# The Basic Spectrum Plan
# For the
# Olympic and Paralympic Games
# Tokyo 2020

**8 November 2017**

The Tokyo Organising Committee of the Olympic and Paralympic Games

# Index

# 1. Outline

## 1.1 The Olympic and Paralympic Games Tokyo 2020

The Games of the XXXII Olympiad and the Tokyo 2020 Paralympic Games (“the Tokyo 2020 Games”) will be held from 24 July to 9 August 2020 and from 25 August to 6 September 2020 respectively.

The competitions will be held mainly in Tokyo, which is the host city of the Tokyo 2020 Games and the capital of Japan, while some competitions will be staged at competition venues located within 10 kilometres of Tokyo in vicinity prefectures such as Saitama, Chiba, Ibaraki and Kanagawa. There will also be competition venues located in Hokkaido, Miyagi, Fukushima and Shizuoka Prefectures, which are much further away than the areas mentioned.

The Tokyo Organising Committee of the Olympic and Paralympic Games ("Tokyo 2020") is responsible for the coordination, assignment and authorisation of radio frequencies for the Tokyo 2020 Games and is working with the cooperation of the Ministry of Internal Affairs and Communications (“the MIC"), which is the authority for frequency assignment in Japan.

## 1.2 Objectives

This document defines the basic plan for the assignment of frequencies for the Tokyo 2020 Games generally based on the data from past Olympic and Paralympic Games as well as other major international sport events and the status of currently assigned frequencies in Japan.

As to the frequency assignment for the Tokyo 2020 Games, Tokyo 2020 should ensure to avoid harmful interference not only among the radio systems operated by the Olympic and Paralympic stakeholders, but also between the systems operated by the Olympic stakeholders and other radio systems already in operation nationwide.

When taking measures to avoid such harmful interference, Tokyo 2020 should be also conform to the applicable Japanese Radio Act and work in cooperation with the MIC for the appropriate frequency assignment for the Tokyo 2020 Games.

# 2. Basic procedures toward the Olympic and Paralympic Games Tokyo 2020

## 2.1 Basic concept

Tokyo 2020 is responsible for obtaining the adequate radio frequencies that the Olympic stakeholders request to use for the smooth operations of the Tokyo 2020 Games in consideration of actual practices of frequency assignment in Japan.

- The current frequency assignment plan in Japan is available on the website provided by the MIC. http://www.tele.soumu.go.jp/e/adm/freq/search/myuse/0002/index.htm
- The current plan is established in accordance with international rules and with the purpose of maximising the efficiency in assigning frequencies without causing harmful interference between radio stations.
- Flexibility in frequency assignment is necessary for the Tokyo 2020 Games to handle extraordinary situations where a considerable number of broadcasters require frequencies to be assigned for covering the Tokyo 2020 Games.
- For that reason, this basic spectrum plan for the Tokyo 2020 Games would not work without the understanding of and cooperation from various stakeholders including the agencies for disaster prevention and public safety.
- Difficulties in frequency assignment are anticipated for the Tokyo 2020 Games because most of the frequencies have already been assigned to many radio systems in Tokyo where there is a high concentration of population and businesses, and the propagation of radio waves covers a large area across the Kanto Plane and Tokyo Bay.
- For these reasons above, Tokyo 2020 would recommend the use of a wired communication system where possible for the Tokyo 2020 Games. The frequency would be assigned only when the wired communication system cannot be used.
- Frequencies need to be assigned to users by venue, considering topography, geography and physical surroundings where the frequencies are to be used. Furthermore, frequency sharing, which refers to the use of the same radio frequency by two or more stations at different designated times or whenever the frequency is not in use, should be taken into account.

## 2.2 Equipment subject to frequency coordination and authorisation

Details of radio systems/equipment requiring frequency coordination and licenses/authorisation are still under examination. In principle, Tokyo 2020 is required to obtain prior authorisation for all radio equipment brought into venues that emits radio waves to avoid harmful interferences. Meanwhile, Tokyo 2020 anticipates that some radio equipment could be subject to a different level of protection from interference or exempt from authorisation requirement.

### 2.2.1 Radio equipment requiring authorisation

The radio equipment named below should be authorised. It is not allowed to emit radio waves from any equipment without the authorisation from Tokyo 2020. The equipment includes wireless-microphone, wireless-camera, PMR (Personal Mobile Radio), telemetry, telecommand and radio data transmission, unless otherwise described in Chapter 2.2.2 below and the decision is taken that authorisation is unnecessary.

The equipment authorised by Tokyo 2020 would be categorised into two types. One is equipment with a newly assigned license issued in accordance with the Japanese Radio Act. Documents should be submitted to obtain such licenses. The other is equipment exempt from any authorised license in Japan that will be operated under conditions specified by Tokyo 2020 to limit the use of the assigned frequency within a venue to ensure the smooth operation of the Tokyo 2020 Games.

As to the levels of protection from interference, among all the equipment with authorisation from Tokyo 2020, some radio equipment requires a higher level of protection from interference caused by other radio stations, while other radio equipment requires a lower level or no protection from interference.

### 2.2.2 Radio equipment that do not require authorisation

Mobile phones, whose services are provided by Japanese telecommunication operators (including mobile phones brought from overseas with roaming services), may not be subject to authorisation. In addition to such mobile phones, the necessity of authorisation to use the following for the

Tokyo 2020 Games is under examination.

- Earth stations of satellite communication whose services are provided by Japanese telecommunication operators.
- Radio equipment exempt from any authorised license that conforms to the technical standard specified by the Japanese Radio Act. Equipment with Wi-Fi Alliance specifications or similar specifications may be used up to 90 days from entry into Japan, except in some specific areas such as competition venues, broadcast areas, Media Centres and the IBC.

### 2.2.3 Procedures for frequency coordination and authorisation

Procedures for frequency coordination/assignment and license/authorisation are still under examination. In the meantime, Tokyo 2020 proposes the following draft of procedure based on the data from the previous Games.

- Tokyo 2020 will notify the Olympic stakeholders of information such as assignable frequency ranges and types of applicable radio equipment. This document outlines the information and is to be updated and detailed when more information becomes available.
- Olympic stakeholders who intend to use a frequency will submit an application for registration to Tokyo 2020 following the schedule and procedure specified by Tokyo 2020.
- Tokyo 2020 will work to assign a designated frequency for each application through consultation with the MIC and will notify the registered members of the confirmation of the frequency requested or a suggested alternative before the Tokyo 2020 Games. In addition to the assigned frequency, some conditions such as transmission power and operating location and dates may be imposed.
- Members with the assigned frequency will adjust their equipment according to the specified conditions and will bring the equipment to a testing counter designated by Tokyo 2020 at an appropriate date and time before the Tokyo 2020 Games to have it inspected.

- Upon confirmation that all conditions are fulfilled, Tokyo 2020 will issue a tag proving that the equipment has been inspected and authorised.
- Monitoring and elimination of unauthorised radio waves will be conducted at competition venues managed by Tokyo 2020 to prevent radio frequency interference. Tag inspection will be implemented as needed when the equipment is brought into the competition venues. During the operation period, tag inspection and/or frequency assignment checking will be implemented by designated Tokyo 2020 staff. Equipment users will be requested to cooperate with the above implementation.

