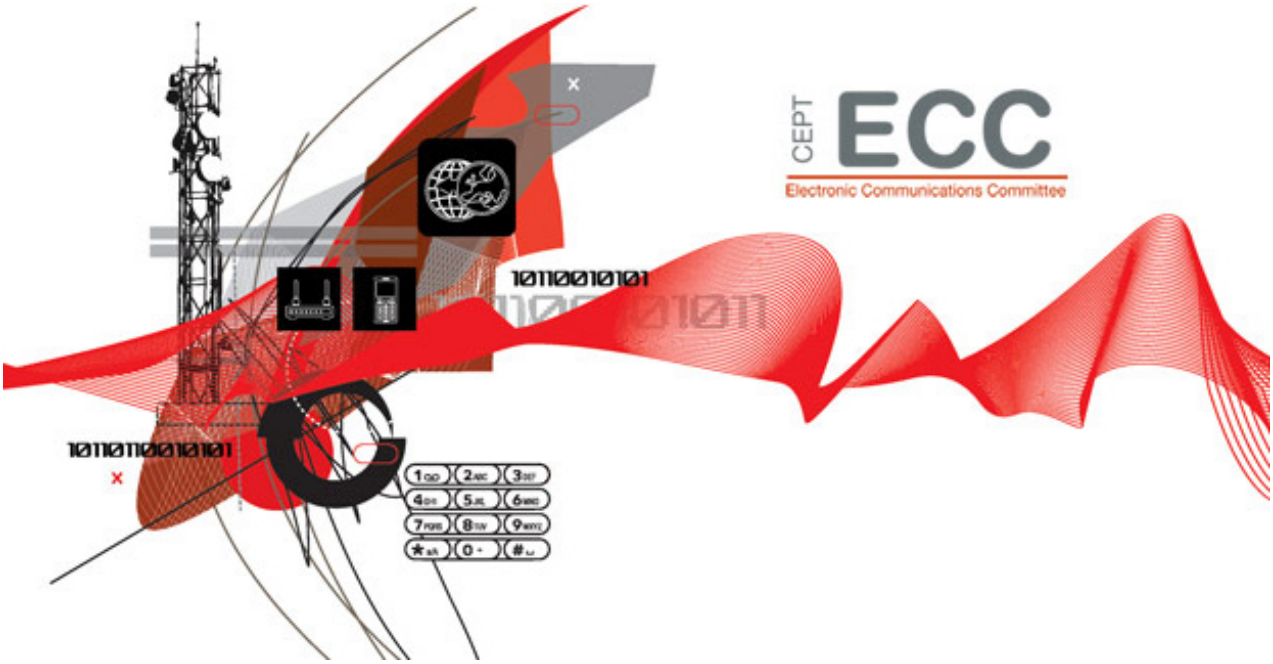


ECC Newsletter July 2016

Short Range Devices: An update of the regulatory approach is on its way

Short Range Devices (SRD) have a huge and increasing significance in our daily lives, so the ECC is working to improve the efficiency of the bands they use. Spectrum demands are on the rise. The long list of requirements include generic SRD, UHF Radio Frequency Identification, home automation and sub metering, automotive SRD, smart meters and smart grids, metropolitan mesh machine networks (M3N) applications, alarm and social alarm systems, and assistive listening devices (including hearing aids), just to give some examples.

Our Newsletter article of October 2013 outlined how the ECC is working to improve the efficiency of the bands used by SRDs, to widen the possibilities for accessing them, and adding new usage opportunities to them.

A key milestone was reached by the ECC in June 2016 with the final approval of CEPT Report 59. It now intends to provide a supplemental Addendum to CEPT Report 59, related to the bands 870-876 MHz and 915-921 MHz. The final approval of this Addendum is planned for the ECC meeting in March 2017. During the public consultation for CEPT Report 59, 22 stakeholders requested a stronger harmonisation proposal in CEPT Report 59 for the bands 870-876 MHz and 915-921 MHz. In our Newsletter article in April 2016 (M2M Workshop Special Edition) we reported that there is a strong request for more harmonisation in 870- 876/915-921 MHz.

Updating the European regulatory framework for SRDs

CEPT Report 59 describes the proposed Sixth Update of the technical annex to the European Commission (EC) Decision on the technical harmonisation of radio spectrum for use by SRDs. It was developed in the 2015-2016 timeframe by the European Conference of Postal and Telecommunications Administrations (CEPT). This was in response to the Permanent Mandate to CEPT to update the technical annex of the Commission Decision on the technical harmonisation of radio spectrum for use by SRDs.

