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**APT report on**

**Study oN Technical and Operational Measures for Coexistence between Terrestrial and Satellite IMT Systems Deployed in the frequency bands of 1 980-2 010 MHz and 2 170-2 200 MHz in the Asia-Pacific Region**

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# 1 Introduction

Noting that there are Fixed Service (FS), Mobile Service (MS), and Mobile-Satellite Service (MSS) for primary allocations in the bands 1 980 - 2 010 MHz and 2 170 – 2 200 MHz in Radio Regulations, an individual administration can decide whether or not these bands to be used for FS, MS or MSS. The ITU-R has developed the frequency arrangements for these two bands to facilitate the implementation of terrestrial IMT systems, as shown in the arrangements B6 and B7 and parts of arrangements B3 and B5 in the Recommendation ITU-R M.1036. Co-coverage and co-frequency deployment of independent satellite and terrestrial components of IMT in the bands 1 980-2 010 MHz and 2 170-2 200 MHz is not feasible unless techniques, such as the use of an appropriate guard-band, or other mitigation techniques are applied to ensure coexistence and compatibility between the terrestrial and satellite components of IMT. When these components are deployed in different countries in the same frequency bands, technical or operational measures need to be implemented if harmful interference is reported.

The ITU set up the issue 9.1.1 under WRC-19 agenda item 9.1, and invited WP 4C and 5D to jointly study possible technical and operational measures to ensure coexistence and compatibility between the terrestrial component of IMT and the satellite component of IMT in the bands 1 980 – 2 010MHz and 2 170 – 2 200MHz in different countries. Based on the conclusion results of these studies, WRC-19, which was held from 28 October to 22 November 2019 in Sharm el-Sheikh, established guidance on the implementation of technical and operational measures to facilitate coexistence between terrestrial and satellite components of IMT in the frequency bands 1 980 - 2 010 MHz and 2 170 - 2 200 MHz in Resolution 212 (Rev. WRC-19). There are however no ITU-R Reports or Recommendations that address sharing and compatibility between MSS and terrestrial IMT systems in these bands and no related study item has been concluded in ITU-R since WRC-19.

# 2 Scope

This report analyzes the current situation and plans of IMT deployment in the bands of 1 980 – 2 010 MHz and 2 170 – 2 200 MHz in APT administrations.

This report does not cover adjacent band interference between the satellite and terrestrial components of IMT because the co-frequency interference is dominant.

Taking account of Resolution 212 (Rev.WRC-19), this Report aims to facilitate the development and co-existence of both satellite and terrestrial components of IMT in the bands of 1 980 – 2 010 MHz and 2 170 – 2 200 MHz in the Asia-Pacific region. It also provides information which may be considered by concerned Administrations.

# 3 Current status and future plans for the usage of the bands in APT countries

Since the 20th AWG meeting, APT Administrations were invited to make contributions to update **APT Report-46** "*APT* *Frequency Usage of the Bands* *1 980 – 2 010 MHZ and 2 170 - 2 200 MHz in Asia Pacific Region*", and the 23rd AWG meeting has finalized the Report, as shown in **APT Report-46 Rev.2**.

According to this Report, 12 APT Administrations took part in the survey, Australia, Bangladesh, Cambodia, China, Japan, Korea, Micronesia, Singapore, Thailand, Tonga, Vanuatu and Viet Nam. As shown in **Table 1**, there is no unified allocation for these two frequency bands 1 980 - 2010 MHz and 2 170 – 2 200 MHz in APT countries for the current status or the future plans. Specifically, considering the important role and the scarcity of the spectrum resource, these bands are currently being used or planned to be used for MSS in some APT countries, like Australia, China, Tonga, Singapore, Micronesia etc. On the other hand, it is well noted that there are also some countries planning to allocate these two bands to terrestrial IMT exclusively, while some countries are still under consideration about the practical allocations in these two bands.

