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International rules and national spectrum planning

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Colin Oliver explains the history and role of international rules in national spectrum planning and argues that we have a vested interest in effective international regulation

Introduction

Since 1903, there have been international agreements on the use of the radio frequency spectrum. Today, these agreements are hammered out by the International Telecommunication Union (ITU), in large and usually lengthy World Administrative Radio Conference (WARCs) and embodied in the international Radio Regulations annexed to the International Telecommunications Convention.

Radio signals are propagated by radiated electromagnetic energy, and the "radio frequency spectrum" is the range of cyclical oscillation rates that can be used to convey information. Cycles per second are expressed as Hertz. One kilo-Hertz equals 1000 Hertz. One Giga-Hertz (GHz) equals 1,000,000,000 Hertz.

Producing multilateral treaty agreements on radiocommunications has never been easy. Right now, demands for spectrum for new technologies like high definition television (HDTV), digital audio broadcasting, satellite and terrestrial mobile services are producing new puzzles for the ITU.

Microwave frequencies in the general range of 1-3 GHz are sought for satellite sound broadcasting, public land mobile telephone services and satellite mobile services. This frequency range is already heavily used by other services. Spectrum for satellite broadcasting of HDTV is being sought at much higher frequencies - up to 25 GHz - where present usage is much lighter.

Toward the lower end of the radio frequency spectrum, the prospects for finding more frequency bands for short wave broadcasting are very daunting: these bands have been congested and turbulent since the 1930s and many neighbouring bands are heavily

used by developing countries for basic national communication links.

History

The discipline of spectrum management developed in response to a real problem. Radio stations interfered with each other, sometimes across national borders, and some agreements were required to prevent this happening. Similarly, it was obvious from the beginning that communications between ships and stations on land required agreement on which particular channels should be used for particular purposes. The apparent failure in 1912 of a nearby ship to listen for SOS signals while the "Titanic" was sinking shocked governments into recognition of a need for greater international discipline in the use of radio communications.

The first American broadcasting services competed with each other by using more and more power in order to be heard by their listeners, and their frustrations prompted the comment from Herbert Hoover, then Secretary of Commerce, that "broadcasting is probably the only industry of the US that is unanimously in favour of having itself regulated." The creation of the Federal

Communications Commission followed in 1927.

Similar problems occurred in Europe where regional agreements were adopted to bring order to the scene and these agreements were later absorbed into the ITU regime.

Some of these problems are still with us. For example, a power struggle continues to this day in the use of the international high frequency (short wave) broadcasting bands, although the outbreak of peace in Europe should have had a positive effect on broadcasters interested in that region.

National rights within the radio regulations

The present international rules for use of the radio frequency spectrum took shape after the Second World War, when there was an urgent need to put an end to wartime disorder in the use of radio and, equally, there was an opportunity to plan the use of new technologies and higher frequency bands which could now be used for peacetime purposes. Subsequently, the international frequency table has grown, as planning has extended, to ever higher frequency bands in an effort to make possible the orderly introduction of new equipment and services.

ITU signatories agree under Article 6 of the ITU Constitution to be bound by Regulations "in all telecommunication offices and stations established or operated by them which engage in international services or which are capable of causing harmful interference to radio services or other countries"

Obviously, as an island continent, Australia has more flexibility in national spectrum planning than many other countries because, at least in some frequency bands, radio

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interference is unlikely between Australia and our neighbours.

The Radio Regulations define which services may use which frequency bands. In some cases, international planning extends to the allotment of individual national frequency assignments, especially for broadcasting services where there is international sensitivity about satellite transponder communications.

Within the Radio Regulations, we should notice not only the existence of world agreements here, but also the way these apparently simple agreements are qualified within the Radio Regulations themselves. Firstly, we should note that for many frequency bands in the international frequency table there are multiple allocations. For example, where the allocation is to FIXED and MOBILE services on an equal primary basis, national administrations have a great deal of flexibility in deciding how best to use the frequency band within its national borders. Will we have fixed or mobile services in Australia? What kind of fixed or mobile service shall we have? In this sense, many international frequency allocations are permissive rather than prescriptive. Other allocations, of course, are very specific indeed, especially for international safety services.

