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**APT REPORT ON**

**SURVEY STUDIES ON REGULATORY INFORMATION FOR IMPLEMENTATION OF IMT NETWORKS IN ASIA-PACIFIC REGION**

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**APT Report on**

**survey studies on regulatory information for implementation of IMT networks in Asia-Pacific Region**

# 1 Introduction

Protection of radiocommunication services is a key cornerstone for spectrum management with the appropriate definition of protection/sharing criteria. Nowadays, we are interested in a much more flexible world that is based on the premise of technology neutrality. Service/Technology neutrality is understood as operators can deploy their networks with any technology in any band, subject to it being economically efficient to do so, and no frequency band should be reserved for the exclusive use of a particular service/technology. Any two networks can be spectral/spatial neighbours. New technologies complies with the relevant spectrum technical requirements can be introduced as and when needed in a dynamic manner for effective spectrum trading.

Reviewing APT/AWG/REP-15 on Information of mobile operators’ frequencies, technologies and license durations in Asia Pacific countries, it is foreseen that IMT technologies (such as UMTS, HSPA, LTE, LTE-Advanced and beyond) would be deployed in the same spectrum band in many markets.

The application of “neutrality” in adopting a system relies on the definition of a minimum set of parameters to which a certain radio system must adhere. Moreover, from a spectrum engineering point of view, the implementation of a radio system in a specific frequency band requires the consideration of many parameters (e.g., transmitter and receiver specific, or access methods TDD, FDD), which goes far beyond the general approach of having a simple analysis (e.g., just based on spectrum emission mask).

Compatibility studies carried out with specific technology / applications are enabling a fine tuning of parameters ensuring the best spectrum efficiency. The wider the assumptions are in relation to interfering and interfered systems (bandwidth, power, antenna category, TDD/FDD, deployment …), the more it is necessary to consider worst case scenarios. Different conditions associated with the assumption scenarios leads to different technical spectrum efficiency. Therefore, there is always a balance between the level of neutrality and the technical spectrum efficiency.

Normally, licensing of radio equipment is controlled by the authorization regimes of the regulators within Member States. National regulators are responsible for setting the conditions under which radio equipment can be authorized for use in their territories. These conditions might include, where appropriate in order to avoid harmful interference, frequency ranges, power limits, spectrum masks, etc. These conditions allow greater flexibility through minimal conditions attached to the authorization of the use of spectrum (i.e. a technology, service and application neutral approach).

# 2 Scope

To support and assist APT Members in using the radio frequency spectrum and deploying radio network effectively, it would be beneficial to commence studies on establishing the minimum recommended technical conditions to be applied for coexistence that could help APT Administrations on regulating the neutrality of bands identified for IMT.

This Report conducts survey studies which collect regulatory information for implementation of IMT networks in the frequency bands identified for IMT in Asia-Pacific Region countries.

# 3 List of the questions:

In order to conduct the survey studies, a questionnaire which contains the following questions were circulated to the APT Members in September 2017 (after the 22nd meeting of AWG) .

**Question 1:**

**Institution/Company Information and Profile**

Name of the institution :

Name of contact person :

Mailing Address :

Phone :

Email Address :

My institution is (please choose) : Regulator / Operator / Vendor / Others <please describe your answer here>

**Question 2:**

Which IMT technology being use and will be used or technology neutral in these bands?

Please fill in the frequency bands used for IMT and specify which IMT technology (e.g. WCDMA, HSPA, LTE, LTE-A, TDD-LTE, 3GPP Release 10, …) being used, if not IMT please answer “non-IMT”.

**Question 3:**

Please provide (or refer to) characteristics, and protection criteria, for implementing the IMT systems/networks in Question 2, and similar information for non-IMT services, within the IMT band and in the neighboring bands.

**Question 4:**

Which case of coexistence as illustrated below and the technical conditions must be applied to each IMT block (e.g. power limit, emission mask for spectrum block, pfd limit, …) to support technology neutrality and spectrum efficiency?



Case A: coexistence between IMT block and IMT in adjacent block in same IMT band

Case B: coexistence between IMT block and non-IMT in adjacent block in same IMT band

Case C: coexistence between IMT block in IMT band and non-IMT block in adjacent band

Case D: coexistence between IMT block and other IMT block co-channel but adjacent geographical area

Case E: coexistence between IMT block and non-IMT block co-channel but adjacent geographical area

# 4 List of the respondents

The following APT Members provided their responses to the questionnaire:

a. Australia (AWG-23/[INP-12](https://www.apt.int/sites/default/files/2018/04/AWG-23-INP-12_Australia_Response_IMT.docx))

b. Islamic Republic of Iran (AWG-23/[INP-15](https://www.apt.int/sites/default/files/2018/04/AWG-23-INP-15_Iran_Response_IMT_0.docx))

c. Singapore (AWG-23/[INP-22](https://www.apt.int/sites/default/files/2018/03/AWG-23-INP-22_Singapore_IMT_Questionnaire.docx))

d. New Zealand (AWG-23/[INP-24](https://www.apt.int/sites/default/files/2018/04/AWG-23-INP-24_New_Zealand_IMT_Questionnaire.docx))[[1]](#footnote-1)

e. Papua New Guinea (AWG-23/[INP-33](https://www.apt.int/sites/default/files/2018/04/AWG-23-INP-33_PNG_Response_to_Questionnaire_IMT_Regulatory_0.docx))

f. Socialist Republic of Viet Nam (AWG-23/[INP-67](https://www.apt.int/sites/default/files/2018/04/AWG-23-INP-67_Vietnam_Response_New_questionnarire_on_IMT_implementation_in_APT.docx))

