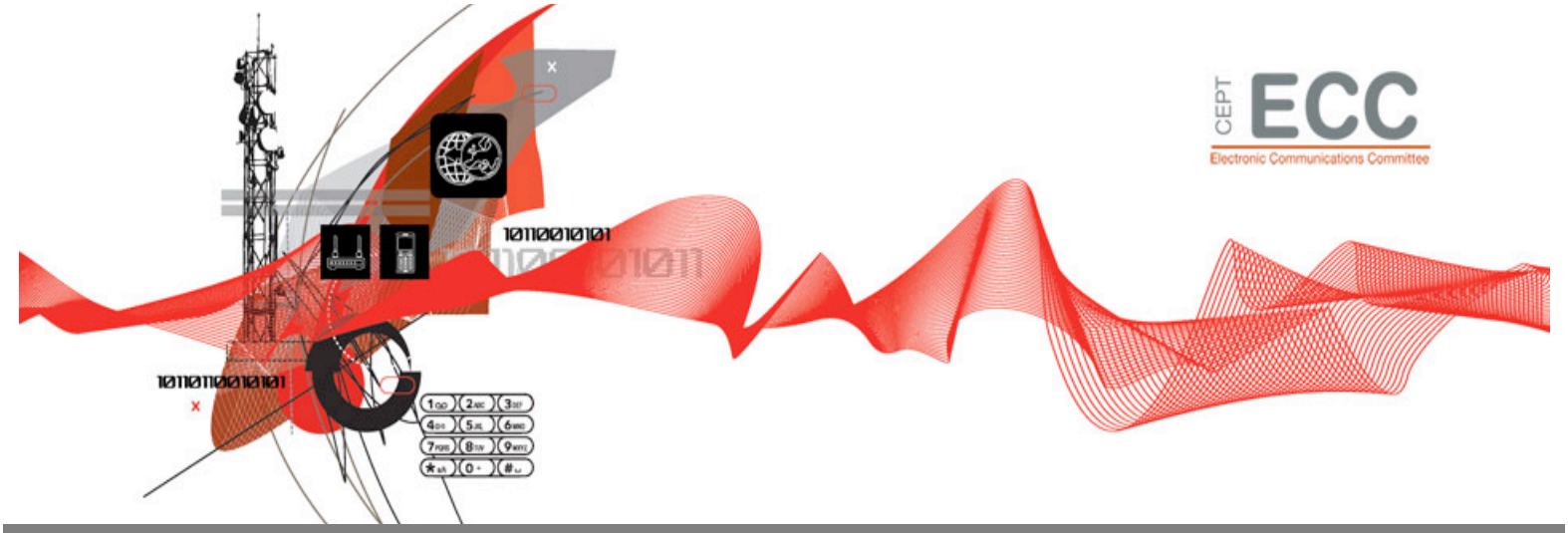


ECC NEWSLETTER **July 2015**

5G: Anywhere, anytime

Did you notice that 5G is everywhere? In 2014, 5G was identified as a major challenge in the Electronic Communications Committee's (ECC) strategic plan. It has been listed as an objective in the International Telecommunication Union's (ITU) roadmap for the standardisation of IMT-2020, the International Mobile Telecommunications system for 2020 and beyond.

In addition, 5G is expected to be high on the agenda at the 2019 World Radiocommunications Conference (WRC-19). It is also part of the Digital Single Market strategy, and 5G research will benefit from €700 million in EU funding.

While 5G will be a prominent feature in our daily lives after 2020, it is already in the daily lives of spectrum managers around the world, and here at the ECC.

What is 5G really?

Put simply, 5G is the next generation of broadband communication technologies. However, this concept of "generation" is misleading. Long-Term Evolution (LTE) has been commonly considered as 4G while some experts would tell you that, technically speaking, 4G corresponds to LTE-advanced technology.

Therefore, it is more convenient to refer to the ambitious efforts of ITU to specify 5G as IMT-2020. Also, we should recognise that there will be some "pre-5G" deployment even before 2020, at the 2018 Olympic Winter Games in South Korea, for example.

