# Radio Regulations

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# Radio Regulations

**are a set of international rules and guidelines established by the International Telecommunication Union (ITU) to govern the use of radio frequency spectrum and satellite orbits.**

**The Radio Regulations play a crucial role in ensuring efficient and interference-free global radio communication and coordination among countries.**

**The ITU Radio Regulations are a foundational document for the global coordination of radio spectrum usage. They promote efficient use of the spectrum, prevent interference, and enable the seamless operation of wireless communication services across borders.**

# International Telecommunication Union

is a specialized agency of the **United Nations** responsible for all matters related to information and communication technologies. **Established in 1865** as the **International Telegraph Union**, it is one of the oldest international organizations in operation.

The ITU was initially aimed at helping connect telegraphic networks between countries, with its mandate consistently broadening with the advent of new communications technologies; it adopted its current name in **1934** to reflect its expanded responsibilities over radio and the telephone. **On 15 November 1947, the ITU entered into an agreement with the newly created United Nations to become a specialized agency within the UN system, which formally entered into force on 1 January 1949.**

ITU has three main areas of activity organized in 'Sectors' which work through conferences and meetings.

- **Radiocommunications**
- **Standardization**
- **Development**

# Radio Regulations

**Key points about the Radio Regulations include:**

**1. International Harmonization:** The Radio Regulations harmonize the use of radio frequencies on a global scale. They allocate frequency bands for various services, applications, and technologies to prevent harmful interference between different users and services worldwide.

**2. Frequency Allocation:** The Radio Regulations allocate specific frequency bands to different types of services, such as broadcasting, mobile communication, aeronautical communication, maritime communication, satellite communication, meteorology, amateur radio, and more.

**3. Spectrum Management:** The regulations facilitate the management of the radio frequency spectrum, a limited and valuable resource. By allocating frequency bands and setting technical parameters, the Radio Regulations ensure that different services can coexist without causing interference.

# Radio Regulations

**4. Satellite Orbit Allocation:** In addition to frequency allocation, the Radio Regulations also address the allocation of satellite orbits. They specify the permissible locations for satellites in space to avoid collisions and ensure proper use of geostationary and non-geostationary orbits.

**5. International Coordination:** The Radio Regulations promote international cooperation and coordination among ITU member states. Countries work together to allocate frequencies and orbits, solve cross-border interference issues, and ensure interoperability of radio communication systems.

**6. World Radiocommunication Conferences (WRCs):** The Radio Regulations are updated and revised through World Radiocommunication Conferences (WRCs), held every few years. At these conferences, member states discuss and decide on changes to frequency allocations, technical standards, and other spectrum-related matters.

# Radio Regulations

**7. Binding Agreements:** Once agreed upon and adopted by the WRC, the Radio Regulations become legally binding on ITU member states. Member states are obligated to implement and follow the regulations within their national jurisdictions.

**8. Global Telecommunication Services:** The regulations facilitate the provision of global telecommunication services by ensuring that equipment and services comply with internationally agreed-upon frequency assignments and technical standards.

# General terms

**Telecommunication:** Any transmission, emission or reception of signs, signals, writings, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.

**Radio Waves Or Hertzian Waves:** Electromagnetic waves of frequencies arbitrarily lower than 3000 GHz, propagated in space without artificial guide.

**Radiocommunication:** Telecommunication by means of radio waves.

**Terrestrial Radiocommunication:** Any radiocommunication other than space radiocommunication or radio astronomy.

**Space Radiocommunication:** Any radiocommunication involving the use of one or more space stations or the use of one or more reflecting satellites or other objects in space.