g. Thailand (AWG-23/[INP-72](https://www.apt.int/sites/default/files/2018/04/AWG-23-INP-72_Thailand_IMPLEMENTATION_IMT_NETWORK_IN_ASIA-PACIFIC.docx))

h. Bangladesh (AWG-23/[INP-109](https://www.apt.int/sites/default/files/2018/04/AWG-23-INP-109_Bangladesh3_IMT.docx), AWG-25/[INP-14](https://www.apt.int/sites/default/files/2019/06/AWG-25-INP-14_BGD_Revision_of_Report_84.docx))

i. India (AWG-24/[INP-48](https://www.apt.int/sites/default/files/2018/09/AWG-24-INP-48_India_Questionnaire_Response_IMT.docx))

j. Japan (AWG-24/[INP-70](https://www.apt.int/sites/default/files/2018/09/AWG-24-INP-70_Japan5.docx))

# 5 Summary and analysis of the responses

It is clearly seen that different technologies (IMT and non-IMT) are deployed in the same band and/or adjacent frequency bands in the respective Asia-Pacific Region countries. In some of these countries technology neutrality is implemented.

Regarding the technical conditions implemented in those countries, various responses were provided such as high level framework and actual values for protection of other services. Example of the major technical conditions implemented for each case of coexistence is summarized in the table below.

|  |  |
| --- | --- |
| 　Cases of coexistence | Example of major technical conditions |
| Case A (adjacent channel)- In region- In IMT band- IMT vs IMT  | Regulation on Transmitter -power limit -spectrum mask -unwanted emissionGuard band (mainly for edge of TDD) |
| Case B (adjacent channel)- In region- in IMT band- IMT vs Non-IMT | Regulation on Transmitter -power limit -spectrum mask -unwanted emissionGuard bandDeployment restriction -separation distance -limiting number of stations -coordination procedure |
| Case C (adjacent channel)- In region- In/out of IMT band - IMT vs Non-IMT |
| Case D (co-channel)- Across regions- in IMT band- IMT vs IMT  | Deployment restriction -maximum level at boundary -separation distance -limiting number of stations -coordination procedure |
| Case E (co-channel)- Across regions- in IMT band- IMT vs Non-IMT |

# ANNEX 1

# Question 2:

Which IMT technology being use and will be used or technology neutral in these bands?

Please fill in the frequency bands used for IMT and specify which IMT technology (e.g. WCDMA, HSPA, LTE, LTE-A, TDD-LTE, 3GPP Release 10, …) being used, if not IMT please answer “non-IMT”.

a. Australia

In Australia, the ACMA adopts a technology flexible approach for the regulatory arrangements in IMT bands.

In the table below, the IMT technology indicated is a guide only to the technology that operators currently have deployed or are most likely to deploy. The operators can use any technology that meets the individual band’s technical requirements and may change the deployed technology at their discretion.

Channel Bandwidths cannot be provided given the technology flexible regulations. Again, it is completely at the discretion of the operator and may change based on the operator’s needs.

| **Frequency band****(MHz)** | **FrequencyBlock (MHz)** | **Operator** | **IMT Technology** | **Channel bandwidth (MHz)** |
| --- | --- | --- | --- | --- |
| **Uplink** | **Downlink** |
| 703 – 748/ 758 – 803 | 703 – 713 | 758 – 768 | Optus | LTE |  |
| 713 - 733 | 768 - 788 | Telstra | LTE |  |
| 733 - 738 | 788 - 793 | Vodafone | LTE |  |
| 738 - 748 | 793 - 803 | TPG | LTE |  |
| 825 - 845/ 870 - 890 | 825-835 | 870 - 880 | Vodafone | HSPA/ LTE |  |
| 835-840 | 880 - 890 | Telstra | HSPA/ LTE |  |
| 890 – 915/ 935 – 960 | 890 – 898.4 | 935 – 943.4 | Telstra | No deployment  |  |
| 898.4 – 906.8 | 943.4 – 951.8 | Optus | HSPA |  |
| 906.8 – 915 | 951.8 – 960 | Vodafone | HSPA |  |
| 1710 – 1785/ 1805 –1880 | 1710 – 1730 | 1805 – 1825 | Various operators | LTE and GSM-R |  |
| 1920 – 1980/ 2110 - 2170 | 1920 - 1935 | 2110 - 2125 | Vodafone | HSPA/LTE |  |
| 1935 - 1940 | 2125 - 2130 | Telstra | HSPA/LTE |  |
| 1940 - 1960 | 2130 - 2150 | Optus | HSPA/LTE |  |
| 1960 - 1970 | 2150 - 2160 | Telstra | HSPA/LTE |  |
| 1970 - 1980 | 2160 - 2170 | Vodafone | HSPA/LTE |  |
| 2302-2400  | 2302-2400 (Cities) |  | Optus | LTE |  |
| 2302-2400 (rural) |  | NBN | LTE |  |
| 2500 – 2570/ 2620 - 2690 | 2500 - 2510 | 2620 - 2630 | TPG | LTE |  |
| 2510 - 2550 | 2630 - 2670 | Telstra | LTE |  |
| 2550 - 2570 | 2670 - 2690 | Optus | LTE |  |
| 3400-3575 | 3400-3425 |  | NBN | LTE |  |
| 3425-3492.5(Cities) |  | Optus | Flexible regulation (No deployment) |  |
| 3425-3492.5(Rural) |  | NBN | LTE |  |
| 3492.5-3542.5 |  | NBN | LTE |  |
| 3542.5-3575(Cities) |  | Optus | (No deployment) |  |
| 3542.5-3575(Rural) |  | NBN | LTE |  |