One of the main objectives of 5G is to increase the current data rates up to several gigabits per second (Gbit/s) with even more than 10 Gbit/s in hot spot environments. Today, carrier aggregation already enables us to increase data rates but its complexity is exponential with the number of possible combinations of frequency bands used. As a consequence, industry wants to consider the use of higher frequencies in order to increase the bandwidth available, which is necessary to achieve such speed.

This would be made possible using massive MIMO (multiple input and multiple output) solutions to compensate for the additional propagation loss in higher spectrum. Array antennas would be integrated in the terminal, which is made possible since the wavelength would become smaller.

Another option for increasing data rates, already envisaged for 4G, is the development of small cells and the combination of the capacity of unlicensed bands (e.g. 5 GHz) with the capacity of a licensed block. This will require technology development such as the Licensed-Assisted Access (LAA) approach, as well as smart

networking for handover and switching between various technologies and frequency bands in heterogeneous networks.

In addition, 5G will offer many features such as improved connectivity, low-latency communication, prioritisation, energy optimisation and greater security. In particular, it aims to address the Machine to Machine/ Internet of Things challenge which will multiply the number of connected devices with very different requirements.

In the future, there will be a vast number of connected devices with very different requirements other than just personal mobile phone terminals. The overall objective will be to adapt the radio networks to the device and user needs. As a result, flexibility and scalability of the radio air interfaces will be essential.

This intrinsic flexibility and adaptability which will be part of 5G may offer side opportunities in terms of more efficient spectrum management. It will facilitate spectrum sharing with other users of the spectrum (e.g. under the Licensed Shared Access approach) or between access and backhauling networks. Also, the 5G waveform may be improved to reduce the unwanted emissions, improve the coexistence in adjacent bands or channels and remove the need for guard bands.

Although ECC harmonisation decisions for mobile broadband (designated as MFCN, mobile and fixed communications networks) are technology neutral, ECC will have to monitor carefully the development of 5G technology to fully understand the requirements and the associated opportunities around spectrum and regulations.

What spectrum are we talking about?

It is now recognised that the first 5G or pre-5G deployments are likely to occur in mobile broadband spectrum harmonised below 3.8 GHz.

In this respect, ECC has already harmonised more than 1200 MHz of spectrum for mobile broadband in the frequency range from 694 MHz to 3.8 GHz. This frequency range has been under permanent study for almost 20 years with a willingness to always increase the availability of bands for mobile broadband.

However, even if CEPT had developed proposals for additional bands for WRC-15, we have certainly reached a point where any additional bands would be under significant sharing constraints. There is a need to provide and secure spectrum access in the same range to other services and applications, i.e. radio-navigation (GPS/GALILEO/GLONASS), civil aviation, scientific /meteorological use of spectrum, satellite communications, safety, defence, etc.

Nevertheless, the current ECC harmonised framework for MFCN is providing 400 MHz of continuous spectrum in 3.4-3.8 GHz which already offers more opportunities for larger bandwidth than any other currently available band.

In the near future, there will be a need to adapt the harmonised regulatory framework in these existing frequency bands to account for 5G. But this is not likely to be the most significant challenge.

As explained above, 5G envisages very high data rates, which will need much larger bandwidths than ever before. Those high data rates may only be found in higher frequency bands.

CEPT is currently working on a proposal for a WRC-19 agenda item to respond to 5G spectrum requirements in frequencies above 6 GHz. This lower edge of 6 GHz was initially proposed to separate the existing spectrum for mobile broadband (including WiFi) and the new *terra incognita* for mobile broadband spectrum. It has become a debate in itself because increasing this lower edge would consequently exclude some bands from any consideration (though this may be welcome by the existing spectrum users!). Alternative lower edge put forward in the discussion is, for example, 24 GHz or 31 GHz.

Identifying suitable spectrums with all necessary studies beginning at 6 GHz will not be without its challenges. In order to simplify the task of preparing the WRC-19 agenda item within CEPT and ITU, several countries have investigated the possibility of limiting or focusing their scope to a list of most promising frequency bands.

