



**SPECTRUM IN AN AGE OF INNOVATION  
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---CHECK AGAINST DELIVERY---

I'm going to begin with a quote, and I'd like to see if you can place it:

*"Wireless communication is plagued by a shortage of space for new services. As new regions of the radio spectrum have been opened to practical operation, commerce and industry have found more than enough uses to crowd them."*

Any guesses?

It is fact a direct quote from a report of the United States Joint Technical Advisory Committee of 1952.

This was the dawn of the colour TV age, a decade before satellite telephone systems and nearly 40 years before the first cellphone call.

Nevertheless, the overriding recommendation – that spectrum should be managed as carefully as other natural resources – is one we all today endorse.

Half a century on I believe we are heading toward a new phase in how we manage and assign this extraordinarily valuable but finite resource.

I want to suggest today that the rapidly increasing *rate* of change in spectrum use – the dynamism in innovation, technology and in market demand – has injected a new urgency into the need to manage spectrum effectively.

I'll argue that, while in general we need greater use of market mechanisms to produce more efficient use, we also need to be both strategic and sometimes straightforwardly pragmatic in our approach.

I want to propose that, in time, we will need to go much further in looking at some of the major settled allocations, particularly of sub 1GHz spectrum.

But, above all, I want to suggest that this era of dynamism requires a significant change in expectations among both industry and consumers about how they use and crucially how they adapt to new or alternative uses of spectrum.

### **The command-and-control era**

As the quote with which I began demonstrated, our predecessors did not consider themselves to live in a land of plenty. Demands on the available spectrum appeared significant at the time. New uses were always emerging.

Spectrum is a resource that does not respect borders, so the international dimension was there from the earliest civil and commercial use. Indeed, it was Prince Henry of Prussia's frustration at not being able to send President Theodore Roosevelt a courtesy message while at sea in 1902 that prompted the first international radiotelegraph conference and the first cross-border spectrum harmonisation.

It was implicit in many decisions taken from the earliest days of spectrum management until relatively recently that assignments would remain unchanged for a very long time and that if spectrum was needed for alternative purposes, a fresh allocation would be made.

In the UK, the spectrum allocated for defence and scientific uses such as astronomy seemed at the time as if they were being made in perpetuity.

Other assignments were made in the belief that there were unlikely to be any rival uses.

As a result some bands below 3 GHz are now, to all intents and purposes, locked down for uses that could exploit less valuable frequencies, because international – often global – agreement is needed to co-ordinate a move.

The way that spectrum has been allocated and assigned reflected the view that the overall range of use could be relatively easily foreseen and was likely to be fairly settled, with new uses eased in and conflicts managed away over many decades.

And even when licences were granted for a limited period, they precluded any meaningful change of use. The 3G mobile licences, auctioned in the UK as recently as 2000, were rigid in prescribing UMTS – and only UMTS – as the technology that could be used.

### **The legacy**

Clearly, this command-and-control approach could not survive the dynamism of contemporary technology and innovation.

That is not a novel point. The economist Ronald Coase argued as early as 1959 that spectrum should be subject to market disciplines.

Ofcom's approach to spectrum since our creation has the use of market mechanisms as its central premise. Many other regulators reached the same conclusion in parallel. The EU has made important moves towards liberalisation and promoted the use of market mechanisms. But because of the absence of effective market signals over many years, significant parts of the spectrum map today are almost certainly inefficiently deployed.

The loss of potential benefits to the economy, and society more generally can be huge; even small delays to realising more effective allocation can have considerable costs.

Where they have been used, pricing, auctions and, to some extent, trading have helped to ensure that many commercial users have to confront the market value, or an approximation of the market value, in making their decisions.

But *public* spectrum holdings were until recently largely exempt from any such pressures, and that imbalance – where one sector faces increasingly clear economic incentives and the other does not – means that the balance between public and private holdings is likely to be far short of optimal.

Even with an increasing and very welcome focus from the UK government in addressing this, the incentives for public bodies, agencies and government departments to rationalise their spectrum holdings remain variable.

Last year, the UK's government announced plans to release 500 MHz of public spectrum below 5 GHz by 2020.

We are supporting the government in identifying candidate bands and already, it looks likely that two high-value bands, at 2.3 GHz and 3.4 GHz, could be available for commercial use in the near future.

So progress in identifying and releasing public sector holdings is being made; the question is whether this change is proceeding at a pace that can match accelerating demand and technological innovation.

### **800MHz/2.6GHz: a case study in the new approach**

A good example of how we are changing the historic, gifted spectrum landscape is in the EU-wide release of harmonised spectrum at 800MHz.