# General terms

**Radiodetermination:** The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves.

**Radionavigation:** Radiodetermination used for the purposes of navigation, including obstruction warning.

**Radiolocation:** Radiodetermination used for purposes other than those of radionavigation.

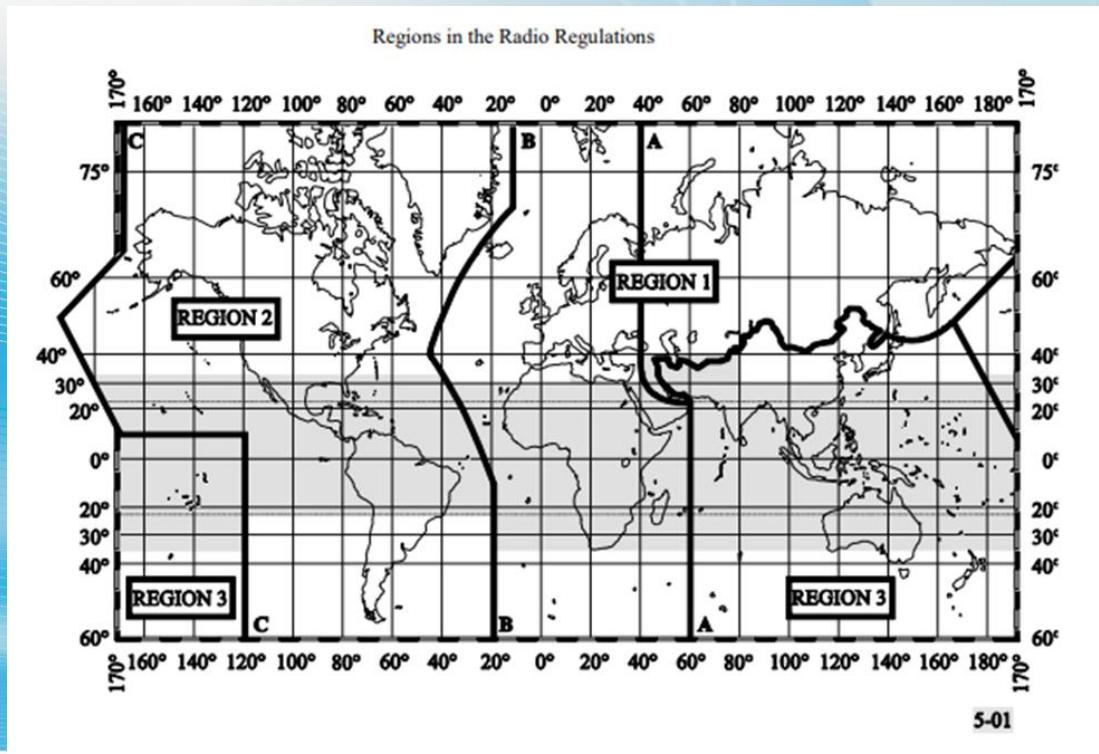
**Radio Astronomy:** Astronomy based on the reception of radio waves of cosmic origin.

# National Frequency Allocation Plan-2018

**The National Frequency Allocation Plan-2018 of India** provides a broad regulatory framework, identifying which frequency bands are available for cellular mobile service, Wi-fi, sound and television broadcasting, radionavigation for aircrafts and ships, defence and security communications, disaster relief and emergency communications, satellite communications and satellite-broadcasting, and amateur service, to name just a few.

For the purpose of frequency allocation, the world has been divided into three Regions.