### 2.2.4 Proposal of frequency to be assigned

- The assignable frequencies for the Tokyo 2020 Games by type of usage are indicated in the following chapters.
- The proposed assignable frequencies include a wider range of frequency bands. Because of a concern that some frequency bands may bring a significant impact on society, the MIC went through a Public Comment process to notify the public of the frequency bands that would be assigned for the Tokyo 2020 Games.
- When assigning the radio frequencies, Tokyo 2020 will ensure that no harmful interference is detected at existing radio stations and no limitation is imposed on operations of the assigned frequencies. Tokyo 2020 may further examine and evaluate the technical condition to avoid harmful interference.
- In case there are no other options available, there is a possibility that frequencies in some bands or the type of usage not mentioned in the following chapters are assigned and authorised. Stricter conditions on transmission power, location and time could be imposed in such a case.

# 3. Assignable frequencies by type of usage

## 3.1 Video link

A video link includes both a wireless camera and a point-to-point link. Broadcasters use them for filming and reporting live events. They are independent circuits to secure stable signal transmission.

### 3.1.1 Basic concept of frequency for wireless cameras

The wireless camera is purely used for broadcasting purposes. It is expected that about 200 rights-holding broadcasters (RHBs) will be working at the Tokyo 2020 Games. Not all but many of them would use wireless cameras. It should be noted that wireless cameras are more susceptible to harmful interference than other equipment.

Tokyo 2020 foresees that at least 100 channels for wireless cameras will be required during the most congested times. For the stable assignment, 150 channels should be prepared. This is based on;

- 75 channels were prepared at the London 2012 Games. For the Rio 2016 Games, more than 100 channels were required. Based on these data, the requirement is expected to increase more than 30 percent.
- The Tokyo 2020 Games venues are located in a wide flat field and along the wide bay area where waves could have less obstacles to propagate.
- Advanced high-definition technology has resulted in the increased use of wide bandwidth for landscape shooting.

Tokyo 2020 also foresees that many broadcasters including the OBS will request assignment of channels below 4GHz because of the propagation characteristic of radio waves and the equipment used. Because the majority of requests will be for wireless cameras and high-definition equipment, the use of bands over 4GHz such as 5GHz, 6GHz, 7GHz or higher should be considered, especially for short range transmission. However, at the Rio 2016 Games, the 16GHz band was recommended but hardly used.

Based on the premise above, Tokyo 2020 will make its best effort to assign channels for all requests for 2GHz to 4GHz

bands, and at the same time will also continue to work closely with broadcasters and manufacturers to encourage the use of the higher frequencies.

Table 3.1.1 indicates the candidate frequency bands to be assigned to the wireless camera.

It should be noted that the bands and expected number of channels contained in the table are the assignment target after further technical studies and operational coordination are made.

**Table 3.1.1** Candidate frequency bands to be assigned to wireless cameras (under assessment)

| From (MHz) | To (MHz) | Expected number of channels | Classification and condition to be noted* |
|---|---|---|---|
| 1260 | 1400 | - 20 | Subject to compatibility with broadcasting, radar, satellite navigation system, image-transmission, amateur radio services and other systems. |
| 1525 | 1559 | | Subject to compatibility with satellite communication service and other systems. |
| 1613.8 | 1700 | | Subject to compatibility with satellite communication service and other systems. |
| 1980 | 2110 | 15 – 25 | Subject to compatibility with satellite communication, mobile-phone, rural-subscriber services and other systems. |
| 2170 | 2300 | | Subject to compatibility with satellite communication, space operation, mobile-phone, rural-subscriber services and other systems. |
| 2300 | 2400 | | Subject to compatibility with public, broadcasting, wireless-LAN services and other systems. |

| From (MHz) | To (MHz) | Expected number of channels | Classification and condition to be noted* |
|---|---|---|---|
| 2483.5 | 2497 | 30 – 40 | Subject to compatibility with wireless-LAN, image-transmission services and other systems. |
| 2500 | 2545 | | Subject to compatibility with satellite communication, BWA services and other systems. |
| 2575 | 2595 | | Subject to compatibility with BWA services and other systems. |
| 2645 | 2660 | | Subject to compatibility with satellite communication, BWA services and other systems. |
| 2660 | 2690 | | Subject to compatibility with satellite communication, BWA services and other system. |
| 2700 | 3100 | | Subject to compatibility with radar service and other systems. |
| 3100 | 3400 | 40 – 60 | Subject to compatibility with radar, satellite communication services and other systems. |
| 3600 | 4200 | | Subject to compatibility with satellite communication, mobile-phone services and other systems. |
| 4400 | 4900 | | Subject to compatibility with wireless - access service, mobile-phone services and other systems. |
| 4900 | 4990 | | Subject to compatibility with wireless - access service and other systems. |
| 5000 | 5150 | 20 – 30 | Subject to compatibility with wireless-access and wireless-LAN services and other systems. |
| 5710 | 6425 | | Subject to compatibility with wireless-LAN, radar, DSRC, broadcasting, image-transmission, satellite transmission, fixed-link services and other systems. |
| 6425 | 7900 | 30 – 60 | Subject to compatibility with broadcasting, satellite communication, public/general (fixed link) services and other systems. |

(*)Channels for airborne use is to be studied further.

All the bands contained in Table 3.1.1 above have already been assigned to many radio stations (including guard bands). Therefore, the assignment of these bands for the Tokyo 2020 Games would be subject to compatibility with these stations. Tokyo 2020 believes that the criteria for compatibility should be studied with the MIC with consideration given to the actual operation during the Tokyo 2020 Games.

The expected number of channel shown in Table 3.1.1 is calculated with the system bandwidth of 10MHz(maximum). It should be noted that the appropriate guard-band (e.g. 1MHz) would be required to use close frequencies at close locations without interference. Channel arrangement and geographical usage are under study.

There are some bands being used by some organisations or agencies for the purpose of national security or public safety. Provided that use of these bands would be prohibited when any disaster occurs, Tokyo 2020 expects these bands will be available for assignment for the Tokyo 2020 Games as long as there would be no impact with the operation of national security or public safety.

### 3.1.2 Airborne use of wireless Cameras

Tokyo 2020 anticipates that airborne use of wireless cameras will be required to cover wide-area events (e.g. marathons). This might involve the use of wireless cameras on helicopters and/or airplanes. Since wireless cameras are operated at high altitude, opportunities for spectrum reuse significantly and the possibility of interference increases. The range of usable spectrum is limited in exchange for the mobility of wireless cameras.

Because of these factors, Tokyo 2020 will limit the number of channels prepared for airborne use as follows:

- Bands in the 1GHz to 4GHz range will be assigned for airborne (wireless cameras) use.
- Bands requiring only a simple study of interference will be used.
- Operational conditions to protect defence, security and public safety will be observed.

To cover outdoor races during the Rio 2016 Games, the OBS operated nine channels for cameras from mobile terrestrial stations to aircraft relay stations, and operated corresponding channels from the aircraft to terrestrial stations. A 2GHz band would be suitable for such purpose. If more channels are required, the use of a 3.5GHz or 5GHz band should be considered.

In case of the Tokyo 2020 Games, outdoor race courses may include many overpasses or tunnels limiting the airborne use of wireless cameras. Thus, coverage of outdoor races may require use of a number of terrestrial receiving stations. This would reduce the number of channels for airborne use and contribute to effective spectrum use.

### 3.1.3 Basic concept of frequency for point-to-point (P-P) link

A point-to-point (P-P) link would be used to connect outdoor studios or remote cameras to the IBC, or outdoor remote cameras to a broadcast van. Though the need for P-P link has decreased over the years with the emergence of optical fibre, but an optical fibre connection may not always be available.

The required bandwidth for such terrestrial P-P links varies, but since sharp directional antennas are used, a detailed study can be made. For the P-P links, Tokyo 2020 intends to select frequencies used for fixed links or for temporary links (fixed wireless access or FWA). Technical coordination for this service should follow the ordinary procedures observed in Japan. Olympic stakeholders should be apply for assignments for the terrestrial P-P link using the pre-arranged application method.

