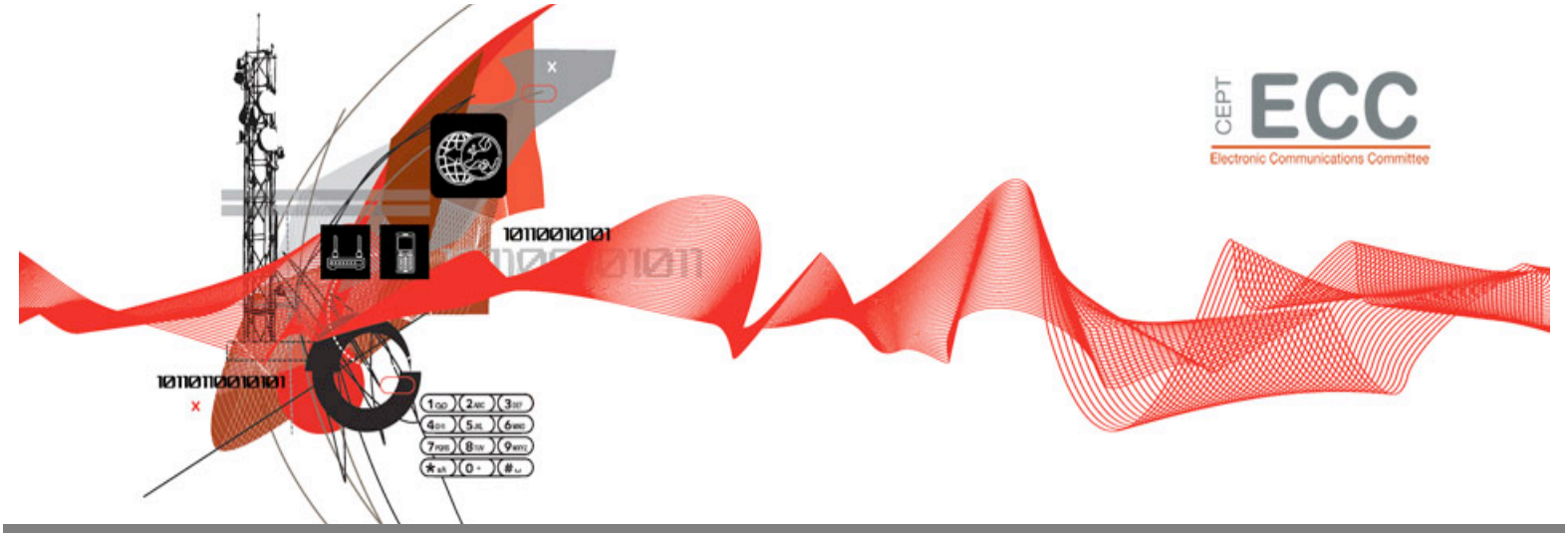


ECC NEWSLETTER **August 2013 Special Edition**

Scrambling for the sweet spot in UHF

Where is the 'sweet spot' in the radio spectrum? For many applications, it is the frequency range from about 380 to 1000 MHz (part of the UHF range). This offers an excellent compromise between the useful range of the signals, better building penetration, and the antenna size on mobile devices.

This popularity is reflected in a number of ways, most visibly in the prices fetched when spectrum is auctioned in this range. But you also see it in other ways, such as the number of spectrum news articles written about it, and the number of people who travel to meetings on the topic in the ECC family. Although the ECC's technical expertise is perhaps its more unique characteristic, it is still the politics of spectrum allocation which brings the largest numbers onto the delegate lists.

There are few if any radio systems which cannot be made to work outside UHF, but that often comes with a higher cost somewhere; typically in the number of fixed base or transmitter stations. That is particularly true of terrestrial broadcasting, and public and private mobile systems. Other frequency dependent factors also play a part such as the engineering of device antennas and electronics (the latter was a bigger issue for early wireless pioneers than it is now). So there is a large element of compromise in order to provide enough frequencies overall for a wide variety of applications. That's why we find broadcasting at VHF and UHF, fixed satellite at ranges between 3 GHz and 27 GHz, mobile phones at 900 MHz, 1800 MHz, 2.1 GHz, and so on. The economics of spectrum use is very complex and involves a large number of factors.

Mobile broadband, with its potential benefits and hunger for capacity, is at the top of the spectrum world's agenda. We hear strong debates about why frequencies already harmonised for mobile broadband are not already full, despite the explosion in traffic demand. Is it because they aren't economically feasible (as administrations we would disagree with that), or is it because mobile operators understandably prefer to wait for the hoped-for spectrum with better coverage potential, and perhaps better device availability?