b. Islamic Republic of Iran

| **Frequency band****(MHz)** | **Frequency Block (MHz)** | **Operator** | **IMT Technology** | **Channel bandwidth (MHz)** |
| --- | --- | --- | --- | --- |
| **Uplink** | **Downlink** |
| 880-914.9/925-959.9In capital(Tehran) | 880-890 | 925-935 | Ritel | 3G | 2\*10 |
| 890-896.25 | 935-941.25 | MTN | 2G | 2\*6.25 |
| 896.3-914.9 | 941.3-959.9 | TCI | 2/3G, LTE | 2\*18.6 |
| 880-914.9/925-959.9In other provinces | 880-890 | 925-935 | Ritel | 3G | 2\*10 |
| 890-898 | 935.1-943 | Irancell | 2G | 2\*8 |
| 898.1-902.7 | 943.1-947.7 | TCI | 2G, LTE | 2\*4.6 |
| 902.7-906.7 | 947.7-951.7 | Kish Telecomin Kish Island | 2G | 2\*4 |
| TCI in rural | non-IMTGSM900-WLL |
| 906.7-914.9 | 951.7-959.9 | TCI | 2G, LTE | 2\*8.2 |
| 1710-1785/1805-1880 | 1710-1713 | 1805.1-1808.1 | Hiweb/Iraphon(rural operators) | non-IMTGSM1800-WLL | 2\*3 |
| 1725.1-1739.9 | 1820.1-1834.9 | TCI | 2/3G, LTE | 2\*14.8 |
| 1740-1752 | 1835-1847 | Ritel | 3G | 2\*12 |
| 1765-1785 | 1860-1880 | Irancell | 3G | 2\*20 |
| 1880-1900 | - | non-IMT(DECT-WLL) | 20 |
| 1925-1980/2110-2170 | 1925-1935 | 2115-2125 | HiWeb Trunk | LTE | 2\*10 |
| 1935-1950 | 2125-2140 | Irancell | 3G | 2\*15 |
| 1950-1965 | 2140-2155 | Ritel | 3G | 2\*15 |
| 1965-1980 | 2155-2170 | TCI | 3G | 2\*15 |
| 2500-2570/2620-2690 | 2500-2515 | 2620-2635 | Irancell | LTE | 2\*15 |
| 2540-2545 | 2665-2670 | Kish TelecomIn Kish island | LTE | 2\*5 |
| 2550-2565 | 2670-2685 | TCI | LTE | 2\*15 |
| 2520-2535 | 2640-2655 | Ritel | LTE | 2\*15 |

c. Singapore

| **Frequency band****(MHz)** | **FrequencyBlock (MHz)** | **IMT Technology** | **Channel bandwidth (MHz)** |
| --- | --- | --- | --- |
| **Uplink** | **Downlink** |
| 880 - 915 / 925 - 960 | 882 - 887 | 927 - 932 | HSPA | 5 MHz |
| 890 - 915 | 935 - 960 | WCDMA / LTE including NB-IoT | WCDMA: 5 MHzLTE: 5, 10 MHzNB-IoT: 0.2 MHz |
| 1710 - 1785 / 1805 - 1880 | 1710 - 1785 | 1805 - 1880 | LTE | 5, 10, 20 MHz |
| 1900 - 1920 | 1904.9 - 1920 | 1904.9 - 1920 | Non-IMT |  |
| 1920 - 1980 / 2110 - 2170 | 1920 - 1979.7 | 2110.3 - 2169.7 | HSPA / WCDMA / LTE | HSPA / WCDMA / LTE: 5 MHz |
| 2300 - 2400 | 2300 - 2340 | 2300 - 2680 | LTE | 20 MHz |
| 2500 – 2570 / 2620 - 2690 | 2500 - 2560 | 2620 - 2640 | LTE | 5, 20 MHz |
| 2570 - 2620 | 2570 - 2615 | 2570 - 2615 | LTE | 10, 15, 20 MHz |

d. New Zealand

| **Frequency band****(MHz)** | **FrequencyBlock (MHz)** | **Operator** | **IMT Technology** | **Channel bandwidth (MHz)** |
| --- | --- | --- | --- | --- |
| **Uplink** | **Downlink** |
| 703 – 748/ 758 – 803 | 703 – 723 | 758 – 778 | Spark NZ | FDD-LTE | 20 |
| 723 – 738 | 778 – 793 | Vodafone NZ Ltd | FDD-LTE | 15 |
| 738 – 748 | 793 – 803 | Two Degrees Mobile Ltd | FDD-LTE | 10 |