If the terrestrial P-P link can be set up directly using an application, the need to coordinate with wireless cameras may be reduced. In that case, Tokyo 2020 would recommend using the less congested bands of 10GHz or higher.

Candidate frequency bands for terrestrial point-to-point link are shown in Table 3.1.3 below.

**Table 3.1.3** Candidate frequency bands to be assigned to terrestrial point-to-point links (under assessment)

| Band | From (GHz) | To (GHz) | Classification and condition to be noted |
|---|---|---|---|
| 6GHz (a) | 5.92 | 6.17 | Subject to compatibility with broadcasting, satellite communication, public/general (fixed link) services and other systems. |
| 6GHz (b) | 6.18 | 6.43 | Subject to compatibility with broadcasting, satellite communication, public/general (fixed link) services and other systems. |
| 11/12GHz (a) | 10.7 | 11.7 | Subject to compatibility with telecommunication (fixed link) service and other systems. |
| 11/12GHz (b) | 12.2 | 12.5 | Subject to compatibility with satellite communication, public/general (fixed link) services and other systems. |
| 18GHz (a) | 17.7 | 18.72 | To be studied further. |
| 18GHz (b) | 19.22 | 19.7 | |
| 40GHz (a) | 38 | 38.5 | |
| 40GHz (b) | 39 | 39.5 | |
| 50GHz | 50.4 | 51.2 | |
| 80GHz (a) | 71 | 76 | |
| 80GHz (b) | 81 | 86 | |

### 3.1.4 License-exempt radio for video links

In Japan, a license-exempt station that uses specified bands and meets the specifications defined in the Japanese Radio Act is entitled to freely operate anywhere in Japan. In addition, any type of usage, including video-link operation, is permitted. However, the operation of such a license-exempt station might be restricted by Tokyo 2020 at the Tokyo 2020 Games, especially in and around the venues.

The bands shown in Table 3.1.4 below could be used for the video transmission within a very short range or by using sharp directional antennas. It should be noted that:

- Tokyo 2020 has not yet decided who should coordinate these systems in and around the Games venues.
- There is a possibility of interference from stations unrelated to the Games operation that are located outside of the Games venue.

**Table 3.1.4** Frequency bands of license-exempt radio for video links

| Band | From (GHz) | To (GHz) | Requirements |
|---|---|---|---|
| 26GHz (a) | 24.77 | 25.23 | A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 26GHz (b) | 27.06 | 27.42 | |
| 60GHz* | 57 | 66 | |

(*)e.g. IEEE 802.11ad

It is highly recommended to refrain from transmitting video by Wi-Fi in the band of 2.4GHz and 5GHz because the traffic would be highly congested.

## 3.2 Wireless microphones/IEMs

Wireless microphones with high sound quality and in-ear monitors(IEMs) with similar quality used as microphones are expected to be used at the Tokyo 2020 Games.

These wireless microphones/IEMs would be used for:

- ceremonies of the Games;
- sports presentation;
- sports coverage requiring wireless microphones(e.g. Sailing, Rowing, Golf, etc.)
- interviews or reports for broadcasting;

Wireless microphones/IEMs require a channel with a bandwidth of 100-300 kHz, which is wider than other sound transmission so that the frequency bands to be assigned for those purposes would be limited.

### 3.2.1 Basic concept of frequency for wireless microphones/IEMs

The frequency bands usually assigned for wireless microphones/IEMs in Japan are WS-1 to WS-4, 710MHz and 1.2GHz bands as shown in Table 3.2.1 below. Basically, Tokyo 2020 will assign these same frequency bands for microphones/IEMs to avoid harmful interference. Also, discussions are on going about using the frequencies presently assigned for the guard band for mobile phones for wireless microphones/IEMs needs at the Tokyo 2020 Games.

The usage of these bands should be consider take into consideration the following points.

- Many of the bands mentioned above are also assigned to terrestrial TV broadcast. (In Japan, a channel for terrestrial TV broadcast that can be used for other purposes without affecting terrestrial TV broadcast is often called a "white space".) Terrestrial TV broadcast services in and around the Tokyo area occupy lower UHF channels (ch15 - ch33), and it would be difficult to assign these lower channels to wireless microphones/IEMs at the Tokyo 2020 Games.
- The usage of many wireless microphones/IEMs at music concerts or theatres in and around the Tokyo area is foreseen during the Tokyo 2020 Games.

In consideration of the above, Tokyo 2020 would request the following to avoid the difficulty of assignment for wireless microphones/IEMs as much as possible.

- To use wired microphones as much as possible. Wireless microphones should be used only when wired microphones cannot be used.
- To avoid using wireless microphones/IEMs where possible, especially in outdoor areas.
- To use a digital wireless microphones/IEMs system that is usually more tolerant to interference.
- Coordination and assignment of frequencies would be easier for systems brought into Japan with specifications that meet Japanese standards.

- Band: WS-1 to WS-4, 710MHz and 1.2GHz. Maximum bandwidth: 288kHz with channel separation of 250kHz or 300kHz. Maximum transmission power: 50mW.

In Japan, frequency bands other than 60MHz, 70MHz, WS-1 to WS-4, 710MHz, 806MHz and 1.2GHz bands shown in Table 3.2.1 are assigned to a guard band to protect adjacent systems. When assigning frequencies, consideration should be made toward other radio stations as channels are shared or adjacent channels are used. To make the assignment work possible, the protection standard should be carefully studied in accordance with the operation and usage of systems.

**Table 3.2.1** Candidate frequency bands to be assigned to wireless microphones/IEMs (under assessment)

| Band | From (MHz) | To (MHz) | Classification and condition to be noted | TV-ch in Japan |
|---|---|---|---|---|
| 60MHz | 54 | 68 | Subject to compatibility with public/general services. | - |
| 70MHz | 68 | 74.8 | Subject to compatibility with FM broadcasting and public/general services. Operational coordination required with wireless microphone operators in Japan.<br>Frequency sharing with designated small power stations (license exempt) requires similar specifications for both systems.<br>When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. | - |
| | 75.2 | 76 | | - |
| WS-1 | 470 | 482 | Subject to compatibility with terrestrial TV broadcasting (DTV), area broadcasting services and other systems. Operational coordination required with wireless microphone operators in Japan. | Ch 13-14 |
| WS-2 | 482 | 596 | Subject to compatibility with DTV, area broadcasting services and other systems. Operational coordination required with wireless microphone operators in Japan.<br>Use of this band is restricted because of DTV service existing in and around the Tokyo area. | Ch 15-33 |

| Band | From (MHz) | To (MHz) | Classification and condition to be noted | TV-ch in Japan |
|---|---|---|---|---|
| WS-3 | 596 | 662 | Subject to compatibility with DTV, area broadcasting services and other systems. Operational coordination required with wireless microphone operators in Japan. | Ch 34-44 |
| WS-4 | 662 | 710 | Subject to compatibility with DTV, area broadcasting services and other systems. Operational coordination required with wireless microphone operators in Japan.<br>Use of this band is restricted because of DTV service existing in and around | Ch 45-52 |
| 710MHz | 710 | 714 | Operational coordination required with wireless microphone operators in Japan. | - |
| 714MHz | 714 | 718 | Subject to compatibility with mobile phone, ITS*, wireless microphone systems and other systems. | - |
| 748MHz | 748 | 755 | Subject to compatibility with mobile phone, ITS, wireless microphone systems and other systems. | - |
| 765MHz | 765 | 773 | Subject to compatibility with mobile phone, ITS, wireless microphone systems and other systems. | - |
| 803MHz | 803 | 806 | Subject to compatibility with mobile phone, ITS, wireless microphone systems and other systems. | - |
| 806MHz | 806 | 810 | Operational coordination required with wireless microphone operators in Japan. Frequency sharing with designated small power stations (license exempt) requires similar specifications for both systems. | - |
| 810MHz | 810 | 815 | Subject to compatibility with mobile phone, MCA, RFID, wireless microphone systems and other systems. | - |
| 845MHz | 845 | 850 | Subject to compatibility with mobile phone, MCA, RFID, wireless microphone systems and other systems. | - |
| 1.2GHz | 1215 | 1400 | Subject to compatibility with broadcasting, radar, image-transmission, amateur radio services and other systems.<br>Operational coordination required with wireless microphone operators in Japan. | - |

(*)ITS: Intelligent Transport Systems.