The work carried out followed the guidance from the EC, and has been split into four tasks:

1. Make bands available which have recently been added in ERC Recommendation 70-03 to SRD usage. This includes: consideration of SRD opportunities in 870-876 MHz / 915-921 MHz; provisions for a Medical data acquisition system in the frequency range 2483.5-2500 MHz, for Assistive Listening Device (ALD) applications on a tuning range basis in the frequency range 173.965-216 MHz and for an obstacle detection application for rotorcraft use in the frequency range 76-77 GHz; and extension of the existing entry for the Transport and Traffic Telematics (TTT) category from 5795-5805 MHz to 5795-5815 MHz for road tolling applications. Another aspect is an amendment of the duty cycle definition allowing more flexibility. It is believed this will lead to additional usage opportunities for SRDs in the future.

2. Investigate the requirements for cognitive radio-enabled SRDs and any potential implications in terms of SRD harmonised technical conditions, taking into account the on-going work in ETSI under mandate M/512. These investigations led to the understanding that for the time being, at European level, there is neither a proposal nor an intention to harmonise the usage of a database to allow for new SRD applications.

3. Re-assess, on a demand basis from stakeholders, the relevance and appropriateness of 'other usage restrictions' for the relevant SRD categories. In this context, several frequency bands were found where the regulation could be streamlined, widened, or an ‘other usage restriction’ could be removed (e.g. below 30 MHz, in 6.7 MHz, 13.56 MHz, 27 MHz, 40 MHz). In combination with a more flexible duty cycle definition, it is proposed to withdraw the ‘Low duty cycle/ High reliability’ category and to relax it to ‘non-specific SRDs’. This concept still supports reliable spectrum access opportunities for some SRDs and is considered to lead to the ultimate withdrawal of ‘other usage restrictions’. In addition, CEPT/ECC also

proposes that additional information could be included into the technical annex of the EC Decision for SRDs regarding the relevant harmonised standard published in the Official Journal of the European Union in relation to the respective entry.

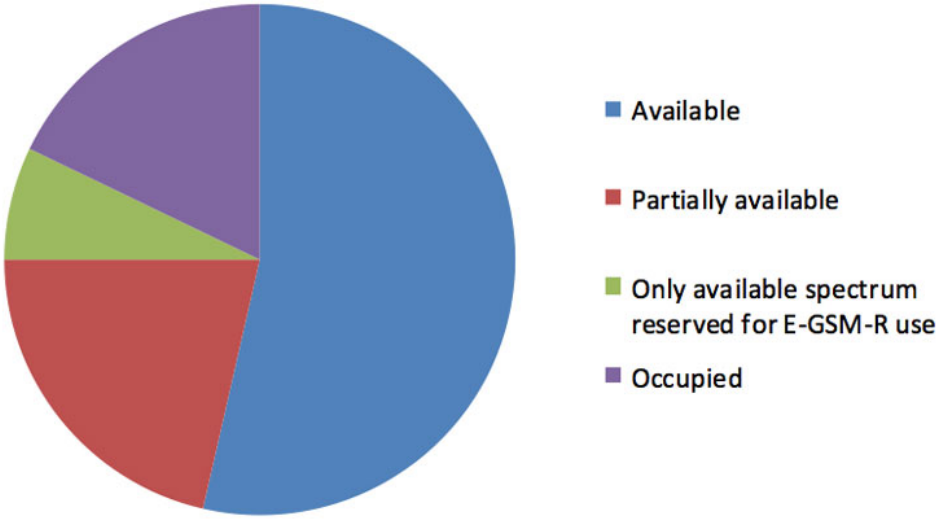
4. Consider merging the existent decisions pertaining to SRDs into one encompassing decision. In this regard, the regulation for UHF RFID currently under 2006/804/EC is proposed to be merged into the EC Decision for SRDs. For UWB-technology based applications, it is important to keep the existing format and to have these applications under a permanent mandate to CEPT. This alleviates national implementation and future changes or additions to the regulations. Finally, a new entry for PMR446 equipment for the harmonised implementation of analogue and digital PMR equipment within the range 446.0-446.2 MHz is proposed to be added in the EC Decision for SRDs. The implementation date, proposed to coincide with the transition deadline, is set in the ECC/DEC/(15)05 to 1 January 2018. Harmonised implementation within Europe using the same date would avoid different implementation dates across Europe for this type of hand-portable equipment.