Secondly, there are regional variations between the Americas, Europe and Africa, and the Asia Pacific region. Often in our region we find that there are equal primary allocations allowing us to follow the lead of the Americans or the Europeans, as we see fit.

Thirdly, within a particular agreed international allocation are national footnotes by which a particular country or group of countries assert the right to do things differently from the crowd. This is not a minor point; AUSSAT is configured within an Australian national footnote to the international frequency table.

Fourthly, when countries sign the Final Acts of conferences amending the Radio Regulations, they may state a "reservation", announcing that they do not accept an obligation to conform to the agreement on some point.

Enlightened self-interest

No country can ignore the Radio Regulations. At the formal level of international law, services that do not accord with the Radio Regulations and which cause interference to the legitimate services of other countries are treaty infringements, and the offender will be expected to stop. There is no enforcement procedure, but it is in everyone's interest to observe the rules.

A number of practical considerations support observance of the Radio Regulations. First, there is the likely economic cost of departing from international practice where

this means having no ready access to transmission equipment, or losing the benefit of world production economies or market opportunities.

Second, there is the problem that idiosyncratic frequency plans must operate within strict geographical limits, to avoid radio interference. Obviously, mobile transceivers in ships, aircraft or international road transports, or the simple broadcasting receiver in a traveller's baggage, will be of no use without uniform international frequency allocations. The increasingly global scale of business activity emphasises the importance of "roaming" capabilities for mobile radio communications - and "mobiles" are the current major growth area.

Finally, there is the risk that new service allocations agreed internationally could be difficult to exploit at home if major investments have been made that diverge from the world pattern. The scope that exists for national variations from international patterns must be assessed case by case. Where international communication links are required, the case for conformity is compelling. Where international interference is a risk, there is an international obligation to conform. Where neither of these constraints apply, national flexibility is constrained primarily by equipment availability and cost. World production of equipment generally conforms with patterns established by the ITU's Radio Regulations.

Innovation and continuity

When new radio communications technology is introduced, it will often fit readily into known operational patterns and established frequency plans. However, where this is not possible, because the technology requires a clear block of spectrum to commence service, new frequency allocations are required.

Unfortunately, many spectrum allocation questions amount to a zero sum game: one new service will gain spectrum only at the expense of another, and frequency bands must often be cleared of one type of user (say a broadcasting service) before another user (such as a mobile service) can take over.

Frequency band clearances or re-organisations are never easy. One thing that makes them a little easier is the existence of an international agreement on what has to be done, and on the time in which a change should be completed. There are usually compelling reasons to conform to the international pattern for the introduction of a new service. For example, if a satellite sound broadcasting service is to be introduced in bands currently used by other services, international agreements help to persuade governments to make the hard decisions on the

necessary band clearances, and they also give investors in the new technology some assurance that they will be able to implement a service.

Prospects for reform of the international system

Although the present international system of spectrum planning has worked well enough for almost a century, the stresses are evident. The pace of change is such that changes to the Radio Regulations often lag behind the technology, and it appears that the Radio Regulations are beginning to fail under their own weight.

We only need look at the two thousand pages of detail in the Radio Regulations; the complexity of the procedures for registration of radio communication services, especially satellite services; the inability of many ITU Members, especially the smaller developing countries, to follow the procedures. All this points to the need for a thorough overhaul of the system. In fact the ITU is currently setting up a group of experts to review and simplify the Regulations.

Conclusions

The ITU is currently looking at spectrum options for satellite sound broadcasting, for new satellite and terrestrial mobile services, and for satellite broadcasting of wide-band high definition television programs. It will also look at expanding the spectrum for high frequency broadcasters. In Australia, a great deal of work is being done to consult with all the interested parties to develop Australian policy positions for WARC-92 which will decide these matters. Local arrangements cannot solve these problems; international agreement is essential.

Australia's geographical place in the world does not isolate us from the major international constraints on spectrum management. In fact, our geography often requires Australian delegations to the ITU to vigorously represent our special requirements for technologies suited to our remoteness, our broad outback spaces, and our industrialised urban centres.

As we proceed with reforms, we should remember that we have an interest in the health of the international spectrum management system.

Colin Oliver has represented Australia in delegations to two World Administrative Radio Conferences and on the special group that drafted the new ITU Constitution and Convention. He is currently Director of the International Section in the Communications Policy and Planning Division, Department of Transport and Communications.