### 3.2.2 License-exempt radio for wireless microphones/IEMs

Table 3.2.2 shows frequency bands for wireless microphones/IEMs with license exemption in Japan. Systems that use these bands and meet the specifications defined in the Japanese Radio Act are entitled to be used freely. However, at the Tokyo 2020 Games, their operation in and around the Games venues might be restricted by Tokyo 2020.

Discussions are on going to determine if Tokyo 2020 should coordinate these systems. It should be noted that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue.

**Table 3.2.2** Frequency bands of license-exempt radio for wireless microphones/IEMs

| Band | From (MHz) | To (MHz) | Requirements |
|---|---|---|---|
| 74MHz | 74.5 | 74.8 | A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely.<br>The transmission power might vary by its usage, but high power should be avoided from the view point of effective frequency usage. Tokyo 2020 requests that the transmission power is maintained below 10mW if possible, or the maximum transmission power to be no more than 100mW. |
| 75MHz | 75.2 | 76 | |
| 320MHz | 322 | 322.42 | |
| 806MHz | 806 | 810 | |

## 3.3 Talk back system (intercom)

The talk back system (intercom) is used primarily by broadcasters for communication between the director of activities and the members of the production team such as presenters, interviewers, cameramen, sound operators, lighting operators and engineers.

Because it provides two-way simultaneous communication, the talk back system with radio wave requires two frequencies in a pair. Its voice delay is small compared with that of a one-way PMR (personal mobile radio).

### 3.3.1 Basic concept of frequency for the talk back system (intercom)

At the London 2012 Games and the Rio 2016 Games, it is reported that more than 400 channels for the talk back system were prepared and used.

Therefore, Tokyo 2020 recognises that the same volume of channels would be required at the Tokyo 2020 Games. As described below, Tokyo 2020 plans to lease PMRs to be used by staff members in order to assign as many frequencies as possible to the talk back system.

Table 3.3.1 shows the candidate frequency bands in Japan for the talk back system (intercom). Some frequencies and/or bands might be shared with PMRs or telemetry and small-capacity data transmissions.

Tokyo 2020 will take appropriate action to ensure that licenses are issued and exclusive frequencies for the Tokyo 2020 Games are prepared to practically avoid interference.

**Table 3.3.1** Candidate frequency bands to be assigned to the talk back system (intercom) (under assessment)

| From (MHz) | To (MHz) | Classification and condition to be noted |
|---|---|---|
| 138 | 170 | Subject to compatibility with broadcasting, amateur radio, public/general services and other systems. |
| 170 | 225 | Subject to compatibility with public/general services and other systems. |
| 335.4 | 380.2 | Subject to compatibility with public/general services and other systems.<br>Frequency sharing with designated convenience radio stations (see 3.4.2) requires similar specifications for both systems.<br>When sharing with convenience radio stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 381.4 | 402 | Subject to compatibility with public/general services and other systems. |
| 406.1 | 420 | Subject to compatibility with public/general services and other systems.<br>Frequency sharing with designated small power stations (license exempt) requires similar specifications for both systems.<br>When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |

| From (MHz) | To (MHz) | Classification and condition to be noted |
|---|---|---|
| 420 | 470 | Subject to compatibility with broadcasting, amateur radio, public/general services and other systems. Frequency sharing with designated small power stations (license exempt) requires similar specifications for both systems. When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 1893.5 | 1906.1 | Subject to compatibility with digital cordless phone services. When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |

### 3.3.2 License-exempt radio for the talk back system (intercom)

Wireless equipment that uses a specified frequency and meets the technical standard specified by the Japanese Radio Act are treated as license exempt. Table 3.3.2 shows the license-exempt system for the talk back system.

However, Tokyo 2020 might restrict or impose special conditions to operate such wireless equipment in and around the Games venues. Discussions are on going to determine if Tokyo 2020 should coordinate the frequencies for this system. It should be noted that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue.

**Table 3.3.2** Frequency bands of license exempt radio for the talk back system (intercom)

| Type | From (MHz) | To (MHz) | Requirements | Notes |
|---|---|---|---|---|
| Pair1-L | 421.5 | 421.9 | A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. | Analog 10mW 28ch |
| Pair1-H | 440.2 | 440.37 | | Analog 10mW 28ch |
| Pair2-L | 413.6 | 414.2 | | Analog 1mW |
| Pair2-H | 454.0 | 454.3 | | Analog 1mW |
| - | 1893.5 | 1906.1 | | Digital (TDD*) |

(*)TDD: Time Division Duplex.

## 3.4 Personal mobile radio (PMR)

The personal mobile radio(PMR) is a mobile communication tool used for broadcast relay, news gathering, operation of competitions and ceremonies. With the exception of the talk back application, the mainly voice-based PMR is expected to use a press-to-talk system.

### 3.4.1 Basic concept of frequency for PMR

The VHF and UHF bands suitable for PMR already have a considerably high number of users in and around the Tokyo area. These bands are expected to be assigned to the talk back system, telemetry and telecommand, and small-capacity data transmissions at the Tokyo 2020 Games.

In consideration of the above, Tokyo 2020 plans to provide an exclusive PMR system for use at the Tokyo 2020 Games. Tokyo 2020 will coordinate and assign frequencies for the PMR brought into Japan by the Olympic stakeholders only if they are unable to use the system Tokyo 2020 provides.

A digital system is recommended to facilitate the frequency assignment and to avoid interference. However, the digital system generates an audio delay of about 100ms to 500ms (in rare cases, up to 1000ms). Tokyo 2020 recognises that frequencies for an analogue system would be required if such a delay cannot be accepted.

Table 3.4.1.1 shows frequency bands for PMR. Tokyo 2020 would take appropriate action to ensure that licenses are issued to the applicants and exclusive frequencies for the Tokyo 2020 Games are prepared to practically avoid interference.

The transmission power might vary by its usage, but high power should be avoided from the view point of effective frequency usage. Transmission power should be preferably no more than 1W or maximum 5W in special cases.

**Table 3.4.1.1** Candidate frequency bands to be assigned to PMR (under assessment)

| From (MHz) | To (MHz) | Classification and condition to be noted |
|---|---|---|
| 138 | 170 | Subject to compatibility with broadcasting, amateur radio, public/general services and other systems. |
| 170 | 225 | Subject to compatibility with public/general services and other systems. |
| 335.4 | 380.2 | Subject to compatibility with public/general services and other systems.<br>Frequency sharing with designated Convenience Radio stations (see 3.4.2) requires similar specifications for both systems.<br>When sharing with convenience radio stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 381.4 | 402 | Subject to compatibility with public/general services and other systems. |
| 406.1 | 420 | Subject to compatibility with public/general services and other systems. |
| 420 | 470 | Subject to compatibility with broadcasting, amateur radio, public/general services and other systems.<br>Frequency sharing with designated small power stations (license exempt) requires similar specifications for both systems.<br>When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |

As an alternative option, the PMR service will also be available via the Rate Card.