e. Papua New Guinea

| **Frequency band****(MHz)** | **FrequencyBlock (MHz)** | **Operator** | **IMT Technology** | **Channel bandwidth (MHz)** |
| --- | --- | --- | --- | --- |
| **Uplink** | **Downlink** |
| 703 – 748/ 758 – 803 | 703 – 718 | 758 – 773 | Under Allocation | LTE | 10 |
| 718-733 | 773-788 | Digicel PNG | LTE | 10 |
| 733 - 748 | 788 - 803 | Telikom PNG  | LTE | 10 |
| 806 – 834/ 851 – 879 | 806 - 824 | 851- 869 | Under re-farming |  |  |
| 824 - 835 | 869 -880 | Telikom PNG | WCDMA | 5 |
| 880 – 915 / 925 – 960 | 880 – 899 | 925 – 944 | Digicel PNG  | Non-IMT (GSM)&WCDMA | 0.25 |
| 899 – 915 | 944 – 960 | Bemobile | LTE | 10 |
| 880 – 899 | 925 – 944 | Digicel PNG  | Non-IMT (GSM)&WCDMA | 0.25 |
| 1710 – 1785/ 1805 –1880 | 1710 – 1740 | 1805 – 1835 | Digicel PNG | LTE | 20 |
| 1740 - 1760 | 1835 -1855 | Under Allocation | LTE | 20 |
| 1760 - 1785 | 1855 - 1880 | Telikom PNG | LTE | 20 |
| 1920-1980/ 2110-2170 | 1920-1940 | 2110-2130 | Under Allocation  | WCDMA | 5 |
| 1940-1950 | 2130-2140 | Bemobile | WCDMA | 5 |
| 1950-1970 | 2140-2150 | Under Allocation | WCDMA | 5  |

f. Socialist Republic of Viet Nam

| **Frequency band****(MHz)** | **Frequency Block (MHz)** | **Operator** | **IMT Technology** | **Channel bandwidth (MHz)** |
| --- | --- | --- | --- | --- |
| **Uplink** | **Downlink** |
| 703-748/758-803 | Planing | Planing | 3-4 operators |  | 5, 10,15 MHz |
| 824-835/869-880 | 824-835 | 869-880 | Considering licensing to a operator |  |  |
| 880 – 915/ 925 – 960 | 880 – 890 | 925 – 935 | Vietnamobile | non-IMT (GSM)WCDMALTE | 0.2MHz (GSM)4,2 MHz (WCDMA)3 MHz (LTE) |
| 890,1 – 898,5 | 935,1 – 943,5 | VNPT | non-IMT (GSM)WCDMA | 0.2 MHz(GSM)4,2 MHz (WCDMA) |
| 898,5 – 906,7 | 943,5 – 951,7 | Viettel | non-IMT (GSM) | 0.2 MHz (GSM) |
| 906,7-914,9 | 951,7-959,9 | Mobifone | non-IMT (GSM)WCDMA | 0.2 MHz(GSM)4,2 MHz (WCDMA) |
| 1710 – 1785/ 1805 –1880 | 1710 – 1730 | 1805 – 1825 | VNPT | non-IMT (GSM)LTE | 0.2 MHz (GSM)10 MHz (LTE) |
| 1730 – 1750 | 1825 – 1845 | Mobifone | non-IMT (GSM)LTE | 0.2 MHz (GSM)10 MHz (LTE) |
| 1750 – 1770 | 1845 – 1865 | Viettel | non-IMT (GSM)LTE | 0.2 MHz (GSM)10 MHz (LTE) |
| 1770 – 1785 | 1865 – 1880 | Gtel | non-IMT (GSM) | 0.2 MHz |
| 1920-1980/2110-2170 | 1920-1935 | 2110-2125 | Mobifone | WCDMA | 5 MHz |
| 1935-1950 | 2125-2140 | Viettel | WCDMA | 5 MHz |
| 1950-1965 | 2140-2155 | Vietnamobile -Viettel | WCDMA | 5 MHz |
| 1965-1980 | 2155-2170 | VNPT | WCDMA | 5 MHz |
| 2300-2400 | 2300-2330 | 2300-2330 | not licensed yet |  |  |
| 2330-2360 | 2330-2360 |  |  |
| 2360-2390 | 2360-2390 |  |  |
| 2500-2570/2620-2690 | 2500-2510 | 2620-2630 | considering licensing in 2018-2019(maximum 4 operators) | LTE/LTE-A | 10-20 MHz |
| 2510-2530 | 2630-2650 |  |  |
| 2530-2550 | 2650-2670 |  |  |
| 2550-2570 | 2670-2690 |  |  |

g. Thailand

| **Frequency band****(MHz)** | **FrequencyBlock (MHz)** | **Operator** | **IMT Technology** | **Channel bandwidth (MHz)** |
| --- | --- | --- | --- | --- |
| **Uplink** | **Downlink** |
| 824-839/869-884 | 824-839 | 869-884 | CAT/True Move H | HSPA | 2x15 |
| 839-849/884-894 | 839-849 | 884-894 | CAT/DTACTo be expired in Sept 2018 | WCDMA | 2x10 |
| 895-915/940-960 | 895-900 | 940-945 | AWN | Non-IMT (GSM)/LTE | 2x5 |
| 900-905 | 945-950 | AWN | HSPA/NB-IoT | 2x5 |
| 905-907.5 | 950-952.5 | TUC | Non-IMT (GSM) | 2x2.5 |
| 907.5-912.5 | 952.5-957.5 | TUC | LTE | 2x5 |
| 912.5-915 | 957.5-960 | TUC | Non-IMT (GSM) | 2x2.5 |
| 1710-1785/1805-1880 | 1710-1715 | 1805-1810 | TUC | Non-IMT (GSM) | 2x5 |
| 1715-1725 | 1810-1820 | TUC | LTE | 2x10 |
| 1725-1740 | 1820-1835 | AWN | LTE | 2x15 |
| 1740-1745.3 | 1835-1840.3 | DTAC | Non-IMT (GSM) | 2x5.3 |
| 1745.3-1760.3 | 1840.3-1855.3 | DTAC | LTE | 2x15 |
| 1760.3-1765.3 | 1855.3-1860.3 | DTAC | GSM | 2x5.3 |
| 1765.3-1785 | 1860.3-1880 | CAT | LTE | 2x20.3 |
| 1920-1980/2110-2170 | 1920-1930 | 2110-2120 | DTN | HSPA | 2x10 |
| 1930-1935 | 2120-2125 | DTN | LTE | 2x5 |
| 1935-1940 | 2125-2130 | TUC | HSPA | 2x5 |
| 1940-1950 | 2130-2140 | TUC | LTE | 2x10 |
| 1950-1965 | 2140-2155 | AWN | HSPA | 2x15 |
| 1965-1980 | 2155-2170 | TOT | HSPA | 2x15 |
| 2010-2025 | TDD |  |  |  |  |