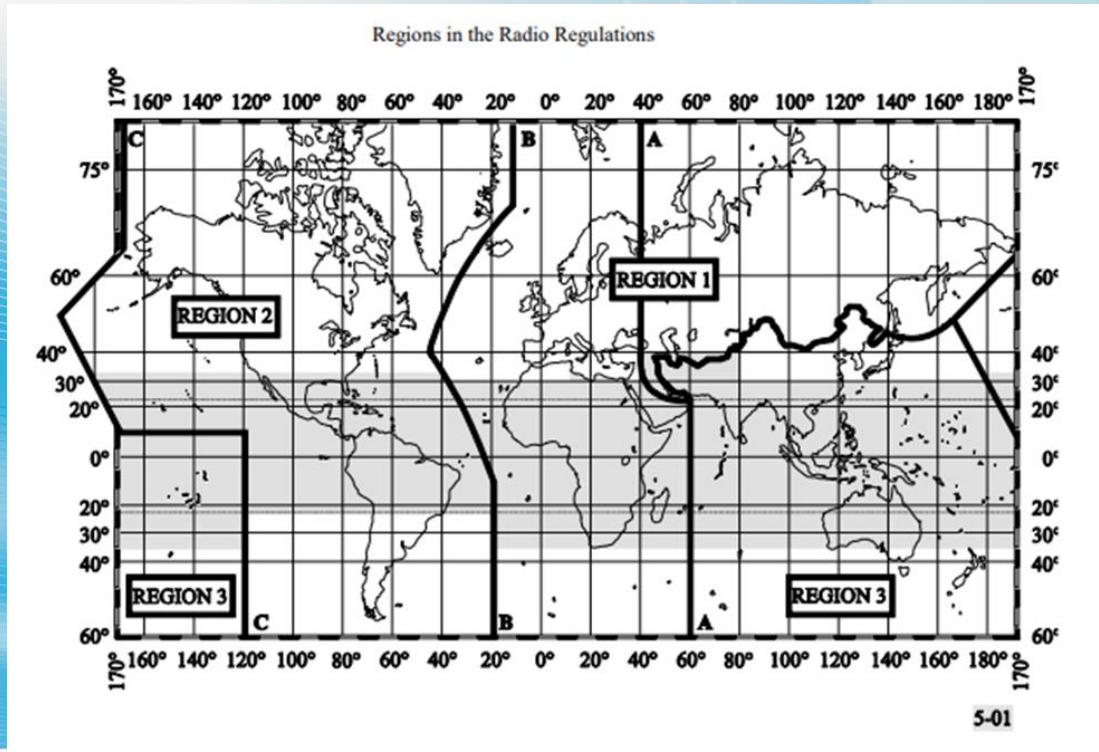
**India is within Region 3.**



# National Frequency Allocation Plan-2018

Where a frequency band is allocated to more than one radio communication service, each service using the band is categorized either as a "**primary**" service or a "**secondary**" service.

A station in a **secondary** service can't cause harmful interference to stations of **primary** services, nor can it claim protection from harmful interference originating from stations of primary services, irrespective of the date the stations in the primary services begin operating



# National Frequency Allocation Plan-2018

## Terms related to spectrum management

**Allocation (Of A Frequency Band):**
Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned.

**Allotment (Of A Radio Frequency Or Radio Frequency Channel):**
Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions.

# National Frequency Allocation Plan-2018

## Terms related to spectrum management

**Assignment (Of A Radio Frequency Or Radio Frequency Channel):**
Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions.

**Interference:**
The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.

# National Frequency Allocation Plan-2018

## Terms related to spectrum management

**Radiocommunication Service:**
A service involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes.

**Meteorological Aids Service:**
A radiocommunication service used for meteorological, including hydrological, observations and exploration.

# National Frequency Allocation Plan-2018

## Earth Exploration-satellite Service:

**A radiocommunication service between earth stations and one or more space stations, which may include links between space stations, in which:**

- **information relating to the characteristics of the Earth and its natural phenomena, including data relating to the state of the environment, is obtained from active sensors or passive sensors on Earth satellites;**
- **similar information is collected from airborne or Earth-based platforms;**
- **such information may be distributed to earth stations within the system concerned;**
- **platform interrogation may be included. This service may also include feeder links necessary for its operation.**

# National Frequency Allocation Plan-2018

## Meteorological-satellite service:

**An earth exploration-satellite service for meteorological purposes.**

- **INSAT-3D,**
- **INSAT-3DR,**
- **Megha-Tropics,**
- **SARAL-ALTICA**

# National Frequency Allocation Plan-2018

## Nomenclature Of Frequency Bands

| Band number | Symbols | Frequency range (lower limit exclusive, upper limit inclusive) | Corresponding metric subdivision |
|---|---|---|---|
| 3 | ULF | 300-3 000 Hz | Hectokilometric waves |
| 4 | VLF | 3-30 kHz | Myriametric waves |
| 5 | LF | 30-300 kHz | Kilometric waves |
| 6 | MF | 300-3 000 kHz | Hectometric waves |
| 7 | HF | 3-30 MHz | Decametric waves |
| 8 | VHF | 30-300 MHz | Metric waves |
| 9 | UHF | 300-3 000 MHz | Decimetric waves |
| 10 | SHF | 3-30 GHz | Centimetric waves |
| 11 | EHF | 30-300 GHz | Millimetric waves |
| 12 | | 300-3 000 GHz | Decimillimetric waves |
| 13 | | 3-30 THz | Centimillimetric waves |
| 14 | | 30-300 THz | Micrometic waves |
| 15 | | 300-3 000 THz | Decimicrometric waves |

NOTE 1 – "Band number N" extends from $0.3 \times 10^N$ to $3 \times 10^N$ Hz.