Tokyo 2020 will request the use of mobile phones or the system provided by Tokyo 2020.

As a reference, the outline of the PMR service that Tokyo 2020 is preparing is shown in Table 3.4.1.2.

**Table 3.4.1.2** Outline of the PMR services (provided by Tokyo 2020)

| Type | Band | Service area | | Notes |
|---|---|---|---|---|
| Type 1 | 900MHz | Specified area in Tokyo | Anywhere in the service area | Press-to-Talk |
| Type 2 | 350MHz | Nationwide | Within 1km distances | Press-to-Talk |
| Type 3 | 900MHz | Nationwide | Anywhere in the service area | Press-to-Talk service with mobile network |

### 3.4.2 License-exempt radio for PMR

Wireless equipment that uses a specified frequency and meets the technical standard specified by the Japanese Radio Act are treated as license exempt. Equipment permitted to operate through a simple registration procedure has become widespread. Tables 3.4.2.1 and 3.4.2.2 show the frequencies of systems that could have functions similar to PMR.

Equipment that meets these conditions could be operated anywhere in Japan under the Japanese Radio Act. However, Tokyo 2020 might restrict or impose special conditions to operate such equipment in and around the Games venues. Discussions are on going to determine if Tokyo 2020 should coordinate the frequencies for this system. It should be noted that there is possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue.

**Table 3.4.2.1** Frequency band of registered systems with functions similar to PMR

| Type | From (MHz) | To (MHz) | Requirements | Notes |
|---|---|---|---|---|
| By registration (CR*) | 351.16 | 351.38 | A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. Registration under the Law is required. | Digital 5W 30ch |

(*)CR: Convenience radio.

**Table 3.4.2.2** Frequency band of license-exempt systems similar to PMR

| Type | From (MHz) | To (MHz) | Requirements | Notes |
|---|---|---|---|---|
| License exempt | 422.04 | 422.35 | A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. | Analog 10mW 21ch |

## 3.5 Telemetry/telecommand and small-capacity data transmission

Telemetry and telecommand are used to control equipment from a remote site and to transmit a measurement result. Most of the small-capacity data transmission systems, including telemetry and telecommand, are expected to be used for such purposes as:

- to control wireless cameras, cable cameras and track cameras;
- to control aerial cameras;
- to press the shutter of a still camera;
- to measure and record competitions;
- to control equipment for ceremonies;

Systems for these services employ a variety of radio waves and bandwidths. They generally transmit small-capacity data using a narrow bandwidth. Systems that require a wide bandwidth transmit signals in a very short time using low transmission power.

### 3.5.1 Basic concept of frequency for telemetry/telecommand

Table 3.5.1 shows the candidate frequency bands in Japan for telemetry/telecommand and small-capacity data transmission.

Some frequency bands in Table 3.5.1 are shared with audio transmission. Frequency assignments for telemetry/telecommand and small-capacity data transmission may be cancelled in order to assign the frequencies to PMR.

Tokyo 2020 will take appropriate action to ensure that licenses are issued to the applicants and exclusive frequencies for the Tokyo 2020 Games are prepared to practically avoid interference.

**Table 3.5.1** Candidate frequency band for telemetry/telecommand

| From (MHz) | To (MHz) | Classification and condition to be noted |
|---|---|---|
| 138 | 170 | Subject to compatibility with broadcasting, amateur radio, public/general services and other systems. |
| 170 | 225 | Subject to compatibility with public/general services and other systems. |
| 335.4 | 380.2 | Subject to compatibility with public/general services and other systems.<br>Frequency sharing with designated convenience radio stations (see 3.4.2) requires similar specifications for both systems.<br>When sharing with Convenience radio stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 381.4 | 402 | Subject to compatibility with public/general services and other systems. |
| 406.1 | 420 | Subject to compatibility with public/general services and other systems. |
| 420 | 470 | Subject to compatibility with broadcasting, amateur radio, public/general services and other systems.<br>Frequency sharing with designated small power stations (license exempt) requires similar specifications for both systems.<br>When sharing with license exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 915 | 930 | Subject to compatibility with RFID and other systems. |
| 2483.5 | 2497 | Subject to compatibility with wireless-LAN, image-transmission services and other systems. |

### 3.5.2 License-exempt radio for telemetry/telecommand

Wireless equipment that uses the specified frequency and meets the technical standard specified by the Japanese Radio Act are treated as license exempt. Table 3.5.2 shows the systems used for telemetry/telecommand. (For Wi-Fi, refer to the "Wireless LAN" chapter.)

However, Tokyo 2020 might restrict or impose special conditions to operate such wireless equipment in and around the Games venues. It should be noted that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue.

**Table 3.5.2** Frequency bands of license-exempt radio for telemetry/telecommand

| Band | From (MHz) | To (MHz) | Requirements | Notes |
|---|---|---|---|---|
| 312MHz | 312.6 | 314.7 | A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. | Digital 1ch 0.25mW |
| 426MHz | 426 | 426.15 | | Digital 18ch 100mW |
| 429MHz | 429 | 430 | A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. | Digital 108ch 1W |
| 449MHz | 449.7 | 449.9 | A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. | Digital 26ch 1W |
| 469MHz | 469.4 | 469.5 | | Digital 8ch 1W |
| 920MHz | 915.9 | 928.1 | | Digital 122ch 1mW |
| | 920.5 | 928.1 | | Digital 38ch 20mW |
| 1.2GHz (a) | 1216 | 1217 | | Digital 80ch 1W |
| 1.2GHz (b) | 1252 | 1253 | | Digital 80ch 1W |

## 3.6 Wireless LAN and data transmission

Wireless LAN is a license-exempt small-scale, large-capacity wireless system used to access the Internet. Wireless LAN with Wi-Fi standard is widespread.

Zigbee and Bluetooth are widely used as well. Furthermore, there are many other data transmission systems with unique standards that are different from these standards.

### 3.6.1 Basic concept of frequency for wireless LAN and data transmission

License-exempt wireless LAN equipment will also be required to obtain authorisation for use in specific areas such as the competition venues, broadcast areas, Media Centres and IBC.

The conditions of license-exempt equipment in Japan are as follows:

- Wireless equipment proven to conform to the technical standard specified by the Japanese Radio Act.
- Wireless equipment that does not satisfy the above condition but proven to meet the standard corresponding to the technical standard specified by the Japanese Radio Act (i.e. Wi-Fi Alliance or Bluetooth SIG logo attached) and will be used within 90 days from entry into Japan.

Other wireless equipment not mentioned above should be authorised by Tokyo 2020. Regardless of a license, wireless LAN equipment should be registered with Tokyo 2020 if the equipment is to be used in specific areas such as the competition venues, broadcast areas, Media Centres and the IBC.

Table 3.6.1 shows the frequency bands for license-exempt wireless LAN. Other data transmission systems using other frequency bands are listed in the “video link” section and the “telemetry/telecommand” section.

**Table 3.6.1** Frequency bands for license-exempt wireless LAN

| Band | From (GHz) | To (GHz) | Classification and condition to be noted |
|---|---|---|---|
| 2.4GHz | 2.400 | 2.497 | - |
| 5GHz* | 5.150 | 5.250 | Indoor use only |
| | 5.250 | 5.350 | Indoor use only, DFS** required (subject to compatibility with meteorological radar). |
| | 5.470 | 5.725 | DFS required (subject to compatibility with meteorological radar). |
| 26GHz | 24.77 | 25.23 | - |
| | 27.06 | 27.42 | - |
| 60GHz | 57 | 66 | - |

(*)Wireless LAN in 5.725-5.835 GHz will not be available. The expansion of frequency bands is under consideration.
(**)DFS: Dynamic Frequency Selection.