Table 1

Summary of the survey in the Report APT /Report 46

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Country** | **Current Allocations** | **Current Applications** | **Future Plans** |
|  | Australia | Fixed service  Mobile service | Point to Point, Television | Mobile-Satellite Service |
|  | Bangladesh | 1 980 – 2 010 MHz, Mobile service  2 170 – 2 200 MHz, No service | 3G, CDMA, Guard band | CDMA  IMT Satellite |
|  | Cambodia | Fixed service | Multichannel Multipoint Distribution Service | None |
|  | China | Mobile-Satellite Service | GMR  Personal Communication | Mobile-Satellite Service |
|  | Japan | Mobile Service  Mobile-Satellite Service | Disaster Relief | Under study |
|  | Korea | Mobile Service  Mobile-Satellite Service | None | Mobile Service  Mobile-Satellite Service[[1]](#footnote-1) |
|  | Micronesia | Satellite Service | VSAT | None |
|  | Singapore | Mobile-Satellite Service | Satellite Mobiles | None |
|  | Thailand | Fixed service  Mobile Service  Mobile-Satellite Service | None | None |
|  | Tonga | Fixed service  Mobile Service  Mobile-Satellite Service | Satellite Mobiles | Under study |
|  | Vanuatu | 1980-2110, No service  2170-2200, Fixed service | Backhaul | None |
|  | Viet Nam | Fixed service  Mobile Service  Mobile-Satellite Service | Identified for IMT | Terrestrial IMT[[2]](#footnote-2) |

Both the terrestrial and satellite components of IMT have already been deployed or are being considered for deployment in these two frequency bands in different countries.

# 4 Related coexistence and compatibility issues[[3]](#footnote-3)

The issue of coexistence and compatibility between the terrestrial component of IMT (comprised of base station(s) (BS(s)) and user equipment (UE)) and the satellite component of IMT (comprised of MSS space stations and mobile earth station(s) (MES(s)) in different countries is considered in four interference scenarios, A1, A2, B1, and B2, respectively.

Figure 1: Interference scenarios between the satellite and terrestrial components of IMT



Scenarios A1 and A2 consider interference to the satellite system from the terrestrial system. In particular, Scenario A1 investigates the uplink interference issue from UEs and BSs to the satellite in 1 980 ‑ 2 010 MHz, and Scenario A2 investigates the downlink interference issue from BSs to satellite MES in 2 170 - 2 200 MHz.

Scenarios B1 and B2 consider interference to the terrestrial system from the satellite system. In particular, Scenario B1 investigates the uplink interference issue from MES to BS and UE in 1 980 - 2 010 MHz, and Scenario B2 investigates the downlink interference issue from the satellite to UE in 2 170 ‑ 2 200 MHz.

Table 1: Interference scenarios

|  |  |  |  |
| --- | --- | --- | --- |
| Scenario | Interference From | Interference To | Frequency Band |
| A1 | IMT BS (downlink)  IMT UE (uplink) | IMT space station | 1 980 - 2 010 MHz |
| A2 | IMT BS | IMT MES | 2 170 - 2 200 MHz |
| B1 | IMT MES | IMT BS  IMT UE | 1 980 - 2 010 MHz |
| B2 | IMT space station | IMT UE | 2 170 - 2 200 MHz |

The outcome of discussion at WRC-19 on this issue are contained in Resolution 212 (Rev. WRC-19).

# 5 Technical and operational measures for coexistence

From Table 1 in section 3 above, it is clear that several countries in the Asia-Pacific region have deployed or are planning to deploy satellite or terrestrial IMT systems in these bands.

It is desirable for the APT countries to study possible solutions related to the frequency arrangements in the bands 1 980 – 2 010 MHz and 2 170 – 2 200 MHz in order to address the specific requirements of the Asia-Pacific region, with the focus to reach the compatibility and coexistence between IMT terrestrial and satellite components in these bands.

The ITU-R has developed the frequency arrangements in the bands 1 980 – 2 010 MHz and 2 170 – 2 200 MHz to facilitate the implementation of terrestrial IMT systems, as shown in the arrangements B6 and B7 and parts of arrangements B3 and B5 in the Recommendation ITU-R M.1036.

Table 2

Frequency arrangements from Recommendation ITU-R M.1036 and possible interference scenarios

| **Frequency  arrangements** | **Mobile station transmitter (MHz)** | **Base station transmitter (MHz)** | **Interferer** | **Interfered** | **Corresponding Interference Scenario** |
| --- | --- | --- | --- | --- | --- |
| B3 | 1 850 - 1 920 | **1 930 - 2 000** | BS | IMT SAT | A1 |
| MES | UE | B1 |
| B5 (harmonized with B3 and partially harmonized with the downlink of B1 and the uplink of B2) | 1 850 - 1 920 | **1 930 - 2 000** | BS | IMT SAT | A1 |
| MES | UE | B1 |
| 1 710 - 1 780 | **2 110 - 2 180** | BS | MES | A2 |
| IMT SAT | UE | B2 |
| B6 | **1 980 - 2 010** | **2 170 - 2 200** | UE | IMT SAT | A1 |
| MES | BS | B1 |
| BS | MES | A2 |
| IMT SAT | UE | B2 |
| B7 | **2 000 - 2 020** | **2 180 - 2 200** | UE | IMT SAT | A1 |
| MES | BS | B1 |
| BS | MES | A2 |
| IMT SAT | UE | B2 |

