INCOMPATIBILITY BETWEEN FS & FSS
ESOA VIEWS

On the basis of studies conducted in ITU & CEPT, it appears that the deployment of the new high bit-rate access systems of fixed services FS is likely to cause difficulties to existing fixed-satellite services FSS operations and will restrict the possibilities of new deployments for FSS the in these bands.

Most satellite earth stations operate within the C band 3,600-4,200 MHz. These earth stations dispersed on several sites and using variable channels make currently difficult the identification of single sub-bands for wireless access systems allowing them to cover the whole territory.

Although an organization of the band between terrestrial and space systems could prove to be necessary in the future to optimize the use of the spectrum in order to allow new development, the best ways to manage this are far from obvious, as explained below.

1. Introduction

The FSS C-band downlink operations are under simultaneous threat from BWA and terrestrial IMT systems. CEPT has decided to open the band 3,400-3,800 MHz for BWA (underlining that protection of incumbent services such as the FSS should be taken into account) and some countries have already licensed systems in parts of this frequency range, mostly below 3600 MHz. The UMTS Forum has suggested identifying a total of 1982 MHz of new spectrum for IMT at WRC-07, including the entire range 3,400-4,200 MHz[1] that is to be considered under WRC-07 agenda item 1.4.

As far as the impact on the FSS is concerned, there is little difference between BWA and beyond IMT systems. The definition of BWA now includes fixed, nomadic and mobile systems and the technical characteristics for BWA and beyond IMT systems are similar. Hence we can consider together the potential impact of these systems on FSS.

We recognise as a general approach that, due to the ever increasing demands on radio spectrum, sharing between services may be necessary and in many cases is feasible. However, the sharing situation with respect to FSS earth stations is particularly unfavourable where those terrestrial services are aimed at providing blanket coverage over large geographic areas, such as BWA and cellular mobile systems. **Of particular concern is the potential use of C-band by BWA and cellular mobile systems such as IMT.** The introduction of such terrestrial services and in bands shared with the FSS increases the likelihood of interference to existing FSS operations, in particular to FSS earth stations which receive in this band.

The band 3,400-4,200 MHz is allocated to the terrestrial fixed service on a co-primary basis in the Radio Regulations. This reflects the fact that sharing with traditional point-point radio-relay systems is feasible, due in part, to the highly directional antennas used by these systems.

[1] Document ECC PT1(06)251

Unfortunately, new fixed BWA systems (e.g. Wimax), while possibly classed as fixed service systems, employ wide beam antennas to maximise coverage, often with the aim of providing blanket coverage over a given area. Hence this type of fixed service system is less amenable to sharing with other services, including the FSS.

The sharing situation is even clearer if mobile systems are envisaged. **It is important to remind that the whole band 3,400-4,200 MHz is allocated to the mobile service in Region 1 on a secondary basis only, in the Radio Regulations.** This is not a mistake, but reflects the fact that the international community has recognised that mobile systems are generally unsuitable for sharing with FSS earth stations. Particularly for Europe, where countries are relatively small, the notification of a typical mobile station within a country causes significant and often unnecessary constraints on the available locations for new earth stations in the same country, and in neighbouring countries.

Draft ECC Report 100[2] concludes that **sharing between FSS and BWA (and also beyond IMT, by analogy) will require coordination zones (mitigation distances) to be implemented around each FSS earth station, and that sharing between these services is therefore not feasible in the same geographical area when ubiquitously deployed**. Furthermore, the deployment of BWA or IMT in one country may also have an impact on FSS reception in neighbouring countries and can therefore not be considered as a domestic only matter.

Considering that FSS and BWA/IMT cannot share in the same geographical area, there are two basic approaches to sharing that need to be considered: geographical segmentation and frequency segmentation.

2. Geographical segmentation

The compatibility studies have examined sharing between FSS earth stations and BWA stations and give some idea of the separation distances that will be required. Typical separation distances for BWA systems have been studied by CEPT and are contained in Draft ECC Report 100. The results show a range of values, depending on the type of BWA station, the interference criterion, and on terrain modelling. It is apparent that the greatest separation distances are required for BWA central stations for which the separation distances are typically tens of kilometres and sometimes hundreds of kilometres. Studies conducted in ITU WP 8F have shown similar separation distances for IMT base stations.

It is apparent that, for any terrestrial operations in any part of C-band, it is necessary to protect existing earth stations from interference through geographic separation. For this reason it would be appropriate to establish a coordination procedure for new terrestrial stations with respect to existing FSS earth stations. As explained in the ECC Report 100, protection is required not just for co-frequency operations, but is also required when terrestrial systems and earth stations operate on different frequencies or in different parts of C-band. This protection requirement also leads to the need for geographic separation and should also be taken into account though a coordination procedure.

[2] The latest draft before consultation is attached to this paper. The final report is to be adopted at the next ECC meeting, in March 2007.

Even with coordination, the required separation distances will be at least tens of kilometres and possibly even hundreds of km. Considering these distances and the number of FSS earth stations in use in Europe, **it is apparent that very large geographic areas could not be used for BWA/IMT**. In some countries, where there are a large number of earth stations with wide geographic distribution, there are almost no areas where BWA/IMT systems could be deployed without major constraints.

Furthermore, the deployment of BWA/IMT in the "gaps" between FSS earth stations would limit the possibilities for deployment of new earth stations, potentially leading to a freeze on current earth station deployment. Recognizing the ongoing importance of the band 3.4-4.2 GHz as a worldwide allocation to the FSS (Space–to–Earth), any new service should not impede the future deployment of FSS earth stations in that band.