Olympic stakeholders have used wireless LAN including Wi-Fi for wireless Internet in past Olympic and Paralympic Games.

Tokyo 2020 is studying the feasibility of providing equivalent services under a secure and stable environment.

Difficulty might arise to coordinate the frequency to provide stable services because of the following factors.

- Wi-Fi uses mainly 2.4GHz and 5GHz bands. Zigbee, Bluetooth and other systems also use the same bands.
- They are often built into a mobile phone (smart phone) and are difficult to distinguish. They could be operating without the knowledge of the mobile phone user.
- At past Olympic and Paralympic Games, the use of Wi-Fi was prohibited or not recommended in many places inside the Games venues. Tokyo 2020 is considering providing Wi-Fi services for spectators at many Games venues during the Tokyo 2020 Games.
- Many of these small-scale data transmission tools have a function that selects the frequency automatically to reduce interference. Artificial frequency management might be difficult during concentrated use.
- In addition to the 2.4GHz and 5GHz bands for these services, a 26GHz band for fixed use and 60GHz for short distance (a few metres) that do not require a license will be prepared. Tokyo 2020 recommends the use of the latter new bands.

In consideration of the points mentioned above, Tokyo 2020 is studying the option of requiring coordination only for the access points, and not requiring coordination and authorisation for terminals.

It should be noted that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue.

It should also be noted that unused wireless LAN devices should be turned off to minimise unexpected interference.

## 3.7 Satellite communication

Tokyo 2020 anticipates that satellite communication would be used to transmit video, audio and data during the Tokyo 2020 Games, both domestically (between venues and the IBC) and internationally.

Table 3.7.1 shows the frequency assignment in Japan for satellite communication.

It is recognised that satellite communication faces the following situations.

- Recent terrestrial communication including fibre optics and mobile phones can replace the above mentioned satellite communication. A number of competition venues for the Tokyo 2020 Games are expected to be equipped with fibre optics facilities.
- Even for the international communication, fibre optics could cover part of the transmission path in case a country to which signals are to be delivered is not covered by satellite.
- Satellite operation requires international coordination. The coordination procedure of frequency, the direction of radiated radio wave, the density of radio wave strength, the orbital slot, etc., are regulated under the ITU (International Telecommunication Union). Difficulty could be foreseen to use a satellite with specific conditions, due to the fact that many satellites are in operation under the international rules in the East Asia region including Japan.

### 3.7.1 Basic concept of frequency for satellite communication

Considering the facts mentioned above, Tokyo 2020 proposes the usage of satellite communication at the Tokyo 2020 Games as follows:

- The use of terrestrial communication networks should be given priority, and the use of satellite communication should be avoided as much as possible.
- If there are no options other than satellite communication, the existing services provided by domestic operators should be utilised to the maximum extent for both domestic and international communication. In this case, it is highly recommended to accept the satellite and the frequency in operation provided by domestic

communication operators. Use of any other satellites or frequencies should be avoided.

- In case of international communication, if domestic communication operators are unable to provide services and there are no alternative means for communication, Tokyo 2020 will try to provide coordination. It should be understood that it will be difficult to obtain approval due to the need for international coordination.

Some of frequency bands for satellite communication, especially C-band, Ku-band and Ka-band, are shared with terrestrial radio links. Tokyo 2020 will give priority to securing satellite communication in case interference is expected to occur in these bands.

Tokyo 2020 is carrying out a study to identify the satellite to be authorised in C-band, Ku-band and Ka-band. All satellites that provide services in Japan will be considered for authorisation. In addition, Tokyo 2020 believes that the frequency band for satellite navigation systems should be protected to avoid interference to its receivers on ground and the measuring instrument used for the Tokyo 2020 Games.

**Table 3.7.1** Frequency bands for the satellite communication

| | Uplink [MHz] | | Downlink [MHz] | | Notes |
|---|---|---|---|---|---|
| | From | To | From | To | |
| - | - | - | 1215 | 1240 | Navigation system |
| | - | - | 1559 | 1610 | |
| L Band | 1610 | 1618.75 | 2483.5 | 2500 | Mobile communication |
| | 1670 | 1675 | 1518 | 1525 | |
| | 1626.5 | 1660.5 | 1525 | 1559 | |
| | 1621.35 | 1626.5 | 1621.35 | 1626.5 | |
| S Band | 2660 | 2690 | 2500 | 2545 | |
| C Band | 5850 | 7075 | 3600 | 4200 | Fixed communication (Subject to compatibility with mobile phone services in the frequencies from 27500MHz to 29500MHz) |
| Ku Band | 13750 | 14500 | 12200 | 12750 | |
| Ka Band | 27500 | 30000 | 17700 | 20200 | |

**Annex 1.**

**Frequency Table** (Under Assessment) - The Basic Spectrum Plan for the Olympic and Paralympic Games Tokyo 2020

| Freq. [MHz] From | | To | Usage: Wireless Camera | Point to Point | Wireless Mic / In Ear Monitor | Talk Back | PMR | Telemetry / Tele command | Wireless LAN | Satellite | Section# | Classification and condition to be noted |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **54** | **-** | **68** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with public/general services. |
| **68** | **-** | **74.8** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with FM broadcasting and public/general services.<br>Operational coordination required with wireless microphone operators in Japan.<br>Frequency sharing with designated small power stations (license-exempt) requires similar specifications for both systems.<br>When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 74.5 | - | 74.8 | - | - | ✓ | - | - | - | - | - | 3.2.2 | License-exempt.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely.<br>- The transmission power might vary by its usage, but high power should be avoided from the view point of effective frequency usage. Tokyo 2020 requests that the transmission power is maintained below 10mW if possible, or the maximum transmission power to be no more than 100mW. |
| **75.2** | **-** | **76** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with FM broadcasting and public/general services.<br>Operational coordination required with wireless microphone operators in Japan.<br>Frequency sharing with designated small power stations (license-exempt) requires similar specifications for both systems.<br>When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 75.2 | - | 76 | - | - | ✓ | - | - | - | - | - | 3.2.2 | License-exempt.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely.<br>- The transmission power might vary by its usage, but high power should be avoided from the view point of effective frequency usage. Tokyo 2020 requests that the transmission power is maintained below 10mW if possible, or the maximum transmission power to be no more than 100mW. |
| **138** | **-** | **170** | - | - | - | ✓ | ✓ | ✓ | - | - | 3.3.1<br>3.4.1<br>3.5.1 | Subject to compatibility with broadcasting, amateur radio, public/general services and other systems. |

