

**PCC.III/REC. 61(XVII-01)**

**FREQUENCY ARRANGEMENTS FOR 3G MOBILE SYSTEMS**

The XVII Meeting of the Permanent Consultative Committee III: Radiocommunications,

**CONSIDERING:**

- a) That many administrations are proceeding expeditiously with the identification of spectrum and frequency band plans for third generation mobile systems;
- b) That considerable work is underway in ITU-R Working Party 8F to identify frequency band plans and technical criteria for the implementation of 3G mobile systems;
- c) That a comprehensive working document (PCC.III/doc. 1842/01 Rev.1), entitled "Working Documents on Frequency Arrangements for 3G Systems" was developed at the XVII meeting of PCC.III, March 5-9, City of Panama (Attached). This document identifies the frequency band plans developed by CITEL countries to date;
- d) That there is a number of similar aspects in the band plans contained in the document PCC.III/doc. 1842/01 Rev.1, and
- e) That ITU-R Working Party 8F established a timeframe for the submission of proposals for examples of possible frequency arrangements for IMT-2000 to be provided at their meeting in October 2001,

**RECOGNIZING:**

That the opportunity exists for the development of harmonized band plans within CITEL countries,

**RECOMMENDS:**

That CITEL countries take into consideration the frequency band plans described in document (PCC.III/doc. 1842/01 Rev.1 ) in their planning for 3G mobile systems.

**INVITES:**

CITEL countries to submit contributions to the Working Group on Terrestrial Fixed and Mobile Radiocommunication Services take into account the timeframe aforementioned in considering e).

Manufacturers to send contributions on those frequency arrangements regarding technical aspects related with their practical implementation, with a focus to the necessary band guards.

**XVII MEETING OF PERMANENT  
CONSULTATIVE COMMITTEE III:  
RADIOCOMMUNICATIONS  
March 5-9, 2001  
City of Panama, Panama**

**OEA/Ser.L/XVII.4.3  
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8 March 2001  
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**WORKING DOCUMENT ON FREQUENCY  
ARRANGEMENTS FOR 3G SYSTEMS**

**(Item on the Agenda: 4.3)**

**(Document submitted by: 3G Ad Hoc Drafting Group)**

## **1. PURPOSE**

The purpose of this document is to identify various options for frequency arrangements for 3G mobile systems under consideration by CITEL countries. This document is intended to form the basis for a future CITEL Recommendation on preferred frequency band plans for 3G mobile systems. This document also includes information of the existing 800 MHz cellular and 1900 MHz PCS bands for their evolution to their 3G systems. Administrations are encouraged to submit contributions regarding this document to the next meetings of CITEL.

## **2. INTRODUCTION**

With the identification of bands for 3G mobile systems by WRC-00 and the activities of ITU-R WP 8F and the technology standards bodies 3GPP and 3GPP2, it is rapidly becoming important for CITEL to identify specific band plans for 3G systems.

Furthermore, worldwide harmonisation of frequency usage by the 3G systems would enhance global roaming and economies of scale. A key element in the success of 3G systems is the ability for the terminal equipment to operate and roam worldwide without any restriction.

Many administrations are proceeding expeditiously with the identification of the spectrum and band plans for third generation wireless, including IMT-2000 which will best meet their domestic requirements. A number of Region 2 countries have begun their consultation processes, aimed at the adoption of harmonized band plans this year or early next year, leading to licensing within the next two years.

The working group on terrestrial fixed and mobile radiocommunicaton services of the Permanent Consultative Committee III held an extraordinary meeting on October 2 and 3, 2000, with the purpose of identifying and elaborating common proposals among the CITEL Administrations to be presented in the third WP-8F meeting. The proposals were not considered CITEL proposals and they were submitted to WP-8F directly by the Administrations which undersigned them.