One of Ofcom's most important tasks at present is preparing the way for the auction of this spectrum, as well as that at 2.6 GHz.

Our current plan is that the auction will take place in the second half of next year, with spectrum available for LTE services to be launched in parts of the UK as early as January 2013.

The work underway here provides a vivid illustration of one area in which we need to change the way we approach these questions, particularly but not exclusively in the UK.

It has been very disappointing to witness the extent to which the incumbent mobile operators have chosen to entangle this process in litigation or threats of litigation.

We recognise, of course, the need for companies to defend their commercial interests and to have recourse to the law in order to do so.

If a regulator or any other public authority makes a decision that is either procedurally or substantively flawed, the right of appeal is there to ensure good decisions replace bad ones. But when litigation becomes essentially strategic rather than based on objective grounds, and when it has the effect of holding back innovation and hampering growth, it is legitimate to ask whether the overall legislative framework fully supports the public interest in this increasingly vital area.

As the UK parliament's Culture, Media and Sport committee recognised only a few weeks ago, the stance of the operators makes it increasingly hard for important decisions to be made and implemented.

This may well be a consideration as British lawmakers consider their approach to a promised new communications bill for the UK.

I think some major companies will have to reflect upon whether they have inadvertently jeopardised the benefits of objective, independent regulation in this area by virtue of their willingness to game the system.

I am sure legislators would be all too willing to accept an argument which returns power in such matters to politicians, in light of the apparent inability of the current model to make timely decisions where the national interest is at stake.

### **Co-existence – the case for pragmatism**

The need for change also extends to those who use spectrum adjacent to the new services. In the case of 800MHz that includes Digital Terrestrial Television. For 2.6GHz, it is air traffic control radars.

In the past, the response to the huge planning and mitigation issues that arise from this might have simply prompted the conclusion that it was all too hard to fix.

We no longer have that luxury. It would not be in consumers' interests or in the interests of the wider economy. And it would not reflect the new realities of a world in which even very important and long established spectrum users may have to adapt to the arrival of new and different neighbours.

The steps we have taken here also illustrate another lesson, namely that market mechanisms – while generally the right approach – cannot be the only set of tools available.

The right approach here has been a mix of measures, including:

- the provision of information to enable the emergency services to plan the steps they will take to mitigate the risk of harmful interference;
- a new body to provide support to consumers and implement appropriate network-based mitigation, balancing the needs of the users of LTE services and DTT viewers;
- a more directive approach for radar where we commissioned the design solution ourselves;
- and finally, direct government funding as the most efficient means of covering the necessary costs.

There is, of course, a market solution. In theory, interference could be managed bilaterally between contracting parties.

In practice, that would have meant potential bidders negotiating with broadcasters, the Home Office, the fire services, the airports and the Ministry of Defence to strike a series of deals about how much to pay for the rights to put in base stations.

Given the variations of buyer and seller power that would exist – Heathrow Airport for example is estimated to be the most economically valuable single site in the UK – some regulatory intervention would probably have been needed in any case.

There are also a series of co-ordination problems, transaction costs and considerable asymmetries in information.

So a more pragmatic inter-agency approach appeared far more likely to ensure a timely and efficient resolution.

### **Structural change – the need for strategy**

Most people agree that the release of the 800MHz spectrum is a major step – the biggest re-allocation of sub 1GHz spectrum in the UK since 1961.

But on its own, it won't be enough. According to some analysts demand for mobile data could be seven times greater than it is today in just the next three years. And while this is at the upper end of estimates, everyone agrees that demand will rise sharply.

The question is probably not whether there is a need for further availability of harmonised spectrum at the sub-1GHz level, but when and how can this be achieved?

The international debate now underway, within both the International Telecommunication Union and the EU, will inevitably consider current allocations of sub-1 GHz spectrum. This will include reference to the adoption in the US and many Asian countries of the 700 MHz band, currently occupied in the UK by Digital Terrestrial Television, for next-generation mobile broadband.

These are longer-term questions. But given the significant lead times that exist, both for equipment and licenses, as well as the procedures and negotiation necessary for international harmonisation, it is right to begin examining them.

Clearly, the consumer interest here is very significant indeed. Digital Terrestrial Television delivers enormous value to many millions of viewers every day of every week, providing access to public service broadcasting services and to a range of other purely commercial services that were out of reach of many households before digital switchover. It is a core element of the UK's broadcasting ecology and provides an important source of platform competition.

It would also be remiss not to acknowledge the importance of this spectrum for programme-making and special events, which supports thousands of live events, community occasions and commercial content production across the UK.