**Table 2** shows the frequency arrangements from Recommendation ITU-R M.1036 with the bands which fully or partially overlap with the MSS allocations emphasized in bold. The possible interference scenarios between the different stations of the satellite and terrestrial components of IMT are shown. However, whether any of these four arrangements could apply to the Asia Pacific region depends largely on the results of compatibility studies. The study results related to the four scenarios could provide guidelines for administrations when deploying the satellite and terrestrial IMT systems to ensure the compatibility in different countries.

For scenarios A2 and B1, the coexistence between the terrestrial and satellite components of IMT could be managed by the current cross-border coordination provisions in the RR Nos. 9.15, 9.16, 9.17, 9.18, employing such as distance separation, more realistic parameters of radio stations and actual local propagation conditions, including actual terrain and clutter effects. Harmonisation of use between neighbouring and near-neighbouring countries would ease cross-border issues.

For scenario A1, there are two options of frequency arrangements for terrestrial IMT system in the band 1 980 – 2 010 MHz in line with Rec. M.1036. Following the B3 and B5 arrangements, the MSS uplink band 1 980 – 2 010 MHz would in part be used for transmitting IMT BSs. Following the B6 and B7 arrangements, the MSS uplink band 1 980 – 2 010 MHz would be used for transmitting IMT UEs. Based on Resolution 212, some measures should be carried out, such as set the transmission direction for the use of the frequency band 1 980 - 2 010 MHz by the terrestrial component of IMT to operate the IMT base station only in receive mode as found in relevant ITU-R Recommendations. Frequency arrangements B6 and B7 are consistent with this measure.

For Scenario B2, in the frequency band 2 170 - 2 200 MHz, potential interference from the IMT space stations to IMT UEs, could be managed by bilateral/multilateral negotiation, in which actual technical/operational characteristics and mitigation measures for satellite and terrestrial components of IMT could be taken into account. Harmonisation of use between neighbouring and near-neighbouring countries would ease cross-border issues.

Some technical and operational measures are found in the Annex to Resolution 212 (Rev. WRC-19) which provide guidance to concerned administrations in the deployment of terrestrial and satellite components of IMT for reducing the potential of harmful interference between two systems. These guidelines identify some of the considerations that should be taken into account as administrations and the AWG develop plans for the satellite and terrestrial components of IMT. Administrations may decide to develop further detailed and precise technical measures to ensure compatibility.

# 6 Possible solutions in Asia-Pacific region

Pursuant to Resolution 212 (Rev.WRC-19) administrations should take the technical and operational measures, such as those found in the annex to that Resolution administrations are invited to consider the possible solutions to facilitate coexistence between the terrestrial and satellite components of IMT in the frequency bands 1 980 - 2 010 MHz and 2 170 - 2 200 MHz in Asia-Pacific.

In the event of harmful interference, the concerned administrations should investigate and take technical and operational measures, as appropriate, to reduce interference to an acceptable level[[4]](#footnote-4).

For those administrations wishing to implement the terrestrial component of IMT in the bands 1 980 – 2 010 MHz and 2 170 – 2 200 MHz, the frequency arrangement B6 in Recommendation ITU-R M.1036 is the only possible solution in Asia Pacific region. When the Satellite and Terrestrial components of IMT are deployed in adjacent geographical areas in the same frequency bands, technical or operational measures may need to be implemented to improve the coexistence and compatibility of the two components of IMT in border areas.

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1. Republic of Korea is planning for Terrestrial IMT [↑](#footnote-ref-1)
2. Viet Nam plans to implement IMT system aligned with frequency arrangement B6 of ITU-R Recommendation ITU-R M.1036-6 or 3GPP band plan number 65 [↑](#footnote-ref-2)
3. These issues result from compatibility studies that, *inter alia,* made use of the characteristics for the terrestrial component of IMT contained in Report ITU-R M.2292. Machine Type Communications (MTC) applications were also considered in some studies submitted to ITU-R in this work, noting that the characteristics of MTC applications did not comply with those contained in Report ITU-R M.2292. Some further studies may be required. [↑](#footnote-ref-3)
4. With respect to acceptable interference, see Provision No. 1.168 of the ITU Radio Regulations along with its associated footnote 1.168.1 [↑](#footnote-ref-4)