There is another problem with geographic segmentation in that there exist many receive only FSS earth stations for which the location is unknown – making coordination impossible. This is because in many countries those earth stations are exempt from licensing. Indeed **there is a CEPT decision[3] which aims to exempt receive only earth stations from individual licensing; and it is to be reminded that this Decision has been implemented by 24 CEPT administrations**.

3. Frequency segmentation

Many earth stations in C-band consist of numerous antennas which operate to difference satellites in different parts of C-band. For operational reasons, earth station antennas may switch from one satellite to another, operating on different frequencies. Therefore many earth stations will require and expect protection throughout the whole of C-band and on the basis of operations to any visible satellite in the geostationary arc. This would also allow such earth stations to meet future requirements for operations to new satellites and on new frequencies, which is particularly important considering the likely difficulty in establishing new earth stations if bands are shared with BWA and mobile systems. For these earth stations therefore, frequency segmentation would remove their capability to adapt the changing requirements and is not an option. For other earth stations however, it could in theory be possible to operate BWA/IMT systems on different frequencies to those received by the earth station.

It was thought by some governments in the world who assigned broadband wireless frequencies below 3.7 GHz that the problem could be limited by frequency segmentation. This has proven to be ineffective in real-world tests. Large-scale disruptions of services operating in non-overlapping frequency bands have taken place in several countries, and as a result, governments, intergovernmental bodies, and the satellite industry – particularly in Asia, which is most dependent on these frequencies -- have begun to recognize the threat that ill-considered assignment of C-band frequencies to terrestrial wireless services poses.

As a typical illustration, the Hong Kong Telecommunications Authority Working Group conducted an extensive series of field tests in 2006, concluding that there are interference problems caused by the proposed allocation of BWA in the 3.4 – 3.6 GHz band to the reception of satellite signals by FSS systems in the whole 3.4 – 4.2 GHz band. For the coexistence of the two services in the same territory, severe technical constraints must be

[3] ERC/DEC/(99)26 – attached to this paper

observed which would imply significant costs to be incurred by both BWA operators and FSS users, and they may make it difficult for a wide and cost-effective deployment of BWA systems in a dense urban environment.

Technical studies conducted in CEPT (draft ECC Report 100 on Compatibility Studies In The Band 3400-3800 MHz Between Broadband Wireless Access (BWA) Systems And Other Services) have also established that frequency separation alone is not adequate to protect FSS earth stations. This is due to two effects: (1) the unwanted emissions from BWA stations received by FSS earth stations, and (2) the relatively high power of BWA stations causing earth station receiver overload. Hence **even where there is frequency segmentation, some geographic separation will also be required, albeit with smaller separation distances.**

In the case of beyond IMT systems, carrier bandwidths greater than 100 MHz are envisaged for high data rate applications. These applications are envisaged to be accommodated in the higher frequency candidate bands such as 3,400-4,200 MHz. In many geographic areas, it would be very difficult to find a single block of 100 MHz that was not used in part by at least one earth station in the vicinity.

Even if frequency segmentation were to be feasible in some limited areas, it would not allow for blanket coverage normally associated with 2G and 3G mobile systems due to the need to protect some earth stations throughout the entire band. Reversely, once a BWA/IMT system were deployed in a particular area, it would likely be impossible to deploy a new earth station in the same area.

4. Alternatives

As a minimum, should C-band be used for new terrestrial services, all existing earth stations must be properly protected and entitled to protection throughout C-band. We also seek to ensure that it will be possible to deploy new earth stations in Europe, to meet future customer requirements. However, we cannot see how these requirements could be met by the proposed introduction of new BWA and IMT systems. In fact, given the number and location of earth stations around Europe, the usefulness of C-band for BWA or IMT systems can and should be questioned.

Some administrations have already authorised FWA systems in bands around 3600 MHz. Those systems have had limited success so far and hence the impact on FSS operations has been small. However, the limited success for FWA to date cannot be relied upon in the future as a methodology to avoid interference and serious constraints on the FSS. This should not be taken as a justification for allowing further terrestrial services in other parts of the range 3,400-4,200 MHz.

We have **severe doubts that sharing between IMT systems and FSS earth stations will be feasible**. The 2G and 3G terrestrial systems deployed in other frequency bands, which are exclusively available for terrestrial applications, provide coverage for almost the entire population. For the operation of IMT systems in C-band, on the other hand, it is apparent that the coverage could not be comparable. The necessary geographic separation for the protection of current FSS earth stations will severely limit the coverage of IMT systems in C-band, excluding in particular some areas of high population density.

For the reasons explained above, C-band remains necessary for FSS operations in Europe now and for the foreseeable future. We would firmly and absolutely reject any suggestion that FSS operations in C-band, or any part of C-band, could be transitioned to alternative frequency bands.

If, on the other hand, the BWA/IMT community considers it can share with existing and future FSS operations, the onus should be on those communities to demonstrate that they can share. Nevertheless, we cannot see how it would be practical for new BWA applications or IMT to operate in the band 3,400-4,200 MHz while sharing with FSS earth stations; and the terrestrial community has not demonstrated how it could share with the existing, known FSS deployment – let alone with future FSS developments or with FSS earth stations at unknown locations.

Mobile terrestrial FS have not demonstrated that they can share C-band with existing satellite FSS in 3,400-4,200 MHz, as reported on paper or as a result of interference incidents that occurred recently. This severely constrains the ability of terrestrial operators to envisage any full coverage with their future services, given the existence of satellite earth stations in several locations.

In any case, we remain with the feeling that the proponents of IMT systems in C-band spectrum consider that, either sharing with the FSS will have little constraint on IMT operations, or FSS operations could transition to alternative frequency bands. **FSS operators do not share these views and urge the European and national authorities to consider our position in a fair balance with terrestrial expectations.**