In order to get the most effective framework in place for this band, we need to look right across the subject and consider long-term solutions. This is central to the ECC's approach to addressing the UHF question. And our three current technical studies, which are inter-related, provide this opportunity. They are:

1. our studies on the '700 MHz' band, and its potential use for more capacity for mobile broadband services in this so-called 'sweet spot' for spectrum;
2. a new Task Group set up to raise and answer questions on the future use of the rest of the UHF broadcasting band (470-694 MHz); and
3. the search for frequencies to deliver high quality video from the scene of incidents and events for public protection and disaster relief (including planned large-scale public events): BB-PPDR.

The benefits of taking this 360-degree look at the UHF band provides us with a unique opportunity to think explicitly about what is needed for the effective development of this important range of spectrum for the longer term. This is an important principle which will help to ensure that this complex policy debate is underpinned by a deeper level of technical understanding which should expose the benefits and trade-offs to the various policy options.

The 700 MHz Band: battleground or 'fait accompli'?

The most important reason for the ECC to look at 700 MHz now (694 – 790 MHz) is the rising demand for mobile broadband services. This is not the only claim on the frequencies; notably there is the widespread existing use for terrestrial TV, using the GE06 digital TV plan which is a commitment by all countries in Europe, the Middle East and Africa. There are other services too, including the aeronautical radio navigation system in parts of eastern Europe (beyond the EU). There are some major differences in the national situations - current and envisaged - across Europe, especially with respect to broadcasting. So an identical pan-European approach based around just one service per frequency range may well be too simple and too inflexible. However, the large technical incompatibility between terrestrial broadcasting and mobile services across national borders, especially uplink mobile traffic, makes it essential to have a management framework and coordination of approach in place at the European level.

Europe's problems are possibly greater than in many other parts of the world due to the relatively small size of the countries and their high population density in many places, including near border areas. However, this challenge is not uniquely European. This is reflected in the treatment of the issue at the World Radiocommunication Conferences (WRC), which regularly modify the framework of international radio regulations. The WRC of 2012 decided that, as of the end of WRC 2015, mobile services would enjoy co-primary status with broadcasting over the frequency range 694 MHz to 790 MHz. At the very least this impacts on how the GE06 plan is used. WRC-15 will refine the technical details of this decision, including exactly where the lower band edge should be placed. It will also consider other frequency ranges for mobile, largely driven by the worldwide demand for mobile broadband services.

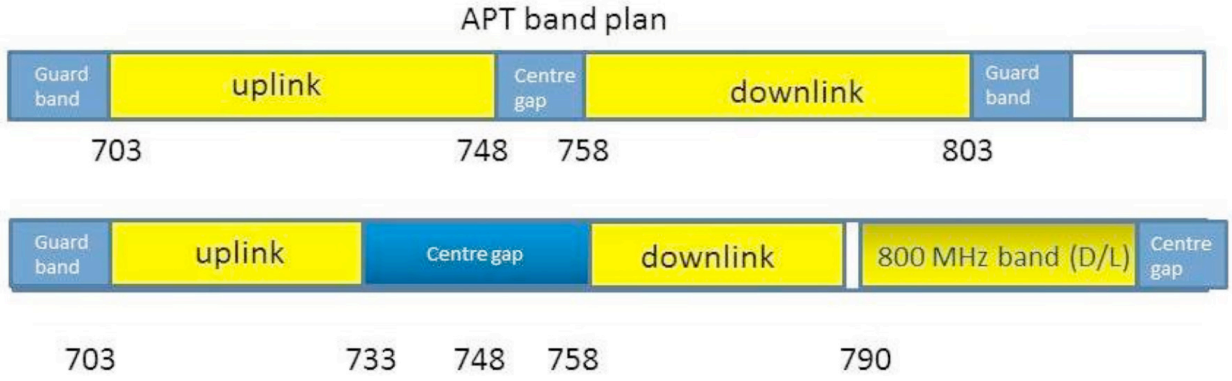
These WRC decisions in particular have shaped the dynamics of the ECC's work. The ECC Conference Preparatory Group's Project Team D (CPG -PTD) is tasked with preparing CEPT's positions on the relevant topics[1] . PTD's meetings are coordinated with those of our public mobile-specialising Project Team, PT1, and both are chaired by Didier Chauveau of France.

[1]Agenda Item 1.2 to review studies on use of 700 MHz for mobile; Agenda item 1.1 considers what other frequencies should be allocated to mobile. PTD will contribute to and therefore seek to influence these studies, which are being carried out in ITU-R's Joint Task Group JTG 4-5-6-7.

