Section 4 Trends of Radio Spectrum Use in Japan

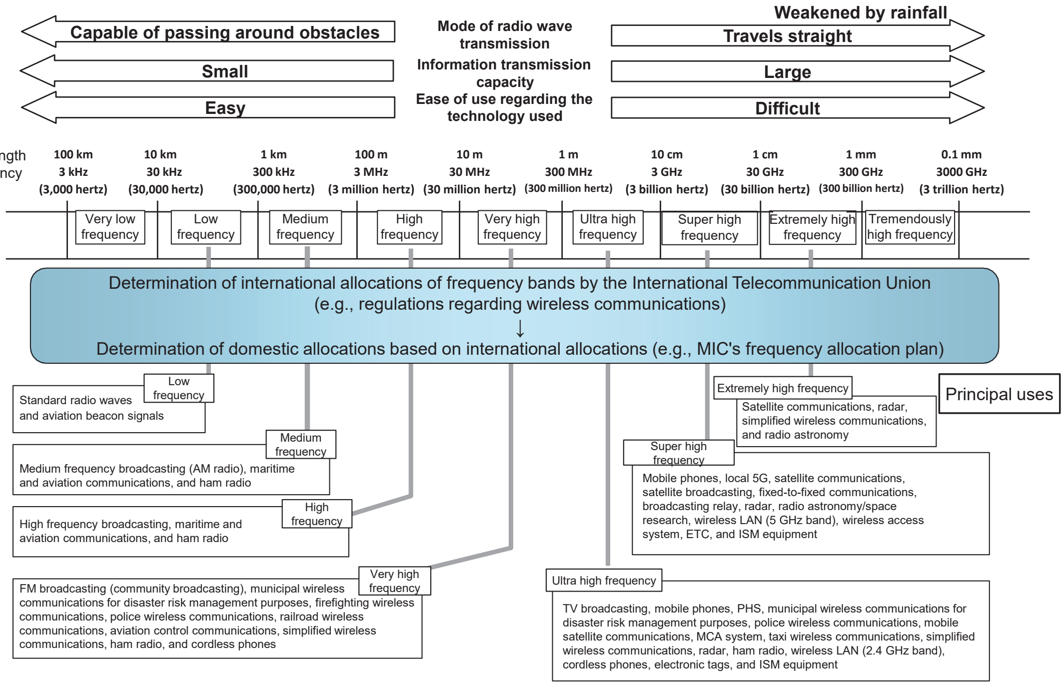
1. Principal use by spectrum

Radio Regulations stipulated in the International Telecommunication Union (ITU) Constitution and Convention have established the international frequency allocation that divides the world into three regions and defines the category of operations for each spectrum.

In order to help application for license of radio stations, MIC has established the Frequency Assignment Plan[51] based on the international allocation and the Radio Act which defines the frequencies that can be assigned, category of operations, purposes, conditions, etc. When establishing or changing the plan, the Radio Regulatory Council is consulted.

Major usage and characteristics of each spectrum in Japan are shown in **Figure 3-4-1-1**.

Figure 3-4-1-1 Major usages and radio wave characteristics in Japan by spectrum



Spectrum	Wave length	Characteristics
Very low frequency	10 to 100km	Propagating along ground surface, waves of this spectrum can go over low hills. Being capable of propagating in water, the spectrum can be used for seabed exploration
Low frequency	1 to 10km	Being capable of propagating to very distant places, the spectrum is used by standard frequency stations to inform radio clock, etc. of time and frequency standard.
Medium frequency	100 to 1000m	Capable of propagating through reflection off the E-layer of the ionosphere that is formed at the height of about 100km, the spectrum is used mainly for radio broadcasting.
High frequency	10 to 100m	Capable of reaching the other side of the globe by being reflected off the F-layer of the ionosphere that is formed at the height of about 200 to 400km and by repeating reflection between F-layer and the ground surface. Widely used for ocean ship and international flight plane communication, international broadcasting and amateur radio.
Very high frequency	1 to 10m	Waves of this spectrum propagate rather straight and are not easily reflected off the ionosphere, but are capable of reaching the other side of mountains and buildings to a certain extent. The spectrum is widely used for a variety of mobile communications including emergency and fire emergency radio.
Ultra-high frequency	10cm to 1m	Waves of this spectrum have stronger tendency to propagate straight compared with very high frequency, but are capable of reaching the other side of mountains and buildings to a certain extent. The spectrum is widely used mostly for a variety of mobile communication systems including mobile phones, and digital television broadcasting and microwave ovens. .
Super high frequency	1 to 10cm	Due to the strong tendency to propagate straight, this spectrum is suitable for emission to a specific direction. It is mainly used for fixed trunk circuits, satellite communication, satellite broadcasting and wireless LAN.
Extremely high frequency	1 to 10mm	With strong tendency to propagate straight, waves of the spectrum can transmit very large information quantity, but not very far in bad weather due to rain or fog. For this reason, the spectrum is used for relatively short-distance radio access communication and image transmission systems, simplicity radio, car collision prevention radar and radio telescopes for astronomical observation.
Trem endously high frequency	0.1 to 1mm	The spectrum has nature similar to light. It is rarely used for communication but used for radio telescopes for astronomical observation as is the case of Extremely high frequency.