The difficulty of the exercise already demonstrates that there is no easy solution to identify large bunches of spectrums (i.e. several GHz) in higher bands, at least up to 50 GHz. Compatibility studies must be carried out in each band, and each band must balance with the requirement of other existing services and applications such as satellite communications, scientific use of spectrum or radio determination.

Another important factor is the on-going technological development of 5G, with yet unknown characteristics. They may impact spectrum requirements and the possibility of coexistence with other spectrum users. Proposals are being discussed within CEPT but it is not clear yet what the final European proposal for WRC-15 will be.

The final text of the WRC-19 agenda item on 5G will be decided by WRC-15, but significant activity will be needed within ITU and CEPT in the meantime. Both organisations must work to understand which frequency bands could be used for 5G in Europe in the future, and also which could have the best potential for worldwide harmonisation, which remains key for 5G's development to limit the complexity of terminals. As an illustration, one may imagine the design of a terminal where the lack of harmonisation would result in having to implement a dozen of array antennas.

This will require due attention to be given to the systems already using these frequency bands but also to get a good knowledge of technical and operational 5G requirements, in order to understand sharing possibilities as well as the impact of convergence between access and backhaul 5G networks.

Future spectrum opportunities and service innovation

5G is already attracting much attention and effort from spectrum managers and, indeed, from CEPT. Industry has been successful in demonstrating the potential of 5G in responding to the challenges already identified for the development of services, devices and networks. Likewise, it has identified new spectrum opportunities for broadband in higher frequency ranges.

The role of CEPT now is to find the suitable spectrum for making such opportunities a reality and to do this by working side by side with the mobile industry and the other users of the spectrum.

Eric Fournier
Chairman, CEPT/ECC

The evolution of EFIS

As the seemingly insatiable appetite for spectrum continues apace, it is important to know how the spectrum is actually used. Indeed, a clear need exists for robust and authoritative information. As a centre of expertise in electronic communications, the European Communications Office (ECO) has been providing and developing, since 2002, a unique and high quality information tool on spectrum use and licensing conditions across Europe. The aim is to improve understanding and advance regulatory solutions for the future allocation of this scarce public resource.

In the April 2013 edition of this newsletter, we published an article highlighting the value of EFIS as a source of information on spectrum use in Europe. More than two years later, it is now time to guide you through the most significant developments we have implemented.

Why use EFIS?

The main benefit is simple: users of EFIS can save time. They do so by easily finding regulatory information as well as informative reports in relation to specific frequency ranges, radio services and applications. This includes information about the tables of frequency allocations and about the applications (national radio interfaces, individual rights-of-use (licenses) in the mobile bands in Europe).

Applicable Electronic Communications Committee (ECC) Deliverables on spectrum harmonisation can be selected and found in EFIS together with the related national implementation information. These include ECC Decisions, Recommendations and also CEPT and ECC Reports. In addition, Harmonised European Standards, mostly developed by ETSI, the European Telecommunications Standards Institute, relevant documentation from the European Commission and national radio interfaces are also available in EFIS.

The system also contains proposals for future spectrum use through the availability of ETSI system reference documents. In addition, it provides a good overview on the actual spectrum use and the necessary spectrum inventory information for the many different radio services categories.

EFIS: A tool for spectrum inventory

EFIS plays a key role in the European Union's spectrum inventory, which is part of the programme of initiatives set out in the EU Radio Spectrum Policy Programme (RSPP). In this context, in 2013, the ECC published CEPT Report 46 and CEPT Report 47 in response to a Mandate from the European Commission. These Reports identified areas for development of EFIS which would enable it to serve as a primary input to the spectrum inventory. In particular, CEPT Report 46 sets out the information considered essential for the different radio services and applications in this context.

As a result, EFIS has been enhanced with the inclusion of complete and up-to-date information on licensing of mobile bands in Europe derived from the information provided by administrations in ECO Report 03.