This work is closely aligned to the equivalent interest of the European Commission. Specifically, the ECC is now working on a response to a mandate from the European Commission to define appropriate technical conditions for wireless (=mobile) broadband over this range. The Commission stresses that this is without prejudice to "the final decision on use of the band, which should be decided by an EU level political agreement", but this work should give a technical basis to inform such an agreement, and the Commission's timescales are in step with CEPT's preparations for WRC-15. The ECC started work on the mandate in March of this year. PT1 is leading it, but other groups, especially PTD, also contribute. After an initial report this October, a draft will go to public consultation in June 2014, with the final mandate response in October 2014. CEPT will be able to draw on this work in preparing for the WRC-15 Conference Preparatory Meeting (CPM) which takes place from 23 March to 2 April 2015.

The mandate work will mainly focus on the core technical arrangements. This includes the channelling and block-edge mask, and compatibility with broadcasting (as well as between the same mobile service) across national boundaries. This is unlikely to reveal major differences of principle compared with equivalent work already done for the first digital dividend in the 800 MHz band (792 - 862 MHz). This mandate directs that other issues be considered also, especially the accommodation of services like Programme Making and Special Events (PMSE), as well as non-radio services such as (particularly) cable television receiver boxes. The latter is not relevant to us in the ECC as a radiocommunications issue but it is a difficult fact of life as an issue of electromagnetic compatibility. To the public the division of responsibilities between regulators and regulations is not of interest – only whether devices work properly, and can be purchased with confidence.

There is significant pressure to adopt the same plan as that already agreed by the Asia-Pacific Telecommunity (APT). This would allow manufacturers to save costs by realising economies of scale into a larger market with a (relatively small) part of the handset design. On the other hand this is only one of a large number of factors which affects the economics of this band of spectrum. The need to be compatible with the now-committed 800 MHz European band structure means that the APT-based band plan may not be the most efficient to use in Europe. So the ECC has a lot of factors to consider in its work.



Constrained by the 800 MHz band, the APT plan would have a large centre gap if adapted for use in Europe. Would this be useful or would it be inefficient?

UHF Band Study: not just 'salami'

The ECC's work on 700 MHz is closely structured around the allocation decision made at WRC-12. The working assumption of a lower limit at 694 MHz is a quasi-arbitrary compromise brokered at WRC-12. That alone is an important and pragmatic constraint, but it may or may not be optimum in terms of the European harmonisation plan for broadcasting and mobile in this band, either in the short or particularly in the longer term. In Europe we are keen to take the whole of the band into account. Already the decisions and implementations on 800 MHz are constraining the efficiency of the solutions considered at 700 MHz, and the phrase 'salami-slicing' is sometimes heard in describing this approach.

It is also very important for incumbent users to work in a predictable environment, with some understanding of where this evolution is heading. Re-engineering high-power UHF TV stations to fit new frequency plans is a very disruptive and expensive business. Another example is with PMSE where there has been some recent investment in equipment designed for the 700 MHz band in a few places, triggered by the allocation of 800 MHz exclusively to mobile broadband in the EU. This may be a relatively small investment so far within the larger context, but it is a major issue for those affected. It is clear that a longer-term vision is vitally important for all users. PT WG51, supported by SE7, is currently reviewing some possibilities for PMSE's future in the changing environment of 800 and 1800 MHz, within another related European Commission mandate.

Is Terrestrial TV in decline, or is it a tower of strength?

Therefore the ECC has set up a Task Group, TG6, to look at the rest of the UHF 'broadcasting' band, from 470 - 694 MHz, to ensure that these longer-term issues are properly captured and taken into account, at least in the considerations for 700 MHz. This should also inform CEPT's approach to WRC-15, where Agenda Item 1.1 could potentially bring the whole band (inter-alia) into negotiation. Furthermore, TG6 should be able to inform the EU's approach to defining a long-term policy for the whole band in the 28 Member States.

The Task Group is chaired by Jaime Afonso of Portugal. It is established with a primarily technical focus. It should help to improve understanding and to enable some reasonable working assumptions to be made at the policy level. Therefore the Terms of Reference reflect the need to take account of the numerous policy issues which are relevant.

Much of the public debate on the subject focuses on the relative merits of the potential and competing uses of the band in the future. It is unlikely that the next 12 months over which TG6 will work will reveal a clear and unanimously supported way forward at the policy level. Several large countries have already made some sort of statement of intent to reallocate 700 MHz to mobile, and the trend will probably continue. But that makes TG6's work more important rather than less, to set out the options in terms of frequency management. The basic challenge facing the group is how to deal with the very different situations in different European countries. There may be a different vision of an endgame, and there will be differences in how quickly different countries should ideally move from a current scenario to a future one, whatever that may be.