CEPT Report 59 has already identified some important issues for the next update process. This includes, inter-alia, to investigate further harmonisation in the 870-876 MHz/915-921 MHz frequency bands, new applications such as Smart-Tachograph and Weight and Dimensions, and usage conditions for DECT/SRD devices in the 1900-1920 MHz band.

A major milestone, driven by demand is in front

At present, the range 863 to 870 MHz is used extensively for SRDs. However, these ranges are filling up quickly and a lot of new developments are anticipated, as set out in ECC Report 182 (a survey about the use of the frequency band 863-870 MHz) and by ETSI in a set of seven System Reference Documents[1]. In addition to capacity constraints, the bandwidth of the existing plans is limited to developing applications, e.g. a wider bandwidth for individual UHF RFID devices will improve their performance and function. With machine mesh networks, the required bandwidth of the systems would not fit into the existing narrow bandwidths that are available in the existing frequency band 863-870 MHz.

Another CEPT survey in 2012 revealed a great variety in the European countries' state of readiness for the release of these bands on a licence-exempt basis. It showed that the bands are partially or completely available in some countries; some countries use all or parts of the spectrum for governmental use; and some countries are reserving the 873-876/918-921 MHz spectrum for national extended GSM-R use. This is reflected in the diagram below:



Availability to consider future new usage for SRDs in 870-876/915-921 MHz

Based on ERC Recommendation 70-03, 14 CEPT administrations have already implemented, at national level, some provisions for SRD and/or RFID usage in this frequency band (status June 2016).

The supplementary Addendum to CEPT Report 59 has the following main targets:

- for the band 870-876 MHz to foster a new SRD regulatory framework for European harmonisation, aiming to assist emerging new applications for SRDs;
- for the band 915-921 MHz to foster a new SRD regulatory framework for new applications. This will have the clear benefit of achieving a global harmonisation.

Existing investigation results described in ECC Report 189 will be used for this purpose, and ongoing studies for the 862-870 MHz frequency range may also have an impact on these considerations.

The aim will be to find a CEPT proposal for the flexible and balanced minimum implementation target for European harmonisation. This will only be possible when achieving a consensus amongst all stakeholders (SRD, governmental, railway) about a compromise solution.

It is hoped that an appropriate harmonisation step will make it possible to achieve a variety of economically important benefits in support of new applications, as well as better service qualities. It should reduce the cost of products, through greater economy of scale productions, or make them viable for the next generation of the Internet-of-Things (IoT). Examples for such M2M/IoT applications include:

- **RFID:** 915-921 MHz presents an opportunity to better define the RFID interrogator signal than was previously permitted in the more limited bandwidth at 865-868 MHz. Technical conditions support faster data rates and greater penetration into

pallets containing high numbers of tagged goods, and so a successful tag read becomes more likely;

- **Home automation and sub-metering:** The need for more comfort with sub-metering functions for heating or electricity, more security with picture checking in case of intrusion, and a strong emphasis on global energy savings require the use of systems with advanced control protocols.These protocols permit the use of dynamic functions that coordinate the operation of actuators though advanced automatic controls and sensors.

- **Smart meters:** Proposals for smart metering have the objective of securing spectrum for technologies intended to deliver significant savings in energy consumption. Smart electricity meters' consumption is intended to give users the necessary information to enable them to use energy more wisely. It is anticipated that this will educate consumers on the impact of their lifestyle choices on energy consumption and reduce the peak and overall demand. This better balancing of the electricity load could potentially reduce the need for the generation capacity to meet peak demand. Smart gas meters consumption would allow for the smarter distribution of the supply where consumers could modify their consumption, particularly in periods of high demand. Smart meters will also allow electricity network operators to understand supply outages (and restoration) in real time, as well as providing detailed information on the quality of the supply to individual homes. Finally, service restoration switches can allow electricity to be disconnected from properties that are unoccupied.