Similarly, EFIS contains comprehensive information derived from ERC Recommendation 70-03 on Short Range Devices and related national implementation information. Thus, it includes information related to the vast majority of applications under general authorisations.

Another new feature in EFIS is the availability of all the fixed service channel arrangements, set out in approximately 25 different ECC/ERC Recommendations. They include the applicable national implementation information. Relevant graphical tools have also been developed to enhance and support the related content.

Into the bargain, improved information on Satellite Services and Private/Professional Mobile Radio (PMR) use has also been included. This supports administrations in their duties to provide information for these services for spectrum inventory purposes.

Information from CEPT questionnaires, notably in connection with EFIS's role as the data collection point for the EU spectrum inventory, is also frequently made available in the system.

EFIS: A tool to visualise national table of frequency allocations and applications

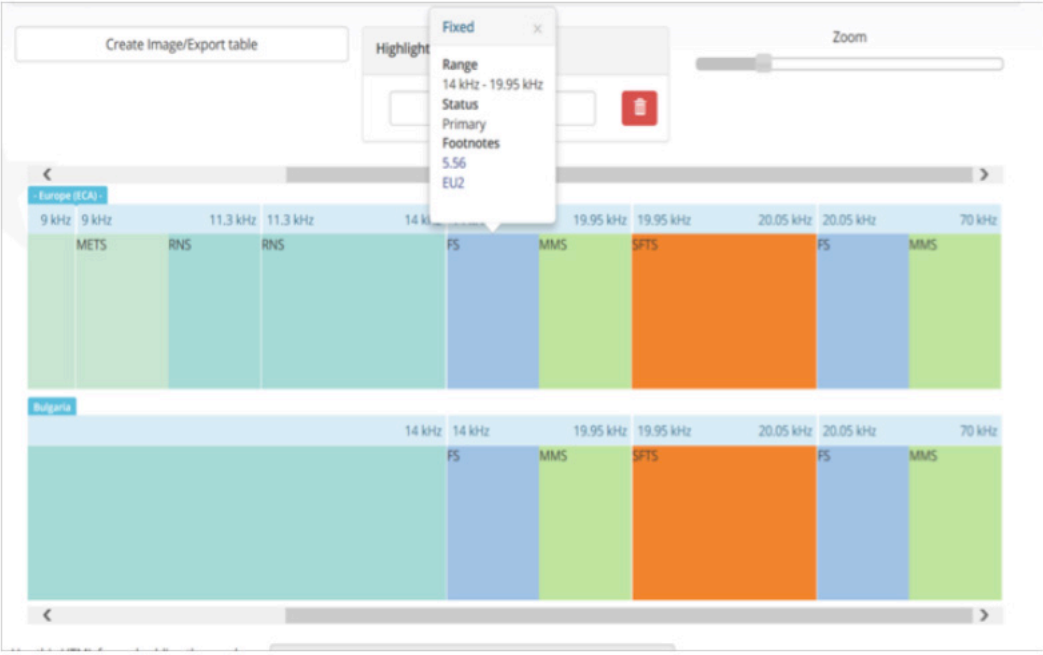
The EFIS web-design and graphical user interface has been completely revamped and modernised. Graphical visualisations are available for:

Frequency allocations (see example below) and applications;

Rights-of-use information in the public mobile bands;

Short range device implementation status information;

Fixed service channel arrangements and the related national implementation information.



The tool can also be separately used outside the EFIS database on other webpages with the allocation and application terminology translated into the user's national language. Consequently, administrations and users can generate pictures or use a link to the tool for parts of their national frequency allocations. Alternatively, they can link to applications tables and export them, show them on their own webpages or even use them as links in documents.