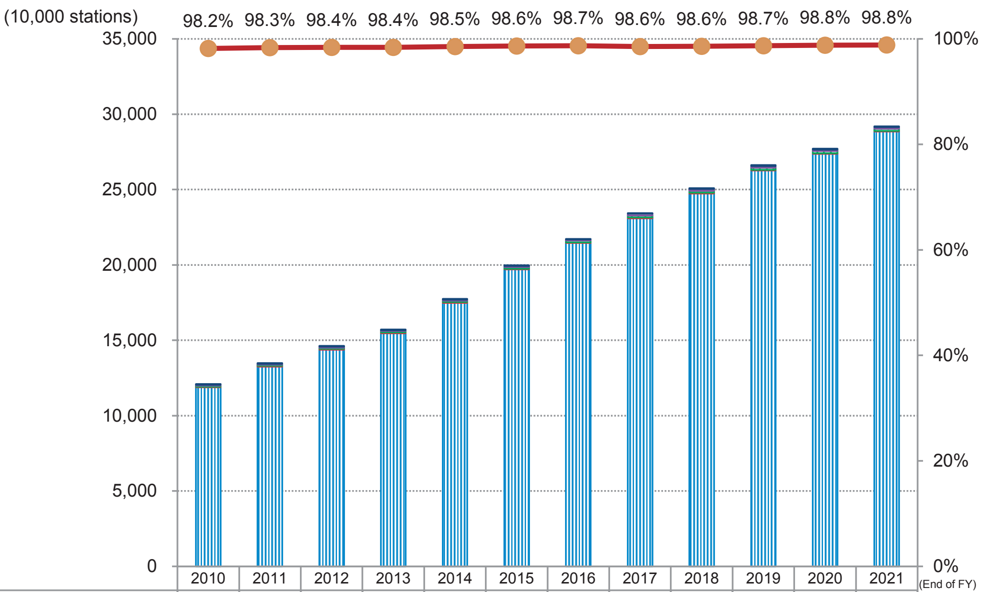
[51] Frequency Assignment Plan: https://www.tele.soumu.go.jp/j/adm/freq/search/share/index.htm

2. Changes in the number of radio stations

The number of radio stations (excluding license-free radio stations such as wireless LAN terminals) at the end of fiscal 2021 was 291.98 million, an increase by 5.4% from the previous year, including 288.59 million mobile phones and other land mobile stations (increase by 5.2% from the previous year). The ratio of mobile phones and other land mobile stations is at a high level of 98.8%.

Simplicity radio stations have also increased to 1.42 million (increase by 3.9% from the previous year) (**Figure 3-4-2-1**).

Figure 3-4-2-1 Changes in the number of radio stations



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Other	46	43	46	50	50	55	49	49	55	59	61	51
Base stations	54	58	63	68	71	70	73	125	132	117	95	108
Convenience stations*2	74	77	84	90	97	105	112	118	125	132	137	142
Amateur stations	45	44	44	44	44	44	43	43	41	40	39	38
Land mobile stations*1	11,879	13,266	14,388	15,472	17,493	19,711	21,457	23,109	24,748	26,278	27,379	28,859
Percentage of land mobile stations	98.2%	98.3%	98.4%	98.4%	98.5%	98.6%	98.7%	98.6%	98.6%	98.7%	98.8%	98.8%

*1 Land mobile station: radio stations operated when moving on land or stopping at unspecified points (e.g. mobile phone terminals)
*2 Simplicity radio station: radio stations for simple radio communication

3. Satellites

In the field of satellite communication, Japan is working to powerfully advance social implementation and international standardization of the results of the development that will realize expansion of communication coverage for seamless connection of land, sea and air (Non-Terrestrial Network (NTN) technology including satellite and HAPS).