Thomas Weber, European Communications Office,
Chairman of the Short Range Devices Maintenance Group

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[1] Generic SRD, RFID, Home Automation & Sub Metering and Automotive SRD, TR 102-649-2, Smart Meters and Smart Grids, TR 102 886]; Metropolitan Mesh Machine Networks (M3N) applications, TR 103 055; Alarm and Social Alarm systems, TR 103 056; Assistive Listening Devices, TR 102 791; Wideband SRDs with advanced spectrum sharing capability, TR 103 245; and Technical characteristics for Ultra Narrow Band (UNB) SRDs operating in the UHF spectrum below 1 GHz, TR 103 435.

CEPT starts preparation process towards World Radiocommunication Conference 2019

Just six months after signing the final acts of the 2015 World Radiocommunication Conference (WRC-15)[1], the preparation cycle for the next WRC has started.

Over the next three years this process will include coordination and agreement of CEPT positions by the European administrations. It will set the basis for negotiations with other regional organisations before and during the four weeks of intense work at the ITU World Radiocommunication Conference in 2019 (WRC-19). The future Conference will address a number of questions within the Radiocommunication sector - of both worldwide and regional relevance. Attendees can expect discussions on particular issues of digitalisation, 5G, satellite communication, digital divide, global maritime and aeronautical transportation.

A framework in place

The long and exciting process of CEPT preparations for WRC-19 started in April 2016. As it has been in the past, it is the responsibility of the Conference Preparatory Group (CPG) of the ECC to prepare for WRC-19 and to develop CEPT positions and proposals for the Conference.

The CPG, under the chairmanship of Mr Alexander Kühn (Germany), had its first meeting in Bonn, Germany, 12 to 14 April. The meeting agreed on the structure, and appointed Mr Alexandre Vallet (France) and Mr Gerlof Osinga (The Netherlands) as CPG vice-chairmen. Both have taken specific active responsibilities within the preparation process.

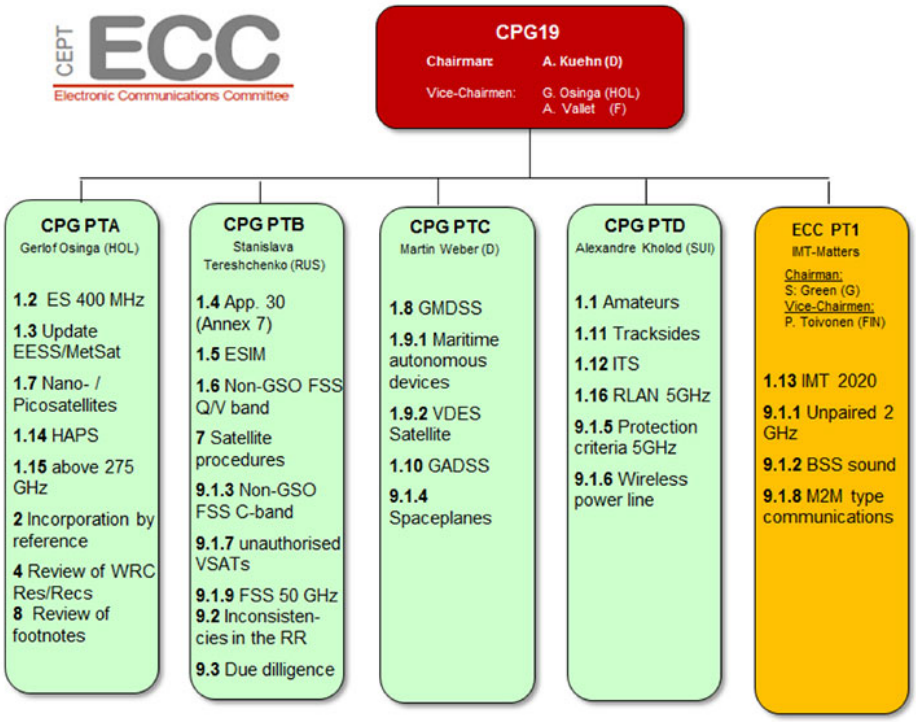
The CPG further decided to create four CPG Project Teams under the chairmanship of Mr Gerlof Osinga (The Netherlands), Ms Stanislava Tereshchenko (Russian Federation), Mr Martin Weber (Germany) and Mr Alexandre Kholod (Switzerland). The CPG followed a well-established approach for the allocation of tasks and the distribution of WRC-19 Agenda items amongst these Project Teams.

The CPG also agreed to assign a number of WRC-19 Agenda items, for example, spectrum for IMT 2020, to ECC Project Team 1. This decision was made in order to work efficiently and continue to use the already established working framework for mobile (IMT) issues.