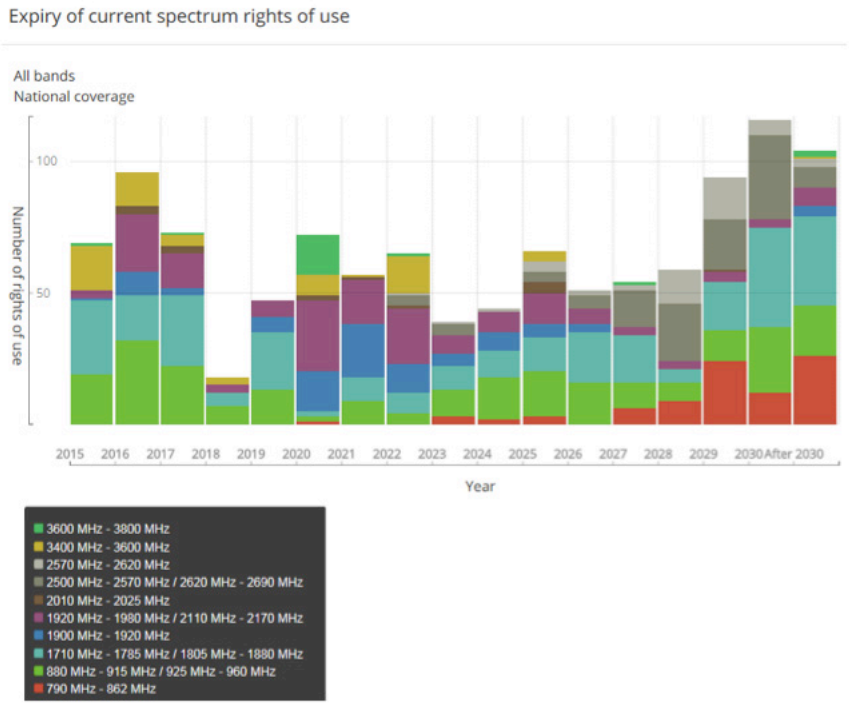
EFIS: A tool to generate reports on spectrum usage

New features have been implemented so that the user can process some of the data included in EFIS to match his purpose. A set of features is now available in conjunction with the EFIS implementation of ECO Report 03 containing the licence information in the mobile communication network frequency bands.

The data contained in EFIS is then searchable, exportable and can be displayed through dedicated graphical visualisations.

It is thus feasible to extract statistics depending upon a range of criteria such as the country, the frequency band, the coverage type (national, regional or single transmitter), and information associated to the rights of

use of the licensee (expiry date, start date or status). Depending on the query, the statistics can be displayed in a graphical format, as a table or a map (see below).



What's next?

As Europe's central resource for spectrum information, EFIS is constantly evolving, not only in terms of the features and facilities it offers to users, administrations, industry and other 'end users', but also in respect of content.

A steadily increasing quantity of information now populates the database. The ECO and the EFIS/MG, in cooperation with the EC and other interested parties, will continue to improve quality and to protect the integrity of the data. It will ensure that strategic spectrum management goals in support of technological growth are met.

EFIS is also being developed to improve the efficiency of some ECC processes. The database will be used in the near future to provide users with a feature to download their version (all or selected content) of an always up-to-date ERC Recommendation 70-03 on Short Range Devices, which is the most downloaded document of all ECC deliverables.

In addition, a new ECO Report on Fixed Service implementation information, which is similar in its structure to ERC Recommendation 70-03, will be available through the EFIS platform. Plans are also in place to improve information on satellite services and Programme Making and Special Events (PMSE) in EFIS in a similar manner in the near future.

In order to respond to the user's needs, a number of new web-services will be developed. They will enable users to export more data and documentation together with the relevant frequency and radio service and application indication.

Facts and figures:

- The ECO Frequency Information System (EFIS) was launched in 2002.
- Some 45 CEPT administrations now publish data in EFIS, the scope of the content is wider and there are many more features and facilities.
- EFIS is available to the public on the Internet either via the ECC website, the ECO website or directly at www.efis.dk.
- The EFIS website had over 100,000 visitors from around the globe in 2014, and in recent years the USA and China have become the top two countries performing searches in EFIS.
- EFIS is administered by the ECO and managed under the supervision of the ECC through its ECO Frequency Information System Maintenance Group (EFIS/MG).