Due to their wide coverage, high broadcast possibilities, disaster resistance and other advantages, communication satellites including geostationary satellites and non-geostationary satellites are used for in-house channels, communication with mountainous regions/isolated islands where use of terrestrial channels is difficult, mobile satellite communication services for ships and aircraft, and communication at the time of disaster. Some communication satellites are used for satellite broadcasting (CS broadcasting).

(1) Geostationary satellite

Rotating in the geosynchronous orbit at the height of 36,000km above the equator with an orbital period matching the Earth's rotation period, geostationary satellites seem to maintain a fixed position when observed from the earth. Thanks to the high position, three geostationary satellites can cover the whole earth except polar regions and are used for fixed and mobile satellite communications. Due to the long distance from the earth, transmission delay is long and high power is required from terminals, which makes terminal downsizing difficult.

(2) Non-geostationary satellite

Non-geostationary satellites travel in an orbit other than geostationary orbit that is generally higher than non-geostationary orbit. For this reason, their transmission delay is shorter and terminal output is smaller, which makes smaller and mobile terminals possible. Communication in polar regions is possible, which is difficult in a geostationary orbit on the equator. On the other hand, because satellites pass over an area in a short period of time, it is necessary to simultaneously operate a large number of satellites in order to cover a wide area while ensuring communicable time.

Related data
Major geostationary satellites used for communication services in Japan (at the end of fiscal 2021)
Major non-geostationary satellites used for communication services in Japan (at the end of fiscal 2021)
URL: https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2022/data_collection.pdf#3-4-3 (Data Collection)

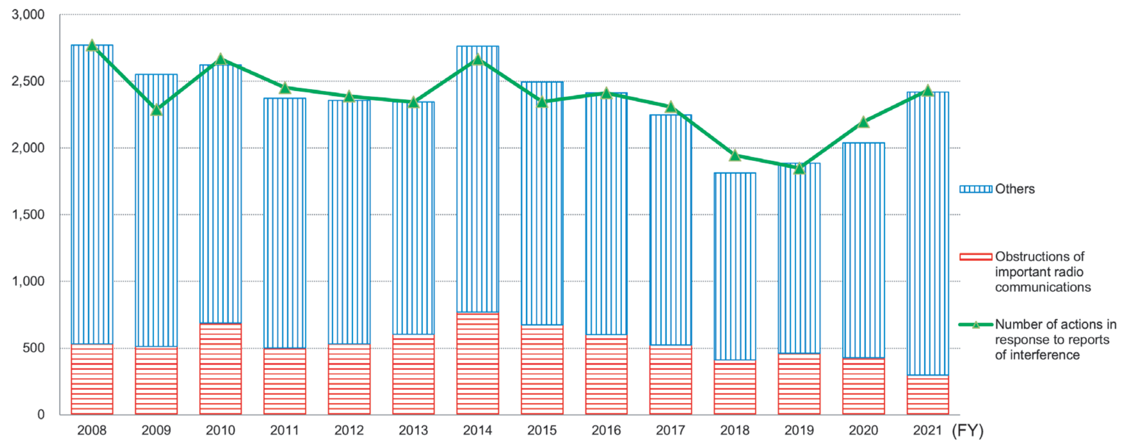
4. Radio wave monitoring to eliminate obstruction of important radio communications, etc.

Using sensor station facilities installed on steel towers and building rooves in major cities across the country and vehicles for search of unlicensed radio stations, MIC is investigating sources of radio emission jamming important radio communications including fire/emergency radio, aeronautical/maritime radio and mobile phones and is cracking down on unlicensed radio stations. In addition, MIC is monitoring radio waves by establishing DEURAS, which is a system to detect emission sources of radio waves including unlicensed radio stations disturbing radio usage environment.[52]

In fiscal 2020, the number of reports of radio interference or obstructions increased 153 to 2,039 (increase by 8.1% from the previous year), 439 of which are obstructions of important radio communications (decrease by 32 cases or 6.9% from the previous year). The number of actions taken against interference or obstructions was 2,198[53] in fiscal 2020 (**Figure 3-4-4-1**).

The number of unlicensed radio stations found in fiscal 2020 increased 228 (3.5% increase) to 6,765. The number of actions taken2 decreased by 304 to 643 (48.4% decrease from the previous year), which is broken down to 62 prosecutions (9.6% of all actions) and 581 guidance (90.4% of all actions) (**Figure 3-4-4-2**).