The structure of the CPG seeks to balance the workloads of the respective Project Teams, to enable an effective CEPT support to the activities, and to offer an efficient platform for the preparation of the ITU-R activities on the way to WRC-19. It also takes account of possible interaction with other ECC entities in a timely manner.

An overview of the CPG-19 structure and the distribution of WRC-19 Agenda items between the Project Teams are given below:

Structure of the CPG



Important topics

One of the most debated topics during the 2015 Conference was the development of the Agenda for WRC-19. This item was a huge success for CEPT as most of the European proposals were included into the next Conference agenda.

Some of the important Agenda items to be addressed at the 2019 Conference include:

- WRC-19 will consider the identification of frequency bands in the millimetre wave length for the future development of International Mobile Telecommunications (IMT). These will include possible additional allocations to the mobile service. The assigned Resolution of WRC-15 focuses on specific frequency bands above 24 GHz, as proposed by CEPT. They will be assessed for worldwide harmonisation for 5G.

- WRC-19 will consider issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5 150 MHz and 5 925 MHz to accommodate for possible mitigation techniques if any.

- In order to accommodate evolving Global Flight Tracking applications, WRC-19 will consider regulatory actions for the development and implementation of a Global Aeronautical Distress and Safety System (GADSS).
- WRC-19 will study possible regulatory actions to support the modernisation of Global Maritime Distress Safety Systems (GMDSS).
- WRC-19 will address spectrum needs for telemetry, tracking and command to accommodate the growing number of satellites with short mission duration.

One challenge of WRC-19 at this stage will be to find the right balance for frequency bands in which several communities (satellite, mobile, HAPS) are interested. In some cases all of them are aiming to enhance the availability of broadband connections.

Ready, steady, go

CPG and its Project teams are open for all interested stakeholders within CEPT, in particular those from industry. The aim is to collect all relevant views for the decisions of European administrations.

With the structure and distribution of work in place, CEPT will now set the wheels in motion within its CPG and initiate all necessary preparations for WRC-19. This includes not only finding common agreement within CEPT, but also using the lessons learned from previous conferences. It is essential to exchange views and cooperate with the five other regional groups representing the key CEPT partners in various regions of the world. Overall, we want to find common solutions.

Further information on CPG can be found here.

Alexander Kühn, Chairman of the ECC's Conference Preparatory Group

Stella Lyubchenko, European Communications Office, Spectrum Expert

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[1] Results of WRC-15 can be found in our article here

An introduction to SEAMCAT

A key goal in the ECC strategic plan for the period 2015-2020 is to provide expertise in managing scarce resources, notably the radio spectrum. The higher penetration of wireless communications in recent years has led to increased congestion in the radio spectrum. As a result, radiocommunication systems must find a way to share the resource efficiently. For this purpose, sharing and compatibility studies need to be carried out to investigate the possibilities for systems to coexist in the same or in adjacent frequency bands.

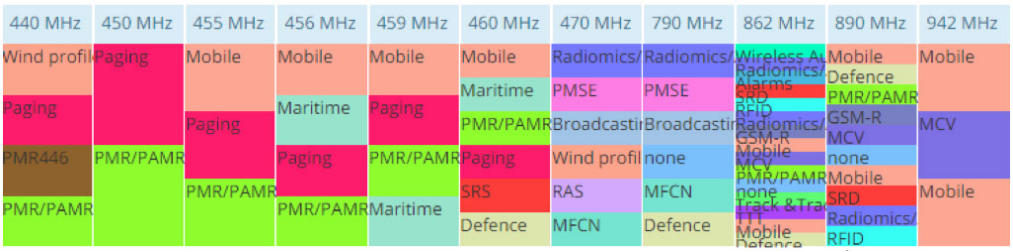

Figure 1: Example of radio spectrum occupancy in Europe[1]

To manage the spectrum resource in an effective and efficient manner, it is necessary to develop methods and tools that are capable of modelling complex compatibility scenarios realistically. They in turn will determine if coexistence between different systems can be achieved.

In that context, SEAMCAT (Spectrum Engineering Advanced Monte Carlo Analysis Tool) has been developed since the late 1990s to respond to the need for a common spectrum engineering analysis tool. The aim is to have a recognised, flexible and reliable platform for assessing the compatibility among various radio systems.