Thomas Weber,
EFIS project manager

When every second counts

Striving for faster emergency response through more accurate and reliable caller location information in Europe

Anyone who has ever had to make a call to the emergency services will know too well the feeling that time stands still. In situations where it is a matter of life or death every second counts. When that call is made seeking emergency assistance, it is vital that the call taker is able to determine the location of the caller quickly. They must do so with a high degree of confidence in the shortest possible period of time.

In most cases callers will have the capacity to verbally communicate their whereabouts but there will always be exceptions. In situations where emergency callers are incapacitated through injury or shock, where they are unfamiliar with their surroundings or where there is a language barrier, other methods of determining location must be available. The provision of accurate and reliable caller location information is therefore crucial in overcoming these barriers. It will ensure that help can be dispatched to the right location in the shortest possible period of time.

Traditionally, it was possible for the emergency services to rely on the installation address associated with a fixed telephone number to determine caller location. However, as 65-70% of emergency calls in Europe are now made from mobile devices the caller location challenge becomes a little more complex. Emergency calls may also be made from the Internet, which poses an additional location challenge.

The ECC's Working Group Numbering and Networks (WG NaN) established a project team on emergency services (PT ES) in 2013 with the objective of producing an ECC Report to help European countries implement improved caller location techniques. PT ES delivered ECC Report 225 in October 2014 following extensive consultation with key stakeholders in Europe, including the national emergency services authorities, public safety answering points (PSAPs), police, ambulance and fire services, network operators and network and handset equipment vendors.

The main objective of this data-gathering exercise was to ascertain the requirements and expectations of emergency services organisations in terms of accuracy and reliability of caller location information. It also aimed to understand the electronic communications industry's perspective on the various positioning techniques, their implementation challenges, potential benefits and associated costs.

The Report identified the implementation of Assisted-Global Navigation Satellite System (A-GNSS) on a harmonised basis across Europe as a first step in a multi-step plan towards improving caller location. The plan is part of an overall programme for improvement aimed at addressing the particular challenges of calls originating on mobile networks, as well as the challenges associated with calls from fixed and IP-based networks.

In a press release to mark 112 day, which took place this year on 11 February, the European Commission reviewed the actions taken in 2014 to improve 112 implementations throughout the EU. It concluded that there is still room for improvement in locating emergency callers. In this context, the Commission mentioned, as a positive step forward, the guidance provided by ECC Report 225. This represents a solid endorsement of the work carried out by the ECC and PT ES.

PT ES has now, based on the conclusions of ECC Report 225, identified and prioritised three key work items that it will continue to work on in the short to medium term. These include:

- An ECC Report that will evaluate the opportunities, challenges and options for a harmonised implementation of A-GNSS location information throughout Europe. Work has already commenced on this deliverable, which will seek to understand how and where A-GNSS location information is available in Europe with a view to recommending a harmonised approach to be implemented across Europe. It will also examine the consequences of potential harmonised A-GNSS methods for onward conveyance of location information to PSAPs and their practical adoption for emergency calling.

- An ECC Report defining PSAP-side statistics to quantify the effectiveness of emergency caller location information received. The objective of this work item is to provide a template for closer cooperation between PSAPs, network operators and national administrations on evaluating the effectiveness of the caller location information received so that concentrated efforts can be made to improve coverage where it is most needed.

- An ECC Report on the provision of caller location information for emergency calls originating on private or corporate networks. This Report will examine the problems and notably the legal issues (as the regulatory framework does not apply to private networks), and attempt to propose concrete solutions for the provision of more accurate and reliable caller location information from private networks.

It is expected that these deliverables will provide guidance and support to European emergency services stakeholders, in accordance with the policies and actions set out in the ECC Strategic Plan.

ECC Report 225 is available for download at the ECC Documentation Database here. Interested stakeholders are encouraged to consult the document for further details.

For more information on the work of PT ES, please visit the PT ES home page here.

Freddie McBride, ECO Expert – Numbering & Networks
Florin Dragomir, Chairman – Project Team - Emergency Services