Will the public be willing to pay enough for universal connectivity for high-bandwidth smartphones, or will they seek out 'free' wi-fi access?

The review is deliberately forward-looking. Although the requirements for broadcasting and mobile broadband are immediate and/or short-term, it is also important to challenge the assumption that broadcasting and mobile networks will always look the same as they do today. Two of the areas the group will consider are the possible development of converged mobile and broadcasting approaches to the delivery of content of common interest to groups of users, and also to recognise the very asymmetrical nature of the traffic which drives demand for mobile broadband. At present this is already estimated at 4:1 (downlink: uplink), so it could in the medium-term seem to have been very short-sighted to have a lot of wasted spectrum locked into provision for uplink traffic that simply isn't there.

The technical incompatibilities between broadcasting and mobile are so great that a universally satisfactory outcome looks improbable: neither a 'one size fits all' solution for every country, still less a completely independent nationally based approach. This is probably the most strategically difficult challenge that has faced regulators for a long time. History has taught us that predicting the future is a dangerous game. And ignoring it is dangerous, too.

Public Protection and Disaster Relief: emergency communications live from the scene

In our October 2011 Newsletter we gave some background to our work to establish a way forward for broadband radio capacity for Public Protection and Disaster Relief (PPDR) services. This is particularly to bring high-quality video from large events and especially the scenes of major accidents. The existing robust and successful networks based on the TETRA technology in the 400 MHz band do not have the bandwidth to support this new and valuable requirement.

The train crash in July 2013 in Santiago de Compostela was an incident where high-resolution video could have been useful

As is usual with ECC project teams, the work of PT FM49, chaired by Peter Buttenschön (Germany) was conducted by member administrations and industry. Another central part of the team was national governmental emergency services organisations and European level associations in this sector. The work is shaped by the input contributions based on the shared knowledge and expertise of the participants.

FM 49 has now developed an ECC Report 199 which defines the user requirements, and therefore estimates the spectrum which a PPDR service would need in dealing with realistic scenarios. As always the figures have to be a compromise between adequacy of capacity but avoiding overstating the case through combining worst-case demands. Based on two independently conceived analyses, the group concluded that the sensible working dimension of this special requirement would be 2x10 MHz (that is 10 MHz each of a balanced uplink and downlink).

Now FM49 is developing a further report which will summarise the most suitable frequency bands and regulatory solutions for future BB PPDR networks, in each case envisaging the 2x10 MHz as a subset of the band concerned. The concept of a 'tuning range' is important here. Equipment could operate across a range of similar frequencies, but the precise range used could vary between countries. The options have now been narrowed to the following preferred bands:

i. from within the 400-470 MHz range;
ii. 1900-1920 + 2010-2025: the 2 GHz unpaired bands; FM 49 has considered these for ad-hoc PPDR networks; and
iii. 694-790 MHz: the same 700 MHz band which we discuss earlier in this Newsletter.

The 400 MHz range is already occupied by specialised private mobile networks, including the existing 'TETRA' PPDR networks, whose retention is expected for some time to come; these networks tend to have good coverage. Introducing BB-PPDR here would therefore be difficult. Introducing BB-PPDR here would therefore be difficult.

The 2 GHz unpaired bands would tend to be a supplementary option, especially for air-ground-air PPDR services (i.e. helicopters at the scenes of disasters), rather than the main means of supporting PPDR video links close to the scene. There are also other candidate uses for these bands which are being reviewed by a correspondence group of the ECC's Working Group Frequency Management (WG FM).

The 700 MHz option comes onto the table because FM49's working assumption is that the PPDR broadband networks would be based on the same technology (typically LTE) as for public mobile broadband; therefore even dedicated PPDR systems could be made less expensive.

At first sight there may seem to be an irreconcilable paradox between developing 700 MHz for public mobile broadband, and allocating it to the dedicated requirements of PPDR. Up to a point this is true, since there is certainly an opportunity cost in the spectrum for one use vis à vis the other.

The ability of governments and public authorities to invest in dedicated PPDR systems is likely to vary a lot between countries. A premise of the approach in 700 MHz is that PPDR would use public infrastructure if outside the coverage range of the dedicated networks. This would include a roaming principle between public and private networks similar to the arrangement between GSM-R used for railway signalling, and public GSM networks.

PT FM49 is now involving other groups: PT1 to take account of PPDR in its work on the 700 MHz mandate, and WG SE to improve knowledge of how BB PPDR would work compatibly with existing services in the 400 MHz range. The Group is also developing its work on the candidate bands, expecting a further ECC Report in April 2014.

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