1. SEAMCAT: what is it and how does it work?

A free of cost, open-source[2] software tool, SEAMCAT performs calculations based on the Monte Carlo simulation method for statistical modelling of different radio interference scenarios. It has been developed to analyse a diverse range of complex spectrum engineering and radio compatibility problems. It aims to obtain close-to-reality results, increasing the chances of using the radio spectrum efficiently.

1.1. The Monte Carlo method

In general, Monte Carlo methods refer to a set of computational algorithms that allow using randomness to solve problems that might be difficult to solve using a deterministic approach. They allow solving problems that have a probabilistic interpretation and are very useful for simulating systems which involve many variable parameters.

This is particularly the case with radiocommunication systems, which are defined by many parameters that vary in real operating conditions. Furthermore, if the aim is to assess the interaction of many systems, the number of variables involved in the exercise substantially increases.

For the purpose of explaining the basics of the Monte Carlo method, let's consider a simplistic scenario involving just one radiocommunication system. Let's imagine that we want to calculate the mean power of the signal received in a system composed of:

- a fixed transmitter operating at constant frequency and power; and
- a moving receiver.

In this basic scenario, the physical location of the transmitter will be fixed while the position of the receiver may vary. Therefore, the power of the received signal may also vary.

In the Monte Carlo method, parameters that vary can be defined as random variables with a given distribution. The basic principle of a Monte Carlo simulation is the random sampling of these distributions at each simulation run (i.e. simulation event) in order to perform a given calculation.

Continuing with our example, all possible positions of the moving receiver are defined as a random variable with a given distribution. In a simulation event, one of the possible positions of the receiver will be chosen randomly across the distribution. This value will then be used to calculate the received signal power for that specific event.

In a Monte Carlo simulation, results of calculations obtained at each event can then be averaged across the total number of events. The number of events required to produce a statistically representative result depends on the number of random variables included in a given scenario.

In our example, after having simulated all events, we can then average all values of the received signal power calculated at each event in order to obtain the resulting mean received power.

1.2. Using the Monte Carlo method with radio systems in SEAMCAT

Calculations performed in SEAMCAT involve one victim system and one or several interfering systems. The radio parameters and locations of the transceivers in each system can be customised.

In the schematic scenario depicted in the figure below the receiver of the victim system gets its ***wanted signal*** from its corresponding transmitter. The victim receiver operates amongst a population of one or more interfering transmitters. Therefore, the victim receiver also gets ***interfering signal(s)*** originated at the interfering transmitter(s), as indicated in Figure 2 below.

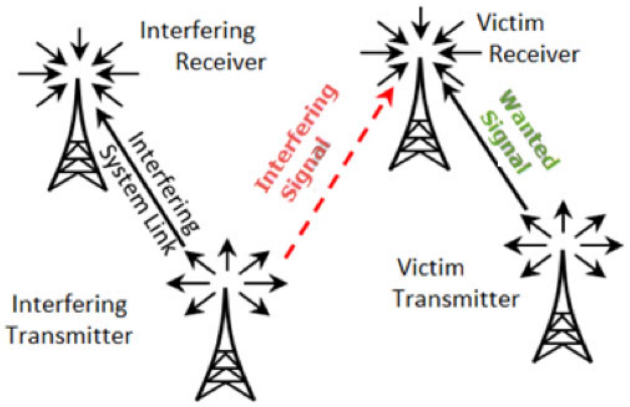

Figure 2: Schematic compatibility scenario

In a SEAMCAT simulation, it is possible to assess the effect of interference into the victim system by comparing what happens before and after the introduction of one or more interfering system(s). At each simulation event, the received signal strengths for each link are calculated. The wanted and interfering signal strengths are compared according to a given criterion (i.e. interference criterion, protection ratio[3], network capacity or bitrate specifications). The final results are typically defined in terms of probability of interference, or indeed average capacity/bitrate loss, averaged over all simulated events. Other results are also provided and may be used for further analysis, such as the distributions of the wanted and interfering signal strengths across all events.

The main interference mechanisms that can be analysed in SEAMCAT are the unwanted emissions of interfering transmitters, the selectivity and overloading of the victim system receiver and the effect of intermodulation products. Figure 3 below depicts the two main interference mechanisms typically analysed (i.e. unwanted emissions and receiver selectivity).