During the aforementioned meeting three proposals of possible frequency arrangements in the spectrum identified by WARC-92 and WRC-2000 for IMT-2000 were identified. Brazil, Chile, Colombia, Guatemala, Mexico, United States of America and Venezuela, supported a frequency arrangement for the 824 MHz to 894 MHz bands (see section 3.3). Chile, Mexico and the United States of America, proposed a frequency arrangement example for the 1.850 MHz to 1.990 MHz bands (see section 3.2). Brazil, Chile, Guatemala, Mexico and Venezuela, supported a frequency arrangement using 1.7 GHz and 1.9 GHz bands for the IMT 2000 reverse link paired with 2110 MHz to 2170 MHz for the forward link (see section 3.1.3).

## **FREQUENCY ARRANGEMENTS for 3G MOBILE SYSTEMS**

### **3.1 Frequency Arrangements in the 1710-2170 MHz range**

In the options 1, 2, and 3, provided below, the frequency ranges considered are 1710-1850 MHz and 2110-2170 MHz. In addition, in options 1 and 3, parts of the PCS band in the range 1920-1980 MHz are also included. It is noted that in these three options, the entire 1710-1850 MHz is used in various pairing scenarios. In order to maximize the use of available spectrum and provide

flexibility, these scenarios include pairing of spectrum both within the 1710-1850 MHz and also with parts of 2110-2170 MHz.

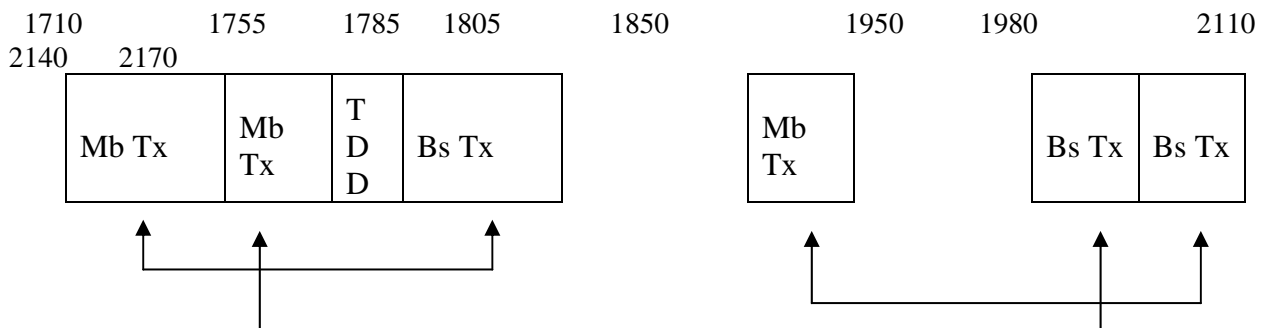
All of these options take into consideration existing and future band plans used in other Regions in order to maximize harmonization.

### 3.1.1 Option 1

The plan illustrated below, submitted by Brazil, could be an alternative for countries which have available, a portion of the band identified by WRC-92, as well as the 1.8 GHz band identified by WRC-2000.

In the case of most Region 2 countries, this proposal could provide 120 MHz of spectrum, in the short term for the IMT-2000, and allow 90 MHz of spectrum for evolution from 2<sup>nd</sup> generation to IMT-2000 systems.

The following figure illustrates the band 1710-1755 MHz paired with 1805-1850 MHz, and the band 2110-2170 MHz combined with 1950-1980 MHz and 1755-1785 MHz.



The plan illustrated above has the following advantages:

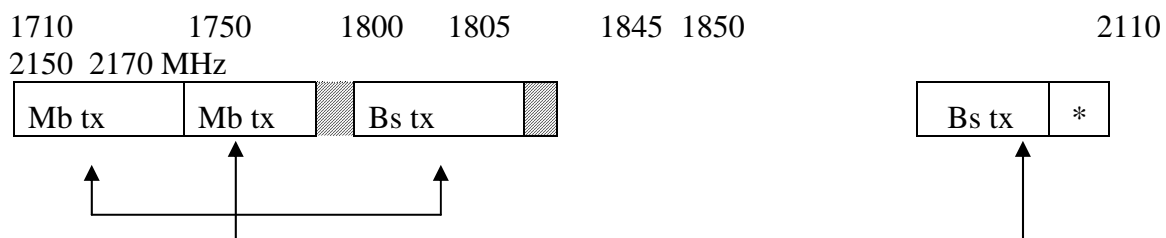
- i) Provides up to 210 MHz of spectrum for IMT-2000.
- ii) Facilitates a global harmonization in the spectrum bands identified for IMT-2000, supporting therefore, global roaming and economies of scale by:
  - Facilitating the evolution of pre-IMT-2000 to IMT-2000 systems, with the pairing of 1710-1755/1805-1850 MHz;
  - Using a common base transmit band already adopted by other Regions, with the pairing of 1755-1785/2110-2140 MHz;
  - Using a common base and mobile transmit bands already adopted by other Regions with the pairing of 1950-1980/2140-2170 MHz.
- iii) Could allow the use of the unpaired spectrum for TDD applications.
- iv) Facilitates flexibility and step by step implementation.

- v) The possible use of the middle part of the band for Mb Tx (1755-1785 MHz) would be compatible with the possible frequency arrangements proposed in the ITU-R WP-8F by countries of other Regions.

However, the plan illustrated in this option does not take into consideration the necessary guard bands.

### 3.1.2 Option 2

The frequency arrangement shown below, was developed by Canada through substantive consultation with their mobile industry. It takes into consideration a 5 MHz guard band between 1 800-1 805 MHz and 1 845 - 1 850 MHz, as suggested in document PCC.III/doc.1788/01.



\* In Canada, the band 2 150 – 2 160 MHz is used by MCS and MDS services.

The band 2 160-2 170 MHz is allocated to MSS, in Region 2 (S5.388, S5.389C, S5.389D).

The plan illustrated above can maximize the use of the 1.7 GHz band. Domestic implementation can vary to balance the spectrum requirements of incumbent and new users and services. With symmetrically paired spectrum in the range 2110-2170 MHz, this provides up to 180 MHz of spectrum, which meets the requirement (160 MHz) identified by the ITU.

This frequency arrangement is aligned with proposals from several Region 2 countries, as reflected in Document 8F/184, Attachment 6, Annex 3. The rationale for this arrangement is that it provides commonalities in band plans with other Regions:

- the 1710-1750/1805-1845 MHz pairing is in alignment with the evolution from 2G to 3G technology of the band, in some Regions;
- the 1750-1800/2110-2160 MHz pairing uses a common base transmit band to the band plans used in other Regions.

This combination strives towards global harmonization of existing bands, leading to economies of scale and roaming capabilities. It will also facilitate the evolution of pre-IMT systems into IMT-2000 systems and networks in the 1710 -1845 MHz band.

Within guard bands, the use of low power TDD could be investigated, as it would increase the total amount of spectrum available for advanced mobile services including 3G, and provides an additional means of addressing traffic asymmetry.

### 3.1.3 Option 3

It was identified that a frequency arrangement using the 1.7 GHz and 1.9 GHz bands for IMT-2000 reverse link paired with the 2110 MHz to 2170 MHz band for forward link, could be an alternative for Administrations that belong to Region 2.

However, various Administrations of Region 2 present some differences in the deployment of existing systems using the frequency range of 1710 MHz to 1850 MHz. On the other hand, it was identified that 2110 MHz to 2170 MHz can be used in part or entirely with no major problems, in many CITEL countries.

For these reasons the ITU Administrations that support this contribution uphold the view that the best way to provide the necessary flexibility would be to consider all bands from 1710-1850 MHz to be used as a reversed link. To accommodate possible differences among Administrations, frequency usage should be solved through technological resources. Bearing this in mind, the alternative that takes into consideration the use of variable duplex separation technology optimises the use of RF spectrum for IMT-2000 and draws near the goal of global harmonisation.