h. Bangladesh

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Frequency band****(MHz)** | **Frequency Block (MHz)** | **Operator** | **IMT Technology** | **Channel bandwidth (MHz)** |
| **Uplink** | **Downlink** |
| 880 – 915/ 925 – 960 | 888.40-890.00 | 933.40 – 935.00 | Robi | Tech Neutral | 1.6 |
| 890.00-895.20 | 935.00 – 940.20 | Teletalk | 5.2 |
| 895.20-900.20 | 940.20-945.20 | Banglalink | 5.0 |
| 900.20-907.60 | 945.20-952.60 | Robi | 7.4 |
| 907.60-915.00 | 952.60-960.00 | GP | 7.4 |
| 1710 – 1785/ 1805 –1880 | 1710.00-1720.00 | 1805.00–1815.00 | Teletalk | Tech Neutral | 10 |
| 1720.00-1737.40 | 1815.0-1832.40 | Robi | 17.4 |
| 1737.40-1752.00 | 1832.40-1847.00 | GP | 14.60 |
| 1752.0-1767.60 | 1847.0-1862.60 | Banglalink | 15.60 |
| 1767.60-1772.60 | 1862.60-1867.60 | GP | 5 |
| 1920-1960/2110-2150 | 1925.00-1935.00 | 2115.00-2125.00 | Banglalink | Tech Neutral | 10 |
| 1935.00-1945.00 | 2125.00-2135.00 | GP | 10 |
| 1945.00-1955.00 | 2135.00-2145.00 | Robi | 10 |
| 1960-1970 | 2150-2160 | Teletalk | 10 |

i. India

In India, DoT has adopted the policy of technology neutrality for IMT bands. The licensee is responsible to provide the details of the technology proposed to be deployed for operation of the service. The technology needs to be based on standards issued by ITU/Telecom Engineering Center (TEC) of the Department of Telecommunications, Government of India (DoT) or any other International Standards Organization/ bodies/Industry. Any digital technology having been used for a customer base of one lakh or more for a continuous period of one year anywhere in the world, is permissible for use regardless of its changed versions.

The Table below indicates the technology currently in use by different operators in India.It is difficult to provide exact frequency blocks and channel bandwidths as India has 22 service areas with different assignments to different licenses.

|  |  |
| --- | --- |
| **Frequency Band (MHz)** | **IMT Technology** |
| B5 : 850 | CDMA, LTE |
| B8 : 900 | GSM, HSPA |
| B3 : 1800 | LTE , GSM |
| B1 : 2100 | HSPA |
| B40 : 2300 | LTE (TDD) |
| B41 : 2500 | LTE |

j. Japan

| **Frequency band****(MHz)** | **FrequencyBlock (MHz)** | **Operator** | **IMT Technology** | **Channel bandwidth (MHz)** |
| --- | --- | --- | --- | --- |
| **Uplink** | **Downlink** |
| 718 – 748 /773 – 803 | 718 – 728 | 773 – 783 | KDDI | LTE |  |
| 728 – 738 | 783 – 793 | NTT DOCOMO | LTE |  |
| 738 – 748 | 793 – 803 | SoftBank | LTE |  |
| 815 – 845 / 860 – 890 | 815 – 830 | 860 – 875 | KDDI | CDMA2000 / LTE |  |
| 830 – 845 | 875 – 890 | NTT DOCOMO | WCDMA/ LTE |  |
| 900 – 915 / 945 – 960 | 900 – 915 | 945 – 960 | SoftBank | WCDMA/ LTE |  |
| 1427.9 – 1462.9 / 1475.9 – 1510.9 | 1427.9 – 1437.9 | 1475.9 – 1485.9 | SoftBank | LTE |  |
| 1437.9 – 1447.9 | 1485.9 – 1495.9 | KDDI | LTE |  |
| 1447.9 – 1462.9 | 1495.9 – 1510.9 | NTT DOCOMO | LTE |  |
| 1710 – 1785 /1805 – 1880 | 1710 - 1730 | 1805 - 1825 | KDDI | LTE |  |
| 1730 - 1750 | 1825 - 1845 | Rakuten | LTE |  |
| 1750-1765 | 1845-1860 | SoftBank | LTE |  |
| 1765 - 1785 | 1860-1880 | NTT DOCOMO | LTE |  |
| 1884.5 – 1915.7 | 1884.5 – 1915.7 (TDD) | SoftBank | PHS |  |
| 1920 – 1980 / 2110 - 2170 | 1920 - 1940 | 2110 - 2130 | KDDI | CDMA2000 / LTE |  |
| 1940 - 1960 | 2130 - 2150 | NTT DOCOMO | WCDMA/ LTE |  |
| 1960 - 1980 | 2150 - 2170 | SoftBank | WCDMA/ LTE |  |
| 2545 – 2575 | 2545 – 2575 (TDD) | Wireless City Planning Inc. | AXGP (Advanced eXtended Global Platform) |  |
| 2595 - 2645 | 2595 – 2645 (TDD) | UQ Communi-cations | WiMAX / WiMAX2+ |  |
| 3400 - 3600 | 3400 – 3440(TDD) | SoftBank | LTE |  |
| 3440 – 3520 (TDD) | NTT DOCOMO | LTE |  |
| 3520 – 3560 (TDD) | KDDI | LTE |  |
| 3560 – 3600 (TDD) | SoftBank | LTE |  |