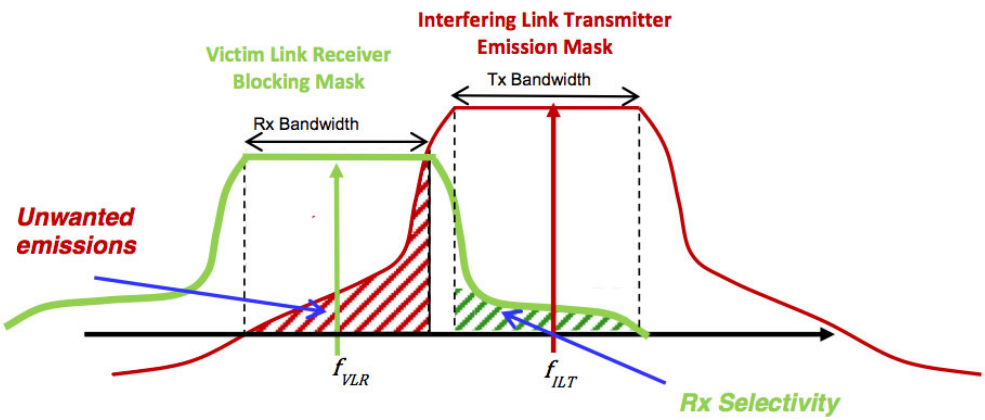

Figure 3: Unwanted emissions and receiver selectivity

Comprehensive information on SEAMCAT, including full details of settings, parameters, computation algorithms and results, is contained in the SEAMCAT handbook. This document was reviewed by the CEPT and was published at the end of April 2016 as ECC Report 252[4].

2. SEAMCAT development and user community

SEAMCAT is developed under the mandate of the CEPT's Electronic Communications Committee. The SEAMCAT Technical Group[5] (STG), under the direction of the Working Group Spectrum Engineering, is the responsible body that proposes, discusses and validates corrections and enhancements to the software and the handbook. The group cooperates closely with other ECC working groups and project teams, to respond to their SEAMCAT-related needs, and to inform relevant sharing and compatibility studies within these groups.

It is important to note that SEAMCAT is not only used within the CEPT, but also worldwide in administrations, industry and academia. These sectors comprise the so-called SEAMCAT community, whose focal point is the ECO[6], and who work together to improve the tool.

3. SEAMCAT key development objectives

The main objectives in SEAMCAT development are to provide a recognised, flexible and reliable platform. That platform enables realistic modelling of complex scenarios for the compatibility assessment involving various radio systems, using the Monte Carlo method. Furthermore, users also expect a tool that is comfortable to use and performs simulations at a satisfactory speed.

3.1. Increase its flexibility

In the context of SEAMCAT development, flexibility refers to the capability of the tool to adapt to emerging needs in terms of availability of input parameters and output results. This also means that it should be able to include new system definitions without requiring radical changes to the program each time a new system is introduced.

One way to achieve this type of flexibility is through a variety of input parameters, which can be specified in SEAMCAT workspaces, and through the availability of a wide range of output results.

Flexibility is also provided through the use of libraries. We can distinguish among two main types of libraries:

- **Libraries for system components and parameters.** SEAMCAT is distributed with a pre-defined set of libraries (see Figure 4 below), which contain system parameters. For example, there are libraries for generic and cellular systems, spectrum emission masks, receiver blocking masks, transceivers, etc. Also, users can build customised libraries for their own requirements, which can then be shared.

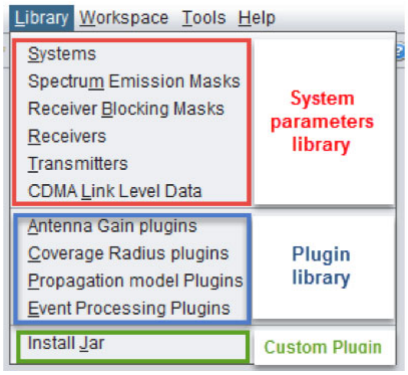

Figure 4: SEAMCAT system parameters and plugin library

- **Plugin libraries.** Plugins are software components that can perform specific calculations, access intermediate results of simulations and enable the customisation of final results. SEAMCAT contains built-in plugin libraries for propagation models, antenna patterns and coverage radii. Additionally, specific types of plugins - event processing plugins - allow defining specific calculations based on the intermediate results of simulations. These are accessible from the computational core of the tool. With this new feature SEAMCAT functionalities can be extended to implement customised algorithms but still use a shared interface.