However, the Administrations that subscribed to this proposal recognised that the commercial availability of variable duplex separation technology is not clearly defined yet. As such, a transitional step must be considered in order to develop in a very short term, terminals for IMT-2000 operating in the two bands mentioned below for reverse link, paired with 2110-2170 MHz for forward link with fixed duplex separation. The two bands for reverse link would be 1920 MHz to 1980 MHz and any (up to) 60 MHz in the band 1710 – 1850 MHz.

Figure 1 illustrates this alternative.

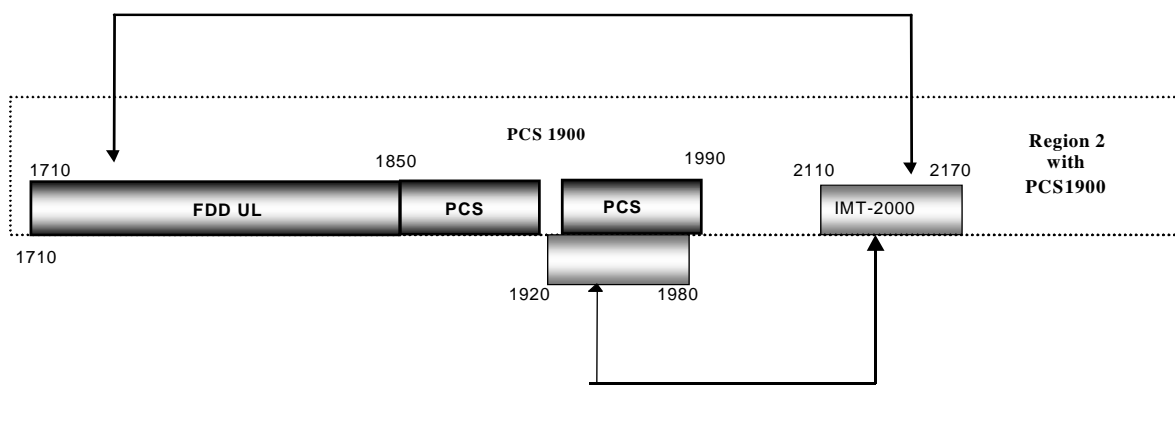


Figure 1

This initial pairing of one part (up to 60 MHz) of the 1710-1850 MHz and 2110-2170 MHz bands offers an opportunity for those administrations that have chosen to implement second generation systems in the original IMT-2000 band, to develop a national plan for bands that is in accordance with international allocations. In addition, this pairing of bands takes into account:

- The capacity of the band 2110 - 2170 MHz to serve as a downward link in the three Regions of the world, and as such, to support global roaming in the three Regions.
- Facilitates the development and production of terminal stations that are cost-effective and that simplify arrangement of duplex frequencies.
- This example of frequency arrangement is basically compatible with the spectrum available in Region 2 and will depend on the availability in each country.
- This frequency arrangement neither limits nor favours the deployment of certain IMT-2000 technologies.
- This arrangement facilitates a step-by-step approach that will allow existing second generation systems to continue operating, as needed, in their current bands, i.e. the 1.9 GHz band.
- Some administrations in Region 2 are still studying the definition of the use of these frequency bands as an additional alternative in offering third generation services.

Such an approach may accommodate the spectrum needs of new operators, as well as of existing operators, and will allow the co-existence between 3G systems and current services.

Since the first phase of this proposal does not entirely cover the approximate 160 MHz of additional spectrum that, as recognized by the administrations of WRC-2000, it will be necessary to satisfy the predicted demand for short-term 3G spectrum, and in order to consider all bands above 1 GHz together, it is important that the administrations and manufacturers concentrate their efforts in order to make the variable duplex separation technology become a reality.