# National Frequency Allocation Plan-2018

## Nomenclature Of Frequency Bands

In most countries the frequency ranges used for FM sound broadcasting and television are designated by the Roman numerals I to V. The frequency ranges are indicated in Table 3. It should be noted that these ranges are, in some cases, not exclusive to the broadcasting services.

| Designation | Frequency range (MHz) | | |
|---|---|---|---|
| | Region 1 | Region 2 | Region 3 |
| I | 47-68 | 54-68 | 47-68 |
| II | 87.5-108 | 88-108 | 87-108 |
| III | 174-230 | 174-216 | 174-230 |
| IV | 470-582 | 470-582 | 470-582 |
| V | 582-960 | 582-890 | 582-960 |

# National Frequency Allocation Plan-2018

## Nomenclature Of Frequency Bands

| Letter symbols | Radar (GHz) | | Space radiocommunications | |
|---|---|---|---|---|
| | Spectrum regions | Examples | Nominal designations | Examples (GHz) |
| L | 1-2 | 1.215-1.4 | 1.5 GHz band | 1.525-1.710 |
| S | 2-4 | 2.3-2.5<br>2.7-3.4 | 2.5 GHz band | 2.5-2.690 |
| C | 4-8 | 5.25-5.85 | 4/6 GHz band | 3.4-4.2<br>4.5-4.8<br>5.85-7.075 |
| X | 8-12 | 8.5-10.5 | – | – |
| Ku | 12-18 | 13.4-14.0<br>15.3-17.3 | 11/14 GHz band<br>12/14 GHz band | 10.7-13.25<br>14.0-14.5 |
| K(1) | 18-27 | 24.05-24.25 | 20 GHz band | 17.7-20.2 |
| Ka(1) | 27-40 | 33.4-36.0 | 30 GHz band | 27.5-30.0 |
| V | – | – | 40 GHz band | 37.5-42.5<br>47.2-50.2 |

(1) For space radiocommunications K and Ka bands are often designated by the single symbol $K_a$.

# Use of Radio Regulation in Meteorology

The use of radio regulation in meteorology involves the allocation and management of radio frequencies for various meteorological purposes. Radio frequencies play a crucial role in meteorology as they enable communication, data transmission, and remote sensing for weather monitoring, research, and forecasting.

1. **Weather Data Transmission:** Radio frequencies are used to transmit meteorological data collected from various weather stations, satellites, and instruments. This data includes information about temperature, humidity, wind speed and direction, atmospheric pressure, and more. These transmissions help meteorologists analyze and predict weather patterns.

# Use of Radio Regulation in Meteorology

2. **Remote Sensing:** Certain radio frequencies are allocated for remote sensing technologies like radar and radiometry. Weather radars, for example, use radio waves to detect precipitation, cloud formations, and other atmospheric phenomena. These remote sensing tools provide critical information for tracking storms, monitoring precipitation, and understanding atmospheric conditions.

3. **Satellite Communication:** Weather satellites use radio frequencies to transmit imagery and data about Earth's atmosphere, oceans, and land surfaces. This data is essential for monitoring global weather patterns, tracking severe weather events, and improving weather forecasts.

4. **Data Exchange and Coordination:** International coordination and data exchange among meteorological organizations require designated radio frequencies. Global collaboration is essential for accurate and timely weather forecasting, and radio regulations ensure that different countries and organizations can share and receive meteorological data without interference.

# Use of Radio Regulation in Meteorology

5. **Aeronautical Meteorology:** Radio frequencies are also allocated for aviation meteorology. Weather information is transmitted to aircraft in-flight to ensure safe operations, especially during takeoff, landing, and en-route flights. This includes providing pilots with real-time weather updates, turbulence alerts, and storm avoidance information.

