|  |  |
| --- | --- |
| **Radiocommunication Study Groups** |  |
|  |  |
|  |  |
| Source: Document 5A/TEMP/21 | **Annex 19 to Document 5A/79-E** |
| **1 June 2012** |
| **English only** |
| Annex 19 to Working Party 5A Chairman’s Report | |
| WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW REcommendation ITU-R M.[LMS.fa] | |
| General guidelines for the planning of frequency block arrangements in large contiguous bandwidths for broadband applications in the mobile service | |

Scope

This Recommendation provides guidance on the development of frequency arrangements for systems operating in large contiguous bandwidths in the mobile service, with a view to assist administrations on spectrum-related technical issues.

The ITU Radiocommunication Assembly,

considering

*a)* that harmonized spectrum and harmonized frequency arrangements for broadband mobile systems in the mobile service are desirable;

*b)* that harmonized frequency arrangements in the bands allocated to the mobile service will reduce the overall cost of broadband systems by providing economies of scale and expanded equipment availability, facilitating deployment and enhancing cross-border coordination;

*c)* that when developing frequency arrangements for mobile systems, possible technological constraints (e.g. cost efficiency, size and complexity of terminals, high speed/low power digital signal processing and the need for compact batteries) need to be taken into account;

*d)* that guard bands between different systems should be minimized to make more efficient use of the spectrum;

*e)* that current and future advances in communication technologies (e.g. multimode/multiband terminals, enhanced filter technology, adaptive antennas, advanced signal processing techniques, techniques associated with cognitive radio systems, variable duplex technology and wireless connectivity peripherals, …) may facilitate more efficient use and increase overall utilization of radio spectrum, including the use of larger contiguous bandwidths;

*f)* that some administrations may have different operational needs and spectrum requirements for broadband applications depending on their circumstances,

noting

*a)* that Recommendation ITU-R F.1399-1 “Vocabulary of terms for wireless access” defines the term “frequency block” as “A contiguous portion of spectrum within a sub-band or frequency band, typically assigned to a single operator”;

*b)* Recommendation ITU-R M.1036-4 “Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)”;

*c)* Recommendation ITU-R M.1808 “Technical and operational characteristics of conventional and trunked land mobile systems operating in the mobile service allocations below 869 MHz to be used in sharing studies”;

*d)* Recommendation ITU-R M.1823 “Technical and operational characteristics of digital cellular land mobile systems for use in sharing studies”;

*e)* Recommendation ITU-R M.2015 “Frequency arrangements for public protection and disaster relief radiocommunication systems in UHF bands in accordance with Resolution 646 (Rev. WRC-12)”,

recommends

that, to increase the efficient use of spectrum, harmonized band plans in large contiguous bandwidths, such as those outlined in [Annex 1](#ann1), be adopted for broadband applications in the land mobile service, wherever possible.

Annex 1

Considerations in the adoption of a harmonized band plan in large contiguous bandwidths for broadband applications in the mobile service

There are certain characteristics that are conducive to efficient use of spectrum for broadband applications. Fundamentally, there should be a harmonized band plan for such applications when large portions of the radiofrequency spectrum are available. That is, instead of first carving the spectrum for different uses and then defining a band plan for each use, a harmonized plan could be adopted first for a larger portion of the bandand then blocks or sub-bands could be designated to different uses (for commercial operators, public safety agencies, utilities, business or industrial companies, etc.). For example, refer to the illustration in Figure 1, which shows a large harmonized band with paired arrangements (A-A’, B-B’, etc.) for various uses that have the same duplex separation. There is a centre gap (H) that can be used for other purposes including some applications requiring unpaired spectrum. If necessary, guardbands can be provided at the frequency boundaries for some blocks. The sub-bands could be assigned as follows, for example:

A-A’ = commercial operator or application #1, B-B’ = commercial operator or application #2, …,   
E-E’ = public safety agency or application #1, F-F’ = public safety agency or application #2,   
G-G’ = Utility company or application #1, etc.

While the blocks in each pair A and A’, B and B’, etc. are of equal size and with a constant duplex frequency separation, they do not necessarily have to be operated as paired blocks. Radiocommunication applications requiring unpaired spectrum (such as those using TDD technology or one-way communication such as mobile broadcasting) can also be implemented in individual blocks taking into account interference avoiding measures such as guard bands, geographic separation, link direction and/or time synchronization that preserve compatibility with services in adjacent paired blocks.

FIGURE 1

Harmonized band plan for various uses in a band of sufficiently large bandwidth



This approach would work best for large contiguous amounts of spectrum that would make available multiple blocks, each containing one or more channels to support broadband applications. While only parts of the larger band may be available at the beginning, it is essential to plan ahead and develop a consistent band plan that can be implemented over time.

This harmonized approach:

– could enable higher spectrum utilization; reduced interference; economies of scale; deployment of the similar type of equipment across various mobile applications;

– would support interoperability and roaming;

[*Editor’s Note: provide more text above to support the statement on interoperability and roaming.*]

– would enhance the technical possibility of specific user groups (e.g., public safety agencies) obtaining additional capacity (traffic overflow) by using adjacent blocks when needed (possibly invoking higher priority traffic) with the same terminal equipment;

* would support implementing paired or unpaired spectrum usage;
* would support technology evolution to larger bandwidths. As technology evolves,   
  the application in each block can be re-deployed or changed as needed to use newer technologies, with minimal or no impact to the adjacent blocks.

Some characteristics of an efficient band plan for broadband applications in the mobile service are as follows:

– large contiguous symmetrical blocks that could support both FDD and TDD;

– efficient transmit and receive spacing, consistent with the available state of the art technology;

– specified and consistent base and mobile transmit direction .

**Technical considerations**

In the context of such a harmonized band plan if FDD technology is implemented in paired adjacent blocks, using a consistent duplex direction (both using either the typical conventional or a reversed duplex direction) would ensure that guard bands between blocks are minimized or not required.

The technical parameters such as transmitter powers, adjacent channel emissions and receiver susceptibility implemented within adjacent blocks of the band plan should facilitate coexistence with minimum interference. High power transmissions should not be located in the same band asother lower power ones as they may overpower the receivers of equipment using adjacent channels. Similarly, the band plan should accommodate services in adjacent bands, so that high and low power signals are not adjacent. For example, mobile devices have difficulty coexisting in a band with close proximity to powerful radio location transmitters.

The duplex frequency separation should be determined based on careful consideration of the possibility of intermodulation products. Thus, it is also best to choose band plans such that harmonics of device transmitter signals do not appear in the receive channels of other bands of the same service.The size of the block in the centre (referred to as block H in the example in Figure 1) should be determined based on both the amount of unpaired spectrum needed, as well as the minimum center gap required between the paired blocks. The centre duplex gap needs to be chosen based on the frequency band so it is not too narrow in relation to the band frequency.  If the gap is too narrow, the duplex filter will require very steep roll-off and such filters have additional pass-band loss and thus are less efficient and reduce the battery life of mobile devices.

Although the centre gap can be used for some other services, these should be defined so that they do not interfere with receivers using the centre gap as part of the duplex gap space. Strong signals in the centre gap may interfere with services as they will not be filtered out by the duplex filter.   
For example, satellite, fixed (P-P) and low power unlicensed use have been implemented successfully in gaps in the past. Another possible use for the centre gap could be for the reception of radio waves of cosmic origin.

[*Editor’s note: the text should be clarified in the last 2 paragraphs. In particular, add text to clarify that block H can be paired outside this block.]*