### **Advantages**

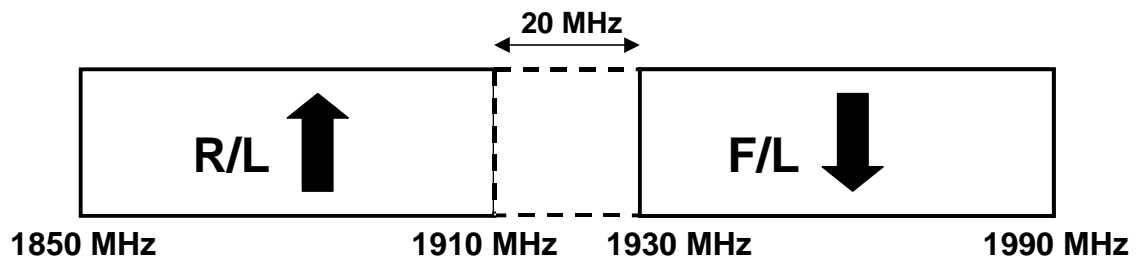
1. A near-term solution for 3G spectrum in the countries that have chosen to implement second generation PCS systems in the bands identified for IMT-2000 by WARC-92.
2. Facilitates a global frequency arrangement in the spectrum bands identified for IMT-2000, supporting, therefore, global roaming and economies of scale.
3. Facilitates flexibility and step-by-step implementation.
4. Offers a clear regulatory framework which allows near-term implementation and development of the IMT-2000 systems.
5. Allows, furthermore, definition of certain TDD blocks in the band 1710 – 1850 MHz.
6. The implementation of variable duplex separation technology, when available, would facilitate the harmonised use of the frequency bands, identified for IMT-2000, by the administrations of Regions 1, 2 and 3.

### **Disadvantages**

1. The asymmetric capacity is at first limited.
2. The example of frequency arrangements for Region 2 is not completely aligned with Regions 1 and 3.
3. The example of frequency arrangements does not cover the approximate 160 MHz of additional spectrum that the administrations identified at WRC-2000.

### 3.2 Use of the PCS Bands for 3G Mobile Systems

There are countries in Region 2 that anticipate that the introduction of IMT-2000 in their countries will first occur in bands where cellular and personal communications services (PCS) currently operate. However, many of these countries have not yet made decisions regarding the implementation of IMT-2000 in bands other than those currently used for PCS systems. As an initial step in implementing IMT-2000, this contribution proposes continued use of the frequency bands 1 850-1 910 MHz/1 930-1 990 MHz and evolution of second generation systems using these bands to IMT-2000. These frequencies fall within the bands identified by WARC-92 and WRC-2000 for IMT-2000. The following chart provides the broadband PCS band plan implemented in Region 2.



Some of the first operators to provide services using IMT-2000 will be current and new operators in the PCS bands. These operators are expected to begin providing these services in early 2001 in response to their customers' need for access to new service features and capabilities.

To promote the continued growth of IMT-2000, it is essential that the Recommendations on frequency arrangements for IMT-2000 include those used by existing second generation mobile systems that allow operators to transition easily, within their current licensed frequencies, to IMT-2000. IMT-2000 has evolved from existing technologies in response to market demand, allowing current operators and new licensees in existing mobile bands to bring advanced services to consumers as rapidly as new technology allows.

Although the ITU plays an invaluable role in facilitating IMT-2000, it will be administrations, technology developers, equipment manufacturers and service providers that will ultimately decide when to introduce IMT-2000 based on market factors. Support for an evolutionary approach in existing mobile bands was included in Resolution 223 (WRC-2000) and Resolution 224 (WRC-2000), recognizing the use of these frequency arrangements may lead to a more expeditious implementation of IMT-2000.

The ITU's recognition of the PCS frequency band as one of the IMT-2000 frequency band arrangements will advance roaming of newly implemented IMT-2000 in much of the Americas and will further encourage the development of handsets to support global roaming among the frequency arrangements that are being implemented for IMT-2000.



