5.455

5.456 ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

TLPR application

ERC/REC 70-03 TTT EN 300 674 Within the band 5795-5805 MHz.

TTT in the band 5805-5815 MHz on a

national basis

Weather radars Ground based and airborne

**5830 - 5850 MHz**

FIXED-SATELLITE (E/S) FIXED-SATELLITE (E/S) Amateur-Satellite EU23 Within the band 5830-5850 MHz

RADIOLOCATION RADIOLOCATION

Fixed ECC/REC/(06)04 BFWA EN 302 502 Within the band 5725-5875 MHz

Amateur Amateur

Amateur-satellite (S/E) Amateur-satellite (S/E) Defence systems Tactical and weapon system radars

Mobile ISM Within the band 5725-5875 MHz

5.150 5.150 EU2

5.451 EU22 ERC/REC 70-03 Non-Specific SRDs EN 300 440 Within the band 5725-5875 MHz

5.453 ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

5.455 TLPR application

5.456

Weather radars Ground based and airborne

**5850 - 5925 MHz**

FIXED FIXED ECC/REC/(06)04 BFWA EN 302 502 Within the band 5725-5875 MHz

FIXED-SATELLITE (E/S) FIXED-SATELLITE (E/S)

FSS Earth stations EN 301 443 Priority for civil networks

MOBILE MOBILE

5.150 5.150 ISM Within the band 5725-5875 MHz

ECC/DEC/(08)01 ITS EN 302 571 Within the band s 5875-5925 MHz and

ECC/REC/(08)01 5855-5875 MHz

ERC/REC 70-03 Non-Specific SRDs EN 300 440 Within the band 5725-5875 MHz

ERC/REC 70-03 Radiodetermination applications EN 302 372 Within the band 4500-7000 MHz for

TLPR application

1. List of referenceS
2. EC Decision 2008/671/EC on the harmonised use of radio spectrum in the 5 875-5 905 MHz frequency band for safety-related applications of Intelligent Transport Systems (ITS)
3. EC Decision 2006/771/EC on the harmonisation of the radio spectrum for use by short-range devices
4. ERC Report 25 The European table of frequency allocations and applications in the frequency range 9 kHz to 3000 GHz
5. ETSI EN 302 372 Tanks Level Probing Radar (TLPR) operating in the frequency bands 5,8 GHz, 10 GHz, 25 GHz, 61 GHz and 77 GHz
6. ERC Recommendation 70-03 Relating to the use of Short Range Devices (SRD)
7. European Commission COM(2012)218 on the establishment of an Intergovernmental Agreement for the operations of the European Earth monitoring programme (GMES) from 2014 to 2020
8. Regulation (EU) No 911/2010 on the European Earth monitoring programme (GMES) and its initial operations (2011 to 2013)
9. Recommendation ITU-R M.1638 on Characteristics of and protection criteria for sharing studies for radiolocation, aeronautical radionavigation and meteorological radars operating in the frequency bands between 5 250 and 5 850 MHz
10. Recommendation ITU-R SM.1896 on Frequency ranges for global or regional harmonization of short-range devices
11. ETSI EN 300 674 on Road Transport and Traffic Telematics (RTTT)
12. Directive 2004/52/EC on the interoperability of electronic road toll systems in the Community
13. ECC Report 101 Compatibility studies in the band 5855– 5925 MHz between Intelligent Transport Systems (ITS) and other systems
14. ECC Report 068 Compatibility studies in the band 5725 – 5875MHz between Fixed Wireless Access (FWA) systems and other systems
15. ECC Recommendation (06)04 Use of the band 5725-5875 MHz for Broadband Fixed Wireless Access (BFWA)
16. ECC Report 173 Fixed Service in Europe: current use and future trends post 2011
17. ETSI TR 102 889-2 Technical characteristics for SRD equipment for wireless industrial applications using technologies different from Ultra-Wide Band (UWB)
18. ECC Report 206 Compatibility studies in the band 5725-5875 MHz between SRD equipment for wireless industrial applications and other systems
19. ECC Decision (08)01 on the harmonised use of the 5875-5925 MHz frequency band for Intelligent Transport Systems (ITS)
20. Directive 2010/40/EU on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport
21. ECC Recommendation (08)01 Use of the band 5855-5875 MHz for Intelligent Transport Systems
22. ETSI EN 302 571 Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range
23. ETSI TS 102 792 Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (CEN DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range
24. ECC Report 210 Compatibility/sharing studies related to Broadband Direct-Air-to-Ground Communications (DA2GC) in the frequency bands 5855-5875 MHz, 2400-2483.5 MHz and 3400-3600 MHz
25. ETSI TR 101 599 Broadband Direct-Air-to-Ground Communications System employing beamforming antennas, operating in the 2,4 GHz and 5,8 GHz bands
26. ETSI TR 103 108 Broadband Direct-Air-to-Ground Communications System operating in the 5,855 GHz to 5,875 GHz band using 3G technology
27. EC Decision 2005/513/EC on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs)
28. EC Decision 2007/90/EC on the harmonised use of radio spectrum in the 5 GHz frequency band for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs)
29. ECC Decision (04)08 on the harmonised use of the 5 GHz frequency bands for the implementation of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs)
30. ITU-R Resolution 229
31. ETSI EN 301 893 5 GHz high performance RLAN
32. Recommendation ITU-R M.1652 Dynamic frequency selection in wireless access systems including radio local area networks for the purpose of protecting the radiodetermination service in the 5 GHz band
33. ETSI EN 302 502 5.8 GHz fixed broadband data transmitting systems
34. CEN EN 12253 Dedicated Short-Range Communication – Physical layer using microwave at 5.8 GHz
35. Draft ETSI TR 103 083 Technical characteristics for road safety and traffic management, and for non-safety related ITS applications
36. Directive 1999/5/EC on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity
37. Standardisation mandate M/453 addressed to CEN, CENELEC and ETSI in the field of information and communication technologies to support the interoperability of co-coperative systems for ITS.

1. At the time of writing this Report, version 1.7.1 of ETSI EN 301 893 was the latest published version. [↑](#footnote-ref-1)
2. WIA is a new radio application for controlling industrial plants and is under development. [↑](#footnote-ref-2)
3. DA2GC is a new radio application for connecting airplanes with ground stations to provide „internet in airplanes“ and is under development. [↑](#footnote-ref-3)