Equally, however, there are major potential benefits that could stem from future international harmonisation and new service and technological developments that merit careful review of the options in this area.

Ofcom's own examination will look at five key areas:

- **Demand and supply of services:** including but not limited to terrestrial television, mobile broadband and emergency services; and the potential consumer and citizen demand for such services.
- **Technological developments:** those that may increase the demand for sub-1 GHz spectrum, including: HDTV, 3DTV and new wireless broadband applications; and those that may reduce demand by making more efficient use of spectrum

- **International developments:** potential future harmonisation, including the harmonisation of the 700 MHz band for mobile use in Europe.
- **Benefits to citizens and consumers:** including continued universal free-to-air access to Digital Terrestrial Television services and potential wider access to wireless broadband services, as well as access to a wider range of attractive services and increasing competition between service providers
- **Future timescales:** we will consider at what point in time any possible future rebalancing of the use of UHF spectrum bands IV and V could be implemented.

Bound up in such an assessment will be the question of the 600MHz band now being cleared in the UK as part of the transition from analogue to Digital Terrestrial Television. If the 700MHz band is harmonised throughout Europe for mobile use in the next decade, the opportunity may exist to replan Digital Terrestrial Television so that we are able to maximise the overall value of sub 1GHz spectrum to society.

The European dimension is therefore of great importance as we attempt to move towards a more efficient allocation of spectrum, determined largely by market mechanisms but supported by a long term strategic coordination plan and delivered often by pragmatic intervention.

### **Why we need to adapt**

If this all sounds like a once-in-a-generation proposed replan of the sub 1GHz spectrum then I've failed to convey the breadth of the new phase that I believe we are now in.

As we look right across the range of different spectrum uses, the future cannot just be about big, open-ended assignments with equally comprehensive guarantees against interference and change.

That is the pattern from which we need to escape if we are going to have the best chance of developing the supply side to meet burgeoning demand.

Across the board, we have to expect technological change and innovation which requires us – companies, regulators and consumers – to accept that having to adapt and change our



assumptions about prevailing spectrum use will not be exceptional, but instead a far more normal course of events.

For example, even as we begin to contemplate the possible co-existence of Digital Terrestrial Television and mobile services in the 600-700MHz bands, we need to think about the changes that lie not very far beyond this.

These will come about as much as a result of smaller, technologically driven developments as by international harmonisation agreements.

Plans are already advancing to make more intensive use of interleaved spectrum by local TV and white space devices.

It is well known within industry that broadcasters and transmission companies are already planning further change from first generation standard definition transmission and compression to second-generation high definition technologies - DVB-T2 and MPEG 4. Not a small step, given the implications for set top boxes, aerials, receivers and multiplexes. And not far behind that, it is possible to foresee the introduction of truly cognitive radio use of the interleaved spectrum, where mobile devices will interrogate the use of spectrum in their location and indentify suitable frequencies.

By this point we might even look to the end of second-generation transmission, and the shift to even more efficient third generation standards, including Multiple Input, Multiple Output (MIMO) antennae and High Efficiency Video Coding compression.

And at the far edge of these horizons, with these substantially more efficient compression and broadcast technologies in place, it would also be feasible to look to a radical single frequency network re-plan of Digital Terrestrial Television across Europe.

The path may end up being rather different to the outline I've just provided, but the pace of change is unlikely to slacken in any fundamental way.

At every stage industry and consumers will need to modify their expectations in relation to the spectrum certainties of the past.

For industry, equipment design and access will have to be predicated on the assumption that adjacent use could change more rapidly than in the past.

For consumers, the flip side of a spectrum map that can adjust and make way for new and innovative uses may often be a shorter product life-cycle, or the need to update and retune existing devices more often.

We expect the market will take care of much of this. Just as computer users don't need to replace their PCs whenever a new use is developed we may move toward a world in which over-the-air patches replace the need for many traditional hardware upgrades in devices. But that may not apply for all devices. In some cases, the price of greater innovation in products and services may be to upgrade equipment more frequently, or to come to terms with greater complexity in tasks such as retuning.

## **Conclusion**

In the past, spectrum was assigned to users in the expectation that it would be effectively held in perpetuity. This has led consumers to a commensurate expectation about the lifecycle of their equipment.

Now, in this new phase, more frequent change may well be necessary to promote more efficient outcomes for everyone.

In spectrum matters, straightforward long range planning will be replaced by adjustment and adaptation to the dynamism of technology and markets, combined with clear strategic coordination and pragmatism in delivery.

As we look ahead, these will be the defining characteristics of successful spectrum management.