## Advantages

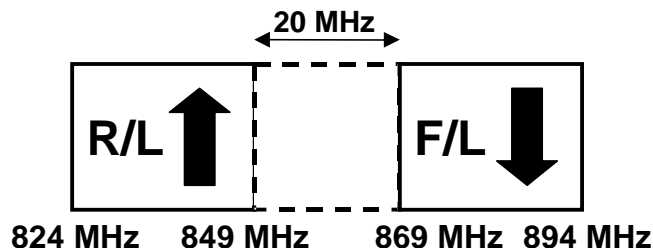
- 1) Utilizing the 1 850-1 910 MHz / 1 930-1 990 MHz frequency bands for IMT-2000 will permit these operators to migrate their current systems to IMT-2000 within their existing allocations, maintaining current reverse- and forward-link bands and duplex spacing.
- 2) This approach has the advantage of not artificially tying the rollout of new technology and services to new spectrum as administrations assess their ability to allocate additional spectrum for IMT-2000 from within the bands identified at WARC-92 and WRC-2000.

## Disadvantages

The 1 850-1 910 MHz / 1 930-1 990 MHz frequency bands are not used on global basis for PCS. While the use of multi-band terminals can facilitate global roaming in these bands, there are disadvantages to this approach, including higher terminal costs.

### 3.3 Use of the Existing Cellular Bands (824-849 MHz / 869-894 MHz) for 3G Systems

There are countries in Region 2 that anticipate that the introduction of IMT-2000 in their countries will first occur in bands where cellular and personal communications services (PCS) currently operate. However, many of these countries have not yet made decisions regarding the implementation of IMT-2000 in bands other than those currently used for cellular systems. As an initial step in implementing IMT-2000, this contribution proposes continued use of the frequency bands 824-849 MHz / 869-894 MHz and evolution of first and second generation systems using these bands to IMT-2000. These frequencies fall within the bands identified by WRC-2000 for IMT-2000. The following chart provides the cellular band plan implemented in Region 2.



Some of the first operators to provide services using IMT-2000 will be current and new operators in the cellular bands. These operators are expected to begin providing these services in early 2001 in response to their customers' need for access to new service features and capabilities.

To promote the continued growth of IMT-2000, it is essential that the Recommendations on frequency arrangements for IMT-2000 include those used by existing first and second generation mobile systems that allow operators to transition easily, within their current licensed frequencies, from analog and digital wireless systems to IMT-2000. IMT-2000 has evolved from existing technologies in response to market demand, allowing current operators and new licensees in existing mobile bands to bring advanced services to consumers as rapidly as new technology allows.

Although the ITU plays an invaluable role in facilitating IMT-2000, it will be administrations, technology developers, equipment manufacturers and service providers that will ultimately decide when to introduce IMT-2000 based on market factors. Support for an evolutionary approach in existing mobile bands was included in Resolution 223 (WRC-2000) and Resolution 224 (WRC-2000), recognizing the use of these frequency arrangements may lead to a more expeditious implementation of IMT-2000.

The ITU's recognition of the cellular frequency band as one of the IMT-2000 frequency band arrangements will advance roaming of newly implemented IMT-2000 in much of the Americas and will further encourage the development of handsets to support global roaming among the frequency arrangements that are being implemented for IMT-2000.

### **Advantages**

- 1) Utilizing the 824-849 MHz / 869-894 frequency bands for IMT-2000 will permit these operators to migrate their current systems to IMT-2000 within their existing allocations, maintaining current reverse- and forward-link bands and duplex spacing.
- 2) This approach has the advantage of not artificially tying the rollout of new technology and services to new spectrum as administrations assess their ability to allocate additional spectrum for IMT-2000 from within the bands identified at WARC-92 and WRC-2000.

### **Disadvantages**

The 824-849 MHz / 869-894 frequency bands are not used on global basis for cellular services. While the use of multi-band terminals can facilitate global roaming in these bands, there are disadvantages to this approach, including higher terminal costs.

## **3.4 Options being considered in the United States**

The U.S. FCC has sought comment in a Notice of Proposed Rule Making on the following options for IMT-2000 band plans. The U.S.A. will make its decision on these or other options after considering all of the comments received in accordance with U.S. law.