# Question 3:

Please provide (or refer to) characteristics, and protection criteria, for implementing the IMT systems/networks in Question 2, and similar information for non-IMT services, within the IMT band and in the neighboring bands.

a. Australia

In Australia, each band has individualised detailed characteristics and protection criteria associated with them. A technical framework is developed for each band. The framework consists of three interlocking elements:

* Conditions on the licence (including [**licence core conditions**](https://www.acma.gov.au/Industry/Spectrum/Radiocomms-licensing/Spectrum-licences/spectrum_24))
* a determination of unacceptable interference for the purpose of [device registration](https://www.acma.gov.au/Industry/Spectrum/Radiocomms-licensing/Spectrum-licences/spectrum_22-1)
* radiocommunications advisory guidelines

These can be found in the various documentation found at the following web location:

<https://www.acma.gov.au/Industry/Spectrum/Radiocomms-licensing/Spectrum-licences>

b. Islamic Republic of Iran

1. There are not any protective channels or regulations between operator's frequency bands in FDD mode. To avoid any interference, operators should coordinate together on their first and last radio channels.
2. For TDD operation mode:
	1. Regulator takes a 5 MHz spacing between the FDD and TDD frequency bands in both ends, but inside the frequency range designated for TDD operation;
	2. Regulator imposes a license-condition by which the operators utilizing adjacent frequency bands in same frequency range:
		1. should synchronize their uplink and downlink sessions, or
		2. should coordinate eachother to consider a small bandwith as guardband.
3. To avoid any interference to/from neighbor countries' operator:
	1. Regulator signs an arrangement with administration of neighbor country to limit radiation beyond cross-border range/zone, and
	2. domestic operators should limit their RF planning and coverage into inside the national border and territorial water.
4. In the frequency band 1 880-1 900 MHz, where the probability of harmful interference exists with WLL-DECT systems, the two beginning RF channels of the WLL-DECT systems should be left unused.
5. CRA Decision No. CRA-DEC 5008-04 provides the list of utilized frequency bands by operators for provision of public cellular mobile services, technology neutral.

c. Singapore

LTE and WCDMA which are based on frequency division duplex, offer sufficient frequency separation between base station/user equipment transmit and receive signals. Both technologies are developed by the 3GPP and occupy bandwidths which are standard compliant. Hence, additional guard band may not be required between adjacent carriers.

LTE TDD will require the coordination of the TDD network parameters such as TDD Configuration, Special Subframe Configuration and Time Offset to reduce interference between TDD networks.

Guard band will be implemented for the co-existence of adjacent services when required (e.g., guard band between the FDD and TDD frequencies in the 2.5 GHz band).

To facilitate cross-border planning, frequency coordination is achieved via the following fora:

* Frequency Assignment Committee of Singapore, Malaysia and Brunei Darussalam (FACSMAB);
* Trilateral Coordination Meeting between Singapore, Malaysia and Indonesia; and
* Border Communication Coordination Meeting (BCCM) between Singapore and Indonesia.

Other possible interference mitigation measures to adopt include, but are not limited to:

1. Antenna tilt (i.e., electrical and mechanical tilt);
2. Panning the antenna;
3. Lowering the effective radiated power to within a stipulated maximum allowable range; and/or
4. Applying RF filters, where appropriate.

d. New Zealand

About the IMT services in (703–748/758–803 MHz):

* In general, New Zealand adopted a technology-flexible approach where the type of technology used is not regulated within the spectrum blocks assigned to each mobile network operator.
* Given the harmonisation of the APT 700 MHz band plan for IMT, the technical characteristics of the spectrum blocks are configured in a frequency pairing arrangement to suit FDD-LTE.
* Protection criteria for preventing the intra-band interference between IMT systems, as well as inter-band interference between IMT systems and other radiocommunication services in adjacent frequency bands, are enforced in the form of emission mask for each spectrum block.
* These out-of-band emission masks, formally known as “Adjacent Frequencies Emission Limit” (AFEL), are derived based on 3GPP specifications, such as 3GPP 36.104 and 3GPP 36.101.
* The diagram below shows an example of the spectrum emission mask for uplink transmission where the mobile network operator amalgamated four blocks of 5 MHz within 703-723MHz:

Figure 1: Spectrum emission mask for 703-723 MHz

* The diagram below shows an example of the spectrum emission mask for downlink transmission where another mobile network operator amalgamated two blocks of 5 MHz within 793-803MHz:

Figure 2: Spectrum emission mask for 793-803 MHz

About the neighbouring non-IMT service:

* A guard band is considered for protection of interference between IMT and non-IMT systems in neighbouring bands.
* For the size of guard bands, please refer to next question.

e. Papua New Guinea

No specific characteristics and protection criteria except for an optimum filter and general guard-band requirement to separate IMT Downlink on 800 MHz band edge and Non-IMT uplink in 900 MHz band.

f. Socialist Republic of Viet Nam

National technical regulation:

* QCVN 110:2017/BTTTT on Universal Terrestrial Radio Access (E-UTRA) Base Stations (BS) (refer to ETSI EN 301 908-1 V11.1.1 (2016-07) and ETSI EN 301 908-14 V11.1.1 (2016-05))
* QCVN 41:2016/BTTTT on GSM base stations (refer to ETSI EN 301 502 v12.1.1 (2015-03))
* QCVN 16:2010/BTTTT on base stations for W-CDMA FDD (refer to ETSI EN 301 908-3 V2.2.1 (2003-10), ETSI EN 301 908-1 V2.2.1 (2003-10) and TS 125 141 V6.4.0 (2003-12))

QCVN: 47:2015/BTTTT on Radio spectrum and radiation of Radio communications equipments

g. Thailand

1. Licensee can select any technologies according to ITU-R Recommendations related to IMT
2. Licensees must coordinate among themselves in order to avoid any interference between different systems.
3. Licensees are required to cooperate with the neighboring countries and follow the agreement in the Joint Technical Committee on Coordination and Assignment of Frequencies along Thailand Common Border Meeting.
4. Licensees shall readjust/retune spectrum use according to the National Broadcasting and Telecommunications Commission’s order to achieve most efficient use of spectrum and highest public benefits.

h. Bangladesh

IMT Bands mentioned in Question 2,all blocks are assigned for implementing only IMT Services for Cellular Mobile Phone Operators. There is no non-IMT services assigned in this Band. Each block of IMT frequency assigned with several licensing and frequency assignment conditions to Cellular Mobile operators under which radio equipment can be authorized for use in their territories.

i. India

In India, the DoT has clearly demarcated the usage of IMT spectrum amongst various users and necessary protection in terms of suitable guard bands has been provided. All these assignments are monitored for any kind of interference including interference from across the borders.

j. Japan

In Japan, at first,we define parameters for sharing studies based on IMT technologies which are considered for introduction. Then, sharing studies between IMT and existing services in the same/adjacent frequency band are conducted,in the frequency bands which are scheduled to be used for IMT.

Subsequently, frequency assignment plans and technical regulations are established, and then operators submit the implementation plan according to guidelines developed by the supervisory authority.Based on the examination of licensing by the supervisory authority, each frequency band is assigned to respectiveoperators. Therefore, characteristics and protection criteria varies in theintroduction of IMT technologies and the existing services in the same/adjacent frequency band.

Further information about radio use and administration such as frequency assignments in Japan can be found at the following web location.

http://www.tele.soumu.go.jp/e/index.htm

# Question 4:

Which case of coexistence as illustrated below and the technical conditions must be applied to each IMT block (e.g power limit, emission mask for spectrum block, pfdlimit, …) to support technology neutrality and spectrum efficiency?



Case A: coexistence between IMT block and IMT in adjacent block in same IMT band

Case B: coexistence between IMT block and non-IMT in adjacent block in same IMT band

Case C: coexistence between IMT block in IMT band and non-IMT block in adjacent band

Case D: coexistence between IMT block and other IMT block co-channel but adjacent geographical area

Case E: coexistence between IMT block and non-IMT block co-channel but adjacent geographical area

a. Australia

| Frequency band (MHz) | Case | Technical condition |
| --- | --- | --- |
| All bands | A | power limit and emission mask for spectrum block. Additional restrictions for edge of block are placed on TDD spectrum  |
| B | power limit and emission mask for spectrum block. Notional receivers for the IMT services are derived for each band for coordination purposes.  |
| C | power limit and emission mask for spectrum block. Notional receivers for the IMT services are derived for each band for coordination purposes. |
| D | Propagation model and Level of Protection limit at boundary |
| E | Propagation model and Level of Protection limit at boundary |

b. Islamic Republic of Iran

| Frequency band (MHz) | Case | Technical condition |
| --- | --- | --- |
| 880-914.9/925-959.9 | A | According to answer of question 3 |
| B | No |
| C | ITU Radio Regulations(aeronautical services) |
| D | 902.7-906.7/947.7-951.7 MHz non-IMT used in rural area according to ITU Radio Regulations and 3GPP standards. |
| E |  No |
| 1710-1785/1805-1880 | A | According to Answer of question 3 |
| B | No |
| C | 1880-1900 MHz used by DECT-WLLaccording to ITU Radio Regulations and international standards |
| D | No |
| E | No |
| 1925-1980/2110-2170 | A | CRA-DEC 5008-4 national Regulations and according to answer of question 3 |
| B | No |
| C | No |
| D | No |
| E | No |
| 2500-2570/2620-2690 | A | According to Answer of question 3 |
| B | No |
| C | No |
| D | No |
| E | No |

c. Singapore

| Frequency band (MHz) | Case | Technical condition |
| --- | --- | --- |
| IMT bands | A | Dependent on the technology deployed. For LTE FDD, guard band may not be required. For LTE TDD, there must be agreement among the TDD network parameters. |
| B | For IMT and non-IMT to co-exist, it is dependent on the non-IMT technology to be deployed. Some guard bands between the two services will be recommended. |
| C | Same as Case B |
| D | Dependent on the technology deployed. For LTE FDD, guard band may not be required. However, it is beneficial to coordinate with neighbouring operators and take note of the center frequencies deployed in both geographical areas. For LTE TDD, there must be agreement among the TDD network parameters. |
| E | For different geographical areas, further technical assessments are required to understand the co-existence required between IMT and non-IMT deployed in the other region.  |

d. New Zealand

| Frequency band (MHz) | Case | Technical condition |
| --- | --- | --- |
| 622 – 698 (Currently unused) / 703 – 748 (IMT mobile transmit) | C | 5 MHz guard band |
| 703 – 748/ 758 – 803 | A | Spectrum emission mask |
| 758 – 803 (IMT base transmit) / 806 – 812 (Fixed links) | C | 3 MHz guard band |