Figure 3-4-4-1 Changes in the number of reports of and actions against interference or obstructions to radio stations

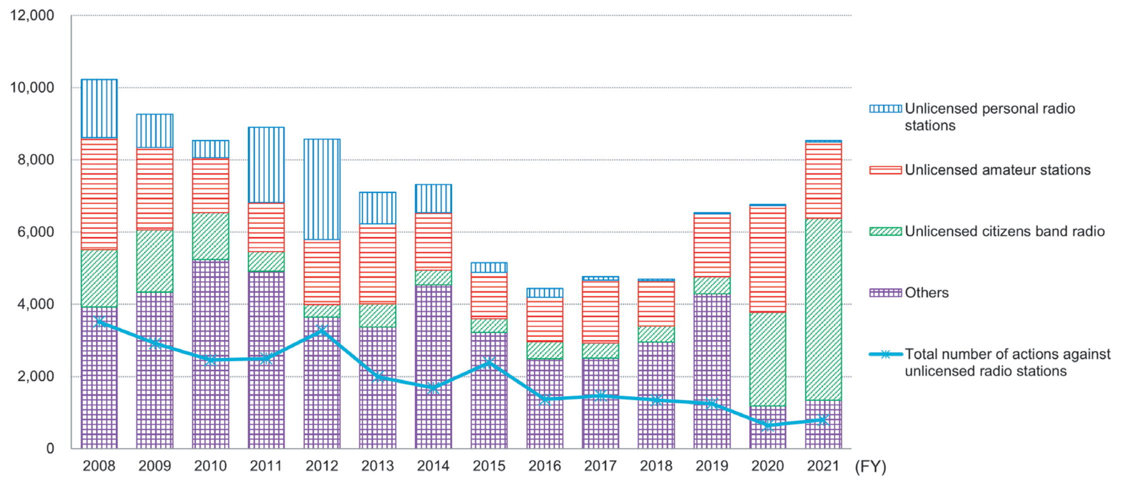


Number of reports of interference or obstruction

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Obstructions of important radio communications	532	513	689	501	532	605	771	676	603	522	412	461	429	298
Others	2,241	2,041	1,934	1,873	1,826	1,740	1,995	1,821	1,811	1,727	1,401	1,425	1,610	2,121
Total	2,773	2,554	2,623	2,374	2,358	2,345	2,766	2,497	2,414	2,249	1,813	1,886	2,039	2,419
Number of actions in response to reports of interference or obstructions														
Number of actions in response to reports of interference	2,772	2,289	2,669	2,453	2,389	2,346	2,667	2,348	2,414	2,310	1,946	1,850	2,198	2,434

[52] In fiscal 2010, DEURAS established a 24-hour system to receive obstruction reports and have been working to promptly eliminate obstructions to important radio communications. As an international radio wave monitoring facility registered with the International Telecommunication Union (ITU), DEURAS plays a role in HF and cosmic radio wave monitoring.
[53] The number of actions taken includes actions in response to the reports made in the previous year, for which action had not been taken.

Figure 3-4-4-2 Changes in the number of unlicensed radio stations found and the number of actions taken



Number of unlicensed radio stations found		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Stations found	Unlicensed personal radio stations	1,617	920	479	2,081	2,788	865	784	265	245	99	40	28	25	32
	Unlicensed amateur stations	3,097	2,283	1,525	1,367	1,803	2,225	1,592	1,291	1,229	1,749	1,253	1,739	2,959	2,126
	Unlicensed citizens band radio	1,592	1,729	1,295	538	342	642	404	375	478	414	443	477	2,594	5,035
	Others	3,926	4,338	5,239	4,917	3,648	3,369	4,541	3,221	2,489	2,508	2,958	4,293	1,187	1,341
	Total	10,232	9,270	8,538	8,903	8,581	7,101	7,321	5,152	4,441	4,770	4,694	6,537	6,765	8,534
Number of actions against unlicensed radio stations															
Number of actions	Prosecution	330	340	262	249	231	228	215	230	168	168	208	189	62	49
	Guidance	3,190	2,578	2,190	2,247	3,038	1,764	1,465	2,156	1,196	1,300	1,136	1,058	581	752
	Total	3,520	2,918	2,452	2,496	3,269	1,992	1,680	2,386	1,364	1,468	1,344	1,247	643	801