### **3.4.1. Option 1**

An option ("Option 1") for advanced mobile and fixed communications systems is our proposal in the *Policy Statement*; *i.e.*, allocating the 1 710-1 755 MHz band paired with the 2 110-2 150/2 160-2 165 MHz band. A variation of this option could be to make spectrum available in phases in the 1 710-1 790 MHz band (similar to the second segmentation option discussed in the NTIA Interim Report), paired with additional spectrum above 2 110 MHz. This option would be consistent with the proposal recently made to ITU-R Working Party 8F by Brazil, Chile, Guatemala, Mexico, and Venezuela that Region 2 countries use for 3G systems spectrum in part of the 1 710-1 850 MHz band (up to 60 megahertz) for mobile-to-base operations paired with spectrum in the 2 110-2 170 MHz band for base-to-mobile operations.<sup>1</sup> As these countries note, this approach could permit compatible base-to-mobile use of the 2 110-2 170 MHz band

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<sup>1</sup> See ITU-R Document 8F/148-E, "Possible Frequency Arrangements in the Spectrum Identified by WARC-92 and WRC-2000 for IMT-2000," October 20, 2000.

among Region 2 and non-Region 2 countries to support global roaming.<sup>2</sup> Accordingly, Option 1 could make available up to 90 megahertz of spectrum for advanced mobile and fixed communications systems and could also promote compatibility in the upper band. We note, however, that compatibility with non-Region 2 countries would not occur in the lower band if non-Region 2 countries use bands other than 1 710-1 755 MHz for 3G mobile-to-base operations.

#### **3.4.2. Option 2**

A second option (“Option 2”) for accommodating advanced mobile and fixed communications systems is allocating the 1 710-1 755 MHz band paired with spectrum in the 1 755-1 850 MHz Federal Government band. As detailed in its Interim Report, NTIA has expressed serious reservations about using the 1 755-1 850 MHz band for non-Federal systems because of that band’s use by critical Government systems. However, if NTIA were to make spectrum in that band available, it could be paired with the 1 710-1 755 MHz band on either a symmetrical or asymmetrical basis. The NTIA Interim Report suggests various band segmentation plans that could make 45 megahertz or more of spectrum available for advanced mobile and fixed communications systems.<sup>3</sup> A symmetrical pairing might permit the 1 805-1 850 MHz band to be paired with the 1 710-1 755 MHz band, whereas an asymmetrical pairing would permit a larger block of spectrum in the 1 755-1 850 MHz band to be paired with the 1 710-1 755 MHz band. Option 2 would also have the potential advantage of permitting compatible Region 2/non-Region 2 use of the 1 710-1 755 MHz and 1 805-1 850 MHz bands because these bands are used in much of Europe for second generation GSM mobile radio systems. However, a disadvantage of Option 2 is that it is unclear whether European countries will transition these bands to 3G systems. A further disadvantage of Option 2 is that even if spectrum in the 1 755-1 850 MHz band is reallocated for non-Federal use, Federal satellite systems may continue to operate in that band on a grandfathered basis for a number of years in a manner that would limit the use of this band for advanced services.

#### **3.4.3. Option 3**

A third option (“Option 3”) for accommodating advanced mobile and fixed communications systems is allocating the 2 110-2 150/2 160-2 165 MHz bands paired with spectrum in the 2 500-2 690 MHz band. Alternatively, the 1 710-1 755 MHz band could be paired with spectrum in the 2 500-2 690 MHz band. Option 3 would also permit either symmetrical or asymmetrical pairing. The potential advantage of this approach is that both the 2 110-2 150/2 160-2 165 MHz and the 2 500-2 690 MHz bands are available for 3G systems in many countries. Accordingly, Option 3 could directly permit 3G compatibility without concern as to whether 2G systems will be transitioned to 3G systems. However, a disadvantage of Option 3 is that it would require reallocation of ITFS/MMDS spectrum in the 2 500-2 690 MHz band, which could adversely impact broadband fixed use of that band, as detailed in the FCC Interim Report. A further disadvantage of Option 3 is that, while the 2 500-2 690 MHz band is potentially

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<sup>2</sup> *Id.* at 2-3.

<sup>3</sup> *See* NTIA Interim Report at 38-46.

available for 3G systems in other countries, it remains unclear how many of these countries will actually use that band for such systems.