**Frequency Table** (Under Assessment) - The Basic Spectrum Plan for the Olympic and Paralympic Games Tokyo 2020

| Freq. [MHz] From | To | Usage: Wireless Camera | Point to Point | Wireless Mic / In Ear Monitor | Talk Back | PMR | Telemetry / Tele command | Wireless LAN | Satellite | Section# | Classification and condition to be noted |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **170** | **225** | - | - | - | ✓ | ✓ | ✓ | - | - | 3.3.1<br>3.4.1<br>3.5.1 | Subject to compatibility with public/general services and other systems . |
| **312.6** | **314.7** | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 1ch, 0.25mW)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **322** | **322.42** | - | - | ✓ | - | - | - | - | - | 3.2.2 | License-exempt.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely.<br>- The transmission power might vary by its usage, but high power should be avoided from the view point of effective frequency usage. Tokyo 2020 requests that the transmission power is maintained below 10mW if possible, or the maximum transmission power to be no more than 100mW. |
| **335.4** | **380.2** | - | - | - | ✓ | ✓ | ✓ | - | - | 3.3.1<br>3.4.1<br>3.5.1 | Subject to compatibility with public/general services and other systems.<br>Frequency sharing with designated convenience radio stations (see 3.4.2) requires similar specifications for both systems.<br>When sharing with convenience radio stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 351.16 | 351.38 | - | - | - | - | ✓ | - | - | - | 3.4.2 | Convenience radio by registration. (Digital, 5W, 30ch.)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely.<br>- Registration under the Law is required. |
| **381.4** | **402** | - | - | - | ✓ | ✓ | ✓ | - | - | 3.3.1<br>3.4.1<br>3.5.1 | Subject to compatibility with public/general services and other systems. |
| **406.1** | **420** | - | - | - | ✓ | ✓ | ✓ | - | - | 3.3.1<br>3.4.1<br>3.5.1 | Subject to compatibility with public/general services and other systems.<br>Frequency sharing with designated small power stations (license-exempt) requires similar specifications for both systems.<br>When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |

**Frequency Table** (Under Assessment) - The Basic Spectrum Plan for the Olympic and Paralympic Games Tokyo 2020

| Freq. [MHz] From | To | Usage: Wireless Camera | Point to Point | Wireless Mic / In Ear Monitor | Talk Back | PMR | Telemetry / Tele command | Wireless LAN | Satellite | Section# | Classification and condition to be noted |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 413.6 - | 414.2 | - | - | - | ✓ | - | - | - | - | 3.3.2 | License-exempt. (Pair2-L; Analog, 1mW)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **420 -** | **470** | - | - | - | ✓ | ✓ | ✓ | - | - | 3.3.1<br>3.4.1<br>3.5.1 | Subject to compatibility with broadcasting, amateur radio, public/general services and other systems.<br>Frequency sharing with designated small power stations (license-exempt) requires similar specifications for both systems.<br>When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 421.5 - | 421.9 | - | - | - | ✓ | - | - | - | - | 3.3.2 | License-exempt. (Pair1-L; Analog, 10mW, 28ch)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 422.04 - | 422.35 | - | - | - | - | ✓ | - | - | - | 3.4.2 | License-exempt. (Analog, 10mW, 21ch)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 426 - | 426.15 | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 18ch, 100mW)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 429 - | 430 | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 108ch, 1W)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 440.2 - | 440.37 | - | - | - | ✓ | - | - | - | - | 3.3.2 | License-exempt. (Pair1-H; Analog, 10mW, 28ch)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 449.7 - | 449.9 | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 26ch, 1W)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 454 - | 454.3 | - | - | - | ✓ | - | - | - | - | 3.3.2 | License-exempt. (Pair2-H; Analog, 1mW)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |

**Frequency Table** (Under Assessment) - The Basic Spectrum Plan for the Olympic and Paralympic Games Tokyo 2020

| Freq. [MHz] From | To | Usage: Wireless Camera | Point to Point | Wireless Mic / In Ear Monitor | Talk Back | PMR | Telemetry / Tele command | Wireless LAN | Satellite | Section# | Classification and condition to be noted |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 469.4 - | 469.5 | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 8ch, 1W)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **470 -** | **482** | - | - | ✓ | - | - | - | - | - | 3.2.1 | WS-1, TV-ch: 13-14;<br>Subject to compatibility with terrestrial TV broadcasting (DTV), area broadcasting services and other systems. Operational coordination required with wireless microphone operators in Japan. |
| **482 -** | **596** | - | - | ✓ | - | - | - | - | - | 3.2.1 | WS-2, TV-ch: 15-33;<br>Subject to compatibility with DTV, area broadcasting services and other systems. Operational coordination required with wireless microphone operators in Japan. Use of this band is restricted because of DTV service existing in and around the Tokyo area. |
| **596 -** | **662** | - | - | ✓ | - | - | - | - | - | 3.2.1 | WS-3, TV-ch: 34-44;<br>Subject to compatibility with DTV, area broadcasting services and other systems. Operational coordination required with wireless microphone operators in Japan. |
| **662 -** | **710** | - | - | ✓ | - | - | - | - | - | 3.2.1 | WS-4, TV-ch: 45-52;<br>Subject to compatibility with DTV, area broadcasting services and other systems. Operational coordination required with wireless microphone operators in Japan. Use of this band is restricted because of DTV service existing in and around the Tokyo area. |
| **710 -** | **714** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Operational coordination required with wireless microphone operators in Japan. |
| **714 -** | **718** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with mobile phone, ITS, wireless microphone systems and other systems. |
| **748 -** | **755** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with mobile phone, ITS, wireless microphone systems and other systems. |
| **765 -** | **773** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with mobile phone, ITS, wireless microphone systems and other systems. |
| **803 -** | **806** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with mobile phone, ITS, wireless microphone systems and other systems. |
| **806 -** | **810** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Operational coordination required with wireless microphone operators in Japan. Frequency sharing with designated small power stations (license-exempt) requires similar specifications for both systems. |

**Frequency Table** (Under Assessment) - The Basic Spectrum Plan for the Olympic and Paralympic Games Tokyo 2020

| Freq. [MHz] From | To | Usage: Wireless Camera | Point to Point | Wireless Mic / In Ear Monitor | Talk Back | PMR | Telemetry / Tele command | Wireless LAN | Satellite | Section# | Classification and condition to be noted |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 806 - | 810 | - | - | ✓ | - | - | - | - | - | 3.2.2 | License-exempt.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely.<br>- The transmission power might vary by its usage, but high power should be avoided from the view point of effective frequency usage. Tokyo 2020 requests that the transmission power is maintained below 10mW if possible, or the maximum transmission power to be no more than 100mW. |
| **810 -** | **815** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with mobile phone, MCA, RFID, wireless microphone systems and other systems. |
| **845 -** | **850** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with mobile phone, MCA, RFID, wireless microphone systems and other systems. |
| **915 -** | **930** | - | - | - | - | - | ✓ | - | - | 3.5.1 | Subject to compatibility with RFID and other systems. |
| 915.9 - | 928.1 | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 1mW, 122ch)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 920.5 - | 928.1 | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 20mW, 38ch)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **1215 -** | **1400** | - | - | ✓ | - | - | - | - | - | 3.2.1 | Subject to compatibility with broadcasting, radar, image-transmission, amateur radio services and other systems.<br>Operational coordination required with wireless microphone operators in Japan. |
| 1216 - | 1217 | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 1W, 80ch)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 1252 - | 1253 | - | - | - | - | - | ✓ | - | - | 3.5.2 | License-exempt. (Digital, 1W, 80ch)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 1215 - | 1240 | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite navigation system. |
| 1260 - | 1400 | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with broadcasting, radar, satellite navigation system, image-transmission, amateur radio services and other systems. |
| **1518 -** | **1525** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (L-Band Downlink 2) |
| **1525 -** | **1559** | ✓ | - | - | - | - | - | - | ✓ | 3.1.1<br>3.7.1 | Satellite communication service. (L-Band Downlink 3)<br><br>Subject to compatibility with satellite communication service and other systems. |