3.2. Improve its reliability

Reliability in this context means the degree of confidence that users can have in the accuracy of simulation results. This is intrinsically related to the design and functionalities provided in SEAMCAT.

Several features have been developed to make SEAMCAT more reliable:

- **Sharing SEAMCAT workspaces and simulation results.** This enables users to verify input parameters, compare and reproduce results and therefore inform discussions to define necessary sharing conditions and regulations.
- **Running simulations in debug mode.** This provides a report containing all variables involved in a given simulation and interim simulation results.
- **Play/replay feature.** Users can analyse parameters and calculations for each event in a specific simulation run.

3.3 Enhance its computation speed and user-friendliness.

The regular maintenance of SEAMCAT aims to produce a software tool that is faster and easier to use

Computation speed has been improved in recent versions with the introduction of parallel processing, which uses the capability of multi-core computers, and with the optimisation of complex algorithms. Continued increases in computation speed are expected in the upcoming releases.

One of the challenges that needs to be further addressed in the upcoming releases is the improvement of the tool's user-friendliness. This can be achieved by improving the graphical interface, by extending the consistency checks for parameters entered in workspaces and by regularly updating the documentation accessible through the program and available in the SEAMCAT handbook.

4. Promoting the use of SEAMCAT

The promotion of SEAMCAT is also an important objective in the ECC strategic plan for the period 2015-2020. In response to this goal, the ECO organises free of charge workshops on a regular basis. They are intended for SEAMCAT users with different levels of expertise, from beginners to experienced users. Additionally, the ECO frequently introduces the tool and its most recent features at international conferences. All these efforts are intended to increase the use of SEAMCAT. In the CEPT context, it is frequently used by spectrum engineering project teams for the preparation of their deliverables. This intensive use can be observed in the number of documents - more than 30 ERC and ECC reports[7] - containing compatibility studies based on Monte Carlo simulations using SEAMCAT.

SEAMCAT: a brief summary

SEAMCAT (Spectrum Engineering Advanced Monte Carlo Analysis Tool) is part of the core objectives of the ECC strategic plan for the period 2015-2020.

Efforts on SEAMCAT development aim to address the challenge, and to produce a **recognised**, **flexible** and **reliable** platform for assessing the compatibility among various radio systems in a **realistic** manner, with satisfactory **computation speed** and **user-friendliness**:

- The power of the Monte Carlo method is key for **realistic** modelling of complex compatibility scenarios between radiocommunication systems.
- **Flexibility** is achieved through the availability of libraries for system parameters and plugins. These libraries are continuously growing.
- Increased **reliability** is attained by enabling saving and sharing of workspaces and full simulation results. Furthermore, running simulations in debug mode and being able to extract intermediate results thanks to the play/replay feature also contribute to this aim.
- The introduction of parallel processing and the optimisation of complex algorithms aim to achieve a higher **computation speed**.
- Improvements to the graphical interface, the addition of consistency checks for workspace parameters, and updates to the available documentation seek to produce a tool which is more **user-friendly**.
- SEAMCAT is already a **recognised** tool and it is used inside and outside the CEPT by administrations, industry and academia. Its promotion though workshops and seminars aims to broaden its use.

José Carrascosa, European Communications Office,
SEAMCAT project manager and chairman of the SEAMCAT Technical group.

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[1] Radio spectrum applications in Europe in the 440 – 942 MHz range , obtained from the ECO Frequency Information System (EFIS): view

[2] The source code can be downloaded free of charge after signing a licence agreement. Further information is to be found at the SEAMCAT Source Code page: view

[3] A protection ratio is the minimum value of the wanted-to-unwanted signal ratio, usually expressed in decibels, at the receiver input, determined under specified conditions so that a specified reception quality of the wanted signal is achieved at the receiver output (c.f. Nr. 1.170, ITU Radio Regulations).

[4] ECC Report 252: SEAMCAT handbook. It can be downloaded here

[5] Further information on the SEAMCAT technical group (STG) can be found here: here

[6] The ECO (European Communications Office) is the permanent office of the CEPT to which it provides advice and support in order to help it to develop and deliver its policies and decisions. ECO further supports CEPT member countries

and other stakeholders providing a forum to debate and advance European communications policy for the benefit of all Europe's citizens

[7] SEAMCAT workspaces used in ERC and ECC Reports are made available in zip files in the ECO documentation database: www.ecodocdb.dk