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SINGAPORE

**RESPONSE TO questionnaire ON regulatory information for implementation IMT network in Asia-Pacific Region**

**Question 1:**

**Institution/Company Information and Profile**

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**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”.

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| **Frequency band**  **(MHz)** | **Frequency Block (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 MHz  LTE: 5, 10 MHz  NB-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 |

**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.

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.

**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?

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| **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 service 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. |



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

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