**Frequency Table** (Under Assessment) - The Basic Spectrum Plan for the Olympic and Paralympic Games Tokyo 2020

| Freq. [MHz] From | - | To | Usage: Wireless Camera | Point to Point | Wireless Mic / In Ear Monitor | Talk Back | PMR | Telemetry / Tele command | Wireless LAN | Satellite | Section# | Classification and condition to be noted |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1559** | **-** | **1610** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite navigation system. |
| **1610** | **-** | **1618.75** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (L-Band Uplink 1) |
| **1613.8** | **-** | **1700** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with satellite communication service and other systems. |
| 1621.35 | - | 1626.5 | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (L-Band TDD Up/Down) |
| 1626.5 | - | 1660.5 | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (L-Band Uplink 3) |
| 1670 | - | 1675 | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (L-Band Uplink 2) |
| **1893.5** | **-** | **1906.1** | - | - | - | ✓ | - | - | - | - | 3.3.1 | Subject to compatibility with digital cordless phone services.<br>When sharing with license-exempt stations, note that there is a possibility of interference from other stations unrelated to the Games operation that are located outside of the Games venue. |
| 1893.5 | - | 1906.1 | - | - | - | ✓ | - | - | - | - | 3.3.2 | License-exempt. (Digital, Time Division Duplex)<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **1980** | **-** | **2110** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with satellite communication, mobile phone, rural subscriber services and other systems. |
| **2170** | **-** | **2300** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with satellite communication, space operation, mobile phone, rural subscriber services and other systems. |
| **2300** | **-** | **2400** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with public, broadcasting, wireless-LAN services and other systems. |
| **2400** | **-** | **2497** | - | - | - | - | - | - | ✓ | - | 3.6.1 | License-exempt.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **2483.5** | **-** | **2497** | ✓ | - | - | - | - | ✓ | - | - | 3.1.1<br>3.5.1 | Subject to compatibility with wireless-LAN, image-transmission services and other systems. |
| **2483.5** | **-** | **2500** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (L-Band Downlink 1) |
| **2500** | **-** | **2545** | ✓ | - | - | - | - | - | - | ✓ | 3.1.1<br>3.7.1 | Satellite communication service. (S-Band Downlink)<br><br>Subject to compatibility with satellite communication, BWA services and other systems. |
| **2575** | **-** | **2595** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with BWA services and other systems. |
| **2645** | **-** | **2660** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with satellite communication, BWA services and other systems. |

**Frequency Table** (Under Assessment) - The Basic Spectrum Plan for the Olympic and Paralympic Games Tokyo 2020

| Freq. [MHz] From | To | Usage: Wireless Camera | Point to Point | Wireless Mic / In Ear Monitor | Talk Back | PMR | Telemetry / Tele command | Wireless LAN | Satellite | Section# | Classification and condition to be noted |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **2660** | **2690** | ✓ | - | - | - | - | - | - | ✓ | 3.1.1<br>3.7.1 | Satellite communication service. (S-Band Uplink)<br><br>Subject to compatibility with satellite communication, BWA services and other systems. |
| **2700** | **3100** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with radar service and other systems. |
| **3100** | **3400** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with radar, satellite communication services and other systems. |
| **3600** | **4200** | ✓ | - | - | - | - | - | - | ✓ | 3.1.1<br>3.7.1 | Satellite communication service. (C-Band Downlink)<br><br>Subject to compatibility with satellite communication, mobile phone services and other systems. |
| **4400** | **4900** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with wireless-access service, mobile phone services and other systems. |
| **4900** | **4990** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with wireless -access service and other systems. |
| **5000** | **5150** | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with wireless-access and wireless-LAN services and other systems. |
| **5150** | **5250** | - | - | - | - | - | - | ✓ | - | 3.6.1 | License-exempt.<br>Indoor use only.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **5250** | **5350** | - | - | - | - | - | - | ✓ | - | 3.6.1 | License-exempt.<br>Indoor use only, DFS required (subject to compatibility with meteorological radar).<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **5470** | **5725** | - | - | - | - | - | - | ✓ | - | 3.6.1 | License-exempt.<br>DFS required (subject to compatibility with meteorological radar).<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| 5710 | 6425 | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with wireless-LAN, radar, DSRC, broadcasting, image-transmission, satellite transmission, fixed-link services and other systems. |
| **5850** | **7075** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (C-Band Uplink) |
| 5925 | 6170 | - | ✓ | - | - | - | - | - | - | 3.1.3 | Subject to compatibility with broadcasting, satellite communication, public/general (fixed link) services and other systems. |
| 6180 | 6425 | - | ✓ | - | - | - | - | - | - | 3.1.3 | Subject to compatibility with broadcasting, satellite communication, public/general (fixed link) services and other systems. |
| 6425 | 7900 | ✓ | - | - | - | - | - | - | - | 3.1.1 | Subject to compatibility with broadcasting, satellite communication, public/general (fixed link) services and other systems. |

**Frequency Table** (Under Assessment) - The Basic Spectrum Plan for the Olympic and Paralympic Games Tokyo 2020

| Freq. [GHz] From | | To | Usage: Wireless Camera | Point to Point | Wireless Mic / In Ear Monitor | Talk Back | PMR | Telemetry / Tele command | Wireless LAN | Satellite | Section# | Classification and condition to be noted |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **10.7** | **-** | **11.7** | - | ✓ | - | - | - | - | - | - | 3.1.3 | Subject to compatibility with telecommunication (fixed link) service and other systems. |
| **12.2** | **-** | **12.75** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (Ku-Band Downlink) |
| 12.2 | - | 12.5 | - | ✓ | - | - | - | - | - | - | 3.1.3 | Subject to compatibility with satellite communication, public/general (fixed link) services and other systems. |
| **13.75** | **-** | **14.5** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (Ku-Band Uplink) |
| **17.7** | **-** | **20.2** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (Ka-Band Downlink) |
| 17.7 | - | 18.72 | - | ✓ | - | - | - | - | - | - | 3.1.3 | To be studied further. |
| 19.22 | - | 19.7 | - | ✓ | - | - | - | - | - | - | 3.1.3 | To be studied further. |
| **24.77** | **-** | **25.23** | - | ✓ | - | - | - | - | ✓ | - | 3.1.4<br>3.6.1 | License-exempt.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **27.06** | **-** | **27.42** | - | ✓ | - | - | - | - | ✓ | - | 3.1.4<br>3.6.1 | License-exempt.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **27.5** | **-** | **30** | - | - | - | - | - | - | - | ✓ | 3.7.1 | Satellite communication service. (Ka-Band Uplink)<br>Subject to compatibility with mobile phone services in the frequencies from 27500MHz to 29500MHz. |
| **38** | **-** | **38.5** | - | ✓ | - | - | - | - | - | - | 3.1.3 | To be studied further. |
| **39** | **-** | **39.5** | - | ✓ | - | - | - | - | - | - | 3.1.3 | To be studied further. |
| **50.4** | **-** | **51.2** | - | ✓ | - | - | - | - | - | - | 3.1.3 | To be studied further. |
| **57** | **-** | **66** | - | ✓ | - | - | - | - | ✓ | - | 3.1.4<br>3.6.1 | License-exempt.<br><br>- A system that uses these bands and meets the specifications defined in the Japanese Radio Act is entitled to operate freely. |
| **71** | **-** | **76** | - | ✓ | - | - | - | - | - | - | 3.1.3 | To be studied further. |
| **81** | **-** | **86** | - | ✓ | - | - | - | - | - | - | 3.1.3 | To be studied further. |

**【NOTE】**

The following frequency bands are already allocated to mobile phones, PHS devices and BWA in Japan. Tokyo 2020 will not authorise use of these frequency bands for any solutions:

718-748MHz,773-803MHz,815-845MHz,860-890MHz,900-915MHz,945-960MHz,1427-1462.9MHz,1475.9-1510.9MHz,1749.9-1784.9MHz,1844.9-1879.9MHz, 1884.5-1893.5MHz, 1906.1-1915.7MHz,1920-1980MHz,2110-2170MHz,2545-2575MHz,2595-2645MHz,3400-3600MHz.