6. **Emergency Communications:** During natural disasters such as hurricanes, earthquakes, or floods, radio frequencies are used for emergency communications. Meteorological agencies can use these frequencies to issue warnings, advisories, and updates to the public, helping to save lives and mitigate the impact of extreme weather events.

7. **Research and Innovation:** Radio frequencies are used for scientific research in meteorology. Researchers use specialized instruments and equipment to study various atmospheric phenomena, and these tools often require specific frequency allocations to ensure accurate measurements.

# National Frequency Allocation Plan-2018

## Frequency Allocated for Meteorological Use

- Use of the **8.3-11.3kHz** frequency band by stations in the meteorological aids service is limited to passive use only.
- In the band **9-11.3kHz**, meteorological aids stations shall not claim protection from stations of the radio navigation service submitted for notification to the Bureau prior to 1January2013.
- In the maritime mobile service, the frequency **490kHz** is to be used exclusively for the transmission by coast stations of navigational and meteorological warnings and urgent information to ships, by means of narrow-band direct-printing telegraphy.
- The frequency **4209.5 kHz** is used exclusively for the transmission by coast stations of meteorological and navigational warnings and urgent information to ships by means of narrow-band direct-printing techniques.

# National Frequency Allocation Plan-2018

## Frequency Allocated for Meteorological Use

- Earth exploration-satellite service applications, other than the meteorological-satellite service, may also be used in the bands **460- 470 MHz** and **1690-1710 MHz** for space-to-Earth transmissions subject to not causing harmful interference to stations operating in accordance with the Table.
- Additional allocation: in Bangladesh, India, Indonesia, Nigeria and Pakistan, the band **1660.5-1668.4MHz** is also allocated to the meteorological aids service on a secondary basis.

# National Frequency Allocation Plan-2018

## Frequency Allocated for Meteorological Use

- In the band **2700-2900 MHz**, ground-based radars used for meteorological purposes are authorized to operate on a basis of equality with stations of the aeronautical radio navigation service.
- Between **5600 MHz and 5650 MHz**, ground-based radars used for meteorological purposes are authorized to operate on a basis of equality with stations of the maritime radio navigation service.
- The use of the band **7450-7550 MHz** by the meteorological-satellite service (space-to-Earth) is limited to geostationary-satellite systems.
- The use of the band **7750-7900MHz** by the meteorological-satellite service (space-to-Earth) is limited to non-geostationary satellite systems.
- In the band **9300-9500 MHz**, Ground-based radars used for meteorological purposes have priority over other radiolocation uses.

# National Frequency Allocation Plan-2018

## Frequency Allocated for Meteorological Use

- The band **9975-10025 MHz** is also allocated to the meteorological-satellite service on a secondary basis for use by weather radars.
- Additional allocation: the bands **18.1-18.4 GHz** in Regions1 and 3 are also allocated to the meteorological-satellite service (space-to-Earth) on a primary basis. Their use is limited to geostationary satellites
- IND 24 Subject to not constraining the deployment of the services by which the bands **470-520 MHz and 520-585 MHz** may primarily be used, the requirements of fixed and mobile services may also be considered in these bands.

# National Frequency Allocation Plan-2018

## Frequency Allocated for Meteorological Use

- IND 25 Subject to coordination and not constraining the deployment of the services by which the band **585-698 MHz** may primarily be used, the requirements of Digital Broadcasting services, including Mobile TV, may also be considered in the band.
- IND 26 In addition to the services by which the bands **902.5-915 MHz and 947.5-960** may primarily be used, certain frequency spots may also be considered for train control & mobile train radio systems at specified locations.

# National Frequency Allocation Plan-2018

## Frequency Allocated for Meteorological Use

- IND 27 INSAT system uses the frequency band **2535-2655 MHZ** for Broadcasting Satellite Service (BSS) downlink providing applications like Radio Networking, Cyclone Warning Dissemination, Meteorological Data Dissemination, Satellite Time and Frequency Dissemination and is planned to provide advanced application like Digital Multimedia. Requirements of IMT may also be considered in the band subject to coordination
- IND 14 The use of sub bands **448–450 MHz and 1270–1295 MHz** by wind profiler radars is subject to Resolution 217 (WRC-97).