e. Papua New Guinea

| Frequency band (MHz) | Case | Technical condition |
| --- | --- | --- |
| 703 – 748/ 758 – 803 | A | None |
| B |  |
| C |  |
| D | Separation distance under consideration |
| E | None |
| 806 – 834/ 851 – 879 | A | None |
| B |  |
| C | Compliant with Emission mask defined in ETSI EN 301 908 |
| D | Separation distance under consideration |
| E | None |
| 880 – 915 / 925 – 960 | A | None |
| B |  |
| C |  |
| D | Separation distance under consideration |
| E | Maximum separation required |
| 1710 – 1785/ 1805 –1880 | A | None |
| B | Compliant with Emission mask defined in ETSI EN 301 908 |
| C | Compliant with Emission mask defined in ETSI EN 301 908 |
| D | None |
| E | Maximum separation required |
| 1920-1980/ 2110-2170 | A |  |
| B |  |
| C | Compliant with Emission mask defined in ETSI EN 301 908 |
| D | None |
| E | Maximum separation required |

f. Socialist Republic of Viet Nam

| Frequency band (MHz) | Case | Technical condition |
| --- | --- | --- |
| 880 – 915/ 925 – 960 | B, C,D,E | QCVN 110:2017/BTTTTQCVN 41:2016/BTTTTQCVN: 47:2015/BTTTT |
| 1710 – 1785/ 1805 –1880 | B, C | QCVN 110:2017/BTTTTQCVN 41:2016/BTTTTQCVN: 47:2015/BTTTT |
| 1920-1980/2110-2170 | A | QCVN 16:2010/BTTTT QCVN: 47:2015/BTTTT |

g. Thailand

| Frequency band (MHz) | Case | Technical condition |
| --- | --- | --- |
| 824-839/869-884 | A | No |
| B | No |
| C | No |
| D |  ECC Rec (08)02 • 59 dBuV/m/5MHz @ 0 km (-77dBm/ 5MHz)• 35 dBuV/m/5MHz @ 9 km (-101dBm/ 5MHz) |
| E | No  |
| 895-900/940-945 | A | No |
| B | No |
| C | No |
| D | * 59 dBµV/m/5 MHz at border (-77.6 dBm) f = 925 MHz
* 35 dBµV/m/5 MHz at 9 km from border (-101.6 dBm) f = 925 MHz
 |
| E | * 59 dBµV/m/5 MHz at border (-77.6 dBm) f = 925 MHz
* 35 dBµV/m/5 MHz at 9 km from border (-101.6 dBm) f = 925 MHz
 |
| 905-915/950-960 | A | No |
| B | No |
| C | No |
| D | 35 dBµV/m/5 MHz at 9 km from border (-101.6 dBm) f = 925 MHz |
| E | 35 dBµV/m/5 MHz at 9 km from border (-101.6 dBm) f = 925 MHz |
| 1710-1785/1805-1880 | A | No |
| B | No |
| C | No |
| D | -85 dBm measured at 5km from border and 1.5 meter above ground level with C/I of 9 dB. |
| E | -85 dBm measured at 5km from border and 1.5 meter above ground level with C/I of 9 dB. |
| 1920-1980/2110-2170 | A | No |
| B | No |
| C | No |
| D | ERC Rec.01-01• 65 dBuV/m/5 MHz @ 0 km (-78.69 dBm/ 5 MHz)• 37 dBuV/m/5 MHz @ 6 km (-106.69 dBm/ 5 MHz) |
| E | No |

h. Bangladesh

In case of technical conditions for IMT Bands, we follow 3GPP standard. As there is no non-IMT frequency in these IMT band so there is no need to consider case B, case C and caseE. In case of IMT blocks in IMT bands, each blocks lower band includes guardband.

i. India

|  |  |  |
| --- | --- | --- |
| Frequency band (MHz) | Case | Technical condition |
| All bands | A | power limit and emission mask for spectrum block. Additional restrictions for edge of block are placed on TDD spectrum  |
| B | power limit and emission mask for spectrum block. Notional receivers for the IMT services are derived for each band for coordination purposes.  |
| C | power limit and emission mask for spectrum block. Notional receivers for the IMT services are derived for each band for coordination purposes. |
| D | Propagation model and Level of Protection limit at boundary |
| E | Propagation model and Level of Protection limit at boundary |

j. Japan

|  |  |  |
| --- | --- | --- |
| Frequency band (MHz) | Case | Technical condition |
| All bands | A | Application of unwanted emissionregulations based on IMT standards should be considered. Also, guard bands are inserted as necessary. |
| B | Policies vary innon-IMT technologies to be protected.Generally, considering unwanted emission characteristics based on IMT standards, we should take theoperating and adjusting approach such as inserting necessary guard bands, taking separate distance, and limiting the number of establishments of radio stations. |
| C | Policies vary innon-IMT technologies to be protected. Generally, considering unwanted emission characteristics based on IMT standards, we should take the operating and adjusting approach such as inserting necessary guard bands, taking separate distance, and limiting the number of establishments of radio stations. |
| D | Policies vary inIMT technologies. We should take theoperating and adjusting approach as necessary, such as taking separate distance and limiting the number of establishments of radio stations. |
| E | Policies vary innon-IMT technologies to be protected.We should take the operating and adjusting approach such as taking separate distancesand limiting the number of establishments of radio stations. |

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1. The response from New Zealand only contains regulatory information on the most recent IMT spectrum auction in the 700 MHz band that was conducted in 2013/14. [↑](#footnote-ref-1)