# National Frequency Allocation Plan-2018

## Frequency Allocated for Meteorological Use

- IND 20 Subject to not constraining the deployment of the services to which the band **174-230 MHz** has been allocated, requirement of fixed and mobile services including those of wireless telemetry seismic systems may also be considered in the band. IND 21Subject to coordination, the requirements of wind profiler radars may be considered in **200-220 MHz** coordination.
- IND 32 It may be borne in mind that the frequency band **18.6-18.8 GHz** is exclusively earmarked for Earth Exploration Satellite Service (EESS-passive) in IRS Satellite system
- IND 35 While considering assignments in the frequency band **25.5.-27.0 GHz**, the protection to facilities in EESS (Earth Exploration Satellite Service) at a few locations shall be taken into account.

# National Frequency Allocation Plan-2018

## India Frequency Call Signs

- All stations open to international public correspondence, all amateur stations, and other stations which are capable of causing harmful interference beyond the boundaries of the territory or geographical area in which they are located, shall have call signs from the international series allocated to its administration as given in the Table of Allocation of International Call Sign Series in Appendix42.

**8TA-8TZ**
**8UA-8UZ**
**8VA-8VZ**
**8WA-8WZ**
**8XA-8XZ**
**8YA-8YZ**
**ATA-ATZ**
**AUA-AUZ**
**AVA-AVZ**
**AWA-AWZ**

# Designation of Emissions

- Emissions are designated according to their necessary bandwidth and their classification eg 304HF1BBN
- The first four characters of the designation of an emission describe the necessary bandwidth.
- These four characters are followed by three to five additional characters which describe the classification.

# Designation of Emissions

- expressed by three numerals and one letter. The letter occupies the position of the decimal point and represents the unit of bandwidth. The first character shall not be zero or K, M, or G.
- Necessary bandwidths shall be designated as shown below:
- **between 0.001 and 999 Hz shall be expressed in Hz (letter H);**
- **between 1.00 and 999 kHz shall be expressed in kHz (letter K);**
- **between 1.00 and 999 MHz shall be expressed in MHz (letter M); and**
- **between 1.00 and 999 GHz shall be expressed in GHz (letter G).**

# Designation of Emissions

0.002 Hz = H002

0.1 Hz = H100

25.3Hz = 25H3

400 Hz = 400H

2.4 kHz = 2K40

6 kHz = 6K00

12.5 kHz = 12K5

180.4 kHz = 180K

180.5 kHz = 181K

180.7 kHz = 181K

1.25 MHz = 1M25

2 MHz = 2M00

10 MHz = 10M0

202 MHz = 202M

5.65 GHz = 5G65

# Designation of Emissions

- A minimum of three symbols are used to describe the basic characteristics of radio waves:

1. **The first symbol—Type of modulation of the main carrier**
2. **The second symbol—Nature of the signal(s) modulating the main carrier**
3. **The third symbol—Type of information being transmitted**

# Designation of Emissions

In addition, a fourth and/or fifth symbol may be used to indicate the following:

4. **The fourth symbol—Details about the signal(s).**

5. **The fifth symbol—Nature of multiplexing**

# Designation of Emissions

| | | |
|---|---|---|
| **7.1** | **First symbol—Type of modulation of the main carrier** | |
| 7.1.1 | Emission of an unmodulated carrier | N |
| 7.1.2 | Emission in which the main carrier is amplitude-modulated (including cases where sub-carriers are angle-modulated) | |
| 7.1.2.1 | Double-sideband | A |
| 7.1.2.2 | Single-sideband, full carrier | H |
| 7.1.2.3 | Single-sideband, reduced or variable level carrier | R |
| 7.1.2.4 | Single-sideband, suppressed carrier | J |
| 7.1.2.5 | Independent sidebands | B |
| 7.1.2.6 | Vestigial sideband | C |
| 7.1.3 | Emission in which the main carrier is angle-modulated | |
| 7.1.3.1 | Frequency modulation | F |
| 7.1.3.2 | Phase modulation | G |
| 7.1.4 | Emission in which the main carrier is amplitude-modulated and angle-modulated, either simultaneously or in a pre-established sequence | D |
| 7.1.5 | Emission of pulses[6] | |
| 7.1.5.1 | Sequence of unmodulated pulses | P |
| 7.1.5.2 | A sequence of pulses | |
| 7.1.5.2.1 | Modulated in amplitude | K |
| 7.1.5.2.2 | Modulated in width/duration | L |
| 7.1.5.2.3 | Modulated in position/phase | M |
| 7.1.5.2.4 | In which the carrier is angle-modulated during the period of the pulse | Q |
| 7.1.5.2.5 | Which is a combination of the foregoing or is produced by other means | V |
| 7.1.6 | Cases (not covered above) in which an emission consists of the main carrier modulated, either simultaneously or in a pre-established sequence, in a combination of two or more of the following modes: amplitude, angle, and/or pulse | W |
| 7.1.7 | Cases not otherwise covered | X |

# Designation of Emissions

| 7.2 | **Second symbol—Nature of signal(s) modulating the main carrier** | |
|---|---|---|
| 7.2.1 | No modulating signal | 0 |
| 7.2.2 | A single channel containing quantized or digital information without the use of a modulating sub-carrier[7] | 1 |
| 7.2.3 | A single channel containing quantized or digital information with the use of a modulating sub-carrier[8] | 2 |
| 7.2.4 | A single channel containing analog information | 3 |
| 7.2.5 | Two or more channels containing quantized or digital information | 7 |
| 7.2.6 | Two or more channels containing analog information | 8 |
| 7.2.7 | Composite system with one or more channels containing quantized or digital information, together with one or more channels containing analog information | 9 |
| 7.2.8 | Cases not otherwise covered | X |

# Designation of Emissions

| | | |
|---|---|---|
| **7.4** | **Fourth symbol—Details of signal(s)** | |
| 7.4.1 | Two-condition code with elements of differing numbers and/or durations | A |
| 7.4.2 | Two-condition code with elements of the same number and duration without error correction | B |
| 7.4.3 | Two-condition code with elements of the same number and duration with error correction | C |
| 7.4.4 | Four-condition code in which each condition represents a signal element (of one or more bits) | D |
| 7.4.5 | Multi-condition code in which each condition represents a signal element (of one or more bits) | E |
| 7.4.6 | Multi-condition code in which each condition or combination of conditions represents a character | F |
| 7.4.7 | Sound of broadcasting quality (monophonic) | G |
| 7.4.8 | Sound of broadcasting quality (stereophonic or quadraphonic) | H |
| 7.4.9 | Sound of commercial quality (excluding categories given in subparagraphs 7.4.10 and 7.4.11) | J |
| 7.4.10 | Sound of commercial quality with the use of frequency inversion or band splitting | K |
| 7.4.11 | Sound of commercial quality with separate frequency-modulated signals to control the level of demodulated signal | L |
| 7.4.12 | Monochrome | M |
| 7.4.13 | Colour | N |
| 7.4.14 | Combination of the above | W |
| 7.4.15 | Cases not otherwise covered | X |

# Designation of Emissions

| | | |
|---|---|---|
| **7.5** | **Fifth symbol—Nature of multiplexing** | |
| 7.5.1 | None | N |
| 7.5.2 | Code-division multiplex[10] | C |
| 7.5.3 | Frequency-division multiplex | F |
| 7.5.4 | Time-division multiplex | T |
| 7.5.5 | Combination of frequency-division multiplex and time-division multiplex | W |
| 7.5.6 | Other types of multiplexing | X |

आज़ादी का अमृत महोत्सव

सत्यमेव जयते

G20 भारत 2023 INDIA
वसुधैव कुटुम्बकम्
ONE EARTH • ONE FAMILY • ONE FUTURE

# *Thank You*

*India Meteorological Department*

*Ministry of Earth Sciences*

*Government of India*